

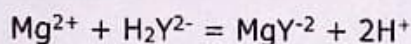
LAB MANUAL: EXPERIMENT 4

Aim: Determination of concentration of Mg^{2+} present in a given aqueous solution by titration with standard EDTA solution.

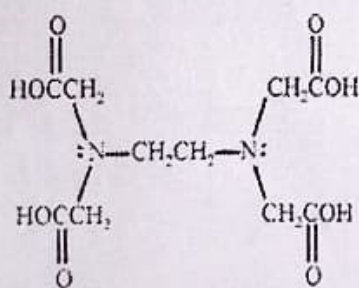
Theory:

Many metal ions react with electron-pair donors to form coordination compounds or complex ions. The formation of a particular class of coordination compounds, called chelates, is especially well suited for quantitative methods. A chelate is formed when a metal ion coordinates with two (or more) donor groups of a ligand. Tertiary amine compounds such as ethylenediaminetetraacetic acid (EDTA) are widely used for the formation of chelates.

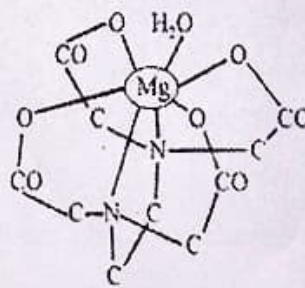
Complexometric titrations with EDTA have been reported for the analysis of nearly all metal ions. Because EDTA or its disodium salt has acidic protons, the formation of metal-ion/EDTA complexes is dependent upon the pH. For the titration of Mg^{2+} , one must buffer the solution to a pH of 10 so that complex formation will be quantitative. The reaction of Mg^{2+} with EDTA may be expressed as:



The structure of EDTA and the magnesium-EDTA complex are shown below:



EDTA



Mg-EDTA complex

The endpoint of the titration is determined by the addition of Eriochrome Black T, which forms a colored chelate with Mg^{2+} and undergoes a color change when the Mg^{2+} is released to form a chelate with EDTA.

Requirements:

EDTA ($\text{Na}_2\text{H}_2\text{Y} \cdot 2\text{H}_2\text{O}$), pH 10 buffer (2000 mL has been prepared by dissolving 140.0 g of NH_4Cl in 650 mL of deionized water, adding 1136 mL of conc. ammonia and diluting to 2000 mL), Eriochrome Black T, Burette, Pipette, conical flask (100 mL), Beaker (200 mL).

Procedure:

- The burette was filled with standard EDTA solution to the zero level.
- Transfer exactly 10 or 20 mL of the given solution of MgSO_4 into a 100 mL conical flask.
- Add 2 mL of pH 10 buffer in the hood.
- Add 2-3 drops of the aqueous solution of Eriochrome Black T indicator to the solution to produce a light wine-red color. (EDT)
- Titrate the solution with the standardized EDTA solution (0.01 M) till it turns a steel blue color at the end point of the titration.
- The titration is repeated to get three concordant titer values.

Titration-1 Estimation of Mg^{2+} in the given solution

The volume of the sample solution (mL)	Burette Reading (mL)			The volume of EDTA solution (mL)
	Initial	Final	Use volume	
10 mL	0	2.5	2.5	2.5
10 mL	2.5	5.0	2.5	2.5
10 mL	5.0	7.5	2.5	2.5

Calculation:

Let the used volume of EDTA is V_1 and its concentration is S_1 which is 0.01M.

Let the volume of the given sample is V_2 and its concentration is S_2 .

Then $V_1 S_1 = V_2 S_2$ or $S_2 = V_1 S_1 / V_2$ $\Rightarrow [0.01] [2.5] = 10 \times S_2$

Result: Concentration of $\text{Mg}^{2+} = 2.5 \times 10^{-2} \text{ M}$

Concentration of MgSO_4 in the solution is $2.5 \times 10^{-2} \text{ (M)} \times 120.36 = \frac{200.9 \times 10^{-3}}{\dots \text{g.lit}^{-1}}$

[Signature]
10/07/23