

Tradename: ProCutiGen® Vegan Thermal Shield

Code: 20830

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Lot #: 7848700

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Test Performed:

Thermal Protection Assay - Flexabrasion

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.

Physical strength of hair can be measured using tensile properties such as tenacity and elasticity. Tenacity reveals the breaking strength of the hair where the higher force needed indicates a stronger and healthier fiber. Force is applied to the hair strands individually until each strand breaks. The Modulus of Elasticity identifies the resistance to being deformed and provides the strength needed to increase fiber length. Force is applied on the hair causing elongation and elasticity is expressed as the ratio of change in stress to change in strain as a fraction of the original hair fiber length. The greater the stress needed the more elastic and stronger the hair. A product that provides thermal protection will maintain hair tenacity and elasticity similar to untreated hair.

Accordingly, a thermal protection assay was conducted to assess the ability of **ProCutiGen® Vegan Thermal Shield** to protect hair against heat styling.

Assay Principle

Chemically treated human hair tresses were tested to understand the protective capability of a cosmetic product. Heat styling was conducted using a ceramic straightener on chemically processed hair tresses. Tresses were repeatedly washed with testing materials before exposure to heat styling. After styling, the physical properties of individual hair fibers were assessed utilizing the Instron which measures tensile properties of hair.

Materials

- A. **Hair Samples:** Human Blonde Hair Tresses Dyed Red
- B. **Products:** Base Shampoo and Conditioner (Table 1)
- C. **Equipment:** Remington Ceramic Hair Straightener; Instron (Method ASTM D3822)
- D. **Software:** Excel Analysis ToolPak (Microsoft)
- E. **Other:** Plastic Syringes

Table 1. Base Shampoo and Base Conditioner Compositional Breakdowns.

Base Shampoo Formulation		Base Conditioner Formulation	
INCI	%	INCI	%
Water	41.0	Water	76.0
Guar Hydroxypropyltrimonium Chloride	1.0	Polyquaternium-10	1.0
Sodium Methyl 2-Sulfolaurate (and) Disodium 2-Sulfolaurate	35.0	Glycerin	3.0
Cocamidopropyl Betaine	15.0	Water & Centrimonium Chloride	2.0
Lactobacillus Ferment & Lactobacillus & Cocos Nucifera (Coconut) Fruit Extract	4.0	Behentrimonium Methosulfate & Cetearyl Alcohol & Butylene Glycol	8.0
Polysorbate 20	2.0	Hydrogenated Ethylhexyl Oliviate (and) Hydrogenated Olive Oil Unsaponifiables	5.0
Fragrance	2.0	Lactobacillus Ferment	4.0
		Fragrance	1.0

Methods

Three blonde hair tresses were collected, dyed red, and assigned to each condition described in Table 2. One tress received Base Shampoo and Conditioner and one tress received 2.0% **ProCutiGen® Vegan Thermal Shield** in base shampoo and conditioner. Both tresses were washed 14 times each with the appropriate conditions and allowed to air dry between each wash. An Untreated Control tress was left unwashed. The Base Control and 2.0% **ProCutiGen® Vegan Thermal Shield** treated tresses were heat styled after the final wash using 20 passes of a hair straightener 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 2. Descriptions of the Conditions and Treatments for each Hair Tress within each Hair Type.

Condition	Treatment Description
Untreated Control	No Washes, No Heat Styling
Heat Control	Washes, Heat Styling
2.0% ProCutiGen® Vegan Thermal Shield	Washes, Heat Styling

The Instron method ASTM D3822 was used to evaluate the effect of **ProCutiGen® Vegan Thermal Shield** on the integral structure and properties of the hair after heat styling. Single fiber testing was performed to assess the strength of the hair in terms of tenacity and elasticity. 25 hair strands from each tress were tested and average values were recorded. One-way ANOVAs were performed between groups with statistical significance accepted at $p \leq 0.05$.

Results

The data obtained from this study met criteria for a valid assay and the controls performed as anticipated. Compared to the Untreated Control, the Heat Control experienced reduced tenacity and elasticity. Alternatively, the tresses treated with 2.0% ProCutiGen® Vegan Thermal Shield exhibited fortified structural integrity through minimal changes in tenacity and elasticity compared to the Untreated Control.

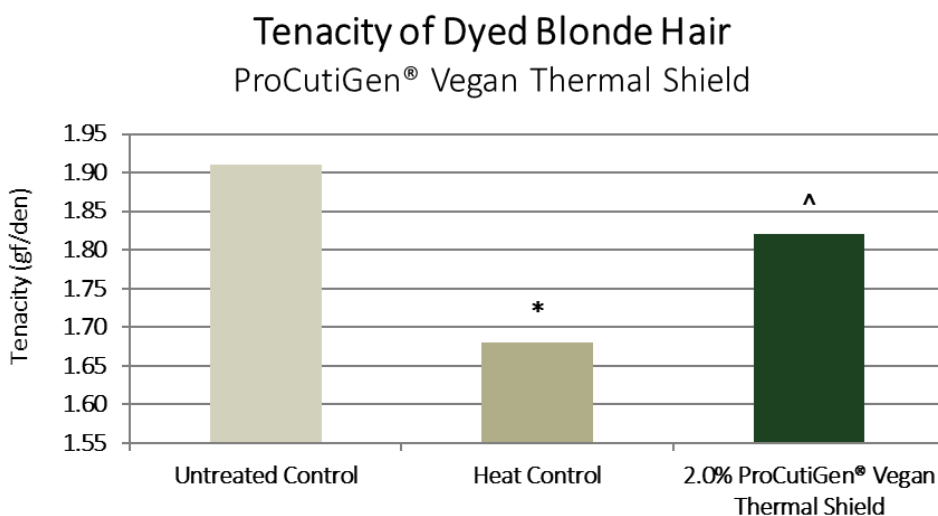


Figure 1. Average Tenacity of Dyed Blonde Hair Tresses. * indicates significance ($p \leq 0.05$) compared to the Untreated Control. ^ indicates significance ($p \leq 0.05$) compared to the Heat Control.

Table 3. Results from one-way ANOVA between Conditions Compared for Dyed Blonde Hair Tenacity (gf/den). * indicates significance ($p \leq 0.05$) compared to the Untreated Control. ^ indicates significance ($p \leq 0.05$) compared to the Heat Control.

	Untreated Control	Heat Control	2.0% ProCutiGen® Vegan Thermal Shield
Untreated Control	-----	0.021*	> 0.05
Heat Control	0.021^	-----	0.037^

Modulus of Elasticity of Dyed Blonde Hair ProCutiGen® Vegan Thermal Shield

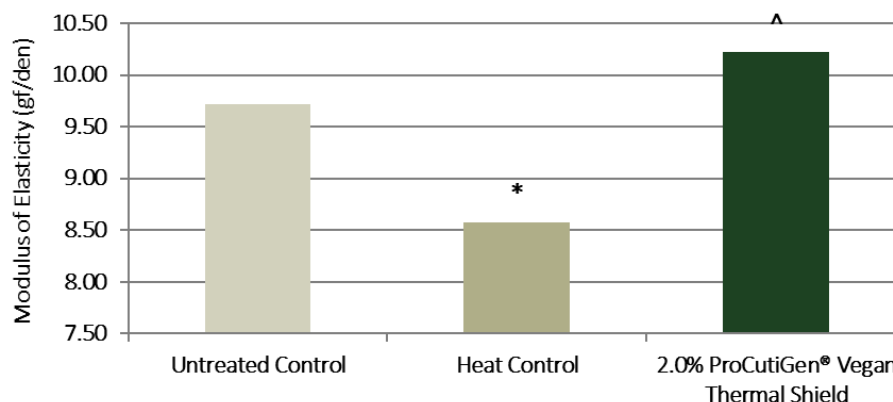


Figure 2. Average Modulus of Elasticity of Dyed Blonde Hair. * indicates significance ($p \leq 0.05$) compared to the Untreated Control. ^ indicates significance ($p \leq 0.05$) compared to the Heat Control.

Table 4. Results from one-way ANOVA between Conditions Compared for Dyed Blonde Modulus of Elasticity (gf/den). * indicates significance ($p \leq 0.05$) compared to the Untreated Control. ^ indicates significance ($p \leq 0.05$) compared to the Heat Control.

	Untreated Control	Heat Control	2.0% ProCutiGen® Vegan Thermal Shield
Untreated Control	-----	0.017*	> 0.05
Heat Control	0.017^	-----	0.020^

Discussion

A thermal protection assay was performed to determine the protective benefits of ProCutiGen® Vegan Thermal Shield on hair with respect to heat styling. The results from this study indicate that 2.0% ProCutiGen® Vegan Thermal Shield provides protection and strengthening benefits against standard thermal styling.

As shown in Figures 1 and 2, the dyed blonde hair utilized as the Untreated Control exhibited an average tenacity of 1.91 gf/den and an average modulus of elasticity of 9.72 gf/den. Conversely, the dyed blonde hair treated as the Heat Control exhibited significant reductions of 12% in both tenacity and modulus of elasticity compared to the Untreated Control confirming the damaging effects of heat styling on dyed blonde hair (Tables 3 and 4). Finally, dyed blonde hair tresses treated with ProCutiGen® Vegan Thermal Shield only experienced a 5% reduction hair tenacity and a 5% increase in modulus of elasticity compared to the Untreated Control. These data indicate applying ProCutiGen® Vegan Thermal Shield protects and strengthens dyed blonde hair against thermal damage.

Collectively, heat styling damages dyed blonde hair, however repeated use of 2.0% ProCutiGen® Vegan Thermal Shield in a shampoo and conditioner application prevents the heat-styled induced reductions in tenacity and modulus of elasticity. Taken together, ProCutiGen® Vegan Thermal Shield protects and strengthens dyed blonde hair against thermal damage.