

**BIO-LUBRICANT PRODUCTION BASED ON
OPTIMUM EPOXIDIZED OLEIC ACID
USING IN SITU PERACID MECHANISM**

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UNIVERSITI TEKNOLOGI MARA

2022

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By

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This report is submitted in partial fulfillment of the requirements
needed for the award of
Bachelor of Chemical Engineering (Environment) with Honours

**CENTRE FOR CHEMICAL ENGINEERING STUDIES
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AUG 2022

ACKNOWLEDGEMENT

First and foremost, I am thankful to God for giving us strength and guidance to finish this report. Special thanks to Dr Mohd Jumain Bin Jalil, my final year project supervisor of who has contributed his knowledge towards my understanding that has guided me throughout this research project. His comments, advices and guidance made me proud and enjoy collaborating with him. I would like to extend my appreciation especially for my friends for their cooperation and willingness to complete this work. They were always there to help me in sharing different opinions and guided me when there are misunderstanding about this topic. My thanks also go to parents and family for giving me such as worthwhile, motivation, financial support, and love throughout our thick and thin. May Allah bless all of you. Thank you.

TABLE OF CONTENTS

	PAGE
AUTHOR'S DECLARATION	i
SUPERVISOR'S CERTIFICATION	ii
COORDINATOR'S CERTIFICATION	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	ix
LIST OF SYMBOLS	x
LIST OF ABBREVIATIONS	xi
ABSTRACT	xii
CHAPTER ONE INTRODUCTION	1
1.1 Introduction	1
1.2 Problem Statement	2
1.3 Objectives	2
1.4 Scope of Work	3
CHAPTER TWO LITERATURE REVIEW	4
2.1 Palm Oil as Raw Material	4
2.2 Palm Oil Properties and demand	5
2.2.1 Palm Oil Properties	5
2.2.2 Palm Oil Demand	7
2.2.3 Fatty Acid Composition Palm Oil and Palm Kernel Oil	8
2.2.4 Palm Kernel Oil and Palm Oil	9
2.3 Epoxidation Process	12
2.3.1 Epoxidation by Peracid Mechanism	13
2.4 Bio-lubricant formation from epoxidation of vegetable oil	13
2.4.1 Ring Opening of Epoxidized Vegetable Oil	14
2.4.2 Production and Process Bio-lubricant	15

ABSTRACT

Conventional bio-lubricants are produced from petroleum, where petroleum-based components have the potential to give environmental threats. Bio-lubricants based on vegetable oil, such as palm oil, can be a replacement for petroleum as the base ingredient. The epoxidation process is essential to alter the vegetable oil into bio-lubricants. However, due to less study on the optimum process parameters, such as the molar ratio of formic acid (FA) to unsaturation dated palm oil oleic acid (OA), molar ratio of hydrogen peroxide (H_2O_2) to unsaturation dated palm oil oleic acid and the agitation speed, the optimum of each parameters was determined for the epoxidation of dated palm oil oleic acid by peracid *in-situ peracid* mechanism. The determination of the optimum process parameters used the one factor at a time (OFAT) method. The research was performed under a constant temperature of $60^\circ C$. Moreover, less research was found regarding the bio-lubricant production using epoxidized palm oil, thus, the second objective was to produce bio-lubricant from epoxidized oleic acid by the chosen method which was alcoholysis. The alcohols used consisted of methanol, tert-butyl alcohol and ethanolamine. The identity of the bio-lubricants were confirmed using Fourier Transform Infrared (FTIR) Analysis. Other than that, a kinetic modelling was performed using MATLAB, genetic algorithm optimization tool as a few research can be found to support the method. Apart from optimizing the epoxidation process, the reaction rates were determined. The optimum molar ratio of FA/OA, molar ratio of HP/OA and the agitation speed were obtained 1.0:1.0, 0.5:1.0 and 200 rpm respectively. Furthermore, the bio-lubricant produced by alcoholysis using three different alcohols were analyzed using Fourier-Transform Infrared Spectroscopy (FTIR). Lastly, the kinetic reaction rates were determined using genetic algorithm MATLAB optimization tool and the experimental data was compared together with the simulation data.