S.N.	Name of Experiment	Date	Page	Remarks
1.	TO DETERMINE THE ALKALINITY OF GIVEN WATER SAMPLE 'A'.	2079/09/26	1-8	17.01.2023
2.	TO DETERMINE THE ALKALINITY OF GIVEN WATER SAMPLE 'B'.	2079/10/02	9-15	24.01.2023
3.	TO DETERMINE THE HARDNESS OF WATER SAMPLE BY COMPLEXOMETRIC TITRATION.	2079/10/10	16-22	31.01.2023
4.	TO DETERMINE THE FREE CHLORINE IN A GIVEN WATER SAMPLE.	2079/11/08	23-28	19.02.2023

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S.N.	Name of Experiment	Date	Page	Remarks
5-	TO ESTIMATE OF DISSOLVED OXYGEN (D.O). ~~of given~~ OF GIVEN WATER SAMPLE.	2079/12/01	1-4	22.03.2022

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Name of Experiment:

TO DETERMINE THE ALKALINITY OF GIVEN WATER SAMPLE 'A'.

APPARATUS REQUIRED:

1. pipette
2. conical flask
3. Burette
4. Beaker
5. Funnel, and
6. stand

CHEMICALS REQUIRED:

1. Methyl orange
2. phenolpthalein,
3. standard HCl.

THEORY:

The alkalinity of water is due to the presence of soluble

a. hydroxides,
b. carbonates, and
c. bicarbonates

of alkali and alkaline earth metals.

With respect to the constituents causing alkalinity in natural waters, the following situation may arise.

1. hydroxides only,
2. carbonates only,

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Name of Experiment:

3. bicarbonates only,
4. hydroxide and carbonates,
5. carbonates and bicarbonates.

Note! The possibility of hydroxides and bicarbonates existing together is ruled out owing to the fact that they combine with each other forming the respective carbonates:

$$OH^- + HCO_3^- \longrightarrow CO_3^{--} + H_2O$$

The type and extent of alkalinity present in the water sample is ~~conviently~~ conveniently determined by titrating an aliquot of the sample with acid using phenolpthalein to detect end-point, (P), and then continuing the titration with methyl orange to another end-point, (M). The reaction taking place may be represented by the following equations:

$$OH^- + H^+ \longrightarrow H_2O \quad \text{—— (1)}$$

$$CO_3^{--} + H^+ \longrightarrow HCO_3^- \quad \text{—— (2)}$$

$$HCO_3^- + H^+ \longrightarrow H_2CO_3 \longrightarrow H_2O + CO_2 \quad \text{—— (3)}$$

The volume of acid run down upto phenolpthalein end point, (P) corresponds to the completion of reactions (1) and (2) given above while the volume

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Name of Experiment:

of acid run down after (P) corresponds to the completion of reaction (3). The total amount of acid used from the beginning of the experiment to the end, i.e. (M) corresponds to the total alkalinity and represents the completion of reactions shown by equation (1), (2) and (3).

The results may be summarized in the following table (1), from which the amount of hydroxides, carbonates and bicarbonates present in the water sample may be computed.

Results of titration to phenolpthalein end point, (P) and Methyl orange end point, (M)	Hydroxide	carbonate	Bicarbonate
	OH^-	CO_3^{--}	HCO_3^-
(P) = 0	Nil	Nil	(M)
(P) = (M)	(M)	Nil	Nil
(P) = 1/2 (M)	Nil	2(P)	Nil
(P) > 1/2 (M)	2(P) − (M)	2[(M) − (P)]	Nil
(P) < 1/2 (M)	Nil	2(P)	(M) − 2(P)

Alkalinity is generally expressed as parts per million (ppm) in terms of $CaCO_3$ or on degrees clark.

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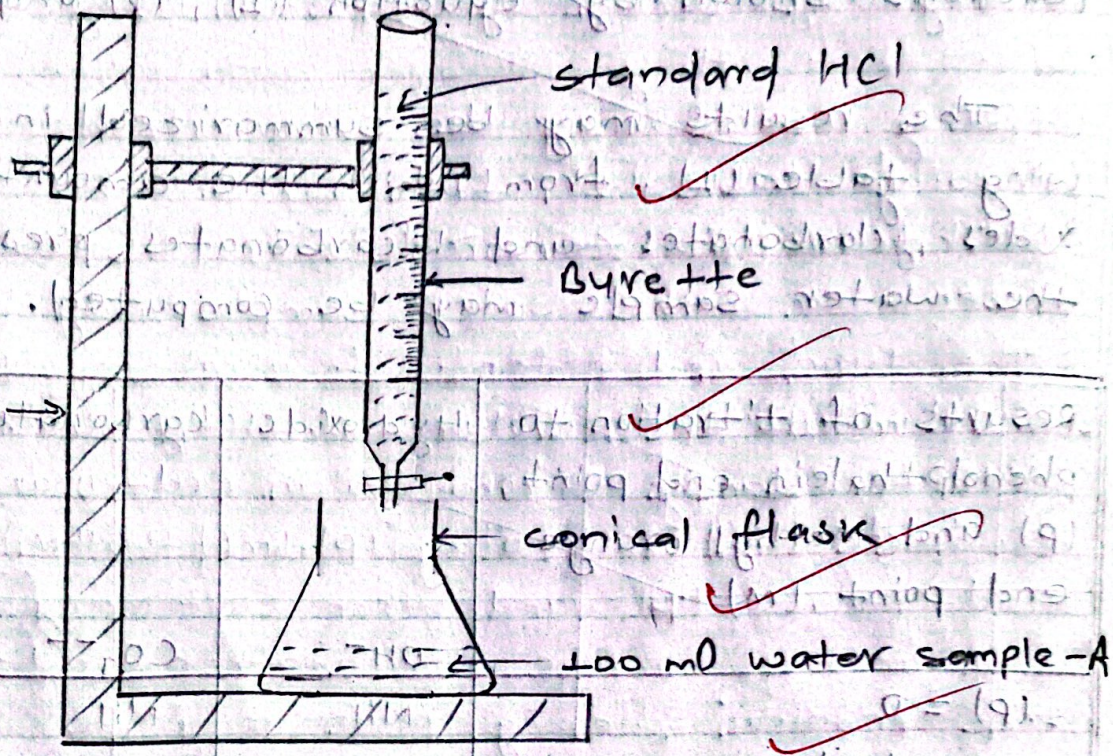

fig:- Determination of alkalinity of given water sa

Name of Experiment:

PROCEDURE:

100 ml of the water sample was transferred into a conical flask, 1 to 2 drops of phenolpthalein indicator was added, and the sample with the standard HCl was titrated until the pink colour just persisted. The tire value was noted as the phenolpthalein end-point, (P). Then 2 to 3 drops of methyl orange indicator was added to the same solution and the titration was continued until a sharp colour change from yellow to red takes place. The total titer value was noted from the beginning of the experiment as methyl orange end-point, (M).

SAMPLE OBSERVATION:

S.No.	Volume of the water sample taken (ml)	Volume of HCl, phenolpthalein end-point, (P), ml	Vol. of HCl, methyl orange end-point (M), ml
1.	100	14.5	38.5
2.	100	13.5	37
3.	100	13.5	37

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CALCULATION:

Now, (P) = 13.5 ml (M) = 37 ml and $\frac{1}{2}$M = 18.5 ml

Since, (P) < $\frac{1}{2}$(M); the sample should contain only CO_3^{--} and HCO_3^- and it does not contain OH^- (vide Table 1).

Further, 2(P) should correspond with the volume of HCl with respect to CO_3^{--} and (M) − 2(P) should correspond with volume of HCl with respect to HCO_3^-.

Thus, volume of N/50 HCl equivalent to CO_3^{--}
= 2(P) = 2 × 13.5 = 27 ml

and Volume of N/50 HCl equivalent to HCO_3^-
= (M) − 2(P)
= 37 − (2 × 13.5)
= 37 − 27
= 10 ml

Now,
Normality of the water sample with respect to CO_3^{--} (N_2) = ?

Since $N_1V_1 = N_2V_2$

$$N_2 = \frac{N_1V_1}{V_2} = \frac{\frac{1}{50} \times 27}{100} N = 5.4 \times 10^{-3} N$$

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Name of Experiment:

Since, strength = Normality × Equivalent weight (g/l)

strength of CO_3^{--} = 5.4×10^{-3} N × 30 = 0.162 g/l

strength of CO_3^{--} in terms of $CaCO_3$

$= \text{strength of } CO_3^{--} \times \frac{\text{Equivalent wt. of } CaCO_3}{\text{Equivalent wt. of } CO_3}$

$= 0.162 \times \frac{50}{30}$ g/l

= 0.27 g/l [∵ 1g = 1000 mg]

= 270 mg/l [1 mg/l = 1 ppm]

= 270 ppm [14.3 ppm = 1 clark]

= 18.88 clark

Similarly,

Normality of water sample with respect to HCO_3^-, $(N_2) = ?$

Since, $N_1V_1 = N_2V_2$

$N_2 = \frac{N_1V_1}{V_2} = \frac{\frac{1}{30} \times 10}{100} N = 2 \times 10^{-3}$ N

strength of HCO_3^- = $2 \times 10^{-3} \times 61$ = 0.122 g/l

(strength = Normality × Eq. wt. of HCO_3^-)

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strength of HCO_3^- in terms of $CaCO_3$

$$= \text{Strength of } HCO_3^- \times \frac{\text{Eq. wt. of } CaCO_3}{\text{Eq. wt. of } HCO_3^-}$$

$$= 0.122 \times \frac{50}{61}$$

$= 0.1$ g/l

$= 100$ mg/l

$= 100$ ppm

$= 6.99$ clark

RESULTS:

Alkalinity with respect to CO_3^{--} in terms of $CaCO_3$ = 270 ppm = 18.88 clark

Alkalinity ~~of~~ with respect to HCO_3^- in terms of $CaCO_3$ = 100 ppm = 6.99 clark.

Total alkalinity in terms of $CaCO_3$ = 370 ppm = 25.87 clark

CONCLUSION:

Thus, the alkalinity of water sample was determined by titrating water sample with standard HCl.

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Name of Experiment:

PRECAUTION:

1. Glass wares should be handled carefully.
2. The end-point should be noted carefully.

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Name of Experiment:

TO DETERMINE THE ALKALINITY OF GIVEN WATER SAMPLE 'B'.

APPARATUS REQUIRED:

1. pipette;
2. conical flask;
3. Burette;
4. Beaker;
5. Funnel, and
6. stand

CHEMICALS REQUIRED:

1. Methyl orange
2. phenolpthalein,
3. standard HCl

THEORY:

The alkalinity of water is due to the presence of soluble

a. hydroxides
b. carbonates, and
c. bicarbonates

of alkali and alkaline earth metals.

With respect to the constituents causing alkalinity in natural waters, the following situation may arise.

1. hydroxides only,
2. carbonates only,
3. bicarbonates only,

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hydroxide and carbonates,
carbonates and bicarbonates.

Note: The possibility of hydroxides and bicarbonates existing together is ruled out owing to the fact that they combine with each other forming the respective carbonates:

$$OH^- + HCO_3^- \longrightarrow CO_3^{--} + H_2O$$

The type and extent of alkalinity present in the water sample is conveniently determined by titrating an aliquot of the sample with acid using phenolpthalein to detect end-point, (P), and then continuing the titration with methyl orange to another end-point, (M). The reaction taking place may be represented by the following equations:

$$OH^- + H^+ \longrightarrow H_2O \quad \text{—— (1)}$$

$$CO_3^{--} + H^+ \longrightarrow HCO_3^- \quad \text{—— (2)}$$

$$HCO_3^- + H^+ \longrightarrow H_2CO_3 \longrightarrow H_2O + CO_2 \quad \text{—— (3)}$$

The volume of acid run down upto phenolpthalein* end point, (P) corresponds to the completion of reactions (1) and (2) given above while the volume of acid run down after (P) corresponds to the completion of reaction (3). The total amount of acid used from the beginning of the experiment to the end, i.e. (M) corresponds to the total alkilinity and represents the completion of

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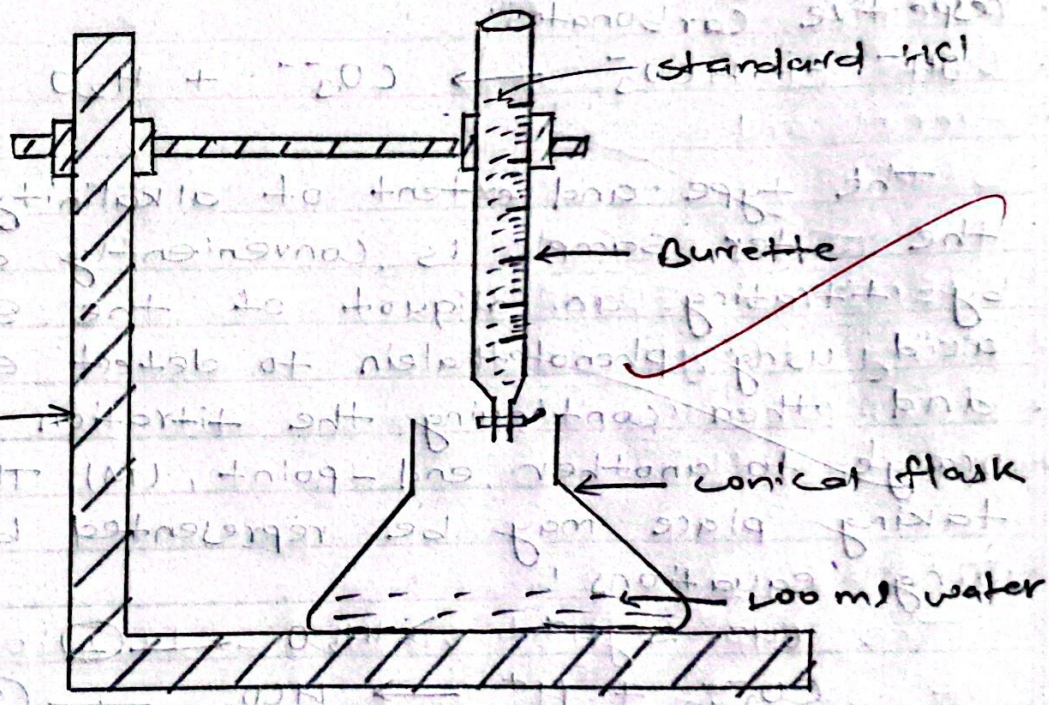

fig:- Determination of alkalinity of given water sample - B:

reactions shown by equation (1), (2) and (3).

The results may be summarized in the following Table (1), from which the amount of hydroxides, carbonates and bicarbonates present in the water sample may be computed.

Results of titration to phenolpthalein end point, (P) and Methyl orange end point, (M)	Hydroxide	carbonate	Bicarbonate
	OH^-	CO_3^{--}	HCO_3^-
(P) = 0	Nil	Nil	(M)
(P) = (M)	(M)	Nil	Nil
(P) = 1/2 M	Nil	2(P)	Nil
(P) > 1/2 M	2(P) - (M)	2 [(M) - (P)]	Nil
(P) < 1/2 M	Nil	2(P)	(M) - 2(P)

Alkalinity ~~of~~ is generally expressed as parts per million (ppm) in terms of $CaCO_3$ or on degrees clark.

PROCEDURE!

100 ml of the water sample was transferred into a conical flask. 1 to 2 drops of phenolpthalein indicator was added, and the sample with the standard HCl was titrated until the pink colour just presisted. The tire value was noted as the phenolpthalein end-point, (P). Then 2 to 3

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drops of methyl orange indicator was added to the same solution and the titration was continued until a sharp colour change from yellow to red takes place. The total titer value was noted from the beginning of the experiment as methyl orange end-point, (M).

OBSERVATION:

S.No.	volume of the ~~sample~~ water sample taken (ml)	volume of HCl, phenolpthalein end-point, (P), ml	vol. of HCl, methyl orange end-point (M), ml
1.	100	33	45
2.	100	32.5	44
3.	100	32.5	44

CALCULATION:

Now, (P) = 32.5 ml (M) = 44 ml and $\frac{1}{2}$M = 22 ml

Since (P) > $\frac{1}{2}$(M), the sample should contain only OH^- and CO_3^{--} and it does not contain HCO_3^- (vide Table 1).

Further, 2(P) - (M) should correspond with the volume of HCl with respect to OH^- and 2[(M)-(P)] should correspond with volume of HCl with respect to ~~OH~~ CO_3^{--}.

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Thus, volume of N/50 HCl equivalent to OH^-

$= 2(P) - (M)$

$= 2 \times 32.5 - 44$

$= 21$ ml

and volume of N/50 HCl equivalent to CO_3^{--}

$= 2[(M) - (P)]$

$= 2[44 - 32.5]$

$= 2 \times 7.5$

$= 15$ ml

Now,

Normality of the water sample with respect to OH^- $(N_2) = ?$

since, $N_1V_1 = N_2V_2$

$N_2 = \frac{N_1V_1}{V_2} = \frac{\frac{1}{50} \times 21}{100} = \cancel{0.0052\ N}\ 4.2 \times 10^{-3} N$

since, strength = Normality × Equivalent weight (g/l)

strength of OH^- = $\cancel{0.0052}\ 4.2 \times 10^{-3}$ N × 17 = 0.0714 g/l

strength of OH^- in terms of $CaCO_3$

$= \text{strength of } CO_3^{--} \times \frac{\text{Equivalent wt. of } CaCO_3}{\text{Equivalent wt. of } OH^-}$

$= 0.0714 \times \frac{50}{17}$ g/l

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$= 0.21\ g/l$
$= 210\ mg/l$
$= 210\ ppm$
$= 14.68$ clark

similarly,
Normality of water sample with respect to CO_3^{--}, $(N_2) = ?$
since, $N_1V_1 = N_2V_2$

$$N_2 = \frac{N_1V_1}{V_2} = \frac{\frac{1}{50} \times 15}{100}$$

$$= 3 \times 10^{-3} N$$

strength of $CO_3^{--} = 3 \times 10^{-3} \times 30 = 0.09\ g/l$

strength of CO_3^{--} in terms of $CaCO_3$

$$= \text{strength of } CO_3^{--} \times \frac{\text{Equivalent wt. of } CaCO_3}{\text{Equivalent wt. of } CO_3^{--}}$$

$$= 0.09 \times \frac{50}{30}$$

$= 0.15$
$= 150\ mg/l$
$= 150\ ppm$
$= 10.48$ clark

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Name of Experiment:

RESULTS:

Alkalinity with respect to OH^- in terms of $CaCO_3$ = 18.68 clark

Alkalinity with respect to CO_3^{--} in terms of $CaCO_3$ = 10.48 clark

Total alkalinity in terms of $CaCO_3$ = 18.68 + 10.48
= 29.16 clark

CONCLUSION:

Thus, the alkalinity of water sample was determined by titrating water sample with standard HCl.

PRECAUTION:

1. Glass wares should be handled carefully.
2. The end-point should be noted carefully.

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Name of Experiment:

TO DETERMINE THE HARDNESS OF WATER SAMPLE BY COMPLEXOMETRIC TITRATION.

APPARATUS REQUIRED:

1) Pipette 2). Burette 3). Funnel 4). conical flask
5) Beaker 6) Bunsen Burner 7) wire gauge
8) Filter paper

CHEMICALS REQUIRED:

i) Ethylene diaminetetra acetic acid (EDTA)
ii) Buffer solution
iii) Eriochrome Black -T indicator

THEORY:

The presence of salt of calcium or magnesium in water which forms a scum with soap and prevents the formation of a lather is known as hardness of water. Other soluble salts of metal like, aluminium, barium, strontium, iron and manganese can also form scum with soap and prevent the formation of lather, but these salts are present in natural water only in trace amount. Hence, the cause of hardness is due to soluble salt of calcium and magnesium only, specially due to presence of chlorides, sulphates and bicarbonates of calcium and magnesium.

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Name of Experiment:

Hardness of water is of two types:
1) Temporary hardness
2) permanent hardness

Temporary hardness is caused due to the presence of bicarbonates (HCO_3^-) of calcium and magnesium. It can be easily removed by boiling.

$$Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3 + CO_2 + H_2O$$

$$Mg(HCO_3)_2 \xrightarrow{\Delta} MgCO_3 + CO_2 + H_2O$$

The temporary hardness is removed by adding lime (calcium hydroxide), which give a precipitates of calcium carbonate.

$$Ca(HCO_3)_2 + Ca(OH)_2 \longrightarrow 2CaCO_3\downarrow + H_2O$$

$$Mg(HCO_3)_2 + Mg(OH)_2 \longrightarrow 2MgCO_3\downarrow + H_2O$$

permanent hardness is caused due to the presence of sulphates and chlorides of calcium and magnesium. It can't be removed by boiling But it can be removed by ion-exchange method using zeolites (e.g. permutit)*. or by treating with Na_2CO_3.

$$CaCl_2 + Na_2CO_3 \longrightarrow CaCO_3 + NaCl$$

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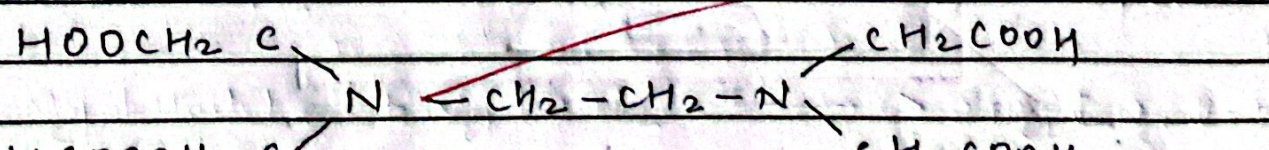
Name of Experiment:

$MgSO_4 + Na_2CO_3 \longrightarrow MgCO_3 + Na_2SO_4$

$CaCl_2 + Na_2Z \longrightarrow CaZ + 2NaCl$
(sodium zeolite)

The hardness of water is not a pollution parameter but indicates water quality. Hard water poses considerable problem in washing, it reduces the efficiency of boiler, in certain industrial process.

Ethylene diaminetetra acetic acid (EDTA) is a well known complexing agent which is widely used in analytical work on account of its powerful complexing action and commercial availability. This is also available under trade names as Verseneor, Tritiplex-III. Its chemical formula can be represented as:



EDTA forms complexes with Ca^{2+} and Mg^{2+} ions as well as with many other metal cations in aqueous solution.

* hydrated sodium aluminium silicate (permutit)
$Na_2Al_2Si_2O_8 \cdot xH_2O$

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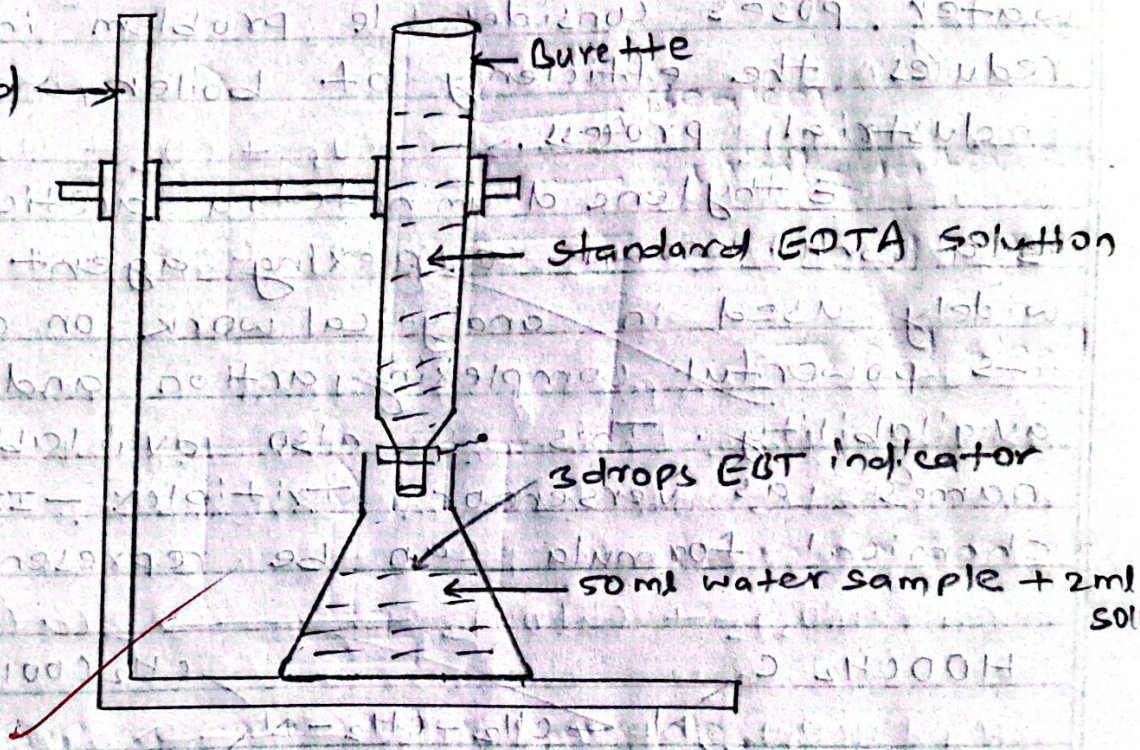

fig: Determination of hardness of water by complexom
titration.

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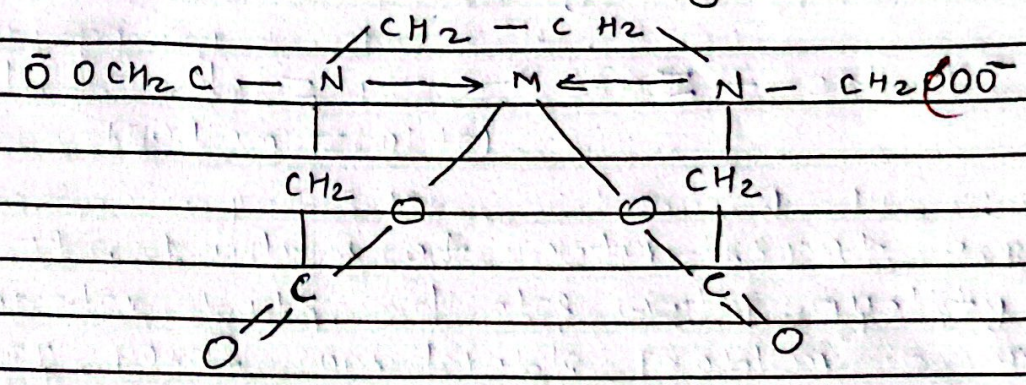
Name of Experiment:

These complexes have the general formula:



EDTA is generally used in the form of disodium salt or tetrasodium salt on account of their greater solubility.

During the titration with EDTA (H_2Y^{--}) when all Ca^{++} and Mg^{++} ions have reacted to form metal EDTA complex (MY^{--}) realizing free indicator (In) and the colour changes from wine red to clear blue.

$$Ca^{++} + H_2Y^{--} \longrightarrow CaY$$

$$Mg^{++} + H_2Y^{--} \longrightarrow MgY$$

$$In - Mg + H_2Y^{--} \longrightarrow MgY + In$$
(blue)

1 mole EDTA ≡ 1 mole of Ca^{2+} ≡ 1 mole of $CaCO_3$

PROCEDURE:

50 ml pipette of the water sample was outed into a 250 ml conical flask. 2 ml of the buffer solution and 3 drops of Eriochrome Black-T indicator was added. The solution with

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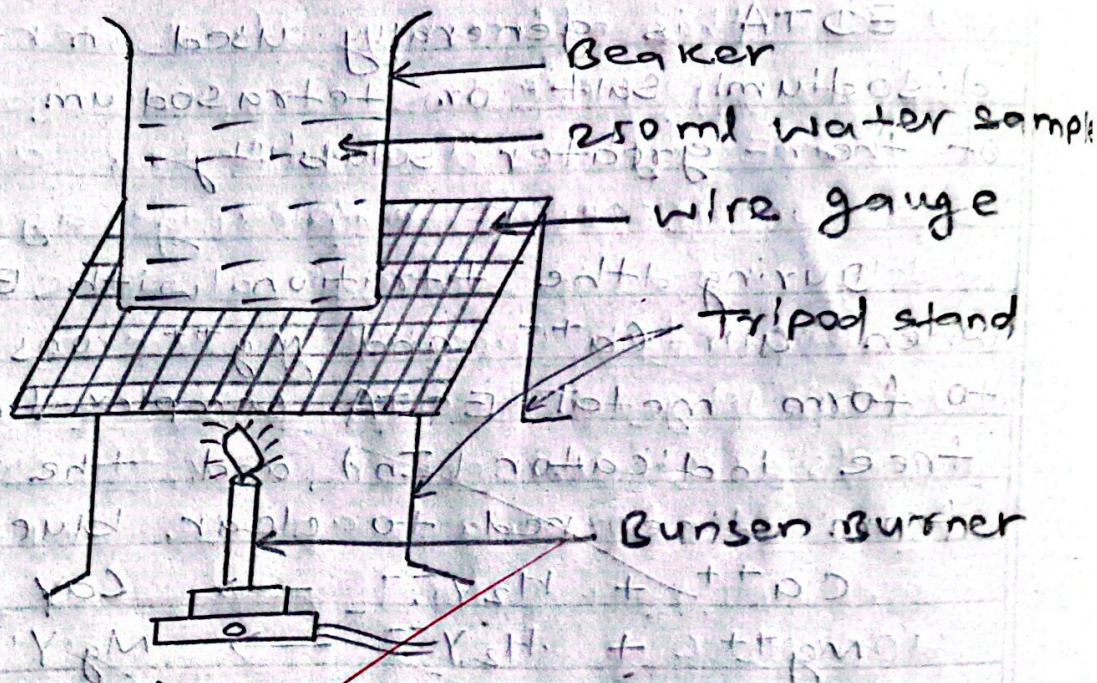

fig: Boiling of water sample.

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Name of Experiment:

standard EDTA solution from the burette was titrated until the colour changes from violet to clear blue at the end-point. The titrate value which was corresponded to total hardness was noted.

250 ml of the water sample was measured out in 500 ml beaker, boiled gently for half-an-hour, ~~filter~~ the solution was filtered into a 250 ml measuring flask. The solution was maked upto the mark with de-ionised water and was shaked thoroughly.

50 ml pipette of this solution was outed into a 250 ml conical flask, 2ml of the buffer solution and 3 drops of Eriochrome Black-T indicator was added. EDTA solution was titrated until the voilet colour changes to clear blue at the end-point. This titre value was corresponded to the permanent hardness

OBSERVATIONS:

S.No.	volume of water sample taken (ml)	volume of 0.01 M EDTA solution runs-down	
		Total hardness (ml)	permament hardness (ml)
1.	50	12	4.5
2.	50	11.5	4
3.	50	11.5	4

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Name of Experiment:

CALCULATION:

1 mole EDTA ≡ 1 mole of Ca^{2+} ≡ 1 mole of $CaCO_3$

∴ 1 ml of 1 M EDTA ≡ 100 mg of $CaCO_3$

1 ml of 0.01 M EDTA ≡ 100 × 0.01 mg of $CaCO_3$

= 1 mg of $CaCO_3$

TOTAL HARDNESS:

11.5 ml of 0.01 M EDTA ≡

Hence, the hardness present in 50 ml of the water sample taken

≡ 11.5 mg of $CaCO_3$

∴ The hardness present in 1000 ml of the water sample

$\equiv 11.5 \times \frac{1000}{50} = 230$ mg of $CaCO_3$

∴ Total hardness = 230 mg/l = 230 ppm

PERMANENT HARDNESS:

4 ml of 0.01 M EDTA ≡ 100 × 0.01 × 4 mg of $CaCO_3$

= 4 mg of $CaCO_3$

∴ The hardness present in 50 ml of the water sample taken

≡ 4 mg of $CaCO_3$

∴ The hardness present in 1000 ml of the water sample $= 4 \times \frac{1000}{50} = 80$ mg of $CaCO_3$

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∴ permanent hardness = 80 mg/l = 80 ppm

TEMPORARY HARDNESS:

Temporary hardness = Total hardness − permanent hardness

= 230 ppm − 80 ppm

= 150 ppm.

RESULTS:

Hence, temporary hardness present in the water sample in terms of $CaCO_3$ = 150 ppm.,

permanent hardness present in the water sample in terms of $CaCO_3$ = 80 ppm,

Total hardness present in the water sample in terms of $CaCO_3$ = 230 ppm.

CONCLUSION:

Thus, the hardness of water sample was determined by titrating water sample with standard EDTA.

PRECAUTIONS:

1) No tinge of reddish hue should remain at the end-point, the solution should be clear blue.
2) Titration should be performed slowly near the end-point.

31.01.2023

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Name of Experiment:

TO DETERMINE THE FREE CHLORINE IN A GIVEN WATER SAMPLE.

APPARATUS REQUIRED:

1) pipette, 2) Burette, 3) stopper conical flask, 4) Beaker, 5) Funnel, 6) Filter paper, 7) stand.

CHEMICALS REQUIRED:

1) standard N/20 $K_2Cr_2O_7$ solution
2) potassium iodide solution (10%)
3) conc. HCl
4). N/20 hypo solution
5) $NaHCO_3$
6) starch solution

THEORY:

Various kinds of undesirable microorganism like algae, bacteria and fungi may present in surface water. The presence of these microorganism in water may lead to serious health hazards. Thus drinking water should sterilized and disinfected before domestic use. Since, chlorine is powerful oxidizing agent and is cheaply available. It is widely used for disinfection of potable and municipal water supplies.

chlorination is done with the help of bleaching powder or chlorine gas or chlorine dissolved in water in the form of concentrated solution or with chloramines

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Name of Experiment:

The sterilizing action of chlorine is supposed to be due to its reaction with water producing hypochlorous acid and nascent oxygen, both of which have powerful germicidal properties.

$$CaOCl_2 + H_2O \longrightarrow Ca(OH)_2 + Cl_2$$
$$Cl_2 + H_2O \longrightarrow HOCl + HCl$$
$$HOCl \longrightarrow HCl + (O)$$

(Hypochlorous acid) (nascent oxygen)

However, excess of free chlorine in drinking water is undesirable as it is not only unpleasant for drinking but it is also injurious for human metabolism. Hence, the amount of free chlorine in municipal water is estimated prior to the domestic supply so as to make necessary adjustments in dose.

The principle involved in the estimation of free chlorine in water is that when a measured quantity of water is treated with excess of potassium iodide, the free chlorine present in the water oxidizes the corresponding amount of potassium iodide to iodine. The liberated iodine is estimated by titrating against standard hypo solution using starch as indicator.

$$Cl_2 + 2KI \longrightarrow 2KCl + I_2$$
$$I_2 + 2Na_2S_2O_3 \longrightarrow Na_2S_4O_6 + 2NaI$$

(sodium thiosulfate) (sodium tetrathionate)

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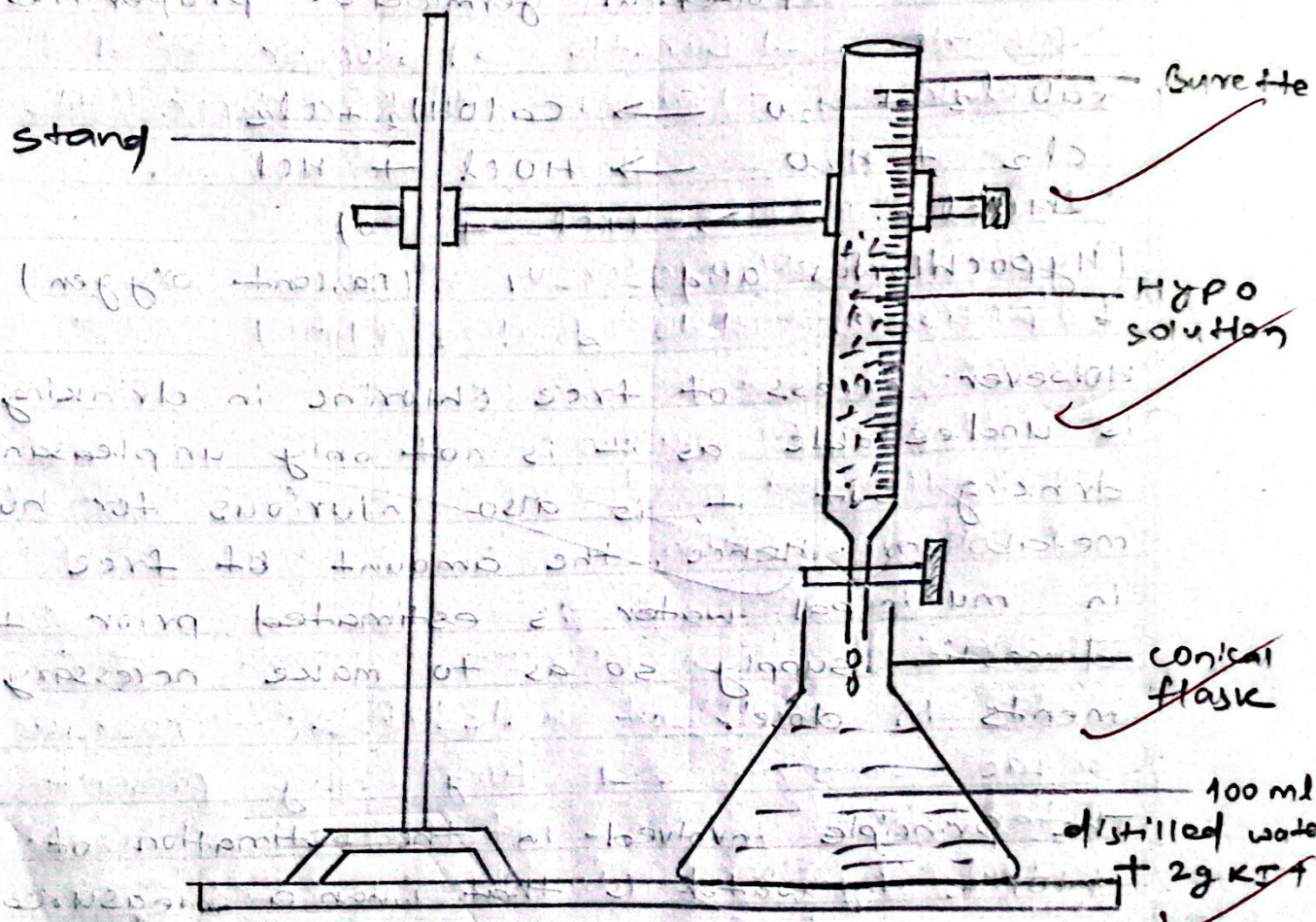

fig: standardization of hypo solution

Name of Experiment:

PROCEDURE:

a) standardization of hypo solution:

100 ml of distilled water was transferred into 250 ml flask, and about 2 g of KI and 2 g of $NaHCO_3$ was added and it was shaked until the salts dissolved. 6 g of conc. HCl was added slowly while gently rotating the flask. 25 g of N/20 $K_2Cr_2O_7$ solution was added and the solution was mixed well. The inner sides of the flask was washed with a little distilled water and stopper of the flask. It was allowed it to standby for 5 minutes in dark for the completion of the reaction:

$$Cr_2O_7^{2-} + 6I^- + 14H^+ \longrightarrow 2Cr^{3+} + 3I_2 + 7H_2O$$

The stopper was rinsed with distilled water and the liberated iodine with the hypo solution from the burette was titrated. when most of the iodine was reacted, the solution acquires a greenish-yellow colour. At this stage, 1 ml of starch solution was added when the solution turns violet due to the formation of starch iodine complex. The titration was continued until the violet colour changes to light green by the addition of a single drop of hypo at the end-point.

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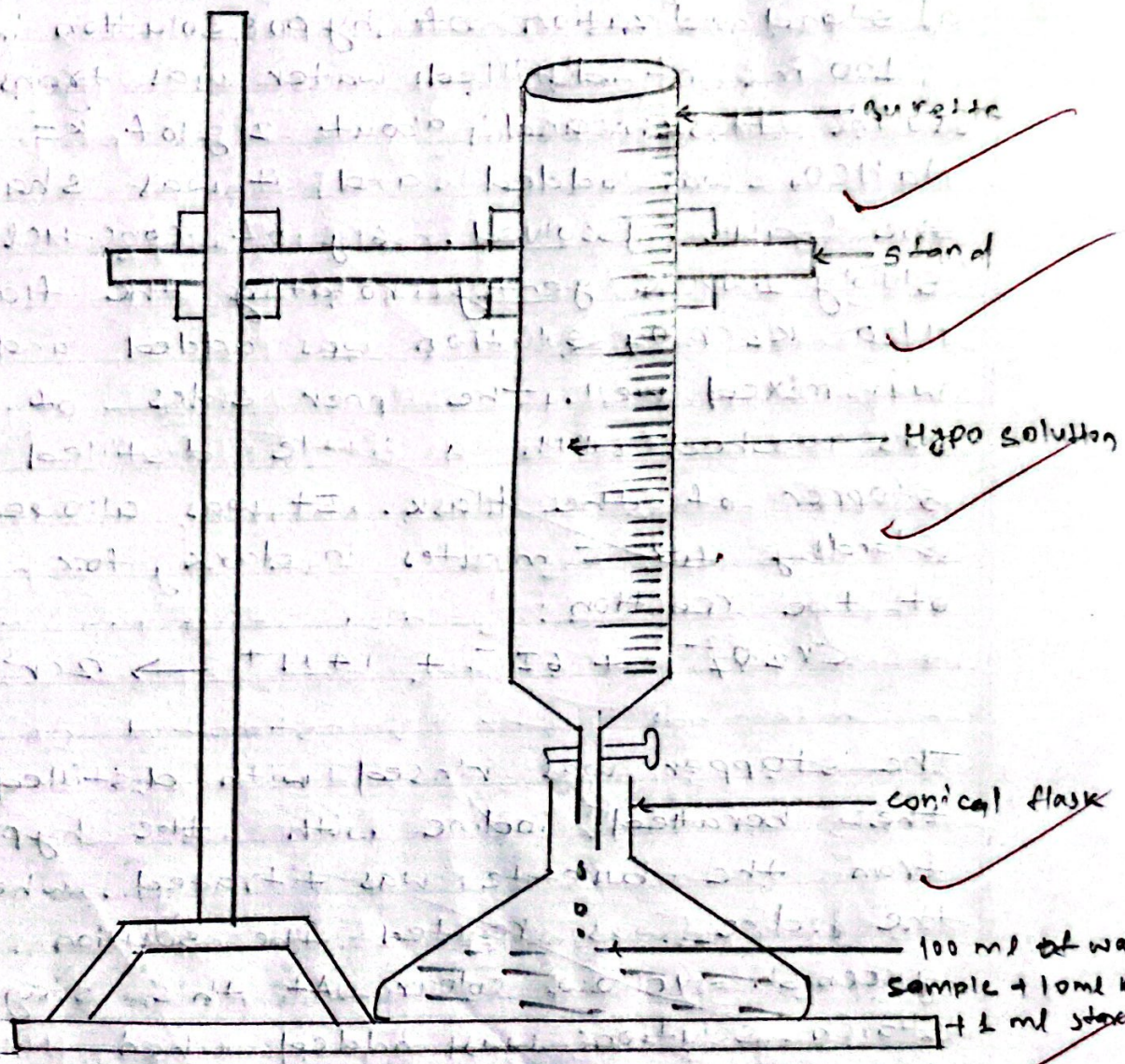

fig: Determination of free chlorine in water sample.

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Name of Experiment:

b) Determination of free chlorine in the water sample:
10% of 10 ml KI solution was transferred into a 250 ml conical flask (or stoppered conical flask) and 100 ml of water was added into it. the stopper was replaced to the flask and was shaked vigorously. the stopper was removed, to washed the solution adhering in the flask with 5-10 ml of distilled water. the solution was titrated with N/20 hypo solution was taken in the burette until the solution was pale yellow. Then 1 ml of starch was added and the titration was continued until the solution becomes just colourless. the titre values was noted.

OBSERVATION:

A) standardization of hypo solution

S.N.	vol. of N/20 $K_2Cr_2O_7$ (V_1) ml	vol. of hypo solution run down (V_2) (ml)
1.	25	25
2.	25	24
3	25	24

B) Determination of free chlorine in the water sample:

S.N.	volume of water sample (ml)	volume of hypo solution run down (ml)
1.	100	3
2.	100	2.5
3	100	2.5

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CALCULATION :-

A) standardization of hypo solution

vol. of $K_2Cr_2O_7$ (V_1) = 25 ml

Normality of $K_2Cr_2O_7$ (N_1) = N/20

vol. of hyposolution (V_2) = 24 ml

Normality of hypo solution (N_2) = ?

Applying formula,

$$N_1V_1 = N_2V_2$$

We have, $N_2 = \frac{N_1V_1}{V_2}$

$$= \frac{\frac{N}{20} \times 25}{24}$$

$$= 0.052\ N$$

B) calculation with the water sample :

vol. of water sample (V_1) = 100 ml

Normality of water sample (N_1) = ?

vol. of hypo solution (V_2) = 2.5 ml

Normality of hypo solution (N_2) = 0.052 N

Applying formula,

$$N_1V_1 = N_2V_2$$

$$N_2 = \frac{N_2V_2}{V_1}$$

$$= \frac{0.052 \times 2.5}{100}\ N$$

$$= 0.0013\ N$$

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Name of Experiment:

Normality of the water sample is $N_2 = 0.0013$ with respect to free chlorine present.

Now, strength of free chlorine in the sample

$= \text{Normality} \times \text{Eq. wt of Cl}$

$= N_1 \times 35.45 \text{ g/l}$

$= 0.0013 \times 35.45 \text{ g/l}$

$= 0.04608 \text{ g/l}$

$= 46.08 \text{ mg/l}$

$= 46.08 \text{ ppm}$

RESULTS:

Free chlorine present in the water sample = ~~46 ppm~~ 46.08 ppm

CONCLUSION:

Thus, the free chlorine present in a given water sample was determined by titrating water sample with standard hypo solution.

PRECAUTIONS:

i) Apparatus should be handled carefully

ii) chemicals should be used carefully.

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Name of Experiment:

TO ESTIMATE OF DISSOLVED OXYGEN (D.O) OF GIVEN WATER SAMPLE.

APPARATUS REQUIRED:
1. B.O.D bottles,
2. Conical flasks,
3. Burette,
4. pipette

CHEMICAL REQUIRED:
1. Manganese (II) sulphate
2. sodium azide
3. potassium iodide
4. sodium hydroxide
5. starch
6. sodium thiosulphate

THEORY:
Dissolved oxygen is the content of oxygen dissolved in water. Dissolved oxygen (DO) is an important parameter of water and is essential to maintain the aquatic life. Dissolved oxygen comes in water from two ways!

a. By continuous diffusion from air
b. By photosynthetic activity of aquatic organisms.

Adequate dissolved oxygen is important for good water quality and is important for good water

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Name of Experiment:

quality and is necessary to all aquatic life. Unpolluted water has 5-7 mg/l of dissolved oxygen. Dissolved oxygen levels that drop below 5 mg/l cause stress to aquatic life.

Dissolved oxygen is usually determined by winkler's method. It is based on the fact that dissolved oxygen oxidizes KI to Iodine. The liberated iodine is titrated against standard ~~solution~~ sodium thiosulfate (hypo) using starch as an indicator. Since dissolved oxygen in water is present in the form of molecule, it cannot oxidize KI. Hence, Manganese hydroxide is used as oxygen carrier to bring about the reaction between KI and oxygen. Manganese hydroxide is obtained by the action of KOH on manganous sulphate.

$$MnSO_4 + 2KOH \longrightarrow Mn(OH)_2 + K_2SO_4$$
$$2Mn(OH)_2 + O_2 \longrightarrow 2MnO(OH)_2$$
$$MnO(OH)_2 + H_2SO_4 \longrightarrow MnSO_4 + 2H_2O + [O]$$
$$2KI + H_2SO_4 + [O] \longrightarrow K_2SO_4 + H_2O + I_2$$
$$2Na_2S_2O_3 + I_2 \longrightarrow Na_2S_4O_6 + 2NaI$$

The oxidizing agents present in water oxidize I^- to I_2 and give positive error. To overcome these problems, Sodium azide is used in alkaline iodide solution.

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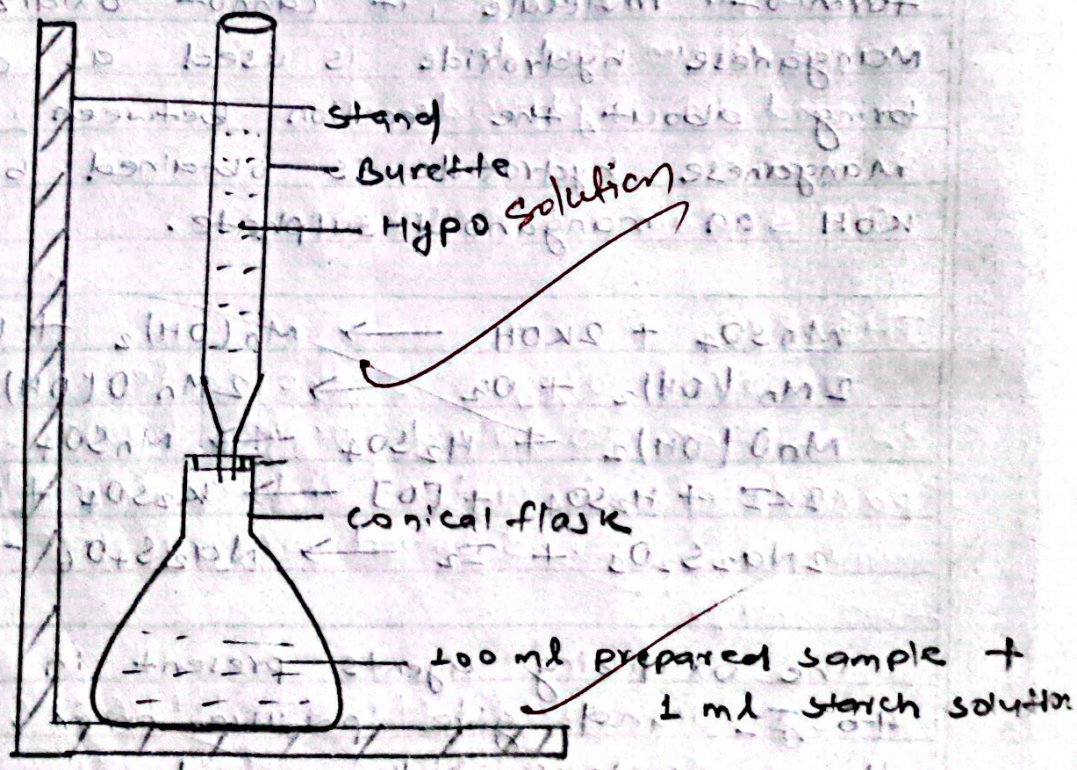

Fig: Estimation of dissolved oxygen present in the given water sample.

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Name of Experiment:

PROCEDURE!

300 ml of water sample was collected without air bubbles. Immediately 1 ml manganous solution and 1 ml alkaline-iodide-azide reagent was added. stopper was placed in the bottle and was shaken vigorously. when the precipitates were settled then 1 ml conc. H_2SO_4 was added and the bottle was shaken well until precipitates were completely dissolved. 100 ml of this solution was taken and was titrated against N/80 hypo solution using starch as an indicator. The end point was indicated by the disapperance of blue colour. Experiments were repeated till the concurrent readings were obtained.

OBSERVATION TABLE!

S.N.	Vol. of water sample (ml)	Burette readings (ml) vol. of sodium thiosulfate (ml)
1.	100	8.5
2.	100	8
3.	100	8

CALCULATION!

When a standardized N/80 (0.0125 N) sodium thiosulfate used as titrant.

1 ml of titrant consumed = 1 mg/l of dissolved oxygen in sample.

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Name of Experiment:

∴ 8 ml of titrant consumed = 8 mg/l of dissolved O_2 in sample.

RESULT:

The amount of dissolved oxygen is 8 mg/l or ppm.

CONCLUSION:

In this way, the dissolved oxygen present in the given water sample was determined.

PRECAUTIONS:

- The chemicals should be handled properly.
- Titration should be performed slowly near the end-point.

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