

**MICROEMULSION FORMATION OF SURFACTANT/OILY
WASTEWATER SYSTEM AND RELATION TO CLEAN-UP
BY FROTH FLOTATION**



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บทคัดย่อ

อมราวดี ญาณทัศนีย์จิต : การเกิดไมโครอิมัลชันของระบบที่ประกอบด้วยสารลดแรงตึงผิวกับน้ำเสียที่มีน้ำมันปนเปื้อน และความสัมพันธ์กับกระบวนการทำให้ลอย (Microemulsion Formation of Surfactant/Oily Wastewater System and Relation to Clean-up by Froth Flotation) อ. ที่ปรึกษา: รศ. ดร. สุเมธ ชวเดช ผศ. ดร. ปราโมช รั้งสรรคร์วิจิตร และ ศ. ดร. สเคมี มาฮอรัน 108 หน้า ISBN 974-9651-74-x

กระบวนการทำให้ลอย (Froth flotation) เป็นหนึ่งในกระบวนการแยกที่ใช้สารลดแรงตึงผิวเป็นองค์ประกอบสำคัญ โดยกระบวนการนี้สามารถประยุกต์ใช้กับการบำบัดน้ำเสียที่มีปริมาณสารปนเปื้อนต่ำในรูปน้ำมันและ/หรืออนุภาคแขวนลอย วิธีการนี้มีข้อดีหลายประการเช่น ต้องการพื้นที่ติดตั้งอุปกรณ์ไม่มาก ประสิทธิภาพการบำบัดสูง สามารถประยุกต์ใช้ได้กับสารมลพิษหลายชนิด และ ค่าใช้จ่ายในการบำบัดต่ำ โดยในงานวิจัยนี้ได้เลือกศึกษากระบวนการทำให้ลอยแบบกะเพื่อกำจัดน้ำมันที่ปนเปื้อนอยู่ในน้ำเสีย จากงานวิจัยที่ผ่านมาพบว่าประสิทธิภาพของกระบวนการนี้จะมีค่าสูงสุดเมื่อสารละลายเกิดเป็นไมโครอิมัลชันชนิดที่ 3 ดังนั้นในงานวิจัยนี้จึงได้นำหลักการของการเกิดไมโครอิมัลชันมาประยุกต์เข้ากับหลักการทำงานของกระบวนการทำให้ลอย เพื่อให้เกิดประสิทธิภาพการบำบัดที่สูงที่สุด ในการทำให้เกิดไมโครอิมัลชันนั้น สารลดแรงตึงผิวที่มีประจุลบ โซเดียม ได-1,3 ไดเมทิลทิลบิวทิล ซันโฟร์ซัคซิเนต (AMA) ถูกนำมาใช้เพื่อทำให้เกิดไมโครอิมัลชันของน้ำ กับเอทิลเบนซีน ในขณะที่สารลดแรงตึงผิว ชนิดที่มีประจุลบที่ส่วนหางประกอบไปด้วยคาร์บอน 14 – 15 จำนวน และมีกลุ่มโพรพิลีนออกไซด์ 4 กลุ่ม (Alfoterra 145 – 4PO) ถูกนำมาศึกษาการเกิดไมโครอิมัลชันของน้ำ กับดีเซล งานวิจัยชิ้นนี้ได้บ่งชี้ประสิทธิภาพของกระบวนการทำให้ลอยมีความเกี่ยวข้องกับค่าแรงตึงผิว ซึ่งเป็นคุณสมบัติที่สำคัญของระบบไมโครอิมัลชันชนิดที่ 3 นอกจากนั้นงานวิจัยนี้ยังได้พิจารณาถึงปัจจัยต่างๆ อาทิ ความเข้มข้นของสารลดแรงตึงผิว ความเข้มข้นของเกลือโซเดียมคลอไรด์ สัดส่วนของน้ำมัน ต่อ น้ำในน้ำเสีย อัตราการไหลของอากาศ และ สภาพะในการเกิดสมดุลของระบบ ที่มีผลต่อประสิทธิภาพการแยกน้ำมันโดยอธิบายในรูปของค่าแรงตึงผิวและลักษณะสมบัติของฟอง จากผลการทดลองพบว่า ระบบที่มีค่าแรงตึงผิวต่ำที่สุดไม่จำเป็นต้องเป็นระบบที่ให้ผลการแยกน้ำมันสูงสุดเสมอไป ดังนั้น ค่าแรงตึงผิว ความสามารถการเกิดฟอง และความเสถียรของฟอง ต่างมีบทบาทสำคัญต่อประสิทธิภาพการแยกน้ำมันของกระบวนการทำให้ลอย นอกจากนั้นแล้วยังพบว่าสัดส่วนของน้ำมันต่อน้ำในน้ำเสียไม่มีผลกระทบต่อประสิทธิภาพการแยกน้ำมัน สำหรับค่าอัตราการไหลของอากาศที่ใช้ในกระบวนการทำให้ลอยนี้ ควรมีค่าเหมาะสมที่ค่าหนึ่งเพื่อให้เกิด

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ABSTRACT

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Froth flotation is one of the surfactant based separation processes which is suitable for treating diluted wastewaters containing oil and/or colloidal particles. In this technique, there are several advantages such as low space requirement, high removal efficiency, flexibility for various pollutants at various scales, and low cost. In this work, batch mode of froth flotation was focused as technique to remove emulsified oil from wastewater. From the previous work, high oil removal was achieved in a Winsor type III microemulsion region. Therefore, microemulsion concept was combined with froth flotation technique to achieve high separation efficiency. Dihexyl sulfosuccinate (Aerosal MA or AMA) was used to prepare microemulsion solutions with ethylbenzene while branched alcohol propoxylate sulfate sodium salt with 14 – 15 carbon number and 4 propylene oxide groups (Alfoterra 145 – 4PO) was utilized to form microemulsion with diesel. Interfacial tension (IFT), which is one of the important characteristics in Winsor type III microemulsions, was investigated as a function of separation efficiency. In addition, performance of froth flotation as a function of foam characteristics was also elucidated. In froth flotation experiments, various parameters such as surfactant concentration, salinity, oil to water ratio, air flow rate, and equilibration condition were studied in order to correlate the oil removal efficiency with IFT value and foam characteristics. From the results, there are conditions of the diesel system where no separation occurs even though IFT value is in the ultra-low range (i.e. 10^{-2} mN/m) because the foam characteristics are extremely low. Therefore, both IFT and the

foam characteristics influence the efficiency of oil removal in the froth flotation process. Moreover, the oil removal is not significantly affected by oil to water ratio. In froth flotation operation, air flow rate should be optimized to achieve high removal efficiency. Ultimately, equilibrium condition always yields the highest separation efficiency in froth flotation operation.

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