New Silicone Technologies for Ethnic Hair Care

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Hair care thrives on innovative technology, allowing consumers to revel in dramatic styling to fit today’s trends, while also tapping a range of products designed for the distinctive hair structures and grooming techniques of various ethnic and regional populations. Silicones have played a major role in product development (1), partly due to their ability as conditioning agents for softness and manageability, but also because they impart shine. Superior conditioning properties are particularly important to African-American hair, with its tighter curls and coarser texture than Caucasian hair, as well as its thinner, more variable and elliptical diameter. Because African-American hair also tends to tangle, knot and break easily, mechanical forces such as combing can easily damage the fragile hair, and chemical treatments such as relaxers and colorants compound these effects.

Soft feel, conditioning effects and shine remain key attributes to be obtained from ethnic hair care products, particularly for those who prefer to straighten or color their hair. This article focuses specifically on the needs of African-American hair and on new silicone technologies that can help formulators create next-generation products that offer multifunctional solutions for consumers.

The Solution for Long-Lasting Shine

Amino-functional silicones are well known in the hair care industry for their ability to improve deposition on negatively charged hair (2). A patented silicone resin (3,4) with the INCI name amino propyl phenyl trimethicone contains both amino and phenyl functional groups. The phenyl group imparts shine due to its high refractive index, and the liquid nature of the resin provides good film-forming capabilities to help ensure efficacy once it is delivered onto the hair. For formulation into both oil- and water-based products, the resin is easily emulsified. Furthermore, because it is able to withstand a high pH environment, the silicone resin can be incorporated into relaxers and permanent wave formulations.

Evaluation was done on a variety of hair tress samples including European slightly bleached blonde, European virgin brown, frizzy and Oriental hair. Hair tresses were treated with 2 percent by weight amino phenyl trimethicone in cyclopentasiloxane. For shine testing, a sample tress was placed in a dip bath of the solution for 30 seconds, the excess was removed by pulling the tress through two fingers, and the tress was dried with a blow dryer while combing. Following application, shine evaluations were conducted using either a gloss meter or sensory panel based on an evaluation technique developed by Dow Corning (5). Untreated tresses were tested as benchmarks. Evaluations were performed immediately after treatment, and again one day and one week following treatment. The results in Figures 1 and 2 clearly show that the resin provides a long-lasting shine benefit for European slightly bleached blonde and frizzy hair, respectively. Similar results were observed with Oriental hair. Figure 1 also shows that the amino phenyl trimethicone gives improved shine performance over phenyl trimethicone, a silicone fluid commonly incorporated in hair care products to claim shine benefits.

Formulation 1 is an example of a prototype pomade formulation that incorporates the amino phenyl trimethicone.

This hair dressing and the same formulation without amino phenyl silicone were used to treat frizzy hair tresses. Figure 3 shows the shine ben-

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**Figure 1.** Long-lasting shine results on slightly bleached hair, using Garner micro-TRI-gloss meter shine measurements.

**Figure 2.** Results of test with shine box panel comparing untreated frizzy hair tress and tress treated with amino phenyl silicone resin, one day after treatment. (Significant difference = 0.01)
Enhanced Straightening Benefits

An additional benefit of the amino phenyl resin is enhanced hair straightening. The resin can be added to a hair relaxer for ethnic hair and may also be a good candidate for Asian consumers who prefer to wear their hair perfectly straight. Figure 4 shows the straightening benefit on a frizzy hair tress when adding the silicone resin to a commercial lye relaxer, compared to a commercial relaxer without resin.

Tests also have shown that the amino phenyl silicone resin is not degraded by an alkaline solution at 50°C for at least 3 weeks. This stability allows the silicone resin to be formulated into relaxers, permanent wave products, colorants and hair fixatives that are highly alkaline, even as high as pH 12 to pH 14.

Focus on Conditioning

While the new silicone resin focuses on styling and maintenance by enhancing shine and straightening, another development in silicone technology can be used to improve hair softness and conditioning. Formulated in leave-on and rinse-off conditioners, an emulsion based on a newly patented silicone quaternary polymer (6) delivers superior hair softness without greasiness. Its conditioning effects can also be documented by reduced wet and dry combing forces.

Silicone quaternium-16 (and) undeceth-11 (and) butyloctanol (and) undeceth-5 is a microemulsion of a quaternized amino-functional silicone polymer. Because of their positive charge, quaternary ammonium functional silicones are useful in treating materials and surfaces that are primarily negatively charged, specifically hair fibers in hair care applications, and also fibers associated with textile applications. The quaternary ammonium functionality makes possible ionic interactions that are the basis of many useful properties, including increase in hydrophilic character, ability to act as a thickener, and improved ability to aid in the deposition of other mate-

Formulation 1

**Golden Hair Dressing**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Wt. %</th>
<th>Trade Name/Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Aminopropyl phenyl trimethicone</td>
<td>2.0</td>
<td>Dow Corning® 2-2078 Fluid</td>
</tr>
<tr>
<td>2. Isopropyl myristate</td>
<td>4.0</td>
<td>Stepan IPM/Stepan</td>
</tr>
<tr>
<td>Phase B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. C30-45 alkyl methicone</td>
<td>3.5</td>
<td>Dow Corning® AMS-C30 Cosmetic Wax</td>
</tr>
<tr>
<td>Phase C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Petrolatum</td>
<td>41.0</td>
<td>White Prototpet 1S/Witco Corporation</td>
</tr>
<tr>
<td>5. Microcrystalline wax</td>
<td>6.5</td>
<td>Microcrystalline Wax White 1275/Frank B Ross Co.</td>
</tr>
<tr>
<td>6. Lanolin</td>
<td>13.0</td>
<td>Lanolin USP/Fisher Chemical Co.</td>
</tr>
<tr>
<td>7. Mineral oil</td>
<td>30.0</td>
<td>Klearol White Mineral Oil/Crompton</td>
</tr>
</tbody>
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**Procedure:** Combine ingredients of Phase A. Add Phase B to Phase A and heat, mixing gently until melted. Add ingredients of Phase C. Heat to 80°C until all ingredients are melted. Mix until uniform. Remove from heat and continue mixing while cooling to room temperature.

Figure 3. Results of test with shine box panel comparing hair dressing with and without amino phenyl trimethicone on frizzy hair. (Significant difference = 0.30)

**Figure 4.** Straightening benefit using the amino phenyl silicone resin on frizzy hair. Left: frizzy tress treated with a commercial lye relaxer containing the silicone resin. Right: tress treated with the same commercial relaxer without silicone.

Dow Corning 5-7113 Silicone Quat Microemulsion
evaluated in several prototype formulations that were compared with various off-the-shelf hair care products. Figure 5 illustrates the improved conditioning effects of the emulsion when evaluated on frizzy hair. The quaternary ammonium silicone has also been tested on other hair types, showing similar superior conditioning benefits.

Conclusions

In today’s competitive ethnic hair care market, formulators are challenged to create high performance, multifunctional products that meet unique needs based on hair structure and styling techniques. Silicones are already recognized for their superior conditioning properties, and materials based on new silicone technologies can provide increasingly specialized solutions for innovative ethnic hair care products.

References


Formulation 2 is an example of a prototype rinse-off conditioner containing the new silicone quaternary emulsion. Silicones are well known in the hair care industry for providing excellent wet and dry conditioning benefits. The silicone quaternary emulsion has been evaluated in several prototype formulations that were compared with various off-the-shelf hair care products. Figure 5 illustrates the improved conditioning effects of the emulsion when evaluated on frizzy hair. The quaternary ammonium silicone has also been tested on other hair types, showing similar superior conditioning benefits.

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