# Development of Hair-Care Products from Rice Water

Visualizing the penetration of a protective compound into the hair using spectroscopy

## Achievements

- Development of a technique to observe the penetration of a protective ingredient into the hair
- Demonstration of the effect of inositol, an ingredient of rice water, on protection and beautification of the hair
- Development of new hair-care products containing inositol

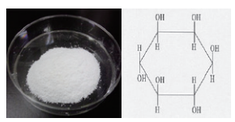
R&D facility: Kracie Home Products, Ltd.

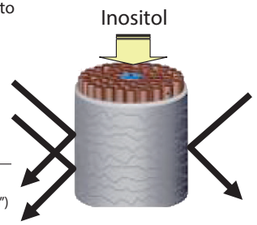
***Fluorescence imaging:** An observation technique using fluorescence microscopes to detect fluorescently-labelled molecules, such as fluorescein isothiocyanate, that have been introduced into proteins.

****Infrared microspectrometer:** This device combines features of an infrared spectrophotometer and microscope; it can measure the distributions of test ingredients. Powerful infrared synchrotron radiation available at the SPring-8's Infrared Materials Science (BL43IR) beamline allows detailed measurements of the distributions of ingredients in the cross-section of individual hairs.

## Hair-protective and -beautifying effects of inositol

Inositol, which is an ingredient of rice water, has the capability to repair damaged hair, as well as protect the hair from damage.






**Protective effects**

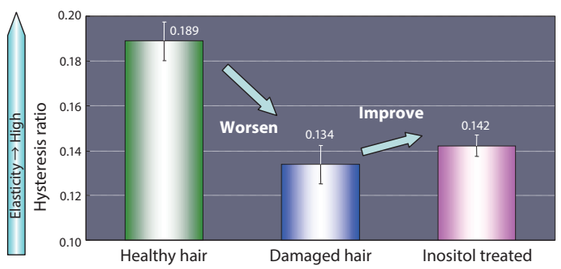
Damages

1) Surface (Hair dye)
2) Inside (Permanent wave, "Perm")

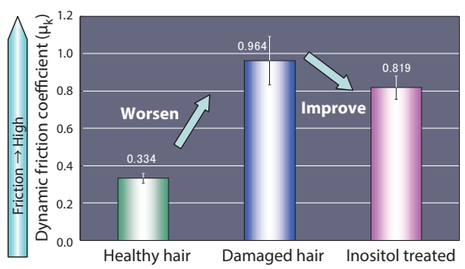
**Protective effects**

Damage-promoting factor

3) Surface friction (While rinsing)

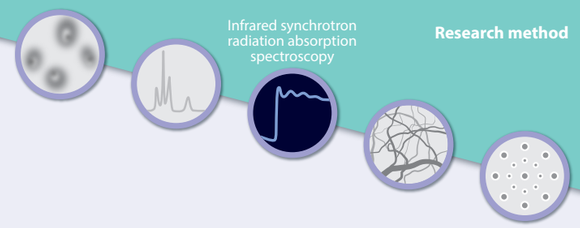



Suppressing the worsening of hair elasticity due to damage from perms (Protection).




Suppressing damage from friction during rinsing (Protection).






## Role of SPring-8

### Background

Evaluation of modern hair-care products requires not only characterization of sensory features, such as improvement in the feel and gloss of the hair, but also scientific explanation of the mechanisms by which the active ingredients exert their effects. Inositol, a carbohydrate contained in rice water, has been used as a hairdressing in Japan since the 8th century. This compound has been demonstrated to have protective and beautifying effects on the hair.

**Fluorescence imaging*** has been used to observe the penetration processes of the active ingredient as it exerts its hair-beautifying effects. However, the quantification of the effects was difficult, and inositol's hair-beautifying mechanisms remain unknown.

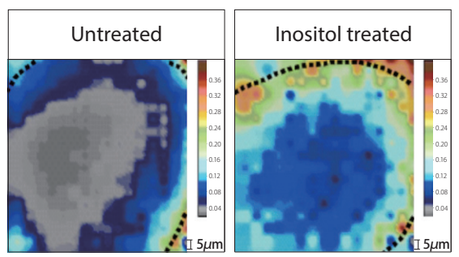
### Results

The **infrared microspectrometer**** at SPring-8, which uses infrared synchrotron radiation, can examine the subtle differences between the interiors of healthy and damaged hair. Examination of hair onto which inositol was applied revealed that signals originating from chemical bonds specific to inositol are stronger near the hair surface, but decrease toward the hair center, indicating that inositol penetrates into the hair gradually. Additionally, we demonstrated that inositol stays inside the hair, allowing its protective and beautifying effects to persist even after rinsing.

Based on this result, new hair-care products containing inositol are being developed. The wisdom of ancient people has contributed extensively to these developments.

## Permeability of inositol into the hair

Numbers in the legend of the figures below represent the absorption intensity of infrared synchrotron radiation. A larger number indicates that there are more chemical bonds specific to inositol. The figure on the right, in which warm colors are highly visible, shows that the inositol concentration is higher along the outer contour of the hair (dashed line). This is the first-ever quantitative visualization of the penetration and persistence of inositol, a hair-protecting ingredient, into the hair.




**Inositol stays inside the hair even after rinsing, resulting in continuing protective hair-beautifying effects!**