SCIENCE FOR FORMULATORS

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Review of silicone emulsifier selection

Abstract This is the fifth in the Science for Formulator series of related to silicone polymers (1-4). This article will deal with emulsions made using silicone based emulsifiers. Despite the large number of chemical classes of silicone polymers, there are several specific functional attributes that make silicone interesting in polymers used in personal care. It is these functional attributes of silicone, which are a direct result of their structure that is being examined in this series of articles. As formulators, we use silicone polymers (1), lower surface tension to levels not achievable with fatty based surfactants (2), provide outstanding spreadability (3), provide a highly prized aesthetic on the hair and skin and (4) are non-irritating. What is tremendously interesting in the formulation of emulsions, is not only are silicone based emulsifiers useful over the wide range of emulsion types (i.e. O/W and W/O) but recent studies indicate the emulsifier not the emollient provides 80% of the initial aesthetics to the emulsion (5). This means that consumer acceptance comes in large part by getting the aesthetics of the emulsifier used in the formulation right.

As pointed out in article 4, emulsification is a process that allows for the preparation of a **metastable single phase** of **two insoluble materials**. The preparation of cosmetically appealing 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. This article will deal with the nature of the emulsion and what factors affect the emulsion. This inclusion of silicone in the emulsifier provides a silicone like feel and can tremendously modify the aesthetics of the emulsion.

Group Opposites

The first requirement for making an emulsion is that it must be made up of at least two insoluble materials. This is due to the observation that if the two materials are soluble in each other, a solution is the result. Solutions are clear and can be prepared using any ratio of the two or more soluble liquids. The most commonly understood insoluble phases are oil and water. It is a standard phrase used commonly in ordinary speech that two people are like oil and water, they simply do not mix. We are all familiar with the separation of oil on top of water in salad dressing. The lowest free energy of the system is with the two phases separated from each other. This is due in part to the hydrogen bonding that is seen between water molecules and the fact that it takes energy to disrupt this organization with oil molecules.

Silicone is a third phase which like oil is insoluble in water, but at the same time is insoluble in oil. This third phase complicates our simple system of water and oil soluble. This model is even further complicated when one considers fluoro compounds which are insoluble in other three. When one talks of oil phase, a full description of the nature of the oil needs to be provided.

Hydrophobic Materials

Hydrophobic literally means water hating. By calling a material hydrophobic, we simply define a material by what it is not (water loving) not by what is. Hydrophobic materials can be soluble in silicone, oil, or fluoro phases that are all insoluble in water and each other. To really define the material an expanded vocabulary is needed. We have proposed the following (5);

Class	Definitions
Water insoluble	Lipophilic – Oil loving Siliphilic – Silicone loving Fluorophilic – Fluoro loving
Silicone insoluble	Lipophilic – Oil loving Hydrophilic – Water loving Fluorophilic – Fluoro loving
Fluoro insoluble	Lipophilic – Oil loving Siliphilic – Silicone loving Hydrophilic – Fluoro loving

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Figure 1 shows that silicone fluid, water and oil, when mixed together will separate into three distinct phases when the agitation ceases.

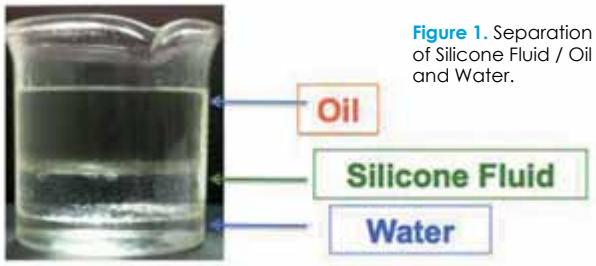


Figure 1. Separation of Silicone Fluid / Oil and Water.

Silicone Containing Emulsifiers

Since silicone fluid, water and oils are mutually immiscible in their pure state, the synthesis of surfactants that have each portion in one molecule will unique properties in terms of solubility, emulsification properties, and aesthetics. The exact properties will be determined not only by the ratio of each group, but the molecular weight of the polymer.

The properties of a molecule with a specific ratio of silicone soluble to water soluble to oil soluble is shown in figure 2.

Figure 2. Silicone Emulsifier Property Triangle.

The ratio of oil soluble, and silicone soluble groups relative to the water soluble groups will determine the emulsification properties. While there are some surfactants that lack the oil soluble group, having only water soluble and silicone soluble, the best emulsifiers have all three and will be the topic of thus paper.

Properly chosen silicone emulsifiers will allow for the efficient preparation of W/O W/Si O/W and Si/W emulsion. This is accomplished by altering the ratio of each group, silicone soluble, water soluble and oil soluble.

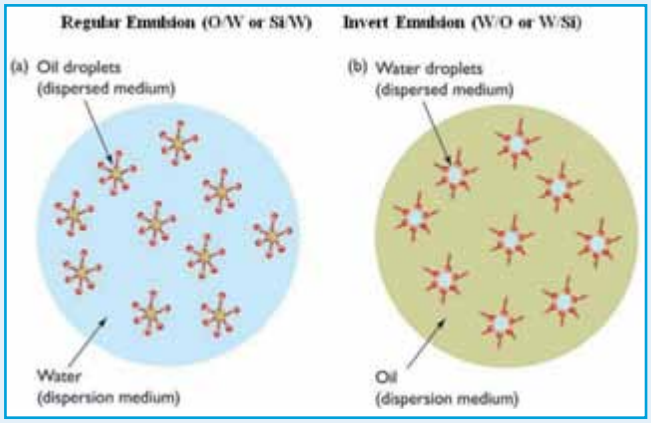
The presence of silicone in the emulsifier molecule results in unique properties. Since silicone emulsifiers lower surface tension, they increase spreadability and result in thin breathable films. Changing the emulsifier, rather than the emollient system, is by far the most effective tool for altering the aesthetics of topical formulations (6). This means that the make or break property from a marketing point of view, aesthetics, is a direct result of selection of the emulsifier.

Since the majority of the foundations use non-ionic invert silicone emulsifiers having a and a silicone elastomer (7), the importance of proper selection of the emulsifier is critical. The difficulty is that the most commonly used emulsifiers were developed almost 30 years ago, long before the importance of aesthetics was understood (8).

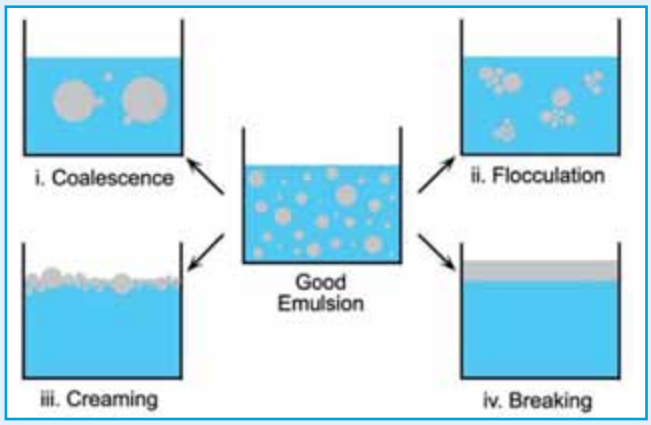
Leonardo da Vinci once said the simplicity is the ultimate sophistication (9). Achieving this sophistication in our formulation requires we fine tune all raw materials in a formulation to optimize aesthetics. As we undertake this project we need to start with the most generic structure of a silicone surfactant, and evaluate the different types of "R" groups and the effect of those variations on functionality.

Attaining simplicity in formulation requires a sophisticated emulsifier, and that in turn requires laboratory evaluation. The selection of emulsifier to provide the most elegant and consumer acceptable product depends upon (1) the type of emulsion (regular or invert), (2) the specific class of emulsifier with suitable "HLB", (3) the specific structure of the emulsifier for the proper aesthetics, and the processing technology for the preparation of the emulsion. This article will address (1) and (3) above in a variety of formulations.

Emulsion Types (10)

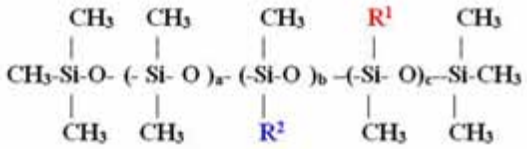


Emulsion Breaking Mechanisms (11)



Each of these mechanisms must be avoided. In order to be able to evaluate emulsifiers in a systematic way, there needs to be a generic emulsifier defined. It is from that generic species that specific species are defined.

Generic Silicone Emulsifier

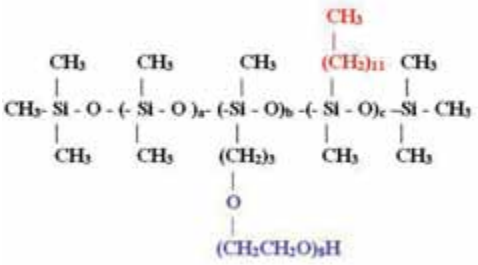


"D" Units – Silicone Soluble Groups (a Value)
R^1 Units – Oil Soluble Groups (c value)
R^2 Units – Water Soluble Groups (b value)

As "a" increases the spacing between groups "b" and "c" increase. A "larger more siliphyllic molecule changes the function of the emulsifier and the aesthetics.
These types of materials evaluated can be broken into groups based upon structure.

Specific Structures

Group 1 (12)
R^1 is a short alkyl group (C12)
R^2 is a short PEG group (PEG 8)

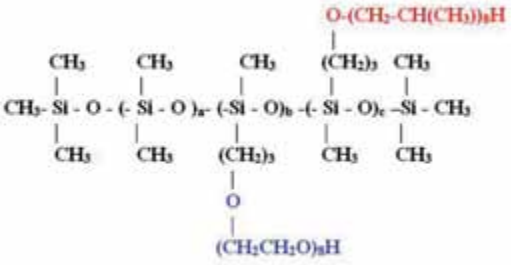


"D" Units – Silicone Soluble Groups (a Value)
R^1 Units – Oil Soluble Groups (c value)
R^2 Units – Water Soluble Groups (b value)

Group 1 is the workhorse emulsifier. The emulsifiers in this class are good general emulsifiers, and generally are the starting point for evaluation.

Product	Chemical Group	INCI Name	HLB Value	Emulsion Type
Silube J208-212	1	Lauryl PEG-8 Dimethicone	9.6	O/W, Si/W
Silube J208-212	1	Lauryl PEG-8 Dimethicone	7.8	O/W, Si/W
Silube J208-612	1	Lauryl PEG-8 Dimethicone	5.6	W/O
Silube J208-812	1	Lauryl PEG-8 Dimethicone	3.2	W/O

Group 2 (13)
R^1 is a short PPG group (PPG 9)
R^2 is a short PEG group (PEG 8)



"D" Units – Silicone Soluble Groups (a Value)
R^1 Units – Oil Soluble Groups (c value)
R^2 Units – Water Soluble Groups (b value)

This group features a polar hydrophobic group (polypropylene glycol). A polar hydrophobic group replaces the non-polar alkyl group in Group 1.

Product	Group	INCI Name	HLB Value	Emulsion Type
Silube J208-21	2	PEG/PPG-8/8 Dimethicone	8.4	O/W, Si/W
Silube J208-41	2	PEG/PPG-8/8 Dimethicone	6.0	O/W, Si/W
Silube J208-61	2	PEG/PPG-8/8 Dimethicone	3.8	W/O
Silube J208-81	2	PEG/PPG-8/8 Dimethicone	1.8	W/O

Group 3
R^1 is a high level of both PEG and PPG (16/16)
R^2 is non-polar alkyl (C12)

"D" Units – Silicone Soluble Groups (a Value)
R^1 Units – Oil Soluble Groups (c value)
R^2 Units – Water Soluble Groups (b value)

Product	Group	INCI Name	Emulsion Type
Silube J1015-O-212	3	Lauryl PEG/PPG 16/16 dimethicone	O/W, Si/W
Silube J1015-O-412	3	Lauryl PEG/PPG 16/16 dimethicone	O/W, Si/W
Silube J1015-O-612	3	Lauryl PEG/PPG 16/16 dimethicone	W/O
Silube J1015-O-812	3	Lauryl PEG/PPG 16/16 dimethicone	W/O

Group 4
R^1 is a short alkyl group (C12)
R^2 is a short PEG group (PEG 8)

"D" Units – Silicone Soluble Groups (a Value)
R^1 Units – Oil Soluble Groups (c value)
R^2 Units – Water Soluble Groups (b value)

Product	Group	INCI Name	HLB Value	Emulsion Applicable
Silube CR J208-412	4	Lauryl PEG 8 dimethicone	3	O/W, Si/W
Silube CR J208-612	4	Lauryl PEG 8 dimethicone	5	W/O

This group is like group 1 except it has higher values of "a" in the molecule.

FORMULATIONS

Foundation Formulation

Ingredients	FM619 .1	FM619 .2	FM619 .3	FM619 .4	FM619 .5	FM619 .6	FM619 .7	FM619 .8
Part A...	W/W%	W/W%	W/W%	W/W%	W/W%	W/W%	W/W%	W/W%
D.I. Water	46.23	46.23	46.23	46.23	46.23	46.23	46.23	46.23
Na_4EDTA	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Magnesium Sulphate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Glycerin	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Propylene Glycol	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Part B								
Silube CR J208-612	5.00	0	0	0	0	0	0	0
Silube J1015-O-612	0	5.00	0	0	0	0	0	0
Silube J1015-O-812	0	0	5.00	0	0	0	0	0
Silube J208-6I	0	0	0	5.00	0	0	0	0
Silube J208-8I	0	0	0	0	5.00	0	0	0
Silube J208-612	0	0	0	0	0	5.00	0	0
Silube J208-812	0	0	0	0	0	0	5.00	0
Silube T308-16	0	0	0	0	0	0	0	5.00
Silwax D02	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DC-200 Fluid, 50 cts	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50
Octyldodecanol	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Siltech CE-2000	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Cetiol Sensoft	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Siltech Gel Blend-1	4.50	4.50	4.50	4.50	4.50	4.50	4.50	4.50
Schercemol NGDO Ester	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Nrobee M5	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Poly C10-30 Alkyl Acrylate	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Bentone 38V	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Phenonip	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
BPD-500	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Talc	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Titanium Dioxide	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40
Iron Oxide Yellow	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Iron Oxide Red	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Iron Oxide Black	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
Part C								
Sodium Hyaluronate	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Wheat Protein	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Vitamin E Acetate	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Fragrance	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.	q.s.
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Procedure:

1. Into a cleaned and sanitized stainless steel tank equipped with a propeller mixer, add ingredients of Part A, mix until homogeneous. Then heat up to 75 ~ 80 C.
2. In another separate clean and sanitized vessel, add all the ingredients of Part B, heat 75-80C, blend well using B mix until uniform, and check pigment dispersions.
3. Add Part A into Part B slowly at 78 ~ 80 C under mixing, and continue stirring.
4. Keep the temperature at 78 ~ 80 C for 5 minutes and cool down to room temperature
5. Add the ingredients of Part C one by one and mix well.

Property	FM619.1 CR J208-612	FM619.2 J1015-O-612	FM619.3 J1015-O-812	FM619.4 J208-6I	FM619.5 J208-8I	FM619.6 J208-612	FM619.7 J208-812	FM619.8 T308-16
Viscosity (cps)	8,000	2,000	2,000	6,600	6,500	6,000	6,000	8,600
PH	6.56	6.52	6.57	6.36	6.45	6.52	6.45	6.55
Feel* (1-10, 10 the best)	9.1	9.2	9.2	9.0	9.2	9.1	9.1	9.0
Stability @ RT	Good	Good	Good	Not Good	Good	Good	Good	Good
Stability @ 45C	Stable	Stable	Stable	Not stable	Stable	Stable	Stable	Stable
Compatibility	Good	Good	Good	Not Good	Good	Good	Good	Good
Conclusion	Good	Good	Good	Not Good	Good	Good	Good	Good

- In terms of texture, skin feel and stability of the liquid foundation:
- Silube J1015-O-812; J1015-O-612 and Silube J208-8I, are the top three emulsifiers.
- Silube CR J208-612 is the strongest emulsifier in this formulation and had the best skin feel.
- Foundation formulated with Silube J1015-O-612 and 812 are particular useful in liquid foundation because both can form very thin fluid foundation (both foundations' viscosity are much thinner than the rest of foundation with other emulsifiers).

O/W CREAM

Ingredients	FC315.1 212	FC315.2 412	FC315.1 2I	FC315.2 4I	FC315.3 CR J208-412	FC315.4 J1015-O -212	FC315.5 si/J1015-O-412
Part A...	W/W%	W/W%	W/W%	W/W%	W/W%	W/W%	W/W%
D.I. Water	68.17	68.17	68.17	68.17	68.17	68.17	68.17
Pemulen TR2	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Na_4EDTA	0.10	0.10	0.10	0.10	0.10	0.10	0.10
DL-Panthenol	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Glycerin	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Propylene Glycol	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Part B							
Silube J208-212	3.50	0	0	0	0	0	0
Silube J208-412	0	3.50	0	0	0	0	0
Silube J208-2I	0	0	3.50	0	0	0	0
Silube J208-4I	0	0	0	3.50	0	0	0
Silube CR J208-412	0	0	0	0	3.50	0	0
Silube J1015-O-212	0	0	0	0	0	3.50	0
Silube J1015-O-212	0	0	0	0	0	0	3.50
Silwax D02	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Silmer Q25	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Silwax J219M	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Silwax D0-MS	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Microcrystalline Wax	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Soybean Oil	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Eutanol G	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Shea Butter	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Coco Butter	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Coconut Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Raspberry Seed Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Sunflower Seed Oil	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Phenonip	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Part C							
TEA	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Wheat Protein	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vitamin C	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Vitamin E Acetate	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Procedure:

1. Into a cleaned and sanitized stainless steel tank equipped with a propeller mixer, add TR-2 in D.I. water, mix until uniform.
2. Add the rest of ingredients of Part A one by one, mix until homogeneous. Then heat 75-80C.
3. In a separate clean and sanitized vessel, add all the ingredients of Part B, and heat mix well until uniform.
4. Add Part B into Part A slowly and continue stirring.
5. Keep the temperature at 75 ~ 80 C for 5 minutes and cool down until 65 C, then add TEA slowly and continue stirring and cool down to room temperature.
6. Add the rest of ingredients of Part C in the order and mix until uniform.

Property	FC315.1 212	FC315.2 412	FC315.1 2I	FC315.2 4I	FC315.3 CR J208-412	FC315.4 J1015-O 212	FC315.5 J1015-O 412
Viscosity(cps)	10,000	10,000	11,000	12,000	13,000	12,000	12,000
pH	6.12	6.11	6.12	6.20	6.15	6.18	6.17
Appearance	White Cream	White Cream	White Cream	White Cream	White Cream	White Cream	White Cream
Stability @ RT	Good	Good	Good	Good	Good	Good	Good
Stability @45 C	Good	Good	Good	Good	Good	Good	Good
Compatibility	Good	Good	Good	Good	Good	Good	Good

Part ID	Ingredients		Weight %
A	Water		57.25
	Glycerine		3.00
	Hydroxyl Ethyl Cellulose		0.85
	Disodium EDTA		0.20
B	Stearyl Alcohol		1.20
	Cetyl Alcohol		2.00
	EGDS		1.00
	Silmer Q25		4.00
	Silsoft Mo25		8.00
	Silwax D0-MS		8.00
	Silsurf D212-CG		10.10
	Silsurf CR J1015-O	(FH156A-1)	3.00*
	or Silsurf J1015-OAC	(FH156B-1)	
	or Silsurf J1015-O	(FH156C-1)	
	or Silube FF108-16	(FH156D-1)	
	or Silube CR J208-412	(FH156E-1)	
	or Silube J208-4I	(FH156F-1)	
	or Silube J1015-O-412	(FH156G-1)	
	or Silube J208-412	(FH156H-1)	
	or Silwax WD-IS	(FH156I-1)	
	or Silube J208-212	(FH156J-1)	
	or Silube J208-2I	(FH156K-1)	
	or Silube J1015-O-212	(FH156L-1)	
C	Wheat Protein		1.00
	Citric Acid		q.s.
	DMDM Hydantoin		0.40
	Total		100.00

* Usage level is 3% for all the emulsifiers above.

Silube J208-2I, 4I and Silube J1015-O-412 are the top three emulsifiers in this kind of emulsions in terms of texture, skin feel and stability.

Procedure: 1. Combine Part A heat up to 75 C. 2. Combine Part B and heat up to 75 C under mixing. 3. Add Part B into Part A at 75 C very slowly under mixing. 4. After 10 minutes, cool batch to RT by cold water. 5. Add Part C one by one under mixing. Adjust pH around 6.5 citric acid.

Product	Viscosity	pH	Appearance	Stability At RT	Stability @ 45C	Feel (1 to 10, 10 is the best)	Compatib
FH156A-1 CR J1015-O	14,500	6.39	White cream	Little bit separatic after 1 month	Separated after 1 day	9.00	Not good
FH156B-1 J1015-OAC	14,600	6.42	White cream	Little bit separatic after 1 month	Separated after 1 day	9.00	Not good
FH156C J1015-O	14,000	6.50	White cream	Little bit separatic after 1 month	Not good	9.00	Not good
FH156D-1 FF108-16	13,000	6.45	White cream	Little bit separatic after 1 month	Not good	9.00	Not good
FH156E-1 CR J208-412	14,800	6.51	White cream	Little bit separatic after 1 month	Not good	9.10	Good
FH156F-1 J208-4I	16,000	6.52	White cream	Good	Good	9.10	Good
FH156G-1 J1015-O-412	14,000	6.45	White cream	Good	Good	9.10	Good
FH156H-1 J208-412	20,000	6.48	White cream	Good	Good	9.20	Good
FH156I-1 WD-IS	15,000	6.47	White cream	Good	Good	9.10	Good
FH156J-1 J208-212	25,000	6.50	White cream	Good	Good	9.20	Good
FH156K-1 J208-2I	20,000	6.53	White cream	Good	Good	9.10	Good
FH156L-1 J1015-O-212	10,000	6.49	White cream	Good	Good	9.10	Good

- Silube J208-4I, 2I, Silube J208-412, 212, Silube J1015-O-212, and 412 are the top emulsifiers in this series of emulsions in terms of texture, skin feel and stability

Emulsifier	W/O Foundation (FM619)	O/W Cream (FC315/342)	S/W Emulsion (FH156)	W/O Sunscreen (FS409)	O/W+E Emulsion (FS211)	W/O Foundation (FM619)	W/O Cream (FC338)
Standard							
Silube J208-212		V/V	V		V		
Silube J208-412		V/V	V		V		
Silube J208-412	V			V		V	V
Silube J208-812	V			V		V	V
EO/PO							
Silube J208-2I		V/V	V		V		
Silube J208-4I		V/V	V		V		
Silube J208-4I				V			
Silube J208-8I	V			V		V	
EO/PO Alkyl							
Silsurf J1015-O			V				
Silube J1015-O-212		V/V	V		V		
Silube J1015-O-412		V/V	V		V		
Silube J1015-O-612	V			V		V	V
Silube J1015-O-812	V			V		V	V
More D Units							
Silube CR J208-412		V/V	V		V		
Silube CR J208-612	V			V		V	V
Silsurf CR J1015-O			V				

CONCLUSIONS

Leonardo Da Vinci observation that "simplicity is the ultimate sophistication" is correct, but the process of picking the proper emulsifier for a personal care formulation to have simplicity, is a complicated process. The successful formulation that is an elegant simple formulation that will excite consumers. The simpler the formulation the more complex the search for the best formulation. The formulator should strive the obtain the simplest formulation.

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SUN PROTECTION CONFERENCE 2017

SUN EXPOSURE VS PROTECTION: GETTING THE RIGHT BALANCE?

6-7 JUNE 2017

Royal College of General Practitioners, 30 Euston Square, London, UK

The Sun Protection Conference will focus on strategies relating to the benefits of unprotected skin exposure and protection against short and long term skin damage from the sun. For years sun protection and avoidance have been the strategies promoted by dermatologists, governments and industry, even though we all derive certain benefits from the sun.

Programme

Programme Director: Dr Jack Ferguson, Skinnovation Ltd, UK

Tuesday 6 June

Session 1: Sun exposure: The benefits and detriment

Keynote: The Yin and Yang of sun exposure: achieving a balance for good health
Professor Robyn Lucas, The Australian National University, Australia

Can we maintain the benefits of sunlight exposure while retaining full protection from potential damaging deleterious effects?
Dr Michael Finnen, RelaxSol Ltd, Edinburgh, UK

The need for broad protection in sun care: a focus on high energy visible and infra-red light
Dr Amy Goddard, Croda, UK

Infra-red: Assessment of hazard and risk to the skin
Benoit Cadars, Bioderma, France

In-use SPF protection efficacy of daily skin care: A comparative study
Dr Joshua Williams, Johnson & Johnson, USA

Keynote: Who are we serving? The desperate need for impeccable public education in sun protection!
Professor Paul Matts, Procter & Gamble, UK

Session 2: Sun exposure: The variability and improvements in sun protection measurement techniques

Intertaboratory variability of in vivo SPF
Sébastien Miksa, Helioscreen, France

On the way for the SPF in vitro validation
Dr Marc Passavini, Coty, France

In vivo SPF variability: The importance of erythema assessment in the reliability of SPF
Dr Caroline Tricaud, L'Oréal, France

HDRS (Hybrid Diffuse Remission Spectroscopy) SPF
Dr Mathias Rohr, Institut Schrader, Germany

Tolerability and efficacy of sunscreen products under conditions of sweating and physical activity
Dr Stephan Bielfeldt, proDERM, Germany

Changes to SPF test ISO 24444 – Why and when?
John Staton, Dermatest Pty, Australia

Wednesday 7 June

Session 3: Current topics in Regulatory and safety of sunscreens

Are US FDA Safety Requirements for GRAS(E) status of new UV filters unreasonable?
Dr Jay Nash, Procter & Gamble, USA

Titanium Dioxide – A safe ingredient for cosmetics
Dr Frank Pfluecker, Merck, Germany

Nano – A challenge for industry!
Mechtild Peterson-Thiery, BASF, Germany

Session 4: New concepts in sun exposure and protection

Enhancing Skin UV Protection using the unique photochemical properties of the Endogenous Natural Folates
Steven Bailey, Department of Pharmacology, University of South Alabama

Cyclobutane Pyrimidine Dimers, NADPH Oxidase and Peroxynitrite: How are they all interlinked?
Dr Ratan K. Chaudhuri, Sytheon Inc, USA

NAD and sun damage
Dr John Oblong, Procter & Gamble, USA

New approach to develop optimized sunscreens enabling dermal vitamin D formation with minimal erythema risk
Dr Bernd Herzog, BASF, Germany

Cutaneous pigmentation effect of blue light. Are UVA and UVB tests enough for sun protection claim?
Jessen Curpen, CIDP, Mauritius

Session 5: Sun protection technologies and measures to improve product performance

Marine mycosporine like amino acids (MAA) – biocompatible sunscreens from nature
Professor Antony Young, Kings College, UK

Segregation of individual sunscreen constituents related to application procedure and substrate probed by Raman confocal microscopy
Dr Jürgen Vollhardt, DSM, Switzerland

Anti-inflammatory activity of sun care products
Dr Ludger Kolbe, Beiersdorf, Germany

The sun- our shared primary reference light source for sunscreen efficacy
John Staton, Dermatest Pty, Australia

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