

## 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, Fourth edition edited by A.H Beckett, J.B Stenlake, CBS Publishers and Distributors, 2005 P-187.

#### Requirements:

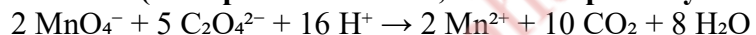
**Chemical Requirement:-** Potassium Permanganate, Sodium oxalate,  $\text{H}_2\text{SO}_4$ ,  $\text{H}_2\text{O}$ .

**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  $\text{H}_2\text{SO}_4$ )  $\text{MnO}_4^-$  is reduced to  $\text{Mn}^{2+}$  while the reducing analyte is oxidized. The reaction is a redox reaction with well-defined stoichiometry.  $\text{KMnO}_4$  is **self-indicating** — the permanganate ion is purple and  $\text{Mn}^{2+}$  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):



#### Procedure:-

##### A. Preparation of ~0.1 N $\text{KMnO}_4$

1. **Weigh & dissolve:** Dissolve about **3.2 g  $\text{KMnO}_4$**  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  $\text{KMnO}_4$  – 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<sub>2</sub>C<sub>2</sub>O<sub>4</sub>** (record to 0.1 mg).
2. Add **~25–30 mL water** and **10 mL of ~4 M H<sub>2</sub>SO<sub>4</sub>**.
3. Warm up **60–70 °C** throughout the titration (reaction is slow at room temp).
4. Fill the burette with the KMnO<sub>4</sub> 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

$$N_{\text{KMnO}_4} = \frac{\text{equivalents of Na}_2\text{C}_2\text{O}_4}{V_{\text{KMnO}_4} (\text{L})} = \frac{m (\text{g}) / 67.00}{V (\text{L})} = \frac{m \times 1000}{67.00 \times V (\text{mL})}$$

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 KMnO<sub>4</sub> solution ..... N.

**Viva-Voce Questions**

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