Date 3/11/20

Expt. No. 6 Page No. 19

EXPERIMENT: To find out the total alkalinity and chloride content of a water sample.

THEORY: Alkalinity of water is due to the presence of hydroxides, carbonates and bicarbonates of the salts of calcium, magnesium, sodium and potassium. Similarly, the chloride content of water is due to the presence of chloride ions of these cations. Total alkalinity is estimated by titrating a known volume of water against a standard acid ($N/20$ H_2SO_4) using methyl orange as indicator in the neutral medium.
Chloride content is estimated by titrating a known volume against a standard silver nitrate solution ($N/100$) using potassium chromate as an indicator in the neutral medium.
If water is found to be acidic, it is made neutral by adding solid calcium carbonate. In this case, some calcium carbonate must remain settled at the bottom. The results are expressed in parts per million (ppm).

PROCEDURE:

(i) Determination of total alkalinity of tap water

1. Wash, rinse and fill the burette with $N/20$ H_2SO_4.
2. Transfer 100 ml of tap water in the titration flask. Add 2-3 drops of methyl orange and titrate it against $N/20$ H_2SO_4 till the color changes from yellow to light pink, as an end point.
3. Note the volume of the solution used and repeat the titration at least 5 times and take the mean of the closely related readings (x ml).

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Expt. No. 6 Date: 03/11/20

EXPERIMENT: To find out the alkalinity and chloride content in a water sample.

APPARATUS: Pipette, burette, beakers, conical flask, funnel, burette stand and clamp.

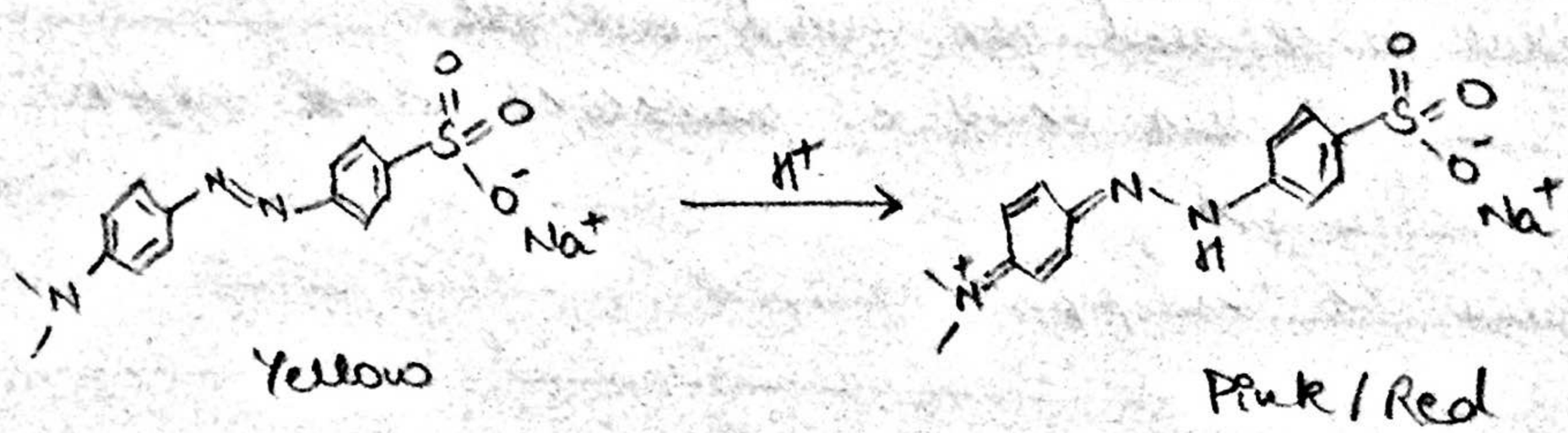
CHEMICALS: Water samples, potassium chromate (K_2CrO_4), silver nitrate ($AgNO_3$), methyl orange and sulphuric acid (H_2SO_4).

CHEMICAL REACTIONS:

$$CO_3^{2-} + 2H^+ \longrightarrow CO_2 + H_2O$$
$$HCO_3^- + H^+ \longrightarrow CO_2 + H_2O$$
$$OH^- + H^+ \longrightarrow H_2O$$
$$Cl^- + Ag^+ \longrightarrow AgCl \text{ (white ppt.)}$$
$$CrO_4^{2-} + 2Ag^+ \longrightarrow Ag_2CrO_4 \text{ (Brick red ppt.)}$$

INDICATORS: Methyl Orange and K_2CrO_4

CHEMICAL STRUCTURES:



OBSERVATIONS:

(i) Determination of total alkalinity of tap water

The volume of tap water taken for each titration = 50 ml

Sr. No.	Burette Reading (in ml)		Volume of N/20 H_2SO_4 required (in ml)
	Initial	final	
1.	0.0	7.1	7.1
2.	0.0	7.1	7.1
3.	0.0	7.1	7.1

Mean volume of H_2SO_4 used (V_2) = 7.1 ml

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(ii) Determination of chloride contents of water sample

1. Take 10ml of water sample in a titration flask.
2. Add 3-4 drops of K_2CrO_4 and titrate it against N/100 $AgNO_3$ from the burette till the appearance of light brick red color.
3. Note the volume of the solution used and repeat the titration at least 5 times and take the mean of the closely related readings (y ml).

RESULTS:

Amount of total alkalinity in water sample = 355 ppm

Amount of chloride content in water sample = 465 ppm

PRECAUTIONS: 1. Do not blow in the pipette.

2. Rinse the pipette with the solution to be transferred to titration flask.
3. Upper meniscus to be read for colored solutions.
4. Lower meniscus to be read for colorless solutions.

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(ii) Determination of chloride contents of water sample

Water sample in a titration flask = 10ml

Sr. No.	Burette Reading (in ml)		Volume of N/100 $AgNO_3$ required (in ml)
	Initial	Final	
1.	0.0	13.1	13.1
2.	0.0	13.1	13.1
3.	0.0	13.1	13.1

Mean volume of $AgNO_3$ used (V_2) = 13.1 ml

CALCULATIONS:

(i) Alkalinity

(Tap water) (H_2SO_4)

$N_1V_1 = N_2V_2$

$N_1 = \frac{0.05 \times 7.1}{50} = 0.0071N$

Amount of $CaCO_3$ (gm/L) = 0.0071×50 (Eq. wt. of $CaCO_3$) = 0.355 gm/L = 0.355×1000 (mg/litre)

= 355 ppm

(ii) Chloride Content

(Tap water) ($AgNO_3$)

$N_1V_1 = N_2V_2$

$N_1 = \frac{0.01 \times 13.1}{10} = 0.0131N$

Chloride Content (gm/L) = 0.0131×35.5 (Eq. wt. of Cl^-) = 0.465 gm/L = 0.465×1000 (mg/litre)

= 465 ppm

RESULT:

Amount of total alkalinity in water sample = 355 ppm

Amount of chloride content in water sample = 466 ppm

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