Complexation of lanthanide metal ion with aminopolycarboxylic acid and amino acid

ABHILASHA ASTHANA*, K. DWIVEDI[1] and REETESH ASTHANA[1]

Department of Chemistry, Gwalior Engineering College, Gwalior (India).
[1]School of Studies in Chemistry, Jiwaji University, Gwalior - 474 001 (India).

ABSTRACT

In the recent years the mixed ligand complexes have gained considerable importance, because they provide good model for various biological reaction. In present paper we have studied the formation of mixed ligand complexes containing 2-amino –n butyric acid and some other amino acid with lanthanide metal ion potentiometrically It is observed that the value of log K_D and Δ log k runs parallel to each other in all the system investigated

Key words: Ternary complex, Ligand, lanthanideand amino acid

INTRODUCTION

In the recent years the mixed ligand complexes have gained considerable importance, because they provide good model for various biological reaction [1-4]. The metal complexes of different amino acids are also important in different field of sciences. The formation constant of the mixed ligand complexes of lanthanides metal ion containing DTA/DTPA-PDA formed through the simultaneous coordination of both the ligand have been reported by Tripathi et.al[5] Bandiwadeker[6] and Kozlowsk *et al.,*[7] studie the formation constant of ternary complexes by simultaneous eqilibria. The present investigations are aimed to study the formation of mixed ligand complexes containing 2-amino-n butyric acid and some other biological important ligand with lanthanide metal ion potentiometrically.

EXPERIMENTAL

All the chemical used were of AnalR grade. The metal nitrate solution were prepared by dissolving accurately weighed amount of corresponding metal nitrate and standardized by usual method[7]. The solution of ligand were prepared by dissolving their acid salt in double distilled carbon dioxide free water

An ELICO P[H] meter (LI-120) fitted with combined calomel glass electrode having reproducibility of ± 0.02 P[H] unit was used for P[H] measurement.

The following titration mixtures were prepared in aqueous medium keeping the total volume to be 50.00ml at three different ionic strengths (Viz 0.05M, 0.01M, 0.15M)
1. Mixture (A):10ml of 0.01M HNO_3 Solution
2. Mixture (B): Mixture (A) +5ml of 0.01M ligand H_2L Solution
3. Mixture(C): Mixture (A)+ 5ml 0.01M metal ion Solution
4. Mixture (D): Mixture (A)+5ml of 0.01M ligand HL'Solution
5. Mixture (E): Mixture (D)+5ml of metal solution
6. Mixture (F): Mixture (E): 5mlof 0.01 ligand H_2L Solution

The titration were carried out against standard sodium hydroxide solution at 25^0C and three different ionic strengths

RESULTS AND DISCUSSION

Diverges of curves 4 from acid titration curve 1at pH $\approx$ 8 Shows the strong basic nature of dissociable proton of the secondary ligand . The displacement of Tb (III) 2- amino – n butric acid curve from the corresponding ligand titration curve from a=0 onwards, suggesting the liberation of extra proton as a result of complexation reaction. The complexes so formed is h hydrolyzed at higher value which indicated by further displacement of curve on X axis.

The curve 6 runs superimposed on the curve 2 up to a=1. $P^H \approx 5$ which indicates that ligand L and L' do not interact with metal ion up to this stage, the cuver 6 diverges from curve 3 at pH $\approx$ 5.2,a=1, which indicates that the formation of mixed ligand complexes takes place from this PH. It also indicated that mixed ligand complexes are formed by formation constants have been calculated by Ramammoorthy and santappa method.

The equilibria can be given as:

$$Tb(III)+H_2L+HL' \underset{\longleftarrow}{\overset{1\leq a \leq 3}{\longrightarrow}} [Tb(III)\text{-}L\text{-}L'] +2H^+$$
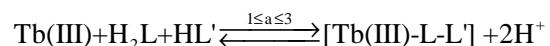
Where,
H_2L = aspartic acid deprived of one proton
HL'=2- amino – n butyric acid /Phenylalanine

The formation of mixed ligand complexes is further supported by the non appearance of any solid phase up to a=3 during the titration of mixed ligand system the stability of the mixed ligand complex is shown fewer than two headings

´ Based on the difference(Δ log k) in the stability of of binary and ternary complexes

´ The disproportionation constant K_D

It is observed that the value of log K_D and Δlog k runs parallel to each other in all the system investigated

The order of the formation constant of the mixed ligand complexes with respect to H_2L -HL' typed systems are

Aspartic acid (H_2L) —Phenylalanine (HL')<
Aspartic acid(H_2L)- 2-amino-n
Butyric acid(HL')
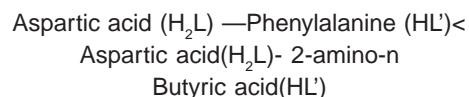
REFERENCES

1. H. Sigel Metal Ions in Biological Systems Marcel Dekker, New York, 12 (1973).
2. A.Santos,M.Gil,.S.Marques,L.Gano and S.Chaver,John Libbey, Eurotext . **7**: 655 (2002).
3. J.J.Bodwin,A.D.Gutland and R.Malkani; *Copr.Chem Rev* 21: 489 (2001).
4. L.Gandhi and B.S.Sekhan; *J.Indian Council of Chemistry* 24: 68 (2007).
5. Tripthi, S.P., Khanna, S., Sharma R.S. and R.C., *J Indian Chem Soc* **20**: 61(1984).
6. Bandiwadekar S.P. and Chavan ,A.M., *Acta Cienc Indica Chem* **14**(3): 231 (1980).
7. Kozlowski, Henryk Anouar, Abdellah Kowalik Jankowska, T.Decok, P.Swiatek Kozlowski J and Pettit Curie , D., *Inorg,Chim Acta* **207**(2): 223(1993).
8. Flaschka H.A.EDTA Titration (Pergamon Press) 2nd Ed (1964).
9. Ramamoorthy,S.and Santappa M.; *Bull Chem Soc* (Jpn) **41**: 1330 (1968).