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Effect of Commercial Hair Blockers on the UV Protection of Hair Fiber

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Excessive sunlight exposure is one of the most frequent causes of hair damage (Sebetic et al., 2008). Sun emits the ultra violet (UV) light which has the wavelength between 100 nm to 400 nm. UV light is largely classified into UVA (400 nm~315 nm), UVB (315 nm~280 nm), and UVC (280 nm ~100 nm). Among the three types, UVC is the most dangerous UV radiation which can kill tissues and bacteria on human. However UVC is less of a concern as long as the ozone layer on the earth atmosphere is intact. Generally, the UV light that is considered in hair damage is UVA and UVB. According to Sebetic et al.(2008) the wavelength of sunlight that is responsible for the damage in hair is between 254 nm to 400 nm. This includes whole wavelength region of UVA and UVB, and some longer waves of UVC. It is said that UVB is responsible for the loss of hair protein and UVA is responsible for the change in hair color (Sebetic et al., 2008). On the other hand, Jeon et al. (2008) reported that UVB induced morphological changes such as cuticle detachment or lift, while UVA induced the biochemical change in hair such as the smoothness and the loss of cuticlar edges.

Previous research indicated that the use of hair care products containing UV filters can protect the hair from serious UV damage (Sebetic et al., 2008). There are basically two types of UV filters used in the cosmetics industry, the physical filter and the chemical filter (Sebetic et al., 2008). Physical filter provides protection by reflecting the UV radiation from the surface (Masnec et al., 2007). Chemical filter prevents the penetration of UV radiation by absorbing the UV rays (Gao & Bedell, 2001). An initial survey on the commercially available hair care products indicated that chemical compounds such as ethyl hexyl methoxycinnamate, octyl methoxycinnamate, benzophenone, benzyl salicylate, titanium dioxide, zinc oxide were incorporated to aid in the UV protective function. Many so-called hair-UV-protective products had various vegetable oil extracts or similar ingredients. However, vegetable oil primarily serves as a moisture barrier to skin and hair rather than provide a direct UV protection. In this regard, the purpose of the present research was to compare the UV protection of commercially available hair care products that contain vegetable oil or similar moisture protectors with that of the products containing known UV filters.

Five commercial hair care products were selected for the study and were labeled 1 through 5. Product 1 contained no direct UV filter, Product 2 contained ethyl hexyl methoxycinnamate, Product 3 contained no direct UV filter but contained Vitamin E, Product 4 contained ethyl hexyl methoxycinnamate, octyl methoxycinnamate, and butyl methoxydibenzoylmethane, Product 5 contained ethyl hexyl methoxycinnamate, titanium oxide, and zinc oxide. In summary, Product 4 and 5 contained both UVA and UVB filters, Product 2 contained UVB filter, Product 3

contained indirect protection, and Product 1 did not contain any UV filter. All were advertised on the on-line store to have the UV protective function.

Prewashed virgin black hair tresses of approximately 15 cm in length, each weighing about 2 g, were purchased from Bona Hair Company of Korea. At least 20 hair fibers were retrieved as a sample tress for each 'hair care product-irradiation time' block. UV irradiation treatment was applied for up to 96 hours for each hair care product. Approximately 0.5 g of each hair care product was applied on the samples by hand in a parallel direction to the length of hair. The hand treatment was chosen to simulate the ordinary application method of the users. The sample was left to dry for an hour before it was subjected to irradiation of UVA (365 nm). Hair sample 0 acted as a control. The hair pieces were subjected to tensile measurement, color evaluation, and protein assay before and after the irradiation time increments. Amount of protein in the treated samples was determined first by delipidizing the samples, extracting protein, and carrying out the protein assay following the Bradford method.

The results of tensile measurement indicated that control sample (0) had the lowest tensile strength than the hair samples treated with Products 1~5 in the UV irradiation time of 0 hr to 96 hrs. Sample treated with Product 5 showed the highest tensile strength in 0~96 hrs. There were no significant differences in the elongation measurement of the control and the samples treated with Products 1~5. Determination of the amount of protein was carried out on selective samples only. The results of protein assay indicated that the protein amount of control sample with no hair care treatment and no UV irradiation was 2.851 μg/μL while the protein amount of this sample after 96 hours of UV irradiation decreased to 1.222 μg/μL. On the other hand, the amount of protein in the sample treated with Product 5 was 2.077 μg/μL after 96 hours of UV irradiation. The overall results showed that Product 5 provided the best UV protection effect to the hair and that the products with moisture barrier but no known UV filters did not show any notable UV protection to the hair. The higher UV protection results of Product 5 must be due to the coexistence of ethyl hexyl methoxycinnamate, zinc oxide, and titanium dioxide in the product.

References

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