

การผลิตไบโอดีเซลจากสต็อกสบู่น้ำมันรำข้าวด้วยตัวเร่งปฏิกิริยาโนโวไซม์ 435



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BIODIESEL PRODUCTION FROM RICE BRAN OIL SOAPSTOCK  
USING NOVOZYME 435 CATALYST

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A Thesis Submitted in Partial Fulfillment of the Requirements  
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By   Miss Sawvalak Rittilak  
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ในงานวิจัยนี้ศึกษาภาวะที่เหมาะสมในการผลิตไบโอดีเซลจากสต็อกสบู่ น้ำมันรำข้าว น้ำมัน  
กรดซึ่งได้จากการบำบัดสต็อกสบู่ น้ำมันรำข้าวด้วยกรด และกรดไขมันของรำข้าวโดยใช้โนโวไซม์  
435 เป็นตัวเร่งปฏิกิริยา สารตั้งต้นทั้งสามเป็นผลิตภัณฑ์ผลอยได้จากกระบวนการกลั่นน้ำมันรำข้าว  
ให้บริสุทธิ์ เนื่องจากสต็อกสบู่ น้ำมันรำข้าวมีน้ำและสบู่มาก ไบโอดีเซลจึงได้มาเพียง 36% ซึ่งไม่  
เหมาะสำหรับการผลิตไบโอดีเซล ดังนั้นจึงศึกษาภาวะที่เหมาะสมในการผลิตไบโอดีเซลจากน้ำมัน  
กรดและกรดไขมันของรำข้าว พบว่าภาวะที่เหมาะสมในการทำปฏิกิริยาคืออัตราส่วนโดยโมลของเม  
ทานอลต่อกรดไขมันในน้ำมันเป็น 2:1, อุณหภูมิ 30 องศาเซลเซียส, ปริมาณโนโวไซม์ 435 10%  
เทียบกับน้ำหนักน้ำมัน, เวลาในการทำปฏิกิริยา 2 ชั่วโมง พบว่ากรดไขมันลดลงเหลือน้อยกว่า 2%  
แต่ไตรกลีเซอไรด์ยังคงอยู่ จากสารตั้งต้นซึ่งมีไตรกลีเซอไรด์ประมาณ 10% ทั้งในน้ำมันกรดและ  
กรดไขมันของรำข้าว โดยไตรกลีเซอไรด์ที่ยังคงอยู่จะถูกทำปฏิกิริยาให้หมดไปได้ในการผลิตแบบ  
สองขั้นตอน (ใช้ตัวเร่งปฏิกิริยาเอนไซม์ในขั้นตอนแรกและเบสในขั้นตอนที่สอง) เป็นกระบวนการ  
ที่เหมาะสมในการผลิตไบโอดีเซล ในขณะที่กระบวนการผลิตไบโอดีเซลอีกทางหนึ่ง ใช้กรดเป็น  
ตัวเร่งปฏิกิริยาซึ่งประกอบด้วยใช้ตัวเร่งปฏิกิริยากรดในขั้นตอนแรกและเบสในขั้นตอนที่สอง โดย  
น้ำมันที่ได้จากขั้นตอนแรก(เอสเทอร์รีฟิเคชัน)มาทำปฏิกิริยาทรานส์เอสเทอร์รีฟิเคชันกับเบสเป็น  
ขั้นตอนที่สอง ภาวะที่เหมาะสมคือ อัตราส่วนโดยโมลของเมทานอลต่อไตรกลีเซอไรด์ 5:1,  
อุณหภูมิ 65 องศาเซลเซียส, ปริมาณโซเดียมไฮดรอกไซด์ 0.8%เทียบกับน้ำหนักน้ำมัน, เวลาในการ  
ทำปฏิกิริยา 1 ชั่วโมง ไบโอดีเซลที่มีสมบัติตามมาตรฐานไบโอดีเซลโดยมี เสถียรภาพต่อการ  
เกิดปฏิกิริยาออกซิเดชันที่สูง (10 ชั่วโมง)

ภาควิชา...ปิโตรเคมีและวิทยาศาสตร์พอลิเมอร์... ลายมือชื่อนิสิต.....  
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SAWVALAK RITTILAK: BIODIESEL PRODUCTION FROM RICE BRAN OIL  
SOAPSTOCK USING NOVOZYME 435 CATALYST. THESIS PRINCIPLE ADVISOR:  
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In this study, the fatty acid methyl ester (biodiesel) production from rice bran oil soapstock, acid oil from neutralization of the soapstock, and rice fatty acid using Novozyme 435 as catalyst were optimized. These substrates are by-product from rice bran oil refining. Biodiesel produced by soapstock was obtained only 36% in biodiesel production because it contained high water and soap content. When acid oil and rice fatty acid were use as substrate, biodiesel was obtained in a good yield. Thus, the acid oil and rice fatty acid were appropriate substrate for biodiesel production and the optimal conditions were a 2:1 molar ratio of methanol to FFA, the reaction temperature of 30°C, 10% Novozyme 435 and reaction time for 2 hrs. In the optimal condition, FFA were reduced to less than 2% while triglycerides were remained. Since about 10% of triglyceride (TG) contained in both acid oil and rice fatty acid, it as found that two step catalyzed process (enzyme and base, successively) is the appropriate procedure for biodiesel production from acid oil or rice fatty acid while the biodiesel production using acid-catalyzed process consisted of this process in the first of two steps and base-catalyzed process in the last step. The optimal reactions for base-catalyzed step were a 5:1 molar ratio of methanol to TG, the reaction temperature of 65°C, 0.8% NaOH and reaction time for 1 hr. The chemical and physical properties of biodiesel produced by this process were investigated and the results showed that this biodiesel reached the standard properties with high oxidation stability (10 hrs).

Field of study...Petrochemistry and Polymer Science... Student's signature...*Sawvalak Rittilak*  
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## LIST OF ABBREVIATIONS

CO <sub>2</sub>	=	Carbon dioxide
NO <sub>x</sub>	=	Nitrogen oxides
SO <sub>2</sub>	=	Sulphur dioxide
ASTM	=	American Standard for Testing Materials
EN	=	European Standards
FAME	=	Fatty acid methyl ester
RBOSS	=	Rice bran oil soapstock
MeOH	=	Methyl alcohol
% wt	=	Percent by weight
C	=	Concentration measured by titration, mol/l
FFA	=	Free fatty acid
W	=	Weight of the sample, mg
TG	=	Triglycerides
V	=	Volume of solution employed for titration, ml
TLC	=	Thin Layer Chromatography
NMR	=	Nuclear Magnetic Resonance
GC/FID	=	Gas Chromatography/ Flame Ionization Detector
% yield	=	Percent yield
% conversion	=	Percent conversion
NaOH	=	Sodium hydroxide
Mijs	=	Unit of iodine value by adding Mij's solution
mg KOH/g	=	Unit of acid value is milligram of potassium hydroxide per weight sample (gram)