Modeling vacuum assisted microwave drying of sapota slices

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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

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