〈Regular Article〉

Effect of Heat Treatment on Human Hair Keratin Film

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Abstract

　　Human hair keratin film consisting of fine fibrous and particle structures has been utilized as an alternative device to hair samples. Since application of heat is a well-known factor causing hair damage, the thermal effects on the keratin films and hair samples were examined focusing on color change, morphological observation, protein solubility, and oxidative proteins. The opaque white appearance of the keratin film changed to a yellow/light brown color by the thermal treatments at more than 170℃. This color change at 170℃ and higher was also detected by spectrophotometry. Scanning electron microscopy (SEM) observation showed that there was little change in the fine structures of the keratin films and hair samples even after a thermal treatment at 200℃ for 10 min. When protein solubility of heat-treated keratin films and hair samples were examined using a solution containing dithiothreitol (DTT) and urea, the amounts of proteins solubilized from heat-treated keratin films and hair samples were less than those from untreated keratin film and hair samples. The protein solubility decreased in a heating time- and temperature-dependent manner. A linear relationship between solubilized proteins and a heating temperature of 110 to 160℃ was found. Compared to hair samples, the degree of change was clearly evident in the keratin films. The solubilized proteins consisted of keratin and keratin-associated proteins (KAPs). The amount of carbonylated proteins increased in the films treated at 120−180℃. This data suggests that thermal treatment promotes protein oxidization and induce the formation of "Stable Structure" which has not yet been identified. In any event, hair thermal damage will be quantitatively evaluated using the keratin films in place of hair samples.

Key words:　human hair keratin film, heat stability, thermal sensitivity, protein solubility, comparison with hair sample.