

**ENHANCEMENT OF CO₂ ADSORPTION ON
POLYBENZOXAZINE-MODIFIED ACTIVATED CARBON**

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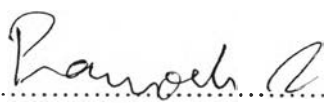
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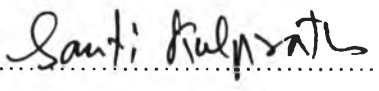
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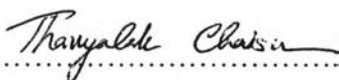
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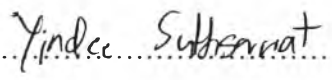
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ABSTRACT

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Thesis Advisors: Assoc. Prof. Pramoch Rangsunvigit, Dr. Santi Kulprathipanja, and Asst. Prof. Thanyalak Chaisuwan 95 pp.

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CO₂ adsorption on the palm shell-based activated carbon (PSAC), coconut shell-based activated carbon (CSAC), and polybenzoxazine (PBZ) grafted CSAC was investigated. The PBZ loading was varied by different benzoxazine monomer (BZ) solution concentrations from 1.0 to 5.0 g/L. The solvents that used for BZ impregnation onto adsorbents were methanol and chloroform. CO₂ adsorption isotherms were investigated at 30, 50, and 75 °C. Adsorbents were characterized by TG-DTA, FTIR, SEM, and surface area and pore size analysis. The results showed that the CSAC had higher CO₂ adsorption capacity than the PSAC, and methanol was a good solvent for the impregnation. The 0.27 wt% PBZ grafted CSAC improved the CO₂ adsorption capacity at 50 and 75 °C because the chemisorption was preferred at these high temperatures. A decrease in the adsorption capacity was found when the CSAC was loaded with 0.92 wt% PBZ or higher because of the pore filling effect. An optimum amount of PBZ loading is needed to increase the CO₂ adsorption capacity. The used adsorbents were regenerated at 120 °C to desorb CO₂ from the adsorbent. The CO₂ adsorption capacity of the regenerated adsorbents had minimal loss in the capacity.

บทคัดย่อ

สิทธิพงศ์ พันธชินรังสีมา: การเพิ่มประสิทธิภาพของการดูดซับก๊าซคาร์บอนไดออกไซด์บนถ่านกัมมันต์ที่มีการปรับปรุงด้วยพอลิเบนซอกซาซีน (Enhancement of CO₂ Adsorption on Polybenzoxazine-modified Activated Carbon) อ. ที่ปรึกษา: รศ. ดร. ปราโมช รั้งสรรควิจิตร ดร. สันติ กุลประทีปปัญญา และ ผศ. ดร. ธัญญลักษณ์ ฉายสุวรรณ 95 หน้า

งานวิจัยนี้ศึกษาความสามารถในการดูดซับก๊าซคาร์บอนไดออกไซด์ของถ่านกัมมันต์ที่ทำจากปาล์ม (Palm Shell-based Activated Carbon, PSAC), ถ่านกัมมันต์ที่ทำจากกะลามะพร้าว (Coconut Shell-based Activated Carbon, CSAC), และถ่านกัมมันต์ที่ผ่านการปรับปรุงคุณสมบัติด้วยพอลิเบนซอกซาซีน (Polybenzoxazine, PBZ) ความเข้มข้นของสารละลายเบนซอกซาซีน (Benzoxazine, BZ) ที่ใช้อยู่ในช่วง 1.0 ถึง 5.0 g/L โดยมีคลอโรฟอร์ม (Chloroform) และเมทานอล (Methanol) เป็นตัวทำละลาย การทดลองนี้ได้ศึกษาไอโซเทอม (Isotherm) ของการดูดซับคาร์บอนไดออกไซด์ที่อุณหภูมิ 30, 50 และ 75 °C พิสูจน์เอกลักษณ์ของตัวดูดซับโดยใช้เทคนิค การทดสอบความเสถียรทางความร้อนด้วย TG-DTA การทดสอบหาหมู่ฟังก์ชันด้วย FTIR การทดสอบหาสัณฐานวิทยาด้วย SEM และการทดสอบหาพื้นที่ผิวและรูพรุนของตัวดูดซับ ผลการทดลองแสดงให้เห็นได้ว่า CSAC เหมาะสำหรับนำมาใช้เป็นตัวดูดซับก๊าซคาร์บอนไดออกไซด์ และ คลอโรฟอร์มเป็นตัวทำละลายที่เหมาะสมในการเติม BZ บน CSAC การเติม PBZ ที่ปริมาณ 0.27 % โดยน้ำหนักลงไปบน CSAC สามารถช่วยเพิ่มความสามารถในการดูดซับคาร์บอนไดออกไซด์ได้ที่อุณหภูมิ 50 และ 75 °C เพราะเกิดการดูดซับทางเคมี (Chemisorption) ได้ดี เมื่อเติม PBZ ที่มีปริมาณ 0.92 % โดยน้ำหนักหรือสูงกว่า ประสิทธิภาพการดูดซับลดลง เนื่องมาจากเกิดการบดบังของรูพรุนบนถ่านกัมมันต์ ปัจจัยสำคัญในการเพิ่มความสามารถในการดูดซับคาร์บอนไดออกไซด์ให้มีประสิทธิภาพคือ การเติม PBZ ลงไปบน CSAC ในปริมาณที่เหมาะสม กับสถานะในการดูดซับตัวดูดซับที่ผ่านการใช้งานถูกนำมาใช้ใหม่โดยการคายคาร์บอนไดออกไซด์ที่ 120 °C ตัวดูดซับสามารถนำกลับมาใช้ใหม่ได้โดยไม่สูญเสียความสามารถในการดูดซับ

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