NEW SILICONE RESIN FILM FORMERS FOR LONGER WEAR AND ENHANCED COMFORT

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Abstract
Trimethylsilylcate (MQ type) and silylalkoxo silane (T type) silicone resins are recognized for their nontransfer and wash-off resistance properties. Two new silicone resins have been developed: a blend of trimethylsilylalkyl and propyl silylalkoxo silane, with excellent wash-off and nontransfer properties, improved flexibility for more comfortable wear in foundations and lipsticks, and improved rub-off resistance. A concentrated propyl silylalkoxo silane resin in an organic carrier, presence of a propyl or methy group improve compatibility for expanded formulating options, especially where high resin content and volatility are needed.

Introduction
Silicone resins are recognized for their use in nontransfer lipsticks. A drawback has been the low volatility of these films, which can reduce comfort. MQ and T propyl resins have been available as pure trimethylsilylalkyl or silylalkoxo silane, typically delivered as a solvent such as cyclopentadecane. Resin powders also are available, which can make handling difficult. Use level and choice of oil phase ingredients are limited. Propyl functionality gives improved compatibility with volatile organic oils, suggesting broader options for new resins.

A new process for making resins in flake form led to a unique blend of trimethylsilylalkyl and polypropyl silylalkoxo silane. Presence of propyl functionality on the silylalkoxo silane resin resulted in a highly concentrated blend delivered in a volatile organic carrier.

Materials and Methods
New materials
- Trimethylsilylalkyl (and) polypropylsilsesquioxane: a blend of MQ and T propyl in a low-refractivity phase point (<120°C).
- Polypropylsilsesquioxane (and) isododecane: a concentrated blend of T propyl resin in a volatile organic carrier.

Existing materials
- Trimethylsilylalkyl (MQ): 100% solid

Properties evaluated
- Compatibility
- Film appearance and flexibility
- Wash-off resistance/nontransfer
- Permeability
- Contact angles for water and artificial sebum

Product forms evaluated
- Lip products (liquid and stick)
- Foundation
- Mascara
- Eyeliner

Test methods
- Visual observation on glass slide and flexible silicone rubber band
- Water vapor permeability (Payne cup and collagen film) [1]
- Sensory evaluation with experienced panelists
- Contact angle on reconstituted glass
- Colorimeter measurement after rub test for lipstick and foundation
- Wash-off resistance with FTIR spectroscopy and attenuated total reflectance (ATR) device [2]

Results and Discussion
Improved compatibility
Silicone resin blend was dispersed into carriers (e.g., silicone oils, volatile organic oils, and waters at 50% active, depending on the resin).

- For the same level of silicone resin, the MQ propyl blend had a lower viscosity, especially in more polar carriers.

This observation indicates positive impact of T propyl functionality on compatibility.

A silicone rubber belt was coated with samples of the three films and imaged at 110% of its original length.

- The MQ resin film became powdery.
- The MQ/T propyl film became slightly flaky.
- The T propyl film was continuously homogeneous.

In most cases, the MQ propyl blend was the best compromise for a hard and nonsticky feel with improved flexibility.

Film-forming properties also were assessed in a foundation formulation (4.25% solid resin). Results were evaluated after stretching and washing.

After stretching, the film with the MQ resin showed some cracks and was easy to peel from the substrate.

- Films containing the MQ/T propyl resin blend and the T propyl resin were still homogeneous.

Penetration to the skin after formulation was measured using an FTIR spectrophotometer equipped with an ATR device.

- A 5% resin solution in isododecane was applied to the forearm of the panelists.

- After 24 hours, the MQ/T propyl resin showed reduction of remaining resin on the forearm. For the MQ/T propyl resin, 70% of the material remained after three washings.

- The MQ resin was probably because the film remains soft.

Nontransfer in liquid lipstick
Nontransfer properties were measured using a liquid lipstick containing 10% silicone resin applied on a collagen film.

- The MQ/T propyl resin may give the best balance between nontransfer and comfortable wear due to its film flexibility.

Performance in solid lipstick
A lipstick containing 10% MQ/T propyl resin was evaluated by paired-comparison sensory testing against a lipstick with the same level of MQ and the same level of T propyl resin.

- No difference was found between the lipsticks containing MQ and T propyl resins.

- The lipstick with the MQ/T propyl resin was shinier and had better color intensity, likely from the T propyl functionality, which adds compatibility with the pigment and has a higher refractive index compared to the MQ, but also more transfer.

- The same lipstick without resin was softer and broke down, making evaluation impossible.

Performance in mascara
A simple test was developed using the feather of a shorn sheep. The mascara was applied and subsequently washed with water.

- The best performance was with the MQ/T propyl and the T propyl resin; almost none of the mascara was washed away.

- Mascara containing the MQ propyl resin was more difficult to remove by rubbing compared to MQ resin; the more powder character of dry films of the MQ/T propyl resin makes them have greater sensitivity to rub-off compared to the MQ/T propyl resin.

Impact of the carrier on nontransfer
Two new resins were evaluated as reconstituted in aqueous solvents and 10% formulations to assess rheological effects.

- The new resins are delivered at 100% active or at a very high level into isododecane; nontransfer properties can be improved compared to the same material in volatile solvents.

- Formulations can be customized to achieve appropriate volatility (e.g., high for lipsticks and eyeliners, medium for foundations).

Conclusions
Two new silicone resins offer formulating advantages in color cosmetics:

- Ease of formulation
- Film flexibility
- Wash-off resistance and nontransfer properties comparable to existing resins

Superior, longer-lasting formulations with improved comfort and minimal impact on the skin barrier function can be achieved.

References

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