

AIM: Estimation of calcium in milk

Apparatus Required: Pipette, burette, measuring cylinders, distilled water, droppers, conical flask, beaker

Chemicals Required: 0.01M EDTA, Magnesium sulphate, Eriochrome Black-T indicator, pH 10 buffer, 0.1M NaOH, phenolphthalein indicator, Mg-EDTA, milk solution

Principle: To estimate calcium in milk, it is approached by doing a complexometric titration with EDTA.

Calcium in milk reacts quantitatively with EDTA at pH 10 to form a stable complex. But with calcium-eriochrome black-T indicator complex, end point is not very clear, so we use Mg-EDTA complex indicator because there is a sharp colour change.

Mg-EDTA complex < Ca-EDTA complex (Relative Stability)

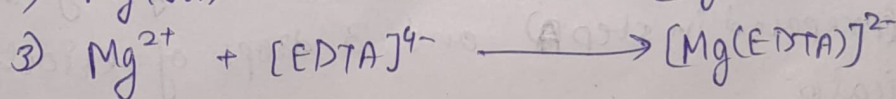
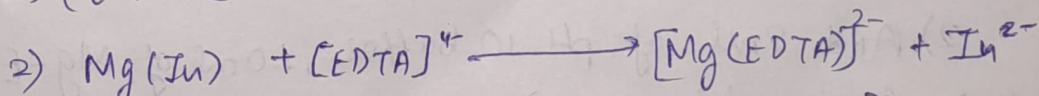
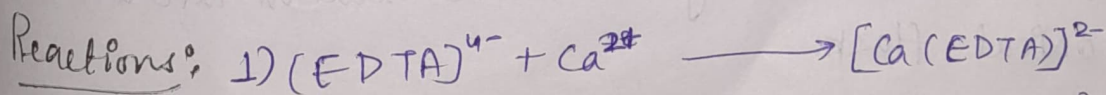
Consequently, during titration of a solution containing Mg & Ca ions with EDTA & indicator, EDTA first reacts with free Ca ions then with free Mg ions

also

Mg-Indicator complex > Ca-Indicator complex

(Relative stability)

so finally EDTA reacts with Mg-Indicator ions, and free blue anion.



Procedure: (A) Preparation of Mg-EDTA indicator

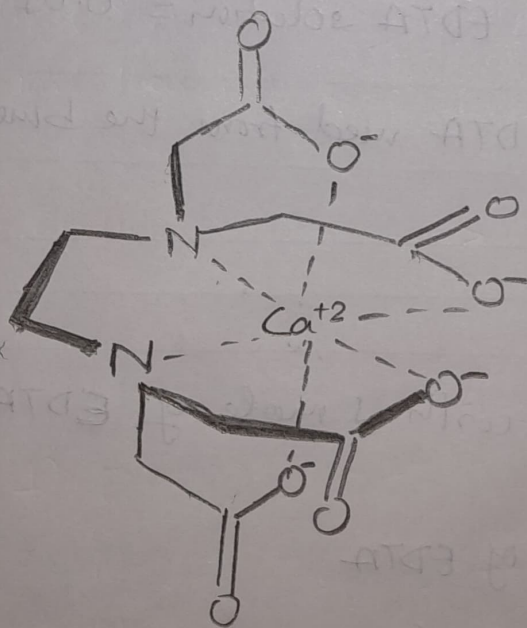
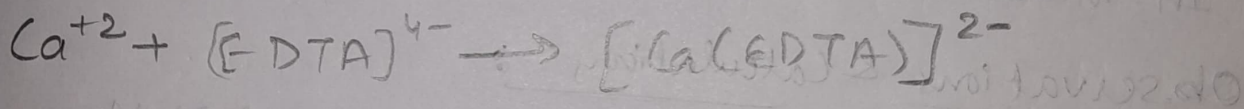
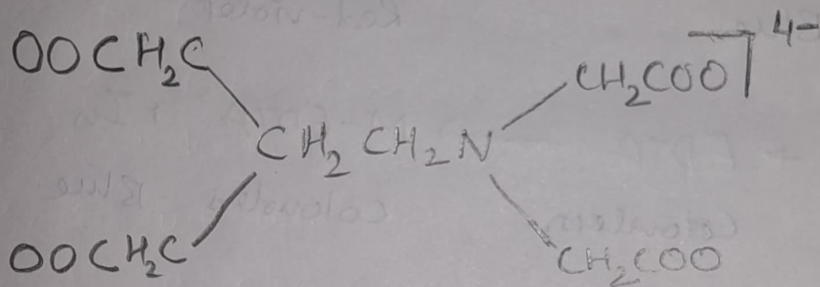
- 1) Take 50ml of Mg-EDTA solution in a 250ml beaker
- 2) Add 2-3 drops of phenolphthalein indicator and 0.1M NaOH solution dropwise to the beaker till it becomes pink. Count the number of drops or volume of NaOH used and discard this solution in chemical waste bucket.
- 3) Take again 50ml of Mg-EDTA solution in a 250ml beaker and add the same no. of drops of 0.1M NaOH solution and make up the total final volume to 95 ml using distilled water
- 4) Add 2ml of pH 10 buffer solution and 8 drops of eriochrome black-T indicator to the above solution. After this there are two possible cases:
 - (a) If the solution is ~~red~~ in colour, add 0.01M EDTA solution dropwise until solution turns blue
 - (b) If the solution is blue in color add 0.01M $MgSO_4$ solution dropwise until solution turns red. then add 0.01M EDTA solution dropwise until the solution turns blue again.

(B) Estimation of Calcium :

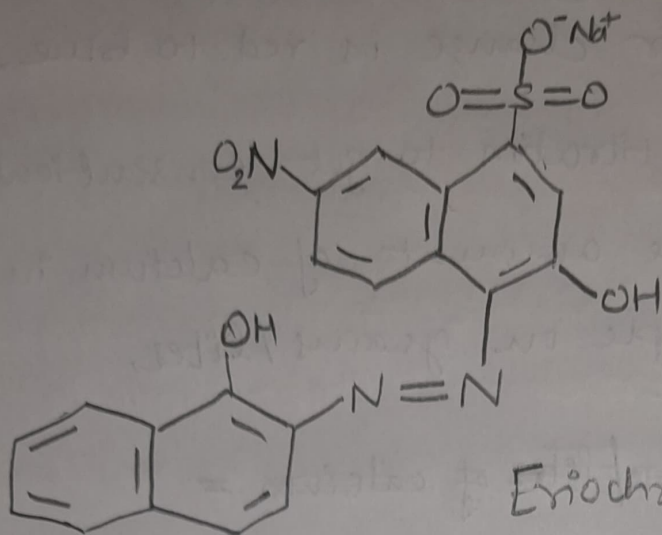
- 1) Pipette out 50ml of the milk solution into a 250ml conical flask.
- 2) Add 2ml of pH 10 buffer, 10ml of Mg-EDTA indicator solution (prepared in step A) and 3 drops of eriochrome black-T indicator.

- Results:

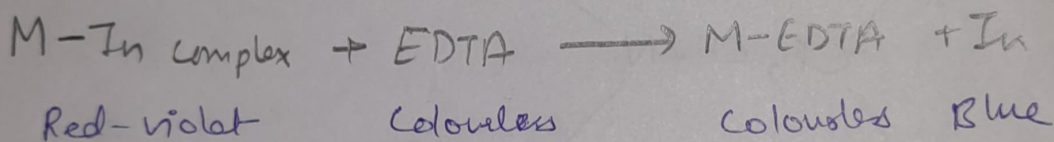
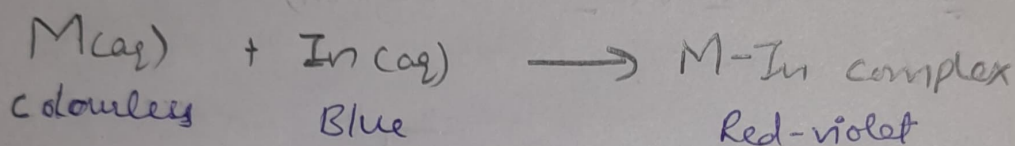
Ethylene Diamine Tetra Acetate (EDTA)



EDTA acting as hexadentate & chelating ligand.



Eriochrome Black - T
indicator



M = metal
In = indicator

Observations & Calculations

Given concentration of EDTA solution = 0.01 M

S.No.	Volume of EDTA used from the burette
1	14.4 ml
2	14.5 ml
3	14.5 ml

1 mole of Ca reacts with 1 mole of EDTA to form Ca-EDTA complex.

Moles of Calcium = Moles of EDTA

(Molarity × volume) of Calcium = (Molarity × volume) of EDTA

(Molarity of calcium) × 50 ml = 0.01 M × 14.5 ml

(suppose burette reading is 14.5 ml)

$$\text{Molarity of Calcium} = 2.9 \times 10^{-3} \text{ M} = 0.0029 \text{ M}$$

Thus, the solution contains 0.0029 moles/liter of calcium.

$$\begin{aligned} \text{Grams/liter of calcium} &= 0.0029 \times 40.08 (\text{atomic wt. of Ca}) \\ &= 0.116 \text{ g/L} \end{aligned}$$

Result: Milk solution contained 0.116 g/L of calcium.

Precautions: 1) Titration to be carried out at pH 10 as it results in increased complexation of EDTA^{4-} with calcium.

2) Apparatus should be handled with care.