CHEMICAL MODIFICATIONS TO PRODUCE SOY-BASED POLYOLS

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ABSTRACT

This project comprises several chemical routes to produce soy-based polyols for future use in polyurethane foam applications. Soybean oil was polymerized by heat and catalyst to increase molecular weight, and viscosity for use as raw material for further reaction to form polyols in a batch reactor. Two different heat polymerization approaches were studied: non-catalyzed and catalyzed soybean oil using antraquinone as catalyst. A continuous flow reactor was designed to evaluate and compare with the batch reactor products.

One approach to imparting functionality was to react polymerized soybean oil. Synthesis consisted of three consecutive reactions: heat polymerization reaction of soybean oil, alcohol addition reaction with acetol as alcohol and residual acid neutralization with epoxy soybean oil. A second approach was based on the thermal polymerization reaction of partially epoxidized soybean oil and bodied partially epoxidized soybean oil with ethylene glycol. These products were tested in water-blown flexible foam polyurethane applications.

Polyols were also synthesized from oxirane ring opening of epoxidized soybean oil by alcoholysis reaction. Epoxidized soybean oil was combined with ethylene glycol and methanol to produce an alkoxy hydroxyl soy-based molecule at temperatures near 150 °C using p-toluenesulfonic acid to promote the reaction. In the first part of the study, different temperatures and reaction times were evaluated to optimize the reaction. In the second part of the study, different mole ratios of ethylene glycol and methanol were evaluated.