

EFFECT OF IRFAGE SPECIFICITY ON THE TRANSESTERIFICATION  
OF CORN OIL WITH GOO LIVER OIL

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EFFECT OF LIPASE SPECIFICITY ON THE TRANSESTERIFICATION OF  
CORN OIL WITH COD LIVER OIL

By

Siti Nur Alia binti Zakaria

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Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:

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## LIST OF ABBREVIATIONS

HPLC	High performance liquid chromatography
CO	Corn oil
CLO	Cod liver oil
DoH	Degree of hydrolysis
DoT	Degree of transesterification
EPA	Eicosapentaenoic acid
DHA	Docosahexaenoic acid
PSI	Positional specificity index
FFA	Free fatty acid
rpm	revolution per minute
NaOH	Sodium hydroxide
DAD	Diode array detector

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## ABSTRACT

The effect of lipase specificity on the transesterification of corn oil with cod liver oil was studied. The lipases used were from: *Rhizomucor miehei*, *Pseudomonas fluorescens*, *Aspergillus niger*, Amano lipase PS-C I and wheat germ. Transesterification reaction was carried out at 60°C and 200 rpm for 6 hours using hexane as medium. The catalytic performance of each lipases were appraised by determining the changes in peak composition and concentration by Reversed-Phase High Performance Liquid Chromatography (RP-HPLC) and the calculated degree of hydrolysis (DoH) and degree of transesterification (DoT). Blending of corn oil with cod liver oil was possible due to the mixture of peaks observed on the HPLC profile of blend compared to the unblended oils. Peak 3 and Peak 10 were observed to increase in concentration after transesterification using *R. miehei* lipase. *P. fluorescens* lipase produced an increase in the concentration of Peaks 3, 4 and 10. Increased in the concentration of Peaks 2, 5, 6 and 8 was observed when *A. niger* was lipase used. Lipases from Amano Lipase PS-C I and wheat germ increased the concentration of Peak 4, and Peaks 1, 10, respectively. Two new peaks, Peaks 7 and 9 were also formed when *R. miehei*, *P. fluorescens* and Amano Lipase PS-C I lipases were used as catalysts. Peaks 9 was the only new peak observed when *A. niger* lipase was used instead. No new peak was formed for wheat germ lipase. The calculated DoT and DoH showed that *R. miehei* lipase gave the highest DoT and DoH with 65.7% and 2.8% respectively. DoT for wheat germ, Amano Lipase PS-C I, *P. fluorescens* and *A. niger* lipases was 44.3%, 29.1%, 20.4% and 3.4%, respectively. DoH for Amano Lipase PS-C I, *P. fluorescens*, *A. niger* and wheat germ lipases was

1.7%, 0.14% and 0.03%, respectively. It can be concluded that for this study, *R. miehei* lipase was the best catalyst that can be used.



# KESAN SPESIFISITI LIPASE TERHADAP TRANSESTERIFIKASI MINYAK JAGUNG DENGAN MINYAK IKAN KOD

## ABSTRAK

Kesan spesifisiti lipase terhadap transesterifikasi minyak jagung dan minyak ikan kod telah dikaji. Lipase yang digunakan adalah daripada: *Rhizomucor miehei*, *Pseudomonas fluorescens*, *Aspergillus niger*, Amano Lipase PS-C I dan germa gandum. Tindakbalas transesterifikasi berlaku pada 60°C dan 200 rpm selama 6 jam menggunakan heksana sebagai medium. Kebolehan setiap lipase sebagai pemangkin dinilai dengan menentukan perubahan pada komposisi dan kepekatan puncak terhasil dengan menggunakan Fasa-berbalik Kromatografi Cecair Prestasi Tinggi (RP-HPLC) dan dengan mengira darjah hidrolisis (DoH) dan darjah transesterifikasi (DoT). Campuran minyak jagung dengan minyak ikan kod berlaku berdasarkan puncak-puncak yang didapati daripada profil HPLC bagi campuran minyak dibandingkan dengan minyak yang tidak dicampur. Kepekatan Puncak 3 dan 10 didapati meningkat selepas transesterifikasi menggunakan lipase *R. miehei*. *P. fluorescens* menghasilkan peningkatan kepekatan Puncak 3, 4 dan 10. Peningkatan kepekatan puncak didapati juga pada Puncak 2, 5, 6 dan 8 apabila lipase *A. niger* digunakan. Lipase daripada Amano lipase dan germa gandum meningkatkan kepekatan Puncak 4 bagi Amano Lipase dan Puncak 1 dan 10 bagi germa gandum. Dua puncak baru, 7 dan 9 juga terhasil apabila *R. miehei*, *P. fluorescens* dan Amano Lipase PS-C I digunakan sebagai pemangkin. Hanya Puncak 9 terhasil apabila *A. niger* digunakan. Sebaliknya, tiada puncak baru terbentuk apabila lipase daripada germa gandum digunakan. Nilai DoT dan DoH menunjukkan *R. miehei* mempunyai nilai tertinggi dengan 65.7% dan 2.8%. DoT bagi germa gandum, Amano Lipase PS-C I, *P. fluorescens* dan *A. niger*

adalah masing-masing dengan 44.3%, 29.1%, 20.4% dan 3.4%. DoH bagi Amano Lipase PS-C I, *P. flourescens*, *A. niger* dan germa gandum adalah masing-masing dengan 1.7%, 0.14%, 0.14% dan 0.03%. Kesimpulannya, lipase daripada *R. miehei* adalah pemangkin yang terbaik boleh digunakan di dalam proses transesterifikasi ini.