

Multifunctional cleansing oils

ABSTRACT

It is a common habit to supply skin with oils after cleansing or to use directly oils for bathing or showering.

Various soils type are oil soluble (sebum, residues from emulsions or waterproof make-up) and in this case anhydrous oil cleansers can be effective (similia similibus solvuntur).

Nevertheless formulations based completely on oils have poor esthetic characteristics.

They can be accepted for baby care or problematic skins but in all the other cases surfactants must be added in order to provide suitable appearance and sensorial attributes.

The work will describe how it is possible to obtain clear multifunctional cleansing oils of excellent mildness, with moisturizing power and additional properties.

INTRODUCTION

Removal of skin lipids due to detergency has always been regarded as one of the most probable cause of skin barrier damage¹.

Even if this mechanism is not completely clear and some authors reject this hypothesis¹, it is a common habit to supply skin with oils after cleansing or to use directly oils for bathing or showering.

The types of soil present on skin can be broadly classified as oil-soluble, water-soluble and insoluble².

Various soils are oil-soluble (sebum, residues from emulsions or waterproof make-up) and in this case anhydrous oil cleansers can be effective (similia similibus solvuntur), but in the cosmetic field consumer acceptance must be always evaluated.

A formulation based completely on oils has poor esthetic characteristics: it is not readily rinsible, gives not clear solution with water, doesn't foam (foam is, if not critical, at least very important) and leaves a greasy residue on bath tube or shower.

This kind of formulations is mainly used for babies or by people with different skin or scalp disorders, where the compliance is based on the feeling to have something really effective for the problem to be solved. In all other cases surfactants must be added in order to provide suitable appearance and sensorial attributes to the product.

CLASSICAL FORMULATIONS

Classical water free foaming oil cleansers are based

on anhydrous alkyl ether sulfates salts like TIPA or MIPA-Laureth Sulfate. These surfactants are often used in combination with Cocamide DEA and/or an ethoxylated fatty alcohol (mainly Laureth-4) in order to have the best foaming power, skin feeling and solubilizing properties. These "classical" surfactants work very well and allow to obtain clear, high foaming, easy to manufacture oil cleansers.

AIM OF THE STUDY

Aim of the study was to formulate an oil cleanser with the following characteristics:

- extremely mild
- with moisturizing properties
- with additional benefits (e.g. for different skin, hair and nail disorders)
- preservative free
- clear and also able to give clear solutions when diluted with water
- containing water in order to increase skin feeling and to have a more pleasant and rinsible product
- with both lipophilic and hydrophilic active agents in the same formulation

Three different formulations were manufactured.

All the formulations were tested with challenge test and two of them also with an in vitro test in order to evaluate their mildness comparing with a classical oil cleanser.

CHOICE OF OILS AND SURFACTANTS

In order to obtain a formulation with the described characteristics, different ethoxylated oils were used while the main surfactants were acylated hydrolyzed proteins or aminoacids, mainly acyl sarcosinates and acyl glutamates.

Acyl sarcosinates are able to foam even in presence of high quantity of lipids.

Acyl glutamates are known for their mildness and moisturizing power³.

Furthermore changing the fatty chain (e.g. into capryloyl or undecylenoyl) suitable products for dandruff, sebum or odour control can be obtained.

FORMULATIONS

Here are shown the different formulations

Formulation 1 – Nourishing Shower Oil with 50% of oils

INCI Name	% by wt.
PEG-10 Olive Glycerides	25
PEG-11 Avocado Glycerides	25
Aqua	19.4
Sodium Lauroyl Sarcosinate	3
Polysorbate 20	7
PEG-7 Glyceryl Cocoate	7.5
Disodium Capryloyl Glutamate	8
Cetrimonium Chloride	0.2
Hydrolyzed Rice Protein	0.2
Citrus Aurantium Dulcis Oil	1.5
Calcium Ascorbate (and) Glycerin (and) Sorbitol	0.1
Lactic Acid	3
Disodium EDTA	0.1

Characteristics:
 Appearance at 20°C = clear solution
 Colour = from light yellow to yellowish, according to the oils used
 Odour = characteristic
 pH = 4.9 - 5.5
 TVC (bacteria, moulds and yeasts) < 10 ufc/ml
 Aw = 0.81

Formulation 3 - Moisturizing Bath Oil with 40% of oils

INCI Name	% by wt.
PEG-10 Olive Glycerides	20
PEG-11 Avocado Glycerides	20
Aqua	30.1
PEG-7 Glyceryl Cocoate	7
Sodium Lauroyl Sarcosinate	3
Disodium Capryloyl Glutamate	8
Rosmarinus Officinalis Leaf Oil	1.5
Saccharomyces/Silicon Ferment (and)	0.1
Saccharomyces/Magnesium Ferment (and)	
Saccharomyces/Iron Ferment (and)	
Saccharomyces/Zinc Ferment (and)	
Calcium Ascorbate (and) Glycerin (and) Sorbitol	0.2
Polysorbate 20	7
Lactic Acid	3
EDTA	0.1

Characteristics:
 Appearance at 20°C = clear solution
 Colour = from light yellow to gold yellow, according to the oils used
 Odour = characteristic
 pH = 4.8 - 5.6
 TVC (bacteria, moulds and yeasts) < 10 ufc/ml
 Aw = 0.80

Formulation 2 - Conditioning Oil Shampoo with 35% of oils

INCI Name	% by wt.
Aqua	32.7
PEG-10 Olive Glycerides	10
PEG-11 Avocado Glycerides	10
PEG-6 Caprylic Capric Glycerides	15
Disodium Capryloyl Glutamate	5
PEG-7 Glyceryl Cocoate	8
Propylene Glycol	5
Polysorbate 20	5
Sodium Lauroyl Sarcosinate	3
Lactic Acid	2.5
Disodium Laureth Sulfosuccinate (and) Sodium Lauryl Sulfoacetate	2
Citrus Aurantium Dulcis Oil	1.3
Cetrimonium Chloride	0.2
Calcium Ascorbate (and) Glycerin (and) Sorbitol	0.2
Disodium EDTA	0.1

Characteristics:
 Appearance at 20°C = clear solution
 Colour = from light yellow to gold yellow, according to the oils used
 Odour = characteristic
 pH = 4.7 - 5.5
 TVC (bacteria, moulds and yeasts) < 10 ufc/ml
 Aw = 0.84

CHALLENGE TEST

All formulations were tested with challenge test⁴. Inoculation was made with the following microorganisms:

Staphylococcus aureus ATCC 6538	5.0 · 10 ⁶ cfu/g
Pseudomonas aeruginosa ATCC 9027	5.3 · 10 ⁵ cfu/g
Escherichia coli ATCC 8739	6.2 · 10 ⁵ cfu/g
Candida albicans ATCC 10231	0.8 · 10 ⁴ cfu/g
Aspergillus niger ATCC 16404	5.0 · 10 ⁴ cfu/g

Vital cells concentration was determined with plate count method after 24 hours, 7, 14 and 28 days. Table 1 shows the obtained results for all formulations.

Different behaviour among formulations was obtained only for Aspergillus niger. Results are shown in table 2.

Table 1. Challenge Test Results

Time	Staphylococcus aureus cfu/g	Pseudomonas aeruginosa cfu/g	Escherichia coli cfu/g	Candida albicans cfu/g
24 hours	< 10	< 10	< 10	< 10
7 days	< 10	< 10	< 10	< 10
14 days	< 10	< 10	< 10	< 10
28 days	< 10	< 10	< 10	< 10

Table 2. Results for *Aspergillus niger*

	Formulation 1 cfu/g	Formulation 2 cfu/g	Formulation 3 cfu/g
24 hours	7.5×10^4	9.0×10^3	2.0×10^3
7 days	< 10	6.0×10^4	< 10
14 days	< 10	7.2×10^2	< 10
28 days	< 10	20	< 10

IN VITRO TEST

Formulation 1 and 2 were tested with NRU (Neutral Red Uptake) assay in order to evaluate their cytotoxicity⁵.

NRU assay is based on the cell ability to incorporate and bind the Neutral Red (NR), a vital weak cationic dye. This dye penetrates the cells membrane and is accumulated in the lysosomes.

Cells and lysosomes membrane alterations cause the decreasing of RN uptake and linking.

In this way alive, damaged and dead cells can be discriminated.

Cells used in the test were human primary fibroblasts in monolayer cultures. Non treated cells were used as negative control. A classical oil cleanser was used as comparison.

Cells were incubated with scalar concentration of the products to be tested for 24 hours. For each dilution, 3 replica were performed and repeated twice. At the end of the exposure period cells were incubated for 4 h at 37°C with NR. Then cells were washed more time to eliminate dye wastes and a spectrophotometric reading at 540 nm was made.

The citotoxicity data obtained were plotted against the concentrations, which generated dose-response curves that allowed to determine the theoretical IC₅₀ value (Inhibiting Concentration 50%), i.e. the concentration of test compound which induces a decrease of cell survival by 50% as compared to untreated coltures. If IC₅₀ is higher than 1 mg/ml, absence of cytotoxic effect can be predicted.

In the case of cosmetic formulations, the range of use concentration must be evaluated correctly in order to estimate the predictive irritation potential. Usually dilution factor is 10.

Figure 1 and table 3 summarize the obtained results.

Table 3 - IC₅₀ on fibroblasts

Product	IC ₅₀
Formulation 2 Conditioning shampoo oil with 35% of oils	7,2
Formulation 1 Nourishing Shower oil with 50% of oils	2,6
Classical shower oil	0,7

CONCLUSION

The work has shown that it is possible to obtain clear, high foaming, water containing and cosmetically acceptable oil cleansers with high content of refatting agents and excellent moisturizing power.

These formulations are suitable for every applications were mildness and multifunctional properties are needed.

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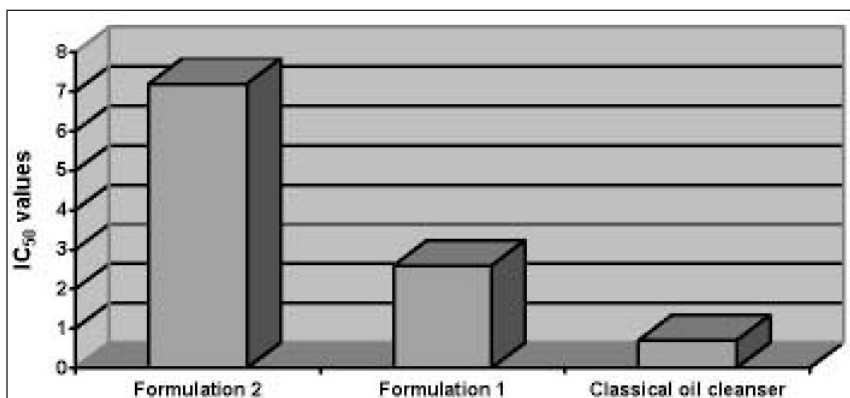


Figure 1 - Compared IC₅₀ on fibroblasts

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