

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*

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Test Performed:

Hirox 3D Imaging Analysis

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.

Accordingly, a Hirox 3D Imaging Analysis was conducted to assess the ability of **ProCutiGen® Hold** to protect hair against heat styling damage.

Assay Principle

Virgin human hair tresses were tested to understand the protective capability of a cosmetic product after heat styling. Tresses were treated with testing materials before exposure to heat styling. After treatment and styling, tresses were examined using Hirox 3D microscopic examination to determine the extent of damage. Image analysis provides quantification of damage via shifts in hair light intensity.

Materials

- A. Hair Samples:** Human Virgin Brunette Hair Tresses
- B. Equipment:** Blow Dryer; Remington Ceramic Hair Curling Iron; Spray Bottle
- C. Software:** ImageJ (NIH); Excel Analysis ToolPak (Microsoft)

Methods

Virgin brunette hair tresses were collected and assigned to each condition described in Table 1. One tress was left untreated and utilized as the control. The Heat Control tress was treated by spritzing with water, air drying, and curling at 450°F for 10 seconds. The remaining hair tress was spritzed with 2.0% **ProCutiGen® Hold** in water, air dried, and curled at 450°F for 10 seconds. No additives or fixatives were incorporated in the water and hair tress treatment was designed to mimic everyday effects of styling the hair. Manufacturing Solutions Center (MSC) located in Conover, North Carolina was asked to perform Hirox 3D Imaging. MSC utilized a KH-7700 Hirox 3D Imaging Microscope with a MX(G)-5040Z lens capable of 50x-300x magnification.

Table 1. Testing Condition Descriptions.

Condition	Treatment
Untreated Control	Untreated
Heat Control	Water spritz, air dry, curled
2.0% ProCutiGen® Vegan Thermal Shield	2.0% ProCutiGen® Hold in water spritz, air dry, curled

Microscopic examination of the hair tresses was conducted on the Hirox 3D Imaging Digital Microscope. 25 individual fibers were selected at random from each sample for imaging. Images were analyzed in ImageJ to assess changes in light intensity where large increases indicate hair damage. Data was averaged and then analyzed using a one-way ANOVA with statistical significance accepted at $p \leq 0.05$. Percent change is expressed relative to the Untreated Control and calculated by the following equation:

$$\text{Percent Change (\%)} = \frac{\text{Mean}_{\text{Sample}} - \text{Mean}_{\text{Untreated}}}{\text{Mean}_{\text{Untreated}}} \times 100$$

Results

The data obtained met criteria for a valid assay. Compared to the Untreated Control, the Heat Control (water-treated) hair tresses experienced significant fiber damage. Conversely, tresses treated with 2.0% **ProCutiGen® Hold** demonstrated less fiber damage compared to the Heat Control, water-treated hair tresses.

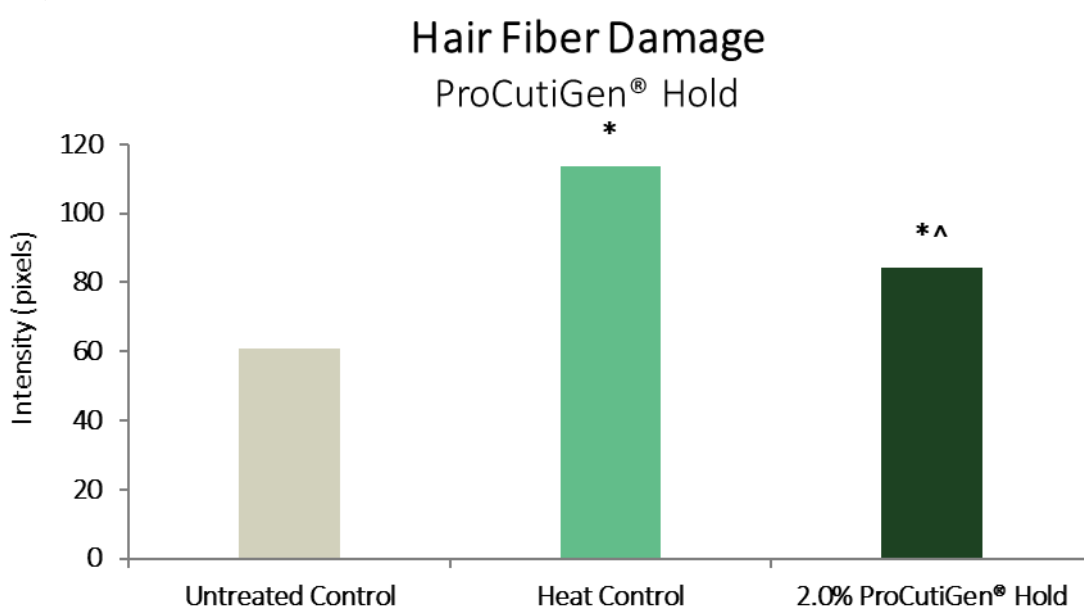


Figure 1. Hair Fiber Damage after Heat Styling. Higher values indicate greater hair fiber damage. * indicates significance ($p \leq 0.05$) compared to Untreated Control. ^ indicates significance ($p \leq 0.05$) compared to Heat Control.

Table 2. Results from one-way ANOVA between Conditions Compared. * indicates significance ($p \leq 0.05$) compared to Untreated Control. ^ indicates significance ($p \leq 0.05$) compared to Heat Control.

	Heat Control	2.0% ProCutiGen® Vegan Thermal Shield
Untreated Control	< 0.05*	< 0.05*
Heat Control	-----	< 0.05^

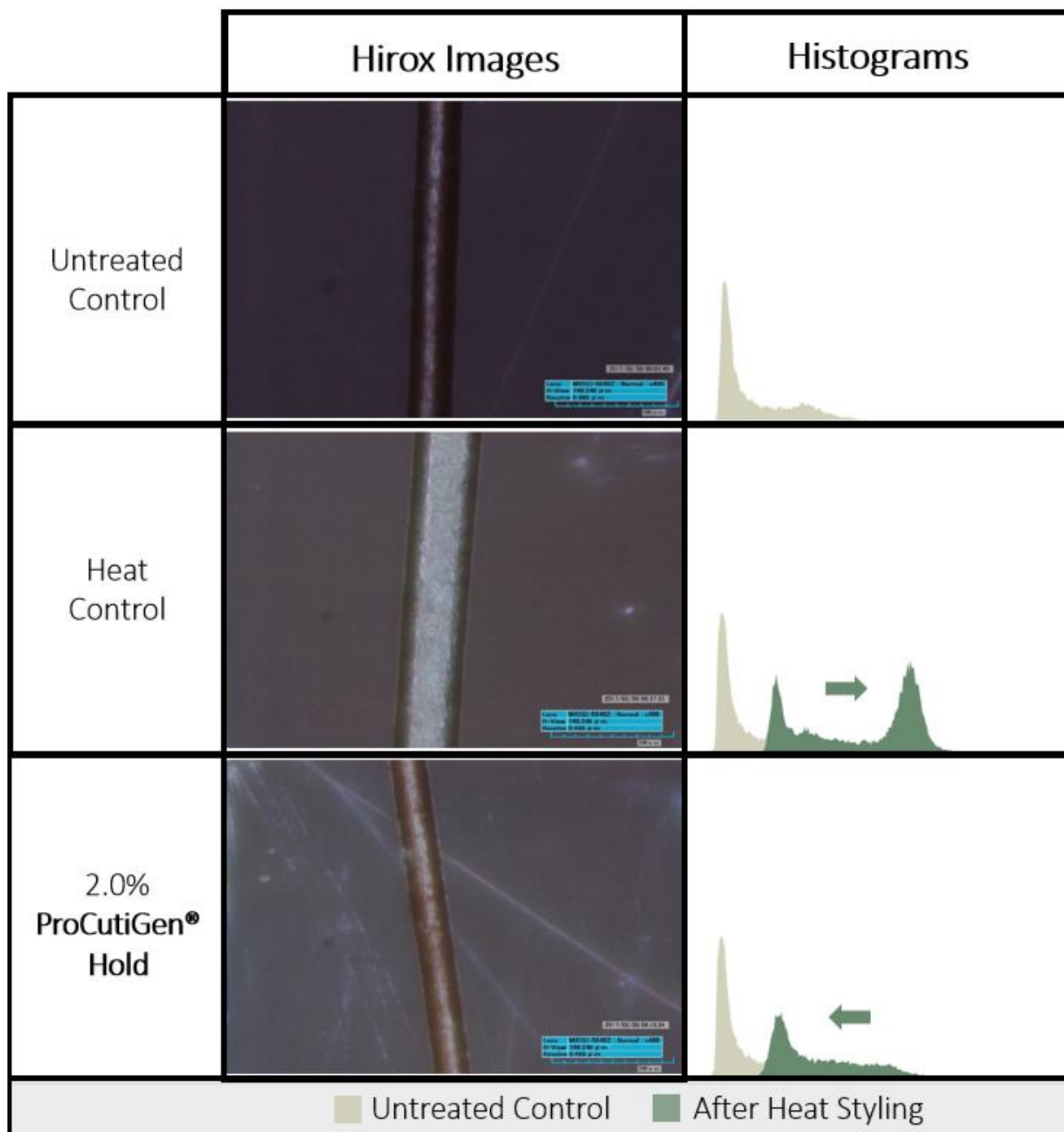


Image 1. Representative Hair Fiber Images and Histograms. Arrows indicate shifts in light intensity after curling. A shift to the right indicates more hair damage, whereas a shift to the left indicates a reduction in hair damage.

Discussion

As demonstrated in Figure 1 and Image 1, heat styling induces shifts in hair light intensity indicating hair fiber damage. Specifically, heat styling increased light intensity by 87% in the Heat Control, water-treated hair tresses compared to the Untreated Control. Conversely, hair tresses treated with 2.0% **ProCutiGen® Hold** only demonstrated a 38% increase in light intensity compared to the Untreated Control. Moreover, the addition of 2.0% **ProCutiGen® Hold** to water exhibited a 26% reduction in light intensity compared to the Heat Control, water-treated tresses. Taken together, this data indicates exposing hair to extreme temperature elicits hair fiber damage that can be mitigated by the application of **ProCutiGen® Hold** prior to heat styling.

Collectively, these results indicate **ProCutiGen® Hold** reduces heat styling-induced hair fiber damage as indicated by shifts in light intensity shifts. In summary, **ProCutiGen® Hold** protects hair from heat styling without influencing the desired results when used at recommended use levels.