

**CARBON DIOXIDE AND METHANE COMPETITIVE ADSORPTION ON
COCONUT SHELL ACTIVATED CARBON**

Napaphat Samanwong

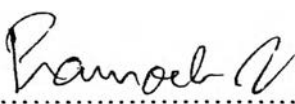
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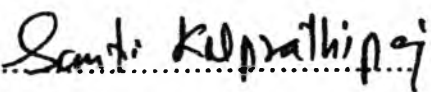
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By: Napaphat Samanwong
Program: Petroleum Technology
Thesis Advisors: Assoc. Prof. Pramoch Rangsunvigit
Dr. Santi Kulprathipanja
Asst. Prof. Boonyarach Kitiyanan

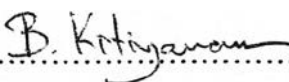
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..... College Dean
(Asst. Prof. Pomthong Malakul)

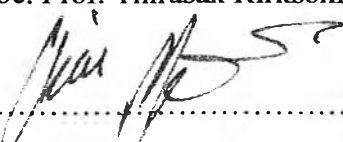
Thesis Committee:


.....
(Assoc. Prof. Pramoch Rangsunvigit)


.....
(Dr. Santi Kulprathipanja)


.....
(Asst. Prof. Boonyarach Kitiyanan)


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


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

ABSTRACT

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Napaphat Samanwong: Carbon dioxide and Methane Competitive Adsorption on Coconut Shell Activated Carbon.

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The use of natural gas as a fuel in natural gas vehicles (NGVs) has become an attractive alternative to gasoline and diesel fuels because of its inherent clean burning characteristics. In adsorbed natural gas (ANG), natural gas is adsorbed by a porous adsorbent material at a relatively low pressure with similar methane capacity as compared to commercially compressed natural gas (CNG). Carbon-based adsorbents, like activated carbon, could provide high adsorption capacity and delivery due to its high specific surface area and high volumetric storage capacity. In this research, the adsorption capacity of methane was investigated using coconut shell activated carbon (CSAC) as an adsorbent in a packed bed column at room temperature (25°C). Binary mixtures of methane and carbon dioxide (10, 20, and 30 vol% of CO₂) were used. Furthermore, to improve adsorption capacity of adsorbent, increasing surface area and increasing hydrophobic characteristic of sample were investigated. The CSAC was treated (1) by soaking into acid/alkali solution to increase their surface area (2) by mixing with methyl ester sulfonate (MES) solution to increase the hydrophobicity. BET, SEM and FTIR techniques were used to characterize the adsorbents. The composition of methane and carbon dioxide adsorption was determined by GC. Results showed that carbon dioxide significantly affects the adsorption of methane. The breakthrough time of carbon dioxide is longer than that of methane, and the methane roll up increases with the increase in the concentration of carbon dioxide because carbon dioxide is more selectively adsorbed on all adsorbents than that of methane.

บทคัดย่อ

ณปภัช สมานวงศ์: การแข่งขันการดูดซับคาร์บอนไดออกไซด์และมีเทนบนถ่านกัมมันต์จากกะลามะพร้าว (Carbon dioxide and Methane Competitive Adsorption on Coconut Shell Activated Carbon) อ. ที่ปรึกษา: รศ. ดร. ปราโมช รังสรรค์วิจิตร ดร. สันติ กุลประทีปัญญา และ ผศ. ดร. บุญรัชต์ กิตติยานันท์ 106 หน้า

การใช้ก๊าซธรรมชาติเป็นเชื้อเพลิงในยานพาหนะได้กลายเป็นทางเลือกที่น่าสนใจ นอกเหนือจากน้ำมันเบนซินและดีเซลเพราะมีการเผาไหม้ที่สะอาด อย่างไรก็ตามการกักเก็บก๊าซธรรมชาติเพื่อใช้งานยังเป็นสิ่งที่ท้าทาย หนึ่งในวิธีการกักเก็บที่ได้รับความสนใจได้แก่ Adsorbed Natural Gas (ANG) โดยใช้วัสดุที่มีรูพรุนเช่น ถ่านกัมมันต์ ซึ่งมีความสามารถในการดูดซับสูง เนื่องจากมีพื้นที่ผิวที่เฉพาะเจาะจงและมีปริมาตรการกักเก็บสูง ในงานวิจัยนี้ศึกษาความสามารถของการดูดซับก๊าซมีเทนโดยใช้ถ่านกัมมันต์จากกะลามะพร้าวในคอลัมน์แบบเบดนิ่งที่อุณหภูมิห้อง (25°C) ในการศึกษาได้ใช้ก๊าซผสมของมีเทนและคาร์บอนไดออกไซด์ (10, 20, และ 30 vol% ของก๊าซคาร์บอนไดออกไซด์) นอกจากนี้ในการทดลองยังนำถ่านกัมมันต์ไปผ่านการปรับสภาพ 2 วิธี เพื่อที่จะศึกษาผลกระทบจากการเปลี่ยนแปลงของพื้นที่ผิวและการเปลี่ยนแปลงลักษณะความไม่ชอบน้ำของถ่านกัมมันต์ในการดูดซับก๊าซมีเทน การปรับสภาพที่ใช้คือ 1) การนำถ่านกัมมันต์ไปแช่ในสารละลายกรดหรือด่างเพื่อที่จะเพิ่มพื้นที่ผิวของถ่านกัมมันต์ให้สูงขึ้น 2) การนำถ่านกัมมันต์ไปผสมกับเมทิลเอสเทอร์ ซัลโฟเนต (MES) เพื่อเพิ่มลักษณะความไม่ชอบน้ำของถ่านกัมมันต์ หลังจากการปรับสภาพ ถ่านกัมมันต์จะถูกนำไปตรวจลักษณะด้วยเครื่องมือการวิเคราะห์หาค่าพื้นที่ผิว กล้องจุลทรรศน์อิเล็กตรอนแบบสแกนและเครื่องมือหาชนิดและปริมาณสาร โดยการผ่านแสงอินฟราเรด ความเข้มข้นมีเทนและคาร์บอนไดออกไซด์ทำโดยใช้ GC เทคนิค ผลการทดลองแสดงให้เห็นได้ว่าคาร์บอนไดออกไซด์ส่งผลกระทบต่ออย่างมีนัยสำคัญต่อการดูดซับของมีเทน คาร์บอนไดออกไซด์ใช้เวลาหลุดออกจากตัวดูดซับนานกว่ามีเทน และการรวมตัวเพิ่มขึ้นของมีเทนจะเกิดขึ้นเมื่อความเข้มข้นของคาร์บอนไดออกไซด์เพิ่มมากขึ้น เนื่องจากตัวดูดซับทุกตัวเลือกดูดซับคาร์บอนไดออกไซด์มากกว่าดูดซับมีเทน

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