2023 EXPERIMENT NUMBER: 11

STANDARDISATION OF $KMnO_4$ USING 0.05M MOHR'S SALT SOLUTION.

→ AIM:

To standardise the given $KMnO_4$ using 0.05M Mohr's salt solution.

→ APPARATUS REQUIRED:

Burette, pipette, standard flask, conical flask, funnel, glass rod.

→ CHEMICALS REQUIRED:

Mohr's salt, $KMnO_4$, 4N H_2SO_4, distilled water.

→ PRINCIPLE:

1. This is an example of a redox reaction.
2. Acidified $KMnO_4$ is the oxidising agent.
3. Mohr's salt is the reducing agent.
4. $KMnO_4$ is the self indicator.
5. End point is the colour change from colourless to permanent pink.
6. During the reaction, the oxidation state of Mn changes from +7 to +2. The oxidation state of Fe changes from +2 to +3.
7. $KMnO_4$ is in the burette and Mohr's salt is in the conical flask taken by the pipette.

→ EQUATION:

Ionic Equations:

$$MnO_4^- + 5Fe^{2+} + 8H^+ \longrightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}.$$

Overall Equation: $2KMnO_4 + 10FeSO_4 + 8H_2SO_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O$.

→ PROCEDURE:

1. Standard solution of 0.05M Mohr's salt is prepared accurately by weighing 4.9g of Mohr's salt using a chemical balance.
2. Rinse the burette with water and then with $KMnO_4$.
3. Fill up the burette with $KMnO_4$.
4. Rinse the pipette with Mohr's salt solution. Pipette out 20mL of mohr's salt solution. Transfer it into the conical flask.
5. Add 10mL of 4N H_2SO_4 into the conical flask to make the medium acidic.
6. Titrate Mohr's salt solution against $KMnO_4$ solution till end point is reached.
7. Note down the initial burette reading and the final burette reading.
8. Repeat the titration till you get concordant value.

→ RESULT:

1. Molarity of $KMnO_4$ = 0.0102 $mol\,L^{-1}$

2. Strength of $KMnO_4$ = 1.611 $g\,L^{-1}$.

→ PRECAUTIONS:

1. The burette & pipette must be washed well.
2. For colourless solutions, lower meniscus must be checked while for coloured solutions, upper meniscus must be considered while measuring the level.

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→ CALCULATION:

Standardisation of $KMnO_4$.

SR. No.	Initial Burette Reading	Final Burette Reading	Volume of $KMnO_4$ (mL)	Volume of Mohr's Salt Soln (mL)
1.	0	19.5	19.5	20
2.	0	19.5	19.5	20

$KMnO_4$ × Mohr's Salt

$$\frac{M_1V_1}{N_1} = \frac{M_2V_2}{N_2}$$

M_1 = Molarity of $KMnO_4$ = ?
V_1 = Volume of $KMnO_4$ used = 19.5mL.
N_1 = No. of moles of $KMnO_4$ = 1.

M_2 = Molarity of Mohr's Salt = 0.05 M
V_2 = Volume of Mohr's Salt used = 20mL
N_2 = No. of moles of Mohr's Salt = 5

$$M_1 = \frac{M_2V_2N_2}{N_2V_1} = \frac{0.05 \times 20 \times 1}{5 \times 19.5}$$

$$M_1 = 0.0102 \text{ mol } L^{-1}.$$

Strength or wt/litre of $KMnO_4$:

Strength = M × Molar mass
= 158 g mol^{-1} × 0.0102 mol L^{-1}
= 1.611 g L^{-1}.