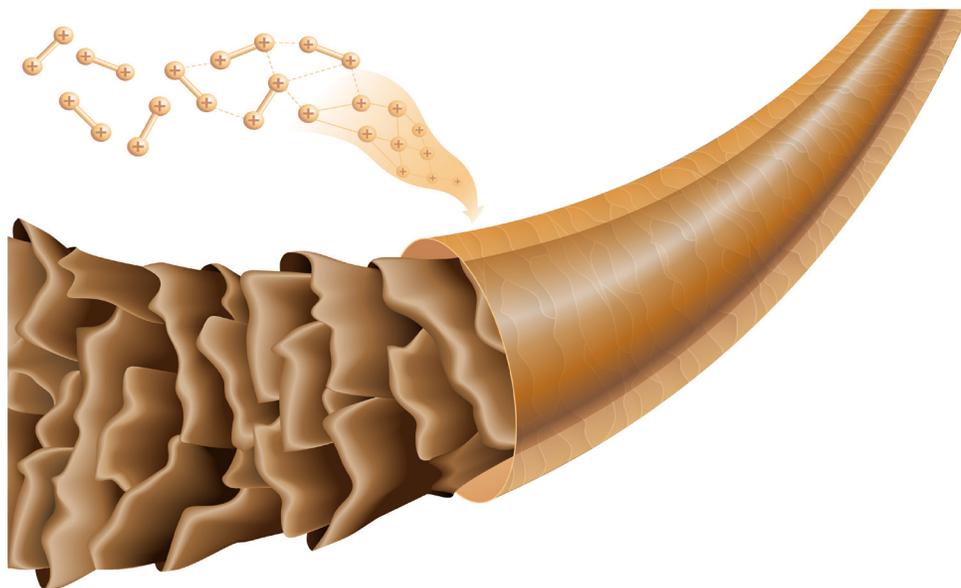


ProCutiGen® Thermal Shield



Bivalent Cationic Lipopeptide
Repair Beyond the Bond

support + protect hair cuticle
ProBonding, Keratin derived
 biomimetic, neo-cuticle
 preventative **haircare**

BACKGROUND

The “Plex Phenomenon” has swept the global haircare industry – resulting in a myriad of products focused on bond multiplying or re-bonding. As the market is currently saturated with formulations claiming to re-bond the hair, **Active Concepts** has taken a *proactive* approach towards technology that *protects* the hair. Active Concepts is shifting the focus to *proactively protect* the hair shaft through “**ProBonding**”. **ProCutiGen® Thermal Shield** is an incredible scientific breakthrough that is slated to shake the foundations of how we consider preventative hair care – repair beyond the bond.

ProCutiGen® Thermal Shield prevents the thermally induced damage that breaks the cysteine bridges of the hair, making it porous, weakened and more prone to breakage. Rather than focusing on repairing broken bonds that occur during thermal stress, **ProCutiGen® Thermal Shield** consists of bivalent cationic peptides that create a *de novo* cuticle on the hair to prevent damage from happening in the first place.

Cuticle preservation is essential to prevent hair damage. The cuticle is the outermost layer of the hair, composed of overlapping cells that shield the cortex, while holding moisture and protecting hair from the environment. Damage to the cuticle compromises the structural integrity of the hair shaft, making hair prone to breakage. Utilizing the concept of synthetic biology, **ProCutiGen® Thermal Shield** is a bivalent cationic lipopeptide that self-assembles into a neo-cuticle on the hair. The formation of this biomimetic cuticle offers protection from high temperature styling to promote healthy hair.

Code Number: 20828

INCI Name: Hydrolyzed Keratin
INCI Status: Conforms
REACH Status: Complies
CAS Number: 69430-36-0
EINECS Number: 274-001-1

Origin: Animal

Processing:

- GMO Free
- No Ethoxylation
- No Irradiation
- No Sulphonation

Additives:

- Preservatives: None
- Antioxidants: None
- Other additives: None

Solvents Used: Water

Appearance: Clear to Slightly Hazy Liquid

Soluble/ Miscible: Water Soluble

Ecological Information:

91.00% Biodegradability

Microbial Count: < 100 CFU/g,
 No Pathogens

Suggested Use Levels: 1.0% - 10.0%

Suggested Applications:

- ProBonding, Thermal Protection,
 Nourishing, Support

Benefits of ProCutiGen® Thermal Shield:

- Protects and Strengthens Hair
- Great for All Hair Types
- Thermal Protection

ProCutiGen® Thermal Shield

SCIENCE

Damage that occurs to hair after heat styling is a result of the structural integrity of the cuticle being compromised. Blow drying and flat ironing hair can strip moisture from the cuticle, resulting in cracking and consequently a rigid, brittle, and dry appearance. Hair needs a solid foundation to prevent damage, and the building block of hair is protein. Hair is full of protein, which is necessary to strengthen and restore the hair fiber. Keratin makes up more than 90% of the hair follicle and is a source of strength and flexibility. Keratin is rich in cysteine, a sulfur-containing amino acid that gives the protein its unique strength and protective quality. When hair undergoes heat styling or chemical processing, cysteine bridges are broken, leaving the hair in a damaged, weakened state. **ProCutiGen® Thermal Shield** is a lipopeptide derived from keratin for hair protection.

The bivalent cation of **ProCutiGen® Thermal Shield** is the anchor to secure the neo-cuticle, as hair is naturally anionic. The structural material of the anchor allows these properties which differentiate the bio-films. Film-forming properties are a popular claim in hair care, however this is boring and usually misleading. A film can loosely be defined as a thin layer of something, by that definition, water on the skin is a film. A bio-film is of much more interest; a polymeric chain forming a conglomeration of proteins, amino acids and polysaccharides that creates a complex, supporting, interwoven matrix on the hair cuticle. A major benefit of the bio-film is its action as a scaffolding rather than a true barrier. Able to support and protect hair, this scaffolding allows small molecules and hydrogen ions in via its semi-permeable facade. It is this scaffolding and its semi-permeable membrane that promotes the exhibition of properties such as moisturization, pH balance, barrier protection, and additionally, protection from hair weakening after exposure to thermal processes.

BENEFITS

ProCutiGen® Thermal Shield utilizes the concept of synthetic biology to self-assemble into a biomimetic neocuticle on the hair. The formation of this biomimetic cuticle offers protection from heat styling and other thermal treatments to promote healthy hair cuticles. **ProCutiGen® Thermal Shield** is an ideal ingredient for use in a wide range of hair care applications to protect hair from thermal styling damage. Incorporate **ProCutiGen® Thermal Shield** into shampoo, conditioner, and styling applications to offer revolutionary *ProBonding* protection!

EFFICACY DATA

Hair fibers generally consist of three distinct morphological components, the outer protective layers known as the cuticle, the major structural components, or the cortex, and the porous components, or the medulla. The cuticle plays an important role both as a protective barrier and for many of the cosmetic properties of the hair, whereas the cortex provides mechanical strength to the hair fiber as a whole. It is known that the physicochemical properties of hair change as a result of damage to hair. Quantitative measurements in the amount of protein removed from hair during heat styling can serve as a method to assess hair damage. Hair protein extraction, Bradford protein analysis, and protein gel electrophoresis were performed to assess the ability of **ProCutiGen® Thermal Shield** to protect hair from heat styling damage.

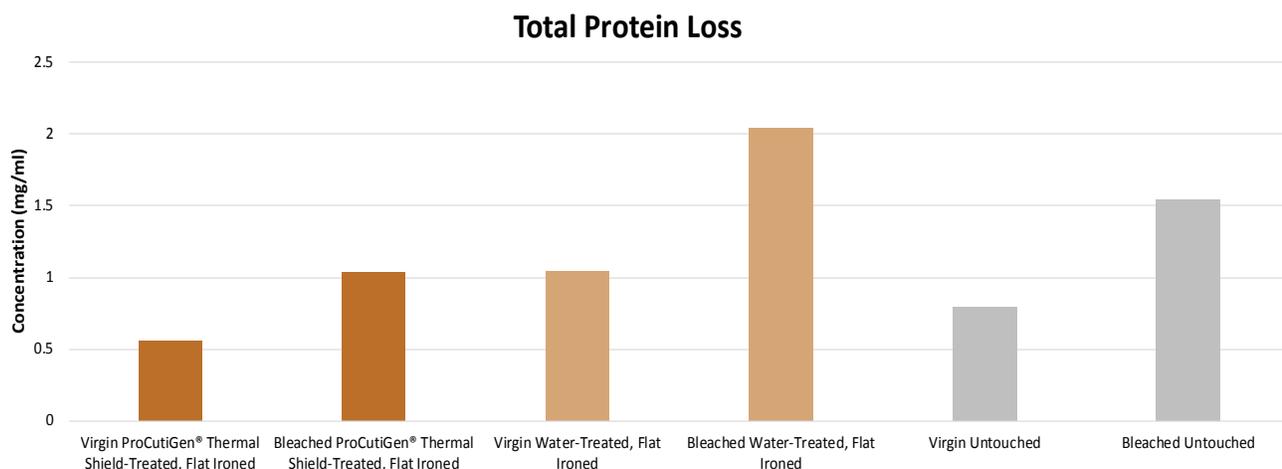


Figure 1. Concentration of extractable protein for each hair sample.

ProCutiGen® Thermal Shield

As seen in Figures 1 and 2, each of the virgin hair samples had lower extractable protein concentrations than their bleached counterpart. Bleaching and heat styling breaks down the protein in the hair fiber and allows for a greater concentration of protein to be extracted. The results in Figures 1 and 2 demonstrate an increase in extractable protein obtained through bleaching and heat treatment. The application of 2.0% **ProCutiGen® Thermal Shield** to both virgin and bleached hair followed by flat ironing helped to decrease the amount of protein lost, when compared to the virgin and bleach hair treated with water and flat ironed. As demonstrated in Figure 3, the application 2.0% **ProCutiGen® Thermal Shield** to virgin hair retained 60.9% more protein concentration during heat styling compared to water alone. For bleached hair, the application of 2.0% **ProCutiGen® Thermal Shield** before heat styling allowed the hair to retain 65.4% more protein, when compared to water alone.

Comparative Protein Retention

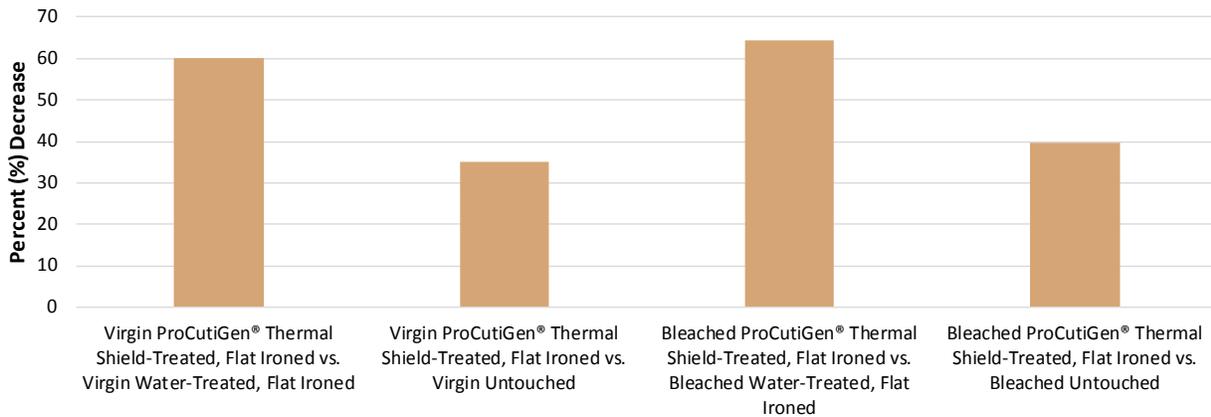


Figure 2. Comparative protein retention.

Protein Gel Electrophoresis

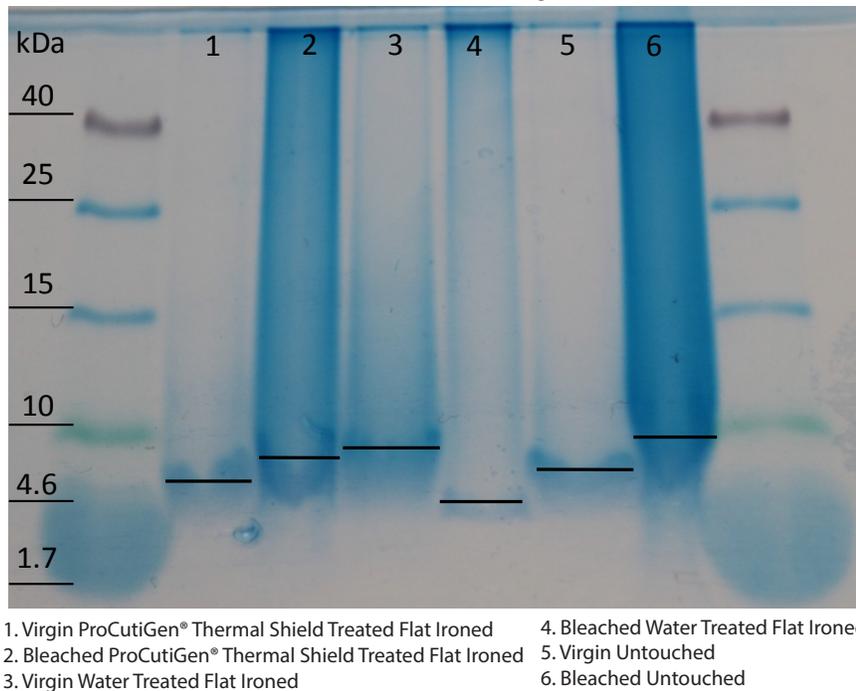


Figure 3. Protein gel electrophoresis of hair samples.

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In Figure 3, the bleached hair samples in lanes 2, 4, and 6, exhibit an increased dye density. This increased dye density correlates a higher amount of protein loss and consequential damage. In hair samples with less damage, such as the virgin hair samples in lanes 1, 3, and 5, the hair follicle is less porous and releases a lower concentration of protein.

A Standard Electron Microscopy (SEM) study was conducted to determine if **ProCutiGen® Thermal Shield** is capable of modifying hair shape while protecting it from styling damage. As seen in Figure 4, the SEM imaging demonstrates that untreated hair is already prone to damage from everyday stressors, showing characteristic signs of breakdown. Treating hair with **ProCutiGen® Thermal Shield**, makes a difference at the microscopic level. The SEM images depict how the outermost layer of the hair, the cuticle, is affected by thermal styling. When the untreated images are compared to both the **ProCutiGen® Thermal Shield** treated swatches, a significant decrease in damage of the cuticle is exhibited.

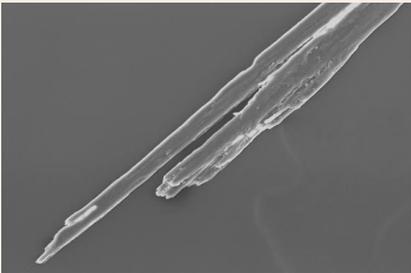
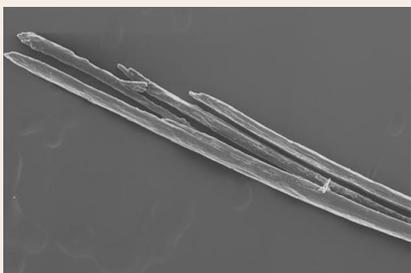
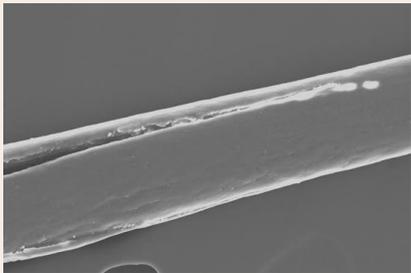
Swatch	SEM Image
Untreated Virgin Hair	
Water Treated + Blown Dry & Flat Ironed	
2.0% ProCutiGen® Thermal Shield + Blown Dry & Flat Ironed	

Figure 4. SEM images.

Hirox 3D Microscopic Examination is a test method for microscopic examination of hair samples. Damage of the hair fiber can be seen within these images in which the damaged areas of the fiber fluoresce. The more fluorescence a fiber exhibits, the more damaged the fiber is. Within the images in Figure 5, significantly less damage can be viewed on both the Untreated Virgin Hair Swatch and **ProCutiGen® Thermal Shield** treated swatch. Whereas, the water treated swatch exhibits significantly more damage visually. In addition to the visual evidence, the photos were quantified via histograms based on luminescence. The values denoted clearly depict the ability of **ProCutiGen® Thermal Shield** to protect the hair fiber reducing overall damage to the fiber.

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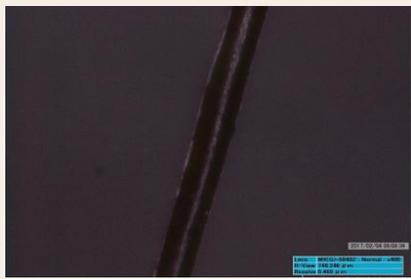
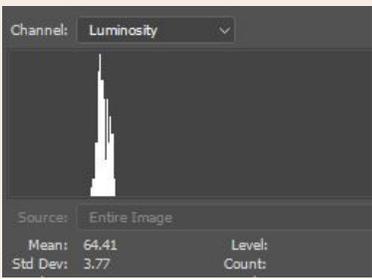
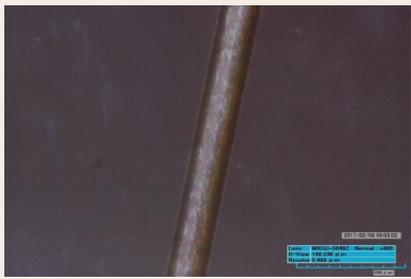
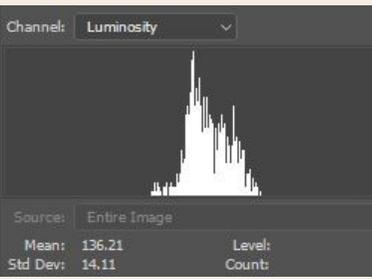
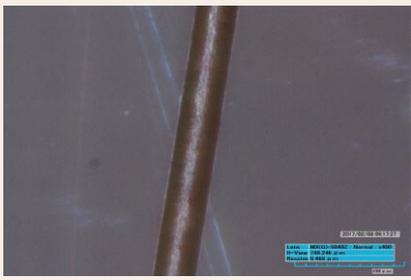
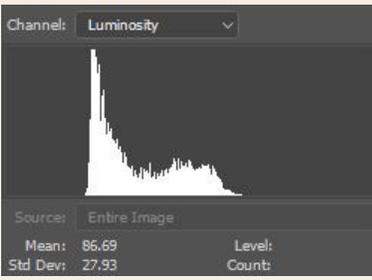
Swatch	HIROX Image	Histogram Quantification
Untreated Virgin Hair		Channel: Luminosity  Source: Entire Image Mean: 64.41 Level: Std Dev: 3.77 Count:
Water Treated + Blown Dry & Flat Ironed		Channel: Luminosity  Source: Entire Image Mean: 136.21 Level: Std Dev: 14.11 Count:
2.0% ProCutigen® Thermal Shield + Blown Dry & Flat Ironed		Channel: Luminosity  Source: Entire Image Mean: 86.69 Level: Std Dev: 27.93 Count:

Figure 5. HIROX results for thermal styled hair.