

Vitamins in Cosmetics

Vitaminok a kozmetikumokban

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ÖSSZEFOGLALÁS

A kozmetikumokban legáltalánosabban használt vitaminok legjelentősebb hatásai és alkalmazási területük. A panthenolt, a B₅-vitamin provitaminját, jó bőrpoló, gyulladásgátló hatása miatt elterjedten használják, és ugyanígy a hajápolásban is. Az E-vitamin elsősorban "in vivo" antioxidáns, védi a bőr zsíradékát az UV-károsodástól, és a bőr belső felületén hatva, kiegészíti a fényvédők hatását. Az A-vitamin legfontosabb kozmetikai hatása az epidermisz megvastagítása, ami növeli a fényártalom elleni védelmet. Az öregedő bőr vitaminjának is nevezik. Még a biotinnak és a C-vitaminnak van jelentősége a kozmetikai ipar számára.

ABSTRACT

Particulars of the most important actions and application areas of vitamins, most commonly used in cosmetics. The panthenol, precursor of vitamin B₅, is widely used for its good moisturizing and anti-inflammatory properties, and also in the hair care. The vitamin E is first of all "in vivo" antioxidant, protects the skin lipids from UV damage, and completes the effect of the sun filters, acting on the inner face of the skin. The most important cosmetic property of vitamin A results in thickening of the epidermis and so increasing the protection against photodamages. It is called also the vitamin of aging skin. Biotin and vitamin C are two other vitamins of interest to the cosmetic industry.

ZUSAMMENFASSUNG

Die bedeutendsten Wirkungen der in den Kosmetika am allgemeinsten verwandten Vitamine und deren Anwendungsgebiete. Das Panthenol, das Provitamin des Vitamin B₅ wird wegen der guten hautfliegenden, entzündungsdämmenden Wirkung und auch in der Haarpflege verwandt. Das Vitamin E ist in erster Linie ein Antioxydant "in vivo", der das Fett der Haut vor den UV-Schäden schützt und auch die Filterwirkung des Sonnenlichtes – wirkend auf der Innenfläche der Haut – ergänzt. Die wichtigste kosmetische Wirkung des Vitamins A ist die Verdickung der Epidermis, durch die der Schutz gegen die Sonnenlichtschäden gesteigert wird. Das Vitamin A wird auch das Vitamin der alternden Haut genannt. Auch das Biotin und das Vitamin C sind in der kosmetischen Industrie noch sehr bedeutend.

Vitamins are used nowadays by all important cosmetic manufacturers and this in increasing quantities. Many cosmetic product lines are positioned in the market on the basis of benefits demonstrated with vitamins. But vitamins are also used to widen the activity spectrum of those cosmetics whose concepts are based mainly on other active ingredients.

There are several reasons for the success of vitamins in cosmetics: the scientific benefits, the trend towards natural and nature-identical cosmetic ingredients and, last but not least, consumer awareness of the beneficial effects of vitamins.

Panthenol, the alcohol form of Vitamin B₅, was the first vitamin used in substantial quantities in cosmetics. Developed in the fifties as a wound healing agent for pharmaceutical ointments and creams it was first used in the sixties by the hair care industry as a conditioning agent for hair and scalp. Later the skin care industry began to make use of its moisturizing and anti-inflammatory properties.

Today there is virtually no cosmetic product category in which Panthenol does not regularly appear as an active ingredient.

In the early eighties, with the increasing scientific evidence of the destruction of the ozone layer and its consequences for the human skin as well as the realisation of function of Vitamin E as a free radical trapper, this vitamin won the attention of the cosmetic industry. As a consequence Vitamin E was incorporated into sun care products in particular, but also in many other cosmetics such as body lotions, facial creams or baby oils.

Eighty years after its identification as an essential nutrient Vitamin A gained the interest of the cosmetic chemists in the early nineties. They use Vitamin A particularly for products targeted for use in aging and photodamaged skin.

Other vitamins used in cosmetics are Vitamin C, Vitamin B₆, Niacinamide and Biotin.

Panthenol

Panthenol is the biologically active alcohol analogue of Pantothenic Acid, a vitamin of the B-complex group, which is a normal constituent of skin and hair. Pantothenic acid, also called Vitamin B₅, carries out its function in the body through its conversion to co-enzyme A. This substance is present in all living cells and serves a vital role in a variety of enzyme-catalyzed reactions. Thus it is involved in many metabolic processes through which energy is released from carbohydrates, fats and proteins.

The use of Panthenol in cosmetics and toiletry products is based on its dual role, as a vitamin precursor and as an ingredient with ideal cosmetic properties. When applied topically, Panthenol is absorbed by the skin where it is converted into pantothenic acid.

Dermatologists have long been aware of the value of Panthenol for the skin. There is considerable evidence that topically applied Panthenol is an aid in the healing of superficial wounds, burns, dermatitis and many other sores of the skin.

Panthenol was tested as a wound healing aid mainly in the 1950's and early 1960's. From those years there exist numerous enthusiastic case reports from medical doctors who tested Panthenol in all kind of skin problems. Aprahamian (1985) demonstrated that Panthenol induces an accelerating effect on the normal healing process and improves the quality of the scar. With an ointment containing 5% Panthenol, Weiser (1986) showed a reduction of the wound healing time by 30%.

Its good moisturizing properties made Panthenol one of the most widely used active ingredients in all kind of skin care products. Its additional effect on the epithelisation process and its anti-inflammatory properties make Panthenol an ideal ingredient for products applied to skin stressed by erythema (Figure 1), inflammation or small skin lesions.

Product	Number of test zones	Intensity of skin reaction			
		none	+	++	+++
Panthenol ointment	58	57	1	0	0
Placebo ointment	65	3	58	4	0

Figure 1. Panthenol helps in the prevention of UV-induced erythema. 62 test subjects irradiated with 1 MED + 2 minutes. Ointment applied before irradiation. Lange 1957.

As a hygroscopic substance Panthenol acts as a humectant for hair (Figure 2). In addition, it strengthens the hair shaft. The efficacy of Panthenol in hair care products is a result of strong deposition onto the cuticle and deep penetration into the hair cortex. Furthermore, it penetrates the scalp and provides the hair roots with the nutrient pantothenic acid.

Panthenol also improves the resistance of hair to mechanical stress. Hair tresses repeatedly treated with a Panthenol-containing shampoo and mechanically stressed in a combing machine have shown less split-end formation than hair treated with a shampoo without Panthenol.

mg water per g hair

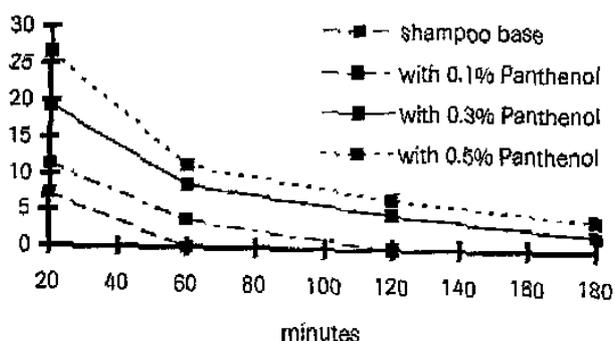


Figure 2. Moisture retention of hair after treatment with a shampoo with various Panthenol concentrations. Dermatech of Connecticut, 1990.

Vitamin E

Vitamin E is known for its protector function. The central role of Vitamin E is that of an 'in vivo' antioxidant. Just as it is used in edible oils and fats to prevent rancidity, it is incorporated into cosmetic products to protect the skin lipids from decomposition.

These lipids, important components of the cell membranes are under constant attack from free radicals formed both in the course of normal biological reactions and also from various external factors, such as oxygen, UV light from the sun or the environmental pollutant ozone. A suc-

cessful attack by these radicals means damage to the skin lipids by peroxidation. Such impairment leads to changes in the structure of the skin. It becomes wrinkled and appears older.

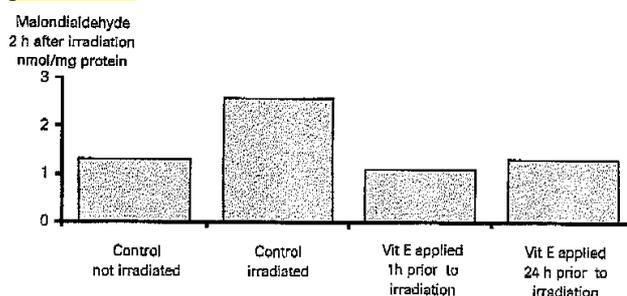


Figure 3. Topically applied Vitamin E acetate (1% in ethanol) reduces UV-induced lipid peroxidation in the epidermis. UV dose 1 MED. Record 1991.

Current research indicates that the extent of peroxidation damage is controlled by antioxidants such as Vitamin E. That Vitamin E protects the skin lipids from UV damage has been shown by, amongst others, Record (1991). Topical administration of a 1% solution of Vitamin E 1 and 24 hours before irradiation reduced the degree of lipid peroxidation (Figure 3). Pathak (1988) reported that repeated application of Vitamin E to the skin reduces the number of sunburn cells formed as a consequence of UVB radiation. In 1990 Bisset published the results of a study on the photoprotective effect of topically applied antioxidants. Both Vitamin E and Vitamin C reduced the severity of UV-induced skin wrinkling in hairless mice.

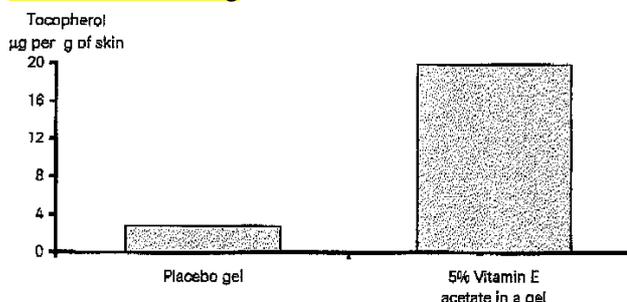


Figure 4. Bioconversion of Vitamin E acetate into tocopherol in the skin. Vitamin E daily applied to hairless mice. Results after 10 days. Norkus 1983.

In a topically applied product containing sun filters and Vitamin E, the filters absorb or scatter the UV rays on the surface of the skin. Vitamin E, however, acts on the inner surface of the skin. It prevents the formation of free radicals in both epidermis and dermis.

Many sun care products include, therefore, beside sun filters. Vitamin E. This vitamin, however, is never an alternative to sunscreens. The main protector agents in sun care products are the sun filters. Vitamin E completes and improves the protector function by reducing the risk of damage that could be caused by UV rays passing through the sunscreen barrier.

Vitamin E is used in cosmetic preparations in its stable ester form, Vitamin E acetate. In the skin, it is bioconvert-

ed into the biologically active antioxidant tocopherol as has been demonstrated by Norkus (1993). Free tocopherol levels in the skin were significantly increased by topical application of Vitamin E acetata (Figure 4).

Vitamin A

Vitamin A is one of those biologically active substances involved in the creation and maintenance of healthy skin. The most important cosmetic property of Vitamin A is its stimulating effect on cell proliferation, an action which finally results in a thickening of the epidermis thus improving the barrier function of the skin.

The first microscopically apparent change that results from a topical application of Vitamin A is an increase in mitosis in the basal layer of the epidermis. Sherman (1961) treated skin with an aqueous suspension containing 1600 IU/ml of Vitamin A acetate. Four hours after a single application the mitotic activity was 65% above the placebo level.

As a result of the increased mitotic activity more cells are formed and the epidermis becomes thicker. Counts and his colleagues (1988) applied varying concentrations of Vitamin A to the skin of mice. After daily application of an emulsion containing 1000 IU/ml of Vitamin A palmitate the epidermis was 50% thicker than placebo treated skin; areas treated with 5000 IU/ml were 75% thicker (Figure 5). In addition, he observed an increase in collagen formation in the dermis.

There is evidence that UV light strongly effects Vitamin A concentration in the epidermis and dermis. Berne (1984) demonstrated low levels of Vitamin A in human epidermis, as well as in epidermis and dermis of rabbits after UV exposure. It cannot be excluded that low levels of Vitamin A in the skin are responsible for some symptoms of photo-damaged skin. The regular use of Vitamin A-containing cosmetics helps to stimulate the cell renewal process so reducing the risk of photodamaged skin.

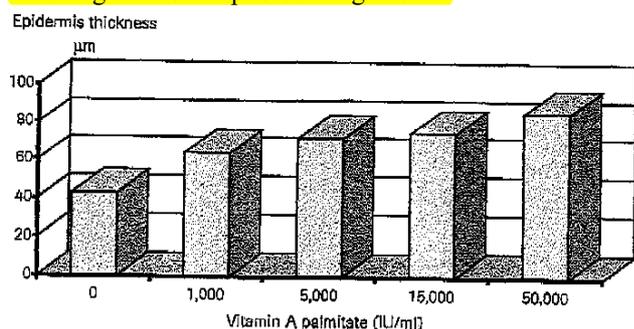


Figure 5. Topically applied Vitamin A increases epidermis thickness. Daily application of Vitamin A palmitate for 13 days to mice. Counts 1988.

In the process of aging many aspects of skin structure are altered, e. g. the epidermis becomes thinner due to a stow-down in the metabolism of the skin. As a result, the skin loses part of its barrier function and, as a consequence

of reduced water retention capacity, it often becomes dry, scaly or even cracked. More seriously even, it renders people more susceptible to environmental assault, disease, etc with age.

By stimulating the cell renewal process Vitamin A can counteract this process. A thickening of the epidermis improves the barrier function of the skin. This reduces the transepidermal water loss which has a positive effect on the symptom of dry and brittle skin. That is why Vitamin A is called the vitamin for aging skin.

Vitamin A not only improves the barrier function of the skin, but also its appearance and, in particular, its elasticity, as was shown by Fthenakis et al (1991). They applied a lotion with or without Vitamin A palmitate to the temples of a group of 40 to 60 year-old volunteers and measured the elasticity of the skin by ballistometry (Figure 6). In the areas treated with placebo there was little difference between the initial and final values. In the areas treated with Vitamin A on the other hand, elasticity improved by 14% after two weeks and by over 22% after six weeks.

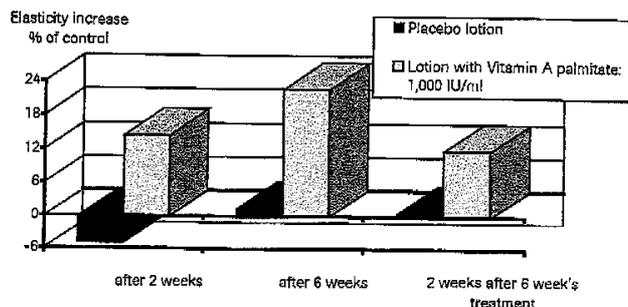


Figure 6: The effect of Vitamin A palmitate on skin elasticity in humans. Vitamin A lotion daily applied to temple. Elasticity measured using ballistometry. Fthenakis 1991.

Vitamin A per se is an alcohol called retinol. In cosmetics, Vitamin A is used mainly in its esterified forms Vitamin A palmitate and Vitamin A acetate. Neither of these is very stable when exposed to light and warmth, and this has to be taken into consideration when formulating and packaging cosmetic products.

Biotin and Vitamin C are two other vitamins of interest to the cosmetic industry. The antioxidant activity of Vitamin C would ideally complement and complete the effects of Vitamin E. Vitamin C could act as a free radical scavenger in the hydrophilic part of the skin whilst Vitamin E would do the same in the lipophilic part. The instability of Vitamin C is, however, a limiting factor for its more regular use in cosmetics.

Biotin is involved in the formation of keratin, the main component of hair, nails and the uppermost layers of the skin. Biotin is used today mainly in oral forms to treat or prevent brittle finger nails. In addition it is ingested to maintain healthy hair. More and more frequently it is also being incorporated into skin care products.