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INVESTIGATES THE IMPACT OF MEDIUM DIELECTRIC CONSTANT ON STABILITY CONSTANTS OF DRUG WITH PR (III) ION

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ABSTRACT
The solution studies of binary complex of dilantin with Pr (III) ion have been performed. The protonation constant of dilantin and the stability constant of complexes with Pr (III) ion at 303.15 K were investigated. The ionic strength is constant maintained 0.03M by adding KNO_3. The pK and logK values of the complexes were determined in 10% to 50% ethanol –Water medium by the pH metric method. The pK and logK values of the complexes increased as ethanol content increased.

KEYWORD: Stability constant, Dielectric constant, Protonation constant.

INTRODUCTION

The lanthanide compounds have a remarkable importance in daily life.[1,2] The influence of dielectric constant on complex equilibrium between substituted pyrazilines and lanthanide metal ions in dioxane-water system have been studied.[3] The stability constant of lanthanides and Iminodiacetic acid in water and dioxane-water mixture have been studied by potentiometric method at constant ionic strength.[4] The dissociation constant of Succenic acid, Azelic acid, Acetic acid in methanol-water, Ethanol-water, dioxane-water system at different dielectric constant have been studied.[5] The stability constant of 4-Amino, 3-Napthol Sulphonic acid with Cu(II) metal ions in different dielectric constant of medium using ethanol-water system by pH metry was studied.[6] Reddy[7] et.al. have showed the effect of dielectric constant on the stability constant of Co(II) and Ni(II) with two mercaptoethyl benzimidazole, glycene, ehtelene diamine and salycilic acid in various properties of ethanol-water mixtures at 30^0C and ionic strength is 0.1M. Sarkar[8] et.al. have showed the values of dielectric constant of medium decreases, the values of proton-ligand and metal-ligand stability constant of complexes increases.[9] Dilantin is an anti-seizure medication.

The present paper describes the complexation of Pr(III) with Dilantin in 0.03M ionic strength. The present work includes the determination of pK and logK values at various percentage of ethanol-water medium.

Experimental

The pH measurements were carried out with equip-tronic EQ-610 pH meter (accuracy ± 0.01 units) using combine glass electrode at 303.15 K. Pure rare earth nitrate (99.9% Pure) was used. Metal nitrate available from Sigma Aldrich Chem. Co., U.S.A. Metal nitrate was prepared in triply distilled water and concentration was estimated by standard method. All chemical reagent used in this work are A.R. grade. The solution of drug was prepared in ethanol .The pH metric readings in different percentage (10%, 20%, 3%, 40%, 50%) of ethanol–water mixture were converted to $[H^+]$ value by applying the correction proposed by Van Uitert Haas. The overall ionic strength of solution was constant maintained by adding KNO_3. All the solutions were titrated with standard carbonate free NaOH (0.2N) solution at constant ionic strength. The titration was carried out in different percentage (10%,20%,3%,40%,50%) of ethanol-water medium. The values of dielectric constant of different percentage of ethanol-water taken form literature.[10]

Data obtained from each titration was plotted as pH Vs volume of NaOH added and corresponding volume at successive pH for each set was determined and calculated.

RESULT AND DISCUSSION

The proton-ligand and meta-ligand stability constant of drug and its complexes with Pr(III) metal ions are given in table -1. It could be seen that pK and logK values increased with increase in the percentage of ethanol with

decrease in dielectric constant of medium, this is due to the interaction between lanthanide ions and ligand is mainly electrostatic, as well as because of the effect of bulk solvent. The lowering of dielectric constant would increase the electrostatic force of attraction between metal ion and negatively charged ligand to form complex. The values of pK calculated by point wise calculation method. The metal-ligand stability constants were determined by half integral method. Higher values of $logK_1$ and log K_2 showed that ligands are stronger chelating agents. The dielectric constant of medium strongly affected on proton–ligand and metal–ligand stability constants because of the fact that at least one of the constituent is charged and other is either charged or has dipole moment. The plots of $logK_1$ and $logK_2$ Vs 1/D for the entire system exhibit a linear relationship.

Table 1: pK and LogK values of ligand and its complexes with Pr(III) in different percentage of Ethanol-water mixtures at 0.03 ionic strength.

% Ethanol	Dieletric constant (D)	1/D	Mole-fraction	Ligand	Ligand + Pr(III)	
				pK	$LogK_2$	$LogK_1$
10	73.95	0.01352	0.0228	4.8464	4.88	3.02
20	69.05	0.01448	0.0499	5.2999	5.44	3.32
30	63.85	0.01566	0.0825	5.7878	5.78	3.47
40	58.36	0.01714	0.1227	6.0150	6.54	3.61
50	52.62	0.01900	0.1735	6.4053	6.77	4.05

CONCLUSION

As the values of dielectric constant of medium decreases, the values of proton-ligand and metal-ligand stability constant of complexes increases. The proton-ligand and metal-ligand stability constant of complexes increased with increased percentage of ethanol. The dielectric constant of medium decreased, as expected from the electrostatic nature of interaction between metal ions and ligands.

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