REMOVAL OF EMULSIFIED OIL FROM WASTEWATER USING FROTH FLOTATION

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ABSTRACT

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Froth flotation is a surfactant-based separation process which is applicable for removing oil from water. Ortho-dichlorobenzene (ODCB) which is commonly used in many industrial applications was used as the oil for studying the removal efficiency by batch froth flotation. Mixtures of sodium dodecyl sulphate (SDS) and nonylphenol ethoxylate ($NP(EO)_{10}$ or Teric 10) were used for studies of microemulsion formation of ODCB. It was found that small amounts of NaCl added to mixed surfactants could improve microemulsion formation. However, precipitation and liquid crystal that limit the solubilization capacity of solution appeared at high NaCl concentration. The mixed surfactants concentrations of 3 and 5 % by weight of mixed surfactants were selected for froth flotation experiment. The prepared solutions i.e. water and middle phase (w-m), water and oil phase (w-o) and water, middle and oil phase (w-m-o) were transferred to a flotation column to determine oil removal efficiency. The results showed that ODCB removal in the w-m-o system was much higher than the w-o and w-m systems.The effect of NaCl in the w-m-o system was studied and showed that adding 0.5 by weight of NaCl increased ODCB removal but adding more than 1.0 by weight of NaCl decreased ODCB removal. The effect of volume of each phase was also studied. The results showed that when volume of oil phase decreased and

volume of water phase increased in the w-o system, ODCB removal decreased. When volume of middle phase increased and volume of water phase decreased in the w-m system, ODCB removal increased.

บทคัดย่อ

วิสาขา ภู่จินดา : การกำจัดอิมัลชิไฟต์ออยด์จากน้ำเสียโดยวิธีการทำให้ลอย (Removal of emulsified oil from wastewater using froth flotation) อ. ที่ปรึกษา : ศ. จอห์น เอฟ สเคม์มาฮอร์น และ รศ. สุเมธ ชวเดช

กระบวนการทำให้ลอย (froth flotation) เป็นกระบวนการแยกสารโดยใช้สารลดแรงตึงผิว ซึ่งสามารถนำไปประยุกต์ใช้ในการแยกน้ำมันออกจากน้ำเสีย ออร์โธ-ไดคลอโรเบนซินเป็นสารทั่วไปที่นำมาไปใช้ประโยชน์ในอุตสาหกรรมและได้นำมาใช้เป็นน้ำมันในการศึกษาประสิทธิภาพของกระบวนการทำให้ลอยแบบกะ สารลดแรงตึงผิวผสมระหว่างโซเดียม-โดเดกซิลซัลเฟต (SDS) กับโนนิลฟีนอลโพลีเอ็ดที่อกซีเลต ($NP(EO)_{10}$) ได้นำมาใช้ในการศึกษาการเกิดไมโครอิมัลชั่นของน้ำและออร์โธ-ไดคลอโรเบนซิน(ODCB) จากผลการทดลองพบว่าการเติมเกลือ(NaCl) ในสารลดแรงตึงผิวผสมในปริมาณน้อยจะช่วยเพิ่มการเกิดไมโครอิมัลชั่น แต่การเติมเกลือ(NaCl) ในปริมาณมากและการใช้สารลดแรงตึงผิวผสมที่มีความเข้มข้นสูงเกินไปจะทำให้เกิดการตกตะกอนและการเกิดผลึกของเหลว(liquid crystal)ของเกลือและสารลดแรงตึงผิว สารลดแรงตึงผิวเข้มข้น 3 และ 5 เปอร์เซ็นต์โดยน้ำหนักถูกนำมาใช้ในการศึกษาประสิทธิภาพของกระบวนการทำให้ลอยแบบกะ ในการทดลองนี้ได้เตรียมสารไมโครอิมัลชั่นระบบวินเซอร์ชนิดที่3 ซึ่งมี 3 ชั้น (น้ำ,สารละลายชั้นกลาง,น้ำมัน)ในปริมาณมากและนำมาแยกเป็น 3 ระบบคือระบบน้ำและสารละลายชั้นกลาง, ระบบน้ำและน้ำมัน และระบบน้ำ,สารละลายชั้นกลางและน้ำมัน เพื่อศึกษาความแตกต่างของทั้ง 3 ระบบที่มีต่อประสิทธิภาพของกระบวนการทำให้ลอย จากผลการทดลองพบว่าประสิทธิภาพของกระบวนการทำให้ลอยในระบบน้ำ,สารละลายชั้นกลางและน้ำมัน ดีกว่าระบบน้ำและน้ำมัน และระบบน้ำและสารละลายชั้นกลางตามลำดับ การเติมเกลือประมาณ 0.5 เปอร์เซ็นต์โดยน้ำหนักในระบบน้ำ,สารละลายชั้นกลางและน้ำมันจะช่วยเพิ่มประสิทธิภาพของกระบวนการทำให้ลอยแต่ถ้าปริมาณเกลือมากกว่า 1 เปอร์เซ็นต์โดยน้ำหนักจะไปลดประสิทธิภาพของกระบวนการทำให้ลอย ผลของความแตกต่างของปริมาณน้ำ,สารละลายชั้นกลาง,น้ำมันได้นำมาศึกษาประสิทธิภาพของกระบวนการทำให้ลอยในระบบน้ำและน้ำมันเพิ่มขึ้นเมื่อปริมาณของน้ำมันเพิ่มขึ้นและประสิทธิภาพของกระบวนการทำให้ลอยในระบบน้ำและสารละลายชั้นกลางเพิ่มขึ้นเมื่อปริมาณของสารละลายชั้นกลางเพิ่มขึ้น

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