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

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By

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JABATAN SAINS BIOLOGI
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PENGAKUAN DAN PENGESAHAN LAPORAN
PROJEK PENYELIDIKAN I DAN II

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: Transesterification of Palm Olein in Organic Solvents by an Immobilized Amano Lipase PS-C1
oleh Liviani @ Nur Atiqah binti Lausin, no. matrik: UK 7489 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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LIST OF ABBREVIATIONS

a_w	water activity
HLPC	High performance liquid chromatography
DoH	Degree of hydrolysis
DoT	Degree of transesterification
DMSO	Dimethylsulphoxide
DET	Diethylether
THF	Tetrahydrofuran
RBD	Refined, bleached and deodorized
CF	Cystic fibrosis
PCL	*Pseudomonas cepacia* lipase
NaOH	Sodium hydroxide
KOH	Potassium hydroxide
DAD	Diode array detector
FFA	Free fatty acid
NT	Non-transesterified
T	Transesterified

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ABSTRACT

The effect of organic solvents as reaction medium for transesterification of palm olein was studied. The organic solvents used were: dimethylsulphoxide (log *P* –1.30), 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 cepacia* as catalyst. The catalytic performance of the lipase was appraised by determining the changes in peak composition and concentrations by Reverse-Phase High Performance Liquid Chromatogram (RP-HPLC) and the calculated degree of hydrolysis (DoH) as well as degree of transesterification (DoT). Transesterification resulted in an increase in Peak 6 and 7 for all the solvents studied except for diethylether. Peak 1 and 3 show increase in at least three of the solvents (i.e. tetrahydrofuran, heptane and isooctane). Peak 5 also observed to increase in three solvents (i.e. dimethylsulphoxide, tetrahydrofuran and heptane). Peak 9 shows increase in two solvents (i.e. dimethylsulphoxide and heptane) whilst Peak 2 increases only in diethylether. Peak 4 and 8 were observed only in diethylether. D_oH was highest when tetrahydrofuran was used with 5.01%. This is followed by dimethylsulphoxide with 3.95%, diethylether with 3.95%, heptane with 2.84% and isooctane with 2.73%. Heptane gave the highest value of D_oT with 4.37%, followed by diethylether with 2.37%, isooctane with 2.08%, tetrahydrofuran with 2.04% and dimethylsulphoxide with 0.61%. The most suitable condition for transesterification using *P cepacia* lipase was in heptane.

TRANSESTERIFIKASI MINYAK OLEIN KELAPA SAWIT DI DALAM PELARUT ORGANIK OLEH ENZIM *Pseudomonas cepacia* LIPASE TERSEKAT-GERAK

ABSTRAK

Kesan pelarut organik sebagai medium tindakbalas untuk transesterifikasi minyak olein kelapa sawit telah dikaji. Pelarut organik yang digunakan ialah dimetilsulfoksida (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 telah dilakukan pada suhu 60°C dan pada kelajuan 200 rpm selama 6 jam menggunakan enzim *Pseudomonas cepacia*. Tindakbalas pemangkinan ditentukan melalui perubahan komposisi dan luas puncak oleh RP-HPLC dan pengiraan darjah hidrolisis (DoH) dan darjah transesterifikasi (DoT). Transesterifikasi menghasilkan peningkatan pada luas puncak 6 dan 7 pada semua pelarut kecuali dalam dietileter. Puncak 1 dan 3 menunjukkan peningkatan dalam tiga pelarut (tetrahidrofuran, heptana dan isooktana). Puncak 5 juga menunjukkan peningkatan dalam tiga pelarut (dimetilsulfoksida, tetrahidrofuran dan heptana). Puncak 9 menunjukkan peningkatan dalam dua pelarut (dimetilsulfoksida dan heptana) sementara Puncak 2 hanya meningkat di dalam dietileter. Puncak 4 dan 8 hanya muncul di dalam dietileter. DoH memberikan nilai paling tinggi apabila tetrahidrofuran digunakan dengan 5.01%. Ini di ikuti oleh dimetilsulfoksida dengan 3.95%, dietileter dengan 3.95%, heptana dengan 2.84% dan isooktana dengan 2.73%. Heptana memberikan nilai DoT paling tinggi iaitu 4.37 % di ikuti oleh dietileter dengan 2.37%, isooktana dengan 2.08%, tetrahidrofuran dengan 2.04% dan dimetilsulfoksida dengan 0.61%. Keadaan yang paling sesuai untuk transesterifikasi menggunakan *P. cepacia* lipase adalah di dalam heptana.