

Public Abstract

First Name:Rui

Middle Name:

Last Name:Xing

Adviser's First Name:Fu-hung

Adviser's Last Name:Hsieh

Co-Adviser's First Name:

Co-Adviser's Last Name:

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Title:Polyurethane foams containing renewable castor oil replacement

Polyurethane foams have a wide variety of commercial applications in daily life due to their unique advantages. Traditionally, polyurethane foams are made from petroleum-based polyols and isocyanates. Due to the shortage of fossil resources, renewable biobased materials are studied as alternatives to petroleum. In this project, castor oil was chosen as a renewable biobased polyol in order to replace the nonrenewable petroleum-based polyols. Water-blown rigid foams were made from polyols with different levels of castor oil replacement. For foams without castor oil and with 25% castor oil replacement, the effects of water added content were studied. Another group of foams made from a castor oil/ glycerol mixture were also prepared to investigate the effects of hydroxyl number. With the help of glycerol, rigid polyurethane foams with 80%-95% castor oil replacement were successfully prepared and showed competitive physical properties. Water-blown flexible foams were made from polyols using different levels of castor oil replacement. At the same time, the influence of cross-linker contents and isocyanate index on flexible foam was studied. Considering the low reaction rate of castor oil during the synthesis of polyurethane, a specific "heated mold" method was applied. Density, compression force deflection (CFD), 50% constant deflection compression (CDC), tear resistance (TR) and resilience were tested to identify the physical properties of flexible polyurethane foams. Results show that castor oil replacement often leads to a high cross-linking density. With 0.5% necessary cross-linker and low isocyanate index, flexible polyurethane foams with 100% castor oil replacement showed a good recovery property and proved to be a suitable alternative to nonrenewable petroleum-based polyols.