

**BATCH AND COLUMN STUDIES ON THE REMOVAL OF HEAVY
METAL IONS AND DYE BY ADSORPTION ON CROSS-LINKED
CHITOSAN BEAD**



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วิทยุวัต สิงหศิริ : การศึกษาการกำจัดไอออนโลหะหนักและสีข้อมโดยการดูดซับด้วยเม็ดไคโตซานแบบกะและแบบคอลัมน์ (Removal of Heavy Metal Ions and Dye by Adsorption on Chitosan Bead: Batch and Column Studies) อ.ที่ปรึกษา : ผศ.ดร. ปมทอง มาลากุล ณ อยุธยา, ผศ.ดร. ปราโมช รั้งสรรค์วิจิตร และ ศ. เจมส์ โอ วิลส์ (Prof. James O. Wilkes) 57 หน้า ISBN 974-17-2315-6

งานวิจัยนี้ศึกษาการกำจัดไอออนของโลหะหนักและสีข้อมพร้อมกันโดยการดูดซับด้วยเม็ดไคโตซาน (cross-linked chitosan beads, CCB) การเตรียมเม็ดไคโตซานเริ่มต้นด้วยการใช้วิธี syringe injection และทำการเชื่อมขวางโครงสร้างเพื่อเพิ่มคุณสมบัติทางกลและความเสถียรในสภาพแวดล้อมที่เป็นกรด การศึกษาจลนศาสตร์ในการดูดซับไอออนของสีข้อมรีแอ็กทีฟ 180 และโลหะทองแดงด้วยเม็ดไคโตซานพบว่า การดูดซับถูกควบคุมโดยการแพร่ภายในเม็ดไคโตซาน (internal diffusion) ซึ่งส่งผลให้อัตราเร็วในการดูดซับมีค่าต่ำ อย่างไรก็ตามเม็ดไคโตซานยังคงมีความสามารถในการดูดซับไอออนทั้งสองชนิดในปริมาณมาก โดยเฉพาะอย่างยิ่งเมื่อเปรียบเทียบกับตัวดูดซับที่ได้มาจากธรรมชาติชนิดอื่น สำหรับผลกระทบของ pH ต่อการดูดซับพบว่าสีข้อมถูกดูดซับในปริมาณมากขึ้นในระบบที่มีค่า pH ต่ำซึ่งตรงข้ามกับการดูดซับของโลหะทองแดง ส่วนการศึกษาทางสมดุลในการดูดซับพบว่าผลการทดลองสามารถอธิบายด้วย Langmuir isotherm และสามารถหาคุณลักษณะต่างๆในการดูดซับได้ เช่น adsorption capacity และ affinity จากการศึกษาในระบบที่มีไอออนทั้งสองชนิดผสมกันพบว่า ไอออนของโลหะทองแดงช่วยเพิ่มความสามารถในการดูดซับสีข้อมเนื่องจากโลหะทองแดงสามารถเกิดสารประกอบเชิงซ้อนกับไคโตซานและสีข้อมได้ นอกจากนี้ยังได้ทำการศึกษาการดูดซับสารปนเปื้อนทั้งสองชนิดแบบต่อเนื่องโดยใช้เม็ดไคโตซานในหอการดูดซับแบบฟิกเบด (fixed-bed column)

ABSTRACT

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Wisuwat Singhasiri : Batch and Column Studies on the Removal of Heavy Metal Ions and Dye by Adsorption on Cross-Linked Chitosan Bead

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Keywords : Chitosan Bead/ Reactive Dye/ Copper/ Adsorption/ Simultaneous Removal/ Fixed-Bed Column.

This study investigated the simultaneous removal of heavy metal ions and dye by adsorption onto cross-linked chitosan beads (CCB). Chitosan gel beads were initially prepared using a syringe injection technique followed by cross-linking the chitosan with glutaraldehyde to improve the mechanical properties and acid stability of the beads. Kinetic studies showed that intraparticle diffusion was the rate-limiting step for the adsorption of Cu^{2+} and reactive dye RR180 by CCB, thus giving relatively low adsorption rates. However, the results showed that CCB was capable of adsorbing large amounts of RR180 dye and Cu^{2+} compared with other natural adsorbents. For the pH effect, adsorption of dye was higher at lower system pH whereas a reverse tendency was observed for Cu^{2+} adsorption. The equilibrium adsorption data were found to be well described by Langmuir isotherm, and thus the adsorption capacity (Q) and affinity (K) were determined. In mixed-solute systems, the presence of Cu^{2+} showed enhanced dye adsorption, which was speculated to be the result of complexation. A preliminary study of the continuous removal of contaminants was also conducted using a fixed-bed adsorption column.

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