

TRANSESTERIFICATION OF PALM OIL IN ORGANIC  
SOLVENTS BY AN IMMEDIATE *Pseudomonas*  
*fluorescens* LIPASE

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TRANSESTERIFICATION OF PALM OLEIN IN ORGANIC SOLVENTS BY  
AN IMMOBILIZED *Pseudomonas fluorescens* LIPASE

By

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Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: Transesterification of Palm Olein in Organic Solvents by an Immobilized *Pseudomonas fluorescens* Lipase oleh Siti Khatijah Aminah binti Muda, no. matrik: UK 6675 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Biologi sebagai memenuhi sebahagian daripada keperluan memperolehi Ijazah Sarjana Muda Sains (Sains Biologi) Fakulti Sains dan Teknologi, Kolej Universiti Sains dan Teknologi Malaysia.

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## TABLE OF CONTENTS

	<b>Page</b>
<b>ACKNOWLEDGEMENT</b>	ii
<b>LIST OF TABLES</b>	v
<b>LIST OF FIGURES</b>	vi
<b>LIST OF ABBREVIATIONS</b>	vii
<b>LIST OF APPENDICES</b>	viii
<b>ABSTRACT</b>	ix
<b>ABSTRAK</b>	x
<b>CHAPTER 1            INTRODUCTION</b>	<b>1</b>
<b>CHAPTER 2            LITERATURE REVIEW</b>	
2.1                    Palm olein	
2.1.1                Introduction	4
2.1.2                Composition of palm olein	5
2.1.3                Health benefit of palm olein	8
2.2                    Lipases	
2.2.1                Definition of lipases	9
2.2.2                Immobilization of lipases	10
2.2.3                Lipase-catalyzed transesterification	12
2.2.4                Application of lipases	13
2.2.5                Organic solvents as reaction media	14
<b>CHAPTER 3            METHODOLOGY</b>	
3.1                    Materials	17
3.2                    Methods	
3.2.1                Transesterification reaction	17
3.2.2                Effect of organic solvents as reaction media	18
3.2.3                Removal of free fatty acids (FFA) from transesterified oils	18

3.2.4	Reversed-Phase High Performance Liquid Chromatography (RP-HPLC) analysis	19
<b>CHAPTER 4</b>	<b>RESULTS</b>	21
<b>CHAPTER 5</b>	<b>DISCUSSION</b>	30
<b>CHAPTER 6</b>	<b>CONCLUSION AND RECOMMENDATION</b>	33
<b>REFERENCES</b>		34
<b>APPENDICES</b>		41
<b>CURRICULUM VITAE</b>		49

## LIST OF TABLES

Table		Page
2.1	Typical fatty acids composition of RBD palm olein.	7
2.2	Typical triglycerides composition of RBD palm olein	7
4.1	Percentage concentration of peaks observed on HPLC profiles of non-transesterified and transesterified palm olein in various organic solvents.	27



## LIST OF FIGURES

Figure		Page
4.1	HPLC profile of non-transesterified palm olein (a) and palm olein transesterified in dimethylsulphoxide (b).	22
4.2	HPLC profile of non-transesterified palm olein (a) and palm olein transesterified in tetrahydrofuran (b).	23
4.3	HPLC profile of non-transesterified palm olein (a) and palm olein transesterified in diethylether (b).	24
4.4	HPLC profile of non-transesterified palm olein (a) and palm olein transesterified in heptane(b).	25
4.5	HPLC profile of non-transesterified palm olein (a) and palm olein transesterified in isoctane(b).	26
B.I	Palm olein	44
B.2	Glyceride sample in sample tube	45
C.1	Orbital Shaker	46
C.2	FFA Removal process	47
C.3	Reverse-Phase High Performance Liquid Chromatography	48

## LIST OF ABBREVIATIONS

HLPC	High performance liquid chromatography
DoH	Degree of hydrolysis
DoT	Degree of transesterification
DMSO	Dimethylsulphoxide
DET	Diethylether
THF	Tetrahydrofuran
RBD	Refined, Bleached and Deodorized
NO <sub>3</sub>	Nitrate
O <sub>2</sub>	Oxygen
NaOH	Sodium hydroxide
KOH	Potassium hydroxide
TG	Triglyceride
DG	Diglyceride
MG	Monoglyceride
rpm	Rotation per minute
DAD	Diode Array Detector
FFA	Free fatty acid
NT	Non-transesterified
T	Transesterified

## LIST OF APPENDICES

<b>Appendix</b>		<b>Page</b>
A	Calculation of percentage of free fatty acid (FFA) removal and example of calculating the degree of transesterification	43
B	Samples analysed	44
C	Equipments used	46

## ABSTRACT

The effect of different organic solvents as reaction medium for transesterification of palm olein was studied. The organic solvents used were: dimethylsulphoxide (log  $P$  – 1.3), tetrahydrofuran (log  $P$  0.49), diethylether (log  $P$  0.85), heptane (log  $P$  4.0) and isooctane (log  $P$  4.52). Transesterification reaction was carried out at 60°C and 200 rpm for 6 hours using an immobilized lipase from *Pseudomonas fluorescens* as catalyst. The catalytic performance of the lipase was by determining the changes in peak composition and concentrations by Reversed-Phase High Performance Liquid Chromatography (RP-HPLC) and the calculated degree of hydrolysis (DoH) and degree of transesterification (DoT). Transesterification resulted in an increase in Peak 5 for all the solvents studied except for tetrahydrofuran. Peak 1, 3 and 4 was observed to increase in at least two of the solvents (i.e. heptane and isooctane) whilst Peak 1 and 3 was observed to increase in at least three of solvents (tetrahydrofuran, heptane and isooctane) studied. A new peak, Peak 6 and 7 were observed in heptane and isooctane. DoH was the highest when isooctane was used as medium with 0.37%. This was followed by palm olein transesterified in dimethylsulphoxide (0.17%), diethylether (0.17%), heptane (0.05%) and tetrahydrofuran (0.03%). Isooctane also gave the highest DoT with 5.44%, followed by heptane (5.22%), dimethylsulphoxide (3.63%), tetrahydrofuran (3.30%) and diethylether (0.82%). The results obtained show that the lipase was active in all range of organic solvents with isooctane being the best medium to be used in this study.

# TRANSESTERIFIKASI MINYAK OLEIN KELAPA SAWIT DALAM PELARUT ORGANIK DENGAN MENGGUNAKAN ENZIM *Pseudomonas fluorescens* TERSEKAT-GERAK

## ABSTRAK

Kesan ke atas pelarut organik yang pelbagai sebagai media tindakbalas transesterifikasi terhadap minyak olein kelapa sawit telah dijalankan. Pelarut organik yang digunakan adalah: dimetilsulfida (Log  $P$  -1.30), tetrahidrofuran (Log  $P$  0.49), dietileter (Log  $P$  0.85), heptana (Log  $P$  4.0) dan isooktana (log  $P$  4.52). Tindakbalas transesterifikasi dilakukan pada 60°C dan 200 rpm selama 6 jam dengan menggunakan enzim *Pseudomonas fluorescens* tersekat-gerak sebagai pemangkin. Perubahan pada luas puncak ditentukan dengan menggunakan fasa berbalik-kromatografi cecair berkuasa tinggi (RP-HPLC) dan pengiraan darjah hidrolisis (DoH) serta darjah transesterifikasi (DoT). Puncak 5 meningkat bagi semua pelarut yang dikaji kecuali untuk tetrahidrofuran. Puncak 1,3 and 4 meningkat sekurang-kurangnya dalam dua pelarut iaitu heptana dan isooktana manakala puncak 1 dan 3 meningkat dalam tiga pelarut iaitu tetrahidrofuran, heptana dan isooktana. Puncak baru terbentuk pada puncak 6 dan 7 dalam heptana dan isooktana. Nilai DoH tinggi dalam isooktana dengan 0.37% diikuti oleh dimetilsulfida (0.17%), dietileter (0.17%), heptana (0.05%) dan tetrahidrofuran (0.03%). Isooktana juga memberikan nilai tertinggi DoT dengan 5.44% diikuti oleh heptana (5.22%), dimetilsulfida (3.63%), tetrahidrofuran (3.30%) dan dietileter (0.82%). Daripada keputusan yang diperolehi, enzim aktif dalam isooktana yang merupakan medium paling sesuai dalam kajian ini.