Experiment No. 3. Name : EDTA Method.

DOMS Page No. Date 26/04.

ESTIMATION OF TOTAL HARDNESS, PERMANENT AND TEMPRARY HARDNESS BY EDTA METHOD

Aim:

To estimate the amount of total hardness, permanent hardness and temporary hardness of a given sample of water by EDTA method by using ammonia buffer (PH=10) and eriochrome black-T-indicator

Burette, pipette, conical flask, standard flask, funnel, burner and 250 ml beaker.

EDTA sol", standard hard water, sample water, eriochrome black-T indicator, $NH_3 - NH_4Cl$ buffer solution

Disodium salt of ethylene diamine tetra amine (EDTA) is used to determine the total hardness of the given hard water. The hardness causing metal ions (calcium and magnesium) form a wine red coloured weak complex with eriochrome black T-indicator in the presence of buffer solution. When EDTA is added, the indicator is

Teacher's Signature:

(i) Standardisation of EDTA.

Standard Hard Water vs EDTA sol^n.

Sr. No	Vol of Sample Hard Water (mL)	Burette Reading Initial	Burette Reading Final	Vol of EDTA (mL)	Indicator
1	20.4	0	20.4	20.4	EDTA
2	20.4	0	20.4		

Calculation

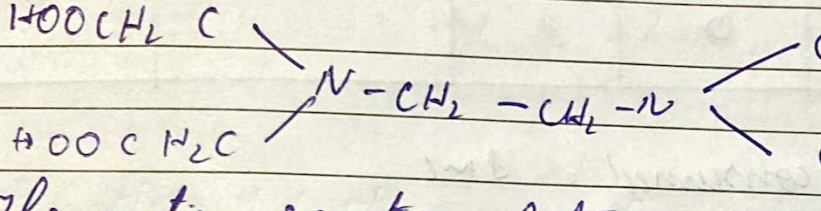
1 mL of standard hard water = 1 mg of $CaCO_3$
Volume of standard hard water taken = 20 mL
20 mL of standard hard water = 20 mg of $CaCO_3$.

Therefore 1 mL of EDTA = $\frac{20}{V_1}$ mg of eq. $CaCO_3$

$= \frac{20}{20.4} = 0.980$ mg of eq. $CaCO_3$.

replaced by EDTA and a stable complex is formed Due to the liberation of eriochrome black T indicator, wine red color changes to steel blue. This is the end point for the titration b/w EDTA and hard water.

Ethylene diamine tetra acetic acid is a tetra carboxylic acid which has the following formula.



The entire reaction between Ca, Mg ions & EBT is represented as.

$$\left[\begin{matrix} Ca^{2+} \\ Mg^{2+} \end{matrix}\right] + EBT \rightarrow \left[\begin{matrix} Ca^{2+} \\ Mg^{2+} \end{matrix} - EBT\right] \text{ wine red.}$$

(Hard water sample)

$$\left[\begin{matrix} Ca^{2+} \\ Mg^{2+} \end{matrix} EBT\right] + EDTA \longrightarrow \left[\begin{matrix} Ca^{2+} \\ Mg^{2+} \end{matrix} EDTA\right] + EBT \text{ (Blue)}$$

When the sample water is boiled, bicarbonates of calcium and magnesium are converted into hydroxides which can be removed by filtration.

The permanent hardness which is not removed by boiling is once again eliminated by EDTA ions

(ii) Determination of Total Hardness

Sample Hard Water vs EDTA soln.

Sr. No.	Vol of std. Hard Water (ml)	Burette Reading Initial	Burette Reading Final	Vol of EDTA (ml)	Indicator
1	20	0	13.9	13.9	EDTA
2	20	0	13.9		

Volume of EDTA consumed = V_2 ml
= 13.9 ml

Now if 1 mL EDTA = $\frac{20}{V_1}$ mg $CaCO_3$.

Then V_2 ml of EDTA = $\frac{20}{V_1} \times V_2$ mg $CaCO_3$

= 13.622 mg $CaCO_3$

If 20 ml sample hard water taken for titration contain = $\frac{20}{V_1} \times V_2$ mg.

Then 1000 ml will contain = $\frac{\frac{20 \times V_2}{V_1}}{20} \times 1000$ mg $CaCO_3$

= 681.37 ppm

Experiment No. 3. Name : Hardness by EDTA.

DOMS Page No. Date

eriochrome black T- indicator.

PROCEDURE :-

STANDARDIZATION OF EDTA -

Pipette out 20 mL of standard hard water into a clean conical flask. Add 5mL of buffer solu and 3 or 4 drops of Eriochrome black - T indicator. The solution turns red in colour. Titrate the coloured solution against EDTA taken in burette. The change from wine red to steel blue is end point. Repeat titration for concordant value.

Determination of Total Hardness -

Pipette out 20 ml of sample hard water in a clean conical flask. Add 5mL of buffer soln. Add 3 or 4 drops of eriochrome black T indicator. Titrate the wine red solution against EDTA. Change of wine red to steel blue is end point. Repeat titration for concordant values.

Teacher's Signature: _____

(iii) Determination of Permanent Hardness

Boiled sample Hard Water vs EDTA sol^n.

Sample No.	Vol of boiled water (ml)	Burette Reading Initial	Burette Reading Final	Volume of EDTA	Indicator
1	20	0	8	8	EDTA
2	20	0	8		

Volume of EDTA consumed = 8 ml

If 1 ml of EDTA = $\frac{20}{V_1}$ mg $CaCO_3$

$\therefore V_3$ EDTA = $\frac{20}{V_1} \times V_3$ mg $CaCO_3$ = 7.84

The boiled hard water sample is equivalent to permanent hardness = $\frac{20}{V_1} \times V_3 \times 1000$ mg $CaCO_3$

$= \frac{V_3}{V_1} \times 1000$ ml $CaCO_3$

$= 392.15$

Permanent Hardness = 392.15 ppm

Experiment No. _____ Name : _____

DOMS | Page No. | Date | |

Elimination of temporary Hardness :

The temporary hardness of water sample
= Total Hardness − Permanent Hardness

Determination of Permanent Hardness :

Take 100 mL of hard water sample in a 250 mL beaker and boil gently for atleast 1 hour. Cool filter it into a 100 mL standard flask and make the volume upto the mark. Take 20 mL of this solution and proceed titration in same way. The volume of EDTA used corresponds to the permanent hardness of the sample. Temporary hardness is calculated by subtracting the permanent hardness from total hardness

RESULT :-

Total Hardness of sample hard water =

Permanent Hardness of sample hard water. =

Temporary Hardness of sample hard water =

Teacher's Signature: _____