

การใช้ซิลิกาจากแกลบข้าวเพื่อการสังเคราะห์เมโซพอร์สโมเลคิวลาร์ซีฟ เอ็ม ซี เอ็ม 41 สำหรับใช้เร่งปฏิกิริยา
ไฮโดรคัลอรีเนชันของสารประกอบอินทรีย์คลอรีนที่ระเหยได้



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UTILIZATION OF RICE HUSK SILICA FOR SYNTHESIS OF MESOPOROUS MOLECULAR SIEVE
MCM-41 APPLIED FOR CATALYTIC HYDRODECHLORINATION OF CHLORINATED VOLATILE
ORGANIC COMPOUNDS

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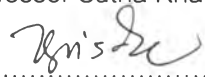
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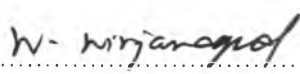
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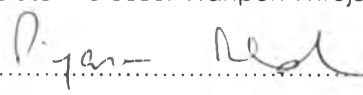
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สิริลักษณ์ เจียรากร : การใช้ซิลิกาจากแกลบข้าวเพื่อสังเคราะห์เมโซพอร์สโมเลคูลาร์ซีฟเอ็มซีเอ็ม 41 สำหรับใช้เร่งปฏิกิริยาไฮโดรคลอรีเนชันของสารประกอบอินทรีย์คลอรีนที่ระเหยได้. (UTILIZATION OF RICE HUSK SILICA FOR SYNTHESIS OF MESOPOROUS MOLECULAR SIEVE MCM-41 APPLIED FOR CATALYTIC HYDRODECHLORINATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS) อ.ที่ปรึกษา : รศ. ดร. นุรักษ์ กฤษดานุรักษ์, อ.ที่ปรึกษาร่วม : Prof. Dr. Hiroshige Matsumoto จำนวนหน้า 166 หน้า. ISBN 974-17-4175-8.

ซิลิกาจากแกลบข้าวสามารถนำมาใช้เป็นแหล่งซิลิกาสำหรับการสังเคราะห์เอ็มซีเอ็ม 41 การสกัดซิลิกาทำได้โดยนำแกลบมาต้มกับกรดไฮโดรคลอริกที่อุณหภูมิ 80 องศาเซลเซียส เป็นเวลา 1 ชม. แล้วนำไปเผาที่อุณหภูมิ 650 องศาเซลเซียส เป็นเวลา 4 ชม. ผลิตภัณฑ์ที่สกัดได้มีส่วนประกอบของซิลิกามากกว่า 99 เปอร์เซ็นต์. เอ็มซีเอ็ม 41 จากแกลบสังเคราะห์ได้จากสารละลายโซเดียมซิลิเกตที่ได้จากซิลิกาแกลบกับเฮกซะเดคซิลไตรเมทิลแอมโมเนียมโบรไมด์ (ซีทีเอบี) ด้วยอัตราส่วนโดยโมลเป็น 1.0 ซิลิกา ต่อ 1.1 โซเดียมไฮดรอกไซด์ ต่อ 0.13 ซีทีเอบี ต่อ 0.12 น้ำ โครงสร้างรูพรุนจะก่อผลึกภายในเวลา 48 ชม. ที่พีเอช 10. เอ็มซีเอ็ม 41 จากแกลบที่สังเคราะห์ได้มีโครงสร้างหกเหลี่ยมที่เป็นระเบียบ, มีพื้นที่ผิวประมาณ 800 ± 8 ตร.ม. ต่อ กรัม, มีเส้นผ่านศูนย์กลางเฉลี่ย 29.5 อังสตรอม และมีการกระจายตัวของรูพรุนน้อย ต้นทุนการผลิตเอ็มซีเอ็ม 41 จากแกลบประมาณ 26,000 บาท ต่อ 1 กก. วัสดุที่สังเคราะห์ได้นี้นำไปใช้ในการศึกษาการดูดซับของสารอินทรีย์ระเหยที่มีส่วนประกอบของคลอรีน เช่น ไตรคลอโรเอทิลีน, เตตระคลอโรเอทิลีน, คาร์บอนเตตระคลอไรด์ พบว่าการดูดซับของไตรคลอโรเอทิลีนและเตตระคลอโรเอทิลีนเป็นแบบกายภาพ ขณะที่การดูดซับของคาร์บอนเตตระคลอไรด์มีความแข็งแรงมากกว่า จากการศึกษาไอโซเทอมด้วยค่าซึ่งที่มีความละเอียดระดับไมโครพบว่าไอโซเทอมของคาร์บอนเตตระคลอไรด์เป็นชนิดที่ 5 ขณะที่ไอโซเทอมของไนโตรเจนเป็นชนิดที่ 4 ซึ่งขนาดของรูพรุนและการกระจายตัวของรูพรุนที่ได้จากไอโซเทอมของไนโตรเจนคำนวณด้วยสมการของบีเจเอชและนาโอโนพบว่ารูพรุนมีขนาด 27 และ 29 อังสตรอม ตามลำดับ ขณะที่ขนาดของรูพรุนและการกระจายตัวของรูพรุนที่ได้จากไอโซเทอมของคาร์บอนเตตระคลอไรด์พบว่ารูพรุนมีขนาด 24 และ 28 อังสตรอม ตามลำดับ นอกจากนี้เอ็มซีเอ็ม 41 จากแกลบถูกนำมาทดสอบเป็นวัสดุซับพอร์ตสำหรับแพลลาเดียมในปฏิกิริยาไฮโดรคลอรีเนชันของคลอโรฟอร์ม. ผลการทดสอบพบว่าเอ็มซีเอ็ม 41 จากแกลบมีประสิทธิภาพดีเยี่ยมในการเกิดผลิตภัณฑ์สูง 80-90 เปอร์เซ็นต์ ที่อุณหภูมิ 150-200 องศาเซลเซียส เมื่อเปรียบเทียบกับซิลิกาและซิลิกาอลูมินา

สาขาวิชา การจัดการสิ่งแวดล้อม
ปีการศึกษา 2546

ลายมือชื่อนิสิต.....
ลายมือชื่ออาจารย์ที่ปรึกษา.....
ลายมือชื่ออาจารย์ที่ปรึกษาร่วม


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 KEY WORD: MCM-41 / RICE HUSK SILICA / HYDRODECHLORINATION /
 PALLADIUM / CVOCS

SIRILUK CHIARAKORN : UTILIZATION OF RICE HUSK SILICA FOR
 SYNTHESIS OF MESOPOROUS MOLECULAR SIEVE MCM-41
 APPLIED FOR CATALYTIC HYDRODECHLORINATION OF
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High silica containing in rice husk was utilized as silica source for MCM-41 synthesis. Rice husk was refluxed in 5 M hydrochloric acid at 80 °C for 1 h and then calcined at 650 °C for 4 h. This method provided more than 99% of silica content. RH-MCM-41 was synthesized using sodium silicate prepared from rice husk as silica source and hexadecyltrimethylammonium bromide (CTAB) as template. The molar composition was 1.0SiO₂: 1.1NaOH: 0.13CTAB: 0.12H₂O. The mesoporous structure was completely crystallized within 48 h aging at pH value of 10. The RH-MCM-41 possessed uniformly hexagonal structure. The BET surface area was around (800 ± 8) m² g⁻¹ with average pore diameter of 29.5 Å and narrow pore size distribution. The estimated cost of 1 kg RH-MCM-41 was approximately 26,000 Baht. This material was applied to the adsorption studies of some chlorinated volatile organic compounds (CVOCs) such as trichloroethylene (TCE), tetrachloroethylene (PCE), and carbon tetrachloride (CT). The adsorption of TCE and PCE was proved to be physical, while the adsorption of CT was stronger. The adsorption capacity of RH-MCM-41 for CVOCs was higher than commercial mordenite and activated carbon. The adsorption isotherm of carbon tetrachloride (CT) at 25 °C on the RH-MCM-41 was determined by using a magnetically coupled microbalance. The CT isotherms were classified as reversible Type V and the nitrogen adsorption isotherm was Type IVc. Pore size distributions (PSD) of nitrogen isotherm for the RH-MCM-41 calculated by using the BJH and Naono methods showed quite narrow pore diameter distributions, centered around 27 and 29 Å, respectively. Similarly, the peak pore diameters calculated from CT isotherms using the BJH and Naono methods were 24 and 28 Å. The RH-MCM-41 was tested as a catalyst support of palladium for the hydrodechlorination of chloroform. The RH-MCM-41 supported palladium showed the best performance with the conversion enhanced up to 80-90 % at 150-200 °C compared to silica and silica-alumina.

Field of study Environmental Management

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