Green University of Bangladesh

Dept. of Computer Science and Engineering

Lab report-1

Course Code: CHE-102

Course Title: Chemistry Laboratory

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Remarks

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Experiment number: 01

Experiment name: Standardization of Sodium Hydroxide solution with standard Oxalic Acid solution.

Objectives:

1. To study the neutralization reaction
2. To observe the quantity of acid or base needed for neutralization.

Theory:

In this experiment we shall determine the strength of NaOH solution by a standard solution of Oxalic Acid. This is done by means of "Titration". The important matters that are related with the experiment are stated below:

Titration:

In presence of a suitable indicator, the volumetric analysis in which a standard solution is added in another solution (whose strength is not known) to reach its end point to determine the strength of that solution is called 'titration'.

Standard Solution: A solution of known concentration is called a 'standard solution'.

Indicator: In our acid-base titration there is an important use of indicator. An 'indicator' is a chemical substance that detects the equivalent point (i.e. the end point) of reaction by changing its color.

Equivalent Point: The 'equivalent point' is the point in a titration when a stoichiometric amount of reactant has been added.

Normality: The number of gram equivalent weight of a solute per liter of solution is called normality.

Normality (N) = gm equivalent of solute /liters per solution.

In this experiment the reaction we shall use is as follows:

$$HOOC\text{-}COOH + 2NaOH \longrightarrow NaOOC\text{-}COONa + 2H_2O$$

The formula required to determine the strength of NaOH solution is: -

$V_{base} \times S_{base} = V_{acid} \times S_{acid}$ (For 1:1 mole ratio)

Modified formula for Oxalic acid and Sodium hydroxide will be:

$V_{base} \times S_{base} = 2V_{acid} \times S_{acid}$

M_{acid}= Molarity of the acid, M_{base}= Molarity of the base

V_{acid}= Volume of the acid, V_{base} = Volume of the base

The volume of Oxalic acid is measured by watching the Equivalent point. The point at which acid-base neutralizes each other is called "Equilibrium point". This point is determined with the help of an indicator.

Why Phenolphthalein is used as indicator:

In this experiment, 'Phenolphthalein' is selected as indicator whose working pH range is 8.3-10.0 i.e. it is works when the environment is acid. This indicator gives pink color in basic solution and becomes colorless when the base is neutralized.

Indicator name	pH range	Colour in Alkaline solution	Colour in Acid solution
Phenolphthalein	8.3-10.0	Pink	Colourless

In this experiment we are using NaOH and Oxalic acid. NaOH is a strong base but

Oxalic acid is a weak acid. So the solution at equilibrium point consists of a salt whose basic part is strong. As a result, there will be more OH- in the solution than H+ as the salt will be dissociated in the aquas solution. So, the solution would be basic which provides phenolphthalein to work properly. So Phenolphthalein becomes the perfect indicator to determine the end point of this reaction.

Apparatus:

1. Conical flask

2. Burette

3. Pipette

4 Volumetric flasks

5. Stand

Name of the chemicals used:

NaOH (sodium hydroxide, base)

1. HOOC-COOH (Oxalic-acid)
2. Phenolphthalein (indicator)

Data and calculation:

Standardization of NaOH solution with standard Oxalic Acid Solution

Number of Observation	Volume of NaOH (ml)	Burette reading (ml)		Volume of Acid (ml)	Average Reading (ml)	Strength of Acid (M)
		Initial Reading	Final Reading			
1	10	0	10	10		
2	10	10	20.2	10.2	10.2	0.5
3	10	20.2	30.4	10.2		

Calculation:

From

$V_{base} \times S_{base} = 2V_{acid} \times S_{acid}$

We get,

$2V_{Oxalic-acid} \times S_{Oxalic-acid} = V_{NaOH} \times S_{NaOH}$

Here,

$V_{Oxalic-acid}$ = 10.2 ml (average)

$S_{Oxalic-acid}$ = 0.5 M

V_{NaOH} =10 ml

S_{NaOH} = ?

We know that,

$2V_{Oxalic-acid} \times S_{Oxalic-acid} = V_{NaOH} \times S_{NaOH}$

$S_{NaOH} = (2V_{Oxalic-acid} \times S_{Oxalic-acid}) / (V_{NaOH})$

$= (2\times 10.2 \times 0.5) / 10$

$=1.02$

Result:

Determined strength of NaOH solution is:

S_{NaOH} = 1.02 M

Discussion:

1. Reagents should be handled very carefully.
2. The ‘Initial burette reading’ and ‘Final burette reading’ should be taken carefully.