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Determination of Formation Constant of Sm (III)-Systems with Different Sulphonanilide Ligands

Naresh kumar[1], Dr H. K. Pandey[2], Dr Gourav Chawla[3]
[1] *Research Scholar, Singhania University, Pacheri Beri, Jhunjhunu (Raj.)*
[2, 3] *Rare Earth Research Laboratory, P. G. Department of Chemistry, Govt. Dungar College, Bikaner (Raj.)*

ABSTRACT: *Formation constant of Sm (III)-Systems with different sulphonanilide ligands have been measured with the help of spectrophotometeric method. Results indicate that isolation of these complexes in solid state is difficult.*

I. INTRODUCTION

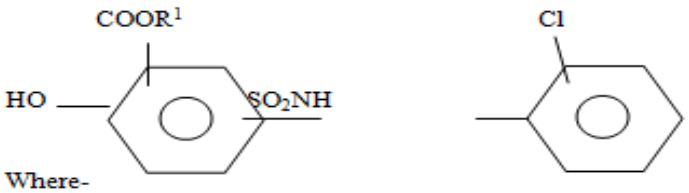
The term stability cannot be generalized for complexes, since a complex may be quite stable to one reagent and may decompose readily in presence of another reagent. **(1-2)**

The complexes of d-block transition metals, alkali metal and alkaline earth metals with various ligands have been studied extensively**(3-16)**,where as in case of f-block lanthanide metal complexes, a limited study has so far been carried out, because of their poor tendency to form complexes. **(17-19)**
Formation constant (K) shows the stability of complex **(20-24)**, although lanthanide complexes are thermodynamically and kinetically less stable as compared to transition metal complexes and actinide complexes.

II. EXPERIMENTAL

Jobs method is a variation of spectrophotometric method**(25-27)**, which is based on the fact that most of the complexes absorb light differently than the metal ions from which they are formed. The relationship between the absorbance or optical density at particular wavelength and concentration is expressed by Beer's law. **(28-29)**

In this method, standard grade chemicals-$SmCl_3.6H_2O$ (molecular weight-364.81) has been used for studies. Three sulphonanilide ligands**(29)** have been used for preparation of systems with Sm(III) and the solution spectra of these systems have been recorded by using a standard spectrophotometer.
Three representative ligands (L_7, L_{10} & L_{13}) have been used for this study.



Where-
R^1= H, CH_3, C_2H_5
Results have been given in table 1.01 to table 1.03.

III. TABLES

TABLE-1.01 Observed Values of Absorbance At Various Concentrations of Sm(Iii) With Sulphonanilides

Metal Sm(III) ion concentration (in %) with sulphonanilide	Values of absorbance in mixed solutions with different sulphonanilides		
	With L_7	With L_{10}	With L_{13}
10	0.089	0.065	0.052
20	0.092	0.066	0.058
30	0.093	0.074	0.064
40	0.096	0.081	0.068
50	0.112	0.123	0.099

60	0.098	0.105	0.096
70	0.091	0.097	0.092
80	0.072	0.095	0.090
90	0.062	0.094	0.081

TABLE-1.02 Values Of Absorbance In Different Mixed Solutions

Concentration of Sm(III)	Concentration of sulphonanilide	Absorbance in mixed solutions of Sm(III) with sulphonanilide		
		L_7	L_{10}	L_{13}
M/40	M/40	0.248	0.245	0.198
M/50	M/40	0.198	0.213	0.175
M/60	M/40	0.142	0.197	0.103
M/70	M/40	0.112	0.143	0.093
M/80	M/40	0.108	0.103	0.085
M/90	M/40	0.248	0.245	0.198

TABLE-1.03 Computed Values of Formation Constant from Observed Data

Ligand No	**Initial conc. of Sm(III) in mole/lit a**	**Initial conc. of ligand in mole/lit a**	**Equilibrium conc. of complex in moles/lit x**	**Equilibrium conc. of Sm(III) in moles/lit a-x**	**Equilibrium conc. of ligand in moles/lit a-x**	**x K = …….. (a-x)(a-x)**	**log K**
7	M/50	M/50	M/70	M/50 -M/70	M/50 -M/70	437.5	2.640
10	M/50	M/50	M/75	M/50 -M/75	M/50 -M/75	300	2.477
13	M/50	M/50	M/64	M/50 -M/64	M/50 -M/64	816.32	2.911

The values of formation constant have been found to be from 2.4771 to 2.9118 (table 1.03).

IV. RESULT & CONCLUSION

Order of Formation constant (K)

The computed values of the formation constant from the spectroscopic data have been tabulated in table – 1.01 & 1.03 and show the following order-

Sm (III) - L_{13} > Sm (III) - L_7 > Sm (III) - L_{10}

The formation constant data show that the stability of lanthanide complexes is similar to following type of complexes, which have been reported by earlier workers **(30-31)** at room temperature.

$[Ag(NH_3)_2]^+$ type of complex (logK =3.24 -3.81)
1:1 Pr(III)-oxy diacetic acid (logK=2.53)
1:1 Nd(III)-oxy diacetic acid(logK=2.67)
1:1 Pr(III)-sulphonanilide ligand (logK=2.9118-3.3551)

Low stability constant makes the isolation of these complexes in solid state difficult, so doped model technique has been taken as system in the electronic-spectral study.

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