

## HEALTH EFFECTS OF RANCID OILS

### What is rancidity?

Rancidity is a term generally used to denote unpleasant odours and flavours in foods resulting from deterioration in the fat or oil portion of a food. Three different mechanisms of rancidity may occur. These are oxidative, hydrolytic, and ketonic.

### Oxidative Rancidity

Oxidative rancidity arises from the decomposition of peroxides. Peroxides are the result of the oxidation of unsaturated fats. The products resulting from the decomposition of peroxides include aldehydes, ketones, and hydrocarbons. These help to produce the flavours and odours associated with oxidative rancidity. The abnormal characteristics of a product that has undergone oxidative rancidity are paint like or acrid (burning) odour and an abnormal (rancid) taste. The colour of a food item is not normally changed due to this deteriorative process. The texture of a food product is not affected by the deteriorative condition.

### Health Effects

Rancid oil forms harmful free radicals in the body, which are known to cause cellular damage and have been associated with diabetes, Alzheimer's disease and other conditions. Rancid oils can also cause digestive distress and deplete the body of vitamins B and E. In his book "8 Weeks to Optimum Health", Dr. Andrew Weil says rancid oil can also cause damage to DNA, accelerate aging, promote tissue degeneration and foster cancer development.

While rancid oil may taste bad, it doesn't normally make you sick, at least not in the short term. Rancid oil does contain free radicals that might increase your risk of developing diseases such as cancer or heart disease down the road.

Rancid oils may produce damaging chemicals and substances that may not make you immediately ill, but can cause harm over time. Chemicals such as peroxides and aldehydes can damage cells and contribute to atherosclerosis. Free radicals produced by rancid oil can also damage DNA in cells. Produced by toxins as well as by normal bodily processes, free radicals can cause damage to arteries as well as act as carcinogens, substances that can cause cancer.

If oxidative rancidity is present in severe quantities, a potential health hazard may exist. High levels of malonaldehyde are found in rancid foods. Malonaldehyde is a decomposition product of polyunsaturated fatty acids. This chemical has been reported to be carcinogenic and a potential health hazard does exist.

Eating rancid oil will expose you to accelerated aging, raised cholesterol levels, obesity and weight gain. Daily consumption increases the risk of degenerating diseases such as cancer; diabetes; Alzheimer's disease; and atherosclerosis, a condition in which artery walls thicken due to a buildup of fatty materials. According to a study from the University of Basque Country, the breakdown rate and total formation of toxic compounds depends on the type of oil and temperature. Initially, the oil decomposes into hydroperoxides, then into aldehydes.

### **What tests show rancidity?**

Depending on the type of oil, its age, storage conditions, etc., one or more of the following tests by themselves or combined are good indicators of oil rancidity:

#### ***Peroxides Value***

The peroxides value is the quantity of hydro peroxides (expressed as meq O<sub>2</sub>/kg) present in the oil that have formed through oxidation during its processing and/or storage. This value is the primary measurement of oils rancidity and it gives us an idea of oils' freshness and storage conditions. The peroxides value will increase during the first part of the life of oils and it will then decrease in more advanced stages of oxidation when more oxidated substances are produced. These new substances are responsible for colour and aroma changes associated with rancidity. If we suspect that the oil could be close to this stage other complementary analysis such as UV absorption are recommended. Based on international rules (IOC, Codex) extra virgin olive oils must show a peroxides value under 20. Nonetheless, it is expected that fresh and well processed oils should show peroxides value less than 12.

#### ***UV Coefficients (K270 & K232)***

The determination of the specific spectrophotometric extinction in ultraviolet at 232 and 270 nm provides a measurement of the state of oxidation of the oils and storage conditions. These methods are based on the properties of conjugated dienes and trienes to absorb UV radiation in those wave length ranges. Higher than normal values of K 270 would indicate an advanced oxidation stage or even a possible adulteration with refined oil. Extra virgin olive oils should have a K 232 below 2.50 and K 270 below 0.22. K 270 and K 232 in freshly produced oils hardly ever exceed values of 0.17 and 2.00 respectively.

#### ***Determination of the degradation products of chlorophylls a and a' (pheophytins a, a' and pyropheophytins) or PPPs***

This method is based on measuring the dynamics of some chlorophyll pigments (pyropheophytin a and pheophytins a and a') in olive oils. The PPPs Ratio shows a very good performance as indicator of overall olive oil quality and freshness showing better correlation with organoleptic scoring than any of the traditional IOC methods. There is no evidence of initial varietal or environmental influence of this test. Freshly produced oils have PPPs levels below 0.5%, this value increases over time and technical evidence shows that when those levels exceed the limits set by the Australian Standard 5264-2011 of 17%, the oil is more than 2-2.5 years old and rancid.

#### ***Determination of relative amounts of 1,2- and 1,3-diacylglycerols or DAGs***

This method is based on the fact that in virgin olive oils, DAGs are present in a range of 1 to 3% and they are found as 1,2- and 1,3- isomers. The 1,2- isomers are attributed to the incomplete biosynthesis of triacylglycerols (TAGs), whereas the 1,3- isomers are attributed to enzymatic or chemical hydrolysis of TAGs occurring before or during the oil extraction process. Consequently, freshly made olive oils from healthy olive fruits contain almost solely 1,2 DAGs; on the other hand, those coming from poor quality fruits show a significant increase of 1,3- isomers. The percentage of 1,2 DAGs decreases over time and technical evidence shows that when those levels fall below the limits set by the Australian Standard 5264-2011 of 35%, the oil is more than 2-2.5 years old and rancid.

### ***Panel Test***

The organoleptic characteristics of virgin olive oils are defined by a group of tasters (Panel). After tasting the oil, each member has to give a concise assessment in the form of a numerical grading (1-10), which is entered in a grading sheet along with the intensity of both positive attributes and defects. Its main objective is to classify virgin olive oils according to their positive attributes (Fruitiness, bitterness and pungency) and their negative attributes (Fustiness, mustiness, mouldy, **rancid**, muddy sediments, etc.). Extra virgin olive oils should have no defects and fruitiness above 0.