Sunless tanners aided by jojoba-derived emollient

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Floraesters K-20W Jojoba ([INCI Name: Hydrolyzed Jojoba Esters (and) Water]) has been shown to enhance the efficacy and sensory properties of multiple finished cosmetic and personal care formulations, and has been explored in various categories such as creams/lotions, hand sanitizers, nonwoven wipes, sunscreens, mascaras/eyeliners, shampoos/conditioners, toners/astringents, face washes, and oil-free formulations. Its film-forming properties make it ideal for rinse-off products and products that require water resistance or an extended period of residence time on the skin.

**Formulation benefits**

The substantivity of Floraesters K-20W Jojoba makes it well-suited to entrap molecules at the skin surface. For example, in combination with glycerin Floraesters K-20W Jojoba enhances skin moisturisation; additionally sunscreen actives used in combination with Floraesters K-20W Jojoba are retained on the skin after water immersion. Clinical studies have also shown that Floraesters K-20W Jojoba (now referred to as ‘the jojoba-derived emollient’) exhibits good substantivity, is water resistant, and is soluble in most alcohols and glycols. Including it within formulations results in a rich emolliency on skin, as well as contributing to botanically-derived, oil-free, and biodegradable claims. This jojoba-derived emollient is also Ecocert certified, sustainable, and EU and China REACH compliant.

**Clinical study**

In double-blind, vehicle-controlled clinical studies, the jojoba emollient in a sunless tanning lotion (containing 5% dihydroxyacetone and 2% glycerin) was shown to provide the following benefits:

- 80% of consumer preference with regard to the smell of the sunless tanning lotion (Fig. 1)
- 82% of consumer preference for overall product preference (Fig. 2)
- 78% of consumer preference for overall tanning experience, as well as >50% preference for other skin characteristics.

![Figure 1: Consumer smell preference.](image1)

![Figure 2: Product characteristics.](image2)

![Figure 3: Skin characteristics.](image3)
attributes such as evenness of tan, moisturisation, longevity of tan, and the overall colour (Fig. 3).

- Prolonged skin colour retention over the vehicle by up to 20% (Fig. 4)
- Increased skin hydration over all test articles by up to 16% at 24 hours post application (Fig. 5).

**Product and skin characteristics**

All of the following studies were run double blind and randomised. Up to 1% jojoba-derived emollient was incorporated into sunless tanning lotion vehicles (which all contained 5% dihydroxyacetone and 2% glycerin). Dihydroxyacetone (INCI: Dihydroxyacetone) was supplied by EMD Chemicals Inc.; Erythrulose (INCI: Erythrulose) was supplied by DSM Nutritional; and Dermacryl-79 (INCI: Acrylates/Octylacrylamide Copolymer) was supplied by Akzo Nobel Chemicals.

Three applications of each sunless tanner were made to the lower legs by female consumers over three days. The consumers evaluated the product characteristics as well as skin characteristics three and seven days after the initial application of two sunless tanners. They were asked to indicate a preference between a sunless tanner with 0.5% jojoba-derived emollient and 0.5% erythrulose, a sunless tanner with 1% erythrulose, or to indicate no preference. A summary of the consumers’ preferences, of those that chose a preference, can be seen in Figures 2 and 3.

Consumers stated an overall preference for the sunless tanning lotion with 0.5% jojoba-derived emollient over the vehicle 82% of the time for overall product preference and 78% for overall tanning experience. Other areas where the jojoba-derived emollient performed particularly well were smell of the product, spreadability, evenness of tan and longevity of tan.

**Colour retention**

Baseline Mexameter melanin measurements for skin colour were taken on normal backs. One application of each test article was then made to the appropriate test site (2.5 mg/cm²). Measurements were repeated 24, 48, 72, and 96 hours post test article application.

The jojoba-derived emollient enhanced skin colour retention in a sunless Tanner containing 5% dihydroxyacetone better than the vehicle test articles at 24, 48, 72, and 96 hours. Peak change in skin colour occurred at 24 or 48 hours for all test articles that did not include the jojoba-derived emollient, and at 72 hours for those that did contain the jojoba-derived emollient. Figure 4 shows the per cent change in skin colour associated with sunless tanning. All test articles containing the jojoba-derived emollient produced statistically significantly (p<0.05) higher per cent changes in skin colour than the vehicles at the 72 and 96 hour time points.

**Skin hydration**

Baseline skin hydration measurements (via Corneometer) were taken on normal backs. One application of each test article was then made to the appropriate test site (2.5 mg/cm²). Measurements took place at the same time points as the colour retention measurements. Figure 5 shows the increase in skin hydration with the addition of Floraesters K-20W Jojoba in a sunless tanning lotion.
were repeated 24 hours post test article application.

The jojoba-derived emollient increased skin hydration in a sunless tanner containing 5% dihydroxyacetone better than all other test articles at 24 hours. Figure 5 shows the per cent change in skin hydration from baseline, 24 hours after test article application. Test article C [vehicle + 1% K-20W (pH=5.5)] resulted in a statistically significant (p<0.01) increase in skin hydration 24 hours post test article application. All test articles containing the jojoba-derived emollient produced statistically significantly (p<0.05) higher per cent changes in skin hydration than all other test articles.

**Example formula**

The emollient phase featuring the jojoba-derived emollient which in combination with glycerin, provides a synergistic moisturisation package that combats the drying-effect caused by dihydroxyacetone (DHA). The jojoba-derived emollient also contributes to the product aesthetic with regard to slip and spreadability. The film-forming nature of the ingredient traps sunless tanning actives within the upper layers of the skin, resulting in prolonged colour retention. Even at low percentages, the jojoba-derived emollient functions as a truly unique cosmetic ingredient in sunless tanning lotions.

Many sunless tanners are formulated within a pH range of 3-5 to ensure the stability of DHA, which typically results in a more even and natural-looking tan. However, the jojoba-derived emollient allows for a slightly elevated pH range (5.0-5.5), more similar to the skin’s natural pH, without sacrificing the colour or evenness of the tan.

Formulation 1 is a starting point for many possible sunless tanning lotions and gel formulations, and can be modified and added upon to create a high performance sunless tanning product.

**Conclusion**

Floraesters K-20W Jojoba, a jojoba-derived emollient, is shown to be an extremely valuable addition to sunless tanning formulas, offering benefits to skin feel, spreadability, hydration, and colour retention. Floraesters K-20W Jojoba can also provide benefits to other product categories. Numerous studies have demonstrated its ability to moisturise skin making it ideal for a multitude of formulations. It also has high substantivity even after rinsing in water, making it suitable for sport sunscreens and long-wearing makeup that does not dry the skin. In addition, due to its solubility in alcohols and glycols, Floraesters K-20W Jojoba also functions very well in hydroalcoholic systems, which makes it a good candidate for use in toners and astringents, perfume sprays, and after-shaves.

**Formulation 1: Sunless tanner.**

<table>
<thead>
<tr>
<th>Phase</th>
<th>Trade/Common Name</th>
<th>INCI Name</th>
<th>% wt./wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Simulgel EG1</td>
<td>Sodium Acrylate/Sodium Acryloyldimethyl Taurate Copolymer (and) Isohexadecane (and) Polysorbate 80</td>
<td>3.00</td>
</tr>
<tr>
<td>Cetiol LC2</td>
<td>Coco Caprylate Caprate</td>
<td>3.00</td>
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</tr>
<tr>
<td>Glycerin, USP3</td>
<td>Glycerin</td>
<td>2.00</td>
<td></td>
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<td>Floraesters K-20W Jojoba4</td>
<td>Hydrolyzed Jojoba Esters (and) Water (Aqua)</td>
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<tr>
<td>B</td>
<td>Deionized Water</td>
<td>Water</td>
<td>q.s.</td>
</tr>
<tr>
<td>Dihydroxyacetone5</td>
<td>Dihydroxyacetone</td>
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</tr>
<tr>
<td>Erythulose6</td>
<td>Erythulose</td>
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</tr>
<tr>
<td>C</td>
<td>Fragrance</td>
<td>Fragrance</td>
<td>q.s.</td>
</tr>
<tr>
<td>Sepicide HB7</td>
<td>Phenoxethanol (and) Methylparaben (and) Ethylparaben (and) Propylparaben (and) Butylparaben</td>
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<td></td>
</tr>
<tr>
<td>D</td>
<td>Citric Acid (30% solution)</td>
<td>Citric Acid (and) Water</td>
<td>q.s.</td>
</tr>
</tbody>
</table>

**Procedure:**

Phase A: Combine Simulgel EG, Cetiol LC and Glycerin USP of in a suitable vessel; then add specified amount of Floraesters K-20W Jojoba. Phase B: Combine water and Dihydroxyacetone in a separate vessel; then add specified amount of Erythulose. Add phase B to phase A with moderate stirring. Add phase C to combined phase AB, in the order listed, with moderate stirring. Phase D: Adjust to specified pH with the Citric Acid (30% solution).

**Manufacturers**

1 Seppic 2 BASF Corporation 3 The Dow Chemical Co. 4 Floratech 5 EMD Chemicals, Inc. 6 DSM Nutritional Products 7 Thor Specialties Ltd. 8 Archer Daniels Midland Co.

Numerous studies have demonstrated its ability to moisturise skin making it ideal for a multitude of formulations. It also has high substantivity even after rinsing in water, making it suitable for sport sunscreens and long-wearing makeup that does not dry the skin. In addition, due to its solubility in alcohols and glycols, Floraesters K-20W Jojoba also functions very well in hydroalcoholic systems, which makes it a good candidate for use in toners and astringents, perfume sprays, and after-shaves.