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Subject :- Chemistry Experiment / Tutorial / Assignment No. :- 7 Page :- 1 Date :- 13/1/2023

SAPONIFICATION VALUE OF OIL

Aim:

To determine the Saponification value of Oil using simulator.

Objectives:

After performing the practical, the learner will be able to:

PRO1: Understand the concept of Saponification Value.
PRO2: Use the Animation provided in simulator for carrying out experiments on simulator.
PRO3: Use the Simulator for carrying out experiment for Blank and Test sample.
PRO4: Calculate Saponification value of all Test Samples.

Reactions:

1] $C_3H_5(COOR)_3$ {Oil} + $3KOH \longrightarrow C_3H_8O_3 + 3R.COOK$

2] KOH {unused} + $HCl \longrightarrow KCl + H_2O$

Apparatus:

- Burette
- Pipette
- Conical flask
- Measuring Cylinder.

Reagents:

- ~~KOH~~ 0.5N KOH
- ~~0.1N HCl~~ 0.5N HCl
- Phenolphthalein.
- Fat Solvent [ethanol/ether mixture]

PART-I

(For Blank solution)

- **Observations:**

  - Solution in Burette: 0.5 N HCL
  - Solution in Conical Flask: Fat solvent + KOH.
  - Indicator : Phenolphthalein
  - End point : Pink to Colourless.
  - Pilot Reading : 19.0 ml to 20.0 ml

- **Observation Table:**

Obs. No.	Initial Reading (ml)	Final Reading (ml)	Diffrence (ml)
1	0.0	20.0	20.0
2	0.0	20.0	20.0
3	0.0	20.0	20.0

Constant Burette Reading = 20.0 ml

Estimation of Saponification Value.

(For Oil Solution)

- **Observations:**

  - Solution in Burette : 0.5 N HCL
  - Solution in Conical Flask : Test Oil Sample + Fat solvent + KOH
  - Indicator : Phenolpthalein
  - End point : Pink to Colourless
  - Pilot Reading : 10.0 ml to ~~11.0~~ 11.0 ml

- Observation Table:

- Test Sample 1: Coconut Oil

Obs. No.	Initial Reading (ml)	Final Reading (ml)	Diffrence (ml)
1	0.0	11.0	11.0
2	0.0	11.0	11.0
3	0.0	11.0	11.0

- Constant Burette Reading = 11.0 ml

- Calculations:

$$\text{Sap value} = \frac{(\text{Blank reading} - \text{Back reading}) \times \text{Normality of KOH} \times 56}{\text{Weight of oil taken}}$$

$$= \frac{(20-11) \times 0.5 \times 56}{1000}$$

$$= 0.252\ g = 252\ mg$$

- Test Sample 2: Sunflower Oil

Obs. No.	Initial Reading (ml)	Final Reading (ml)	Diffrence (ml)
1	0.0	13.0	13.0
2	0.0	13.0	13.0
3	0.0	13.0	13.0

- Constant Burette Reading = 13.0 ml

- Calculations:

$$\text{Sap value} = \frac{(\text{Blank reading} - \text{Back reading}) \times \text{Normality of KOH} \times 56}{\text{Weight of oil taken}}$$

$$= \frac{(20-13) \times 0.5 \times 56}{1000}$$

$$= 0.196\ g = 196\ mg$$

• Test Sample 3: Butter

Obs. No.	Initial Reading (ml)	Final Reading (ml)	Diffrence (ml)
1	0.0	12.5	12.5
2	0.0	12.5	12.5
3	0.0	12.5	12.5

• Constant Burette Reading = 12.5 ml

• Calculations:

$$\text{Sap value} = \frac{(\text{Blank reading} - \text{Back reading}) \times \text{Normality of KOH} \times 56}{\text{Weight of oil taken.}}$$

$$= \frac{(20 - 12.5) \times 0.5 \times 56}{1000}$$

$$= 0.210\,g = 210\,mg$$

• Test Sample 4: Rice Bran Oil

Obs. No.	Initial Reading (ml)	Final Reding (ml)	Diffrence (ml)
1	0.0	13.3	13.3
2	0.0	13.3	13.3
3	0.0	13.3	13.3

• Constant Burette Reading = 13.3 ml

• Calculations:

$$\text{Sap value} = \frac{(\text{Blank reading} - \text{Back reading}) \times \text{Normality of KOH} \times 56}{\text{Weight of oil taken}}$$

$$= \frac{(20 - 13.3) \times 0.5 \times 56}{1000}$$

$$= 0.1876\,g = 187.6\,mg$$

- Test Sample 5 : Castor oil

Obs. No.	Initial Reading (ml)	Final Reading (ml)	Difference (ml)
1	0.0	13.5	13.5
2	0.0	13.5	13.5
3	0.0	13.5	13.5

- Constant Burette Reading = 13.5 ml

- Calculations:

$$\text{Sap value} = \frac{(\text{Blank reading} - \text{Back reading}) \times \text{Normality of KOH} \times 56}{\text{Weight of oil taken}}$$

$$= \frac{(20 - 13.5) \times 0.5 \times 56}{1000}$$

$$= 0.182\,g = 182\,mg$$

Result & Discussions:

PRO1: Fats (triglycerides) upon Alkaline Hydrolysis (either with KOH or NaOH) yield glycerol and Potassium or Sodium salts of fatty acids (soap). This process is called as Saponification. The Saponification Number is the number of milligrams. of Potassium Hydroxide - KOH required to neutralize the fatty acids resulting from the complete hydrolysis of 1 g fat. As KOH is used in Excess some of it remains Unreacted. This Amount can be found using Redox Titration to obtain Saponification Number.

PRO2: The Procedure of Experiment is explained through Animation. Adding Ether/Ester Mixture Solution i.e. Fat Solvent in the Oil sample bit by bit Results in Complete Dissolution of the fats present in the Oil. Reflux Condensers are used for Cooling the Sample Vapors to Turn them back into Liquid state, thus Reducing the Loss of Sample.

PRO3: The Saponification Experiment is Vast & requires a lot of Time to perform for its Tedious Procedure, Hence it is not advisable to be conducted in a Single Setting. Hence we perform this Experiment using a Simulator. Use of simulator Not only saves time but also Nullifies every possible Human Error that can happen while performing the Experiments Manually, Resulting in Accurate Readings.

PRO4: The Saponification Value is calculated as the Number of mg of KOH consumed by 1 g of Fat. The Blank Solution is made using just the Fat Solvent & KOH & since No Hydrolysis Take place, KOH solution remains Unreacted, Causing its Complete Titration Against HCl. Hence the Saponification value of Blank is Always Greater than Any oil sample.

Conclusion :

The Saponification Value of Any Triglyceride (Fat) can be found using its Ability to Hydrolyse with Alkali. The higher the Saponification number, the more capable the Oil is in making Soap.

Precautions:

While performing the practical, the learner must:

1. Ensure that glassware is clean.
2. Ensure Burette is holding properly to burette stand.
3. Ensure Safe handling of all glassware used.
4. Ensure safe handling of Alcholic KOH and Oil solution on water bath.

Quiz:

1] What is the role of Phenolpthalein Indicator?

⇒ Phenolpthalein is a Visual Indicator which gives Pink Color to an Alkaline Solution & stays Colourless for Acidic Solutions. As this change of colour can be Observed while

changing the pH, Phenolphthalein is Used as a Indicator in Titrations.

2] Why heating of oil solution is required?

⇒ Heating of Solution has a Big Role in Saponification Reaction as when the Reaction Takes place at Temprature Higher than 120°, it helps in Easier & Better Saponification Also Increasing its stability.

3] Why water bath is needed for heating?

⇒ In the Saponification Experiment the Fat Solutions we use are Highly Flammable Chemicals. Hence Water baths are used as Preferred Source of Heating these solutions to prevent Direct Ignition.

4] Name the type of titration involved in Saponification of Oil.

⇒ Acid-Base Titration using Phenolphtalein Indicator is used while Performing Saponification of Oil.

Objective	PRO 1	PRO 2	PRO 3	PRO 4	Total
Weight Points	20	20	20	20	Score
Score					

Earned Points (EP) =	Marks in 100 =
Total Score / 80 =	EP * 20