

**FOAMING PROPERTIES OF ALCOHOL ETHOXYLATES DERIVED
FROM NATURAL PRODUCTS**




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A Thesis Submitted in Partial Fulfilment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
in Academic Partnership with
The University of Michigan, The University of Oklahoma,
Case Western Reserve University and Institut Français du Pétrole
2009

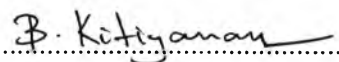
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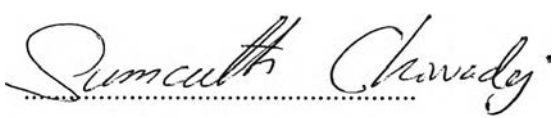
Thesis Title: Foaming Properties of Alcohol Ethoxylates Derived from Natural Products
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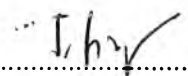
Accepted by the Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfilment of the requirements for the Degree of Master of Science.

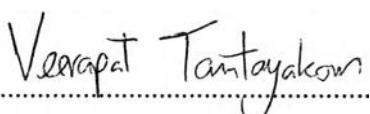

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ABSTRACT

5071029063: Petrochemical Technology Program
Supoj Jirawatanaporn: Foaming Properties of Alcohol Ethoxylates
Derived from Natural Products
Thesis Advisor: Asst. Prof. Boonyarach Kitiyanan,
Assoc. Prof. Sumaeth Chavadej
121 pp.
Keywords: Alcohol ethoxylates / Critical micelle concentration / Cloud point /
Contact angle / Gel range / Foamability / Foam stability

Alcohol ethoxylates (AEs) produced from natural products (palm oil and coconut oil) have been increasingly considered to replace NPEs (nonylphenol ethoxylates). In this work, the properties of fatty alcohol ethoxylates— $C_{12-14}EO_3$, $C_{12-14}EO_5$, $C_{12-14}EO_7$, and $C_{12-14}EO_9$ —were studied and the results are compared to those from nonylphenol ethoxylates—NPE-6 and NPE-9. The CMC, cloud point, contact angle, and gel range were studied. The foam characteristics were determined in terms of foamability and foam stability by using the simple shaking test, the Ross–Miles foam test, and pneumatic foam test. The results showed that the CMC slightly increased when the number of the ethylene oxide (EO) group increased. An increase in EO number resulted in an increase in cloud point temperature. The contact angle of 1 wt% surfactant aqueous solution on the nonpolar parafilm surface was found to increase from 38 to 53° with increasing the number of the EO group. In gel range experiment, the phase of these ethoxylates were observed at increasing concentration of surfactant solution which occurred the phase in order following; L_1 (micellar solution) → H (hexagonal phase) → L_2 Lamellar phase. Concentration of surfactant solution and the effect of the number of the EO group affected to the performance of foam of all studied methods. However, the high EO unit around 7 to 9 EO of fatty alcohol ethoxylates showed good foam performance when compared with nonylphenol ethoxylates.

บทคัดย่อ

สุพจน์ จิรวัฒนาภรณ์ : คุณสมบัติในการเกิดฟองของสารลดแรงตึงผิวชนิดแอลกอฮอล์ออลีทอกซิลเลทที่ผลิตจากผลิตภัณฑ์ธรรมชาติ (Foaming Properties of Alcohol Ethoxylates Derived from Natural Products) อ. ที่ปรึกษา : ผศ. ดร. บุญยรัชต์ กิตยานันท์ และ รศ. ดร. สุเมธ ชวเดช 121 หน้า

สารลดแรงตึงผิวชนิดแอลกอฮอล์ออลีทอกซิลเลทที่ผลิตจากผลิตภัณฑ์ธรรมชาติ โดยกระบวนการแปรรูปจากน้ำมันธรรมชาติ เช่น น้ำมันปาล์มและน้ำมันมะพร้าว ผลิตเป็นสารลดแรงตึงผิวในกลุ่มออลีทอกซิลเลทที่มีชื่อว่า “เฟตตีแอลกอฮอล์ออลีทอกซิลเลท” ซึ่งสามารถย่อยสลายได้ง่ายในธรรมชาติ การประยุกต์ใช้เฟตตีแอลกอฮอล์ออลีทอกซิลเลทมีแนวโน้มมาแทนที่สารลดแรงตึงอัลคิลฟีนอลออลีทอกซิลเลท เนื่องจากสารฟีนอลถูกปลดปล่อยออกมาสู่สิ่งแวดล้อมระหว่างกระบวนการสลายตัวในธรรมชาติซึ่งสามารถทำลายระบบต่อมไร้ท่อของสัตว์ อย่างไรก็ตามการนำเฟตตีแอลกอฮอล์ออลีทอกซิลเลทมาใช้แทนที่สารลดแรงตึงผิวในปัจจุบัน ยังไม่สามารถทำได้ เนื่องจากยังขาดความรู้พื้นฐานทางกายภาพและเคมี ซึ่งสามารถที่จะนำความรู้ดังกล่าวไปประยุกต์ใช้ในการกำหนดส่วนผสมที่เหมาะสมกับการใช้งานในด้านต่างๆต่อไป งานวิจัยนี้มุ่งศึกษาเฟตตีแอลกอฮอล์ออลีทอกซิลเลท ได้แก่ $C_{12-14}EO_3$, $C_{12-14}EO_5$, $C_{12-14}EO_7$ และ $C_{12-14}EO_9$ โดยการทดสอบคุณสมบัติอันประกอบด้วย Critical micelle concentration (CMC) อุณหภูมิของจุดขุ่น มุมของการเปียกบนพื้นผิว การเกิดเจล และการเกิดฟอง โดยศึกษาคุณสมบัติในการเกิดฟองสามวิธี ได้แก่ การเขย่า Ross–Miles foam และ การเป่าอากาศ เปรียบเทียบกับสารลดแรงตึงผิวชนิดโชนิลฟีนอลออลีทอกซิลเลท ได้แก่ NPE-6 และ NPE-9 จากผลการทดสอบพบว่า CMC มีค่ามากขึ้นเล็กน้อยเมื่อจำนวนหมู่เอทิลีนออกไซด์เพิ่มขึ้น โดยมีค่าอยู่ในช่วง 0.007 ถึง 0.014 ร้อยละโดยมวลต่อปริมาตร อุณหภูมิของจุดขุ่นมีค่ามากขึ้นเมื่อจำนวนหมู่เอทิลีนออกไซด์เพิ่มขึ้น ค่ามุมของการเปียกมีค่ามากขึ้นเมื่อจำนวนหมู่เอทิลีนออกไซด์เพิ่มขึ้น คุณสมบัติในการเกิดเจล พบว่าเมื่อความเข้มข้นสารลดแรงตึงผิวเพิ่มขึ้น เกิดการเปลี่ยนแปลงวัฏภาค สารละลายไมเซลล์าร์ (Micellar solution) เฮกซะโกนอล (Hexagonal phase) และลามลาร์วัฏภาค (Lamellar phase) เรียงตามลำดับ คุณสมบัติในการเกิดฟองพบว่าทั้งจำนวนเอทิลีนออกไซด์และความเข้มข้นของสารลดแรงตึงผิวมีผลต่อคุณสมบัติในการเกิดฟองทั้งสามวิธี และยังพบว่าสารเฟตตีแอลกอฮอล์ออลีทอกซิลเลทที่มีจำนวนหมู่เอทิลีนออกไซด์ 7 และ 9 โมล มีคุณสมบัติในการเกิดฟองที่ดีเมื่อเทียบกับสาร โชนิลฟีนอลออลีทอกซิลเลท

ACKNOWLEDGEMENTS

This work has been a very memorable and valuable experience as well as a lot of knowledge to the author. It would not have been successful without the assistance of a number of individuals and organizations. The author would like to thank all of them for making this work a success.

First of all, I would like to take this opportunity to express my deep gratitude to Asst. Prof. Boonyarach Kitiyanan and Assoc. Prof. Sumaeth Chavadej, who acted as my thesis advisors, for providing many necessary things throughout this work. I would like to thank them for his constant valuable advice and support. This thesis would not have been successful without their professional aids.

I would like to special thanks to Asst. Prof. Siriporn Jongpatiwut who acted as advisory committee member for giving the valuable comments and recommendation.

Also, I would like to thanks Dr. Veerapat Tuntayakom for being my advisory committee member outside PPC and giving his valuable time to comment and recommendation.

I am grateful for the partial scholarship and partial funding of the thesis work provided by the Postgraduate Education and Research Programs in Petroleum and Petrochemical Technology (PPT Consortium).

I would like to express my deep appreciation to Dr. Sunisa Watcharasing, and Ph.D. students for their excellent suggestions and encouragements as well as making this research to be a fun filled activity. Besides, I would like to especially thank for their efforts to develop my technical writing style.

I would like to express my sincerely gratitude to all faculties and staff of the Petroleum and Petrochemical College for their kind assistance to facilitate all works. Special thanks go to all PPC friends for their friendly assistance and creative suggestions.

Finally, the author would like to express deep appreciation to my parents and my sisters for their endless support, encourage and love throughout the two years study period of my M.S.

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