

Development of Biodegradable Polyurethane Film Based on Castor Oil and Poly (3-hydroxybutyrate) †

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Abstract: In this study, biodegradable polyurethanes (PUs) were produced from castor oil (CO) and poly (3-hydroxybutyrate) diol (PHBD) using hexamethylene diisocyanate as a coupling agent. PHBDs of different molecular weights were synthesized through transesterification reaction between bacterial PHB and ethylene glycol by changing the reaction time from 2 to 8 hours. The synthesized PHBDs were characterized by Fourier transform infrared spectroscopy (FTIR) and proton nuclear magnetic resonance (¹H NMR). A series of PUs at different NCO/OH and CO/PHBD ratios were prepared. The resulting CO/PHBD-based PUs was then characterized in terms of mechanical and thermal properties. Increased PHBD content significantly enhanced the tensile strength and glass transition temperature (T_g) of CO/PHBD-based PUs compared to neat CO-based PU. Furthermore, CO/PHBD-based PUs synthesized from short-chain PHBD exhibited higher tensile strength compared to those produced from long-chain PHBD. Such improvement in stiffness can be due to the good compatibility between CO and PHBD. The incorporation of PHBD content also increased the crystallinity of the resulting PUs. In addition, higher degradation rates were obtained for CO/PHBD-based PUs compared to neat CO PU.

Keywords: poly (3-hydroxybutyrate); castor oil; polyurethane; biodegradation.

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Conflicts of Interest

The authors declare no conflict of interest.