Engineering Chemistry

CYC 102

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Overview

- **Numerical problems based on EDTA method**

- **Summary**

- **Reference**

- **Topics to be covered in next lecture**

Numerical problems based on EDTA method

1. 50 mL of standard hard water containing 1 mg of pure CaCO3 per mL consumed 25 mL of EDTA. 50 mL of water sample consumed 25 mL of same EDTA solution. Using EBT as indicator, calculate the total hardness of water sample in ppm.

Solution:

Step (i) standardization of EDTA solution.

Given, 1 mL of standard hard water contains 1 mg of CaCO3

Now, 25 mL of EDTA = 50 mL of standard hard water

= 50 mg of CaCO3 eq. hardness

Hence, 1mL of EDTA = 50/25 = 2mg of CaCO3 eq. hardness   **…(i)**

Numerical problems based on EDTA method…Contd.

Step (ii) Determination of total hardness of water sample

Given, 50 mL of unknown sample of water = 25 mL of EDTA

$$= 25 \times 2 = 50 \text{ mg of CaCO}_3 \text{ eq. hardness } \textbf{(using (i))}$$

Hence, 1000 mL of unknown sample of water $= \dfrac{50}{50} \times 1000 = 1000$ mg of $CaCO_3$ eq. hardness

Thus, total hardness of water sample = 1000 ppm

Numerical problems based on EDTA method…Contd.

2. The standard hard water contains 15 g of CaCO3 per litre. 20 mL of this required 25 mL of EDTA solution. (i) 100 mL of sample of water required 18 mL of EDTA solution (ii) The same sample after boiling required 12 mL of EDTA solution. Calculate the temporary hardness of the given sample of water, in terms of ppm.

Solution:

Step (i) Standardization of EDTA solution.

Given, 1L of standard hard water contains 15 g of $CaCO_3$.

Therefore, 1 mL of standard hard water (SHW)= 15,000/1000 = 15 mg of $CaCO_3$ equivalent.

Now, 25 mL of EDTA solution = 20 mL of SHW contains [20 ×15] = 300 mg of $CaCO_3$ equivalent.

Therefore, 1 mL of EDTA solution = 300/ 25 = 12 mg of $CaCO_3$ equivalent.

Numerical problems based on EDTA method…Contd.

Step (ii) Calculation of total hardness of water

100 mL of water ≡18 mL of EDTA solution

$\equiv$ [18×12] = 216 mg of CaCO3 equivalent.

Therefore, 1000 mL of water ≡ 2160 mg of CaCO3 equivalent.

Hence, total hardness of water = 2160 mg/L or ppm.

Step (iii) Calculation of permanent hardness of water

100 mL of water (after boiling) ≡ 12 mL of EDTA solution.

$\equiv$ [12 × 12] =144 mg of CaCO3 equivalent.

Therefore, 1000 mL of water contains 144 ×1000/100 =1440 mg of CaCO3 equivalent.

Hence, permanent hardness of water = 1440 ppm.

Numerical problems based on EDTA method…Contd.

Step (iv) Calculation of temporary hardness of water

Temporary hardness of water = [Total – Permanent] hardness

$$= [2160 - 1440] = 720 \text{ ppm.}$$

Summary

- Hardness can be determined by EDTA method
- Problems based on Temporary, permanent and total hardness can be solved easily by this method

Reference

- O.G Palanna, Engineering Chemistry, Page No. 268-270.

Topic to be covered in Class

- Alkalinity
- Numerical based on alkalinity

Thank You!