EFFECT OF THE CONCENTRATION OF FIBERS ON THERMAL PROPERTIES OF CASTOR OIL POLYURETHANE COMPOSITES REINFORCED WITH CELLULOSE FROM SUGARCANE STRAW

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Abstract

The development in the area of natural-fiber-reinforced composites has greatly increased in recent years. Using castor oil polyurethane (PU) as matrix for composites reinforced with lignin and cellulose from sugarcane straw is in tune with economical and environmental interests. The aim of this work was to study the effect of the concentration of fibers on thermal properties of castor oil-polyurethane composites reinforced with cellulose from sugarcane straw. For the obtainment of cellulose, sugarcane straw was pretreated by steam explosion, followed by a delignification with NaOH 1.5% (w/v). For the production of the PU, the mass ratio between polyol (castor oil) and diisocyanate was 1.5:1.0. Reinforcement of the matrix was done changing the concentration of cellulose fibers (5 to 20% w/w). Differential scanning calorimetry (DSC) and thermogravimetric (TGA) analysis were done. TGA curves obtained for the pure PU and the composites show a small weight loss up to 100°C. After this temperature, there may still some volatilization of water molecules tightly bound to the fibers. Comparing TGA curves, it can be observed that the decay of the polyurethane matrix occurs in one step, while for the composites process takes place in two steps. The first stage is the decomposition of the fibers and the second of the matrix. It was noticed that when inserting a greater amount of reinforcement in the matrix the thermal stability of the composite decreases. The DSC curve of pure PU shows two glass transition temperatures (Tg), one near 40°C, and one higher around 163.7°C. Comparing the DSC curves of the composites reinforced with cellulose fibers with the pure PU, it was observed a small exothermic peak near 100°C, which has its peak area increase as the load of cellulose increases, probably due to the poor cure of the polymer caused by the presence of cellulose.

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