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Index

Toxic symptoms of aluminium in plants

A.K.Rath, N. Panda, S. Bhattacharyya*
Department of Botany, School of Applied Sciences (Bolangir Campus), Centurion University of Technology and Management, Odisha, India

Abstract
Aluminium, which is the most abundant mineral on earth crust, can be a major crop limiting factor in acid mineral soils where it attains its exchangeable form. The toxic effect of Al can come within minutes of exposure basically affecting the rhizosphere in plants. Al significantly alters the mineral uptake by plants. Hence, the result is the expression of various toxic symptoms. Plant roots are directly and severely affected by the mineral with a decrease in root length as the primary symptom. In shoot parts, the development of purple colouration and loss of vigour were also noticed including even a change in flower colour. Moreover, cytotoxic symptoms of aluminium were not uncommon. Thus, the negative impacts have a significant role in reducing the crop yield in acid soils. Here, there is an attempt to provide a concise account of the phytotoxic symptoms of aluminium.
Key words*:* Aluminium, Aluminium Toxicity, Crop Yield, Metal, Rhizosphere, Symptoms

Introduction
Aluminum (Al) is a major abiotic stress factor for plants in acidic mineral soils (Lianwen Qian et al. 2018) affecting crop production around the globe (Gupta 2013). Al-Phytotoxicity is expressed primarily by inhibition of root elongation and/or reduction in the uptake of nutrients (Magalhaes et al. 2018; Xiang Zhang et al. 2019). At an acidic pH range, the resulting toxic species of Al^{3+} ligands with the groups like carboxylate, phosphate and sulfate of both soil solution and of the root cells, to hamper cell elongation, cell division and also the intake of essential cations such as K^+, Ca^{2+}, and Fe^{2+} including phosphate anions (Nguyen et al. 2003), Researchers revealed that the calculated activity of the Al^{3+} ion is the single best indicator of toxicity, but reports were also there for toxicity of the monomeric hydroxyl cations $Al(OH)^{2+}$ and $Al(OH)^+$ and again for the polynuclear hydroxy complexes of Al (Foy 1992).Within minutes after exposure to Al^{3+}, the toxic symptoms in the form of retardation of root growth and/or decrease in water and mineral uptake start appearing in roots (Silva et al. 2012). Toxic symptoms of aluminium; either in natural condition or in controlled environment appear at lower pH range affecting morphological, physiological and cytological processes considerably. Also, these symptoms are expressed in terms of various abnormalities in almost all the part of the plants there by limiting the crop yield in different crop species. The review provides an insight into the range of phytotoxic symptoms induced by aluminium.

Major toxic symptoms induced by aluminium
Al-induced symptoms can be reflected as deficiencies of P, Ca, Mg or Fe or even as drought stress (Foy 1988, 1992; Kamprath and Foy 1985). Inhibition of root elongation or root growth is a primary symptom of aluminium toxicity (Frankowski 2016; Kopittke et al. 2016). In some cases, however, the toxic symptoms also include dwarfing of roots (Gunse et al. 2000). Reduction in shoot growth was observed as in rice Fageria (1982), coffee (Braccini et al. 1998) and in barley (Alam 1981). It was a later happening effect, of the negative effect of Al in roots (Larsen et al. 1997). Further, purpling of stem was noticed in some systems (Foy, 1992).Leaf symptoms are more commonly induced by Al. It ranges from curling along the margin to marginal chlorosis (Pavan and Bingham 1982), dark green and prupling of leaves and/or veins, yellowing and death of leaf tips and even collapse of petiole (Foy 1992), leaf necrosis (Nguyen 2003) and a decrease in leaf size (Braccini et al, 1998).
Aluminium induced change in flower colour was reported for the first time by Rath and Behera (2004) in *Brassica* wherein, the normal homogeneous yellow petal was modified to half-yellow half-white type. This notorious element had also altered many other specific functions like nodulation. Decrease nodulation with the damage to root hairs was reported by Kim et al. 1985. Al was found to be toxic to

Rhizobium trifolii by Whelan et al. (1986). Finally, aluminium did reduce the yield of crops significantly by various workers as in rice (Miyazawa et al 1981; Sarkunan et al. 1984), in Brassica (Rath et al. 2010). Aluminium does alter the cellular functions at various levels. It is often associated with decreased mitotic activity (Bennet et al. 1987) leading to reduced cell production (Lazof and Holland 1999). A gradual fall in mitotic index and increase in percentage of aberrations linked to increase in Al concentration was revealed in allium test by Rath (2020). Inhibition of cell division will be lethal cause for the complete inhibition of root elongation by Al toxicity even though this is not the primary symptom induced by Al in terms of the inhibition of root elongation (Matsumoto, 2000).

Conclusion

Aluminium attains its notorious exchangeable form in acidic mineral soils to enter into the plants via their roots where it also gets aggregated. Rhizospheric Al basically induces several toxic symptoms in the plants that extend through their parts as a periodic response which is also dose specific. The toxic symptoms in root include decrease in root length to brittleness. Also, the metal has some shoot symptoms both in stem and leaves wherein development of pink-purple colouration is of importance. Some abnormal symptoms of the metal include the change in flower colour as well. The cytotoxic symptoms of Al were also well documented. As a whole, the mineral can induce loss of vigour thereby reducing the crop yield considerably. Though the detail molecular mechanism of Al-induced toxicity is yet to be known, it is however, clear that the total negative activity in such cases in the outcome disruption of mineral intake in plants by aluminium.

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Role of integrated marketing communication (IMC) in crisis management in the post globalization era in India

Kamalesh Chawda
Research Scholar, Centurion University of Technology and Management, Odisha
Sisir Ranjan Dash
Assistant Professor, Centurion Univeristy of Technology and Management, Odisha

Abstract

Globalization refers to the process of *integration* of international markets in the global economy, by which national economies are *interconnected*. Globalization is particularly significant in financial markets, commodity markets and product markets.

This article presents an insight into the market dynamics in India, following the Globalization which was a part of economic liberalization during early 1990's. The decade of the 90's was instrumental in shaping the future of a modern India.

On the other hand, Integrated Marketing Communication has emerged as a handy tool in the hands of the marketers to establish and maintain relationship with the consumers. In the post Globalization era, this tool has been widely used by the marketers to save the dying image of a company and position its products in a completely new way.

On a positive note, Globalization brought with itself a galaxy of new opportunities. Foreign money was allowed in India such as FDI(Foreign direct investment) FII (Foreign institutional investment) and FPI (Foreign portfolio investment). As foreign companies started investing in India, the technology and innovative processes also entered India. Thus Integrated Marketing Communication made its way into Indian markets.

This article focuses upon the vital role Integrated Marketing Communication played in repositioning different brands and come up with a robust crisis management strategy.

Further, this article also highlights some of the renowned companies, how they found themselves at the eye of a cyclone and finally how they could save the day by effectively communicating with all stakeholders including the consumers.

Introduction

"Integrated marketing communications is a way of looking at the whole marketing process from the view point of the customer."

— Philip Kotler

The above definition best describes the meaning of Integrated marketing communication. But when we look it from the prism of post globalization era, one can find glaring examples of how Integrated marketing communication has helped companies in reviving their fortunes. In this paper we will analyze some classic cases which turned into nightmares for those companies and how they successfully turned those threats into opportunity.

The basis of integrated marketing communications (IMC) is to gain advantage by reaching potential customers and to raise responsiveness of the companies' products and services. IMC has a series of promotional tools which include advertising, sales promotions, digital marketing and so on. Lets first understand the various IMC tools which are alternatively known as promotional mix. It defines the characteristics of each marketing communication tools. It takes into consideration various agents which helps successful implementation of an IMC , which includes the measurement of its effectiveness.

As customers, we come across many forms of advertisements right from the beginning of the day till our day ends. They might be in the form of TV commercials, emails, calls from telemarketers, web page banners and so on and so forth. The promotional tools used by marketers depends upon the depth of their pockets, higher the budget diverse are the promotional tools. Accordingly, following are the list of promotional tools used by marketers.

Integrated Marketing Communications Campaign

These campaigns are based upon different promotional mix. They keep an eye on businesses' communications objectives.These may extend from weeks, months or even for years. These marketing tools are different from one another when it comes to their end result. Sometimes these tools are used by blending a few of them together. Hence the task of the marketing managers becomes even more crucial in terms of decision making following the POSDCORB principle (Planning, Organising, Staffing, Directing, Coordinating, Reporting and Budgeting). It becomes challenging to when they have to club all the promotional tools into a planned campaign. Finance is the major motivating factor and hence adequate financial adequacy is highly desired. This is the reason why big marketers are able to project their products wide and deep in to the markets. The managers have to keep in mind the time during which the objectives are to be achieved.

Globalization

Globalization is the way by which different countries are integrated with companies and people of the respective countries. The rapid developments in the fields of transport and communication has boosted globalization especially after the industrial revolution. Gradually, with opening up of economies of different countries, the activities such as trade and commerce started gaining momentum. Looking from a broader perspective, globalization is keenly associated with sociocultural dimensions. For an example, many Chinese products find their place in Indian homes, and at the same time those products are associated with our culture such as the Idols of Ganesha, Sai Baba etc, firecrackers, holi colours and so on.

In the Indian context, the process of globalization kicked off with the introduction of the New Economic Policy under which the government of the day introduced the LPG policy. It was a daring and a path breaking initiative by the government. This was perhaps the biggest economic reforms after the independence of our country. The term LPG stands for Liberalization, Privatization and Globalization. As mentioned, globalization is the process of integrating the economies of different countries together to realize common economic goals.

Lets now analyze the role, Integrated Marketing Communication played in the post globalization era in India. For this we will take some real life examples of certain companies and understand how they used the concept of Integrated Marketing Communications to turn their fortunes in troubled waters.

1.Crisis Management By Cadbury India

This company was started in 1824. The city was Birmingham which is in England by John Cadbury as a small unit. Dairy Milk chocolate is the identity of Cadbury. The Indian unit was started in 1948 as they simply imported the chocolate. Presently, it has manufacturing units at different parts of India.

Problem

It was a normal trend that, very year, during the festival of Diwali, Cadbury used to see high demand of its products.

But a small incident on October 2003, closed all the gates for Cadbury. It all started from Pune where consumers complained about ***worms*** found in the packets of its blockbuster product, Dairy Milk. The company smelled a rat when similar complaints were noticed in Mumbai.

The State Food and Drugs Administration was quick to respond and seized the entire stocks of Cadbury chocolates. The plant at Talegaon which was at the epicenter of the issue was seized. The seizure was done with immediate effect as children were the key consumer of Dairy Milk and any negligence on the part of the administration would put compromise their safety of life. The investigation report confirmed the allegations and the chocolates were found unfit for human consumption.

The seizure had been widely reported by the local media. Over the following 3-week period, resultant adverse media coverage touched close to 1000 clips in print and 120 on TV news channels. In India, where Cadbury is synonymous with chocolate, the company's reputation and credibility was under intense scrutiny. Sales volumes came down drastically in the first 10 weeks, which was the festival season; retailer stocking and display dropped, employee morale — especially that of the sales team — was shaken. The media continued its onslaught; in those three weeks, there were close to 1,000 adverse newspaper articles and about 120 TV clips in ten languages. The infestation incident became the subject of SMS jokes and warnings, cartoons and TV tickers.

This incident occurred just before Diwali in 2003. As a result, Cadbury's sales dropped by around 30% when they were actually supposed to go up 15%. For the first time, Cadbury did not advertise for a month and a half.

Result:

It made their partner salesperson angry

The consumers felt uncared for, as no one was ready to take the responsibility of the incident.

The sales dropped by 30% within 15 days and the stakeholders started to doubt the credibility of Cadbury.

Fight Back

The following shows How Cadbury overcame the Identity Crisis in 2003 by successfully implementing the concept of Integrated Marketing Communication"

Cadbury responded with a set of conclusions to persuade the customers ;

1. "infestation was a storage problem".
2. "Cadbury chocolates were safe,"
3. "consumers be careful enough while purchasing chocolates.

Cadbury came up with Project Vishwas in a firefighting mode to win the lost ground.

The key stakeholders were Retailers and consumers who were approached through different medias such as print and electronic media.

The episode was projected as 'Facts about Cadbury' and was released in 55 publications and in 11 languages.

Further the star of the millennium, Amitabh Bachchan, was roped in to endorse the company heavily with a tag line "Kuch meetha Ho jaye".

Next focus was on packaging which was the root cause of entire issue. For the older machines were replaced by new machines. Hence, the new packaging was airtight which reduced the chances of worm infection. Hitting the last nail on the coffin, Cadbury started providing small refrigerated devices called Visi Coolers which completely eliminated the chance of any type of fungal or worm infections.

2.Coke and Pepsi Pesticide Issue

Yet another controversial companies which weathered the storm were Coca cola and Pepsi. Actually, these companies are the leading manufacturer of carbonated drinks like Mountain Dew, Mirinda, Sprite and so on. He controversy started in 2003 when these companies were alleged that their products contained higher amount of Pesticides and insecticides. These allegations were labeled by Centre for Science and Environment (CSE), New Delhi. The amounts were way higher than the permissible limits laid down according to European Economic Commission (EEC).

It was revealed that the levels of pesticides in pepsi were 36 times higher and that of coca cola were 30 times higher than the permissible level.
According to Centre for Science and Environment report, toxins such as lindane and DDT were found in all the 12 samples which were collected. It is believed that a long term consumption of these toxins could lead to cancer and immune system failure.

The Fightback
Coca Cola India, jumped into the fray and made a public statement that its products had remnants of toxins but under the safe limits as guided by the FSSAI(Food safety and standard authority of India).
On the contrary, the petitioners led by eminent lawyer Mr. Abhishek Manu Singhvi revealed in front of the court that the source of the controversial toxic residue was due to the toxic ground water used for the manufacturing process.

He further argued that the Food Safety and Standards (Contaminant, Toxins and Residues) Regulations, 2011 nowhere mentions the regulations related to toxins in food and beverage items in India. Rather, it has a mention of upper limits of toxins to be tolerable in food and beverage items like DDT and arsenic.

3. Maggie Crisis:-

In similar incidents, some samples of Maggie, "the Two Minute noodle"
In a laboratory in Gorakhpur were found suspicious. It was alleged that these samples were having the quantity of MSG (monosodium glutamate1), which is an artificial taste enhancer, more than the safe level. This allegation which was labeled by the by Kolkata central laboratory in the year 2015, was contested in the court by NESTLE. The court found the allegations to be true. In a series of incidents, different state governments started checking the samples of Maggie and following the trends all over the country, Maggie was banned in India.
It was a fatal blow on the trustworthiness of such a successful noodle.
As a wise corporate, NESTLE INDIA admitted the loophole in the production process. In a face saving effort and to restore the reputation, it appointed Mr. Suresh Narayanan. It was a herculean task Narayanan saw immense opportunity in it.
He started with digging out reasons behind the crisis.
Following were the conclusions he drew from the entire episode.

1. There was a gross violation in the manufacturing process. As against the safe levels of 2.50 PPM (parts per million), the product had it in excessively high amount, somewhere around 17.2 PPM. It must be noted that Lead and MSG are carcinogenic in nature. In simple terms the excessive and prolonged intake of these can lead to cancer.
2. As per the guidelines of FSSAI, every packaged food items in India should contain minimum information on the packets which included the term 'No added MSG' as well.
3. But even though Maggie was adding it but never mentioned on its products.

The gravity of the ban was so severe that within the blink of an eye, Maggie lost its market share from nearly 80 per cent to a surprising Zero. This was indeed a big jolt to NESTLE India.

Crisis Management:-

The crisis came in such a lightning quick time, that Maggie was not in a position to handle it. It was engaged in the first part just to deny the allegations with no real plan to defend the company. There were severe protests all around the company as the consumers felt being cheated by their favorite company. It was certainly not the time to sit back and think, rather to turn into action mode.

The team led by Mr. Suresh Narayanan, responded aggressively.

Their first decision was to withdraw all the instant noodles from the shelves within a time line of mere two days. At the same time in a brand building effort, it held press meets and stayed in touch with the media on a regular basis.

Further, on an aggressive note, they petitioned in the Bombay High Court. As an interim relief, the court allowed the company to export its products to foreign markets.

Going a step ahead, the company approached APCO which was a public relations company from USA. It was hired to upgrade the relationships with customers.

The company used nearly every methods to rebuild the brand image. Here they harnessed the benefits of IMC (Integrated Marketing Communications).

And as expected the company launched an intensive campaigns on different social media platforms such as instagram, facebook, linkedin and so on.

The benefits of such aggressive efforts were visible within a year the company was able to win the lost ground and at present it is still the most loved noodle brand.

Conclusion

The above examples have made the idea stronger that Role of Integrated Marketing Communication (IMC) In Crisis Management in the Post Globalization Era In India has been an exciting journey.
Globalization has made a turnaround of the modern Indian society. Companies are no longer afraid to counter the crisis. However grave may be the problem, these modern corporate have an answer. Just imagine, a company lost nearly 80 per cent of its market share and even then bounced back within a year. But much of the credit goes to globalization. Because, in all the three above mentioned examples, one factor was common, i.e; all of them were multinational companies.
This has been possible just because globalization that they were allowed in India and expand their business.
I am quite skeptical here to say that, had there been any Indian company, they would have had surrendered to the market pressure and succumbed to an untimely death.

To conclude a few more words.The world has changed a lot and the dynamics of marketing communication has changed as well.
The marketers of present generation are not willing to defend in the situations of crisis but are taking aggressive steps to face the music. Whether it is The Cadbury India,Coke,Pepsi or Nestle Maggie or any such company, it is clear that the companies post globalization have applied the concepts of Integrated Marketing Communication in true spirit. Going a step further, they have given a new definition to this concept. The have become the torch bearers for the companies of future times. They have set higher standards when it comes to Crisis Management.

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A review on harvesting and threshing methods for paddy crop - I

Shekhar Kumar Sahu[1]
[1]Assistant Professor, Farm Machinery and Power, SoABE, Centurion University of Technology and management, Odisha, India
E-mail: shekharsahu6789@gmail.com

ABSTRACT
Harvesting methods adopted for paddy crop are largely dependent on the land size of the farmers. Mechanized methods are completely implemented by the farmers of medium and large category. On the other hand, the marginal and small farmers are struggling between manual and mechanized methods because of unavailability of implements that can suits to their land size an economic level. Cutting and threshing operations are performed separately which are responsible for more input cost and grain loss. Various methods of harvesting were studied and the loss of grain associated with the methods is emphasized. In manual method, before threshing, the cutting, collecting, bundling and transportation operation requires which consumes time, energy and cost, and increase the grain loss significantly. In mechanized methods, these factors can be minimized. The manual crop cutting requires about 8 to 12 and 25 to 45 times, respectively more man-hour per hectare compared to rotary blade cutter and vertical conveyor reaper. The field capacity of manual harvesting methods is 4 to 10 times less than the mechanized methods.
KEYWORDS: Conventional header, Harvesting, Header loss, Reel index, Stripping.

INTRODUCTION

Rice, (*Oryza sativa*) is a staple cereal food consumed by a large population in India. In the past several years, Indian farmers have been facing a challenge of producing enough food for a very large and rapidly growing population while the labour engagement in the farm has been declining. In the year 2004-05, the agricultural workforce was 258.93 million which decreased to 228.36 million in the year 2011-12 (Singh and Kapoor, 2015). To increase production with a decrease in the agricultural workforce, it has become essential to mechanize the farm operations to save time and reduce dependency on human labour. This will also help in maintaining the timeliness of agricultural operations. As per the statistics of Food and Agriculture Organization (FAO) of the United Nations, the production and productivity of rice in India were 169 million tons and 3.87 ton/ha, respectively in the year 2017 (Anon, 2020a). This puts India to a second position in the world in the production of rice after China. As per the land use statistics of 2016-17, the total geographical area of India was 328.7 million hectares and the net sown area was 156.4 million hectares. Out of this, 43.79 million hectare land, that is, approximately 28% of the total sown area was under cultivation of rice. It contributes significantly to the economy of India. According to the FAO report, rice was grown globally over an area of 167.13 million hectare land in the year 2018 from which the production was 782 million ton (Anon., 2020b). Asia had the largest share of 90.7% in production. On the other hand, the share of America, Africa, Europe and Oceania was 5.2, 3.4, 0.6 and 0.1%, respectively. Average production of top ten rice producing countries of the world in the 25 years from 1994 to 2018 is shown in Figure 1.

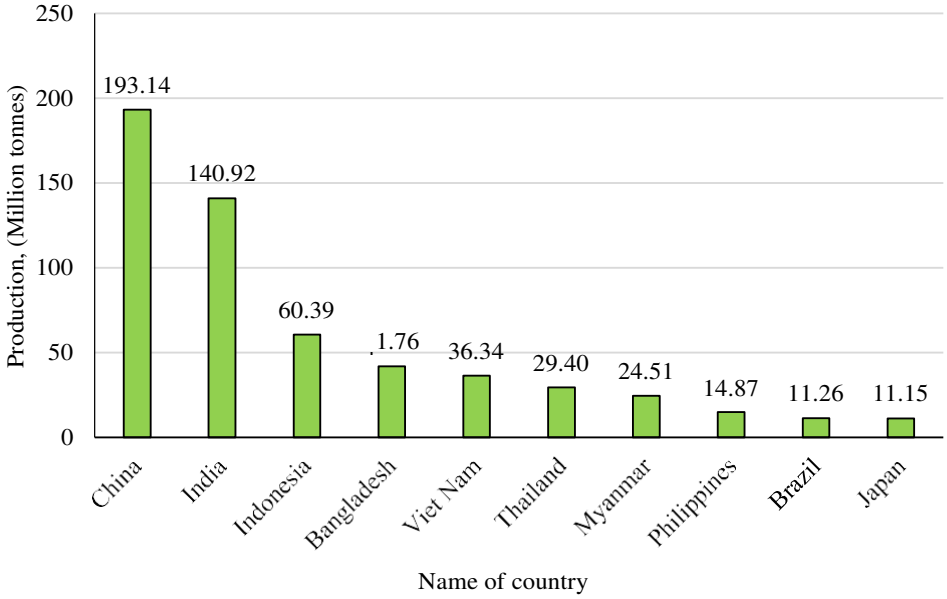

Figure 1: Average paddy production of top ten producer countries of 25 years from 1994 to 2018 (Anon., 2020b)

To feed the huge population, it is necessary to reduce the losses that occurred during the various farm operations. In different studies, it was reported that harvesting and threshing are major operations that are responsible for grain loss. It may reach more than 8% only in harvesting and threshing operations.In this study, different methods adopted for harvesting of paddy crop and the grain loss occurred during harvesting is discussed.

Harvesting of paddy crop

Separation of main or economic product in a crop is known as harvesting (Srivastava et al., 2006; Anon., 2019a). Cutting, picking, plucking, digging or a combination of these operations comes under harvesting (Anon., 2019b). Selection of the harvesting method depends on the type of crop. Cutting of the crop is the first operation (Srivastava et al., 2006). In shear cutting the plant is supported by one hand in manual methods or on a counter blade in mechanical methods and a cutting blade applies the force on the stems. In impact cutting the inertia of the plant, stem provides enough stiffness during the application of force. In rice cultivation, harvesting is a very important operation. It involves cutting of the plants, bundling them, transportation of the bundles and threshing. In India, these field operations are carried out either manually or using small equipment at different stages.

Separating of individual panicles of paddy crop with the hands, gathering them and then cutting them with a knife required an average of 240 man-hours/ha (Khan, 1971). Cutting of paddy crop using sickle consumed an average of 80 to 160 man-hours/ha. International Rice Research Institute estimated that the manual cutting cum gathering operation and threshing operation required 200 and 120 man-hours/ha, respectively (Anon., 2013).Singh (2016) evaluated the work capacity and physiological workload of women during manual cutting of paddy crop variety Kanti. Three types of sickle viz. Naveen, Vaibhav and an improved local design were used. It was reported that average cutting capacity of a woman when using these sickles was 0.0047, 0.0061 and 0.0065 ha/h and consumed physiological energy 0.61, 0.52 and 0.47 kWh/ha, respectively. Harvesting one hectare of paddy crop manually required 213, 164 and 154 man-hours, respectively. Blade design affected labour requirement.Bora and Hansen (2007) assessed the performance of a rotary blade cutter in cutting paddy crop. It was equipped with circular disc of 25 cm diameter and powered by a gasoline engine. Average cutting capacity and fuel consumption were reported

to be 0.064 ha/h and 0.25 l/h. In comparison with sickle harvesting, it consumed 7.8 times less time.Murumkar et al. (2014) evaluated the performance of a self-propelled vertical conveyor reaper (VCR) in paddy crop. They operated a model "VCR KAMCO KR 120" which had 1.20 m working width and was fitted with a 2.6 kW engine. At an average forward speed of 3 km/h, actual field capacity and fuel consumption of machine were 0.28 ha/h and 0.8 l/h, respectively. It cut the crop and laid them on the ground. Collection and bundling of the cut crop were carried out manually. Total labour required for reaper operation, manual collection and bundling were 88 man-hours per hectare. Out of this, only 3.6 man-hours per hectare (4.10 %) was used in reaper operation.

There is a shortage of labour at the peak season leading to delay in the operation. Delay in cutting the crop and delay in threshing after cutting lead to grain loss (Selvi et al., 2002). Selvi et al. (2002), reported that 1, 2, 3 and 4 weeks of delay increases the grain loss by 5.63, 8.64, 40.70 and 60.46%, respectively. Prabakar et al. (2011), reported that labour scarcity and technology deficiency can cause a reduction in productivity of rice crop up to 11.80 and 12.60%, respectively. According to them, Indian farmers are not very adaptive towards new technologies due to the high initial cost. Combine harvester can reduce dependence on labour. It accomplishes all operations- cutting, threshing, separating and cleaning at a timein a single pass. It starts the operation with the header. It guide, cut and gather the plants and transport them to the threshing cylinder (Anon., 1994). In a crop cutting machine, components are provided to guide the crop plants. These are used to perform proper collection, holding and windrowing of the crop, respectively, before, during and after cutting operations. In rotary blade cutter, a semi-cylindrical sheet is provided. In vertical conveyor reaper, the crop divider, star-wheel and lugged flat belts are provided for this purpose. The spread plants are required to be guided before feeding to the cutting and stripping units of header. In standard and stripper header combines, reel and guiding hood are provided for this purpose.

Conventional grain header

The components of a grain header are reel, cutter bar, platform and conveyor (Figure 2). The reel is equipped for gathering and guiding the plants. It bend the plants at the top, holds them for cutting and push them towards the platform after cutting. The reel lifts the lodged plants (Miu, 2015). The reel has several bars that are perpendicular to the direction of travel. These bars are arranged on a circle around a shaft and rotate along the circle. The bars are interconnected through rings of polygonal or circular shape. The rings are connected to shaft through spokes. The bars carry spikes that maintain proper inclination when rotates. They gather and hold the plants. The shaft of reel is mounted horizontally and is located above and ahead of the cutter bar. The height and forward distance of the shaft from the cutter bar shall be adjusted according to the height of the plants to be harvested. The header has a cutter bar which cut the plantsat height $h_{ct}$and the plants fall over the platform. A conveyor conveys the cut plants towards the middle from both sides of the platform. Another conveyor provided at the middle of the platform delivers the plants to the threshing cylinder (Kepner et al., 2005).

Effect of reel index on operation

The reel index is a kinematic parameter and is defined as the ratio of peripheral speed of reel tip to the forward speed of machine. This ratio decides the shape of path of the spike which affects posture of the plant and its falling tendency (Miu, 2015).

$$\lambda_r = R_r \times \omega_r / V_c \quad \ldots (2.1)$$

Where λ_r, R_r, ω_r and $V_c$are the kinematic reel index, reel radius, angular velocity of reel and forward velocity of harvester, respectively. If $\lambda_r < 1$, then the reel bar does not bend the crop towards the cutter bar, adversely, it moves the crop farther to the front side of the machine and no part of the crop will be

collected. If, $\lambda_r = 1$, then the reel does not influence the crop movement, but its striking spikes may cause shattering of grain, and if $\lambda_r > 1$, this is a condition for the reel to serve its purpose. This condition allows the uncut crop to bend towards the header platform.

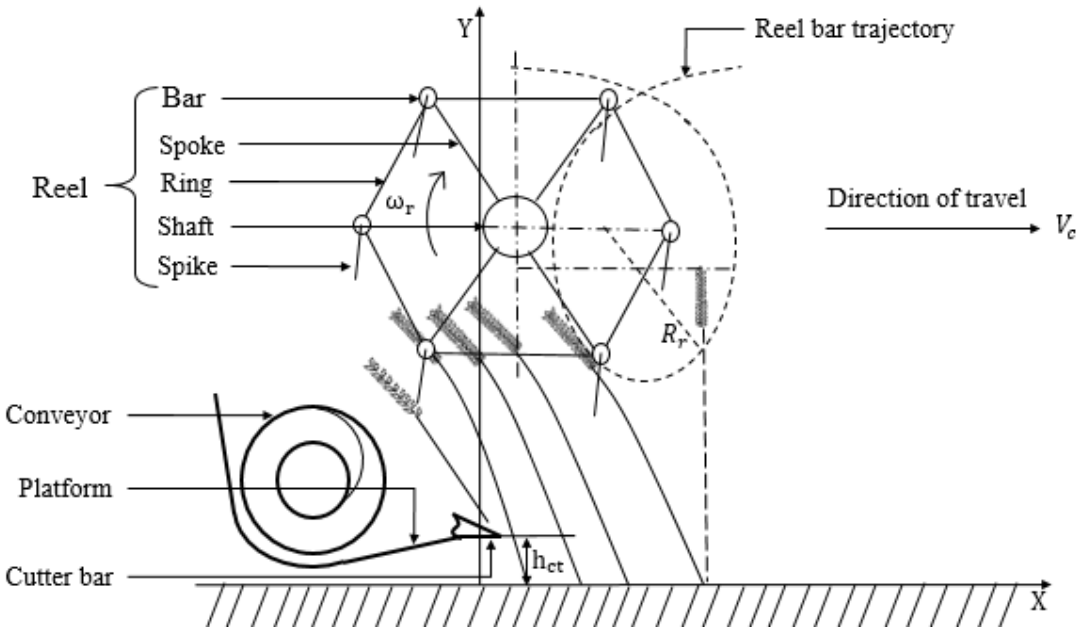

Figure 2: Schematic side view of the grain header during operation.

Pick-up reel header

The pick-up header combine is used for picking up the crop which is previously cut and windrowed in the field (Srivastava et al., 2006). It has a wide conveyor belt equipped with equidistant tines. The belt rotates on the roller in a direction perpendicular to the direction of machine travel. When the machine moves forward, the tines of the belt penetrates into the stubble and lift the swath on to the belt. The front end of the header is supported on two wheels that help to maintain the clearance against the undulated ground and ensure proper picking of the crop. The picked crop is moved towards the auger from where it is delivered to the threshing unit through another conveyor. The speeds of picking belt and feeding auger are synchronized with the forward speed of the machine. These can be varied according to the moisture content and straw length.

Stripper header

A stripper header introduced by Keith Shelbourne (Anon., 2019d) in the mid of 1980s.and first model was launched in the market in the United Kingdom in 1989 (Anon., 2019d). Within a few years till 1996, it had been exported from the United Kingdom to more than 30 countries (Tado et al., 1998). It was used to harvest up to 25% of the total paddy crop in United States, Australia and South America (Miu, 2015). The reason behind its acceptance was its higher throughput capacity at 61.2 tons/h and higher operating speed at 2.2 to 5 m/s (Kutzbach and Quick, 1999). The grain loss remained within acceptable limits. It consumed less amount of fuel compared to the standard and pick-up reel-type headers. The modificationson header were made regularly as per the need of the farmers (Peries, 1990 and Anon., 2018a).

In the very initial design, the stripper rotor first delivers the stripped ear heads to the draper belts which feed the material to the auger. Due to concerns regarding the life of draper belts, it was discontinued. In the next model, the conveyor belt was replaced by a steel shaker pan which enhanced the convenience in

the feeding of wet and heavy panicles from the stripping rotor to the auger. To improve the durability of the header, its components were made of hardened stainless steel. Later its production was stopped because it was not able to feed the crop directly to the auger conveyor. In all the previous models, the auger and rotor are kept close to each other so that the grains could be delivered directly to the auger. Later auger platform was modified by making it deeper. It was evaluated extensively on the field conditions. Thereafter, it was found that it served better in feeding than the flat one.

The stripper header consists of a hood, stripper rotor and two conveyors (Rahman, 2007). In comparison with a conventional grain header which feeds the whole plants into the threshing cylinder, it strips off the panicles only. It does not cut the plants. Schematic diagram of the stripper header is shown in Figure3. The hood (1) deflects the upper part of the plants in the forward direction through a guide nose (2). The ear heads then reach the stripper rotor (3). The stripper rotor rotates about a horizontal axis perpendicular to the direction of travel of the machine. It carries a set of fingers (4) on its periphery. Slots are provided on the stripping fingers. This is shown in an expanded view in Figure 3. The ear heads (5) are stripped from the plants by the combing action of the fingers and thrown to a platform (6). The auger conveyor (7) convey the stripped material. These are then picked by another conveyor and delivered to the cylinder. The stem portion of plant remains in field in a standing posture.

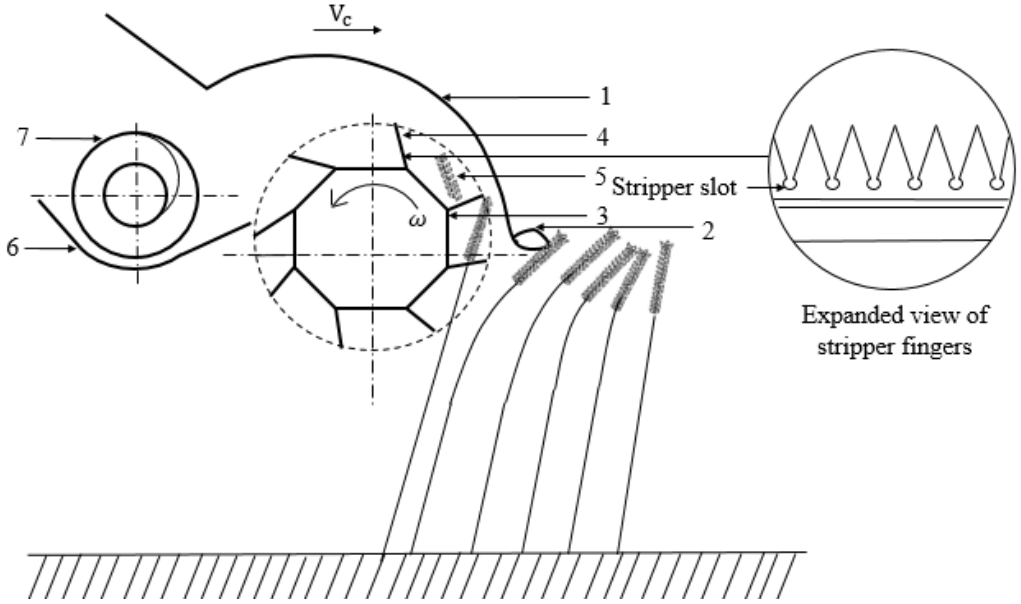

Figure3: Conceptual diagram of the stripper header.

Chowdhury (1977) proposed the design of stripper harvester that can be operated using power tiller and thresh only the ear heads in the field itself. A technique of a differential impact action of the stripping spikes was suggested. The crop row was passed through the gap between units composed of two shafts mounted parallel at a distance. The shafts were equipped with stripping fingers and rotates about vertical axis for stripping the ear heads. This design was proposed for the crop that remains in standing posture and had limitations for the lodged crop.

The main purpose of stripper header combine is to strip only the panicles from the plants for reducing the high feed rate. Before it was tried, the cutter bar of some conventional harvesters was raised and tried. The throughput capacity increased with a decrease in energy consumption. Klinner et al. (1987) justified the increase in height of the cutter bar. They operated the conventional harvester keeping the cutter bar as high as possible and found that the grain throughput capacity could be increased by 50 to more than 100%. It

indicated that the work rate of the harvester depended on straw throughput rate. The conventional header could be replaced by a stripper header. Also, the ear heads could be transported after stripping for threshing at a different location. These reduce the straw intake and energy consumption per unit grain throughput considerably. The Silsoe Research Institute, UK developed a stripper harvester and evaluated its performance. They reported that the stripper header increased the capacity of the harvester by 50-100% while power consumption decreased (Miu, 2015). Progressively the concept of stripper grain harvester came into existence.

Effect of stripper index on operation

The stripper index is given by an expression given in Eq. 2.1 (Yuan and Lan, 2007 and Miu, 2015).

$$\lambda_s = \frac{R_s \omega_s}{V_c} \quad \ldots (2.2)$$

Where, λ_s, R_s, ω_s and $V_c$are the stripper index, radius of the stripper rotor, angular velocity of the stripper rotor and forward velocity of combine harvester, respectively. The stripper index value influences the grain loss by stripper rotor if $\lambda_s \leq 1$, the rotor does not strip the ear heads of the plant, but deflect them in the forward direction and if $\lambda_s > 1$, this is the condition at which stripper finger of the rotor strips the panicles.

Losses associated with header

To achieve higher throughput capacity, there is a need to operate the combine at a higher forward speed with low straw intake. The straw intake can be minimized by increasing the cutter bar height which depends on the crop variety. According to different researchers, the height of paddy plants ranges from 47 to 182 cm for different varieties. The speeds of reel and cutter bar are synchronized with the forward speed. When forward speed increases, speed of reel and cutter bar was also increased. An increase in reel speed increases grain loss due to shattering. This was found in an experiment carried out by Goss et al. (1958) and Wilkinson and Braumbeck (1977) during harvesting of barley crop. They varied reel index and determined the grain loss. The X value in (X, Y) notation shown in Figure 4 represents the horizontal distance in centimeter of the spike tip at its lowest position from cutter bar tip. The Y value represents vertical distance of tip at the same position.Goss et al. (1958) operated a combine harvester in an upright crop with fixed bat reel which was 24 cm ahead and 15 cm above the knife bar. They observed that the variation in reel index from 1.25 to 2.80 resulted in an increase in loss from 3 to 6%. When operated with fixed bat reel and with pick-up reel in upright and in lodged crop conditions the reel index varied from 1.25 to 2.80 at various reel locations alsoshown in Figure4. It was reported in their study that the grain loss increased from 4 to 8% and 3.2 to 8%, respectively in fixed bat and pick-up reel when the reel index increased from 1.25 to 2.80 for the upright crop. In the case of the lodged crop, the grain loss increased from 0.6 to 4% and 1.4 to 2% in fixed bat and pickup reel, respectively. This shows that the cutter bar loss was least at the reel index value of 1.25 for lodged and upright crop.

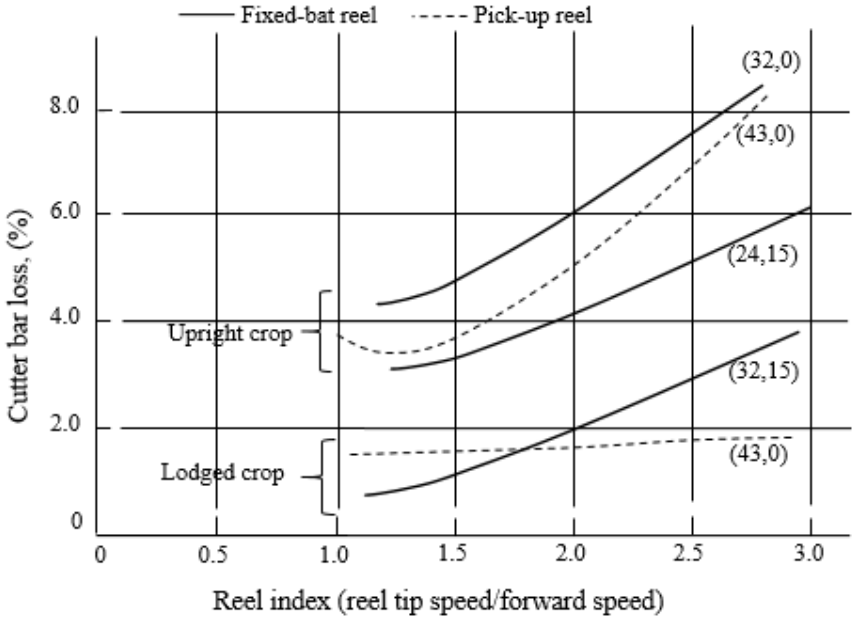

Figure 4: Losses associated with reel adjustment in reel header combine harvester (Wilkinson and Braumbeck, 1977)

The conventional and stripper headers are capable of harvesting the moist crop which reduces the possibilities of grain loss due to shattering (Anon., 2013). The load on the threshing system can be reduced by reducing the straw intake by raising the cutter bar in the conventional header while in the case of stripper rotor the load is minimized by feeding only the panicles (Yuan and Lan, 2007 and Chegini, 2013). In case of undulated fields, the reel and cutter bar need to be raised to reduce damage of the knife, while in case of stripper header, the field undulation does not affect the header. The pickup reel header works effectively in case of lodged or windrowed crop conditions (Srivastava et al., 2006). The grain loss occurs due to shattering when the rotating reel strikes the ear heads of the crop. Moreover, the vibratory action of the cutter bar may also cause shattering loss (Hunt, 2008). Above this range, the cutter bar requires more power to cut the plants and more load is experienced by the threshing cylinder (Miu, 2015). It consists of many moving components which include reel (or stripper rotor), cutter bar, auger and conveyor. These components consume a significant amount of power to deliver the crop into thresher (Kalsirisilp and Singh, 2001).The standard reel header and stripper header are less efficient for harvesting of lodged crop compared to the pick-up reel header. In the standard header, the shattering of grain occurs during lifting of the lodged crop by the reel (Hunt, 2008), whereas, in a stripper header the grain loss increases due to poor stripping of the panicles. The straw portion of the crop is left in the field in standing condition after stripping of the panicles. However, in the standard and pickup reel header the straw portion is cut and collected (Kalsirisilp and Singh, 2001).

SUMMARY AND CONCLUSIONS

The manual crop cutting requires about 8 to 12 and 25 to 45 times, respectively more man-hour per hectare compared to rotary blade cutter and vertical conveyor reaper. It is more time-consuming and costlier than mechanized methods. In harvesters, the crop guides are provided for directing the crop before or during the cutting and stripping operation. The height of guiding units i.e. reel and guiding nose depends on the height of the plants. According to different researchers, the height of paddy plants ranges from 47 to 182 cm for different varieties. Grains are distributed along the height of the plant starting from

a minimum height and up to the tip of the plant.The field capacity of manual harvesting methods is 4 to 10 times less than the mechanized methods. The grain throughput rate of conventional combine harvester can be increased by reducing the straw intake by increasing the cutter bar height.

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A review on harvesting and threshing methods for paddy crop - II

Shekhar Kumar Sahu[1]

[1]*Assistant Professor, Farm Machinery and Power, SoABE, Centurion University of Technology and management, Odisha, India*
E-mail: shekharsahu6789@gmail.com

ABSTRACT

Threshing of paddy crop can be carried out using manual, animal or mechanized power sources depends on the farmland size. In a thresher, rasp bar, spike tooth, peg tooth and wire-loop type threshing elements can be fitted with the threshing cylinder irrespective of direction of crop feed and flow. Different elements are responsible to thresh the crop with different actions which include impact, rubbing, combing, squeezing and their combination. In paddy threshing, removal of hull is not required which determines the selection of threshing elements and thus the threshing efficiency, energy consumption and grain loss. The wire loop type threshing element was reported most suitable for paddy threshing. Factors like cylinder speed, cylinder type and diameter, concave clearance and throughput rate affect the threshing performance. A low speed of cylinder produces more un-threshed grains. It can be compensated using for axial flow thresher as it has high crop retention period. Contrarily, a high speed is responsible for better threshing efficiency along with the more grain breakage and energy consumption. Using tangential flow thresher crop retention period can be minimized. The work rate of pedal and power thresher was, respectively 2 and 10 times more than that of manual threshing.

KEYWORDS: Energy consumption, Grain loss, Threshing element, Threshing efficiency.

INTRODUCTION

Reaping and threshing of the crop are two most important operations which determine the percentage of grain recovery from the crop standing in the field. It requires appropriate mechanization to produce efficient threshing with minimum grain loss. In India, threshing of paddy crop is carried out through various methods. Other than the threshing efficiency ofmanual and mechanized methods, the throughput capacity is a major concern which can be achieved only using power-operated threshers. The methods adopted for paddy threshing is largely dependent on the field size.Unavailability of proper size machines in peak season leads to increase in time requirement and input cost. Small scale combine harvester is not very popular in India because its cost is not affordable for small farmers. The paddy thresher may be equipped with different types of threshing elements. In this study, the performance of different types of threshing methods, threshing elements that are used in paddy thresher and the factor that affects the threshing performance are reviewed and discussed.

Threshing is the process of separation of grains from the crop. It involves impact, rubbing, squeezing, combing or a combination of these actions (Reddi, 1970 and Miu 2015). In ancient days, paddy threshing was carried out manually by beating the plants on a wooden plank or beating by stick after laying them on the ground (Anon., 1986). Animal treading was also used. In this method, the plants were spread on the floor and the farm animals walked over them. Threshing took place by the force appliedthrough animal's feet. The production rate of manual and animal power source was very low. To increase the work capacity, mechanical method was introduced. According to Smith (1929) and Hunt (2008), a thresher has two main components - a threshing cylinder and a concave. Kanafojski and Karwowski (1976) stated that the thresher was invented in 1785 by Mr Andrew Meikle who was a Scottish mechanical engineer. It had a drum of diameter 25 cm. Four rasp bars were mounted on its periphery. The cylinder could be rotated at a peripheral speed of 4 to 6 m/s using wind power, horsepower or steam power. Later a pedal-operated mechanical thresher was introduced. It had a cylinder that carried a set of threshing elements. A pedal-operated mechanism was used to rotate the cylinder (Chakraverty et al., 2003). The grain bearing portion of the crop was placed over the cylinder and the plants were held in hands at one end. Sketch of a thresher is shown in Figure 1.

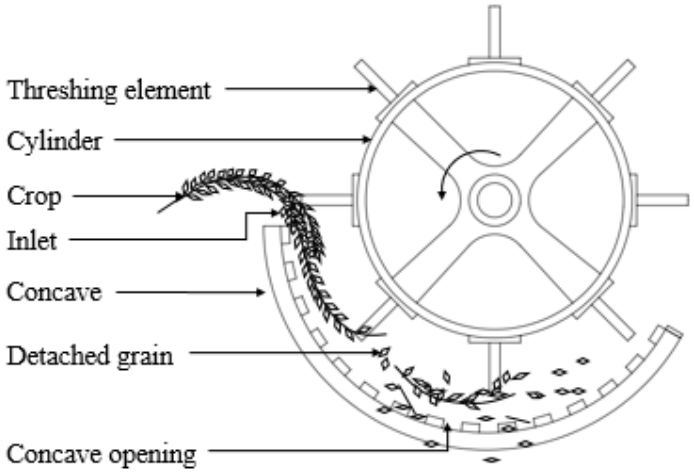
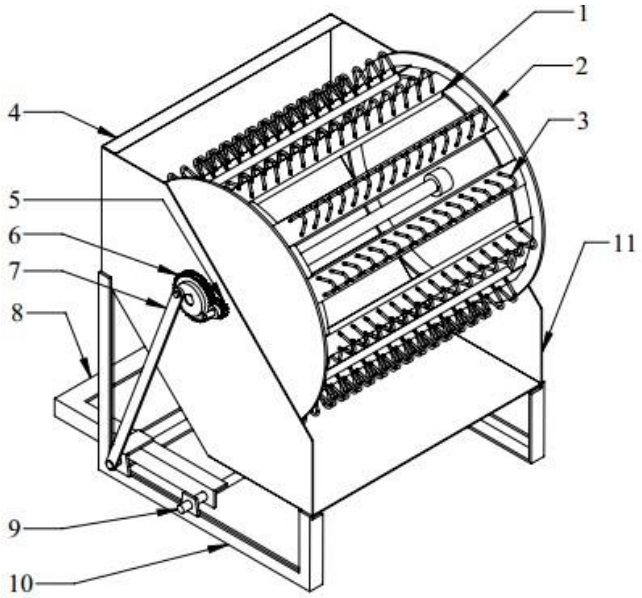


Figure 1: A conceptual diagram of tangential feeding of crop in a thresher.

The threshing cylinder is made of a set of bars arranged on its circumference, rings, hubs, spokes, shaft and a set of threshing elements arranged on the bars. The threshing elements are considered to be a part of the threshing cylinder. The crop is fed in a direction perpendicular to the axis of the threshing cylinder. The plants enter through the inlet. The threshing element act on the plants imparting impact and rubbing. This results in separation of the grains. The concave hold the plants so that the threshing elements act on them repeatedly. The separated grains and the broken stem pass through the opening in the concave.An

ideal thresher should thresh completely at maximum throughput rate without any change in the natural size and shape of the grain. There should be minimum grain loss and quality of grain should be preserved (Miu, 2015 and Anon., 2008).

The threshing efficiency and capacity significantly vary according to the type of thresher (Devnani and Ojha, 2016 and Singh, 2016). Based on the type of power source, the paddy thresher can be classified as manually operated, animal operated and power operated (Anon., 1982 and Anon., 1985). Example of a manually and animal power operated thresher are pedal-operated thresher and olpad thresher, respectively. The power-operated threshers are driven by a tractor, power tiller, stationary engine or an electrical motor. In pedal-operated paddy thresher, the crop is held in hand. Ear-head portion of the crop is placed over the threshing cylinder. The cylinder is rotated by a pedal-operated mechanism (Chakraverty et al., 2003 and Agrawal et al., 2012). Pinion gear, crank gear, connecting rod and pedal form parts of the mechanism. The thresher is illustrated in Figure2. The pedaling action is converted into the rotary motion of the cylinder using a crank- follower mechanism.



1. Threshing cylinder
2. Cylinder end disc
3. Threshing element
4. Hand support
5. Pinion gear
6. Crank gear
7. Connecting rod
8. Pedal
9. Pedal shaft
10. Frame
11. Side casing

Figure2: Schematic diagram of a pedal-operated paddy thresher

The olpad thresher is made of a set of discs fitted on shafts. Commonly a unit has three parallel shafts carrying a total of 20 number of discs. The front and the rear shafts have 7 discs each and the middle shaft has 6 discs (Devnani and Ojha, 2016). The discs are notched. The shafts are mounted on a beam through supports provided at their ends. The beam is hitched through a single point hitch. The crop is spread over the floor. The thresher is pulled over the crop by a pair of bullocks. Separation of grains occurs when the

discs press the plants due to their weight. The discs are covered from the top and a seat is provided. An operator sits over the seat and controls the movement of the bullocks (Chaudhuri and Saini, 1968). The bullocks move in a circle over the crop.

The power thresher mainly comprised threshing cylinder, concave, blower, casing, feeding chute, flywheel, straw outlet, sieves and grain and chaff outlets. Electric motor, IC engine, tractor or power tiller can be used as prime mover (Devnani and Ojha, 2016). The crop is fed to the cylinder through the feeding chute. The threshing occurs inside the chamberand threshed mixture fall through the concave opening. A fan produces a high-velocity air stream which passes over the mixture and removes the impurities due to their lightweight. Some pieces of straw residue which cannotbe blown away are separated later. The grains and finer impurities pass-through the first sieve and fall on to a second sieve kept below. The second sieve has openings of size smaller than the grain size and the finer impurities are separated. Thus the clean grains are discharged through the grain outlet (Chakraverty et al., 2003). The size of the prime mover used in power threshers varies from 3.5 to 30 kW (Pandey et al., 2013).

In a combine-harvester, the crop standing in the field is cut and then fed to a threshing cylinder (Anon., 1994). The functional components of a combine harvester are header, threshing cylinder, concave, sieve, blower, straw walker, grain storage tank and grain conveyor. The function of the header is already explained. Threshing process is similar to that of stationary power operated thresher. The grains along with the straw and chaff passes through the concave after threshing and fall over a grain pan. It oscillates and transfers the mixture to a straw walker. It is a perforated sieve. It also oscillates continuously. It passes the grain through the perforations and discharges the straw at its rear end. A blower is provided at this end for removing the chaff. Few of the grains which remain un-threshed falls over a tailing auger through an extension chaffer. This un-threshed portion is transported back to the inlet of the threshing cylinder using an elevator for threshing again (Kepner et al., 2005; Bosoi et al., 1987; Culpin, 2013 and Miu, 2015). The clean grains fall from the straw walker over a second sieve for removal of any impurities that remain. Then grains are discharged into the grain collecting tank using a grain conveyor. From the tank, the grains may be transferred to a trailer using an unloading conveyor.

Khan (1971) carried out experiments on threshing of paddy crop by manual, animal and mechanized methods. In manual methods treading under feet and beating on wooden plank were studied. It was reported that a grain throughput rate of 15 to 40 kg/h could be obtained in manual and animal threshing methods. Foot treading by man and by animal required a minimum 200 and 89 man-hours/ha, respectively. In mechanical methods, pedal threshing and threshing with combine harvester were carried out. The threshing capacity was 40 to 70 and 412 kg/h respectively in the above methods. The average

labour requirement was 128 and 12.5 man-hours/ha, respectively. Khan (1971) also stated that tractor treading also was carried out, threshing capacity was 640 kg/h and average labour requirement was 80 man-hours/ha. In case of tractor treading, it appears that the labour requirement was quite high. The crop variety threshed by the combine harvester used here was "IRRI-PAK" variety. This combine harvester was a two-row model having effective field capacity and fuel consumption of 0.08 ha/h and 2.26 l/h, respectively when operated at 0.62 km/h forward speed.

Varshney et al. (2004) reported that threshing of one-ton paddy crop by manual beating, animal trampling and tractor treading required 1.85, 17.90 and 9.90 kWh energy respectively. Threshing with power thresher required 19.75 kWh energy/ton. Singh et al. (2008) reported that the threshing capacity and threshing efficiency of a commercial model pedal-operated paddy thresher used in different crop varieties varied between 55 and 63 kg/h and between 97 and 99 % respectively. Agrawal et al. (2008) reported that the power requirement and energy consumption of the pedal-operated thresher were 35.2 W and 0.78 KWh/ton of crop, respectively when operated at a peripheral speed of 6.2 m/s and a feed rate of 45.1 kg/h. Amponsah et al. (2017) compared manual and mechanical methods of threshing on Amankwati paddy variety. In the manual method, the crop was threshed by impacting its panicles on a wooden box. The average output capacity was 64.9 kg/h with an average energy consumption of 12.85 kWh/ton of grain. In mechanical threshing method, a commercial model power thresher model "Yanmar DB 1000" fitted with a 4 kW diesel engine was used. Diameter and length of its threshing cylinder were 500 and 1000 mm, respectively. The cylinder was operated at speeds of 200, 400 and 600 rpm. At recommended cylinder speed and feed rate of 600 rpm and 400 kg/h, respectively, the output capacity, threshing efficiency, grain loss, and energy consumption were 158.4 kg/h, 95 %, 5.86 % and 4.16 kWh/ton of grain.

Harvesting of paddy with combine harvester

Kalsirisilp and Singh (2001) used a stripper header combine for harvesting paddy variety SP-60 at straw and grain moisture content of 69 and 20% respectively. Diameter and length of the stripper rotor were 540 and 3000 mm respectively. It was reported that average effective field capacity, field efficiency, threshing capacity, grain loss and fuel consumption were 0.66 ha/h, 74 %, 3.64 ton/h, 4% and 15.9 l/ha, respectively. Average forward speed of machine was 5.5 km/h and speed of stripper rotor was 600 rpm. It was also reported that the power consumed in stripping the panicles by the stripper rotor, threshing, traction and transmission loss was 17.2 (29%), 11.6 (20%), 23 (39%) and 7.2 kW (12%), respectively.

Alizadeh and Allameh (2013) compared work rate of manual method with mechanical methods of harvesting paddy crop variety Fadjr. Sickle was used for manual harvesting. Reaper, head-feed rice combine and standard header combine harvesters were used in mechanical harvesting. Their working width was 1.2, 1.4 and 2.38 m respectively. The engine size was 3.7, 35.8, and 56 kW, respectively. It was reported that the field capacity in manual harvesting was 0.009 ha/h and in mechanical harvesting 0.240, 0.303 and 0.254 ha/h respectively with the above methods. Therefore, the work rate of manual harvesting was about 27, 34 and 28 times lower than that of reaper, head-feed and standard header combine harvesters, respectively. Hossain et al. (2015) used combine harvesters of different configuration and compared standard a header combine with two models of head-feed combines of different capacities. Cutter bar width of standard header, head-feed combine-I and head-feed combine-II was 2.60, 1.44, and 2.0 m, respectively and their engine power was 44.8, 37.3and 26.1kW, respectively. Their average operating speed was 3.00, 2.65 and 1.75 km/h, respectively. Correspondingly, the effective field capacity was 0.62, 0.30 and 0.26 ha/h and harvesting efficiency was 97.65, 96.43 and 96.78%, respectively. Total grain loss was 4.42, 4.63 and 4.38% and fuel consumption was 18.5, 18.5 and 15.0 l/ha, respectively. After harvesting with the head-feed combines, straw was left out in the field. The higher field capacity of standard combine was due to larger cutter bar width and higher operating speed. Its field capacity was twice that of the head-feed combine. They had nearly the same fuel consumption per hectare.

Amponsah et al. (2017) evaluated performance of a mini combine harvester Model 4LZ-1.0 fitted with a 16 kW diesel engine and having 1360 mm cutter bar width. Paddy crop varieties IR841 and Nerica L20 were harvested. The harvesting capacity was reported to be in the range of 0.10 to 0.39 ha/h at forward speed in the range of 2.1 to 4.46 km/h irrespective of the crop variety. The grain throughput rate was 350 to 1515 kg/h and 500 to 3160 kg/h, respectively for crop varieties IR841 and Nerica L20. Fuel consumption was 9.05 down to 7.13 l/ha irrespective of crop variety. Effect of crop variety on fuel consumption was not reported.

From the review, it can be said that in a combine harvester, the field capacity can be increased by increasing the forward speed. Throughput rate can be increased by reducing the straw feed rate. The power and energy consumption in threshing can be minimized by minimizing the straw intake.The performance of different methods of crop cutting and threshing are summarized as given in Table 1.

Table 1: Performance parameters in different methods of threshing and harvesting. (Khan, 1971; Bora and Hansen, 2007; Murumkar et al., 2014; Varshney et al., 2004; Kalsirisilp and Singh, 2001; Alizadeh and Allameh, 2013 and Hossain et al., 2015).

S. no.	Operation	Field capacity	Grain throughput rate (kg/h)	Fuel consumption (l/h)	Energy consumption (kWh/ton	Efficiency (%)	Grain loss (%)	Labor requirement (Man-hour/

		(ha/h)			of crop)			ha)
1.	**Crop cutting**							
a)	Sickle	0.006 – 0.012	NA	NA	2.5–3.05	98.10	3.2	80 – 160
b)	Rotary blade cutter	0.064	NA	0.25	–	–	2.3	16
c)	VCR	0.28	NA	0.80	–	–	1.05	3.6
2.	**Crop collecting + bundling + transportation**							
a)	Manually	0.0125– 0.025	NA	NA	–	NA	2-4	40-80
3.	**Threshing**							
a)	Manual treading	NA	15	NA	12.85	–	4.50	200
b)	Hand beating	NA	64.9	NA	1.85	91.67	4.35– 8.46	80 (16/ton)
c)	Animal treading	NA	40	NA	17.90	–	6.20	89
d)	Pedal thresher	NA	40–70	NA	0.78	97–99	1–3	100–128
e)	Tractor treading	NA	640	–	19.75	–	7.0	80
f)	Power thresher	NA	158.4-1000	NA	4.16–9.90	96.30– 99.75	1.28– 5.95	10–25
4.	**Combine-harvester**							
a)	Mini	0.10– 0.39	1515	11.0	–	98.18	4.4-5.6	7.69
b)	Japanese two row	0.08	412	2.26	–	98.50	6.08	12.5
c)	Head-feed	0.26– 0.30	1450	15-18.5	–	96.95	4.48	5.28–7.52
d)	Standard reel header	0.62	2480	18.5	–	97.65	4.42	2.2–4.4
e)	Stripper header	0.66	3640	15.9	7.91	98.05	4.00	7.6

Threshing element

The threshing element plays an important role in threshing performance. Different types of threshing elements that can be used in paddy thresher were studied. When the cylinder rotates, the threshing elements strike the crop and transfers an impact force to various parts of the plant. Due to the impact, the grain gets separated from the pedicel of the plants. Different types of threshing element are used in various crops. Rasp bar, spike tooth, peg tooth, and wire-loop type are described by Kanafojski and Karwowski, (1976); Kepner et al. (2005) and Srivastava et al. (2006). Sketches of these elements are given in Figure 3.

Rasp bar

A rasp bar threshing element is made by preparing corrugations on the surface of a flat bar. The corrugation makes an angle with the longitudinal axis of the bar as shown in Figure 3(a). It is used for a wide variety of cereal and pulse crops (Pierre, 1979 and Chakraverty et al., 2003). Threshing occurs mainly due to rubbing of the plants between surfaces of the rasp bar and concave and transfer of very little impact force (Kanafojski and Karwowski, 1976; Singh 2016; and Fu et al., 2018). Due to inclination of the corrugation, the plants tend to move towards one side of the bar. To reduce the accumulation due to this movement, the adjacent bars are provided with inclination in opposite directions. The breakage of straw is less due to its shape and the power requirement is also less (Anon., 2019a). The demerit is its low threshing efficiency with moist and long-stemmed plants (Bosoi et al., 1987). This type of threshing element is generally used in tangential flow threshers.

Spike tooth

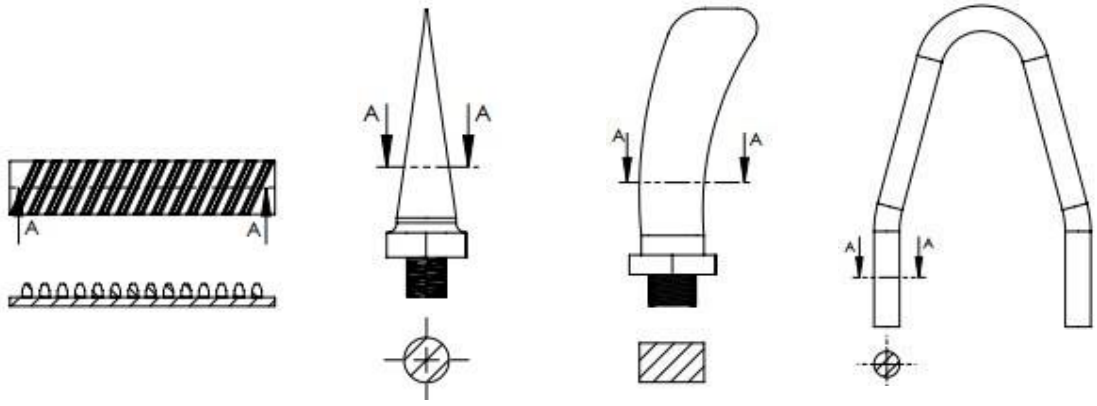
The spike tooth threshing element is an impact type threshing element (Fu et al., 2018). Threshing occurs when the tooth makes an impact on the grains. Combing also thresh up to some extent. The surface of the tooth which strikes the plant is curved (Figure 3b) like the curve on a cone. It makes a smooth and gradual penetration into the plant layers. The gradual curvature is responsible for reducing the magnitude of impact force (Kanafojski and Karwowski, 1976). It is used mainly in wheat and paddy crops (Majumdar, 1985).

Peg tooth

Peg tooth type threshing element is made of bars having either rectangular or circular cross-section. A rectangular cross-section type element is shown in Figure 3(c). Its striking surface has a larger contact area compared to the spike tooth type which helps in breaking of the pods or cobs of the crop by impact, crushing and squeezing. It is an impact type of threshing element.

Wire-loop

In wire-loop type threshing element separation of grains occurs mainly due to impact and combing actions rather than the rubbing action (Chakraverty et al., 2003). It has an inverted V-shape (Figure 3d). It is used commonly in paddy crop. Indian Standard Specification for Pedal Operated Paddy Thresher (Anon., 1982) recommends following specifications. The diameter of the wire should not be less than 3 mm. Distance between the legs should be between 25 and 32 mm. The vertical distance between its tip and the mounting surface known as the height of the threshing element should be about 50 mm. The lateral spacing between two threshing elements on a bar should be in the range of 50 to 70 mm. The elements should be arranged on adjacent bars in a staggered pattern. It is primarily meant for threshing paddy crop.



(a) Rasp bar (b) Spike tooth (c) Peg tooth (d) Wire loop

Figure 3: Schematic view of different types of threshing elements

Submergence in the crop layers is more in peg tooth, spike tooth and wire-loop type threshing elements than in the rasp bar type because of their geometry and spacing. The rasp element has poor penetration in crop layer and the bar slips when it comes in contact with the crop (Kanafojski and Karwowski, 1976). For the same reason, these elements work well in the moist crop conditions also. However, breakage of the straw is also more which increases the load on the cleaning units. Breakage of straw is not required in paddy crop, therefore, peg tooth type element is not used frequently in paddy thresher (Bosoi et al., 1987). The choice of the threshing element depends on the crop to be threshed. The spike tooth threshing element is also used for paddy. Due to its conical tip, the breakage of straw will be more which is not desirable for the paddy crop. The peg tooth experiences more thrust force compared to rasp bar, spike tooth and wire-loop type threshing element. This is because the striking surface of peg tooth is rectangular which has more contact surface area than the circular one. The peg tooth threshing element is used less commonly for the paddy crop. The breakage of grains and straw is more with spike tooth and peg tooth type threshing elements compared to the other two (Majumdar, 1985; Sudajan et al., 2002 andYaoming et al., 2008).On the other hand, a wire-loop type threshing element has less weight and less frontal area and hence the probability of breakage of grains and straw is less. The lightweight element is responsible for low momentum transferred to the crop. These elements are arranged on the threshing cylinder and allow feeding of crop in different and methods.

Movement of crop during threshing

According to the method of feeding the thresher has been classified into two types (Chakraverty et al., 2003; Devnani and Ojha, 2016, Fu et al., 2018 and Anon., 2019b) – throw-in type and hold-on type. In the throw-in type thresher, the whole crop is fed into the thresher through a feeding chute. Depending on the

movement of the crop inside the thresher, this is further divided into tangential and axial flow types (Singh, 2016).

Tangential-flow thresher

In a tangential flow thresher, the crop is fed from one side of the cylinder and the crop moves in a direction tangential to the cylinder and perpendicular to its axis (Miu, 2015 and Fu et al., 2018). This is illustrated in Figure1 earlier. In this arrangement, the crop passes through the space between the cylinder and concave only once (Khan, 1986). Therefore, the time available for separation of grains is less. To overcome poor separation, the cylinder speed is increased which increase the impact force and the frequency of hitting resulting in good separation. Consequently, the grain damage increases and fragmentation of the straw and leaves increases. Consequently, more amount of straw and leaves pass through the concave perforations. These mix with the grains and increases the load on the cleaning units. The power requirement increases. It is used mostly for the crops in which the straw breakage is considered to be advantageous (Singh, 2016).

Axial-flow thresher

In an axial flow thresher, the movement of the crop occurs in a helical path while being threshed. However, the feeding can be kept tangential or axial. The threshing elements are arranged on the cylinder in a helical path (Khan, 1986). This is shown in Figure 4. Movement of the crop takes place parallel to the axis of the cylinder in addition to its movement in tangential direction (Keller, 1969 and Fu et al., 2018). The retention time of the crop in the thresher is increased which gives ample time for detachment of the grains. A lower speed of the cylinder may be sufficient to give full separation. Damage to the grains is also less. It does not cause excessive breakage of the straw and is suitable for paddy crop (Singh, 2016). In this type of thresher, the straw comes out from one end of the cylinder after separation. In a hold-on type thresher, only the panicles or ear-heads portion is fed inside the thresher.A pedal-operated paddy thresher is an example of hold-on type thresher.

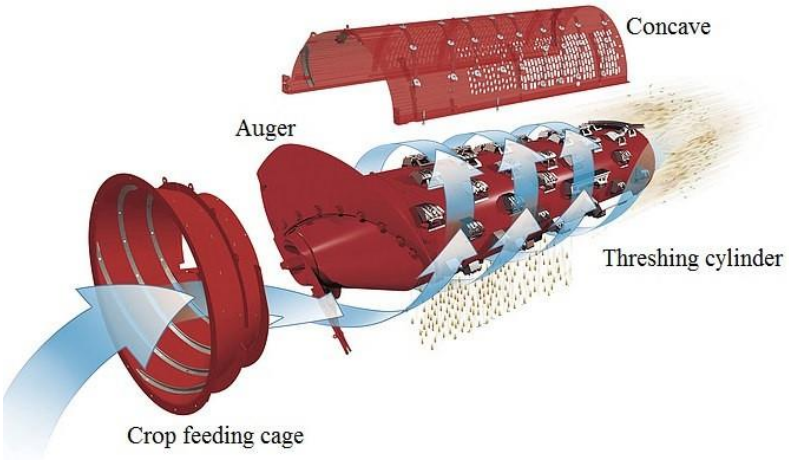


Figure 4: Movement of crop in a helical path in an axial flow thresher (Fu et al., 2018)

Thresher performance parameters

The parameters that affect performance of a thresher are grouped as machine parameters, crop parameters and operational parameters.

Machine parameters

Type and spacing of threshing element

Sarwar and Khan (1987) conducted a comparative study of the performance of paddy threshers fitted with the rasp bar and wire loop threshing elements. They found that the rasp bar cylinder produced more un-threshed as well as damaged grains than the wire loop. They also reported that at a constant peripheral speed of 22.35 m/s and at a low concave clearance the percentage of damaged grain was seven times more in the rasp-bar cylinder than in the wire loop cylinder. Dutt (1993) carried out a comparative study on different types of threshing elements on two varieties of gram crop, B-108 and Vijaya. Three types of threshing elements were used, rasp bar, plastic-covered peg tooth type and plastic covered wire-loop type, at five levels of peripheral speed, 9.43, 10.78, 12.13, 13.48 and 14.83 m/s; three levels of concave clearance, 10, 12.5 and 15 mm and five levels of crop feed speed, 0.044, 0.088, 0.133, 0.177 and 0.222 m/s. The threshing efficiencies were 80.02, 72.50 and 75.25%, and percentage of damaged grains were 3.99, 6.40 and 5.71%, respectively with the rasp bar, peg tooth and wire loop threshing elements at mid-levels of cylinder speed, concave clearance and crop feeding speed for B-108 crop variety. In identical operating conditions, the threshing efficiencies were 79.76, 75.25 and 77.85% and percentage of damaged grains were 5.40, 7.30 and 7.0%, respectively for Vijaya crop variety. Lohan et al., (2007) compared the performance of the thresher with a hammer, spike tooth and rasp bar type threshing elements. Pigeon pea

crop was threshed at different combinations of the speed of threshing cylinder of 400, 450 and 500 rpm and concave clearance of 5, 10 and 15mm. Threshing efficiency was a maximum of 99.02% for the cylinder equipped with spike tooth threshing element. It decreased with decrease in speed and increased with increase in concave clearance. They reported that the damage of grain was a maximum of 16.54% with hammer mill cylinder at speed and concave clearance of 500 rpm and 5 mm, respectively. Minimum damage of 3.5% was with rasp bar threshing element at a cylinder speed of 400 rpm and 15 mm concave clearance.

Singh et al. (2008) investigated the effect of spacing between threshing elements on the performance of a pedal-operated paddy thresher. They varied the spacing from 35 to 45 mm at an interval of 2.5 mm. They reported that at a cylinder peripheral speed of 7.32 m/s the threshing capacity and threshing efficiency were increased with increase in spacing up to 40 mm and thereafter it decreased.Khayer et al. (2019) carried out experiments on threshing of paddy crop. They varied tooth spacing in the bar, spacing between the bars fitted on the cylinder, height of teeth, and cylinder speed. Each variable was varied in three levels. The wire-loop element spacing was 35, 45 and 55 mm; height was 40, 50 and 60 mm, and cylinder speed was 300, 400 and 500 rpm. Spacing between the bars was changed by varying the number of bars fitted on the cylinder which was 12, 13 and 14. The experiment was designed with response surface methodology. They reported that there was a significant effect of element spacing and element height on threshing capacity. At cylinder speed of 400 rpm, it was reported to be more than 52 kg/h at 35 mm spacing and then increased marginally at about 40 mm and then again decreased at 55 mm.

From the above-discussed finding, it can be concluded that the types and spacing of threshing element affect the performance of thresher. The hammer mill and rasp bar are responsible for most and least damage of grains, respectively. Spacing below or near to 40 mm gives more threshing efficiency and capacity for the pedal-operated thresher. The less number of impact per unit length of bar could be the possible reason for greater spacing. On the other hand, improper penetration and poor combing could be the reason for low spacing.

Diameter of threshing cylinder

Abich et al. (2017) examined the effect of cylinder diameter and cylinder speed on the performance of a sorghum thresher. They used threshing cylinders of 200, 300 and 400 mm diameter and carried out threshing at 8, 10 and 12 m/s peripheral speed. The threshing cylinder was equipped with peg tooth type threshing element. The diameter of the threshing cylinder was varied by using the pegs of different length. They observed that the threshing efficiency increased with increase in the cylinder diameter at all levels of peripheral speed. The cylinder diameter and speed significantly affected threshing efficiency. The

percentage of grain damage increased with increase in the cylinder diameter at all peripheral speeds. The cylinder diameter and the cylinder speed significantly affected the grain damage. There was a significant effect of cylinder diameter and cylinder speed on the throughput per unit power consumption. It was minimum at 300 mm diameter mainly because the detachment of grains was greater due to the increased height of peg. At 200 mm diameter, the throughput was low due to less detachment of grains. At 400 mm diameter, the throughput per unit power consumption was less because the power consumption was affected by the weight of the cylinder.

Concave clearance

Physical dimensions of the grain affect the concave clearance and its grate size. Vas and Harrison (1969) investigated the grain damage and 'threshability' of wheat crop in a stationary thresher. They took three levels of concave clearance i.e. 6.35, 12.70 and 19.05 mm and operated the threshing cylinder at five levels of peripheral speed i.e. 22, 25, 28, 31 and 34 m/s, respectively. They found that the grain damage was a minimum 5% and maximum 8% at concave clearance of 19.05 and 6.35 mm, respectively at all levels of cylinder speed. The low clearance cause thin crop bed therefore, cushioning reduces and direct impact of element increase breakage and vice versa is also true.

Method of threshing

Alizadeh and Bagheri (2009) investigated the effect of threshing methods on two varieties of paddy crop (Hashemi and Khazer). Four methods of threshing were used. In the first method (T_1), a power tiller operated cross flow thresher having wire-loop type threshing element was used. The diameter and peripheral speed of cylinder were 490 mm and 15.40 m/s, respectively. In the second method (T_2), a tractor operated axial-flow thresher having spike tooth type threshing element was used. The diameter and peripheral speed were 400 mm and 13.13 m/s, respectively. In the third method (T_3), a tractor operated cross-flow thresher having spike tooth type threshing element was used. The diameter and peripheral speed were 580 mm and 19.60 m/s, respectively. In the fourth method (T_4), the threshing unit of a combine harvester having spike tooth type threshing element was used. The diameter and peripheral speed of cylinder were 600 mm and 19.60 m/s, respectively. They reported that with the above input parameters, the threshing efficiency was 99.56, 99.52, 99.46 and 99.42% and shattering loss was 0.46, 0.62, 0.52 and 0.57% for the above four methods, respectively with Hashemi variety. The broken and hulled grain losses were affected significantly by the type of threshing method. Minimum loss of 0.98% was found with treatment T_1 and maximum loss of 2.82% was found with treatment T_4. There was hardly any significant difference between the methods in Khazer variety. However, significant effects were reported on grain

loss due to shattering and on damage to the grain. Shattering loss was 0.43, 0.56, 0.54 and 0.52% and grain damage was 0.83, 1.80, 2.57 and 3.14%, respectively with the above four methods.

Based on the above explanation, it can be concluded that there was a significant effect of threshing methods on threshing efficiency and grain loss. The grain loss was reported more in the thresher which was operated at higher cylinder speed and equipped with spike tooth type threshing elements. The grain loss was reported to be low for the thresher in which wire-loop type threshing elements were used.

Crop parameters

Moisture content

It has been reported in many studies that the threshing efficiency and breakage of grain decreases with the increase in moisture content whereas the power consumption increases (Singh and Singh, 1981; Vejasit and Salokhe, 2004; Alizadeh and Khodabakhshipour, 2010 and Osueke, 2014). Singh and Singh (1981) investigated the effect of moisture of soybean crop on the threshing efficiency and seed loss. They selected two varieties of soybean crop Ankur and PK 71-21 and carried out threshing at cylinder peripheral speeds of 8.2, 11 and 13.7 m/s. They observed that the threshing efficiency decreased with increase in moisture content for the range of cylinder speed tried. The percentage of damaged seed decreased with an increase in moisture for both the varieties. Amount of un-threshed seed and power requirement during threshing was less if the crop is dry but the percentage of damaged grain increases. The dried grains are more susceptible to damage as their elasticity is reduced (Kanafojski and Karwowski, 1976). The power requirement for breakage of the straw also decreased because the strength of dried straw is less. It is recommended by the Indian StandardIS: 8122 (Part 1) (Anon., 1994) that the ranges of moisture content for the paddy grain and straw should be from 10 to 25% and 20 to 70%, respectively when it is harvested using a combine harvester.

Amount of non-grain materials in the crop

It has been reported by several researchers (Price, 1993; Chinsuwan, 2010; Sangwijit and Chinsuwan, 2010, and Olaye et al., 2016) that the amount of non-grain materials which includes straw, chaff and leaves substantially affects the functioning of a thresher. It is obvious that longer the straw higher is the ratio of MOG to the grain. Relative increase of the amount of straw causes formation of a thick bed between the cylinder and the concave. It reduces the movement of the separated grains. In addition, it creates a cushioning which decreases the effect of the impact force of the threshing elements on the crop. Therefore, threshing efficiency reduces.Price (1993) conducted laboratory and field experiments on threshing of wheat and barley crops using a modified stripper combine harvester. He observed that during stripping of the ear-heads the grains got separated in the stripper rotor itself before reaching the threshing

unit. This process was termed pre-separation. To collect this separated grain, he incorporated a sieve below the conveyor augur and placed a set of trays below them. The percentage of grain separated at the stripper rotor and the thresher outlet was evaluated with pre-separator as well as without pre-separator. The grain throughput rate was 5, 10 and 15 t/h, and straw throughput rate ranged from 0 to 5 t/h.Straw intake in a stripper harvester is less when feeding only the ear-heads instead of the whole crop. In the laboratory experimentcarried out byPrice (1993), the straw to grain ratio was 0.26:1 and 0.52:1 for wheat and barley crops, respectively. Threshing efficiency and grain loss were determined. It was reported that at zero straw throughput, the threshing efficiency was low because the grain is not retained in the threshing chamber for enough time. It passed easily through the concave when impacted by the threshing elements. The efficiency was increased with increase in the straw feed rate and reported to be a maximum at 1 t/h throughput. With further increase in the straw feed rate from 1 to 5 t/h in the machine they used, the efficiency decreased. This was because the impact of the threshing element was dampened by the layer of the non-grain materials.

Operational parameters

Important machine specifications and settings are specified by the Bureau of Indian Standards in a test code IS: 8122-2000 onharvesting paddy crop by a combine harvester (Anon., 2000). It is recommended that the peripheral speed of threshing cylinder and concave clearance should be within 6 to 15 m/s and 5 to 10 mm, respectively. The range of forward speed of operation should be between 2.5 and 4.5 km/h for standing crop and 1 to 1.5 km/h in case of lodged crop. The reel index should be in the range of 1.10 to 1.15. Speed of cylinder determines the frequency of hitting and the magnitude of momentum transferred to the plant. It has been reported in numerous studies that higher the speed higher the percentage of grain separation. However, the percentage of damaged grain and power consumption increase with the increase in cylinder speed. Studies of some researchers like Kradangnga et al. (1991); Miuand Kutzbach, (2000); Sudajan et al. (2002); Vejasit and Salokhe, (2004); Osueke, (2014) and Olaye et al. (2016) confirms the above facts. Kradangnga et al. (1991) studied on threshing of paddy crop using an axial flow thresher. The thresher consisted of a cylinder fitted with spike tooth threshing elements whose diameter and the length was 49 and 122 cm, respectively. The experiment was carried out with the crop variety LuangPathan at 13.60% grain and 10.20% straw moisture content, respectively. They varied the peripheral speed from 12.83 to 20.52 m/s at constant concave clearance of 15 mm. Average threshing efficiency, cleaning efficiency and percentage of broken grain were reported as 92.68, 94.07 and 4.15, respectively at the speed of 12.83 m/s. These values were increased by 5, 1.6 and 93.37%, respectively when the speed increased to 20.52 m/s. Average grain throughput rate, power consumption and specific energy consumption

were810.70 kg/h, 3.5 kW and 4.35 kWh/ton of grain, respectively at the cylinder speed of 12.83 m/s. These values were increased by 65.77 and 118.10 and 31.29%, respectively when the crop was threshed at **20.52** m/s. Alizadeh and Khodabakhshipour (2010) investigated the interaction effect of cylinder speed and grain moisture content on damage of paddy grain in an axial flow thresher. They evaluated the performance at five different values of peripheral speed, 12.01, 14.67, 17.35, 20.01 and 22.37 m/s and three levels of grain moisture content, 17, 20 and 23% (wet basis). The percentage of broken and cracked grains increased significantly with the increase in peripheral speed at all levels of grain moisture content. The breakage of moist grains was less compared to grains having less moisture. The reason for this behavior was justified as the grain with less moisture has more plasticity and absorb less impact force.

SUMMARY AND CONCLUSIONS

Threshing capacity of pedal thresher and power operated thresher wasreported to be 2 and 10 times higher, respectively than manual threshing. However, in power thresher,energy consumption is also high. It requires 4 to 10 times less labour and produces clean grain which cannot be obtained in manual and pedal threshing. In a cereal crop thresher, different types of threshing elements are used. The wire-loop threshing element is recommended for paddy crop. The tangential flow thresher is recommended where breakage of straw is required along with threshing. A low cylinder speed is suitable of axial flow thresher because of high crop rotations period compared to tangential flow. Different researchers suggested the range of peripheral speed of threshing cylinder from 6 to 25 m/s at different values of crop moisture content and grain to straw ratio. According to various researchers, the cylinder speed and throughput rate are the most important parameters that influence the performance of a thresher.Theselection of cylinderspeed depends on the moisture content of the plant, grain to straw ratio and throughput rate. A low cylinder speed is responsible for low threshing efficiency and high speed is accountable for improved threshing efficiency, but it causes more breakage of grains and greater energy consumption.

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Essentials to improve crop genetics

Devidutta Lenka[1], Udit Nandan Mishra[2*], Chandrasekhar Sahu[2], Deepak Kandher[2]
[1]Assam Agricultural University, Jorhat, Assam, India,
[2]M S Swaminathan School of Agriculture, CUTM, Odisha, India
[*]Corresponding author: udit.nandan@cutm.ac.in

Abstract

Climatic changes along with growing population, climate resilient, high yielding and nutritious varieties are must needed to meet the future demand. Five different breeding approaches are suggested as Genome assembly, Germplasm characterization, Gene function identification, Genomic breeding (GB), and Gene editing (GE). For the identification of desirable and superior genotypes, it is necessary to carry genome assembly for every crop and germplasm characterization at agronomic and genomic levels. Plant breeding coupled with genetic diversity is key component in tackling climate changes and integration of these strategies is best way for sustainable food production.

Key words: Climate resilient, Genetic diversity, Sustainable food

INTRODUCTION

Agriculture is vulnerable towards the changing climatic conditions. Quick climate change causes adverse weather which includes floods, droughts, rise in temperature and many other disasters. Around 80% of the world's rural poor population lives in risk prone, resource poor and highly heterogeneous area typically depending on local agriculture for their life (FAO, 2019). Zhao *et al.*, (2017) predicted that yield of main crops on average will be decreased by 7.4 % in maize, 6% in wheat, 3.1% in soybean and 3.2% in rice for world mean temperature rise in each degree Celsius. The CGIAR started a "Two Degree Initiative for Food and Agriculture" which focused on giving assistance to 200 million small food producers worldwide to modify the scale and speed for current rate of climate change. To bring forth an opportunity to get climate smart results, there should be improvement in methods and practices for climate smart technologies which takes into account the progress of high yielding, climate resilient cultivars and rapid access for farmer's cultivation (Atlin *et al*.,2017). The rapid population growth along with water scarcity and climate change is a global matter of concern which aims to focus at improvement of crop for nutritional and food security (Hickey *et al*., 2019). In facing the threats, the current breeding program will not give enough improvement in yield of crop to fulfill the needs of near future.

To face the future demands, five breeding approaches have been proposed to accelerate the genetic crop improvement. Varshney *et al.* (2020) suggested five approaches as Genome assembly (for every crop species), Germplasm characterization (at agronomic and genomic stages), Gene function identification, methods for Genomic breeding and technologies for Gene editing. Therefore, these strategies will help in boosting the crop improvement.

GENOME ASSEMBLY

More than 264 genomes of plant including crops as maize, wheat, rice, sorghum, barley, groundnut, chickpea, pigeon pea, tomato, soybean and cotton have promoted de novo method through improvement in genome assembly algorithms along with NGS (next-generation sequencing. The genome assembly's quality differs from completed genomes to draft genomes but most genomes of plant are draft type genomes. In molecular breeding and trait discovery, the usefulness of assembly of genome gives an opportunity for genomic technologies and tools development Insertions, transversions, deletions, epigenetic changes, variation in copy number and SNPs are all included under genetic variation (Johannes

and Schmitz, 2019), that are used for developing SNP arrays design (Rasheed *et al*., 2017). These arrays designed can be exploited for making QTL identification and genetic maps. In breeding, haplotypes that are sequence variant information can be considered for reducing the linkage disequilibrium (Voss-Fels *et al*., 2019). Information about genome assembly is important for development of proteome maps, epigenome maps, metabolome maps and gene expression atlas. As current decrease in the sequencing cost, large number of re-sequencing projects has been started that are generating "big data" and leading to computational and storage challenges (Stephens *et al*., 2015). In advance breeding for fast use of genome sequence information, different informatics platforms are required. Genomic Open-source Breeding Informatics Initiative (GOBII), SNPSeek (for rice) and Excellence in Breeding Platform (EiB) are the available platforms important for breeders for mining haplotypes/superior alleles, therefore most desirable parental lines can be identified in a population.

GERMPLASM CHARACTERISATION

During crop domestication, genetic diversity of crops is narrowed for different traits but 'gene banks' (international and national) offers a good diverse source of alleles that is essential for further crop improvement (Smy´ kal *et al*., 2018). At specific locations in nursery and community, the phenotyping gives information to find identification of genotype X environment interaction and GWAS (genome wide association studies). Phenotype association along with entire germplasm sequencing could be a major part for breeding techniques. For breeding based on haplotypes or genomic selection, large number germplasm characterization gives information on existing of haplotypes at specific locus for a desirable trait could be used (Bevan *et al*., 2017). The NGS technology has provided information on improvement and modification of time-consuming and traditional bulked segregant analysis (Michelmore *et al*., 1991) into quick and whole genome sequencing based on high resolution trait mapping (Schlotterer *et al*., 2014). These trait mapping based on NGS is advantageous over traditional through identification of genes or by quantitative trait nucleotides (QTN) for specific character. In some cases, these QTNs change into diagnostic markers; it has a unique prediction power towards breeding approaches (Varshney *et al*., 2019).

GENE FUNCTION IDENTIFICATION

Through trait mapping and functional genomics approach, many candidate genes along with linked molecular markers for a desirable trait has been identified. The system biology study is carried out to understand the molecular interaction occurring in a biological system. It mainly aims at development of epigenome maps (Junaid *et al*., 2018; Li *et al*., 2019), metabolome maps (Chen *et al*., 2018; Zhou *et al*., 2019), proteome maps (Duncan *et al*., 2017; Barua *et al*., 2019) and gene expression atlas (Nobuta *et al*., 2007; Pazhamala *et al*., 2017; Hoopes *et al*., 2019) in several crop. When the character are found associated with specific pathways, superior alleles can be identified which will help breeders in better understanding of plant's biology for allelic and parental combination. Therefore, it will help in improvement in character in agronomic level.

GENOMIC BREEDING

Crop breeding can be promoted by genomic breeding that includes using of multiomics data, genes, knowledge as resource and technology in genomic research (Wing *et al*., 2018). Marker-assisted backcrossing (MABC), marker-assisted recurrent selection (MARS) and marker-assisted selection (MAS) are considered under genomic breeding (GB) whereas genomic selection (GS), haplotype-based breeding (HBB) and forward breeding (FB) along with speed breeding (SB) are new methods to promote precise and good genetic gain. The genomic selection method does not require markers particularly linked with character as other methods require diagnostic markers linked with genes. The introgression of few loci in improvement of cultivars MABC is used whereas, in segregating population of early generation of plants

which carry target gene/QTL then FB is used (Varshney *et al*., 2019). For 10-40 loci introgression in intercrossing elite parents to get superior lines, MARS method is used (Varshney *et al*., 2019). The idea of speed breeding was given by Watson *et al*. (2018) by providing only 2 hours of dark and 22 hours of light in plants as it shortens the generation time. SpeedGS is process of speed breeding along with genomic selection (FAO, 2019) and Haplo-GS is superior haplotypes in combination with GS for quick production of new lines in breeding.

GENE EDITING

In developing stress (biotic and abiotic) tolerance cultivars and improvement of plant performance, gene editing has turned up as a powerful tool. With the current findings of Cas9 guide RNA and accessibility to genomics data along with bioinformatics research, desirable trait are identified and considered for editing. Gene editing is being widely used for generating desirable traits in various crops as rice, maize, wheat, sugarcane and many more. Eom *et al*.(2019) developed a method to track the disease and alleles responsible for its disease virulence and resistance. There is always a doubt towards non-GMO or GMO status for germplasm in different countries (Schulman et al., 2020), hence a better exposure and legislation will allow to learn the need of this research for the farming society (Varshney *et al*., 2019). Gene editing strategy is advantageous in creating novel alleles, eliminating deleterious effect of alleles which are identified through large sequencing process (Johnsson *et al*., 2019), and editing genes associated with domestication character in wild cultivars. It is suggested 'ExpressEdit' is an approach that brings gene editing with speed breeding (FAO, 2019).

CONCLUSION

All these above approaches are used in improvement of crop in many developed countries but still such approaches are not being fully exploited in developing countries. With the recent development in phenotyping, data analysis and sequencing will give a thrust to the five different approaches in breeding program globally. In developing countries, exposures of young and emerging scientist are necessary for handling, analyzing and interpretation of large data seta from molecular biology, omics, sequencing, genotyping and phenotyping across large number of germplasm collections. These five different approaches will promote the efficiency, effectiveness and precision of breeding to develop climate resilient, nutritious and high yielding cultivars along with high genetic gain.

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Response of rice (*Oryza sativa* L.) plant upon drought stress

Chandrasekhar Sahu[1*], Udit Nandan Mishra[1], Deepak Kandher[1]
[1]M S Swaminathan School of Agriculture, CUTM, Odisha, India
[*]Corresponding author: chandrasekhar.sahu@cutm.ac.in

Abstract

Growing population needs immediate attention in terms of quantum jump in the crop yield especially rice since it is consumed as a staple food worldwide. Variability in the field and environmental conditions has challenged the farmers and agricultural scientists to co-op up with full potential of rice production and its yield underlying the suboptimal conditions. Stress contributes majorly towards the yield penalty out of which stress due to abiotic factors (drought, submergence, salinity, temperature) imparts maximum percentage. Changing climate has resulted in erratic rainfall pattern causing water scarcity in the agricultural field and subsequently drought stress. Prolonged drought stress results in generation of internal reactive oxygen species (ROS), membrane damage, reduced height, imbalanced assimilate partitioning, impaired cell division, elongation and vegetative phase which ultimately lead to deterioration of rice grain quality and quantity irrespective of the genotypes. Further, this review has highlighted the impact of drought stress on rice plants' response in terms of their morphology, physiology and yield.

Key Words: Rice, Abiotic stress, Drought

INTRODUCTION

Cereal is one of the main foodstuffs for an increasing human population. The total human population depends on wheat, rice and maize approximately 50% of calories consumed (Zibaee, 2016). Although rice is second to the planted area, it is the main source of food in Asian countries, particularly in south-eastern parts, where it is economically cultivated by farmers and workers growing it on millions of hectares in the entire region (Gomez, 2001). In the past, rice has been grown in the South and Southeastern Asian and Chinese river valleys over 10000 years since rice served as the main food for humans. Although Asia is the principal rice crop, it was harvested on other continents, such as Latin America, Europe, certain parts of Africa and even the United States (Zibaee, 2013). Most crop plants grow in suboptimal environments, preventing plant growth and reproduction to their full genetic potential (Bray, 2000). The difference from the maximum cultivation yield and the mean yield for that crop is analysed. This is underlined. The effect on international agriculture is huge, and it has been suggested that abiotic stress factors like heat, cold, drought, salinity, and nutrient stress decrease their average output of over 50 percent on most major plants (Wang et al., 2003). Drought is one of the most significant abiotic stresses affecting and reducing worldwide production and productivity of food crops by up to 70% (Thakur et al., 2010; Akram et al., 2013). Plants' response to drought stress is complicated and changes in morphology, physiology, and

metabolism are involved. The most typical drought stress symptom is reducing plant growth (Sairam & Srivastava, 2001).

Drought stress causes accumulation of the mostly chloroplast-based reactive oxygen species (ROS) and some mitochondrial stress, which causes oxidative stresses. Oxygen having lone pair of electron, anionic superoxide radicals, hydroxy radicals, and hydrogen peroxide are frequently occuring reactive species. Drought stress plants display certain defence mechanisms to guard against the damaging effect of oxidative stress. Plants with high antioxidant concentrations have greater tolerance and oxidative damage resistance (Parida & Das, 2005). One of the most common defence response to abiotic stresses is the ROS scavenging mechanism (Vranová et al., 2002). In order to detoxify ROS, different types of antioxidants can be inherently developed that reduce oxidative damage and give tolerance of drought. ROS scavengers are enzymes that contain dismutase, peroxidase and catalase superoxides (Khan & Panda, 2008). Rice is often at risk of serious abiotic stress, the most frequent of which is drought. While upland rice is the predominant rice cultivation method in crops under rainfall such as Latin American and West Africa, which contributes relatively little to the global rice area (Gupta & O'Toole, 1986). Highly adaptable rice species to drought stress when exposed to many environmental constraints (Ji et al., 2012).

Effect of Drought on different Parameters of Rice

Drought stress reduced the plant height irrespective rice genotypes. The drought stress reduces the metabolic activity due to lack of water. Such condition due to reduce turgor pressure affects the cell division and cell elongation activities of plant and resultantly plant height reduces. Similar results were reported by (Yeo, 1998) who observed that water deficit reduced yield in Oryza Sativa. However the reduction in plant height is less in drought tolerant genotypes as compared to susceptible one. As high as 50% reduction is reported in verities like Swarna sub-1(Singh et al., 2018). When rice plant is subjected to drought stress decrease in tiller number is observed as compared to control condition. The decrease in tiller number is due to stunted growth and reduction in photosynthesis of the crops (Quampah et al., 2011). As per (Singh et al., 2018) around 26% reduction in number of tiller is found in rice when subjected to drought condition. However the reduction in tiller number is less in drought tolerant genotypes as compared to susceptible one.

Significant reduction in leaf area irrespective of the varieties is observed in rice plants when subjected to drought stress condition. Reduction in leaf area and imbalanced portioning of assimilates among different plant organs is may be due to negative impacts of of water on metabolism and mineral nutrition (Zain et al., 2014). Around 50% decrease in leaf area is observed in sensitive genotypes when subjected to drought stress(Singh et al., 2018). Variability in days to 50% flowering is observed in different genotypes because of drought stress. When rice is exposed to drought stress reduction in days to

50% flowering occurs for example in sensitive genotypes like Swarna Sub-1 it is as high as 18.56%(Singh et al., 2018). Because of the exposer of the rice plants to drought stress phasic change occurs leading to reduction in vegetative phase in susceptible genotypes however resistant plant maintains little bit normal condition(Fukai et al., 1999)

Generally variation in chlorophyll content is found in rice genotype when subjected to drought stress. Because of the drought stress Chlorophyll-a, Chlorophyll-b and total Chlorophyll decreases. In susceptible genotypes like Swarna Sub-1 33% decrease in total chlorophyll is observed(Singh et al., 2018). Because of the water stress chloroplast's energetic status increases which results in the above. Variation in test weight, grain shape, size and weight of different genotypes can be seen under water stress condition. Reduction in all the above mentioned parameters occur when subjected to drought stress condition. In sensitive verities the reduction is higher as compared to the tolerant ones. Approximately 46% reduction in test weight is seen in susceptible variety Swarna Sub-1(Singh et al., 2018). In water deficit condition plants generally arrests its reproductive development which results in the decreased grain shape, size and weight(Pantuwan et al., 2002).

Yield of rice gets affected severely by drought. Significant reduction in rice yield seen in rice genotypes and are found under drought stress. It is less (19.71%) in case of tolerant genotypes like Nagina and high (46.07%) in case of sensitive varieties like Swarna Sub-1(Singh et al., 2018).

CONCLUSION

Among different stress faced by rice crop every year drought is one of the important one. It affects various growth and yield parameters of rice such as plant height, number of tillers, chlorophyll content, stomatal conductance, grain weight and yield. The degree of effectiveness of drought depends upon the severity, timing and duration of water stress.

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Classification of avocado fruit disease using wca based deep cnn model

Demissie J. Gelmecha[1], Satyasis Mishra[2], Sunita Satapathy[3]
,T.Gopi Krishna[4] ,Harish Kalla[5] , Susanta K..Biswal[6]
[1,2,5]Dept. of ECE, Adama Science and Technology University, Adama, Ethiopia
[3]Dept. of Zoology, Centurion University of Technology and Management, Odisha, India
[4]Dept. of CSE, School of Electrical Engineering and Computing, Adama, Ethiopia
[6]Dept. of Chemistry, Centurion University of Technology and Management, Odisha, India

*Corresponding author: sunita.mishra@cutm.ac.in

Abstract
Classification of diseases automatically reduces a large work of monitoring in big farms. Deep learning plays an important role in classification diseases from the fruits. This research work presents a WCA (Water Cycle Algorithm) based Deep Convolutional Neural Network (DCNN) model for classification of Avocado fruit diseases occurred in agricultural product. This research work considers Avocado fruit disease image databases as input to the proposed model. It is proposed to identify and classify the disease by taking high resolution images from FAOSTAT, **Database** (2019). The proposed WCA based deep convolutional neural network model obtained an accuracy of 98.82% in comparison to DCCN and LSTM (Long short-term memory) model and the comparison results are presented.
Keywords: convolutional neural network, Avocado, Deep CNN, LSTM model,

Introduction

Crop and fruit do suffer from diseases and there are number of plant related diseases which affects the normal progress of a fruit. Suitable analysis of such diseases is required to for accurate identification and treatment of diseases. To detect a fruit disease in very initial stage, use of disease classification is beneficial. The existing method for fruit disease detection through naked eye observation by the agricultural experts and due to which consulting experts becomes even cost high as well as time consuming too through the conventional observations. The automatic detection and classification of fruit disease will help the agricultural experts. So the solutions to the above problems can be achieved by using image processing algorithms for automatic identification of affected areas of disease and determination of the difference in the color of the affected area. Classification of diseases in fruits is a relatively complex and a tedious task if considered manually due to varieties of shape and size of the fruit. Agricultural productivity of fruit highly depends on the economic growth. Automatic classification of Avocado disease is beneficial, since it reduces a large monitoring work in large crop farms. If proper attention is not emphasized in this area then it effects the fruit due to which product quality and productivity is affected. Some of the conventional classifiers are proposed by researchers for plant disease using ANN, SVM, and PNN, to increase the recognition rate of classification process. The remote area plant disease detection can be accomplished by using texture segmentation, K-means clustering technique, Bayes classifier and principal component classifier etc. The Avocado diseases identification and classification is focused in this research work. The fruit Avocado is highly appreciated not only because of its high nutritional value but also for its role in the cosmetic and health industries. Now a days the production rate of Ethiopia becomes 3,300 tons per year in the tropical and subcontinent areas. However the production is high, at the same time the fruit Avocado is threatened by diseases which affects economically which limit production and reduce fruit quality in the country like Ethiopia. In Avocado fruits, some general diseases seen are “brown and yellow spots, early and late scorch, and others are fungal, viral and bacterial diseases”. Castro AI et al.(2015)[1] presented a study to evaluate the potential to discriminate “laurel wilt-affected avocado trees”

using aerial images using a modified camera (RmodGB). Abdulridha et al.(2016)[2]used "RBF, MLP" for detecting Laurel wilt (Lw)disease of avocado at early and late stage of infection. The MLP (Multi-Layer Perceptron model obtained classification accuracy nearly 98%. Jaafar Abdulridha et al.(2018)[3] presented a "nondestructive remote sensing method" to detect "Lw-infected avocado trees". J Abdulridha et.al (2019)[4] proposed, an automated early disease detection technique by utilizing MLP classification method for avocado fruits based on remote sensing technique and achieved an accuracy of 99%. Jeanette Hariharan et al.(2019)[5] developed a novel method using "finite difference approximation (FDA)" and "bivariate correlation (BC)" to discriminate Lw, Nitrogen (N), and Iron (Fe) deficiencies from healthy avocado plants. Bhargava, A et al.(2019)[6] utilized "support vector machine (SVM), sparse representative classifier (SRC), and artificial neural network (ANN)" and achieved 91.03% (ANN), and 98.48% (SVM) for fruit classification.

Further, Deep learning has been successfully applied in the domain of agriculture. Recently, several researchers have studied different fruit and related plant disease identification and classification based on deep learning approaches. With the recent advancements in deep learning, the method will recognize the diseases in the image in all cases. Since the main challenge is recognizing the different diseases of fruit, this work emphases on the classification of diseases of popular fruit Avocado in Ethiopia. The application of deep learning techniques for different fruit and crop diseases are presented.

Kawasaki et al.(2015)[7] proposed CNN-based and obtained 94.9% accuracy in classifying cucumbers. Mohanty et al. (2016)[8] developed a CNN-based model to detect 26 diseases and 14 crop species and achieved an accuracy of 99.35%. D. Oppenheim et.al (2017) proposed potato disease classification using convolution neural networks and taken four classes for classification and achieves an accuracy of 98% [9]. Sladojevic et al.(2016)[10] proposed a novel approach based on deep convolutional networks to detect disease. The experimental results showed that the proposed CNN-based model can reach a good recognition performance, and obtained an average accuracy of 96.3%. Tan et al. (2016)[11] presented an approach based on CNN to recognize apple pathologic images, Lu et al.(2017)[12] proposed deep convolutional neural networksfor rice leaves and stems, and obtained an accuracy of 95.48%. K. Pranali et.al (2018) proposed leaf disease detection and recommendation of pesticides using convolution neural network [13]. As per the literature survey it is observed that, no researcher has proposed the identification and classification technique for Avocado fruit disease using deep learning method. When the volume of dataset increases, the classification methods MLP, PNN, RBFNN, SVM takes larger computational time for classification. To overcome the difficulties involved in the conventional algorithms, we are motivated to propose the novel SCA-PSO based Deep CNN model to improve the performance of the conventional classifiers along with the CNN.

This research presents Avocado fruit disease classification. The proposed DCCN+WCA algorithm uses to classify the diseases into different classes, and a healthy class. To improve the drawback of the automatic classification of Avocado disease, the WCA based Deep CNN is proposed. The proposed WCA based Deep CNN model employs different layers to smooth images in order to improve the noise-immunity. Therefore, the proposed WCA based Deep CNN considered to be robust than these algorithms for images corrupted by different types of noise and the proposed model is suitable for good classification results. The proposed WCA based Deep CNN method can also be applied for other plant, leaf and fruit diseases which are the future scope of the project.

The research proposes two fold contribution

- Development of a new Deep CNN model for classification technique.
- To develop a new WCA algorithm for weight optimization of Deep CNN to enhance the performance and testing the performance of proposed model with conventional CNN

The remaining part of the paper is dived into further section as: Section-2 presents the materials and methods, section-3 presents results of the classification, Section-4 presents the detailed discussion of results and section-5 presents conclusion and references of the research.

MATERIAL AND METHOD

Research implementation diagram

The research flow diagram in **Fig.1** indicates the step by step accomplishment of the research work. Further the block diagram shows the flow of algorithm application for detection and classification of fruit and crop disease.

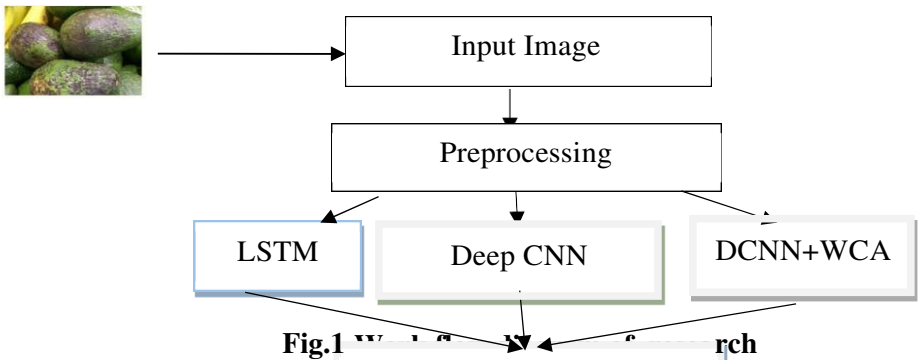


Fig.1 W rch

Proposed WCA based Deep CNN M

CNN consists two main layers called "convolution and max pooling layer" and end up with "fully connected layer". However a genera ng Deep CNN [14, 15] is missing from the literature. In this study, the n **Fig.2.** The input image is taken as 28x28x3 pixels for the Avocado fruit disease.

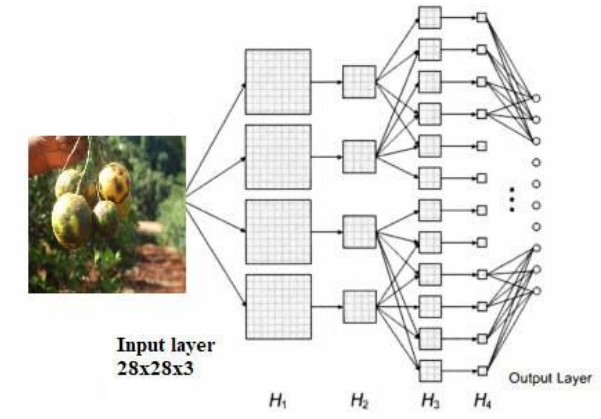


Fig .2Architecture of CNN for Avocado disease classification

Weight optimization of Deep CNN using sine cosine optimization algorithm.

The general CNN [14-15] weights are optimized by back propagation algorithm. When the dataset increases it takes more computational time for classification. To enhance the performance of CNN, we propose WCA optimization algorithm for weight optimization. The Deep CNN can be shown in a structure of conventional network in **Fig.3**.

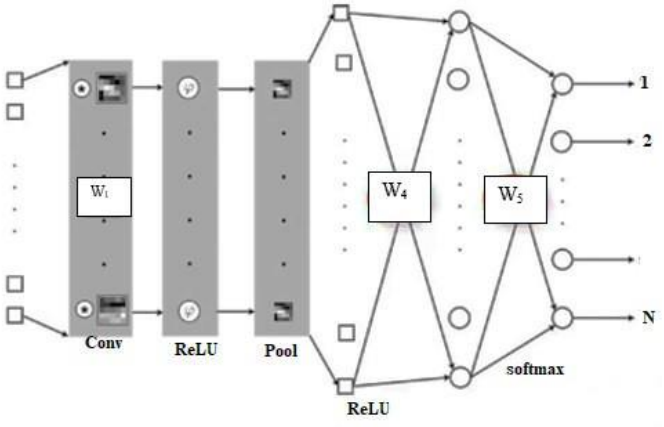


Fig.3 Output Layer of Deep CNN with weights

Here W1 is the weights of the convolutional layer. In this network W4 and W5 are connected weights of the output layer. These weights are to be updated by the Water Cycle Algorithm (WCA)- to improve the performance of the deep convolutional network. Then the results of the proposed network will be compared with the conventional CNN [19-21] with back propagation weight updation algorithm. Softmax is the activation function of the output layer. Due the complexity involved in learning the mathematical calculations of the WCA has improvised to maximize the performance of the Deep CNN. The WCA optimization is inspired from the PSO [16-18] algorithm. The WCA [22, 23] algorithm. The WCA is based on the directions of the flow of streams and rivers which is merged into the sea with the process of water cycle. The matrix of water courses of size $S_{Population} \times D$, where "D"is the "dimension" and the corresponding matrix is given by

$$S_{Totpop} = \begin{bmatrix} Sea \\ riv-1 \\ riv-2 \\ \\ \text{M} \\ \\ strS_{sr+1} \\ strS_{sr+2} \\ strS_{sr+3} \\ \text{M} \\ strS_{pop} \end{bmatrix} = \begin{bmatrix} w_{11}^{1} & w_{12}^{1} & \Lambda & w_{D(i,j+1)}^{1} \\ w_{21}^{1} & w_{22}^{2} & \Lambda & w_{D(i+1,j+1)}^{2} \\ \text{M} & \text{M} & \Lambda & \text{M} \\ w_{i+1,i}^{pop} & w_{i+1,j+1}^{pop} & \Lambda & w_{D(i+n,j+n)}^{pop} \end{bmatrix} \quad (1)$$

Where S_{sr} values are selected as the sea and rivers.

$$S_{sr} = No.of\ rivers + 1(sea) \quad (2)$$

$$S_{Stream} = S_{population} - S_{sr} \quad (3)$$

Now mapping with the stream with rivers

$$Ws_n = round\left\{\left|\frac{f(River_n)}{\sum_{i=1}^{W} f(River_i)}\right| \times W_{Stream}\right\}, \quad n = 1,2,3 \ldots W_{sr} \tag{4}$$

Where, Ss_n is the "number of streams', and evaluation function is given by f .

Where $W = [W_1 \ldots\ldots W_4, W_5]$ are the weights of the Deep CNN.

SCA Algorithm implementation for weight optimization of Deep CNN Model.

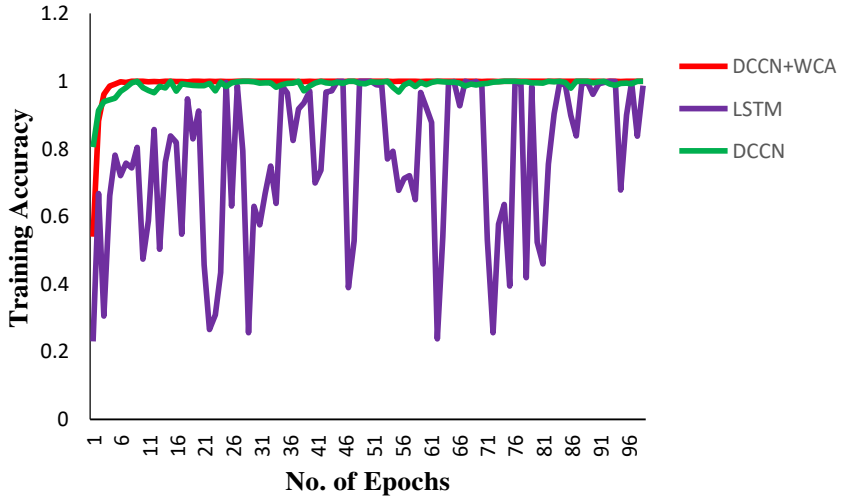
1. Initializing particles (CNN weights) with random position and velocity vectors.
2. Initialize the WCA parameters W_{sr}, W_{pop}
3. Evaluate the objective function in the next phase to evaluate fitness based on x_{ij}
4. Update Ws_n for best fit
5. %Program loop
6. for i=1:L
7. for j=1:N
8. update(Eqn.4)
9. update WCA parameter
10. end for the loop j
11. continue till converges, else go to step 6, and repeat until convergence is satisfied.

Data Collection

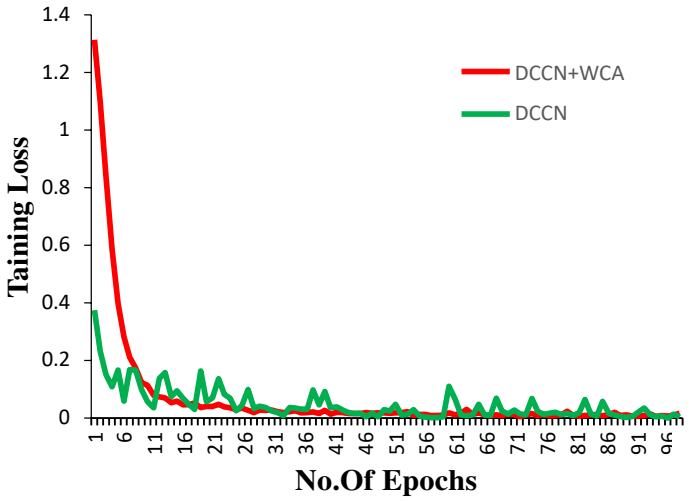
The real time Avocado [24] disease related data are collected from the various agricultural farms and research organizations. The data will be collected from the dataset of Avocado FAOSTAT, **Database** (2019)[25] Food and Agricultural Organization, https:// doi.org/10.1016/j.compag.2018.12.018 and validation with the data collected from the Ethiopia. The collected data along with the symptoms of the Avocado diseases are analyzed and presented for classification.

RESULTS

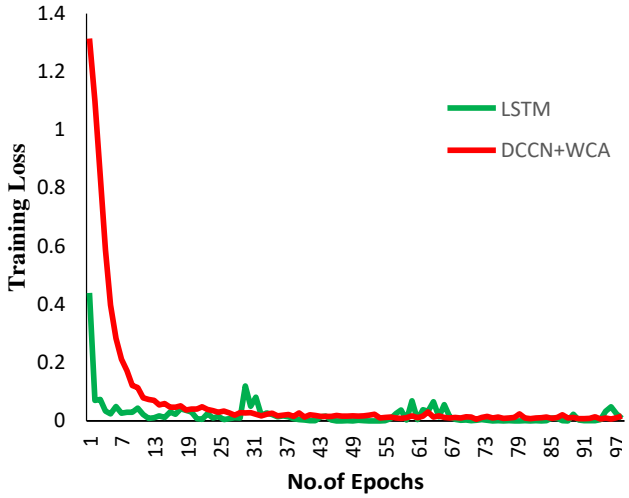
Classification results



Fg.4 Training accuracy of the Avocado disease classification using DCNN,LSTM,DCCN+WCA



Fg.5 Training loss incurred during Avocado disease classification using DCNN and DCCN+WCA



Fg.6 Training loss incurred during Avocado disease classification using LSTM and DCCN+WCA

Table 1 Performance measure

Classifier	Accuracy in (%)		Computational time(Training) in sec
	Training	Testing	
LSTM	92.52	91.14	117.2371
DCCN	95.33	94.12	60.3428
DCCN+WCA	**98.82**	**97.97**	10.2567

DISCUSSION

A total of 5000 real time and web dataset images are considered for classification. Out of which 80% of the images are considered for training and 20% of images are taken for testing. Fig.4 shows the training accuracies of LSTM, DCCN and DCCN+WCA models. It is found that the proposed DCCN+WCA model

outperforms in classification in comparison to the DCCN and LSTM model and obtained an accuracy of **98.82%**. The proposed DCCN+WCA model took nearly 30 epochs to converge and takes 10.2567 seconds, whereas DCCN took nearly 90 epochs to converge and the computational time is 60.3428 seconds which is presented in Table-1. The LSTM took 117.2371 second for convergence but there are so many variations which can be found from the Fig.4. Fig.5 and Fig.6 shows the training loss in case of LSTM, DCCN and DCCN+WCA models. It if found that the LSTM model loss is more in comparison to the DCCN and DCCN+WCA.

CONCLUSION

In this investigate work, the avocado diseases are considered for the classification. The images are employed for the task of classification by utilizing DCCN+WCA model. It is observed that the proposed DCCN+WCA model acquires superior value of classification accuracy in comparison to DCCN and LSTM models. The images are preprocessed at the first stage and then fed as input to the DCCN+WCA model for classification purpose. The WCA algorithm is utilized for weights optimization of DCCN model. To authenticate the robustness of DCCN+WCA model, the classification performances are compared with DCCN and LSTM classifiers and presented. The convergence rate is quicker in the case of DCCN +WCA model and took 10.2567 seconds whereas the LSTM model and DCCN model took 60.3428 seconds and 117.2371 seconds. The proposed classifier DCCN+WCA model has proven to be a skilled classifier in classifying the healthy and diseased avocado from the avocado dataset considered for the research work.

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Emerging computational trends for nanoscale data analysis with nanoinformatics

Jayakishan Meher

Centurion University of Technology and Management, Odisha, India
Corresponding author: jk_meher@yahoo.co.in

Abstract: Numerous key challenges in nanotechnology research specify a need for nanoinformatics that uses informatics practices to process and manage information on nanobiomolecules and nanomedicines in particular and nanomaterials in general. Nanoinformatics being a subset of materials informatics, allows discovery of hidden information and patterns in nanoscale data. Usually, nanomaterials datasets are small with considerably both large dimensionality and variance. Analysis of such nanoparticles datasets using existing big data analytics is a challenging and computationally intensive task. This study has been focused on survey of emerging databases and computational tools for the progress of nanotechnology research and exploring nanoinformatics that can be optimally used to address the challenges on nanolevel data analysis.

Keywords: *Nanotechnology, nanoinformatics, computational tools, nanomedicine, nanomaterials, machine learning.*

1. Introduction

Nanoinformatics deals with nanoscale information and aims to develop tools for its management and application in nanotechnology research [1]. The integration of nanobiotechnology, bioinformatics and computational material science with machine intelligence in nanoinformatics enables to study structure-function relation and properties of nanomaterials. Nanotechnology allows the handling of particle of scale ranging from 1 to 100 nanometers [2]. The behavior of such nanoparticles is subjected to molecular, atomic and ionic interactions and hence nanoparticles exhibits variable properties with the effect of quantum mechanics [3]. These effects alter the electrical, magnetic and optical properties of nanomaterials due to the random activities of the electrons. Informatics practices on material science enable the study of nanostructures and properties of these smart nanomaterials. Nanoinformatics is a subclass of informational materials science that allows uncover of significant information and patterns from the existing data. The

advancement in nanoinformatics develops computational methods for the study of smart materials property, characterization and hyperspectral image data analysis [4].

Computational tools used in bioinformatics and computational chemistry have standardized the analyses and manage the nanobiotechnological information [5]. Several computing tools have emerged in the field of biomedicine and bioinformatics resulting into medical informatics. Nanoinformatics can address the problems that can be computationally handled at the nanolevel particularly focused on nanomedicine [6]. Nanomaterials can not only enable opportunity for developing applications for industry and scientific research fields but also promote innovation on the treatment of diseases. The development in nanotechnology has unlocked the scope for nanomedicine in which informatics practices for DNA computing can enable health care uses at nanobiomolecular scales. Nanoinformatics could accelerate developments in nanomedicine and its applications into clinical practice called translational nanoinformatics. Thus, nanoinformatics and DNA computing together can impact strongly the existing model and practice the information in biomedicine. [7].

Machine learning computation can handle large data sets having lesser numbers of features. However, nanomaterials datasets are attributed as small with both large dimension and variance and also affected by many destructive biases [8]. Analysis of such nanomaterials datasets using existing data analytics along with machine learning methods is a challenging and computationally intensive task. In this review, it has been focused on survey of emerging databases and computational tools that can help in growth of nanotechnology research.

2. Emerging Nanoinformatics Databases

Informatics practices have been implemented to accelerate the nanomaterials research exploration. Being a subcategory of materials informatics, nanoinformatics is an significant tool for characterization and design of nanostructures that play vital roles in the study of materials properties [4]. *Nanoparticles database* aims at collecting, analyzing, and publishing the information on nanomaterials in several aspects of research in nanotechnology. The nanomaterials such as nano-objects possesses multidimensional nanoscale structures whereas the nanostructured materials dimensions have a microscopically or morphologically nanoscale structure [9]. Nanoinformatics practices allow discovery of meaningful information and patterns from the databases. The analysis of such digital data with machine-learning allows exploring the structural characteristics of materials and extracting hidden information and patterns from current datasets [4, 10].

The availability of DNA and protein structures publicly in GenBank [11] and Protein Data Bank [12] respectively have motivated researchers for biomolecules bigdata analysis. Progression in computational platform has driven a new direction for bimolecular data analysis. Bioinformatics has emerged with publicly available large databases along with plenty number of bioinformatics tools. The informatics practices used for growth of bioinformatics has led to the development of nanoinformatics [13]. Nanotechnology has become a vital performer in the arena of nanomedicine. Biomolecules are the nanomaterials such as proteins that can be designed for biomedical applications such as drug delivery and other medical applications [14]. Computational practices enable binding models of protein nanoparticle like molecular modeling and docking and simulate for molecular dynamic in the binding processes.

The nanoinformatics databases like ISA-TAB-Nano, nanowerk, NBI and caNanoLab help in not only data sharing and data standards but also assists to develop tools relating to the growing nanoscale data. An indication of some of the nanomaterial related databases related to nanomaterials is accumulated in Table 1.

3. Computing Tools in Nanoinformatics

The need of computing applications at the nanolevel is addressed by the nanoinformatics tools. Much of the research analysis performing nano-scale experimentation is computer-driven due to the physical scale of nanotechnology. Thus, computational tools that includes data analytics tools have been developed to address the needs of the nano-scale research to make advances in nanotechnology [17]. The commonly used nanoinformatics tools based on relevant computational tasks such as molecular modeling, visualization, molecular docking and molecular dynamics have been discussed as follows.

Table 1. Nanomaterial databases.

Database	Brief Report
Nanowerk (www.nanowerk.com)	The Nanoparticle Database includes the information of various nanoparticles. Currently, there are about 2860 nanoparticle products in database.
NBI Knowledgebase (nbi.oregonstate.edu)	It works for repository of nanomaterial data, synthesis methods, and nanomaterial-biological interactions.

InterNano (www.internano.org)	It presents progress in applications, devices, and materials required for nanomanufacturing community.
NIL (nanoparticlelibrary.net)	The Nanoparticle Information Library offers links to databases with health and safety information of nanotechnology to health authorities, industrial operators and researchers.
nano-HUB database (nanohub.org/resources/ databases)	It provides searchable database and nanoBIO tools.
BioPortal (www.bioontology.org)	"National Center for Biomedical Ontology" Bioportal includes the organization and analysis of data resulting from experiments
ISA-TAB-Nano (nci.nih.gov/display/ICR /ISA-TAB-Nano)	It represents and shares nanomaterials information and biological specimens with their assay characterization.
caNanoLab (cananolab.nci.nih.gov/c aNanoLab/)	It helps by sharing the information to accelerate the practice of nanotechnology in the field of biomedicine and supports annotation of nanomaterials with characterizations.
Toxicology Data Network (toxnet.nlm.nih.gov/)	Toxnet includes information on hazardous chemicals, environmental health, toxicology and toxic releases and provides references from the toxicology literature.
NanoParticle Ontology (nano-ontology.org/)	The NPO provides information on description, preparation, and characterization of nanomaterials in cancer nanotechnology research.
Nanodatabase (http://nanodb.dk/)	DTU Environment is involved in development of database, the data collection, the scientific assessments of the nanomaterials used in the several consumer products.

3.1 Molecular Modeling

Molecular modeling is increasingly used as a vital methodology for bionanotechnological activity. It predicts the interaction of various blends of biomolecules [18]. The structures of biomolecules are obtained by complex methods like crystallography, electron microscopy and nuclear magnetic resonance etc. The study of structural information of biomolecules by structural biology can only offer static nature. However, biomolecules seem to be highly dynamic in nature which is extremely related to their functions. Experimental techniques can offer to make analysis of dynamics of biomolecules with its own limitations. But recently computational technique is gradually increasing to solve these problems. The theoretical and computational methods used to model the structural and functional properties of molecules constitute molecular modeling. The 3D structures of molecules can be visualized and analyzed using software tools available. The commonly used visualizing software for macromolecules is shown in table 2.

Table 2. Visualization tools

Visualization tools	Description
RasMol/ RasWin (bernstein-plus-sons.com/software/rasmol)	It is the software intended for visualization of graphics structure of nucleic acids, protein and small molecules.
PyMOL (www.pymol.org/)	PyMOL is commercial software used for visualization of complex molecules.
Raster3D (skuld.bmsc.washington.edu/raster3d)	It is used for creating high quality raster images of proteins or other molecules.
UCSF Chimera (cgl.ucsf.edu/chimera/index.html)	This program is used for the interactive visualization of high-quality images and animations and analysis of molecular structures, density maps trajectories and sequence alignments.
Cn3D (ncbi.nlm.nih.gov/Structure/CN3D/cn3d.shtml)	Cn3D allows viewing 3D structures of "NCBI's Entrez" database.
Chemkit (sourceforge.net/projects/chemkit)	chemkit is used for applications in cheminformatics, molecular visualization and modeling.
ChemSketch (acdlabs.com/resources/freeware/chemsketch)	This drawing tool is used to draw structure of organics, organometallics, polymers and helps for calculation of molecular weight, density, molar refractivity etc.
Jmol (jmol.sourceforge.net/)	It allows viewing 3D chemical structures with features for chemicals, crystals, materials and biomolecules.

3.2 Molecular Docking

The nanomedicine for targeted drug delivery is a growing field of research with application to several biomedical problems. The information revolution with biomolecular data mining and advanced machine learning has been applied to drug delivery [20]. Computational methods allow studying many protein-nanoparticle interactions effectively. Docking allows predicting protein-ligand interactions in the drug discovery process by detecing the low-energy binding modes ligand within the active site of a macromolecule. The degree of interaction or binding of ligand with receptor related with a disease may inhibit its function and thus act as a drug [21]. The performance of docking software is attributed by docking accuracy. The commonly used docking software is are included in Table 3.

Table 3. List of Docking Software Tools

Docking software	Brief Description
Biovia Discovery Studio (3dsbiovia.com/products/collaborative-science/biovia-	BIOVIA's Discovery Studio acts as predictive tool for the Life Science problems. It is a graphics visualization tool that can analyze protein and modeling data with interactive

discovery-studio/)	3D visualization and docking.
MOE (chemcomp.com/Products.htm)	Molecular Operating Environment is a *molecular modeling* tool that allows handling large biological molecules.
Autodock 4 (autodock.scripps.edu)	This automated docking tool can predict small molecules bind to a receptor of known 3D structure.
AutoDockVina (vina.scripps.edu/)	It is from the Molecular Graphics Lab that undertakes advances in accuracy of binding predictions and two orders of magnitude faster than AutoDock 4.
Dock (dock.compbio.ucsf.edu)	DOCK addresses the problem of docking molecules to each other.

3.3 MD Simulations

The dynamic structure-function relationships in biomolecules are established using computational technique called as molecular dynamics (MD) simulation. MD simulation describes the atomic motion and the forces acting on atoms over time at a given temperature are computed using force field [22]. Molecular docking is an instance of MD simulation which is used on intervals to replace lengthy segments of MD simulation trajectories of certain domains undergoing large translations, rotations and conformation changes, like biological interactions in large protein folding [23]. The some frequently used molecular modeling tools are shown in Table 4.

Table 4. List of tools available for molecular modeling

Molecular modeling tools	Brief Description
YASARA	YASARA is a molecular modeling and simulation program that allows visualizing the large proteins and allows interactive real-time simulations with accurate force fields.
Amber (http://ambermd.org/)	Amber consists of biomolecular simulation programs with source code and demos. It allows simulation of biomolecules.
NAMD (ks.uiuc.edu/Research/namd/)	NAMD performs efficient simulation of large biomolecular systems.
Gromacs (www.gromacs.org/)	GROMACS is a software tool that simulates the Newtonian equations of motion for systems with hundreds to millions of particles.
LAMMPS (http://lammps.sandia.gov/)	It is used to model atoms as a parallel particle simulator at the atomic, meso or continuum scale.
VMD (ks.uiuc.edu/Research/vmd/)	It allows vizualizing, animating, and analyzing large biomolecular systems using 3-D graphics program and built-in scripting.

4. Conclusions

The databases and computational tools specific to the nanoscale data used in nanoinformatics are increasing exponentially that are helpful to the nanotechnology research community. Nanoinformatics could accelerate developments in nanomedicine by molecular modeling tools and simulation methods. The informatics practices used in genomic research projects has also transformed progress in biomedicine. Since nanomedicine and hence the nanomaterial data seems to be more complex than sequence or molecular data, an upcoming research evolving from the nanotechnology community are promising to address additional challenges in future.

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Medicinal plants with antimicrobial potential against urinary tract infection causing microbial pathogens: An overview

Jyotismita Satpathy, Mirkashim H. Saha, Aditya S. Mishra, Sujit K. Mishra*

Department of Zoology, School of Applied Sciences, Centurion University of Technology and Management, Odisha, India

*Corresponding author: sujitkmishra1990@gmail.com

Abstract

Urinary Tract Infection is a very common microbial infection affects the health of many people throughout the world. In the current scenario, antibiotics use against the infectious microbes has been given much importance to treat this disease. But antibiotic resistance and side effects associated with the synthetic drugs identified as emerging problem for successful treatment of this disease. Many studies have been performed to study the activity of medicinal plants against UTI causing microbes *vis-a-vis* to explore alternative sources of medicines to fight against UTI. With this outset the present study reviewed the activity of medicinal plants against UTI causing microbial pathogens and also emphasized the bioprospecting of the medicinal plants with antimicrobial properties to develop novel drug to treat UTI.

Keywords: UTI, Alternative medicine, Uropathogens, Medicinal plants, Antimicrobial phyto-compounds

Introduction

Urinary Tract Infection (UTI) is a common infectious disorder caused by various microbial pathogens and occurs in any part of the urinary tract including kidneys, renal pelvis, ureters, urinary bladder and urethra (Barnett et al., 1997; HA Abdalla., 2014). Anatomically, the main types of UTIs are classified as- acute pyelonephritis, an infection more extensively affects the upper urinary tract structures-the kidneys; cystitis-an inflammation of the bladder and, urethritis-an inflammation of the tube of urethra, which carry urine from the bladder to the outside of body (Barnett et al., 1997). However, clinically, the UTIs are classified as "uncomplicated" and "complicated" (Yasmeen et al., 2015). The uncomplicated UTI usually shows minimal effect on long term renal function and mostly seen in patients with normal urinary tracts and are treated with small dose of antibiotics. The complicated UTI is caused by antibiotics resistance bacteria and is more difficult to cure. This type of UTI is mostly seen in patients with anatomically abnormal urinary tract and leads to undesired renal function (Barnett et al., 1997).

A group of pathogens isolated from urine so called "Uropathogens" are the causative agent of UTI, particularly in human beings. Uropathogens such as *Enterococci*, *Enterobacteriaceae, Staphylococcus, Saprophyticus* and *E. coli* are possessing virulence factor(s) that triggers colonization and attack of urinary tract epithelium and hence causes UTIs (Barnett et al., 1997). The clinical symptoms of UTI typically includes pelvic pain, increases urge to urinate, pain with urination, blood in the urine, back pain, nausea, vomiting, and fever. The clinical manifestation of UTIs depends on the site of infection as follows:

Cystitis: It is usually manifested as dysuria with or without frequent urination, urgency, supra pubic pain or haematuria (Hooton, 2012)

Urethritis: It is a condition of swelling and irritation of the urethra. Dysuria and high frequency of urination are the symptoms associated with urethritis.

Pyelonephritis: It refers to the inflammation of kidney parenchyma and pelvis. The clinical manifestation associated with this includes fever, chills, flask pain, costovertebral-angel tenderness and nausea or vomiting. 40% of patient with acute phylonephritis will be bacteriomic (Otto et al., 1993; Shaaban et al., 2012).

Microorganisms causing UTIs

UTIs are often caused by bacteria but are also caused by fungi and in rare cases by viruses (Piotrowska et al, 2017). The bacterium *E. coli* is the common infecting agent which causes more than 95% of UTIs (Beyene et al., 2011). In addition, bacteria including the species of *klebsiella*, *Pseudomonas*, *Enterobacter*, *Proteus*, *Staphylococcus*, *Mycoplasma*, *Chlamydia*, *Serratia* and *Neisseria* are the UTI causing pathogens (Mahalik et al., 2017).

***Proteus*:** This is a group of Gram –ve, facultative anaerobic, heterotrophic and proteolytic rod-shaped bacteria. *Proteus mirablis* is an important proteus species of medicinal importance and causes urinary tract infection commonly in the elderly and young male often following catherization or cytoscopy. It is often associated with urinary stones, probably because these organisms produce ammonia rendering the urine alkaline (Sleigh and Timbury,1998).

Staphylococcus: Staphylococcus is a group of Gram +ve bacteria. They are non-motile, non-capsulated and are catalase, DNAase and lonagulase positive, and ferment mannitol. These bacteria rarely cause UTI (Chessbrough, 2006). *S. saprophticus* causes UTIs in sexually active women. The surface agglutinins of these pathogens appear to be a determinant of the virulence promoting it colonizes urinary tract (Collee et al., 1996).

Mycoplasma: Mycoplasma is a group of small typically parasitic bacteria that lack cell walls and are mostly seen in the mouth, the distal parts of genitourinary tracts and the upper respiratory tract of humans and other

animals. Due to lack of cell wall, they cannot classify as rods or cocci (Gladwin et al., 2004). Nitrogen availability shown to alter codon bias and genome evolution in mycoplasma (Seward et al., 2016).

Chlamydia: Chlamydia are though bacteria, exhibits intermediate characteristics between viruses and bacteria. These are the dimorphic bacteria with a two-phase life cycle and are proficient to do independent reproduction. *Chlamydia trachomatis* is one of the important obligate intracellular, gram –ve bacteria of this genus which causes acute and chronic UTI (Wanic-Kossowska et al., 2001).

Serratia marcescens: *Serratia marcescens* is a facultative-anaerobic species of rod-shaped Gram -ve bacteria which involves in hospital acquired infections (HAIs) more particularly UTI and wound infection (Falkiner, 1997). This pathogen is mostly found in respiratory and urinary tract of hospital admitted adults and in gastrointestinal system of children, and reported to cause UTI (Su et al., 2003).

Neisseria: Neisseria is a large genus of bacteria that colonize the mucosal surfaces of many animals. *N. gonorrhoeae* is a species of gram –ve diplococcic bacteria (Judith., 2009). It is oxidase positive and aerobic & it survives with in neutrophils. (Serruto et al., 2004) This species along with *Neisseria mucosa* have reported to cause UTI (Osses et al., 2016).

Klebsiella pneumonia: It is a gram –ve, rod shaped, facultatively anaerobic bacteria. This bacterium produces acid and gas from lactose, and is oxidase negative. *Klebsiella pneumonia* profoundly found in the intestinal tract, skin and mouth of humans and have reported to cause UTI in majority of the cases (Ganaway, 1976; Ryan et al., 2004; Riggs et al., 2001).

Pseudomonas: Pseudomonas are the gram –ve rod shaped bacteria. Flagellum may be one or more and provides motility. It is aerobic in nature, non-spore forming. Pseudomonas species such as *Pseudomonas aeruginosa* produces pyocyanis (Lau et al., 2004) and *Pseudomonas fluorescens* produces thioquinolobactin (Matthijs et al., 2007). Most of the pseudomonas species are naturally resistance to penicillin and beta lactam antibiotics but some are sensitive to pipercillin, imipenem and tricillin (Ryan et al., 2004). These bacteria are reported to have low antibiotic susceptibility. (Van Elder,2003).

Enterobacter: It is a large family of gram –ve bacteria and are typically 1-5µm in length. They are facultative anaerobes, motile, encapsulated and do not form spores (Brenner and Farmer, 2005). The colonies are usually nonpigmented or sometimes yellow pigmented. They sometimes produce gas from sugars, but not from

starch (Abbott, 2011). Enterobacter found in the human intestinal tract and reported to cause UTI (Pallett and Hand, 2010)

Sources of antimicrobials against uti causing pathogens

Antibacterial, antiviral, antifungal, and antiprotozoan are the different types of antimicrobials exist in our environment with profound effect against the microorganisms. Antibiotics are obtained from either natural or synthetic sources and are utilized in the treatment of various bacterial diseases. Some of antibiotics such as aminoglycosides (gentamycin, streptomycin), polyketides (tetracycline), phenyl propanoids (chloramphenicol), macrolides (erythromycin), glycopeptides (vancomycin) are the naturally originated while the sulphonamides, cephalosporins, quinolones and oxazolidinones are originated from synthetic sources. Many anti-viral, antifungal, antiprotozoan and anticancer drugs have also acquired from synthetic sources. Most of the antibiotics shows their mode of action by inactivating the protein synthesis process or by inhibiting the bacterial cell wall. Sulphonamides usually inhibits the synthesis of metabolites used for the synthesis of deoxyribonucleic acid (DNA). Quinolones also inhibits the DNA synthesis process (Singh and Barrett, 2006).

Various types of treatment options are available for the treatment of UTI such as antibiotic treatment, homeopathic treatment, and ayurvedic treatment in different areas based on regional pattern of drugs resistance. Antibiotics used in the treatment of UTIs consist of sulphamethoxazole / trimethoprime, fluroquinoles (ciprofloxacin), nitrofurantoin, aminoglycosides (zaentamicin, amikacin), cephalosporin, aminopenicilin (ampicillin and amoxicillin), ceftriaxon, fosfomycin, levofloxacin (Heffner et al., 2008). Cephalosporin, Trimithoprime/ sulphamethoxazole and amoxicillin-clavulanate have considered as the most appropriate antibiotics for UTI treatment as compared to the quinolones antibiotics which was reported to have adverse effect on joint development. Further, amoxicillin has been reported to be resistant to *E. coli.* Fluroquinoles are preferred as the initial agents of therapy in an area where resistance is likely to be of concern (Goldstein 2000; Gupta et al., 2012; Tankhiwale et al., 2004). Cantharis, *Nux vomica*, Sarsaparilla, *Aconitum napellus*, *Apis mellifica*, Belladonna, *Berberis vulgaris*, Borax, *Chimaphila umbellata*, Clematis, Equisetum, Lycopodium, Sepia, Staphysagria are come under homeopathy mode of treatment. The medicinal plants used for ayurvedic treatment are Shilajit, Gokshura, Punarnava, Guduchi and Chandan (Tankhiwale et al., 2004).

Medicinal plants: the potent source of antimicrobials against uti causing pathogens

Due to antibiotic resistance as well as side effects associated with the antibiotics, the medicinal plants have been gaining much importance as alternative sources of antimicrobials because of their antimicrobial properties. Since the Middle Paleolithic Age (about 60 000 years ago), human uses plants and plant products as medicines (Fabricant and Farnsworth, 2001). Health care systems in the ancient times were utilizing the leaves, stems, flowers, roots and berries of herbal plants in the form of crude drugs such as teas, tinctures, powders, poultices, and also other herbal formulations for their therapeutic values (Balick and Cox, 1996; Samuelsson 2004). The medicinal plant produces secondary metabolites which shows their effects against the UTI causing pathogens in isolation or synergistically with other phytochemicals (Abreu et al., 2012). Plant provides hope for the development of novel drug compounds (Iwu et al., 1999). The plant extracts with active constituents with known antimicrobial properties have tremendous importance for therapeutic use against the microbial pathogens (Ahmed et al., 1998). A major segment of the global population, particularly, in the developing countries, utilizes the traditional systems of medicine for the treatment of infectious diseases (Ahmed et al., 1998).

Sohali et al. (2014) studied five different medicinal plants, which were subjected to preliminary screening for antibacterial potential against four pathogenic microorganisms causing urinary tract infection (UTI). Saranraj and Sivasakthivelan (2012) studied the antimicrobial potential of the *Phyllanthus amarus* against UTI. It was found that methanol extraction showed highest inhibitory activity against UTI causing pathogens. Sharma et al. (2012) took 17 medicinal plants of Indian origin and evaluated the antimicrobial activity of ethanol, acetone and aqueous extracts against 66 multidrug resistant UTI causing isolates. They found that ethanol extracts of *Terminallia chebula* and *Ocimum sanctum* effective against *Klebsiella pneumoniea*; ethanol extract of *Cinnamomum cassia* found effective against *Pseudomonas aeruginosa*; ethanol extract of *Azadirachta indica* found effective against *Enterococcus faecalis.* Dhanalakshmi and Selve (2013) studied the antibacterial activity of some medicinal plants i.e., *Tribulus terrestris, Cinnamomum verum* and *Punica grantum* against UTI causing pathogens. They found that the ethanolic extract of *P. grannatum* has greater antibacterial activity against *E. coli, and Staphylococcus*. Mahesh and Satish (2008) also studied the anti-UTI activity of *Acacia nilotica*, *Sida cordifolia*, *Tinospora cordifolia, Withania somnifera* and *Ziziphus mauitiana* and found their profound effect against *Pseudomonas, E. coli, Bacillus subtilis and S. aureus.* Sahu and Sinha (2013) studied the antibacterial effect of *Cassia tora* against pathogenic bacteria *E. coli, P. aeruginosa, S.aureus* and *K. pneumoniae* isolates from patients of UTI and found *E. coli* as most susceptible. Tabassum et al. (2013), studied taking six plants such as *Coriander sativum, Syzygium aromaticum, Cinnamomum cassia, Zingiber officinale, Terminallia chebula and Azadirachta indica* to assess the antibacterial activity against five bacteria causing UTI. The finding from this

study showed highest antibacterial activity of *Cinnamomum cassia* against *E. coli*. Ravikumar et al. (2010) studied five Indian mangrove plants to evaluate the antibacterial activity against UTIs pathogens. The plants were *Rhizophora apiculata, Rhizophora mucronata, Bruguiera cyclindrica, Ceriops decandra, Avicennia marina*. From this study it was observed that *R. mucronata and A.marina* exhibited antibacterial activity against *P. aeruginosa, K. pneumoniae, Enterobacter species and E.coli*. Samy et al. (1998), studied 34 plants to evaluate the antibacterial activity against four UTI causing bacteria. Of these 16 plants showed activity against the pathogens. Snowden et al. (2014) studied the effect of nine medicinal plants and found many of them with antibacterial activity against *S. aureus*. Parekh and Chanda (2008) studied the effect of 34 medicinal plants belonging to 28 different families to evaluate the antibacterial activity against six bacterial strains belonging to *Enterobacteriaceae* and found many of them with antibacterial properties. Maji et al. (2010) examined antimicrobial effecicy of 20 ethnomedicinal plants using water, benzene, and acetone as solvents and tested against several human UTI-pathogens like *E. coli, S. aureus, K. pneumoniae* and *Bacillus cereus*. Among the tested plants, *Emblica officinalis* showed profound antimicrobial activity. Again, *Lawsonia innermis* powder has been found to have inhibitory effect against urinary pathogens like *E. coli, S. aureus* and *Proteus mirabilis* (Bhuvaneshwari et al., 2002). Ahmed et al. (2001) studied ethanolic extracts of 45 Indian medicinal plants for their antimicrobial activity against drug resistant bacteria. Broad-spectrum antimicrobial activity was observed in 12 plants. Hazrat et al. (2013) studied 16 species of medicinal plants to evaluate the antibacterial activity against some pathogens. Highest antibacterial activity was displayed in 10 species of medicinal plants. A list of medicinal plants with their phytoconstituents showing activity against UTI causing microbial pathogens is presented in Table 1.

Table 1: Medicinal plant showing activity against UTI causing microbial pathogens

S. No.	Plant name	Part of plant used	Compounds present	Effective against microorganism	Reference
1	*Eucalyptus globulus*	Leaf	Eucamalol, terpinol, pinene, terpinene, allocimene, citronellol	*E. coli* and *S.aureus*	Bachir and Benali(2012) Mohd Adnan (2019)
2	*Terminilia chebula*	leaf	Punicalin, saponins,quinines, terflavins, punicalagin	*E. coli*	Kirtikar and Basu(1935), Espenti et al.(2016)
3	*Boerhaavia diffusa*	leaf	Borhavine,campesterol, liriodendrin, sitosterol, punarnavoside	*S. aureus*	Girish and satish(2008), Olaleye et al. (2010)

5	*Senecio jacobaea*	Leaf		*E. coli* and *S. aureus*	Macel et al. (2004)
6	*Emblica officinalis*	Fruit	*Phyllantine, ouercetin, emblicanin, punigluconin*	*E. coli, S. aureus*and *Enterococcus*	*Ahmed et al.* (1998*), Hasan et al.* (2016)
7	*Drynaria quercifolia*	Rhizome	Friedelin, amyrin narginin, sitosterol, epifriedelinol	*Enterococcus faecalis, P. aeruginosa*	Mithraja and Jeeva (2012) Prasanna and Anuradha (2015)
8	*Hybanthus enneaspermus*	Whole plant	Carotene, milbemycin, lycoxanthin, astaxanthin	*E. coli, P. aeruginosa, Klebsiella pneumoniea*	Sahoo et al. (2006) MK et al. (2018)
9	*Aloe barabadensis*	Leaf	Alkaloids, anthraquinones, anthrones, coumarins, pyrones	*P. aeruginosa. E. coli*	Pandey and Mishra (2010), Dagne et al. (2000)
10	*Hibiscus sabdariffa*	calyx	Aglycone, hibiscitrin, sabdaritrin, gossypetin, anthocyanin	*E. coli, Klebsiella, Pneumonia*	Alshami and Alharbi (2014) Ali et al. (2005)
11	*Mangifera indica*	Leaf	Flavonols, mangiferin, benzophenons, gallotannis	*E. coli*	Doughari and Manazara (2008) Fernandez- ponce et al. (2015)
12	*Origanum vulgare*	Seed	Myricetin, kaemferol, catechin, rutin, apigenin, quercetin	*K. pneumoniae,Entero-bacter species*	Chaudhry et al. (2007) Kursat et al. (2011)
13	*Abrus precatorius*	Seed	Abrine, abrasine, anthocyanins, choline, hypaphorine, campesterol, abrisapogenol, trigonelline	*Enterococcus faecalis*	Bobbarala and Vadlapudi (2009) Bhatia et al. (2013)
14	*Lawsonia innermis*	Leaf and seed	Luteolins, apegenin, esculetin, scopletin	*P. aeruginosa*	Habbal et al. (2011) Borade et al. (2011)
15	*Verbascum sinuatum*	Leaf	Sinuatol, aucubin, catalpol, poliumoside, flavones, luteolin	*Enterococcus faecalis, P. mirabilis*	Sener and Dulger (2009) Tatli and Akdemir (2004)

16	*Vernonia amygdalina*	Leaf	Vernolepin, vernodalin, luteolin, vernodalole, myrtenal	*Klebsiella species*	Uzoigwe and Agwa(2011) Alara et al. (2017)
17	*Chebula myrobalan*	Leaf	Punacalagin, casurarinin, terchebulin, corilagin, chebulanin	*E. coli, P. aeuroginosa*	Anwesa et al. (2009) Rathinamoorthy and Thilagavathi (2014)
18	*Ballota acetabulosa*	Leaf	Ladanein, rutin, leufolins A, leufolins B, ballonigrin, hispanone	*E. coli*	Dulger and Dulger (2012) Roselli et al. (2019)
19	*Barringtonia acutangula*	Twig	Saponins, acutagenol A, B, amyrin, barringtogenols, stigmasterol	*E. faecalis, S. aureus, K. pneumonia*	Sahoo et al. (2008) Sultana et al. (2019)
20	*Cinnamon cassia*	Fruit	Sinapic acids, cinnamic acid, caffeic, vanillin	*E. coli, S. aureus, P. aeruginosa*	Nazia and Perween (2006), Dvorackova et al. (2015)
21	*Cymbopogon citratus*	Whole plant	Luteolin, quercetin, betanidin, caffeoylquinic	*P. aeruginosa*	Naik et al. (2010) Roriz et al. (2014)
22	*Eucalyptus tereticornis*	Leaf	Pinine, limonene, nerolidol, aromadendrene, guaiol, borneol	*E. coli*	Ammer et al. (2016) Pujiarti and Fentiyanti (2017)
23	*Memecylon umbellatum*	Leaf	Sitosterol, umbelacetone, betaamyrin, oleanolic acid	*P. aeruginosa*	Murugesan et al. (2011) Harkare et al. (2013)
24	*Momordica charantia*	Fruit and Leaf	Charantin, momordicin, momordin, betasitosterol, momordicoside G	*P. aeruginosa, E. coli, K. pneumoniae*	Mwambete (2009) Desai and Tatke (2015)
25	*Cassia alata*	Leaf and Root	Emodin, diosmetin, ziganein, physcion, kaemferol	*S. aureus, P. mirabilis*	El-mahmood and Doughari (2008) Promgool et al. (2014)
26	*Tamarindus indica*	Leaf	Orientin, vitexin, saponaretin, sixtien, iso-	*E. coli, K. pneumoniae P. aeruginosa*	Daniyan and Muhammad (2008) Gumgumjee et al.

			orientin		(2012)	
27	*Larrea tridentata*	Leaf	Kaemferol, quercetin, NDGA (nordihydroguaiaretic acid)	*Methicillin resistant S. aureus*	Martins et al. (2013) Martins et al. (2012)	**CONCLUSION AND**

FUTURE PROSPECTIVE

UTI is one of the very common infectious disease (more than 10 million cases per year seen in India alone). It is more prevalent in women than men. Presently use of antibiotics has been given due importance to treat this disease. Antibiotic resistance has been emerged as one of the biggest problem due to frequent use of the same antibiotics. Further, synthetic antibiotics are found to be linked with severe side effects. Considering this, various studies have been carried out to reveal the potentials of medicinal plants against UTI causing pathogens. In this direction, tremendous success has been achieved. Many medicinal plants with antimicrobial potential against UTI causing pathogens have been identified. However, dearth of literature available on the bioprospecting of the medicinal plants with antimicrobial potential against UTI causing pathogens. Pleasing success has not been achieved in identifying the phytochemical constituents showing activity against the UTI causing pathogens. Further research is needed in this direction to develop plant-derived antimicrobials against UTI causing microbial pathogens.

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Impact of corona virus on broader indices of indian stock market

Ratidev Samal[1] and Girija Nandini[2*]
[1]School of Management Studies, Jain University, Bengaluru, Karnataka, India.
[2]School of Management, Centurion University of Technology and Management, Odisha, India
*Corresponding author: girijanandini@cutm.ac.in

Abstract
Purpose- The purpose of the study is to explore the impact of coronavirus (COVID-19) on two major indices of Indian stock market i.e NIFTY and BANKNIFTY, to find suitable combination of technical indicators to catch the trend of the market, to identify the abnormal movement in indices and finding different entry-exit points and to find out probable future trend.
Design/Methodology/Approach- The data have been obtained from NSE site over a period of one year and analysis is conducted on excel with the help of selected technical indicators like EMA, MACD and BB
Findings-Using a combination of technical indicators is better than depending on any individual indicators, coronavirus has a deep impact on market but the recovery is also faster and behind any abnormal moment in the market there is a valid event.
Research Implication/Social Implication- The research captures different impetus of financial markets which enhances better decision making at the part of day and swing traders and investors. The larger part of the society which are unemployed and those having leisure time will be benefitted by earning part of their livelihood.
Originality/Value- To the author's knowledge the paper is quite unique in terms of enhancing quantitative and qualitative decision making aspects and simplest language being used for the interest of the society at larger.
Keywords- Stock market, Price, Indicators, Technical analysis, Trading, Investment
Paper Type- Technical paper

Introduction

This study focuses on technical analysis of two major indices of Indian stock market i.e. NIFTY and BANKNIFTY. The objective is to identify the trend in price movement of the two indices, and finding if any abnormalities present in the movement during the period of study. The study includes two broader indices i.e. NIFTY and BANKNIFTY. These two indices are choosen because they include all quality NIFTY 50 stocks and quality banks and the trend of the market can be judged by looking at the performance of these indices. NIFTY represents top 50 companies where as BANKNIFTY includes top 12 banks of our stock market which are subject to change by NSE based on their performance. The indicators used in this study are Exponential moving average (EMA), Moving average convergence divergence (MACD) and Bollinger Band (BB). Technical analysis is performed through different indicators in order to forecast the future price movement based on past price movement. The study aims at conducting technical analysis of indices for assisting investment decision in Indian stock market.

Indian stock market is been the major attraction centre among traders and investors across the globe. The major factors behind the attraction are large economy, consistent growth, potential for development and huge customer base. The citizenship amendment act (CAA), 2019 will further increase the population in our country there by increasing the number of potential customers.

Review of Literature

National stock exchange's, NIFTY includes top fifty companies from different sectors (Setty, Rangaswamy & Suresh, 2010; Ahmed, 2008). Juhi Ahuja (2012) made a review of Indian Capital Market & its structure. It is observed that there has been a paradigm shift in Indian capital market. There were

many reforms & developments in Indian capital market, which made the Indian capital market comparable with the capital markets across the globe. Now, Indian stock market is recognized as a modern market infrastructure with growing market capitalization, market liquidity, and mobilization of resources. The lag can be reduced by exponential moving averages to recent prices (Setty, Rangaswamy & Suresh, 2010). It can be calculated in three steps. At first simple moving average is calculated. Secondly, perform the calculation of the weighting multiplier. At last the exponential moving average is calculated. Financial markets are a platform where buy and sell of financial assets such as financial securities, commodities and fungible items can be carried out at lower transaction costs based on type of market (Setty, Rangaswamy and Suresh, 2010). With the introduction of financial market, investors started to find out the way for better investment opportunity and started ways to analyze the market (Patel, 2014). Stock Market talks about two types of analysis, Fundamental analysis and Technical analysis. Fundamental analysis is all about financial performance of the company, growth in share price and market (Setty, Rangaswamy & Suresh, 2010). Technical analysis is basically used to identify the trend of future stock price with the usage of past stock price (Ramadoss & Muthuvel, 2013). So technical analysis is not considering the company's consideration and only looks at the past performance of stocks (Ahmed, 2008).

Fundamental analysis is all about financial performance of the company, growth in share price and market (Setty, Rangaswamy & Suresh, 2010). Technical analysis is basically used to identify the trend of future stock price with the usage of past stock price (Ramadoss & Muthuvel, 2013). So technical analysis is not considering the company's consideration and only looks at the past performance of stocks (Ahmed, 2008). Armour et al (2010) tested the standard MACD(12,26,9) , on 20 years of data of the main index of Irish Stock market. It found that the MACD rule underperformed the buy and hold system. Dr. S. Krishnaprabha and Mr. M. Vijayakumar (2015), undertaken a survey on risk and return analysis of selected stocks in India. Long term investors were mostly benefited as the market is less volatile. Due to less volatility the long-term investors are able to predict when the share will rise. The sectors like IT, FMCG and Pharma give more return while compared to Banking and Automobile sector. Masood, O. & Ashraf, M. (2012) studied on "Bank-specific and macroeconomic profitability determinants of Islamic banks". The purpose of study is to inspect whether bank-specific and macro-economic factors influence the profitability of Islamic banks' of different regions. It is found that banks having larger assets size and efficient management gets greater return on assets. Moritz, A., Block, J. & Lutz, E. (2015) studied on "Investor communication in equity-based crowdfunding: a qualitative-empirical study". The objective is to investigate the investor communication role in equity-based crowdfunding. It is found that the venture's overall impression like sympathy, openness and trustworthiness are important to reduce asymmetries of investors in equity-based crowdfunding.

DeBondt, W. et al.(2010) studied on "What can behavioural finance teach us about finance?". This paper draws inferences raised at round table discussion on behavioural finance attended by academics and practitioners. The result indicates about numerous benefits of behavioural finance, but there is an opinion difference between the academic and the professional world regarding utilising behavioural finance research. Burton, B.(2007) studied on "Qualitative research in finance – pedigree and renaissance". The study aims at qualitative research in finance focussing on the pedigree of such analyses and describing the renaissance. The result indicates regarding the need for more qualitative research in finance, and illustrates recent renaissance in such work to generate novel and important empirical insights. Alexiou and Sofoklis (2009) found out a negative relationship with return on assets and profitability level and there exist a positive relationship found between debt to equity ratio and profitability of Islamic banks. Ali et al. (2011) found the positive and significant relationship between capital adequacy and profitability model. Berger, A. (1995), The surprising positive Granger-causation from capital to earnings occurred primarily through lower interest rates paid on uninsured purchased funds. The asset management higher ratio is beneficial for banks. The positive relationship exhibited between ratio and profitability of Islamic banks (Chirwa, 2003; Miller and Noulas, 1997). Berkovich, E. (2011), The study indicates that most investors in equity-based crowd funding take investment decision based on evaluation of the management team and

the importance of soft facts in uncertain environments. Fernandez *et al.* (2011), cited that when investors think that others have more or better information, they tend to ignore important issues hence leading to poor decision making. Nandini.G. & Samal.R (2020),have collected data for a period of one year that is from 20.03.2019 to 19.03.2020 from NSE site. The day wise historical data is collected for three companies that is HDFC Bank, RELIANCE and TCS over the same period . In the period of study it is found that in majority of time technical analysis is correct,investors should have confidence in those points and the entry and exit timing has to be proper. In the period of study lots of events have been occurred. Positive events impacted the market in a very positive way and negative events also drastically affected the market. So one should always have updated information about the happenings in business world and in general to grab the opportunity.

Objectives of the study

- To analyze the performance of NIFTY & BANKNIFTY and to predict the future trends of Indian stock market through technical analysis.
- To identify different entry and exit points of the Indices during the period and identifying points for long and short position.
- To identify any abnormal movement in the period of study if any.
- To study the reasons behind such abnormal movements and capturing the impacts before and after the event occur.
- To suggest the correct timing and price level for traders and investors in taking position or making investment decisions.

Research framework

Data collection

To accomplish the objectives of the study we need the help of historical data. The data is collected for a period of one year that is from 11.07.2019 to 10.07.2020 from NSE website. The data is filtered on the basis of closing prices of every single trading day and it is being imported to excel for further analysis. The historical data is collected for both the indices i.e. NIFTY & BANKNIFTY.The data is collected on all the trading days during that period for closing prices on day basis. The collected data has been analysed with the help of technical indicators i.e. EMA, MACD and BB. To have more accurate prediction about the trend both candlestick chart and line chart will be presented. The Line charts will be presented manually from excel and candlestick charts will be presented from i-chart website by applying different technical indicators. At last all the indicators will be applied combining on one chart to identify the co-ordination among them. Under each indicator two charts will be presented on line and candlestick and the interpretation will be discussed together

Data analysis, findings and discussion

Simple moving average (SMA) and exponential moving average (EMA)

Here we have chosen two time frame lines that are 10 days & 15 days for both SMA & EMA. First the calculations are done for SMA by taking the average of closing price of last 10 days and last 15 days. In SMA equal weightage is given to past data. Hence we draw 3 lines for each company, Where 1st line represents the actual line of price movement (based on closing prices), 2nd line represents 10 days SMA (average of last 10 days closing prices) and the 3rd line represents 15 days SMA (average of last 15 days closing prices). Out of two SMA line the longer time frame SMA line (15 days) is known as slow line and the shorter time frame SMA line (10 days) is known as fast line. When the fast line cuts the slower line from bottom it is considered as a bullish cross over where we can take long position. When the fast line cuts the slower line from above it is considered as a bearish cross over where we can take short position.

EMA is considered as a more smooth line in comparison to SMA as it gives more weightage to recent data than past data. EMA is calculated by using formula

EMA= {closing price- EMA(previous day)}x multiplier+ EMA(previous day)

Where multiplier = {2/(Time period+1)}
The 1st EMA will be the SMA for the said period (since we don't have any previous EMA before that).

Here we draw 3 lines for each company, Where 1st line represents the actual line of price movement (based on closing prices), 2nd line represents 10 days and the 3rd line represents 15 days EMA. Out of two EMA line the longer time frame EMA line (15 days) is known as slow line and the shorter time frame EMA line (10 days) is known as fast line. When the fast line cuts the slower line from bottom it is considered as a bullish cross over where we can take long position. When the fast line cuts the slower line from above it is considered as a bearish cross over where we can take short position.

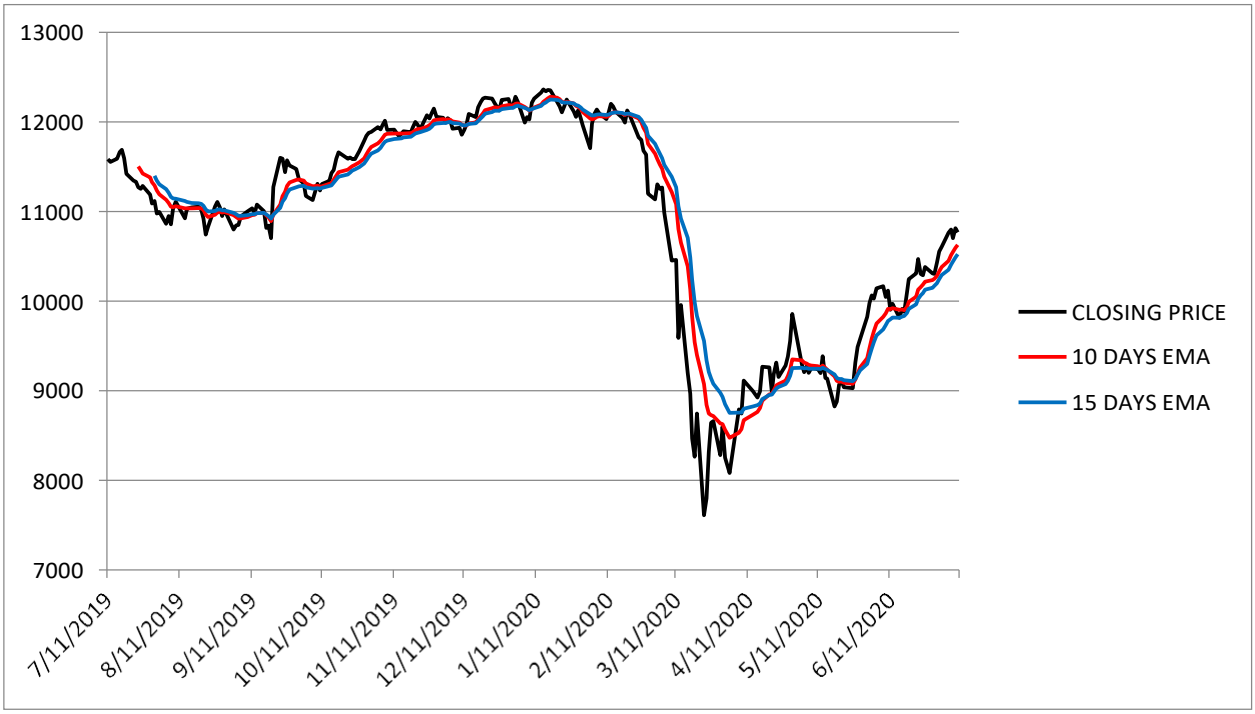

Fig. No. 4.1 10 & 15 Days EMA line chart of NIFTY

Fig. No. 4.2 10 & 15 Days EMA candlestick chart of NIFTY

As per the analysis of EMA lines the important dates are 19.07.2019, 20.09.2019, 24.02.2020 & 22.04.20. On date 19.07.2019 & 24.02.2020 there is a clear bearish crossover where the 10 days EMA line cutting the 15 days EMA from above. After the first date the trend continued for some period but did not last long. After the second date the fall in NIFTY was drastic and the trend continued for long period. Because during the period market responded negatively to the corona virus situation. Hence there was opportunity for making short position. On date 20.09.2019 & 22.04.2020 clear bullish crossovers are generated, the 10 days EMA line cuts the 15 days EMA line from below. The trend has continued for a long period, one could have created long position. The crossover on 22.04.2020 was rather a recovery after the panic fall due to corona virus. All four entry points continued and maintained the trend; hence traders and investors should have made handsome money. Since NIFTY & BANKNIFTY are the indices we can't buy it as shares but we can trade and invest in respective futures & options on different strike price. Options are categorized as Call options and put options. When we feel that the market is bullish we have two choices either we can buy/long call option or we can sell/short put option. In other hand when market is bearish we again have two choices either we can buy/long put option or we can sell/short call option. Based upon the technical analysis we need to decide which option to trade i.e. ITM (In the money), ATM (At the money) or OTM (Out of the money).

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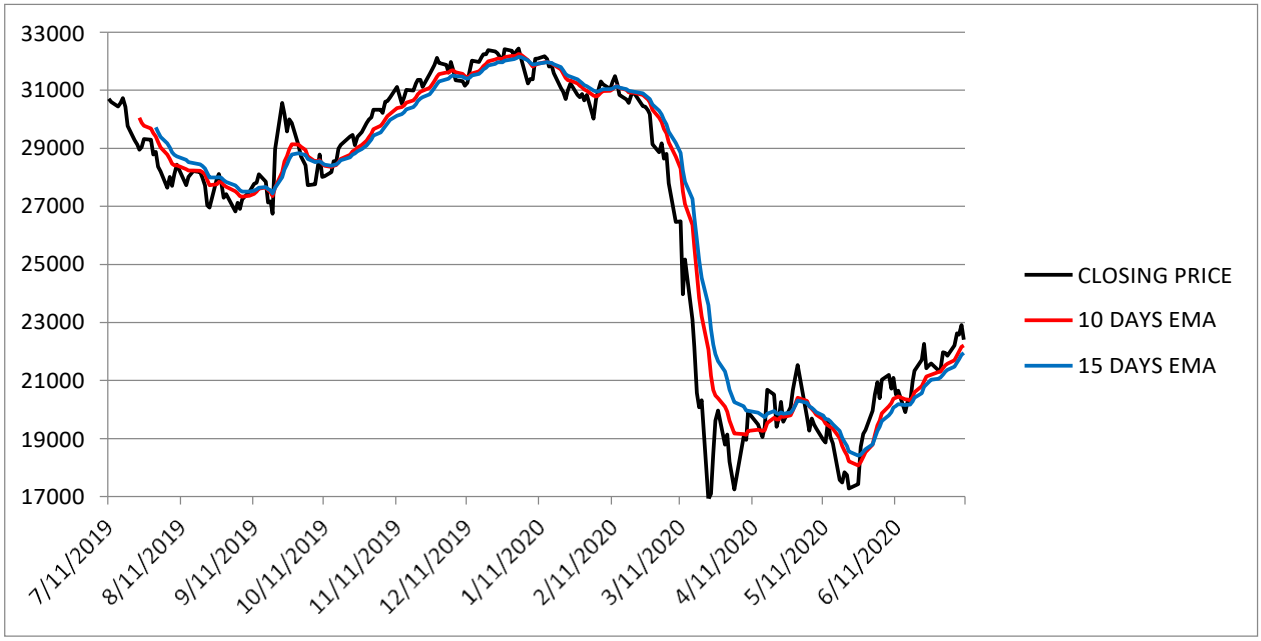

Fig. No. 4.3 10 & 15 Days EMA line chart of BANKNIFTY

Fig. No. 4.4 10 & 15 Days EMA candlestick chart of BANKNIFTY

As per the analysis of EMA lines the important dates are 19.07.2019, 20.09.2019, 27.02.2020 & 02.06.20. On date 19.07.2019, 27.02.2020 there is a clear bearish crossover where the 10 days EMA line cutting the 15 days EMA from above. After the first date the trend continued for some period but did not last long. After the second date the fall in BANKNIFTY was drastic and the trend continued for long period. Because during the period market responded negatively to the corona virus situation. Hence there was opportunity for making short position. On date 20.09.2019, 02.06.2020 clear bullish crossovers are generated, the 10 days EMA line cuts the 15 days EMA line from below. The trend has continued for a long period, one could have created long position. The crossover on 22.04.2020 was rather a recovery

after the panic fall due to corona virus. All four entry points continued and maintained the trend; hence traders and investors should have made handsome money. Since NIFTY & BANKNIFTY are the indices we can't buy it as shares but we can trade and invest in respective futures & options on different strike price. Options are categorized as Call options and put options. When we feel that the market is bullish we have two choices either we can buy/long call option or we can sell/short put option. In other hand when market is bearish we again have two choices either we can buy/long put option or we can sell/short call option. Based upon the technical analysis we need to decide which option to trade i.e. ITM (In the money), ATM (At the money) or OTM (Out of the money).

Moving average convergence and divergence (MACD)

Here we have chosen MACD (12,26,9) time frame for the analysis. MACD indicator has two lines one is MACD line another line is signal line. Here MACD line is drawn by taking the difference of 12 days EMA and 26 days EMA (MACD line=12 days EMA-26 days EMA). Signal line is drawn by taking 9 days EMA of MACD line. MACD histograms are drawn by taking the differences of MACD line and signal line. When both MACD & signal line are above the zero line it is considered to be bullish trend. When both MACD & Signal line are below the zero line it is considered as a bearish trend. If both the lines are below zero line and MACD line cuts the signal line from bottom it is considered as initial buying signal. If both the lines are above the zero line and MACD line cuts the signal line from bottom it is considered as conform buying signal. If both the lines are above zero line and MACD line cuts signal line from top it is considered as initial selling signal. If both the lines are below zero line and MACD line cuts signal line from above it is considered as conform selling signal. Based upon this position will be taken. Histogram represents the difference between MACD line and signal line. The histograms are drawn above the zero line when the MACD line is above signal line and histograms are drawn below the zero line when the MACD line is below the signal line. If the size of histograms are small it represents there is less strength in taking any decision.

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Fig. No. 4.5 MACD(12,26,9) line chart of NIFTY

Fig. No. 4.6 MACD(12,26,9) candlestick chart of NIFTY

As per MACD the important dates are 22.07.19, 20.09.19, 26.02.20 &07.04. because on these dates important crossovers are generated. On date 20.09.19 & 07.04.20 the MACD line cuts the signal line from below hence the bullish crossover is generated and there is significant rise in price of NIFTY. The strength of the bullish crossover generated near 20.09.19 is comparatively low as the angle of cutting is low, hence the trend could not sustain for long & there is not much rise in price. The strength of bullish crossover generated near 07.04.2020 is quite high as the angle of cutting is significant, trend is still continuing with aggression & there is significant growth in NIFTY. So there was excellent opportunity for creating long position there by generating huge money. On date 22.07.19 & 26.02.20 two bearish crossovers are generated where the MACD line cuts the signal line from above. The strength of the bearish crossover generated near 22.07.19 is comparatively low as the angle of cutting is low, hence the trend could not sustain for long & there is not much fall in price. The strength of bearish crossover generated near 26.02.2020 is quite high as the angle of cutting is significant, the trend is continued for long with aggression & there is drastic fall in the price of NIFTY. The trend has got lot of fuel from increased number of corona virus cases during the period across the globe. After completion of the trend some recovery is seen in the indices due to initiative taken by central banks of the respective countries across the globe in terms of bringing liquidity and pumping cash into the market very aggressively.

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Fig. No. 4.7 MACD(12,26,9) line chart of BANKNIFTY

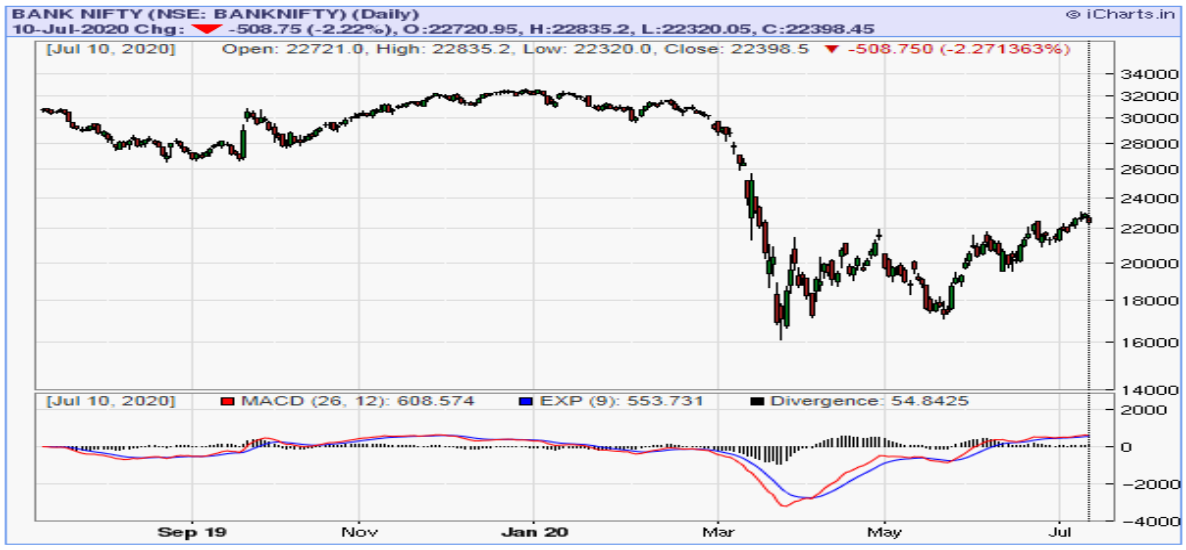

Fig. No. 4.8 MACD(12,26,9) candlestick chart of BANKNIFTY

As per MACD the important dates are 19.07.19, 12.09.19, 28.02.20 &08.04.20 because on these dates important crossovers are generated. On date 12.09.19 & 08.04.20 the MACD line cuts the signal line from below hence the bullish crossover is generated and there is significant rise in price of BANKNIFTY. The strength of the bullish crossover generated near 12.09.19 is comparatively low as the angle of cutting is low, hence the trend could not sustain for long & there is not much rise in price. The strength of bullish crossover generated near 08.04.2020 is quite high as the angle of cutting is significant, trend is still continuing with aggression & there is significant growth in BANKNIFTY. So there was excellent opportunity for creating long position there by generating huge money. On date 19.07.19 & 28.02.20 two

bearish crossovers are generated where the MACD line cuts the signal line from above. The strength of the bearish crossover generated near 19.07.19 is comparatively low as the angle of cutting is low, hence the trend could not sustain for long & there is not much fall in price. The strength of bearish crossover generated near 28.02.2020 is quite high as the angle of cutting is significant, the trend is continued for long with aggression & there is drastic fall in the price of BANKNIFTY. The trend has got lot of fuel from increased number of corona virus cases during the period across the globe. After completion of the trend some recovery is seen in the indices due to initiative taken by central banks of the respective countries across the globe in terms of bringing liquidity and pumping cash into the market very aggressively.

Bollinger band (BB)

Bollinger band is a technical indicator which carries three lines they are upper band, lower band and middle line. Middle one is 20 days SMA line. Upper band line is drawn by taking data of (SMA+2 x standard deviation). Similarly the lower band will be drawn by taking data (SMA+2 x standard deviation). Here standard deviation will be calculated on closing prices of last 20 days. The interpretation is if the candle or line touches the upper or lower band but if it could not break it there is possibility of reversal in the movement. If one candle breaks either upper band or lower band then we have to wait for the formation of the next candle, if the next candle clearly cross the previous breakdown candle then we can create position in that direction. If the next candle could not cross the breakdown candle there is possibility of reversal. If the cross over candle is too big we should not create position even if the next candle cross this. When both upper and lower band becomes squeeze or narrow there is a possibility of break out in either direction. If one candle is formed outside of the bubble & the next candle formed inside the bubble there might be trend reversal. Mostly the share price moves within both lines.

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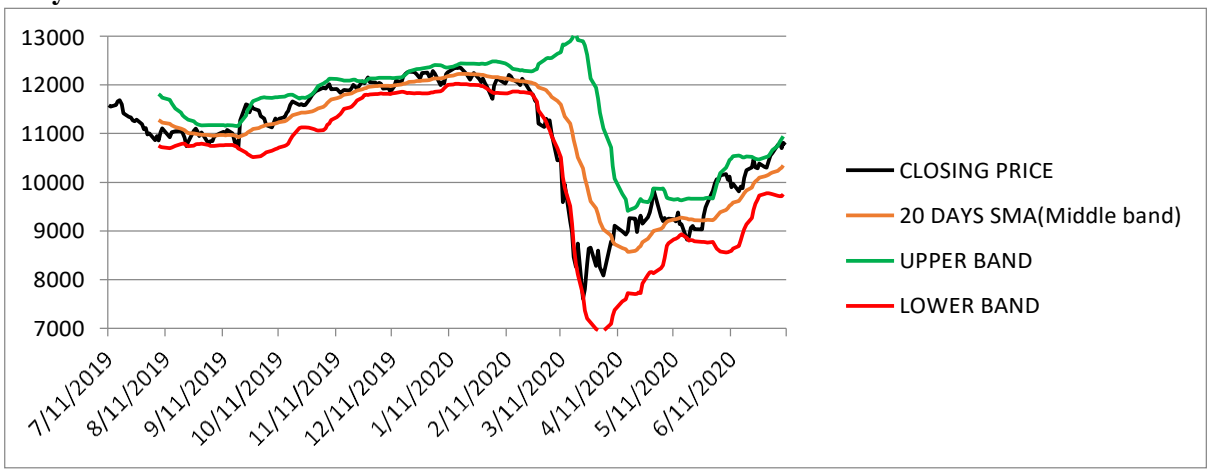

Fig. No. 4.9 BB(20,2) line chart of NIFTY

Fig. No. 4.10 BB(20,2) candlestick chart of NIFTY

The technical indicator Bollinger Band has indicated four important dates where significant movement has seen once closing price line touched either lower or upper band. The important dates are 19.07.19, 19.09.19, 20.01.20and 25.03.20. On 19.07.19 there is a bearish trend generated as the candle touches the middle band of BB, the trend continued for some time then there is reversal as the candle touched the lower band of BB. On 19.09.19 a bullish trend is generated as the candle touches the lower band of BB, this trend continued for some time but in a range basis then there is a reversal as the candles touches the upper band. On date 20.01.2019 the candle has touched the upper band, from that point there is a drastic fall in price, the trend was continued for months supported by corona virus cases. On 25.03.20 a bullish trend is generated as the candle touches the lower band of BB, the trend is still continuing and is seen as a recovery after damage done by corona virus. The recovery is seen in the indices due to initiative taken by central banks of the respective countries across the globe in terms of bringing liquidity and pumping cash into the market very aggressively.

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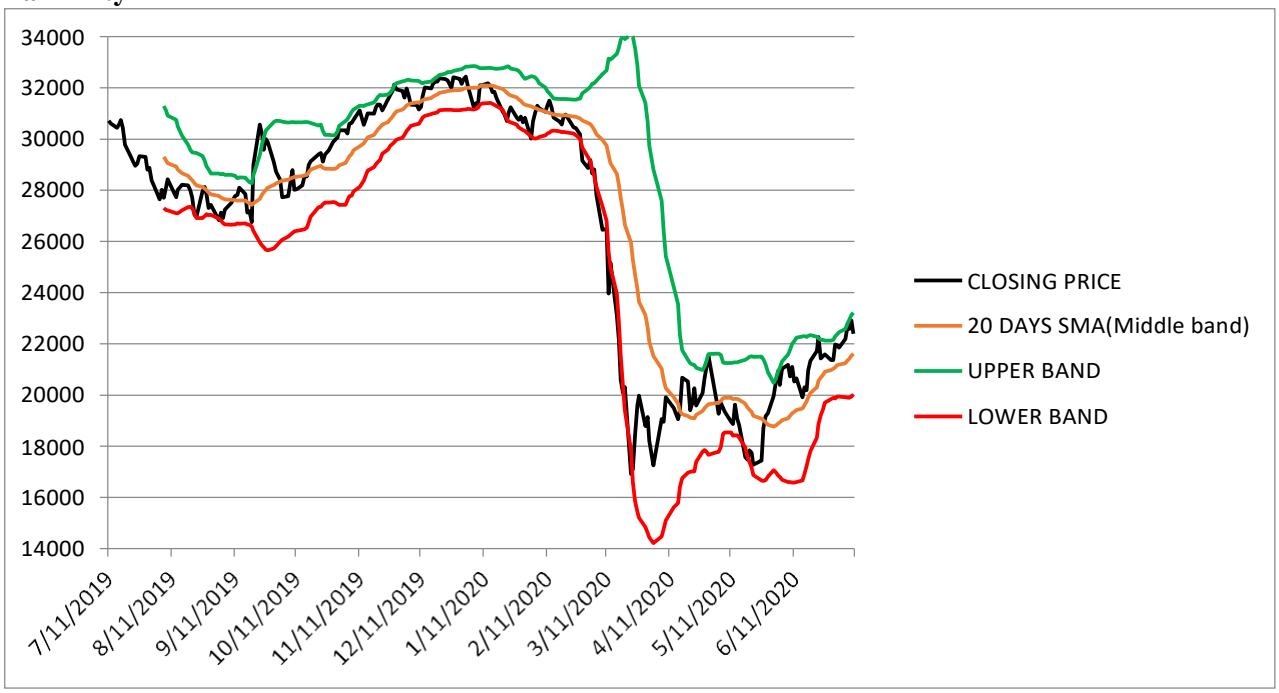

Fig. No. 4.11 BB(20,2) line chart of BANKNIFTY

Fig. No. 4.12 BB(20,2) candlestick chart of BANKNIFTY

The technical indicator Bollinger Band has indicated four important dates where significant movement has seen once closing price line touched either lower or upper band. The important dates are 19.07.2019, 04.09.2019, 14.02.2020 & 25.03.2020.

On 19.07.19 there is a bearish trend generated as the candle touches the middle band of BB, the trend continued for some time then there is reversal as the candle touched the lower band of BB. On 04.09.19 a bullish trend is generated as the candle touches the lower band of BB, this trend continued for some time but in a range basis then there is a reversal as the candles touches the upper band. On date 14.02.2020 the candle has touched the upper band, from that point there is a drastic fall in price, the trend was continued for months supported by corona virus cases. On 25.03.20 a bullish trend is generated as the candle touches the lower band of BB, the trend is still continuing and is seen as a recovery after damage done by corona virus. The recovery is seen in the indices due to initiative taken by central banks of the respective countries across the globe in terms of bringing liquidity and pumping cash into the market very aggressively.

Combined indicators

The stock market is very much uncertain, that is the reason we cannot predict the stock movement accurately every time. But in lot of darkness the indicators shows some light to predict the movement. The problem occurs if we are depending upon any single indicator that might generates some false buying and selling signals, hence to remain in safe side and to predict the movement with higher accuracy we should use a combination of technical indicators. Here in the below mentioned figures simultaneously I am using different indicators like EMA, MACD and BB for indices under study. The analysis is done through application of all the indicators together and found out points of entry where all indicators support. Through this approach the risk of false signals automatically gets reduced. This set up helps the traders & investors to create long and short position with more confidence.

Nifty

Fig. No. 4.13 combined indicators candlestick chart of NIFTY

As per combined indicators chart pattern the important dates are 24.07.19, 24.09.19, 27.02.20 & 29.05.20. On date 24.07.19 all the indicators display a bearish movement at this point anyone could have generated short position, the trend continued for significant amount of time. On date 24.09.19 all the indicators display a bullish movement at this point anyone could have generated long position, the trend also continued for significant amount of time. On 29.05.20 a strong bearish trend is generated with the support of all indicators, both traders and investors could have generated short position. The trend continued long and there is a drastic fall in price with the increased no of corona virus positive cases across globe, hence opportunity was there to generate huge amount of money. On 24.07.20 all the indicators display a bullish movement at this point anyone could have generated long position, the trend also continued for significant amount of time. This is rather considered as recovery after the market is badly affected by corona virus, it became possible due to initiative taken by central banks of the respective countries across the globe in terms of bringing liquidity and pumping cash into the market very aggressively.

Banknifty

Fig. No. 4.14 combined indicators candlestick chart of BANKNIFTY

As per combined indicators chart pattern the important dates are 22.07.19, 24.10.19, 27.02.20 & 02.06.20. On date 22.07.19 all the indicators display a bearish movement at this point anyone could have generated short position, the trend continued for significant amount of time. On date 24.10.19 all the indicators display a bullish movement at this point anyone could have generated long position, the trend also continued for significant amount of time. On 27.02.20 a strong bearish trend is generated with the support of all indicators, both traders and investors could have generated short position. The trend continued long and there is a drastic fall in price with the increased no of corona virus positive cases across globe, hence opportunity was there to generate huge amount of money. On 02.06.20 all the indicators display a bullish movement, at this point anyone could have generated long position, the trend also continued for significant amount of time. This is rather considered as recovery after the market is badly affected by corona virus, it became possible due to initiative taken by central banks of the respective countries across the globe in terms of bringing liquidity and pumping cash into the market very aggressively.

Major events and abnormal movements

It is true that market is driven by the sentiment of the people and in market two factors work one is fear and greed. So the abnormal movement comes from abnormal events, during my period of study some important decisions were taken at our country level to which the market reacted.

The major events are

On 05.07.19 the union budget was declared, it do not had much impact on market as there is no significant hike or fall in share prices neither in broader indices like SENSEX, NIFTY and BANKNIFTY. Overall the market was not quite excited and perhaps things declared did not match to the expectations of the market.

On 23.08.19, our finance minister Nirmala Sitharaman had announced a slew of measures to eradicate slowdown and bringing growth. The steps include an upfront release of Rs 70,000 crore to public sector banks, announcement regarding mega merger of different public sector banks where the total number of banks will come down to 12 from 27, measures to remedy slowdown in auto sector, improve taxes compliance and help MSMEs and India Inc. These news has excited the market significantly the announcements were as per the expectation of the market. Since the declaration came in evening the serious positive impact has seen on market both on date 23.08.19 and 24.08.19. The impact was so exciting there was huge growth in most of the shares prices and important indices like SENSEX, NIFTY and BANKNIFTY.

On 20.09.19 another very important event occurred when our country's finance minister declare about the historic decision taken by the government i.e. regarding reduction in corporate tax. The decision was for existing companies it is reduced to 22% from 30% and for new companies it is reduced to 15% from 25%, market responded this news very positively and the impact was seen on stock market in terms of huge growth in most of the shares prices and important indices like SENSEX, NIFTY and BANKNIFTY.

30.01.2020 India reported the 1st case of coronavirus (COVID-19) pandemic which was originated from china belongs to kerala. After this date the number of COVID cases went on increasing across the globe and in India day by day. The WHO also declared COVID-19 as a pandemic on 11th march 2020. Since no vaccination is available for this disease yet and it can easily spread from one person to another, so the most of the country went for lockdown and shutdown as a precautionary measure. The world economy has been stopped due to shut down of many industries. India and the world have never seen such things before in history. The immediate impact has seen on stock market in terms of drastic fall in all the individual share prices and on our major indices like SENSEX, NIFTY and BANKNIFTY. The fall was so furious nifty came down to below 8000 pts. This incident has almost dragged back the share market to 10 yrs. before.

CONCLUSIONS

Stock market is highly uncertain as it is affected by many internal and external factors of the organization like news, business situation different rates, pandemic disease, disaster etc. In such uncertainties of

darkness technical indicators provides some lights to traders and investors to take better decision. Instead of depending on any single technical indicator we should use a combination of few technical indicators reason being one indicator might give a false signal but not all at a time. As per technical analysis market is weak now and further market will become weaker and it might continue a long bearish trend.

In the period of study we found that in majority of time technical analysis is correct, we should have confidence in those points and the entry and exit timing has to be proper. In the period of study lots of events have been occurred. Positive events impacted the market in a very positive way and negative events also drastically affected the market. So one should always have update information about the happenings in business world and in general to grab the opportunity. In this paper different entry and exit points and whether to take long and short positions are highlighted for indices. Similarly in future traders and investors should focus on using a combination of technical indicators to identify different points to create a position.

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Exon junction complex: the guardian of messenger RNA

Annapurna Sahoo[1] and Kunja Bihari Satapathy[1]*
[1]School of Applied Sciences, Centurion University of Technology and Management, Odisha, India
*Corresponding Author's email: kunjabihari.satapathy@cutm.ac.in

Abstract

The exon junction complex (EJC) proteins closely associate with messenger RNA (mRNA) to form messenger ribonucleoprotein (mRNP) that essentially assembles during the splicing event. This mRNP firmly binds to mRNAs upstream of the exon-exon junctions. Most importantly EJC proteins strongly regulate the post-transcriptional fate of mRNA. EJC proteins escort the newly synthesized mRNA from the nucleus into the cytoplasm, where the translation event is destined. EJC proteins participate and actively control several major molecular events such as pre-mRNA splicing, mRNA export, translation and nonsense-mediated mRNA decay (NMD). Primarily the EJC proteins guards the mRNA from being hijacked into the decay process under typical physiological conditions, but favours the decay process when the mRNA is aberrant in nature thus allowing the cell to escape from any post-translation detrimental effect(s). Mutations in EJC proteins possess detrimental effects in metazoans. This review mostly summarizes the components of the EJC complex and their role in maintaining the cellular homeostasis.

Keywords: Exon junction complex, messenger RNA, post-transcriptional, pre-mRNA splicing, nonsense-mediated mRNA decay.

Introduction

In eukaryotes the efficiency and fidelity of key molecular events is possible due to a number of transcriptional and post-transcriptional regulatory mechanisms (Fig.1). The exon junction complex (EJC) in metazoans is a multi-protein complex and associates with the spliced messenger RNA (mRNA) to form mRNA-ribonucleoproteins (mRNPs) which further facilitates the post-transcriptional events [1,2,3]. Primarily EJCs consist of three core factors and many associating proteins, depending on the cellular event that they will be engaged upon. During the pre-mRNA splicing process, in a sequence-independent manner the EJCs assemble and bind to the mRNAs in the region of 20-24 nucleotides (nts) upstream of exon–exon junctions [4,5]. Throughout the life cycle of the EJCs, they remain bound to mRNA [6,7]. Post-transcriptional and the translational events are well regulated by the EJC proteins, but the detailed mechanism(s) in which they regulate the events still remains blurred. Currently the EJCs are believed to be one of the key complexes which eventually contributes the life forms to remain alive [8,9]. The EJC proteins affect the fate of mRNA as they regulate the mRNA export, translation and consequently the

mRNA turnover (Fig. 2, Fig. 3) [10,11,12]. This review largely highlights the major components and the physiological role of EJCs which would primarily represent the role of EJC as the guardian of mRNA.

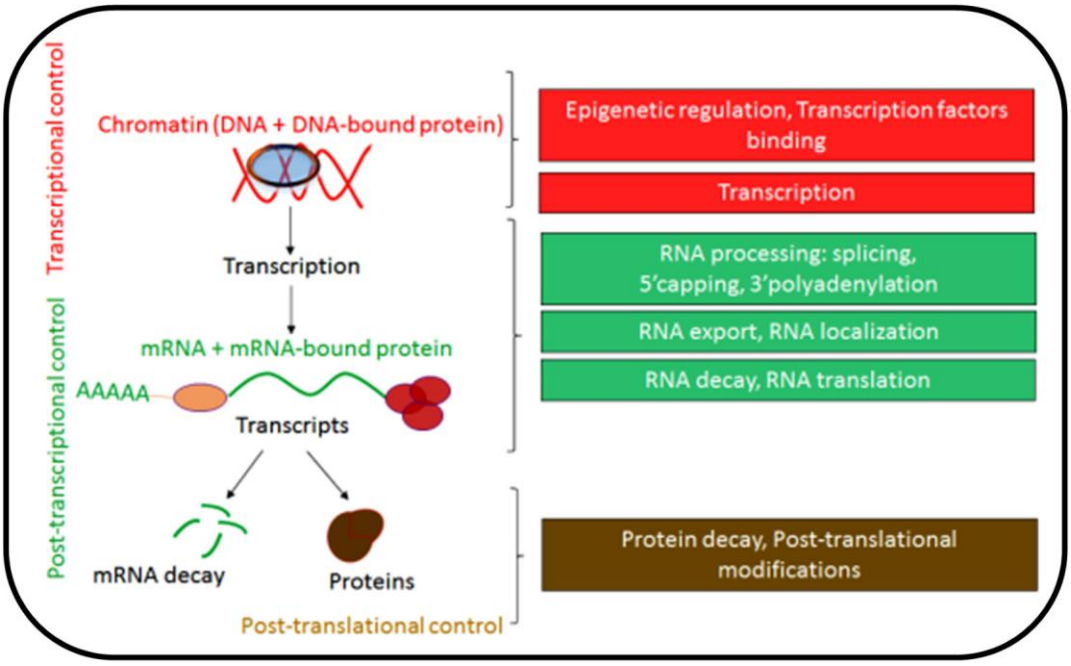

Fig. 1: Schematic representation of the several layers of gene expression regulation.

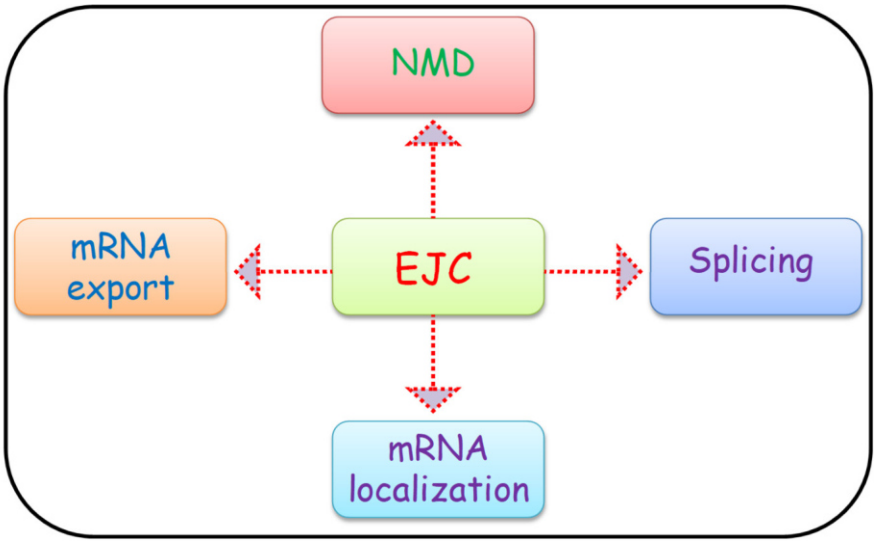

Fig. 2: Schematic representation of the EJC-mediated key molecular events.

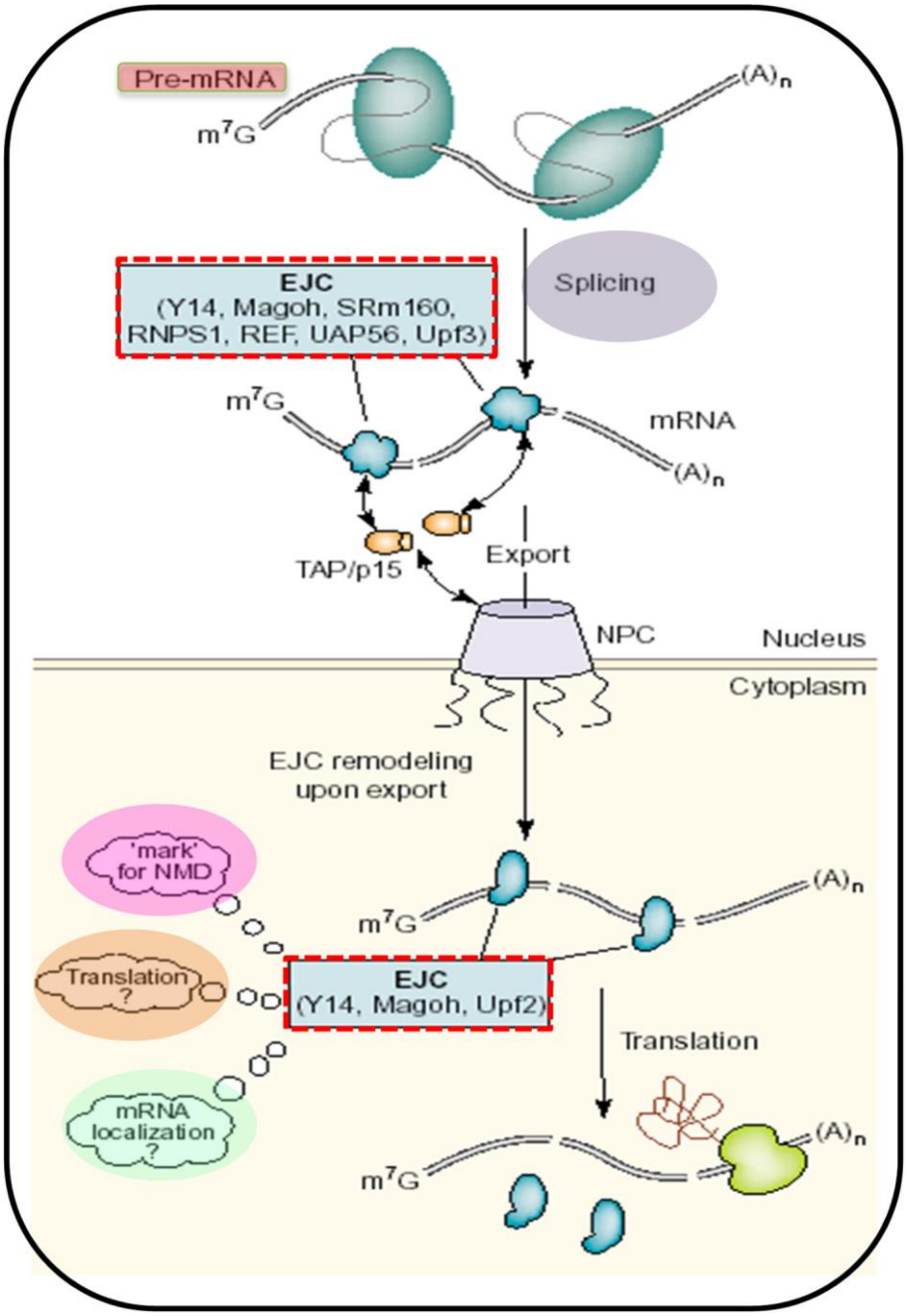

Fig. 3: EJC as the mediator of mRNA functions.

Components of the EJC

The three core proteins of the EJC complex are Y14, MAGOH and EIF4A3 [13,14]. The Y14 and MAGOH associate with each other to form a stable heterodimer and lock the EIF4A3-mRNA complex (Fig. 4). Among the three core complex, EIF4A3 is the RNA-binding protein factor. Another protein factor CASC3 (also known as MLN51) was considered to be one of the core factors of the EJC owing to its close association with the EIF4A3 (Fig. 4) [13,15]. Later it was confirmed that the CASC3 has

differential localization unlike the rest of the core proteins which predominantly localizes in the nucleus. CASC3 shuttles between nucleus and cytoplasm [16,17,18]. The abundancy of CASC3 is also less as compared to other EJC core proteins and knockout mutants of CASC3 are also not embryo lethal [19,20]. Essentially, Y14-MAGOH complex gets imported into the nucleus from the cytoplasm by importin 13 [21,22]. Individually Y14 and MAGOH are involved in various physiological events such as in DNA damage repair and processing body formation [23,24]. Likewise, as soon as EIF4A3 is synthesized in the cytoplasm, it moves into the nucleus to carry out its canonical function. Few protein factors are described as the peripheral EJC components which primarily associate with the core EJC factors when bound to the mRNA [25]. Functionally, peripheral EJC proteins act as regulators of splicing, mRNA export and nonsense mediated mRNA decay. For the most part, peripheral proteins complexes such as PSAP (PNN-RNPS1-SAP18), ASAP (ACIN1-RNPS1-SAP18), the TREX and the NMD protein UPF3B (Fig. 4) are highly significant in terms of regulatory mechanism(s) modulated by the EJC [25,26,27,28].

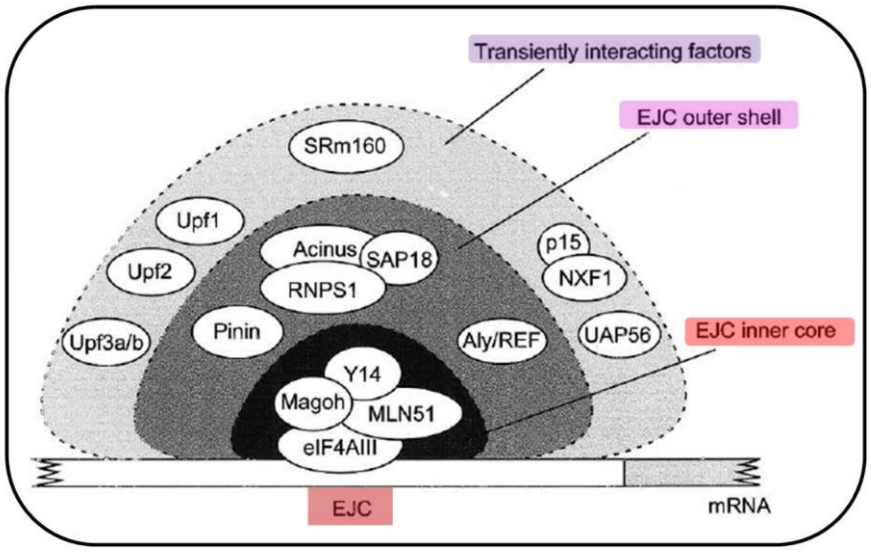

Fig.4: The core and peripheral protein factors of the EJC.

Role of EJC during mRNA Translation

Spliced mRNAs synthesize abundant amount of proteins, thus the pre-mRNA splicing is one of the key molecular events [29]. The role of EJC in the splicing process is highly regarded and thought to play a central role in determining the fate of the mature mRNA (Fig. 5) [30]. Three different EJC-mediated

mechanism(s) have been reported so far. The protein PYM1 recruits the EJC to the 48S pre-initiation complex and subsequently fastens the translation process of mRNAs. Knockdown of the PYM1 significantly decreases the translation yield. Specifically, PYM1 binds to the Y14-MAGOH complex [31,32]. Interestingly, PYM1 regulates the association of EIF4A3 with the Y14-MAGOH complex by dissociating itself from the heterodimer [32]. Similarly, another EJC-associated protein complex (S6K1 Aly/REF-like target; POLDIP3) mediates the functional role of EJC in the translation process [33]. It is evident that EJC proteins mediate the phosphorylation of key protein factor(s) which eventually strongly accelerate the translation event, though the targets are yet to be fully revealed. CASC3 has been considered to be a translational stimulator mostly by interacting with translational initiation factors such as eIF3 [10]. Strikingly, the EJC increases the fidelity of the mRNA translation primarily by leaving distinguished marks on the newly synthesized mRNA so that the transcripts that have already been translated can easily be differentiated [34].

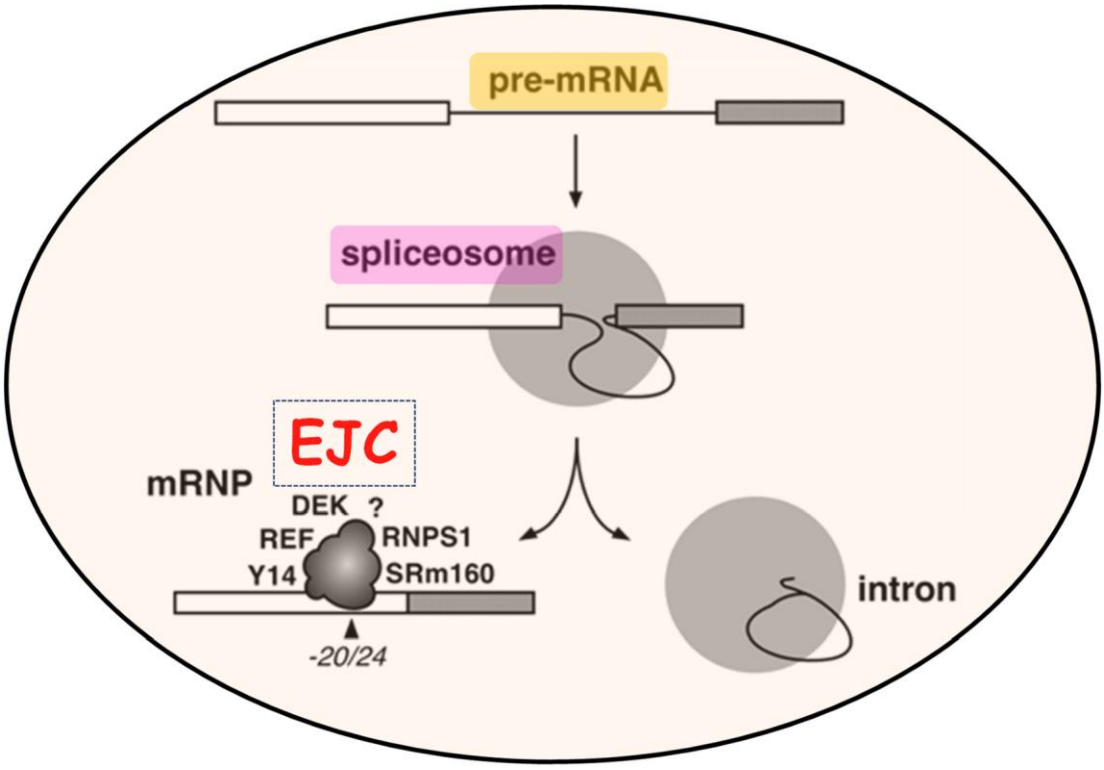

Fig.5: EJC as a 'Molecular Link' between splicing and downstream events. EJC is deposited 20-24 nts upstream of the exon-exon junction.

EJC-mediated Nonsense-mediated mRNA Decay

Nonsense-mediated mRNA decay (NMD) is a eukaryotic surveillance mechanism that detects and degrades aberrant mRNAs. Thus syntheses of truncated proteins are restricted. NMD also regulates the expression of naturally occurring mRNAs [35]. How NMD machinery distinguishes endogenous mRNAs from that of the aberrant mRNAs has always been the question to ponder. NMD occurs through various mechanism(s), but the EJC-mediated NMD is one of the canonical means to degrade the mRNAs destined for decay (Fig. 6). Subsequently it was reported that the presence of EJC proteins on the exon-exon junctions of the mRNA facilitates the NMD process to distinguish between endogenous and aberrant mRNAs and ultimately results in the degradation of non-physiological mRNAs [36,37, 38,39,40,41]. It has been reported that NMD factors, UPF3A and UPF3B physically interacts with the EJC core proteins (Fig. 6) [42,43,44,45] and ultimately modulates the mRNA quality control process [46,47]. UPF3B bridges the EJC to the NMD machinery, though the exact mechanism remains blurred. It was reported that the UPF3-EJC complex recruits other NMD components which ultimately exposes the aberrant mRNAs for destruction [48]. The peripheral EJC protein RNPS1 is also involved in the NMD process [49,50]. CASC3 is also been reported to be well involved in degradation of a set of mRNAs harbouring NMD features, since the CASC3 knockout cells accumulate a number of aberrant mRNAs [20,51,52]. It is of the opinion that EJC increases the fidelity and efficacy of the NMD process in an EJC-dependent manner [53,54,55,56].

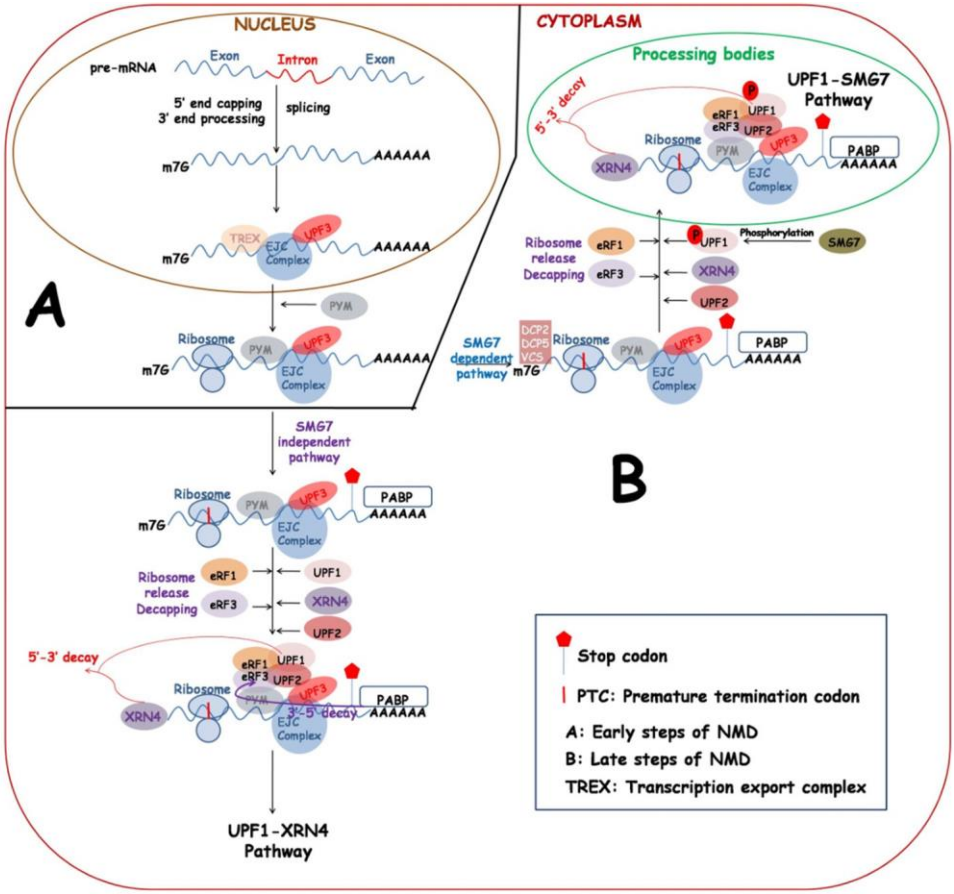

Fig.6: Involvement of the EJC in the NMD process.

CONCLUSION AND FUTURE PROSPECT

In this review we have summarized the basic roles of EJC in a living cell. The functional and physiological role of the EJC is of great interest. For instance, the EJC is indispensable for the development of nervous system in case of mammals by regulating the neuronal differentiation and brain development processes. Moreover, knockout of both the core and peripheral EJC proteins significantly affects the growth of the cell and mostly lead to hereditary diseases. It seems worthwhile to focus on the underlying molecular mechanism(s) through which EJC mediates a wide range of physiological events. The detailed mechanism(s) of the translocation of EJC proteins into the nucleus is yet to be revealed. How EJC-mediated NMD occurs is still to be answered in detail. The significance of the peripheral EJC proteins is also to be revealed. Future research on these aspects will enable the researchers to improvise the general understanding of the EJC and its role as the guardian of the mRNA.

CRediT authorship contribution statement

Annapurna Sahoo: conceived the idea, wrote the manuscript, have read and approved the final manuscript before submission. **Kunja Bihari Satapathy:** conceived the idea, have read and approved the final manuscript before submission.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Emission characteristics of a diesel engine using different blends of simarouba glauca biodiesel

Manas Ranjan Padhi
Centurion University of Technology and Management, Odisha, India

Abstract
The exhaust gas from automobiles is a prime cause for air pollution in recent times. The use of fossil fuels is one of the major contributing factors to this. Therefore substantial research is going on for replacing the fossil fuels. The use of biodiesel which is a liquid alternative fuel is a nice attempt in this context. It has become very popular as it can be prepared from both edible and nonedible oil. The use of nonedible oils such as karanja, Jatropha, Kusuma, Mahua, Neem etc., to produce biodiesel mainly in tropical country like India is an added advantage due to their wide availability. Several research works is going on for use of the biodiesel to run internal combustion engine and subsequent analysis of engine emission levels. In the present work, a diesel engine is run by using Simarouba glauca biodiesel and engine emission is analysed. The amount of exhaust gases present in engine emission are found to be reduced significantly that supports its use as an alternative fuel.
Keywords-Emissions, Diesel Engine, Blends, Simarouba, Biodiesel

I. INTRODUCTION

The extensive use of petroleum fuels in automobile is the main reason behind air pollution in recent times. The emissions from the automobiles consisting of hazardous gases like Carbon Monoxide (CO), Carbon Dioxide (CO2), Oxides of Nitrogen (NOx), and Hydrocarbon (HC). This emission from automobiles is the reason behind global warming and possesses threat for the mankind. Hence use of alternate fuel is a wise option as the emission comes out as a result of burning these fuels is very less as compared to petroleum fuels. Biodiesel which is a liquid alternative fuel is an excellent option to be used as fuel in automobiles. It is alkyl esters of long chain fatty acid and having properties resembles with diesel. Moreover it can be used in automobile engines without or very little modification in engine. This biodiesel can be obtained from large variety of plants which are the sources of edible and non-edible oils. The non-edible oils, such as Jatropha, Microalgae, Neem, Karanja, Rubber seed, Mahua, Silk cotton tree, etc., are easily available in developing countries and are very economical comparable to edible oils. Simarouba glauca is a flowering tree normally found in tropical countries. Simarouba oil is potential edible oil which is prepared from its seeds as a result of crushing in mills. It has wide variety of industrial and medicinal use.

Several works have been carried out by different researchers on different biodiesels regarding their property and emission analysis. Madiwale and Bhojwani [1] presented an overview on production, properties, performance and emission analysis of different biodiesels. Ismail et al. [2] worked on the production of biodiesel from simarouba oil and its application in running a diesel engine. However they have not studied their emission characteristics. Prasada Rao and Appa Rao [3] carried out their research on performance and emission analysis of diesel engine using mahua biodiesel. Padhi and Singh [4] carried out their work towards the optimization of biodiesel from mahua oil. Rathore and Pandey [5] carried out experimental work on diesel engine performance and emission with mixed biofuel of karanja and coconut. Mahalingam et al. [6] did their search on emission analysis by mixing alcohol with mahua oil and reported a reduction in CO, HC and NO_x. Jena et al. [7] carried out their investigation on biodiesel preparation from mahua and simarouba oil. Ogunkunle and Ahmed [8] experimentally evaluated the performance of a diesel engine using sand apple (Parinari polyandra) oil biodiesel. Padhi [9] carried out the performance analysis of a variable compression ratio diesel engine using castor biodiesel. In the present work, Biodiesel was prepared from simarouba oil by esterification followed by transesterification process. Then different blends of biodiesel were prepared by mixing with diesel in required proportions. The biodiesel

blends were used to fuel a diesel engine and engine exhaust gases were analysed by means of a gas analyser. The amount of constituent gases of engine emission was found to be reduced as compared to engine emission using diesel fuel that makes it suitable to use without any modification in engine design.

II. MATERIAL AND METHOD

2.1 Properties of simarouba oil

The simarouba trees are large flowering tree and can grow easily in warm and humid climate. Hence simarouba trees are shown all over the India and easy to collect seeds and oil directly. All the properties like acid value, viscosity, density of the crude simarouba oil were determined and reported in table-1.

Table-1: Properties of simarouba oil

S.N	Properties	Crude simarouba oil
1	Calorific value (KJ/kg)	38500
2	Density (kg/m^3)	915
3	Kinematic viscosity	18.4
4	Flash point (^oC)	228
5	Acid value	2.39
6	Pour point (^oC)	14

2.2 Preparation of biodiesel

The biodiesel was obtained from two steps i.e the first step is the acid catalysed esterification with the acid H_2SO_4 as catalyst and second step is the base catalysed transesterification with the base KOH as catalyst. In this study, the simarouba oil was converted into simarouba biodiesel by the two step transesterification process. Here in the first step the free fatty acid (FFA) in the simarouba oil was converted into methyl ester by acid-catalysed esterification and the second step was the base-catalysed transesterification using potassium hydroxide as catalyst. The esterification was carried out to reduce the FFA of the oil. In the first step the temperature was maintained about 60-64^oC with 200ml methanol and 10gm of concentrated H_2SO_4. After 3hour of heating simarouba oil with methanol and H_2SO_4, the product was poured into a separating funnel and alcohol with impurities was removed. After removing the impurities from the lower layer, the upper layer of was collected from the separating funnel to undertake transesterification process. In the transesterification process, 10gm of KOH was added to 200ml of methanol then poured in the flask. The mixture was heated at constant temperature about 62^0C and stirred continuously for 3hr.After 3hr of heating the mixture was poured into a separating funnel for about 12hr where two layers were formed. The upper layer contained methyl ester and the lower layer contained glycerol, extra methanol, catalyst and other by products were removed. The upper layer of methyl ester or biodiesel was collected and washed several times with water to remove the soppy nature of methyl ester. The biodiesel layer was filtered to remove impurities and then heated up to 100^0C to remove any remaining water. The biodiesel was tightly sealed and kept for storage. The prepared simarouba biodiesel was then mixed with diesel in required proportion to produce three different blends of biodiesel such as B10, B20 and B30. These biodiesel blends were used to run a diesel engine and the exhaust gas coming out of the exhaust pipe was analysed by passing through a gas analyser.

2.3 Emission Test

The exhaust gas from diesel engine was analysed by means of gas analyser in pollution testing apparatus shown in Figure 1, which was integrated with the engine. The probe of the analyser was inserted in the exhaust pipe of the engine to sense the exhaust gas. The composition of exhaust gases which mainly consists four major pollutants such as CO, CO_2, NO_x and HC were recorded during testing of different blends of simarouba biodiesel. The comparison of exhaust emissions was shown in Table 2-5.

Figure 1: Pollution Testing Apparatus

III. RESULT AND DISCUSSION

3.1. Carbon Monoxide (CO) emission

The CO content of the engine emission by burning different blends of simarouba biodiesel is presented in Table-8 and graph is plotted by taking the results at different loads on the engine.

Table-2: CO emission of conventional diesel and simarouba biodiesel at different loads.

Load(kg)	CO(%) Diesel	CO(%) B10	CO(%) B20	CO(%) B30
2	0.08	0.05	0.05	0.04
4	0.07	0.05	0.04	0.03
6	0.06	0.05	0.04	0.04
8	0.05	0.04	0.04	0.03

From Table-2, it is observed that the simarouba biodiesel has lower CO emission than conventional diesel. It is due to the additional oxygen content in the simarouba biodiesel

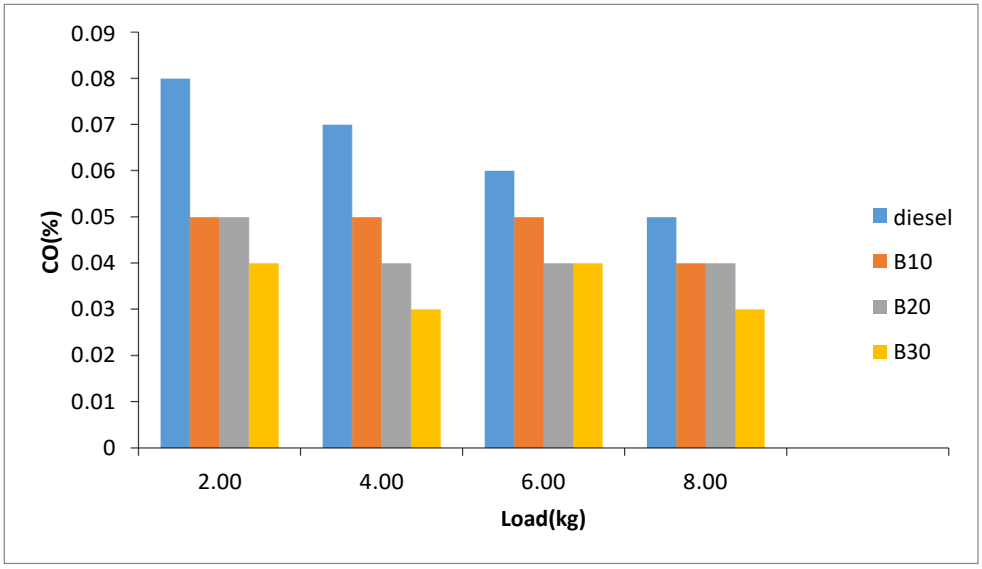

Figure-2: CO Vs load for different simarouba biodiesel blends.

From Figure-2, It can be noticed that when load increases with increasing biodiesel perentage, the CO emission of castor biodiesel blends decreases. This is because of the variation in air fuel ratio for the various operating conditions of the engine.

3.2 Oxides of Nitrogen (NO_X) emission

Table-3: NO_X emission of conventional diesel and simarouba biodiesel at different loads.

Load(kg)	NO_X(ppm) diesel	NO_X(ppm) B10	NO_X(ppm) B20	NO_X(ppm) B30
2	37	45	68	89
4	107	118	149	162
6	156	160	178	191
8	201	216	237	253

The NO_X emission increases with the increase ratio of biodiesel blends with increase load is due to high oxygen content in the biodiesel which cause the formation of NO_X in the emission chamber.

The NOx emission is a function of the total oxygen inside the combustion chamber, temperature, pressure, compressibility, and velocity of sound. Again, the increase of NOx emission is due to the higher cetane number of biodiesel which will reduce the ignition delay. The increase of NOx emission is a result of the reduced ignition delay.

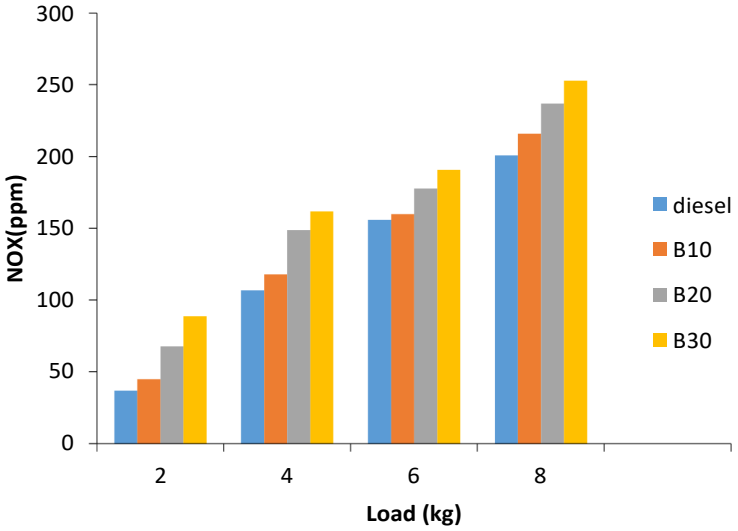

Figure-3: NO_X Vs load for different simarouba biodiesel blends.

Figure-3 shows the emission of NO_X of conventional diesel with B10, B20 and B30. From the graph it was observed that with more biodiesel blend ratio the NO_X emission increases.

3.3 Hydrocarbon (HC) emission

Table-10 shows that the HC emission of simarouba biodiesel is less as compare to conventional diesel. When the load increases, the HC exhalation of the diesel also increases. This is due to the shortage of oxygen in diesel.

Table-4: HC emission of conventional diesel and simarouba biodiesel at different loads

Load(kg)	HC(ppm) Diesel	HC(ppm) B10	HC(ppm) B20	HC(ppm) B30
2	19	18	17	15
4	30	19	18	16
6	40	21	18	17
8	42	24	21	19

From table-4, it was observed that in B30 the HC emission is less as compare to B20, B10 and the conventional diesel because in B30 there is more biodiesel as compare to B20 and B10. As B30 contains more oxygen as compare to B20 and B10, it emits less HC.

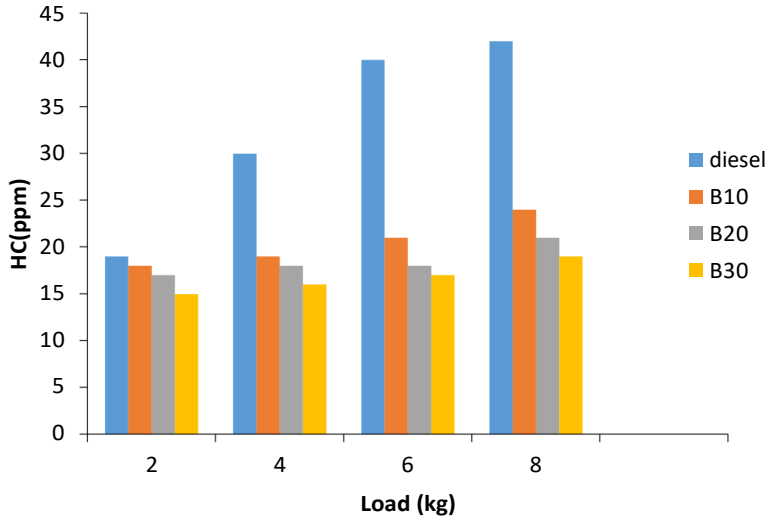

Figure -4: HC emission Vs load for different simarouba biodiesel blends.

3.4 Carbon Dioxide (CO_2) emission

The CO_2 emission in conventional diesel is more as it contain less oxygen. However it was shown from table-5 that the CO_2 emission of B30 was less as compare to B20, B10 and the diesel.

Table -5: CO_2 emission of conventional diesel and simarouba biodiesel at different loads

LOAD	CO2 Diesel	CO2 B10	CO2 B20	CO2 B30
2	2.7	2.4	2.5	2.6
4	3	2.6	2.8	2.9
6	3.2	2.5	2.8	3
8	3.3	2.4	2.8	3.1

The graph shows that the carbon dioxide emission is decreases with increasing biodiesel blends. Hence B30 had the less CO_2 emission. However, the emission is not so less than the diesel. Lower emission of biodiesel blends is due to high oxygen content than the diesel.

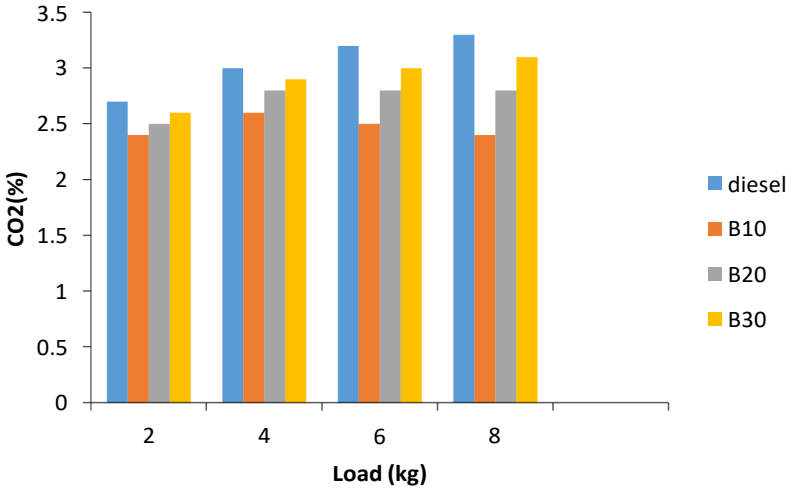

Figure-5: CO_2 Vs load for different simarouba biodiesel blends.

CONCLUSION

The biodiesel we obtained from simarouba oil has good inherent properties than the conventional diesel and most of its properties resembles to that of diesel. From the above result it can be stated that the biodiesel can be used as the alternative fuel of diesel. The biodiesel contains more oxygen which promotes complete combustion in diesel engine and it led to lower emission. Due to high oxygen content, biodiesel emits lower CO and CO_2 as compare to diesel. The lower NO_X emission and lower HC, CO emissions of biodiesel blends of simarouba oil has a scope to check the overall performance of the blends by adapting engine modifications. The higher biodiesel blends shows less or similar emission as diesel. As simarouba biodiesel has lower emission than the conventional diesel, the biodiesel can not pollute the environment and can be considerd as a green fuel. The simarouba biodiesel blends shows higher performance and lower emission than the conventional diesel. Hence simarouba biodiesel is a suitable fuel to be used as diesel blends.

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Ethnomedicinal and antimicrobial activity of some medicinal plants used to cure various diseases in Kaptipada and Udala block of Odisha, India

Bijaylaxmi Das and Gyanranjan Mahalik*
Department of Botany, School of Applied Sciences, Centurion University of Technology and Management, Odisha, India
*Corresponding author: gyanranjan.mahalik@cutm.ac.in

Abstract
This paper presents a review of various plants identified from different botanical surveys and folklore medicinal surveys with antimicrobial properties. In the developing country, conventional medicinal plants are the main part of the initial health care set up. The ethnobotanical survey updating knowledge about herbal medicine to cure different infectious diseases. It mainly points of convergence on the relation between local inhabitants and indigenous plant. This review discusses medicinal plants, their habit, preparation of drugs, and mode of application with their botanical identification. The plant parts used in the form of paste, powder, decoction, juice, infusion, and also in crude form, with other additional like curd, urine, cow milk, and honey to cure various disorders including backache, burn, fever, cough, diarrhea, headache, malaria, post-partum, sprain, stomach, wound, joint pain, diabetes, vascular disorders, antibacterial, antifungal, etc.

Keywords: Antimicrobial, Decoction, Ethnobotanical, folk, Medicinal, Infections

Introduction

Ethnobotany is defined as the traditional use of medicinal plants and the study of the relationship between plants and local people. It mainly points of convergence on the relation of local plant and local people. Herbal use in our country has a long historical convention. This conventional awareness reported by teachers, physicians, students of the university, naturalists, and professors during the 19th and 20th centuries. These ethnobotanical studies give information awareness about herbal medicine in the Udala and Kaptipada area of Mayurbhanj district. Most ethnobotanical studies report on the important plant families use as medicine and drugs (Koleva, et al., 2015). In the developing world, traditional medicinal plants are an important part of the primary health care system. The ethnobotanical survey to give different information Nowadays various diseases are treated using the herbal remedy without any side effects. In many countries, human beings are trusting conventional awareness and medicinal plants for their initial health care. Many people are depending on local plant resources for medicine. But this conventional awareness decreases, so it is preserved in various forms for future generations. This survey aimed to give detailed information about this plant and its medicinal properties (Manjula & Mamidala, 2013). Ethnomedicinal studies are of the important cost to find simultaneous drugs from local medicinal plant

resources. The information on conventional awareness of indigenous plant species has supplied a number of medicines. The natural remedy value is very high to discover new contemporary drugs (Umair, et al., 2013). Antimicrobial activity defined as the process of killing the infection cause microbes. Antimicrobial maybe anti-fungal, anti-viral, anti-bacterial. All are different, they act to restrain the disease. As long as historicism, people have found the antimicrobial activity of plant to treat contagious diseases and some of these herbal remedies as part of the requirements of different disease (Singh, et al., 2010). Due to antibacterial and antioxidant activities of various medicinal plants has increased during the last decagon. Ascertainment of the antimicrobial activities of various medicinal plants is interested due to the current global issue of the high antibiotic power of microorganisms. It is accepted that the drug hostility in microorganisms is grown to use of trade antimicrobial drugs (Farjana, et al., 2014). Pharmacological industries have made a number of new antibiotics for the recovery of different diseases. Plant are important sources of nature and it helps both animal and human beings to cure various diseases. The plants extract and phytochemicals both have antimicrobial properties, and it can use for treatment (Mahalik, et al., 2015).

Materials and Methods

Study area

Udala is a block/Tehsil of Mayurbhanj district, Odisha. The total area of Udala is expanded 525 sq. km including 517.43 sq. km of the rural area and 7.89 sq. km in the urban area. Udala is situated at 21.57^0 N and 86.57^0 E and is situated near the Devkund waterfall of Similipal. Udala block is bounded by Nilgiri Tehsil at East, Kaptipada Tehsil at South, and Khunta Tehsil at North. The climate of the Udala block is dry with no precipitation and cloud covering 0% of the sky and the humidity will be around 46% and average annual rainfall is 67mm, snowfall is 0cm and the temperature is maximum 30 ^{0}C and minimum 20 ^{0}C.

Table 1. List of villages of Kaptipada and Udala

Sl. No	Study area name
1	Adapal
2	Ambadiha
3	Balabhadrapur
4	Balichatrara
5	Belpal
6	Brahmapur
7	Brundagadi
8	Dibyasinghpur

9	Dugudha
10	Gobindpur
11	Jaida
12	Jaipur
13	Khuntapal
14	Kundabai
16	Manidi
17	Manikpur
18	Naraharipur
19	Nuagaon
20	Similabandha
21	Sridamchandrapur
22	Urmal
23	Uttarpal
24	Asanbani
25	Chuinposi
26	Jhinkpada
27	Kukurdima
28	Mahuldiha
29	Nuasahi
30	Pingu

Field survey

The field survey has been undertaken from local aged people of Devkund, Kundabai, Sridamchandrapur, Balichatra, Nudhudiha, Sambrukya, Kaladem, Suneidem, Sankua, Podadiha, Pingu, Divyasinghpur, Urmad, Kukrdima, Kaptipada, Kasigadia, Dehasahi, Khapra Pahar, Tangrasuni Pahar, Nuagaon, Jamdiha, Budamara, Chuiposi, Hatigodia, Hatingsai, Adapal, Baliposi, Bankapal, Belpal, Gobindapur, Jaida, etc. village of Udala and Kaptipda area of Mayurbhanj district. Tribal communities like Ho, Munda, Santal (Majhi), Gond (Nayak), Mahanta, Kolha, Bhumij, Bhuyan, Kumhar, Bathadi, Lodha, Kharia, Adibasi, Tanti were dominated in this study area. During the survey plants were collected, identified and ethnobotanical uses of plants were studied by intervening and establishing close intimacy with the local people of this area. Traditional roadside plants and their uses were collected from local people of this area (Dash et al., 2018; Saxena and Brahmam, 1994; Haines, 1921).

Data recording

The complete information regarding the plants, dosages, duration, and process of preparation and mode of uses was recorded in standard questionnaires (Sahoo & Mahalik, 2020).

Antimicrobial assay

A standardized concentration of inoculums with fixed volume is spread evenly on the surface of the gelled agar plate. A hole of about 6mm in diameter is punched with a sterile cork borer aseptically plates. A fixed volume of plant extract was introduced into the bored agar well and incubated at the optimum temperature (Bacteria 37 oC for 24 hours) depending on the test microorganism (Mbata et al., 2008; Mahalik et al., 2017).

RESULT AND DISCUSSION

The ethnobotanical study documented the use of 125 medicinal plant species belonging to 72 families which mostly used by indigenous people, ayurvedic doctors in this area for the treatment of various diseases. The total number of plants their growth, habits were; tree (42%), shrubs (22%), herb (51%), and climber (10%). The most used families were Fabaceae, Moraceae, Apocynaceae, Euphorbiaceae, Asteraceae, Solanaceae, Apiaceae, and Zingiberaceae. The most plant parts used were leaves 68%, roots 37%, bark 22%, stems 7% whole plant 12%, bulb 2%, and rhizome 4%. Other seeds and fruits were used 41%. This study provided information about plants with their botanical name, vernacular names, mode of use, and doses. The plants and plants part is used to treat various disorder these are Skin infection, acid, gastric problem, diabetes, cold, fever, worm, gynecology problem, urine infection, diarrhea, sciatica, piles, hair fall problem, dandruff, eye infection, dysentery, joint pain, wound, pimple, block spot, nervous, insect bite, headache, sore, dry cough, abdominal pain, irregular menstruation, epitasis, vomiting, malaria, stomach pain, and child fever, etc. In the present survey, males are involved more than females. The local informants were farmers, ayurvedic doctors, foresters, shop keepers, teachers, craftsmen, herdsmen, etc. The tribal people rely on herbal drugs to cure diseases and they know all medicinal properties are present in nature. Approximately 80% of traditional healers received their herbal medicinal plant knowledge from their older relatives, supernatural power such as dreams and visions, and the rest 20% received their knowledge from Vaidya kabiraj, Ayurveda shop and book of Laxman Mishra. The information on the use of medicinal plants against to treatment of different diseases were collected from the traditional healers and described below.

Antimicrobial Activity

The antimicrobial activity of four different plants was screened against five pathogenic microorganisms. Methanolic extracts of Oxalis corniculata, Cissus quadrangularis, Canna indica, and Pongemia pinnata was subjected to fast of their antimicrobial properties by agar well diffusion method. This result improves that most of the extracts exhibited antimicrobial properties. The highest potential was observed in the

extract of *Oxalis corniculata* against *Escherichia coli*, *Salmonella typhi*, *Klebsilla pneumoniae* and *Citrobacter koseri* with zone of inhibition (ZOI) of 16 mm, 15 mm, 12 mm, 11 mm, and 12 mm respectfully and the lowest potential was observed in the extract of Canna indica. Oxalis corniculata have the highest MIC against test organisms. The methanolic extract of *Canna indica* showing efficacy against *Staphylococcus aureus*. By using a cold preparation method the highest yield was obtained for *Cissus quadrangularis*. The study gives details information on all plant extracts used to study antimicrobial activity against all tested microorganisms. It was observed that Oxalis corniculata was the most effective among the four plant extract. Cissus quadrangularis was found to be effective against both gram-negative and gram-positive bacteria. The extract of *Canna indica* showed ZOI against S.aureus as well as *S.typhi*.

Table 2. List of ethnomedicinal plants

Sl. No	Botanical name	Family	Local name	Habit	Part use	Mode of uses &Cure diseases
1	*Achyranthes aspera*	Amaranthaceae	Apamaranga	herb	Leaf, root, whole plant	The leaves paste to apply to teeth to relieve the pain and root extract adding with milk taken once a day in an empty stomach to cure Piles, colic in children.
2	*Adhatoda vasica*	Acanthaceae	Basanga	Shrub	Bark & leaf	Leaf juice mixed with 1 teaspoon of honey taken twice a day on empty stomach to cure Cold, cough, asthmatic attack, ulcer.
3	Aegle marmelos	Rutaceae	Bela	tree	Fruit, leaves	The leaf is taken on an empty stomach in the morning to reduce Acid, digestion& gastric problem.
4	*Ageratum conyzoides*	Compositae	Pokasunga	herb	leaf	Fresh leaves are eaten in 3 days on empty

						stomach to increasing milk flow by nursing mother, leaf extract 2 teaspoons taken twice a day to cure diarrhea and dysentery and without flower the whole plant paste mixed with neem paste to cure scabies.
5	*Allium cepa*	Amaryllidaceae	Piaja	Herb	Bulb, leaf	Bulb paste mixed with honey and lemon juice and applies on the head to cure Hair fall, dandruff, and blood purification.
6	*Allium sativa*	Amaryllidaceae	Rasuna	Herb	Bulb	Boil Bulb & Brassica oil, then apply on the feet and body to cure Cold, joint pain, body pain.
7	*Aloe vera*	Asphodelaceae	Ghikuari	herb	Whole plant	Leaf gel mixed with lemon juice and honey and applies to skin to cure Skin disease, pimple, and acid.
8	*Ananas comosus*	Bromeliaceae	Sapuri	herb	leaf	Leaf juice is taken twice a day to cure Wound, ring wound.
9	*Andrographis paniculata*	Acanthaceae	Bhui nimba	Herb	Leaf & root	Whole plant juice or syrup is taken once a

						day on empty stomach to cure Colic pain, high blood pressure & fungal and skin infection.
10	*Argemone mexicana*	Papaveraceae	Kanta kusuma	Herb	leaf	Leaf paste applies rat-bite place to reduce poison & it also to cure Fever.
11	*Artocarpus heterophyllus*	Moraceae	panasha	Tree	root	Root juice is taken once a day for Lactation and the expectant mother.
12	*Asparagus racemosus*	Liliaceae	Satabari	shrub	tuber	The plant part paste applied in the place of Joint pain& leaves juice used to cure stomach pain.
13	*Azadirachta indica*	Meliaceae	Nimba	Tree	Leaf, bark	The leaves paste mixed with Curcuma longa and applied through skim to cure Skin disease, chicken pox, fungal infection, blood purification.
14	*Bacopa monnieri*	Plantaginacea e	Brahmi	Herb	Leaves, whole plant	Two teaspoons of plant juice mixed with *Azadiracta indica* leaf juice and *Mentha spicata* leaf juice taken once a day in empty stomach to cure skin

						infection, increase immunity system & blood purification & whole plant use to the development of memory power.
15	*Balanites roxburghii*	Zygophyllaceae	Hengu	shrub	Seed, leaf	The seed powder of half teaspoon mixed with jaggery taken once a day in three days in the full stomach to the treatment of abortion and the root paste use to cure teeth pain.
16	*Barleria prionitis*	Acanthaceae	Daskarandi	Herb	Leavers, whole plant	2.5 ml of leaves decoction is given with *Momordica charantia* leaf juice 2.5 ml to cure wound and leaf paste used to cure bleeding from teeth, teeth pain.
17	*Basella alba*	Basellaceae	Poi	Climber	leaves	The leaf fine paste is used in the place of insect bites and leaf juice is taken for the treatment of dysentery.
18	*Bauhinia variegata*	Fabaceae	Kanchana	Tree	Leaf & root	50 ml of leave decoction is given 2 *Paper nigrum* to treat blood impurification.

19	*Beta vulgaris*	Amaranthaceae	Beet	Herb	root	Half teaspoon of beet juice mixed with coconut oil to the treatment of Cracked lips and bulb juice taken during weakness.
20	*Bombax ceiba*	Bombaceae	Simili	Tree	Seed & root	Two teaspoons of dried bark powder mixed with the desired amount of honey applied on the face to reduce pimples, skin infections, and root powder used to cure dysentery.
21	*Brassica juncea*	Brassicaceae	Sorisa	Herb	Seed (oil)	Seed oil applied all over the body twice a day to treat Cold, joint pain, and seed oil used to cure synopsis.
22	*Bryophyllum pinnatum*	Crassulaceae	Hemsagara	Herb	leaves	Leaf juice mixed with palm candy and 125 gm of fresh milk taken 3 to 5 days on empty stomach to cure Leucorrhoea& leaf juice also use for the treatment of dysentery and dysuria.
23	*Bryophyllum fedtschenkoi*	Basellaceae	Garden plant	Herb	leaves	Leaf paste mixed with potato juice is used for

						the treatment of the appearance of blisters all over the body.
24	Butea superba	Fabaceae	Palasa	Shrub	Leaves, root	Root paste applies to the place of crack to cure Joint facture, bone fracture.
25	*Cajanus cajan*	Fabaceae	Harada	Shrub	Leaves	Two teaspoons of the leaf juice are taken once a day on empty stomach in 1-2 weeks to cure Urine infection, menstruation problems.
26	*Calotropis procera*	Apocynaceae	Arakha	Shrub	leaves	The leaves are bind on the lower feet keep it a night for the treatment of cold.
27	*Cannabis sativa*	Cannabaceae	Bhanga	Shrub	Leaves & seed	Leaves juice 1.5 ml is taken once a day in full stomach & leaf and seed use to cure Chickenpox and headache.
28	*Canna indica*	Cannaceae	Sarbojoa	Herb	Leaves & rhizome	Two teaspoons of fresh rhizome or rhizome powder mixed with 2 cups of boil water is taken twice a day for the treatment of Blood

						pressure and rhizome also use to cure dysentery and diarrhea.
29	*Cardiospermum halicacabum*	Sapindaceae	Phutiphutica	Herb	Leaves, root	Tuber or root paste apply on the place and keep overnight to cure Joint pain.
30	*Carica papaya*	Caricaceae	Amrutabhanda/papaya	Tree	Fruit	The ripe fruit paste mixed with 2 teaspoons of milk and some honey apply to the skin to cure black spot skin disease, glowing skin.
31	*Cassia fistula*	Fabaceae	Sunari	Tree	Leaves, bark, root	The leaf paste mixed with neem leaf paste use to cure skin infection, itching.
32	*Cassia occidentalis*	Fbaceae	Kalachanjunda	Herb	Leaves, root	Taken 2 teaspoons of leaf juice once a day on empty stomach to cure the wound.
33	*Centella asiatica*	Apiaceae	Thalkudi	Herb	Leaf, whole plant	Leaf paste or juice mixed with Alovera jell and 1 teaspoon of honey apply on face to cure Pimple, black spot& leaf also use to cure acid, and gastric.
34	*Chenopodium ambrosioides*	Amaranthaceae	Kendiriphulo	Herb	Stem	The leaf juice 1.5ml taken once a day on

						empty stomach to cure nervous disorder.
35	*Cicer arientinum*	Fabaceae	Buta	Herb	Leaves, seed	Two teaspoons of seed powder mixed with 4 teaspoons of tomato juice and 1 teaspoon Haldi powder and apply on face and body to cure Pimple, dark circle on face and eye.
36	*Cinnamomum zeylanicum*	Lauraceae	Dalchini	Tree	Leaves, bark	Leaf juice or paste apply in place of insect bite to decrease poison and infection & leaf juice use to cure Insect bite, headache.
37	Cissampelos pareira	Menispermaceae	Akanbindi	Herb	Root & leaf	Leaf juice is taken twice a day in the full stomach to cure dry cough and leaf also use to cure sore.
38	*Cissus quadrangularis*	Vitaceae	Hadabhanga	climber	Whole plant	Whole plant paste applies twice a day on the place of fracture to cure bone fracture both human and animal.
39	*Citrus lemon*	Rutaceae	Lembu	shrub	Fruit, leaf	Two teaspoons of fruit juice taken to cure acid and fruit juice also use to cure

						dandruff, hair fall, pimple.
40	*Clitoria ternatea*	Fabaceae	Aparajita	Climber	Root	4 cm of root taken and bind on wrist & abdominal to cure abdominal pain and root also used to cure irregular menstruation.
41	*Cocos nucifera*	Arecaceae	Nadia	Tree	Fruit	The oil applies on the body and Hair to cure skin and hair fall problem & coconut water is used to cure black spot pimple.
42	*Combretum indicum*	Combretaceae	Madhumalati	climber	Leaves, root	The leaf juice 1.5 ml taken once a day to cure body pain and leaf juice used to cure worms& diarrhea.
43	*Coriandrum sativum*	Umbelliferae	Dhania	Herb	Leaves & seed	Seed mixed with *Foeniculum vulgare* and *Trachyspermum ammi* is fry without oil and taken to cure Gastric, acid problem.
44	*Cuminum cyminum*	Apiaceae	Zira	Herb	Seed	Seed mixed with some salt and taken to cure acid and gastric problem.
45	*Curcuma amada*	Zingiberaceae	Amba ada	Herb	Rhizome, root	The rhizome juice is taken 1.5 ml after food twice a day to cure

						acid, gastric, improve digestive power.
46	*Curcuma longa*	Zingiberaceae	Haladi	Herb	rhizome	The rhizome juice 4 teaspoons taken once a day on empty stomach to cure ringworm and skin disease& rhizome juice also use to improve the immunity system and fungal infection.
47	*Cuscuta reflexa*	Cuscutaceae	Nirmuli	climber	Whole plant	Whole plant juice 1.5 ml taken to cure child fever and plant juice also use to cure Chest pain.
48	*Cycas circinalis*	Cycadaceae	Arguna	Tree	Bark & seed	Bark mixed with *Azadhiracta indica* bark and *Mangifera indica* bark boil use for bathing for the treatment of cold, sciatica, and Swelling.
49	*Cynodon dactylon*	Poaceae	Duba	Herb	Whole plant	The leaf juice 3 to 4 drops applies in the nose to cure Epistaxis and vomiting.
50	*Cyperus rotundus*	Poaceae	Mutha	Herb	Root	The root powder mixed with sunthi powder and ashwagandha powder in warm water and

						taken empty stomach in the morning to cure sciatica & root powder also use to cure Malaria, stomach pain, gynecology problem, and piles.
51	*Datura metel*	Solanaceae	Kala dudura	Shrub	Seed, leaf	Seed used to cure leukoderma and cold.
52	*Diospyros melanoxylon*	Ebenaceae	Kendu	Tree	Stem & bark	Stem and bark paste mixed with Baula seed paste and use to cure cut injury and bark also use to cure leucorrhoea.
53	*Elettaria cardamomum*	Zingiberaceae	Gujurati	Herb	Seed	1 to 2 seed taken after a meal to improve digestive power, acid and gastric
54	*Eugenia jambolana*	Myrtaceae	Jamokoli	tree	Fruit, seed	The fruit juice mixed with *Paper nigrum* and black salt is taken once a day to cure blood dysentery& bark powder used to cure diabetes.
55	*Ficus benghalensis*	Moraceae	Bara	Tree	Stem	The stem is used to cure bleeding of teeth or teeth pain & leaf mixed with tobacco leaf and use to cure boils on a child's head.

56	*Ficus racemosa*	Moraceae	Dimiri	Tree	Fruit, leaves	The leaves paste mixed with coconut oil to cure crack feet and fruit is used to cure cough and piles.
57	*Opuntia stricta*	Cactaceae	Nagapheni	Shrub	flower	The flower used for the treatment of reducing bleeding, cut, and wound.
58	*Ficus religiosa*	Moraceae	Aswastha	Tree	Root, leaves, bark	The bark mixed with Arjuna bark and Neem bark boil in water and use for bathing for reducing skin rashes and skin irritation and bark also use to cure the wound, skin disease, vomiting and boil.
59	*Foeniculum vulgare*	Apiaceae	Panmahur	Herb	Seed	Seed mixed with palm sugar candy and taken once empty stomach in the morning for the treatment of Dysentery, leucorrhoea, and acid.
60	*Helianthus annuus*	Asteraceae	Surjyamukhi	Herb	Seed, oil	Leaves mixed with fresh water and make a fine paste & apply overboils or wound and seed also use to cure Hair fall and

						dysentery.
61	*Hibiscus rosa-sinensis*	Malvaceae	Mandara	shrub	Leaf & flower	Leaf and flower mixed with Curry leaves to make fine paste use for the treatment of hair fall, hair growth& leaf juice 5 to 6 spoon taken for the treatment of dysentery.
62	*Holarrhena pubescens*	Apocynaceae	Kuduchi	Tree	Bark, root	Bark mixed with Mint leaves taken to cure blood dysentery and root paste used to cure stomach pain.
63	*Jasminum sambac*	Oleaceae	Mali	Shrub	Leaves, root	Root powder mixed with freshwater has taken empty stomach to control diabetes and leaves and flower paste use to cure Skin infection, pimple.
64	*Laportea interrupta*	Urticaceae	Bichhuati	Herb	Root	The root and leaves paste used for the treatment of Knee pain and leave juice used to cure insect bites.
65	*Lawsonia inermis*	Lythraceae	Henna	Tree	Leaf	Leaves mixed with neem leaves and tulsi leaves taken regularly in empty stomachs to improve the immunity system and leaves also

						use to cure hair fall, hair growth, skin disease.
66	*Lens culinaris*	Fabaceae	Muga	Herb	Seed, root, leaves	The leaves juice or fine paste is applied to insect bite place for reducing infection and leaf, root and seed also use for the treatment of Acid and skin infection.
67	*Mallotus philippensis*	Euphorbiaceae	Sinduri	Tree	Root	Root powder mixed with milk used for the treatment of Rheumatoid, gynecology problems.
68	*Mangifera indica*	Anacardiaceae	Aamba	Tree	Stem,	The white juice of this plant used for the treatment of Crack feet.
69	*Marsilea quadrifolia*	Marsileaceae	Susundi	Herb	Leaf	The leaves juice taken daily on empty stomach for the treatment of Blood pressure and dacryocystitis.
70	*Martynia annua*	Martyniaceae	Bagha nakhi	Herb	seed	The seed powder used to cure Rheumatism, spondylosis, itching and skin infection.
71	*Mentha viridis*	Lamiaceae	Podina	Herb	leaf	The leaves mixed with neem leaves taken for

						the treatment of skin disease and the leaf juice mixed with *Paper nigrum* and black salt taken to reduce the acid problem.
72	*Mesua ferrea*	Clusiaceae	Nageswara	Tree	leaf	The leaves juice is applied in the place of insect bites to reduce the poison spread on the body and seed oil used to cure scabies and wound.
73	*Mimosa pudica*	Fabaceae	Lajkuli	Herb	Root	The leaf juice uses internally and externally in piles & roots, leaf also use to cure urogenital disease, piles, wounds.
74	*Mimusops elengi*	Sapotaceae	Baula	Tree	Leaves, bark, leaves seed	The internal seed part pastes to use to reduce insect bite poison & leaf and bark also use to cure Fungal infection.
75	*Momordica charantia*	Cucurbitaceae	kalara	climber	Leaf	The fresh leaf juice 2.5 ml and mixed with 2.5 ml of Haldi juice taken once a day to cure Chicken pox, skin diseases, dog bite,

						wound.
76	*Moringa oleifera*	Moringaceae	Sajona	Tree	Leaf	The fresh leaf juice and leaf powder mixed with water taken once a day to cure Cold, diabetes, high blood pressure, dysentery, eye infection.
77	*Murraya koenigii*	Rutaceae	Bhusanga	Shrub	Leaves, root	The leaves mixed with *Hibiscus rosa-sinensis* use to cure Hair fall and 8 to 10 leaf taken once a day on empty stomach to cure acid, diabetes.
78	*Musa sapientum*	Musaceae	Kadali	Shrub	Seed, leaves	The leaf and bark used for the treatment of stoop bleeding from cut and leucorrhoea.
79	*Nelumbo nucifera*	Nelumbonaceae	Padma	Herb	Root	Seed mixed with gaisira root, ramdantuni root, sunthi, paper nigrum, para pani, rasa sindura, harada leaves, dalcini and kayadaru juice to cure leucorrhoea and root used to cure menstruation problem.
80	*Nerium oleander*	Apocynaceae	Karabira	Shrub	Bark	The leaf, bark, and root are external use for the treatment of

						skin disease and wound and the leaf juice or fresh root juice use externally on the place of the wound.
81	*Nicotiana tabacum*	Solanaceae	Dukta	Tree	Leaves	The leaves are used for the treatment of bleeding from cut and to reduce insect bite poison.
82	*Nyctanthes arbor-tristis*	Oleaceae	Gangaseoli	Tree	Leaf, stem, bark & seed	The leaves juice mixed with honey taken once a day on empty stomach to cure cough, cold, and fever.
83	*Ocimum basilicum*	Lamiaceae	Nadababuli	Herb	Whole plant	The whole plant used to remove lice.
84	*Ocimum sanctum*	Lamiaceae	Tulasi	Herb	leaves	The leaf juice mixed with honey and taken empty stomach in the morning for 5 to 7 days to cure cold, cough and viral fever.
85	*Oryza sativa*	Poaceae	Dhana	Herb	Seed	The seed powder mixed with tulsi and duba for the treatment of cold & and rice powder used to cure Skin disease, pimples.
86	*Oxalis corniculata*	Oxalidaceae	Amruli	Herb	Leaves	Leaf juice mixed with *Paper nigrum* seed

						taken for the treatment of Cough, breast pain.
87	*Phyllanthus emblica*	Phyllanthacea e	Aila	Tree	Fruit, leaves, root	Fruit juice mixed with *Paper nigrum* and a pinch of black salt and use to cure Gastric, migration
88	*Phyllanthus fraternus*	Euphorbiacea e	Bhui aila	Herb	Fruit, leaves	The whole plant or leaves are used for the treatment of Jaundice.
89	*Piper betel*	Piperaceae	Pana	Climber	Leaves	The leaf uses for the treatment of Digestion, acid, gastric, pimple.
90	*Piper nigrum*	Piperaceae	Golmaricha	Herb	Fruit	The seed is used for the treatment of Gynecology problems cold, headache, etc.
91	*Pongamia pinnata*	Fabaceae	Karanja	Tree	Seed, leaves, bark	The leaves, seed, and seed oil used to cure Cold, skin infection, fungal infection, cracked feet.
92	*Psidium guajava*	Myrtaceae	Pijuli/peda	Tree	Leaves, seed	The fruit juice mixed with black salt and *Paper nigrum* to improve digestive power and fruit also used to cure wound.
93	*Pterocarpus marsupium*	Fabaceae	Piasala	Tree	Leaves, root, seed	The leaves, roots, and bark used for the treatment of Skin disease, control blood

						and sugar level.
94	*Punica granatum*	Lythraceae	Dalimba	Shrub	Young seed, leaves	The unripe fruit juice and leaf juice is taken once a day to cure Diarrhea and dysentery in children.
95	*Rauwolfia serpentina*	Apocynaceae	Patalagaruda	Shrub	Root	The root and leaves are used to cure pneumonia& snake bite.
96	*Ricinus communis*	Euphorbiaceae	Joda	Shrub	Seed	The seed oil used for the treatment of Rheumatic joints and leaves is boil and applied to annus for the treatment of piles.
97	*Rosa indica*	Rosaceae	Golapa	Shrub	flower	The flower is mixed with fresh water after one day this water is applied to the skin to reduce dark circle and use for glowing skin.
98	*Santalum album*	Santalaceae	Chandana	Tree	Bark	Whole plant parts use for the treatment of Skin disease, acne, insect bite, and scabies and burn.
99	*Saraca asoca*	Fabaceae	Ashoka	Tree	Bark,	The bark and leaves tonic took 2.5 ml twice a day on an empty stomach to cure Gynecology problem,

						irregular menstruation.
100	*Sesbania grandiflora*	Fabaceae	Agasti	Tree	Leaf, bark, flower	The leaves, bark, and flowers are used for the treatment of Leucorrhoea, urine infection.
101	*Shorea robusta*	Dipterocarpaceae	Sala	Tree	Seed, bark	Seed oil is used Ear trouble and leaves and seed also use to cure skin disease& seminal weakness.
102	*Sida acuta*	Malvaceae	Bajramulee	Herb	Leaves, whole plant	The leaves paste applied on the head for the treatment of Headache and the leaf and whole plant use to cure fever.
103	*Smilax macrophylla*	Smilacaceae	Kumbhatua/ muturi	Climber	leaves	Leaves juice taken once a day after meal for the treatment of leucorrhoea and irregular menstruation.
104	*Smilax zeylanica*	Smilacaceae	Ramdantun	Climber	root	The root or root powder is used for the treatment of menstruation problems and abdominal pain during menstruation time.
105	*Solanum xanthocarpum*	Solanaceae	Bheji baigana	Herb	Leaves, root, stem &	1.5 ml Leaf juice taken once a day for the treatment of Digestive

					whole plant	problem & root, stem and whole plant are use for the treatment of children chronic cough, rheumatism.
106	*Spondias pinnata*	Anacardiaceae	Ambaada/ Salama	Tree	Bark	The bark powder is used for the treatment of Body pain and bark juice and leaf juice taken 1.5 ml on empty stomach to cure diarrhea.
107	*Streblus asper*	Moraceae	Sahada	Tree	Stem, bark	The stem is used for the treatment of tooth pain and the stem and root also use for the treatment, bleeding on teeth, snake bite and dysentery.
108	*Strychnos nux-vomica*	Loganiaceae	Kochila	Tree	Bark, seed (oil),	The seed oil is applied to Joint pain to relieve pain and the seed or leaves paste applied to rat-bite place for reducing rat poison of rat.
109	*Syzygium aromaticum*	Myrtaceae	Labanga	Tree	Bark, seed	Seed oil is used for the treatment of teeth pain, leaves, bark and seed is used for the treatment of cold and dental problem.

110	*Tagetes patula*	Asteraceae	Gendu	Herb	leaves	Leaves fine paste or juice applied for the treatment of Skin disease, stop bleeding on body parts and glowing skin.
111	*Tamarindus indica*	Caesalpiniaceae	Tentuli	Tree	Fruit & leaf	Leaf juice 2.5 ml mixed with Haldi juice taken once a day on an empty stomach to cure roundworm.
112	*Terminalia bellirica*	Combretaceae	Bahada	Tree	Seed, leaves	The leaves juice 2.5 ml taken once a day in empty stomach regularly for the treatment of Acid, gastric, improve digestion power & seed boil in freshwater taken during abdominal pain in menstruation time for relieving pain.
113	*Terminalia chebula*	Combretaceae	Kasaphala/ karedha	Tree	Seed, leaves, bark	The bark is boiled freshwater with arjuna bark and neem bark used for bathing for reducing infection in our body & seed, leaves and bark are used for the treatment of acid problem and

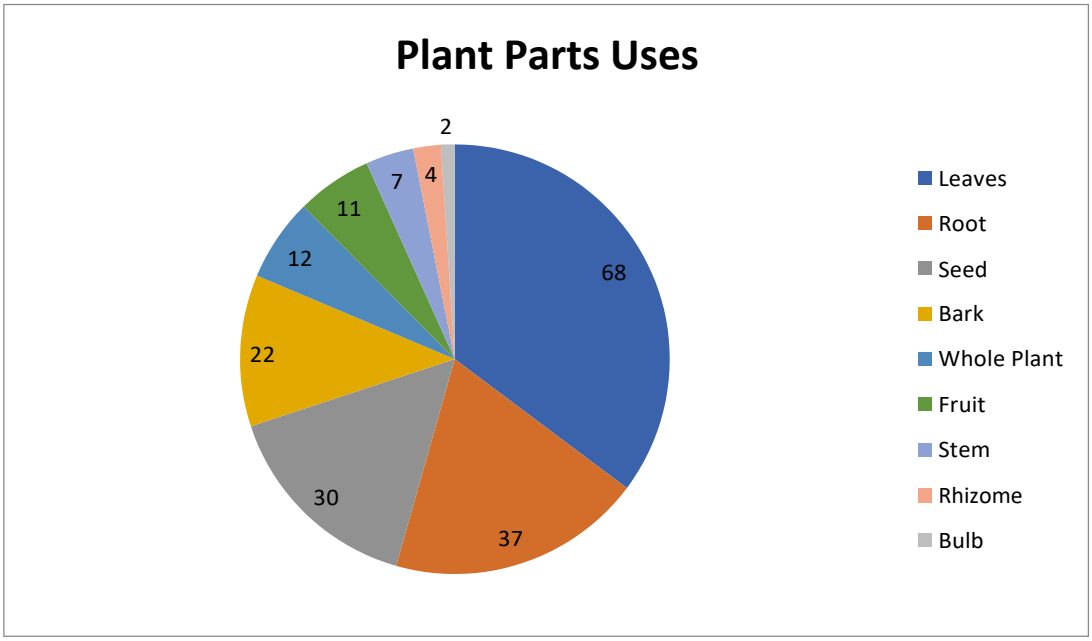
						gastric problem.
114	*Trachyspermum ammi*	Apiaceae	Juani	Herb	seed	Seed and plam candy mixed with freshwater then kept it overnight taken once a day in empty stomach for the treatment of leucorrhoea & seed is used to cure hyper acid, gastric problem acid.
115	*Tragia involucrata*	Euphorbiaceae	Bichhuati	Herb	Root	One teaspoon of root paste taken once a day on empty stomach for the treatment of a cold.
116	*Trewia nudiflora*	Euphorbiaceae	Pithaliya	Tree	root	The root is used for the treatment of leukemia.
117	*Trichosanthes dioica*	Cucurbitaceae	Potala	Climber	root	Leaves juice 2.5 ml mixed with Momordica charantia leaves juice 2.5 ml taken twice a day during jaundice time for control of jaundice and root used for the treatment of diabetes.
118	*Tridax pocubinas*	Asteraceae	Bisalyakarani	Herb	Leaves, whole plant	The leaves paste or juice used for the treatment of wound cut injury, scabies, prickly heat.

119	*Vanda tessellata*	Orchidaceae	Malang	shrub	Root & bark	Root & bark is used for the treatment of menstruation problems and hepatitis.
120	*Vinca rosea*	Apocynaceae	Sadabihari	Herb	Root, leaf	The root juice is taken 1.5 ml once a day for the treatment of diabetes leaf paste used to cure skin itching and insect bite.
121	*Vitex negundo*	Verbenaceae	Begunia	Tree	Root, leaf	Leaves paste or juice used for the treatment of chest pain and ear pain.
122	*Withania somnifera*	Solanaceae	Ashwagabdha	Shrub	Root, leaves	Root paste one teaspoon taken once a day in an empty stomach for the treatment of Sciatica leaves juice 21.5 ml taken once a day for the treatment of body pain in the fever time and cold.
123	*Zingiber officinale*	Zingiberaceae	Ada	herb	rhizome	The rhizome juice 1.5 ml taken twice a day after meal for the treatment of gastric & the rhizome also use for the treatment of cold and cough.
124	*Ziziphus jujuba*	Rhamnaceae	Barakoli	tree	fruit	Fruit juice taken 2.5

						ml twice a day use for the treatment of ulcers and hypertension.
125	*Zigadenus zinnia*	Asteraceae	Jinia	Shrub	Leaves, root	The root and leavers paste use for the treatment of Fungal infection, wound and allergy.

Plant parts uses

The ethnobotanical study documented the use of 125 medicinal plant parts used by indigenous people, ayurvedic doctors in this area for the treatment of various diseases. The most plant parts used were leaves 68%, root 37%, seed 30%, bark 22%, whole plant 12%, fruit 11%, stem 7%, rhizome 4% and bulb 2% (Fig. 1).



CONCLUSION

Udala and Kaptipada consist of rich varieties of medicinal plants and herbs. About 80% of world populations relax on traditional medicine for primary health care. The knowledge about the ethnobotanical uses of these plant species and their status of distribution in Indian world is helpful in explosion those plant resources of large scale, the active ingredients present in these plants and herbs may be used for designing some new drugs & be a blessing for mankind. Alternative medicines are better than our

conventional allopathic medicine & con enhance the impact of conventional drugs if used properly. So it is concluded that there is a promising future for medicinal plants as there are about half a million plants around the world and most of them are not investigated. Yet for those medical activities could be decisive in the treatment of present and future studies. As science advanced, it becomes possible to use Ayush to solve the new challenges of the modern healthcare system.

Conflict of interests

Author declares that they do not have any conflict of interest.

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Molecular perspectives of plant-pathogen interactions: An overview on plant immunity

Satyabrata Nanda*

MS Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India.

*Corresponding author: satyabrata.nanda@cutm.ac.in; sbn.satyananda@gmail.com

Abstract

In nature, there is constant arm race is going on in between plants and pathogens. These plant-pathogen interactions are complex and multifaceted. To tackle the invading pathogens, plants have developed multiple resistance responses at several levels. On the contrary, adapting capabilities and evolution of new effector molecules help the phytopathogens to outrun plant defenses and proliferate in the host cells. Although, many theories and models have been proposed to address these interactions, none of them are exhaustive and fully understood. In this review, two crucial pathways of plant immune response, including the pathogen-associated molecular patterns (PAMP)-triggered immunity (PTI) and effector-triggered immunity (ETI) has been discussed elaborately. In addition, a comparative discussion of the different models proposed for understanding the ETI has been presented. Understanding of these complex interactions can facilitate the unravelling of the involvement of different plant resistance pathways. Moreover, the review will serve as a basic layout to have an overview of the molecular mechanisms of plant immune responses against phytopathogens.

Keywords: Plant immunity, PTI, ETI, plant-pathogen interactions

Introduction

Being sessile, plants are constantly exposed to an array of biotic stresses including bacteria, fungi, and nematodes. The plant homeostasis is challenged by these pathogen invasions. However, plants don't possess a well characterized and systematic immune system, like in animals to overcome such stresses. Plans employ their survival strategies against the biotic stresses, which is further fine-tuned by several lines of defense. Epidermis, the outermost layer of plants, operates as a corporal wall for the external stress and threats. Further, deposition of lignin, resins or silica on the epidermal layer, and/or development of modified leaves such as trichomes, spines, thrones and prickles restricts pathogen invasion. Plants deploy the use of secondary metabolites as the second line of defense against the invading pathogens and their effector molecules. Hypersensitive responses (HR), programmed cell death, tissue reinforcement at the site of infection and expression of defense-related proteins are often regarded as the third line of defense by plants in response to pathogen or herbivore attacks. The induced local responses at the site of

infection followed by the establishment of immune response throughout the plant known as the systemic acquired resistance (SAR). SAR gives the plant the long lasting and broad spectrum pathogen defense capability (newer reference). In addition to this, plant defense is significantly monitored by the resistance genes (R gene) (newer ref). The pathogen attacks result in oxygen burst inside the cell thereby releasing intermediate signal molecules such as reactive oxygen species (ROS), superoxides (O_2^-), nitric oxide (NO) and hydrogen peroxide (H_2O_2), which in turn induces the defense responses through activation of downstream targets (Wang et al., 2013). Similarly, several phytohormones like abscisic acid (ABA), salicylic acid (SA), jasmonic acid (JA), ethylene (ET) and gibberellins (GA) also regulate the defense responses and modulate the expression of several downstream target genes (Davière and Achard, 2013; Shin et al., 2014). Additionally, calcium-dependent protein kinase (CDPK), cyclin-dependent protein kinase (CDK) and mitogen activated protein kinase (MAPK) serve as an important component of the defense signaling cascades (Kitsios and Doonan, 2011; Hettenhausenet al., 2014). By the fine tuning of all these defense responses plants tackle the pathogen invasions.

Mechanism of plant-pathogen interactions

The specificity of plant-pathogen interactions starts even before a pathogen actually invades or attacks upon a plant. The pathogens follow host specificity, and mostly attack those plants which fall within their compatible range. The plant-pathogen interactions are complex and fine-tuned biochemical processes occurring inside both plants and pathogens. Thus, almost all of these interactions are two-way communications between the attacking pathogen and the host plant (Boyd et al., 2013). The invading pathogen tries to escape or out run the plant defense responses and thus, creating an apt environment for the disease progression. On the contrary, the host plant tries to trigger the defense responses by recognizing the pathogen or its effector molecules to neutralize the pathogen attack. In due course of evolution, both plants and pathogen have developed immaculate machinery including metabolites, signaling molecules, and genes fitting for these interactions. The communications during the pathogen invasions and the triggered plant immunity against them are mainly divided into two types such as pathogen-associated molecular patterns (PAMP)-triggered immunity (PTI) and effector-triggered immunity (ETI) (Jones and Dangl, 2006). PAMPs are usually highly conserved, vital components of pathogens, such as glycans, flagellin in bacteria, and chitin in fungi, those can be recognized by plant receptors and thus, a defense response can be induced (Boller and Felix, 2009; Maverakis et al., 2015). However, ETI is triggered by recognizing the effector molecules, often regarded as the avirulence (Avr) proteins secreted by the pathogen, by the resistant (R) genes of the plants. Thus, ETI works on the basis of *R-Avr* gene interactions which is commonly referred as “gene-for-gene resistance” (Boyd et al., 2013).

Both these plant immune responses and their roles during the plant-pathogen interactions are discussed in detail in the followings.

Plant-pathogen interaction and PTI

Among the extensive microbial species, some of the comprehensively explored PAMPs or microbial-associated molecular patterns (MAMPs) are flg22 and elf18 of bacterial origin, and glucans and chitin from the fungi (Boyd et al., 2013). One of the initial events of PTI is perceiving the stimulus of pathogen attack by the recognition of PAMPs/MAMPs via plant pattern-recognition receptors (PRRs) (Bigeard et al., 2015). PRRs are localized on the surface of plant cells and function as immune receptors. PRRs of plant cells are usually either receptor kinases (RKs) or receptor-like proteins (RLPs) (Zipfel, 2008). The RKs possess a ligand-binding ectodomain, a single-pass transmembrane domain, and an intracellular kinase domain, whereas RLPs lack an intracellular kinase domain but have the other domains. Due to the non-availability of any intracellular signaling domains, RLPs mostly function in association with RKs to transduce the perceived signal further (Zipfel, 2014). Flagellin Sensing2 (FLS2), a Leucine repeat receptor kinase (LRR-RK) from *Arabidopsis* that recognizes and binds to the bacterial PAMP flg22 (Boller and Felix, 2009). Perception of flg22 from the invading pathogen activates immune responses, including H_2O_2 generation, hypersensitive cell death and pathogenesis-related (PR) gene expression (Yu et al., 2017). Similarly, one more LRR-RK, EF-Tu Receptor (EFR) of *Arabidopsis* recognizes EF-Tu and triggers the immune responses via PTI (Zipfel et al., 2006). Plant PRRs also possess the ability to detect the cell wall components or peptides as PAMP signatures during the pathogen attacks (De Lorenzo et al., 2011). Chitin, a major compound of fungal cell walls is recognized by Chitin-Elicitor Binding Protein (CEBiP) in rice. CEBiP is a LysM domain-containing receptor-like protein (RLP) which requires the RLK Chitin Elicitor Receptor Kinase1 (CERK1) to activate PTI (Miya et al., 2007). The chitin-CEBiP interactions result in activation of defense responses, including reactive oxygen species (ROS) generation, PR gene expression, and phytoalexin biosynthesis. Rice cells having lower CEBiP expression exhibit decreased response to chitin, signifying the pivotal role of CEBiP in chitin perception and subsequent downstream signal transduction (Chen and Ronald, 2011).

To penetrate through different structural barriers of plants, pathogens secrets lytic enzymes that degrade plant cell components. These cell wall fragments act as endogenous elicitors and induce plant defense responses and termed as damage-associated molecular patterns (DAMPs) (Muthamilarasan and Prasad, 2013). The first plant DAMP receptor, PEP receptor1 (PEPR1), has been identified from *Arabidopsis* belongs to the LRR-RK family (Yamaguchi et al., 2010). PEPR1 and PEPR2 detect AtPep1, a danger signal peptidic DAMP in *Arabidopsis*. AtPep1 is a 23-amino-acid peptide generated from the C-terminus of a wound-induced protein PROPEP1, and upon recognition by PERP1/2, it induces the

downstream defense signaling. The activation of immune responses by DAMP are very similar to that of PAMPs, which suggests the possible connection between PAMP and DAMP signaling. Additionally, the perception of PAMPs/MAMPs by the PRRs generate some immune receptor complexes that initiate signal transductions triggering PTI. Upon recognition of a PAMP at the cell membrane, the immune receptor complexes are formed and induce several auto- and trans-phosphorylation reactions downstream. Post-recognition of a PAMP/MAMP, BRI1 associated receptor kinase1 (BAK1), Botrytis-induced kinase1 (BIK1) and PBL (PBS1-like) kinases bind to FLS2 and EFR, get rapidly phosphorylated and then get dissociated from the PRR complexes (Zhang et al., 2010). One of the earliest physiological responses upon PAMP/MAPM detection is calcium (Ca^{2+}) and oxidative bursts (Jeworutzki et al., 2010). Ca^{2+} burst is initiated by the influx of extracellular Ca^{2+} ions into the cytosol, which occurs within minutes of PAMP perception by the PRRs. The Ca^{2+}burst further stimulates the opening of other membrane-bound transporters such as NO_3^-, H^+, K^+, resulting in depolarization of the cell membrane (Jeworutzki et al., 2010). In *Arabidopsis*, the membrane-bound *Arabidopsis*-autoinhibited Ca^{2+}-ATPase8 (ACA8) makes a complex with FLS2 and fine tune the intracellular Ca^{2+} levels during MAMP-responsive signal transductions (Frei dit Frey et al., 2012). Similarly, in response to PAMP/MAMP detection, the oxidative burst is produced by nicotinamide adenine dinucleotide phosphate (NADPH) oxidases. The perception of PAMP/MAMP signatures in apoplast activates the respiratory burst oxidase homolog D (RBOHD), which generates ROS or superoxide (O_2^-) ions (Zhang et al., 2007). Detection of PAMP/MAMP then promotes phosphorylation of RBOHD on different residues by CDPKs and BIK1, making the NADPH oxidase fully activated (Kadota et al., 2014). Both ROS and H_2O_2 has the capacity to regulate the intracellular Ca^{2+} levels and can induce downstream signaling cascades like CDPK or MAPK mediated defense responses.

Plant-pathogen interaction and ETI

The membrane-bound PRRs perceive the invading pathogens or PAMPs and trigger PTI, which seizes further colonization or spreading of infection. Conversely, at times, pathogens can successfully dodge the PTI responses and deploy effectors those contribute to pathogen virulence (Jones and Dangl, 2006). This results in the pathogen proliferation causing the effector-triggered susceptibility (ETS). On the other hand, plants have evolved different sets of receptors such as resistance (R) proteins which can efficiently detect the pathogen-generated effectors and initiate immune responses. The “zig-zag model” proposed by Jones and Dangl (2006) describes this communication between the pathogen effector molecules and the plant R proteins. These cytosolic immune receptors usually contain nucleotide binding (NB) and leucine rich repeat (LRR) domains (NLRs) and recognize the pathogen-delivered effector proteins and trigger effector-triggered immunity (ETI) (Elmore et al., 2011). The effector molecules produced by pathogens are encoded by specific sets of genes known as *avirulence* (*Avr*) genes. The *Avr* gene products, when enter

into a plant cell destabilize the cell homeostasis. Subsequently, the plant R proteins perceive these effectors and trigger immune responses referred as *R*-gene mediated pathogen resistance (Nimchuk et al., 2003). These Avr-R protein interactions were first proposed by Flor (1971) and coined as gene-for-gene relationships. Once an effector molecule is detected either by an appropriate R protein, it usually triggers the HR response leading to programmed cell death (PCD) (Nimchuk et al., 2003). The activation of HR or PCD often accompanied by Ca^{2+} burst or oxidative burst (ROS), and defense responsive gene expressions ultimately leading to local and systemic acquired resistance (SAR) (Gururani et al., 2012). The exact mechanism of interaction of pathogenic effectors and plant resistant genes or specific receptor in ETI is debatable. However, some interesting models have been put forwarded to understand these interactions occurring during ETI. To illustrate the R-effector interactions, one such model is the "direct interaction" model. Here, the effector physically interacts and binds to the receptor protein or NB-LRR resistance proteins and triggers defense signals via ETI. The recognition of the effector Avr9 from fungus *Cladosporium fulvum* by the tomato Cf-9 (R protein), supports the direct interaction hypothesis. However, in many cases, the association of R-Avr proteins are not direct, and often assisted by the accessory proteins. In indirect interactions, the effector-R protein binding is facilitated by an accessory protein, which also happens to be a pathogen virulence target or a structural analog. After entering into a plant cell, the effector persuades structural changes of the accessory protein, which is later recognized by the R protein (van der Hoorn and Kamoun, 2008). Another model named as the 'guard' model was proposed to illustrate the R-Avr indirect interactions. According to this model, the R or NB-LRR proteins safeguard an accessory protein referred as "guardee" which is targeted and modified by the pathogen effectors (Dangl and Jones, 2001). Defense signals leading to ETI are generated once the R protein perceives any structural change of its guardee or any attacks on it (McDowell and Woffenden, 2003). The interaction of *Arabidopsis* RPM1 interacting protein4 (RIN4) with RPM1 and Resistance to *Pseudomonas syringae*2 (RPS2) elucidate the guard model. However, the guard model couldn't stand universal for all the indirect interaction of R-Avr proteins and lacked the evolutionary aspects of plant R proteins (Dodds and Rathjen, 2010). Yet another model, describing the possible interaction strategies of R-Avr proteins came up, known as the "decoy" model (van der Hoorn and Kamoun, 2008). As per this model, the independent progression of the target analog or duplication of the target gene will favor the sole participation of the accessory protein in effector recognition. The mechanism of interaction between tomato R protein Prf and pathogenic effector AvrPto supports the postulates of this model. During the interaction between Prf-AvrPto, the NB-LRR protein Prf makes a complex with the accessory protein Pto kinase. Though the decoy model exemplified the role of accessory protein in recognition of effector by the R proteins, it didn't explain its role in activation of R proteins. To further clarify the interactions of effectors and plant

R proteins, the "bait and switch" model was proposed (Collier and Moffett, 2009). In this concept, the recognition of an effector molecule is carried away in two steps: first, the effector binds to an accessory protein (bait) associated with a R protein, secondly, the effector is recognized by a NB-LRR R protein triggering the downstream signaling events. Thus, according to this model the R protein directly interacts with the accessory protein or the effector target, rather than interacting with the modified accessory protein. All these afore-discussed models are proposed according to some of the interactions between R-Avr proteins leading to ETI. However, none of the models are universally acceptable and fully understood.

The interactions between effector and R proteins initiates a signal transduction cascade leading to the activation of defense responses. The plant R proteins are highly polymorphic which helps in recognizing diverse Avr proteins from the invading pathogens. The rice resistant allele Xa27 exhibits induced expression when challenged by bacteria containing the effector AvrXa27 (Gu et al., 2005). Similarly, the resistance gene Ve1 in tomato differs from the closely linked Ve2, in providing defense responses against *Verticillium spp.* (Fradin et al., 2009). Thus, the sequence variations in R genes can lead to plant resistance or susceptibility against a particular pathogen. The activated R proteins or NLRs instigate a set of immune responses including oxidative burst, ion fluxes, MAPK cascades, accumulation of phytohormones, and transcriptional reprogramming (Buscaill and Rivas, 2014). For example, interactions between barley MLA10 protein and transcription factors HvWRKY1 and HvWRKY2 resulted in immunity against powdery mildew infection (Shen et al., 2007). Further, MLA10 also interacts with HvMYB6, a positive regulator of resistance to powdery mildew via its CC domain. MLA10 releases HvMYB6 from HvWRKY1 and promotes its DNA binding activity, thus enhancing the immunity against powdery mildew (Chang et al., 2013). Similarly, in rice, ETI is regulated by the CNL receptor Pb1, which interacts with OsWRKY45 to provide resistance against rice blast fungi (Inoue et al., 2013). During ETI, the recognition of pathogenic effectors is often associated with activation of HR and/or generation of ROS. The generation of ROS during plant-pathogen interactions was first studied in *Phytophthora infestans*—potato interactions. Till date, numerous studies have revealed the role of ROS and HR in plant defense during plant-pathogen interactions. The WRKY53 transcriptional network mediates ROS generation and oxidative responses during interactions between AvrRxo1 and R protein in *N. benthamiana* plants (Triplett et al., 2016). Albeit defense responses like ROS production, Ca^{2+} bursts, and protein kinase signaling are shared by PTI and ETI, but the kinetics of these responses are way too prolonged in ETI (Gao et al., 2013). Furthermore, the downstream defense gene expression patterns are mostly similar in PTI and ETI, however, the magnitude is higher during the ETI responses. Additionally, the defense signalings in ETI are robust and flexible against pathogen effector alterations in compared to PTI. For example, in *Arabidopsis*, the prolonged MAPK activation during ETI resulted in robust immune responses

and expression of defense-specific genes like PR1 (Tsuda et al., 2013). Further, during ETI many of the SA-dependent genes could be controlled in a SA-independent manner. In addition, the CNL RPM1 or RPS2-mediated continual activation of Ca^{2+}-dependent protein kinases (CPKs) in *Arabidopsis* resulted in the phosphorylation of several WRKY transcription factors ultimately achieving transcriptional reprogramming (Gao et al., 2013). Conclusively, the robustness and flexibility of ETI varies from that of PTI and can be controlled both quantitatively and qualitatively by several factors.

CONCLUSION

The interactions between plant-pathogen are complex and multi-faceted. Innumerable studies have been carried out from last decade to the present day to unveil the mechanism of these interactions. When exploring the avenues of plant-pathogen interactions, mainly two broad nodes comes into pictures such as PTI and ETI. The former one is based on the strategic detection and neutralization of conserved PAMP or MAPM signatures, whereas the later one relies on the plant resistance genes to confer immunity. Like plants employ PTI or ETI to get rid of the invading pathogens, some of the pathogens can produce potent effectors that can dodge the plant patrolling and spread further infection and pathogen colonization. Thorough understanding and characterization of the different physiological and genetic processes involved in plant-pathogen interaction and exploring more on the phyto-pathosystems will pave ways for exploiting these phenomena in crop protection and improvement. This review, serving as a comprehension of all such investigations, will help to understand and interpret the several mechanisms of the plant-pathogen interactions.

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Identification of real-time maglev system using ga based low complexity based ANN

Amit Kumar Sahoo
Department of Electrical & Electronics Engineering, Centurion University of Technology and Management, Odisha, India
*Corresponding author: amitkumar@cutm.ac.in

Abstract

In the recent past identification of nonlinear plant is a significant work has done by many researcher and it is found to be an emerging area for further research due to its wide application. In this article, the characteristics and behavior of a real time maglev plant has been identified using an efficient low complexity based Artificial Neural Network (ANN) based on functional expansion technique i.e. functional link artificial neural network (FLANN). The weights of FLANN has been iteratively updated by a heuristic optimization algorithm i.e. a natural genetics. So that the error needs to minimized, which is considered as a cost function. To demonstrate the robust identification performance of the Maglev plant Mean square error (MSE) and CPU time is considered for analysis. The simulation results justify the proposed model robustly identifies the characteristics and parameters of non-linear dynamic maglev plant.

Keywords: Non-linear System; System Identification; FLANN; Maglev plant; Chebyshev Expansion; GA.

Introduction

The principle of identification is to formulate a mathematical modeling of plant by taking its input-output data. A mathematical modeling of a system can be determined by using laws of nature or through the experimentation. Out of many techniques to find out the mathematical modelling (using parameter estimation) of the system, direct modeling and inverse modeling, have most attractive features [1], [2]. As maximum plants are non-linear and dynamic in nature, their identification is a thought provoking. Accurate and fast identification of above system is still a nightmare. Identification of non-linear plants finds application in the area of control system, power system, communication, instrumentation and many other fields.

To perform the above task in highly non-linear environment, an ANN is the best solution for it. As ANN can take the non-linear decision based on the objective. Pao et al. have proposed FLANN to overcome the above issue [3], [4], [5]. The FLANN is one of its kind and it holds the advantages of both single layer and multi-layer network. Mainly the FLANN is popular for its simple structure and less computation complexity due to absence of the hidden layer. The input of the FLANN gets functional expanded and combined to a linear combiner. The functional expansion of inputs gets by different expansion method like power series expansion, trigonometric expansion and Chebyshev expansion [6]. In this article, the Chebyshev expansion has been used to functionally expand the input.

The FLANN model has been trained by using the GA technique. This is a random search algorithm, which is based on the three steps, which includes selection, crossover, and mutation. Using these steps, the cost function is minimized. Here, the error is considered as the cost function. The performance of the proposed identification technique has been studied in terms of error, MSE and the CPU time.

This paper layout having, Section 2 presents the model of maglev plant. In Section 3 deals with the principle of system identification. Section 4 explain the basics of Genetic Algorithm (GA). The proposed GA based FLANN structure is discussed in section 5. The simulation result is discussed in section 6. Finally, the concluding remarks of the paper is outlined in section 7.

The Magnetic Levitation System

Magnetic levitation (Maglev) has been extensively accepted due to its contactless, low noise and low friction behavior and has application in many engineering field [7], [8]. Basically, Maglev plant is a highly non-linear plant and their control and identification is still a problem.

The Maglev setup consist of two parts i.e. a physical Maglev plant and a computer interface. The Maglev plant is consist of electromagnet, IR sensor, amplifier and control objects. The electromagnet helps to control the steel ball in moving up and down from the equilibrium position. When current flows in the electromagnet, then their induces an emf, which controls the position of the steel ball. The steel ball is balanced by electromagnet force and gravitational force to keep it in the desired positon. The IR senor helps to measure the position of the ball and send a signal to input. The amplifier used to improve the level of the input voltage. The Maglev laboratory setup used for experimentation is manufactured by Feedback Instrument Ltd. and it works with MATLAB environment.

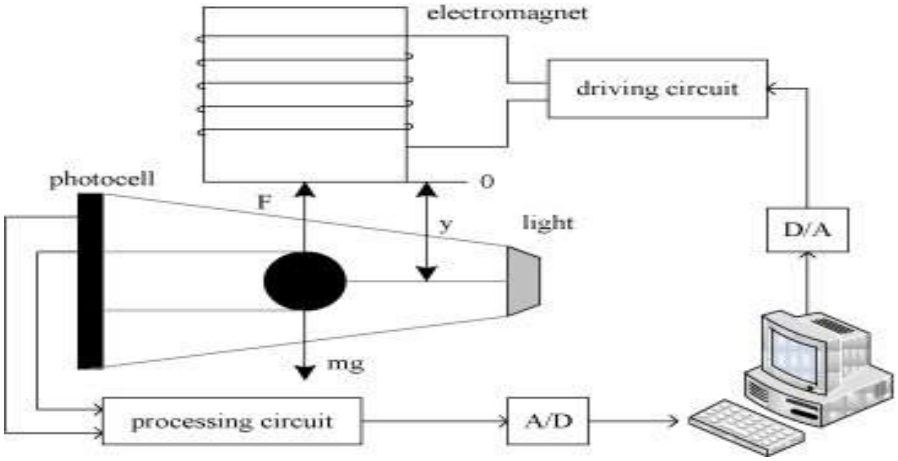

Figure 1. Block diagram of the MAGLEV system

where, m is the mass of the ball, y(t) is the distance between ball electromagnet, g is the acceleration constant., F indicates electromagnetic force, i(t) is the current through the coil. The physical parameters of Maglev plant is given in Table 1.

Sl. no.	Parameters	Value
1	m—Steel ball mass	0.02kg
2	g—Acceleration Constant	9.81m/s2
3	i0— Current value at equilibrium	0.8 A
4	x0—Equilibrium position	0.009m

5	Control input (u)	±5v
6	output voltage (x_v)	+1.25v to -3.75 v

Table 1. The physical parameter of MAGLEV plant

System Identification Overview

System identification is a technique that helps to estimate a mathematical modeling for any system from its input-output data. The proposed ANN based FLANN model is a single layer network with absence of hidden layer and the weights are updated by a nature-inspired algorithm GA [9], [10], [11]. Here, $u(k)$ represents the input, $y(k)$ is output, $\hat{y}(k)$ indicates the estimated output and $e(k)$ is the error. The cost function is taken as error for the identification of Maglev plant. The cost function need to minimize to get an efficient identified model whose response efficiently track the real-time Maglev plant response.

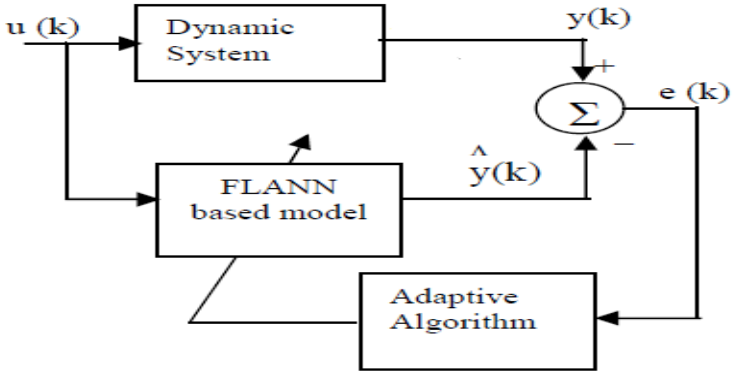

Figure 2. Schematic diagram of Maglev plant identification

The Genetic Algorithm (GA)

Genetic Algorithms (GA) is a nature inspired and natural genetics random search algorithms. John Holland has developed a random search GA with a concept of survival of fittest [12], [13], [14]. The GA is basically a random search in complex spaces and its concept based on the Darwinian natural biological selection rule and genetic mechanism. It provides a space for searching of global minima or maxima within a limited search space. By using GA does not guarantee for an optimal solution, but it provides on average a good solution. GA can be modified depends on the type of application.

The GA algorithm has broadly three steps, which includes selection, crossover, and mutation. The selection process takes place from the initial population by evaluating the fitness. The crossover represents mating between individuals and the mutation introduces random modifications in the population. These steps are being repeated until it gets an optimal solution. Over successive generations, GA converges towards the global optimum. The selection process and the crossover process are converges the cost function. For the simulation, we have considered 0.8 as the crossover probability and 0.125 as the mutation probability.

Proposed GA based FLANN Network

Pao et al. has proposed a single layer ANN i.e. functional link artificial neural network (FLANN), in which the inputs are expanded functionally. It generates the decision boundaries, which is capable of

taking complex decision. Mainly the FLANN improves the learning rate with less computational complexity for identification problem. The proposed FLANN model with input signal x(k) is functionally expanded to a number of non-linear components which is given as input to a linear combiner with weighs are associated with it as shown in Figure 3.

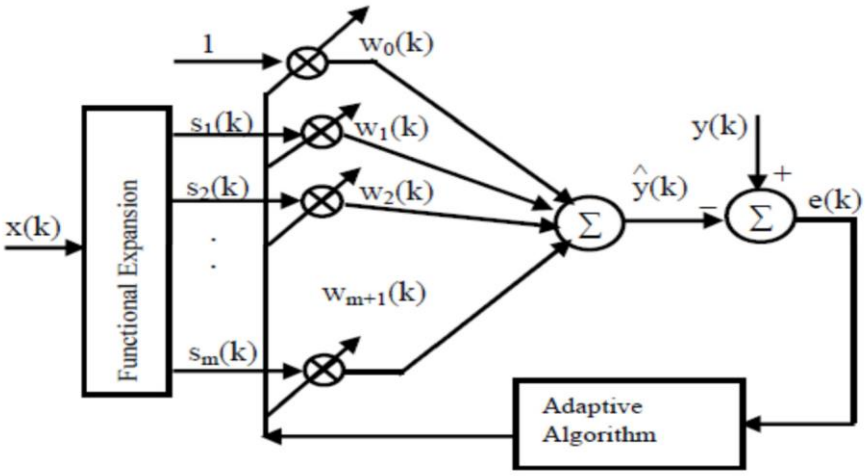

Figure 3. Structure of FLANN Model

The functional expansion of inputs gets by different expansion method like power series expansion, trigonometric expansion and Chebyshev expansion. In this article, the Chebyshev expansion has been used to functionally expand the input. Mathematically, Chebyshev expansion can be written as,

$$T_0(x_k) = 1 \quad \text{for} \quad k = 0$$
$$T_1(x_k) = x_k \quad \text{for} \quad k = 1$$
$$T_2(x_k) = 2x_k^2 - 1 \quad \text{for } k = 2$$
$$T_{k+1}(x_k) = 2x_k T_k(x_k) - T_{k-1}(x_k) \quad \text{for} \quad k > 2 \qquad (1)$$

where, x(k) is the input and w(k) is the weights of the model. The output of the proposed model is given as

$$\hat{y}(k) = \sum_{m=1}^{Q-1} s_m(k) w_m(k) \qquad (2)$$

The weights of the proposed FLANN model are updated by GA algorithm for identification of Maglev plant.

RESULT AND DISCUSSION

The proposed method is simulated and test by using *acer Aspire* V, 8 GB RAM, intel CORE i5 processor, 1.80GHZ with Windows 10. For identification of real time Maglev plant 5000 no. of samples have been taken, out of that in 8:2 propotion is taken for training and testing with 10 no. of iteration. The performance of the proposed FLANN network updated by GA algorithm is analysised in terms of error, MSE and CPU time. Here, the error is 0.0014, MSE is 0.00001 and CPU time is 31.866 sec. From Figure 6, it shows that the high convergence rate of MSE curve.

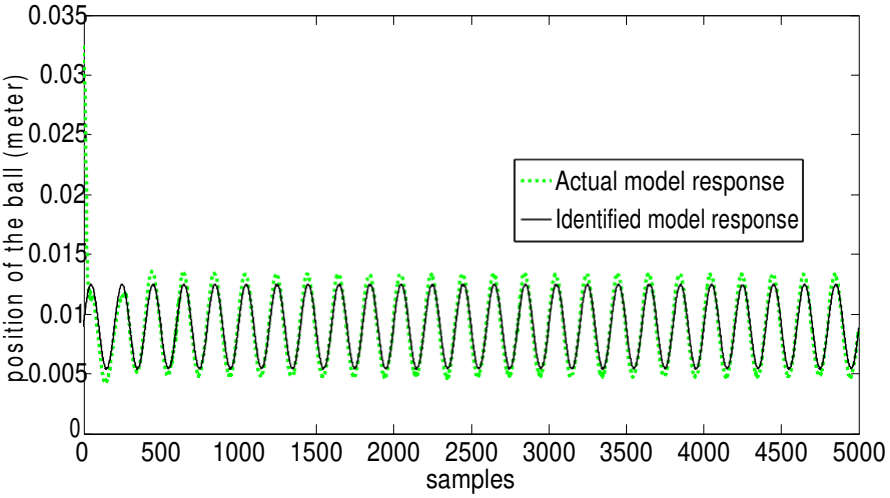

Figure 4. Actual and Identified model response (position of the ball)

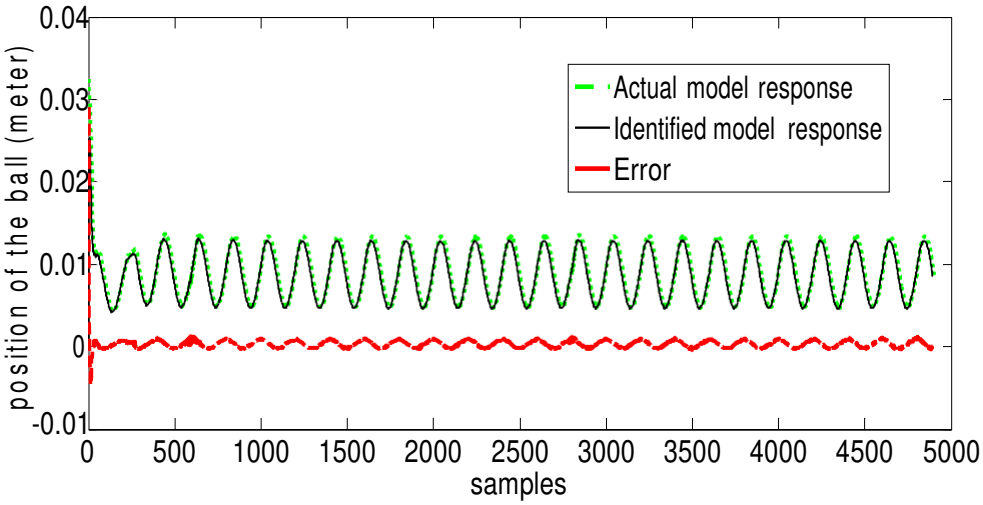

Figure 5. Identified model response generated by FLANN-GA

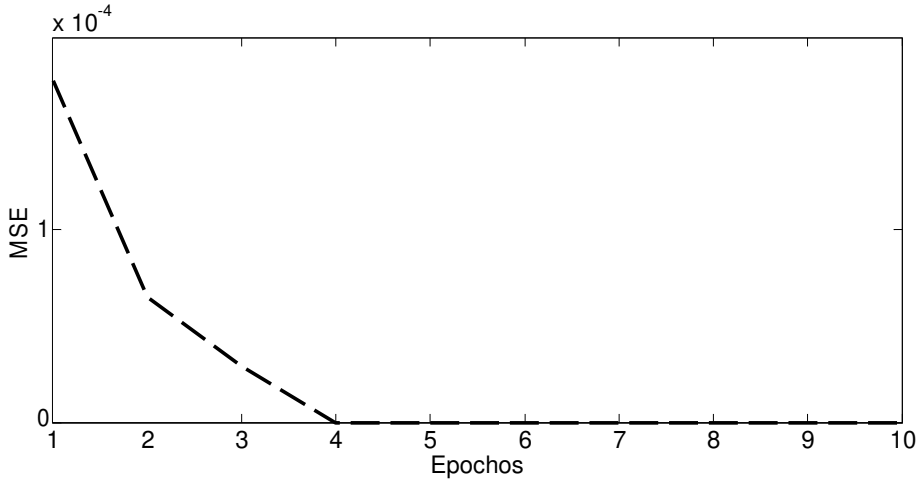

Figure 6. MSE plot of FLANN-GA

CONCLUSIONS

In this paper, the proposed model successfully identified the real time Maglev system based on the input-output data. Here, GA technique has play the important role to updated the weights of the FLANN model. A simulation study is carried to check the effectiveness of proposed GA based FLANN network. The efficacy of proposed model found from the closed fitting of identified model response and actual model response, which exhibit that the proposed model using GA is more suitable for identification of highly nonlinear Maglev plant. The research work in this area includes efficient neural network structure optimized by efficient nature inspired algorithm for further development to enhance its robustness and efficiency.

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Extraction and Purification of Pectin from Papaya

Tapasya Kumari[1], S G Kulkarni[2], Vivek Kumar[3*], Moirangthem Kalpana Devi[4] and Pasupuleti Vijayanand[2]

[1] Tezpur University, Assam

[2]Central Food Technological Research Institute, Mysore

[3]Centurion University of Technology and Management, Odisha

[4]National Institute of Technology Rourkela, Odisha,

*Corresponding Author: vivek.btag@gmail.com

ABSTRACT

Papaya is a potential source of pectin. Physico-chemical analysis of Unripened and ripened papaya was carried out. Both the samples were blanched at 95ºC for 5min and dehydrated. The chemical characterisation was done to see the maximum yield for pectin. Blanched dehydrated samples were finally taken for purification and extraction of pectin. The effect of ethanol treatment on the yield of pectin in unripe papaya powder was studied. Treatment with 90% ethanol, the pectin content of unripe papaya increased to 18.36%. Water holding capacity of the papaya extract was 41.9%. The moisture content in pectin extract from unripe papaya pulp was found to be 3.32%.

Keywords: Papaya, Pectin, Purification

Introduction

Papaya (*Carica papaya*) is grown in tropical and subtropical area and having commercial importance because of its high nutritive value. India is one of the leading producers of papaya with the annual production of 4.681 million tonnes during 2014-15 (Anonymous 2016). In India, the papaya is more common fruit with a number of varieties. Some of the common varieties of papaya grown throughout the

world are Coorg Honey Dew, Pusa Dwarf, Pusa Giant, Pusa Majesty, Pusa Delicious, Solo, Taiwan-785, Taiwan-786, Solo Sunrise, Solo Sunset, Red Amazon and Improved Peterson (Anonymous 2014). The yield of papaya varies between 75-100 tonnes /ha area in the season. Papaya is gaining popularity worldwide not just for the delicious ripe fruit but also for its medicinal properties of the whole plant parts. These include leaf, fruit, root, bark, peel, seed and pulp (Aravind et al. 2013). Papaya is considered as one of the important fruit because it is rich source of antioxidants, phytochemicals, nutrients such as carotenes, vitamin C, and flavonoids, the B vitamins including folate and panthothenic acid, minerals such as potassium and magnesium, and dietary fiber. The papaya fruit is fleshy and usually green but turns yellow or orange when ripe. Ripe papaya is usually consumed as table fruit whereas unripe fruit is added into fresh salads. In many parts of the world including India, green papaya fruit is also cooked as vegetable. The unripe papaya fruits are also valuable as a source of the proteolytic enzyme papain which has many economic and industrial applications (Boshra and Tajula 2013). It is reported that the enzyme papain is at its peak concentration in the green and unripe papaya fruits. Papain enzyme is produced from unripe green but fully mature fruits. Fruits are cut with SS knife by giving four cuts on single fruit to collect the latex in a vessel or aluminium trays and dry it as crude papain. After collecting the latex, the unripe fruits are harvested which are unsuitable for product making. It is reported that green unripe papaya fruits are used for making tuti fruity (Malathi et al. 1986). It is also reported that green unripe papaya contains good quantity of pectin on dry weight basis. Generally, unripe green papaya fruits are discarded after extracting papain enzyme. These unripe and green papaya fruits are not used for ripening purpose also. A little work has reported on the utilization unripe papaya fruits to processed products after papain extraction like tuti fruity and mixed vegetable pickles. Unripe papaya fruits are generally cooked and used as vegetables (Mendoza 2007). It is reported that unripe papaya pulp flour was used as a substitute for normal wheat flour used in cookies (15, 30 and 50%) with sensory acceptability (Boshra et al. 2015). The unripe green papaya is a good source of carbohydrates starch and pectin. Hence, the present work deals

with the utilization of green unripe papaya fruits which are unsuitable for product making after extracting latex.

Materials and Methods

Raw materials

Papaya fruits of different stage of ripening viz. green unripe and ripe papaya were procured from local fruit market, Mysore, India and used for experiments. The fruits were washed, peeled and sliced in 0.4 mm thickness with slicing machine (Hallde-CG100 slicer and dicer). Five fruits from each ripening stage were selected and used for physic-chemical analysis. The physical parameters include peel weight and pulp weight. For chemical analysis, edible portion of peeled papaya was taken for estimating various chemical parameters.

Blanching of slices

Blanching of papaya slices were conducted with known weight of slices in hot water (95°C), for 5 minutes in water to sample ratio of 1:2 (Kumar and Shrivastava 2017). The blanching of papaya slices of different ripening stages was done to inactivate the enzyme activity. Blanched slices were removed, drained excess water and dipped in cold water to avoid excess cooking.

Dehydration of blanched papaya slices

The blanched slices were loaded to SS trays at 7.57 Kg/sq meter and dried at 65±2 °C in a cross-flow hot air cabinet dryer (Magumps, Dadar, Mumbai, India). The slices were weighted periodically at 1 h interval during drying till constant weight is obtained.

Dehydration ratio (DR) of papaya slices was calculated by the ratio of weight of material (g) kept for dehydration to the weight of dehydrated material (g) and expressed as (w/w) as per the method described by Ranganna (Ranganna 1986).

Dehydrated papaya slices with or without blanching were weighed (5g) and put it in 200 ml of boiling water for 5minute and noted weight. Rehydration ratio was calculated as gain in weight. Rehydration of ratio (RR) of dehydrated material was determined as per method suggested by Ranganna (1986).

$$RR = \frac{W_r}{W_d} \quad (1)$$

Where, W_r = weight of rehydrated sample (g); W_d = weight of dried sample (g)

Water solubility index Two gram of papaya powder was dissolved in 100 ml of distilled water. Twenty five ml aliquot was taken and then transferred to a pre-weighed glass petri dish and oven-dried at 100°C until a constant weight was obtained. The solubility was calculated as the weight difference and expressed as percentage.

Dehydrated papaya slices were passed through pulveriser to get powder. The resultant powder was passed through 100 mesh to get fine powder and packed in 300 gauge LDPE bags and stored.

Physico-chemical analysis

The fresh and dried papaya slices of different stage of ripening were analyzed for total soluble solids (TSS), titratable acidity, pH, ascorbic acid, sugars and starch and pectin. Non-enzymatic browning (NEB) as per the method described by Ranganna (Ranganna 1986). Hunter Lab Colour Difference Meter (Konica Minolta Spectrophotometer CM-5) was used to measure the colour. Hunter Lab values (L, a, b) of papaya pulp, powder and jams prepared from them were determined. The colour of a sample is denoted by the three dimensions L, a, and b values. The 'L' value gives a measure of the lightness of the product, colour from 100 for perfect white to zero for black, as the eye would evaluate it. The 'a' value indicates measure of redness when positive, and greenness when negative 'a', and 'b' measures yellowness when positive, and blueness when negative. Colour measurements were carried out in triplicate (Kumar et al. 2019).

Moisture

A flat bottom dish was taken and dried at 110ºC for 1 hr; then the dish was cooled in desiccators and weighed. Sample was weighed quickly to avoid absorption of moisture. The sample was placed in an oven at 60ºC for 12 to 14 hrs. After drying weight the sample. The percentage of moisture was calculated.

$$\% \text{ Moisture } = \frac{W_3 - W_1}{W_2} \times 100 \qquad (2)$$

Where W1= weight of empty dish

W2=weight of dish +sample

W3=weight of dish +dried sample

pH

pH was determined using digital pH meter, model no. APX 175.

Total Acidity (%)

Known weight of sample was taken in a conical flask. Add distilled water and shake thoroughly for 5 minutes. Titrate it against 0.1N NaOH using phenolphthalein indicator till the solution turns pale pink (Ranganna 1991).

$$\% \text{ Acidity} = \frac{\text{Titre value} \times \text{Normality of NaOH} \times \text{Equivalent wt of acid} \times 100}{\text{Weight of the sample} \times 1000} \qquad (3)$$

Sugars

Reducing and total sugars were determined by Lane and Eynon method as described by Ranganna (Ranganna 1986).

Preparation of Sample

Ten gram of sample was weighed and ground with water using pestle and mortar. The mixtures were transferred to 250 ml conical flask, then 2 ml of neutral lead acetate was added and shaken for 30 minutes. Ten ml of potassium oxalate solution was added to remove excess of lead acetate and the solution volume was made up to 250 ml and filtered.

Reducing sugars

The filtrate was titrated was against Fehling A and Fehling B as in case of Fehling Factor.

$$\% \text{ Reducing Sugar} = \frac{0.05 \times \text{volume (250 ml)} \times 100}{\text{Weight of sample} \times \text{Titre value}} \quad (4)$$

Total sugars

Fifty ml of filtrate was taken and added 2.5 ml of Con. hydrochloric acid and kept for overnight complete inversion of sugar, filtrate was neutralized by 10% NaOH and the volume was made up to 100 ml which is taken in the burette and titrated as in case of Fehling Factor.

$$\% \text{ Total Sugar} = \frac{0.05 \times 1000}{\text{Weight of sample} \times \text{Titre value} \times 50} \quad (5)$$

Carotenoids (µg/100g)

10g of sample is ground in a pestle and mortar with 80% acetone, filtered and transferred into a conical flask until the sample becomes colour less. The filtrate is taken in a separating funnel and 50-80 ml of petroleum ether is added, followed by addition of 30 ml of water and left for 30 minutes. The colourless water was discarded and the procedure was repeated thrice. Volume of petroleum ether was measured and anhydrous sodium sulphate was added and then absorbance of the ether extract at 452nm (Genesys 10 SUV-VIS Spectrophotometer) was taken by using petroleum ether as blank.

$$\mu\text{g of carotene per kg sample} = \frac{3.857 \times \text{OD at 452 nm} \times \text{volue} \times 100}{\text{Weight of sample (g)}} \quad (6)$$

Determination of fat content

Crude fat content in unripe papaya powder was determined using Soxhlet solvent extraction method (Ranganna 1986). Two gram of the sample was weighed into the extraction thimble and the thimble was blocked with cotton wool. It was then placed back in the Soxhlet apparatus fitted with a weighed flat bottom flask which was filled to about three quarter of its volume with petroleum ether with boiling point of 40 to 60°C. The extraction was carried out for a period of 4 h after which complete extraction was done. Petroleum ether was removed by evaporation and the remaining portion in the flask was removed along with water during drying in an oven at 80°C for 30 min and weighted.

$$\% \text{ Fat} = \frac{\text{Weight of extracted fat}}{\text{Weight of sample taken for estimation}} \times 100 \quad (7)$$

Determination of ash content

The ash content was determined as described by Rangana (Ranganna 1986). The weight of the crucible dish was determined. Two gram of the sample was added to the crucible. The dish and content were placed on the furnace rake and the furnace temperature was set to 500°C for 16 h until the sample completely turned into ashes. The crucible dish was removed and kept in desiccators to cool and percentage ash was calculated as:

$$\% \text{ Ash} = \frac{\text{Weight of extracted Ash}}{\text{Weight of sample taken for estimation}} \times 100 \quad (8)$$

Crude fiber determination

This was determined by the procedure given by Ranganna (Ranganna, 1986). Three gram of the sample was weighed into a 500 ml round bottom flask and fixed lebig condenser and the content was boiled in 200 ml sulphuric acid (1.25%) for 30 min. The suspension was filtered and the residue was washed vigorously with boiling water until it was no longer acidic. The sample residue was then boiled again in a 200 ml of 1.25 % sodium hydroxide solution for 30 min, filtered through filter paper (Whatman no.1) and the residue obtained was transferred into a crucible in an air oven 80°C for 30 min. The dried residue was then cooled in a desiccator and weighed. The weighed sample residue was turned into ash in a muffle furnace at 550°C for 30 min. The sample was removed from furnace when its temperature was 200°C. It was cooled in a desiccator and weighed. The loss in weight of the incinerated residue before and after incineration was taken as the crude fibre content. Percentage crude fibre was calculated as:

$$\text{Crude Fiber} = \frac{\text{Total weight of fiber}}{\text{Weight of sample}} \times 100 \quad (9)$$

Ascorbic acid

10g sample was transferred into a 100 ml volumetric flask. Make up to 100 ml using 3 % oxalic acid. Pipette 5 ml into a conical flask and add 5 ml oxalic acid solution. Titrate it against 2-6 DCPIP (diluted solution) till pink colour occurs.

$$\text{Ascorbic acid (mg/100g)} = \frac{0.1 \times \text{titre value} \times \text{volume (100 ml)} \times 100}{\text{Weight of sample} \times \text{aliquot (5ml)}} \qquad (10)$$

Non – enzymatic browning

The non-enzymatic browning (NEB) was determined by measuring the absorbance of the alcoholic extract of sample at 440 nm (Ranganna 1986). Two gram of sample was soaked in 50ml of 60% alcohol overnight and the extract was filtered through Whatman No: 41filter paper. The optical density of the filtrate was measured at 440 nm is spectrometer (Kulkarni et al. 2008).

Pectin Estimation

Pectin estimation was done as suggested by Rangana (Ranganna 1986). Eq.11 was used for the calculation of Pectin in the samples.

$$\% \text{ Pectin} = \frac{\text{Final Filter weight-Initial Filter weight} \times \text{vol. make up}}{\text{Weight of sample} \times \text{Vol. taken out}} \times 100 \qquad (11)$$

Calcium Pectate: Calcium pectate was calculated by the method suggested by Rangana (Ranganna 1986) with little modification. Following equation was used for the calculation of the calcium pectate.

$$\% \text{ Calcium pectate} = \frac{\text{Weight of calcium pectate} \times 100 \times 500}{\text{ml of filtrate taken} \times \text{weight of sample}} \times 100 \qquad (12)$$

***Characterization of pectin*:** The pectin extracted was analyzed for equivalent weight, methoxyl content and galacturonic acid (Ranganna 1986). Standard galacturonic acid Sigma AR grade was used to prepare standard solutions containing 10 µg to 50 µg galacturonic acid and a standard curve was drawn.

Equivalent Weight

Sample (1g) was taken in a conical flask (250 ml) and ethanol (5 ml) was added. Sodium chloride (1g) and 100 ml of distilled water were added. Phenol red indicator was added and titrated against 0.1 N NaOH

to purple colour. Then neutralized solution was used for determination of methoxyl content. Equivalent weight was calculated by following formula.

$$\text{Equivalent weight} = \frac{\text{Weight of sample} \times 1000}{\text{ml of alkali} \times \text{Normality of alkali}} \quad (13)$$

Methoxyl Content (MeO)

The neutralized solution was mixed with 25ml of 0.25 N sodium hydroxide, then stirred thoroughly and kept for 30 min. (25 ml) 0.25 N hydrochloric acid was added and titrated against 0.1 N NaOH.

$$\text{Methoxyl Content g/100g} = \frac{\text{ml of alkali} \times \text{normality of alkali} \times 31}{\text{Weight of sample}} \quad (14)$$

Galacturonic acid content

Galacturonic acid content of pectin samples was estimated by the modified uronic acid carbozole reaction as recommended by Rangana. The colour forming product was measured by spectrophotometer using galacturonic acid as a standard.

Calculation: From the standard curve, the concentration of the anhydrogalacturonic acid (AuA) corresponding to the reading of the sample was determined and calculated as shown below.

$$\text{AuA (\%)} = \frac{\mu\text{g of AuA in aliquot} \times \text{Dilution} \times 100}{\text{ml taken for estimation} \times \text{Weight of pectin sample} \times 1000000} \quad (14)$$

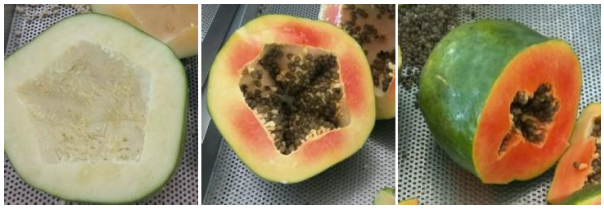
Viscosity of papaya pectin solution

Viscosity of the sample were determined by using a viscometer, (Brook field Viscometer (RV) –DV-II+Pro). The viscosity was measured by using viscometer spindle No- 2 and 100 rpm. The sample was taken in a glass beaker and the viscometer was operated at 100 rpm. Auto zeroing at the start standardized the instrument, the spindle No. 2 were inserted up to mark and reading was noted and expressed as centipoises or m Pa.S

1 milli pascal second (m. Pa.S) = 1 centipoise (CP)

RESULT AND DISCUSSION

Papaya is a tropical fruit which contain a fair amount of pectin, a partially methylated polygalacturonic acid found in all fruits. The quantity of pectin in mature unripe fruit and ripe fruit could be different because of pectin degradation during ripening. The edible portion in mature unripe papaya is almost 83% which reduces to 78% when ripe.



Unripe Semi ripe Firm ripe papaya

Figure 1. Papaya fruits at different maturity

Chemical composition of freshly extracted pulp from unripe and ripe papaya fruits are given in Table 1. The moisture in unripe papaya fruit was found to be 91.5% (wb). The moisture content decreased significantly in ripened fruits to 88.8% (wb). This could be due to migration of moisture from peels to pulp during ripening. Figure 1 shows the papaya at different maturity level.

Table 1 Chemical composition of freshly extracted pulp from unripe and ripe papaya fruits

Parameters	Unripe mature papaya pulp	Ripe papaya pulp
Moisture (%)	91.5 ±1.0	88.8 ±1.0
TSS (%)	6.0 ±0.03	10.5 ±0.05
pH	5.42 ±0.04	5.34 ±0.04
Titrtable acidity (%)	0.14 ±0.02	0.08 ±0.01
Reducing Sugars (%)	3.2 ±0.03	4.6 ±0.04
Total Sugars (%)	4.5 ±0.03	8.2 ±0.04
Non Reducing Sugars (%)	1.23 ±0.03	3.24 ±0.03
Ascorbic acid (mg/100g)	14.9 ±0.06	45.9 ±0.11

Calcium pectate (%)	1.1 ±0.03	0.37 ±0.01

Mean ± SD (n=3)

Total soluble solids (TSS) of unripe and fully ripe papaya were found to be 6.0 and 10.5% respectively. The results indicated that TSS of papaya fruits increased from mature unripe stage to ripe stage. The increase in TSS could be due to hydrolysis of starch during ripening. Papaya fruits had the high titratable acidity (0.14%) in unripe fruits than in ripe fruit pulp (0.08%). Such a decrease in acidity during ripening of papaya has been reported by Kulkarni et al. 2008. The reducing sugars and total sugars content of the unripe and ripe papaya fruit showed increasing trend during the ripening process, while the non-reducing sugars content increased from mature unripe stage to ripened stage. Similar type of observation has been reported for Indian papaya by Boshra et al. 2015. The highest total sugars content was recorded in ripe fruits (8.2%) followed 4.3% in unripe fruits.

Unripe papaya fruits had the lowest content of ascorbic acid (14.9 mg/100g) whereas the ascorbic acid content in the fruits increased in ripened fruits (45.9 mg/100g). Pectin content was the most important parameter of papaya pulp at unripe and ripe stage of papaya (Nurul and Asmah 2012). The data indicated that the pectin content in unripe papaya pulp was estimated as 1.1% as calcium pectate. Calcium pectate decreased from 1.1 % at unripe stage to 0.37% at ripe stage. The results indicated that at ripened stage pectin content in the pulp reduced 0.37 %, could be due to the degradation of pectin.

The results on chemical composition of unripe, ripe fruits indicated that there is lot of variation at different maturity stage of papaya fruits. It was found that unripe papaya pulp contains good amount of pectin and ripe fruits had good amount of ascorbic acid.

Effect of Blanching and Drying on the Quality Characteristic of Papaya Slices

***Unripe papaya slices*:** It is important to maintain the original colour of dried papaya slices. The enzymes activities are responsible for undesirable colour in papaya slices. The colour of blanched slices did not undergo changes during drying process.

Dehydration was carried out at cabinet drier at 60°C. Figure 2a shows dehydrated unripe papaya slices with and without blanching. Figure 2b shows the dehydrated ripe papaya slices. Results indicated that blanching slices at boiling water for 5 minutes inactivates the enzyme activities and prevented browning in the sample. In comparison, control samples (without blanching) showed 1½ hours less drying time at 60°C. The weight loss during dehydration of papaya slices are presented in Table 2.

Table 2 Effect of blanching of unripe, semi ripe and ripe papaya slices on weight loss during drying at 60ºC

	Weight loss (%) during drying of papaya slices (hrs)											
Stage of ripening	**Initial**	**0.5**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**	**5.0**	**5.5**
I). Unripe papaya Slices												
Control	0.0	24.1	50.5	66.1	74.4	80.0	84.7	87.9	90.1	-	-	-
Blanched	0.0	15.5	25.2	36.6	45.76	54.9	60.4	66.7	73.9	77.8	82.7	89.0
II). Firm ripe papaya slices												
Control	0.0	25.8	42.3	54.9	60.5	68.5	77.7	84.1	88.4	90.0		
Blanched	0.0	19.4	36.4	44.0	53.9	58.8	63	65.8	72	77.5	83.3	87.9

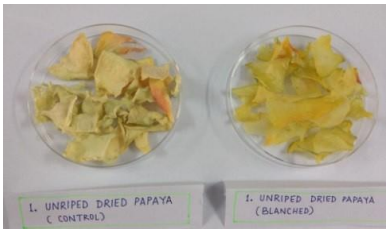


Figure 2a. Dehydrated unripe papaya slices before and after blanching

Figure 2b. Dehydrated ripe papaya slices

Table 3 Dehydration properties of papaya powder from papaya fruit of different ripening stages

Stage of ripening	Moisture (%)	DHR	RHR	*Hunter colour*		
				L	*a*	*b*
I) Unripe papaya powder						
a) Control	6.71 ±0.04	10:1	1: 6.2	80.20 ±1.0	2.43 ±0.03	29.35 ±0.08
b) Blanched	6.82 ±0.04	18.5	1:8.2	78.10 ±1.0	0.16 ±0.01	27.16 ±0.08
II) Firm ripe papaya powder						
a) Control	6.88 ±0.04	9.1:1	1: 6.8	62.37 ±1.0	11.57 ±0.06	34.93 ±0.09
b) Blanched	6.9 ±0.04	14.2 :1	1: 9.2	70.09 ±1.0	12.51 ±0.06	36.97 ±0.09

Mean ± SD (n=3)

However, there were not many changes in moisture content in dehydrated products for control and blanched of unripe papaya slices.

The characteristic properties of unripe papaya slices and ripe papaya slices obtained after dehydration at cabinet drier are presented in Table 3. The moisture content in dehydrated unripe sample was found to be 6.71% and 6.82% in blanched slices. The samples dehydrated after blanching had 6.9% moisture content (wb).

Dehydration ratio in control samples of unripe and ripe slices was lower than the blanched slices. This could due to the gain in water during blanching and cooling of slices and also loss of solids during 5 minutes blanching of slices at higher temperature. The dehydration ratio of unripe and firm ripe papaya slices of control samples were found to be 10:1 and 9.1:1 respectively, whereas blanched slice sample of the respective fruit slices were recorded as 1:18.5 and 1:14.2 of unripe and ripe slices, respectively.

The rehydration ratio papaya fruit slices obtained at different stage of ripening before and after blanching as shown in Figure 3, indicated that rehydration ratio increased from 1:6.2 to 1:8.2 in unripe papaya slices. In ripe fruits the rehydration ratio is high 1:9.2. Increase in rehydration ratio for blanched slices could be due to the loss of solids and gain in moisture content during boiling and cooling (Kumar et al. 2019).

During blanching and drying of unripe papaya slices had significant effect on hunter colour values. 'L' values decreased from 80.20 to 78.10 and 'a' values also decreased from 2.43 to 0.16 and 'b" values also decreased from 29.35 to 27.16. These changes may be due to the loss of soluble solid and fruit pigment got concentrated. In ripe fruit slices L, a, b all the three values increased due the loss of soluble solids and fruit pigments concentrated.

Figure 3. Rehydrated samples of dehydrated unripe papaya slices

Table 4 Chemical properties of dehydrated papaya slices obtained from unripe and ripe papaya.

Papaya powder from	Moisture (%)	pH	Total acidity (%)	Reducing sugars (%)	Total Sugars (%)	Ascorbic Acid (mg/100g)	Pectin (%)	Starch (%)
I) Unripe papaya powder								
a) Control	7.76 ±0.04	5.70 ±0.03	1.39 ±0.03	42.77 ±0.11	47.98 ±0.11	205.98 ±8.0	7.7 ±0.04	35.37 ±0.09

b) Blanched	7.66 ±0.04	6.79 ±0.04	0.58 ±0.02	33.00 ±0.09	36.94 ±0.09	113.33 ±3.0	10.0 ±0.06	24.84 ±0.07
II) **Firm ripe papaya powder**								
c) Control	7.85 ±0.04	5.24 ±0.04	1.35 ±0.03	37.60 ±0.10	47.14 ±0.10	232.55 ±8.0	4.77 ±0.03	29.19 ±0.09
d) Blanched	7.12 ±0.04	6.69 ±0.04	0.58 ±0.02	21.60 ±0.07	41.41 ±0.10	159.46 ±5.0	6.34 ±0.04	20.21 ±0.07

Mean ± SD (n=3)

Chemical characteristics of papaya powder prepared from dehydrated slices (before and after blanching) of unripe and ripe papaya powder are presented in Table 4. The data revealed that the moisture content in dehydrated papaya powder obtained before and after blanching for both stages of ripening ranged from 7.12% to 7.92% (wb). pH of papaya powder prepared from unripe papaya fruit for control samples was 5.7. Whereas powder prepared from blanched slices was increased to 6.79. Similar trend of observations was recorded for ripe papaya powder prepared with and without blanching. The increase in pH in the entire sample may be due to decrease in acidity of fruit powder during blanching.

The ascorbic acid in powder prepared from dried unripe papaya fruit slices was found to be 205.98 mg/100. The ascorbic acid decreased to 133.33 mg/100 in blanched powder. This loss of ascorbic acid could be due to oxidative destruction. Similar trend observations were recorded for semi ripe papaya powder and ripe papaya powder (Yi Zhuo et al. 2013).

The pectin content (7.7%) was estimated in control unripe papaya powder. Whereas the powder prepared from blanched unripe papaya slices showed the highest content of pectin 10.0 %. The pectin content decreased from unripe stage to ripe stage. The powder prepared from semi ripe papaya before

blanching was 7.5% which was increased to 8.71% after blanching. Similar results were obtained in case ripe papaya fruits. The results indicated that the effect of blanching increased pectin content in the fruit powder could be due to conversion of insoluble pectin to soluble form.

It may be concluded that the unripe dehydrated papaya slices yielded maximum pectin content 10.0% as compared with control samples. Whereas ripe fruit papaya powder obtained after blanching gave very less pectin (6.34%) content.

Purification of Blanched Unripe Papaya powder

Purification of blanched unripe papaya powder Based on the studies carried out, it could be concluded that mature unripe papaya powder contains significant quantity of pectin. It is reported that unripe papaya powder contains pectin alongwith D-galacturonic, D-glucuronic acids, L-arabinose, D-galactose, L-frucose, L-rhamnose and D-xylose. Most of these are soluble in water but pectin precipitates in ethanol and remains insoluble. Figure 4a and 4b show papaya powder before and after purification, respectively. The effect of ethanol treatment on blanched unripe papaya powder with 70%, 80% and 90% concentration for 30 minutes were evaluated. Loss of ethanol soluble (or loss in weight from powder) during treatments are presented in Table 5. The data indicated that treatment of blanched unripe papaya powder with 70% ethanol, had loss of weight 20.66 %. The loss of weight was increased to 34.5% when the papaya powder washed with 90% ethanol.

Table 5 Effect of ethanol treatment on weight loss and yield of pectin in unripe blanched papaya powder

Papaya powder treatment with ethanol	Weight loss (As alcohol soluble) (%)	Pectin content (%)	% increase in pectin
Control (without treatment)	-	10.0 ±0.06	---
First treatment with 70% ethanol	20.66 ±0.07	12.08 ±0.06	20.8 ±0.07

Second treatment with 80 % ethanol	29.89 ±0.08	14.62 ±0.06	36.2 ±0.10
Third treatment with 90 % ethanol	34.5 ±0.09	18.32 ±0.07	83.2 ±2.0

Mean ± SD (n=3)

Figure 4a. Papaya powder before purification

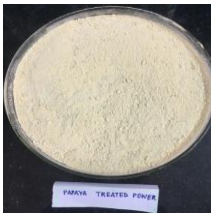
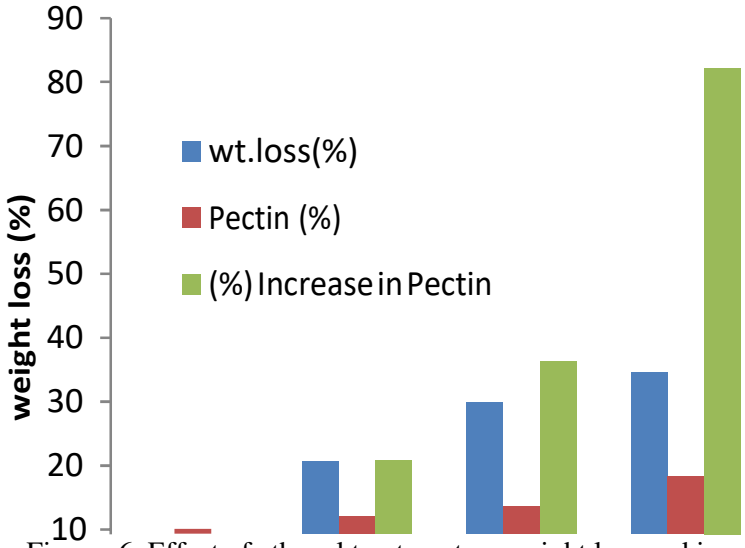


Figure 4b. Papaya powder after purification



Figu re 6. Effect of ethanol treatment on weight loss and increase in pectin in unripe aya powder

Due to the removal of ethanol soluble solids, the quantity of pectin in unripe blanched powder increased rapidly. The pectin content increased from 10.0 % to 18.32 % as the pectin is insoluble in ethanol media.

Figure 6 shows the effect of ethanol treatment on weight loss and increase in pectin in unripe blanched papaya powder. The significant increase in pectin content (18.32%) was observed when the unripe papaya powder washed with 70, 80 and 90% ethanol (18.32%). Results showed that by most of the soluble sugars are removed by treating the papaya powder with different concentration of ethanol.

Effect of treatment on the yield of pectin in unripe papaya powder

Data presented in Table 5 revealed that the pectin in blanched powder contained 10.0 %. In the first treatment with 70% ethanol, the pectin content increased from 10.0% to 12.08%. This increase in pectin was calculated as 20.8%. In second treatment with 80% ethanol, pectin content increased to 13.2%. Figure 7 shows the alcoholic precipitation of pectin from unripe blanched and purified papaya powder. In the second treatment the increase in pectin was calculated as 36.2%. Similarly, in third and final treatment with 90% ethanol, the pectin content of unripe papaya increased to 18.36%.

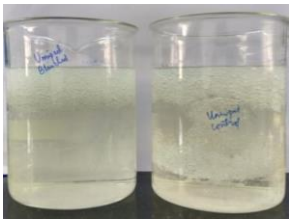


Figure 7. Alcoholic precipitation of pectin from unripe blanched and purified papaya powder

Figure 8. Pectin extracted from unripe blanched and purified papaya powder

The third treatment increased the pectin substantially to 83.2 % level. It may be concluded that washing the unripe blanched papaya powder with ethanol had significant effect on yield of pectin. Figure 8 shows the pectin extracted from unripe blanched and purified papaya powder.

Table 6 Composition of blanched and ethanol treated unripe papaya powder

Parameters	Unblanched	Blanched	Blanched and

	papaya powder	papaya powder	ethanol treated
Moisture	7.76 ±0.04	7.66 ±0.04	6.81 ±0.04
pH	5.7 ±0.04	6.78 ±0.04	6.33 ±0.04
Acidity (%)	1.39 ±0.03	0.58 ±0.02	0.39 ±0.01
Crude fat (%)	0.92 ±0.02	0.43 ±0.01	0.04 ±0.01
Reducing Sugars (%)	42.77 ±0.10	33.0 ±0.09	0.15 ±0.01
Total Sugars (%)	47.98 ±	36.94 ±0.09	0.23 ±0.01
Ascorbic acid mg/100g	205.98 ±8.0	113.33 ±3.0	26.49 ±0.08
Crude fibre (%)	3.64 ±0.03	5.64 ±0.04	16.53 ±0.06
Total carotenoids (µg/100g)	1350 ±12.0	1615 ±15.0	205.70 ±8.0
Starch (%)	35.37 ±0.09	24.84 ±0.07	5.70 ±0.04
Total Ash (%)	4.85 ±0.03	5.36 ±0.04	7.35 ±0.04
NEB at 440 nm	0.995 ±0.02	0.088 ±0.0	0.024 ±0.0
Water holding capacity (g/g)	41.91 ±0.1	40.67 ±0.1	59.43 ±1.0
Alcohol insoluble (g/g)	0.49 ±0.01	0.57 ±0.01	0.85 ±0.02
Pectin (%)	7.7 ±0.04	10.0 ±0.06	18.32 ±0.06

Mean ± SD (n=3)

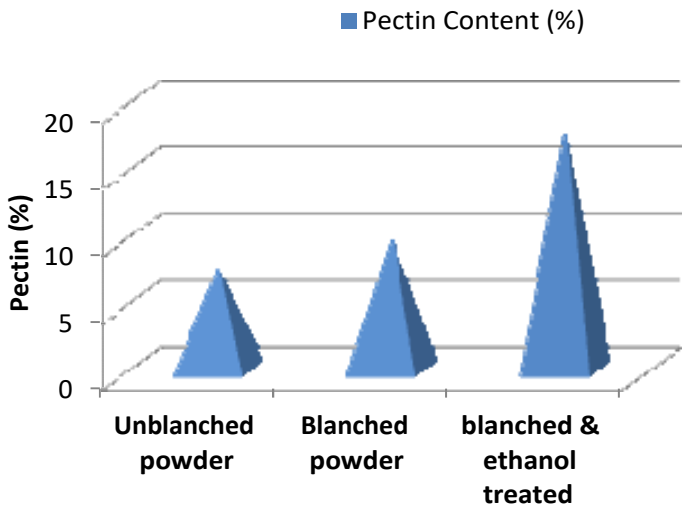


Figure 9. Changes in chemical content during blanching and ethanol washing of unripe papaya powder

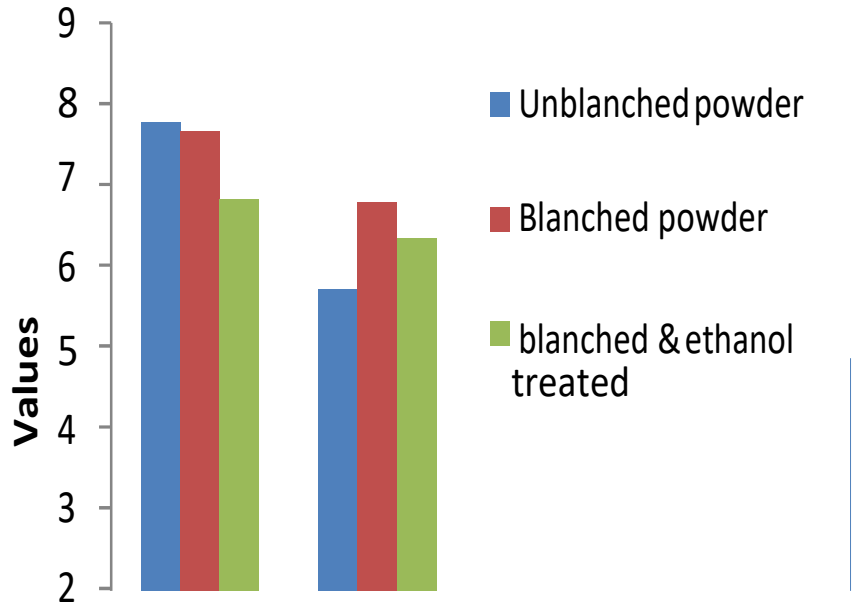


Figure 10. Changes in chemical content during blanching and ethanol washing of unripe papaya powder

The compositional analysis of ethanol treated unripe blanched papaya powder is presented in Table 6. The data showed that the moisture content was found to be 6.81%, acidity 0.39%. The ascorbic acid , total

carotenoids and total ash content and non-enzymatic browning of treated unripe treated papaya powder was recorded as 20.49 mg/100g, 205µg/100g, 7.35% and 0.024 (OD at 440 nm), respectively. There was significant loss in ascorbic acid and was recorded as 26.49 mg/100g in the treated powder. The pectin content in washed papaya powder was significantly as high as 18.32% (Figure 9). Figure 10 shows the changes in chemical content during blanching and ethanol washing of unripe papaya powder.

Characterization of pectin extracted from unripe powder

Water holding capacity: Unripe papaya powder could hold 41.91% water. Blanched and ethanol washed unripe papaya powder could hold 59.4% of water. Increase in water holding capacity of blanched papaya powder could due to the loss of sugars when washed the powder with ethanol of different concentrations.

Ethanol Insoluble solids: Ethanol insolubles include fibres, cellulose, hemicelluloses and lignins and pectin materials in food products. Ethanol insolubles in unripe papaya powder (control) was very high (0.49g/g). Alcohol insolubles of blanched unripe papaya powder increased to 0.57g/g. The increase in alcohol insoluble was due to the solubilisation of sugars and starch. Similarly, ethanol washed unripe papaya powder showed very high alcohol insoluble 0.85g/g . The results indicated that most of the soluble are sugars and starch. The insoluble compounds includes pectin and fibres. The pectin extracted from treated unripe ethanol treated papaya powder was analysed for moisture, methoxyl content, equivalent weight, galacturonic acid and degree of esterification and viscosity. The results are discussed below.

Table 7 Characterization of pectin extracted from blanched and ethanol treated unripe treated papaya powder

Parameters	Pectin extracted from un blanched slices	Pectin extracted from blanched slices	Pectin extracted from blanched and ethanol washed

Moisture (%)	3.32±0.04	3.04±0.03	3.32±0.05
Methoxyl content (%)	4.98±0.03	6.31±0.04	7.57±0.05
Equivalent weight€	1086±10.0	771.69±6.0	610±7 .0
Viscosity, mpS	9.57±0.05	17.3±0.06	30.2±0.08
DE (%)		45.0±0.11	54.84±1.0
AUA	28.0±0.07	35.99±0.08	45.9±0.11

Mean ± SD (n=3)

The data pertains to characterization of pectin extracted from blanched and ethanol treated unripe papaya powder is presented in Table 7. The moisture content in pectin extracted from unripe papaya pulp was found to be 3.32%. The equivalent weight of treated papaya pectin was found to be 6.31. The methoxyl content of papaya pectin was found be 7.57%. Since the methoxyl content is more that 7.0 %. The Unripe blanched and ethanol treated papaya pectin called high methoxyl pectin. This pectin can be used as a gelling agent in the preparation high sugar fruit jam. The degree of etherification of papaya pectin was 54.84 and AUA (45.9 %) and the viscosity of 1% pectin solution were recorded as 30.2.

CONCLUSIONS

Unripe papaya fruit is good source of pectin. The blanched dried sample with 90 % ethanol treatment yielded maximum pectin. The method is quite useful when the pulp is left after papain extraction. The Unripe blanched and ethanol treated papaya pectin called high methoxyl pectin. This pectin can be used as a gelling agent in the preparation high sugar fruit jam. The degree of etherification of papaya pectin was 54.84 and AUA (45.9 %) and the viscosity of 1% pectin solution were recorded as 30.2.

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Study on Image De-noising Methods and their Performance Comparison

Debaraj Rana*, Nimay Chandra Giri, Swarna Prabha Jena
Centurion University of Technology and Management, Odisha
Corresponding author:

Abstract

In real time image acquisition, the image sensor may be exposed to various noise resources. It needs to be restored before further processing. So image restoration is a vital step in image processing. In this paper, a study on different image restoration filters and their performances comparison through image quality matrices has been done. The study has been undergone through software simulated using MATLAB platform. The process involves the execution of image de-noising methods on a noisy image followed by the measurement for image quality matrices after getting the recovered image. The matrices like Peak Signal to Noise Ration (PSNR) is a key factor to determine which de-noising filter performance better than others and finally a comparison has been shown through a graph.

Keyword: *Image Restoration, Image Quality Metric, Peak Signal to Noise Ratio, Minimum Mean square error.*

Introduction

Digital image are represented as a two dimensional function f(x, y), and the processing of the digital image are done with the help of digital computer. Digital image processing has many application in the filed of medical science, remote sensing, pattern recognition, security, video processing etc [1]. The processing of raw image is necessary for any application, but the image acquisition is the first stage of image processing. The main challenge in image acquisition is the affect of noise during acquisition which is a vital thing and this is due to the image sensor. So the image restoration is a main part in the steps of image processing. The image is get affected by noise and the noise is random signal which is described by random variable and its probability distribution [2]. Many noises like Gaussian noise, impulse noise are affecting the quality of the image. But during the restoration, different de-nosing methods like, mean filter median filter etc are available to recover the original image from the noisy image [3]. After recovery of the image the quality can be measure by different image quality matrices like mean square error and peak signal to noise ratio [4]. In the paper the section II has focused on different noise distribution, de-noised method and different image quality matrices. Section III describes the process to perform the de-noising process and comparison of different methods and their performance. The section IV the results have been shown and discussion about the result and finally in section V the conclusion has been mentioned.

Noise Distribution and Filtering Method

Digital images get affected by noise during the image acquisition, and that should be filtered to get back the original image using image reconstruction. As the noise is a random signal, so it can be analyze through probability density function [5]. There some common probality density function which are mostly used in image processing. Some of the listed noise distributions are Gaussian noise, Rayleigh noise, Gamma noise, Exponential noise, uniform noise, Impulse or Salt & pepper noise [6].

Gaussian Noise: Gaussian Noise is a statistical noise having a probability density function equal to normal distribution, also known as Gaussian distribution [7]. The probality density function of Gaussian random variable z , is given as

$$p(z) = \frac{1}{\sqrt{2\pi}\sigma} e^{-(z-\mu)^2/2\sigma^2}$$

where z represent gray level, μ is mean of average value of z and σ is standard deviation

Impulse Noise: Generally impulse function exists at 0 with unit area under the curve. Likewise the impulse noise is called as Salt and pepper noise. This noise affects the image by adding random bright and random dark point inside the image. Where salt noise means random addition of white and pepper noise

means random addition of black pixel over the image [8, 9]. The probability density of function of impulse noise is given as

$$p(z) = \begin{cases} P_a & \text{for } z = a \\ P_b & \text{for } z = b \\ 0 & \text{otherwise} \end{cases}$$

Restoration using spatial filtering

There are different filtering methods available for restoration of noisy image, and can be classified as mean filter and order statistic filter [1].

Arithmetic mean filter: The arithmetic mean filtering process computes the average value of noisy image g(x,y) in a area defined by Sxy. The restored image can be derived from

$$\hat{f}(x, y) = \frac{1}{mn} \sum_{(s,t)\in S_{xy}} g(s, t).$$

Median filter:

Median filter is an order spastics filter, this filter operation replace the pixel value by the median of the gray level in the neighborhood of the pixel. This performs well in impulse noise.

$$\hat{f}(x, y) = \underset{(s,t)\in S_{xy}}{\text{median}} \{g(s, t)\}.$$

Similarly min filter and max filter are also kind of order spastics filter, which replace the pixel value by the minimum and maximum gray level in the neighborhood of the pixel respectively.

$$\hat{f}(x, y) = \max_{(s,t)\in S_{xy}} \{g(s, t)\}$$

$$\hat{f}(x, y) = \min_{(s,t)\in S_{xy}} \{g(s, t)\}.$$

Wiener Filter

One of the important filtering methods is Minimum mean square error filter or Wiener filer which follows inverse filtering approach [10]. This is applicable when the image is blurred by a known low pass filter, then it is possible to recovered the image by inverse filtering. It generally minimizes the overall mean square error in the process of inversing filtering and noise smoothing.

Image Quality Metrics

The quality of image can be degraded due to distortion in the process of image acquisition. The quality metrics are used to track the effect of error through the processing of image while get affected by noise. These metrics are measured after recovering the image with the original image which is taken as a reference image. Some matrices are Mean squared error (MSE), Peak signal to noise ratio (PSNR), Structural similarity index (SSIM) [4].

MSE measures the average squared difference between actual and ideal pixel values. PSNR is derived from the mean square error, and indicates the ratio of the maximum pixel intensity to the power of the distortion. The SSIM metric combines local image structure, luminance, and contrast into a single local quality score. In this metric, structures are patterns of pixel intensities, especially among neighboring pixels, after normalizing for luminance and contrast.

$$\text{MSE} = \frac{1}{n} \sum_{i=1}^{n} (Y_i - \hat{Y}_i)^2$$

n= number of data points, Yi= observed values , Y'i=predicted value

$$PSNR = 10\, log \frac{(255)^2}{MSE}$$

Implementation:

In the implementation part, an image of cameraman.jpg of dimension 256x256 was taken. Different noise distribution has been added to the image to get it affected by the noise. Then different filtering operation was done to recover the original image from the noisy image. The simulation for the study on image de-noising has done using MATLAB 8.4. The MATLAB contain inbuilt function imnoise() under image processing tool box, which uses different parameter in the argument. In the argument, the original image was taken with that any specific option taken to get the effect of different noise distribution. Mostly Gaussian, spectacle and salt & pepper noise distribution was added to the image. After that filtering operation has been done which are mostly arithmetic mean filter, median filter and wiener filter. The recovered images are undergone for some image quality metrics measurement to determine the performance of the filtering method. Matrices like MSE, PSNR and SSI were calculated and most the PSNR for each filter has been compared. A basic flow diagram has been shown in figure 1 about the process.

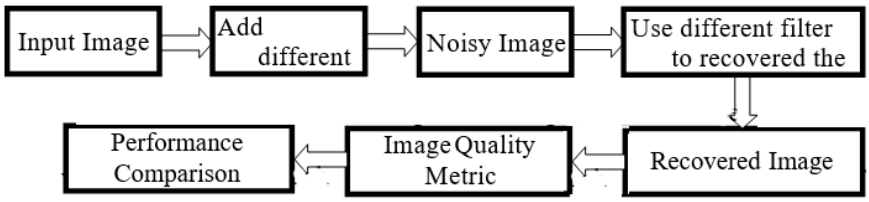


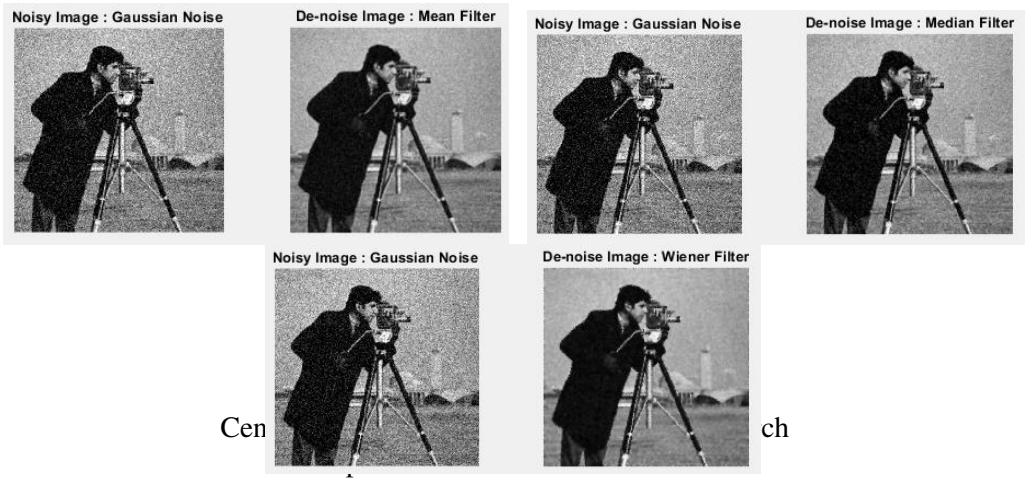
Figure 1. Flow Diagram for Image De-noising and Performance Comparison

Results and Simulation:

The cameraman.jpg image of dimension 256x256 was taken as a test image for the simulation purpose. Different noise has been added to the test image, after those different de-noising methods have been applied to recover the original image from the noisy image. During the de-noising process default parameter has been set for impartial performance.

After removing the noise from the noisy image, the quality of recovered images has been checked through different image quality matrices like mean, square error, peak signal to noise ration and structural similarity index. Finally a performance comparison has been shown through a graph.

In the experiment, some noise distribution like Gaussian, Speckle, Salt and Pepper are simulated and as a different case salt and pepper noise distribution simulated separately. From the de-noising process some order statistics filter like mean filter, median filter, max filter and min filter has taken, and lastly all result has been compared with Wiener Filter. It has been seen that the wiener filter perform better in case of Gaussian noise as compared to mean and median filter, whereas mean filter works better than median filter in case of Gaussian Noise. The result are shown in figure 2 and the Image quality matrices given in Table 1



Cen ch

Figure 2. Result of Image De-noising for Gaussian Noise

Table 1. Image Quality Metrics for Gaussian Noise

Image Affected with Gaussian Noise			
	MSE	PSNR	SSIM
Noisy Image	0.009	20.464	0.024
De-noised Image using Mean filter	0.001	28.106	0.668
Noisy Image	0.009	20.515	0.027
De-noised Image using Median filter	0.002	24.453	0.543
Noisy Image	0.009	20.495	0.276
De-noised Image using Wiener filter	0.002	28.126	0.769

In the second case for speckle error, the performance of mean filter is better as compared to median and wiener filter. The result are shown in figure 3 and the Image quality matrices are shown in Table 2

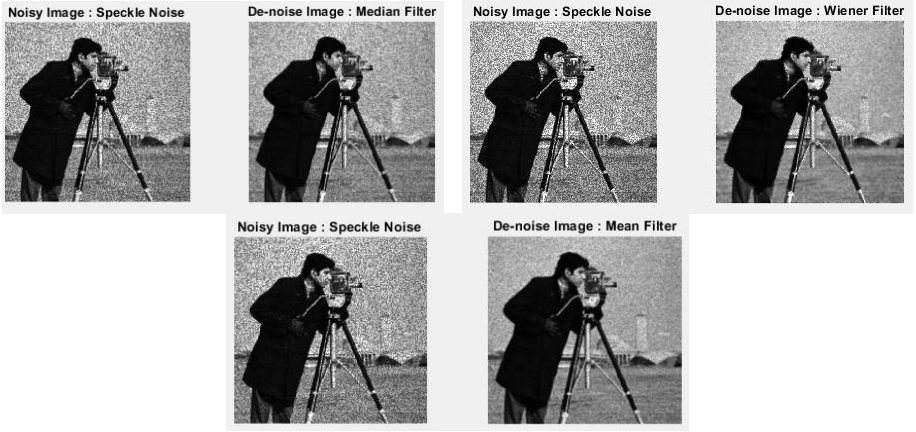


Figure 3. Result of Image De-noising for Speckle Noise

Table 2. Image Quality Metrics for Speckle Noise

Image Affected with Speckle Noise			
	MSE	PSNR	SSIM
Noisy Image	0.0129	18.9052	0.4102
De-noised Image using Mean filter	0.0019	27.2623	0.6654
Noisy Image	0.0128	18.9344	0.4106
De-noised Image using Median filter	0.0044	23.5787	0.5324
Noisy Image	0.0129	18.906	0.409
De-noised Image using Wiener filter	0.0022	26.618	0.679

In the third case for salt and pepper noise, the median filter is working fine and gave good performance as compared to mean and wiener filter. The output result shown in figure 4 and the matrices shown in table 3

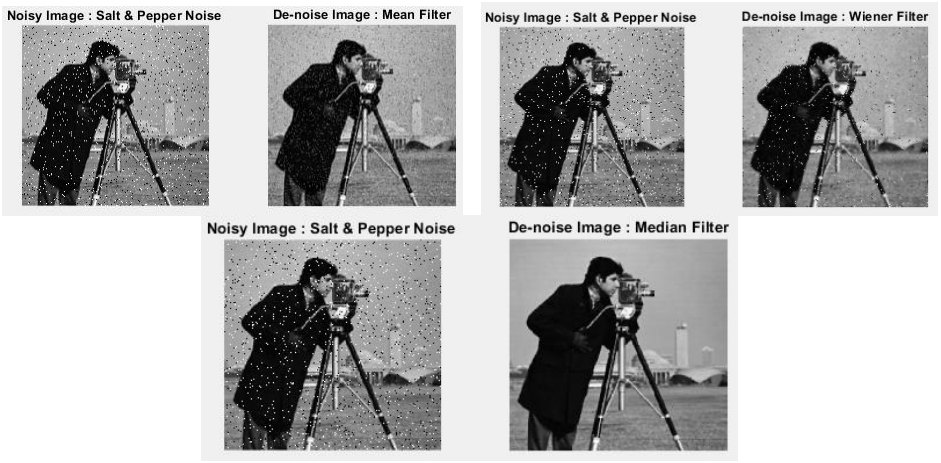


Figure 5. Result of Image De-noising for Salt and Pepper Noise

Table 3. Image Quality Metrics for Salt and Pepper Noise

Image Affected with Salt and Pepper Noise			
	MSE	PSNR	SSIM
Noisy Image	0.0159	17.9833	0.3362
De-noised Image using Mean filter	0.0024	26.2234	0.6173
Noisy Image	0.0162	17.9011	0.3269
De-noised Image using Median filter	0.0019	37.1189	0.9812
Noisy Image	0.0159	17.9841	0.333
De-noised Image using Wiener filter	0.0047	23.2435	0.5952

In a special study it has been seen that only for salt noise, the performance of min filter is better and for pepper noise, the performance of max filter is better. The result shown in figure 6 and corresponding matrices are shown in table 4

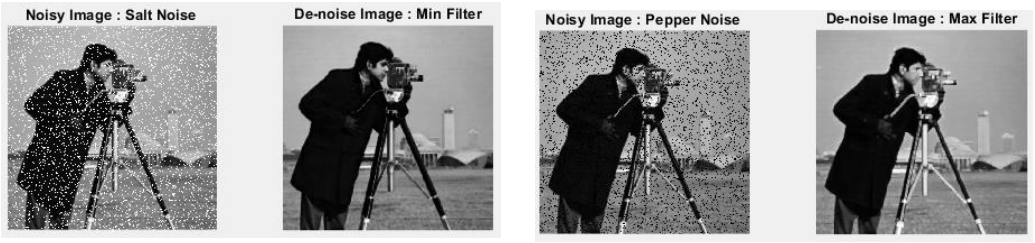


Figure 6. Result of Image De-noising for Min and Max filter

Table 4. Image Quality Metrics for Min and Max Filtering

Image Affected with Salt Noise			
	MSE	PSNR	SSIM
Noisy Image	0.0367	14.3548	0.1932
De-noised Image using Min filter	0.0051	22.9591	0.8701
Noisy Image	0.0361	14.4206	0.0193
De-noised Image using Wiener filter	0.0135	18.7115	0.05508
Image Affected with Pepper Noise			
	MSE	PSNR	SSIM
Noisy Image	0.0245	16.1036	0.3712
De-noised Image using Max filter	0.0052	26.8071	0.882
Noisy Image	0.0245	16.1017	0.3734
De-noised Image using Wiener filter	0.0084	20.7765	0.5574

The quality matric PSNR for all the three filter in different noise distribution has been compared. The figure 7 reveals that Wiener filter perform better in case of Gaussian filter, Mean filter perform better in case of Speckle Noise and the median filter perform better in case of salt & pepper noise.

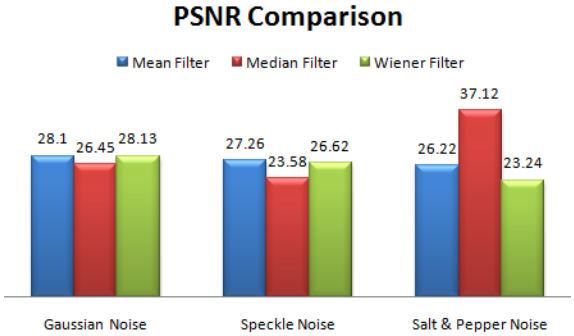


Figure 7. Performance Comparison of different filtering method based on PSNR

CONCLUSION

In this paper, a study has been developed on the performance comparison of different de-nosing filter to recover the images which are affected by different noise like Gaussian, Speckle, salt and pepper noise. Mostly order statistics filter has been focused here. The performance has been compared based on the image quality metrics which are determined after recovering the image from the noisy image. The matrices like MSE, PSNR and SSM are compared for image affected by different noise distribution. It has been observed that arithmetic mean filter perform well in case of speckle noise where as median filter perform well in case of salt and pepper noise. But when the image is affected by Gaussian noise then the wiener filter perform well as compared to other filters. Finally the PSNR of each filter for each category of noise affect has been compared. In the future work the PSNR level can be improved by mixing any two filters to develop a hybrid filter.

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A review on morphology of spot billed pelican

Sasmita Das and Debashish Tripathy*
Department of Zoology, School of Applied Science, Centurion University of Technology and Management, Odisha
*Corresponding author: debashish.tripathy@cutm.ac.in

Abstract:
The Spot billed Pelican (*pelecanus philippensis*) , which is a threatened Bird . There are 8 species of Pelicans in the world. The Spot billed pelicans are found in South and Southeast Asia over an area between 1,29,000 km^2 and 1,81,000^2 i.e in India , Sri Lanka , Cambodia and Coastal areas of Sumatra . These birds are distributed in Southern and Northeastern India of states like Andhra pradesh, TamilNadu, Karnataka , Assam. The Review on this Species provide perception into different factors that can be weighted and combined while making a decision .

Key words : Spot billed pelican, threatened, perception

INTRODUCTION:

Spot Billed pelican (*pelecanus philippensis*) is otherwise known as Grey pelican or Spotted pelican or Philippine pelican .These Birds come under Threatened species.In many areas, the number of these species are redced due to loss of habitat .

SYSTEMATIC POSITION:

Kingdom- Animalia
Phylum - Chordata
Class - Aves
Order – Pelecaniformes
Family – Pelecanidae
Genus – *Pelecanus*
Species – *philippensis*

MORPHOLOGY :

The Spot Billed Pelican is comparatively smaller than other Pelican species .It is about 125-152cm(49-60inches) long and a weight of 4 to 6kg(9.0 to 13.6 lb).Its colour is distinct.Skin of face is whiten. It has a grey Crest , hindneck and a brownish tail . Curly feathers are found in its hindneck. Its pouch is pink and has large pale spots . It is spotted on the sides of upper mandible. Yellow or orange colour Bill tip is found .Spot billed pelican possess a round tail .They lack bright colours. The plumages are distinctive with grey colour.

The Spot on the bill appears after one year of the hatching .In 3rd year of the hatching the full adult breeding plumage appears . Both the sexes become browner on head , back and the whiten face change to greyish colour after breeding .

HABITAT:

The Spot billed pelican found in water bodies like lagoons , rivers , estuaries, reservoirs, tanks. As per nesting habitat , the bird is likely to live on large trees . This bird is not a migratory bird but it has some local movements.

BREEDING :

The Spot billed pelican is also a colonial breeder that means it breeds in groups .The breeding season of Spot billed pelican is in October/November or January/ February. In summer season , it moves away from nesting grounds . Its eggs take 30-33 days to hatch .Eggs are chalky white in colour.

FEEDING:

The Spot billed pelican mostly feeds on fish .Except fish it also eats prawn , tadpoles, frogs , lobsters. It is an opportunistic feeder.

BEHAVIOUR:

The Spot billed pelican is a silent bird and it rarely calls to its partner . It makes hisses , grunts or snaps its bill. The colonies of these birds are noisy .

The other behaviours are :

1.Stretching :

Stretching occurs when the bird have been resting for a long period .This bird stretches its legs , wings and body .

Stretching is performed in two ways . First one is, one wing and leg on the same side are extended downward, with the feathers spread on the extended wing and the tail. This type of stretching is called wing and leg stretching.

The second one is that the bird raises to a certain extent its wings and extends its neck horizontally. This type of stretching is called Body stretching.

2.Bill Gaping:

Bill gaping involves that the bird opens its mouth widely and extends its pouch like yawning .This type of behaviour is seen after Stretching .

3.Scratching:

For the scratching of its body the bird shifts its weight onto one leg and scratches the body surface by another leg. By this scratching process the bird scratches its body parts like leg , neck, head , pouch.

4.Preening :

The preening process involves the contact between the bill and the feathers . The bird uses its bill to straighten the feathers on its breast, neck, tail, legs or wings .While arranging the feathers, the dirt and ectoparasites are also removed from the body by its bill.This types of behaviour occurs when the bird is sitting ,standing , swimming .

5. Pouch shaking and spreading:

This process is done after preening that bird flutters its pouch and feeds the youngs after foraging . After fluttering the bird spreads and retracts its pouch for a while .

6.Body fluffing:

This occurs when the feathers on the neck, wings, back become erected. After some time the feathers smoothed down .

7.Dust bathing:

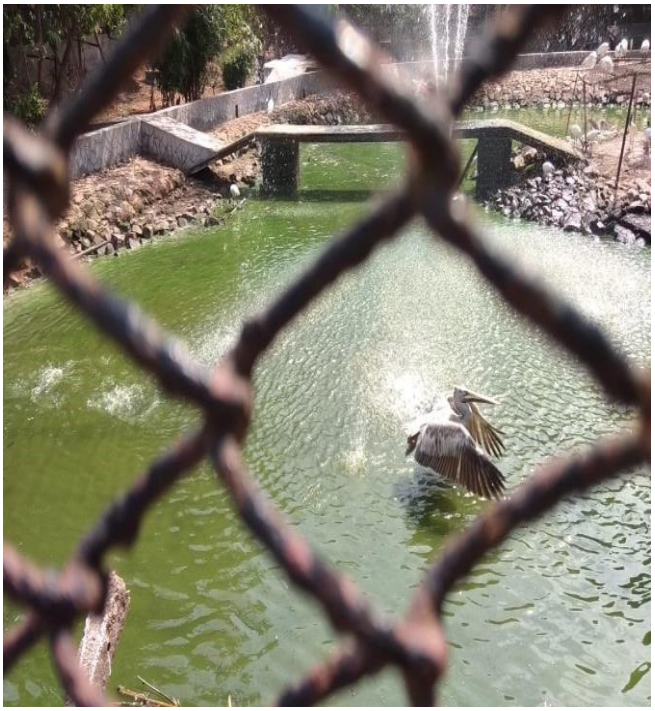
The Spot billed pelican lies flat on the ground and rubs its belly, head, neck, wings . To keep plumage clean , the Dust bathing is helpful

8.Sun bathing:

The bird spreads its wings in sunlight and stands for a while .

LOCOMOTION :

Locomotion of Spot billed pelican involves in 4 ways i.e walking, Running, Flying , swimming .



DISCUSSION

The Research on Spot billed pelican is a very long process .It needs immediate and specific attention, gathering of vital information for Practical conservation .This review is a description of morphology and behaviours of Spot billed pelican which I have observed . Though it is a threatened species , conservation for these species is needed. The Spot billed pelican is listed under schedule lV of the Wildlife(protection)Act , 1972 .We should provide better protection for their habitat so that they can breed properly and so that their number will be increased.

CONCLUSION

The Spot billed pelican has so many economic importance for human beings. It has no adverse effects . The droppings of these bird are used as Fertilisers . It is necessary to step forward for the improvement,proper management and conservation for the Spot billed pelican.

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Bird Families of the world Pelicans, Cormorants, and their Relatives *The Pelecaniformes* , J, Bryan Nelson , illustrated by John Busby, Andrew Mackay, and Bas Teunis

CFD analysis of concept design 500kg drone with ducts using 3D experience

MUKUNDJEE PANDEY[1*] SNIGDHA NAYAK[2], RITESH KUMAR SETH[2] ,RIDDHI BARIK[2]
[1]Mechanical Engineering Department, Centurian University of Technology and Management, Odisha, India
[2]MSc. In MATHEMATICS, Centurian university of Technology and Management, Odisha, India
*For correspondence:mukundjee.pandey@cutm.ac.in

Abstract
An unmanned aerial vehicle(UAV) or unscrewed aerial vehicle commonly knownas a drone.DRONE denoted as Dynamic Remotely Operated Navigation Equipment.Drone is an aircraft that is not operated by a pilot on board.Drone includes a UAV , aground-based controller and a system of communications between the two.Drone use rotors for propulsion and control. The simulation shows a very stable operation and control of the developed Drone.For this purpose, we importing the model in 3D experience software and giving the velocity from 80km/hr to 500km/hr in each interval of 10km/hr through CFD analysis using 3D experience.

Key points

UAV, Analysis of Drone,LBM,CFD, Lift force, Drag force

INTRODUCTION

Computational fluid dynamics (CFD) based on the Lattice – Boltzmann Method (LBM) has the potentiality to make it possible for all people to understand this application of CFD, allowing more engineers of varying skills and experience to start applying CFD even to complicated aircraft designs in dynamic flight [1].

Nowadays unmanned aerial vehicles (uavs) are plays an important part in both military and space.Advantages of substitute for vehicles are they protecting human life from multiple dangerous environments[2].

Currently unmanned flying vehicle market represented by military applications,and this industrial sector is growing strongly. It is becoming common vehicles that can be used in many places with many designs and features & it is developing technology[3].

Drone is an aircraft that is not operated by a pilot on board,it is also known as remotely operated aircraft[4].

After first flight of wright Brothers' , aerial vechlies have been improved speedily,because aerial vehicles are difficult to design,due to low efficiency & high cost[5].

The unmanned aerial vehicles(UAVS) also known as drones are also use for agriculture for critical problem faced by agriculture in terms of acces to actionable real-time quality data[6].

For both commercial & military uav exports,motivate the export of uav services by allowing recipients to receive the benefits of category[7].

A large-scale aircraft design process is iterative and follows a certain methodology.It requires highly creative thinking and compromise between the variousdesign parameters and eventually optimization[8].

The capacity of drone to fly at elevation is indirectly related to maximum range requiremt since earth curvature influences LOS(line of sight) distance[9].

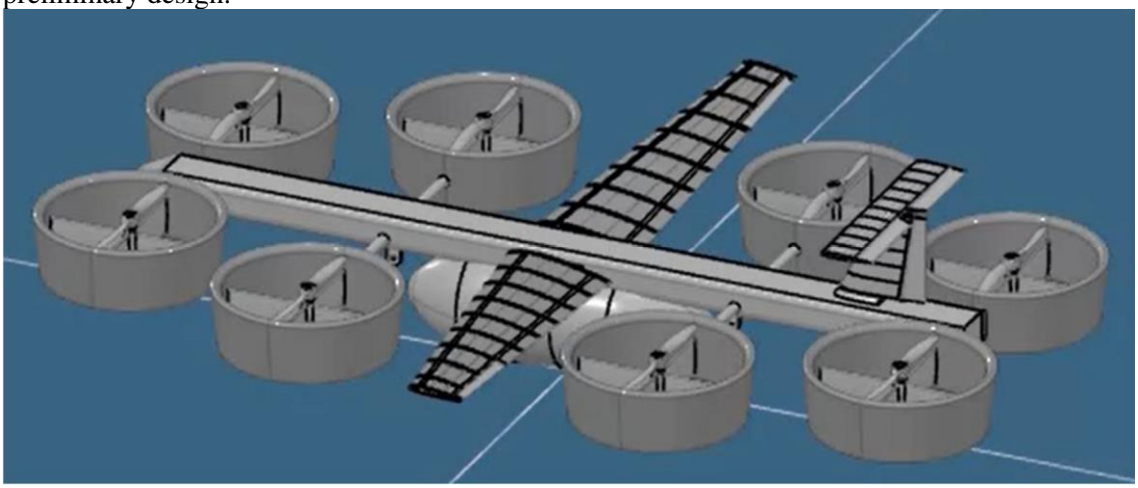
Eren Turanoguz has studied aircraft design is an engineering technique that is considering balance betweendefined specifications,aspects and requirments.Aerodynamics structures,weight , production, cost, stability, control are the main requirement in aircraft design process [10].

Wang et al. have studied the method of numerical simulation of fluid dynamic to calculate numerically the 3D flow field around the uav & propeller engine[11].

Der-Mingma et al. have studied fuel burn reduction is an important part in aircraft design.To use an unusual aircraft configuration such as flying wing,is a possible ways to reduce fuel burn[12].
Prashant et al. have studied aircraft technologies include a large improvement in Lift-to-Drag ratio of a wing[13].
To search and rescue missons,security and surveillance,real-time monitoring of road traffic,delivery of goods uavs are used[14][15].

DESINING OF 500KG DRONE

The 500kg drone design process is a advancing process which can be described drone sizing, analysis and preliminary design.



- This is the model of 500kg drone.The model has been designed with many parts like rudder, elevator, stabilizer, fin, ailerons, wings and duct fan.
- Rudder – The rudder used to controls rotation about the vertical axis of a drone.
- Stabilizer – Stabilizer use for keep it flying straight.
- Elevator – An elevator used for controls movement about the lateral axis of a drone.
- Fin – Fin used for provide directional stability.
- Ailerons – Ailerons use for causing lift to increase or decrease.
- Wings – Wings used to hold the plane in the air.
- Duct fan – The duct reduces losses in propel from the tips of the propeller blades.

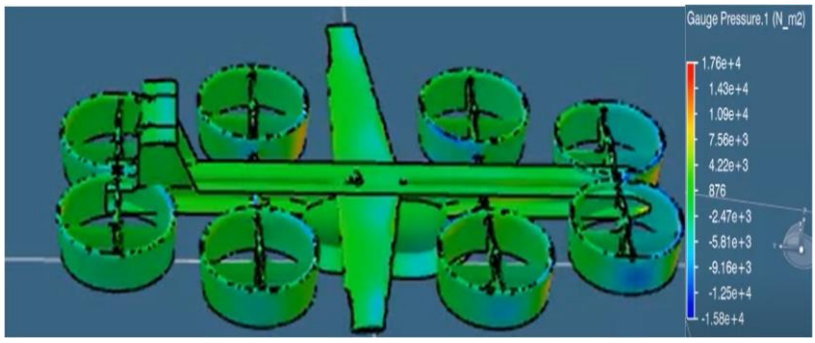
PROCEDURE

First we imported the model in 3D EXPERINCE software.After imported the model we go to compass and select fluid scenario creation app.After select fluid scenario creation app there is an assistant panel.From this assistant panel, first we select model section.From model section we select fluid domain commands.In fluid domain commands we select parts, exterior boundaries(we create bounding box half of model of UAV to the y-axis because of less simulation time),Regions, Surface selections. Also select fluid section commands (Air as the material).Next, we move to physics section. In physics section we select the physics behavior and steady state step.In physics behavior, we select enable temperature effects and Realizable k-s as turbulence model and in steady state step we take maximum iteration as 500.Next we move to boundaries. In boundaries we give the boundary conditions like velocity inlet(front face of bounding box) and pressure

outlet(opposite face of bounding box).Then we select the output requests section. In output request, we select 3 output inlet,outlet and surface selecton of the drone model for the purpose of calculating both lift and drag force over a drone.After that we select the mesh section. In mesh section, we take the hex -dominant mesh for meshing.Then we simulate it.

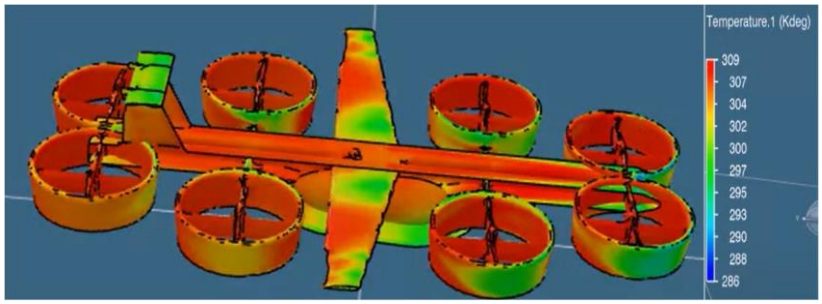
RESULTS AND DISCUSSION

After simulation we got the different plots and results and we plot the gauge pressure, temperatute and velocity distribution around the drone. Similarly we do 43 simulations by taking velocity from 80km/hr to 500km/hr with an interval of 10km/hr with the same process and compare the results.



(GAUGE PRESSURE PLOT)

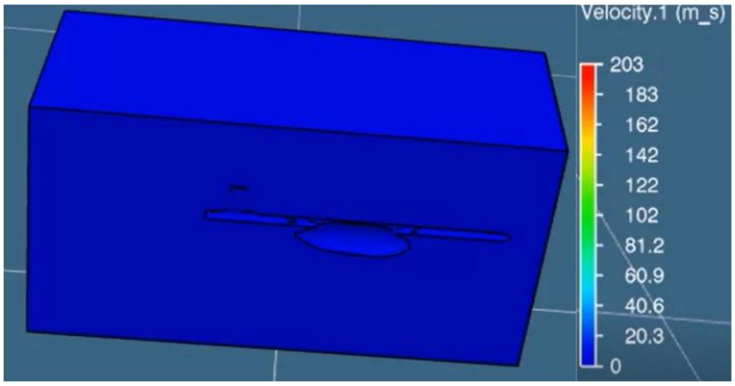
- In gauge pressure plot different colours shows that different range are ploted for gauge pressure.
- Red colour shows that the maximum range of gauge pressure that is 1.76e + 4 N_m2.
- Blue colour shows that the minimum range of gauge pressure that is -1.58e + 4 N_m2.
- Remaining part shows the moderate gauge pressure.



(TEMPERATURE PLOT)

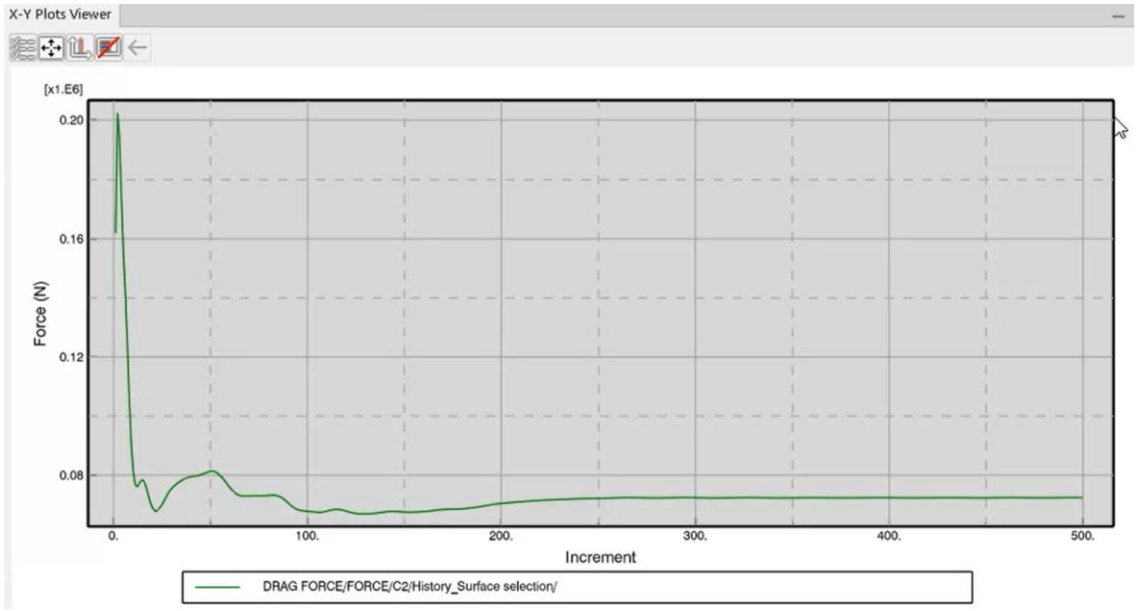
- Similarly in temperature plot different colours shows that different range are plotted for temperature.

- Red colour shows that the maximum range of temperature that is 309Kdeg and blue colour shows that the minimum range of temperature that is 286Kdeg.
- Remaining part shows the moderate temperature.

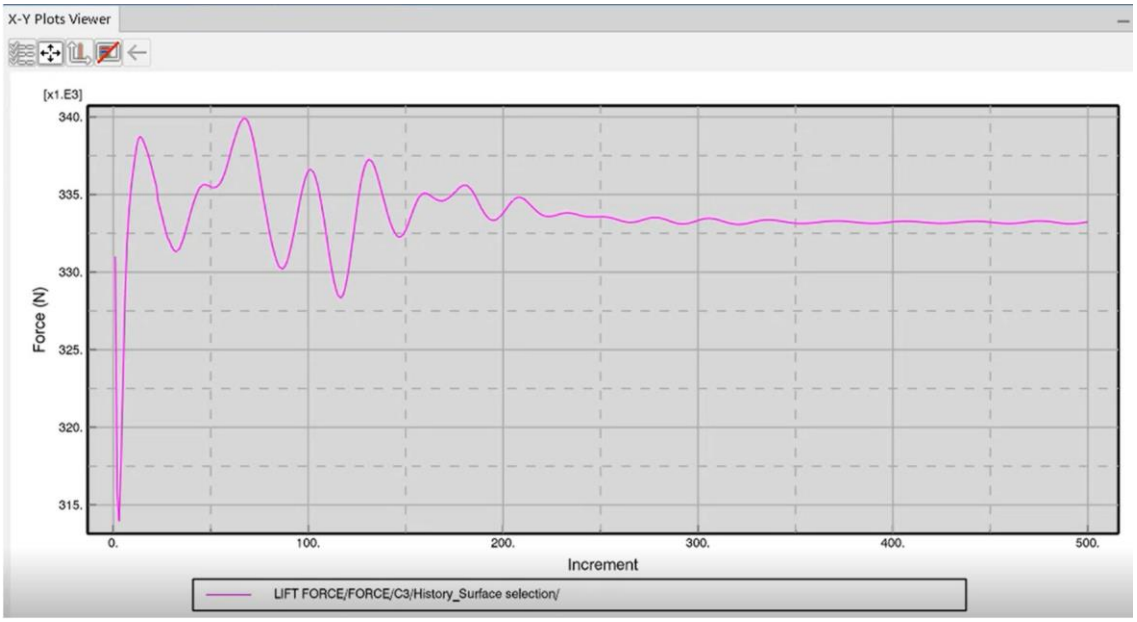


(VELOCITY PLOT)

- Here also in velocity plot different colours shows that different range are plotted for velocity.
- The value of velocity ranging from 0 m/s to 203 m/s.
- The remaining part shows the moderate velocity.

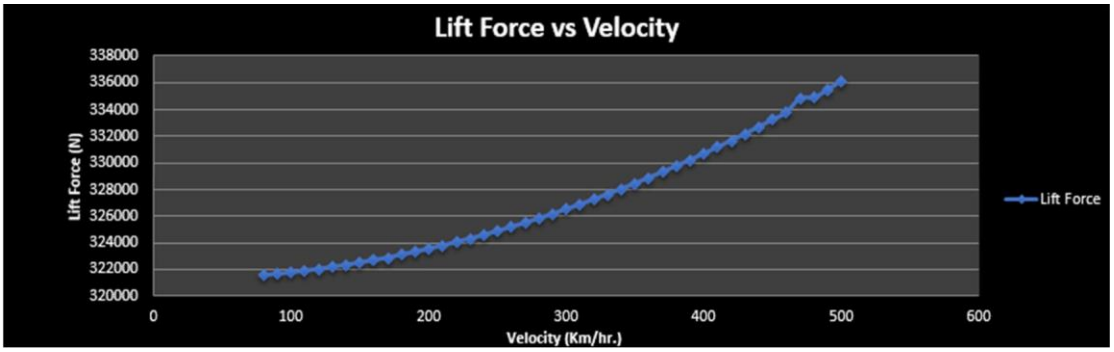


- This is the x-y plot of drag force.In x-y plot we take quantity as vector component-2 according to the axis of the model.



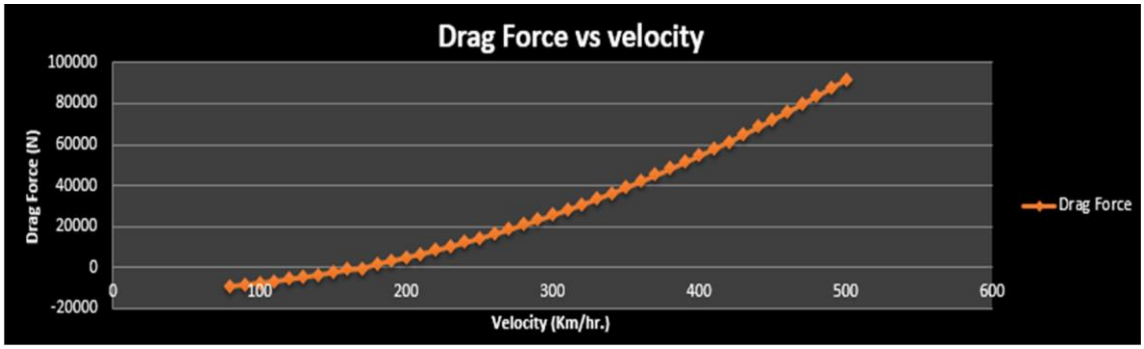
- This is the x-y plot of lift force.In x-y plot we take quantity as vector component-3 according to the axis of the model.

GRAPHICAL PLOTS -



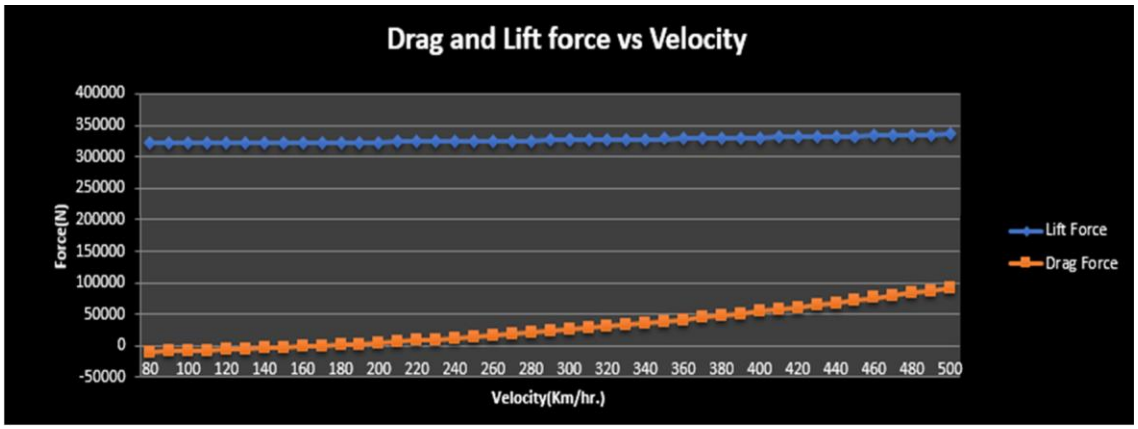
(LIFT FORCE VS VELOCITY)

- This is the graph of lift force vs velocity (80km/hr to 500km/hr).
- In this graph we gave x-axis for velocity and y-axis for lift force.
- Then we concluded that with the increase of the velocity lift force also increases.



(DRAG FORCE VS VELOCITY)

- This is the graph of drag force vs velocity (80km/hr to 500km/hr).
- In this graph we gave x-axis for velocity and y-axis for drag force.
- It shows that with the increase of the velocity drag force also increases.



(DRAG AND LIFT FORCE VS VELOCITY)

- This is the graph of drag and lift force vs velocity.
- The blue colour indicates the graph of lift force and the orange colour indicates the graph of drag force.
- Here we gave x-axis for velocity and y-axis for forces.
- It shows that with the continuous increase of velocity drag force and lift force also increases.

CONCLUSION

This article reports an aerodynamics performance of UAV. Computational fluid dynamics model were applied to external aerodynamics in order to find out a flow field around an aerial vehicle.We achive desired result in terms of maximum efficiency and better L/D ratio by modified the important parameters. It is concluded that with the increase of the velocity gauge pressure, temperature, lift force and drag force increases.

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Analysing the drone of weight 10 kgusing 3D experience

Mukundjee pandey[1*] Suparna priyadarshinee dash[2,] lopamudra mahanta[2,]guptesh mohanta[2]

[1]Mechanical Engineering Department, Centurion University of Technology and Management, Odisha, India
[2]MSc. MATHEMATICS, Centurion University of Technology and Management, Odisha, India

[*]Corresponding author:mukundjee.pandey@cutm.ac.in

Abstract

Over the past few years, unmanned aerial vehicles (UAVs) or drones have been a most important and beneficial application of this cutting-edge technology. The Drone is nothing but a type of airplane which can operate without the physical presence of a human being in it. It can work with the remote sensing technology and basically, they are the best aids for reaching the places where we can't reach easily and it is used for the security issues, laws & regulations worldwide owing to impressive advances and use in bio remote sensing and photo grammatical surveying. In this research paper, we will draw a clear understanding of analysing the drone using CFD techniques along with it we will use the 3DEXPERINCE SOFTWARE for performing our simulation tasks and for a detailed study of the drag and lift force changes when subjected to certain velocity and temperature at different steps.

Key points

Analysis of Drone, Velocity distribution, Efficiency and correctness of the drone,Drag force vs lift force.

Introduction

Nowadays technologies are being upgraded on a daily basis. One of the most advanced technologies is the Unmanned aerial vehicle. This unmanned aerial vehicle is using in various fields such as military purpose, home delivery, monitoring, etc. Both developed and developing countries using this technology. Further, in upcoming days we can see many upgraded versions of these technologies with better function & performance.

Drone is a part of an aircraft system while other aircraft can be operated by a human being but Drone can be operating without human so this is called UAV (Unmanned aerial vehicle). This UAV controlled by remote or autopilot. In 1916, a semi-automatic airplane was designed. In the armed forces, it plays an important role. [1]

Aircraft system that will have better efficiency includes a major improvement in the Lift-to-Drag ratio of a wing coupled to transformative improvement in composite structure and engines, such as Blended Wing Body aircraft configuration. The principle of drones is controlling the upwards and downward force with the help of spinning blades in lift force. [2]

Drone consists of battery or fuel, propeller, rotors, and a frame to achieve its flight. Drones are extensively used in American Vietnam War because most of the American pilots were killed by Vietnamese force so using drones is more efficient than manned aerial vehicles. For National Security UAV is used in surveillance and rescue operations in the air force. [3]

Nowadays the advance of technology makes today's drones more powerful. UAV Networks vary in their mobility, processing power, localization, power consumption, and communication protocols from the conventional wireless network. [4]

For a well-organized aircraft designing a good knowledge of aerodynamic forces is required.

Additive manufacturing method first brought in 1980, which is categorized into several processes called SLS (Selective laser Sintering). With the help of SLS, a computer aided design is required, which is created in CAD software. With the help of the SLS machine, the Vehicle body is designed. [5]

In various field UAV technology are used like delivery, observation, guarding the border, etc.

UAV helps in monitoring irrigation in agricultural land and capturing aerial imaging and gave intensively detailed data in place. [6]

Hang Zhu et al. have studied the performance characterization of UAV chemical application based on CFD simulation for theoretical support to improve the spray quality of UAV and reduce the drift of droplets. UAV pesticide application technology is an unavoidable direction for green farming. [7]For live concerts, sports, games resilient camera of drone gives better placing with a wide view. [8]

We can't ignore the advantages of the drone in various fields as it plays an important role in maintaining shape environment. UAV is an easily controllable cost-saving technology as it is used for a quick inspection, through it, we can reach the hazardous areaK Sreelakshmi et al. has studied the aerodynamics behaviour of a baseline design and analysis of a UAV. [9]
M. Atmaca et al. has analysed the models of an unmanned aerial vehicle and propellers of an UAV designing with computationalfluid dynamics. Especially turbulence, pressure, and speed changes have been investigated.[10]

R. Suresh et al.did experiment on the development of the amphibious drone andmeasured their efficiency in both air and water after experimentation it may be used for coastal rescue, surveillance, oceanographic research etc. [11]

Christian Rodriguez et al.did CFD Analysis on the Main-Rotor Blade of a Scale Helicopter Model using Overset Meshing. [12]

P. Jagadeeshwaran et al.dealt with the numerical estimation of maximum specification of Tilt-Hexacopter, which indented for critical applications. [13]

Khuntia SK et al.the complete methodology applied to optimally design the wing of a small scale Unmanned Aerial Vehicle with help of widely used CFD software, ANSYS to maximize its efficiency.[14]

Vasile PRISACARIU et al. has studied a case of numerical analysis of the lifting surface on the UAV type flying wing. [15]

Procedure

The are many ways as along with the different software applications are there for performing the simulation for obtaining the desired results, but we have selected 3-D experience software according to our compatibility. In the 3DExperience software, the analysis has been carried out using the fluid scenario creation. It comes with all the properties and the necessary options which makes it easier for us to take out the results and find the efficiency of selected models.

The first step in the analysis operation is the importing of the model into the CATIA part design application. Then we have checked into the Fluid scenario window from the 3D Compass which can be seen on the left side of the top corner of the software. There using V+R button we can search for the fluid scenario creation application. It will result in the opening of the new interface namely Simulia fluid scenario Creation, this name will appear just after the 3DEXPERIENCE name on the screen. This indicates that we have successfully switched to the scenario wind and everything set for beginning our work.

After switching to fluid scenario creation assistant will appear. Then we have clicked on the model optionto assign a finite element Model. From the command section of Model, fluid domain has been selected where the complete model is selected as part and just after thisan exterior bounding box is a given as it is an external flow. One wetted surface of drone is taken as region where as all faces are selected as surface selection. In fluid section air is picked from material palette with default material properties. Just after assigning the fluid section the model option on the assistant will turn green, it shows that all the things are properly assigned to the model in terms of the fluid domain along with fluid section.

Now the Realizable k-ε turbulence model is selected with enabled temperature effects and maximum number of iterationsgiven in steady state step. Just after assigning physical properties the boundary conditions are assigned in whichthe Velocity inlet, Pressure outlet, symmetry and wall boundary conditions are taken. As Output request help in controlling the volume of output in a simulation, Force-total fluid force is chosen and then we have switched to meshcreation window.

Mesh generation is a subdivision of a continuous geometric space into discrete geometric and topological cells. A local mesh size on sub domain box and on geometry is given. A hex dominant mesh is generated followed by simulation is run.

Results and Discussion

The Simulation of the drone of weight 10Kg has been carried out in the 3DExperience using 15 number of cases with the value of velocities varying from 80km/hr to 220km/hr with a value gap of 10m/s between two subsequent values are provided and the temperature values are kept constant i.e. 300kDeg. In this paper the snapshots of values at 80km/hr ~22.22m/s i.e.Velocity, Velocity vector, gauge pressure and temperature distribution values have been provided In Fig 1,2,3 & 4 respectively.

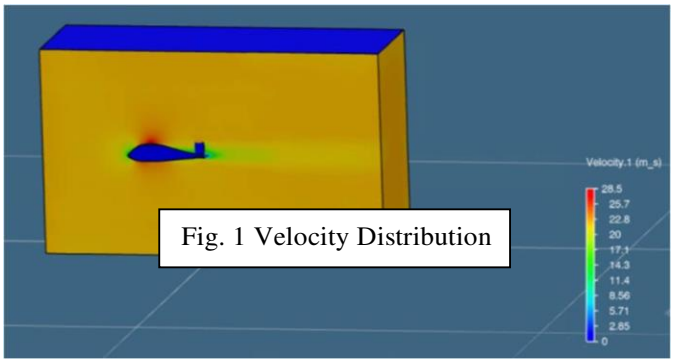


Fig. 1 Fig. 1 Velocity Distribution shows the velocity

distribution across the Drone whose values are ranging from 0 m/s to 28.5 m/s. The Intensity of velocity is highest at the top and bottom side of the drone and the remaining part of the drone has been hit with a moderate velocity.

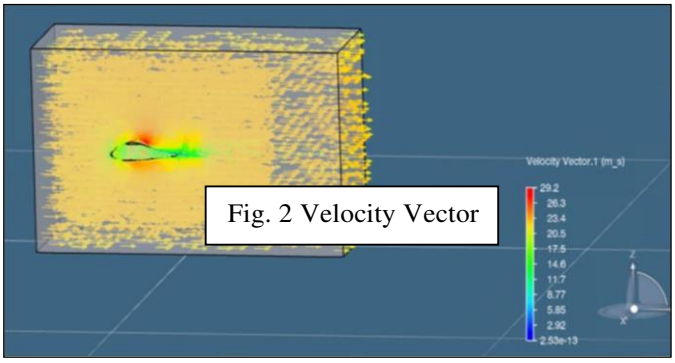


Fig. 2 Velocity Vector

The above shown Fig. 2 shows the directional velocity in the bounding box, here we can clearly see the movement of air particles in a closed environment. The denser portion is found near to the drone area.

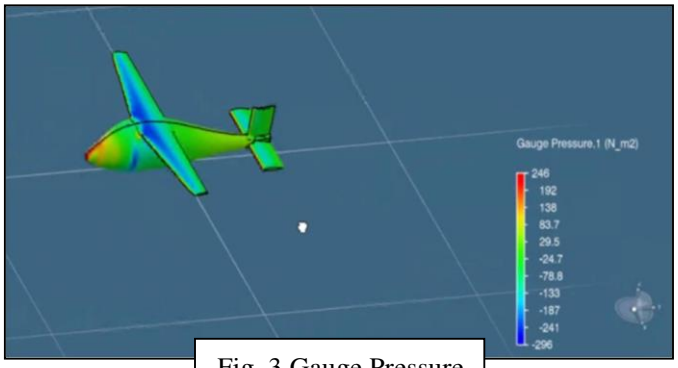


Fig. 3 Gauge Pressure

Fig. 3 shows the Gauge pressure distribution on the model. It is recorded that the pressure is highest at the tip of the airplane and moderate on the remaining body.

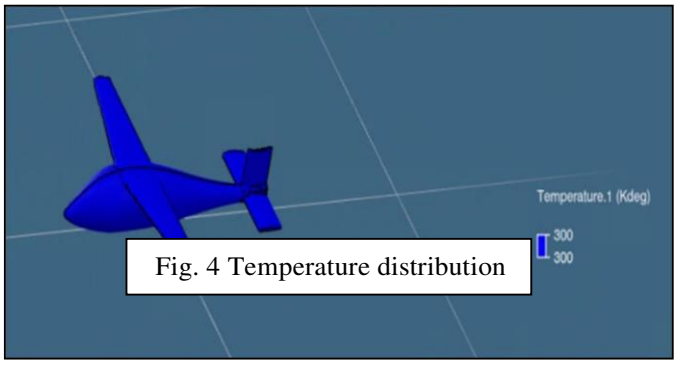
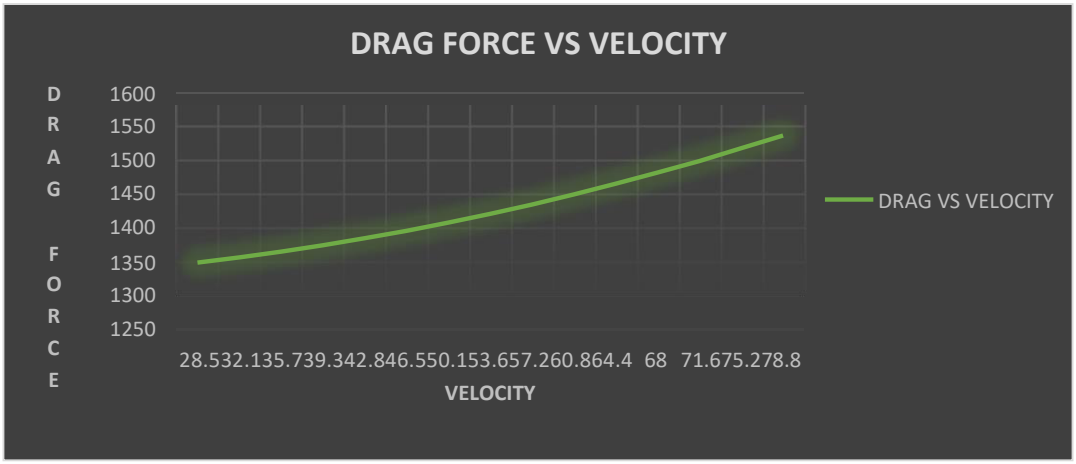


Fig. 4 Temperature distribution

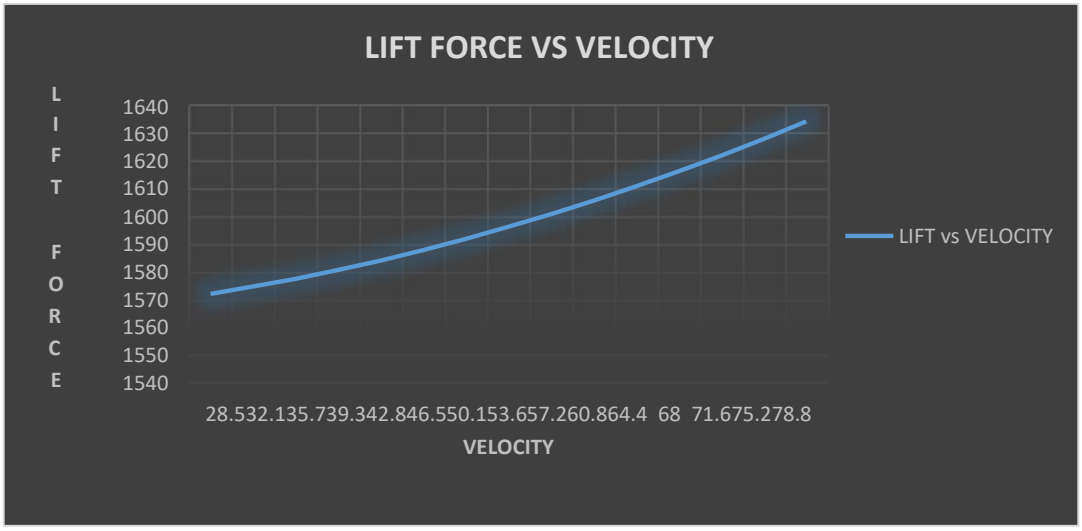
Fig. 4 on top of this line shows the distribution of

temperature on the whole body, for this case it is noted that the value and impact of temperature remains uniform across the whole body. The highest and lowest value is same 300kDeg.

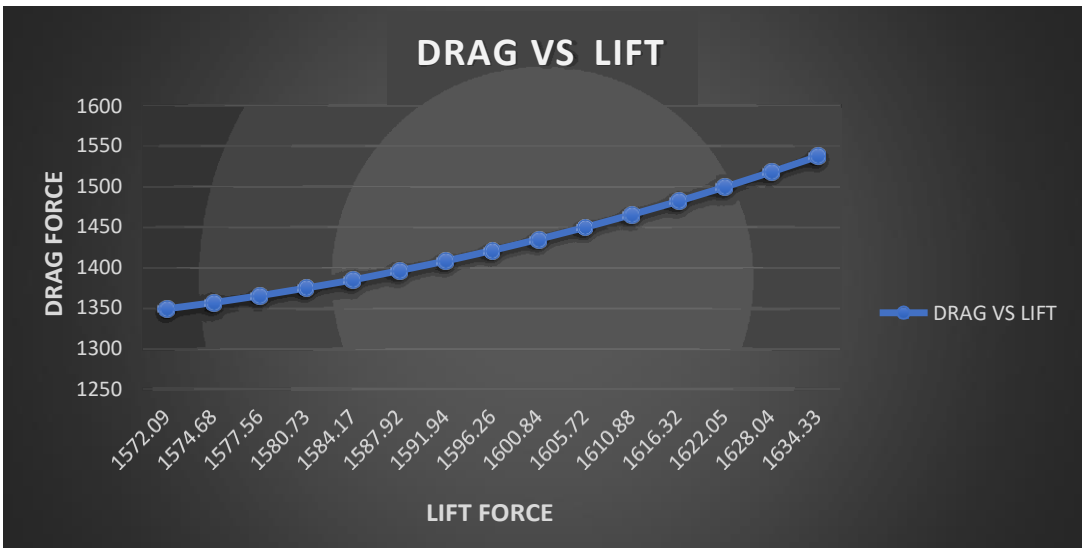
GRAPHICAL PLOTS



As we can see in the graph above with the rise of velocity, drag force is also increasing. The drag force is indicated by a green line which is gradually increasing in contrast with the velocity.



The graph just above this line shows the graphical representation of Lift force and velocity. As concluded in drag force case, the lift force is also increasing with respect to the increment in the velocity row.



The above graph signifies the comparison between the values of drag force values placed in the Y-axis to the lift force values placed in X-axis.

Conclusion

In this study, CFD simulation method is followed to analyse the aerodynamic behaviour and performance of an unmanned aerial vehicles. Different contour plots are analysed to find out the physical distributions around the 10kg Drone. Lift is created by deflecting a flow of air and drag is generated on the body in various ways. Lift directly opposes the weight of the drone to keep it aloft. As the drone moves faster, lift increases until its force is equal to weight. When equilibrium between weight and lift is established, the drone is pushed upward. While lift is produced by every part of the drone, the wings create most of the lift used by the Drone.

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CFD analysis of a UAV plane

Mukundjee Pandey[1*] and Jagadish Dash[2]
[1]Mechanical Engineering Department, Centurion University of Technology and Management, Odisha, India
[2]Bachelor of Technology, Mechanical Engineering, Centurion University of Technology and Management, Odisha, India
[*]For Correspondence: mukundjee.pandey@cutm.ac.in

ABSTRACT:
Unmanned aerial vehicles (UAVs) are playing major roles in various application of this cutting-edge technology. UAVs can be operated without the physical presence of a human being. In this article, 3D Experience, Simulia software is used to analyze the UAV using CFD techniques. The 3D model was designed in CATIA and CFD analysis was conducted with the help of Simulia software. Investigation is displayed in steady state 3D computational fluid elements (CFD) at variation of velocity from 80km/hr. to 500km/hr.

Keywords: UAV, CFD analysis, drone, plane

INTRODUCTION:

Yakinthos et al. presented different phases of aerodynamic design for the aerodynamic design of fixed-wing UAVs. The CFD simulation was done using BETA CAE software coupled with the CFX flow solver to find out the stability of UAV[1]. *Ebubekir* et al. investigated UAV design, analysis and production incorporating SLS and CFD analysis[2]. *Pastor* et al. studied a hardware/software architecture designed to operate as a flexible payload and mission controller in a mini/micro UAV[3]. Mairaj et al. described the current challenges and issues in research for drone simulators[4]. Atmaca et al. presented UAV model and its cfd analysis was conducted[5]. Carvalho presented low subsonic aerodynamic theories, through CFD analysis,in order to optimize the main wing of a MALE UAV[6]. Naresh et al. described lift and drag coefficients with different match number, velocity and pressure with help of ***ANSYS ICEM CFD analysis***[7]**.** Suresh et al. represented drone which was capable to travel in both air and water[8]. Manikantissar et al. presented CFD analysis of delta wing UAVs with help of ANSYS CFX software[9]. Khuntia et al. described advantages of CFD analysis to analyse strength and stiffness of UAV wing. CFD was done with help of ANSYS software [10]. Sreelakshmi et al. investigated CFD analysis at different match numbers to calculate drag, lift coefficients of UAVs [11]. Kumar et al. studied NACA 651-212 model in wind tunnel and its simulation was performed in Ansys Fluent. Both the simulation and experimental results were compared [12].

PROCEDURE:

First of all importing the cad file of UAV plane into 3d experience platform. Then open the fluid scenario creation app,then click on the model from assistant and create the final element model. From the assistant panel select model and select fluid domain in the command section. In the fluid domain editor select the part from the specification tree; choose the wetted surface of the drone as region. Create an exterior bounding box, as the plane is symmetry to the y-axis so that half of the model of UAV inside the box because of less simulation time. Then assign the fluid section from the material pellet take air as the fluid material. Then give the physics properties as steady state conditions and assign the turbulence model as SST-k omega. For CFD analysis we have to give boundary conditions for this as velocity inlet and pressure outlet and symmetry. A finite volume and density mesh is generated using unstructured Hexa- dominant cell in the area closely surrounding the UAV, to allow for the complexities of the geometry with local specification subdomain box and surface selection mesh size assigned. The number of nodes and elements will be display. Then put the output request as we want drag and lift force for this model. Then simulate it. The simulation time will be taken as per the size of nodes and elements.

RESULTS AND DISCUSSION:

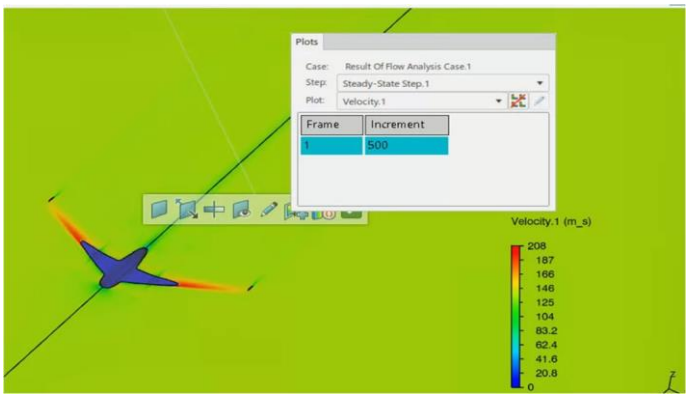

Fig1: Velocity distribution around the plane

The velocity distribution can be seen around the plane n fig1. It can be seen from the fig1, the velocity maximum with the value 208m/s at the wing of the plane and minimum towards the body of the plane.

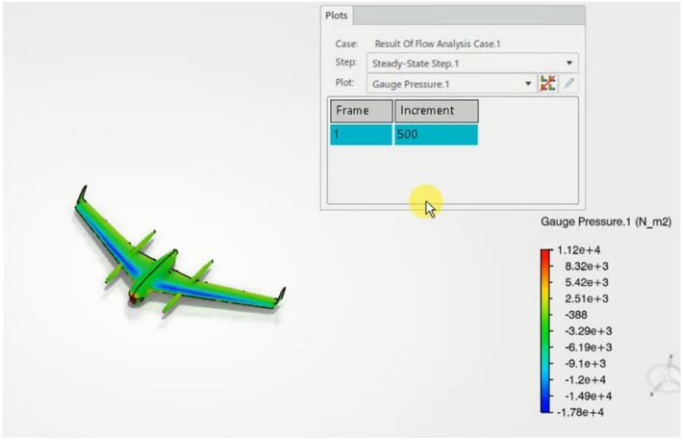

Fig2: Pressure distribution around the plane

Fig.2 shows the pressure distribution around UAV plane. It can be clearly seen that the pressure distribution is maximum with a value of 5240 Pa around the radio transmitter/receiver of the plane i.e. head of the plane and is lowest around the some surfaces of the wing.

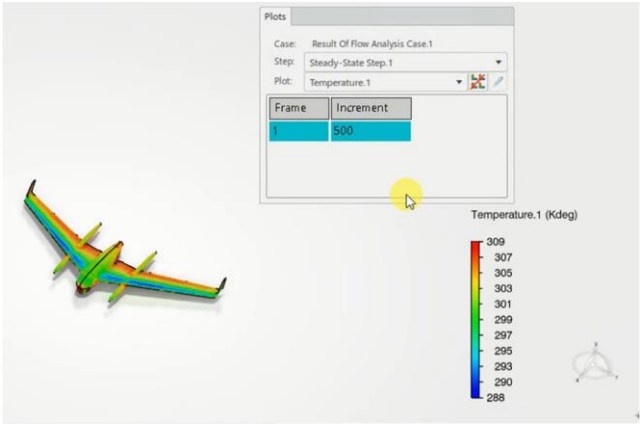

Fig3: Temperature distribution around the plane

It can be seen from the Fig.3 that the temperature distribution around the plane and contour of the back tail portion is the highest with a value of 309 K as compared to other bodies. Whereas the lowest temperature of about 288 K is shown by the some portions of wing.

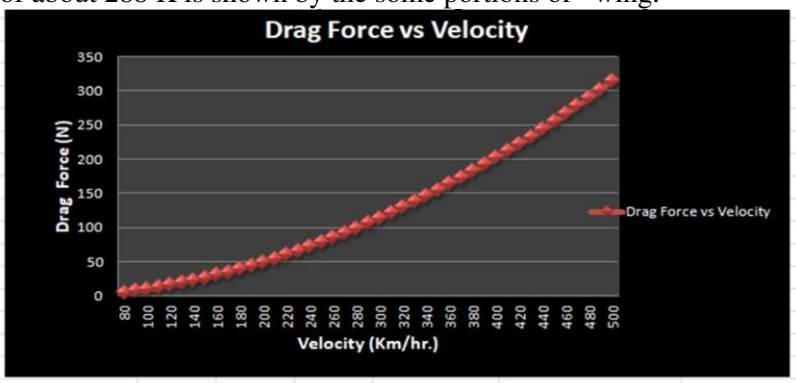

Fig4: Graph of drag force vs. Velocity (80km/hr. to 500km/hr.)

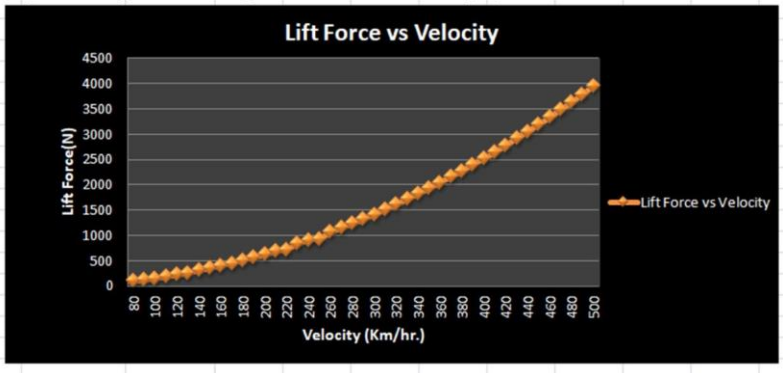

Fig5: Graph of lift force vs. Velocity (80km/hr. to 500km/hr.)

It can be seen in the fig4& fig5 that with the continuous increase of the velocity drag force and lift force also increases simultaneously. Since the aerodynamic force depends on the square of the velocity, doubling the velocity will quadruple the lift and drag.

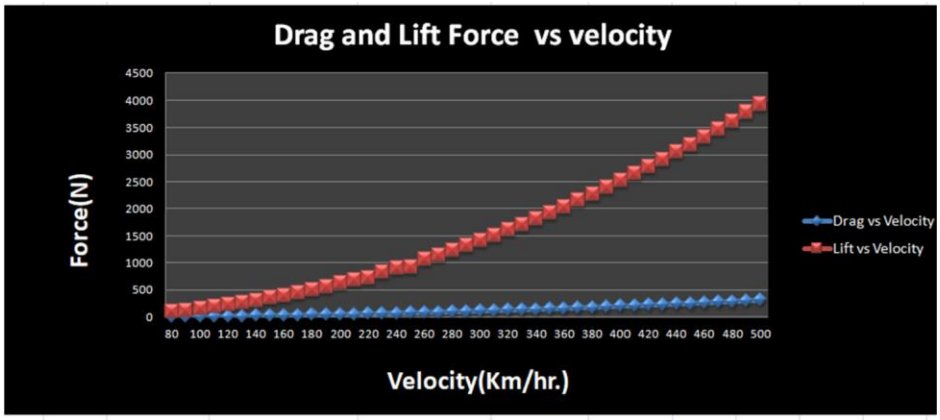

Fig6: the red color line indicates the graph of lift force with velocity and the blue color line indicates the graph of drag force with velocity.

CONCLUSION:

This article represents an aerodynamics performance of UAV. Computational fluid dynamics model were applied to external aerodynamics in order to find out a flow field around an aerial vehicle .CFD Analysis was done to check the drag and lift of the current model.3D Experience, Simulia software was used to do the analysis. The different contours show that the most effective distribution of physical quantity occurs at the wings of the plane.

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A review on electrical property of $BaTiO_3$

Meena K Sahu*, Gyanendra K Mishra, Lokanath Meher

Centurion University of Technology and Management, Odisha, India

*Corresponding author: meenakumari.sahu@cutm.ac.in

Abstract

BaTiO3 is a ferroelectric material having perovskite structure. It is the first ferroelectric material having perovskite structure. It has important functional properties, so it can be used in various devices . BaTiO3 is a lead-free piezoelectric material so it is eco-friendly. The BTO has wider field of applications. The properties of this material can be enhanced by doping with suitable dopants. Using different methods of synthesis the grain size can be changed and hence the properties also enhanced.

Keywords: BTO, Perovskites, Ferroelectric.

Introduction

Ferroelectrics or ferroelectric materials belong to a group of materials which have spontaneous polarization even in the absence of the applied electric field. In this type of materials the direction of polarization can be reversed which results in the formation of hysteresis loop. The materials having ferroelectric property attracted the scientist community because of their wide applications. The ferroelectric materials have wide range of applications. BaTiO3 is a ferroelectric material having perovskite structure. It is the first ferroelectric material having perovskite structure. It has important functional properties, so it can be used in various devices [1]. BaTiO3 is a lead-free piezoelectric material so it is eco-friendly [2,5]. The BTO has wider field of applications. It has applications in devices like sonar, actuator etc. But the electrical properties of pure phase BaTiO3 are weak as compared to other lead-based materials [9]. The dielectric constant of the materials should be large if it is used in capacitors .Also the size of grain has impact on the properties of the sample [3].The crystal structure of BTO undergoes transition as temperature changes. It changes from cubic to tetragonal phase due to change in temperature. Then the tetragonal structure changes to orthorhombic structure. At last the rhombohedral phase is obtained by further decrease in temperature. The cubic structure of barium titanate does not have spontaneous dipole. So this phase is paraelectric. The cooling enhance the dipole moment so other phases are ferroelectrics [4]. There is presence of ferroelectric, piezoelectric, pyroelectric properties and also high dielectric permittivity in lead free Barium titanate-based composites. The temperature coefficient of resistivity is also positive. Due to the above said properties the bulk ceramics and thick films applied in multilayer ceramic capacitors. Also in posistors, piezoelectric and ultrasonic actuators it is used. It is applied tunable elements in microwave circuits for telecommunication [6]. The properties of this material

can be enhanced by doping with suitable dopants. Using different methods of synthesis the grain size can be changed and hence the properties also enhanced [7].

Aside from electric fields, other external stimuli can also be utilized to manipulate the polarization direction in ferroelectrics. For example, magnetic fields have been employed to switch polarization in several multiferroic materials. [8]. BaTiO3 is used in optoelectronic devices because of its electrical properties. With change in temperature, the crystal structure undergoes phase transitions. It changes from cubic to tetragonal phase due to change in temperature. Then the tetragonal structure changes to orthorhombic structure. At last the rhombohedral phase is obtained by further decrease in temperature. The cubic structure of barium titanate does not have spontaneous dipole [10].

The dielectric constant of pure phase BaTiO3 shows a great variation. When the pure BTO is doped with any impurities the properties get modified and also the field of applications broadened. Addition of PbTiO3 results in the increase of Curie temperature. Solubility of BaTiO3 is increased by the addition of excess TiO2. Addition of niobium alters the dielectric properties. Adding of NaNbO3 increases dielectric constant. The addition of La results in the change in structure and there by changing the dielectric constant of the sample[11]. Multi-layer ceramic capacitors (MLCC) are made from layers of metallic electrodes and dielectric ceramic. In most cases of MLCC the dielectric materials are BaTiO3-based[12]. There is necessity of more efficient microwave absorbers in the field of radar detections. Also in the military applications it is greatly used. The microwave absorber dissipates the electromagnetic waves and converts into thermal energy. The microwave absorber plays an active role in the stealth technology. The BTO has been found to be used as microwave absorber due to its ferroelectric properties [13].The compound BTO has a high dielectric constant and the dielectric loss is very small. So the applications is unlimited in various fields. It has different properties which are exhibited above room temperature, so it can be used as ferroelectrics and piezoelectric materials. The cost factor and low v/v ratio are some demerits of the materials[14]. BTO is a photocatalyst as it absorbs light as the band gap is of the order of 3eV. As it absorbs light energy it has the capacity to produce electron –hole pairs. It is used to produce hydrogen by degrading organic pollutant [15].

In this article we review the different process of synthesis of barium titanate .We focus on the electrical property of the BTO.

Synthesis of BTO

Different methods of fabrication of barium titanate have been developed in the last decade. Here we will discuss the following three methods of preparation. The method of preparation depends on the required characteristics and particle size of the materials.

Solid State Reaction

Solid state reaction route is the most widely used method for the preparation of polycrystalline solid from a mixture of solid starting materials. Solid do not react at room temperature over normal time scales, it is necessary to heat them to a much high temperature.

Highly pure $BaCO_3$ and TiO_2 are taken in calculated amount. These ingredients are dry mixed and wet mixed with methanol to get a homogeneous mixture and then calcinated at temperature 800^0 C to1200^0 C. Then the mixture is sintered at high temperature to obtain dense BaTiO3 ceramic. [16,17]

Sol Gel Route

In material science sol-gel method is used for preparing solid materials at low temperature. The method is used for the fabrication of metal oxides. Barium acetate solutions and titanium isopropoxide reacted with each other and there is formation of gel. This gel then dried and calcined to form barium titanate ceramic [6,7].

Hydrothermal Method

In hydrothermal method of synthesis the material is crystallized from the aqueous solution which is at high temperature. Also the solution is kept at high vapour pressure. The solution is placed in the apparatus called autoclave. The solution which contains the precursors are placed in the autoclave. A temperature different is kept in between two ends of the autoclave. At the cooler end the required crystal is deposited.

Anhydrous Barium hydroxide Ba(OH)2·8H2O is taken and TiO2 added to it .The reaction is carried out in an alkaline medium. The mixture is stirred constantly for nearly 30mins. The mixture placed in autoclave and crystal was obtained [3,15,18].

Electrical Property of BTO

The compound barium titanate exists in one of the four structure depending on the temperature. The four forms are cubic, tetragonal, orthorhombic and rhombohedral structure. The cubic form phase is paraelectric and all other are ferroelectric.

Barium titanate is a compound, with general formula ABO_3. In power form it is white and in large crystal it appears transparent. It is the most widely studied ceramic material. It has great dielectric, ferroelectric and piezoelectric properties [14]. The dielectric constant of BaTiO3 is very high. It results from its crystal structure. BaTiO3 has perovskite structure. Pure BaTiO3 is a ferroelectric perovskite. The value of permittivity is 2000–3000 at room temperature. The value of permittivity is maximum at the Curie temperature (Tc=120–130 °C)[19]. The room temperature ferroelectric properties of the sample is quite good. The hysteresis loop in non-linear.The remnant polarization value is satisfactory as stated by V.

Dwivedi [20]. Due to this electrical properties BTO has wide range of applications. It is used in non-volatile memory devices.

CONCLUSIONS

Barium titanate is a compounds with general formula ABO_3 called perovskite. The ferroelectric properties of this compound are related with the phase transition. The most interesting change of phase is from tetragonal to cubic structure. There the ferroelectric state changes to paraelectric at Curie point Tc $=120^0$C. Generally solid state reaction method and various wet chemical methods are employed for the fabrication of the ceramic. The preparation method has a greater impact on the grain size and the characteristics of the materials.

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Studies on Heritability and Genetic Advance in Brinjal (*Solanummelongena* L.) Genotypes

[1]Ronanki Divya, [2]K Mallikarjunarao, [3]Barsha Tripathy and [4]Praveen Kumar

[1]PG Research Scholar, Department of Horticulture, M.S. Swaminathan School of Agriculture,Centurion University of Technology and Management, Paralakhemundi, Odisha, India

[2& 3]Assistant Professor, Department of Horticulture,M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha, India

[4]Assistant Professor, Department of Genetics and Plant Breeding, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha, India

Corresponding author Email: divyaronanki004@gmail.com

Abstract

This experiment existed towards assessing the magnitude of heritability and genetic advance in 15 brinjal genotypes. Under this study,genotypes had shown significant differences forentire traits.Genotypic and phenotypic coefficient of variations remainedhigh for fruit and shoot borer incidence (37.72 % and 39.75 %), fruit yield plant^{-1} (37.96 kg and 38.84 kg), vitamin C (37.01 mg 100g^{-1} and 38.82 mg 100g^{-1}), stem girth (27.67 cm and 27.96 cm), number of fruits plant^{-1} (20.06 and 21.04), dry matter (19.09 g and 13.39 g), fruit weight (16.01 g and 16.72 g), number of primary branches plant^{-1} (14.79 and 17.63) and fruit length (14.12 cm and 14.99 cm). High magnitude of heritabilityfor fruit yield plant^{-1} (95.50 %) followed by stem girth (93.70 %), fruit weight (91.70 %), number of fruits plant^{-1} and vitamin C are having similar heritability values (90.90 %), fruit and shoot borer incidence (90.00 %), fruit length (88.70 %), days to first harvest (77.60 %), number of primary branches plant^{-1} (70.50 %), TSS (69.20 %), plant spread (N-S) (68.0 %), flesh thickness (67.70 %), fruit girth (67.30 %), days to first flowering (63.80 %), days to 50% flowering (61.10 %). Genetic advance, in general, was high for fruit yield plant^{-1} (76.43 %) followed by vitamin C (72.68 %), stem girth (53.96 %), number of fruits plant^{-1} (39.40 %), fruit weight (31.58 %), fruit length (27.39 %) and number of primary branches plant^{-1} (25.59 %), fruit and shoot borer incidence (20.26 %). The characteristics such as fruit yield plant^{-1}, vitamin C, stem girth, fruit length, number of fruits plant^{-1}, fruit weight, number of primary branches plant$^{-1,}$ and fruit and shoot borer incidence were established by high heritability along with high genetic advance. Therefore in addition to pedigree selection, a simple selection process corresponding to mass selection will remain successful for character-based improvement. Hence, the particular traits might exist for selection criteria in a breeding program.

Key words: Brinjal, Genetic variability, Genetic advance, Genotypic coefficient of variation, Heritabilityand Phenotypic coefficient of variation.

Introduction

In India brinjal (*Solanummelongena* L.)be present as a major important also popular solanaceous vegetable crop. De Candolle (1883), stated that brinjalexistedand well-known in India in antiquatedtimes as well asindigenous of India. In India, brinjal accounts an area for 726 million ha area and producting12660000 metric tonnes. (Agriculture research data book, ICAR 2019).Due to its sky-scraping production rate all over the world, it is often referred to as a poor man's vegetable (Kumar *et al*., 2014).Rapid improvement in yield in addition tofurtherrequired traitsandheaded for select the potential

parent designed for hybridization programs genetic variability plays a chief crucial role in crops or vegetables.Therefore, variability is there headed forjudge through various genetic parameters like the genotypic also phenotypic coefficient of variation.'High heritability along with high genetic advance as percent of mean remains an indication in case of further additive gene action' (Panse, 1957).

Materials and Methods

By taking 15 brinjal genotypes, the present study was conducted during *kharif* at Bagusala (Village) instructional farm, Paralakhemundi, Department of Horticulture, MSSSoA, CUTM. The trial was laidout with with three replications in an RBD (Randomized Block Design). Genotypes were allocated randomly to a unit plot in each replication. The unit plot size is about 12 m^2 (3 m x 4 m). The seedlings were planted on the ridges of the row using a spacing of 60 cm among the rows and 45 cm among the plants. There were six plants in each ridge. some cultural practices arefollowed for raising a healthy crop. Five randomly selected plants are chosen from each replication aimed at recording the observations for the growth parameters (plant height (cm), number of primary branches $plant^{-1}$, plant spread (E-W) (cm) and (N-S) (cm), and stem girth (cm)), earliness parameters (days to first flowering, days to 50% flowering and days to first harvest); yield parameters (number of fruits $plant^{-1}$, fruit length (cm), fruit girth (cm), fruit weight (g) and fruit yield $plant^{-1}$ (kg)); pest incidence *(*fruit and shoot borer incidence (%)), and quality parameters *(*pericarp thickness (mm), flesh thickness (cm), TSS (^{0}Brix), vitamin C (mg/100g) and dry matter (g).

Methods used to define genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV) and heritability was given by Adesoye*et al.* (2013). Expected genetic advance was computed by Ramesh and Arumugam, 2013.

Results and Discussion

Table 1 shows the existence of much more variability within the genotypes utilized in the current study is shown.A high value of the genotypic and phenotypic coefficient of variations recorded for fruit and shoot borer incidence (37.72 % and 39.75 %), fruit yield $plant^{-1}$ (37.96 kg and 38.84 kg), vitamin C (37.01 mg $100g^{-1}$ and 38.82 mg $100g^{-1}$), stem girth (27.67 cm and 27.96 cm), number of fruits $plant^{-1}$ (20.06 and 21.04), dry matter (19.09 g and 13.39 g), fruit weight (16.01 g and 16.72 g), no of primary branches per plant (14.79 and 17.63) and fruit length (14.12 cm and 14.99 cm). These findings are in accordance withNilayadhara*et al*. (2007), Sheryl and Shanthi (2008), Sharma and Swaroop (2000) and Vidya and Kumar (2015). The characters which exhibited high phenotypic, asas well asgenotypic coefficient of variation,exist economic value also there is potential for the development of these traitsover selections. Many characters showed high broad-sense heritability. High heritability recorded to fruit yield $plant^{-1}$ (95.50 %) accompanied by stem girth (93.70 %), fruit weight (91.70 %), number of fruits $plant^{-1}$ and vitamin C are having same heritability values (90.90 %), fruit and shoot borer incidence (90.00 %), fruit length (88.70 %), days to 1st harvest (77.60 %), noof primary branches $plant^{-1}$ (70.50 %), TSS (69.20 %), plant spread (N-S) (68.0 %), flesh thickness (67.70 %), fruit girth (67.30 %), days to 1st flowering (63.80 %), days to fifty percent flowering (61.10 %), dry matter (56.70 %) and plant spread (E-W) (52.20 %). These findings are agreed through Dash and Mishra (1995) for number of fruits $plant^{-1}$; Rai *et al.* (1998) average fruit weight;Kumar *et al*. (2000) and Chung *et al.* (2003) for weight of fruit also no of fruits per plant; Prasad (2003) for fruit weight and girth, number of fruits/cluster and number of fruits/plant; Prasad *et al*. (2004) for fruit weight and fruit girth; Naik (2006) for fruit girth, number of fruits $cluster^{-1}$. Genetic advance as a percentage of mean noted high towards the fruit yield per plant (76.43

%) followed by vitamin C (72.68 %), stem girth (53.96 %), number of fruits plant^{-1} (39.40 %), weight of fruit (31.58 %), length of fruit (27.39 %) alsono of primary branches per plant (25.59 %), fruit and shoot borer incidence (20.26 %). Genetic advance as percentage of mean remainedset up from moderate to high formaximum characters studied with the exception of plant height, days to 50% flowering, pericarp thickness and flesh thickness which exhibited low genetic advance as percentage of mean.In the present research, the characteristics including fruit yield plant^{-1}, vitamin C, stem girth, fruit length, number of fruits plant^{-1}, fruit weight, number of primary branches plant$^{-1,}$ and fruit and shoot borer incidence existed with high heritability combined with high genetic advance.

Therefore, a simple selection procedure resembling mass selection as well as pedigree selection desiressuccesfull for the improvement of traits. These characters also could be used in conventional breeding for selection criteria.Consequently, selection establishedon phenotypic performance of those characters could be actual headed for select required plant types. The remaining traits showed 'moderate to low heritability' combined with 'moderate to low genetic advance' as a percentage of a mean exhibiting a role of nonadditive genetic variance in their expression.

Table 1 Genetic parameters of fifteen brinjal genotypes

Variables	General mean	Range	Minimum variety	Maximum Variety
Plant height (cm)	82.16	68.46-93.13	Andra	UtkalKeshari
Number of primary branches plant^{-1}	5.67	4.13-7.20	Andra	UtkalAnushree
Plant spread (E-W)	83.90	73.06-102.39	Rayagada Local	UtkalKeshari
Plant spread (N-S)	81.92	65.68-98.54	Andra	UtkalKeshari
Stem girth (cm)	1.39	0.83-2.05	Brinjal Blue Green	Green Thorny Heera
Days to first flowering	35.49	30.75-42.00	Green Suvarna	Andra
Days to 50% flowering	52.28	47.0-56.66	Green Suvarna	Green Harsha
Days to first harvest	69.18	62.10-82.0	Green Thorny Heera	Bhagyamati
Fruit length (cm)	10.21	7.53-13.05	Andra	UtkalKeshari
Fruit girth (cm)	5.48	4.93-7.03	Banarasi Selection	Green Thorny Heera
Fruit weight (g)	135.84	93.04-165.98	Andra	Green Thorny Heera
Number of fruits plant^{-1}	20.82	14.33-29.50	Andra	UtkalAnushree
Fruit yield plant^{-1} (kg)	2.58	0.95-4.16	Andra	UtkalAnushree
Fruit and shoot borer incidence (%)	21.44	7.80-39.46	Green Thorny Heera	Andra

Pericarp thickness (mm)	5.62	4.80-6.28	Andra Green Heera	Thorny	
Flesh thickness (cm)	4.35	3.27-5.59	Andra Green Heera	Thorny	
TSS (^{0} Brix)	4.75	3.57-5.66	Berhampur Local	Paralakhemundi Local	
Vitamin C (mg/100g)	12.69	5.10-20.11	Andra Green Heera	Thorny	
Dry matter (g)	11.19	9.00-13.93	Andra Green Heera	Thorny	

Table 2. Genetic parameters for nineteen characters infifteen brinjal genotypes

Variables	Heritability (%)	GCV	PCV	GA	GA (%)
Plant height (cm)	37.70	6.84	11.16	7.13	8.65
Number of primary branches plant $^{-1}$	70.50	14.79	17.63	1.45	25.59
Plant spread (E-W)	52.20	9.00	12.45	11.24	13.40
Plant spread (N-S)	68.0	10.49	12.73	14.60	17.82
Stem girth (cm)	93.70	27.67	27.96	0.75	53.96
Days to first flowering	63.80	8.05	10.08	4.70	13.25
Days to 50% flowering	61.10	4.89	6.26	4.12	7.89
Days to first harvest	77.60	6.60	7.49	8.29	11.98
Fruit length (cm)	88.70	14.12	14.99	2.79	27.39
Fruit girth (cm)	67.30	9.51	11.59	0.88	16.08
Fruit weight (g)	91.70	16.01	16.72	42.91	31.58
Number of fruits plant^{-1}	90.90	20.06	21.04	8.20	39.40
Fruit yield plant^{-1} (kg)	95.50	37.96	38.84	1.97	76.43
Fruit and shoot borer incidence (%)	90.00	37.72	39.75	15.81	20.26
Pericarp thickness (mm)	42.30	5.17	7.95	0.39	6.93
Flesh thickness (cm)	67.70	11.08	13.47	0.81	1.03
TSS (^{0}Brix)	69.20	9.59	11.96	0.81	17.07
Vitamin C (mg/100g)	90.90	37.01	38.82	9.22	72.68
Dry matter (g)	56.70	10.09	13.39	1.75	15.65

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Variability in Brinjal (*Solanummelongena* L.): A review

[1]Ronanki Divya, [2]K Mallikarjunarao and [3]Sirapu Poornima

[1& 3]PG Research Scholar,Department of Horticulture, M.S. Swaminathan School of Agriculture,Centurion University of Technology and Management, Paralakhemundi, Odisha, India
[2]Assistant Professor, Department of Horticulture,M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha, India
Corresponding author Email:mallikarjuna.rao@cutm.ac.in

Abstract
Brinjal (*Solanummelongena*L.) is a commercial vegetable as well asmain crop in the world, particularly in the tropics also in subtropics. According to De Candolle, brinjalis the native of India in ancient times. In the 15thcentury in Europe eggplant was first recorded. Among people it remains popular inentire social strata, therefore it wascalled as vegetable of masses. Sound knowledge of genetic variability, heritability &genetic advance, correlation, path coefficient and genetic diversity of different quantitative as well asqualitative characters, as well as effects regarding yield, is necessary to achieve highest production and productivity. Consequently, the information underneath gives a sound breeding plan for the enhancement of brinjal.

Keywords: Brinjal,Correlation, Variability, Genetic diversityand Path coefficient

Introduction:

Genetic variability prevailingin breeding material provide benefits for any crop improvement programme (Meena and Bahadur, 2013).For recognition of considerable genotypes, evaluation of germplasm is the basic tool.Genetic variability remainsessential in case of any crop enhancement programme. The plant genetic makeup along with the environment will control the phenotypic expression of the plant character. Correlation coefficient analysis evaluates the mutual relationship among 2 plant traits also also set up yield components and thereby selection have been done for yield improvement. Path co-efficient analysis estimates the direct as well asan indirect effect of various components therefore providing an understanding of the direct &indirect contribution of each trait towards yield. For a hybridization programme selection of parents is a good scope from divergence analysis. The assessment of diversity and establishing relationships between cultivated species plays a vital role in genetic divergence. Therefore, the major concern for any breeder is the genetic variability concerning fruit yield and its attributes.

Genetic variability:

Genetic variability is the basis for rational plant breeding programme. The variability that exists within the population is generally measured by variables likephenotypic coefficient of variation (PCV) as

well as genotypic coefficient of variation (GCV). Brief literature available on those feature brinjal is presented below.

Kafytullahet al. (2011) investigated 20brinjal genotypes and noticed that GCV and PCV were highest in fruit weight and volume, leaf area index (LAI), number of fruitsplant-^{1}, fruit length and fruit diameter, fruit and shoot borer incidence, fruit yield per plot, fruit set %, number of fruitscluster-^{1} and fruit yieldhectare-^{1}.

Kumar et al. (2013)investigated 34brinjal genotypes for 8 characters. GCV and PCV was observed highest in case of number of branches plant^{-1}, fruit length&width, number of fruitsplant^{-1}, average fruit weight and fruit yield plant^{-1}.

Miliet al. (2014) estimated on 36 genotypes of brinjal during *Rabi* on genetic variability indicating significant variance betweenthe genotypes of all traits except days to 50 % flowering (2.75%). High GCV was recorded for single fruit weight (37.54%), fruit diameter (37.77%), total fruit yield plot^{-1} (36.66%), fruit length (27.47%) and fruit yield plant^{-1}(30.67%) and low GCV was recorded for days to 1stfruitharvest (4.20%) and a number of days to last picking (3.10%).

Vaishya et al. (2017) evaluated on 25 genotypes of brinjal for nine characters, they observed that sufficient variability has existed among the genotypes while variance caused by treatments exist highly significant in all characters. Among all those characters days to first fruit exhibit low value of variability among different genotypes. The environment acts as a crucial role for expression of different traits while it indicates that PCV was higher than GCV in case of all nine characters.

Divyaand Sharma(2018) recorded that the phenotypic coefficient of variability as well as genotypic coefficient of variability was recorded high for the fruit rot incidence (85.69, 85.36), the incidence of fruit borer (64.19, 63.99), number of marketable fruits plant^{-1} (62.46, 61.34), fruit weight (49.01, 47.45), yield plant^{-1} (50.42, 48.16), yield plot^{-1} (50.61, 46.59), yield hectare^{-1} (50.61, 46.59), fruit length (33.80, 32.85), number of primary branches plant^{-1} (32.32, 31.17) and fruit breadth (31.75, 30.92).

Jyothiet al. (2019) evaluated one hundred and two genotypes of brinjal during *Kharif*and reported that high genotypic coefficient of variability and phenotypic coefficient of variability was recorded for leaf area and a number of primary branches/plant and low genotypic coefficient of variability, as well as phenotypic coefficient of variability, was recorded in 50%flowering.

Heritability and Genetic Advance:

"Heritability is defined as the transmission of characters from parents to offspring (Falconer, 1960)". "The ratio of genotypic variance to total or phenotypic variance in percentage is called as broad-sense heritability."Equaling to original (Parental) population enhancement of genotype value of the new

population, indicates the genetic advance. For designing an effective breeding programmeknowledge of genetic advance is useful inspread over selection pressure towards segregating alsovariable population.

Kumar et al. (2012) studied 31brinjalgenotypes estimated that highest heritability coupled along with higher genetic advance as per cent of mean was noted for growth parameters number of primary branches per plant,internodal length and yield parameters (fruit length, average fruit weight, ascorbic acid content, number of fruitsplant^{-1} and fruit yieldplant^{-1} and vit-C content.

Kumar et al. (2013) studied forty hybrids and their fourteen parents and reported that high heritability coupled together by high genetic advance is recorded in traits like calyx length (67.98 %), little leaf incidence (53.71 %), fruit yield plant^{-1} (51.68 %), total phenol content (47.18 %), number of fruitsplant^{-1}(43.79 %) alsolength of fruit (41.63 %).

Akpanet al. (2016) observed a highly noteworthyvariation between genotypes in all characters. Highheritability estimated in number of fruits plant^{-1}, circumstances of fruit, fruit yieldplant^{-1}.

Rani et al. (2017) investigated 36 brinjal genotype revealed high heritability, as well as high genetic advance, were high for a number of fruitsplant^{-1} (0.99 %), yieldplant^{-1} (0.99 %), average fruit weight (0.98 %), shoot and fruit borer infestation (0.97 %), days to firstflowering (0.86 %) alsotrichome density (0.78 %).

Divyaand Sharma (2018) investigated and estimated that high broad sense heritability were found in all the traits studied *viz.,* incidence of fruit borer (99.39 %), incidence of fruit rot (99.23 %), ascorbic acid content (97.39 %), number of branchesplant^{-1} (96.65 %), number of marketable fruits plant^{-1} (96.44 %), fruit breadth (94.80 %), fruit length (94.42 %), fruit weight (93.75 %), total harvest duration (90.43 %), total soluble solids (90.33 %), days to fifty percent flowering (85.10 %), days to first harvest (84.82 %), yield plot^{-1} (84.72 %) and yield hectare^{-1} (84.72 %) and yield plant^{-1} (83.87 %).

Pandey et al. (2019) studied genotypic parameters and revealed that estimates for different characters of heritability were recorded for all characters except yield plant^{-1}. The days to fifty percent flowering (77.80) percent exhibited high heritability coupled with low genetic advance as percent of mean whereas yield plant^{-1} (61.50) percent observed moderate heritability as well as high genetic advance thus indicated the environment influence.

Correlation study:

The relative study on the analysis of correlation coefficient is presented below.

Kumar et al. (2016) experimented 34brinjal genotypes and revealed that yield plant^{-1} resultedpositive high correlation innumber of fruitsplant^{-1} as well as fruit weight whereasthe negative correlation with day to 1stharvest and fruit borer infestation.

Sujin et al. (2017) revealed number of long style flowers plant^{-1}, number of fruitsplant^{-1}, number of short-styled flowersplant^{-1}, fruit weight, days to 1stfruit harvest and fruit & shoot borer incidence noted direct positive effect whereas a number of flowers per plant recorded as maximum negative effect and after that fruit set % and plant height.

Mangiet al. (2017) estimated that out of 60 genotypes for seventeen characters and estimated that total fruit yield plant^{-1} showed significantly positive association on genotypic as well as phenotypic level in vegetative traits like (height of plant (0.385), plant spread (0.660), no of primary branchesper plant (0.545), stem girth (0.509)) at 90 days after transplanting, early yieldplant^{-1}, number of fruitsplant^{-1}, whereas,significantly negative association with earliness traits like (days to 1stflowering (0.302-0.230), days to fifty percent flowering (-0.272 and 0.229) and days to 1st fruit maturity (-0.164 and 0.168)).

Chauhan et al. (2017) revealed that strong positive association was found among yield contributing traits like number of fruits plan^{-1}t, height of plant, fruit weight and fruit yield and noted that genotypic correlation was high as compared to phenotypic revealing a strong inherent association present among those traits.

Yadav et al. (2018) studies that out of 32 genotypes two groups (long purple and round purple) including three checks (Punjab Sadabahar, Navina and Swarnamani). Total fruit yield plant^{-1} had exhibited the highest positively significantassociation with fruitsplant^{-1} (0.670) and total fruit yieldplant^{-1}but negativelysignificant to fruit length (-0.348).

Pandey et al.(2019) evaluated on 36 brinjalgenotypes during *Kharif*and they reported as yield plant^{-1} exhibited significantly high as well asa positive association to fruits plant^{-1}as well as early fruit yield. Number of primary branchesplant^{-1}showed negatively significant association with yield plant^{-1}.

Path coefficient analysis:

This concept was given by 'Wright (1921)' but 'Dewey and Lu (1959)' was first used this technique for selection of plant. It measures the relative importance of direct as well as indirect effects for several dependent and independent characters. By following a simple correlation coefficient study the relative importance of indirect as well as a direct influence for every constituent trait towards the desired character does not provide an exact picture. So, by following path coefficient technique helps in binding the total correlation towards yield and also it will estimatethe direct as well asthe indirect contribution of different components.

Lakshmi et al. (2014) estimated and observed that traits like fruit set percentage, fruit weight, number of fruits plant^{-1}, relative style length, number of flowers cluster^{-1}were having highestcorrelation values.

Kumar et al. (2014) investigated 34brinjal genotypes revealedno of fruitsplant^{-1} (43.73%) as well as average fruit weight (26.68%) are having high direct effects and they are the importantfactors for determining fruit yieldper plant (45.39%).

Shendeet al. (2014) reported positive and highly significant at genotypic level fruit yieldplant^{-1}with characters like a number of fruits cluster^{-1} and number of fruitsplant^{-1}. Path coefficient analysis reported that length of fruit, number of fruitscluster^{-1}, plant height, days to the last picking, average fruit weightand number of fruitsplant^{-1} could be selected forthe improvement of yield in brinjal.

Neha et al. (2017) studied and estimated that out of 40 genotypes, the observation noted on qualitative&quantitative characters. The maximum positive direct effect (0.866) on fruit yieldplant^{-1} followed by a number of flowerscluster^{-1} (0.355) as well as fruit yield plant^{-1}(0.610) showed in genotypic path coefficient

Mangiet al. (2017) investigated and reported that positive significant association at a genotypic level between the characters*viz.,* plant height, area of a leaf (at 90 days after transplanting), days to 1stfruit maturity, number of fruits cluster^{-1}and early fruit yieldplant^{-1}showeddirect effect on yield plant^{-1}.

Kumar et al. (2018) estimated that path coefficient analysis showed the considerable amount of positive direct effect of fruit yieldplant^{-1} followed by phomopsis blight incidence on the shoot, leaf breadth, days to 50 % flowering and plant height on phomopsis incidence on fruit.

Tripathy (2018) study revealed that out of 18 genotypes for 14 characters, the fruit length is major yield contributing character, because of its higher direct effect as well as indirectly effects the fruit yield by number of clusters plant^{-1}, plant height and plant spread. Therefore, for yield improvement in brinjal,these characters should be given the much importance in a selection programme

Genetic Diversity:

According to 'Mahalanobis (1936) D^2 statistics is used for estimating the genetic divergence among populations. Rao (1952) in plant breeding, proposedfor the estimation ofgenetic diversity. Genetic diversity plays a very crucial role for any crop development programme and also for further hybridization programmeit helps in selecting the suitable parents thus resulting in superior hybrids and desirable recombinants (Rathiet al., 2011). The available literature under genetic diversity is briefly reviewed below.

Rahman et al. (2014) experimented on 100 genotypes and are grouped into 8 clusters. The maximum and minimum inter-cluster divergence recordedamong cluster II and VI (32.234) alsoamong cluster V and VII (2.841), respectively. The maximum intracluster divergence in cluster II. Based on the mean performance of dissimilar clusters, accession hasgood enough yield waslocated in clusters, IV, VI and VIII.

Sandarunnisaet al. (2015) studied genetic diversity among 50 brinjalgenotypes for 16 characters and grouped into 8 clusters. The maximum and minimum intra-cluster distance among cluster VI &cluster I, respectively. The inter-cluster values are maximum as well as minimum was noted among cluster VI, VII alsocluster I, II. For mean values majority of the characters were highest in cluster VII.

Madhaviet al. (2015) experimentedand reported that twentyone genotypes are grouped into six clusters. The cluster IV (628.54) also cluster I (93.87) recorded the highest as well as lowest intracluster distance, respectively. Maximum inter-cluster genetic distance was recorded among cluster V and VI (3041.06) followed by cluster II &VI (3041.06). The clusters with higher inter-cluster distances showed that maximum genetic variation was found in the genotypes included in those clusters.

Samlindsujin and Karuppuaiab (2016) estimated that 60 genotypes are grouped into five clusters indicating no parallelism among geographic as well as genetic diversity. Cluster V has the largest clusters consisting of 43 genotypes, cluster I-11 genotypes, cluster II, III and IV of 2 genotypes each. Cluster V & II showed good result in most of the biometric traits. Maximum inter-cluster distance reported in III &V cluster. Maximum inter-cluster distance observed in cluster V followed by I &IV. Cluster II had the least intracluster distance.

Kumar et al. (2016) investigated on 33 genotypes of brinjal and reported that cluster I had 15 genotypes then cluster IX 5 genotypes, cluster II, V, VII &X contain a minimum number of genotypes. Intermating among genotypes cluster I, IX will producedrequired transgressive segregants in breeding.

Karim et al. (2016) revealed that 26 genotypes are grouped into 5 clusters. The inter-cluster distance was among cluster II &III (37.82) and lowest among cluster I & III (4.39). Cluster III reported maximum intracluster distance (1.58), cluster II resulted inthe lowest intracluster distance (0.48).

Yadav et al. (2017) investigated that genotypes of forty brinjal grouped into 7 clusters. Average intra & inter-cluster D^2 value between 40 genotypes estimated that cluster II recorded the lowest amount intracluster values of 3.739, indicated that genotypes contained by this cluster were similar, cluster I reported maximum intracluster from 4.657-7.174. The minimum inter-cluster D^2 values resulted among cluster III, IV (4.657), representing the close relationship among those clusters. Maximum inter-cluster values showed among cluster V, II (7.174) resultingthat genotypes in those clusters had upper limit divergence.

Bushanet al. (2018) estimated that the 25 genotypes into 6 cluster. Cluster III resulted fromthe mean value highest for fruit weight (141.788) alsofruitdiameter (7.71). Highest mean value for the fruit length(18.6), and plant height (90.69) recorded in cluster VI and for unmarketable yield $plant^{-1}$ (0.11) cluster II resulted as least mean value.

Artiet al. (2018) studied and observed that fifty genotypes were grouped into eight clusters. Cluster II, V &VIII consisted of a maximum no of genotypes (9), followed by cluster IV (7) as well as four genotypes in cluster I, III, VI &VII. The intracluster distance was highest in cluster VII (164.49) and least in cluster V, VI &VIII (536.13) indicated broad diversity among those 2 clusters, while lowest (59.63) has resulted among cluster IV &V.

Conclusion: The literature reviewed on in this paper illustrated variability as well as genetic divergence accessible in brinjal genotypes. Information of the relationship among yield as well as its components is valuable for effective choice of desirable plant type. Hence, genetically divergent genotypes might also be used for brinjalcrop enhancement.

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A Review onKrishiVigyanKendras (KVKs) Training Programmestowards Upliftment of Farmers ofOdisha

Ajay Kumar Prusty[1], Ansuman Satapathy[2], DwitySundar Rout[1*], PratyushRanjan Tarania[3], Avisweta Nandy[2] and Chitrasena Padhy[1]

[1]Department of Agricultural Extension and Communication, M. S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Gajapati, Odisha-761211, India.
[2]Department of Agricultural Economics, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha-751003, India.
[3]Department of Extension Education, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha-751003, India.
[*]**Corresponding Author:** dwity.sundar@cutm.ac.in

Abstract

Training goes about as a significant undertaking in the improvement of human execution in a predefined circumstance. Training gives a deliberate improvement of information and abilities which thusly causes the students to work productively and successfully in their predetermined employment on finishing of the preparation. KrishiVigyanKendras (KVKs) do a scope of trainings for the benefit of farmers and provincial youth in each region. KVK training program begins with the acknowledgment of training needs, the main advance in the association of a particular training program. This audit recognizes the preparation needs of farmers, advancement of farmers through training and the imperatives looked by farmers towards upliftment of farmers via training of KrishiVigyanKendras. The partners should pay genuinely higher significance and care to exact significant necessities while defining assorted training procedures and projects for the farmers of Odisha and other comparative agro-climatic areas of the country.

Watchwords: Farmers, KrishiVigyanKendras (KVKs), Programs, Training.

Presentation

Training is important concerning the topic and more prominent accentuation should be given on farming, plant insurance and improved actualizes. The students, topic, coaches and actual offices were found emphatically and fundamentally identified with one another (Chauhan, 1972). Greater part of prepared farmers said that preparation was valuable to expanding their advantage in cultivating and expanding creation (Raman et al., 1974). With few exemptions, practically all the prepared farmers picked up higher appropriation scores than those coordinated undeveloped farmers in all classifications of socio individual attributes and presumed that preparation had impressive effect on the selection of improved homestead rehearses (Mathur, 1976).

Training Need of Farmers

Little and peripheral farmers didn't contrast in their preparation needs on the significant branch of knowledge and plant assurance, soil protection and soil recovery found as the main zones of training (Ananthanarian, 1977). The farmers should be propelled to take a stab at independence in food. Non-conventional schooling and training should assist them with utilizing their accessible assets completely and add new strategies on innovations inside their abilities. The farmer should get full data for development in quality and amount alongside inspiration to receive (Radja, 1981).

The mechanical developments in agribusiness including high creation cost can't be outcome situated except if they are overseen appropriately and effectively. This requires training which should be given first

concern as the executives device (Ghani, 1982). There is critical associationship between training, size of family, yearly pay, wellsprings of data, expansion and cosmopoliteness with level of information on suggested dry land innovation (Jagdale and Nimbacker, 1993). Training, cultivating experience, social cooperation, augmentation contact and accomplishment inspiration had positive and critical relationship with the information level of little farmers (Kanungo et al., 1996).

Extraordinary training project should be led to create logical direction, innovative capacities and working information on ranch ladies on rural exercises. Training programs on sericulture, lac development, mushroom creation, honey bee keeping and so on might be fused especially for ancestral ladies towards vocation uphold (Majhi and Patra, 1996). Normal yearly pay, social support, expansion contact monetary and accomplishment inspiration had positive and huge relationship with appropriation conduct of little farmers (Rath and Mahapatra, 1996).

There was critical improvement among the cross variety steers proprietors to conquer the barrenness issue because of adjusted eating regimen taking care of through KVK training programs (Mishra, 2002). Training of shrimp farmers dependent on their need appraisal would help in respecting them aptitudes as well as refreshing them. Training and expansion backing should be given to the farmers to receive the eco agreeable shrimp cultivating advances (Ponnusamy, 2002). KVK training programs made the young, ranch ladies, and even all the farmers to take up cultivating on business premise. They have likewise been made cognizant about the market interest and raising harvests appropriately (Ray et al., 2004).

Degree of Development through Training Program

There was a relationship among training and the degree of information on the farmers. The farmers had a decent impact of training on their insight concerning manures, plant security synthetic substances and reasonable effect on improved seed and executes (Chaudhury, 1971). Critical ascent in the degree of information and appropriation of farmers subsequent to undertaking institutional training at farmers training focus (Renukaradhya, 1971).

Reception of bundle of practices on high yielding assortments of paddy was higher among the prepared farmers. He likewise further expressed that the most minimal, most elevated and normal scores on reception conduct of the prepared farmers were essentially higher than those of coordinated undeveloped farmers (Sukumaran, 1972). There was huge relationship between level of information, mentality and reception of improved poultry the executives rehearses with that of training granted to the poultry farmers (Pimprikan et al., 1974). Prepared farmers fundamentally contrast from undeveloped farmers concerning degree of selection on bundle of practices (Singh, 1974). Effect of training on information level was profoundly huge in regard of half breed jowar development just as soil and water the board rehearses (Ganesh, 1975). There was a huge contrast in the information level and selection conduct according to improved practices because of training (Gangadharappa, 1979). There was huge change in information on the larger part farmers in all the practices like assortment, season of planting, supplement the executives, plant security measures, water system and water the board, collecting and capacity because of training at KVK (Ramkrishna, 1980).

The creation cum show training was more powerful in expanding the information on practices for developing high yielding assortments, crossover jowar and so forth (Gopalkrishnan, 1978). The prepared farmer had higher selection of half breed maize and critical affiliation found among training and the yield level of cross breed maize (Krishna and Jalihal, 1976). The prepared homestead ladies had essentially higher information and good disposition in reception of improved practices (Shashikumar, 1978).

Farmers training and schooling program assume significant function in exchange and reception of new agrarian advances by the cultivating network. The investigation further uncovered that specialized training in both Kharif and Rabi season is basic for expanding creation and further dispersal of horticultural innovation to other individual farmers (Gill and Singh, 1979). Effect of training concerning pick up in information on suggested cotton development rehearses was huge (Halappanarar and Rajendra, 1979). There was critical change in the advancement of water system offices through KVK training programs where 66 percent of the prepared farmers developed burrowed well of their own. The pay level had

additionally been expanded multiple times alongside change in social interest and ranch power ownership.

There was critical change in the information level of the farmers through KVK training programs. Most extreme information were expanded on plant assurance measures, excrements and manure the executives, seed treatment, ideal plant populace upkeep, seed rate and assortment (Singh, 1990).

There was a critical change in the degree of innovation selection, pay and social cooperation through KVK training program followed by convenient specialized direction (Kanungo and Sangramsingh, 1993). The prepared farmers rehearsed all suggested practices of poultry and 32% in dairy rehearses just as communicated their expansion in pay level (Dimple et al., 1996). Horticultural and country advancement approaches should accord at ladies' admittance to and authority over beneficial resources instead of simply moving pay for utilization. Training and direction are a lot of fundamental to assemble their capacities for the admittance to land, credit, inputs, innovation, transport and market offices (Sinha, 2004).

The inclusion of KVK training program radically changed the disposition of farmers a favored way. Strategies and plans to build up the selection of rural advancements in India ought not ignore the significance of the need to change the contrary viewpoints and view held by those farmers who are considered as conventional and traditionalist (Dubey et al., 2008). Palatable improvements have been made on mechanical selection, social and natural viewpoints. Much improvement has not been seen on affordable, infrastructural, material belonging and ranch exercises (Bar et al., 2014). In an investigation at Jagatsinghpur District of Odisha, the effect of training gave by KVK on the farmers of the District were surveyed and the hole saw being developed were recorded as innovative turn of events (2.61), financial turn of events (2.46), social turn of events (2.45), ranch movement advancement (2.35) and foundation improvement (1.44) (Meena et al., 2020).

Constraints Experienced in Training

Prepared farmers can acquire all round advancement their homestead through reception of beneficial trimming design with all administration rehearses. Endeavor should be made to manage them appropriately to make their homestead as showing place for different farmers for brisk exchange of innovation in the area (Sinha and Sohal, 1970). Both reformist and non reformistfarmers perceived the requirement for training. In any case, non reformist just as little farmers usually liked more than one introduction. Also, accentuation should be laid on field preliminaries. Visit to exhibit ranch and monetary motivations for going to training rather than hypothetical presentation.

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The Blocking Ability of Daidzen against the Active Pocket of the SARS-Cov-2 Enzyme

Gagan Kumar Panigrahi[1,a], Annapurna Sahoo[1,a] and Kunja Bihari Satapathy[1]*
[1]School of Applied Sciences, Centurion University of Technology and Management, Odisha, India

[a]Author's contributed equally

*Corresponding Author's email: kunjabihari.satapathy@cutm.ac.in

Abstract

2019 Novel corona-virus (2019-nCoV) came up as a worldwide risk factor and put the entire human species into unrest. Till date, specific drug against the virus is not available. The current state of affair demands the development of anti-viral molecules against 2019-nCoV. The three dimensional structure of SARS-CoV-2 main protease (M^{pro}) can be used for high throughput screening of potential chemicals by *in silico* docking. This may result into identification of active biomolecules like phytochemicals. *In silico* Molecular Docking revealed that the phytochemical, Daidzein which belongs to isoflavone category effectively binds to the active pocket of the severe acute respiratory syndrome Corona-virus 2 (SARS- CoV-2) or the 2019-nCoV main protease.

Keywords: 2019-nCoV, SARS-CoV-2 main protease, SARS-CoV-2, *in silico*, molecular docking, phytochemicals.

Introduction

Owing to the spread of 2019-nCoV which resulted into the pandemic situation represents a severe public health crisis. Outbreak of this human pathogen emerged in the city of Wuhan, and resulted to human illness, termed as COVID-19 (Chen et al., 2020, Huang et al., 2020). SARS-CoV-2 belongs to the Beta corona-virus genus, closely related to the previously identified severe acute respiratory syndrome corona-virus (SARS-CoV) [3,4]. Public Health Emergency of International Concern (PHEIC) was declared by the World Health Organization (WHO) owing to its fast rate of transmission within the humans (Panda et al., 2016, Lu et al., 2020, Wu et al., 2020). Novel coronavirus induces respiratory disease and around 10-15% patients have acute respiratory distress syndrome, which is triggered primarily by cytokines. It has been reported that the neutrophilic extracellular traps (NET) contributes to organ damage and mortality in COVID-19. NET is also linked to pulmonary diseases, thrombosis, mucous secretions and cytokine production. NETs may be well targeted to reduce the clinical severity of COVID-19. The severity of COVID-19 depends upon the pandemic spread and unprecedented pressure on health care system (Chen et al., 2020, Chan et al., 2020, Li et al., 2020). Crystal structure of the SARS-CoV-2 main protease (M^{pro}) can be effectively used for screening specific ligands (Liu et al., 2020). M^{pro} and other known viral proteins are defining features which allow the virus to enter and infect the host cell (Wrapp et al., 2020, Lung et al., 2020, Ton et al., 2020). M^{pro} can be an effective target to diminish the viral replications within the host cells since it facilitates the synthesis of functional viral proteins (Panigrahi et al., 2016, Panda and Sahoo 2016, Panigrahi et al., 2016). Effective curative measures against SARS-CoV-2 are lacking. Plants are enriched with tremendous defense response capabilities (Panigrahi and Satapathy 2020, Panigrahi et al., 2021). Elaborated defense mechanism(s) in plants need to be explored (Panigrahi and Satapathy 2020a, 2020b, 2020c). Phytochemicals which are fundamentally bioactive compounds and has the potential to amend cellular physiology may be screened against the viral proteins (Sahoo et al., 2020a,b). Here, we report that Daidzein, a phytochemical binds to the active site of the SARS-CoV-2 main protease as revealed by the *in silico* molecular docking and thus further studies may reveal the effectiveness of Daidzein to be used as COVID-19 therapeutics.

Methods

Viral Protein Structure and Phytochemical dataset collection

The 3D structure of M^{pro} was accessed from Protein Data Bank accession 6M03 (Fig. 1). The SDF accession CHEBI:28197 corresponding to the Daidzein (Fig. 2) was obtained and consequently both the protein and the ligands were used for *in silico* analysis.

Molecular docking

For the *in silico* molecular docking, BIOVIA's Discovery Studio docking method was used for molecular docking. The catalytic pocket of the M^{pro} protein was specified and targeted for binding of the ligand. -CDOCKER Energy and -CDOCKER Interaction Energy signify the affinity of the ligands with the protein receptors. Basically, high positive values of the CDOCKER Energy, CDOCKER Interaction Energy and a diminutive difference between the -CDOCKER Energy and -CDOCKER Interaction Energy are considered to be the most favourable (Behera et al., 2020, Das et al., 2020, Jena et al., 2020, Ray et al., 2020).

Results and Discussion

It was found that Daidzein specifically binds to the active pocket of the SARS-CoV-2 M^{pro} (Fig. 3), as apparent from higher -CDOCKER energy and -CDOCKER interaction energy (Table 1). Since, Daidzein effectively binds into the active pocket of the M^{pro} under *in silico* conditions it is quite possible to design pharmacophore molecules based on the structural and functional identity of Daidzein. Chemical synthesis of Daidzein can be cost effective as compared to the isolation process from specific plants.

Table 1: -CDOCKER ENERGY and -CDOCKER INTERACTION ENERGY values generated for the interaction of Daidzein with the active site of SARS-CoV-2 main protease (M^{pro}).

Ligand		Receptor		Interaction Status		
SDF accession	Phytochemical	Protein	PDB accession	Docking Result	CDOCKER ENERGY	CDOCKER INTERACTION ENERGY
CHEBI:28197	Daidzein	COVID-19 Main Protease	6M03	POSITIVE	11.21	14.32

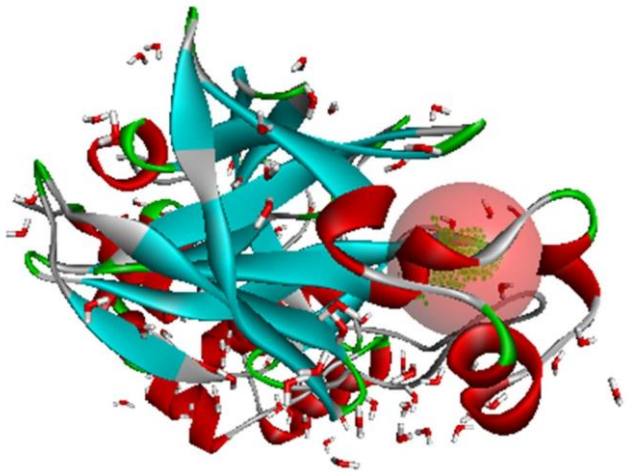

Fig. 1: 3-D Structure of the SARS-CoV-2 M^{pro} showing the active site of the protein.

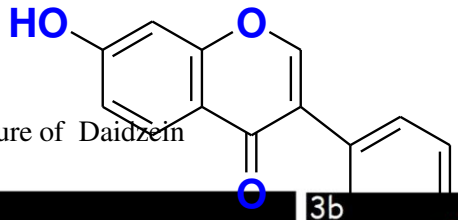

Fig. 2: Chemical structure of Daidzein

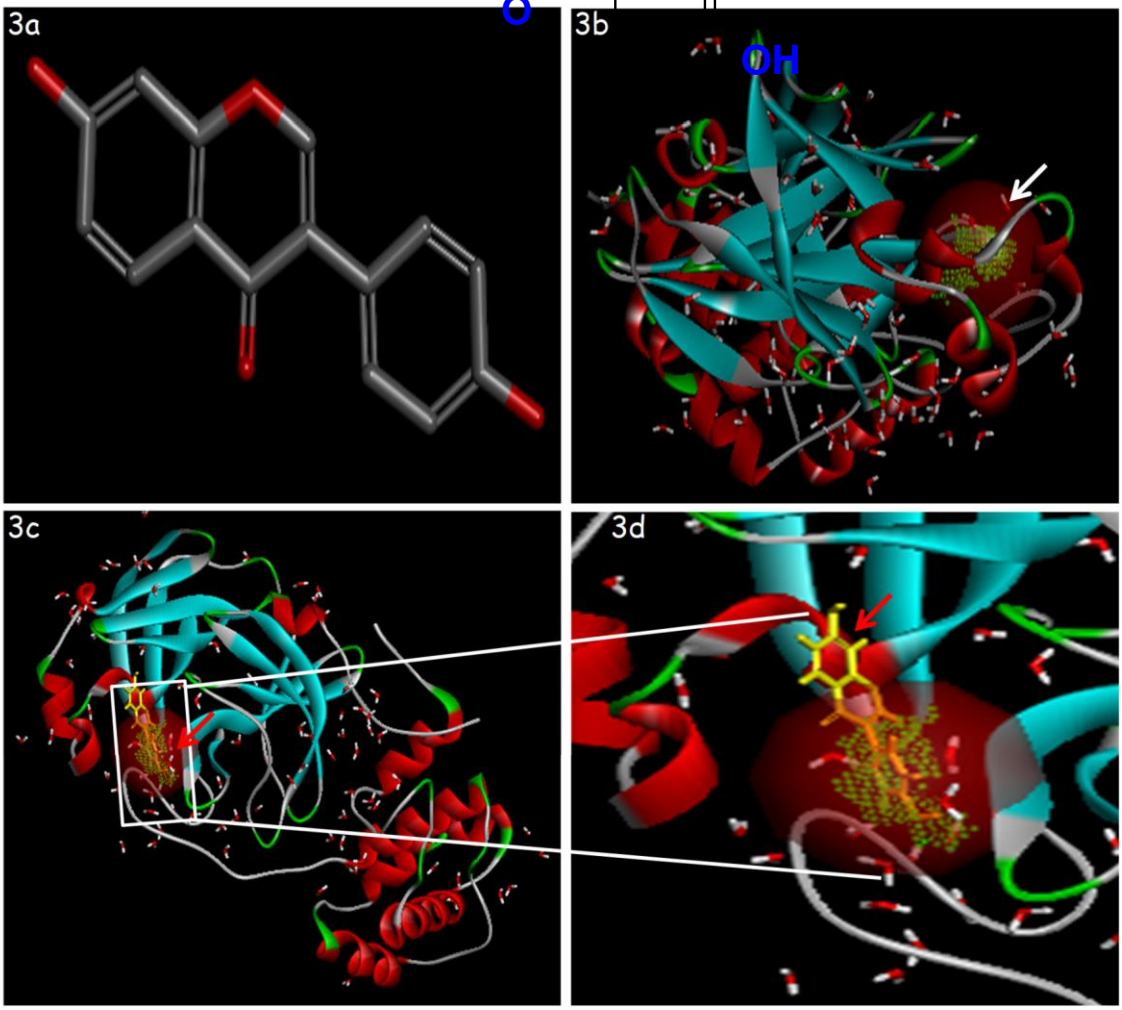

Fig. 3: The active site of the SARS-CoV-2 main protease (M^{pro}) interacts with Daidzein. **3a:** Phytochemical, Daidzein. **3b:** Free form of the M^{pro}. **3c:** M^{pro} associated with the ligand, Daidzein. **3d:** Magnified image showing the association of the Daidzein with the M^{pro}. (The white coloured arrow and the red coloured arrow indicate the active site of the M^{pro} and binding of Daidzein respectively).

Conclusion and Future perspectives

The current *in silico* molecular docking based study reveals that Daidzein can target the reported SARS-CoV-2 M^{pro} (Fig. 4). It would be extremely noteworthy being confirmed *in vivo*. It is crucial to develop diagnostic tools, potential therapeutics and antibodies selectively for the COVID-19 proteins. Phytochemicals like Daidzein is commercially available and thus may be effectively prescribed to circumvent the current global scenario. Essentially, this study makes an attempt to reveal simple phytochemicals like Daidzein which can be employed for designing novel therapeutics.

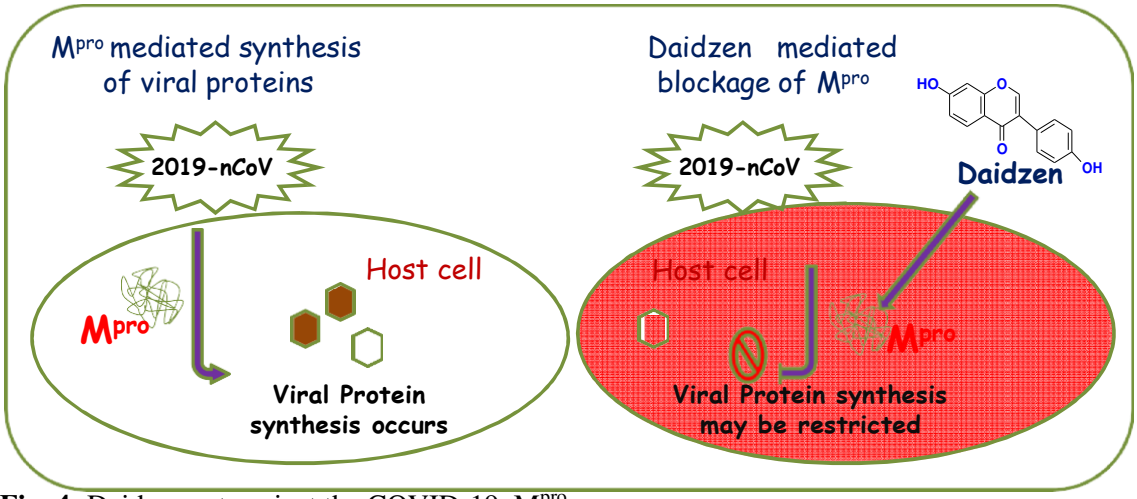

Fig. 4: Daidzen act against the COVID-19 M^{pro}.

CRediT authorship contribution statement

Gagan Kumar Panigrahi: conceived the idea, performed the experiments, analyzed the results, wrote the manuscript, have read and approved the final manuscript before submission. **Annapurna Sahoo:** conceived the idea, performed the experiments, analyzed the results, wrote the manuscript, have read and approved the final manuscript before submission. **Kunja Bihari Satapathy:** conceived the idea, analyzed the results, have read and approved the final manuscript before submission.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Effective inhibitory effect of alliin against the SARS-Cov-2 main protease

Gagan Kumar Panigrahi[1] and Kunja Bihari Satapathy[1]*
[1]School of Applied Sciences, Centurion University of Technology and Management, Odisha, India
*Corresponding Author's email: kunjabihari.satapathy@cutm.ac.in

Abstract

The deadly infectious 2019 Novel corona-virus (2019-nCoV) also referred to as severe acute respiratory syndrome Corona-virus 2 (SARS-CoV-2) that took stem in Wuhan, China has spread all over the globe within no time. It is the cause of the increasing death rate of people. This challenging situation requires development of pharmacophore for efficient treatment against severe acute SARS-CoV-2. The available crystal structure of SARS-CoV-2 main protease (M^{pro}) can be used effectively for fast *in silico* docking. This may result into identification of active biomolecules including phytochemicals. *In silico* Molecular Docking revealed that the phytochemical, Alliin effectively binds to the active pocket of the SARS-CoV-2 main protease.

Keywords: 2019-nCoV, SARS-CoV-2, SARS-CoV-2 main protease, docking, phytochemicals, Alliin.

Introduction

The pandemic situation caused due to the 2019-nCoV represents a severe public health calamity across the globe. The city of Wuhan was the epicentre where the outbreak of this human pathogen emerged, and resulted to human ailment, termed as COVID-19 (Chen et al., 2020, Huang et al., 2020). Coronavirus belongs to the family of Coronaviridae including 4 genera i.e. Alpha coronavirus, Beta coronavirus, Delta coronavirus, Gamma coronavirus. Among these, Beta coronavirus are severe acute respiratory syndrome coronavirus (SARS-CoV) and Middle East respiratory syndrome corona virus (MERS-Cove), which have engulfed more than 10,000 people around the globe in past two decades. SARS-CoV-2 belongs to Beta corona virus comprising of a positive single stranded RNA genome having 29,903 base pairs (Panda et al., 2016, Lu et al., 2020, Wu et al., 2020). These also show the characteristics of having genes encoding 3C-like proteins, RNA dependant RNA polymerase, 2′-O-ribose methyltransferase, spike protein, envelope protein, nucleocapsid phosphor protein and several unknown proteins. Public Health Emergency of International Concern (PHEIC) was declared by the World Health Organization (WHO) owing to its fast rate of transmission within the humans (Chen et al., 2020, Chan et al., 2020, Li et al., 2020). The virus shows the symptoms such as fever, dry cough and difficulty in breathing. However, the treatment cannot be achieved by developing drugs against at this current time as it will take many years (Panigrahi et al., 2016, Panda and Sahoo 2016, Panigrahi et al., 2016). Thus a strategy of rapid application of drug is necessary at this very moment. Crystal structure of the SARS-CoV-2 main protease (M^{pro}) proves to be an exceptional ground for screening specific ligands (Liu et al., 2020). SARS-CoV-2 main protease can be beleaguered for developing antibodies, diagnostics and vaccines. Reportedly, M^{pro} and other known viral proteins are defining features paving the path of virus from entry to infection in the host cell (Wrapp et al., 2020, Lung et al., 2020, Ton et al., 2020). Moreover, M^{pro} can also be an effectual target to diminish the viral replications within the host cells since it facilitates the synthesis of functional viral proteins. The effectiveness of traditional medications on the restriction of COVID-19 growth does not have any scientific back up as of now, since the underlying molecular mechanisms are unclear. Plants are enriched with tremendous defense response capabilities (Panigrahi and Satapathy 2020, Panigrahi et al., 2021). Elaborated defense mechanism(s) in plants need to be explored (Panigrahi and Satapathy 2020a, 2020b, 2020c). The phytochemicals are fundamentally bioactive compounds and has the potential to amend cellular physiology (Sahoo et al., 2020a,b). Here, we report that Alliin, a phytochemical mostly enriched in some selected plants binds into the active site of the SARS-CoV-2 main protease as revealed by the *in*

silico molecular docking and thus further studies may reveal the effectiveness of Alliin to be used as COVID-19 therapeutics.

Methods

Viral Protein Structure and Phytochemical dataset collection

The 3D structure of M^{pro} was accessed from Protein Data Bank accession 6M03 (Fig. 1). The SDF accession CHEBI:2596 corresponding to the Alliin (Fig. 2) was obtained and consequently both the protein and the ligands were used for *in silico* analysis.

Molecular docking

For the *in silico* molecular docking, BIOVIA's Discovery Studio docking method was used for molecular docking. The catalytic pocket of the M^{pro} protein was specified and targeted for binding of the ligand. -CDOCKER Energy and -CDOCKER Interaction Energy signify the affinity of the ligands with the protein receptors. Basically, high positive values of the CDOCKER Energy, CDOCKER Interaction Energy and a diminutive difference between the -CDOCKER Energy and -CDOCKER Interaction Energy are considered to be the most favourable (Behera et al., 2020, Das et al., 2020, Jena et al., 2020, Ray et al., 2020).

Results and Discussion

It was found that Alliin specifically binds to the active pocket of the SARS-CoV-2 M^{pro} (Fig. 3), as apparent from higher -CDOCKER energy and -CDOCKER interaction energy. Since, simple active biomolecule like Alliin effectively binds into the active pocket of the M^{pro} under *in silico* conditions it is quite possible to design pharmacophore molecules based on the structural and functional identity of Alliin and eventually can be used in the pharmaceutical sector. Chemical synthesis of Alliin can be cost effective as compared to the isolation process from specific plants.

Table 1: -CDOCKER ENERGY and -CDOCKER INTERACTION ENERGY values generated for the interaction of Alliin with the active site of SARS-CoV-2 main protease (M^{pro}).

Ligand		Receptor		Interaction Status		
SDF accession	Phytochemical	Protein	PDB accession	Docking Result	CDOCKER ENERGY	CDOCKER INTERACTION ENERGY
CHEBI:2596	Alliin	COVID-19 Main Protease	6M03	POSITIVE	9.36	12.78

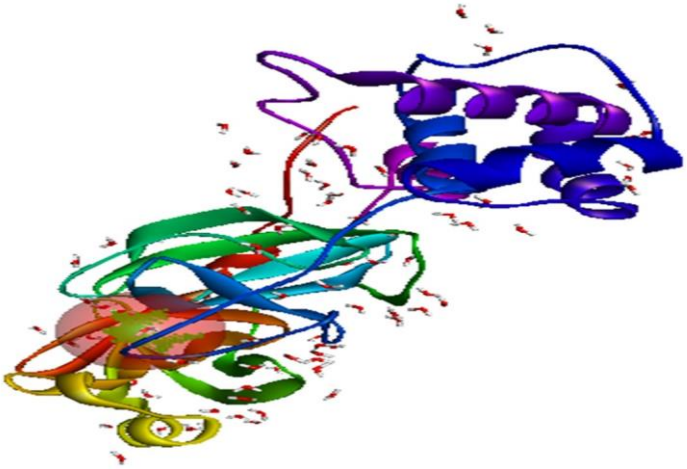

Fig. 1: 3-D Structure of the SARS-CoV-2 M^{pro} showing the active site of the protein.

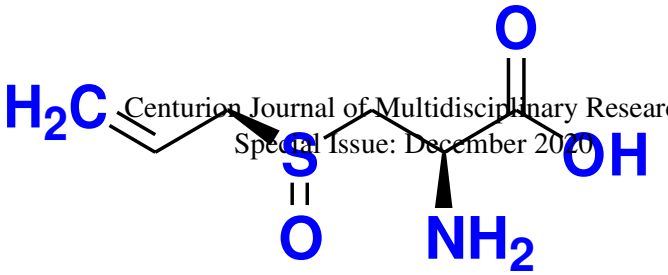

Fig. 2: Chemical structure of Alliin

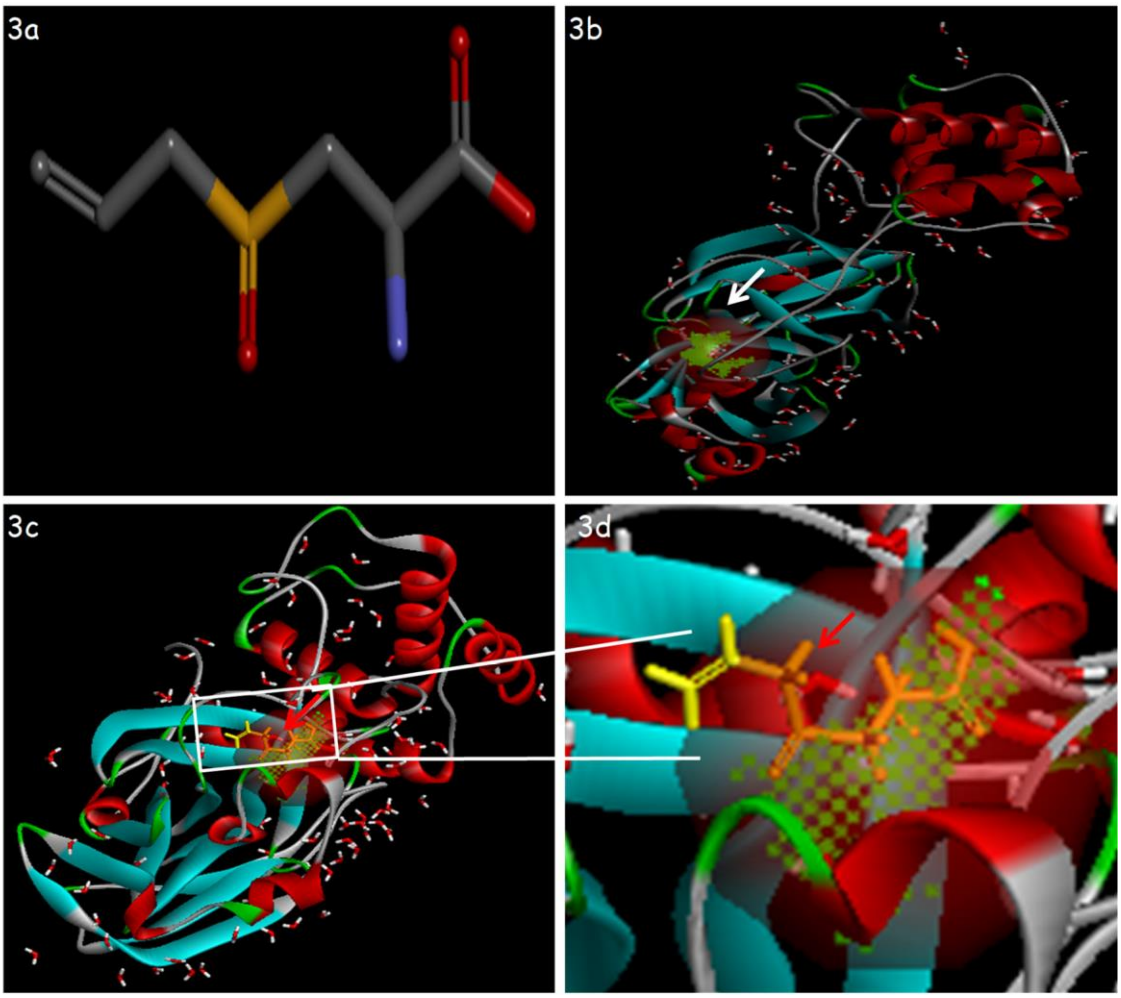

Fig. 3: The active site of the SARS-CoV-2 main protease (M^{pro}) interacts with Alliin. **3a:** Phytochemical, Alliin. **3b:** Free form of the M^{pro}. **3c:** M^{pro} associated with the ligand, Alliin. **3d:** Magnified image showing the association of the Alliin with the M^{pro}. (The white coloured arrow and the red coloured arrow indicate the active site of the M^{pro} and binding of Alliin respectively).

Conclusion and Future perspectives

The emerging coronavirus has become a nightmare throughout the globe. Though many attempts were made to defeat the virus, we are incapable of targeting the stem of it. This study has focused on the use of phytochemicals for treatment. The solved crystal structure of SARS-CoV-2 i.e. main protease (M^{pro}) can be considered as the root molecule and inhibitory ligands may be screened for detection of bioactive molecules. *In silico* molecular docking revealed the effectiveness of Alliin to bind to the active site of SARS-CoV-2 main protease. The current *in silico* molecular docking based study reveals that Alliin can target the reported SARS-CoV-2 M^{pro}. It would be extremely noteworthy being confirmed *in vivo*. It is crucial to develop diagnostic tools, potential therapeutics and antibodies selectively for the COVID-19

proteins. Phytochemical like Alliin is commercially available and thus may be effectively prescribed to circumvent the current global scenario. Essentially, this study makes an attempt to reveal simple phytochemical like Alliin which can be employed for designing novel therapeutics.

CRediT authorship contribution statement

Gagan Kumar Panigrahi: conceived the idea, performed the experiments, analyzed the results, wrote the manuscript, have read and approved the final manuscript before submission. **Kunja Bihari Satapathy:** conceived the idea, analyzed the results, have read and approved the final manuscript before submission.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Organosulfides effectively bind to 2019- nCoV main protease

Gagan Kumar Panigrahi[1] and Kunja Bihari Satapathy[1]*
[1]School of Applied Sciences, Centurion University of Technology and Management, Odisha, India
*Corresponding Author's email: kunjabihari.satapathy@cutm.ac.in

Abstract

The emerging 2019 Novel coronavirus (2019-nCoV) threatens public health. 2019-nCoV is also referred to as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Within no time it emerged as a global risk and was declared as pandemic. Specific drug against the virus is yet to be discovered. Development of biomolecules for proficient treatment against severe acute SARS-CoV-2 is challenging. The solved crystal structure of SARS-CoV-2 main protease (M^{pro}) can be used as one of the primary target molecule and possible inhibitory ligands may be screened using *in silico* docking. Primarily phytochemicals can be screened to detect any potential bioactive molecules. *In silico* molecular docking revealed that the phytochemicals, benzyl isothiocyanate and phenyl isothiocyanate belonging to the organosulfide group of phytochemicals may effectively binds to the active site of the SARS-CoV-2 main protease.

Keywords: 2019-nCoV, SARS-CoV-2, SARS-CoV-2 main protease, *in silico* docking, phytochemicals, organosulfides.

Introduction

Numerous members of the family Coronaviridae continuously circulate in the human population and usually cause mild respiratory disease (Chen et al., 2020, Huang et al., 2020). Whereas, the severe acute respiratory syndrome Coronavirus (SARS-CoV) and the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) are transmitted from animals to humans resulting into SARS and MERS, respectively (Panda et al., 2016, Lu et al., 2020, Wu et al., 2020). Natural reservoir hosts for SARS-CoV were Chinese horseshoe bats (Panda et al., 2016, Lu et al., 2020, Wu et al., 2020). Intermediate hosts like civet cats and raccoon dogs, which are habitually sold as food sources in Chinese wet markets mediated the human transmission (Lu et al., 2020, Wu et al., 2020). At present, no precise antivirals or approved vaccines are available to combat the current pandemic situation. Presently, conventional control measures, including travel restrictions and self-quarantine are practiced. The pandemic situation caused due to the 2019-nCoV represents a severe public health calamity across the globe. This pathogen emerged from the city of Wuhan and resulted into this scariest situation, COVID-19 (Chen et al., 2020, Chan et al., 2020, Li et al., 2020). SARS-CoV-2 belongs to the beta corona-virus genus, closely related to the previously identified severe acute respiratory syndrome corona-virus (SARS-CoV) (Panigrahi et al., 2016, Panda and Sahoo 2016, Panigrahi et al., 2016). Public Health Emergency of International Concern (PHEIC) was declared by

the World Health Organization (WHO) owing to its fast rate of transmission within the humans (Liu et al., 2020). Crystal structure of the SARS-CoV-2 main protease (M^{pro}) proves to be an exceptional ground for screening specific ligands (Wrapp et al., 2020, Lung et al., 2020, Ton et al., 2020). SARS-CoV-2 main protease can be beleaguered for developing antibodies, diagnostics and vaccines. Reportedly, M^{pro} and other known viral proteins are defining features paving the path of virus from entry to infection in the host cell (Panigrahi and Satapathy 2020, Panigrahi et al., 2021). Moreover, M^{pro} can also be an effectual target to diminish the viral replications within the host cells since it facilitates the synthesis of functional viral proteins. Elaborated defense mechanism(s) in plants need to be explored (Panigrahi and Satapathy 2020a, 2020b, 2020c). The effectiveness of traditional medications on the restriction of COVID-19 growth does not have any scientific back up as of now, since the underlying molecular mechanisms are unclear. The phytochemicals are fundamentally bioactive compounds and has the potential to amend cellular physiology (Sahoo et al., 2020a,b). Here, we report that benzyl isothiocyanate and phenyl isothiocyanate, a mostly enriched in some selected plants bind into the active site of the SARS-CoV-2 main protease as revealed by the *in silico* molecular docking and thus further studies may reveal the effectiveness of benzyl isothiocyanate and phenyl isothiocyanate to be used as COVID-19 therapeutics.

Methods

Viral Protein Structure and Phytochemical dataset collection

The 3D structure of M^{pro} was accessed from Protein Data Bank accession 6M03 (Fig. 1). The SDF accession CHEBI:17484 corresponding to the benzyl isothiocyanate and CHEBI:85103 corresponding to the phenyl isothiocyanate (Fig. 2) was obtained and consequently both the protein and the ligands were used for *in silico* analysis.

Molecular docking

For the *in silico* molecular docking, BIOVIA's Discovery Studio docking method was used for molecular docking. The catalytic pocket of the M^{pro} protein was specified and targeted for binding of the ligand. -CDOCKER Energy and -CDOCKER Interaction Energy signify the affinity of the ligands with the protein receptors. Basically, high positive values of the CDOCKER Energy, CDOCKER Interaction Energy and a diminutive difference between the -CDOCKER Energy and -CDOCKER Interaction Energy are considered to be the most favourable (Behera et al., 2020, Das et al., 2020, Jena et al., 2020, Ray et al., 2020).

Results and Discussion

It was found that phenyl isothiocyanate and benzyl isothiocyanate binds effectively to the active pocket of the SARS-CoV-2 M^{pro} (Fig. 3 and Fig. 4), as apparent from higher -CDOCKER energy and -CDOCKER interaction energy. Since, simple active biomolecule like benzyl isothiocyanate and phenyl isothiocyanate

effectively binds into the active pocket of the M^{pro} under *in silico* conditions it is quite possible to design pharmacophore molecules based on the structural and functional identity of benzyl isothiocyanate and phenyl isothiocyanate and eventually can be used in the pharmaceutical sector. Chemical synthesis of benzyl isothiocyanate and phenyl isothiocyanate like molecules can be cost effective as compared to the isolation process from specific plants.

Table 1: -CDOCKER ENERGY and -CDOCKER INTERACTION ENERGY values generated for the interaction of Plant organosulfides (Benzyl isothiocyanate and Phenyl isothiocyanate) with the active site of SARS-CoV-2 main protease (M^{pro}).

Ligand		Receptor		Interaction Status		
SDF accession	Phytochemical (Organosulfides)	Protein	PDB accession	Docking Result	CDOCKER ENERGY	CDOCKER INTERACTION ENERGY
		COVID-19 Main Protease (M^{pro})	6M03			
CHEBI:17484	Benzylisothiocyanate			POSITIVE	11.54	13.34
CHEBI:85103	Phenyl isothiocyanate			POSITIVE	13.76	16.31

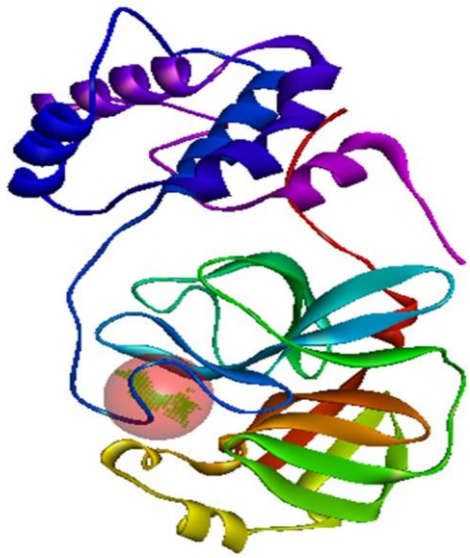

Fig. 1: 3-D Structure of the SARS-CoV-2 M^{pro} showing the active site of the protein.

2(a)

2(b)

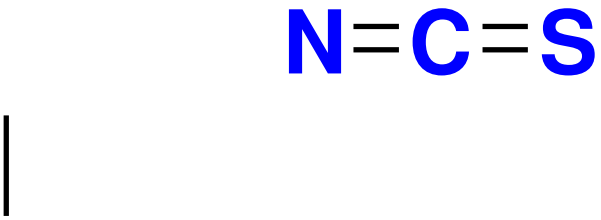

Fig. 2: Chemical structure of **(a):** benzyl isothiocyante and **(b):** phenyl isothiocyanate

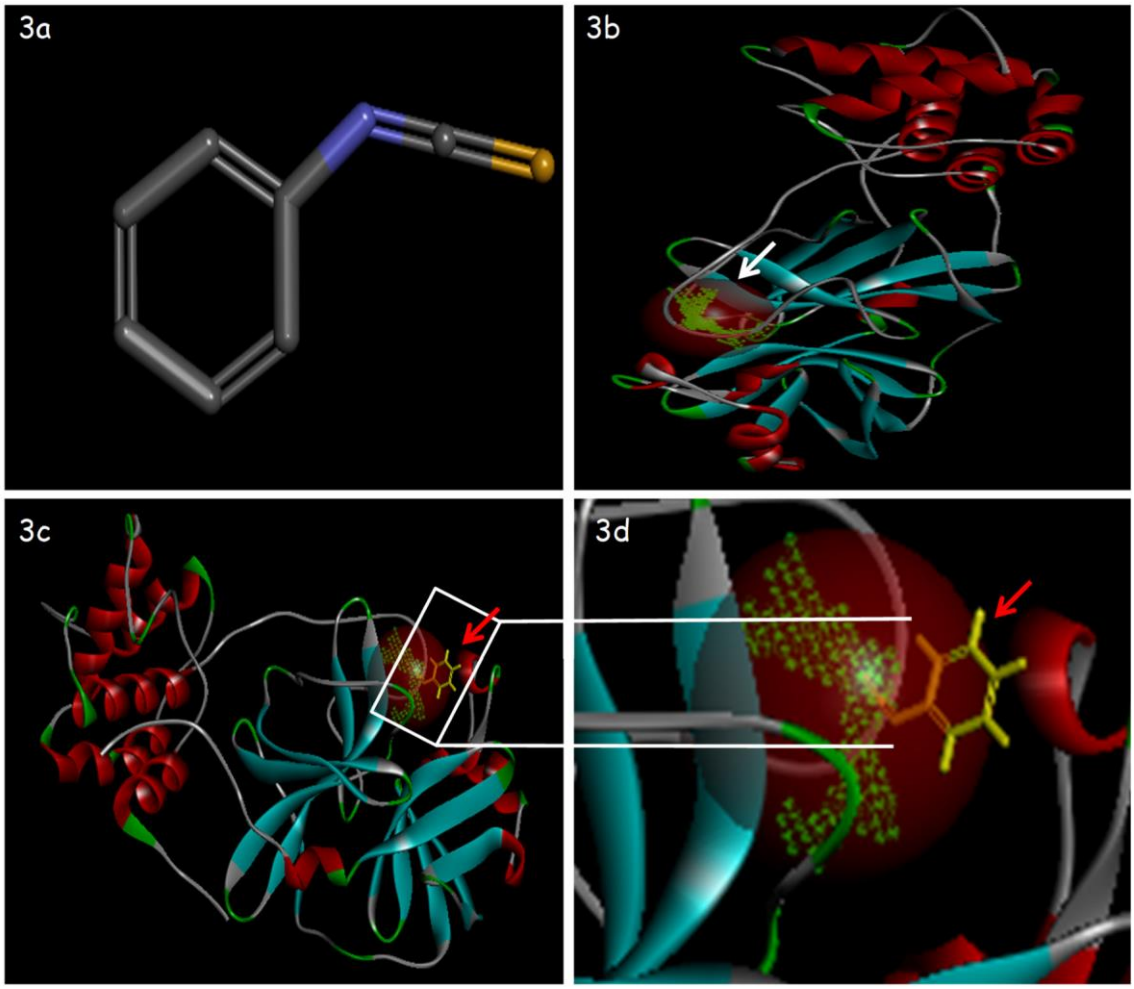

Fig. 3: The active site of the SARS-CoV-2 main protease (M^{pro}) interacts with Phenyl isothiocyanate. **3a:** Phytochemical, Phenyl isothiocyanate. **3b:** Free form of the M^{pro}. **3c:** M^{pro} associated with the ligand, Phenyl isothiocyanate. **3d:** Magnified image showing the association of the Phenyl isothiocyanate with the

M^{pro}. (The white coloured arrow and the red coloured arrow indicate the active site of the M^{pro} and binding of Phenyl isothiocyanate respectively).

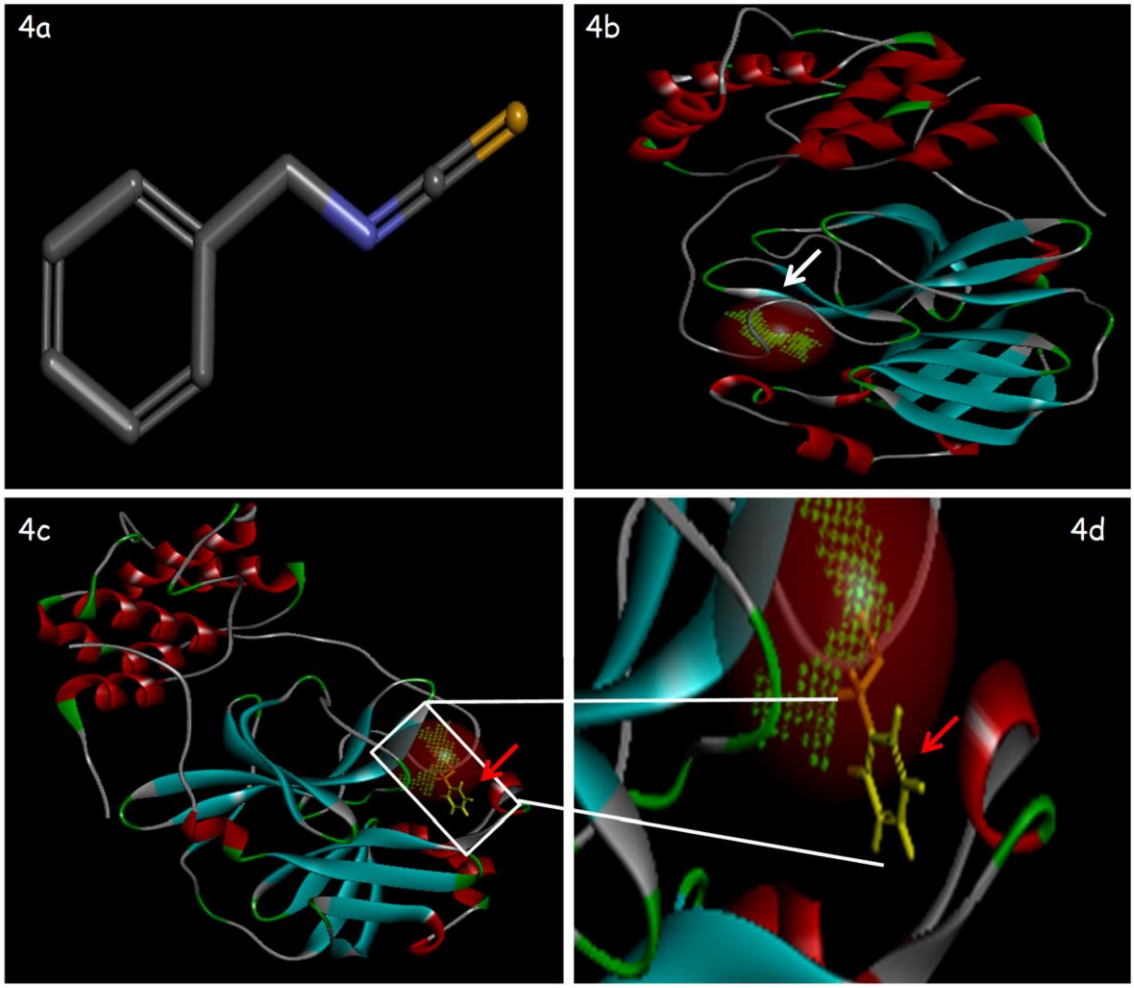

Fig. 4 : The active site of the SARS-CoV-2 main protease (M^{pro}) interacts with Benzyl isothiocyanate. **4a:** Phytochemical, Benzyl isothiocyanate. **4b:** Free form of the M^{pro}. **4c:** M^{pro} associated with the ligand, Benzyl isothiocyanate. **4d:** Magnified image showing the association of the Benzyl isothiocyanate with the M^{pro}. (The white coloured arrow and the red coloured arrow indicate the active site of the M^{pro} and binding of Benzyl isothiocyanate respectively).

Conclusion and Future perspectives

The current *in silico* molecular docking based study reveals that benzyl isothiocyanate and phenyl isothiocyanate can effectively target the SARS-CoV-2 M^{pro} (Fig. 5). It would be exceedingly notable being confirmed *in vivo*. It is crucial to develop diagnostic tools, potential therapeutics and antibodies selectively for the COVID-19 proteins. Phytochemicals like benzyl isothiocyanate and phenyl isothiocyanate may be effectively prescribed to circumvent the current global scenario. Essentially, this study makes an attempt

to reveal simple phytochemicals like benzyl isothiocyanate and phenyl isothiocyanate which can be employed for designing novel therapeutics.

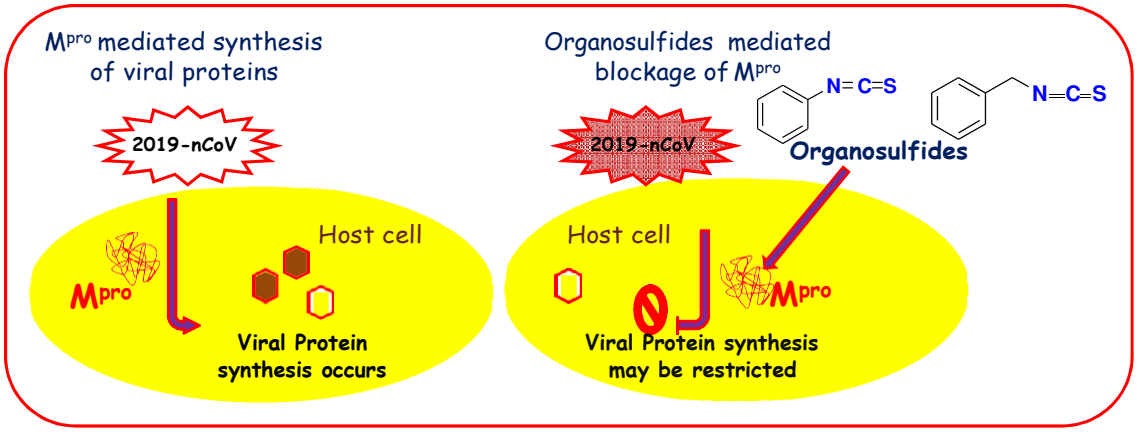

Fig. 5: Plant organosulfides act against the COVID-19 M^{pro}.

CRediT authorship contribution statement

Gagan Kumar Panigrahi: conceived the idea, performed the experiments, analyzed the results, wrote the manuscript, have read and approved the final manuscript before submission. **Kunja Bihari Satapathy:** conceived the idea, analyzed the results, have read and approved the final manuscript before submission.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Kaempferol: a potent phytomolecule against SARS-Cov-2

Gagan Kumar Panigrahi[1] and Kunja Bihari Satapathy[1]*
[1]School of Applied Sciences, Centurion University of Technology and Management, Odisha, India
*Corresponding Author's email: kunjabihari.satapathy@cutm.ac.in

Abstract

The emerging 2019 Novel coronavirus (2019-nCoV) threatens public health. 2019-nCoV is also referred to as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). Within no time 2019-nCoV emerged as a global risk and was declared as pandemic. Specific drug against the virus is yet to be discovered. Development of biomolecules for proficient treatment against severe acute SARS-CoV-2 is challenging. The solved crystal structure of SARS-CoV-2 main protease (M^{pro}) can be used as one of the primary target molecules and possible inhibitory ligands may be screened using *in silico* docking. Primarily phytochemicals can be screened to detect any potential bioactive molecules. *In silico* molecular docking revealed that the phytochemical, Kaempferol belonging to the flavanoid group of phytochemical may effectively binds to the active site of the SARS-CoV-2 main protease.

Keywords: 2019-nCoV, SARS-CoV-2, SARS-CoV-2 main protease, *in silico* docking, phytochemicals.

Introduction

Corona viruses are the group of viruses, which are able to cause diseases in both animal and humans. One of the best examples of previously known coronavirus is severe acute respiratory syndrome (SARS) and the virus strain is known as SARS-CoV. Further new strains of Corona virus are identified, known as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). This virus is responsible for causing coronavirus disease 19 (COVID-19). The new coronavirus has spread very rapidly in different parts of the world. The city of Wuhan was the epicentre where the outbreak of this human pathogen emerged, and resulted to human ailment, termed as COVID-19 (Chen et al., 2020, Huang et al., 2020). SARS-CoV-2 belongs to the beta corona-virus genus (Panda et al., 2016, Lu et al., 2020, Wu et al., 2020). On 11th March, 2020 the World Health Organization (WHO) declared that COVID-19 as a pandemic. A pandemic occurs when, the disease that people are not immune to spread across the large region. Countries including United States of America, Italy had largest outbreak outside China with increased number of infected people leading to death of individuals (Chen et al., 2020, Chan et al., 2020, Li et al., 2020). The pandemic ratio changes very rapidly with fresh data collected on the basis of chemical and serological characteristics of affected case being reported every day (Panigrahi et al., 2016, Panda and Sahoo 2016, Panigrahi et al., 2016). Crystal structure of the SARS-CoV-2 main protease (M^{pro}) proves to be an outstanding ground for screening specific ligands (Liu et al., 2020). Reportedly, M^{pro} and other known viral proteins infect the respiratory tract (Wrapp et al., 2020, Lung et al., 2020, Ton et al., 2020). Moreover, M^{pro} can also be an

effectual target to diminish the viral replications within the host cells since it facilitates the synthesis of functional viral proteins. Plants are enriched with tremendous defense response capabilities (Panigrahi and Satapathy 2020, Panigrahi et al., 2021). Elaborated defense mechanism(s) in plants need to be explored (Panigrahi and Satapathy 2020a, 2020b, 2020c). The phytochemicals are fundamentally bioactive compounds and has the potential to amend cellular physiology (Sahoo et al., 2020a,b). Here, we report that Kaempferol binds into the active site of the SARS-CoV-2 main protease as revealed by the *in silico* molecular docking and thus further studies may reveal the effectiveness of Kaempferol to be used as COVID-19 therapeutics.

Methods

Viral Protein Structure and Phytochemical dataset collection

The 3D structure of M^{pro} was accessed from Protein Data Bank accession 6M03 (Fig. 1). The SDF accession CHEBI:28499 corresponding to the Kaempferol (Fig. 2) was obtained and consequently both the protein and the ligands were used for *in silico* analysis.

Molecular docking

For the *in silico* molecular docking, BIOVIA's Discovery Studio docking method was used for molecular docking. The catalytic pocket of the M^{pro} protein was specified and targeted for binding of the ligand. -CDOCKER Energy and -CDOCKER Interaction Energy signify the affinity of the ligands with the protein receptors. Basically, high positive values of the -CDOCKER Energy, -CDOCKER Interaction Energy and a diminutive difference between the -CDOCKER Energy and -CDOCKER Interaction Energy are considered to be the most favourable (Behera et al., 2020, Das et al., 2020, Jena et al., 2020, Ray et al., 2020).

Results and Discussion

It was found that Kaempferol specifically binds to the active pocket of the SARS-CoV-2 M^{pro} (Fig. 3), as apparent from higher -CDOCKER energy and -CDOCKER interaction energy (Table 1). Since, simple active biomolecule like Kaempferol effectively binds into the active pocket of the M^{pro} under *in silico* conditions it is quite possible to design pharmacophore molecules based on the structural and functional identity of Kaempferol and eventually can be used in the pharmaceutical sector. Chemical synthesis of Kaempferol can be cost effective as compared to the isolation process from specific plants.

Table 1: -CDOCKER ENERGY and -CDOCKER INTERACTION ENERGY values generated for the interaction of Kaempferol with the active site of SARS-CoV-2 main protease (M^{pro}).

Ligand		Receptor		Interaction Status		
SDF accession	Phytochemical	Protein	PDB accession	Docking Result	CDOCKER ENERGY	CDOCKER INTERACTION ENERGY
CHEBI:28499	Kaempferol	COVID-19 Main Protease	6M03	POSITIVE	15.71	22.01

Fig. 1: 3-D Structure of the SARS-CoV-2 M^{pro} showing the active site of the protein.

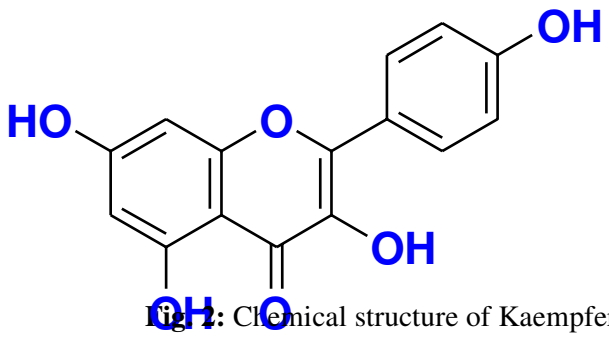

Fig. 2: Chemical structure of Kaempferol.

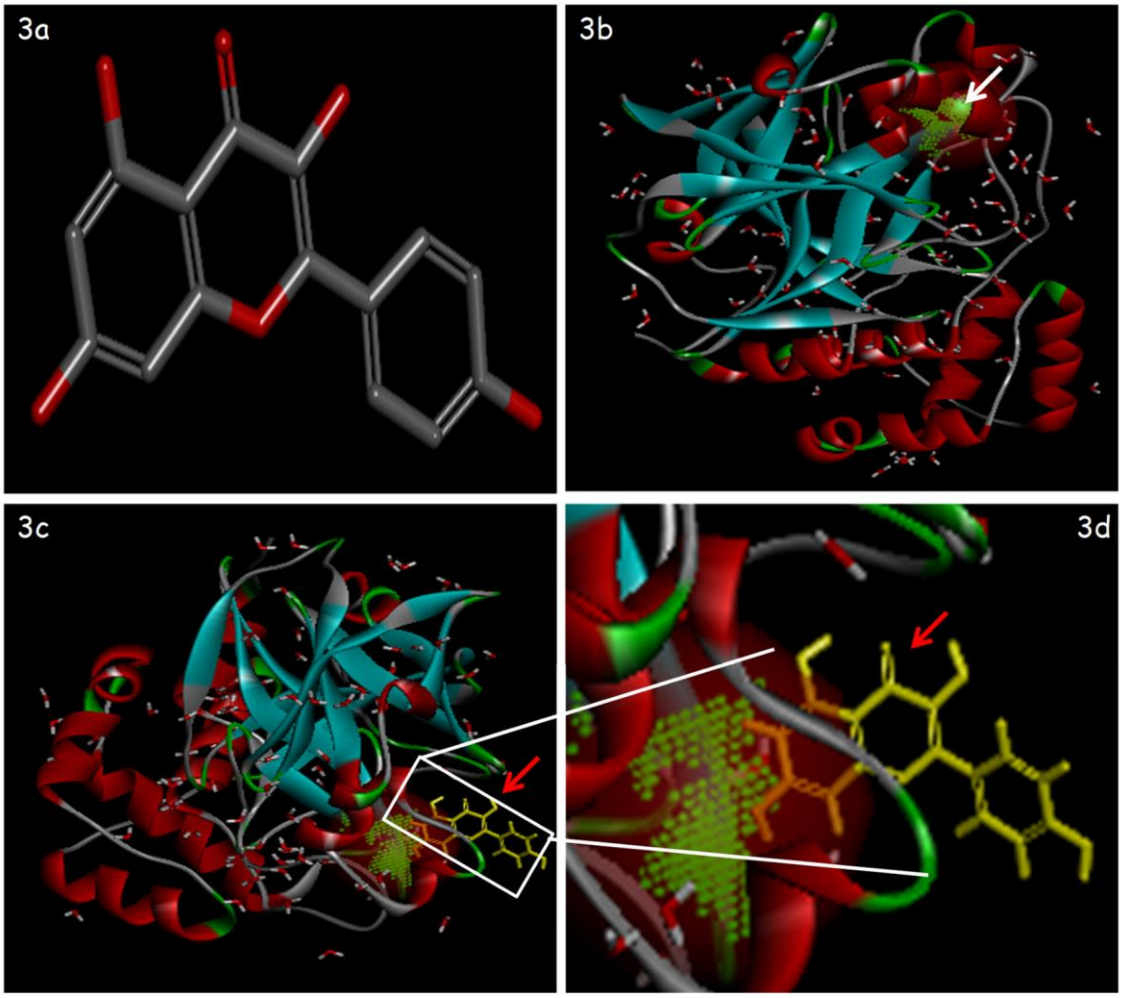

Fig. 3: The active site of the SARS-CoV-2 main protease (M^{pro}) interacts with Kaempferol. **3a:** Phytochemical, Kaempferol. **3b:** Free form of the M^{pro}. **3c:** M^{pro} associated with the ligand, Kaempferol. **3d:** Magnified image showing the association of the Kaempferol with the M^{pro}. (The white coloured arrow and the red coloured arrow indicate the active site of the M^{pro} and binding of Kaempferol respectively).

Conclusion and Future perspectives

Among the large family of corona viruses, about hundreds of these viruses circulate in animals. Among them only seven infect humans and cause symptoms of common cold. SARS coronavirus emerged in 2002 and was controlled by public health measures. But MERS which emerged in the year 2012, still exists in camels, it can also affect humans who come in contact with infected camels. The 2019-nCoV reported from the city of Wuhan, has now spread into more than 200 countries. The World Health Organization declared novel coronavirus outbreak "a public health emergency of international concern" on 30th January. On 11th March WHO declared COVID-19 epidemic a pandemic. The current *in silico* molecular docking based study reveals that Kaempferol can target the reported SARS-CoV-2 M^{pro} (Fig. 4). It is crucial to

develop diagnostic tools, potential therapeutics and antibodies selectively for the COVID-19 proteins. Pharmacophores developed from Kaempferol can be synthesized and may be effective against SARS- CoV-2 M^{pro}. Essentially, this study makes an attempt to reveal simple phytochemicals like Kaempferol which may be employed for designing novel therapeutics and hopefully blunt the spread of this deadly virus.

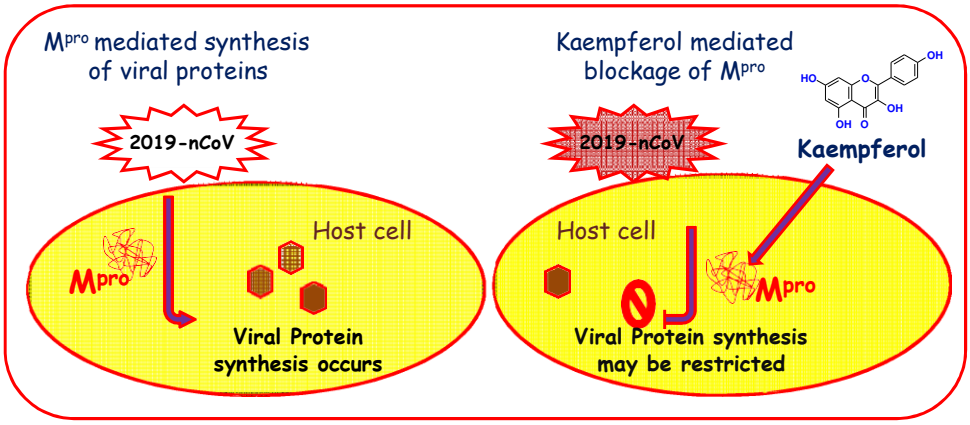

Fig. 4: Kaempferol inhibit the activity of COVID-19 M^{pro}.

CRediT authorship contribution statement

Gagan Kumar Panigrahi: conceived the idea, performed the experiments, analyzed the results, wrote the manuscript, have read and approved the final manuscript before submission. **Kunja Bihari Satapathy:** conceived the idea, analyzed the results, have read and approved the final manuscript before submission.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Nutritional content of five selected leafy vegetables

Kadambini Parida, Sagarika Parida*

Department of Botany, School of Applied Sciences, Centurion University of Technology and Management, Odisha, India

Email: *sagarika.parida@cutm.ac.in*

Abstract

Green leafy vegetables are obtained from a wide variety of plants and are known for its nutritional content. They are rich in fibers, minerals ascorbic acid and carotene which are required for maintaining the health. Leafy vegetables are consumed both in raw as salads or as cooked food. Regular intake of leafy vegetables also reduces different kind of diseases and strengthens the immune system. Leafy vegetables carry many minerals like Fe, Ca, P, Cu, Cl, Zn and Na and vitamins. This article reflected the information regarding the uses and nutritional composition of five rarely used leafy green vegetables viz. *Lactuca sativa* L. (Red variety), *L. sativa* L. (Green variety), *Brassica oleracea* L., *Anethum graveolens* L. and *Petroselinum crispum* (Mill.) Nym. Ex A. W. Hill.

Keywords: Chlorophyll estimation, nutritional content, leafy vegetables

Introduction

Vegetables are the eatable parts of the plants. They are consumed wholly or in parts, raw or cooked as part of main dish or salad. A healthy life can be maintained by eating green leafy vegetables daily because it contains fibers, minerals, vitamins, and different nutrients. Green leafy vegetables play a major role in human health. A healthy life style can be maintained by doing regular exercise and a well balance diet. Regular intake of leafy vegetables also reduces different kind of diseases. Leafy vegetables carry many minerals like Fe, Ca, P, Cu, Cl, Zn and Na and vitamins. Vitamins are major for human health and out of different vitamins, vitamin C is an essential micronutrients required for normal metabolic functions of the body. Vitamin C is water soluble antioxidant in human body. Vitamin C is also lowering the risk of developing cancers in breast, cervix, colon, rectum and stomach. Chlorophyll is an antioxidant. They are found in the chloroplast of green parts of plants. Generally it has been found in the area of green leaves, stems and flowers and is an essential element to the plants and it also has medicinal value (Jinasena, 2016). It is an important substance that can be used as nutritional approaches in decreasing blood sugar, in detoxification, in digestion, excretion and lowering the allergens. Assessment of nutritional values in

selected 9 herbs and one tree species of edible greens was reported based on chlorophyll content of leaves (Vivek et al., 2013). About 48 leafy vegetables were documented belonging to 38 genus and 26 families which are used by seven tribes of Odisha for fulfilling their nutritional requirements (Parida and Mahalik, 2020). The degree of consumption of different types of leafy vegetables depends on the eating habits (Dansi et al., 2008). Leafy vegetables are the good source of protein, vitamins and minerals (Aletor et al., 2002). Green leafy vegetables are the primery source of lutein and zeaxanthine (Burney et al., 2004; Singh et al., 2014) and these compouns are known to prevent eye diseases and cataract.. This article aims to gather the importance and nutritional content of t five types of rarely used cultivated leafy vegetables.

1. Red Leaf Lettuce (*Lactuca sativa* L.)

In the group of leafy vegetables *Lactuca sativa* L is one of the important crop. It is an annual and laticiferous plant and can be easily cultivated. It requires low temperature for the growth. It belongs to the family Asteraceae. It is medium to large in size, growing in elongated shape, and is narrow and small at the base fanning out to a wide, curly and loose top. The leaves connect to a central stalk, branch out in all directions and are tender, smooth and broad with curls and frills. The edges of the leaves are dark to bright green and as they transition into the juicy stalk the color changes to pale green or white. The leaves also have a mildly sweet or semi-bitter flavor. Nutritional qualities of lettuce vary depending on the variety but in generally they are rich source of vitamin K. Lettuce is reported to contain bioactive compounds such as folate, β-carotene, lutein and phenolics. Lettuce is a good source of fiber, iron, folate, vitamin C and therefore is also a good source of health beneficial bioactive compounds (Kim et al., 2016). Anti-inflammatory, cholesterol lowering and anti-diabetic compounds are present in different types of lettuce. Nutrient composition varies among lettuce types. It was reported that red lettuce contains more phenolic compounds in comparison to green leaf lettuce. β-carotene content was found to be higher in red leaf lettuce varieties (Mampholo et al., 2016).

Uses: Lettuce is consumed in both as raw and cooked. In cooked state it used in main dishes, soup. It is also used in salad.

2. Green Leaf Lettuce

Scientific name: *L. sativa* L.

Family: Asteraceae

It is annual or biennial herbaceous leafy vegetable belonging to the family Asteraceae. It is easily cultivated and for its growth it requires low temperature. Leaves of the leafy vegetables have a mildly sweet or semi- bitter flavour.

Uses: It is used in soups, salads, and sandwich for extra flavour and color. It is also used in main dishes.

Nutritional Values: *Lactuca sativa* L. is rich in vitamin K and vitamin A. Moderate amount of folate and iron is also reported to present. It was also reported that baby green lettuce contains vitamin C.

3. Kale

Scientific name: *Brassica oleracea* L.

Family: Brassicaceae

It is an herbaceous biennial or perennial plant and belonging to Brassicaceae family. Structure of the leaves is curly or straight, loose blue–green or purple in color and is easy to cultivate. It is cabbage like plant with no head. Four types of kale are present. These are Curly kale, Dinosaur kale, Redbor kale, and Russian kale. Curly kale is the common type and its flavor is pungent and peppery. Dinosaur kale has narrow green and wrinkle leaves, Redbor kale with ruffled leaves with variables colours from red to purple and the Russian kale has flat fringed leaves, which are green to red to purple colour with sweet and peppery flavor.

Uses: This leafy vegetables consumed in cooked form, stir fried, steamed, roasted and also eaten raw and also used in preparation of sauce (Anonymous, 2010). Some of the varieties of kale are grown for decorative ornamental purposes because it has attractive and brightly colored foliage.

Nutritional Values: Kale is rich in vitamin A, K, B_6 C and vitamin E, calcium, copper, manganese and phosphorus. Raw kale contains 33 calories and very less amount of carbohydrates of 7 grams, therefore it is considered as weight and diabetes friendly vegetables. Raw kale contains 84% water, 4 per cent of protein and 1 percent of fat. It is also a good source of riboflavin, thiamine and pantothenic acid [Wikipedia online source].

4. Dill

Scientific name: *Anethum graveolens* L.

Family: Apiaceae

It is an herbaceous annual plant and belongs to Apiaceae family. The plant is also known as dillweed and it has slender erect stems has soft and fiber like alternate leaves. The color of the leaf is blue-green and has sweet and grassy flavour. The plant has yellow flower. It is also an aromatic plant and can be easily cultivated.

Uses: Leaves of dill are used to make tea. It is used in soup for garnishing. It is also used in main dishes viz. fish and egg curry to add extra flavour. In addition to the culinary uses, it has been also used traditionally to treat different ailments like in curing digestive problem, reducing colic pain in infants and also used to reduce bad breadth.

Nutritional Values: Fresh dill is low in calories. It contains essential vitamins like vitamin A and vitamin C and also is a good source of manganese, iron and folate. Therefore it is an important leafy vegetable for maintaining the vision and promotes a healthy immune system. Apart from this it is also a good source of magnesium, potassium, copper, riboflavin and zinc.

5. Parsley

Scientific name: *Petroselinum crispum* (Mill.) Nym. Ex A. W. Hill

Family: Apiaceae

It is a biennial or perennial herbaceous plant which belongs to Apiaceae family. Plant has erect growth with hollow stem and dark green curled or flat leaves with yellow flowers, aromatic and is easily cultivated. Leaves are arranged in alternate manner on stem.

Uses: Essential oil of parsley flowers is used as a flavoring agent and the leaves are used in dishes for garnishing. Tap root of this plant is edible and used as vegetables.

Nutritional Values: This leafy vegetable is low in calorie content and saturated fat is also low. It is a good source of proteins, vitamin A, C, E and K, thiamine, riboflavin, pantothenic acid, phosphourus, iron, folate, niacin, pyridoxine, calcium, magnesium, manganese and zinc. Along with these vitamins and phytominerals, it also contains important phytonutrients like Carotene-β, Crypto-xanthin-β and Luteine-zeaxanthine.

Conclusion

This article will be valuable for the growers to choose the varieties of leafy vegetables to be grown based on the higher nutritional content. Based on the nutritional value these species can be cultivated to meet the nutritional requirements.

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Psychological Safety of Farmers

Chitrasena Padhy[1], Pakalpati Satyanarayana Raju[2], Rabindra Kumar Raj[3], Kalee Prasanna Pattanayak[4] and Ajay Kumar Prusty[5]

[1]Assistant Professor/Ph. D student, Department of Agricultural Extension, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India.

[2]Professor Emeritus, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India.

[3]Professor, Siksha 'O' Anusandhan (Deemed University), Bhubaneswar, Odisha, India

[4]Assistant Professor, School of Management, Centurion University of Technology and Management, Odisha, India.

[5]Assistant Professor, Department of Agricultural Extension, M S Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India

[1]chitrasenapadhy@cutm.ac.in, [2]profraju@cutm.ac.in, [3]raj_rabindra@rediffmail.com [4]kaleeprasanna@cutm.ac.in and [5]prusty.ajay@cutm.ac.in

Abstract

Mental health issues are affecting farmers, their families, and farming communities. Mental health is impacting their thoughts, moods, and behaviours. By simply looking at the face of a farmer, one cannot know whether he is happy. Keeping a positive attitude is very important. The farmers can learn new skills to cope with stress. Laughter helps for relaxation and well being. During laughter physical changes occur in the body and many organs are stimulated. Brain's natural pain killers are stimulated and the immune system is improved. Laughter can help in improving one's mood. Controlling events, attitudes, and responses are also important. Farmers should plan ahead. They should prepare a list of things to do beforehand. Farmers should focus on what is right and what is wrong. They should concentrate on the good in people. Talking to a family member, friend, or counselor is important. Farmers should learn to say 'no' before taking too many commitments. Saying 'no' can bring more control over life. Social support is essential for reducing stress, depression, and suicides. Managing time is also very important.

Key words: Laughter, mental health, mood, new skill, positive attitude, social support

Introduction

A book cannot be judged by its cover. By simply looking at one's face, it is dangerous to presume someone's welfare and farmer is also no exception to this. It may be far from truth to envisage the day-to-day farmer and picture someone as happy with crops or livestock. The status of mental health impacts one's thoughts, moods, and behaviours. Isolation of the farmers can create both physical and mental threats. When farmers are isolated, it brings both physical and mental threats. There are some additional stressors like financial strains associated with with land and equipment, poor return on capital. Increased regulation, natural disasters and uncertain weathering affect them (Megalac.com, 2019).

Stressors Affecting Farmers

Mental health issues are affecting one in four people every year. Illness rates among agricultural workers are 46% higher than among industrial workers and the most common illnesses among them are anxiety and depression. Farm Safety Foundation reported that 81% of farmers aged 40 said that mental health was the biggest hidden problem of farmers and 92% of farmers said that if farmers' lives are to be kept safe, promotion of mental health is very essential(Megalac.com, 2019).

In countries with sub-tropical weather, climate change is worser than in countries of other regions. The changes in climate greatly impact farmers' approach to farming. Although farmers have lot of experience and knowledge, they are getting confused by the changing weather patterns. Changing climate affects

adoption of newer technologies and causes monetary losses, cost or price squeeze, etc. (Bomma reddy, 2020).

Farmers generally seek less help than non-farmers for mental health (Staniford *et al.*, 2009). COVID-19 has shaken the farming communities. It has disrupted the supply chains and exacerbated the financial instability of many farm families. Due to this, psychologists and other mental health professionals are concerned about the undiagnosed mood disorders and substance misuse in farming communities. In the beginning, many farmers did not feel the impact of COVID-19 as said by Meg Moynihan, a dairy farmer and advisor at the Minnesota Department of Agriculture, as farm life takes place largely outdoors and is naturally socially distanced (Pappas, 2020).

Financial issues (91%), fear of losing the farm (87%), and farm or business problems (88%) are the factors affecting mental health of farmers. As a part of an obligation to their families and fore bearers, some people do farming. 91% of the rural adults say that mental health was important for them. Three fourths of the rural adults told that it is very important to reduce the stigma attached to mental health in agricultural communities (AFBF, 2019).

Some people do farming and run century old farms, where they are third, fourth or fifth generation farmers. They have a responsibility to their families and forbearers and maintain the farm for future generations. There are daily challenges in farming, such as fluctuating market prices, unpredictability over trade and tariff policies, ongoing consolidation of the farming industry, changes in weather, natural disasters, floods, droughts, pests, and diseases (American Psychological Association, 2020).

Mental disorders include a combination of abnormal thoughts, feelings, behaviours, and relationships with others (WHO, 2007). Mental disorders include depression, anxiety, stress, schizophrenia, bipolar disorder, and emotional/psychological distress. These have subsequent impact on health, social interaction, human rights, and economic consequences around the world (WHO, 2007). Farmers had increased levels of stress, anxiety, depression, and burnout as compared to general population norms as reported in a recent Canadian study (Jones-Bitton *et al.*, 2019). The most common mental disorders anxiety and depressive disorders are a reaction to the stresses of life. For no apparent reason, a person with anxiety disorder feels distressed a lot of the time. A person with depressive disorder experiences a long term depressed mood and finds loss of interest in activities otherwise enjoyable (Department of Health and Ageing, 2013).

Working in the agricultural sector is physically and mentally very demanding (Keating 1987; McCurdy *et al.*, 2000). More than 90% of the agricultural area is located in rural regions (European Commission, 2010) and in the European Union 78% farmers work alone (European Commission, 2012). Positive associations exist between poor social support and increased stress symptoms (Kallioniemi, 2013), depression (Booth *et al.*, 1999), and suicides (Malmberg *et al.*, 1999).

Stress Management Strategies

Some farmers have the ability to handle lot of pressure, but others have very little. Three key factors are identified by the researchers that make a differentiation between successful and unsuccessful stress managers. Individuals vary in capacity to tolerate stress. For a young farmer prolonged fatigue and exertion may be little stressful, but for an old farmer or for a farmer with a heart problem the same situation may be very difficult to cope with. Confident farmers can face emergencies, delays, and other problems, whereas farmers who are not confident may find them to be stumbling blocks. To tolerate stress, a part of the capacity is inborn, but some skills to counter stress should be acquired. Once one learns to cope with a stress, it becomes easy to face the same stressor next time. Feeling in control is very important. Successful stress managers know which stressors are out of their control e.g weather and stock market fluctuations and which stressors are within their control. Attitudes and perceptions determine the stress levels. If a dog is barking in the middle of night, one will feel more stressed than if a skunk wandered into the yard (NASD, 1999).

Laughing is very important. It helps for relaxation and well being. When one laughs, 17 muscles in the face relax, blood circulation improves, respiration increases, muscles in the abdomen are massaged, and

the brain's natural pain killers are stimulated through the release of endorphins (National Centre for Farmer Health, 2016).

The Australian Government and the University of Newscastle's centre for rural and remote mental health partnered to develop Farm-link, a program aimed to improve access to mental health services for the farming community (Perceval *et al.*, 2011).

Conclusion

The continuing tough economic conditions in agriculture have a serious effect on farm families and their rural communities. Chronic stress impacts their mental and physical well-being, and decision making. Agricultural Extension helps farmers, farm families, farming communities and businesses to remain strong to cope with stress and use planning tools for good decision making and create guidelines for future (University of Wisconsin-Madison, 2020). Life and work stress can be reduced by eating a well-balanced diet, keeping a positive attitude, exercising daily for 30 minutes, getting enough sleep, accepting stress as a part of life, clearly defining responsibilities, managing time efficiently, setting realistic goals, learning to relax, and spending time with family (Bean *et al.*, 2008).

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Development of immune boosters

Arjun Hansdah and Pradip Kumar Prusty
Department of Zoology, School of Applied Sciences,Centurion University of technology and management, Odisha
Mail id – pradipkumar.prusty@cutm.ac.in

Abstract –

Immune system havean vital role in defencing behaviour in our body system. Food enriched with different type of phytochemical and vitamin rich is to be ingested so as for maintanceof our immune system. I have summarized some of the basic things which is a primary knowledge and these are easy to access and can be found easily. I have mainly focused on plant extract such as fruits and also physical activity. Immunity is boosted so good enough if we take care of our diet. As far as the food intaking in our daily life is on balance or enhancive then immune system is balanced accordingly. Many researchers are trying to identify those particular antioxidants, vitamins, and other therapeutic agents which is useful in treatment as also replace vaccines etc .

Plant extracts are considered as best for therapeutic agents. Milk and its product are also best benefits for our immune system. We should maintain our sleeping pattern and maintain a regular diet so as it will keep awake our immunity always alert.

Regular Yoga and Exercise can cause our immunity to strengthen up so as we are exposed to different pathogens every day. Even if we are taking good diet but exercise are necessary. The fighting cell such as macrophages ,neutrophills, natural killer cells are the main barrier to antigens . Development of immune boosters simply confers to that the food which are beneficial to our health as so long it have the ability to treat diseases .

So we can simply say as healthy diet creates a healthy mind and healthy mind creates a healthy day.

Key features includes here is vitamins , minerals , fruits , dairy product , healthy life style.

Introduction-

Immune system is an excellence system working in our body which enables safe from various foreign antigens including virus, bacteria, parasites and allergens by fighting against them. but in order to maintain our health issue of our body system we have to emphasize on quantity and quality of food we intake . But now a days it is very important to focus on our immune system , and we have to boost in a such a manner that we can resist to different types of antigen.

Summary-

when we are supposed to protect ourselves from the virus from outside , we need to protect ourselves beginning right from within our body by strengthening the immune system . there are many factors that affect our functioning of the immune system. The healthy lifestyle involves eating nutritious food , practising hygienic habits, walking and exercising regularly ,maintaining good health and having adequate sleep .

A healthy body has a healthy gut. It is important to maintain a healthy gut which helps to prevent impaired digestion that can damage the vital organs like lungs causing respiratory failure. Recent research has proved that the gut microbes can be controlled with a good food regime and a healthy diet. Instead of following uncertified and unverified supplements , which don't have any scientific evidence , we should eating time tested foods routinely consumed by us .

Recommended foods rich in antioxidants and minerals to improve immunity-

Rich in vitamin A- cereals , legumes, green leafy vegetables .

Rich in vitamins B(B6 ,B9, B12)- cereals, legumes, fruit , nuts soy milks, dairy products fish , chicken and egg

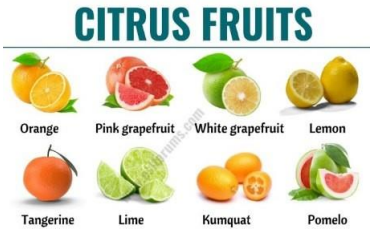
Rich in vitamin C – orange , lemon , guava , kiwi , gooseberry , cauliflower tomatos

Rich in vitamin E – nuts , green leafy vegetables and vegetables oil

Rich in vitamin D – egg ,fatty fish, milk and its products exposure to sun light

Rich in iron – cereals , legumes , dry fruits , fish and chickens
Rich in zinc – wheat germ, dried bean , nut , tofu , sea foods
Rich in selenium – cereals , nuts , mushrooms , meats
Rich in antioxidants –garlic , onion, ginger, green tea
Apart from above it is important to follow healthy life styles which involves , consuming nutritious foods , abstaining from alcohol, smoking , destressing with hobbies , adequate amount of sleep , exercise regularly .
These are the main immunobooster that keeps our body well and to be ingested in our daily diet routine .
Such as- 1.citrus fruit
2. red bell peppers
3. brocoli
4. garlic
5. ginger
6. spinach
7. yoghurt
8. almonds
9. sunflower seeds
10. turmeric

1. Citrus fruits
   When peoples are exposed to common cold most of them are turns straight to the vitamin c , as it has the capability to fight against infections thus by increasing the production of white blood cells .
   Popular citrus fruits such as- grape fruit , oranges , lemons, limes
   Because of your body doesn't produce or store it that's why you need constant vitamin c for continued health .
   Recommended amount for daily dose – 75 mg for women &90 mg for men



2. Red bell peppers
   Red ball peppers contains almost 3 times as much vitamins c (127) as a florida (45) and are rich source of beta carotene.
   Besides boosting the immune system it also maintain healthy skin by converting beta carotene into vitamin A , helps you to keep your eyes and skin healthy .

3. Broccoli
   It contains vitamin C , A ,E as well as fibres and many other antioxidants.

4. Garlic

   It adds zinc to food and great for health .It has recognized as for fighting against the infections. Garlic may also down hardening of the arteries , and there is a weak evidence that it helps lower blood pressure .garlic immune- boosting properties seems to come from a heavy concentration of sulfur containing compounds , such as allicin .

5. Ginger

   Ginger has so many benefits such as decrease inflammations , which can help reduce a sore throat and inflammatory illness also helpful in nausea.

   It also reduces choric pain and might even possess cholesterol – lowering properties.

6. Spinach

   It is rich in vitamin C – itsalso packed with numerous antioxidant and beta carotene ,which increases the infection –fighting ability of our immune system . spinach is healthiest when cooked as little as possible so that it retains its nutrients.

7. yoghurt
   plain yoghurt when loaded with sugar is good for taste as well as health .you can sweeten plain yoghurt yourself with healthy fruits and dizzle of honey instead. It is also a great source of vitamin D .

8. almonds
   vitamin E is as great as vitamin C as it is an powerful antioxidant and also key to an healthy immune system . It is an fat soluble vitamin and absorbed properly ,and found in nut such as almonds are best source.

9. Sunflower seed
   Sunflower seeds are full of nutrients , including phosphorous , magnesium and vitamin B6 and E. These are high in selenium which are also essential to us .

10. tumeric

this is also used for anti- inflammatory in treating both osteoarthritis and rheumatoid arthritis . cucurmin obtained from turmeric have great beneficial effect on our body.

EATING CAN BE THRERAPUTIC AND ENJOYBLE, IF YOU EAT THE RIGHT THING

- Tomates are the super food as it is delicious and cooked in many curry recipes due to the nature of adding flavour and taste in it. It contains lycopene which gives colouration and a good dietary source. It contains powerful antioxidants also an good scavenger of the free radical oxygen inside of our body .lycopene contains phytochemical which can inhibit the cancer growth . tomato sauce are good for Mediterranean diet . the main benefits include that it can prevent the prostate cancer .it is been reported in a study that consistent intake of tomatoes are protective and effective against the digestive tract cancer and also 50% decline in cancer related death rates. Out of 35 case studies it is found that regular intake of tomatoes benefited against cancers of the pancrease ,colon , rectum , oesophagus ,breast, cervix etc. An 83% reduction in prostate cancer was observed with person having high concentration of lycopene in blood plasma than that of person lack of such concentration .

  Lycopene source- tomato sauce, tomato juice .

  Other benefits as such it is rich source of vitamin C, potassium and silicon . potassium lowers blood pressure and silicon thickening of skin
- Grapes are sweet and also having great healing power. they have great pharmacological properties as it contains polyphenols it have some great properties such as they inhibit oxidative stress and show a potent anti – radical effect , they inhibit uncontrolled cell proliferation . Also grapes can combat the cancer . great hunger fighters also maintain blood sugar level. Resveratrol found in grapes helps in increasing life span , reduce platelets clotting . Resveratrol contains polyphenols which effective against the microorganism .Resveratrol have growth stimulatory effect of linoleic acid .
- Nuts are healthy food containing healthy fats. In-fact nonetheless , almonds and other nuts are important for health benefits even if it is usually scared by west dietician for intaking those nuts . these are also called as little power house as it provides strength enough if we consume daily. Nuts contain magnesium which is a powerful mineral that is linked with 325 different enzymes reaction in our body .In addition to it also contains riboflavin , which helps body cells create energy from carbohydrates , protein etc and niacin which keep our digestive system healthy and keep skin and nerve healthy . nuts contain omega -3 fatty acid which are actually disease fighter .

- Apples are a natural source of health promoting phytonutrient , a plant based antioxidant that promotes bone health. Apples combat intestinal infections ,inflammation and overly acidic stomach .It reduce appetite , cleanser of liver gallbladder and colon .
- Sweet potatoes contains antioxidants , key tools in the fighting disease. Popeye contains antioxidants that neutralize the free radicals .
- Pomegranate is also a good fruit which helpful in boosting immunity so as to fight against the viral pathogens.
- Oatmeals are considerd to be healthy breakfast as long as it have good fibres that maintains the LDL . It is a natural way to increase the serotonin level in blood which is a hormone that regulates sleep , mood , temperature , sexual behaviour and appetite.
- Flex seeds are more than good fats because they are polyunsaturated fatty acid . These are playing a role in fibre consumption .Also these are great in dealing with menopause. It also have antioxidant and reduce the serum cholesterol .
- Yoghurts are the best when it comes to gut immune system . it contains goods protein , calcium ,potassium boost our immune system. It is also a good source of probiotic which manage fod allergy , strengthen our gut immunity and improve digestion by adding good bacteria .

ROLE OF HERBAL MEDICINE IN BOOSTING IMMUNITY

- Herbs are used as medicine in many ways in human beings in their life. In different herbs , a wide ranging of phytochemicals have been identified as the flavonoid , lignans, terpenoids , sulphides , plant sterol .Many pant potent antioxidants against chronic disease.
- The plant rich in flavonoid , vitamin C can boost our immunity and also have anti inflammatory action . It can promotes increase phagosytosis , activity of lymphocytes. A garlic have the potent of stimulates the production of natural killer cell , also improve our homeostasis and also have therapeutic effect.
- Many herbs contain a wide range of phytosterol , saponin , flavonoid , carotenoids, which have been isolated from fruits and vegetables are chemo-protectives.these beneficial substances act as antioxidants and electrophile hunter ,, stimulates immune system, inhibit hormonal action for cancer . In herbs ,terpenoids present in are effective against environmental stress and provide repair mechanism for injury. Natural product s represent a rich reservoir of potential of small chemical molecules exhibiting antiproliferation and anticancer properties . From 1982 to 2002 most of the chemical compounds were derived directly or indirectly from natural product .It is believed that plants have launched terpene based host defence during evolution which also shows a cornucopia of effective remedial compounds for common human disease .And at last it is hence can be concluded that medicinal herbs are potential candidates for anticancer and immune boosting therapeutic drugs .

Heavy strenuous workout should be done and also do some yoga inorder to keep yourself healthy ,
Some of yoga as such anulambilum , bhramari pranayama are good for our respiratory system and improve brain functioning .
Other type of way to boost the immune systems –
Learm healthy cooking and eating fruits , fixed meal time , reduce eating of sugar rich food such as ice cream sweets chocolates frizzy drinks , energy and sports drink, keep urself hydrated .

Have positive mind , handle stress in positive way through meditation , yoga , exercise , workout , reading developing hobbies

Improve digestion here by reduce the chance of chorionic disease.seven to eight hours of sleep is essential for us as sleep is essential for us as sleep deprivation significantly weakens our immunity .

Present scenario (during covidpandemic)-

During this stressful covid pandemic situation the doctors recommends us for improving the immune health . as there is no cure for this disease has been found till yet that's why only the prevention can be done in this situation .

As the reseaech for cure for this disease is still on going we must improve our immune health.The novel corona virus is responsible for this serious disease ,as it is directly affect the lungs leads to difficulty in breathing. In this serious condition we should intake food such as kadha , chamnprash in our daily food diet . This is the only way to keep our body proper immunized . So consulting with dietician we add this food in our diet . Social distancing , masking while going outside these can prevent the virus to enter our body through nose ,mouth ,but we have to make sure that we also have good immune system .So now a days these immune booster plays a vast role in defensive against these virus as stonger the immune system weaker the effectiveness of corona disease if being infected .

Safety measures –

All vegetables and fruits to be washed thoroughly , rinse the chopping knife , utensils used while cutting

raw meats ,chicken and fish .

Stay home , stay healthy, stay positive and spread the positivity.

Conclusion -

Immune system can be maintained through proper diet , healthy thinking , execise regularly. For the athletes and bodybuilder they have to check out there fat gain during the pandemic period .some of guidelines are-

- Avoid sugar and fat rich foods
- Switch to low fat milk , curd,
- Vitamin and mineral rich fruit should be intake
- Avoid deep fried food
- Do regular exercise.

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In-silico Identification of Metal Transporter Genes from Mycobacteria Sp.

Nimisha Repaka[2], Jai Satya Gowri Gogada[1], Praveen Boddana[3], Shanti Kumari Lunavat[4], Surya Satyanarayana Singh[4], Prakash-Babu Phanithi[2] and Raghu Gogada[1,2*]

[1]Department of Biochemistry and Plant Physiology, [3]Department of Plant Pathology, M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Odisha, India.

[2]Department of Biotechnology and Bioinformatics, School of Life Sciences, University of Hyderabad, Hyderabad, India

[4]Department of Biochemistry, University Collage of Science, Osmania University, Hyderabad, Telangana, India.

*Correspondence author: raghu.gogada@cutm.ac.in

ABSTRACT

Mycobacterium is immovable; induce aerobic, acid-fast gram-positive bacilli with high genomic content (59-66%). In the operon structure frequently establish for the genes of three molecular components: the ABC-binding protein, the membrane protein, and the substrate-binding protein, the rates of multidrug resistant and metal ions. The main objective of this study was to analyze the metal ions from five *Mycobacterium* species and to recognize the metal transporters with "Genomic Island" associated features, Insilico analysis allowed identification of metal and drug transporters, phylogenetic analysis, genomic island path analysis, prediction of interacting metal ions & 3D structure, domain analysis & for the NiCoT metal transporter from *Mycobacterium tuberculosis.* Interestingly, many genes showed specific expression profiles that might suggest a role in accumulating metals in an organ specific manner. These data are the first results of a big frame project that aims to accelerate the prioritizing of gene candidates that control element accumulation by taking advantage of high-throughput. The present *Insilico* study reveals the complete suite of NiCoT Metal Transporter in *Mycobacterium tuberculosis* H37Rv, which is involved in urease enzyme activity and biological function. The STRING analysis defines that the functional partners involved in transport of metal ions. While high expression yields of membrane proteins remain significant bottleneck for many proteins.

INTRODUCTION

In recent years the complete genome sequences of versatile organisms from the three domains of life are rapidly accumulating. "It is now possible to attempt to reconstruct and analyze a complete set of biochemical reaction pathways that an organism adopts, especially on the transport, synthesis, and degradation of specific chemical compounds. Through comparative studies, metal ions play a life preserve role in prokaryotic metabolism. Biological management of metal ions is skilled by a complex interplay between metal ion and drug transporters (transmembrane importers, transmembrane exporters) and their

regulatory components. *Mycobacteria* belong to the family *Mycobacteriaceae* and are members of the CMN group (*Corynebacteria, Mycobacteria and Nocardia*). The families *Mycobacteriaceae* are Gram-positive, immobile, catalase-positive have a rod like to filamentous morphology and it could be pleomorphic. As a group, they produce characteristic long chain fatty acids termed mycolic acids. *Mycobacteria* are acid-fast rods of variable appearance, approximately 0.2 - 0.6 by 1-10 micrometer. The genus *Mycobacterium* consists of 127 species according up to the minute approved list of bacterial species. *Mycobacteria* arranged into four groups according to the Runyon classification:

- Photochromogens: slow growers and form pigment when exposed to light. (e.g.: *M. kansasii, M. marinum, M. simiae*)
- Scotochromogens: slow growers and form pigment in the dark (e.g., *M. scrofulaceum, M. szulgai, M. gordonae*)
- Non-photochromogens: slow growers and not pigmented (e.g., *M. malmoense, M. xenopi, M. avium*-complex, *M. ulcerans, M. haemophilum*)
- Rapid growers: fast growers. (e.g., *M. fortuitum, M. chelonae, M. abscessus*)."

Most slow-growing species have been associated with disease in humans while only few species of group 4 are disease associated. The identification of a new species was conventionally based on the description of the Runyon classification, the biochemical properties of the strain(s) and the degree of DNA-DNA hybridization. Taxonomically, *Mycobacteria* are the single genus within the family of *Mycobacteriaceae*, in the order *Actinomycetales*. It includes pre-nominal micro-organisms and they are traditionally differentiated on the basis of phenotypic characteristics, culture properties that help to separate among various species of *Mycobacteria*. It is also a leading cause of infection in various domesticated animals and wildlife. The *Mycobacterial* cell envelope, which is an analyzable tripartite structure containing a high proportion of lipids (approximately 30% to 40% of the total weight) could play an essential role in the adaptation of *Mycobacteria* to intracellular growth and survival, immune modulation and drug resistance. The availability of complete genome sequences of 5 species namely *Mycobacterium avium* K-10, *Mycobacterium leprae, Mycobacterium bovis* AF2122/97, *Mycobacterium tuberculosis H37Rv, Mycobacterium smegmatis str.* MC2155 provided an opportunity to analyze the metal transporters and multidrug transporters. Secondary transporters from the NiCoT family are able to uptake either both Ni and Co, or prefer only Ni ions. NiCoT's are widespread among bacteria and found in some Archaea and fungi. Substrate preferences correlate with the genomic localization of NiCoT genes adjacent to clusters of

Ni/Co -dependent enzymes and enzymes of B12 biosynthesis, as well as with the presence of Ni or B12 regulatory sites upstream.

METHODS

Compilation of metal and multidrug transporters: The genome sequence information of five sequenced species *M. avium* K-10, *M. leprae, M. bovis, M. tuberculosis* H37Rv*, M. smegmatis str.* MC2155 in this study were employed in this study were selected from Transport Database. Transport Database, a relational database describing details of a comprehensive IUBMB approved classification system for transport proteins known as classification of enzymes. Web accessible, curated relational database containing sequence, classification, structural, functional and evolutionary information about transport systems from a variety of living organisms. It offers several tools specifically designed for analyzing the unique characteristics of transport proteins and serves as a genome transporter- annotation tool. In order to search for homologs of a transporter family the best-composed hit was used in a subsequent BLASTP search against the five genomes and retrieved the members. From the compiled sequences Phylogenetic trees were constructed for substrate specific transporters individually and through analyzing the aligned sequences conserved domains for individual metal ion and drug transporter were reported, protein search was also carried out with retrieved homolog's using CLC Sequencer database version 6.9.1. (9) For some of the specific Nickel secondary transporter and Cobalt transporters orthologous and paralogous sequences were obtained using KEGG database and Phylogenetic trees were generated for them (KEGG database). Transmembrane helix prediction for the membrane transporters was performed using Transmembrane Hidden Markov Model (TMHMM) version 2.0. Genomic location and gene organization search was carried out using ISLAND PATH analysis (11, 35 and 36).

Protein Sequence Analysis: CLC Workbench has employed to analyze the metal transporter and multidrug transporter proteins. The protein sequences are collected and aligned to identify regions of similarity that may be a consequence of functional, structural or evolutionary relationships between the sequences. Conserved domains are identified by using Motif Search in KEGG database. The conserved motif in the ATP dependent transporter's membrane domain "LSGGQ" has been identified. This domain is the signature sequence for the ABC transporter proteins (9, 35 and 36).

Phylogenetic Analysis: Phylogenetic analysis is an illustration of the evolutionary relationships among a group of organisms. "It was performed with the characterized prototypes using CLC protein workbench. For this analysis, multiple sequence alignments (MSA) were produced using progressive alignment algorithm. The generated pair wise alignments were used for finding the evolutionary distance between the pairs. Pair wise distances thus calculated was used to create a Phylogenetic tree-employing neighbor joining (NJ) algorithm with 1000 bootstrap replicates" (9, 35 and 36).

Island Path Analysis: *Mycobacteria* species are ecologically diversified organisms habituated to grow in host-associated environmental conditions and some are multiple. In the five species named above except *Mycobacterium leprae* all are host-associated and it is multiple. Organisms to get acquainted to specific niche, they need to meet the requirements to survive in that conditions. Horizontal gene transfer mechanism is involved in the achievement of essential needs. "Island Path Analysis was used for the detection of metal and drug transporters acquired through HGT. After generating the complete inventory of metal and drug transporters, we inspected the genomes of five *Mycobacterium* species with island path software (IPA version 1.0 tool) for the identification of those transporters located in GI's or exhibiting GI associated features like anomalous %G+C, dinucleotide bias above 1 STD DEV, presence of RNA genes (tRNA, rRNA genes) and mobility genes (transposons, insertion sequences). A pre-nominal GI can be identified with certainty by the presence of eight or more consecutive ORF's with dinucleotide bias alone or dinucleotide bias plus a mobility gene in proximity" (1).

Identification of Metal Ion transporters and their Sub cellular localization: The protein transporter has transmembrane helices which are identified using a tool TMHMM (Trans Membrane prediction using Hidden Markov Models) an option present in Transport DB. The transporters with transmembrane helices are then subjected for the identification of protein sub cellular localization using PSORTdb (http://db.psort.org/). It is a web accessible database of SCL for bacteria that contains both information determined through laboratory experimentation and computational predictions (11).

Prediction of Interaction and interacting partners of the metal ion transporters: The Nickel & Cobalt metal transporters are the major constituents in urease enzyme & many biological functions. The protein-protein interactions are studied using STRING database (http://string-db.org/). It is pre computed "global resource for the exploration and analysis of the associations. Since the evidence differs conceptually, and the number of predicted interactions is very large, it is essential to be able to assess and compare the significance of individual predictions. Thus, STRING contains a unique scoring-framework based on benchmarks of the different types of associations against a common reference set, integrated in a single confidence score per prediction" (12, 35 and 36).

Prediction of 3D Structure and Domain analysis: After STRING analysis, the NiCoT transporter which is involved in transport of Nickel efflux are subjected to Homology Modeling and their 3D models are generated by selecting the reliable template using Swiss-Model (http:// swissmodel.expasy.org/) (13). The SWISS-MODEL template library provides annotation of quaternary structure and essential ligands and cofactors to allow for building of complete structural models, including their oligomeric structure. The 3D structures that were built are subjected for verification using RAMPAGE (http://mordred. bioc.cam.ac.uk) and active domains are analyzed using ProDom (http://prodom.prabi.fr) (1).

RESULTS AND DISCUSSIONS:

From Genome to Metal and Drug Transportome: Based on the global features of five *Mycobacteria* genomes we could draw a comparison among the genome size, total number of genes, transporter proteins, G+C content (%), total number of metal transporters, total number of drug transporters. Among the five species *Mycobacteria smegmatis* has largest genome size and *Mycobacteria leprae* has smallest genome size in comparison. Among the total metal and drug transporters *Mycobacteria smegmatis* has the highest number of proteins when compared with *Mycobacteria leprae*.

Topology	*M. avium K-10*	*M. bovis* AF2122/97	*M. leprae*	*M. tuberculosis* H37Rv	*M. smegmatis* MC2155
Genome size(bp)	4829781	4345492	3268203	4411532	6988209
G+C content (%)	69.39	65.47	59.70	65.47	67.48
Total no. of genes	4350	3920	1605	3999	6716
Total Transporter Proteins	170	153	56	148	423
Total Metal Transporters	23	20	7	12	42
Total drug Transporters	27	26	3	31	156
Selected Metal Transporters	19	14	6	11	19

Table 1: Global features of five representative *Mycobacteria* species

Based on membrane transporter database (Transport DB) we compiled the metal and drug transportomes for the alkaline earth metal (Mg2+), transition metal ions (Zn2+, Mn2+, Cu2+, Ni2+, Co2+), and heavy metal (Cd2+) in five species of *Mycobacteria.*

Metal Transporter Type/ Family	Number of Transporters				
	M. avium	*M. bovis*	*M. leprae*	*M.tuberculosis*	*M. smegmatis*
ATP- Dependent	11	9	3	8	12
ATP-Binding Cassette (ABC Superfamily)	9	4	2	2	9
P-type ATPase (P-ATPase) Superfamily	2	5	1	6	3
Ion Channels	1	1	1	0	2
CorA Metal Ion Transporter	1	1	1	0	2
Secondary Transporters	5	2	2	1	2
Ni2+ Co2+ Transporter family	1	1	0	1	0
Metal Ion Transporter family (Nramp)	4	1	2	0	2
Unclassified transporter	2	2	0	2	3
Mg2+ Transporter-E family	2	2	0	2	2
Peptidoglycolipid Addressing Protein (GAP) family	0	0	0	0	1

Table: 2 Comparative analyses of Metal Transporters

From the above analysis we were reported that *M. smegmatis* has the highest no: of ATP dependent transporters (12 ATP dependent metal & 28 drug transporters) among the group and secondary metal transporters are high *in M. avium* (5) and drug transporters in *M. smegmatis* (128). Ion channels and also the unclassified transporters are very less in number in all the group members and they are identified in metal transporters.

Multidrug Transporter Type/Family	No. of transporters				
	M. avium	*M. bovis*	*M. leprae*	*M. tuberculosis*	*M. smegmatis*
ATP-Dependent family	11	8	2	10	28
ATP-Binding Cassette (ABC) Super family	11	8	2	10	28
Secondary Transporter	16	18	1	20	128
Drug/Metabolite Transporter family	2	0	1	1	15
Major Facilitator Super family	14	18	0	18	95
Resistance-Nodulation-Cell division (RND) Super family	0	0	0	0	17
MOP Super family	0	0	0	1	1

Table: 3 Comparative analyses of drug transporters.

Salient Features of Metal and Multidrug Transportomes: Apart from the Transporter Database the protein information is provided in *Mycobacterium* database as well as in Transport DB of Tuberculosis Database. The up to date information is maintained and updated if any new protein is identified. The metal ion transporters and multidrug transporters are identified in all five species mentioned above and conserved motif domains are also identified for these respective species. Dataset cataloguing and multiple sequence alignment of the sequences helped us to find the unique signature sequences. The major finding of our study is that there is only three Nickel transporters from three species found among all the organisms from the ground and it is secondary transporter belongs to Ni2+Co2+ transporter family. We have mainly focused on Nickel-Cobalt metal ion transport and multidrug transporters. The nickel-cobalt metal ion is identified in three species of selected five species. It is identified in *Mycobacterium bovis* (Mb2881), *Mycobacterium tuberculosis* (Rv2856) *and Mycobacterium avium* (MAP2924).

As of now up to date the main motif is identified in Nickel-Cobalt is "HAFDADH" in second transmembrane helix. But when compared to these three species we have identified the main motif "HAFDADH" in third transmembrane helix and also other three conserved motif regions are identified in sixth, seventh and eighth peaks of transmembrane helix. The proteins were collected and by using Motif search from KEGG database motifs are identified and by using TMHMM version 2 software the conserved domain motifs are confirmed by analyzing the transmembrane helix regions.

"VGFLFGLGFD" – in sixth peak,
"IDGSFMNAYGWAFS" – in seventh peak and
"LGGLDLNTVG"- in eighth peak.

In fourth and fifth transmembrane helix the conserved motifs are identified but around 95% identity. In these two conserved domain motifs one of the amino acid sequence is 99% identity. "SSTLHHYTG"- in fourth peak and "LEQQLDNRGL" – in fifth peak.

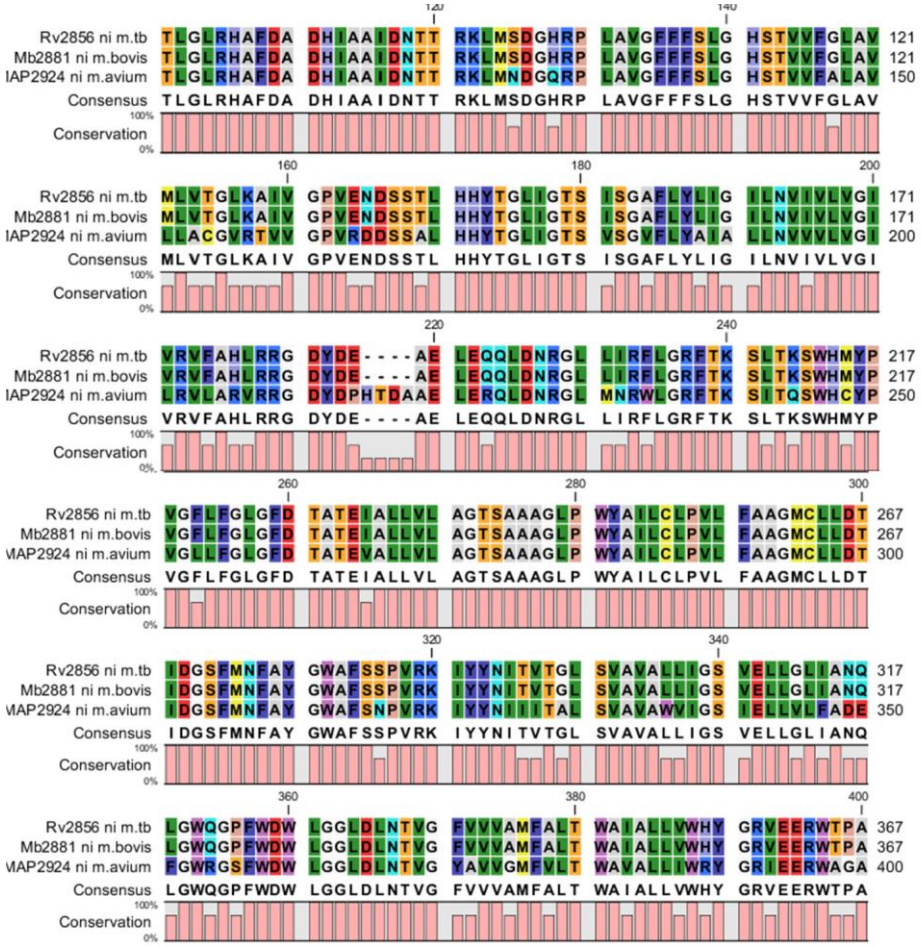


Fig.1: Multiple sequence alignment of nickel transporters from *M. avium, M. bovis, M. tuberculosis*

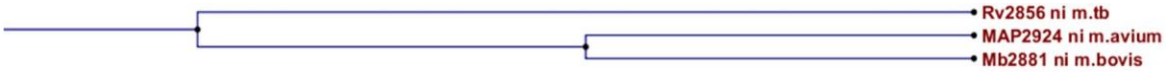
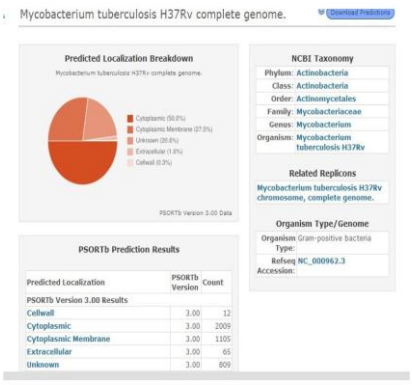


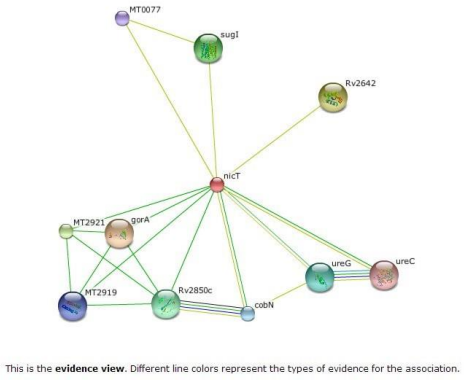
Fig.2: Phylogenetic tree construct of nickel transporters from M. *avium, M. bovis, M. tuberculosis* using CLC Workbench Software

The multidrug transporters are aligned using CLC Workbench Software and ClustalW and Phylogenetic tree is also constructed. Horizontal gene transfer effect plays an important role in the acquisition of the requirements to adapt to specific niche conditions. Island path analysis tool is used to analyze Genomic island associated features of metal ion transporters for 5 *Mycobacterial sp.* Thus, island path analyzer gave us the clear idea on the no. of metal ion transporters acquired through HGT mechanism in the *Mycobacterial* sp. (10)

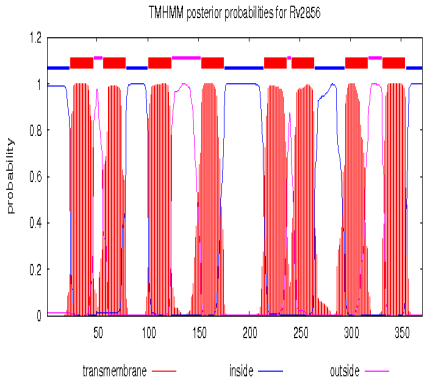
The NiCoT (Rv2856) metal transporter with its sub cellular localization is identified from Transport DB and PSORTdb respectively. From the above-mentioned data, the protein is subjected to STRING analysis and their interactions and interacting partners are identified. The interactions indicate their functional protein partners are involved in the mechanism of transport of metal ion are interacting with each other.

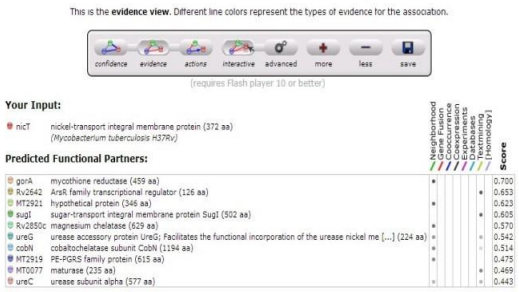
STRING database analyzed protein is subjected to Homology Modeling & 3D structures are relied which are generated using the template from Swiss Model tool. The structures are validated using RAMPAGE and its function & domains are identified using PRODOM. From this analysis it is clear that the NiCoT protein transports the metal ion as their functional domain is Secondary Transporter.

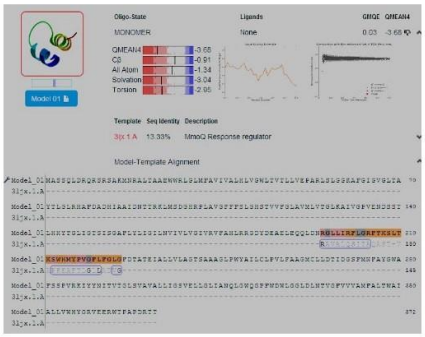


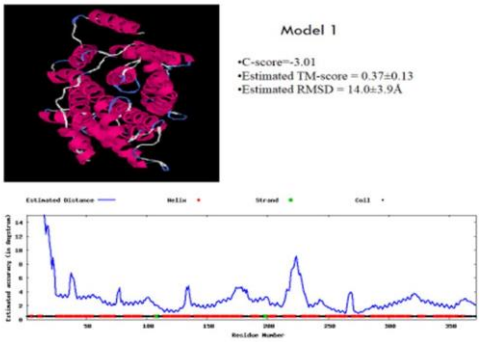


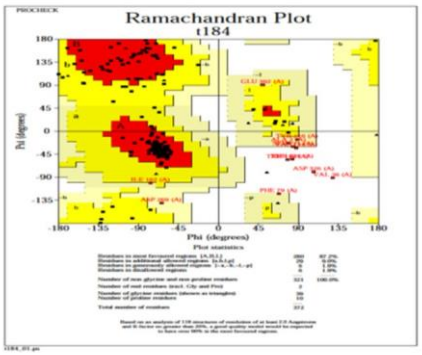
This is the **evidence view**. Different line colors represent the types of evidence for the association.

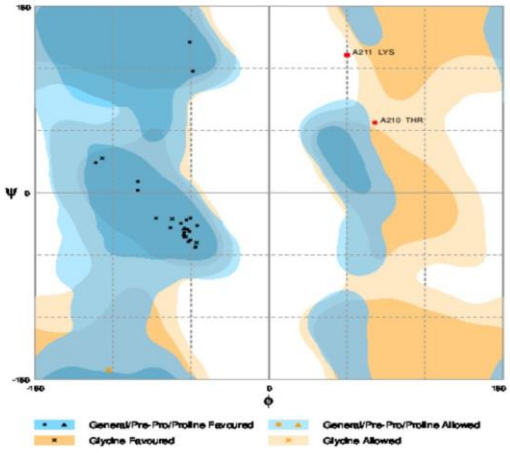






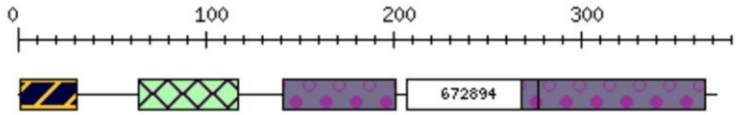






RAMPAGE VALIDATION

Swiss Modelled protein



ORF FINDER

CONCLUSION:

In this study we have performed a dataset cataloguing for 69 metal and 243 drug transporter proteins from five *Mycobacterial sp.* This is the comprehensive genomic comparison of metal transporters, providing potentially important insights into the fundamental molecular aspects and novel facets of *Mycobacterial* metal transporters.

Transition metals Nickel and Cobalt are essential components of many metalloenzymes. Ni-dependent enzymes are urease, [NiFe] hydrogenase, [Ni] superoxide dismutase, CO dehydrogenase, and methyl-CoM reductase. In the form of coenzyme B12, cobalt plays a number of crucial roles in many biological functions. Also, there are some noncorrin-cobalt-containing enzymes (e.g. nitrile hydratase). Synthesis of Ni / Co enzymes and coenzyme B12 requires high-affinity uptake of the metal ions from natural environments where they are available only in trace amounts. Ni and Co uptake in bacteria is mediated by various secondary transporters and by at least two different ATP-binding cassette (ABC) systems. It is thought to be involved in transport of nickel across the membrane responsible for translocation of substrate across membrane. For the urease enzyme activity nickel metal ion is used as a co-factor and vitamin B12 enzyme activity cobalt ion is used as a co-factor. The present *in-silico* study reveals the complete suite of NiCoT Metal Transporter in *Mycobacterium tuberculosis* H37Rv, which is involved in urease enzyme activity and biological function. The STRING analysis defines that the functional partners involved in transport of metal ions.

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Natural Antioxidants and its application in traditional Indian dairy products – An Overview

Soma Maji[1*], Mitul Bumbadiya[2], Sukthija M.P.[3]

[1]Assistant professor, Centurion University of Technology and Management, Odisha, India
[2]Assistant Professor, College of Dairy Science, Kamdhenu University, Amreli, Gujarat
[3]Assistant professor, Vignan University, Guntur, Andhra Pradesh
*Corresponding author email: soma.maji@cutm.ac.in

Abstract

Natural antioxidants have been suggested to have beneficial effects on human wellbeing and various disease conditions such as cardiovascular diseases, neurodegenerative disease, diabetes and cancer. The application of antioxidant products for various diseases by natural plants has ancient origins, long before modern synthetic medicines and antioxidants have been created. The ability of natural antioxidants to scavenge reactionary oxygen species (ROS) against oxidative stress has been attributed to several of the biological activity. Milk products, due to their possible antioxidant activities, are the most promising and fascinating foods. The most commonly consumed food in Indian countries are the traditional dairy products such as paneer, chhana, sandesh, dahi, lassi, ghee, butter and so on. Fortified natural antioxidants may enhance their nutritional and therapeutic values in milk products.

Introduction

Rapid urbanisation and industrialisation in developing countries such as India have led to drastic lifestyle change leading to life style related conditions on the social and economic fronts. Because of the appearance of numerous life style related health conditions, the study of functional foods complemented by functional constituents or substances is increasingly concerned. Other than their nutritional value, functional foods provide a health advantage. Functional foods contain bioactive compounds that provide the health and well – being benefits of functional foods.

Herbs were widely used for centuries as food and medicine. It has reported a broad range of active plant compounds such as flavonoids, terpenoids, ligans, sulphides, polyphenols, carotenoids, coumarin, saponins, plant sterols, curcumins and phthalides. Recently, research interests have centred on many herbs which may be useful adjacent in reducing risks of cardiovascular (CVD) and cancer diseases that have hypolipidemic, antiplatelet, anti- tumour or immune stimulation properties (Hussain *et al.* 2015). Today, industry is very interested to use these herbal bio-actives for the variety of ways that the medicinal benefits of herbs could be transmitted as carriers through certain foods. Milk and milk products are one of the most significant sources and can be used as carriers for such foods (Sawale *et al.* 2013). A large quantity of milk is used for the manufacturing of Indian dairy products. Converting liquid milk into

standard milking products retains milk solids not only for a longer period of time but adds value of milk as well. Indian conventional milk products have enormous demand and well-developed domestic markets. The inclusion of herbal bio-actives in traditional Indian milk products not only allows the industry to meet the growing demands of customers for such foods but also helps to compete with increasingly functional food markets around the world. Research to trigger and/or enhance the functionality of many conventional dairy products has been conducted.

Major group of antioxidants

A. **Carotenoids:** This group of antioxidants contains mainly beta carotene, lutein, zeaxanthin and lycopene. These compounds help in neutralizing free radicals, bolsters cellular antioxidant defences, maintains healthy vision and also prostate health. The source of beta carotene is carrot, spinach etc.; source of lutein, zeaxanthin is kale, collards, corn, eggs and citrus fruits and source of lycopene is tomatoes and processed tomato products.
B. **Flavonoids:** This group contains anthocyanidins, flavanols—catechins, epicatechins, procyanidins and flavanones compounds. These compounds help to boost cellular antioxidant activity, maintain brain function, heart health and neutralize free radicals etc. Source of anthocyanidins is berries, cherries and red grapes; source of flavanols—catechins, epicatechins, procyanidins are tea, cocoa, chocolate, apples and grapes and the source of flavanones is citrus fruits.
C. **Isothiocyanates:** This group comprises of sulforaphane compounds. This compound helps to enhance detoxification of undesirable compounds and boosts the cellular antioxidant defences system. It is widely found in cauliflower, broccoli, cabbage, horseradish etc.
D. **Phenols:** This group contains caffeic acid and ferulic acid which increases cellular antioxidant defences, maintain a healthy vision and heart health. The source of these components are apples, pears, citrus fruits, some vegetables etc.

Mechanism of action of antioxidants

An antioxidant is a material which at low concentrations, slows or prevents oxidation of a product. Antioxidant compounds interact with a few chemical processes: Hydrogen Atom Transmission (HAT), Single Electricity Transmission (SET), chelating metals in transition. Oxidation or loss of electrons can also lead to reactive free radicals that can cause oxidative stress or damage to cells. Before they can react and cause harm, antioxidants are in their nature capable of stabilizing free radicals just like a buffer does an acid to retain the natural pH. Because oxidation is a natural method of the body, in order to maintain a healthy state, balance with antioxidants is needed.

It is assumed that the ingestion of antioxidants offers protection against oxidative harm and brings beneficial health benefits. The carotenoids such as lutein and zeaxanthin, are involved in antioxidant activities that have been shown to increase the density of macular pigments in the eye. It is observed that the antioxidants present in strawberries, chocolate, blue berries and teas have beneficial effects on "cardiovascular health, Alzheimer's disease and even a reduction in the risk of some cancers".

Application of herbs and spices into traditional Indian dairy products

In recent days, herbal extracts and preparations are gaining importance than less toxic antioxidants and radio protectors. Herbs have been used as preservatives, flavourings and therapeutic materials to fortify foods. While herbs "are low – cost commodities, they are now priced for several decades as gold or jewels" (El–Sayed and Youssef, 2019). Herbal intake has a significant health – promoting effect and reduces the incidence of different deadly diseases (Singh *et al*., 2006; Shishodia *et al*., 2003). "Dairy products are a special carrier that has been successfully used in our dietary food systems to carry phytochemicals and other nutrients for health benefits" (El–Sayed and Youssef, 2019). In traditional Indian milk products, the use of diverse herbs and spices is discussed here.

Sandesh

Sandesh is a very common heat – desiccated commodity called chhana, a mass of coagulated milk protein. The inclusion separately as a paste "of herbs such as turmeric (*Curcuma longa*), coriander (*Coriandrum sativum L.*), curry leaf (*Murraya koenigii L.*), spinach (*Spinacia oleracea*) and aonla (*Emblica officinalis*)" improved its antioxidant properties at 10 % level in Sandesh. The addition of herbal coriander resulted in increased shelf life of herbal Sandesh when stored at 30±1°C and 7±1°C respectively for up to eight days and 30 days (Bandyopadhyay *et al.* 2007). The antioxidant levels of these herbs were compared at levels of 100 and 200 mg/kg with the synthetic antioxidants TBHQ and BHA: BHT (1:1). The author has confirmed that herbal sandesh's total antioxidant status was lower than TBHQ samples but comparable to those with 200 mg/kg BHA: BHT (1:1). Sen and Rajorhia (1985) reported that the rate of chemical and microbiological degradation was significantly shown in the product samples stored in sanitized tin containers at 30^0C and 7^0C when cardamom powder was incorporated in sandesh at the rate of 0.05, 0.1 and 0.15 % by weight of chhana.

Khoa

"Khoa is a heat desiccated Indian dairy product used as a base material for a variety of sweetmeats like burfi, peda, gulabjamun etc. It has been estimated that about 50-55 % of milk produced is being converted into variety of traditional Indian dairy products of which 6.5% of milk is used for manufacture of khoa mostly in private and unorganized sector (Jadhav *et al*. 2011). Khoa has a limited shelf life of less than a week under ambient condition. Khoa is more prone to chemical and microbial spoilage irrespective of the

storage conditions due to presence of high moisture content" (Kumar *et al.* 2010). A study was undertaken by Sivakumar and Dhanalakshmi (2015), who added 0.5% aqueous extract of betel leaves into khoa and "revealed that the sensory evaluation of khoa was not influenced by the presence of aqueous extract of betel leaves up to 9 days of storage period". It was also observed that "khoa with 0.5 aqueous extract of betel leaves restricted the free fatty acid compared to control due to antioxidant property of betel leaves".

Lassi

In India, as well as in overseas markets, Lassi which is a ready -to -serve traditional fermented milk beverage has become widely popular. As a food carrier for herbal bio-actives such as Aloe- vera juice etc., sweet lassi with its characteristics sweet and slightly sour taste can be used. By supplementing the herb Aloe vera and probiotics, functional lassi was grown. The inclusion of aloevera juice in lassi at a rate of 15% increases the shelf life of lassi with satisfactorily good consistency for up to 23 days and also increases antioxidant activity, texture and aroma profile (Singh *et al*. 2012; Moussa *et al.* 2020; Pal *et al.* 2012). Hussain *et al.* (2017) revealed that probiotic lassi supplemented with alovera decreases Shigella count and raises the amount of Hb, RBC and WBC haematological parameters in mice. In 2020, Maji and co-workers reported that ginger, turmeric and carrot juice fortification significantly increased the overall phenolic content of herbal lassi compared to control lassi. The sensory scores of the three forms of herbal lassi i.e ginger, turmeric and carrot, at a level of 2%, 1% and 15% (v/v) respectively were ranked highest. It was also reported that turmeric fortified lassi showed the highest phenolic content compared to the ginger and carrot fortified lassi having shelf life 9 days at refrigeration temperature (Maji *et al*. 2018).

Dahi

Herbal supplemented probiotic dahi prepared by Hussain *et al.* (2011) with the herb Aloe barbadensis Miller. The authors stated that the growth of the probiotic strain was assisted by Aloevera supplementation (*Lactobacillus paracasei ssp paracasei L*). During the 12-day storage cycle, the probiotic viability was found greater than 7 log cfu/ml. Singh *et al.* (2013) prepared strawberry fortified stirred dahi (0.5 mg/ml) polyphenol extract. This fortification resulted in a sevenfold increase in polyphenol enriched stirred dahi's antioxidant activity. In terms of antioxidant activity and preservation of total phenolic content, no statistically significant difference ($p>0.05$) was identified during 3 weeks of storage at refrigeration temperature (7–8^{o}C).

Shrikhand

As a semi-soft, sweetish- sour, whole milk product prepared from lactic fermented curd, shrikhand can easily harbour herbs/herbal extracts without major sensory quality changes. A study conducted by Landge *et al.* (2011) stated that the addition of 0.5% Ashwagandha powder to shrikhand improved organoleptic consistency and at refrigeration temperature, the product remained acceptable for up to 52 days. Pal (2019)

also added 0.2% ashwagandha powder in shrikhand and found excellent overall acceptability compared to control shrikhand. Addition of tulsi extract at different proportion for the preparation of shrikhand was reported to increase the flavour, taste and overall acceptability. It also increases the chemical structure of shrikhand as compared to control (David, 2015; Rai *et al*. 2018). In 2018, Goswami and co- workers added tulsi, turmeric powder and honey as a sweetener for the preparation of shrikhand by the weight of chakka. The highest overall acceptability was recorded when adding 0.4g tulsi powder and 0.5 g turmeric powder in combination. Another study conducted by Waghmare (2018) and found that the addition of 4% ginger powder improves the overall acceptability of shrikhand, in addition to improving the product's medicinal benefit.

Paneer

In 2014, Buch and co- workers added turmeric to the paneer at 0.0 (control), 0.2, 0.4, 0.6, 0.8 and 1.0 % by weight of the predicted paneer yield to research the degree of paneer shelf life. The rate of addition of turmeric to milk was selected as 0.6% turmeric by weight of the predicted paneer yield based on changes in the sensory score of the paneer, which remains suitable for storage at 7±1 °C for up to 12 days.

By adding herbs viz. black pepper (0.25 %) and cardamom powder (0.5 %), Badola *et al*. (2018) developed herbal paneer results revealed that the herbal paneer was organoleptically better than control samples. In the herbal paneer study, the overall phenolic content was found to be marginally higher, suggesting the possibility of using herbs to grow a new functional milk product with improved antioxidant properties and ultimately improved shelf – life.

Ghee

The Indian name of clarifies butter fat is Ghee which is prepared by boiling off method. It is usually made from buffalo and cow milk individually or in combination. Around 30 – 35% of the milk produced in India is converted into ghee (Varkey, 2010). The herbal ghee sold in India is currently commonly sold as a medicine for the treatment of certain diseases and is thus known as 'medicinal ghee'. Parmar *et al.* (2013) reported that ethanol extract of Arjuna bark improved ghee's shelf life compared to the control sample at 8^{o}C in storage. Freshly prepared cow milk ghee with arjuna bark added also has excellent potential to act as a free radical scavenger. Parmar and Khamrui (2017) found that the ghee produced with 7% arjuna extract supplemented by creamery buffalo butter had maximum phytosterol content with sufficient sensory characteristics. Merai *et al.* (2003) added 0.6% 0f the creamery butter ghee with Tulsi (Ocimum sanctum) leaf powder. They observed that the ghee obtained had comparable stability to the ghee containing 0.02 % BHA for 8 days at high storage temperatures. They also consider that Tulsi leaves were the primary factor in prolonging ghee's oxidative stability.

In addition, incorporation of a mixture of alcoholic and aqueous satavari herb extracts, Pawar *et al.,* (2012) successfully improved the oxidative stability of ghee. Moreover, the antioxidant role of coriander extract in ghee was evaluated by Patel *et al.,* (2013). They observed that the coriander extract provided better oxidative stability for ghee throughout storage as compared to control samples.

Conclusion

Incorporation of plant-based antioxidants in milk products has met acceptance for the delay of oxidation. Natural antioxidants often have lower side effects than synthetic antioxidants for the human body. As a natural substance, herbs are used to improve the shelf life of different food products. Traditional dairy products are able to provide the herbs with a strong carrier, enabling the product to incorporate practical features that enhance customer health. In order to produce milk products enriched with herbs, many technical challenges must be addressed. Changes to the process are required to reduce the unintended effects of the bioavailability of functional components in plants and research must be based on the influence of processing conditions.

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Novel schiff base derived uranyl complexes: its synthesis and characterization

Pravin Kumar Kar[b], Jamini Ranjan Mohanty[c],Bandana Padhan[a], Ankita Upadhyay[b] and Aditya Kumar Purohit[a]*

[a]Department of chemistry, School of Applied Sciences, Centurion University of Technology and Management, Odisha, India.
[b]Department of chemistry, Veer Surendra Sai University of Technology, Burla, Odisha, India, 768018
[c]Department of Chemistry, S. B. Women's (Auto) College, Cuttack, Odisha, India, 753001
*Corresponding author: adityakumarpurohit@gmail.com

Abstract

Two novel N-salicylidine-2-aminophenol and N-salicylidine-2-aminothiophenol Schiff base ligands were prepared by following the literature procedure. Than by taking these ligands, Uranium(ll) complexes were synthesized. The ligands and complexes were characterized by their IR spectra, melting points, magnetic susceptibility and Uv-visible spectra.

Introduction

A Schiff base can be formed by the condensation reaction of any primary amine with an aldehyde or a ketone under specific conditions. Schiff base was named after Hugo Schiff. Structurally, it "is a nitrogen analogue of an aldehyde or ketone in which the carbonyl group (C=O) has been replaced by an imine or azomethine group" [1].

Schiff bases derived from amino and carbonyl compounds are the important class of ligands that coordinate to metal ions through its azomethine nitrogen. In Schiff bases, the C=N moiety is essential for several antibacterial, antifungal, anticancer and diuretic activities. It has widespread application in food industries, dye companies and biological activities[2]. Owing to their biological activities these compounds have much applications in medicinal and pharmaceutical fields. Transition metal complexes of the ligands derived from pyridoxal and amino acids are important enzyme models.

"Transition metal complexes with Schiff bases derived from 2-formylindole, salicylaldehyde and N-amino Rhodanine show antimicrobial activities. The results showed that the complexes have more biological activity than their ligands in proper experimental conditions" [3].

Macrocyclic Schiff base complexes have been extensively employed in the understanding of molecular processes occurring in biochemistry, material science, catalysis, encapsulation, activation, transport and separation phenomena[4].

Schiff base metal complexes can be act as catalyst like enantioselective oxidation of cyclohexene and styrene by using polymer-supported catalysts[5].

So many Schiff bases with their complexes have important properties like their ability to reversibly bind with oxygen, as a catalyst for the hydrogenation of olefins and form complexes with toxic metals etc[6].

Schiff base ligands can form complexes of mononuclear, dinuclear, "one-dimensional (1D), two-dimensional (2D) and three-dimensional (3D)" according to their denticity[7, 8]. These ligands have so many biological uses like antimicrobial, antitumor, and other medicinal agents[9, 10]. Also Schiff base metal complexes act as catalyst for the "aerial oxidation of benzaldehyde to benzoic acid. The ONO tridentate schiff base N-salicylidene-*o*-aminophenol ligands" act as catalyst and in many industrial application[11].

The Schiff base 3-methoxy-salicylidene-2-aminothiophenol "is a bivalent anion with tridentate ONS donors derived from the phenolic oxygen, azomethine nitrogen and thiophenolic sulfur have important properties, i.e. their ability to reversibly bind oxygen, catalytic activity in hydrogenation of olefins and transfer of an amino group, photo-chromic properties and complexing ability towards certain toxic metals" [12].

Metal complexes play an important role in agriculture, pharmaceutical and industrial chemistry. The metal surrounded by molecules named as Schiff bases, which are condensation product of primary amines and aldehydes or ketones (RCH=NR') where R and R' represents alkyl or aryl substituents. Schiff bases and their metal complexes can be used as catalysts, antifertility and enzymatic agents, also these have wide application in various biological systems, polymers and dyes[13].

The work embodied in this thesis focus around exploring the complex chemistry of Uranium with Schiff base ligands. The new Schiff base derived Uranium complexes have been synthesized. Recently, the chemistry of UO_2 (II) has attracted special interest, because this field of actinides is poorly explored. The interest behind synthesis and investigation of Schiff base derived Uranium complexes is generally due to: (i) understand the bonding interaction between the metal center and Schiff base ligand (ii) explore possible application of the new complexes.

With a view to expand the scope of metal complexes based on Uranium, we have attempted the synthesis of Uranium based complexes having Schiff base as its ligating units.

1. Materials and Methods

All the chemicals like salicylaldehyde, 2-aminophenol, 2-aminothiophenol, uranylacetate, etc and solvents like ethanol used were of Merck grade and Qualigen grade.

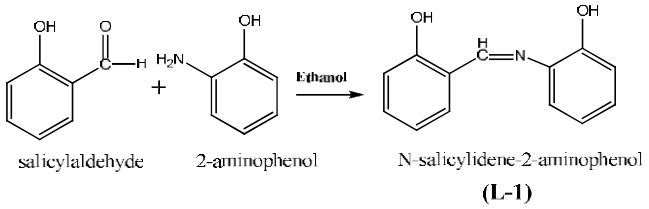
2.1. Characterization Techniques

The synthesized compounds have been categorized with the help of physicochemical methods i.e. IR, electronic spectral studies and magnetic susceptibility measurements. Infrared spectra of the ligand and metal complexes were recorded in Shimadzu-FTIR-Prestige-121 spectrophotometer in KBr phase in the

region 250-4000 cm^{-1}. The electronic spectra of complexes in methanol were taken by using Shimadzu- UV-Vis spectrophotometer-2450 model within the range 200-800 nm. Gouy method has been used to determining magnetic susceptibilities of complexes. Melting points of the complexes were measured by Zenith Melting Point Appartus.

2.2. Synthesis of N-salicylidine-2-aminophenol

A solution of 2-aminophenol (1.09 g, 0.01 mol) in ethanol (10 mL) was taken in a 100 mL round bottom flask. Then it was heated on a magnetic stirrer. To this a ethanolic solution (~ 10 mL) of salicylaldehyde (1.22 g, 0.01 mol) was added drop wise. The reaction mixture was heated up to reflux for another one hour (Scheme 1). Then it was brought to room temperature and filtered. An orange colour precipitate was isolated (M.P. = 190°C). IR (KBr, cm^{-1}): 3442(br), 1631(s), 1274(s), 1461(b), 1139(s) (Fig. 1).



Scheme 1. Synthetic route for N-salicylidine-2-aminophenol ligand.

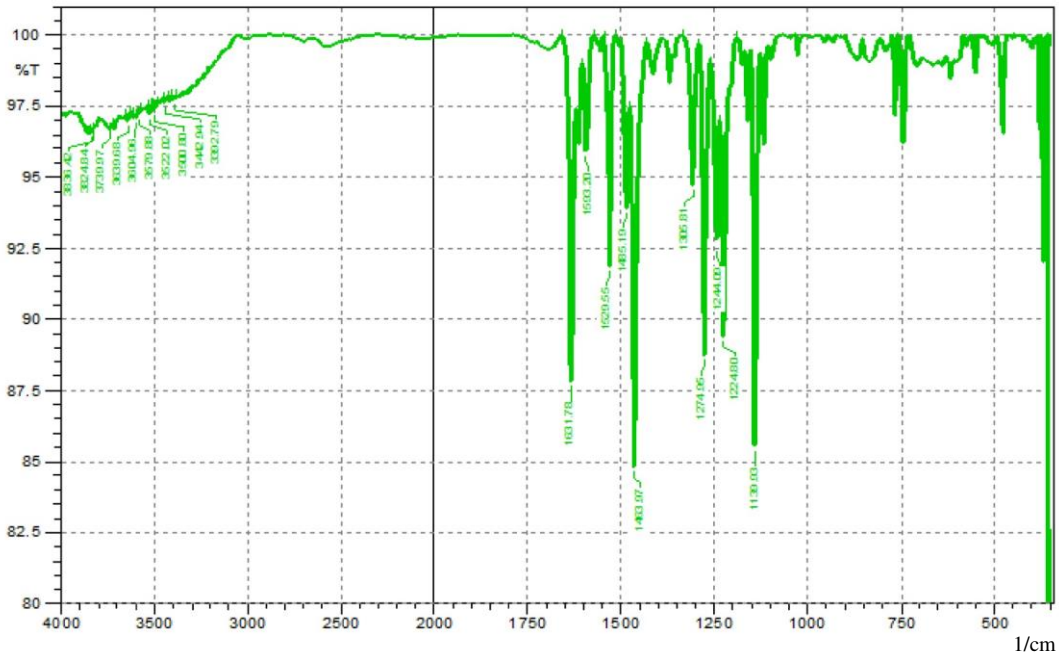
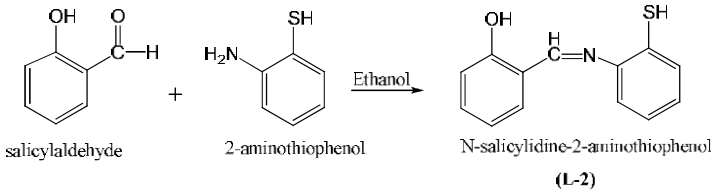


Fig. 1. FTIR of N-salicylidine-2-aminophenol.

2.3. Synthesis of N-salicylidine-2-aminothiophenol

In a 100 mL round bottom flask, 2-aminothiophenol (1.25 g, 0.01 mol) was taken. Then 15.0 mL ethanol was added. Then it was heated on a magnetic stirrer. To this a solution of salicylaldehyde (1.22 g, 0.01 mol) was added drop wise. The reaction mixture was further refluxed for one hour (Scheme 2). After bringing the reaction mixture to room temperature, the yellow coloured precipitate was filtered out. Further it was washed with ethanol 2-3 times (M.P. = 178^{o}C). IR (KBr, cm^{-1}): 1612(s), 1278(s), 1278(s), 754(s) (Fig. 2).



Scheme 2. Synthetic route for N-salicylidine-2-aminothiophenol ligand.

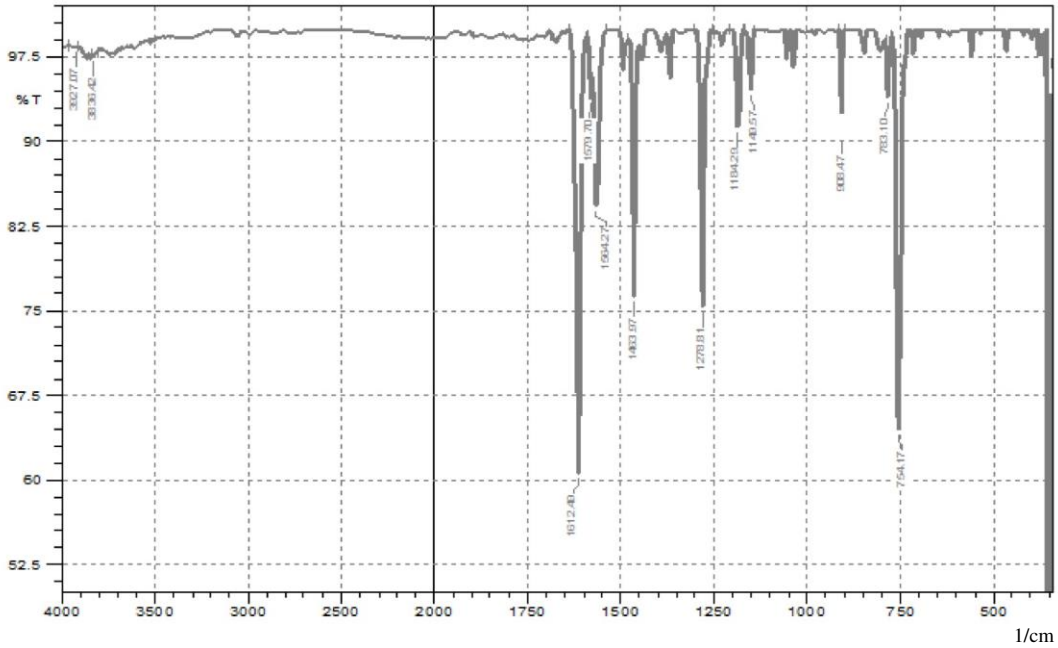
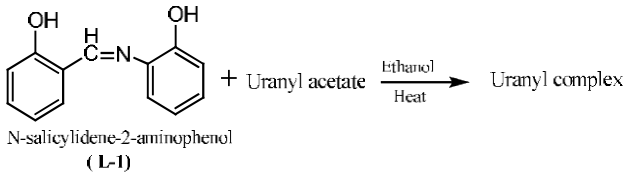


Fig. 2. FTIR of N-salicylidine-2-aminothiophenol.

2.4. Synthesis of Uranyl complex containing N-salicylidine-2-aminophenol

In a 100 mL round bottom flask, ligand L-1 (0.21 g,1.0 mmol) was taken. Then 20.0 mL ethanol was added to it. Then the solution was heated on a magnetic stirrer till complete mixing. A complete solution of Uranyl acetate (0.42 g, 1.0 mmol) in 15.0 mL ethanol was added slowly drop wise to it. Then the whole solution was stirred for two to three hours and filtered (Scheme 3). A grey colour precipitate was isolated. Then it was washed repeatedly with ethanol and dried in desiccator to get the desired compound. M.P. = 265^{o}C and yield = 0.06 g (9 %). IR (KBr pellets, cm^{-1}): 3442(m), 1604(s), 1238(br), 920(s), 487(w) (Fig. 3).



Scheme 3. Synthetic route for Uranyl complex containing N-salicylidine-2-aminophenol.

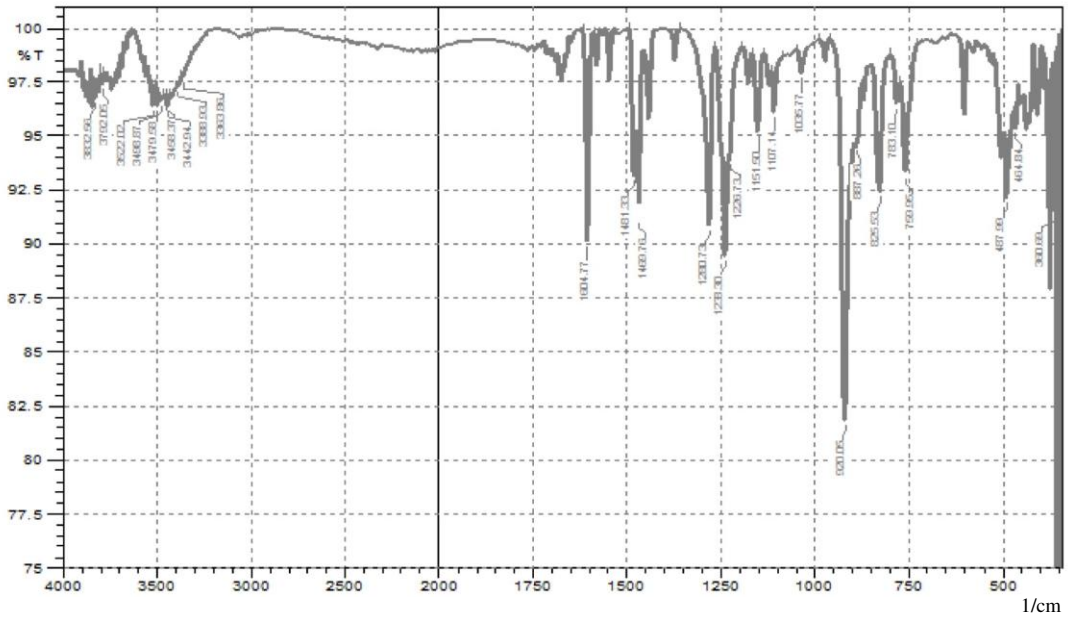
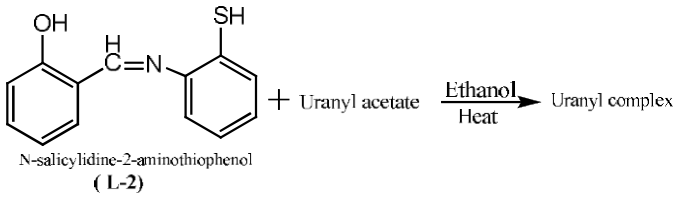


Fig. 3. FTIR of Uranyl complex containing L-1 ligand.

2.5. Synthesis of Uranyl complex containing N-salicylidine-2-aminothiophenol

In a 100 mL round bottom flask, ligand L-2 (0.22 g, 1.0 mmol) was taken. Then 20.0 mL ethanol was added to it and heated on a magnetic stirrer till complete mixing. A complete solution of Uranyl acetate (0.42 g, 1.0 mmol) in 15.0 mL ethanol was added slowly drop wise to it. The whole solution was then stirred for two to three hours and filtered. A yellow colour precipitate was isolated (Scheme 4). Then it was washed repeatedly with ethanol and dried in dessicator to get the desired compound. M. P. = 240^{o}C and yield 0.23 g (32 %). IR (KBr pellets, cm^{-1}): 3298(br), 1517(w), 1024(s), 929(s), 667(s), 528(w), 439(w) (Fig. 4).



Scheme 4. Synthetic route for Uranyl complex containing N-salicylidine-2-aminothiophenol.

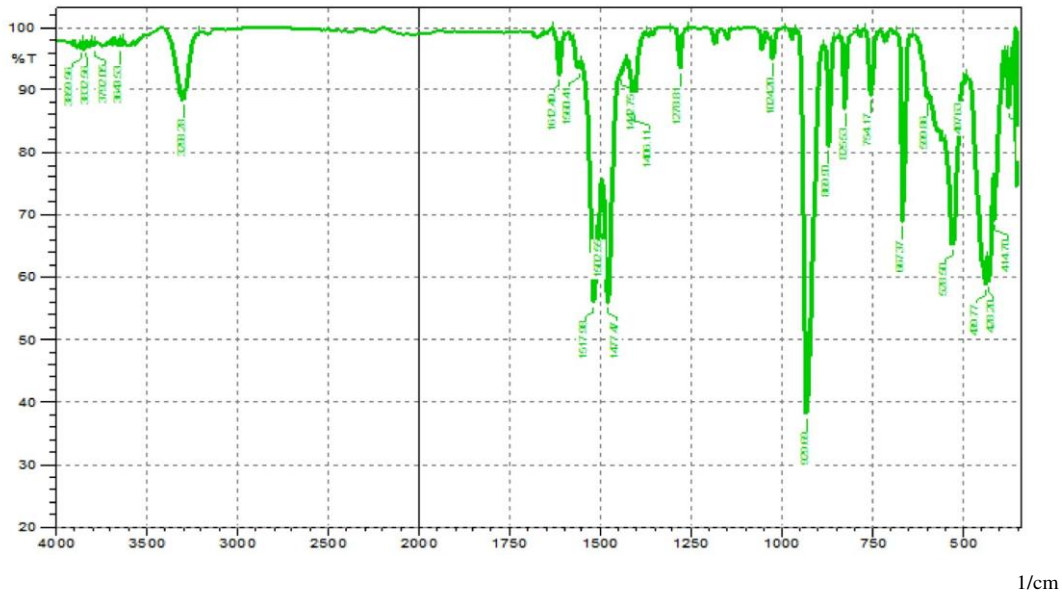


Fig. 4. FTIR of Uranyl complex containing L-2 ligand.

2. Results and Discussion

The N-salicylidine-2-aminophenol and N-salicylidine-2-aminothiophenol Schiff base ligands in the formation of uranium complexes were prepared by following the literature procedure. The ligands and complexes were characterized by their IR spectra (fig. S1, S2, S3, S4) m.p, magnetic susceptibility, UV spectra. The ligand frame work contains azomethine linkages which mediated novel co-ordination geometry around the metal center in its complex formation. The sharp change of colour of the reaction indicates the possibility of formation of metal complexes.

2.1. IR spectra and mode of bonding

The IR spectra of the complexes were compared with those of the free ligands in order to determine the coordination sites that may be involved in complexation. There were some guide peaks in the spectra of the ligands, which were helpful in achieving this goal. The position and/ or the intensities of these peaks are expected to change upon complexation.

2.1.1. Uranyl complex containing N-salicylidine-2-aminophenol

In the IR spectra of N-salicylidine-2-aminophenol, a band at 1631cm^{-1} which is the characteristic of ν(C=N) was shifted to 1604 cm^{-1} after coordination to Uranium centre. "The band at 1274 cm^{-1} in IR spectrum of ligand was ascribed to the phenolic ν(C-O) stretching vibration in case of ligands. This band was found in the region 1238 cm^{-1} in the spectra of complexes and intensity of the band has decreased showing the involvement of the phenolic oxygen in coordination. Also the band at 600 cm^{-1} and 487 cm^{-1}

was ascribed to M-O and M-N in the complexes, which were absent in the IR spectra of the ligand" (Aziz et al. 2012).

2.1.2. Uranyl complex containing N-salicylidine-2-aminothiophenol

A band at 1612 cm^{-1}, characteristic of ν(C=N) of N-salicylidine-2-aminothiophenol was shifted to 1604 cm^{-1} after coordinating with Uranium atom. The band at 1278 cm^{-1} in IR spectrum of ligand was ascribed to the phenolic ν(C-O) stretching vibration. The shifting of band at 1278 cm^{-1} of ligand to 1024 cm^{-1} of complex gave the evidence about the coordination of phenolic oxygen. Also the band at 667 cm^{-1} 528 cm^{-1} and 487 cm^{-1} were ascribed to M-O, M-N and M-S in the complexes, which were absent in the IR spectra of the ligand.

3.3. Magnetic susceptibility measurements

The magnetic susceptibility measurement of the synthesized complexes apart from the complexes derived from mixed ligand reactions show that the complexes to have diamagnetic character. we have proposed an octahedral geometry around Uranium centre of complexes. Physical data are given in table 1.

Table 1. Physical data of synthesized compounds.

Compounds	Colour	m. p. (°C)	χ_M (B.M)
N-salicylidine-2-aminophenol	orange	190	_
N-salicylidine-2-aminothiophenol	Pale yellow	178	_
Uranyl acetate	Fluorescent	80 (decomp.)	0.3
Uranyl complex containing L-1 ligand	Coffee	265	0.004
Uranyl complex containing L-2 ligand	yellow	240	0.03

3.4. UV-Visible spectra of complexes

The absorption spectra for the complexes in absolute methanol at λ ranging from 200 to 800 nm were carried out (fig. 5 and 6). For Uranyl complex containing N-salicylidine-*o*-aminophenol as it ligating unit, bands observed at 380 nm, 239 nm and for Uranyl complex containing N-salicylidine-*o*-aminothoiphenol, bands observed at 348 nm, 269 nm were attributed to π-π* and n-π* transitions. The absent of bands above 800 nm may be due to forbidden f→f transition (Laporte forbidden). Also the shifting of bands of complexes as compared to the ligands indicates the formation of complexes.

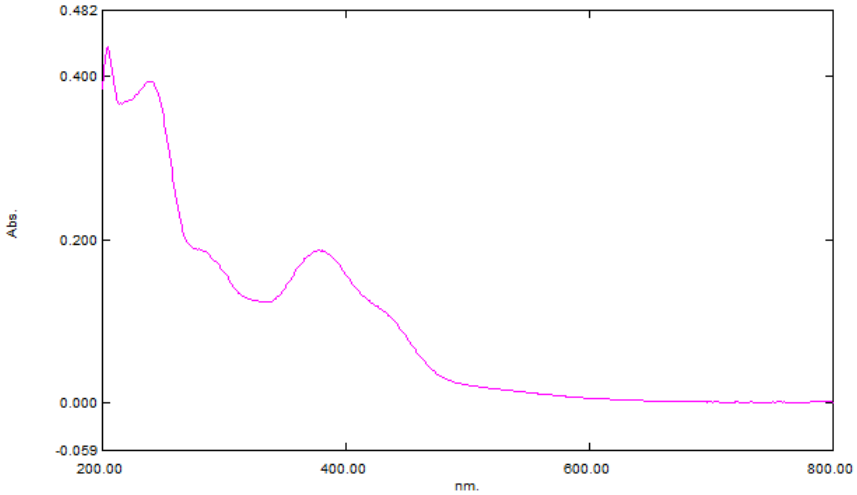


Fig. 5. UV-Visible Spectra of Uranyl complex containing L-1 ligand.

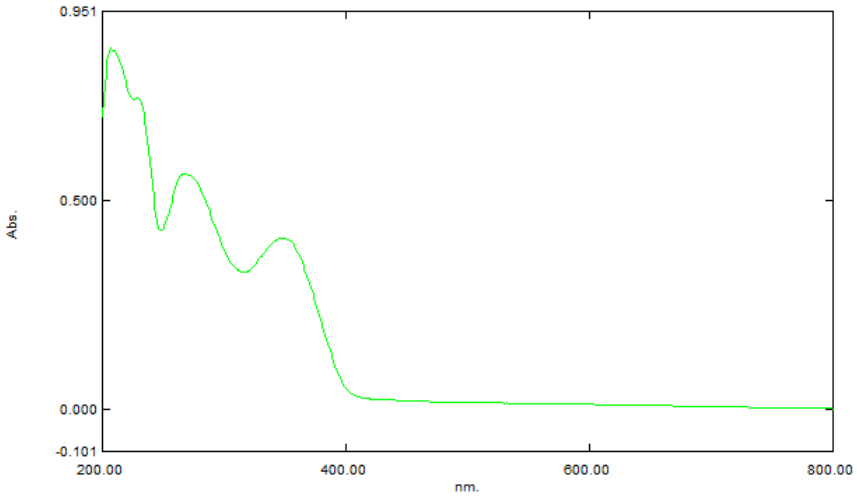
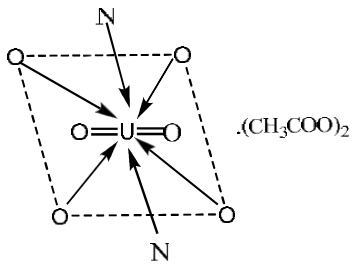
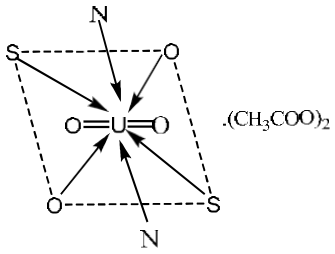


Fig. 6. UV-Visible Spectra of Uranyl complex containing L-2 ligand.

On the basis of the above observations and from the magnetic measurements, octahedral geometries are suggested (Fig. 7) for the investigated complexes.



(I)



(II)

Fig. 7. Proposed structures of Uranyl complex containing N-salicylidine-*o*-aminothiophenol (I) and Uranyl complex containingN-salicylidine-*o*-aminothiophenol (II).

4. Conclusion

Two new Uranyl complexes have been synthesized by the reaction of Uranyl acetate with tridentate N-salicylidine-2-aminophenol ligand which was prepared by the condensation of salicylaldehyde ONO donor and 2-aminophenol, and with tridentate N-salicylidine-2-aminothiophenol ligand which was prepared by the condensation of salicylaldehyde and 2-aminothiophenol ONS donor. The melting point of every compound has been taken. The Schiff base behaves as tridentate with ONO and ONS donor sites. The co-ordination sites of the metal ions were found to have occupied by the azomethine nitrogen, oxygen atom of hydroxyl ions and sulphur atom. An octahedral geometry for the Uranyl complex containing L-1 ligand and Uranyl complex containing L-2 ligand has also been proposed for the complexes.

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Computational methods for drug discovery and personalized medication

Jayakishan Meher

Centurion University of Technology and Management, Odisha, India
Corresponding author: jk_meher@yahoo.co.in

Abstract: Advanced computational methods have received wide attention in recent years due to its several applications relating to healthcare for opening new directions in the area of diagnostics and drug discovery including vaccine for unforeseen viruses. The drug discovery involves identifying a ligand that can optimally fit to a definite cavity on a target protein. The drug discovery has speeded up its process with advanced computational methods effectively. An enhanced quality of software and computational tools enables to reduce the drug discovery cycle. The bioinformatics research made available a noteworthy volume of data sources. This paper gives an overview of computational methods and databases that helps in acceleration of drug discovery and personalized medication.

Keywords: *Drug discovery, personalized medication, computational methods, Bioinformatics, molecular docking, deep learning.*

1. Introduction

The complexity in drug discovery needs combined effort to design effective drugs. In drug design it is required to detect a ligand that can fit effectively to a specific cavity on a targeted protein [1]. The traditional drug discovery methods take long process cycle with considerable cost. Current methods that utilize computational methods in structure-based drug design has improved the speed in the process of drug discovery effectively. An enhanced quality of software and computational tools enables to reduce the drug discovery cycle thus making more cost-effective.

The bioinformatics research made available a noteworthy volume of data sources that required in various phases of drug discovery and development pipeline. Some of the public databases that provide the biomolecular information are GenBank, PDB, SWISS-PROT, PIR, SCOP and CATH etc. The informatics practice tools like BLAST, FASTA and CLUSTALW perform sequence analysis using these databases. Further the molecular structures are visualized using software like Rasmol. PyMOL, UCSF Chimera etc.

can help in understanding the complex phenomena of the molecules and hence useful for biomedical investigation in testing the clinical samples [2].

Computational drug discovery can help in recognizing effective ligand and targets to evaluate possible binding or active sites and allows to produce active drug molecules effectively by docking parameters [3]. High performance computing system and software can help to produce high quality data to discover a novel drug molecule [4]. The validation of drug target is needed to check failure in the clinical testing stages. Drug discovery also involves several segments of identification of target to preclinical progress [5]. Thus, there is a need of effective analysis by computational techniques for high efficiency.

"Rational Drug Design" (RDD) is tool for molecular modeling that helps to study the knowledge of 3D structure of the desired target proteins. The concept of RDD "has enabled drug target identification and validation to be more specific. In addition, several novel technologies and approaches have been introducing genomics, proteomics and other omics areas such as 3D QSAR, pharmacophore modeling and other, which playing a promising role in accelerating the pace of drug discovery process" as mentioned by Hamad et al. [2018]. Since the in-silico drug design methods are cost effective, hence a number of software is currently used in drug design. In-silico drug designing can be performed by homology modeling, molecular dynamic, energy minimization, docking and QSAR etc. and found to have great importance in target identification and novel drugs prediction [7].

Many bioinformatics technologies are growing importance fields to understand and predict the potential drug because it focuses on Data Management and Data Analysis [8]. Drug discovery practice involves a series of events that include target drug identification and validation, pre-clinical pharmacology and toxicology. "Computer-aided drug discovery" (CADD) tools are potentially used to automate and speed up this process and to reduce the cost. Hence CADD has become an essential tool in drug development. The bioinformatics and CADD approaches play a critical role in addressing different challenges in drug design. [9-10]. This paper gives an overview of computational methods databases that helps in acceleration of drug discovery and personalized medication.

2. Computational Methods for Drug Discovery

The growth in biomacromolecule and micromolecule data can be analyzed by computational tools for aspects of the drug discovery process and its validation. The commonly used computational drug discovery approaches are structure-based drug design (SBDD), ligand-based drug design (LBDD) and

sequence-based approaches (SBDD) methods including quantitative structure-activity relationship (QSAR) [11].

The computational informatics tools are used for performing various tasks such as molecular modeling, visualization, molecular docking and molecular dynamics. The nanomedicine for targeted drug delivery is a growing field of research with application to several biomedical problems. The information revolution with biomolecular data mining and advanced machine learning has been applied to drug delivery. Docking allows predicting protein-ligand interactions in the drug discovery process by detecting the low-energy binding modes ligand within the active site of a macromolecule. The degree of interaction or binding of ligand with receptor related with a disease may inhibit its function and thus act as a drug[12]. There are large numbers of tools available for researchers as shown in table 1 for helping in drug discovery.

Artificial Intelligence (AI), in particular ANN like deep neural networks perform a crucial role in drug discovery. AI drives the novel active molecules towards preferred properties [13]. Neural networks (NNs) find rules for drug discovery according to training molecules. With deep learning, variants of ANNs are now able to use different kinds of inputs, that help researchers with variation in the analysis for drug discovery. The integration of AI-aided drug discovery and and precision medicine-aided drug application, patient management will transform the arena of medicine. The authors in [14] initiated the base of AI and precision medicine revolutions in drug discovery and patient management.

Table 1. Computational Drug Discovery Tools

Computational Methods	**Software Tools**
Molecular Visualization	Raswin, Raster3D, Chemlab, Jmol, PyMOL, VMD, Webmol etc.
Active Site prediction	LIGSITE, POOL, Pocket-Finder, 3DLigandSite, FINDSITE etc.
Molecular Docking	MOE, PyRx, Autodock Vina, Biovia material studio, Schrodinger, Libdock
Molecular dynamic simulation	LAMMPS, Gromacs, YASARA, Amber, CHARM, Gromos, NWChem
Homology modelling	Sybyl, ICM, MODELLER, MOE, SWISS-MODEL, Phyre etc.

Support vector machines (SVM), Particle Swarm Optimization (PSO) and Genetic algorithm are widely applied in drug progress for huge data used in drug research studies. Deep neural network learning has

achieved significant achievement in drug discovery. Deep learning in pharmaceutical research has helped in addressing diverse problems in drug discovery with bioactivity prediction, molecular design, synthesis prediction and bioimage analysis [15]. DeepScreening constructed a deep learning model and generate the libraries and used for virtual screening against diverse chemical libraries in stock. The deep learning-based web server will assist for drug discovery [16]. The authors in [17] provide outline of the applications of NNs in drug discovery including *de novo* drug design, ligand-based and receptor-based drug design and allows molecules can be inputs of NN-based models and achieve suitable results.

3. Personalized medication

The developments in computational skill are gradually altering the mode that explain disease, improve drugs and advise treatments. Personalized medication also recognized as precision medicine is an evolving arena of medicine that can identify specific biological markers, based on genotype and phenotype to help assess suitable treatments for each patient and determine the right treatment for the person at right dose in right time. It is centered on the patient's distinctive individualities which is comparatively innovative in medical community.

The genetic makeup varies from patient to patient and risk of side effects may be observed for specific drugs and accordingly need a different dose than normally prescribed. Personalized medication and genetic categorization of severe diseases can provide way to the development of new drugs. Genetic testing is progressively acting as vital portion of clinical decision-making towards actual treatment of disease [18]. Genetic characteristics and other factors such as age, genus, eating habit play a role for specific use of various medicines [19]. Advanced statistical and machine learning tools are required to mine complex gene polymorphisms data gathered by pharmacogenetics researchers for analyzing during drug discovery. Computational methods such as ANN and GA are used for Genome-wide studies [20].

The aim is to optimally use obtainable data and patients' physiognomies for research. This also holds good for the transformation of research outcomes into clinical practice. New technologies have the potential to enhance the use of genetic evidence in clinical decision-making, its prevention, surveillance, and safer drug therapies for patients. Thus there is a need of this analysis more effectively by computational intelligence techniques to deliver better treatment for patients, deliver benefits development of new medicines of healthcare systems and society and more efficient.

4. Conclusions

The wide variety of computational tools has been developed by the scientific community to address the drug discovery process. The drug discovery has been reformed with innovations of fresh methods in bioinformatics tools. Computational drug discovery can help in recognizing effective ligand and targets to evaluate possible active sites and allows to produce active drug molecules effectively using computer added tools like molecular docking and molecular dynamics simulation. The Artificial Intelligence and deep learning techniques have the potential to play vital role in drug discovery for effective novel drugs prediction and more emphasis on personalized medication in future.

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Prevalence of Protein Energy Malnutrition among Under-five children in Odisha: A Review

Ayusi Satapathy[1], Ansuman Satapathy[2], Dwity Sundar Rout[3*], Ajay Kumar Prusty[3] Subrat Kumar Mahapatra [4], Sandeep Rout[5]

[1]Department of Food Science and Nutrition, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha-751003, India.
[2]Department of Agricultural Economics, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha-751003, India.
[3]M. S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Paralakhemundi, Gajapati, Odisha-761211, India.
[4]Department of Agricultural Statistics, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha-751003, India.
[5]Faculty of Agriculture, Sri Sri University, Cuttack, Odisha-754006, India

*Corresponding Author: dwity.sundar@cutm.ac.in

Abstract

The WHO has identified PEM as one of the major problems among the children round the world. Also, over the years it has been found that developing countries like India have been facing the issue of PEM among children particularly at the most crucial stage of their development. Moreover, this is prevalent mostly among the rural masses and the poor and arises due to issues relating to poverty, poor environmental sanitation, poor dietary practices, low socioeconomic status, maternal education, frequent infection, and poor household food security, high consumption of rice, frequency of acute illness and low birth weight of child. This paper is a review on the status of PEM among young children (under the age of five) in Odisha. The study is based on analysis and meta-analysis of secondary sources of relevant literature and the inferences thereof suggesting possible strategies to combat this problem.

Keywords: Malnutrition, Stunting, Underweight, Wasting.

Introduction

Under-five children, being the most vulnerable group of the population serves as a crucial indicator of community health and nutrition. They are mostly affected by PEM due to inadequate supply of nutrients as per their requirements. Malnutrition affects children below 5 years age group, mostly among poor communities. Kwashiorkor affects the children mostly among 1 - 3 years age group whereas marasmus affects children below 2 years age group. According to National Family Health Survey (NFHS)-4(2015-16), India records the highest level of stunting despite marginal improvement over the years. In India, during the year 2015-16, 38.4%, 35.8% and 21% children were found to be in stunting, under weight and wasting category whereas in Odisha the figures were 38.2%, 34.4% and 18.3% respectively. Malnutrition occurs due to the lack of assess to highly nutritious foods, poor feeding practices such as non-exclusively breast feeding, poor environmental conditions, large family size, poor maternal health, premature baby, adverse cultural practices related to child rearing and weaning, delay introduction of supplementary

feeding, high female illiteracy. Frequent Infection like (Diarrhoea, Respiratory infections, measles, intestinal worms) contribute to malnutrition (Motakpalli *et al* 2013). More than one third of child deaths are mainly due to malnutrition. Malnutrition leads to permanent impairment in later life which includes reduced work capacity, growth retardation and poor social and mental development. The consequences of malnutrition comprises child death, disability, stunting, retardation of mental and physical growth.

Materials and Methods

The study is primarily based on secondary sources of literature. A systematic review of published articles was done from different online databases like research gate and google scholar. The articles were chosen on the basis of relevant topics including measuring different types of malnutrition and factors affecting it. The authors' own perception and analysis was used to draw suitable conclusions.

Review of Literature

The back drop of the study was to know the prevalence and factors affecting malnutrition through the study entitled "Prevalence of Protein Energy Malnutrition among under-five children in Odisha." Therefore, a review of the available literature relevant to the study are presented under following headings.

Prevalence of Protein Energy Malnutrition among under-five years of children

Khargekar *et al.* (2016) conducted a study to assess the protein energy malnutrition in children between one to five years of age in a tribal area Parol, Thane district, Maharashtra, India. A sample size of 225 children within the age group of 1-5 years was selected for the study. The result revealed that prevalence of malnutrition was higher (26.83%) among children of 2-3 years of age group whereas 38.67%, 34.67%, 36% were found to be within underweight, stunting and wasting category. Based on mid upper arm circumference, it was found that 25.78% and 9.33% children were suffering from mild and severe malnutrition.

Sethy *et al.* (2017) conducted study on "prevalence of malnutrition among under-five children of urban slums of Berhampur, Odisha, India. A sample size of 300 children within 6-59 months age group was selected for the study. The study revealed that 69% of children were having under nutrition in the form of underweight (55.3%), wasting (75%) and stunting (42%).Out of total 208 under nourished children, 59.6% were male and 40.4% were female. Maximum number of underweight children (52.6%) were observed within 37-60 months of age group. Malnutrition was significantly associated with factors like maternal education, hygienic practices and feeding practices of mother".

Agrawal *et al.* (2016) studied the nutritional status of 12-36 months aged children and factors associated with it in rural area of Maharashtra. According to MUAC criteria, malnutrition was 40% among children

(MUAC < 13.4 cm) comprising of 36.4% males and 43.7% females. Nearly 13% (7.5% males and 19.41% females) were suffering from severe malnutrition (MUAC < 12.4 cm).

Jena *et al.* (2019) conducted a hospital based prospective observational study on social and demographic determinants of severe acute malnutrition in children aged 6-59 months in a tertiary care center of Odisha, India. The study showed that prevalence of severe acute malnutrition was (2.8%). More cases were observed in case of male children (54.2%) compared to female children (45.8%). Age group of 6-12 months (37.4%) was majorly affected by malnutrition. Majority of children (96.4%) suffering from malnutrition were from lower socio-economic status.

Darsene *et al.* (2017) conducted a "cross-sectional study in Ethiopia among children of age group 6-59 months to know the magnitude and predictors of undernutrition". A total sample size of 811 children were randomly selected for the study. The result indicated a stunting of 39.3% followed by underweight (15.8%) and wasting (6.3%). Underweight was highest among the age group of 36–47 months i.e 4.6% of the total sample of which male (8.4%) and female (7.4%). Maternal education, diarrhoeal morbidity in the past 1 year and family size were associated significantly with underweight. Similarly, wasting was found to be associated significantly with factors like "frequency of complementary feeding, age at cessation of breastfeeding, preceding birth interval and not fed on colostrum".

Ntenda *et al.* (2019) conducted a cross-sectional study to know the association of low birth weight with undernutrition in preschool-aged children in Malawi. A total sample of 4047 children under 5 years were selected for the study. "The prevalence of stunting, underweight, wasting and LBW were found to be 39%, 11%, 2% and 10% respectively. Severe stunting was observed under LBW category with adjusted odds ratio (AOR): 1.72; 95% confidence interval (CI): 1.35–2.20), underweight (AOR: 2.30; 95% CI: 1.68–3.14) and wasting (AOR: 1.47; 95% CI: 1.38–4.25)".

Yalew *et al.* (2014) conducted a cross-sectional study on "Prevalence and Factors Associated with Stunting, Underweight and Wasting among Children Age 6-59 Months at Lalibela Town, Northern Ethiopia". The study was carried out with sample size of 844 households. The results revealed "stunting, underweight and wasting of 47.3% (95%CI: 43.2-51.1), 25.6% (95%CI: 20.6-30.6) and 8.9% (95% CI: 6.9-10.2) respectively". Stunting was significantly associated with factors like deworming status and sex of the child. Children of mothers with higher education (0.2%) were less wasted compared to children of illiterate mothers (5.7%). Occupation of father statistically associated with wasting ($p < 0.05$).

Hoque *et al.* (2016) carried out a study among under-5 Children in Dhaka city to know their nutritional status. A sample size of 100 children within the group of under 5 years were purposively selected for the study. Nutritional status was estimated by calculating Z-score. It was found that among wasting category, 39% and 13% of total children were moderately and severely wasted while 47% and 4% were found to be

moderately and severely stunted. In case of underweight, 46% and 16% were observed among moderately and severely underweight category.

Meena *et al.* (2015) conducted a cross-sectional study on "nutritional status of children of under-five year in anganwadi centres in Kolar, Madhya Pradesh". Nutritional status was assessed using anthropometric measurements and clinical examination. As per WHO child growth standards "51% of under-five children were observed in varying degree of malnutrition. The clinical examination confirmed malnutrition of 49%. Around 40% of the children above one year of age had mid arm circumference of less than 13.5cm. Factors such as family size, education of mother, occupation of mother, environment and child feeding, rearing practices were found to be significantly associated with malnutrition".

Kumari *et al.* (2017) conducted a cross-sectional study on "Prevalence of Protein Energy Malnutrition among Under-Five Children in Rural Areas of Ambala, Haryana, India". A total no. of 300 under- five children were selected for the study. According to the Gomez classification, 44.43% was observed in normal category whereas 39.34%, 15.66% and 0.66% were observed under first, second and third degree of malnutrition respectively.

Factors affecting Protein Energy Malnutrition

Dietary Factors

Adequate nutrition is the most important requirement for growth throughout the childhood. Childhood is characterized by learning, exploration, socialization, increased physical activity. Preschool children require relatively more calories and protein/kg body weight. Niraula *et al.* (2015) conducted a "cross sectional study to know the prevalence and risk factors associated with malnutrition among under-five children of Borbote, Nepal. Purposive sampling method was used to select 186 under-five children". The result obtained was compared with the WHO classification of malnutrition which revealed that "a malnutrition of 20% among children out of which 14% were moderately undernourished and 6% were severely undernourished". The mothers with practice of exclusively breast feeding for 6 months were found to be 20.0% underweight and those who lack the practice of breast feeding were observed to be 34.8% underweight (P=0.041). More number of females (27.7%) were found to be malnourished as compared to males (20.4%).

Emmanuel *et al.* (2016) conducted a comprehensive study to know the factors associated with malnutrition among under-five children in Nigeria local government area. A sample size of 250 was studied using multi-stage sampling technique. The study revealed stunting, wasting and underweight of 47.6%, 8.8% and 25.6% respectively in the study area. About 18% were diagnosed with various forms of protein energy malnutrition. It was observed that malnutrition was most pronounced in case of male children. Protein energy malnutrition (63.6%) was mainly due to Marasmus. The study also revealed that

(23.2%) children had PEM, out of which 13% was female. Significant association was observed between gender and PEM. PEM was found among 19.7% children who were not exclusively breast fed while 7.1% were diagnosed with PEM with practice of exclusive breast feeding.

Shukla N *et al.* (2018) conducted a cross-sectional study on Malnutrition and associated risk factors among children of age 06-59 months in urban area of Jabalpur district (M.P.). Random sampling method was used to select 720 children of age group 6-59 months. The data collection and anthropometric measurements were recorded. The underweight, stunting and wasting were reported to be 34.3%, 41.5% and 18.9% respectively. Among female, underweight and wasting were reported to be 34.7% and 20% respectively. Stunting was observed to be high among male (42.7%) compared to female (40.4%). Malnutrition was more pronounced among the children born with low birth weight, birth order of the child, incomplete immunization and inappropriate feeding practices i.e. lack of exclusive breast feeding and improper weaning.

Sharma *et al.* (2015) conducted a community based cross sectional study with sample size of 496 under five children aged 6-59 months to know the factors associated with malnutrition. The study reported underweight of 83% among out of which 6% were severely underweight. The case of stunting and wasting were 54% and 63% respectively. Out of 54% of stunting 2.2% were severely affected. Higher prevalence of under nutrition among early age of children was mainly due to faulty feeding practices such as untimely initiation of complementary feeding, non-exclusively breast feeding up to first six months and high prevalence of infections such as diarrhoea, ARI, worm infestation.

Teferi *et al.* (2016) conducted a study using simple random sampling technique to select 324 among 6-59 months children. The result revealed that the prevalence of stunting was relatively high (33.3 %) within age group 6-59 months. Children age group of 12-24 months were "0.06 times [AOR0.06; 95CI (0.02-0.08)] and children above 24 months were 0.12 times [AOR0.12; 95 % CI (0.03-0.56)] less likely to be affected by stunting. Children who had born less than 2 years interval were 2.31 times more likely to be affected by chronic malnutrition [AOR 2.31;95 % CI (1.43- 3.08)]. Children who had started complementary feeding at less than six months or above six months were 3.78 [AOR 3.78; 95 %CI (1.39-4.25)] times more likely to be affected by stunting compared to those started complementary feeding at the age of 6 months".

Ecological Factor

Ingestion of high quantities of faecal bacteria from both human and animal sources by infants affect their nutritional status by diminishing appetite, impairing nutrient absorption and increasing nutrient losses.

Khan *et al.* (2016) conducted a study on 3964 children of under-five years. The WHO growth standards height-for-age Z-scores (HAZ), weight-for-height Z-scores (WHZ) and weight-for-age Z-scores (WAZ)

were used to measure stunting, wasting and underweight respectively. The stunting, wasting and underweight were reported to be 48.2%, 16.2% and 39.5% respectively. Slightly higher stunting was reported among boys (51%) compared to girls (45%), which was highly significant at 1% level. Diarrhoea was associated mainly with underweight. Significant association was found among household wealth with stunting, wasting and underweight. The result revealed stunting of 50% and 42% among children of the poorest and wealthiest households respectively. Two times higher stunting (20.6%) was recorded among the poorest households compared to the wealthiest households (10.3%).

Gebre *et al.* (2019) conducted a community based cross-sectional study on Prevalence of Malnutrition and associated Factors among Under-Five Children. The study was carried out among 840 children of age group 6–59 months. A structured questionnaire was constructed to measure the anthropometry related data. The study revealed that the prevalence of wasting, stunting and underweight were 16.2%, 43.1% and 24.8% respectively. Wasting was significantly associated with factors like family size (AOR=2.72, 95% CI: 1.62–4.55), prelacteal feeding (AOR=3.81, 95% CI: 1.79–5.42), and diarrhoea (AOR=4.57, 95% CI: 2.56–8.16) in the past two weeks. Age of the child (12–23months :AOR=3.44,95%CI:2.24–5.29); (24–35months: AOR=3.58,95% CI:2.25–5.69) and (36–59 months: AOR=4.42,95%CI:2.796.94) and immunization status of child (AOR=3.34,95%CI:1.31–4.81) were predictors for stunting. Moreover, mother's education, sex of the child, prelacteal feeding and immunization status of child were significantly associated with underweight.

Chaudhary *et al.* (2019) carried out an empirical study on factors affecting malnutrition among below five years children in Slum Area of Jaipur City, Rajasthan, India. A sample of 200 children within age group 6-59 months was selected using anthropometric measurements i.e height, weight and mid upper arm circumference (MUAC). Prevalence of underweight (35.7%), stunting (43%) and wasting (10.5%) were observed. Malnutrition was found to be associated with socio-demographic factors such as age, caste, family type, birth weight, birth order, educational profile of parents and family economic status. More than half of the children (56%) were born with low birth weight. Prevalence of stunting was recorded to be high i.e 43%. Rah *et al.* (2015) studied the association between household access to water, sanitary and personal hygiene practices with stunting among children aged 0-23 months in rural India. A stunting and wasting of 41% and 27% were reported. The diarrhoea was reported among 15% of children in the past 2 weeks. Inverse association was found among stunting and caregiver's practices of washing hands with soap before meals and after defecation. Sanitation facility of households was associated with stunting among children of age group 0–23 months.

Other factors contributing to childhood malnutrition

Undernutrition among children mostly associated with higher family food insecurity, low quality of complementary foods and intestinal parasites and other infections, poor socio-economic status, low birth weight (LBW). Rural and tribal community are mainly affected by undernutrition.

Tiwari *et al.* (2016) conducted an empirical study on assessment of prevalence of PEM among under-five year children and association of socio-demographic factors in an urban slum of Mumbai, India. Out of 450 children, Prevalence of PEM was found to be 56%. Majority of PEM was found within age group of 13-24 month compared to 3-5 years age group. The study revealed that 52.3% children of illiterate mothers and 47.7% children of literate mothers were affected with malnutrition which statistically significant (p=0.004). Among 450 children, 75.7% of children who were not given exclusive breast feeding were found to be malnourished, while only 24.3% of children were malnourished having exclusive breast feeding. The association was also found statistically significant (p=0.007). PEM was associated with the factors such as age of the child, mother's education, birth order, immunisation status, exclusive breast feeding, early marriage of mother, history of acute respiratory infection (ARI), diarrhoea and socio-economic status of the family.

Kassa *et al.* (2017) studied the magnitude of malnutrition and its associated factors among under-five children. The study revealed that the magnitude of stunting, underweight and wasting among under-five children were 38.3%, 49.2% and 25.2% respectively. Stunting was significantly associated with factors like mother's educational status and age of the child. Underweight was found to be associated with complementary feeding practices while wasting with occupation of mother. Majority of malnourished children within 6-59 months age group were female. Stunting was most prominent among 24-35 months age group i.e. 9.9% followed by children among age group of 12-23months (9.6%). However, the lowest rate of stunting (3.1%) was observed among children of age group 48-59 months.

Abdulrahim *et al.* (2015) conducted cross-sectional study on Prevalence of Underweight and Its Determinant Factors among Children Aged 0-59 Months. A sample size of 365 children under five years were selected using systematic sampling method. The proportion of underweight was significantly more among children aged 37-54 months (38.6%) compared to children aged 12 months. Children with birth weight less than 2.5kg had significantly high prevalence of underweight (41.9%) compared to children with birth weight of 2.5kg and above (21.8%).

Purohit *et al.* (2017) conducted a community based descriptive cross sectional study at Urban Health Centre on Nutritional status of under- five children in Maharashtra state. Stratified random sampling technique was used to select 650 under- five children from slum and Non-slum area proportionately i.e. 400 from slum & 250 from Non slum area. The study revealed that among 650 subjects, (40.46%) under-five children were stunted, (38.15%) were underweight, (16.00%) were wasted, (5.23%) were having

severe acute malnutrition (SAM) and (10.77%) were having moderate acute malnutrition (MAM). The proportion of under-five children with underweight showed statistically significant association with their age, socioeconomic status, education of mother, birth weight and birth order of the child.

Jain *et al.* (2019) conducted a cross-sectional study on "Prevalence of Under-Nutrition among Children and its Association with Educational and Occupational Status of Mothers in an Urban Area of Haryana. The study was conducted among 400 children (1-5 years of age) which were randomly selected from 14 anganwadi centres. The prevalence of stunting, wasting and underweight were observed to be 33.8%, 21.5% and 34.5% respectively. Undernutrition rates were found to be higher in children whose mothers were illiterate and working outside".

Yadav *et al.* (2016) conducted an Epidemiological Study of Malnutrition among under-five Children of Rural and Urban Haryana. A total no. of 750 children was selected for the study. Out of 750 children, 41.3% were underweight (WAZ < -2 SD) and 14% were severe underweight (WAZ <-3 SD). Highest prevalence of underweight was found within 12-23 month age group. Prevalence of underweight was higher in female i.e. 42.9%. The prevalence of severe underweight among male and female were 13.4% and 14.7% respectively. Maternal education, occupation of the mother were highly significant with underweight.

Sarkar *et al.* (2016) conducted a "cross-sectional study on Malnutrition and associated risk factors among children aged under-five in West Bengal, India". The study revealed that as per WHO child growth standards, stunting was observed to be 51% followed by underweight (41%) and wasting (22%). Majority (56%) of underweight children was found to be within 24−35 months age group followed by 47% and 39% within 36−37 months and 6−11 months age groups respectively. The study revealed that gender discrimination, religion, caste, and birth-order of the child were significantly associated with malnutrition.

Nigatu *et al.* (2018) conducted a cross-sectional study on "prevalence and associated factors of underweight among children 6–59 months of age in Takusa district, Northwest Ethiopia". A total no. of 645 children was selected using the multi-stage sampling technique. The study revealed that the prevalence of underweight, stunting, and wasting were 19.5%, 36.5% and 8% respectively. Marital status, occupation of the mother, age of mother, child caring practices, household income and complementary feeding were significantly associated with underweight.

Conclusion

The study concluded that poverty, poor environmental sanitation, poor dietary practices, low socioeconomic status, maternal education, frequent infection, poor household food security, high consumption of rice, frequency of acute illness and low birth weight of child were the main reasons behind malnutrition. "Emphasis should be given to strengthen the health extension programme to improve and

provide participatory nutrition education by creating awareness and developing better child feeding and caring practices". Nutrition education should be intensified by ASHA, ANM, Anganwadi Workers (AWWs) of the villages so that vital information on child care can be transferred to mothers to improve the nutritional status of the children. Supplementary feeding should be introduced immediately after completion of six months of age as a better practice to combat malnutrition.

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Successful synthesis of Iron Oxide-Graphene Oxide composites

Tapan Dash

Centurion University of Technology and Management, Odisha, India.

*Corresponding author: tapan.dash@cutm.ac.in; tapanphy@gmail.com

Abstract

In steel industry iron oxide has numerous applications. Dry planetary ball milling technique along with sintering is employed for successful synthesis of composites of graphene oxide and iron oxide. Graphene oxide (1.5 and 3 wt%) is added to iron oxide to prepare composites with improved mechanical properties. Iron oxide and graphene oxide composites were ball milled for 10 hrs followed by sintering. By X-ray diffraction (XRD) analysis infers peaks of iron oxide and graphene oxide (GO). Hardness of iron oxide and GO composite was found to be developed significantly when 3% of GO is added to it. The as prepared composites can be used on mild steel as coating material to enhance its mechanical and physical properties.

Keywords: Graphene oxide, Iron oxide, Hardness, Nano composite

1. Introduction

As the natural abundant resources iron oxide has been attracted greatly by researchers. Iron oxide found in three forms wustite (FeO), magnetite (Fe_3O_4), and hematite (Fe_2O_3) [1-4]. The development of any country is greatly influenced by the use and modernization of iron industry. It is involved with grate disadvantages because of involvement of corrosion and low surface hardness [5-10]. To overcome such disadvantages a suitable alloy or composite is expected to be developed. It is found that graphene oxide reinforced iron oxide composites “can develop efficient nano engineering components” with the attractive properties [11-12]. For “magnetic-assisted absorption and separation, platforms for electrochemical sensing and catalysis and as magnetic resonance”, etc. [13-17] “iron oxide-graphene oxide nano composites reported to be used. Tancredi, et al was reported to be prepared composite iron oxide and graphene via step-by-step process structure” [18]. “Graphene is one-atom-thick having 2D nanostructure having superior mechanical properties, thermal and physical properties” [19-24]. The honeycomb structure of GO/iron oxide composites is a unique material. Graphene oxide can control the microstructure, mechanical and physical properties of iron oxide. Iron oxide also can play important role in resisting re-stacking of graphene oxide layers. In this back drop, “it is more important to do research on iron oxide and

graphene oxide composite". In this paper graphene oxide reinforced iron oxide is successfully prepared and microhardness of as prepared composites is determined.

2. Experimental

Iron oxide and grapheme oxide (GO) composite were prepared by 10 hrs of ball milling. Graphene oxide of 1.5 and 3 wt.% added to iron oxide for synthesis of composites. The ball mill attached with a gyratory shaft and two steel jars of cylindrical shape. 300 rpm and 250 rpm were used by the gyratory shaft and two cylindrical steel jars respectively in the ball milling. In 1:9 weight% ratio, composite and ball was kept in jars during synthesis of composites. 8 and 2 mm in diameter of hardened steel balls were used in ball milling. The two jars are found sealed without any addition of solvents, additives and chemicals. At a time two jars can be added in the machine.

"After ball milling over, samples are taken for cooling and opened in normal atmosphere followed by characterizations. After ball milling over powder samples are kept under sintering at 1250 ^{o}C for 6 hrs. After the completion of sintering, samples were taken for XRD (X-ray diffraction), micro Raman and hardness studies". "PANalytical X'Pert Pro diffractometer equipped with CoKα radiation was used for X-ray diffraction analysis (XRD). A dispersive type Renishaw invia Reflex (UK) spectrometer was used for Micro Raman study. Nanoindenter (UMIS system Fisher-Cripps, Australia) with diamond Berkovich indenter (tip diameter: 400 nm) was used at a maximum applied load of 40 mN for hardness determination". Average of around 10 indentations were taken per sample to evaluate hardness.

3. Results and Discussion

Phases of different planes iron oxide-graphene oxide composites were studied by XRD. The analysis of XRD results is presented in the XRD analysis (Fig. 1-2). XRD was carried out within two theta of 10-80^{o}. Phases with corresponding planes were determined by "comparing the observed *d*-values with the *d*-values of standard powder diffraction data file, Fe_3O_4: 01-075-1609, FeO: 00-046-1312, Fe_2O_3: 01-084-8104, C (graphite-2H): 00-025-0284 supplied in JCPDS-ICDD PDF-2 (2004)". "XRD analysis of ball milled iron oxide shows the peaks of hematite, wustite and magnetite. But ball milled iron oxide-GO composite (3 wt%) shows peaks of GO as C(001) and C(002) along with three other peaks of iron oxide". This result is found because of possible uniform dispersion of graphene oxide in the matrix of iron oxide. The FWHM along with position of the peaks are well matches to the standard reported values regarding crystallinity and well-ordered atomic structure. Micro Raman study of composites show different type of peaks of carbon i.e. the peak of "G, D, 2D and Fe-O" (Fig. 3). The peak of "G is appeared due to the first-order scattering of the E^2g phonon from sp^2 carbon (graphite lattice), D (1^{st} order disorder peak)

corresponds to the stacking order of the graphite along the c-axis and 2D (2^{nd} order disorder peak of graphite)" [19, 25]. "D infers about the structural changed caused due to disorderness and imperfections created due to milling effect and attachment of hydroxyl, carboxyl and epoxide groups on the basal plane of carbon. D peak is due to the sp^2 reduced domain size. 2D represents stacking nature of graphene oxide". The important observation got from Raman analysis that "2D (2^{nd} order disorder peak)" peak position is not shifting towards higher wave number side, which is the clear representation of proper Bernal layer stacking. In comparison to literature [19-20], it may be represented that 2-3 layers of graphene oxide layers possibly found in the iron oxide-graphene oxide composite. Raman study confirms the presence of GO carbon.

Microhardness was determined by nanoindentation technique. First the sintered samples were prepared in pellet form. The pellet samples were surface polished. The micro hardness of iron oxide found around 155 ± 04 VHN. Iron oxide-GO (3 wt%) exhibits hardness value of 250 ± 06 VHN. The above improved hardness of the composite makes it a suitable material for coating work over mild steel to improve its mechanical and physical property.

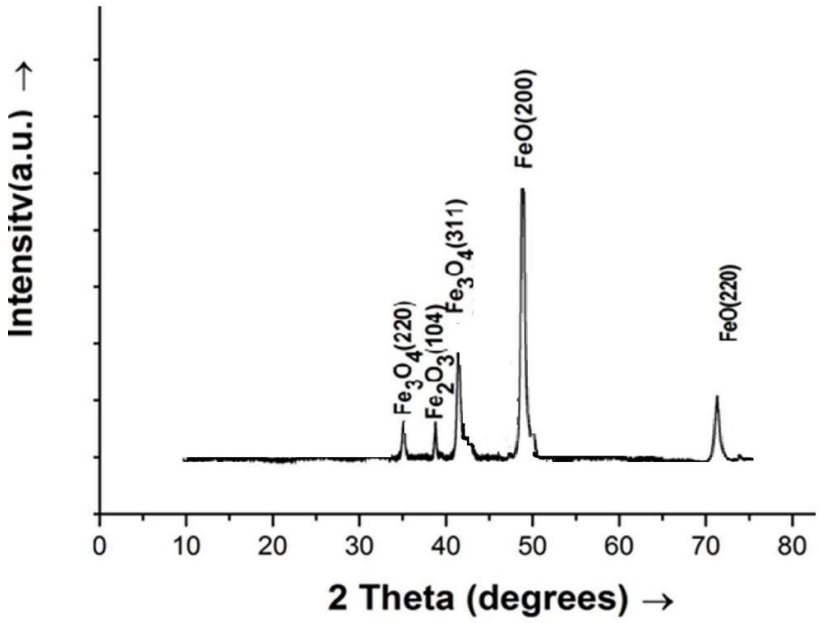

Fig.1 XRD study of ball milled iron oxide

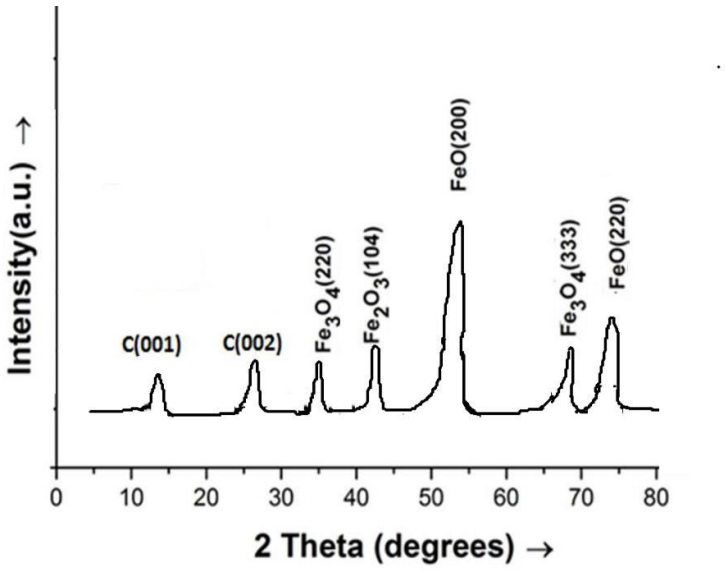

Fig.2. XRD study of ball milled iron oxide-GO (3 wt %) composite

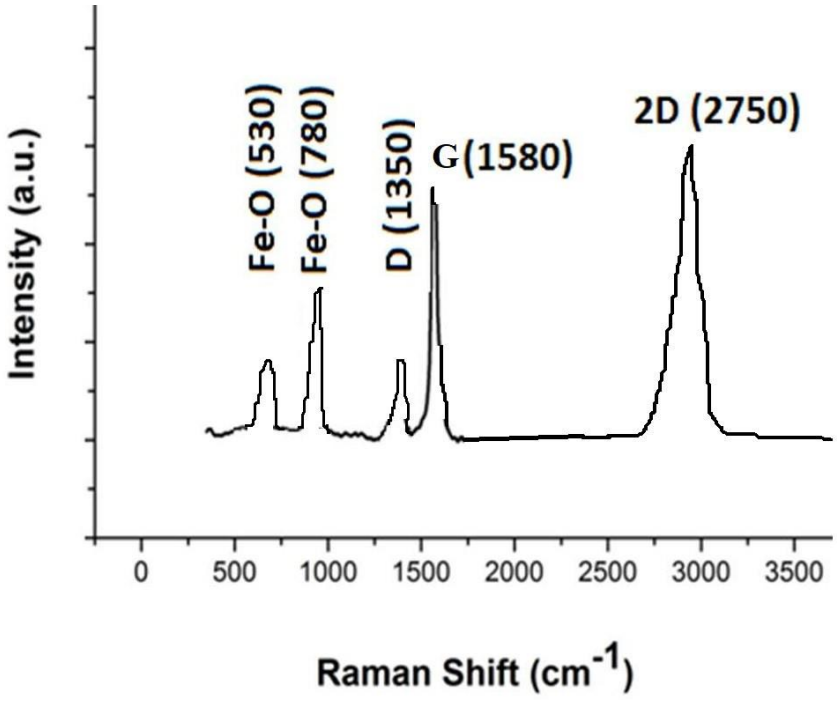

Fig.3. Micro Raman study of iron oxide-GO (2 wt %) composite

4. Conclusion

In this paper successfully iron oxide-GO (1.5 & 3 wt. %) composites were prepared by dry ball milling process followed by 1250 ^{o}C. Composites were prepared by 10 hrs of milling. Peaks of hematite, wustite and magnetite are detected in ball milled pure iron oxide. Iron oxide-GO composite ball milled sample shows peaks of C(001), C(002) along with three peaks of iron oxide. It is observed that hardness increases with adding GO content (3 wt.%) in the composite. While pure iron oxide shows hardness of 155 ± 06, iron oxide-GO (3 wt%) composite exhibits hardness value of 250 ± 06 VHN.

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Static Structural Comparision Analysis For Composite Mono leaf Spring

[1*]Sujit Mishra, [2]Manas Ranjan Padhi, [3]Preetipadma Patro, [4]MVSG Santosh Kumar,
[5]Balla Yogendar, [6]Epili Susanta, , [7]N Kiran Chawdhury, [8]Tapan Barado
Centurion University of Technology and Management, Odisha, India
*Corresponding Author: sujit.mishra@cutm.ac.in

Abstract

Present scenario in automotive industry forms by replacing leaf springs from steel with composites. Studies show the benefits of leaf springs from composite materials over steel forging metals. Present work uses the CATIA V5 platform to describe its architecture and modelling in Ansys 18.1 platform to test its static content that can be comparable and analysed for steel over various other composites. The findings show that the structural strength has more superior in E-glass epoxy with less weight than the steel mono leaf spring.

Introduction

Recent advances in automotive suspension systems has brought major improvements in performance and efficiency. In vehicles, the leaf spring in graduated laminated strips carries more power. The automotive industry is still seeking to take advantage of overall performance and to simplify the leaf spring structure and cost-efficient suspension systems. Over the life cycle, the laminated steel leaf springs become heavier, more spacious and corrosive because they are fully exposed to external environments. A compound leaf spring has an advantage and provides comparable mechanical performance such that it is possible to replace the next generation suspension system with single-leaf springs. In order to optimise the cost and shape, however the required strength to weight ratio and stress on the durability of the spring should be met. Studies using composite materials, a mixture of fibres and a refurbishing material embedded in the polymer matrix has been suggested for mono leaf springs. “The matrix protects the fibres against environmental and external damage and transfers the load between the fibres. The fibres offer strength and rigidity to the matrix and allow it to resist cracks and fractures”. For chipping, fatigue and impact resistance, the prototype of “the carbon/glass reinforced plastic leaf spring” (Tanabe 2018) has been selected and experimentally tested. The results show that compared with steel springs, the CFRP/GFRP (Swanson et al. 1997) leaf springs with high weight loss capabilities have optimum durability.The most critical one in today's mono-blade springs made from different composite combinations resign in their weight-to-weight strength and corrosive properties. In addition, a special mixture of composite material and experimental testing involves tremendous expenditure and procurement costs. Therefore, simulation processes using the FEA module yield faster test results that can produce and produce mono-leaf springs. Laminated leaf spring design and analysis with ANSYS software (Janarthanan et al. 2018), used to analyse carbon-/glass epoxy leaf spring comparison content EN45. The results of the simulation show improved mechanical properties with a weight reduction of 78 percent. It was a challenge to build the best combination of carbon fiber/epoxy composites, in particular, based on “the effects of a variety of piles, the fibre quality and the angle plying layers. (Ke et al. 2019), a composite leaf spring analysis based on material selection, design methods and efficiency”. The theory of the laminated plate using FEA methods, which can be optimised using genetic algorithms to estimate production costs and its recyclability. In selecting the leaf spring, the importance of the use of natural or basalt fibre was emphasised. EM500 Epoxy Resin (Rahmani et al. 2014) predicts that “the highest improved tensile and pliable characteristics in 35^{o} fibre orientations are showed by the different combinations of fibre orientation, the amount of laminates and the resin in use.(Thippesh 2018) has studied the effect of stress and deflection using E-Glass/Epoxy composites mono leaf spring experimentally”. He found that the mono-leaf spring is more effective than the steel leaf spring with a weight reduction of 80 percent. The same material has been used for one-way laminates in the design of composites to be studied with Ansys FEA for multilaminated leaf spring (Sorathiya et al., d.). The findings conclude that 80% of weight

reduction can be achieved with a single leaf spring 90%. The overall results show that the composite material used in mono-leaves has an advantage over the laminated leaf spring. Not only does it improve mechanical properties, it also optimises the reduction of weight. The selection of the superlative composite material at the same time shows its efficiency characteristics. This paper attempts to develop the mono leaf springs in ANSYS 18.2 solutions for composite materials such as E Glass epoxy, Carbon epoxy and making a comparison analysis over the conventional steel under static loading conditions. The application of this model will be done for MAHENDRA BOLERO.

Method for SIMULATION OF MONO LEAF SPRING

CAD Modelling

The development of "mono leaf spring CAD modelling" (Rath and Mishra, 2013) using the "CATIA platform offers a 3D environment space in product design and development with all the basic features" needed for analysis captured. Its immersive 3D application allows the product to be visualised in more detail. The spring of the mono-leaf comprises one spring plate that is thick at the middle and tapers to the ends. Figure 1 displays the dimensions used for the latest study of composite mono leaf springs. (Borković et al., n.d.) . Taken from previous work.

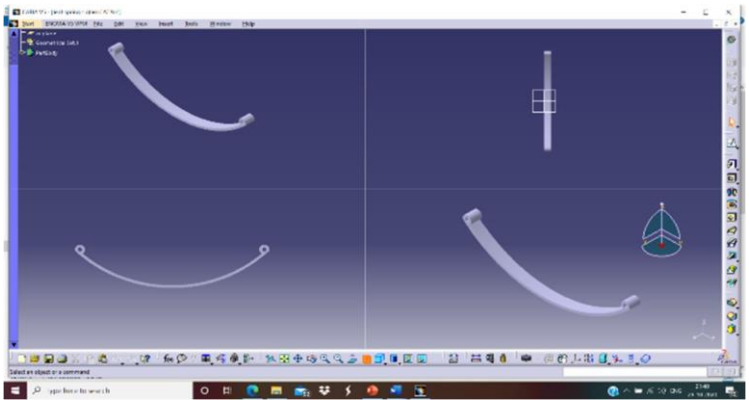

Figure 1 The design of the leaf spring model

1.6 Material properties

The materials used for this work chosen as the carbon epoxy, S Glass, E Glass epoxy composites and conventional steel. The detail properties of the composites used and applied for the analysis has been listed in the table 1.

Material	steel	E Glass Epoxy	Carbon epoxy	Unit
Youngs modulus	250Gpa	39gpa	68Gpa	Gpa
Poisson ratio	0.28	0.367	0.299	-
yield strength	440Mpa	35000Mpa	650Mpa	Mpa
density	7.75 g/cc	2.5g/cc	1.8 g/cc	g/cc
FOS	6	1.6	1.5	-
Orientation type	-	unidirectional	unidirectional	-

Table1: Mechanical Properties of Carbon/Glass Epoxy Composite

Meshing and Boundary conditions

To start the FEA in Ansys solver, the meshing method has been applied. In STEP (Standard for Exchange of Product Data), an ISO standard exchange format, the CAD model been imported into the Ansys domain interface. The division into parts of 3D mesh elements such as Tetrahedron, hexahedral, prism, and wedge elements of the mono leaf spring domain. Unstructured meshing can accommodate the versatility of node moments in such a way that it can comfortably suit the geometry. In global mesh, proximity and curvature choices made for better mesh and for adequately capturing geometry characteristics. At the eye ends and the middle part of the mono leaf spring, the local size feature is used, as this region is curious in producing excellent results. The total nodes were 154630 and 112018 respectively, which is adequate, as shown in Figure 2, for the current FEA analysis.

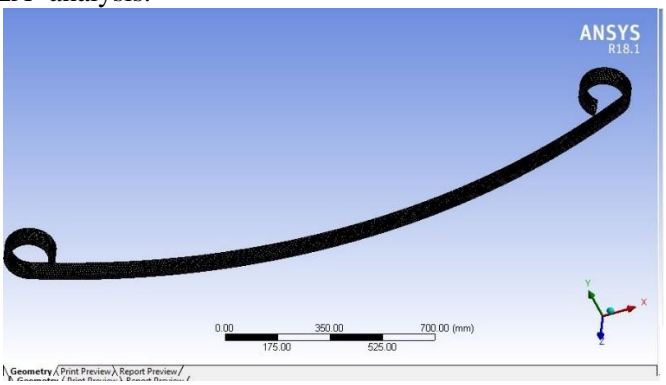

Figure 2. Unstructured Mesh elements for mono leaf spring.

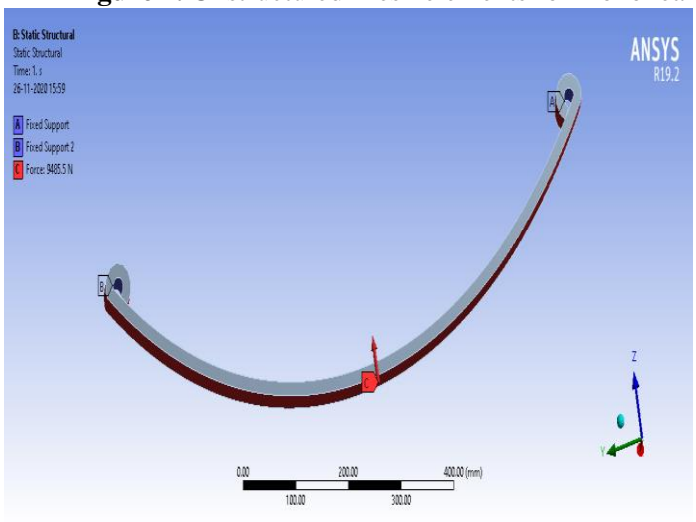

Figure 3. Boundary conditions for mono leaf spring.

The interior surface of the both ends has been fixed and load of 9589 N is applied on the bottom surface of the spring in z-direction shown in figure 3.

Results and Discussion

The simulations for static analysis of mono leaf springs has covered in this section. The results obtained as total deformation, stress and strain from Von- Mises. The von- mises or the equivalent stress has been obtained since the composite has ductility property in nature. Figure 4. displays the total deformation output results and von-mises stress respectively.

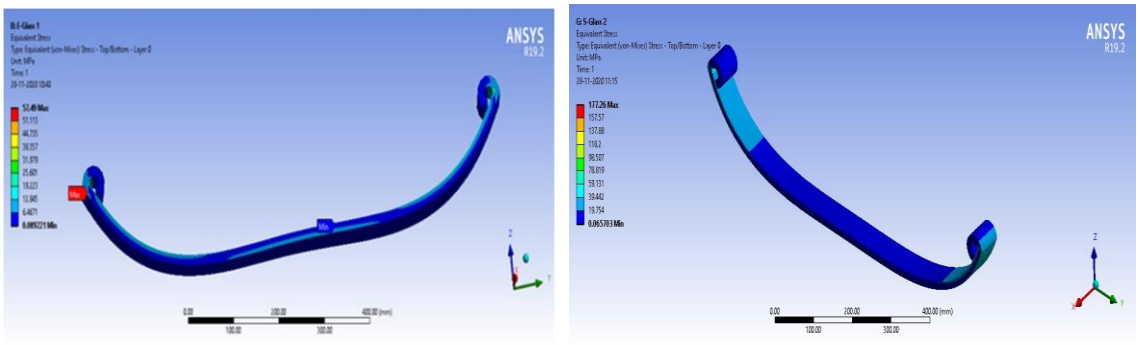

Figure 4. Von-Mises stress in (a) E-Glass Epoxy composites (b) S- Glass Epoxy composites

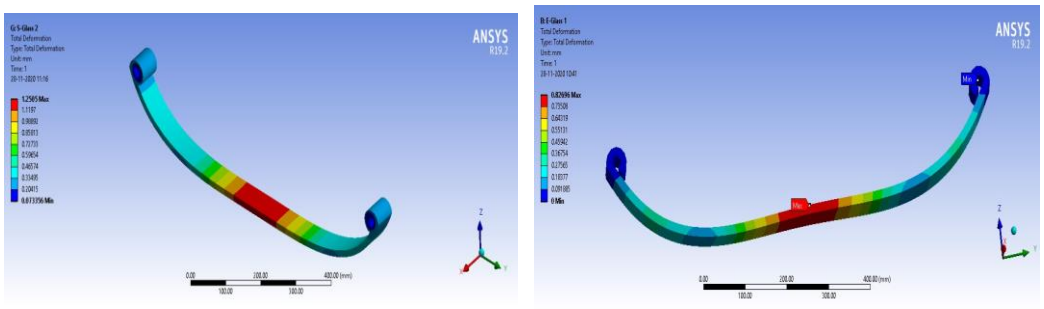

Figure 5. Total Defomation in (a) E-Glass Epoxy composites (b) S-Glass Epoxy composites

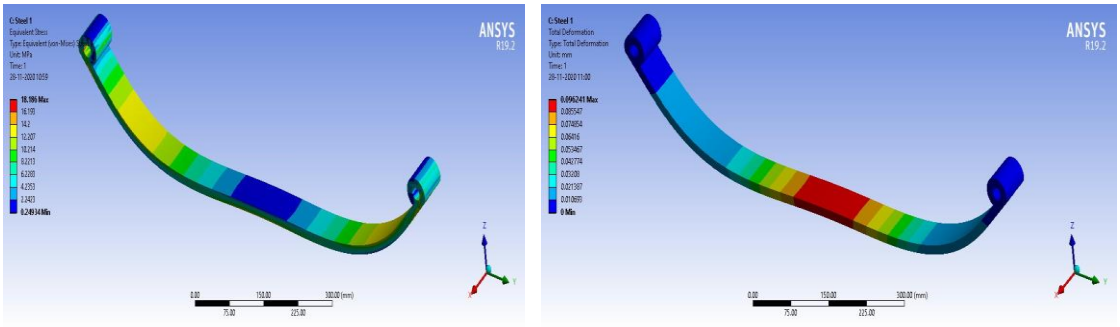

Figure 6. Von mises and total deformation in existing 56SiCr7 Steel

Material	Maximum stress (Mpa)	Deformation (mm)	Weight Reduction (%)
56SiCr7 Steel	18.186	0.096	
E glass Epoxy	57.490	0.826	78.73%
S glass Epoxy	38.942	0.373	75.61%

Table 2. Comparison of maximum stress and deformation and its weight in composites

The above results show that the overall deformation and equal stress of the current material E Glass epoxy composite mono leaf spring are in good agreement with existing data for the mono leaf spring of steel and other composite materials. Under the safe limits of yield and safety variables, the equivalent stress lies. Table 2. Shows the cumulative deformation is around 0.8 mm applied under the conditions of static loading. In addition, the overall output of the mono leaf spring with the composite material present brings around 80% weight reduction.

Conclusion

It can be inferred from the above static simulation review that,

- Analysis of simulations also given us an intuitive method for better outcomes. In the mono leaf spring application, the E-Glass composite might be a better replacement.
- Compared with the steel mono leaf spring, the E-Glass epoxy laminated composite mono leaf spring has superior strength properties with less weight.
- With the new steel mono leaf spring, an 80 percent weight reduction has been achieved.
- To forecast the life and fatigue stress for the selected mono leaf composite, a transient simulation analysis is needed.
- The experimental tests for the mono leaf spring can be done as simulation findings show a stronger agreement with that of current ones.

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Neem: Powerhouse of phytochemicals with anti – diabetic properties

Soma Maji*

Centurion University of Technology and Management, Odisha

*Corresponding author: soma.maji@cutm.ac.in

Abstract

Neem, "the bitter gem" is one of the most valued trees with many medicinal applications. The scientific name of neem is *Azadiracthta indica* and belongs to Meliaceae family. It is the world's most studied tree in the world and most promising one in the 21st century. Every part of the tree has medicinal value, such as flowers, leaves, neem cake, fruits and seed oil. Almost 300 different phytochemicals have been found in neem tree with versatile application. The aqueous and alcoholic leaf extract of neem is accounted for to have different pharmacological activities like anti-inflamatory, hypolipidaemic, immunostimulant, hepatoprotective and hypoglycaemic impacts. Considering the pharmacological importance of neem, different studies reviewed in this chapter confirming the immense possibilities of neem for prevention and treatment of diabetes. Neem tree is a rich source of flavonoids, terpenoids, tannins, saponins, anthraquinones, sterols and alkaloids which helps in diabetes management.

Keywords: Neem, leaf extract, bio active component, Diabetes

Introduction:

For millennia, the primary source of medicine has been the agents that are originating from natural sources especially the plant sources. *Azadirachta indica* is an evergreen tree cultivated in he Indian subcontinent which is popularly known as Indian neem (Margosa tree) or Indian Lilac. Since long back, Ayurveda has considered neem (*A. indica*) as a cure for many ailments, predominantly due to its superb antimicrobial activity (Jadge *et al*. 2008). Neem has been used in ayurveda and homeopathic medicines and has become a cynosure of modern medicine. The neem tree's Sanskrit name is 'Arishtha' which means 'Reliever of Sickness', also regarded as 'Sarba-roga-nibarini'. In India, the neem tree is still known as 'Village dispensary'. During the most recent fifty years, extensive advancement has been accomplished with respect to the biological and therapeutic utilizations of neem. Presently it is considered to be an essential source of unique natural ingredients, both for the development of medicines against different diseases and also for the production of industrial goods. The therapeutic value of the medicinal plant is because of some bio-chemical substance that has a definite physiological activity on the human body. The bioactive isolates of the plant include: nimbin, nimbolide, azadirachtin, meliacin, gedunin, valassin, salanin etc. The bitterness of neem seed oil is created by Meliacin. Tignic acid (5-methyl-2-butanoic acid), extracted from neem seed is responsible for characteristics odour of the oil (Uko and Kamalu, 2001; Lale, 2002). These

compounds belong to the natural products called triterpenoids. The active components are slightly hydrophilic, but mostly lipophilic in nature and soluble in organic solvents like hydrocarbons, alcohols etc. (Ogbuewu *et al.* 2011). In the on-going time, the use of medicinal plants for treating regular ailments has accepted extraordinary contemporary significance because of the increased side effects of chemical drugs. In this view, numerous studies on the biological role of certain neem components, neem extract pharmacological activities, clinical trials and plausible medical application of neem are already available (Biswas *et al*. 2002).

Morphology of neem tree:

The tree is flexible for a wide variety of climates and can flourish in sandy, stony shallow soils, as well as hard clay pan soils. Little water and plenty of daylight are needed for the tree. In a wide range of (0 – 49ºC) temperatures, it can grow well. The needed pH for neem tree growth is between 4 to 10 and it is also capable of neutralising acidic soils through a specific calcium mining property (Hegde, 1995).Neem is likely to be native to the subcontinent of India and to dry areas throughout South Asia. Parts of Africa, the Caribean and various countries in South and Central America have also been added. Neem tree belongs to the Meliaceae family (Table 1). The word "*Azadirachta"* came from "azaddhirakt" in Persia, which means "Noble tree".

Taxonomy of neem tree:

The taxonomy of neem tree is given in table 1.

Table 1: Taxonomy of neem plant (Alzohiry, 2016)

Order	Rutales
Suborder	Rutinae
Family	Meliaceae (Mahogany family)
Subfamily	Melioideae
Tribe	Melieae
Genus	Azadirachta
Species	Indica

Neem as a medicinal plant

Over 2000 years, In India and its neighbouring nations, neem is used versatile medicinal plants. All parts of the neem tree have immense therapeutic value and traditionally been used for the treatment of fever,

skin diseases, inflammations, infections and dental disorders (Subapriya and Nagini, 2005). Some of the medicial values of the different part of neem tree are given below (Girish and Shankara, 2008):

Seeds: Neem oil and cake are obtained from neem seeds. Neem oil is used as analgesic, anti-helminthic, anticholinergic, antihistaminic, antipyretic, antiviral, antiprotozoal, insecticides, bactericidal, insect repellents, fungicides and as veterinary medicines. Neem cake is used as animal feed, soil protectant, soil fertilizer and soil neutralizer.

Leaves: Neem leaves have antiemetic, antifungal, anticlotting agent, anti-helminthic, anti-tuberculosis, antitumor, antiseptic, antiviral, insecticides, nematicides, insect repellents activity.

Twigs: Twigs are used as oral deodorant, tooth cleaners, toothache reliever.

Bark: Neem ark has antidermatic, antiallergenic, antiprotozoal, antitumor and antifungal property.

Flowers: Neem flowers have analgesic and stimulant property.

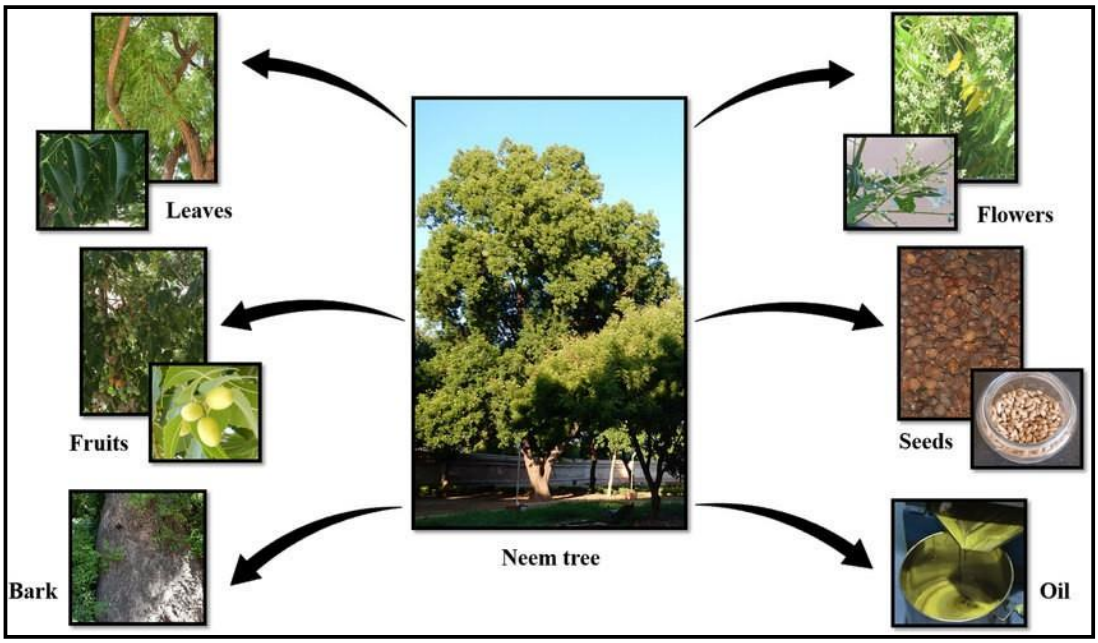

Figure 2: Neem plants and its components like leaves, flowers, fruits, seeds and Bark

Phytochemicals present in different parts of neem tree:

Neem can be called as the "storehouse" of a number of phytochemicals. More than 300 phytochemicals were extracted from neem tree (Biswas *et al*. 2002; Subapriya and Nagini, 2005; Akhila and Rani, 1999). The most two important classes of phytochemicals which "have been isolated from various parts of neem are isoprenoids, and non-isoprenoids. The most widely recognized isoprenoids include diterpenoids, vilasinins, triterpenoids, limonoids, and C-secomeliacins while proteins, carbohydrates (polysaccharides),

sulphur compounds, tannins, polyphenolics such as flavonoids and their glycosides, dihydrochalcone, coumarin and aliphatic compounds, phenolic acids comes under non- isoprenoids" (Biswas *et al*. 2002; Akhila and Rani, 1999; Brahmachari, 2004; Siddiqui *et al*. 2004; Singh *et al*. 2005).

Each part of the neem tree viz. leaves, fruit, seeds, oil, roots, bark and twigs contains large number of phytochemicals with verified antimicrobial, antiviral, antifungal, anti-inflammatory, antiplasmiodal, antiseptic, antipyretic, anti-diabetic, anti-ulcer properties (Pandey *et al*. 2012). Numerous biologically active compounds like triterpenoids, alkaloids, flavonoids, phenolic compounds, carotenoids, steroids and ketones can be extracted from neem tree. Nimbin is the first compound to be studied. Other phytochemicals derived from neem are nimbolide, azadirachtin, azadiradione, gedunin and azadirone (Gupta *et al*. 2017). The complex structure of the phytochemicals has made a large diversity (Figure 1).

Azadirachtin, consists of seven isomeric compounds which are denoted as azadirachtin A-G. Among them, the more adequate is azadirachtin E [Dash et al., 2017]. The neem leaves are enormously used among the tribal people of India in house hold level to cure cuts, wounds and other minor dermis illnesses (Jain *et al*. 2010). The triterpenoid nimbin constitute maximum biological activity which is present in neem seed oil. It has antipyretic, antiseptic, anti- inflammatory, fungicidal and antihistamine properties (Gupta *et al*. 2017). Bioactivities of some compounds extracted from neem tree have shown in table 2.

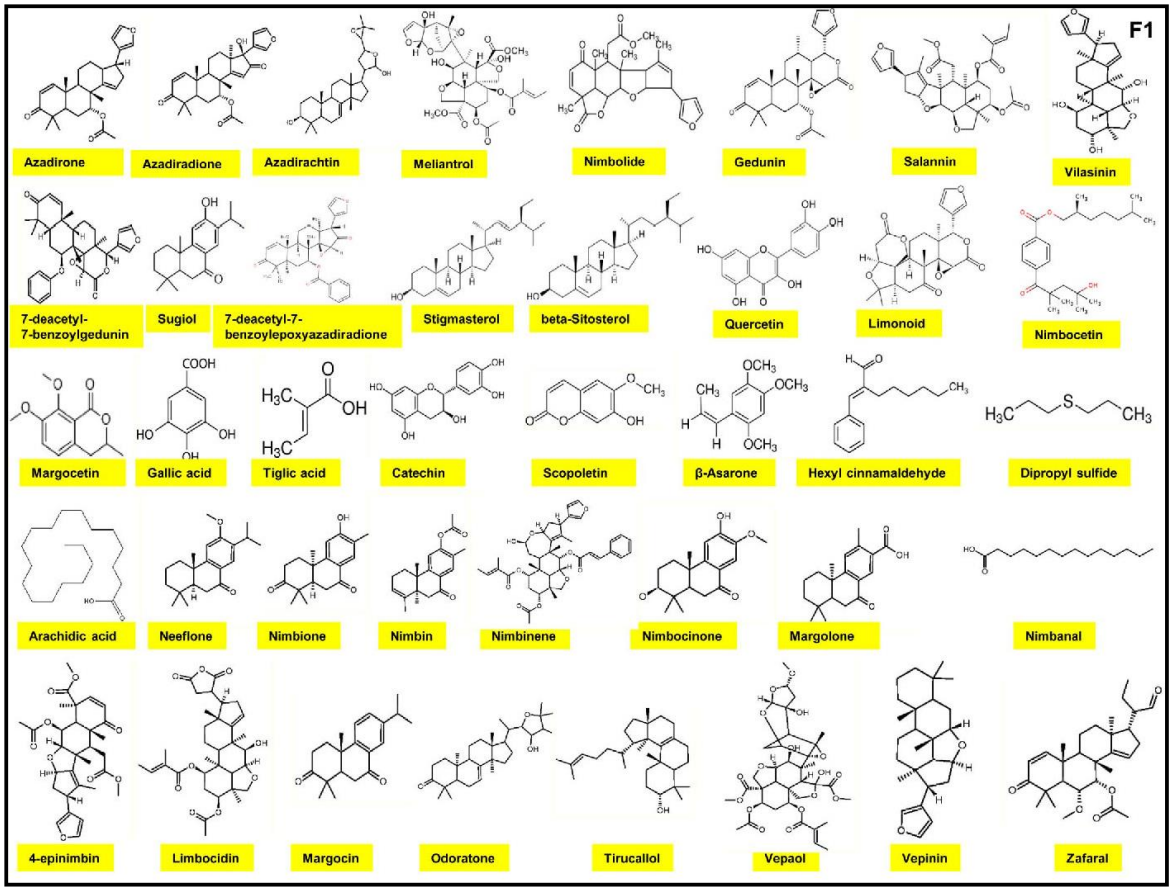

Figure 1: Structure of different phytochemicals present in neem tree

Table 2: Bioactive compounds extracted from different parts of neem tree (Biswas et al., 2002)

Neem compound	**Source**	**Biological activity**
Nimbidin	Seed oil	Anti-inflammatory, Antiarthritic, Hypoglycaemic Antigastric, Antipyretic, ulcer, Antibacterial, Diuretic, Antifungal and Spermicidal
Sodium nimbidate		Anti-inflammatory

Nimbin	Seed oil	Spermicidal
Nimbolide	Seed oil	Antibacterial Antimalarial
Gedunin	Seed oil	Antifungal Antimalarial
Mahmoodin	Seed oil	Antibacterial
Azadirachtin	Seed	Antimalarial
Cyclic trisulphide and cyclic tetrasulphide	Leaf	Antifungal
Gallic acid, (–) epicatechin and catechin	Bark	Anti-inflammatory immunomodulatory
Margolone , margolonone and isomargolonone	Bark	Antibacterial
Polysaccharides		Anti-inflammatory
Polysaccharides GIa , GIb	Bark	Antitumour
Polysaccharides GIIa , GIIIa	Bark	Anti-inflammatory
NB-II peptidoglycan	Bark	Immunomodulatory

Phytochemicals present in neem leaves:

In Ayurveda, neem has been used widely and among all part of the neem tree, the medicinal utilities have been described more especially for neem leaf (Brahmachari, 2004; Akhila and Rani, 1999).

The following discussion will be limited to neem leaves on pharmacological activities. Neem leaves are available throughout the year. The easy extraction of the phytochemicals has made neem as widely used ingredient in ancient as well as modern medicinal preparations. More than 200 compounds isolated from different aspects of the neem tree, among them contribution of leaves are more than 50 compounds. New young neem leaf contains water, carbohydrate, protein, minerals, calcium, phosphorus (Puri, 2003). Neem leaf is a high source of different type of fatty acids and amino acids. Some of the amino acids are glutamic acid, glutamine, tyrosine, alanine, and cysteine (Table 3). Neem leaf extracts and its constituents shows

antibacterial (Pokhrel *et al*. 2015), anticarcinogenic (Paul *et al*. 2011, Subapriya and Nagini, 2003), antihyper- glycemic (Niture *et al*. 2014), anti-inflammatory (Sikdar *et al*. 2014), antimutagenic (Brahmachari, 2004), antioxidant (Ghimeray et al., 2009), antiulcer (Maity *et al*. 2009) cardioprotective (Koul *et al*. 2014a), hepatoprotective (Koul *et al*. 2014b) and immuno- modulatory (Mukherjee *et al*. 2014) properties (Table 4).

Table 3: Chemical Constituents of Neem Leaf (Subapriya and Nagini, 2005**)**

Compositional parameter	**Content (on dry matter basis)**
Carbohydrate (per cent/100g)	47.46 - 51.2
Crude protein (per cent/100g)	14.01 - 18.82
Crude fiber (per cent/100g)	11.20 - 23.80
Fat (per cent/100g)	2.31 - 6.93
Ash (per cent/100g)	7.73 - 8.52
Moisture (g/100g)	59.49
Amino acids (mg/100g)	
Glutamic acid	73.3
Aspartic acid	15.5
Tyrosine	31.5
Alanine	6.4
Proline	4.0
Glutamine	1.0
Minerals (mg/100g)	
Calcium	3.4
Iron	510.0
Phosphorus	0.13 - 0.24
Thiamine	80.0
Niacin	17.1
Vitamin C	0.04
Carotene	1.4
Calorific value (K cal/100g)	129.0

Table 4: Bio- activities of various compounds from neem leaf (Yadav et al., 2016)

Compound	Bio-activity
Azadirachtin	Antioxidant, anti-inflammatory
Chlorogenic acid	Antioxidant, anti-inflammatory
Quercetin	Antioxidant, anti-inflammatory
Kaempferol/derivatives	Antioxidant, anti-inflammatory
Myricetin	Antioxidant, anti-inflammatory
Nimbin	Antioxidant
Nimbolide	Antioxidant
Rutin	Antioxidant ,antihyperglycemic
Scopoletin	Antioxidant
Sigmasterol/β-Sitosterol	Antioxidant

Diabetes:

Now a days Diabetes is a major disease worldwide and that is approach*in*g epidemic proportions globally. By the year 2000, the number of diabetic individuals was 170 million, and this figure is expected to ascend 366 million by 2030 (Wild *et al*., 2004). Sometimes the non- desirable side effects of the allopathic antidiabetic drugs may cause the reason of this disease (Singh *et al*. 2007). Neem is one of the commonly used plants for the treatment of diabetes mellitus in conventional medicine. Diabetes is a chronic-metabolic condition caused by elevated levels of blood glucose (or blood sugar) that can cause significant damage to the blood vessels, heart, kidneys and nerves (Mohammed *et al*., 2007). Oxidative stress, the difference between the development of reactive oxygen species (ROS) and the ability of enzymatic or non-enzymatic antioxidants may be the reasons for the pathophysiology involved in this condition. Such ROS can activate multiple harmful pathways that play an important role in diabetes disease development. The mode of action results in insulin resistance or molecular mimicry. That, on the other hand, results in autoimmune destruction of Langerhans islet β- cells and insulin deficiency or both (Ngugi *et al*. 2015). On peripheral tissues, the deficiency and improper action of insulin hampers the dietary carbohydrates, fats and proteins metabolism (Abdirahman *et al*. 2015).

Effect of neem leaves on diabetes:

The hypoglycaemic effect of neem leaf aqueous extract may be due to increased "insulin release from islet pancreatic beta cells or increased peripheral glucose absorption and utilization" (Bedoya *et al*. 1996; Amjad *et al*. 2013). Insulin released from remaining "β-cells and/or regenerated β-cells improves the extract's antidiabetic impact" (Esmaeili *et a*l. 2004; Sharma *et al*. 2006), re-develop insulin sensitivity

(Yolanda and CHICCO, 2006), malabsorption in the small intestine of dietary carbohydrates (Ortiz-Andrade *et al*. 2007) or enhance the blood glucose uptake through "peripheral tissues regulated by an insulin dependent glucose transporter named GLUT-4 (Obatomi *et al*. 1994). Several phytochemicals are found in plant extracts, such as flavonoids, free and bound anthraquinones, terpenoids, tannins, saponins, sterols and alkaloids, which have been related to the hypoglycaemic effect and ultimately serve to prevent diabetes" (Middleton *et al*. 2000). In addition, flavonoids in the adipocytes also increase the rate of lipogenesis and glucose transport activity which significantly reduces blood sugar (Middleton *et al*. 2000, Viana *et al*. 2004).

Case study on effect of neem leaves on diabetes:

The neem leaf extract contains alkaloids that are responsible for facilitating the restoration of insulin secretion through the regeneration of pancreas islets. Further, saponins and tannins were also found to have hypoglycemic activity (Broadhurst *et al*. 2000). The terpenoids, found in the plants are very heart-friendly as they significantly minimize diastolic blood pressure and decrease the blood sugar levels (Hawkins and Ehrlich, 2006). Anthraquinones are widely used to treat peripheral neuropathy, and has also been reported to reduce the level of blood glucose (Broadhurst *et al*. 2000). As per the study conducted by Arica *et al.* (2016), observed that the administration of different doses (25, 48.4, 93.5, 180.9 and 350 mg/kg) of aqueous neem leaf extract in different time interval, decreases blood glucose levels in diabetic mice (alloxan induced). The plant extract was comparable to standard drug (glibenclamide) in all doses and both routes (Figure 3).

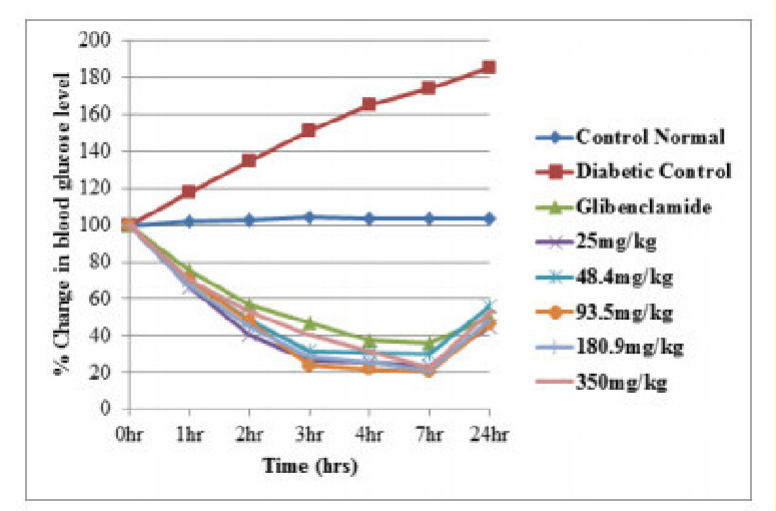

Figure 3: The change in blood glucose levels of orally administered neem (*Azadiratchta indica*) in alloxan induced diabetic mice. Arica *et al.* (2016)

The same type of effect of neem leaf extract was observed in alloxan induced diabetic rat, rabbit and dogs for the reduction of blood glucose level (Dholi *et al*. 2011; Khosla *et al*. 2000; Satyanarayana *et al*. 1978). It was also noted that in experimentally induced diabetes in rats and rabbits that resulted in decreased blood glucose levels. The anti-hyperglycemic effect is because of the antiserotonin function of neem leaf (Khosla *et al*. 2000). Along with glucose, it was found that the neem leaf extract can reduce cholesterol (15%), lipids (15%), triglycerides (32%), creatinine (23%), and urea (13%) in rats (Dholi et al., 2011). This form of effect can be useful to avoid diabetic states because early intervention may avoid or postpone disease onset by an irregular glucose metabolism. Increased peripheral use of direct metabolism effects on tissues, especially on the liver, may lead to the hypoglycaemic effect of neem leaf. Among different compounds neem, "rutin and quercetin have been found to have hypoglycemic/antihyperglycemic effects recently" (Subapriya and Nagini, 2003). Neem leaves with chloroform as a solvent were collected and showed promising results for oral glucose tolerance testing and decreased significantly the activity of intestinal glucosidase. Meliacinolin, a new tetranortriterpinoid from chloroform extract also demonstrated in vivo anti-diabetic property against streptozotocin induced type 2 diabetes in mice. Alpha – glucosidase and alpha amylase activities have also been inhibited by meliacinolin, which may be an important technique to reduce the postprandial hyperglycemia levels.

Conclusion:

Neem is one of the India's most prestigious trees. Different parts of the plant have long been used by humans to treat various diseases from the ancient times, such as leaf, bark, flower, root and seed. Modern science, now a days, has discovered molecules behind pleiotropic behaviour of neem and its constituents. Modern science has exposed the molecular basis for the pleiotropic activities of neem and its constituents. Since in recent years the prevention and treatment of different diseases over the harmful side effect of chemical drugs has been increasingly being considered in medicinal plants and phytochemicals, this pharmacological study is a useful tool for the development of neem medicines.

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Differential Expression of *Arabidopsis* EJC Core Proteins under Short-Day and Long-Day Conditions

Annapurna Sahoo[1] and Kunja Bihari Satapathy[1]*
[1]School of Applied Sciences, Centurion University of Technology and Management, Odisha, India
*Corresponding Author's email: kunjabihari.satapathy@cutm.ac.in

Abstract

Exon junction complexes (EJCs) associate with mRNAs, mediate the pre-mRNA splicing and eventually gets displaced by ribosomes during the initial phase of translation. EJCs are involved in several critical physiological pathways. The functional nature of EJCs and the underlying molecular mechanism(s) still needs to be elucidated particularly in case of plants. Here, we report that the putative core protein factors of the EJC differentially express under short-day and long-day conditions. Since, plants are constantly exposed to biotic and abiotic factor(s), it would be significant to see how the EJCs respond to different stress inducing conditions. The protein levels of EJC core proteins under short-day conditions were 1.25 times higher relative to the protein levels under long-day conditions. Similar results were observed for the mRNA transcripts of the EJC core protein factors as evident from the semi-quantitative reverse transcriptase polymerase chain reaction (sq-RT PCR). These results signify that under short-day conditions, the EJC proteins are more activated and might be involved in few events which are yet to be revealed.

Keywords: Exon junction complexes, splicing, short-day, long-day, transcripts.

Introduction

The exon junction complex (EJC) comprising of three core protein factors is a multi-protein complex and interacts with the spliced messenger RNA (mRNA) to form mRNA-ribonucleoproteins (mRNPs). EJC manipulates the post-transcriptional events (Woodward *et al*., 2017, Boehm and Gehring 2016, Le Hir *et al*., 2016, Panigrahi and Sahoo 2016). Several associating proteins bind to the core EJC factors, depending on the cellular event that they will mediate. Essentially in a sequence-independent manner the EJCs assemble and bind to the mRNAs in the region of 20-24 nucleotides (nts) upstream of exon-exon junctions (Obrdlik *et al*., 2019, Saulière *et al*., 2012). EJCs remain bound t*o* the mRNA throughout their life cycle (Bono *et al*., 2006, Andersen *et al*., 2006). The central dogma is regulated by the EJC proteins, but the underlying molecular mechanism(s) in which they still remains blurred. The role of EJC in the splicing process is highly regarded and thought to play a central role in determining the fate of the mature mRNA (Nott *et al*., 2003). The EJC increases the fidelity, efficiency and productivity of the translation event (Le

Hir and Séraphin 2008, Panigrahi *et al*. 2016). Interestingly, how the EJC proteins respond to changes in plant growth conditions still remains to be revealed. Light, being an abiotic factor plays a significant role in regulating the growth of the plant. Flowering and other developmental stages are affected depending on the availability of light (Hegland *et al*. 2009, Behera *et al*. 2020, Das *et al*. 2020, Jena *et al*. 2020, Ray *et al*. 2020). It is intriguing to reveal the role of EJC when the plants are grown at different exposure to light. Plants invariably alter the key molecular processes when exposed to different stress conditions (Panigrahi and Satapathy 2020a, Panigrahi *et al*., 2021). Since, EJC is well involved in various physiological pathways; it would be significant to reveal the role of EJC when plants are grown at varied growth conditions (Panigrahi and Satapathy 2020b,c). Here, we provide evidence that the EJC core protein factors; Y14, MAGOH and EIF4A3 gets differentially expressed under short-day and long-day growth conditions, which specifically highlights that the EJC proteins are more activated and get accumulated to respond to changed environmental conditions by modulating the key molecular events.

Materials and Methods

Plant materials and growth conditions

Seeds of wild-type Arabidopsis (*Arabidopsis thaliana*) ecotype Columbia-0 (Col-0) were sown in soil. The plants were grown simultaneously under short-day (12/12 h light/dark) and long-day (16/8 h light/dark) conditions at 22° C with 70-80% relative humidity. Western blotting and semi-quantitative reverse transcriptase polymerase chain reaction (sq-RT PCR) assays were done using the leaves of *Arabidopsis thaliana*.

Semi-quantitative reverse transcriptase polymerase chain reaction (sq-RT PCR)

Full-length cDNA of Y14, MAGOH and EIF4A3 was obtained by RT-PCR using Col-0 RNA. For RNA extraction, twenty-one-day-old plants were used. Semi-quantitative reverse-transcriptase polymerase chain reactions were carried out using gene-specific primers. Reactions were performed in triplicate and the relative levels of the transcripts were normalized to the expression levels of genes used as internal controls, which included EF1α.

Protein extraction and Western blotting

Total proteins were isolated from 0.1g leaf of the twenty-one-day-old *Arabidopsis thaliana* Col-0 plants. The leaves were harvested from plants which were grown simultaneously under short-day (12/12 h light/dark) and long-day (16/8 h light/dark) conditions at 22° C. The composition of the extraction buffer

was 20 mM of Tris-Cl (pH 8.0), 100 mM of NaCl, 1 mM of EDTA, 1 mM of PMSF, and 1X proteinase inhibitor. Western blot analysis was done using protein-specific antibodies.

Result and Discussion

The putative EJC core proteins, Y14, MAGOH and EIF4A3 are highly conserved across various plant species.

The protein sequence of the core EJC protein factors are highly conserved across various plant species (Fig. 1, Fig. 2, Fig. 3). The protein sequence of the *Arabidopsis* proteins shares maximum number of fully conserved residues relative to other plant species. From the remaining, substantial fraction of amino acid residues share similarity >70%. Interestingly, the *Arabidopsis* proteins, Y14, MAGOH and EIF4A3 are highly conserved in various plant species, suggesting that they all are equipped with these vital protein factors.

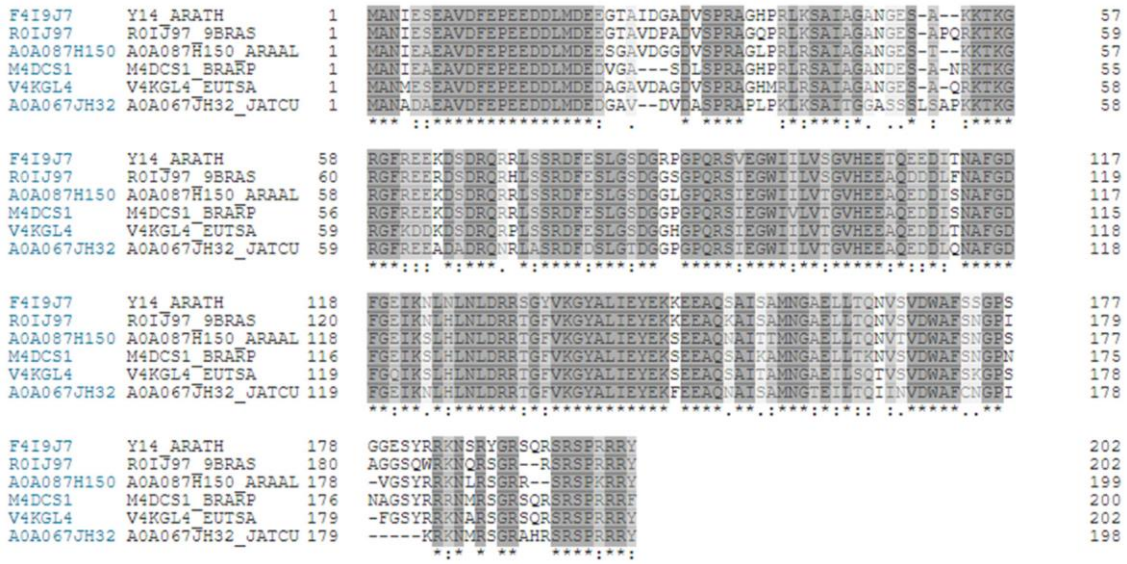

Fig. 1: Protein sequence alignment of the YI4 of *Arabidopsis thaliana*. Residues that are conserved are represented in box shades. Figure was generated with UniProt. (F4I9J7: *Arabidopsis thaliana*; R0IJ97: *Capsella rubella*; A0A087H150: *Arabis alpina*; M4DCS1: *Brassica rapa*; V4KGL4: *Eutrema salsugineum*; A0A067JH32: *Jatropha curcas*).

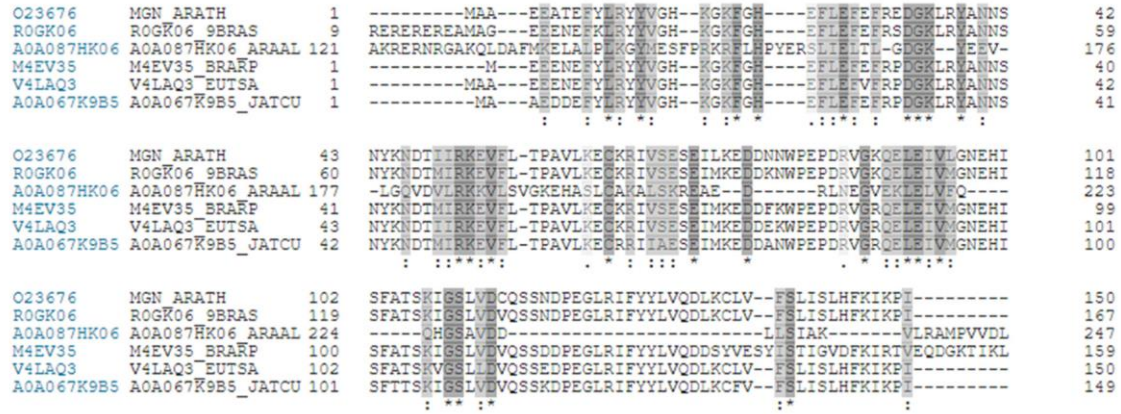

Fig. 2: Protein sequence alignment of the MAGOH of *Arabidopsis thaliana*. Residues that are conserved are represented in box shades. Figure was generated with UniProt. (O23676: *Arabidopsis thaliana*; R0GKQ6: *Capsella rubella*; A0A087HK06: *Arabis alpina*; M4EV35: *Brassica rapa*; V4LAQ3: *Eutrema salsugineum*; A0A067K9B5: *Jatropha curcas*).

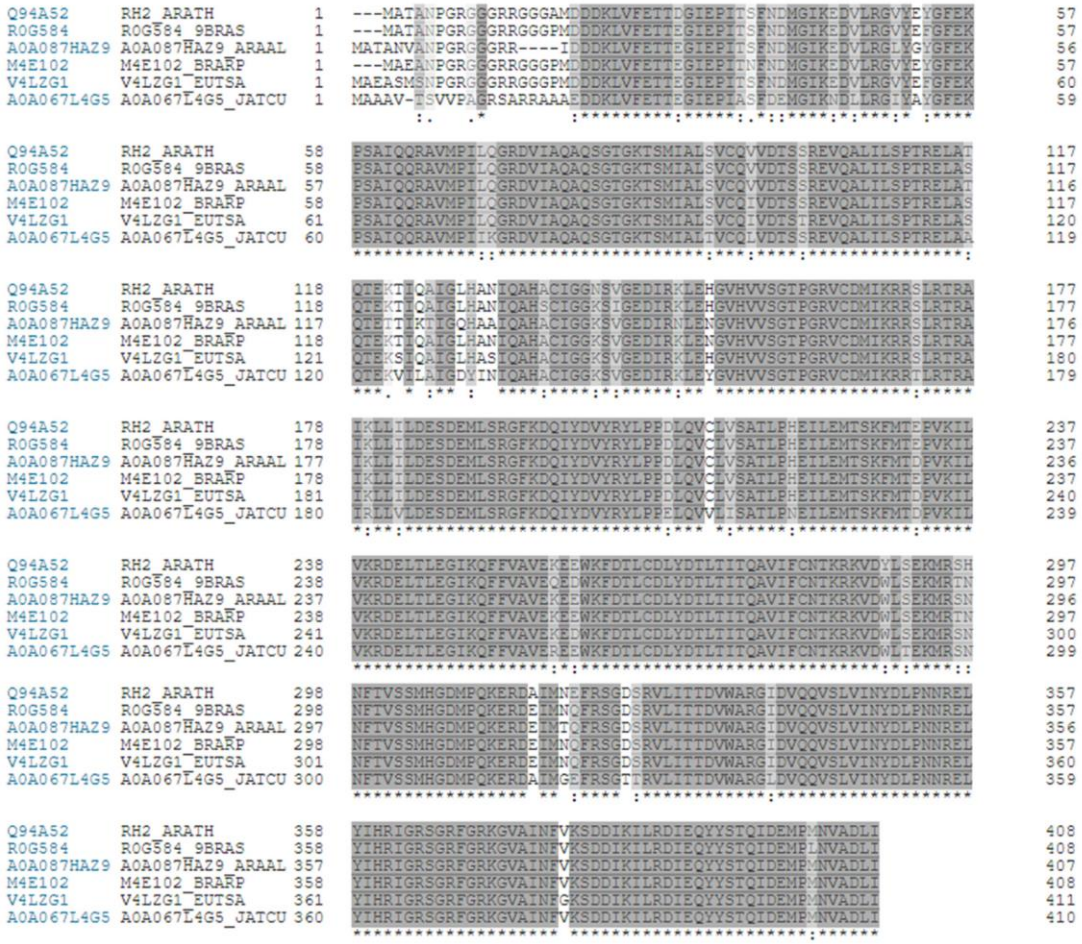

Fig. 3: Protein sequence alignment of the EIF4A3 of *Arabidopsis thaliana*. Residues that are conserved are represented in box shades. Figure was generated with UniProt. (Q94A52: *Arabidopsis thaliana*; R0G584: *Capsella rubella*; A0A087HAZ9: *Arabis alpina*; M4E102: *Brassica rapa*; V4LZG1: *Eutrema salsugineum*; A0A067L4G5: *Jatropha curcas*).

The *Y14*, *MAGOH* and *EIF4A3* transcripts are differentially expressed under long-day and short-day conditions.

The core EJC protein factors are engaged in several key molecular events. Plants when exposed to varied environmental conditions acclimatize themselves according to the prevailing stimulus. We intended to see the expression pattern of the core EJC proteins at the transcript level under long-day and short-day growth conditions. Interestingly, it was observed that the expression levels of *Y14*, *MAGOH*, *EIF4A3* were upregulated for short-day grown plants relative to the long-day plants to 1.26, 1.25 and 1.09 times respectively (Fig. 4A, Fig. 4B). The transcript level of *ACTIN* represents the control of the experiment. Heat map of differential expression patterns of the EJC core genes under long-day and short-day growth conditions are represented in Fig. 4C.

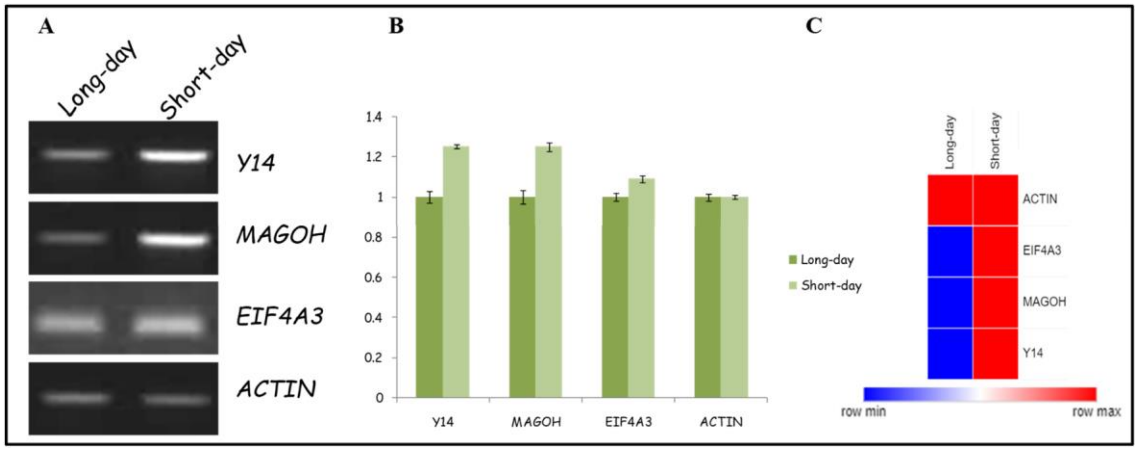

Fig. 4: Differential RNA level expression of the *Y14, MAGOH, EIF4A3* under long-day and short-day conditions. (A) The agarose-gel images were generated using primers specific for *Y14*, *MAGOH* and *EIF4A3*. *ACTIN* amplification represents the control of the experiment. (B) The expression levels of *Y14*, *MAGOH*, *EIF4A3* were upregulated for short-day grown plants relative to the long-day plants to 1.26, 1.25 and 1.09 times respectively. (C) Heat map of differential expression patterns of the EJC core genes under long-day and short-day growth conditions. Web-based tool Morpheus was used to generate the heat map.

The protein products of *Y14*, *MAGOH* and *EIF4A3* are higher at short-day growth conditions.

The protein levels of the core EJC protein factors are differentially regulated under long-day and short-day growth conditions. Concurrently, it was observed that the protein levels of Y14, MAGOH, EIF4A3 were upregulated for short-day grown plants relative to the long-day plants to 1.38, 1.21 and 1.1 times

respectively (Fig. 5A, Fig. 5B). The protein level of ACTIN represents the internal control of the experiment. Protein loading is shown by Ponceau S staining for RuBisCo. This result signifies that the EJC core proteins might accumulate under short-day growth conditions so that the plants can respond at a molecular level. The increase in protein levels of the Y14, MAGOH, EIF4A3 also highlights that under short-day growth conditions these protein factors may be involved in molecular events which are yet to be exposed. It would be interesting to reveal the underlying molecular mechanism(s).

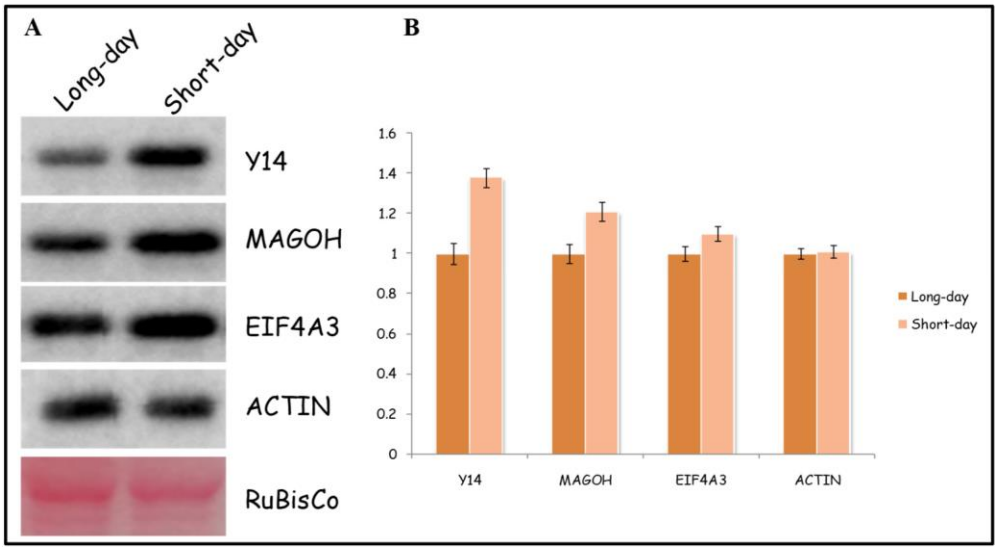

Fig. 5: Differential protein level expression of the Y14, MAGOH, EIF4A3 under long-day and short-day conditions. (A) The Western blots were generated using α-Y14, α-MAGOH and α-EIF4A3 antibodies. Protein loading is shown by Ponceau S staining for RuBisCo. (B) The protein levels of Y14, MAGOH, EIF4A3 were upregulated for short-day grown plants relative to the long-day plants to 1.38, 1.21 and 1.1 times respectively.

Conclusion

Revealing the functional and physiological role of the EJC is of great interest may unravel many hidden molecular mechanism(s). For instance, the EJC is indispensable for the growth of plants as the knockout of the core EJC protein factors results in embryo lethality conditions in *Arabidopsis*. Similarly in animals, knockout of both the core and peripheral EJC proteins significantly affects the growth of the cell and mostly lead to hereditary diseases. It seems worthwhile to focus on the underlying molecular mechanism(s) through which EJC mediates a wide range of physiological events. The detailed mechanism(s) of the EJC-mediated events remains to be elucidated. How EJC-mediated response is triggered in plants in response to stress conditions is not yet fully understood. Our results gives a prima facie evidence that the EJC core proteins are differentially expressed under short-day growth conditions in

Arabidopsis and may be well involved in modulating different physiological processes necessary for the plant to resist the environmental changes. Future research on understanding the role of EJC would be significant.

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Application of Probiotics in Aquaculture

Sagarika Swain[1], Hauzoukim[1] and Biswajit Mohanty[1]
School of Fisheries, Centurion University of Technology & Management, Odisha, India

Abstract

Aquaculture is one of the world's fastest growing industries, and Asia currently accounts for about 90 percent of global production. However, disease outbreaks in many countries in the Asia-Pacific region are restricted to the production of aquaculture, thereby affecting both the economic growth of the country and the socio-economic status of local citizens. Disease management in the aquaculture industry has been accomplished by using conventional techniques, synthetic chemicals and antibiotics in various ways. However, the use of such costly chemotherapeutants for disease control has been widely criticized for their negative effects, such as residue accumulation, development of drug resistance, immunosuppression and decreased consumer demand for antibiotic-treated aqua products, and conventional methods are ineffective in large aquaculture systems to control new diseases. Therefore, in order to preserve the health of the cultured species, alternative methods need to be established to maintain a stable microbial environment in the aquaculture systems. One of these approaches is the use of probiotics, which is gaining popularity in the management of possible pathogens. This analysis summarizes the requirements for the selection, significance and future prospects of potential probiotics in the aquaculture industry.

Introduction

Aquaculture has become a significant economic operation in the field of a number of countries. In large-scale manufacturing premises, where aquatic animals are subject to harsh environments, disease-related issues and environmental degradation also occur, leading to severe economic problems. During this time, the prevention and control of diseases led to the use of veterinary medicinal products has increased significantly in recent decades. However, given the extensive evidence of antimicrobial evolution between pathogenic bacteria, resistance, the usefulness of antimicrobial agents has been questioned as a preventive measure (Balcazar,2003). Globally, during an antibiotic period of just around 60 years length, antibiotic tones were dispersed throughout the biosphere. Out of the “18,000 tons of antibiotics developed annually for medical and agricultural purposes in the United States, 12,600 tons are used for non-therapeutic treatment of livestock” for growth promotion purposes (SCAN, 2003). “1600 t of antibiotics, representing approximately 30% of the overall use of antibiotics in farm animals, are similarly used for growth promotion purposes in the European Union and Switzerland” (SCAN, 2003). These quantities of antibiotics exert a very strong selection pressure on the resistance of bacteria adapted to this situation, primarily through the horizontal and promiscuous flow of genes of resistance (SCAN, 2003). Mechanisms of resistance can evolve in one of two ways: chromosomal mutation or plasmid acquisition. Chromosomal

mutations can not be transmitted to other bacteria, but tolerance can be easily transferred by plasmids (Lewin, 1992). Several bacterial pathogens can develop resistance mediated by plasmids. In marine Vibrio species, plasmids carrying genes for resistance to antibiotics have been identified and could be laterally exchanged. Genetic exchange mechanisms could all be probable at "high population densities of bacteria found in aquaculture ponds, transfer via plasmids, transduction via viruses, and even direct transformation from DNA absorbed into particles in the water or on sediment surfaces" (Moriarty,1997). Furthermore other evidence of resistance transmission between aquaculture ecosystems and humans has been shown in *Salmonella typhimurium* DT104, "with a novel florofenicol resistance gene floR, which confers resistance to chloramphenicol and is almost identical by molecular sequence to the florofenicol resistance gene first identified in *Photobacterium damsela*". There is a growing interest in the regulation or removal of antimicrobial usage within the industry at present. Therefore to maintain a healthy microbial environment in aquaculture systems, alternative methods need to be created. The use of probiotic bacteria to control possible pathogens is one such technique that is gaining significance within the industry.

Definition of probiotic

The term probiotic means "for life," derived from the Greek words "pro" and "bios" (Gismondo *et al*. 1999). Lilley and Stillwell (1965) originally used the concept of probiotics to mean a substance (s) that promotes the growth of other microorganisms (Chukeatirote, 2002). The description was changed by Parker in 1974 to "organisms and substances that contribute to intestinal balance." "The definitions were revised by Fuller (1992) "as a live microbial feed supplement that benefits the host animal by improving its intestinal microbial balance". The meaning of live cells as the live cells has been put forward by this definition "A potential probiotic's essential component and its clears the confusion created by the use of the term "substance". Gram *et al.* (1999) suggested that probiotic is to be any live microbial supplement that benefits the host animal by improving its microbial balance. In this instance, there is no connection to food. In addition, "Salminen *et al*. (1999) suggested that a probiotic is regarded as any microbial (but not necessarily living) preparation or component of the microbial cells that have a beneficial impact on the host's health". Verschuere *et al*. (2000) proposed the concept "a live microbial adjunct that has a beneficial effect on the host by modifying the host" by ensuring improved use of the feed or improving its nutritional value by improving the host response to disease, or by improving the quality of its environmental climate, the related or ambient microbial population. A portion of the probiotic requirement to be a live organism culture, as defined by Irianto and Austin (2002), this definition is a long way to describe a probiotic, so a probiotic is an entire or component of a microorganism that is beneficial to the host's health." The use of microorganisms or their products (element of microbial cells or cell-free supernatant factors) in these

definitions reflects in "tanks and ponds in which animals live as biological control or their ability to change the bacterial composition of the intestine, water and sediment of aquatic animals or to use feed as a health supplement and/or as a feed supplement and/or biological oversight".

Criteria for selection of probiotics in aquaculture

The main objective of the initial use of probiotics is to preserve or restore a favorable relationship between friendly and pathogenic microorganisms that make up the intestinal flora or skin mucus of fish. A good probiotic is supposed to have a few unique characteristics. And the following steps should be taken in order to produce probiotics for commercialization.

- A healthy source of microorganisms must be selected from the digestive tract of healthy aquatic animals.
- The microorganisms in which to carry out the work are isolated by means of selective culture and established.
- A modern society of interest only in the colonies for conducting in vitro assessments, e.g. pathogen inhibition; pathogenicity to target species; host conditions of resistance; among others are conducted.

In the absence of any limits on the use of the target species, in vivo supplementation experiments, on a small and wide scale, it is carried out to verify whether the host has real advantages. Finally, the probiotic that produced a considerably satisfactory outcome commercially and used may be manufactured.

Characteristics of good probiotics

The following were identified by Fuller (1989) as features of healthy probiotic bacteria:

(i) A strain capable of exerting a beneficial effect on the host animal, such as increased growth or resistance to disease, should be considered.

(ii) It should be non-toxic and non-pathogenic.

(iii) They should be present, ideally in large numbers, as viable cells.

(iv) It should be capable of survival and metabolization, e.g. tolerance to low pH and organic acid, in the gut environment.

(v) Under storage and field conditions, it should be stable and capable of remaining viable for periods.

Probiotics significance in aquaculture

There are some potential advantages linked to the administration of probiotics that are already proposed as:

Improvement of water quality

Pollution of nitrogenous compounds such as ammonia, nitrite, nitrate has become a severe problem in fish culture systems/ponds. In general, the vulnerability of cultivated aquatic organisms to high concentrations of these compounds is species-specific, but these compounds can be extremely harmful at high concentrations and cause mass mortality in all cases. The capacity of Lactobacillus spp. was stated by Ma *et al*. (2009). JK-8 and JK-11 extract all nitrogen and pathogens from infected shrimp farms at the same time. In several other studies, the addition of probiotics, particularly Bacillus spp., has improved the quality of water (Verschuere *et al*. 2000 and Kolndadacha *et al*. 2009). Gram-positive Bacillus spp. is the explanation for this. According to Stanier et al. (1963), organic matter is typically more effective than gram-negative bacteria in converting organic matter back to CO2, which will transform a higher percentage of organic carbon to bacterial biomass or slime.

As growth promoters

It has been experimentally shown that probiotics can actually improve fish development. It was a probiotic bacterium because of "the ability of species to out-grow the pathogens in favor of the host or to enhance the growth of the host and still no side effect on the host. In an attempt to use probiotic bacteria as a growth promoter for tilapia (*Oreochromis niloticus*), Yassir *et al*. 2002 identified that the highest growth output with *Micrococcus luteus* was documented as a probiotic and the best feed conversion ratio with the same organism was observed. So *M. luteus*, as a growth promoter in fish aquaculture, can be considered. As growth promoters, lactic acid bacteria have had an effect on growth rates in juvenile carps, but not in sea bass" (Noh, 1994).

For disease prevention

"Probiotics or their host health products have been shown to be useful in aquaculture, terrestrial animals and human diseases. These include microbial adjuncts that prevent the production of pathogens, proliferation of cultivated organisms in the intestinal tract, superficial surfaces and in the cultural environment" (Verschuere *et al*. 2000). The effect of these beneficial organisms is accomplished by improving the culture organism's immune system, enhancing their resistance to disease, or creating inhibitory substances that prevent the host disease from being developed by pathogenic organisms.

Enhancement of the immune response

"Among the various beneficial effects of probiotics, one of the most widely claimed benefits of probiotics is immune system regulation. The ability of *Lactobacillus fermentum* LbFF4 isolated from Nigerian fermented food ('fufu') and *L. Plantarum* Fish larvae shrimps and other invertebrates have immune systems that are less well evolved than the adult stage and are primarily dependent on non-specific immune responses for their resistance to infection" (Verschuere *et al*. 2000 and Ogunshe, 2009) evaluated

LbOGI from the drink 'Ogi' to induce immunity against some selected fish bacterial pathogens in *Clarias gariepinus*.

Source of nutrients and enzymatic contribution to digestion

Some studies have suggested that probiotic microorganisms have a beneficial effect on marine animals' digestive processes. Bacteroides and Clostridium sp. have been recorded in fish. They have contributed to the nutrition of its host, especially by providing fatty acids and vitamins (Sakata,1990). Some microorganisms, such as Agrobacterium sp., Pseudomonas sp., Microbacterium sp., Staphylococcus sp., and Brevibacterium sp. Arctic charr (Salvelinus alpinus L.) may contribute to nutritional processes (Ringo *et al*. 1995). In addition, by producing extracellular enzymes such as proteases, lipases and providing required growth factors, some bacteria can participate in the digestion processes of bivalves (Prieur *et al*. 1990). Similar findings have been recorded for the adult penaeid shrimp microbial flora (*Penaeus chinensis*), where there is a complement of digestive enzymes and synthesis compounds that are assimilated by the animal (Wang et al., 2000). Microbiota may serve as a supplementary food source, and vitamins or essential amino acids may be a source of microbial activity in the digestive tract (Dall and Moriarty, 1983).

Production of inhibitory compounds

A number of chemical compounds that are inhibitory to both gram-positive and gram-negative bacteria are released by probiotic bacteria. These include bacteriocins, lysozymes, siderophores, proteases, peroxides of hydrogen, etc. Lactic acid bacteria (LAB) are known to generate compounds inhibitory to other microbes, such as bacteriocins (Saurabh *et al*. 2005).

Competition for adhesion sites:

Probiotic species compete with the pathogens in the gut epithelial surface for adhesion sites and food and eventually avoid their colonization (Vanbelle *et al*. 1990). Fish pathogens such as *Vibrio anguillarum* and *Aeromonas hydrophila* have been shown to bind to and expand on or in the intestinal or external mucous membrane in vitro (Krovacek *et al*. 1987).

Competition for nutrients:

Nutrients otherwise ingested by pathogenic bacteria are used by probiotics. Nutrient competition may play an important role in the composition of the intestinal tract microbiota or the cultured aquatic organisms' ambient setting (Ringo and Gatesoupe, 1998). Therefore, it is not easy to effectively apply the concept of competition to natural settings, and this remains a major challenge for microbial ecologists.

Probiotics in aquaculture management

These species may be administered through the feeding, infusion or immersion of probiotic bacteria for aquaculture management (Irianto and Austin, 2002).

Application in feed

With the feed and binder (egg or cod liver oil), probiotics are added and most commercial preparations contain either *Lactobacillus* sp or *Saccharomyces cerevisiaee* (Abidi, 2003). Probiotic species used in food must be able to withstand passages through the gut according to FAO and WHO guidelines, i.e. they must have the ability to avoid gastric juices and bile exposure (Senok *et al*. 2005). They must also be able to proliferate and colonize the digestive tract and for the duration of the shelf life of the product, they must be healthy, efficient and retain their efficacy and potency (Senok *et al*. 2005).

Direct application of probiotics to pond water

There are some strains of bacteria in the water probiotics, such as *Bacillus acidophilus*, *B. subtilis*, *Nitrobacter sp*, *Aerobacter* and *Sacharomyces cerevisiae*, *Lecheniformis*. Probiotic application through the water of tanks and ponds can also have an impact on fish health by improving many water qualities, as the bacterial composition of water and sediments is changed (Ashraf, 2000 and Venkateswara, 2007).

Application of probiotics through injection

Applying probiotics by injection is an alternative. The idea of freeze-drying the probiont like a vaccine was proposed by Austin et al. in 1995 and applied either by bathing or injection. "The experimental administration of probiotic, *Micrococcus luteus* by injection through intra peritoneal route to *Oreochromis niloticus*, which had only 25 percent mortality compared to 90 percent with Pseudomonas using the same route, was demonstrated by Yassir *et al*. 2002. The use of probiotics promotes Rainbow trout immunity by stimulating the activity of phagocytes, complementing mediated bacterial killing and production of immunoglobulin", according to Yassir *et al*. 2002 and Noh *et al*. 1994).

Conclusion

The efficacy of probiotics was associated with strain multiplications and/or their existence after application in the environment, and this attribute was associated with host strain colonization and some beneficial health effects. These are not in accordance with all products of probiotics and help to achieve conflicting results about their impact on aquatic species. Probiotic evolution is correlated with a greater understanding of the use of these types of products, properties, and the particular strain-host in intestinal ecology. A particular point of environmental science consideration is the direct use of a probiotic on water (from fresh to seawater from farms and laboratories). These products (probiotics) are usually foreign or exogenous strains and pose a potential risk of infection by microorganisms, in particular with the use of genetically modified strains, complex adhesions or colonization niches, the development of antibiotics and synergistic action. It is important to understand the use and environmental impact of those new generations of probiotics before massive application to aquaculture. Nonetheless a range of probiotic products have been extensively tested, demonstrating their effectiveness and potential use in aquaculture.

The aquaculture group has become more commonly available with beneficial bacterial preparations that are species-specific probiotics. As disease prevention, these preparations display particular beneficial effects and provide a natural factor to obtain a stab le stable gut environment and immune system. To increase the development of aquatic organisms, the establishment of a strong disease prevention program, including probiotic and good management practices, can be beneficial.

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Expression of *Arabidopsis* resistant genes under abiotic stress conditions

Gagan Kumar Panigrahi[1] and Kunja Bihari Satapathy[1]*
[1]School of Applied Sciences, Centurion University of Technology and Management, Odisha, India
*Corresponding Author's email: kunjabihari.satapathy@cutm.ac.in

Abstract

The plant immune system is equipped with several defensive layers to evade pathogen attack. One of the primary defense includes plasma membrane-localized receptors explicitly detect conserved pathogen-associated molecular patterns (PAMPs). Transcriptional reprogramming of resistant genes confers PAMP-triggered immunity (PTI). Consequently basal immunity is triggered which is primarily mediated by several intracellular nucleotide-binding leucine rich repeat (NLR) receptors. Subsequently, NLRs sense pathogens and activates another defense response known as effector triggered immunity (ETI). Both the PTI and ETI are mediated by resistant genes. Interestingly, the detailed molecular function of resistant genes is not yet fully revealed. Resistant genes are also well involved in non pathophysiological conditions such as during cold stress, heat stress, duration of exposure of light and drought stress. Here, we have reported that the *Arabidopsis* resistant genes *AT1G17600*, *AT4G14368*, *AT4G16860, AT5G40910* and *AT5G45050* are temperature regulated. We found that the transcript levels of *AT1G58400*, *AT2G14080*, *AT2G17055*, *AT3G51560*, *AT4G16950*, *AT5G40910* and *AT5G45050* were significantly raised for the plant samples grown under short-day conditions. The transcript levels of *AT1G17600*, *AT1G27180*, *AT1G33560, AT2G14080*, *AT3G51560*, *AT4G16860* and *AT4G16950* were upregulated for plants grown under drought stress conditions. In *Arabidopsis* the transcriptional reprogramming is modulated by decapping protein factors. There was no significant change in the protein level of DCPs. Our results suggest that under abiotic stress conditions, the resistant genes differentially express independent of the decapping event.

Keywords: Pathogen-associated molecular patterns, PAMP-triggered immunity, effector triggered immunity, resistant genes, abiotic, decapping

Introduction

Plant immune response activation is based on precise recognition between a plant receptor and a cognate pathogen effector, famously described as gene-for-gene relationship among plant host disease resistant genotypes and avirulent pathogenic strains (Flor, 1971). Overall, the plant immune system executes its role via two distinct arms, namely, pattern triggered immunity (PTI) and effector triggered immunity (ETI) (Panigrahi and Satapathy 2020a). Plant immunity, as a counter-attack against microbial infection, is exquisitely controlled by two different immune receptors known as extracellular immune receptors (pattern recognition receptors, PRRs) and intracellular immune receptors [resistance (R) proteins,

nucleotide-binding oligomerisation domain (NOD)-like receptors (NLRs) or nucleotide-binding site- leucine-rich repeat (NBS-LRR) proteins], which recognise microbe-associated molecular patterns (MAMPs) and pathogen-derived effectors, respectively. Once the cell surface bound pattern recognition receptors (PRRs) perceive conserved pathogen associated molecular patterns (PAMPs), this sets the stage for onset of primary first line plant defence leading to pattern triggered immunity (PTI) (Böhm et al., 2014, Macho and Zipfel, 2014). With the onset of PTI, several other known defence pathways including, reactive oxygen species (ROS) burst, activation of mitogen activated protein kinases (MAPKs), expression of immune related genes is induced in order to prevent non-adapted pathogens from infecting (Boller and Felix, 2009). Another arm of plant immune response, commonly called as effector-triggered immunity (ETI), commonly considered as an amplified version of PTI, is equally vital for provoking an effective response against pathogenic molecules (Panigrahi et al., 2021). With an increasing adaptive nature of pathogens to evade the primary defence system of host plant, they are able to release virulence factors known as effectors into the apoplast or cytoplasm of the host cell. Previous findings have shown that effectors do interfere with the PTI pathway so as to allow pathogens to colonize the host cell and thus leads to effector-triggered susceptibility (ETS) (Jones and Dangl, 2006). In turn, effector molecules are specifically recognized by intracellular nucleotide binding/leucine rich repeat (NLR) receptors resulting to the activation of the ETI (Cui et al., 2015, Dodds and Rathjen, 2010). ETI is essentially characterized by a tightly regulated transcriptional reprogramming followed by a phenotypic event that is, localized plant cell death known as hypersensitive response (HR) (Cui et al., 2015, Panigrahi and Sahoo 2016, Panigrahi et al., 2016, Tsuda et al., 2008, Tsuda et al., 2009). In general, pattern-triggered immunity (PTI), which is controlled by PRRs, confers moderate disease resistance to a broad spectrum of pathogens, and effector- triggered immunity (ETI), which is controlled by R proteins, is responsible for the resistance to a specific pathogen carrying a cognate avirulence gene (Chisholm et al., 2006, Jones and Dangl, 2006). In addition to their predominance, R genes are also indispensable in establishing basal immunity to virulent pathogen infection and maintaining the balance between growth and defense (Karasov et al., 2017, Li et al., 2001, Maekawa et al., 2011, Palma et al., 2010, Shirano et al., 2002). However, the regulatory circuit of the two classes of plant R genes encoding Toll/interleukin-1 receptor (TIR)-NBS-LRR (TNL) and coiled coil (CC)-NBS-LRR (CNL) proteins has yet to be elucidated (Halter and Navarro, 2015, Lai and Eulgem, 2017). Interestingly, there are no direct evidences related to the role of *R* genes under abiotic stress conditions. *R* genes are also well involved in non pathophysiological conditions such as during cold stress, heat stress, duration of exposure of light and drought stress. In *Arabidopsis* the transcriptional reprogramming is modulated by decapping protein factors (Panigrahi and Satapathy 2020b,c). Here, we reported the effect of abiotic stress on the expression of *R* genes.

Materials and Methods

Plant materials and growth conditions

Seeds of wild-type Arabidopsis (*Arabidopsis thaliana*) ecotype Columbia-0 (Col-0) were sown in soil. The plants were grown simultaneously under short-day (12/12 h light/dark) and long-day (16/8 h light/dark) conditions at 22° C with 70-80% relative humidity. Western blotting and RNA-seq assays were done using the leaves of *Arabidopsis thaliana*. The *Arabidopsis* plants grown under long-day conditions were used for cold stress, heat stress and drought stress experiments. For heat stress assays, the plant samples were incubated at 37° C for 10 minutes. *Arabidopsis* plants were grown under water deficient conditions for carrying out drought stress assays. Likewise for performing cold stress experiments, plants were grown under 16/8 h light/dark at 16° C and 16/8 h light/dark at 4° C growth conditions.

RNA-seq

Fully grown rosettes of three-week-old *Arabidopsis* plants were used for the RNA-seq analysis. Plant samples to be dipped in 0.5x MS medium, vacuum infiltrated and to be incubated in the dark for 4 hours. After the RNA purity is confirmed with a bioanalyzer, the total RNA would be processed for preparation of the mRNA sequencing (Illumina). 500 ng total RNA to be used to obtain mRNAs. A-tailing and end-repair was done after first and second-strand complementary DNA synthesis. All samples were processed in three biological replicates.

Protein extraction and Western blotting

Total proteins were isolated from 0.1g leaf of the twenty-one-day-old *Arabidopsis thaliana* Col-0 plants. The leaves were harvested from plants which were grown simultaneously under short-day (12/12 h light/dark) and long-day conditions (16/8 h light/dark) at 22° C. Similar approach was followed to isolate the total protein from cold stress, heat stress and drought stress induced plant samples. The composition of the extraction buffer was 20 mM of Tris-Cl (pH 8.0), 100 mM of NaCl, 1 mM of EDTA, 1 mM of PMSF, and 1X proteinase inhibitor. Western blot analysis was done using protein-specific antibodies.

Statistical Analysis

A two-tailed Student's't' test was employed in this study to analyze significant differences between the control and treatment groups. The error bars are indicated. All physiological experiments were performed in at least triplicate.

Result and Discussion

Differential temperature affects the mRNA levels of *Arabidopsis* resistant genes

The defense-related genes in *Arabidopsis* predominantly are involved in conferring the plants to defend against incoming pathogens. But, their role during abiotic stress is yet to be revealed. In this context, the current study intended to see the behaviour of resistant genes when plants are challenged with heat and cold stress. Under cold stress conditions, it was observed that the resistant genes *AT1G17600*, *AT4G14368* and *AT4G16860* are highly expressed when plants are exposed to cold stress (16/8 h light/dark; 16° C and 16/8 h light/dark; 4° C) relative to their transcript levels under normal physiological growth conditions (16/8 h light/dark; 22° C; Fig. 1). Similarly, when plants were exposed to heat stress conditions (37° C; 10 minutes) several resistant genes were expressed at a higher level relative to the transcript levels under normal physiological growth conditions (16/8 h light/dark; 22° C). The transcript levels of *AT5G40910* and *AT5G45050* were 1.6 times with respect to their counterparts (Fig. 2). The differential expression of *Arabidopsis* resistant genes under temperature stress reveals that apart from their canonical role; defense-related genes may also be well involved in supporting the plants to respond to any change in temperature conditions. Changes in cellular homeostasis under different temperature conditions might be manipulated by a set of temperature-regulated resistant genes in *Arabidopsis*.

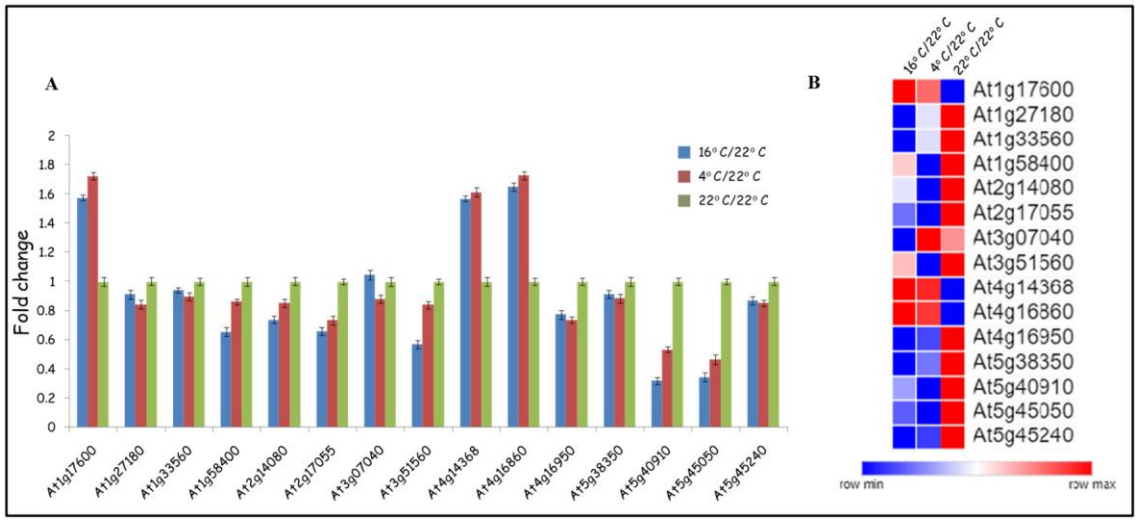

Fig. 1: Differential RNA level expression of the *Arabidopsis* resistant genes under cold stress. (A) The expression levels of *AT1G17600*, *AT4G14368* and *AT4G16860* were upregulated for plants exposed to cold stress. (B) Heat map of differential expression patterns of the *Arabidopsis* resistant genes under cold stress. Web-based tool Morpheus was used to generate the heat map.

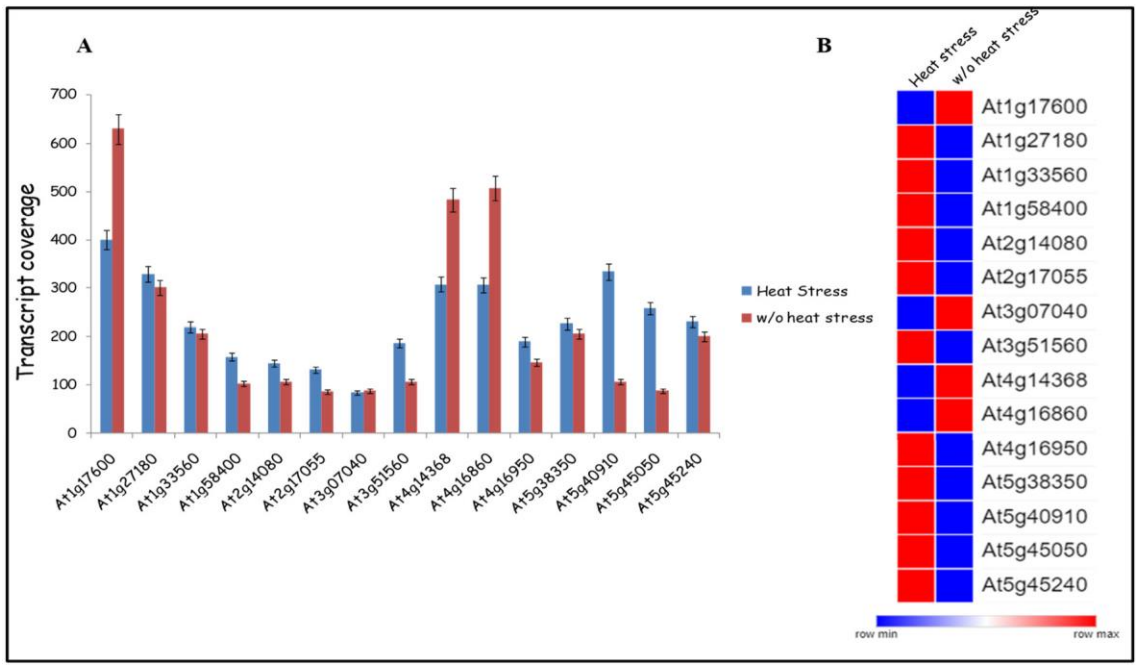

Fig. 2: Differential transcript coverage of the *Arabidopsis* resistant genes under heat stress. (A) The transcript coverage of *AT5G40910* and *AT5G45050* were higher for plants exposed to heat stress. (B) Heat map of differential transcript coverage of the *Arabidopsis* resistant genes under heat stress. Web-based tool Morpheus was used to generate the heat map.

The duration of exposure of light modulates the expression level of resistant gene transcripts

To validate our assumption that the *Arabidopsis* resistant genes are regulated by the duration of exposure of light, we checked the transcript level of the *Arabidopsis* defense genes for the plant samples grown at long-day and short-day conditions. Interestingly, we found that the transcript levels of *AT1G58400*, *AT2G14080*, *AT2G17055*, *AT3G51560*, *AT4G16950*, *AT5G40910* and *AT5G45050* were significantly raised for the plant samples grown under short-day conditions relative to their expression levels for plants grown under long-day conditions (Fig. 3). This previously unrevealed fact makes sense in a manner that it represents specific *Arabidopsis* defense genes which also get involved in non-pathophysiological environment in plants and identifying the detailed role(s) of these specific genes would be intriguing.

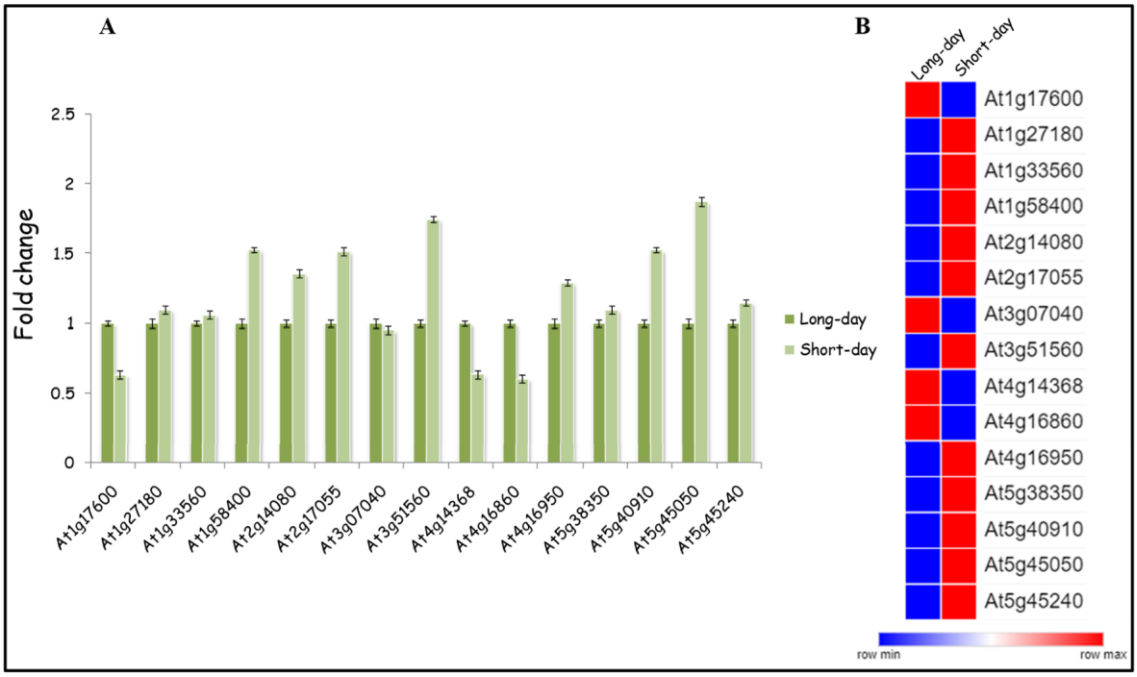

Fig. 3: Differential RNA level expression of the *Arabidopsis* resistant genes under short-day conditions. (A) The expression levels of *AT1G17600*, *AT4G14368* and *AT4G16860* were upregulated for plants grown under short-day conditions. (B) Heat map of differential expression patterns of the *Arabidopsis* resistant genes under short-day conditions. Web-based tool Morpheus was used to generate the heat map.

Under drought stress conditions, the transcript level of several resistant genes is upregulated

Similarly when plants were challenged with drought conditions, several *Arabidopsis* resistant genes were differentially expressed. The transcript levels of *AT1G17600*, *AT1G27180*, *AT1G33560, AT2G14080*, *AT3G51560*, *AT4G16860* and *AT4G16950* were upregulated for plants grown under drought stress conditions relative to the plants grown under normal physiological growth conditions (Fig. 4). This result hints out that several defense related genes in *Arabidopsis* are also being involved in molecular events specific to drought stress. The underlying molecular mechanism(s) through which resistant genes participate during drought conditions needs to be revealed. Resistant genes-mediated response of plants during drought stress could be edifying.

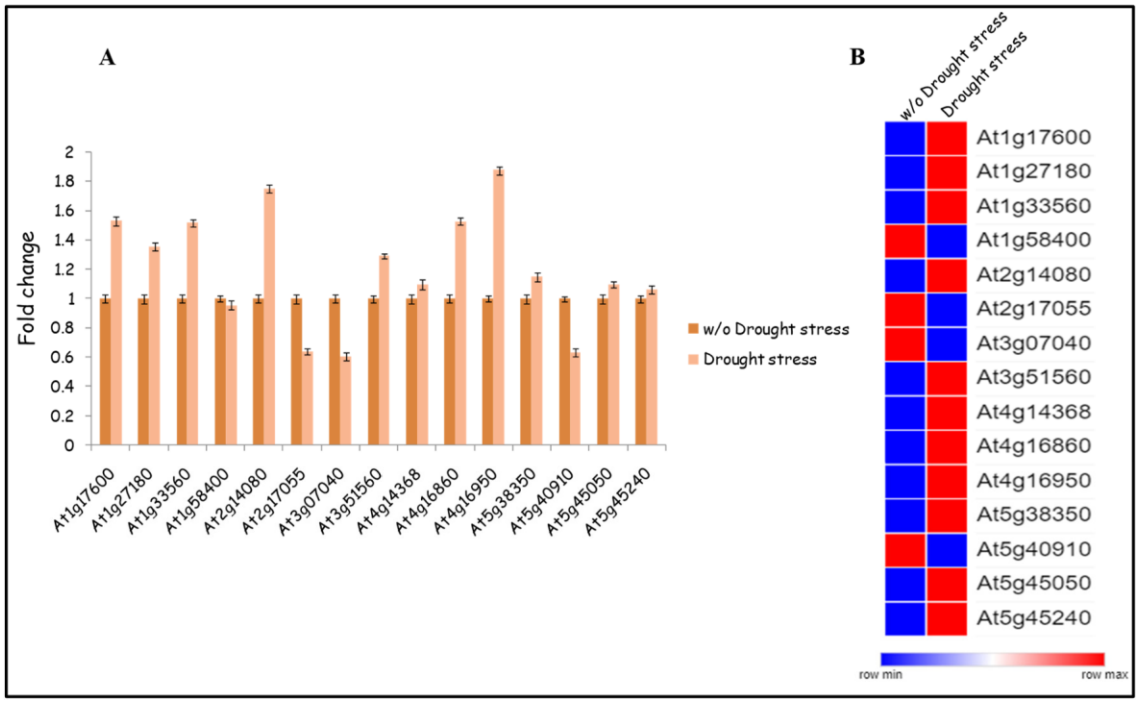

Fig. 4: Differential RNA level expression of the *Arabidopsis* resistant genes under drought stress conditions. (A) The expression levels of *AT1G17600*, *AT1G27180*, *AT1G33560,* *AT2G14080*, *AT3G51560*, *AT4G16860* and *AT4G16950* were upregulated for plants grown under drought stress conditions. (B) Heat map of differential expression patterns of the *Arabidopsis* resistant genes under drought stress conditions. Web-based tool Morpheus was used to generate the heat map.

The protein level of decapping protein factors remains unaffected under abiotic stress conditions.

Transcriptional reprogramming depends on several factors. The expression of immune genes under varied abiotic stress conditions would certainly be under strict regulation. One of such regulatory mechanisms that eventually determine the fate of mRNA is the mRNA decapping event, essentially mediated by decapping proteins (DCPs): DCP1, DCP2 and DCP5. To validate whether there is any change in the protein level of the DCPs when plants are challenged with abiotic stress, we performed immunoblotting assays to confirm the protein levels. There was no significant change in the protein level of DCPs (Fig. 5). The protein level of actin was also considered to be the internal control. Equal concentration of protein loading was done as revealed by Ponceau S staining for RuBisCo.

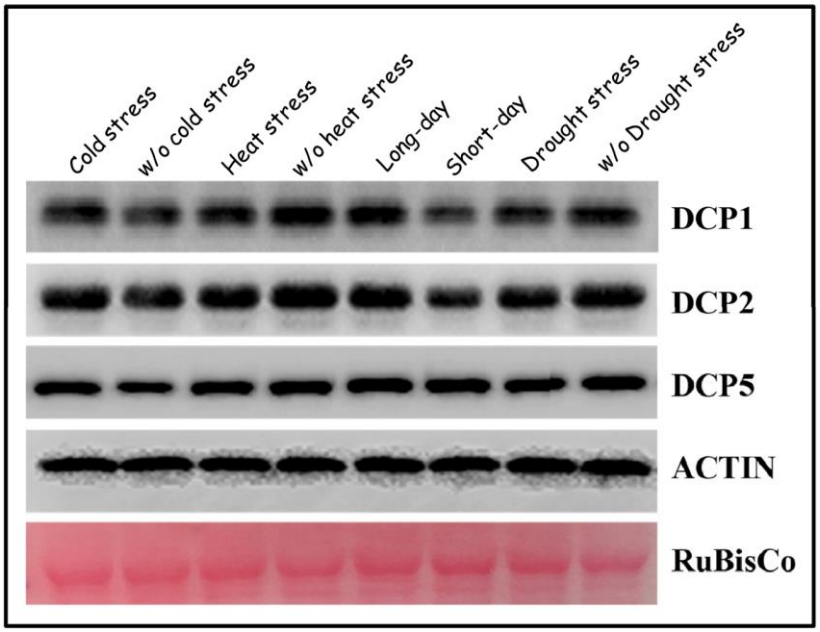

Fig. 5: The protein level of the *Arabidopsis* decapping protein factors; DCP1, DCP2 and DCP5 remains unaffected under the abiotic stress conditions. The Western blots were generated using protein-specific antibodies. Protein loading is shown by Ponceau S staining for RuBisCo.

Conclusion

Revealing the functional and physiological role of the *Arabidopsis* resistant genes is of great interest may unravel many hidden molecular mechanism(s). Apart from its canonical function, the resistant genes might be involved in regulating unknown cellular events in *Arabidopsis*. In animals, resistant genes are well involved in diversified metabolic pathways apart from being involved in defense response. It seems worthwhile to focus on the molecular mechanism(s) through which resistant genes mediates a wide range of physiological events. The detailed mechanism(s) of the resistant genes-mediated events remains to be elucidated. How resistant genes-mediated response is triggered in plants in response to abiotic stress conditions is not yet fully understood. Our results gives a prima facie evidence that the resistant genes are differentially expressed under varied abiotic conditions in *Arabidopsis* and may be well involved in modulating different physiological processes necessary for the plant to resist the environmental changes.

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In vitro regeneration of local *Musa* varieties using different growth regulators

Bandita Deo[1], Mainak Sinha[1], Gyanesh Dash[1] and Gyanranjan Mahallik[2]

[1]Plant Physiology and Biochemistry Division, Regional Plant Resource Centre, Nayapalli, Bhubaneswar-751015, Odisha, India.

[2]Department of Botany, School of Applied Sciences, Centurion University of Technology and Management, Odisha, India

Corresponding author: bdeo2008@gmail.com

Abstract

A study was carried out to standardize a simple and efficiently protocol for micro propagation of banana *using* shoot meristem. After growing *in-vitro* cultures on different hormonal combinations, Murashige and Skoog's medium supplemented with BAP, Kinetin, IAA, NAA and ADS, BAP(3mg/l), IAA(1mg/l), NAA(0.1mg/l) and ADS 75 mg showed maximum shoot proliferation. Initiation of shoot bud and establishment of culture from shoot meristem was achieved on solid media. Further shoot proliferation of cultures up to 6 subcultures of 21 days each was achieved on the agar gel solidified hormonal supplemented media after culture establishment. The proliferated shoots were excised and transferred to different root induction media, which resultantly showed that MS media supplemented with NAA (2mg/l), was the most efficient root inducing media. Rooted plantlets after primary and secondary hardening were transferred to the green house. Finally, these disease free plants were successfully established in soil.

1.Introduction

Eatable bananas (*Musa* spp.) are the significant fruits for rural and metropolitan shoppers in the tropical and sub-tropical countries. The genus Musa (family Musaceae) begins in Asia (Simmonds, 1962). Developed banana is gotten from two diploid types of family Musa. *M. acuminata* (Malaysia) and *M. Balbiciana* (India) parent genomes (Stover & Simmonds, 1987; Simmonds, 1962; George *et al*. 2000). Banana is a decent wellspring of sugars, proteins, nutrients and minerals. Numerous vermin and infections (especially viral sicknesses for example banana mosaic infection) oblige banana production which brought about genuine outcomes for environment through the utilization of pesticides. Thus, major limitations in the banana creation framework are the non-accessibility of infection free, consistent with type planting material, low ripeness because of triploidy, slow engendering and long interval of time from one age to the next generation. "Traditional rearing is troublesome because of its

high level of sterility and polyploidy of the edible varieties" (Stover and Simmonds, 1987). Bananas have a place to group of harvests which are typically engendered through vegetative pieces of the plant on the grounds that practically all cultivated banana cultivars are triploid, seedless, or seed sterile. The materials utilized for traditional proliferation includecorms, enormous and little suckers, and blade suckers (Cronauer & Krikorian, 1984; Arias, 1992; Haq & Dahot, 2007).

"Mass propagation of selected genotypes, somaclonalvariation techniques, and genetic engineering and other biotechnological applications can be utilized for bananacrop improvement which is based on reliable plant regeneration protocols. Tissue culture also plays a vitalrole in the distribution of germplasm, conservation, safeexchange of internal planting material and rapid propagation of newly selected hybrid cultivars. Several researchers have reported the regeneration of Musa spp.via micro propagation" (Cronauer & Krikorian, 1986; Jarret, 1986; Diniz *et al*. 1999; Nauyen & Kozai, 2001; Krishnamoorthy *et al*. 2001; Kagera *et al*. 2004; Muhammad et al, 2004; Roels et al*.,* 2005; Madhulatha et al., 2004). Shoot proliferation rate and elongation are influenced by cytokinin types and their concentration. Adenine-based cytokinins are used in several Musa spp. for in-vitro propagationEffect of plangrowth regulators for production ofmultiple shoots through *in vitro* culture of Yangambi and Champa variety of banana (*Musa* spp.) studied by (Keshari & Deo, 2020).

"But, propagation percentage and repeatabilityof the method are matters of concern which ultimatelyneed a comprehensive, repeatable and applied method fora wide range of genotypes to facilitate disease freeproduction of banana crop on commercial scale. For invitro micropropagation of banana, bacterial contaminationis a big problem. Although initially surface sterilizationworks, latter on microbial contamination at the base of theexplant appears within 7 to 15 days after inoculation. Huge number of explants is destroyed in the culture due toendogenous bacteria" (Habiba *et al*., 2002).

The present study suggests a rapid banana multiplication protocol from shoot meristem by using a medium withoptimized concentration of auxins or cytokinins. Here, we reported a very simple, efficient, economical, rapidly multiplying and highly reproducible protocol for the micro-propagation ofbanana on commercial scale.

2.Materials and methods

2.1 Collection of different banana cultivars

Gaja Bantal and Patakpura variety were collected from different parts of Odisha, i.e., Balipatna, Nimapara, Satsankha, Sakhigopal, Pipili, Garia and Rajas of Puri District and mother block was developed inside RPRC premises.

2.2 Surface sterilization

The healthy sword suckers were collected from RPRC mother block plantation site for initial culture. The processed explants were then washed with normal water followed by washing with detergent (4 drops of Labolene) to remove excess mud form it. Then it was washed with running water to remove the remaining detergent on it, and treated with 1% Bavistin for 25min. 0.5% of $HgCl_2$ was used for surface sterilization of explant. The explants were then transferred to bottle containing $HgCl_2$ (1.250 g in 250 ml of distilled water) for 40-45 min for surface sterilization. Afterwards, the explants were washed three times in sterile water in aseptic condition (under laminar air flow) to remove all traces of the $HgCl_2$.

The outer surface of explant exposed to sterilizing agent was removed and the explants trimmed using scalpel to bring the final size to about 2.0cm. X 3.0cm. The entire surface sterilization process was done in an aseptic condition (inside laminar air flow) to avoid infection.

Fig.1: Surface sterilization in 0.5% $HgCl_2$

2.3 Culture medium

Murashig and Skoog (1962) media was initially tried for shoot culture *in vitro.* The medium was supplemented with differing concentrations of various phytohormones to find their effect on shoot induction individually or in combination. The phytohormones used for the shoot culture studies were Benzyl Amino Purine (BAP), Kinetin (kn.), Indole -3-acetic acid (IAA), Indole -3-butaric acid (IBA) and Adenine Sulphate (ADS) in suitable combination were determined.

2.4 Preparation of culture media

For convenience and in order to reduce the time in weighing individual ingredients each time, concentrated stock solution of the mixture of selected components such as macronutrients, micronutrients, vitamins and phytohormones were prepared in sterile Millipore water and stored in laboratory refrigerator(4^0C). All the chemicals were procured from Sigma Aldrich, India. Fresh stock solution was prepared at every 1–2 month interval to avoid contamination. To prepare 1 litre medium, required volume of salts, vitamins and phytohormones from the respective stock solution were taken into conical flask (1000ml.) and to this 100mg. of myoinositol and 30g.of sucrose were added. The volume was made up to 1000ml with double distilled water. The pH of the medium was adjusted to 5.8 with 0.1N NaOH or 0.1N HCl. To one litre of semi-solid medium, 5.0gms of agar (Plant tissue Culture grade, Hi-Media, India) was added. All the media were autoclaved at 104kPa and 121^0C for 20 minutes. The autoclaved molten media were then dispensed into sterilized test-tubes/ conical flasks(30ml/25mm test-tubes or 75ml/ 250ml conical flask) inside a laminar air flow cabinet. Following inoculation the test-tubes and the conical flask were capped with aluminium foil.

2.5 Aseptic transfer of the core meristematic part of the ex-plant

The working area of the laminar airflow cabinet was first wiped with cotton moistened with ethanol and then irradiated with ultraviolet light for 20 minutes before inoculation. The explants were surface sterilized as described earlier and cut aseptically at the middle by a sterile surgical scalpel. Then the explants were inoculated in the test-tubes containing induction medium. This sterilised tissue block was cut longitudinally into two, the half containing the apical dome was retained and used as an explant; the remainder was discarded. The second set of explants were prepared as above but had their apical domes together with subjacent leaf primordial removed so that the effect of apical dome on shoot initiation could bedetermined.

2.6 Culture condition

The test-tube / conical flask containing the semisolid media were kept in culture rack. The culture was maintained at 25±1^{0}C, 16 h photo period of 35-50µEm^{-2}s^{-1} intensity provided by cool white fluorescent tubes (Phillips, India).

3. Results

The rhizomes cultured on MS medium without supplementation of growth regulators responded within three weeks of culture and slightly increased in size. Then shoot bud development started from the explant; an average of one shoot bud produced from each explant. The shoot bud developed in to a shoot and produced 2.5 numbers of leaves after three subcultures. Healthy roots were also produced from the shoots, in an average, 3 roots produced from the eachshoot.

3.1 Shoot induction and multiplication from Apical meristem of Bantal variety

Cytokinins were found to be essential for shoot induction and multiplication. The rhizome explants on MS medium supplemented with cytokinins swelled and increase in size after two weeks of culture. These were cut in to pieces and sub-cultured into the multiplication medium where it multiplied two more times and produced more pieces of rhizomes. In an average, 10 numbers of rhizomes were produced from a single rhizome; each had number of shoot buds depending on the growth regulator used in the medium. All these pieces whenever transferred to shoot elongation medium containing less amount of ADS (100mg/l), shoot bud elongated and produced healthy shoots with the mediums tested.

Among the different combinations of medium tested, induction medium supplemented with BAP 6.0 mg/l, IAA 0.5 mg/l and ADS 150mg/l and multiplication medium supplemented with BAP 3.0 mg/l along with, IAA 0.5 mg/l, 0.1mg/l NAA and ADS 75mg/l produced the highest number of plantlets. On this medium, an average of 361 number of plantlet produced from each rhizome after six cycle of subculture on multiplication medium. From the results it is clearly evident that efficiency of shoot bud regeneration from the rhizome ex plants depends on the concentration of cytokinins used in the medium. Supplementation of Kinetin in the induction medium as well as multiplication medium also produced healthy plantlets from the rhizomes. From the three concentrations of Kinetin used alone or in combination in the culture medium 3.0 mg/l BAP in combination with 3.0mg/l kinetin in induction medium found to be produced highest number of shoot buds from the explants. The plantlets produced from different culture mediums were healthy and acclimatized successfully in the green house.

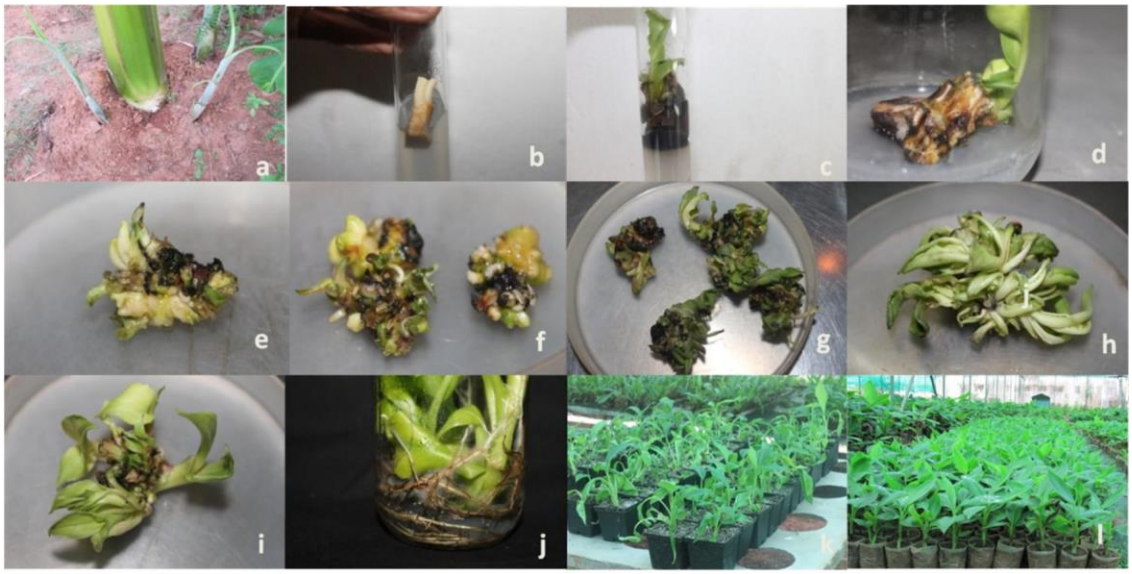

Fig. 2. Rhizome culture for banana mass propagation:

(a) Sucker grown at Banana mother block (RPRC) ;(b) Initial culture; (c) Initial culture after 21 days (deposition of phenolic on the surface of explant turns it in to black);(d)Observation after first subculture; (e) Observation after second sub culture; (f) Observation after third sub culture; (g) Observation after fourth sub culture; (h) Observation after fifth sub culture; (i) Explant inoculated in elongation medium; (j) Explant inoculated in rooting medium; (k) plantlets transferred to primary hardening chamber; (l) Secondary hardeningchamber.

Table 1. Effect of different growth regulators on rhizome as an explant for the regeneration of shoots of Bantal

SI. No	INDUCTION MEDIUM (15 Days) All hormone conc. in mg/I				SI. No	MULTIPLICATION MEDIUM (21 Days for each subculture) All hormone conc. in mg/I					NO.OF SHOOTS BUDS/ EXPLANT
	BAP	Kn	IAA	ADS		BAP	Kn	IAA	NAA	ADS	Mean± SE
1.	2.5	-	0.5	75	1.	3.0	-	1.0	0.25	150	358.6±0.35
					2.	4.0	-	1.0	0.25	150	448.1±0.22
					., .	6.0	_	1.0	0.25	150	253.8±0.07
2.	4.0	-	0.5	75	1.	3.0	-	1.0	0.25	150	5 76.1±0.52
					2.	4.0	-	1.0	0.25	150	540.0±0.69
					3.	6.0	-	1.0	0.25	150	288.4±0.89
..,	6.0		0.5	75	1.	3.0		1.0	*0.15*	150	631.3±0.08
., .		-			2.	4.0	-	1.0	0.25	150	553.1±0.21
					., .	6.0	_	1.0	0.25	150	468.0±0.03
4.	8.0	-	0.5	75	1.	3.0	-	1.0	0.25	150	396.8±0.71
					2.	4.0	-	1.0	0.25	150	371.2±0.04
					3.	6.0	-	1.0	0.25	150	228.6±0.63
5.	3.0	3.0	0.5	75	1.	3.0	-	1.0	0.25	150	524.7±0.59
					2.	4.0	-	1.0	0.25	150	551.4±0.27
					...,	6.0	_	1.0	0.25	150	360.3±3.1
6.	4.0	4.0	0.5	75	1.	3.0	-	1.0	0.25	150	258.6±0.40
					2.	4.0	-	1.0	0.25	150	299.5±0.49
					3.	6.0	-	1.0	0.25	150	185.6±0.27
7.	-	6.0	0.5	75	1.	3.0	-	1.0	0.25	150	428.1±0.84
					2.	4.0	-	1.0	0.25	150	359.6±0.50
					3.	6.0	-	1.0	0.25	150	211.8±0.31

3.2 Adventitious Root Induction

Well-developed shoots (7-9cm in height) regenerated *in vitro* from various induction and multiplication medium were excised and transferred to MS medium supplemented with growth regulators (**Table.2**). None of the shoot cultured on growth regulator free medium formed roots. Depending on the growth regulators type and concentration, efficiency of root induction varied; number of roots induced per shoot varied from 6.2 to 9.5. Among the different root induction medium tested, MS medium supplemented with NAA 2.0 mg/l found to be most suitable on which 9.5 number of roots were produced per shoot within 10 days of culture. Higher concentrations of NAA did not produce more roots. The roots lengths were also higher on this medium, average lengths were 15.2 cm. IAA supplemented mediums also produced healthy roots whenever supplemented with the MS medium, however the efficiency was less as compared to the optimum medium. It was observed the healthy shoots giving rise roots more quickly than thin shoots.

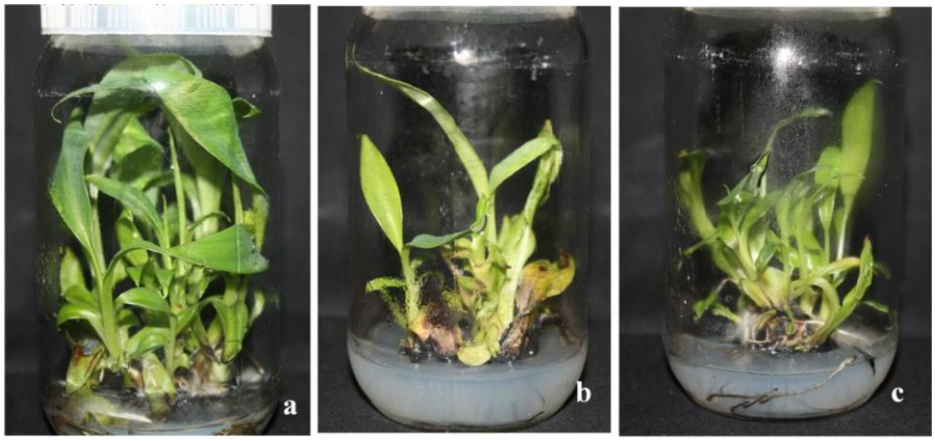

Fig.3. Effects of different medium on shoot and root growth

Table 2. Effect of Auxin on root regeneration of Bantal

SL. NO.		IAA (mg/l)	NAA (mg/l)	DAYS OF ROOT INITIATION	% OF RESPONSE	NO. OF ROOT / SHOOT	ROOT LENGTH (cm)
1	MS	1.0	-	13	80	6.6 ± 0.14	11.3 ± 0.29
2	MS	2.0	-	10	90	9.5 ± 0.35	15.3 ± 0.32
3	MS	3.0	-	8	50	7.2 ± 0.22	13.9± 0.21

4	MS	-	1.0	11	80	5.9 ± 0.08	9.4 ± 0.04
5	MS	-	2.0	11	40	6.2 ± 0.26	12.2 ± 0.03

3.3 Shoot induction and multiplication from Apical meristem of Patakpura variety

3.3.1 **Type of growth:** Two types of shoots were initiated from explants with intact apical domes.Thesewere:singleapicalshootsformedfromthemainapexandthebasal rhizomatous tissue swelled and occasionally, outgrowths of two to four shoots from the adventitious buds at the bases of the leaf axils.

3.3.2 **The effect of cytokinin on shoot proliferation:** Shoots did not proliferate if cytokinin was omitted from the medium. The cytokinin BAP was found consistently more effective than Kn for shoot proliferation. New shoots arose from the base of excised shoots. Proliferation of shoots only occurred when rhizomatous base material was included in eachshoot.

Among the different combinations of medium tested, induction medium supplemented with BAP 2.5 mg/l, IAA 0.5 mg/l and ADS 75mg/l and multiplication medium supplemented with BAP 3.0 mg/l along with, IAA 0.5 mg/l, 0.1mg/l NAA and ADS 75mg/l produced the highest number of plantlets. On this medium, an average of 22 number of plantlet produced from each apical meristem after four cycle of subculture on multiplication medium.

Table 3. Effect of different growth regulators on apical meristem or shoot tip as an explant for the regeneration of shoots of Bant

SL NO.	INDUCTION MEDIUM (15 Days) All hormone conc. in mg/I				SL NO.	MULTIPLICATION MEDIUM (21 Days for each subculture) All hormone conc. in mg/I					NO. OF SHOOTS BUDS/ EXPLANT
	BAP	Kn	IAA	ADS		BAP	Kn	IAA	NAA	ADS	Mean ±SE
1.	2.5	-	0.5	150	1.	3.0		1.0	0.25	75	22.3±0.58
					2.	1.5	1.5	1.0	0.25	75	17.3±0.13
2.	5.0	-	0.5	150	1.	3.0		1.0	0.25	75	11.1±0.14
					2.	1.5	1.5	1.0	0.25	75	16.3±0.74
3.	3.0	3.0	0.5	150	1.	3.0		1.0	0.25	75	9.12±0.28
					2.	1.5	1.5	1.0	0.25	75	10.02±0.36

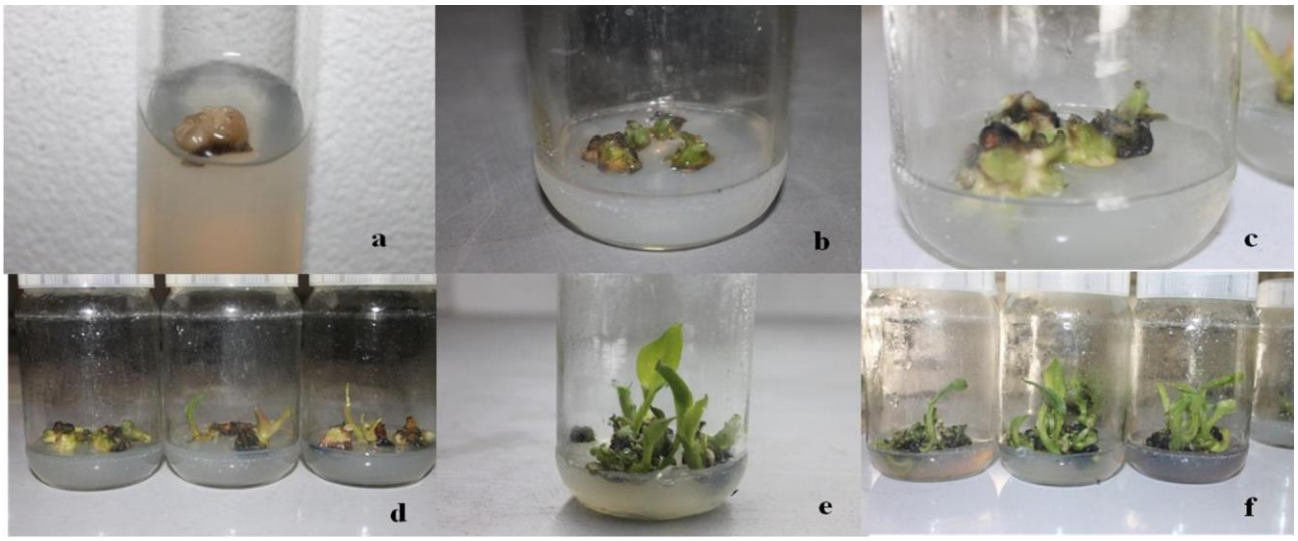

Fig. 4. Shoot tip culture for banana mass propagation:

(a) Inoculation of meristem in the culture medium; (b) 1st sub culture of the explant; (c) 2nd sub culture of the explant; (d) Shoot bud immerging during 3rd sub culture; (e) Healthy shoot bud with some leaves in 4th sub culture; (f) Comparison of different hormones on apicalmeristem.

4. Discussion

Banana is becoming one of the important crops for the tropical countries. Banana requirement for the state of Odisha is mostly fulfilled by the neighboring states particularly coming from Andhra Pradesh. In recent years cropping area of banana in the state of Odisha has been increased significantly and there is a huge demand for the quality planting material. Using the conventional way, the demand cannot be fulfilled; recently tissue culture is being used widely as means to produce large scale plantlet production throughout the world. Using this technique millions of plants can be produced to fulfilthemarket.

Tissue culture protocols for the commonly used banana like Grand Naine has been standardized and being used widely and number of studies has been conducted (ref).There are also reports exists for other banana cultivars. However, enough studies have not been reported from the plantains particularly for the Gaja Banatal which is a local variety. Thus this study has been undertaken to standardise the protocols for mass propagation through tissue culture. Rhizomes was used as the explants as it possess the shoot meristem and have the highly active meristematically active cells those have the capacity to induce and multiply shoot production. For any kind of mass propagation systems leaf tissue are ideal explants as proved to be in tobacco and many other plants, however, in monocots, these explants do respond well for generation ofplantlets.

Cytokinins proved to be the most efficient growth regulator for production of multiple shoots from number of explants like axillary buds, shoot tips, cotyledonary nodes, leaf and root tissues etc. However, the requirement of the cytokinins concentrations varies from explant to explant and species to species. For generation of plantlets from leaf tissue and cotylendonary nodes, lower concentrations of cytokinins are required for the generation of multiple shoots. Higher concentrations, although induced shoot multiplication, produce abnormal shoot and have difficulty in elongation. In case of banana rhizomes, higher concentrations found to be essential for induction and multiplication of shoot buds. In most of the cultivars tested in the induction BAP 6.0 mg/l found to be essential for the shoot induction. In the multiplication medium, also higher concentrations of BAP (8.0 mg/l) are being used in many cultivars of banana. Basing on these finding we have tested two types of cytokinins (BAP and Kn) in various concentrations in the induction medium as well as in the multiplication medium. In this

case of Gaja Bantal, we have found similar kind of observations as that of other verities. Higher concentrations are required for the shoot induction as well as for multiplication medium. Lower concentrations although produced shoot buds, the efficiency was very low as only 253.8 number of shoots could be produced after six rounds of sub-culture (Table.1.). This number will not be economically viable as the cost of production of plantlets will increase significantly. With the 6.0 mg/l of BAP in the induction medium and 3.0 mg /l BAP in the multiplication medium produced 631.3 numbers of shoots after six rounds of sub- culture in the multiplication medium. This number of is less as compare to the protocols used for other cultivars. In most of the protocols, in the multiplication medium 10 rounds of sub culture being used that produce approximately 1,200 plantlets from a single rhizome. In our case, the low number of production is due to the six rounds of sub-culture that produced only 64 pieces of rhizomes, each piece produced an average of 9 numbers of plantlets per piece of rhizome. Another two rounds of sub culture would increase the number of rhizome pieces to 240 to 260 those could produce 12,00 plantlets from eachrhizome.

In the multiplication medium, the plantlets regenerated were devoid of roots as they are from higher cytokinins. Similar kinds of observations were also reported from other plant species including the other cultivars of banana. In these experiments, NAA and IAA used for root induction and it was found that IAA is more efficient in the induction of roots in the banana plantlets. Among the auxins Indole-3-butyric acid (IBA) used to be best growth regulator for root induction, however, in this case not tested because of the lack of sufficient time for the study.

Conclusion

The study revealed that Murashige and Skoog's medium supplemented with BAP(3mg/l), IAA(1mg/l), NAA(0.1mg/l) and ADS 75 mg showed maxmimun shoot proliferation whereas MS medium supplemented with NAA (2mg/l) exhibited maximum root induction. This protocol might be useful for large scale invitro propagation of elite and disease-free banana plants cv Bantala and Patakpura.

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A review: to develop low cost omega 3 fatty acid capsule from tenualosa ilisha fish oil.

Sanjib Kumar Mohanty and Debashish Tripathy
Department of Zoology, School of Applied Science,
Centurion University of Technology and Management, Odisha
Corosponding author: debashish.tripathy@cutm.ac.in

Abstract

Attempt was made in the article to extract Tenualosa ilisha and analyse the quantity of omega-3 fatty acid by developing low cost omega-3 capsules. The oil was extracted using soxhlet apparatus and developing capsules.Fish oil is a rich wellspring of omega 3 unsaturated fats, a basic unsaturated fat, fundamental for the working of the human body. Yet, the bothersome flavor is an inborn restriction of fish oil which diminishes its worthiness. Concealing its fish flavor can build agreeableness of fish oil. The current investigation was centered around twofold exemplification of fish oil to cover its unmistakable flavor. Fish oil was emulsified utilizing soya lecithin where emulsifier to fat proportion was kept 1:4.. The emulsion was blended with whey protein—sodium alginate arrangement and converted to dabs by dropwise expulsion in calcium chloride arrangement. Drops were changed over to delicate gel dabs containing fish oil. The embodiment effectiveness was 89.3%. Fish oil flavor was seen from the dried dots. Thus, dabs were additionally covered with high softening fat utilizing container coater and enhanced for making dabs satisfactory to use as an oral enhancement. Globules were free-streaming and light yellowish in shading. Dots covered with high liquefying fat and vanilla flavor scored more in the tangible assessment by specialists. Dots were kept in hermetically sealed pack and put away under refrigeration.

Keywords: DHA,EPA,Omega 3 Fatty Acid, Soxhelt method, Gas Chromatography, Encapsulation, High melting fat, Whey- protein, Sodium alginate, fish oil.

Introduction

Normally fish is a significant staple in non-industrial nations, because of its high protein content and healthy benefit. Fish are found in new and salt water all through the world. There are living species going from crude fishes like jawless Lampreys and hagfishes, cartilaginous sharks, skates and beams to broadened hard species. The majority of fish species present are heartless aside from nearly barely any species like the Opah (Lampris gauttatus) is warm blooded. Significant unsaturated fat substance in fish oil are palmitic corrosive, stearic corrosive, omega-3 and omega-6 greasy acid.(Abdul, 2010 Fish is the vertebrate with a few transformative lines. It is more a daily existence structure than a scientific classification. Alongside proteins and minerals, fishes are additionally having therapeutic qualities. They are utilized to treat asthma, in medicines in imprisonment period, inward wounds, recuperating wounds and others. Numerous wellbeing specialists propose that a few serving for every seven day stretch of fish ought to be burned-through so as to meet the suggested degree of fundamental unsaturated fats for pregnant ladies, youngsters and older individuals (Hughes, 1995, Olsen and Secher, 2002).

Scientists found that omega-3-unsaturated fat, explicitly EPA (Eicosapentaenoic corrosive) have an extremely constructive outcome on fiery reaction. Exploration found that omega 3 unsaturated fat extricated from Tenualosa ilisha by EPA (Eicosapentaenoic Acid) have a constructive outcome on provocative reaction.

“The interest for practical nourishments is developing as they are incredibly imperative for anticipation, control and treatment of different persistent illnesses (Lee *et al*. 2012). Omega-3 (x-3) furthermore, omega-6 (x-6) unsaturated fats found in fish oils are among the main

useful food fixings. They improve the cardiovascular movement, upgrade long haul memory and ordinary cerebrum work" (Kralovec *et al*. 2012). Notwithstanding, x-3 unsaturated fats are helpless to corruption undesirable items, for example, auxiliary oxidation results of polyunsaturated unsaturated fats, "aldehydes, ketones, alcohols, unstable natural acids, hydrocarbons and epoxy aggravates" detailed by Shahidi and Zhong (2010). Exemplification is a brilliant way to deal with keep away from above issues as it can give steadiness and assurance, present directed and controlled delivery qualities. Furthermore, it veils terrible scent and taste, expands the time span of usability and upgrades the bioavailability and tastefulness of the exemplified materials. For powerful conveyance of useful nourishments, the transporter frameworks ought to have properties for example, great take-up, broadened, nonacceptable clinical results, "high biocompatibility and low immunogenicity' (McClements *et al.* 2007). "Assortment of materials, for example, cyclodextrin, spring dextrin, chitosan, gelatin and non-gelatin globular proteins, for example, cow-like serum egg whites, egg whites, b-lacto globulin, soy proteins, pea proteins and whey proteins have been utilized to create transporter frameworks for useful nourishments" (Schmitt and Turgeon 2011; Xu *et al*. 2013).

Among every single biodegradable polymer, alginate is one of the promising contender for conveyance framework since gel globules can be arranged effectively in watery arrangement at room temperature without the utilization of any natural dissolvable (Kikuchi et al. 1999). "Chen and Subirade (2006) documented that alginates are normal polysaccharides separated from earthy colored green growth and have a direct chain of 1 ? f4 connected b-D-mannuronic corrosive (M) and R-L-guluronic corrosive (G) deposits. Embodiment utilizing alginates is frequently done by drop-wise expulsion of alginate arrangement through a needle into a gelation mechanism of calcium chloride arrangement. Because of the supplanting of sodium particle with calcium particles, alginate structures an "egg-box" structure and crosslinking for hydrogel development happens. Being food grade, alginate has been utilized for typifying proteins, cancer prevention agents, polyphenols, nutrients (Chen and Subirade, 2007) and probiotics (Hansen *et al*. 2008; Subirade *et al*. 2010)".

Wichchukit *et al*. (2013) have utilized "whey protein/alginate globules as a transporter of riboflavin as a bioactive part. They have likewise announced the utilization of tween 80 for round globules development. Chen and Subirade (2006) created alginate and whey protein based granular microspheres (dabs) as a transporter of the bioactive compound like riboflavin".

Epitome innovation is notable in food, pharmaceuticals, substance and restorative industry. In food industry, it is utilized for fat, oils smell, nutrients, colorants also, catalysts. Fish oil, being a rich wellspring of exceptionally long chain omega 3 unsaturated fats, have a solid smell because of oxidation of unsaturated fats. Epitome would shield fish oil from auto-oxidation of polyunsaturated unsaturated fats (Jafari *et al*. 2008). "Chen *et al*. (2013) have embodied fish oil with phytosterol esters also, limonene by milk proteins. Their investigation has given some valuable bits of knowledge into the utilization of the co-encapsulation idea to shield splash dried fish oil microcapsules from oxidation by presenting other lipophilic bioactive parts, in particular phytosterol esters and limonene additionally as center materials. Co-embodiment of fish oil with phytosterol esters could adequately forestall unsaturated fats from oxidation, and the incorporation of limonene indicated great capacity to cover the unwanted fishy smell. Thinking about advantages and imperatives of utilizing omega 3 rich fish oils the current work is done with a perspective on typifying fish oil in alginate dots and coat them with high liquefying fat and flavor to fill in as oral enhancements"

Omega3 fatty acids:
Omega-3s are a "group of basic unsaturated fats that assume significant parts in your body" and may give various medical advantages (1Trusted Source, 2Trusted Source). As your body can't deliver them all alone, you should get them from your eating routine. "Basic nourishments that are high in omega-3 unsaturated fats incorporate greasy fish, fish oils, flax seeds, chia seeds, flaxseed oil, and walnuts.For individuals who don't eat quite a bit of these nourishments, an omega-3 enhancement, for example, fish oil or algal oil, is regularly suggested".

Types of Omega3 fatty acids:-

There are three main types of omega-3 fatty acids — ALA, DHA, and EPA.

ALA—"Alpha-linolenic corrosive (ALA)is the most well-known omega-3 unsaturated fat in our eating regimen (3Trusted Source). Our body fundamentally utilizes it for energy, yet it can likewise be changed over into the organically dynamic types of omega-3, EPA and DHA.However, this transformation cycle is wasteful. Just a little level of ALA is changed over into the dynamic structures (4Trusted Source,(5Trusted Source, 6Trusted Source).ALA is found in nourishments like flax seeds, flaxseed oil, canola oil, chia seeds, pecans, hemp seeds, and soybeans".

EPA-"Eicosapentaenoic corrosive (EPA) is generally found in creature items, for example, greasy fish and fish oil. Nonetheless, some microalgae likewise contain EPA.It has a few capacities in our body. Some portion of it very well may be changed over into DHA".

DHA-"Docosahexaenoic corrosive (DHA) is the main omega-3 unsaturated fat in our body.It's a key basic segment of our cerebrum, the retina of our eyes, and various other body parts (7Trusted Source).Like EPA, it happens primarily in creature items like greasy fish and fish oil. Meat, eggs, and dairy from grass-took care of creatures likewise will in general contain huge amounts. Vegetarians and veggie lovers regularly need DHA and should take microalgae enhancements to ensure they get enough of this omega-3 (8Trusted Source, 9Trusted Source)".

For extraction oil from Tenualosa ilisha soxhelt extraction technique was picked on the grounds that it is modestly practical and generally utilized by ventures and research centers. Likewise it gives better outcome and less tedious when contrasted with other technique. This test was set up to dissect the amount of omega 3 greasy acid,EPA or Eicosapentanoic

Acid and DHA or Docosahexaenoic Acid of Tenualosa ilisha fish and afterward utilized the studio of biovia and arranged to sedate plan.

Methodology

Material requirements: For extraction of fish oil sample fish, knife, mortar pestle, hot air oven, Soxhlet apparatus, petroleum benzene, tissue paper, air tight glass container are required. Fish species used in this study were-Tenualosailisha. Solvent used in Soxhlet extractor was- Petroleum benzene

Sample preparation- 500 gm of ilisha fish species were taken and washed completely. Head, tail, blades, scales and inward organs were eliminated and was washed with cold water to eliminate lingering blood. At that point the fish was fileted by cutting length shrewd along the spine to get most extreme measure of substance barring the spine. At that point a thick glue was made of fish fragile living creature and dried in stove at 1000 Celsius independently for the two species. In the wake of drying totally, dried tissue was powdered utilizing mortal pestle and gauged. 50 gm of powdered tissue was taken of every species independently and put in discrete packs comprised of channel paper and taken for extraction of oil.

The extraction of oil was finished by Soxhlet extractor. 50 grams of filet powder was kept in a sack of channel paper and put in the thimble. 250 ml of oil benzene was estimated. Absolute time taken for extraction was 6 hours for each example. The removed oil was then gathered in a carafe. At the point when the extraction cycle was finished, the dissolvable was eliminated utilizing rotating evaporator yielding the removed compound.

The temperature of turning evaporator ought to be set over the breaking point of the dissolvable so the solvents will be dissipated and just unadulterated oil was left. Revolution speed was set at 50 rpm. Dissolvable gathered can be recycled. Volume of fish oil acquired was estimated and kept in impenetrable container. Analysis strategy Prior to extraction of oil the dampness substance and unrefined protein content was resolved. Protein content was dictated by Lawry's strategy. Dampness content was controlled by estimating the heaviness of wet and dried tissue powder.The unrefined petroleum which was extricated utilizing Soxhlet appaaratrus was derivitized to plan Fatty Acid Methyl Esters (FAMEs) and afterward exposed to gas chromatography-mass spectrometry (GC-MS) for examination of unsaturated fat composition.The singular constituents appeared by gas chromatography were recognized and evaluated by utilizing the NIST library. After measurable investigation

of arrangement omega 3 unsaturated fat then it go through to create stable emulsion of hilsha fish oil.

Design Experiment

The investigation was intended to create "stable emulsion of fish oil utilizing dairy protein and common emulsifier, and convert stable emulsion" to attractive globules. In view of fundamental preliminaries, "soya lecithin and whey protein concentrate (WPC) were chosen for arrangement stable emulsion of fish oil. Coarse emulsion was set up by blending fish oil, WPC and soya lecithin utilizing overhead stirrer. Fine emulsion were arranged utilizing two unique techniques viz. Ultra Turrex (High Shear Mixture) and high-pressure homogenizer. Emulsifier to fat proportion (EFR) was kept 1:4 and 1:6 in both tests while different boundaries were shifted concurring to gear. Revolution every moment (rpm) of high shear blend viz., 10,000, 12,000 rpm and time for shear viz., 12, 8 min were kept as factors for Ultra Turrax while pressure viz., 10, 15, 20 Kpsi and number of pass viz., 1–4 were kept as factor for high-pressure homogenizer". The test scope of variable was chosen dependent on preliminary preliminaries. The two techniques were looked at on the premise of molecule size (in mm) and the best blend was chosen further experimentation. These formed emulsions were changed over into globules utilizing sodium alginate and calcium chloride as per past work. For dish covering of globules, wax and high dissolving fat were utilized and analyzed. The seasoning was finished with vanilla and orange flavor to expand its satisfactoriness. The consequences of all the analyses were acquired in three-fold.

Preparation of beads

"Fish oil (2 g) and lecithin (0.5 g) were gauged and blended appropriately. 100 ml water was added and blended utilizing overhead stirrer (EUROSTAR, IKA, USA) with 4 edge propeller type stirrers (R 1342) of 50 mm breadth at 1700 rpm for 15 min to make a coarse emulsion. After 15 min 2 g. whey protein concentrate was added gradually to the emulsion and stirred for another 20 mins. It was kept overnight for complete hydration of whey proteins. Coarse emulsion was spent multiple times through high-pressure homogenizer (Constant Systems Limited, UK) at 15,000 psi for fine emulsion arrangement. The emulsion was kept overnight at room temperature for protein-liposome complex development". After overnight stockpiling, sodium alginate was continuously added to the fine emulsion 2% w/v. At that point the blend was mixed at 1700 rpm for complete blending of sodium alginate. The blend was moved to the perforated measuring utencil to fall dropwise in 0.2 M

CaCl2 arrangement (mixed at 500 rpm utilizing attractive stirrer) for quick globule development. After culmination of dabs development, globules were saved for solidifying in 0.2 M CaCl2 for another 30 min. Globules were isolated utilizing a muslin fabric and washed with refined water to eliminate abundance of CaCl2 clung to the globules. Washed globules were dried in the stove at 50 C for 3–4 h. Dried dabs were put away at refrigeration temperature for additional application. For covering of dots, high dissolving fat (HMF) was taken in the proportion of 1 g HMF: 10 g globules. Flavor was added to the HMF in the proportion of 1:5 [Vanilla Flavor: (HMF)]. Dish covering method was utilized for covering globules. Dried globules were straightforwardly added to the dissolved and enhanced HMF and container covering was finished. Globules were wrapped by seasoned HMF after cooling. These globules were stuffed water/air proof and avoided direct light to check oxidation of fats. During the investigation of emulsion Ultra Turrax homogenizer emulsion instead of high-pressure homogenizer.

Result and Discussion

Emulsification of fish oil was attempted to make oil in water emulsion utilizing distinctive emulsifier and regular emulsifier soya lecithin was chosen for additional examination. Klinkesorn and colleagues have arranged emulsion utilizing fish oil and lecithin. They have made a coarse emulsion utilizing highspeed blender and sonication for 2 min at a recurrence of 20 kHz, a plentifulness of 70%, and an obligation pattern of 0.5 (Klinkesorn *et al*. 2005).

Emulsions were set up with UT and HP utilizing different blends and analyzed for molecule size. On the off chance that of UT technique, it very well may be seen from Table 1 that normal molecule size was lower in EFR 1:4 when contrasted with 1:6 which showed that EFR 1:4 proportion was satisfactory to encompass fish oil globules shaped because of shearing in UT. A higher level of oil in the emulsions brings about a bigger mean bead breadth for the equivalent homogenizing conditions (Floury *et al*. 2000). Molecule size was lower (248.5 nm) at the point when the example was away for UT for 12 min term than 8 min. Likewise, molecule size was lower when tests are exposed to 12,000 rpm than 10,000 rpm. High rpm of UT what's more, longer term may have given higher shearing prompted more modest bead size. As beads were more modest, complete surface zone of bead was expanded which was covered by lecithin, emulsifier. Henceforth adequate emulsifier must be there to wrap the recently framed beads in any case these little beads join with one another and structure greater size globule. This might be the conceivable purpose behind

having greater measured bead in examples having EFR 1:6. Measurable information investigation demonstrated a huge impact of emulsifier on the mean particle size while others boundaries and association impact was not critical which show that factually rpm and time haven't any critical impact on mean molecule size.

"A similar report was directed with HPH strategy, in which EFR were kept same as past one yet levels of homogenizer weight and levels of passes were fixed rather than rpm and time which was done in UT. As like the prior investigations, molecule size was discovered lower (182 nm) in EFR 1:4 than 1:6 (Table 2). Some laborer likewise announced an increment in mean fat globule width with expanding oil content for the homogenization of oil in water emulsions with the APV Gaulin homogenizer. The lessening in bead breadth was seen with expanding weight and number of passes, which is in concurrence with past examinations" (Qian and McClements 2011; Tan and Nakajima 2005; Tcholakova *et al*. 2003). Factual information uncovered that impact of EFR and number of passes have an exceptionally critical impact on molecule size. This examination likewise supplemented consequences of the past examination with respect to EFR. So ideal level of emulsifier was important to shape little estimate emulsion. Also, as the quantity of passes in homogenizer expanded, example endured more shear brought about a lot more modest bead. The mean bead width kept on diminishing as emulsions were passed through the homogenizer an expanding number of times (Qian and McClements, 2011), yet the further decreases were genuinely unobtrusive. As per Trotta *et al*. (2002), term of preparing can influence emulsion strength. Revealed examines demonstrated that the occasions the item was gone through the gadget influenced the mean molecule size and the molecule size dispersion. Measurable investigation demonstrated that beads acquired after the third pass what's more, forward pass were not altogether unique . Additionally, higher weight and the higher number of passes brought about expanded in size of beads which can be seen when an example having EFR 1:6 gone through HPH four time at pressure 20,000 psi. It was seen that rehashing the preparing or cycling brought about an abatement in normal molecule size of the bead and a narrowing of the molecule size appropriation, after which mean molecule size and standard deviation both expanded as handling proceeded as revealed previously. This perception was in concordance with reports approving that bead size was the aftereffect of breakage and mixture and that, for frameworks containing moderately high rates of oil, expanding the usable pressure doesn't generally prompt a decrease of emulsion bead size. Ideal shear and ideal emulsifier were needed for the fine emulsion.Both the studies gave similar result about optimum level of EFR 1:4 for good emulsion.

. At the point when both UT and HPH was looked at on molecule size, HPH gave a lot better beads when contrasted with UT. Likewise, PDI (Poly Dispersity list) of emulsion made by HPH was very low when contrasted with UT. The mean molecule size and the PDI impact the actual steadiness, dissolvability, organic execution, discharge rate, turbidity and substance strength of emulsions (Tamjidi *et al*. 2013). High-pressure homogenization produced more steady emulsions than high-shear homogenization (Trotta et al. 2002). In light of these contemplations, HPH strategy was chosen for making emulsion and best mix weight and pass for example 15,000 psi and 4 passes were chosen in which more modest measured fish oil globules were revealed. Molecule size examination of chose mix demonstrated lower an incentive for both mean molecule size (163.6 nm) furthermore, PDI.

Tenualosa ilisha fish oil contains proteins, dampness and unsaturated fat. It go through detailing of case utilizing the application technique biovia. A 1 gm portion taken under specialist's proposal. The blend of Ecosapentanoic Acid(EPA) and Docosahexanoic Acid(DHA) unsaturated fat gives diverse medical advantages. Freshwater fishes of nine distinct types of various size gatherings were taken at various seasons and the variety in proximate arrangement and mineral substance with connection to impacts of season and body weight was contemplated. Protein content, lipid content, debris substance and mineral substance in all the types of separate size gatherings were resolved likewise by accepting season as a factor. Furthermore, by this, the fishes were requested agreeing their wellbeing recipient impacts. (Soumen Chanda, 2019)

Omega-3 unsaturated fats particularly EPA and DHA assume a significant function in the development of myelin sheath. They advance development of neurons and help the mind to fix the harm soon. So significant levels of these unsaturated fats ought to be devoured due to significant significance. It has been accounted for that normal utilization fish and fish oil supplement diminish the complete mortality and cardiovascular occurrences and angioplasty method to clear hindered conduits (for example myocardial localized necrosis). The American Heart Association (AHA) dietary rules suggested incorporation of at any rate two servings of fish for every week.(Kris *et al*. (2002). Omega 3 unsaturated fat enhancements assumes significant part to forestall the coronary heart illnesses, yet additionally it forestalls diabetes , hyper strain and furthermore malignant growth. It additionally assists with bringing down the cholesterol level.

Conclusion:-

The research was meant to find out the designing capsules of Omega 3 fatty acid extracted from Tenualosa ilisha fish. It can be concluded that Tenualosa ilisha is the best term of Omega 3 fatty acid capsule that is why along with economical importance.Fish oil, rich wellspring of unsaturated fats, is inclined to oxidation bringing about sharp off scent because of oxidation items. Likewise, fish oil has its own unmistakable flavor, unsuitable to most of the populace which creates a further issue in its utilization and application. Subsequently, a dot containing fish oil was defined utilizing whey protein-alginate framework and further, they were covered utilizing high softening fat and enhanced utilizing vanilla flavor to make it more agreeable. Reports of tangible assessment uphold that they were sensorially adequate. Further work around there can be kept utilizing other covering material, exemplification procedure and crude fixing to created oral enhancements having greater agreeableness and control discharge.

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Effect of drip irrigation and plastic mulch on performance of turmeric (*Curcuma Longa* L.,) under different irrigation level

Santosh D.T[1], K. N. Tiwari[1], Subhankar Debnath[2]

[1]Indian Institute of Technology Kharagpur, West Bengal, India

[2]Centurion University of Technology & Management, Odisha, India

Corresponding Author: Subhankar.debnath@cutm.ac.in

Abstract

A study on crop water requirement for turmeric was conducted during 2016-2018 at experimental field of Indian Institute of Technology Kharagpur. The study mainly focused on determination of optimum water requirement for turmeric crops and economic feasibility of drip irrigation with applying black plastic mulch for the crop cultivation. Reference evapotranspiration was estimated in this study by using the FAO-56 Penman-Monteith equation. The experiment consists of four irrigation treatments namely, 100% irrigation requirement through a drip (DI), 80% DI, 60% DI and conventional furrow irrigation (FI); and two sub-factors of black plastic mulch (PM) and no mulch (NM). The effect of different irrigation and plastic treatments were studied on crop growth, yield, and quality response. Results showed that 100% DI along with PM treatments produced better crop growth parameters and yield. The maximum yield was recorded under treatment 80% DI along with PM (16.64 t ha^{-1}) with an 85% increase in yield as compared to furrow irrigation (8.99 t ha^{-1}). The crop growth response under 100% DI along PM gives statistically at par growth parameters and crop yield. The cost economics of turmeric crop under 80% DI along with PM shows highest gross income (INR 1,66,400) as well as benefit-cost ratio (2.88) followed by the 100% DI with a net profit of INR 1,00,347 and B.C. ratio of 2.73.

Keywords: Drip irrigation; Reference evapotranspiration, Mulching; Water requirement; Benefit-cost analysis.

1. Introduction

Turmeric (*Curcuma longa* L.) is belonging to the *Zingiberaceae* family and is originated from Southeast Asia. Turmeric is called the “spice of life” and also as “golden spice”. Turmeric may be consumed as food, spice, and medicine. It is also included in organic cosmetics. In India, it is used as medicine and also considered sacred from ancient times. Turmeric is grown in 1,90,860 ha with a production of 7,92,980 tonnes per annum in India.

It can also be grown in partially shaded condition as it is a shade loving crop. Therefore, turmeric can be grown as an intercrop in fruit orchards.

Soil and water are two important components for growing any crop. In the modern-day of agriculture, modern irrigation practices are needed to adapt to get maximum productivity on a sustainable basis. A conventional method such as furrow irrigation is a commonly used method to apply irrigation water for vegetable crops grown in India. Earlier researches showed greater water productivity under drip irrigation in comparison to the traditional irrigation system. Drip irrigation saves a great amount of water and increases the yield of horticultural crops (Tiwari *et al*. 1998 a, b). Tiwari *et al*. (2014) recommended a "drip system of irrigation in place of conventional furrow irrigation due to economy in water utilization" without any loss of yield of Sapota crop. A plant is grown under drip (100% required irrigation water) and black plastic mulch records better growth parameters and yield of the sapota in comparison to the plant grown under furrow irrigation with the same amount of water.

Jaswal *et al*. (1993) recorded higher plant growth and yield of turmeric as intercrop compared to the turmeric grown as a single crop. Turmeric may be grown either as rain-fed or irrigated crop. The irrigated turmeric crops require 15-40 irrigations at a regular interval based on adopted methods to get a greater yield. Subramanian *et al*. (2001) found that turmeric crop requires about 1390 mm water with surface irrigation method whereas 650 mm of water applied through the drip method on daily basis recorded a significantly greater yield of turmeric. A major portion of water requires during the initial and developmental stage of the turmeric. The crop water requirement may reduce up to 20% to 60% due to the applied irrigation water through drip as the findings of the studies carried out in the soils of Tamil Nadu and Maharashtra (Selvaraj *et al*. 1997; Singte *et al*. 1997).

There are different types of organic mulches, such as straw, leaves, husk, and crop residues used conventionally to conserve soil moisture. In recent times, plastic mulches replace the organic mulches with added benefits like controlling weeds, soil temperature, and increase in yield of different vegetables and fruit crops. Some of the studies showed the beneficial response of crops under plastic mulch with facilitation of earlier harvest (Tiwari *et al*. 2014; Santosh and Tiwari, 2017), and decrease in the incidence of pest and disease (Greenough et al., 1990). The yield harvested from fruit and vegetable crops grown using plastic mulch is significantly greater in comparison to the yield of crops without applying plastic mulch (Tiwari *et al*. 1998 a, b; Tiwari *et al*. 2014).

Many studies revealed the benefits of drip and plastic mulch individually for various crops. However, the combined effect of drip with plastic mulch on turmeric is not reported for Indian sub-humid climatic conditions. Crop water requirement information on turmeric under drip irrigation alone and drip along with plastic mulch is not available. The information on economic feasibility of turmeric cultivation using drip and plastic mulch is not well known. Therefore, a field experiment was carried out for 3 consecutive years (2016-2018) to study the yield response and economical feasibility of drip irrigation along with plastic mulch for turmeric cultivation.

2. Materials and Methods

A field experiment was carried out at the experimental area of Precision Farming Development Centre, Agricultural and Food Engineering Department, Indian Institute of Technology Kharagpur, West Bengal, India, located at 22°19' N latitude and 87°19' E longitude at an altitude of 52 m above mean sea level. The study was conducted for three consecutive years (2016-2018) on sandy loam soil (59% sand, 23% silt, and 18% clay) with a maximum soil water holding capacity of 15% and bulk density of 1.44 g cm^{-3}. An area of 1000 m^2 with field plot is divided into beds of equal size of 1m × 10m and each bed is represented as a single treatment. Turmeric (var. PCT-13 (Suguna)) was selected for this study and planted in two rows with a plant to plant spacing of 0.3 m and row to row spacing of 0.5 m. A wide-furrow 0.5 m was prepared in between two treatments (i.e beds) and it is blocked with plastic barriers to prevent the migration of moisture from one treatment to another. The randomized block design (RBD) was adopted for conducting the experiments with 8 treatments and 3 replications (Fig.1).

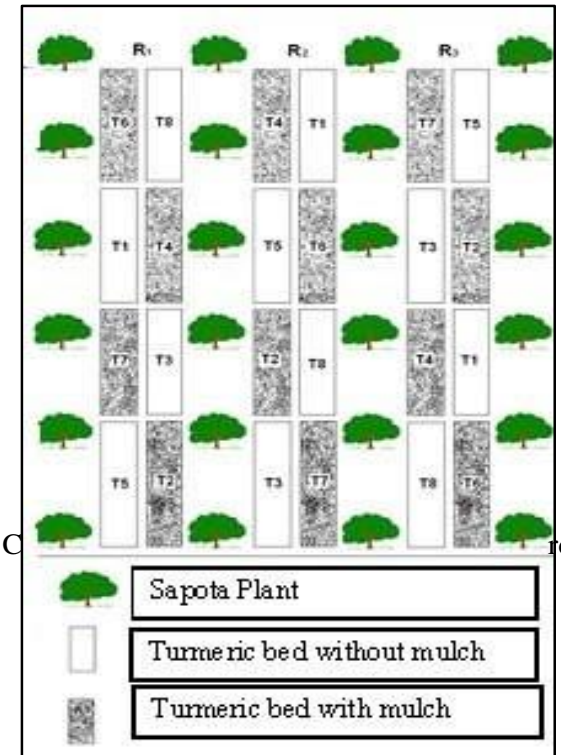

Fig 1. Schematic layout of the experimental plot

The designed treatments were as follows:

T1 (DI) :100% water requirement applied using drip with no mulch

T2 (DIM) :100% water requirement applied using drip along with black plastic mulch

T3 (0.8DI) :80% water requirement applied using drip with no mulch

T4 (0.8DIM) :80% water requirement met using drip along with black plastic mulch

T5 (0.6DI) :60% water requirement met using drip with no mulch

T6 (0.6DIM) :60% water requirement met using drip along with black plastic mulch

T7 (FIM) :100% water requirement using furrow method along with black plastic mulch

T8 (FI) :100% water requirement using furrow method with no mulch (Control)

The FAO-56 equation was used to estimate the reference crop evapotranspiration using daily weather data collected at weather station situated 1 km away from the experimental farm. The crop coefficient values were considered as suggested by Allen et al., 1998 for similar crops and also considering a local unpublished study on turmeric cultivation. In general, crop evapotranspiration (ET_c) value varies for turmeric cultivation under plastic mulch and reduced by 10% to 30% depending on the number of irrigation (higher will be for drip irrigation). The Kc value of plastic mulch applied turmeric crop at the initial stage (Kc_{ini}) is often low as 0.10 (Allen *et al*. 1998). The product of daily reference evapotranspiration value (ET_0) and crop growth stage-wise Kc values gives the daily ET_c values. The daily irrigation water requirement for the turmeric crop under drip along with plastic mulch and no mulch was determined using the following relationship

$$IR = ET_0 \times Kc \qquad \text{.....(1)}$$

Where

IR - Net depth of irrigation (mm day^{-1})

ET_0 - Reference evapotranspiration (mm day^{-1})

Kc - Crop coefficient

The net volume of water required by the plant can be calculated by the relationship

$$V = (IR-R_e) \times A \quad \text{.....(2)}$$

Where

V - Net volume of water required by a plant (L day^{-1} $plant^{-1}$)

A - Area for each plant (i.e. spacing between rows, m x spacing between plants, m)

R_e - Effective rainfall (mm day^{-1})

The effective rainfall is the part of the rainfall that forms part of the consumptive use after surface runoff and drainage took place. The irrigation water was supplied after subtracting the effective rainfall from the total irrigation requirement (Eq. 1). The crop water requirement was determined for the growing season of turmeric, (i.e. from July to December) for 3 years using Eq. (2).

The drip irrigation system was operated on an alternate day to supply water as per the requirement of the crop. The drip lateral laid above the soil surface and parallel to a row of the plants. A single lateral is sufficient for two rows of turmeric crop and laterals are provided with drip emitter with the discharge of 4 Lh^{-1} at 30 cm apart to supply water for 4 plants at a time. Experimental beds of 1 m wide, 10 m length, 0.15 m deep with 0.2% slope has been provided in all the experimental plots. For the crop irrigated with the furrow method, irrigation water was applied at 5 days interval. The volume of irrigation water required for all the plants in a single furrow for an irrigation interval of 5 days was estimated using Eq. (2).

The black plastic LLDPE film of 50-micron thickness was applied above the soil surface to cover the 100% irrigated area of each treatment. In the furrow irrigation method, a 20 cm wide bed on both sides of the furrow was covered with black plastic. A standard package of practices includes fertigation and integrated plant protection measures were followed during the crop cultivation. The turmeric crop fertigated as per the recommended dose of fertilizer using water-soluble fertilizers at 7 days intervals to meet the nutritional requirement of the crop. Plant biometric parameters such as plant height (cm), stem girth (cm), and functional leaves (nos.) were measured at 15 days interval. The crop yield parameters such as corm weight (g), corm length (cm), and yield (t ha^{-1}) were recorded for each treatment at the time of harvest.

The working life of a drip irrigation system was considered as 7 years (Pattanaik *et al.* 2003). Crop cultivation cost which includes the expenses for land preparation, seed, sowing, intercultural operations, fertilizer application, crop protection measures, irrigation water,

and harvesting was calculated. The income from produce was calculated using the prevailing average market price of Turmeric corm @ Rs. 10000 t^{-1}.

3. Results and discussion

The daily reference evapotranspiration (ET_0) values were determined using recorded weather parameters of three consecutive years (2016-2018) with the help of the FAO-56 modified Penman-Monteith approach. The product of turmeric Kc value for different growth stages and daily ET_0 values were values of actual crop evapotranspiration (ET_c) on daily basis. Table 1 presents the monthly average of daily ET_0, ET_c, irrigation requirement, and drip irrigation operating time. According to Allen *et al*. (1998) values for Kc_{mid} and Kc_{end} of the Turmeric, the crop can be reduced by 10 to 30% for plastic mulch depending on the frequency of irrigation. The value for Kc_{ini} for mulched Turmeric crop was taken as low as 0.10 and Kc_{mid} and Kc_{end} is taken 15% and 30% less of the turmeric crop grown under drip with no mulch condition and furrow irrigated crops with no mulch respectively. The daily irrigation water requirement for the Turmeric crop was estimated by subtracting the effective rainfall from the ET_c.

The total estimated quantity of water applied to Turmeric plants was 416 mm in an open condition and 325 mm under plastic mulch treatment respectively. The irrigation water requirement of turmeric varies, respectively, from 0.23 to 0.49L day^{-1} $plant^{-1}$ from early-stage to peak demand period in open field condition and 0.06 to 0.41 L day^{-1} $plant^{-1}$ for Plastic mulch covered condition. Average daily turmeric ET_c values for different months in different years are shown in Fig. 2. The Turmeric crop ET_c shows more or less the same trend for all three years, however, the average maximum ET_c was 0.49 L Day^{-1} $plant^{-1}$. Variation of crop evapotranspiration values for the open field (without mulch) and plastic mulch condition are shown in Fig. 3.

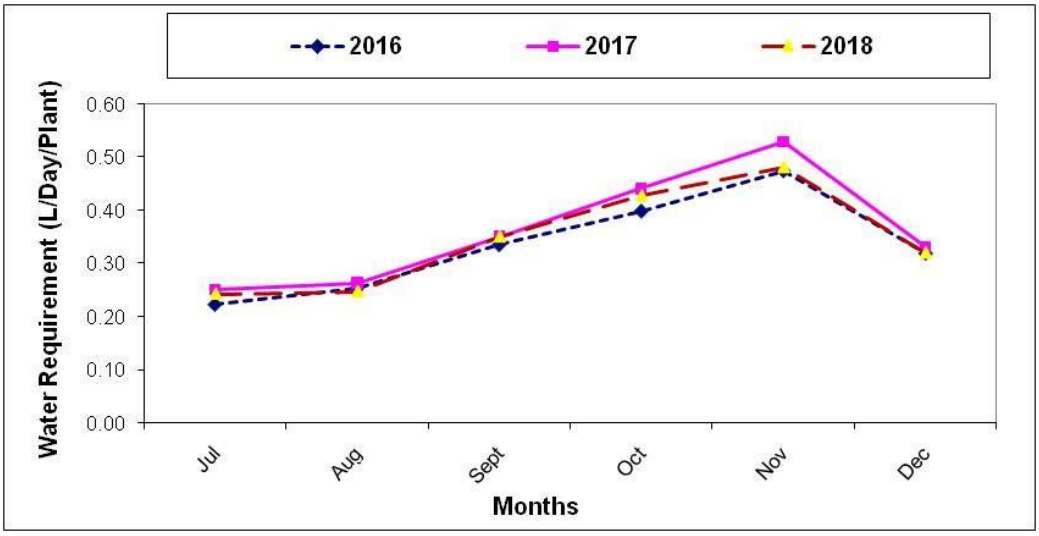

Fig. 2. Estimated irrigation water requirement of Turmeric crop with drip irrigation without mulch in different years

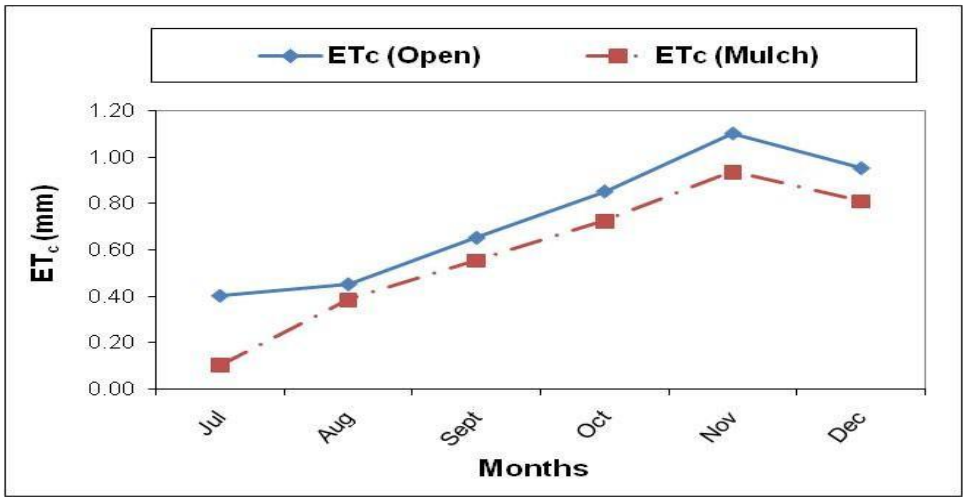

Fig. 3. Estimated ET_c values for Turmeric crop in open and plastic mulch condition

The duration of the operation drip system was estimated considering the discharge of each dripper and water requirement of 4 plants. The duration of operation of the drip system was worked out for the different levels of irrigation (i.e. DI, 0.8DI, and 0.6 DI) and with plastic mulch. The duration of irrigation to each treatment was controlled by gate valves provided at the inlet end of each drip laterals. The duration of operation of the drip system varies with

treatment both for mulch and without mulch conditions. The average duration of operation varied from 7 min to 59 min.

Table 1. Monthly average of daily water requirement of Turmeric crop

Months	ET_0	Kc		ET_C (mm day $^{-1}$)		Water Requirement (L plant^{-1} day^{-1})		Average duration of drip system (min)	
		Without mulch	Mulch	Without mulch	Mulch	Without mulch	Mulch	Without mulch	Mulch
JULY	3.85	0.40	0.10	1.54	0.39	0.23	0.06	28	7
AUG	3.68	0.45	0.38	1.65	1.41	0.25	0.21	30	25
SEPT	3.40	0.65	0.55	2.21	1.88	0.33	0.28	40	34
OCT	3.27	0.85	0.72	2.78	2.36	0.42	0.35	50	42
NOV	2.95	1.10	0.94	3.24	2.76	0.49	0.41	59	49
DEC	2.28	0.95	0.81	2.16	1.84	0.32	0.28	38	34

The response of biometric parameters of turmeric crop on drip irrigation and plastic mulch was recorded for three crop seasons (2016-2018). Table 2 presents the 3 years pooled data of biometric parameters such as plant height, stem girth, and functional leaves for different treatments. The table also presents the response of Turmeric yield and yield parameters for drip irrigation and plastic mulch.

Table 2 shows that drip irrigation and plastic mulch has a significant effect on plant growth and yield in comparison to the yield of Turmeric grown under furrow irrigation with no mulch (T_7 and T_8). A number of functional leaves and corm weight of turmeric crop under DIM (T_2) and 0.8 DIM (T_4) treatments are statistically at par. Table 2 also shows that better

growth parameters such as maximum height (145 cm), stem girth (11.2) and functional leaves (11.41) and yield parameters such as corm weight (898 g), corm length (12.2 cm), and yield (17.3 t ha^{-1}) were recorded under treatment T_4. The lowest values for the biometric and yield parameters were recorded under treatment T_8.

The yield and yield parameters of the Turmeric crop presented in Table 2 show a significant difference between the treatments. The maximum yield was obtained with treatment T_4 (16.6 t ha^{-1}). However, with the same amount of water applied with drip irrigation in treatment T_3 (15.8) yield is significantly lower than the yield of treatment T_4. This shows that even though some level of irrigation water was applied between the two treatments, the yield was always recorded higher for the crops treated with plastic mulch. This increase in yield may be due to conserved moisture and higher water availability to plants in comparison to without mulching plants. The same results were found for the Sapota crop by Tiwari et al. (2014). The Turmeric yield was recorded to be 86% greater with the 80% irrigation with drip and plastic mulch (T_4) treatment in comparison to conventional furrow irrigation. It is also observed from the table that with the 20% increased water supply i.e (from 60 to 80 %) there was a corresponding 29.6 % increase in yield. However, there was 5.5 % decreases in yield with the 20% increased water supply i.e. from 80 to 100 %. This is because of developed better soil-water environment in the plant root zone due to drip irrigation and hence drip irrigation will be a viable option wherever there is a water scarcity problem existed.

The yield recorded for drip treatments T_1, T_3, and T_5 is always greater in comparison to the conventional furrow irrigation system. A significant increase in yield with combination of drip and plastic mulch was noted than drip alone (no mulch) and furrow irrigation method. The percentage increase in yield for different levels of irrigation under drip with plastic mulch was found to be 12.3 % (T_2), 5.7 % (T_4), and 21.6 % (T_6) as compared to that of drip alone (T_1, T_3, and T_5) respectively. The furrow irrigation method with plastic mulch (T_7) resulted in a yield 14.7 % increase in yield as compared to furrow irrigation without mulch (T_8). The treatment T_8 recorded the lowest yield (8.99 t ha^{-1}) comparing to all other treatments. This may be due to the water stress created during the critical growth period, coupled with the aeration problem in the first few days immediately after irrigation. The shortage of soil nutrients for crop growth due to the leaching of nutrients that took place while applying water through surface irrigation may be the other reason to get the lowest

yield in treatment T_8 (Pattanaik *et al*. 2003). This statement is also supported by the results of a study conducted by Tiwari *et al*. (1998 a, b) and Singh (2007).

The total water requirement to grow Turmeric with 100% irrigation volume of water through drip irrigation system was estimated as 416 mm. The maximum yield was obtained under treatment T_4 with the 80% volume of water applied as 259.9 mm under drip and plastic mulch. The drip treatment of irrigation with LLDPE plastic mulch (T_4) increased Turmeric yield by 86% in comparison to surface irrigation. Similar results were obtained by Tiwari *et al*. (1998a) for the okra crop at Kharagpur, India.

Analysis of qualitative characteristics of turmeric (Table 3) shows the maximum value of crude fiber, oleoresin, curcumin, and essential oil content for the treatment T_4. The qualitative response characteristics of turmeric were superior with drip and plastic mulch as compared to surface irrigation without mulch. The percentage of curcuminoids (>5%) and essential oil (>6%) is above the standards. The presence of oleoresin and curcumin in turmeric indicated lesser pest and disease infestation in the turmeric crop.

Table 2. Four years (2016-2018) pooled data of biometric parameters and yield (t ha^{-1}) of turmeric

Treatment	Plant Height (cm)	Stem Girth (cm)	Functional Leaves (Nos.)	Corm Weight (g)	Corm Length (cm)	Yield (t ha^{-1})
T_1 (DI)	110.3	9.1	9.89	445.4	8.7	14.1
T_2 (DIM)	131.6	10.3	10.91	839.1	10.1	15.84
T_3 (0.8 DI)	111.7	10.0	9.28	372.6	9.0	15.75
T_4 (0.8 DIM)	145.0	11.2	11.41	898.0	12.2	16.64
T_5 (0.6 DI)	107.2	8.6	9.41	368.9	6.9	10.56
T_6 (0.6 DIM)	118.1	10.0	10.24	624.2	9.2	12.84
T_7 (FIM)	99.8	8.7	9.08	298.8	6.1	10.31
T_8 (FI)	95.2	7.6	8.74	262.8	5.9	8.99

C.D. (P=0.05)	**10.8**	**0.9**	**0.73**	**69.5**	**0.6**	**0.66**

Table 3. Qualitative characters of Turmeric

Treatments	Crude Fiber (%)	Oleo resin (%)	Curcumin (%)	Essential oil (%)
T_1	6.7	14.8	6.83	6.83
T_2	6.8	15.2	7.03	7.30
T_3	6.7	14.8	6.80	6.80
T_4	7.0	15.4	7.27	7.47
T_5	6.5	14.9	6.63	6.80
T_6	6.6	15.1	6.90	7.30
T_7	6.4	13.8	6.57	6.70
T_8	6.1	13.2	6.40	5.37
CD (P=0.05)	0.45	0.63	0.48	0.63

Table 4 presents the nutrient status of Turmeric rhizomes. The nutrient content of the rhizome at harvest records the highest K contents of 2.2 percent K (in treatments T_4 and T_2) contrasted markedly different against the treatments T_7 and T_8 of 1.6 percent. This beneficial effect of water application rate on rhizome K content is in agreement with the findings of Subramanian *et al*. (2001). The N and P content of rhizome in different treatments were not significantly different. Both N and P contents were also greater in drip-irrigated plots compared to surface furrow irrigations. However, there was a marginal improvement in the nutrient uptake due to plastic mulch. This beneficial effect of increasing the uptake and utilization of other nutrients is an important aspect of water application and plastic mulch.

Table 4. Influence of treatments on nutrient uptake of Turmeric rhizome

Treatments	N (%)	P (%)	K (%)
T_1	1.23	0.18	2.10
T_2	1.24	0.20	2.20
T_3	1.24	0.18	2.10
T_4	1.25	0.20	2.20
T_5	1.20	0.16	1.80
T_6	1.23	0.16	1.93
T_7	1.20	0.16	1.60
T_8	1.20	0.16	1.60
CD (P=0.05)	NS	NS	0.20

Table 5 shows that the water use efficiency decreased with an increase in irrigation levels i.e. 0.6 DI, 0.8 DI, and VD drip treatments. There was a significant increase in water use efficiency due to the application of plastic mulch with drip irrigation in comparison to the treatments drip irrigation system alone (with no mulch). The increase in water use efficiency for the drip irrigation system alone (T_3) and drip irrigation system with plastic mulch (T_6) over conventional surface irrigation (T_8) was 119 % and 204 % respectively. A similar trend has been reported for the improved water use efficiency for the Okra crop by Tiwari *et al*. (1998a) and for the tomato crop by Singh (2007).

Maximum net profit of Rs.1,08,664 ha^{-1} with B:C ratio of 2.88 were Found for the treatment T_4 whereas the treatment T_8 (furrow irrigation) resulted in the lowest net profit of 45,418 with a B:C ratio of 2.02 (Table 5). It is found that the Turmeric crop with mulch treatments T_2, T_4, and T_6 gave greater net return per ha and a higher B:C ratio in comparison to their corresponding drip irrigation treatments with no mulch. The results are in agreement with the findings of Singh (2007). The B:C ratio was 2.02 in conventional irrigation method (T_8) was due to no investment cost of a drip system and plastic mulch. However, the net profit in drip-irrigated treatments with mulch was observed to be highest (Rs. 1,00,347) for treatment T_4 followed by T_2 (Rs. 1,00,347). The net profit per mm of water used (Rs. 418.10 ha^{-1}) was maximum in the case of T_4. Similar trends have been reported in net profit, B.C. ratio, and

net profit per mm of water used for Okra crop by Tiwari et al. (1998a) and for tomato crop by Singh (2007).

Table 5. Cost economic of Turmeric crop with drip irrigation and plastic mulch for different treatment

Cost of economics per hectare of land	T_1 (VD)	T_2 (VDM)	T_3 (0.8VD)	T_4 (0.8VDM)	T_5 (0.6VD)	T_6 (0.6VDM)	T_7 (FM)	T_8 (F)
1. Cost of installation	86674.00	86674.00	86674.00	86674.00	86674.00	86674.00	0	0
(a) Life in years	7	7	7	7	7	7	0	0
(b) Depreciation amount (Rs.)	12382.00	12382.00	12382.00	12382.00	12382.00	12382.00	0	0
(c) Interest @ 12% (Rs.)	10400.88	10400.88	10400.88	10400.88	10400.88	10400.88	0	0
(d) Repair and maintenance @ 1% (Rs.)	866.74	866.74	866.74	866.74	866.74	866.74	0	0
(e) Annual cost of installation of drip{1(b)+1(c)+1(d)}(Rs.)	23649.62	23649.62	23649.62	23649.62	23649.62	23649.62	0	0
2. Cost of mulching (Rs.)	0	40238.10	0	40238.10	0	40238.10	40238.10	0
(a) Life in years	0	3	0	3	0	3	3	0
(b) Depreciation amount (Rs.)	0	13412.70	0	13412.70	0	13412.70	13412.70	0
(c) Interest @ 12% (Rs.)	0	4828.57	0	4828.57	0	4828.57	4828.57	0
(d) Annual cost of mulching {2(b)+2(c)} (Rs.)	0	18241.27	0	18241.27	0	18241.27	18241.27	0
3. Total annual fixed cost {1(e)+2(d)}(Rs.)	23649.62	41890.89	23649.62	41890.89	23649.62	41890.89	18241.27	0
4. Water used (mm)	416.0	324.9	332.8	259.9	249.62	194.9	269.7	416.0
5. Cost of fertilizers & pesticides used(Rs.)	15000.00	10000.00	15000.00	10000.00	15000.00	10000.00	10000.00	15000.00
6. Electricity charges @ 4 Rs. per unit (Rs.)	1581.89	1581.89	1265.52	1265.52	949.13	949.13	1581.89	1581.89
7. Labour charges @ 186 Rs. per day (Rs.)	22320.00	4580.00	22320.00	4580.00	22320.00	4580.00	24180.00	27900.00

8. Yield of produce (t/ha)	14.10	15.84	15.75	16.64	10.56	12.84	10.31	8.99
9. Income from produce @ 10 Rs./ kg (Rs.)	141000	158400	157500	166400	105600	128400	103100	89900
10. Gross cost of production (3+5+6+7)(Rs.)	62551.51	58052.78	62235.14	57736.41	61918.75	57420.02	54003.16	44481.89
11. Gross Income (9) (Rs.)	141000	158400	157500	166400	105600	128400	103100	89900
12. Net profit (11-10), Rs/ha	78448	100347	95265	108664	43681	70980	49097	45418
12. Gross benefit cost (B-C) ratio (11/10)	**2.25**	**2.73**	**2.53**	**2.88**	**1.71**	**2.24**	**1.91**	**2.02**
13. Water use efficiency (kg $ha^{-1}mm^{-1}$)	33.89	48.75	47.33	64.02	42.30	65.88	38.22	21.61

Conclusion

Drip irrigation with plastic mulch was found to be more economically feasible and profitable in comparison to conventional furrow irrigation and drip irrigation without mulching. The use of drip irrigation alone (no mulch) or use of drip and plastic mulch combination in turmeric cultivation results in an 85% increase of turmeric yield in comparison to the furrow irrigation method with comparatively less water application. A quantity of 259.9 mm of water can be considered for irrigating turmeric under the drip irrigation along with black plastic mulch for sub-tropical conditions and profitability can be increases by 139% over the normal surface irrigation.

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Resource conservation techniques in rice

Santosh kumar lenka, Jami Naveen, Kandapu Sai Teja
Centurion University of Technology and Management, Odisha
Ph.D. Scholar, M.Sc. Student, Department of Agronomy, Assam Agriculture University, Jorhat-785013

Abstract

Resource conservation techniques (RCTs) are the practices which result in saving the energy, cost and also reduce the environmental pollution over conventional practices. The resource conservation technologies primarily focus on saving of resources through minimal tillage, ensuring soil nutrients and moisture conservation through crop residues and cover crops and adoption of spatial and temporal crop sequencing. Rice is a major staple crop in India and requires special focus in minimizing the production cost, effective utilization of resources and doubling the farmer's income to achieve sustainability. Adopting RCTs into the production system enables to fulfill the above objectives. Rice is one of the major contributors of greenhouse gas emission in agriculture. This can be compensated by implementing RCTs in rice production system.

Keywords: RCTs, rice, zero tillage, laser land leveling, urea deep placement

Introduction

In recent years, farmers concerned in sustainable crop production systems have initiated to adopt and adapt improved crop management practices as a step towards resource conservation, which is considered as an ultimate solution for doubling the income. To realize the potential of the production system on a sustained basis, efficient management of resources is very essential. Hence, the role of modern tools and techniques plays a major role to enlarge carrying capacity, enhance the input use efficiency without declining the resource base have become an important mean for sustained growth (Meena, 2013). Soil, water, climate and vegetation are considered to be a basic natural resource for agricultural growth and development. "Resource conservation, which focuses on the complete agricultural system, involves major changes in farm cropping operations from the traditional tillage-based farming practices to irrigation management". Resource conservation techniques (RCTs) are the practices which result in saving the energy, cost and also reduce the environmental pollution over conventional practices. "The resource conservation technologies primarily focus on saving of resources through minimal tillage, ensuring soil nutrients and moisture conservation through crop residues and cover crops and adoption of spatial and temporal crop sequencing". For example, growing new varieties that use nitrogen more efficiently may be considered RCTs. Zero or minimum tillage practices that conserve the fuel may also be considered RCTs. RCTs also help to mitigate the effects of climate change, at least concerning the emission of greenhouse gases. The utilization of fossil fuel for agricultural production is significantly minimized under RCTs and burning of crop residues is eliminated, which also contributes to a reduction in greenhouse gas release.

Rice is a major staple crop in India and requires special focus in minimizing the cost of production, effective utilization of resources and doubling the farmer's income to achieve sustainability. Adopting RCTs into the production system enables to fulfill the above objectives. This paper gives an emphasis on how RCTs will conserve the natural resources in rice crop production system with special reference to soil, nutrient, water, energy and environmental conservation.

1). Soil Conservation

Tillage is one of the factors which are accountable for soil degradation. Intensive tillage practices result in water and wind erosion and destroy the soil structure. So, there is a necessity of decreasing the tillage practices for conserving soil. "Zero tillage is a practice in which the seeds are directly placed into untilled soil which has retained the previous crop

residues. The aim is to disturb the soil as little as possible not to bring weed seeds to the surface and not stimulating them to germinate". Zero tillage helps in improving soil structure as well as decreasing erosion. If properly implemented, zero tillage system improves soil structure, increases the proportion of bio-channels and macrospores, decreasing susceptibility to crusting and increases homogeneity in soil. Improvement in soil structure by zero tillage promotes high biotic activity. The zero- tillage technology was popularized during the last decade, mainly in northwest India. In 2008, Rice- wheat cropping system amounted to 1.76 million hectares aggregately under zero or reduced tillage in India (Erenstein, 2009).

Laser land leveling: "Precision land leveling using laser land leveller equipped with drag scrapper is a process of smoothening the land surface within ±2 cm of its average micro-elevation". Laser land leveling has the potential to conserve soil moisture, reduce production costs, improve input-use efficiency, reduce lodging of crops, produce higher yield, and "provide more sustainable soil management while still allowing the use of the existing, widespread gravity irrigation system" (Saha *et al.* 2018). "Laser leveling in rice fields reduced irrigation time by 47–69 h/ha/season and improved yield by approximately 7 % compared to traditionally leveled fields" (Aryal *et al.* 2015).

2). Nutrient Conservation

Fertilizers account for "40%-60% of increases in cereal production and will continue to play a crucial role in reaching future food production targets. Generally, N fertilizer is the single most important input to increase crop yields, and globally urea is the primary fertilizer used to supply this plant macronutrient" (Robertson and Vitousek, 2009). "Application of nitrogen fertilizer has improved crop yield in the world during the past five decades but with considerable negative impacts on the environment. New solutions are therefore urgently needed to simultaneously increase yields while maintaining or preferably decreasing applied N to maximize the nitrogen use efficiency (NUE) of crops. However, traditionally adding N fertilizer to improve crop yields may have reached a plateau. Indiscriminate application of nitrogen fertilizer may not result in yield improvements but will lead to serious environmental problems.

High N fertilizer input leads to low nitrogen use efficiency due to the rapid N losses from ammonia volatilization, denitrification, surface runoff, and leaching in the soil-flood water system. As a consequence, significant environmental problems (i.e., soil acidification, air pollution, water eutrophication) occurred" (Smil, 1993). To attain further high "crop productivity and high NUE under well-fertilized conditions, new solutions are urgently needed to increase yields while maintaining or preferably decreasing applied N" (Han *et al.* 2015).

In most of the rice production systems, N fertilizer is applied as basal broadcasting with or without incorporation prior to transplanting and one or two topdressings immediately after transplanting up to flowering. In general, only about one-third of the N fertilizer is utilized by the plants. The rest is lost through ammonia volatilization and denitrification, runoff and leaching. So by adopting approaches like urea deep placement, using slow release fertilizers, nitrification inhibitors and real time nitrogen management will improve nitrogen use efficiency in rice crop production. Application of green manures will decrease fertilizer requirement and promotes sustainable crop production.

Urea deep placement is an effective method to reduce N losses and improve fertilizer efficiency. it is a simple, farmer-friendly technology that enhances the efficiency of applied N fertilizer. There are two elements to this technology: (1) urea super granule (USG) and (2) point placement of USG at 7-10 cm depth in the reduced [anaerobic] soil layer for near the root zone of the crop. UDP enable to achieve15%-20% higher crop yields than broadcast application of urea with lesser use for about one-third lower than broadcast. Through UDP, the possibilities for N losses are reduced, and enhanced N uptake by the plant is possible

(IFDC, 2016). "Deep placement of urea briquettes manually or by mechanical applicator resulted in the higher yields, N uptake and N use efficiency than broadcasting of urea granules" (Nayak, 2017).

Neem coated urea: "Urea coated with neem cake (200 kg per tonne) (NCU) or neem oil (NOCU) possesses nitrification inhibition properties and can increase yield and N use efficiency in field crops compared to untreated urea. The average increase in the grain yield of rice by applying NCU/NOCU is around 5 to 6 per cent over the yields obtained by urea at the same N level". Possibly, applying NOCU following the site-specific nutrient management principles will lead to the production of yield levels higher than or similar to that obtained with untreated urea but with lower rates of application. In 2015, "the Government of India directed that all fertilizer urea manufactured in the country or imported will have to be coated with neem oil at the rate of 0.5 kg per tonne" (Singh, 2019).

Nitrification inhibitors:

Blending fertilizers with nitrification inhibitors (NI) is a technology to reduce nitrogen (N) lo ss.

The application of NI could improve the soil N supply capacity over time and contribute to an enhancement of crop recovery. Urease and nitrification inhibitors showed good potential in increasing soil retention and plant recovery of applied fertilizer N. Use of nitrification inhibitors like Dicyandiamide (DCD), thiosulphate can reduce the GHG emission to various extend thus help in mitigation of climate change.

Real-time N management: Right amount of N fertilizer applied at the right time is known as a real time N management. It will improve the crop growth and development. Among the various strategies available for N management, leaf colour chart (LCC), SPAD meter and green seeker are handy, portable and easy options for real time N management.

Leaf colour chart for N management: Leaf colour chart is an inexpensive and a very easy to use tool for efficient management of N fertilizers in rice. It is like a ruler about 15 cm in length, made of plastic, consisting of six colour shades from light yellowish (no.1) to dark green (no. 6). The colour strips are fabricated with veins resembling rice leaves.

SPAD Meter: It measures the chlorophyll content of the leaf. It is a non-invasive, non-destructive measurement. With the help of this instrument, the indexed chlorophyll content reading can be collected in <2 seconds. Research shows a strong correlation between SPAD measurements and leaf N content. The SPAD Value for relative chlorophyll content ranges from -9.9 to 199.9.

Green Seeker: The Green Seeker "handheld crop sensor is an affordable, easy-to-use measurement device that can be used to assess the health—or vigour—of a crop. readings taken by the Green Seeker handheld can be used to make non-subjective decisions regarding the amount of fertiliser to be applied to a crop, resulting in more efficient use of fertiliser—a benefit to both a farmer's bottom line and the environment". The sensor works on the principle of NDVI and displays NDVI value ranging from 0.00 to 0.99. The Trimble Ag Software scout app on a smartphone should be used to calculate fertilizer application rates.

Green manures: "If legume crops are used as green manure, they can supply up to 200 kg/ha of nitrogen (N) to the soil; in case of rice, this can result in mineral fertilizer savings of 50 to 75%". In paddy cultivation, Azolla is considered as one of the major green manure crops. it is has been used for thousands of years as a 'green' nitrogen fertilizer to increase rice production. "Azolla is a freshwater water fern that lives in association with blue-green alga Anabaena and can fix atmospheric Nitrogen (N) into ammonia". It can fix 2−5% N and 0.3−6.0% Potassium (K) (dry weight). Azolla can be used as a green manure either as pre transplanting incorporation or intercropping.

3). Water Conservation

Good irrigation schedule showed the supply of the optimum amount of water at the right time ensuring that water is available when the crop needs it. This often results in lower energy and water use and optimum crop yields. Paddy is a crop with highest water requirement leads to heavy consumption of water as well as energy. So by adopting new practices like Alternate Wetting and Drying (AWD) reduces the water requirement with limited yield reduction.
"AWD is a water-saving technology that can be practiced to reduce irrigation water consumption in rice fields without decreasing the yield. In AWD, irrigation water is provided a few days after the disappearance of the ponded water. Hence, the field gets flooded and non-flooded alternately" (Allen and Sander, 2019). Water savings could be up to 15 to 25 per cent with no yield reduction. AWD minimize the methane emissions by 48% without affecting the yield. (Richards and Sander, 2014).

System of rice intensification (SRI) proved that keeping the paddy soil moist gives better results, both agronomically and economically, compared to continuous flooding throughout the crop cycle. Thus SRI is presently drawing the greatest attention to address the issue of producing more rice with less water. The SRI can also reduce GHG emission and improves soil health.

Direct seeded rice: Direct-seeded rice is a affordable alternative to conventional puddled transplanted rice. Earlier crop establishment through direct-seeded rice DSR also reduces the risk of yield loss from late-season drought, and the cost of additional irrigation. The capacity of poor farmers to cope with climate-induced change can be increased by adopting the direct seeded rice practice and reducing the amount of water required for crop establishment and subsequent crop growth. Further, if faced with early drought, farmers can direct seed with minimal soil moisture, rather than wait for adequate rainfall for transplanting.

4). Energy Conservation

In the present scenario of the global energy crisis and high cost of production, efforts have been made towards finding new alternative fuel and rational ways of saving energy in crop production. Practices like zero tillage, direct seeded rice, alternate wetting and drying helps in energy conservation. AWD reduces water use by up to 30% and can save farmers money on irrigation and pumping costs. Incentives for the adoption of AWD are higher when farmers pay for pump irrigation.

5). Environmental conservation

Agriculture is one of the key sectors of GHG emissions, in which rice cultivation alone contributes 18 % of the agricultural emissions. There is a need to develop suitable practices that maintain or enhance soil carbon pools, improve NUE to minimize N_2O and CH_4 emissions from rice production systems. By adopting less water demanding rice production systems like direct seeded rice, SRI and nutrient management techniques (urea deep placement, real-time nitrogen management, slow-release nitrogen fertilizer can decrease GHG emissions from the rice (Naveen *et al.* 2020).

Conclusion

Resource conservation techniques (RCTs) are the practices which result in saving the energy, cost and also reduce the environmental pollution over conventional practices. RCTs in rice crop production system will reduce the cost of cultivation which directly involves in doubling the farmers income and makes production system sustainable. RCTs are the key solution against global climate change contributed through agriculture.

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Modeling vacuum assisted microwave drying of sapota slices

Vivek Kumar[1], Moirangthem Kalpana Devi[2]
[1] Department of Agricultural Engineering, SoABE, Centurion University of Technology and Management, Odisha, India
[2] Department of Food Process Engineering, NIT Rourkela Odisha
Corresponding Author: vivek.kumar@cutm.ac.in

ABSTRACT

The effect of microwave power, vacuum and slice-thickness on drying characteristics of sapota (*Achras sapota*) slices in a microwave vacuum (MV) drying system was studied. The results were compared with those obtained in tray drying at 60^0C. The experiments were conducted for combination of microwave power (100, 200 and 300 W); vacuum (100, 250 and 400 mmHg) and the slice-thickness (4, 6 and 8 mm) as obtained by applying face centre design of response surface methodology. MV drying methods offered a maximum reduction of 90% in drying time as compared to that in tray drying. Page model showed a good fit to experimental data with high value of R^2 ranging from 0.9712 to 0.9994. The activation energy of the sapota drying was evaluated to be 18.154 Wg^{-1}.

Keyword: Sapota drying, Vacuum assisted microwave drying, drying model, activation energy

INTODUCTION

Sapota (*Achras sapota L.*), commonly known as *chiku* is an important fruit of India and the country ranks fourth in the world in sapota production. In India sapota is cultivated in 52 thousand ha with a production of 5.94 lakh tonnes (nhb.gov.in/horticulture). "Sapota fruit is highly perishable and is also sensitive to cold storage. Therefore, bulk of the produce is used for table purpose and is handled at ambient climatic conditions causing considerable post-harvest losses. Due to mishandling of produce about 24 – 40% is being wasted. Commercial processing is negligible due to the sensitivity of the fruit to heat (changing the flavour & colour of the pulp), high labour requirement in peeling, removal of seeds etc. Nowadays dry segments and flakes of the fruit are being processed but to a limited extent. Processed food items viz. jam, jelly, squashes and fruit drinks are produced from sapota after blending it with other fruits. It is essentially to produce value added products based on sapota, so that farmers get an assured price for their produce all the time" (nhb.gov.in/horticulture).

In such a situation the dehydration of sapota becomes essential. The dehydrated sapotas are becoming popular as they provide greater self-life, palatability, convenience during transport and handling. Besides this, surplus sapota during glut season can be dehydrated and used during lean season. In addition to quality aspect of dehydrated sapota mentioned above, the dehydration offers considerable scope for export market. To achieve a dehydrated product of high quality, the drying should be such that it allows effective retention of colour, flavour, texture, and nutritive value of fresh sapota. The conventional drying techniques for sapota includes sun drying and tray/cabinet drying. These processes fail to yield dehydrated sapota which has characteristics of fresh sapota upon rehydration. "An important alternative to convective drying is MV drying, which can be used for the manufacturing of products with superior quality" (Drouzas and Schubert, 1996; Durance and Wang, 2002; Kaensup *et al*. 2002; Ahrne *et al*. 2003). "In MV drying, electromagnetic energy is directly converted into kinetic energy of the water molecules, thus generating heat within the product, and energy transport is not affected by conductivity barriers, especially in high viscosity or lumpy materials" (Kudra and Majumdar, 2002). "The amount of heat

generated depends on the strength of the electromagnetic field and the dielectric porperties of the material being heated" (Gracia *et al*. 1992). The energy absorbed by the material initiates moisture evaporation, which increases internal pressure and drives the moisture from the interior to the surface. An absolute pressure of 3 – 10 kPa, usually applied during MV drying, corresponds to a water evaporation temperature and, consequently, product temperature; of approx. 23–45^{0}C.Thus, the major advantages of microwave drying in conjunction to vacuum includes saving time, energy and yield superior product quality.

Several studies reported on the beneficial effects of MV drying texture and colour (Raghavan and Venkatachalapathy, 1999) and on nutritional quality (Erle, 2000) of dehydrated fruits and vegetables. "The retention of aroma compounds can significantly be improved as long as these are not associated with the aqueous phase (Erle, 2000), and puffing effects due to the internal expansion of the microstructure during drying are responsible for improved rehydration and textural properties" (RaghavanansSilveria, 2001; Lin *et al*. 1998).

The present work was aimed to study the suitability of applying MV drying method for sapota as no studies have been reported on this aspect in available literature. To compare drying behaviour of sapota under MV drying with those of tray drying method, samples were also dried at 60^{0}C in an electrically heated tray dryer.

MATERIALS AND METHODS

The independent variables of MV drying experiments were microwave power, slice thickness and vacuum levels (negative gauge pressure). "The levels of these independent variables were selected by applying Face Centred Central Composite Design (CCD). The CCD suits for fitting a quadratic surface, which usually works well for process optimization. Lower and higher levels of both the independent variables were chosen on the basis of preliminary trials which showed that microwave power higher than 300 W was too high for the drying purpose, as the sample underwent cooking rather than drying and there were high occurrences of burning of the samples. Also, the microwave power below 100 W prolonged drying and yielded product of higher moisture content". Further, studies have confirmed that the vacuum less than 10 kPa was insignificant in regard to the drying of the food material by VAM (Rohm *et al*., 2005). So, a vacuum range of 100 – 400 mmHg (negative gauge pressure) was selected in combination with the microwave power range of 100 – 300 W.

The CCD, for a three factor response, comprises of following three parts.

1. 4 central points (0, 0) are at centre.
2. 6 axial points (-α, 0, 0); (0, -α, 0); (0, 0, -α); and (α, 0, 0); (0, α, 0); (0, 0, α).
3. 8 factorial points (-1, -1, -1); (-1, 1, 1);(1, 1, -1);(1, -1, 1);(1, -1, -1);(-1, 1, -1);(-1, -1, 1);(1, 1, 1); are included to form a CCD. This distance 'α' is a measure in terms of coded factor levels and for Face Centred it is 1.

Hence, in all, 32 runs were conducted for MV drying experiments.

Experimental Setup for Vacuum Assisted Microwave Drying

The experimental microwave vacuum drying setup (Fig. 1), consisted of a microwave oven (Kenstar – Ken Chef, Model: MO – 9760A). The oven was modified to give variable power output by incorporating a voltage variac (SE, Powerstat, 10A-240V, 50-60Hz) in the circuit. A vacuum

desiccator (J-SIL (P) Ltd., Kolkata) containing the material to be dried was put inside the microwave cavity to which a vacuum pump was attached to maintained vacuum conditions inside the desiccator. Vacuum was monitored using a vacuum gauge. The vacuum system also included a pressure regulator valve to maintain the pressure at the desired level, and a cooling unit for condensing the water vapour at low temperature. The microwave oven was connected t aAC power supply (240V, 50 Hz) via a 3 kVA servo-type constant voltage stabilizer (CYBEX, India).

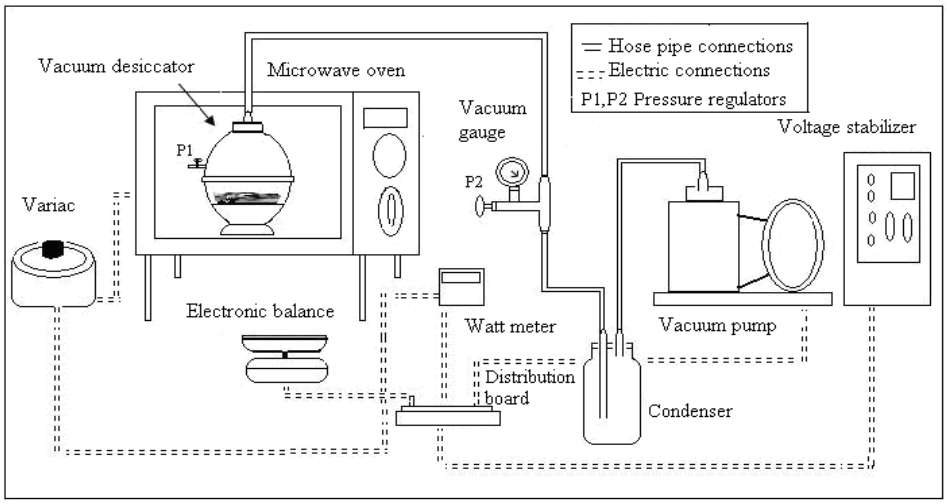


Fig. 1 Block diagram of MV drying experimental setup

Experimental Setup for Tray Drying

Tray dryer (M/S Khera Instruments Pvt. Ltd., New Delhi) was used for the comparative drying study. The equipment consists of insulated cabinet in which 12 trays (85 cm×40 cm) are placed one above the other with some gap in between them. The trays are made of aluminium and the drier needs two electric heaters for heating drying air. Heated air is circulated in the cabinet with the help of a circulating fan. A thermostat is provided to control and maintain the desired temperature. Analog type thermometer (range: 0 – 300 ^{0}C) is provided with drier to measure the air temperature inside the drying chamber. Air movement over the product surface is at relatively higher velocities to achieve effective heat and mass transfer.

Drying Experiment

For each experiment, 50g accurately weight sample of sliced sapota were evenly spread over the perforated plate of the vacuum desiccator. It was then kept inside the microwave oven and covered with the lid. The vacuum pump was then switched on and desired vacuum was maintained inside the vacuum desiccator. Then, "microwave was switched on and desired microwave power was maintained by adjusting variac. The samples were periodically weighed to note the weight loss. For this, the microwave was switched off"; the vacuum was quickly released followed by quick weighing of the perforated plate, placed at the desiccator base, along with the sample on an electronic balance. The samples were subjected to further drying in similar way as described above. Samples were dried to their constant weight for a given set of vacuum level and microwave power. The constant weight was measured by two consecutive readings of sample's weight being the same.

"The dried sample was then kept inside the desiccator for cooling. When the temperature of the sample lowered to normal, it was packed in the LDPE pouches (100 gauge) and heat sealed. These dried sapota slices were then utilized further for the determination of various physical and chemical properties. The energy consumption in the drying was measured by connecting an energy meter in series. The electric supply to the experimental setup was controlled by using a servo voltage stabilizer".

The fresh sapota slices were also dried in an electrically heated tray dryer. The experiment was carried out at the temperature of 60 ^{0}C. Tray dryer was switched on and the desired temperature achieved by regulating its knob. Initially dryer was run idle for about 20 min to stabilize the temperature. When the temperature got stabilized, the samples were spread uniformly over the drying tray and placed in the drying chamber. At predetermined time interval, the samples was taken out of the trays, weighed on the electronic balance and again placed into the dryer for further drying. Drying was carried out until two consecutive readings were obtained as same. At the end of the experiment the sample was cooled in inside the desiccator and packed in similar fashion.

Drying Calculations

Following formulae were used for the calculation of moisture ratio and drying rate:

$$\text{Moisture ratio(MR)} = \frac{X_e - X_f}{X_o - X_f} \quad (1)$$

$$\text{Drying rate} = \frac{X_n - X_{n-1}}{t_{n+1} t_n} \quad (2)$$

Where X_o, X_n, X_{n+1}, and X_f are moisture contents of sample in g/g of dry matter at beginning of drying, at any t = n and t_{n+1} and at the end of drying, respectively.

Statistical Analysis

The goodness of fit of the used thin layer drying models were evaluated by calculating correlation coefficient (R^2) (Eq 3). The suitability of the correlation coefficient is determined by its value, if the value is close to 1 then it is good fit and can closely predict the drying time or drying rate. It can also be used to test linear relationship between experimental and model predicted values.

$$R^2 = \sum_{i=1}^{N} (X_{ci} - \bar{X}_{ei})^2 \Big/ \sum_{i=1}^{N} (X_{ei} - \bar{X}_{ei})^2 \quad (3)$$

Where, Xci = Calculated moisture content (db)

Xei = Experimental moisture content (db)

$\bar{X}_{ei}$ = Average moisture content (db)

Determination of Moisture Content

Moisture content of samples was determined as per the procedure adopted by Fernandes & Sueli, 2008. 5 g samples were dried for 24 h in hot air oven at a temperature of 60±2^{0}C.

Calculation of Activation Energy

As the temperature is not precisely measurable inside the microwave drier, the activation energy was found from the revised Arrehenius equation. The activation energy was assumed as being related to the drying kinetics rate (k) and the ratio of sample weight to microwave output power (w/p) instead of air temperature Kumar and Shrivastava, 2017). Then Eq. 4 could be effectively used as follows:

$$k = k_o e^{-\frac{E_{aW}}{p}} \quad (4)$$

Results and Discussion

Fig. 2 (a to c) represent drying curves of sapota at 100, 200 and 200 W microwave power levels respectively under varied levels of vacuum, viz. 100, 250 and 400 mmHg and slice-thickness i.e. 4, 6 and 8 mm. Since Face centred design of Response Surface Methodology has been applied in the experimental design, experiments of only selected combination of above mentioned parameters were. It is clearly evident from the figures that moisture content of samples decreased with the increase in drying time until they reached a constant value. Average initial moisture content of fresh samples was 258.46±23.01 % (d.b.) which reduced faster during initial stage of drying as evident by steeper slopes of drying curves, however, as the drying proceeded the slope of curves became flatter, indicating slower drying. At a given microwave power level, the drying occurred relatively faster for the thinner slices. For example in Fig 2(a) at power level of 100W, the sapota slices of 4 mm thickness dried comparatively faster (380 min) than the slices of thickness 8 mm (690 min) at 100 mmHg vacuum. This effect of slice thickness on drying time was due to the fact that with increase in slice thickness the intensity of microwave power at inner section of the slices reduces, resulting in heat generation and lower penetration power, moisture could not be removed from inner sections of thicker slices and samples reached dynamic equilibrium at a higher level of moisture. Equilibrium (dynamic) moisture content was taken as that moisture content of sample, which did not reduce further up to next time interval i.e. next observation. As can be seen from Fig. 2 (b) and 2 (c), at higher microwave power level the drying time increased with increase slice thickness as was the case at 100W microwave power, however, equilibrium (dynamic) moisture contents of the samples decreased with increase in slice thickness unexpectedly. The exact reason for this could not be understood, however, the probable reason may the longer drying time which would have caused over drying of upper strata of slices, resulting in a lower moisture content (after equilibration of moisture).

Microwave power level had pronounced effect on drying time which reduced with increase in its level, at a given vacuum level and for a given slice thickness. For example, for 6 mm samples the drying time were 600 min at 100 W, 112.5 min at 200 W and 57.5 min at 300 W, all at 250 mmHg vacuum. This effect of microwave power was due to the fact that its higher level caused more rapid moisture migration from core of sapota slices to their surfaces and hence facilitating faster removal of moisture.

On comparing Fig. 2(a), (b) and (c) it is observed that slices subjected to 200 W microwave power level were dried to least moisture content as low as 2.26% (db) and took an optimum time of approximately 120 min at 400 mmHg vacuum having a final moisture content of 4.96% (db).

Drying curve of samples dried in tray dryer is presented in Fig. 3. The nature of drying curve was observed to be similar to those of dried in vacuum assisted microwave drying system. The drying time to attain equilibrium (dynamic) moisture content was not within the range observed in vacuum assisted microwave drying experiments. At 60 ^{0}C temperature, drying time to attain equilibrium (dynamic) moisture content for slice of thickness 4, 6, 8 mm were 420, 480, 600 min, respectively. The final moisture contents attained by the slices were 18%, 20%, 22% respectively. The experiments have revealed that the application of vacuum assisted microwave drying reduces drying time manifolds and final moisture is also several times lower when compared to those of tray drying.

Drying rates of sapota, dried at 100 W, 200 W and 300 W microwave powers are presented in Fig. 4 (a to c) for various vacuum levels, viz. 400, 250 and 100 mmHg and various slice-thickness i.e. 4, 6 and 8 mm. The trends shown by the graphs in Fig 4(a-c), suggests that there was pronounced effect of microwave power on the drying rate of specified thickness of the slices subjected to various vacuum levels.

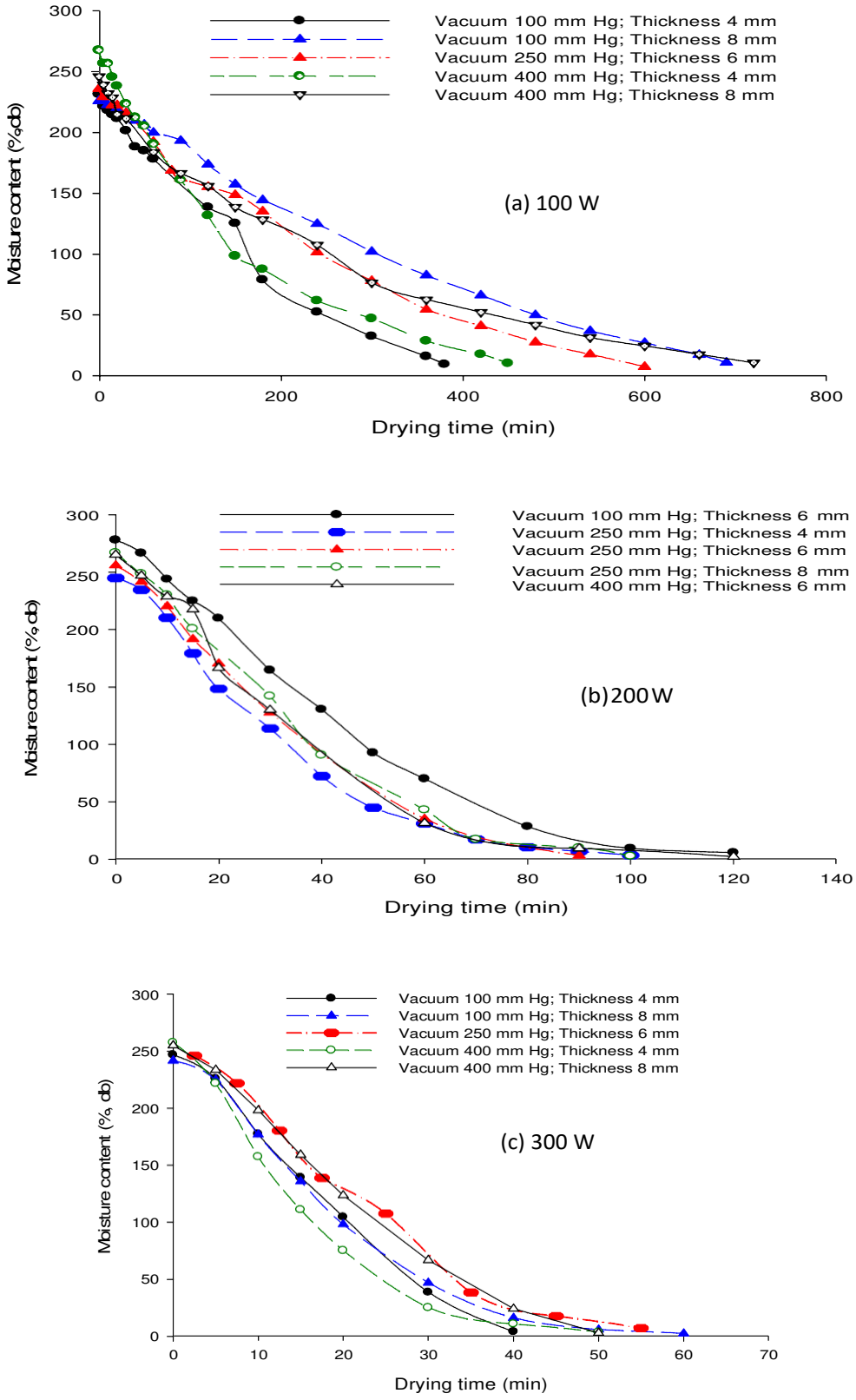


Fig. 2: Effect of vacuum and slice-thickness on moisture content of sapota slices during drying at various microwave power level.

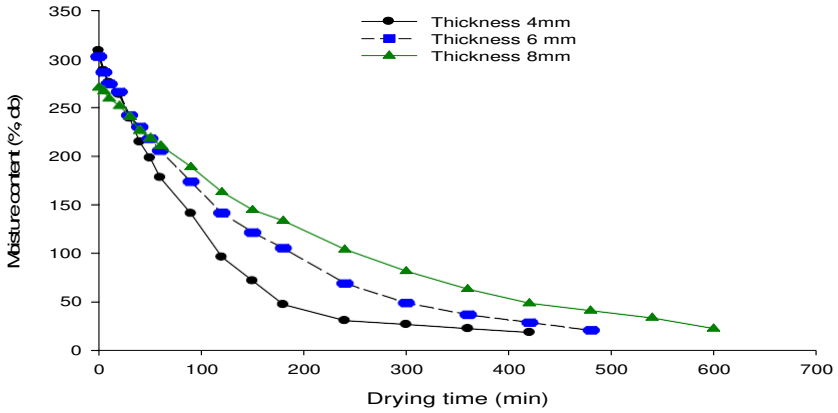


Fig. 3 Drying characterisitics of sapota slices during tray drying (at 60 ^{0}C)

Fig 4(a) shows the drying rate curve against time at 100 W microwave power rating. At 100 W microwave power levels, the drying rate under various levels of applied vacuum and thickness of sapota slices were close to zero at the initial stage. The drying rates of all the samples except one never increased beyond 0.05g/min/g of dry samples. The samples having thickness of 6 mm subjected to 250 mmHg only exhibited drying rate upto 0.20 g/min/g of dry matter.

Fig. 4(b) shows the graph of drying rate against time at 200 W. At 200 W power level, the drying rates under various levels of applied vacuum and slice-thickness were close to 0.03 g/min/g of dry matter at initial stage. The sapota slice of 6 mm thickness, subjected to 400 mmHg showed maximum drying rate of 0.10 g/min/g of dry matter at 18th minute. A sudden fall in the drying rate was also seen after that time.

Fig 4(c) shows the graphs of drying rate against time at 300 W. At microwave power level of 300 W, the drying rates under various level of applied vacuum and slice-thickness of sapota were close to 0.04 g/min/g dry matter at the initial stage. Only the initial drying rate of sample of thickness 4 mm subjected to 400 mmHg had the value of 0.07 g/min/g dry matter. The drying rate increased sharply with increase in time up to 7.6 minutes. After that there was fall in the drying rate.

Drying Rate

As evident from Fig (4a-c), the drying rate first rose to a peak value and then declined as the drying proceeds further and most of the drying occurred in the falling rate period. In drying curves some stray points are seen where a minor rise in drying rate have occurred. Error in data recoding due to limitation of weighing samples on a balance of low resolution seems to be the sole reason for these stray points. The effect of vacuum level on drying was also observed, though not as pronounced as was the effect of microwave power and slice thickness.

Drying rate curve of tray dried samples is presented in Fig. 5. The initial drying rate in tray drying experiment was found to be the highest, however it felt rather more rapidly as compared to that observed in samples dried at 100, 200, 300 W microwave power and vanished after 420, 480 and 600 min of drying for 4, 6, 8 mm, respectively.

Validity of drying model

Since constant rate drying period either not observed or if observed it existed for a very short period. Hence falling rate drying models, commonly used (Brooker et al., 1974) were tested for the validity to drying data.

1) Henderson and Pabis model

$MR = a \exp(-kt)$

2) Page model

$MR = \exp(-kt^n)$

Where MR (moisture ratio) = $(X_t - X_e)/(X_i - X_e)$

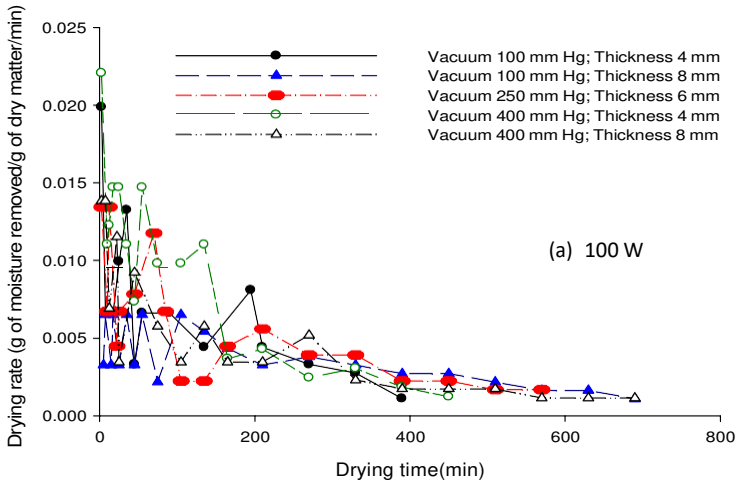
X_t= Moisture content (db) at drying time 't' min

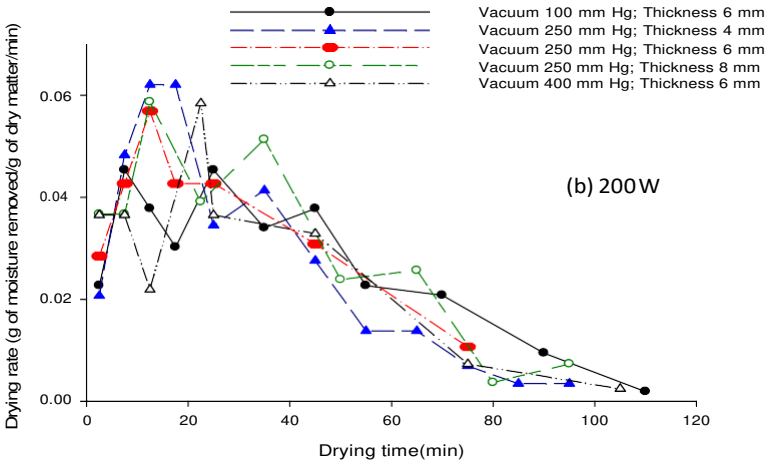
X_e = Equilibrium moisture content (db)

X_i= initial moisture content (db)

t = drying time period, min

a, n and k are constant.





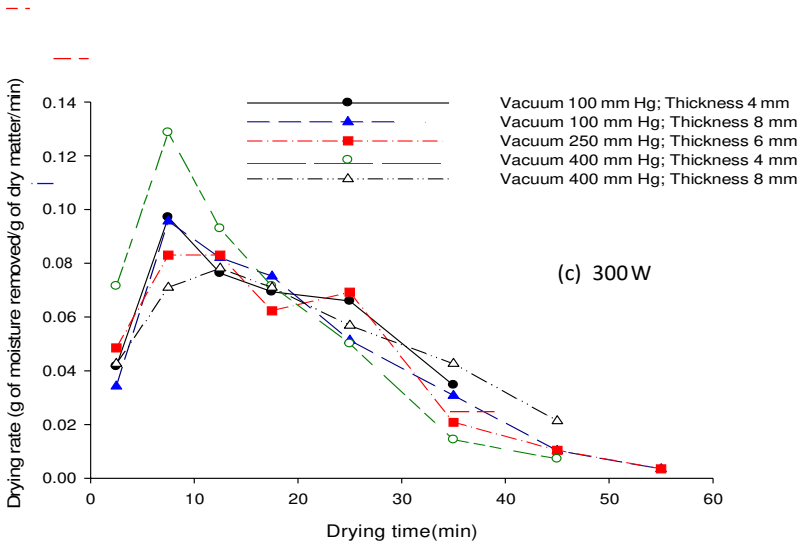


Fig. 4 Effect of vacuum and slice-thickness on drying rate of sapota during drying at various microwave power levels. (a) 100 W; (b) 200 W; (c) 300 W

Henderson and Pabis model

The drying constants('a' and 'k') of the Henderson and Pabis model for various experimental conditions are reported in Table 1. The R^2 value ranged from 0.943 to 0.996. For tray drying R^2 value of 0.9975, 0.9975, 0.9970 for slice-thickness 4, 6, 8 mm, indicate a good fit of the Henderson and Pabis model.

Page model

Experimental data yielded value of constants 'k' and 'n' as reported in Table 1. The R^2 values ranged from 0.987 to 0.999. In all cases R^2 value was above 0.987 which indicated that least deviation in fitted Page model and experimental data was existing and between the two drying model tested, Page model fits better. For tray drying the values of R^2 were 0.9929, 0.9972 and 0.9977 for slice-thickness of 4, 6 and 8 mm respectively; higher in comparison with the VAM dried samples; indicate good fit to Page model. However, for 4 and 6 mm samples the Henderson model in tray drying experiments had slightly higher values of coefficient of regression (R^2value being 0.998 in both the cases).

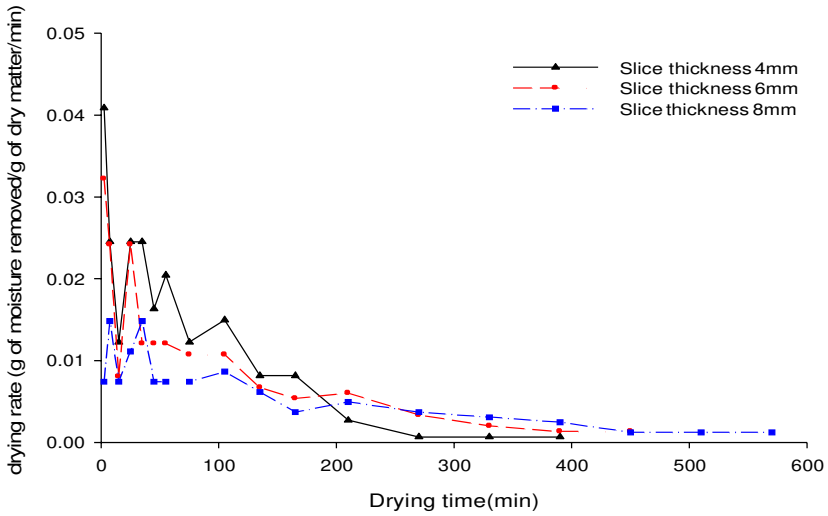


Fig. 5 Drying rate characteristics of sapota during tray drying (at 60 ^{0}C)

Table 1: Results of regression modelling of MV drying and tray drying of Sapota

Microwave drying condition			Henderson &Pabis model			Page's Model		
Microwave power (W)	Vacuum (mm Hg)	Slice thickness (mm)	Model Constants and R^2 value			Model Constants and R^2 value		
			a	-k	R^2	-k	n	R^2
100	100	4	1.027	0.006	0.974	0.0002	1.690	0.989
100	100	8	1.054	0.003	0.980	0.00003	1.740	0.987
100	250	6	1.025	0.006	0.976	0.0002	1.696	0.989
100	400	4	1.017	0.007	0.996	0.0021	1.221	0.990
100	400	8	0.980	0.004	0.995	0.0011	1.230	0.989
200	100	6	1.088	0.024	0.975	0.0006	1.926	0.993
200	250	4	1.101	0.033	0.980	0.0046	1.516	0.999
200	250	6	1.070	0.027	0.980	0.0048	1.480	0.999
200	250	8	1.076	0.029	0.979	0.0049	1.473	0.989
200	400	6	1.080	0.028	0.974	0.0070	1.390	0.997
300	100	4	1.093	0.052	0.943	0.0049	1.758	0.997
300	100	8	1.102	0.052	0.966	0.0052	1.712	0.999
300	250	6	1.094	0.052	0.964	0.0068	1.646	0.998
300	400	4	1.072	0.065	0.975	0.0174	1.446	0.999
300	400	8	1.095	0.045	0.954	0.0038	1.750	0.997
Tray Drying (at 60 ^{0}C)		4	1.095	0.011	0.998	0.0087	1.059	0.993
		6	0.989	0.007	0.998	0.0032	1.155	0.997
		8	1.014	0.005	0.997	0.0018	1.181	0.998

Activation Energy

The activation energy was evaluated by calculating the coefficients in Eq. 4 from k versus (w/P) curve, which yielded k_o and E_a values of 1.03×10^{-6} m^2s^{-1} and 18.154 Wg^{-1} which were in range of comparison with the reported value of 14.194 Wg^{-1} for green bell pepper (Darvishi, et. Al., 2013), 16.67 and 24.22 $Wg^{-1}$for sweet and sour pomegranate (Minaei, 2011).

CONCLUSION

The drying of sapota slices can be accomplished in a much shorter period and to a much lower moisture content in a microwave-vacuum drying system in comparison to that in a tray dryer at 60 ^{0}C temperature. Page model best fit the drying data on the basis of R^2. The activation energy was calculated on the assumption that it is correlated with Arrhenius equation.

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A Review on ZIKA Virus

Kruttidipa Jena and Sunita Mishra
Department of Zoology, School of Applied Sciences,
Centurion University of Technology and Management, Odisha
Corresponding author: sunita.mishra@cutm.ac.in

Abstract

ZIKA virus is a single stranded RNA structure and primarily spread through the bite of an infected Aedesaegypti or Ae. Albopictus mosquito. Many people infected with ZIKA virus won't have symptoms or will only mild symptoms.It is more dangerous in infants than adults.ZIKA virus may be transmitted from mother to the baby , inside the womb .It is also related to dengue, yellow fever, West Nile and Japanese encephalitis virus. The name ZIKA comes from the ZIKA forest of Uganda. This virus can also harm the fetal development and cause serious neurodevelopmental abnormalities. In 1947 it was first isolated from a nonhuman primate and then from mosquitoes in Africa in the year 1948. The antibodies of this virus have been found in several animal species like elephants, monkeys, lions, zebras. U.S territories reported that there have been no confirmed ZIKA virus disease in 2020.

Key word: ZIKA virus, RNA

Introduction

The name ZIKA comes from the ZIKA forest of Uganda in 1947, where the virus was first isolated. The structure of the virus is a single stranded RNA structure. This disease spread through the bite of an infected mosquito. It comes under the family Flaviviridae and genus Flavivirus. It is also called arthropod borne virus. ZIKA virus particles are spherical in shape and small in size. Majority of infected people may show mild symptoms, but it may cause birth defects, stillbirth and miscarriage during pregnancy. "ZIKA outbreaks occurred in Africa, Southeast Asia, and the pacific Islands before 2015. Now outbreaks occurring in many countries and territories". The virus spread eastward, from 2007 to 2016, across the Pacific Ocean to Americans. Till now there is no specific treatment for this disease, although several vaccines are in clinical tries. The fatality rate of ZIKA virus is 8.3%. Zika virus disease with Sickle cell disorder and Guillain-Barre syndrome can cause death.

Table 1:

Areas and countries potentially at risk of Zika

Africa	Angola, Benin, Burkina-Faso, Burundi, Cameroon, Cape Ver
	(Congo-Brazzaville), Côte d'Ivoire, Democratic Republic of
	Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Libe
	Leone, South Sudan, Sudan, Tanzania, Togo, Uganda
Asia	Bangladesh, Burma (Myanmar), Cambodia, India, Indonesia,
	Singapore, Thailand, Timor-Leste (East Timor), Vietnam

Transmission

Primarily "ZIKA virus is transmitted to people by the bite of an infected Aedes species mosquito". Generally, when a mosquito bites an infected person it is also infected and then

spread the virus to other people through bites. The ZIKA virus can present in infected persons blood during the first week of infection.

- **From mother to child**

"An infected pregnant woman can pass the virus to her fetus during her pregnancy or at the time of the birth". It can cause miscarriage, stillbirth, hearing deficits and impaired growth in fetus. Although ZIKA virus found in the breast milk CDC encourages mothers to breastfeed even they are infected or not.

- **Through sex**

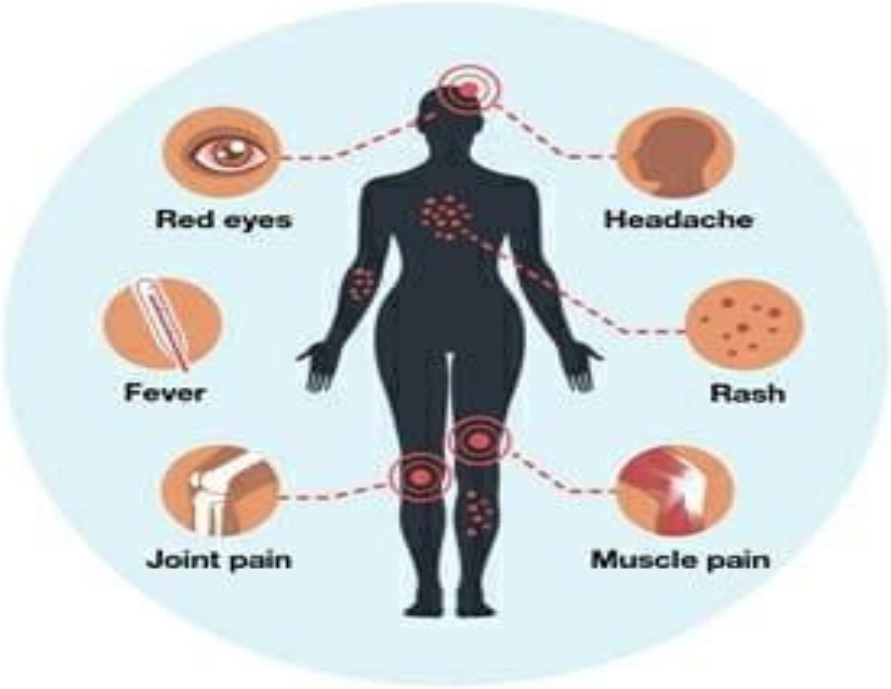
ZIKA virus can be transmitted through sex. The virus stays in the semen of infected male or in the vaginal fluid of infected female. The virus stays in semen for longer period than other body fluids like urine, blood, vaginal fluids.

- **Through blood transfusion**

ZIKA virus can also be spread through blood transfusion .

Symptoms

The ZIKA fever has some symptoms like – "fever, rash, joint pain, conjunctivitis or red eye , muscle pain, headache". Many infected people do not have symptoms or have mild symptoms.



Diagnosis

ZIKA virus disease can be diagnosed depending upon infected person's travel history ,symptoms or from the test results. From blood test or urine test this disease can also be diagnosed.

Treatment

Till now there is no specific treatment for ZIKA virus infection.

Treatment can be done according to the symptoms of the infected person. Protect the infected person from mosquito bites otherwise the virus can spread to other people. Bed nets and screened rooms can helps in keeping mosquito outside. Can create a barrier between infected person and mosquito by wearing a long sleeved shirts and long pants. Carefully check the

expire date of the product before use. The infected person should use condoms or not have sex for six months after symptoms begin. WHO has declared a public health emergency for ZIKA virus.

Results

Here we discuss about ZIKA virus infection like virology, epidemiology, pathogenesis of disease.

Virology of the ZIKA virus

It is a mosquito borne virus of the family Flaviviridae and belongs to Flavivirus genus which is related to spondweni virus. The members of this family cover viruses with a single stranded RNA. It contains one ORF (Open reading frame) with two nonconforming flanking regions. ORF coded the polyprotein and processed in to three structural proteins like envelope, capsid and the prM.

Epidemiology of ZIKA virus infection

In 2013 a lot of Guillain – Barre syndrome was reported after the ZIKA virus infection in French Polynesia. In Easter Island autochthonous transmission of ZIKA virus occurred . A large number of Guillain – Barre cases were found in Bahia state of Brazil in which half of the patient had symptoms of ZIKA virus.

Pathogenesis of ZIKA virus

ZIKA virus pathogenesis have similarities with other FLAVIVIRUS Infections . In the transmission by mosquito the virus can infect skin keratinocytes, demal fibroblasts and dendritic cells. Among all fibroblasts have high infection rate 24 to 48h after infection. In a pregnancy it might lead to fetal VIREMIA. The virus can infect fetal monocytes and then it infect the nervous system. In case of adult the virus might responsible for ADEM (Acute Disseminated Encephalomyelitis). It causes varieties of viral and non-viral infections in CNS.

Conclusion

Scientists are still engaged in finding the health disorders caused by ZIKA virus during pregnancy. CDC recommends for "ZIKA virus testing for symptomatic people living in an active ZIKA transmission area , or who have recently traveled such area with ZIKA virus, or who had unprotected sex with a man confirmed to have ZIKA virus infection. Available tests may not accurately identify the presence of the virus or a man's risk of passing it on through sex. As tests improve, these tests may help for determining a man's risk of passing the virus through sex." ZIKA virus disease have the potential to cause severe health issues. This virus is more dangerous in case of fetus because it causes severe fetal abnormalities in time of pregnancy. ZIKA virus is one of the disease among the PHEIC declarations by WHO in the year 2016. This virus has the ability for congenital infections or abnormalities. So by proper awareness and improvements in treatment in medical science can control ZIKA virus in different places of the world.

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Seborrheic dermatitis: a review of the most common chronic inflammatory skin disorder

Rudranarayan Sahoo and Debashish Tripathy
Department of Zoology, School of Applied Science
Centurion University of Technology and Management, Odisha
Corresponding author: debashish.tripathy@cutm.ac.in

Abstract

Seborrheic dermatitis is a common chronic inflammatory skin disorder, affecting the scalp, face (FSD), chest, back, axilla and groin. This condition appears in infants (ISD), adolescents, and adults (ASD). Occurrence of seborrheic dermatitis is more in children between three months of age and people having immunodeficiency. The characteristic symptoms of seborrheic dermatitis include scaling, erythema, inflammation and itching. Pathophysiology of seborrheic dermatitis thought to result of several factors such as, stress response, hormonal effect, sebum gland activity, fungal infection (*Malassezia* yeast), cold and dry weather, viral and neurological diseases and certain medical conditions. The prevalence of seborrheic dermatitis is about 2%-5% worldwide in general adult population, while its prevalence is more in infants than adults and more on males than females. Diagnosis is done by normally reviewing the site of infection but several differential diagnosis procedures are done to confirm the disease. The treatment of seborrheic dermatitis is done by using "topical antifungals, calcineurin inhibitors and corticosteroids". Antifungals such as ketoconazole 1% or 2% and shampoos containing selenium sulphide, zinc pyrithione, or coal tar are effective against seborrheic dermatitis. In severe conditions "anti-inflammatory agents such as corticosteroids and calcineurin inhibitors should be used only for short duration". As seborrheic dermatitis is a chronic condition continuous treatment is done to reduce the symptoms.

Keywords: Seborrheic Dermatitis; Immunodeficiency; Inflammation; *Malassezia;* Corticosteroids; Calcineurin Inhibitors; Ketoconazole; Selenium Sulphide; Zinc Pyrithione; Antifungals; Dandruff; Sebaceous Gland; Epidermal Barrier

Introduction

Seborrheic dermatitis (SD) is the most common chronic inflammatory skin disorder. It occurs in areas rich in sebum production i.e. particularly the scalp, face and body folds [1]. All age group i.e. new-borns, infants and adults can be affected by SD. SD is severe in males than in females due to androgen hormones and also by emotional stress [2,3]. It is maximum in infants in the first three months of life i.e. 70% [4]. SD occurred in 1%-5% of population worldwide. In Asia, the occurrence of SD was reported between 2%-7% and 26.5% of people having age of 12-20 years [5].

On the basis of age SD can be infantile (ISD) and adult (ASD). ISD is more common but less effective found mostly in scalp. SD can be associated with HIV infection (increasing to 30%-83%) and "neurologic diseases (e.g., cerebrovascular event, Parkinson disease)" [6]. SD is more severe in winter season or in cold and dry climate and in high mental and emotional stress [7].

Etiology

The etiology of SD is not clearly identified but it seems to be occurred by multiple factors such as fungal infections, hormone levels, viral diseases, nutritional deficits, neurogenic factors and in several health conditions.

The *Malassezia* (*M. globose* and *M. restricta*) yeast is more likely to cause SD by beginning a cascade of nonspecific immune response that results in skin changes [8,9]. *Malassezia* yeast lives in the skin of human without causing any harm, "but in persons with SD, the yeast invades the stratum corneum and release lipases which hydrolyzes human sebum triglycerides and releases unsaturated free fatty acids such as oleic and arachidonic acid and begins inflammatory responses" [10,11,12]. "The free fatty acids increase the growth of the yeast because *Malassezia* grow vigorously in high lipid environments. These metabolites cause aberrant keratinocytes differentiation, resulting in alteration of the stratum corneum". This causes reduced function of epidermal barrier by hyper proliferation of stratum corneum. This increase *Malassezia* growth and allow to dry the cells [10]. In addition to *Malassezia* growth "these metabolites induce keratinocytes to produce pro inflammatory cytokines i.e. IL-1α, IL-6, IL-8 and TNF-α. These cytokines increase inflammatory responses" [13,14]. Arachidonic acid, released by lipases, can be a "source of prostaglandins (pro-inflammatory mediators), which cause inflammation via neutrophil recruitment and vasodilation" [15].

SD is also associated with sebum production. Sebum glands are found all over the skin but maximum secretion seen in scalp, face and chest [16]. Production of sebum is controlled by hormones. During first few weeks of birth sebum production is done by effect of maternal androgens. At puberty, circulating androgens again activate sebum production which continues between 20 and 30 years of age and then decreases [17]. Sebum secretion is high in males than females. SD shows strong correlation with sebum gland activity, with cradle cap after birth, increased incidence throughout the teens, between third and sixth decades and then decreasing and males also shows more SD than females.

Hormones plays some role for the cause of SD. The hormonal link can explain why the disease occurs more in infancy and decreases spontaneously and again reappears. Androgens also increase chances of SD. Patients with AIDS or HIV infection have more chance to acquire SD [6]. Nutritional deficit like altered essential fatty acid pattern may cause pathogenesis of ISD. SD is also associated with neurological problems such as Parkinson's disease, epilepsy, central nervous system trauma, syringomyelia and facial nerve palsy [18]. According to recent studies some newly recognized genetic influences in seborrheic dermatitis. Eleven gene mutations or protein deficiencies appear to be more common in individuals with SD. Common triggers for SD includes:

- Stress response
- Effect of hormone changes
- Yeast infection
- Cold, dry weather
- Harsh detergents, solvents, chemicals and soaps
- Genetic mutations
- Certain medical conditions
- Viral diseases
- An immune system response

Classification

SD can be classified on the basis of age, area of occurrence and appearance. On the basis of age, it can be infantile (ISD) and adult (ASD). ISD may present as thick, greasy scales on the

scalp (cradle cap) [2,3]. These scales are different in colour and appearance i.e. white, off-white, or yellow. It usually occurs in infants in the first three months of life (Figure 1) [4]. The scales appear in the scalp, central face, forehead, and ears. Sometimes it occurs throughout the body. Generalized SD is uncommon in healthy children and common in children having immunodeficiency. These children having immunodeficiency are often suffering from diarrhoea and failure to thrive [19].

Table 1: Clinical presentation of seborrheic dermatitis in infants. [2,3,4,19]

Area of occurrence	**Features**
Scalp	"Cradle Cap: Most Common. Red-yellow plaques coated by thick, greasy scales on vertex, appearing within 3 months of age".
Face	"Erythematous, flaky, salmon-colored plaques on forehead, eyebrows, eyelids, nasolabial folds, or retro-auricular areas".
Trunk	"More extensive form: Sharply limited plaques of erythema and scaling that cover lower abdomen".
Body folds	"More extensive form: Sharply limited plaques of erythema and scaling that cover lower abdomen".
Generalized	"Leiner's Disease: Unusual, associated with immunodeficiency. Absent to mild pruritus. Concurrent diarrhea and failure to thrive. Spontaneous clearing within weeks to few months".

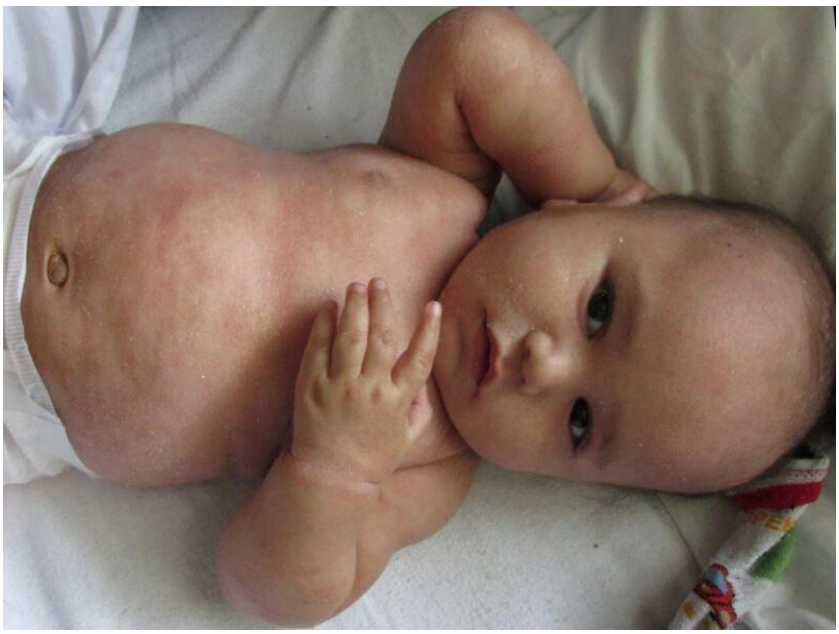

Figure 1: Infantile seborrheic dermatitis.

ASD starts as mild scaling on the scalp associated with erythema and scaling of the naso-labial folds or post auricular skin (Figure 2). The areas having more sebaceous glands i.e. auricles, beard area, eyebrows and trunk are often affected by SD. Central face may be affected by SD in severe condition. In chest area generally two types of SD appear i.e. a common petaloid type and a rare pityriasiform type (Figure 3) [2]. Petaloid type starts as small, reddish-brown follicular papules. These papules then turn into patches and finally

resemble as a flower petal. The pityriasiform type often has generalized macules and patches that resemble extensive pityriasis rosea.

Table 2: Clinical presentation of seborrheic dermatitis in adults. [2,3,4,16,19]

Area of occurrence	**Features**
Scalp	"From mild desquamation to honey-colored crusts attached to scalp and hair leading to alopecia".
Face	"Forehead, eyebrows, glabella or nasolabial folds. May spread to malar regions and cheeks in butterfly distribution. Eyelids: Yellowish scaling between eye lashes. Can lead to blepharitis with honey-colored crusts on free margin. Retro-auricular area: Crusting, oozing and fissures. May expand to external canal, with marked itching on occasionally secondary infection (otitis externa)".
Upper chest	"Petaloid type (common): small, reddish follicular and peri-follicular papules with oily scales at onset that become patches resembling a medallion (flower petals). Pityriasiform type: Widespread 5–15 mm oval-shaped, scaly macules and patches. Distributed along the skin tension lines (similar to extensive pityriasis rosea). New eruptions can continue for >3 months. Commonly on face and intertriginous areas".
Body folds	"Moist, macerated appearance with erythema at the base and periphery on axillae, umbilicus, breast fold, genital or inguinal area. May progress to fissures and secondary infection".

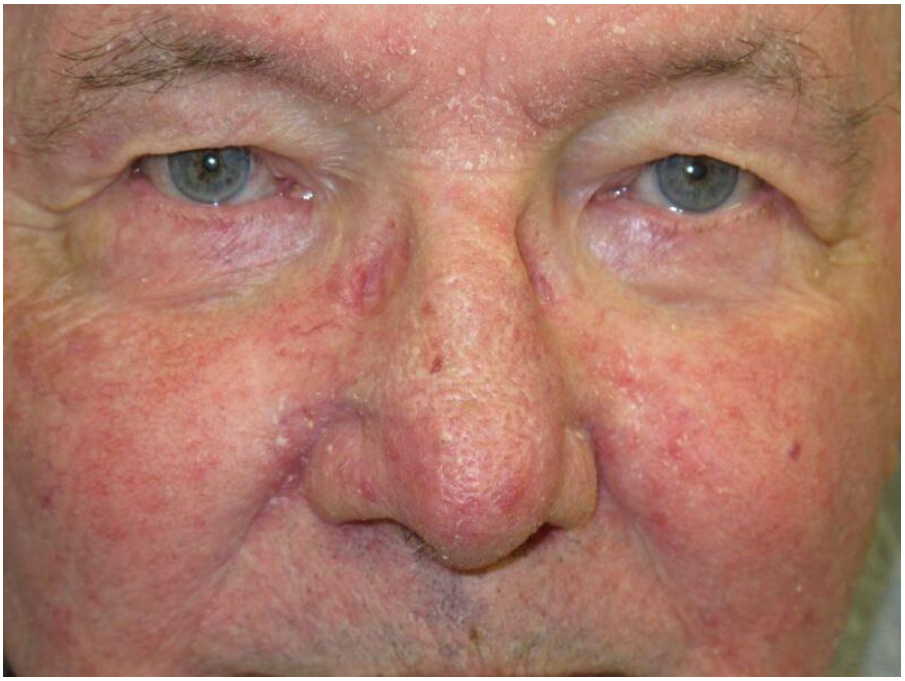

Figure 2: Adult seborrheic dermatitis of face.

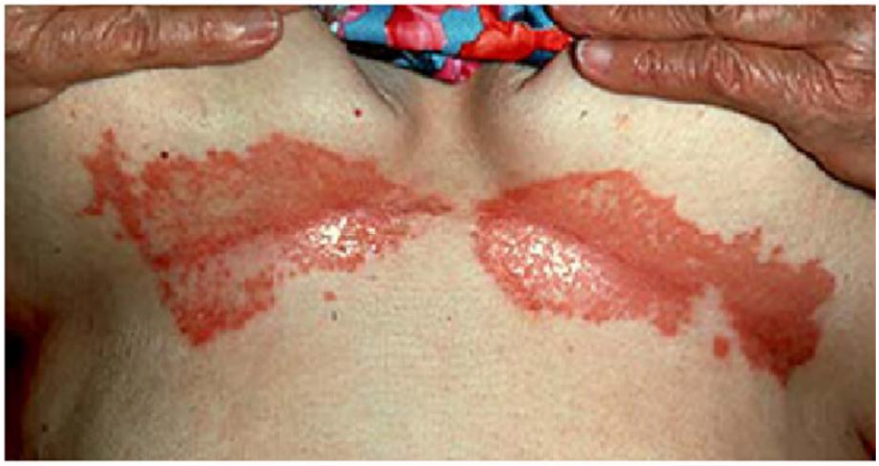

Figure 3: Severe persistent seborrheic dermatitis of the inframammary folds.

On the basis of affected area SD can be divided into facial SD (FSD), SD of scalp and SD of body. FSD is a chronic and relapsing inflammatory skin disorder which occurs more in the area of face having high sebum production. It is also called as facial seborrheic eczema. FSD have a prevalence of 10% of the adult population [20]. FSD occurs more in males than females. Itchy, erythematous, greasy, scaly plaques are symptoms of FSD. FSD affects forehead, eyebrows, glabella and nasolabial folds of face [21]. In severe cases crusting, oozing, fissures, and extension to other areas such as the cheeks may also occur [22]. SD in scalp is more common than face. In scalp it appears as reddish inflammation shedding off scales continuously. SD of body is rare and affect only some people having other medical condition.

Epidemiology

SD have a prevalence of about 2%-5% worldwide, but dandruff, non-inflammatory variant of SD, have prevalence of about 50%. People of all regions and countries are equally affected by SD [23]. Three age groups are affected more by SD i.e. in the first three months of life, during puberty, and in adulthood (40-60 years). In infants the incidence is up to 42% while in adult it is about 1%-3% [24,25]. Immunocompromised patients are more prevalent towards SD. Patients of HIV/AIDS (Figure 4), organ transplant recipients [26], and patients having lymphoma [27] have high chance to be affected by SD. The incidence among HIV patients ranges from 30% to 83% [28]. SD can be developed by many risk factors such as:

- Age (first three months of life, puberty to 30 years of age)
- Male sex (due to high androgen and high sebum production)
- Increased sebaceous gland activity
- Immunodeficiency, including [29]:
    - Lymphoma
    - Renal transplantation
    - HIV-AIDS (high chances of SD)

- Neurological and psychiatric disease, including [30]:
    - Parkinson disease
    - Stroke
    - Alzheimer dementia
    - Major depression
    - Autonomic dysfunction
- Exposure to drug treatment, including:
    - Dopamine antagonists
    - Immunosuppressants
    - Psoralen/PUVA
    - Lithium
- Low ambient humidity and/or low ambient temperature

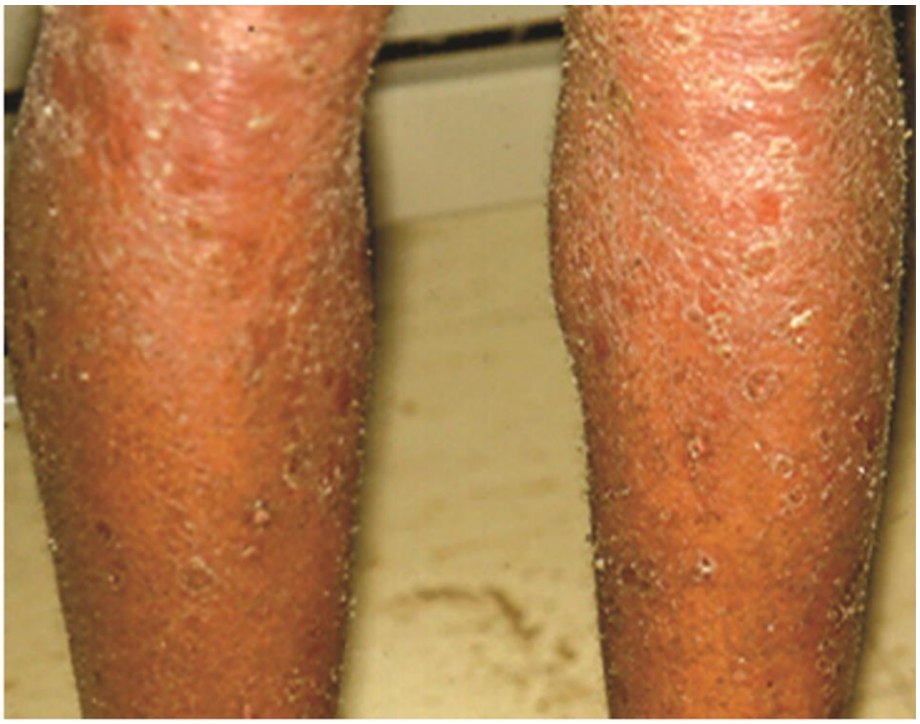

Figure 4: Generalized seborrheic dermatitis-like eruption associated with acquired immunodeficiency syndrome (AIDS).

Diagnosis

Diagnosis of SD can be done by normally reviewing the site of infection or some clinical diagnosis may occur. :In infants, SD may present as thick white or yellow greasy scales on the scalp, face or body. In adults it is found as flaky, greasy, erythematous patches on the

scalp" (Figure 5), nasolabial folds (Figure 6), ears, eyebrows (Figure 7), anterior chest, or upper back [7]. Many other diseases show resemblance with SD, so a differential diagnosis is done to confirm whether it is SD or other disease like, Atopic dermatitis, Candidiasis, Psoriasis, Rosacea, etc. "If the diagnosis is uncertain a biopsy of the skin is done to examine it more preciously. The diagnosis can be challenging in patients with darker skin".

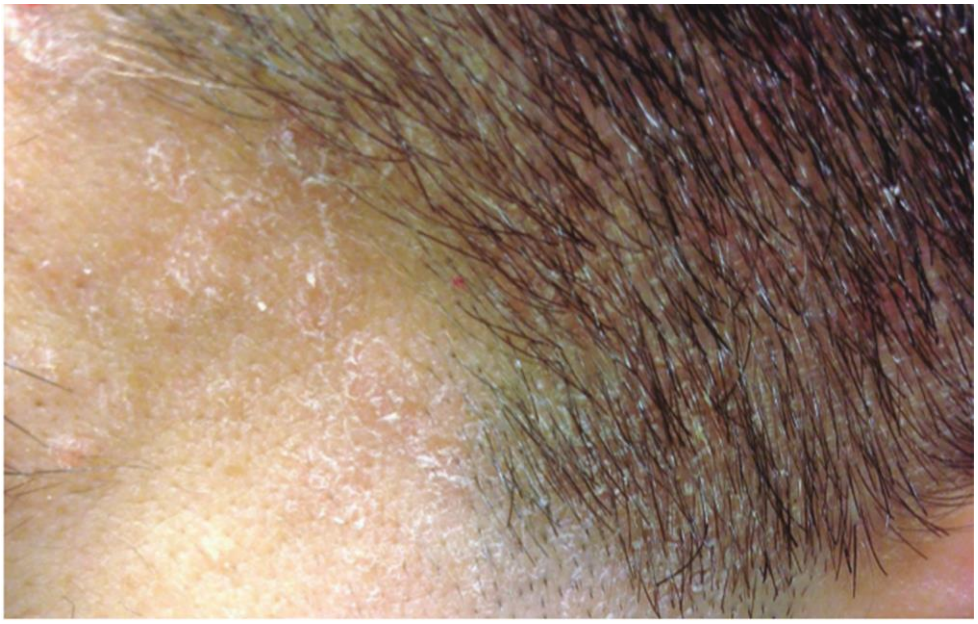

Figure 5: Seborrheic dermatitis of the scalp.

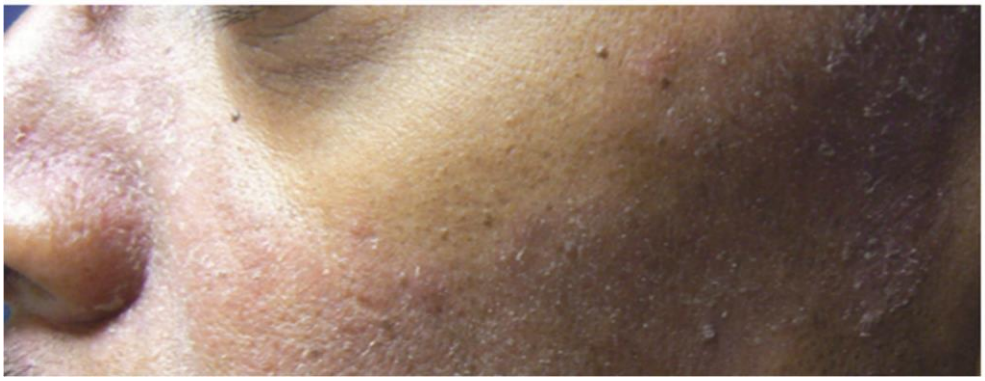

Figure 6: Seborrheic dermatitis of the nasolabial fold.

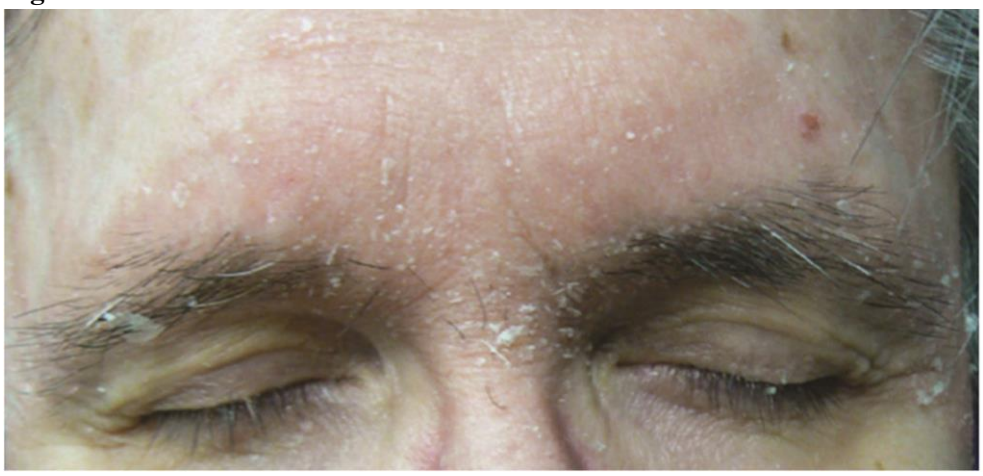

Figure 7: Seborrheic dermatitis of the eyebrows.

SD can be mild or severe. Mild SD can be characterized by dry scales on scalp without inflammation. Severe SD can be characterised by greasy and yellowish scales, also with erythematous plaque with diffuse border. SD can be diagnosed without any tools but sometimes specific therapy is done to differentiate SD from other diseases. Scalp SD is sometimes difficult to distinguish from other infections these can be diagnosed by trichoscopy (Figure 8) [31].

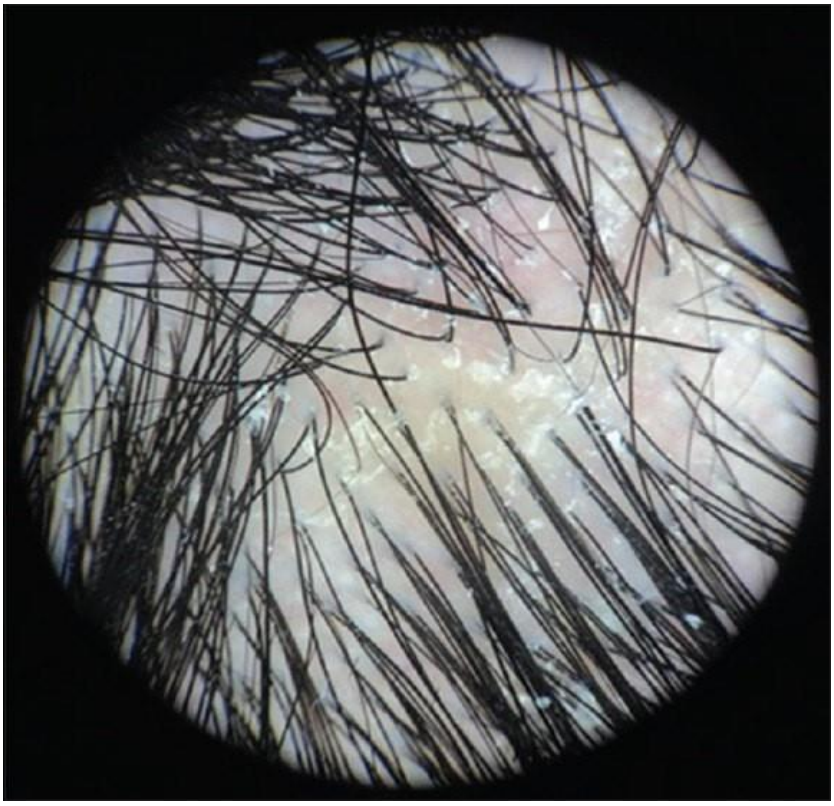

Figure 8: Trichoscopic findings in moderate seborrheic dermatitis with white scales and yellowish area.

Differential diagnosis

Psoriasis, atopic dermatitis, tinea capitis, rosacea, and systemic lupus erythematous (SLE) are the main differential diagnosis of SD. Area of appearance is same in SD and psoriasis but psoriasis has thicker lesions and present as plaques with silvery white scales [32]. SD is more frequent in infants between three months of life while atopic dermatitis does not appear until three months of age. In tinea capitis hair loss is common which is absent in SD [33]. Rosacea affects same areas as in SD but don't produce any scales [34]. SLE often follows a clear photo distribution and associated with other abnormalities such as arthritis, mouth ulcers and many more, which are not seen in SD [35].

There are some other rare conditions that may resemblance SD, these are pemphigus foliaceous, pityriasis rosea, secondary syphilis, diaper dermatitis and cutaneous Langerhans cell histiocytosis [36], which are summarized in Table 3. Some drugs and nutritional deficiencies may induce SD like dermatitis. These make the diagnosis procedure more complex [37,38].

Table 3: Differential Diagnosis of seborrheic dermatitis. [56,57]

Diagnosis	Distinguishing features
Psoriasis	"Distinctive red, scaling papules that coalesce to form round-to-oval plaques"
Darier's disease	"Yellowish-brown clusters of rough dome-shaped papules in Seborrheic distribution; acanthosis"
Atopic dermatitis	"Flexural lichenification in adults; facial and extensor involvement in infants and children"
Candidiasis	"Typically confined to mucous membranes and intertriginous regions"
Contact dermatitis	"Characteristic distribution patterns from irritant or allergen"
Erythrasma	"Brown-red, scaly eruption of toe webs, groin, and axillae"
Nummular dermatitis	"One or several coin-shaped plaques on extremities, typically on backs of hands"
Pityriasis rosea	"Begins with herald patch; Christmas-tree distribution of salmon pink papules over trunk and proximal extremities"
Rosacea	"Erythematous, edematous eruptions of papules and pustules on forehead, cheeks, nose, and eyes"
Secondary syphilis	"One or several coin-shaped plaques on extremities, typically on backs of hands"
Systemic lupus erythematosus	"In acute stage, butterfly rash on face that spares the nose bridge or nasolabial folds. Photosensitivity is common. Skin lesions are generally associated with other clinical signs of SLE. Histology and serologic tests such as antinuclear autoantibodies confirm the diagnosis".
Tinea capitis, corporis	"Dermatophyte infection of the scalp or body; leading edge (active border) scaly, red, and slightly elevated with central clearing; vesicles appear at active border when inflammation is intense; classic ringworm pattern"
Pemphigus Foliaceous	"Erythema, scaling and crusting that first present on the scalp and face can expand to chest and back. Histology, direct immunofluorescence with anti-desmoglein antibodies confirm diagnosis".
Diaper Dermatitis	"Occurs on convex skin surfaces in contact with diaper, such as lower abdomen, genitalia, buttocks and upper thighs. Spares skin folds. Pustules are common".

Treatment

"There is no specific treatment for infants, the treatment is done by first removing the scales with help of emollients i.e. mineral or olive oil and petroleum jelly and then ketoconazole 1% or 2% cream is used twice daily for two weeks" [39,40,41]. Treatment of SD is same in adolescents and in adults [40]. Decreasing the visible signs and inflammation is the primary goal of treatment. Treatment includes using of "shampoos and topical antifungals, calcineurin inhibitors, and corticosteroids". SD is chronic so continuous treatment is necessary [42]. "Shampoos containing selenium sulphide, zinc pyrithione (ZPTO), or coal tar can control symptoms" of mild SD on scalp [42,43,44]. Tea tree oil shampoo and apple cider vinegar shampoo may also decrease symptoms [42]. For the control of the *Malassezia* yeast,

antifungal shampoos containing ketoconazole 2% (Nizoral)[45] or ciclopirox 1% (Loprox)[46,47] can be used 2-3 times per week for several weeks. These shampoos should remain at least five minutes in hair to ensure adequate exposure to scalp [42]. If the SD is severe, topical corticosteroid can be beneficial to decrease inflammation. "Fluocinolone 0.01% solution (Synalar) or shampoo (Capex) and betamethasone valerate 0.12% foam (Luxiq) can reduce itching and inflammation [48]. Use of clobetasol 0.05% shampoo (Clobex) along with ketoconazole 2% shampoo reduce symptoms more quickly" [49].

The treatment of FSD includes "topical antifungals, corticosteroids, and calcineurin inhibitors". Hydrocortisone 1% cream work like ketoconazole 2% cream [50]. Ketoconazole 2% gel (Xolegel) reduce symptoms of erythema, pruritus, and scaling [51]. Ciclopirox is more effective than ketoconazole 2% gel [52,53]. Sertaconazole 2% cream (Ertaczo) was more effective than hydrocortisone 1% cream [54]. Topical corticosteroids with low and mild potency are successful "in reducing the symptoms of SD and are as effective as antifungal and anti-inflammatory agents" [50,55]. Corticosteroids are effective and cost efficient but they are used as second line agents, because long term use of corticosteroids can cause "thinning of skin and formation of telangiectasia" [48,49,50,54,55].

Table 4: Treatment of seborrheic dermatitis. [7, 10, 13, 41-61]

Medication		Formulation	Doses	Mechanisms
Antifungals	Ketoconazole	2% Shampoo, cream, gel or foam	Scalp or skin: Twice/ week × 4 weeks, then once/week for maintenance.	Inhibition of fungal cell wall synthesis
	Bifonazole	1% shampoo, cream or ointment	scalp: every other day or once daily. Skin: once daily	Inhibition of fungal cell wall synthesis
	Ciclopirox Olamine	1.5% shampoo, cream, gel or lotion	Scalp: 2–3 times/week × 4 weeks, then once/ week for maintenance. Skin: twice daily.	Inhibition of metal-dependent enzymes.
	Selenium sulphide	2.5% shampoo	Scalp: Twice/week × 2 weeks, then once/week × 2 weeks. Repeat after 4–6 weeks.	Cytostatic and keratolytic.
	Zinc Pyrithione	1% shampoo	Scalp: 2–3 times/week	Increased cellular copper interferes with iron-sulfur proteins.
Corticosteroids	Hydrocortisone	1% cream	Skin: 1–2 times daily	Anti-inflammatory, anti-irritant.

	Betamethasone dipropionate	0.05% lotion	Scalp and skin: 1-2 times daily	Anti-inflammatory, anti-irritant.
	Desonide	0.05% lotion, gel	Scalp and skin: 2 times daily	Anti-inflammatory, anti-irritant.
	Fluocinolone	0.01% shampoo, lotion or cream	Scalp or skin: Once or twice daily	Anti-inflammatory, anti-irritant.
Immune-modulators	Pimecrolimus	1% cream	Skin: 1–2 times daily	Inhibition of cytokine production by T-lymphocyte
	Tacrolimus	0.1% ointment	Skin: 1–2 times daily × 4 weeks, then twice/ week for maintenance	
Miscellaneous	Coal tar	4% shampoo	Scalp: 1–2 times/week	Antifungal, anti-inflammatory, keratolytic, reduces sebum production.
	Phototherapy	UVB: Cumulative dose of 9.8 J/cm2	Three time/week × 8 weeks or until clearing.	Immuno-modulation and inhibition of cell proliferation
Systemic	Itraconazole	Oral: 200 mg	Once daily × 7 days, then once daily × 2 days/month for maintenance.	Inhibition of fungal cell wall synthesis. Anti-inflammatory via inhibition of 5-lipoxygenase metabolites.
	Terbinafine	Oral: 250 mg	Once daily × 4–6 weeks or 12 days monthly × 3 months.	Inhibition of cell membrane and cell wall synthesis.

Seborrheic dermatitis vs. Dandruff

SD and dandruff are a continuous spectrum of the same disease that affect the seborrheic areas of the body. Dandruff is found only in scalp while SD occurs in scalp, retro-auricular area, face (nasolabial folds, upper lip, eyelids, eyebrows), upper chest and body. SD is characterized as erythematous patches, with large, oily or dry scales, while dandruff appears as white to yellow flakes dispersed on the scalp and hair; without erythema. SD is less frequent than dandruff as SD found in 1-3% general adult population worldwide while dandruff found in almost 50% of adult population [22].

Conclusion

Seborrheic dermatitis is a common skin condition affecting about 5% of population worldwide. Prevalence of SD is more in infants and people having immunological conditions. The best known cause for SD is the yeast, *Malassezia,* infection associated with other viral and neurological diseases. Although there is no permanent cure for SD, there is some treatment method using antifungals, corticosteroids and calcineurin inhibitors to reduce the symptoms. As SD is a chronic condition, continuous treatment is required to reduce the symptoms. Further researches to be done to discover treatments to cure the disease completely.

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A review on physico-chemical parameter of frshwater

Soumya Bahalia and Debashish tripathy
Department of Zoology, School of Applied Sciences
Centurion University of Technology and Management, Odisha
Corresponding author: debashish.tripathy@cutm.ac.in

Abstract

Water is an important part of all living beings. People depend on water for his all works. Due to increase of population, industrialization, use of fertilizers and manmade activity water is highly polluted. Polluted water causes nuisance, degrades land, aquatic body and also create water borne diseases in human. A good quality of water prevents all problems of animals. It is necessary to know details about different physico chemical parameters such as colour, pH, temperature, electrical conductivity, total carbon dioxide, chloride contents, carbonet contents, bicarbonet contents, total hardness, dissolve oxygen (DO), biological oxygen demand(BOD), chemical oxygen demand(COD), total alkalinity used for testing of water quality. Some water analysis reports with physico-chemical parameters have been given for the exploring parameter study. Guideline of different physico-chemical parameters also have been given for comparing the value of real water.

Keywords: Water, Physico-chemical parameters, Hardness, BOD, COD, DO, Heavy metals.

Introduction

Water is the most vital substance for ecosystem. Without water the life cant survive, In world, about only 1.69% of fresh water available & other is marine water 65% of human body made by water, more than 50% of water cosumed by industrial activity and only a small propation is used for drinking purposes . Good quality of drinking water prevent from discases. Now water pollution is a great problem due to rapid curbanization & industrialization. In the 3rd world countries, 80% off all disease are directly related to polluted water physico chemical quality of water is very important from the health point of view , In present review it is emphasize the various parmeter of drinking water by various agencies,

Material & Methods

Physico-chemical parameter is very important tatest “water before it is used for ,drinking ,domestic, agricultural or industrial purpose, water must be tested with different physico-chemical parameters .Water must be tested with different physico-chemical parameters for different purpose & we need its quality and purity. Water does content different types of floating, dissolved, suspended & microbiological impurities”. Especially water in industrial area is highly polluted with large number of impurities. “It is necessary to know details about different physico-chemical parameters such as color , temperature acidity, hardness PH , sulphate, chloride ,DO , BOD, COD, alkalinity used for testing of water quality,Some physical test should be performed for testing it physical appearance” .Its main purpose to protect aquatic animal & other animal from polluted water

Study area

The study area is Kalinga Nagar industrial area located at 20degree57- 21degree3 N latitude & 85degree 59- 86degree5 E Longitude near Duburi and bank of Bramhani river. It is a renowned mining area of Jajpur District Odisha. This area is promotion the steel production in the north eastern Odisha in India, these industries used water for different purpose from Bramhani river

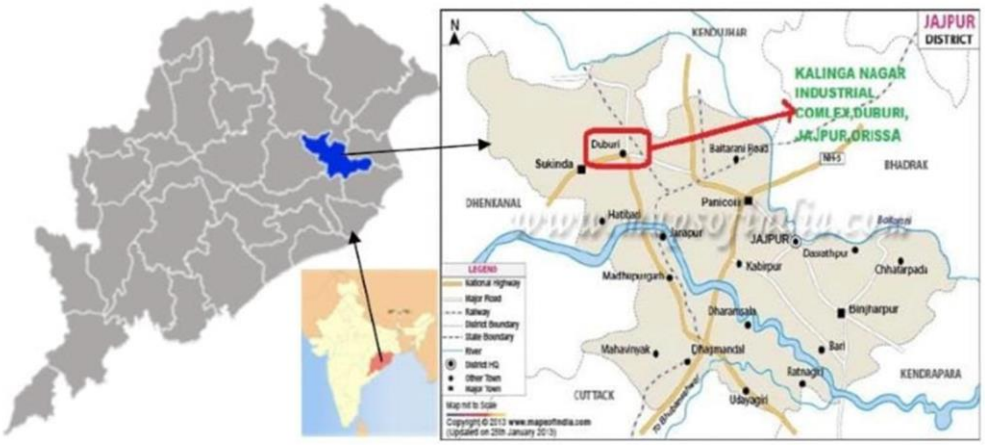

Figure-1: Map showing location of study area

Source- http://en.wikipedia.org/wiki/Jajpur_district.

Tabulation:-

Analytical water quality parameters according to WHO & INDIAN standard guideline value

Parameter	Mean (range)	coefficient		n
		WQI (2)	WQI	
TN	83.06 (34.11–100.00)	0.60**	0.55**	359
TP	70.21 (29.33–100.00)	0.36**	0.50**	356
NH_4-N	26.45 (2.27–100.00)	0.51**	0.39**	299
COD_{Mn}	28.80 (3.54–92.04)	0.54**	0.39**	360
pH	10.83 (0.00–100.00)	0.39**	0.31**	360
DO	26.38 (6.64–99.80)	−0.13*	−0.093	344

** $p < 0.01$; * $0.01 < p < 0.05$.

According to Adnan Asad Karim ,Md Osim Aquatar, Rahas Bihari Panda physico-chemical parameters of effluent water.

Table-2: Physico-chemical parameters of effluent water

Parameters	1	2	3	4	5	6	7	8	9	10	Mean	Standard as per IS:10500
Temperature(^{0}C)	34	30	32	42	33	28	37	35	46	33.4	35.04	-
pH	8.8	8.8	8.4	10.5	11.8	9.5	6.3	5.8	9.4	8.9	8.82	6.5 to 8.5
Turbidity (NTU)	21.3	22	52	74.5	78.2	52.35	31.01	35.64	47.65	35.15	44.98	5
Conductivity (μScm^{-1})	1123	1240	1021	1534	1183	1477	1562	1023	1254	1204	1262.1	-
TSS (mg/l)	1210	1042	2512	2720	2061	2345	2547	1148	1425	1477	1848.7	500
TDS (mg/l)	2321	1817	2207	2451	2655	2457	2136	2454	2861	1943	2330.2	500
Nitrate(mg/)	223	211	252	241	262	254	248	205	294	265	245.5	45
COD (mg/l)	346	452	466	340	464	512	412	365	547	487	439.1	-
BOD (mg/l)	224	246	329	346	245	276	198	215	365	286	273	-
Sulphate(mg/l)	172	154	252	215	264	285	148	162	176	224	205.2	200
Chromium as Cr^{6+}	0.012	0.018	0.007	0.008	0.014	0.016	0.006	0.021	0.007	0.004	0.0113	0.05
Fe (Iron)	3.28	3.37	2.70	2.19	4.06	3.41	3.32	1.86	2.54	1.62	2.835	0.3

Table-3: Calculation of Water Quality Index

S.no	parameters	Observed values (Mean Values)	Standard values (S_i)	Unit weight (w_i)	Quality rating (Q_i)	W_iQ_i
1.	pH	8.82	8.5	0.11764	103.764	12.2067
2.	BOD	273	30	0.03333	910	30.3303
3.	TDS	2330.2	500	0.002	466.04	0.93208
4.	TSS	1848.7	500	0.002	369.74	0.73948
5.	Nitrate	245.5	45	0.02222	545.55	12.12212
6.	Sulphate	205.2	200	0.005	102.6	0.513
7.	Cr	0.0113	0.05	20	22.6	452
8.	Fe	2.835	0.3	3.3333	945	3149.9685
				$\sum Wi=23.51549$		$\sum QiWi=3658.81218$
WQI = $\sum QiWi/\sum Wi$ = 3658.81218/23.51549=155.59						

Result and Discussion

Temperature

Temperature is an important factor of physico-chemical parameters and the biological reaction in water. Temperature of water depends on the seasonal and durinal variation. Higher value of temperature reduce dissolve oxygen, which is difficult for aquatic animal to survive. In the present study temperature varied from 22 degree C to 35 degree C.

pH level

The pH level od normal pure water is 6.5 – 8.5 (Henery and Heinke , 2005). If pH of water is high or low , the aquatic animals will die. pH of water also affect other terrestrial animals. In the present study pH value varied from 8.8 to 11.8.

Dissolve Oxygen (D.O)

Oxygen is essential for living organism. The D.O in water is the most important for all aquatic animals. The chemical and biochemical processes in water body depend upon the presence of oxygen. A high level of D.O in a river water sample is good for drinking and bathing point of view and friendly for aquatic lives. However, high D.O levels speed up corrosion in water pipes. For diverse fish population the D.O level must range from 4-9 mg/l. The river water of Brahmani is good fishing water. The average D.O values of water samples from the river ranges from 5.6mg/l to 7.5mg/l.

Biochemical Oxygen Demand (BOD)

"The degree of microbial mediated oxygen consumption in water is known as Biochemical Oxygen Demand. BOD is a measure of organic material contamination in water specified in mg/l". According to WHO normal value of pure water is 273 mg/l. But in water of Brahmani river value of BOD varies 224mg/l to 365 mg/l.

Chemical Oxygen Demand (COD)

"COD is another measure of organic material contamination in water specified in Mg/l. COD is the amount of DO required to cause chemical oxidation of the organic material in water. COD of normal water is 439.1". In the present study COD values were found to be ranged from 340-547 mg/l.

Carbon Dioxide

"Carbon dioxide is the end product of organic carbon degradation in almost all aquatic environments. It is the most common important green house gas on Earth". Carbon dioxide also important for ecosystem. All animal exhale carbon dioxide and inhale oxygen. But plant take carbon dioxide for their photosynthesis. In aquatic ecosystem carbon dioxide also play important role. If carbon dioxide level increase in water aquatic animal can't be survive. The level of carbon dioxide in water can be measured by different method such as: pH(pCO2), total alkalinity and total dis solved inorganic carbon(DIC).

Sulphate

"It is measured by nephelometric method in which the concentration of turbidity is measured against the known concentration of synthetically prepared sulphate solution. Barium chloride is used for producing turbidity due to barium sulphate and a mixture of organic substance and sodium chloride is used to prevent the setting of turbidity". Normal value of sulphate is 205.2 mg/l. But sulphate value were found in Brahmani ranged from 148 to 285 mg/l.

Conclusion

It is very essential to test water quality before it is use for different purpose. Water must be tested with different physico-chemical parameter. If water is pure then all animal became healthy. In case of Brahmani river, water highly polluted. Especially the water quality near Kalinga Nagar Industrial Complex(KNIC) is very poor and unfit for any purpose(according to Adnan Asad Karim, Md Osim Aquatar and Rahas Bihari Panda). Industrial waste water mixed with river water. As a result all living organism affected. If waste water will be treated before it is discharged from industries, then it will be use for living organism.

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Electrical conductivity analysis of $BaBi_2V_2O_9$ ceramic compound

N. K. Mohanty*[1], Gyanendra Kumar Mishra,

Department of Physics, Centurion University of Technology and Management, Odisha, India

Corresponding author: nilaya.mohanty@cutm.ac.in

Abstract

The ceramic compound $BaBi_2V_2O_9$ (BBV) having Aurivillius type structure was synthesized by solid state reaction technique. The X-ray analysis shows the orthorhombic crystal structure at room temperature. The electrical quantities were calculated using an LCR meter in a wide range of frequencies and temperatures. The conductivity data have been calculated through empirical relation and found to obey Jonscher's universal power law as well as Arrhenius equation. The compound exhibits the negative temperature coefficient of resistance (NTCR). The activation energy have been calculated from the ac and dc conductivity plot and lies in the range of 0.34-0.64eV.

.**Keywords:** Solid state reaction; XRD; Conductivity properties, activation energy.

1. Introduction

The Aurivillius structure materials were first reported by Aurivillius [1] which is the family of layered bismuth oxides ceramics. The Bismuth Layer-Structured Ferroelectrics (BLSF) materials have been proved to be good candidate for nonvolatile Ferroelectric Random Access Memory (FRAM) application [2, 3]. There are various BLSF compounds containing Strontium(Sr) with Tantalate and Niobium (Nb) which is one of the good replacement of lead free compositions and having FRAM characteristics[4]. The important common chemical formula for Bismuth Layered Structure Ferroelectrics family is $(Bi_2O_2)^{2+}$ $(A_{m-1}B_mO_{3m+1})^{2+}$ in which 'A' may be mono-valent or di-valent or tri-valent ion for example metals , non-metals and rare- earth and B represents transition metal ions such as Ti^{4+},Cr^{3+}, Nb^{5+}, Ta^{5+} Fe^{3+}, W^{6+} with comparatively charge is maximum [5]. The hieroglyph 'm' denotes the number of pseudo perovskite layers interspersing with bismuth-oxide layer $(Bi_2O_2)^{2+}$. The value of 'm' vary from one to ∞.The paramount of Bismuth-Oxide is most focused in this family as it is used various field such as non-volatile random access memories, photoconductivity in thin films, bio-medicals etc due to their outstanding electrical and

[1] **Corresponding Author: Dr. N K Mohanty**
Email nilaya.mohanty@cutm.ac.in

optical properties. In Bismuth Layered Structure Ferroelectrics compounds one of the most important oxide named as vanadium pentoxide (V_2O_5) was discovered to be an worthwhile microstructure alterer and is used as growth curtailer. Vanadium–Pentoxide manifests metal semiconductor transitions having energy gap is nearly equal to 2.2eV. This oxide is one of the best stable oxide.[6,7]. It is an important material to prepare energy storage devices because this belongs to the category n-type semiconductor. Lamellar layered structure is found in this oxide.[6-8].

Apprehending the significance of vanadium pentoxide (V_2O_5), the ceramic $BaBi_2V_2O_9$ (BBV) has been prepared in the laboratory and the structural and conductivity properties was studied.

2. Experimental

The ceramic sample "$BaBi_2V_2O_9$ (BBV) was prepared by solid state reaction method by using chemicals: $BaCO_3$, Bi_2O_3, V_2O_5 in a suitable proportion. The ingredients were mixed together. The mixed powders were calcined at 600^oC for 4h and the formation was checked through an X-ray diffraction (XRD) method. Then the calcined powder was mixed with PVA (polyvinyl alcohol) and made into cylindrical pellets using a hydraulic press. The pellets were sintered at 650^oC for 4h and in order to study electrical properties the sintered pellets were electroded with silver paste". The electrical measurements were carried out using an Impedance Analyser.

3. Results and discussion

3.1 Structural Study

Fig.1 shows the XRD pattern of the studied sample BBV at room temperature.The orthorhombic crystal system was confirmed. The lattice parameters were refined by taking the help of "POWD" software program [9]. The lattice parameters of the unit cells are calculated as a = 7.6825Å, b= 7.2924 Å, c= 11.0297 Å.

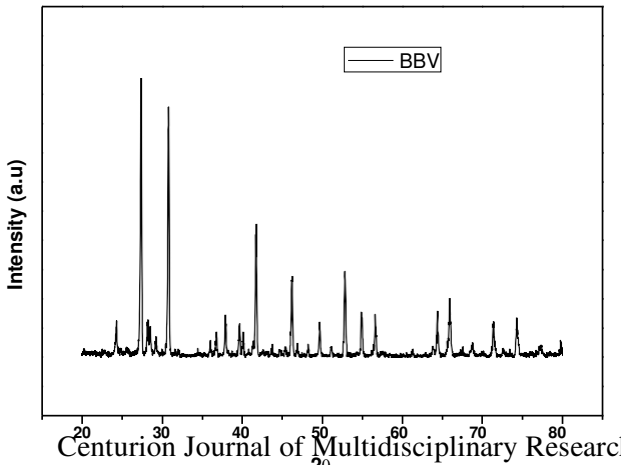

Fig.1 X-ray diffraction pattern of BBV at room temperature.

3.2 AC Conductivity

The electrical conduction process in compound with respond to the field is computed "by the parameter named as electrical conductivity". The ac electrical conductivity (σ_{ac}) of the samples has been calculated by employing an empirical formula $\sigma_{ac} = \omega\varepsilon_r\varepsilon_0 \tan\delta$, where ε_r is relative permittivity of the medium, ε_0 is the permittivity of the free space, ω is the angular frequency and $\tan\delta$ is the loss tangent. From the plotted figure 2, it is found that shows the variation of σ_{ac} with frequency at different temperatures for BBV. From the graph it is found that when frequency and temperature increase the σ_{ac} value also increases.

The nature of conductivity data "at high temperature follow the universal Jonscher's power law [10] $\sigma(\omega) = \sigma_{dc} + A\omega^n$ where σ_{dc} is dc conductivity, n is the exponent and A is the temperature dependent pre-exponential factor. The term $A\omega^n$ describes the dispersion mechanism in the conductivity of the sample". The parameters such as A and n are evaluated from the non-linear fit of fig-2 and listed in table 1. The value of 'n' reclines underneath 1 which shows that the charge carriers are supposed to be starting a rectilinear motion with a immediate hopping [11]. The decreasing trend of n with rise in temperature suggest the conduction mechanism in the system may be due to the correlated hopping of electrons over barrier [12].

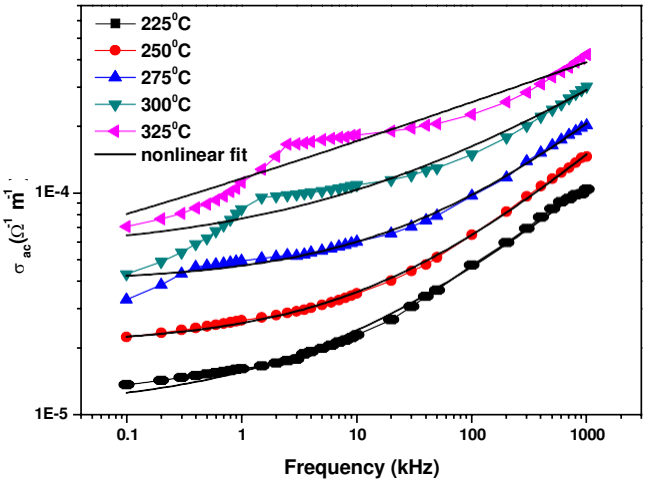

Fig. 2 Variation of ac conductivity with frequency of BBV in the temperature range 225°-325°C

Table.1 Fitting values σ_{dc}, A and n of BBV

$T(^oC)$	σ_{dc}	A	n
225	1.07308×10^{-5}	2.52646×10^{-7}	0.47
250	2.07337×10^{-5}	2.03894×10^{-7}	0.46
275	3.97736×10^{-5}	3.08035×10^{-7}	0.45
300	5.41587×10^{-5}	2.10076×10^{-7}	0.34
325	1.53451×10^{-5}	2.70881×10^{-7}	0.18

Fig 3 shows the change in σ_{ac} with inverse of temperature of BBV at different frequencies. The plot follows Arrhenius equation $\sigma_{ac} = \sigma_0 \exp\left(-E_a / K_B T\right)$, where the symbols have their usual meaning. Analyzing the increasing value of conductivity with increase in temperature, confirms negative temperature of coefficient of resistance (NTCR behavior). From the graph the slope was plotted and the calculated activation energy was in the range between 0.30-0.44eV.

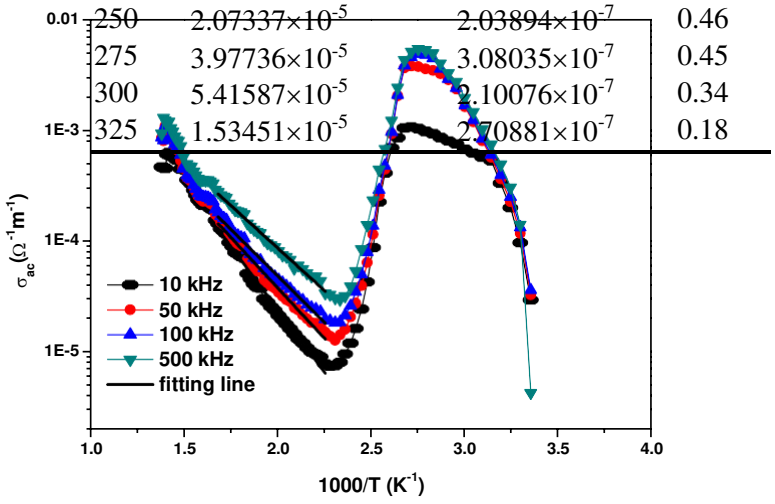

Fig 3 Change of σ_{ac} with inverse of temperature at different frequencies for BBV

3.3 DC Conductivity

The dc electrical conductivity is calculated from the impedance data using the relation, $\sigma_{dc} = t/AR_b$ where t and A are thickness and area of sample respectively, R_b is the bulk resistance. Figure 4 shows the change in dc conductivity with inverse of temperatures for BBV. It is observed that the dc conductivity increases with rise in temperature. The behavior of the plot found to obey the Arrhenius relation $\sigma_{dc} = \sigma_0 \exp\left(-E_a/K_B T\right)$. The value of activation energy calculated from the slope of the plot as 0.64eV.

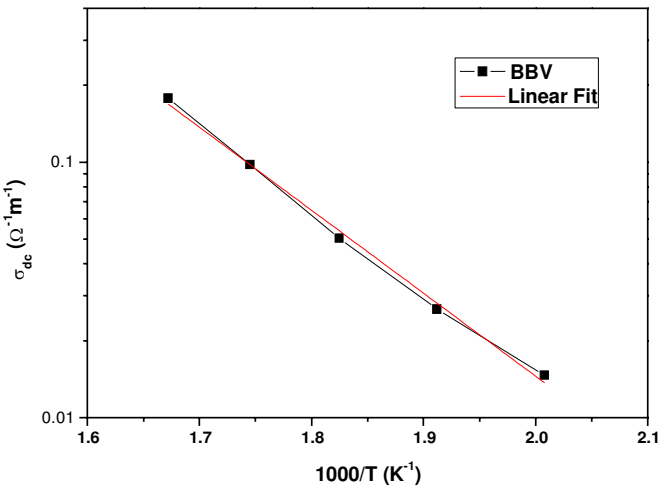

Fig 4 Variation of σ_{dc} with inverse of absolute temperature for BBV

4. Conclusion

The Aurivillius type sample of $BaBi_2V_2O_9$ (BBV) was prepared by solid state reaction technique. The X-ray structural analysis suggests the orthorhombic structure. The ac conductivity is found to obey the universal Jonscher's power law. The electrical conduction

mechanism in the materials can be explained through correlated barrier hopping (CBH) model. The variation of ac conductivity of the material as a function of temperature exhibits Arrhenius type of electrical conductivity. The activation energy lies in the range 0.34-0.64 eV.

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Career development in service sector: challenges and future prospects

Lipsa Jena[1], Umakanta Nayak[2]
[1]Research Scholar, Centurion University of Technology and Management, Odisha, India
[2]Associate Professor, Centurion University of Technology and Management, Odisha, India
Corresponding author: [1]jena.lipsa13@gmail.com, [2]uknayak@cutm.ac.in

Abstract

The intent of the paper is to find out the significance of career development in service sectors. The prosperity or adversity of any organization notably rests on the career development to a large extent. The study focuses on service sectors like banking, insurance, hospitality, telecom, and information technology to generate information and evidences related to the need of employee career development from organizational point of view. It is found that job dissatisfaction, low productivity, high attrition rate are the major negative outcomes when organizations fail to provide an appropriate career development opportunities for its employees. The analysis endorses the requirement of further study in career development practices in service sector.

Key Words: Career development, Banking industry, Insurance industry, Hospitality industry, Tourism industry, Telecom industry, Information technology industry.

1. Introduction

Although human resources are being considered as the most valuable asset for an organization (Armstrong & Taylor, 2014), the stirring level of employee quitting rate due to insufficient programs of employee career development is one of the top challenges that is being faced by an establishment (Deloitte, 2014). Reitman and Benatti, (2014) have validated career development as a program for supporting employee retention of employees. It is required for every individual irrespective of their group, age, and profession. Career development should not be focused on any particular group of employees as it has its mark upon every group of individuals reflecting various generations like- X, Y and Z. "There are evidences where generation X employees expects organization's support for career development" (Hamori, *et al*. 2012, Hansen and Leuty, 2012; Chuang, 2019) and demands a clear career opportunities (Teng, *et al*. 2018). "Generation Y longs for the possibilities of rapid advancement and supportive management" (Solnet and Hood, 2008); training and development (Price Water house Coopers, 2008); "personal growth and professional development" (Martin, 2005) and can be better engaged by administering a suitable career development (Kovarik, 2008). They look for a swift growth and development in their career (Weyland, 2011; Burmeister, 2009) rather than waiting for promotion in decades (Cherri Ho, 2010). The study conducted on generation Z indicates that this generation stay loyal when provided with self-development, and professional satisfaction (Logan, 2008; Sayers, 2007). Thus, it is more apt to consider career development as an important part for an organization which has been neglected. Career development should help employees to check stagnation in their professions, and organizations could enhance employee job performance through career development (Craig *et al*. 2013). Career development is considered approximately equal to vertical movement within an organization (McDonald and Hite, 2005). The analysis of available literatures has revealed that there exists a need of employee career development for the mutual benefit for individual and organization as well. Rather than shifting the responsibility of career development upon individuals, an organization should act as a platform for employee career development.

The service sector has been focused in the study as it is attracting "significant level of foreign investment flows, and contributing towards large-scale employment. India's service sector covers a wide varied range of activities such as financing, insurance, trade, hotel and restaurants, transport, storage, communication, real estate, business services, community, social and personal services etc., which is contributing 55.3% to India's GVA in 2019-2020".

2. Objectives:

- To identify the importance of career development.
- To know the organizational problems connected with the lack of employee career development

3. Methodology

This study is based on the secondary data and available literature pertaining to this field of research. Search engines like google scholar, emerald insight, ProQuest are used for searching relevant literatures including journal papers, books, and conference proceedings to develop this article. Peered reviewed journals articles are collected and evaluated on for studying career development in different service sector. After viewing the literatures, the major notion of studies have been depicted with the issues pertaining to career development in banking industry, insurance industry, hospitality industry, tourism industry, telecom, information technology.

4. Career development in Service Sectors

4.1 Banking Sector

"Banks are the main source of financial system, have been going through heterogeneous challenges" like demographical, economic and technological that demands change in skills, new business models, customer services etc. (Bhatta, 2012). The study conducted in Indian banking Human Resource Development system showed the shortfall of knowing the challenges that are faced by Indian banks (Chhabra and Thangaraj, 2018). Evidences have shown career planning as the weakest factor in public sector banks (Henry et al, 2014). "Researchers have also stressed that banks should foster development" for employees (Moschetto, 2014). The RBI data has disclosed that the industry is facing various uneven career system and financial losses every year (Kawad and Patinder, 2014; Singh, 2013). Other surveys highlighted the need for promotion, career development, and compensation (Parveen and Khan 2014) and reducing job dissatisfaction among private employees (Bora, 2014; Pragya and Sandeep, 2015).

4.2 Insurance Sector

There is a need for designing plan of action in career development for the employees in insurance sector (Adeoye et al. 2014). Employee training is considered as a career development practice for getting higher level of productivity for the firm (Yean and Yahya, 2013). "Studies conducted in the insurance sector of American market (Ernst & Young,

2012) and Chinese market (Qian, 2010; Luo, 2010) also divulged that most of the insurance agents do not have an option for career growth. The promotion and developmental opportunities can be the main source of attraction for the migration of agents (Chowdhury, 2016). The attrition of agents gives an estimated of 12 percentage of the total loss to the sector (IRDA annual report, 2015). Many new modules of change related to career, creating agent tool-kits, management, and motivating agents to bring people through references etc. are now practiced in the insurance sector" (Chowdhury, 2016).

4.3. Hospitality Industry

4.3.1 Hotel Industry:

"The hospitality industry comprises of a broad category of services that includes lodging, food and drink services, transportation, event planning, travelling, airlines etc. where many researchers felt the need of integration of career development in the industry. Career development maintains a positive attitudes among its employees by giving benefits both to employees and organization" (Joseph, 2013), and fulfilling customer requirements as well (Kiruthiga and Magesh, 2015; Petrovic and Markovic, 2012). A study in a hotel industry in Malaysia also found that employees experience limited satisfaction level at the work place (Arokiasam, 2013) and it was "deduced that employee recognition, and career development opportunity within a system can make them to stay in an organization" (Kusluvan *et al*. 2010). Hotel functions in an uncertain environment due to fluctuations for seasonal demands, trends, and lack of labour and skilled employees (Poescu and Avram, 2012; Sonia and Neetu, 2012), where occupation is transitory and "employees gets frustrated due to lack of career development opportunities" (Ladkin, 2013).

4.3.2 Tourism Industry:

"Employees are vital for the success an organization and therefore it is essential to develop employees through career development opportunities in this sector (Cappelli and Keller, 2014). Scholars have viewed that individuals join organisations to develop and fulfil their own careers (Panda and Sahoo,2015) and therefore it should not be neglected by an organization. Other scholars have made opinion that career management practices should aid and assist the career development of employees without neglecting organisational needs" (Kong *et al*.2010).

4.4 Telecom Industry

"There are a lot of issues found in telecom companies. A study investigated on the employee turnover intention in a leading telecom organization in the State of Karnataka, found lack of job satisfaction, career development opportunities, and pays and benefits, leads to turnover of employees" (Krishnan, 2011). Sultana *et al*. (2012) emphasised on employee training in telecom sector for improving their performance. Jabber and Uddin (2014) identified lack of employee satisfaction and career development opportunities as the factors contributing towards employee turnover intention in telecom sector. This "sector has lost over 100,000 employees in the last two years due to financial turmoil where it is quite difficult to maintain a career" developmental opportunities.

4.5 Information Technology Industry

"A little study to know the career demands of IT employees has increased the likelihood of losing valuable employees" (Chang and Lee, 2012). Frequent job changes among IT professionals are reported (Schropshire and Kadlec, 2012). The professionals seek for the development in terms of their career is considered as a major reason for job changes (Clayton *et al*. 2012; Joseph *et al*. 2012). Other literature have uncovered that IT professionals who move from one functional area to another area are dissatisfied with their careers (Ramos &Joia 2013). Some survey shows that job dissatisfaction and lack of leadership contributes to voluntary turnover of IT employees (Aiswarya and Ramasundaram, 2012; Thirulogasundaram and Kumar, 2012). "It is essential to retain the employees as the inability to retain qualified IT professionals may lead to the downfall of organizations as it will bring lose their competitive advantage" (Erturk and Vurgun, 2014). Other explorations among IT professionals have shown the lack of role clarity (Jung, 2013) and inefficient supervisors leads to burnout as employees lose track over their own careers (Armstrong *et al*. 2015).

5. Conclusion, Suggestions, and Further research:

The study shows that service industries like banking, telecom, information technology, hospitality and insurance are facing lack of employee career development. The literatures have shown that career development has remained a mutual problem faced by employees who are working in service sector that needs considerable attention from organizations. The reason may be unawareness in the part of organization about the benefits that it can achieve through employee career development. Without a prospect for developing one's career, no employee can stay attached with the organization for a longer period of time. The importance

of career development is seen vital for the existence of the organization itself without which many negative consequences can be noticeable. Establishments will incur loss of time and finance while providing recruitment and training for filling up the vacancies that arises due to attrition because of lack of career development in organization.

By encapsulating the previous literatures it can find out that very less number of surveys shows ways to practically implement career development based on size, sector and other factors that regulate the firm and stands as a barrier while implementing the program. Moreover, most of the investigation are based on career related studies rather than career development which is a long term phenomenon. The absence of proper career development practices have led to increase the attrition level, low performance, and employee dissatisfaction, which will affect the image and productivity of an organization. A fair career development practices is required that can rise up positivism and there is a need of implementing career development by organization for its employees (Eversole et al., 2012; Guan et. al., 2014, 2015). Further research can be done for executing career development for employees by remaining within an organisation. As a précis it can be said that career development should be further studied because a very less number of literatures are there that accentuate the ways for exercising career development in organizational context, particularly in any above mentioned service industry.

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Studies on callusing efficiency of popular indica genotypes

Jyoti Behera[1]*, Ranjan Kumar Sahoo[1], Lotan Kumar Bose[2]

[1]Department of Biotechnology, Centurion University of Technology and Management, Odisha-752050, India

[2]National Rice Research Institute, Cuttack

*Corresponding Author: rijabehera210@gmail.com

Abstract

An investigation was made on the initiation and maintenance of callus from explants (mature seeds) of five popular *Oryza sativa* varieties- CR Dhan 300, Lalat, MTU-1010, Maudamini and IR-64. Mature seeds were used as explants in MS medium supplemented with 2mg/L of 2, 4-D. It was found suitable for inducing high amount of embryogenic calli in the studied genotype. It was induced with hormone kinetin with 2, 4-D with different concentration. In this hormonal concentration maximum 99.1% callus was induced in MTU 1010 variety followed by 98.4% in MAUDAMINI variety. The range of shoot germination was 2-10 days and the highest number of shoot were obtained by using ms medium containing 1mg/L kinetin.MTU 1010 was found most suitable for in vitro culture among the five genotypes used.

Key words: *Oryza sativa* L., Callus induction, 2, 4-D, kinetin, CR Dhan 300, Lalat,MTU-1010, Maudamini, IR-64

Introduction

Rice (*Oryza sativa* L.) is the staple food for two-third of the world's population. It has been cultivated in warm climates since ages. According to the Asia rice foundation, "people of china, Indonesia and india-2.5 billion i.e. more than half of the world's population rely on rice as staple food. In the next 20 years the number of people depending on rice will grow by 1.2 billion. Rice belongs to the Gramineae family and the genus Oryza. It is believed to have originated 130 million years ago. Rice has 24 species, of which are 22 are wild and two viz. *Oryza sativa and Oryza glabrima* are cultivated. At present there are twenty one wild species and two cultivated species in the genus oryza , nine are tetraploid and the remainder are diploids. O. Sativa is Asian rice, grown only in limited areas of West Africa.There are three main varieties of o.sativa" [1,2]

1. Indica:- This variety is long –grained ,for example Basmati rice, grown notably on the Indian sub-continent.[2]
2. Japonica:-This rice is short grained and high in amylopectin (thus becoming "sticky" when cooked) and is grown mainly in more temperature or colder region such as Japan.[3]
3. Javonica:- This rice is grained and grown in tropical climate.

Recent advances in plant biotechnology (i.e., in plant tissue culture, molecular breeding and transgenic research) have made it possible to reduce crop resistant to variety of biotic and a biotic stress and that can help to substantially reduce or even eliminate the huge crop losses. "The introduction of beneficial genes from other

organisms such as those encoding disease and inert resistance via genetic transformation in t the rice genome arose from developments in this area" [5,6]. "Furthermore, the development of molecular maps, tagging important genes with RFLP markers and direct genes transfer were all made possible because of transgenic rice research. These important steps as dramatic genetic improvement were not possible through breeding and selection" [7,8]. Transgenic research "can significantly strengthen rice breeding problem and help to produce new varieties with higher yield potential and greater yield stability. These should improve the efficiency of rice production and allow an expansion of the rice growing area. Biotechnology will enable rice breeders to achieve result, ore quickly and efficiently and will help them to attain breeding goal not complement, not replace breeding"[9,10].

Materials and methods

Callus induction and plant regeneration from indica rice (*Oryza sativa* L.)

Plant material:

Field grown material seed pod five different genotypes of rice were used for study –

1. MAUDAMINI
2. LALAT
3. CR DHAN -300
4. MTU- 1010
5. IR-64

The experiment was carried out in the cytogenesis Laboratory of crop improvement division of National Rice Research Institute (NRRI) Cuttack, Odisha.Pure seeds of all the lines were available from field grown plants at NRRI. All these rice genotypes are used for the study is very popularly grown rice varieties of this part of the country[11,12].

Method:

Cleaning and sterilization of glass wares:

Soak the glassware's and equipment in soap water.

↓

Brush and wash them with tap water

↓

Then, wash them with tabolene

↓

Rinse them with distilled water properly

↓

Dry them in hot air oven

↓

Wrap them with brown paper

↓

Autoclave them at 121degree Celsius for 15-20minutes

Table 1: culture media used for callus induction

Medium	COMPOSITION
MS 1	MS(Murashige and skoog,1962)medium(obtained from Hi-media)supplemented with vitamins 2,4-D 2mg/L, Sucrose 30gm/L, kinetin 1.5mg/l, Ph-5.8
MS-2	MS(Murashige and skoog,1962)medium(obtained from Hi-media)supplemented with vitamins 2,4-D 2mg/L, Sucrose 30gm/L, kinetin 1mg/l, Ph-5.8
MS-3	MS(Murashige and skoog,1962)medium(obtained from Hi-media)supplemented with vitamins 2,4-D 2mg/L, Sucrose 30gm/L, kinetin 0 .5mg/l, Ph-5.8

Table 2: basic composition of basal media for callus

Component macro salt	MS Original strength
1.NH4NO3	1.65 gm/l
2.KNO3	1.90 gm/l
3.(NH4)2SO4	----
4.MgSO4.7H2O	0.37 gm/l
5.KH2PO4	0.17 gm/l
6.CaCl22H2O	0.44 gm/l
7.FeSO4.7H2O	27.85 mg/l
8.Na2-EDTA.2H2O	37.25 mg/l
9.Microsalts	----
10.KI	0.83 mg/l
11.MnSO4.4H2O	22.3 mg/l
12.ZnSO4.7H2O	8.60 mg/l
13.H3BO3	6.20 mg/l
14.Na2MO42H20	0.25 mg/l
15.CuSO4.5H20	0.025 mg/l
16.CoCl2.6H2O	0.025 mg/l
17.Glycine	0.3 mg/l
18. Thiamine HCL	0.1 mg/l
19.Pyridoxine HCL	o.5 mg/l
20.Nicotinic acid	0.5mg/l
21.Myo-insitol	100 mg/l

Plant induction:

There is a need to supply the basic nutrient in media with different growth regulator. There are many types of formulation of media for plant tissues culture according to different workers. Murashige and skooge developed the most common and all purpose basic media formulation in 1962(MS).[5,6]

Preparation of iron edta:

Iron was added in chelated from containing Na2 and FeSO4 for preparing iron complex. First Na2-EDTA solution was heated to boiling and Feso4 was added to it. Finally the iron complex was stored in amber glass bottles in refrigerator.[11,12,13]

Growth regulator:

The auxin and cytokinins were taken at required quantities in a sterile container, dissolved in their respective solvent, made up to their volumes, made up to their volumes, sterilized and stored.[12,13,16]

Sucrose:

In the media, the main sucrose of carbon was sucrose. For induction and plantlet regeneration from inflorescence culture 3% (w/v) sucrose was routinely used except where ever it was mentioned. In all media preparation the required amount of sucrose was routinely used except wherever it was mentioned. In all media preparation the required amount of sucrose was dissolved before the final adjustment of the volume and PH.[14,15,16]

Preparation of medium:

Appropriate amount of stock solution along with other growth supplement were mixed and final volume was adjusted with the addition of double distilled water. The PH of the medium was adjusted to 5.8 using dilute concentration of NaOH and HCL. After adjusting the PH of medium, 0.75% agar agar was added after boiling. Hot medium was poured into 25*150mm culture tubes at the rate of 20ml per tube. All culture tubes were autoclaved at 0.78kg//cm2 (15 Ibs) for 20mins.[17,18]

Sterilization of media:

“Tissue culture medium especially when contains sugar will also support the growth of the microbes, like bacteria, fungi etc. Once they come in contact with medium, either in cellular from or in spore from or in spore form, they grow faster than the plant cell or tissues. The microbes may come glass vials, instruments and nutrients medium used for the culture and even from the plant material itself. Therefore the surface of plant tissue and all type of glass wares, instruments is sterilized” [14,15].

Procedure:

1. Take the prepared media in conical flask/tubes as required.
2. Plug the vessels with tightly rolled non-absorbent cotton wrapped in gauge cloth/plastic autoclavable caps.
3. Cover the exposed part of the plug with brown paper.
4. Autoclave at 121 for 15-20 min.
5. Once the media were completely sterilized by autoclaving, media were allowed to cool to 55c.
6. The cooled media were then dispensed at 20ml per flask 10ml per testtube.

Surface seritilization:

Glumes (outer coat) from 180-200 seeds of each over mentioned five varieties were removed by individually peeling apart the halves of the glumes or by rubbing the dry rice kernels between the users finger. Healthy, Good shaped with normal colored seeds were taken for the experimental observation. First of all the seeds of different five varieties were soaked in 70% alcohol for 10mins.[19,20]

Then after the seeds are transferred to the sterilized petriplate containing 1% mercuric chloride (Hgcl2) for 2-3 which kills the harmful organisms.

There the seeds were transferred to the petriplate containing sterilized distilled water and kept there for 20-25 minutes. Then also the seeds were rinsed 1-2 times with sterile distilled water to remove the bleach with vigorous agitation in the laminar air flow cabinate. Then after surface sterilization of explants they were allowed to immobile for 15-20 min under sterile condition. The seeds were then partially dried on sterile blotting paper and culture in callus induction medium.[21,22]

Seeds inoculation and incubation:

Four different culture media (MS 1, MS-2, MS-3) were used in callus induction from matured seeds.4-5 surface sterilized seeds were partially submerged on a single culture flask semi solid medium with embryo facing down. Seeds were placed in such a way that plumule-radicle side of the seeds was facing up and scutellum was in contact with the medium. Likewise flask, 1-2 sterilized seeds were partially submerged on a single culture test tube. Then the flasks were sealed with cotton plugs and the tubes were sealed with parafilm. This minimizes dehydration of the media but allows good gas exchange and incubated at 25+2 degree Celsius under in the dark. All the experiments were repeated

thrice. The cultures were checked time to time for monitoring the response. After 10 days swelling portion were observed in culture seeds.

Callus induction:

Callus tissue is an unorganized proliferative mass of cells which is produced from isolated plant cells, tissue or organs.it is grown aseptically in an artificial nutrient medium in glass vials under controlled experimental condition. After 10-15 days, calli were formed.

Maintenance of embryogenic calli:

Two types of rice callus (embryogenic and non-embryogenic), which is formed at the surface of the scutella of the mature seeds were separated aseptically from the scutella tissue without injury. The embryogenic calluses were then separated from the scutella tissue without injury. The embryonic callus was then separated from the non-embryogenic callus and teased apart into small pieces and allowed to grow in fresh medium. Care was taken to minimize any damage to the embryogenic calli were sub cultured every 12-15 days interval. At each subculture, non-embryonic callus was discarded. Cultures showing severe browning and rhizogenesis were also each subculture.[23,24,25]

Results

Nature of calli, their growth rate, texture and colour were varied on number of factors e.g.- type of explants, media and treatment.

The observation on the effect of 2, 4-D and kinetin on the cultured embryos were summarised in the table 1&2.

The result indicates that when the level of sucrose was constant (3% W/V) and the concentration of KIN is increasing slowly that resulted in callusing of the embryos.

Table 1: effect of genotypes on germination in Different medias

Ms medium	Seeds	Range of days for the germination
Ms- 1 (2:1.5)	Lalat	5th day
	CR-Dhan 300	8th day
	Maudamini	4th day
	IR-64	5th day
	MTU 1010	4th day
Ms- 2 (2:1)	Lalat	2nd day
	CR-Dhan 300	5th day
	Maudamini	3rd day
	IR-64	3rd day
	MTU 1010	2nd day
Ms- 3 (2:0.5)	Lalat	10th day
	CR-Dhan 300	12th day
	Maudamini	8th day

IR-64	6th day
MTU 1010	4th day

Table 2: effect of genotypes on callus induction

Ms medium	Seeds	No. Of seeds inoculated	No .of callus formed	Induction frequency (%)	Peak callusing period(days)
Ms -1 2,4-D:Kinetin (2:1.5)	Lalat	120	106	88.3%	13
	CR Dhan-300	120	92	76.6%	10
	IR-64	125	101	80.8%	11
	MTU-1010	115	110	95.6%	5-7
	Maudamini	130	125	96.1%	5-8
Ms -2 2,4-D:Kinetin (2:1)	Lalat	120	110	91.6%	9
	CR Dhan-300	118	85	72%	5-8
	IR-64	117	99	84.6%	5-7
	MTU-1010	115	114	99.1%	5-8
	Maudamini	130	128	98.4%	5-9
Ms -3 2,4-D:Kinetin (2:0.5)	Lalat	100	72	72%	11
	CR Dhan-300	100	69	69%	5-8
	IR-64	100	86	86%	5-9
	MTU-1010	100	89	89%	7
	Maudamini	100	79	79%	10

The result revealed that concentration of 2, 4-D, in different types of genotypes had great variability for early induction and high production of callus. By summarization of above tables .it is clear that the response was the highest in MS Medium 2 that contain 2, 4-D (2.0mg/l) and kinetin (1.0mg/l). there genotype MTU1010 Showed high callusing efficiency i.e., 99.1% and followed by MAUDAMINI callusing efficiency i.e. 98.4% and seeds of rest three genotypes ranged from (72-91) %.Similarly, in MS-2 medium (2:1) ratio of 2,4-D & kinetin showed genotype

MTU1010 Showed high callusing efficiency i.e. 96.1% and followed by MAUDAMINI callusing efficiency i.e. 95.6% and seeds of rest three genotypes ranged from (76-84)%.

Similarly in MS -3 medium (2:0.5) ratio of 2,4-D & kinetin showed genotype MTU1010 Showed high callusing efficiency i.e. 89% and followed by IR-64 callusing efficiency i.e. 86% and seeds of rest three genotypes ranged from (6979)%.

Figures of seed germination in MS Media 1 that contain 2, 4-D (2.0mg/L) AND KIN (1.5mg/L)

Fig:1 Seed germination of Maudamini, Lalat and CR Dhann-300 respectively

Fig:2 Seed germination of IR-64 and MTU -1010 respectively

Figures of callus formation and seed germination of

MS Media 2 THAT CONTAIN 2, 4-D(2.0mg/L) and kin(1.0mg/L)

Fig:3 Seed germination of IR-64, Lalat and Maudamini, respectively

Fig;4 callusing of seed

Figures of seed germination in MS media 1 that contain

2, 4-D(2.0mg/L) AND KIN(0.5mg/L)

Fig:5 Seed germination of IR-64, MTU 1010, Maudamini and CR Dhann-300 respectively

The mature seeds derived calli were creamy white to creamy in MS medium. The natures of mature seeds derived calli were compact and fragile and tend to be very dry with increasing concentration.

Conclusion

Rice genotype showed significant divergence for their in vitro response to callus induction. The quality and frequency of callus induction and subsequent plant regeneration, however, ultimately depends on composition of initial callus induction between auxin type and carbon source. The cultivars response to tissue was also dramatically different. The result of this study revealed that there are possibility of enhancing callus induction and subsequent green plant regeneration from rice seeds by manipulating media compositions and identifying superior and responsive genotype. Rice genotype showed variable response to media for callus induction from seeds.In general, MTU 1010 and MAUDAMINI are more responsible to in vitro culture, compared with, CR Dhan 300, Lalat and IR-64. Although a dozen optimized tissue culture media for Indica rise have been published in literature, they are largely genotype-dependent. So far, no universal medium adaptable to all indica genotype

has been developed[27,28]. In the mean time many studies and discussions have been carried out to clarify the genetic basis of the tissue culture responsible in Gramineae. Therefore the quality and frequency of callus induction could be improved by selecting better responsive rice genotype like MTU 1010 and Maudamini. The callus induction MS media would offer great promise for the overall enhancement of seeds culture in Indica rice.

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Media and Questions on Credibility: A Study on Minority Community

Mohammad Aamir Pasha
Centurion University of Technology and Management, Odisha

Abstract

Media is able to set its plan to produce a specific idea, desired effects and it also has the power to influence the audience within the society or for the people living in that specific society. Whatever content media present, portrait, what it planned to promote and creating some issues as the importance of each audience. Agenda-setting theory also tries to explain the same phenomenon of media. Maxwell & McCombs explain that the media (especially the news media) is not only successful in telling us what to think but also, they are stunningly successful in telling us what to think about (McCombs & Maxwell, 2005). But several report state that in the last few years media lose the credibility between the audience, as well as media content, is also poor quality. Credibility is the most important factor to influence the information. This paper emphasis the credibility of media.

Key word: Media, Minority, Credibility.

Introduction:

There has been a lot of development in the Indian media sector in the last decade but it is also noticed that lack of quality content emerges in the media sector. According to the various reports that most of the developed countries media reach in their pick point and now their growth graph is in saturation point. It is also noticed that most of the media institute facing financial challenges not only in a developed country but also in developing countries.

In May 2017 the ABC (Audit Bureau of Circulation) published a report on the status of print media all over the world. ABC revealed that in the last decade, the spread of newspapers has increased by 60 per cent, 39.1 million copies to 62.8 million from 2006 to 2016 respectively. In recent years, according to the report, data of the year 2015 shows that the circulation of newspapers in India has increased by 12 per cent. Other developed countries like the United Kingdom (12 per cent), the United States (7 per cent) France and Germany have declined in the circulation of the newspaper by 3 per cent. That is the exact scenario in India which shows that the future of the print media is on the boom. After the massive growth in Indian media sector, After the notable growth in the Indian media sector, it is also noticed that the lack of quality in media content which is separate the media from the real world.

In recent few years, Indian media has down the quality of public opinion, It also seems in several reports that most of the media institutions emphasize to spread the voice of the upper class or elite group of communities, not the marginalised group (Bidwai, 2011).

In the subject of media credibility audience responsibilities also plays a crucial role in it. Every person has their own ways of acknowledging. There are many paths to we try to know things, idea and knowledge gain about the world around us. One way is through direct experience, involvement and practice. This approach is sometimes called observation or empiricism. Authority is another way of knowing, obviously we can't know everything there is to know, when we get sick, we usually refer a doctor and follow whatever recommendation the doctor gives. Because of the doctor as a specialist or authority on medical diagnosis. Prediction is also a way of knowing for instance weather forecast. Insurance businesses also depend upon prediction. An every policies price are fixed according to the prediction but they have proper reason and explanation that why they are fixed exact price. So the explanation is another approach of knowledge. And good explanations cater to a sense of understanding. What does it mean to say that we understand how something works? It's all about that is depends upon understanding like watching media violence is might increase aggressive behaviour. After the good knowledge of the phenomenon, they control the situation (Sparks, 2010). Media has all the above characters and qualities so that the media give us information about any case and event. We think that all information is accurate and correct because we understand or feel that Media has an agency and authority to gives us information which has all qualification.

We live in a media age. For more than two decades we have been observed statistics about how much time people spend in newspaper, novel, magazine, watching TV, listening to popular music and radio. The point of mentioning these practices and emotional labour which is affecting our lifestyle, ideology, behaviour, development and most important is what types of information disseminate and what type of sense or angle we observed.

In the communication process, the important part is the notion of audience. The term audience is one that we use quite frequently in our everyday conversations. There are two basic notions of the audience, each with a core perspective about the communication process. The first is an information-based notion of the audience experience (Frey, Botan, & Kreps, 1999 in Sullivan, 2013). It also defined as a transmission view of communication (Care, 1989). The most simplified form, then every act of communication requires two sections a message sender and a receiver (Shannon & Weaver, 1949 in Sullivan, 2013). And the second notion is meaning-based view; in this model, the interaction between the sender and receiver is an ongoing process that may or may not be intentional. The main part of this second model

is the notion of feedback between sender and receiver. That is some basic point between audience receiver and the message. Hamid Mowlana and Majid Tehranian two Iranian-American media scholars have developed an Islamic model of communication. The Ummah or the community or public is at the centre point of communication in Islam, as against the individual who is the primary focus of attention in western models. The primary purpose and experience of communication, according to this view, is to build relationships in a public or community rather than persuasion or propaganda (Kumar, 2015).

Methodology:

Research methodology is the most important part of every research. Research methodology works to give direction to research that prevents the researcher from biasedness. The main challenges in this research were how to reduce the impact of social research in media research so that the objectivity of the research remains. In this paper, Mixed Method has been applied. The study uses both qualitative and quantitative methods to analyse factors associated. Qualitative interviews provide an in-depth analysis of not only media as well as users also. The qualitative interviews with journalist and selected respondent, Journalist interviewed include both editors and prominent reporters for a mainstream newspaper, interview schedule with open-ended and close-ended questions and we try to collect data both qualitative and quantitative manner.

Objectives:

- To analyse the media credibility status among minorities.
- Study on media literacy status in minorities.

Analysis and Interpretation:

Considering the quality of the research, distribution of schedule has been done according to the purposive sampling. In which 386 respondents have been selected for participation in research. After that interview techniques also adopted for the collection of data. Meanwhile, we tried to collect data through the group interview.

Table-1: Respondent select from the Minority Community.

Community	No.	%
Muslim	200	51.8
Christian	186	48.2
Total	386	100.0

According to the data, found that about the minority community. 51.8% of the minority respondent is from the Muslim community. Whereas 48.2% of the minority respondent is from the Christian community. The total number of respondents 386. The number of people from the Muslim community is 200 whereas the number of the minority from the Christian community is 186.

Table-2: Sex of the respondent.

Gender	No.	%
Male	258	66.8
Female	128	33.2
Total	386	100.0

In the above table, the percentage of the sex of the respondent is collected. According to the survey it was found that the number of male respondents is 66.8% whereas a number of female respondents were 33.2%.

Table-3. Educational Qualification Status.

Education Status	No.	%
Up to 12^{th}	80	20.72
UG	135	35.0
PG	171	44.3
Total	386	100.0

The above the data table shows the educational status of the respondent. The respondent who has studied up to 12^{th} is 20.70% and 35% of the sampled respondent completed their graduation whereas 44.3% of the people have done their further study by completing their post-graduation. The maximum respondent is literate and more than 50% of respondent complete their graduation.

For any successful communication, the most important part is the credibility of the sources or medium. Regarding the credibility on media, most of the respondent seems to not satisfy the media performance or portray or representation of minorities.

Table-4: Respondents credibility on media.

Credibility on Media	Yes		No		50% Only		Total	
	No.	%	No.	%	No.	%	No.	%
	64	16.6	178	46.1	144	37.3	386	51.8

Regarding the credibility of media, only 16.6% of the respondent have credibility on media. Majority of the respondents i.e. 46.1% felt that media is not credible. However, 37.3% of the respondents felt that credibility on media, in this section of the questionnaire the separate response of both communities approximately mixed or same. Approximately more than 60% of the respondent the newspaper is most effective or reliable news media.

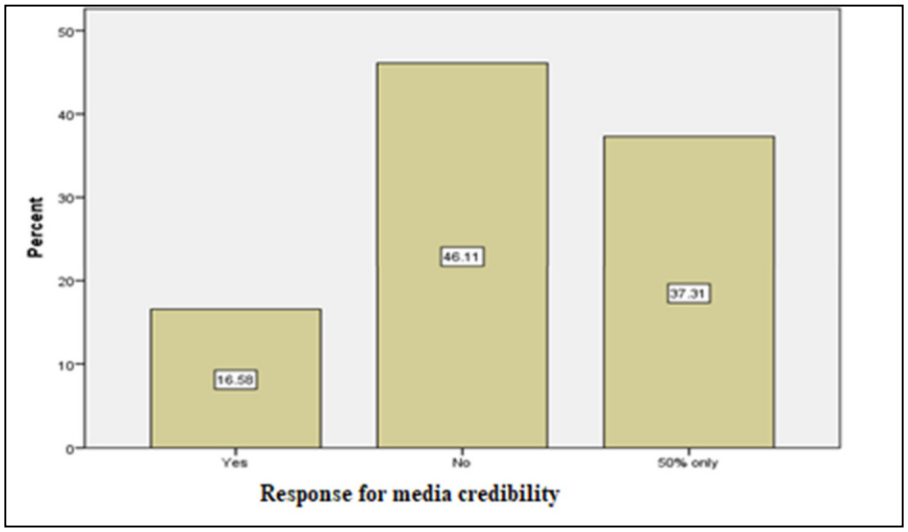

Figure-5.1: Respondent credibility on Media in the research area.

The purpose of this question was to find out whether the relatives working in the media institutions would leave an impact in their areas. Approximately one-third of the respondents' relatives working in the media institute. Despite this, the most of the respondent says that they all have no credibility on media and also, they the data of the research found that the minorities' community facing lots of obstruction on the way of the social development process. Despite that their voices are being suppressed. There is a limited representation in the media of minorities. The image of the media is not trustworthy in the psyches of minorities.

Table-5: Respondent relative working in media institutions.

Community	Yes		No		Total	
	No.	%	No.	%	No.	%
Muslim	80	40	120	60	200	51.8
Christian	44	23.7	142	76.3	186	48.2
Total	124	32.1	262	67.9	386	100
X^2 **=11.06,** df **= 1,** p **= 0.0009**						

The association between both communities relative working in media institutions is considered to be strong statistically significant ($p < 0.05$).

Above the table revealed that the respondents from both the communities were asked about whether any of their relatives were working in any of the media institutions. 60% of the respondents from the Muslim community said that they did not have any relatives working in the media sector. While 76.3% of the respondents from the Christian community confirmed that they did not have any relative working in media institutions.

The media controls a distinctive capability to shape public policy. A useful, if well-worn way to think about the media-policy link is, to begin with, David Easton's (1953) notion of the political system. Categorise the policymaking process is composed of three basics part Policy Input, Policy Process and Policy Outputs in the input section cover the factor which is influencing the formation of policy and the shaping of policy by institutions is lies on the policy process part and policy outputs part is the concrete products of this process - i.e., the authoritative actions and decisions emanating from government designed to address public problems, it observed that the media has an impact on all the three stages.

The media cannot make or construct policy, as this activity is limited to the administrative structures of government, but, this does not mean that the media cannot implement decisive influence over policy structure, content, promotion and follow up on the news. The media is more logically thought of as an institution that, in structural terms, mediates between the state and society. But the audience not doing their duty in the proper manner so the media will not be able to fully support them. The cultivation theory also explains that the media and society both connect to each other. That the effect of both of them is on one another. According to the data of the research, another side of this portion is that media doesn't have the full resources for the work and also ignorance of the media ethics has also been noticed. Media busy the making of Public Opinion instead of informing people about the governments' plans and policies (Reddy, 2006).

Media is able to set its plan to produce a specific idea, desired effects and it also has the power to influence the audience within the society or for the people living in that specific society. Whatever content media present, portrait, what it planned to promote and creating some issues as the importance of each audience. Agenda setting theory also tries to explain the same phenomenon of media. Maxwell & McCombs explain that the media (especially the

news media) is not only successful in telling us what to think but also, they are stunningly successful in telling us what to think about (McCombs & Maxwell, 2005).

Similar is the case in audience perception, whose use media frequently like the active user, people create their thought what media present to them. Perception plays a very important role in making some issues important and some unimportant, this is due to many reasons; occasionally perceptions are influenced or affected by lots of other things. But it also influences several expect of the media image. This perception shapes the behaviour, trust, belief and credibility towards media. According to Severin (2001), different psychological factors influence perceptions and they include past experience, cultural expectations, motivations, moods, needs and attitudes. Feldman (1999) also explains in this context, "Perception is the sorting out, interpretation, analysis and integration of stimuli involving our sense organs and brain" (Sadaf, 2011).

In the United State a survey conducted to analyse of media credibility, the General Social Survey data show that the rate of US citizens having hardly any trust in the press grew from a low of 14.6% in 1973 to a high of 41% in 2006. Media scholar James Carey (1995) explain that the above all, the press lost credibility and respect; it was no longer believed. As poll after poll showed, journalists have earned the distrust of the public. Some put the blame for the decline in audience trust on politicians, who rapidly slam the media (Domke, Watts, Shah, & Fan, 1999). At this point, other scholars argued that the journalistic practice and representation of public issues is to create distrust.

Another side is that audience mistrust is the product of mounting coverage of the media that results in heightened or increase audience awareness of journalistic blunders and scandals (Watts, Domke, Shah, & Fan, 1999). According to other explanations (Cappella & Jamieson, 1997), people are unbelieving or cynical about the media because the media themselves are cynical. In line with this explanation, journalists strategic or decisive framing of politics leads to political cynicism which in turn feeds back on journalists (see also D' Angelo & Lombard, 2008) (Yariv & Jonathan, 2013).

A lot of aspects of media effect is present but it leaves the impact on the audience which appears after a long duration. The credibleness and acceptability of the media system are also conserved by the media's lack of complete agreement or unbiasedness on all issues. Indeed, there is lots of unnecessary debate and dispute or conflict over various issues, as Herman and Chomsky readily acknowledge. They argue, however, that debate within the dominant media

is limited to "responsible" opinions acceptable to some segment of the elite group. This type of pattern also influences in the audience, the selection of news or adaptation of news or information also depend upon how many numbers of people adopt or consume the information in a specific manner.

Table-6: Respondent think that being connected with the media makes socially aware

Community	Yes		No		Total	
	No.	%	No.	%	No.	%
Muslim	124	62	76	38	200	51.8
Christian	104	55.9	82	44.1	186	48.2
Total	228	59.1	158	40.9	386	100
X^2 **=1.23,** df **= 1,** p **= 0.26**						

The association between both communities think that being connected with the media makes socially aware is considered to be not statistically significant ($p > 0.26$).

Above table explain that after the connect to the media, respondent feel that media makes them socially aware or not the majority of the respondents from the Muslim community i.e. 62% said that yes media makes them socially aware. While 38% of them are not aware socially through media. In the case of the Christian community, 55.9% of the respondents said that yes they are connected to media and are socially aware through it. While 44.1% of them said that they were not socially aware through media.

Bandwagon theory is also cited as a possible explanation by researchers while understanding the perception of the audience in news selection (Sundar & Nass, 2001). Chaiken (1987) argued that people use the heuristic that, if many think an opinion is valid or legal, the opinion is probably correct. The bandwagon effect is characterized by the probability of individual adoption increasing with respect to the proportion who have already done so. As more people come to believe in something, others also "hop on the bandwagon" regardless of the underlying evidence (Yariv & Jonathan, 2013). Accordingly, they could just follow the evaluations and choices made by others, thereby limiting their own cognitive selection efforts. Affiliation motives may be another reason for the bandwagon effect, even when relating to strangers (Byrne, 1961) (Yariv & Jonathan, 2013). Most people agree that news works as a catalyst for social development and awareness.

Conclusion:

Most of the respondents belong to the 1 to 5 Lakhs annual income group, according to obtained data from the survey higher income consume more media and they can be two or more media for information access. According to the data, media access depends upon the annual income, higher income group access more media than the lower income group. But there is no any data come from the survey or any other literature that income depends upon the media use. Other data collected through the survey reveal that the uses of media do not change the status of minorities. Minorities have less believed or credibility for media it can be another reason for that. According to the data obtained from the research, 46.1% of the respondent have no credibility to media. And 37.1% of the respondents are in the confusing state about whether they have credibility in the media or not. And 64.50% of the total respondents believe that they did not feel any effect in the development of their life. 35.49% of the respondents believe that they feel the effect of media on their life. Inadequate coverage of the minority's development related issues in the newspaper is another reason for the respondents less credibility on newspaper or media.

Media is the vehicle of opinion makers and plays an essential role in represents the images in society. People trust and believe whatever is being portrayed or presented in the media. Particularly, the newspaper is the main portion of decision-making and image framing in India.

Development and evaluation of residue cutter for cereal crops

Shekhar Kumar Sahu[1*], Alpna Dubey[2],Saurabh Yadav[3]

[1]Centurion University of Technology and Management, Odisha, India

[2]Birsa Agriculture University, Ranchi, Jharkhand

[3]Indian Institute of Technology Kharagpur, West Bengal

* Corresponding Author: shekhar.sahu@cutm.ac.in

ABSTRACT

Harvesting of cropthrough combine harvester causes inappropriate disposal of residues of cereal crops which laid on the field. Burning of residue turned into a cause of pollution and wastage of fuel that can be produced from it. Residue recovery from the field may add a profit in farmer's income. On the other hand, burying the residue under the soil at the time of plowing improves soil health. However, the huge amount of residue also creates difficulty in tillage and sowing operations. A small-scale residue cutter was developed to retrieve the residue from the field. It was equipped with two knives which were kept 180° apart and mounted on a hub. Itrotates abouta vertical axis at a high-speed and was powered by a vertical head gasoline engine of 1 kW. The diameter of rotor was 230 mm and was tested on a paddy straw at 2586 rpm (31.15 m/s) and 0.86 km/h forward speed. Excellently, its cutting efficiency was reported more than 99% at power and fuel consumption of 0.40 kW and 0.23 l/h, respectively. It consumes 45 man-hours to cut the residues of one-hectare land.

Keywords: Residue cutting,Cutting efficiency, Power consumption, Fuel consumption.

Introduction

Leftovers of crop residue on the field after harvesting create adverse environmental effects. In India, cereal crops like rice, wheat, and barley are majorly grown. Rice production significantly contributes tothe economy of India. More than 20 states across the nation

produce it as a major cropover 43.3 million hectares of agricultural land strength India leads in rice production across the world and ranked second after China, sharing for 20% of all world rice production(Anonymous, 2020b). Rice is India's pre-eminent crop and is the staple food of the populationthroughout the country. The overall production of rice is 172.58 million tons in 2018 in an area of 44.5 million hectares(Anonymous, 2020a). In India, West Bengal is the third largest rice-producing state followed by Utter Pradesh and Andhra Pradesh, respectively. In West Bengal, rice is grown in a large area in more than 5 Mha of land, which is almost 50% ofagricultural land of the state, and is grown in Utter Pradesh in an area of more than 59 Mha (Anonymous, 2017 and Anonymous, 2020a). This makes India hold first position in the world in rice cultivation considering the largest area, as it is one of the principal food crops. It is, in fact, the dominant crop of the country.

Rice is mostlycultivated in rain-fed areas under heavy annual rainfall. Different cultivation practices are adopted for producing rice based on the type of region. But in India, the traditional methods are still in use for harvesting rice, especially by the marginal and small farmers.

Crop harvesting producesa large volume of residues both on and off-farm. It is estimated by the Ministry of New and Renewable Energy, India that this country generates nearly 500 Mt of crop residues annually (Agarwal et al. 2016). Its production is highest in Uttar Pradesh (60 Mt), followed by Punjab (51 Mt) and Maharashtra (46 Mt)(Anonymous, 2014).From the available estimates,it was reported bythe Directorate of Economics & Statistics, MOA, DAC, New Delhi that India produced about 93.51, 105.24, 22.26, 16.03, 341.20, 7.79, 18.34 and 30.94 million tons (Mt) of crop, respectively, for wheat, rice, maize millets (Jawar, bajra, ragi and small millet), sugarcane, fiber crops (jute, mesta, cotton), pulses and oilseeds. Among different crops, cereals generate maximum residues (352 Mt), followed by fibers (66 Mt), oilseeds (29 Mt), pulses (13 Mt), and sugarcane (12 Mt). Cereal crops (rice, wheat, maize,

millets) contribute 70%, while rice crop only shares 34% to the crop residues. Sugarcane residues involvingleaves and top produce 12 Mt, i.e., 2% of the crop residues in India(Anonymous 2014).

Among various crops produced, rice, wheat, and sugarcane are inclined toresidue burning. Since these crops are preferably produced by Indian farmers because of generating a higher economic return, as compared to other crops. Crop residues are mostly used for feedinglivestock, soil mulching, bio-fuel and energy production, bio-fertilizer, rural homes raw material, mushroom cultivation, domestic and industrial use, etc. Nevertheless, anenormousfraction of crop residue is burnt 'on-farm' predominantly before sowing the next crop. The problem of burning crop residues 'on-farm' is escalating in recent years due to labor shortage, high-cost input in the recovery of crop residue from the field while harvesting of crops is mechanized. As per available estimates, crop residues burning is leading in four states, specifically, Haryana, Punjab, Uttar Pradesh, and West Bengal(Anonymous, 2014 and Jain et al., 2014).

To recover the straw from the field a machine was developed which can cut the straw at very low or no ground clearance. A study carried out by O'dogherty(1991)was undertaken of the principle of engaging static elements to support stems for the duration of cutting, using a comparatively high clearance (about 5 mm) by rotating knives. The objective of research was to examine whether cutting speeds could be reduced under 80 to 90 m/s significantly used in exercise. Equipment was fabricated which employed a piezoelectric force transducer for measuring specific force and energy while cutting a single stem at speeds up to 45 m/s. To study the kinematics of stem cutting high-speed tine photography was used. The modification was carried out on the effect of cutting speed, blade arrangement, clearance between static and moving elements, blade sharpness and blade rake angle. Additionally,restraining the tops of stems, cutting of whole plants of ahill and stem inclination were focused during study. It

was reported that at a critical cutting speed of 15 to 30 m/s, less than this range cutting became progressively more inefficient while accounting specific cutting energy. However, low energy consumption was reported with low cutting efficiency at 5 to l0 m/s which is relatively lower than the previous range. It was also reported that the shear of stem using double blade arrangement was responsible formost effective cutting efficiency. Although, the effect of blade clearance was non-significant while varied within 2 to 5 mm. It was concluded that the sharp blades consumed about l/3rdof specific energy and half the specific peak force of blunt blades.

Considering above arguments based on straw use and its effect on environment while improper disposal a straw harvesting machine was developed and following objectives were adopted for the study.

1. To develop a field prototype rotary blade cutter for harvesting the paddy crop residue
2. To test the developed prototype in actual field conditions.

Materials and Methods

Development of residue cutter

The residue cutter comprised blades, belt-pulley transmission, ground wheels, prime mover associated frame and handle. The blades were made of harden steel of 115×50×5 mm flat bar and sharped. Such tow blades were welded on hub and keyed with a vertical shaft attached to engine shaft through belt-pulley. The shaft was supported on bearings and mounted on frame and the engine was also mounted on a frame. Two iron wheels of 30 cm diameter and 3 cm wide were fabricated and mounted on two sides of the frame as given in schematic diagram Figure 1. A small wheel of 12 cm diameter was prepared and attached at the rear end of the machine. It works as supporting wheel and its height from the frame can be adjusted. Increasing and decreasing the height leads to decrease and increase in the gap

between plane of cutting blade and ground and thus the stubble height. The handle is fixed with the rear frame so that the machine can be pushed manually.

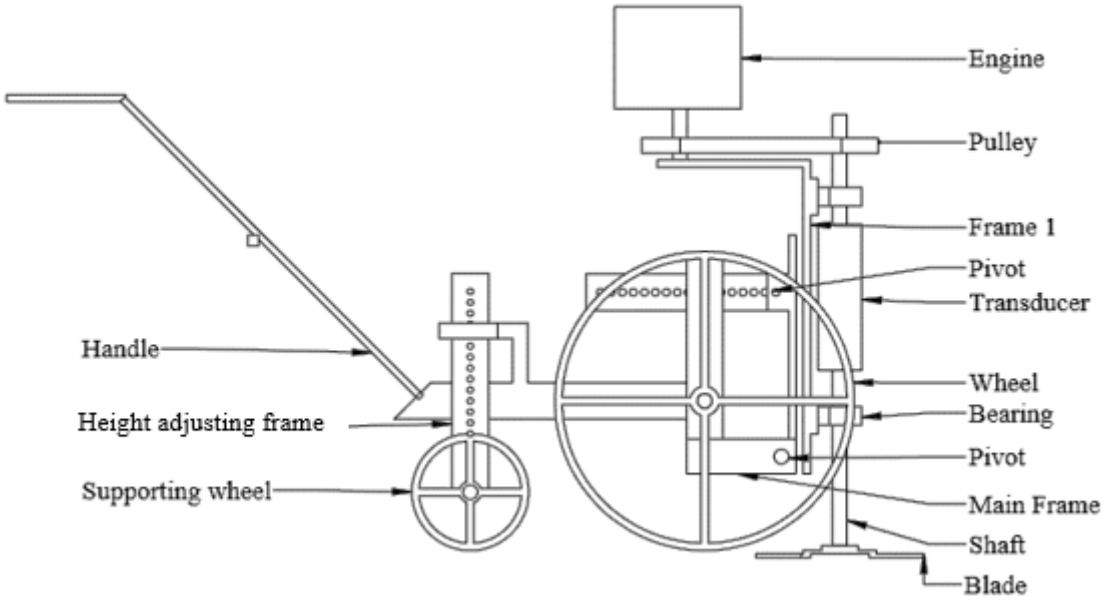

Figure 1. Schematic view of residue cutter

Preparation of experimental plot

Paddy crop variety IR-36 was grown in the Research field (size: 20×20 m) of Indian Institute of Technology Kharagpur and general cultivation practices were adopted. The spacing between row and plant were maintained as 25×15 cm while seedling transplanting. At the time of harvesting stage i.e. 90 DAT (Days after Transplanting), the crop was cut manually at nearly 60 cm height from where the grain bearing portion begins. The cut portion was removed and the remaining straw was left on the ground in standing posture. This straw was cut during testing of machine.

Before cutting the straw, physical properties of paddy crop like number of tillers per hill, diameter and wall thickness of plant stem, and straw moisture content were measured.

Measurement of physical properties of crop

The number of tillers per hill was counted for 30 different hills selected from the experimental plot. From each hill, a single tiller was cut from the base leaving 5 mm stubble height on the ground and its diameter and wall thickness were measured using vernier-calliper at cut portion. Because the cutting height of straw is expected to near this height. The plants were brought into laboratory for measuring the moisture content.

Working of residue cutter

The residue cutter was set in corner and aligned with the residue row of the plot. The engine was put on and allowed to run idle for two minutes so that it can attain uniform speed. The cutting blade rotates on vertical axis at high speed and cuts the residue once strikes with stem when pushed forward manually. The residues spread over the field after cutting and leave almost 5 mm straw on the ground. The blade sharpness, strength, engine speed and torque are designed to cut the soil also.

Torque and speed acquisition system

During cutting the residue, blade rotational speed and torque acting on it and forward speed of machine were measured. A data acquisition system was developed which consists of torque transducer (Model: HBM T22) and a data logger (Mx840A) and interfacing software CATMAN Easy version 4.2 a 12 volt DC battery and a laptop. The torque transducer was attached between the shaft of cutting blade and engine. A 12 volt DC battery was used to provide input power supply to torque transducer. Its output was connected with the channel 1 and 6 data logger which gives outputs of torque and speed, respectively. The output cable of data logger was connected with the laptop through a lane wire cable so that output can be displayed and recorded in a hard drive.

The torque was recorded during and idle (no load) and cutting (load) and plotted against time as shown in Figure 3. It is depicted from the figure that torque waves at no load vary between 0.152 to 0.576 Nm for idle run of five seconds. The average torque at no load was calculated

as 0.350 Nm. The fluctuation of torque waves was found to be increased gradually as its bladed strikes with the plants of a hill. At loading condition, travel of five seconds was recorded and the plants cut at this time.

Initially, before cutting the residue, the cutting blade wasrun idle. The idle torque and speed were measured and recorded. As soon as the machine moves forward its blade cuts the straw as well as soil in some proportion. Thesestraw and soil cutting resistances were experienced by the torque transducer and recorded on the hard drive of laptop. At the same time, rotational speed of blade was also measured. The power required for cutting the straw was calculated by multiplying the speed and torque. A stopwatch used for measuring the time taken to travel the distance between first and last plant of the row and forward speed of machine was calculated by dividing this distance with the time.

Figure 2. Photograph of residue cutter

Results and Discussion

The machine was tested in prepared field and its working view is shown in photograph in Figure 2. Cutting efficiency was calculated by taking the ratio of number of plant straw available on the hill after and before cutting. After cutting the straw, height of straw remains

on the ground was also measured. The effective field capacity was determined by recording the time taken to cut the residue of experimental field of 0.04 ha area. The fuel consumption was measured by top-up method and cost of operation was also estimated.

The torque was measured as discussed in no-load and loading condition and plotted against time as shown in Figure 3.It is depicted from the Figure that the torque required for cutting the paddy crop was cyclic and make waves about 1.5 Nm. Initially, these waves gradually increase, reach to peak and then decrease during cutting the plants of a hill. This could be because the number of tillers or density were less at the beginning increases towards center and then decreases again. However, the torque at no load condition was reported near 0.35 Nm. Linear regression was fitted to individual curve. Regression equations y = 0.0009x + 1.4869 and y = 0.0019x + 0.3456 are obtained respectively for load and no-load conditions.

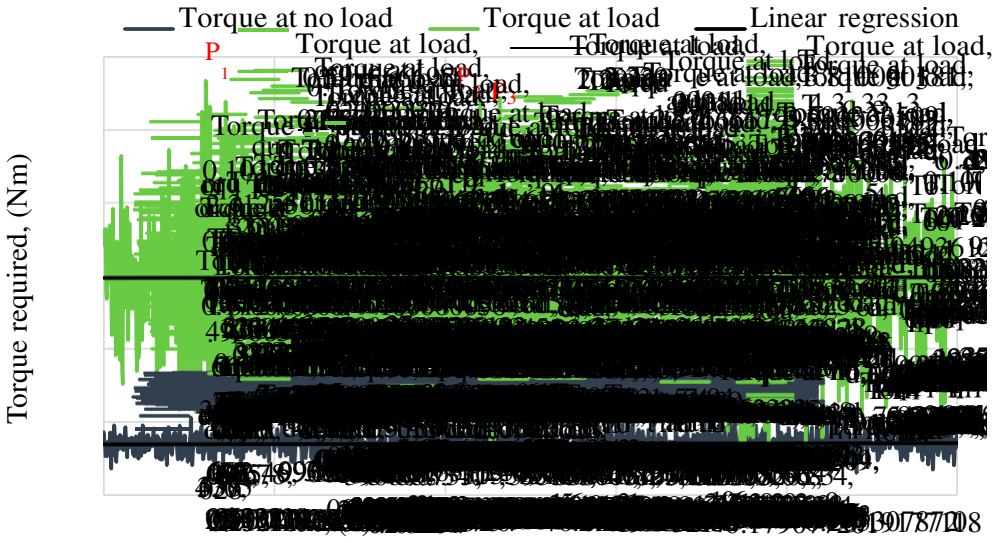

Figure 3. Torque required by cutting blade at no-load and load conditions against time

It is shown in Figure that peak of torque waves was unusually high at some points i.e. point 'P_1'. It reflects that the cutter blade interacted with the soil also and made a shallow cut of few millimeters.

The values of torque and speed were multiplied for calculating the power consumption for cutting the residues. The power consumption was also plotted against time as shown in

Figure. 4. It can be interpreted from the Figurethat the power consumption follows cyclic nature as near as formed by torque. The average torque at no-load and load was observed as 0.10 and 0.40 kW, respectively.

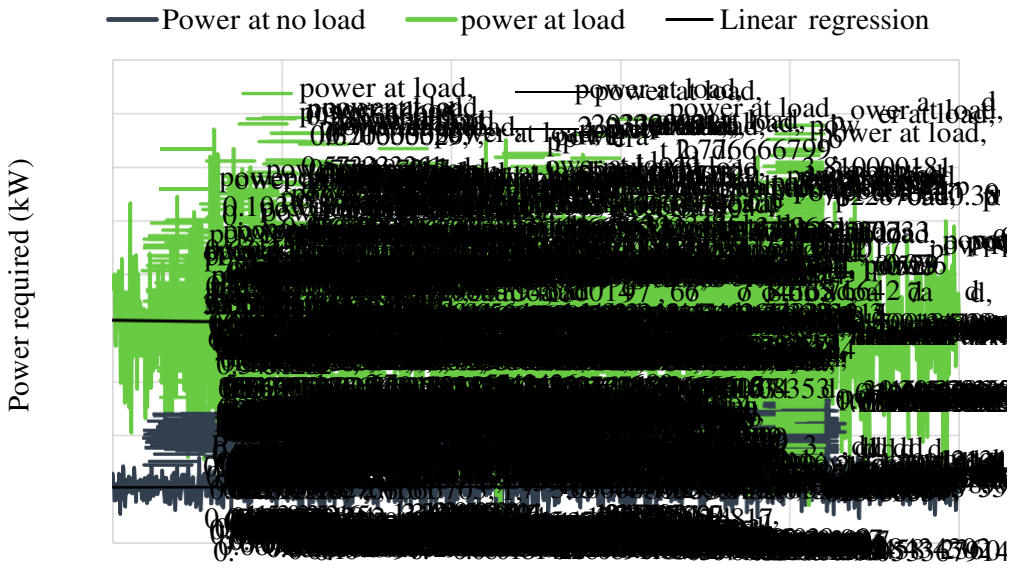

Figure 4. Power required by the cutting blade at no-load and load conditions

At the time of cutting, the rotor rotates in a plane 10°inclined to horizontal. A typical curve is shownin Figure. 5 which represents the torque required for cutting the soil along with paddy plants of a single hill. It isdepicted from the figure that the torque was low at point A which reflects the beginning of soil cutting or starting of blade penetration. The torque increases gradually could be due to more penetration of blade in soil and due to more contact of blade with the soil which leads to more cutting and frictional resistance and thus the torque. It reaches a peak at point B and thereafter started to decrease. Probably due to the reason that the blade starts exiting gradually and completely comes out at point C where the soil cutting ends. This behaviouris in good agreement with the findings of Sahu and Tiwari, (2018) and Marenya (2010).

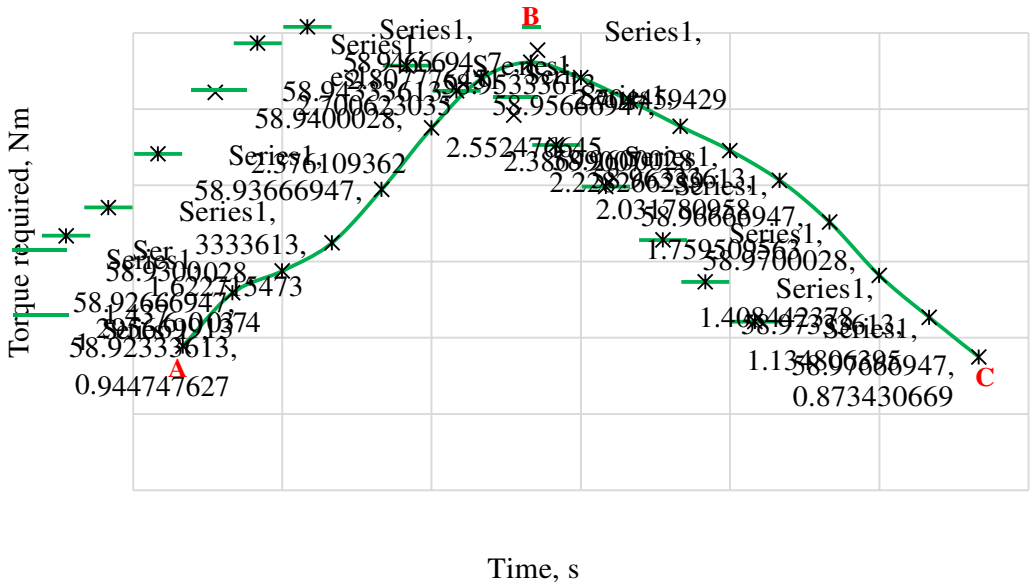

Figure 5. Torque variation during cutting of plants of a single hill

Conclusions

The small-scale straw cutter was developed to retrieve the cereal crop residue from the field. It was tested in paddy field. The average number of tillers per hill, diameter and wall thickness of straw and moisture content for 30 samples are 22, 5.89, 1.04 and 37.48%, respectively. The average height of straw remains on the ground after cutting was about 8 mmand sometimes the blade penetrates the soil which leaves no straw. The average cutting efficiency was measured as 99.95% at an average blade speed of 2586 rpm (31.14m/s) and forward speed of machine of 0.86 km/h. At these conditions, the average torque and power consumption were reported as 1.49 and 0.40 kW, respectively. The effective field capacity and fuel consumption were measured as 0.022 ha/h and 0.23 l/h, respectively. The cost of operation was estimated as 3464 ₹/ha.

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Exploring implementation of bioinformatics computational spectrum by high performance reconfigurable fpga based accelerators

Jayakishan Meher

Centurion University of Technology and Management, Odisha, India
jk_meher@yahoo.co.in

Abstract

Recently an exponential progress of biological datasets generated due to genome projects has been observed. Bioinformatics computational spectrum has made substantial efforts in genomics research to drive biological discovery. Advanced computational methods are indispensible for analysis of high dimensional biological datasets. The speed of computation of such large-scale data requires hardware accelerators in Biocomputing applications. The execution of such problems can be accelerated by either designing efficient algorithmic or using high performance computing architectures. Out of several hardware configurations like Graphics Processing Unit (GPU), ASIC, FPGA and multi-core processors, FPGAs have emerged as improved reprogrammability computing accelerators that can implement huge parallelized section of computational algorithms. Several Biocomputing applications with huge data are being implemented in FPGA reconfigurable computing platforms, In this paper, we present a survey of real-time implementation of hardware accelerators for Biocomputing applications.

Keywords: *Digital signal processing, FPGA, reconfigurable, ASIC, SoC, Bioinformatics, parallel processing.*

1. Introduction

Bioinformatics plays significant roles in biomedical applications. The analysis of genomic data helps in determination of disease prediction and pharmacogenomics. Bioinformatics emphases on data mining and its applications (Liang et al., 2019). Recently an exponential progress of biological datasets generated due to genome projects has been observed. Bioinformatics computational spectrum has made considerable devotion in genomics research to drive biological discovery [2].

The software used for data processing of biocomputing applications is very slow because they run in operating systems environment. Signal processing and computational intelligence methods are increasingly used in bioinformatics research [3]. Digital signal processing methods are faster to analyse these data. In the present trend, architecture implementation of DSP is extended from telecommunication systems, image processing, video processing applications, multimedia systems and computer networks to implementation of complex mathematical procedures for Bioinformatics data analysis.

Though use of reprogrammable microprocessors has its own importance; hardware implementation of computational algorithms is essential. Developments in integrated circuits have provided high-speed digital ICs

available in ASICs, FPGAs and SoC to implement the computational algorithms in hardware [4]. Hence it is encouraging to solve Biocomputing problems by designing advanced algorithm or implementing in efficient architectures. FPGA has appeared as improved reprogrammability hardware accelerators that can implement huge parallelized section of computational algorithms [5]. In this paper, we present a review of real time implementation of hardware accelerators for Biocomputing applications.

2. Bioinformatics Computational Spectrum

Bioinformatics deals with many computational tools and resources to handle life sciences datasets by transformed to a quantitative information rich society. It consists of large-scale heterogeneous data of biomacromolecules such as DNA and aminoacid sequence, protein multidimensional structures, gene expression data and uncovers the hidden information and pattern [6]. Fortunately, the DNA and Protein sequences are digital in nature. These sequences can be represented in numerical sequence by substituting nucleotide sequence and amino acid sequences by their physicochemical properties. Now these numerical sequences can be analyzed by computational algorithms.

The several computational problems in Bioinformatics are gene prediction, sequence comparison, protein structure prediction, microarray data analysis, drug discovery and design, drug toxicity prediction, molecular modelling, molecular docking, molecular dynamics, motif prediction, metal binding prediction, transmembrane protein analysis etc [7]. Further the protein molecules are available in structural form. These data can be analyzed by many graphical tools and visualization tools. The various computational methods used in bioinformatics data analysis are DSP tools such as FFT, digital filter, wavelet transform, statistical methods such as linear discriminant analysis, factor analysis, PCA, computational intelligence algorithms like machine learning, particle swarm optimization, genetic algorithms, support vector machine, image processing etc [8].

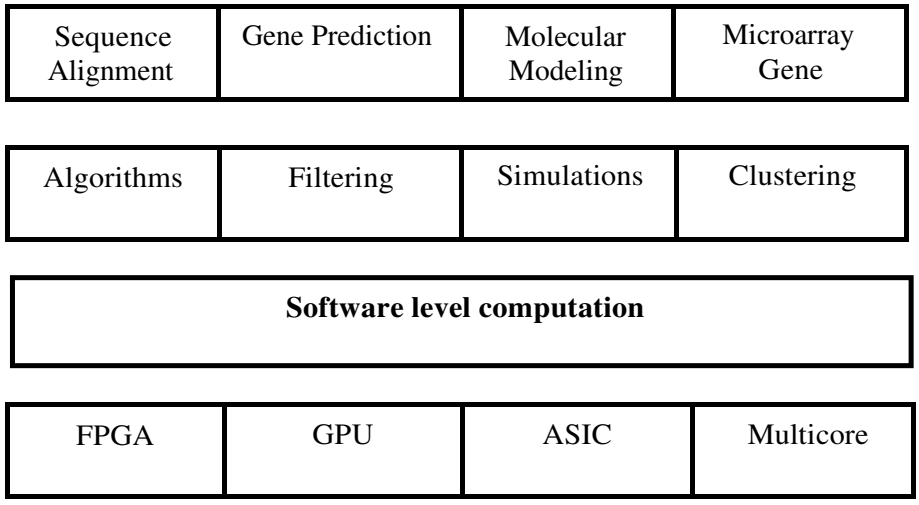

Figure 1. Computational Spectrum of bioinformatics algorithms

Developments in ICs have resulted in high-performance and high-speed digital circuit available in ASICs, FPGAs and SoC to implement the computational algorithms in s hardware [9]. All these methods are subjected to use in bioinformatics problems and need to be implemented in FPGA reconfigurable architecture. The computational spectrum of Bioinformatics is shown in figure 1.

3. FPGA-based reconfigurable architecture for Bioinformatics

Many bioinformatics applications are explored to get benefits of high-performance reconfigurable computing platforms. The rapid growth of Bioinformatics databases has created a challenge of processing speed for traditional processor. The analysis of these data with the help of computer software degrades the processing speed because they are running in operating system environment. Hence the operations can be accelerated utilizing the computing architectures. Such computing architectures include superscalar processors, parallel and pipelined processing architecture systems and implementations of algorithms in hardware. Advances in integrated circuits have provided digital circuitries such as FPGAs, ASICs and SoC that enable us for implementing complex algorithms in hardware and perform high-speed operation [4].

Such huge computation can be addressed by reconfiguring huge parallelized accelerator to attain improved performance. The high-density data-rich biomedical problems are formulated by computational techniques and its efficient algorithm is implemented in real time hardware architecture. But the most widely used hardware reprogrammable platform is the FPGA. FPGA has emerged as a high-performance computing accelerator that is capable of implementing massively computational algorithms [5]. The reprogramability feature of FPGA allows much algorithm-specific computing architecture to be implemented using the same hardware resource. This setup provides the developer flexibility in design before going to actual implementation. Several Biocomputing applications such as algorithms on sequence comparison, multiple sequence alignment, gene predictions etc mapped in FPGA are presented here.

3.1 Sequence comparison algorithms

Various algorithms relating to alignment of sequence are being accelerated in FPGA. Fernandez and co-authors implemented a design for straight comparison of a running sequence as reference and a fixed sequence of short read [10]. The Aho-Corasick algorithm [11] and hash table [12] have been adopted in FPGA aligners. The implementing the BLAST algorithm on FPGA architecture has been an innovative work in mapping bioinformatics tools on FPGAs [13-16]. Significant work contributed by Muriki et al. [17] and Herbordt et al. [18] towards development of hardware architecture were fully BLAST compliant, that the entire NCBI BLAST can be mapped on FPGAs.

3.2 Multiple sequence alignment

The homologous biomolecules of three or more sequences can be studied in multiple sequence alignment that determines molecular structure and function information. The T-Coffee and MAFFT algorithms have been implemented on FPGA producing outstanding results [19].

3.3 Gene prediction

Gene prediction is a fundamental aspect in computational molecular biology in which a segment of DNA sequence is repeatedly checked for presence of gene by framing and sliding the along the large sequence data. The decoding of information present in genome leads to gene detection problems. The research has done to design and develop and implement exclusive architectures such as Glimmer algorithm with its advancement denoted as Glimmer HMM. The Interpolated Markov Models has also been used in prediction of gene [13]. Hidden Markov model (HMM) has been integrated with Glimmer algorithm resulting in Glimmer-HMM for improvement in gene identification and designed the required core for Glimmer-HMM implementing the four HMMs of the algorithm on Virtex-5.

3.4 RNA and protein secondary structure prediction

The protein secondary structure prediction based on Predator algorithm has been presented in architecture for parallel implementation of the two initial steps of the algorithm with protein database stored in internal FPGA memory and having six parallel computing modules. The architecture was mapped on a Xilinx Virtex-5 with 30 to 50 times faster than general computer. The Zuker algorithm predicts the secondary structure of RNA sequences. A pipelined architecture in FPGA has been designed, which calculates the matrix coefficients, on a Virtex-5, with the FPGA utilization almost at 100% [20].

Similarly there are several Biocomputing algorithms implemented in FPGA based reconfigurable accelerator. K-means algorithm for clustering Microarray gene expression data has been implemented in FPGA for five k-mean cores on Xilinx Virtex4 XC4VLX25 FPGA and achieved about 51.7x speed-up in contrast to a software model with speed 206.8x [21].

Molecular Dynamics tool helps for study of properties of molecular particles and its simulation has been implemented in FPGA accelerator using C-based OpenCL and achieved over 4.6 times of speed-up compared to microprocessor-based system [22]. AutoDock tool performs molecular docking for drug identification which is implemented in FPGA-based acceleration and achieved a ×10-40 speedup over a 3.2 GHz processor [23].

5. Comparison and Result Analysis

FPGA reconfigurable architecture is a promising technology widely used in simulation and synthesis of Bioinformatics algorithms for sequence alignment, multiple sequence alignment, gene prediction, protein structure prediction etc. Several computational algorithms are being synthesized in FPGA Spartan 3E and Vertex-5 using Xilinx software. The representative algorithms implemented in FPGA based reconfigurable hardware accelerator for different Bioinformatics problems are represented in table 1.

Table 1. FPGA based Bioinformatics algorithm.

Bioinformatics Computational Spectrum	Computational Algorithms implemented in FPGA
Sequence alignment	BLAST, CAST
Multiple sequence alignment	T-Coffee, MAFFT
Phylogenetic Tree Construction	RAxML

Gene Prediction	Glimmer, GlimmerHMM, Digital filter
RNA and Protein Secondary Structure Prediction	Predator, Zuker algorithm
Clustering Microarray Data	K-means Algorithm
Molecular Dynamics	C-based OpenCL
Molecular Docking	Docking algorithm

The speedup achieved for sequence analysis for different hardware accelerators are represented in table 2.

Table 2: Speedups achieved for sequence analysis for different hardware accelerators

Sequence Alignments	**Speedup over Serial Implementation**		
	FPGA	GPU	Multicores
PSA	100	70	22000
MSA	13	7	NA
BLAST	NA	16	NA

Conclusions

It is seen that real time implementation of biocomputing applications in FPGA based high performance reconfigurable platform is the current trend of computing. In this paper we presented bioinformatics computational spectrum requires efficient hardware accelerator computing systems. A comprehensive range of bioinformatics algorithms has been shown to have improved execution times on FPGA system. We noticed that performance of FPGA is better than those of other computing systems that can address the future challenges associated with exponential growth of biological data. However, a substantial design effort remains for system level development to promote the use of FPGA among the life sciences community.

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Aerodynamic flow parameters simulation over a ahmed body using 3d experience- simulia

Sujit Mishra[1], Sri Devi G [2], Santosh Patro [3], Srinivasa Rao P[4]

[1]Centurion University of Technology and Management Odisha, India
*sujit.mishra@cutm.ac.in

Abstract

Due to the economic developments in society, enormous demand for sedan cars leads to growing competitions in the automotive sectors that undergo numerous tests to improve the fuel efficiency and performance of these cars where aerodynamics plays an avital role. The performance of sedan cars has influenced by aerodynamics due to changes in parameters such as lift and drag forces at high speed. Manufacturers are looking at computational fluid dynamics (CFD) modelling of sedan cars instead of wind tunnel testing with the advancement in computer technology to decrease the testing time as well as the cost of research & development. In the present analysis, a 3D Experience-Simulia Platform simulation has been performed using a Realizable-k-e turbulent scheme to obtain the results of various flow parameters, viz. Over a benchmark test model- 3D Ahmed body, drag force, drag coefficient, turbulent kinetic energy and wake flow structures. It has been observed that in evaluating the aerodynamic parameters, the results of the current simulations satisfy the study requirements.

Keywords: 3D Experience- Simulia, Ahmed Body, Aerodynamics, Realizable k-e model.

Introduction

Aerodynamics, when dealing with a moving object, is a branch of fluid mechanics concerned with the study of air movement. In recent years, it has played a crucial role in the automotive market. In the early stages of the 1990s, the advancement of automotive aerodynamics began with various phases of shape optimization, leading to vehicles from the small range to luxury levels. For the mid-range people not only in aesthetics and safety comforts but also for better fuel quality, the sedan category is found to be the most fiscal from this large range of vehicles. The big concerns of automotive industries in achieving improved engine performance and aerodynamic drag reduction are increased fuel costs and environmental issues. It could be done either by altering the working of the engine or by supplementing eco-friendly fuels with commonly used fuel or changing the existing nature of the vehicle. As far as engine optimization is concerned, we have all accomplished the most at the saturation stage. Eco-friendly fuels are an environment still under progress and worldwide acceptance will take a few more years. Therefore, decreasing aerodynamics drag is the simplest way to increase sedan vehicle efficiency. In this area, studies have been carried out to formulate flow phenomenon techniques over the various sedan shapes, reducing aerodynamic drag & fuel efficiency. Car models carried out studies both by wind tunnels and numerical simulations. If the air moves over the body, as we pass from the front to the rear end, distinct differences occur. In order to visualise the effect of time-average wake structures on the geometry with different configurations at the rear end, Ahmed[1] intended a simplified model. Moreover, (Le Good and Garry, [2]) reviewed the designs of various reference scaled models used in the vehicle production phase in the automotive aerodynamics market.

Ahmed, Han, Khan, et.al[3-5] conducted a series of wind tunnel experiments to investigate the pressure and wake structures predicting the difference between the centre and the rear of the vehicle. With the growth and use of CFD packages Bijlani[6] has studied and examined various car models, contrasting the aerodynamic forces acting on them with their effect on fuel consumption and vehicle stability. Some researchers [7, 8, 9] have also adopted various

turbulence schemes such as the K-epsilon model, the large eddy simulation and the detached eddy simulation for estimating drag coefficients for the vehicle body.

The present study is based on adopting the 3D experience- SIMULIA platform tool that supports fluid problems through Computational Fluid Dynamics (CFD) framework to investigate the capabilities aerodynamics features available that can be undertaken as a research tool.

Methodology

A. Geometry modelling

The Ahmed model is a simple geometric body that retains the main flow characteristics, particularly the vortex wake flow, where most of the drag is concentrated, and it is a good perfection to be used as a benchmark test. 3D model of Ahmed body consisting of inlet, outlet, nose, upper bottom, slope, back, symmetry. Variation of drag coefficient changes with rear slant angle 35^0 is numerically investigated in turbulent solver schemes designed to meet desirable simulation conditions.

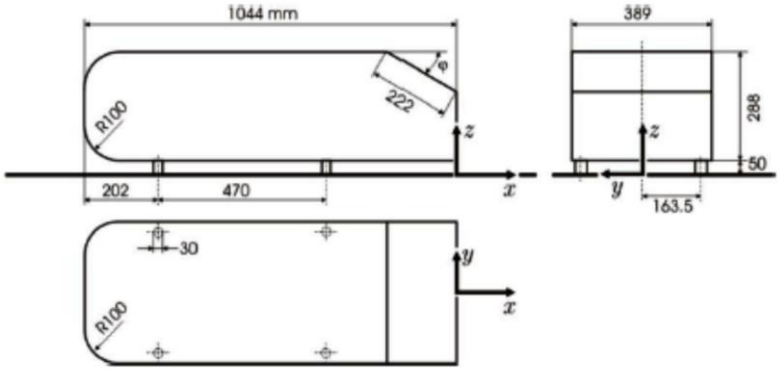

Fig 1: Geometry of Ahmed body

Numerical implementation requires the setting of the problem to be analysed by solvers. SIMULIA, where 3D modelling for transient state incompressible fluid flow in CATIA V5 has been performed, as the solver used in the current study.

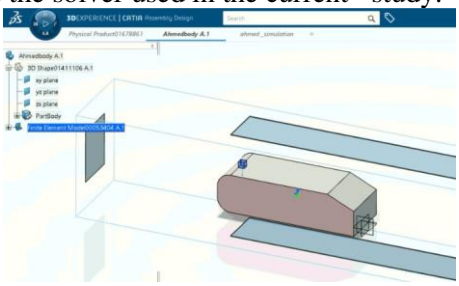

Fig 2. Ahmed Body model in 3D Experience-CATIA

The geometrical details gets presented and listed in table 1.

Length	1.044m
Height	0.288m
Front radius	0.1m
Ground clearance	0.05m
Slant angle	35°
Inlet velocity	10,20,30,40 m/s
Yaw angle	B=0°
Blockage ratio	3.8%
Cross-sectional area	A=0.112m^2
Wind tunnel domain.	10.5m length, 3.03m wide, 5.03 height

Table1. Geometrical dimensions used for the Ahmed Body

The 3D experience- SIMULIA platform uses the assistance feature to assist the carried out the simulation procedure shown in the figure 3.

Figure3. Procedure setup for simulation in 3D Experience- SIMULIA

The Physics Simulation applications divide these resources into different applications to provide the advanced analyst with more features, including complicated models and assemblies and complex loading conditions. This separation enables one part of the simulation to be controlled at a time. Each app only contains the resources that are suitable for the current context and the type of simulation you make. The background is split between:

Model: A model's physical features as they pertain to simulation. The background of the model is where you connect existing geometry and materials of the model and identify other physical characteristics that decide how the model under simulation conditions will react.

Scenario: The instructions for the simulation to be completed. The context of the scenario is where you create one or more cases of analysis. You define things such as

constraints, loads, and interactions; this is also where the simulation is generated and run, using procedures that explain how the model is applied to each function.

Results: The results of the simulation that has executed. The meaning of the outcomes is where you review and construct charts, reports, and animations of a simulation's different performance data.

B. Meshing

The 3D computational domain, which has triangular components, is discretized after physical modelling. Grid independence experiments are performed to ensure that a solution that is almost independent of the grid can be achieved. Initially, coarse mesh with approximately 1274362 grid components has generated for the car model; later on, the mesh has refined by increasing the grid components with 1318949, 1563745, 1603464 & 1806491. In order to run at the same velocity but with different mesh sizes, the same problem has developed. Fig4 depicts the mesh domain of the body of Ahmed.

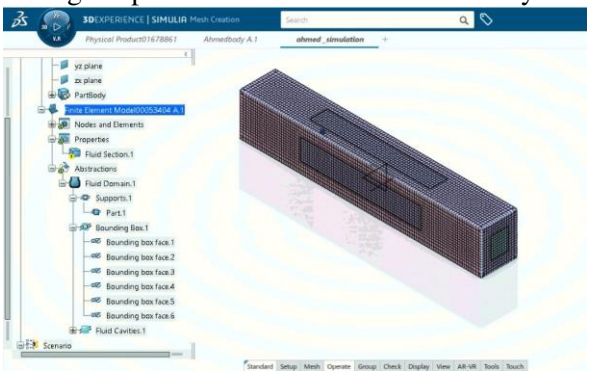

Fig.4 Meshing for Ahmed model domain

C. Boundary conditions

The state of the input boundary needed for the simulation was taken from the experimental data given by Lienhart et al[10]. The boundary conditions used to model the Ahmed body's success in various dimensions are as follows:

-Inlet-inlet velocity

-Outlet-pressure outlet of pressure (atmospheric)

-Wall condition-no condition of slip and adiabatic wall.

Results

The aerodynamics parameters such as Drag force, can be represented as follows:

$$F_D = \frac{1}{2}\rho v^2 C_D A$$

F_D = drag
ρ = density of fluid
v = speed of the object relative to the fluid
C_D = drag coefficient
A = cross sectional area

Figure 7 shows that the drag coefficient that has been calculated with the above formula provides a good agreement with that of the comparison values.

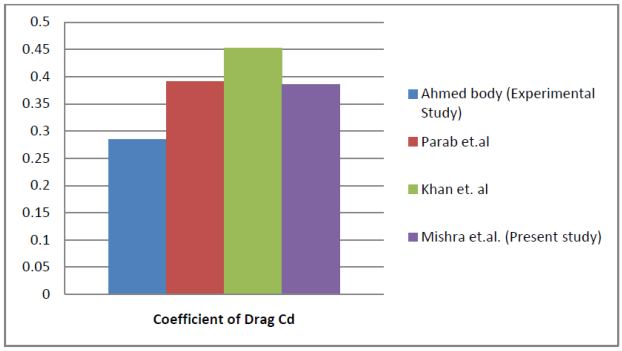

Fig 7. Comparison of Drag coefficient

The velocity, pressure contours obtained in SIMULIA output results are shown at follows:

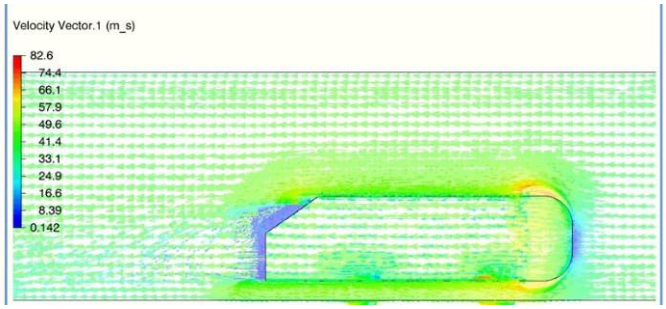

Fig.8 Velocity Profile plot at 40m/s in Ahmed Body

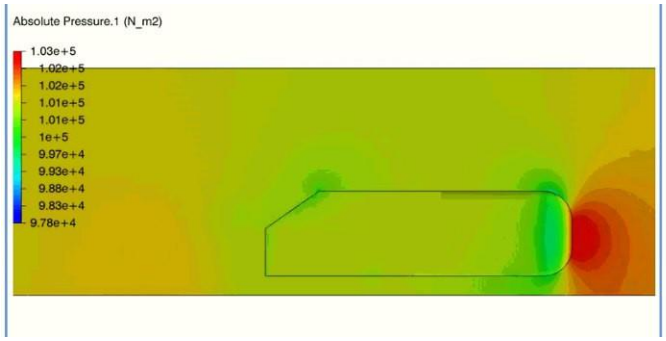

Fig 9. Pressure Couture Plot at 40m/s in Ahmed body

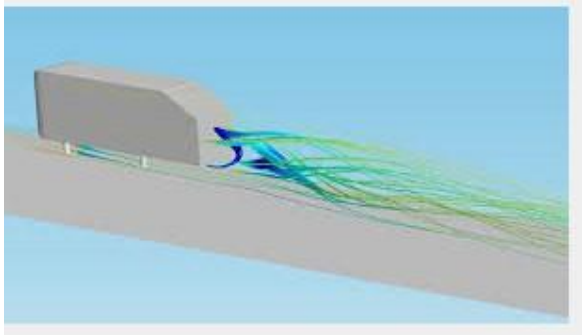

Fig 10. Streamline plot at the rear end of Ahmed body

From the above results, it is revealed that

- From Fig 10. The Ahmed model, 3D Streamline patterns are observed where the flow is detached from the eddies and vortices towards the rear part of the body.

- It is obvious from Fig. 8 & Fig.9 that at the front nose portion, the high pressure (stagnation point) works and this pressure is reduced with the increase in velocity.
- 3D Experience- SIMULIA provides an intuitive tool for simulations that can be use CFD research

Conclusion

CFD analysis was successfully performed over the Ahmed 3D Benchmark model with the Realizable k-e turbulent method. The findings in the latest 3D Experience-SIMULIA, drag coefficient simulations have been found to be in near agreement with the experimental results of the wind tunnel and can be used for CFD research.

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COVID 19 – A Viewpoint

Kakani Grihalakshmi

School of Management, Centurion University of Technology and Management, Odisha, India
Kakani.grihalakshmi@cutm.ac.in

Abstract

Pandemics are known to have occurred previously however, recent incidences of frequent outbreaks have highlighted the increasing emergence of transmission of viral diseases from animals to humans. The evolution of corona virus and possible role of animal reservoirs and vectors in the disease transmission is not completely known. The viral jump from animal reservoirs to humans is very intriguing and speculative and not well understood till date and environment can be assumed to have played a very important role. A great deal of research that is ongoing in the laboratories is still far away from giving definite answers about the causative agent and possible treatment options that can effectively control the disease. Corona virus is understood to be specific to ACE2 that are found abundantly in lung epithelial cells and enterocytes of the small intestine. Prevention and treatment options can be effectively developed only when the genetic changes that impact the degree of pathogenicity of the virus are well understood. Treatment options include use of indigenous herbal remedies or drugs for respiratory diseases.

Keywords: COVID19, Pandemic, Epidemiology, Infectious, Transmission

Introduction

The pandemic Corona Virus Disease (COVID 19) that is currently sweeping the world is unprecedented and is shrouded in mystery in several aspects – origin, mode of transmission from animals to humans, pathogenicity, and the most intriguing of all is how to control it. World has witnessed some of the deadly epidemics in the recent past – Ebola, Severe Acute Respiratory Syndrome (SARS), and Middle East Respiratory Syndrome (MERS), all of these however have been less disruptive and less fatal in that they were confined to specific regions with low mortality and morbidity rates when compared to COVID19.

A great deal of research that is ongoing in the laboratories is still far away from giving definite answers about the causative agent and possible treatment options that can effectively control the disease. The measures that are employed to halt the infectious transmission are based upon some of the known methods, such as previous experiences with Spanish Flu of 1918 and treatment strategies have been those that are typically followed for treating respiratory diseases.

Despite several approaches being engaged, there are significant gaps in understanding the epidemiology of the virus, disease transmission rate, variable disease symptoms in the populations, and developing efficient and effective mitigating strategies.

Significance of the Pandemic

A pandemic is defined as “an epidemic occurring over a very wide area, crossing international boundaries, and usually affecting a large number of people” [4]. Pandemics are known to have occurred previously however, recent incidences of frequent outbreaks has highlighted the increasing emergence of transmission of viral diseases from animals to humans and is commonly referred to as zoonosis. Global outbreaks are known to cause

significant fatalities and most often affect the populations disproportionately both within and across the regions and communities [2] and the differential response is not well understood however, factors such as genetic variability in populations especially with respect to the immune response, rate of mutations in the disease causing agent, environmental factors and dietary habits are thought to play a critical role. In addition, a global outbreak has a devastating impact on the economy in the long term disrupting the institutions and potentially disturbing the social fabric of the society.

COVID 19 Origins and Symptoms

The 2019 Novel (referred to as Novel to indicate that the virus was previously not known to cause disease in humans) Coronavirus is known to have originated in "wet Wuhan, Hubei province, China. Cases reported in China exhibited symptoms similar to that of pneumonia and further gene sequencing of the isolated organism from the patients revealed the causal agent to be CoV19[8]. New cases were reported in other parts of the world – Japan, Korea, Singapore, Thailand, and USA and it also emerged that health care workers attending to patients became infected indicating human-to-human transmission thus establishing infectious nature of the disease [8].

It is hypothesized that the virus jumped from bats (asymptomatic carriers and considered as reservoirs) to an intermediate vector (pangolins, not definitely established) undergoing mutations in the process thus enabling it to infect humans. Several other investigators have also reported that the viral strain isolated in China was different from that of the strain identified in patients elsewhere (in other countries) indicating that the causal agent is undergoing mutations at a very rapid rate. The clinical symptoms vary from common cold, dry cough and fever initially to pneumonia affecting the lungs manifesting sometimes in the throat or in the head or in the intestine with some cases reporting diarrhea [7]. Incubation time (time of infection to onset of symptoms) is supposed to be about 15 days wherein the disease may have already aggravated leading to death in certain cases.

Pandemic – Causative Factors

The immediate known primary factor responsible for the current outbreak is thought to be human encroachment into wild habitats and the ability of the virus to transmit to humans. What factors have contributed to the jump? The viral jump from animal reservoirs to humans is very intriguing and speculative and not well understood till date and environment can be assumed to have played a very important role. The natural environment is constantly changing and the changes are either caused by human activity or induced naturally. Increased industrial and economic activity has had serious implications on air, soil, land and water (climate) and changes in the climate alter the living and non-living systems. Majority of these alterations are known to have negative impact on human populations especially in aspects of infectious diseases [5].

Changed environmental conditions also impact the microbial biological and ecological systems by way of mutations. These sudden heritable changes equip the microorganisms to better adapt and may confer virulent properties consequently increasing the risk of transmission to different hosts. Increased virulence in pathogens with concomitant decreased immune resistance in humans (attributed to several factors such as changed lifestyle, dietary habits – more of animal based food consumption especially wild animals in certain regions and communities, lack of sanitation, poor hygienic practices, and poor health care systems) provides for favorable conditions for frequent incidences of infectious diseases.

Climate is also known to influence the abundance, presence or absence of vector/s in certain geographical regions, and ability to transmit disease. An importance consequence of global warming is loss of biodiversity that has resulted in twin disadvantages – natural predators that keep up the ecological balance are lost providing for increased abundance of harmful organisms and valuable plant species that are repositories of natural compounds used for

therapeutic purposes are being lost. This also led to emergence of new pathogens commonly referred to as opportunistic pathogens (a previously less virulent organism gaining selective advantage due to changed climatic conditions and turning into a potent disease causing agent).

Structure of the Causative Agent

COVID 19 is a positive single-stranded Ribonucleic Acid (RNA) virus belonging to a large family of enveloped RNA viruses (Figure 1) that are more often implicated in causing respiratory, enteric, hepatic, and neural infectious diseases in humans and animals [3]. The virus particle has an envelope glycoprotein E, a spike protein S, which aids in twin purposes - attachment of the viral particle to the host cell (Angiotensin Converting Enzyme -2, ACE-2), membrane protein (M) and the nucleocapsid protein (N) and transmission of genetic material between the species**.**

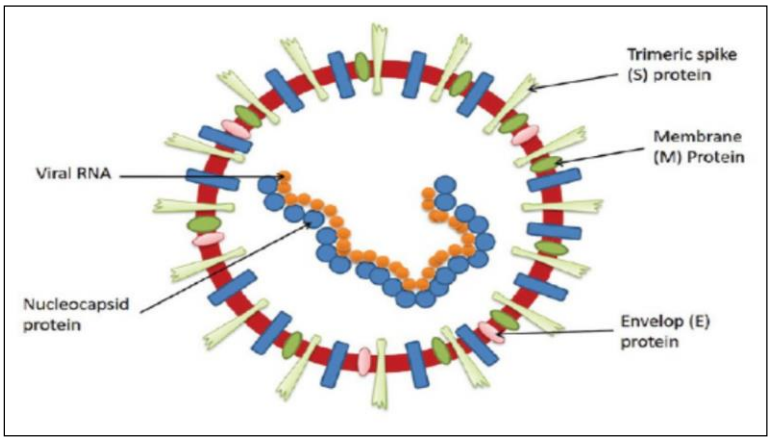

Figure 1. **Structure of Coronavirus**

Life Cycle of the Virus

Viruses unlike other microbes such as bacteria and fungi are void of innate molecular machinery that is required for replication, hence are in need of other organisms for survival. Basic viral structure as indicated above is a genome (RNA or Deoxyribose Nucleic Acid, DNA) enveloped in a protein coat typically referred to as capsid. Proteins and phospholipids constitute the capsid which interacts with specific host proteins (receptors ACE2) by a phenomenon known as endocytosis. Corona virus is understood to be specific to ACE2 that are found abundantly in lung epithelial cells and enterocytes of the small intestine [6].

Upon entry into the host, the genome enveloped within the capsid is released (uncoating) and transported to the nucleus (host) where transcription occurs utilizing cellular polymerases. Viral RNA transcripts (mRNA) are transported to cytoplasm where viral proteins are produced by translation. Replicated genome along with proteins are assembled in the cytoplasm and released from the host by budding (Figure 2). The released viral particles mature and infect surrounding cells resulting in exponential growth.

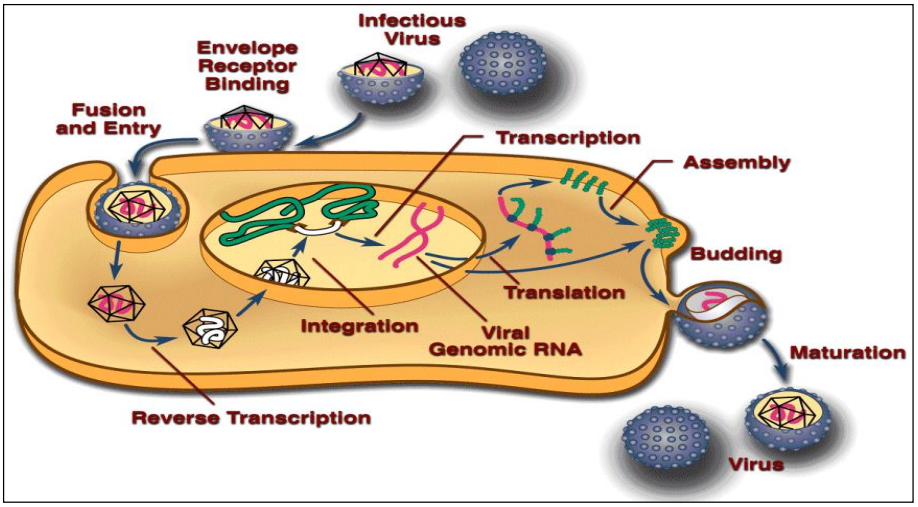

***Figure 2*. Viral Replication inside the Host Cell**

Epidemiology

The persistence of the virus and its spread in the population depends on several factors – number of infected persons, transmission of the disease and the range of symptoms exhibited which can be anywhere between being asymptomatic to symptomatic, mild to severe requiring hospitalization and to being critical. The ability to transmit the disease and the characteristics of the infectors – age, severity of the infection play a vital role in transmitting the disease to others. It also becomes essential to identify the risk factors associated with severe illnesses and specific groups that are most affected so as to focus on the prevention and cure alternatives.

Understanding the transmissibility is crucial in modeling and predicting the path of the pandemic and it is very essential to estimate the reproductive number (R0 – a measure to know the transmission potential of a disease). It becomes crucial to have robust surveillance systems for collecting data to identify populations for the respiratory syndrome and for testing these groups for corona virus. The incidence of the infection when multiplied with the percent population testing positive in a given area will give an estimate of the number of infectors that are capable of transmitting the disease. All of the disease parameters can be understood only when data is collected from hospitals, towns, villages which needs to be sorted, calculated and studied to make meaningful conclusions and this needs collaborative efforts between workers engaged in various departments – public health experts, microbiologists, and medical experts [1] .

Prevention and treatment options can be developed only when the genetic changes that impact the degree of pathogenicity of the virus are well understood and correlated with clinical manifestations and this requires a thorough understanding of the structural and genetic variations of the virus, susceptibility of the populations, and epidemiological data which are not yet concretely available for drawing realistic conclusions about the infectious nature of the disease.

Preventive and Control Measures

The evolution of corona virus and possible role of animal reservoirs and vectors in the disease transmission is not completely known and the only possible cause of the disease outbreak is thought to be the close proximity of humans with the wild animals. The immediate need of the hour is to arrest the spread of the disease and this can be achieved in the following ways:

- Follow personal hygienic practices such as frequent hand washing, use of clean water and clean clothes
- Consumption of nutritive food rich in fruits and vegetables, pulses, and spices to boost the immunity and resistance to the disease
- Avoid places of gatherings as the disease is known to spread rapidly in crowds
- Get lot of fresh air and ventilation and exercise frequently and rigorously
- Keep social distance and wear masks especially when travelling outside
- Treatment options include use of indigenous herbal remedies or drugs for respiratory diseases
- If diagnosed positive with mild symptoms, be self restricted at home and avoid hospitalization
- Get plenty of rest

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Analysis of Aerodynamic Car in CFD

MUKUNDJEE PANDEY*
*Mechanical Engineering Department
Centurion University of Technology and Management, Odisha, India
*For correspondence: E-mail: mukundjee.pandey@cutm.ac.in
AKASH KUMAR RANSINGH[1], ANUSWAR SATPATHY[2], ITISHREE PANDA[3]
[1,2,3]M.Sc. MATHEMATICS
Centurion University of Technology and Management, Odisha,
India

ABSTRACT:

The aerodynamics behaviour of a car basically consists of two forces that is drag and lift forces which are the neediest thing for the safety, consumption of fuel, consistency for a car. Previously there are many articles published in the aerodynamics field for vehicle for the purpose of optimizing the configuration of the vehicle to decrease the consumption of fuel and to optimize the aerodynamic performance by discouraging the two forces (Drag and Lift forces). Now a days, there are many researchers who are keep going on this field. Here the purpose of this article is to reduce the aerodynamic behaviour (Drag and Lift forces) by analysing the flow field around the car. In this paper there is a comparison of result obtained from CFD analysis of the model that exist. This paper is also intending to simulate the model and compare the results. This analysis is done by using 3D EXPERIENCE software by importing the model from grab card and giving the velocity from 80 km/h to 500 km/h in each interval of 10 km/h.

KEY WORDS: AERODYNAMIC, 3D EXPERIENCE, DRAG FORCE, LIFT FORCE.

INTRODUCTION:

For the transportation purpose, the wheeled-motor vehicle car came into global in 20^{th} century and it is kept on developing itself day by day(gradually) for the betterment of beings and economics.

Car deals with its own aerodynamical physics that is when a car travels, the fluid i.e., air around the car imposes pressure above it, which creates the viscous effect in the fluid which is observed in a thin layer, which is called as boundary layer too. When car moves, the air also moves around it and get separated while reaching the rear end of the car. The viscous property of the fluid governs the motion of the fluid which is dependent upon Reynolds number, where Reynolds number is depending upon length, viscosity, velocity of the car.[1][2]

T.D. IPILAKYAA et al. describes the use of spoiler and experimentally show us by comparing the results of two car model, one having spoiler and the other don't have the spoiler. He also concluded that the car model having spoiler in rear gave less drag or lift. Spoiler are used to rise the grip of car on road. Only the weight of car forces the tire down onto the road. It actually gives more down force not more power. It works like airplane wings and generate down force on the body of car. It is also helpful in reducing the drag and lift by which we get the car having less fuel efficiency, better speed.It is attached on the real side of vehicle at different angles from -5° to 5°.[3][4]

SAUD HASSAN describes about the designing of rear back light angle and it affects the drag force, lift force. He took an Ahmad body with different back light angles and compared the results. He concluded that if we will increase the backlight angle, the drag force will reduce but the lift force is not affecting so much.[5]

Racing cars are always at high speed as compare to normal cars. So, the designing of racing car is different from normal cars. The racing cars focus to increase the down force and

normal cars focus to reduce drag. The lowest coefficient of drag should be ~ 0.16 for a right car.[6]

Subhasis Sarkar et al. have described different procedures for reducing the drag like bumps are used on rear cabin of truck, using of lights on roof of emergency vehicles.[7]

Jason Moffat has simulated a BMW Z4 car 3 times and compared which is the best result. He has chosen the appropriate model by taking drag lift ratio.[8]

Aerodynamic design takes a vital role for making of vehicles. The carswhich are designed aerodynamically may provide better facilities like firmness, low fuel consumption rate, better speed. The vortices of back side of car helps to reduce the drag and to increase the fuel efficiency.[9][10]

Shyam P. Kodali and Srinivas Bezavada have simulated a passenger car by taking different velocities for the car and comparing the results.[11]

R.B. Sharma, Ram Bansal have simulated a passenger car by adding tail plates. He has concluded that by adding tail plates, the drag and lift force reduced.[12]

N. Stojanovic et al. have simulated a car and plot the results. Here he has found that when the velocity of car increased, the drag coefficient increased and when the velocity overcame 100 m/s, the drag coefficient decreases.[13]

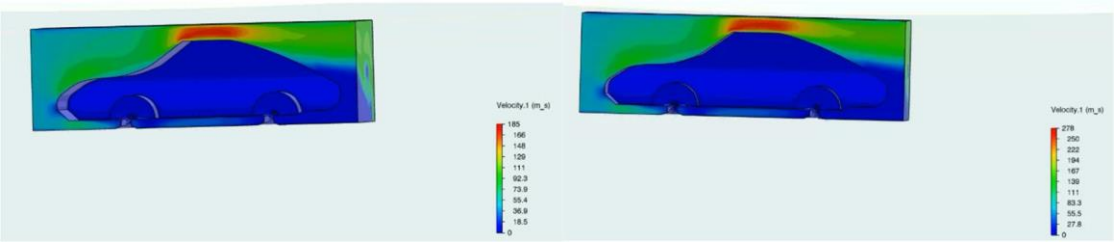
Peter Kuchar et al. have studied about the aerodynamic forces for different parts of car.[14]

PROCEDURE:

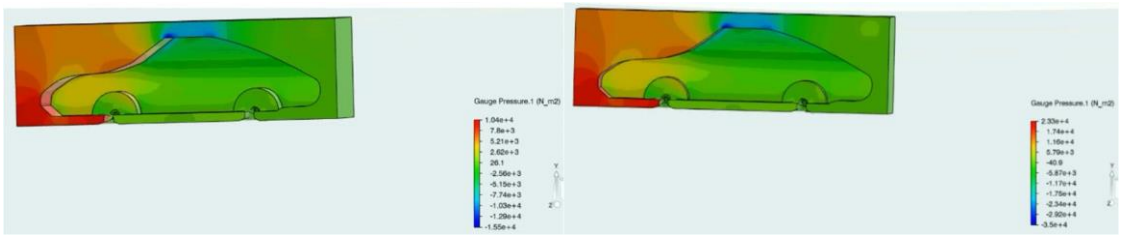
1) Draw the appropriate car model in Catia.
2) Import this model in 3D EXPERIENCE software.
3) In this software, there is an assistant tool. From this tool, first select the model section. In model selection select the part, exterior boundary, region, surface selection. Also select the fluid (Air) for this model.
4) Next,move to physics section. In physics sectioncreate the physics behaviour and steady state step.
5) After that move to boundaries. In boundaries give the boundary conditions like velocity inlet, pressure outlet, wall.
6) After that move to output request section. In output request select the whole car model for the purpose of calculating the drag and lift over car.
7) Then move to mesh section. In mesh section mesh it by taking hex-dominant mesh.
8) Then simulate it and get different plots and results.
9) After getting the results, again do the same process for different velocities. Like that,do 43 simulations by taking velocity from 80 km/h to 500 km/h with an interval of 10 km/h and compare the results.

RESULTS AND DISCUSSION:

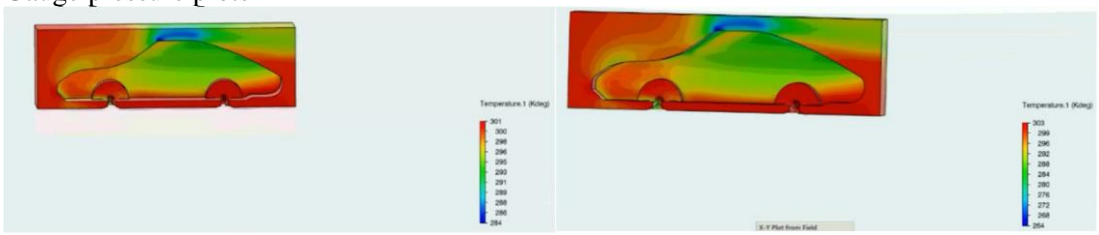
After completing all the simulations, we got different plots for velocity, gauge pressure, temperature for different velocities. Below, we have attached some different types of plots only for 2 velocity cases (180 km/h and 270 km/h)which we took in this experiment.



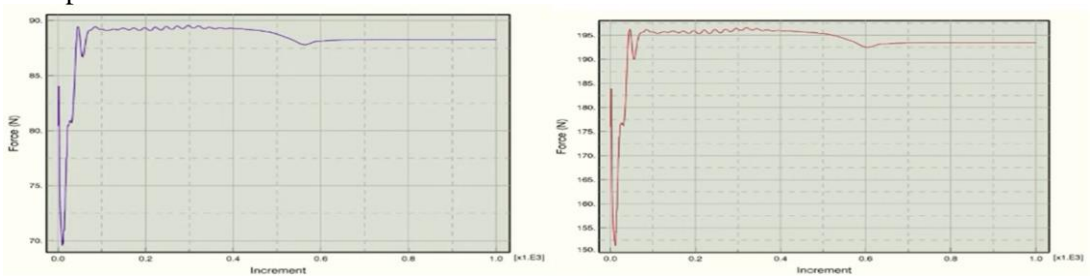
Velocity plots



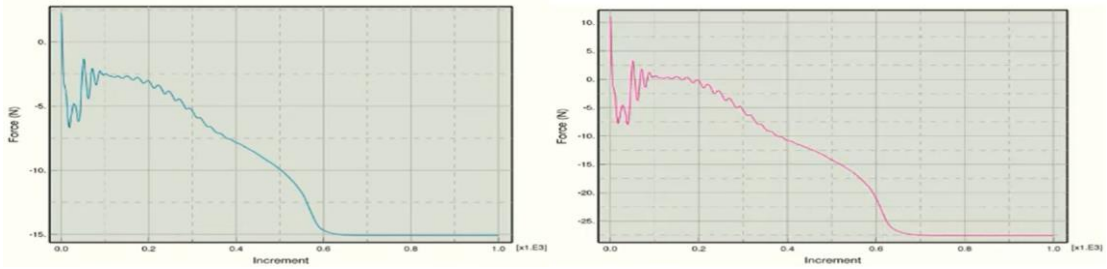
Gauge pressure plots



Temperature Plots



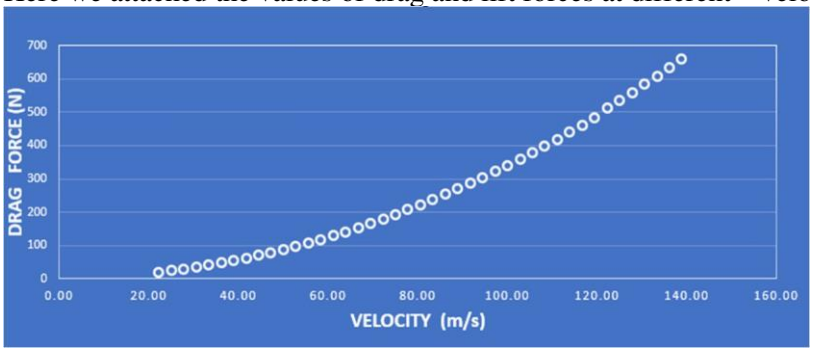
Drag Force Plots



Lift Force Plots

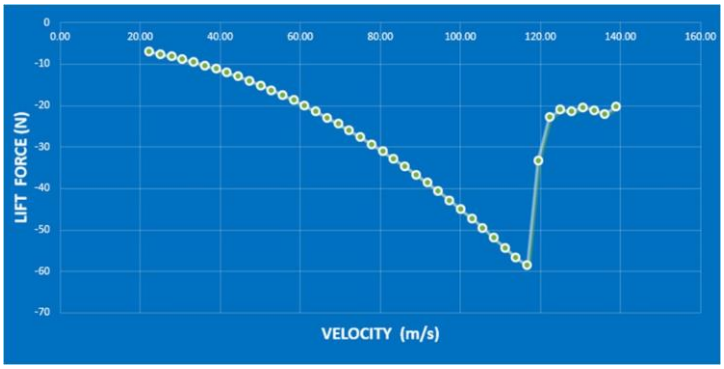
(All the results of left side are at velocity 180 km/h and all the results of right side are at velocity 270 km/h).

Here we attached the values of drag and lift forces at different velocities in a table format.



Drag Force vs Velocity graph

The above graph shows the graphical representation of Drag force vs Velocity. In X-axis. velocity has been taken as variable and in Y-axis, drag force has been taken as variable. From this graph, it is cleared that by the increasing of velocity the drag force also increases.



Lift Force vs Velocity graph

The above graph shows the graphical representation of Lift force vs Velocity. In X-axis, velocity has been taken as variable and in Y-axis (negative direction), lift force has been taken as variable. From this graph, it is cleared that by the increasing of velocity the lift force increases in negative direction and suddenly at a point the lift force decreases.

Also, from the formula for drag and lift force i.e.

$$D_f = \frac{1}{2} C_d \rho V^2 A$$

$$L_f = \frac{1}{2} C_l \rho V^2 A$$

Here, D_f= Drag Force L_f= Lift Force

C_d= Drag Coefficient C_1 = Lift Coefficient

q= Density of Fluid

V= Velocity

A= Frontal Area

It is clear that the value of drag and lift force is proportional to the square of velocity. So, by the increase in velocity, Drag and Lift force also increases.

CONCLUSION:

From the above theory and analysis, we get to know that, aerodynamics has a vital role in a car travelling. For the safety of passenger, fuel consumption, mobility of car one should know the importance of aerodynamics effect on a car. From the above experiment, we concluded that the drag and lift force have the major role in steadiness and economy of car. So, by increasing the velocity, the drag force also increases and lift force also increases (in negative direction).

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Designing along with the analysis of a cyclone dust collector using 3dexperience

MUKUNDJEE PANDEY*
Mechanical Engineering Department
Centurion University of Technology and Management, Odisha, India
[*For Correspondence: E-mail: mukundjee.pandey@cutm.ac.in]

B. PAVAN KALYAN[1], SAI KIRAN KUMAR PANDA[2], ROHIT KUMAR[3]
Bachelorof Technology, Mechanical Engineering
Centurion University of Technology and Management, Odisha, India

ABSTRACT

Dust collector or the cyclone dust collector is the device which is very popularly used to separate the dust particles from the air or the gas and to deliver the best quality of air i.e. which hits our aspirations. The most relevant application of this air filtration device is used in the Industries. At first, the air which the Industry is wishing to dump into the atmosphere is passed through the dust collector, the air enters into the processing chamber through the inlet opening then it gets introduced to the whole air filtration process in which the dust particles start making their way to the bottom most section of the collector. This collector is made up of disposable materials. So that there should be no harmful effect it on nature as well as our surrounding this is our understanding from this collector.

KEYWORDS: Cyclone dust collector, Velocity distribution, Efficiency of collection, filtration index.

INTRODUCTION

The most common as well as widely used remedies for air pollution and gas-solid separation is the Gas cyclone separating technique. The device which uses this technique is called a cyclone dust collector. The most important condition for making this device is that the resultant product should be able to resist the harsh and tough conditions in the commercial sector. The performance of the collector generally works

well where the particle size is bigger than 5µm. In this cyclone principle-based collector the eddy turbulent flow is utilized to separate the aspects with the different values of densities[1].Now basically these collectors are designed in a way that they should be able to bear very much high volume of the dust along with it as they are going to be used for commercial purposes so they are provided with a blower, filter of dust, a system for cleaning dust and dust removal system. Now coming to the CFD point of view we have to make a model of a cyclone dust collector after that we can vary our inlet velocity ranging from different velocities as well as the distinct value of temperatures for finding the most efficient form of the model for our use.

If coming to the problematic view about the cyclone collector is that this collector it disputes the most mathematical models. The longer is the duration of the cyclone the lesser is its efficiency of separation. In some cases, the vortex cores bend at the wall as an outcome it doesn't reach the bottom of the collector [2].The Industrial dust collectors have namely four types which are named as i) inertial separators ii) fabric collectors iii) electrostatic precipitators and, iv) electrostatic precipitators. The inactive separators separate the dust from the combination of the forces that can be named as Centrifugal, Gravitational, and inertial. These are the forces that make the dust move to an area where there is a minimal range of forces are exerted on the gas steam. Then the separated dust is moved into the hopper by the action of gravity into the hopper, where it is stored temporarily. The three primary types of inertial separators are settling chambers, baffle chambers, and centrifugal collectors (For e.g. cyclone separator) [3].B. WANG[a,b] et al. have studied the gas powder flow of a typical cyclone collector. They have used the Reynold's stress model for obtaining the turbulence of gas flow model[4]. SEYED EHSAN RAFIEE et al. have made the case study on experimental and 3D CFD analysis on optimisation of geometrical parameters of parallel vortex tube cyclone collector [5].KARTIK.VISWANATH. BHADTI et al. have performed the studies and research on the dust separation technology[6]. HARSH PATEL et al. have made the review on a design and analysis of cyclone separator for increasing the efficiency using the CFD analysis[7].BHARAT RAJ REDDY DERI et al. have worked on design and analysis of cyclone separator[8].ABHIJEET C GAYAKWAD et al. and ABHIJEET GAYAKWAD et al. have drawn a report study CFD analysis of symmetrical inlet cyclone dust separator and symmetrical tangential inlet cyclone separator[9] [14].RAHUL PANCHAL et al. have presented a paper on design and development of

tangential cyclone dust collector [10].SAKURA GANEGAMA BOGODAGE et al. have well considered the CFD simulation of cyclone collectors to reduce air pollution[11].CHINE SHWETA et al. have done CFD analysis for investigation of design parameter of cyclone separator[12]. JIGNESHKUMAR H CHHUCHHAR et al. have examined the design and analysis of ayclone dust Separator to improve dust collective capacity by changing performance parameters[13]. ARMAN RAOUFI et al. presented CFD analysis of flow field in square cyclones[15].

DESIGNING OF CYCLONE DUST COLLECTOR

The first thing which has been done before performing this analysis is the preparation of the model. There are many ways to perform the designing operation but the software app which is used here in this paper for the preparation of the necessary model is CATIA part design. After enabling the Part design application in the 3DEXPERIENCE SOFTWARE. The model has been designed in two halves. The first half contains the part body with two openings, out of these two openings the front face part will be used as an inlet and the topmost part will be used as an outlet. The second half consists of a long conical type of structure that interlinks the path of the dust particles to the collector. The diameter of the both inlet opening as well as the outlet opening is kept uniform i.e. 154 mm each. In an above-explained manner, the whole planning, as well as the modelling part, has been executed in a proper manner. The fig. 1 below shows the complete prepared model.

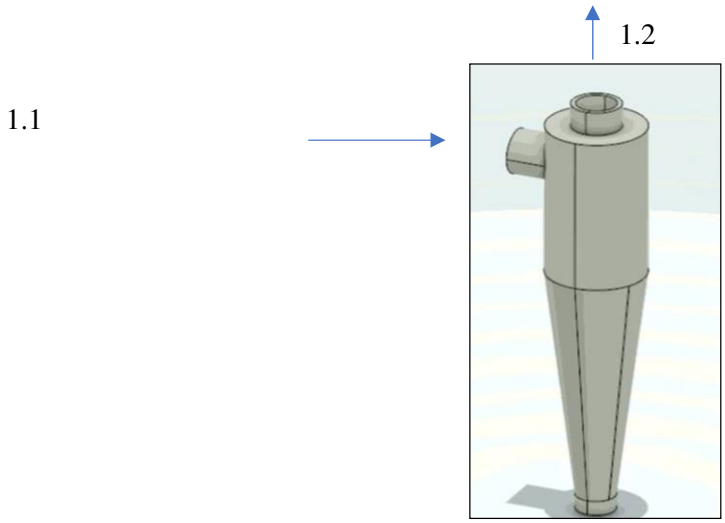


FIG. 1

ANALYSIS OF CYCLONE DUST COLLECTOR

- Now coming to the analysis part, the first step that we have done in this analysis is, importing of the prepared model using the import option in Catia Part design. Then switched to fluid scenario creation using the compass tool present on the top left corner of the window. We have checked whether all roles for analyst are provided or not, just after switching to the scenario creation the name "Simulia fluid scenario creation" will appear on the screen. This indicates that we have successfully entered into the scenario window.
- After this process we have assigned the fluid domain in which the part body, regions as well as openings are specified. This can be done by using the assistant tool then click the model button. For our case we have to select three openings for our model, these openings will be later assigned with the boundary conditions. Then assignment the fluid Section is done by selecting the region as the support and choosing the fluid as air.
- Moving towards the next part, we have assigned the physical properties of the simulation i.e. Turbulence model, which we have chosen as realizable-k-ε and also gave the Maximum number of Iterations that we want to reach at the end of the simulation.
- The boundary conditions are assigned to the model which will define the nature of flow of the simulation. In this analysis process, two boundary conditions are selected that are Velocity inlet and pressure outlet which are applied on 1.1 and 1.2 respectively on FIG. 1.

- Right after this step the meshing has been allocated in which the Hex-Dominant mesh has been chosen as the type of mesh with a maximum size of 30mm and minimum size of 21mm and no other layers are provided.
  The meshing quality check has been done after this which gave satisfactory results. FIG. 2 below shows the meshing of the model after providing the boundary

conditions. The simulation process has been carried out after clicking on the simulate button after checking all the things to be fine.

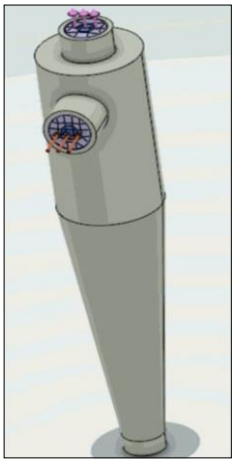
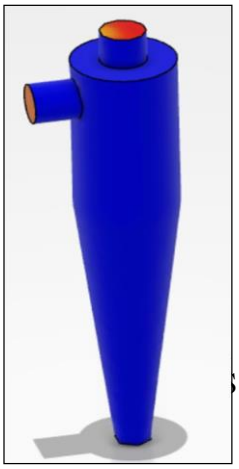


FIG. 2 MESH AND

RESULTS WITH EXPLANATION

- The analysis of the dust collector has been made by employing thirteen different cases in which the velocities values are assigned as 1 m/s, 1.5 m/s, 2 m/s, 2.5 m/s, 3 m/s. These cases are repeated with temperature values ranging from 293.5 K to 317.5 K with a difference of 2K. For e.g. 293.5,295.5,297.5.....317.5m/s.
- Out of these 13 cases the results at Inlet temperature 307.5 K and velocity 2 m/s resultant model visualisation and output velocity, velocity vector, pressure and temperature values are provided below in FIG. 3,3.1,4,4.1,5,5.1,6 and Fig 6.1 respectively.



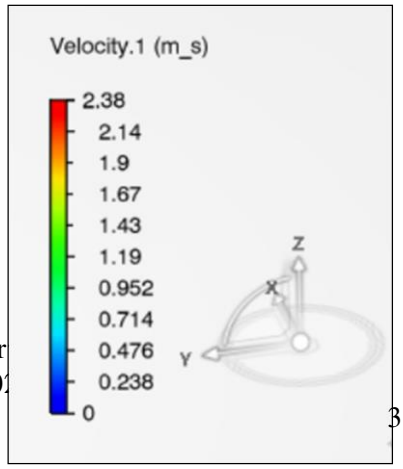


FIG. 3 OUTPUT

FIG. 3.1

- In the above FIG 3&3.1, the velocity distribution has been shown. The velocity at the inlet and outlet opening is recorded as the highest while the least value is shown on the outer surface of the collector.

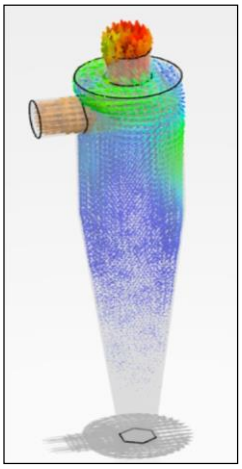


FIG. 4 VELOCITY

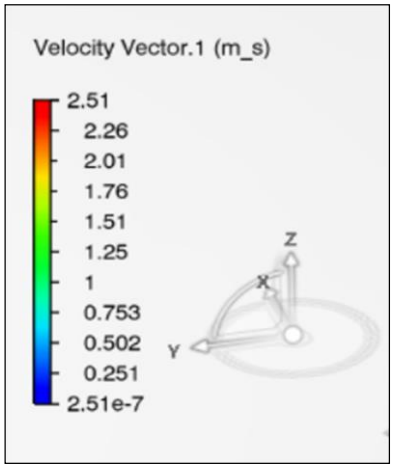


FIG. 4.1

- In the above FIG. 4&4.1, the velocity distribution has been shown. This shows the intensity of the velocity of particles inside the body. Here we can see how the particles are hitting the walls of the collector and getting out.

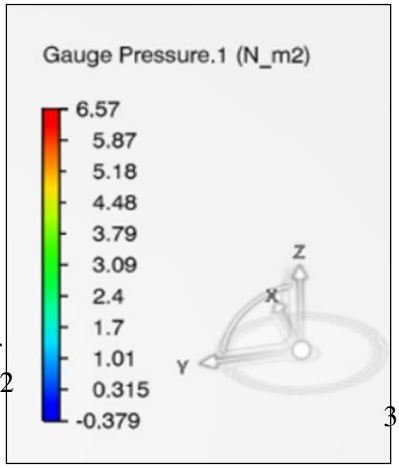


FIG. 5 GAUGE

FIG. 5.1 VALUES

- The FIG. 5&5.1 shows the distribution of gauge pressure across the cyclone dust collector. It is observed that the place where the particles strike in the collector has given the highest-pressure value, while the remaining part remains constant in terms of pressure distribution.

FIG. 6

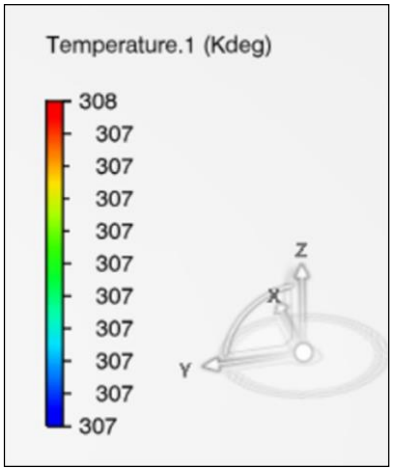


FIG. 6.1 VALUES

- In the FIG 6&6.1 shown superior to this line signifies the temperature distribution across the whole part body. The potion where the whole filtration process has been carried out has thrown out the highest value of temperature and as we can see its potency gets decreased gradually when it reaches the non-action part.

GRAPHICAL PLOTS FOR COMPARISION

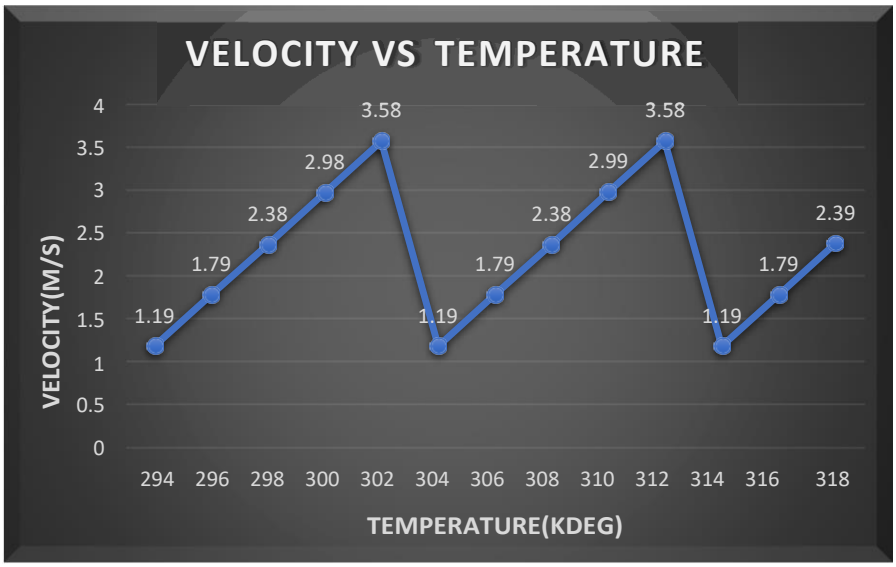


FIG. 7 VELOCITY VS

- The above shown FIG. 7 shows the graphical representation of Velocity vs Temperature. We have noticed that the velocity is reaching the same crest as well as a trough at some point. It is because the velocity values are repeated. The first sequence of inlet velocities 1, 1.5, 2, 2.5, 3m/s is again repeated for the remaining value of inlet temperatures provided. The highest output velocity is obtained at temperatures 302K & 312K and the least at 304K & 314K respectively.

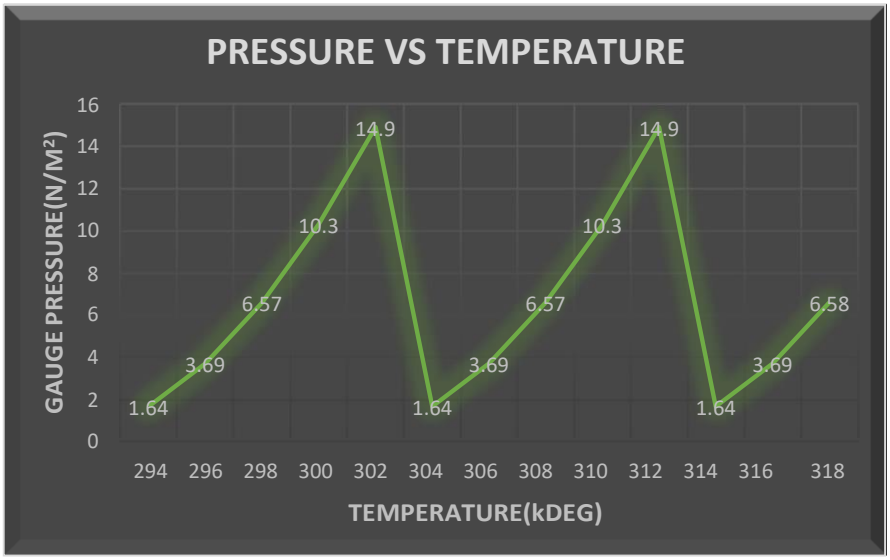


FIG.8 shows the graph **FIG. 8 PRESSURE VS** e pressure and temperatures comparison. The highest value of pressure is obtained at temperature 302K & 312K and the least is obtained at 304K & 314 K.

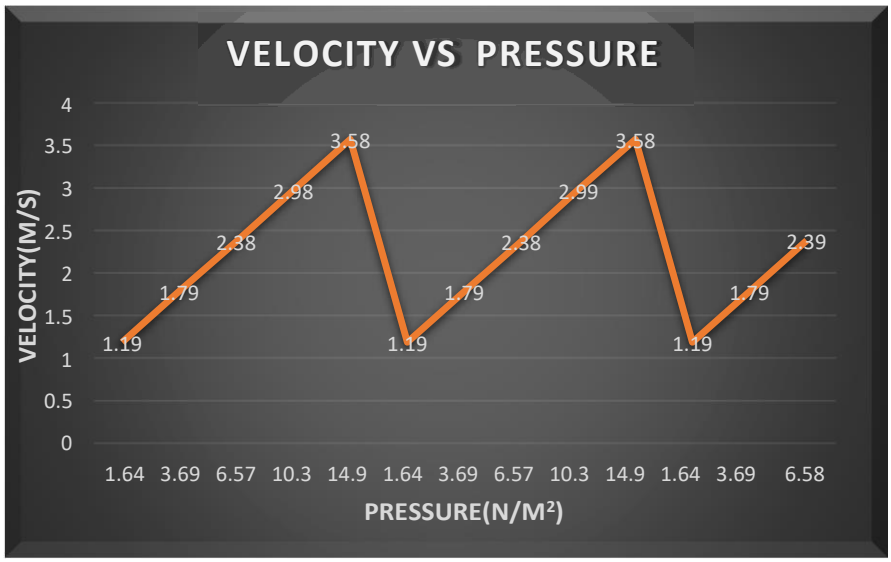


FIG. 9 VELOCITY VS G.

- FIG. 9 shows the graphical scenario of Output Velocity vs Gauge Pressure comparison. The value of velocity is highest where the pressure values came as 14.9 & 14.9 N/M^2 and least at 1.64 & 1.64 N/M^2 respectively.

CONCLUSION

- The analysis on the Cyclone dust collector with both inlet and outlet diameter 154mm proclaims that it can work at its full pace where the value of inlet velocity high. As shown in the graphical plots more value of velocity leads to a higher value of outcomes.

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A novel spectral analysis method for detection of exoplanets

Subrata Sarangi*, Kunmee Das, Radharani Das and Pranab P Rout

Centurion University of Technology and Management, Odisha, India

Abstract:

Exoplanet search is a very active area of research interest of late. Several methods for detection of exoplanets have been proposed. Here a novel method, based on spectral analysis of the orbit of the host star to detect the existence of exoplanets, is proposed. From the knowledge of the first two orbital elements, namely, the Semi-Major Axis and the eccentricity of the star orbit, the existence of exoplanets in the system can be inferred. Using these two observed elements, the orbits of the entire star planet system is generated by numerical simulation of the orbital dynamics. As a case for demonstration of the concept, the method is applied to the case of β-Pictoris system which has 2 known exoplanets.

1. INTRODUCTION:

The twinkling stars in the skies, the various heavenly spectacles that Nature has put up for the humanity to marvel at, have generated great curiosity in human societies across the world, perhaps, since the evolution of the *homo sapiens*. In the 16th century AD renowned astronomers like Copernicus propounded his Heliocentric Hypothesis and later Tycho Brahe, Kepler and Gelileo developed it. Galileo's observations conclusively proved the Heliocentric Hypothesis. The size of the Solar System was a revelation to the Mankind. Galileo's later observations of the Milky Way Galaxy showed existence of innumerable stars and threw open the possibility of "infinite number of worlds" as remarked by Giordano Bruno. Later, Newton also expressed similar speculations. However, it was not until in 1995, that the *observation* of the exoplanet 51 Peg b , a "Hot Jupiter" planet orbiting its host star 51 Pegasi in a hitherto unknown close orbit was announced by Mayor and Queloz [1]. These results clinched the question of existence of "exoplanets" and earned Mayor and Queloz the Physics Nobel of 2019. "Exoplanets" or "Extra Solar Planets" are planets orbiting other stars, just like the Earth and other members of the Solar System orbit the Sun.

Corresponding Author:subrata.sarangi@cutm.ac.in, Phone: 773578203

At present, more than two decades down the history of Astronomy and Astrophysics, we have more than 4000 confirmed exoplanets and more than a thousand candidate planets

awaiting confirmation [2]. According to current estimates, there could be trillions of exoplanets orbiting the hundreds of billions of stars in the Milky Way galaxy itself. In fact, the current interest in the "Exoplanet Community" of researchers, besides the search and confirmation of new exoplanets, is also to classify the confirmed planets into various types (Rocky or Gas Giants, Hot Jupiter, Hot Neptune, Diamond Planets, Rogue Planets). And, of course, in order to answer the iconic question "Are We Alone (in this Universe)?", the search for exoplanets with potential for sustaining life.

Normally, direct observation and photography of exoplanets orbiting other stars is a challenging task. The leading reasons behind this challenge are the basic facts like the large distances combined with inverse square law of light intensity, the planets being non-luminous entities, the gas and dust of the stellar environment which may block the reflected light coming from the planets from reaching the detectors. Therefore, historically speaking, various indirect methods of detection of exoplanets have been developed [3]. The leading methods among these methods are the Transit Method and the Radial Velocity Method. The Transit Method is based on photometry. It measures the minute reduction in the light intensity (or radiant flux) received from the host star due the transiting exoplanet(s) along the line of sight between the host star and the detector. The periodic reduction in the radiant flux over a certain fixed time interval of the star implies transit of planets along the line of sight. This reduction of radiant flux (or brightness) of the star implies presence of planets. The Radial Velocity Method, on the other hand, is based on Astrometry wherein variations in the velocity of the host star(s) resulting from its gravitational interaction with the planets are measured through measurement of red-shift and blue-shift of the star. The periodic red-shift and blue-shift shows the wobbling motion of the star and is a tell-tale sign of presence of exoplanets. Besides these two methods, "Gravitational Microlensing" and "Direct Imaging" are two other popular methods of exoplanet detection. Gravitational Microlensing method works by observation of lensing images of a known background star when a planet passes in front of it along the line of sight of observation. It can show presence of the non-attached "Rogue" exoplanets orbiting no particular star but the galactic centre. "Direct Imaging" and observtion with various variants has also been established as a successful method [4] since 2004. This method works best when the planets are young (emitting substantial infrared radiation) and located far from the glare of the star. Out of the more than 4000 currently confirmed exoplanets, 76% have been detected by Transit Method, 19.1% by Radial Velocity Method, 2.5% by Microlensing and 1.2% by Direct Imaging methods; the remaining fraction being various other methods which are still evolving. The method we discuss here belongs to the class of methods based on Astrometry. This is because the method is based on the spectral analysis of the orbital motion of the host star.

In the Section 2, a brief description of the necessary theoretical formulation and numerical integration needed for the simulation to be carried out here has been given. We have applied this theoretical formulation and have developed the use-case for □-Pictoris system (of a host star and its 2 confirmed planets). In Section 3, we present the salient features of this system along with the observed and published parameters. These parameters are used to generate the initial conditions needed for executing the orbit integration code. In Section 4, the results and discussions have been presented followed by concluding remarks in Section 5.

2. THEORETICAL FORMALISM

2.1 The Equations of Motion and their Integration:

The equations of motion of an *N*-body system with masses M_i (i = 1, 2,..., *N*) is given by

$$\ddot{\vec{r}}_i \equiv \dot{\vec{v}}_i = -G \sum_{j=1;j\neq i}^{N} M_j \frac{\vec{r}_i - \vec{r}_j}{|\vec{r}_i - \vec{r}_j|^3} \qquad (1)$$

where $\vec{r}_i$ and $\vec{r}_i$ are, respectively, the position and velocity of the i-th body with respect to the origin of an inertial reference frame and *G* is the Universal Gravitational Constant.

The Leap-Frog Algorithm, also otherwise known as the Drift-Kick-Drift method, is known to be a very efficient, phase space volume conserving symplectic method [5] to solve for the orbits of any system over long time periods (sufficiently larger than the typically observed orbital periods of the system under study). Under this algorithm, the set of phase space vectors $\{(\vec{r}_i, \vec{r}_i),\ i = 1, 2,.. N\}$ are obtained by the following set of steps executed in the given order:

$$\vec{r}_i\,' = \vec{r}_i^{\,Present} + \vec{v}_i^{\,Present}(\frac{1}{2}\triangle t) \qquad (2)$$

$$\vec{v}_i^{\,Next} = \vec{v}_i^{\,Present} - G \sum_{j=1,j\neq i}^{N} M_j \frac{\vec{r}_i\,' - \vec{r}_j\,'}{|\vec{r}_i\,' - \vec{r}_j\,'|^3}\triangle t \qquad (3)$$

$$\vec{r}_i^{\,Next} = \vec{r}_i\,' + \vec{v}_i^{\,Next}(\frac{1}{2}\triangle t). \qquad (4)$$

The first step (eq. 2) can be visualized as a "Drift". It produces an interim position vector $\vec{r}_i'$ using the present values of the position vector $\vec{r}_i^{Present}$ and the velocity vector $\vec{r}_i^{Present}$ over half the chosen time step, i.e. $\frac{1}{2}\Delta t$. The second step, now a Kick (eq. 3), is produced by generating the next set of velocity vectors $\vec{r}_i^{Nest}$ over a full time step $\triangle t$ by using the accelerations evaluated at the interim position vectors $\vec{r}_i'$. The acceleration term (the 2nd term in eq.3) provides the "Kick". Finally, in the last step, again a Drift, (eq. 4), enables the calculation of the next set of position vectors $\vec{r}_i^{Nest}$ over the remaining half a time step $\frac{1}{2}\Delta t$.

The system now "drifts" over half a time step with the new set of velocity vectors at $\vec{r}^{Nest}_i$. As stated above, this method has been shown [5] theoretically to be phase volume conserving and far more efficient (in terms of computational costs) compared to even the well-known Runge-Kutta Algorithms when long period orbit integrations have to be carried out.

In order to appreciate the effect of an exoplanet on its star(s), we shall need to carry out the orbit integrations over a long period of time, typically several times the periods of the stars. The process begins with specification of the initial values $\{(\vec{r}_i(t_0), \vec{r}_i(t_0))\ i = 1, 2,.. N\}$, representing the respective "Present" set of vectors in the set of equations [2- 4]. These initial values are computed using the first two observed Keplerian Orbital Elements (Green [6]) of the system, namely, the Semi Major Axis (a) and the eccentricity (5) of the 2-body system comprising the heaviest two bodies in the system.

2.2 Evaluation of Initial Values:

The initial values $\{(\vec{r}_i(t_0), \vec{r}_i(t_0))\ i = 1, 2,.. N\}$ are the values of position and velocity vectors along the trajectory of the i^{th}-body in the Centre of Mass coordinate system at the "epoch" $t = t_0$. We follow the procedure outlined by Saha and Taylor [7]. Following this prescription, we first evaluate the set of initial values of the heavier two bodies, say, *A* and *B* ($M_A > M_B$), of the system with respect to the Centre of Mass (CM) O of these two bodies. A parametric solution to the equation of motion of the equivalent 1-body system with reduced mass in terms of the relative position vector $\vec{r}_{BÆ}$, that is, position of B with respect to A, can be obtained [7]:

$$(x_{BA}, y_{BA}) = a\ (cos\ \eta - e, \sqrt{1-e^2}\ sin\ \eta) \qquad (5)$$

where *a* and *e* are, respectively, the semi-major axis and eccentricity of the orbit of the "reduced mass body" around the Center of Mass (CM) of the system located at one of the foci of the orbit and $5 = \eta(t)$ is the "Mean Anomaly" providing the solution. However, in case of a star-planet system ($M_{Æ} \gg M_B$), the reduced-mass object is effectively the planet of mass M_B. It fixes the initial position of the body along the elliptical orbit; the values we are seeking to obtain in order to start the orbital integration. Towards this purpose, we need to evaluate $5_0 \equiv \eta(t_0)$ at the chosen initial time t_0. Towards this end, we note two important orbital scale parameters for time period P_{orb} and orbital speed V_{orb} of the system:

$$P_{orb} = 2\pi\sqrt{\frac{a^3}{G(M_A+M_B)}},\quad V_{orb} = \sqrt{\frac{G(M_A+M_B)}{a}} \qquad (6)$$

Using eq. (5), we also have the magnitude of the relative position vector :

$$\vec{r}_{BA} = a(1 - e\ cos\ \eta) \qquad (7)$$

The relative angular momentum along the *z*-direction, perpendicular to the orbital plane is also obtained by using the relation

$$l_{BA,z} = x_{BA}\dot{y}_{BA} - y_{BA}\dot{x}_{BA} = V_{orb}\ a\sqrt{1-e^2}. \qquad (8)$$

Substituting in eq. (8) for the position coordinates and their time derivatives (using eq. (5)), we obtain the first order differential equation for η:

$$r\frac{d\eta}{dt} = V_{orb} \qquad (9)$$

whose solution with the use of eq. (7) becomes

$$t(\eta) = \frac{P_{orb}}{2\pi}(\eta - e\ sin\ \eta). \qquad (10)$$

The expression for $t(\eta)$ (eq.(10) is, in literature, referred to as the Kepler's Equation. It is solved numerically to obtain η_0 for a chosen value of t_0.

This value of η_0 is used in eq. (5) and the initial values of $x_{BA}(t_0)$ and $y_{BA}(t_0)$ are obtained. The initial value of the relative velocity vector is obtained using the following equations along with eqns.(5) and (10):

$$\dot{\vec{r}}_{BA}(t_0) = \frac{\frac{d\vec{r}_{BA}}{d\eta}|_{\eta_0}}{\frac{dt}{d\eta}|_{\eta_0}} \qquad (11)$$

The Orbital Dynamics computer code needs input of the initial values of phase space variables ($\vec{r}_{AO}(t_0)$, $\dot{\vec{r}}_{A\ O}\ (t_0)$) and ($\vec{r}_{BO}(t_0)$, $\dot{\vec{r}}_{B\ O}\ (t_0)$) evaluated with respect to O (the CM) of the system. These values can be obtained by the coordinate transformation (and corresponding velocity transformation) rules to the CM frame of reference:

$$\vec{r}_{BO} = \frac{M_A}{M_A + M_B}\vec{r}_{BA} \qquad (13)$$

$$\vec{r}_{AO} = -\frac{M_B}{M_A + M_B}\vec{r}_{BA} \qquad (12)$$

Following a similar procedure, with respect to the CM of this 2-body system and the third body (with Mass M_C in the sequence of decreasing masses), we evaluate the initial values of all the 3-bodies with respect to the overall CM of the entire 3-body system. This process can be generalized to include any number of masses. We put this algorithm to test for the β-Pictoris system [8] which comprises a single Sun-like star and 2 planets. Using these initial values as the starting point of orbit integration in the equations (2-4), the numerical simulation code generates the orbits of the bodies.

2.4 The Spectral Analysis of the Stellar Orbit:

We Fourier analyze the orbits, i.e., the *x*- and *y*-coordinates of the host star and generate its Power Spectrum. We expect that these coordinates should contain the information about the number of planets orbiting the star, their orbital periods and their mass etc. The number of peaks in the Power Spectrum tells us the number of planets orbiting the host star. The positions of the peaks on the frequency axis provide the orbital periods (the inverse of the frequency values) of the planets, whereas the height of the peaks provide information on the planetary mass.

As a proof of this concept, we present here the use-case of the β-Pictoris system of star with 2 known exoplanets. Using the observed orbital parameters of the 2 planets orbiting the host star β-Pictoris, we generate the initial conditions for the orbit integration (implementing the formalism outlined above in a Python code) of the system of equations. The orbit integration code then generates the orbits of the star and the 2 planets. The power spectrum of the star's the *x*- and *y*-coordinates are then generated and examined.

It may be noted that the case of β-Pictoris system is just a proof-of-concept case study. A complete exercise would be to extract the orbit data from observed Astrometric Data Sets, for example, the data published by GAIA Data Release-2 [9] and test the application potential of this algorithm [10].

3. THE CASE OF □□□□PICTORIS SYSTEM□

The ***β*-Pictoris** (or ***β*-Pic,** in short) [8] with a mass of $1.75M_{\odot}$(1.75 times the Solar Mass) and luminosity of 8.7 $L_{\odot}$ is the second brightest star in the constellation Pictor. It is located at a distance of 63.4 light years from the Solar System. Compared to Solar System with an estimated age of 4.5 billion years, the Pictoris system is very young with only 20 to 26 million years into its evolution. Due to its higher mass and luminosity, even at this young age, it is already in the Main Sequence stage of its evolution.

This star has two confirmed planets, namely, *β*-Pictoris b and *β*-Pictoris c. Some of the detailed properties of these two planets and their orbit elements necessary for our simulation are given below in Table-1.

Table-1: Observed Properties and two (of six) orbit elements (needed for our simulations) of the two confirmed planets in the □-Pictoris system. Mass, radius, semi-major axes and the Orbital Periods (P_{orb}) are expressed in units of Jupiter Mass $M_J(= 9 \times 10^{-4}M_{\odot})$, Jupiter Radius R_J (= 0.1 $R_{\odot}$) and Astronomical Unit (AU) (= 1.496×10^{11}m).

Planet	**Mass** (M_J)	**Radius** (R_J)	**Semi-major axis** a **(AU)**	**Eccentricity** e	**Orbital Period** P_{orb} **(days)**
□-Pictoris b	12.9	1.46	9.2	~0.1	7890
□-Pictoris c	9.0	Not available	2.7	0.24	1200

As the radius of the planets does not enter our calculations, its non-availability for □- Pictoris c is not of any consequence to us here.

Using the mass, semi-major axes and eccentricity values, we generate the initial values of all the three (the star and the two planets) entities with respect to the Centre of Mass of the system. These values are given in Table-2 below.

Table-2: The masses in units of solar mass ($M_{\odot}$) and the respective initial values in SI Units are given.

Entity	**Mass** ($M_{\odot}$)	x_0 **(m)**	y_0 **(m)**	$\dot{x}_0$ **(m/s)**	$\dot{y}_0$ **(m/s)**
□- Pictoris (star)	1.75	8.13 e+09	1.25 e+08	-1.16 e+00	-3.08 e+01
□- Pictoris b	0.0123	-1.44 e+12	-1.78 e+10	1.59 e+02	-1.23 e+04
□- Pictoris c	0.00859	4.12e+11	1.24 e+08	-1.12 e+00	2.39 e+04

4. RESULTS AND DISCUSSION

The Orbit Integration Code is executed using the initial conditions specified in Table-2. The orbits generated by the code are plotted in Fig. 1 and Fig.2. Fig.1 shows plots of the x- and y-coordinates of the □- Pictoris star (red), the planet □- Pictoris c (green) and □- Pictoris b (blue). As noted in Table-1, the planet □- Pictoris c is closer to the star (at a mean distance of 2.7 AU) and has a smaller time period (1200 days). In comparison, the planet □- Pictoris b is

farther away (at 9.2 AU) with a time period of 7890 days. These numbers are reflected in the plots of these two planets. However, the plot of the star □- Pictoris is more noteworthy. While the larger period oscillation due to the heavier planet □- Pictoris b is evident, the perturbations in the orbit originating from the influence of □- Pictoris c are seen in the small amplitude and higher frequency wiggles.

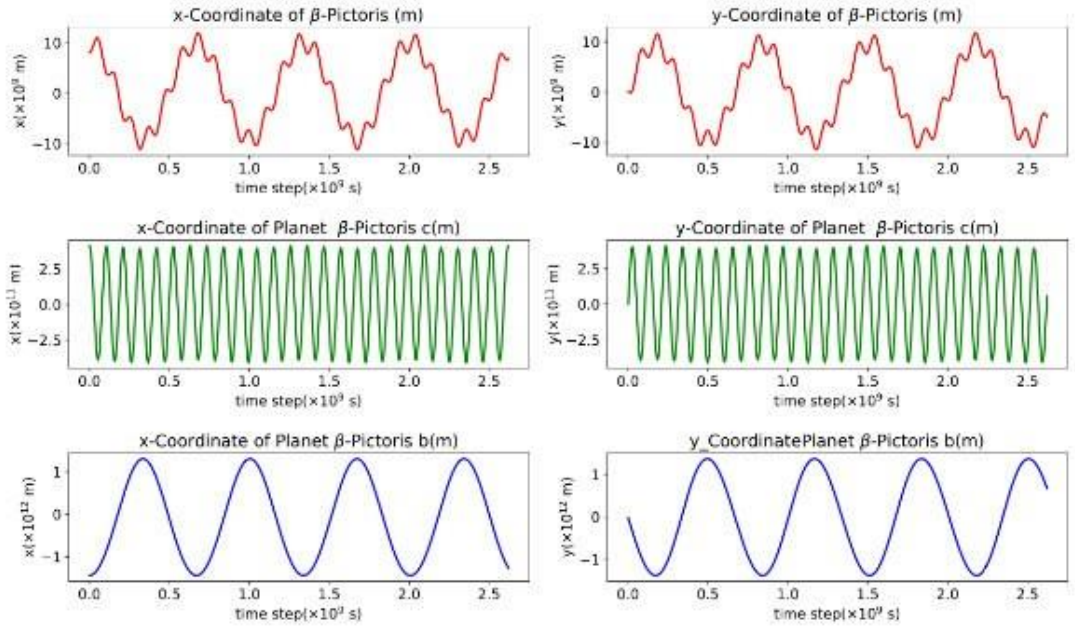
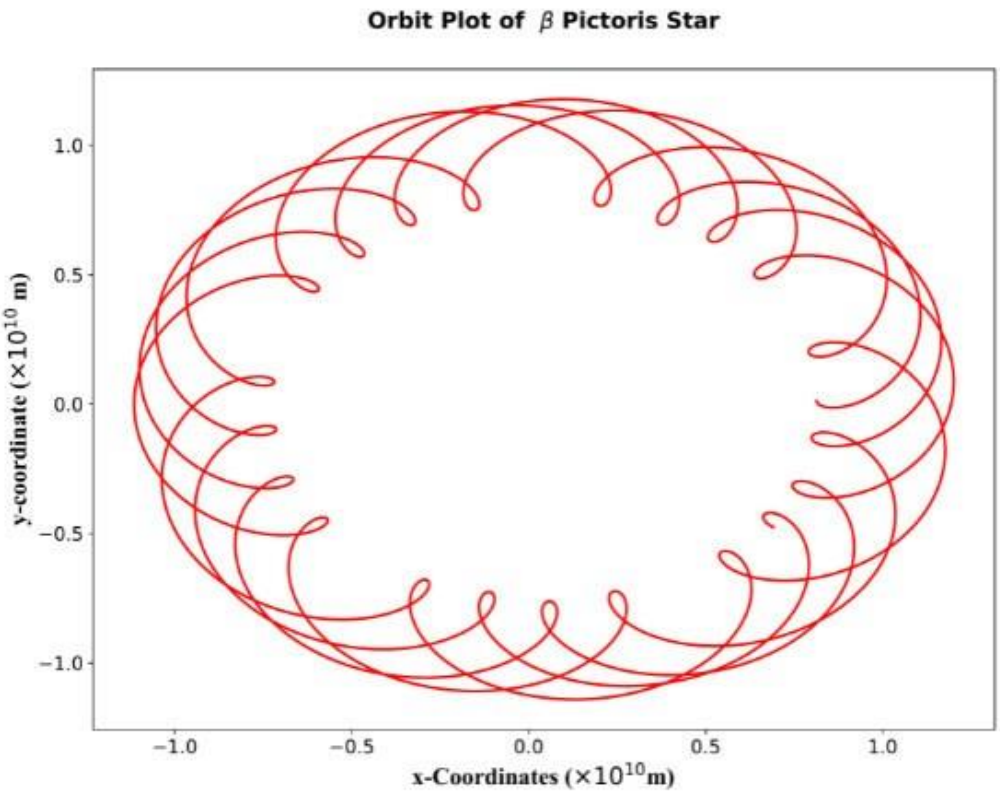


Fig.1: Plots of the x- and y-coordinates of the □□-Pictoris star (red), the planet □- Pictorisc (green) and □□-Pictoris b (blue). The planet □□-Pictoris c (green curves) orbits closer to the star with smaller time period compared to that of the planet planet □□-Pictoris b (blue curve). The star's orbit (red curve) is much smaller (due to its heavy mass). It show two types of periodicities. The larger period is dictated by the heavier planet □□-Pictoris b with the small wiggly perturbations due to □□-Pictoris c.

In Fig.2, the configuration space plot of the star is shown. Again the periodic motion originating due to □□-Pictoris b is seen in the larger elliptical shape of the plot. The perturbative influence of □□-Pictoris c is seen in the small wobbles.



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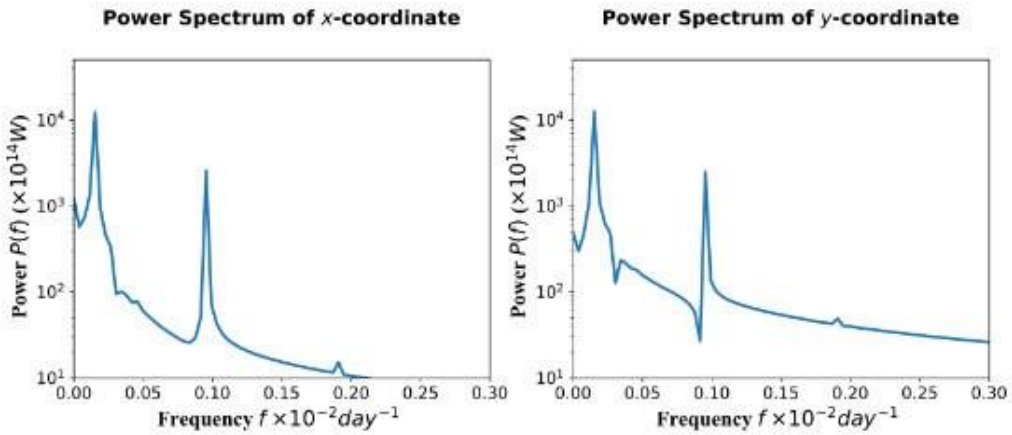

Fig.3: Power Spectrum of the star generated from the Fourier Analysis of its x- and y-coordinates is plotted. The two major peaks show the existence of the two planets. The inverse of these frequencies corresponding to the two peaks yield the orbital periods of the two planets respectively at be 6535 days (for □□-Pictoris b) and 1046 days (for □□-Pictoris c) with percentage discrepancies of 17% and 15% respectively.

In Fig. 3, the Power Spectrum of the star generated from the Fourier Analysis of its x- and y-coordinates. The two peaks show the existence of the two planets. The two peaks occur at frequencies 1.53×10^{-4} day^{-1} and 9.54×10^{-4} day^{-1} respectively. The inverse of these frequencies provide the orbital periods of the two planets respectively at be 6535 days (for □- Pictoris b) and 1046 days (for □□-Pictoris c) with percentage discrepancies of 17% and 15% respectively with respect to the observed values.

5. CONCLUDING REMARKS

The spectral method of detection of exoplanets shows the existence of planets by analysing the motion of the host star. This method needs to be further benchmarked against the orbital data directly taken from the observed data bases like that of the recently published GAIA Data Release 2 [9].

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Exploring the therapeutic role of epicatechin in diabetes: a review

Jyoshna R. Dash[1], Biswakanth Kar[2], Gurudutta Pattnaik[1]

[1]Centurion University of Technology and Management,Odisha, India

[2]School of Pharmaceutical Sciences, SOA University, Bhubaneswar, Odisha, India

1.jyoshnadash92@gmail.com, ORCID ID-0000-0001-6082-9900

2. biswa_kanth2005@yahoo.co.in, ORCID ID-0000-0002-4530-1005

Abstracts

Diabetes mellitus develops as a result of prolonged insulin resistance and insufficient insulin production. The significance of this review is to highlight the importance of the usage of natural products as an alternative for the treatment of diabetes. There is several antidiabetic agents are available having many side effects and other secondary complications thus there is a need to find the alternative add on therapy to treat diabetes. Epicatechin due to its potent antioxidant activity as well as effective against lipid peroxidation and free radical scavenging and thus alter many metabolic and physiologic process and found to be effective against diabetes due to its glucose lowering and improving β-cell regeneration. Epicatechin can be used as an add-on therapy for the management of diabetes mellitus. Evidence of antidiabetic effect of Epicatechin is being identified for future therapy to treat diabetes. The significance of this review is to highlight the importance of the usage of natural products as an alternative for the management of diabetes.This review will discuss the role of Epicatechin on oxidative stress,endoplasmic reticulum stress, mitochondrial dysfunction, activation of redox pathway and inflammation.

Key words: Epicatechin, diabetes mellitus,antidiabetic agents, insulin sensitivity, Oxidative stress, β cell regeneration, inflammation

1.Introduction

Diabetes mellitus refers to a group of chronic metabolic disorders which are generally characterised by hyperglycemia, which eventually leads to damage of multiple body systems. Diabetes is classified into two types, type 1 (T1DM) and type 2 (T2DM) diabetes mellitus. T1DM is referred as insulin-dependent diabetes mellitus (IDDM) and is caused by the impaired insulin production. T2DM, on contrary, is frequently associated with cells inability to respond to insulin or insulin resistance, hence referred as non-insulin dependent diabetes mellitus (NIDDM). Epicatechin is natural flavanol mainly found in cocoa, tea, peanuts, grapes and other berries [1]. Several beneficial effects are shown by consumption of food rich in Epicatechin[2]. Among various phytochemicals phenolic compounds are most commonly used because of their safety and efficacy[3].

2.Efficacy of Epicatechin in diabetes:

Ahmad, F. et al have determined the antidiabetic effect of water extract of the bark of plant *Petrocarpus marsupium* containing Epicatechin, its active principle. In vitro study suggest insulin like activities of Epicatechin which stimulate oxygen uptake in fat cells and tissue slices of various organs [4]. A study by Rizvi SI. et al has revealed that in vitro effect of insulin and Epicatechin on the reduced glutathione content in normal and type 2 diabetic

erythrocytes. As compared to normal individual GSH content was lowered in type 2 diabetic patients.Long term complication of diabetes can be prevented by taking higher contents of dietary flavonoids [5]. In a clinical trial conducted by Dower, J. I., et al. on the effect of Epicatechin on insulin resistance in overweight and normal individual.By giving 100mg/day for 4 weeks showed improved in insulin sensitivity [6]. Epicatechin has efficacy to alter the postprandial metabolism in overweight individuals [7]. Another study revealed that dietary supplements of cocoa have significantly decrease glucose level and body weight in wistar rats [8]. Epicatechin ameliorate the insulin resistance through alteration of redox regulation in rat model [9]. Epicatechin has significantly able to reduce body weight and obesity in wistar rats [10]. Another study suggest that dietary administration of Epicatechin have reduce body weight and attenuate insulin sensitivity in high fat-fed mice [11]. A recent study investigate the efficacy of grape pomace extract rich in Epicatechin on its antiinflammatory activity in high fat –fed wistar rats [12]. A study by Kim, M. J., revealed the protective effect of Epicatechin on pacreatic islets of STZ induced rats [13]. Another study by Basu, A. revealed that cocoa supplementation effectively increased post prandial insulin [14]. In addition, Epicatechin was able to attenuate the insulin resistance in HepG2 cells through insulin signailling pathway [15].

3.Hypoglycemic effect of Epicatechin

Diabetes induced peroxynitrite cause retinal neuro degeneration through various mechanism like glial activation and activation of proapoptotic pathway which can be reduced by treatment with Epicatechin as a dietary supplement [16]. Methanol extract of *cassia fistula* stem bark possesses catechin which shows the potential agonistic characteristics that is capable of activating insulin receptor and peroxisome proliferetor activated receptor gamma and shows the hypoglycemic effect[17].

In *in-vitro* study of catechin was grafted onto inulin which shows a potential antidiabetic effect [18]. Skeletal muscle oxidative stress is associated with type 2 diabetes mellitus. They examined the oxidative stress related alterations in skeletal muscle in type 2 diabetes mellitus which can be reduced by treatment with Epicatechin rich cocoa [19]. Epicatechin which is isolated from bark of *petrocarpus marsupium* used as an antidiabetic agent due to its hydroxyl radical scavenger and is safe in higher doses [20]. Epicatechin was administered to albino rats of either sex in doses of 30mg/kg by intraperitoneal route for two days prior to alloxan administration and continued for next 24 hours and antidiabetic action was found [21].The therapeutic actions shown by Epicatechin is may be due to scavenging of highly reactive hydroxyl radical caused due to alloxan [22].

Epicatechin which is a flavonol found in abundant amount in cocoa prevented type 1 diabetes in nonobese diabetic mice [23]. Epicatechin increase the circulating anti-inflammatory cytokine interleukin- 10 levels and improve the pancreatic insulitis as well as islet mass [24].These findings reveals that Epicatechin can be a novel compound derived from plant source which can be used for the management of diabetes by modifying the immune function and retaining islet mass[24].

Combination of catechin and Epicatechin is responsible for the adipogenic activity of Labrador tea and shows the antidiabetic activity[25]. Smirin P have determined the antidiabetic effect of plant extract of *sarcopoterium spinosum*[26].They conduct the in vitro study using RINm pancreatic beta cells[26].

Lipolysis is inhibited and glucose uptake is induced by *sarcopoterium spinosum* extracts in AML-12 hepatocytes and L6 myotubes [26]. Extracts of *sarcopoterium spinosum* help in prevention of the progression of diabetes [26].In vivo study were conducted by using mice which confirmed antidiabetic effect by measuring IPGTT and plasma insulin [26]. Ethanol extract of *petrocarpus marsupium* have been reported as potential antidiabetic agent[27].

Extract of *petrocarpus marsupium* containing Epicatechin as its active constituents were given to fasted rabbits and blood glucose level was measured and found to reduced to 25% [27].

Interleukin- 1β stimulates inducible nitric oxide synthase expression and nitric oxide over production which cause β –cell damage [28]. Epicatechin effectively inhibit IL-1β induced NO production in pancreatic β – cells and prevent the IL-1β induced β- cell damage(Kim MJ et al). Epicatechin antagonize the effect of IL-1β induced inhibition of insulin secretion in RINm 5F cells[29]. It also reduce the IL-1β induced inhibition of of glucose stimulated insulin releases in islets [30].

Alteration in lipid metabolism leads to hepatic steatosis in diabetes [31].This reveals the efficiency of cocoa which is rich in flavanols such as Epicatechin in attenuating hepatic lipid metabolism in rats and high glucose exposed in HepG2 cells[32]. A study by Cordero-Herrera, investigate the phenoli extract of cocoa significantly improve the glucose homeostasis by altering the insulin signaling pathway [32]. Epicatechin protects the hepatocytes by improving lipid metabolism was confirmed through *in vitro* and *in vivo* study[33]. In another study conducted by Álvarez-Cilleros D investigate the effect of Epicatechin on insulin signaling by using NRK-52E cells and found that Epicatechin regulate the renal glucose homeostasis by altering glucose uptake and production [34]. A recent study show that epicatechin treatment significantly improve the insulin secretion by reglating Ca MKII in the presence of high glucose[35].

4.Role of Epicatechin in oxidative stress

Oxidative stress is one of the leading cause involved in pathogenesis of diabetes[36]. Morever the increased reactive oxygen species causes impaired glucose tolerance, insulin registance, beta cell degeneration [36]. Increased in reactive oxygen species has a vital role in development of insulin resistance[37].

Martin MA have determined the protective effect against oxidative stress which is induce by tert- butyl hydroperoxide (t-BOOH) on Ins1E pancreatic beta cells [38]. t-BOOH induces reactive oxygen species like p-JNK, carbonyl group, decreased glutathione, and insulin secretion were effectively prevented by pretreatment of cells with Epicatechin ameliorate the cell viability as well as insulin secretion which indicate that Epicatechin has protected effect against oxidative stress [38]. Aprevious study also revealed the association of c-Jun amino-terminal kinas(JNKs) with obesity and insulin resistance and also explained the increased activity of JNK in obesity[39].

In addition to that Epicatechin has potential role in restoration of skeletal muscle mitochondrial dysfunction[40].

Another study conducted by Martin MA revealed the protective effect of phenolic extract of cocoa against oxidative stress[41]. Pretreatment of Ins-1E cells with cocoa phenolic extract of 5, 10,20 µg/ml was found to significantly improve the cell damage and protective against oxidative stress [41]. Cocoa is a rich source of flavonoid containing the epicatechin as an active constituent [42]. Epicatechin has the protective effect against oxidative stress in HepG2 cells [43]. The cells treated with Epicatechin improve the glutathione level as well as reduce the ROS level [43]. An ex vivo study conducted by Vinson, J et al. revealed that Epicatechin has potency to inhibit lipid oxidation and can mitigate oxidative stress [44].

Another published work revealed that regeneration of functional beta cell mass and delays of diabetes can be enhanced by consuming cocoa rich diet [45].This study suggested that mechanism behind prevention of progression of diabetes and restoration of beta cell is due to its antioxidant activity [45]. It was recently found that Epicatechin treatment can prevent the diabetes by reducing the inflammation biomarkers as well as oxidative stress and increase hepatic glutathione level [46]. Morever a study by Rein, D. et al revealed the antioxidant

properties of Epicatechin in vivo [47]. In vivo study by Wang, J. F. et al have examined the antioxidant properties of Epicatechin[48]. Long term exposure of oxidative stress impair glucose metabolism [49]. Another study revealed that lipoic acid treatment can decreased blood glucose level by increasing the concentration of GLUT4 in streptozotocin induced diabetic rats [50]. A recent study showed that Epicatechin significantly prevent the development of reactive oxygen species and insulin resistance in HepG2 cells *in vitro* [51].

5.Effect of Epicatechin in insulin sensitivity

In vitro effect of epicatechin on 3T3-L1 preadipocytes have the ability to mitigate TNFα mediating signaling pathway associated with insulin resistance [52].

Another published work determined that in vivo Epicatechin supplementation can ameliorate the alteration of metabolic process induced by high fructose feeding and also enhanced the impaired insulin secretion [53].

In vivo supplementation of epicatechin effectively enhance the insulin sensitivity in high fat diet –fed mice [54]. Supplementation of Epicatechin rich food can improve the insulin resistance associated with obesity [54].

However the mechanism behind improving insulin sensitivity is associated with down regulation of the inhibitory signal molecules JNK, IKK, PKC and protein tyrosine phosphatase 1B [54]. In vivo supplementation of gren tea for 12 weeks improve the insulin sensitivity in sprague- Dawley rats[55]. A group of researchers revealed the role of protein kinase c in the progression of insulin resistance in high fat-fed rats [56]. A recent study showed that Epicatechin supplement in high fat- fed mice improve the insulin sensitivity which is confirmed through *in vivo* and *in vitro* study [57]. However Epicatechin can improve the insulin resistance and some biomarkers associated with oxidative stressed and inflammation [58]. Epicatechin was able to increased insulin secretion and reduced nitrite production in STZ induced diabetic rats [59]. Another study showed that Epicatechin has potency to stimulate insulin release and conversion of proinsulin to insulin [60]. Another study also revealed the role of PKC and other inflammatory pathway in the development of fat induced hepatic insulin resistance [61]. Cocoa rich diet can attenuate the hepatic insulin resistance by downregulation of C Jun N- terminal kinase and p38 activation in Zucker diabetic fatty rats [62].

6.Effect of Epicatechin in β cell regeneration

The blood glucose lowering potential of Epicatechin in alloxan induced diabetic rat was probably due to restoration of pancreatic β cell [63].

Chakravarthy, B. K. et al. have determined the anti diabetic effect of ethanolic extract of bark of petrocarpus marsupium in alloxanised albino rats and show preventive action against alloxan induced beta cell degeneration [64].

7.Role of Epicatechin in secondary complication of diabetes

Chennasamudram, S. P. et al. have revealed the catechin has the ability to protect nephropathy associated with diabetes mellitus through its antioxidative and anti-inflammatory properties [65]. Another published work suggested the renoprotective effect of epicatechin obtained from cocoa by reducing NOX4/TGFβ-1 signaling pathway in experimental diabetic rats [66].

A study by Tanabe, K et al. found the preventive action of Epicatechin against cisplatin induce nephropathy in mouse proximal tubular cells [67]. In mouse model of diabetes Epicatechin effectively ameliorated renal dysfunction and showed protective effects against cisplatin induce nephropathy [67].

Another published work suggested that Epicatechin can effectively prevent lipopolysaccharide induced renal inflammation through activation of TLR4-NF-Kb pathway associated with renal dysfunction [68]. Epicatechin was able to prevent the physiological

renal alteration associated with inflammation in sprague dawley rats [69]. Epicatechin also effective against restoration of NO in renal cortex, reduce the oxidative stress and alteration in podocyte as well as attenuate inflammation in renal cortex of fructose-fed rats [69]. Another study evaluate the efficacy of Epicatechin in the prevention of inflammation in renal cortex of fructose-fed rats induced by high fructose consumption in rats [69]. A study by Kim, J., et al. showed that Epicatechin was effectively able to break down preformed glycated human serum albumin in vitro as well as reduce advanced glycation end products in retina in vivo study [70]. Another published work revealed that in neonatal streptozotocin induced diabetes mellitus Epicatechin significantly increase the nitric oxide synthase activity and improve the scar formation in Nstz diabetes mellitus type 2 [71].

8.Role of Epicatechin in inflammation associated with diabetes

Cordero-Herrera have determined the protective effect of epicatechin against NF-Kb and TNF-α induced inflammation in human monocytic cell [72]. Another study suggested that visceral adipose tissue inflammation associated with high fat consumption can be effectively prevented by EC supplementation in mice [73].

A recent study investigate the protective effect of Epicatechin in iflammation associated with diabetes [74]. The study discuss the protective effect of Epicatechin through inhibition of activation of NF- Kb and NOX [74].A study revealed the correlation between obesity and inflammation [75]. A study by Gu, Y., investigate the efficacy of cocoa powder administration on inflammation associated with obesity and found that cocoa powder can effectively reduce the body weight as well as ameliorate insulin resistance [76].

However interleukin-1β stimulate the inducible nitric oxide synthase expression and over production of nitric oxide lead to β-cell damage.The authors revealed that Epicatechin inhibited the IL-1β induced expression of Inos by blocking the NF-Kb in RINm cells [77]. Epicatechin has ability to prevent intestinal inflammation in acute and chronic rat models [78]. Epicatechin improve glutathione levels and decreased COX-2 expression showed antiinflammatory response in rat [78]. Epicatechin ameliorate atherosclerosis due to its antiinflammatory response [79]. These study indicate that the Epicatechin have the capability to reduce the inflammatory response associated with Diabetes. Another study discuss the role of Epicatechin in alteration of proinflammatory biomarkers [80]. PPAR plays a important role in modulation of various biological activity including inflammation and glucose metabolism [81].

9.Mechanism of action of Epicatechin associated with glucose homeostasis

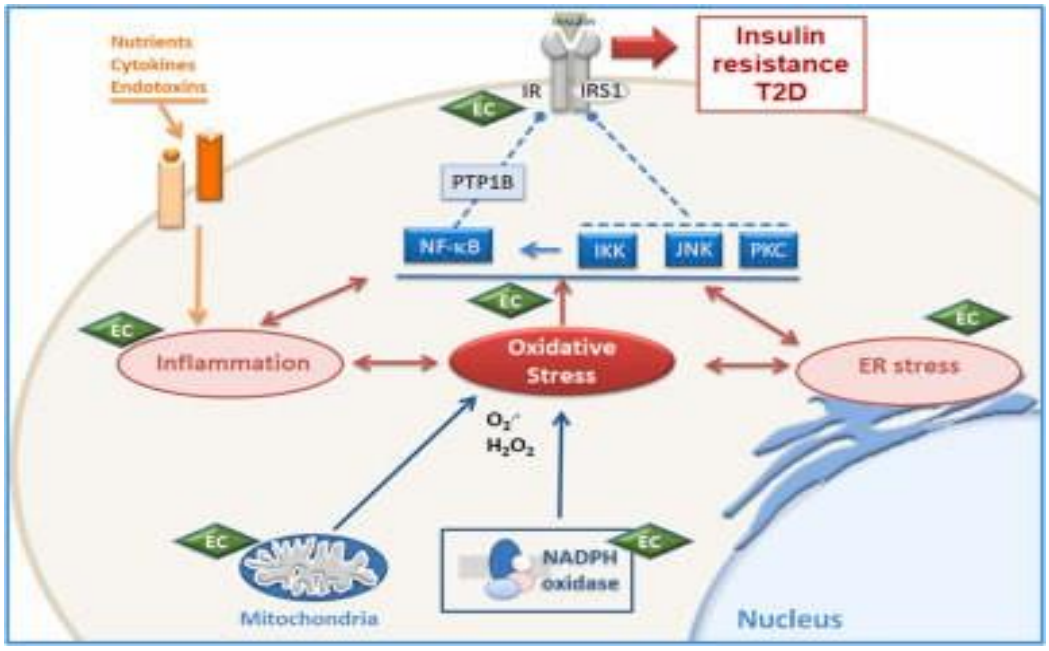

Fig1: Summary of cellular and molecular mechanism of events that have been regulated by Epicatechin on insulin resistance and glucose metabolism

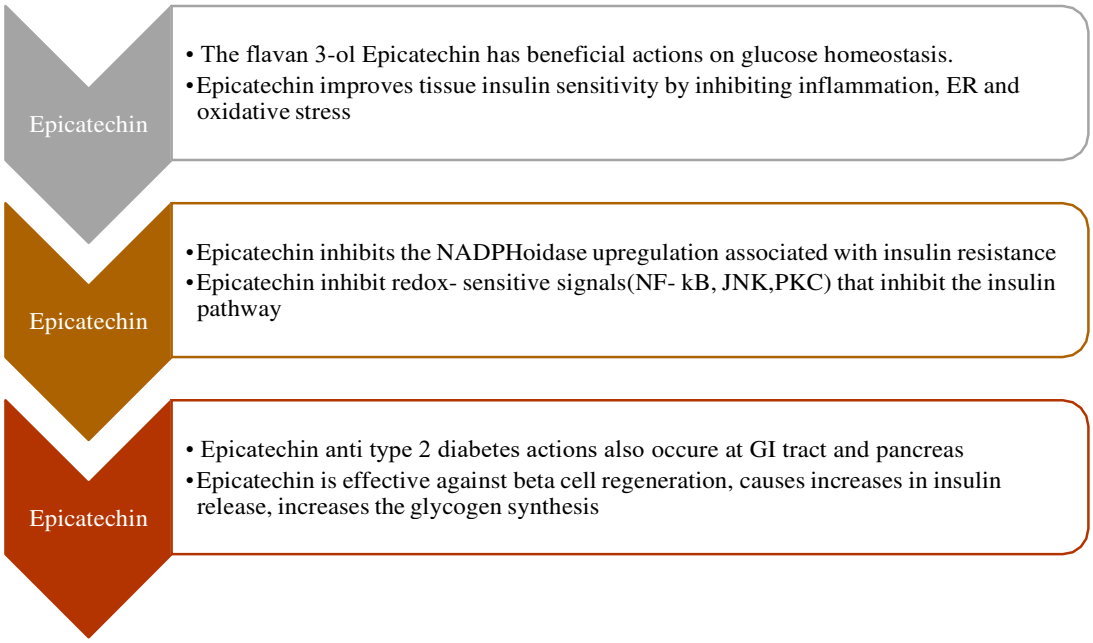

Fig 2: Summary of therapeutic role and its mechanism of action of Epicatechin in Diabetes

10.General discussion and conclusion

In conclusion this paper has presented the therapeutic role of Epicatechin in prevention of diabetes. Epicatechin has been shown to play a major role in prevention of diabetes through regulation of endoplasmic reticulum and oxidative stress, inflammation, redox pathway, mitochondrial dysfunction.This review will summarize the current evidence on efficacy of Epicatechin in prevention of inflammation, oxidative stress associated with diabetes mellitus. Future research on Epicatechin are necessary to understand its efficacy and mechanism of action associated with improving hypoglycemic effect. NOX and NF-kB showed as one of the major target of the protective action of Epicatechin in regulation of oxidative stress and inflammation.

Antidiabetic drug-herbal formulations have been increasingly reported but are unde rresearched. For most of the herbal drugs used as an antidiabetic agent are lacking on their safety, efficacy or standards of manufacture. Prospective randomized clinical trials assessing dosage regimen and toxicity study is an urgent need for the evaluation of safety and efficacy in the management of diabetes. Many clinical and lab trials of Epicatechin were successful on DM mice and rats but same effect were not observed in clinical trials.The effective dosage on patients need more research.

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Conflicts of interest: The authors declare that there is no conflicts of interest.

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Synthesis and characterization of a new 4 – aminoantipyrene based schiff base ligand and its cobalt complex

Aditya Kumar Purohit [a]*, Pravin Kumar Kar[b], Jamini Ranjan Mohanty[c], Somanath Sarangi[a], Tusar Kanta Pradhan[a] and Bandana Padhan[a]

[a]Department of Chemistry, Centurion University of Technology and Management, Odisha, India

[b]Department of Chemistry, Veer Surendra Sai University of Technology and Management, Burla, India

[c]Department of Chemistry, S. B. Women's (Auto) College, Cuttack, Odisha, India, 753001

*Corresponding author Email: adityakumarpurohit@gmail.com

Abstract

A new 4–(2,5–dimethoxybenzylideneamino)–1,2–dihydro–2,3–dimethyl–1–phenylpyrazol–5–one Schiff base ligand was synthesized by condensation of 4 – aminoantipyrene and 2,5 – dimethoxy benzaldehyde in 1:1 ratio. After that its cobalt (II) complex was prepared. Than their melting point and FT-IR spectra were recorded.

Keywords: Schiff base, FTIR, antimicrobial, metal complex.

1. Introduction

In recent years, Schiff base complexes of transition metals are giving an attention and interest to inorganic chemists due to their wide range of diverse biological activities with chemical, structural and spectral properties [1 - 2]. The metal-based drugs have gained much importance in medicinal field for the treatment of diabetes, cancer, anti-inflammatory and cardiovascular disease [3 - 5]. The Schiff bases are widely employed as ligand in complex formation. Schiff base metal complexes are considered as simple and suitable candidate for catalytic application [6 – 8]. Schiff bases are also used as optical and electro sensors, as well as in various chromatographic methods, to enhance selectivity and sensitivity [9 - 11]. Numerous Schiff based chemo sensors are reported for metal ions such as Hg^{2+} [12], Zn^{2+} [13], Ca^{2+} [14] and Pb^{2+} [15]. Also in many reports most of them showed fluorescence quenching due to the paramagnetic nature of Fe^{3+} [16, 17].

The Schiff base derived from 4-aminoantipyrene and its complexes shows various types of applications such as catalysis [18, 19], clinical applications [20], pharmacology [21] and also possess numerous biological applications that include antifungal, antibacterial, analgesic, antipyretic and anti-inflammatory [22 - 24].

The cobalt based Schiff base complexes have attracted significantly scientist towards themselves due to their numerous applications like antibacterial [25] antifungal [26] antivirus [27] antiproliferative [28] and anticancer activity [29]. Also in several reactions these can be utilized as catalysts for instance electrochemical reactions [30], cross-coupling reactions [31], polymerization [32], hydrogenation [33], Lewis acid catalysts in organic synthesis [34]. Thus we have synthesized a new Schiff base ligand and its cobalt complex in this work.

2. Experimental Details

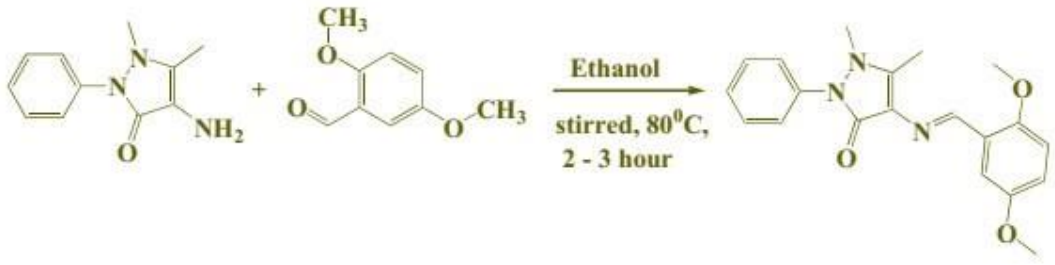
4 – aminoantipyrene, 2,5 – dimethoxy benzaldehyde and cobalt chloride were purched from Aldrich. The solvent used in this work is ethanol. Melting points of the complexes were measured by Zenith Melting Point Appartus. FT-IR spectra were recorded on Eco-ATR, Alpha, BrukerOptik GmbH, Ettlingen, Germany spectrophotometer.

3. Results and Discussion

3.1. Synthesis of 4–(2,5–dimethoxybenzylideneamino)–1,2–dihydro–2,3–dimethyl–1–phenylpyrazol–5–one Schiff base ligand

4 – aminoantipyrene (1.01 gm, 5 mmol) was taken in 20 mL ethanol, which was stirred till mixing. To this solution 2,5 – dimethoxy benzaldehyde (0.83 gm, 5 mmol) taken in 20 mL ethanol was mixed drop wise. Upon addition orange colour solution was changed to a light yellow colour solution, which indicates the formation of product. To the mixture 1 drop of glacial acetic acid was added. Than the reaction mixture was refluxed for 2 to 3 hours at 80^0C where the light yellow colour becomes dark yellow. After that the precipitate was washed with ethanol for several times to get a yellow colour crystal. After that the precipitate was kept overnight in oven to become dry. (Yield=65%). FTIR (υ) cm^{-1}: υ(C = 0)= 1638, υ(C = N)= 1568, υ(C = C)= 1490, υ(C – O)= 1447, υ(N − N)= 1168.

Figure 2.1. Images of Schiff base ligand



Scheme 1. Reaction scheme for 4–(2,5–dimethoxybenzylideneamino)–1,2–dihydro–2,3–dimethyl–1– phenylpyrazol–5–one Schiff base ligand.

3.2. FT-IR spectra of 4–(2,5–dimethoxybenzylideneamino)–1,2–dihydro–2,3–dimethyl–1– phenylpyrazol–5–one)

From FT-IR data we found functional group of the Schiff base ligand with their various types of stretching and bending vibration. Then the ligand was characterized by FT-IR spectroscopy to confirm the presence of different functional groups. IR data showed a

vibration band at 1568 cm^{-1} which could be attributed to stretching vibrational mode of imine (−CH=N−) groups. The vibrational band of (C = C) was found at 1490 cm^{-1}, vibrational band of (C – O) was found at 1447 cm^{-1}, vibrational band of (N − N) was found at 1168 cm^{-1}, vibrational band of (C = 0) was found at 1638 cm^{-1}. Also its melting point was found to be 136^0C.

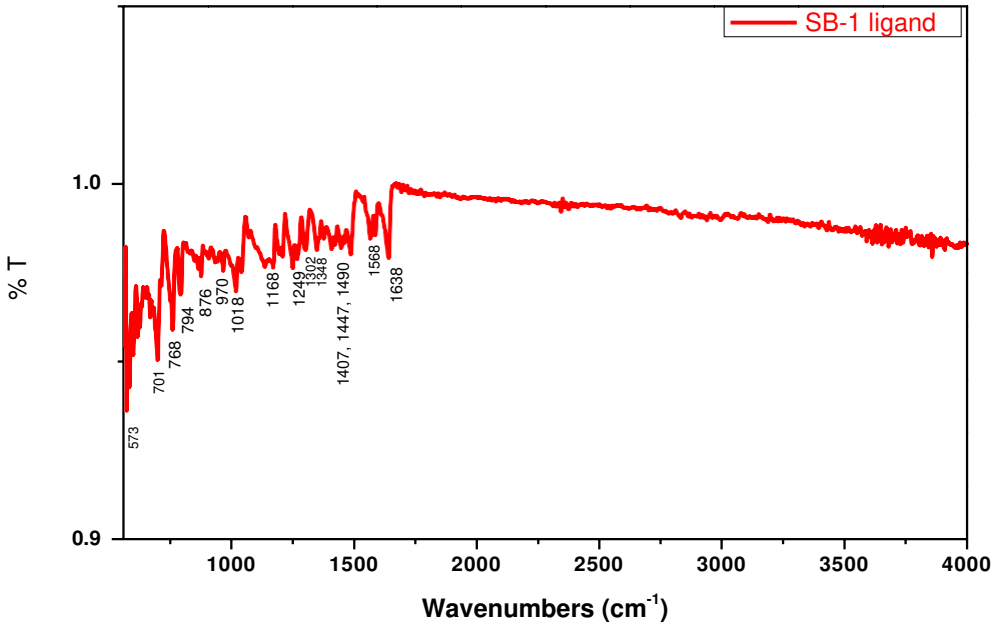
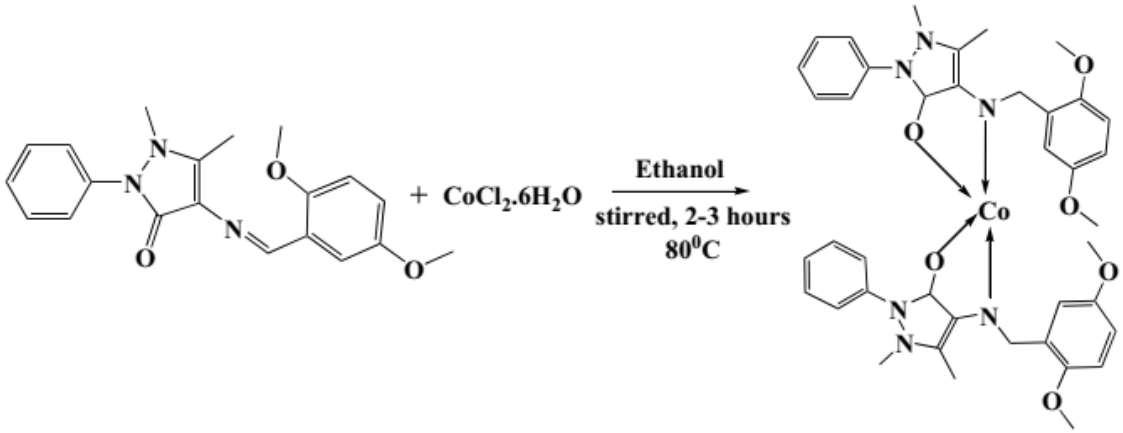


Figure 2.2. FT-IR spectra of Schiff base ligand.

3.3. Synthesis of Co (II) Schiff base complex

Schiff base ligand (0.351 gm, 1 mmol) was taken in 10 mL ethanol, which was stirred till mixing. To this solution $CoCl_2.6H_2O$ (0.118 gm, 0.5 mmol) taken in 10 mL ethanol was mixed drop wise. Upon addition light yellow colour solution was changed to an orange colour solution. Than the mixture was refluxed for 2 to 3 hours at 80^0C, where the orange colour becomes green. After that the precipitate was washed with ethanol for several times to get a green colour crystal. After that the precipitate was kept overnight in oven to become dry. Upon addition of the ligand with $CoCl_2$ the colour changes from light yellow to green. This confirms the formation of the Schiff base complex with a yield of 55% with a melting point of 278^0C. From FT-IR data we found functional group, also found various types of stretching and bending vibration. FTIR (υ) cm^{-1}: υ(C = 0)= 1641, υ(C = N)= 1593, υ(C = C)= 1475, υ(C – O)= 1454, υ(N − N)= 1134.

Figure 2.3. Image of Co (II) Schiff base complex.



Scheme 2. Reaction scheme for Cobalt(II) Schiff base complex

3.4. FT-IR spectra of Co (II) Schiff base complex

After that we have characterize the Cobalt complex by FT-IR spectroscopy to confirm the different functional groups. The IR spectrum showed a vibration band at 1593 cm^{-1} which was assigned to stretching vibrational mode of imine group (−CH=N−). The vibrational band of (C = C) was found at 1475 cm^{-1}, vibrational band of (C – O) was found at 1454 cm^{-1}, vibrational band of (N − N) was found at 1134 cm^{-1}, vibrational band of (C = 0) was found at 1641 cm^{-1}. Here the shifting of peaks for different functional groups from ligand to complex conform the formation of the Cobalt complex.

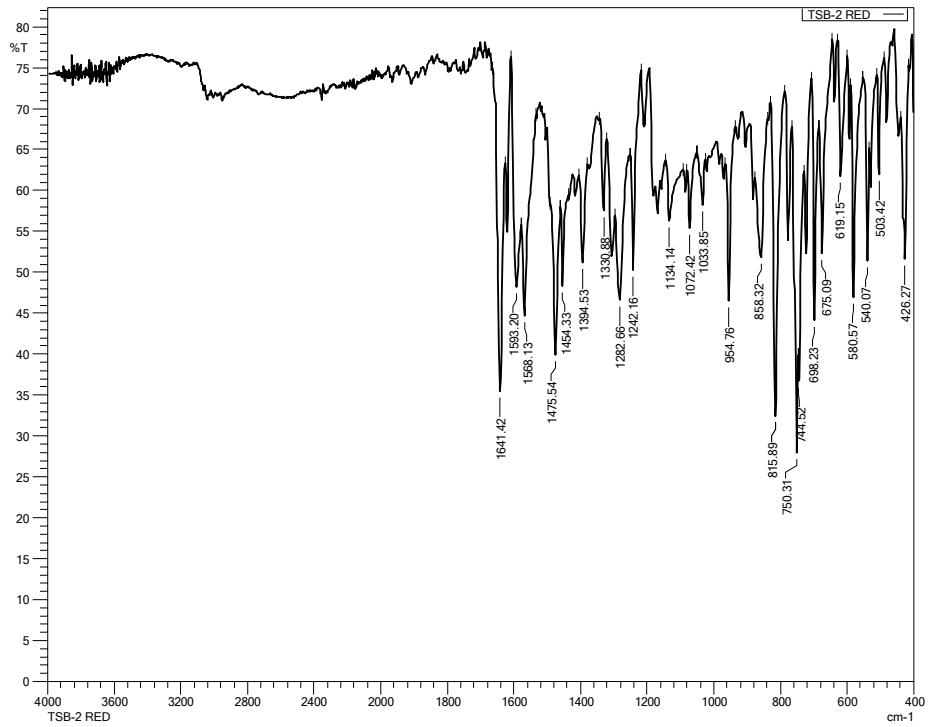


Figure 2.4. FTIR spectra of Co (II) complex of Schiff base ligand.

3.5. Colour and melting point data of Schiff base ligand and its cobalt complex

Table 1. Physical data of synthesized compounds.

Sl. No	Compound	Colour	M.P. (°C)
1	Schiff base ligand	Yellow	136
2	Co (II) Schiff base complex	Green	278

4. Conclusion

Thus in this present study we have reported a new 4–(2,5–dimethoxybenzylideneamino)–1,2–dihydro–2,3–dimethyl–1– phenylpyrazol–5–one Schiff base ligand by the condensation between 4 – aminoantipyrene and 2,5 – dimethoxy benzaldehyde. Than we have prepared a cobalt complex with the Schiff base ligand. After that we have characterized the Schiff base ligand and its cobalt complex by using FT-IR spectroscopy to conform the presence of different functional groups. Here the change in colour, difference in melting point and shifting of peaks for different functional groups in FTIR from ligand to complex conform the formation of the Cobalt complex. These newly synthesized Schiff base ligand and its cobalt complex can be applied for so many biological applications like antimicrobial and anti tumor activities. Thus this work carried out by us as highly beneficial biological point of view.

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Impact of technology on industrial relations: study on it industry

Dr. GirijaNandini[1] and Dr.Bhanupriya Khatri[2]
[1]Associate Professor, School of Management,Centurion University of Technology and Management,Odisha, India

[2]Assistant Professor, USB-MBA,Chandigarh University, Mohali, India

Abstract
India is the uppermost offshoring destination for IT companies across the world. Today, India is unique nation that offers cost-effectiveness, abundant excellence, high trustworthiness, above all, the use of state-of-the-art technologies in IT industry. Technology has modified the system the individuals work. The consequence of technology is that more and more assignments and activities to be automated. The normal employee of IT Industry often bears more similarity to a highly-skilled "independentexpert" than to the normal employee of other industries.Digital technologies deals prospects for employment opportunities as well as new empowered and self-determined techniques of working. They also offer work related challenges like technological redundancy, digitally augmented restructuring and worldwide relocation of work, fragmentation of workforces through mobile and hyper flexible work, new forms of low-paid and hazardous work on platforms. Industrial relations is art of doing together in organisations. To generate congruence and symmetry, it is essential that all the stakeholders i.e. workers, managers, employees should put efforts for the common objectives of the organization so as to achieve a synergetic result. Technology can increase the way the employees do their employments, creating them more competent, resourceful and free from the load of monotonous tasks. This research study includes 200 sample size and the study has been conducted to examine the impact of technology on industrial relations in IT Industry. It also explains the methods adopted by IT Companies to encourage the IT learning at workplace and the positive and negative effects of IT at workplace.
Key Words: Technology, Industrial Relations, IT learning, Internet of things (IoT)

1. Introduction

Due to globalisation, the managers are incorporating technology in order play challenging roles and generate competitive advantage for their concern.Today, the companies are introducing 4.0 technology which has totally changed the Industry 4.0 is the incorporation of cyber-physical systems that interconnect and co-operate with humans and other smart systems to advance day-to-day processes - and this includes the amalgamation of Internet of things (IoT), Artificial Intelligence (AI) and smart technology. Technological change affects more than production, occupation, and income inequality. The growth of IT-based work stages that maintain new descriptions and distributions of work tasks in new ways provides additional illustration of the variable potential for application.As a result of information technology, employers are boosting telecommuting which permits workforces create usage of the internet and efforts from their locations of prime. Additionally,high-techdevelopments are predictable to endure to upsurge the need for anextremelycompetent personnel, upkeepadvancedoutputprogress, and transform the organization of business and the nature of industrial relations. The use of ICTs can also increase the employees' control over their work by providing more flexibility in time and location, as the performance of work tasks is not necessarily tied to a desk in an office. (Day, Scott, &Kelloway 2010). Now employees are

doing work in more decentralised manner. They prefer work life atmosphere which gives them high level of job satisfaction. Kehoe and Wright (2013)employees also need advancement in the industry. That is the opportunity to move up in the company. With increasing use of technology, employees are bind to work from their home after office hours also. This has led to work life imbalance. Technology also results into conflicts between young and old age people as young age people are more energetic, young and adaptive towards recent changes in technology.A good combination of Industrial Relations and technology result into uninterrupted production, high morale, mental revolution and reduced wastage. Technology also results in socialisation of industries. The companies should have the point in mind that the technology adopted for the organization should be directed towards industrial democracy and should upgrade the economic status of the employees. Proper implementation of information technology can build the bridge between employees and the management. Security of the employees should be ensured in order to overcome resistance to technological change and improve industrial relations.

2. Review of Literature

Flanders (1965) analysed on Industrial relations by taking job regulations into consideration. They tried to find out the relationship between employers and employees within the rule of Industrial relations. He found that the development of these relationships is not systematic. Graetz and Michaels (2017)done their research on use of robot in Industries and its impact on employment, wages and productivity. They found that the industries which are using robot have more labour productivity than the industries which are not using. (Shaaban, 2006) done his research on Arab human resources. He tried to find out how the human resources are used to develop the knowledge society. He also found the problems in Arab in human resources in the era of development of information technology and globalisation. Postman (1998) has done his research on change in culture due to technology. There are always changes happen in culture due to change in technology. Now technology is impacting our society in a bigger way. Parasuraman and Colby (2001) analysed on technology readiness. It means how the people are adopting technology in their life at home and work. They have calculated the scores on technology readiness. Rogers (1995)tried to do the research on adoption curve. The S shaped adoption curve includes innovators, early adopters, early majority, late majority and laggards. He found that innovation and technology adoption is very important for every organisation. Goldfard and Henrekson (2003)have done their research on technology push. They found that because of the use of innovations market pull is increased.Martin Ford (2019)analysed on effect of technology on human resources, employability and work organisation. He found that technology like AI, IoT, Machine learning have a great impact on human resources.

3. Objectives of the study

a. To know about how Industrial relations change due to increase use of IT.
b. To study the positive effects of technology on Industrial Relations.
c. To study the negative effects of technology on Industrial Relations.
d. To know about the impact of change due to change in technology.

4. Research Methodology

India is home to a large number of IT professionals but still there is high rate of attrition. So, updating the knowledge with the changes in technology plays an immense role in making cordial relations effective. The data has been collected from the IT Employees of India for the study. 200 sampleshave been taken by using convenience sampling method. Primary data is collected by online questionnaire link. Links sent to LinkedIn & through E-mails. Secondary data is used from journals, magazines & internet.

Links for survey is as follows:

https://docs.google.com/forms/d/e/1FAIpQLSf7-EeUuhvQQYYO58jjJ13-nipuJWdLli_MyReSZkmsli4L-w/viewform

5. Data Analysis and Interpretation

5.1 Change of Industrial relations due to increase use of IT at your workplace

Table 1 - Distribution of direction of Industrial relations changed in recent years due to increase use of IT at your workplace

Direction	Increased	Increased somehow	No Change	Decreased Somehow	Decreased	Mean
From employees to managers	82	45	26	22	25	3.685
From managers to employees	86	43	36	21	14	3.83
From employees to employees	87	32	45	23	13	3.785

Figure 1 - Proportion of direction of Industrial relations changed in recent years due to increase use of IT at your workplace

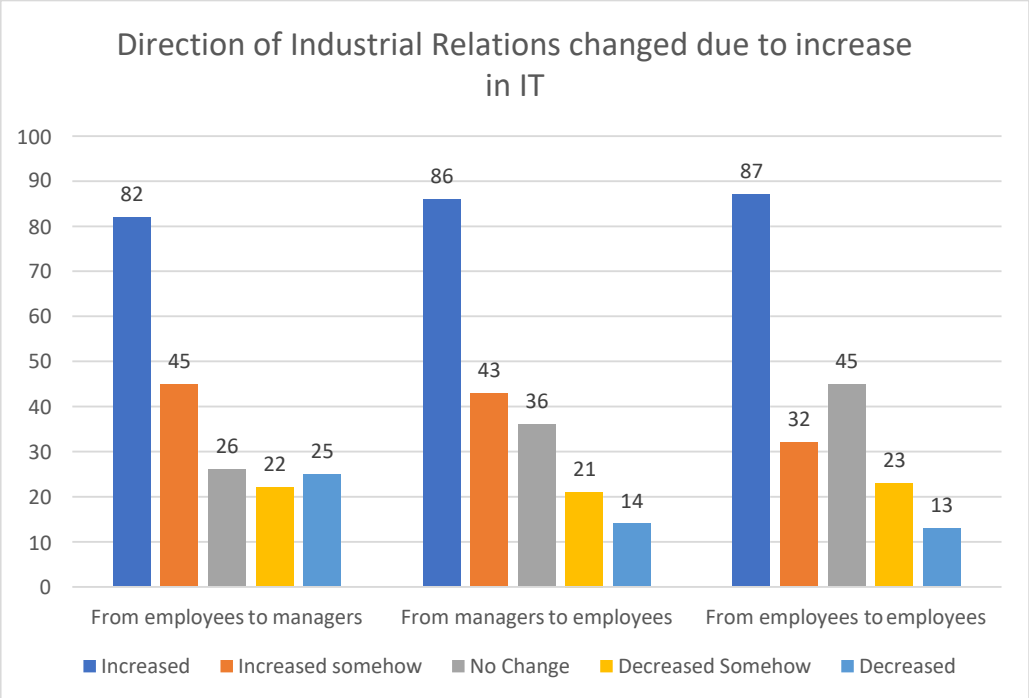

Figure1 depicts show the direction of Industrial relations changed in recent years due to increase use of IT at your workplace. The table shows that mean for the direction of relations from employees to managers is 3.69, the mean for the direction of relations from managers to employees is 3.83 and the mean for the direction of changes from employees to employees is 3.79.

5.2 Methods adopted by Companies to encourage the learning of IT

Table 2 - Distribution of Methods adopted by Companies to encourage the learning of IT

Methods by Companies to encourage learning of IT	Percentage
Financial assistance for acquiring training from outside	23%
Hosting of lectures, seminars etc.	27%
Paid leave for IT training	20%
Arrangement of flexible working hours	18%
In-house learning	12%

Figure2- Proportion of Methods adopted by Companies to encourage the learning of IT

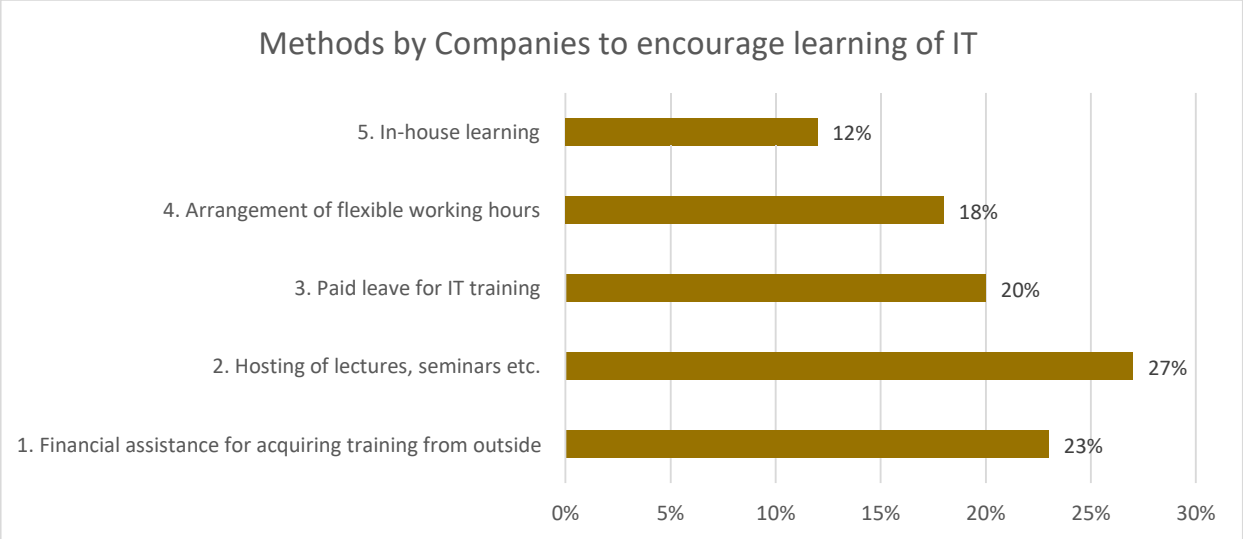

Figure 2 refers to Methods adopted by Companies to encourage the learning of IT. The percentage for financial assistance for acquiring training from outside, hosting of lectures, seminars etc, paid leave for IT training, arrangement of flexible working hours, in-house learning are 23%, 27%, 20%, 18% and 12% respectively.

5.3 Adverse effect of technology on Industrial Relations:

Figure 3 - Proportion of factors for adverse effect of technology on Industrial Relations

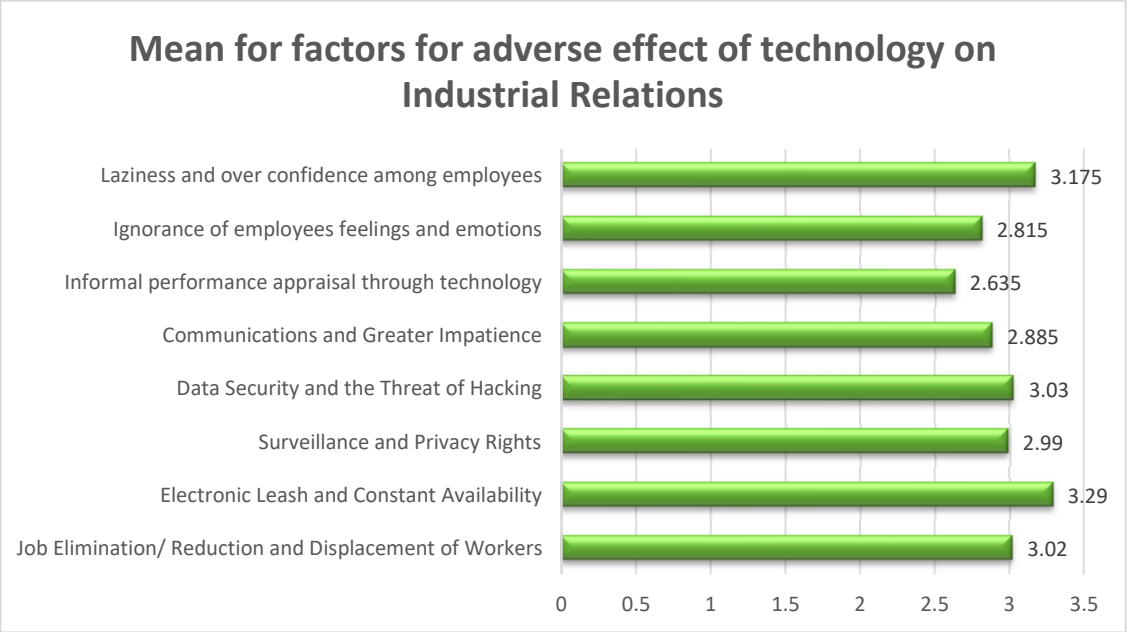

Figure3 resembles the factors for adverse effect of technology on Industrial relations. The mean calculated for Job Elimination is 3.02, Electronic Leash and Constant Availability is 3.29, surveillance and privacy rights is 2.99, data security and the threat of hacking is 3.03, communication and greater impatience is 2.89, informal performance appraisal through technology is 2, ignorance of employees feelings and emotions is 2.82 and laziness and over confidence among employees is 3.18.

5.4 Positive effects of technology in creating cordial relations in organization:

Figure4 - Proportion of the positive effects of technology in creating cordial relations in organization:

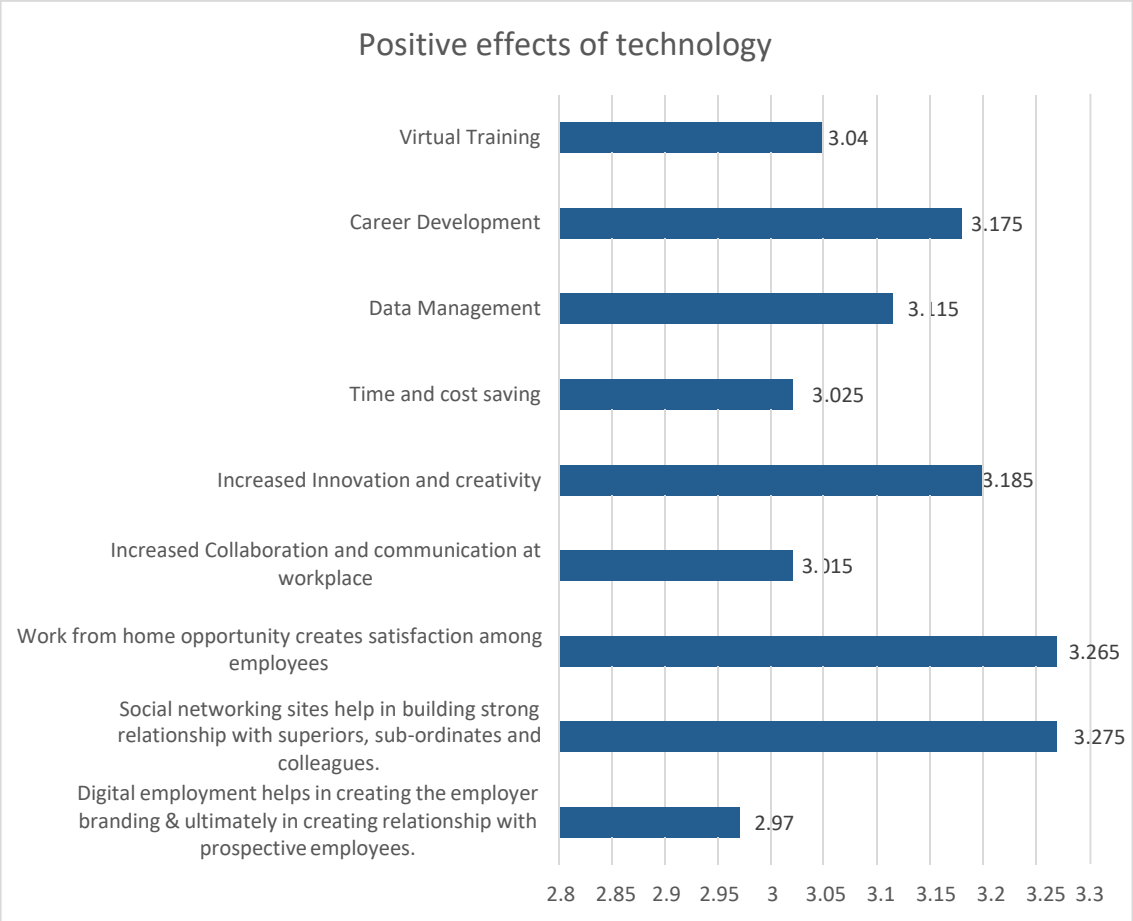

Figure 4 shows the positive effects of technology. The mean for Digital employment helps in creating the employer branding & ultimately in creating relationship with prospective employees is 2.97, the mean for Social networking sites help in building strong relationship with superiors, sub-ordinates and colleagues is 3.27, the mean for Work from home opportunity creates satisfaction among employees is 3.26, the mean for Increased Collaboration and communication at workplace is 3.02, the mean for Increased Innovation and creativity is 3.19, the mean for time and cost saving is 3.03, the mean for data management is 3.12, the mean for career development is 3.18 and the mean for virtual training is 3.04.

5.5 Statements with regard to Technology and Industrial Relations:

Figure 5 - Distribution of statement related to Technology and Industrial relations

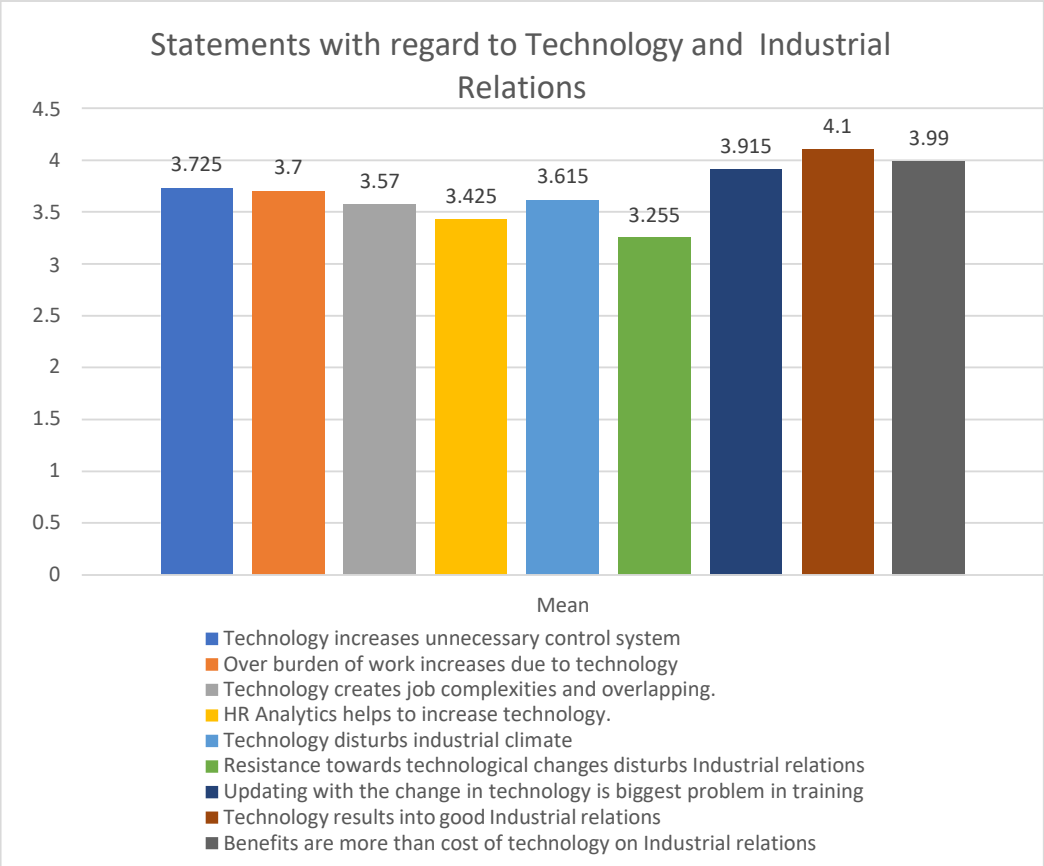

Figure 5 shows the distribution of statement related to Technology and Industrial relations. The mean forTechnology increases unnecessary control system is 3.73, over burden of work increases due to technology is 3.7, technology creates job complexities and overlapping is 3.57, HR Analytics helps to increase technology is 3.43, Technology disturbs industrial climate is 3.62, resistance towards technological changes disturbs Industrial relations is 3.26, updating with the change in technology is biggest problem in training is 3.92, Technology results into good Industrial relations is 4.1 and benefits are more than cost of technology on Industrial relations is 3.99.

5.6 Findings

a. Mean for the direction of relations from employees to managers is 3.69
b. Mean for the direction of relations from managers to employees is 3.83
c. Mean for the direction of changes from employees to employees is 3.79.
d. For the purpose of learning IT: The percentage of financial assistance for acquiring training from outside is 23%, percentage for hosting of lectures is 27%, percentage for paid leave for IT training is 20%, percentage for arrangement for flexible working hours is 18% and percentage for in-house learning is 12%.

5.7 The ranks for adverse effects of training is as follows:

Rank 1: Electronic Leash and Constant Availability (Mean: 3.29)
Rank 2: Laziness and over confidence among employees (Mean: 3.18)
Rank 3: Data Security and the Threat of Hacking (Mean: 3.03)
Rank 4: Job Elimination/ Reduction and Displacement of Workers (Mean: 3.02)
Rank 5: Surveillance and Privacy Rights(Mean: 2.99)
Rank 6: Communications and Greater Impatience (Mean: 2.89)

Rank 7: Ignorance of employees' feelings and emotions (Mean: 2.82)
Rank 8: Informal performance appraisal through technology (Mean: 2)

5.8 The ranks for positive effects of training is as follows:

Rank 1: Social networking sites help in building strong relationship with superiors, sub-ordinates and colleagues (Mean: 2.37)
Rank 2: Work from home opportunity creates satisfaction among employees (Mean: 3.26)
Rank 3: Increased Innovation and creativity (Mean: 3.19)
Rank 4: Career Development (Mean: 3.18)
Rank 5: Data Management (Mean: 3.12)
Rank 6:Virtual Training (Mean 3.04)
Rank7: Time and cost saving (Mean: 3.03)
Rank 8: Increased Collaboration and communication at workplace (Mean:3.02)
Rank 9:Digital employment helps in creating the employer branding & ultimately in creating relationship with prospective employees (Mean: 2.97)

5.9 The mean for statements related to Technology and Industrial relations are as under:

- Technology increases unnecessary control system is 3.73
- Over burden of work increases due to technology is 3.7
- Technology creates job complexities and overlapping is 3.57
- HR Analytics helps to increase technology is 3.43
- Technology disturbs industrial climate is 3.62
- Resistance towards technological changes disturbs Industrial relations is 3.26
- Updating with the change in technology is biggest problem in training is 3.92
- Technology results into good Industrial relations is 4.1
- Benefits are more than cost of technology on Industrial relations is 3.99

6. Suggestions

- The companies should properly train the human resources for technology so that there will be no sense of job insecurity. Updating the knowledge with the change in technology is must.
- Companies should frame strategies to overcome resistance to change for technology.
- Unnecessary control system through technology should be avoided.
- Companies should focus on digital employment practices in order to make relationship with prospective employees
- Innovation and creativity should be encouraged within the organization.
- Surveillance and Privacy Rights of the employees should be secured.
- The companies must not take undue advantage from Electronic Leash and Constant Availability of technology.
- Companies have to carefully deal with Job Elimination/ Reduction and Displacement of Workers in the organisations.
- Companies should take care of people's emotions while introduction of technology in order to make good IR.
- Continuous Feedback serves as an input for enhancement in all types of technical activities and so in IR as well.

7. Conclusion

The growth and development in the field of IT results into strategic shift from traditional personnel management to strategic HRM. The IT industry is enormously competitive and companies may have a high turnover rate, which is not cost effective to support.Businesses are faced with unstable and dynamic environments that require uninterrupted enhancements not only in products and services but also in their overall functioning of technology in order to promote good IR practices. HR professionals can modify their methodologies to emphasis on the retention of the company's top talent by making co-ordial industrial relations. HR representatives need to inspire and facilitate a collaborative environment by appropriate use of technology to increase efficiency within IT firms.

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Acoustical studies of aqueous dextran at various frequencies

Subhraraj Panda
Department of Physics,Centurion University of Technology and Management, Odisha, India
E-mail: subhraraj4u@gmail.com

ABSTRACT
In recent years, ultrasonic velocity calculation has been helpful in the understanding of solvent-solute, solvent-solvent interaction in an aqueous medium.The "ultrasonic speed (U), density (ρ) and viscosity (η)" at 323 K have been determined using ultrasonic interferometer at four different frequencies *i.e.* "1MHz, 5MHz, 9MHz and 12 MHz", pycnometer and Ostwald's viscometer of dextran in aqueous medium respectively. The derived acoustical parameters such as "Acoustic impedance (Z), Adiabatic Compressibility (β), Intermolecular free length (L_f), Relaxation time (τ), Gibb's free energy (ΔG)"have been determined from experimental data. Molecular interactions in aqueous dextran in terms of these thermo-acoustical parameters have been discussed.

Key Words: Molecular interaction, density, viscosity, frequency

Introduction

In determining the molecular structure and molecular properties of different solutions, there are many physical methods that play significant roles. The progress in ultrasonic technique has become a powerful tool in recent years in analyzing knowledge about the physical and chemical behavior of liquid molecules. The ultrasonic analysis of liquid mixtures made up of polar and non-polar components is of greater significance in understanding the intermolecular interaction between the molecules of components and they find many applications in industrial and technical processes.

In this study, "ultrasonic speed (U), density (ρ) and viscosity (η)" values of aqueous dextran over the concentration percent ranges like "0.1%, 0.25%, 0.50%, 0.75% and 1%" have been measured and reported at "1MHz, 5MHz, 9MHz and 12 MHz" at 323 K temperature. The other thermodynamic parameters like "Acoustic impedance (Z), Adiabatic Compressibility (β), Intermolecular free length (L_f), Relaxation time (τ), Gibb's free energy (ΔG)" are also evaluated and reported. The variation of these parameters with concentration and frequency of the solution are studied in terms of molecular interaction between molecules of the solution. Studies in predicting the nature and frequency of molecular interaction in the liquid medium have proved to be enormous.

Dextran is a α-D-1, 6-glucose connected glucan with side chains-3 linked to the spine units of the polymer. We have chosen a polymer dextran as a solute with distilled water as a solvent. This is the only polymer which is water soluble. It has involved a different region of examinations by analysts due to its flexible pharmaceutical, biomedical and modern application

EXPERIMENTAL SECTION

Materials

The dextran solution has been prepared by taking freshly prepared distilled water. The dextran 70,000 was used as a solute in different concentration percent ranges.

Methods

Adopted are equivalent to in my earlier paper

Measurements

(i) "Velocity Measurement"

The velocity of ultrasonic wave in the solution have been measured using "multi-frequency ultrasonic interferometer"(Model M-84).The interferometer measurement cell is a specially built double walled vessel with temperature constancy provision. In order to circulate water through the outer jacket of the double walled measuring cell containing the experimental liquid, an electronically controlled digital constant temperature bath (Model SSI-03spl) operating in the temperature range of -10 ^{0}C to 85 ^{0}C with an accuracy of ± 0.1K was used.

(ii) "Density Measurement"

The "densities" of the mixture were measured using a 10 ml "specific gravity bottle". The density was measured using the formula

$$\rho_2 = \frac{w_2}{w_1}\rho_1$$

"Where, w1 = weight of distilled water, w2 = Weight of experimental liquid, ρ1 = Density of water, ρ2 = Density of experimental liquid"

(iii) "Viscosity measurement"

The "viscosities" of the solution were measured using an "Ostwald's viscometer" The viscosity was determined using the relation,

$$\eta_2 = \eta_1 \left(\frac{t_2}{t_1}\right)\left(\frac{q_2}{q_1}\right)$$

"Where, η_1 = Viscosity of water, η_2 = Viscosity of mixture, ρ_1 = Density of water, ρ_2 = Density of mixture, t_1 = Time of flow of water, t_2 = Time of flow of mixture".

THEORETICAL ASPECT

The "density, viscosity and ultrasonic velocity" were measured and the following thermo-acoustic parameters were determined using the standard formula using these experimental results.

"Acoustic impedance" $$Z = U.\rho \quad (1)$$

"Adiabatic Compressibility" $$\beta = \frac{1}{\rho U^2} \quad (2)$$

"Intermolecular free length" $$L_f = \frac{K_T}{U\rho^{\frac{1}{2}}} \quad (3)$$

"Relaxation time" $$\tau = \frac{4}{3}\frac{\eta}{\rho U^2} \quad (4)$$

"Gibb's free energy" $$\Delta G = kT \ln \frac{kT\tau}{h} \quad (5)$$

"Where ρ density, U velocity, η viscosity KT is the temperature dependent constant. KT = (93.875+0.375T) x10-8 'T' is the absolute temperature; 'k' is the Boltzmann's constant and 'h' is the Planck's constant".

RESULTS AND DISCUSSION

The experimental data relating to "density and viscosity" at 323 K for the given solution have been presented in table 1. Calculated values of "Acoustic impedance (Z), Adiabatic Compressibility (β), Intermolecular free length (Lf), Relaxation time (τ), Gibb's free energy (ΔG)" are presented in tables 2, 3 and 4.

Table 1 Values of "density (ρ) and Viscosity (η)"

T (K)	Concentration									
	0.10%		0.25%		0.50%		0.75%		1%	
	ρ kg.m^{-3}	$\eta 10^{-3}$ N.s.m^{-2}	ρ kg.m^{-3}	$\eta 10^{-3}$ N.s.m^{-2}	ρ kg.m^{-3}	$\eta 10^{-3}$ N.s.m^{-2}	ρ kg.m^{-3}	$\eta 10^{-3}$ N.s.m^{-2}	ρ kg.m^{-3}	$\eta 10^{-3}$ N.s.m^{-2}
323	988.46	0.58354	989.25	0.59752	989.64	0.62488	990.5k0	0.64347	991.62	0.71262

Table 2 Values of "Ultrasonic velocity (U) and Acoustic impedance (Z)"

	(U) m/s				**(Z) 10^6 kg·m^2·s^{-1})**			
Conc.	1MHz	5MHz	9MHz	12MHz	1MHz	5MHz	9MHz	12MHz
0.10%	1550.40	1545.00	1542.00	1547.00	1.5325	1.5272	1.5242	1.5291
0.25%	1548.67	1544.00	1541.50	1547.40	1.5320	1.5274	1.5249	1.5308
0.50%	1548.00	1542.50	1540.00	1545.60	1.5320	1.5265	1.5241	1.5296
0.75%	1549.93	1545.50	1543.05	1546.20	1.5352	1.5308	1.5284	1.5315
1%	1552.00	1548.00	1543.50	1550.00	1.5390	1.5350	1.5306	1.5370

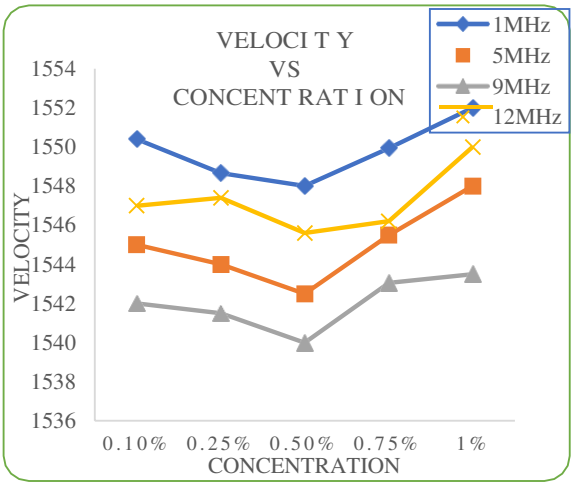

Fig.1 "Ultrasonic velocity vs concentration"

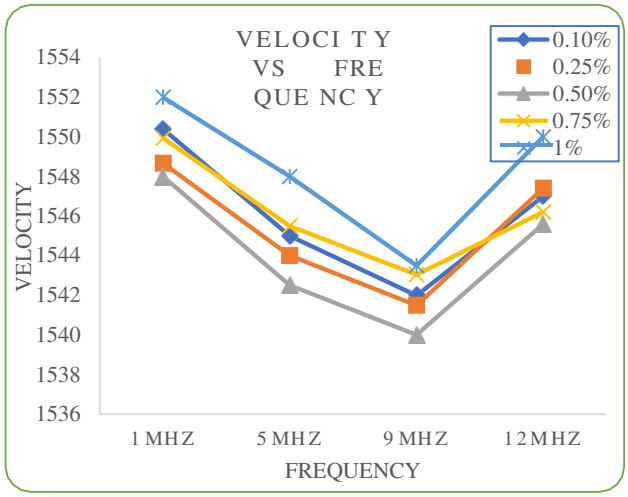

Fig.2 "Ultrasonic velocity vs. frequency"

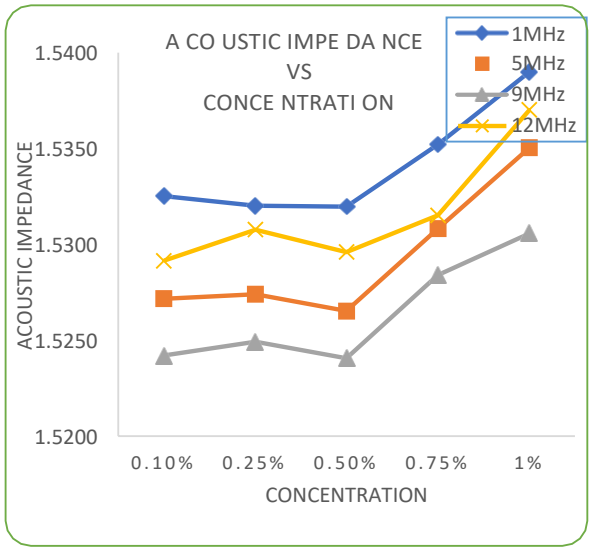

Fig.3 "Acoustic impedance vs. concentration"

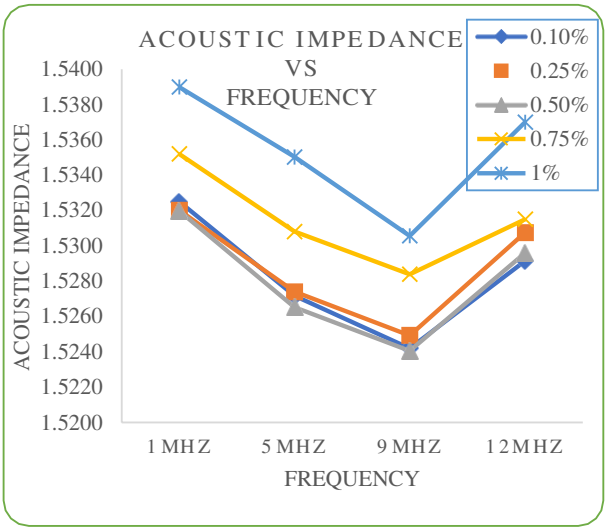

Fig.4 "Acoustic impedance vs. frequency"

It is observed that, although 'U' rises with rise in concentrations at a particular frequency, it gradually decreases at initial concentrations like 0.1%, 0.25% and 0.50 %. This is due to the structural changes in the polymer solution which lead to an increase in intermolecular forces .Further, 'U' decreases with frequency from 1MHz-9MHz for a given concentration and temperature. Such a velocity decrease is an indicator of the presence of a weak molecular interaction between the liquid and the solvent. However, the situation is reversed when the frequency is high (12MHz), which may be due to thermal agitation

In comparison with water higher acoustic impedance values in the corresponding dextran solution and progressively higher values with an increase in the concentration of the solute.Concentration stays constant with rising frequency, velocity decreases and hence acoustic impedance decreases.The inertial and elastic properties of the medium control this aspect and thus promote the likelihood of molecular interactions.The decreasing property of the frequency-increasing acoustic impedance supports the possibility of poor interaction between different molecules. When the frequency is high, the case is just reverse at 12MHz.

Table 3 Values of adiabatic compressibility (β) and Intermolecular free length (L_f)

Conc.	(β)($10^{-10}N^{-1}.m^2$)				(L_f) 10^{-10} m			
	1MHz	5MHz	9MHz	12MHz	1MHz	5MHz	9MHz	12MHz
0.10%	4.2088	4.2382	4.2547	4.2273	4.2120	4.2267	4.2349	4.2212
0.25%	4.2148	4.2403	4.2541	4.2217	4.2150	4.2278	4.2346	4.2185
0.50%	4.2168	4.2469	4.2607	4.2299	4.2160	4.2310	4.2379	4.2225
0.75%	4.2026	4.2268	4.2402	4.2229	4.2089	4.2210	4.2277	4.2191
1%	4.1867	4.2084	4.2329	4.1975	4.2009	4.2118	4.2241	4.2064

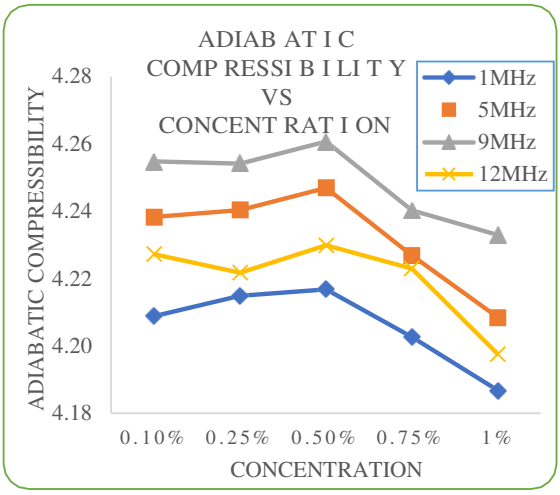

Fig.5 "Adiabatic compressibility vs.concentration"

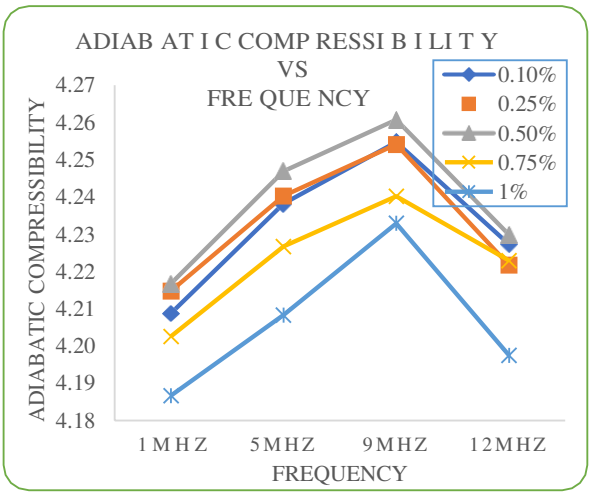

Fig.6 "Adiabatic compressibility vs frequency"

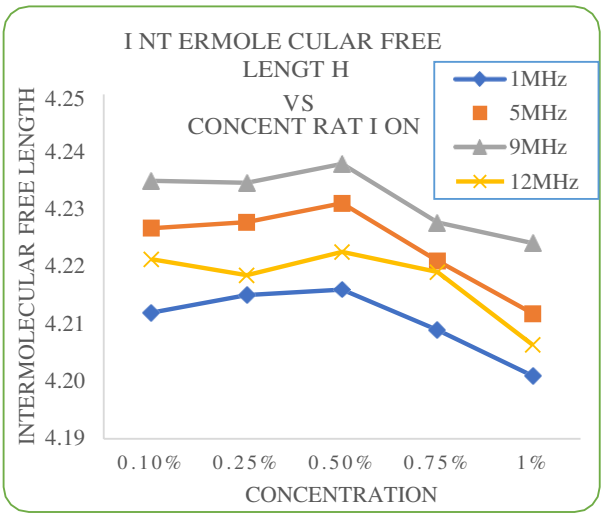

Fig.7"Intermolecular free length vs concentration"

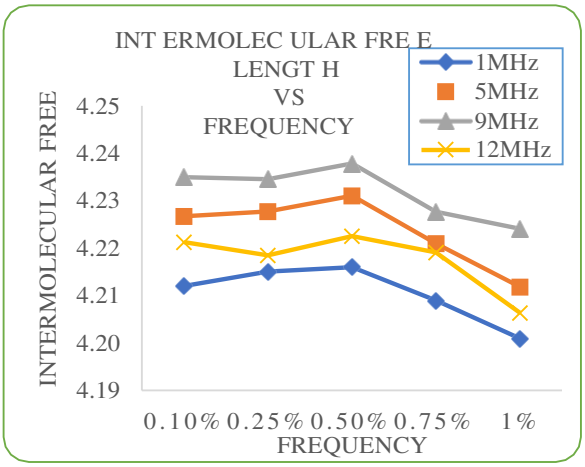

Fig.8 "Intermolecular free length vsfrequency"

"Adiabatic compressibility" decreases as concentration increases (fig.5), suggesting a strong interaction between solvent and solvent molecules at a specific frequency (Fig.5).The interaction between the molecules in the mixture changes as frequency increases, causing a structural change and thus an increase in adiabatic compressibility but reversed at 12 MHz high frequency.The increase in adiabatic compressibility (fig.6) indicates limited interaction between molecules that are not identical.

"Intermolecular free length" relies on "adiabatic Compressibility" and is similar to compressibility behaviour.Therefore, but at a slower pace, "free length" often increases.
If the "intermolecular free length" rises and vice versa, "ultrasonic velocity" can decrease.With concentration that can be due to dipole-dipole interaction, decrease in "free length", H-bonding relationship between solvent and solvent molecules.

Table 4 Values of "relaxation time (τ) and Gibb's free energy (ΔG)"

	(τ)(10^{-13} s.)				**(ΔG)10^{-20}kJ·mol^{-1}**			
Conc.	1MHz	5MHz	9MHz	12MHz	1MHz	5MHz	9MHz	12MHz
0.10%	3.2746	3.2976	3.3104	3.2890	153.05	154.40	155.15	153.90
0.25%	3.3579	3.3782	3.3892	3.3634	157.91	159.08	159.71	158.23
0.50%	3.5133	3.5384	3.5499	3.5242	166.67	168.05	168.68	167.27
0.75%	3.6057	3.6264	3.6379	3.6231	171.70	172.81	173.42	172.63
1%	3.9780	3.9986	4.0220	3.9883	190.73	191.73	192.86	191.23

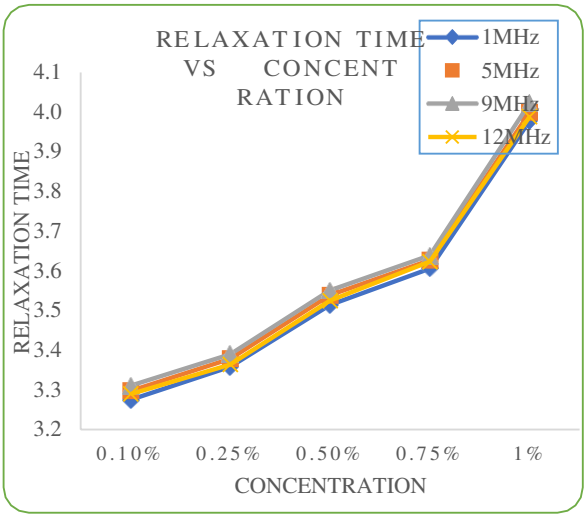

Fig.9"Relaxation time vs. concentration"

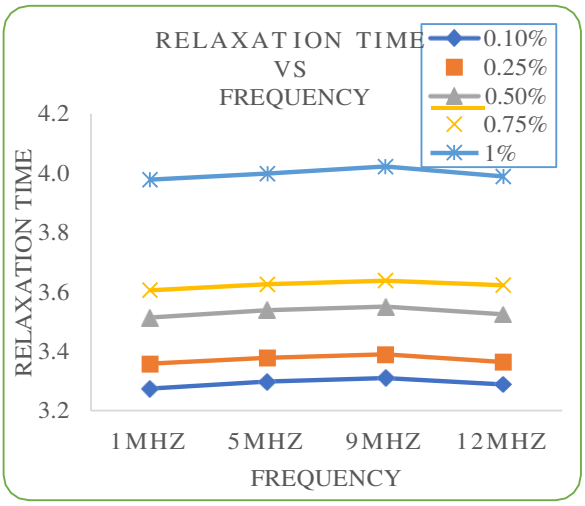

Fig.10 "Relaxation time vs. frequency"

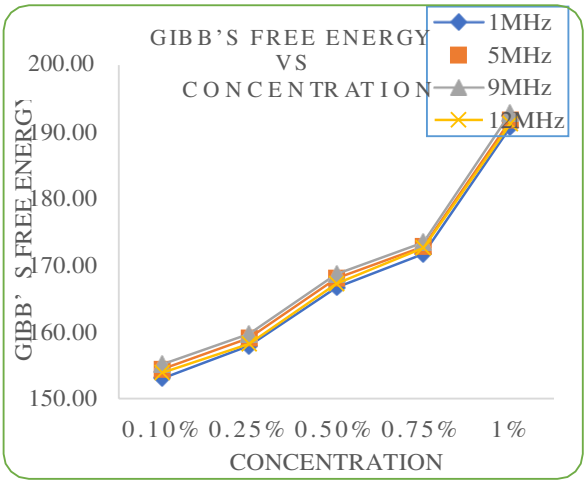

Fig.11 "Gibb's free-energy vs.concentration"

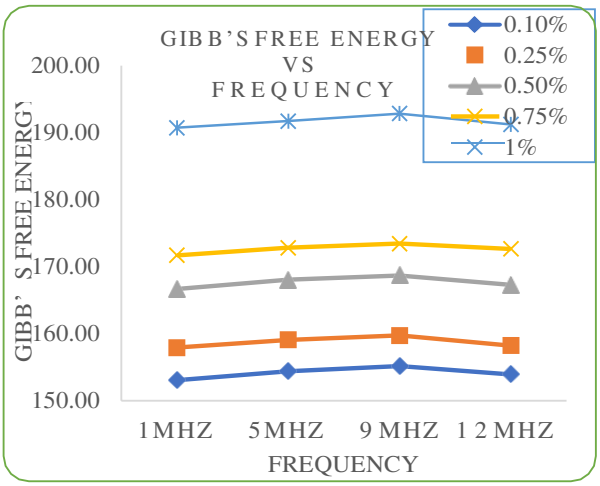

Fig.12 "Gibb's free-energy vs. frequency"

"Relaxation time" rises with a rise in dextran concentration.This scenario means that the molecules are rearranged because the free duration of the cooperation mechanism often increases, however as frequency increases at a slower rate.

With the rise in dextran concentration as well as frequency, the "Gibbs free energy" increases, but reverse order is more frequent.A growing value of "Gibbs free energy" means that the closer approach to unlike molecules is due to bonding with hydrogen.For the rearrangement of molecules in the mixture, the rise in "Gibbs free energy" implies shorter time. The energy imparted to the molecules obviously speeds up the rearrangement procedure as frequency increases. This suggests the presence of a molecular interaction between the liquid solution components.

CONCLUSION

Ultrasonic speed, density and viscosity have been measured for aqueous dextran solution at different frequencies in constant temperature. When the concentration increases, more and more solute molecules move closer to the solvent molecules and thereby increasing the solute-solvent interactions. This is a clear indication of intermolecular interactions because of hydrogen bonding of aqueous dextran solution.

Acknowledgment

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Responsible and sustainable electronics waste management

Sangram Keshari Swain[1] and Bikash Kumar Samantaray[2]
Centurion University of Technology and Management, Odisha, India
E-mail: sangram@cutm.ac.in[1], bikash.samantaray@cutm.ac.in[2]

Abstract:
Electronic waste or e-waste is one of the quickest developing area of the global waste stream and is expanding at a lot higher rate than all other waste streams. Main focus of the current study is electronics waste (e-waste) which is growing as a serious environmental challenge for coming days. The rapid sell and use of electronic products, discarded electronics equipment has become a matter of concern as it contains hazardous and toxic substances. Computers are made from more than 1,000 materials, a considerable lot of which are harmful and they contribute considerably to the e-waste stream, which is assessed to be ca. 20 to 50 million tons every year at the same time E-waste, while reusing or recycling is likewise dangerous because of harmfulness of some of the substances which contains different cancer-causing elements. Different methods adopted by different nations to manage the e-waste by reusing, re-manufacturing, extending producer responsibility and standard to the sustainable management of e-waste.

Keywords: E-Waste, WEE, Sustainable Waste Management

Introduction

Waste electrical and electronic equipment (WEEE) or Electronic waste (E-waste) is a vital flow of waste in the modern-day global environment. Electronics waste is the quickest developing waste stream in the industrialized and urbanized world. [1] Last 10years back, the quantity of waste generated was treated as small enough to be diluted within the environment. With enormous development of hardware and electronics area, the requirement of the hardware items has been improved complex. The quicker change of different features in the electronic gadgets and in the hardware with accessibility of the improved items driving the users to dispose the electronics devices quickly. [2] This has become the main reason for generation of e-waste critically. The main source of electronics waste is the disposal of the electronic and hardware

items from private sectors, Government offices, public sectors and various research institutes. The household consumers are also playing significant role in the production of electronic waste. [3]

Some other factors accountable for the vast generation of E-waste include speedy modifications in data and communication technologies, growing versatility of almost all EEEs, rapid technological developments and improvements and the downward fashion in price tags. E-waste became one of the highest growing waste among all groups of waste streams nowadays and is taken into consideration a tremendous environmental disaster. E-waste consists of enormous amount of precious and important metals, restoration of that's vital for both environmental and economic reasons. It, as a consequence, has attracted massive international interest due to its rich precious metal content. [4]

Electronics Waste Management

What is Electronics Waste:

E-Waste can be characterized as outdated, broken electrical and electronic gadgets which have arrived at their finish of life period or are not, at this point fit for the ideal use and are bound for reusing, recuperation, or removal. On India E-Waste is characterized according to schedule I of E-Waste management rules 2016.

Global Electronics Waste Flow and Quantity

As per the Global E-Waste Monitor 2017, the total volume of electronic waste in the year 2016 is surveyed to be at 44.7 million metric tons, which is indistinguishable from 4500 Eiffel towers. Be that as it may, under 20% of this waste are recorded and reused in a naturally and socially reasonable way.

The majority percentage of E-Waste across the world is recycled in highly hazardous conditions in the developing parts of the world like Africa, South East Asia, and Latin America. [5]

E-Waste Material Composition

It contains different valuable metals like Gold, Silver, Copper, Palladium, Platinum, and so on. The overall assessment of the assistant unrefined material present in e-waste in 2016 would be more than 50,000 crores of rupees from United Nations reports. Careful and intelligent e-waste organization, as it generates new openings, is helpful for our world, the economy and people too. [6]

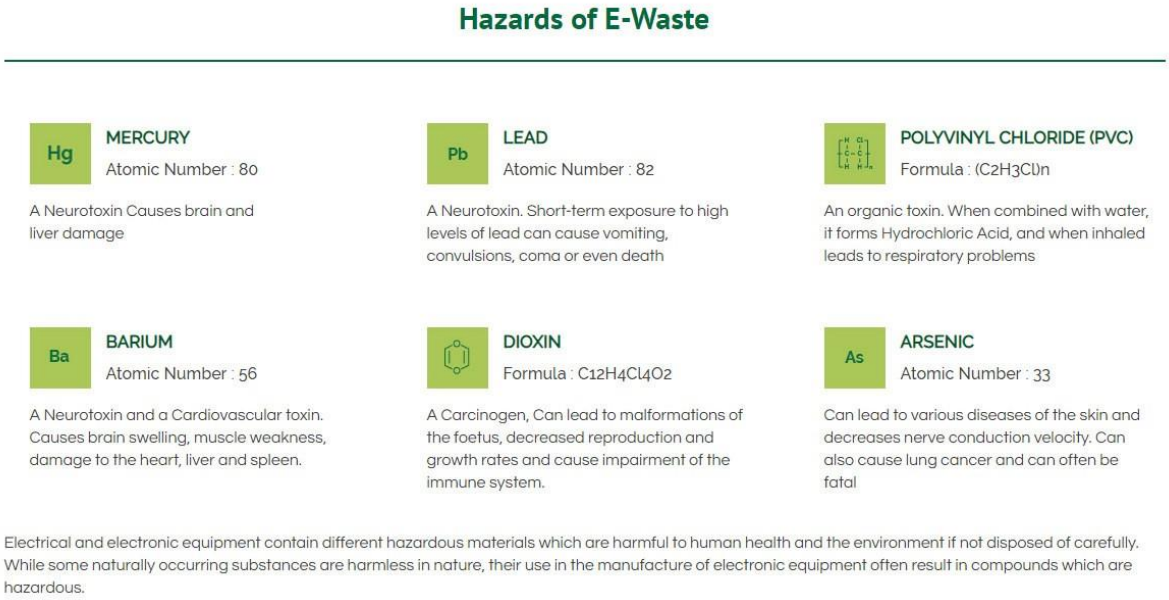
Constituents of E-Waste:

E-Waste Source	E-Waste Component	Environmental Hazard	Effects on Human
CRTs (used in TVs, Monitors, ATM, Video Camera, etc), Batteries, PVC cables, Paints	Lead, barium & other heavy metals	These metals leaching into the ground water and release of toxic phosphor	Anemia, Renal Toxicity, Insomnia
Batteries, Housing & Medical Equipment	Mercury	Air emissions as well as discharge into rivers of glass dust	Renal Toxicity, Muscle tumors, Mental retardation, Cerebral palsy
Plastics from printers, keyboards, monitors, etc	plasticizer bisephenol-A(or BPA), as well DEHP and DBP, plastic compounds known as phthalates	Chlorinated plastics release harmful chemicals into the surrounding soil, which seep into ground water or other surrounding water sources which cause serious harm to the species that drink this water.	Risk in developing heart problems, obesity, reproductive disease
PVC & polymer, Paints, Printing inks, Electrical transformers & capacitors	Polychlorinated Biphenyls (PCBs)	include extreme pollution from production, toxic chemical exposure during use, hazards from fires	Suppression of immune system; Damage to the liver, nervous and reproductive systems

Table: Constituents of e-waste

Hazardous Components in E-Waste

Electronics waste substitutes dangerous substances like Lead, Mercury, Cadmium, CFCs, and Flame Retardants which when managed in an unscientific manner can cause serious health hazards not only to the person exposed to the toxic substances but also to the population leaving in the surrounding area by polluting the air, water, and soil. However, not everything about E-Waste is bad news. E-Waste also contains a large variety of valuable materials and plastics. Nearly 60 elements of the periodic table can be extracted from complex electronics. [7]



Picture: Hazards of e-waste

Picture: Adverse Impact of e-waste

Source: https://greencitizen.com/learn-more/harmful-effects/

Conception and Generation of E-waste:

E-waste refers to electronic gadget and electrical gadgets which are disposed by consumers, mainly comprises computers, televisions, air conditioners, washing machines andrefrigerators. Additionally, monitors, printers, mobile phones and photocopiers considered outdated by their owners also included in E-Waste. As of 2018, China has 109 traditional E-Waste disassembling companies and the first listed on the subsidy catalog for the dedicated fund was E-Waste such as air conditioners, televisions, laptops, refrigerators and washing machines. The Chinese government has not yet made any regulation about how to subsidize the proper destroying of small appliances like printers, monitors, cell phones etc. With the quick improvement in economy, the longevity of applications is reduced, leading to the creation of a massive amount of E-Waste. Basically, the material composition of E-Wastecontains metals, additives and plastics. Different research has shown that plastics predominantly comprise of acrylonitrile butadiene

styrene, polystyrene and polypropylene. Most of the metals in nature can be found in E-Waste. [8]

According to different researchers, the production of E-waste increases every year. Because of the missive generation of E-Waste, many technics must be adopted to resolve this issue. If no worldwide measures are executed to discard E-Waste, landfill area could be occupied with the aid of E-Waste. At the same time organic pollutants and heavy metals present in the E-Wastewill create pollution in surrounding environment. However different metals present in E-Wasteare likewise assets, andif with appropriate strategies, the lack of metal assets worldwide these metals can be alleviated. [9]

E-waste and global market:

From different studies it is observed that around 50 million tons ofE-Wastewas produced worldwide in 2018. Half of which is personal gadgets like smart phones, tablets, screens, TVs and computers, with the rest being larger residential electrical appliances and heating and refrigeration equipment.Regardless of 66% of the global population is protected by E-Waste enactment, just 20 percent of worldwide E-Waste is reused every year, which implies that 40 million tons of E-Waste is either scorched for asset recuperation or wrongfully exchanged and handled in an unacceptable manner. Alone in the US, in excess of 100 million PCs are discarded with under 20% being reused appropriately. [10] China disposes of 160 million electronic gadgets a year. Before, China has been viewed as the biggest E-Waste unloading site on the planet. A huge number of individuals have skill in destroying electronic garbage. The rate at which the E-Waste volume is rising worldwide is between 5% and 10% per year. In India, the volume of E-Waste produced was 146,000 tons per year. Although, this information just incorporates e-waste produced nationwide and does exclude waste products (both lawful and unlawful) which are generous in arising economies like China and India. The cause is that a huge quantity of waste of electronic and electrical equipment approaches India from overseas nations. Switzerland is the primary nation in the universe to have set up and executed a proper E-Waste management system that has reused 11 kg/capita of E-Waste against the 4 kg/capita goal set by EU. [11]

E-Waste and Indian Market:

India creates almost 2 million tons of electronic waste every year. E-waste is creating veritable general prosperity and biological affair in India. India is the "fifth-largest exported electronic waste on earth"; around 2 million tonnes of electronic waste are shipped annually and an unknown proportion of electronic waste is imported from different countries around the world. [12]

Yearly, computer gadgets represent almost 70 percent of e-waste, 12 percent originates from telecom sector, 8 percent of clinical, and 7 percent of electric equipment. Practically 75% of electronic waste is generated by both government and private entities, with the liability of the individual family being merely 16%.

Electronic waste is a standard, easy-going name for electronic things moving toward the completion of their "supportive life." PCs, televisions, VCRs, sound frameworks, copiers, and fax machines are typical electronic things. You may reuse, renovate, or reuse a large number of these items. With this E-waste trash list, which includes devices such as mobile phones, laptops, PCs, video game consoles, cameras, and some more, an up-grade is done. In January 2018, India had 1,012 billion complex Portable Associations. The number is continuously developing exponentially. [13]

The Compound Yearly Production Rate of electronic waste is 30 percent, as indicated by ASSOCHAM, a modern body in India. With changing purchaser conduct and fast financial development, ASSOCHAM gauges that India will create 5.2 million tons of E-Waste by 2020.

While electronic waste recycling is a wellspring of pay for some individuals in India, it additionally represents various health and environmental dangers. Over 95% of India's electronic waste is unlawfully reused by casual waste pickers called kabadiwalas / raddiwalas.

Impact of Recycling E-waste:

Generally, most of the E-Waste contain some sort of recyclable materials, including metals, plastic and glass. Since these materials cannot be retrieved for various uses due to incorrect

removal techniques and methods. IfE-Waste is disassemble and processed in a rough way, its poisonous constituents can unleash destruction on the human body. Processes like disassembly, incineration and wet chemical processing are utilized to discard the waste and result in the direct introduction and inward breath of destructive synthetic compounds.Protection materials like hand gloves and face covers are not generally utilized and labourers regularly come up short on the information and experience needed to complete their job. Recycling or reusing of E-Waste is contaminating the water, air and soil. By burning of wires and cables emits chlorinated dioxins, brominated dioxins cause air pollution and it also causes cancer. During the recycling, because of no economic value, chemicals which are present in E-waste simply dumped. These harmful chemicals substances drain into underground water in this way degrading the nearby groundwater quality and delivering the water unsuitable for human utilization just as farming purposes. When E-Wasteis disposed in landfills, mercury, arsenic, lead, PCBs and cadmium make the soil polluted and not useful for agricultural purposes. [14]

It is assessed that about 50 million tons of e-waste were collected worldwide in 2018. Most of these are personal E-Waste like smartphones, tablets, computers, TVs and screens, while the others are massive household appliances like refrigerators.

Opportunities of E-Waste Management in India:

The Ministry of Environment, Climate Change and Forestdisclosed the E-Waste(Management) Rules in 2016 to minimize E-Waste generation and improve re-use and recycling.Because of these principles, the government body introduced the EPR, which makes manufacturers subject to the collection of 30 percent to 70 percentages (more than seven years) of the e-waste they generate, according to the report. [15]

E-Waste is a valuable source of metals such as silver, copper, and gold, which can be extracted and brought back into the cycle of creation. There is notable economic prospective in the effective recuperation of significant materials in E-Wasteand can turn out revenue producingchance for both individual and endeavours. The E- squander Management Rules, 2016 were revised by government of India in March 2018 to smooth and constructively execute the eco-friendly management of E-Wastein India.

Amendments to E-Waste Management Rules (2018)

- The spectrum of electronic waste based on EPR has been updated and is acceptable as of October 1, 2017. For E-Waste in weight, the stage informative assortment focuses on 10 percent of the amount of waste produced as shown in the Extended Producer Responsibility Plan during 2017-18, with a 10 percent continuous expansion until 2023. The goal was to create 70 percent of the amount of electronic waste created after 2023.
- The amount of electronic waste that is collected by producers from 1st October 2016 to 30th September 2017 need to be reflected by March 2018 in the revised Extended Producer Obligation orientation.
- The PROs shall apply for enlistment by the CPCB to approve exercises endorsed in the Guidelines.
- Separate electronics waste assortment expectations have been included for new makers, those makers whose number of long stretches of deals activity is not exactly the normal existences of their items. The normal degrees of the items will be according to the rules gave by CPCB now and again.
- Under the Reduction of toxic materials (RoHS) arrangements, the expenses for inspection will be bear by the administration to reduce the Hazardous Substances test. On the off

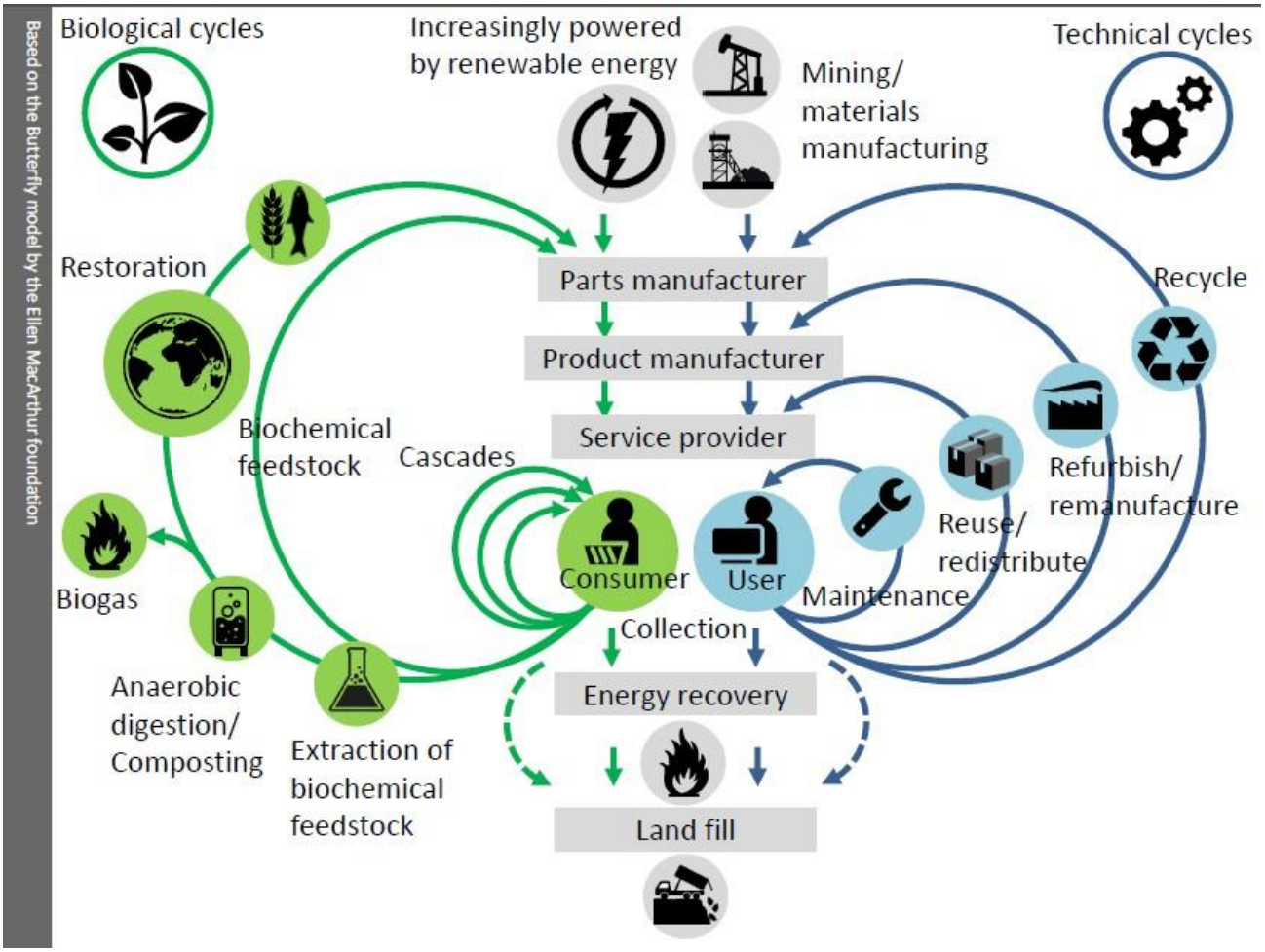
chance that the item doesn't consent to RoHS arrangements, at that point the expense of the test will be borne by the Makers.

Revised Collection Targets for Producers and OEMs

* Of the amount of waste created as shown in Extended Producer Responsibility Plan

** Revised goals as amended by the electronic waste rules amendment dated 22nd March 2018 by G.S.R. 261(E) vide notification.

*** New makers and existing makers those have begun activities as of late for example number of long periods of activity is not exactly the normal existence of their items referenced in the rules gave by CPCB.



Picture: Butterfly model for e-waste recycling

Key stakeholders for a Sustainable e-waste management system

The key stakeholders distinguished along the administration chain have their individual jobs and duties towards feasible E-Waste the board in the nation. Inside the recycling or reusing network, numerous partners are included. Every partner shares its particular duties regarding data, material and monetary streams.Each and every stakeholder works as per their role and responsibility. Table 1 presents the stakeholders and their roles.

Stakeholders		Responsibilities
Management authorities	E-waste recycling Fund Management Centre	Operation of the system
	State Council	Release of Regulation
	Authorities from local municipal level, provincial level, and state council level	Planning; Technical policy; Environmental inspection, etc;
Collectors	Retailer	Collection of the e-waste and submit them to qualified recyclers.
	Professional collector	
	Repair shops	
Third party Service Provider	Logistics Providers	Transportation
	Quality Inspector	Environmental inspection
	IT service provider	IT service
Producers		Pay the e-waste recycling fee according to market share
Recyclers		Sorting; dismantling; treatment of e-waste
Waste disposers		Landfill or incineration of hazardous material & waste
Consumers		Submit (or sell) the e-waste to the qualified collectors

(Table 1. Stakeholders in E-waste Recycling unit)

Associates in the Non-formal area in India include IT enterprises, government workplaces, public and private area foundations, business and corporate houses and educational institutes, etc alongside Kawadiwalas (ragpickers), scrap vendors, entire merchants, recyclers, dismantlers. Among these various partners, IT ventures, government workplaces, public and private area establishments, business and corporate houses educational institutes, and so on are predominantly liable for the creation of the E-Waste. They produce the E-Waste and then move it on to the Kawadiwalas (rag pickers), scrap vendors, entire merchants, recyclers for the

management motive. The associates liable for overseeing E-Waste in the non-formal area fundamentally do significant tasks like assortment, isolation, disguising, and dismantling. Kawadiwalas and little piece sellers are predominantly accountable for collection work. They typically collect the E-Waste from a buyer with an appropriate compensatory cost. Kawadiwalas are one of the most effective authorities of E-Waste. E-Waste is gathered in mass amount by huge piece sellers from IT enterprises, government workplaces, public and private area offices, school, colleges and other business and corporate houses, etc.

India has EPR based E-Waste legislation since the year 2011 and more recently the electronic waste management rules, 2016, and rules for amending electronic waste, 2018, apply to each maker, maker, shopper, mass buyer, assortment focus, vendor, e-retailer, refurbisher, dismantler and recycler associated with fabricate, deal, move, buy, assortment, stockpiling, and preparing of E-Waste or electrical and electronic gear recorded in Schedule I of the guidelines.

EPR- Extended Producer Responsibility

As per the 2001 OECD Guidance, Extended Producer Liability (EPR) is defined as an objective ecological arrangement-based strategy in which the producer is responsible for an item over the life cycle of an item's post-purchase process. It gives a structure to the mindfulness age on E-waste just as financing to empower a framework for assortment, invert coordination, reusing, and removal of E-waste in a naturally and socially dependable way.

More Research on E-Wastemanagement:

Significantly more ecological epidemiological investigations are expected to assess the current standing of E-Wastemanagement framework in India, to survey the E-Waste amounts and definite adequacy of the issue in Indian metropolitan zones, and to develop associations with the casual recycling sectors. The critical data will be created by these learningsthat may facilitate in designinga scheme for E-Wastemanagement.India should start a perception system for diseases and prosperity results of e-waste. The manageability of e-waste the board systems should be ensured by improving the collection and reusing structures. It is appealing to set up an open private relationship in setting up repurchase or drop-off core interests.Demanding improvement reusing charges is another approach to manage to ensure waste the board viability. The approach

to sustainable future growth can be to find and effectively implement the best solutions for e-waste management around the globe. The elimination of dangerous substances in electronic and electrical supplies and the expansion in the use of their safer alternatives have been adopted by a number of nations by the Restriction of Hazardous Substances Legislation in the production of such substances.So many more such less dangerous substitutes should be defined which can be used in electrical components.

Conclusion

Problems, because of E-Waste, are probably going to be major in near future. At whatever point a client replaces PC or cell phone, the item may disappear from the client however it never disappears from the surrounding. Thusly, there should be systematic development through innovative work, in the items to upgrade andrecycle. Additionally, there is require of a structure that can manifest the way for the administration of E-Waste. Most likely India is being overwhelmed by casual area in administration of E-Waste as of now however India has likewise begun thinking on practical administration of E-Waste. The outline has been ready for E-Waste dealing with and rules, which is accessible at site of Ministry of Environment and Forests. The obligations of assortment focus, makers, recyclers, dismantlers, customers, and so forth, are remembered for it. It will be intriguing to see that how effectively these standards can help in the reasonable administration of E-Waste.

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Waste management and innovative ways of hand paper making

Sangram Keshari Swain[1] and Bikash Kumar Samantaray[2]

Centurion University of Technology and Management, Odisha, India

E-mail: sangram@cutm.ac.in[1], bikash.samantaray@cutm.ac.in[2]

Abstract:

In the present case, the recycling and reuse of waste substances plays a key role in the environme nt. Paper is a really useful thing for all. Reuse of waste paper can solve many environmental issues and reduce environmental pollution, keeping the ecosystem stable. It is estimated that around 35 percent of our waste consists of paper products. This high demand for paper is a major factor in the deforestation of the world's forests. It also contributes greatly to the waste management problems we are facing around the world. To combat these problems, paper recycling has become a large industry.This chapter gives an insight into the composition, creation, and recycling of the various waste papers and their products with different innovative ways of hand paper making.

Keywords: Paper Waste, Hand Paper, Waste Management

1. Introduction

Growing quality of life and high resource use habits have unwittingly and adversely influenced the urban environment – creating waste far beyond urban and agency control. Cities are now addressing the problems of high waste volumes, the costs involved, recycling processes and methods and the effect on local and global ecosystems of waste.[1]Universally, population growth together with economic growth, production of waste also increasing, which is remain as major concern for developing as well as developed countries [2]. Most developed nations went through a period when they were growing ecologically. Today, notwithstanding, the majority of these nations have successfully tended to a significant part of the wellbeing and natural contamination issues related with squanders age.

General Aspects of Paper Waste Management

Early researcher cited as the waste control is one of the public infrastructures which might be based on a particular form of physical infrastructure to offer the products or services, and in this respect, it resembles the strength, herbal gasoline, and water region. Waste control rehearses shift for developed and developing nations, for city and country areas and for private and business makers. The board for non-hazardous private and institutional waste in metropolitan districts is commonly the duty of neighbourhood government specialists, while the executives for non-unsafe business and business squander is regularly the obligation of the generator. While recycling began to be recognized as critical for each environmental and aid control reasons, recycling rates for family wastes in maximum advanced international locations inside the Nineteen Eighties were inside the low single figures with the aid of percentage. Modern-day western waste management systems have rebuilt recycling prices over the past 20 years. Modern-day waste control structures, which many growing united states cities aspire to, are all characterised via high recycling quotes of clean, supply separated materials [3].

Maximum technologies for waste management are mature and have been efficiently carried out for decades in many countries. In Turkey, solid Waste control law got here into pressure in order to control solid waste in 1991. The regulation has been constantly updated. Considering the directive of Waste body EEC and the other directives as part of the requirements of the integration process, the department has started the arrangements for the regulation of Waste body and the draft of the law has been presented for attention. Subsequently, the waste management is carried out consistent with the Turkish stable Waste control that become adopted in 2008. Within the regulation, the procedures about the category of the wastes, collection, transportation, and transient storage of the wastes inside the institutions and the transportation of them to the final disposal region were defined. Within the closing a part of the law, the technique of the disposal of the wastes was cited. New trends in the discipline of waste control ought to be covered into the gadget.[4]

Massive portions of this waste cannot be eliminated. But the environmental impact can be reduced with the aid of making extra sustainable use of this waste. This is called the “Waste

Hierarchy". The hierarchy of disposal alternatives, which categorizes environmental affects into six degrees, from low to excessive; namely, lessen, reuse, recycle, compost, incinerate and landfill. The waste pecking order remains the foundation of most waste minimization procedures. The expectation of the waste pecking order is to remove the most extreme reasonable preferences from stock and to create the base amount of waste. Waste arrangement strategies range widely among explicit nations and areas. Homegrown waste arrangement administrations are regularly given by utilizing neighbourhood specialists, or by method of private industry. A few regions, mostly those in less created global areas, do presently don't have a proper waste-assortment device [5].

Utilization of Paper Waste

In pulp and paper industries, considerable amount of solid waste, waste water and waste gases are generated. Notwithstanding of different strategies alongside various methods used to change over waste materials for recuperation of crude materials, it is likewise used for land filling, Fertilizing the soil, Vermi-treating the soil, creation of Lactic corrosive, assembling of Ethanol, creation of creature Feed, Anaerobic absorption and so on. Distinctive paper waste sludge produced from paper fabricating industry can be used as a substitution to the diverse mineral filler material for different cement blends according to their physical and synthetic properties for some fundamental quality trademark like compressive quality, water assimilation, thickness and flexural and so on. Similarly, waste material utilized for the manufacturing of ceramic materials, fiber board products, Cellulose-primarily based specialty products, Nanocomposites etc.[6]There are opportunities for awareness of ecological improvements of this industry both by using development of the used technologies of various merchandise and through usage of some of the generated wastes like secondary raw cloth and strength resources.

Paper is one of the easiest and most commonly recycled products. Recycled paper already saves millions of trees, immense amounts of water, space in landfills, and all the fossil fuels and other resources that go into the process of making and disposing of paper. The more we recycle, the more we can save.

Sustainably Repurposing Paper into Compost

For most people, adding shredded paper to compost is probably the easiest and best way to repurpose it. Benefits of this approach include:

- Paper is a Source of Carbon: Shredded paper is an excellent source of Carbon, especially newsprint and financial-statement types of paper. Carbon is an essential component of a healthy compost system and adding shredded paper can help you attain the ideal Carbon to Nitrogen ratio of 25C:1N. A simple rule is, if your compost pile is smelly, you need more carbon.
- Moisture Retention: Adding shredded paper increases moisture retention which helps material break down faster and reduces odors and leakage issues. When used in soil, moisture can be recovered more at the root level and this promotes healthy growth.
- Increases Soil Volume: The volume of soil is increased with the addition of shredded paper. This means morefresh compost is available to use around your landscape.
- Worms: Shredded paper helps with vermicomposting because worms love paper and use it as a source of food and shelter in compost. Shred your paper if you'd like it to be easier for your worms to consume.[7]

Keep in mind however that there are some papers that shouldn't be recycled or composted. These include waxy papers, papers with foil or tape on them, and papers that have strong dyes, heavy inks, and other printing chemicals. Also don't compost coffee cups, take-out boxes, milk or juice cartons and paper plates because they often contain plastic. Only compost them if they are certified compostable.[8]

Fundamentals of Hand Paper Making

The essential papermaking measure includes plunging a screen extended over a casing (the form and deckle) into a tank of mash, lifting the screen out of the tank, and shaking it to and fro - and side to side - with the goal that the strands interlock and bond on head of the screen surface as the water channels through the screen. The newly made piece of paper is then framed (moved) onto a surface - generally a felt and is then squeezed and dried.

People in this field are always inventing new equipment, adapting items from other industries, and redesigning old machines to function better. Networking is a great way to find the things you need or learn how to build them. There are several papermaking organizations, a trade magazine called Hand Papermaking, and a wealth or information to be found on the Internet, from papermaking Web sites that highlight artists' offerings to those that show the uses of the process in the developing world to sites that feature university ang art center course offerings.

Collecting and Preparing the Fiber

Paper can be made out of a variety of materials, ranging from recycled paper to plant fibers, such as flax, corn husks, or iris leaves, to pre-processed pulps, such as, cotton linter and other natural fibers including cotton and linen rags. All these materials contain fiber, an essential ingredient in papermaking. Fibrous plants have been used throughout history to create many of the things we use every day, such as clothing, linens, baskets, and rugs.[9]

Fiber comes from plants with an abundant supply of cellulose. All plants contain cellulose, but some contain a higher percentage than others. Cotton linter, one of the staples in Western papermaking, contains the most cellulose - up to 95 percent.

Bast fiber the inner bark of tree branches and the stall herbaceous annuals and perennials - is located between the bark and the core of a branch. The inward barks of many arrangement very meaty and veld a decent measure of fiber for making strontrous pieces of paper. Bast fibers were used to make the first papers in Asia and are still in use today. There are two main types of bast fiber: woody bast, from the branches of trees such as elm (Ulmus americana) and paper mulberry (Broussonetiapapyriferal) and herbaceous bast, from the stalks of herbaceous annuals and perennials such as milkweed (Asclepias speciosa) and nettles (Urtica dioica). A third type of bast fiber is found in the petiole, or leaf stem, of plants such as abaca (Musa textilis), Petiole fibers are typically long, tough. and stringy - similar to the stringyWoody bast comefrom tree branches fiber found in pineapple tops.

To acquire the usable fiber in bast fiber plants, the branches on stalks must be steamed (to isolate the inward bark fiber from the center) and afterward scratched (to eliminate the external dull hued bark).

Beating Pulp

Beating the pulp is an essential step in the paper making process. The fiber needs to be turned into a loose viscous matter that can be scoped onto a screen to form sheets of paper. This can be achieved by several methods, including hand beating using simple house hold equipment, such as blender or using specialized equipment designed for paper making such as Whiz mixer, a stamper or a Hollander beater.[10]

The equipment used to beat the fiber and length of time will vary the resulting paper. Particularly when you use a Hollander beater, lengthening the beating time can produce dramatic result. Abaca fiber beaten for 30minutes will produce a soft opaque sheet that shrinks very little: if it is beaten for more than 8 hours, the resulting sheets are crisp and translucent, with a high shrinkage rate.

How Beating Works:

Individual papermaking fibers are slender, just millimetres in length. They are made up of cellulose molecules - long chains of hydrogen and oxygen atoms - with tiny fibrils resembling pipe cleaners, which interlock and bond when formed into sheets of paper. This bonding is called hydrogen bonding, and it occurs naturally between cellulose and water molecules because they have similar polar charges, which allow them to attach together like magnets. As the cellulose molecules are beaten, tiny fibrils on the fiber surfaces are raised, creating sites for water molecules to attach.[11]

Beating also shortens the fibers, so they are evenly distributed during sheet forming. As water is removed and evaporates throughout pressing and drying, the fibers are actually pulled closer together, and hydrogen bonds form between the cellulose molecules.A few fibers can be beaten right after they are obtained, with having to be cooked first such as recycled paper, prepared

sheet pulp from paper making supplier. Also, plant fibers like flax or hemp can be beaten without cooking if it will be beaten in a Hollander beater. Plant fibers can be beaten by different processes like Hand beating, Blender beating, Hollander beating, beating with drill attachments and whiz mixers and beating with stampers

Using Additives

Several additives can be blended into your papers to colour and coat them and protect them from deterioration. These additives are ne necessary, but they will change the quality of your pulp and, in many cases, enhance your papers. Most of them can be blended into the pulp at the end of the beating cycle and before you start making sheets. If you wish to add something to only one particular batch of pulp. You can stir it directly into the vat.[12]

Sizing:

Sizing is a liquid substance that coats fibers and makes them more water repellent and bleed-resistant. It allows you to use watercolours and inks on the finished sheets.

Surface Sizing:

Sizing can also be applied to papers after they are formed into sheets and dried. This technique, called surface sizing, adds an additional layer of protection against contaminants in the air. Traditionally used throughout Asia and Europe, surface sizing may have contributed to the permanence and durability of many historical papers.This technique coats the paper and gives it a sturdier finish than internal sizing. Surface sizing can also be purchased from papermaking suppliers.

Some common materials used for sizing include corn, rice, and wheat starch, as well as gelatine.

Buffers, Brighteners, and Fillers:

Some additives can make paper smoother, opaquer, and resilient to environmental conditions that cause degradation. Calcium carbonate ($CaCO_3$) comes in powder form and can be added to the pulp at the end of the beating cycle. It protects the paper from acidic contaminants in the air by slightly increasing the paper's alkalinity. It also acts as a filler, occupying the subtle crevices

between the fibers and thus making sheets of paper smoother and opaquer. Clay or kaolin, also comes in powder form; it can be used to make paper opaque and smooth. It is also useful in paper casting, because it reduces shrinkage during drying. Titanium dioxide (TiO2) is a white pigment that can be added to make paper whiter, opaque, and smooth. A number of other additives, each with its own specific purpose, can be used in the papermaking process.[13]

Formation aid: This slimy substance is added to the vat during use of the Japanese sheet-forming technique, or any other techniques to slow the drainage time. This leaves more time for dispersing fibers during sheet forming. It also prevents the fiber from clumping. The traditional Japanese formation aid is neri, which is extracted from the roots of the Japanese tororo plant (Abelmoscshusmanihot Medikus or Hibiscus manihot L.) by a process of pounding and soaking them in water. In a few hours the water becomes a thick, gooey slime called tororo-aoi.There are also natural alternatives to neri, such as the fruit of the okra plant and the roots of hibiscus and hollyhock.

Retention aid (also known as retention agent) is a cationic substance (made up of positively charged ions) that binds pigment to the fiber's surface. Pigments tend to have a negative charge and will therefore attach to the pulp if the proper amount of retention agent is added. Soda Ash (NA_2CO_3) powder is a base substance that guides in the expulsion of non cellulose materials from a plant fiber when it is doused or cooked in arrangement with the fiber. It is the most widely recognized antacid utilized in papermaking.

Methyl cellulose is an archival water-based adhesive, it can be used to size paper externally, strengthen bonding when casting with pulp and to attach paper to paper in the wet or dry state. It is available in powder form.

There are several methods of colouring paper, but the two main tinting agents are pigments and dyes. Colour permanence is of great concern to many papermakers. In general, pigments are more permanent than dyes, especially in terms of being lightfast (not fading over time): these are the most typical colorants used by hand papermakers.

Making Paper

There are three basic types of papermaking Western, Eastern, and deckle box. Eastern papermaking and the deckle box technique came before Western papermaking and were originally used with bast fibers, such as kozo, mitsumata, daphne, gampi, and hemp. These fibers produced smooth surfaces for the ink and brushwork common in Eastern countries. When papermaking found its way to Europe, where the stylus was the common writing tool, cotton and linen rags were the usual raw materials. These types of paper were also used when the printing press was invented.

Although each technique was developed for use with certain fibers, they are somewhat interchangeable. Western papermaking is suitable for many fibers, but when couching (transferring paper from a mould to a felt) becomes difficult, you might try Japanese paper making, which is also ideal for making very strong, thin papers. The deckle box technique can be used to make very large sheets of paper, because you can pour rather than dip the sheets, thereby eliminating the need to lift a large mould and deckle. It is also good for making thick sheets nick sheets, combining pulps, and making a sheet without a vat.[14]

Papermaking Techniques and Projects

Pulp Painting:

Paper pulp can be pigmented and used as a medium to paint on surface of a wet sheet of paper - the wet base sheet is similar to painting canvas. Layers of pulp can be applied and built up on the freshly made sheet of paper. When pressed, the layers flatten and bond, becoming one uniform surface.

Pigmented paper pulp has a different consistency than paint. It can be applied by squirting it through a bottle, turkey baster, or syringe. If it is refined enough, it can even work with a brush. As layers of pulp are applied to the base sheet, they can be misted with water to create varying intensities of color, scraped through to bring up colours that lie underneath, and manipulated in a variety of ways. Using pulp painting techniques different projects can be done.

Ex: Marbleizing paper, Fine-Line Stencilling

Laminating:

Laminating can be done while working on top of a freshly couched sheet of paper. Several sheets can be laminate one on top of the other, or collage other materials onto the sheet. A two-toned sheet of paper also can belaminate one color or fiber to another; when pressed and dried, the fibers will bond and become one sheet of paper. Or, collage items such as photographs, strings, and fabric directly onto the surface of a sheet when it's still wet.

Embedding:

One can sandwich items between two sheets of paper to creating textures or add structure to a sheet. Use a translucent fiberon one side (or both) to embed an object such as a photograph, or a leaf to make it visible or slightly hidden. Embed a piece of lace, plastic mesh, or a handful of seeds to make a textured paper. Or, sandwich pieces of string or wire to make structural sheets that can be bent or manipulated.

Ex: Making a Laminated Wire Lantern, Laminated book cover with pocket.

Decorating with inclusions:

Adding items to paper making Vat is one of the simplest ways to make unique and intriguing papers. Decorative elements should be small and light weight so they don’t sink to the bottom of the vat. They should also be flat, so they don’t cause problem when pressing.Plantfibers, flower petals or small swatches of fabric are just a few possibilities.

Ex: Flower petal paper.

Making shaped sheets:

Shape of the paper can be varied by designing shaped deckles which control where pulp flows onto the mould. For small sheets like cards or stationery,circles and cards can be made or even mould surface can be divided to make more than one sheet at a time.

Ex: Making multiple cards and envelopes.

Papermaking using Plant Fiber

Papermaking is a craft whose ancient methodology and techniques, developed almost 2.000 years ago. The interest today in making paper from plants, which still guide the ways in which paper is made today. Papers possibilities are endless, and there is heightened interest today in making paper from plants, which are plentiful, easy to harvest, and require little equipment to process. Professional papermakers and entrepreneurs around the world are using handmade paper made from common plant fibers to develop new products in the form of stationery, books, lamps, and jewellery in addition to simply selling unique handmade sheets.

One ought not need to go farther than their own lawn or neighbourhood to locate various plants reasonable for papermaking. Numerous regular nursery plant parts make dazzling papers, for example, the leaves of irises, gladioli and daylilies, the stems of okra and hollyhocks and the stalks of corn. Indeed, even in your kitchen manure, one can discover papermaking plant parts, for example, onion skins, artichoke leaves, and corn husks.

Collecting Plant Fiber

Fiber is a major component of paper making plants providing elasticity, flexibility and tensile strength. Fabrious plants have been used for long time to make items such as cloth, mats and baskets. These plants can likewise be utilized to make papers and they will they will frequently get the job done as the sole fixing in the pieces of paper. Papermaking plants can be found at river beds, swamps, garden, and plants. [15]

There are three main type of plant fibers used in paper making:

Bast Fiber:

The fibrous inner bark located between the outer surface bath and the inner core of trees or shrubs is called the bast. There are three types of bast fiber: woody, taceous and petrole.

Leaf Fiber:

Moody bast is found in the stems, branches of shrubs such as Blackbe, Vines, Petrole bast is Stalks and stems or long leaved plants the banana family the manila hemp.

Grass Fiber:

The short fibers of grass like plants contain less cellulose and are more brittle than leaf or bast fiber, but nevertheless they make interesting papers. Tall weeds and wild grasses such as straws, rushes, sedges, swamp grasses, and beach grasses are good sources of papermaking fiber. The best papermaking grasses are the ones that are the most difficult to tear.

Getting ready to Make Paper

There are several steps involved in making a sheet of paper. Raw material (papermaking fiber) can be obtained by collecting plant material or from a papermaker. Once the fiber got selected, it will process further or break it down into the tiny individual strands that will bond with each other to form sheets of paper. This process is differing from fiber to fiber.

Most of the plants fiber needs cooking while all the fibers required to be beaten using one of the beating processes like hand beating process or beating in a Hollander beater to break it down and to make into paper pulp by hydrate the fiber. After the beating cycle, mash can be blended in with water in a tank at that point shape and deckle (an edge that moulds and supports the strands in sheet like structure) must be plunged all through the tank of mash. To make settle the mash on the screened surface of the shape, water must deplete through gaps in the screen.

The pulp settling onto this screened surface becomes the sheet of paper. Remove the deckle, tilt the mould (and your sheet of paper) to let the excess water drain off, and then transfer, or couch, the sheet of paper onto a felt or blanket. You can couch seat various pieces of paper one on head of the other, each isolated by a layer of felt or cover. You must press the sheets to remove most of the remaining water, and then dry them using any of the techniques.

Tools and Equipment:

The basic tool and equipment required for paper making are as follows:

- Moulds and Deckles
- Vat
- Felts
- Table, tray or stand for couching

- Strainers lined with mesh or drain basket
- Scoops
- Plastic buckets with handles
- Sponges

Processing Plant Fiber

Fiber preparation is possibly most important step in papermaking process. All plants must be cooked and beaten to obtain the fibrous material that constituents paper pulps but some require further processing.

Cooking the Fiber

All plant fibers must be cooked in an alkali solution called a caustic solution prior to making paper. Cooking breaks down the fiber into a pulpable material with the aid of an alkali, such as soda ash, washing soda, lye, or lime, the non-cellulose materials like lignin, pectin, waxes and gums are dissolved and then rinsed out. There are several alkalis that you can use, but the one most commonly used by papermakers is soda ash, which is inexpensive and available from papermaking suppliers. Cooking can be done in step by step process.

Beating the Fiber

Individual papermaking fibers are long, slender shafts, only millimeters in length, with hairlike projections called fibrils. If enlarged, they might look like pipe cleaners. The fibrils are raised from the outer cell walls of cellulose and other fibers during beating. Beating roughens the fibrils and makes it possible for them to inter twine and form connections, or bond, and allows water to penetrate the walls of the fiber (called hydration). This bonding of the cellulose fibers is called hydrogen bonding, and it occurs during sheet formation as the hydrated cellulose fibers interlock.

Beating of the fiber can be done through hand beating process or with a blender, both are simple and inexpensive way to beat pulp. The blades of a blender actually cut the fibers so the resulting paper will have a different look than hand beaten. There are few additives can be added to paper

to color coat or protect them from the elements in the environment that cause deterioration. These additives are not necessary but they can change the quality of the pulp.

Recycling of Paper Into New Paper:

The manual production of paper at home can be very simple. It is also an excellent way to use your old receipts, junk mail,paper and scrap paper to dump in a recycle bin to make something of glorious handmade beauty instead.Paper can also be recycled into new paper. Here is a DIY process from for recycling paper to make your own paper. Buying all the equipment new would cost around $120 USD, but most people already own the items needed. One exception would be a shredder, but the paper can also be shredded by hand before being added to the blender. A really high-powered blender (like a BlendTec or Vitamix) can also blend and shred. This leaves only the cost of the mesh and picture frame without the glass, both of which can be purchased for less than $10 USD.

Most types of paper are usable for this paper making process, except for:

- Used paper towels
- Paper that is stained with food dirt or paint
- Greaseproof or baking paper
- Wallpaper
- Paper with gum on it like stickers etc.

Here is a summary of the equipment and process.

Equipment:

- Picture frame without the glass
- Mesh larger than the picture frame
- Kitchen bowl larger than the picture frame
- Sponge
- Towel
- Blender
- Shredder or shred by hand or use a high-powered blender like a BlendTec or Vitamix

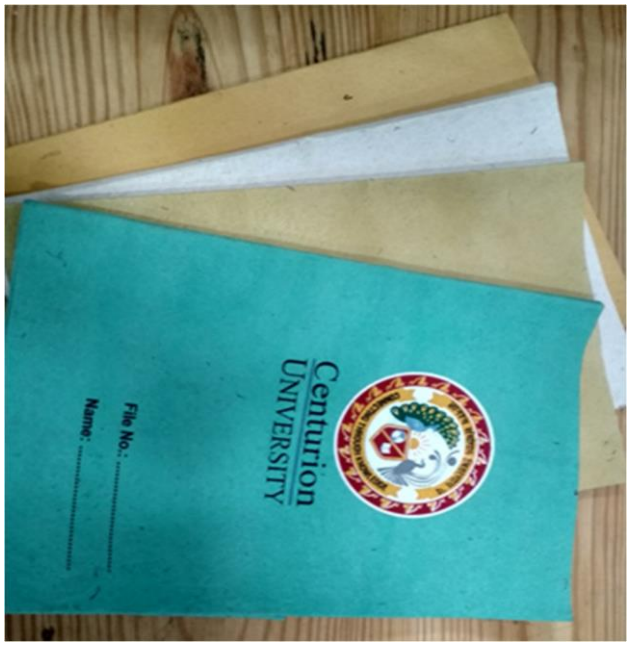
Process:

- Creating the screen: Tape or staple the mesh to the picture frame
- Mixture: Shred the paper you are recycling and blend it with warm water in the bowl
- Once you have a smooth pulp, submerge the picture frame into the mixture
- Pull the frame back out and rest it on an old towel. The mesh should be full of the paper pulp from your washing-up bowl
- Add any decorations, such as dried flowers, or scraps of colored paper that you like and cover with a little more pulp from your bowl
- Press the sponge across the frame to squeeze excess water from the pulp
- Leave the frame to dry for at least a day, and then peel off your new sheet of paper

Alternative Business Option: Recycled Paper Products:

An alternative approach to a paper recycling business is to collect the paper and create a product from it that you can sell to make a profit. If you live in a small community, you can offer to collect their recyclable paper from them and use it in your products. It is also a great way to recycle your own paper.

By treating the paper pulp, you can recycle it into paper for your own use and for creation of new products. Some potential products you can manufacture at home are paper plates, paper envelopes, paper pockets, and many more. With a little creativity, you can turn an old paper bag into a cute holiday gift bag. You can also turn paper bags into actual gift wrap by turning them inside out or turn them into gift tags! You can also create your own paper (see above) and sell it as an arts and crafts option for others.



(Recycled Paper Products)

Creative retailers are also selling other items that have not traditionally been made from recycled paper. For instance, Different people sell flower vases, picture frames, clocks, and other crafts made from recycled paper. Here are a couple Etsy retailers who sell recycled paper products they made themselves too.

Conclusion

Paper is a crucial material that is utilized all around. Perilous Waste Specialists would prefer not to suspend paper creation as it is extremely important and the vast majority of the paper waste can be reused. Wastepaper can be remake environmentally friendly manner for a nominal fee so that recycled paper products can be used in our daily life.On a final note, It can be recommend that everybody should compost as many paper products and junk mail letters as possible! Every paper composted is a paper saved from the harmful process of paper recycling—or worse yet, wasteful landfill disposal. For those of you who are still skeptical, I find it helps to look at the situation this way: there are pollutants virtually all around us, both in the air and in the water table. Does it really do that much harm if some contaminants end up as insoluble compounds in the soil? After all, there's probably not a single place on earth that is completely contaminant-free. So, in my opinion, it's much better to compost than not to compost.

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Aquaponics: a dynamic technology for enhancement of future food production

Satyajit Mohanty and Yashaswi Nayak
Department of Zoology,School of Applied Sciences, Centurion University of technology and management, Odisha
Email: yashaswi.nayak@cutm.ac.in

Abstract

Aquaponics is a nature-friendly system where poduction of food performed by utilizing aquaculture and hydroponics to cultivate fish and crops without using soil in a common ecosystem. In aquaponics the fish waste is served as nutrient for the plant and in return clean the water for fish. Aquaponics has a great role for producing healthy and nutritious safe food. Faster growth of both plant and fish without any artificial fertilizer. Utilization of small space setup than the traditional farming. The water in aquaponics system is recycled well and not wasted.It gives us possibility to increase economic efficiency to grow vegetable and rise fish at the same time ,so farmers can continue to earn money even in any season. Various types of plants , fish are being used in it for multiple purposes. More and more research and analysis should be do towards this technology for enhancing a quality produt for the future generation. Future study will tell us the greatness of this technology to support us ae well as to support our economy.
Keywords: - Aquaculture, Aquaponics, Hydroponics, Recirculating system, parameters.

Introduction

In the present situation the population of the world is increasing day by day and the technology also plays a vital role for fulfilling all the necessary needs of humanbeing. By the improvement of technology and peoples lifestyle, Ornamental fish and hydroponics plants become a part of daily life.Hydroponics means production of plant without soil where Aquaponics means farming of fish and plants in a single recirculating system. Its a ecofriendly way to produce both the fish and vegetable in a common ecosystem without any hegitation. In this process we can produce safe food without any environmental hazards.It is the interrelationship environment between the fish and vegetable where fish provides fertillizer to the plant and also the plants inreturn helps to purify the water which is used as a nutrient where the fish live in.The aquaponics system is a recirculating close loop aquaculture system designed to remove toxic waste product and reusing it, and in reusing process the non-toxic product and organic matter accumulate. The nutrients in the form of ammonia are converted by denitrifying bacteria in the hydroponics system into forms readily up taken by plants for energy and growth . mainly the hydroponics system and its crops serves as biofilter for the fish waste water before it is returned ,then it cleaned back into the fish tank.

History

The development of aquaponics is clearly marked by the work of the New Alchemy Institute and the work of Dr. Mark McMurtry at the north California state university. And starting in 1979 Dr. James Rakocy and his colleagues at the university of the virgin Islands developed the use of deep water culture hydroponic grow in a large scale aquaponics system. In the year of 1990 the farmers of Missouri Tom and Paula Speraneo modified the NCSU system and introduced their bioponics concepts grew herbs and vegetables in ebb and flow irrigation cycle.

Parts of an aquaponicsyste

The aquaponics system mainly consist of two parts , the first one is aquaculture parts which raising aquatic animals and the second one is hydroponics parts for growing plants. But there is some responsible subsystem is present for maintaining an effective system. These include:-

Bio filter is a place where the nitrification bacteria can grow and convert ammonia into nitrates, which is useable by plants. Fish tank is for raising and feeding fish. It may be round, oval, square in shape .material like cement, plastic, fibre glass and the colour of the tank should be white or any light colour. Mechanical filter is meant for separation and removal of solid and suspended fish waste from fish tank.Hydroponic components: - For plant growth in this unit and its design should be familiar with aquaponics design.

Types of Aquaponics system

The aquaponics system mainly 3 types based on the hydroponic components used.

Deep water culture

The deep water culture method is also known as raft method or floating system. It includes suspending plants in polystyrene sheets and their root is hanging down into the water. The water from the fish tank continuously pumped into the grows bed and

flows back to the fish tank .In the deep water culture there are some discharge of water during the filtration process.

Nutrient film system

The nutrient film system is widely used in the commercial field. Nutrient flows in a thin film over the base of the growing baskets which supports or hangs the plants. And there is no growing medium other than the air.

Flood and drain system

This is based on media where the plants are grown. Here the purpose of media is serves as mechanical and biological filter which provides supports to the plants .In this system during the flood the nutrient and water is brought from the plant root part and during drain air is drawn into root zone and water returns to fish tank.

Nitrogen cycle in aquaponics system

Nitrogen is a fundamental needs for all forms of life in earth. Nitrogen cycle has a significant role in aquaponics that it is responsible for the conversion of fish waste into a nutrient for plant growth.Without this process the water quality of the system may not be maintain properly or become toxic to both for the plant and fish. And in this system the water does not need to chemically treated to make the safe water quality.Ammonia usually begins risingly by the third day after introducing fish to the system.after this the nitrosomonas bacteria oxidize the ammonia and change it to nitrite,which may be toxic to the fish.In the last stage of the cycle the nitrobacter bacteria convert the nitrites to nitrates , which is not toxic to the fish. And the established tanks should be teste for nitrates every few months to check that levels are not becoming high high. high. The bacteria will arrive automatically to a system and colonize the water column and biofilter

Live components and species selection in Aquaponic system

In aquaponics system the live components like fish, plants, and bacteria have so much impact to successfully running of a aquaponic system.The freshwater fish are suitable for aquaponics due to their ability to tolerate crowding, and in some cases saltwater fish and prawn may used .Fish like tilapia are used for commercial purposes. otherwise we can use goldfish,jadeperch,murray cod and rainbow trout .Now for the plant we can take beans,broccoli,cucumbers,peas,spinach, for vegetable purpose and for hers like basil, thyme,lemongrass ,wheatgrass ,oregano, parsley,sage etc . strawberries, watermelon, tomatoes, cantaloupe etc for fruits puropose and also for flower purposes we can take all garden varieties.In case of bacteria there are two main types of bacteria mostly seen in case of aquapoic system like nitrosomonas which converts ammonia into nitrites and nitrobacter which then converts nitrites into nitrates.

Water quality parameters for aquaponic system

Ideal water qualiy parameters for aquaponic system are :-near neutral PH (6.5-7.5), ammonia and nitrite (<1 ppm),Nitrate about (5-150 pp),high dissolved oxygen about (6+ ppm).The temperature and Salinity ranges vary with depends upon fish and crop species.

In the current scenario of the world the human population is increasing day by day so we have to step forword for the aquaponics cultivation method so that we can easily get sufficient amount of both plant produt as well as the fish which is our daily need.The global aquaponics market is expected to be 15% during 2020-2025. But if we step forward to create technological and research awareness among the farmer then the percentage will be increased.IfGoverment and some NGO support to the farmers and motivate them to enhance this technique for better result in future for food purpose.And this farming is set as indoor farming and can provide food which is free from chemical fertilizers, pesticides etc.It is also possible for commercial implementation of aquaponics on large scale basis, we can provide food for our future generation through this.

Advantages of aquaponics

The crops from the aquaponics system excellent in taste and apperance.And provide 100%organic forms of nutrient for better plant growth and development.No soil borne disease is seen in case of plants and also zero application of artificial fertilizers.On an average of 95% of water in aquaponics system is recycled .Mainly the growth of plants and growth of fish is faster in this system because of proper nutrient supply .The hydroponic plants used as biofilter and the plant uses nutrients from fish waste to produce a valuable marketable product.Low electrical uses and low man power is needed.It requires small amount of space for easy set up and It gives more profit fromtraditional farming.

Disadvantages of aquaponics

Aquaponics system requires better skill as well as experience for maintain a good system and profitable food production.Its initial set up cost is very high because it needs some selected species to culture in it.Water quality must be checked properly , whenever the crop is in developing stage the water quality testing is useally carried out only once in a week if there is no problem in the system.If some components fails this could leads to the loss for both plants and fish.A green house is important for a maintaining a good aquaponics system , this is depends upon the climate condition in your area, a green house provides heat during winter seasons .

Conclusions

The both indoor and commercial aquaponics system are profitable for mankind for getting both plant product as well as fish. Now it presents opportunities for young people to adopt this dynamic technology to grow their own protein, vitamins,and vegetable to feed their family,society, future generation. It is also a ongoing system which could support our economy, and create a sustainable livelihoods to enhance the business sense.Here some suggestion are , develpoment of aquaponics model and create awareness about the aquaponics product that its healthier,and nutritious for all kinds of human being. Aquaponics saves more water than the conventional agriculture and its a challenge to every farmer to manage two agricultural enterprises (fish and vegetable) in a single system.

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Kepler Exoplanet Search Results using Machine Learning Classification Model

Sasmita Kumari Nayak[1], Nikita padhan[2], Atasi pradhan[3] and Mohammed Siddique[3*]
[1]Department of CSE, Centurion University of Technology and Management, Odisha, India
[2,3]School of Applied Sciences, Centurion University of Technology and Management, Odisha
[1]Department of Mathematics, Centurion University of Technology and Management, Odisha, India
Corresponding author Mail id: siddique1807@gmail.com, siddique@cutm.ac.in

Abstract
The Kepler exoplanet mission is specially organised for searching of the Milky Way galaxy to discover many earth-size and tiny planets near or in the habitable zone. Exoplanet means orbiting of planet around the other stars beyond our solar system. The dataset contains 9564 samples and 50 columns which is collected from kaggle website. The dataset, target variable is KOI-disposition which contains confirmed, false positive and candidate. Out of 9564 samples we found 5000 samples are false positive, each confirmed and candidate are 2282. In the Milky Way galaxy many stars and planets are there, but we have considered some of them. We have used machine learning algorithms like decision tree, random forest, KNN classification and Naive Bayes classification on stars and planets for searching of exoplanets beyond our stellar atmosphere.
Keywords: Exoplanets; Kepler data; Solar System, Koi, Decission Tree, Random Forest, KNN.

1. Introduction

The Kepler space observatory is a NASA build satellite that was launched in 2009. The telescope is dedicated to searching for exoplanets in star systems beside our own , with the ultimate goal of possibly finding other habitable planets besides our own. The mission results provided data on a wide range of planet and planetary systems orbiting both single and multiple stars of differing sizes , temperatures and ages.

The original mission ended in 2013 due to some technical failures, but the telescope has still been functional since 2014 on a “K2” extended mission. The telescope is still alive and continuously collects new data on its extended mission. The main objective of our project is searching of exoplanets using kepler data like koi_slogg , koi_impact , koi_depth , koi_period , koi_duration , koi_impact and koi_score to get the target variable i.e. koi_disposition which contain false positive , confirmed and candidate. Till the effects of these biases are correctly determined and the full range of orbital periods are considered, estimations of parent distributions come with large uncertainties.

2. Implementation of the Model

Model implementation is a most important part for a machine learning project. In this part we have to chose the columns for feature selection then remove all other unnecessary columns after

that we have put machine learning algorithms to get results that which is most accurate for this dataset.

2.1 Decision Tree Algorithms

Decision tree means it is a decision support tool that uses a tree like model or chart to determine a course of action or represents a possible decision, outcomes or reaction. The accuracy for decision tree model is 100% and for entropy is 81.06%.

Decision tree Classifier	Decision Tree Classifier using Entropy
Accuracy: 1.0 Confusion matrix: [[1797 0 0] [0 1839 0] [0 0 4015]]	Accuracy: 0.81 Confusion matrix: [[798 553 446] [397 1394 48] [5 0 4010]]

2.2 Random Forest Algorithms

The random forest is a model made up of many decision trees. The random forest algorithms combine the output of multiple decision trees to generate the final output. The accuracy for random forest is 82.97%.

2.3 K-Nearest Neighbors (KNN) Algorithm

K-Nearest Neighbors (KNN) is one of the simplest algorithms used in Machine Learning for regression and classification problem. KNN algorithms use data and classify new data points based on similarity measures. The accuracy for KNN classification model is 66.38%.

2.4 Naive Bayes Classifier

Here we used Naïve Bayes classifiers which are collection of classification algorithms based on Bayes' Theorem. It is not a single algorithm but a family of algorithms where all of them are share a common principle. The accuracy for Naïve Bayes model is 44.29%.

3. Methodology

Dataset collection is a vital thing for a project which we have collected from the kaggle website that contains 9564 samples and 50 feature columns. In this dataset we have gone through many algorithms to finding the exoplanet which is our aim to. For the experimental purpose we have used google colab for running the program. Many people done this dataset using regression model but we thought for classification because of exoplanet are in categorical format.

3.1 Pre-processing

Early of pre-processing, basic dissemination of data analysis was done to find a high level understanding of the data. First of all we have looked for the proportion of the number of sample and found out that the dataset consist of equal no. of samples for each class.

3.2 Visualization

After analysed the sample we go for visualization, first visualization is based on all target variable which magnitude is lower in bright position. Then for confirmed planet only it is based on magnitude. The third graph shows us the stellar surface gravity of the kepler planet means the base 10 logarithmic of the acceleration due to gravity at the surface of the star. The 4th figure shows the 'latitude' and 'longitude' of the objects , so this plot show their position in the sky. The telescope pointed the same patch of sky for the entire mission and the distribution looks the way it does due to that reason. The 5th figure indicate that the orbital period is the time given astronomical object takes to complete one orbit around the other object. Most confirmed planets have lower orbital periods. This proves that the closer the planet is to its original star. The 6th plot is based on duration of star for orbiting around another star. Durations are on the order of hours, with more detection at smaller hours, again showing the detection bias towards smaller orbits. Duration is measured from first contact between the planet and star until last contact. The 7th graph indicates that the stellar effective temperature in Kelvin and also shows the photospheric temperature of the star. The last graph i.e. 8th graph gives that stellar radius of star (solar radii) and planetary radii (earth radii). The radius of the planet is the multiplication of the star radius ratio and the stellar radius and the photographic radius of the star.

4. Result Analysis

Instead looking at the visualization we simply consider on the model implementation that is much better for our project to find out the most appropriate consideration. After implementing all the model we got the most accuracy in Decision tree model which percentage is 100. We have done model visualization to show the accuracy.

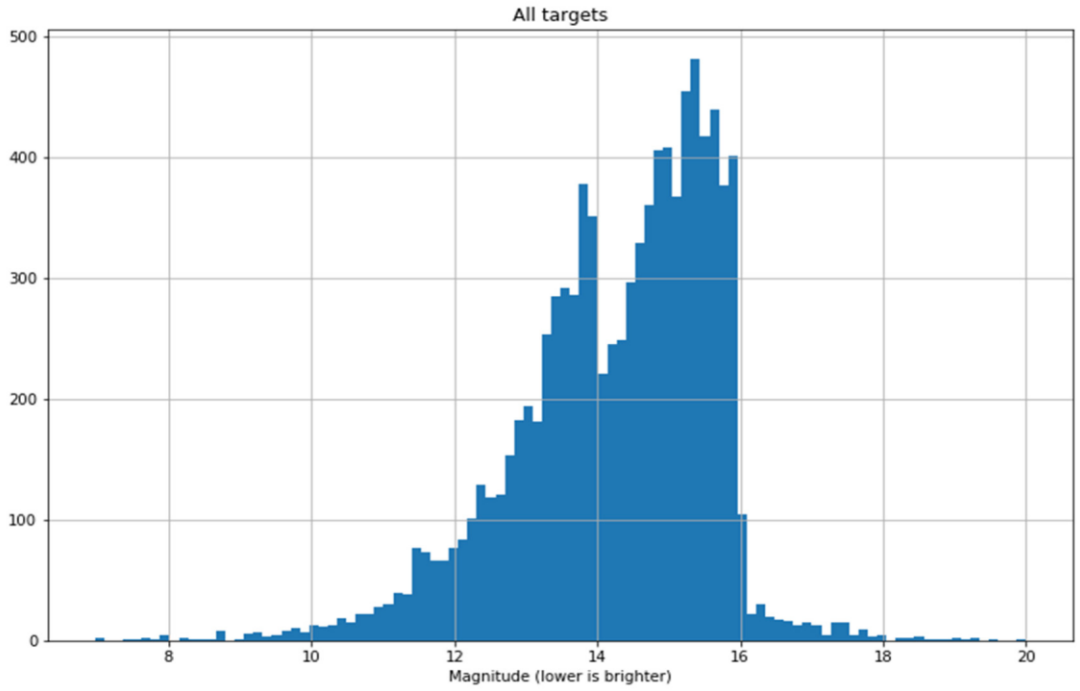

Figure-1: Magnitude wise all targets variable

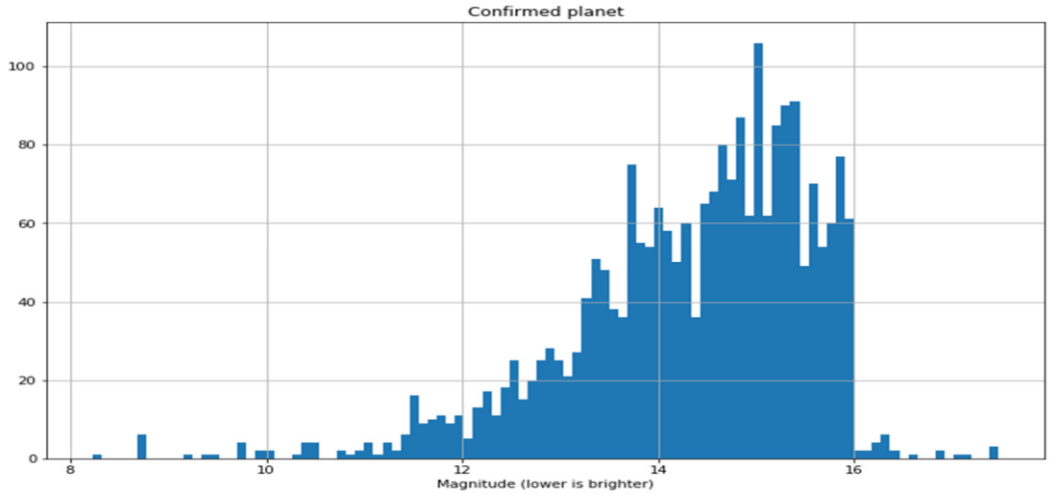

Figure-2: Available of confirmed Exoplanet

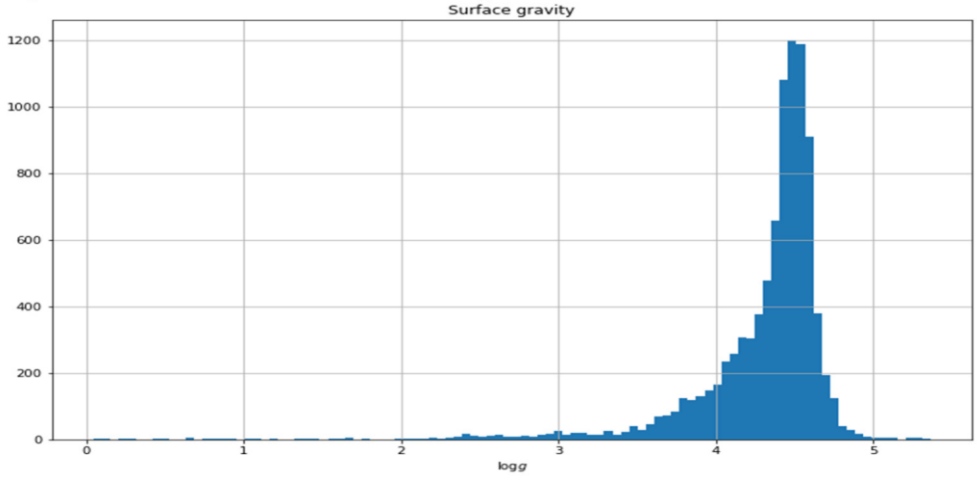

Figure-3: Stellar surface gravity of the Kepler exoplanet

Figure-4: Position of planets in the sky

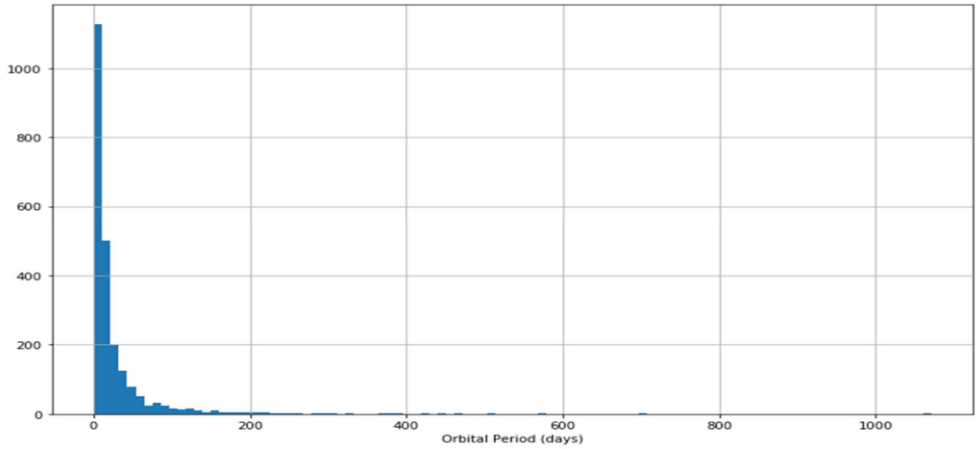

Figure-5: Orbital period in the interval of the consecutive planetary transits

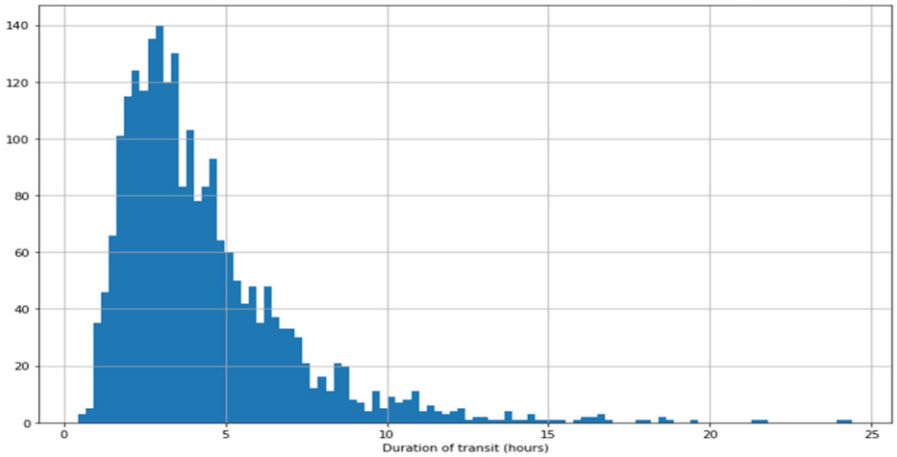

Figure-6: Observation on Duration of Transits

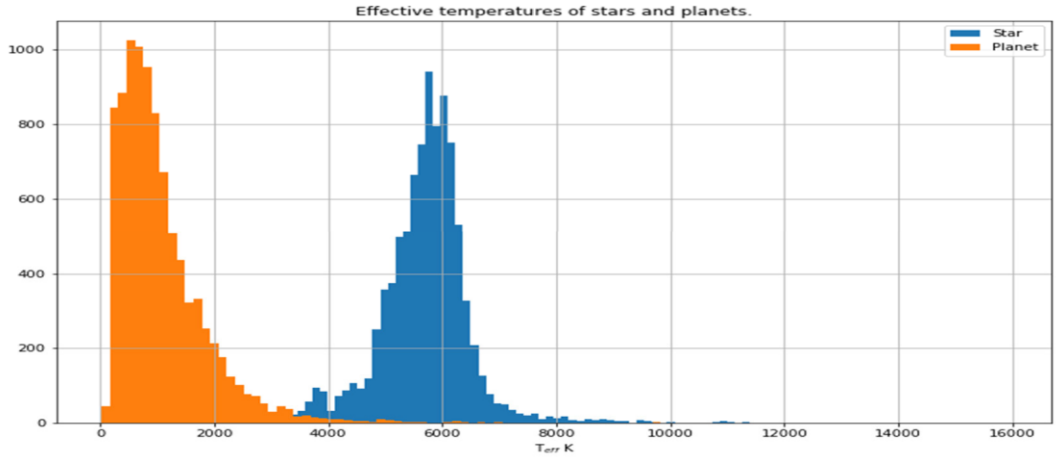

Figure-7: Stellar Effective and Photospheric Temperature of the star

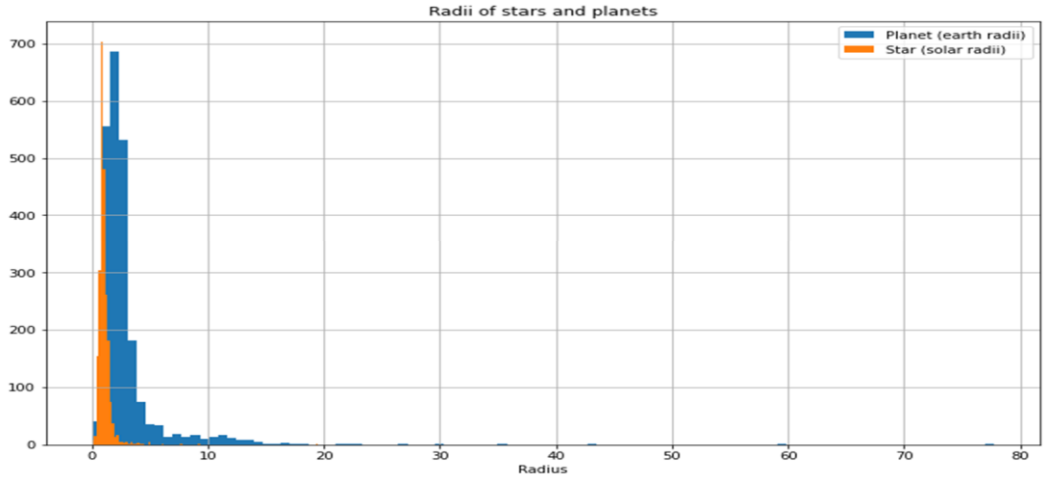

Figure-8: Radius of Star and Planets (Earth)

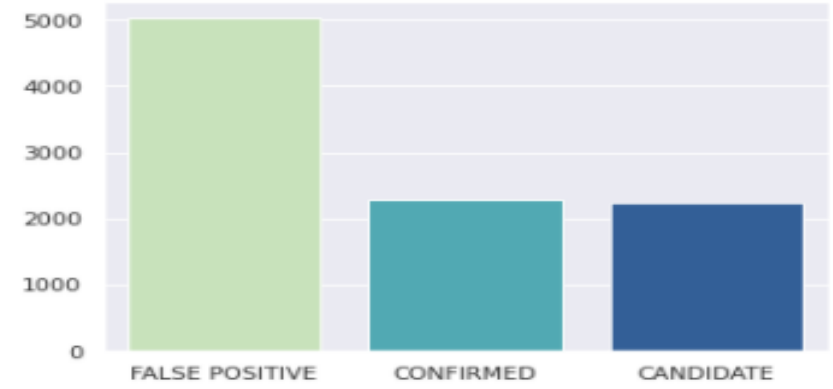

Figure 9: Comparisons of False Positive, Confirmed and Candidate

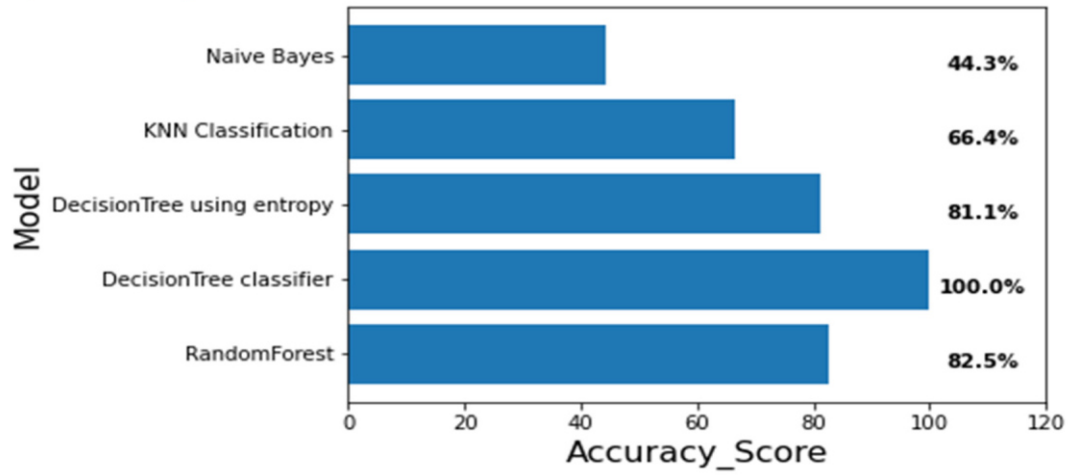

Figure 10: Accuracy of the models

5. Conclusion

This paper accompanied an experiment on a dataset that contained information about kepler objects of interests. The dataset hold features observed from the kepler satellite. Using this

dataset , basic exploration of data analysis help us to visualization the data and get a proper understanding of the data. The selection of the machine learning models were carried out depending on the binary classification with the selected model will perform comparable to other experiments with similar conditions. The models were perfectly run with cross-validation to help the best meta-parameters for each model. The kepler journey was found out how many stars hosted planets and especially to estimate the frequency of earth like planets.

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Forecasting of stock price of Hindustan Bio Science Ltd using hybrid model of PCA, SVR and PSO

Sumanjit Das[1], Dillip Kumar Mohanta[2] and Mohammed Siddique[3]*

[1]Indian Institute of Technology, Bhubaneswar, Odisha, India
[2]Department of Mechanical Engg., Centurion University of Technology and Management, Odisha, India
[3]Department of Mathematics, Centurion University of Technology and Management, Odisha, India

E-mails: dassumanjit@gmail.com , dillip.mohanta@cutm.ac.in, siddique1807@gmail.com

Abstract: Stock market is one of exciting and demanding monetary activities for individual investors, and financial analysts. The stock market is an inter-connected important economic international business. Prediction of stock price has become a crucial issue for stock investors and brokers. The stock market is able to influence the day to day life of the common people. The stock price is based on the state of market stability. As the dormant high noises in the data impair the performance, reducing the noise would be competent while constructing the forecasting model. To achieve this task, integration of Principal component analysis (PCA), Support vector regression (SVR) with particle swarm optimization (PSO) is proposed in this research work. PCA is able to remove the unnecessary and unrelated factors, and reduces the dimension of input variables and time complexity. The feasibility and efficiency of this proposed hybrid PCA-SVR-PSO model was applied to forecast the daily open prices of stock index of Hindustan Bio Science Ltd. The performance of the proposed approach is evaluated with 3543 daily transactional data of Hindustan Bio Science Ltd (13th December 2001 to 4th December 2020) stocks price from Bombay Stock Exchange (BSE). Empirical results show that the proposed model enhances the performance of the prediction model and can be used for taking better decision and more accurate predictions for financial investors.

Keywords: *Hindustan Bio Science Ltd, Financial time series forecasting; Principal component analysis; Support vector regression; Particle swarm optimization.*

1. Introduction

This paper is aiming to anticipate the upcoming stock price using machine learning based optimization techniques. The evolution of computing power, database technology, and machine learning algorithms helps to predicts stock market index more accurately. However, high volatility in stock prices makes it difficult to predict the stock market movements. Though many specialized techniques of machine learning such as neural networks, support vector machine, genetic algorithms are already established, there are still scope for developing innovative models or systems which can cater the rising needs of investors. The dimension reduction technique PCA is implemented to SVR-PSO to predict the stock price of Tata Motors. Here PCA extracted the relevant features from the data sets which improve the prediction accuracy.

A supervised machine learning task undergoes two main steps, i.e., training and testing phase. During training phase, the model is constructed and same is tested during the testing phase. Then the selected data of Hindustan Bio Sciences are being divided into training (2654) and testing (889) dataset. Now, before entering into the training phase, the dataset undergoes a data pre-processing phase of feature extraction. Then the learning algorithm is selected and its parameters are initialized. In order to end the training process, termination criteria are set.

Finally, the training starts and enters an iterative process of parameter optimization and a post processing phase. During this post processing phase, in order to evaluate the model the testing dataset is applied. On application of new unseen and unlabeled data, prediction result is generated. In the proposed model, we used SVM for regression, PCA is used for reducing the dimension and PSO is used to optimize the values of it's free parameters (C and γ) for better forecasting. In this paper, we proposed a hybrid regression model consisting of principal component analysis, support vector regression and particle swarm optimization. This hybrid model, referred as PCA-SVR-PSO, is considered for the prediction of stock price of Hindustan Bio Science Ltd.

2. Literature Review

From the literature survey we analyzed that the impact of hybrid concepts has improved the prediction accuracy of financial market. Not a particular combination of methods gives good result always. The literature survey speaks about both approaches of machine learning i.e traditional approaches and hybridization approach in the field of financial stock market prediction. In the traditional approaches mostly one technique were used to address the forecasting the stock market for example only ANN and only BP were used by many authors. But with the hybridization of machine learning techniques leads the scope in improvement in accuracy. Traditional regression methods gives optimal result to some extent but a new hybridization method may give more accurate towards optimal solution but it does not mean that always that 1st method has drawback. As second method gives more accurate towards result, so that method should be adopted in a particular category of problems. In the forthcoming chapters, hybridizations of different methods were adopted to solve optimal forecasting problems of stock market. Since we are adopting different non traditional methods meant for handling large data set, the method consists of two parts. In first part, the re-organization of huge data set is required where as in second part; a suitable optimization technique is used.

Das and Padhy (2015) projected he experimental results using the dataset of everyday's last prices of the COMDEX commodity futures index and it observed that their planned model was very good as well good as camper to SVM and hybrid model of SVM and particle swarm optimization (PSO). Wei-Chiang Hong (2011) presented a forecasting model which combines the seasonal recurrent SVR with chaotic ABC algorithm and investigated electric load forecasting of Northeast China. The study employed here for SVR model to solve the non-linear forecasting problem and the messy behaviour of honey bees, to determine suitable values of the three free parameters of SVR, i.e., C, ϵ, and γ. The performance results of the investigation indicated that the proposed model (namely SRSVRCABC) gives better prediction results than ARIMA and TF-ϵ-SVR-SA models.

Hong et al. (2011) proposed a hybrid model of support vector regression and CGA to forecast the tourism demands. In the proposed model named as SVR-CGA, CGA was employed in overcoming premature local optimum in determining three free parameters of SVR (i.e. σ, ϵ, and C). The empirical results which were evaluated using on MAPE, MAE, and RMSE, demonstrated that the proposed SVRCGA model outperformed other competing approaches on the data of tourist arrivals in Barbados. Jiang et al. (2011) studied the application of KPCA and SVR for reconstruction of cardiac transmembrane potentials. In the hybrid model, SVR addressed the prediction mechanism, PCA and KPCA were used for feature extraction, and GA and simplex optimization method was used to determine the parameters of the SVR. It was found from the analysis that the SVR with feature extraction performed good as compare to that of

without feature extraction. Kazem et al. (2013) proposed a forecasting model using SVR with chaos-based firefly algorithm for prediction of stock index. The model had three steps in which a delay coordinate embedding method was employed ,followed by, a chaotic firefly algorithm was applied for getting optimal free parameters of SVR, then lastly, the optimal SVR was invoked to predict stock market price. The performance of the proposed model, named as SVR-CFA, was also compared with its competing models such as GA-based SVR, CGA-based SVR, firefly-based SVR, ANNs, and ANFIS based on MSE and MAPE. The results demonstrated over its competing models with MSE and MAPE.

3. Methodology

3.1. Principal Component Analysis (PCA)

PCA is a feature extraction method based on linear statistical approach. The objective of the method is to reduce the dimension of original feature data set .It applies an orthogonal transformation to transform n dimensional data to m dimension (m<n), possibly correlated features into uncorrelated features. These uncorrelated i.e distinct features called as Principal Components. The transform technique is designed in so that the 1st Principal Component has possibly highest variance as compare to rest. The 2nd Principal Component is possibly 2nd highest variance among them and so on. Again another most important characteristic is that 1st Principal components are orthogonal to the 2nd one and so on. For example, we consider the distribution of data in two dimensional spaces as shown in figure. Here one can mark that the greater deviation occur in x-direction and a very small deviation occurred in y direction. It is very much clear that the x-direction has much dominance over y direction. If we sacrifice i.e omits the y-components of data and retaining the x- components only, we can reconstruct the data set within the limit of permissible error. Of course it may not happen always but it can be possible in high dimensional data set, where we can neglect the less important attributes of the sample. By this process a high dimensional statistical sample possible be reduced effectively onto lower dimension without loss of essential required information. This reduction helps to large economy in computation, transmission and also storage costs. Our next issue is to identify the principal components which are sufficiently accurate for reformation of data.

The eigenvectors of correlation matrix obtained from input data are the principal directions. The eigenvector corresponding to largest eigen value give rise to principal component of the data set. The eigenvector corresponding to next largest eigen value represents next principal component of the dataset. Similarly we can find m (m < n) number of eigenvectors representing dominant directions from n dimensional given data set. This is known as projection of n-dimensional data onto m-dimensional subspace that is spanned by these m number of principal components. By this way the m prime information are retained and n-m numbers of least important information are neglected.

Let us consider N number of samples $X_1, X_2, X_3 \ldots\ldots\ldots\ldots X_N$ such that every sample has 'n' number of attributes or features. So each sample has a representation in the form of a vector having n components. Each vector X_j, j= 1, 2, 3.....N has features whose mean value is zero, it means, the mean value of original feature has been subtracted from feature value of each. Then the Covariance matrix of above vectors is computed as follow $C = \frac{1}{N} \sum_{k=1}^{N} X_k X_k^T$

Then a_{ij}th member of the matrix C can be expressed as $C_{ij} = \frac{1}{N} \sum_{k=1}^{N} X_k(i) X_k^T(j)$

Here $X_k(i)$ represents i^{th} component of the k^{th} sample. Next we compute the n eigen values of C

and denoted by $ß_1$, $ß_2$, $ß_3$.....$ß_n$ and we arrange them as $ß_1 \geq ß_2 \geq ß_3$.....$\geq$..$ß_n$.Then we compute eigen vector for each eigen value and denoted as α_1, α_2, α_3, ... α_n respectively. Now we choose m number of eigen values among largest to larger and next to larger as per our requirement to retain the number of features of given data. Alternatively we can select the smallest value of m, so that $ß_{m-1} - ß_m$ is larger i.e $\sum_{i=1}^{m} ß_i \geq t \sum_{i=1}^{N} ß_i$, Where t = 0.90 as we want to maintain 90 % variance among the transformed sample ,here $\sum_{i=1}^{N} ß_i$ is the total variance. Now the collection of eigen vectors form a matrix is known as transformation matrix and is denoted as A = [α_1 α_2 α_3 ... . α_n]. Now each data X_i with n features is transformed to matrix Y_i in the m-dimensional system by using $Y_i = A^T X_i$, i=1,2,.....N. Then the j^{th} component Y_i (j) is the projection of X_i on α_i i.e Yi (j) = α_j^TXi .

3.2 Support Vector Regression (SVR)

SVR is a supervised machine learning method developed by Vapnik and Cortes (1995). SVR makes a decision boundary by which the greater part of the data points of the relevant kind falls on the same side of the boundary. Let us consider the data points of an n-dimensional feature vector space X = (x_1, x_2, ... … ... ,x_n), from which we construct a hyper plane $\alpha_0 = \sum_{j=1}^{n} \alpha_j x_j = 0$, where the boundary of the optimal hyperplane can be obtained by the maximizing the distance from any point to the plane. The maximum margin hyperplane (MMH) separates the similar types of data points. The necessary feature is that only neighboring points to the boundary of the hyperplane are participated in selection keeping all other points as it is. These points are well-known as the support vectors, and support vectors are separated in respective class by a hyperplane, which is called the Support Vector Classifier (SVC). The inner products of support vector classifier are weighted by their labels, and it helps to maximize the distance from support vectors to the hyperplane.

For given a sample data-set S = (x_1; y_1); (x_2; y_2); ::: ::: (x_l; y_l) representing l input-output pairs, where each $x_i \in X \subset R^n$, where X represents the n dimensional input sample space and matching target values $y_i \in Y \subset R^n$ for i = 1, 2, … … l, where l is the size of the training data. The purpose of this regression problem is to construct a function $f : R^n \to R$, to approximate the value of y for unseen data x, which was not participated in training sample. By taking a nonlinear function ϕ, the input data is mapped from R^n to a high dimensional space R^m, m > n, and consequently the estimation function f is defined as $f(x) = (w^T \varphi(x)) + b$

3.3 Particle Swarm Optimization (PSO)

PSO is a novel nontraditional population-based search method and an alternative method to find solution for complicated optimization problem of highly non-linear in nature. The PSO algorithm was first developed and implemented in 1995 by Dr Kennedy and Dr. Eberhart. They developed the PSO algorithm after inspired by social behaviour of some of living beings such as bird flocking, fish schooling and many others. Then they simulated the social behaviour of living beings in mathematical model. In the development of the model they followed how a group of birds or insects uses their optimal path to search their food or place of comfort stay zone. It is observed that birds are moving in large groups, every member has contribution in the activity of searching and communicating among themselves about better position. The birds do not have any idea about the best position. But by virtue of social behaviour, if any one finds the better path towards comfort zone, then all of others follow to him.

The PSO algorithms are nature inspired population based algorithm and basically learned from birds' activity to solve the optimization problem. In PSO, each member of the population is termed as particle and the population is termed as swarm. The algorithm is initiated with any random values and moving in arbitrarily chosen direction. Each particle moves through searching space, keeping in mind the best past positions of itself and its nearest places. The swarm particles communicate with each other about good positions .Then they adjust dynamically their own position and velocity resulted from the best position among all particles at any instant of time. After reaching all the swarm particles at the new best position of that instant, again they start repeating the same procedure for getting better and better position. This procedure continues up to the swarm reaches approximately an optimum of the object function which is known as fitness function f: $R^n \rightarrow R$.

4. Result Discussion

Projected PCA-SVR-PSO model is designed with PCA for feature extraction, SVR as core prediction mechanism and its hyper parameters are optimized by PSO. Through the training data we built the hybrid model and after completion of training phase, we applied the testing data sets to the proposed model to measure the prediction efficiency of both phases. The hybrid model is used to predict the opening share price of Hindustan Bio Science Ltd. Errors evaluated with MAE, RMSE, and MAPE in training phase are 0.39, 1.2, and 3.69 (approx) respectively and the errors in testing phase are 0.06, 0.07 and 3.21 (approx.) respectively.

```
Epoch 298/300
2654/2654 - 4s - loss: 1.4620e-04
Epoch 299/300
2654/2654 - 4s - loss: 1.4619e-04
Epoch 300/300
2654/2654 - 4s - loss: 1.4619e-04
Train RMSE: 1.20
MAPE train error: 3.69

Train Mean Absolute Error:: 0.39
Test RMSE: 0.07

Test Mean Absolute Error:: 0.06
MAPE test error: 3.21
```

		PCA-SVR-PSO
Training	**MAE**	0.39
	RMSE	1.2
	MAPE	3.69
Testing	**MAE**	0.06
	RMSE	0.07
	MAPE	3.21

The Figures 1 to 3 shows the comparison of the actual stock value and prediction of training and testing phase error graph

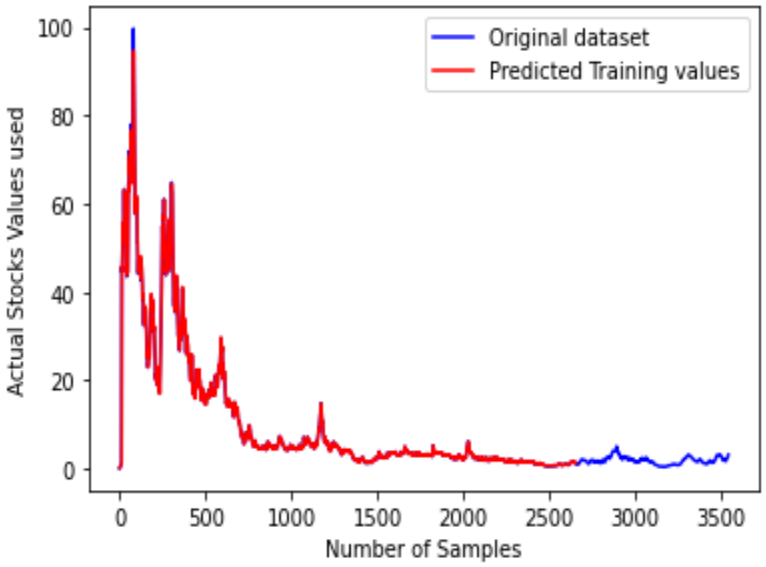

Figure 1: Actual vs predicted stock value of Hindustan Bio Science Ltd. In training phase

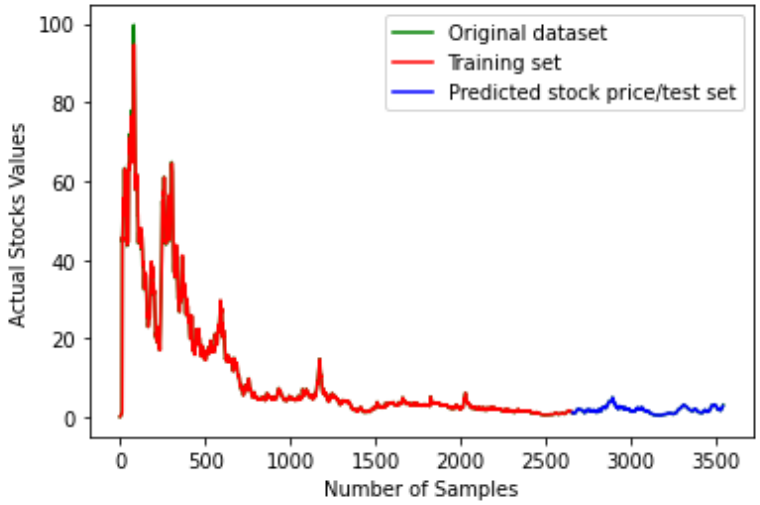

Figure 2: Actual vs predicted stock value of Hindustan Bio Science Ltd. In training phase

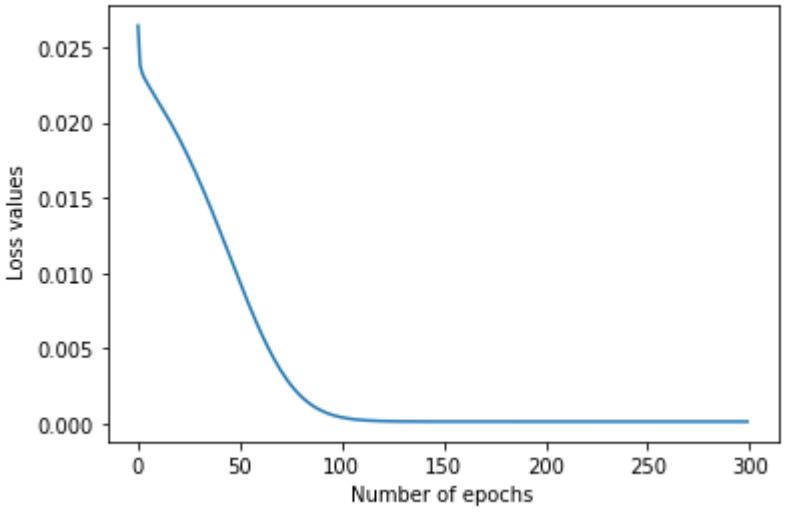

Figure 3: Error graph in of Hindustan Bio Science Ltd. in whole data set

5. Conclusions

Our PCA-SVR-PSO hybrid model which is comprising of three leading techniques, is applied to the forecasting problem of next day stock price and the results indicate that the model is acceptable not only for research but also from application view point. The testing results obtained from the empirical study demonstrated 0.06 mean absolute error (MAE). The PCA-SVR-PSO hybrid model also outperformed SVR-PSO in all the three evaluation measures, i.e., MAE, RMSE, and MAPE. Such remarkable performance is achieved due to the application of principal component analysis (PCA) on the lagged time-series dataset and use of particle swarm optimization (PSO) to optimize the hyper parameters of support vector regression (SVR). Based on the outcome of this piece of research work, we propose to use our proposed PCA-SVR-PSO hybrid model for the future applications of regression based forecasting tasks.

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Identification of real-time maglev system using cat swarm optimization based flann

Amit Kumar Sahoo[1]
[1]Department of Electrical & Electronics Engineering, Centurion University of Technology and Management, Odisha, India

Abstract

In the recent past identification of nonlinear plant is a significant work has done by many researcher and it is found to be an emerging area for further research due to its wide application. In this article, the characteristics and behavior of a real time maglev plant has been identified using an efficient Artificial Neural Network (ANN) based on functional expansion technique i.e. functional link artificial neural network (FLANN). The weights of FLANN has been iteratively updated by a heuristic optimization algorithm i.e. Cat Swarm Optimization (CSO). So that the error needs to minimized, which is considered as a cost function. To demonstrate the robust identification performance of the Maglev plant Mean square error (MSE) and CPU time is considered for analysis. The simulation results justify the proposed model robustly identifies the characteristics and parameters of non-linear dynamic maglev plant.

Keywords: Non-linear System; System Identification; FLANN; Maglev plant; Chebyshev Expansion; CSO.

1. Introduction

The principle of identification is to formulate a mathematical modeling of plant by taking its input-output data. A mathematical modeling of a system can be determined by using laws of nature or through the experimentation. Out of many techniques to find out the mathematical modelling (using parameter estimation) of the system, direct modeling and inverse modeling, have most attractive features [1], [2]. As maximum plants are non-linear and dynamic in nature, their identification is a thought provoking. Accurate and fast identification of above system is still a nightmare. Identification of non-linear plants finds application in the area of control system, power system, communication, instrumentation and many other fields.

To perform the above task in highly non-linear environment, an ANN is the best solution for it. As ANN can take the non-linear decision based on the objective. Pao et al. have proposed FLANN to overcome the above issue [3], [4], [5]. The FLANN is one of its kind and it holds the advantages of both single layer and multi-layer network. Mainly the FLANN is popular for its simple structure and less computation complexity due to absence of the hidden layer. The input of the FLANN gets functional expanded and combined to a linear combiner. The functional expansion of inputs gets by different expansion method like power series expansion, trigonometric expansion and Chebyshev expansion [6]. In this article, the Chebyshev expansion has been used to functionally expand the input.

The FLANN model has been trained by using the Cat Swarm Optimization (CSO) technique. This is a random search algorithm, which is based on the achieving the best arrangement to avoid failure to get optimal solution. Using this steps the cost function is minimized. Here, the error is considered as the cost function. The performance of the proposed identification technique has been studied in terms of error, MSE and the CPU time.

This paper layout having, Section 2 presents the model of maglev plant. In Section 3 deals with the principle of system identification. Section 4 explain the basics of CSO. The proposed CSO based FLANN structure is discussed in section 5. The simulation result is discussed in section 6. Finally, the concluding remarks of the paper is outlined in section 7.

2. The Magnetic Levitation System

Magnetic levitation (Maglev) has been extensively accepted due to its contactless, low noise and low friction behavior and has application in many engineering field [7], [8]. Basically, Maglev plant is a highly non-linear plant and their control and identification is still a problem.

The Maglev setup consist of two parts i.e. a physical Maglev plant and a computer interface. The Maglev plant is consist of electromagnet, IR sensor, amplifier and control objects. The electromagnet helps to control the steel ball in moving up and down from the equilibrium position. When current flows in the electromagnet, then their induces an emf, which controls the position of the steel ball. The steel ball is balanced by electromagnet force and gravitational force to keep it in the desired positon. The IR senor helps to measure the position of the ball and send a signal to input. The amplifier used to improve the level of the input voltage. The Maglev laboratory setup used for experimentation is manufactured by Feedback Instrument Ltd. and it works with MATLAB environment.

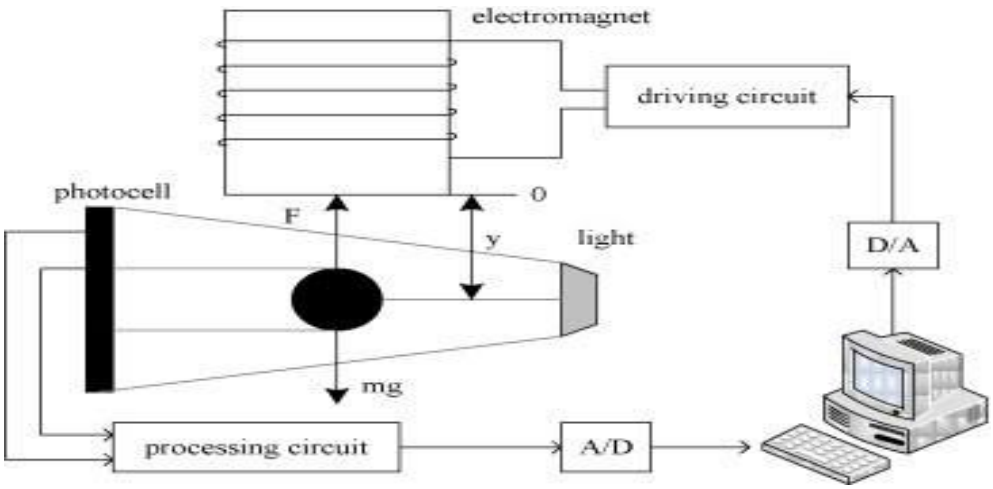

Figure 1. Block diagram of the MAGLEV system

where, m is the mass of the ball, y(t) is the distance between ball electromagnet, g is the acceleration constant., F indicates electromagnetic force, i(t) is the current through the coil. The physical parameters of Maglev plant is given in Table 1.

Sl. no.	Parameters	Value
1	m—Steel ball mass	0.02kg
2	g—Acceleration Constant	9.81m/s2
3	i0— Current value at equilibrium	0.8 A
4	x0—Equilibrium position	0.009m
5	Control input (u)	±5v
6	output voltage (x_v)	+1.25v to -3.75 v

Table 1. The physical parameter of MAGLEV plant

3. System Identification Overview

System identification is a technique that helps to estimate a mathematical modeling for any system from its input-output data. The proposed ANN based FLANN model is a single layer network with absence of hidden layer and the weights are updated by a nature-inspired algorithm CSO [9], [10], [11]. Here, $u(k)$ represents the input, $y(k)$ is output, $\hat{y}(k)$ indicates the estimated output and $e(k)$ is the error. The cost function is taken as error for the identification of Maglev plant. The cost function need to minimize to get an efficient identified model whose response efficiently track the real-time Maglev plant response.

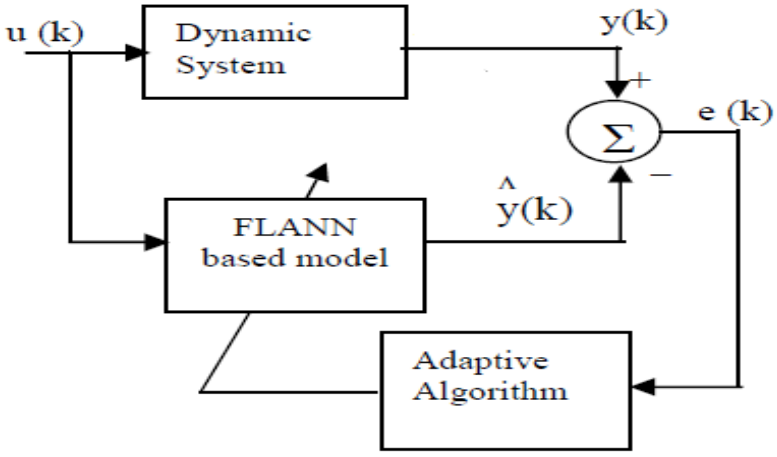

Figure 2. Schematic diagram of Maglev plant identification

4. The Cat Swarm Optimization (CSO) Algorithm

In 2007, Chu and Tsai was introduced the Cat Swarm Optimization (CSO) optimization technique [12]. This technique is based on the behavior of a cat searching its prey and it is used for optimization problem. In CSO, the behavior of cat during searching of its prey are divided into two modes, i.e., the seeking mode and the tracing mode. In the seeking mode, cats targets its prey and changes its position. Similarly, in the tracing mode, cats tries to trace/track it's desired target. In this process, if the cat finds the desired prey, then they immediately their behavior into the tracing mode. The seeking mode always provides the global search procedure, whereas the tracing phase resembles a local search procedure. The positions of the cats are always a solution sets in the CSO algorithm. The cost function of all candidate points are evaluated and assigned with a probability to identical fitness function of the cats. The probability of each candidate point is calculated by using equation (1). In this mode, only the best, maximum and minimum fitness values are to be calculated and this can be further utilized in the tracing mode. In the tracing mode, the velocity and the position is to be initiated. The fitness values of all cats are to be calculated and out of that, the best fitness values are to be kept for computer memory. The iteration is continued until cost function finds an optimal solution otherwise again, the process of CSO algorithm repeats.

Seeking Mode:

Probability:

$$P^k = \frac{FS_k - FS_b}{FS_{max} - FS_{min}} \quad (1)$$

Tracing Mode:

$$\text{relocity: } V_{k,d} = þ \times V_{k,d} + c \times r_1 \times (x_{best,d} - x_{k,d}) \quad (2)$$

$$\text{where dimension: } d = 1,2 \dots \dots \dots, M.$$

$$\text{position: } x_{k,d} = x_{k,d} + V_{k,d} \quad (3)$$

where, FS, P_i are the fitness value and the probability of each candidate, þ is the inertia weight, c is the acceleration constant and r_1 is any random values between 0 and 1, $x_{best,d}$, and$x_{k,d}$ are the global and present positions respectively.

4.1 Algorithm for Cat Swarm Optimization

Step 1: In M dimensional space Random position of cats is initialized, i.e., $x_{k,d}$.
Step 2: Cat velocity is initialized as $V_{k,d}$.
Step 3: According to mixture ratio, the Cats are randomly chosen from the population. The cats are assigned for seeking mode and tracing mode.
Step 4: The fitness and local position of each cat is to be calculated $x_{1,d}$ and global position $x_{best,d}$ of cat will be assigned.

Step 5: The previous global best and current global best position are compared according to the fitness function and the best one is saved.
Step 6: The Cat's position and velocity will be updated using equation (2) and (3) for a new population.
Step 7: Check the termination condition, if satisfied, terminate the program otherwise repeat the Steps from 4 to 6.

5. Proposed CSO based FLANN Network

Pao et al. has proposed a single layer ANN i.e. functional link artificial neural network (FLANN), in which the inputs are expanded functionally. It generates the decision boundaries, which is capable of taking complex decision. Mainly the FLANN improves the learning rate with less computational complexity for identification problem. The proposed FLANN model with input signal $x(k)$ is functionally expanded to a number of non-linear components which is given as input to a linear combiner with weighs are associated with it as shown in Figure 3. The functional expansion of inputs gets by different expansion method like power series expansion, trigonometric expansion and Chebyshev expansion. In this article, the Chebyshev expansion has been used to functionally expand the input.

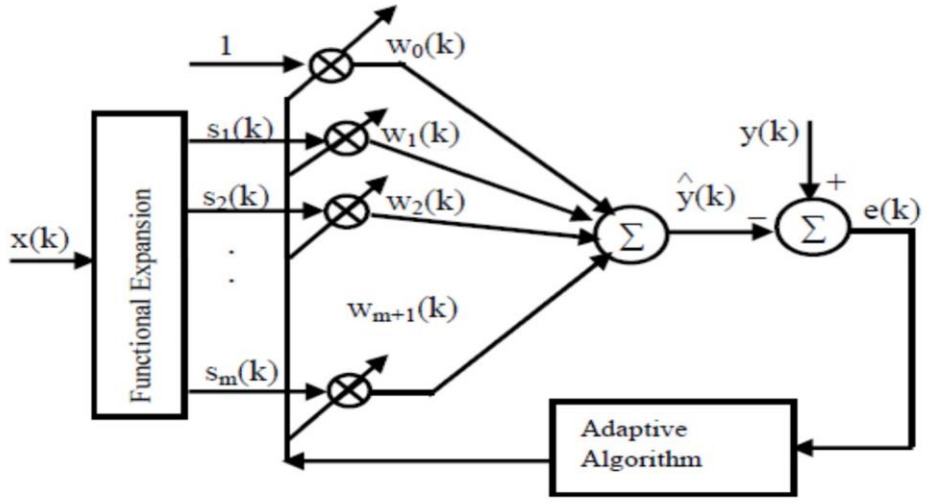

Figure 3. Structure of FLANN Model

Mathematically, Chebyshev expansion can be written as,

$$T_0(x_k) = 1 \quad \text{for} \quad k = 0$$
$$T_1(x_k) = x_k \quad \text{for} \quad k = 1$$
$$T_2(x_k) = 2x_k^2 - 1 \quad \text{for} \quad k = 2$$
$$T_{k+1}(x_k) = 2x_k T_k(x_k) - T_{k-1}(x_k) \quad \text{for } k > 2 \qquad (4)$$

where, $x(k)$ is the input and $w(k)$ is the weights of the model. The output of the proposed model is given as

$$\hat{y}(k) = \sum_{m=1}^{Q-1} s_m(k) w_m(k) \quad (5)$$

The weights of the proposed FLANN model are updated by CSO algorithm for identification of Maglev plant.

6. Result and Discussion

The proposed method is simulated and test by using acer Aspire V, 8 GB RAM, intel CORE i5 processor, 1.80GHZ with Windows 10. For identification of real time Maglev plant 5000 no. of samples have been taken, out of that in 8:2 propotion is taken for training and testing with 10 no. of iteration. The performance of the proposed FLANN network updated by CSO algorithm is analysised in terms of error, MSE and CPU time. Here, the error is 0.0029, MSE is 0.0213 and CPU time is 28.043 sec. From Figure 6, it shows that the high convergence rate of MSE curve.

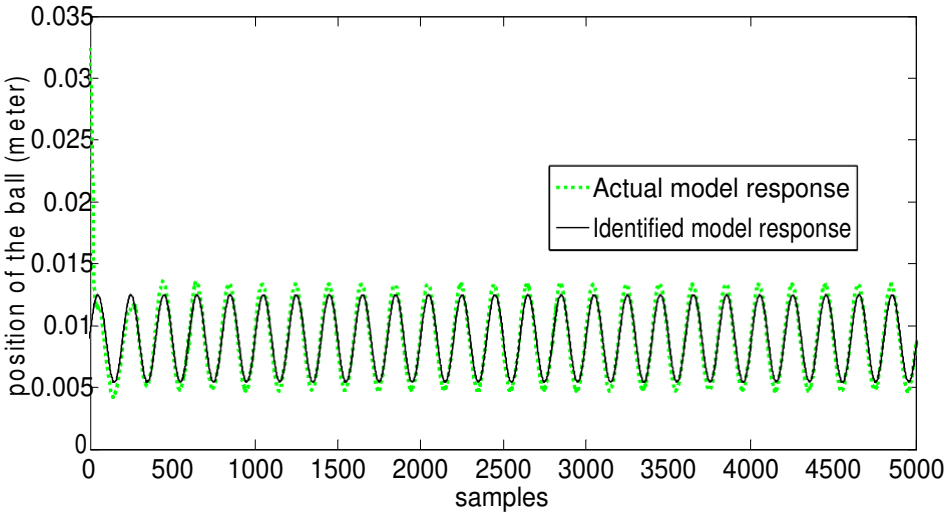

Figure 4. Actual and Identified model response (position of the ball)

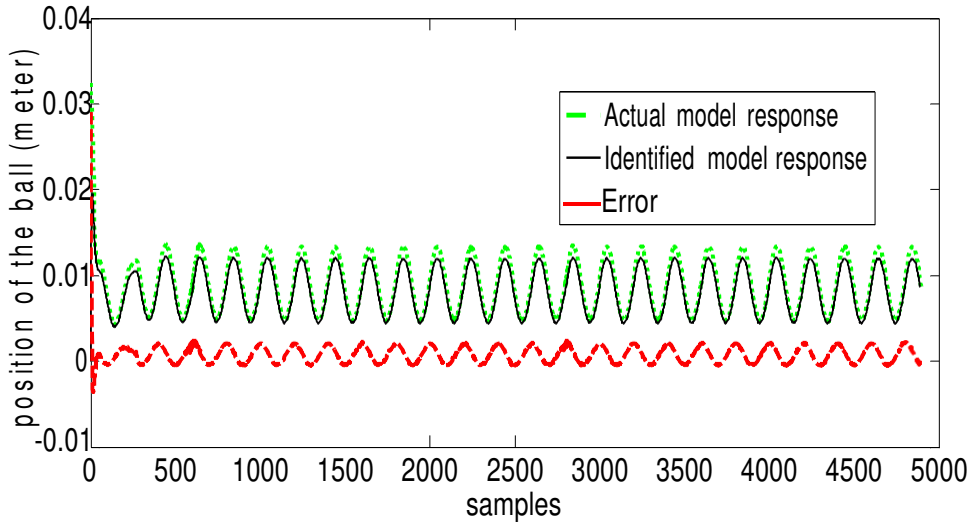

Figure 5. Identified model response generated by FLANN-CSO

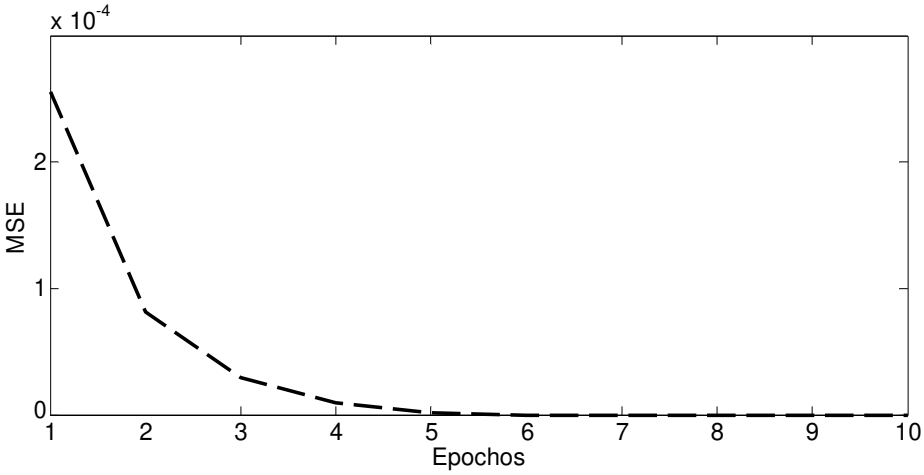

Figure 6. MSE plot of FLANN-CSO

7. Conclusions

In this paper, the proposed model successfully identified the real time Maglev system based on the input-output data. Here, Cat Swarm Optimization (CSO) technique has play the important role to updated the weights of the FLANN model. A simulation study is carried to check the effectiveness of proposed CSO based FLANN network. The efficacy of proposed model found from the closed fitting of identified model response and actual model response, which exhibit that the proposed model using CSO is more suitable for identification of highly nonlinear Maglev plant. The research work in this area includes efficient neural network structure optimized by efficient nature inspired algorithm for further development to enhance its robustness and efficiency.

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Authors

Amit Kumar Sahoo, received his Bachelor's degree in Electrical Engineering from Institute of Technical Education and Research, Odisha, India in 2008. In 2010, he has completed his Master's degree in Electrical & Electronics Engineering from National Institute of Technology, Rourkela, India with Power System and Control specialization. Currently, he is pursuing his PhD from Birla Institute of Technology, Mesra, India. He is presently working as an Assistant Professor in the Department of Electrical & Electronics Engineering, Centurion University of Technology and Management, Odisha, India. He is a life member of IEI, India. He has total 9 years of teaching experience. His specializations include Electrical Machines, Control System, and Network Theory. His current research interests are System Identification, Linear and Non-Linear Control System, Integral and Fractional Order Controller Design, and Soft and Evolutionary Computing.

Jaya based functional link artificial neural network for identification of real-time maglev plant

Amit Kumar Sahoo[1]
[1]*Department of Electrical & Electronics Engineering, Centurion University of Technology and Management, Odisha, India*
[1]*amitkumar@cutm.ac.in*

Abstract

In the recent past identification of nonlinear plant is a significant work has done by many researcher and it is found to be an emerging area for further research due to its wide application. In this article, the characteristics and behavior of a real time maglev plant has been identified using an efficient Artificial Neural Network (ANN) based on functional expansion technique i.e. functional link artificial neural network (FLANN). The weights of FLANN has been iteratively updated by a heuristic optimization algorithm i.e. JAYA. So that the error needs to minimized, which is considered as a cost function. To demonstrate the robust identification performance of the Maglev plant Mean square error (MSE) and CPU time is considered for analysis. The simulation results justify the proposed model robustly identifies the characteristics and parameters of non-linear dynamic maglev plant.

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This paper layout having, Section 2 presents the model of maglev plant. In Section 3 deals with the principle of system identification. Section 4 explain the basics of JAYA. The proposed JAYA based FLANN structure is discussed in section 5. The simulation result is discussed in section 6. Finally, the concluding remarks of the paper is outlined in section 7.

2. The Magnetic Levitation System

Magnetic levitation (Maglev) has been extensively accepted due to its contactless, low noise and low friction behavior and has application in many engineering field [7], [8]. Basically, Maglev plant is a highly non-linear plant and their control and identification is still a problem.

The Maglev setup consist of two parts i.e. a physical Maglev plant and a computer interface. The Maglev plant is consist of electromagnet, IR sensor, amplifier and control objects. The electromagnet helps to control the steel ball in moving up and down from the equilibrium position. When current flows in the electromagnet, then their induces an emf, which controls the position of the steel ball. The steel ball is balanced by electromagnet force and gravitational force to keep it in the desired positon. The IR senor helps to measure the position of the ball and send a signal to input. The amplifier used to improve the level of the input voltage. The Maglev laboratory setup used for experimentation is manufactured by Feedback Instrument Ltd. and it works with MATLAB environment.

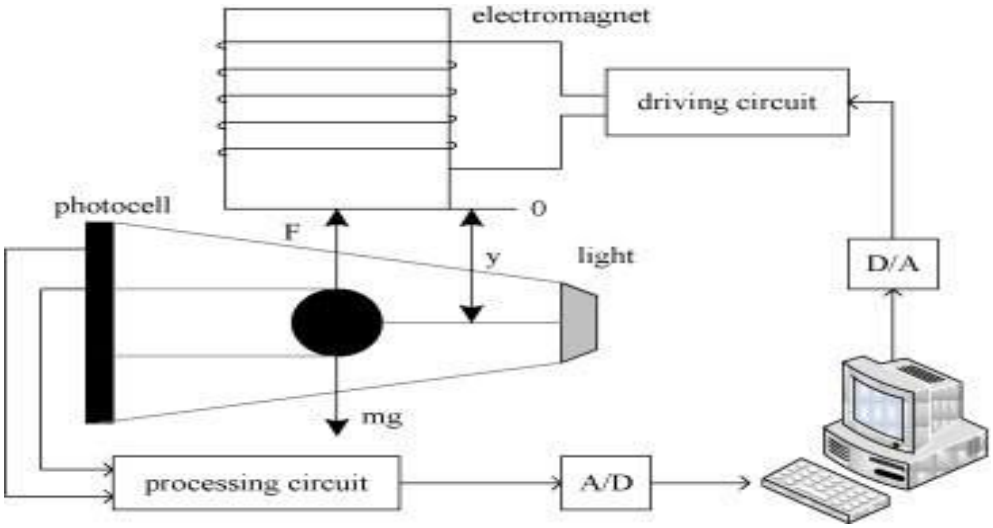

Figure 1. Block diagram of the MAGLEV system

where, m is the mass of the ball, y(t) is the distance between ball electromagnet, g is the acceleration constant., F indicates electromagnetic force, i(t) is the current through the coil. The physical parameters of Maglev plant is given in Table 1.

Sl. no.	Parameters	Value
1	m—Steel ball mass	0.02kg
2	g—Acceleration Constant	9.81m/s2
3	i0— Current value at equilibrium	0.8 A
4	x0—Equilibrium position	0.009m
5	Control input (u)	±5v
6	output voltage (x_v)	+1.25v to -3.75 v

Table 1. The physical parameter of MAGLEV plant

3. System Identification Overview

System identification is a technique that helps to estimate a mathematical modeling for any system from its input-output data. The proposed ANN based FLANN model is a single layer network with absence of hidden layer and the weights are updated by a nature-inspired algorithm JAYA [9], [10], [11]. Here, $u(k)$ represents the input, $y(k)$ is output, $\hat{y}(k)$ indicates the estimated output and $e(k)$ is the error. The cost function is taken as error for the identification of Maglev plant. The cost function need to minimize to get an efficient identified model whose response efficiently track the real-time Maglev plant response.

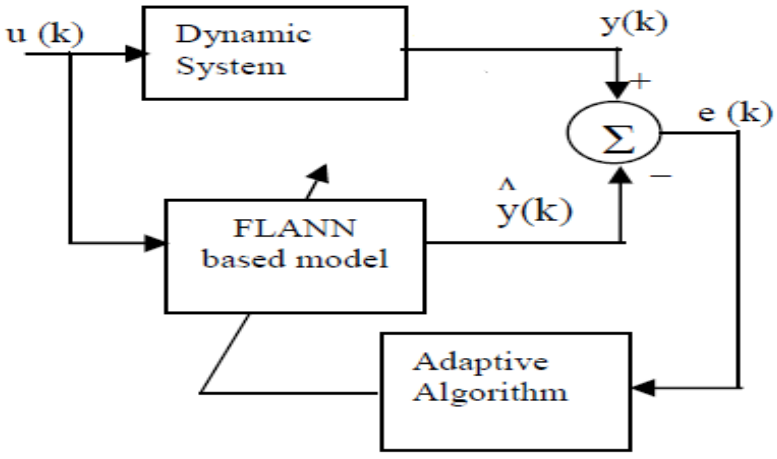

Figure 2. Schematic diagram of Maglev plant identification

4. The JAYA Algorithm

JAYA is a heuristic population-based optimization technique. The algorithm always endeavors to get closer to success (i.e. achieving the best arrangement) and endeavors to avoid failure (i.e. moving away from the most exceedingly terrible arrangement). This algorithm always trying for the victory by getting the optimal solution [12], [13]. So, it named as Jaya (a Sanskrit word meaning victory).

$$z = W_i^n + r_d * (b_v - abs(W_i^n)) - r_d * (w_v - abs(W_i^n)) \quad (1)$$

$$W_i^{n+1} = z \quad (2)$$

Where, r_d represents the random number between 0 to 1. b_v is the best value, which represents the weights having the lowest cost function value. w_v is the worst value, which represents the weights having the highest cost function value.

In this algorithm, a random set of weights are generated to choose the best value and worst value depending on the cost function value. By using equation (1), the weights are updated using the best value and worst value. If the new set up of weights gives the effective result than the previous one, then the new set up weights are considered for the next iteration as given in equation (2) else weights are left unchanged.

5. Proposed JAYA based FLANN Network

Pao et al. has proposed a single layer ANN i.e. functional link artificial neural network (FLANN), in which the inputs are expanded functionally. It generates the decision boundaries, which is capable of taking complex decision. Mainly the FLANN improves the learning rate with less computational complexity for identification problem. The proposed FLANN model with input signal $x(k)$ is functionally expanded to a number of non-linear components which is given as input to a linear combiner with weighs are associated with it as shown in Figure 3. The functional expansion of inputs gets by different expansion method like power series expansion, trigonometric expansion and Chebyshev expansion. In this article, the Chebyshev expansion has been used to functionally expand the input. Mathematically, Chebyshev expansion can be written as,

$$\begin{aligned} &T_0(x_k) = 1 \quad \text{for} \quad k = 0 \\ &T_1(x_k) = x_k \quad \text{for} \quad k = 1 \\ &T_2(x_k) = 2x_k^2 - 1 \quad \text{for} \quad k = 2 \\ &T_{k+1}(x_k) = 2x_k T_k(x_k) - T_{k-1}(x_k) \quad \text{for } k > 2 \end{aligned} \quad (3)$$

where, $x(k)$ is the input and $w(k)$ is the weights of the model. The output of the proposed model is given as

$$\hat{y}(k) = \sum_{m=1}^{Q-1} s_m(k) w_m(k) \quad (4)$$

The weights of the proposed FLANN model are updated by JAYA algorithm for identification of Maglev plant.

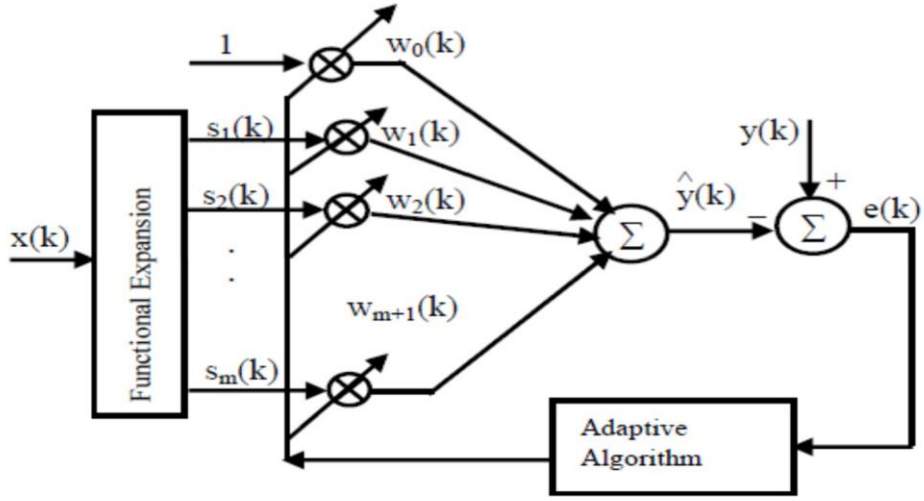

Figure 3. Structure of FLANN Model

6. Result and Discussion

The proposed method is simulated and test by using *acer Aspire* V, 8 GB RAM, intel CORE i5 processor, 1.80GHZ with Windows 10. For identification of real time Maglev plant 5000 no. of samples have been taken, out of that in 8:2 propotion is taken for training and testing with 10 no. of iteration. The performance of the proposed FLANN network updated by JAYA algorithm is analysised in terms of error, MSE and CPU time. Here, the error is 0.0011, MSE is 0.00001 and CPU time is 23.012 sec. From Figure 6, it shows that the high convergence rate of MSE curve.

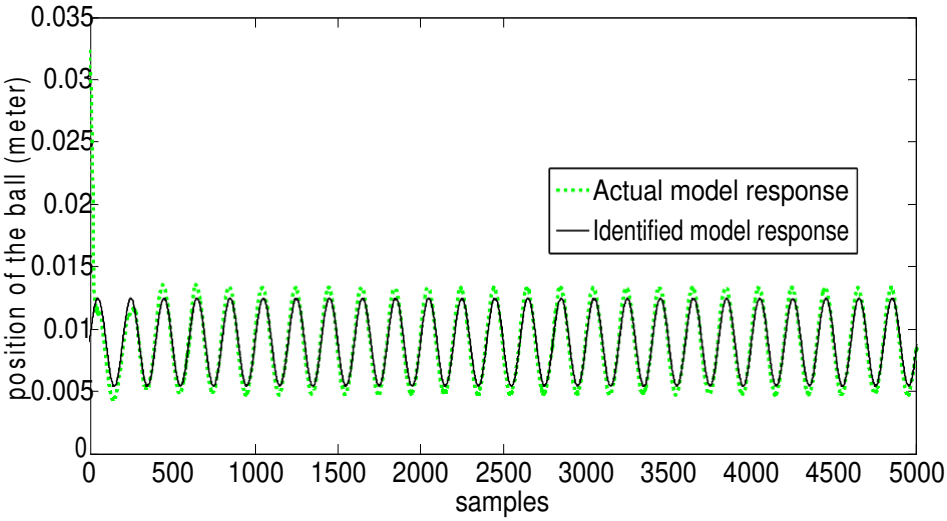

Figure 4. Actual and Identified model response (position of the ball)

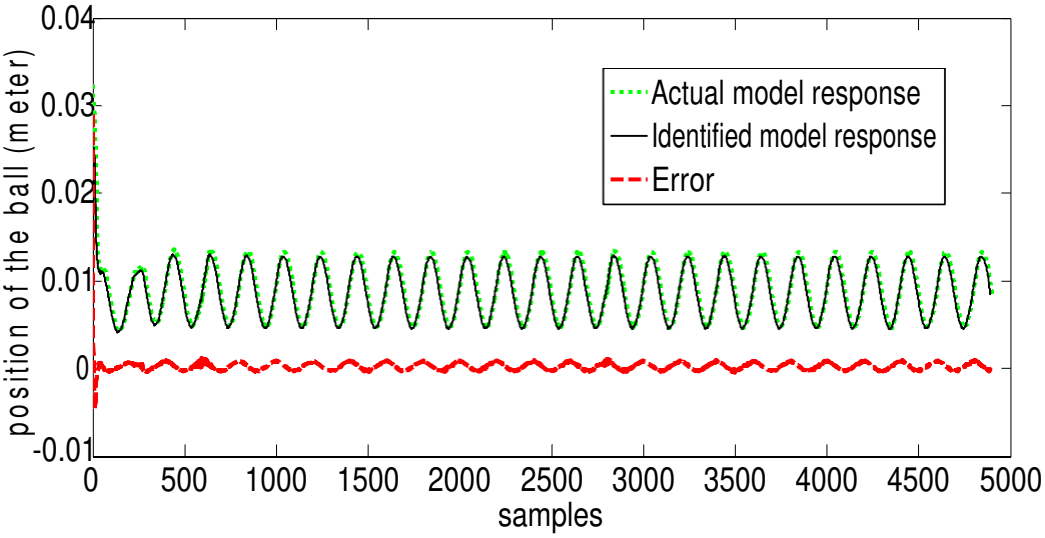

Figure 5. Identified model response generated by FLANN-JAYA

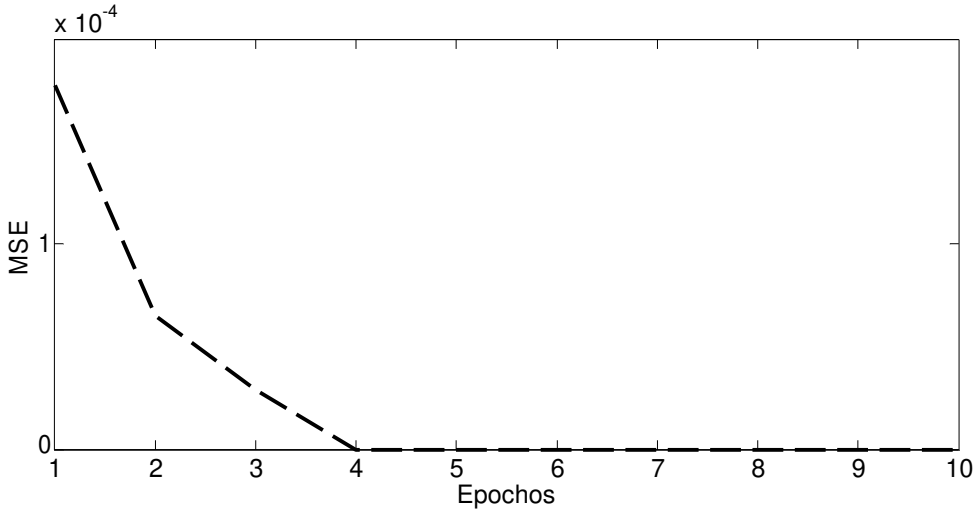

Figure 6. MSE plot of FLANN-JAYA

7. Conclusions

In this paper, the proposed model successfully identified the real time Maglev system based on the input-output data. Here, JAYA technique has play the important role to update the weights of the FLANN model. A simulation study is carried to check the effectiveness of proposed JAYA based FLANN network. The efficacy of proposed model found from the closed fitting of identified model response and actual model response, which exhibit that the proposed model using JAYA is more suitable for identification of highly nonlinear Maglev plant. The research work in this area includes efficient neural network structure optimized by efficient nature inspired algorithm for further development to enhance its robustness and efficiency.

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Authors

Amit Kumar Sahoo, received his Bachelor's degree in Electrical Engineering from Institute of Technical Education and Research, Odisha, India in 2008. In 2010, he has completed his Master's degree in Electrical & Electronics Engineering from National Institute of Technology, Rourkela, India with Power System and Control specialization. Currently, he is pursuing his PhD from Birla Institute of Technology, Mesra, India. He is presently working as an Assistant Professor in the Department of Electrical & Electronics Engineering, Centurion University of Technology and Management, Odisha, India. He is a life member of IEI, India. He has total 9 years of teaching experience. His specializations include Electrical Machines, Control System, and Network Theory. His current research interests are System Identification, Linear and Non-Linear Control System, Integral and Fractional Order Controller Design, and Soft and Evolutionary Computing.

Biotechnology for agriculture – is it sustainable?

Kakani Grihalakshmi
School of Management, Centurion University of Technology and Management, Odisha, India
Kakani.Grihalakshmi@cutm.ac.in

Abstract

Gene modification for improved crop varieties has been in vogue for centuries. Several plant varieties were selectively bred over hundreds of years into domesticated food plants. A process known as Artificial Fertilization was used wherein an elaborate process involving collection and application of pollen onto the stigma yielded hybrids with desirable traits. Green revolution had brought in plant varieties resistant to biotic and abiotic stresses by carrying out crosses between several related species. A more precise gene manipulation by specifically combining genes from one organism into another commonly referred to as Genetic Engineering came into existence. Plant breeding for pest resistance has been considered the most critical application of genetic engineering. Transgenic crops especially cotton and maize were being developed by inserting genes from *Bacillus thuringiensis* to prevent pests. It is considered that introduction of novel traits with taxonomically different organisms can have intense negative impact on the environment bringing about changes in the genetic makeup of the population.

Keywords: Genetic Engineering, Transgenic, Conventional, Environment, Sustainability

Introduction

Although the first known evidence of genetic modification in plants was observed for wheat varieties dating back to 7800 BC [2], the most popular genetic manipulation in the history has been in maize. Maize initially was a wild grass known as “Teosinte” and the most important characteristic feature of this variety was that it had very few kernels on tiny ears. Several plant varieties were selectively bred over hundreds of years into domesticated food plants and the famous plant hybridization experiments by an Austrian Monk Gregor Mendel are well known. A

process known as Artificial Fertilization was used wherein an elaborate process involving collection and application of pollen onto the stigma yielded hybrids with desirable traits. The principle behind the experiments was the following – when two plants that differed in one or more attributes were crossed (artificial fertilization) the resultant hybrid had features that were common in both the parent plants but the differential attributes present in the parents combined and resulted in a new character in the hybrid and this trait in the progeny of the hybrid varied in successive generations. The characters transferred from parents to offspring were classified as being dominant (traits transmitted entirely or almost unchanged) or recessive (those that are dormant). The recessive traits disappear completely in the hybrids however, reappear in successive generations[7].

Green Revolution and Genetic Modification

Borlaug's experiments with wheat were more focused on increasing the food production to meet the growing population needs in third world countries especially in India, Mexico, and Pakistan. Plant varieties resistant to biotic and abiotic stresses were developed by carrying out crosses between several related species. Hybrids thus obtained responded favorably to fertilizer and irrigation practices which resulted in higher yields.

Similarly, high yielding varieties were developed for rice and other cereals. Nevertheless, the fruits of the revolution were short lived. Promised higher yields were not evident in Africa and in other parts of the world. In addition, other challenges, such as depletion of soils - massive chemical fertilizer use rendering the soil unfit for cultivation with no concomitant increase in yields and huge irrigation systems were required to meet the water demands of the crops.

The above two methods, commonly referred to as conventional breeding methods involved selection of the superior genotypes especially with regards to higher yields, uniformity in flowering, growth and development, and resistance to drought and pests and diseases. Over a period of time the performance of the genotypes were assessed based on the interaction with the environment and genotypes with better adaptation were selected and propagated. The underlying criterion for selection of genotypes was natural mutations and genetic modification was largely confined to genetic variability that was apparent in the phenotypes [18].

Modern Genetic Modification

A more precise gene manipulation by specifically combining genes from one organism into another commonly referred to as Genetic Engineering came into existence in 1973. A gene encoding for antibiotic resistance of one bacterial strain was successfully transferred into another [4]**.** A similar technique was used by Rudolf and Jaenisch to transfer genes into mouse embryos. This technique is widely being used in crop plants where genes for unique traits from one organism are selected and inserted into the target plant creating genetic diversity.

The technology simply stated involves the following steps – a desirable attribute (resistance to pests) is selected and the gene encoding for the attribute is then isolated from an organism. A classical example is creation of herbicide resistant plants that conferred resistance to pests (Roundup Ready) plants. The most popular procedure followed by Monsanto uses the bacteria *Agrobacterium tumefaciens* that is capable of invading and inserting the genes in the seeds and in due process changing the genome of the plant. After the gene insertion, the modified plant is replicated through successive generations and in each generation it is ensured that the target trait is retained and this is done by growing plants in controlled growth conditions.

Bt Crops

Plant breeding for pest resistance has been considered the most critical application of genetic engineering. Transgenic crops especially cotton and maize were being developed by inserting genes from *Bacillus thuringiensis* (*Bt*) to prevent pests such as boll worm, European corn borer, and root worm [19, 20] **.** The toxic action of the bacterium was discovered in 1950 and is primarily through crystal like proteins called Cry proteins that are formed in Bt spores. These proteins upon ingestion by the insect larvae undergo proteolytic digestion in the midgut releasing toxins that bind to the epithelial receptors causing irreversible destruction of the gut membrane and eventually leading to lysis of the cell [14, 19] .The proteins were however found to be non-toxic to mammals hence, were considered as optimal for GM food applications.

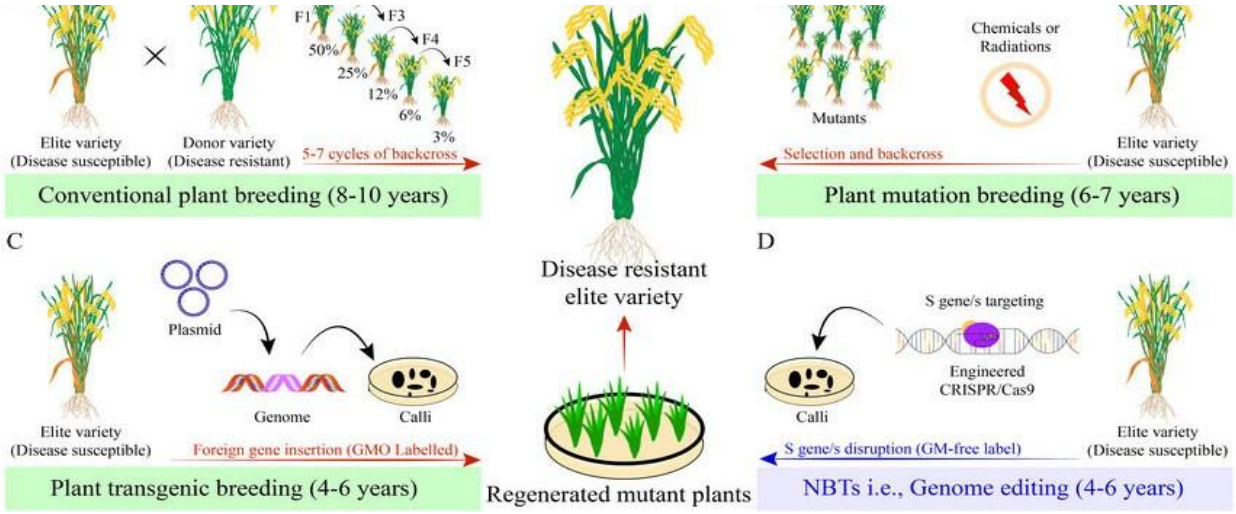

Figure 1. Illustration of comparison of plant breeding and mutagenesis methods used in crop (e.g. rice) improvement modified from Chen et al. [6]. (A) Conventional plant breeding method, known as cross breeding, is used to improve plant traits, e.g. disease resistance since long time via crossing an elite recipient parent line with a donor line with desirable trait. Finally, an outstanding progeny with the desired trait/s is selected after many successive backcrossing and rigorous selection cycles. This technique is time-consuming, laborious, less efficient and contains many other limitations as well. (B) Mutation breeding refers towards chemical or physical mutagenesis. Usually, the seeds are treated with different mutagens to generate mutations in plant's genome. Mutants developed through this process go through rigorous selection during the evaluation of desirable phenotype/s. This is also a way of identification and mapping of novel genes in genome. It also takes around 6–7 years to get desirable results, which is time-consuming and tedious process. One of the major limitations and disadvantages of this technique is the random mutations in genome, which sometimes become hard to detect and predict. (C) Transgenic breeding, importing a gene of interest from one genome to other, has been successfully utilized to improve different traits of several crops (e.g. Bt cotton, Bt maize, etc.). Gene of interest is inserted into the genome of host elite variety with great precision and accuracy and improves the targeted trait/s. However, these are genetically modified plants due to the insertion of foreign DNA/element into one's genome. Despite many other issues, one of the biggest problems with the GMOs is less acceptance by public and a group of plant scientists around the globe. (D) New genetic modification techniques, also referred to as 'new (breeding) techniques' like genome editing, are equally hope and hype for sustainable future of crop improvement. Plants are getting improved through targeting and disrupting any specific negative regulator/s or genes, on a specific gRNA-guided target site, and reorganizing chromosomes in the genome of elite varieties. Traits improvement via genome editing tools such as CRISPR/Cas9 system is an efficient, robust, time saving, less laborious and cost-effective way as compared with other techniques. Additionally, due to the absence of any foreign DNA, this technique may also evade the plants from GMO legislation and can be labeled as non-GMOs.

Source – CRISPR/Cas9 for development of disease resistance in plants: recent progress, limitations and future prospects (Shakeel Ahmad et al, 2020)

Impact on the Environment

Conventional breeding methods (Mendel's peas experiments and Green revolution) primarily aimed at introducing genes into crops for novel traits such as high yielding, resistance to stress, and improving quality attributes such as taste, and color. An important distinctive feature of these methods was selection of traits after hybridization of closely related genera/species and the performance of the traits in the natural environment (natural selection). These methods by large were considered to bring about minimal to negligible genetic changes and were not subjected to regulatory scrutiny. This is in sharp contrast to the breeding methods employed for transgenic and *Bt* crops where the traits selected for the hybrid are usually the resultant of hybridization between distant organisms and more often belonging to different genera/species. Moreover, the resultant hybrids are grown in growth chambers in controlled environment conditions unlike the traditional breeding methods.

In addition, the novel traits introduced into the environment can bring about changes in the existing organisms that are established in the ecosystem. It is also considered that introduction of novel traits with taxonomically different organisms can have intense negative impact on the environment bringing about changes in the genetic makeup of the population. Other probable effects include unpredictable changes in the recipient population, and uncertain behavior of the modified transgenic in the ecosystem.

Some of the harmful consequences of introduction of novel traits in new environment (differences in physical environment) include the following: *Abuttlon theophrasti* (native of Asia) is a weed in the temperate environment [11] new varieties of maize cultivated in Mexico has resulted in loss of native taxa (teosinte – progenitor of maize) [17, 21]. Similar observations were made with rice – natural species (wild varieties) of rice almost were extinct after a shift to the cultivated species [13]. Plants intended for agricultural purposes eventually were know to become weeds – Bermuda grass (*Cynodon dactylon*) was initially introduced as a forage grass however, later had become an obnoxious weed [10].

Hazards associated with Transgenic Plants

Some of the hazards associated with the release of the transgenic plants have been identified and classified as below:

a) Hazards due to transfer of genes with ultimate expression of trait in a different organism and this is usually accomplished either as unintended seed dispersal – transfer of genes by seeds during planting in the field or during transport of crop to the market [5] horizontal transfer (asexual) of genes from one species to another such as in fungi [1], and dispersal of pollen (sexual transfer) resulting in transfer of genes from transgenic crops to wild varieties leading to weediness [6].

b) Hazards with whole plants – Certain crops such as tomatoes could grow and evolve to feral population (wild type) and become wild varieties quickly and existence of such crops demonstrates that transgenes conferring adaptation to the environment and eventually becoming a whole-plant hazard. It also becomes increasingly difficult to distinguish the gene transfer and the whole plant hazard and gene flow between the feral population and the transgenic plant may result in weeds that are sources of plant hazards in the ecosystem.

c) Non-target hazards are usually associated with *Bt* crops where the crops are genetically modified to target specific pests of the crop. A case in example is *Bt* corn that was modified to control pests namely *Ostrinia nubilalis* (European corn borer), *Diatraea grandiosella* (southwestern corn borer) [16]. Transgenic corn in addition to being harmful to the pests was found to increase mortality of green lacewing larvae (a natural predator of insect pests) [8, 9]. In addition, *Bt* toxin was also known to leak into the soil particles and was found to be toxic to nematodes. The most important concern was effect on monarch butterflies [12, 15].

d) Hazard of evolution of resistance – By far the most risky of all the hazards associated with the transgenic crops. Pests that are targeted for control by the transgenes become resistant and this poses a huge environmental risk because other controls will be rushed through without careful assessment of potential toxic effects on the ecosystem [3]. Emergence of herbicide resistant weeds is another phenomenon that has become an

increasing concern of late that is seen as having a enormous negative impact on the environment.

In addition, transgenic crops can have adverse environmental impact when grown on commercial scale, an analysis of which is complex and beyond the scope of this paper.

The environmental risk posed by the conventional and transgenic breeding methods has been an intense scientific debate for decades and transgenic crops have been under scrutiny right from the inception. Till date, crops that have been genetically modified in the lab (transgenic) are only regulated and protected by patents owned by multinational giants.

Summary and Conclusions

Agriculture for ages has been the backbone of major economies across the globe and continues to be the only source of livelihood for small and marginal farmers. Crop production practices have seen major shifts from subsistence farming with cultivation of traditional (wild) varieties adhering to traditional practices to green revolution and to modern transgenic crops. It is quite intriguing though that modern approaches with gene manipulation have had limited success. Emerging issues such as climate change, low agricultural productivity, new diseases and pests continue to pose challenges in meeting the food requirements of the growing population. This warrants a system or an approach with practices that are sustainable and that can withstand the vagaries of the climate. Biotechnology has had its presence for about fifty years for now but has remained very controversial all through in its methods. The technology could not be scaled up for majority of the staple crops especially grown in the third world where agriculture is considered as the only source of income for about 60-80 percent of the population. Majority of this population comprises of small and marginal farmers who own less than one hectare of land and who traditionally save seed from the previous crop for further cultivation. Biotechnology while claiming to be all natural is protected by royalties which again is highly contentious. A technology that is protected cannot

meet the requirements of the marginal farmers and sustainability of the technology is questionable.

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Teosinte: Implications for Transgenic Maize, J.A. Serratos, M.C. Willcox, and F. Castillo, eds. Mexico:Center for Research on Wheat and Maize (CIMMYT)

Breast cancer classification using deep learning

Prangyan Paramita Das, Sujata Chakravarty
[1,2]Centurion University of Technology and Management, Odisha, India
[2]sujata.chakravarty@cutm.ac.in

Abstract:

Breast Cancer is the most common type of cancer in women;one out of 8 females worldwide is affected by breast cancer.This is diagnosed by the identification in malignancy of breast tissue cells.Here I am classifying the different types of tumour formed in the breast and classify it into cancerous or non-cancerous.Thisdataset collected in Brazil from 82 patients, which consists of 7909 histopathology images. Using various algorithms and tools, advanced medical image processing techniques work on histopathological images captured by a microscope and then interpret them.For the retrieval of medical imaging and pathological devices, machine learning algorithms are also used.A tiresome activity is manual identification of a cancer cell which requires human error and thus computer assistance.This is normally achieved in deep learning by extracting characteristics from a convolutional neural network (CNN) and then classifying them using a fully connected network.In the area of medical imaging, deep learning is widely used as it does not involve previous experience in a related field. I have equipped a pre-trained convolutional neural network which ResNet50, it's pre-trained on ImageNet database, to learn the domain-specific characteristics needed to identify the histology images and obtained 97.77 percent prediction accuracy.

Keywords:

Histopathology image; Medical image processing; Pre-trained Convolutional neural network; ResNet50; Deep learning; Breast cancer

1. Introduction:

Breast cancer is most likely to develop amongst all forms of cancer in women.Breast cancer accounts for 14 percent of cancers in Indian women, with it being the most prevalent form of cancer in women.It is estimated that an Indian woman is diagnosed with breast cancer every four minutes.Breast cancer, both in rural and urban India, is on the increase [1, 2]. The best possible way to cure the cancer is to detect the cancer by an efficient detection system.

We already have some detection systems like digital mammography, biopsy, MRI and many others. In general biopsy is used to acquire the histopathology images and from that affected cells are identified. The tissues infected by the tumor are removed by the pathologist and stained by H&E, a mixture of histological stains called hematoxylin and eosin, during which malignant characteristics in cellular structures such as the nuclei are inspected under a microscope for cancerous cells. The microscopic images are collected and by using these images computer based detection system are developed. As manual detection methods are tiring and there are high chances of getting more errors, examining a microscopic image is a difficult job and even a small irregular arbitrary visual perspective can misguide the result. The main objective of examining the images is to classify the tumor type whether its malignant or benign, malignant tumors are basically cancerous and it should be diagnosed as soon as possible otherwise it can be very much dangerous and can cause death[3]. As per previous experiences computerized detection using machine learning has better performance than any human pathologist. In contrast to the impartial diagnosis provided by a pathologist, a number of researchers have found that medical image recognition using machine learning produces more precise outcomes. As per a study conducted in Europe, where a set of algorithms were used along with breast images and it had higher detection accuracy, this study is also proof that when high resolution images are used with better algorithms it can give very high accuracy and it will enhance the performance of cancer detection[4].In a recent review [5], the authors suggested a convolutional neural network-based approach with a small number of training samples to identify H&E-stained breast histology photos into four tissue groups, namely, safe, benign, in situ carcinoma and invasive carcinoma. For the preparation of a Support Vector Machine classifier, the features extracted from CNN were used. Accuracies of 77.8 percent for the classification of four classes and 83.3 percent for the classification of carcinoma / non-carcinoma were obtained. In this analysis, I analyze the effectiveness of transfer-learning on the BreakHis data set for the task of image-wise classification of H&E-stained breast cancer histology images and examine the classification efficiency of the pre-trained ResNet50 [6] networks. The structure of the paper is reminded as follows: Section II, describes the overall flow and structure of the Work. Section III, describes of the BreakHis dataset used in this experimentation. Section IV, describes about the CNN used in the following experiment. Section V, describes the preprocessing steps and architecture of the

CNN used in the experiment followed by neural network classification. Section VI, discusses about the hardware and software required to perform this experiment. Section VII, Discusses the Result obtained in this experiment. Section VIII, concludes the work by presenting some insights for further research.

2. Related Work:

Digital Mammography, Magnetic Resonance Imaging (MRI) scans, Biopsy, ultrasound, and nuclear imaging are many ways to diagnose breast cancer [3]. None of these above methods, however, offer an absolutely accurate cancer prediction. Staining Methodology is basically used for tissue based treatment. Some staining elements, typically hematoxylin and eosin (H&E), are coloured by tissue elements in this process. For clear visibility under high resolution each and every part of tissue (such as cell structure, type and other elements) are stained properly. The stained images or the high resolution images taken bycamera are examined by the pathologist. For detection of lump pathology test are very much essential as it's an old technique to predict or identify the invasive cancer cells. This technique requires different intra-observer differences, cancer cells and tissues may have several different features, and all of the other cell types have the same hyper chromatic characteristics, making detection very much difficult, the field preference is also a consideration, since only a small region of the tissue is used to choose the area in the periphery of the tumour [4]. To solve the above mentioned problems deep learning is used, it's a subset of machine learning. It doesn't require any domain knowledge to extract and organize different features but in manual method domain expertise is must. There are various deep learning methods to predict tumour, the only basic requirement is proper format of dataset and a Network as parameter for the problem [7].

Several Networks are there, which are also proposed by various scholars, which can be used to classify breast cancer. For example, ANN(Artificial Neural Network)[8] which uses MLE(Maximum likelihood Estimation)[9], RBF Neural Networks [10] and Convolutional Neural Network (CNN)[11]. In this context, we examine the profound learning approach to the problem of classification of the Breast Cancer histopathology picture.We often research various ways of working with high-resolution texture images without modifying the architecture used for low-resolution images, as well as comparing different CNN architectures. As per an experiment conducted on BreaKHis dataset, CNN has a better result than the best result obtained by other

methods. The result obtained by using different CNNs in fusion was 6% more accurate than other methods [12]. ResNet50 is pre-trained CNN model, by using this, it can give best and improved accuracy and will get the best result. ResNet50 is pre-trained on ImageNet database.

3. Dataset:

Multiple dataset are available for histopathological stained images, such as Breast Cancer for breast (WDBC) cancer Wisconsin Original Data Set (UC Irvine Machine Learning Repository)[13], MITOS- ATYPIA-14 [14] and BreakHis [15]. Here I have used the BreakHisdataset, taken from 82 individuals with various magnifiers (40X, 100X, 200X and 400X) with 7,909 microscopic photographs of the breast tumour tissue obtained.Up to now, 2,480 benign samples and 5,429 malignant samples (700X 460 pixels, three channels RGB, per channel 8-bit depth, PNG format).The P&D Laboratory–Pathological Anatomy and Cytopathology, Parana, Brazil was developed in accordance with this database. Samples present in the dataset were obtained in this version by the SOB procedure, also referred to as partial mastectomy or excisional biopsy.Compared to any process of needle biopsy, this sort of treatment avoids the greater size of the tissue sample and is administered in a hospital with general anesthetic.We assume this index is a valuable method for researchers because it allows possible future assessment and benchmarking.

Table 1. Image distribution in dataset

Magnification	Benign	Malignant	Total
40x	652	1370	1995
100x	644	1437	2081
200x	623	1390	2013
400x	588	1232	1820
Total	2480	5429	7909

4. Convolutional Neural Network (CNN) and Pre-trained CNN:

Convolutional neural network is a subset of deep neural networks in deep learning, most widely applied to visual imagery analysis.Based on their shared-weight architecture and translation invariance properties, they are also known as shift invariant or space invariant artificial neural

networks [16].CNN is an altered deep neural net variety that relies on the association between adjacent pixels. At start it uses random patches of input then modifies it to training process. After training is completed, the modified patches of images are used by the network to predict and validate the result in testing or validation process. In the image classification problem, convolutional neural networks have achieved success, as the specified nature of CNN fits the distribution of data points in the image [17].

In CNN architecture two main transforms are there. One is Convolution, kernel is used for convolving pixels, and it results as a dot product of image patch and kernel. And second is subsampling (pooling), different types of pooling methods are used as per the requirement. Pooling is used to reduce the dimensionality of data and it's quite helpful in reducing overfitting. The output can be fed to a fully-connected layer for efficient classification after using a mixture of convolution and pooling layers[16,18].

Here I used pre-trained CNN model. For various classification activities, the application of pre-trained CNNs on large annotated image databases, such as ImageNet, for example, to images from different modalities / domains is referred to as transfer learning. On medical picture data sets, pre-trained CNNs can be fine-tuned, allowing large networks to converge faster and learn domain-/task-specific functionality [19]. I learned a well-known pre-trained CNN architecture, namely the deep residual convolutional (ResNet50)[6] network, which is fine-tuned to learn basic features of the domain and modality to distinguish images of breast histology. ResNet50 is based on a residual learning system in which layers within a network are reformulated rather than the desired undefined mapping between the inputs and outputs to learn a residual mapping. Such a network is easier to optimize and hence requires deeper network preparation, which, in turn, leads to an overall increase in network ability and performance.

5. Methodology:

This paper presents and tests a deep learning architecture for automatic detection of breast cancer that combines machine learning and image recognition principles. Here I have used pre-trained Convolutional Neural Network from different neural network architectures. This used the labeled (benign / malignant) input image from the raw pixels and highlighted the visual patterns, and then, with the aid of a classifier network, used those patterns to discriminate between non-cancerous and tissue-containing cancer, functioning close to digital staining, which highlights

image segments critical for diagnostic decisions. By using 2480 benign and 5429 malignant samples CNN was trained. The suggested method therefore provides an appropriate model of classification to classify breast tissue as either benign or malignant. Fig 1 shows the flow digram.

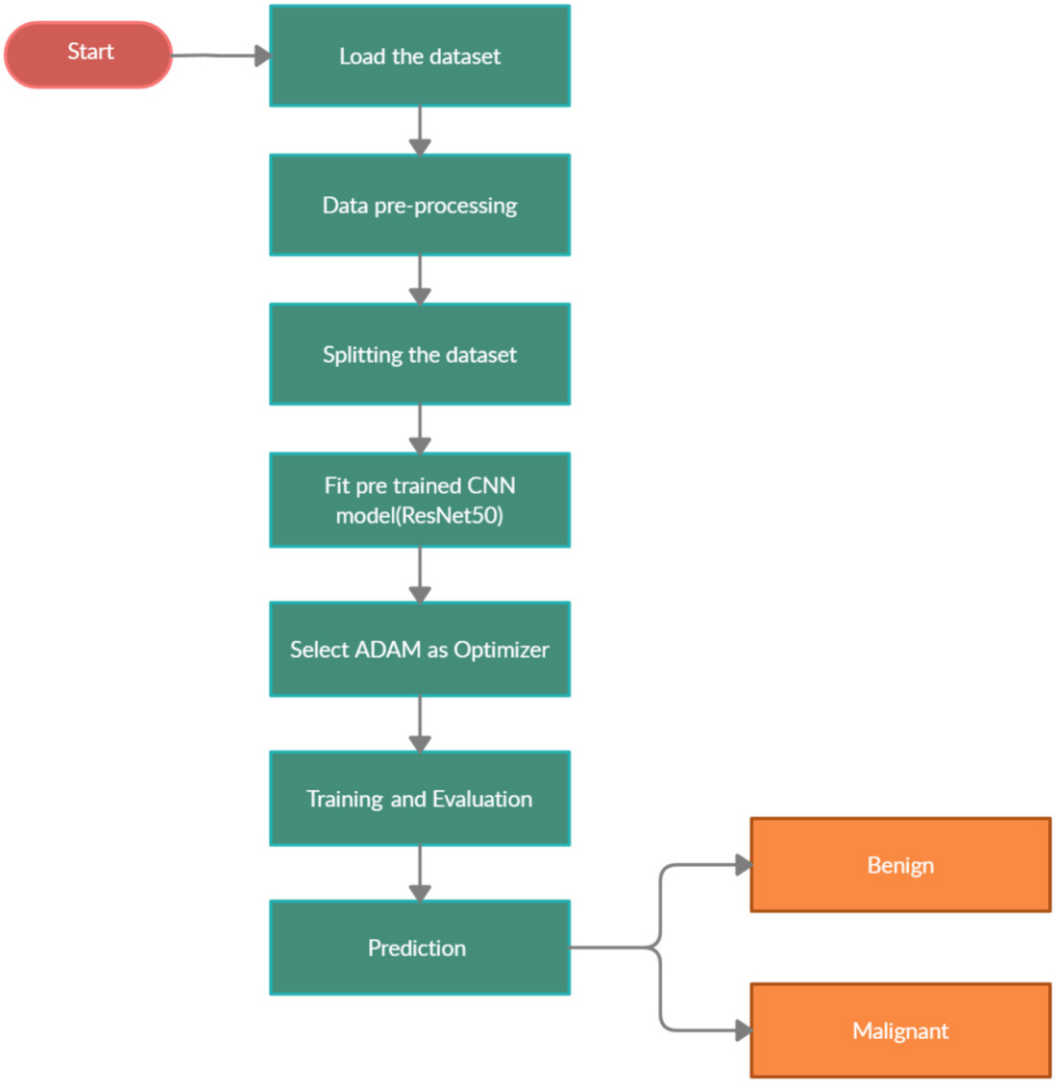

Fig. 1 Flow Diagram

5.1 Image preprocessing

Deep learning methods are highly dependent on the amount of available training data, with higher difficulty models needing more data to generalize well and prevent over-fitting the samples of training. The Breast histology images used in this model are of large size (700X460 pixels).By using limited number of data sample, augmentation of data is done using various

augmentation types to increase the number of training samples [16].Image-wise grouping into tissue/cancer sub-types involves studying features defining overall tissue architecture. Thus,I resampled the size of images (224 X 224 pixels). As there is no fixed orientation adopted for the pathologist to analyze the images, data augmentation is used to emulate this real time scenario. Here augmentation is done by flipping (horizontal and vertical), zooming and rotating (90 degree).

5.2 Feature Extraction:

Feature learning is a key step for both human and computer algorithms in the classification process.A research has found that, while computers are more sensitive to patterns and texture, the human brain is sensitive to shapes. Features learning in both the cases are different. In visual context, in malignant tissue undergoes various changes. The extracted features are analyzed by the experts, or these features are quantified by the algorithm to automate detection. In supervised learning, the images are given as input to architecture such as CNN, along with its class label, which eliminates the requirement of providing these features explicitly.CNN is able to derive computational functionality from the automated updating of filter values in the training phase.CNN takes raw pixels of an image in this technique and produces output as learned filter weights. These weights act as an input to the deep neural network's dense architecture for final prediction. Here I have used pre-trained CNN model called ResNet50. In my architecture ResNet50 is made up of 4 layers. DenseNet201 was used as the pre-qualified weights that were already trained in the competition for Imagenet., the learning rate was selected to be 0.0001. I used globalaveragepooling layer followed by 50% dropouts to reduce over-fittingDense layer batch normalization with 2 neurons for 2 outputs, i.e. benign and malignant with softmax, was used as the activation function. Adam as optimizer and binary-cross-entropy as loss function were used.

5.3 Classification:

By taking the flattened weighted function map obtained from the final pooling layer, the classification process is carried out and is used as an input to the fully connected network, which measures the loss and modifies the weights of the internal hidden nodes accordingly. The parameters of the layers are stacked after the completion of preprocessing and the final output is taken from the last layer.

6. Experimentation:

6.1 Hardware and Software Used:

For this experiment hardware's used is a PC, having at-least 4GB of RAM, 500GB HDD, i3 processor and good internet connectivity. Software used is from open source site called **Google Colab**, it provides all the necessary specification such as 13GB of RAM, 12GB NVIDIA Tesla K80 GPU and good amount of storage though Google Drive or from the Local Host. As it has very high specification as compared to the Local PC the processing becomes very smooth and very fast.

6.2 Performance Matrix:

A confusion matrix is a table frequently used to define the output of a classification model (or "classifier") on a collection of test data that are considered to be true values. It has four field called (i) True Positive (TP) (ii) True Negative (TN) (iii) False Positive (FP) and (iv) False Negative (FN).Accuracy is the calculation made by the classifier of a successful forecast.This provides the output potential of the entire classifier. The accuracy is defined as

accuracy = (TP+TN)/(TN+FP+FN+TP)

7. Experimental Result:

I obtained a training precision of 97.77 percent with a test train break of 0.2 by considering the previously mentioned configuration. Evaluation metrics are defined as follows.Precision is a probabilistic test to decide if a positive case really belongs to the positive class, described by our terminology. A recall is a probabilistic measure for evaluating if the positive class is appropriately classified as a real positive case. The geometric mean of precision and recall is calculated as F1 score [17]. Support is defined as the number of samples of the true response that resides in that class. The result of the Evaluation metrics is summarized in **table 2**, there we can see that the precision for benign is 87% and for malignant is 95%, recall for benign is 96% and for malignant is 85% and F1-score for benign is 91% and for malignant is 90%.

F1 = 2(precision * recall) / (precision + recall)

Table 2. Result Summary

	Precision	recall	F1-score	Support
0	0.87	0.96	0.91	255
1	0.95	0.85	0.90	260

Accuracy			0.90	515
Macro avg	0.91	0.91	0.90	515
Weighted avg	0.91	0.90	0.90	515

From the experiment the confusion matrix is obtained **(Fig 2)** from which its concluded that Malignant class is the true class in this case; hence values of True-Positive, True-Negative, False-Positive and False-Negative are45.04%, 5.43%, 46.99% and 2.52% respectively.

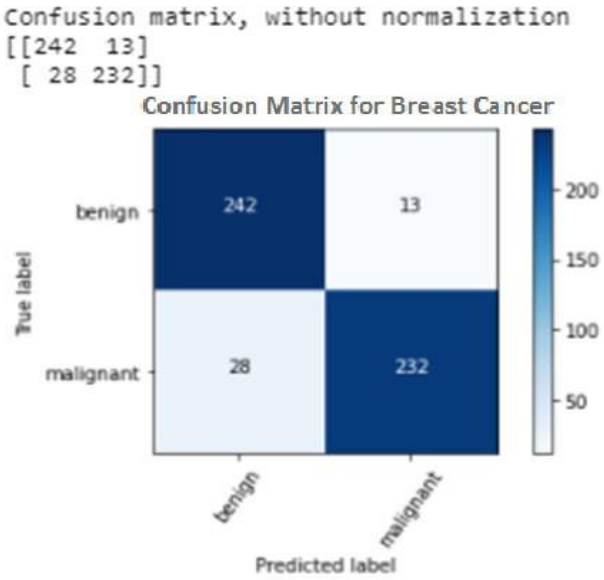

Fig 2. Confusion Matrix

Training and validation curves acquired during the training process are shown for loss and accuracy is shown in the **Fig 3** and **Fig 4**respectively.

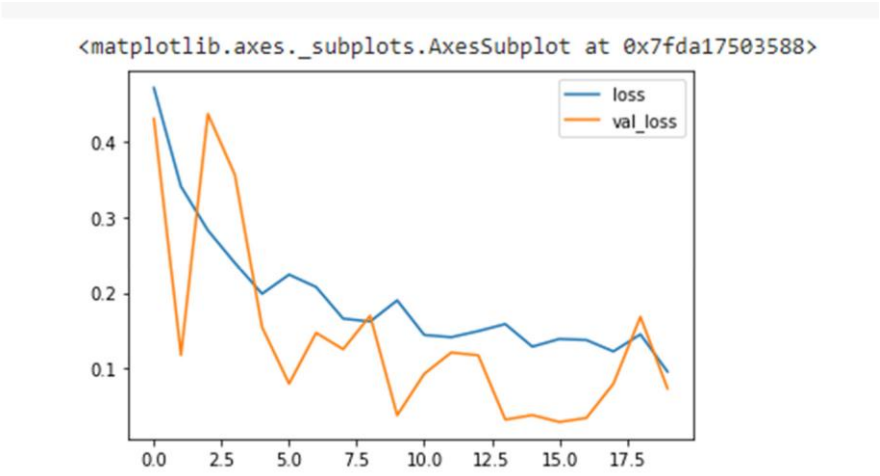

Fig 3. Training loss and validation loss.

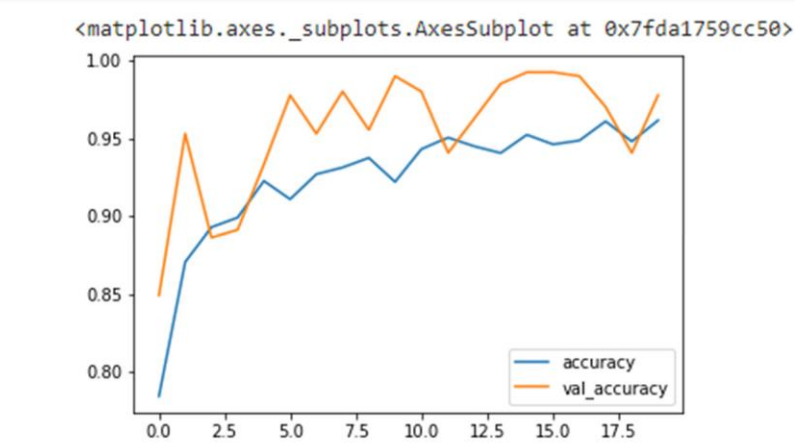

Fig 4. Training accuracy and validation accuracy.

As per the expectation from an network, As shown in Fig 3 both the losses start with high value and decrease while the training continues, which is similar to standard training procedure in deep learning. The difference between the saturation of training loss and validation loss is 0.09, it lies within the permissible range for a network to avoid over and under fitting.

Fig 4represents the graphical plot of accuracy distribution. With the increase in number of epochs accuracy increases, and ultimately saturates, which represents that the training on the dataset is completed for the network.

A random line is a line at 45 *degrees*, here the AUC is 0.5. The higher the curve from *the line*, the greater the AUC and better the model. The highest value of AUC for a model is 1, there the

curve forms *a* right angle. ROC curve can also help in debugging a model. In this model ROC curve is implemented as shownin Fig 5.

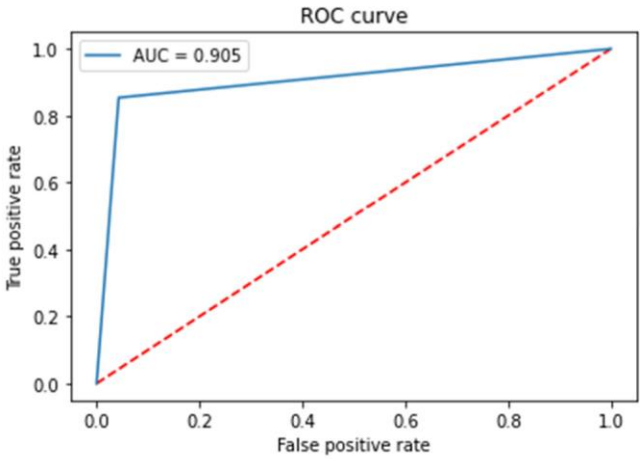

Fig 5. Graph representing sensitivity and fallout.

8. Conclusion and Future scope:

In the world of medical pathology, breast cancer diagnosis using digital histopathology images is a landmark. It also creates new research opportunities, as there are many undiscovered areas that can be exposed by machine learning and deep learning techniques. We may combine other imaging technologies like MRI, CT Scan, ultrasound, and mammographic images, and collective results can be determined, this procedure is also called multimodal fusion[18].Once again, the above problems can be quickly solved by deep learning and can be used to conduct high-quality research that might produce much better outcomes.

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Cow milk adulteration: it's side effects and detection methods

Janmejaya Nayak and Pradip Kumar Prusty

Department of Zoology, School of Applied Sciences,Centurion University of Technology and Mangement, Odisha
Email- pradipkumar.prusty@cutm.ac.in

Abstract:-
Natural unadulterated milk has a high food value, because it comprises of a wide variety of essential nutrients that helps in growth and development of the human body. In recent decades the consumption of the milk has been increasing worldwide,mostly in the developing countries and it is now a major part of diet of the population around the globe. Due to its high demand in the market, some unscrupulous producers have been associated with adulteration of the milk,which is a very common issue in developing countries. The main aim behind the adulteration of the milk is to get some more financial surplus. Most commonly the water is used to adulterate the milk but it decreases quality and nutritions that the pure raw milk retains. If the water is contaminated with chemicals or with some other pathogens,this can posses a hazardous health risk to consumer. Some cheap adulterants like Urea, Sugar, Starch and harmful chemicals like formalin,melamine and detergents can be added to the diluted milk to make it toxic and can causes a severe health related problems to the human beings. The main aim of this review is to study about cow milk adulteration and some common detection techniques to check the adulterants that present in the milk and the health related problems that associated with the consumption of adulterated milk.

Keywords: milk, adulteration, health, hazardous, starch, formalin, urea, Vanaspati.

Introduction:-
Food is the basic necessity of life. Food adulteration is an act of intentionally degrading the quality of the food offered for the sale either by admixture or by the substitution of the inferior substances or by the removal of some of the valuable ingredients. Milk and dairy product adulteration came into known by globally in 2008 after the breakthrough of the melamine contamination in the infant milk product which was made by China. However the history of milk adulteration is very old. Milk is the best source of proteins, carbohydrates, fats and different types of minerals and vitamins, which is considered as ideal food. Milk is very nutritious for which it is a major requirement for both infants and adults. The main possible reasons behind the milk adulteration are low purchasing capability of the customer higher demand of the consumer, supply gap and the lack of the suitable detection tests. The main motive behind the adulteration is economic but its impact on the consumer's health is the great concern. There are several ways to detect adulterant in the milk. The qualitative detection technique can be performed with chemical reactions, while the quantitative detection techniques depend on the nature of the

adulterants present in the milk. The details of the detection method are mentioned in the further parts.

Types of adulterants:-

Based on the types of contaminants, the adulteration can be divided into 3 main categories, these are:
1-Intended adulterants
2-Accidental adulterants
3-Metallic contamination

1-Intended adulterants:-

These are the intentionally added adulterants by the producer in the food, which may include sand, chips, stones, water, mud, chalk powder, coal or tar dyes and are very hazardous to human body.

2-Accidental adulterants:-

Accidental adulterants enter into the food during processing and such accidental adulterants are pesticides residues, larvae in foods, dropping of the rodents and some insects that trespasses the food at a high degree temperature and produces the impurity in the form of bodily secretion, excretion, and also causes spoilage through microbes.

3-Metallic contamination:-

Metals like arsenic, lead and tin that are present in the pesticides, water and cans are mainly responsible for metallic contamination of food products. Such adulterants unintentionally become the part of food during processing.

Adulterants used in milk:-

Most commonly water is diluted in Milk, which not only reduces its nutritional value but also it causes additional health related issues. Sometimes the milk of other species is added in the milk as adulterant, but it does not possess any severe health risk.

The other types of adulterants used in milk are Glucose, Starch, Ammonia, Urea, Formalin, Melamine, Hydrogen Peroxide, Detergent, Vegetable fats, Vanaspati, Soy milk etc., and these adulterants have severe health related impact that slowly degrades our body system.

Materials and methodology:-

To determine the adulterant present in the milk various detection techniques are done like Enzyme Linked Immuno-Sorbent Assay (ELISA) and Liquid Chromatography (LC) used to detect foreign proteins. Detection like Polyacrylamide Gel Electrophoresis (PAGE) and Polymerase Chain Reaction (PCR) techniques are usually used to determine the milk from the different species used as adulterant. The milk adulterants (Mainly Starch,

Urea,Vanaspati,Formalin)has been tested in our laboratory and the results were observed. During the testing time period, the OMFED Milk has been taken as the test sample and the associated materials were Test tubes, Pipette, Dropper, Teaspoon, Red litmus paper, Spirit lamp, test tube holder, a match box, and the chemicals used were Iodine solution, Soybean or Arhar powder, Diluted HCl, Concentrated H_2SO_4 and Sugar.

The tests which have done are as follows:

(1) To test the presence of Starch in milk:-

Starch is a polysaccharide that is mainly prepared in the green plants. The starch is not naturally present in the milk rather it is intentionally added to the milk to increase its solidity and also the value of the milk. To test the presence of starch, 5ml of milk was taken in a test tube and was heated till boiling and was then allowed to cool. Then few drops of Iodine solution was put into it and shaken well and the result was observed.

(2) To test the presence of Urea in milk:-

Urea is a natural constituent of milk which is also an adulterant. To detect the presence of urea, at first a Teaspoon of milk was taken in a test tube and ½ teaspoon of Arhar or Soybean powder was added to it. Then the content was thoroughly mixed up by shaking the test tube. After 5 minutes, a red litmus paper was dipped into it and the result was observed.

(3) To test the presence of Vanaspati in milk:-

Vanaspati is an adulterant which is not primarily present in the milk, but it is added intentionally to increase the fat content. To check the presence of Vanaspati in milk, 3ml of milk was taken in a test tube and then 10 drops of diluted HCl was added to it. A full teaspoon of sugar was then added to it and after 5 minutes the mixture was examined and the result was observed.

(4) To test the presence of Formalin in milk:-

Formalin is a type of adulterant that mainly increases the shelf life of the milk and also used as preservative. To check the presence of formalin, 10ml of milk sample was taken in a test tube and 3ml of concentrated sulfuric acid was added to it from the sides of the test tube wall without shaking and then the result was observed.

Results and Interpretation:-

Types of adulterants	Present	Absent
1. Starch	**-**	Yes
2 Urea	Yes	-

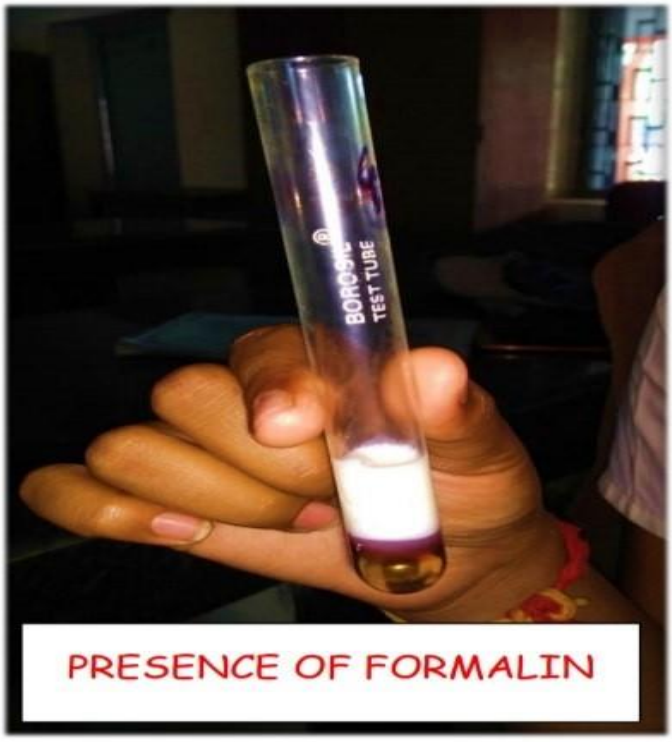
3. Vanaspati	**-**	Yes
4. Formalin	Yes	-

1-For Starch: Appearance of blue colour in the sample indicates the presence of the starch in the milk. If the milk is pure, then a deep yellow colour will appear, due to casein (A protein of the milk).

2-For Urea: If the colour of the dipped litmus paper changed from red colour to blue colour, then it indicates the presence of urea in the milk.

3-For Vanaspati: During the time of examination of the prepared sample if the Red colour appears, it indicates the presence of Vanaspati in the sample milk.

4-For Formalin: If a violet or blue ring appears at the intersection of two layers in the prepared sample, then it shows the presence of formalin.



Discussion:-

Side Effects

due to presence of these adulterants, the quality of milk deteriorate thereby leading to various health hazards like skin diseases, eye diseases, gastro intestinal diseases like ulcer, cancer, heart diseases(such as high or low

blood pressure, cardiac arrhythmia),kidney diseases, poor digestive system and also causes the death.

The milk adulteration can have very high impact on a new born babies and infants. The preservatives present in the milk also deteriorate our body system. Now a days, the rate adulteration is frequently increasing, thereby decreasing the shelf life of human being.

Conclusion:-

The presence of adulterants in the food leads to various disorder like cardiac disease, kidney disease, cancer, skin diseases, loss of memory etc., and should be prevented to protect ourselves from many disorders.

(a)-We should always go for the branded products, especially the one with ISI mark.

(b)- We should try to buy fruits and vegetables from organic markets or directly from the farmers. Though we are not sure how far the so called the organic products are good but we can at least be safe when we are buying it directly from the farmers.

(c)-We all have limited space but within that limited space if we can cultivate few easily growing veggies it can help also a lot. It is not only healthy for us but also it saves us on the cost also. Terrace, Balcony, Courtyard Should be selected for such purpose

(d)-Instead of buying readymade Masala powder we should make it our own by grinding those raw materials at home.

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Importance of microalgae in aquaculture

Sushantika Biswal and Pankaj Meher
Department of Zoology, School of Applied Sciences,Centurion University of Technology and Management, Odisha
Email- pankaj.meher@cutm.ac.in

ABSTRACT

The review article provides a reasonable analysis on the usage of microalgae in aquaculture, focusing on their nutritional value and transferring nutrients through food chains, waste water treatment ability and improving production in aquaculture industries. The review is divided into 8 sections:

(a) Microalgae in aquaculture
(b) Available additive in feeding in aquaculture
(c) Coloring and biological active compounds
(d) Purification of water
(e) Algal toxins
(f) Nutritional properties
(g) Use of algae to enrich Zooplanktons
(h) Status or use of microalgae in future

Microalgae usage has been increased nowadays because it has been proven much better than traditional systems. As traditional system produces large amount of waste water which affects global sustainability but microalgae purifies the wastewater in a low cost. To overcome environmental and economic problems in aquaculture industry, microalgae is widely used nowadays. Microalgae rich nutrient content, it's biomass production ability, value adding quality enhances the production in aquaculture.

Microalgae is important for better yielding in aquaculture but it is as important and widely used in other industries also. It plays a very important and vital role in other industries like (1) Health and functional food, (2) Used as feed for animals and aquaculture, (3) Cosmetics and dyes, (4) Substrate for bio refineries, (5) Pharmaceuticals, (6) Fertilizers, (7) Bioenergy and biofuels and (8) Carbon dioxide and pollution control.

KEYWORDS

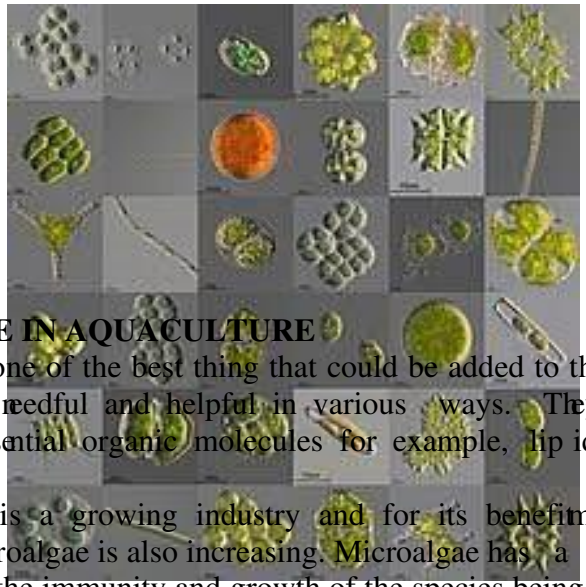
Microalgae,nutrient content, wastewater treatment, Chlorella, spirulina, PUFAs

INTRODUCTION

Microalgae which are otherwise called as microphytes. These are smallest size algae. They are availablein fresh, brackish and marine water bodies and also in the sediment. They are made up of only one cell in which all needed functions are carried out by the organism. Microalgae is an extremely important food chain in aquaculture.

Microalgae, can be a good way for wastewater remediation as it can achieve maximum productivity by assimilating nutrients in water bodies and can increase oxygen level in it. The property of microalgae increasing the nutrients is helpful in the industries preparing food materials, improving waste agricultural water, improving waste water quality from municipal corporations and treating many more other type of water so that it could not get wasted.

Microalgae has many advantages as it is rich in a variety of essential bio active protein , amino acids, cytochrome, unsaturated fatty acid and polysaccharides etc, which make it become a new source of feed material which are the source of proteins, vitamins and fatty acids etc.
Some of previous studies have suggested and also applied some of the micro algal species like chlorella sp,dunaliellasp and scenedesmussp, for the better production of nutrientional biomass that could be used as the feed for aquatic animals for enhancing there immunity and health.
All these features of microalgae, makes it a important element to use in aquaculture industry and in recent years it has been used very widely in the whole world as it has an ability to help in increasing the production of aquaculture industry .
There are about 200,000-800,000 estimated species of microalgae and between then about 50,000 species are described. Different types of microalgae are*Euglenoids* (Euglena), *Chrysophyta(*golden-brownalgae) , *Pyrrophyta(*fire algae), *Chlorophyta*(green algae), *Rhodophyta*(red algae) , *Phaeophyta*(brown algae) and *Xanthophyta(*yellow-green algae). The main types are green, red and brown algae.



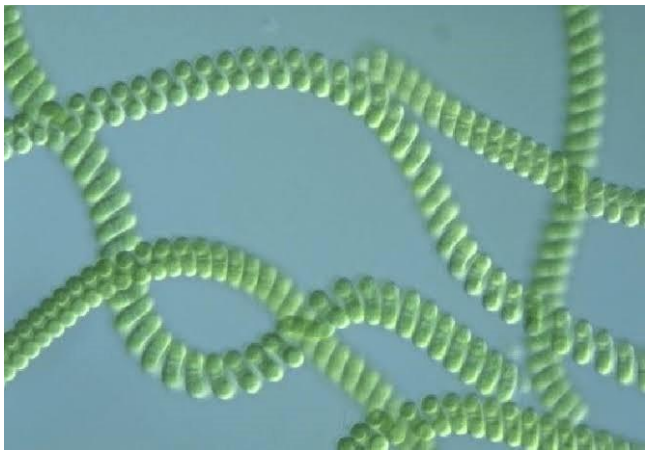
MICROALGAE IN AQUACULTURE
Microalgae are one of the best thing that could be added to the aquaculture industry for various purposes. It is needful and helpful in various ways. They play a very important role in synthesizing essential organic molecules for example, lip ids by using sunlight and carbon dioxide.
As aquaculture is a growing industry and for its benefitmicroalgae is much needed so the demand for microalgae is also increasing. Microalgae has a great nutrient content so it have a great impact on the immunity and growth of the species being cultured. Microalgae are also used in some cases to directly feed to some of the species in there earliest growth stages. Microalgae could also be used as feed for zooplankton, for ex, rotifers which is important to feed some fish larvae. Microalgae are used in so called “Green water” feed technique, in which the microalgae are suspended indirectly to the organisms simultaneously in tanks with larvae.

Types of microalgae use in aquaculture*Spirulina, Chlorella, Scenedesmus, Dunaleilla, Skeletonema, Chaetoceros, Phaeodactylum, Nitzyschia, Thalassiosira.* The 3 main types that are widely used in aquaculture are *Spirulina, Chlorella* and *Dunaliella.*

1. *Chlorella minutissima*:
   It is the most important Chlorella species, which is widely used for nutrient source for aquaculture industry in whole world. It is a type of green algae. It is a unicellular microalgae which do not bear flagella . They are recognized as an oil rich green algae that has many important functions in easy cultivation, fast growth and high levels of

amino acids and polyunsaturated fatty acids (PUFAs). This makes it important for pharmaceutical industries also.They are used as anti-microbial, anti-fungal and anti-viral activities. They are used in green water techniques also.

2. *Antrospiraplantesis*(Spirulina):
   They play a vital role in fast growth and high yielding. They improves the digestive system in the organisms. It leads the better body weighs , high health,optimum immunity and provides resistance to diseases. It contains much percentage of protein which makes it a very nutritious diet. It has a spiral thread like body shape. It is a type of blue-green algae (green due to chlorophyll & blue due to pigment phycocyanin). The most nutritious species are *Spirulina maxima* and *Spirulina plantensis.* It is considered as rich source of protein, vitamins, essential pigments, amino acids and antioxidants pigments like carotenoids.



3. *Dunaleilla salina*:

It is a type of halophile green algae. They is very popular because of it's antioxidants quality. They have high amount of beta-carotene. They have 2 2 flagella. They are very rich source of vit A .

They are very important for shrimp farming as it has carotenoids which is very essential and beneficial in shrimp farming. They contains a good amount of minerals , vitamins ad fatty acids . It is used in green water techniques. They act as fed for white shrimps in there juvenile stage in shrimp farming improving there fast growth rate, nutrition content and higher productivity.

MICROALGAE –A VALUABLE ADDITIVE IN FEEDING IN AQUACULTURE

As nowadays the demand of protein and high cost fish meal is increasing so microalgae algae demand is increasing. As it had a good amount of nutrient content itcould be easily replaced with the high expensive feed. Some of the experiments were conducted with the hydrobiontsthat was spirulina species. They also can be used as live feeds for the b etter growth of cultured organisms.

It can be used as live feeds for all growing stages of bivalve molluscs (oysters, scallops, clams, mussels), for the juvenile stages of abalone, crustaceans and also for zooplanktons in aquaculture food chain. Microalgae are of different types so they vary in there nutrient content also. They have a good nutritional properties as monospecies or within a mixed diet which includes *C. calcitrans, C. muelleri , P. lutheri , Isochrysissp, T. suecica, S.costatum and Thalassiosirapseudonana.*

The genera of microalgae for larvae feed are Tetraselmis, Chaetoceros, Thalassiosira, Isochrysis and Nannochloropis. All these organisms are fed to the cultured larvae directly or indirectly. Indirect methods are through artemia, rotifers, daphnia, then these organisms are fed to the cultured larvae.

By combining different algal species can provide adult which is very rich nutricinous and balanced in diet for better growth and immunity of the cultured species. Microalgae is less toxic , has high nutritional value and most importantly has correct cell size and shape with a digestable cell wall which makes the easy availability of nutrient. The protein, fatty acid and vitamin contents of microalgae makes it more important to use. As microalgae is providing a lot of positive effective such weight gain in the species, more availability of triglycerides and protein deposition in the muscle, it improves resistance to the disease, increases the quality of digestive system of the organisms, increasing more good physiological activities, starvation tolerance and carcass quality.

COLOURING AND BIOLOGICALLY ACTIVE COMPOUNDS

Microalgae are used as a source of natural pigments which are *Dunaliellasalina, Haematococcuspluvialis*and *Spirulina sp.*for the better culture of prawn , salmoidfish and ornamental fish. Some species like *Dunaliellasp, chlorella sp*and *spirulina sp* provides high concentration of valuable compounds such as lipids, proteins and pigments. In some ornamental fishes some species like *spirulina sp* and *chlorella sp* are used for better coloration of fishes. Microalgae has the ability to change some of the physical properties of water such as salinity, temperature, nutrients, UV-vis irradiation which are not found in any other organisms so it should be used in a large number.

The pigment lutein is common in green microalgae (*Tetraselmis sp.)*which could be used to improve the nutritional value of artemia. The lutein pigment could be converted in vitA from halibut larvae when aquatic crustaceans were used as a feed. *Dunaliellasalina*is usually grown for getting a photosynthetic pigment that is beta-carotene which is used as a vit C supplement and also as a orange dye. Some of the high value bio products extracted from microalgae are astaxanthin andleutinproduce- *Haematococcuspluvialis*,phycocyanin – *Spirulina platensis,* polyunsaturated fatty acid- *Chlorella sp, Schizochytriumsp,* biotin and vit E – *euglena gracilis*.

PURIFICATION OF WATER

The microalgae cultivation is done in a suitable nutrient media to aggregate a biomass used for food or for biofuel production cultivation leads to a better production of inorganic and organic substances for aquaculture industry and for better biomass production also. In such case species like *C.vulgaris, N.oculata* and *T.chuii*are used as they show high potential to accumulate the nitrogen and phosphorus compounds from wastewater. In previous years micro algal bio remediation systems are mostly used in aquaculture.

Microalgae has the ability to solve environmental and sanitary problems along with economic feasibility. The microalgae species like *chlorella, Ankistrodesmus, Scenedesmus, Euglena , Chlamydomonas, Oscillatoria,Micractinium and Golenkinia*has a role of treatment plant in aquaculture industry, where the waste water nutrients are converted into essential biomass protein. As they are unicellular organisms so could absorb the nutrients well than terrestrial plants. Nowadays microalgae are used in aquaculture widely because of the wastewater treatment feature without any secondary pollution and also the end product which we get as nutritious biomass. So they are proved as most efficient, environmental friendly, cheap, easily available and simple alternative for treatment of wastewater, by this method, huge machineries and costly wastewater treatment techniques could be easily avoided.

ALGAL TOXINS

Algal toxins are produced by the algae or the variety of algae used in all types of water bodies (brackish, marine and fresh) . If the algal toxins production quantity increases then it could be harmful for the aquaculture industry. As the excesses accumulation can affect the growing and feeding rate of the organisms. Excess production of these can give rise to algal blooms which can be the cause of oxygen depletion. Some species of blue-green algae like *Microcystis* and *Anabaena* can produce such harmful toxins which could be poisonous for the fishes. Some of the example are neurotoxin which affects the nervous system of the organisms.

Neurotoxins are produced by many genera of Cyanobacteria which includes *anabaena, aphanizomenon ,microcystis , planktothrix, raphidiopsis, arthrospira, cylindrospermum , Phormidium, Aphanizomenon, oscillatoriasp*and *Aphanizomenonflos-aquae*blooms which are used as poison for the animals. Blooms of the algal species *Prymnesiumparvum* could kill the fishes and could cause severe economic loss. The symptoms for these disease are flared gills that

because of the breathing difficulty and swimming difficulties of the fish. Some fish species, tadpoles and mussels get affected by the P.parvumichthyotoxin which affects the gills of the fish and could lead them to death. Some of the research in previous years has proven that Euglena species produces ichthyotoxinin fresh water aquaculture species tissue of the catfish, tilapia and stripped bass leading them to death .

NUTRITIONAL VALUE

In aquaculture industry the microalgae could be used directly or indirectly to feed the organisms for there better growth. Microalgae is more preferable than the traditional fed because of there nutrient content and water quality maintenance ability. They are reach in some of the essential nutrients like lipids, proteins, carbohydrates which is necessary for the aquatic organisms. They could synthesize some of the value added components like pigments and antioxidants which helps in gene's better growth of the organism. Not only microalgae but it's biomass is proven to be very rich in nutrient content, so it is in demand. The value added components of microalgae that is used in aquaculture could be classified into 3 categories. Firstly, it is rich in protein and carbohydrates so it could be a better replacement of the traditional feed . Secondly, the antioxidants that is produced by microalgae, could be used as immunity enhancer of the organisms, it could be a better replacement for costly antibiotics. Thirdly, it plays an important role in growth of some special fish like astaxanthin which helps in determining skin and flesh colour of some fish, which is an important pigment in salmon and helps in increasing it's production. These 3 categories makes microalgae relatively cheap to use.

PUFAs which is derived from microalgae that is Docosahexaenoic acid (DHA) , Eicosapentaenoic acid (EPA) and Arachidonic acid (AA) are known to be essential for various larvae. PUFAs having 46 strains are the most effective . Most of the microalgae species have medium to high concentration of EPA. Cryptomonedsand prymnesiophytesis mostly rich in DHA , where as eustigmatophytesand diatoms have highest percentage of AA. Low PUFAs in diet is not suitable for normal diet. Some pigments of microalgae that are astaxanthin, chlorophyll and carotene in microalgae are very important for the growth of the cultured organisms. Intake of microalgae components determines the biochemical characters of fish. Some pigments play a major role in immunity enchantment of the organisms. Traditionally feed with pigments are used because of the production, extraction, purification and preservation rate is high and cost is low. The biomass also are very rich in natural pigments which could be directly feed to the organisms thus reducing the cost and increasing the productivity.

Table 1. Nutrients profiles of aquaculture wastewater.

Animal Type	TN (mg/L)	NH_3-N (mg/L)	TP (mg/L)	COD (mg/L)	Total Solids (g/L)
Shrimp	361	90	*NA*	1321	*NA*
NA [a]	1023.84	28.08	239.76	904.2	21.6
NA	777.87	50.25	383.91	348.8	20.1
NA	533.42	23.84	458.92	2494	14.9
Shrimp	>365	83.7	*NA*	1593	*NA*
NA	110.8	0.07	*NA*	19.7	*NA*
Shrimp	230	101.1	*NA*	1201	13.1
Rainbow trout	118	0.37	0.09	176	0.11
Chiffon carp	6	0.9	>0.7	*NA*	*NA*
Water eel	12.4	4.6	5.2	48	*NA*
Crucian carp	47.6	72.0	*NA*	368	1.02

USE OF ALGAE TO ENRICH ZOOPLANKTONS

Microalgae helps in enriching the zooplankton so that they could be used as feed for fishes in there different growth stages. Microalgae increases the protein, vitamins, essential PUFAs , pigments and sterols content in zooplanktons , which are been transferred through the food chain. As an example we could take rotifers, when the rotifers are fed with microalgae they be come

more rich in Ascorbic acid (AsA) . In studies it is found that rotifers when fed with baker's yeast they are deficient in AsA but microalgae helps in improving this quality. PUFAs rich microalgae, such as *Pavlova sp*. and *Isochrysisspa*re fed too with zooplanktons which enriches there DHA content. Dried preparations of the *Thraustochytridschizochytrium*species is widely used for increasing DHA content. Some researchers also informs that live and dried thraustochytrid as good dietary constituents.

Some researchers also informs that some microalgae pigments that are transferred to the cultured species through zooplankton are highly nutritious. It is found that adding microalgae to the tank which contains larvae can improve there growth. They help in light attenuation, which is beneficial for the larvae , maintenance of the nutritional quality of zooplankton, an excretion of vitamins or other growth promoting substances by algae. These helps in maintenance of ammonia and oxygen balance. Most popular and useful algal species used for green water application are *N.oculata*and *T.suecica*. Green water addition in the water increases the better growth of zooplanktons also .

Table 1. Microalgae commonly used in aquaculture, either as individual diets or components of mixed diets. (++ denotes more popular than +).

	Bivalve molluscs	Crustacean larvae	Juvenile abalone	Zooplankton (used for crustacean, fish larvae)
Isochrysis sp. (T.ISO)	++	+		++
Pavlova lutheri	++	+		++
Chaetoceros calcitrans	++	++		+
C. muelleri or C. gracilis	+	++		+
Thalassiosira pseudonana	+	+		
Skeletonema spp.	+	++		
Tetraselmis suecica	+	+		++
Rhodomonas spp.	+			
Pyramimonas spp.	+			
Navicula spp.	+	+	++	
Nitzschia spp.	+	+	++	
Cocconeis spp.	+		+	
Amphora spp.	+		+	
Nannochloropsis spp.	+			++

References: Brown *et al.* (1997); Reitan *et al.* (1997); Lee (1997); Kawamura *et al.* (1998); Wikfors & Ohno (2001); Johnston per. comm. (CSIRO Collection of Living Microalgae)

FUTURE USE OF MICROALGAE

Rather than previous years the demand of microalgae has been increased and it will increase more in future years because its cheap , easily available, wastewater treatment facility and nutrient content. Nowadays in fish hatcheries microalgae preferred much than traditional feed. May be in future microalgae could completely replace the traditional feed technique. For better production the main thing to do is choosing right algal species . Due to microalgae are found in low prices, the amount to be used in the feed could be used for new machinery or techniques for improving aquaculture production.

As it is cheaper, new methods are being evolved to produce biomass by heterotrophic methods or photo bioreactors. These technologies are used with post harvest processing such as spray-dryin or algal bloom concentration to develop off the shelf algae biomass to be used in hatcheries for better production. The new algae like thraustochytrid are highly rich in DHA and helps in enriching zooplanktons to produce a good DHA:EPA ratio. As microalgae is rich in DHA, EPA ,PUFAs , AA, AsS there demand is highly increasing. They could be used directly or indirectly in every way. For future developments focus should be on algal blooms, then the balance of PUFAs , EPA+DHA should be used and then the total saturated fatty acid for better growth, energy metabolism and better production.

CONCLUSION

Microalgae has been proved useful in so many ways that now traditional aquaculture system demand is decreasing. Microalgae is proving to be more efficient in less cost than traditional systems . Microalgae are more preferable because of there nutrient content, its wastewater treatment ability, can be used as fed for organisms directly or indirectly, produces value added bio mass and reduces energy consumption. Inspite of the great progress in the aforementioned fields , microalgae assisted aquaculture still has some problems related with biomass safety level, lack of knowledge and life cycle analysis. If these problems would be solved in future then microalgae will play a vital role in aquaculture industry. Microalgae has a lot of economic benefits like, they can produce oxygen by themselves so the use of aerator devices will decrease. Survival of microalgae in a fish rearing tank or pond may limit the growth of unfavourable or toxic organisms, creating a good environment for aquatic animals. It enhances the immunity of aquatic animals, so that antibiotics or medicines could be avoided. It helps in reducing usage of the pollution free products. Recently, the researchers developed a lot of efforts in aforementioned issues and had a lot of important findings that merit attention from the fields of environmental protection and aquaculture.

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Study on Complex Impedance Properties of Polyvinyl alcohol (PVA)-Bismuth ferrite ($BiFeO_3$)-Graphite Nanopowders (GNP) Composites

[a]Ankita Subhrasmita Gadtya, [a]Anupam Sahoo and [a] S. Moharana*

[a]School of Applied Sciences, Centurion University of Technology and Management, Odisha, India

E-mail: srikanta.moharana@cutm.ac.in

Abstract

In this study, the composites comprising polyvinyl alcohol (PVA), bismuth ferrite (BFO) particles and graphite nanopowder were prepared by solution casting technique. The frequency dependence of impedance properties was analyzed by using an impedance analyzer in a frequency range from 10^2-10^6 Hz at room temperature. The real and imaginary parts of the impedance properties exhibited the semicircle in the complex planes. The complex impedance analysis of the PVA-BFO-GNP composites shows the presence of bulk and grain effect. The Nyquist plot suggested the presence of only bulk effects of the resultant composite systems.

Key words: Polyvinyl alcohol, Composites, Complex Impedance

1. Introduction

In recent times, there is an enormous interest in polymer based composite materials in the field of various industrial and electronic applications including gate dielectrics [1], microelectronic devices [2] and embedded capacitors [3] because of their ease of processing and good flexibility [4]. However, the bismuth ferrite ($BiFeO_3$; BFO) is a promising multiferroic ceramic material for energy storage applications due to their existence of ferroelectricity and ferromagnetism at room temperature [5]. It has a distorted rhombohedral crystal structure with lattice parameters a=5.58A^0 and C=13.90 A° and these materials used in the field of embedded devices [6-8]. Although, the BFO is a promising multiferroic material with relatively high dielectric constant and less practical applications due to its high leakage current and brittleness in nature. On the other hand, polymeric materials have good flexibility, better electrical resistance and relatively high breakdown strength [9-10] due to which they can be used in various electronic industries. Moreover, polyvinyl alcohol (PVA) is extensively used as a polymer matrix to fabricate polymer composites due to its easy processing, good film forming ability, low cost and excellent solubility in water [11]. Here in this communication we have chosen graphite nanopowders (act as conductive filler) to improve dielectric and electrical properties of the said composites because they are carbon rich materials with high conductivity, having low cost and abundance of present [12]. Particularly, Polymer based GNP composites are talented materials for embedded capacitors due to their high dielectric constant of graphite with good process ability and flexibility of polymeric matrix [13]. In view of the above facts, the present work relating to the study of GNP incorporated PVA-BFO composites with impedance properties have been carried out.

2. Experimental Sections

2.1. Materials and Methods

The $BiFeO_3$ powders were synthesized by solid state reaction technique and the Graphite nanopowders (GNP) incorporated PVA-BFO composites were prepared by solution casting techniques. The high purity starting materials such as Bi_2O_3, Fe_2O_3, polyvinyl alcohol (PVA), and graphite nanopowders (GNP) were carefully weighted with stoichiometric proportion. For the preparation of GNP incorporated PVA-BFO composites, PVA and BFO particles were well homogeneously mixed in the solvent with continuous stirring. The dispersion of BFO-PVA

composite, the GNP particles was incorporated into the solutions. Then the resulting product was cast into the container and then it is dried. The electrical properties (Impedance) of the sample were measured by an LCR meter (HIOKI Model: 3532) in a wide range of frequencies.

3. Results and discussion

3.1. Impedance properties

Complex impedance spectroscopy (CIS) [14] is a powerful process to study the electrical response (i.e. transport properties) of the composite materials in a broad range of frequency from 10^2-10^6 Hz. The electrical properties of the composite materials can be associated with complex dielectric constant (ε*), complex impedance (Z*) and tangent loss (tan δ) which is interrelated to each other as follows:

Complex impédance : $Z^* = Z' - jZ'' = R - j / \omega C$, ---------- --- (1)

Complex permittivity: $\varepsilon^* = \varepsilon' - j\varepsilon''$, ---------- (2)

Loss tangent, $\tan \delta = \varepsilon'' / \varepsilon' = M'' / M' = - Z' / Z'' = Y' / Y''$---------- (3)

Fig.1 represents the function of (a) real part (Z') and (b) imaginary part (Z") complex impedance of various percentage of graphite nano-powder (GNP) loading on PVA-BFO composites as a function of room temperature frequency (10^2-10^6Hz). It is found that the real part of the impedance (Z') and imaginary part of the impedance (Z") value decreases with increase in the frequency. At higher frequency range the value of Z' merge which may be due to the release of space charge effect. The value of the impedance decrease with frequency may be attributed to the dielectric dispersion polarization [15].

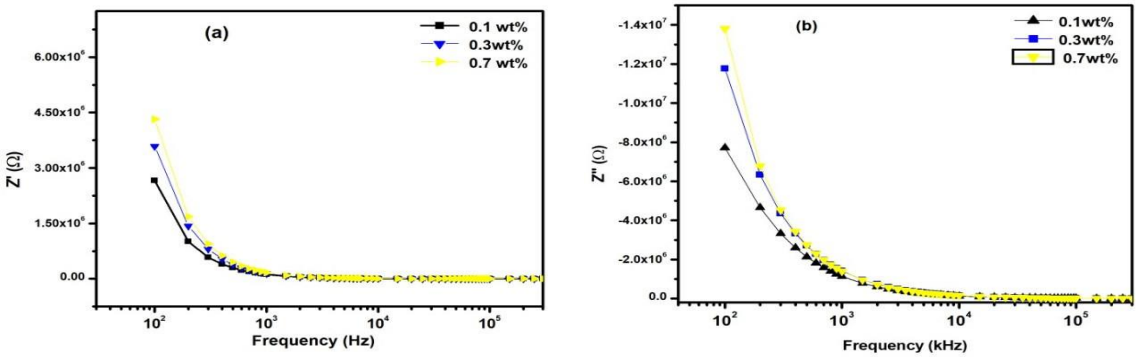

Fig.1: shows the real part of impedance and (b) imaginary part of impedance as a function of frequency at room temperature.

Fig. 2 shows the complex impedance formalism (Z' Vs. Z''), (Nyquist plot) of PVA-BFO composites at different percentage of GNP contents. From the figure it is clear that the single semicircle arcs which are obtained due to the lack of data to complete the semicircle in the lower frequency region. This indicates the presence of a bulk effect of the composites and it is also revealed that the semicircle arcs move towards the origin with an increase in frequency which indicates an increase in the conductivity value [16].

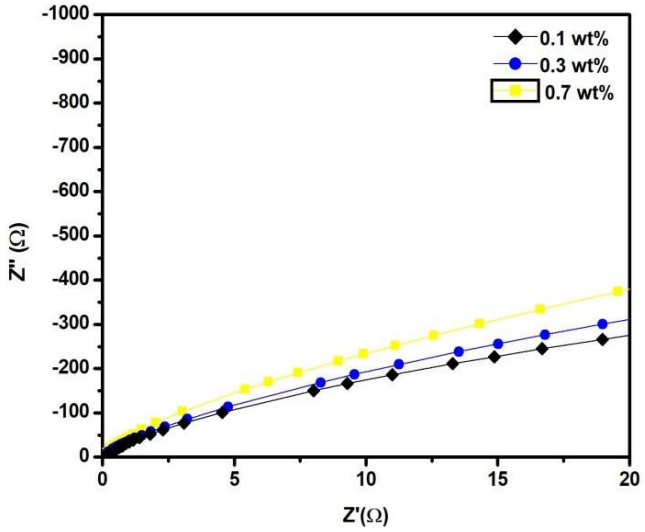

Fig. 2: Nyquist plot of real part (Z') vs. imaginary part (Z'')

4. Conclusions

The present work illustrates that the Graphite nanopowders incorporated PVA-BFO composites were prepared by solution casting methods and their impedance were studied. Complex impedance spectroscopy is used to analyze the electrical properties of the composite materials. Impedance studies show the important contribution of the bulk effect present in the composites. Hence the GNP incorporated PVA-BFO composite system show a well and good application properties which may be used in electronic devices.

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Cfd analysis of vortex tube

MADHUSMITA NAIK[1],JYOTSNA RANI SAHU[2],RAJASHREE DAS[3]

[1,2,3]Mechanical Engineering Department,Centurion University of Technology and Management, Odisha, India

ABSTRACT

The vortex tube is a simple device used by many industries to produce cold and hot air streams at the same time from a single compressed air source with no external energy source or chemical reactions. By applying various inlet pressure, we can obtain different temperatures from the outlets of the vortex tube.In this CFD analysis,the Ranque-Hilsch Vortex Tube (RHVT) performance has been carried out using 3D Experience to examine the situation in which the vortex tube emits air of 0^0C from the cold outlet and 40^0C from the hot outlet. For this purpose, we took six3D models with six different openings and applied 6 different pressures in each of the models resulting in 36 different instances.

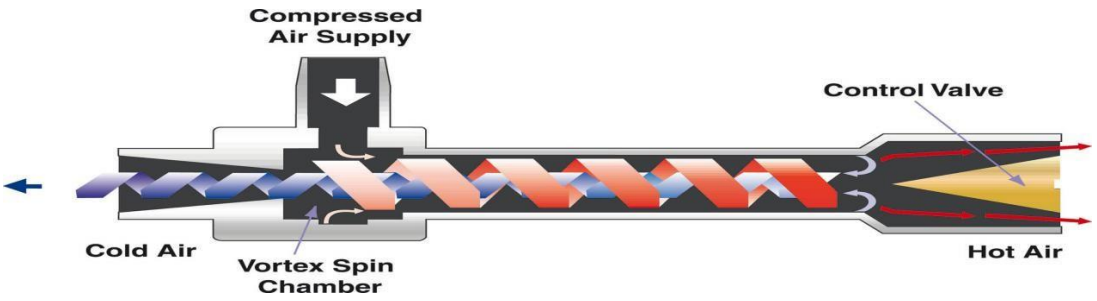
KEY WORDS: Ranque-HilschVortex Tube, CFD Analysis, 3D Experience, Compressed Air.

INTRODUCTION

Cooling is the practical application of thermodynamics, where heat is transported by the refrigerant, a working fluid from the low temp to the high-temperature region. However, the refrigerants that have been used are the basis of environmental issues such as the loss of ozone and global warming. The vortex tube is one of the non-conventional systems for using air to act as a refrigerant[1]. The Vortex Tube is a cost-effective solution for a wide variety of cooling and manufacturing uses for industrial spots[2].it is a compact pneumatic product with no moving parts intended to separate regular compressed air into the cold and hot air stream. They are completely operated by compressed air, reducing the need for toxic refrigerant or freon gases.

WORKING OF VORTEX TUBE

The Ranque-Hilsch vortex tube is a mechanical system that acts as a refrigerator without moving components, by splitting the compressed gas stream into a low and high-temperature area. Such a division of the flow into low- and high-temperature regions is known as the separation effect of temperature (or energy)[3].It is consists of a nozzle, diaphragm, valve, hot-air side and a cold-air side.



(Working of Vortex Tube)

As seen in the figure above, compressed air enters the vortex tube at the regular NPT inlet port and passes through the vortex generator to the spin chamber.The vortex flow is produced in the spin chamber, and the air travels in a spiral like motion, up to 1 million revolutions per minute along the periphery of the hot side. The valve limits this flood. As the pressure of the air near the valve is made more than outside by partially shutting the valve, the reversed axial flow through the center of the hot side continues from the high-pressure region to the low-pressure region[4].During this process, the heat transfer takes place between the inverted stream and the forward stream. The air flow through the center is then cooled below the inlet temperature of the air in the vortex tunnel, while the air flow in the forward direction is heated up[4].The cool stream exits through the diaphragm hole to the cold side, while the hot stream passes through the valve gap.The amount of cold and hot air, and its temperature, can be varied by controlling the valve opening and the inlet pressure.

The vortex tube has remained a matter of considerable concern for researchers since its discovery by Ranque. Many researchers carried out experimental experiments to determine if the vortex tube was working for different parameters without a universal consensus. The findings of the experimental research are generally limited to average or integral values due to greater stress gradients in the narrow dimension of the vortex tube that is additionally complicated due to high-speed swirling and turbulent flow inside the tube[5].RATTANONGPHISATet al. have studied the thermal separation of flow characteristic in a vortex tube.[6]HITESH R. THAKARE et al. have studied the characteristic of flow physics parameters inside vortex tube also have compared present CFD study with experimental and CFD results.[7]D. PAWAR et al. and UPENDRA BEHERA et al. have performed computational fluid dynamics analysis on Vortex Tube in an attempt to optimize the geometry of Vortex Tube.[8][12]DUTTA et al. have studied energy separation in Ranque-Hilsch Vortex Tube at cryogenic temperature.[9]Nader Pourmahmoud et al. have investigated the effect of using a convergent hot tube on the vortex tube refrigeration capacity.[10]K.ARUN et al. have analyzed the performance of vortex tube with different profile, length and diameter ratio of vortex tube and cold orifice diameter and hot outlet area using CFD tool to show the vortex tube is alternative and sustainable tool for spot cooling in machining operation.[11]AQSA RUKHSAR et al. have analyzed the swirling air flow field inside the vortex tube[13].DEWASHISH PATEL et al. have studied the performance of Vortex Tube for various

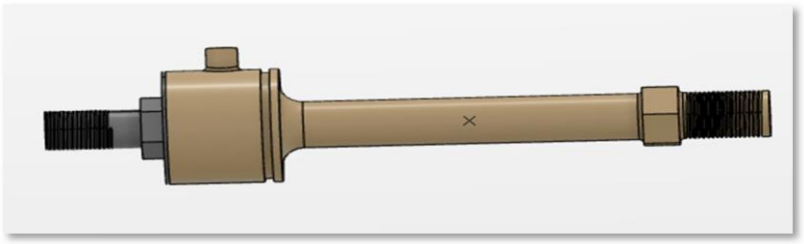
length of tube.[14]PAVITHRA1 et al. have analyzed the Vortex Tube for Refrigeration using Computational Fluid Dynamics.[15].

This paper aims to examine the efficiency of the vortex tube at different opening of the valve and at different given pressure at the inlet to figure out which opening and pressure would give stream of 0^0C at the cold outlet and 40^0C at the hot outlet through CFD analysis using 3D Experience software.

CFD ANALYSIS

I. Design of Simulation Model

For this analysis in CFD, 6 separate vortex tubes with different percentage of valve openings (60%, 70%, 80%, 90%, 95%, 100%) are modeled in ***CATIA*** Then these 3D models are exported in IGS format to 3D Experience> Part design and with the help of Fluid Scenario Creation Application their analysis is carried out.



(Vortex Tube)

It consists of pressurized gas inlets and two outlets for cold and hot streams with compressed air as a working fluid.

II. Boundary Conditions:

The boundary conditions used in this analysis are the static pressure inlet with the temperature at the inlet of the vortex tube and the pressure outlet at the cold and hot end.

For each model pressure of 2bar, 3 bar, 4 bar, 5 bar, 6 bar and 7 bar is used at the inlet of our vortex tube with constant temperature of 300K and 0 pressure is used for our outlets in all the experiments.

III. Meshing:

After giving boundary condition hex dominant mesh is generated using the same software in mesh generation application with maximum and minimum element size of 2mm and 0.5mm respectively resulting in a total of 189821 elements and 180757 nodes.

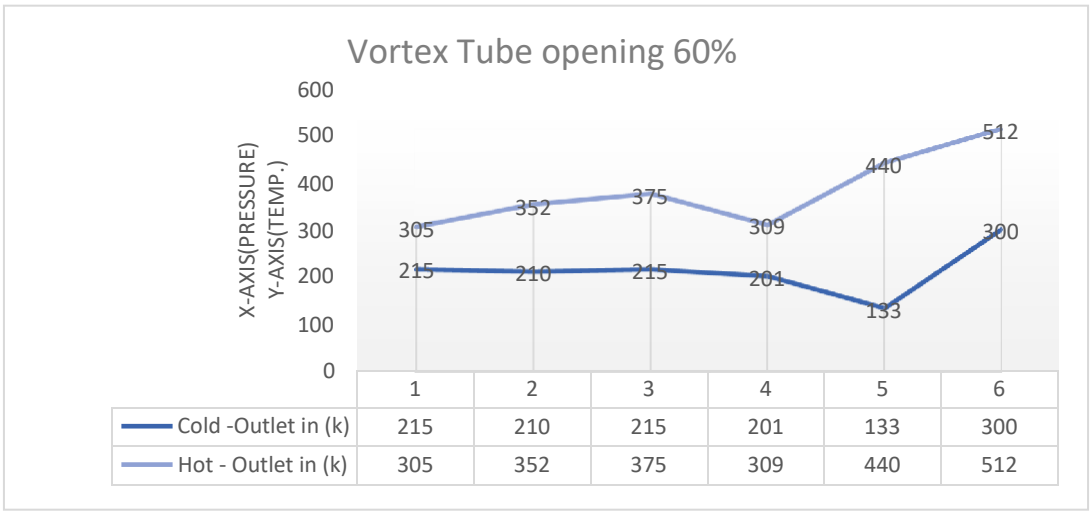
IV. Turbulence Model:

Realizable-k-epsilon turbulence model is used to hold the turbulence flow inside our vortex tube. For maximum increment steady state step is considered and 2000 number of iterations were taken.

RESULT AND DISCUSSION

After simulation, six separate graphs were obtained by holding the model with a certain opening constant in each graph and taking the stagnation inlet along the x-axis and the temperature along the y-axis.

For the first table, the 60% opening Vortex Tube is kept constant and the outputs for various pressure inputs are as follows:-



	1	2	3	4	5	6
Cold -Outlet in (k)	215	210	215	201	133	300
Hot - Outlet in (k)	305	352	375	309	440	512

Fig3: Pressure(bar) Vs Temperature(K)

For the second table, the 70% opening Vortex Tube is kept constant and the outputs for various pressure inputs are as follows:-

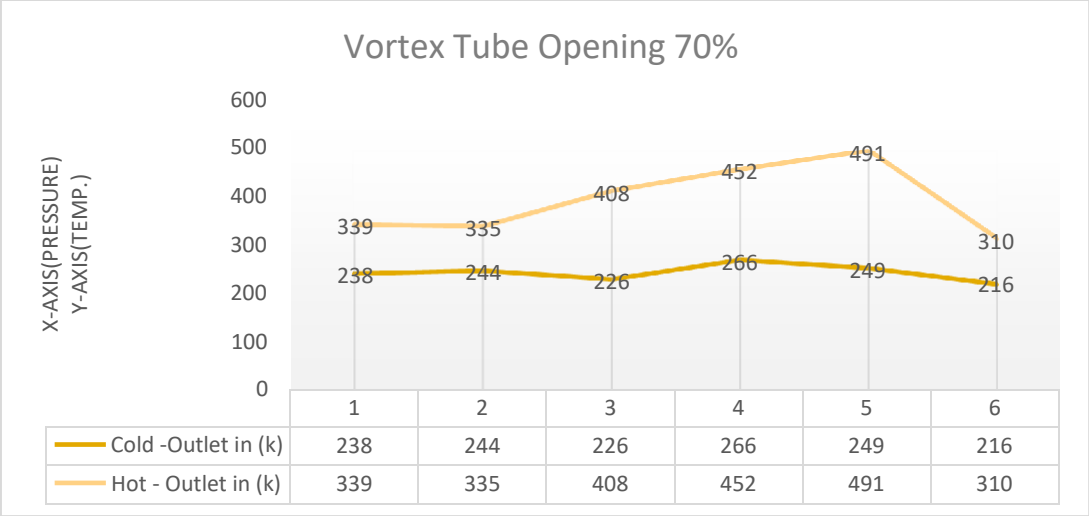


Fig4: Pressure(bar) Vs Temperature(K)

For the third table, the 80%opening Vortex Tube is kept constant and the outputs for various pressure inputs are as follows:-

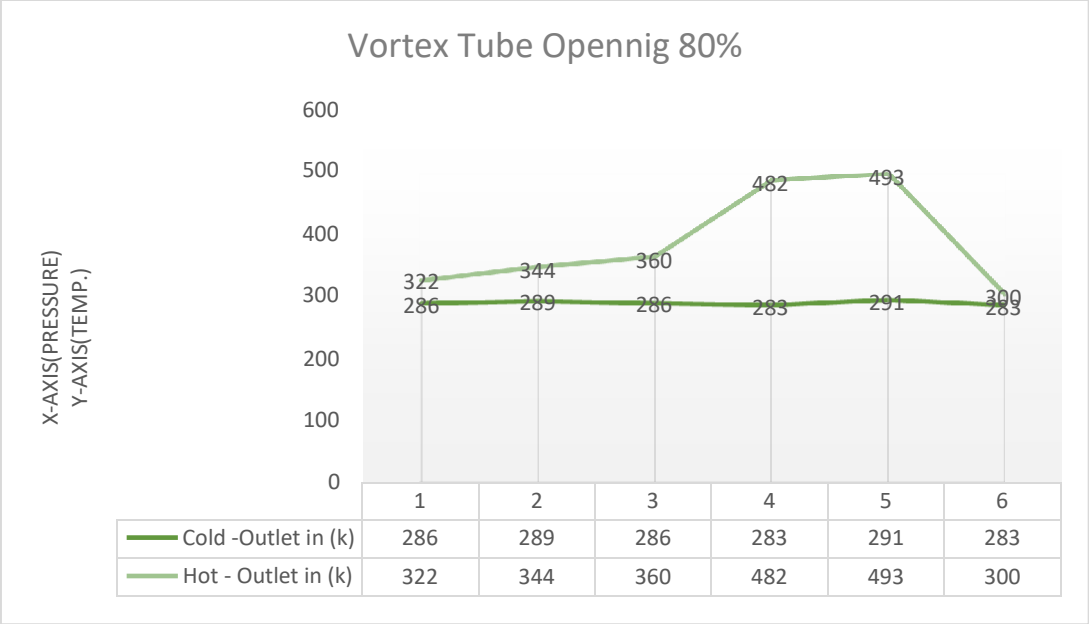


Fig5: Pressure(bar) Vs Temperature(K)

For the forth table, the90%opening Vortex Tube is kept constant and the outputs for various pressure inputs are as follows:-

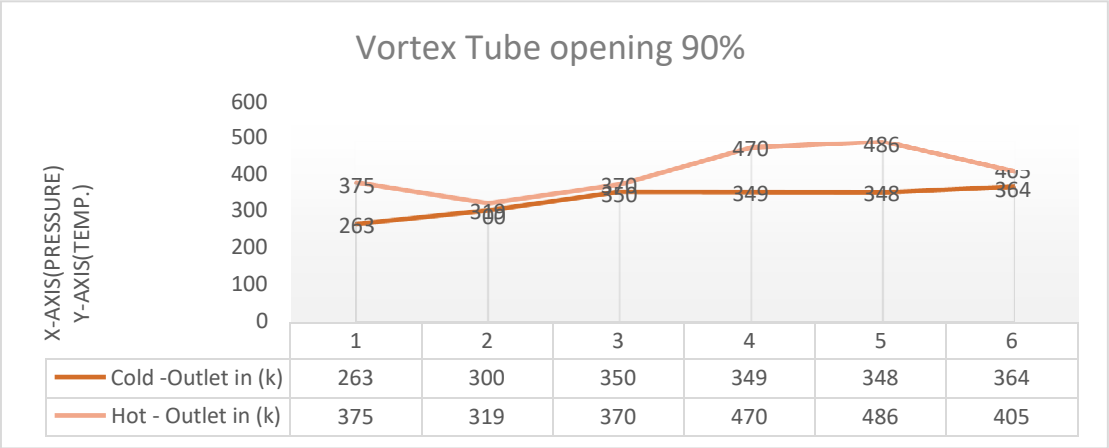


Fig6: Pressure(bar) Vs Temperature(K)

For the fifth table, the 95%opening Vortex Tube is kept constant and the outputs for various pressure inputs are as follows**:-**

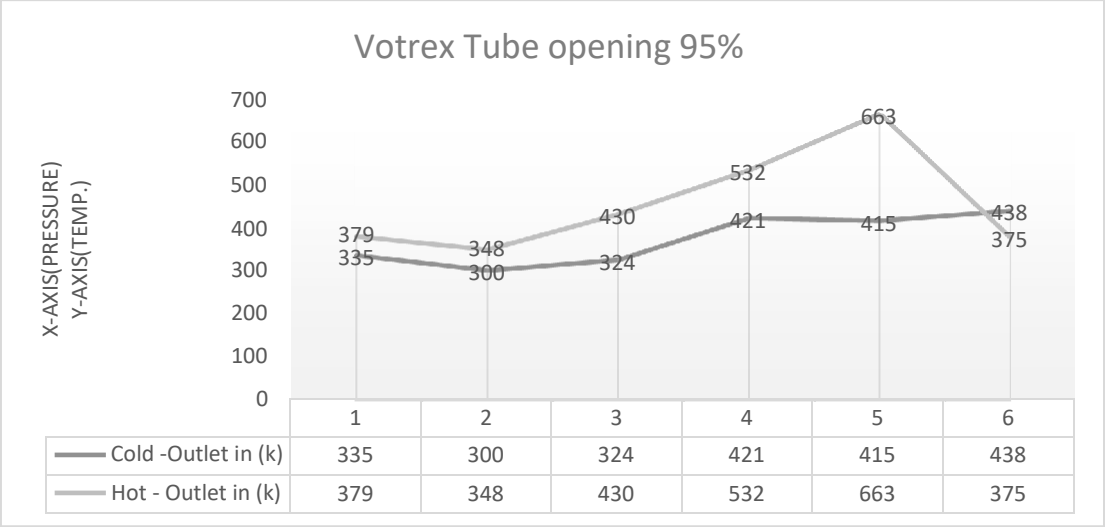


Fig7: Pressure(bar) Vs Temperature(K)

For the sixth table, the 100%opening Vortex Tube is kept constant and the outputs for various pressure inputs are as follows:-

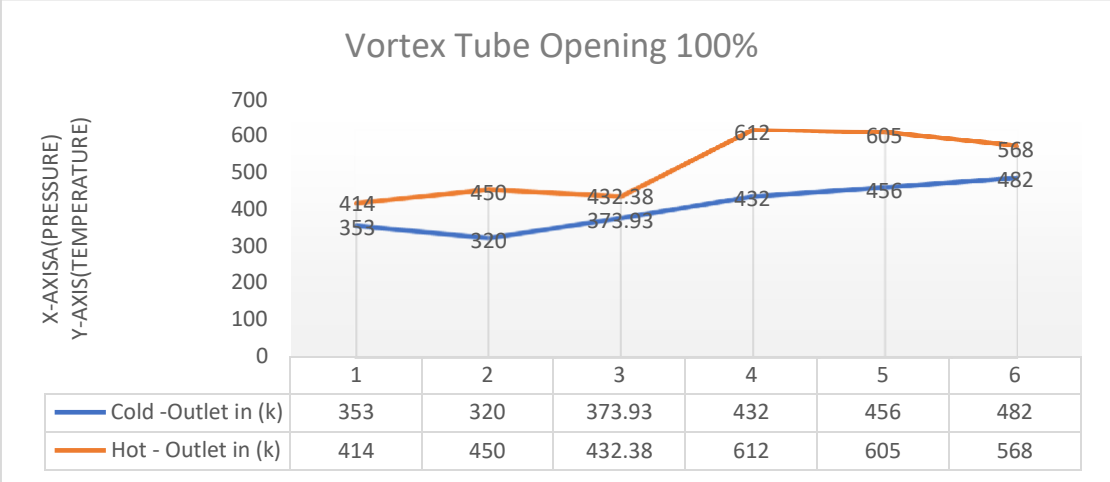
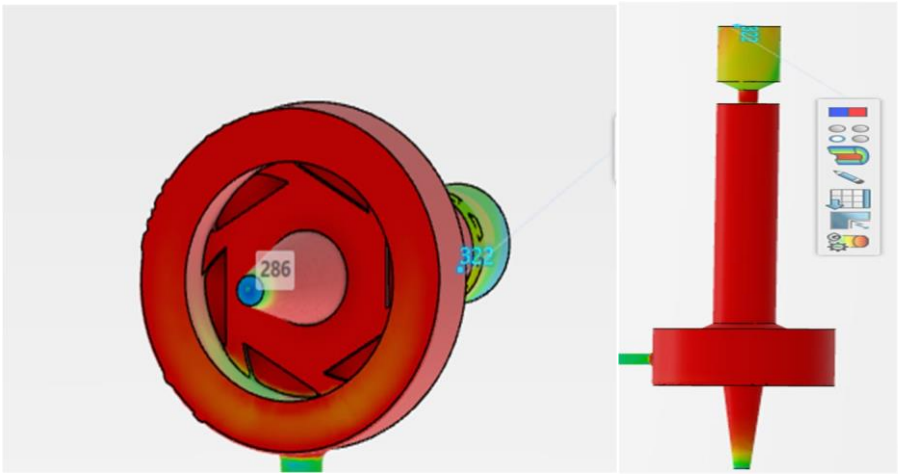


Fig8: Pressure(bar) Vs Temperature(K)

As we can see from the Fig3 to Fig8 non of the graphs are consistent and the vortex tube with 80% opening is nearest to our ideal output while given a pressure of 2 bar at the inlet.



IDEAL OUTPUTS		OUR OUTPUTS	
COLD OUTLET	HOT OUTLET	COLD OUTLET	HOT OUTLET
0^0C	**40^0C**	**12.85^0C**	**48.85^0C**

Some results of our experiment are near our optimal cold output but their hot output is far away from our ideal hot output and so forth.

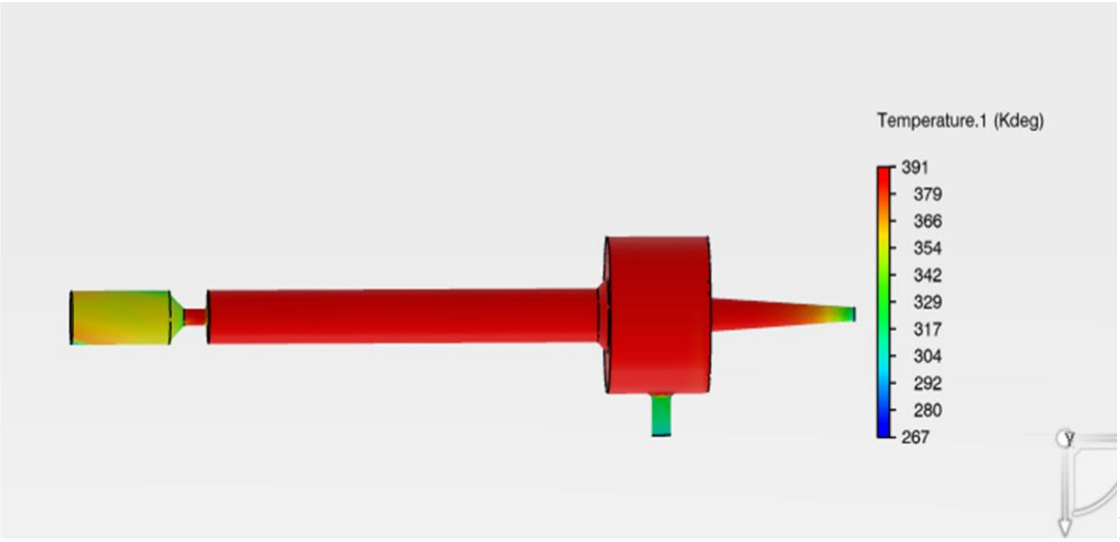


Fig9

The above figure shows the temperature distribution along the whole body of vortex tube with an opening of 80% with an inlet pressure of 2 bar. As we can see, the temperature at the plenum chamber is the highest, while at the hot outlet it is mild and at the cold output it is the least.

CONCLUSION

The three-dimensional model is used to predict which opening is optimal to provide 0^0C of cold air stream at the cold end and 40^0C of hot air stream at the hot end, and we infer that if given a pressure of 2 bar at the inlet of the vortex tube with an 80% opening, it will produce 12.85^0C of cold air stream at the cold end and 48.85^0C of hot air stream at the hot outlet.

We also infer that both the pressure at the inlet of the vortex tube and the vortex tube openings play a significant role in the outcome of the hot air stream and the cold air steam at the hot and cold ends of the vortex tube respectively, but the outputs are not consistent, which implies that increasing pressure at the inlet of the vortex tube does not generally result in a comparatively higher temperature at the hot end and lower temperature at the cold end.

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Peptic ulcer: a serious destruction of protective layer of stomach

Susmita Chakrabarty
School of Paramedics and Allied Health Sciences, Centurion University of Technology and Management, Bhubaneswar – 752050, Odisha, India.

Peptic means anything related to digestion i.e., word comes from pepsin enzyme which present in stomach and cancer means a malignant abnormal growth or tumor which leads to uncontrolled cell division. Peptic ulcer means a severe inflammation occur in digestive organ specially in stomach and small intestine. It is a disease of gastrointestinal tract. In this disorder destruction occurs in intestinal mucosal lining. Mainly occur in stomach and duodenum. The digestive system incorporates the digestive tract along with its accessory organs which helps in breaking down of intake food and liquid into substances. These substances are used to produce energy for metabolism, growth and tissue repair.

The associated organs (liver, pancreas and gall bladder) along with the Gastrointestinal (GI) tract completes the infrastructure of digestive system. The digestive tract is otherwise known as Gastrointestinal (GI) tract. GI tract is a progression (series) of about 10 hollow organs which are joined in a tube like structures for transportation of raw materials from mouth to anus. In order to their respective function, these organs are mouth, oesophagus, stomach, small intestine, large intestine, rectum and anus which are responsible for utilizing nutrients from food and to excrete out waste materials after digestion.

Generally in stomach there is a protective layer present which is made up of Mucus and bicarbonate which it protects the stomach from direct contact of gastric acids. Similarly we can say it helps to neutralize the acids secreted by the stomach mucosa. Because the acids and enzymes secrets in stomach are very highly concentrated and they use to digest food material which we intake. If this mucosal layer not been present then these acids can easily destroy the wall of stomach and which leads to severe inflammation and destruction and this condition is known as ulcer. It can be happen same with the small intestine because the gastric juices flows through the small intestine also. This protective layer might be broken down by the medication

like steroid or non-steroid, anti inflammatory drugs like ibuprofen and also through bacteria like *Helicobacter pylori.* These drugs destroyed hormonal balance of stomach and can slow down the mucosal secretion in stomach rapidly. Most ulcers caused by bacteria and in this case *H. pylori* a bacteria which weakens the mucosal layer of stomach and duodenum and in this way acids can contact easily with the wall of stomach. Acids and bacteria both together form that line of stomach destroy and irritate also try to eat. With the help of acid bacteria easily can survive and destroy the stomach line because it secrets enzyme which neutralize acids and forms sore and became ulcer.

Some times in some cases acid secretion gets high and it caused broken stomach mucosal layer and occur ulceration. This secretion gets high due to specific reason. Those are: stress, alcohol, Caffeine, smoking and spicy foods, acidic foods etc.

Types of Peptic Ulcer:

- Gastric Ulcer: Ulcer that present in Stomach
- Duodenal Ulcer: Ulcer that present in duodenum.

Sign & Symptoms:

- Severe burn sensation in stomach anytime
- Feeling irritation at the time of spicy food intake
- Loss of appetite
- Blood in Vomiting or light brown coloured vomiting
- Unexpected Weight loss
- Blood in stool
- Rectal bleeding
- Realization of pain in upper abdomen or chest

Causes:

Common

- Infection with *H. pylori*
- Non-steroidal anti-inflammatory drugs such as aspirin and ibuprofen.
- Anti-inflammatory drugs

Rare

- Hyper acidity
- Anxiety
- Venous deficiency
- Radiotherapy
- Any Cancer treatment with chemo

Pathophysiology of Peptic ulcer:

So if we talk about peptic ulcer, it is a condition where there is a formation of lesion at acid bearing region in the stomach or duodenum; initial part of the small intestine. There is an imbalance factor between aggressive factor and defensive factor of stomach. Stomach has 4 layers; mucosa, sub-mucosa, muscularis and serosa. There are many layer subdivision also. Mucosa has epithelial layer, lamina propia and muscularis mucosae. Muscularis has circular layer, longitudinal and oblique layers. So all these layers help in churning of the food in the stomach and function of the mucosa and sub-mucosa have function of the secretion in stomach. We know stomach contain HCL and enzymes which helps to do digestion means it has mix up with food which we intake then completely digest it. The inner lining of stomach, oesophagus has a thick layer of mucus. This mucus layer is affected by inflammation of sores being developed which leads to peptic ulcer.

PATHOLOGICAL INVESTIGATION:

Gastric Juice Analysis:

For detection of peptic ulcer generally doctor suggest to do gastric juice analysis. In this pathological diagnosis pathologist used to collect gastric fluid and proceed to do microscopic

analysis to detect abnormal findings. Procedure of gastric juice collection is quite difficult so it will be better that to collect sample only by professionals with the help of nasogastric tube.

Professionals need to gently enters the nasogastric tube through the nostril, pass the tube along the floor of the naso passage and advice the patient to swallow some fluid and in this way we can insert the tube completely to the stomach and attach a 10ml syringe with the tube and aspirate the gastric juice and store in a sterilized container. Then pathologist can check the fluid physically and under microscope also to identify the abnormal presence. Pain in stomach is considered as one of the symptoms of this ulcer. The erosion of inner layer of stomach by the secretion of acids leads to this disease.

Gastric Juice having blood cells(Ulcer)

Stool analysis(Occult blood): Occult blood means hidden blood; patient having peptic ulcer should diagnose through stool analysis once, Because hidden blood or occult blood found in stool due to stomach wall disruption and corrosion of mucus layer.

Serological test:

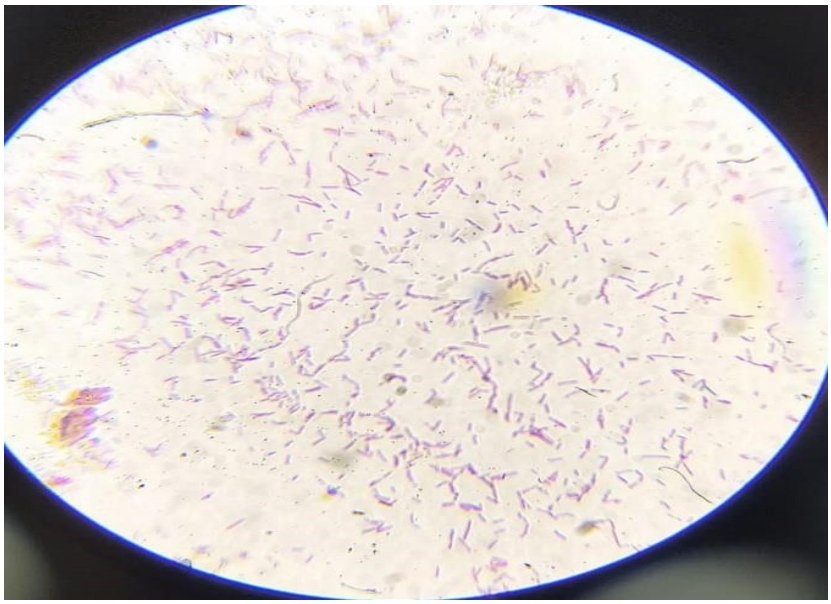
Liver function test

Enzyme serum test

H. Pylori antigen detection

Microbiological Identification:

Helicobacter pylori mainly caused stomach ulcer so it's specially suggested to do microbiological analysis with gastric fluid to know the presence of this bacteria. This diagnosis is recommended for all patient with peptic ulcer. It is a gram negative bacilli found in gastric epithelial cells. This bacteria has wide spectrum of virulence factor and has capability to inflame the gastric mucosa layer. In this way this is also responsible for occurring peptic ulcer.



H. pylori

Endoscopy:

The best way to detect ulcer or any abnormal changes is endoscopy. It is radio-logical diagnosis. For visualization and observation of internal organs and tissues in detail, Endoscopy is preferred

which is minimally invasive. A long thin tube with a tiny camera attached to it is inserted directly into the openings of body such as mouth (through throat), anus.

Endoscopy Preparations

Endoscopy is proceeded with few steps we need to take:

- In case of General Anesthetic, eating is not recommended for 6-8 hrs before the procedure.
- In case of Colonoscopy, avoiding certain food is leaded in the days to the procedure. To clear out bowel, laxatives are taken before a day prior to the procedure.
-We have to stop medication a few days before endoscopy.

The process

This is an invasive (or non-surgical) technique, to investigate symptoms and diagnose the relevance condition in a person's digestive tract.
This is practised with two procedures- Anaesthetic and Sedation

Anaesthetic: A local anaesthetic is given before the procedure where the thin tube, endoscope will be inserted.

Sedation: Sedative is provided for most endoscopy if we are having local anaesthetic, which helps in relaxing through out the process, increases the comfort. This is administered with a syringe that will be injected through the vein.

Renal calculi

Susmita Chakrabarty

School of Paramedics and Allied Health Sciences, Centurion University of Technology and Management, Bhubaneswar – 752050, Odisha, India.

Kidney is a part of internal excretory Organ. Kidney stone or renal calculi associated with abnormal function of kidney and it is the very usual disorder of Urinary system. Kidney also know as renal and stones also know as calculi; kidney stone also known as renal calculi, nephrolithiasis or urolithiasis are strong accumulation made of minerals and salts that form inside your renal system. Recurrence of this renal calculi is to be a very much serious issue in health of human. Regarding prevention of the recurrence stone formation in renal needs well understanding about the renal stone formation. Renal calculi can causes severe chronic renal disorder, final stage of kidney failurity, heart and vascular disorder, dyslipidemia, Hyperglycemia and high blood pressure. Many researchers found and suggested about systemic disease and clarify that the renal calculi might be a systemic disorder related to metabolic syndrome. Nephrolithiasis is responsible for 2 to 3% of final stage of kidney disorder interlinked with nephrocalcinosis (Alelign et al., 2019).

Renal calculi otherwise known as nephrolithiasis, and it has been a worldwide problem. Day by day it's increasing rate puts affect on developed and under developed countries. Life style also can affect and can cause the formation of different types of renal stones. Person at any age can get affected with this serious disorder and it has been reported in age of 21-50 years it might crossed high level in graph of age group. It has been reported that men found more than women also. The exact factors associated with stone formation is still not confirmed yet. (Aggarwal et al., 2017).

History of patient and proper laboratory analysis is required to get confirmation of the renal calculi formation. A renal calculi made up of some accumulation of crystals and acids when they get together after that they form in a hard stone like material. Those are might be different in shape and structure. In some cases calculi pass out through urine from urinary system with the medicine treatment but in some cases patient need to do surgery for removal of calculi. With the

presence and accumulation of large amount of uric acids, magnesium, phosphates and another electrolytes the renal calculi have been formed (Khan et al., 2019).

Calcium phosphate calculi

Calcium phosphate if secretes in more amount in blood then it gets filtered through urinary system and accumulate and forms stone like structure. It shows the similar risky factor as with calcium oxalate calculi as high amount in urine calcium and lower of urine citrate. Reduction of phosphate diet might be helpful by reducing excretion of urine phosphate .

Uric acid calculi

When pH will increase in someone urine that prevent the confluence of uric acid. It is one of the important type of calculi. Minerals get accumulate in crystal masses and then it has started to be form. Some food also can cause formation of the uric acid. Those are beef, eggs, milk, cheese etc protein containing diet also increase the uric acid calculi formation.

Struvite calculi

Containing struvite calculi needs to be complete remove by a surgeon and recurrence of formation might be stop through prevent UTIs.

Calcium oxalate calculi

Mainly some food contain highly oxalate like; potatoes, spinach and rhubarb. People should be avoided who have kidney function disorder. In case of common nephrolithiasis, person should be avoid highly vitamin C contained foods and drink is the better way to suppress oxalate production in blood (Aggarwal et al., 2017).

Dietary habit, abundance weight, some clinical state, and bound enhancements and medicated drugs are among the various reasons for urinary organ stones. These stones affects some parts of urinary system from your kidneys to your bladder. Frequently, similar to hard lump like once the urine gets focused, allowing minerals to take shape in crystals and remain.

Passage of calculi through urinary system will be quite excruciating, anyway the stones sometimes cause no indefinite mischief. Figuring on your situation, you would like nothing quite to require torment prescription and guzzle ample water to passage a renal calculus. In elective instances — as an example, if hard accumulation become stopped inside the tract, are identified with a urinary disease or cause inconveniences — medical procedure like surgery is additionally required.

Your doctor may advocate treatment for prevention to scale back the chances of perennial urinary organ stones if you are at accumulated risk of evolving them once more.

The genitourinary system is comprises of 2 significant bean formed kidneys, ureters, bladder and epithelial duct. These kidneys set simply center of the rear and underneath the sets of ribs. Water along with the body waste is transported in kidney from the current blood then believers it to create urine. These also are helpful for creating a steadiness balance of salts and alternative ions with in body fluid. The urethral tubes that are slender in size; convey the amount and concentration of urine from the kidneys that transport to a triangle formed chamber referred to as bladder. At constant time, urine keep in an exceedingly elastic, swell kind chamber referred to as bladder that gets flacid once urine is taken out through epithelial duct to out the body. The term 'Urolithiasis' could be a world drawback poignant personalities for precedent days and conjointly referred to as ‘Nephrolithiasis’ or urinary organ stones (Khan et al., 2019).

Renal calculi are related with increased serious factor of nephritic cell malignant neoplastic disease and carcinoma in upper tract urothelial malignant neoplastic disease as per the analyzer. Since it is considered as high risk factor to cause cancer in excretion system.

Day by day these growth rate of renal calculi disorder causes serious economical losses in world wide of medical laboratory sciences. The growth rate of nephritic calculi is adding to the morbidness and big economical dropping over world of medical laboratory sciences. The advancement in technology have assisted with early identification and cure. But more associate action of nephritic calculi with diseases related to defect of metabolism like high blood pressure, hyperglycemia, and fatness prominence the importance of diet routine and habit in their

prevalence and recurrence. More water in-taking and maintaining healthy life style are measure a number of the cheap measures of prevention of nephritic calculi (Aggarwal et al., 2017).

Sign & symptoms (Khan et al., 2019):

The patient do not identify if he or she is suffering from renal calculi disorder, there is no specific sign to be noticed without laboratory analysis. Some stones denatured and excrete through renal, so in that case it passage through whole urinary system and stored in urinary bladder and accumulate the chemical components and convert as a form of hard particle or stones. Stones like substances accumulate at the place of urinary excretion and block the system which subject to be super painful urination and some times no urination might be found and resulting as swelling. This condition is called as hydronephrosis.

However there are some Common symptoms also found:

I. At the back bone and back side of body leads to severe pain suddenly and its not get reduce with pain killers also. Some of ladies also experienced worsen pain than labour pain during pregnancy.

The sign and symptoms are:

II. Urinary burning sensation.

III. Unexpected urination.

IV. As per the presence of red blood cells urine colour might be red or brick red. In some cases it has been difficult to identify blood cells because of less amount of blood found in urine.

V. Somehow vomiting also might be found.

VI. At the tip of Penis male patient feels pain (Khan et al., 2019).

Pathological Diagnosis:

Pathological diagnosis is very much necessary for identify if a person has suffering from Renal calculi disorder but at radiology ultrasound or CT scan is the best way to detect calculi formation.

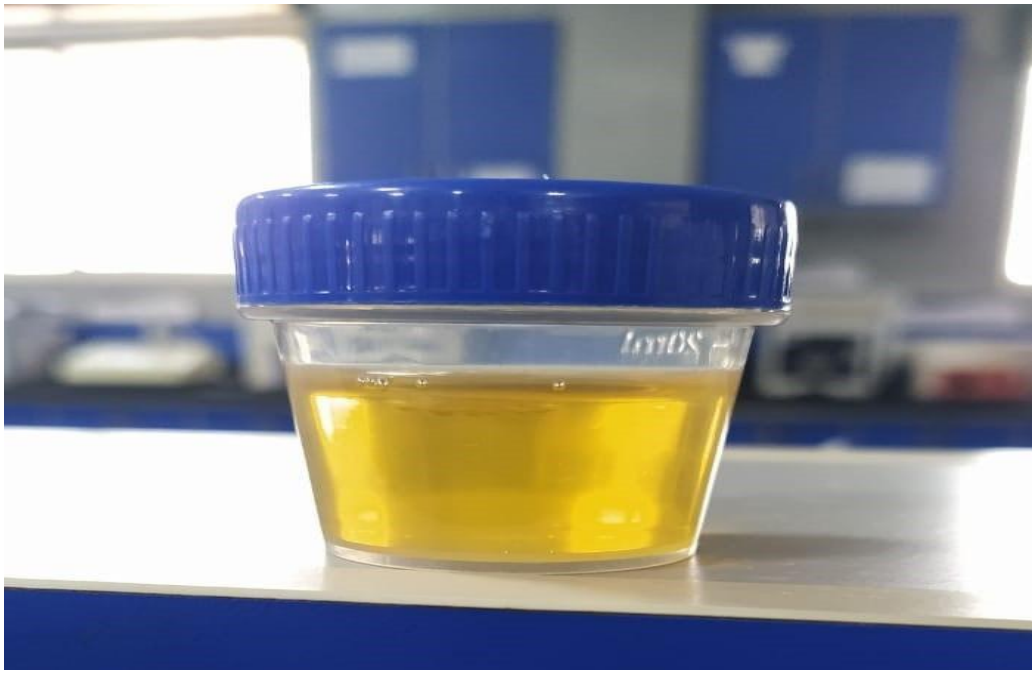
Biochemical Serum Analysis:

To get knowledge about kidney health patient should do their serum test. After analyzing blood serum if we found elevated level of electrolytes, calcium or uric acid in the serum then physician advised to proceed for urinalysis. Blood serum analysis value help physician to track and resolve the issue related to health of the kidneys and may leads physician to check for other laboratory analysis.

Blood serum sample

Urinalysis:

Doctor advise to do urine test if biochemical blood test report found abnormal results of electrolytes and some components related to kidney functions. Pathologist will advise to collect 24 hrs urine specimen for doing analysis of abnormal biochemical present in urine. In this case healthcare providers may suggest to collect sample alternatively in two consecutive days.(Khan et al., 2019).



Urine Sample

Urine Cytology:

Cytology is a laboratory investigation of cells under microscope. Observation of Malignant or precancerous cells in liquid sample should diagnose in this department. Through this cytological investigation pathologist can identify cancerious cells under microscope.

Kidney tissue Biopsy:

It is a histopathological invesigation. In which pathologist analyse the tissue sample collected from kidney and process that to identify presence of malignant cell under microscope

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Ocular manifestation of allergy: allergic conjunctivitis

Ranitava Banerjee

Centurion University of Technology and Management , Odisha

1. Introduction to Allergy:

Allergy is the process of adaptive immune response towards any kind of allergens (environmental particles which are not infectious), which maybe sterile parts of the specific infectious organism. Anaphylaxis, Hay fever also known as Allergic rhinitis, food allergies and allergic asthma, the allergen-specific IgE and T helper 2 (TH-2) cells recognize the antigens and acts against them. Allergic rhinitis (AR) is caused by the IgE-mediated inflammatory changes of the mucus layer of the nose. Currently 10% and 30% of the population is affected by allergy and it continues to increase worldwide. Out of these around 400 million suffer from allergy and nearly 300 million from asthma according to the latest World Health Organization (WHO) reports. Heredity, environmental factors, lifestyle changes are the precursor to the growth in allergic population.

2. Mechanism of allergy:

Clinically four types of hypersensitivity reaction can occur due to any kind of allergic reaction. Which are:

Type 1: Immediate Hypersensitivity (Anaphylactic Reaction) –Immunoglobulin E (IgE) antibody reacts against the soluble antigen, causing the mast cells to degranulate. This type of hypersensitivity reaction is called Type 1 Hypersensitivity.

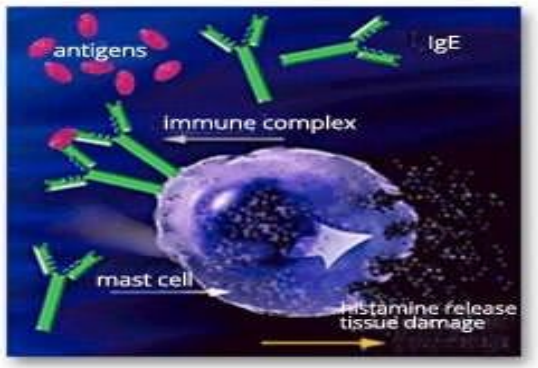
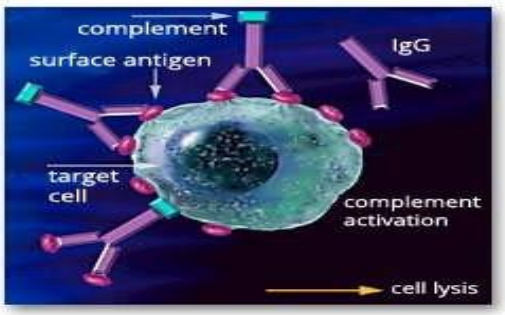


Fig: 1

Type 2: Cytotoxic Reaction (Antibody-dependent) - The other immune system effectors can cause cell damage when the IgG and IgM antibody react with the cellular



antigen. This type of hypersensitivity reaction is called T (Fig: 2)

Fig: 2

Type 3: Immune Complex Reaction – The IgG, IgM, and sometimes IgA antibodies react with antigen to form immune complex. The other immune system effectors can cause tissue damage as a result of the accumulation of immune complex in the tissue. This type of hypersensitivity reaction is called Type 3 Hypersensitivity reaction (Fig: 3)

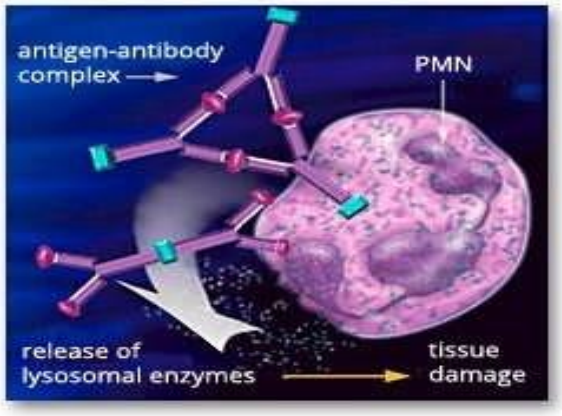


Fig: 3

Type 4: Cell-Mediated (Delayed Hypersensitivity) - Activated macrophages and cytotoxic T cells lead to this type of cell mediated hypersensitivity in the body. Basically, the T-cells are responsible for this Type 4 hypersensitivity reactions (Fig: 4)

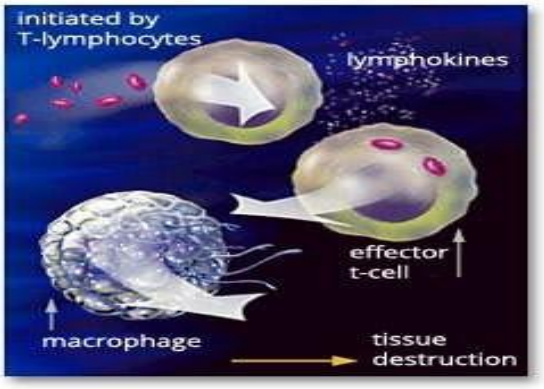


Fig: 4

3. Classification of Ocular allergies:

The ocular allergy is commonly called as Allergic conjunctivitis (AC) which is again subdivided into the following:

3.1 Seasonal allergic conjunctivitis (SAC)

3.2 Perennial allergic conjunctivitis (PAC)

3.3 Vernal keratoconjunctivitis (VKC) *or* Spring Catarrh

3.4 Atopic keratoconjunctivitis (AKC)

3.5 Giant papillary conjunctivitis (GPC)

3.1 Seasonal Allergic Conjunctivitis (SAC)

It appears on a seasonal basis, mostly as a part of seasonal rhino conjunctivitis (hay fever) and is majorly triggered by grass, plant and weed pollen particles and sometimes the outdoor moulds. Though the conditions are not sight-threatening but affects the quality of life in the individual.

3.2 Perennial Allergic Conjunctivitis (PAC)

Perennial allergic conjunctivitis generally occurs all-round the year majorly due to house dust mites, animal scruffs, insect parts and indoor moulds. Signs and symptoms generally develop gradually but sometimes it develops all of a sudden when there is direct contact with the allergen. PAC is often bilateral followed with symptoms like itching, tearing, swelling of the lids and conjunctival hyperaemia, chemosis and papillary reaction. They most of the time share their clinical features with SAC.

3.3 Vernal Kerato-Conjunctivitis (VKC) *or* Spring Catarrh

Vernal Kerato-conjunctivitis (VKC) (Fig: 5), is a rarely occurring ocular allergy which recurrent and bilateral in nature. It occurs generally during spring and summer months. Children and adolescents specially boys are affected by the disease.

The major symptoms include burning, itching, photophobia. While the sings are clinically of two types:

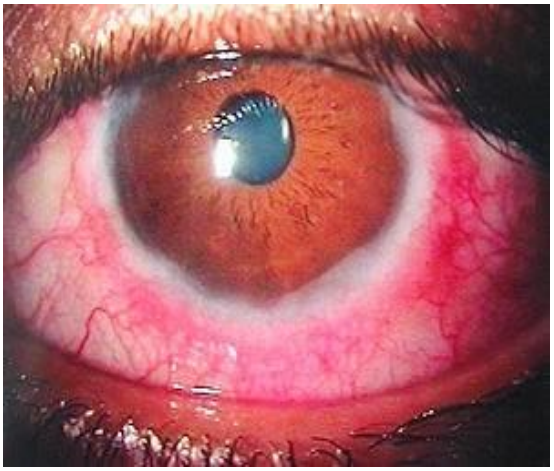


Fig: 5

(i) Palpebral form and **(ii) Limbal or bulbar form**

Sometimes both palpebral and vernal form can co-exist simultaneously with appearance of diffuse Superficial Punctate Keratitis (SPK); it is called as **Mixed form.**

3.4 Atopic Kerato-Conjunctivitis (AKC)

Generally seen in young adults and most often associated with history of asthma, allergic rhinitis, atopic dermatitis in the patient or their family.

AKC results in severe and chronic disorder of the ocular surface and the inflammation that occurs in this case are generally persistent in nature (Fig: 6). They share the symptoms with VKC with only the symptoms in case of AKC being more severe and chronic.

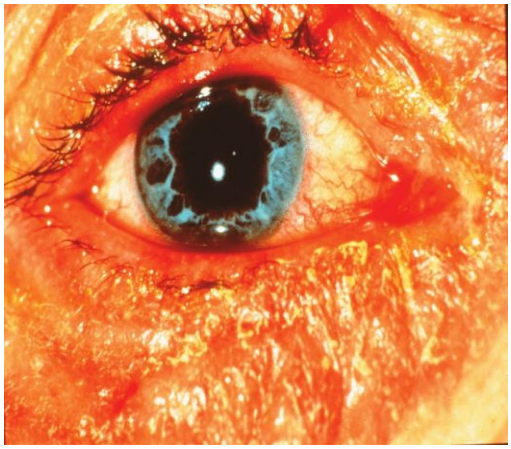


Fig: 6

3.5 Giant Papillary Conjunctivitis (GPC)

In this form of conjunctivitis only the superior tarsal conjunctiva is inflamed. The major cause or aetiology lies in the form of reaction to the soft hydrophilic contact lens use, protruding suture ends and ocular prosthesis. (Fig: 7)

Person suffering from GPC usually presents symptoms of watering, itching, foreign body sensation and occasional blurry vision. Clinical examination reveals signs of conjunctival congestion in the upper palpebral regions with typical polygonal appearance of the papillae on the superior tarsal conjunctiva.

The size of the papillae ranges from 0.3-1.0 mm (micro-papillae) to 1-2 mm (giant-papillae)

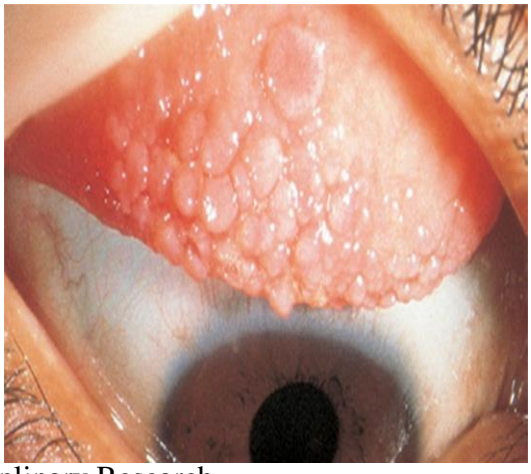


Fig: 7

4. Management

The management of allergic conjunctivitis is targeted at treating the allergen and generally it is seen that with the withdrawal of the offending allergen from the system the sings of allergic conjunctivitis start receding. Though some form of the allergic conjunctivitis requires special intervention and the treatment is aimed at specific cause.

- For treatment of VKC the treatment is followed based on the symptoms like:

  (i) **Topical therapy** with eyedrops containing anti-histamine, mast cell stabilizers, decongestants, NSAID (*non-steroidal anti-inflammatory drugs)* along with lubricants are prescribed.

  (ii) Along with this use of cold compress and use of tinted glasses are helpful and provides comfort to the patient; it comes under **supportive therapy**.

- Giant Papillary Conjunctivitis (GPC) treatment includes the following:

  (i) Discontinuation of the soft contact lenses which triggered the reaction along with removal of sutures and cleaning and removal of ocular prosthesis and replacing them with bio-compatible material such as biocoat.

  (ii) Along with this the **topical therapy** of VKC can be followed.

  (iii) As a part of the **local therapy** sometimes sub-tarsal injection of long-acting steroids like triamcinolone along with cryotherapy of the tarsal conjunctiva is done to control giant papillae.

  (iv) Surgical excision of giant papillae sometimes is required to manage the condition.

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Pathogenic *Escherichia coli*: a public health inference

Sonali Dash* Sunil Kumar Jha, Nishit Kumar Bebarta

Centurion University of Technology and Management, Odisha

Introduction:

Symbiotic natural microflora *Escherichia coli* harbours gastrointestinal tract of neonates from birth. Both bacteria and host provides benefit to each other and develops a symbiotic association between them. However in immunocompromised individual harmless *E.coli* can start infection. Although pathogenic *E.coli* infection may be confined to mucosal surface but sometimes causes mild to very severe infection. This facultative anaerobic gram negative bacilli is classified under *Enterobacteriaceae* family. In populous developing countries like India infectious diarrheal disease caused by *E.coli* is very common and can spread rapidly. Various clinical syndromes like urinary tract infection (UTI), sepsis or meningitis and enteric or diarrheal diseases may arise due to this bacterial infection. On the basis of antigenic properties and pathogenicity it is classified into different strains like enterotoxigenic *E.coli* (ETEC), enteropathogenic *E. coli* (EPEC), enteroinvasive *E. coli* (EIEC), enterohemoragic *E. coli* (EHEC), enteroaggregative *E. coli* (EAEC). *E.coli* serotyping is based on the surface antigen profile which includes 'O (somatic) antigen', H (flagella) antigen and K (capsule) antigen. Different *E.coli* serotype is on the basis of specific combination of O and H surface antigen. As this bacteria inhabits the colon or GI tract of human and endothermic animal, hence presence of *E.coli* in water is considered as contamination of water and not suitable for consumption (Jang et al 2017.,). Hence *E.coli* is a biological indicator of fecal contamination and mostly used to check water quality. *E.coli* associated UTI is extra intestinal, more frequent and prevalent in human population. Specific virulence factor of uropathogenic *E.coli* (UPEC) colonizes the lower urinary tract which results UTI. By forming biofilm, the bacterial surface protein adhesins attaches onto the urinary tract tissue and restrict the attack of neutrophils (John A S et al.,). This ubiquitously present bacteria is greatly concern now a days for public health perspective.

Overview on morphology:

This bacterium was first identified by bacteriologist Theodor Escherich in the year 1885. Genome size is approximately 4600Kb with some open reading frame and more than 1800 proteins. This gram negative bacilli consists of an outer lipopolysaccharide layer, periplasmic space, inner cytoplasmic membrane and Peptidoglycan layer. Some *E.coli* strain also contains extrachromosomal genetic material that is plasmid. Presence of outer membrane helps the bacteria to increase its pathogenicity.

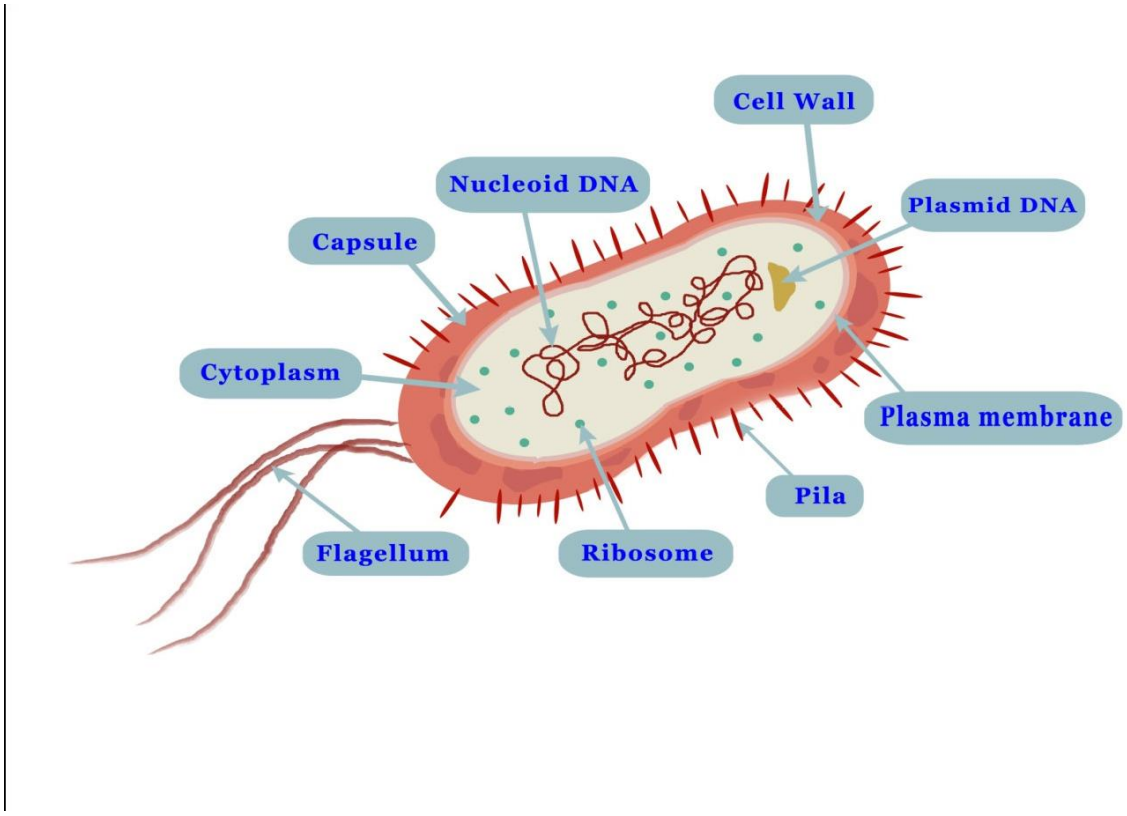

Figure 1: Structure of *E. coli*

The optimum temperature for the growth of non-spore forming *E.coli* is 37^0 C and can be easily destroyed by heat and sterilization process. Presence of different surface antigen such as 'O (somatic) antigen', H (flagella) antigen and K (capsule) antigen is the basis of classification bacteria into variety of serotype. Shiga toxin producing *E.coli* (STEC) is mainly responsible for water and food borne diseases through the consumption of contaminated water and food.

***E.coli* associated UTI:**

Although many organisms are associated with urinary tract infection, but *E.coli* is the chief source of UTI infection accounting for 80-85% of total isolates. Burning sensation when

urinating, frequent urination, passage of offensive, cloudy and dark colour urine, rise of body temperature and pain are the major clinical sign and symptoms. Based on the site of infection in urinary tract UTI are classified into different types such as cystitis (infection in urinary bladder), pyelonephritis (infection in kidney) and urethritis (infection in urethra). Anatomy of female excretory system, frequent change in sex partner, menopause, abnormalities in urinary tract, blockages in the urinary tract and weak immunity are the key factors which enhances the UTI infection rate. Frequent urination may eliminate the bacteria from urinary tract and reduces the chance of infection.

***E.coli* associated infectious diarrhea:**

EPEC, EHEC, STEC and *E.coli* serotype O157:H7 are mainly involved in food and water borne outbreaks. Severe enteric diseases, hemolytic uraemic syndrome and hemorrhagic colitis, bloody diarrhea and traveler's diarrhea are the major clinical features associated with *E.coli* infection. Enterotoxigenic *E.coli* strains are capable to produce two types of enterotoxin that is heat stable (ST) enterotoxin and heat labile (LT) enterotoxin. LT toxin is similar to cholera enterotoxin by protein structure and sequence. This LT toxin is 86kDa molecular weight protein have one A and five B subunit. In contrast to the LT toxin, ST toxin is monomeric, small and presence of many cysteine residues (disulfide bond) are mainly account for heat stability of this protein.

Sl No	Name of the strain	Types of diarrhea	Name of the toxin
1	Enterotoxigenic E.coli (ETEC)	Traveler's diarrhea	Heat liable toxin (LT) Heat stable toxin (ST)
2	Enteropathogenic E.coli (EPIC)	Traveler's diarrhea	No toxin (attachment and effacing lesion)
3	Enteroinvasive E.coli (EIEC)	Dysentry High fever	No toxin (mechanical cell destruction)
4	Enterohemoragic E.coli (EHEC)	Bloody diarrhea Hemolytic uremic syndrome(HUS)	Shiga toxin
5	Diffuselyadherent E.coli (DAEC)	Watery and mucoid diarrhea Cholecysttis	Sigha toxin
6	Enteroaggregativ E.coli(EAEC)	Acute or persistent diarrhea	Enterotoxin Cytotoxin

Table 1: List of infectious diarrhea caused by *E.coli*

***E.coli* as a faecal indicator:**

As a lower intestinal tract inhabitant, *E.coli* is believed to discharge into the water bodies through the faecal matter. It is one of the predominant natural microflora of human present in GI tract. Hence, presence of *E.coli* in water confirms the faecal contamination of water. Discharge of effluent into the water bodies and improper sewage treatment are also some additional factors associated with it. As per the U. S. Environmental Protection Agency (USEPA), presence of more than 235 Colony Forming Unit (CFU) per 100 ml of water is not recommended for drinking purpose (Jang et al 2017.,). Membrane filtration technique and determination of most probable Number (MPN) are very useful techniques to check water quality.

***E.coli* as antibiotic resistance bacteria:**

Frequent use of antibiotics against *E.coli* infection both in case of human and animal is the chief reason behind the development of antimicrobial resistance strain of *E.coli*. Horizontal transfer of resistance gene between bacteria is mainly occurs in water and soil. Antibiotic resistance encoding genes are associated with mobile genetic elements or plasmids increase the possibility of horizontal transfer of these resistance gene. Studies have reported that many multi drug resistance strains of *E. coli* are present in environment.

***E.coli* associated sepsis or meningitis:**

Neonatal septicemia or meningitis is the major issue in most developing countries and one of the principal reason of neonatal mortality and morbidity. Different microorganisms like Group B streptococcus (GBS), *Escherichia coli* and *Listeria monocytogenes* are involved in meningitis infection (Furyk et al 2011). Due to weak immunity new bornes are more prone for this infection than adults. Fever, irritability and poor feeding are the chief complain and isolation of bacteria from cerebrospinal fluid (CSF) is the main diagnosis method. Blood culture is not sensitive or confirmatory as like as CSF culture.

Acknowledgment:

I am eternally grateful to Dr. Soumya Jal, Dr. Monali P Mishra, Mr. Sanjay Gouda and Senior Management team of Centurion University of Technology and Management for their constant

and kind cooperation. Avery special thanks to Dr. A P Rath from reading early drafts to giving me advice.

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Virological perspective of cancer: a global health concern

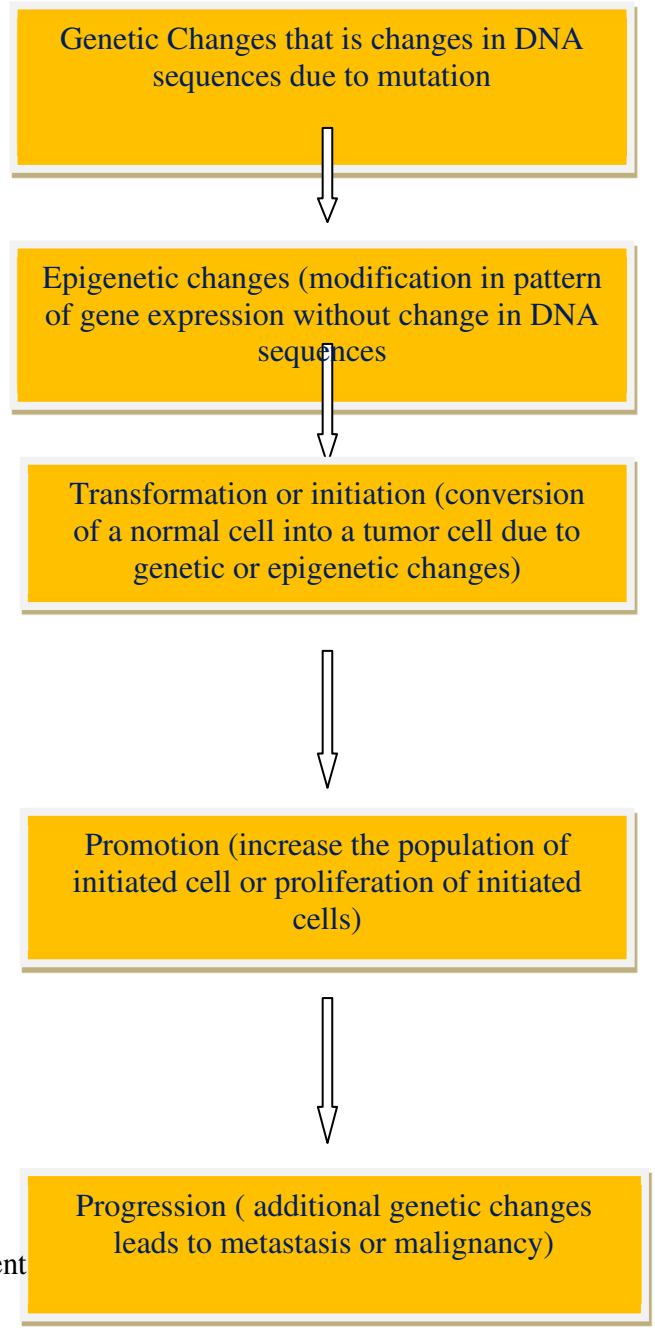
Sonali Dash* Siba Sankar Acharya
Centurion University of Technology and Management, Odisha

Introduction:

In most affluent countries, poorest countries, developing countries and developed countries cancer is playing a leading role in mortality. Globally, rapid increase of cases and its prevalence is severely affecting all human societies. Unfortunately, the natural and anthropogenic cause of cancer is multidirectional and most vital for its early diagnosis followed by treatment and prevention. As per the data provided by the American Cancer Society (ACS), more than 17 lakhs new cases and approximately 6 lakhs cancer deaths were reported in the United States (Siegel et al., 2020) in the year 2019. In comparison to the most developed country, in developing countries like India, the mortality rate is also spectacular, dramatic and noticeable. Ahead of World Cancer Day, 2018 World Health Organization (WHO) official reported that, the ratio of cancer case and cancer death are one in ten Indians and one in fifteen Indians respectively (WHO 2018). Among different types of cancer, in male oral cancer, lung cancer, stomach cancer, colorectal cancer and oesophageal cancer are more prevalent and similarly breast cancer, cervical cancer, ovarian cancer and oral cancer are more common in female. Genetic and epigenetic changes, familial history, obesity, smoking, chewing of tobacco, consumption of alcohol, exposure to UV radiation, mutation and red meat are the principal causative factors for cancer development. Many number of malignancies and tumorigenic are virus originated. Nearly 20% of cancers are caused by various infectious agents including virus (Zhang et al., 2013). Most predominant viral strain linked to human cancer includes Epstein Barr virus (EBV) and Kaposi sarcoma associated herpesvirus or human herpesvirus type 8 (KSHV/ HHV8), Human papilloma viruses (HPVs) . Oncovirus related cancers are now becoming a global concern. Broad understanding and deep knowledge about the host virus interaction, receptor responsible for the adherence of virus, factors promoting the survival of virus can be used as a strategy for prevention, control and treatment of oncoviral infection in human. The convoluted mechanism of

virus survival by escaping host immune recognition is still very difficult to understand and a key research topic to be studied.

An overview of cancer development:



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Role of different Oncovirus in cancer development:

Papillomavirus-linked cancers:

Human Papillomavirus (HPV) is mainly associated with cervical cancer in women, which is the third most commonly found cancer with more than half a million new cases in the world per year. There is evidence that, HPV can infect other body sites including the vulva, neck, penis, anus and head. Hence, may be a reason of some other carcinoma. Small ds DNA covalently closed circular genome size of HPV is approximately 8Kb in size (Fernandes et al., 2020). Different DNA sequence leads to develop more than 100 HPV types. The portal of entry for this virus is through the keratinocytes in skin and mucous membrane. The most preferred site of HPV is hands or genital organ. Entry of this virus into the host cell may result in a benign wart or papilloma. Transmission of Papillomavirus through the genital organ is mainly during the sexual intercourse. All papilloma virus infection may not lead to develop cancer but in minority of hosts, the virus is not cleared by the host immune response. Among different types of HPV, high risk types include HPV 16 and 18 (Fernandes et al., 2020) however infection with HPV 6 and 11 are not associated with cancer. Viral genome replication needs the help of host cell DNA-replicating machinery and forms new virion inside the host keratinocytes. Morphological changes of cervical cell are the sign of cancer development and can be detected by observation of a cervical smear. Detection of precancer cells and their removal can prevent tumor formation. Presence of viral genome (fully or a part of genome) can nearly always detected in precancer cells which may reduce the risk of HPV associate cancer development. HPV associated skin cancer is primarily due to UV light exposure.

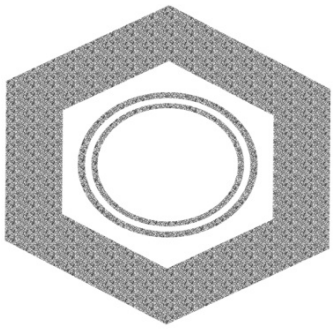

Figure 1: Human Papilloma virus (HPV); icosahedral symmetry

Epstein- Barr virus linked cancers:

Ubiquitously present Epstein Barr virus (EBV) is primarily associated with Burkitt's lymphoma. This virus was first observed in Burkitt lymphoma cell line and described by Denis Burkitt. Burkitt's lymphoma is tumour in immune B cell and the frequency of occurrence is very high in Central Africa. This virus can infect B cell as well as epithelial cell by changing its protein (Fernandes et al., 2020). This DNA virus associate lymphoma is a chromosomal rearrangement that results the replacement of c-myc gene. The relocation of c-myc gene is next to an enhancer region of an immunoglobulin gene. This rearrangement results the continuous expression of c-myc at abnormally high levels. In addition to Burkitt's lymphoma, nasopharyngeal carcinoma (NPC) is also associated with EBV. In both of these cases viral genome is present associatively with host tumour cell chromosome. Some other types of cancers have been found to have associations with EBV including Hodgkin's lymphoma, non- Hodgkin's lymphoma in AIDS and immunosuppressed patient (Fernandes et al., 2020).

Hepatitis B and Hepatitis C linked cancers:

Hepatitis B virus (HBV) and Hepatitis C virus (HCV) are implicated as causative agents for hepatocellular carcinoma (HCC) or liver cancer with remarkable mortality rate. Consumption of mould toxin, excess alcohol may also leads to develop liver cancer. The frequency of hepatocellular carcinoma is very high in Asia, central and southern Africa (Petruzziello 2018). In most of the HBV infection, the viral DNA genome is integrated into the host cell chromosome and undergone rearrangement or deletions. HCC is arbitrated by virus induced factors or host immunologic factors. Studies have reported that, HCV core protein affects oxidative stress metabolism. Viral proteins induces cell growth and division by modulating tumor suppressor gene function and cell cycle check point (Axley et al 2018.,). The HCV is only class IV positive sense RNA virus that is known to be oncogenic. HBV and HCV evoke immune responses when infects host body. Sometimes host immune response is able to eliminate the virus but in many cases the infection is persists for a longer time period.

Human T-lymphotropic virus 1 linked cancers (HTLV-1):

HTLV-1 is associated with adult T cell leukemia infection. South-west Japan have a high prevalence of T cell leukemia infection. HTLV virus is a retro virus. Each infected host cells have a copy of the viral genome integrated into the host chromosome.

Kaposi's sarcoma associated herpes virus (KSHV) linked cancers:

In 19th Century it was first identified that the tumour cells contain the viral genome DNA is unique and novel. Subsequently this virus DNA was isolated and named as Kaposi's sarcoma associated herpes virus. This virus infection is more prevalent in Central Africa and more frequent in homosexual men. This virus mainly affects gingiva, dorsal tongue, oral cavity and oropharynx. Multiple size lesion, enlarge and merged lesion is the sign of any stage of cancer development. Mostly it is associated with pain, bleeding and ulcerated but sometimes asymptomatic also (Fatahzadeh et al 2013.,) . Advancement of this infection from patches to plaque or nodular form may start immunosupression.

Sl No	Name of the virus	Type of Cancer
1	Epstein-Barr virus (EBV)	Stomach cancer, Hodgkin's and Non-Hodgkin's cancer
2	Hepatitis B Virus (HBV)	Hepatocellular Carcinoma (HCC)
3	Hepatitis C Virus (HCV)	Hepatocellular Carcinoma (HCC)
4	Kaposi's sarcoma associated herpesvirus (KSHV)	Kaposi's sarcoma
5	Human T lymphotropic virus 1 (HTLV- 1)	T- cell leukaemia and lymphoma
6	Human papillomavirus (HPV)	Anal,cervical, Head and Neck cancer, penile, throat and vaginal cancer

Table 1: List of oncogenic virus and the cancer type

Acknowledgment:

I am eternally grateful to Prof. S K Jha, Dr. Soumya Jal, Dr. Monali P Mishra, Mr. Sanjay Gouda and Senior Management team of Centurion University of Technology and Management for their constant and kind cooperation. Avery special thanks to Dr. A P Rath from reading early drafts to giving me advice.

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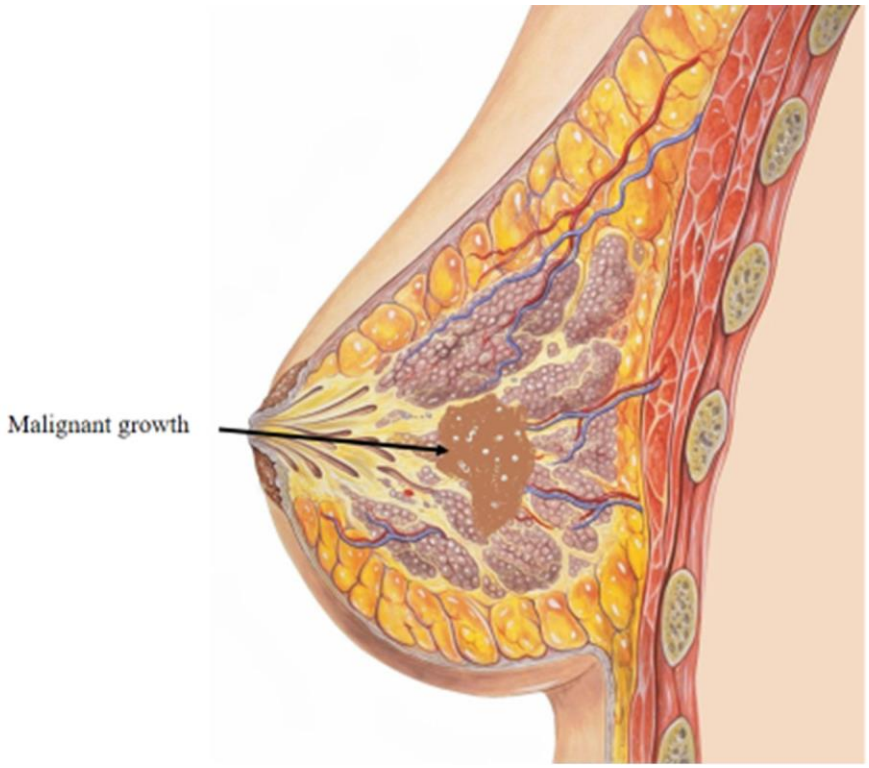
Imaging of Breast cancer

Manzoor Ali P.

Centurion University of Technology and Management, Odisha

Breast cancer is one of very common carcinoma. According to studies conducted, breast cancer is the second largest reason for the death after the cardiovascular disease. It can be a malignant or benign growth. If the breast cancer is able to diagnose early and treat the patient the survival rate will increases. Early diagnosis of the breast cancer is very important in treating and managing of breast cancer.



WHO classification of Breast Cancer

- Epithelial tumors
- Invasive breast carcinoma
- Rare and salivary gland type tumors
- Neuroendocrine neoplasms
- Epithelial - myoepithelial tumors

- Non invasive lobular neoplasia
- Ductal carcinoma in situ (DCIS)
- Benign epithelial proliferations and precursors
- Adenosis and benign sclerosing lesions
- Papillary neoplasms
- Adenomas
- Mesenchymal tumors
- Vascular tumors
- Fibroblastic and myofibroblastic tumors
- Peripheral nerve sheath tumors
- Smooth muscle tumors
- Adipocytic tumors
- Other mesenchymal tumors and tumor-like conditions
- Tumors of fibroepithelial
- Nipple tumors
- Lymphoma of breast
- Metastatic tumors
- Male breast tumors

Mammography

It is a radiographic examination of the breast. Breast screening is indicated in the patients above age of 40 years and above. There are many different projections in mammography. In the screening protocol of the breast usually contains two views. They are the carniocuadal (CC) and Medeolateral oblique (MLO). Once the screening of breast with these views shows some positive findings, then the patient should undergo other mammographic views includes point compression, magnification and lateral views etc.

Mammography lexicon

Mammography lexicon is a technique in which X-rays used to diagnose and locate breast cancer. Mammography lexicon includes the evaluations of the composition of breast, calcification,

asymmetry of breast, mass in the breast, distortion of breast architectural, and associated changes.

Breast composition

- Completely fat
- Fibroglandular density scattered
- Heterogeneous density
- Extremely dense

Mass

- Shape
  - Round
  - Oval
  - Irregular
- Mass
  - Circumscribed
  - Obscured
  - Microlobulated
  - Indistinct
  - Soicukated
- Density
  - Density low to fat
  - Density equal to fat
  - Density high to fat

Asymmetry

- Global
- Focal
- Developing

Architectural distortion

- Parenchyma is distorted with no any visible mass

Calcification

- Morphology
- Distribution

Associated futures

- Retraction of skin
- Retraction of nipple
- Thickening of Skin
- Thickening of trabecular
- Adenopathy of Axillary
- Architectural distortion

Breast Imaging-Reporting and Data System (BI-RADS)

There should be a standard methods for the assessment of the breast cancer. **BI-RADS** is the tool which is developed by the American College of Radiology. BI-RADS is a tool used in the assessment of the breast cancer. It is widely accepted reporting scheme for the breast cancer. In BI-RADS the breast imaging is divided in to seven assessment categories.

Those categories includes

BI-RADS 0:

- They are incomplete studies
- Additional evaluation is needed for the further evaluation
- Additional imaging includes ultrasonography and additional mammographic views

BI-RADS 1:

- They are negative
- The breast is symmetry, no presence of masses, calcifications and architectural distortions

BI-RADS 2:

- They are benign

- The probability for the malignancy is 0%

BI-RADS 3:

- Here the probability is for benign
- Malignancy probability is less than 2%
- Here short follow up suggested in short intervals

BI-RADS 4:

- Malignancy suspected
- The probability for the malignancy is 2 to 94%
- They are further divided
- Biopsy should be considered
    - **BI-RADS 4A:**
        - Low susceptible for malignancy
        - 2 to 9%
    - **BI-RADS 4B:**
        - Susceptible for malignancy is moderate
        - 10 to 49%
    - **BI-RADS 4C:**
        - Susceptible for malignancy is high
        - 50 to 94%

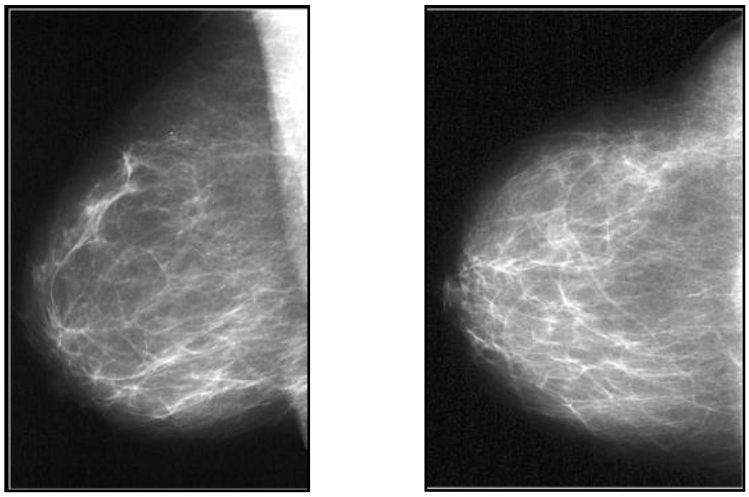
BI-RADS 5:

- Very highly indicative for malignancy
- More than 95%

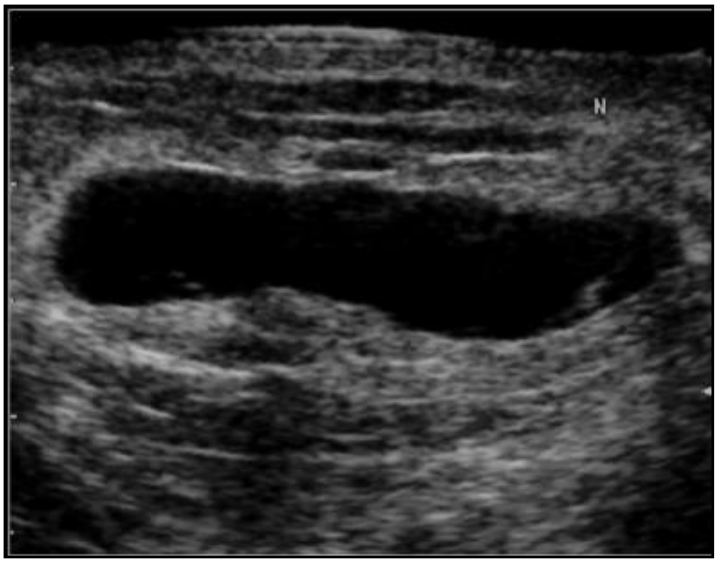
BI-RADS 6:

- Malignancy is confirmed by histopathological studies such as biopsy

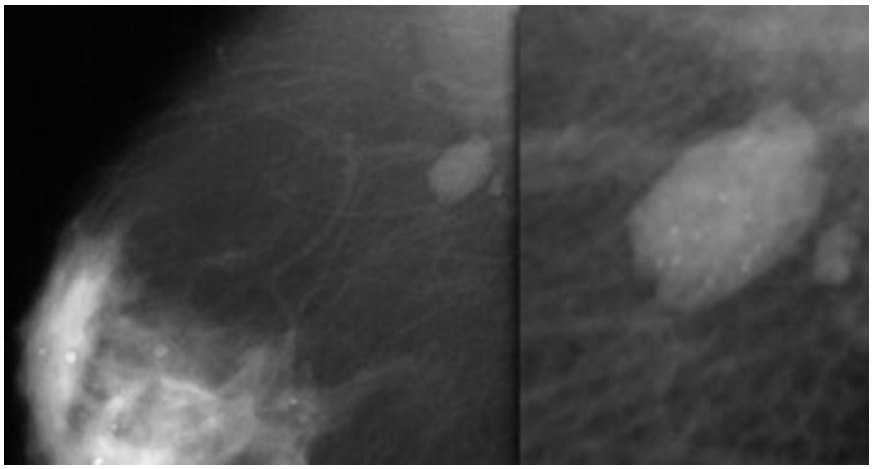
BI-RADS is used in the reporting of the breast cancer. After the evaluation of the breast images acquired by the imaging modality, the case put in to the suitable category. The patient should undergo for the biopsy if the lesion comes in BI-RADS 4.



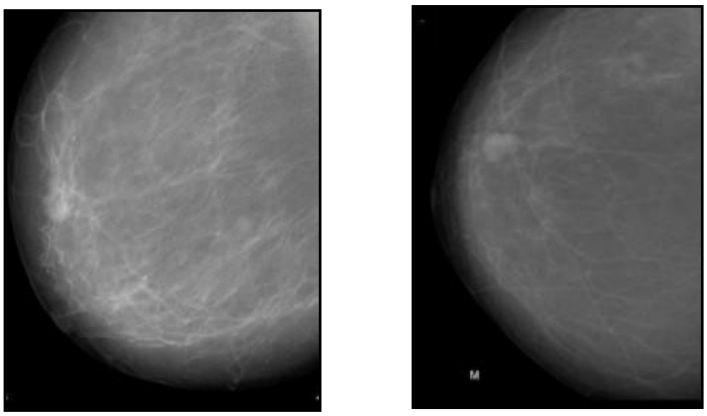
BI-RADS 1, mammogram normal



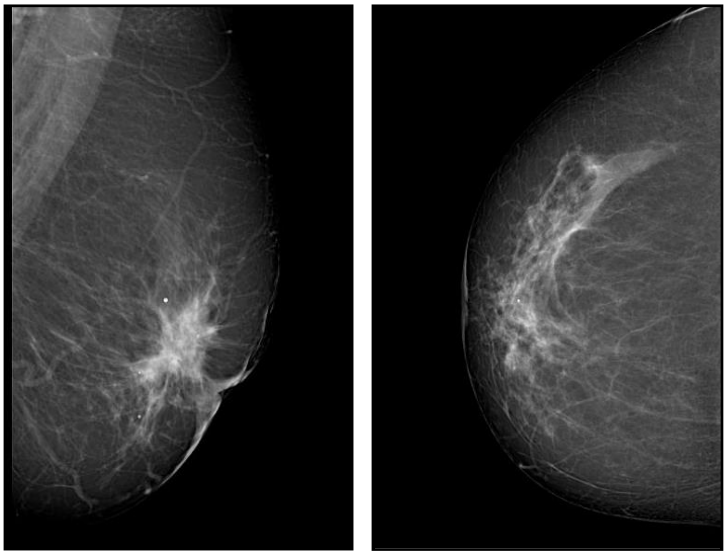
BI-RADS 2, Ultrasonography image shows cyst



BI-RADS 3, further follow up needed



MLO and CC mammography categorised the BI-RADS 4 mammographic lesion



BIRADS 5, Mammography shows highly suggestive malignancy

Table: BI-RADS Category and percentage for malignancy

BI-RADS group	Percentage for malignancy (%)
BI-RADS 1	0
BI-RADS 2	0
BI-RADS 3	2
BI-RADS 4	30
BI-RADS 5	97

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Clinical features of *Staphylococcus aureus*

Monali P Mishra*, Sunil K Jha
Centurion University of Technology and Management, Odisha

Staphylococcus aureus, a bacterium belongs to Staphylococcaceae family. These are Gram positive cocci arranged in grape like clusters. *S. aureus* are most clinically relevant organisms producing catalase and bound coagulase which enhances the breakdown of the beta-lactam rings of penicillin group of antibiotics and develops antibiotic resistance. *S. aureus* can cause suppurative wound infections with the disruption of the mucosal barrier of the cutaneous layer of the skin and get access to the underlying tissues or to the blood stream and cause infection. However, *S. aureus* is the most prevalent organism in the hospital and community settings. Individuals indewelling intravenous catheters and immunocompromised persons are at increased risk to get the staphylococcal infections.

In 1880, Louis Pasteur cultured *S. aureus* in liquid medium for the first time and Sir Alexander Ogston coined the term 'Staphylococcous' due to the appearance of the microorganism similar to a bunch of grapes under microscope.

Methicillin resistant *Staphylococcus aureus* (MRSA) is a considerable universal healthcare issue showing significant mortality and morbidity and increasing hospital stay costs. It has been reported that the prevalence of MRSA in a hospital setting has increased worldwide. The MRSA are two types, the strains associated with hospitals are known as Hospital Acquired MRSA (HA-MRSA) and strains associated with the community are called as Community Acquired MRSA (CA- MRSA). Septic shock, pneumonia, endocarditis, bacteremia, cellulitis are caused due to the invasive MRSA infection.

Development of MRSA

S. aureus became resistant to penicillin within a year from the introduction of the antibiotic. Then after, Methicillin was introduced as an antibiotic and the bacteria became resistant over the antibiotic in the year 1960. The strains which had developed resistance to common antibiotics like penicillin and cephalosporin groups are also collectively considered to be MRSA. However, these MRSA strains have some unique characteristic that, they can viable for 2-3 months in the surface or the environment and infects individual from the month of its initial deposition. Thus, it

creates the nosocomial infection in the hospital setting from an infected individual to a healthy adult and also transferred in the community. Then, MRSA strains started evolving around the world and acquired resistant over drugs like macrolides, flouroquinolones, aminoglycosides and after some years got resistance to trimethoprim sulfamethoxazole. After emergence of this kind od strain vancomycin was the drug of choice for the control of this MRSA. Soonafter, some vancomycin resistant strains were also reported and are a major clinical concern now.

Risk Factors for the Infection

1. Immunocompromised individual
2. Infants
3. Elderly people
4. Chronically ill person
5. Burn survivors
6. Organ transplant recipients
7. Cancer Patient
8. Diabetes Patient
9. Steroid users
10. Intravenous drug users

Clinical presentation

S. aureus causes a broad range of infection and all the organs of the body can be infected by this pathogen, mostly it is associated with the tissue destruction and severe pain even if in the abrasions or cuts formed due to small accidents or injuries. *S. aureus* strain cause pyogenic infections like cellulitis, abscesses, carbuncles, erysipelas etc. Sometimes infections with MRSA becomes more complicated and systemic causes purpura fulminans, pyomyositis, myositis, necrotizing fasciitis, osteomyelitis and pneumonia. The CA-MRSA infection spreads due to contaminated objects, crowding, where is lack of cleaniliness or no personal hygiene is maintained, when a healthy person come in contact with an infected person or his clothing or personal items, those persons with compromised skin , which leads to affect the community and creates epidemics.

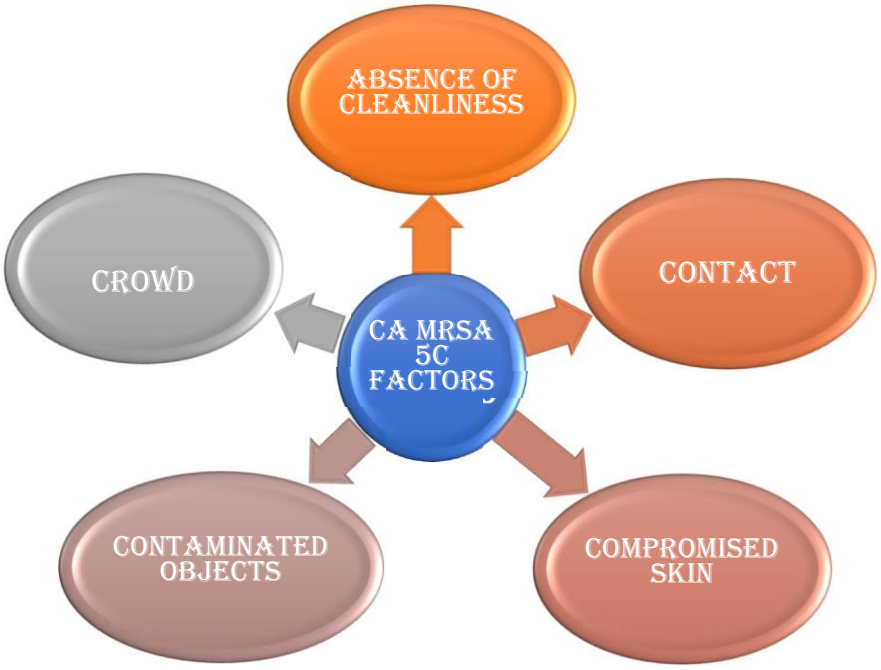


Figure 1: The 5Cs related to CA-MRSA Infection.

Toxins associated with *S. aureus*

Hemolysin

S. aureus produces 4 types of hemolysins i.e., α, β, γ and δ hemolysins. α-hemolysins are responsible for the lysis of RBCs by causing pathogenesis in humans. These hemolysins are produced by the coagulase-positive strains. Generally these toxins are leucocidal, cytotoxic and lethal to the host cells in nature and brings necrosis to the dermal cells. It is antigenic in nature and can be neutralized by the application of anti-toxin.

β-hemolysins is produced by the *S. aureus* strain isolated from animals and is produced in both aerobic and anaerobic conditions. δ- hemolysin is less toxic in nature and the γ- hemolysin is the weakest toxin among these 4 types.

Leucocidin

α-lysin is having leucocidal activity and its pantovalentine structure kills the polymorph cells and macrophages in humans. It is consisting of 2 heat and oxygen labile proteins known as F and S proteins.

Leukolysin is a thermostable toxin produced by *S. aureus*.

Enterotoxin

The staphylococcal food poisoning happens due to the enterotoxin produced by the pathogenic strain. The clinical manifestations associated with the infection are vomiting, nausea and diarrhoea. The symptoms will arise only after consuming infected or contaminated food material within or after 6hours of consumption. This toxin is heat stable in nature and can be neutralized by antitoxin. However, there are 6 types of enterotoxins are produced from A to F types.

Fibrinolysin

The staphylokinase produced by the *S. aureus* at the end of the growth phase causes lysis of fibrin. This condition leads to the cause of staphylococcal septicemia infection.

Exfoliative toxin

This toxin is the potent cause for the development of staphylococcal scalded skin syndrome. Two proteins are responsible for this syndrome and individuals can be protected from this syndrome by producing 2 specific antibodies.

Toxic Shock Syndrome Toxin (TSST)

Some of the strains of *S. aureus* produces TSST-1 which causes fever, shock, skin rashes in humans and affects other organ systems which leads to death of the individuals sometimes.

S. aureus also produces some other toxins like nucleases, lipases, proteases etc. The cell wall components like polysaccharides, peptidoglycan, teichoic acid and capsule act as the antigenic structure and along with the above said toxins are responsible for the virulent nature of the microorganism.

Enzymes produced by the *S. aureus*

Coagulase (free coagulase): it is antigenic in nature and has anti-phagocytic action. Along with the coagulase reacting factors converts the fibrinogen into fibrin as a resultant the clotting of human plasma cells occurs.

Clumping factors (bound coagulase): it is a heat stable protein which releases from the cell wall and released during the autolysis of the bacterial cell.

Phosphatase: It is produced by the coagulase positive strains.

Hyaluronidase: the strains causing impetigo contagiosa possess this enzyme.

Laboratory Diagnosis

Hematological investigation

(a) Total leukocyte counts: > 10,000 leukocyte cells per cubic mm.

(b) Differential leukocyte count: increase in neutrophil count i,e > 80%.

Bacteriological investigation

(i) For Smear examination, specimens like pus from suppurative lesions and sputum from respiratory infections are used for study. In case of food poisoning fecal matter, contaminated food sample is used for the smear study. The smears are stained with Gram staining method and observed under microscope which shows Gram positive cocci arranged in clusters.

(ii) Isolation of organism: The collected specimen is plated on nutrient agar and Blood agar media, after incubation there will be golden yellow and beta haemolytic colonies grow in media plates respectively. The isolated colonies are used for the coagulase production by slide and tube coagulase test methods for the biochemical identification. The cultures are also tested for catalase production and fermentation of sugars.

(iii) Other tests used to diagnose the pathogen are the bacterio phage typing, antibiogram, plasmid typing, ribotyping, and DNA finger printing.

Treatment

The antibiotic for the treatment is chosen based on the antibiotic sensitivity testing report. Benzyl penicillin is an effective drug to control the pathogen. But some of the strains are producing penicillinase and get resistance to penicillin. Methicillin, coxacillin is used against the penicillinase producing strains. As the development of MRSA is now a common clinical issue , Vancomycin is the perfect drug of choice to control this multi drug resistant pathogen.

Hepatocellular carcinoma and radiological features

Manzoor Ali P.

Centurion University of Technology and Management, Odisha

Hepatocellular carcinoma (HCC) is a major and frequent malignancy affected by liver. HCC is the liver cancer which is accompanied by the liver cirrhosis. Cirrhosis resulted from viral aetiologies and alcohol. Hepatitis B infection causes the HCC. Approximately five percentage of cancers due to pandemic rates of Hepatitis B infections are HCC [(1)]. In the list of most common cancer affected, HCC is in the fifth place. HCC also in the top lists of cancer which lead to most death of patients caused by cancer after the stomach and lung cancer. HCC become the third cancer which lead to most number of person to death.[(2)]

Clinical history

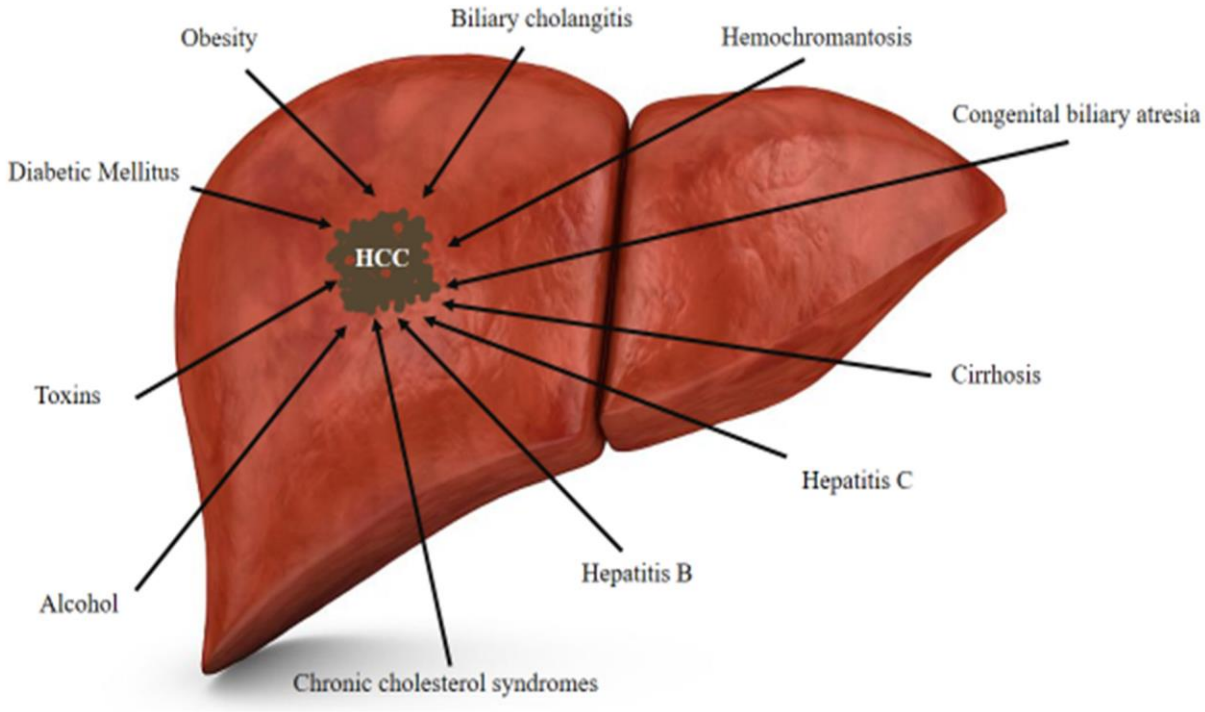
- Jaundice
- Hepatomegaly
- Portal hypertension
- Haemorrhage from the lesion

Risk factors of HCC

- Hepatitis C (30%)
- Hepatitis B (10%)
- Hemochromantosis (20%)
- Alcohol (8%)
- Biliary cholangitis (5%)

- Obesity
- DM
- Chronic cholesterol syndromes
- Food toxins
- Congenital biliary atresia

To diagnose and evaluate the HCC imaging modalities plays a great role. Contrast Enhanced Computed Tomography (CECT) and the Contrast Enhanced (CE) Magnetic Resonance Imaging (MRI) are used to diagnose the HCC. CECT and CE MRI are able to detect the early HCC related hepatic chnages.



Radiological diagnosis

Hepatic nodules seen in ultrasound which are less than 1 cm cannot be diagnosed HCC. Those lesions should be follow up with repeat ultrasound scan in 3 to 4 months. Liver nodules

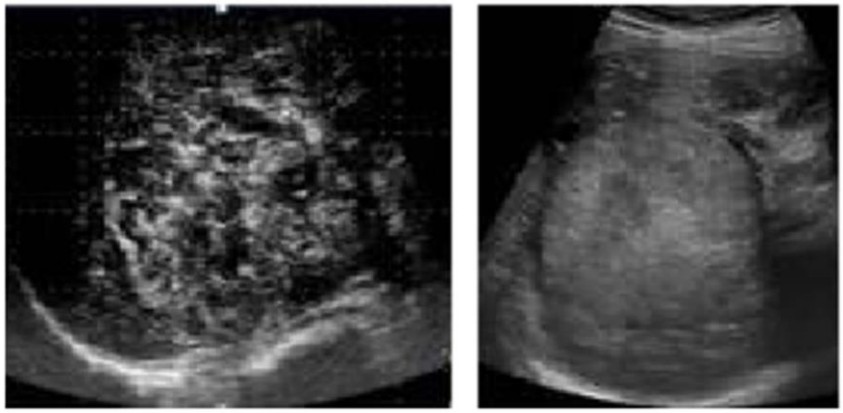
more than 1 cm diagnosed with the ultrasound should have further radiological investigation with the computed tomography or MRI. CECTs and contrast enhanced MRI shows the contrast enhancements of the HCC. As HCC receives majority of its blood from the hepatic artery branches, there will be early enhancement and immediate washout of the lesion [3,4].

Ultrasound

Appearance of HCC in ultrasonography is depends on the lesion size and background liver echogenicity

Typical appearances includes

- Small HCC lesions appears hypoechoic while compare with liver
- Larger HCC due to fibrosis, necrosis, calcification and fatty changes appears heterogeneous



HCC Appearances of HCC in ultrasonography

CECT Abdomen

CECT studies has a major contribution in the diagnosis of the HCC. In CECT scan the liver is scanned with different phases which includes arterial, portal, venous and delayed phases. Each of these phases will shows the different types of enhancement of the HCC. A major portion of the blood perfusion to the HCC is done by the hepatic artery. Hence there will be early enhanced HCC in the arterial phase and immediate washout of the HCC in the following phases such as

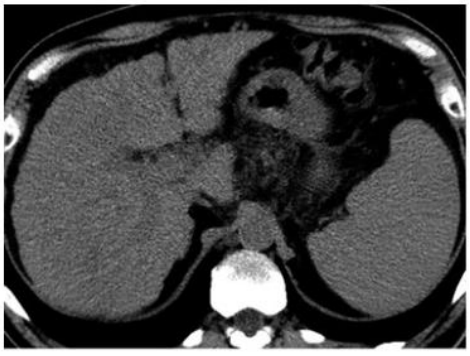
portal and venous phase. CECT protocols should optimised according to the enhancement of the HCC lesion in the arterial phase [5, 6].

CT image characteristics includes

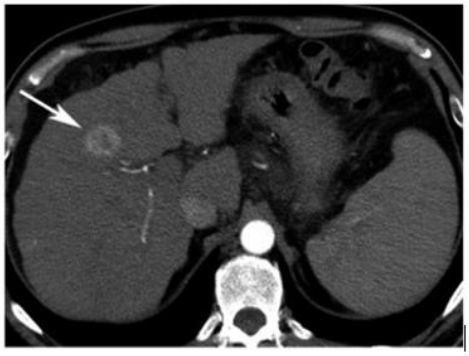
- HCC lesion enhances in arterial phase
- Rapid washout
- Hypoattenuating compared with normal liver area attenuation in portovenous phase or delayed phase

Rapid washout has 95 to 96 % specify in the diagnosis of HCC [7, 8]. Absence of rapid washout never promise absence of HCC, it may appear isointense or hyperintense during portal phase [9].

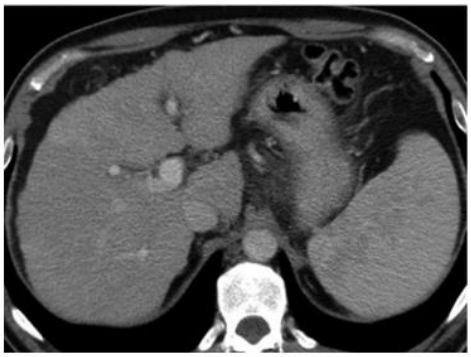
Case (1)



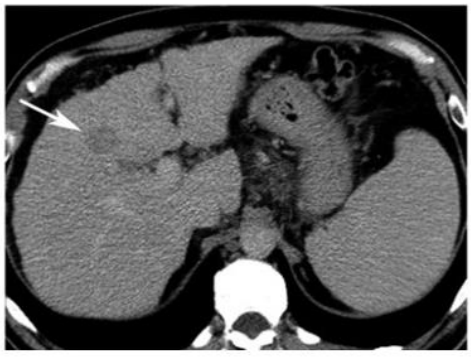
Non contrast image no enhancements



Late arterial phase shows enhancement



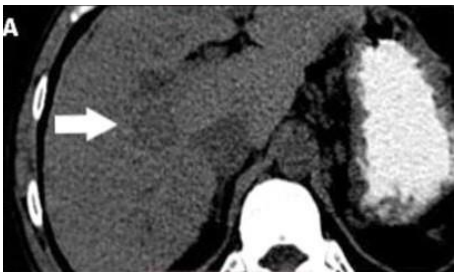
Venous phase no enhancement



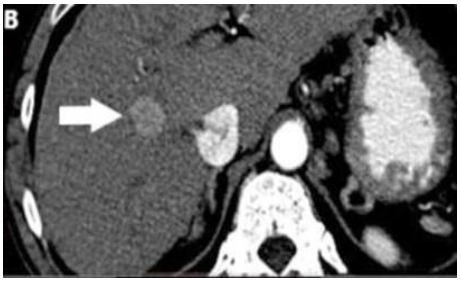
Delayed phase no enhancement

HCC is characterised by combination of late arterial hyper-vascularity and washout.

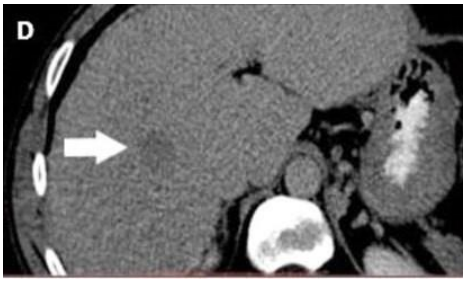
Case (2)



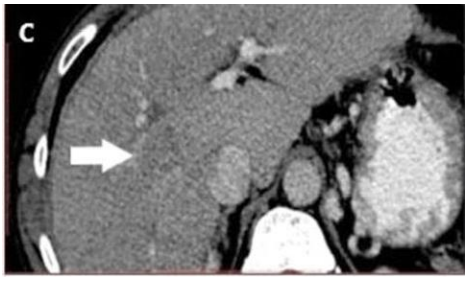
Pre-contrast image with no enhancement



Arterial phase image shows enhancement



Venous phase shows no any enhancement



Delayed phase shows no any enhancement

Magnetic Resonance Imaging

Recent studies done in the diagnosis of the HCC concluded that MRI has the ability to pick up small HCC lesions and high per lesion sensitivity with respect to CT. Those studies suggest that MRI must be the preferred primary diagnosing modality for the imaging of HCC especially the patients who with the long term liver disease [(10)]. MRI uses different sequences for diagnosis.

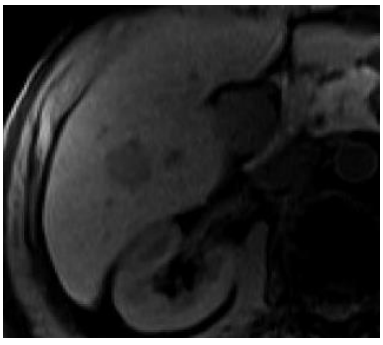
Radiological appearances of HCC in MRI

- T1w sequence
  - Cystic fibrosis seen iso or hypointense surrounding liver
  - T1 it may appear hyperintense due to decreased surrounding liver intensity and intra-tumour fat
- T2 w sequence
  - It is variable, most cases can be seen moderate intensity to hyperintense
- T1 fat saturation with contrast (gadolinium)
  - Arterial phase lesion enhancement seen
  - Rapid washout (96% specific)
  - Rim enhancement may seen in case of pseudocapsule
- DWI
  - Show hyperintense intra-tumour

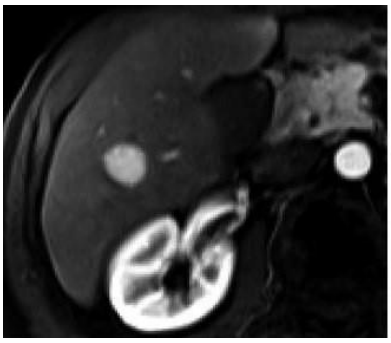
Gadolinium Ethoxybenzyl MRI (Gd-EOB-DTPA)

Gd-EOB-DTPA MRI is very sensitive to early changes of the HCC. Once these contrast agents pooled to the hepatocytes they are excreted through liver and kidney. Once they reach liver excreted through biliary duct system. With a approximate time of 6 to 20 minutes after the injection liver demonstrate in diffuse hyperintense. The nodules of HCC are lacking the hepatocytes and normal liver parenchymal cells, it makes them in hypointense.

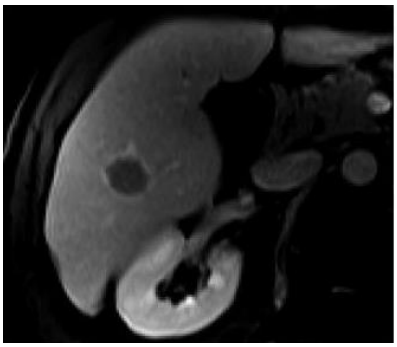
Case (3)



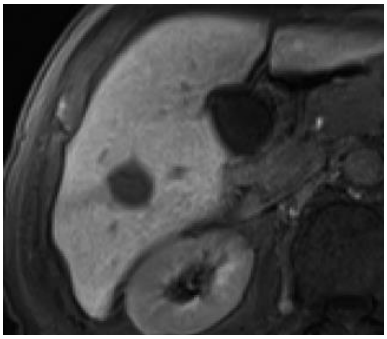
Pre- contrast T1w immages shows no any enhancements



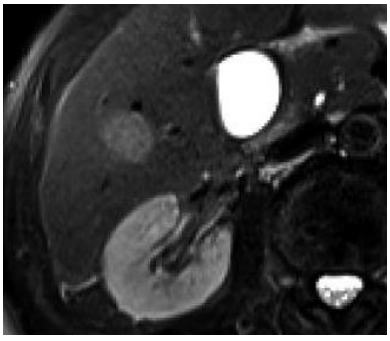
Post contrast arterial phase T1w image shows contrast enhancement



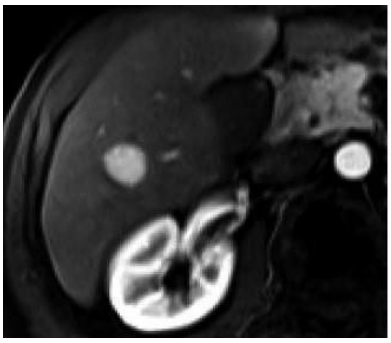
Transitional phase shows rim enhancement with non enhancing lesion



Hypointensity noted in the hepatob



T2w image shows hyperintensity of the lesion



Diffusion shows high signal intensity of the lesion

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Clinical features of *Streptococcal* Sp.

Monali P Mishra*, Sangita Patra

Centurion University of Technology and Management, Odisha

INTRODUCTION

Streptococcal infecton is an infection caused by streptococcus species which is a gram positive coccus .the shape of the bacteria is spherical or round with 10 um of diameter. *Streptococcus* bacteria belongs to the famly streptococcaceae, order of the bacteria is lactobacillales and in the phylum firmicutes. They are found in pairs and chain like structures because the cell division of streptococcus occurs in a single axis. The chain like structure of streptococcus may appear as bent or twist. There are many strains of streptococcus that lives naturally in an individual and do not show any symptoms. *Streptococcus* are important pathogen of human that cases pyogenic infection,this infection have characterstics tendency to spread.This type of coccus can cause non-suppurive lesions such as ARF[Acute Rheumaic Fever]and glomerulo nephritis.At the time of microbiological investigation, it is required to add some carbohydrate that must be fermentable(eg;glucose), blood or serum.They do not grow properly in simple media.

CLASSIFICATION

Streptococcus are classified as for their oxygen requirement first one is aerobic and facultative anaerobes and second is obligate anaerobes i.e eg is peptostreptococci. Further aerobic and facultative anaerobes classified as per their hemolytic activity that is alpha hemolytic, beta hemolytic, gamma haemolytic these three haemolytic reaction appearing blood Agar when streptococcus is investigated in laboratory obligate anaerobes are non sporing anaerobes

A. Alpha haemolytic *Streptococci*

due to partial haemolysis this caucus produce greenish discoloration around the colonies the size of the zone of innovation is about 1 to 2 mm wide this can be observed under microscopically two types of streptococci shows Alpha hemolytic properties these are Streptococcus pneumonia and viridians streptococci.

B. beta haemolytic *Streptococci*

in case of Beta haemolysis the blood Agar media will so clear colorless zone of complete hemolysis that is (2 to 4 mm in diameter) around the colonies. Here erythrocytes are complete lysed ,that is due to the production of two types of streptolysin by the organism 'streptolysin O' and 'streptolysin S' *Streptococcus pyogenes* is the pathogenic bacteria that produce beta haemolysis in blood Agar.

C. Gamma haemolytic *Streptococci*

in this case there is no production of haemolysis *Streptococcus faecalis* is a typical example

Classifications based on antigenic structure:

the beta hemolysis producing Streptococcus classified by Lancefield group [A,B,C,D,E…….,S,T,U,V]. Among the Streptococcus pyogens, Viridans streptococci, enterococcus, Group B streptococci, Group D streptococci, are pathogenic to human.

***Streptococcus pyogens**:*

Streptococcus pyogens are spherical or oval, 0.5 – 1.0 micrometer in diameter and arranged in chains. These are gram positive, non-motile and non-sporing. Some strains of *Streptococcus pyogens* are coated with capsules that composed with hyaluronic acid. As these are aerobic and facultative anaerobes, they can grow properly at 37°c. for the better and fastidious growth of the bacteria blood serum or sugar is added to the medium. *S. pyogens* after overnight incubation, it will show 0.5-1.0 mm in diameter of colony, pinpointed, round or circular, semitransparent, low convex with a wide zone of beta hemolysis around them. Blood agar is an enriched media also a selective media for streptococcus because blood agar contains 1:500,000 crystal violet which permits growth of streptococci but inhibit other bacteria especially staphylococci. The hemolysis that produced by blood agar is promoted by the presence of 10 % co2 in the environment. Streptococcus pyogens will show negative in catalase test and not soluble in 10% bile after chemical investigation. *S. pyogen* is a delicate organism, inactivated at 56°c temperature for 30 minutes. It dies in culture medium but it can be stored in Robertson's cooked medium at 4°c.

Group B *Streptococci*:

Streptococci agalactia is the example of group B Streptococci. It has been recognized as the

single pathogen in neonates causing neonatal septicemia and meningitis. The habitat of this bacteria is female genital tract from where bacterial infection in neonates occurs. There are many other diseases caused by group B infections in neonates includes oestrogenitals, arthritis, conjunctivitis, respiratory infection, endocarditis and peritonitis. There is another test to identify group B is the CAMP reaction [Christie Atkins And Munch Peterson], that can be demonstrated by the production of an accentuated zone of hemolysis (as butterfly appearance).

Group D Streptococci:

Enterococci [fecal streptococci] and non-enterococci [non-fecal streptococci] belongs to group D. There are many strains have alpha and beta hemolytic properties but these group D streptococci are non-hemolytic in nature. The enterococci group has been reclassified as a separate genus called enterococcus. The Group D streptococci may cause Genito-urinary Infection or endocarditis rarely.

Enterococcus:

This also belongs Group D streptococci as they contain the same antigen as that of group D in streptococci. Enterococcus commensal in human intestinal tract and possess. Some distant properties as follows

- Enterococcus will show positive for bile aesculin hydrolysis test.
- Enterococcus is usually heat resistant and can withstand heat at 60°c for 30 minutes.
- They have the ability to grow in the presence of 6.5 % sodium chloride.
- They will show PYR test positive.

These bacteria appear as tiny deep pink colonies on MacConkey Agar and in gram stain it will arranged in pairs of oval coccus and short chains.

Viridians Streptococci:

On Blood agar these types of streptococci produce alpha hemolysis. It produces greenish discoloration on blood agar medium that why it is called Viridans streptococci[viridis meaning green.This groups of streptococci mainly found in mouth and upper respiratory tract.
These are mainly non pathogenic but on occasion it can cause dsease accidently.

RISK FACTORS:

Streptococcus pneumoniae have greater risk factors for children and aged i. e above 60 years individuals as they have low immune power. It has been recognised that more than 50% higher in children more than 2 years of age and more than 65 years of age in adult. Streptococcus pneumoniae is mainly seen in man rather than women as their lifestyle differences such as smoke cigarette and drinking alcohol. Streptococcus pneumoniae is a bacteria that causes pneumoniae in immune compromised individual such as AIDS(Acquired immune deficiency syndrome).

Those individual are habitual with drinking alcohol have an increased hazard for a strong desire. Due to the presence of ethyl alcohol in alcohol can cause lower neutrophiles count and decreased germicidal activity in human body.

Streptococcus pyogen causes pyogenic infection i.e produces pus in wound so whenever an individual directly contacted with the infected person having pus containing wound they can be higher risk factor for streptococcus pyogenes.

The streptococcal pharyngitis is usually contaminatd by direct contact with mucus or sores of someone else with streptococci.

Streptococcus can also cause many other types of disease such as rheumatoid arthritis in both children and adult individuals, septicemia or sepsis in children, endocarditis, pneumonia, pharyngitis, skin infection and wound. It is also responsible for the disease such as rheumatic fever, glomerulonephritis, and scarlet fever,myonecrosis and streptococcal toxc shock syndrome[strep. TSS]

TOXIN:

The toxins that produces by streptococcus are

1. Hemolysins
2. Pyrogenic exotoxin[Erythrogenic Toxins]
3.

1. **Hemolysin:**

Streptococcus produces two types of hemolysin toxin these are streptolysin ‘O’ and streptolysin ‘S’. due to oxygen labile streptolysin O is named as for this characteristics. It lyses read cells and also act as the cytotoxic for neutrophils platelets and Cardiac tissue.In case of streptococcal

infection antistreptolysin O regularly appears in Sera and it is antigenic. Streptolysin 'S' is an oxygen stable hemolysin and is responsible for the hemolysin that seen around the colonies in blood agar plate.

2. **Pyrogenic exotoxin[Erythrogenic Toxins]:**

In case of Scarlet fever this toxin is responsible for causing rashes in skin. Lysogenic strains of group A streptococcus produces this toxin. It is renamed as streptococcal pyrogenic exotoxin [Spe].

SITE OF INFECTION:

This group of streptococci mostly found in the skin wound, mouth, gut and genital region.

Group A streptococcus(GAS) are bacteria that are generally found in the throat and on the skin. The majority of GAS infections are usually mild illness such as streptococcus throat or streptococcus pharyngitis and impetigo.

These streptococcal infection affects various areas of the body including the throat, middle ear, sinuses, lungs, skin tissue under the skin, heart valves, endocardium, and blood streams. Symptoms and signs that appears in the site of infection include redness, pimple like lesions and painful swollen tissues, sore throat and a rash, depending on the area affected.

LABORATORY DIAGNOSIS:

There are various types of test performed to identify streptococcus species.

These are:

1. Haemtological Investigation:
   - Those individuals are infected by streptococcus they will show increased level of total leukocyte count.
   - In differential leucocytes count, there will be increased neutrophil count i.e. polymorph neutrophil may constitutes more than 80 percents.
   - ESR [Erythrocyte sedimentation rate] will be raised in case of Rheumatic disease.

2. Bacteriological Investigation:
   - Specimens that collected for bacterial investigatation includes- Throat swab, nasopharyngeal swab, pus swab, sputum, CSF, blood etc.
   - After collection of specimen, the specimen will undergoes in smear preparation and then stained with Gram Stain. In microscope, Gram positive cocci are arranged in chains.

- Culture: Blood agar media or Crystal violet blood agar media is often used for culture of streptococcus. Took a loopfull of specimen and inoculated on the blood agar media then incubate at 37°c overnight. After incubation the colonies appears as a pin pointed eased colonies showing beta haemolysis. Make smears from colony heat fix the smear, stain with Gram stain after then put an oil immersion observe under the microscope.

3. Serological Test:
   - Serological test mainly performed to confirm occurrence of rheumatic disease. Anti streptomycin 'O' is a toxin that mostly found in patient having rheumatic disease.

4. Skin Test or Dick Test:
   - This test generally known by Dick Test. Those individuals having Scarlet Fever they are sensitive to this Dick test.
   - 02 ml of erythrogenic toxin is injected intradermally on the forearm and same amount of heated inactivated toxin injected on the other forearm.
   - A bright red rash appears within 6 hours and became maximum within 24 hours, there after these fades away and in control forearm does not show any reaction.
   - If the individual does not produce any reaction in test forearm then this test refers as positive as it indicate that the person have no immunity to scarlet fever, A negative reaction means presence of immune power in human.

TREATMENT & PROPHYLAXIS:

- To treat this hazardous infection that caused by streptococcus bacteria the physician must advice the individual to perform the test such as throat culture.
- People who have rheumatic disease they are at higher risk of reoccurrence of group A streptococcal infection i.e. streptococcus pharyngitis.
- These people must continue their antimicrobial prevention against reoccurrence of disease. Penicillin is an antibiotic that very sensitive towards reoccurrence of disease.
- Penicillin is referred as the drug of choice for streptococcal infection. If some strains of streptococcus resistant to penicillin then they should advised to take sulfonamide and several antibiotic to treat streptococcus.
- Antitoxic serum was used to be administrated effectively in scarlet fever.

Ocular manifestation of cancer: retinoblastoma

Arup Saha

Centurion University of Technology and Management, Odisha

Introduction to cancer and intraocular cancer:

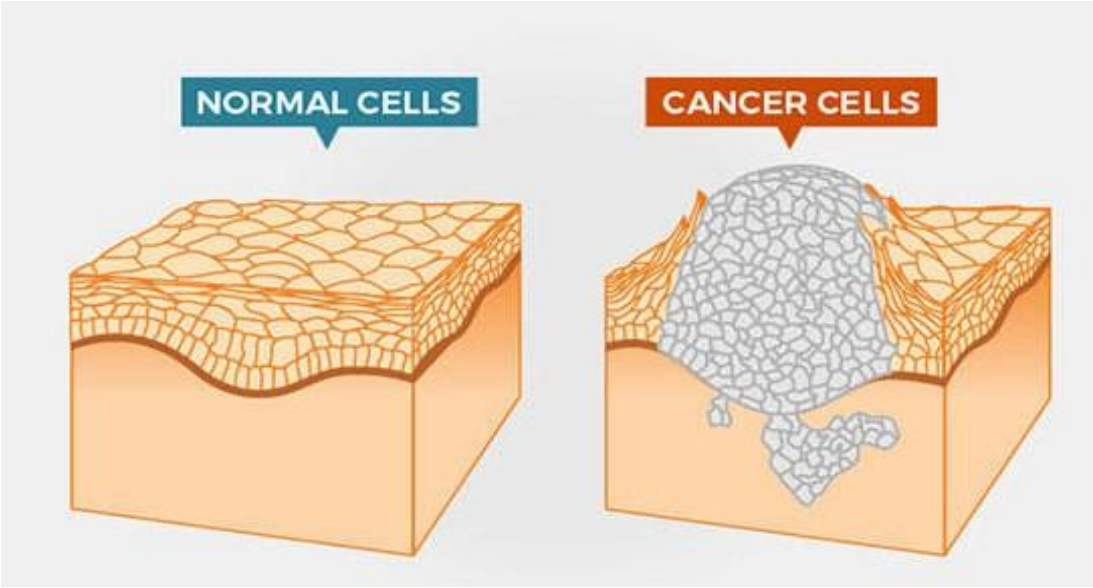
Cancer is nothing but abnormal growth of cell and tissue inside our body which can be acquired or can be genetically inherited. Normally cell division is very natural when one cell is divided and can make numerous cells. Cell and all characteristics about its nature, shape, structure, function, growth and degeneration, duration of life all are programmed inside genetic code. But in some cases, cell grows and mutation occurred within its genetic body so that abnormality happened in its growing stage and divided into trillions of cells with abnormal characteristics and transform into tumor. Normally tumor is not always cancerous here it is further classified as malignant and benign tumor. Sometimes it may occur anywhere in our body (locally) and sometimes also can be transferred from one place to another via connective tissue like blood and lymphatic circulatory system. The process of transfer of cancerous cell from one part to another is named as metastasis and such types are called as metastatic cancer.

When cancer cell growth take place inside ocular cells and ocular nervous layer named as intraocular cancer .It is vision threatening and in sometime if it spread to whole over body via circulatory system then it can be life threatening also./ Various types of ocular cancer we can see in clinical practice like Melanoma, lymphoma etc and retinoblastoma is quite common among most intraocular cancer patient study.

Formation:

Naturally body cells divide it into numerous cells for growing and when one particular cell is dead then that dead cell is replaced by another new cell made by cell division process. Tissue is made up with numerous number of body cell and several numbers of tissues made an organ so cell division plays a very important role when cell is the functional and structural unit. Cells characteristics like its functions, shapes, size, growth, life time, degeneration and destruction all are controlled by genetic coding .Each and every cell contents gene inside it and it can control cells activity and generally mutation is happening every time among genes but small mistakes are always corrected by the cells but in some time when its

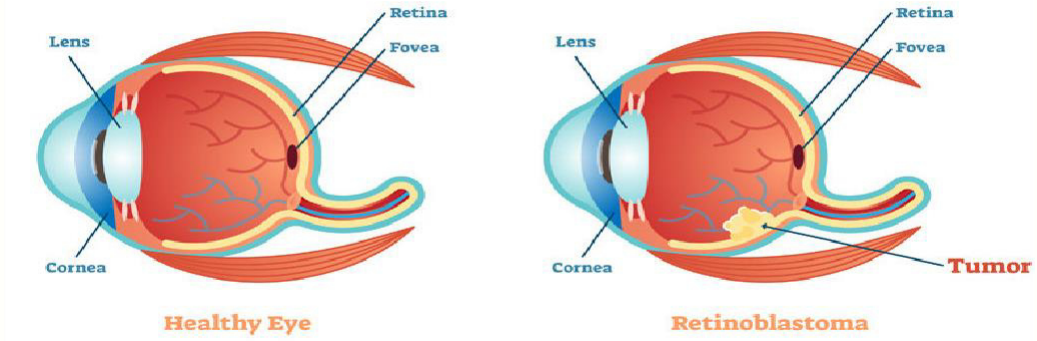
failed to control its activity in growing then here is a chance to develop cancer cells. Generally gene mutation can be occurred by irregular life style, excessive smoking, intake of toxic substances, drug abuse, excessive intake of alcohol, exposure to pollution and polluted environment, presence of free radicals inside our body etc. Also abnormal gene mutation can be happened by genetically inherited characteristics. However In case of abnormal cell growth it generally grows very faster than the normal cells and transformed to tumor. Tumor can be cancerous and also can be non cancerous also. Malignant tumor can any time converted to cancer cells which can grow like large tissue masses .Benign tumor generally not invade nearby tissues but grow rapidly to form a large cell masses. Cancer cell or tumor not only solid all the time but can also took place in blood stem also like leukemia's. It may affect nearby cells and tissues also. Cancer cell can be stable to one specific location but in later stage it may travel to another part of the body also which is far from cancer origin cells and tissues. This is named as metastatic cancer. Cancer status can be demonstrated with number of stages depend on its proliferation and malignancy. Therapeutically Radiation, heat, chemotherapy, surgically removal of cancerous cells etc normally used to do to control of cancer. Sometimes cancer can be recurring issue so that follow up is necessary.

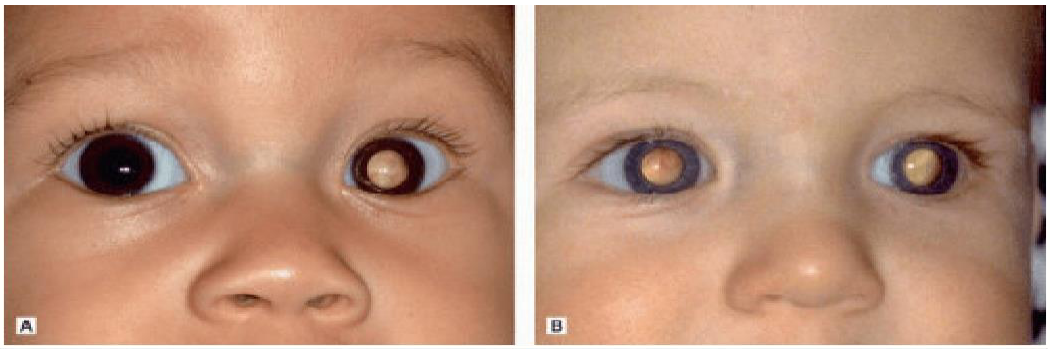


Here is some discussion about retinoblastoma which is common among intra ocular cancer cases, can be found in clinical optometry practice.

Retinoblastoma :

Retinoblastoma is an example of eye cancer which can be intraocular and also can be extra ocular. Generally cancer cell developed inside the eye and at the later stage due to metastasis it also can affect the extra ocular part also. It can affect in any ages but normally occurred to pediatric patient within 2 years old. It can be occurred in one eye (unilateral problem) or both eye (bilateral problem) also. Retinoblastoma can be inheritable and also can be non inheritable. In case of non heritable retinoblastoma one eye is affected. But treatment need to carry on for both eye until it is verified that it is non inherited .So in case of pediatric patient work up, parents and family history is very necessary to ruled out existence of retinoblastoma. On the other hand genetically inherited retinoblastoma may increase chance of developing trilateral retinoblastoma which is actually brain tumor. Retinoblastoma occurred due to mutation of RB1 gene. This type of mutation may be inherited genetically so gene test is also necessary here. At the later stage it also may increase risk of pineal tumor. In such cases white pupil can be seen with red reflex named as cat's eye reflex. Retinoblastoma further classified into Intraocular, extra ocular, recurring and progressive retinoblastoma etc.





Cat's eye reflex

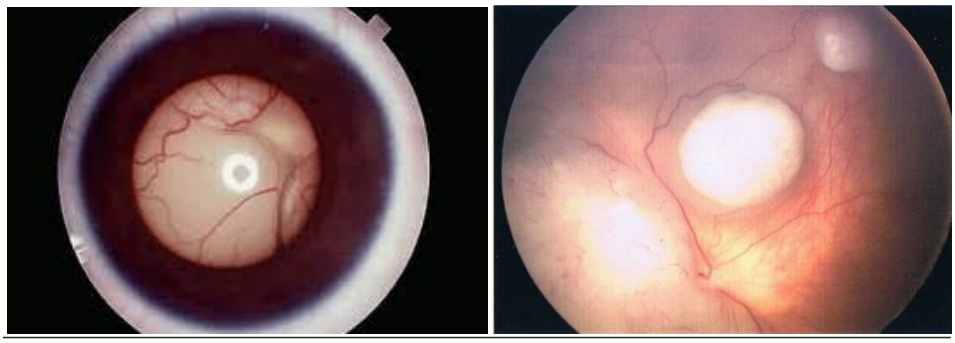
Investigation:

Following investigation need to perform to clinically investigate Retinoblastoma,

(1) General health examination and history taking: Physical examination and family history is very necessary because retinoblastoma can be inherited so both eyes can be affected for abnormal gene mutation and later stage it also can be metastatic so that it may travel to another parts also to spread. Need to investigate about signs symptoms of any lump formation anywhere in the body, existence of swelling, painful swelling, infections etc.

Previous treatment history, medication history and current medication history, allergy history induced by drugs, any history of intake of toxic substances like methyl alcohol all need to ruled out by history taking.

(2) Dilated eye examination: Mydriatic drugs, cycloplegic medicated dilator drops used to dilate the pupil so that posterior segment investigation can be performed. Retinal nerve fiber changes, cup disc ratio, blood vessels, optic nerve etc need to investigate .Direct and indirect ophthalmoscope performed for clinical examination for eye posterior segment examination, Fundus fluorescein angiography (FFA) performed to do broad spectrum retina as well as posterior segment investigation .Normally sodium fluorescein dye is injected through intravenous route then retina need to observe in blue light and need to observe fluorescein green appearance emitted from by the dye absorbed by blood vessels inside retina, optic disc , We can observe nature, shape , color , blood flow and any other changes in the blood vessels.

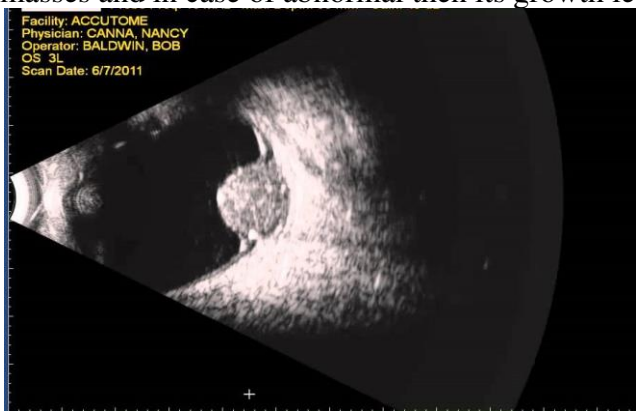


Gene test :

RB1 Gene test is very necessary for retinoblastoma patient investigation because in most of the case retinoblastoma is a genetically inherited. So before treatment we need to know that is that abnormal mutation occurred that is genetically inherited or not. In case of genetically inherited problem retinoblastoma may be occurred on both eyes. So patient should be under observation and treatment for both eye until this is proved that this is not genetically inherited.

B scan test:

B-scan is ocular ultrasound test by which we can understand about current status about tissue structure inside eye. After local anesthesia done by anesthetic drops then high wave ultrasound is used here which normally generated by small ultrasound probe then it get reflected back from the inner tissue structures and the nature of reflection of that rays which we can observe by computer display helps to measure the condition of structure weather it is normal or any abnormal tissue masses and in case of abnormal then its growth level, surfaces location etc we can understand.



Beside this NMRI means nuclear magnetic imagination system using magnetic field with radio wave used for inner tissue layer and surface nature investigation.

Eye cancer and stages :

STAGES OF CANCER:

Stage 0:

Tumor is inside the eyeball only and treated none surgically without removing eye.

Stage 1: Tumor occurred within the eye ball only and surgically eye ball is removed and no any other cancer cell remaining.

Stage 2: Tumor growth seen only inside the eye ball and eye ball is eliminated surgically but still cancer cell is remaining only can be seen under microscope.

Stage 3: Stage 3 is further divided into another 2 stage.

Stage 3a (Eye cancer spread within eye cavity and orbit only)

Stage3b (Eye cancer proliferated to the ear and neck also)

Stage 4: Stage 4 is also divided into two stages

Stage 4a (Eye cancer spread to the various parts of the body like liver, kidney)

Stage 4b (Eye cancer proliferated to brain and spinal cord)

Prevention and treatment

Retinoblastoma can be treated by Chemotherapy, heat therapy, therapy with radioactive rays, surgically extraction etc. Actually, it depends on cancer proliferation stages. In case of early stages cancer can be treated by radiation therapy or chemotherapy to destroy the cancer cells but in case of more proliferation surgery is necessary to eliminate that cancerous part of the body to avoid the chance to spread to the brain and spinal cord.

Prevention:

That is very difficult to prevent cancer but we can reduce chances by following some rules given below;

- Need to stop or control smoking so that it reduce amount of free radical inside our body
- Sun beam is good for health because it enhances vitamin d process but also harmful due to ultraviolet rays .so need to avoid excessive exposure to sun.
- Need to have healthy food so that it may boost our immunity system

- Physical exercise is necessary and keeps our body fitness active and reduces chance of obesity.
- Alcoholism is very bad and should be controlled strictly.

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Vitamin deficiency: ocular manifestation

Arup Saha

Centurion University of Technology and Management , Odisha

Introduction:

Vitamin is very necessary for our body for normal growth, nutrition, immunity power, metabolism, muscular body growth, strength of bony structure, nerve function such as sensory stimulations, receptor function, motor function etc which are very essential for our day to day activity. We normally can get vitamins by having healthy foods which are enriched with vitamins but normally we need very small amount of this and in case of excessively increased amount in the body here can be chance for toxicity also. There are various types of vitamins and absence of any components may cause severe diseases and malfunctions in normal growth, metabolism and nerve malfunctions etc. In some case it works as bio-catalyst which helps in metabolismactivity by acting as co-enzyme. In case of very high temperature, during cooking with heat, excessive presence of sun rays and in high basic environment quality and efficacy of vitamin can be decreased. We can get vitamins from green and yellow vegetables, fruits, small fishes but vitamin d can be processed in our skin by presence of sun beam.

Vitamins is also very necessary for our Ocular health also as ocular system is connected with central nervous system (brain and spinal cord) as it enriched with many nerves, photoreceptors cells,ganglion cells nerve fiber layer functions, lots of motor and sensory functions as well as reflex arc etc. So, in case of deficiencies lots of ocular malfunction may occur.

Classifications:

Vitamin can be classified into

(1) Water soluble

(Vitamin B complex which can be further classified as Thiamine known as B1, Riboflavin known as B2, pantothenic acid known as B3, Niacin or nicotinic acid known as B5, pyridoxine known as B6 as well as folic acid, cyanocobalamin known as B12, biotin known as vitamin H etc).

And vitamin c **(ascorbic acid)**

(2) Fat soluble

Vitamin A (Retinol), Vitamin D (cholecalciferol), vitamin E (Tocopherol) and vitamin K (Phylloquinone and Napthoquinone)

Importance of vitamin

The names and functions of fat-soluble vitamins are:

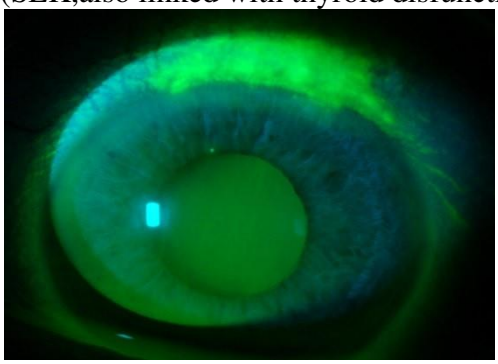
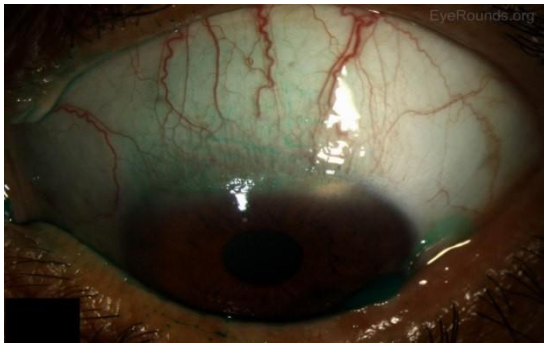
(Fat soluble)

Vitamin A: very necessary for night vision and overall vision formation

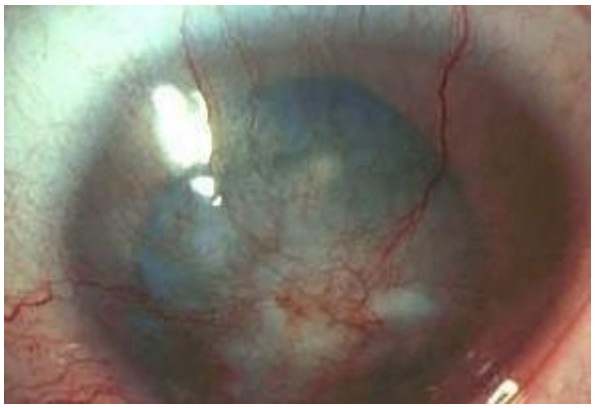
VitaminD: very necessary for calcium and mineral absorption for bony structure to keep it strong.
Vitamin E: Keep well maintenance for hormonal balance, sterility, antioxidants andas well as reduce cell degeneration
VitaminK: Necessary for connective tissue function especially coagulant factors and control hemorrhage.
(Water soluble)
Vitamin B1: Helps in metabolism and prevent edema and dropsy
Vitamin B2: Also essential for metabolism and prevent skin diseases like stomatitis, glossitis etc)
Vitamin B3: plays vital role in metabolic activity.
VitaminB5: metabolism activity specially act on fatty acid conjugation
VitaminB6: Essential for carbohydrate metabolism prevent hair falls and skin degenerations also
VitaminB7: overall metabolic activity for carbohydrate, protein, fat and helps in general growth
Vitamin B9: Plays vital role in the cellular activity and division.
Vitamin B12: plays vital role in nerve function like sensory and motor functions.
Vitamin C: acts as antioxidants, increase immunity system maintain collagen formation and nerve activities prevent scarvy disease.

Vitamin deficiencies and ocular health:

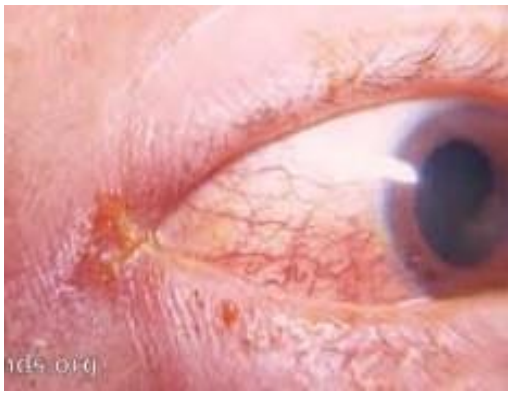
Vitamins are very necessary for our ocular system as it consist of various types of nervous layer, ganglion and nerve fiber layers and photoreceptors and their functional activity. Vitamin A is very essential for maintain corneal layers and transparency.Beside this vitamin A plays a vital role in corneal dryness treatment also. Lack of vitamin A caused dryness to cornea and also increased the chance of corneal ulcer formation. Vitamin A lowers the chance of inflammation tendency in superior corneal junction with bulbar conjunctiva and palpebral conjunctiva (SLK,also linked with thyroid disfunction).

Vitamin B2(riboflavin)also may reduce corneal vascular formation and also helps to lower the chance of angular and blepharoconjunctivitis .

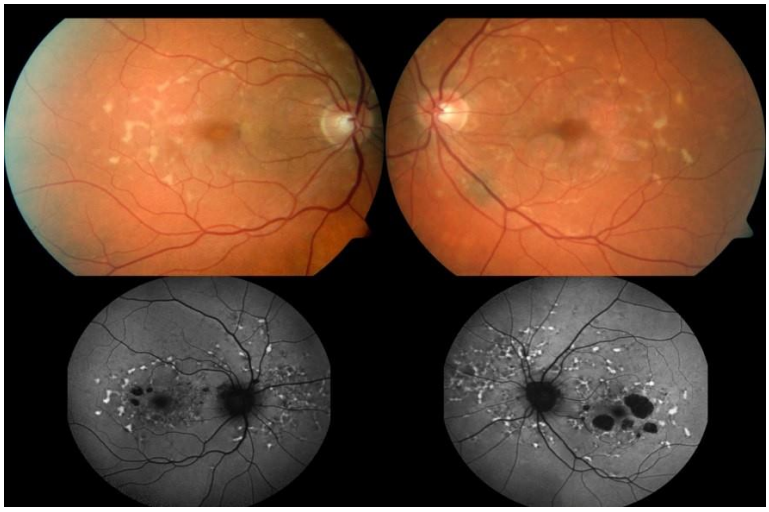


Neovascularization



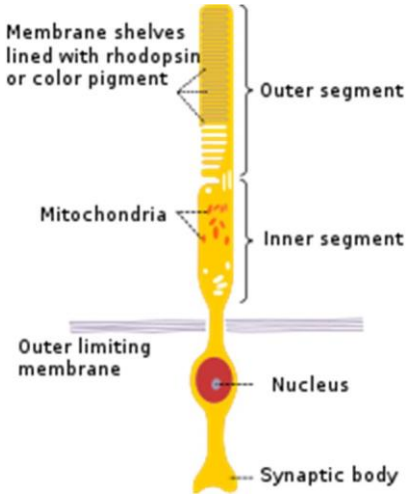
Angular and blepharon-conjunctivitis

Vitamins are also antioxidant so that it may control degeneration of cellular structure and improve surface quality. As it can delay aging so vitamin A, E,C with zinc and copper is essential to delay aging and age-related macular degeneration.
Another study from Harvard Medical School found that daily intake of at least 15000IU of vitamin A with 15mg of Lutein may lower the chance of Retinitis pigmentosa.
Beside this Colombia University also done a research that adequate vitamin A can slow the process of Stargardt's disease in which the light sensing receptors and nerves inside the retina starts degeneration which may cause visual field defect.



Stargardt's disease and retinal changes

Vitamin A (retinol) helps rhodopsin cycle inside the retinal rod cell layers. Rhodopsin is a type of pigment very sensitive to light which acts most in dim light vision. It absorbed light and convert it to sensitive impulse and forwarded to brain. In case of vitamin A deficiency rhodopsin cycle hampered most so patient face problem in night vision formation as well as night blindness.



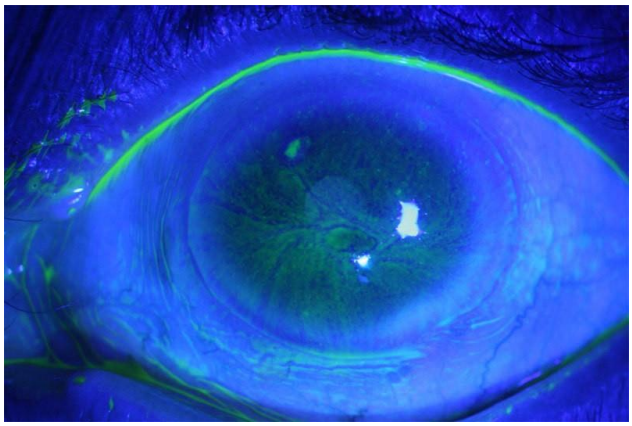
Rod cell and rhodopsin pigment

Vitamin B12 is also very necessary as its deficiency may cause lack of RBC formation and ultimately leads to anemia, dizziness, breathlessness etc. Vitamin b 12 lack may lead optic neuropathy which may cause optic nerve damage and color vision problems also. So patient face problem by central scotoma.

Vitamin c is powerful antioxidant can delay cataract formation and also can lower chance of ARMD and also slower the aging.

ARMD and drusen

Vitamin D increased corneal barrier function and boost immunity system so that eye infection, inflammation, dry eye symptoms, uveitis chance can be lower. Vitamin D plays a vital role in lacrimation and salivary system.



Dry eye investigation

Vitamin E also acts as immune booster and lower the chance of photoreceptor cells degeneration.

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Ocular manifestations of AIDS (accuired immune-deficiency syndrome)

Ranitava Banerjee

Centurion University of Technology and Management , Odisha

1. Introduction to AIDS/HIV

The disease Acquired immune deficiency syndrome (AIDS) is the manifestation ofHuman immunodeficiency virus (HIV), an RNA virus. The virus has two subtypes of which HIV-1 is responsible for human infection. HIV (Human Immuno-deficiency Virus) infection is seen in a variety of ways associated with the ocular structures, with the influx of CD4+ T lymphocyte in the bloodstream the disease becomes more severe and its association with the ocular structures increases. In earlier stages Kaposi sarcoma, herpes zoster ophthalmicus (HZO), candidiasis, and lymphoma are commonly seen whereas tuberculosis, toxoplasmosis, etc occur later with more advancement of the disease. In patients with huge reduction of CD4 cell count, cytomegalovirus retinitis and mycobacterium-avium complex disease is also seen as the manifestation of HIV in individuals.

2. History and prevalence of HIV infection

In 1981, for the first time the clinical manifestations to human immunodeficiency virus-I (HIV-I) infection werelinked with common eye involvements including cotton wool spots, cytomegalovirus, periphlebitis, and Kaposi sarcoma. Individuals who showed positive response to **Highly active anti-retroviral therapy (HAART)** showed improvement in their immune status.

From 2007 till 2016 the demographic data shows that, out of all the individuals affected with HIV/AIDS worldwide, ninety-five percent of the infection and death occurred in developing nations. HIV transmission occurs by sexual contact, by exposure to infected blood or fluids; of the common route the needle-sharing is the most common way for HIV to transmit, or it can transmit through an infected mother to the foetus during gestational stage.

3. Ocular Structures affected by HIV

3.1. Adnexa and orbit

Molluscum contagiosum, Herpes zoster ophthalmicusandKaposi sarcoma are the adnexal involvement following HIV infection. The orbit can also become infected due to contiguous sinus disease. Aspergillosis is the most common orbital infection reported in individuals diagnosed with HIV/AIDS.

3.2. Conjunctiva

The person suffering from HIV/AIDS shows major microvascular changes in the conjunctiva. This micro vasculopathy of the conjunctiva is associated with segmental dilatation, narrowing of blood vessels, sludging of blood column.

3.3. Cornea

The HIV infection can have variety of reaction on the cornea starting with dry eye symptoms to severe keratitis. Herpes simplex virus (HSV) keratitis are seen to recurr more often in HIV/AIDS.

3.4. Iris and ciliary body

Generally, Iritis is associated with HIV infection which though shwo sings of improvement with treating the HIV disease but sometimes it is seen that the drug used for the treatment of HIV or its related condition causes iritis; generally termed as **Drug-induced Iritis**.

3.5. Retina

The most common eye involvement of HIV infection is microangiopathy associated with cotton wool spots. It constitutes the non-infectiousretinitis which is different from an infectious retinitis in the following segments:

- The size less than 500um
- Feathery edge.

Visual functions are hampered by microangiopathy where it is seen that majority of the individuals suffer from VA (Visual Acuity) of less than 20/40 (equivalent to 6/9) or more.

❖ ***The common retinal diseases associated with HIV infection:***

- The incidence of **Cytomegalovirus Retinitis (CMVR)** infection increases in an individual with HIV infection.
- **Necrotizing Herpetic retinitis (NHR)** is the term associated with Progressive outer retinal necrosis which is associated with HIV infection in an individual.
- Along with this another common manifestation of HIV seen in patients is **Toxoplasma retinochoroiditis.** As the patients suffering from HIV are immunocompromised so sometimes it is associated with cerebral toxoplasmosis.
- **Syphilitic chorioretinitis** is a condition in which retinal and subretinal fluid is seen, it is believed that the manifestation of this disease increases with HIV infection.

[N.B: Of the major complaints the patients may complain of floaters, flashes, compromised visual acuity or defects in the visual field.**]**

❖ ***The clinical pearls of retinal changes associated with HIV infection follows:***

- HIV infected individuals present with signs of CMV in 30-40% of the cases where the CD4 count is less than 100/microliters.
- Full thickness intraretinal opacification is seen with retinal haemorrhages when a detailed fundus examination is indicated.
- On ocular investigation it is seen that vitreous is clear along with no major reaction of the anterior chamber.
- Retinal detachment along with direct involvement of macula can cause loss of vision in individuals.

- CMV retinitis which was very commonly associated with HIV infection before have brought to control with extensive use of HAART worldwide. Leading to a very low incidence of this clinical condition in the population.
- Varicella Zoster virus (VZV) retinitis is clinically found associated with whitish retinal reflex and multiple haemorrhages, these lesions progress rapidly and are generally not confined to a single location.
- Toxoplasma retinochoroiditis which is one of the major complications of the individuals diagnosed with HIV is seen to affect the CNS activity at large.
- Ocular syphilis is a rare complication of HIV which is generally found in less than 2% of the cases. The AC inflammation and other ocular involvement are the major signs associated with this condition.
- Another rare clinical manifestation of HIV infection in humans is infectious choroiditis; this condition is often confused to be associated with Pneumocystis, Cryptococcus or TB so a detailed diagnosis should be carried to find out the actual cause of the infection in the patient and to follow a proper treatment plan based on the underlying condition.
- Approximately 20% of the patients diagnosed with HIV presents with sings of papilloedema, palsy of CN (cranial nerve), ocular motility disorders, and visual field defects.
- Cryptococcal meningitis, CNS lymphoma, neurosyphilis, and toxoplasmosis may be seen in few patients diagnosed with HIV.

4. Diagnosis

HIV as we all know presents with a detailed and wide range of ocular manifestations in the individuals for which performing detailed investigation is of utmost importance. Taking proper history of the patient is very much necessary as it can help an examiner get a clear picture of the nature of the presenting illness, it should be followed with a detailed examination of the adnexa and fundus with the help of a slit-lamp and ophthalmoscope to mark any associated changes in these structures which maybe clinically associated with HIV infection. To confirm the ocular involvement of HIV the viral load in the system along with the CD4+ cell count is taken into consideration. Performing visual function test followed by visual acuity, visual field testing, ocular motility

testing, examination of the pupil, and fundus examination are important in diagnosing and identifying the various infective stages and their associated complications with HIV.

Dry eye evaluation for kerato-conjunctivitis sicca which is a major associated condition of HIV infection in patients requires evaluation with Schirmer's strip and Rose-Bengal staining. To confirm the status of keratitis gram-staining is indicated most of the time. To perform the tests like venereal disease research laboratory (VDRL) test, fluorescent treponemal antibody absorption (FTA-ABS) test, and tests for TB (Tuberculosis) dilatation with dilating ophthalmic drugs like Tropicamide (Tropicacyl Plus and Tropicacyl plain) is carried out followed with posterior segment evaluation by Ophthalmoscope and 90D lens using a slit-lamp. To investigate the orbital involvement the use of CT scan, MRI, biopsy, and culture is carried out in most of the individuals diagnosed with HIV. Neuro-ophthalmological manifestations are commonly seen in patients diagnosed with HIV; to understand the extent of the infection and the nature of the condition it is suggested to carry out MRI and lumbar puncture for cytology, culture, and antigen-antibody testing in the affected individuals.

4.1. Differential Diagnosis

The following retinal conditions present cases with similar aetiology with HIV manifestations thus it has to be ruled out in first hand whether the presenting condition is a manifest of AIDS or not. The associated conditions are as follows where we need to perform a differential diagnosis:

Bacterial retinitis

CMV retinitis

Fungal retinitis

Microangiopathy

Toxoplasma retinochoroiditis

VZV retinitis

5. Treatment

There is no fixed treatment module practiced for this condition. Treatment is generally indicated to those patients who present ocular symptoms and the nature of the ocular symptoms are treated individually.

- The use of systemic acyclovir, famciclovir, valacyclovir are indicated in treating a condition of Herpes Zoster Ophthalmicus;theresistant cases of HZO infection are generally treated with IV (intravenous)foscarnet.
- The HAART therapy and radiation therapy are generally the treatment of choice for managing the case of Kaposi sarcoma.
- The practice of cryotherapy, curettage, and surgical excision are the treatment modules followed in the case of Molluscum contagiosum.
- Keratoconjunctivitis sicca leads to the development of dry eye in the individual suffering from HIV which needs to be managed by the application of artificial tear drops and lubricants.
- Keratitis is which is one the major sign associated with HIV in an individual is generally treated depending on the cause of the disease; which includes the treatment of viral keratitis by oral acyclovir or famciclovir; the microsporidial keratitis is treated by the application of oral itraconazole, topical fumagillin, and oral albendazole; and the bacterial and fungal keratitis by appropriate anti-microbial and anti-fungal therapy respectively.
- Iridocyclitis is treated with topical corticosteroids.
- CMV retinitis can be medically managed with drugs such as oral valganciclovir, oral or IV ganciclovir, foscarnet, and cidofovir.
- Treatment of toxoplasma retinochoroiditis is with pyrimethamine and sulphonamides.

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The several facets of diarrheal diseases, their causes and lab diagnosis

*Sangita Patra, S K Abarar Hussain, Sangeeta Chhotaray, Ramakrishna Tripathy, Sunil Kumar Jha and Soumya Jal**

Centurion University of Technology and Management; Odisha; India.

Corresponding Author:

Dr. Soumya Jal;

Associate Professor;

Centurion University of Technology and Management;

Odisha, India.

E-mail: soumya.jal@cutm.ac.in

Mobile: +91-8825864370

1. INTRODUCTION

Diarrheal Disease is defined as an increase in the frequency, fluidity or volume of bowel movements relative to the unusual habits of an individual's whenever a person passage of 3 or more motion a day that can see as diarrhea. Acute diarrheal disease is also called as gastroenteritis, in this case nausea and vomiting may occur.

Diarrheal disease mainly affects the body parts such as GI tract, stomach and both small and intestines. Different types of microorganisms are responsible for causation of diarrhea in an individual.

When a healthy individual comes contact with polluted water, food materials or in direct contact from an infected person, they may gain diarrheal disease.

The diarrheal diseases occur in an individual those do not have inadequate food. The main cause of this disease is virus or bacteria but sometimes it can spread through food containing diarrheal causing microorganisms. Individual having diarrhea may feel irritation in bowel and an inflammation in intestine [V I Mathan,1998].

A bacterium called vibrio cholerae is very common for diarrheal diseases. This bacterium secretes a toxin called endotoxin and exotoxin; this toxin provokes the production of ions which is chloride ions.

There are many microorganisms those are mainly responsible for diarrheal disease. The diarrheal disease occurs in a cyclic manner. An infected person having diarrhea contain diarrheal causing microorganisms in his intestine.

The contaminated stool comes contact with river water or any other source of intake materials. A healthy individual accidently contacts with the infected food materials or drinking water and consume that without his concerns and get infected with the microorganism that causes diarrhea.in this way the microorganism completes their life cycle and infect the individuals rapidly [Melissa Tobin-D'Angelo, et al, 2008].

Escherichia. Coli is the common bacteria that can cause diarrhea in human & mainly affects the genitourinary route and bowel of human body.
Undeveloped countries are the most prevalence area for diarrheal disease and the etiological agents includes *E. coli*, rotavirus and vibrio cholerae types of bacteria commonly cause diarrhea. There are other bacteria such as shigella and cryptosporidium species also cause diarrhea [James P. Nataro,et al, 1998].

2. TYPES OF DIARRHEA:

There are various types of diarrhea, these include:

Acute Diarrhoea:

Acute diarrhoea is a condition of passages liquid stool more than 3 times a day and it may continue for 1 to 2 days. This acute diarrhoea is very often cause in human so it doesn't need any treatment and generally symptoms will vanish after some period. Generally, virus is responsible for this type of diarrhoea disease. It has been observed that rotavirus is the most common cause of severe diarrhoea among infants and children and norovirus i.e also called 'Roskilde illness' or 'winter vomiting disease' and diarrhoea in moderate age person. This norovirus generally spread by the direct contact to the individual who have already infected with diarrhoea disease. Diarrhoea occurs within 10 days of travelling to an area with poor public hygiene. So this diarrhoea is named as tourist diarrhea.
The symptoms is characterized by loss or liquid stool, stomach bug and abdominal pain.
This acute type of diarrhoea generally lasts for 1 to 2 days and it can sometimes last upto 2 weeks.generally in this diarrhoea blood passes in stool but it is not visible by the naked eye but in microscope presence blood can be easily identified,occult blood,high temperature in body due to loss of blood(red blood cell contain haemoglobin that balance the temperature of the body)due to blood and water loss patient may shows higher temperature, feeling nausea and vomiting are the most common symptoms of acute diarrhoea or also known as acute watery diarrhoea.[Brandt KG, et al, 2015]

Persistent Diarrhoea*:*

More than 3 times stool per a day which continue nonstop for 14 days is refferre as Persistent diarrhoea.Nutritional and metabolic complications e.g.growtg failure is the result of this diarrhoea.[J. Pediatr. (Rio J.) ,2011]

Long term or incurable Diarrhoea:

Long term diarrhoea is a condition, where the individual is continuing the regular watery stool more than several weeks or the diarrhoea may come and go away frequently over a aeon of time and also known as acute bloody diarrhoea. The common sign and symptoms of this diarrhoea are include, Hematocheria (fresh blood seen in the outer surface of stool), reduce appetite, unexpected weight reduction, there are some invassive bacteria that will harm or destruction of mucosal layer of gut.
If a parasite cause diarrhoea in an individual this type of characteristics shows in the person [Lawrence R, et al, 2017]

Infectious Diarrhoea*:*

Infectious Diarrhoea or gastroenteritis that leads to inflation of the GI tract, small intestine and stomach.it also responsible for structural injury of GI tract.

Osmotic Diarrhoea:

In this characteristics of diarrhoea food particles remains in the intestine,the solute cannot be absorbed properly that emerge from the food particle.due to this mechanism it leads to water loss from the body.

***Secondary diarrhoea**:*

It happens when the body secreats electrolyts such as Na,k,c,mg into the intestine which helps in water build up in the body it does not damage the structure of GI tract [Roberto Corinaldesi, et al, 2012].

3. CAUSES OF DIARRHEAL DISEASE:

Diarrhoea can be caused by several factors like micro-organisms, side-effects from food, and some other causes. Micro-organisms responsible for causing diarrhoea are bacteria, viruses and parasites their list is given below;

BACTERIA	VIRUSES	PARASITES
GRAM -ve bacteria	*Astroviruses*	*Balantidium coli*
Aeromonas hydrophila	*Enteric*	*Blastocystis hominis*
Salmonella	*adenoviruses*	*Cyptosporidium*
*Campylobacter jejuni**	*(serotypes **40, 41**)*	*parvum**
*Enterohemorrhagic **E.** coli**	*Calicivirus'*	*Cyclospora*
*Enterotoxigenic **E.** coli**	*Norwalk viruses*	*cayetanensis*
Shigella	*Norwalk-like viruses*	*Dientamoeba*
Plesiomonas shigelloides	*Coronavirus*	*fragilis**
Vibrio cholerae	*Rotavirus*	*Entamoeba polecki*
Other Vibrio		*Entamoeba*
Yersinia enterocolytica		*histolytica**
		*Giardia lamblia**
		lsospora belli
		Strongyloides
		stercoralis
GRAM +ve bacteria		
Bacillus cereus		
*Clostridium dificile**		
*Clostridium perfringens**		
Staphylococcus aureus		

The above mentioned bacteria are the etiological agent of causing diarrhoea (David K, et al 2001). When the bacteria enter in to the host organism it moves towards the stomach and intestine, and adhere the lining then invade the intestinal mucosal membrane. The no of bacteria then increases rapidly in the intestinal environment and starts toxin secretion. The secreted enterotoxin or cytotoxin mostly responsible for causing diarrhoea (Blanco J, et al, 1993). In this case the fluid secretions in the intestine or stomach get increased than the normal situation and reduce the absorption of fluid. Just like bacteria viruses also caused diarrhoea, and the rate of infection is much higher in case of virus. Viruses also produce enterotoxins and stimulate the intestinal secretion and decrease the re absorption of fluid. The rate of transmission may be less in case of parasitic diarrhoea but the morbidity and mortality rate is same like others. Parasites enter in to the host organism by ingestion, penetration of intact skin or mucosal membranes, moves towards the stomach and small intestine. After reaching to the site of infection the causative agent get replicated itself by completing its life style in the host organism and secrets toxins mostly stimulate the fluid secretion of the host organism that leads to cause diarrhoea. Then the diseases transmit from the affected person to the healthy person by different modes like food, water , air and also from stool sample.

Escherichia coli

Escherichia coli is a gram –ve bacteria commonly found in lower intestine of Endothermic animal. Pathogenic ones causes food poisioning , meningitis and urinary tract infection .

ETEC - ENTERO TOXIGENIC E. COLI

It mainly causes watery diarrhea in human. It mainly produces ENTERO TOXIN which is 2 types

ST –Small entero toxin

LT – Which is similar to cholera toxin

EPEC – ENTERO PATHOGENIC E. COLI

It binds with host intestine and causes inflammatory response; which is similar to Shigella .

ETEC – ENTERO TOXIGENIC E. COLI

It cause bloody and non – bloody diharrea, symptoms include diharrea with high fever.

EHEC – ENTERO HEMMOREGIC E. COLI

Also known as Siga toxin *E. coli*,it causes haemolytic uremic syndrome and inflammatory response without diahhrea .

EAEC – ENTERO AGGRIGATIVE E. COLI

It binds with intestinal mucosa to cause watery diahhrea without fever and it also similar to ETEC [Vivian Peirano et al, 2018].

4. **SYMPTOMS OF DIARRHEA**:

Cramps in the abdomen, nausea, weight loss, dehydration, vomiting, liquid stool, stomachache, stomach spasm, high temperature, hematochezia, mucousy feces, Digestive disturbance, felling vomiting, tiredness, sudden and intolerance felling of motion. These are the most frequently symptoms found in a diarrhoea patient [Margaret Mokomane et al, 2017]

5. **LAB DIAGNOSIS**:

There are various types of investigation performed. These include
Hematological Investigation:
A complete blood count [CBC] test done to diagnose diarrhea. In CBC , the hemoglobin level will show less as blood passes in stool.
Pathological Investigation:
Stool sample is collected from an infected person and prepare the smear on a glass slide by adding iodine & observed under microscope.
Pathological investigation mainly done to check the presence of bacteria and parasite in stool.
Microbiological investigation:
For Microbiological investigation
Specimen: To investigate microorganism stool sample, blood sample is collected from the infected person.
Culture: MacConkey agar and nutrient agar is widely used to culture of stool sample.
There is a selective media i.e Alaline peptone water media and TCBS that is thiosulfate ctrate bile salts sucrose agar that is used specifically for Vibrio cholerae. Blood agar also used for Vibrio cholera.
Another media i.e Eosin Methylene Blue [EMB] Agar media is also used to culture forgastrointestinal bacteria.This media contaion digested meat protein as a source of organic nutrients.
Culture Procedure:
Take a loopfull of bacterial suspension and inoculated on the appropriate culture media. lebelled the media with given details and wrap with parafilm then incubate at 37 degree celceus for overnight.
After incubation prepare a smear from the single colony, heat fix the smear then stain with Gram Stain to identify wheather the agent is gram positive bacteria or gram negative bacteria.
Cultural Characteristics of Virio Cholera:
V. cholera shows cultural characteristics in Nutrient Agar translucent smooth, shiny colonies.
In MacConkey agar it shows colourless to light pink colonies[1-3 mm in diameter].
In Blood agar medium it shows colourless colonies with hemolysis.
In Microscope: V. cholera is coma shape and shows sluggishly motile.
Cultural characteristic of E. coli:
In MacConkey agar: Bright pink or red colour, convex, flat colony wll appear.
In Nutrient Agar: Colourless and yellowish whit, circular, smooth colonie with entire edge. It is also non hemolytic in nature.

In Microscope: E. coli seen as red or pink colour that's means It is a gram negative bacteria. Non motile, Non sporing.

6. TREATMENT & PROPHYLAXIS

To treat diarrhoea disease an individual will take extra attention on sanitization of both environment and him.
There are many drugs that are used to diagnose diarrhoea disease
For older age people (above 75-80 years), Bismuth subsalicylate (BSS) is used. This drugs also effective for chronic or long term diarrhoea in case of infants.
A liquid suspension also prepare from this BSS to prevent travelers diarrhoea.
Azithromycin drugs referred generally used for acute watery diarrhoea [Herbert L. Dupont,1987].
Prophylaxis measures includes:

- ✓ Make sure drinking water is boiled at hundred degree Celsius and filtrated.
- ✓ Ensure that your hands have been properly washed with soap or normal water after toilet.
- ✓ Wash your hands before and after taking food.
- ✓ Take properly cooked food and avoid street food. Educate the people about spreading of diarrhoea disease.
- ✓ Keep your toilet clean and wash regularly [Melese Dubie Agegnehu, et al, 2019].
- ✓

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Breast cancer: its pathogenesis, types and metastasis associated with breast cancer

*Sangeeta Chhotaray and Soumya Jal**

Centurion University of Technology and Management; Odisha; India.

Corresponding Author:

Dr. Soumya Jal;

Associate Professor;

Centurion University of Technology and Management;

Odisha, India.

E-mail: soumya.jal@cutm.ac.in

Mobile: +91-8825864370

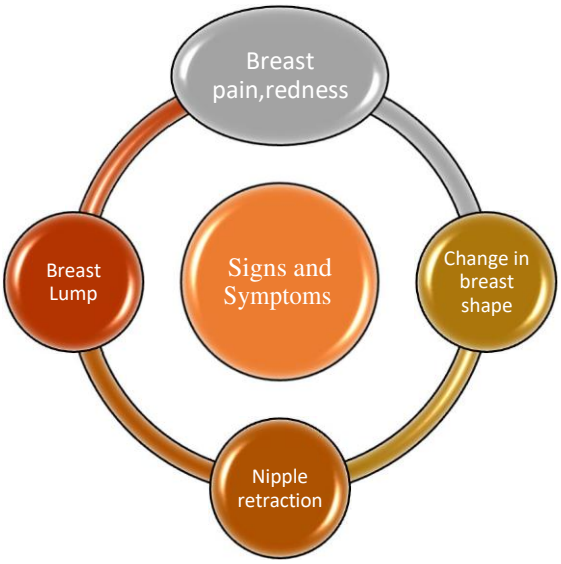
1. INTRODUCTION

Generally, a cell undergoes regulated division and terminates with the occurrence of programmed death or apoptosis. But in case the cell is unable to reach that natural death, it loses control on cell division leading to cancer or tumor formation. Cancer is presumed to be among the most dangerous disease due to its unbearable impact on a person's life as well as the difficulty associated during their detection and treatment. Among the various types of cancers that are reported, breast cancer is the most common type of cancer occuring in the women globally and sometimes it is reported in men as well. It is the foremost common malignancy type detected in the women in developed countries and the second most known type detected in developing countries. Approximately it was recorded in one fourth of all the cancer diagnosed in the year 2018. This disease can be curable if detected at an early stage, otherwise it has inevitably lethal consequences.

2. PATHOGENESIS

When the breast grows abnormally, it affects the ducts of the breast and begins to proliferation, further leading to hyperproliferation. As a result of such changes, a benign tumor may develop in those regions. This can later proceed to be cancerous in nature, after being

constantly stimulated by various carcinogenic factors (Maffin et al., 2004). It may also be described as an intractable development of cancerous cells in the epithelial tissue located in the breast region of male and female, which could be affected by proliferative growth (Van et al., 2015). In the cases of breast cancer, hyperplastic terminal ducts are found in a higher scale in those breast areas in which malignancy has developed in comparison with the normal breasts (Russo et al., 1988). And to escape from the immune rejection the macrophages can originate a mutagenic inflammatory micro environment which can assist angiogenesis and then permit the cancer cells to slip away (Qian et al., 2010; Dumars et al., 2016).



Fig;1 Signs and symptoms of breast cancer

3. TYPES OF BREAST CANCER

Although it commonly develops in women worldwide, it is considered as a heterogeneous disease. It is classified into several categories based on its histological type, clinical features and its reaction with the markers. The most notable types of breast cancers are:

i. Metastatic breast cancer (MBC)
ii. Ductal carcinoma in situ (DCIS)
iii. Invasive ductal carcinoma (IDC)
iv. Triple-negative breast cancer (TNBC)
v. Inflammatory breast cancer (IBC)

3.1. METASTATIC BREAST CANCER:

Metastatic extension recounts on the complex interactivity of tumor intravasation, circulation, extravasation of the tumor, proliferative characteristics, occurrence of angiogenesis and the comprehensive interpretation of the microenvironment of the targeted tissue (Paget, 1989). All the facets of a primary tumor are usually preserved in metastases. This usually includes the lungs, liver, bones or brain**.** Malignant type of cells can get away from the original site of tumor in the breast and move to various parts of the body, which consists of the largest network system of nodes and vessels that works to eliminate bacteria, viruses, or any other micro-organisms and cellular pollutants and toxins.

Bone Metastasis: The elite signs and symptoms of breast cancer is seen as instant, detectable new pain. Breast cancer can spread out to the bones located at various regions of the body, but most often it is reported to lay out to the parts of the ribs, spine, pelvis and mostly to the long bones located in the arms and legs.

Lung Metastasis**:** When the cancerous cells of a breast cancer progresses towards the lungs, it often doesn't cause any signs and symptoms. In this asymptomatic state the cancer spreads in the lungs. If the lung metastasis commences with symptoms, they will comprise of pain and discomfort to the lung, which is accompanied by shortening of breath, persisting cough, and various other symptoms.

Brain Metastasis**: When the cancer starts to spread through the lymphatic system, it is very easy to reach the brain and cause diseases like brain metastasis. In** such situations, the symptoms of breast cancer commencing towards brain metastasis will lead to headache, changes in speech or blurring of vision, issues with memory, accompanied by mental discomfort.

Liver Metastasis**:** When the malignant cells of the breast cancer lay out through blood stream into the liver, it is often not associated with any prominent signs and symptoms. However when they elaborate into a metastasis, features such as pain or discomfort in the mid-section is

reported, it can also lead to fatigue and weakness, loss of appetite, chills, fever, and many others complications. In the later stages it may lead to liver damage which may be untreatable.

3.2. DCIS (DUCTAL CARCINOMA IN SITU)

Ductal carcinoma in situ is a kind of breast cancer where in the production of abnormal cells takes place within the milk duct or in the lining of the duct. However, this type of cancer is non-invasive in nature that is the reason why it is not able to spread from its originating site to other part of the body. DCIS occurs in response to the expansion in the malignant-appearing cells that are present in the milk ducts and also are found in the terminal lobular units of the breast that would have still not ruptured the membranes of the ductal basement lining (Landis et al., 1999). DCIS is reported to encounter invasive potentials; when the characteristic features of it are associated with some risk factors like age, comorbidities, size of the breast, or any of the carcinogenic factors. DCIS can also results from a disarrangement in the architectonics or construction in the architecture of the glandular epithelium of the breast in association with the loss of the hollow lumen along with the expansion of epithelial cells in acinar units that can transpire due to the imbalance occurring between apoptosis and hyperproliferation (Debnath, J et al,2002).

3.3. INVASIVE DUCTAL CARCINOMA

When abnormal cells begin to originate in the milk ducts, they expand beyond the ducts into various parts of the breast tissue. As it is invasive in nature it grows in the milk ducts of the breast areas and it also lay out to the nearby tissues or any other tissues of the breast and start growing rapidly. It affects the nearby fatty or fibrous tissues present beyond the ducts. The normal tissues mostly get affected by such kind of breast cancer. It is also sometimes called infiltrative ductal carcinoma. It accounts for 80% of all types of breast cancer. Mutations in BRCA1 and BRCA2 genes are involved in high risk factors associated with this disease.

3.4.TRIPLE-NEGATIVE BREAST CANCER (TNBC)

Triple-negative breast cancer is known to account for approximately 10-15 % of the total cases of breast cancer reported. Persons affected with it are known to lack the expression of receptors

such as estrogen receptor (ER), progesterone receptor (PR) and human epidermal growth factor receptor 2 (Pegram et al., 1998; Wiggans et al., 1979). Hence, Triple-negative breast cancer shows a negative result towards the above three hormones. Generally, estrogen and progesterone hormones have significant role in the progression of breast cells. When in abnormal conditions, its functions are obstructed, it leads to cancer but in this case the receptor present in the breast does not show any kind of abnormality. The secretion of HER2 is also normal in this state which titres too high in the cancerous condition. TNBC refers to an immunophenotypic condition seen in case of breast cancer that has an immunologically negative response towards diagnosing ER, PR, and HER2. (Carey, LA et al, 2007).

TNBC of a truncated histological level can include carcinomas associated with secretory, adenoid cystic, acinic cell, and apocrine breast carcinoma (Rakha, EA et al, 2008). TNBCs are characteristic to biologically aggressiveness just as seen in case of basal-like breast cancer. However, their response to chemotherapy is better compared to other variants of breast cancer. The prognosis of TNBC still remains deficient as they show negligible response to targeted therapy (Giorgi et al., 2007).

In terms of response to chemotherapy, a Triple-negative tumors shows better initial response particularly to anthracycline and taxane based treatment. At the beginning, they show a level of sensitivity towards neoadjuvant chemotherapy, but it exhibits short term disease-free survival (Kalpana HG, et al, 2007). TNBCs is also known to originate due to genetic errors comprising the BRCA1 gene mutation (Haffty BG, et al, 2006).

3.5. INFLAMMATORY BREAST CANCER (IBC)

Inflammatory breast cancer is known to be an unaccustomed but antagonistic subtype of breast cancer, that was contemplated to be lethal in nature (Sharon H Giordano, 2003).

It comprehends about 5% of the total breast cancer cases that are reported (Levine PH, 1985). Clinically, it characterizes of a rapid onset of warmth in the breast, erythema, edema and is commonly diagnosed unaccompanied by any well-defined mass. It also causes breast extension accompanied with the involvement of axillary lymph nodes (Sharon H Giordano, 2003). The proliferation of the breast in case of IBC may extend 2-3 times its original volume within a duration of few weeks. The expeditious development of carcinoma seen in Inflammatory Breast

Cancer identifies the true primary inflammatory carcinoma from a neglected and localized advanced breast tumor that would have developed inflammatory characteristics (i.e. Secondary inflammatory carcinoma) (Taylor and Meltzer, 2017).

4. RISK FACTORS ASSOCIATED WITH BREAST CANCER:

There are some risk factors along with the diseases like that breast cancer carried out some risk factors those are depicted on the diagram.

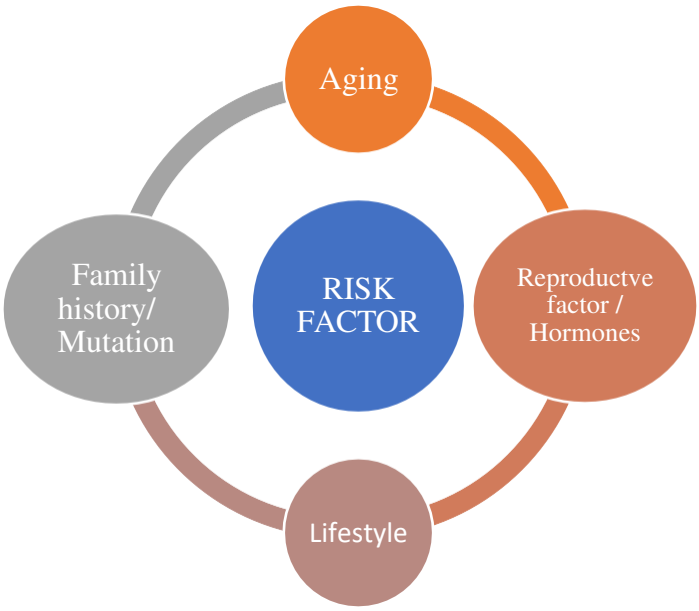


Fig:2 Risk factor related to Breast Cancer

4.1. AGING

Alongside the sex of a person, aging also acts as a vital factor concerning the development of breast cancer, as the ubiquity of it is linked to increasing aging as well. Other factors that contribute to its carcinogenicity are radiations from UV source, chemical exposure, exposure to sunlight (Siegel et al., 2017).

Another factor linked with the risk of commencement of cancer is the body mass of a person. Increased body mass index (BMI) can unfold the risk of post-menopausal breast cancer. With respect to the body weight, the size of breast also tends to increase leading to formation of tissues causing cancer. Hence, the density of breast can act as a predictive element in understanding the risk of developing breast cancer (Shmurl et al., 2017).

4.2. REPRODUCTIVE FACTORS / HORMONES

Other factors can also be indicative of development of breast cancer, these may include, menstruation occurring at an early age or incidence of menopause at a later age, pregnancy if induced late. A report suggests that every 1-year retarding in the commencement of menopause increases the possibility to develop breast cancer by a chance of 3% (Washbrook, 2006).

Hormones that are evocative of breast cancer are exogenous and endogenous estrogens. Some of the medications that can be presumed as exogenous estrogen includes, oral contraceptives and hormone replacement therapy (HRT). Hence, it is suggestive that high intake of HRT can increase the risk of breast cancer (Beral V, 2003). Endogenous estrogen hormone can also play a key role in development of breast cancer. It is generally produced by ovary of premenopausal women (Key, et al, 2013).

4.3. LIFE STYLE

In this modern era the lifestyle of every person is full of unhealthy habits. Modern lifestyle which witnesses increased alcohol consumption, high content of dietary fat can prompt the development of breast cancer. Frequent consumption of alcohol reduces estrogen associated hormones and hence activates estrogen receptor pathway and obstructs breast development, leading to cancer (Hamama et al., 2002). As mentioned above, saturated fat intake in excess amount leads to poor prognostication in person affected with breast cancer (Makaram et al., 2013). It can also induce increased production of estrogen in adipose, leading to inflammation and alterations that increases the possibility of breast cancer (Peters et al., 2017).

4.4. FAMILY HISTORY / MUTATION

Ancestral history also in crucial in the diagnosis of breast cancer. Women with siblings detected with breast cancer or mother diagnosed with breast cancer are at risk of developing cancer (Brewer et al., 2017).

Susceptibility to breast may occur due to mutations associated with genes like the *BRCA1* and *BRCA2* gene. Mutations and abnormal amplification of both oncogenes and anti-oncogenes play an important role in the processes of tumor formation and proliferation.

List of genes responsible for causing Breast Cancer			
ATM	H19	FGFR2	TP53
BARD1	LSP1	CYPI9A1	XRCC2
BRCA1	MAP3K1	RAD51	XRCC3
BRCA2	MRE11	RAD51C	CDH1
BRIP1	NBN	STK11	PTEN
CASP8	PALB2	TERT	TOX3

Table 1: Genes responsible for Breast Cancer

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Pathogenesis, biosynthesis and mechanism of toxicity of aflatoxin, a potent hepatocarcinogen

Bismaya Kumar Dash and Soumya Jal*

Centurion University of Technology and Management; Odisha; India.

Corresponding Author:

Dr. Soumya Jal;

Associate Professor;

Centurion University of Technology and Management;

Odisha, India.

E-mail: soumya.jal@cutm.ac.in

Mobile: +91-8825864370

1. INTRODUCTION

Aflatoxin B1 (AFB1) is a wide spread mycotoxin. It is recurringly generated by the popularly known saprophytes i.e. *Aspergillus flavus* and *Aspergillus parasiticus*. Mycotoxin is produced by these fungi in foodstuffs when they lack the optimum association with moisture and humid conditions, such as in case of oil seeds, peanuts and dry fruits (Baydar et al., 2005). They show an expeditious growth in food sources like maize also, and can further increase in unsanitary or improper storage conditions. AFB1 intoxication is also prevalent in products from farm animals. Illustrations of its intoxication are reported from their milk, meat and eggs, when these animals are fed on fodder contaminated with aflatoxin (Fink-Gremmels, 1999; Bennett and Klich, 2003). Also, reports suggest of high probability of chronic exposure of more than 4.5 billion population towards aflatoxin-contaminated foods. Hence, the US Food and Drug Administration considers it as an inevitable source of food contamination, which requires imperative measures to be minimized (Williams et al., 2004).

Four variants of aflatoxin are described to have carcinogenic effect. Out of these variants of aflatoxin i.e. B1, B2, G1, G2, the variant type B1, which is known as Aflatoxin B1 is the most potent hepatotoxic and hepatocarcinogenic agent. AFB1 is believed to be associated with a number of biological anomalies, such asteratogenicity, acute toxicity, mutagenicity leading to carcinogenicity (McLean and Dutton, 1995). Epidemiological surveys have exemplified it to be involved the utmost in hepato-carcinogenicity caused due to any mycotoxin and primarily contributing towards increased incidence of HCC (Wang et al., 2001). AFB1 is even categorized by the International Agency for Research on Cancer (IARC) as a category I carcinogens for its ability in leading to HCC.

AFB1 is pervasive in Geographical locations of Southeast Asia and Sub-Saharan Africa. The pattern of its distribution is often correlated with the socio-economic status of the countries, and

is therefore observed to be more extensive in low-income countries due to improper sanitation, inadequate food handling and inefficient food regulations. Both acute hepatotoxicity and HCC may occur due to continuous exposure of individuals to this toxin via infected food grains and animal products.

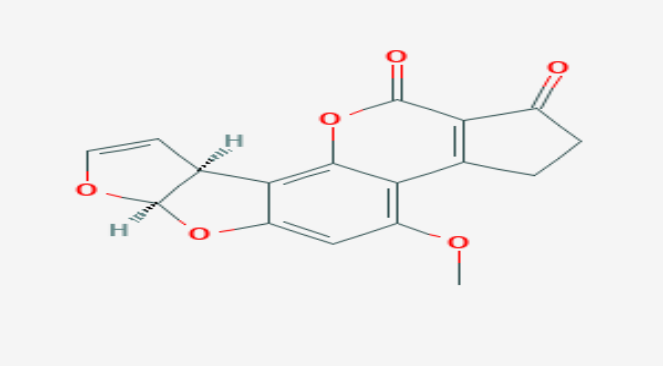

Fig 1: Structure of Aflatoxin

2. MECHANISM OF ACTION OF AFB1 IN DEVELOPING HCC

Due to the ability of food mutagens in causing cancer, they can be categorized under genotoxic or non-genotoxic agents (Sugimura, 2000). Genotoxic agents which include nutritional micro components, such as aflatoxin, are precisely characterized as genetic altering agents with mode of action at the molecular level. Non-genotoxic agents, however, are primarily nutritional macro components that can influence cells indirectly via tumor promoters (Sugimura, 2000; Sutandyo, 2010).

AFB1, being a genotoxic hepatocarcinogen has the ability to form DNA adducts, and presumptively triggers cancer, that causes genetic modifications in the target cells, which leads to the destruction of the DNA helix, defilement of the DNA bases, and causes oxidative damage engendering cancer (Sharma and Farmer, 2004). DNA adducts are known to emerge due to chemical alteration in response to the toxic action of carcinogenic chemicals of the bases present in the DNA or due to amino acids present in the proteins. The common cause of cancer in human is due to the defect in the Tp53 gene.

In 50 percent of HCCs, mutations such as the transformation of codons are reported, such as mutation in the codon 249 from guanine (G) to thymine (T), causing substitution of argenine (R) to serine (S) are recorded (Jackson et al., 2003; Martin and Dufour, 2008). Such observations are related to the consumption of food that are contaminated with mycotoxin AFB1(Bressac et al., 1991; Montesano et al., 1997). Survey conducted in locations with predominant exposure to AFB1 have revealed that AFB1 associated HCC may occur due to mutation in the p53 gene. A report from Qidong and Guanxi, China, and South Africa indicates that mutation in the codon 249 hotspot in exon 7 of the p53 gene was responsible for the occurrence of HCC (Bressac et al., 1991; Hsu et al., 1991; Ozturk, 1991; Stern et al., 2001; Egal et al., 2005).

The mutation caused due to conversion of G to T, is called 249ser, that leads to the p53 protein mutation from R to S (Nogueira et al., 2009). The organ responsible for the metabolism for the mycotoxin AFB1 is liver. Biotransformation by cytochrome-P450 can exert the hepatocarcinogenic effect, leading to the formation of a reactive intermediate chemical compound, AFBO, which is a highly reactive genotoxic compound binds to the DNA in liver cells producing DNA adducts, namely 8, 9-dihydro-8 (N7guanyl)-9-hydroxy-AFB1-9-hydroxy-

AFB1-8 (N7guanyl) (AFB1 N7-Gua) (Lewis et al., 2005; Obuseh et al., 2011). Interfere of the DNA adducts with that of the guanine base instigates the mutations in the tumor suppressor gene p53. As a consequence, to this, hepatocarcinogenesis may occur, if the alteration is not repaired before the event of next DNA replication.

In order to avert the genesis of DNA adducts, detoxification of the genotoxic AFBO intermediate is required. One possible way for the removal of AFBO can be its unification with glutathione by glutathionine S-transferase (GST), which further can precede by its hydrolysis by human microsomal epoxide hydrolase to dihydrodiol (mEH) (London et al., 1995; Eaton et al., 2001; McGlynn and London, 2005; Kirk et al., 2005; Dash B et al., 2007; Martin and Dufour, 2008). Conjugation of AFB1 to glutathione can lead to a significant detoxification of this mycotoxin and resulting in its subsequent excretion (Guengerich et al., 1998; Smela et al., 2001; Wild and Turner, 2002).

3. PATHOPHYSIOLOGY

The dosage and duration of exposure towards aflatoxin has a distinctive ascendency on its toxicology. Aflatoxicosis, occurring due to increased exposure of aflatoxin results in acute illness leading to death. High-level of exposure can even cause acute hepatic necrosis, eventually resulting in cirrhosis or HCC sequelae. Fever, nausea, vomiting, stomach pain, bleeding, digestive disorders, edema, malabsorption, behavioral changes, and coma are among the reported symptoms that are caused due to acute liver failure.

There are several nutritional and immunological implications due to exposure to a chronic sublethal dose of aflatoxin, which is largely associated with aflatoxin B1 DNA alkylation. Regardless of the dosage, any amount of exposure to this toxin has a cumulative effect towards the risk of cancer.

The metabolites of aflatoxin are known to have carcinogenic effect owing to intercalation into DNA and also due to epoxide moiety alkylation of the bases. The resultant p53 gene mutation is an important event associated with prevention of progression of cell cycle in cases of DNA mutations or apoptosis (Aguilar et al., 1993; Williams et al., 2004; Jolly et al., 2013).

4. HISTOPATHOLOGY

Aflatoxin intoxication primarily effects the liver. Histopathological alterations identified with acute aflatoxin liver toxication are fatty changes of the hepatocytes, acute hemorrhagic necrosis, and bile duct proliferation. Chronic exposure to this mycotoxin can lead to distinctive histopathological traits of cirrhosis-nodular degeneration, fibrosis that can further extend to HCC.

5. TOXICOKINETICS

The customary route of ingression of Aflatoxin into human body is through Ingestion. Further, in the liver, its metabolism by microsomal mixed-function oxidase (MFO) enzymes into a reactive epoxide intermediate occurs. The MFO enzyme associated with this function is a member of the superfamily CYP450.

The epoxide intermediate (8,9-epoxide) in generated due to mutations in DNA caused by the mycotoxin intoxication. Here, the codon 249 that is present in the p53 tumor suppressor gene, predominantly mutatesand is recognized as G-T transversion. Its coherence with other macromolecules such as RNA and proteins, can also evoke cellular dysregulation.This toxin is

also accountable for the synthesis of proteins, RNA, and DNA inhibition. Depletion of Glutathione and toxicity from ROS species also lead to toxicity.

The metabolism of this toxin can occur by Microsomal biotransformation involving the process of hydroxylation. This biotransformation causes formation of less poisonous, non-polar metabolite, e.g. AFM1 and Aflatoxin Q11 (AFQ1). A dialdehyde metabolite conformation can also be generated through the approach involving enzymatic and non-enzymatic activities on AFB1 (Aguilar et al., 1993; Gallagher et al., 1996; Jolly et al., 2013 Marchese et al., 2018).

6. BIOSYNTHESIS OF AFLATOXIN B1

BIOSYNTHESIS OF NORSOLORINIC ACID

Extension in the polyketide backbone in AFB1 by a polyketide synthase (PKS) in a hexanoate cell by the assemblage of seven acetyl units from malonyl CoA can lead to the formation of noranthrone without the involvement of ketoreduction (Bhatnagar et al., 1992; Brobstand Townsend, 1994). Noranthrone, in association with an oxidase, synthesizes norsolorinic acid (NA) (Bhatnagar et al., 1992; Trail et al., 1995). The gene involved in this step is pksA gene.

CONVERSION OF NORSOLORINIC ACID TO AVERATIN

Norsolorinic Acid with the action of ketoreductase forms Averatin (AVN) (Bhatnagar et al., 1992).

CONVERSION OF AVERATIN TO VERSICOLORIN A

The involvement for several metabolite helps in the transformation of Averatin to Versicolorin A (VER A). This includes alterations from AVN to Averufanin, further forming 1-hydroxyversicolorone (HVN) through the genesis of Averufin. The formation of VER A from HVN, involves production of VER B from versiconal hemiacetal acetate and versiconal. This transformation requires the involvement of avnA gene (Bhatnagar et al., 1992; Yu et al., 1997).

CONVERSION OF VERSICOLORIN A TO STERIGMATOCYSTIN

Production of sterigmatocystin takes from the substrate VER A. This process requires several reaction to take place with the help of enzymatic actions involving in oxidation, ketoreduction, decarboxylation, methylation. A metabolite of paramount significance in this transformation pathway is demethysterigmatocystin (Bhatnagar et al., 1992)

CONVERSION OF STERIGMATOCYSTIN TO AFLATOXIN B1

In this step, O-methyltransferase acts as a crucial enzyme which involves in the transformation of Sterigmatocystin to O-methylsterigmatocystin (OMST). This in turn is transformed into AFB1.

7. TREATMENT AND DETOXIFICATION OF AFLATOXIN B1

AFLATOXIN WASHING AND DIFFERENTIATION

The foremost procedure widely applied for mitigating the commination caused by aflatoxin is by physically isolating mold infected grains or feed from rest of the uncontaminated food grains. Other approaches that can me implied for physical removal of the contaminant is by cleaning, arranging, handpicking or hand sorting, etc (Whitaker and Dickens, 1975; Matumba et. al., 2015).

TREATMENT WITH HEAT

Although, Aflatoxins remain stable at increased temperatures, heating technique can be used to degrade them to a certain extent. Also, AFB1 is reported to get eliminated at conditions of high humidity (Raters and Matissek, 2008; Park et al., 2005; Arzandeh and Jinap, 2011; Lee et al.,

2015). Heat therapy, however, is considered as a feasible technique for partially decreasing the concentration of mycotoxin in food/feed stuffs since it is simple to execute heating technique at low cost. Extrusion cooking, is also considered as a beneficial technique in food industry. High temperatures of short-term extrusion are usually used in the industrial practices (Wu et al., 2009).

TREATMENT WITH MICROWAVE HEAT

Perez-Flores and coworkers have analyzed that techniques of microwave acquired thermal alkaline treatment. This technique finds use in the reduction of aflatoxin contents in typical Mexican food tortillas.

TREATMENT WITH IRRADIATION

Gamma (γ) radiations have turned out to become a popular technique in decontamination of aflatoxin. It is widely used in eradication of contaminant from food substrates at high irradiation dosage, such as in case of grains, palm juice, groundnuts and animal feed, showing an overall 65 percent reduction (Applegate and Chipley, 1974; Priyadarshini and Tulpule, 1979; Ogbadu, 1980; Schindler et al., 1980; Di Stefano et al., 2014; Zhang et al.,2018; Domijan et al., 2019).

TREATMENT WITH ELECTROLYZED WATER(EOW)

The use of Electrolyzed water technique for the treatment of Aflatoxin toxication has been recently accepted (Xiong et al., 2010; Xiong et al., 2012; Fan et al., 2013).

TREATMENT WITH PULSED LIGHT TECHNOLOGY TO REMOVE AFLATOXIN B1

For the purpose of decontamination on aflatoxin toxicity, this technique has been applied due to its ability to destroy bacterial, viral and fungal cells (Moreau et al., 2013; Elmnasser et al., 2007).

AMMONIA DECONTAMINATION METHOD

The ammonization of corn, rice, wheat, peanuts, and cotton seeds to modify the harmful and carcinogenic properties of aflatoxin contamination has been intensively researched by scientists from government departments and universities around the world. Numerous tests have shown that aflatoxin B1 levels have been effectively and permanently lowered by 1-hour ammonia application (Jorgensen and Price, 1981; Martinez et al., 1994; Weng et al., 1994; Hoogenboom et al., 2001).

TREATMENT WITH HYDROCHLORIC ACID (HCL)

Aly and Hathout, 2011 examined the impact of hydrochloric acid on AFB1 degradation in contaminated corn gluten under various HCl concentrations. The effect of AFB1 degradation by HCl is in a temperature-, HCl concentration-, and time-dependent manner.

TREATMENT WITH LACTIC ACID AND CITRIC ACID

Past experiments have demonstrated that, when treated, some organic acids have the ability to detoxify foods polluted with aflatoxin (Mendez-Albores et al., 2008; Lee et al., 2015).

TREATMENT WITH OZONE

Ozonation is another frequently used method of chemical regulation. Ozonolysis at a dosage of 6-90 mg/L is efficient in destroying AFB1 for short term therapy. For as little as 15 minutes, all molds were detoxified and *Aspergillus parasiticus* and *Aspergillus flavus* were extracted from dried figs, while Aflatoxin B1 was deteriorated time-dependently (Zorlugenc et al., 2008; Chen et al., 2014; Diao et al., 2013).

TREATMENT WITH SOIL BACTERIA

Aflatoxins have the ability to degrade many bacteria in the soil. A type of soil and water bacteria, *Flavobacterium aurantiacum* NRRL B-184, has demonstrated that high-efficiency aflatoxin detoxification is feasible (Arai et al., 1967; Wu et al., 2009).

TREATMENT WITH YEASTS AND LACTIC ACID BACTERIA

The destruction process of Aflatoxin by yeast and lactic acid bacteria is due to their adhesion to cell wall components (Jespersen et al., 1994).

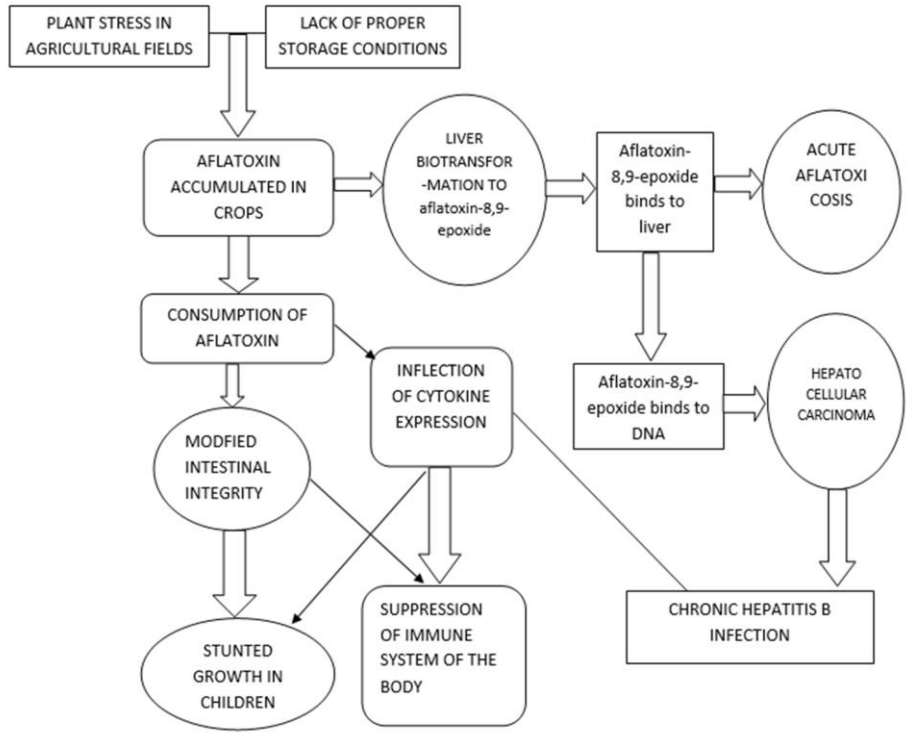

Fig 2: Toxigenesis by Aflatoxin

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Constraints in cotton cultivation and suggestive measures

Chitrasena Padhy[1*], Kalee Prasanna Pattanayak[2] ,Satarupa Modak[1], Ajay Kumar Prusty[1]

[1] Department of Agricultural Extension, Centurion University of Technology and Management, Odisha, India

[2] School of Management, Centurion University of Technology and Management, Odisha, India

*Corresponding author: chitrasenapadhy@cutm.ac.in

Abstract

Owing to low plant density, Indian cotton yields are low. Cotton damage is repeatedly caused by jassids, aphids, whiteflies and others. Biodiversity is a significant factor for preserving the sustainability of cotton. Intercropping with crops of legumes is beneficial. Proper efforts should be made to make quality quality seeds available to farmer at a fair price. For this to be done, the public and private sectors should come forward. In order to grow hybrid seeds, the cost should be decreased. The network of seed villages should be encouraged to ensure cheap and quality seed supply. Desi varieties are strong and suitable for difficult conditions with low inputs. Short duration Desi varieties under high density planting can provide good yields.

Keywords: Biodiversity, Desi species, network, quality seed, short duration, sustainability

INTRODUCTION

Cotton is one of the most important fibre crops in India as well as the world. It plays a big role in the country's industrial and agricultural economy. It supplies the basic raw material to the cotton textile industry (Reddy, 2019). In terms of cotton, biodiversity is a significant sustainability indicator. Around the world, around 500 recognised varieties of cotton are found. Varieties have been produced to fit geographical conditions and include many interesting features and characteristics, such as coloured cotton, stapled cotton, extremely long and fine, and indigenous or wild cotton (Textile Exchange, 2011).

CONSTRAINTS

It is a belief that a large variety of insects are affecting the cotton crop. A number of insects are repeatedly causing damage to cotton such as jassids, aphids, whiteflies and others (Kranthi, 2015).

The use of fertilizer is among the highest in the world for cotton. There is a decline in soil health due to continuous use of fertilizer and the crop does not respond well to fertilizer use (Kranthi, 2015).

Compared to other nations such as China, the United States Brazil, Mexico and Australia, Indian yields are low due to low plant density (Kranthi, 2015).

Diseases and insect pests affect cotton crops more and cause nutrient deficiencies due to monocropping. Cotton grown on the same land as a single crop results in insect pests and diseases. From June to May, cotton is grown in large parts of India all year round. By growing in repeated cycles, cotton sown in the area is harmed by insect pests such as mealy bugs and pink bollworms (Kranthi, 2015).

The key issues are the diverseness of cotton varieties, unauthentic seeds, more use of low quality and adultered insecticide chemicals and misuse of pesticides. This leads to reduced yields and other social problems in some high yielding areas of Andhra Pradesh. Due to heavy rainfall, the

climate causes devastation, During October and November, the prolonged wet spell results in the outbreak of pests and cause more damage to cotton production. The main disadvantages in Andhra Pradesh are heavy doses of imbalanced chemical fertilizers and cotton mono-cropping. The broad use of chemicals pesticides from the seedling stages destroys the parasites and predators. Because of this, mainly the bollworms, aphids, jassids, thrips and whitefly affect and cause serious damage to cotton crop(Gopalkrishnan et al. 2007).

Inadequate input use, rain fed cultivation, ill-timed field operations and inefficient crop production technologies in India result in low cotton yields (Majumdar, 2012).

The most harmful are the bollworms. It takes considerable efforts to save the crop from them. Out of the insecticides used annually on all crops in India, about half are used on cotton alone (Manjunath, 2004; Rai et al., 2009).

SUGGESTIVE MEASURES

Azadirachta indica, neem tree that grows naturally in the cotton regions of India plays an important role in ecological pest control. Very strong alkaloids with insecticidal properties are found in it which is considered effective against the control of a broad range of pests including cotton crops (UNIDO, 2010).

It is to ensure that quality seeds are available at fair price and that adequate efforts are required. A greater effort should be made by the public and private sectors. There should be a decrease in the cost of hybrid seed production. In the case of varieties, a network of seed villages should be encouraged to ensure cheap and quality seed supply. Total discontinuance was seen about acid delinting in cotton in a study rice fallow cotton in Thanjavour. In acid delinting, the complicated method of buying loose amount of buying loose quantities of chemicals is involved. These should be taken home safely and it is important to ensure proper transport and adherence to strict timing should be maintained. But farmers generally wanted already delinted seeds or community acid de linting (Ramasundaram et al, 2001).

The Gossypium arboretum and Gossypium herbaceum Desi species are ideal and solid with low inputs for tough conditions. Short period with low inputs in rainfed farming, these desi varieties can give good yields (Kranthi, 2015).

It is important to intercrop with legume crops such as soybeans, green grams, black grams or cow peas for nitrogen fixation and Integrated Pest Management is essential (Kranthi, 2015).

Growing a variety of crops on a farm is advantageous for farmers as it can serve as an insurance against the failure of one specific crop, and farmers can get the return of other crops. Scientists have found that crop diversity increases soil fertility, allows decreased use of chemical inputs, and can maintain high yields (Smith et al., 2008).

CONCLUSION

In India, cotton is a long duration crop where flowering begins at the end of the monsoon. After the end of the monsoon, it will continue for about 80-90 days. Unde rain-fed conditions in India, the crop suffers severe water stress and nutrient deficiency, mainly at the stage of flowering and boll formation, resulting in low yields (Kranthi, 2015). By improving the irrigation performance, significant water savings can be made .Just 30-35% of the water withdrawn for irrigation in many countries actually enters the crop and the rest is lost from irrigation channels and fields. Flooding the fields is a common practice in many nations that causes major water losses by evaporation and overflow from the other end of the field. The cotton crop may be damaged when the roots stand in water for too long. The development of ridges for planting and applying water

along the furrows dramatically reduces the use of water and improves plant growth (WWF, 2013).

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Prospects of kharif onion cultivation in India

Smaranika Mohanta
M.S. Swaminathan School of Agriculture, Centurion University of Technology and Management, Odisha, India

Corresponding email: smaranika.mohanta@cutm.ac.in

Abstract

Onion (*Allium cepa* L.) is important and indispensable item in worldwide kitchen as condiment & vegetable. Kharif onion production is a new technology in India. Production of onion in *kharif* and late *kharif* season is more important to have continuous supply of onion round the year. Importance of *Kharif* cultivation of onion to stabilize the prices. Eastern Indian states are depended upon Maharashtra and Western state in off season and stabilize the price in lean period. Research will be conducted in different dates of planting, varieties trial, agronomical trial and for crop improvement in different area of India. All varieties of kharif season are cultivated in rabi season but all rabi season varieties are not cultivated in kharif season. For increase economic returns manage the crop scientifically and professional strengthen the production and research for dehydration and suitable varieties for export to foreign.

Introduction: Onion (*Allium cepa* L.; 2n=16) belongs to family *Alliaceae* is most widely grown in worldwide and popular vegetable crop as spice crop and leaves are used as leafy vegetable among the Alliums. After tomato, onion is the second most important among vegetable crop and it is known as "Queen of Kitchen" because of indispensible ingredient item in every Indian kitchen as a seasoning wide varieties of dishes. Pungency is the special characteristic of onion is due to the oil known as "Allyl propyl disulphide". Due storage quality onion are withstand in hazard of long distance transport also. Onions have wider use in manufacture of soaps, ketchups, onion flakes (dehydrated) and food seasoning besides being used as salad and pickle. Also dehydrated white onion used as dehydrated product like flakes, rings, granules, powder etc and processed onion as onion in vinegar and brine are marketed worldwide and exported from India. The bulb is useful as diuretic and heart stimulant. Onion has many uses as folk medicine and recent reports suggests that onion plays an important role in preventing heart diseases and other ailments (Augusti, 1996). The problems of heart diseases, rheumatism, cancer, digestive disorders, blood sugar and prolonged cough as well as it lower the blood sugar are prevented by regular consumption of onion.

Area and Production: Among the onion producing countries, India is the second largest producer of onion after China with an area 1051.5 thousand hectares (11.4% of total vegetable cultivated area) with a production 16813.0 thousand MT (10.4% of total vegetable cultivated area) and productivity is 16.0 tones/ha (NHB, 2012-13). Among the states of India, Maharashtra stands first in area (2.60 lakh ha) and production (46.60 lakh tones) of onions with a productivity of 17.9 MT/ha (NHRDF, 2013). Karnataka and Rajasthan rank 2nd and 3rd in onion cultivated area (159.60 thousand hectare and 139.05 thousand hectare) and production wise Madhya Pradesh and Karnataka occupied 2nd and 3rd rank after Maharashtra. As per productivity, Gujarat rank 1st, with a productivity of 24.4 t/ha, followed by MP (24.1 t/ha) (NHB, 2012-13). The area has increased by 50.07% up to 2012-13(9.92 lakh ha) as compared to 2005-06 (6.61 lakh ha). Onion is an important export oriented crop. India exports 7.78 lakh MT fresh onions during

2005-06 to 18.23 lakh MT during 2012-13 (NHRDF, 2012-13). Onion mainly exports to other countries like Malaysia, Russia, Kuwait, Sri Lanka, Singapore, Germany, Japan, Iran, Myanmar and UK etc. (Shinde and Sontake, 1993). Presently the major export markets for Indian onions are Middle East and Gulf countries, Singapore, Malaysia, Sri Lanka, Bangladesh, and Japan

Kharif onion:

In India onion is grown under three crop seasons *kharif*, late *kharif* and *rabi* season. The main season or *rabi* crop about 60% of total cultivation and each 20% in *kharif* and late *kharif* season. India is one of the largest producers of onion in the world second only to China (Anonymous, 2013). Production of onion in *kharif* and late *kharif* season is more important to have continuous supply of onion round the year. Three crops *viz., Kharif*, late *kharif* and *rabi* are taken in Nasik division of Maharashtra whereas Gujarat, Andhra Pradesh, Rajasthan, Punjab, Haryana, Madhya Pradesh, Karnataka and Tamil Nadu take up two crops that is *Kharif* and *rabi*. Planting of *Kharif* onion starts in June and it arrives in market during Sept – November. The late *Kharif* onion planted in August arrives in the market during December- January. In Maharashtra, Madhya Pradesh, Karnataka, Gujarat, *kharif* crop of onion accounts for about 30% of the total production (Mohanty and Prusti, 2001). Rainy season onion cultivation is a new strategy in Northern, Eastern and Central India mainly to meet the demand of fresh bulb in off season. There is critical gap in supply of onion in the country from October to December and as a result the prices shoot up. Importance of *kharif* cultivation of onion to stabilize the prices is well accepted.

Varieties

Originally native of central Asia of temperate region with perennial/biennial habit with long day character but in India short day varieties are available which required 11-11.5 hrs photoperiodic condition. For the higher productivity of *kharif* onion could be determined by selection of suitable varieties, nutrient application, water management and plant protection measures. Among these factors, selection of suitable variety(s) plays an important role in enhancing the yield as well as productivity. Effect of cultivars Indian cultivars are short day type. According to the variety these bulbs are vary to in size (small, medium and large), colour (White, yellow and red), texture (fine, or coarse and pungency), and shape (flattened, round or globular).

Conclusion

Kharif onion cultivation is new technology and it is stabilized the market price in off season.

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Waywards to way founders: success stories of farmers of Odisha

Dwity Sundar Rout*
Assistant Professor, Department of Agricultural Extension & Communication
M. S. Swaminathan School of Agriculture
Centurion University of Technology & Management, Odisha , India
*Email: dwity.sundar@cutm.ac.in

Introduction

Odisha is an agri-based economy with over 60% of its population relying upon agriculture for their everyday resource. Likewise, over 83% of its population live in country regions. The presentation of farming decides food and sustenance security of individuals and is significant for diminishing neediness and accomplishing comprehensive development. However, as the majority of the farmers are little and minimal there should be some drive from the people to improve benefits and produce a feasible vocation. As opposed to looking for pitiful positions or working under property managers, it is better for a rancher to go for his own endeavour. Business venture is the driver of monetary development of a country. It improves the monetary exercises in every circle of financial existence of individuals. It is an expertise that creates over the long run and regularly relies upon the risk bearing capacity of the person. In this specific situation, here are some examples of overcoming adversity of certain farmers of Odisha who have put forth their lives better with their untiring attempts and devotion.

Documentation of a Success Stories:

1. Story of Mr. Chaitanya Naik

This story is of organic rice and Hybrid rice cultivar producer Chaitanya Naik .For the 1st time he cultivated rice crop in organic method. He talked to kvk scientist regarding organic farming. Now-a-days organic farming is very much essential and it improves nutritional value of the soil. So, he cultivated 1.3 ha of organic rice. In the middle, he was loosing hope because of the wastage of time in organic farming and appearance of diseases in the field. So, he contacted the AAO and KVK scientists and discussed regarding the program and then he felt good. Then he started 0.032374 ha of tomato and brinjal cutivation. He had sown some quality seeds as suggested by KVK Scientists and he always worked hard on field. Later he harvested 9-10 tons of tomato and brinjal in a week. Now he is very happy and much thank full to AAO and KVK Scientists.

2. Story of Mr. Asish Pradhan

Mr. Asish Pradhan was born in a poor family in a village named Redhua , Jagatsinghpur . They lived in a small cottage. Because of his Father and his daily wage, he was capable to afford the school fees there and completed schooling. He used to do tuitions to earn

money. Somehow managed to earn some extra income for his family . When he was 28 , his parents passed away . Then he went to the town and looked for small business along with tuitions. Then started a small business but that business did not go well so he was bound to return to his village. Somehow the tution fees was only source of income. He grew crops in small quantities near his home for his family consumptions only. He used to read the newspapers and read books related to agriculture. This is how he started gaining knowledge about agriculture. At first, he grew some sort of crops in kitchen garden and sold them to market. Here he got a good profit so decided to take loan from bank and he owned a small piece of land and bought .He used to cultivate tomato, okra, cucumber and pointed gourd there and got good returns. His son was helping him in his works. Then gradually by gaining experience, he started learning modern techniques and methods. He started doing this by growing Rice, followed some other sources like television (Annadata programmes). By the help of Government irrigation system, he got some help too. Then He started doing more vegetable crops like Cabbage , cauliflower and Raddish. He got good returns and bought more land and grown vegetables and rice. Then he became capable to meet all his needs like buying manure, paying workers and settling his loans. He planned to develop his business by utilizing some land in banana orchard and guava cultivation. Now he has 7 acres of land 2 bore wells. He is Growing Rice, cauliflower, cabbage, raddish and banana. He is paying his workers properly and also believed that farming is the best way to get profit along with peace.

3. Story of Mr. Rajkumar Mallick

Rajkumar Mallick, who has studied up to 10^{th}, started vegetable cultivation at an age of 28. He started with cowpea in 1 acre of land. Now-a-days the 47 years old person grows brinjal crops in 1 ha of land using only compost and gets over 1 Lakh per year. He prepares his own compost out of weeds, plant residues as well as food waste and uses them in the brinjal crops. He even prepared the neem insecticide by his own and spray for his crops. He believes chemicals are harmful as well as hazardous for the future generation. He owns 4-5 cows and sells milk in the village as well. beside this he has the poultry farm that gives him a good profit. Initial days were very harsh for the farmer due to bad weather conditions and lack of knowledge. With the help of kvk and Krishi yojana plan in the panchayat committee, the farmer was able to learn many things and used in his crop plan. The crop rotation importance was very new to him. He used to sow one crop always in the same field but later practised and followed all the instructions given by the supervisors who visit the village once in every month. The farmer uses the kishan toll free number and shares all the queries. The farmer has been provided with the tools and the traps used for pest incidence. The proud farmer practises organic farming and strongly denounced the use of chemical pesticides and fertilizers. He believes that organic farming keeps the soil fertile and enrich it with micronutrients. He says govt provides much opportunities that need to be grabbed. After earning a good income from brinjal cultivation the farmer is planning to start integrated farming system and shares his art and success among his co-villagers.

FARMER WITH HIS BRINJAL FIELD

4. Story of Mr. Radhanatha Singh

A farmer named Radhanatha Singh prepard the seedbed of papaya (Redlady variety) in an area of 0.8 Ha and got the success from the seedbed bed of 1000 seedlings collection from the bed and they have in good condition for transplanting. He also uses different advanced technologies for the propagation of seedlings and also uses different vegetative propagation methods.

5. Story of Mr. Tanka Chenndia

Coming to the success story of farmer, it was since many years, he along with the villagers who are in agriculture are practicing only mono-cropping in their fields. So as part of the farmer, he thought to take a risk one day and start up something new for the enhancement of agriculture and better sustainability of livelihood. Around the year 2017-18, when there was emphasis on millet improvement programme by government, he was the 1st person from the Village who took part in the millet improvement programme. Under the guidance of M. S. Swaminathan research foundation located at Jypore, he started his work on millet. The seed was provided by the research foundation alongwith different types of pesticide and fungicides. He had grown Finger millet, small millet and foxtail millet in kharif season in the year 2017 and he was the first one to follow the millet intensification. He used to sow/transplant the seedlings by the SMI method, direct seeding method and line transplanting method. In these methods, he observed that there was very less disease pest incidence and he got proper space for weeding and fertilizer application there. Furthermore, he got somewhat more yield at the time of harvest than the practice of the normal broadcasting method in the previous years. After that he was selected from his village macchra and was awarded for his immense contribution towards millets improvement programme when there was the international year on millet in 2018. Again he was selected as krushaksathi of his village and by his part he became a helping hand to the farmer society. He has encouraged many farmers of his village for millet production by sharing his experience towards new aspects in agriculture as like mixed farming concepts. Now many farmers of that village are being selected under the M. S. Swaminathan research foundation for the millet growing and millet intensification programme so also seed production. All of them are contributing their level best. In this way Tanka Chenndia made his success in agriculture and became an example for the nearby localities.

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