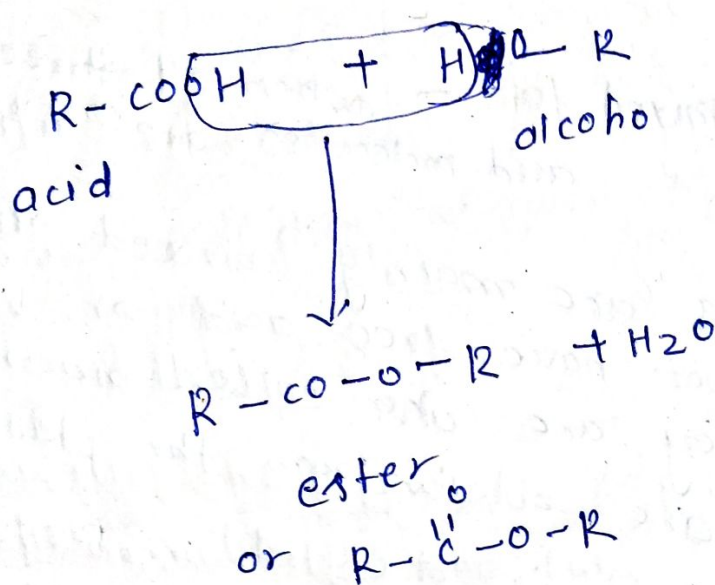


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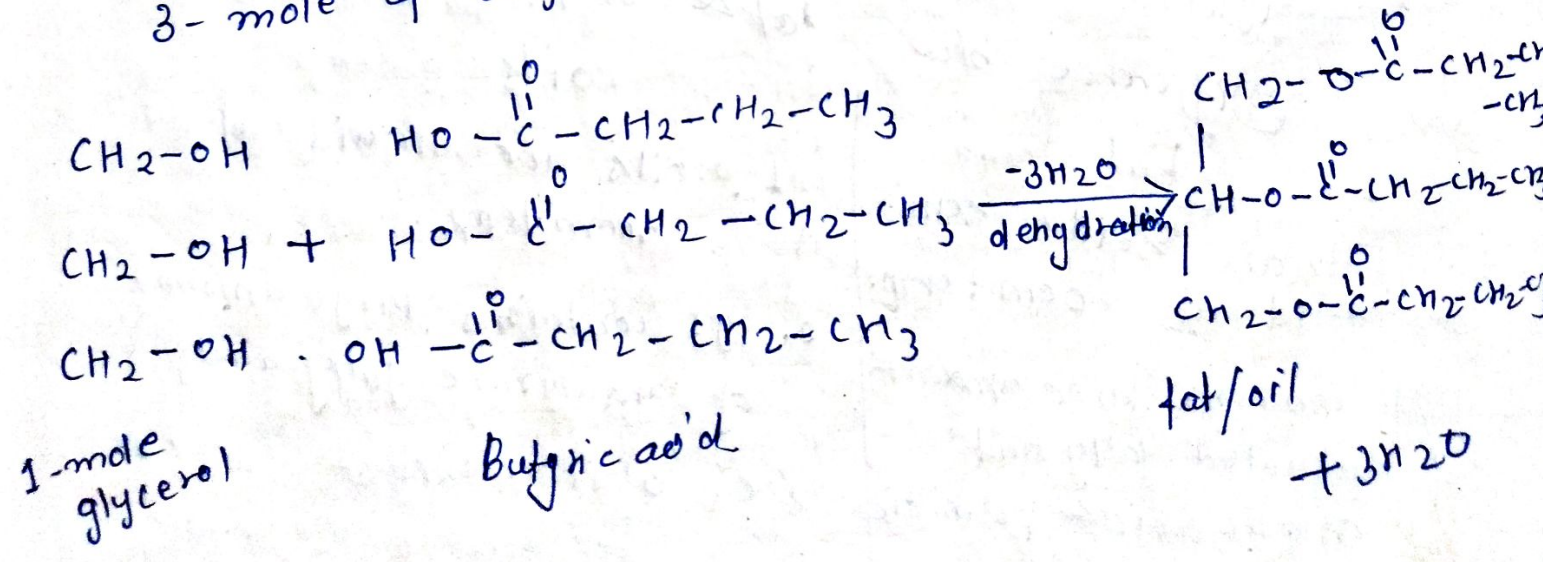
Unit - IIIrd

(अ) (ब) Fat & oils

- * Fat and oils are the basic component of the animal body and it also store energy.
- * Generally fat & oils are the ester of fatty acid and alcohol.



- * generally fat & oils are the tri glycerides of the fatty acid, 1 molecule of fat is prepared by the dehydration reactⁿ of 1 mole of glycerol and 3-mole of butyric acid.



Types of fat

After hydrolysis fat dissociates into glycerol & 3 molecules of fatty acid.

* On the basis of 3-molecules of fatty acid fat is of two types.

1. Simple fat - when all three fatty acid molecules are similar (समान).

2. Compound or mixed fat - when all three fatty acid molecules are diff.

* Natural fats are mainly mixed glycerides and they do not have free acid or base group so they are also called neutral fat.

* Fat and oils are obtained from the plant as well as animals. i.e., pig fat (Lard), Beef fat (tallow), coconut oil, castor oil, olive oil, soyabean oil, almond oil, mustard oil, Linseed oil, etc.

* Difference b/w Fat

1. Fats are solid & semi solid at room temp.

2. It contains large amount of saturated fatty acid i.e. stearic acid & palmitic acid

fat & oils :- oils

1. oils are liquid at room temp.

3. It contains large amount of unsaturated fatty acid i.e. oleic acid

Fats are melt at high temp.

Fats are obtained from animal sources

5 Fats contains ~~do not~~ double & triple bond

6. Fats are more stable

3. Oils are melt at low temp,

4 oils are obtained from vegetable sources,

5 Oils contains ~~do not~~ contain double & triple bond.

6. oils are less stable.

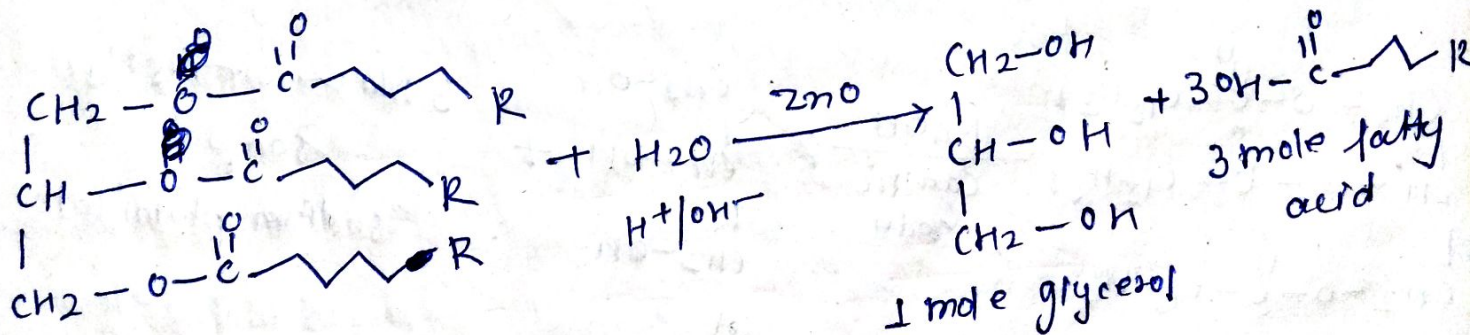
Physical and chemical properties of Fat :-

1. Hydrolysis Reaction:-

dissociate into glycerol and fatty acid.

(i) with water -

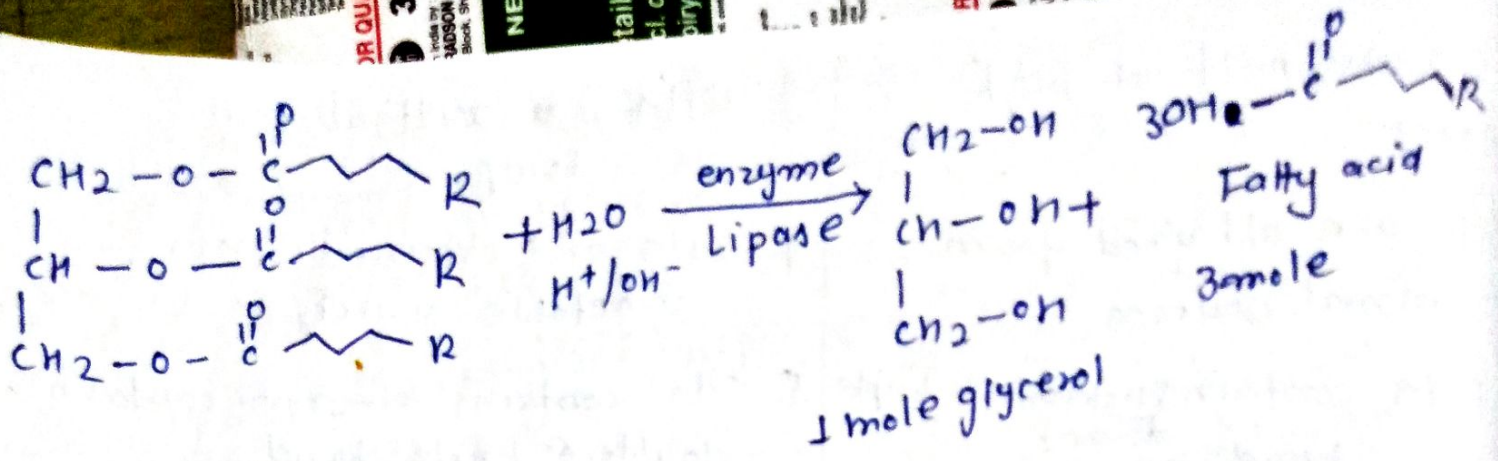
At high temp when fat is dissolve in water in the presence of catalyst ZnO then they produce glycerol & fatty acid.



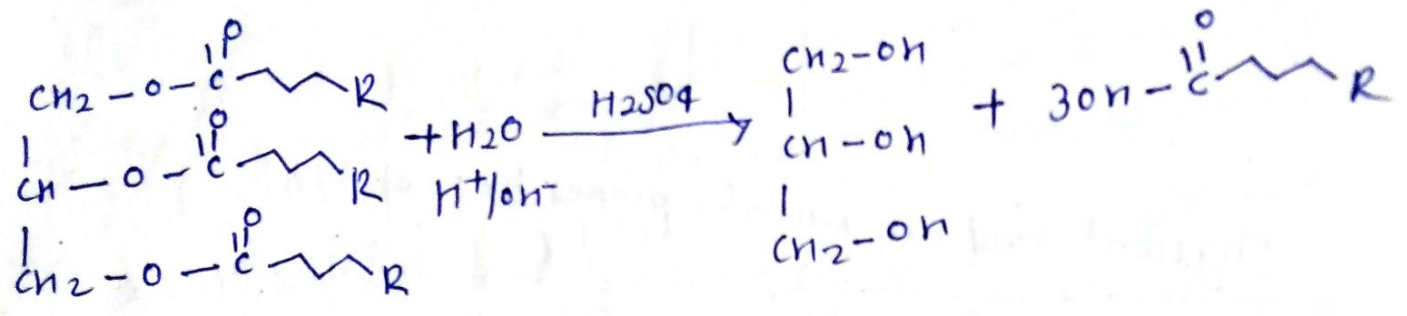
(ii) By enzyme hydrolysis -

lipase fat is hydrolysed formation.

In the presence of enzyme this is used in emulsion

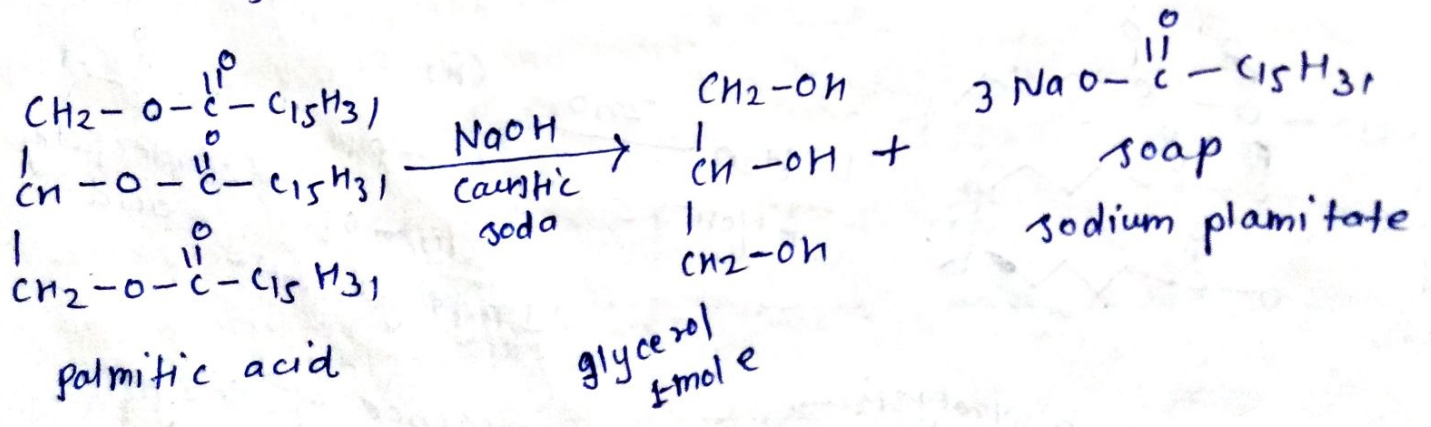


(C) Acid hydrolysis:-



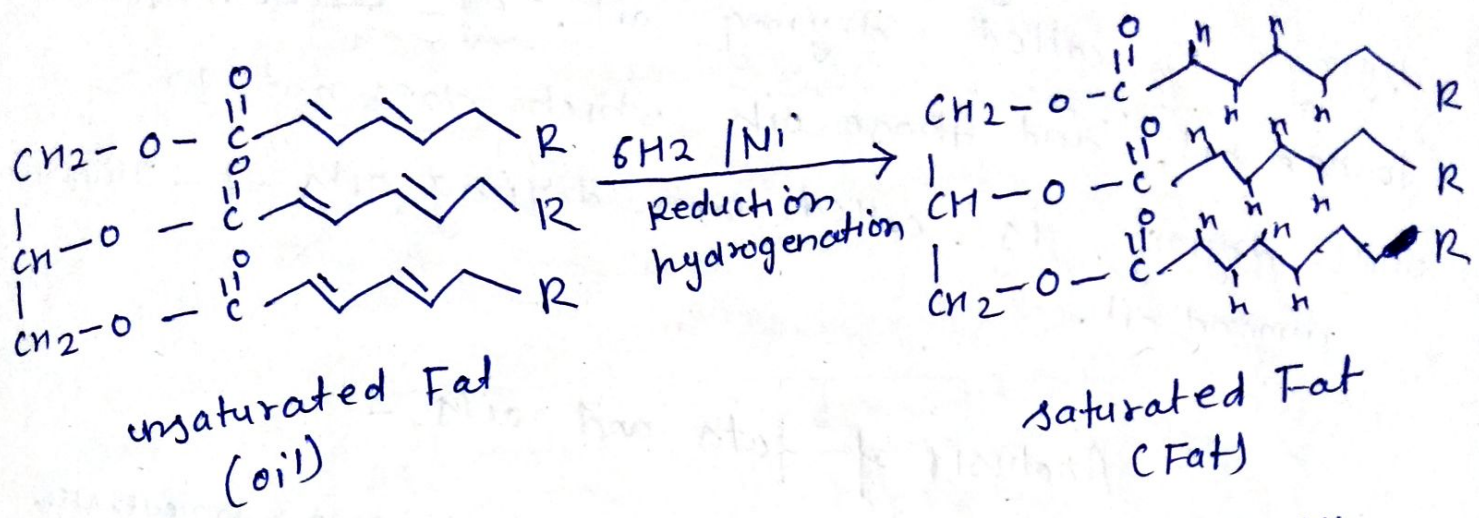
साबुनीकरण

2. Saponification:- when long chain fatty acid reacts with NaOH (caustic soda) then after dissociation reaction they form soap and sodium salt of fatty acid. The process of formation of soap in the presence of caustic soda is saponification.

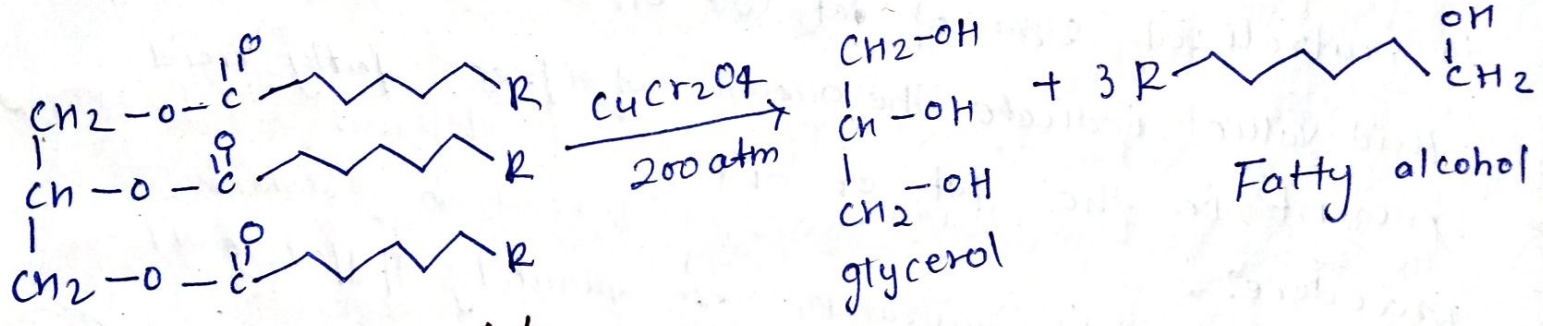


3. Hydrogenation:- The addition of hydrogen in fat/oil in the presence of metal catalyst Ni/Pd/Cd/Pt is called hydrogenation reaction.

After hydrogenation reactⁿ unsaturated fat is converted into saturated fat.



4. Hydrogenolysis Reaction When fat is treated with excess of hydrogen in the presence of catalyst copper chromate $[\text{CuCr}_2\text{O}_4]$ then after break down it produce glycerol and fatty alcohol or (long chain aliphatic alcohol)



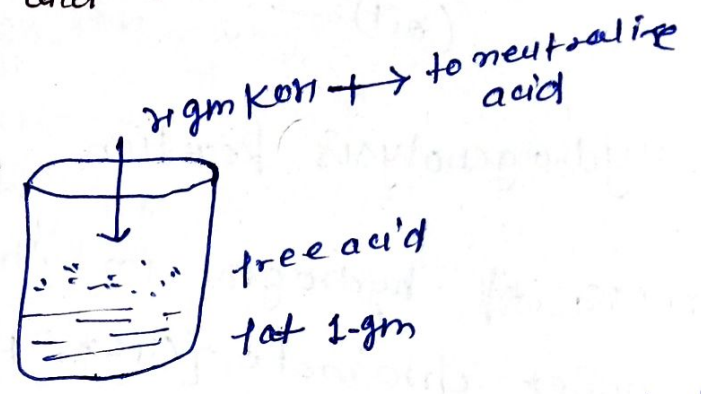
5. Rancidification: -
 When oil and fats are kept in long exposure of air and H_2O then it will decompose and produce a unpleasant smell and taste become bitter, this fat is called rancid fat and the process is known as Rancidification.

6. Drying oils unsaturated fatty acid/ oils absorb oxygen from environment and get polymerised

to form a hard transparent coating, this phenomenon is called drying. Those oils which undergo drying is called drying oil. eg. - ~~linseed~~ linseed oil, tounge oil. and those oils which does not go under drying is called non-drying oils eg. - olive oil, almond oil.

Analysis of fats and oils:-

Evaluation of Oil/Fat:-



Acid value:-

It is defined as no. of miligram of KOH required to neutralized 1gm of fat or oil.

Acid value indicate the amount of free fatty acid present in the fat or oil

procedure:-

1. weight accurately a quantity of fat or oil in a conical flask
2. Then added 50 ml of ethanol-ether soln, shake it well.
3. Titrate the soln with KOH using phenophthalin as a indicator untill pink colour is obtained.

* measure the amount of KOH (ml) used and calculate the acid values as -

$$\text{Acid value} = \frac{V_{\text{KOH}} \times 5.61}{W}$$

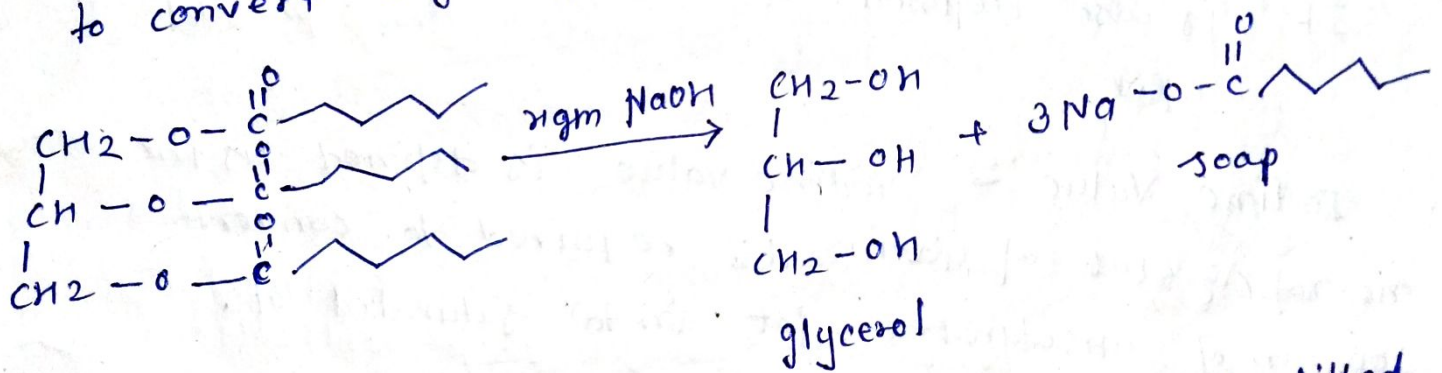
Formula

$$\text{Acid value} = \frac{5.61 \times V}{W}$$

2. Saponification value:-

the no. of mg of NaOH to convert 1-gm of fat

this value is defined as required or KOH required completely into soap



procedure:-

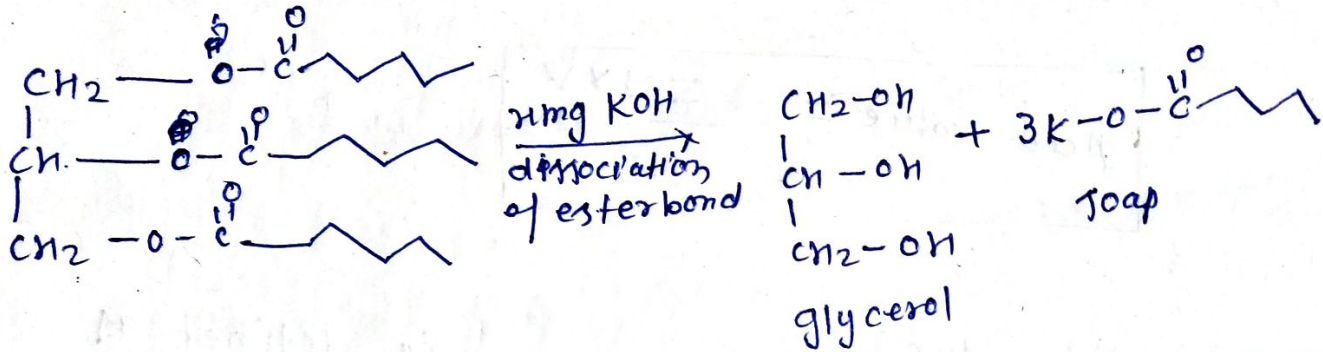
1. Take 2 gm of sample in a conical flask fitted with reflex condenser.
2. Add 25 ml of 0.5 N ethanolic KOH and boil under reflex on a water bath for 30 min.
3. Add 1 ml of phenolphthaleine solⁿ and titrat with 0.5 N HCl solⁿ

$$SV = 28.05 \times \frac{(B - A)}{W}$$

where B = ml of HCl used of blank titration

$A = \text{ml of } 0.5N \text{ HCl sol}^m \text{ used for titration}$
 $w = \text{weight of the sample.}$

3. Ester value:- ester value is defined as the no. of mg of KOH required to react with the ester in 1- gm of Fat/oil and to break down into glycerol and fatty acid.

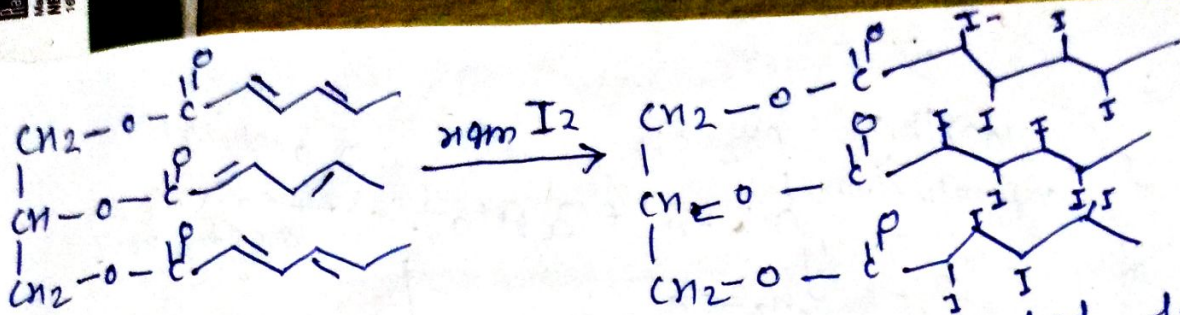


$$\text{Ester value} = \text{Saponification value} - \text{Acid value}$$

It is also defined as the diff. in S.V and A.V.

4. Iodine Value:- iodine value is defined as the no. of grams of iodine is required to convert 100 gm of unsaturated fat into saturated fat. I_2 reacts with the π -bond and convert then into sigma bond.

The main significance of iodine value is to determine the degree of unsaturation of fat.



unsaturated fat/oil

saturated by fat to methods

Iodine value can be determined by

1. Hubl's method \rightarrow CCl_4 / I_2
2. Wigg's method \rightarrow ICl / I_2

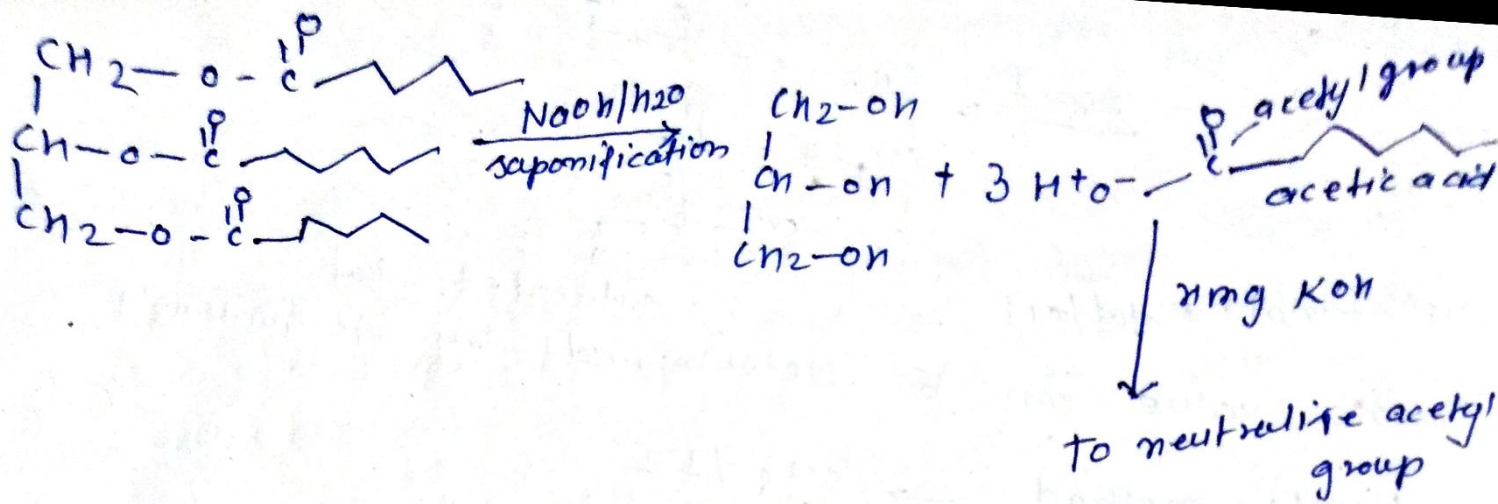
Hubl's method: - The sample is dissolve in CCl_4 solⁿ and it is treated with excess of ethanolic iodine solⁿ in the presence $HgCl_2$

Wigg's method: - In this method iodine mono chloride solⁿ in acetic acid is used.

$$\text{Iodine value} = \frac{(a-b) \times 1.27}{W}$$

where - a = reading for blank titration
 b = actual titration
 w = weight of sample

5 Acetyl group (CH_3COO): - It is defined as the total no. of mg of KOH required to neutralise acetic acid produced by the saponification of 1gm of fat /oil.



$$\text{actual value} = \frac{E}{A} \times 4.3$$

w = weight of acetylated sample

E = Equivalent acidity

* The main significance of acetyl value is to determine to no. of alcoholic group present in fat/oil

6. R.M value (Reicher meisl) :- It is defined as the no. of ml of 0.1 N KOH solⁿ required to neutralise the H₂O soluble steam or 5 gm of hydrolysed fat/oil sample.

It is an indicator of how much volatile fatty acid can be extracted from fat through saponification.

procedure:-

1. 10 gm of sample added in 0.1 N NaOH solⁿ for complete saponification.
2. Now the solⁿ is acidified with H₂SO₄ and undergoes steam distillation.

2 The distillate containing volatile liquid acid is then titrated with 0.1 N KOH soln using phenolphthalein as indicator.

$$\text{R.M Value} = 1.10 (T_1 - T_2)$$

$T_1 =$ volume of 0.1 N KOH used for titration

$T_2 =$ Blank titration

* The main significance of R.M value is to determine the purity of fat/oil and natural ghee which may contain high amount of glycerides soft & butyric acid.