

**SIMULTANEOUS REMOVAL OF HEAVY METAL AND ORGANIC
CONTAMINANTS USING SURFACTANT-MODIFIED ADSORBENTS
(SMADs)**

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ABSTRACT

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The concern over wastewater problems has led to the development of various treatment technologies. Adsorption has been increasingly interesting due to its versatility. In this research, two types of surfactant-modified adsorbents (SMADs) were developed from natural zeolite and clay mineral by using a two-step surface modification technique. A monolayer of a cationic surfactant (CTAB) and a second layer of an anionic surfactant (DOWFAX 8390) were formed on clinoptilolite and bentonite clay surfaces. The adsorption of organic compounds with different functional groups (benzene, phenol, benzoic acid, chlorobenzene and naphthalene) and heavy metal ions by SMADs were investigated. For the organic adsorption, both surfactant-modified zeolite (SMZ) and surfactant-modified bentonite (SMB) exhibited linear-type isotherms, suggesting that the adsorption is mainly through the partitioning process. SMZ was shown to enhance the sorption of organic compounds more than 3.5 times when compared to unmodified clinoptilolite; whereas SMB could increase organic sorption over 13 times when compared to ordinary bentonite. In the adsorption of heavy metal ions, SMZ was shown to be inferior to unmodified adsorbents. Different from SMB, the removal of cadmium ions significantly decrease from ordinary bentonite. It can be concluded that SMADs could be considered as effective potential adsorbents for heavy metal and organic contaminant removal from wastewater.

บทคัดย่อ

พัชรารักษ์ นิลแก้ว : การกำจัดสารปนเปื้อนประเภทโลหะหนักและสารอินทรีย์ด้วยซีโอไลต์และดินเบนโทไนท์ที่ถูกปรับปรุงด้วยสารลดแรงตึงผิว (เฮสเอ็มเอดีส์) (Simultaneous Removal of Heavy Metal and Organic Compounds using Surfactant-modified Adsorbents (SMADs)) อ. ที่ปรึกษา : ผศ. ดร. ปมทอง มาลากุล ณ อยุธยา และ ศ. ดร. เดวิด เอชาบาตินี 75 หน้า

ในปัจจุบัน ความตระหนักถึงมลภาวะทางน้ำได้นำไปสู่การพัฒนาเทคโนโลยีในการบำบัดน้ำเสียหลายแบบขึ้นอย่างต่อเนื่อง การดูดซับเป็นวิธีการที่ได้รับความนิยมเพิ่มขึ้นเนื่องจากมีประสิทธิภาพและสามารถใช้งานได้หลากหลาย ในงานวิจัยนี้ ตัวดูดซับที่ถูกแปลงสภาพด้วยสารลดแรงตึงผิว (SMADs) สองชนิดได้ถูกพัฒนาขึ้นจากซีโอไลต์และดินเบนโทไนท์โดยการปรับเปลี่ยนสภาพพื้นผิวด้วยสารลดแรงตึงผิว เพื่อก่อให้เกิดชั้นผสมของสารลดแรงตึงผิวแบบประจุบวก (ซีเทป) ชั้นแรกและแบบประจุลบ (คาวน์แฟกซ์) เป็นชั้นที่สอง SMADs ที่เตรียมได้ถูกนำมาใช้ในการศึกษาคุณสมบัติการดูดซับสารอินทรีย์จำพวกอนุพันธ์เบนซีน (เบนซีน, กรดเบนโซอิก, ฟีนอล, คลอโรเบนซีนและเนฟทาลิน) และโลหะหนัก (แคดเมียม) จากผลของการศึกษาการดูดซับสารอินทรีย์พบว่า การดูดซับของซีโอไลต์ที่ถูกปรับปรุงด้วยสารลดแรงตึงผิว (SMZ) และดินเบนโทไนท์ที่ถูกปรับปรุงด้วยสารลดแรงตึงผิว (SMB) สามารถอธิบายได้ด้วยสมการเส้นตรง (Linear isotherm) ซึ่งแสดงถึงการดูดซับแบบพาร์ทิชัน (partitioning process) โดยที่ SMZ สามารถเพิ่มประสิทธิภาพในการดูดซับได้สูงกว่ากลินออปติไลต์ถึง 3.5 เท่า ในขณะที่ SMB เพิ่มมากขึ้น 13 เท่าจากดินเบนโทไนท์ ในการศึกษาการดูดซับแคดเมียมพบว่า SMZ สามารถดูดซับได้น้อยกว่าซีโอไลต์เพียงเล็กน้อย ซึ่งแตกต่างจาก SMB ที่การดูดซับลดลงอย่างมีนัยสำคัญจากดินเบนโทไนท์เดิม ดังนั้นจึงสามารถสรุปได้ว่า สามารถใช้ SMADs ในการกำจัดสารอินทรีย์และโลหะหนักจากน้ำเสียได้อย่างมีประสิทธิภาพ

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