Physicochemical properties of jatropha oil-based polyol produced by a two steps method

ABSTRACT

A low cost, abundant, and renewable vegetable oil source has been gaining increasing attention due to its potential to be chemically modified to polyol and thence to become an alternative replacement for the petroleum-based polyol in polyurethane production. In this study, jatropha oil-based polyol (JOL) was synthesised from non-edible jatropha oil by a two steps process, namely epoxidation and oxirane ring opening. In the first step, the effect of the reaction temperature, the molar ratio of the oil double bond to formic acid, and the reaction time on the oxirane oxygen content (OOC) of the epoxidised jatropha oil (EJO) were investigated. It was found that 4.3% OOC could be achieved with a molar ratio of 1:0.6, a reaction temperature of 60 °C, and 4 h of reaction. Consequently, a series of polyols with hydroxyl numbers in the range of 138-217 mgKOH/g were produced by oxirane ring opening of EJOs, and the physicochemical and rheological properties were studied. Both the EJOs and the JOLs are liquid and have a number average molecular weight (Mn) in the range of 834 to 1457 g/mol and 1349 to 2129 g/mol, respectively. The JOLs exhibited Newtonian behaviour, with a low viscosity of 430-970 mPas. Finally, the JOL with a hydroxyl number of 161 mgKOH/g was further used to synthesise aqueous polyurethane dispersion, and the urethane formation was successfully monitored by Fourier Transform Infrared (FTIR).

Keyword: Epoxidation; Jatropha oil; Oxirane ring opening; Polyol; Polyurethane