UNIVERSITI TEKNOLOGI MARA

PALM OIL-BASED COATING MATERIAL FROM EPOXIDIZED UNRIPE PALM OIL AND USED COOKING OIL

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ABSTRACT

The popularity of using green alternatives to petroleum-based products has been driven by the growing societal concerns over sustainability, depletion of fossil raw materials and a perceived negative environmental impact of petroleum-based polymers. On account of that, this research utilized the unripe palm oil (UPO) and used cooking oil (UCO) as an alternative to minimize the use of diglycidyl ether of bisphenol A (DGEBA) in the formulation of epoxy coating. UPO and UCO were epoxidized by performic acid generated in situ by reacting formic acid with hydrogen peroxide producing epoxidized unripe palm oil (EPO) and used cooking oil (ECO). Epoxidation of EPO is succeeded when Transform Infrared Spectroscopy (FTIR) analysis of EPO show that oxirane ring was present at a wavenumber 844 cm–1 whereas absent in ECO. This is due to decomposition of unsaturated fatty acids of UCO during frying process as carbon-carbon double bonds are crucial for reaction to takes place to produce epoxy rings. The highest percent oxirane oxygen content yielding is 89.6 % conversion at 45°C for 150 minutes for EPO. EPO and ECO were formulated with commercial epoxy resin based on diglycidyl ether of bisphenol A (DGEBA) at five different ratios (0:100, 10:90, 20:80, 30:70 and 40:60). EPO-based coating material with ratio 30:70 gave the best performances as the coated test panels experienced only a small trace of peeling from adhesion strength test while also succeeding to protect the metal from corrosion or rusting phenomenon in chemical resistance test. However, ECO-based coating material showed poor performances as the coating film detached off the surface and failed to protect substrate from rust and corrosion for all formulation ratios. Overall, it can be concluded that EPO has the potential to replace petroleum-based resin in coating formulation for industrial purposes compared to ECO.

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