EXPERIMENT NO. 2

Aim: To determine the amount of Oxalic acid and H_2SO_4 present in 1 L. of solution **by** using N/10 NaOH and N/10 $KMnO_4$ solution.

Apparatus required: Burette, pipette, beakers, titration stand, conical flask and glass funnel etc.

Chemicals Required: NaOH, Oxalic acid, H_2So_4, Phenolphthalein and $KMnO_4$.

Theory: This involves double titration.

1st Titration- Mixture (H_2SO_4 + Oxalic Acid) Vs NaOH:

NaOH reacts with oxalic acid as well as H_2SO_4 and find out the normality of oxalic acid and sulphuric acid. Reactions involves

1. $(COOH)_2$ 2 H_2O + NaOH $(COONa)_2$ + 4 H_2O
2. H_2SO_4 + 2 NaOH Na_2SO_4 + 2 H_2O

By titrating NaOH against the mixture, we find out the total normality of mixture. 2nd Titration- Mixture (H_2SO_4 + Oxalic Acid) Vs $KMnO_4$: The mixture of solution is treated with $KMnO_4$ solution which will react with oxalic acid in the presence of H_2SO_4.By this titration we find out the normality and strength of oxalic acid.

1. 2 $KMnO_4$ + 3 H_2SO_4 K_2SO_4 + $2MnSO_4$ + 3 H_2O + 5 [O]

   60^0- 70^0C

2. $(COOH)_2$ + [O] 2 CO_2 + H_2O] x 5

Complete reaction -

2 $KMnO_4$ + $3H_2SO_4$ + 5 $(H_2C_2O_4)$ K_2SO_4 + $2MnSO_4$ + $8H_2O$ + 10 CO_2

Procedure:

i)Titration of mixture (Oxalic Acid +H_2SO_4) and NaOH

1. Fill NaOH solution in the burette.
2. Now pipette out 10 ml of mixture (Oxalic Acid +H_2SO_4) in the conical flask.
3. Add 2-3 drops of Phenolphthalein indicator in the conical flask.
4. Now start pouring NaOH in the flask till the colourless solution in the flask turns to pink. And note the volume of NaOH used.
5. Repeat the experiment for concordant readings.

ii)Titration of Mixture (Oxalic Acid + H_2SO_4) and $KMnO_4$:

1. Fill 50 ml of $KMnO_4$ solution in the burette. Since it is coloured solution we note upper meniscus

for taking the initial reading.

2. Now pipette out 10 ml of mixture (Oxalic Acid + H_2SO_4) in the conical flask and add 5 ml of H_2SO_4 in the flask.
3. Then heat the conical flask up to $60^0 - 70^0$C.
4. Now start pouring $KMnO_4$ solution in the conical flask till the colourless solution in the flask turns to pink. And note the volume of KMnO4 used.
5. Repeat the experiment for concordant readings.

Observations:

Titration i)

Solution in burette - NaOH

Solution in conical flask – (Oxalic Acid + H_2SO_4)

Indicator – Phenolphthalein

End Point – Colourless to Pink

Serial no.	Burette Reading		Volume Used(ml)
	Initial	Final	
1	0	28	28
2	0	29	29
3	0	29	29

Titration ii)

Solution in burette – $KMnO_4$

Solution in conical flask – (Oxalic Acid + H_2SO_4)

Indicator – $KMnO_4$

End Point – Colourless to Pink

Serial no.	Burette Reading		Volume Used(ml)
	Initial	Final	
1	0	10.2	10.2
2	10.2	20.4	10.2
3	20.4	30.6	10.2

Calculations:

Titration- i)

Mixture Vs NaOH

$N_1 \times V_1 = N_2 \times V_2$

(Mix.) (NaOH)

$N_1 = N_2 \times V_2 / V_1$

$= 0.1 \times 29 / 10$

N_1(Mix.) = 0.29 N

Titration ii)

Mixture Vs $KMnO_4$

(Here, only Oxalic acid is titrated with $KMnO_4$)

$N_1' \times V_1' = N_2' \times V_2'$

(Oxalic acid) ($KmnO_4$)

$N_1' = N_2' \times V_2' / V_1'$

$N_1' = 0.1 \times 10.2 / 10$

N_1'(Oxalic acid) = 0.102 N

Normality of H_2SO_4 = N_1(Mix.) - N_1'(Oxalic acid) =

0.29 - 0.102 N

= 0.188 N

Strength of oxalic acid = N1' x Eq.wt.

= 0.102 x 63

= 6.426 g/L

Strength of H_2SO_4 = 0.188 x Eq.wt.

= 0.188 x 49

= 9.212 g/L

Result:

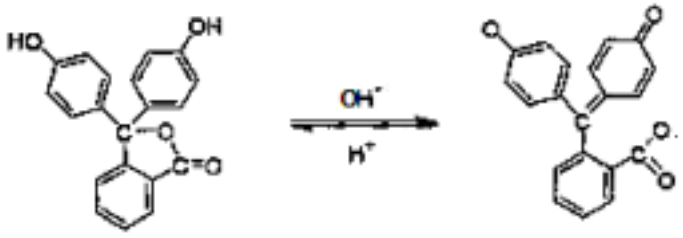
Oxalic Acid in the given mixture = 6.426g/L.

H_2SO_4 in the given mixture = 9.212 g/L

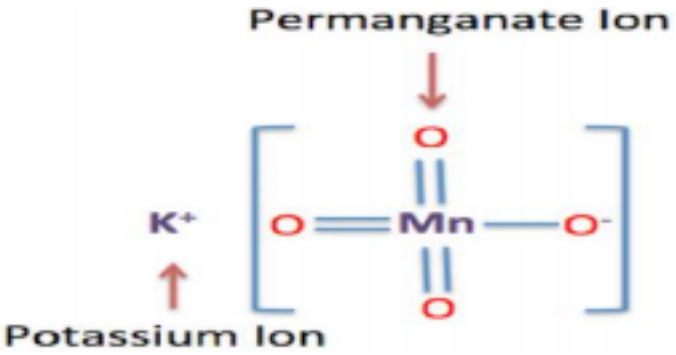
Structures:

Phenolphthalein

Colourless (Acidic Medium) Pink (Basic Medium)



Structure of $KMnO_4$



Precautions:

1. All the apparatus should be washed before use.
2. For measurement of coloured solution check the upper and lower meniscus of solution.
3. Rinse the burette with $KMnO_4$ solution and pipette with the given solution. **4.** Always use freshly prepared $KMnO_4$ solution.

Applications:

1. It is used to determine the amount of various nutrients present in a particular food item.
2. It is used in innovation of medical sciences.