

**ENHANCEMENT OF CO<sub>2</sub> ADSORPTION ON ACTIVATED CARBON VIA  
SURFACE FUNCTIONALIZATION**

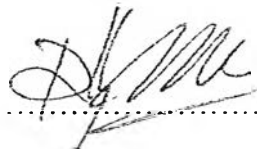
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A Thesis Submitted in Partial Fulfilment of the Requirements  
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**Program:** Petrochemical Technology  
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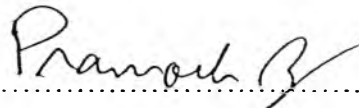
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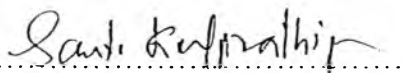


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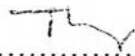
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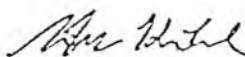
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## ABSTRACT

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Promptorn Ritmongkolpun: Enhancement of CO<sub>2</sub> Adsorption on Activated Carbon via Surface Functionalization

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Keywords: Adsorption/ Activated Carbon/ Carbon dioxide/ Polyethyleneimine

The effect of different polyethyleneimine (PEI) molecular weights on CO<sub>2</sub> adsorption on activated carbon (AC) was investigated. The PEI loading was varied by different PEI solution concentrations from 1.0 to 5.0 g/L. CO<sub>2</sub> adsorption isotherms were investigated at 30, 50, and 75 °C. Adsorbents were characterized by TG-DTA, FTIR, and surface area and pore size analysis. The results showed that PEI impregnated on activated carbon improved the CO<sub>2</sub> adsorption capacity due to the synergistic effects between physical and chemical adsorption. AC impregnated with the low molecular weight PEI showed improvement in the CO<sub>2</sub> adsorption capacity at a low temperature. Higher PEI molecular weights showed higher adsorption capacity at a high temperature. An optimum amount of PEI loading and appropriate PEI molecular weight are needed to increase the CO<sub>2</sub> adsorption capacity.

## บทคัดย่อ

พรหมกร ฤทธิมงคลพันธุ์: การปรับปรุงความสามารถในการดูดซับคาร์บอนไดออกไซด์ด้วยวิธีปรับปรุงหมู่ฟังก์ชันบนพื้นผิวของถ่านกัมมันต์ (Enhancement of CO<sub>2</sub> Adsorption on Activated Carbon via Surface Functionalization) อ. ที่ปรึกษา: รศ. ดร. ปราโมช รังสรรค์ วิจิตร และ ดร. สันติ กุลประทีปปัญหา 85 หน้า

งานวิจัยนี้ศึกษาความสามารถในการดูดซับก๊าซคาร์บอนไดออกไซด์ของถ่านกัมมันต์ (Activated Carbon, AC) ที่ผ่านการปรับปรุงคุณสมบัติด้วยพอลิเอทิลีนอิมิน (Polyethyleneimine, PEI) ที่มีน้ำหนักโมเลกุลที่แตกต่างกัน การใช้ความเข้มข้นของสารละลาย PEI ที่แตกต่างกันจะให้ปริมาณ PEI บน AC แตกต่างกันไปด้วย โดยความเข้มข้นของสารละลายที่ใช้อยู่ในช่วง 1.0 ถึง 5.0 g/L การทดลองนี้ได้ศึกษาไอโซเทอม (isotherm) ของการดูดซับคาร์บอนไดออกไซด์ที่อุณหภูมิ 30, 50 และ 75 °C พิสูจน์เอกลักษณ์ของตัวดูดซับโดยใช้เทคนิค การทดสอบความเสถียรทางความร้อนด้วย TG-DTA การทดสอบหาหมู่ฟังก์ชันด้วย FTIR และการทดสอบหาพื้นที่ผิวและรูพรุนของตัวดูดซับ ผลการทดลองแสดงให้เห็นได้ว่า การเติม PEI ลงไปบน AC สามารถช่วยเพิ่มความสามารถในการดูดซับคาร์บอนไดออกไซด์ได้ โดยสามารถทำให้เกิดการส่งเสริมกัน (synergistic effect) ระหว่างการดูดซับทางกายภาพ (physical adsorption) และการดูดซับทางเคมี (chemical adsorption) การเติม PEI ประเภทน้ำหนักโมเลกุลต่ำลงไปใน AC สามารถช่วยเพิ่มความสามารถในการดูดซับคาร์บอนไดออกไซด์ได้ที่อุณหภูมิประมาณ 30 °C เมื่อเติม PEI ที่มีน้ำหนักโมเลกุลสูงกว่าลงไปใน AC สามารถเพิ่มความสามารถในการดูดซับคาร์บอนไดออกไซด์ได้ที่อุณหภูมิสูงประมาณ 50 และ 75 °C ปัจจัยสำคัญในการเพิ่มความสามารถในการดูดซับคาร์บอนไดออกไซด์ให้มีประสิทธิภาพคือ การเติม PEI ลงไปใน AC ในปริมาณที่เหมาะสม และเลือกใช้น้ำหนักโมเลกุลของ PEI ให้เหมาะสมกับสภาวะในการดูดซับ

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