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Preparation and characterization of biodegradable acrylic acid grafted poly(ϵ -caprolactone)/chitosan blends

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Abstract

The objective of this work was to study the effect of blending chitosan (CS) with poly(ϵ -caprolactone) (PCL) and acrylic acid grafted PCL (PCLgAA) on their biomechanical properties. Blend films with different compositions were prepared from acetic acid in order to improve the properties of chitosan and obtain new fully biodegradable materials. The blends were characterized by Fourier transform infrared analysis (FTIR), differential scanning calorimetry (DSC), wide-angle x-ray diffraction (WAXD), and tensile tests. FTIR results showed that intermolecular hydrogen bonds existed between these components in the blends, and the hydrogen bonds were mainly between carbonyls of PCL and amino groups of chitosan. In addition, the amino groups were shown to form amide or imide linkage with the grafted carboxylic acid in PCLgAA. The melting temperatures, cold crystallization and crystallinity of the PCL component decreased with the increase in chitosan content. Blending chitosan with both PCL and PCLgAA suppressed the crystallization of the polymeric component. Although the crystal structure of PCL component was not changed, the crystallization of the blends was affected because of the existence of hydrogen bonds between two components, which was proved by WAXD results. Finally, the ductility of CS was improved during tensile testing when blended with both polymers.

Keywords: polycaprolactone, chitosan, biodegradable, solution blended film