

**EVALUATION OF HETEROGENEOUS CATALYST FOR BIODIESEL  
PRODUCTION**



Ms. Rattiya Saetang

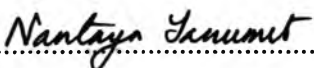
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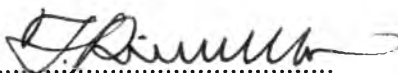
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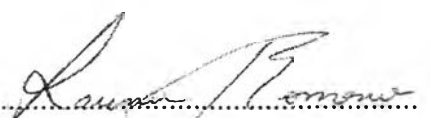
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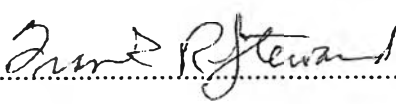
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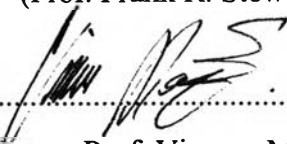
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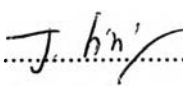
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## ABSTRACT

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The transesterification reaction of local canola oil was carried out using different catalyst concentrations, methanol to oil molar ratios, and reaction temperatures. The heterogeneous catalyst evaluated in this study was strontium oxide (SrO) as compare to 1,5,7-triazabicyclo[4.4.0]dec-5-ene (TBD), which is an organic base with potential for heterogenization. In addition, sodium methoxide (NaOCH<sub>3</sub>) was used as the homogeneous reference catalyst for comparison purposes. The optimum reaction conditions for the transesterification of canola oil using these catalysts were investigated. The reaction was conducted at a fixed mixing rate of 800 rpm and under nitrogen gas atmosphere at 15 psi in a lab-scaled reactor. The progress of the reaction was monitored by <sup>1</sup>H NMR spectroscopy. The experimental results demonstrated that the optimum conditions for transesterification reaction of canola oil with methanol using NaOCH<sub>3</sub> are 0.59 wt% catalyst concentration, 6:1 methanol/oil molar ratio, 90°C for a biodiesel yield of higher than 90% after 20 min of reaction time. In the case of TBD, the optimum reaction conditions are 2.29 wt% catalyst concentration, 3.5:1 methanol/oil molar ratio, 60°C for a biodiesel yield of more than 90% after 20 min of reaction time. While the highest reaction yield was reached using 5 wt% SrO, 6:1 methanol/oil molar ratio, 90°C which renders a biodiesel yield of more than 94% after 10 min of reaction time. The catalyst combination effect was also studied. The results indicated that the combination of catalyst with egg shell and lobster shell does improve the biodiesel yield.

## บทคัดย่อ

รศ.ดร. รัตติยา แซ่ตั้ง: การประเมินประสิทธิภาพของตัวเร่งปฏิกิริยาแบบวิวิธพันธุ์ที่ใช้ในการผลิตไบโอดีเซล (Evaluation of Heterogeneous Catalyst for Biodiesel Production) อาจารย์ที่ปรึกษา: รศ. ดร. วีรศักดิ์ ฤกษ์สมบูรณ์ รศ. ดร. โรมิโร ลอถ่า ซีรอน และ ศร. ดร. แฟรงค์ อาร์ สจ๊วต 83 หน้า

งานวิจัยนี้ได้ศึกษาปฏิกิริยาทรานส์เอสเทอร์ริฟิเคชัน (Transesterification) ของน้ำมันคาโนลาโดยใช้ปริมาณของตัวเร่งปฏิกิริยา อัตราส่วนของน้ำมันพืชต่อเมทิลแอลกอฮอล์ และอุณหภูมิในการทำปฏิกิริยาที่แตกต่างกัน ตัวเร่งปฏิกิริยาวิวิธพันธุ์ที่ศึกษา ได้แก่ สดอนเทียม ออกไซด์ และ 1,5,7-triazabicyclo[4.4.0]dec-5-ene (TBD) ซึ่งเป็นด่างอินทรีย์ที่มีศักยภาพสำหรับปฏิกิริยาวิวิธพันธุ์ ตัวเร่งปฏิกิริยาอ้างอิงที่ใช้ในการทดลองคือ โซเดียมเมทออกไซด์ จากการทดสอบพบว่าสภาวะที่เหมาะสมสำหรับปฏิกิริยาทรานส์เอสเทอร์ริฟิเคชันของน้ำมันคาโนลาที่อัตราเร็วในการผสมคกที่ 800 รอบต่อวินาที ภายใต้ความดัน 15 ปอนด์ต่อตารางนิ้ว กับตัวเร่งปฏิกิริยาที่กล่าวถึงข้างต้น โดยพบว่าสภาวะที่เหมาะสมสำหรับตัวเร่งปฏิกิริยาชนิดโซเดียมเมทออกไซด์คือใช้ปริมาณของตัวเร่งปฏิกิริยาร้อยละ 0.59 โดยน้ำหนัก อัตราส่วนของน้ำมันพืชกับเมทิลแอลกอฮอล์เป็น 6 ต่อ 1 และที่อุณหภูมิ 90 องศาเซลเซียส โดยให้ผลได้ของไบโอดีเซลมากกว่าร้อยละ 90 หลังจากใช้เวลาในการทำปฏิกิริยานาน 20 นาที สำหรับตัวเร่งปฏิกิริยาชนิด TBD สภาวะที่เหมาะสมคือใช้ปริมาณของตัวเร่งปฏิกิริยาร้อยละ 2.29 โดยน้ำหนัก อัตราส่วนของน้ำมันพืชกับเมทิลแอลกอฮอล์เป็น 3.5 ต่อ 1 และที่อุณหภูมิ 60 องศาเซลเซียส โดยให้ผลได้ของไบโอดีเซลมากกว่าร้อยละ 90 หลังจากใช้เวลาในการทำปฏิกิริยานาน 20 นาที ในขณะที่ผลได้ของไบโอดีเซลจะสูงสุดมากกว่าร้อยละ 94 เมื่อใช้ตัวเร่งปฏิกิริยาชนิดสดอนเทียมออกไซด์ในปริมาณร้อยละ 5 โดยน้ำหนัก อัตราส่วนของน้ำมันพืชกับเมทิลแอลกอฮอล์เป็น 6 ต่อ 1 และที่อุณหภูมิ 90 องศาเซลเซียส หลังจากใช้เวลาในการทำปฏิกิริยานานเพียง 10 นาที นอกจากนี้ได้ศึกษาอิทธิพลของการผสมตัวเร่งปฏิกิริยากับเปลือกไข่และเปลือกกุ้งมังกร โดยพบว่า การผสมตัวเร่งปฏิกิริยากับเปลือกไข่และเปลือกกุ้งมังกรช่วยเพิ่มผลได้ของไบโอดีเซล

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