FAQs

1. **What is the difference between hydrolytic rancidity and autoxidation?**

   There are two changes that the fat undergoes chemical changes during storage. They are hydrolytic rancidity and autoxidation. The end products of these reactions bring about sensory changes particularly the flavour changes in milk and milk products. Hydrolytic rancidity is a result of hydrolytic degradation of milk lipids due to action of lipase enzyme on lipids, whereas, autoxidation is the oxidation of milk lipids.

2. **What is induced lipolysis? What are the factors those favors the induced lipolysis?**

   Induced lipolysis is a type of lipolysis wherein certain activities will facilitates the reaction between milk fat and natural enzyme present in milk. The activities will disrupt the fat globule membrane and brings the free fat directly into contact with lipase enzyme resulting in hydrolysis of fat and release of free fatty acids which causes rancidity in the products. The factors which favor the induced lipolysis are vigorous agitation, homogenization, freezing and thawing and temperature activation by repeated chilling and thawing to room temperature.

3. **What is autoxidation of milk fat?**

Lipid oxidation is an auto-catalysed free radical chain reaction. Although saturated fatty acids may lose H^+ and undergo oxidation, the reaction principally involves unsaturated fatty acids, especially polyunsaturated fatty acids (PUFA), the methylene, -------CH_2------ , group between double bonds being particularly sensitive. The polar lipids in milk fat are richer in PUFA than neutral lipids and are concentrated in the membrane with several pro-oxidants and are therefore sensitive to oxidation.

4. **What is hydrolytic rancidity? How it affects the quality of fat rich products and can be prevented?**

Hydrolytic rancidity refers to the breakdown of triglycerides (i.e free fat) into its basic components of free fatty acids and glycerol by the enzyme lipase. The released free fatty acids particularly short chain fatty acids such as butyric acid and caproic acid contribute to the rancid flavour to the fat rich product and results in flavour deterioration. On the other hand the hydrolytic rancidity has

favorable effect during ripening of cheese which contributes to the cheesy flavour. The hydrolytic rancidity can be prevented giving proper heat treatment to the milk which can inactivate the lipase enzyme. Generally the lipase enzyme gets inactivated when milk is heat treated to more than 60^0C for 2 to 3 minutes or 80^0C for 20 seconds. Hygiene on the farm and at the processing units is of importance in controlling the microbial growth and minimizing the microbial lipolysis problems.

5. How autoxidation of milk fat can be prevented?

The autoxidation of milk fat can be prevented by use of natural antioxidants such as tocopherols and ascorbic acid. The thiol groups of β lactoglobulin and proteins of fat globule membrane are activated by heating. These thiolgroups have antioxidant properties. The use of permitted synthetic antioxidants such as ButylatedHydorxy Anisole (BHA), ButylatedHydroxy Toluene (BHT), Tertiary ButylatedHydroxy Quinone (TBHQ), and gallic acid ester. In India use of BHT is banned in dairy products by Food Safety and Standards Authority of India (FSSAI).

6. **What is the mechanism by which autoxidation occurs in milk fat?**

   Chemical reactions involved autoxidation of milk fat are grouped in to three phases. *viz.* initiation, propagation and termination. The initial step in the autoxidation of unsaturated fatty acids is the formation of free radical. In the case of monounsaturated fatty acids the reaction is initiated by the removal of hydrogen atom from the methylene group of adjacent to the double bond. The resulting free radical combines with oxygen to form peroxide containing free radicals. These in turn react with another mole of unsaturated compound to produce two hydroperoxides in addition to free radicals capable of continuing the chain reaction. In a polyunsaturated fatty acid methylene groups located other than those located between the double bonds can also involve in these reactions but to a lesser degree. Hydroperoxides formed due to autoxidation being unstable they readily decompose forming the saturated and unsaturated aldehydes. Formation of other products such as unsaturated ketones saturated and unsaturated alcohols saturated and unsaturated hydrocarbons and semialdehydes are also being observed. Saturated and unsaturated aldehydes impart characteristic off-flavours in the products. The terms often used to characterize the flavor are “painty”, nutty, melon-like, grassy, tallow, oily, card board, fishy, cucumber etc.

7. **Write the mechanism of preventing autoxidation of milk fat?**
   Antioxidants are molecules with an easily detachable H atom which they donate to fatty acid free radical or fatty acid peroxy radicals, which would otherwise takeout a H from another fatty acid forming another fatty acid free radical. The residual antioxidant i.e. the molecule without the donated H is stable and the antioxidants break the autocatalytic chain reaction.