

# Vitamins in cosmetic products – just additives or added benefit as well?

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Vitamins belong to the most frequent components in cosmetic products. With their positive image they always are useful for marketing purposes – even when added to a rinse-off product where they will not remain on the skin. By the same token, specific vitamin-containing products are beneficial in the treatment of various skin conditions. The survey informs on the use and treatments with vitamins.

**V**itamins are multifunctional substances that also occur as additives in cosmetics. Typical additive function is the protection of sensitive ingredients against oxidation during storage and application. Vitamin C (INCI: ascorbic acid) and vitamin E (INCI: tocopherol) belong to the classic substances among antioxidants.

Almost all the vitamins serve as active agents for skin care applications. According to the Cosmetic Directive, vitamin D has been banned and vitamin K<sub>1</sub> (INCI: Phytonadione) has been withdrawn from cosmetic applications based on directive 2009/6/EC since skin allergies cannot be excluded. Vitamin A is exceptional in that its effective metabolite, vitamin A acid (INN: Tretinoin) is banned in cosmetic applications. In dermatology, tretinoin is used to treat acne and cornification disorders.

Vitamins either are synthetically produced or already naturally contained in vegetable extracts and oils. In this case they are not mentioned on the INCI declaration. Vitamin-rich oils for instance are wheat germ oil (E, carotenoids) and avocado oil (E, A, D, carotenoids). Vitamin E occurs in different forms: d- $\alpha$ -tocopherol is known for its highest biological efficacy and actually referred to as vitamin E in the narrower sense of the word. Other vitamins are used as provitamins. Among them are  $\beta$ -carotene (provitamin A) which provides minimal dermal light protection if taken orally in the longer term; it should however be noted that it will not replace UV filters. It is a popular food colorant (E 160). D-panthenol (provitamin B<sub>5</sub>) is beneficial in healing minor skin lesions. It retains water, increases the skin hydration, improves the penetration of other active agents and hence is a frequent ingredient of lotions applied before masks.

Vitamin derivatives often show improved bioavailability and are chemically more stable

than free vitamins. In the skin the vitamins are released through enzyme activity. Typical examples (INCI) are Ascorbyl Palmitate and Ascorbyl Stearate. Esterification with palmitic or stearic acid converts the water soluble vitamin C into a lipid soluble state. In contrast to the free acid which has keratolytic effects in higher concentrations similar to a fruit acid, esters can easier pass the skin barrier. In the case of Sodium Ascorbyl Phosphate the vitamin remains water soluble; it is more stable against oxidation, can be liposomally transported and stimulates the collagen synthesis. Already in minor dosage the derivative is an effective tyrosinase inhibitor which for instance completely impedes melanin formation during laser treatments.

Tocopheryl acetate is a transport variant of vitamin E without antioxidant effects and frequently combined with vitamin C - analogous to the synergistic behaviour of vitamins in the cellular range. The radical scavenging property of free vitamin E minimizes the stress caused by UV radiation and has anti-inflammatory effects. Vitamin E additionally supports epithelialisation and improves the moisturizing capacity of the skin.

In the skin Retinyl Palmitate and Retinyl Acetate form free vitamin A which has regenerative effects after oxidizing into vitamin A acid. In order to stimulate the formation of vitamin A receptors it is recommended starting the treatment with low dosages. In the case of overdosing, irritations are to be expected similar to the medical tretinoin therapy. It regenerates and stimulates cell formation and collagen synthesis, a feature which is used in the care of the acne-prone skin. Systemic relevant concentrations will not occur so that it can also be moderately applied during pregnancy.<sup>1,2</sup>

<sup>1</sup> Nohynek GJ, Meuling WJA, Vaes W, Lawrence RS, Shapiro S, Schulte S, Steiling W, Bausch J, Gerber E, Sasa H, Nau H, Repeated topical treatment, in contrast to

The bioavailability of vitamins is improved when they are combined with penetration improving carrier systems. Vitamins and the native phosphatidylcholine (PC) contained in the carriers come as close as possible to the physiological conditions in the body: Water soluble vitamins can be liposomally formulated with PC. Aqueous nanodispersions transport lipid soluble vitamins. The increased bioavailability can for instance be recognized by the irritation threshold of vitamin A which is lower in this context than in so-called classic emulsions.

Vitamins interfere in various ways in the metabolism of the skin and represent an elegant variant to stimulate growth factors. Additional vitamins are compiled in the following overview:

- Vitamin B<sub>1</sub> (thiamin) is a component of yeast extracts and used to treat blemished skin.
- Vitamin B<sub>2</sub> (riboflavin): yellow colouring agent in food and cosmetics (E 101).
- Vitamin B<sub>3</sub> (niacin): in the form of nicotinic acid or nicotinic acid amide vitamin B<sub>3</sub> has regenerative and anti-inflammatory effects for blemished skin.
- Vitamin B<sub>6</sub> (pyridoxine) is a coenzyme of the amino acid metabolism. A deficiency causes dermatitis.
- Vitamin B<sub>7</sub> (biotin): a deficiency involves growth disturbance of hair, nails and the skin. The consequences are loss of hair and dermatitis.
- Vitamin B<sub>9</sub> (folic acid) influences the C1 metabolism and participates in the DNA synthesis.
- Vitamin B<sub>12</sub> (cobalamin) only is activated through conversion into coenzyme B<sub>12</sub>. Its topical effect against inflammatory skin conditions is controversially discussed.

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single oral doses with Vitamin A-containing preparations does not affect plasma concentrations of retinol, retinyl esters or retinoic acids in female subjects of child-bearing age, Toxicology Letters, 163 (1), 65-67 (2006)

<sup>2</sup> 5<sup>th</sup> Meeting of the BfR Committee for Cosmetics, Minutes of the Meeting on 6 May 2010.