

**MICROEMULSION FORMATION OF MOTOR OIL
WITH ALCOHOL ETHOXYLATES: EFFECTS OF TEMPERATURE
AND COSURFACTANT CHAIN LENGTH**



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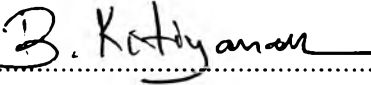
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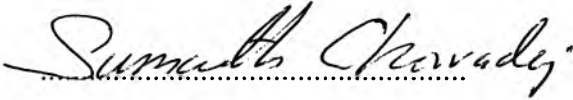
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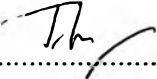
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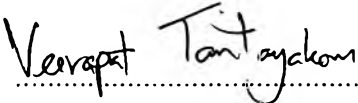

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ABSTRACT

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Cloud point/Nonionic surfactant/Alcohol/Solubilization parameters

The aim of this research was to investigate the microemulsion formation of motor oil with alcohol ethoxylates (AEs), nonionic surfactants derived from palm oil. The AEs with different numbers of the ethylene oxide group (EO) (3, 5, 7, and 9) were used for forming microemulsions at various temperatures (20 °C, 30 °C, 40 °C, and 50 °C). The addition of medium-chain alcohols (*n*-butanol, *n*-hexanol, and *n*-octanol) as cosurfactants was crucial to the formation of these microemulsion systems. Among the studied alcohols, *n*-hexanol was the most effective cosurfactant in terms of middle microemulsion phase formation (Winsor Type III microemulsion). For the same number of EO, as the temperature increased, not only the critical microemulsion concentration ($C_{\mu C}$) was decreased, but the amount of AEs that is required in order to form Winsor Type IV microemulsion was also reduced.

บทคัดย่อ

ชฎากาญจน์ สิทธิอาจหาญ: การเกิดไมโครอิมัลชันของน้ำมันเครื่องด้วยแอลกอฮอล์ อีทีออกซีเลท: ผลของอุณหภูมิและความยาวสายโซ่ของสารลดแรงตึงผิวร่วม (Microemulsion Formation of Motor Oil with Alcohol Ethoxylates: Effects of Temperature and Cosurfactant Chain Length) อาจารย์ที่ปรึกษา: ผศ. ดร. บุญยรัชต์ กิตติยานันท์ และ รศ. ดร. สุเมธ ชวเวช 107 หน้า

งานวิจัยนี้ได้มุ่งศึกษาพฤติกรรมการเปลี่ยนแปลงวัฏภาคของการเกิดไมโครอิมัลชันของน้ำมันเครื่องกับแอลกอฮอล์ อีทีออกซีเลท ที่มีหมู่อีโอ (EO Group) จำนวนแตกต่างกันตั้งแต่ 3, 5, 7 และ 9 หมู่ โดยเติมแอลกอฮอล์ซึ่งทำหน้าที่เป็นสารลดแรงตึงผิวร่วมที่มีความยาวสายโซ่แตกต่างกัน ได้แก่ นอมีล บิวทานอล (*n*-butanol) นอมีล เฮกซานอล (*n*-hexanol) และนอมีล ออกทานอล (*n*-octanol) ในช่วงอุณหภูมิ 20, 30, 40 และ 50 องศาเซลเซียส โดยการสังเกตการณ์เปลี่ยนแปลงวัฏภาคของแต่ละระบบหลังเข้าสู่สมดุล แล้วนำมาสร้างพีชโคอะแกรมเพื่อหาค่าความเข้มข้นของสารลดแรงตึงผิวและสารลดแรงตึงผิวร่วมต่ำสุดที่ทำให้เกิดวัฏภาคชั้นกลางของไมโครอิมัลชัน (วินเซอร์แบบที่ 3) ค่าความเข้มข้นของสารลดแรงตึงผิวและสารลดแรงตึงผิวร่วมต่ำสุดที่ทำให้เกิดวัฏภาคเนื้อเดียวของไมโครอิมัลชัน (วินเซอร์แบบที่ 4) นอกจากนี้ยังหาค่าความสามารถในการละลาย และอุณหภูมิที่ทำให้เกิดความขุ่นของสารละลายลดแรงตึงผิวในแต่ละระบบอีกด้วยจากการศึกษา พบว่า การใช้แอลกอฮอล์ทั้งสามชนิดเป็นสารลดแรงตึงผิวร่วม โดยเฉพาะการเติมนอมีล เฮกซานอล สามารถช่วยให้เกิดวัฏภาคชั้นกลางของไมโครอิมัลชันได้เป็นอย่างดี สำหรับการศึกษาค่าผลของอุณหภูมิต่อการเกิดไมโครอิมัลชัน พบว่า เมื่ออุณหภูมิเพิ่มขึ้นส่งผลให้ค่าความเข้มข้นของสารลดแรงตึงผิวและสารลดแรงตึงผิวร่วมต่ำสุดที่ทำให้เกิดวัฏภาคชั้นกลางของไมโครอิมัลชัน และความเข้มข้นของสารลดแรงตึงผิวที่ทำให้เกิดวัฏภาคเนื้อเดียวของไมโครอิมัลชันมีค่าลดลง

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Abbreviations

AEs	Alcohol ethoxylates
AE3	Alcohol ethoxylate with 3 Ethylene oxide groups
AE5	Alcohol ethoxylate with 5 Ethylene oxide groups
AE7	Alcohol ethoxylate with 7 Ethylene oxide groups
AE9	Alcohol ethoxylate with 9 Ethylene oxide groups
CMC	Critical micelle concentration
$C_{\mu}C$	Critical microemulsion concentration
EO	Ethylene oxide
O/W	Oil – in – water microemulsion
SP	Solubilization Parameters
SPw	Volume of water solubilized per weight of total surfactants in the microemulsion phase
SPo	Volume of oil solubilized per weight of total surfactants in the microemulsion phase
Vw	Phase height fraction of water
Vo	Phase height fraction of oil
W/O	Water – in – oil microemulsion

List of Symbols

α Weight fraction of oil in oil and water mixture