

Mechanical, thermal, and morphology properties of poly(lactic acid) plasticized with poly(ethylene glycol) and epoxidized palm oil hybrid plasticizer

ABSTRACT

Poly(lactic acid) (PLA) has received great attention recently due to its good physical and mechanical properties such as high tensile strength and modulus, good processability and biodegradability. In this study, low molecular weight poly(ethylene glycol) (PEG) and epoxidized palm oil (EPO) were used as hybrid plasticizers to improve toughness and ductility of PLA. Using the solubility parameter, a tentative evaluation of the hybrid plasticizer that could act as the most effective plasticizer for PLA has been performed and the obtained results have been corroborated with the materials physical properties. Excellent plasticizing effect was obtained by hybrid plasticizer PEG:EPO with ratio 2:1. Addition of PEG:EPO (2:1) hybrid plasticizer to PLA shows a significant improvement of 12,402%, compared to neat PLA. The improvement in flexibility and decrease in rigidity for the plasticized PLA is well evidenced by lower glass transition temperature (T_g) and tensile modulus values. In relation to the thermal stability, a decrease in thermal properties of the hybrid plasticized PLA was observed due to the volatility of the plasticizers. Scanning electron microscopy (SEM) shows that the hybrid plasticizer was turned PLA's smooth surface to fibrous structure and rough fracture surface.

Keyword: Poly(lactic acid); Poly(ethylene glycol); Epoxidized palm oil; Hybrid plasticizers