

**ZEOLITE-POLYIMIDE MIXED MATRIX MEMBRANES FOR  
OLEFIN/PARAFFIN SEPARATION**

Ms. Arunee Srisilp

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Case Western Reserve University, The University of Michigan,  
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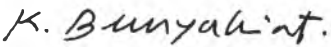
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**By:** Ms. Arunee Srisilp  
**Program:** Petrochemical Technology  
**Thesis Advisors:** Assoc. Prof. Thirasak Rirksomboon  
Prof. Somchai Osuwan  
Dr. Santi Kulprathipanja

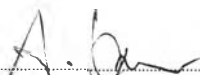
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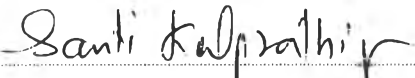
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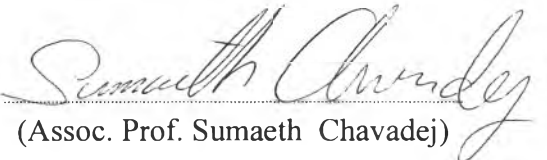
  
.....  
(Assoc. Prof. Kunchana Bunyakiat) College Director


**Thesis Committee:**

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

  
.....  
(Prof. Somchai Osuwan)

  
.....  
(Dr. Santi Kulprathipanja)

  
.....  
(Assoc. Prof. Sumaeth Chavadej)

  
.....  
(Asst. Prof. Pramoch Rangsunvigit)

## ABSTRACT

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Currently the olefin/paraffin separation is carried out by cryogenic distillation, which is a highly energy intensive process. Membrane technology has been considered as an attractive alternative due to its low energy consumption. The aim of this study was to develop mixed matrix membranes (MMMs) by introduction of olefin selective zeolite into the polymeric membrane and to investigate their potential for olefin/paraffin separation. Silicalite-Polyimide(PI), NaX-PI and AgX-PI MMMs were fabricated. Void formation appeared to be a major problem due to partial incompatibility between polymer chains and zeolite surfaces. Aminofunctional silane agent was successfully employed to overcome such a problem. The membrane performances for separation of  $C_3H_6/C_3H_8$  were carried out using pure gas measurements at room temperature. However, all types of MMMs showed increases in gas permeabilities without improving in the  $C_3H_6/C_3H_8$  selectivities when compared to that of zeolite-free polyimide membranes. A new parameter, the facilitation ratio was introduced to characterize the function of zeolite in the membrane matrix.

## บทคัดย่อ

อรุณี ศรีศิลป์ : การศึกษาการแยกก๊าซโอเลฟินส์ออกจากพาราฟินส์โดยใช้เยื่อเลือกผ่านเนื้อผสมของซีโอไลต์และpolyimide (Zeolite-Polyimide Mixed Matrix Membranes for Olefin/Paraffin Separation) อ. ที่ปรึกษา : รศ. ดร. ชีรศักดิ์ ฤกษ์สมบูรณ์ ศ. ดร. สมชาย ไอสวรรณ และ ดร. สันติ กุลประทีปปัญญา 62 หน้า ISBN 974-9651-22-7

ปัจจุบันนี้การแยกก๊าซโอเลฟินส์ออกจากก๊าซพาราฟินส์ดำเนินการโดยการกลั่นที่อุณหภูมิต่ำซึ่งเป็นกระบวนการที่ต้องใช้พลังงานมาก เยื่อเลือกผ่านถูกพิจารณาเป็นทางเลือกที่น่าสนใจ จุดประสงค์ของงานวิจัยนี้เพื่อพัฒนาเยื่อเลือกผ่านผสมโดยการเติมซีโอไลต์ที่ชอบต่อโอเลฟินส์ผสมลงไปในเยื่อเลือกผ่านชนิดที่เป็นโพลิเมอร์และ ทดสอบประสิทธิภาพต่อการแยกโอเลฟินส์ออกจากพาราฟินส์ ซิลิกาไลร์ผสมกับโพลีอีมีท โซเดียมเอ็กซ์ผสมกับโพลีอีมีทและ ซิลเวอร์เอ็กซ์ผสมกับโพลีอีมีทถูกเตรียมขึ้นมา การเกิดช่องว่างเป็นปัญหาหลักเนื่องมาจากความเข้ากันไม่ได้บางส่วนระหว่างสายของโพลิเมอร์และอนุภาคของซีโอไลร์ สารอะมิโนฟังก์ชันนอล ไชเลนประสบความสำเร็จในการแก้ปัญหานั้น การทดสอบประสิทธิภาพของเยื่อเลือกผ่านสำหรับการแยกโอเลฟินส์ออกจากพาราฟินส์ถูกทดลองที่อุณหภูมิห้องและวัดปริมาณก๊าซที่ผ่านเยื่อเลือกผ่านที่ละก๊าซ อย่างไรก็ตามเยื่อเลือกผ่านผสมทุกชนิดให้ผลเฉพาะเพิ่มปริมาณก๊าซที่ผ่านเยื่อเลือกผ่านแต่ไม่ส่งผลกระทบต่อค่าการแยกของโอเลฟินส์ออกจากพาราฟินส์เมื่อเปรียบเทียบกับเยื่อเลือกผ่านโพลีอีมีทที่ไม่มีการเติมซีโอไลร์ สัดส่วนของการเลือกผ่านถูกนำมาใช้เพื่ออธิบายหน้าที่ของซีโอไลร์ที่เติมลงไป

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