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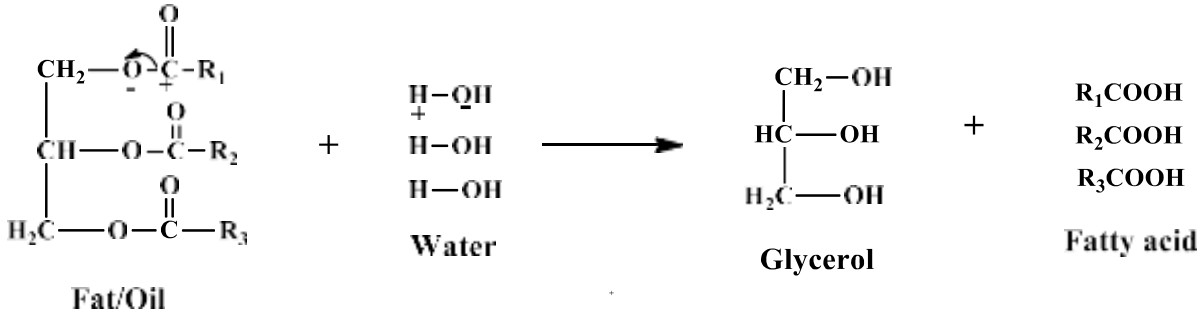
COIMBATORE-641 035, TAMIL NADU

DEPARTMENT OF FOOD TECHNOLOGY
23FTT204- BIOCHEMISTRY & NUTRITION
UNIT 2- LIPIDS
TOPIC 4,5,6 - Chemical properties of fats – Hydrolysis, saponification, Halogenation and Rancidity

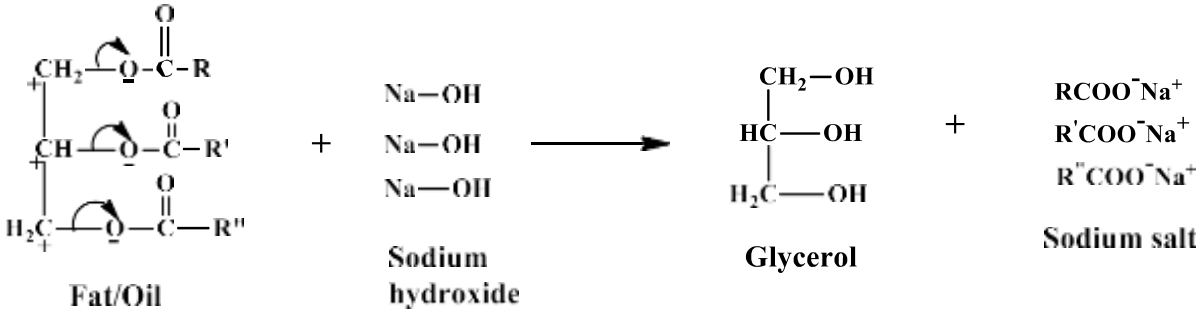
Chemical Properties

1. **Hydrolysis -**

They undergo hydrolysis, when heated with superheated steam or mineral acids or alkali. They can also bring out by enzymes (lipases).



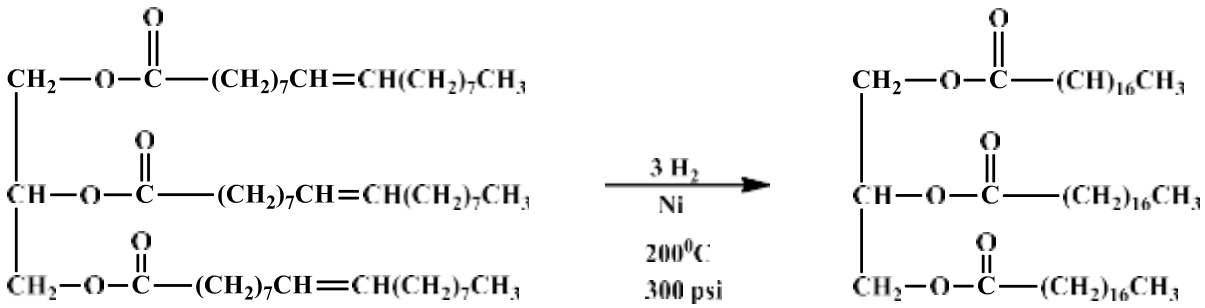
Hydrolysis of oil/ fat with alkali (NaOH or KOH) gives a mixture of sodium or potassium salt of long chain fatty acid which are referred to as **soaps.** This process is k/a **saponification** (soap formation).



Note:- Bad smell of fat/oil is often due to volatile bad smelling fatty acids formed by slow hydrolysis of fat/ oils in contact with moisture over long period. Such samples of oil/fat are often referred to a rancid oil/fats.

Prepared by Ms.Mohana Priya R AP/FT

2. **Hydrogenation-** (formation of fats from oil = Vanaspati, ghee or dalda)
   Oils containing unsaturated glycerides add on hydrogen in presence of fine divided nickel catalyst, giving solid fats. this hydrogenation process is called hardening.
   Eg.

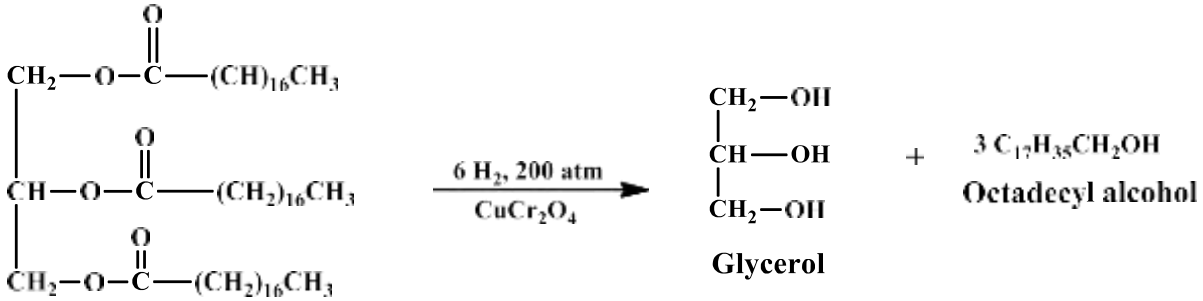


Triolein
(liquid), oil
mp=60^{0}C

Tristearin
fat, solid
mp=70^{0}C

3. Hydrogenolysis-

If the hydrogenation of an oil is allowed to continue for a long period under high pressure and temperature in presence of nickel or copper chromite ($CuCr_2O_4$) catalyst, the oil/fat undergo reductive cleavage to glycerol and long chain aliphatic alcohols. This process is called as hydrogenolysis.



Tristearin

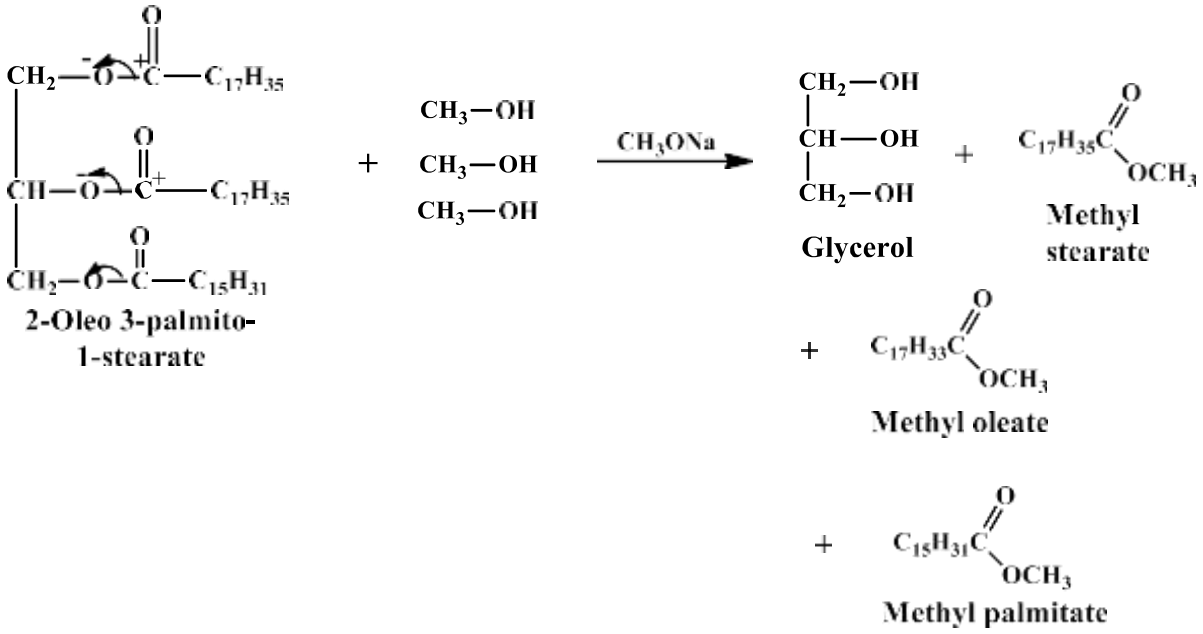
Glycerol

Octadecyl alcohol

Note:- The resulting long chain aliphatic alcohols are used it manufacture of synthetic detergents.

4. Transesterification -

They undergo transesterification when they are allowed to react with an excess of alcohol in the presence of an acidic or basic catalyst.

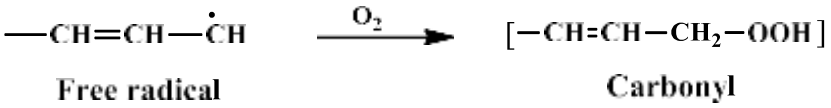


5. Rancidity and autoxidation-

The term rancid is applied to any oil /fat that develops a disagreeable odour due to its slow decomposition (by air) into lower acids. the reactions response for rancidity are hydrolysis and oxidation.

i. **Oxidative rancidification** - Triglycerides, containing unsaturated acids are more susceptible to oxidative rancidity on storing for a long period.

This reaction takes place via formation of free radicals, followed by the production of hydro peroxides which later on cleavage into carbonyls.



ii. Hydrolysis rancidification- Butter, for example, is susceptible to hydrolytic rancidity as it contains lower acids (butyric acid and caproic acid moiety) which have offensive odour, liberated during hydrolysis of ester linkage. Further, micro- organisms, present in air contain enzyme lipase that catalyses hydrolytic process. This type of rancidity can be prevented by storing butter in refrigerator.

The commonly used antioxidant added (0.01%) to oil/fat to prevent rancidity are ascorbic acid (Vit. C) and (Vit. E) tocopherol.