

**VOLATILE ORGANIC COMPOUND REMOVAL FROM NONIONIC
SURFACTANT COACERVATE PHASE SOLUTIONS BY
CO-CURRENT VACUUM STRIPPING**



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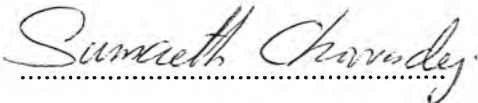
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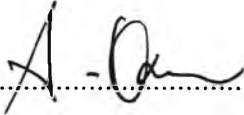
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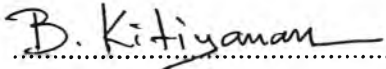
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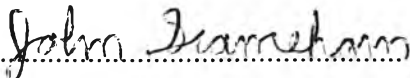
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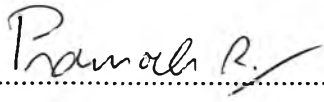

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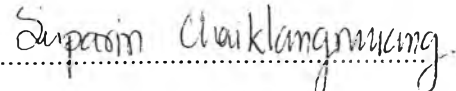

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ABSTRACT

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Suratsawadee Kungsanant: Volatile organic compound removal from nonionic surfactant coacervate phase solutions by co-current vacuum stripping

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Cloud point extraction

Cloud point extraction (CPE) has been demonstrated to remove volatile organic compounds (VOCs) from wastewater by using a nonionic surfactant as a separating agent. To make the CPE process economically feasible, the surfactant in the concentrated, or coacervate, phase must be recycled and reused. This work utilized a packed column operated under rough vacuum in co-current mode to remove the VOCs (benzene, toluene, ethylbenzene, 1,2 dichloroethane, trichloroethylene, and tetrachloroethylene) from the *t*-octylphenolpolyethoxylate (OP(EO)₇) coacervate solution. Despite the viscous nature of the coacervate solution, the co-current operation can effectively avoid plugging, excessive foaming, and flooding. The Henry's law constants of the VOCs are substantially reduced up to 90% due to the solubilization of VOCs in the surfactant micelles. For continuous operation, more than 87% for all VOCs is removed from a 450 mM OP(EO)₇ solution within a single stage operation. The VOC removal percentage decreases with increasing liquid loading rate, column pressure, surfactant concentration, and solute hydrophobicity, but it substantially increases with increasing number of distributor holes and temperature.

บทคัดย่อ

สุรัสวดี กังสนันท์ : การแยกสารระเหยอินทรีย์ออกจากสารละลายของสารลดแรงตึงผิวชนิดไม่มีขั้วที่อยู่ในวัฏภาคโคเอกเซอร์เวทโดยใช้หอสูญญากาศแบบการไหลทิศทางเดียวของไอและของเหลว (Volatile Organic Compound Removal from Nonionic Surfactant Coacervate Phase Solutions by Co-current Vacuum Stripping) อ. ที่ปรึกษา: ศ. ดร. สมชาย โอสุวรรณ ศ. ดร. จอห์น เอฟ. สแกมเมอร์ตัน ผศ. ดร. บุนยรัชต์ กิตยานันท์ และ รศ. ดร. วีรศักดิ์ ฤกษ์สมบูรณ์ 98 หน้า

งานวิจัยเรื่องการกระบวนการสกัดโดยใช้วัฏภาคโคเอกเซอร์เวทแสดงถึงความสามารถในการสกัดสารระเหยอินทรีย์ออกจากน้ำเสียโดยใช้สารลดแรงตึงผิวชนิดไม่มีขั้ว แต่เมื่อนำไปใช้จริง ราคาที่สูงของสารลดแรงตึงผิวทำให้กระบวนการนี้ไม่น่าสนใจในเชิงเศรษฐศาสตร์ดังนั้นควรมีการนำสารลดแรงตึงผิวที่อยู่ในวัฏภาคโคเอกเซอร์เวทกลับไปใช้ใหม่ งานวิจัยนี้ได้ทำการศึกษาการแยกสารระเหยอินทรีย์ ได้แก่ เบนซีน โทลูอิน เอทิลเบนซีน 1,2 ไดคลอโรอีเทน ไตรคลอโรเอทิลีน และเตตระคลอโรเอทิลีน ออกจากสารละลายที่มีสารลดแรงตึงผิวเตตระออกทิลฟีนอลโพลีโทกซีเลตที่ได้จากวัฏภาคโคเอกเซอร์เวท โดยใช้หอบรรจุภายใต้สูญญากาศที่มีการไหลทิศทางเดียวกันของไอและของเหลว พบว่าแม้สารละลายที่ทำการศึกษามีความหนืดสูง แต่การไหลแบบทางเดียวกันของไอและของเหลว ช่วยหลีกเลี่ยงการเกิดการอุดตัน การเกิดฟองที่มากเกินไป และการไหลล้นของของเหลวในหอสูญญากาศได้เป็นอย่างดี นอกจากนี้ยังพบว่าค่าคงที่เฮนรีของสารระเหยอินทรีย์ลดลงถึงร้อยละเก้าสิบ เนื่องจากการละลายของสารระเหยอินทรีย์ในไมเซลล์ของสารลดแรงตึงผิว สำหรับการศึกษากิจกรรมการแยกในหอสูญญากาศพบว่า มากกว่าร้อยละแปดสิบเจ็ดของสารระเหยอินทรีย์ทุกตัวสามารถแยกออกจากสารละลายลดแรงตึงผิวที่เข้มข้นสี่ร้อยห้าสิบลิลลิโมลาร์ได้ และร้อยละการแยกลดลงเมื่อเพิ่มอัตราการไหลของสารป้อน ความดันในระบบ ความเข้มข้นของสารลดแรงตึงผิว และความไม่ชอบน้ำของสารระเหยอินทรีย์ แต่ร้อยละการแยกจะเพิ่มขึ้นอย่างมาก เมื่อการกระจายตัวของสารละลายที่ทางเข้าและอุณหภูมิในระบบเพิ่มขึ้น

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