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EXPERIMENT NO. 6

NAME OF EXPERIMENT: TO DETERMINE THE STRENGTH OF SUPPLIED $KMnO_4$ SOLUTION BY USING STANDARD N/10 OXALIC ACID

APPARATUS REQUIRED

1. Volumetric flask
2. Beaker
3. Conical flask
4. Burette
5. Burette stand
6. Funnel
7. Pipette

CHEMICALS REQUIRED

1. $KMnO_4$
2. H_2SO_4
3. Oxalic acid

THEORY

The unknow solution of potassium permanganate can be standardized by titrating it against standard oxalic acid solution. It's a redox titration. Redox titration can be defined as the titration in which the redox reaction takes place completely at the end point. Here, potassium permanganate, in acidic medium, acts as an oxidizing agent and oxalic acid acts as a reducing agent. $KMnO_4$ solution owing to its pink colour acts as a self indicator. Titration in which potassium permanganate is

used is called permanganometric titration.

$$2KMnO_4 + 3H_2SO_4 + 5H_2C_2O_4 \rightarrow K_2SO_4 + 2MnSO_4 + 8H_2O + 10CO_2$$

Pink → colourless

Equivalent mass of $KMnO_4 = \frac{158}{5} = 31.6$

Now,
To prepare 1000 ml of N - $KMnO_4$ solution,
31.6 gm of solute is needed.
∴ To prepare 100 ml of $\frac{N}{10}$ - $KMnO_4$ solution,
0.316 gm of the solute is needed.

Molecular weight of oxalic acid $(H_2C_2O_4 \cdot 2H_2O)$ = 126

∴ Equivalent wt. of oxalic acid = $\frac{\text{Molecular wt.}}{2}$

$= \frac{126}{2}$

$= 63$

Now,
To prepare 1000 ml of N - oxalic acid solution,
63 gm of crystals are required.
∴ To prepare 100 ml of $\frac{N}{10}$ oxalic acid solution,
0.63 gm of crystals
are required.

The unknown strength is calculated by using normality equation;

$$N_1V_1 = N_2V_2$$

Where.

N_1 = Strength of $KMnO_4$ solution (say)
V_1 = Volume of $KMnO_4$ solution
N_2 = Strength of oxalic acid solution
V_2 = Volume of oxalic acid solution

PROCEDURE

1. The whole apparatus was washed with water.
2. The burette was cleaned with distilled water and it was rinsed with the given $KMnO_4$ solution.
3. The burette was clamped to the stand and it was filled with the $KMnO_4$ solution upto the zero mark.
4. The pipette was cleaned with distilled water and it was rinsed with standard oxalic acid solution.
5. 10 ml of the acid solution was pipette out into a conical flask. A test tubeful of bench H_2SO_4 was added to the flask and it was heated to about 60-70°C.
6. The hot oxalic acid solution was titrated by adding $KMnO_4$ solution from the burette dropwisely, swirling the flask continuously.

7. $KMnO_4$ solution was added continuously untill a light pink colour was seen permanently.
8. The volume of the $KMnO_4$ solution in the burette was read by observing the upper meniscus of the solution.
9. The titration was repeated to get at least two concurrent readings.

OBSERVATION TABLE

Indicator: $KMnO_4$ acts as a self indicator.

No of Obs.	Vol. of acid	Burette reading		Difference	Concurrent vol. of alkali ($KMnO_4$)
		Initial	Final		
1	10ml	0	10.1	10.1	
2	10ml	10.1	21.2	11.1	10.1
3	10ml	21.2	33	11.8	
4	10ml	33	43.1	10.1	

CALCULATION

Vol. of $KMnO_4$ (V_1) = 10.1 ml

Strength of $KMnO_4$ (N_1) = 0.1N

Vol. of oxalic acid (V_2) = 10ml

Strength of oxalic acid (N_2) = ?

Now,

$$N_1V_1 = N_2V_2$$

or, $$10 \times N_2 = 0.1 \times 10.1$$

$$\therefore N_2 = 0.101N$$

Now,

Normality = Molarity × n

Or, 0.101 = M × 5

∴ M = 0.02M

Then,

Gram/litre = Normality × Eq. wt of $KMnO_4$

= 0.101 × 31.6

= 3.1916 g/l

Again,

% purity = $\frac{g/l}{10} = \frac{3.1916}{10}$ = 0.319%

RESULT

Hence, the strength (N_2), Molarity, g/l, % purity are 0.101 N, 0.02M, 3.1916 g/l and 0.319% respectively.

PRECAUTIONS

1. All the glasswares should be handled with care.
2. Conical flask should never be rinsed with chemicals.
3. $KMnO_4$ solution should never be taken in conical flask.
4. $KMnO_4$ solution should not be added rapidly at beginning.