RECOVERY OF MIXED SURFACTANTS FROM WATER USING MULTI-STAGE FOAM FRACTIONATION: EFFECTS OF FEED POSITION, REFLUX POSITION AND REFLUX RATIO

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ABSTRACT

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Surfactants are widely used in many industries, such as healthcare, food processing, and textile, as well as several surfactant-based separation processes, and the effluent streams of these processes usually contain surfactants that need to be removed and recovered for both environmental and economic reasons. In this study, a multi-stage foam fractionation column using bubble-cap trays was used to recover surfactants, and the effects of feed position, reflux position and reflux ratio on surfactant recovery were investigated for two single-surfactant systems and a mixed system of cetylpyridinium chloride (CPC), a cationic surfactant, and polyethylene glycol tert-octylphenyl ether ($OPEO_{10}$), a nonionic surfactant. For the two single-surfactant systems, both the surfactant recovery and the enrichment ratio were strongly affected by feed position. The surfactant recovery decreased with increasing reflux position and reflux ratio. In contrast, the effects of reflux position and reflux ratio were not significant on the enrichment ratio. The results of the mixed surfactant system showed that the recovery of CPC was lower than that of the pure CPC system. Interestingly, for the case of $OPEO_{10}$, it was higher than that of the pure $OPEO_{10}$ system due to the synergism effect.

บทคัดย่อ

ราชฤทธิ์ ศรีพิทักษ์: การนำสารลดแรงตึงผิวกลับมาใช้ใหม่โดยใช้ Multi-Stage Foam Fractionation Column โดยศึกษาอิทธิพลของตำแหน่งการป้อนสารละลาย ตำแหน่งการป้อนกลับ และอัตราส่วนการป้อนกลับ (Recovery of Mixed Surfactants from Water Using Multi-Stage Foam Fractionation: Effects of Feed Position, Reflux Position and Reflux Ratio) อ.ที่ปรึกษา: รศ.ดร. สุเมธ ชวเดช, ศ. จอห์น เอฟ สเกมาฮอร์น และผศ. ดร. ปมทอง มาลากุล ณ อยุธยา 56 หน้า ISBN 974-9937-73-2

ปัจจุบันนี้ สารลดแรงตึงผิวถูกนำมาใช้ในอุตสาหกรรมต่างๆมากมาย เช่น อุตสาหกรรมด้านการดูแลสุขภาพ อุตสาหกรรมอาหาร อุตสาหกรรมสิ่งทอ และโดยเฉพาะอย่างยิ่งกับกระบวนการแยกโดยใช้สารลดแรงตึงผิว ซึ่งทำให้มีการสูญเสียสารลดแรงตึงผิวจำนวนมากไปกับน้ำเสียที่ปล่อยทิ้งจากกระบวนการเหล่านั้น จึงมีความต้องการที่จะแยกสารลดแรงตึงผิวออกเพื่อนำกลับมาใช้ใหม่ด้วยเหตุผลด้านสิ่งแวดล้อมที่เข้มงวดขึ้นและมูลค่าของสารลดแรงตึงผิว ในงานวิจัยนี้ได้นำวิธีการทำให้เกิดฟองแบบลำดับส่วนมาใช้ในการนำสารลดแรงตึงผิวกลับมาใช้ใหม่ โดยศึกษาผลกระทบของตำแหน่งการป้อนสารละลาย ตำแหน่งการป้อนกลับ และอัตราส่วนการป้อนกลับ ต่อประสิทธิภาพของหอลำดับส่วนทั้งในระบบสารลดแรงตึงผิวแบบเดี่ยวและแบบผสม สารลดแรงตึงผิวที่เลือกใช้ในงานวิจัยนี้มี 2 ชนิด คือ ซีติลพีริดิเนียมคลอไรด์ (สารลดแรงตึงผิวชนิดประจุบวก) และ โพลีเอทิลีนไกลคอลเทอเทียรีอ๊อกทิลฟีนิลอีเทอร์ (สารลดแรงตึงผิวชนิดไม่มีประจุ) จากผลการทดลองพบว่าการเปลี่ยนแปลงตำแหน่งการป้อนสารละลายมีผลต่อความสามารถในการนำสารลดแรงตึงผิวกลับมาใช้และอัตราส่วนของสารลดแรงตึงผิวในโฟมเป็นอย่างมาก เมื่อเพิ่มตำแหน่งการป้อนกลับและอัตราส่วนการป้อนกลับส่งผลให้ความสามารถในการนำสารลกแรงตึงผิวกลับมาใช้ลดลง แต่ไม่มีผลต่ออัตราส่วนของสารลดแรงตึงผิวในโฟมมากนัก สำหรับระบบสารลดแรงตึงผิวแบบผสมพบว่า ความสามารถในการนำสารลดแรงตึงผิวชนิดประจุบวกกลับมาใช้ลดลงเมื่อเทียบกับระบบสารลดแรงตึงผิวชนิดประจุบวกแบบเดี่ยว ในทางตรงกันข้าม ในระบบสารลดแรงตึงผิวแบบผสมสามารถนำสารลดแรงตึงผิวชนิดไม่มีประจุกลับมาใช้ใหม่ได้ทั้งหมด

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