ACTIVE BEAUTY

BSB 2024 Innovation Award Cosmetics 1st Prize Category Most Innovative Raw Material

FCE COSMETIQUE INNOVATION Challenge 2nd place Silk-iCare™

Silk-iCare™

The vegan silk veil for skin perfection

High performance functional / Film former

Givaudan

Human by nature

Focus on the product

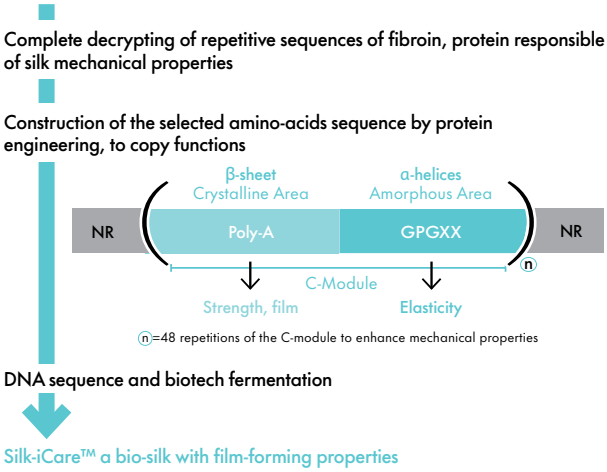
Silk: the science behind an iconic material

Silk is probably the most beautiful, delicate and lustrous material ever created. Silk has a high level of elasticity and can stretch on average 30 to 40%, and it is more resistant than steel (5 to 10 folds) and Kevlar (3 folds). Incredibly light, a silk fiber thread long enough to go around the Earth (40,075 km at the equator) would only weigh 420 g. Silk from Silkworms is not usable for cosmetics: due to low solubility, silkworms silk must be hydrolysed to be formulated, losing all its properties.

The composition of the silk has been decrypted and it highlighted a complex organisation made of amorphous and crystalline areas. Those areas are characterised by specific structures, respectively a-helices and β-sheets, in which numerous repetitive amino-acids sequences are observed.

The repetitive sequence GPGXX is constitutive of a-helices and poly-A mades β-sheets. Those particular structures are responsible for the different functions of silk: elasticity, strength and ability to form films.
Using biotechnologies, an optimised sequence of silk protein has been designed and used to produce, by fermentation, a new vegan silk: Silk-iCare™ is a pure biomimetic silk.

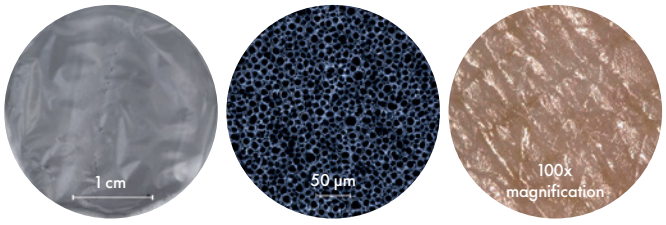
This is Silk-iCare™ the first vegan silk, a protective veil for your skin.



Silk-iCare™ forms an invisible film on the skin

The film of Silk-iCare ™ is very thin, light, breathable, with a regular network and homogeneous 3D structure.

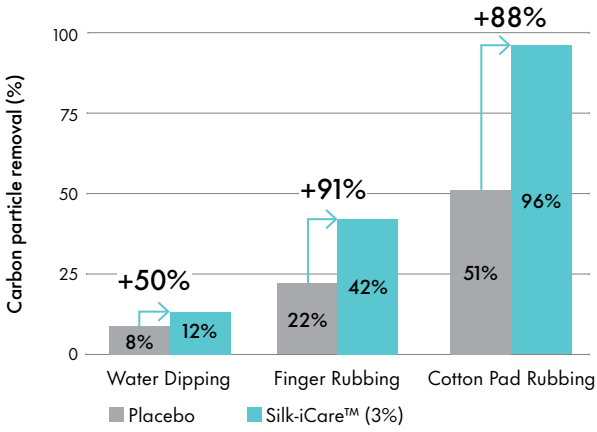
On the skin, it is invisible, with no cracks and no residue during application and drying.

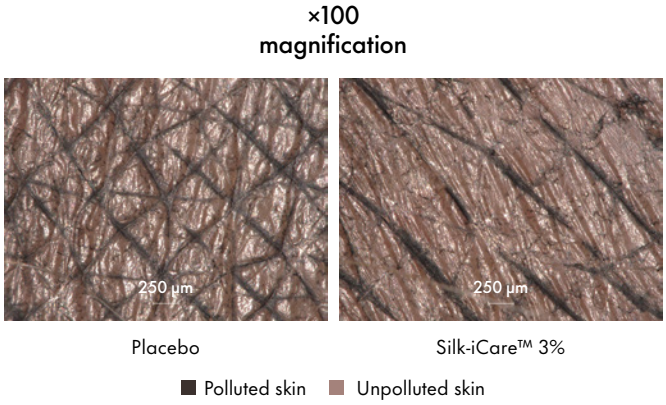


Macroscopic observation | Microscopic observation | Human skin treated with Silk-iCare™, after 5 min.

2 in 1 anti-pollution effect

Forearms were treated with 3% Silk-iCare™ in water, and then saturated with carbon particles (Ød50 < 2.5 µm) to mimic urban pollution. Elimination of those particles was done at several strength: under water, rubbing with fingers, rubbing with cotton pad.





Results: Silk-iCare™ showed a immediate recovery from pollution only with water wash (+50% vs placebo). Additional rubbing increases the removal of pollution to over +90% vs placebo.
Silk-iCare™ makes a film able to remove almost all the pollution particles (96%).

Under microscopic observation (x100), the skin protected by Silk-iCare™ showed more clean fine lines without pollution than placebo. **Silk-iCare™ creates a film that protects the skin from pollution and helps to remove carbon particles for a cleaner skin.**

Biological mode of action

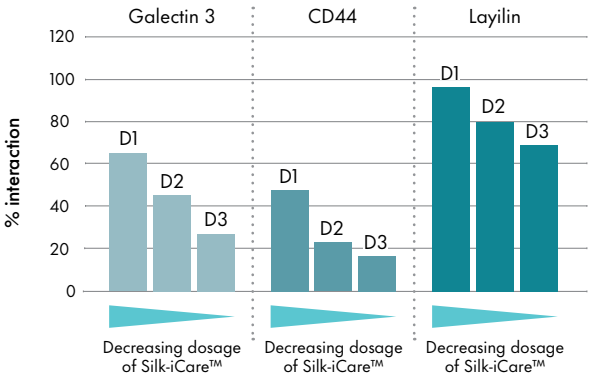
Silk-iCare™ can interact with skin lectins

The biological interactions between Silk-iCare™ and some recombinant human lectins has been evaluated, through a dose response effect measurement.

Galectin 3: strongly expressed in keratinocytes, essential role in inflammatory responses, cell differentiation and maturation.
CD44 & Layilin: involved in cell homeostasis (growth, apoptosis, migration, cells barrier protection...)

Results: Silk-iCare™ interacts with proteins Galectin 3, CD44 and Layilin that seem to promote skin wound healing and protect skin against irritation.

Biological interactions between Silk-iCare™ and recombinant human lectins



Improvement of skin repair in 5 days (*ex vivo*)

Skin explants from a 50 y/o woman were maintained in survival, and injured by a circular wound (biopsy punch). Every day, silk-iCare™ 2% is applied, during 5 days, and then several observations were done:

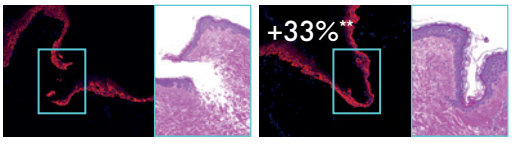
- Hematoxylin-Eosin staining to see the epithelialisation.
- Cytokeratin 16 immunostaining to see the activation of epidermis repair process.
- Cut scoring done by an expert

Results: Microscopic observation of stained skin explants after application of Silk-iCare™ showed an **improvement of the general morphology of the epidermis**, and the **recovery of the epidermis**, vs untreated condition.

With the application of Silk-iCare™ on injured skin, an increase of **CK16 expression +33%**** is observed in the wound area, implying an improvement of wound healing.

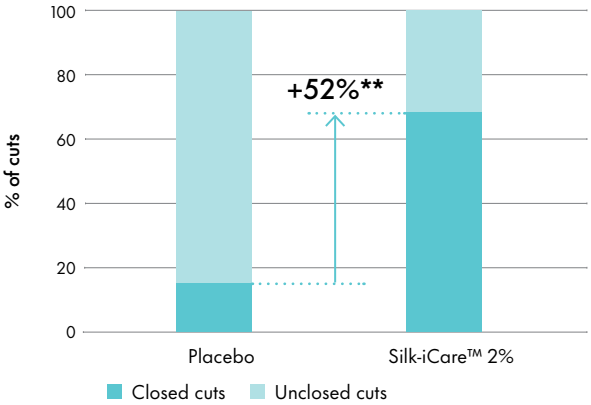
Silk-iCare™ triggered the **close of cuts +52%**** on injured skin, and is able to **promote rehabilitation of epidermis** through its film-forming property.

CK16 expression in wound healing



Unpaired t-test with **p<0.01

Promotion of skin wound healing



Fisher's exact contingency test: ** p<0.01

Skin repair under exposome context (*ex vivo*)

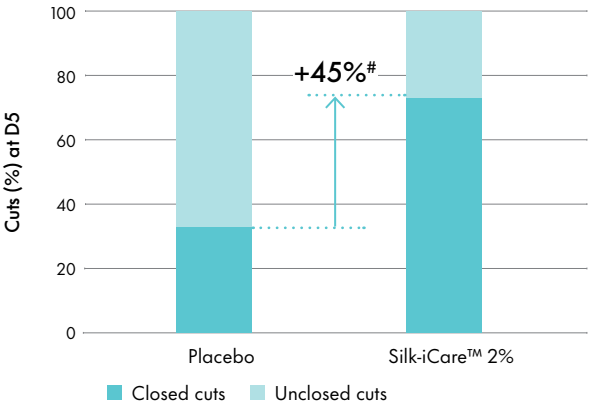
Skin explants from a 32 y/o woman were maintained in survival, then a wound was created, and Silk-iCare™ is applied to protect and trigger recovery of the skin. Then, every day, during 3 days, Silk-iCare™ 2% is applied (○), and skin explants were exposed to UV + urban dust (ϟ), i.e; 3 times in total.

Then several observations were done:

- Cytokeratin 16 immunostaining to see the activation of epidermis repair process
- Cut scoring done by an expert.

Results: With the application of Silk-iCare™ on injured skin, under exposome context (UV + pollution), an increase of **CK16 expression +23%*** is observed in the wound area, meaning a **recovery of epidermis (+45%#)**.

Promotion of skin wound healing under exposome context



Fisher's exact contingency test: # p<0.1

Clinical activity

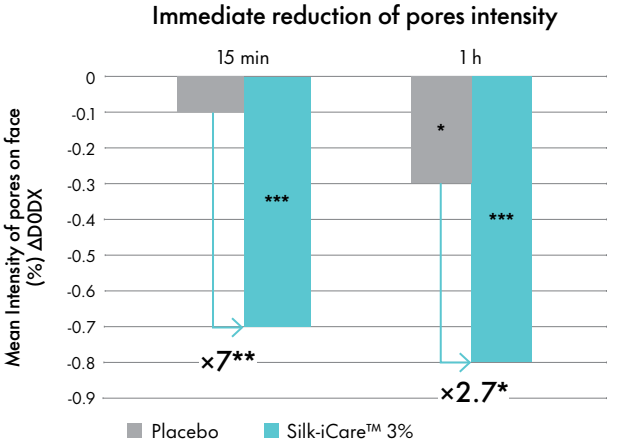
Less visible pores in one application: ×7 in 15 minutes (*in vivo*)

In a randomised and double blind study, 36 Caucasian women, i.e. 2 groups of 18 subjects (active vs placebo), aged between 41 and 69 years old, presenting a clear phototype and presenting skin with roughness, applied Silk-iCare™ 3% in a cream on the face.

Observation of the quality of the skin is made with Visia CR 2.3® analysis + illustrative photos (not shown)

As an immediate effect is expected, measures were made at T0, T15min, T1h.

Results: Silk-iCare™ showed in clinical study an immediate effect. A **significant decrease in pores size was observed, and quantified at ×7 less compared to placebo after 15 minutes**.
The effect continued to increase after 1h.



Paired t-test vs D0, unpaired t-test vs placebo: *p<0.05, **p<0.01, ***p<0.001

Additional data showed a significant decrease also in the total area of pores.

Silk-iCare™ acts by a physical mode of action: the film formation is responsible for the speed of action. The thin and supple film modified the visibility of pores of the surface of the skin.

Results not significant versus placebo

Immediate and perceivable benefits:
Comfort and softness (self-assessment at 15 min).

Improvement of skin perfection (*in vivo*)

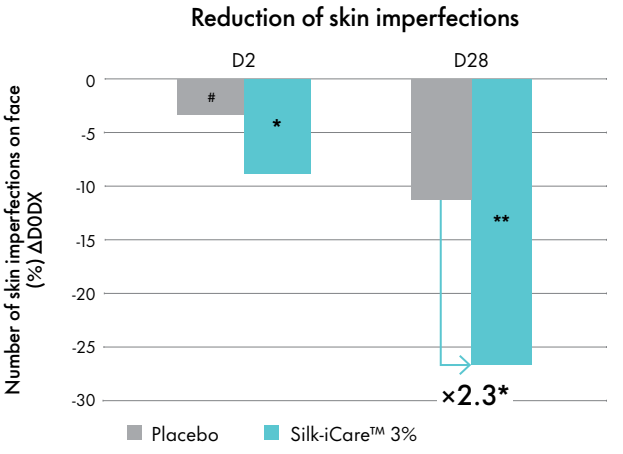
In a randomised and double blind study, made in Guangzhou (China), 46 Asian women, i.e. 2 groups of 23 subjects (active vs placebo), aged between 18 and 40 years old, presenting an oily skin on the face with a cutaneous sebum rate≥140µg/cm² and with large pores and at least 4/5 breakouts on the face, have been selected.

They applied Silk-iCare™ 3% in a cream twice daily morning and evening on face.

At D0, D2, and D28, observations were done with Visia CR 2.3® and illustrative photos (not shown), and a clinical grading of the counting of the breakouts by a dermatologist.

Results: Silk-iCare™ showed strong improvement **as soon as 2 days** of application, and finally a significant **decrease of 2.3 fold on the number of skin imperfections (inflammatory elements)** in comparison to placebo after 28 days.

The film-former property of Silk-iCare™, and the activation of some specific lectines, allow to hypothesise a protective effect on the appearance of new breakouts and a repair effect on existing ones.



Wilcoxon test vs D0, Mann Whitney vs placebo: *p<0.05, **p<0.01, ***p<0.001

Efficacy anti-irritation

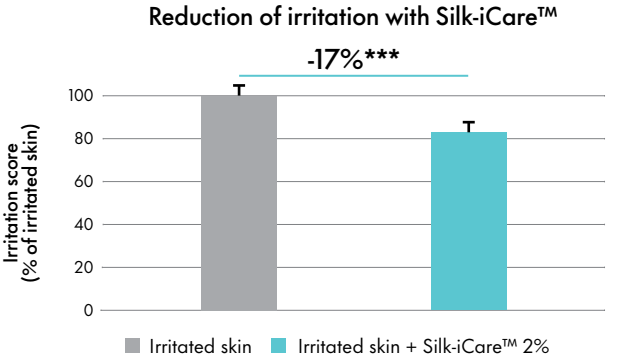
On human skin explants (women 56 y/o average), two times per day, a stress was created with 2% SLS for 40 min.

After each stress, skin explants were topically treated with 2% Silk-iCare™ versus untreated control.

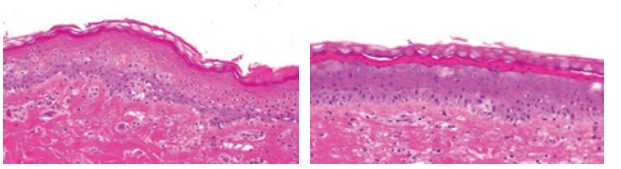
After 4 days of treatment, an Hematoxylin-Eosin staining was performed and skin irritation was scored by skin biology experts.

Results: Silk-iCare™ is able to **reduce skin irritation -17%*****
through its film-forming property.

Like an invisible bandage, Silk-iCare™ protects the skin against irritation and promotes epidermis recovery.



3 independent experiments, Mann Whitney test: * p<0.05, ** p<0.01, *** p<0.001



Placebo Silk-iCare™ 2%

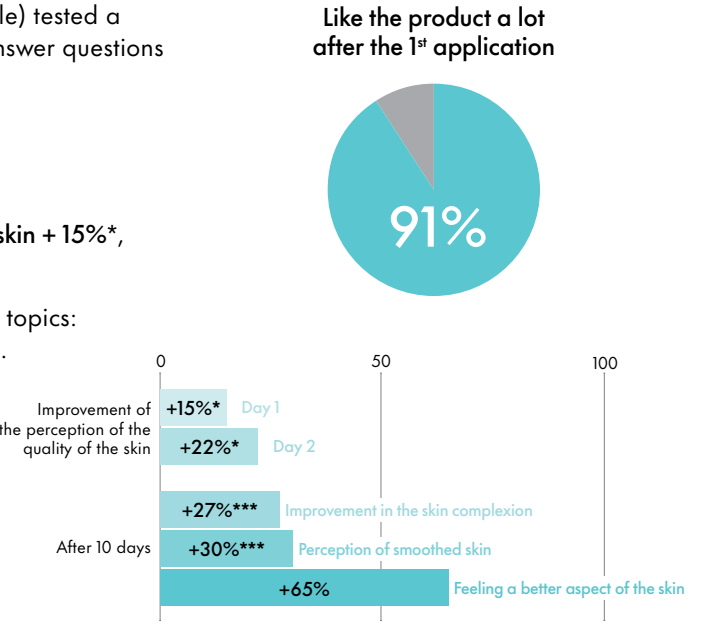
Silk-iCare™: validated by consumers (Home usage test)

On a Home usage test in France, 118 consumers (male & female) tested a primer with Silk-iCare™ for 10 days. Every day, they have to answer questions on a scale 1 (no) to 10 (yes).

The evolution of the scoring showed:

- Immediate effect (vs D0):
  Day 1: **after the 1st application, 91%** like the product a lot
  Day 2: Improvement of the perception of the **quality of their skin + 15%***, and at **day 3 +22%***.
- Each day is significantly better than the day before, on the topics: global satisfaction, smoothness, uniformity, starting from day 5.
- Continuous improvement after 10 days (vs D0):
  Improvement in the **skin complexion** +27%***
  Perception of **smoothed skin** +30%***
  Continuous increase during 10 days: **65% feel their skin looks better**.

Conclusion (from CRO): Silk-iCare™ is a great functional ingredient for primer care as it brings a lot of benefits on the skin with immediate gratification.

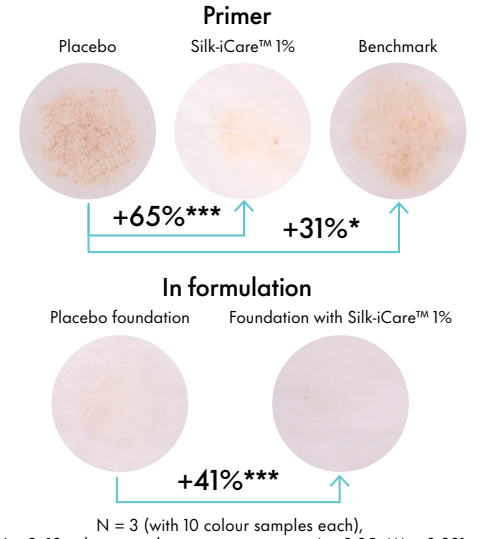


ANOVA test: *p<0.05, Chi2 test: ***p<0.001

Makeup fixation with Silk-iCare™

On a forearm, a primer was applied: 1% Silk-iCare™ in water (compared to a commercial benchmark) and subsequently a liquid foundation, or a in-house foundation containing 2% of Silk-iCare™ in the formulation. After application and drying, the forearm was pressed with a paper tissue. Evaluation of makeup transfer using greyscale colour analysis.

Results: **As a primer**, 1% Silk-iCare™ **increases the fixation effect by 65%*****
compared to placebo, more efficient than a commercial cosmetic product.
When 2% Silk-iCare™ is **added into a liquid foundation** formulation, **makeup fixation is increased by 41%*****.



N = 3 (with 10 colour samples each),
N = 3, 10 colour samples per measurement, *p<0.05, ***p<0.001

Summary

Technical information

INCI: Water (and) Silk (and) 1,2-Hexanediol (and) Caprylyl Glycol

Origin: White biotechnology (fermentation)

Preservation: None

Appearance: Transparent to light beige

Solubility: Dispersible in water

Dosage: 1-3%, up to 10%

Processing: Under ambient and warm (up to 85°C) process conditions.
- **Emulsion:** water phase or after the emulsification process
- **Gel:** water phase before or after the addition of the gelling agents (depending on the gelling agent system).

After the addition of Silk-iCare™, the formulation should be homogenised for 2-3minutes using an Ultra-Turax (approx. 12000-15000 rpm) to avoid gel lumps

Claims

Claims: Anti-pollution effect, Improvement of skin surface, Skin blemish correction, Skin perfection, Skin protection, Make-up fixative properties.

Applications:
- **Skin care:** Skin Perfector, Anti-imperfection solutions, Anti-pollution serum, Skin regeneration cream, Repairing soothing balm, Weakened skin patch.
- **Make-up:** Make-up primer, Foundation.

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