Aim: To estimate strength of the given oxalic acid in g/L by using approximately N/50 potassium permanganate as an intermediate solution.

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Requirements: Standard flask, conical flask, burette, pipette, burette stand, beaker, wash bottle, spatula etc.

Solutions and Reagents: Oxalic acid, Potassium permanganate and dilute sulphuric acid.

Theory:

$KMnO_4 \longrightarrow K^+ + MnO_4^-$ (2 e^- change)

$2MnO_4^- + 5H_2C_2O_4 + 6H^+ \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

(Oxidation; Reduction (5 e^- change))

$MnO_4^- \longrightarrow Mn^{2+}$

Pink → Colourless

$H_2C_2O_4 \longrightarrow 2CO + 2H^+ + 2e^-$

(Change in O.S. 8 − 6 = +2)

Indicator: Potassium permanganate is a self indicator.

Colour Change at End Point: Colourless to pink

Equivalent Weight of Potassium Permanganate in acidic medium:

$2KMnO_4 + 3H_2SO_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 3H_2O + 5O$

(no. of e^- change = 5 e^-)

Equivalent wt. of $KMnO_4$ = Molecular wt. / 5

= 158 / 5

Equivalent wt. of $KMnO_4$ in acidic medium = 31.6

Equivalent weight of Oxalic Acid: (O.A)

$H_2C_2O_4 \longrightarrow 2CO_2 + 2e^- + 2H^+$

Equivalent wt of O.A = Molecular wt. / 2

Why potassium permanganate is a secondary standard?

1. Potassium permanganate has some impurities of manganese dioxide.
2. It is unstable in water.

$4MnO_4^- + 2H_2O \longrightarrow 4MnO_2 + 3O_2 + 4OH^-$

→ The presence of MnO_2 catalyses the auto-decomposition of MnO_4^-

→ MnO_4^- is unstable in presence of $Mn(II)$ ions.

$2MnO_4^- + 3Mn^{2+} \longrightarrow 5MnO_2 + 4H^+$

→ This reaction is slow in acidic medium, but it is very fast in neutral medium.

→ Because of these reasons $KMnO_4$ is always prepared with some amount of dilute acids.

Procedure: Step 1. fill the burette with $KMnO_4$.

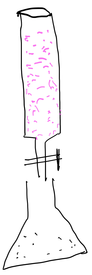
→ $KMnO_4$

Step 2. Pipette out 10mL given oxalic acid solution in a clean conical flask and add to it 10mL dil. H_2SO_4

10mL O.A. solution + 10mL dil. H_2SO_4

Step 3. Heat the contents gently to about 60 °C.

Step 4. Titrate with $KMnO_4$ with constant stirring.



Step 5. At the end point faint pink appear which persists for 30s.

→ faint pink colour solution (End point)