Hydrolyzed Jojoba Esters Improves Water Resistance of Sunscreen Formulas

Abstract

Hydrolyzed Jojoba Esters (HJE) is a botanically-derived cosmetic/personal care ingredient that has previously demonstrated its ability to act as a fixative within various finished cosmetic applications. The present research further explores its fixative potential by evaluating the water resistance properties imparted by HJE when incorporated into a sunscreen. A sunscreen formula (active: 7.5% titanium dioxide), with and without 5% HJE, was evaluated for static and 40-minute water immersion SPF (n=3) in accordance with US FDA Final Rule, 21 CFR Parts 201 and 310. The results show that after 40 minutes of water immersion, the sunscreen formula containing 5% HJE had a 28% higher SPF and maintained an SPF rating of 15 (which was not observed in the formula without HJE). In addition to this property, HJE increases skin hydration when used with glycerin and enhances consumer skin feel, making it a multifunctional ingredient for sun care applications.

Sunscreen Formula

Table 1. Sunscreen Formula

<table>
<thead>
<tr>
<th>Ingredient Name</th>
<th>% w/w/ wt.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>65.40</td>
</tr>
<tr>
<td>C12-15 Alky Benzilate</td>
<td>8.00</td>
</tr>
<tr>
<td>Titanium Dioxide (and) Dimethicone</td>
<td>7.50</td>
</tr>
<tr>
<td>Floramacs 19 (Incl. Ethyl Macadamiamine)</td>
<td>3.00</td>
</tr>
<tr>
<td>Potassium Cetyl Phosphate</td>
<td>3.00</td>
</tr>
<tr>
<td>Sunflower Seed Oil Sorbitol Esters</td>
<td>2.00</td>
</tr>
<tr>
<td>Polyhydroxyactic Acid</td>
<td>1.00</td>
</tr>
<tr>
<td>C12-15 Alcohol</td>
<td>1.00</td>
</tr>
<tr>
<td>Glycerin</td>
<td>1.00</td>
</tr>
<tr>
<td>Floramacs K-20W Jojoba (INCl. Hydrolyzed Jojoba Esters (and) Water (Aquos))</td>
<td>5.00</td>
</tr>
<tr>
<td>Phenoxyethanol (and) Methylparaben (and) Ethylparaben (and) Butylparaben (and) Propylparaben (and) Isobutylparaben</td>
<td>0.80</td>
</tr>
<tr>
<td>Triethanolamine</td>
<td>0.20</td>
</tr>
<tr>
<td>Acrylates/C10-30 Alky Acrylate Crosspolymer</td>
<td>0.10</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Formulation Benefits of Floramacs K-20W Jojoba

- Rich emolllency that remains after rinse-off
- Substantive
- Water resistant
- Soluble in most alcohols and glycols
- Dispersible in glycerin
- Allows for oil-free claims
- Botanically derived
- Skin hydration synergy with glycerin
- Readily biodegradable
- Enhances barrier recovery
- Reduces erythema

Improved Water Resistance

Objective: Determine the water resistance potential between a sunscreen with and without Floramaces K-20W Jojoba.

Results: The Minimum Erythema Dose (MED) is the lowest UV dose required to produce perceptible erythema. The MED for each subject was measured and used to determine the proper UV exposure during testing of the sunscreen formulas. The static SPF value was calculated using the MED of sunscreen protected skin (MEDp) relative to the MED of unprotected skin (MEDu) on each subject using the following equation: MEDp/MEDu. For the 40-minute immersion test, subjects sat with the testing site submerged in a water bath for 20-minute immersion periods prior to UV exposure, and SPF was calculated in the same manner as above.

Subjects:
- n = 3 (male and female)

Vehicle 15.97
Vehicle + 5% Floramacs K-20W Jojoba 15.59
Vehicle + 10% Floramacs K-20W Jojoba 15.13

Figure 1. Static and 40-Minute Water Immersion SPF

Increased Skin Hydration

Objective: Determine the skin hydration potential between a sunscreen with and without Floramaces K-20W Jojoba.

Results: The sunscreen formula containing 5% Floramaces K-20W Jojoba increased skin hydration statistically significantly (p<0.05) more than the formula without, one and two hours post-test article application (14% and 15% more, respectively). (Figure 2)

Conclusions

- Incorporating Floramaces K-20W Jojoba within a sunscreen formula resulted in improved SPF following 40-minute water immersion.
- Floramaces K-20W Jojoba increased skin hydration within a sunscreen formula.
- Floramaces K-10 enhances dispersion on titanium dioxide.

Improved TiO₂ Dispersion with Floramacs 10

Objective: A comparison of Floramacs 10 (Mac 10) and isopropyl myristate (IPM) to minimize quantity and size of titanium dioxide (7.5%) particles with and without a dispersing agent (DA).

Design:
- One application (0.2ml) of each test article was made to the Fineness of Grind Gage. The sample was then scraped across the gage and particle quantity (by size) was determined by counting undispersed particles.

Results:
- The sunscreen formula containing 5% Floramacs 10 resulted in fewer and smaller undispersed titanium dioxide particles than the formula with IPM. (Table 2 and Figure 3) Additionally, the sunscreen formula containing 5% Floramacs 10 resulted in a more uniform dispersion. (Figure 4)

Table 2. Dispersion of Titanium Dioxide

<table>
<thead>
<tr>
<th>Particle Size Microns (µ)</th>
<th>Average Undispersed-Particle Count (% of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1-1.64 µ</td>
<td>260</td>
</tr>
<tr>
<td>1.65-2.50 µ</td>
<td>150</td>
</tr>
<tr>
<td>2.51-3.50 µ</td>
<td>30</td>
</tr>
<tr>
<td>3.51-4.50 µ</td>
<td>2</td>
</tr>
<tr>
<td>4.51-5.50 µ</td>
<td>1</td>
</tr>
</tbody>
</table>

Footnotes/References

1. The test material is known as Floramacs K-20W Jojoba, is a 20% hydrolyzed jojoba esters dilution in water (INCl. Hydrolyzed Jojoba Esters (and) Water (Aquos)).
2. The test articles included either 5.00% Floramacs K-20W Jojoba or 0.20% Triethanolamine (INCl. Ethyl Macadamiamine) in water (q.s. deionized water).
3. SPF testing was conducted in accordance with the US FDA Final Rule; 21 CFR Parts 201 and 310 by Suncare Research Laboratories, LLC (Winston Salem, NC).
4. The dispersing agent used was Polyhydroxystearic Acid produced by Innospec Performance Chemicals (Saltlake, NC).
5. The Fineness of Grind Gage is a product of Precision Gage & Tool Company (Dayton, OH).
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FLORAESTERS
K-20W JOJOBA

INCI: HYDROLYZED JOJOBA ESTERS, WATER (AQUA)

LOT: SAMP013

HMIS: 0,1,0