Formulating sulfate-free liquid hand soaps for all your needs

Nowadays SLES and other sulfated anionics have been in the spotlight because of their impact on the environment and human health and, as a result, sulfate-free products have become more attractive to consumers.

In this article we discuss our sulfate-free chassis (aka base) for liquid hand soap to illustrate just how easy it can be to formulate sulfate-free products without compromising on their cleansing and foaming properties.

Our focus is on cold processable formulations and in the following prototype formulations we have combined Glutamates with Lauryl Glucoside and amphoteric surfactant to create efficient yet mild products. To make a complete formulation we have used long-lasting moisturizer in combination with a green solubilizer that also brings some thickening properties to the formulation.

The purpose with these chassis is to provide a good starting point for formulation development, whether it is a heavy-duty garage soap or a more luxurious hand soap.

Key components

Rheo2Green2 *(INCI: Aqua, Lauryl Glucoside, Disodium Cocoyl Glutamate, Sodium Benzoate, Potassium Sorbate).* This is a ready-to-use surfactant concentrate base. It has a robust viscosity without a thickening agent thanks to micellar self-thickening at pH 4.8-5.2. Usually a concentration of 35-40% of the product is needed to obtain the preferred viscosity. It is also sulfate free and COSMOS, ECOCERT and Nordic ECOLABEL compliant. It is cold processable and is a good cleanser. In some cases, a secondary foaming booster might be needed.

Dapracare PG4C-MB *(INCI: Polyglycerol-4 Caprate).* This is a PEG-free solubilizer that also acts as a thickening agent in hand sanitizers, body washes, liquid soaps and bath oils. It is mass balance certified and COSMOS compliant. It is also cold processable and efficient from a 2.5% usage level. It can be used as an alternative to polysorbates.

Elfamoist AC (*Acetamidoethoxyethanol).* This is a non-tacky humectant for high performing formulations with deep, instant and long-lasting moisturizing benefits.

Amaze XT *(INCI: Dehydroxanthan Gum).* This is a multifunctional natural rheology modifier with superior suspension capabilities. It is cold processable and suitable for many rinse-off products and toiletries.

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Our prototype formulations

Different formulations for different needs

Depending on your specific needs and requirements, an efficient sulfate-free cleansing product can be built up by combining different products and concentrations. Below we have put together a few examples of prototype formulations for different market needs, all based on the same chassis.

The formula and mixing procedure listed below are for non-commercial use only and therefore suitability, stability and safety should be confirmed in all respects prior to commercial use.

The first two examples of chassis formulation give a liquid hand soap with good cleansing properties. In the second formulation prototype called 'Regular', Cocoamidopropyl betaine has been added as a foam enhancer and part of the Glycerin has been replaced by Acetamidoethoxyethanol to improve moisturization and to leave skin feeling less sticky.

You start by mixing the components in phase A. Then add the components in phase B in the order listed. Stir until the formulation becomes clear and then add phase C to the mixture. Stir until the formulation appears homogeneous and then you can adjust the pH with phase D.

Formula Trade Name	INCI Name	Function	Chassis %w/w	Regular % w/w
Phase A				
Fragrance*	Perfume	Perfume	0.5	0.5
Preservatives	Phenoxyethanol (90.0) & Ethylhexylglycerin (10.0)	Preservatives	1.0	1.0
Glycerin	Glycerin	Moisturizer	5.0	2.5
Elfamoist AC*	Acetamidoethoxyethanol	Moisturizer		2.5
Ester ETO 7*	PEG-7 GLYCERYL COCOATE	Solubilizer	2.0	2.0
Phase B				
Deionized Water	Aqua	Solvent	51.5	48.5
Betaine AAB*	COCOAMIDOPROPYL BETAINE	Foaming, Solubilizer		3.0
Phase C				
Rheo2Green2*	Aqua, Lauryl glucoside, Disodium cocoyl glutamate, Sodium benzoate, Potassium sorbate	Cleansing agent, thickening	40	40
Phase D				
Citric acid	Citric acid	pH	qs	qs

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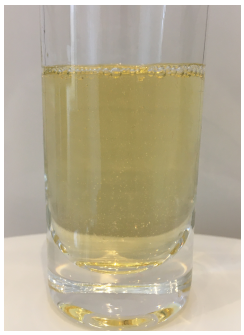
In the third prototype formulation called 'Premium', Caprylic-Capric Triglyceride has been added as an emollient in combination with Polyglyceryl-4 Caprate to give the hand soap a more luxurious feel.

Again, you start by mixing the components in phase A and then add the components in phase B in the order listed. Stir until the formulation appears homogeneous and then you can adjust the pH with phase C.

Formula Trade Name	INCI Name (active % w/w)	Type	Premium % w/w
Phase A			
Fragrance*	INCI (00.0)	Perfume	0.5
Preservatives	Phenoxyethanol (90.0) & Ethylhexylglycerin (10.0)	Preservatives	1.0
Glycerin	Glycerin	Moisturizer	1.5
Elfamoist AC*	Acetamidoethoxyethanol	Moisturizer	1.5
Ester ETO 7*	PEG-7 GLYCERYL COCOATE	Solubilizer	2
Ester 610*	CAPRYLIC-CAPRIC TRIGLYCERIDE	Emollient	0.5
Dapracare PG4C-MB*	Polyglyceryl-4 Caprate	Solubilizer	4
Phase B			
Deionized Water	Aqua	Solvent	44.0
Betaine AAB*	COCOAMIDOPROPYL BETAINE	Foaming, Solublilizer	5
Rheo2Green2*	Aqua, Lauryl glucoside, Disodium cocoyl glutamate, Sodium benzoate, Potassium sorbate	Cleansing agent	40
Phase C			
Citric acid	Citric acid	pH	qs



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Industrial scrub soap

The last prototype formulation in this article is an industrial scrub soap where apricot kernels have been added as exfoliants. The superior suspension capabilities of Dehydroxanthan Gum keep the apricot kernels suspended. The scrub soap was tested on a hand soiled with grease from a MC (both particle soil and oily grease). As you can see from the photos, the soap provided a good cleansing effect, and the hand was completely cleaned.

Industrial scrub soap.

Soiled hand (before cleansing).

Hand cleaned with Industrial scrub soap.

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You start by mixing the components in phase A. Then you add the components in phase B in the order listed. Stir until the formulation becomes clear. Carefully add phase C while still stirring. Stir until the formulation appears homogeneous and then slowly add the components in phase D to the mixture. Stir until the formulation appears homogeneous and then you can adjust pH with phase C.

Formula Trade Name	INCI Name (active % w/w)	Function	Scrub soap %w/w
Phase A			
Fragrance*	Perfume	Perfume	0.5
Preservatives	Phenoxyethanol (90.0) & Ethylhexylglycerin (10.0)	Preservatives	1.0
Glycerin	Glycerin	Moisturizer	3.0
Elfamoist AC*	Acetamidoethoxyethanol	Moisturizer	2.0
Ester ETO 7*	PEG-7 GLYCERYL COCOATE	Solubilizer	2.0
Phase B			
Deionized Water	Aqua	Solvent	53.0
Betain AAB*	Cocoamidopropyl betain	Foaming, Solubilizer	4.0
Phase C			
Amaze XT*	Dehydroxanthan Gum	Rheology modifier / Suspension	2.5
Phase D			
Rheo2Green2*	Aqua, Lauryl glucoside, Disodium cocoyl glutamate, Sodium benzoate, Potassium sorbate	Cleansing agent, Rheology modifier	30
Apricot kernels	Apricot kernels	Exfoliant	2.0
Phase E			
Citric acid	Citric acid	pH adjuster	qs

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Summary

With these prototype formulations we have shown that it is quite easy to create efficient, cold processable sulfate-free formulations just by combining a few ingredients to achieve good functionality. You can customize these chassis with additional ingredients as long as you follow the steps in the manufacturing process.

Please feel free to contact our dedicated sales team at any time for further information about our products, documentation, application know-how and formulation consultation.