Enhanced Flexibility of Biodegradable Polylactic Acid/Starch Blends Using Epoxidized Palm Oil as Plasticizer

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Abstract

The brittleness of polylactic acid (PLA) has always limited its usage, although it has good mechanical strength. In this study, flexibility of PLA/starch (PSt) blend was enhanced using epoxidized palm oil (EPO) as the green plasticizer. The PLA/starch/EPO (PSE) blends were prepared while using the solution casting method by fixing the content of starch and varying ratio of EPO. The thermal properties, such as glass transition temperature (T-g), melting temperature (T-m), and crystallization temperature (T-cc) were decreased by increasing the amount of EPO into PSt, indicating that EPO increases the chain mobility. Thermogravimetric analysis (TGA) showed that thermal degradation resistance of PSE was higher when compared to PSt. The mechanical testing revealed that EPO at all contents improved the mechanical properties, such as increment of the elongation-at-break and impact strength. Whereas, dynamic mechanical analysis showed that the addition of filler into PLA decreased the storage modulus of PLA. The carbonyl group of the aliphatic ester remained the same in the PSE blends. The morphological study verified the ductility of PSE blends surface when compared to the brittle surface of PSt. As for the soil burial tests, EPO accelerated the degradation of blends. From these results, it can be concluded that EPO improved the flexibility of PLA blends.

Keywords

Author Keywords: polylactic acid; biodegradable; starch; epoxidized palm oil; solution casting; green plasticizer
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