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Dacula, Ga 30019

Andrew O'Lenick
Editor

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Emulsions Using Silicone Emulsifiers

Editors note:

The Silicone Spectator is constantly looking for articles and suggestions that can simplify the process of developing personal care products. These can include new formulation techniques, new raw materials or new analytical methods. This supplement provides a very basic approach to making emulsions using four silicone emulsifiers.

It is our hope that it will be of interest to both the experienced formulator, who may not be an emulsion expert and the new the formulator. The new formulator makes up an increasing part of our industry.

Andrew O'Lenick Editor

Silicone Emulsifiers

Kevin O' Lenick
SurfaTech Corporation

Valerio Vergani
Akott Italia

Despite the fact emulsions are found in almost every category of cosmetic product, the preparation of stable, cosmetically elegant emulsions remains one of the most daunting tasks undertaken by the cosmetic chemist. The inclusion of coated pigments, sunscreen actives, fragrances, humectants and other actives tend to complicate the process even more.

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Emulsion Theory

Emulsions are systems composed of two (or more) immiscible materials (usually liquids, although solid PEGS are used) in which one material (the dispersed/ internal phase) is suspended or dispersed throughout another material (the continuous/external phase) in separate droplets. All emulsions are inherently unstable (with the exception of spontaneously forming micro emulsions). All we can do is delay the day when the instability will arrive.

Emulsification is a process that allows for the preparation of a **metastable single phase** of **two insoluble materials**. The preparation of cosmetically acceptable emulsions is a very challenging and often frustrating undertaking. The metastable nature of the two insoluble materials is critical to understanding the nature and performance of emulsions. The metastable nature of the emulsion, and the requirement that the emulsion be cosmetically appealing, offer unique challenges to the formulator. The challenge is two fold; to delay the onset of separation and to provide a cosmetically elegant product.

There are fundamentally two types of emulsions, the more common oil in water and the water in oil (or invert emulsion). The type of emulsifier used will to a great extent determine the type of emulsion that is formed with a specific oil and water combination. Table 1 shows some basic definitions.

Table 1 Emulsion Definitions

Dispersed Phase	Continuous Phase	O/W Emulsion	W/O Emulsion
The phase, which is disrupted or finely divided within the emulsion.	The phase or medium in which the dispersed phase is suspended.	An emulsion in which the oil phase is dispersed into a water phase, e.g., mayonnaise, lotions.	An emulsion in which the water phase is dispersed into the oil phase, e.g., margarine, icings, some hand creams.

Emulsion Terms

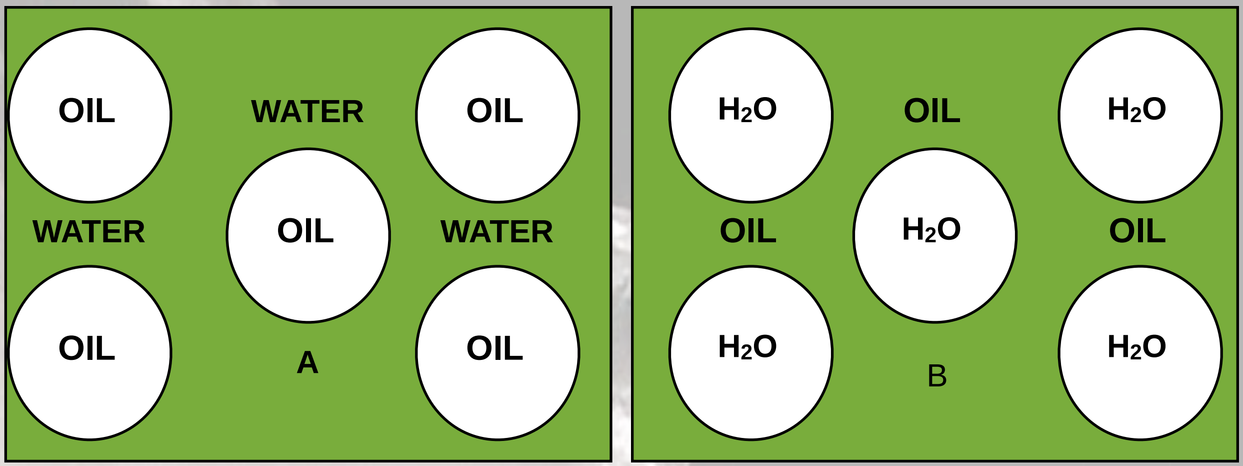
Continuous phase- The continuous phase is also called the external phase. While it is true in many emulsions that the continuous phase is the larger of the two phases as far as weight percentage is concerned it does not have to be the larger. The general rule is that if you can dilute an emulsion with water without splitting it is a water continues emulsion, or an O/W emulsion.

Discontinuous phase- The discontinuous phase is the phase that is dispersed into the continuous phase. Again, it may be the predominant percentage by weight material, but does not have to be so.

Dispersion or Emulsion There has been much confusion generated about the difference between an emulsion and a dispersion. The former is metastable and can be diluted and remain stable, while the latter is only stable in a thickened state. The high viscosity is required to keep the product from splitting. Antifoam compounds are dispersions. They stay together by virtue of their viscosity. If diluted they split into two phases, but can be made into one phase again only by adding thickener. Care must be exercised to make sure the so-called emulsion is indeed not a dispersion, since use of a dispersion will almost always result in an unstable product. High viscosity materials may in fact fail to split, but high viscosity, but are not stable upon dilution. True emulsions can be diluted to low viscosity with addition of continuous phase, while dispersions will split into two phases.

Triple Emulsions – Triple emulsions are the so-called W/O/W emulsions. This is only one type of multiple emulsion. These emulsions are water in oil emulsions that subsequently emulsified in water. They have unique properties, including outstanding skin feel, but can present problems during preparation, being the most technically sophisticated emulsions made. The technology has been around since the late 1970's and is now gaining acceptance as more sophisticated technology becomes available. Stability is still a difficulty.

Figure 1 shows a graphic representation of the two types of emulsions.



Emulsion Graphic
Figure 1

Emulsifiers are key to making emulsions. The type of emulsion (O/W or W/O), the emulsion stability and the cosmetic aesthetics are all determined in great part by the emulsifier or emulsifiers chosen to make the emulsion. Processing technology is another key factor.

Fatty Emulsifiers

The selection of a surface active agent for a specific emulsification application has been made simpler and more systematic by the development of the HLB System. The system

was proposed by Griffin[1] and has been widely promoted by ICI[2], and over the years has proven to be a very valuable aide to the formulator.

HLB SYSTEM

HLB, the so called Hydrophile - Lipophile Balance, is the ratio of oil soluble and water soluble portions of a molecule. The system was originally developed for ethoxylated products. Listed in Table 1 are some approximations for the HLB value for surfactants as a function of their solubility in water. Values are assigned based upon that table to form a one-dimensional scale, ranging from 0 to 20.

We are using the generic term "hydrocarbon" to designate the oil soluble portion of the molecule. This generic term includes the more specific terms fatty, lipid, and alkyl.

The appearance of a surfactant in water relates directly to its HLB. Table 2 shows this.

Table 2

Surfactant in Water

There are two basic types of emulsions envisioned by the current HLB system.

They are the oil in water (O/W) and the water in oil (W/O). The phase listed first is the discontinuous phase. That is it is the phase that is emulsified into the other. Bancroft[3] postulated that upon mixing of the two phases with a surfactant present, the emulsifier forms a third phase as a film at the interface between the two phases being mixed together. He also predicted that the phase in which the emulsifier is most soluble will become the continuous phase. The continuous phase need not be the predominant quantity of material present. There are emulsions where the discontinuous phase makes up a greater weight percent than the continuous phase. A simple test is if the emulsion is readily diluted with water, water is the continuous phase.

It has been stated "The HLB system has made it possible to organize a great deal of rather messy information and to plan fairly efficient systematic approaches to optimize emulsion preparation. If one pursues the concept too far however the system tends to lose itself to complexities.[4]" We agree with this and believe that a system which provides direction in the selection of an emulsifier is the first objective. A new mathematical model has been developed to allow for approximations of HLB.

Calculation of HLB

The HLB system, in it's most basic form, allows for the calculation of HLB using the following formulation:

$$\text{HLB} = \frac{\text{\% Hydrophile by weight of molecule}}{5}$$

Example:

Oleyl alcohol 5 E.O.

$$\frac{\text{M.W. Hydrophile (5) (44) = 220}}{\text{Total M.W of molecule}} = 45.0\ \%$$

HLB= 45% / 5 = 9.0 HLB = 9.0

APPLICATION OF HLB

One can predict the approximate HLB needed to emulsify a given material and make more intelligent estimates of which surfactant or combination of surfactants is appropriate to a given application. When blends are used the HLB can be estimated by using a weighted average of the surfactants used in the blend.

Many oils have been evaluated to determine the HLB of the surfactant needed to make emulsions. Table 3 shows the HLB needed to emulsify a variety of oils.

Table 3

HLB NEEDED TO EMULSIFY [2]

Acetophenone	14	Lanolin	12
Acid, Lauric	16	Lauryl amine	12
Acid, Oleic	17	Mineral spirits	10
Beeswax	9	Nonylphenol	14
Benzene	15	Orthodichlorobenzene	13
Butyl Stearate	11	Pine Oil	16
Carbon Tetrachloride	16	Toluene	15
Castor Oil	14	Xylene	14
Chlorobenzene	13	Kerosene	14
Cottonseed Oil	6	Cyclohexane	15
Petrolatum	7	Chloranated Paraffin	8

For those materials that are not listed above, it is recommended that the oil be tested using specific blends have known emulsifiers. This allows the formulator to calculate the HLB needed to emulsifying the non-listed oil.

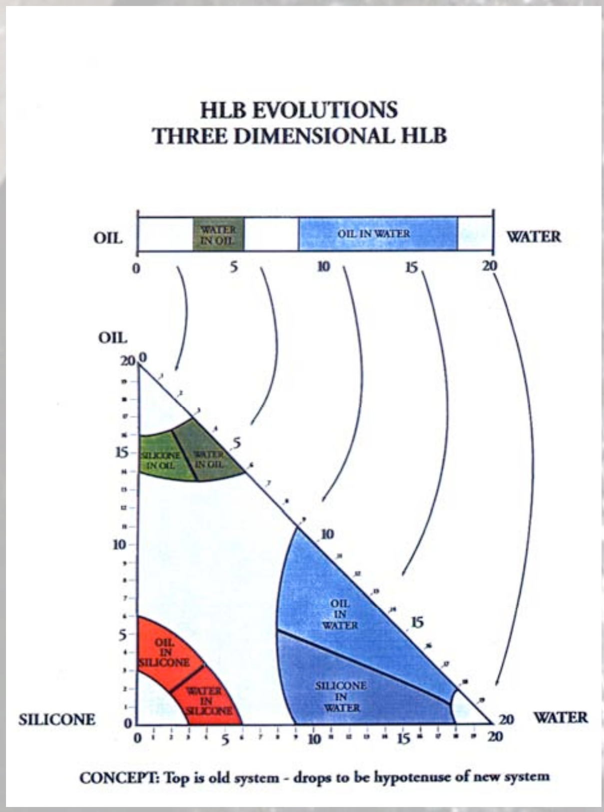
The appearance of the emulsion is dependant upon the particle size of the discontinuous phase. Table 4 shows the effect of particle size upon emulsion appearance (Particle size is listed in nanometers). One can improve clarity by matching refractive index of the oil and water. This results in so called clear emulsions.

Table Four Emulsions Appearance	
Appearance	**Particle Size**
White	> 1
Blue White	0.1 - 1.0
Translucent	0.05 - 0.1
Transparent	< 0.05

Silicone Emulsifiers

In recent years, there has been a greater acceptance of silicone surfactants in the preparation of emulsions. The direct application of the HLB concept to these materials has resulted in an approximate value. Many manufacturers of silicone surfactants, rather than dealing with the differences between calculated and observed HLB, have dropped specific values and adopted the use of high, middle or low as a classification of HLB values. This approach simply begs the issue.

In 1996, we proposed a modification of the famous HLB system to make it more applicable to silicone based surfactants[6]. The intent was to be able to accommodate the difference in hydrophobicity between fatty materials and silicone materials, a fact that cannot be done with the standard formulas for HLB.



The system is based upon two calculations one for the x coordinate and the other for the y points.

X coordinate	Y coordinate
% water soluble/5	% oil soluble/5

This calculation gives the two values that describe the point. Essentially the amount of silicone is be difference.

Examples

(A) Standard Fatty Surfactant

% Oil Sol.	% Water Sol.
50.0 %	50.0 %
(x)	(y)
50/5= 10.0	50/5= 10.0

Point is on line (CB).

(B) Standard Silicone Surfactant

% Oil Sol.	% Water Sol.
0.0	50.0
(x)	(y)
0/5= 0	50.0/5 = 10.0

Point is on line (AB)

(C) Three Dimensional Surfactant

% Oil Sol.	% Water Sol.
30.0	20.0
(x)	(y)
30.0/5=6.0	20.0/5=4.0

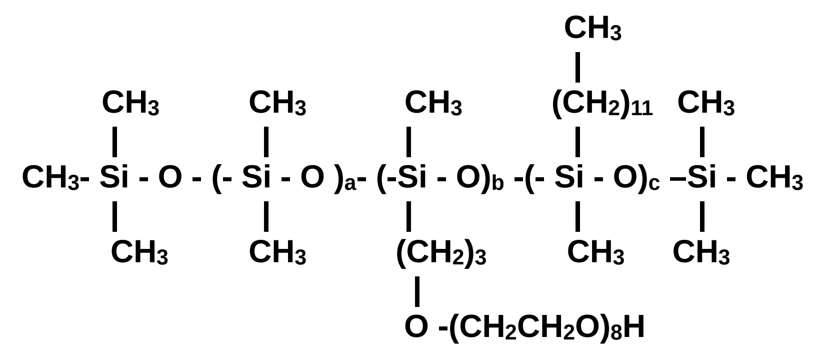
Selection of Silicone Emulsifiers

Silicone emulsifiers are not one product but a mixture of related polymers called oligomers. A major problem with these products can be phase separation, most commonly in cold weather. This is due to the fact that when the number of each type of group in the emulsifier is low, there are molecules that lack those groups entirely. This means that you can have a mixture of molecules some containing zero water-soluble groups, and others with zero alkyl portion in the same mixture. If this product gets cold phase separation will occur. Separation will cause tremendous difficulty in production especially if you are using part drums of emulsifier, where the entire drum may not be homogeneous from top to bottom. Depending upon which phase or phases actually get into a batch, the HLB of the emulsifier can vary widely, resulting in unstable and unpredictable emulsions. The silicone emulsifier must be homogeneous and stable to low temperature. In order to select the proper emulsifier for a particular application, there need to be a number of different “3D HLB” materials that have roughly the same molecular structure.

One such series of products assembled to make emulsions have the INCI name Lauryl PEG-8 Dimethicone. The difference among them is the percentage alkyl, silicone and PEG. These differences make surfactants with different 3D HLB values.

The structure of the compounds is shown in figure 3 [7]:

Silicone Emulsifiers
Figure 3



The compositions of the products are disclosed in Table 5. The series of products have been designed to have different solubility in a variety of solvents shown in Table 6. We have adopted the 3D HLB system in describing the molecules, since we feel that it is much more descriptive than the standard HLB.

Emulsifier Composition

The emulsifiers ranging in HLB from 3.2 to 9.6. This range of emulsifiers allows for the emulsification of a wide range of oils. The composition shown in Table 5

Table 5 Surfactant Compositions

	%		3D HLB	
Product	EO	Alkyl	X % EO/5	Y % Alkyl/5
J208-212	48	6	9.6	1.2
J208-412	39	13	7.8	2.6
J208-612	28	22	5.6	4.4
J208-812	16	32	3.2	6.4

Table 6 Solubility

	Water		IPA		Mineral Spirits		Mineral Oil		Aromatic 150		D-5		Silicone 350 Visc.	
	1%	10%	1%	10%	1%	10%	1%	10%	1%	10%	1%	10%	1%	10%
J208-212	S	S	S	S	I	I	D	D	S	S	D	D	D	D
J208-412	D	D	S	S	D	D	D	D	S	S	D	D	D	D
J208-612	I	I	S	S	S	S	S	D	S	S	D	D	D	D
J208-812	I	I	S	S	S	S	S	S	S	S	S	S	D	D

A new innovative kit of emulsifiers that will take some of the stress out of formulating. These molecules are composed of three parts; (1) an alkyl soluble part; (2) a water-soluble part and (3) a silicone soluble part. Choosing the right ratio of the three parts is critical in creating a stable emulsion. As the required HLB of your formulation changes with selection of oil or oils, the HLB of your emulsifier will change along with it.

Emulsion Formulation

The first set of experiments are conducted using all four emulsifiers, and allow the formulator not only the ability to evaluate emulsion stability, but also cosmetic aesthetics. The formulation is shown in Table 7.

Table 7 Emulsifier Formula

Material	%
Water	4.725
Oil	4.725
Emulsifier	5.00
Salt	0.5

Procedure:

1. Place emulsifier or emulsifier blend into the oil phase.
2. Mix well, noting clarity.
3. Add salt to water phase.
4. Heat both phases to 50ºC
5. Add water phase to oil phase and using mixer mix for 120 seconds.
6. Note appearance.

The above process is repeated with emulsifier blends depending upon the results of the first emulsion

Sheer Mixer - Laboratory Evaluation

Sheer Mixer

Sheer apparatus for lab evaluation

Picture by Kevin O'Lenick

Product Evaluation

Typical results are shown below. Two of the formulations are emulsions, and the others are not. This means the HLB needed for the emulsion is between that of Silube -208-212 and Silube J208-412.

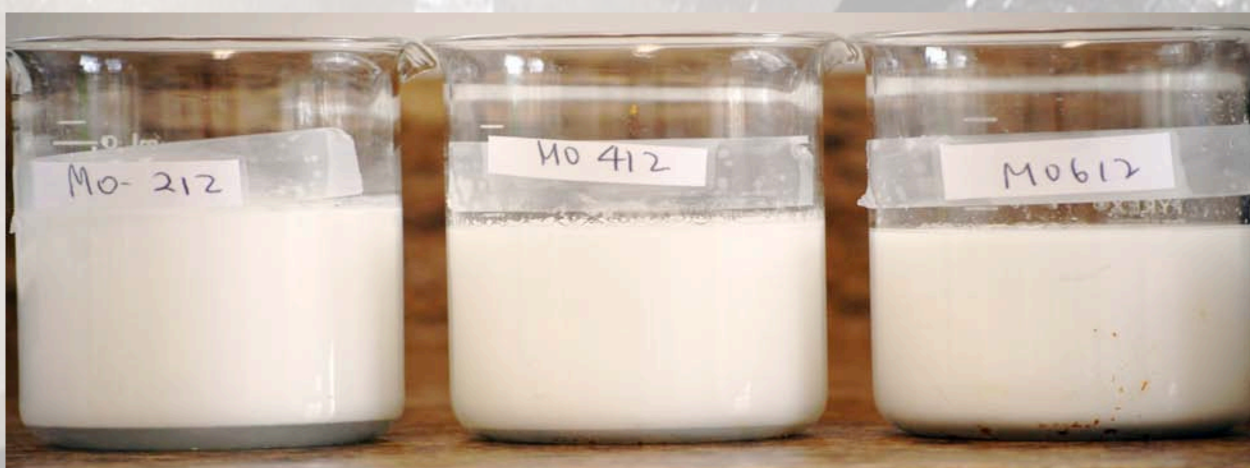
The process is repeated using blends of Silube J208-212 and Silube J208-412 until optimized. The material is then homogenized using commercial equipment.

Mineral Oil

Time = 0

J208- 212 **J208- 412** **J208- 612** **J208- 812**

Time = 3 hours



J208 - 212 **J208 - 412** **J208 - 812**

Time = 24 hours

J208- 212 J208- 412 J208- 612

Regular Emulsion Invert Emulsion

Soybean Oil

Time = 0 hours

J208- 212 J208- 412 J208- 612 J208- 812

Time = 3 hours

J208- 212 J208- 412 J208- 612 J208- 812

Time= 24 hours

J208- 212 J208- 412 J208- 612

Regular Emulsion Invert Emulsion

Cetyl Dimethicone

TIme= 0 hours

J-208-212 J-208-412 J-208-612 J-208-812

Time= 3 hours

J-208-212 J-208-412 J-208-612 J-208-812

Time= 24 hours

J-208-412 J-208- 612 J- 208- 812

Regular Emulsion Invert Emulsion

Emulsion Equipment

The examples given above do not make use of any high energy emulsification equipment. The making of emulsions includes not only the proper selection of a discontinuous phase, the proper selection of a continuous phase and an emulsifier, it will also include a number of additives like salt and processing aides, and includes high energy processing to provide small particle size. As previously stated, the smaller the particle size the more stable the emulsion. There are a number of high energy pieces of equipment that include;

Homogenizer

Homogenization is a mechanical treatment to lower particle size of the discontinuous phase brought about by passing the emulsion under high pressure through a tiny orifice, which results in a decrease in the average diameter and an increase in number and surface area, of the oil globules. The net result, from a practical view, is a much reduced tendency for separation. Three factors contribute to this enhanced stability: a decrease in the mean diameter of the globules (a factor in Stokes Law), a decrease in the size distribution of the globules (causing the speed of rise to be similar for the majority of globules such that they don't tend to cluster during creaming), and an increase in density of the globules (bringing them closer to the continuous phase).

Auguste Gaulin's patent in 1899 consisted of a 3 piston pump in which product was forced through one or more hair like tubes under pressure. It was discovered that the size of fat globules produced were 500 to 600 times smaller than tubes. The homogenizer consists of a 3 cylinder positive piston pump (operates similar to car engine) and homogenizing valve. The pump is turned by an electric motor through connecting rods and a crankshaft.

Colloid Mill

A colloid mill does its work by hydraulic shear, bringing to bear a tremendous amount of energy on a small portion of material in the form of a thin film. This action overcomes the strong polar forces which bind together small clumps of solids or which hold together drops of liquid. A colloid mill will not break down hard crystalline particles by fracturing them across the crystal planes as an impact type mill would do. It will, however, reduce these particles down to their ultimate crystal size by breaking up the agglomerates into which they form.

In the case of emulsions, the same principle holds. As the particles of the dispersed phase of the emulsion get smaller and smaller it requires progressively more energy to overcome the surface tension holding them together. Enormous hydraulic shear is needed to do the job and a colloid mill is an ideal means of accomplishing it.

Formulations

Soothing Cream

Formulation FC322

This is a creamy light water-in-oil emulsion that spreads easily and absorbs quickly. Its protective action is given by allontoin, Betaine 18-beta-glycirrhetinic acid, providing soothing, moisturizing and anti-reddening effect. The emollient oil phase contains shea butter, brassica abissinica oil and vitamin E acetate. The emulsifier, Silube J208-212, allows for the addition of high amounts of volatile silicone and of the silicone polymer, thereby giving the product an extremely soft touch.

Phase	Ingredient	INCI Name	%w/w
Part A	Deionized Water (+1% evaporation)	Aqua	59.70
	Glycerin	Glycerin	2.00
	Natural Extract AP (Danisco)	Betaine	1.00
	Ronacare Allantoin (Merck)	Allantoin	0.10
	Dissolvine GL 38 (Akzo)	Tetrasodium Glutamate Diacetate	0.30
Part A1	Carbopol Ultrez 10 (Noveon)	Carbomer	0.50
Part A2		Ammonium Acryloyl-Dimethyltaurate Copolymer	1.00
Part B	Marigold Oily Extract	Zea Mays Oil, Calendula Officinalis Extrac	1.00
	Lipex Shea	Butyrospermum Parkii Butter	1.00
	Abyssinian Oil (Fancor)	Crambe Abyssinica Seed Oil	1.00
	Eutanol G (Cognis)	Octyldodecanol	6.00
	Nexbase 2004 (Fortum)	Hydrogenated Polydecene	6.00
	Glycyrrhetinic Acid (Indena)	Glycyrrhetinic Acid	0.10
	Tocopheryl Acetate	Tocopheryl Acetate	0.30
	Silube J208-212 (Siltech)	Lauryl PEG-8 Dimethicone	5.00
	Phenoxyethanol	Phenoxyethanol	0.80
Part C	Siltech 1050	Dimethiconol Cyclopentasiloxane	2.00
	Cyclopentasiloxane	Cyclopentasiloxane	6.00
Part D	Deionized Water	Aqua	2.00
	Lactic Acid (sol. 80%)	Lactic Acid Aqua	0.15
	NaOH (sol. 10%)	Sodium Hydroxide Aqua	2.50
Part E	Deionized Water	Aqua	2.00
	Germall II (ISP)	Diazolidinyl Urea	0.25
Part F	Fress Area 131/ES 0702131/ES (M&M)	Parfum	0.30

Fluid Foundation

Formulation: FM600

This Fluid Foundation is easy to apply and dries quickly to a matte finish. It perfectly equalizes the skin color, while minimizing all imperfections. Silube J208-212 is used as an emulsifier to help optimize the dispersion of pigments, while increasing the layer resistance to humidity and sweat. Silube J208-212 also increases its long lasting effect, while the oils (Meadowfoam Seed Oil and Shea butter) provide emollients. Anti-aging actives (tripeptide with tensor effect) and moisturizers (hrehalose) are also part of this product.

Phase	Ingredient	INCI Name	%w/w
Part A	Deionized Water (1% evaporation)	Aqua	50.60
	Glycerin	Glycerin	4.00
	Trehalose 100 (Hayashibara)	Trehalose	0.20
	Dissolvine GL 38 (Akzo)	Tetrasodium Glutamate Diacetate	0.30
Part A1	Comixan ST/HV (Comiel)	Xanthan Gum	0.30
Part A2	Aristoflex AVC	Ammonium Acryloyl-Dimethyltaurate/VP Copolymer	0.30
Part B	Eutanol G (Cognis)	Octyldodecanol	8.00
	Fancol VB (Fancor)	Butyrospermum Parkii Butter Limnanthes Alba Seed Oil	4.00
	Lipex Shea	Butyrospermum Parkii Butter	2.00
	Silwax D221M (Siltech)	Cetyl behenyl dimethicone	3.00
	Silube J208-212 (Siltech)	Lauryl PEG-8 Dimethicone	8.00
	Tinogard TT (Ciba)	Pentaerythrityl Tetra-DI-T-Butyl Hydroxyhydrocinnamate	0.05
	Irgasan DP 300 (Ciba)	Triclosan	0.20
	Fenossietanolo	Phenoxyethanol	0.80
Part B1	Titanium Dioxide	CI 77891	10.00
	A 403 Tudor Oak	CI 77491, CI 77492, CI 77499	1.10
	A 407 Tudor Willow	CI 77491	1.45
Part C	Deionized Water	Aqua	3.00
	Germall II (ISP)	Diazolidinyl Urea	0.25
	Syn Coll (Pentapharm)	Glycerin Palmitoyl Tripeptide-5	0.30
Part D	Deionized Water	Aqua	2.00
	Lactic Acid	Lactic Acid	0.20
	NaOH	Sodium Hydroxide	0.06
Part E	Fleur de Pommier M040629 (Robertet)	Parfume	0.30

Sun Protection Cream

Formulation FS401

This is a facial water-in-oil sunscreen. It offers an SPF 20 protection against UV rays as well as photo-aging protection following UVA exposure. Thyme extract provides an additional protection from photo-induced irritation and so this product is especially suited for sensitive skin. By using Silube J208-612 as the emulsifier the perfect amount of zinc oxide is dispersed in this elegant product.

Phase	Ingredient	INCI Name	%w/w
Part A	Deionized Water (+1% evap)	Aqua	53.80
	NaCl	Sodium Chloride	1.00
Part B	DUB 12 15	C12-15 Alkyl Benzoate	10.00
	Eutanol G (Cognis)	Octyldodecanol	10.00
	Uvinul A Plus B (BASF)	Ethylhexyl Methoxycinnamate Diethylamino Hydroxybenzoyl Hexyl Benzoate	10.00
	Nomcort HK-G (Nisshin Oillio)	Glyceryl Behenate/Eicosadioate	3.00
	BHT	BHT	0.05
	Timo Estratto Liposolubile (L'Angelica))	Thymus Vulgaris Extract	1.00
	Silube J208-612 (Siltech)	Lauryl PEG-8 Dimethicone	6.00
Part C	Germaben II (Sutton)	Propylene Glycol Diazolidinyl Urea Methylparaben Propylparaben	1.00
Part D	Noce di Cocco e Menta 441/AP 0308441/ap (M&M)	Parfum	0.15
Part E	Z-Cote (BASF)	Zinc Oxide	5.00
			101.00

Appearance: Creamy, white emulsion
Viscosity: pH 10%: 5.0 – 6.3
25°C – Brookfield RVT-Helipath C

Procedure:

1. In the main mixer melt B at 70-75°C, then add A to B under slow mixing.
2. After complete addition of the water phase, homogenize.
3. Cool to 40°C while mixing and add C and D.
4. Disperse E and cool to room temperature under vacuum.

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Sunscreen Body Milk

Formulation FS402

This product is characterized by an emollient, but non-oily, feel. It is suitable for all skin types. Formulated with mineral and organic based UVA and UVB sunscreens it provides an average SPF 20. The moisturizing complex of xylitol, inositol and maltitol provides osmo-protection, while the aleo vera extracts provides protection from chapping. In this formula the Silube J208-412 emulsifier helps to optimally disperse the micronized titanium dioxide.

Phase	Ingredient	INCI Name	%w/w
Part A	Deionized Water	Aqua	57.05
	Glycerin	Glycerin	2.00
	Dissolve GL 38 (Akzo)	Tetrasodium Glutamate Diacetate	0.30
	Maltitolo 70	Maltitol	0.25
	Xylisorb 300 (Roquette)	Xylitol	0.50
	Inositol (Danisco)	Inositol	0.50
Part A1	Comixan ST/HV (Comiel)	Xanthan Gum	0.80
Part B	Parsol MCX (Res Pharma/DSM)	Ethylhexyl Methoxycinnamate	4.00
	Parsol 1789 (Res Pharma/DSM)	Butyl Methoxydibenzoylmethane	1.00
	Nexbase 2006 (Fortum)	Hydrogenated Polydecane	2.00
	Dermofeel BGC	Butylene Glycol Dicaprylated/Dicaprate	4.00
	Nomcort T.I.O. (Ikeda)	Triethylhexanoin	5.00
	Silube J208-412 (Siltech)	Lauryl PEG-8 Dimethicone	5.00
	Tocopheryl Acetate	Tocopheryl Acetate	0.10
	Nipagin M (Clariant)	Methylparaben	0.25
	Nipagin A (Clariant)	Ethylparaben	0.20
	Phenoxyethanol	Phenoxyethanol	0.80
	MT 100 Z (LCM)	Titanium Dioxide Aluminium Hydroxide Stearic Acid	10.00
Part C	Cyclopentasiloxane	Cyclopentasiloxane	3.00
Part D	Deionized Water	Aqua	2.00
	Lactic Acid (sol. 80%)	Lactic Acid Aqua	0.35
	NaOH (sol. 10%)	Sodium Hydroxide Aqua	0.60
Part E	Aloe Vera Gel	Aloe Barbadensis Gel	1.00
Part F	Drago Beta Glucan (Symrise)	Aqua Butylene Glycol Glycerin Avena Sativa Kernel Extract	1.00
Part G	Maddalena 781 0601781 (M&M)	Parfum	0.30

Appearance: Fluid, white emulsion

Viscosity: pH 5.1 – 5.5

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Aftershave Balm

Formulation: FX902

This Aftershave is formulated as a light, non-greasy emulsion that absorbs quickly providing a long-lasting protective effect. Characterized by an immediate perception of freshness, it leaves the skin feeling dry and silky. The innovative silicone emulsifiers provide a pleasant skin feel and a film-forming effect, with better performances than traditional systems.

Phase	Ingredient	INCI Name	%w/w
Part A	Deionized Water	Aqua	50.00
	Acqua Distillate Menta	Mentha Piperita Water	2.00
	Glycerin	Glycerin	3.00
Part A1	Artistoflex AVC (Clariant)	Ammonium Acryloyl-Dimethyltaurate/VP Copolymer	0.70
Part B	Sun 90 Plus Type CC (Oleochemie)	Helianthus Annuus Seed Oil	1.00
	Ceramide III (Degussa)	Ceramide 3	0.03
	OH-Isostearyl	Isostearyl Lactate	2.00
	Siltech F-100	Dimethicone	2.00
	Silube J208-212 (Siltech)	Lauryl PEG-8 Dimethicone	3.50
	Silube J208-412 (Siltech)	Lauryl PEG-8 Dimethicone	1.50
	BHT	BHT	0.05
	Irgasan DP 300 (Ciba)	Triclosan	0.20
Part C	Deionized Water (+1% evap.)	Aqua	25.12
Part D	Optiphen (ISP)	Caprylyl Glycol Phenoxyethanol	1.50
	Dragosantol (Symrise)	Bisabolol	0.10
	Fresh Woody 129 (M&M)	Parfum	0.30
Part E	Alcohol 96%	Alcohol Denat	8.00

Procedure:

1. Prepare A in the main mixer, under vacuum. Then add A1, heat to 70-75^{o}C while mixing and homogenizing until complete swelling.
2. Melt B at 70-75^{o}C , then add to A+A1. Homogenize.
3. Slowly add Phase C, then cool to 40^{o}C while mixing.
4. Add D and E. Cool to room temperature under vacuum.
5.

Appearance: Creamy, white emulsion

Viscosity: 25^{o}C-Brookfield RVT-Helipath pH: 5.0-5.4

SILICONE SPECTATOR

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