ESTIMATION OF TOTAL HARDNESS OF WATER BY COMPLEXOMETRIC METHOD USING EDTA

AIM:

To estimate the total hardness, permanent hardness and temporary hardness of water by using standard solution of EDTA

APPARATUS:

Burette, pipette, Conical flask, Beakers, Standard flask, Burette stand and funnel etc.,

CHEMICALS REQUIRED:

Magnesium sulphate, Buffer, Disodium salt of EDTA, Eriochrome black-T or Solochrome balck -T etc.

PRINCIPLE:

Hard water which contains Ca²⁺ andMg²⁺ ions which forms wine red color complex with the indicator

EDTA forms a colour less complex with the metal ions (Ca²⁺ andMg²⁺)

Ca-EBT (or) Mg-EBT + EDTA ------> Ca-EDTA (or) Mg-EDTA + EBT (Wine red colour complex) Colorless stable complex) (Blue)

When free ions are not available, EDTA extracts the metal from (ion) metal ion indicator complex, there by releasing the free indicator.

PROCEDURE:

STEP-I

PREPARATION OF STANDARD SOLUTION OF MgSO4:

Weigh the approx 0.25gm of MgSO₄ and transfer into 100ml standard flask through the funnel and dissolve in minimum quantity of distilled water. Make up the solution up to the mark with distilled water and shake the flask well for uniform concentration then calculate the Molarity of MgSO₄

Molecular Weight of MgSO_{4 =} 246.48gm Molarity of MgSO₄=0.01M

STEP-II

STANDARDISATION OF EDTA SOLUTION:

Pipette out 20ml of $MgSO_4$ solution into a clean conical flask. Add 2ml of buffer solution and add 2 to 3 drops of EBT indicator and it gets wine red color solution Take EDTA solution in a burette after titrate with EDTA solution till wine red color changes to blue color. Note the burette reading and repeat the titration to get concurrent values.

S. No	Volume of MgSO ₄ in ml	Burette Reading (ml)		Volume of EDTA
		Initial	Final	consumed (ml)
1	20			
2	20			
3	20			

 $M_1 = MgSO_4$ molarity $M_2 = EDTA$ molarity

 $V_1 = volume \ of \ MgSO_4 \qquad V_2 = volume \ of \ EDTA \ consumed$

 $M_1V_1=M_2V_2\\$

STEP-III

STANDARDISATION OF HARD WATER:

Pipette out 20ml of tap water into a 250ml conical flask add 2 ml of buffer solution and add 2-3drops of EBT indicator. Titrate the wine red color solution with EDTA taken in burette, till a blue color end point is obtained. Repeat the titration to get concurrent values.

S. No	Volume of Hard water in(ml)	Burette Reading (ml)		Volume of EDTA
		Initial	Final	consumed (ml)
1	20			
2	20			
3	20			

 M_3 = molarity of hard water M_2 = EDTA molarity

 V_3 = volume of Hard water V_2^1 = volume of EDTA consumed

 $M_3V_3=M_2V_2{}^l\\$

 $M_3 = M_2 V_2{}^l \! / \ V_3$

Total hardness= $M_3X100X1000 = -----PPM$

STEP-IV

STANDARDISATION OF PERMANENT HARDNESS OF WATER:

Pipette out 100ml of hard water sample into a beaker containing 250ml and boil the water till volume reduces to 50ml (all the bicarbonates of Ca²⁺, Mg²⁺ decomposes toCaCO₃and Mg(OH)₂ respectively). Cool the solution and filter the water into beaker then pipette out 20ml of this cool water sample in to 250ml conical flask add 2ml of buffer solution and 2-3 drops of EBT indicator. Titrate the wine red color solution with EDTA taken in the burette, till a blue colored solution end point is obtained. Repeat the titration to get concurrent values.

S. No	Volume of Hard water in (ml)	Burette Reading(ml)		Volume of EDTA
		Initial	Final	consumed(ml)
1	20			
2	20			
3	20			

 M_4 = molarity of hard water M_2 = EDTA molarity

 V_4 = volume of hard water V_2^{ll} = volume of EDTA consumed

$$M_4V_4=M_2\;V_2{}^{ll}$$

$$M_4 = M_2 V_2^{ll} / V_4$$

Permanent hardness = M4X100X1000 = -----PPM

RESULT:

1) Total hardness in _____ PPM

2) Permanent hardness in _____ PPM

3) Temporary hardness in _____ PPM (Total hardness – Permanent hardness)