Characterization of films of PHBV/Cellulose Nanocrystals nanocomposites

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The poly(3-hydroxybutyrate-co-3-hydroxyvalerate), PHBV, is a biodegradable and biocompatible polymer having high potential in packaging applications. Although it has great academic and commercial interests because some properties are similar to polyethylene and polypropylene properties, its application is limited by low mechanical resistance [1,2]. Thus, the development of PHBV nanocomposites using cellulose nanocrystals (CNC) as a reinforcing agent is very promising, since the polymer matrix and the nanoparticles are renewable and biodegradable. Therefore, the objective of the present work was production and characterization of nanocomposite films of PHBV/CNC. The films were obtained by solvent casting in which the CNC were dispersed in the PHBV solution in chloroform using an ultrasonic processor with concentrations of 1, 2 and 3% (w/w) CNC. The films produced were characterized by scanning electron microscopy (SEM), mechanical tensile tests and water vapor permeability. The visual analysis of the films of nanocomposite showed a small increase in the opacity of the films with the increase of the CNC concentration, but the transparency of the films was maintained. The introduction of CNC caused a reduction in the water vapor permeability coefficient of the films, an interesting result for the possible application in packages. The CNC affect the mechanical properties of the PHBV causing a decrease in the elastic modulus and, consequently, increasing the fragility of the nanocomposites. This can be caused by a deficient dispersion of CNC in PHBV matrix or by a low interaction between PHBV and CNC. In the SEM images of the films after mechanical testing, it was observed that they presented a typically fragile fracture.

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