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Novel Blend Films Prepared from Solution of Collagen and Cellulose in 1-Allyl-3-methylimidazolium Chloride Ionic Liquid

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Novel Blend Films Prepared from Solution of Collagen and Cellulose in 1-Allyl-3-methylimidazolium Chloride Ionic Liquid

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Keywords: ionic liquid, collagen, cellulose, blend films, mechanical properties, compatibility

Abstract. Collagen/cellulose films were made by the blend solutions of collagen, cellulose in this paper. To begin with, collagen and cellulose was dissolved in 1-allyl-3-methylimidazolium chloride ([Amin]Cl). The structure of the blend films was characterized by FTIR and XRD. The effects of weight ratio between the two polymers on light transmittance, tensile strength, elongation at break and water absorption of the film were studied. The results showed that there were strong interactions and good compatibility between collagen and cellulose in the film and the polymers have strongest interactions at the mixing ratio of 5:5. The blend films possess better properties such as mechanical and water absorption properties than those made of single polymer.

Introduction

Collagen is a well known protein for its excellent biocompatibility and safety due to its biological characteristics, such as biodegradability and weak antigenicity [1]. It is also proved to be important in the formation of tissues and organs [2], and also is a surface active agent able to penetrate a lipid-free interface. However, the biomaterials made of pure collagen show poor water resistance, mechanical properties and other defects [3]. Solution blending is an effective method to modify the properties of polymer materials. Blends of collagen with other polymer, such as chitosan, poly (vinyl pyrrolidone) [4], glucomannan [5] and other macromolecule [6, 7] have been investigated to impart materials better properties than those of the single components.

Cellulose, the most abundant renewable polymer materials in nature, is regarded as a promising chemical material for possessing good biocompatibility, biodegradability and other excellent properties [8]. However, cellulose cannot be melted to fabricate into a desired form or to be dissolved in a common solvent for there are strong inter- and intra-molecular hydrogen bonding, which is the maximum limitations of natural cellulose in the practical application.

Ionic liquids are organic salts that usually melt below 100°C. They are considered to be a new green solvent for their strong polarity, "zero" vapor pressure, low melting point, high solubility and molecular design, etc. The ionic liquids have been used to dissolving natural polymers such as cellulose [9-11], silk fibroin [12], wool keratin [13], collagen [14], etc.

In this paper, an ionic liquid, 1-allyl-3-methylimidazolium chloride, was used as a solvent to prepare solutions of collagen and cellulose, and then the solution was blended and then casted on the glass plate to make a series of films. FTIR and XRD were applied to analyze the structure of the films. And transmittance, mechanical properties and water adsorption of the films were also investigated to research whether cellulose can be used to modify the poor mechanical and water-resistant properties of collagen.

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