

POLYBENZOXAZINE SORBENTS FOR CO₂ CAPTURE

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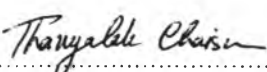
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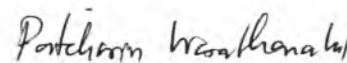
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ABSTRACT

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Adsorption is a promising technique to capture CO₂ from flue gases in post combustion. Nitrogen loading has been proposed to increase adsorption performance because the formation of carbamates by nitrogen bonded on the adsorbent surface. Polybenzoxazine (PBZ) is used in this study both as an impregnating material and as the porous adsorbent by carbonizing under nitrogen and activating by CO₂. Two amines, diethylenetriamine (DETA), and pentaethylenhexamine (PEHA), were used in the synthesis of PBZ to investigate the effect of amine structure to the CO₂ adsorption capacity. Various amine loadings on activated carbon and a number of PBZ activating conditions were studied to evaluate the CO₂ adsorption performance. A gravimetric method was used to measure CO₂ adsorption capacity and using characterization techniques such as surface area analyzer, FTIR and XPS. The results showed that the synthesis of benzoxazine and PBZ were successful. The CO₂ adsorption capacity of impregnated adsorbents with PEHA-derived benzoxazine were higher than impregnated adsorbents with DETA-derived benzoxazine because PEHA contains more nitrogen functional groups and more chain length than DETA, however, both impregnating adsorbents perform lower CO₂ adsorption capacity than the untreated activated carbon probably, due to pore blocking. The PBZ-derived activated carbon obtained by carbonizing at 300 °C and activating at 800 °C showed the highest CO₂ adsorption capacity at 1.65 mmol_{CO₂}/g_{adsorbent}.

บทคัดย่อ

ณรงค์ธร ธีรภมร: ตัวดูดซับจากพอลิเบนซอกซาซีนสำหรับการจับก๊าซคาร์บอนไดออกไซด์ (Polybenzoxazine Sorbents for CO₂ Capture) อ.ที่ปรึกษา: ดร. อุทัยพร สุริยประภาคิลก 111 หน้า

การดูดซับเป็นเทคนิคที่น่าสนใจเพื่อการจับก๊าซคาร์บอนไดออกไซด์จากปล่องไฟที่มาจากโรงไฟฟ้า การเพิ่มไนโตรเจนได้ถูกเสนอเพื่อเพิ่มสมรรถนะของการดูดซับเนื่องจากรูปแบบของคาร์บามेटโดยพันธะของไนโตรเจนบนพื้นผิวของตัวดูดซับ พอลิเบนซอกซาซีนได้ถูกนำมาใช้ในการศึกษานี้โดยเป็นทั้งวัสดุในการเติมและเป็นตัวดูดซับที่มีรูพรุน โดยการคาร์บอนในเซชันภายใต้บรรยากาศของไนโตรเจนและการกระตุ้นด้วยก๊าซคาร์บอนไดออกไซด์ เอมีนสองชนิดคือไดเอทิลีนไตรเอมีนและเพนตะเอทิลีนเฮกซามีนได้ถูกนำมาใช้ในการสังเคราะห์พอลิเบนซอกซาซีนเพื่อตรวจสอบผลของโครงสร้างของเอมีนที่มีต่อความสามารถในการดูดซับก๊าซคาร์บอนไดออกไซด์ การเพิ่มไนโตรเจนที่แตกต่างกันบนก้านกับมันด์และพอลิเบนซอกซาซีนที่ถูกเพิ่มอำนาจดูดซับแต่ละสภาวะถูกนำมาศึกษาเพื่อประเมินสมรรถนะของการดูดซับก๊าซคาร์บอนไดออกไซด์ วิธีวัดค่าโดยน้ำหนักได้ถูกใช้เพื่อวัดความสามารถในการดูดซับก๊าซคาร์บอนไดออกไซด์และการใช้เทคนิคพิเศษอวกาศลักษณะ เช่น การวิเคราะห์พื้นที่ผิว ฟูเรียร์ทรานสฟอร์มอินฟราเรดสเปกโตรมิเตอร์ และเอกซเรย์โฟโตอิเล็กตรอนสเปกโตรสโคปี ผลที่ได้จากการทดลองแสดงให้เห็นว่าการสังเคราะห์เบนซอกซาซีนและพอลิเบนซอกซาซีนประสบความสำเร็จความสามารถในการดูดซับก๊าซคาร์บอนไดออกไซด์ของตัวดูดซับที่ถูกเติมด้วยเบนซอกซาซีนที่มาจากการใช้เพนตะเอทิลีนเฮกซามีนเป็นสารตั้งต้นสูงกว่าตัวดูดซับที่ถูกเติมด้วยเบนซอกซาซีนที่มาจากการใช้ไดเอทิลีนไตรเอมีนเป็นสารตั้งต้นเนื่องจากเพนตะเอทิลีนเฮกซามีนมีหมู่ฟังก์ชันของไนโตรเจนและความยาวของสายโซ่มากกว่าไดเอทิลีนไตรเอมีน แต่อย่างไรก็ตามตัวดูดซับที่ถูกเติมทั้งสองชนิดนี้แสดงความสามารถในการดูดซับก๊าซคาร์บอนไดออกไซด์ต่ำกว่าก้านกับมันด์ อาจเป็นผลมาจากการกีดขวางรูพรุน พอลิเบนซอกซาซีนที่ถูกคาร์บอนในเซชันและกระตุ้นที่ได้มาจากการคาร์บอนในเซชันที่ 300 องศาเซลเซียส และการกระตุ้นที่ 800 องศาเซลเซียสแสดงค่าความสามารถในการดูดซับก๊าซคาร์บอนไดออกไซด์สูงที่สุดที่ 1.65 มิลลิโมลของก๊าซคาร์บอนไดออกไซด์ต่อกรัมของตัวดูดซับ

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