TRANSESTERIFICATION OF PALM OLEIN IN ORGANIC SOLVENTS BY AN IMMOBILIZED *Aspergillus niger* LIPASE

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Transesterification of palm olein in organic solvent by an immobilized (aspergillus niger) lipase / Nur Asiah Hashim.

Lihat sebelah

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By

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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 *Aspergillus niger* LIPASE oleh NUR ASIAH BT. HASHIM, No. Matrik UK 6600 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

MUFA	Monounsaturated fatty acid
PUFA	Polyunsaturated fatty acid
RP-HPLC	Reversed-Phase High Performance Liquid Chromatography
REFPO	Refined palm olein
RPO	Red palm olein
POP	Palmitic-Oleic-Palmitic
IV	Iodine value
CBE	Cocoa butter equivalent
CBI	Cocoa butter improver
PMF	Palm mid fraction
C14:0	Myristic acid
C16:0	Palmitic acid
C18:0	Stearic acid
C18:1	Oleic acid
C18:2	Linoleic acid
PPP	Tripalmitin
SOS	Disteroolein

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ABSTRACT

The effect of different organic solvents as reaction media for transesterification of palm olein was studied. The organic solvents studied used were: dimethylsulphoxide (log *P*-1.3), tetrahydrofuran (log *P* 0.49), dietylether (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 *Aspergillus niger* as catalyst. The catalytic performance of the lipase was appraised 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) as well as degree of transesterification (DoT). Transesterification resulted in an increase in Peak 3 for all the solvents studied except for diethylether. Peak 8 was observed to increase in at least three of the solvents (i.e. tetrahydrofuran, heptane and isooctane) whilst Peak 1 was observed to increase in at least two of the solvents (i.e. tetrahydrofuran and diethylether) studied. Peak 2 and Peak 6 was increased when palm olein was transesterified in dimethylsulphoxide and heptane, respectively. A new peak, Peak 4 was only observed in diethylether. DoH was the highest when isooctane was used as medium with 0.4%. This was followed by palm olein transesterified in heptane (0.11%), diethylether (0.09%), tetrahydrofuran (0.03%) and dimethylsulphoxide (0.03%). Isooctane also gave the highest DoT with 5.47%, followed by tetrahydrofuran (2.97%), diethyleter (2.25%), dimethylsulphoxide (0.84%) and heptane (0.05%). 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 KE ATAS MINYAK OLEIN KELAPA SAWIT DALAM PELARUT ORGANIK MENGGUNAKAN *Aspergillus niger* LIPASE TERSEKAT-GERAK.

ABSTRAK

Kesan ke atas pelbagai pelarut organik sebagai media tindak balas untuk transesterifikasi ke atas minyak olein kelapa sawit telah dijalankan. Pelarut organik yang digunakan adalah dimetilsulfida (log *P*-1.3), tetrahidrofuran (log *P* 0.49), dietileter (log *P* 0.85), heptana (log *P* 4.0) dan isooktana (log *P* 4.52). Tindak balas diteruskan pada 60°C dan 200 rpm selama 6 jam menggunakan lipase dari *Aspergillus niger* sebagai katalisis. Persembahan katalitik dari lipase ditentukan dengan melihat perubahan pada komposisi dan kepekatan puncak yang didapati dari RP-HPLC dan juga pengiraan darjah hidrolisis serta transesterifikasi. Hasil transesterifikasi menunjukkan peningkatan pada puncak ke 3 untuk semua pelarut kecuali dietileter. Puncak ke 8 didapati menunjukkan peningkatan pada sekurang-kurangnya tiga pelarut (tetrahidrofuran, heptana dan isooktana) manakala Puncak 1 didapati meningkat pada sekurang-kurangnya dua pelarut (tetrahidrofuran dan dietileter). Puncak 2 dan 6 menunjukkan peningkatan apabila transesterifikasi dalam dimetilsulfida dan heptana. Puncak yang baru, iaitu Puncak 4 diperhatikan dalam dietileter. Darjah hidrolisis yang tertinggi didapati apabila isooktana digunakan sebagai media dengan nilai (0.4%). Ini diikuti oleh minyak olein kelapa sawit yang ditranseterifikasi dalam heptana (0.11%), dietileter (0.09%), tetrahidrofuran (0.03%) dan dimetilsufida (0.03%). Isooktana juga memberi nilai darjah transesterifikasi tertinggi dengan nilai 5.47%, diikuti oleh tetrahidrofuran (2.97%), dietileter (2.25%),dimetilsulfida (0.84%) dan heptana (0.05%). Keputusan ini menunjukkan bahawa lipase aktif dalam semua julat pelarut organik dan isooktana adalah media terbaik untuk kajian ini.