Unique&Easy Micro-Encapsulation Solutions

SalSphere® Style Protector

"Advanced Style Memory with Lasting Protection"

SalSphere® Style Protector is an advanced encapsulation system designed to lock styles in place, shield hair from frizz-inducing humidity, and deliver a radiant, silky-smooth finish. It enhances style longevity while leaving hair visibly shiny, polished, and touchably soft.

Protecting a hairstyle throughout the day delivers multiple consumer and functional benefits that enhance both performance and appeal:

Encapsulation Enhances Hair Style Protection

1. Extended Hold Through Controlled Release
Encapsulation enables gradual, time-controlled release of styling polymers or actives, maintaining hold throughout the day without buildup or stiffness.

2. Humidity Resistance
Encapsulated anti-frizz agents form a barrier on the hair shaft, shielding it from environmental moisture and preventing style collapse or puffiness in humid conditions.

3. improved Sensory Feel
Encapsulation reduces direct contact between styling resins and hair fibers, delivering a lightweight, non-greasy, and touchable feel—a key consumer demand.

4. Enhanced Shine and Finish
Encapsulated oils or glossing agents release evenly and gradually, providing consistent shine and smoothness without overloading the hair.

5. Style Memory
Innovative delivery systems help reinforce style memory, allowing hair to return to its original shape after movement or exposure to mild humidity.



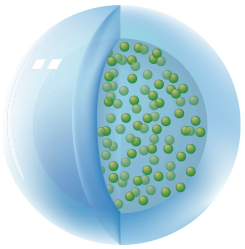


Figure 1. Submicron sphere of SalSphere® Style Protector.

SalSphere® Style Protector comprises hydro phobic sub-micron spheres (fig. 1) infused with phenyl trimethicone, encased by a shell made of conditioning ingredients.

This unique technology enables efficient deposition of sub-micron spheres onto the hair shaft, forming a protective layer. The release of silicone from the encapsulation is activated by heat, which seals the technology into the hair cuticle and prolongs the anti-frizz benefit. The protective layer provides humidity resistance, shine, and easy-to-manage hair.

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The functional ingredient

Phenyl Trimethicone is a silicone-based compound commonly used in hair care formulations for its ability to enhance shine, reduce frizz, and provide long-lasting styling support.
Phenyl Trimethicone Helps Retain Hair Style by:

1. Humidity Resistance

- Forms a hydrophobic (water-repellent) film on the hair shaft
- Helps block moisture from the environment, reducing frizz and style collapse in humid conditions.

2. Shine and Smoothness

- Its high refractive index enhances light reflection, making hair appear glossier and healthier
- Smooths the hair cuticle, improving detangling and manageability, which helps maintain a set style

3. Weight and Light Hold

- Provides light conditioning without heavy buildup
- Adds a lightweight structure to help hold styles in place without stiffness.

4. Thermal Protection

- Offers some heat resistance, acting as a partial barrier against styling tools
- Helps minimize cuticle damage during blow-drying or flat-ironing.

Encapsulated phenyl trimethicone

Offers significant advantages over the free form, mainly when used in styling products.

Here’s why hairstyles can benefit more from the encapsulated version:

- **Controlled Release:** Delivers phenyl trimethicone gradually, avoiding heaviness and extending shine and smoothness.
- **Even Distribution:** Prevents buildup and ensures a polished, uniform finish.
- **Humidity Resistance:** Maintains an anti-frizz barrier longer, even in high humidity.
- **Water-Based Compatibility:** Works in sprays and foams without greasiness or separation.
- **Less Build-Up:** Reduces residue and the need for clarifying shampoos.
- **Innovative Styling: Heat Activates** for lasting hold and shine.



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SalSphere® Style Protector Structure & Function

1. Core (Inner Compartment), made out of mainly Ozokerite wax. The sub-micron size (typically 1-3 micrometers) enables efficient deposition onto hair and ensures uniform distribution during application.

Function:

- Encapsulates phenyl trimethicone and other key active ingredients
- Serves as a reservoir for the controlled release of phenyl trimethicone, used to retain styling and conditioning agents

Benefits:

- Improves shine and smoothness
- Protects from humidity and frizz
- Enhances thermal protection when styling

2. Shell (Polymeric coating, based on Behentrimonium Chloride, a quaternary ammonium compound).

Function:

- Acts as a barrier controlling the release of active ingredients from the core
- The cationic agents contribute to targeted deposition along the hair shaft.

Benefits:

- Enhances stability and compatibility in various formulations (e.g., water-based sprays)
- Improves the retention of the microspheres on hair shafts
- Enhances frizz resistance and style memory
- Provides a clean, soft feel without greasiness

The mechanism of silicone release from SalSphere® Style Protector

- **Modulated Diffusion:**

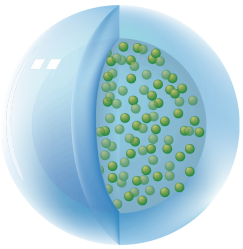
The release of silicone is primarily governed by diffusion through the lipid matrix of the microspheres. This process ensures a slow, controlled release of the silicone onto the hair surface, prolonging the anti-frizz and styling benefits without weighing down the hair or causing buildup.

The diffusion rate is influenced by the composition of the lipid shell and environmental factors, such as humidity or hair condition, allowing for sustained delivery over time.

- **Heat Activation:**

The spheres are designed to be heat-activated, meaning the release of silicone is enhanced when exposed to heat (e.g., from a hairdryer or styling tools). Heat disrupts the lipid matrix, facilitating the release of encapsulated silicones that then coat the hair cuticle, providing frizz control, heat protection, and enhanced shine.

This heat-triggered mechanism ensures the active ingredients are released precisely when needed during styling.



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Technical Data Sheet

INCI
Aqua
Phenyl Trimethicone
Ozokerite Wax
Cetearyl Alcohol
Behentrimonium Chloride
Perservative

Table 1: INCI list of SalSphere® Style Protector 8388-05.

Specifications

Property	Specification
Appearance at 20C	Opaque Viscous liquid
Odor	Characteristic
Color	White
pH (1% soln)	4.0 - 6.0

Table 2: Specification

Flash point: SalSphere® Style Protector contains water. The estimated flash point is approximately 212°C (414°F).

Recommended Usage Levels:

Application Type	Use Level (%)
Leave-in Conditioner / Cream	5–10
Styling Gel / Serum	3–8
Spray / Mist (Alcohol-Free)	2–6

Processing Guidelines

- Add during the cooling phase: Incorporate HydroSal® Style Protector below 40°C to prevent damage to the encapsulation.
- Use gentle mixing: Stir gently or use a low-shear mixer to maintain capsule integrity. Avoid high shear or homogenization.
- pH Compatibility: 4.5–7.5 (ideal for hair/scalp applications)
- Solubility: Water-dispersible; compatible with most aqueous-based systems

Formulation Compatibility

- Compatible with: Cationic and non-ionic surfactants
- Conditioning agents (e.g., behentrimonium chloride)
- Polyquaterniums and quaternary emulsifiers
- Silicones (dimethicone, amodimethicone)
- Humectants (glycerin, propanediol)
- Natural oils (argan, jojoba, coconut – used at low levels)

Avoid:

- Anionic systems (may reduce capsule adhesion to hair)
- High ethanol (>20%) or high-shear emulsification processes
- High temperature (>40°C after addition)

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Qualification

To qualify for style protection against humidity, we conducted a humidity challenge test using standardized hair swatches. This method assesses the effectiveness of the SalSphere® Style Protector in maintaining curl and providing anti-frizz control under controlled humidity conditions. Below is a step-by-step lab protocol we used:

1. Materials Needed
- Standardized virgin or bleached human or yak hair swatches (e.g., 1g, 6-inch long)
- Leave-in conditioner with 10% SalSphere® Style Protector.
- Control product, Leave-in conditioner
- Curling iron
- Humidity-controlled enclosure

2. Swatch Preparation
- The swatches were washed and dried.
- Apply the product evenly, using 0.2 g of Leave-in conditioner for a 1 g swatch.
- Style the swatches: The swatches were cured using a standardized method, where they were wrapped around a rod at 120°C for 15 seconds.
- Let all swatches dry and set at room temperature (22°C, 50% RH) for 2-4 hours.

3. Humidity Exposure
1. The swatches were placed in a climate chamber set to high humidity (100% RH), exposed to a hot stream for a duration of 1 hour.
2. Keep swatches suspended (not touching any surface) to allow free movement.

Results.

4. Evaluation Criteria
- Visual Documentation: Hair swatches were photographed before and after humidity exposure to capture visible changes in frizz, curl definition, and style retention.
- Curl Droop / Reversion Measurement:
- Each swatch was placed on a flat surface with a measurement scale in place. The length of the swatch was recorded before and after humidity exposure.
  - A longer length after exposure indicates curl relaxation or droop.
  - A shorter or unchanged length indicates better curl retention.

5. Data Analysis
- The percentage of Curl Retention was calculated using the formula:

- Curl Retention (%)

$$\text{Curl Retention (\%)} = \left(\frac{\text{Initial Swatch Length}}{\text{Final Swatch Length After Humidity}}\right) \times 100$$

- Results were compared between the control and treated swatches to determine the effectiveness of the styling product in resisting humidity-induced deformation.

- A higher percentage indicates better style retention and resistance to frizz or reversion.

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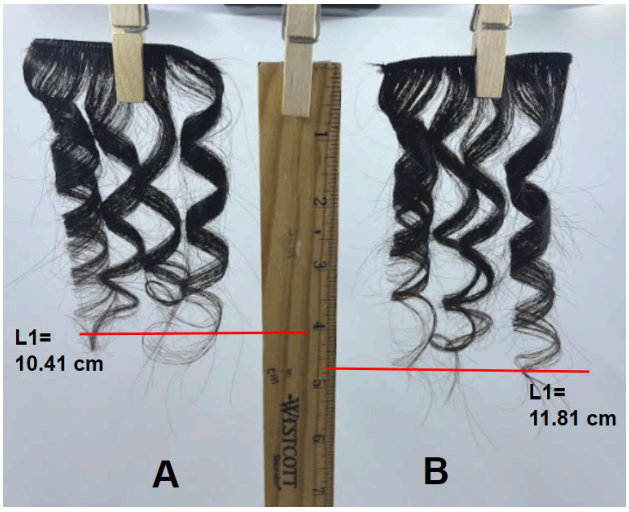


Figure 2: Hair swatches before the frizz test. Hair with leave-in conditioner base containing no technology (A) and hair treated with leave-in conditioner base with 10% SalSphere® Style Protector 8388-05 (B). Length before test (L1) for A = 10.41 cm and B 11.81 cm.

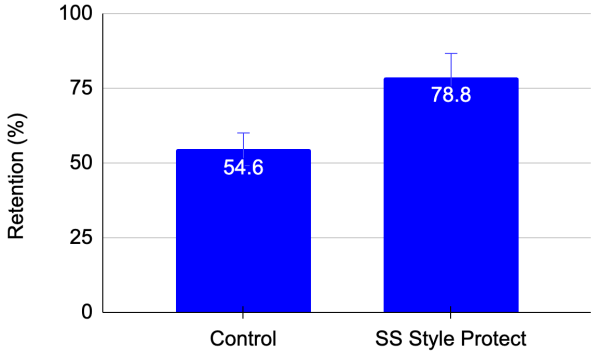


Figure 4: Style retention (%) of SalSphere® Style Protector compared to the control.

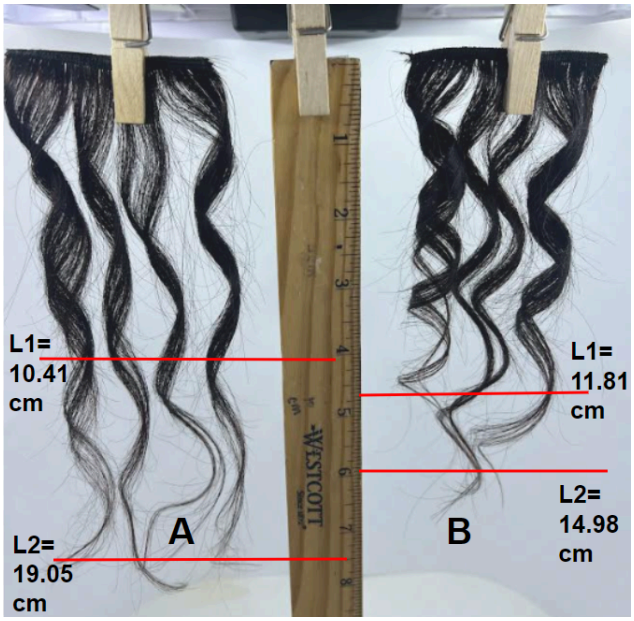


Figure 3: Hair swatches after the frizz test. Hair with leave-in conditioner base containing no technology (A) and hair treated with leave-in conditioner base with 10% SalSphere® Style Protector 8388-05 (B). L1 is the length before exposure to steam, and L2 is the length after exposure. Length after test (L2) for A = 19.05 cm, and B = 14.98 cm.

Results Summary:

The SalSphere® Style Protector demonstrated superior performance in maintaining hairstyle integrity under high humidity conditions. The treated hair swatch showed a style retention of 78.83%, significantly outperforming the control swatch, which retained only 54.64% of its original style. This represents an improvement of 24.19 percentage points in style retention, confirming the technology's effectiveness in reducing frizz and preserving the intended hair shape.

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Applications

Table 3: Formulation of heat protective spray with SalSphere® Style Protector technology.

INCI	Wt (%)
Water	79.20
Tetrasodium Glutamate Diacetate	0.30
Propanediol	3.00
Panthenol	0.5
PVP	1.00
Magnesium Sulfate	5.00
SalSphere® Style Protector	**10**
Preservative	1.00
Total	**100**



Table 4: Formulation of leave-in conditioner with SalSphere® Style Protector technology.

INCI	Wt (%)
Aqua	84
Polyglyceryl-4 Laurate	1.7
Bis-(isostearoyl/oleoyl isopropyl) dimonium methosulfate	1.7
Glycerin	1.7
SalSphere® Style Protector	**10**
Preservative	0.9
Total	**100**

Anti-Frizz Serum: A lightweight serum that coats the hair, providing long-lasting frizz control and smoothness in any weather.
Frizz-Blocking Spray: A spray that forms a protective shield against humidity, keeping styles intact and frizz-free all day.
Smoothing Cream: A leave-in cream that tames frizz, smooths flyaways, and enhances the overall shine and manageability of hair.
Humidity-Resistant Gel: A styling gel designed to hold styles in place while preventing frizz caused by moisture in the air.
Silk-Infused Hair Oil: A nourishing oil that smooths hair, reduces frizz, and adds a silky finish to any hairstyle.

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Key Features for Comparison

Technology Type	Humidity Resistance	Heat Activation	Long-Lasting Style	Natural Claim Possible	Film Formation	Example Brand
Amino-silicones	High	Yes	Yes	No	Flexible	Dow, Momentive
Polyquaterniums	Moderate–High	No	Moderate	No	Yes	PQ-55, PQ-10
Heat-activated polymers	High	Yes	Yes	Sometimes	Yes	Ashland, Gattefossé
Proteins	Low–Moderate	Some	Moderate	Yes	Light	Croda
Responsive Polymers	High	Yes	High	No	Yes	Ashland, BASF
Encapsulation systems	High	Yes	High	Yes	Yes	Salvona

Table 5: Comparison of different solutions to protect hair style.

Marketing claims:

- Style memory that withstands humidity and movement
- Protects against environmental stress for smoother styles
- Delivers a radiant, healthy-looking shine

Claims Support

- Reduces frizz under high humidity
- Improves curl retention
- Prolongs hairstyle longevity
- Heat-compatible (pre-blow dry or heat styling)
- Non-greasy, smooth finish