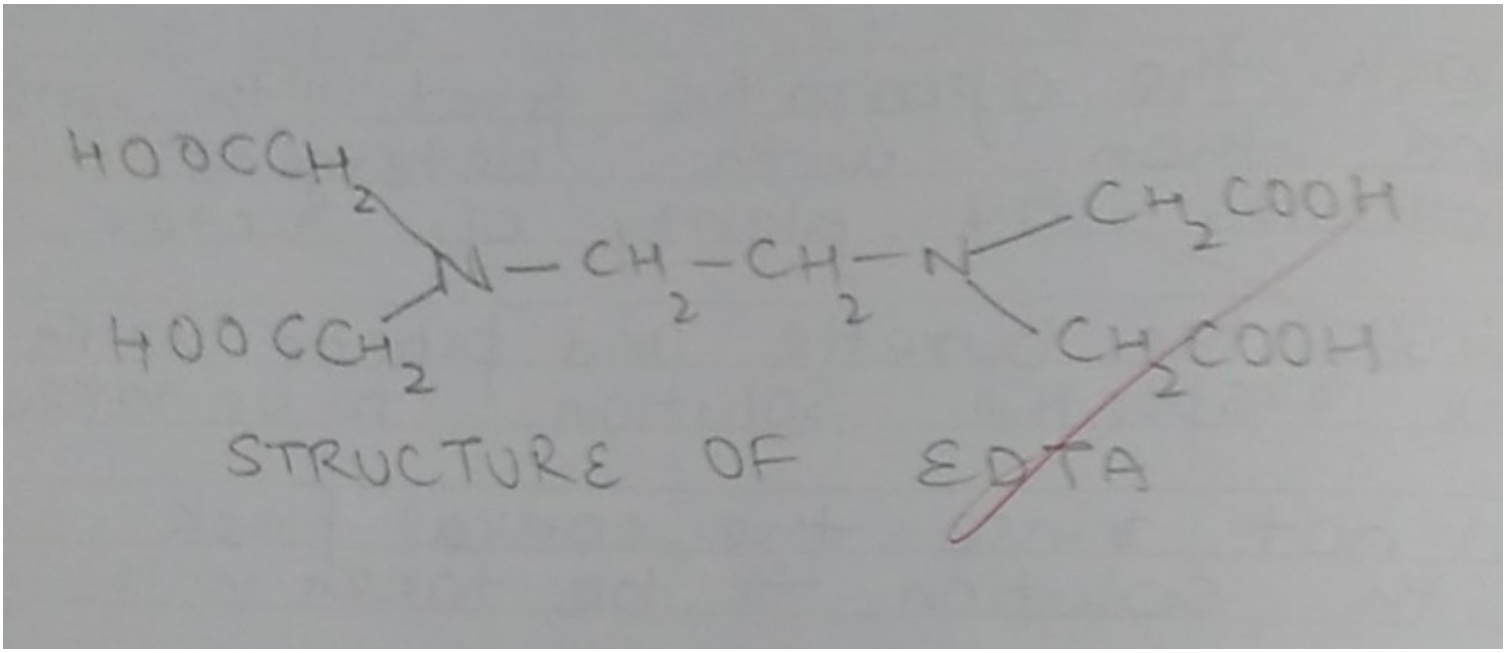

STRUCTURE OF EDTA

Expt. No. 2 Date 23/08/2016

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AIM : To determine the temporary, permanent & total hardness of a given water by complexometric titration method.

CHEMICALS REQUIRED : 0.01M EDTA Erichrome Black-T (EBT), Water sample, buffer solution

THEORY : The hardness of water can be determined by complexometric titration. EDTA is used as complexing agent. It forms stable complexes with Ca^{2+} & Mg^{2+} and number of other metal ions in the solution. The Ca^{2+} & Mg^{2+} present in water are titrated with EDTA using Eriochrome black T as indicator.

EDTA is generally used in form of its disodium salt on account of their greater stability in aqueous medium.

PRINCIPLE :

$Ca^{2+}/Mg^{2+} + EBT \longrightarrow [Mg/Ca - EBT]$

$\xrightarrow[EDTA]{Titration}$ Temporary complex $\longrightarrow$

$[Ca^{2+}/Mg^{2+} - EDTA]$

Blue colour

- The temporary hardness is removed by boiling and after the removal of precipitate by filtration, the permanent hardness in the filtrate is determined by titration with EDTA.

Temporary hardness is given by difference bet of total hardness and permanent hardness.

PROCEDURE:

~~I Preparation of Standard Hard water.~~

I Standardization of EDTA solution (V_1)

Rinse & fill the burette with EDTA solution. Pipette out 25mL of standard hard water into volumetric flask & add 20mL of distilled water & 10mL of buffer solution. Add 2-3 drops of indicator EBT.

Titrate against 0.01M EDTA solution till the colour of solution changes from wine red to blue.

- Note the final reading & repeat to get 3 concordant readings.

II Measurement of total hardness

Pipette out 25mL of sample water into volumetric flask & add 20mL of distilled water & 10mL of buffer solution

Add 2-3 drops of indicator EBT

Titrate against 0.01 M EDTA solution till the colour of solution changes from wine red to blue

Note the final reading & repeat to get 3 concordant readings

III Measurement of Permanent Hardness

Take 250mL of water sample in a large beaker and boil it till the volume is reduced to 1/4th

filter wash the percipitate with distilled water, collecting filterate & washing in a 250mL measuring flask.

Make up the volume to 250mL with distilled water then titrate 25mL of boiled water sample as described in para II by adding distilled water, buffer & indicator

CALCULATION:

Standard water (V_1) $V_1 = 22.8$

$$= \frac{20}{V_1} \times 1000 = \text{\_\_\_\_\_ ppm}$$

$$= \frac{20}{22.8} \times 1000 = 877.19 \text{ ppm}$$

OBSERVATIONS

Volume of hard water for each titration = 25 mL

Molarity of EDTA = 0.01M.

OBSERVATION TABLE

Standard Hard water (V_1)

S.No	Volume of sample (mL)	Burette		Actual amount of EDTA used
		Initial	Final	
1	20 mL	0 mL	22.8 mL	22.8 mL
2	20 mL	0 mL	22.8 mL	22.8 mL
3	20 mL	0 mL	22.8 mL	22.8 mL

CALCULATION

(2) Hard water (V_2) = 13.3

$$= \frac{V_2}{V_1} \times 1000 = \text{—} \text{ ppm}$$

$$\text{Total Hardness} = \frac{13.3}{22.8} \times 1000 = 583.33 \text{ ppm}$$

(3) For boil water (V_3) = 7.8

$$\text{Permanent Hardness} = \frac{V_3}{V_1} \times 1000 = \frac{342.10}{} \text{ ppm}$$

$$= \frac{7.8}{22.8} \times 1000 = 320.17 \text{ ppm}$$

Temporary Hardness = (Total − Permanent) Hard

= 241.33 ppm

② For sample water (V_2)

S.NO	Volume of sample (mL)	Burette reading		Actual amount
		Initial	Final	
1	20 mL	0 mL	13.3 mL	13.3 mL
2	20 mL	0 mL	13.3 mL	13.3 mL
3	20 mL	0 mL	13.3 mL	13.3 mL

③ For permanent hardness (V_3)

S.NO	Volume of sample (mL)	Burette reading		Actual amount
		Initial	Final	
1	20 mL	0 mL	7.8 mL	7.8 mL
2	20 mL	0 mL	7.8 mL	7.8 mL
3	20 mL	0 mL	7.8 mL	7.8 mL

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PRECAUTIONS

1. The burette, pipette & conical flask should be rinsed with distilled water.
2. The colour change near the end point is very slow & thus should be observed carefully.

RESULT :

Total hardness of water = 583.33ppm

Permanent hardness of water = 320.17ppm

Temporary hardness of water = 241.23 mg/l

REACTIONS

$$OH^- + H^+ \rightarrow H_2O$$

$$CO_3^{2-} + H^+ \rightarrow HCO_3^-$$

$$HCO_3^- + H^+ \rightarrow H_2CO_3$$

Expt. No. 3 Date 30/08/16

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AIM: To determine the type and extent of alkalinity of given water sample.

APPARATUS: Burette, pipette, conical flask, beakers.

CHEMICALS REQUIRED: N/10 HCl, Phenolphthalein, methyl orange

THEORY: Determination of alkalinity due to different ions is based on titration of water sample against a standard acid making selective use of indicators. The indicators used are phenolphthalein and methyl orange. The reactions taking place may be represented by the following equations.

$$OH^- + H^+ \longrightarrow H_2O$$

$$CO_3^{2-} + H^+ \longrightarrow HCO_3^-$$

$$HCO_3^- + H^+ \longrightarrow H_2CO_3$$

The volume of the acid used to phenolphthalein end point corresponds to the reaction a & b

that is complete neutralization of OH^- ions and neutralization of CO_3^{2-} ions up to HCO_3 stage.

The volume of acid used upto methyl orange end point corresponds to the reaction a, b, c i.e complete neutralization of OH^-, CO_3^{2-} and HCO_3^- ions. Thus from the respective volumes of acid used, the respective strengths of various ions can be determined.

INDICATORS: Phenolphthalein & methyl orange

END POINT: Pink to colourless (Phenolphthalein), yellow to red (Methyl Orange)

PROCEDURE:

1 Rinse & fill the burette with N/10 HCl

2 Pipette out 20 mL of water sample into a conical flask. Add 1-2 drops of phenol

CALCULATIONS:

For phenolphthalein

$N_1V_1 = N_2V_2$

HCl sample

$\frac{1}{10} \times 11 = N_2 \times 20$

$N_2 = \frac{11}{200}$

Strength $= \frac{11}{200} \times 50 = 2.3\ g/L$

$= 2.11 \times 1000\ ppm = 2110\ ppm$

3 Titrate the water sample in a conical flask with N/10 HCl till the pink colour just disappears.

4 Note down the reading.

5 Add methyl orange to the same solution

6 Titrate it using N/10 HCl till a red colour is obtained

Record the observation and repeat to get three concordant readings.

OBSERVATION TABLE

S.NO	Volume of solution taken in solution	Burette Reading	
		Initial	Final
1	20 mL	0 mL	9.5 mL
2	20 mL	0 mL	9.5 mL
	20 mL	0 mL	9.5 mL

For Methyl Orange

$N_1V_1 = N_2V_2$

$\frac{1}{10} \times 26.6 = N_2 \times 20$

$N_2 = \frac{26.6}{200}$

Strength $= \frac{26.6}{200} \times 50$

$= 4.1 \times 1000$ ppm

$= 4100$ ppm

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S.No	Volume of solution taken	Burette Reading	
		Initial	Final
1	20ml	0ml	26.6ml
2	20ml	0ml	26.6 ml
3	20ml	0ml	26.6ml

RESULT.

Phenolphthalein alkalinity = 2110 ppm

Methyl Orange " = 4100 ppm.

PRECAUTIONS.

1. Rinse & fill the burette with N/10 HCl
2. Clean the apparatus before use

REACTIONS:

$Cl_2 + 2KI \rightarrow 2KCl + I_2$

$2OCl + 2KI \rightarrow 2KCl + I_2 + O_2$

$HOCl + 2KI + HCl \rightarrow 2KCl + I_2 + H_2O$

$NHCl_2 + 2KI + HCl \rightarrow 2KCl + I_2 + NH_4$

Expt. No. 4 Date 6/9/16

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AIM: To determine the total residual in chlorine water.

APPARATUS: Burette, Pipette, Conical Flask, & Beaker.

CHEMICALS REQUIRED: N/50 $Na_2S_2O_3$, 10% KI.

THEORY: Estimation of residual chlorine is based on oxidation of K.I by residual chlorine that iodometric titration.

When the water sample containing residual chlorine is treated with KI the residual chlorine oxidizes KI and liberates I_2 in equivalent.

Liberated I is titrated against hypo solution using starch as indicator.

End pount is disappearance of blue colour.

PROCEDURE:

1. Pipette out 100mL of given water sample in conical flask and add 5mL of 10% KI solution and about 3mL of HCl to maintain PH upto 3-4
2. Cover the flask and shake it well to mix the solution
3. Using a wash bottle rinse the sides of flask
4. Titrate it with N/50 $Na_2S_2O_3$ solution from burette till the solution becomes straw yellow.
5. Add 2mL of starch solution The solution will turn blue
6. Continue titration with $Na_2S_2O_3$ till blue colour dissapears
7. Note the final reading and repeat to get three concordant readings

CALCULATIONS

$N_1 V_1 = N_2 V_2$

$N_1 \times 20 = \frac{1}{50} \times V_2$

$N_1 = \frac{V_2}{1000}$

Total chlorine residual $= N_1 \times Eq.wt$

$= N_1 \times 35.5 \times 1000$ mg/L

i $V_2 = 9.5$

$N_1 = \frac{9.5}{1000} = 9.5 \times 10^{-3}$

2 Total Chlorine residual $= 9.2 \times 10^{-3} \times 35.5 \times 1000$

$= 337.25$ mg/L

OBSERVATIONS:

Normality of $Na_2S_2O_3$ solution = N/s

S.No	Volume of solution taken in flask (mL)	Burette Reading	
		Initial	Final
1	20 mL	0 mL	9.5 mL
2	20 mL	0 mL	9 mL
3	20 mL	0 mL	10 mL

RESULT: Amount of total residual chlorine in a given water sample ~~333.25 mg/L~~ mg/L.

PRECAUTIONS

1. Chlorine vapours are harmful so the solution should not be sucked into the pipette
2. The titration should be completed rapidly in order to avoid atmospheric oxidation of Iodide