Jojoba Esters in Lipsticks

Their effect on the lipstick's strength and cosmetic properties

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Lipsticks are worn by many women and are one of the most popular color cosmetic products available. Lipstick is composed of an emollient/wax base strong enough to form a molded stick, along with various additives, primarily pigments, pearls and preservatives. This research was conducted to study the benefit jojoba esters may impart to the stick strength of lipstick formulations.

The addition of jojoba esters-70 (melting point is 70°C) to a lipstick formula can significantly improve the strength of a lipstick, depending on the wax used. Previous work by Cadicamo demonstrated stick strength improvement with the addition of jojoba esters-70, but the actual improvement was not quantified.

Our experiment expanded on Cadicamo's work by using additional waxes and by quantifying the change in stick strength. We prepared lipsticks using emollient/wax blends consisting of one of nine emollients and one of six waxes. Pigments and other additives were not incorporated to simplify sample preparation. Results indicate that it is possible to increase stick strength in the majority of formulations when half the wax component is replaced with jojoba esters-70.

Experiment

Using a breakage meter, we determined the relative effect of jojoba esters-70 (JE-70) on lipstick strength. Table 1 shows the nine emollients and six waxes evaluated in this study. The wax phase remained constant at 18% in all formulations. Stick strength was measured in kilograms (kg) of force required to break the stick. As a comparison, five lipsticks available over-the-counter (with the same diameter stick) were tested on the breakage meter. Their values ranged from 0.285 kg to 0.610 kg. The lowest value (0.285 kg) was considered the minimum acceptable value for the tested blends.

Each emollient was combined with each wax in a ratio of 82:18 and melted at 90°C. Sticks were prepared in a 12.5 mm diameter lipstick mold. For example, 18% beeswax was mixed with 82% of each emollient, producing nine mixtures. This procedure was followed for each of the remaining waxes, producing a total of 54 blends for strength testing.

In the next phase, JE-70 was substituted for half of the wax in each previous test.
formulas, melted at 90°C with each emollient, and sticks prepared, as before. For example, half of the beeswax in each lipstick formula was substituted with JE-70 (98% beeswax and 9% JE-70). This 50/50 wax blend representing 18% of the total formula was mixed with each emollient at 82%, producing nine additional mixtures. This format was followed for each of the remaining waxes, to produce 45 additional blends for strength testing.

In total, we tested 99 emollient/wax combinations: 45 contained no jojoba esters in the waxes; 45 others contained waxes that were 50% jojoba esters; and 9 others contained waxes that were 100% jojoba esters. This paper reports our findings on the stick strength resulting from some of these combinations. The complete findings are available from the authors.

**Results**

Interestingly, we found that several synergies existed between JE-70 and the waxes evaluated. For example, in the lanolin oil formulation results (Figure 1), neither JE-70 (A) nor microcrystalline wax (B) used alone at an 18% level yielded a material that was strong enough to form a stick when mixed with lanolin oil. However, a blend of 50% JE-70 with 50% microcrystalline wax was used at 18% with 82% lanolin oil formed a stick exhibiting better than the minimum acceptable value. Candellina and carnauba also both performed better in the lanolin oil emollient when the single wax was blended with JE-70.

The same synergy phenomenon was demonstrated between beeswax, microcrystalline wax and JE-70 when used in formulations with jojoba esters (JE-15), as illustrated in Figure 2. In this figure, low or no stick strength is exhibited by beeswax (A), microcrystalline (B), and JE-70 (C) when used alone at 18% with JE-15. The 50/50 blend of beeswax JE-70 (D) and microcrystalline JE-70 (E) used at 18% with JE-15 showed improvement over the wax without addition of JE-70. Both candellina and carnauba performed better in the JE-15 emollient when the single wax was blended 50/50 with JE-70.

Beeswax, microcrystalline wax and JE-70 demonstrate this synergy in the emollient isopropyl jojobate/jojoba alcohol (IPJA) as well. In Figure 3, notice that no stick was formed when either beeswax (A), microcrystalline wax (B), or JE-70 (C) was used alone with IPJA. Stick strength is improved when half the beeswax (D) or half the microcrystalline (E) in each formulation is replaced with JE-70. Candellina also performed better in the IPJA/JE-70 emollient when the single wax was blended 50/50 with JE-70.

In castor oil (Figure 4), cokerite had a low stick strength (B) and JE-70 (C) did not form a stick at the 18% use level. Beeswax with castor oil did form a stick with good stick strength (A). However, good synergy exists with 50/50 blends of beeswax/JE-70 and cokerite/JE-70, breakage strengths were increased by a factor of two over beeswax alone and by a factor of nine over cokerite alone (D).

**Discussion**

For a given emollients system, the observed increase in stick strength are not attributable solely to substituting a wax having a higher melting point, as Table 1 indicates. Using a combination of waxes is the key.

Lipstick formulation is as much art as science, with experience and hands-on knowledge being the predominant prerequisites for developing a good lipstick. In the emollient/wax system, trade-offs are made to achieve certain characteristics while maintaining stick strength. For example, carnauba wax imparts shine to the stick after flaming (enhancing visual effect), but it does not impart gloss to lips. If gloss is desired in the applied product, this is achieved by increasing the appropriate emollient. Generally, as wax levels (and stick strength) are reduced, slip and gloss are increased. An intimate knowledge of the way waxes and emollients behave in stick formulations is gained with time. It is seldom taught in books or reported in vendor technical data sheets.

The information developed in our wax-substitution experiments expands the formulator’s knowledge base, adding a touch of science to the art of lipstick formulation. A formulator desiring to use a particular emollient or wax can use the information in this report to help predict or improve stick strength.

**Table 1. Emollients and waxes used to prepare lipsticks tested for stick strength**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Abbreviation</th>
<th>Melting point (°C)</th>
</tr>
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<tbody>
<tr>
<td>Emollient</td>
<td></td>
<td></td>
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<tr>
<td>Cetyl/Palmitic triglycerides</td>
<td>CCT</td>
<td></td>
</tr>
<tr>
<td>Castor oil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isopropyl jojobate/jojoba alcohol</td>
<td>IPJA</td>
<td></td>
</tr>
<tr>
<td>Isopropyl laurate</td>
<td>IPL</td>
<td></td>
</tr>
<tr>
<td>Jojoba esters 15</td>
<td>JE-15</td>
<td></td>
</tr>
<tr>
<td>Lanolin oil</td>
<td>Mineral oil (paraffinum liquidum)</td>
<td>Oleyl alcohol</td>
</tr>
</tbody>
</table>

**Wax**

- Beeswax: 63
- Candellina: 70
- Carnauba: 94
- Microcrystalline, SPI96: Microcrystalline: 90
- Cokerite: 79
- Jojoba esters: 70

JE-70: 70
Conclusion

The data shows that 50% replacement of a single wax with jojoba esters-70 in experimental lipstick formulations increased stick strength by more than 20% in 71% of the trials. The improved stick strength cannot be attributed to the melting point of the waxes used. It is a function of the particular combination of waxes and emollients.

Additional work is underway to examine minimum wax combination levels required to achieve positive results and to evaluate the possibility of decreasing total wax required in a formula while still maintaining stick strength. The object is to allow formulators to improve pay-out and gloss in long-wearing lipsticks that tend to have an unacceptable impression of dryness to the consumer.

References