UNIVERSITI TEKNOLOGI MARA

SYNTHESIS AND CHARACTERIZATION OF EPOXIDIZED PALM OIL BASED POLYOL-SILANE COATED FILM

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Thesis submitted in fulfillment
of the requirements for the degree of
Master of Science

Faculty of Applied Sciences

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 28th September 2015to conduct the final examination of Siti Munira bt Yahaya on her Master of Science thesis entitled "Synthesis and Characterization of Epoxidized Palm Oil based Polyol-Silane Coated Film" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The panel of Examiners recommends that the student be awarded the relevant degree. The panel of Examiners was as follows:

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AUTHOR'S DECLARATION

I declare that the work in this thesis/dissertation was carried out in accordance with the regulation of Universiti Teknologi Mara. It is original and is the result of my own work, unless otherwise indicated or acknowledge as reference work. This thesis has not submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

Epoxidized palm oil (EPO) based polyols were produced from three different molar ratios of EPO and glycerol (1:1.0, 1:1.5, 1:2.0) via hydroxylation reaction. The reduction of oxirane content from 2.9 to 0.04%, the increase in hydroxyl value to 509.6 mgKOH/g and high viscosity of synthesized polyols indicates the opening of epoxy ring and also showed the grafting process had been occurred. Based on FTIR and NMR spectrum, hydroxyl group has been chemically grafted onto the opened epoxy ring of EPO. Polyol-1.5 synthesized from 1 mol of EPO react with 1.5 mol of glycerol was chosen in formulating polyol-silane resin due to its optimum properties and characteristics compared with others. The polyol-1.5 was mixed with different types of silane and hardener to formulate polyol-silane resin. Each silanes was varied with three different weight percentages (10, 30 and 50 wt %). Result shows that only polyol-3-Isocyanatepropyltrimethoxysilane (ICPTES) resin was successfully formed coated film. The disappearance of OH groups at 3450 cm^{-1} and detection of strong siloxane, Si-O-Si signal at 1077 cm^{-1} showed silane was chemically grafted. Based on Thermogravimetric analysis (TGA), it showed that the degradation temperature (T_d) of all coated films was increased with the addition of percentage of silane. However, the glass transition temperature (T_g) of coated film obtained from Differential Scanning Calorimetric (DSC), did not follow the same trends. The T_g of sample with 50 wt% of silane exhibits lower T_g than sample with 30 wt% of silane. This may due to the fact that the greater functionality of siloxane network contributing to poor chain rigidity. Meanwhile, the hardness and adhesion strength of coated film increased as the percentage of silane used increased due to excellent structural compatibility of mixture which formed crosslinked polymer. Wettability and surface energy of film was determined using water contact angle analyzer and results showed that the polyol-ICPTES coated film formed hydrophobic and water-repellent surface which is good to used as sealant and adhesives.

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