

**BIODIESEL FUEL PRODUCTION WITH SOLID CATALYSIS
IN A FIXED-BED REACTOR**




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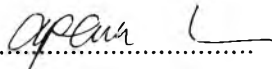
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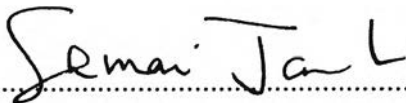
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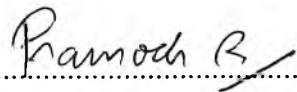

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ABSTRACT

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Nowadays, the use of heterogeneous catalysts for biodiesel production is an attractive solution because it can be separated more easily from the reaction products (biodiesel and glycerine). In this work, KOH/ZrO₂ and KOH/mordenite catalysts were used as a solid base catalyst for biodiesel production via the transesterification of refined palm oil with methanol using a fixed-bed reactor. Both catalysts showed good activity at a methanol-to-oil molar ratio of 15:1, a reaction temperature of 60°C, 12 wt% of the catalyst (based on the weight of the vegetable oil), and a flow rate of 11 ml/min. The results demonstrated that the KOH/ZrO₂ gave a high percentage of methyl ester (95.29%) at a residence time W/F = 0.013 g cat/(g feed.h), whereas the KOH/mordenite gave higher reusability of the catalyst. The leaching of active components and the regeneration of the catalyst have been studied. In addition, characterizations of the prepared catalysts and the biodiesel were done using several techniques.

บทคัดย่อ

พิชญา พานทอง : การผลิตไบโอดีเซลด้วยการเร่งปฏิกิริยาของแข็งในเครื่องปฏิกรณ์แบบเบดนิ่ง (Biodiesel Fuel Production with Solid Catalysis in a Fixed-bed Reactor) อ. ที่ปรึกษา : ผศ.ดร.อาภาณี เหลืองนฤมิตชัย และนาวาเอก ดร. สมัย ใจอินทร์ 81 หน้า

ในปัจจุบัน การผลิตไบโอดีเซลด้วยตัวเร่งปฏิกิริยาวิวิธพันธ์ได้รับความนิยมเป็นอย่างมาก เนื่องจากความสามารถในการแยกตัวเร่งปฏิกิริยาออกจากผลิตภัณฑ์ ได้แก่ ไบโอดีเซลและกลีเซอรอล ในงานวิจัยนี้ เป็นการศึกษาการผลิตไบโอดีเซลด้วยปฏิกิริยาทรานเอสเตอริฟิเคชันจากน้ำมันปาล์มกลั่นและเมทานอล ในเครื่องปฏิกรณ์แบบเบดนิ่ง โดยใช้ตัวเร่งปฏิกิริยาวิวิธพันธ์ชนิดต่างเป็นตัวเร่งปฏิกิริยา 2 ชนิด ได้แก่ โพแทสเซียมไฮดรอกไซด์บนเซอร์โคเนีย (KOH/ZrO_2) และโพแทสเซียมไฮดรอกไซด์บนมอร์ดีนไนต์ ($\text{KOH}/\text{Mordenite}$) นอกจากนี้ ยังศึกษาสภาวะที่เหมาะสมในการทำปฏิกิริยา โดยกำหนดสภาวะเริ่มต้น ดังนี้ อัตราส่วนโดยโมลระหว่างน้ำมันกับเมทานอลเป็น 15:1 อุณหภูมิในการเกิดปฏิกิริยาที่ 60 องศาเซลเซียส ปริมาณตัวเร่งปฏิกิริยาร้อยละ 12 โดยน้ำหนัก (เทียบกับน้ำหนักของน้ำมันพืช) และอัตราการไหลของสารตั้งต้น 11 มิลลิลิตรต่อนาที จากผลการทดลองพบว่า ตัวเร่งปฏิกิริยาทั้งสองชนิดมีความเหมาะสมในการผลิตไบโอดีเซล โดยการใช้ตัวเร่งปฏิกิริยาโพแทสเซียมไฮดรอกไซด์บนเซอร์โคเนีย (KOH/ZrO_2) ให้ผลผลิตไบโอดีเซลในปริมาณสูง (ร้อยละ 95.29 โดยน้ำหนัก) ด้วยระยะเวลาในการเกิดปฏิกิริยาเป็น 0.013 กรัมของตัวเร่งปฏิกิริยาต่อกรัมของสารตั้งต้นต่อชั่วโมง แต่การใช้ตัวเร่งปฏิกิริยาโพแทสเซียมไฮดรอกไซด์บนมอร์ดีนไนต์ ($\text{KOH}/\text{Mordenite}$) มีประสิทธิภาพสูงในการนำตัวเร่งปฏิกิริยามาใช้ใหม่ นอกจากนี้ยังศึกษาการถูกชะล้างของสารประกอบสำคัญที่มีผลต่อการเกิดปฏิกิริยาและการฟื้นฟูตัวเร่งปฏิกิริยาที่ใช้แล้ว ในงานวิจัยนี้ใช้เครื่องมือและเทคนิคที่หลากหลายในการวิเคราะห์หาคุณสมบัติของตัวเร่งปฏิกิริยาและปริมาณร้อยละการเกิดไบโอดีเซล

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