Floramac 10 [INCI: Ethyl Macadamiate] is a unique botanically-derived, oil-free emollient that can be utilized in a variety of cosmetic and personal care formulations, including hair care products. Floramac 10 provides hair care formulations with enhanced product functionality. Floramac 10 contributes to hair conditioning by improving combability, in addition to delivering protective properties to the hair (from e.g. heat, UV, grooming, etc.), which subsequently reduces hair breakage. The inherent refractive index of Floramac 10 lends to its ability to promote shine and gloss, without the use of silicones, when used in leave-in hair care products, resulting in the healthier appearance of hair.

Floramac 10 is also a suitable substitute for low viscosity silicones. It delivers favorable product aesthetics similar to silicones (without the volatility). Additionally, Floramac 10 imparts a degree of hydration greater than silicones and can also be gelled to mimic the properties of traditional silicones. Floramac 10 is sustainable, EU and China REACh compliant, TGA approved, and listed on AICS.

Formulation Benefits:

- Provides hair conditioning functionality similar to silicones
- Alternative for some silicones
- Compatible with oils, volatile and non-volatile silicones
- Assists in the dispersion and solubilization of sunscreens
- Botanically-derived
- Allows for oil-free and silicone-free claims
- Non-volatile
- High spread and low viscosity
- Tolerant of pro-oxidative environments
- Biodegradable

Hair Study Facts:

In double-blind, vehicle-controlled ex vivo and in vivo studies, Floramac 10 produced the following benefits:

- Reduced wet comb force up to 45% more than silicones (Figure 1)
- Reduced dry comb force up to 2.6 times more than silicones (Figure 1)
- Reduced hair breakage up to 57% more than silicones (Figure 2)
- Increased hair shine up to 2 times more than silicones without the use of heat (Figure 3)
- Increased hair shine up to 1.7 times more than silicones with the use of heat (Figure 3)
- Significantly improved consumer perception of hair qualities for multiple categories (Figure 4)

Purpose:

The purpose of this investigation was to evaluate Floramac 10 as a botanically-derived silicone alternative in hair care products. A hair serum containing Floramac 10 was compared to hair serums containing common silicones (i.e. cyclopentasiloxane and phenyl trimethicone), and the following conditioning attributes were evaluated: shine, comb force (ease of combing), hair breakage due to repeated grooming, and consumer preference. Additionally, neat Floramac 10 was compared to neat cyclopentasiloxane and phenyl trimethicone2 using consumer perception to evaluate the differences in the physical properties of Floramac 10 versus silicones, and to determine whether or not these differences had an effect of the functionality of the finished product.

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1. Final Reports available upon request. Figures and Tables can be found on the next two pages of this document.
2. When comparing Floramac 10 with SF 1550 (INCI: Phenyl Trimethicone), Floramac 10 was gelled with 10.0% Nomcort SG (INCI: Glyceryl Tribehenate/Isostearate/Elcosadiate) and 2.7% Cera Bellina #106P (INCI: Polyglycerol-3 Beeswax) to mimic the viscosity of the silicone; and from here on out will be referred to as Floramac 10+.
Comb Force:
Leave-in hair serums containing either Floramac 10, cyclopentasiloxane, or phenyl trimethicone, were applied to wet hair tresses. Wet and dry comb force measurements were taken at baseline and post-treatment. The results appear below in Figure 1.

Figure 1. Reduced Comb Force with Floramac 10 vs. Silicones

<table>
<thead>
<tr>
<th>A - Floramac 10</th>
<th>B - cyclopentasiloxane</th>
<th>C - phenyl trimethicone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Comb Force</td>
<td>Dry Comb Force</td>
<td></td>
</tr>
</tbody>
</table>

Hair Breakage from Repeat Combing:
Leave-in hair serums containing either Floramac 10, cyclopentasiloxane, or phenyl trimethicone were applied to wet hair tresses, which were then blow dried and combed 1000 times. The broken fibers were collected and counted. The results appear below in Figure 2.

Figure 2. Reduced Hair Breakage with Floramac 10 vs. Silicones

<table>
<thead>
<tr>
<th>A - Floramac 10</th>
<th>B - cyclopentasiloxane</th>
<th>C - phenyl trimethicone</th>
</tr>
</thead>
<tbody>
<tr>
<td># of broken hair fibers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hair Shine:
Naturally straight, brown hair tresses were treated with leave-in hair serums containing Floramac 10, cyclopentasiloxane, or phenyl trimethicone. Hair gloss measurements were taken before and after hair serum treatment, with heat (i.e. flat iron) and without heat. The results appear below in Figure 3.

Figure 3. Increased Hair Shine with Floramac 10 vs. Silicones

<table>
<thead>
<tr>
<th>A - Floramac 10</th>
<th>B - cyclopentasiloxane</th>
<th>C - phenyl trimethicone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Change in Hair Shine (relative to untreated hair)</td>
<td></td>
<td></td>
</tr>
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</table>

3. All studies were blinded, and carried out under controlled temperature and humidity conditions.
4. The inclusion of Floramac 10 resulted in statistically significant (p<0.05) reductions in wet comb force compared to phenyl trimethicone; and in statistically significant (p<0.05) reductions in dry comb force compared to both cyclopentasiloxane and phenyl trimethicone. All test articles resulted in statistically significant (p<0.05) changes in wet and dry comb force from baseline.
5. The inclusion of Floramac 10 resulted in statistically significant (p<0.05) fewer broken fibers compared to the phenyl trimethicone.
6. The inclusion of Floramac 10 resulted in statistically significant (p<0.05) increase in shine compared to each respective silicone-containing test article with heat, compared to the cyclopentasiloxane-containing test article without heat, and compared to baseline (with and without heat).
**Consumer Preference:**
Leave-in hair serums containing either Floramac 10 or phenyl trimethicone were compared by consumers (n=24) in a half head, randomized, double-blind fashion after one week of every other day product use. The results appear below in Figure 4.

![Figure 4. Increased Consumer Preference with Floramac 10 vs. Silicones](image)

**Figure 4.** At least 80% of consumers preferred the leave-in hair serum with Floramac 10 for smoothness, shine, softness, and ease of combing compared to the leave-in hair serum with phenyl trimethicone.7 (See Claim Sheet 17-094.)

**Consumer Perception:**
Each neat silicone / silicone alternative pair, was compared by consumers (n=27) in a randomized, double-blind fashion on a 1-5 scale for initial product evaluations and skin feel observations (30 minutes post-application). The higher the score, the more the listed attribute was perceived by consumers (e.g. a score of 5 for moisturization indicates very moisturized skin, whereas a score of 1 indicates dry skin). For the texture attribute, a higher score indicates a thicker silicone or silicone replacement. The results for each pair appear below in Figures 5 and 6.

![Figure 5. Floramac 10 vs. Cyclopentasiloxane](image)

**Figure 5.** Initially, there were few perceivable differences between Floramac 10 and cyclopentasiloxane. Thirty minutes post-application, Floramac 10 left the skin perceivably more silky / smooth and moisturized.7

![Figure 6. Floramac 10+ vs. Phenyl Trimethicone](image)

**Figure 6.** Initially, phenyl trimethicone was visually more glossy, more transparent, wetter, more absorbent, and thinner (texture); however, there were few perceivable differences between the Floramac 10+ and phenyl trimethicone 30 minutes post-application to the skin.7

**Conclusions:**
Floramac 10 can be used to mimic silicones within hair care products. Although physical properties and initial observations of the neat ingredients vary between Floramac 10 and the respective silicones, skin-feel as perceived by the consumer was very similar. Additionally, hair care benefits such as increased shine, decreased breakage, and reduced hair comb force were superior when Floramac 10 was evaluated within a leave-in hair serum compared to silicones.

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7. Statistical (**) and directional (*) significance was apparent where indicated (p<0.05 and p<0.1, respectively).
Formula: Silicone-Free Heat Protection Hair Serum

From root to tip, this natural, silicone-free, leave-in serum protects hair from heat damage and increases shine. Non-volatile Floramac 10 has the silky feel of silicone and can be used as a silicone alternative, or in combination with most silicones. Floramac 10 also assists in the solubilization of benzophenone-3, and has been shown to increase hair shine more than silicones in a leave-in hair serum.

### Procedure:

1. In the main vessel, mix all the ingredients of Phase A at 80°C with moderate propeller agitation.
2. When the mixture becomes uniform, begin cooling to 38-40°C. Stop mixing when the mixture reaches 45°C. Continue evenly cooling to 38-40°C. Phase A should become a soft, pasty wax at 38-40°C.
3. Add Phase B to Phase A at 35-38°C with rapid propeller agitation. (Overheating can break the viscosity of the finished product.)
4. In a separate vessel, mix all the ingredients of Phase C, except the Floramac 10, with low to moderate propeller agitation at room temperature.
5. When the mixture is clear and uniform, slowly add the Floramac 10, and continue mixing with low to moderate propeller agitation at room temperature.
6. Add Phase C to Phase AB at 35-38°C with rapid propeller agitation.
7. In a separate vessel, mix the ingredients of Phase D with moderate propeller agitation at 35-38°C.
8. Add Phase D to Phase ABC at 35-38°C with rapid propeller agitation. Once Phase ABCD becomes uniform, begin cooling to room temperature. Stop propeller mixing at 35°C. Continue evenly cooling to room temperature.
9. Add Phase E to Phase ABCD in the order listed at room temperature with rapid propeller agitation. Continue mixing until uniform.

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<tbody>
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### Ingredient Information

24/7 Online

Visit www.floratech.com/info for more information.  

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