A Novel Silicone Copolymer to Protect Hair Against Solar Damage

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Introduction

Skin damage due to sun exposure is well documented and understood by the consumer. There is a growing body of knowledge that suggests that exposure to the sun and UV irradiation in particular also damages hair. Unlike reddening skin, damage to hair fibers is not immediately perceived. Like skin however, the alterations that occur to hair fibers are both chemical and physical in nature. These alterations manifest themselves to the consumer over time as a lack of manageability and changes in hair appearance and elasticity.

Methodology

In this study we document the benefits of a novel polysiloxane copolymer modified with methoxycinnamic acid ester and cationic alkylamidopropyl ammonium groups to protect hair from the deleterious effect of UV irradiation. Methods used to establish key parameters such as molecular weight, degree of cationic substitution and the number of UV-absorbing units was also addressed in the earlier body of work (1).

This polysiloxane copolymer's performance was evaluated for tensile strength (MTT670 Diastron, Andover, U.K.), keratin integrity through differential scanning calorimetry (2) and color protection using the CIE= L*a*b* colorimeter method (Dr. Lange, Düsseldorf, Germany). The color protection assessments were conducted for both demipermanent (Garnier Movida #27, L'Oreal) and permanent (Poly Brilliance # 868, Schwarzkopf & Henkel) hair dyes. European bleached hair tresses (Kerling International Haarfabrik GMBH, 20cm, 1gm/cm) were used for all measurements. Tresses were UV/VIS irradiated using a SOL 2 sun simulator (Dr. Hoenle AG, Graefeling, Germany). The SOL 2 uses a D65 light source that simulates a dose rate of 1 day at 50° northern latitude per 4 hours. Prototype shampoo and conditioner were used to deliver the 2% UV actives to hair fibers with commonly used raw materials.

Results

Tensile Strength

Tensile strength measurements were conducted on bleached European hair. Initial values were generated using fibers that were not treated with any UV active. The fibers were allowed to relax in water (2h) and allowed to dry. Conditioner prototypes contained 2% active level of the UV active. All samples were subject to four treatment cycles. Treatment cycles included soaking in the conditioner for 10 minutes, rinsing under tap water for six seconds and all samples were allowed to dry for 12 hours at 22°C and 50% relative humidity. Samples were irradiated for seven hours following each treatment cycle. Single hair fibers (30 per test formula) were evaluated at a "load 15% (mN)" and force value at 15% elongation. The tensile strength of the fibers treated with the polysiloxane copolymer remained higher than the control with approximately 40% protection (Fig. 1).

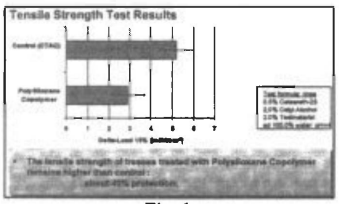

Fig. 1

Keratin Integrity by DSC

Hair samples were treated with 0.5g shampoo for 30 seconds and allowed to rest on the hair for one minute followed by one minute of rinsing. Tresses treated with conditioner were treated with 0.5g conditioner. The conditioner remained in contact with the hair for two minutes followed by a two minute rinse. Samples were air dried and then irradiated for 4.25 hours. All tresses were subjected to four treatment cycles. The tresses were fanned out for uniform irradiation. The polysioxane copolymer delivered from a shampoo or conditioner provides about 11 % and 12% protection respectively versus the CTAC control (Fig. 2 and Fig.3).

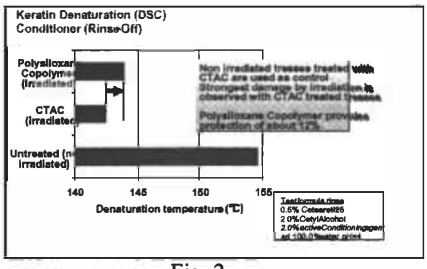

Fig. 2

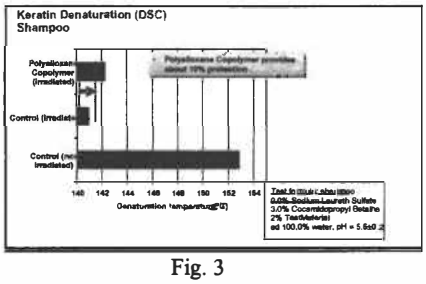

Fig. 3

Color Protection

Bleached tresses were dyed with demipermanent or permanent hair color following the package instructions. Initial color measurements were taken after the dying process was completed. Samples were dried for 24 hours and then treated either with a shampoo or conditioner prototype prior to irradiation for 7 hours. A final color measurement was taken. The color difference was calculated using the following equation.

$$\Delta E^* = [(\Delta L^*)^{\wedge}2 + (\Delta a^*)^{\wedge}2 + (\Delta b^*)^{\wedge}2]^{\wedge}1/2.$$

Shampoo samples delivering 1.0% polysiloxane copolymer reduced color fade of permanent dye by 50%. Conditioner samples delivered similar results (Fig. 4).

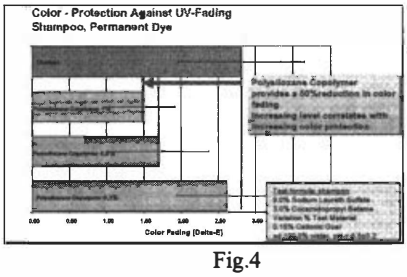

Fig.4

Conclusion

The polysiloxane copolymer is proven effective for shampoo and conditioner applications fiber and color protection especially for permanent hair dye.

References

1. H.I. Leidreiter, etal, *Proc. 23rd. IFSCC Congress*, 2004.
2. F.J. Wortmann, etal, *J. Cosmetic Science*, (53), 219-228, 2002.