

**PARAFFIN EXTRACTION BY ADSORPTION EMPLOYING  
DIVALENT METAL EXCHANGED ZEOLITE A**



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## ABSTRACT

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Recently, the normal paraffins market has been growing steadily every year as C10-C14 normal paraffins are used as a feedstock for the production of surfactants such as linear alkyl benzene (LAB). One way to obtain this range of normal paraffins is to extract them from middle distillate (kerosene and gas oil) by adsorption technique. In this research, three types of divalent cation ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ , and  $\text{Sr}^{2+}$ ) were exchanged with sodium in zeolite NaA (4A). Three exchanged zeolite A samples obtained, 57% Mg-Na-A, 53% Ca-Na-A, and 54% Sr-Na-A, were used for normal paraffins adsorption. Two sets of experiments consisting of thermogravimetric and breakthrough curve experiments were used to test these three samples. From thermogravimetric analyses, it is found that the larger the size of the cations exchanged into the zeolite NaA ( $\text{Mg} < \text{Ca} < \text{Sr}$ ), the more difficult the desorption of normal paraffins. This is most probably due to the confinement effect. For the breakthrough curve experiment, the magnesium form of zeolite A which was expected to be a better adsorbent turned out to have a lower capacity than those of calcium and strontium. This may be due to the disruption of the structure during the dehydration of the Mg-Na-A before adsorption.

## บทคัดย่อ

สุทธิภูมิ พุ่มหิรัญ : การสกัดนอร์มอลพาราฟินด้วยวิธีการดูดซับโดยใช้ซีโอไลต์เอทีถูกแลกเปลี่ยนด้วยธาตุโลหะไดวาเลนต์ (Paraffins Extraction by Adsorption Employing Divalent Metal Exchanged Zeolite A) อาจารย์ที่ปรึกษา: รศ. กัญจนา บุญเกียรติ ผศ.ดร. ปมทอง มาลากุล ณ อยุธยา และ ดร. โซฟี จูเลียน 37 หน้า ISBN 974-9651-16-2

ในปัจจุบันตลาดของนอร์มอลพาราฟินเติบโตขึ้นอย่างต่อเนื่อง เนื่องจากนอร์มอลพาราฟินที่มีคาร์บอนอะตอมอยู่ในช่วงระหว่าง 10-14 สามารถนำไปใช้เป็นวัตถุดิบในการผลิตลิเนียร์อัลคิลเบนซีน (LAB) ซึ่งเป็นสารลดแรงตึงผิวชนิดหนึ่ง วิธีหนึ่งที่จะสามารถนำนอร์มอลพาราฟินมาได้คือการสกัดออกจากส่วนกลั่นกลางด้วยวิธีการดูดซับ ในงานวิจัยนี้ใช้ไดวาเลนต์แคทไอออนสามชนิดแลกเปลี่ยนกับโซเดียมในซีโอไลต์โซเดียมเอ (4A) และนำตัวดูดซับสามชนิดที่ได้จากการแลกเปลี่ยนไอออนคือ 57% Mg-Na-A, 53% Ca-Na-A และ 54% Sr-Na-A ไปทดสอบการดูดซับนอร์มอลพาราฟิน การทดลองสองชุดที่ใช้ในการทดสอบนี้ได้แก่เทอร์โมกราวิเมตริกและ breakthrough curve จากผลการทดลองเทอร์โมกราวิเมตริกพบว่าเมื่อขนาดของไอออนที่ถูกแลกเปลี่ยนลงไปนซีโอไลต์โซเดียมเอใหญ่ขึ้น (Mg<Ca<Sr) การคายออกของนอร์มอลพาราฟินจะเป็นไปได้ยากขึ้นด้วยซึ่งน่าจะเกิดจาก confinement effect สำหรับการทดลอง breakthrough curve Mg-Na-A ซึ่งถูกคาดการณ์ไว้ว่าจะเป็นตัวดูดซับที่ดีกลับมีความจุที่ต่ำกว่า Ca-Na-A และ Sr-Na-A ที่มีความจุใกล้เคียงกันซึ่งน่าจะเกิดจากการที่โครงสร้างบางส่วนถูกทำลายระหว่างการไล่น้ำที่อุณหภูมิสูง

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## TABLE OF CONTENTS

|   | <b>PAGE</b> |
|---|-------------|
| Title Page                                  | i           |
| Abstract (in English)                       | iii         |
| Abstract (in Thai)                          | iv          |
| Acknowledgement                             | v           |
| Table of Contents                           | vi          |
| List of Tables                              | viii        |
| List of Figures                             | ix          |
| <br>  |             |
| <b>CHAPTER</b>                              |             |
| <b>I INTRODUCTION</b>                       | <b>1</b>    |
| <br>  |             |
| <b>II BACKGROUND AND LITERATURE SURVEY</b>  | <b>3</b>    |
| 2.1 Zeolite (molecular sieve)               | 3           |
| 2.2 Ion Exchange in Zeolites                | 6           |
| 2.3 Normal Paraffins Extraction Conditions  | 8           |
| 2.4 Displacement Purge Adsorption (DPA)     | 9           |
| <br>  |             |
| <b>III EXPERIMENTAL</b>                     | <b>11</b>   |
| 3.1 Materials and Equipment                 | 11          |
| 3.1.1 Chemicals                             | 11          |
| 3.1.2 Equipment                             | 11          |
| 3.2 Molecular Sieve Preparation             | 11          |
| 3.2.1 Molecular Sieve Preparation Procedure | 12          |
| 3.2.2 Cation Exchange Analysis              | 12          |
| 3.3 Paraffins Adsorption                    | 12          |
| 3.3.1 Feed Model                            | 12          |
| 3.3.2 Thermogravimetric Analyses            | 12          |
| 3.3.3 Breakthrough Curve Experiment         | 13          |

| <b>CHAPTER</b>   | <b>PAGE</b> |
|--|-------------|
| <b>IV RESULTS AND DISCUSSION</b>   | 16          |
| 4.1 Molecular Sieve Preparation  | 16          |
| 4.1.1 Initial Amount of Sodium on Zeolite 4A (NaA)                             | 16          |
| 4.1.2 Calcium Exchanged on Zeolite 4A (NaA)                                    | 16          |
| 4.1.3 Strontium Exchanged on Zeolite 4A (NaA)                                  | 18          |
| 4.1.4 Magnesium Exchanged on Zeolite 4A (NaA)                                  | 19          |
| 4.1.5 Level of Exchange Chosen for Paraffins Adsorption                        | 22          |
| 4.2 Paraffins Adsorption   | 22          |
| 4.2.1 Thermogravimetric Analyses   | 22          |
| 4.2.2 Breakthrough Curve Experiment  | 26          |
| <b>V CONCLUSIONS AND RECOMMENDATIONS</b>                                       | 30          |
| 5.1 Conclusions  | 30          |
| 5.1.1 Molecular Sieve Preparation (ion exchange)                               | 30          |
| 5.1.2 Paraffins Adsorption   | 30          |
| 5.2 Recommendations  | 30          |
| <b>REFERENCES</b>  | 32          |
| <b>APPENDICES</b>  | 34          |
| <b>Appendix A</b> Sample of calculation  | 34          |
| <b>Appendix B</b> Calibration curve of Atomic Absorption<br>Spectrometer (AAS) | 36          |
| <b>CURRICULUM VITAE</b>  | 38          |

**LIST OF TABLES**

| <b>TABLE</b> |   | <b>PAGE</b> |
|--------------|---|-------------|
| 2.1          | Exchange capacity of various zeolites   | 7           |
| 4.1          | Final concentration of Ca solution after various contact times between the solid and the solution | 16          |
| 4.2          | Calcium exchanged results (proceeded at 30°C)   | 17          |
| 4.3          | Final concentration of Sr solution after various contact times between the solid and the solution | 18          |
| 4.4          | Strontium exchanged results (proceeded at 30°C)   | 18          |
| 4.5          | Final concentration of Mg solution after various contact times between the solid and the solution | 19          |
| 4.6          | Magnesium exchanged results (proceeded at 30°C)   | 20          |
| 4.7          | Magnesium exchanged results (proceeded at 90°C)   | 20          |
| 4.8          | Peak position and amount of normal decane desorbed  | 25          |
| 4.9          | Condition chosen for breakthrough curve experiment  | 26          |
| 4.10         | Average times obtained from breakthrough curve experiments  | 28          |



## LIST OF FIGURES

| FIGURE   | PAGE |
|--|------|
| 2.1 Pseudo unit cell and cationic sites of zeolite A.  | 8    |
| 3.1 Temperature profile used to study TPD of normal decane.  | 13   |
| 3.2 Breakthrough curve experimental set up.  | 15   |
| 4.1 Calcium exchanged isotherm proceeded at 30°C.  | 17   |
| 4.2 Strontium exchanged isotherm proceeded at 30°C.  | 19   |
| 4.3 Magnesium exchanged isotherm proceeded at 30°C.  | 21   |
| 4.4 Magnesium exchanged isotherm proceeded at 90°C.  | 21   |
| 4.5 Water desorption curve of 97% Mg-Na-A powder form and<br>75% Sr-Na-A powder form.                | 22   |
| 4.6 TPD thermogram of n-C10 on 53% Ca-Na-A.  | 23   |
| 4.7 TPD thermogram of n-C10 on 57% Mg-Na-A.  | 24   |
| 4.8 TPD thermogram of n-C10 on 54% Sr-Na-A.  | 24   |
| 4.9 Compared TPD curves between 53% Ca-Na-A, 57%<br>Mg-Na-A, and 54% Sr-Na-A, all in extrudate form. | 25   |
| 4.10 53% Ca-Na-A Breakthrough curve<br>(adsorption temperature = 300°C) .                            | 27   |
| 4.11 57% Mg-Na-A Breakthrough curve<br>(adsorption temperature = 300°C) .                            | 28   |
| 4.12 54% Sr-Na-A Breakthrough curve<br>(adsorption temperature = 300°C) .                            | 28   |