

〈一般論文〉

毛髪の損傷に伴う毛髪微細構造の変化

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Change of Hair Ultra-Structure Caused by Hair Damage

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Abstract

Recent changes in fashion trends have increased the Japanese consumer demand for hair damage care. The hair damage progresses synergistically by various damaging factors such as chemical treatments, UV rays and brushing. As a result, these multiple causes lead to considerable hair damage in the forms of cuticle lifting, split-ends and breakage, further contributing to a worsening texture and luster. It is thought that these types of hair damage occur by repetitive irreversible structural changes due to the degradation of hair proteins. We have characterized the ultra-structure of various models of damaged hair, with respect to morphological features and mechanical properties, both in the hair cuticle and the hair cortex, using transmission electron microscopy and scanning probe microscopy, focusing on changes in ultra-structure caused by bleaching and UV radiation.

We observed that three layers in the cuticle (A-layer, exocuticle, and endocuticle) change in stainability and mechanical property during hair damage. As the damage progresses, cavities were generated in the endocuticle. Further in-depth observations revealed that this cavity was formed by elution of granulated substances in the endocuticle, which are clearly observed in non-damaged hair. This granulated substance was degraded in initial stages of damage by bleaching and UV exposure, and easily flowed out. In the hair cortex, the structure of the microfibril protein was more clearly observed in damaged hair compared with non-damaged hair. Therefore, the results suggest that the matrix protein that surrounds the microfibril protein flowed out following damage. This suggests that elution of both the granulated substance in the endocuticle and the matrix protein in the hair cortex contributes to the promotion of hair damage.

Key words: hair, Transmission Electron Microscope, Scanning Probe Microscope, ultra-structure, endocuticle.