

# HIGH-OLEIC SUNFLOWER OIL

## – a healthy alternative

*Every diet should contain some form and a certain amount of fat. All fats and oils are not the same. Some are considered healthier than others.*

*By Dr Roulene van der Merwe,  
University of the Free State*

*High-oleic sunflower oil is regarded as a healthy alternative to traditional sunflower oil.*

Research has shown that a diet high in oleic acid, such as the famous olive oil-rich Mediterranean diet, is considered healthier than others. Traditionally the boundaries of edible oils were set as the more expensive olive oil on the one side and the cheaper palm oil on the other. South African sunflower oil lies somewhere in-between.

### Traditional vs high-oleic sunflower oil

Sunflower cultivars with high-oleic acid content were introduced in the 1980s. High-oleic oil differs from traditional sunflower oil with a significantly higher oleic acid content of more than 80% (compared to 20-30% for traditional sunflower oil), a low concentration of linoleic acid of 2-9% (compared to 60-70% for traditional sunflower oil) and generally less than 10% saturated fatty acids (SFAs).

Because of the high oleic acid content, the oil is referred to as monounsaturated, while the traditional oil with its high linoleic acid content is referred to as polyunsaturated.

Traditional sunflower oil with its high polyunsaturated fatty acid (PUFA) content and relatively low total SFA content, has excellent nutritional properties. It is primarily used for cooking, frying, preparing salad dressing and margarine production.

However, traditional sunflower oil is not optimally suited to some potential applications that require a high oxidative stability, for example for the manufacturing of shelf-stable fried foods. In addition, the oil is often judged as unsuitable for continuous deep-frying because of its high unsaturation level and susceptibility to oxidation.

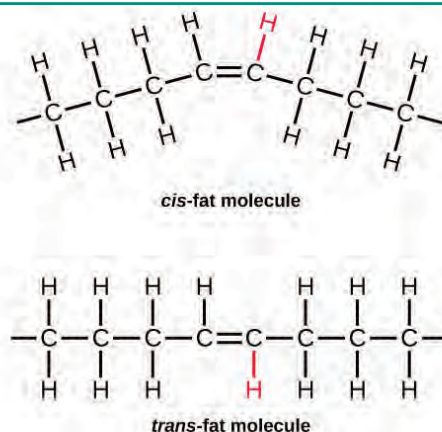
### Lipid oxidation

Lipid oxidation is a significant reaction that can cause deterioration in the quality of edible oil. The consequences of lipid oxidation are the formation of off-flavours and odours associated with rancidity, as well as a loss in functional and nutritional value.

### The hydrogenation process

Traditionally some oils need to be hydrogenated to enhance their oxidative stability. Hydrogenation involves the chemical addition of hydrogen to unsaturated fatty acids, by mixing heated oil and hydrogen gas in the presence of a catalyst. During this chemical process, not only are unsaturated fatty acids converted to saturated ones, but many positional and trans-isomers (Figure 1), not normally found in nature, are also produced.

**Figure 1: Fatty acid chain containing a double bond in the "cis" and "trans" configuration.**



The intake of these artificial or trans-fatty acids raises health concerns, as the evidence suggests. Consequently, there is an increasing interest within the food industry to produce oil crops containing higher amounts of saturated and monounsaturated fatty acids (MUFAs) in their oils.

Fortunately, plant breeders have been successful in overcoming the limitations of traditional oil by developing novel and healthier oil types. Research has led to the development of high-oleic acid sunflower varieties, with oil that approaches or exceeds an 89% oleic acid content.

They were developed through conventional breeding methods, and are speciality oils particularly useful for food products

such as spray oils (snacks and crackers), frying oils and other products that require an oil with high oxidative stability. Due to their natural stability, these oils do not need to be hydrogenated in order to be used for the applications

mentioned. Additionally, high-oleic sunflower oil is considered healthier, because it contains no trans-fatty acids.

### More stable to lipid oxidation

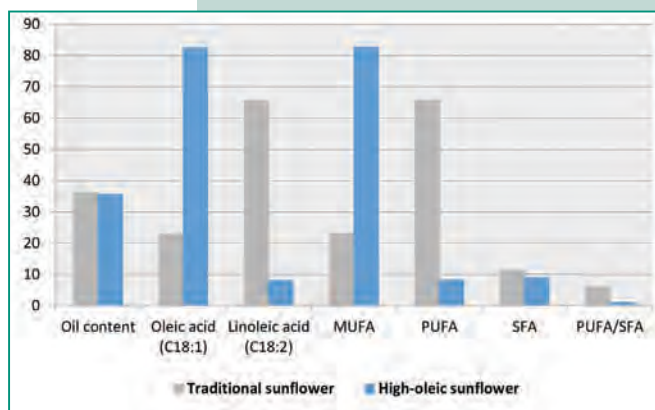
Oil oxidative stability depends on various factors, including oil composition, minor antioxidant or pro-oxidant compound content and degree of processing. The degree of unsaturation of fatty acids is one of the most important parameters that influence oil oxidative stability.

Oxidative degradation is directly related to the PUFA content of the oil, and oxidation essentially takes place at the double-bond (unsaturation) sites in triglyceride molecules (Figure 1). Consequently, the higher the number of double bonds in the triglyceride structure (the unsaturation level of fatty acids), the

more susceptible the oil is to oxidative degradation and the higher the rate of oxidation. As a result, traditional sunflower oil, which is highly polyunsaturated, should be more susceptible to oxidation than high-oleic sunflower oil, which is highly monounsaturated.

This conjecture was verified in a study conducted to evaluate and compare the oxidative quality and stability of traditional and high-oleic sunflower oil. The PUFA-SFA ratio is a measure of the extent of polyunsaturation and is therefore taken as a measure of an oil's tendency to experience autoxidation (Figure 2).

**Figure 2: Comparison of traditional and high-oleic sunflower oil with regard to oil quality and level of unsaturation.**



Oils with the highest ratio are the most likely to experience autoxidation. The different refractive index and iodine values of the traditional and high-oleic sunflower oil can be attributed to differences in their unsaturation levels (Table 1).

Refractive index and iodine values increase with the number of double bonds present in the fatty acid, and thus with the unsaturation level. As a result, the traditional oil with the higher unsaturation level indicated higher refractive index and iodine values than the high-oleic sunflower oil.

**Table 1: Comparing mean values of certain physico-chemical parameters in traditional and high-oleic sunflower oil.**

Oil type	Refractive index (ND 40°C)	Iodine value	Peroxide value (meq/1 000g)	p-Anisidine value	OSI at 110°C (hours)
Traditional	1,467142	105,64	10,33	4,55	2,70
High-oleic	1,462098	83,86	3,17	0,44	10,38

The initial oxidative status of the two oil types was evaluated by measuring peroxide and p-anisidine values. This is an indication of the oxidative quality of the crude oil. The peroxide test measures the hydro-peroxide content of an oil sample and is a useful index for the early stage of oxidation. The p-anisidine test assesses secondary oxidation by estimating the amount of unsaturated aldehydes generated during the decomposition of hydro-peroxides, and is a reliable indicator of oxidative rancidity in oils. The lower peroxide and p-anisidine values observed for the high-oleic oil, confirm that this oil type is of better quality and should be more stable to oxidation than traditional sunflower oil.

The oxidative stability of the two oil types was assessed under accelerated oxidation conditions, using the Rancimat or Oil Stability Index (OSI) test. Since OSI measures the resistance of lipids to oxidation, OSI duration is positively associated with oil stability. The high-oleic oil proved to be the most stable with the highest mean OSI value.

Since oxidative stability is related to the unsaturation level of oil, the high oleic oil, with considerably reduced linoleic acid content, indicated the highest resistance to oxidation. Oil shelf life is estimated by using the OSI values, and the high-oleic oil exhibited a predicted shelf life of almost three times that of the traditional oil.

In conclusion, although traditional sunflower oil is popular for its nutritional value, oil of the high-oleic sunflower hybrids has proved to be of superior quality and oxidative stability. Due to its natural stability and zero trans-fatty acids, high-oleic sunflower oil is regarded as a healthy alternative to traditional sunflower oil.

For more information, contact Dr Rouxlene van der Merwe of the Faculty of Natural and Agricultural Sciences at the University of the Free State at [vandermerwer@ufs.ac.za](mailto:vandermerwer@ufs.ac.za).