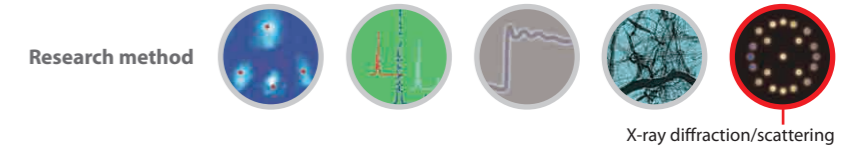


Development of Hair-Care Products That Make Hair Shiny

Quantification of hair shine at the cellular level



Beamline used at SPring-8: High Flux (BL40XU)

Award for this research: The 6th Hyogo SPring-8 Award (2008)

Achievements

- Cellular-level quantitative evaluation of **hair curliness** related to the **shine of hair**
- Commercialization of hair shampoos, conditioners, and treatments containing an organic acid that can suppress hair curliness and restore shine to hair.

R&D facility: Kao Corporation

***Cortex cell:** Hair comprises three tissues; the medulla at the center of a hair is surrounded by a cortex, which is covered with a cuticle layer. Nearly 90% of a hair is composed of the cortex, and the cortex cells are longitudinally lined. Internal fibers are aligned parallel to each other in some cells and twisted in other cells. The cells with twisted internal fibers are concentrically surrounded by the cells with parallel internal fibers in straight hair. In contrast, these two types of cell are nonuniformly distributed in curly hair.

****Small-angle X-ray scattering technique:** The structure of a substance can be analyzed from the X-ray scattering intensity profiles obtained by irradiating a micrometer-size X-ray beam onto the substance. The data revealing the tilt angle of internal fibers were obtained by the measurement of cortex cells by this method.

Role of SPring-8

Background

Many women worry about losing the shine of their hair with aging, but the causes behind this loss have remained unclear. First, the degree of hair shine was evaluated quantitatively, and it was clarified that hair shine decreases with aging. It was found that the decrease in the degree of shine is related to the increase in the curliness of hair.

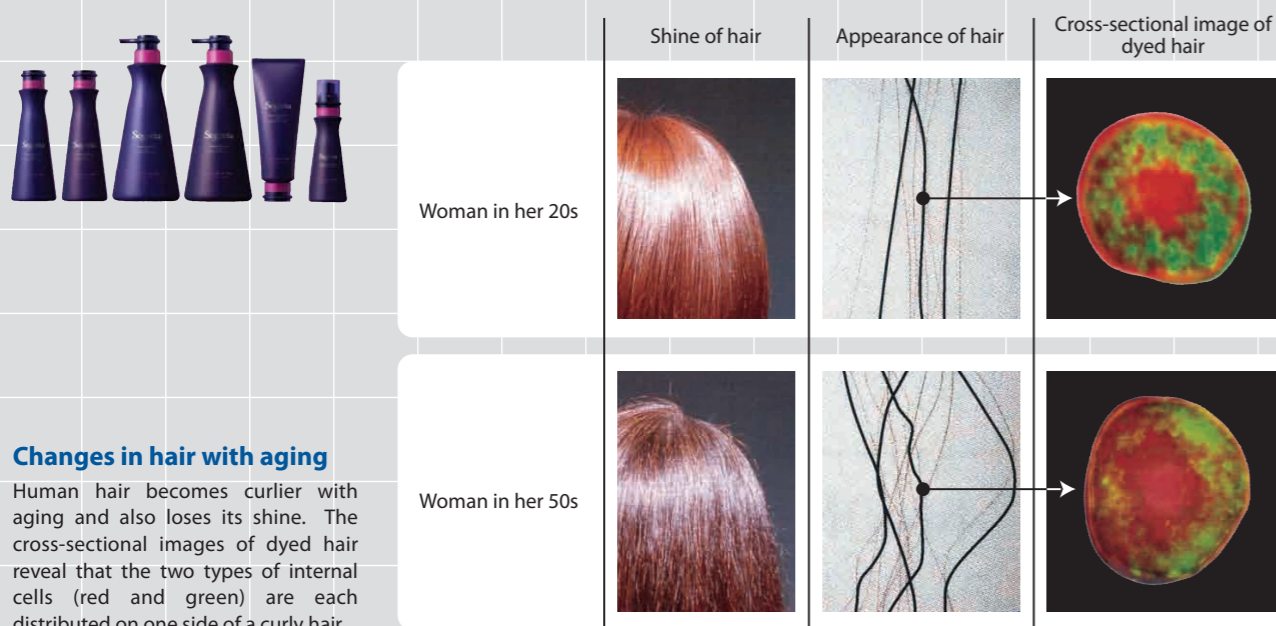
Furthermore, the observation of the **cortex cells*** inside hair by dyeing revealed that the two types of cell in a curly hair were unevenly distributed in the hair.

Results

It is necessary to examine how the cells with twisted internal fibers are arranged in order to clarify the relationship between the **uneven distribution of cortex cells** and the curliness of hair. Unfortunately, a hair is 100 μm in diameter (1 μm is one-thousandth of 1 mm). Only the high-performance X-ray at SPring-8, with a high-accuracy analysis capability at a resolution of 5 μm , offers a sufficiently high resolution to observe and analyze the structure of fine regions in a hair.

From the analysis of the images obtained by the **small-angle X-ray scattering technique****, it was quantitatively clarified that the curliness of a hair is related to the degree of distributional inhomogeneity of the two types of cortex cells.

Publication: S. Nagase et al.; Proceedings of the 8th Conference of Asian Society of Cosmetic Scientists (ASCS2007), 86-BBC-A0132, Singapore (2007)
T. Itou et al.; Proceedings of the 25th Congress of International Federation of Societies of Cosmetic Chemists (IFSCC), PS-254, Barcelona, Spain (2008)

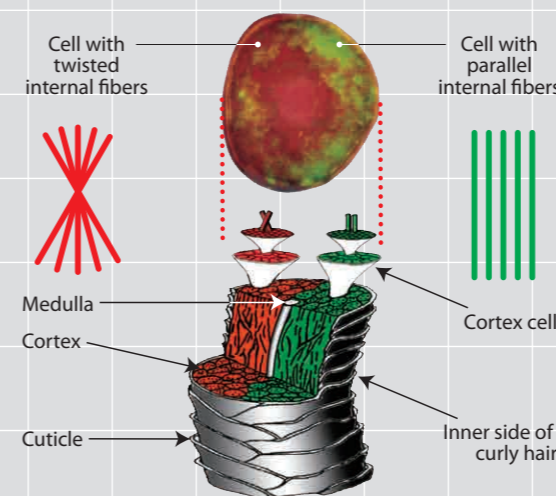


Changes in hair with aging

Human hair becomes curlier with aging and also loses its shine. The cross-sectional images of dyed hair reveal that the two types of internal cells (red and green) are each distributed on one side of a curly hair.

Distribution of cells inside curly hair

The cells with parallel internal fibers (green part) and those with twisted internal fibers (red part) are each distributed on one side of the hair.



Images obtained by small-angle X-ray scattering technique

The circle at each center shows the shadow of the beam stop. Black parts left and right of the circle show the scattering pattern that indicates the arrangement of internal fibers in the hair. The pattern for a straight hair has only minor differences between the inner and outer sides, whereas a curly hair has a different pattern on each side.

