

**MICROEMULSION FORMULATION FOR LOW TEMPERATURE
CLEANING USING NOVEL SURFACTANT SYSTEMS**

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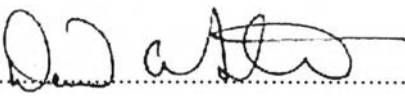
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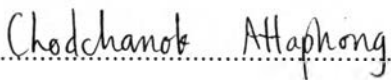

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ABSTRACT

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The eco-friendly surfactant detergency in future is motivated by environmental saving. The design of cold water detergency to perform well requires formulation of detergency not only making them effective but also highly solubilizing semi/solid fats in vegetable oil at low temperature. One of the most important mechanisms of cleaning is solubilization capacity of surfactant system. Therefore, this work intended to form vegetable oil based microemulsions for cleaning applications. The surfactant and oil interactions was investigated through the microemulsion phase scan, IFT measurement and solubilization capacity. The anionic $[C_{14-15}H_{29-31}-(PO)_8-SO_4Na]$ and nonionic $C_{12-14}H_{27-29}-(EO)_n-OH$ with three differences in EO groups ($n=3, 5, \text{ and } 9$) and their mixture were investigated. Palm olein and palm stearin were selected and represented as a liquid and a solid vegetable oil, respectively. The results indicated that middle phase microemulsion with palm olein was difficult to observe for all surfactant systems. The IFT results showed that at 4.6%w/v NaCl of single and mixed surfactant systems provided the lowest IFT value for each surfactant system. The result of solubilization capacity with palm stearin showed the highest solubilization capacity by mixed surfactant system $[C_{14-15}H_{29-31}-(PO)_8-SO_4Na/C_{12-14}H_{27-29}-(EO)_3-OH, 1:1 \text{ by molar ratio}]$ at 4.6%w/v NaCl, representing by the molar solubilization ratio (MSR) value of 0.399 and micelle partition coefficient (K_{mic}) of 6.30.

บทคัดย่อ

ปาริฉัตร เผ่าดี : การศึกษาวัฏภาคของไมโครอิมัลชันสำหรับการทำความสะอาดที่อุณหภูมิต่ำด้วยสารลดแรงตึงผิวชนิดใหม่ (Microemulsion Formulation for Low Temperature Cleaning using Novel Surfactant Systems) อ. ที่ปรึกษา : ดร. อัมพิรา เจริญแสง และ Prof. David A. Sabatini 72 หน้า

การศึกษาผงซักฟอกที่เป็นมิตรต่อสิ่งแวดล้อมในอนาคตได้รับความสนใจเนื่องจากต้องการลดการใช้พลังงานและอนุรักษ์สิ่งแวดล้อมการออกแบบผงซักฟอกที่มีประสิทธิภาพที่อุณหภูมิต่ำต้องการผงซักฟอกที่ไม่เพียงมีประสิทธิภาพสูงแต่ยังต้องมีความสามารถสูงในการละลายน้ำมันพืชที่สถานะของแข็งที่อุณหภูมิต่ำ หนึ่งในกลไกที่สำคัญในการทำความสะอาดคือความสามารถในการละลายของสารลดแรงตึงผิว ดังนั้นงานวิจัยนี้จึงได้ศึกษาความสามารถในการเกิดไมโครอิมัลชันของน้ำมันพืชสำหรับการทำความสะอาด แรงกระทำระหว่างสารลดแรงตึงผิวและน้ำมันถูกศึกษาโดยการเปลี่ยนแปลงวัฏภาคของการเกิดไมโครอิมัลชัน การวัดแรงตึงผิวระหว่างน้ำมันและสารลดแรงตึงผิว และความสามารถในการละลาย สารลดแรงตึงผิวประจุลบ $[C_{14-15}H_{29-31}-(PO)_8-SO_4Na]$ สารลดแรงตึงผิวไม่มีประจุ $[C_{12-14}H_{27-29}-(EO)_3-OH, C_{12-14}H_{27-29}-(EO)_5-OH$ และ $C_{12-14}H_{27-29}-(EO)_9-OH]$ และสารลดแรงตึงผิวผสมระหว่างประจุลบและไม่มีประจุถูกศึกษาเช่นกัน ปาล์มโอเลอินและปาล์มสเตียร์นถูกใช้เพื่อเป็นตัวแทนของน้ำมันที่มีสถานะของเหลว และของแข็งตามลำดับ ผลจากงานวิจัยพบว่าการเปลี่ยนแปลงวัฏภาคของไมโครอิมัลชันสังเกตได้ยาก พบว่าที่ความเข้มข้นเกลือที่ 4.6% โดยน้ำหนัก ให้ค่าแรงตึงผิวระหว่างสองวัฏภาคที่ต่ำที่สุดทั้งในสารลดแรงตึงผิวระบบเดี่ยว $[C_{14-15}H_{29-31}-(PO)_8-SO_4Na]$ และผสม $[C_{14-15}H_{29-31}-(PO)_8-SO_4Na/C_{12-14}H_{27-29}-(EO)_3-OH]$ และจากการศึกษาความสามารถในการละลายปาล์มสเตียร์นด้วยสารลดแรงตึงผิวระบบผสม $[C_{14-15}H_{29-31}-(PO)_8-SO_4Na/C_{12-14}H_{27-29}-(EO)_3-OH]$ ที่ 4.6% โดยน้ำหนักเกลือ, 1:1 สัดส่วนโดยโมล ให้สัดส่วนในการละลายของสารอินทรีย์ในไมเซลต่อสัดส่วนโมล (MSR) ที่มากที่สุด คือ 0.399 เนื่องจากค่า X_{mic} (0.29) และ ค่าคงที่ของการละลายของสารอินทรีย์จากไมเซล (K_{mic}) เท่ากับ 6.30

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Abbreviations

PO	Polypropylene oxide
EO	Polyethylene oxide
SS	Sorbitan stearate
SO	Sorbitan oleate
CMC	Critical micelle concentration
IFT	Interfacial tension
HLB	Hydrophilic-Lipophilic balance
MSR	Molar solubilization ratio
X_a	Mole fraction of organic in micelle-free aqueous phase
X_{mic}	Mole fraction of organic in micelle pseudophase
K_{mic}	Micelle-water partition coefficient

List of Symbols

β	Interaction parameter
A_s	Effective area per molecule
X	Mole fraction of component in mixed surfactant solution
α	Mole fraction of surfactant in total concentration
S^*	Optimum salinity
γ	Surfactant tension