Unique&Easy Micro-Encapsulation Solutions

Product Overview - 8337-24

SalSphere® Apple

Nourishes the scalp for thicker stronger-looking hair

SalSphere® Apple is a scalp-targeted delivery system formulated to stimulate the growth of new hair and reinitiate the hair growth cycle in dormant follicles. By encapsulating Procyanidin B2, a natural polyphenol derived from apple extract, this technology enhances stability, bioavailability, and follicular delivery, offering a safe and effective solution for supporting healthier, fuller hair.

This technology is designed to counteract biological hair decline, reactivate dormant follicles, and naturally restore hair growth, particularly in cases where conventional cosmetic products have become ineffective. By delivering potent natural actives directly to the scalp, it offers a targeted approach to support healthier, fuller hair through non-pharmaceutical means.

The technology represents an efficient vehicle for follicular delivery, significantly enhancing the bioavailability of active ingredients at the precise site of hair growth, the hair follicle.
Recommended Applications Include:

- Progressive hair thinning or reduced hair density
- Dormant or miniaturized hair follicles that need reactivation
- Early-stage hair loss in both men and women
- Postpartum or stress-related shedding
- Age-related slowdown in the hair growth cycle
- Supportive care alongside non-cosmetic treatments for hair regrowth.



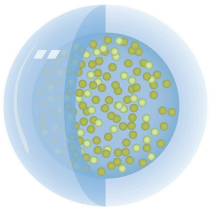


Figure 1: image of a model of SalSphere® Apple

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SalSphere® Apple is an advanced encapsulated delivery system that transports a blend of botanical actives—primarily Procyanidin B2 from apple extract—directly to the hair follicle to help reduce hair loss and stimulate regrowth.
The system utilizes submicron SalSphere® microspheres, featuring a lipid-rich outer shell that adheres to the scalp and an internal core designed for gradual, targeted release. This structure enhances active deposition, improves follicular penetration, and supports prolonged bioavailability at the site of hair regeneration.

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The active ingredient

Apple Procyanidin B2 is one of the key active ingredients in SalSphere® Apple It is a potent polyphenol extracted from unripe apples and has been clinically studied for its hair regrowth benefits.

Procyanidins are a class of polyphenolic compounds belonging to the flavonoid family, specifically oligomeric catechins.

In hair care, Procyanidin B2—a dimer of epicatechin—is the most studied and effective type.

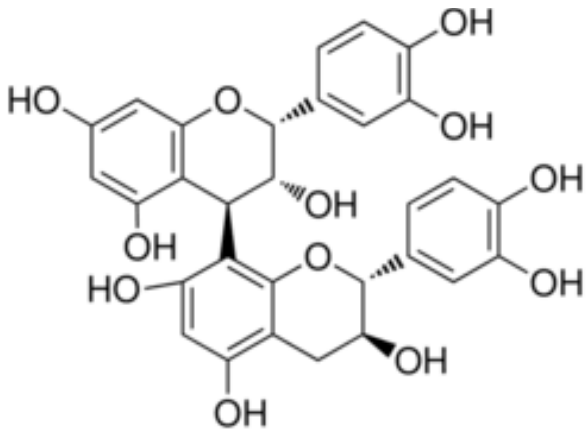


Figure 2: Molecular structure of the active ingredients, Procyanidin, used in SalSphere® Apple

Procyanidin B2 is the source used in SalSphere® Apple, selected for its proven ability to:

- Promote the anagen (growth) phase
- Increase hair diameter and density
- Inhibit follicle regression pathways

Limitations of Using Procyanidin for Hair Growth

While Procyanidin B2 is as promising as a natural hair growth promoter, it also has some inherent limitations, mainly related to stability, bioavailability, and delivery to the follicle.

1. Water-Soluble = Poor Skin Penetration

- Procyanidin B2 is hydrophilic, which limits its ability to penetrate through the lipid-rich stratum corneum.
- As a result, only a small portion may reach the hair follicle bulb, where it's biologically active.

2. Stability Issues

- Procyanidins are sensitive to oxidation, light, and heat.
- In unprotected formulations, they may degrade quickly, reducing potency over time.

3. Short Residence Time

- Being water-soluble, procyanidin tends to be washed off or evaporated quickly from the scalp surface.
- It may not remain in contact with the skin long enough to support sustained follicle stimulation.

4. Lack of Targeted Delivery

- When applied freely in solution or serum, procyanidin disperses on the scalp surface instead of targeting the follicular opening or the dermal papilla, where it's most effective.

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The hair growth cycle

The hair growth cycle (Figure 3) is a natural, repeating process through which hair grows, rests, and sheds. Understanding this cycle is key to developing technologies, such as SalSphere® Apple, that enhance growth by targeting specific phases and biological mechanisms.

The 3 Main Phases of the Hair Growth Cycle

Phase	Duration	What Happens
1. Anagen (Growth)	2–6 years	Active hair growth from the follicle; cells divide rapidly
2. Catagen (Transition)	2–3 weeks	Growth stops; follicle shrinks and detaches from blood supply
3. Telogen (Resting/ Shedding)	2–3 months	Old hair falls out; follicle rests before restarting growth

At any time, 85–90% of hairs are in anagen, 1% in catagen, and 10–15% in telogen.

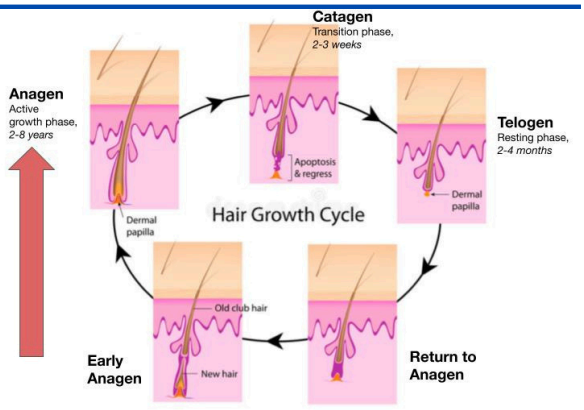


Figure 3: Hair Growth Cycle

How to Enhance Hair Growth via the Cycle

Apple Procyanidin B2 is a powerful natural polyphenol that promotes the transition of hair follicles into the anagen phase—the active growth stage—and is clinically shown to increase hair diameter.

✅ Stimulate the Anagen Phase

- Extend the duration of active growth
- Enable more hairs to enter and remain in the growth phase
- Support the development of longer, thicker, and healthier strands.

By targeting key biological checkpoints within the hair growth cycle, effective treatments can:

- Regrow thicker, stronger hair
- Reduce active hair loss and shedding
- Restore density and scalp coverage over time

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SalSphere® Apple technology

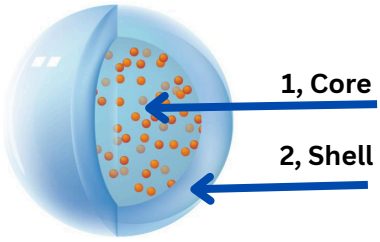


Figure 4: The structure of SalSphere® Apple

SalSphere® Apple is a controlled-release microsphere delivery system specifically developed to encapsulate Apple Procyanidin B2, a natural polyphenol known for its hair regrowth and follicle-activating properties.

Structure of SS Apple Microsphere

Component	Function
1. Lipid-Rich Core	Contains the Apple Procyanidin B2, Penetrates easily into scalp and localizes around hair follicles due to several key factors: • Sebum Affinity: Lipid carriers blend with sebum, helping them travel deep into follicles. • Small Size: Sunmicron-sized particles fit easily into follicular openings. • Bioadhesion: Lipids stick to follicle walls for targeted, lasting delivery. • Follicular Flow: Hair and sebum movement naturally pull lipid particles inward.
2. Hydrophilic Shell	Enables to suspend the core in water based formulations

Why It's Unique

- Protects procyanidin B2 from degradation by light, heat, or oxygen
- Targets the follicle for more effective stimulation of the anagen (growth) phase
- Improves absorption into the skin despite procyanidin's water solubility
- Sustains release over hours to keep follicles continuously nourished.

Follicular delivery

Follicular delivery refers to the targeted delivery of active ingredients directly into the hair follicle, rather than just remaining on the surface of the scalp. This approach leverages the follicle's natural structure and permeability, particularly during the anagen (growth) phase, when follicles are more open and active.

Follicular Delivery is Important for Hair Health

1. Enhanced Efficacy
Delivers active ingredients like procyanidins directly to the root, boosting hair growth and scalp health.

2. Improved Absorption
Follicles act as reservoirs, enabling deeper, longer-lasting delivery of actives.

3. Reactivates Dormant Follicles
Stimulates inactive follicles, aiding hair regrowth in thinning areas.

4. Minimized Side Effects
Local delivery reduces systemic exposure and potential side effects.

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SalSphere® Apple stabilized Procyanidin

SalSphere® Apple stabilizes procyanidin by protecting it from oxidation, extending shelf life, and preserving its potency for effective hair growth support.



Figure 5: 5% of procyanidin in a base A, free and B, SalSphere® Apple after 60 days at accelerated aging at 45 °C.

The dark color of free procyanidin indicates oxidation, while the brighter appearance of SalSphere® Apple reflects its stabilized, less oxidized form.

Procyanidin B2 is not stable in water primarily due to its chemical sensitivity to environmental factors that trigger oxidation and degradation. Here's why:

1. **Susceptibility to Oxidation**

Procyanidin B2 is rich in hydroxyl (-OH) groups, making it highly reactive with oxygen. In water, exposure to air, light, heat, or metal ions leads to:

Discoloration (brown/red)
Loss of antioxidant activity
Degradation into inactive compounds

2. pH Sensitivity

Acidic or alkaline conditions promote hydrolysis and structural breakdown.

Afficacy of Apple Procyanidin B2 Previous Data

Several clinical studies demonstrated that the topical application of 1% procyanidin B2 promoted hair growth in humans. (Takahashi T et al 1999).

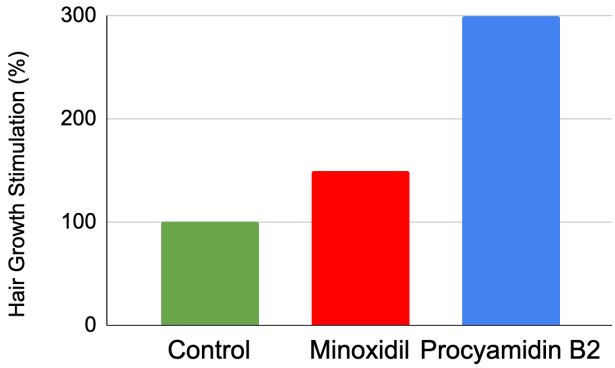


Figure 6: Studies have demonstrated that apple-derived procyanidin B2 can stimulate hair growth by up to 300% compared to control and 200% greater than minoxidil, highlighting its potent follicular activity and potential as a natural alternative for hair regeneration.

3. Temperature & Light

Heat and UV light accelerate oxidation, causing instability in typical water-based formulations.
s or altering its molecular structure.

💡 3. Temperature and Light

Heat and UV exposure accelerate oxidative degradation in water-based systems, which is especially problematic for cosmetic formulations stored at room temperature or above.

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Rationale for Encapsulation

The decision to encapsulate Apple Procyanidin B2 in SalSphere® Apple is based on addressing the known limitations of using the free (non-encapsulated) apple extract for hair growth:

1. Product Instability:
Free Procyanidin B2 is highly prone to oxidation in aqueous formulations, leading to discoloration, degradation, and reduced efficacy over time.

2. Delayed Onset of Results:
In its free form, the active ingredient requires prolonged use—typically several months—before visible results occur, which can discourage consistent consumer use and reduce product appeal.

By encapsulating Procyanidin B2 in submicron lipid-based spheres, the technology enhances stability, protects the active from degradation, and improves delivery to the follicle, ultimately aiming to accelerate the onset of visible benefits and support long-term hair regrowth.

Consumer Assessment of Cosmetic Products tested in China:

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Many Chinese consumers strongly believe that product testing should be conducted on Chinese individuals, due to:

- Differences in skin and scalp biology
- Variations in lifestyle, diet, and climate.

Clinical Consumer Assessment

The objective of the consumer assessment for the cosmetic hair regrowth product based on SalSphere® Apple was to evaluate:

- Perceived hair regrowth and improvement in hair density
- Ease of use and integration into daily routines
- Cosmetic acceptability, including texture, scent, and scalp feel
- Tolerance and absence of side effects such as irritation, redness, or itching
- Overall user satisfaction and likelihood of repurchase or recommendation

This assessment aimed to capture real-world consumer impressions and validate the product's appeal, safety, and performance in a cosmetic application.

A total of approximately 60 volunteers, aged 26 to 65 years, men with visible thinning and hair loss, agreed to participate in the study. Participants were instructed to apply 0.5–1 mL of the toner twice daily in the morning and evening, by gently massaging it into the scalp. The volunteers were supplied with a sufficient amount of the product for 4-12 weeks (1-3 months).

The study team conducted periodic follow-up visits to monitor participant progress, document visible changes, and assess any signs of hair regrowth.

Volunteers completed self-assessment surveys using a 5-point scale to rate their perceived changes over time. Additionally, each participant submitted scalp photographs at baseline (before the first application) and again after several weeks of use to visually track any improvement.

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Figure 5: Three clear and compelling examples of hair regrowth based on consumer-use observations using SalSphere® Apple.

Observed Results:

- 80% of volunteers experienced visible hair regrowth after using the product.
- 100% of participants reported no adverse side effects, including inflammation, redness, or itchiness.
- Among volunteers with white or graying hair, 80% observed regrowth in their original (black) hair color.
- Initial signs of regrowth were typically observed within the first month of use.

The effect was found to be more pronounced in older individuals (aged >45 years).

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Technical Data

Specification	Characteristic
Color	White to Off White
Odor	Generic
Appearance	Opaque Paste
pH (1%)	4.5-6.5

Estimated shelf life (Months)	18
Use level (wt %	5-10
Storage (oC)	12-25

INCI
Water
Isostearyl Isostearate
Propanediol
Oryza Sativa (Rice) Extract
Cetearyl Alcohol
Glyceryl Stearate
Xanthan Gum
Pentylene Glycol
Cetearyl Glucoside
Tocopherol
Tetrehexyldecyl Ascorbate
Phenethyl Alcohol
Sodium Citrate
Butyrospermum Parkii (Shea) Butter
Lactic Acid
Glucose
Pyrus Malus (Apple) Fruit Extract
Citric Acid

Functional Ingredient

CAS: 29105-49-8
Synonyms: Epicatechin, Proanthocyanidin B2

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Sample Formulas Using SS NHGP • China Compliant & PEG Free



Foaming Mousse

Ingredients	(W/W%
SS NHGP	5.00
SS SalOxy PID# 5079-03	7.50
Propanediol	5.00
Carrageenan	0.75
Xanthan Gu	0.35
Phosphate Buffered Saline and) Aqua	1.00
Sodium Laureth Sulfate	2.25
Cocamidopropyl Betaine	2.25
Oryza Sativa (Rice) Extract	1.50
Citrus Grandis(Grapefruit) Peel Oil	0.05
Phenethyl Alcohol (and) Pentylene Glycol (and) Propanediol	0.75
Blue 1	0.01
Water (Aqua)	73.59
Total	**100**



Fixative

Ingredients	(W/W%
SS NHGP	3.00
HS SalSilk	3.00
Water, Carbopol, Phenoxyethanol, Ethylhexylglycerin, Disodium EDTA	25.00
Phenethyl Alcohol (and) Pentylene Glycol (and) Propanediol	1.00
Propanediol	1.00
Water, Arginine	1.00
PVP	1.50
Water (Aqua)	63.50
Total	**100**



Serum

Ingredients	(W/W%
SS NHGP	2.00
SS Hair Stimulator	3.00
Polyhydroxystearic Acid	1.00
Sodium Hydroxy Propyl Sulfonate Lauryl Glucoside Cross Polymer	1.78
Phosphate Buffered Saline	0.01
Disodium EDTA	0.10
Phenethyl Alcohol (and) Pentylene Glycol (and) Propanediol	1.00
Lactic Acid	0.01
Aqua (and) Acrylates/C10-30 Alkyl Acrylate Crosspolymer	18
Arginine	0.10
Glycerin	4
Propanediol	46
Water (Aqua)	23
Total	**100**

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Summary of the mechanisms of action of Procyanidin (especially Procyanidin B2) on hair performance—focusing on how it promotes hair growth, increases thickness, enhances follicular function, and prevents hair loss.

	Mechanism	Effect on Hair
1	Promotes anagen phase entry	Initiates and prolongs active hair growth
2	Stimulates **keratinocyte activity**	Increases hair thickness and matrix growth
3	Inhibits 5α-reductase/DHT	Reduces hair follicle miniaturization
4	Boosts **VEGF (vascular endothelial growth factor) expressio**	Improves microcirculation and follicle support
5	Acts as antioxidant	Protects hair follicles from oxidative damage
6	Anti-inflammatory	Reduces local scalp inflammation

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Key Publications on Procyanidin and Hair Growth

1. Takahashi, T., Kamimura, A., & Kuwahara, M.
"Procyanidin B-2, extracted from apples, promotes hair growth: a clinical study."
Journal of Cosmetic Dermatology, 2005; 4(4): 245–249.

- 4-month study showed:
  - 79% increase in hair diameter
  - 84.2% increase in hair density
  - 63.2% of subjects showed visible regrowth

Mechanism Highlighted: Stimulates hair growth by promoting the transition from telogen to anagen phase in hair follicles.

2. Kamimura, A., & Takahashi, T.
"Procyanidin B-2 extracted from apples increases hair diameter in human subjects."
British Journal of Dermatology, 2003; 149(2): 354–356.

- Double-blind clinical trial showed that Procyanidin B2 significantly increased hair shaft thickness over 6 months.

Mechanism Highlighted: Enhances hair shaft thickening by stimulating keratinocyte proliferation and hair matrix activity.

3. Takahashi, T.
"Hair growth promoting activity of apple polyphenols: application in cosmetics."
In: Forum of Nutrition, 2009; 61: 129–134.

- Discusses the mechanism of action, clinical outcomes, and safety profile of Procyanidin B2 in cosmetics.

4. Kamimura, A. et al.
"Hair cycle arrest in mice by procyanidin extract."
Biological & Pharmaceutical Bulletin, 2000; 23(7): 771–775.

- Animal model study showed prolongation of the anagen (growth) phase in hair follicles.

Mechanism Highlighted: Promotes anagen phase prolongation in murine models; inhibits premature transition to catagen.
Mechanism Highlighted: Suggests anti-androgenic effects by inhibiting 5α-reductase, reducing DHT (a driver of hair follicle miniaturization).

5. Yamamoto, T. et al.
"Inhibitory effect of apple polyphenols on 5α-reductase activity."
Bioscience, Biotechnology, and Biochemistry, 2002; 66(5): 1123–1126.

- Suggested that apple polyphenols may suppress DHT, a known factor in androgenetic alopecia.

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5. Takahashi T. (2009)
"Hair growth promoting activity of apple polyphenols: application in cosmetics."
Forum of Nutrition, 61: 129–134.

Mechanism Highlighted:
Anti-inflammatory and antioxidant protection of the follicular environment
Increased expression of VEGF (vascular endothelial growth factor), enhancing blood flow and follicle nourishment

Publications on Encapsulation Systems for Hair Growth & Hair Loss Prevention

1. Fernandes, A. R., et al. (2018)
"Encapsulation of bioactives for preventing hair loss: An overview."
Trends in Food Science & Technology, 78: 122–132.
Overview of natural bioactives and encapsulation strategies (liposomes, SLNs, hydrogels) for hair care applications.

2. Rehman, K., et al. (2019)
"Nanomedicine-based drug delivery system for the treatment of alopecia: current status and future prospects."
Therapeutic Delivery, 10(1): 27–45.
Discusses the role of nanocarriers (SLNs, polymeric nanoparticles, nanostructured lipid carriers) in improving follicular delivery and hair regrowth.

3. Choi, M. J., & Maibach, H. I. (2005)
"Liposomes and niosomes as topical drug delivery systems."
Skin Pharmacology and Physiology, 18(5): 209–219.
Reviews topical liposomal delivery, including hair follicle targeting.

4. Mitragotri, S., et al. (2011)
"Overcoming skin barriers for transdermal drug delivery using nanoparticles."
Advanced Drug Delivery Reviews, 63(6): 478–491.
Includes discussion on particle size and skin/hair follicle penetration relevant to hair regrowth systems.

5. Nasir, A., et al. (2021)
"Solid lipid nanoparticles: A modern formulation approach in drug delivery system for topical applications."
Journal of Drug Delivery Science and Technology, 61: 102256.
Explores SLNs for delivering actives to skin and follicles, improving stability and penetration.

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6. Padois, K., et al. (2011)
"Solid lipid nanoparticles for the delivery of minoxidil: development and in vitro evaluation."
International Journal of Pharmaceutics, 428(1–2): 103–109.
SLNs enhanced the retention and penetration of minoxidil into the skin and follicle, improving its efficacy.

7. Shah, P., et al. (2016)
"Nanocarriers for topical delivery of minoxidil: current status and future perspectives."
Drug Delivery, 23(2): 519–535.
Reviews encapsulation strategies (liposomes, nanoemulsions, SLNs) for improving minoxidil delivery to the follicle.

8. Rajitha, P., et al. (2019)
"Nano-therapeutics for treatment of alopecia: A review."
Current Pharmaceutical Design, 25(38): 4080–4091.
Focuses on targeted delivery systems to hair follicles, including polymeric nanocarriers and lipid-based systems.

9. Nasrollahi, S. A., et al. (2020)
"Hair follicle targeting with nanoparticles."
International Journal of Pharmaceutics, 587: 119679.
Explores mechanisms and advantages of nanoparticle-mediated delivery into follicles.

10. Li, W., et al. (2018)
"Targeted delivery of herbal extracts for hair regrowth using lipid nanoparticles."
Journal of Drug Delivery Science and Technology, 45: 272–281.
Describes lipid nanoparticle systems encapsulating herbal actives for hair regeneration.