

**INFLUENCE OF OXIDATION AND NITROGEN TREATMENT ON
ACTIVATED CARBON FOR CO₂ ADSORPTION**

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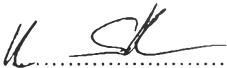
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ABSTRACT

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Carbon dioxide (CO₂) is the most influential greenhouse gas causing a rise in global surface temperature. The technique for capturing CO₂ from post combustion flue gases, namely adsorption, is considered to be a promising technique. Activated carbon (AC) was modified by oxidation in nitric acid and impregnation with branched polyethylenimine (PEI). Oxygen functional groups obtained by oxidation can increase CO₂ adsorption performance by electron donating that participates in electrostatic interactions with CO₂. Incorporation of nitrogen functional groups can increase the interaction between CO₂, as Lewis acid, and nitrogen functionalized compounds, as Lewis base. The effect of the modification steps were studied to understand differences in surface properties by employing X-Ray photoelectron spectroscopy (XPS). The results of impregnation with branched PEI showed that in spite of the increasing in the amount of nitrogen incorporated into activated carbon, the adsorption capacity of impregnated samples was lower than the untreated AC. Furthermore, branched PEI was impregnated on oxidized AC, and their CO₂ adsorption capacity was slightly higher than the PEI impregnated only samples; however, they still gave lower CO₂ adsorption capacity than the untreated AC due to the pore blocking effect. On the other hands, the oxidized only samples gave a higher adsorption capacity as compared to an untreated AC because the presence of more acid functionalities, such as carbonyl and carboxyl on their surface, could promote the CO₂ adsorption. In terms of regeneration, both untreated AC and oxidized only samples were easily regenerated, whereas all PEI impregnated samples were regenerated slower due to their chemisorption process.

บทคัดย่อ

ธีรภัทร สุรินทร์ : อิทธิพลของการออกซิเดชันและการเติมหมู่ไนโตรเจนบนถ่านกัมมันต์สำหรับการดูดซับก๊าซคาร์บอนไดออกไซด์ (Influence of Oxidation and Nitrogen Treatment on Activated Carbon for CO₂ Adsorption) อ.ที่ปรึกษา : ดร. อุทัยพร สุริยประภาคิลก 93 หน้า

ก๊าซคาร์บอนไดออกไซด์เป็นหนึ่งในก๊าซเรือนกระจกที่ส่งผลกระทบต่อการเพิ่มขึ้นของอุณหภูมิพื้นผิวโลก จึงจำเป็นต้องจำกัดการปล่อยก๊าซคาร์บอนไดออกไซด์สู่ชั้นบรรยากาศโดยกระบวนการดูดซับด้วยถ่านกัมมันต์ ซึ่งประสิทธิภาพของการดูดซับสามารถทำให้เพิ่มขึ้นได้โดยการปรับปรุงคุณสมบัติของพื้นผิวถ่านกัมมันต์ด้วยการออกซิเดชัน และการเติมหมู่ไนโตรเจนด้วยพอลิเอทิลีนอิมิน การปรับปรุงคุณสมบัติพื้นผิวของถ่านกัมมันต์ถูกพิสูจน์เอกลักษณ์ด้วยเอกซเรย์โฟโตอิเล็กตรอนสเปกโทรสโกปี จากผลการทดลองการดูดซับก๊าซคาร์บอนไดออกไซด์ การเติมหมู่ไนโตรเจนด้วยพอลิเอทิลีนอิมินลงบนถ่านกัมมันต์ที่ถูกปรับปรุงคุณสมบัติพื้นผิวสามารถดูดซับก๊าซคาร์บอนไดออกไซด์ได้มากกว่าการเติมหมู่ไนโตรเจนลงบนถ่านกัมมันต์ที่ไม่ผ่านการปรับปรุงคุณสมบัติ แต่ยังไม่สามารถปรับปรุงประสิทธิภาพของการดูดซับให้มีปริมาณการดูดซับที่มากกว่าถ่านกัมมันต์ เนื่องจากพอลิเอทิลีนอิมินเคลือบลงบนพื้นผิวของถ่านกัมมันต์ ทำให้ความสามารถในการดูดซับทางกายภาพลดลง ในขณะที่การปรับปรุงผ่านกัมมันต์ด้วยการออกซิเดชันเพียงอย่างเดียว สามารถปรับปรุงความสามารถของการดูดซับก๊าซคาร์บอนไดออกไซด์ให้ได้ปริมาณที่มากกว่าถ่านกัมมันต์ เนื่องจากการออกซิเดชันช่วยในการเพิ่มความเป็นกรด โดยเฉพาะหมู่คาร์บอกซิลลงบนพื้นผิวของถ่านกัมมันต์ ซึ่งหมู่คาร์บอกซิลมีคุณสมบัติที่เหมาะสมที่ช่วยในการดูดซับก๊าซคาร์บอนไดออกไซด์ การออกซิเดชันเพียงอย่างเดียวยังมีประสิทธิภาพสูงในกระบวนการฟื้นฟู โดยสามารถฟื้นฟูประสิทธิภาพได้ทั้งหมด ในขณะที่การเติมหมู่ไนโตรเจนด้วยพอลิเอทิลีนอิมินไม่สามารถฟื้นฟูได้ทั้งหมด เนื่องจากการดูดซับทางเคมีระหว่างก๊าซคาร์บอนไดออกไซด์และพอลิเอทิลีนอิมิน ต้องใช้พลังงานสูงในการสลายพันธะ

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