

EXPERIMENT: 04

AIM:

TO PREPARE AND STANDARDIZE 0.1 N SOLUTION OF POTASSIUM PERMANGANATE

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REQUIREMENTS

A. Glassware & Instruments

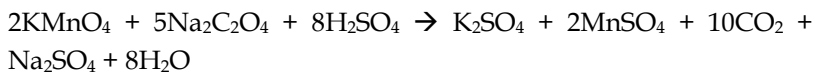
1. Clean and calibrated burette
2. Pipette
3. Weighing balance
4. Burette stand
5. Thermometer
6. Spatula
7. Measuring cylinder
8. Wire gauze
9. Conical flask
10. Bunsen burner
11. Tripod stand

B. Chemicals & Reagents

1. Analyte- 0.1N Potassium permanganate
2. Titrant- Oxalic Acid
3. Dilute Sulphuric Acid
4. Distilled water

THEORY

Oxalic acid is oxidized by Potassium permanganate, in acidic medium to Carbon dioxide and water.



The reaction is complete between 60 and 90 degrees Celsius.

KMnO₄ is a potent oxidizer in acidic environments. Under suitable storage conditions, it can hold its concentration for an extended period. In addition to being a self-indicator, its small excess provides the solution a distinctive pink colour.

HCl cannot be substituted for H₂SO₄ due to its rapid oxidation to chlorine in the presence of permanganate. Nitric acid is stronger than KMnO₄.

PRINCIPLE

A redox reaction is used to standardise potassium permanganate in relation to sodium oxalate, which serves as the primary standard. During this reaction, potassium permanganate plays the role of the oxidising agent, and sodium oxalate takes on the role of the reducing agent. The titration is conducted using an acidic media.

PROCEDURE

Preparation of 0.1N KMnO₄ Solution

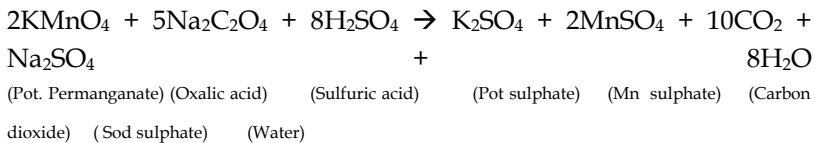
- We know that the equivalent weight of KMnO₄ is 31.6 g/eq.
- For preparation of 1N solution, we will require 31.6g of KMnO₄.
- So, for 0.1N solution, 3.2g of analytical grade of KMnO₄ will be taken on a watch glass.
- Transfer it into a big 250 ml flask.
- Add warm distilled water to the flask and shake well in order to dissolve KMnO₄.

- Now decant the upper clear solution on the top and transfer it to 1000 ml clean flask.
- Repeat this process several times but be careful not to add water up to the mark.
- Finally, when the powdered KMnO_4 is completely dissolved, make up the solution up to mark 1L.
- The prepared solution will be approximately 0.1N. It will be standardized with oxalic acid or preferably sodium oxalate.
- Prevent this solution from direct sunlight because photodecomposition occurs.

Standardization of KMnO_4 solution

- Dry sodium oxalate for 2 hours at 105-110°C.
- Place it in a desiccator and let it cool.
- Transfer 6.7g (the equivalent weight of sodium oxalate is 67g) of the pure sodium oxalate to a 1000ml volumetric flask holding 500ml of water.
- Complete the volume with purified water
- Pour 10 ml of this solution into a conical flask and add 5 ml of diluted H_2SO_4 along the side of the flask. Heat the contents to 70 degrees Celsius.
- Titrate against potassium permanganate solution from the burette until a faint pink colour persists for 30 seconds upon shaking the flask.
- Repeat the procedure until you have 3 concordant readings.

REACTION



Oxidation reaction: $[\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}] \times 2$

Reduction reaction: $[(\text{COO}^-)_2 - 2\text{e}^- \rightarrow 2\text{CO}_2] \times 5$

CALCULATION

Observation table

S. No.	Volume of Sodium oxalate solution taken (ml)	Burette reading of KMnO_4		Volume of KMnO_4 consumed (ml)
		IR	FR	
1.				
2.				
3.				

mEq. of Oxalic acid = mEq. of Potassium permanganate at the end point

$$N_1 V_1 = N_2 V_2$$

Where N_1 = Normality of $\text{Na}_2\text{C}_2\text{O}_4$

V_1 = Volume of $\text{Na}_2\text{C}_2\text{O}_4$

N_2 = Normality of KMnO_4

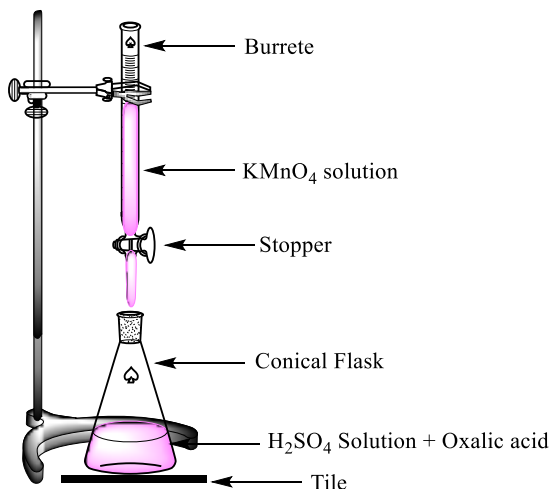
V_2 = Volume of KMnO_4

$$N_1 V_1 = N_2 V_2$$

$(0.1N) (10ml) = (\text{unknown } (N_2)) \times \text{Volume of } KMnO_4 \text{ consumed (from burette)}$

$N_2 \text{ (Normality of } KMnO_4) = (0.1 \times 10) / \text{Volume of } KMnO_4 \text{ consumed (from burette)}$

DIAGRAM



APPLICATION

1. Potassium permanganate's oxidising characteristic makes it an effective disinfectant. It is effective against dermatitis, canker sores, ulcers, eczema, and fungal infections.
2. In water treatment plants, chlorine is used to eliminate pollutants and remove foul odours. It oxidises iron, hydrogen sulphide, and manganese into solid particles that are subsequently filtered out. It can also be used to purify swimming pool water.
3. When combined with 80 percent hydrogen sulphide, it functions as a rocket and torpedo propellant.

4. It can be utilised as an antidote for phosphorus poisoning.
5. In the paper manufacturing sector, the kappa number (amount of standard permanganate solution consumed by wood pulp) is used to determine the amount of bleaching chemical required.
6. It functions as a disinfectant.
7. Extremely good for treating athlete's foot infections.
8. It is utilised in water treatment facilities
9. It is frequently used to treat fish parasite infestations. Etc.

RESULT

Based on the results of the experiment described above, it is clear that potassium permanganate can be standardised using oxalic acid in an efficient manner. Calculations revealed that the prepared Potassium permanganate solution has a concentration of.....N.

VIVA QUESTIONS

1. What is the chemical formula of potassium permanganate?
2. What do you understand by the term standardization?
3. What is secondary standard substance?
4. What do you understand by the term self indicator?
5. Why sulfuric acid is used during titration?
6. Why external indicator is not required in this titration?
7. What is the molecular weight of oxalic acid?
8. Why heating is required during titration?