Find Out the Percentage Purity Of Impure Sample Of Oxalic Acid. You Are Supplied M/100 $KMnO_4$ Solution

Chemical Equations

Molecular equations

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

$$\begin{matrix}COOH\\|\\COOH\end{matrix} . 2H_2O + [O] \xrightarrow{60—70°C} 2CO_2 + 3H_2O] \times 5$$

$$2KMnO_4 + 2H_2SO_4 + 5 \begin{matrix}COOH\\|\\COOH\end{matrix} . 2H_2O \longrightarrow K_2SO_4 + 2MnSO_4 + 18H_2O + 10CO_2$$

Ionic equations

$$MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O\ ] \times 2$$

$$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-\ ] \times 5$$

$$2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \longrightarrow 2Mn^{2+} + 8H_2O + 10CO_2$$

Indicator

$KMnO_4$ is a self-indicator.

End Point

Colourless to permanent pink colour ($KMnO_4$ in burette).

Procedure

1. Weigh exactly 2.0 g of oxalic acid and dissolve in water to prepare 500 ml of its solution using a 500 ml measuring flask. Rinse the pipette with the oxalic acid solution and pipette out 20 ml of it in a washed titration flask.
2. Rinse and fill the burette with M/100 $KMnO_4$ solution.
3. Add one test-tube (~ 20 ml) full of dilute sulphuric acid (~ 2 M) to the solution in titration flask.
4. Note the initial reading of the burette.
5. Heat the flask to 60-70°C and add $KMnO_4$ solution from the burette till a permanent light pink colour just appears in the solution in the titration flask.
6. Note the final reading of the burette.

7. Repeat the above steps 4-5 times to get a set of three concordant readings.

Observations

Weight of watch glass =……. g
Weight of watch glass + Mohr's salt =……..g
Weight of Mohr's salt = 2.00 g
Volume of Mohr's salt solution prepared = 500 ml
Solution taken in burette = M/100 $KMnO_4$
Volume of Mohr's salt solution taken for each titration = 20.0 ml

S. No.	*Initial reading of the burette*	*Final reading of the burette*	*Volume of the $KMnO_4$ solution used*
1.	—	—	— ml
2.	—	—	— ml
3.	—	—	— ml
4.	—	—	— ml

Concordant volume = x ml (say).

Calculations

(a) Molarity of the $KMnO_4$ solution
From the overall balanced chemical equation it is clear that 2 moles of $KMnO_4$ react with 5 moles of oxalic acid.

$$\therefore \quad \frac{M_{KMnO_4} \times V_{KMnO_4}}{M_{\text{oxalic acid}} \times V_{\text{oxalic acid}}} = \frac{2}{5}$$

$$\frac{\frac{1}{100} \times x}{M_{\text{oxalic acid}} \times 20} = \frac{2}{5}$$

$$M_{\text{oxalic acid}} = \frac{x}{800}$$

(*ii*) *Strength of oxalic acid solution (in g/l)*

= Molarity × Molar mass

$$= \frac{x}{800} \times 126 = y \text{ g/litre (say).}$$

(*iii*) *Percentage purity of oxalic acid*

$$= \frac{\text{Strength of pure sample}}{\text{Strength of the given sample}} \times 100$$

$$= \frac{y}{4} \times 100$$

Instructions for the Preparation of Solutions

Provide the following :

1. Impure sample of oxalic acid
2. $KMnO_4$ solution (1.58 g/litre)
3. 4N H_2SO_4.