Unique&Easy Micro-Encapsulation Solutions

SalSphere® Light

Enhanced delivery of skin toning for improved complexion

SalSphere® Light is a delivery system designed to tone the skin and treat hyperpigmentation, dark spots, and melasma.

SalSphere® Light is an innovative skin brightening system that combines natural Alpha-Arbutin and Resveratrol, both encapsulated for stability, targeted delivery, and sustained release.

Using the SalSphere® delivery system to lighten the skin offers distinct advantages over free (non-encapsulated) brightening agents.

SalSphere® Light delivers Alpha-Arbutin to reduce melanin production, and Resveratrol to block pigmentation triggers and protect skin. Together, they work synergistically to:

- Brighten dull, uneven skin
- Fade dark spots and melasma
- Prevent new discoloration
- Deliver visible results with leSalSphere® irritation

SalSphere® Light enhances the bioavailability of alpha-Arbutin at the deeper layers (Figure 2) of the skin—specifically near the melanocytes in the basal layer of the epidermis—through a combination of encapsulation design, targeted adhesion, and controlled release mechanisms.

SalSphere® Light enables:

- Dual-delivery of hydrophilic and lipophilic actives
- Sustained, targeted release of both ingredients where they are most needed
- Increased efficacy in treating pigmentation, dark spots, and uneven tone
- Lower irritation potential by avoiding overload

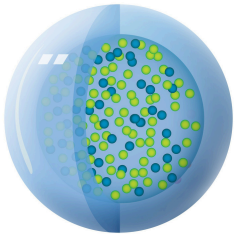

Figure 1: The sub-micron structure of SalSphere® Light, with the α-arbutin and resveratrol infused within the core.

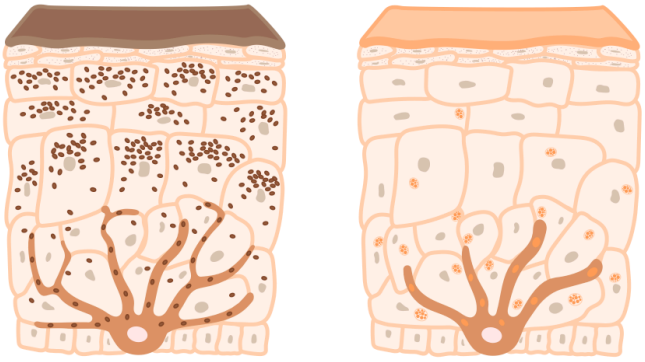

Figure 2: In the deeper layers of the skin, melanosomes are transferred from melanocytes to neighboring keratinocytes to be visible just under the skin's surface.

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The functional ingredients

Alpha-Arbutin
A potent, well-tolerated skin brightener.
How It Works:
Inhibits tyrosinase, the key enzyme involved in melanin production
Reduces existing hyperpigmentation, including dark spots and acne marks
Helps even skin tone without irritation (ideal for all skin types)
✅ Benefits:
Fades dark spots and sun damage
Brightens dull, uneven skin
Safer alternative to hydroquinone
Works well with encapsulation for better stability and delivery.

Resveratrol
A potent antioxidant derived from grapes and Japanese knotweed.
How It Works:

- Neutralizes oxidative stress that triggers melanin overproduction (UV, pollution)
- Inhibits MITF*, a key protein in melanogenesis (the process of melanin creation)
- Provides anti-aging and anti-inflammatory benefits alongside brightening

✅ Benefits:

- Reduces inflammation-triggered pigmentation
- Protects skin from UV-induced darkening
- Enhances skin radiance and clarity

*MITF stands for Microphthalmia-associated Transcription Factor — a master regulator of melanocyte function and melanin production. MITF controls the expression of key melanogenic enzymes: Tyrosinase (TYR), Tyrosinase-related protein-1 (TRP-1), Tyrosinase-related protein-2 (TRP-2). These enzymes are critical for the synthesis of melanin in melanocytes.

Benefits of SalSphere®Light

Alpha-Arbutin – Water-Soluble Active
Challenge:
Alpha-Arbutin is highly water-soluble and unstable when exposed to light, heat, or oxidation.
SalSphere® Light Solution:
Alpha-Arbutin is encapsulated within a lipid-based microsphere, surrounded by a protective shell that shields it from degradation. Upon application, it is gradually released into the lipid-rich domains of the skin, allowing sufficient time for penetration into the basal layer where melanocytes reside.
✅ **Result:**
Improved stability, extended duration of action, and enhanced bioavailability, enabling Alpha-Arbutin to inhibit tyrosinase and reduce melanin production effectively.
Resveratrol – Oil-Soluble Active
Challenge:
Resveratrol is poorly bioavailable due to its lipophilic nature, low skin permeability, and susceptibility to oxidative degradation in conventional water-based systems.
SalSphere® Light Solution:
Resveratrol is entrapped in the lipophilic core of the microsphere. The lipid-based structure mimics the skin's intercellular lipid matrix, promoting deeper penetration through the stratum corneum. The microsphere also protects the active from UV exposure and oxidation, allowing it to reach the viable layers of the epidermis.
✅ **Result:**
Resveratrol retains its potency for longer and effectively penetrates the skin to neutralize oxidative streSalSphere® and suppreSalSphere® melanin synthesis triggers such as ROS and MITF activation.

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Unique natural delivery technology

SalSphere® Light is a unique natural delivery system that combines advanced encapsulation technology with biocompatible, lipid-based materials to deliver skin-brightening actives more safely, effectively, and sustainably.

What Makes SalSphere® Light a Unique Natural Delivery System

1. **Lipid-Based, Biocompatible Microspheres**
   - Made from materials that mimic the skin's natural lipid matrix
   - Enhances compatibility with the skin and supports penetration without synthetic carriers
2. **Dual-Compartment Encapsulation**
   - Simultaneously delivers water-soluble (Alpha-Arbutin) and oil-soluble (Resveratrol) actives.
   - Maintains the integrity and activity of both activities in a single, stable format
3. **Gradual, Triggered Release**
   - Releases ingredients in response to rubbing it into the skin
   - Provides sustained brightening benefits without overloading the skin
4. **Improved Stability of Natural Actives**
   - Shield sensitive natural ingredients from light, oxidation, and degradation
   - Increases shelf life and potency at the time of application
5. **Gentle Yet Effective Performance**
   - Reduces irritation often caused by potent brighteners
   - Ideal for sensitive skin and natural formulations

Carrier System: SalSphere® Microsphere

Lipid Matrix – typically composed of skin-friendly, biodegradable lipids (e.g., hydrogenated lecithin, stearic acid, or triglycerides)
Emulsifiers or Stabilizers – to maintain sphere integrity and dispersion in the final product (may include natural surfactants or polysaccharides).

Protective Shell – a multilamellar layer that shields actives from oxidation and controls their release while enabling the suspension of the lipid core.

Delivery Format:
Suspended in aqueous or oil-compatible medium, depending on formulation use (e.g., serum, cream, lotion, or mask)

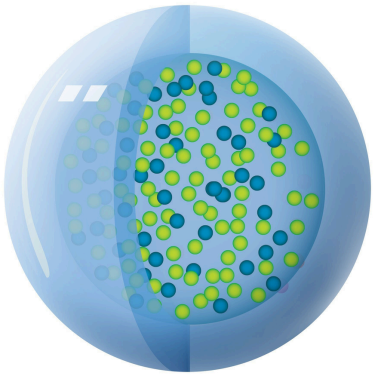

Figure 3: The composition of SalSphere® Light (SalSphere® Light) is carefully engineered to align with its functional goals—skin brightening, stability, safety, and sustained efficacy. The lipid core mimics skin's natural lipids, improving biocompatibility and enhancing skin penetration. The protective shell shields actives from light, heat, and oxidation; enables the suspension of the lipid microsphere in an emulsion

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Treating hyperpigmentation, dark spots, and melasma involves targeting similar underlying processes, primarily the excess production of melanin.

1. Hyperpigmentation (General Term)

An umbrella term for any excess melanin production that causes areas of skin to darken unevenly.
Causes:

- Sun exposure (UV damage)
- Inflammation (acne, injury, eczema)
- Hormonal changes
- Medications
- Post-treatment irritation (e.g., laser, peels)

2. Dark Spots (Post-Inflammatory Hyperpigmentation – PIH)

Flat, isolated spots caused by localized skin trauma or inflammation, such as acne, bug bites, or burns.
Common in: All skin types, but especially darker skin tones

3. Melasma

A hormonally triggered condition causing symmetric patches of discoloration (often on cheeks, upper lip, forehead).
Causes:

- Hormonal fluctuations (pregnancy, birth control)
- Sun exposure
- Genetic predisposition
- Heat and visible light can also trigger

Mechanism of Melanogenesis Inhibition
The enzyme tyrosinase, one of the key enzymes involved in melanin synthesis, is activated in melanocytes by the stimulation of free radicals induced by UV irradiation and stre. Its activation triggers melanogenesis, a complex series of enzymatic and chemical reactions, ultimately leading to the formation of freckles and a suntan. The rate-limiting step is the conversion of tyrosine to DOPA, followed by the conversion of DOPA to dopaquinone, catalyzed by tyrosinase (Figure 4).

Alpha-Arbutin's Role
Alpha-Arbutin is a glycosylated derivative of hydroquinone. It competitively inhibits tyrosinase, preventing it from converting tyrosine to melanin precursors. This reduces the overall production of eumelanin and pheomelanin (brown and red pigments).

Result:

- Slows down melanin formation at the source
- Leads to a brighter, more even skin tone
- Le irritation than traditional actives like hydroquinone, making it ideal for sensitive skin

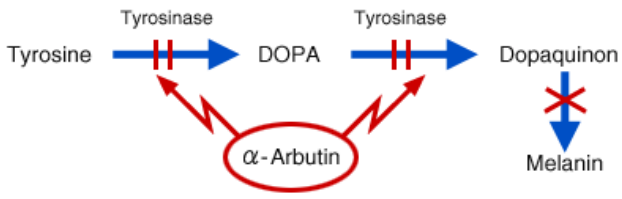

Figure 4: Mechanism of Melanogenesis: Inhibition of α-Arbutin

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Ex-vivo Testing

Method 1: Bioavailability of α-Arbutin

To assess the bioavailability of α-Arbutin delivered by SalSphere® Light, an Ex-vitro skin penetration study was conducted using a Franz Diffusion Cell system with excised pig skin, a well-established model for human epidermis.

Procedure Overview:

Objective: Measure the concentration of α-Arbutin that penetrates into the epidermis
Model: Pig skin mounted between donor and receptor chambers in a Franz Cell (Figure 5)
Sample Applied: 0.5 mL of a suspension containing 5% SalSphere® Light
Receiving Medium: Phosphate buffer (pH 7.0)
Temperature: Maintained at 37°C to simulate physiological skin conditions
Duration: Monitored over time to assess cumulative penetration
This setup allowed for the quantitative determination of α-Arbutin permeation through the stratum corneum and its retention in the viable epidermis, reflecting enhanced delivery performance of the encapsulated system.

Figure 5: Franz Cell used to measure the penetration of free α-arbutin and SalSphere® Light containing α-arbutin at the same dosage.

Results 1: *Ex-vivo* results, with pig skin as a model, show that SalSphere® Light delivers 60% more α-Arbutin through the skin compared to free (Figuer 6).

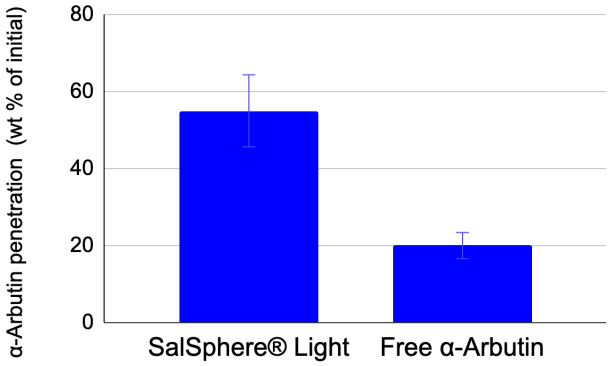

Figure 6: Penetration of α-Arbutin through a pig's skin into a buffer solution. SalSphere® Light enables the enhancement of the penetration of α-Arbutin by **275%** vs the free.

Franz cells are in vitro experiments used to measure the penetration of ingredients through the skin.

What It Tells You

- Rate and extent of skin penetration
- Bioavailability of actives (e.g., α-Arbutin, resveratrol)
- Effectiveness of a delivery system (e.g., encapsulation vs. free form)
- Retention in the skin layers vs. systemic absorption

Why It Matters in Cosmetics

Franz Cell studies help evaluate whether:

- The active reaches its target site (e.g., melanocytes in the basal layer)
- Encapsulation improves skin delivery
- The product is likely to be effective when applied topically.

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Clinical and Self-Evaluation of SalSphere® Light

A clinical study was conducted to compare the efficacy of SalSphere® Light versus non-encapsulated (free) ingredients in a real-world application setting.

Study Design:
Participants: 5 volunteers
Location: Southeast Asia (SEA)
Product: Lotion containing 5% SalSphere® Light

Application:
One arm: lotion with the technology (5% SalSphere® Light).
The other arm served as a control, using the same lotion with free-form Alpha-Arbutin and Resveratrol at equivalent concentrations. Both samples are applied daily in the morning.

Duration: 14 days
Conditions: Normal daytime activity; no change in participants' daily routines

Results – Self-evaluation:
The arm treated with SalSphere® Light showed noticeable skin lightening compared to the control (Figure 7).
The majority (**80%**) of participants observed a more even skin tone and a visible reduction in dark patches on the SalSphere Light-treated side within 14 days.

Importantly, no irritation or adverse reactions were reported during the study.

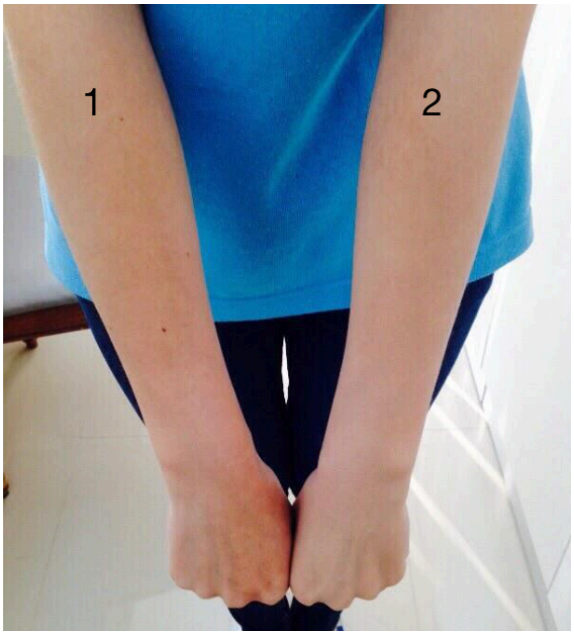

Figure 7: The effect of lotion containing 5% SalSphere® Light, applied daily after 14 days. Arm 1 is the control (containing equal %wt of unencapsulated α-arbutin), and Arm 2 used the experimental 5% SalSphere® Light lotion.

Self-evaluation can be more meaningful than machine readings in skin lightening studies because it directly reflects the consumer's perception of visible improvement, which ultimately determines product satisfaction and repurchase behavior.

- Consumers judge skin lightening based on what they see in the mirror.
- Self-evaluation captures changes that matter most to users: radiance, even tone, and clarity, not just numerical values.

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Commercial aspects of lightening

The value of brighter skin extends across multiple dimensions—aesthetic, psychological, and commercial—making it a highly sought-after outcome in skincare:

1. Consumer Perception & Aesthetic Value

- Radiance and glow are associated with youthfulness, health, and vitality.
- Brighter skin is perceived as clearer, more even-toned, and well-cared-for, often reflecting good lifestyle and skincare habits.
- Consumers often equate brightness with freshness and a “bare-skin confidence” look, especially in cultures where even tone is preferred over coverage.

2. Emotional & Psychological Impact

- A brighter complexion can boost self-esteem and confidence.
- It reduces the appearance of fatigue, dullness, and aging, which are commonly linked to stress or environmental damage.
- Skin that looks brighter is often interpreted as healthier, influencing first impressions and self-image.

3. Commercial Value for Brands

- "Brightening" is one of the top claims in global skincare markets—particularly in Asia, the U.S., and Europe.
- It supports multiple product types: serums, creams, masks, exfoliators, and anti-aging treatments.
- Offers long-term consumer engagement since users tend to repeat-purchase when visible results are achieved.

Skin lightening technology—like SalSphere® Light—can be effectively used in a wide range of skincare products.

Product Categories that benefit from SalSphere® Light:

1. Facial Serums
2. Creams & Moisturizers
3. Cleansers & Toners
4. Face Masks (Sheet, Cream, Peel-off)
5. Spot Treatments / Roll-Ons
6. Sunscreens
7. Body Lotions & Brightening Creams

You can enhance the skin lightening effect of SalSphere® Light by combining it with synergistic active ingredients that target different pathways of melanin synthesis, skin turnover, and inflammation. This multi-mechanism approach boosts visible results while maintaining skin safety and comfort.

Ways to Enhance Skin Lightening with SalSphere® Light:

-**Add additional Tyrosinase Inhibitors** that block melanin production more effectively when used together:

- Niacinamide – Reduces transfer of melanin to keratinocytes
- Kojic Acid – Inhibits free radical-stimulated tyrosinase
- Tranexamic Acid – Targets UV-induced pigmentation and melasma
- Licorice Extract (Glabridin) – Natural inhibitor of melanin synthesis

-**Support with gentle exfoliants like SalSphere® Even Skin.**

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Technical Data Sheet

INCI

Active ingredients: Alpha-Arbutin, Resveratrol

Others: Water, Glyceryl Stearate, Polysorbate 80, Perservative

Specifications

Property	Specification
Appearance	Opaque paste
Form @RT	Solid
Color	White to off-white
pH (1% soln)	4.0 - 6.0

How to Use

To incorporate SalSphere® Light into a lotion or serum, it's important to preserve the integrity of the encapsulated microspheres and ensure even dispersion.
Here's how to do it effectively:
For Lotions (O/W Emulsion):

General Guidelines:

- Add Phase: Add SalSphere® Light to the cool-down phase (<40°C)
- Usage Level: Typically 3–10%, depending on desired strength and claim
- Mixing: Use gentle stirring or low-shear mixing to avoid breaking the microspheres

Suggested Process:

1. Prepare the oil and water phases separately and heat (typically to ~70–75°C)
2. Emulsify and then cool the emulsion to below 40°C
3. Add SalSphere® Light slowly while stirring gently
   - Adjust pH if needed (ideal pH: ~5.0
   - Add any sensitive actives, preservatives, or fragrance last

Tip: Avoid high-shear homogenization or sonication after adding SalSphere® Light to preserve encapsulation.

Skin Brightening Cream Gel
(PID: 11415)

	INCI	%WT
A	*Isononyl Isononanoate (and) Ethylhexyl Isononanoate*	10.00
A	*Isohexadecane*	2.00
A	*Dimethicone*	1.00
B	*Ammonium Acryloyldimethyltaurate/VP Copolymer*	1.20
C	*Water*	Q.S.
C	*Glycerin*	5.00
C	***SalSphere® Light 8361-18***	**3.00**
C	*Lycium Barbarum Fruit Extract (and) Coffea Arabica (Coffee) Seed Extract*	1.00
D	*Preservative*	Q.S.
	Total	**100.00**

1. Combine PHASE A in the main kettle with prop mixing @300rpm at RT.
2. Mix until uniform.
3. When homogenous, add PHASE B to main kettle
4. In a side kettle, combine PHASE C ingredients with prop mixing @200rpm
5. When both kettles are homegenous, add PHASE C to the main kettle with prop mixing @800rpm.
6. Homogenize batch with hi-shear.
7. Add PHASE C.
8. Mix an additional 10 mins at the end. Check pH and adjust if necessary with 20% Citric Acid or 20% Arginine.

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Formulation Tips

Skin Toning Lotion
(PID: 11417)

	INCI	%WT
A	*Water*	Q.S.
A	*Propanediol*	8.00
A	*Xanthan gum*	0.30
A	*Ethylenediaminetetraacetic acid tetrasodium salt dihydrate*	0.10
B	*Caprylic/Capric Triglyceride*	4.00
B	*Simmondsia chinensis (Jojoba) seed oil*	2.00
B	*Diheptyl succincate (and) capryloyl glycerin/sebacic acid copolymer*	3.00
B	*Butyrospermum Parkii (Shea) Butter*	1.00
B	*Stearic acid*	4.00
B	*Tocopherol*	0.10
B	*Cetyl alcohol*	2.00
C	***SalSphere® Light 8361-18***	**4.00**
C	*Preservative*	Q.S.
D	***SalColor FX Pink to White MBFX-1003***	**1.50**
	Total	**100**

1. Combine PHASE A in order listed while mixing with paddle blade @ 200rpm. Mix until uniform. Heat to 75-80C
2. Add PHASE B in order listed to the main kettle while mixing with paddle blade @ 400rpm. Mix until uniform before each addition. Mix for 10 mins at the end.
3. Mixing with paddle blade @ 500rpm while cooling to 40-45C.
4. Add PHASE C in order listed to the main kettle with paddle blade @ 500rpm at 40-45C. Cool to RT.
5. Check pH and adjust if necessary with 20% Citric Acid or 20% Arginine.
6. Post-add phase D carefully; slow mixing or hand-mixing

Brightening Face Cream
(PID: 11414)

	INCI	%WT
A	*Water*	Q.S.
A	*Acrylates/C10-30 Alkyl Acrylate Crosspolymer*	0.35
A	*Propanediol*	5.00
A	*Glycerin*	3.00
A	*Xanthan Gum*	0.15
B	*C14-22 Alcohols (and) C12-20 Alkyl Glucoside*	3.00
B	*Butyrospermum Parkii (Shea) Butter*	0.90
B	*Caprylic/Capric Triglyceride*	3.00
B	*Isononyl Isononanoate*	7.00
B	*Diheptyl Succinate (and) Capryloyl Glycerin/Sebacic Acid Copolymer*	5.00
B	*Squalane*	0.10
C	***SalSphere® Light 8361-18***	**5.00**
C	*Polyglutamic Acid, Water, Butylene Glycol*	1.00
C	*Preservative*	Q.S.
	Total	**100.00**

1. Combine PHASE A in order listed in the main kettle with prop mixing @ 300rpm at RT. Mix until uniform before each addition. Heat to 75-80C.
2. In the side kettle, Combine PHASE B ingredients with prop mixing @ 200rpm at 75-80C.
3. Add PHASE B to the main kettle with prop mixing @ 600rpm at 75-80C. Mix for 15 mins. Then cool to 40-45C.
4. Add PHASE C ingredient in order listed with prop mixing @ 600rpm at 40-45C. Mix for 5 mins between each addition. Mix an additional 10mins at the end. Then Cool to RT.
5. Check pH and adjust if necessary with 20% Citric Acid or 20% Arginine.

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Active	Mechanism of action	Clinical Evidenace	Reference
Alpha-Arbutin	Inhibits tyrosinase and melanosome maturation → reduces melanin	In a randomized trial (n = 60), 1% cream significantly lightened skin within 1 month—better efficacy than kojic acid and hydroquinone; UV-induced pigmentation was also suppressed in a 2% cream trial (n = 23). alpha-arbutin possesses strong inhibitory effects on tyrosinase. When tested against other popular skin lighteners in a 4-week study, alpha-arbutin exhibited **20%** and **60%** higher depigmenting activity than kojic acid and hydroquinone, respectively. And in a three-month study, researchers found that alpha-arbutin diminished the appearance of age spots in **85%** of participants.	• M. Funayama et al., Effects of α- and β-Arbutin on Activity of Tyrosinases from Mushroom and Mouse Melanoma. Biosci. Biotech. Biochem. 59: 143-144 (1995) • K. Sugimoto et al., Syntheses of Arbutin-α-glycosides and a Comparison of Their Inhibitory Effects with Those of α-Arbutin and Arbutin on Human Tyrosinase. Chem. Pharm. Bull. 51: 798-801 (2003) • https://www.illuminatural6i.com/science.html. Accessed January 4, 2017.
Resveratrol	Resveratrol (natural & analogs) applied topically	Inhibits tyrosinase activity, gene expression, and melanosome maturation; modulates MITF, Nrf2, and antioxidant pathways to reduce pigmentation in vitro & models	Yong Chool Boo et al., Antioxidants (2019).
Resveratrol	Nanoliposome-resveratrol topical application	Demonstrated enhanced skin penetration and retention; improved brightness & reduced melanin vs free Res	Zhang et al., Molecules (2023)

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