

PET waste depolymerization with multifunctional alcohol: FT-IR characterization

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Abstract – The effect of the composition on the chemical structure of the resultant products of PET waste depolymerization with multifunctional alcohol was assessed, at different middle infrared regions using Fourier transform infrared spectroscopy (FT-IR). Changes in the hydroxyl stretching, carbonyl symmetric stretching, carbonyl asymmetric stretching and alcohol linkage regions were monitored.

Due to their large use, the discharge of polymeric materials is a complex problem, and demands active participation of the industry, government and public. The recovering of polymeric thermoplastic wastes through recycling and reprocessing represents a great effort concerning the environmental pollution. Two of the most important methods in polymer chemical recycling of PET are alcoholysis and glycolysis which are commercial scale processes from that molecular degradation of PET is carried out in the presence of transesterification catalysts, mainly metal acetates [1-2]. The objective of this study was development new polymeric materials employing melt processing obtaining product oligomeric capable to act for reinforcement for changing properties. Fourier transform infrared spectroscopy (FT-IR) as tool for evaluating end-products from alcoholysis of poly(ethylene terephthalate) (PET) scraps in the presence of multifunctional alcohol and zinc acetate, was carried out. The effect of the composition on the chemical structure of the resultant products was assessed, at different middle infrared regions. Changes in the hydroxyl stretching, carbonyl symmetric stretching, carbonyl asymmetric stretching and alcohol linkage regions were monitored. Blends of poly(ethylene terephthalate) (PET) waste and pentaerythritol, herein named PENT, were prepared in an internal mixer Haake Rheomix 600, at 270 °C, 60 rpm, during 10 minutes. For all systems, it was noticed that ester linkages were broken and replaced with hydroxyl terminals of the alcohol through *in situ* transesterification reaction. The chemical structure of the new ester consists of PET low molar mass attached to the oxygen atom of the alcohol achieving in a branched polymer (star-branching polymer) which the number of branches depends on the degree of transesterification (DTE) (Figure 1). The lowest DTE seems to occur in the system with lower PET content because the remainder hydroxyl group in the alcohol could interact with the PET carbonyl ester group through intramolecular hydrogen bond, leading to the absorption of the carbonyl symmetric stretching to lower frequency.

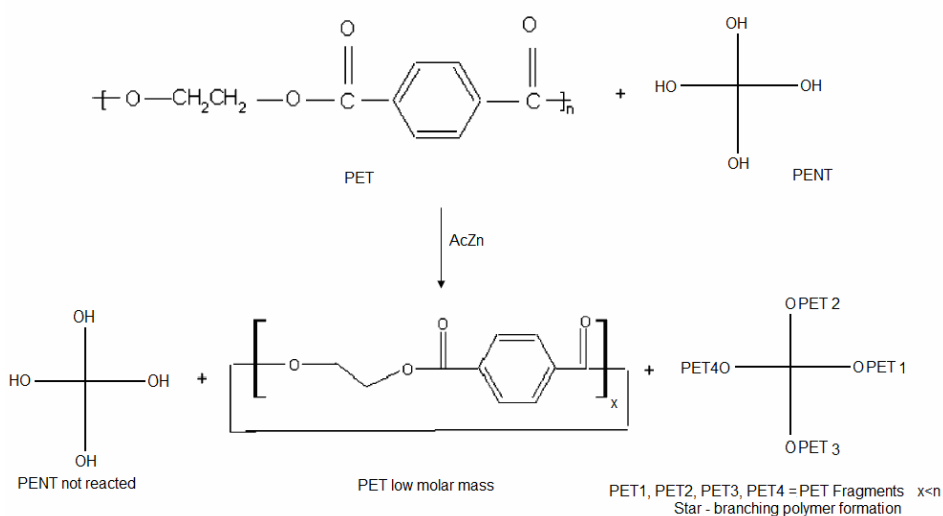


Figure 1: Probable structures from PET waste depolymerization with Pentaerythritol (PENT)

References

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