

**THE EFFECT OF CHELATING AGENT TYPE ON EQUILIBRIUM
SOLUBILITY OF CALCIUM AND MAGNESIUM SOAP SCUM IN
DIFFERENT SURFACTANT SYSTEMS**

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Thesis Title: The Effect of Chelating Agent Type on Equilibrium Solubility of Calcium and Magnesium Soap Scum in Different Surfactant Systems

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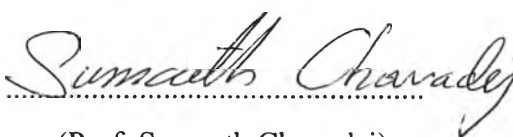
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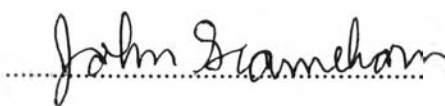
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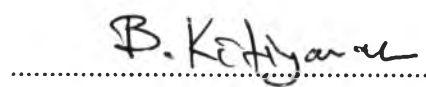
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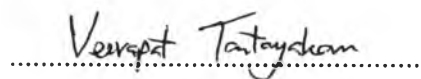

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ABSTRACT

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Prariyada Theptat: The Effect of Chelating Agent Type on Equilibrium Solubility of Calcium and Magnesium Soap Scum in Different Surfactant Systems

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Soap scum can be removed by using an appropriate surfactant with a chelating agent. However, ethylenediaminetetraacetic acid (EDTA), one of the most widely used chelating agents has low biodegradability and is suspected to be toxic to aquatic life. The purpose of this research was to investigate an approach to dissolve different types of soap scum by using different surfactants with various biodegradable chelating agents. The solubilities of two soap scum (calcium stearate, $\text{Ca}(\text{C}_{18})_2$ and magnesium stearate, $\text{Mg}(\text{C}_{18})_2$) were investigated at various solution pHs (from 4 to 11) and different types of surfactants: methyl ester sulfonate (MES) as an anionic surfactant, alcohol ethoxylate with 9 ethylene oxide groups (EO9) as a nonionic surfactant, and dimethyldodecylamine oxide (DDAO) as an amphoteric surfactant in the presence of different biodegradable chelating agents: ethylenediaminedisuccinic acid (EDDS) and glutamatediacetic acid (GLDA). The highest equilibrium solubility of any soap scum was observed at a pH of 11 with DDAO and GLDA. In addition, the calcium soap scum system had higher equilibrium solubility than the magnesium soap scum system.

บทคัดย่อ

ปริญาดา เทพทัต : การศึกษาผลของสารคีแลนที่มีต่อค่าสมดุลการละลายของคราบไคลสบู่แคลเซียมและแมกนีเซียมภายใต้สภาวะที่มีสารลดแรงตึงผิวชนิดต่างๆ (The Effect of Chelating Agent Type on Equilibrium Solubility of Calcium and Magnesium Soap Scum in Different Surfactant Systems) อ.ที่ปรึกษา : ศ.ดร.สุเมธ ชวเวช และ ศ.ดร. จอห์น เอฟ. สกามีฮอร์น 34 หน้า

คราบสกปรกหรือคราบไคลสบู่สามารถกำจัดออกได้ด้วยสารลดแรงตึงผิวที่เหมาะสมกับสารคีแลนที่ ทว่าเอทิลีนไดอะมีนเตตระอะซิติกแอซิด (EDTA) ซึ่งเป็นสารคีแลนที่นิยมใช้กันอย่างแพร่หลายนั้นมีการย่อยสลายในสิ่งแวดล้อมที่ต่ำมาก และอาจเป็นพิษต่อสิ่งมีชีวิตในน้ำ จุดประสงค์ของการศึกษานี้เพื่อที่จะขจัดคราบไคลสบู่ด้วยสารลดแรงตึงผิวชนิดต่างๆ ประกอบกับการใช้สารคีแลนที่สามารถย่อยสลายได้ โดยใช้โมเดลของคราบไคลสบู่ที่สังเคราะห์ขึ้น 2 ชนิด คือ คราบไคลสบู่แคลเซียมและคราบไคลสบู่แมกนีเซียม ภายใต้สารละลายที่ค่าพีเอช 4 ถึง 11 ในสารลดแรงตึงผิวชนิดต่างๆ ดังนี้ สารลดแรงตึงผิวประจุลบ คือเมทิลเอสเทอร์ซัลโฟเนต (MES), สารลดแรงตึงผิวไม่มีประจุ คือแอลกอฮอล์เอทอกซิลเลทที่มีเอทิลีนออกไซด์ 9 กลุ่ม (EO9) และสารลดแรงตึงผิวชนิดที่มีทั้งประจุลบและบวก คือไดเมทิลโคเคคซิลลามีนออกไซด์ (DDAO) ร่วมกันนี้สารคีแลนที่ใช้เป็นแบบย่อยสลายได้ มีด้วยกัน 2 ชนิด ได้แก่ เอทิลีนไดอะมีนไดซัคซินิกแอซิด (EDDS) และกลูตาเมทไดอะซิติกแอซิด (GLDA) จากการทดลองพบว่าค่าการละลายของคราบไคลสบู่ที่สูงที่สุดอยู่ในระบบที่มีการใช้สารลดแรงตึงผิวไดเมทิลโคเคคซิลลามีนออกไซด์ (DDAO) พร้อมกับสารคีแลนที่กลูตาเมทไดอะซิติกแอซิด (GLDA) นอกจากนี้ยังพบว่าคราบไคลสบู่ชนิดแคลเซียมมีค่าการละลายที่สูงกว่าในคราบไคลสบู่แมกนีเซียมอีกด้วย

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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 | xi |
| | |
| CHAPTER | |
| I INTRODUCTION | 1 |
| | |
| II LITERATURE REVIEWS | 3 |
| 2.1 Soap | 3 |
| 2.2 Cleaning Process | 6 |
| 2.3 Water Hardness | 7 |
| 2.4 Soap Scum | 8 |
| 2.5 Removal of Soap Scum | 8 |
| 2.6 Effect of Solution pH | 9 |
| 2.7 Surfactant | 10 |
| 2.8 Chelating Agents | 11 |
| | |
| III EXPERIMENTAL | 18 |
| 3.1 Materials | 18 |
| 3.2 Equipment | 18 |
| 3.3 Methodology | 19 |
| 3.3.1 Soap Scum Preparation | 19 |
| 3.3.2 Solubility Experiments | 19 |
| 3.3.3 Soap Scum Dissolution Experiments | 19 |

| CHAPTER | | PAGE |
|----------------|--|-------------|
| IV | RESULTS AND DISCUSSION | 21 |
| | 4.1 Characteristics of synthesized soap scum | 21 |
| | 4.2 Chelating agent-only systems | 23 |
| | 4.3 Surfactant-Chelating agent systems | 24 |
| V | CONCLUSIONS AND RECOMMENDATIONS | 30 |
| | 5.1 Conclusions | 30 |
| | 5.2 Recommendations | 30 |
| | REFERENCES | 31 |
| | CURRICULUM VITAE | 34 |

LIST OF TABLES

| TABLE | | PAGE |
|--------------|--|-------------|
| 2.1 | Typical composition of natural oils and fats | 5 |
| 2.2 | Definitions for chelating agent | 12 |
| 2.3 | Physicochemical properties of EDDS and GLDA | 17 |

LIST OF FIGURES

| FIGURE | PAGE |
|---|------|
| 2.1 Saponification of a triglyceride. | 3 |
| 2.2 The structure of a micelle. | 6 |
| 2.3 Oils dissolve inside micelle. | 7 |
| 2.4 The surfactant molecule. | 10 |
| 2.5 The percentage contribution of different application of APCs. | 13 |
| 2.6 Chemical structure of EDTA. | 14 |
| 2.7 The structural isomers of EDDS. | 15 |
| 2.8 Scheme of GLDA production. | 17 |
| 4.1 Particle size distribution and average diameter of two soap scum: (a) calcium stearate; and (b) magnesium stearate. | 21 |
| 4.2 SEM images of: (a), (b) calcium stearate; and (c), (d) magnesium stearate. | 22 |
| 4.3 FT-IR spectra of (a) calcium stearate and (b) magnesium stearate. | 23 |
| 4.4 Equilibrium solubility of calcium soap scum in chelating agent-free system at various solution pH. | 24 |
| 4.5 Equilibrium solubility of magnesium soap scum in chelating agent-free system at various solution pH. | 24 |
| 4.6 The equilibrium solubility of calcium soap scum in MES with chelating agent system at various solution pH. | 26 |
| 4.7 The equilibrium solubility of magnesium soap scum in MES with chelating agent system at various solution pH. | 26 |
| 4.8 The equilibrium solubility of calcium soap scum in EO9 with chelating agent system at various solution pH. | 27 |
| 4.9 The equilibrium solubility of magnesium soap scum in EO9 with chelating agent system at various solution pH. | 27 |
| 4.10 The equilibrium solubility of calcium soap scum in DDAO with chelating agent system at various solution pH. | 28 |

| FIGURE | PAGE |
|--|-------------|
| 4.11 The equilibrium solubility of magnesium soap scum in DDAO with chelating agent system at various solution pH. | 29 |

ABBREVIATIONS

| | |
|------------------------------|--|
| AAS | Atomic absorption spectrometer |
| $\text{Ca}(\text{C}_{18})_2$ | Calcium stearate or calcium soap scum |
| CMC | Critical micelle concentration |
| DDAO | Dimethyldodecylamine oxide |
| EDTA | Disodium salt of ethylenediaminetetraacetate |
| EDDS | Trisodium salt of SS-ethylenediaminedisuccinic acid |
| GLDA | Tetrasodium salt of N,N-bis(carboxymethyl) glutamic acid |
| HCl | Hydrochloric acid |
| H_2O | Deionized water |
| K_{sp} | Solubility constant |
| $\text{Mg}(\text{C}_{18})_2$ | Magnesium stearate or magnesium soap scum |
| NaOH | Sodium hydroxide |