

Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science

Subject: Chemistry

Paper Code: CHS101

Paper Title: Natural Resources and Analysis

Unit: 5 – Analysis of Soil

Module Name: Complexometric titrations, chelation, chelating agent, use of indicators

Module No: 23

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Notes:

Complexometric Titrations- It's a form of volumetric analysis in which the formation of a colored complex is used to indicate the end point of titration.

It is a quantitative chemical analysis, particularly useful for the determination of a mixture of different metal ions in solution.

Theory of titration

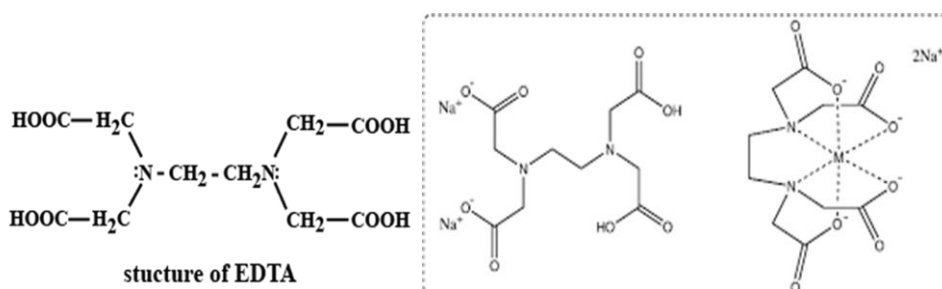
Many metal ions can be determined by titrating them with a reagent that complexes them in solution.

The solution to be titrated is buffered at a suitable pH, an indicator is added and the metal ion is titrated with a standard solution of complexing agent.

A sharp colour change signals the end point of the titration.

Complexing agent

EDTA - Ethylene Diamine Tetra Acetic Acid



Effect of pH

- For EDTA to form complex with the metal ion, it should exist in unprotonated form i.e Y^{4-}
- Only at high pH values i.e greater than 12, most of the EDTA exists as the tetraanion Y^{4-}
- At lower pH values, the protonated species H_2Y^{2-} , HY^{3-} predominates.
- So high pH value of the solution is more favourable for the complexation to take place.
- To maintain the pH, a buffer of pH 10 (ammonia-ammonium chloride) solution is used.

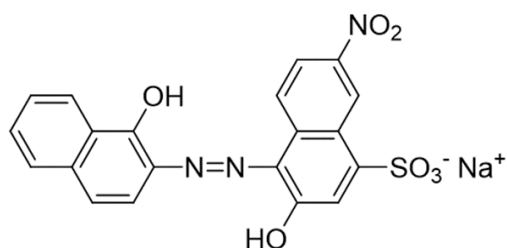
Metal Ion Indicators

- Metal Ion Indicator are organic substances capable of forming intensely colored complexes with metal ions.
- This metal indicator complex (M-In) is weaker than the EDTA complex of the metal being titrated and has a different colour from the free (unmetallised) indicator.
- During the course of titration, the metal progressively gets complexed with the EDTA, and at the equivalence point, the metal is withdrawn from the indicator complex and transferred to the EDTA.
- The indicator changes its 'metallized' or M-In complex colour to its 'unmetallized' or free colour.

Example of metal ion indicators

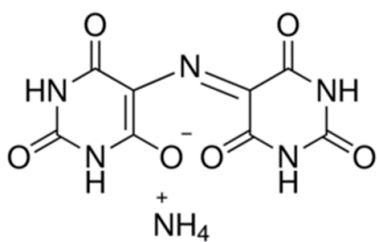
Eriochrome Black T

- Sodium salt of 1-(1- hydroxy -2naphthylazo) – 6-nitro-2 naphthol-4- sulphonic acid



- It is a dark powder with a slight metallic lustre.
- M-In complex is RED in colour.
- End point colour change is from RED to BLUE.
- Mg, Mn, Zn, Cd, Hg, Pb, Cu, Al, Fe, Ti, Co, Ni, Pt shows the above colour change.

Murexide



- Ammonium salt of purpuric acid
- Murexide solutions are colored reddish violet up to pH 9, violet from pH 9 to 11, and blue violet above pH 11.
- End point colour change is from red to blue violet.
- Ca, Ni, Co, Zn, Cd and Cu are some of the metals which shows colour change with this indicator.