Scanning Electron Microscopy Assay

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Tradename: ProCutiGen® Hold

Code: 20831

CAS #: 999999-99-4 & 1686112-10-6 (or) 9015-54-7

Test Request Form #: 3152

Lot #: NC170117-M

Sponsor: *Active Concepts, LLC; 107 Technology Drive Lincolnton, NC 28092*
Study Director: *Maureen Danaher*
Principal Investigator: *Jennifer Goodman*

Test Performed:
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 Scanning Electron Microscopy (SEM) assay was conducted to visually assess the ability of **ProCutiGen® Hold** to protect hair against thermal 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 curling iron 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.

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Materials

A. **Hair Samples:** Human Virgin Brunette Hair Tresses
B. **Equipment:** Remington Ceramic Hair Curling Iron

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

Methods

Three virgin brunette hair tresses were collected and assigned to each condition described in Table 1. Two tresses were dampened then one received a Deionized (DI) Water spritz while the other received a spritz containing 2.0% **ProCutiGen® Hold** in DI water. A third Untreated Control tress was left untreated. The Heat Control and 2.0% **ProCutiGen® Hold** treated tresses were air dried then curled for 10 seconds using a curling iron set to the highest setting of 450°F. The Untreated Control tress did not receive heat styling. The study was conducted using a blind protocol.

Table 1. Descriptions of the Conditions for each Hair Tress

Condition	Treatment Description
Untreated Control	No Product, No Heat Styling
Heat Control	DI Water Application, Heat Styling
2.0% **ProCutiGen® Hold**	Product Application, 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-800x. 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, heat control experienced visual fiber damage. Conversely, tress treated with 2.0% **ProCutiGen® Hold** demonstrated less visible fiber damage compared to the heat treated control.

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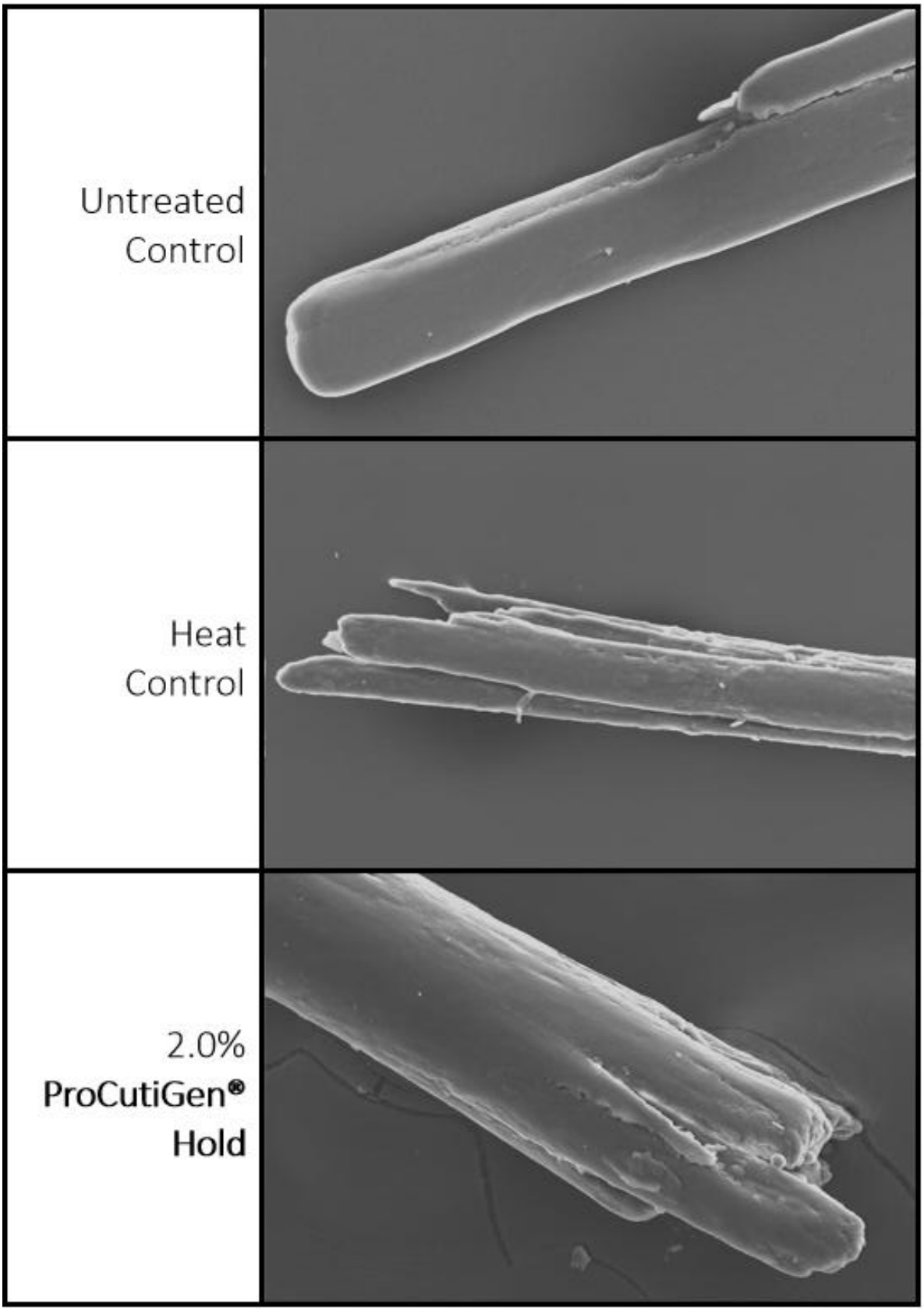

Figure 1. Representative SEM images of brunette hair fibers.

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Discussion

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

As demonstrated in Figure 1, the Untreated Control exhibited a mostly smooth cuticle with some visible damage while the Heat Control tress experienced severe damage visualized as splitting and cracking in the cuticle. Alternatively, the experimental tress treated with 2.0% **ProCutiGen® Hold** demonstrated improved texture compared to the Heat Control and Untreated Control indicating its protective and restorative properties. This data indicates **ProCutiGen® Hold** protects and strengthens virgin brunette hair against thermal induced damage.

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