CH1102

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Expt. NO. 06: Estimation Method for Calcium in water or milk by standard EDTA solution.

Aim & Objectives:

The aim of this experiment is to estimate the amount of calcium dissolved in milk, and the hardness of water sample due to

- $CaCO_3$ by standard EDTA sol^{n}.
  - → % of calcium in milk
  - → % of calcium in egg-shell.
  - → % of calcium in solid samples.

Apparatus Required:

- → Conical Flask
- → Pipette
- → Volumetric Flask (250 mL)
- → Volumetric Flask (100 mL)
- → Measuring Cylinder

Chemicals Required:

→ EDTA
→ $Zn(COOCH_3)_2 \cdot 2H_2O$
→ NH_4Cl
→ NH_3
→ $MgSO_4 \cdot 7H_2O$
→ $CaCO_3$
→ EBT
→ Methyl Red Indicator.

Procedure :-

i) Control Experiment (avoid Ca^{2+} and other ions which are present in water) :

Take (25+20) mL = 45 mL water into a 250 mL conical flask. Add 5 mL of $NH_4Cl - NH_3$ buffer solution and 2-3 mL blue colored $[Mg(EDTA)]$ - EBT mixture, when the experimental solution assumes a wine-red color. Titrate with standardized EDTA solution, while swirling the flask gently, until wine-red color changes to blue. Record the titre of EDTA sol^n.

ii) Estimation of Calcium :

Take an aliquot of 25 mL of prepared Ca^{2+} sol^n into a 250 mL conical flask, dilute with 20 mL of distilled water. Add 1 drop of methyl red indicator, the sol^n becomes red in color. Neutralize with drops of (1:1) aq - NH_3 until color changes to yellow. Bring to 70-80°C, add 5 mL of $NH_4Cl - NH_3$ buffer sol^n and 2-3 mL of blue color $[Mg(EDTA)]$ - EBT mixture, when experimental sol^n assumes a red wine color. Titrate with standardized EDTA sol^n, until wine red color changes to blue. Record the titre value for EDTA sol^n and calculate strength of Ca^{2+} sol^n.

Results and Observations :-

Strength (S) of Zinc Acetate Solution.

Sl. No.	Vol. of Zinc Acetate sol^{n} (mL)	Required vol. of EDTA (mL)	Avg. reqd. vol. of EDTA (V_1) (mL)
01.	25	24.6	24.63 mL
02.	25	24.7	
03.	25	24.6	

- $\Rightarrow M_{Ca^{2+}} = 0.01232\ M$

Hence, strength of $Ca^{2+} = 0.01232M$

$$V_{EDTA} M_{EDTA} = V_{Zn} M_{Zn} \quad (M_{Zn} = 0.02)$$

$$\Rightarrow M_{EDTA} = \frac{V_{Zn} \times M_{Zn}}{V_{EDTA}} = \frac{25 \times 0.02}{24.63} = 0.0203M$$

- (S_1) Strength of EDTA = <u>0.0203M</u>.

Sl. NO.	Volume of water (mL)	Req. volume of EDTA (mL)	Avg. reqd. volume of EDTA (mL)
01	45 mL	24.56 mL	24.6 mL
02	45 mL	24.64 mL	
03.	45 mL	24.6 mL	

Sl. No.	Volume of Ca^{2+} sol^n (mL)	Reqd. vol. of EDTA (mL)	Avg. req. vol. of EDTA (V_3) mL.
01	25 mL	15.1 mL	15.167 mL
02.	25 mL	15.2 mL	
03	25 mL	15.3 mL	

$$M_{Ca^{2+}} V_{Ca^{2+}} = N_{EDTA} \cdot V_{EDTA}$$

$$\Rightarrow M_{Ca^{2+}} = \frac{0.0203 \times 15.167}{25}$$

$$\Rightarrow M_{Ca^{2+}} = 0.01232\,M$$

Hence, strength of Ca^{2+} = 0.01232 M

Molar mass of Ca = 40.08 g.

∴ Strength of Ca^{2+} in milk (gL^{-1}) is = 40.08×0.01232

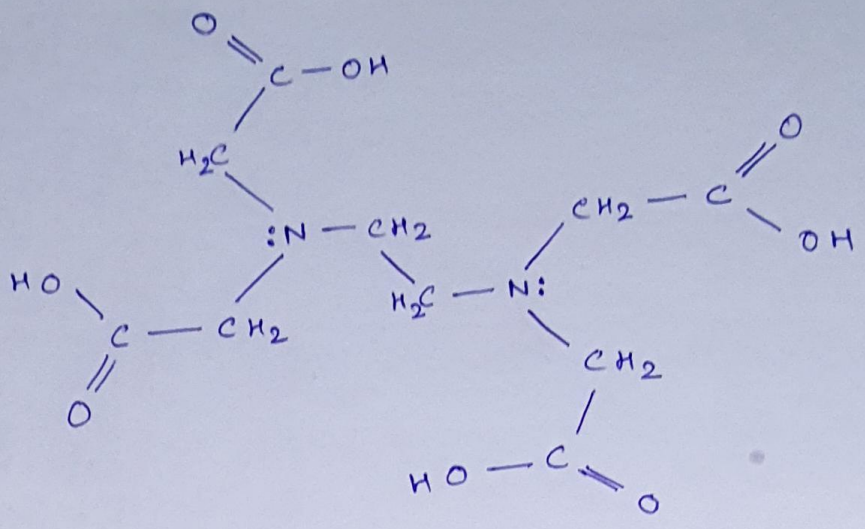
$= 0.494\,gL^{-1}$

∴ Strength of Ca^{2+} in milk (gL^{-1}) is = $\underline{0.494\,gL^{-1}}$.

Conclusion:

Thus, we conclude that conc^n of Ca^{2+} ion in the supplied sample of milk is 0.01232 M.

Structure of EDTA :-



Ethylenediaminetetraacetic Acid (EDTA) Structure.