International Journal of Education and Science Research Review
E-ISSN 2348-6457
Volume-2, Issue-2 April- 2015
www.ijesrr.org Email- editor@ijesrr.org

MN (II) Complexes: Synthesis and Spectral Studies with Aza-Macrocyclic Ligand

Anupma
Department of Science and Humanities
SRM University
NCR Campus
Ghaziabad

Sulekh Chandra
Department of Chemistry
Zakir Husain College
University of Delhi
J. L. N. Marg, New Delhi

Deepali Jain
Department of Chemistry
DN College
Meerut

Shweta Soam
National Insitute of Solar Energy
Gurgaon

ABSTRACT
The complexes of Mn(II)) were synthesized with the new aza-macrocyclic ligand. The ligand was prepared by the reaction of 3-ethyl-2,4-pentadione and 2,6diamino-pyridine. All the complexes have been found to have general composition $[M(L)X_2]$ [where M = Mn(II) and X = Cl^-,& NO^-_3,]. All the complexes are characterized by the conductance measurements, magnetic susceptibility measurements, mass, I.R,EPR and electronic spectral studies. An octahedral geometry was assigned for Mn(II) complexes .

Key word: Mn(II), 2,6-diaminopyridine, 3-ethyl-2,4-pentadione, EPR, IR

INTRODUCTION

The chemistry of macrocyclic polyamine ligands having functional pendent arms has a great interest in research field in recent years .Mainly as the metal complex of such ligands are effective models for protein metal binding sites in metalloprotein in some biological system as potential therapeutic reagents or as multi electron catalysts. Manganese is a constituent and an activator of several enzymes and proteins in plants, animals and humans**.** Manganese is an essential trace element that occurs in the cells of all living creatures. Manganese and its compounds are widely used in analytical processes, metallurgical processes paint and pigments industry. **[1-16]**.
In view of the above in the present paper we report the synthesis and spectroscopic characterization of Mn(II) with a aza- macrocyclic ligand.

EXPERIMENTAL

All the chemicals used were of AR grade and procured from Fluka and Sigma Aldrich. Metals salts were purchased from Emerck and were used as received.

PREPARATION OF LIGAND

Preparation of ligand has been discussed in previous paper **[16].**

Preparation of Complexes

A hot ethanolic solution of the manganese salt (0.002 mol) and hot ethanolic solution of corresponding ligand (0.001 mol) were mixed together with constant strirring. The mixture was refluxed for 5 to 7 hrs at

70-80^{0}C. On cooling, coloured complex was precipitated out. It was filtered, washed with cold ethanol and dried under vacuum over P_4O_{10}.

RESULT AND DISCUSSION

Characterization of ligand has been discussed in previous paper.

Characterization of the complexes On the basis of elemental analysis, the complexes were assigned to possess the composition as shown in Table 1. The molar conductance measurements of the complexes in DMSO, correspond to non-electrolyte nature. Thus these complexes are formulated as $[Mn(L)X_2]$ [M = Mn(II), X = Cl^-, NO_3^- .]

The IR spectra of nitrato complexes with ligand L show absorption bands in the region 1410-1430 (ν_5), 1305-1315 (ν_1) and 1010-1035 cm^{-1} (ν_2). This indicates that nitrate group is coordinated to the metal ion as an unidentate fashion**].**

MAGNETIC MOMENT AND ELECTRONIC SPECTRAL STUDIES

Electronic spectra of Mn(II) complexes, under study show absorption bands in the range of 15798-19120 (ν_1)**,** 22573-23529 (ν_2)**,** 23310-28328 (ν_3) and 27933-18167 cm^{-1} (ν_4) which is characteristics to an octahedral geometry.

The ESR spectra of the complexes were recorded as polycrystalline sample and in solution of DMSO. **[Table 3] [17-37].**

On the basis of elemental analysis, molar conductance measurements, magnetic moment susceptibility, IR, electronic and EPR spectral studies, all the complexes of Mn(II) under study were found to possess an octahedral geometry **.**

ACKNOWLEDGEMENTS

We are thankful to the UGC New Delhi for financial assistance and IIT Mumbai for recording EPR spectra.

REFERENCES

1. S. E. Bailey, T. J. Olin, R. M. Bricka and D. D. Adrin, Water Res., 1999, 33, 2469
2. R. M. Leach and M. S. Lilburn, World Rev. Nutr. Diet, 1978, 32, 123.
3. J. D. Crowley, D. A. Traynor and D.C. Weatherburn, Enzymes and proteins containing manganese: an overview. In A. Sigel and H. Sigel, Eds. Metal Ions in Biological Systems, Marcel Dekker Inc, New- York, Basel, 2000, 37, pp. 209-278R
4. H. A. Schroeder, J. J. Balassa and I. H. Tipton, J. Chron. Dis., 1966, 19, 545..
5. P. Merdy, E. Guillon and M. Aplincourt, New. J. Chem., 2002, 26, 1638.
6. J. W. Hamaker and J. M. Thompson, "Adsorption in Organic Chemicals in the Soil Environment" Vol. Ed. C. A. Marcel Dekker, New- York, 1972 pp. 49-143.
7. World Health Organization (WHO), Trace Elements in human nutrition and health, Geneva, Chapter 10, pp. 163-167.
8. R. M. Leach and E. D. Harris, Ed. Manganese, In : B.L. O'Dell and R. A. Sunde, eds. Handbook of Nutritionally Essential Mineral Elements, Marcel Dekker Inc, New –York, Basel, Hong- Kong, 1997, pp. 335-355.
9. H. J. Schneider and M. Anke, Arch. Exp. Vet. Med. 1971, 25, 787.
10. C. R. K. Rao and P. S. Zacharias, Polyhedron, 1977, 16, 1201.
11. M. Shakir, S. P. Varkey and P. S. Hameed, Polyhedron, 1993, 12, 2775.
12. S. Chandra and L. K. Gupta, Spectrochim. Acta A, 2004, 60, 2767.
13. (a) K. Nakamoto, Infrared and Raman Spectra of the Coordination Compounds, Wiley Interscience, New- York, 1970.
14. (b)E. Q. Gao, H. Y. Sun, D. Z. Liao, L. H. Jiang, S. P. Yan, Polyhedron, 2002, 21, 359.
15. F. Lions, Rev, Pure Appl. Chem., 1969,19, 777 .
16. S.Chandra and Anupma and.D.Jain, IJPAC. 2009, Vol 2,
17. P. S. Kalsi Spectroscopy of Organic Compounds, Fourth ed., New Age International, New Delhi, India, 2001.
18. R. K. Rao, P. S. Zacharias, Polyhedron, 1997, 16, 1201.
19. K. Nakmoto, Infrared spectra of Inorganic and Coordination compounds, Wiely, Interscience, New York, 1970.
20. A. B. P Lever, Crystal Field Spectra, Inorganic Electronic Spectroscopy, First ed., Elsevier, Amsterdam, 1968, 249.
21. M. Shakir, O. S. M. Nasman, A. K. Mohamed, S. P. Varkey, Ind. J. Chem., 1996, 25 A, 710 .
22. A. G. Tomilnson, B. J. Hathway, D. E. Billing and P. Nicholls, J. Chem. Soc.,1965, 65.
23. S. Chandra, K. Gupta. S. Sharma, Synth. React. Inorg. Met. Org. Chem.,2001, 31, 1205.

24. W. G. Hanna, M. M. Moawad, Trans. Met. Chem., 2001, 26, 644.
25. M. Sakai, A. Hara, S. Anjo, M. Nakamura, J. Pharm. Biomed. Anal.,1999, 18, 1057.
26. P. Kopel, Z. Travnicek, J. Marek, M. Korabik, J. Mrozinski, Polyhedron, 2003, 22, 411.
27. S. Chandra and L. K. Gupta, Spectrochim. Acta , 2004, 60 A, 3079 (2004).
28. S. Chandra and S. Sharma, Trans. Met. Chem., 2007, 32, 150.
29. S. Chandra, L. K. Gupta and D. Jain, Spectrochim. Acta., 2004, 60 A.
30. M. Shakir and S. P. Varkey, polyhedron, 1995, 14 , 1117.
31. K. Anuradha and R. Rajavel., IJPT,2011, Vol.3, Issue-2.
32. S.Chandra Anupma and.D.Jain, J. Ind. chem. soc., vol 86,2009,p 220-224.
33. S.Chandra Anupma and.D.Jain and Anupma, J. Ind. chem. soc., vol 87 2010, p 1245-1249.
34. S.Chandra and Anupma and.D.Jain, , IJPAC, 2009, Vol.4, , issue 3.
35. R.A Sheikh ,I Ab Rahman Int .J.Electrochem.Sci. 2013, Vol.8 6972-6987.
36. M.Razaeivala and H .Keypour, Coordination Chemistry Reviews, 2014 Vol.280, ,p203-253
37. S.Chandra and Ruchi . Spectrachim acta, 2013 Vol.(103), p338-348.

Table – 1

Molar Conductance and Elemental Analysis

Complexes	Colour	Molar cond. $\Omega^{-1}cm^2mol^{-1}$	Yield (%)	M.P. (^{0}C)	Elemental analysis found (calculated) (%)			
					Mn	C	H	N
$[Mn(L)Cl_2]$ $MnC_{24}H_{30}N_6Cl_2$	Light Brown	13	58	290	10.38 (10.40)	58.60 (54.54)	5.64 (5.68)	15.86 (15.90)
$[Mn(L)(NO_3)_2]$ $MnC_{24}H_{30}N_8O_6$	Light Brown	11	55	286	9.46 (9.93)	49.56 (49.73)	5.12 (5.16)	14.39 (14.45)

Table 2

Magnetic Moment and Electronic spectral data of the complexes

Complex	μ eff (B.M.)	λ max (cm^{-1})
$[Mn(L)Cl_2]$	6.02	19120,23529,28328,38167
$[Mn(L)(NO_3)_2]$	5.98	14970,15798,22573,23310,27933

Table 3

EPR Spectral data of the Mn(II) Complexes

	g_{II}	$g_{\perp}$	g_{iso}
$[Mn(L)Cl_2]$	2.0192	2.2115	2.2115
$[Mn(L)(NO_3)_2]$	2.1458	2.2405	2.1458

Table4

Ligand Field Parameters Of Mn(II) Complexes

Complexes	Dq (cm^{-1})	B (cm^{-1})	β	C (cm^{-1})	F_4	F_2	h_x
$[Mn(L)Cl_2]$	1912	685.57	0.8722	3334.65	95.27	1161.94	1.8257
$[Mn(L)(NO_3)_2]$	1579	660.43	0.8402	3341.14	95.46	1137.74	2.2823