SELECTIVE ADSORPTION OF NATURAL ZEOLITE FOR CONTROLLED-RELEASE OF FERTILIZER

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ABSTRACT

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In this study, batch liquid adsorption of NH_4^+ and K^+ ions on clinoptilolite was carried out to obtain equilibrium and kinetic data at room temperature. From the analysis of the kinetic data, conformity to the Elovich model suggested that the adsorption of both cations was governed by a heterogeneous diffusion process. Equilibrium adsorption studies showed that an increase in pH and the initial concentration of NH_4^+ and K^+ ions resulted in faster sorption and greater amounts of both ions being adsorbed. In addition, it was found that K^+ ions were adsorbed to a much greater extent compared with NH_4^+ ions. From the desorption studies using NaCl, quantitative amounts of sorbed NH_4^+ and K^+ ions on clinoptilolite could be desorbed, depending on salt concentration. When NH_4^+ and K^+ ions were equally loaded on clinoptilolite, approximately the same amount of both ions were released from the adsorbent. In contrast, when the loading ratio of NH_4^+ and K^+ ions was relatively high, a much higher amount of sorbed K^+ ions was released, suggesting that the desorbed NH_4^+ ions may also be involved in the release of sorbed K^+. The results indicate that clinoptilolite can potentially be used for the controlled release of ions such as NH_4^+ and K^+ at desired compositions from fertilizers.

บทคัดย่อ

นิธิดา นาคะปรีชา : การดูดซับแบบเฉพาะเจาะจงของสารประกอบซีโอไลท์ธรรมชาติเพื่อใช้ในการควบคุมการปล่อยปุ๋ย (Selective adsorption of natural zeolite for controlled-release of fertilizer) อ.ที่ปรึกษา : ผศ.ดร. ปมทอง มาลากุล ณ อยุธยา, ผศ.ดร. ปราโมช รังสรรค์วิจิตร และ ศ. เออโดแกน กูลารี (Prof. Erdogan Gulari) 79 หน้า ISBN 974-17-2290-7

งานวิจัยนี้เป็นการศึกษาการดูดซับแอมโมเนียมและโพแทสเซียมไอออนโดยคลินอพทิลโอไลท์โดยใช้การทดลองในภาวะของเหลวแบบกะที่อุณหภูมิห้อง การศึกษาทางจลนศาสตร์พบว่าการดูดซับและการคายแอมโมเนียมและโพแทสเซียมไอออนของคลินอพทิลโอไลท์เป็นไปตามสมการเอลโอวิช ซึ่งแสดงว่าการแลกเปลี่ยนแอมโมเนียมและโพแทสเซียมไอออนถูกควบคุมโดยกระบวนการแพร่แบบหลากหลาย จากการทดลองสมดุลการดูดซับ พบว่าการดูดซับแอมโมเนียมและโพแทสเซียมไอออนเพิ่มขึ้นเมื่อค่า pH และความเข้มข้นเริ่มต้นมีค่าสูงขึ้น นอกจากนี้โพแทสเซียมไอออนยังถูกดูดซับโดยคลินอพทิลโอไลท์ในปริมาณที่มากกว่าแอมโมเนียมไอออน การศึกษาการคายแอมโมเนียมและโพแทสเซียมไอออนพบว่าปริมาณการคายไอออนที่ถูกดูดซับเพิ่มขึ้นเมื่อความเข้มข้นของสารละลายเกลือที่ใช้และปริมาณของแอมโมเนียมและโพแทสเซียมไอออนที่ถูกดูดซับมีค่าเพิ่มขึ้น ในขั้นตอนสุดท้ายเป็นการศึกษาการปล่อยแอมโมเนียมและโพแทสเซียมไอออนจากคลินอพทิลโอไลท์ที่มีการดูดซับของไอออนทั้งสองในอัตราส่วนต่างๆ พบว่าเมื่อทำการดูดซับไอออนทั้งสองในอัตราส่วนที่ใกล้เคียงกัน ปริมาณการปล่อยออกของไอออนทั้งสองมีค่าใกล้เคียงกัน แต่เมื่อแอมโมเนียมไอออนถูกดูดซับมากกว่าโพแทสเซียม พบว่าสัดส่วนปริมาณโพแทสเซียมไอออนที่ถูกปล่อยออกมามากกว่าสัดส่วนปริมาณโพแทสเซียมไอออนที่ถูกปล่อยออกในกรณีแรก ในขณะที่สัดส่วนปริมาณแอมโมเนียมไอออนที่ถูกปล่อยออกมีค่าใกล้เคียงกับสัดส่วนปริมาณแอมโมเนียมไอออนที่ถูกปล่อยออกในกรณีแรก การศึกษานี้แสดงให้เห็นว่าคลินอพทิลโอไลท์สามารถนำมาใช้เป็นตัวดูดซับแอมโมเนียมและโพแทสเซียมไอออนเพื่อนำมาประยุกต์ใช้ในการควบคุมการปล่อยสารอาหารในปุ๋ยได้ดี

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