


**PRODUCTION OF BIOJET FROM HYDROGENATED BIODIESEL OVER
Pt/HY CATALYSTS: EFFECT OF ZEOLITE CRYSTAL SIZE**

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ABSTRACT

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The use of biojet fuel in commercial aviation has received considerable attention in recent years because it can solve the problems associated with petroleum-based fuels such as unstable prices and environmental issues. In this research, the effect of different crystallite sizes of Pt/HY catalysts were studied for producing hydrotreated renewable jet (HRJ) fuel. The smaller Y zeolite of catalyst results in shorter pore length, thus reducing the diffusion limitation. HY zeolite and Pt/HY catalysts were prepared by using microwave-hydrothermal (M-H) and incipient wetness impregnation (IWI) method, respectively. In order to prepare the different crystallite sizes, aging time, crystallization temperature, and alkalinity were adjusted. The catalysts were tested in a continuous flow packed-bed reactor at 450 °C, 500 psig, liquid hourly space velocity of 1.0 h⁻¹, and H₂/feed molar ratio of 30. The XRD results showed that NaY zeolite was successfully synthesized after hydrothermal reaction at 100 °C for 2 h by using the microwave technique. The lower crystallization temperature, longer aging time, and higher Na₂O contents resulted in small crystal size zeolite because the conditions allow an increase in number of nuclei precursors and reduce the growth rate of crystallization. In comparison with the three different crystal sizes, the results showed a good correlation between the crystal size of zeolites and conversion in which the smaller crystal size of synthesized Y zeolite exhibited higher catalytic activity and higher selectivity of jet fuel.

บทคัดย่อ

นิศั จัดพล : การผลิตน้ำมันไบโอดีเซลจากน้ำมันไฮโดรจีเนตเต็คไบโอดีเซลโดยใช้ตัวเร่งปฏิกิริยา Pt บนตัวรองรับ HY: ผลของขนาดผลึกซีโอไลต์ (Production of Biojet from Hydrogenated Biodiesel over Pt/HY Catalysts: Effect of Zeolite Crystal Size) อ. ที่ปรึกษา : ผศ. ดร. ศิริพร จงผาคิวติ และ รศ. ดร. เมตตา เจริญพานิช 83 หน้า

การใช้้ำมันเจ็ทที่มาจากพลังงานหมุนเวียนที่ผลิตจากชีวมวลในเชิงการบิพาณิชย์มีความน่าสนใจอย่างมากเมื่อไม่นานมานี้เพราะว่าสามารถแก้ปัญหาที่เกี่ยวข้องเนื่องจากปิโตรเลียม เช่น ความไม่เสถียรของราคา และ ปัญหาทางสิ่งแวดล้อมได้ งานวิจัยนี้เป็นการศึกษาการผลิตน้ำมันเจ็ทที่มาจากพลังงานหมุนเวียนโดยใช้ตัวเร่งปฏิกิริยา Pt บนตัวรองรับ HY ที่มีขนาดที่แตกต่างกัน ตัวเร่งปฏิกิริยาที่มีขนาดเล็กลงจะทำให้ระยะทางของรูพรุนลดลงและยังสามารถลดข้อจำกัดการแพร่ของสารตั้งต้นซึ่งจะส่งผลต่อความว่องไวและความคัดสรรของตัวเร่งปฏิกิริยาได้อีกด้วย ในงานวิจัยนี้ตัวเร่งปฏิกิริยา HY และ Pt/HY เตรียมโดยใช้เทคนิคไมโครเวฟและวิธีการฝังแบบขึ้นตามลำดับ อีกทั้งตัวแปรที่ใช้ในการศึกษาการเตรียมตัวเร่งปฏิกิริยาที่มีขนาดผลึกที่แตกต่างกัน ได้แก่ เวลาที่ใช้ในการบ่ม อุณหภูมิในการตกผลึก และความเป็นเบสในขั้นตอนการเตรียมสารละลาย ตัวเร่งปฏิกิริยาที่เตรียมขึ้นจะถูกนำมาทดสอบโดยใช้เครื่องปฏิกรณ์แบบเบดนิ่งชนิดไหลต่อเนื่อง ที่อุณหภูมิ 450 องศาเซลเซียส ความดัน 500 ปอนด์ต่อตารางนิ้ว สัดส่วนสารป้อนต่อปริมาณตัวเร่งปฏิกิริยา 1 ต่อชั่วโมง และสัดส่วนโดยโมลของไฮโดรเจนต่อสารป้อนที่ 30 จากผลการทดลองแสดงให้เห็นว่าตัวเร่งปฏิกิริยาชนิด NaY สามารถสังเคราะห์ได้อย่างสมบูรณ์ที่ 100 องศาเซลเซียส เป็นระยะเวลา 2 ชั่วโมง โดยใช้เครื่องไมโครเวฟเป็นตัวให้พลังงานความร้อน การลดลงของอุณหภูมิในการตกผลึก การเพิ่มขึ้นของเวลาที่ใช้ในการบ่มและปริมาณ Na_2O จะส่งผลให้ขนาดผลึกของตัวเร่งปฏิกิริยาที่สังเคราะห์ได้มีขนาดเล็กลง เนื่องจากจะส่งผลต่อการเพิ่มของสารตั้งต้นนิวคลีไอด์ และการลดลงของอัตราการใช้ของผลึก นอกจากนี้เมื่อเปรียบเทียบของขนาดผลึกซีโอไลต์ที่แตกต่างกัน พบว่าขนาดผลึกที่เล็กกว่าจะทำให้ความว่องไวในการเกิดปฏิกิริยาสูงขึ้น และการคัดสรรเป็นผลิตภัณฑ์เจ็ทก็มีมากขึ้นเช่นกัน

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