Additives in cosmetic products

published in Kosmetische Praxis 2004 (1), 8-10

Besides the lipid substances for skin caring purposes and the lipid and water soluble active agents the INCI declaration of a cosmetic product generally lists a variety of further ingredients. They may be categorized with the term “additives” and have various functions.

Additives have various functions. Among other things they enable the manufacturing of products with different structures like creams, gels, pastes, lotions, solutions, varnishes, sticks, powders and aerosols. They provide the products with their long-term physical stability for transport and storage, inhibit germinating through mould, yeast and bacteria, increase the chemical stability of sensitive active agents towards the atmospheric oxygen and influence the sensory perception as e.g. consistency, dispersion on the skin, scent (fragrance) and color. They are actually not required for the skin care as such; they may even be stressful or counterproductive in this respect but may also have synergetic effects together with other active agents as some examples can prove.

Water

One of the most frequently used cosmetic additives is water (INCI: aqua) sometimes also called “profitol” with a winking as it definitely is the most profitable additive due to its low raw material cost. Water is an essential ingredient of emulsions and in combination with emulsifiers it contributes to a drop-like dispersion of the lipid substances (O/W emulsions) intended for the skin care and thus substantially facilitates their application on the skin. This also applies for W/O emulsions i.e. when drops of water are included in a lipid phase. Our sensory perception recognizes the evaporation of water as a very agreeable cooling effect. Apart from that water plays an important role as a polar solvent for (hydrophilic) active agents and additives. In combination with moisture-retaining active agents the water content of the products not only increases the skin moisture on a temporary but even on a measurable long-term base.

Preservatives

Products containing a aqueous phase are susceptible to microorganisms whereas products free of water practically will not be affected by germs. Hence, products containing water generally will be preserved. A precondition for the efficacy of preservatives is that they adequately dissolve in water on the one hand and have sufficient affinity to the lipid phase as the microorganisms settle on the interfaces of the tiny emulsion drops. Although W/O emulsions are less susceptible than O/W emulsions due to their external lipid phase there are also mostly preservatives added. The preservatives which are currently officially approved are listed in the appendix of the German Cosmetic Decree (KVO). They can be applied in small and cost effective concentrations which is an advantage however all of them include an allergenic potential for individuals with a particular disposition.
As a alternative to the KVO preservatives an adequate concentration of alcohol or moisture-retaining substances as e.g. glycerin, glycols as well as of sugar substitutes like sorbitol may provide sufficient microbiological stability. These compounds are considered to be free of preservatives however particularly the latter mentioned are more expensive to produce and hence less frequently found on the market. High concentrations of alcohol have a dehydrating effect. The advantage of the alternatives mentioned before is that they are more or less free of any allergenic potential.

Emulsifiers

Regarding the physical stability of emulsions, emulsifiers which mean a group of surface-active substances combining the aqueous with the lipid phase play a significant role. In terms of quantity they frequently are listed right after the water and the lipid substances for the skin care. In chemical respect, this group of additives shows the greatest variety of particular features. For their efficacy in the specific product physical characteristics like their molecular weight, their critical micelle concentration (CMC), their HLB value (hydrophilic-lipophilic balance), phase-inversion temperature (PIT) and the molecular geometry play an important role. These characteristics are also

important to evaluate their tolerance on the skin: the lower the molecular weight and the higher the critical micelle concentration, the higher the probability for irritating side effects for sensitive skin. This also applies for surface-active agents which are closely related to emulsifiers and used in cleansing products.
Most of the emulsifiers currently used will not modify after their penetration into the skin i.e. they will not integrate into the physiology of the skin. Particularly the use of O/W emulsifiers consequently will cause the emulsifiers to reactivate in the skin after contact with water and this even with increased effects when cleansing the skin. This gradually will lead to a loss of the natural lipid substances of the skin. In case of a long-term application of creams with a specific composition, the consumer will have the impression that his skin obviously is becoming dehydrated.
An alternative to conventional emulsifiers are natural membrane-forming substances like ceramide and phosphatidylcholine. They form layered lamellar structures in the creams similar to the barrier layers of the skin, are free of the above mentioned side effects and perfectly integrate into the physiology of the skin. A disadvantage are higher manufacturing costs compared to conventional products however it should be kept in mind that they provide an excellent combination of the positive features of additives and active agents. (For further details see KOSMETISCHE PRAXIS 5/2003).

Antioxidants

The group of antioxidants also simultaneously provides a combination of additive and active agent properties. Thus, the vitamins C and E as well as their derivates protect the sensitive ingredients of cosmetic products against the atmospheric oxygen and free radicals; on the other hand they provide the skin with specific effects. By contrast synthetically produced phenolic antioxidants as e.g. butylated hydroxytoluene (INCI: BHT) only have to be classified as additives.
As already small traces of some of the heavy metals cause the natural substances which are sensitive to oxidation to become rancid by their radical-forming effect, together with the anti-oxidants additional complexing agents based on ethylendiaminetetraacetic acid (EDTA), citric acid and salts of the phosphonic acid are combined. Traces of heavy metals which get into the product after opening the jar will thus be inactivated.

Substances controlling the consistency

Besides emulsifiers which also influence the consistency of products apart from their specific functions, additional additives are used to control the consistency of formulations. These can be thickening agents like e.g. xanthan, carrageenan, alginate or chemically modified cellulose compounds. They form gel-like structures which solidify the aqueous solutions and emulsions proportionately to their concentration.
Due to the easily reproducible properties of synthetic polymers polyacrylates have gained acceptance and can be recognized in the INCI by the term sodium carbomer. After penetration of the cream they virtually remain indifferent on the surface of the skin. Polyacrylates may be modified to provide thixotropic or quick break features which means that they liquefy after spreading or after contact with the skin.
Substances controlling the consistency which are based on sugar-like structures as e.g. xanthan influence the skin hydration as they have water-retaining features. Simultaneously the invisible film which forms on the surface of the skin decreases the transepidermal water loss. Also the mucins of aloe show a similar behavior. Thus there is no clear dividing line between additives and active agents.
Closely connected to the consistency is the spreadability of the product on the skin. For this purpose, frequently additives with specific spreading properties are used. These are substances which more or less automatically spread on the skin as e.g. synthetic esters like isopropyl myristate (IPM) or diisopropyl adipate. The advantage of an easily spreading product however can also be counterproductive as e.g. in areas like the mucous membranes of the eye which should be left untouched as irritations may result.

Perfumes in cosmetic products: improved ingredient-labeling

For the sensory acceptance of a product the perfume or scent of the preparation has proved to be of specific importance. The scent of a product finally is composed of a multitude of different chemical compounds which are impossible to specifically declare. Predominantly low-molecular compounds can be found which easily penetrate into the skin. Therefore it is no surprise that perfume oils head the list of the number one allergenic substances. For the sensitive skin dermatologists hence recommend products which are free of perfumes.

On the packaging so far the aromatic principles in perfumes just have been labeled with the term “perfume”. This however is not very helpful for the identification of the different components of perfume oils. The publication of a modified European cosmetic legislation in March 2003 changed the routine applied so far. In the appendix for the guidelines, 26 aromatic substances are listed which are more frequently associated with allergenic reactions than all the rest of them. If the agreed concentration is exceeded there has to be an indication regarding the percentage contained on the packing of the cosmetic product using the INCI terms as e.g. anise alcohol, benzyl alcohol, coumarin, eugenol, hydroxycitronellal, limonene and geraniol.
The leaflet "Klarheit für ein ungetrübtes Duftvergnügen“ which provides information on perfumes can be ordered free of charge at the following address: Industrieverband Körperpflege- und Waschmittel e.V. (IKW), Karlstraße 21, 60329 Frankfurt am Main, Tel. +49-69-25561323, e-mail: info@ikw.org, www.ikw.org

Dyes and pigments

This group of substances also comprises many different substances. Pigments sometimes are used to lighten creams and pastes and thus influence the optical acceptance. In the field of decorative cosmetics pigments are used for the skin coloring and thus actually are not part of the additives in the narrower sense. This also applies for camouflage products which predominantly have a covering function. Anorganic pigments and their product mixtures are widely used and examples here are titan dioxide and iron oxide. Organic dyes also are applied in this field. Due to their insolubility they stay on the surface of the skin and will be rinsed off with the cleansing.
Anorganic pigments like titan dioxide and zinc oxide also provide UV filter features. Therefore in sun protection products they have an active agent instead of additive function.

Dr. Hans Lautenschläger