Synthesis and Characterization Study of Chitosan Based Natural Fiber: Biodegradable Polymer Composite

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Abstract. Polymer matrix composites are thermoplastic or thermosetting polymers reinforced with organic or inorganic fillers. Reports on all-green biocomposite films based on chitosan matrix are very few as of now and the available reports have not fully explored the influence of fiber-biopolymer ratios, pre-treatment of fibers and reinforcement with nanoparticles on film characteristics of such combinations. Considering the immense potential for such all-green blends as emerging biomaterials, the current investigation focused on blending an abundantly available biopolymer with natural fiber for the fabrication of films. Chitosan fitted the requirement on account of its easy availability, low cost, excellent compatibility with hydrophilic fiber surfaces and desired inherent biocompatibility. The chosen fiber, namely sisal is hydrophilic in nature. Since, both chitosan and the chosen natural fiber were hydrophilic in nature, the resulting blends were expected exhibit complete interfacial adhesion between the two, in order to propose thermally and mechanically stable films that can be customized for suitable applications. For this purpose, chitosan an inexpensive, biodegradable and biocompatible biopolymer was chosen to be blended sisal fibers. The raw fibers were pre-treated by mercerization (5% of NaOH solution) The results of pre-treatments showed that the removal of lignin and hemicelluloses materials from the fibers effected decrease in hydrophilicity, Increase in surface smoothness, thus rendering the fibers suitable to be Blended with chitosan. Pre-treated fibers were mixed with chitosan and cast in to films. The effects of pre-treatment of fibers, percentage compositions of the blends film were evaluated by using tear test, peel test, water absorption, biodegradable test, FTIR, SEM & EDS. Based on the above results chitosan sisal films prepared in the present study can be proposed as materials suitable to be developed for tissue engineering and food packaging applications.

Key words: Chitosan, Sisal Fiber, Tear, Peel, Biodegradation.

INTRODUCTION

In the present study, one of the inexpensive, promising biopolymer, Chitosan, is used as a film forming material. Chitosan, a natural, linear polysaccharide (poly-2-amino-2-deoxy-β-(1,4)-D-glucopyranose), is derived from chitin which is poly-2-acetamide-2-deoxy-β-(1,4)-D-glucopyranose. After cellulose, chitin is the most abundant natural polysaccharide found in crustacean shells such as crabs, prawns, insects and shrimps. It is a white, inelastic, hard and nitrogeneous polysaccharide [1-4] that can be extracted from seafood wastes by deproteination and demineralization. Chitin can be converted into chitosan by enzymatic treatment or alkali deacetylation, the later being the mostly used method [5-7]. During the deacetylation of chitin, part of the N-acetylated units is cleaved with the formation of D-glucosamine units. These units contain free amino groups, which enhances the solubility of chitosan in aqueous medium [8-11]. Degree of deacetylation of chitin and the resultant molecular weight, viscosity and solubility of chitosan depend on the method of conversion of chitin to chitosan. Commercial chitosan generally has a degree of deacetylation usually between 70 to 95% and molecular weight ranging from 50 to 2000 kDa [12-14]. Sisal fiber is completely biodegradable, green composites were manufactured with soy protein gum altered with gelatin. Sisal fiber, changed soy protein gums, and composites were described for their mechanical and warm

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