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Diploma in Pharmacy 1st Year Pharmaceutical Chemistry Experiment

To prepare and standardise potassium permanganate standard solution

Aim:

To prepare and standardise potassium permanganate standard solution

Reference:

[•] Dr. Gupta G.D., Dr. Sharma Shailish, Kaur Baljeet [•] "Practical Manual of Pharmaceutical Chemistry" Published by Nirali Prakashan, Page no 29 - 32

Apparatus and Material Required :

Watch glass, beaker 250 ml, glass wool, funnels, cleaned and calibrated volumetric flask-1000 ml, pipette, burette, conical flask, electronic balance, Potassium permanganate, oxalic acid and cone sulphuric acid.

Theory:

Potassium permanganate is an oxidising agent Under the right storage conditions, it can keep its concentration for a long time. Permanganate reactivates quickly in solution. It also serves as a self-indicator, as its little excess gives the solution an unique pink colour. It isn't a mandatory requirement. The ability to oxidise potassium permanganate solution is owing to the conversion of the MnO₄⁻ ion to MnO₂⁺ in acidic solution, MnO₄⁺ in alkaline solution, and MnO₂ in neutral solution. The MnO₄⁻ ion is decreased as a result of the processes below.

 $2KMnO_4 + 3H_2SO_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 5O + 3H_2O$ (Pot Permanganate) (sulphuric acid) (Pot.sulphate) (Mn.sulphate) (oxygen) (water)

Therefore, $MnO_4 + 8H^+ + 5e \longrightarrow Mn_2^+ + 4HO$ Equivalent Weight = Molecular weight/No. of electron transferred = 158/5 = 31.6 = 3



So, 32gm of KMnO₄ when dissolved in 1000 ml of water = IN KMnO₄

Therefore 3.2gm of KMnO₄ when dissolved in 1000 ml of water = 0.1N KMnO₄

As potassium permanganate is not a major standard, sodium oxalate or oxalicacid can be used to standardise it. The former is favoured over acid since it has abetter purity (99.95%). It is accessible in both anhydrous and dehydrated forms.



Equivalent weight of $Na_2C_2O_4$ = Molecular weight/2 = 134.01/2=67.01 67.01 gm of Sodium oxalate when dissolved in 1000 ml of water = IN oxalic acid

67.01 gm of Sodium oxalate when dissolved in 1000 ml of water = 0.1N oxalic acid

Hence, based on the above theory our aim is to prepare and standardisepotassium permanganate solution with oxalic acid.

Principle

The principle of potassium permanganate standardisation is based on redox titration, which involves estimating thes strength of an oxidising agent by titrating it with a reducing agent and vice versa. In an acidic media, potassium permanganate serves as a strong oxidising agent, converting oxalic acid to carbon dioxide. Potassium permanganate is used to titrate the known strength of oxalic acid. Potassium permanganate functions as a self-indicator and can be used to detect the end point by the appearance of a persistent pink colour.

 $2KMnO4 + 5H2CO2 + 3H_2SO_4 \rightarrow K_2SO_4 + 2MnSO_4 + 8H2O + 10CO2$



Procedure:

Preparation of Potassium Permanganate Soultion

- 1) 3.2g of KMnO4 should be weighed on a watch glass.
- 2) The contents should be transferred to 250 ml beaker containing cold distilled water and stirred completely.
- 3) The crystals should be broken down with the help of glass rod to affect the solution.
- 4) The solution should be poured via a small plug of glass wool supported in a funnel into a 1000 ml volumetric flask.
- 5) More distilled water should be added to the beaker.
- 6) The above procedure should be repeated till all the potassium permanganate gets dissolved.
- 7) The volume should be maintained and shake well so as to affect continuous mixing.
- 8) The flask should be kept with the stopper for 24 hr and then filter through asbestos.
- 9) Potassium permanganate should be used to decompose the organic matter present in the distilled water resulting in the formation of MnO2 during 24 hr.
- 10)The filterate solution should be kept in dark glass bottle.
- 11) The solution should be standardised 24 hr after its preparation.

Standardisation of Potassium Permanganate Solution

- 1) Standard sodium oxalate should be dried at 105-110°C for 2 hr.
- 2) It should be allowed to cool in a covered vessel in a desiccator.
- 3) 6.7g of above pure sodium oxalate should be weighed accurately and transferred into 1000ml volumetric flask containing 500 ml of water.
- 4) The volume should be maintained with the distilled water.
- 5) 20 ml of this solution should be poured into a conical flask and 5ml of conc. H_2SO , should be added along the side of the flask.
- 6) The contents should be heated upto 70°C.
- 7) It should be titrated against potassium permanganate solution from the burette until a faint pink colour last for 30 second upon shaking the flask.
- 8) The procedure should be repeated until 3 concordant reading will be obtained



Observation Table

Sl.No.	Volume of Sodium Oxalate Solution taken	Burette Reading of KMnO ₄		Average Volume
	(ml)			of KMnO4 used
		IR	FR	
1)	20 ml	0.0	19.5	
2)	20 ml	0.0	19.6	19.5
3)	20 ml	0.0	19.5	

Calculation

 $N_1V_1 = N_2V_2$

Where,

 $N_1 = Normality of (COONa)_2$ $N_2 = Normality of KMnO_4$

 $V_1 = \text{Volume of (COONa)}_2$

 $V_2 = Volume of KMnO_4$

 $N_1 \text{ o.1N} = \text{Normality of Oxalic acid Solution}, N_2 = ?= \text{Normality of KMnO}_4$ $V_1 = 20\text{ml} = \text{Volume of Oxalic acid Solution}, V_2 = 19.5\text{ml} = \text{Volume of KMnO},$ $N_2 = N_1 V_1 / V_2$ $N_2 = 20\text{mlx 0.1/19.5}$ $N_2 = 0.102\text{N}$

Result: The strength of the given solution of potassium permanganate is 0.102 N.



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