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DETERMINATION OF HARDNESS OF WATER-THREE DIFFERENT PALCES IN HYDERABAD BY EDTA METHOD(COMPLEXOMETRIC TITRATION)

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ABSTRACT

A simple, novel method for the determination of hardness of water in different places BOGARAM, UPPAL & KUSHAIGUDA of Hyderabad by Ethylene Diamine Tetra Acetic acid (EDTA) method. This method successfully employed for the determination of hardness of water and the results are 1350 ppm,1600 ppm and 3150 ppm. BOGARAM is a village where TIRUMALA ENGINEERING COLLEGE has been established we have taken water sample of Bogaram. UPPAL is an area which is in distance of about 20 Km from our college, that water sample we have collected. KUSHAIGUDA is an area which is 10 Km away from our college, that water sample we have to compare the hardness of water.

KEY WORDS: Water Samples, EDTA solution, $CaCl_2$ (0.02N), Eriochrome black T indicator, Buffer solution of P^H 10.

INTRODUCTION

Water covers 71% of Earth surface, in that 96.5% of the planets crust water found in seas and oceans, 1.7% in ground water, 1.7% in glaciers & icecaps, only < 0.003% of fresh water found. So we are having less quantity of fresh water in underground. The water becomes hard because of earthy impurities and hardness causing salts like chlorides and sulphates of Ca & Mg. In order to get pure and soft water we have to find the hardness[1-4] of that water to make hard water into soft water. Here we are using EDTA compound by complexometric Titration It is very Desirable method and experiment cost is also relatively less.

Advantages of EDTA method. This method is definitely preferable to the other methods, because of: (i) Greater accuracy,

(ii) Convenience and

(iii) More rapid procedure

When Eriochrome Black T indicators is added to the hard water at pH around 10 it gives wine red coloured unstable complex with Ca^{+2} and Mg^{+2} ions of the sample water. Now when this wine red-coloured complex is titrated agianst EDTA solution (of known strength) the colour of the complex changes wine red to original blue colour showing the endpoint.

In aqueous solution EDTA ionises to give 2Na+ ions and act as a strong chelating agent.

Eriochrome Black-T (EBT) is the metal ion indicator used in the determination of hardness[5-9].

INSTRUMENTS USED: Weighing machine (SF-400D), Burette, Pipette, conical flask.

PREPARATION OF REAGENTS & SOLUTIONS

1. Standard EDTA Solution 0.01M: Dissolve 3.723 gm EDTA disodium salt and dilute to 1000 ml.
2. Standard Calcium Chloride Solution(0.02N): Dissolve 1.11g of $Cacl_2$ and dilute to 1000ml of distilled water.
3. Eriochrome Black-T Indicator: Dissolve 0.5g of powdered compound in 100ml of ethyle alcohol.
4. Ammonia Buffer P^H 10: Dissolve 67.5g of NH_4Cl in 570ml of conc.ammonia solution and dilute it to 1 litre distilled water.

RESULTS AND DISCUSSION

Water when treated with EDTA forms calcium-EBT complex,which is used to determine the hardness of water. In this process standardization of EDTA solution, estimation of hardness of sample 1, sample 2, sample 3 will be determined and the procedures adopted in described as follows:

PART-A: Standardization of EDTA solution

(i) Rinse and fill the burette with EDTA solution.

(ii) Pipette out 20ml of 0.02N $Cacl_2$ solution into a clean conical flask.

(iii) Add 1ml of Ammonia buffer solution and drop of Eriochrome black T indicator and titrate with standard EDTA solution till wine red colour changes to blue, then note down the volume of EDTA consumed.

(iv) Repeat the titration till concordant readings are obtained.

(v) Calculate Normality of EDTA required by sample using given formula below:

$$N_1V_1 = N_2V_2$$

Determination of volume of EDTA

S.NO.	Volume Of $Cacl_2$ (V_1 ml)	Burette Reading(ml)		Volume of EDTA Used(V_2ml)
		Initial	Final	
1	20 ml	0	2.5	2.5
2	20 ml	2.5	4	1.5
3	20 ml	4	5.5	1.5

AVERAGE = 1.8 ml

$N_1V_1 = N_2V_2$

N_1 = Normality of $Cacl_2$ = 0.02N

V_1 = Volume of $Cacl_2$ = 20 ml

N_2 = Normality of EDTA = ?

V_2 = Volume of EDTA = 1.8 ml

$N_2 = N_1V_1 / V_2$

N_2 = 0.02 X 20 / 1.8

N_2 = 0.2 N

Normality of EDTA = 0.2 N

PART-B: ESTIMATION OF HARDNESS OF WATER SAMPLE (BOGARAM, KUSHAI GUDA,UPPALWATER SAMPLES)

(i) Rinse and fill the burette with EDTA solution.

(ii) Pipette out 20ml of water sample(s) into a clean conical flask.

(iii) Add 1ml of Ammonia buffer solution and pinch of Eriochrome black T indicator and titrate with standard EDTA solution till wine red colour changes to blue, then note down the volume of EDTA consumed.

(iv) Repeat the titration till concordant readings are obtained.

(v) Calculate the amount of hardness of sample using given formula below:

Amount of hardness interms of $CaCO_3$ equivalents

$$= \frac{Titre\ value\ X\ conc.of\ EDTA\ X\ 50\ X\ 1000}{Volume\ of\ sample}$$

1. OBSERVATION & CALCULATION OF UPPAL SAMPLE WATER HARDNESS

S.NO.	Volume Of Water Sample UPPAL	Burette Reading(ml)		Volume of EDTA Used(V_3ml)
		Initial	Final	
1	20 ml	11.2	14	2.8
2	20 ml	14	17.5	3.5
3	20 ml	17.8	21	3.3

AVERAGE = 3.2 ml

Titre value (V_3) = 3.2 ml

Concentration of EDTA = 0.2 N

Volume of water sample(uppal) = 20 ml

Amount of hardness interms of $CaCO_3$ equivalents

$$= \frac{Titre\ value\ X\ conc.of\ EDTA\ X\ 50\ X\ 1000}{Volume\ of\ sample}$$

$$= \frac{3.2\ X\ 0.2\ X\ 50\ X\ 1000}{20}$$

= 1600 ppm

The total amount of hardness of UPPAL ground water is = 1600 ppm.

2. OBSERVATION & CALCULATION WATER SAMPLE (KUSHAIGUDA)

S.NO.	Volume Of Water Sample KUSHAIGUDA	Burette Reading(ml)		Volume Of EDTA Used(V_3ml)
		Initial	Final	
1	20 ml	0	6.2	6.2
2	20 ml	6.3	12.5	6.2
3	20 ml	12.6	19.3	6.7

AVERAGE = 6.3 ml

Titre value (V_3) = 6.3 ml

Concentration of EDTA = 0.2 N

Volume of water sample(kushaiguda) = 20 ml

Amount of hardness interms of $CaCO_3$ equivalents

$$= \frac{Titre\ value\ X\ conc.of\ EDTA\ X\ 50\ X\ 1000}{Volume\ of\ sample}$$

$$= \frac{6.3\ X\ 0.2\ X\ 50\ X\ 1000}{20}$$

= 3150ppm

The total amount of hardness of KUSHAIGUDA ground water is = 3150ppm.

3. OBSERVATION & CALCULATION OF SAPMLE WATER (BOGARAM)

S.NO.	Vol. of Water Sample BOGARAM	Burette Reading(ml)		Volume of EDTA Used(V_3ml)
		Initial	Final	
1	20 ml	0	2.8	2.8
2	20 ml	2.9	5.7	2.8
3	20 ml	5.9	8.6	2.7

AVERAGE = 2.7 ml

Titre value (V_3) = 2.7 ml

Concentration of EDTA = 0.2 N

Volume of water sample(bogaram) = 20 ml

Amount of hardness interms of $CaCO_3$ equivalents

$$= \frac{Titre\ value\ X\ conc.of\ EDTA\ X\ 50\ X\ 1000}{Volume\ of\ sample}$$

$$= \frac{2.7\ X\ 0.2\ X\ 50\ X\ 1000}{20}$$

= 1350ppm

The total amount of hardness of BOGARAM ground water is = 1350ppm.

CONCLUSION

From the above observations, it can be concluded that, the hardness of water in different areas is found for different samples are 1350 ppm,1600 ppm and 3150 ppm. From the observations it can be concluded that, hardness of water from Bogaram village is less when compared with Uppal & Kushaiguda. It may advisable as potable water also.These results are showing significant values when compared with standard values. industrial-sized water boilers become coated with scale: the cost in heat-transfer efficiency can have a dramatic effect on your power bill! Furthermore, scale can accumulate on the inside of appliances, such as dishwashers, and pipes. As scale builds up, water flow is impeded, and hence appliance parts and pipes must be replaced more often than if Ca^{2+} and Mg^{2+} ions were not present in the water.

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