



Formulator Report: Benefits of Floramac® 10 in Sunscreens



Floramac 10 [INCI: Ethyl Macadamiate] is a unique emollient that can be utilized in a variety of cosmetic and personal care formulations including creams / lotions, sunscreens¹, moisturizers, serums, color cosmetics, and hair care products. Its dry emolliency gives it a skin feel similar to that of cyclopentasiloxane, without the volatility. **Floramac 10** can be gelled to mimic the skin feel of other silicones, but is also miscible² in silicones such as cyclopentasiloxane, dimethicones (<100 cst), and phenyl trimethicone. It can easily work as a silicone alternative, or in conjunction with silicones in a finished formula. With its low slip and high spread, its physical behavior is similar to that of isopropyl myristate.³ Furthermore, its inherent refractive index (1.44) lends to its ability to provide shine and gloss when used in leave-on products. In addition to benefits associated with product aesthetics, **Floramac 10** is also functional within a formulation, assisting in the dispersion and solubilization of sunscreens, and boosting the SPF of inorganic sunscreens, as this report will describe.

Botanically-derived **Floramac 10** is EU and China REACH compliant, TGA approved, and listed on AICS.

Formulation Benefits:

- Boosts SPF of inorganic sunscreens
- Assists in the dispersion and solubilization of sunscreens
- Dry emolliency
- Compatible with oils, volatile and non-volatile silicones
- Non-comedogenic
- Botanically-derived
- Allows for silicone-free claims
- Non-volatile
- High spread and low viscosity
- Tolerant of pro-oxidative environments
- Biodegradable⁴

SPF Boosting of Inorganic Sunscreens⁵:

In a double-blind, static SPF study, the sunscreen containing 12% **Floramac 10**:

- Boosted SPF by 13% more than the sunscreen with 5% Floramac 10 (**Figure 1**)

Dispersion of Titanium Dioxide⁶:

In a double-blind, vehicle-controlled, dispersion study, **Floramac 10** produced the following benefits:

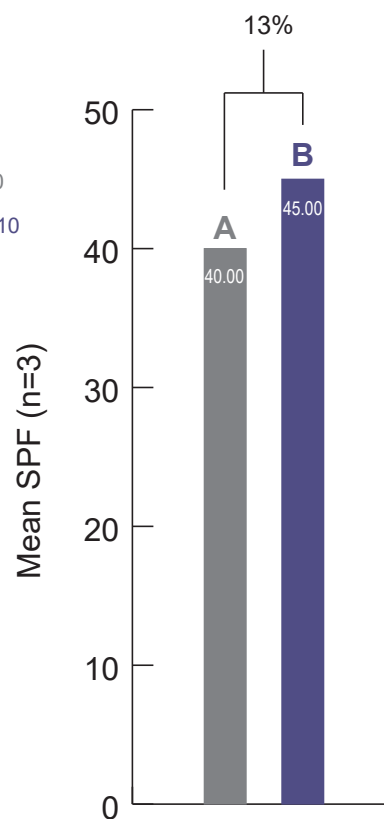
- Assisted in the dispersion of titanium dioxide in a sunscreen formula better than the other emollients⁷ without the inclusion of a dispersing agent (**Table 1**)
- Reduced the size of undispersed particles, and created a more uniform dispersion without the aid of a dispersing agent (**Figure 2**)

Solubility of Avobenzone and Benzophenone-3⁶:

In a double-blind, vehicle-controlled, solubility study, **Floramac 10** produced the following benefits:

- **Floramac 10** assisted in solubilizing Avobenzone and Benzophenone-3 in a similar manner as Finsolv TN (**Tables 4 and 5**)

Figure 1. Static SPF



1. Cargill has not tested Floramac 10 in final OTC drug formulations. Compliance with FDA regulations is the responsibility of the customer.

2. Miscibility is defined as a 50:50 mixture remaining clear and homogenous at room temperature after sitting overnight.

3. See The Importance of Slip and Spread (MKT12) for more information.

4. Biodegradable according to OECD 301B.

5. The study was conducted by Eurofins CRL on 4 separate panels, with a total of 12 male and female subjects aged 25-62 for static SPF testing (n=3 per test article). Testing was conducted according to the US FDA Final Rule; 21 CFR Parts 201 and 310. Final reports available upon request.

6. Final Reports available upon request. Figures and Tables can be found on the next two pages of this document.

7. Other emollients include the following: Caprylic/Capric Triglyceride Oil (CCT), Coco-Caprylate (CC), Cyclopentasiloxane (CPS), Finsolv TN (FTN), and Isopropyl Myristate (IPM).

Improved Dispersion of Titanium Dioxide with Floramac 10:

Sunscreen formulas containing 7.5% dimethicone-treated titanium dioxide⁸ pre-dispersed with 5% of each of the tested emollients, were prepared with and without the dispersing agent (DA) polyhydroxystearic acid. One application (0.2ml) of each formula was placed on and scraped across the Fineness of Grind Gage,⁹ and particle quantity was determined by counting the total number of undispersed particles (Table 1). Additionally, the number of particles between each Mills marker was also determined. (Mills markers are associated with micron size of undispersed particles. See Table 3 for micron sizes.) The counted particles were then used to calculate the percentage of large undispersed particles (*i.e.* >50.8 microns) relative to the vehicle (Figure 2).

Figure 2. Percentage of Large Undispersed Particles (>50.8 microns)

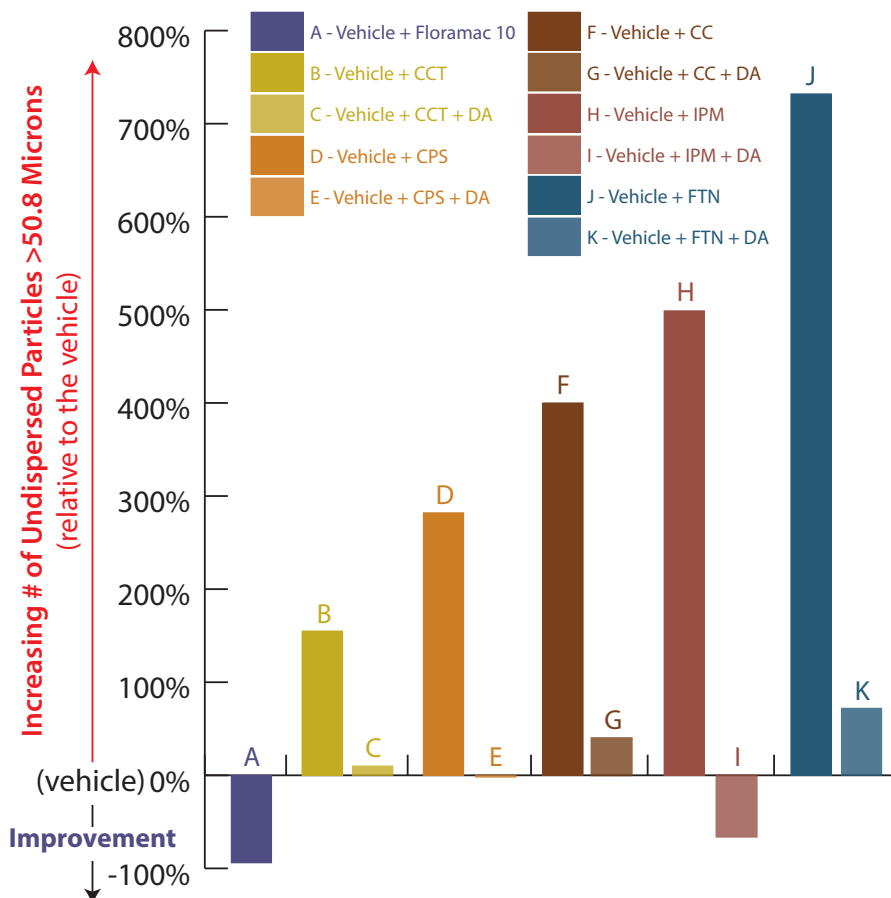


Figure 2. The test article containing 5% **Floramac 10** produced fewer large (>50.8 microns) undispersed particles than any other emollient both with and without a dispersing agent.

Table 1. Undispersed Particle Counts (total number)

Test Emollient	Undispersed Particle Count
Vehicle	233
A - Vehicle + Floramac 10	46
B - Vehicle + CCT	954
C - Vehicle + CCT + DA	1393
D - Vehicle + CPS	1252
E - Vehicle + CPS + DA	1271
F - Vehicle + CC	1581
G - Vehicle + CC + DA	1805
H - Vehicle + IPM	1350
I - Vehicle + IPM + DA	298
J - Vehicle + FTN	2266
K - Vehicle + FTN + DA	1933

Table 1. The test article containing 5% **Floramac 10** produced fewer total undispersed particles than any other emollient both with and without a dispersing agent.

Table 2. Sunscreen Formula

Trade Name	INCI Name	Supplier	% wt./wt.
Finsolv® TN	C12-15 Alkyl Benzoate	Innospec Performance Chemicals	8.00
Amphisol® K	Potassium Cetyl Phosphate	DSM Nutritional Products	3.00
Crodacol® CS-50	Cetearyl Alcohol	Croda, Inc.	1.00
Test Emollient	Emollient	Emollient	0.00 or 5.00
Hostacerin® SFO	Sunflower Seed Oil Sorbitol Esters	Clariant Corporation	2.00
Dispersun DSP-OL100	Polyhydroxystearic Acid	Innospec Performance Chemicals	0.00 or 1.00
Phenonip®	Phenoxyethanol (and) Methylparaben (and) Ethylparaben (and) Butylparaben (and) Propylparaben (and) Isobutylparaben	Clariant Corporation	0.80
Hallbrite® T-97	Titanium Dioxide (and) Dimethicone	The HallStar Company	7.50
Pemulen® TR-1	Acrylates / C10-30 Alkyl Acrylate	The Lubrizol Corporation	0.10
Polymeric Emulsifier	Crosspolymer		
Glycerin	Glycerin	The Dow Chemical Co.	1.00
Floraesters K-20W® Jojoba	Hydrolyzed Jojoba Esters (and) Water (aqua)	Floratech	5.00
Deionized Water	Water	---	q.s.
		Total	100.00

Table 3. Mills Markers

Mils Marker	Particle Size Range (microns)
3-4	76.2-101.6
2-3	50.8-76.2
1-2	25.4-50.8
0-1	<25.4

8. Hallbrite T-97, INCI: Titanium Dioxide (and) Dimethicone (The HallStar Company).

9. The Fineness of Grind Gage (*i.e.* an apparatus that allows for quantification of particle size) is a product of Precision Gage & Tool Company (Dayton, Ohio).

Improved Solubility of Sunscreens with Floramac 10:

Avobenzone¹⁰ and Benzophenone-3¹¹ were mixed at a 10% concentration by hand into each test emollient at room temperature (RT). Solutions rested at room temperature for one hour before solubility evaluations were conducted: soluble (S) or insoluble (IS, *i.e.* visually apparent crystallization). If the sunscreen was insoluble at room temperature, the solution was slowly heated to 70°C with mixing (stir bar) and additional solubility evaluations were conducted. Solutions then rested at room temperature for seven hours to determine if the sunscreens would remain soluble when the solution cooled down to room temperature. Sunscreen concentrations were increased in intervals of 5% until sunscreens were insoluble at room temperature after being heated to 70°C.

Table 4. Solubility of Avobenzone

Sunscreen concentration in Floramac 10	RT	70°C (initial)	70°C (7 hours)	Sunscreen concentration in Finsolv TN	RT	70°C (initial)	70°C (7 hours)
10%	IS	S	S	10%	IS	S	S
15%	IS	S	S	15%	IS	S	S
20%	IS	S	S	20%	IS	S	S
25%	IS	S	IS	25%	IS	S	S

Table 4. Avobenzone was soluble in both Floramac 10 and Finsolv TN (with heat) up to a concentration of 25%. Additionally, Avobenzone was soluble in Floramac 10 (with heat followed by cooling) up to a concentration of 20%.

Table 5. Solubility of Benzophenone-3

Sunscreen concentration in Floramac 10	RT	70°C (initial)	70°C (7 hours)	Sunscreen concentration in Finsolv TN	RT	70°C (initial)	70°C (7 hours)
10%	IS	S	S	10%	IS	S	S
15%	IS	S	S	15%	IS	S	S
20%	IS	S	IS	20%	IS	S	IS

Table 5. Benzophenone-3 was soluble in both Floramac 10 and Finsolv TN (with heat) up to a concentration of 20%, and with heat followed by cooling up to a concentration of 15%.

Summary:

The solubility of sunscreen actives is important to formulation stability, and thusly the maintenance of the SPF of a sunscreen over time. This often requires dispersion or solubilization of sunscreen actives in an emollient prior to addition to the rest of the formulation. This helps to ensure the formulation is initially homogeneous and remains so over time.

Most sunscreen formulations include both organic and inorganic sunscreen actives. **Floramac 10** can be used to facilitate the incorporation of either type into sunscreen formulations. Additionally, it provides a dry, silky emolliency to the finished formula, similar to that of cyclopentasiloxane. However, due to its lack of volatility, unlike cyclopentasiloxane, **Floramac 10** remains on the skin and imparts a degree of skin hydration greater than traditional silicones.

10. Parsol® 1789 (Avobenzone) INCI: Butyl Methoxydibenzoylmethane (DSM Nutritional Products).

11. Eusolex® 4360, INCI: Benzophenone-3 (EMD Chemicals).

Formula: Zinc Oxide & Titanium Dioxide Pre-Sun Lotion with Emulsun¹²

This versatile lotion with mineral sunscreen actives provides even coverage and superior protection without drying the skin. Floramac 10 evenly disperses the zinc oxide and titanium dioxide particles for maximum coverage while Floraesters® K-20W Jojoba helps form a water-resistant barrier for lasting protection. This expert blend of Floratech botanical ingredients also gives the added benefits of increased skin hydration, enhanced barrier function, and increased sunscreen retention.

Phase	Trade/Common Name	INCI Name	Manufacturer	% wt./wt.
A	Deionized Water	Water	----	q.s.
	Dissolvine® GL-47-S	Tetrasodium Glutamate Diacetate	Nouryon	0.10
	Keltrol® CG-T	Xanthan Gum	CP Kelco	0.30
	Sunspheres® LCG	Styrene/Acrylates Copolymer	The Dow Chemical Co.	5.00
B	UV Cut ZnO-50-W	Zinc Oxide (and) Water (and) Glycerin (and) Sodium Polyacrylate (and) Phenoxyethanol (and) Xanthan Gum (and) Chlorphenesin	Grant Industries	25.00
C	Floramac 10	Ethyl Macadamiate	Floratech	8.00
	Floramac Macadamia Oil Refined	Macadamia Integrifolia Seed Oil	Floratech	0.50
	Floralipids® Moringa Oil Refined	Moringa Oleifera Seed Oil	Floratech	0.50
	L22®	Jojoba Oil/Macadamia Seed Oil Esters (and) Squalene (and) Phytosteryl Macadamiate (and) Phytosterols (and) Tocopherol	Floratech	0.50
	Pelemol® IN-2	Isononyl Isononanoate	Phoenix Chemical, Inc.	4.00
	Vitamin E Acetate	Tocopheryl Acetate	Essential Ingredients	0.20
	Emulsun®	Hydrogenated Sunflower Seed Oil Polyglyceryl-3 Esters (and) Hydrogenated Sunflower Seed Oil Glyceryl Esters (and) Cetearyl Alcohol (and) Sodium Stearoyl Lactylate	Floratech	6.50
D	Covascreen UVR CCT	Caprylic/Capric Triglyceride (and) Titanium Dioxide (and) Triethoxycaprylylsilane	Sensient Cosmetic Technologies	6.00
E	Glycerine 99.7% USP Kosher	Glycerin	Acme-Hardesty Co.	2.50
	Floraesters K-20W® Jojoba	Hydrolyzed Jojoba Esters (and) Water (Aqua)	Floratech	1.00
F	Preservative ¹³	----	----	q.s.
	Citric Acid, USP (30% Solution)	Citric Acid (and) Water	Archer Daniels Midland Co.	q.s.
			Total	100.00

Procedure:

- Mix the Dissolvine GL-47-S into the deionized water of Phase A using moderate propeller agitation. Add the Keltrol CG-T and heat to 75-80°C. Once the Keltrol CG-T is fully hydrated, add the remaining ingredients of Phase A.
- Add Phase B to Phase A with moderate propeller agitation at 50-60°C.
- Heat Phase AB to 75-80°C.
- Mix Phase AB with homomixing agitation at 75-80°C.
- Once Phase AB is uniform, shift to moderate propeller agitation at 75-80°C.
- In a separate vessel, combine all ingredients of Phase C except Emulsun. Heat to 75-80°C with moderate propeller mixing until uniform.
- When the mixture becomes uniform, add Emulsun and continue mixing until uniform.
- Heat the Covascreen UVR CCT of Phase D to 75-80°C.
- Add Phase D to Phase C with moderate propeller agitation at 75-80°C.
- Add Phase CD to Phase AB with moderate propeller agitation at 75-80°C.
- When the mixture becomes uniform begin cooling to 55-60°C.
- In a separate vessel, mix all ingredients of Phase E at room temperature until uniform. Add Phase E to Phase ABCD at 55-60°C with moderate propeller agitation.
- Add Phase F, in the order listed, to Phase ABCDE at 50-55°C with moderate propeller agitation.
- Stop mixing at 40-45°C.

Ingredient Information

24/7 Online

iLabel®
www.floratech.com/info



Floramac 10

Formula Properties:

Property	Result
pH	8 - 9
Viscosity	100 - 255kcP
Mean SPF (n=3) ¹⁴	34.89

12. INCI/Trade names must be verified with each manufacturer.

13. Preservative: Euxyl® PE 9010 [INCI: Phenoxyethanol (and) Ethylhexylglycerin] supplied by Schülke & Mayr

14. 12. The clinical study of S013 was conducted by Eurofins CRL Inc. on a panel with a total of 3 male and female subjects aged 31-33 for static SPF testing. Testing was conducted according to the US FDA Final Rule; 21 CFR Parts 201 and 310. Final Report available upon request.