Unit-III
Analytical constants of Fats and Oils

Ms. M. Abinaya, B. Pharm,
Lecturer,
Department of Chemistry,
SS Institute of Pharmacy, Sankari.

Acid Value

- It is the number of milligrams of KOH required to neutralize the free fatty acids present in 1 g of fat or oil.
- Free fatty acids along with the triglycerides are present in oils in small amounts.
- Free fatty acid content - the acid value – Increases during the storage period.
- Acid value is also called as acid number, which is determined to assess the rancidity of the oil or fat.
- Thus, It indicates degree of rancidity – decomposition of glycerides.
- Higher the acid value-higher the free fatty acid- higher the rancidity
- Prevention- airtight, away from light and moisture

Chemicals Required

- Titrant – 0.1 N NaOH or KOH
- Indicator – 1% Phenophthalein in 95% ethanol
- Neutral solvent – 25 ml of ether and 25 ml of ethanol

End point – Pink Color appears which remain for 15 seconds

Determination

$$Acid\ value = \frac{Titre\ value\ \times Normality\ of\ alkali\ \times 56.1}{Wght\ of\ sample\ (g)}$$

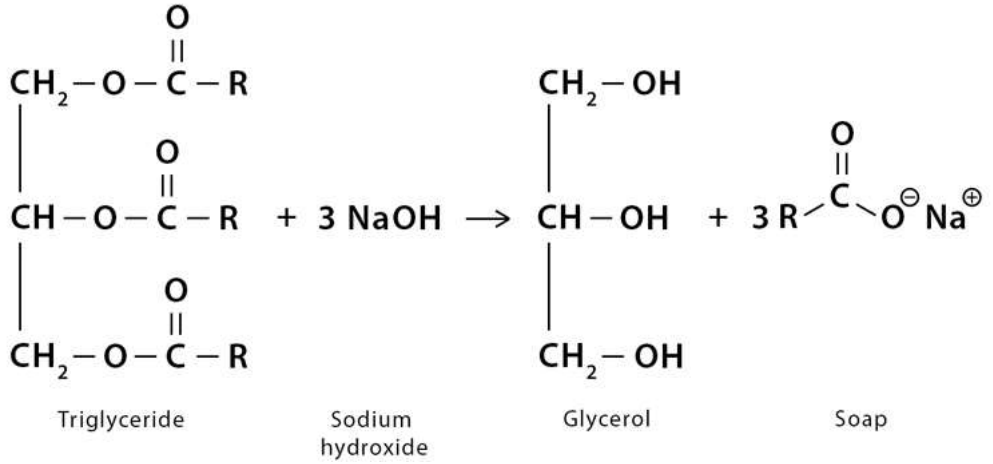
$$Acid\ value = \frac{Volume\ of\ NaOH\ or\ KOH \times 56.1}{Wght\ of\ sample\ (g)}$$

Reaction

Saponification Value or Koettstorfer number

- It is the number of milligrams of KOH require to saponify 1g of fat or oil under the conditions specified. – measure of cont. of ester linkages
- Saponification number – app. Mol. wt. of fat or oil – lower or higher fatty acids preponderate in the formation of glyceride esters (length of the C chain

Reaction



- 3 × 56 = 168 g or 168,000 mg of KOH for saponification
- $Saponification\ number\ of\ fat = \frac{168000}{M}$
- The lower the saponification number, high mol wt fatty acid residues in fat.
- The higher the saponification number, low mol wgt fatty acid residues in fat. – fewer no. of –COOH func. Grps per unit mass
- Adulteration with mineral oils would be shown by saponification value,
- Rancidity- formation of low mol. fatty acids – high value
- All edible oils- between 188 and 196
- $Saponification\ value = \frac{28.05 \times (Titre\ value\ of\ blank - Titre\ value\ of\ sample)}{Weight\ of\ sample}$
- The saponification value is used primarily as an identification aid to detects adulteration with unsaponifiable matter.
- It is also used to determine the extent of compounding (fats and oils added to improve oiliness) in a lubricant

Chemicals Required

- Clear alcoholic KOH
- Titrant – 0.5 N HCl
- Indicator – 1% Phenophthalein in 95% ethanol
- End point - disappearance of pink colour

Ester value

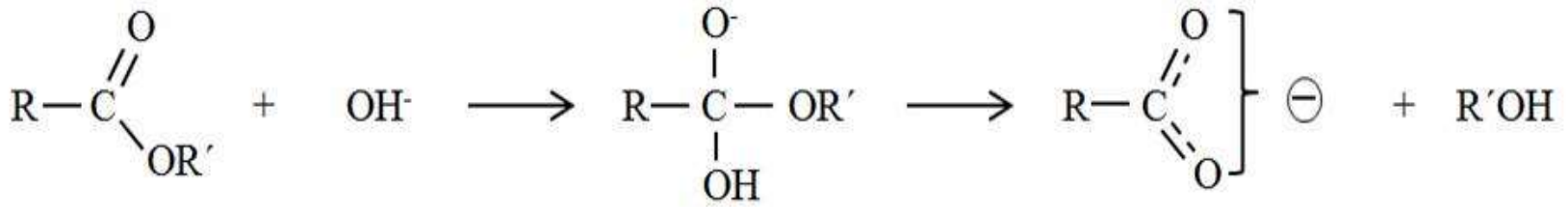
- No. of mg of KOH required to react with the esters in 1 g of fat or oil.

$$Ester\ value = Saponification\ value - acid\ value$$

Chemicals Required

- Neutraised alcohol (20-30ml)
- Titrant – 0.5 N alcoholic KOH and 0.5 N HCl
- Indicator – Phenophthalein 1 ml
- End point – disappearance of pink colour

$$\text{Ester value} = \frac{(B - T) \times 28.05}{\text{wt of sample}}$$



Iodine value or Iodine number

- No. of grams of iodine absorbed by 100 g of fat or oil. - constant for a particular oil or fat.
- The degree of unsaturation of fat or oil is measured by this number.
- Iodine gets incorporated into the double bonds present in the fatty acid chain.

Fat or oil	No. of C=C double bonds	Iodine number
Saturated fatty acid	0	0
Oleic acid	1	90
Linoleic acid	2	181
Linolenic acid	3	274

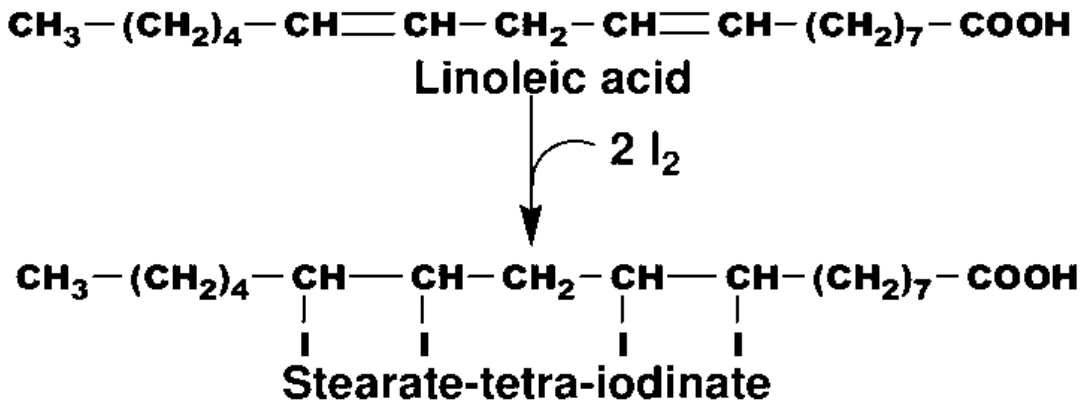
- Animal fats- higher proportion of saturated fatty acids - lower iodine number
- Vegetable oils - higher proportion of unsaturated fatty acids - Higher iodine number (excp. for linseed oil)
- It is used to study the oxidative rancidity of oil. Greater C=C bonds - greater amt of iodine that adds up to 100 g.

Chemicals Required

- Solvent - Chloroform
- Hanus iodine solution or Hubl's reagent

or Wij'sreagent

- 15% potassium iodide solution
- Titrant - 0.1 N sodium thiosulphate
- Indicator - 1% starch



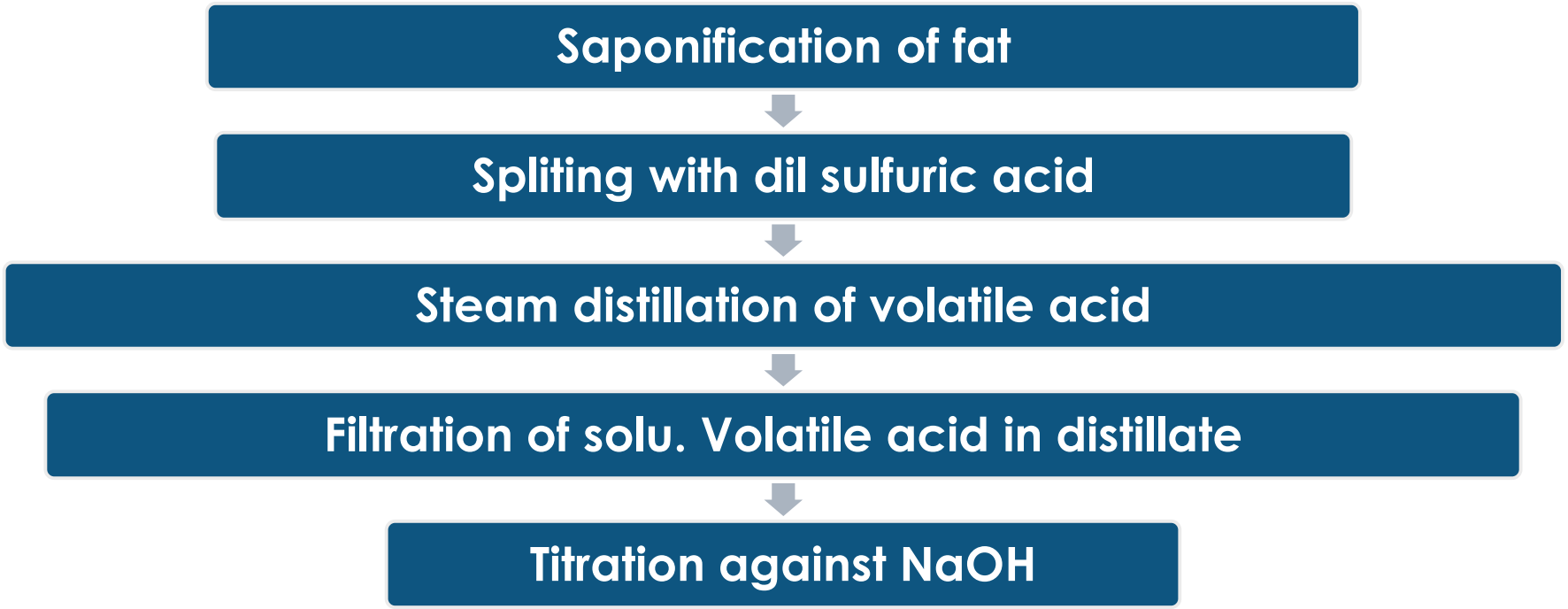
$$Iodine\ number = \frac{(B - S) \times N \times 12.69}{wt\ of\ sample}$$

$$\frac{126.9\frac{g}{L} \times 100}{1000} = 12.69$$

- 12.69 is the conversion factor from mEq sodium thiosulfate to grams of iodine (the molecular weight of iodine is 126.9 g/mol).

Reichert – Meissl value

- **No. of millilitres of 0.1 N KOH required to neutralize the soluble, volatile fatty acids derived from 5g of fat or oil.**



Significance

$$R.M\ value = \frac{No.of\ ml\ of\ 0.1\ N\ KOH\ \times\ 5}{Wt.of\ oil\ or\ fat}$$

- It is the quantity of short chain fatty acids (upto C10) in a fat molecule.
- RM number coconut and palm oil ranges between 5 and 8.
- For Butterfat – bw 17 and 35
- High RM value aids in detecting any foreign fats which adulterate the manufactured butter.