**Lipid Oxidation**

Lipids are important in foods due to their contribution to palatability, satiety and nutrition. Lipid oxidation occurs as a result of oxidation of the unsaturated points in fatty acids. The important lipids involved in oxidation are the unsaturated fatty acids: oleic, linoleic, and linolenic. The rate of oxidation of these fatty acids increases with the degree of unsaturation. Oleic – 1 times rate; linoleic – 10 times; linolenic – 100 times.

Oxidative deterioration of fat is a large economic concern in the food industry because it affects many quality parameters such as flavour (rancidity), colour, and the nutritive value of foods. In addition, it produces potentially toxic compounds. It also limits the shelf life of foods.

**Stages of Lipid oxidation**

* 1. Initiation: This is called the formation of free radicals. In this stage the molecule of unsaturated fatty acid loses a hydrogen atom leaving a free radical which is required to start the propagation reaction.

 RH -->R· + ·OH

Where RH is any unsaturated fatty acid;

R· is a free radicalformed

(2) Propagation: This is called the free-radical chain reaction stage. Oxygen reacts with the free radicals to form peroxide-containing free radicals.

R· + O2 --> ROO·

These in turn react with another mole of unsaturated compound to produce hydroperoxides and new free radicals capable of continuing the chain reaction.

ROO· + RH --> R· + ROOH

The hydroperoxides formed are unstable and will break down rapidly to form two or more free radicals. This reaction is catalysed by trace amount of transition metals (M)

ROOH M RO. + .OH

 Each of these radicals is then able to react with an RH group yielding more free radicals.

 RO· + RH· --> ROH + R.

 OH· + RH· --> H2O + R.

The lipid hydro peroxide concentration in oils is generally expressed as peroxide value (PV).

1. Termination: When the free radical species react together to give the stable non-radical end-products.

R· + R· --> RR

RO· + R. --> ROR

**Factors influencing the rate of lipid oxidation**

* The nature of the oil (degree of unsaturation)
* High temperature
* Presence of pro-oxidants like copper, tin, iron
* Presence of oxygen
* Light

**Prevention**

* Putting inside coloured or opaque packages
* Desist from exposing the oil into air
* Use of antioxidants-they chelate metals and they are oxygen scavengers making oxygen unavailable.

**Measurement of Lipid oxidation**

* Peroxide value: measured by techniques based on their ability to liberate iodine from potassium iodide, or to oxidize ferrous to ferric ions. Their content is usually expressed in terms of milliequivalents of oxygen per kilogram of fat. Peroxide value is a measure of the degree of rancidity in fat and oil.
* **Thiobarbituric acid (TBA)**

TBA is the most widely used test for measuring the extent of lipid peroxidation in foods due to its simplicity and because its results are highly correlated with sensory evaluation scores. The basic principle of the method is the reaction of one molecule of malonaldehyde and two molecules of TBA to form a red malonaldehyde-TBA complex, which can be quantitated spectrophotometrically (530nm).

* **Iodine Value**

Iodine value is a measure of the extent of unsaturated fatty acid present in fat and oil and is expressed in terms of percentage of iodine absorbed.