FOOD CHEMISTRY SOCIETY

- Specialist group in the SOCIETY OF GERMAN CHEMISTS -

Working group cosmetics

Data sheets for evaluating the effectiveness of active ingredients in cosmetic products.

Niacinamide (Vitamin B3)

1. Definition of terms

Niacin is the collective term for nicotinic acid (pyridine-3-carboxylic acid) and nicotinic acid amide (pyridine-3-carbamide), which belong to the vitamin B complex [1].

2. Active substance used

Common name	INCI-designation	CAS-Number
Niacinamide Nicotinamide	Niacinamide	98-92-0

3. Application as a cosmetic active ingredient

Niacinamide is used as a skin and hair conditioner. In contrast, nicotinic acid esters are used to stimulate blood circulation, whereby the release of nicotinic acid on the skin can cause reddening [2]. Niacinamide does not have these properties and is well tolerated by the skin in the commonly used concentrations (up to 5%) [21]. When using niacinamide as a skin and hair care substance, the release of nicotinic acid in the cosmetic formulation should be avoided.

3.1. Skin penetration and release

As a water-soluble substance, the penetration of niacinamide is limited. From different formulations, 10-30% of niacinamide is absorbed by the skin after 1 to 2 days [3; 4; 21].

3.2. Stability

Like all B vitamins, niacinamide is readily soluble in water [1].

Niacinamide is stable in a pH range from 3 to 7.5 [4; 5].

In strongly acidic or alkaline formulations, niacinamide hydrolyzes to nicotinic acid [4; 6]. As a result, it can only be used to a limited extent next to strongly acidic or basic components [7].

In stability studies, no instabilities were observed in care creams containing niacinamide in the above-mentioned pH range.

4. Described cosmetic effects

Improvement in skin regeneration and reduction of wrinkles

- Accelerated skin renewal [8; 9] by activating cellular proliferation and differentiation processes, which can be detected via the biomarkers involucrin and filaggrin [10].
- wrinkle reduction [11; 12] as well as higher skin elasticity due to increased collagen production [10] and normalisation of the GAG (glucosaminoglycan) content in the skin [12].
- Reducing pore size and improving a smooth skin surface by enhancing collagen synthesis [12; 13].
- Improved skin barrier by reducing TEWL (transepidermal water loss) [14; 9] and increased ceramide synthesis [8; 14].

Reduction of uneven pigmentation and skin lightening

- Inhibition of transport of melanosomes from melanocytes into keratinocytes, melanin release is prevented [15; 16; 17] which leads to:
    - skin lightening [15; 23].
    - Reduction of hyperpigmentation; this effect is reversible (no death of melanocytes and keratinocytes) [16].
- Reduction of red spots on the face [11; 12].

- Reduction of yellow complexion by inhibition of Amadori reaction products of proteins and sugars in the skin [11; 23].

Reduction of sebum production

- by inhibiting the reaction of malonyl-CoA to fatty acids [18].
- Reduction of the formation of tri- and diglycerides [18].
- Relief of impure skin (acne) [19].

Reduction of damage caused by UV radiation.

- By increasing levels of NAD (nicotinamide adenine dinucleotide), which serves as a substrate for the production of PARP (poly [ADP-ribose] polymerase 1), DNA repairs more efficiently. Also decrease in PGE2 (prostaglandin-E2), which is also an inflammatory marker [20].

5. Use and effective concentrations

5.1. Usage recommendations

The following application concentrations for niacinamide are described:

Product group	Active concentration
Hair care products	0,05 – 0,2 % [21], 0,05 – 0,5 % [6]
Skin products in general	1 - 3 % [22], 0,5 – 5 % [5]
Anti-aging cream	Up to 5 % [3; 22; 23]
Anti-cellulite remedies	0,05 – 0,5 % [6]
Remedies against impure skin	4 % [3; 5; 22]
Skin lightening agents	2 - 5 % [3]

5.2. Effective concentrations

The following effective concentrations for niacinamide are described:

Demonstrable effect	Effective concentration
Improvement of the skin barrier	2 % [14; 9]
wrinkle reduction	5 % [11; 12]
Accelerated skin renewal	2 % [9]
Improving uneven pigmentation	
- skin lightening	5 % [15]
- Reduction of red spots on the face	5 % [11; 12]
- Decrease in yellowing	5 % [11]
- Alleviation of hyperpigmentation	5 % [11; 12; 15] not significant at 2% [16]
Reduction of sebum production	
- Improvement of the complexion of impure skin (acne)	4 % [19]
- Reduction of skin sebum content	2 % [18]

6. Clear statement of effect, promotional statements and information

Statements or "claims" with a statement on a specific effect, should always be substantiated by taking into account the conditions of use and the formulation.

7. Note

In addition to the mandatory requirements of the applicable legal standards, the general information and recommendations in this series of data sheets must be taken into account.

8. Literature

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[5] Produktinformation des Rohstoffanbieters DSM (DSM Nutritional Products Europe) zum Rohstoff Niacinamide PC

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[16] *Greatens, A*. et al: Effective inhibition of melanosome transfer to keratinocytes by lectins and niacinamide is reversible. Exp. Dermatol. 14 (2005), 498-508

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[23] *Kerscher, M.:* Update on cosmeceuticals. JDDG 9 (2011) 4, 314–327

Notice

All valid data sheets in the current version can be found at:

https://www.gdch.de/netzwerk-struktur/fachstruktur/lebensmittelchemie-gesellschaft/arbeitsgruppen/kosmetische-mittel.html