ThermoShield Premium

Description

ThermoShield Premium is an active ingredient for heat protection which retains water inside the hair fiber and forms a protective film through a technological mechanism, it protects the hair from thermal damages without compromising styling.

INCI

Water (and) Glycerin (and) Salvia Hispanica Seed Extract (and) Trehalose (and) Xylitol (and) Caprylyl/Capryl Glucoside (and) Ethyl Linoleate (and) Ethyl Oleate (and) Sorbitan Oleate (and) Polyquaternium-37 (and) Sodium Phosphate

Introduction

Temporary hair styling by application of heat is a common beauty practice [1]. However, hair becomes severely damaged when exposed to the frequent use of blow driers, flat irons and curling irons [2].

Several publications have demonstrated these damaging effects which includes alteration in the cuticular structure of the hair fiber; modification and decomposition of keratin; loss of water content and changes to the hair's physical properties [1, 3, 4, 5, 6].

Over the years, ingredients such as silicones have proven their performance. Due to their physicochemical characteristics, they are considered a benchmark, covering hair damage and eliminating most of the mentioned negative effects [8].

However, an increasing number of consumers follows the global natural trend and are aware of the impact the products they use have on their personal wellbeing and the environment. As such, they want personal care products based on alternative eco-friendly ingredients, but they are not willing to sacrifice product performance or convenience [3].

In this context, silicones are being excluded from natural cosmetics because of the environmental hazardous chlorinated compounds they are made of and the questions arising concerning their bioaccumulative properties. Moreover, some silicones are known to build-up multiple layers on the hair, thereby making it difficult to style [4].

As consumers start to look for silicone-free solutions, manufacturers who want to develop products without silicones must find efficient, innovative and more natural ingredients that come as close as possible to their efficacy profile [3].

ThermoShield Premium

Following the Fundamentals of Green Chemistry from the American Chemical Society, **Chemyunion** has developed a process that converts vegetable oils into esters with unique sensorial and functional profiles without using organic solvents, with low energy consumption, renewable feedstocks and efficient processes that minimize environmental impacts [4, 5, 6, 7]. Combining the products of this process with vegetal actives, we have found a perfect synergy between nature and technology to deliver pleasant sensorial and efficacy against thermal damage. **ThermoShield Premium** is an active ingredient for heat protection which retains water inside the hair fiber and

forms a protector film through a technological mechanism, it protects the hair from thermal damages without compromising styling.

Benefits

- Preserves cuticle integrity, promoting shine, softness and anti-frizz effect
- Maintains straightening effect for 24 hours
- Alignment of the cuticles and film formation without build-up
- Compliant to vegan claims
- Alternative to silicone heat protectants
- 100% Biodegradable

Tests

In order to evaluate the heat-protecting effect of **ThermoShield Premium**, tests were carried out with standard Caucasian curly hair purchased from International Hair Importers. After a standard pre-cleaning process with regular shampoo, hair tresses (each one with approximately 2g) were dried with a hair dryer (80°C) for 6 minutes and divided into three groups: control (untreated), placebo and treated with leave-on containing 2% **ThermoShield Premium** or 2% Benchmark.

1. Evaluation of water content

Hair tresses were flat ironed 10 times at 232°C (450 °F) from the top to the bottom. The process was repeated 3 times and samples of 0.3 g hair fibers were separated from each group in order to measure the water content of hair. The measurements were carried out with a Moisture Analyzer HX204 at 200°C (392 °F) for 10 minutes. Graphic is shown in **Figure 1**.

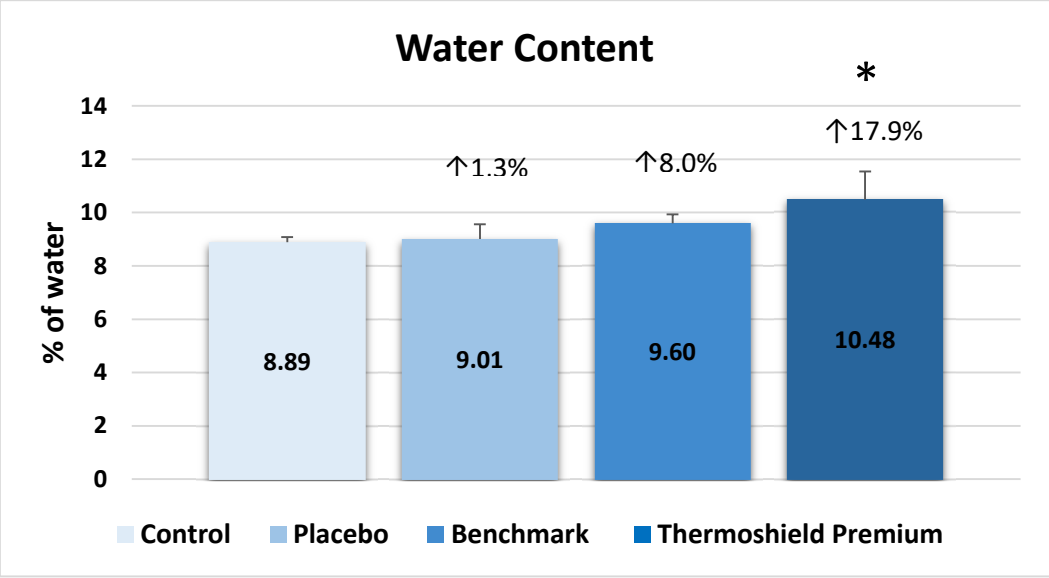


Figure 1: Water content of hair fibers. (*) Different from Control and Placebo (P<0.05). ANOVA-Tukey

ThermoShield Premium presented a significant increase (P <0.05) in water content in relation to the control and placebo groups. The hair fibers treated with **ThermoShield Premium** presented water content values 17.9% higher than the control group, 16.1% higher than the placebo group and 9.2% with respect to the Benchmark Silicone.

These extreme temperatures cause moisture inside the hair fibers to rapidly evaporate, leading to bubbling and cracking of the cuticles. The maintaining of the hair fiber's natural moisture is critical to reduce thermal damage. Physical characteristics of water, such as low thermal conductivity and high specific heat, allow it to act as a thermal insulator, including in the hair.

Hair tresses submitted to thermal treatment presented lower water content. The ones treated with **ThermoShield Premium**, water content is 25% higher compared to placebo.

Market product containing Benchmark: INCI: Bis-Cetearyl Amodimethicone (and) Ceteareth-7 (and) Ceteareth-25

2. Maintenance of hair temperature

Hair tresses were flat ironed 10 times at 232°C (450°F) from the top to the bottom and temperature was measured with an infrared camera model FLIR T4XX, before and immediately after thermal treatment. Images and graphics of the results are shown in **Figure 2**.

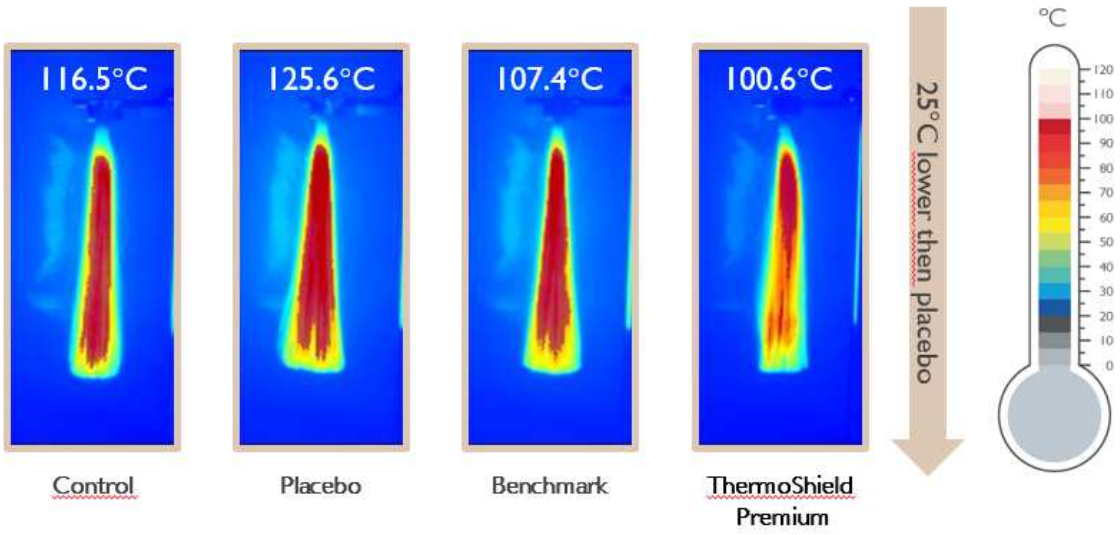


Figure 2: Thermal images of tresses immediately after thermal treatment.

Flat ironing the tresses at 232°C (450°F) caused the hair temperature to reach 125.6°C in the placebo group. At the same conditions, the tresses treated with the benchmark reached 107.4°C whereas the one treated with **ThermoShield Premium** reached 100.6°C (reduction by 25°C). The results show that **ThermoShield Premium** has superior performance to the benchmark and prevented hair from overheating more efficiently.

A probable mechanism of action of **ThermoShield Premium** for the temperature reduction is related to the decrease of the heat flow through the hair fiber and also the maintenance of the moisture of the fiber. High conductivities imply rapid heat transfer. Ingredients that have low conductivity can promote a slow flow of heat through the fibers, and thereby reduce heat damage. Thus, **ThermoShield Premium** could act in two ways: by preventing the loss of moisture and promoting a slow transfer of heat through the fiber.

Benchmark: Bis-Cetearyl Amodimethicone (and) Ceteareth-7 (and) Ceteareth-25

3. Evaluation of hair surface

Hair tresses were flat ironed 10 times at 232°C (450°F) from the top to the bottom. The process was repeated 3 times and images were captured with Atomic Force Microscope (AFM) and Scanning Electronic Microscope (SEM) after thermal treatment. Results are shown in **Figure 3**.

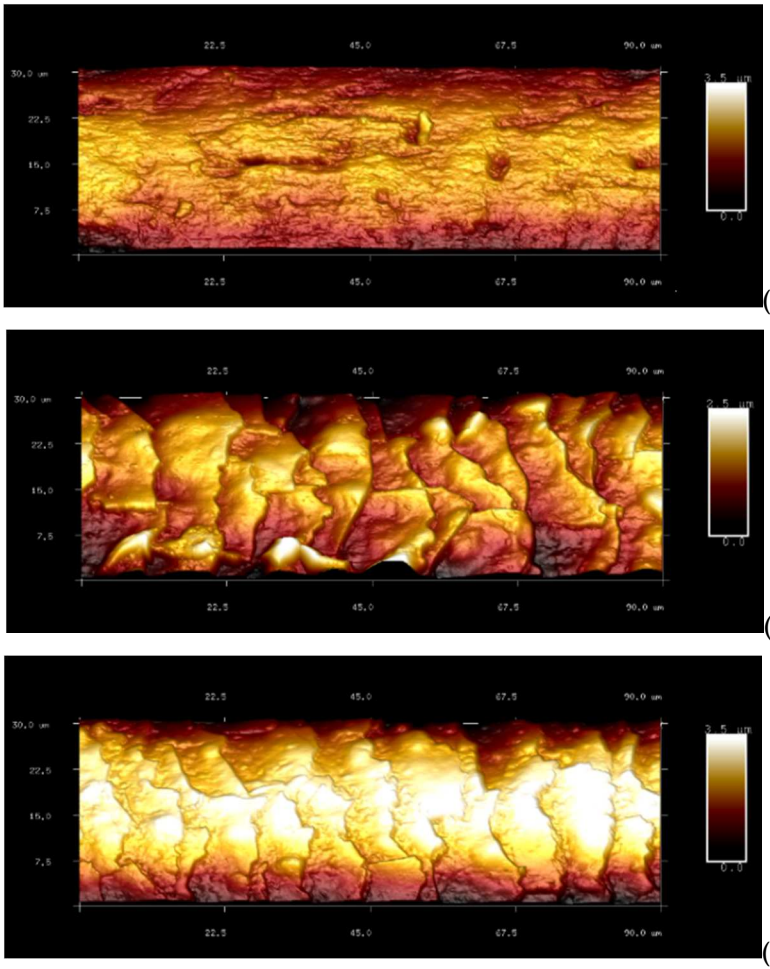


Figure 3: AFM - Images obtained from the evaluation of hair surface after thermal treatment. (A) Control (thermal treatment only), (B) Benchmark and (C) **ThermoShield Premium**.

AFM micrographs of the cuticle region indicate that thermal treatment caused severe hair damage. It was possible to see signs of cuticle rubbed off, worn off the surface and others parts of the hair cuticle becoming fused to the below surface (cortex). The Benchmark group fibers presented a preserved cuticular region in relation to the control group. It was also possible to observe in the micrographs an accumulation of product deposited on the surface of some fibers. Some silicones are known to create build-up on the hair, making it heavy, difficult to style and dull looking due the coating that may attract debris and dirt.

The hair fibers treated with **ThermoShield Premium** also showed a greater preservation of the cuticular region in relation to the control group, demonstrating its protective effect. The fibers presented an organized cuticular region and a smaller irregularity at the edges of the cuticles. It was also possible to observe a reduction in the accumulation of product deposited on the fibers surface compared to the Benchmark group, which provide better sensory characteristics, leaving hair lighter and more moving.

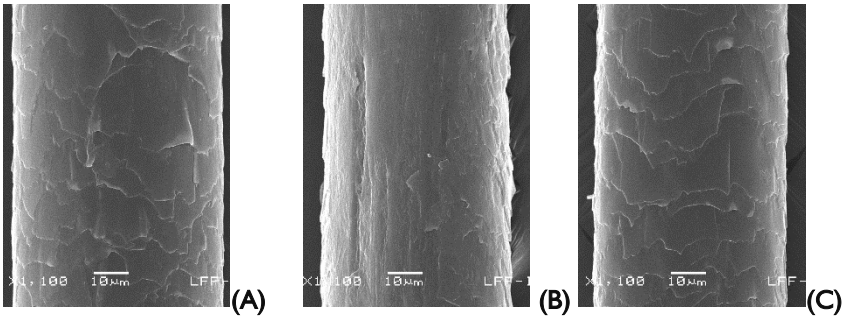


Figure 4: SEM – Images (magnification of 1100x) obtained from the evaluation of hair surface after thermal treatment. (A) Control (thermal treatment only), (B) Benchmark and (C) **ThermoShield Premium**.

The SEM micrographs of the Control and Benchmark groups showed signs of cuticle abrasion with cuticle rubbed off, worn off the surface and opened. It is also possible to observe some examples of hair fiber with long lengthwise cracks through hair fiber at different points along hair. **ThermoShield Premium** showed superior performance, protecting the hair and keeping cuticles closed, with film formation without build-up.

Benchmark: INCI: Bis-Cetearyl Amodimethicone (and) Ceteareth-7 (and) Ceteareth-25

4. Evaluation of hair straightening

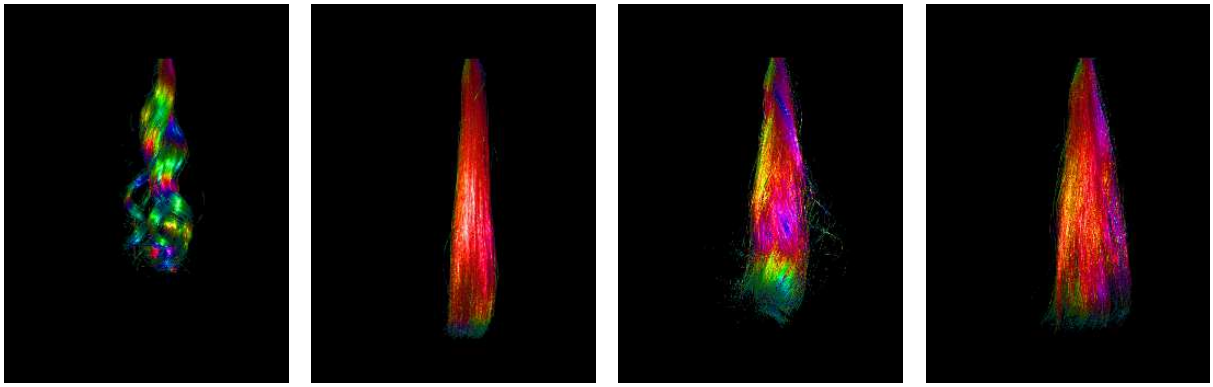
Three hair tresses in each group were flat ironed 10 times at 232°C from the top to the bottom and submitted to evaluation of hair fiber orientation with RUMBA.

The hair straight effect was evaluated using the equipment Rumba (Bossa Nova Tech). After hair image processing, an orientation image where each pixel of the image represents the local angle, a user-friendly software allows to acquire a complete analysis of fiber orientation by calculating the standard deviation of an angle reflections in the hair tresses image. A reduction in the standard deviation represents an increase in the hair straight effect. For the test, the tresses were exposed to high humidity environment in a photo aging and

weathering Chamber Suntest XXL+ FD (Humidity: 60% and Temperature: 25°C) during 24 hours. Fiber orientation measurements were performed before, immediately after and 6 and 24 hours after the straightening process. Three hair tresses in each group were flat ironed 10 times at 232°C (450°F) from the top to the bottom and submitted to evaluation of hair fiber orientation with RUMBA (**Figure 5**).

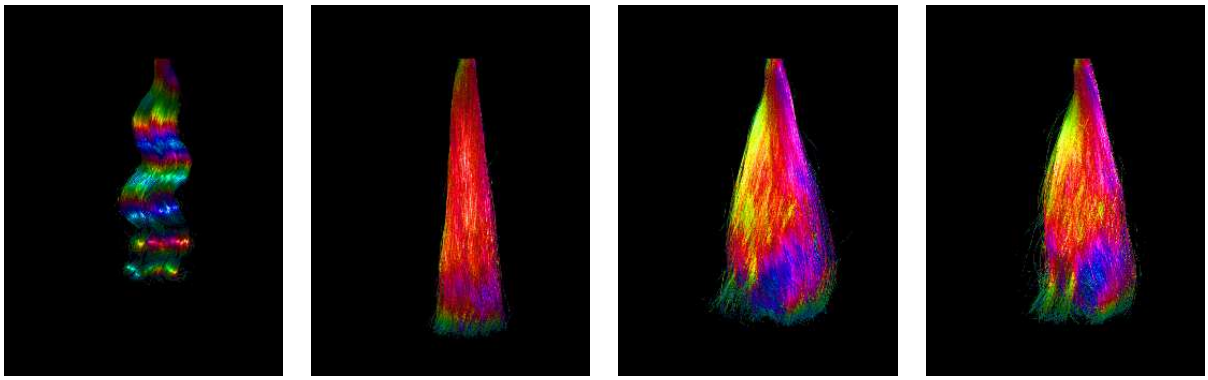
Images of the tresses of the control group before, soon after, 6h and 24h after thermal process.

Before	After	6 hours	24 hours
A	B	C	D



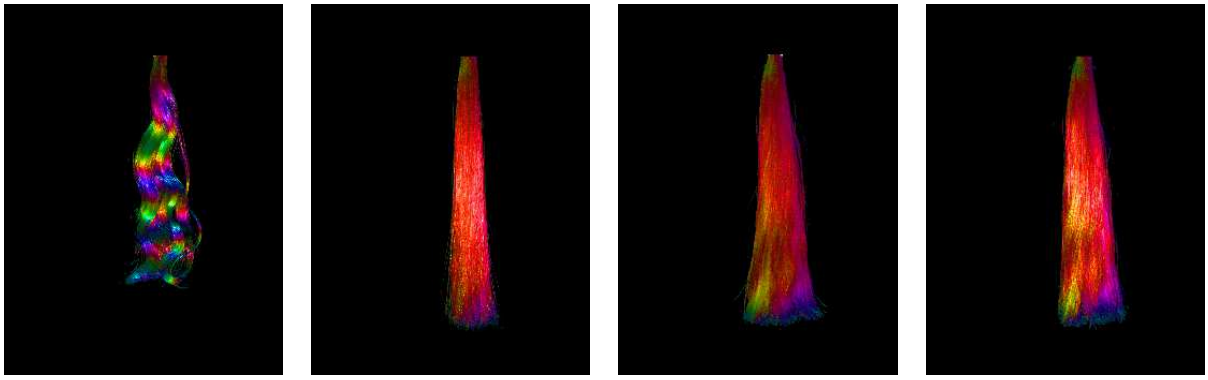
Images of the tresses of the placebo group before, soon after, 6h and 24h after thermal process.

Before	After	6 hours	24 hours
E	F	G	H



Images of the tresses of the **ThermoShield Premium** group before, soon after, 6h and 24h after thermal process.

Before	After	6 hours	24 hours
I	J	K	L



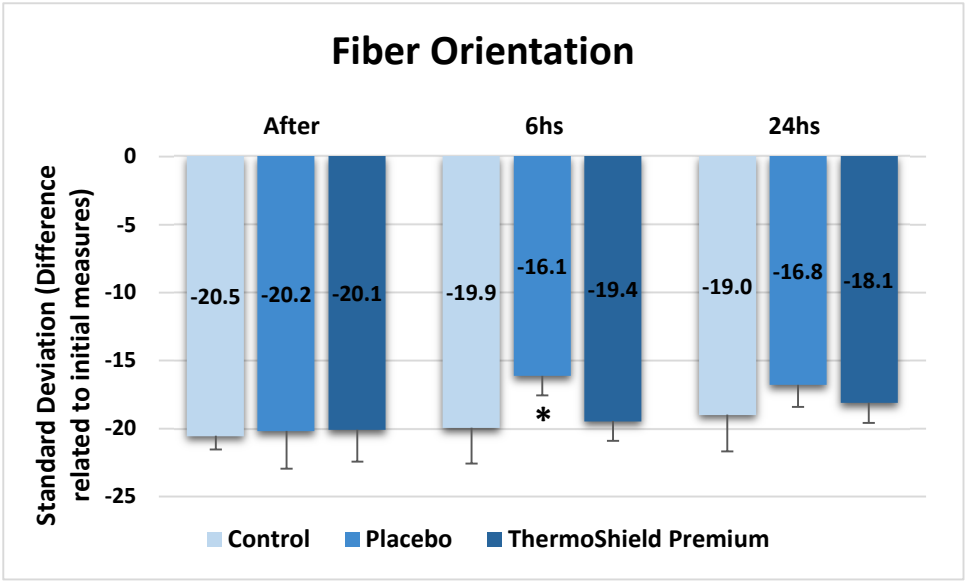


Figure 5: Straight effect on hair tresses immediately after thermal treatment and after 24h.

Results showed that **ThermoShield Premium** prevented and reduced damage from thermal treatments on hair fibers, reducing the temperature of the hair fibers and maintaining the cuticular structure of the hair after exposure to thermal treatment without compromising hair styling.

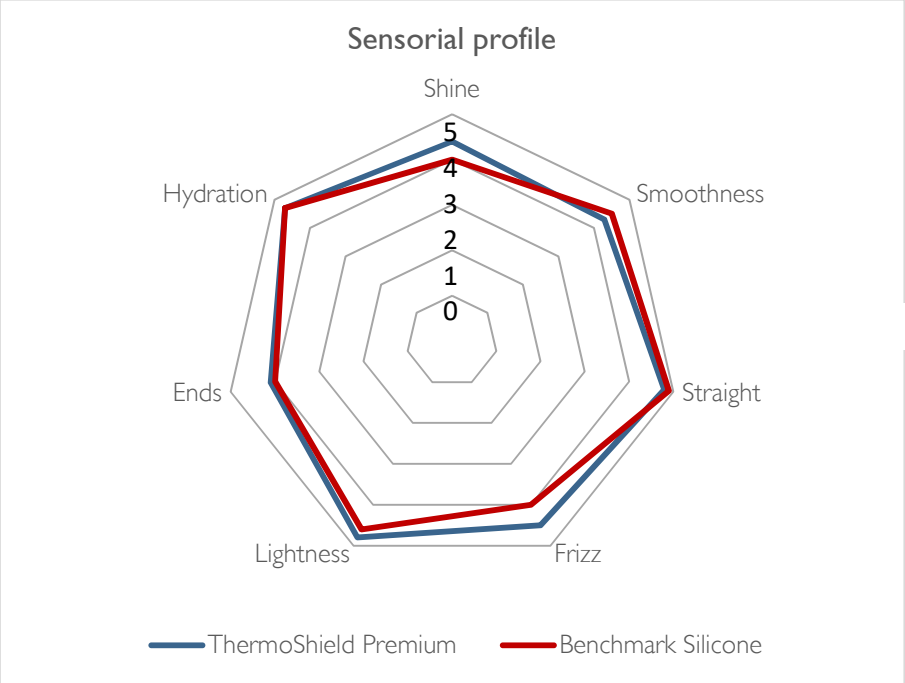
5. Salon Test

Half head test

The hairdresser applied shampoo and conditioner (placebo), then applied Leave-on with:

ThermoShield Premium 2% and Benchmark 2%. Dried and then used flat iron.

The panel was performed with 10 volunteers and the following sensory parameters were evaluated.



The salon test demonstrated that the **ThermoShield Premium** is similar in sensorial performance to the Benchmark Silicone in the analyzed parameters.

Benchmark: Bis-Cetearyl Amodimethicone (and) Ceteareth-7 (and) Ceteareth-25

Application

Leave-on and finishing products intended for protecting hair against thermal damage.

Stability and Compatibility

ThermoShield Premium is water dispersible and must be incorporated at the end of the formulation, below 40 °C.

Soluble in vegetable oils, surfactants with a high HLB level, glycerin, propylene glycol.

Concentration of Use

2% (w/w)

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