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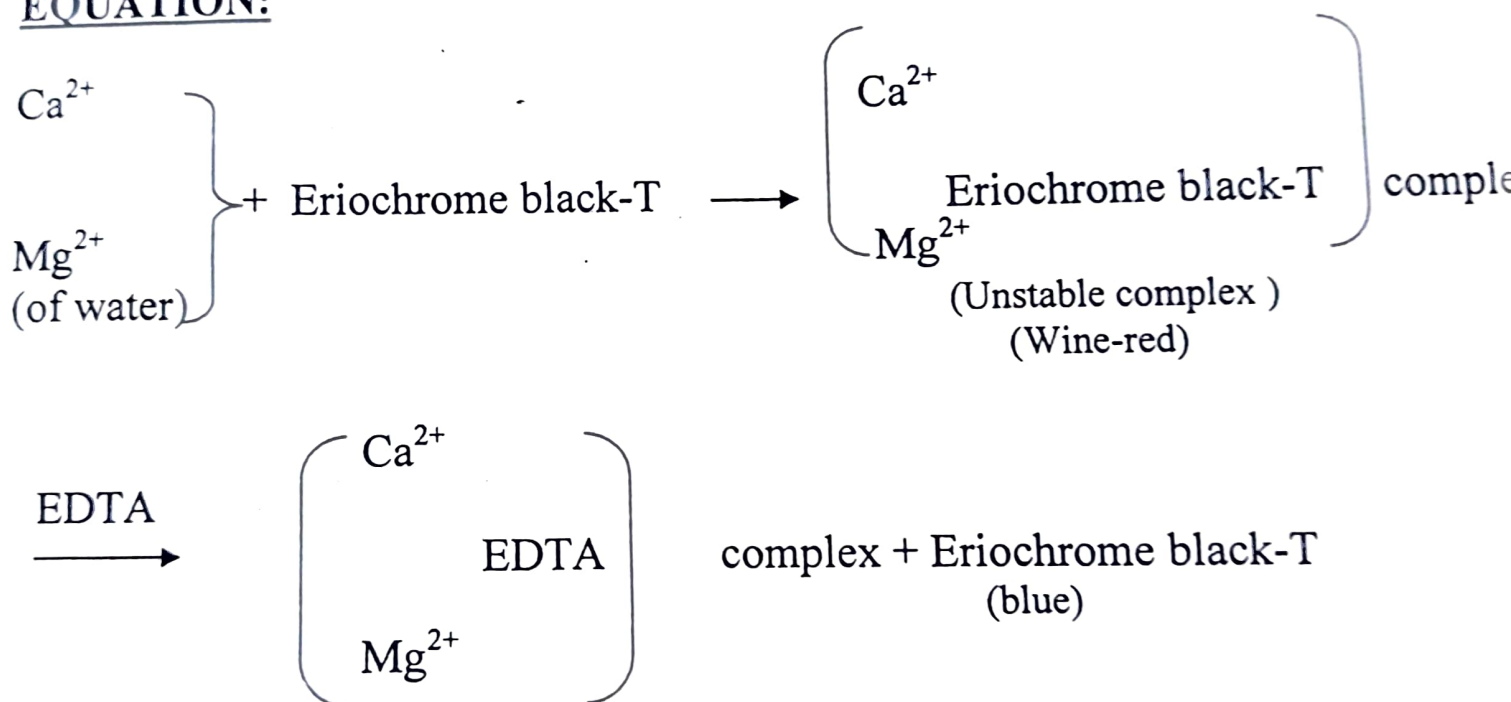
EXPERIMENT NO: 14.

DETERMINATION OF HARDNESS OF WATER

AIM: To determine the hardness of a given sample of water using EDTA method.

REQUIREMENTS: Eriochrome black-T indicator, 0.01N $ZnSO_4$ solution, EDTA solution, buffer and water sample

EQUATION:

$$\left.\begin{array}{l} Ca^{2+} \\ \\ Mg^{2+} \\ (\text{of water}) \end{array}\right\} + \text{Eriochrome black-T} \longrightarrow \left[\begin{array}{l} Ca^{2+} \\ \quad\quad \text{Eriochrome black-T} \\ Mg^{2+} \end{array}\right] \text{comple}$$

$$(\text{Unstable complex})$$
$$(\text{Wine-red})$$

$$\xrightarrow{\text{EDTA}} \left[\begin{array}{l} Ca^{2+} \\ \quad\quad \text{EDTA} \\ Mg^{2+} \end{array}\right] \text{complex} + \text{Eriochrome black-T}$$
$$(\text{blue})$$

PROCEDURE: Fill the burette with 0.01N EDTA solution. Pipette 25ml of $ZnSO_4$ in the conical flask, add 3ml of buffer solution and 3 drops of indicator, then titrate it against EDTA solution till the colour changes from wine red to li blue. Note down the burette reading. Take three such readings.

OBSERVATION:

Burette solution :   0.01N EDTA solution
Pipette solution : 0.01N $ZnSO_4$ solution
Indicator   : Eriochrome black-T
Colour change : wine red to light blue

1st Reading in 'ml'	2nd Reading in 'ml'	3rd Reading in 'ml'	Mean in 'ml'
24 9	24 8	24 9	

CALCULATIONS:

$N_1 V_1 = N_2 V_2$

Where $N_1 =$ Normality of EDTA solution

$V_1 =$ Volume of EDTA solution

$N_2 =$ Normality of $ZnSO_4$ solution

$V_2 =$ Volume of $ZnSO_4$ solution

The normality of EDTA solution = _____ N

Part II : Pipette 25ml of water sample in a conical flask, add 3 ml of buffer solution, 2-3 drops of indicator and titrate this against EDTA solution from the burette till the colour changes from wine red to blue, repeat the procedure thrice. Let the mean reading be 'X' ml.

OBSERVATIONS:

Burette solution :   0.01N EDTA solution

Pipette solution :   25ml water

Indicator   :   Eriochrome black-T

Colour change   :   wine red to blue

1st Reading in 'ml'	2nd Reading in 'ml'	3rd Reading in 'ml'	Mean in 'ml'
1.9	1.9	1.8	

CALCULATIONS

1000 ml of 1M EDTA   =   100gm of $CaCO_3$

1ml of 0.01M EDTA   =   1mg of $CaCO_3$

But 1mg/l of $CaCO_3$ =   1 ppm of $CaCO_3$

1ml of 0.01M EDTA   =   1 ppm of $CaCO_3$

'X' ml of N_1 EDTA   = $\dfrac{1 \times X \times N_1}{0.01}$

=   _____ ppm.

RESULT: The hardness of the given water sample is _____ ppm.