Engineering Chemistry Laboratory

Subject code: BCY-101

Essentials of Titrimetric /Volumetric Analysis

1.The reaction i.e., chemical equation taking place must be known.

2.The reaction should be fast as possible.

3.The solutions /reagents to be used must be stable to light and atmospheric conditions.

REAGENTS:

(1) **Primary** reagents: reagents that can be prepared directly by dissolving known amount of substance/solute in a definite volume of the solvent or are those that known to us. e.g., oxalic acid
(2) **Secondary** reagents: those reagents that can not be prepared directly by weighing definite amount of substance or solute or are those reagents that not known to us. e.g., NaOH
(3) **Standard** reagents: are those whose normality or strength is known or in which definite amount of a substance/solute is present in a definite volume of solvent.

TYPES OF SOLUTIONS:

(1) Normal solution: No. of gram equivalents of solute contained in one liter of solution. (gram equivalents/litre)
(2) Molar solution: No. of gram moles of solute per litre of solution.
(3) Molal solution: No. of gram moles of solute per 1000 gm of solvent.
(4) Formal solution: formula weight of solute per litre of solvent.
(5) PPM (Parts per million) solution: 1 mg of solute per litre of solvent.
(6) PPB (Parts per billion) solution: 1 microgram of solute per litre of solvent.

TITRATION:

Titration is volumetric analysis or method in which known and unknown reagents are compared under same conditions of volume, end point, indicator and procedure to find the strength of unknown or given solution.

Every titration consists of two steps:

(1) Titration of **known solution** or standardization titration to find the normality of intermediate or titrant.
(2) Titration of **unknown** or given solution.

TYPES OF INDICATORS:

Indicator: is a substance which changes the color in response to a chemical reaction (specially in titrations). It is added to derive the exact end point for volumetric as well as complexometric titration.

(1) **Internal indicator:** These are those indicators which takes part in the reaction (titration) and after completion of titration it changes the color of the solution indicating the sharp end point or are those that added in to reaction mixture or titration flask. for e.g., Phenolphthalein, methyl orange etc.

(2) **External indicator:** Indicator which never takes part in the chemical reaction but after completion of reaction it also changes the color of solution to indicate the endpoint or are those that we do not added in to reaction mixture or titration flask but used outside the titration flask for e.g., K_3 Fe $(CN)_6$

(3) **Self-indicator:** is not an indicator it is one of the reacting species of titration, which is after completion of reaction changes the color of the solution itself. for e.g., $KMnO_4$ has an intense purple color that disappears when it is reduced to Mn^{++} in acidic solution; the appearance of a persistent pink is usually sufficient to show that the oxidized species is totally oxidized.

End point: A point during the course of titration, where sudden color change takes that indicate completion of the reaction.

Buffers: are the reagents that resist the pH change. e.g., NH_4Cl- NH_4OH

Accuracy: refers to correctness of measurement or analysis.

Precision: refers to concordance among the measurements or readings.

Sensitivity: refers to min. and min. amount of a substance/sample that can be measured maintaining the accuracy and precision, hence as amount of sample decreases the sensitivity increases.

Precautions to be used to maintain the accuracy and precision:

1. Amount of indicator should be same throughout the titration.
2. All volume measurements should be correct.
3. Titration should be carried out drop by drop with shaking the contents.
4. End point should be observed carefully