

Vitamins Portfolio Overview

March 2025

Agenda

- 01 The Vitamins Journey
- 02 Vitamin C – Antioxidant Superhero
- 03 Vitamin B3 – Multi Benefits Wonder
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- 06 Vitamin A – The Golden Age Defyer
- 07 Vitamin E – The Defender
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The Vitamins Journey

From discovery to industrialization



1911
Kazimierz Funk called 'Vitamin' (Vital Amine) this nutritional factor (Thiamin), creating the revolutionary concept of nutritional factor essential for Life, and that Humans (and Animals) need to find in daily food.

1930
Vitamin A
The discovery of Retinol.

1936
Vitamin C.
It was at today's DSM's site in Grenzach, Germany, that vitamin C has been first industrially produced. The revolutionary process proposed by the biochemist Tadeusz Reichstein to Roche is the base of the production technique still in use today.

1938
Vitamin E is produced industrially.
Otto Isler, who joins Roche in 1936, succeeds in 1938, together with P. Karrer and A.R Todd in the industrial production of Vitamin E.

1944
Panthenol.
The Swiss scientist Dr. Gustav Erlemann discovers that panthenol works wonders on the hair – helping to repair damaged hair. Inspired by panthenol properties, Pantene® Hair tonic, created by Hoffman-LaRoche, makes its debut as a premium hair care line across Europe.

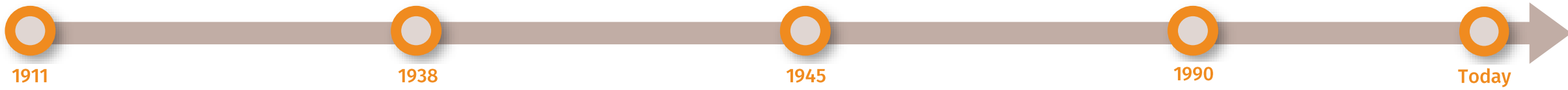
1945
Vitamin E
The first antioxidant theory of vitamin E activity is proposed by Danish biochemist Henrik Dam and his coworkers.

1947
DSM pioneered the large-scale industrial synthesis and production of vitamins.

1990s
Vitamin B12 is produced for pharmaceutical application.

1994
Panthenol and **Ascorbic acid** production started at today's DSM's site in Dalry, Scotland.

2022
DSM launches a naturally derived grade of vitamin B12 in PC portfolio (INCI: Cyanocobalamin) produced via non-GMO bacterial fermentation, with natural origin index of 68.7%, and both Halal-approved and vegan-compliant.



dsm-firmenich Pioneer & Leader

Leading the way in understanding the role of vitamins in cosmetics: First efficacy studies initiated on Panthenol, Vitamin A and Vitamin E have been highly recognized in the cosmetic industry

dsm-firmenich – A leader in the vitamin journey since 1936



The longest-standing producer of vitamins in the world



First to explore the beauty of potential of vitamins in beauty and personal care



The 1st to bring vitamins production on the industrial level

Today, dsm-firmenich remains fully committed to explore the beauty potential of our vitamins further.



Comprehensive portfolio: Full range of 13 vitamins, including the most demanded forms for cosmetics



Leading production capabilities: DSM high commitment to keep technology leadership at best value for money



Vitamin C industrial production, Grenzach, 1936

The importance of Vitamins-rich skincare routine

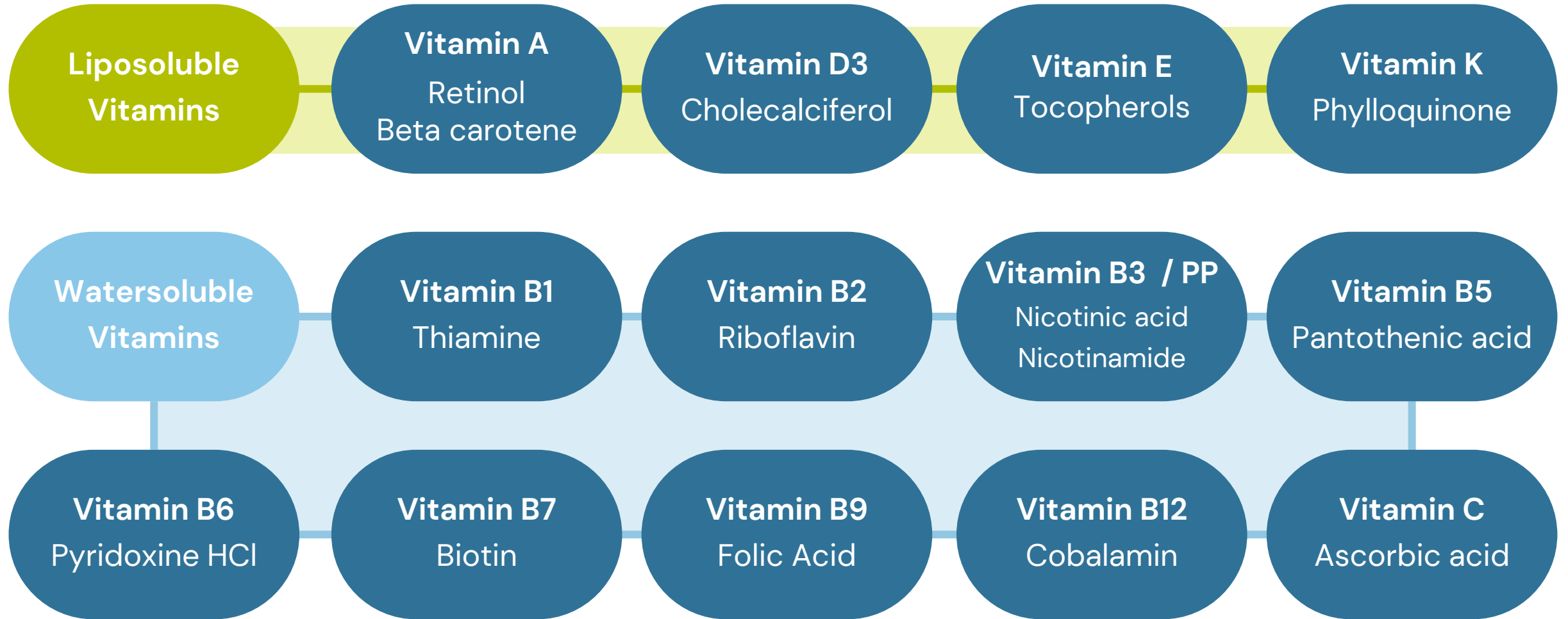
Humans are unable to synthesize Vitamin and therefore rely entirely on external supplementation such as topical application.

Epidermis doesn't contain blood vessels that supply the cells with nutrients, therefore **topical application of vitamins can effectively complement dietary consumption**, leading to a stronger and healthier protective barrier.

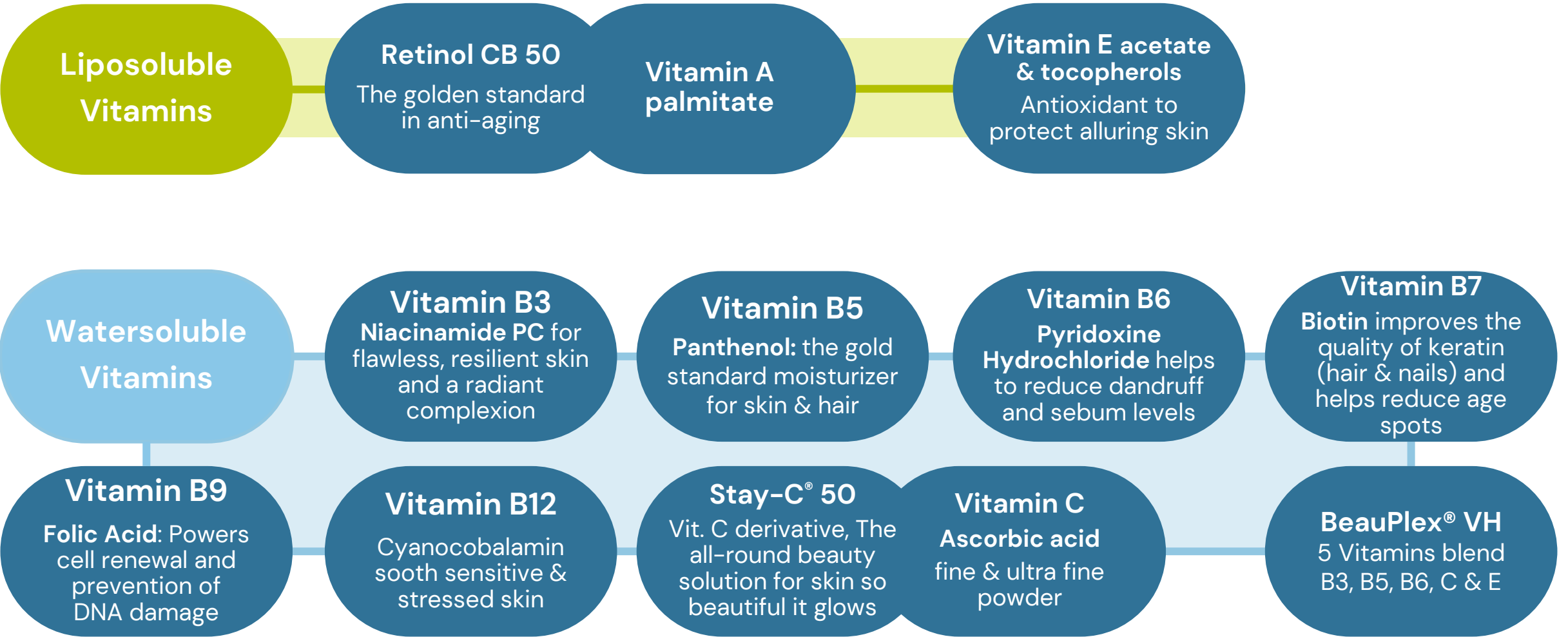
Skin is the primary defense organ, constantly exposed to external aggressors: **a solid, properly nourished skin immune system can help protect from invading pathogens, cause of dermatologic problems.**



The 13 vitamins essential to life



B&C Vitamins portfolio at dsm-firmenich



dsm-firmenich vitamins promise

Today we are adding value to our trusted heritage in Vitamins



Quali-E[®] Quali-C[®]
Quali-A[®] Quali-B[®]

Quality

Quality is the cornerstone of our delivering. You can trust DSM to bring you products that are consistent in quality and high in purity.

Reliability

Our vitamins are reliable, meaning they will consistently deliver on their intended use — whether it is your skin cream, the milk you pack in your child's lunch or the daily supplement you take to help ensure optimal nutrition.

Traceability

Our ability to track and verify the quality of our products throughout their life cycle is what makes traceability essential to answer the clean beauty.

Sustainability

Quality extends beyond products and services and includes our commitment to the environment, which we show by reducing the environmental impact of our activities while simultaneously optimizing land and resource use.

Our Vitamins that are not only of the highest quality, totally reliable and fully traceable, but have minimum impact on the planet

Made with care

Best in class for Vitamins

Based on life cycle analysis, our Quali® vitamins have the lowest carbon footprint across their respective industries.

Vitamins A & E

Lowest carbon and environmental footprints. Vitamin E: up to 89% less from raw materials vs. conventional building blocks and 74% less from energy generation compared to coal-based production.



Vitamin B3

Niacinamide PC is crafted with natural-origin ingredients and powered primarily by Renewable Energy (by 2025).

It is readily biodegradable, and it has only 7.4 kg CO₂ eq. / kg in carbon footprint.



Vitamin B6

Lowest Carbon Footprint by at least 10% compared to alternative production driven by the avoidance of coal-based steam, the use of renewable electricity and waste reduction.



Vitamin C

51% lower greenhouse gas emissions compared to average competitors. Production with 100% purchased renewable electricity (completing self-generated electricity and steam from burning natural gas).



Vitamin B5

Lowest Carbon and Environmental Footprint driven by the avoidance of coal-based steam. Repurpose of waste generated into fertilizer and for land restoration.



Reliable Supply Chain Worldwide

Made with care



Elevating sustainability at Dalry, Scotland, the United Kingdom

CO₂ emission reduction
of -22% since 2016
(while increasing
production volumes)

Most recent reductions
achieved with use of
high-tech digital solutions
(Digital Twins, Advanced
Analytics,
Online Monitoring)

Energy transition program
in planning stage to move
to wind-energy as per
2026
(and options for heat being
studied)

Diverse workforce across
all age – groups and well
recognized apprenticeship
program

>99% of process waste is
valorised in 2023
(as fertilizer / for land
restoration)

Dalry Site selected for the
first large scale production
plant for Bovaer®
(>30% methane-emission
reduction for cattle)

Key employer (direct and
indirect) in North Ayrshire,
on of the most deprived
area in Scotland

Launch of the
DSM Chemical Engineering
scholarship (4250£ and
mentoring) in 2021

Hero Vitamins to nourish skin beauty

and keep skin defenses robust!

Golden Anti-Aging

Vit.
A

- Reduces skin photo-damage and discoloration
- Improves the appearance of fine lines, wrinkles, firmness, and elasticity
- Enhances skin smoothness and decreases roughness
- Rebalances uneven skin tone and reduces mottled pigmentation

Moisture & Restore

Vit.
B5

- Strong skin moisturizer
- Soothes irritated skin
- Helps protect and regenerate compromised skin
- Rejuvenates the skin
- Tightens the skin barrier against external insults

Energize & Glow

Vit.
C

- Energizes tired skin, leaving it fresher and revived
- Protects against UV/ozone-induced oxidative damage
- Fights photoaging
- Collagen booster
- Ensures resilient immune function

Resilient & Radiant

Vit.
B3

- Protects from external stressors (UV, blue light & pollution)
- Rebalances even skin tone
- Moisturizes and improves skin elasticity
- Boosts skin immunity

Sensitive & Stress

Vit.
B12

- Relieves sensitive and stressed skin, enhancing vibrancy
- Speeds up cell recovery and regeneration, supporting the treatment of different skin conditions
- Prevents photo-damage and protects against inflammation
- Maintains healthy skin microbiome

Anti-oxidant & Protect

Vit.
E

- The preventer, protects the skin against oxidative stress, for comfortable, beautiful and healthy-looking skin
- Ideal partner for vitamin C



Vitamin C

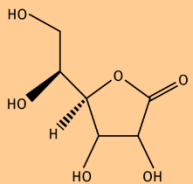
*The all-round beauty solution
for skin so beautiful it glows*



Vitamin C at a glance

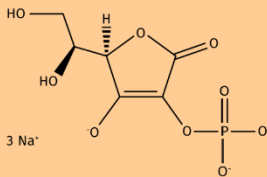
Essential for our body, from external sources to support health

- Vitamin C is Ascorbic Acid in different forms
 - **Vital functions** for life
 - Humans are **unable to synthesize** Vitamin C and therefore rely entirely on **external supplementation** such as topical application
 - Vitamin C is the **most abundant anti-oxidant in the skin**
 - Exposure to oxidative stress via pollutants or UV irradiation provokes Vitamin C depletion in the epidermis
 - **Even high dose oral supplementation does not provide the sufficient amount of Vitamin C into the skin**
- ➔ We need topical application with Vitamin C to afford skin benefits!



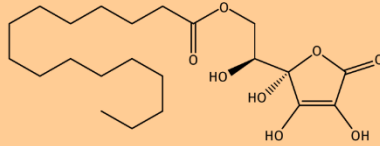
L-ASCORBIC ACID

Genuine Vitamin C



SODIUM ASCORBYL 2-
PHOSPHATE
STAY-C® 50

Stable cosmetic
Vitamin C specialty



ASCORBYL 6-PALMITATE

Widely used oily technical
ingredient in cosmetic



Vitamin C : benefits in Beauty & Care

SKIN CARE

- Stimulates collagen synthesis ^{1,2}
- Improves skin firmness¹
- Protects from environmental damage and premature aging ^{1,2}
- Decreases melanin synthesis reducing hyperpigmentation ^{1,2}
- Improve appearance of acne-prone skin ^{1,2}



HAIR CARE

- Support hair care and promotes hair growth³



BODY CARE

- Enhances skin elasticity²
- Shields against oxidative stress²
- Evens skin tone^{1,2}



SUN CARE

- Neutralizes the oxidative stress acting as radical scavenger¹
- Protects against UV- and ozone-induced oxidative damage^{1,2,3}
- Reduction of photodamage^{1,2}

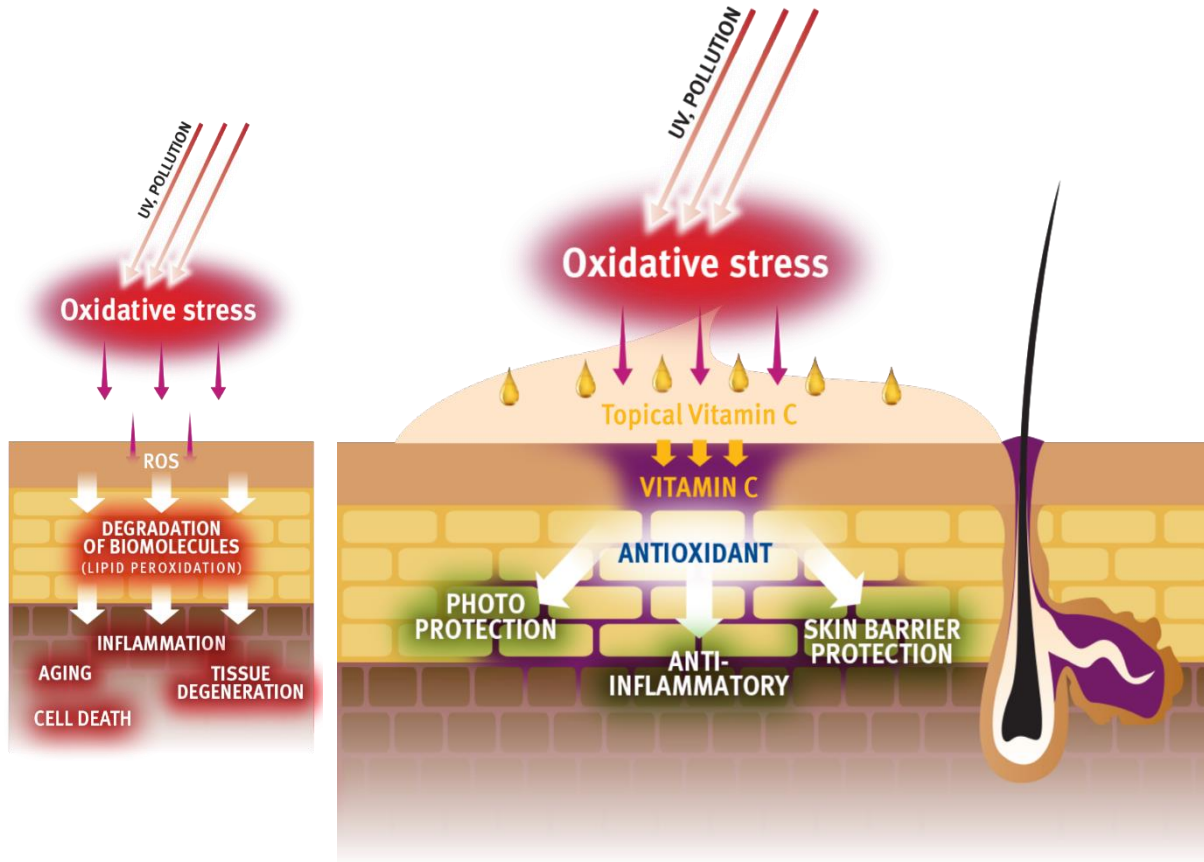


1. In vivo. 2. In vitro. 3. Ex vivo

Vitamin C – N. 1 benchmark anti-oxidant



Vitamin C protects the skin against oxidative damage by neutralizing reactive oxygen species (ROS)



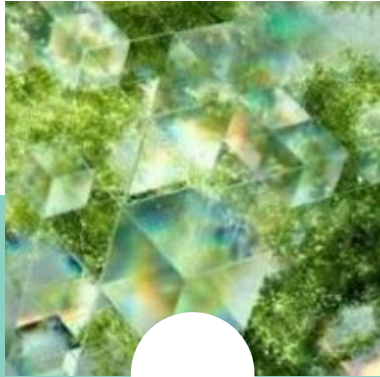
- UV radiation, pollution and smoking accelerate damage to the skin through the generation of the “oxidative stress”
- ROS are highly toxic, unstable molecules that cause damage to nucleic acids, proteins and lipids in cells
- **Vitamin C neutralizes the ROS generation** by a process of electron transfer and/or donation **and limits the propagation of the oxidative stress**

Vitamin C is still very trendy!



Different forms of Vitamin C

Advantages & Solutions

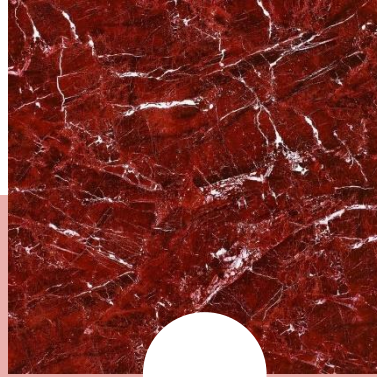


Pros

The only biological active form of Vitamin C is L-ascorbic acid!

Many other form of vitamin C must be converted into ascorbic acid in the skin

Water-soluble



Cons

Unstable at neutral and basic pH

Highly susceptible to oxidation (water, light, air, heat)

Penetration into the skin depends on formulation



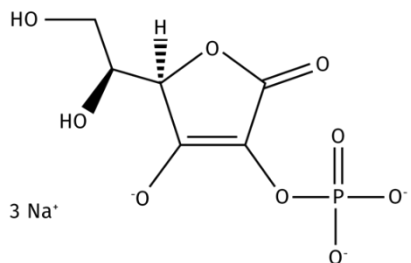
Solution

To ensure better stability and skin penetration of Vitamin C, different forms of L-ascorbic acid have been developed and launched on the market

STAY-C® 50 : improved stability of Vitamin C

Our stable cosmetic Vitamin C specialty

To ensure better stability of Vitamin C,
dsm-firmenich developed STAY-C® 50:
SODIUM ASCORBYL 2-PHOSPHATE



- **Stable, water soluble** cosmetic Vitamin C specialty

- **100% naturally derived** (based on renewable carbon)

- **Fully bio-converted** into ascorbic acid in the skin

- **Powerful antioxidant** and multi-talented active

Benefits vs other derivatives

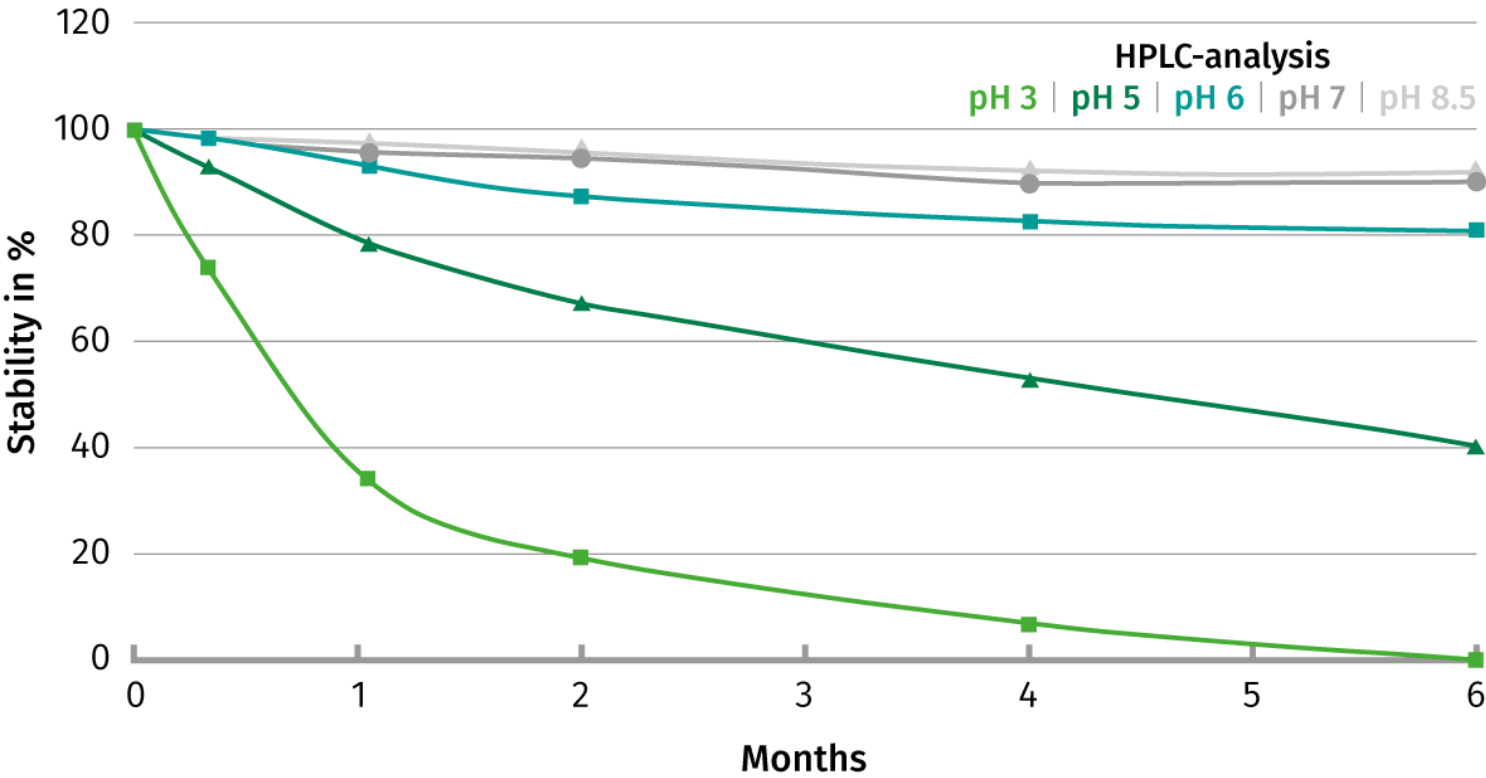
- Good **skin penetration**
- **Proven conversion** into the active form ascorbic acid
- **A multi-talent beauty** remedy addressing almost every skin concern from acne to UV damage...and **its activity is proven!**
- **Overperformance in melanin synthesis inhibition and antioxidant properties** vs other derivatives
- **Stable in aqueous** environment
- Easy to formulate
- Only derivative with use level **up to 15%**
- 19 • **Approved quasi-drug** active ingredient for whitening products in Japan



STAY-C® 50 – Stability in formulation

80 to 100% stable after 6 months in solution at pH ≥ 6

Stability of 3% STAY-C® 50 in water 43°C without light



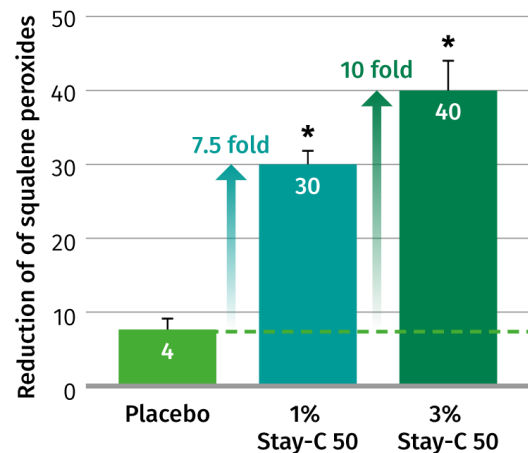
STAY-C® 50 is highly stable at a pH of 6 and higher

Even at 43°C 90% of the STAY-C® 50 initial concentration has been detected after 6 months

STAY-C® 50 – in photoprotection

STAY-C® 50
reduces the UV-induced lipid peroxides up to 40%

Reduction of lipid peroxides formation (%)



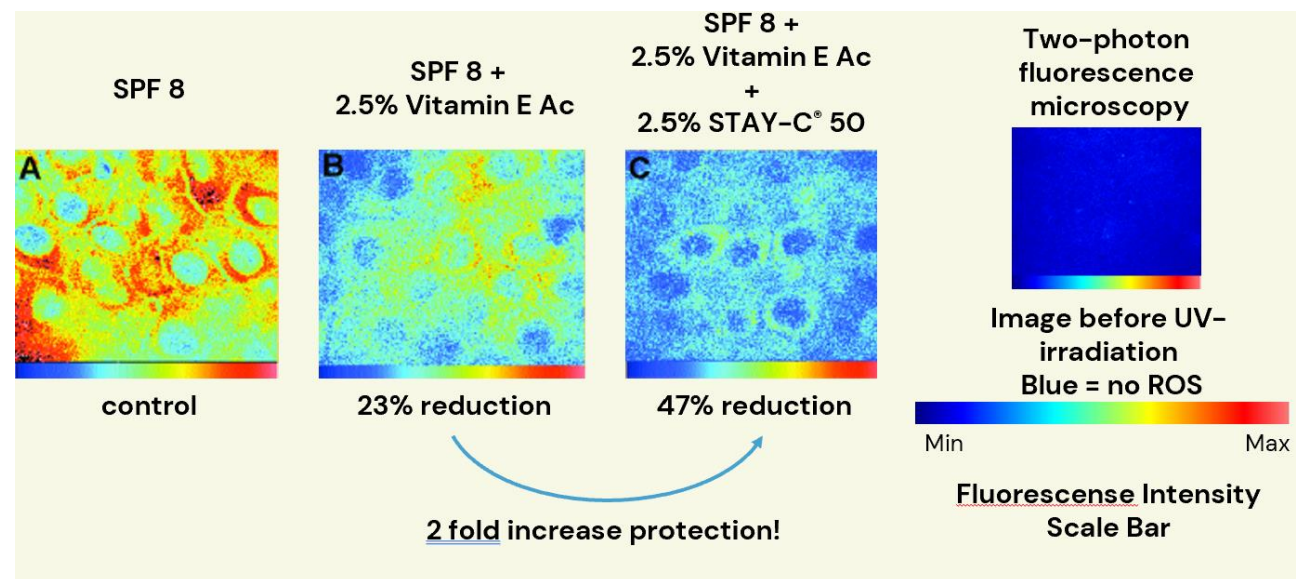
* $p < 0.05$ versus placebo

STAY-C® 50 significantly protects against the UV-induced formation of oxidized molecules in human skin in a dose-dependent way

- 20 volunteers
- 7 days prior UV-irradiation, twice daily
- 1% STAY-C® 50 or 3% STAY-C® 50 vs placebo

STAY-C® 50 doubles the UVA/UVB protection of sun filters and Vitamin E

Image of live human skin showing the effect of three products on reduction of ROS after UV irradiation (1600J/m²)



- Ex vivo human skin (breast and facial), 2 individuals
- Formulations applied for 3h

STAY-C® 50 – skin lightening activities

Visibly evens the skin tone and reduces the color intensity of age spots by 25% in 3 month

in vivo

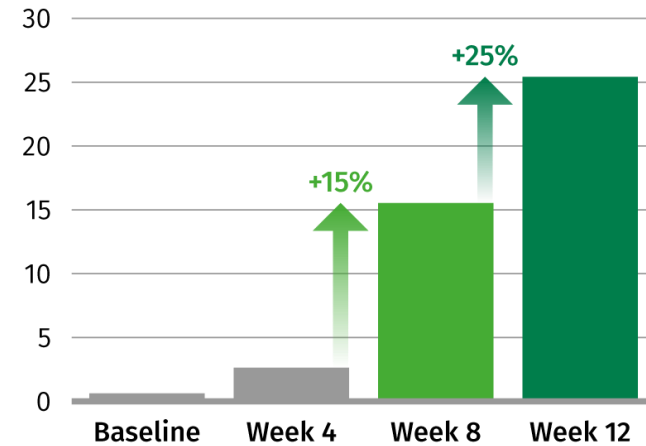
dsm-firmenich own study

Photographic evidence of spot reduction



J. Klock. SÖFW-Journal | 130 | 9-2004 (no data report available)

Quantification of improvement by visual assessment (dermatological evaluation)



- Double blind study with half face treatment
- 39 female volunteers
- Test cream with 3% STAY-C® 50 and 1% Vitamin E acetate
- 12 weeks, twice daily application

STAY-C® 50 – reduces the appearance of acne

Visibly improves skin condition of acne vulgaris by 77 % in 12 weeks

in vivo

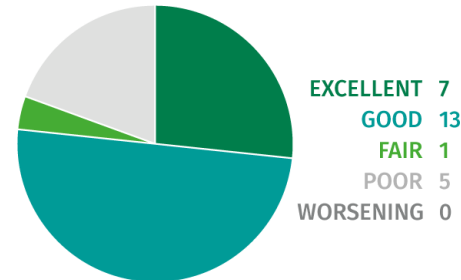
dsm-firmenich
own study



Klock J et al. Int J Cosmet Sci 2005;27:171-176
Benzoyl peroxide is a bactericidal powerful ingredient against acne

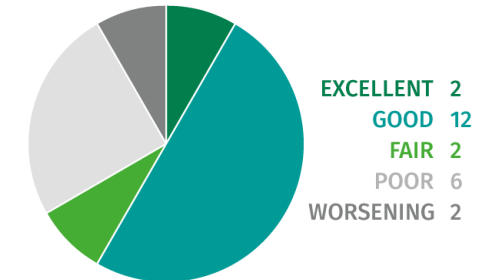
Improvement of skin conditions after treatment

5% STAY-C® 50



77% excellent/good

5% Benzoyl Peroxide



61% excellent/good

STAY-C® 50 visibly reduces the appearance of acne lesions in 12 weeks and outperforms Benzoyl Peroxide[#]

- 2x30 patients with acne vulgaris
- 5% STAY-C® 50 or 5% Benzoyl Peroxide
- 12-week treatment, twice daily application

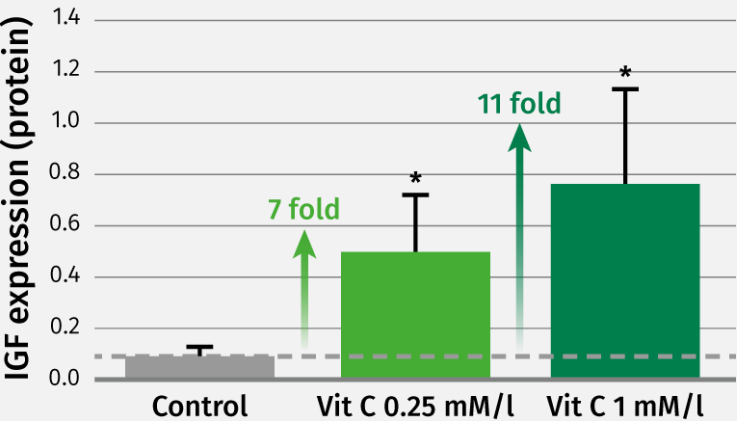
STAY-C® 50 – in hair care

Induces hair follicle growth up to 25%

ex vivo



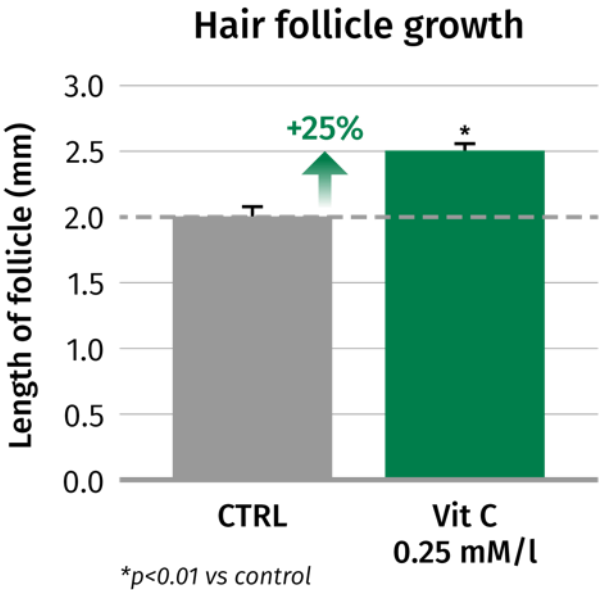
Insulin-like growth factor-1 (IGF1) expression in hair follicle



Kwack MH et al. Br J Dermatol. 2009 Jun;160(6):1157-62.
L-Ascorbic acid 2-phosphate

STAY-C® 50 stimulated the growth of cultured human hair follicle by upregulating IGF-1 up to 11-fold

- Human hair follicles obtained from scalp biopsies
- Vitamin C #,0.25 and 1 mM/l, 9 days



Formulating with STAY-C® 50

Stability

- $\text{pH} \geq 6$
- Add 0.05–0.1% Sodium Metabisulfite to improve color stability
- Add chelating agents (EDTA, phytic acid, etc..) to prevent degradation
- Check stability with acrylic acid thickeners and some ionic emulsifiers

Solubility

- Readily soluble in water
- Insoluble in lipophilic comp. or alcohols



Formulating with Ascorbic Acid

Stability

- Low pH (3–4)
- Low water content (adding alcohol, glycols, etc..) or anhydrous formulations oil-/silicone-based
- Antioxidants (Tocopherol,... etc..)
- Packing (airless)

Solubility

- Freely soluble in water
- Sparingly soluble in alcohol
- Soluble in glycols

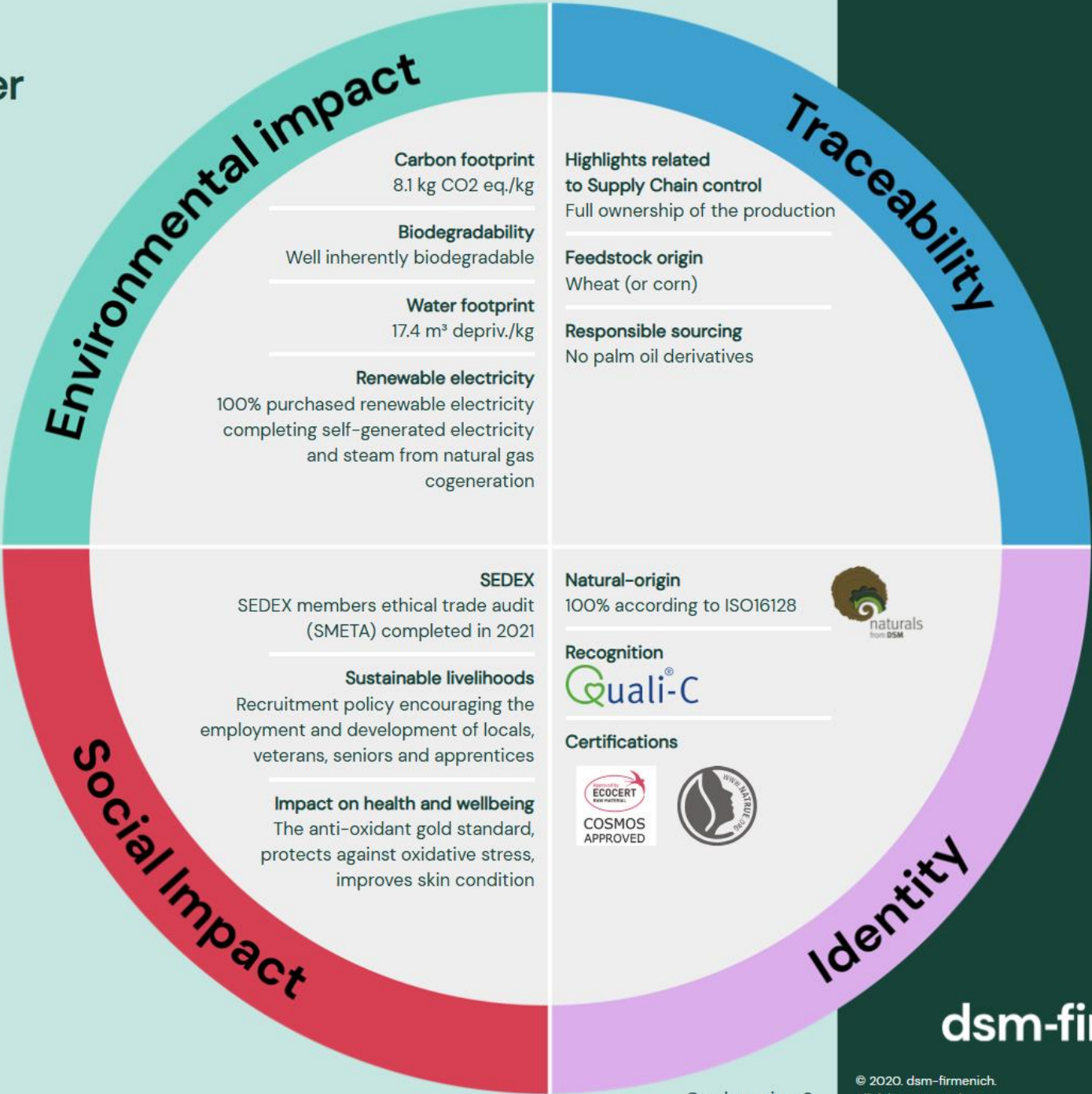


Ascorbic Acid Fine Powder

INCI name: Ascorbic Acid
Product codes: 0422460

Ascorbic Acid
The anti-oxidant gold standard
Vitamin of natural origin,
sustainably produced with a
low carbon footprint

The carbon and water footprint calculations are based on internally conducted LCA according to ISO 14040/44 guidelines, dsm-firmenich LCA policy and validated by an internal reviewer. The biodegradability is based on relevant OECD tests.



Aligned with and contributing to the
SUSTAINABLE DEVELOPMENT GOALS



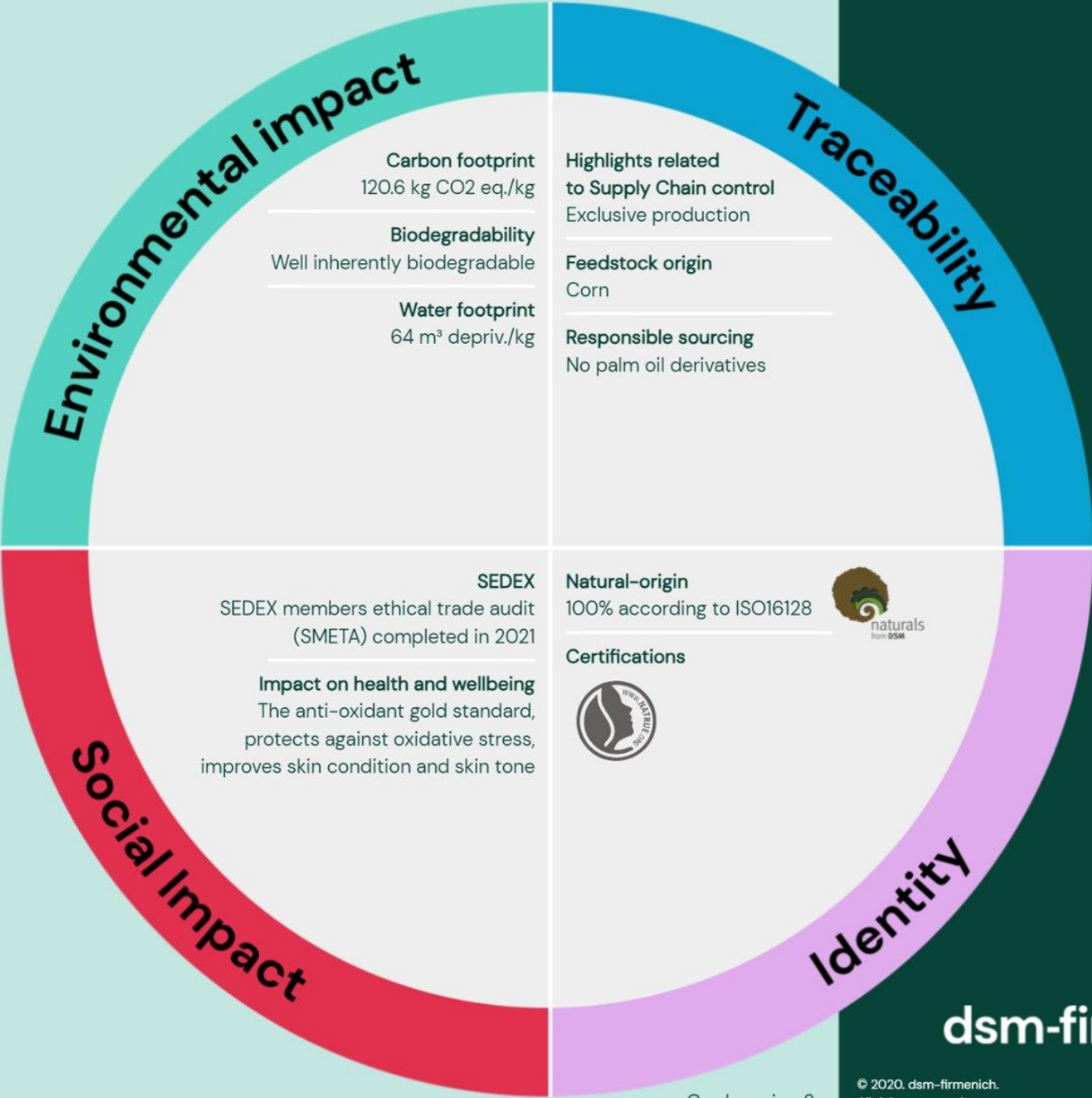
dsm-firmenich

STAY-C® 50

INCI name: SODIUM ASCORBYL PHOSPHATE
Product codes: 5016285

STAY-C® 50
The stabilized form of vitamin C,
anti-oxidant gold standard
Vitamin of natural origin

The carbon and water footprint calculations are based on internally conducted LCA according to ISO 14040/44 guidelines, dsm-firmenich LCA policy and validated by an internal reviewer. The biodegradability is based on relevant OECD tests.



Aligned with and contributing to the
SUSTAINABLE DEVELOPMENT GOALS



dsm-firmenich

Niacinamide PC

*The multi-functional vitamin
for menopausal skin changes*



Niacinamide PC

The multi-purpose Vitamin

- Niacinamide (Vitamin B3) is a very stable vitamin which offers a wide range of well-documented topical benefits.
- Niacinamide improves skin health by strengthening the skin barrier, minimizing the appearance of pores, evening out skin tone, and protecting against environmental stress.
- Niacinamide is a key component of NAD+ and NADP, essential coenzymes in ATP production, also having a central role in DNA repair and skin homeostasis.

What is special about Niacinamide PC?

- Niacinamide PC is a special cosmetic proprietary grade of DSM, which has a low guaranteed level of residual nicotinic acid to address any concerns about unpleasant skin sensations.
- Fully raw material backward integrated (picoline – intermediates of niacinamide– from natural origin, ex tapioca)

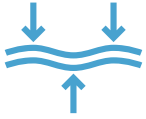
An all-round product for my skin?

- Niacinamide PC is the ideal candidate for day care and sun care products.
- Suitable for all skin types and well tolerated.



Niacinamide PC: proven benefits

Resilient, flawless skin and radiant complexion



CORNEOCARE® – Skin Resilience

- Strengthens the skin barrier and stimulates and rebalances ceramides and lipids in stratum corneum¹
- Increases key skin barrier proteins: involucrin, filaggrin, keratin²



Environmental stress protection

- Boost cell energy production and repair (UV induced DNA damage)^{2,3}
- Protection against urban pollutants, UV and blue light related premature aging damage^{1,2,3}



Even skin tone

- Inhibition of melanosome transfer²
- Rebalances uneven skin tone^{1,3}



Blemish Care

- Reduces the appearance of acne¹
- Helps to reduce sebum level¹



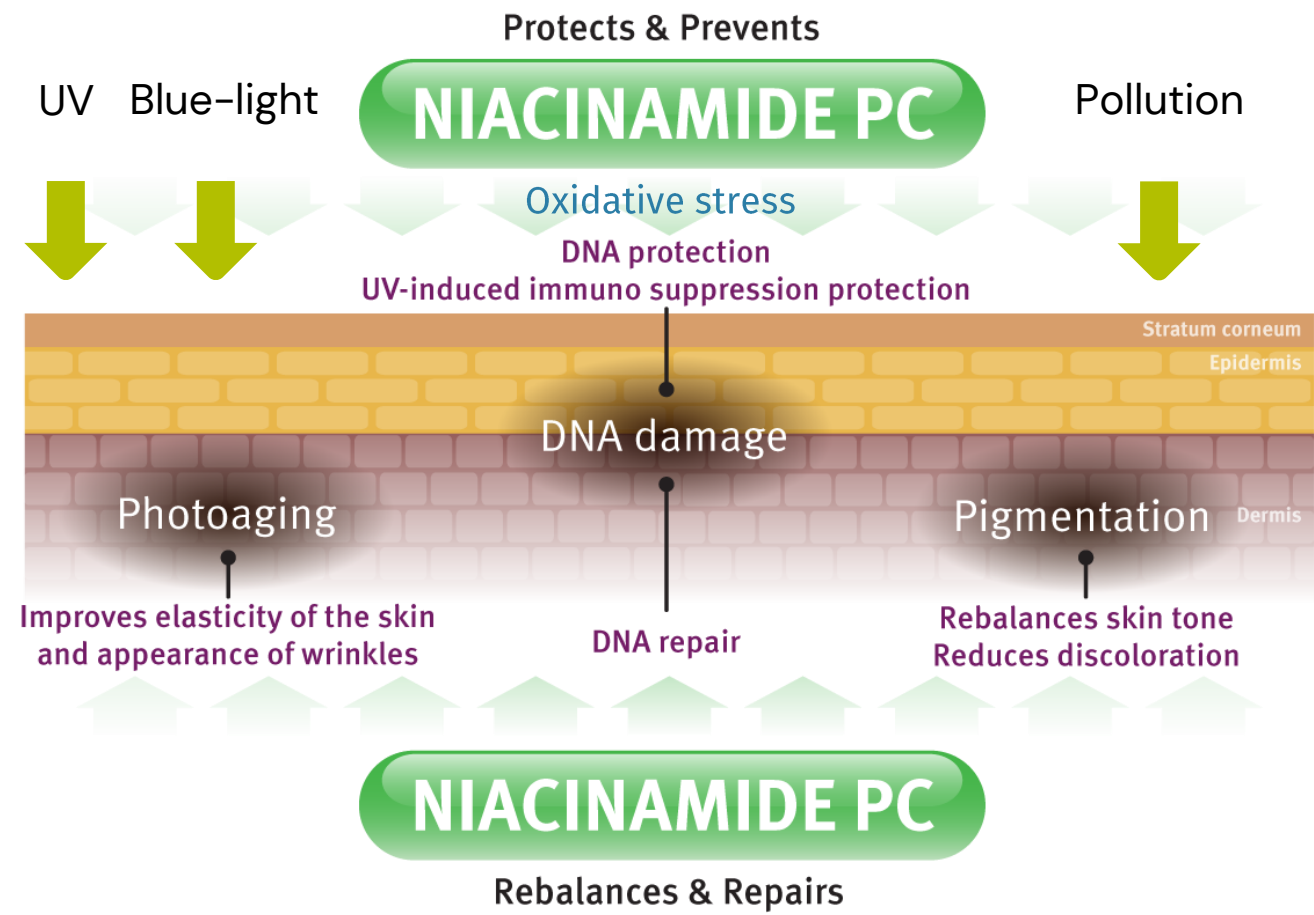
Anti-aging activities

- Stimulates and protects collagen^{1,2}
- Improves the appearance of lines, wrinkles and skin elasticity¹



Environmental stressed Skin Care

Protection & Repair



Niacinamide is everywhere

A key ingredient in B&C, and at L'Oréal

Niacinamide doubled its usage, from 10% to 20% penetration, in only 5 years.*



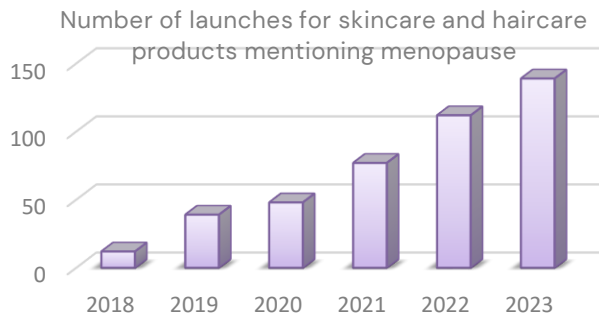
*[Mintel search years 2020-2025]

From taboo to trending topic:

Personal care innovations to be more inclusive on menopause



According to 2021 data from Grandview Research, the global menopause cosmetics market size will reach \$22.7 billion by 2028.



Product launches incl. menopause claim increase from 2018 to 2023 by 35 folds, and +24% from 2022 to 2023.
Source: Mintel, gnpd.



Neovadiol by Vichy is a line of cosmetics designed to reduce visible signs of post-menopausal skin aging. Backed by dermatological tests and endorsed by experts in the field, Neovadiol offers targeted solutions for menopausal skin care.



No. 7 Menopause Skincare line specially developed to target fine lines and wrinkles. Dermatologically tested and approved by dermatologists with expertise in menopausal skincare.



Pantene Pro V Hair Biology Menopause: a range to help manage the changes brought about by age and hormone imbalance.

Niacinamide PC

The multi-functional vitamin for menopausal skin changes

The multi-change stage of menopausal skin aligns well with the multi-benefit properties of **Niacinamide**, making it **an excellent ingredient for counteracting the skin effects of menopausal hormonal changes**.

The new *in vivo* study from dsm-firmenich shows that Niacinamide PC is an **effective solution for menopausal skin concerns**. It addresses issues such as dryness, sensitivity, fine lines, wrinkles by strengthening the skin barrier and protecting against collagen degradation. Its DNA repair properties and ability to fade hyperpigmentation make Niacinamide PC ideal for menopausal women skincare routines, enhancing overall skin health and resilience during this multi-change period.

Niacinamide PC strengthen the scalp barrier while keeping it hydrated, providing comprehensive care for scalp and healthy hair.

A **naturally-derived and sustainable** grade of Niacinamide PC.



Multipurpose vitamin for multiple skin changes during menopause

Niacinamide: the versatile vitamin

Menopause skin changes	What happens in the skin			Niacinamide Treatment
Epidermal barrier dysfunction	↓	Different distribution of Ceramides	↑	Re-balance ceramides composition to pre-menopausal level Restores hydration Reinforces Epidermal barrier
Loss of hydration	↓	Hydration	↑	
	↑	TEWL	↓	
Sensitive skin	↑	Skin homeostasis and NMF disruption: release of imidazole compounds	↓	Helps to relieve sensitive skin
Reduced energy availability	↓	NAD+ ¹	↑	Supports cellular energy metabolism
Slower skin repair ability	↓	DNA protection and repair	↑	Enhances skin repair
	↓	Cytosine level (marker of DNA protection)	↑	
Reduced skin elasticity, promotes wrinkles	↓	Collagen protection	↑	Boosts skin elasticity, reduced wrinkles
	↑	Free proline (marker of collagen degradation)	↓	
	↓	Collagen production	↑	
Increased UV induced skin damage and photoaging effects	↑	Upregulating histidine degradation (marker of skin homeostasis disruption):	↓	Protects against UV-induced skin damage and photoaging
	↑	release of markers of UV skin damage	↓	

¹: NAD⁺ oxidized form of Nicotinamide Adenine Dinucleotide

New Science on Niacinamide in post-menopausal skin

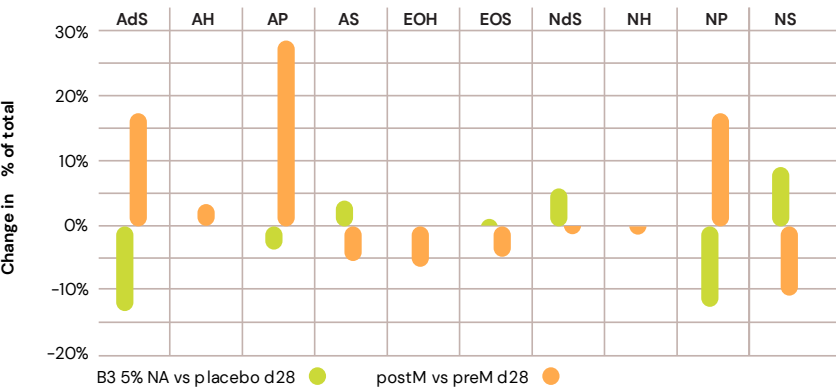
New
in vivo study

dsm-firmenich
own study

Re-balancing of Ceramides

Menopausal skin is subject to different ceramides' composition compared to pre-menopausal skin. Niacinamide PC treatment boost all endogenous ceramides (with highest increase around 30%, restoring the native distribution of pre-menopausal levels of different ceramide types in the skin, much better than with topical application

Relative content of ceramides and % change pre- vs post Menopause and by Niacinamide PC treatment

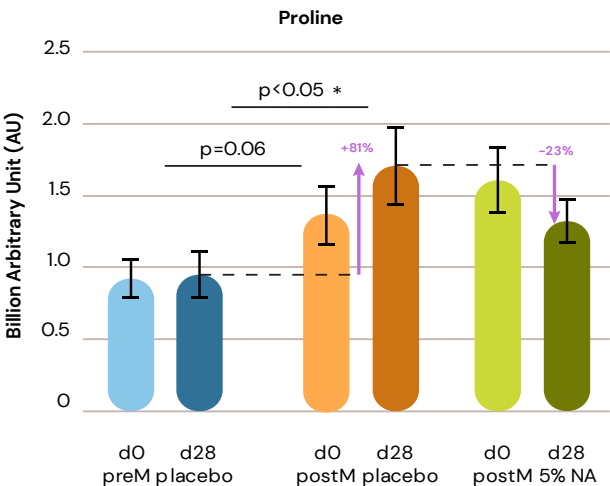


Niacinamide PC rebalances the ceramide distribution

Protection against Collagen degradation

Collagen synthesis is generally reduced during menopause. Treatment with Niacinamide PC resulted in lower levels of free proline and acetyl-proline, confirming its effectiveness in preserving collagen integrity and maintaining skin elasticity.

Free proline content

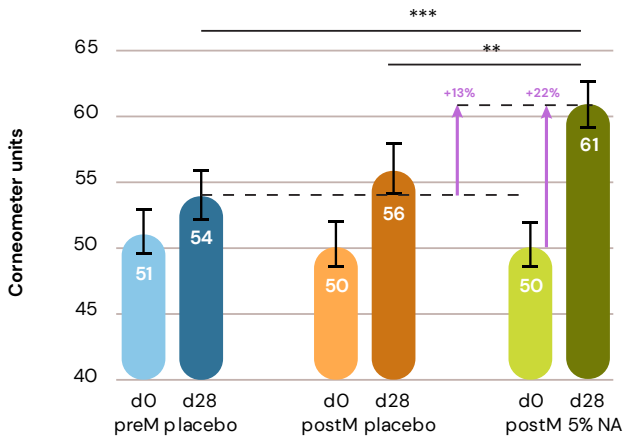


Significant increase of free proline by 80% and significant reduction of free proline by 24% after treatment by 5% Niacinamide PC vs placebo

Skin Hydration

Due to hormonal changes menopausal skin tends to become drier, giving the skin an itchy feeling. High level of Niacinamide is correlated with reduced trans epidermal water loss (TEWL) and consequent increase of skin hydration.

Skin hydration by cutometer



Significant increase of skin hydration by 22% vs TO and by 13% vs Post Menopause group

New Science on Niacinamide in post-menopausal skin

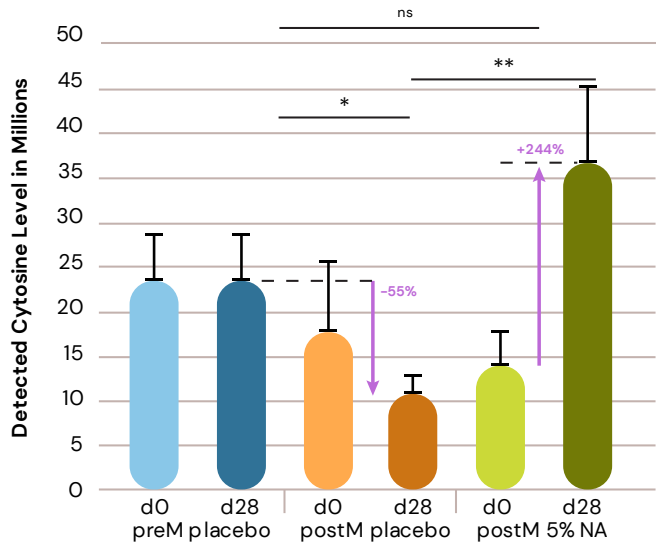
New
in vivo study

dsm-firmenich
own study

DNA Repair

Post-menopausal skin is prone to DNA damage and more subject to UV-induced DNA damage compared to pre-menopausal skin. Treatment with Niacinamide PC shows significant increase of cytosine level (+244%), confirming the ability of Vitamin B3 to enhance DNA repair.

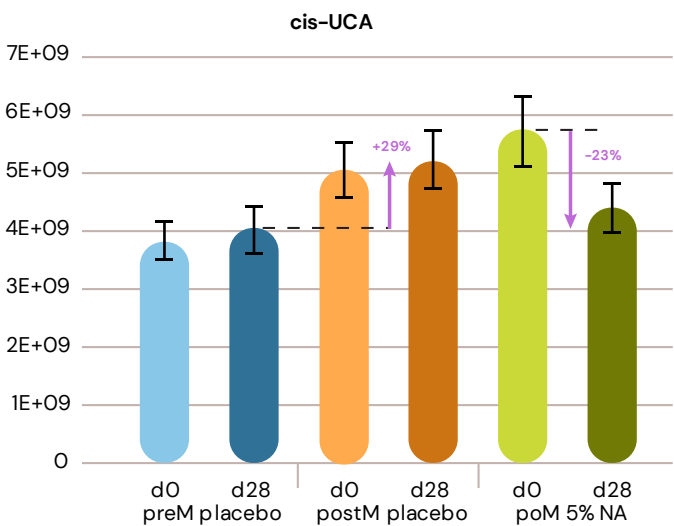
Cytosine level before and after treatment



Photoprotection

UV-stress markers such as cis-urocanic acid can be found at increased level in post-menopausal skin. Treatment with Niacinamide PC shows a decrease of 28% in cis-urocanic acid content vs placebo. By promoting different catabolic pathways, Niacinamide PC provides biological protection from UV damage in postmenopausal skin.

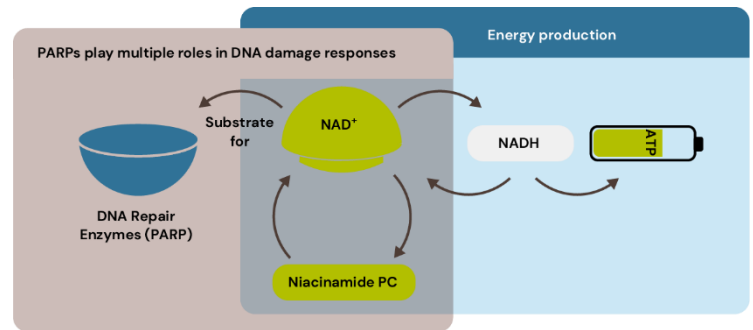
Cis-urocanic acid



Energy Boosting

NAD+ is a key molecule of cellular energy metabolism, and it appears to be in lower level in aged skin. As precursor of NAD+, Niacinamide is a building block to boost energy production at cellular level.

Simplified pathway of cellular energy production (ATP production) with niacinamide and NAD+



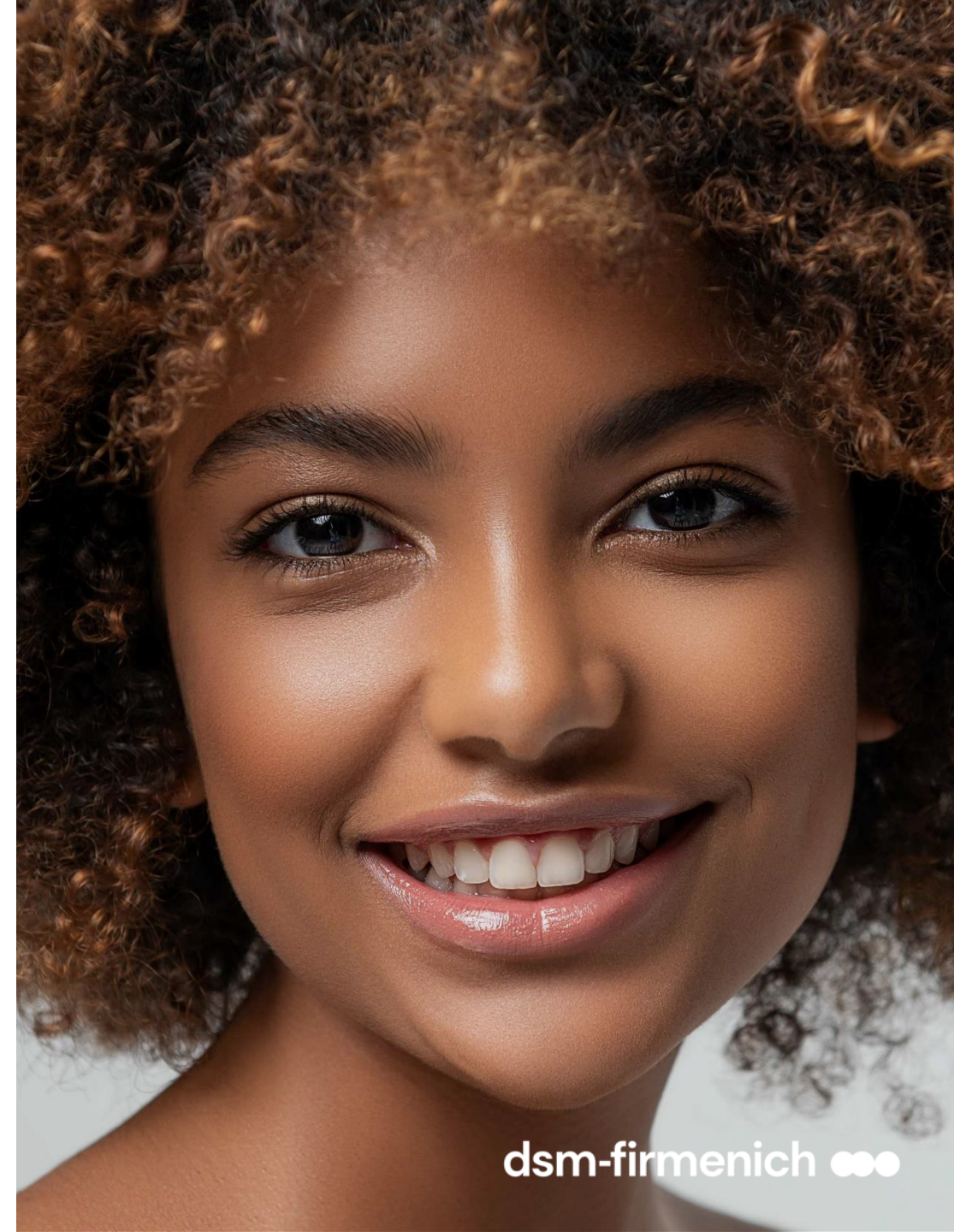
Formulating Niacinamide PC

- Niacinamide PC is very **stable** (air, heat, light) and **easy** to formulate with.
- **Highly soluble** in water and alcohol and soluble in glycerol.
- Niacinamide PC shows **a very good compatibility** with all groups of cosmetic ingredients
- Niacinamide PC can be **processed either cold or hot** at temperatures up to 70°C . Generally added in the aqueous phase of a cosmetic formulation

Caution: Niacinamide PC is incompatible with strong acids and bases and oxidizing agents which may cause hydrolysis to nicotinic acid. It is important to not use ingredients containing enzymes such as amidases to avoid biological hydrolysis of niacinamide to nicotinic acid

Recommended pH of the final formulation: **4.0 – 8.0**

Suggested dosage : 1 to 7%

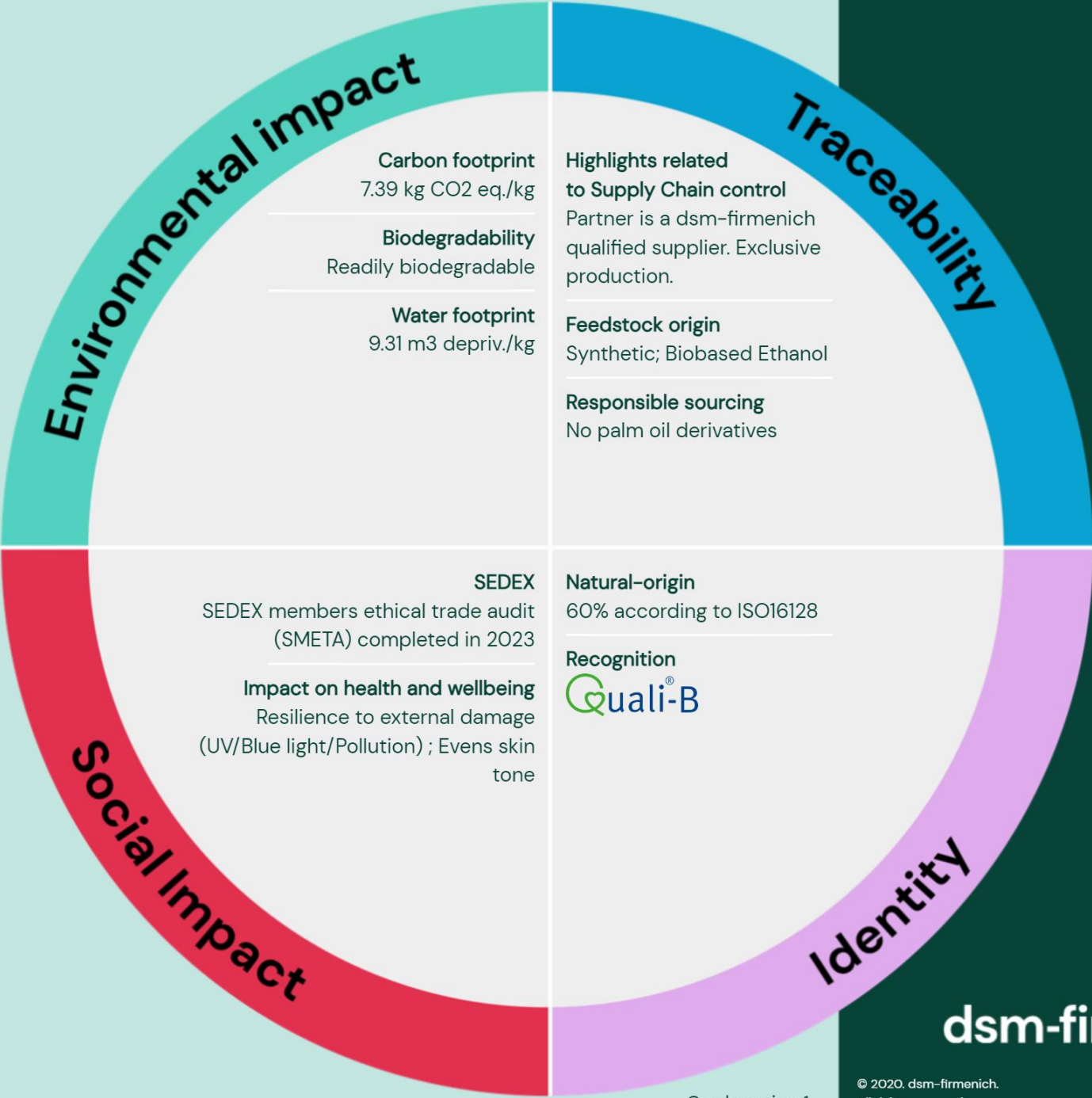


Niacinamide PC

INCI name: NIACINAMIDE
Product codes: 5006066

Renewable grade of Niacinamide (60% according to ISO16128)
Guaranteed to contain max 100 ppm residual nicotinic acid, making it exceptionally well tolerated

The carbon and water footprint calculations are based on internally conducted LCA according to ISO 14040/44 guidelines, dsm-firmenich LCA policy and validated by an internal reviewer.
The biodegradability is based on relevant OECD tests.



Aligned with and contributing to the
SUSTAINABLE DEVELOPMENT GOALS

3 GOOD HEALTH AND WELL-BEING

8 DECENT WORK AND ECONOMIC GROWTH

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

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Vitamin B12

*The Biotech pink vitamin
for sensitive and stressed skin*



Vitamin B12



The biotech pink vitamin
for sensitive and stressed skin

Unique Product Features

- **Biotech naturally derived pink vitamin**
- Active on **atopic dermatitis, reducing erythema and pruritus *in vivo***
- Prevents inflammation *ex vivo*: **significant and strong reduction of inflammasome and inflammatory cytokines such IL1- β .**
- **Epigenetic regulation of inflammasome: over-expression by 61% of miR-22-3p with vitamin B12 leads to a reduction of inflammasome *ex vivo***
- **Significantly reduction of Mast cell degranulation by 27%, drops the histamine release *in vitro***
- **Maintains healthy skin microbiome**, by reducing pathogenic *S. aureus* vs beneficial bacteria *in vitro*

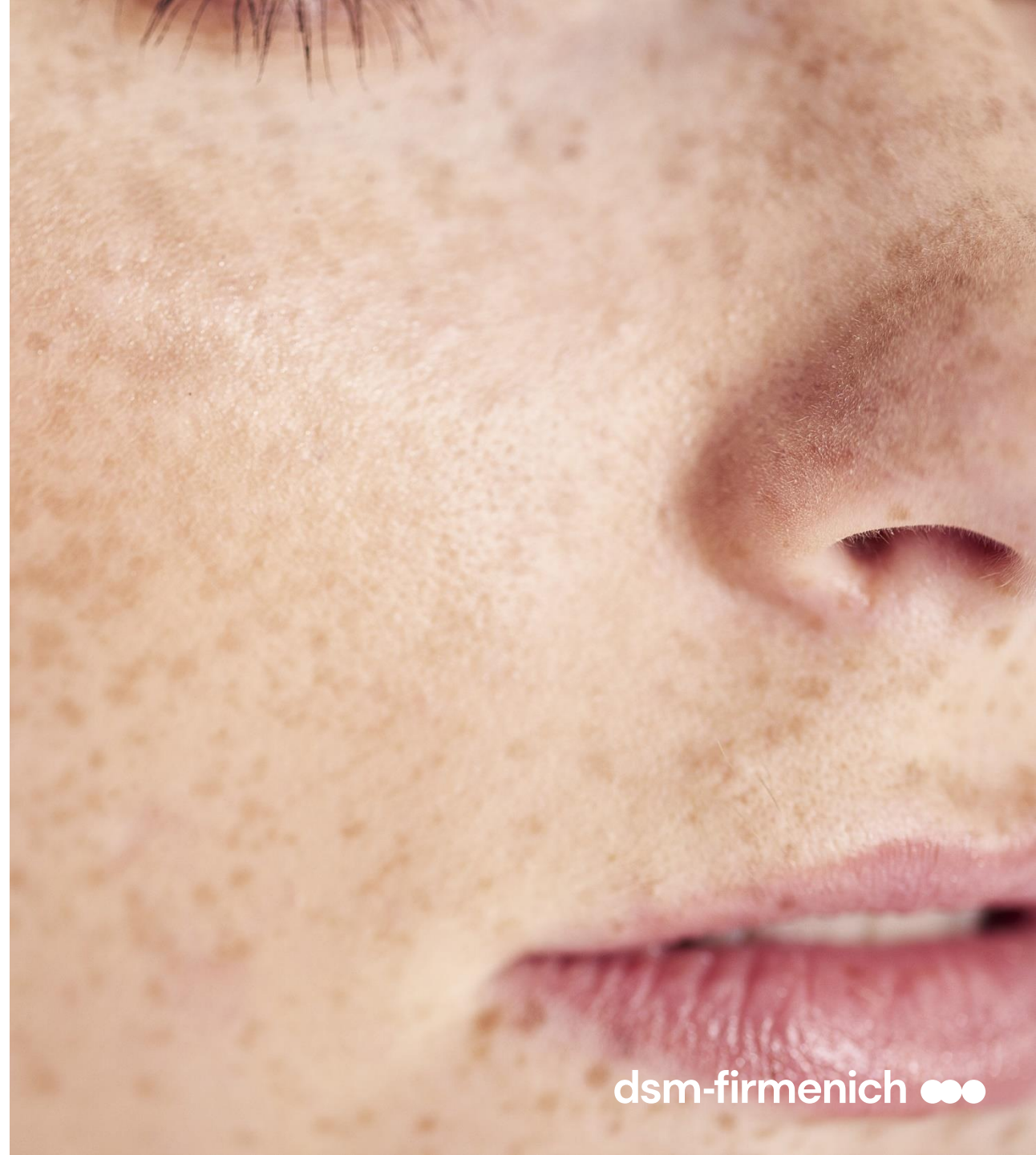


Vitamin B12

Soothes and regenerates sensitive skin,
making it look more vibrant

Consumer benefits

- Vitamin B12 relieves sensitive and stressed skin
- Dermatological treatments for skin conditions like itchy, dry, inflamed, red and cracked skin
- Helps prevent photo-damaged skin
- Protects the skin barrier damage induced by inflammation
- Plays an important part in speeding up cell recovery and regeneration
- Skin looks more vibrant
- Nice pink color of the formulations



Vitamin B12 is gaining traction

Continuous growth of total of launches containing Cyanocobalamin where Asia is the leading region followed by Europe. The application most used is face care.



dsm-firmenich scientists discovered the action of Vitamin B12 on the inflammasome

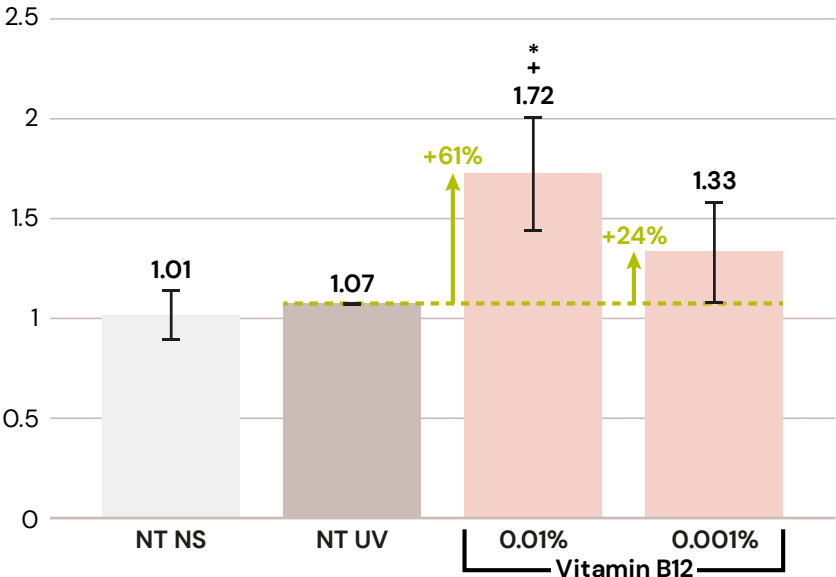
NEW

dsm-firmenich
own study

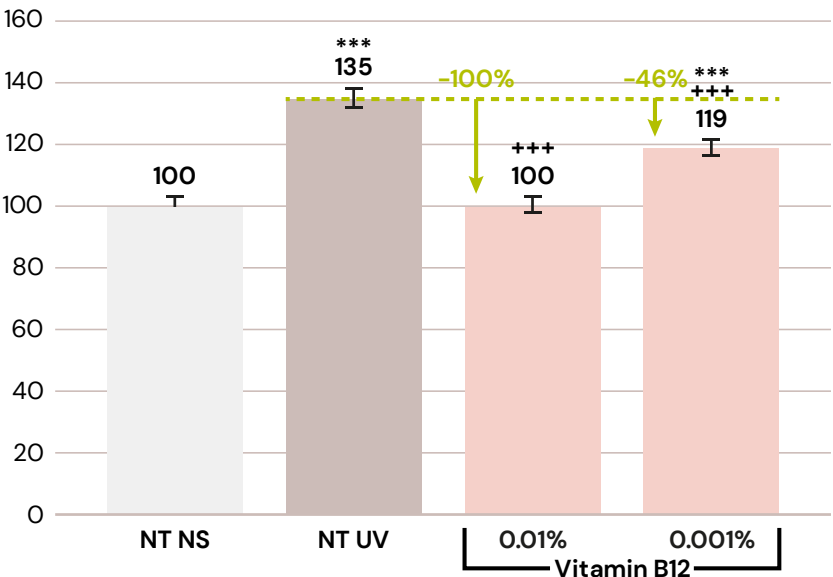
Vitamin B12 reduces UV-B induced inflammasome reaction *ex vivo*

- Vitamin B12 significantly up regulates by 61% miR-22-3p at 0.01%
- Vitamin B12 significantly down regulates ASC complex activation by 100%, to the level of non-treated, at 0.01% after UV-B stress

• miR-22-3p expression after UV stress



• Mean ASC intensity



UV, pollution, bacterial invasion or any oxidative stress induce the formation of the inflammasome, especially in keratinocyte.

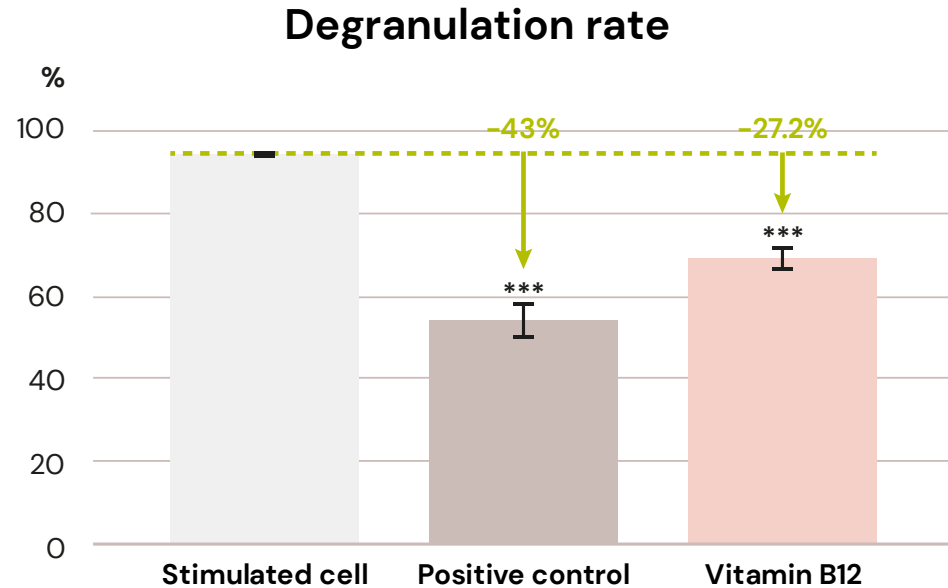
Its components are **pro-Caspase-1, ASC and NLRP3** which is regulated by the epigenetic factor **miRNA 22-3p**.

If it gets chronically activated, it **causes skin irritation, skin tissue damage and premature aging**

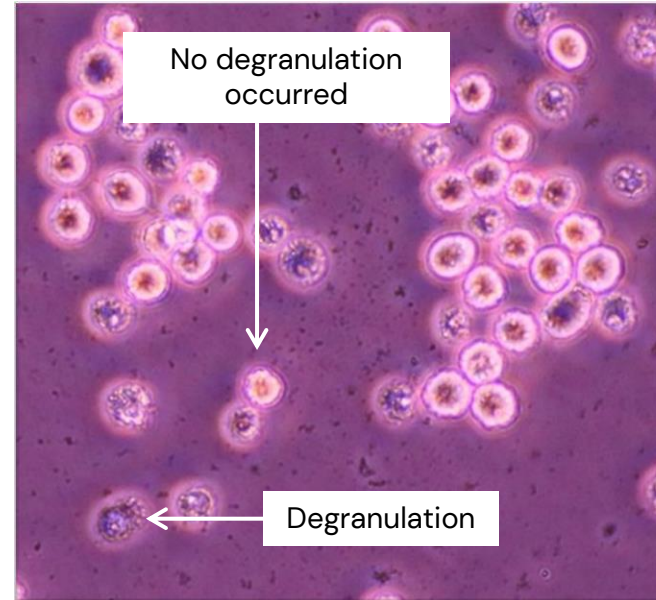
First discovery: Vitamin B12 reduces histamin by inhibiting mast cell degranulation *in vitro*

NEW

dsm-firmenich own study



*** p-value<0.001



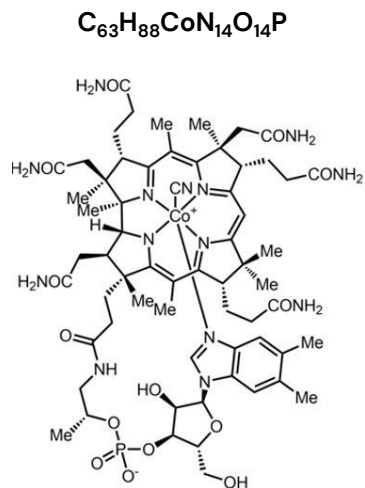
Vitamin B12 significantly inhibits mast cell degranulation by 31% at 0.00015%.

It helps to protect inflammation induced skin barrier damage and relieves sensitive and irritated skin

Mast cells can be activated by environmental stress factors like allergens, UV light, pollution and free radicals. Degranulation is the release of pro-inflammatory mediators such as histamine, cytokines, proteases,...leading to itching, stinging, burning, redness, dry and sensitive skin

Formulating Vitamin B12

- Easy-to-use
- **Sparingly soluble in water**, slightly soluble in ethanol, insoluble in lipophilic components
- **Can be used for different kinds of leave-on and rinse-off** products like O/W, W/O or W/Si formulations, cream gel, clear gel, shower gel, shampoo, body wash
- To be incorporated **into the aqueous phase** at any time (<80°C)
- Is **sensitive to high temperature storage and day light**. It is recommended to add a chelating agent (such as sodium phytate, Etidronic Acid, Disodium EDTA). For better stability at 50°C sodium gluconate or glycine could be added
- Recommended pH of the final formulation: **3.5–7.5**
- Perfectly fitting to any **natural formulations**
- Use level: **0.001–0.1%**

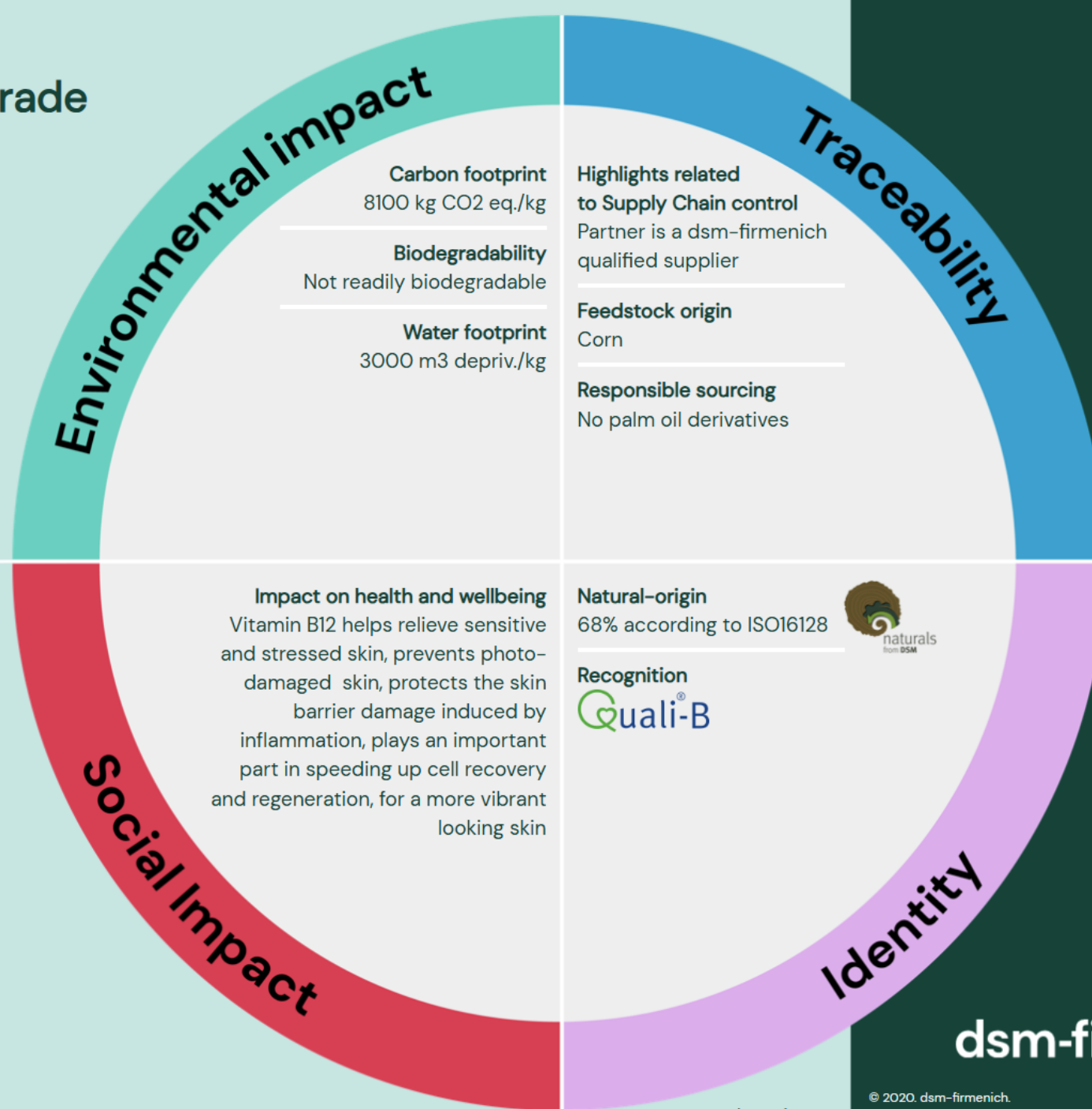


Vitamin B12 cryst Food Grade

INCI name: Cyanocobalamin
Product codes: 5016420

The biotech pink vitamin for sensitive and stressed skin. The use level of this pure Vitamin B12 cryst is 0.001% to 0.01% which considerably relativizes the carbon footprint of the final formulation.

The carbon and water footprint calculations are based on internally conducted LCA according to ISO 14040/44 guidelines, dsm-firmenich LCA policy and validated by an internal reviewer. The biodegradability is based on relevant OECD tests.



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SUSTAINABLE DEVELOPMENT GOALS



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Card version 1

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Panthenol

*The gold standard moisturizer
for skin and hair care*



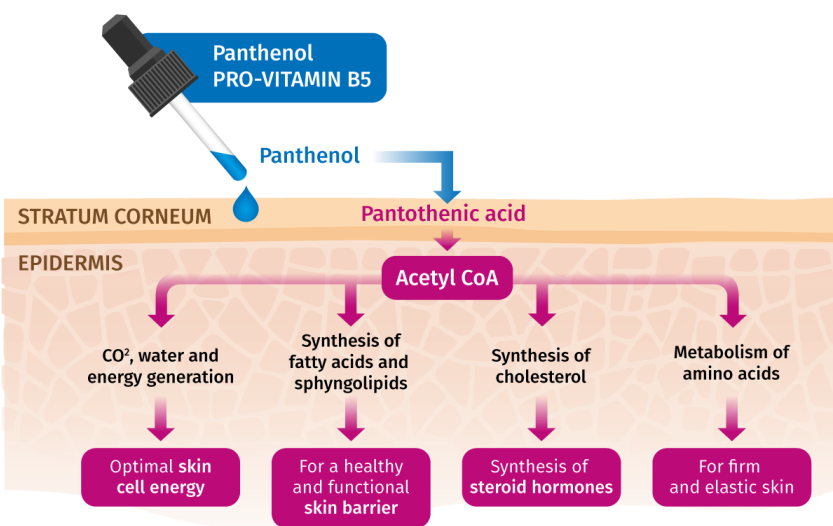
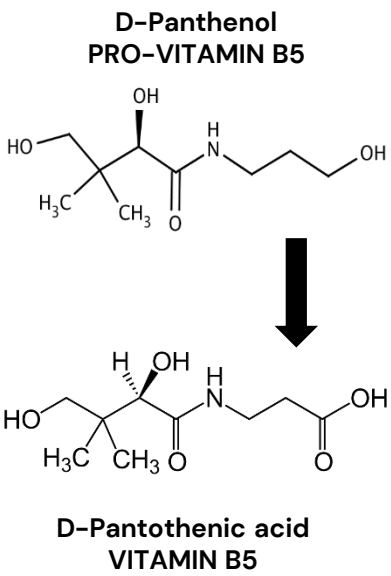
D-Panthenol is pro-vitamin B5!

D-Panthenol (or Dexpanthenol) is the provitamin of D-Pantothenic acid, identified in 1933 in liver and yeast.

D-Panthenic acid is Vitamin B5, a water-soluble vitamin.

Its name originates from the Greek word 'pantos', meaning 'everywhere', as it naturally occurs in foods and plants as well as throughout all living cells.

The human body converts D-Panthenol to Vitamin B5.



Panthenol / Pro-Vitamin B5 : Benefits in Beauty & Care

SKIN CARE

- Improves skin hydration
- **Rejuvenates** the skin by promoting cell **stemness**
- Soothes irritated skin reducing **itching, redness and inflammation**
- **Promotes wound healing**, stimulates epithelization



BODY CARE

- Softens body skin (**moisturizing effect**)
- Brings **relief** and **regenerates** damaged skin (burns, scars)



SUN CARE

- Keeps **skin hydration** after UV stress



HAIR CARE

- Long lasting **moisturization**
- **Prevents hair damage**
- **Strengthens** the hair
- **Gives shine**



1. *In vivo*. 2. *In vitro*. 3. *Ex vivo*

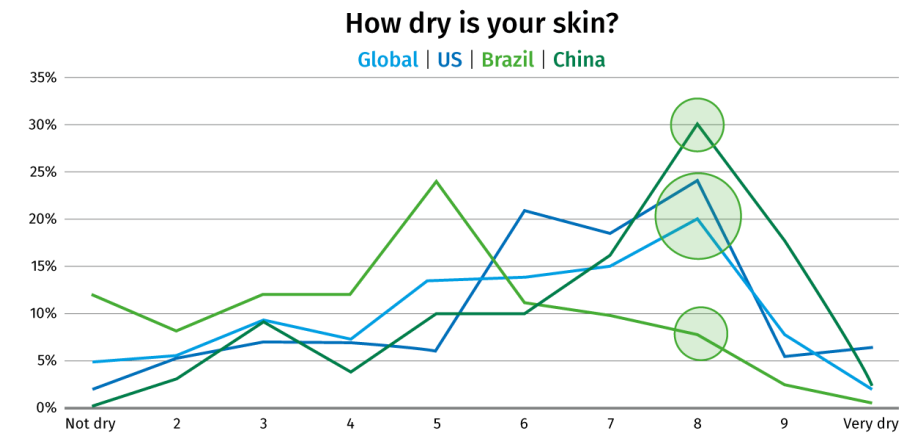
Panthenol is the gold standard of moisturizers

Panthenol is primarily found in hair care, but its presence in skin care is equally impressive.

Market penetration 2025: haircare >30% and skin care 20%*

*[Mintel search years 2020-2025]

Dry Skin is the 1st unmet need in term of Skin Care



Chinese women claim to have the driest skin



65% of
Chinese
women

53% of
American
women



scored between 7-10 on the dry skin scale

Moisturizing claims are by far the most popular functional claims in face/neck care

CORNEOCARE™ : Moisturization – Skin barrier on healthy skin

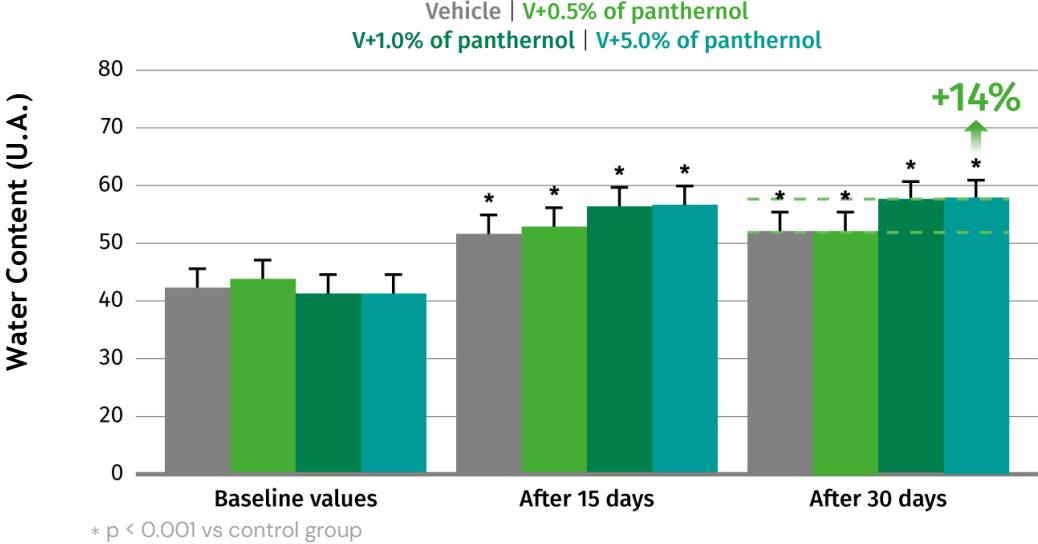
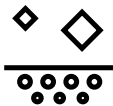
Panthenol significantly enhances the water content of the healthy stratum corneum by 14% and decreases transepidermal water loss by 34%

Panthenol maintains the hydration of **healthy skin** and **protects the skin barrier**

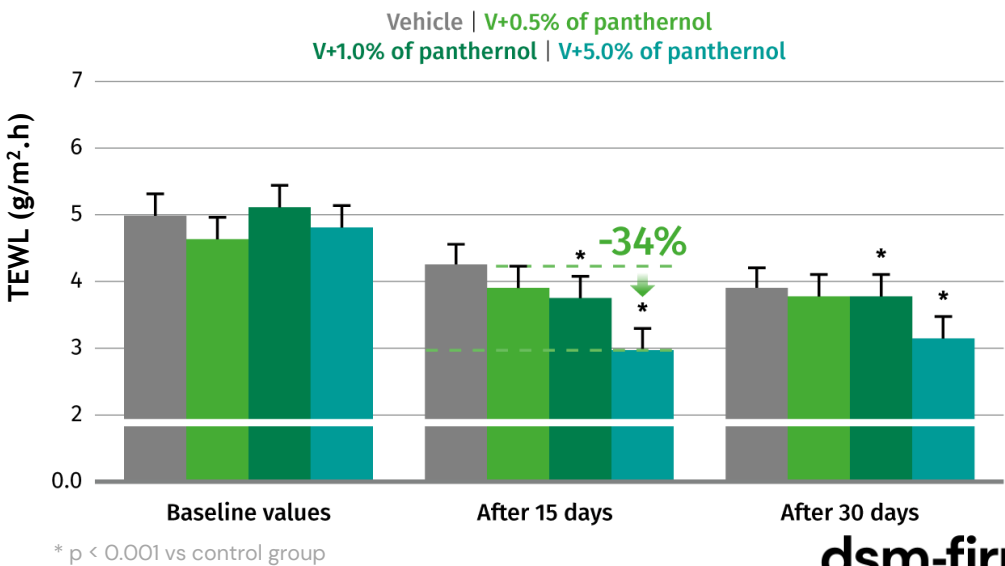
- 40 healthy female subjects, forearm, 20–35 years old
- 0.5%, 1.0%, or 5.0% (w/w) D-panthenol formulation vs placebo
- 15 and 30 days, twice daily

Water content of the stratum corneum (measured by Corneometer)

in vivo study



Transepidermal water loss (measured via Tewameter)



F.B. Camargo, L.R. Gaspar, P.M.B.G. Maia Campos. J. Cosmet. Sci., 2011, 62, 361–369

Skin Repair

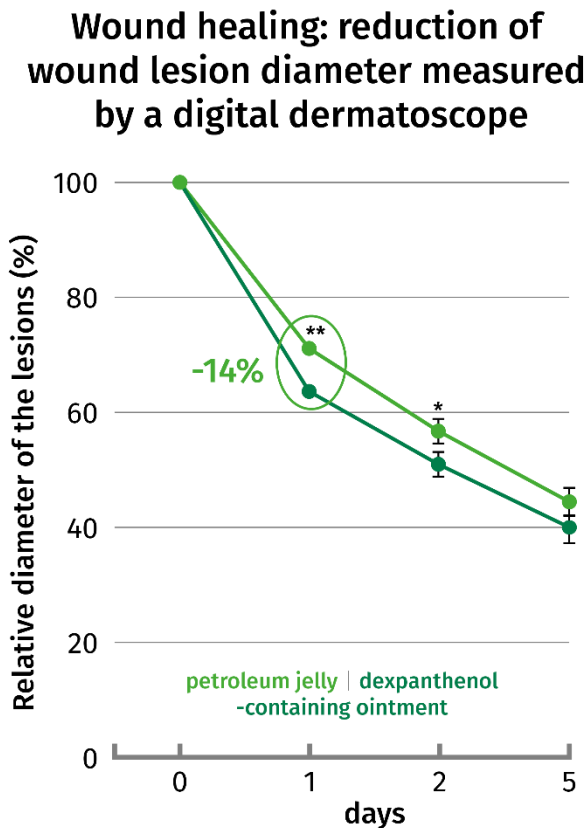
in vivo study



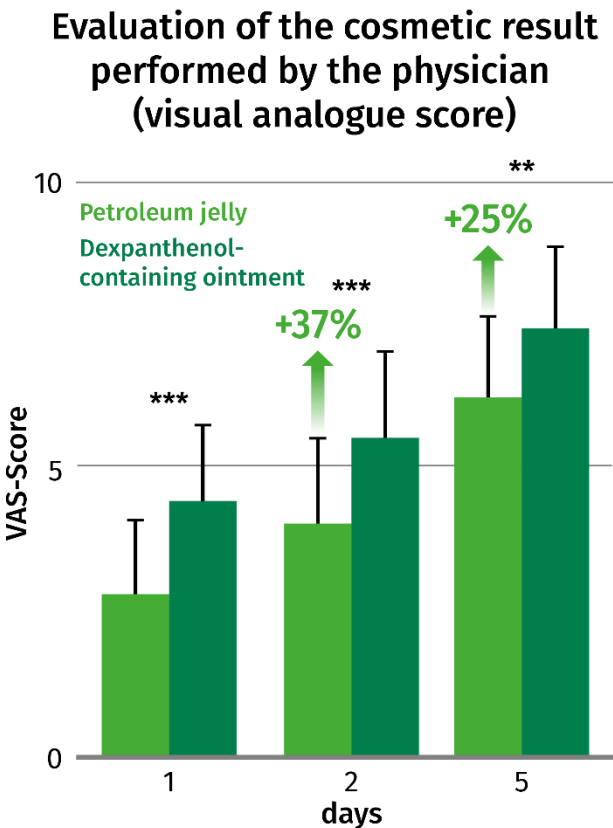
Panthenol improves the cosmetic appearance of wound by 37% after 2 days compared to baseline

Panthenol leads to faster closure, re-epithelialization and better cosmetic appearance of wounds after fractional ablative CO2 laser resurfacing of photodamaged skin

- 38 subjects with photodamaged skin
- 7 days, once daily
- wound area in two sections: D-panthenol ointment (Bepanthen® Wound Healing Ointment, Bayer, Leverkusen, Germany) vs petroleum jelly (Vaseline)



*p<0.05, **p<0.01 (Mann-Whitney U-test); ns: not significant



Panthenol: Hair Care Benefits



in vivo study

DEPOSITION



Panthenol deposits on hair from both shampoo and conditioner.

MOISTURIZATION



Excellent water retention by Panthenol alone and in Synergy with Phytantriol

STRENGTHENING



Greatly strengthens damaged hair when delivered in shampoos and conditioners

SPLIT-END PROTECTION



Excellent prevention of split ends after just one application

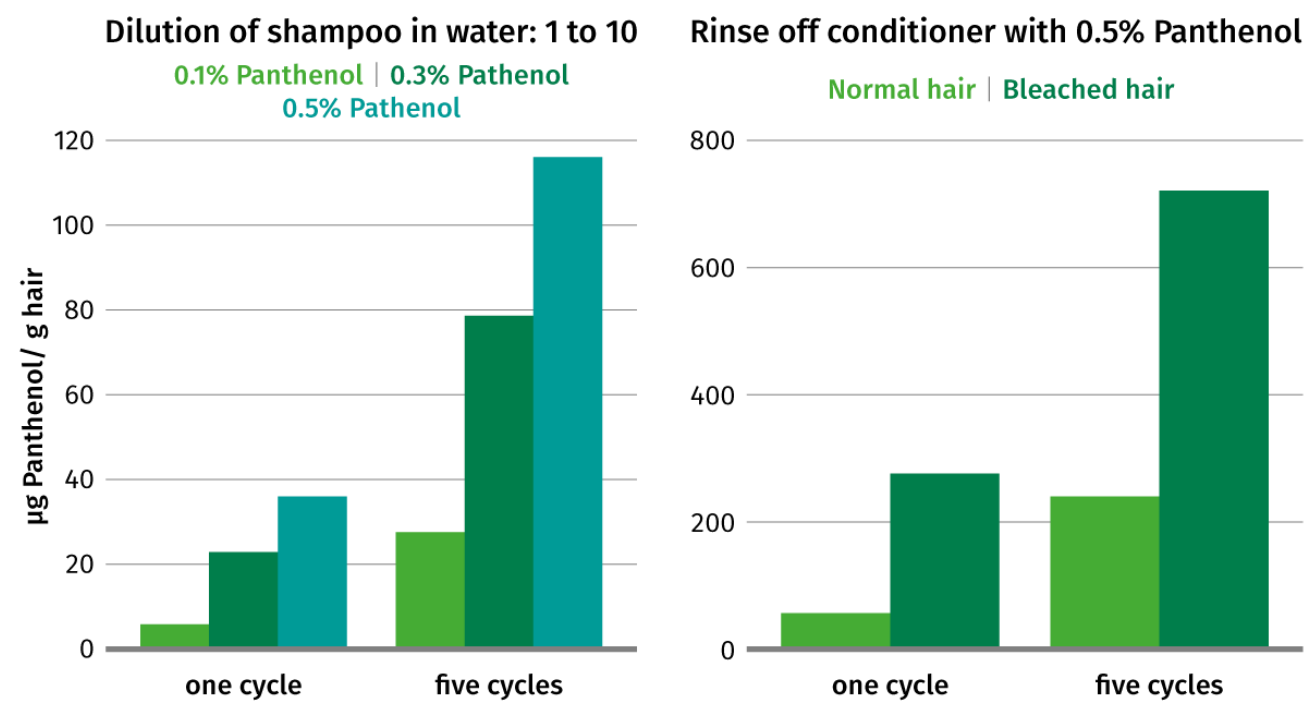
Hair Care benefit – Hair Deposition

Panthenol deposits on hair from both shampoo and conditioner proportionally to its concentration in formulation



Both in shampoo and in rinse-off conditioner, the Panthenol deposition is always higher on bleached hair

Average Panthenol deposition by scintillation (µg/g hair)



Ref.: E. Wagner , Parfumerie und Kosmetik, 1994; 75 :260-267

Hair Moisturization

Panthenol improves, dose dependently, long lasting hydration in hair

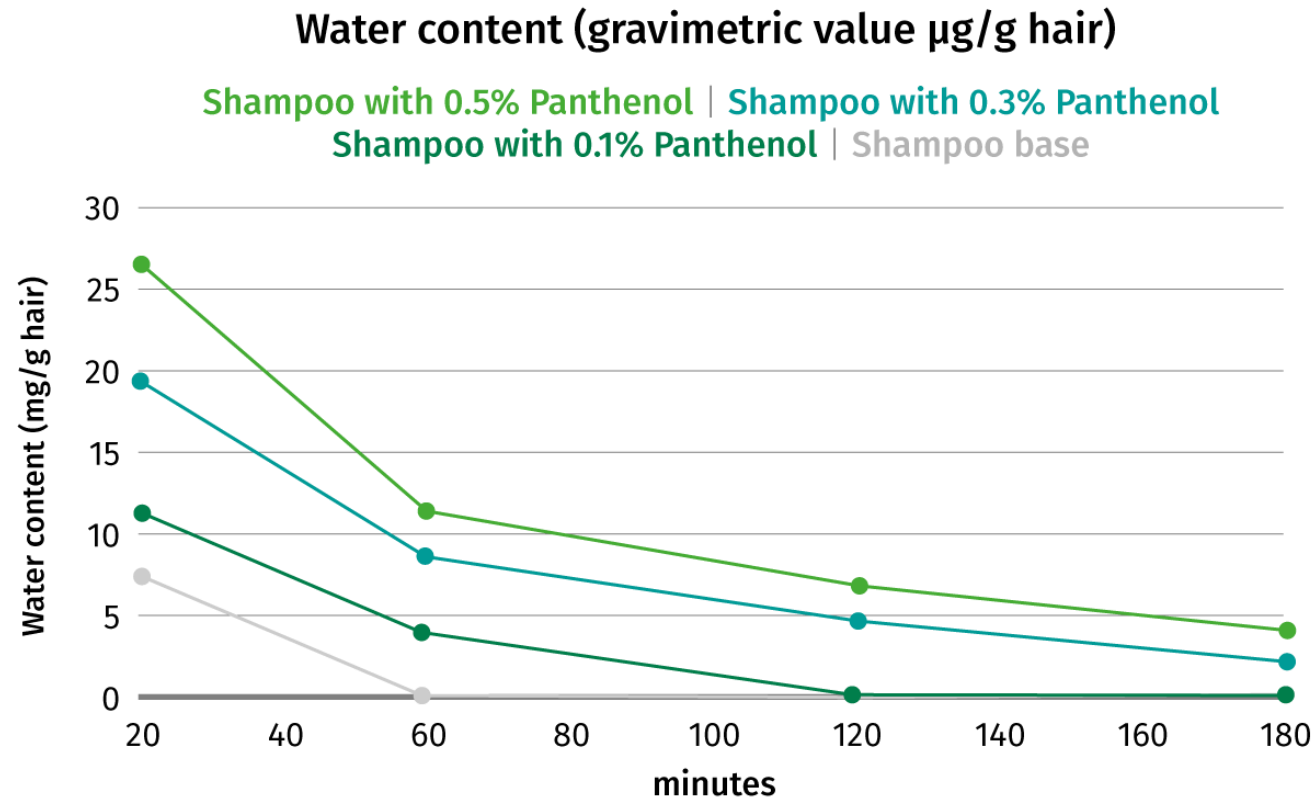


in vivo study

Moisturization level is proportional to panthenol content in formulation

Improves water retention

Hair soaked in a 10% shampoo solution, rinsed twice with water and blotted with tissue paper



Ref. Dermatech – Roche – dsm-firmenich 1990

Formulating with Panthenol

- Soluble in water, freely soluble in ethanol and glycol, slightly soluble in glycerin and ether. Not soluble in fats and oils
- Panthenol forms are very stable to air and light but high temperature should be avoided.
- It is recommended to add it below 40°C to avoid unnecessary heating of the active
- Compatible in a wide pH 4.0–7.5
- **Suggested dosage**
- **D-Panthenol: up to 5%**
- **(except for eyeliner & eye shadow: 1%)**

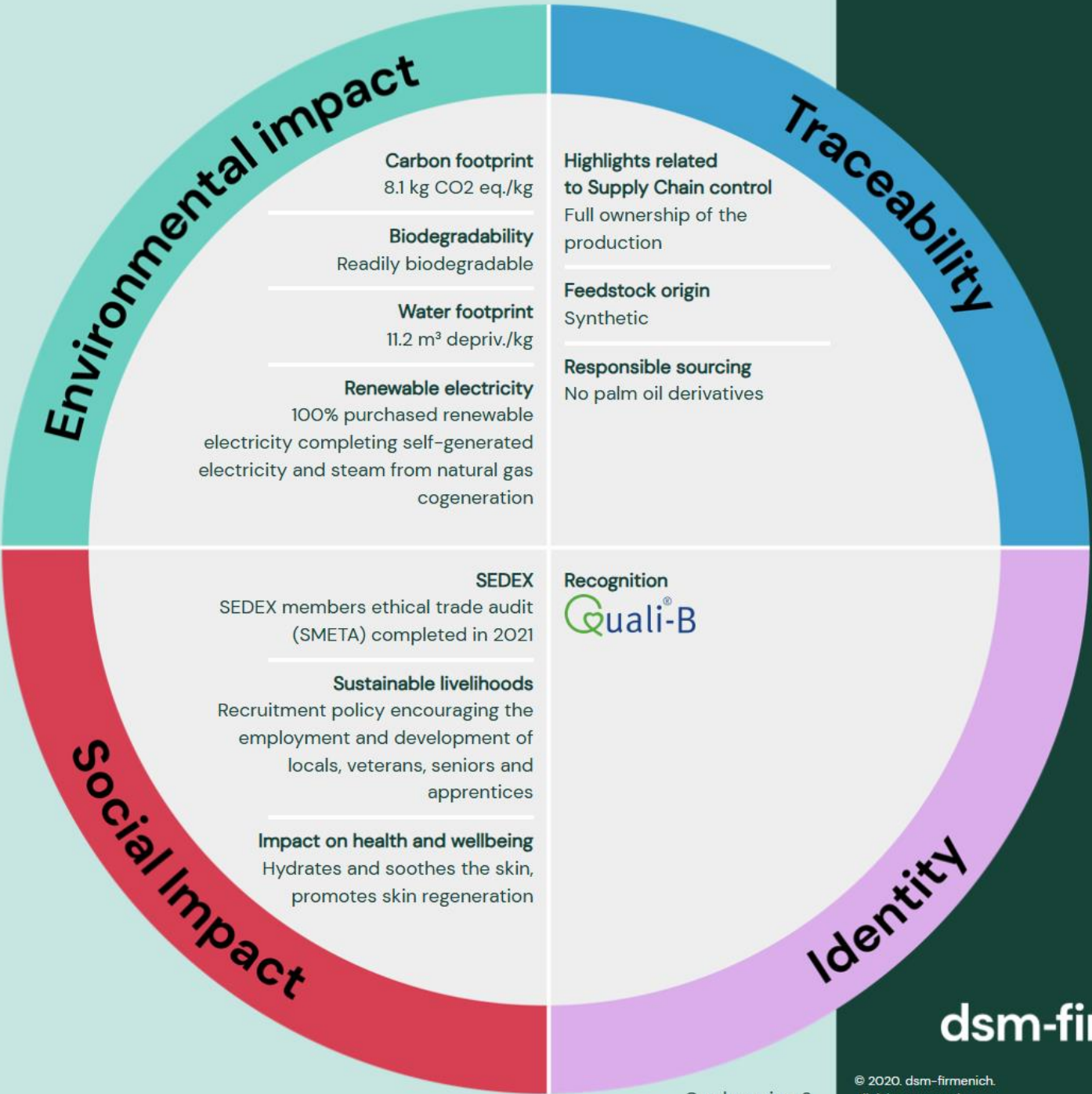


D-Panthenol

INCI name: Panthenol
Product codes: 0413852

Our Scottish plant produces electricity for its own use and exports to the national grid (30000 homes powered)

The carbon and water footprint calculations are based on internally conducted LCA according to ISO 14040/44 guidelines, dsm-firmenich LCA policy and validated by an internal reviewer. The biodegradability is based on relevant OECD tests.



Aligned with and contributing to the
SUSTAINABLE DEVELOPMENT GOALS



Vitamin A

Restore healthy-looking skin



Retinol & Vitamin A : benefits in Beauty & Care

SKIN CARE

- Stimulates collagen production, reducing the appearance of fine lines and wrinkles, leading to smoother, and firmer skin.
- Promotes cell proliferation, enhancing skin texture and tone, resulting in a more radiant complexion.



SUN CARE

- Helps in repairing sun-damages by promoting cellular regeneration and collagen synthesis, supporting the reduction of Sun-Induced Wrinkles hyperpigmentation.
- Strengthens the skin's barrier, improving defenses.



HAIR CARE

- Enhances hair strength by promoting keratin production, reducing breakage and split ends.
- By promoting cell turnover in hair follicles, retinol can encourage new hair growth.



MAKE-UP

- By improves skin texture and tone, Retinol and Vitamin A derivatives provides a smoother canvas for makeup application.



Retinol Efficacy

The gold standard of anti-aging



Scientific evidences that might explain why Vitamin A/Retinol is so popular !



WRINKLES REDUCTION

Consumer Benefits

- Reduces appearance of fine lines & wrinkles
- Improves skin firmness & elasticity

Molecular & Gene Level

- Increases synthesis of Collagen & Elastin
- Inhibits MMPs, reducing Collagen & Elastin degradation

Structural & Functional Level

- Improves organization of Collagen and Elastin fibres in papillary dermis
- Improves structure of Dermal-Epidermal Junction (DEJ)



EPIDERMAL THICKENING

Consumer Benefits

- Improves skin smoothness
- Decreases skin roughness

Molecular & Gene Level

- Stimulates Ki-67 expression
- Increases deposition of Glycosaminoglycan in the epidermis

Structural & Functional Level

- Increases epidermal proliferation
- Thickens the epidermis
- Compacts the stratum corneum



EVEN SKIN TONE

Consumer Benefits

- Reduces discoloration, mottled pigmentation
- Rebalances uneven tone

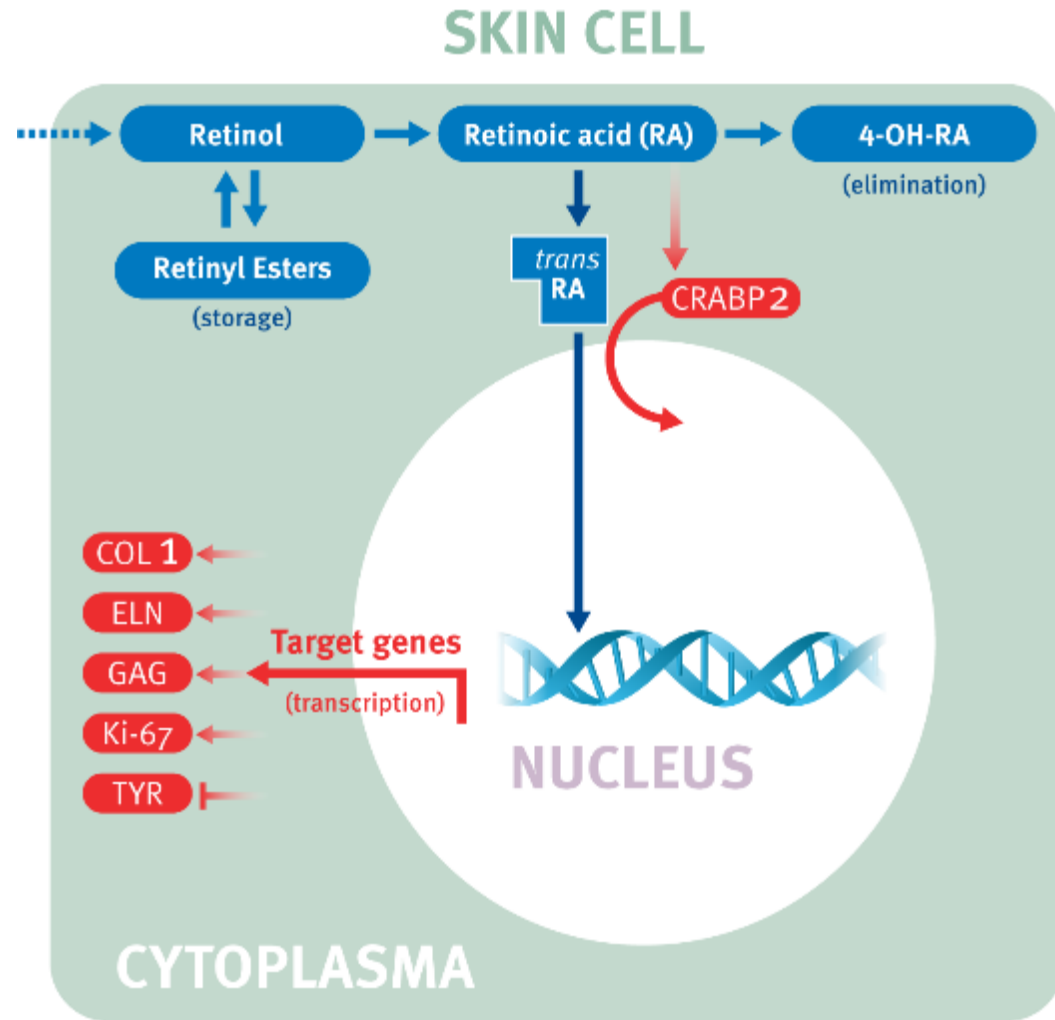
Molecular & Gene Level

- Downregulates Tyrosinase activity
- Decreases Melanin content

Structural & Functional Level

- Inhibits Melanosome transfer

Retinol : mode of action in the Skin



After it enters the cell, Retinol is metabolized to Retinoic Acid (RA), its most active form.

Abundant Retinol is stored in the form of Retinyl Ester until needed or is degraded by enzymes and eliminated as polar metabolites (4-OH-RA). Retinoic acid is transported into the nucleus by specific receptors (retinoic acid-binding protein type 2, CRABP-2). Into the nucleus, Retinoic Acid binds to receptors (RAR) and mediates RA-responsive gene expression. Some of such key gene products are:

- Type I procollagen (Col1),
- Elastin (ELN),
- Fibrillin-1
- Glycosaminoglycans (GAG)
- Ki-67 proliferation marker
- CRABP-2 (cellular retinoid transporter protein)

These key biomarkers can be detected by *in vitro* techniques and are the foundation for the beneficial anti-aging effects of Retinol.

G. Bellemere et al Antiageing action of retinol: from molecular to clinical.

Skin Pharmacol Physiol 2009, 22: 200-209

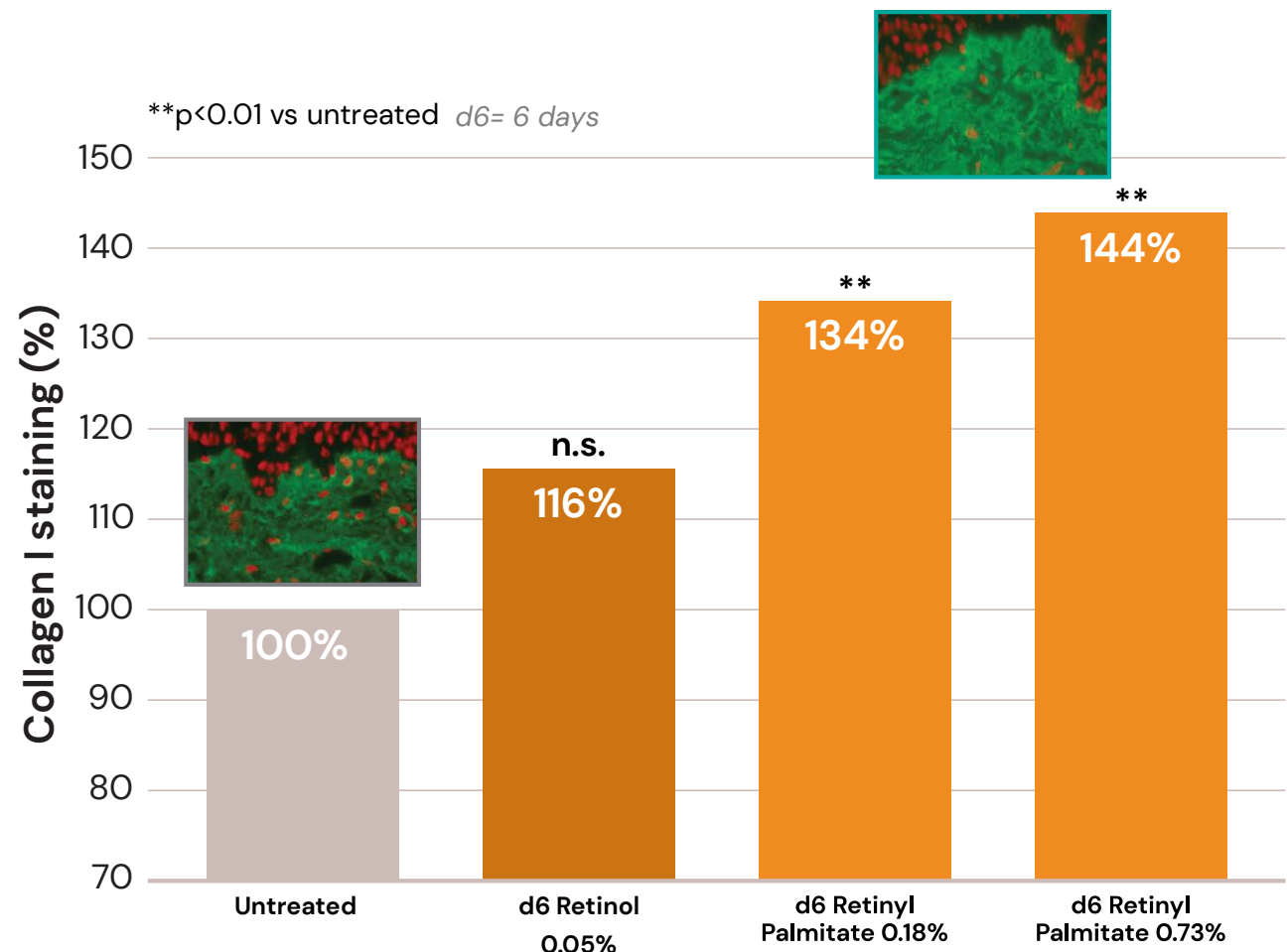
J. Varani et al Vitamin A antagonizes decreased cell growth and elevated collagen-degrading matrix metalloproteinases and stimulates collagen accumulation in naturally aged human skin. The society for investigative dermatology Inc, 2000, 114 (3): 480-486

Retinol is the gold standard for aging care

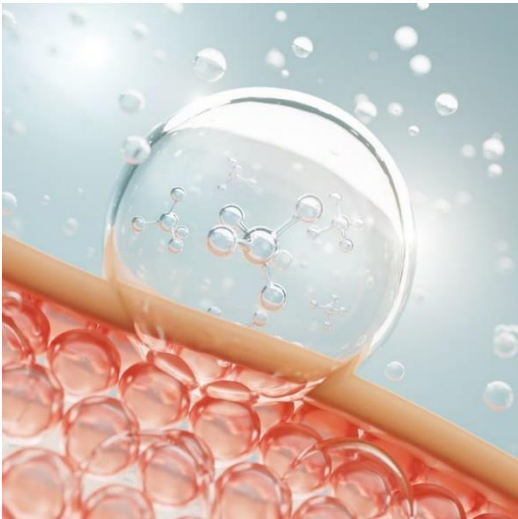


Retinol and derivative – Collagen I

6 days of ex vivo skin treatment



Collagen I staining was quantified in the papillary dermis using cellSens software



Retinol 0.05% boosts collagen I by **16%**

Retinyl Palmitate, significantly boosts collagen I, but at higher concentration than Retinol – and dose dependently

- **34%** collagen I boost at 0.18%
- **44%** collagen I boost at 0.73%

Column	Retinol equivalent
0.05% Retinol = 0.1% Retinol CB50	1x
0.18% Retinyl Palmitate	2x
0.73% Retinyl Palmitate	8x

Collagen I is the most abundant collagen in the dermis but more difficult to boost

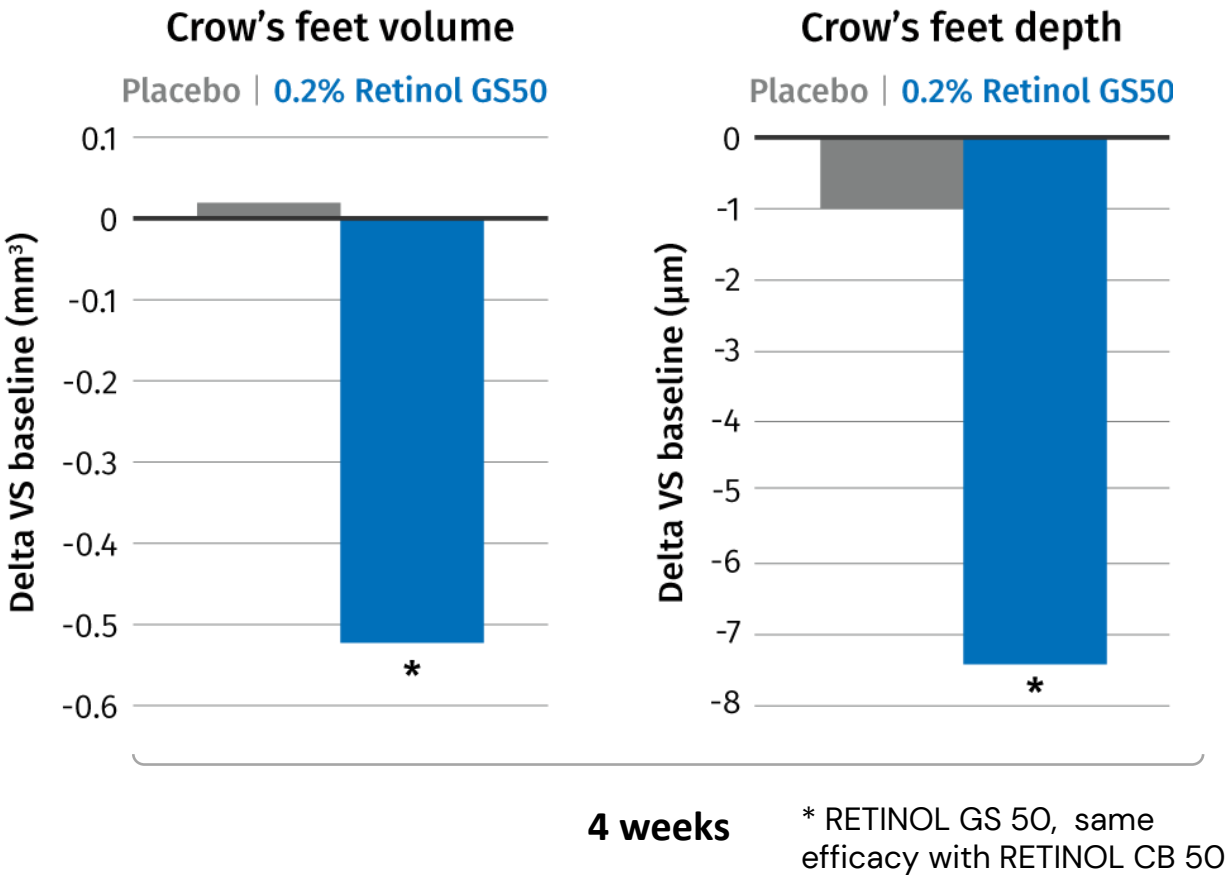
Retinol* proven to reduce crow's feet wrinkles in just 4 weeks

Visible effect and quantification by Primos^{lite} measurement

Wrinkles reduction



In 4 weeks only

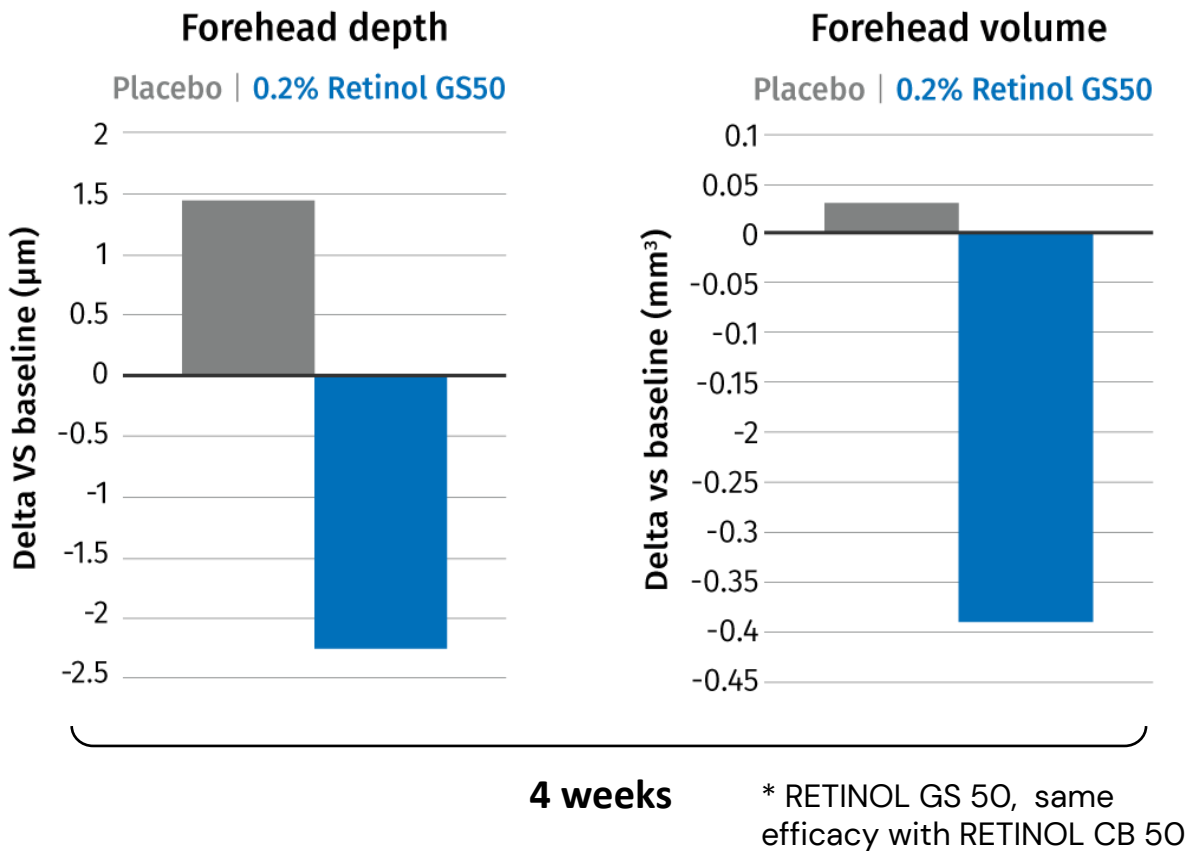


Significant ($p<0.05$) improvement on crow's feet parameters (less volume and depth).
In the same time placebo effect was negligible.
With prolonged retinol application a continuous improvement over time is expected

Retinol* proven to reduce forehead wrinkles in just 4 weeks

Primos^{lite} measurement

Wrinkles reduction



Strong trend for improvement on forehead wrinkles (less volume and depth)

In the same time placebo was ineffective with slight aggravation

With prolonged retinol application a continuous improvement over time is expected

Formulating with Retinol CB 50

- **RETINOL CB 50** is soluble in fats and oils
- Sensitive to Oxygen. It is therefore recommended to manufacture retinol formulations under an inert atmosphere or to reduce the presence of Oxygen during handling and production to the possible minimum.
- Sensitive to higher temperatures (> 40°C) and daylight.
- To improve the stability of **RETINOL CB 50** in the formulation it is recommended to add chelating agents like EDTA, UV absorbers like PARSOL® Guard* and antioxidants like Mixed Tocopherols or STAY® -C 50.
- **STAY-C® 50** has recently shown high performance to recover retinol content at room temperature and 40 °C. Be aware, that it is a salt and may impact the stability of electrolytes sensitive systems.
- Recommended pH of the final formulation: 4.5 – 8.0

Suggested dosage :

Retinol: 0,1 to 0,2%

Vitamin A palmitate 1 Mio (for ex): 0,05 to 0,6%

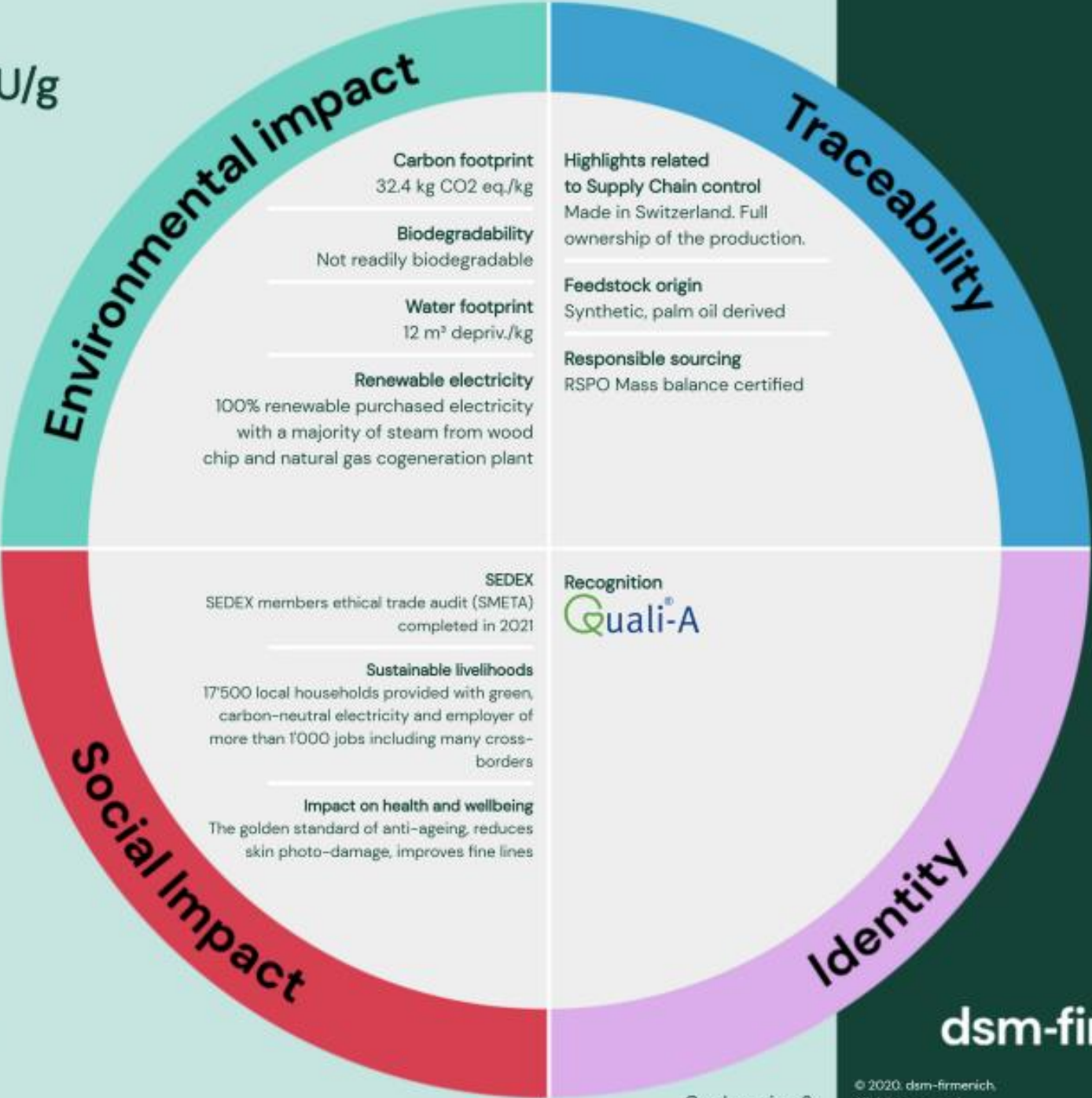


Vitamin A Palmitate 1.7 MIU/g (tocopherol)

INCI name: TOCOPHEROL, RETINYL PALMITATE
Product codes: 0418579

Vitamin A:
protects the skin against
photodamage for better ageing

The carbon and water footprint calculations are based on internally conducted LCA according to ISO 14040/44 guidelines, dsm-firmenich LCA policy and validated by an internal reviewer. The biodegradability is based on relevant OECD tests.



Aligned with and contributing to the
SUSTAINABLE DEVELOPMENT GOALS



Vitamin E

*Antioxidant to create and
protect alluring skin every day*



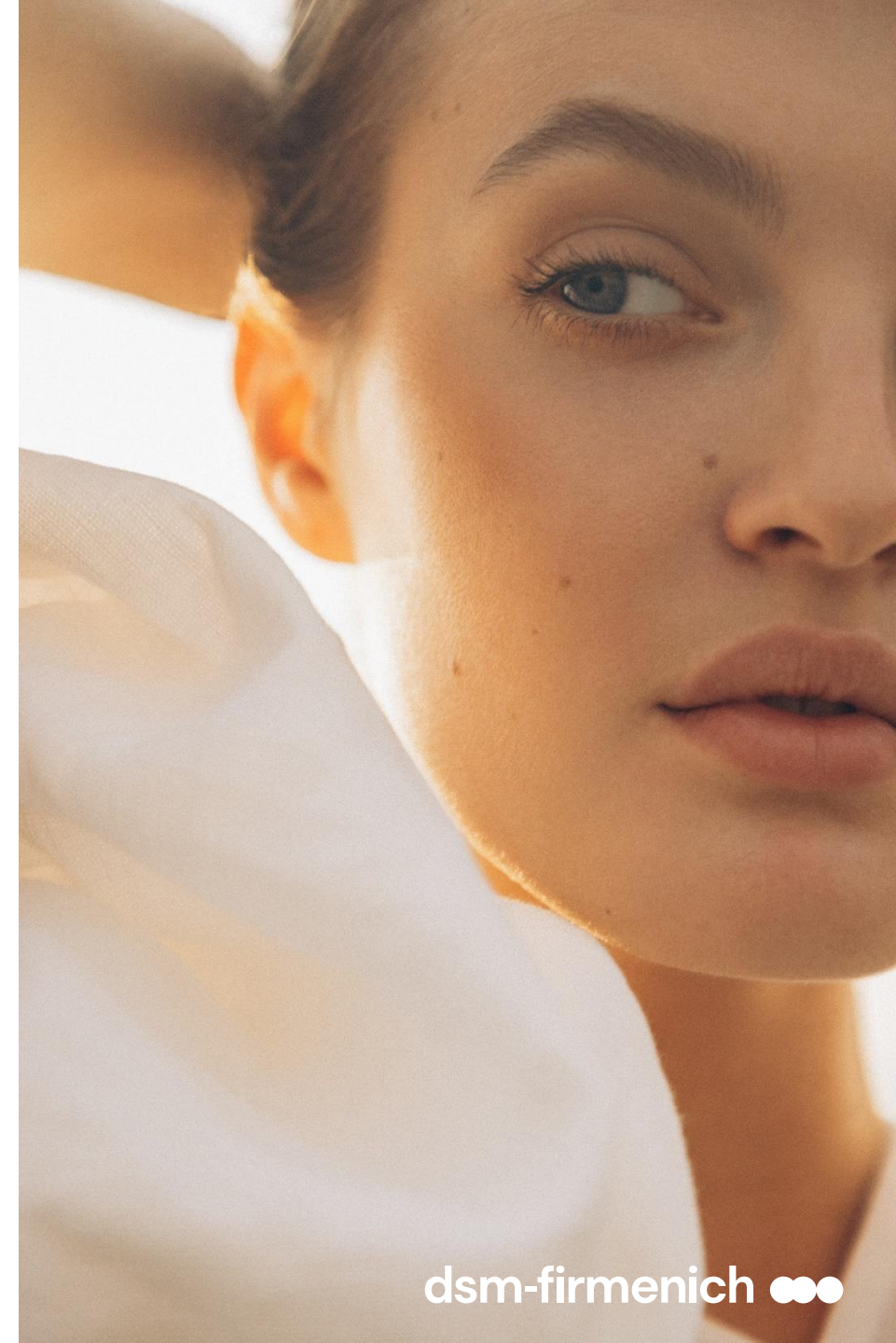
Vitamin E

The most often used active in Cosmetics !

Almost 1 out of 2 cosmetic products contains Vitamin E

The scientific evidences that might explain why Vitamin E is so popular:

- Its biology in the skin
- Its delivery to the skin
- Its activity ➔ **the anti-oxidant powerhouse**
the preventer



Vitamin E in cosmetics

What forms for what?

	Natural Source vitamin E 	Synthetic vitamin E 
Bioavailability Stability	Tocopherol = Free alcohol form	 AND Strong Antioxidant  Mixed Tocopherols 95 dl-α-tocopherol
	Tocopheryl Acetate = Stabilized form = Ester	d-α-tocopheryl acetate dl-α-tocopheryl acetate

Vitamin E benefits in Beauty & Care

SKIN CARE

- Improves skin hydration
- Soothes and calms irritated skin thanks to *in vitro* anti-inflammatory properties
- Strengthens the skin's barrier function, protecting it from environmental stressors.
- Helps improve acne-prone skin



SUN CARE

- Protects the skin from UVs acting as a free-radical scavenger
- Synergistic Effects with Sunscreen
- Moisturizing and anti-inflammatory properties can soothe sunburned skin, reducing discomfort (aftersun)



HAIR CARE

- May support hair growth and Hair Shine by reducing oxidative stress in the scalp.
- Prevents split ends thanks to its moisturizing properties that reduces hair dryness
-



MAKE-UP

- Provides antioxidant protection to the skin against environmental aggressors
- May support the shelf-life extension of products



Vitamin E is in 1 out of 2 cosmetic products

45% of cosmetic products contains Vitamin E*



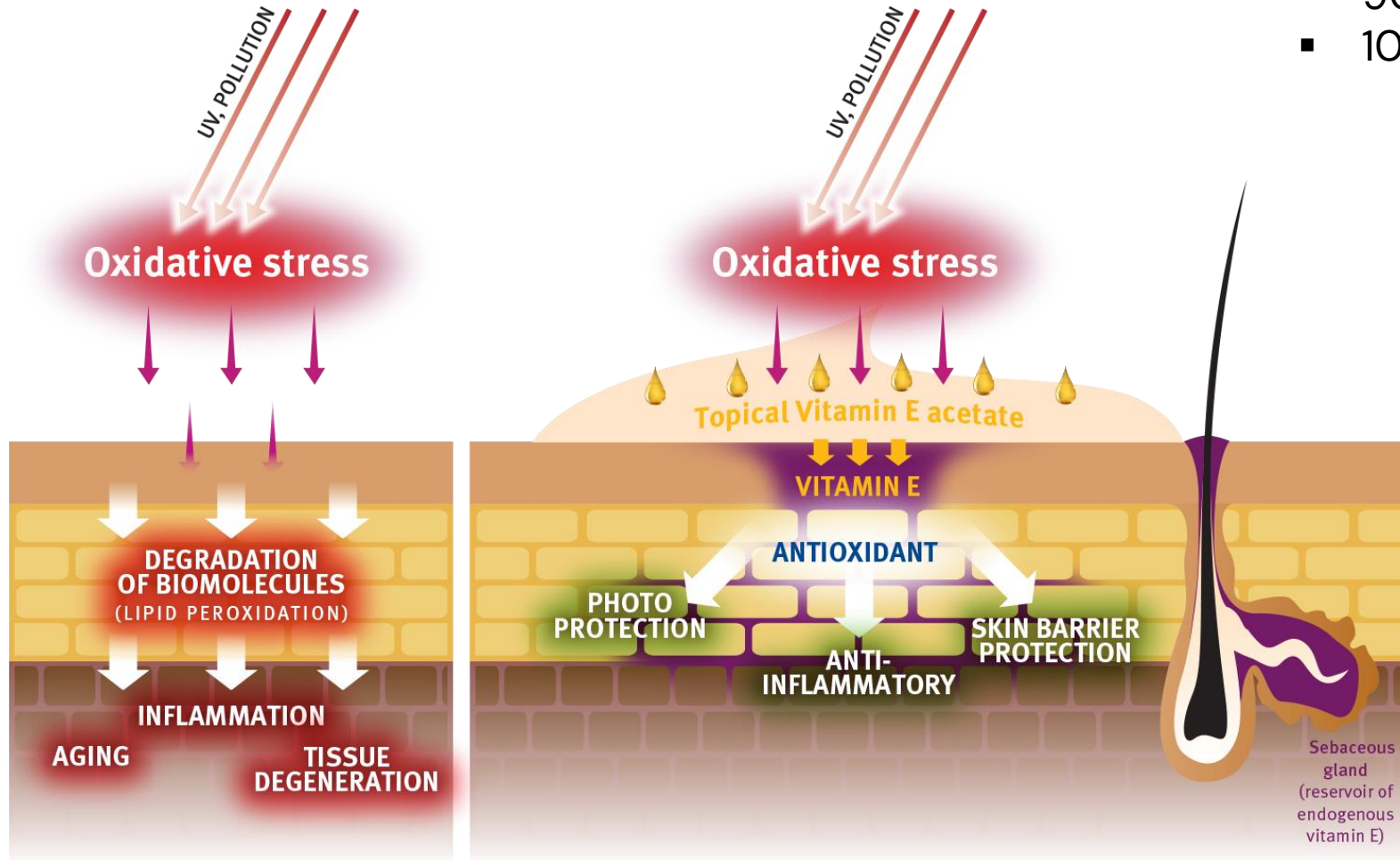
*[Mintel search years 2020–2025]

Vitamin E

Biological activity on skin

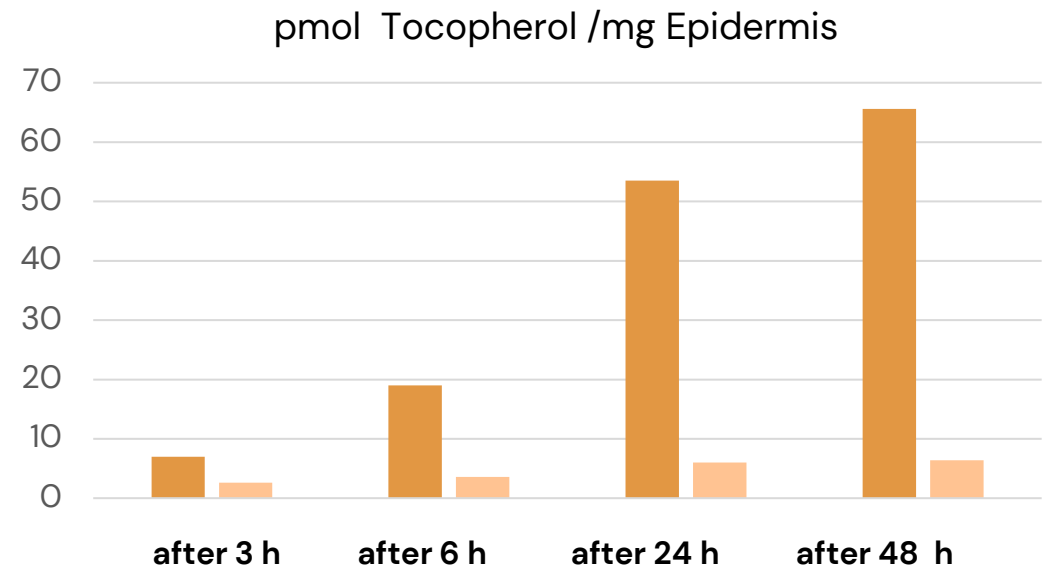
In the Skin⁽¹⁾

- 90% α - Tocopherol
- 10% β -, γ -, δ - Tocopherol



Vitamin E

Vitamin E acetate is converted to tocopherol on skin (1,2)

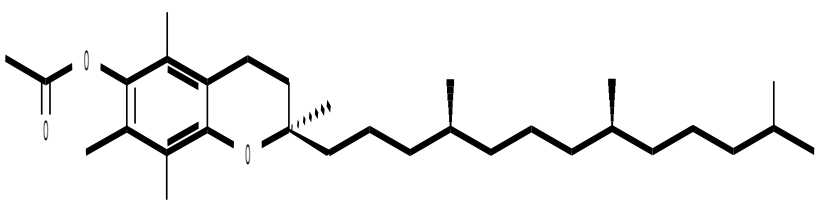


- Single application of a 5% Vitamin E acetate in cream
- Determination of released tocopherol in the skin by GC-MS

 Tocopherol from hydrolysis of applied deuterium-labeled Vitamin E acetate

 Endogeneous tocopherol

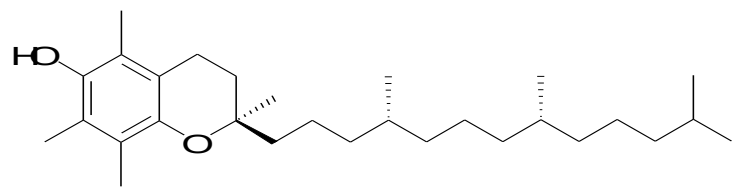
K.A.Kramer-Strickland,
J.Invest.Dermatol, 1998



Vitamin E acetate



Conversion on human skin by esterases (1)(2)



α-tocopherol

Vitamin E helps preventing photo-aging

Helps to reduce formation of sunburn cells

Sunburn cells are keratinocytes undergoing programmed cell death (apoptosis) after they have received a UVB dose that irreversibly and severely damaged their DNA.

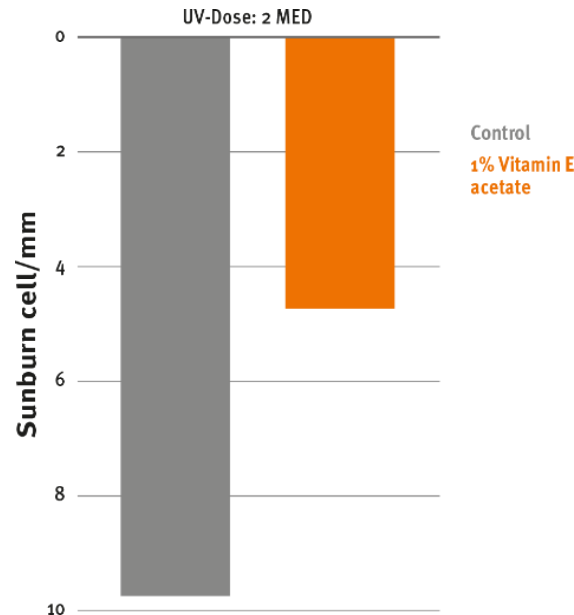
An increasing number is a key indicator for ongoing damage in the epidermis

This increasing number can easily be quantified by characteristic staining (hematoxylin-eosin)/ morphology in histology.

An in-house competence

Internal study details

1% Vit E acetate twice daily for 5 days prior UV irradiation.
Biopsies taken 18h after UV exposure.
Sunburn cells were counted and are expressed as cells per mm of epidermis



Formulating with vitamin E

- Vitamin E forms are miscible in fats and oils
- The ester forms (toco. acetate) are extremely stable (e.g. towards temperature and air) in formulations.
- The tocopherol forms (dl- α tocopherol and mixed tocopherols) are sensitive towards oxidation. It is recommended to add them below 40°C or at the end of the heating phase

Suggested dosage:

dl- α tocopherol : 0,05 to 0,2%

tocopheryl acetate : 0,5 to 5%

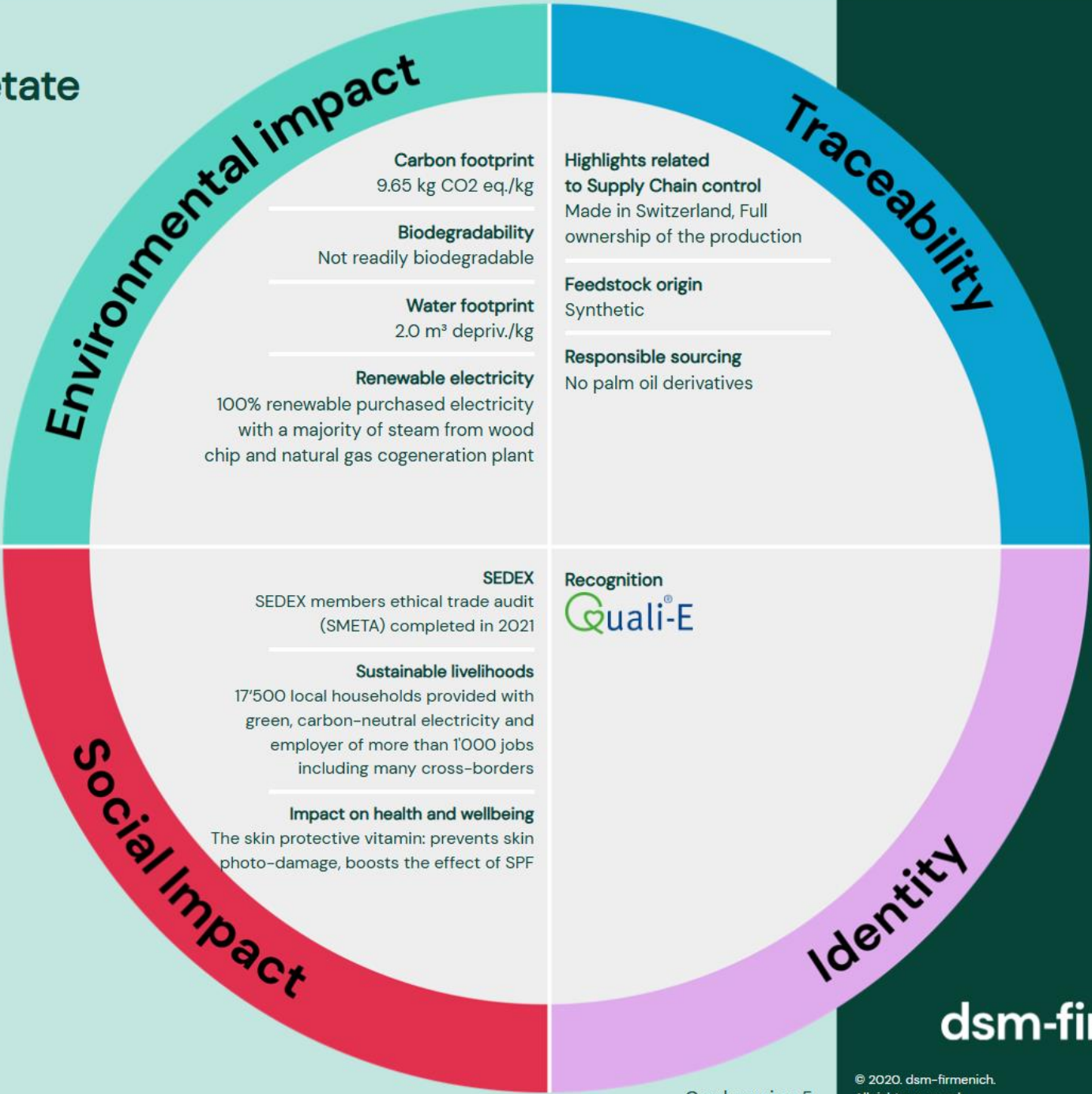


DL-alpha-Tocopheryl Acetate

INCI name: Tocopheryl Acetate
Product codes: 0420085

The sustainably produced Vitamin E with a lower carbon footprint compared to coal based supply.
Vitamin E plays a crucial role in oxidative regeneration of skin exposed to stressors.

The carbon and water footprint calculations are based on internally conducted LCA according to ISO 14040/44 guidelines, dsm-firmenich LCA policy and validated by an internal reviewer.
The biodegradability is based on relevant OECD tests.



Aligned with and contributing to the
SUSTAINABLE DEVELOPMENT GOALS



dsm-firmenich

BEAUPLEX™

*All-in-one vitamin compound
for successful skin care products*

VH



BeauPlex® VH

Hair Benefits for the Vitamin Blend



dsm-firmenich own study

Innovation

Helps prevent hair loss (improves hair density and thickness)

- **76% Proliferation** of hair follicle keratinocytes- *ex vivo*
- **Prolongation of anagen phase of hair follicles.** 2x more than placebo- *ex vivo*
- **Increases hair thickness** (4%) and **density** (+7%) – *in vivo*
- **Increase Anagen to Telogen ratio** –*in vivo*

Helps prevent the appearance of greying hair
(helps recover hair pigmentation)

- **7% hair greying reduction** after 4 months– *in vivo*
- **60% of volunteers** showed **improvement in hair pigmentation** with BeauPlex® VH

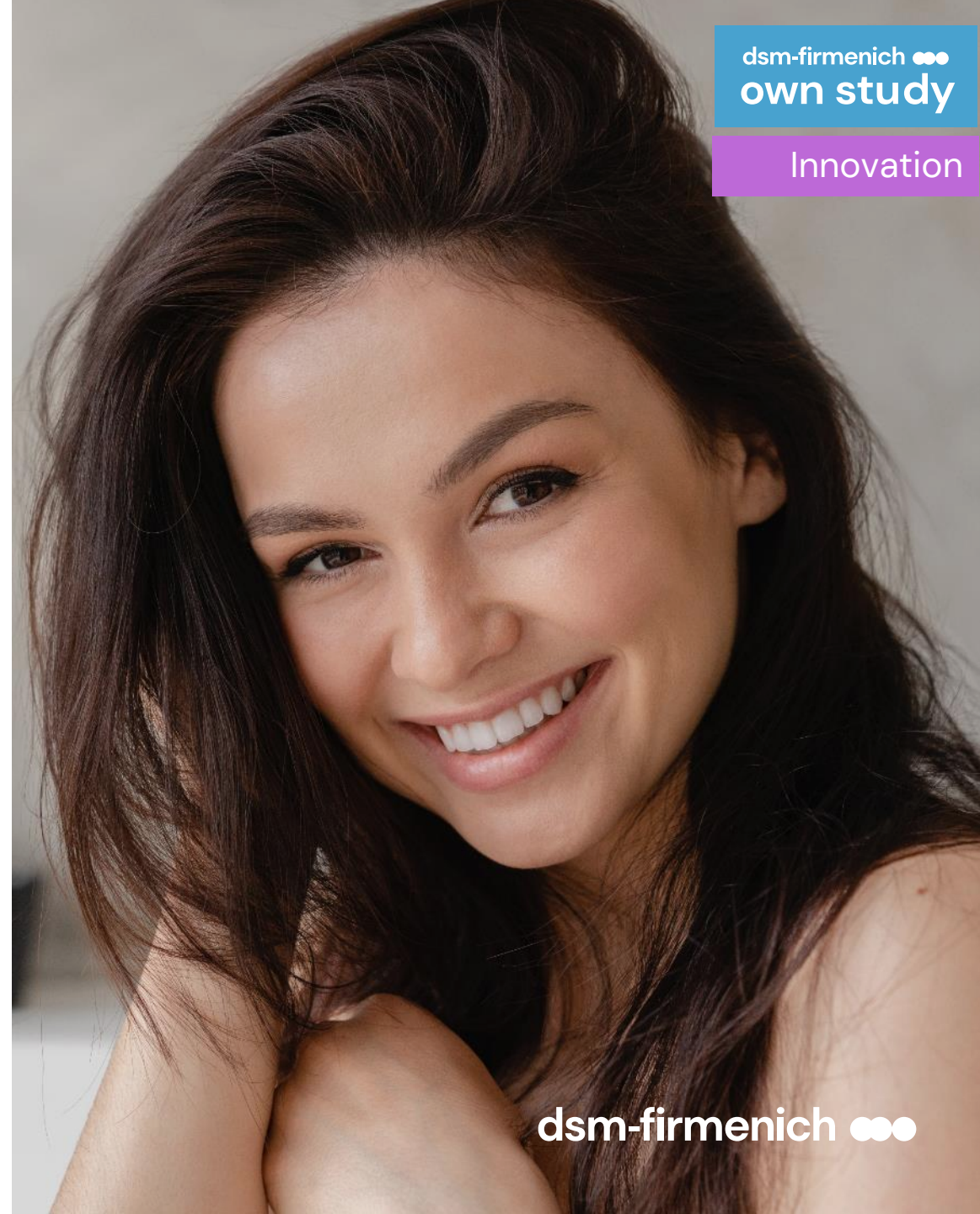
Other benefits: base on individual vitamins results

- **Hydration and scalp barrier** improvement
- Strong **anti-oxidant properties**

Key features:

Blend of Vitamins for Hair & Scalp
(Vitamin B3, B5, B6, C and E)

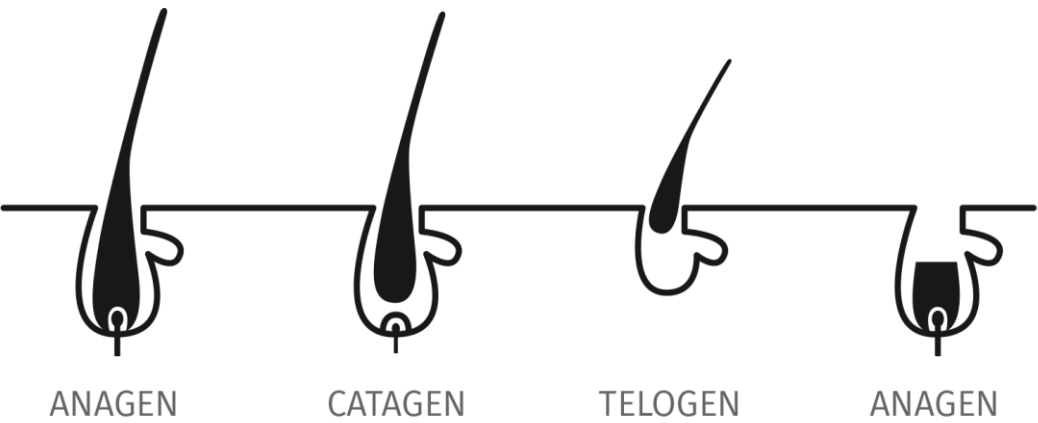
Use level: 1.5%



dsm-firmenich

BeauPlex® VH
Help prevent hair loss

The hair growth cycle consists of 3 distinct stages:



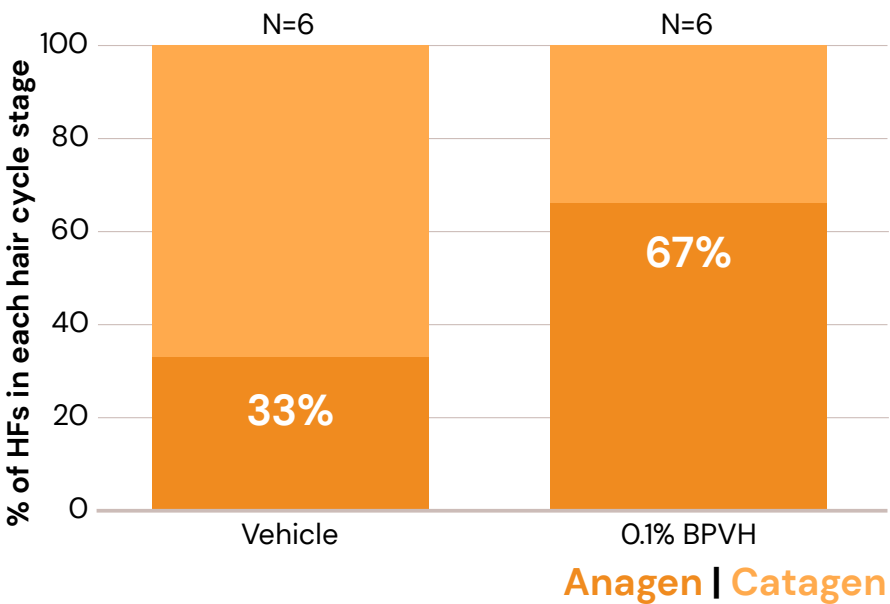
BeauPlex® VH 0.1% prolongs anagen phase of hair follicles

dsm-firmenich own study

ex vivo study

Innovation

Macroscopic hair cycle staging



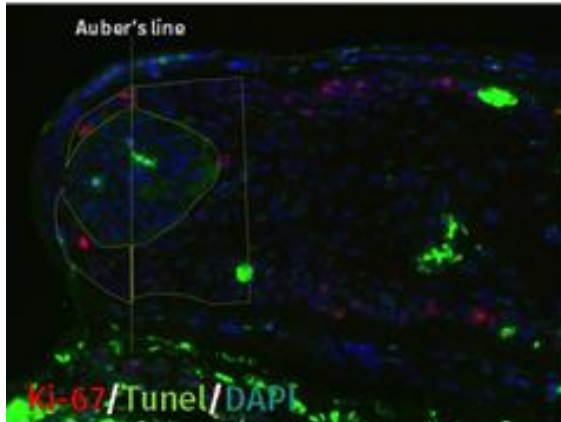
2x more hair follicles in the anagen phase with BeauPlex® VH than placebo

BeauPlex® VH

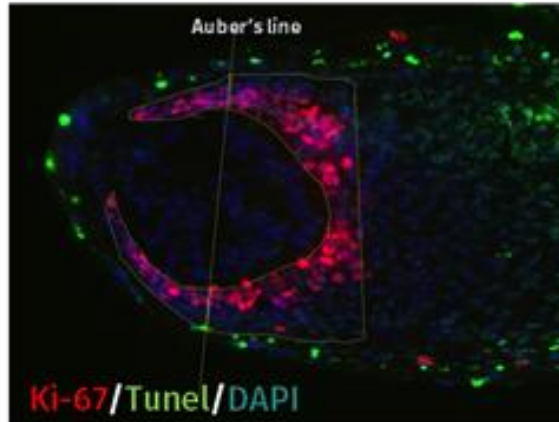
Helps prevent hair loss

Keratinocytes make up the hair shaft and need to proliferate in order to support the hair growth.

Vehicle

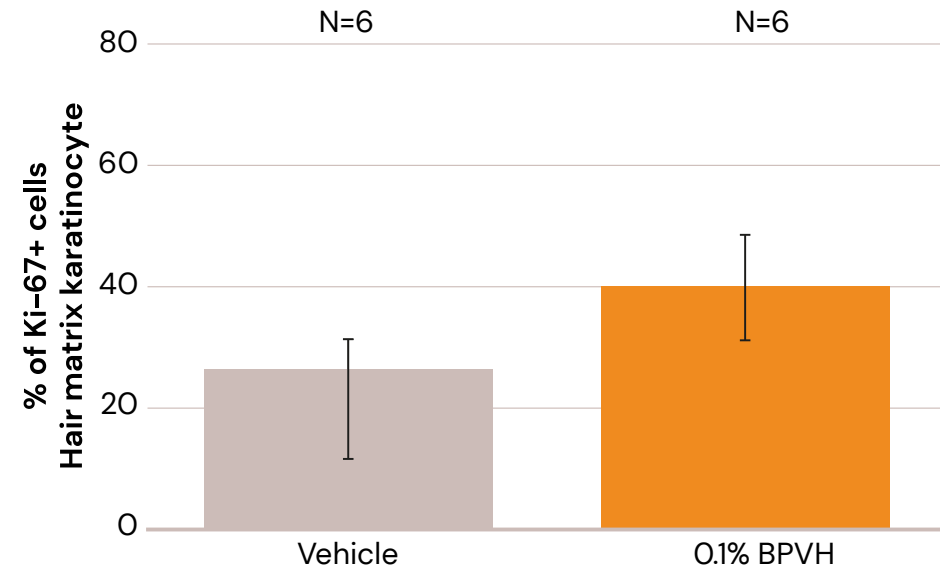


0.1% BeauPlex® VH



Increased Ki67-staining (red) in **BeauPlex® VH** treated follicles compared to vehicle.

Hair matrix keratinocytes proliferation

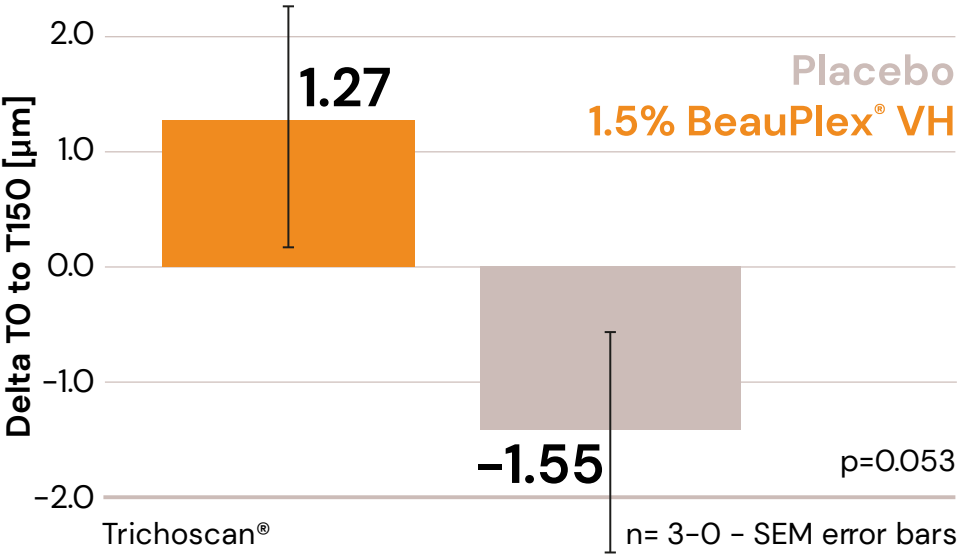


76% increase of hair matrix keratinocytes proliferation with **0.1% BeauPlex® VH**

BeauPlex® VH

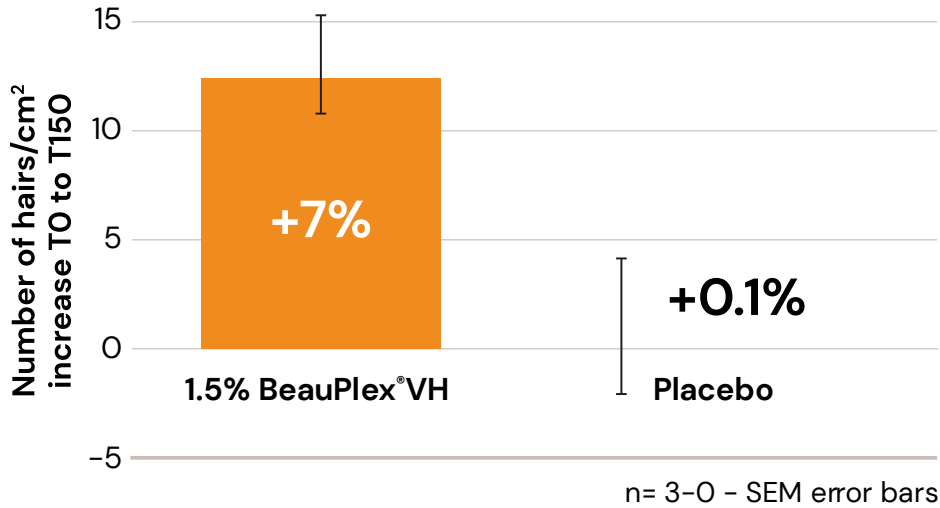
Increases hair thickness and density

Hair Thickness



4% Increase of hair diameter using Vitamin blend BeauPlex® VH, while hair thinning is observed with the Placebo Leave-on after 5 months treatment

Hair Density



7% increase in hair density versus T0 using BeauPlex® VH

Better performance than Placebo after 5 months

BeauPlex® VH

ID Card

Key benefit:	Helps prevent hair loss (improves hair density and thickness)	Anti-aging (anti-oxidant properties)	
	Helps reduce the appearance of greying hair	Scalp Care (improves scalp barrier and moisturization)	
INCI name:	Niacinamide, Calcium Pantothenate, Sodium Ascorbyl Phosphate, Tocopheryl Acetate, Pyridoxine Hydrochloride, Maltodextrin, Sodium Starch Octenylsuccinate, Silica		
Description:	Vitamin blend (B3, B5, B6, C and E)		
Technical:	Form: Powder	Preservative: Free	Target: Scalp and hair fiber
	Use level: Up to 2%	Solubility: Dispersible in water	Biodegradability: Not expected to be persistent, bioaccumulative nor toxic.
	pH of use: 5 to 9		

Registration certification



Prevent hair loss is a drug claim in USA to use improves hair density
Quality for Life™ seal that guarantees the highest standards for Quality, Reliability, Traceability, and Sustainability.

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