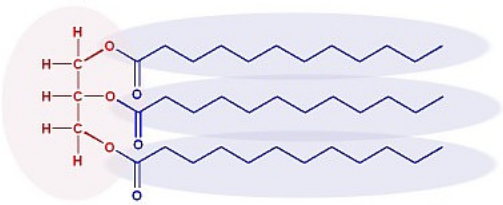
# Oils & Waxes Used in Cosmetics

T. Bombeli, MD BBA. In many cosmetic products oil components form an important part of the formulation. Oils can be categorized into three major groups including oils (incl. fats/butters), esters and waxes. All of them are emollients, but based on their different chemical structure they have very different, additional properties.

### Natural Oils

Oils and fats differ in that the latter are generally solid at room temperature. Chemically, both fats and oils are glycerol esters composed of glycerol and fatty acids and are called triglycerides.



Glycerol (red) + 3 fatty acid chains (blue) = Triglyceride (natural oil)

Fatty acids can be saturated (no double bonds between the carbon atoms) or unsaturated (one or more double bonds), thereby determining the stability and property of the oil. Oils with a high degree of saturated fatty acids (lauric, myristic, palmitic and stearic acids) include coconut oil, cottonseed oil, and palm oil. Oils with a high degree of unsaturated fatty acids (oleic, arachidonic, linoleic acid) are canola oil, olive oil, corn oil, almond oil, safflower oil, castor oil and avocado oil. Saturated oils are more stable and do not become rancid as quickly as unsaturated oils. However, unsaturated oils are smoother, more precious, less greasy, and better absorbed by the skin. As compared to synthetic oils, natural oils have the disadvantage to be more greasy, comedogenic, and to spread only little on the skin. They are also more difficult to build into emulsions, are unsoluble in alcohol (except castor oil) and require antioxidants (e.g. vitamin E or C) to prevent rancidity. Natural butters like shea butter, avocado butter or cocoa butter are not true butters (= emulsion of water and fats) but natural fats. Shea butter consists mainly of stearic and oleic fatty acids and is thus a half saturated and half unsaturated fat. Stearic acid gives the shea butter its solidness. In general, natural butters are excellent emollients and thickeners and, dependent on the type, may have various additional properties (e.g. antioxidant & and soothing properties in shea and avocado butter due to phenolic compounds).

### Synthetic Oils

Synthetic oils are esters, usually obtained by direct reaction of fatty acids with alcohols. As compared to the natural oils which have 3 chains of fatty acids (trigycerides), synthetic oils usually have only one fatty acid chain. Based on the variety of fatty acids (see above) and alcohols (e.g. butyl, isopropyl, ethylhexyl, myristyl, oleyl alcohol), a wide range of synthetic oils with very different properties is available (see list below).

### Natural Waxes

Chemically, waxes are esters of a fatty acid and a fatty alcohol. Jojoba oil is therefore a wax, not an oil. Physically, waxes are characterized by a high melting point (50-100ºC). The most used wax is beeswax which is a good emollient and thickener. Together with borax beeswax has also emulsifying properties which is used in classic cold-creams. Two other natural waxes often used in cosmetics are carnauba and candelilla wax. Both are harder and have a higher melting point making them more stable and suitable for dry products (e.g. lipsticks).

### Synthetic Waxes

Synthetic waxes do not form a chemical entity but are more the result of empirical research. Beeswax can be replaced by hydroxyoctacosanyl hydroxystearate. It has very similar properties to beeswax but is a better emulsifier. Spermaceti, a natural wax and originally obtained from whales, is now replaced by cetyl palmitate or cetyl ester wax. Emulsifying waxes are a special group of synthetic waxes that are used primarily as emulsifiers and not as emollients.

## Important Synthetic Oils

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| **White Oils**<br>Mineral Oil (liquid), Petrolatum / Vaseline (semisolid) | Colorless, odorless, tasteless oils consisting of saturated paraffinic & naphthenic fatty acids, no skin penetration, forms a film on the skin, good skin compatibility, not comedogenic, may be considered natural since it is made of natural occurring petroleum (crude oil) |
| **Isopropyl Esters**<br>Isopropyl Myristate, Isopropyl Palmitate | Universal oil for soft skin feel & spreadability, dry emollience; miscible with other oils (opens their films), substitute for mineral oil (similar viscosity), excellent solvent for lipophilic active ingredients |
| **Ethylhexyl Esters**<br>Ethylhexyl Stearate, Ethylhexyl Palmitate, Cetearyl Ethylhexanoate | Universal, medium viscosity oil with excellent spreadability & low skin occlusivity, oxidation stable, good conditioning properties; cetearyl ethylhexanoate is very similar to natural purcellin oil |
| **Stearyl / Isocetyl Esters**<br>Stearyl Stearate, Isocetyl Stearate | Universal oil with good emollient properties, often used as opacifier & pearlizer, miscible with other oils, low occlusivity effect (water can easily evaporate through) |
| **Propoxylated Alcohols**<br>PPG-3 Myristyl Ether, PPG-11 Stearyl Ether | Highly polar oil with solubilizing properties for lipophilic active ingredients & perfume oils, especially suitable for deodorants & antiperspirants, gives very soft & elegant skin feel |
| **Caprilic/Capric Esters**<br>Triglyceride, Propylene Glycol Diester, Glycerine Tri-Isostearate | High polarity oil with similar properties to natural oils (triglycerides), gives very pleasant feel (not greasy), vegetable based, oxidation stable, good solvent for UV filters |
| **Oleic Acid Esters**<br>Decyl Oleate, Decyl Cocoate, Oleyl Oleate | Very light low-viscosity oil with low spreadability, often based on natural oil fatty acids, especially suitable for eye care & makeup products and oil-in-water emulsions |
| **Polymer Oils**<br>Polyisobutene | Non-polar polymer of isobutylene, subsitute for mineral oil, easily emulsifiable, shine enhancer in lipcare products, non-comedogenic, non-greasy feel, moisturizer (prevents water loss) |
| **Silicone Oils**<br>Stearoxy Dimethicone, Cetyl Dimethicone | High-molecular weight polymer oil consisting of silicone & oxygen (polysiloxanes), very high spreading, non-greasy velvety feel, moisture barrier for skin protection, improves hair combing |