

Tradename: AC Kerazyme®

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Lot #: 27630

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Test Performed:

Heat Protection Scanning Electron Microscopy (SEM) Assay

Introduction

Heat styling, chemical coloring, and other environmental aggressors lead to extensive damage of hair fibers causing thinning, split ends, and breakage. Ceramic straighteners and other heat styling appliances operate at temperatures up to 450°F which causes significant damage to hair keratin and structure. Protecting hair from these high temperatures is vital in preventing dry, brittle ends as well as permanent damage. Application of cosmetic products before heat styling helps combat the deleterious effects by strengthening and protecting hair fibers. Therefore, products designed to maintain the structural integrity of the hair cuticle and reduce the damage caused by heat styling are essential.

Visual damage of hair fiber cuticles can be examined with Scanning Electron Microscopy (SEM) imaging. Damage caused by heat styling is observed as irregular textures, flaking, and fragmenting whereas healthy hair appears smooth with no fragmenting and flakes. A product that provides protection against heat styling will maintain visible structures similar to untreated hair.

Accordingly, a Heat Protection Scanning Electron Microscopy (SEM) assay was conducted to visually assess the ability of **AC Kerazyme®** to protect hair against heat styling.

Assay Principle

Virgin human hair tresses were tested to understand the protective capability of a cosmetic product. Heat styling was conducted using a ceramic straightener on virgin hair tresses. Tresses were treated with testing materials before exposure to heat styling. After styling, tresses were examined using scanning electron microscopy examination to visualize the extent of damage. Images provide qualitative damage of the hair fibers.

Materials

- A. **Hair Samples:** Human Virgin Brunette Hair
- B. **Products:** Herbal Essences Hello Hydration Moisturizing Shampoo (Base Shampoo)*
- C. **Equipment:** Remington Ceramic Hair Straightener
- D. **Software:** ImageJ (NIH); Excel Analysis ToolPak (Microsoft)

*Or suitable alternatives, subject to change without notice based off vendor availability

Methods

Four virgin brunette hair tresses were collected and assigned to each condition described in Table 1. One tress was treated with 2.0% **AC Kerazyme®** in water one time as an Active Control to demonstrate how the product interacts with hair. Two tresses were washed with Base Shampoo and allowed to fully air dry before heat styling. While damp, the experimental tress received 2.0% **AC Kerazyme®** in water as a leave-in application. An Untreated Control tress was left unaltered. The Base Control and 2.0% **AC Kerazyme®** treated tresses were brushed five times and then heat styled using 10 passes of a hair straightener set to the highest setting of 450°F. This protocol was repeated 29 times for the two washed tresses.

Table 1. Descriptions of the Conditions for each Hair Tress

Condition	Treatment Description
Untreated Control	No Washes, No Heat Styling
Active Control (2.0% AC Kerazyme®)	No Washes, No Heat Styling, Leave-In Application
Base Control	Washes, Brushing, Heat Styling
2.0% AC Kerazyme®	Washes, Leave-In Application, Brushing, Heat Styling

Microscopic examination of the hair tresses was conducted on a Zeiss DSM 962 at 20.0 kV with a magnification range from 200x-1250x. The electron microscope produces images of hair fibers by scanning them with focused beams of electrons. The electrons interact with the atoms of the hair sample to provide images of the hair's surface topography and surface composition. Ten individual fibers were selected at random from each sample for imaging.

Results

The data obtained met criteria for a valid assay and the controls performed as anticipated. Compared to the Untreated Control, the Base Control experienced visual fiber damage. The Active Control demonstrated a film forming effect of **AC Kerazyme®** compared to the Untreated Control. Furthermore, the tress treated with **AC Kerazyme®** 2.0% exhibited less structural damage compared to the Base Control and appeared similar to the Untreated Control.

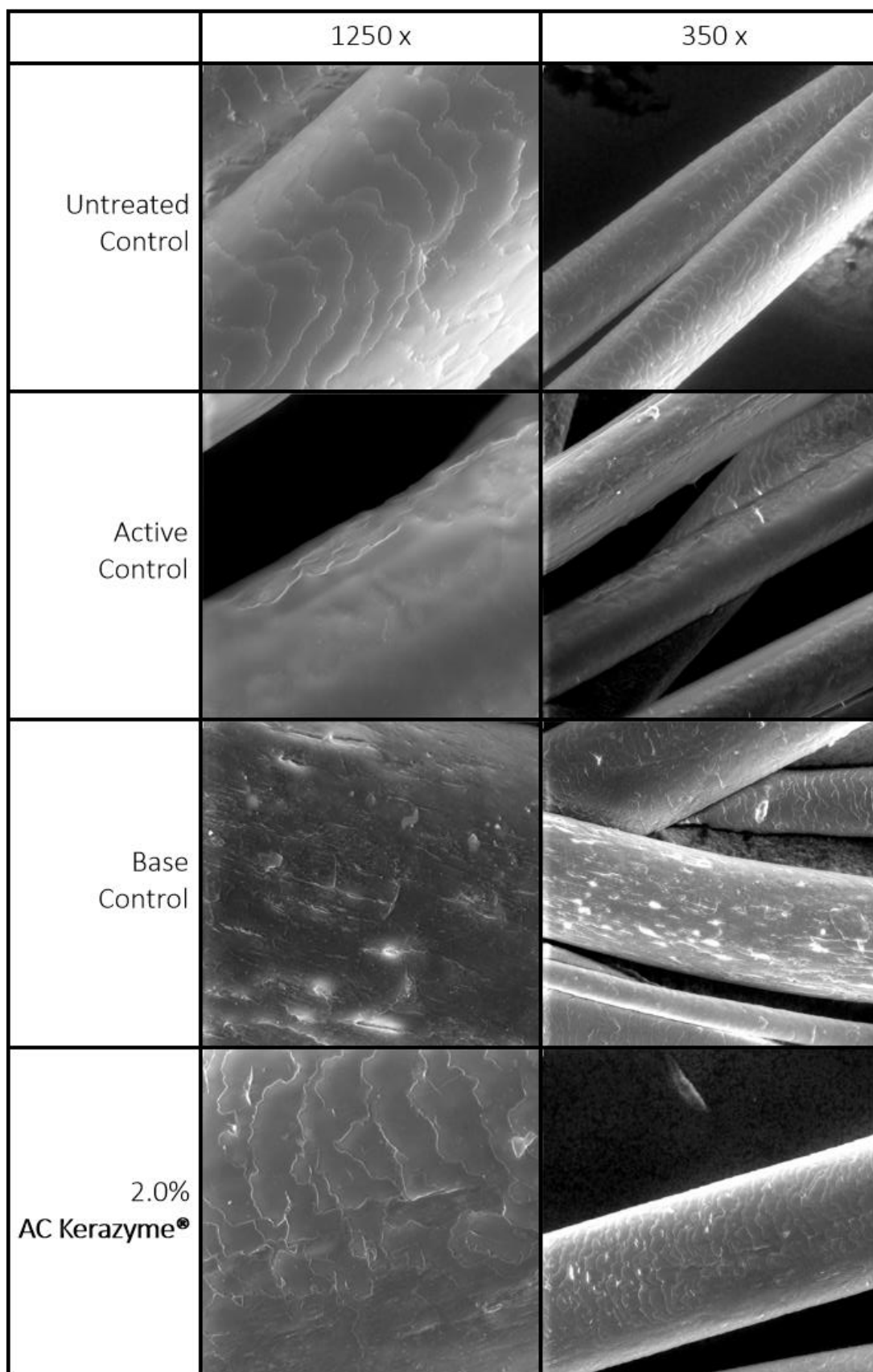


Figure 1. Representative SEM images of treated brunette hair fibers

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Discussion

A qualitative heat protection assay was performed to determine the protective benefits of **AC Kerazyme®** on hair with respect to repeated washing and heat styling. The results from this study indicate that 2.0% **AC Kerazyme®** provides visible protection benefits against standard thermal styling.

As demonstrated in Figure 1, the Untreated Control exhibited a smooth cuticle with no visible damage. The Active Control, 2.0% **AC Kerazyme®** leave-in, remained undamaged and a visible film can be observed around the hair fibers. This data confirms the film forming capabilities of **AC Kerazyme®** on hair.

Compared to the Untreated Control, the Base Control experienced severe damage visualized as increased texture and cracks in the cuticle. Alternatively, the experimental tress treated with 2.0% **AC Kerazyme®** demonstrated improved texture compared to the Base Control indicating its protective properties. Moreover, the **AC Kerazyme®** hair fibers appear comparable to the Untreated Control. This data indicates **AC Kerazyme®** protects and strengthens virgin brunette hair against repeated washing and thermal induced damage.

Collectively, heat styling damages virgin brunette hair, however repeated use of 2.0% **AC Kerazyme®** after washing visibly prevents heat-styled induced damages when utilized as a leave-in product. Taken together, **AC Kerazyme®** protects and strengthens virgin brunette hair against thermal damage when used at recommended use levels.