

## CHAPTER – 3 Precipitation Titration

### 3.1

### INTRODUCTION

In precipitation titration, the titrant reacts with the analyte and forms an insoluble substance called a precipitate. It continues till the last amount of analyte is consumed.

It is a titrimetric method which involves the formation of precipitates during the experiment of titration. The titrant reacts with the analyte and forms an insoluble substance. The titration is continued till the last drop of the analyte is consumed. When the titrant is excess it reacts with the indicator and signals to terminate the titration process.

### 3.2

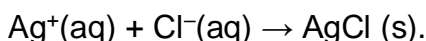
### Principle of Precipitation Titration

Precipitation titration is a type of titration which involves the formation of precipitate during the titration technique.

### 3.3

### Precipitation Titration Example

**Example:** To determine the concentration of chloride ion in a certain solution we can titrate this solution with silver nitrate solution (whose concentration is known). The chemical reaction occurs as follows:



AgCl in the form of a white precipitate can be seen settled at the bottom of the flask during titration. The quantity of silver ion used to the equivalence point is equal to the quantity of chloride ion which was originally present.

To calculate the number of moles of chloride ion or silver ion we can use  $n = cV$  (molarity definition)

To calculate the volume of the added solution or molar concentration of ion the corresponding values of either of the ions should be known.

Where  $n$  is the number of moles,  $c$  is the concentration and  $V$  is the volume in  $\text{dm}^3$ .

### 3.4

### Methods of Precipitation Titration

#### Volhard's method

- This method involves the titration of bromides, iodides, and chlorides, in an acidic medium.
- The chloride in the solution is converted to silver chloride when reacted with excess silver nitrate solution. The leftover silver nitrate is estimated against potassium thiocyanate solution.
- When all thiocyanate consumes all the silver, the excess of thiocyanate is made to react with an indicator.

- It gives a red colour on reacting with ferric ammonium sulfate indicator and a ferrous thiocyanate complex is formed.

**Fajan's method**

- This method uses the reaction between the precipitate formed and indicator.
- The indicator used is dichlorofluorescein which acts as an anion in solution.
- In chloride solution, due to excess chloride ions, they form the primary layer of the precipitate. The second layer is formed by the cations of sodium.
- The reaction ends with the silver ion in excess. Therefore the positively charged silver ion becomes the primary layer and attracts indicator to form a second layer. The colour of the indicator signals the end of the reaction.

**Mohr's method**

- This method is used to determine chlorides in a neutral solution.
- The chromate ion in acidic conditions is protonated to form chromic acid. Therefore does not produce a precipitate.
- Highly alkaline solutions result in forming the silver hydroxide.
- This formation results in brown colour and this infers the endpoint.