Technical Information

Phytosphingosine SLC

Reducing the appearance of photo-damaged skin

Intended use

Skin care

Benefits at a glance

- Helps to reduce the appearance of photodamaged skin
- Stregthens the dermal-epidermal junction of the skin
- Smoothes the skin‘s appearance by reducing the appearance of wrinkles
- Reduces the appearance of pore size
- Reduces the appearance of inflamed skin
- Promotes youthful looking skin
- Usage concentration: 0.05 – 0.2%

INCI (PCPC name)

Salicyloyl Phytosphingosine

Chemical and physical properties (not part of specifications)

Form	off-white powder
Melting point [°C]	approx. 105

Introduction

Over time, the skin underlies two major causes of aging: intrinsic or chronological aging, and extrinsic aging by environmental influences, e.g. UV radiation, pollution, stress.

Chronological aging occurs naturally as the body grows older and the biological processes in the skin slow down. The changes are taking place at different levels of the skin. For example, in the epidermis the reduced levels of stratum corneum lipids leads to a disrupted skin barrier functionality which can be observed in challenge testing. The epidermis of aged skin becomes thinner and can also possess reduced skin natural moisturizing factors, which consequently leads to a dry and fragile skin appearance.

The so-called dermal-epidermal junction (DEJ) is a basement membrane marking the interface between epidermis and dermis. It is responsible for the supply of nutrients from the vascular dermis to the avascular epidermis. During chronological aging the DEJ is altered structurally. In young human beings the DEJ is characterized by finger-like projections into the dermis. These so-called rete ridges are required to stabilize the connection between epidermis and dermis. The age induced changes at the DEJ are leading to a reduced resistance of the tissue, to a reduction in skin firmness and to an increase in the formation of wrinkles.

The dermis contains collagen, elastin, and other fibers which make up a large part of the extracellular matrix (ECM) to support the skin’s structure. These elements give skin its resiliency and youthful appearance. Therefore, the reduced supply of the components of the ECM will lead to loss of elasticity, wrinkle formation, and eventually sagging skin.

These changes in skin appearance, however, are accelerated and intensified by the influence of prolonged exposure to UV radiation (UVR), which is termed photoaging. Two types of UV rays are responsible for the deleterious effects of the sun: (1) UVA with a wavelength of 400–315 nm, and (2) UVB with a wavelength of 315–280 nm. Following UV exposure, a chain reaction of biochemical events is triggered that overrides the normal function of skin cells. A state of inflammation is established and immune cells are activated. These processes lead to sensitive skin, and induce skin (hyper-) pigmentation to shield the skin against future UV insults. Although UVB radiation penetrates only into the epidermis, it is a primary mutagen. Here, evolution has led to the formation of the skin pigment melanin in the epidermis to act as a DNA protectant against UV radiation. However, extended exposure to UVB radiation will not only induce a – sometimes desired – protective skin tan, but also hyperpigmentation, like freckles and age spots. Even worse, UVA radiation hits both the epidermis and the dermis, and is able to harm cells in the deeper skin layer. In this case, the extracellular matrix (ECM) of the dermis consisting of collagen and elastin for example, can be damaged directly. Mature photoaged skin leads to a DEJ dysfunction resulting in a flattened epidermis Consequently, the skin becomes fragile and due to a reduced surface area the supply of nutrients from the dermis to the epidermis is impaired. As mentioned above UVA radiation is able to penetrate into the dermis, and the strongest effect of prolonged UV exposure is exhibited by the dermal fiber network. Already minimally photoaged skin presents a loss of fibrillinrich microfibrils at the DEJ. This leads to a weakening of the skin structure which manifests itself in reduced skin elasticity and wrinkles. This multitude of destructive effects will eventually lead to the typical signs of photoaging: dryness, redness, coarse wrinkles, rough skin texture, loss of elasticity, and hyperpigmentation.

Phytosphingosine SLC consists of the naturally occurring skin-identical molecule phyto-sphingosine (PS) with an attached salicylic acid moiety. It presents many features that combat the signs of aging on different levels of the skin (Figure 1).

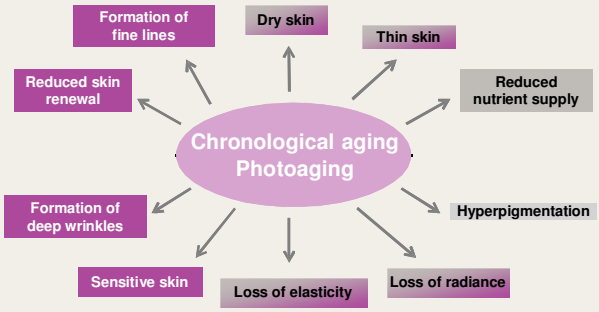

Figure 1: The consequences of skin aging. Phytosphingosine SLC addresses the appearance of the effects in purple.

Due to its ceramide character it acts on the stratum corneum by inducing both lipid synthesis and differentiation of keratinocytes to result in the strengthening of the skin barrier. Further, Phytosphingosine SLC possesses an anti-inflammatory potential. Especially on photoaged skin, reduces the appearance of pore size and visibly smoothes wrinkles.

To summarize, Phytosphingosine SLC could provide answers to improve the appearance of photo-aged skin.

Improved appearance of photaged skin

In vivo biopsy study on photoaged skin

The aim of this study was to evaluate the efficacy of Phytosphingosine SLC in improving the symptoms of photoaged skin, like a compromised dermalepidermal junction (DEJ) due to a decreased fibrillin level, reduced content of collagen, and an increased amount of matrix metalloproteinase 1. The evaluation was done by immunostaining (fibrillin-1, procollagen-1) and determining the amount of MMP-1 positive keratinocytes in punch biopsies after eight days of application. The respective levels of fibrillin-1, procollagen-1, and MMP-1 have been determined. The results for the different photoaging markers are shown in table 2.

	Fibrillin-1 [Mean value]	Procollagen-1 [Mean value]	MMP-1 [Mean value]
Vehicle	1.28 ± 0.75	2.14 ± 0.83	33.95 ± 13.01
0.025% RA	2.86* ± 2.86	2.27 ± 0.60	36.82* ± 16.01
0.05% PS SLC	1.78 ± 0.24	2.25 ± 0.34	18.40 ± 12.6
0.2% PS SLC	2.33* ± 0.83	2.78 ± 0.52*	22.72* ± 10.47

Table 2: Summary of the mean values of the investigated photoaging markers in punch biopsies (Statistics: ANOVA vs start: * $p<0.05$)

Phytosphingosine SLC deposits a remarkable amount of the fibrillin-rich microfibrillar network proximal to the dermal-epidermal junction (DEJ) of photoaged skin. This leads to a reinforcement of the DEJ and was also observed with the positive standard all-trans retinoic acid (RA).

In addition, Phytosphingosine SLC showed beneficial effects on procollagen-1 in the papillary dermis and the reduction of matrix metalloproteinase 1 which is responsible for the degradation of collagen in the dermis. This increases the amount of dermal collagen and protects against degradation of extracellular matrix components to eventually strengthen the underlying skin tissue. These markers were not improved by treatment with all-trans retinoic acid.

Thus, the data obtained prove that Phytosphingosine SLC effectively improves the appearance of photodamaged skin.

Reduction of appearance of wrinkles and smoothing the skin

In vivo wrinkle appearance study

The obtained in vivo data indicate that Phytosphingosine SLC has a remarkable effect on skin biology. The present study was conducted in order to investigate the effect of Phytosphingosine SLC on the skin surface, i.e. on fine lines and wrinkles in proximity to the eye by using a contactless method referred to as “fast optical in vivo topometry of human skin” (FOITS).

Volunteers applied an O/W cream containing 0.2% Phytosphingosine SLC and the vehicle in the periorbital region of their face for only four weeks. Figure 3 is a digitalized picture of in vivo photographs, and demonstrates the reduction of wrinkles around the eye before (grey) and after (purple) four weeks of treatment. The peaks and valleys of the skin surface are more balanced around the zero baseline in the presence of Phytosphingosine SLC which leads to a smoothing effect of the skin surface.

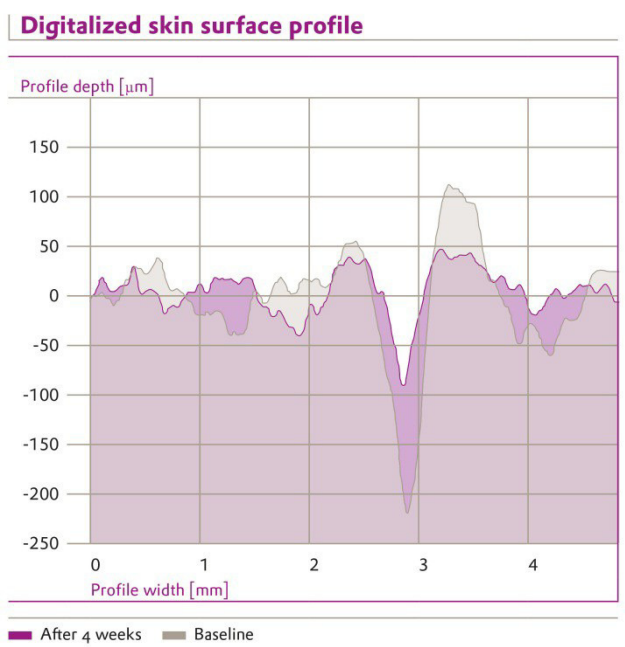

Figure 3: Digitalized skin surface profile before (grey) and after (purple) four weeks of application of 0.2% Phytosphingosine SLC.

The detailed evaluation of skin surface structure by frequency distribution of depth (FDD) demonstrates the smoothening of the skin surface. Wrinkle depths are divided into three depth groups: (1) micro structure,

<50 .m, (2) fine structure, 50-170 .m, and (3) macro structure, >170 .m. While the micro structure is rather negligible, especially macro structures are responsible for an aged, and wrinkled appearance. They display the visible appearance of deeper wrinkles. Figure 4 shows that the macro structure has been reduced after 4 weeks of treatment with 0.2% Phytosphingosine SLC, partially by shifting macro structure to fine structure. This smoothening is expected when the treatment has a positive effect on wrinkle appearance.

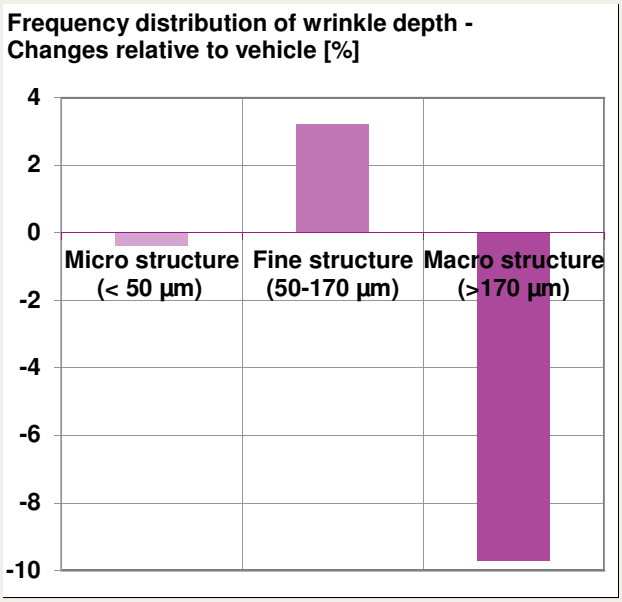

Figure 4: Evaluation of skin surface structure by frequency distribution of depth after four weeks of application of 0.2% Phytosphingosine SLC. Three depth groups are defined to evaluate fine lines and deep wrinkles.

The results show that Phytosphingosine SLC effectively smoothes the skin by improving the appearance of the skin surface. This can be particularly visualized close to the eye where deep wrinkles are transformed into fine lines.

Improvement of skin surface profile

In vivo pore size reduction study

Enlarged pores are also a sign of aging skin. To a large degree, pore size is determined by genetics; however, as we age, our pores tend to appear larger. The pore's enlarged appearance is due to a buildup of dead cells around the pore. As more collagen breaks down and production slows, the supportive structures surrounding cells decrease and cells can appear stretched. Keeping the skin exfoliated and the pores clear will help reduce the appearance of pore size. Also, consistently using a sunscreen to protect collagen helps maintain pore size.

The next study was thus conducted in order to investigate the effect of Phytosphingosine SLC on the skin surface profile, i.e. pore size.

In the cosmetic consumer study volunteers treated their face on either half side with a formulation containing 0.1% Phytosphingosine SLC and vehicle formulation, respectively. The images in figure 5 exemplify the change of skin surface structure before (A) and after eight weeks (B) of treatment with the active ingredient. The size and thus the perception of pores on the cheek was visibly reduced.

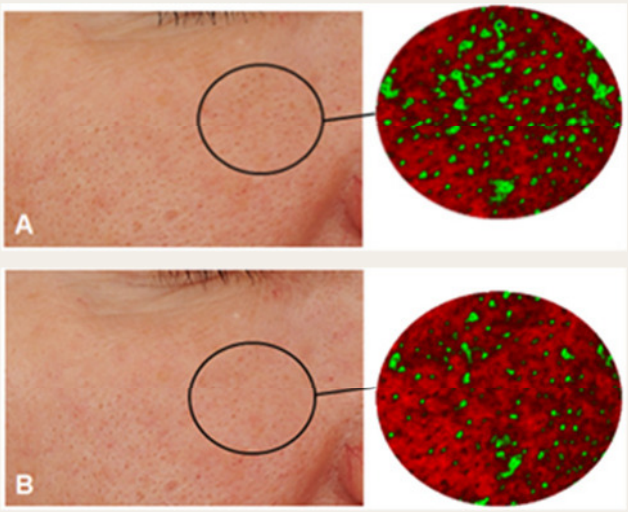

Figure 5: VISIA-CR images before (A) and after (B) eight weeks of treatment with 0.1% Phytosphingosine SLC.

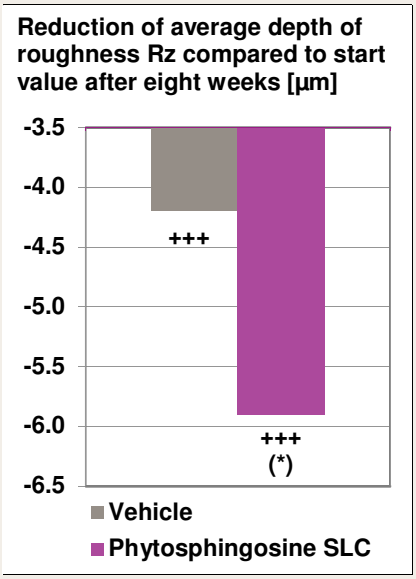

Figure 6: Skin roughness parameter Rz (relative to vehicle and start) eight weeks after application of 0.1% Phytosphingosine SLC (Statistics: ANOVA vs. start: +++ $p<0.001$; vs. vehicle: (*) $p<0.10$).

Figure 6 illustrates the reduction of the average depth of roughness Rz along the skin surface profile

lines in the face and thus the reduction of pore depth and perceivable pore size after eight weeks of treatment with either vehicle or 0.1% Phytosphingosine SLC. Although both treatments showed a certain effect, there is a statistically significant improvement of treatment with Phytosphingosine SLC compared to vehicle treatment. Photographic documentation not only supported the visualization of the effect of Phytosphingosine SLC treatment on porse size, but additionally also revealed the effect of the treatment on fine lines and wrinkles. Thus, the results of the cosmetic consumer wrinkle study were independently confirmed. Figure 7 shows the visible reduction of fine lines and wrinkles after 8 weeks application of 0.1% Phytosphingosine SLC on two panelists.

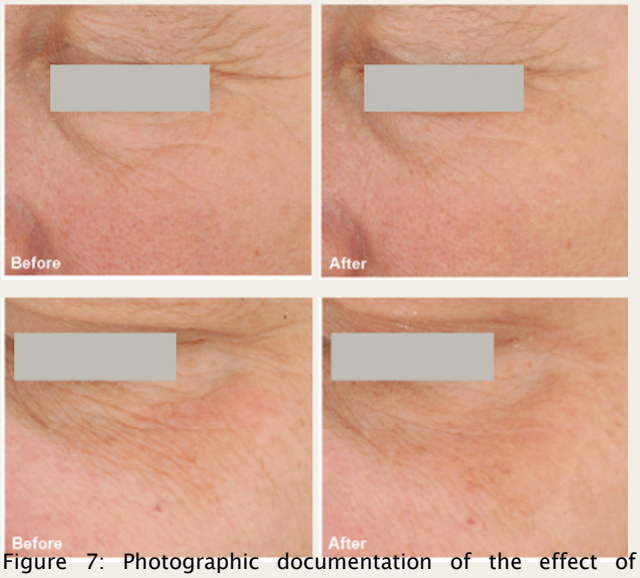

Figure 7: Photographic documentation of the effect of treatment with 0.1% Phytosphingosine SLC for 8 weeks in the face of two individual panelists

In the present in vivo study the smoothing of the skin surface profile, and in particular the reduction of the Rz parameter representing a reduction of facial pore size, has been investigated using the FOITS (Fast Optical In vivo Topometry of Human Skin) method. The results show that within eight weeks tretament with 0.1% Phytosphingosine SLC pore size is visibly reduced. In addition, a reduction in the appearance of facial wrinkles was confirmed by photographic documentation.

To summarize, Phytosphingosine SLC delivers a complete response within the different skin layers, especially in photoaged skin. Eventually, this results in reduced visible wrinkle depth and a smoother and younger overall skin appearance which may find its application in daylight defense care.

A detailed test summary report (technical dossier) is available on request.

Claim summary

- Helps to reduce the appearance of photodamaged skin
- Stregthens the dermal-epidermal junction of the skin
- Smoothes the skin‘s appearance by reducing the appearance of wrinkles
- Reduces the appearance of pore size
- Reduces symptoms of inflamed skin
- Promotes youthful looking skin

Formulation hints

Phytosphingosine SLC is an amphiphilic molecule and can be readily incorporated into the lamellar liquid crystalline phases of cosmetic O/W emulsions. An outstanding solubility in low molecular weight alcohols broadens the formulation utility.

Preparation of O/W and W/O Emulsions (creams or lotions):

Phytosphingosine SLC must be clearly solubilized in the hot oil phase. The temperature of oil and water phase should be high enough to ensure that Phytosphingosine SLC does not recrystallize during the homogenization step. Depending on the composition of the oil phase, the temperature should be around 70-90 °C.

Choosing emollients with a good solvency for Phytosphingosine SLC, e. g. TEGOSOFT® APM (PPG-3 Myristyl Ether), TEGOSOFT® TN (C12-15 Alkyl Benzoate) and TEGOSOFT® CT (Caprylic/ Capric Triglyceride), and prolonging the heating time facilitates the formation of clear Phytosphingosine SLC solutions.

Recommended usage concentration

0.05 – 0.2%, clinically tested at different concentrations.

Possible Applications

- Protection cream for photo-aged skin
- Skin smoothening formulations
- After sun products
- BB creams

Packaging

0.10 kg

1.25 kg

Hazardous goods classification

Information concerning

- classification and labelling according to regulations for transport and for dangerous substances
- protective measures for storage and handling
- measures in accidents and fires
- toxicity and ecological effects

is given in our material safety data sheet.

Guideline formulations

Soothing day cream for mature skin (WR 3/04-2c)	
Phase A	
TEGO® Care 450 (Polyglyceryl-3 MehylglucoseDistearate)	3.0%
TEGIN® M Pellets (Glyceryl Stearate)	2.5%
TEGO® Alkanol 18 (Stearyl Alcohol)	1.5%
TEGOSOFT® CT (Caprylic/Capric Triglyceride)	3.3%
TEGOSOFT® TN (C12-15 Alkyl Benzoate)	4.0%
TEGOSOFT® APM (PPG-3 Myristyl Ether)	4.0%
TEGOSOFT® DEC (Diethylhexyl Carbonate)	1.0%
Tocopheryl Acetate 0.5%	0.5%
Phytosphingosine SLC (SalicyloylPhytosphingosine)	0.2%
Phase B	
Glycerin	3.0%
Allantoin	0.1%
Panthenol 0.5%	0.5%
Water	74.4%
Phase C	
TEGO® Carbomer 134 (Carbomer)	0.2%
TEGOSOFT® TN (C12-15 Alkyl Benzoate)	0.8%
Phase D	
Sodium Hydroxide (10% in water)	q.s.
Phase E	
LACTIL® (Sodium Lactate; Sodium PCA; Glycine; Fructose; Urea; Niacinamide; Inositol; Sodium Benzoate; Lactic Acid)	1.0%
Phase Z	
Preservative, Perfume	q.s.

Preparation:

1. Heat phase A and B separately to 70 – 75 °C.
2. Add phase A to phase B with stirring[1)].
3. Homogenise.
4. Cool with gentle stirring.
5. Add phase C at 40 °C.
6. Homogenize for a short time.
7. Add phase D.

[1)] Important: If phase A has to be charged into the vessel first, phase B has to be added without stirring.

Rejuvenating facial serum (CD 963)	
Phase A	
TEGO® Care PSC 3 (Polyglyceryl-3 Dicitrate/Stearate)	3.00%
TEGOSOFT® CT (Caprylic/Capric Triglyceride)	2.00%
TEGOSOFT® OER (Oleyl Erucate)	2.00%
Avocado (Persea Gratissima) Oil	1.00%
Phytosphingosine SLC (Salicyloyl Phytosphingosine)	0.05%
Phase B	
Glycerin	5.00%
SKINMIMICS® (Ceteareth-25; Glycerin; Cetyl Alcohol; Behenic Acid; Cholesterol; Ceramide NP; Ceramide NS; Ceramide EOS ; Ceramide EOP; Ceramide AP; Caprooyl Phytosphingosine; Caprooyl Sphingosine)	1.00%
Water	84.45%
Phase C	
Xanthan Gum (Keltrol CG-SFT, Kelco)	0.50%
Phase D	
TEGO® Arjuna S (Terminalia Arjuna Bark Extract; Pentylene Glycol)	1.00%
Phase Z	
Preservative, Perfume	q.s.

Preparation:

1. Heat phase A and B separately to 70-75 °C.
2. Add phase A to phase B with stirring.[1)]
3. Homogenize.
4. Cool with gentle stirring.
5. Add phase C at 40 °C.
6. Homogenize for a short time.
7. Add phase D.

[1)] Important: If phase A has to be charged into the vessel first, phase B has to be added without stirring.

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