



19CH103- ENGINEERING CHEMISTRY

Unit-5 INSTRUMENTAL METHODS OF ANALYSIS

CONDUCTOMETRIC METHOD

- It is an electrochemical method of analysis concerned with electrical conductance through an electrolyte solution . (or)
- It is defined as determination or measurement of the electrical conductance of an electrolyte solution by means of a conductometer .
 - electric conductivity of an electrolyte solution depends on :
 - Type of ions (cations, anions, singly or doubly charged)
 - Concentration of ions
 - Temperature
 - Mobility of ions

PRINCIPLE:

- Based on the conductance of electrical current through electrolyte solutions similar to metallic conductors
- The electric conductance in accordance with ohms law which states that the strength of current passing through conductor is directly proportional to potential difference & inversely to resistance.

$$i = V/R$$

● Conductance:(G)

- Which current flows per unit area of conductor per unit potential applied & is reciprocal to resistance(R)

$$G = I/R$$



● Instrumentation

The instrument used for measurement of conductance are known as conductometers. It consists of :

1. Current source
2. Conductivity cells
3. Electrodes

- electrical potential is applied across electrodes two processes occur.
- Ions accumulate near the electrodes.
- Transfer of charge through the interface.
- Note : DC current is not employed in conductance measurement because
- Electrodes become polarised leading to high cell resistance.

● Conductivity cells:-

- Made of pyrex or quartz and are fitted with two platinum electrodes.
- Should be placed in a vessel containing water to maintain constant temperature
- Types :
 1. Wide mouthed cell
 2. Cell for reactions producing precipitation
 3. Dip type cells





● **Electrodes:**

- Platinum sheets, each of 1 cm² are fixed at distance of 1 cm
- The surface is coated with platinum black to avoid polarization effects and increase effective surface area.
- Platinisation of electrodes is done by coating solution of 3% chlorplatinic acid and lead acetate on it to get uniform coating
- Electrodes usage depends on conductivity and concentration
- If conc is low then electrodes should be largely and closely packed

● **Measurement:-**

- The instrument used to measure conductance is called conductance bridge or conductometer
- Classical circuit employed for measurement is wheat stone bridge
- All other work on this principle

● **TYRES OF CONDUCTOMETRIC TITRATIONS:**

- Acid -base or neutral titrations
- Replacement or displacement titrations
- Redox titrations
- Precipitation titrations
- Complexometric titrations
- Non-aqueous titrations

➤ **STRONG ACID-STRONG BASE**

EG: HCL vs NaOH

➤ **STRONG ACID-WEAK BASE**

EG: HCL vs NH₄OH

➤ **WEAK ACID-STRONG BASE**

EG: CH₃COOH vs NaOH

➤ **WEAK ACID -WEAK BASE**

EG: CH₃COOH vs NH₄OH

● **ADVANTAGE OF CONDUCTOMETRIC TITRATIONS:**

1. Does not require indicators since change in conductance is measured by conductometer
2. Suitable for coloured solutions
3. Since end point is determined by graphical means accurate results are obtained with minimum error
4. Used for analysis of turbid suspensions, weak acids, weak bases, mix of weak & strong acids



● **Disadvantages of conductometric titration:**

1. Increased level of salts in solution masks the conductivity changes, in such cases it does not give accurate results
2. Application of conductometric titrations to redox systems is limited because, high concentrations of hydronium ions in the solution tends to mask the changes in conductance

● **Applications :**

1. Check water pollution in rivers and lakes
2. Alkalinity of fresh water
3. Salinity of sea water (oceanography)
4. Deuterium ion concentration in water- deuterium mixture
5. Food microbiology- for tracing micro organisms
6. Tracing antibiotics
7. Estimate ash content in sugar juices
8. Purity of distilled and de-ionised water can determined
9. Solubility of sparingly soluble salts like AgCl , BaSO_4 can be detected
10. Determination of atmospheric SO_2 , estimation of vanillin in vanilla flavour