

# Vegetable oils and extracts - essential components

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The use of oils and extracts for basic skin care purposes already has a long tradition and still retains its relevance today. Frequently singular substances with defined effect can successfully be isolated, very often however this specific effect is closely related to the extract or respectively the oil as an integral whole or, in other words it results from synergy effects of different substances. More information on the extraction, manufacturing process and properties of fatty and essential oils as well as vegetable extracts is provided in the following.

**O**ils and extracts are mixtures of a lot of substances - frequently with multifunctional effects - in contrast to chemically homogenous substances, also called mono substances. In chemical respect these mono substances are clearly defined, usually they are produced synthetically with excellent and any time reproducible purity standards. As examples may be mentioned glycerin, fruit acids, fatty acid esters, amino acids, peptides and vitamins.

## Natural substances

In oils and extracts however, predominantly substance mixtures of natural origin are found in various different substance combinations depending on origin, season, and climate conditions. The most exiting feature of these products which may even consist of several hundred singular substances is the **interesting history** ascribed to their use. Oils that already Cleopatra used to apply for her anti aging skin care still are of interest today. Experiences in this context are not only limited to cosmetic applications they partly have their origin in folk medicine. In some cases the mechanism generating these effects is not yet identified as a considerable percentage of the synergies i.e. the correlation of substances or factors in the sense of a joint support, and the interactions of the different substances have not yet been detected.

Oils and extracts are typical components of the **natural** and physiological **cosmetics**. Physiological cosmetics focus not only on non-irritating and non-allergenic natural substances but also on the fact that the substances smoothly integrate into the metabolism of the skin. This, however, cannot be taken for granted as far as natural substances are concerned.

## Blossoms, leaves, seeds & co.

Oils as well as extracts are basically essences gained from natural vegetable material like fruits, cores, seeds, roots, blossoms and leaves. Apart from a few exceptions, animal extracts no longer play a significant role today. While oils to which both groups, fatty and essential oils belong to, cannot be mixed with water, i.e. they have lipophilic characteristics, components of **extracts** rather have polar and hydrophilic features. They are extracted with solvents like water, alcohol, glycols or their compounds and as of late increasingly with supercritical carbon dioxide which is a rather gentle process. There is however no clear dividing line and also **fatty oils** like soybean oil are extracted now with hexan in a first step, just to remove the hexan again after the process and refine the resulting raw oil.

An alternative way is to cold-press and filter the fatty oils. A consequence of this process is however, that they frequently contain traces of metals, mucins, free fatty acids, highly color intensive particles, pesticides, bitter constituents and smelling substances which may affect shelf life and sensory perception. On the other hand, they also have a higher content of additional valuable substances like vitamin E.

In a refining process, mucins and acids are removed from the fatty oils which then are bleached by adsorption of bleaching clay. In a last refining step, the desodoration process, the oils are treated with hot steam in order to remove any odorous volatile impurities. The specific pre-treatment process however depends on the intended use of the oil.

The manufacturing process of **essential oils** appears as a book with seven seals especially if the oils will be used in perfume formulations. Distillation, steam distillation, extraction of blossoms and seeds with alcohols and other solvents are the most frequently applied procedures.

### It's the fatty acid...

The evaluation of fatty oils which are also used as lipid phase in creams specifically depends on which types of fatty acids are bonded to glycerin to which percentage (fatty oils = triglycerides: three fatty acids are bonded to one glycerin molecule). In the skin the fatty acids are hydrolyzed by enzymatic reaction of the triglycerides and then used as a substrate for various other processes.

Thus the **palmitic acid** of the avocado and wheat germ oil has an excellent protective effect as it is a component of the skin barrier.

**Linoleic acid**, a double unsaturated essential  $\omega$ -6 fatty acid is chemically bonded to the ceramide I which also is an important barrier component. Larger quantities of linoleic acid can be found in grape seed, safflower and soybean oil. Just like the  **$\alpha$ -linolenic acid**, a  $\omega$ -3 fatty acid of linseed and rose hip oil; and  **$\gamma$ -linolenic acid**, a  $\omega$ -6 fatty acid of evening primrose and borage oil, the **linoleic acid** is transformed into an anti-inflammatory hydroxy fatty acid (13-HODE, 13-HOTrEg, 13-HOTrE) by 15-lipoxygenase of the skin. Beyond that,  $\gamma$ -linolenic acid is an essential substance for those atopics who are not able to synthesize the acid from linoleic acid due to an enzyme defect.

### Synergies of the components

Further important components of the fatty oils are phytosterols which are similar to the natural cholesterol of the skin and provide the same skin protecting effects, as well as the vitamins A and E. Vitamin E increases the oxidative stability of the oils. Regarding the **oxidative susceptibility** it is an interesting fact that the content of unsaturated fatty acids is not the only criterion. The synergism of different components may cause a comparatively high stability regardless of the high content of unsaturated fatty acids.

Synergies influence the **efficacy** in the cosmetic field as well and are specifically significant in extracts. Time and again there have been experiments to isolate the respective efficacy profiles and mechanisms in form of singular substances which has been successful in some cases however has failed in other cases as the deciding factor influencing the efficacy proves to be the synergy of various substances or in other words it is affiliated to the extract as a whole.

### Sensory characteristics and availability

Fatty and essential oils vary considerably in their **penetrating behavior**. As the molecules of the essential oils mostly consist of terpenes and are relatively small compared to the molecules of fatty oils, they penetrate faster through the skin without the greasy feeling on the skin surface.

By **encapsulating** both the oil varieties in **liquid nanoparticles** they take up hydrophilic features which means their sensory characteristics are comparable to watery solutions or dispersions. The nano encapsulation increases the penetrating speed with the effect that the unpleasant greasy sensation on the skin which is typical for fatty oils will not occur at all. The advantage of using liquid nanoparticles in finished cosmetic products compared to the use of emulsifiers is that they will not cause any surface-active reactions and their potentially harmful effects on the skin barrier.

### Tolerance

**Allergenic potential:** While allergenic components rarely occur in fatty oils, they are quite frequently found in essential oils and extracts. The European Cosmetic Decree took this into account and included a statutory separate declaration for the most significant allergens - besides the declaration of the botanical terms. Specific characteristic of essential oils are their **perfuming effects**, frequently also accompanied by cooling, heating, refreshing or stimulating effects. The healing effects which were described in the literature are certainly not allowed for marketing purposes in the cosmetic field. It is recommended to use a combination of essential oils with fatty oils for massages to improve the microcirculation. Depending on the specific essential oil a variety of additional effects up to aroma therapy applications for massages or baths may be obtained.

**Preservatives:** Lipids and essential oils in pure form do not require any preservatives. Even on the contrary: Components of fatty oils frequently have antimicrobial effects like e.g. the sesquiterpen farnesol which smells like lilies of the valley. Just the opposite effect can be observed in watery extracts. Due to their water content and the rich supply of nutrients they are an ideal breeding ground for microorganisms. This is the reason why extracts are either preserved or enriched with appropriate concentrations of alcohols or glycols to prevent the growth of microorganisms.

The problems involved with the use of preservatives may be avoided by **spray drying** or **lyophilisation** (freeze drying) of the extracts with the result of so-called **dry extracts** (pow-

ders) which are largely resistant against germs and which can be stored as raw materials without any problems. Spray drying sometimes requires carrier substances which are able to integrate liquid components of the extracts.

In this context also the term "**dry residue**" has to be mentioned which refers to the solvent-free residue of the extract. It is the only determinant to measure the concentration of active agents dissolved in extracts in order to permit a comparison of different products. The high active contents sometimes specifically emphasized in advertisement campaigns quite often turn out to comprise extracts and solvents.

**Protein components:** Fatty and essential oils are largely protein free, however the content of protein components in extracts may significantly contribute to individual intolerance reactions like nuts allergy, soybean allergy etc. This potential intolerance risk is the reason why in certain cases essential oils and extracts should be tested on the forearm before its use.

**Packed in liposomes:** Complementary to the nano encapsulated oils the efficacy of hydrophilic extracts may be improved by liposomal formulations. Examples in this case are green tea (stimulating), para cress (reduction of wrinkles due to spilanthol content), yeast extract (acne treatment), and red clover (phytohormones).

### Important: the intended use

A major criterion for the manufacturing of oils and extracts is their intended use. If the focus here is on the **scent** of essential oils they should only be applied on the skin surface and not penetrate into the skin. Regarding their use in massage oils, they should be added just before application.

If the focus is on their **active agent characteristics**, besides nanoparticles and liposomes also today's barrier creams can be taken into account, as they have a specifically positive effect on sensitive skin and correspond to the above mentioned physiological concept. In this context also well-tried substances come back into use like sage extract in antiperspirant cream formulations.

### Same origin - yet different

Oils and extracts of the same plant (usually) have different denominations in the INCI and also have different effects. **Vitis Vinifera** for example is the term for the fatty oil gained from grape seeds with a 60-80 % content of linoleic acid, while Vitis Vinifera (Grape) Seed Extract is the alcoholic and watery extract gained from grape seeds with a proanthocyanidin (OPC) content of more than 95 percent, which has

antiradical effects due to the flavonoids contained. Liposomal grape seed extract is a favorite component of the anti aging skin care.

**Boswellia sacra** or *Boswellia carteri* as it is also called is grown in Somalia, Yemen and Oman. By means of steam distillation an essential oil with a balmy note is gained. The alcoholic extract gained from the resin inhibits the natural 5-lipoxygenase of the human body which means it has anti-inflammatory effects and is also helpful against actinic keratoses. The essential oil of the Indian *Boswellia serrata* though excels by its fresher scent and a different content of boswellia acids. Hence, the characteristics of oils and extracts frequently depend on their origin and their specific manufacturing process.

Dr. Hans Lautenschläger