

**SELECTIVITY OF RING-CONTRACTION PRODUCTS  
IN THE HYDROISOMERIZATION OF METHYLCYCLOHEXANE**



Mr. Teerawit Prasomsri

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**By:** Mr. Teerawit Prasomsri  
**Program:** Petroleum Technology  
**Thesis Advisors:** Assoc. Prof. Thirasak Rirksomboon  
Prof. Daniel E. Resasco  
Dr. Siriporn Jongpatiwut  
Prof. Somchai Osuwan

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Accepted by the Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfilment of the requirements for the Degree of Master of Science.

*Nantaya Yanumet*  
.....College Director  
(Assoc. Prof. Nantaya Yanumet)

**Thesis Committee:**

*Thirasak Rirksomboon*  
.....  
(Assoc. Prof. Thirasak Rirksomboon)

*Daniel E. Resasco*  
.....  
(Prof. Daniel E. Resasco)

*J. hn*  
.....  
(Dr. Siriporn Jongpatiwut)

*A. Osuwan*  
.....  
(Prof. Somchai Osuwan)

*Vissanu Meeyoo*  
.....  
(Assoc. Prof. Vissanu Meeyoo)

*T. Sreethawong*  
.....  
(Dr. Thammanoon Sreethawong)

## ABSTRACT

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Teerawit Frasomsri: Selectivity of Ring-Contraction Products in the Hydroisomerization of Methylcyclohexane.

Thesis Advisors: Assoc. Prof. Thirasak Rirksomboon, Prof. Daniel E. Resasco, Dr. Siriporn Jongpatiwut, and Prof. Somchai Osuwan.  
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The hydroisomerization of methylcyclohexane (MCH) was conducted at the temperature 533 K in the presence of hydrogen at a total pressure of 2 MPa, and H<sub>2</sub>/MCH molar ratio of 40. Zeolitic (FAU, MFI, and BEA) and non-zeolitic (tungstated zirconia) solid acids were used as the catalysts and the supports. Bare and Pt-supported (1 wt%) catalysts were used to study the effect of the hydride transfer rate to the product selectivity. Observed products under these conditions are mainly the MCH ring-contraction (RC) isomers consisting of 1,1-dimethylcyclopentane, *cis*-1,3-dimethylcyclopentane, *trans*-1,3-dimethylcyclopentanes, *trans*-1,2-dimethylcyclopentane, and ethylcyclopentane. Acid strength played an essential role to the different carbenium ion intermediate formations resulting in different RC isomers. Besides the acid strength, the shape selectivity of the catalysts was important to the RC product distribution. Interestingly, effect of hydride transfer rate influenced to the selectivity of RC isomers over all kinds of zeolites, but tungstated zirconia. Moreover, two different Si/Al ratios (2.5 and 30) of FAU zeolites with and without loaded platinum revealed the insignificant difference in selectivity.

## บทคัดย่อ

ธีรวิทย์ ประสมศรี : การเลือกเกิดผลิตภัณฑ์ที่มีวงแหวนขนาดเล็กลงในปฏิกิริยาไฮโดรไอโซเมอไรเซชันของเมทิลไซโคลเฮกเซน (Selectivity of Ring-Contraction Products in the Hydroisomerization of Methylcyclohexane) อาจารย์ที่ปรึกษา: รศ.ดร. ชีรศักดิ์ ฤกษ์สมบูรณ์ ศ.ดร. แดเนียล อี ริชส์โก ดร. ศิริพร จงผาดิวฒิ และ ศ.ดร. สมชาย โอสุวรรณ 69 หน้า

ปฏิกิริยาไฮโดรไอโซเมอไรเซชันของเมทิลไซโคลเฮกเซนถูกศึกษาภายใต้สภาวะการทดลองที่อุณหภูมิ 533 เคลวิน ในบรรยากาศไฮโดรเจน 2 เมกกะปาสกาล และอัตราส่วนโดยโมลของไฮโดรเจนต่อเมทิลไซโคลเฮกเซนเท่ากับ 40 ในงานวิจัยนี้ได้ทำการศึกษาค่าการเลือกเกิดผลิตภัณฑ์บนตัวเร่งปฏิกิริยาซีโอไลต์ (FAU MFI และ BEA) และเซอโครเนียที่เติมทังสเตน (tungstated zirconia) สำหรับผลของอัตราการส่งถ่ายไฮโดรเจนที่มีต่อค่าการเลือกเกิดผลิตภัณฑ์นั้น ได้ถูกศึกษาบนตัวเร่งปฏิกิริยาที่เติมและไม่เติมแพลททินัม โดยผลิตภัณฑ์ที่พบได้แก่ 1,1-ไดเมทิลไซโคลเพนเทน ซิส-1,3-ไดเมทิลไซโคลเพนเทน ทราน-1,3-ไดเมทิลไซโคลเพนเทน ทราน-1,2-ไดเมทิลไซโคลเพนเทน และ เอทิลไซโคลเพนเทน ความเป็นกรดของตัวเร่งปฏิกิริยามีบทบาทสำคัญต่อการเกิดผลิตภัณฑ์ตัวกลางซึ่งจะมีผลต่อผลิตภัณฑ์สุดท้ายแต่ละตัว นอกจากความเป็นกรด ลักษณะโครงสร้างของตัวเร่งปฏิกิริยาก็มีความสำคัญอย่างมากต่อการกระจายตัวของผลิตภัณฑ์ ส่วนผลของอัตราการส่งถ่ายไฮโดรเจนนั้นมีต่อค่าการเลือกเกิดผลิตภัณฑ์สำหรับตัวเร่งปฏิกิริยาที่เป็นซีโอไลต์ แต่ยกเว้นเซอโครเนียที่เติมทังสเตน นอกจากนี้ สองอัตราส่วนซิลิกาต่ออะลูมินา (2.5 และ 30) ของซีโอไลต์ FAU ทั้งที่มีและไม่มีแพลททินัมแสดง ความแตกต่างต่อค่าการเลือกเกิดผลิตภัณฑ์น้อยมาก

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