

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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TABLE OF CONTENTS

	Page
CONFIRMATION BY PANEL OF EXAMINERS	ii
AUTHOR'S DECLARATION	iii
ABSTRACT	iv
ACKNOWLEDGEMENT	v
LIST OF TABLES	x
LIST OF FIGURES	xii
LIST OF ABBREVIATIONS	xv
CHAPTER ONE: INTRODUCTION	1
1.1 Research Background	1
1.2 Problem Statement	3
1.2.1 Poor Fracture Toughness of DGEBA	3
1.2.2 Negative Impact of BPA in Health	4
1.2.3 Mistakenly Harvested Unripe Oil Palm Fresh Fruit Bunches (FFB)	4
1.2.4 Effect of Used Cooking Oil on Human Health and Environment	5
1.3 Research Objectives	6
1.4 Research Hypothesis	6
1.5 Scope of Research	7
CHAPTER TWO: LITERATURE REVIEW	8
2.1 Vegetable Oils – An Alternative Source to Petroleum-Based Polymer	8
2.1.1 Composition and Chemistry of Vegetable Oils	8
2.1.2 Types of Vegetable Oils (VO)	11
2.1.3 Selection of Vegetable Oils: Palm Oil as Raw Material	13

2.1.4	The Role of Palm Oil in The Coatings and Paints Industry	14
2.2	Crude Palm Oil	14
2.2.1	Compositions and Characteristics	15
2.2.2	Crude Palm Oil Production	16
2.2.3	Unripe Fresh Fruit Bunch Palm Oil	18
2.2.4	Used Cooking Oil	20
2.3	Epoxidation of Palm Oil	32
2.3.1	Epoxide Functional Group	33
2.3.2	Selection of Oxidizing System	34
2.3.3	Selection of Oxygen Carrier	35
2.3.4	Factors Affecting Epoxidation	36
2.3.5	Mechanism of Epoxidation Reaction	42
2.3.6	Importance of Carbon-Carbon Double Bonds in Epoxidation Reaction	44
2.4	Coating	45
2.5	Components in Epoxy Coating	47
2.5.1	Epoxy Resin	47
2.5.2	Curing Agents/ Hardener	50
2.5.3	Pigment	54
2.5.4	Solvents	57
2.6	Coating Application	58
2.6.1	Surface Preparation	58
2.6.2	Methods of Coating Application	60
2.7	Adhesion	62
2.7.1	Mechanical Interlocking	63
2.7.2	Adsorption	65
2.7.3	Chemical Bonding	68
2.8	Coating Failure	71