NANOBIO-PLASTICS AND COMPOSITES FROM LINSEED OIL AND SACCHARIDIC SOURCE MATERIALS

Michelle R. While, Annie M. Thompson, David A. Bovles, Jon J. Kellar and William M. Cross
Materials Engineering and Science
South Dakota School of Mines and Technology
Rapid City, SD 57701

ABSTRACT

Commercial resins are nearly entirely synthetic, poorly biodegradable and petroleum derived. Owing to these limitations, an investigation to determine the viability of novel bio-based resins both as stand-alone materials for polymer matrix composites as well as additives for commercial synthetic resins has been conducted. The objective was to ultimately evaluate the mechanical and thermal properties and compare the new materials and their additive counterparts with the known epoxy vinyl resin, Derakane Momentum 470-300 (Dow Chemical). Syntheses have relied on commercially available flax seed fatty acids and saccharidic source materials of which the latter have included sucrose octaacetate and β-cyclodextrin. Initial studies were conducted with methyl stearate as a model compound for interesterification reactions prior to the use of methyl linolenate. Syntheses of sucrose octastearate, sucrose octalinolenate and heptokis(2,3-0-linolenyl)β-cyclodextrin were performed and monitored by 1H NMR, 13C NMR and FTIR. Methyl stearate, sucrose stearate and methyl linolenate were compounded with Derakane, and polymerization was performed using dimethylaniline accelerator and benzoyl peroxide catalyst. Young’s Modulus has been determined to be lower relative to that of Derakane coupon standards. Glass transition temperatures have also been determined by differential scanning calorimetry.