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Benefits of jojoba-derived waxes and butters

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Floraesters® 15, 20, 30, 60, and 70 [INCI: Jojoba Esters] are derived from jojoba oil (*Simmondsia chinensis*), and are widely used in a variety of finished product categories for skin care, hair care, and color cosmetic applications. Due to their composition and occlusivity, each of the Floraesters provides multiple benefits to personal care and cosmetic formulations, including skin hydration[1] and barrier repair and protection.[2] Floraesters also enhance product shelf life due to their superior oxidative stability.

Unlike some 'jojoba butter' ingredients, jojoba esters are interesterified, not partially-hydrogenated or a mixture of the oil and wax. Interesterification produces only cis-unsaturated esters and no trans-fats. Because jojoba is a wax ester and not a triglyceride oil, jojoba esters are 'oil-free' emollients. Ranging from liquid to soft paste to solid (see Table 1), Floraesters can be utilized within emulsion systems to provide body and skin care benefits, and within anhydrous formulas like lipsticks to achieve the desired hardness, payout, and shine / matte finish.

Table 1: Physical characteristics.

Test Emollient	OSI (hours)	Melting Point (°C)	Texture at 25°C
Floraesters 15	95	liquid @ 25	cushiony liquid
Floraesters 20	135	42 – 48	soft, creamy paste
Floraesters 30	165	47 – 51	soft, creamy paste
Floraesters 60	190	56 – 60	firm paste
Floraesters 70	>600	66 – 70	hard wax

Oxidatively stable jojoba-derived butters and waxes

The inherent stability of an emollient must be taken into consideration when selecting optimal ingredients for a shelf-stable finished product. Many natural butters and waxes degrade over time due to oxidation. This can negatively impact a finished formula's texture, odor, and sensory attributes. The oxidative stability index (OSI – measured in hours) predicts the oxidative stability of an emollient.

Floraesters (now referred to as 'Jojoba Esters') are much more oxidatively stable than other butters such as cocoa butter (80 hours), shea butter (25 hours), and mango butter (<10 hours). The OSI of each of the Jojoba Esters can be found within Table 1. Utilizing stable butters and waxes like the Floraesters, helps create highly stable finished products.

Increasing skin hydration

Jojoba Esters 20 and 60 were evaluated for skin hydration at 2% in a very simple o/w emulsion (4.00% Glyceryl Stearate (and) PEG-100 Stearate, 3.00% Cetyl Alcohol, 0.80% preservative, 0.20% Xanthan Gum, 0.03% Disodium EDTA, and q.s. Water) compared to 5% Shea Butter, 5% Canola Oil (and) Zea Mays (Corn) Starch (and) Silica (corn-based butter), or 5% Castor Isostearate Succinate (and) Hydrogenated Castor Oil (castor-based butter). Ten percent petrolatum was used as the positive control. One application of each test article was made to the dry outer legs of female subjects (n=11). Skin hydration measurements using the Corneometer CM 825[3] (in triplicate) were taken at baseline, and four hours post-test article application. The results appear in Figure 1.

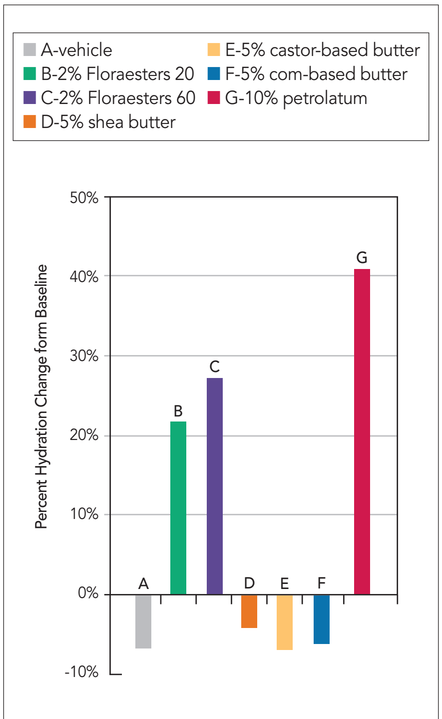

Figure 1: Increased skin hydration with Floraesters.

The data in Figure 1 show that the inclusion of 2% Jojoba Esters 60 increased skin hydration ($p<0.01$) more than all of the other butters, and 2% Jojoba Esters 20 increased skin hydration ($p<0.01$) more than the castor oil based butter. There was no statistically significant differences between Jojoba Esters 20, Jojoba Esters 60, and the positive control (10% petrolatum); and each of these performed statistically significantly ($p<0.01$) better than the vehicle.

Improving skin barrier function

Jojoba Esters 20, 30, and 60 were evaluated at 2% in the same simple o/w emulsion for mitigation of skin barrier disruption and skin barrier recovery, as compared to the vehicle without Jojoba Esters. Five percent petrolatum was used as the positive control and untreated skin was used as the negative control.

For mitigation of skin barrier disruption, one application of each test article was made to the volar forearms of male and female subjects (n=8), followed by a 12 hour exposure to the skin irritant, sodium lauryl sulfate (SLS – 0.3% solution), under occlusion using 19 mm Hill Top Chambers.[4] Transepidermal water loss (TEWL) measurements using the Tewameter TM 300[5] (in duplicate) were taken at baseline, and post-patch removal. Percent improvement in SLS-induced TEWL was determined relative to the untreated skin (i.e. skin which was only exposed to the SLS). The results appear in Figure 2.

The data in Figure 2 show that the inclusion of Jojoba Esters 20, 30, and 60 prevented disruption of the skin by SLS, and improved skin barrier function ($p<0.001$) better than the vehicle, and performed statistically equivalent to the positive control (5% petrolatum).

For skin barrier recovery, 18 hours of SLS exposure (0.3% solution) under occlusion using 19 mm Hill Top Chambers was made prior to three applications of each test article (performed hourly) to the volar forearms of male and female subjects (n=12). TEWL measurements were taken at baseline, 30 minutes after chamber removal, and one hour after the final test article application. Percent barrier recovery was determined relative to baseline. The results appear in Figure 3.

The data in Figure 3 show that the inclusion of Jojoba Esters 20, 30, and 60 protected the skin, and improved skin barrier recovery ($p<0.05$) better than the vehicle, and performed statistically equivalent to the positive control (5% petrolatum).

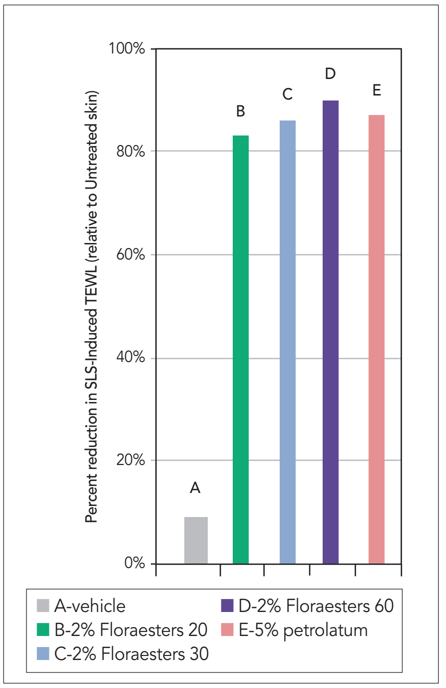

Figure 2: Mitigation of skin barrier disruption with Floraesters.

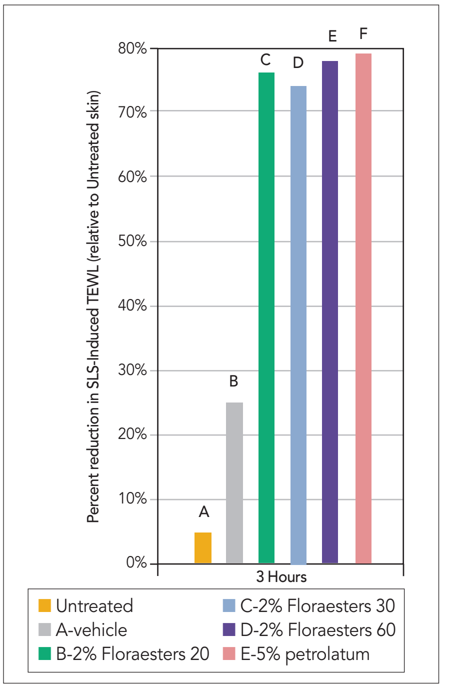

Figure 3: Improved skin barrier recovery with Floraesters.

Table 2: Vehicle lipstick formulas[7]

Ingredient (INCI)	Caprylic/Capric Triglyceride Oil Base (%wt.wt)	Castor Oil Base (%wt.wt)
Caprylic/Capric Triglyceride Oil	49.65	0.00
Ricinus Communis (Castor) Seed Oil	0.00	70.20
Macadamia Oil	15.00	0.00
Copernicia Cerifera (Carnauba) Wax	4.34	3.00
Euphorbia Cerifera (Candelilla) Wax	5.79	4.00
Beeswax	5.07	3.50
Microcrystalline Wax	5.79	4.00
Preservative	0.10	0.10
Silica	0.20	0.80
Polyhydroxystearic Acid	0.20	0.50
Pigment Blend	13.8	13.85
Tocopherol Acetate / Tocopherol	0.05	0.05

Increasing lipstick break strength without sacrificing payout

Lipsticks were formulated with and without Jojoba Esters 60 and 70 with either a primarily caprylic / capric triglyceride or castor oil base (see Table 2). Break strength and penetration were evaluated.

For break strength, a fully extended lipstick was moved mechanically at a consistent speed into the detection bar of a Chatillon Digital Force Meter (Model DFM).[6] The peak compression force required to break the lipstick (n = 3) was determined in kilograms.

For penetration, the hardness of each formula was tested by means of needle penetration with a penetrometer equipped with a 50g weight. Each formula was melted and poured into a cylinder form to solidify overnight. The needle was placed in slight contact with the smooth surface of the molded wax, then the weight was released. The depth the needle penetrated into the molded wax (n = 5) was recorded in decimillimeters. As penetration increases, hardness decreases (i.e. softness increases). Increasing the hardness of a lipstick can decrease payout. The results of break strength and penetration appear below in Figures 4, 5, and 6.

The data in Figure 4 show that the inclusion of 1% Jojoba Esters 60 increases softness without decreasing break strength of lipsticks, therefore, Jojoba Esters 60 can be used to increase payout without losing break strength. Additionally, 1% Jojoba Esters 70 increases break strength of lipsticks without increasing the hardness of lipsticks, therefore, Jojoba Esters 70 can be used to create a more resilient lipstick without decreasing payout.

The data in Figure 5 show that the inclusion of 0.5-1% Jojoba Esters 70 increases break strength of lipsticks without increasing the hardness of lipsticks, therefore, Jojoba Esters 70 can be used to create a more resilient lipstick without affecting the product aesthetics.

The data in Figure 6 show that the inclusion of Jojoba Esters 60 and 70 increases softness of lipsticks without decreasing the break strength of lipsticks, again demonstrating that Jojoba Esters can be used to create a lipstick with better payout without reducing the resilience.

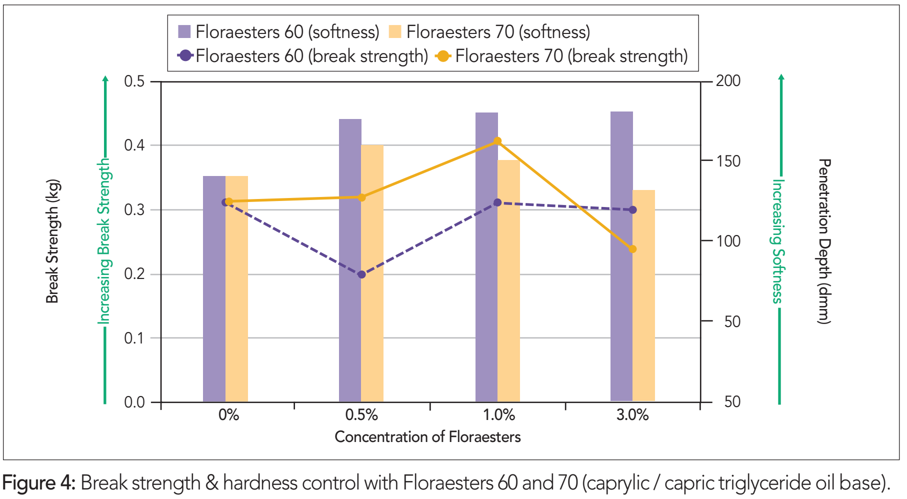

Figure 4: Break strength & hardness control with Floraesters 60 and 70 (caprylic / capric triglyceride oil base).

Conclusion

Jojoba-derived butters and waxes, such as Floraesters 20, 30, 60, and 70 offer formulators a multitude of benefits, even at relatively low usage levels. Floraesters not

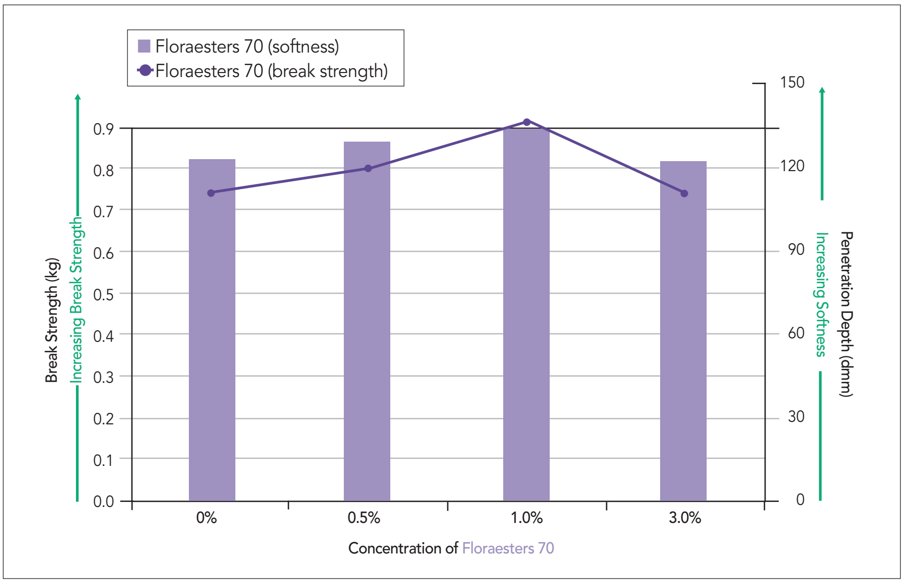

Figure 5: Break strength & hardness control with Floraesters 70 (castor oil base).

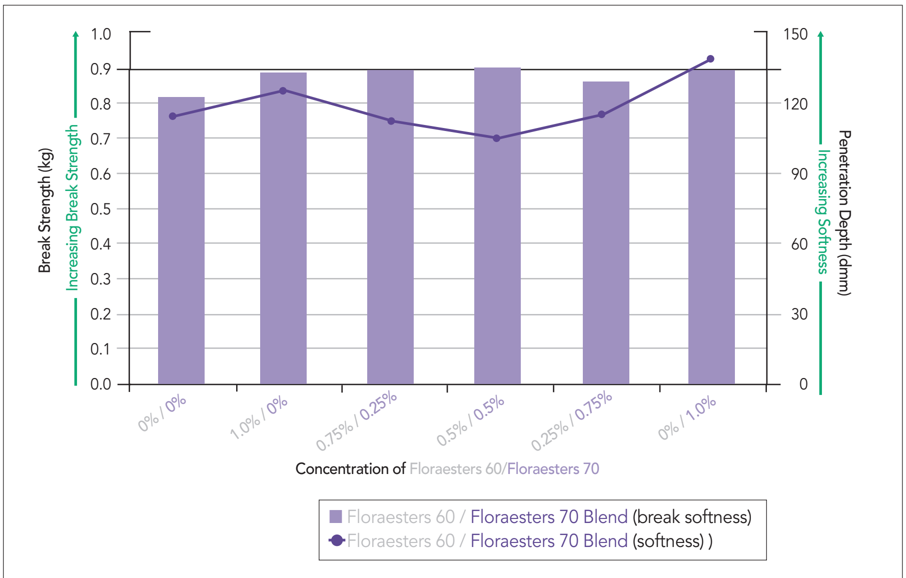

Figure 6: Break strength & hardness control with Floraesters 60 and 70 (castor oil base).

only offer advantages at the bench, such as increased formulation stability, low color and odor, flexibility of product texture and feel with one INCI name (i.e. Jojoba Esters), reduced syneresis in lipsticks, and the ability to customize the aesthetics of stick products (e.g. lipsticks, lip balms, antiperspirant sticks) without sacrificing payout, but they also provide a variety of skin care benefits. As this paper discusses, due to their occlusivity and unique jojoba origin, Floraesters provide increased skin hydration, mitigation of barrier disruption, and improved barrier recovery. In addition, previous studies have also demonstrated that Floraesters strengthen and protect the skin by decreasing skin redness (associated with irritation),[2] decreasing skin roughness, and increasing consumer preference, all while providing a non-greasy emolliency.[8] The results of all of these studies prove why Floraesters are ideal for a multitude of skin care, hair care, or color cosmetic applications. PC

References:

1 Oliphant T, Harper R. Functionality with Jojoba-Derived Ingredients – Increased Skin Hydration and Consumer Preference with Floraesters . Society of Cosmetic Chemists Technology Showcase. December 2010. Poster.

2 Oliphant T, Harper R. Skin Barrier Protection with Jojoba Esters. American Academy of Dermatology 71st Annual Meeting. March 2013. Poster.

3 Corneometer® CM 825 is a product of Courage + Khazaka (Köln, Germany).

4 Hill Top Chamber® is a registered trademark of Hill Top Research, Inc. (Cincinnati, OH).

5 Tewameter® TM 300 is a products of Courage + Khazaka (Köln, Germany).

6 Chatillon® Digital Force Meter (Model DFM) is a product of Technitrol Investments, Inc. (Wilmington, DE).

7 Waxes were removed in equal proportions to accommodate the addition of Floraesters 60 and/or 70. All formulas maintained color and odor over 12 weeks at room temperature and 43°C, and 2 weeks at 50°C.

8 Floratech final reports available upon request.