



Synopsis:

Pigment wetting is the first step of dispersing a pigment in formulation. Sufficient wetting is crucial; this involves surrounding the pigment particles in liquid instead of air to reduce surface tension, before proceeding with steps such as milling. Once a pigment is wet, it must then be dispersed, to remove agglomerates and reduce flocculation (*i.e.* particles are separated from one another). Stabilization of the dispersion keeps pigments properly suspended throughout the lifetime of a formulation.

Floratech emollients such as **Floramac® 10** [INCI: Ethyl Macadamiate], **Floraesters® IPJ** [INCI: Isopropyl Jojobate (and) Jojoba Alcohol (and) Jojoba Esters], **Floraesters 15** [INCI: Jojoba Esters], **Floramac Macadamia Oil Refined** [INCI: Macadamia Integrifolia Seed Oil], and **Florasun® 90** [INCI: Helianthus Annuus (Sunflower) Seed Oil] are suitable options for color cosmetics and other pigmented systems to both wet and stabilize pigment dispersions. Additionally, Floratech emollients are useful for such systems due to their inherent oxidative stability.

Floramac 10, Floraesters IPJ, Floraesters 15, Floramac Macadamia Oil Refined, and Florasun 90 are sustainable and EU and China REACH compliant. Floraesters 15, Floramac Macadamia Oil Refined, and Florasun 90 are Cosmos certified.

Floratech Emollient Profile

Floratech emollients were compared relative to one another for a variety of sensory attributes and categorized by low, medium, and high (see Table 1).

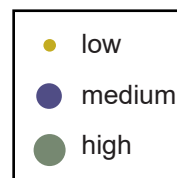


Table 1. Emollient Profile

Sensory Attribute	Floramac 10	Floraesters IPJ	Floraesters 15	Floramac Macadamia Oil Refined	Florasun 90
Color / Odor	clear to pale yellow / none	clear to pale yellow / none	clear to pale yellow / none	clear to pale yellow / none	clear to pale yellow / none
Pigment Wetting	●	●	●	●	●
Pigment Dispersion Stability	●	●	●	●	●
Oxidative Stability ¹	●	●	●	●	●
Slip ²	●	●	●	●	●
Spread ²	●	●	●	●	●
Absorption	●	●	●	●	●
Gloss	●	●	●	●	●
Occlusivity	●	●	●	●	●
Viscosity	●	●	●	●	●

Conclusions:

Floratech emollients can be used in a variety of pigmented systems, depending on the finished product category, skin feel, and desired attribute.

1. MKT15 (Improve Shelf Life of Finished Formulations) available upon request.
2. MKT12 (The importance of Slip and Spread) available upon request.













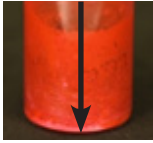
Technical Report: Pigment Wetting and Dispersion Stability

Visual Pigment Wetting Methodology³:

The pigment blend⁴ was added to a vial followed by the emollient for a total of 15 grams (40% pigment blend + 60% emollient). Vials were allowed to rest for 2 hours undisturbed and images were captured (Table 2).

Improved Pigment Wetting with Floratech Emollients

Table 2. Visual Pigment Wetting (2 hours)

Floramac 10	Floraesters IPJ	Floraesters 15	Floramac Macadamia Oil Refined	Florasun 90
				
Diisostearyl Malate	Octyldodecanol	Pentaerythrityl Tetraisostearate	C12-15 Alkyl Benzoate	The arrows indicate dry pigment (<i>i.e.</i> pigment that has not been sufficiently wet by an emollient).
				
Caprylic/Capric Triglyceride	Castor Oil	Cyclopentasiloxane	Dimethicone	
				

Conclusions:

All of the Floratech emollients visibly wet the pigment within 2 hours of contact.

³. Final Report AR-008, which includes complete methodologies for all pigment wetting and dispersion stability studies, is available upon request.

⁴. The pigment blend consisted of the following pigments: Titanium Dioxide (45.5%), Iron Oxide Yellow (27.3%), Red 7 Lake (22.7%), and Red 6 Lake (4.5%).

Technical Report: Pigment Wetting and Dispersion Stability

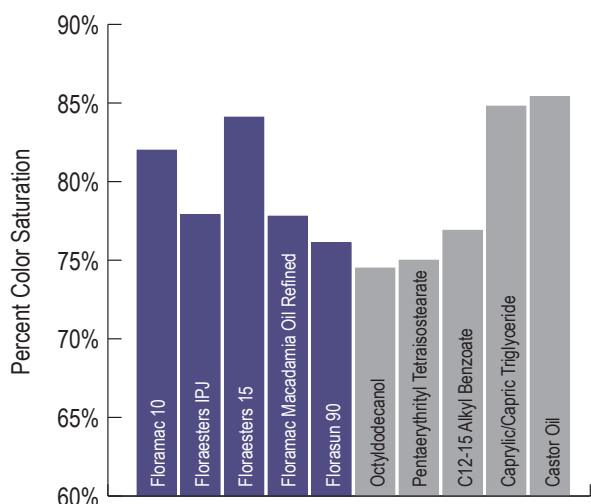
Color Saturation (Pigment Wetting) Methodology:

The pigment blend was added to a beaker followed by the emollient for a total of 60 grams (40% pigment blend + 60% emollient), and allowed to rest for 24 hours undisturbed. The mixture was then mixed by hand at room temperature until uniform, and placed on a 3 roll roller mill and rolled through 4 times. One milliliter of each mixture was pipetted onto parchment paper, covered with clear plastic wrap, and color measurements were taken in triplicate using a Colorimeter CL400. Percent color saturation was determined for each emollient [$s = \sqrt{(a^2+b^2)}/L$] (Figure 1).

Diisostearyl Malate, Cyclopentasiloxane, and Dimethicone were too thick to roller mill after being mixed with the pigment, indicating they may not be the most suitable emollients for pigment wetting and dispersion stability.

Improved Pigment Wetting with Floratech Emollients

Figure 1: Pigment Wetting (Saturation)



Conclusions:

Floramac 10 and Floraesters 15 resulted in **higher color saturation**, which is indicative of **better pigment wetting**.

Improved Pigment Dispersion Stability with Floratech Emollients

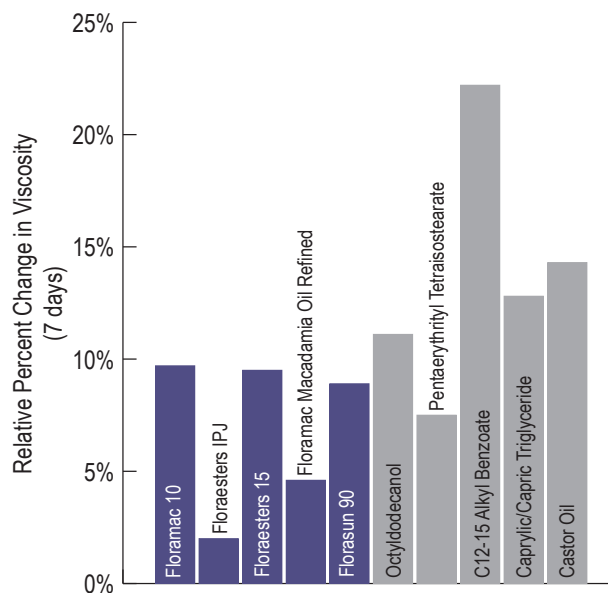
Pigment Dispersion Stability Methodology:

The pigment blend was added to a beaker followed by the emollient for a total of 60 grams (40% pigment blend + 60% emollient), and allowed to rest for 24 hours undisturbed. The mixture was mixed by hand at room temperature until uniform, and then placed on a 3 roll roller mill and rolled through 4 times. Viscosity measurements were taken of each mixture immediately after milling, and 7 days after milling (Figure 2). A change in viscosity over time is indicative of pigment agglomeration.

Conclusions:

Floraesters IPJ and Floramac Macadamia Oil Refined resulted in **smaller viscosity changes over time**, which is indicative of **less pigment agglomeration**.

Figure 2: Dispersion Stability (Viscosity)





Technical Report: Pigment Wetting and Dispersion Stability

Pigment Dispersion Stability Methodology:

The pigment blend was added to a beaker followed by the emollient for a total of 60 grams (40% pigment blend + 60% emollient), and allowed to rest for 24 hours undisturbed. The mixtures were mixed by hand at room temperature until uniform, and then placed on a 3 roll roller mill and rolled through 4 times. Each mixture (10ml) was allowed to rest in a vial for **24 hours** undisturbed. Each mixture (10ml) was also **centrifuged** at 3400rpm for 1 minute. Additionally, each mixture was propeller mixed at 450rpm until uniform, **heated** to 50°C, and allowed to rest in a vial (10ml) for up to 24 hours undisturbed.

Separation was noted in each case, and a lack of separation is noted with a ✓ (Table 3).

Improved Pigment Dispersion Stability with Floratech Emollients

Table 3. Visual Dispersion Stability

Emollient	24 Hours	Centrifuge	Heat (30 min)	Heat (2 hr)	Heat (4 hr)	Heat (24 hr)
Floramac 10	✓		✓	✓		
Floraesters IPJ	✓		✓	✓	✓	✓
Floraesters 15	✓		✓	✓	✓	
Floramac Macadamia Oil Refined	✓	✓	✓	✓	✓	✓
Florasun 90	✓	✓	✓	✓	✓	✓
Octyldodecanol	✓	✓	✓	✓	✓	✓
Pentaerythrityl Tetrastearate	✓	✓	✓	✓	✓	✓
C12-15 Alkyl Benzoate	✓		✓	✓	✓	
Caprylic/Capric Triglyceride	✓		✓	✓	✓	
Castor Oil	✓	✓	✓	✓	✓	✓

Conclusions:

All of the Floratech emollients remained stable for 24 hours at room temperature, and **Floramac Macadamia Oil Refined** and **Florasun 90** withstood centrifugation, which are both indicative of **good pigment dispersion stability properties**.