

**PHASE STUDIES OF MICROEMULSIONS WITH ALCOHOL  
ETHOXYLATE: EFFECTS OF TEMPERATURE AND SALINITY**



Parichat Tongkak

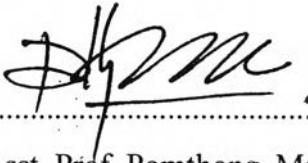
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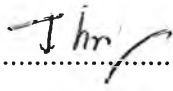
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**ABSTRACT**

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The phase behavior of microemulsions of motor oil with alcohol ethoxylates was studied. The addition of n-butanol as a cosurfactant was found to facilitate microemulsion formation. For the alcohol ethoxylate (EO3)-n-butanol-motor oil-water system, temperature had a significant effect on the microemulsion phase transformation and the lowest value of critical microemulsion concentration ( $C_{\mu C}$ ) was achieved at 40 °C, the solubilization capacity increased with increasing in temperature. For the mixed surfactants of methyl ester sulfonate (MES) and alcohol ethoxylate (EO3) at a weight fraction of MES = 0.02, an increase in NaCl concentration increased the  $C_{\mu C}$  and the solubilization capacity. From the solubilization parameter (SP) results, temperature and salinity facilitated the solubilization of oil and the formation of the middle (Winsor type III) microemulsion phase. In addition, the lowest IFT increased with increasing temperature. For salinity effect, the IFT reached ultra-low value at the salinity range from 3.9 to 4.7 %wt/vol. The CMC of the alcohol ethoxylate(EO3)/MES mixed surfactants was 0.01 %wt/vol which was close to those of both single alcohol ethoxylate(EO3) and single MES surfactant systems.

## บทคัดย่อ

ปาริฉัตร ทองกัก : การศึกษาวัฏภาคของไมโครอิมัลชันของแอลกอฮอล์ อีท็อกซีเลท: ผลของอุณหภูมิ และความเค็ม (Phase Studies of Microemulsions with Alcohol Ethoxylates: Effects of Temperature and Salinity) อ. ที่ปรึกษา : รศ. ดร. สุเมธ ชวเดช 62 หน้า

งานวิจัยนี้ได้ศึกษาพฤติกรรมของการเปลี่ยนแปลงวัฏภาคของการเกิดไมโครอิมัลชันของน้ำมันเครื่อง กับแอลกอฮอล์อีท็อกซีเลท โดยพบว่าการเติมนอมัล บิวทานอล ซึ่งทำหน้าที่เป็นสารลดแรงตึงผิวร่วม ช่วยในการเกิดไมโครอิมัลชันได้ดีขึ้น ในระบบที่ประกอบด้วยแอลกอฮอล์อีท็อกซีเลท ที่มีหมู่เอทิลีนออกไซด์ (EO) 3 หมู่ นอมัลบิวทานอล น้ำมันเครื่อง และน้ำ พบว่าอุณหภูมิมีผลต่อการเปลี่ยนแปลงวัฏภาคของไมโครอิมัลชัน และค่าต่ำสุดของการเกิดไมโครอิมัลชัน (C<sub>μC</sub>) เกิดขึ้นที่อุณหภูมิ 40 องศาเซลเซียส และค่าความสามารถในการละลายสูงขึ้นเมื่ออุณหภูมิเพิ่มขึ้น ในระบบสารลดแรงตึงผิวผสมของเมทริลเอสเทอร์ซัลโฟเนท (MES) และแอลกอฮอล์อีท็อกซีเลท ที่มีหมู่เอทิลีนออกไซด์ (EO) 3 หมู่ ที่สัดส่วนโดยน้ำหนักของ เมทริลเอสเทอร์ซัลโฟเนท (MES) คือ 0.02 พบว่าการเพิ่มความเข้มข้นของโซเดียมคลอไรด์ (NaCl) ทำให้ค่า C<sub>μC</sub> และค่าความสามารถในการละลายสูงขึ้น จากผลของพารามิเตอร์ของค่าความสามารถในการละลาย พบว่าอุณหภูมิและความเค็มช่วยในการละลายของน้ำมันให้เกิดวัฏภาคชั้นกลางของไมโครอิมัลชัน (วินเซอร์แบบที่ 3) นอกจากนี้พบว่าแรงตึงผิวต่ำสุดเพิ่มขึ้นเมื่ออุณหภูมิสูงขึ้น สำหรับผลของความเค็ม พบว่าแรงตึงผิวต่ำสุดอยู่ในช่วงความเค็ม 3.9 ถึง 4.7 %ของน้ำหนักต่อปริมาตร ค่า CMC ของระบบสารลดแรงตึงผิวผสมของเมทริลเอสเทอร์ซัลโฟเนท (MES) และแอลกอฮอล์อีท็อกซีเลท ที่มีหมู่เอทิลีนออกไซด์ (EO) 3 หมู่ คือ 0.01 %ของน้ำหนักต่อปริมาตร ซึ่งมีค่าเท่ากับค่า CMC ในระบบสารลดแรงตึงผิวของแอลกอฮอล์อีท็อกซีเลทที่มีหมู่เอทิลีนออกไซด์ (EO) 3 หมู่ และสารลดแรงตึงผิวของเมทริลเอสเทอร์ซัลโฟเนท (MES)

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## TABLE OF CONTENTS

	<b>PAGE</b>
Title Page	i
Abstract (in English)	iii
Abstract (in Thai)	iv
Acknowledgements	v
Table of Contents	vi
List of Tables	ix
List of Figures	xii
Abbreviations	xiv
List of Symbols	xv
 <b>CHAPTER</b>	
<b>I INTRODUCTION</b>	<b>1</b>
<b>II THEORETICAL BACKGROUND AND LITERATURE REVIEW</b>	<b>3</b>
2.1 Surfactants	3
2.2 Alcohol Ethoxylates (AEs)	6
2.3 Microemulsions	7
2.4 Fish Diagram	12
2.5 Oils	13
2.5.1 Motor Oil	13
2.5.2 Palm Oil	13
2.5.3 n-Octane	13
<b>III EXPERIMENTAL</b>	<b>20</b>
3.1 Materials	20
3.2 Methodology	20

<b>CHAPTER</b>	<b>PAGE</b>
3.2.1 Microemulsion Formation	20
3.2.2 Surface Tension Measurements	22
3.2.3 Interfacial Tension Measurements	22
<b>IV RESULTS AND DISCUSSION</b>	<b>23</b>
4.1 Microemulsion Phase Diagram	23
4.1.1 Effects of oils	23
4.1.2 Effects of EO Groups	24
4.1.3 Effects of Temperature	25
4.1.4 Effects of salinity	27
4.1.5 Comparison of phase diagram between single and mixed system	28
4.2 Solubilization Parameter (SP) Results	29
4.2.1 Effects of temperature	30
4.2.2 Effects of salinity	32
4.3 Equilibrium Interfacial Tension (IFT) Results	34
4.3.1 Effects of temperature	34
4.3.2 Effects of salinity	35
4.3.3 Comparison of IFT between single and mixed system	36
4.4 Critical micelle concentration (CMC)	37
<b>V CONCLUSIONS AND RECOMMENDATIONS</b>	<b>40</b>
5.1 Conclusions	40
5.2 Recommendations	41
<b>REFERENCES</b>	<b>42</b>

<b>CHAPTER</b>	<b>PAGE</b>
<b>APPENDICES</b>	45
<b>Appendix A</b> Experimental Data of Solubilization Parameter (SP)	45
<b>Appendix B</b> Experimental Data of Equilibrium Interfacial Tension (IFT)	50
<b>Appendix C</b> Experimental Data of Critical micelle concentration (CMC)	58
<b>Appendix D</b> Experimental Data of Conductivity	60
<b>CURRICULUM VITAE</b>	62



## LIST OF TABLES

TABLE		PAGE
4.1	$C_{\mu}C$ value and AE3 and n-butanol concentrations at point E for the system of AE3/n-butanol/motor oil/water with $\alpha = 0.5$ at different temperatures	26
4.2	$C_{\mu}C$ value and AE3 and n-butanol concentrations at point E for the system of AE3/MES/n-butanol/motor oil/water with $\alpha = 0.5$ at 30 °C at different NaCl concentrations	28
4.3	$C_{\mu}C$ value and AE3 and n-butanol concentrations at point E for the AE3/(MES)/n-butanol/motor oil/water system with $\alpha = 0.5$ and $\delta = 0.02$ at 30 °C of single and mixed surfactant systems	29
A1	Solubilization parameter (SP) of AE3/n-butanol/motor oil/water system with $\alpha = 0.5$ at 20 °C	46
A2	Solubilization parameter (SP) of AE3/n-butanol/motor oil/water system with $\alpha = 0.5$ at 30 °C	46
A3	Solubilization parameter (SP) of AE3/n-butanol/motor oil/water system with $\alpha = 0.5$ at 40 °C	47
A4	Solubilization parameter (SP) of AE3/MES/n-butanol/motor oil/water system with 0%NaCl, $\alpha = 0.5$ at 30 °C	47
A5	Solubilization parameter (SP) of AE3/MES/n-butanol/motor oil/water system with 3%NaCl, $\alpha = 0.5$ at 30 °C	48
A6	Solubilization parameter (SP) of AE3/MES/n-butanol/motor oil/water system with 5%NaCl, $\alpha = 0.5$ at 30 °C	48
A7	Solubilization parameter (SP) of AE3/MES/n-butanol/motor oil/water system with 7%NaCl, $\alpha = 0.5$ at 30 °C	49

<b>TABLE</b>	<b>PAGE</b>
B1 Interfacial tension of each phase in microemulsion formation of AE3/12%n-butanol/motor oil/water system with $\alpha = 0.5$ at 30 °C	51
B2 Interfacial tension of each phase in microemulsion formation of AE3/12%n-butanol/motor oil/water system with $\alpha = 0.5$ at 40 °C	52
B3 Interfacial tension of each phase in microemulsion formation of AE3/MES/16%n-butanol/motor oil/ water without NaCl at $\alpha = 0.5$ , $\delta = 0.02$ , and 30 °C	53
B4 Interfacial tension of each phase in microemulsion formation of AE3/MES/16%n-butanol/motor oil/water with 3%NaCl at $\alpha = 0.5$ , $\delta = 0.02$ , and 30 °C	54
B5 Interfacial tension of each phase in microemulsion formation of AE3/MES/16%n-butanol/motor oil/water with 5%NaCl at $\alpha = 0.5$ , $\delta = 0.02$ , and 30 °C	55
B6 Interfacial tension of each phase in microemulsion formation of AE3/MES/16%n-butanol/motor oil/water with 7%NaCl at $\alpha = 0.5$ , $\delta = 0.02$ , and 30 °C	56
B7 Interfacial tension of each phase in microemulsion formation of AE3/16%n-butanol/motor oil/water with $\alpha = 0.5$ at 30 °C	57
C1 Critical micelle concentration (CMC) of mixed AE3/MES at $\delta = 0.02$ and 30 °C	58
C2 Critical micelle concentration (CMC) of single alcohol AE3 system at 30 °C	59
C3 Critical micelle concentration (CMC) of single MES system at 30 °C	59
D1 Conductivity of the mixed surfactant system (AE3/MES) in Winsor Type II	60

<b>TABLE</b>	<b>PAGE</b>
D2 Conductivity of the single surfactant system (AE3) in Winsor Type I and III	61

## LIST OF FIGURES

FIGURE		PAGE
2.1	The basic molecular structure of a surface-active material.	4
2.2	Schematic of a monomer, micelles, and micellization.	4
2.3	Schematic of normal micelle and inverse micelle.	5
2.4	Schematic of surfactant association structures.	5
2.5	Ethoxylation Reaction.	6
2.6	Illustration of the oriented-wedge theory of emulsion type.	8
2.7	Microemulsion phase behaviour for a model system.	9
2.8	Transition of the microemulsion structure and the interfacial tension as a function of salinity or temperature scan.	11
2.9	Schematic representation of normal fish phase diagram. Roman numerals refer to the Winsor Type microemulsion existing at that condition.	12
3.1	Schematic of experiment for microemulsion formation.	21
4.1	Phase behavior of AE3/n-butanol/motor oil/water with $\alpha$ (weight fraction of oil in oil and water mixture) = 0.5 at 20 (◆), 30 (■) and 40 °C (▲).	26
4.2	Phase behavior of the system of AE3/MES/n-butanol/NaCl/motor oil/water with $\alpha = 0.5$ and $\delta = 0.02$ at 30 °C and different NaCl concentrations.	27
4.3	Phase behaviors of the pure AE3 and mixed surfactant system (AE3/(MES)/n-butanol/motor oil/water) with $\alpha = 0.5$ and $\delta = 0.02$ at 30 °C for single surfactant system (◆) and mixed surfactant system(■).	29

<b>FIGURE</b>	<b>PAGE</b>
4.4 Solubilization parameters (SP) and phase height fraction as a function of AE3 concentration and temperature of the AE3/n-butanol/motor oil/water system with $\alpha = 0.5$ : (a-1) 20 °C, (a-2) 30 °C and (a-3) 40 °C.	31
4.5 Solubilization parameters (SP) and phase height fraction as a function of AE3 concentration and salinity of the AE3/MES/n-butanol/motor oil/water system with $\alpha = 0.5$ , and $\delta = 0.02$ at 30 °C : (b-1) 0%NaCl, (b-2) 3%NaCl, (b-3) 5%NaCl and (b-4) 7%NaCl.	33
4.6 The interfacial tension between the oil and aqueous phase as a function of AE3 concentration of the AE3/n-butanol/motor oil/water system with $\alpha = 0.5$ at 30 (◆), and 40 °C (■).	35
4.7 The interfacial tension between the oil and aqueous phase as a function of AE3 concentration of the AE3/MES/n-butanol/motor oil/water system with $\alpha = 0.5$ , $\delta = 0.02$ at 30 °C for 0%NaCl (◆), 3%NaCl (■), 5%NaCl (▲) and 7%NaCl (●).	36
4.8 IFT as a function of total surfactant concentration of both system at $\alpha = 0.5$ , $\delta = 0.02$ and 30 °C for single surfactant system (AE3/n-butanol/motor oil/water) (◆), and mixed surfactant system (AE3/MES/n-butanol/motor oil/water) (■).	37
4.9 Surface tension isotherm of the mixed AE3/MES system at $\delta = 0.02$ and 30 °C.	38
4.10 Surface tension isotherm of the single AE3 system at 30 °C.	38
4.11 Surface tension isotherm of the single MES system at 30 °C.	39

### Abbreviations

AEs	Alcohol ethoxylate
MES	Methyl ester sulfonate
EO	Ethylene oxide
CMC	Critical micelle concentration
$C_{\mu}C$	Critical microemulsion concentration
IFT	Interfacial tension
SP	Solubilization Parameter
SP <sub>w</sub>	Volume of water solubilized per weight of total surfactants in the microemulsion phase
SP <sub>o</sub>	Volume of oil solubilized per weight of total surfactants in the microemulsion phase
V <sub>w</sub>	Phase height fraction of water
V <sub>o</sub>	Phase height fraction of oil

### List of Symbols

$\alpha$	Weight fraction of oil in oil and water mixture
$\delta$	Weight fraction of MES in alcohol ethoxylate(EO3) and MES
$\gamma_{mw}$	Interfacial tension of microemulsion-water interface
$\gamma_{mo}$	Interfacial tension of microemulsion-oil interface