PROCESSING AND CHARACTERIZATION OF POLYETHYLENE TEREPHTALATE AND HIGH DENSITY POLYETHYLENE COMPOSITES WITH AGAVE FIBERS

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Introduction

This work describes the study of processing and characterization of the mechanical properties of recycled polyethylene terephthalate (PET) and recycled high density polyethylene (HDPE) composites using agave fiber, adding a compatibilizer and a coupling agent to the mixture to modify its properties.[1] The PET and HDPE containers used in this study came from the Laboratory and Technological Development in Plastics Recycling (LIDETREP), which supports the solid residue management of the University of Guadalajara.

Experimental Phase

The materials are collected, separated and manually classified; then enter a milling, washing and drying process. To obtain the composite, the plastics and the compatibilizers are mixed in an extruder with a single screw at a maximum processing temperature of 250 °C. The mixtures contain 10%, 20%, 30% and 40% wt. of PET. After that, the materials are submitted to a second extrusion in which we add the coupling agent and the fiber in a proportion of 10% wt. at a maximum temperature of 200°C.[2] With the obtained granules the fluidity index is measured, differential scanning calorimetry analysis (DSC) and thermogravimetric analysis (TGA) are realized. The extruded material is submitted to a drying process at 60°C and finally it goes through a thermo-compression modeling process at 200°C to obtain test specimens of the established measures for the realization of the following mechanical tests: tensile properties, flexural properties and impact resistance.

Results and Discussions

From the composites without fiber; at the mechanical tests, the material shows a general increase on its tensile resistance and flexural resistance (Figure 1); contrary to the impact resistance (Figure 2) where we observe an important decrease in such property, according to the content of PET. This results in a more breakable and rigid material when we increase the amount of PET in the mixture. From the thermogravimetric analysis of the polymeric matrix, we know that the highest processing temperature is of 375°C for PET, whereas for HDPE is 400°C, because of this, the selected temperature doesn't cause any thermal deterioration in the materials.

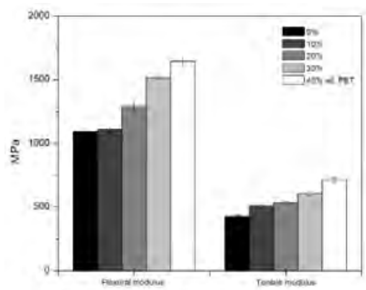

Figure 1. Properties of flexural and tensile without agave fiber or compatibilizer added to the composite.

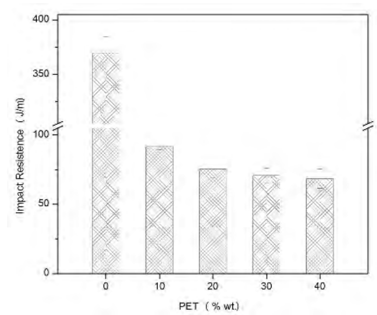

Figure 2. Property of impact resistance without agave fiber or compatibilizer added to the composite.

Conclusions

In the present study, we show the advances on the mechanical behavior of the recycled PET/HDPE composites. By DSC characterization we observed that the melting temperature of the polymeric matrix is within the processing range of temperatures. On the mechanical properties, the tensile modulus increases up to 67% and the flexural modulus up to 50% with the highest amount of PET. However impact resistance decreased considerably when increasing the amount of PET in the mixture.

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References

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