

Chemistry of Oils and Fats

What Are Oils and Fats?

Like most organic materials, Oils and fats are made up of three elements:-

- Carbon
- Oxygen
- Hydrogen

These elements combine together to form chains known as fatty acids. Three of these chains then join together to form a molecule known as a triglyceride. The triglyceride molecule is the basis of all oils and fats.

Oils and fats vary in both their appearance and functionality due to differences in the types of fatty acid chain which join together to form the triglyceride molecule.

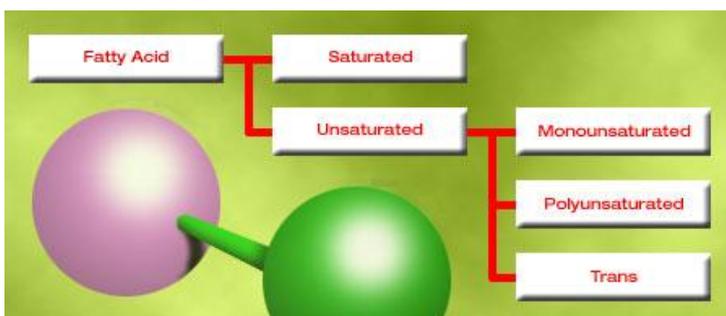
What Is the Difference between Oil and Fat?

Individual fatty acids can be either saturated or unsaturated and the latter being further sub-divided into mono and polyunsaturated. All oils contain a proportion of all three types and it is this combination in any one oil which determines whether it will be a solid fat or liquid oil at ambient temperature. The functionality of liquid oils and solid fats varies considerably and which to choose will depend on the intended application.

Generally speaking, oils containing a greater proportion of unsaturated fatty acids are liquid at room temperature whereas those with higher amounts of saturated fatty acids will be solid.

The Chemical Structure of Fatty Acids

Fatty acids are either saturated or unsaturated.



a) Saturated Fats

Certain fatty acids are already 'naturally saturated' in that they cannot be made 'harder' than they are in nature. As previously noted, the levels of saturates is generally higher in those fats which are solid at ambient temperatures.

Saturated fatty acids are extremely stable i.e. they do not easily become rancid, meaning they have good keeping properties (shelf life). However, Government recommendations advise consumers to limit their intake of saturated fats as they can increase blood cholesterol levels, one of the major factors in heart disease.

Most animal fats such as meat, butter, cheese and cream contain relatively high levels of saturated fat and as such should be eaten in moderation. Many baked goods such as cakes, biscuits and pastries can also be high in saturated fat.

b) Unsaturated Fats

There are three types of unsaturated fatty acids:-

1. Monounsaturated Fatty Acids (MUFA)

Fatty acids in this category have what is known as one double bond in their chemical make-up. They are relatively stable to oxidation and the development of rancidity and are now considered, in nutritional terms, as being the best type of fat to eat.

The most common source of monounsaturates are Olive Oil and Rapeseed oils.

2. Polyunsaturated Fatty Acids (PUFA)

Polyunsaturated fatty acids contain two or more double bonds in their chemical make-up. They are least stable fatty acids to oxidation and as such are best used in cold applications. The most common source of polyunsaturates is Sunflowerseed oil

3. Trans Fatty Acids (TFA)

Trans fatty acids typically come from two sources, hydrogenated vegetable oils and animal fats. Recent scientific research suggests trans fats, although consumed in relatively small proportions, should be avoided due to their negative affect on blood cholesterol levels.

This table indicates the fatty acid profiles of the most common oils and fats:-

Fatty Acid Composition	Polyunsaturated (%)	Monounsaturated (%)	Saturated (%)
Rapeseed Oil	32	62	6
Sunflower Oil	63	26	11
Olive Oil	11	72	17
Soyabean Oil	61	24	15
Corn Oil	59	28	13
Palm Oil	10	39	51
Butter	3	31	66
Vegetable Oil Spread	30	60	10

Role of Fats in the Diet?

Fats are part of a normal, balanced, healthy diet and the body needs them for a variety of reasons. Fats provide a concentrated source of energy. 1g of fat provides 37kJ (9kcal), more than double that provided by either protein or carbohydrate which provide 17kJ/g (4kcal) and 16kJ/g (3.75kcal), respectively. Fat is a carrier for fat-soluble vitamins A, D, E and K.

Some fats are essential to our well-being; these are known as the essential fatty acids (EFA's) often referred to as the omega fatty acids. Linoleic acid (omega 6) and alpha linolenic acid (omega 3) are the most common essential fatty acids found in vegetable oils. The most prolific source of essential fatty acids are fish oils such as cod liver oil. It is recommended that 1-2% of our energy intake should come from essential fatty acids which we need as our body cannot produce them.

Unsaturated fatty acids (mono and poly) have a beneficial effect on people's cholesterol profile and consequently should form the largest proportion of fat intake. Saturated fats can increase the levels of LDL (low density lipoprotein) cholesterol and should therefore be limited.

Whilst the main focus of fats in our diets is health and nutrition, they are an important ingredient in the manufacture and taste of many food products. Fats contribute to the property of foods including aeration (e.g. ice cream), moisture retention (e.g. cake), glossy appearance (e.g. chocolate) and texture (e.g. margarine).