

SYNTHESIS & CHARACTERIZATION OF MIXED LIGAND COMPLEXES OF Al(III) METAL SALTS OF SOME ORGANIC ACIDS WITH BIS(8-HYDROXY-5-QUINOLYL)-METHANE

ASHOK KUMAR GUPTA

Deptt. of Chemistry, Sri Arvind Mahila College (Patliputra Univ.), Patna - 800004 (India)

SHALINI PRIYA

Research Scholar, B.I.T. Mesra (Jharkhand)

AND

BIRENDRA KUMAR

Deptt. of Chemistry, Maharaja College (VKS Univ.), Ara - 802301 (India)

RECEIVED : 26 June, 2019

The present investigation has been undertaken to examine complex formation by Al(III) derivatives of o-nitrophenol (ONP), 2,4-dinitrophenol(DNP), 2,4,6-trinitrophenol (TNP), 1-nitroso-2-naphthol(1N2N), o-aminobenzoic acid (OABA) or salicylic acid (SalA); with bis(8-hydroxy-5-quinolyl) methane. They have general formula $[Al(L_2)_2L']$, where L = depro-tonated ONP, DNP, TNP, 1N2N, OABA or SalA; L' = bis(8-hydroxy-5-quinolyl)methane synthesized. Stereochemistry of the complexes have been studied by elemental analysis, IR, UV-Visible spectral data, conductance measurements.

KEYWORD : Mixed ligand complexes, Al(III) metal chelates, Organic derivatives, Bis(8-hydroxy-5-quinolyl) methane & Spectral data.

INTRODUCTION

In continuation of our earlier study [1, 2], we report some novel mixed ligand complexes of Al(III) metal. Bis(8-hydroxy-5-quinolyl)methane is a quadridentate ligand, which form stable complexes [3-7] with a number of transition and non-transition metals. It, however, appears from literature survey that no Al(III) metal complex with bis (8-hydroxy-5-quinolyl) methane has yet been reported. It was, therefore, decided to examine this ligand for possible complex formation with Al(III) metal.

EXPERIMENTAL

The ligand bis(8-hydroxy-5-quinolyl)methane was prepared by the method of Horowitz and Perros [3]. The Al(III) metal salts of some organic derivatives viz. o-nitro-phenol(ONP),

2,4-di-nitrophenol (DNP), 2,4,6-trinitrophenol (TNP), 1-nitroso-2-naphthol (1N2N), o-amino-benzoic acid (OABA) or salicylic acid (SalA) were prepared by reported method.

Synthesis of mixed ligand complexes : A mixture of bis (8-hydroxy-5-quinoly) methane and Al(III) metal salt of organic derivative (ONP, DNP, TNP, 1N2N, OABA or SalA) was refluxed in DMF in 1 : 2 (mole) at 80°C for 2 - 3 hours with continuous stirring, The coloured solution thus obtained was cooled. On addition of solvent ether to it, characteristic coloured solid adduct came apart almost instantaneously. It was filtered, washed thoroughly with solvent ether and dried in an electric oven at 80°C

RESULTS & DISCUSSION

Colours, melting points, molar conductances values and analytical data of the prepared complexes are given in Table 1. All the complexes are characteristic coloured. They are partially soluble in polar solvents and insoluble in non-polar solvents. All the complexes are stable in air under dry condition. They either decompose or undergo a transformation at temp. which are considerably higher the ligand indicating their greater stabilities.

Table 1

Compound	Colour	M.P./Decomp./ Trans. Temp. (°C)	Molar Conductance	Analysis % found/(calcd.)			
				C	H	N	Al
Bis (8-hydroxy-5-quinoly) methane(H ₂ L')	White	280m
[{Al(ONP) ₂ } ₂ .L']	Yellow	260t	7.0	56.95 (57.08)	2.79 (2.87)	9.18 (9.29)	5.81 (5.97)
[{Al(DNP) ₂ } ₂ .L']	Yellow	290m	9.0	49.95 (50.05)	1.99 (2.09)	13.15 (13.31)	5.01 (5.13)
[{Al(TNP) ₂ } ₂ .L']	Deep yellow	250t	9.5	41.75 (41.88)	1.39 (1.46)	15.75 (15.91)	4.25 (4.38)
[{Al(1N2N) ₂ } ₂ .L']	Brownish yellow	150m	5.9	67.75 (67.94)	3.39 (3.45)	7.95 (8.06)	5.05 (5.18)
[{Al(OABA) ₂ } ₂ .L']	Pale brown	250d	6.9	62.75 (62.81)	3.96 (4.01)	9.25 (9.35)	5.91 (6.01)
[{Al(SalA) ₂ } ₂ .L']	Pale brown	260m	8.5	62.45 (62.53)	3.49 (3.55)	2.98 (3.10)	5.91 (5.98)

Molar conductance : Molar conductance values of the complexes were measured on Systronic digital direct reading conductivity meter - 304 at 27°C in methanol at a concentration of 10⁻³ M. The low values (5.9 - 9.5 ohm⁻¹ cm² mol⁻¹) of molar conductances suggest the covalent nature of the complexes [8].

Infrared spectra : The IR measurements of the ligand(H₂L') and mixed ligand Al(III) complexes were recorded in the region 4000 – 400 cm⁻¹ in KBr phase with the help of FTIR spectrophotometer. Pertinent IR data for these complexes were shown in Table 2. The absorption band of principal interest in infrared spectra of the ligand (H₂L') are 3335 cm⁻¹,

1580 cm^{-1} and 1120 cm^{-1} . The moderately strong band at 3335 cm^{-1} in the spectrum of $\text{H}_2\text{L}'$ is attributed to the stretching O-H vibration frequency, while the strong band at 1120 cm^{-1} is probably due to bending C-OH frequency. The absorption band at 1580 cm^{-1} has been assigned to $\nu_{\text{C}=\text{N}}$ in the quinoline ring. The moderately strong band of the ligand ($\text{H}_2\text{L}'$) at 3335 cm^{-1} shifted by 14 - 85 cm^{-1} in the complexes indicating the coordination through oxygen atom of the -OH group of $\text{H}_2\text{L}'$. In the IR spectra of these complexes, the 1580 cm^{-1} band of the the ligand (assigned to $\nu_{\text{C}=\text{N}}$) has shifted to higher frequency by 8 - 35 cm^{-1} . In few case, this band has appeared as split band most probably due to presence of $-\text{NO}_2$ group in various Al(III) metal salts. After complexation shifting of 1120 cm^{-1} bending-OH band of the ligand ($\text{H}_2\text{L}'$) by 34 - 51 cm^{-1} , indicating the coordination of oxygen atom of the C-O moiety of the ligand($\text{H}_2\text{L}'$). All the complexes show new medium intensity bands in the region 545 - 500 cm^{-1} and 659 - 585 cm^{-1} may be assigned to $\nu_{\text{M}-\text{N}}$ and $\nu_{\text{M}-\text{O}}$ [9, 10] respectively. The above data confirm the coordination of oxygen atom of -OH (phenolic) and N/O atom of first ligands (ONP, DNP, TNP etc.) to Al(III) metal in all the complexes.

Table 2

Compound	$\nu_{\text{O-H}}$	$\nu_{\text{C}=\text{N}}$	$\nu_{\text{C-O}}$	$\nu_{\text{M-O/M-N}}$
Bis(8-hydroxy-5-quinoly) methane($\text{H}_2\text{L}'$)	3335	1580	1120	---
[{Al(ONP) ₂ } ₂ .L']	3321	1615, 1596	1164	650, 600, 588, 541, 500
[{Al(DNP) ₂ } ₂ .L']	3408	1598	1171	645, 605, 590, 545, 503
[{Al(TNP) ₂ } ₂ .L']	3420	1590	1170	650, 606, 594, 544, 509
[{Al(1N2N) ₂ } ₂ .L']	3398	1601	1164	645, 610, 589, 539, 507
[{Al(OABA) ₂ } ₂ .L']	3384	1588	1154	659, 606, 585, 528

Electronic spectra : Electronic spectra of the complexes were recorded on UV-VIS CINTRA-10 spectrophotometer in methanol. Bands observed in electronic spectra of the compounds are given in Table 3. The ligand ($\text{H}_2\text{L}'$) exhibits sharp intense bands in the region 205 - 270 nm and 395 nm. These bands indicate $\pi-\pi^*$ transition as well as charge transfer in aromatic ring. The electronic absorption bands of the complexes are observed in the region 210 - 290 nm, which indicate $\pi-\pi^*$ transition in the complexes. The mixed ligand complexes also show charge transfer bands in the region 395 - 410 nm. The shift in position of $\pi-\pi^*$ transition bands of the ligand in the complexes show that there is a π -interaction between metal and ligand orbitals.

Table 3. Major diffuse reflectance bands(in nm) for mixed ligand Ag(I) complexes with ethylenediamine(en)

Compound	Diffuse reflectance (in nm)
Ag(DNP).en	353, 250, 236
Ag(TNP).en	390, 351, 339, 240
Ag(8HQ).en	371, 328, 248

Structure & bonding : On the basis of analytical and spectral datas, the probable structures and bonding of the newly synthesized complexes are shown in Fig. 1.

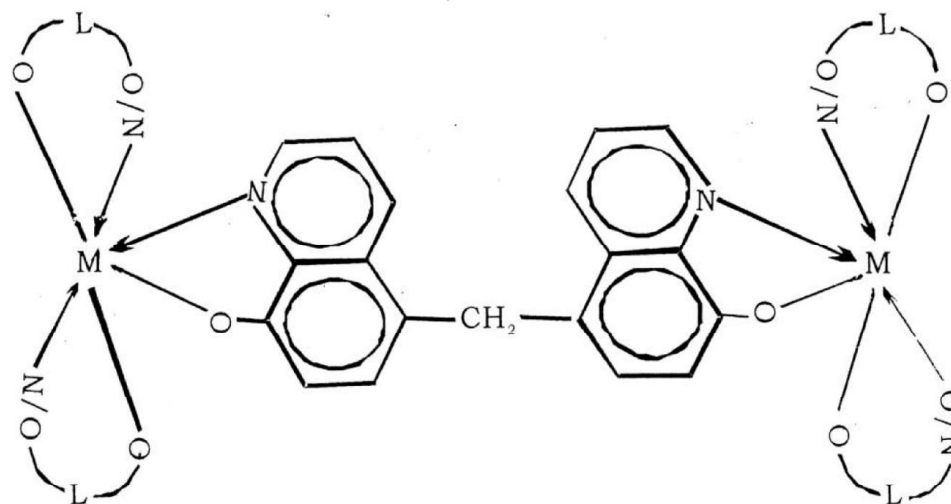


Fig. 1

where M = Al(III) or L = deprotonated ONP, DNP, TNP, 1N2N, OABA or Sala,

L' = deprotonated bis (8-hydroxy-5-quinolyl)methane,

REFERENCES

1. Prakash, D. and Singh, S. P., *J. Ind. Chem. Soc.*, **58**, 1143 (1981).
2. Korshak, V. V., Vinogradova, S. V. and Babchinister, T. M., *Polymer Science (USSR)*, **2**, 344 (1960).
3. Horowitz, E. and Perros, T. P., *J. Inorg. Nucl. Chem.*, **26**, 139 (1964).
4. Sen, D. N. and Umapathy, P., *Ind. J. Chem.*, **5**, 209 (1967).
5. Poller, R. C. and Toley, D.L.B. Gorge, *J. Inorg. Nucl. Chem.*, **31**, 2973 (1969).
6. Prakash, D., Roy, A. P. and Gupta, O. P., *Asian J. Chem.*, **6(4)**, 956 (1994).
7. Prakash, D. and Yadav, A. K., *Idem.*, **11(3)**, 1037 (1999).
8. Banerjee, A. K., Layton, A. J. and Nyholm, R. S., *J. Chem. Soc.(A)*, 2536 (1969)
9. Shyamal, A. and Singhal, O. P., *Trans. Met. Chem.*, **4**, 179 (1995)
10. Condrate, R. A. & Nakamoto, K., *J. Chem. Phys.*, **42**, 2590 (1965)

□