Methods of analysis

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Complexation : Methods of analysis

Method of analysis:

Estimation of 2 parameters

1. Stoichiometric ratio of Ligand: Metal / Donar : Acceptor
2. Stability Constant of complex.

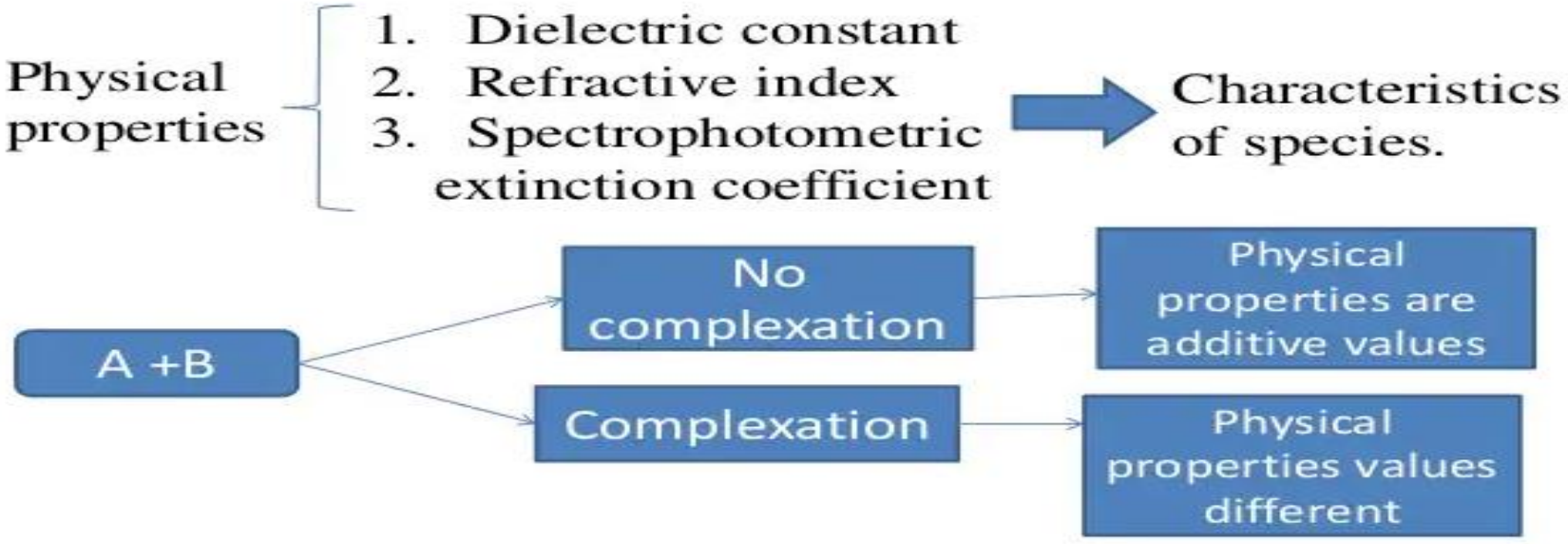
Methods:

1. Method of continuous variation.
2. Distribution method
3. Solubility method
4. pH titration method.

Continuous variation method

It is a simple method to determine whether a complex is formed by complexing agent or other compound. One can determine stoichiometric ratio of ligand and metal or donor to acceptor.

Some physico-chemical properties such as dielectric constant, refractive index, UV absorbance, etc are proportional to formation of complex. The point where they get changed suggest formation of complex.



Solubility method

It is the most widely used method.
When a component is mixed with a complex equation it will either increase or decrease its solubility and change in solubility profile determine the complex formation.

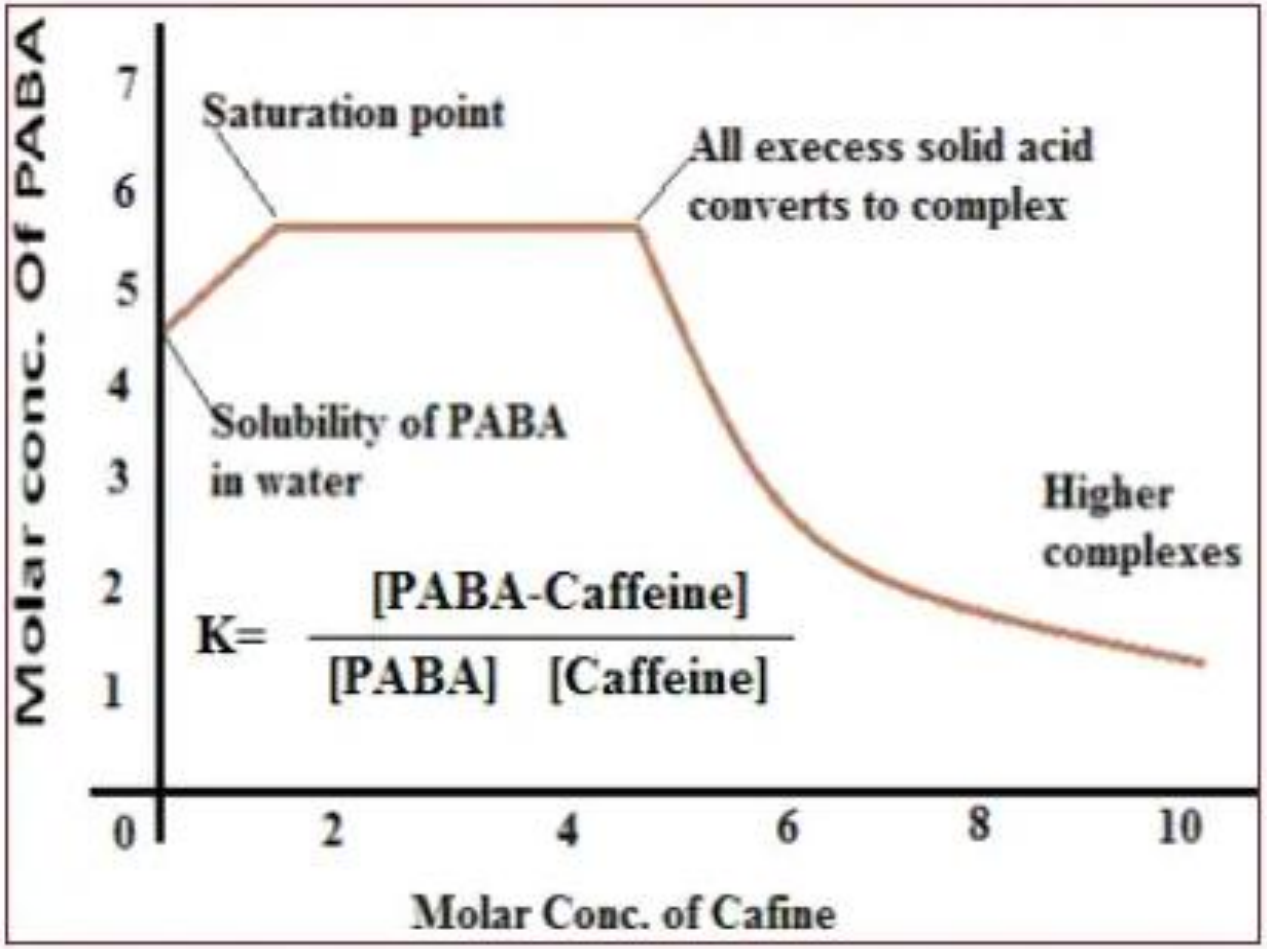
Step1) excess of drug is placed in well stoppered containers with solution of complexing agent.

Step2) bottles are agitated at constant temperature bath until equilibrium is achieved. Then supernatant liquid are removed and analyzed to obtain the total drug concentration.

Step3) concentration of drug is plotted against concentration of caffeine to obtain of curve that can be used to calculate the stability constant.

Solubility method

1. Caffeine (Complexing agent) taken in different concentrations
2. Add PABA, Agitate, Filter & analyze drug content.



3. pH titration method-

Formation of complex is indicated by change in pH of the mixture.

Ex- Chelation of cupric ion by glycine molecule.

- This is one of the most reliable methods and can be used whenever the complexation is attended by a change in pH.

- The chelation of the cupric ion by glycine, for example, may be represented as:

$$Cu^{+2} + 2NH_3CH2C00^- = Cu(NH2CH2C00)_2 + 2H^+$$

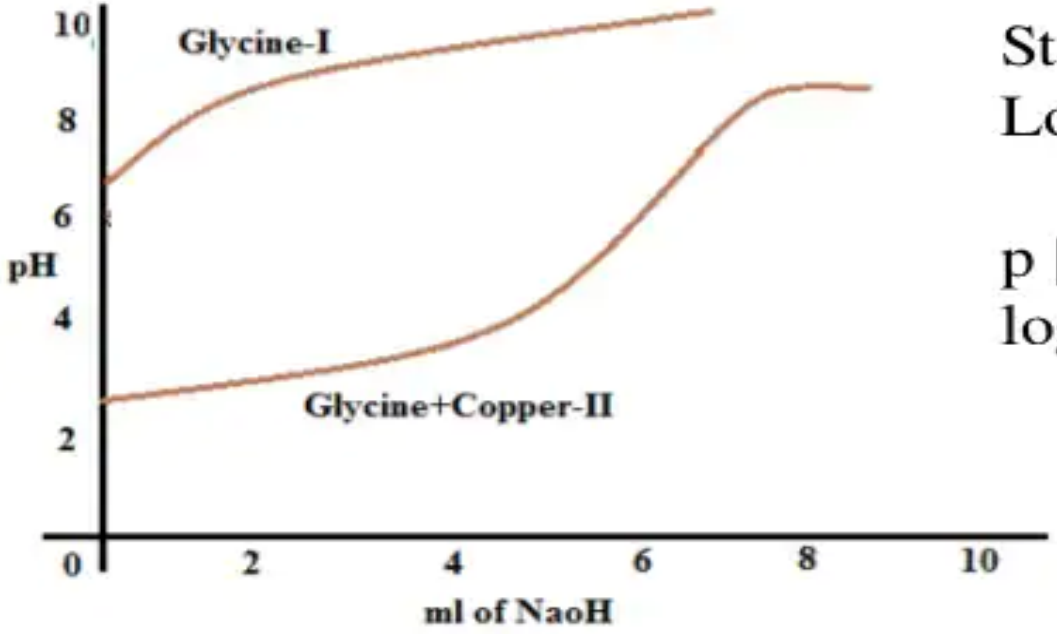
- Since two protons are formed in this reaction, the addition of glycine to a solution containing cupric ions should result in a decrease in pH.

pH titration method

Experiment:

1. Glycine solution (75 ml) titrated with NaoH, pH is recorded.
2. Glycine solution (75 ml) + Cu^{+2} Complex titrated with NaoH, pH is recorded. (Complexation releases Protons and pH decreases)

➢ Quantity of alkali = Concentration of ligand bound.



Stability constant

$\text{Log } \beta = 2 \text{ X p [A]}$

$\text{p [A]} = \text{pKa-pH-log([HA]initial-[NaoH])}$

4. Distribution method

- Distribution of solute between two phases can be used to calculate the stability constant of complexes.
- This depends on the fact that the distribution coefficient applies only to the species common to both phases.
- Example: The complexation of iodine (I_2) with potassium iodide (I^-)can be represented by the following equilibrium:

$$I_2 + I^- = I_3^-$$

$$K = \frac{[I_3]_w}{[I^-]_w * [I_2]_w}$$

- The method of distributing a solute between two immiscible solvents can be used to determine the stability constant for certain complexes.
- The complexation of iodine by potassium iodide may be used as an example to illustrate the method.

$$I_2 + KI^- = KI_3^-$$