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Solubilization of Squalene in Surfactants Solutions

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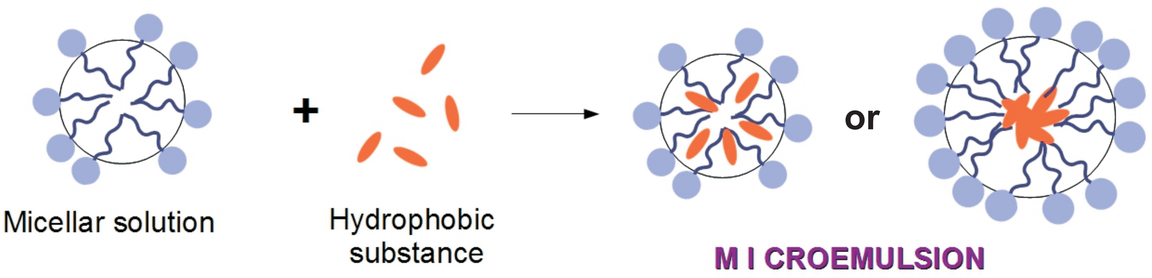
SCIENCE & RESEARCH

EMOLIENT

Liquid, hydrofobic substance

SOLUBILIZATION



M I CROEMULSION

PHYSICOCHEMICAL PROPERTIES

- thermodynamic stability
- transparency
- low viscosity

APPLICATIONS

COSMETICS

- Face and body tonics
- Liquid soap
- Liquids for cleansing wipes

HOME CARE

- Glass cleaners (spray)
- Hard surface cleaners
- Windshield washer fluid

FOODS

- Soft drinks and refreshments
- Flavored mineral water
- Cakes additives
- Refreshments

INTRODUCTION

Squalene - triterpene primarily known as an intermediate in the biosynthesis of sterols. It is found in shark liver oil, virgin olive oil, amaranth oil, or in wheat germ oil. Current use of squalene is mainly associated with cosmetic industries. It is an emollient and being a quencher of singlet oxygen can protect the human skin surface from lipid peroxydation due to various sources of oxidative damage. Scientific research has also indicated that squalene may contribute to the reported anti-carcinogenic activity of olive oil, especially for colon cancer.

The squalene is poorly soluble in water which is basic solvent according to green chemistry principles. To overcome this problem we can use surfactant/co-surfactant solution as the solubilization system.

AIM OF WORK

The purpose of this work is to study the influence of surfactant (Polysorbate 80, Polysorbate 20, Oleth – 20, Cocamide MEA, PEG – 60 Hydrogenated Castor Oil) and cosurfactant (glycols, alcohols) on the shape and size of the one phase region (oil in water µe) in the surfactant / squalene / water system.

EXPERIMENTAL PART

Pseudo-ternary phase diagrams were constructed in the following way: The mixtures of surfactant/cosurfactant and oil were titrated with water, at room temperature, to the solubilization limit, which was defined as the transition from the monophasic region to a polyphasic region or to a birefringent phase. The transition to a two-phase system could be detected visually by the appearance of cloudiness.

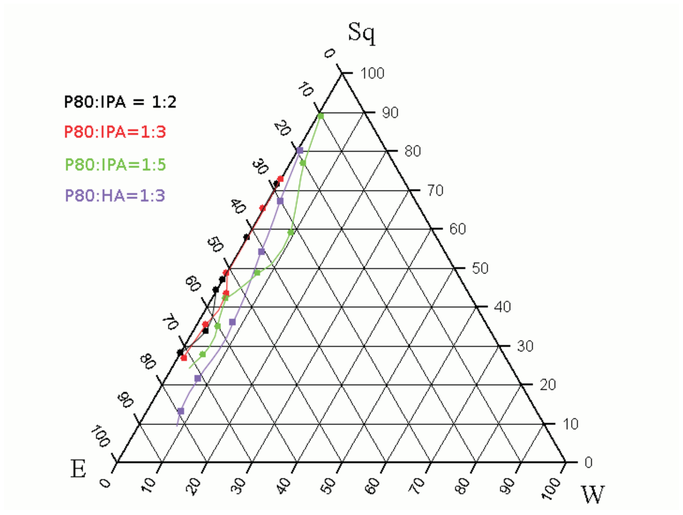


Fig.1. Pseudoternary phase diagram for squalene (**Sq**) / water (**W**) / solubilizer (**E**). **P20** - Polysorbate 20, **IPA** - Isopropyl Alcohol,

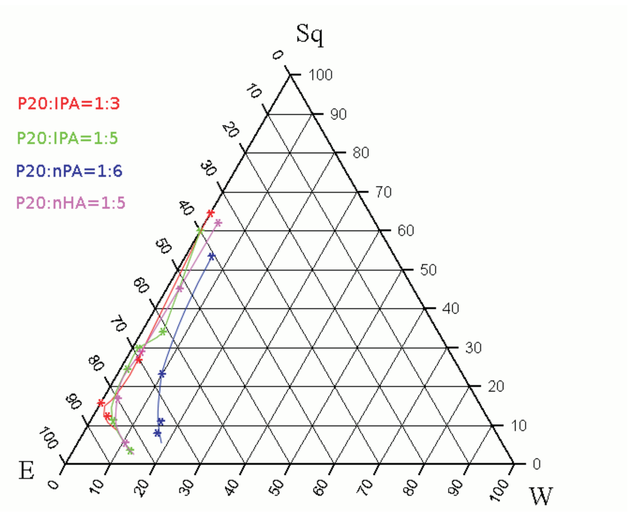


Fig. 2. Pseudoternary phase diagram for squalene (**Sq**) / water (**W**) / solubilizer (**E**). **P20** - Polysorbate 20, **IPA** - Isopropyl Alcohol, **nPA** – Pentyl Alcohol, **nHA** – Hexyl Alcohol

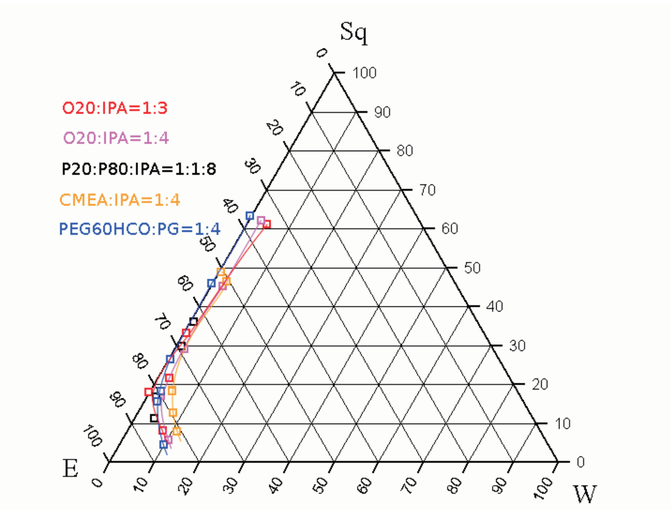


Fig. 3. Pseudoternary phase diagram for squalene (**Sq**) / water (**W**) / solubilizer (**E**). **O20** - Oleth-20, **P20** - Polysorbate 20, **P80** - Polysorbate 80, CMEA – Cocamide MEA, PEG60HCO – PEG60 Hydrogenated Castor Oil, **IPA** - Isopropyl Alcohol, **PG** – Propylene Glycol

CONCLUSIONS

1. The largest isotropic region was obtained for Polysorbate 20 /Pentyl Alcohol solubilizing system.
2. The size of the isotropic region increases as a function of the cosurfactant content but shrank (or disappear) when Isopropyl Alcohol is replaced with Propylene Glycol.
3. The maximum amount of solubilized squalene is 12,5% (for oil in water system).
4. In studied systems it was impossible to obtain fully water soluble squalene concentrate.

Tabel 1. Total isotropic monophasic area (A_T), maximal amount of water (**W**) and suitable amount of solubilized squalene (O_m) for selected squalene (**Sq**) / water (**W**) / solubilizer (**E**) systems

E	A_T [%]	O_m [%]	W [%]
P80:IPA = 1:5	7,5	26	9,4
P80:IPA = 1:3	0,9	42,5	2,9
P80:HA = 1:3	10,3	12,5	8,0
P20:nPA =1:6	14,4	9,0	16,8
P20:IPA = 1:5	6,0	5,0	12,7
O20:IPA = 1:3	7,8	6,2	11,3

E – silubilizing system, **P80** - Polysorbate 80, **P20** - Polysorbate 20, **O20** – Oleth-20, **IPA** – Isopropyl Alcohol, **nPA** – Pentyl Alcohol, **nHA** – Hexyl Alcoho

References

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10 years Cosmetics and Health Care