Experiment

Preparation and standardization of Potassium permanganate

Aim:- To prepare and standardize 0.1N potassium permanganate Solution.

Reference:- Indian Pharmacopoeia by Ministry of Health And Family Welfare, Gov. of India, Volume I 2007, P-316.
Practical book of Pharmaceutical Chemistry, F ourth edition edited by A.H Beckett, J.B Stenlake, CBS Publishers and Distributors, 2005 P-187.

Requirements:

Chemical Requirement:- Potassium Permanganate, Sodium oxalate, **H_2SO_4, H_2O.**
Glassware Requirement:- Conical flask, Burette ,Pipette ,Water bath, Burner ,Measuring Cylinder ,Beaker ,Dropper , Glass rod ,Butter paper.

Principle:-

Potassium permanganate is a strong oxidizing agent. In acid medium (commonly H_2SO_4) MnO_4^- is reduced to Mn^{2+} while the reducing analyte is oxidized. The reaction is a redox reaction with well-defined stoichiometry. $KMnO_4$ is **self-indicating** — the permanganate ion is purple and Mn^{2+} is nearly colourless, so the end point is the first persistent faint pink colour that remains in the titrated solution.

Reaction (example with oxalate, the usual primary standard):
$2\ MnO_4^- + 5\ C_2O_4^{2-} + 16\ H^+ \rightarrow 2\ Mn^{2+} + 10\ CO_2 + 8\ H_2O$

Procedure:-

A. Preparation of ~0.1 N $KMnO_4$

1. **Weigh & dissolve:** Dissolve about **3.2 g $KMnO_4$** in ~500 mL warm water. Transfer to a 1 L volumetric flask and make up to the mark with water.
2. **Condition the solution:** Let the solution stand **24–48 h** in the dark (or heat gently ~60–70 °C for 1–2 h, cool, then stand).
3. **Filter:** Filter through a **sintered-glass** funnel (or tightly packed glass wool).
4. **Store:** Keep in an **amber bottle**, well-stoppered, away from light. Label "Approx. 0.1 N $KMnO_4$ – standardize before use."

B. Standardization options

Option 1: Sodium oxalate (preferred)

- **Why:** Excellent primary standard; endpoint is sharp; minimal hygroscopicity.

Procedure

1. Accurately weigh **~0.12–0.15 g $Na_2C_2O_4$** (record to 0.1 mg).
2. Add ~**25–30 mL water** and **10 mL of ~4 M H_2SO_4**.
3. Warm up **60–70 °C** throughout the titration (reaction is slow at room temp).
4. Fill the burette with the $KMnO_4$ solution. Titrate with **gentle swirling**, added **dropwise**.
5. **Endpoint:** First **permanent very pale pink**.
6. Perform **3 concordant titrations** (agree within 0.1 mL).

Calculation

$$N_{KMnO_4} = \frac{\text{equivalents of } Na_2C_2O_4}{V_{KMnO_4}\,(\text{L})} = \frac{m\ (\text{g})/67.00}{V\ (\text{L})} = \frac{m \times 1000}{67.00 \times V\ (\text{mL})}$$

Example: If $m = 0.1340$ g and $V = 19.80$ mL,

$$N = \frac{0.1340 \times 1000}{67.00 \times 19.80} = 0.1010\ \text{N}$$

Result:-The normality of given KMnO4 solution …… N.

Viva-Voce Questions

1. Which primary standards are used for standardization of $KMnO_4$?
2. Why is $KMnO_4$ self-indicating?
3. Why should the solution of oxalic acid be heated during titration with $KMnO_4$?
4. Why is standardization of $KMnO_4$ necessary every time before use?
5. What is the role of sulfuric acid in the redox reaction?