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PREPARATION AND CHARACTERIZATION OF CASSAVA STARCH ACETATE–POLY CAPROLACTIN NANOCOMPOSITES FOR CONTROLLED RELEASE OF DRUG DOXORUBICIN

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ABSTRACT
A series of Cassava Starch Acetate (CHS)/Poly Caprolactin (PCL) based Cloisite 30B nano clay (CHS-PCL-C30B) composite nanomaterials have been prepared in aqueous media by taking different weight ratios of CHS, PCL, and C30B using simple stirring condition at convenient temperature. The prepared nanocomposites have been used to investigate the extended-release of doxorubicin (DOX) drugs by changing formulation variables. The structure, morphology, and stability of these nanocomposites were investigated by FTIR, XRD, SEM, TGA, DSC, and tensile strength test machine. The CSH/PCL-C30B(75:25:5) nanocomposites displayed higher weight loss nearly about 95.54% compared to CHS/CS (75:25) blend polymer value (95.56%) at 500 ^{0}C.The DSC of CSH/PCL-C30B nanocomposites described the energy liberated in the pure blend(without C30B) is 135.7J/g while that of CSH-PCL blend with 5% C30B is 239.4J/g.Further, the addition of C30B nano clay increases the extent of swelling of the CSH/PCL-C30B(75:25:5) blending matrix to the maximum during the formulation of DOX-CSH/PCL/C30B which contains a higher amount of C30B nanoclay. The equilibrium swelling indicates the distinct sensitiveness of the matrix to pH and temperature. At pH =7.4, the cumulative release amount of DOX-loaded in the nanocomposites was about 85% within 10h whereas this value reached 89% at pH =3.4 using phosphate buffer solution(PBS). Cassava starch-based nanocomposites are found to be excellent multifunctional nanocomposites and are useful in drug delivery and other medical applications.

Keywords: Cassava Starch Acetate (CHS), Poly Caprolactin (PCL), Cloisite30B nano clay, doxorubicin (DOX), phosphate buffer solution (PBS).

1. INTRODUCTION

Nowadays health care is a demanding issue for medical science due to the rapid growth of new diseases. Hence, advancedpharmaceutical science and technology mainly focus to develop a new opportunity to understand, prevent and control serious diseases by a different type of modern techniques (Casino et al., 2019, Materla et al. 2019, Fino&Mazzetti, 2019). Drug delivery system (DDS) is a known technique to prevent and cure too many diseases (Wangetal., 2012; Chaudhary&Haldas 2003; Lipshultz et al., 1995; Matsumura&Maeda, 1986;Ochekpe et al.,2009; Bangham et al.,1965; Chaudhury & Das, 2011). DDS is a challenging subject to promote the drug for implication in the body for the treatment of diseases. Currently, various bio-molecules or drugs are already developed for the treatment of serious diseases like cancer, diabetes, heart problem, etc, but it is a challenge to implement this into the human body by oral dosage. The current medical and pharmaceutical science are researching different types of drug delivery vehicle to promote new drug molecules through drug carrier (Islam et al.,2012; Janes et al.,2001; Yousefpour et.al,2011; Wang et al.,2013; Cho et al.,2008; Huh et al.,2008).

Recently the combination of nanotechnology and polymer science has supported pharmaceutical science for the preparation and synthesis of a new drug carrier for new drug molecules. A wide spectrum of nontoxic, biocompatible natural and synthetic polymers are available for drug carriers such as chitosan, starch, gelatine, soya protein isolate polyvinyl alcohol, polylactic acid, poly caprolactin acid, etc.