

**MICROEMULSION FORMATION OF MOTOR OIL WITH MIXED  
SURFACTANTS AT LOW SALINITY FOR DETERGENCY**

Ms. Parichat Korphol

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**By:** Ms. Parichat Korphol  
**Program:** Petrochemical Technology  
**Thesis Advisors:** Assoc. Prof. Sumaeth Chavadej  
Asst. Prof. Boonyarach Kitiyanan  
Prof. John F. Scamehorn

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*K. Bunyakit.*

..... College Director  
(Assoc. Prof. Kunchana Bunyakit)

**Thesis Committee:**

*Sumaeth Chavadej*

.....  
(Assoc. Prof. Sumaeth Chavadej)

*B. Kitiyanan*

.....  
(Asst. Prof. Boonyarach Kitiyanan)

*John Scamehorn*

.....  
(Prof. John F. Scamehorn)

*Pomtong Malakul*

.....  
(Asst. Prof. Pomtong Malakul)

*Chantra Tongcumpou*

.....  
(Dr. Chantra Tongcumpou)

## ABSTRACT

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The ultimate objective of this work was to form microemulsion with motor oil at low salinity for detergency application. To produce the desired phase behavior, three surfactants of alkyl diphenyl oxide disulfonate (ADPODS, Dowfax 8390), bis (2-ethylhexyl) sulfosuccinic acid sodium salt (AOT) and sorbitan monooleate (Span 80) were used to obtain a proper balance between hydrophobicity and hydrophilicity in order to form microemulsion with motor oil. The mixed surfactant system of 1.5 wt% Dowfax 8390, 5 wt% AOT and 5wt% Span 80 was found to exhibit a Winsor Type III microemulsion (middle phase) at a very low salinity of 2.83%. Under this selected formulation, detergency performance increased with increasing active surfactant concentration and the maximum oily soil removal was at around 0.1 % active surfactant concentration on all three types of fabrics (pure cotton, polyester/cotton (65/35) blend and pure polyester). Moreover, for any given active surfactant concentration, % detergency and % oil removal on pure cotton were as slightly higher than those on the other two types of fabrics and the lowest %detergency was found on the pure polyester. In addition, the amount of rinsing water was found to affect the oil removal in each rinsing step but not affect the overall oil removal. Therefore, the low rinsing water (333.33 ml) should be used in rinsing step. In addition, the detergency performance was optimized with twice rinse steps.

## บทคัดย่อ

ปาริฉัตร ก่อผล: การเกิดไมโครอิมัลชันระหว่างสารลดแรงตึงผิวและน้ำมันเครื่องด้วยปริมาณเกลือต่ำเพื่อใช้การทำความสะอาด (Microemulsion Formation of Motor Oil with Mixed Surfactants at Low Salinity for Detergency) อ.ที่ปรึกษา: รศ.ดร. สุเมธ ชวเดช ผศ.ดร. บุญยรัชต์ กิตติยานันท์ และศ.ดร. จอห์น เอฟ สกามีฮอร์น 94 หน้า ISBN 974-9651-33-2

วัตถุประสงค์ของงานวิจัยเล่มนี้ คือ การสร้างระบบไมโครอิมัลชันกับน้ำมันเครื่องในปริมาณเกลือต่ำเพื่อประยุกต์ใช้ในการทำความสะอาด ในการสร้างระบบเฟสที่เหมาะสม สารลดแรงตึงผิว 3 ชนิดถูกเลือกมาใช้ในการเกิดไมโครอิมัลชันกับน้ำมันเครื่อง ได้แก่ ดาวแฟกซ์ 8390, เอโอที และ ซอร์บิแทน โมโนโอลิเอต หรือ สเปน 80 ซึ่งสามารถสร้างความสมดุลที่เหมาะสมของค่าความสมดุลย์ความชอบน้ำและความชอบน้ำมัน ระบบของสารลดแรงตึงผิวที่สามารถเกิดวินเซอร์แบบที่ III ในปริมาณเกลือ 2.83 เปอร์เซ็นต์ คือ 1.5 เปอร์เซ็นต์ของสารลดแรงตึงผิวดาวแฟกซ์ 5 เปอร์เซ็นต์ของสารลดแรงตึงผิวเอโอที และ 5 เปอร์เซ็นต์ของสารลดแรงตึงผิวสเปน 80

ในระบบสารลดแรงตึงผิวผสมนี้ ประสิทธิภาพของการทำความสะอาดเพิ่มขึ้นเมื่อปริมาณความเข้มข้นของสารลดแรงตึงผิวเพิ่มขึ้น และพบว่าที่ 0.1 เปอร์เซ็นต์ของความเข้มข้นสารลดแรงตึงผิวให้ประสิทธิภาพสูงสุดในการทำความสะอาดบนวัสดุ 3 ชนิด คือ ผ้าฝ้าย, ผ้าโพลีเอสเตอร์ และ ผ้าผสมโพลีเอสเตอร์/ฝ้าย นอกจากนี้ยังพบว่า การทำความสะอาดบนผ้าฝ้ายให้ประสิทธิภาพสูงกว่าผ้าอีก 2 ชนิด และการทำความสะอาดบนผ้าโพลีเอสเตอร์ให้ประสิทธิภาพต่ำที่สุด จากกระบวนการทำความสะอาดพบว่า ปริมาณน้ำในการชะล้างทำความสะอาดมีผลต่อประสิทธิภาพในการทำความสะอาดในแต่ละขั้นตอนการชะล้าง แต่ไม่มีผลต่อประสิทธิภาพโดยรวมของการทำความสะอาด ดังนั้น สามารถใช้น้ำปริมาณต่ำในขั้นตอนการชะล้างได้ นอกจากนี้ ยังพบว่า ประสิทธิภาพของการทำความสะอาดให้ผลดีโดยใช้น้ำในการชะล้างเพียง 2 ครั้ง

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## ABBREVIATIONS

ADPODS	Alkyl diphenyl oxide disulfonate
AOT	Aerosol-OT or dioctyl sodium sulfosuccinate
EACN	Equivalent alkane carbon number
HLB	Hydrophilic-lipophilic balance
IFT	Interfacial tension (mN/m)
IFT <sub>m/o</sub>	Interfacial tension between middle phase and excess oil phase (mN/m)
IFT <sub>m/w</sub>	Interfacial tension between middle phase and excess water phase (mN/m)
IFT <sub>o/w</sub>	Interfacial tension between oil and water (mN/m)
O/W	Oil-in-water microemulsion
W/O	Water-in-oil microemulsion
PIT	Phase inversion temperature
S*	Optimum salinity (wt%)
SP*	Optimum solubilization parameter (ml/g)
SP	Solubilization parameter (ml/g)
SP <sub>o</sub>	Solubilization parameter of oil (ml/g)
SP <sub>w</sub>	Solubilization parameter of water (ml/g)

**LIST OF SYMBOLS**

$\theta$	Contact angle (degree)
$\rho$	Density (g/ml)
$d$	Diameter (mm)
$\gamma_{O/M}$	Interfacial tension between excess oil phase and middle phase (mN/m)
$\gamma_{W/M}$	Interfacial tension between excess water phase and middle phase (mN/m)
$\gamma_{OB}$	Interfacial tension at the liquid soil-bath interface (mN/m)
$\gamma_{OS}$	Interfacial tension at the liquid soil-substrate interface (mN/m)
$\gamma_{SB}$	Interfacial tension at the substrate-bath interface (mN/m)