

**OILY SOIL DETERGENCY UNDER MICROEMULSION CONDITIONS:
EFFECTS OF OIL LOADING AND SURFACTANT ADSORPTION**



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ABSTRACT

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Detergency process of oily soil removal from fabrics is of interest and the mechanisms of oily soil removal are very complicated involving several factors: interfacial tension, oil loading and surfactant adsorption. In this study, the effects of oil loading and the surfactant adsorption on the detergency performance of oily soil removal were investigated. Mixed surfactant systems of branched alcohol propoxylate sulfate sodium salt (Alfoterra 145-3PO), an extended anionic surfactant, and secondary alcohol ethoxylate (Tergitol 15-S-5), a nonionic surfactant, were used to form microemulsions with motor oil. The CMC and $C_{\mu}C$ values of the mixed surfactants were 0.015 and 0.04 % total active mixed surfactants concentration, respectively. A polyester/cotton blend [65/35] was selected to use as a testing fabric in detergency experiments. The results showed that the oil loading and fabric weight did not affect the efficiency of oil removal. Furthermore, with the selected formulation (0.1 wt.% Alfoterra 145-3PO and 5 wt.% Tergitol 15-S-5), the oil detachment time was investigated at different temperatures (30-50°C) and different total surfactant concentrations (0.04-0.5 %). The results showed that surfactant concentration was found to decrease the oil detachment time, leading to increasing oil removal. But the temperature did not affect to the oil detachment time.

บทคัดย่อ

นางสาวรัชฎาพร แก้วพุกผา : การกำจัดคราบน้ำมันเครื่องภายใต้สภาวะไมโครอิมัลชันเพื่อใช้ในการทำความสะอาด โดยศึกษาผลกระทบของปริมาณน้ำมัน และการดูดซับของสารลดแรงตึงผิว (Oily Soil Detergency under Microemulsion Conditions: Effects of Oil Loading and Surfactant Adsorption) อ. ที่ปรึกษา: รศ.ดร. สุเมธ ชวเดช ศ.ดร. จอห์น เอฟ สแกมมัสตัน และ ดร. วีระภัทร์ ตันตยาคม 51 หน้า

กระบวนการซักทำความสะอาดเพื่อกำจัดคราบน้ำมันออกจากเสื้อผ้าเป็นกระบวนการที่มีความน่าสนใจประกอบกับกลไกในการกำจัดคราบน้ำมันนั้นมีความซับซ้อนโดยมีปัจจัยโดยทั่วไป ได้แก่ ความเข้มข้นของสารลดแรงตึงผิว , ปริมาณน้ำมันและการดูดซับของสารลดแรงตึงผิว ในงานวิจัยนี้ผลกระทบของปริมาณน้ำมันและการดูดซับของสารลดแรงตึงผิวถูกนำมาศึกษา ในการซักทำความสะอาดกำจัดคราบน้ำมันเครื่อง ระบบของสารลดแรงตึงผิวแบบผสม ได้แก่ สารลดแรงตึงผิว 0.1 เปอร์เซ็นต์ของสารลดแรงตึงผิวอัลโฟเทอร์รา 145-3PO โพลีเอทิลีน ออกไซด์ และ 5 เปอร์เซ็นต์ เทอิจทอล 15 เอส 5 ถูกใช้ในการเกิดไมโครอิมัลชันกับน้ำมันเครื่อง ผ่าผสม โพลีเอสเทอร์ / ฝ้าย [65/35] ถูกนำมาทดสอบในการทดลองการซักล้าง ผลการทดลองพบว่าปริมาณน้ำมันเครื่องและน้ำหนักของผ้ามีผลต่อประสิทธิภาพการกำจัดคราบน้ำมันเครื่อง มากไปกว่านี้สารลดแรงตึงผิว 0.1 เปอร์เซ็นต์ของสารลดแรงตึงผิวอัลโฟเทอร์รา 145-3PO โพลีเอทิลีน ออกไซด์ และ 5 เปอร์เซ็นต์ เทอิจทอล 15 เอส 5, เวลาในการหลุดของหยดน้ำมันเครื่องถูกนำมาศึกษาที่อุณหภูมิต่างกัน (30-50°C) และที่ความเข้มข้นต่างกัน (0.04-0.5 %) ผลการทดลองแสดงให้เห็นว่าการเพิ่มความเข้มข้นของสารลดแรงตึงผิวช่วยให้เวลาที่ใช้ในการหลุดของน้ำมันเครื่องเกิดได้เร็วขึ้นและนำไปสู่การเพิ่มการขจัดคราบน้ำมันเครื่อง แต่อุณหภูมิไม่มีผลต่อเวลาที่ใช้ในการหลุดของหยดน้ำมันเครื่อง

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TABLE OF CONTENTS

	PAGE
Title Page	i
Abstract (in English)	iii
Abstract (in Thai)	iv
Acknowledgements	v
Table of Contents	vi
List of Tables	viii
List of Figures	ix
Abbreviations	xiii
List of Symbols	xiv
 CHAPTER	
I INTRODUCTION	1
 II LITERATURE REVIEW	 3
 III EXPERIMENTAL	 15
3.1 Chemicals:	15
3.2 Equipment:	15
3.3 Material	15
3.4 Experimental Procedures	16
3.4.1 Phase study	16
3.4.2 Detergency measurement	16
3.4.2.1 Fabric preparation and soiling procedure	16
3.4.2.2 The laundry procedure	17
3.4.2.3 Detergency measurement	17
3.4.2.4 Oil removal measurement	18
3.4.2.5 Interfacial tension measurement	18

CHAPTER	PAGE
3.4.2.6 Adsorption Isotherm measurement	19
3.4.2.7 Contact angle measurement	19
3.4.2.8 Oil Detachment	19
IV RESULTS AND DISCUSSION	
4.1 Microemulsion Phase Formation	
4.1.1 Fish diagram of motor oil with the selected formulation	20
4.1.2 Effect of oil-to-surfactant ratio on IFT	22
4.2. Detergency Performances	
4.2.1 Effect of oil loading on the detergency Performance	23
4.2.2 Effect of fabric weight on the detergency Performance	24
4.2.3 Correlation between mixed surfactant adsorption and % oil removal	26
4.2.4 Oil detachment at different concentrations	30
4.2.5 Oil detachment at different temperature	37
V CONCLUSIONS AND RECOMMENDATIONS	42
REFERENCES	43
APPENDICES	46
Appendix A Experimental Data of Microemulsion Formulation	46
Appendix B Experimental data of detergency experiment	49
CURRICULUM VITAE	51

LIST OF TABLES

TABLE		PAGE
A-1	Equilibrium interfacial tension as a function of Surfactant ratio : oil loading ratio with formulation of 0.1 wt% Alfoterra 145-3PO, 5%wt Tergitol 15-S-5, and 5%wt NaCl.	47
A-2	Dynamic interfacial tension as a function of %active surfactant concentration with formulation of 0.1 wt% Alfoterra 145-3PO, 5%wt Tergitol 15-S-5, and 5%wt NaCl.	48

LIST OF FIGURES

FIGURE	PAGE
2.1 Type of microemulsion phase behavior showing the transition from oil in water (Type I) to bicontinuous structure (Type III) and water in oil structure (Type II)	3
2.2 Phase behavior showing the relationship of temperature of the system and the salinity	4
2.3 Phase behavior showing interfacial tension (IFT) as a function of the hydrophile-lipophile balance (HLB) and the salinity	5
2.4 Contact angle between an oil droplet and substrate in bath	9
2.5 Roll-up mechanism shows the complete removal of oil droplets from the substrate by hydraulic currents when $\theta > 90^\circ$	9
2.6 Emulsification mechanism shows partial removal of oil droplets from substrate $\theta < 90^\circ$	10
2.7 The solubilization mechanism of removal of oily soil from a solid surface	11
4.1 Dynamic IFT at 20 min as a function of total surfactant concentration at 30 °C using a mixed surfactant of 0.1 wt.% Alfoterra 145-3PO and 5 wt.% Tergitol 15-S-5	20
4.2 Fish phase diagram of selected formulation (of 0.1wt.% Alfoterra 145-3PO and 5wt.% Tergitol 15-S-5, and 5% salinity) at an oil-to-water volumetric ratio of 1 to 1 at 30 °C.	21

LIST OF FIGURES

FIGURE		PAGE
4.3	Phase Height Fraction and interfacial tension (mN/m) between washing solution (before washing process) and dyed oil as a function of oil-to-surfactant ratio by using a mixed surfactant of 0.1wt.% Alfoterra 145-3PO and 5wt.% Tergitol 15-S-5, and 5% salinity.	22
4.4	Percentage of oil removal and detergency for studied the effect of oil loading on detergency performance with difference oil loading by using fixed amount of total surfactant concentration at 0.3%.	23
4.5	Oil removals in each step on studied the effect of oil loading on detergency performance with difference oil loading by using fixed amount of total surfactant concentration at 0.3%.	24
4.6	Percentage of oil removal and detergency for studied the effect of fabric weight on detergency performance at the total surfactant concentration of 0.3%.	24
4.7	Oil removal in each step studied the effect of fabric weight on detergency performance at the total surfactant concentration of 0.3%.	25
4.8	The Critical Micelle Concentration (CMC) values were measure by Surface tensions measurement as a surfactant concentration of different surfactant system at 30°C.	26
4.9	Contact angles of mixed surfactant solution on soiled fabric surface and unsoiled fabric surface versus surfactant concentrations.	27

LIST OF FIGURES

FIGURE	PAGE
4.10 Adsorption isotherms for mixed surfactant solutions of 0.1 wt.% Alfoterra 145-3PO and 5 wt.% Tergitol 15-S-5 with 5% salinity. Correlation between adsorbs of mixed surfactant solution and % oil	27
4.11 removal by different % total active mixed surfactants. The amount of mixed surfactant in each step of washing process of soiled polyester/cotton blend fabric, which varied fabric weights by using a % total active mixed surfactant concentration of 0.3% total active surfactant concentration with 5% salinity.	28
4.12 Consecutive photos of the motor oil detachment from horizontal dry compressed fabric surface in 0.07 % active mixed surfactant solution at 30°C.	29
4.13 Consecutive photos of the motor oil detachment from horizontal dry compressed fabric surface in 0.1 % active mixed surfactant solution at 30°C.	30
4.14 Consecutive photos of the motor oil detachment from horizontal dry compressed fabric surface in 0.3 % active mixed surfactant solution at 30°C.	31
4.15 Consecutive photos of the motor oil detachment from horizontal dry compressed fabric surface in 0.5 % active mixed surfactant solution at 30°C.	32
4.16 % oil detachment as a function of % active of mixed surfactant concentration of the motor oil detachment from dry compressed fabric surface at 30°C.	33
4.17 % oil detachment as a function of % active of mixed surfactant concentration of the motor oil detachment from dry compressed fabric surface at 30°C.	34

LIST OF FIGURES

		PAGE
	Contact angle as a function oil detachment time at different	35
4.18	percentage total surfactant concentration of the motor oil detachment from dry compressed fabric surface at 30°C.	
	Correlation between oil detachment time, % oil removal, and % oil	36
4.19	detachment by difference % active of mixed surfactant of 0.1 wt.% Alfoterra 145-3PO and 5 wt.% Tergitol 15-S-5.	
	Consecutive photos of the motor oil detachment from horizontal dry	37
4.20	compressed fabric surface in 0.3 % active mixed surfactant solution at 30°C.	
	Consecutive photos of the motor oil detachment from	38
4.21	horizontal dry compressed fabric surface in 0.3 % active mixed surfactant solution at 40°C.	
	Consecutive photos of the motor oil detachment from	39
4.22	horizontal dry compressed fabric surface in 0.3 % active mixed surfactant solution at 50°C.	40
	% oil detachment as a function of different temperature of the	
4.23	motor oil detachment from dry compressed fabric surface at 30°C.	40
	Contact angle as a function oil detachment time at different	
4.24	temperature of the motor oil detachment from dry compressed fabric surface.	41
	Correlation between oil detachment time, % oil removal and	
4.25	oil detachment by different temperature of system of mixed surfactant of 0.1wt% Alfoterra 145-3PO and 5%wt Tergitol 15-S-5.	

ABBREVIATIONS

HLB	Hydrophilic-lypophilic balance
IFT	Interfacial tension (mN/m)
IFT _{m/o}	Interfacial tension between middle phase and excess oil phase (mN/m)
IFT _{m/o}	Interfacial tension between middle phase and excess water phase (mN/m)
IFT _{m/o}	Interfacial tension between oil and water phase (mN/m)

LIST OF SYMBOLS

θ	Contact angle (degree)
ρ	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)
γ_{OB}	Interfacial tension at the liquid soil-bath interface (mN/m)
γ_{OS}	Interfacial tension at the liquid soil-substrate interface (mN/m)
γ_{SB}	Interfacial tension at the substrate-bath interface (mN/m)