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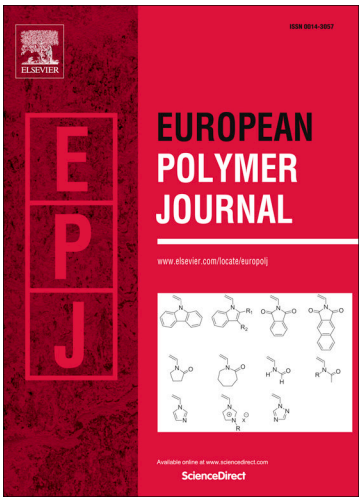

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Synthesis and characterization of a waterborne polyurethane made from castor oil and tartaric acid

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Abstract

Waterborne polyurethanes (WBPU) based on the reaction of unmodified castor oil (CO) with isophorone diisocyanate (IPDI) were synthesized using dimethylolpropionic acid (DMPA) or tartaric acid (TA) as internal emulsifiers. The effect of the incorporation of TA, a bio-based carboxylic acid, in the synthesis of castor oil-based WBPU was carefully investigated. For comparison, two WBPUs were synthesized using DMPA. The chemical changes that took place during the reaction were followed using FTIR. The raw materials and the final polymeric films were characterized by this technique as well as ^{1}HNMR, XRD, DSC, DMA and TGA. Results indicated that in the case of the sample prepared with TA, the isocyanate reacts with the hydroxyls of the acyl groups of the acid additionally to the alcoholic ones. In all cases, the films prepared by casting were translucent and showed glass transition temperatures above room temperature, although comparatively lower for the WBPU formulated with TA. Differences were also observed in the thermal degradation performance of the films. The observed differences were tracked to those in the molecular structures of the WBPUs.

Keywords: bio-based waterborne polyurethane; castor oil; tartaric acid.

1. Introduction

Polyurethanes (PU) were first synthesized by Bayer over 75 years ago. Since then and because of the large variety of possible raw materials offering different chemical structures, polyurethanes have been produced with different chemical characteristics, morphologies, and mechanical responses, thus having applicability in many and different industries. PUs can display thermoplastic, elastomeric or thermoset behavior