DISSOLUTION OF SOAP SCUMS SYNTHESIZED FROM STEARIC ACID AND COMMERCIAL SOAP

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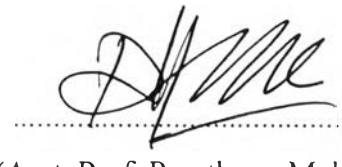

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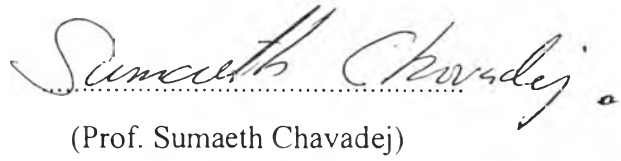

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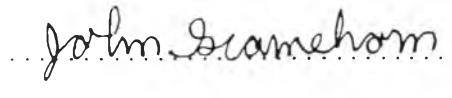

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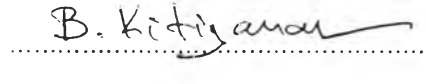

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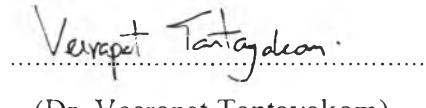

(Dr. Veerapat Tantayakom)

ABSTRACT

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Soap scum is generated from long chain fatty acids of soap reacting with divalent cation, especially calcium and magnesium ion in natural hard water. It is precipitate on the surface of sink and bathtubs as a white stain. Soap scum can be removed by using an appropriate surfactant and a chelating agent. The purpose of this research was to investigate the equilibrium solubility of different soap scums from steric acid (S) or Lux commercial soap (CS) and water containing with pure Ca, pure Mg, mixed Ca and Mg at a molar ratio of Ca:Mg = 4:1 or natural hard water (NHW) with a high hardness in different solution systems: pure water pH 4, dimethyldodecylamine oxide/tetrasodium glutamate diacetate (DDAO/Na_4GLDA), and dimethyldodecylamine oxide/disodium ethylene diamine tetraacetate (DDAO/ Na_2EDTA) pH 11 were investigated at a constant temperature of 25°C. The results showed that soap scums synthesized from stearic acid in the Na_2EDTA/DDAO and Na_4GLDA/DDAO system seem to have lower equilibrium solubility than commercial soap scums. In addition, calcium commercial soap scum was higher equilibrium solubility than the magnesium commercial soap scum. The further study of dissolution rate showed that for both stearic acid and commercial soap in natural hard water is no significant different in the Na_2EDTA/DDAO and Na_4GLDA/DDAO system.

บทคัดย่อ

กิ่งกาญจน์ ปันเต: การศึกษาผลของการละลายคราบไคลสบู่ที่สังเคราะห์จากกรดสเตียริกและสบู่ที่ผลิตเชิงอุตสาหกรรม (Dissolution of Soap Scums Synthesized from Stearic Acid and Commercial Soap) อาจารย์ที่ปรึกษา: ศ.ดร.สุเมธ ชวเดช และ ศ.ดร. จอห์น เอฟ สกามีฮอร์น 69 หน้า

คราบสกปรกหรือคราบไคลสบู่เกิดจากโมเลกุลกรดไขมันของสบู่ทำปฏิกิริยากับไอออนบวกโลหะไดวาเลนต์ โดยเฉพาะอย่างยิ่ง แคลเซียมและแมกนีเซียมไอออน ซึ่งมีมากในน้ำกระด้างตามธรรมชาติ จึงเกิดเป็นคราบสีขาวขุ่นเกาะติดที่กระเบื้องหรือบริเวณพื้นที่อาบน้ำ โดยคราบไคลสบู่นี้สามารถกำจัดได้ด้วยการใช้สารลดแรงตึงผิวที่เหมาะสมกับสารคีแลนท์ วัตถุประสงค์ของการศึกษานี้คือ การศึกษาค่าสมดุลการละลายของคราบไคลสบู่ที่สังเคราะห์ขึ้นจากกรดสเตียริกและสบู่ที่ผลิตเชิงอุตสาหกรรม ในสารละลายแคลเซียม, แมกนีเซียม, อัตราส่วนแคลเซียมต่อแมกนีเซียม 4:1 และน้ำกระด้างตามธรรมชาติ ภายใต้สภาวะต่างๆ ได้แก่ น้ำบริสุทธิ์ ที่พีเอช 4, สารลดแรงตึงผิวไดเมธิลโดเดกซิลลามิน ออกไซด์กับสารคีแลนท์เทตตะโซเดียมกลูตาไดอะซิติกแอซิด (DDAO/Na_4GLDA) และสารลดแรงตึงผิวไดเมธิลโดเดกซิลลามิน ออกไซด์กับสารคีแลนท์ไดโซเดียมเอทิลีนไดเอมีนเตตระอะซีเตต (DDAO/Na_2EDTA) ที่พีเอช 11 และอุณหภูมิคงที่ 25 องศาเซลเซียส พบว่า ไคลสบู่สังเคราะห์จากกรดสเตียริกในระบบที่มีการใช้สารลดแรงตึงผิวไดเมธิลโดเดกซิลลามิน ออกไซด์ กับสารคีแลนท์เทตตะโซเดียมกลูตาไดอะซิติกแอซิด และสารลดแรงตึงผิวไดเมธิลโดเดกซิลลามิน ออกไซด์ กับสารคีแลนท์ไดโซเดียมเอทิลีนไดเอมีนเตตระอะซีเตต ให้ค่าสมดุลการละลายต่ำกว่าไคลสบู่สังเคราะห์จากสบู่ที่ผลิตในเชิงอุตสาหกรรม อีกทั้งคราบไคลสบู่แคลเซียมจากสบู่ที่ผลิตในเชิงอุตสาหกรรมยังละลายได้มากกว่าคราบไคลสบู่แมกนีเซียมจากสบู่ที่ผลิตในเชิงอุตสาหกรรม สำหรับการศึกษาอัตราการละลายของคราบไคลสบู่ พบว่า คราบไคลสบู่สังเคราะห์จากกรดสเตียริก และสบู่ที่ผลิตเชิงอุตสาหกรรมในน้ำกระด้างตามธรรมชาติ ไม่มีความแตกต่างกันในระบบที่มีการใช้สารลดแรงตึงผิวไดเมธิลโดเดกซิลลามิน ออกไซด์กับสารคีแลนท์เทตตะโซเดียมกลูตาไดอะซิติกแอซิด และสารลดแรงตึงผิวไดเมธิลโดเดกซิลลามิน ออกไซด์กับสารคีแลนท์ไดโซเดียมเอทิลีนไดเอมีนเตตระอะซีเตต

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ABBREVIATIONS

4:1 Ca/Mg-CS	Commercial soap in 4:1 calcium and magnesium ratio solution
4:1 Ca/Mg-S	Stearic acid in 4:1 calcium and magnesium ratio solution
AAS	Atomic absorption spectrometer
$Ca(C_{18})_2$	Calcium stearate or calcium soap scum
Ca-CS	Commercial soap in pure calcium solution
Ca-S	Calcium stearate
CMC	Critical micelle concentration
CS	Commercial soap
DDAO	Dimethyldodecylamine oxide
H_2O	Deionized water
HCl	Hydrochloric acid
K_{sp}	Solubility constant
$Mg(C_{18})_2$	Magnesium stearate or magnesium soap scum
Mg-CS	Commercial soap in pure magnesium solution
Mg-S	Magnesium stearate
Na_2EDTA	Disodium salt of ethylenediaminetetraacetate
Na_4GLDA	Tetrasodium salt of N,N-bis(carboxymethyl) glutamic acid
NaOH	Sodium hydroxide
NHW	Natural hard water
NHW-CS	Commercial soap in natural hard water
NHW-S	Stearic acid in natural hard water