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Water Analysis by Na_2EDTA method

Aim: To estimate the Total Hardness present in the supplied sample of water by Na_2EDTA method.

Apparatus: Burette, pipette, conical flask, volumetric flask, beakers, funnel and glass-rod.

Chemicals: Disodium salt of ethylene diamine tetra acetic acid crystals, Eriochrome black-T indicator, Buffer solution (Mixture of NH_4OH and NH_4Cl).

Theory:

Hardness is that characteristic property of water, which prevents lather formation with soap solution. There are two types of hardness, viz., temporary and permanent hardness.

Temporary hardness of water is due to the presence of soluble salts of bicarbonates of calcium and magnesium in water that can be removed merely by boiling. Boiling of water converts the bicarbonates of soluble salts present in the water into insoluble carbonates and hydroxides of metal ions, which can be removed by filtration.

Permanent hardness of water is due to the presence of soluble salts of chlorides, sulphates and nitrates of Ca & Mg which cannot be removed by boiling the water. Hence permanent hardness is due to the presence of these salts.

Total hardness of water is the algebraic sum of temporary and permanent hardness and it is expressed in terms of $CaCO_3$ equivalent hardness in ppm. or mg./lit., because

1) The amount of Ca is maximum in the earth's crust compared to any other hardness producing substances.
2) Its molecular weight is 100, which makes mathematical calculations easier.
3) It is most insoluble salt, thus can be easily precipitated.

Total hardness of water permissible in potable water is 200 ppm. Water samples having Total hardness greater than 250 ppm causes scale deposits in plumbing, boilers and leads to corrosion.

The hardness of water is determined by using Std. disodium salt of EDTA solution and EBT indicator

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Procedure:

Preparation of Standard EDTA solution:

Dissolve the supplied disodium salt of EDTA ('W'g.) in a 250ml clean beaker by adding 4 test tubes of warm distilled water. Transfer this solution to 250ml volumetric flask. Wash the beaker 2-3 times with distilled water thoroughly and transfer the same to the volumetric flask. Dilute up to the mark of the volumetric flask using distilled water. Shake the flask well to make the solution homogeneous. Rinse and fill the burette with the prepared std. disodium salt of EDTA solution.

Weight of disodium salt of EDTA = '**W**' g.

Molecular weight of disodium salt of EDTA = **372.24**

Molarity of disodium salt of EDTA = $\frac{W \times 4}{372.24}$ = '***x***' M.

Titration:

. Pipette out **50 ml of the supplied hard water sample** into a clean conical flask. Add about **5ml of buffer solution, 2-3 drops of EBT indicator** and **titrate against std. disodium salt of EDTA solution** until a **sharp colour changes from wine red to clear blue**. Note down the burette reading and perform another 2 sets of titrations for accuracy.

B.R. → / **B.L.** ↓	**I ml.**	**II ml.**	**III ml.**	**Mean BR**
Final level				**…' V ' ml**
Initial level				
Difference				

Calculate the amount of total hardness present in the supplied sample of hard water in terms of calcium carbonate equivalent hardness, in ppm, using the standard conversion factor.

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Calculation:

The given **Conversion Factor** is:

1000 ml of 1M Na_2EDTA solution ≡ 100 g. of $CaCO_3$ equivalent hardness.

i.e. 1ml of 1M Na_2EDTA solution ≡ 0.1 g. of $CaCO_3$ equivalent hardness.

Now, 'V' ml of 'x' M Na_2EDTA solution ≡ 0.1 x '*x*' x 'V' = 'y' g. of $CaCO_3$.

i.e., **50 ml** of hard water sample contains = '***y***' g. of $CaCO_3$ equivalent hardness.

Therefore, **1000ml** of hard water sample ≡ $\frac{\text{'y' x 1000}}{50}$ = '**z**' g./lit. of $CaCO_3$

Hence, Total Hardness of water in terms of $CaCO_3$, in ppm. = '**z**' x 1000 mg/lit. = 'H' ppm.

i.e., Total Hardness = 'H' ppm.

Result:

Total Hardness of Water in terms of $CaCO_3$ equivalent hardness = **'H' ppm.**