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ABSTRACTS

Characterization of nanocomposites of polyurethane based on castor oil and cellulose nanofibers

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Natural fibers have been used as thermoplastic reinforcement because low cost of raw materials, biodegradability, and enhancement of mechanical properties of composites [1]. In this work, polyurethane based on castor oil (PUR), a polymer obtained from renewable source, was used as matrix to compound nanocomposites with cellulose nanofibers, also a material from natural source. It was used processing pre-polymer followed by casting to produce the PUR and nanocomposites with 1, 2 and 5% (w/w) of cellulose nanofibers. The materials were characterized using UV-VIS spectroscopy, X-ray diffraction (XRD), dynamic mechanical analysis (DMA), and thermogravimetry (TGA). DMA results showed that addition of 5% (w/w) of cellulose nanofiber in PUR has increased the storage modulus from 1060 MPa to 1378 MPa, at 20ºC. Glass transition temperature (Tg) of PUR measured was 54ºC, shifting to 60ºC to nanocomposite with 5% (w/w) of cellulose nanofiber. It was calculated crosslink density above Tg [3], and the results showed that a decrease of crosslink density with the increase of cellulose nanofiber content in the nanocomposites. This effect observed should be explained because the presence of chemical reactions between pre-polymer isocyanate with hydroxyl groups of cellulose nanofibers, reducing crosslink density of PUR. UV-VIS results showed a decrease of transparency with the increase of cellulose nanofiber content, and it was characterized the coefficient of molar extinction of cellulose nanofiber in the nanocomposites in the range 400 to 800 nm. It was detected by X-ray diffraction (XRD) the presence of crystalline monoclinic phase of cellulose ($2\theta = 22^{o}$) [2] only at composition with 5% (w/w) of cellulose nanofiber. Thermogravimetry in air atmosphere has showed that onset oxidative temperature of all nanocomposites studied were 14ºC higher than PUR, indicating an effect of increase in thermal stability of nanocomposites comparing with PUR. These results indicate that the PUR/cellulose nanofiber nanocomposites studied showed effective enhancement of mechanical and thermal properties comparing with PUR, with viable use in technological applications.

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