

Comparative study of physico-chemical properties of pure Polyurethane and Polyurethane based on Castor Oil

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Abstract. Petroleum based polyurethanes are contributing major portions in the world requirement. To overcome the environmental issues and price adaptability, there is always a massive demand of utilization of renewable resources for polyurethane synthesis with comparable physico-chemical properties. Castor oil is the only major natural vegetable oil that contains a hydroxyl group (-OH) and unsaturated double bonds (C=C) in its organic chain and therefore can be employed with or without modification due to the excellent properties derived from the hydrophobic nature of triglycerides. In this study, physico-chemical properties of high performance polyurethane synthesized from Poly propylene glycol (PPG) in comparison with a combination of PPG and Castor oil (a renewable source), by in situ polymerization technique has been studied. The variations in properties of both types of polyurethanes are evaluated by Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM) and Thermogravimetric analysis technique (TGA). Tensile strength properties were investigated by Film Tensile testing equipment. Results indicated the presence of large -CH stretching in castor oil mixed polyurethane with a larger oxidative thermal stability, over a pure PPG polyurethanes. Tensile properties were found almost comparable in pure and mixed polymers, which signify the usage of mixed polymer in coming future, to overcome the environmental and economical crisis in polyurethanes synthesis.

Introduction

Polyurethanes (PU) have been extensively used due to excellent physical properties (e.g. low flexibility, high tensile strength, tear and abrasion resistance, solvent resistance, etc.) and high versatility in chemical structures [1-2]. Polyurethane is generally synthesized from the isocyanate reaction with polyol. Polypropylene glycol (PPG) is a polyol, is basically derived from the petrochemical industry [3]. High rising costs of petrochemical feedstock's and enhanced public desire for environmentally friendly green products, utilization of renewable resources to manufacture the rigid polyurethane is a work necessary at the present time [4-6].

Polyurethane based on polyols derived from different vegetable oils, like castor [7-8], sunflower and rapeseed oils [9]. Castor oil is one of the major natural vegetable oil that contains a hydroxyl group and so it is widely used in many chemical industries, especially in the production of polyurethanes [10]. Krushna Chandra Pradhan and P. L. Nayak investigated the synthesis of polyurethane nanocomposites prepared from natural oil like castor oil using HMDI and organically modified clay and covalently linked PU/n-HMDI composite, which was later collected successfully by the electro spinning process [7]. D.J. dos Santos et al., study preparation ,diagnosis from castor oil exhibited increasing of diisocyanate groups, in relation to polyol amount, has increasing of