

# SalSphere® Hair Stimulator (SS HS)

*A time release technology of caffeine.*

**Application for SS HS:** Caffeine inhibits 5-alpha reductase, the enzyme responsible for the conversion of testosterone to dihydrotestosterone (DHT), a metabolite implicated in hair loss. The enzyme is ubiquitously expressed in epidermal keratinocytes and dermal papilla cells. Caffeine increases cyclic AMP levels in cells and stimulates hair follicle metabolism to ultimately counteract DHT-induced hair follicle miniaturization.<sup>1</sup>

Free caffeine is expelled into the blood stream within minutes after topical application, which results in a short residence time of caffeine on the skin.<sup>2</sup> SS HS allows for formulation without these challenges.

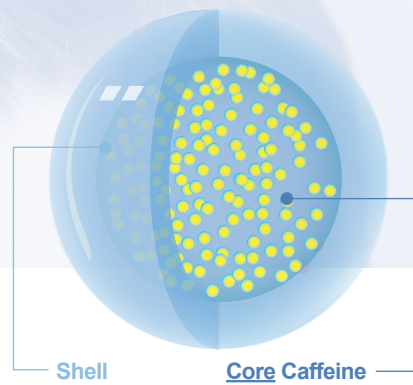


Figure 1: The sub-micron structure of SS HS, with caffeine infused within the core.



## UNIQUE FEATURES

### 1 TIME RELEASE

The SalSphere® encapsulation system allows for higher caffeine dosage and sustains the release for longer time on skin which can increase efficacy.

### 2 TARGETED DELIVERY

SalSphere® technology is designed to deliver caffeine where it is needed most in the hair follicles.

### 3 STABLE, ELEGANT FORMULATION

Easy to formulate with, and prolong contact between the caffeine and the matrix follicular cells.

## HOW THE TECHNOLOGY HELPS YOU

SS HS consists of hydrophobic sub-micron spheres with a core infused with caffeine and a shell that is composed of a hydrophilic layer (Figure 1). The spheres enable targeted delivery to the hair follicle, forming a reservoir from which the caffeine is slowly released, sustaining the efficacy over time.

## DESIGNED FOR TARGETED DELIVERY

The diameter of hair follicular orifice is estimated to be at 30-50µm. SalSphere® delivery system, with a diameter of 0.8µm, can facilitate penetration into the hair follicle in a targeted manner, thus increasing its efficacy (Figure 2).

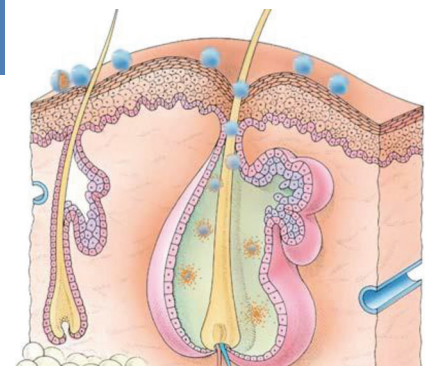


Figure 2: Method of penetration of SS HS.

# SalSphere® Hair Stimulator (SS HS)

A technology designed to stimulate new hair growth.

## CONTROLLED RELEASE IN-VITRO

The penetration of caffeine from SS HS as compared to free caffeine was evaluated over a period of six hours (Figure 3).

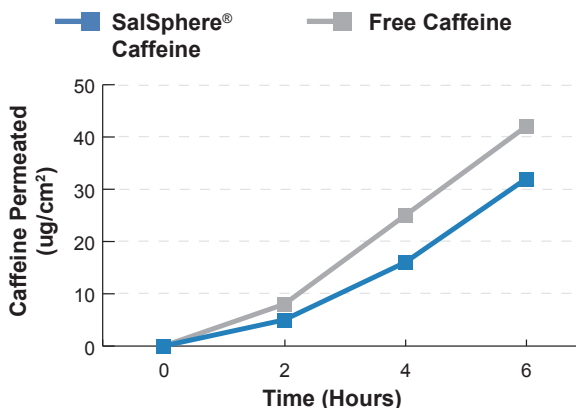


Figure 3: Release kinetics of caffeine over 6 hours at 3% loading from SS HS vs. free caffeine. The test was done on Franz cells using a Strat-M membrane and phosphate buffer as a medium.

## MICROSCOPIC ANALYSIS OF CAFFEINE

Free caffeine has a stringy, fibrous appearance, while the encapsulated caffeine in SS HS is finer and more uniform (Figure 4).

The crystal fibers (Figure 4, A) illustrate that free caffeine is insoluble in water at 10% loading. The solubility of free caffeine in water is 2%. SS HS, however, is characterized by very fine particles (Figure 4, B), and is soluble in water at 10% loading.

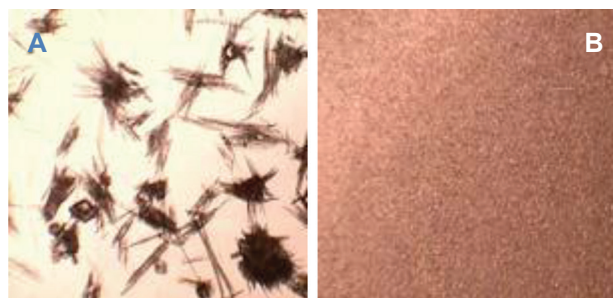


Figure 4: Microscopic images of 10% free caffeine in water (A) and 10% caffeine from SS HS (B). Images were taken at 100x magnification.

## FORMULATION

Ingredients	(W/W %)
SalSphere® Hair Stimulator	2
HydroSal® SalSilk	5
SalSphere® Natural Hair Growth Promoter	2
HydroSal® SalCool	1
Salvona Pre-Mix CW #5018	30
DI Water	60

## TECHNICAL DATA

Appearance @ 20°C	Opaque paste
Applications	Leave-on hair treatment applications such as serums, creams, and conditioners
Color	White
Odor	Characteristic
pH (1% Solution)	4.0 ± 1.0
Shelf Life (months)	18
Usage Level (wt%)	3-5
Storage (°C)	Closed container at 12-32°

## References

- Fischer TW, Hipler UC, Elsner P. Effect of caffeine and testosterone on the proliferation of human hair follicles *in-vitro*. International Journal of Dermatology. 2007; 46: 27-35.
- Trauer S. Permeation of topically applied caffeine through human skin - a comparison of *in-vivo* and *in-vitro* data. British Journal of Clinical Pharmacology. 2009 Aug; 68 (2): 181.