PERSONAL CARE
INGREDIENTS • FORMULATION • MANUFACTURE

A natural silicone alternative in skin care products
Floramac® 10 [INCI: Ethyl Macadamiate] is derived from Macadamia Oil (Macadamia integrifolia), and is widely used in a variety of cosmetic and personal care products for both skin and hair care applications.

Floramac 10 is not only functional, but also provides favorable product aesthetics. Its many attributes include assisting in the dispersion and solubilization of sunscreens; providing a dry emolliency, giving formulas a silky skin feel similar to that of cyclopentasiloxane (without the volatility); and imparting a degree of skin hydration greater than silicones.

Additionally, Floramac 10 can be used in oil-free products, while still imparting some of the benefits of natural botanical oils. It can be gelled to mimic the properties of medium viscosity silicones, and can be used in combination with silicones.

Silicones, particularly volatile silicones like D4 and D5, have recently come under scrutiny. Silicones are used in a variety of skin care formulations for sensory attributes and hydration, as well as in hair care formulations for conditioning properties. This article will discuss the functional and sensory aspects of Floramac 10 and how it can be used as an alternative for silicones.

Mimicking the sensory profile of silicones

Neat Floramac 10, or gelled Floramac 10 (indicated with a + sign), was compared to a variety of neat silicones of varying viscosities (Table 1). Each silicone / silicone alternative pair (as listed in Table 1), was compared by female consumers (n=27) on a 1-5 scale for initial product evaluations (initial) and skin-feel post-application (30 min) observations. The higher the score, the more the listed attribute was perceived by consumers (e.g. a score of 5 for moisturization indicates moisturized skin, whereas a score of 1 indicates dry skin). For the texture attribute, a higher score indicates a thicker silicone or silicone alternative. The results for each pair appear in Figures 1-5.

<table>
<thead>
<tr>
<th>Test Emollient</th>
<th>Viscosity (cP)</th>
<th>Refractive Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floramac 10</td>
<td>7 – 8</td>
<td>1.44</td>
</tr>
<tr>
<td>Cyclopentasiloxane</td>
<td>4 – 5</td>
<td>1.40</td>
</tr>
<tr>
<td>Floramac 10+4</td>
<td>7 – 8</td>
<td>1.45</td>
</tr>
<tr>
<td>Dimethicone (5cs)</td>
<td>5 – 6</td>
<td>1.40</td>
</tr>
<tr>
<td>Floramac 10+4</td>
<td>303 – 304</td>
<td>not transparent</td>
</tr>
<tr>
<td>Dimethicone (10cs)</td>
<td>10 – 11</td>
<td>1.40</td>
</tr>
<tr>
<td>Floramac 10+5</td>
<td>548 – 549</td>
<td>not transparent</td>
</tr>
<tr>
<td>Dimethicone (20cs)</td>
<td>19 – 20</td>
<td>1.40</td>
</tr>
<tr>
<td>Floramac 10+7</td>
<td>77 – 78</td>
<td>not transparent</td>
</tr>
<tr>
<td>Dimethicone (100cs)</td>
<td>96 – 97</td>
<td>1.40</td>
</tr>
</tbody>
</table>

The data in Figure 1 show initially there were few perceivable differences between Floramac 10 (now referred to as ‘ethyl macadamiate’) and cyclopentasiloxane; however, 30 minutes post-application, ethyl macadamiate left the skin perceivably more glossy, silky / smooth, and moisturized.

The data in Figure 2 show few perceivable differences between the gelled ethyl macadamiate and dimethicone (5cs) for initial product observations and skin feel attributes 30 minutes post-application. The data in Figure 3 show initially dimethicone (10 cs) was visually more glossy, more transparent, wetter, and thinner (texture); however, there were few perceivable differences in skin feel attributes between the gelled ethyl macadamiate and dimethicone (10 cs) 30...
Statistical (**) signiﬁcance was apparent where indicated (p<0.05).

Figure 6: Increased consumer preference with Floramac 10.

Statistical (**) signiﬁcance was apparent where indicated (p<0.05).

Figure 3: Floramac 10+7 versus dimethicone (10 cs).

Figure 4: Floramac 10+6 versus dimethicone (20 cs).

Figure 5: Floramac 10+5 versus dimethicone (100 cs).

Statistical (**) signiﬁcance was apparent where indicated (p<0.05).

minutes post-application.

The data in Figure 4 show initially dimethicone (20 cs) was visually more glossy, more transparent, and thinner (texture) than the gelled ethyl macadamiate; however, 30 minutes post-application, the gelled ethyl macadamiate left the skin perceivably more glossy, silky / smooth, and moisturized.

The data in Figure 5 show initially dimethicone (100 cs) was visually more glossy, more transparent, wetter, and thinner (texture); however, 30 minutes post-application, the gelled ethyl macadamiate left the skin perceivably glossier.

The sensory studies shown in this paper indicate that ethyl macadamiate can be used to mimic silicones with a viscosity of ≤100 cP. Although physical properties and initial observations of the neat ingredients vary between ethyl macadamiate and the respective silicones, skin-feel as perceived by the consumer was very similar. The most notable differences between the silicone alternatives and silicones were that ethyl macadamiate produced greater skin hydration, gloss, and silkiness / smoothness as perceived by consumers.

**Consumer preference**

Ethyl macadamiate was compared to cyclopentasiloxane in a clear under-eye stick product by female consumers (n=31) in a blinded fashion immediately after one use, and after seven days of twice daily use. The results appear below in Figure 6.

The results presented in Figure 6 were similar to the sensory studies comparing neat ethyl macadamiate and cyclopentasiloxane (Fig 1). Eighty seven percent of the consumers preferred the skin hydration provided by ethyl macadamiate versus cyclopentasiloxane, and ethyl macadamiate left the skin feeling silkier than cyclopentasiloxane.

**Increased skin radiance and hydration**

Ethyl macadamiate, gelled ethyl macadamiate, and the respective silicones (see Table 1) were also evaluated at 5% in a very simple o/w emulsion (0.20% Acrylates/C10-30 Alkyl Acrylate Crosspolymer, 0.06% Aminomethyl Propanol, and q.s. Water) for skin radiance and hydration. One application of each test article was made to the dry outer legs of female subjects (n=17). Skin radiance measurements using the Glossymeter GL 200 and skin hydration measurements using the Corneometer CM 825 (both in triplicate) were taken at baseline, and 30 and 60 minutes post-test article application, respectively. The results for each pair appear below in Figure 7.

The data in Figure 7 show the inclusion of ethyl macadamiate increased skin radiance and hydration (p<0.05) more than each respective silicone, which also supports the results seen in the sensory study (Figures 1, 4, and 5).
Conclusion
Floramac 10 is a moisturizing mixture of macadamia esters.
Floramac 10 leaves a silky, smooth after-feel similar to cyclopentasiloxane and provides excellent oxidative stability, high spread, and low slip.
Naturally-derived ingredients, such as Floramac 10, that offer functionality similar to silicones can be very useful to skin and hair care applications, particularly with the regulatory and health issues surrounding volatile silicones. Floramac 10 is a dry emollient that can be used to provide a similar skin feel to silicones, in addition to providing functionality such as skin radiance and hydration. Previous studies have also demonstrated that Floramac 10 provides conditioning benefits to hair care products similar to those provided by silicones. The results of all of these studies offer formulators an effective natural alternative to silicones in skin and hair care applications.

References:
2 https://tinyurl.com/ydgdzste
3 All studies were IRB-approved, randomized, double-blind, and vehicle-controlled.
4 Gelled with 0.5% CAB-O-Sil M-5, INCI: Silica (Cabot).
5 Gelled with 5.0% Nomcort® SG, INCI: Glyceryl Tribhehenate/Isostearate/Eicosadioate (Nisshin Oillio).
6 Gelled with 5.0% Nomcort® SG, INCI: Glyceryl Tribhehenate/Isostearate/Eicosadioate (Nisshin Oillio); 2.0% Natrasorb® HFB, INCI: Aluminum Starch Octenylsuccinate (and) Acrylates Copolymer (and) Magnesium Carbonate (AkzoNobel Chemicals); and 5.0% Bentone Gel® GTCCV, INCI: Cetyl/Capric Triglyceride (and) Stearalkonium Hectorite (and) Propylene Carbonate (Elementis Specialties), and 5.0% Glycerine 99.7% USP Kosher, INCI: Glycerin (Acme-Hardesty Co).
7 Gelled with 10.0% Nomcort® SG, INCI: Glyceryl Tribhehenate/Isostearate/Eicosadioate (Nisshin Oillio); 2.0% Natrasorb® HFB, INCI: Aluminum Starch Octenylsuccinate (and) Acrylates Copolymer (and) Magnesium Carbonate (AkzoNobel Chemicals); and 5.0% Bentone Gel® GTCCV, INCI: Cetyl/Capric Triglyceride (and) Stearalkonium Hectorite (and) Propylene Carbonate (Elementis Specialties), and 5.0% Glycerine 99.7% USP Kosher, INCI: Glycerin (Acme-Hardesty Co).
8 Glossymeter GL 200 and Corneometer CM 825 are products of Courage + Khazaka (Köln, Germany).

Figure 7: Increased skin radiance and hydration with Floramac 10.

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