

Active agents – the effective skin care: lipids, the basic elements

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Lipids play an important role among cosmetic active agents for the skin care. In terms of quantity, they are the most frequently used ingredients of cosmetics besides water. Seen from the historic perspective, skin care actually began with the use of lipids. Depending on geographical regions and culture, olive oil, sesame oil, sperm oil and animal lipids of different origin were the first basic skin care substances.

Still today a wide selection of products contains so-called "classic" lipids like beeswax and wool grease. With the development of the petrochemical industry the natural lipids were replaced by the less expensive refined mineral oils. However, they experience quite a revival today due to the fact that the physiological point of view has become more and more important.

Animal fats and vegetable oils

Animal fats and vegetable oils mainly consist of triglycerides that are of glycerine, a trivalent alcohol which is combined with three fatty acids (esterified). When speaking of lipids in today's cosmetic products the term lipid generally is extended to other lipophilic substances like waxes and mineral oils. The difference between oil containing triglyceride and wax oil like jojoba oil consists in the fact that the chemically combined fatty acids are linked with a so-called fatty alcohol (wax ester) instead of glycerine. Wax esters and triglycerides have in common that they can easily integrate into the natural balance of the skin due to their skin-related chemical structure. However, under given physiological conditions triglycerides easier split into their components and depending on their specific composition they may release essential active agents like linoleic acid during this process whereas wax esters retain their structure and complement the natural triglycerides by their skin-protecting function.

Synthetic esters

One special group are synthetic esters consisting of an alcohol and one or more fatty acids. For instance the spreading i.e. creeping oils like isopropyl myristate (IPM) which is widely used in cosmetic products due to its excellent spreading properties belong to this group (for further information regarding the role

of lipid-bound fatty acids refer to *Beauty Forum* 4, 54-56 (2003)).

Smoothing and protecting

Mineral oils and waxes like paraffin oil, vaseline (petrolatum), microcrystalline wax, ceresin (ozocerite) and hard paraffin consist of hydrocarbon compounds with different chain lengths and branches. These substances will not be integrated by the skin and therefore stay on the surface, a fact which explains their excellent smoothing properties. The increase of occlusive capacity involved in this connection reduces the transepidermal water loss, which leads to minor skin swellings and is basically the principle of quite a series of anti-wrinkle products with short term effects. Compared with vegetable oils however, they have a major disadvantage: they slow down the natural regeneration of the skin.

Whether the lipid is in liquid or solid form mainly is determined by the relative molecular mass and in case of natural oils by the specific fatty acid combined. The less saturated the acids, the higher the liquidity of the lipid. Also the branching of hydrocarbon chains plays a role here, so for example even in low temperatures the oil from the uropygial gland of ducks stays liquid, water resistant and has no occlusive effects because of branched fatty acids.

Lipids mainly help to soften the skin (emollients), to smooth it and to provide elasticity. The more lipids are applied on the skin the lower will be the transepidermal water loss (see above). This also reduces the evaporative cooling which explains why cold protection products as e.g. lip care products have a high fat content. Furthermore, it increases the water resistance of the skin which is quite important for skin protection products in general as it impedes water-soluble pollutants from penetrating into the skin. The

essential aspect however should always be the support of the natural skin regeneration.

Pure oils are very rarely used today because of the unpleasant greasiness which remains after their application. However for the treatment of dry and very sensitive skin and above all in cases of irritations or neurodermatitis they are still very useful today as they help to avoid a vast number of additives which are quite stressful for the skin.

Oils – natural and pure

As oils are free of water, it is not necessary to add preservatives and naturally, also emulsifiers can be avoided which may lead to disorders within the sensitive barrier layers of the skin. The slow penetration into the skin which actually is a disadvantage can be accelerated by adding natural barrier substances. This concept resulted in modern oleogels with excellent properties for the application on the skin. They are used for pedicure and in cases of decubitus and perianal skin disorders.

If natural oils are used in these products, linoleic acid as well as valuable accompanying substances like phytosterols and vitamins may be released. A typical example here is avocado oil. In this case also oil extracts enriched with the accompanying substances as mentioned above are available (as e.g. avocadin). Pure oils increasingly are used in the wellness sector and for ayurveda treatments.

In contrast to mineral oils and waxes, vegetable oils with a relatively high content of polyunsaturated fatty acids may become rancid. This disadvantage however can largely be compensated by adding vitamin E and C in form of lipid-soluble derivatives. Even though, oils like evening primrose or wheat germ oil show the disadvantage of a shorter shelf life. In the end, however, the specific type and the percentage of fatty acids contained as well as the content of the above mentioned accompanying substances are the deciding factor for the selection of a certain oil. The trick here consists in choosing the individually appropriate oil for the individual skin.

Waxes - with cooling effect

Quite some time ago the rather solid consistency of waxes with the exception of jojoba oil however, their natural sterol content (animal or vegetable phytosterols) and the water absorbing capacity connected herewith resulted in the development of the so-called cold creams which have a cooling effect on the

skin due to the evaporation of water. Beeswax and wool grease are typical lipid bases for these specific creams which have a relatively short shelf life if they are not specially preserved.

Besides other sterols, wool grease also contains cholesterol which has an important skin barrier function. Today, a frequently used wax in skin care creams is shea butter which contains phytosterols. A synthetic wax is i.e. cetyl palmitate. Carnuba wax with its high melting point can be found in lipsticks.

Waxes are frequently mixed with oils to increase their liquidity and applicability. On the other hand, the consistency of very liquid oils can be increased by adding waxes.

Products containing water

Emulsions which allow dispersing of oil in water or vice versa, are widely used and their advantage is that the oil phase rapidly penetrates into the skin which avoids an annoying oil film. Moreover, the oil allows infiltrating simultaneously water soluble active agents into the skin. There are however serious disadvantages: the watery phase has to be stabilized against microorganisms and the emulsifiers which are deposited in the skin will be reactivated during skin cleansing which means that even more lipids are transported out of the skin. Good alternatives for the application on problem skin are therefore products based on nanoparticles or DMS (Derma Membrane Structure) which are free of emulsifiers.

Applicability and use of lipids

The use of animal fats and waxes has continuously decreased over the past years. In this field only wool grease (Latin term: *adeps lanae*) and its admixture with paraffin oil and water (lanolin according to the German Pharmacopoeia "DAB") still play a major role. Wool grease supports the formation of water in oil emulsions (W/O) and has valuable skin protecting properties. However it is not recommended for oily and bad skin and skin which is susceptible for acne. This also applies for mineral oils and mineral waxes as they generate a humid and occlusive microclimate. In cases of skin barrier disorders, vegetable wax esters like shea butter, jojoba oil as well as vegetable oils with a specific composition of fatty acids are recommended. Evening primrose oil for example has a high percentage of gamma linolenic acid which may be very helpful for the skin that is susceptible for neurodermatitis.

Furthermore, oils with a high percentage of linoleic acid like sunflower and wheat germ oil support the formation of linoleic acid containing ceramide I in the barrier layers of the skin. Similar to the avocado oil, wheat germ oil also has a sizable percentage of palmitic acid which is a typical component of the stratum corneum. Palm oil contains a considerably higher percentage of palmitic acid.

Meanwhile, also olive oil is increasingly found in cosmetic products. Olive oil is relatively resistant to oxidation and has an outstandingly high share of the monounsaturated oleic acid whose triglycerides already have proved successful in skin care products.

A very interesting and different oil is castor oil which almost exclusively contains ricinoleic acid in form of triglycerides. Ricinoleic acid is a monounsaturated acid with specific adhesive and sliding properties. Therefore castor oil frequently is used in lipsticks.

From the perspective of lipophilic substances squalene, squalane and silicone oil should be mentioned. While squalene as a preliminary stage of cholesterol is skin-related and while olives are the source for squalane which is more frequently used due to its better resistance against oxidation, silicones are produced absolutely synthetically. In contrast to mineral oils, silicones are highly water resistant but depending on their structure they do not cause the same increased occlusive effects. Other substitutes for mineral oils are polyolefins, as for example polyisobutylene. These are hydrocarbons and unlike mineral oils they have a very uniform structure.

This overview shows substances which are very useful for the basic skin care as well as substances which develop specific active agent properties. It is a deciding factor for a well adapted skin care to carefully consider both features.

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