

Spectral Studies of some Complexes with Chloramphenicol

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Abstract: Co(II) and Ni(II) complexes with Chloramphenicol have been synthesized and characterized. On the basis of elemental analysis and molar conductance, formulas $\text{Co}(\text{C}_{11}\text{H}_{12}\text{Cl}_2\text{N}_2\text{O}_5)\text{VO}_3 \cdot 2\text{H}_2\text{O}$ and $\text{Ni}(\text{C}_{11}\text{H}_{12}\text{Cl}_2\text{N}_2\text{O}_5)\text{VO}_3 \cdot 3\text{H}_2\text{O}$ have been suggested for the complexes under study. The geometries of the complexes have been proposed on the basis of magnetic moment, electron and infrared spectral data. TGA studies have also been carried out to know the pattern of their decomposition. The crystal system, lattice parameters, unit cell volume and number of molecules in it have been determined by X-ray diffraction data, various ligand field parameters like Dq , B , β etc have been evaluated. The aim of investigation is to study coordination behavior of Co and Ni in the presence of VO_3 anion.

Keyword – Cobalt, Nickel, Infrared spectroscopy, X-ray Powder Diffraction, Thermo- gravimetric analysis.

INTRODUCTION

In continuation of the work being carried out in this laboratory on the metal vanadate with organic ligand¹, the present note describes two new complexes of Cobalt(II) and Nickel(II) with Chloramphenicol in the presence of vanadate. The complexes have been synthesized and characterized using analytical and spectral methods

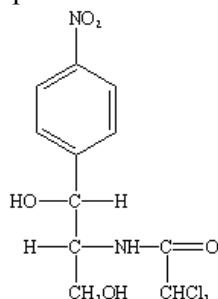


Figure 1. Structure of Chloramphenicol

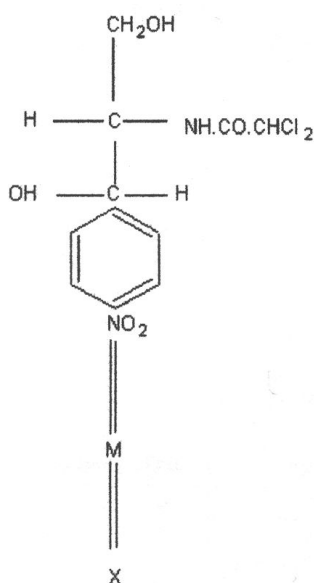
EXPERIMENTAL

The starting material $\text{MVO}_3 \cdot n\text{H}_2\text{O}$ [where $\text{M} = \text{Co(II)}$ and Ni(II) $n = 2-3$] was synthesized by reported

methods²⁻¹⁰. Complexes were isolated by shaking $\text{M.VO}_3 \cdot n\text{H}_2\text{O}$ (0.01 mole) with a require amount of $\text{C}_{11}\text{H}_{12}\text{Cl}_2\text{N}_2\text{O}_5$ (0.03 mole) in water (~100 ml). The products were filtered, washed 3-4 times with diethyl ether and dried. The metal was determined by various methods. Lab India and ASCHO Lab Mumbai carried out elemental analyses of the prepared complexes; the Inter University Consortium (IUC), Indore, India, carried out X-ray diffraction (XRD) of the prepared complex. Thermogravimetric and Infrared spectral analyses (FTIR) of synthesized complexes were performed at Centre for Advanced Technology (CAT) Indore, India, KBr pellets were used in the FTIR spectral analyses. The weight loss was measured from room temperature up to 950 °C at a heating rate of 15 °C per minute. The electronic spectra of solution of the complexes in the water were (taken at approximate concentration M/500) recorded on chemito-2500 UV/visible spectrophotometer. Electronic spectra were carried out at Forensic Science Laboratory (FSL) Sagar, India in the range of 300-900 nm.

Table 1: Analytical and Physical Data of the Complexes

Mol. formula	Observed/ (Calculated) %							
	Colour	M.W.	Co/Ni	VO ₃	C	H	N	Cl
Co(C ₁₁ H ₁₂ Cl ₂ N ₂ O ₅) VO ₃ ·2H ₂ O	yellow	500.13	11.582 (10.835)	21.926 (22.140)	23.125 (22.971)	2.525 (2.320)	4.572 (4.923)	12.202 (13.104)
Ni(C ₁₁ H ₁₂ Cl ₂ N ₂ O ₅) VO ₃ ·3H ₂ O	light blue	612.21	10.154 (9.326)	24.388 (25.101)	22.211 (22.813)	3.002 (3.985)	4.995 (5.301)	12.326 (12.896)



M = Co(II)/ Ni(II)

X = VO₃

Figure 2. Representative structure of the complexes.

RESULTS AND DISCUSSION

Table 1 shows Physical and analytical data of the prepared complexes. The Cobalt(II) and Nickel(II) complexes found yellow and light blue in color respectively. Molecular formula of the complexes has been worked out on the basis of the above data, to $MLVO_3 \cdot nH_2O$. [where M = Co(II) and Ni(II) L= Ligand n = 2-3] Prepared complexes are insoluble in water and soluble in common organic solvents like DMF (Dimethyl formamide). The complex of Co(II) shows lower value of conductance. (41-49 $\text{ohm}^{-1} \text{cm}^2 \text{mol}^{-1}$) Ni(II) complex also shows lower value of conductance. (40-45 $\text{ohm}^{-1} \text{cm}^2 \text{mol}^{-1}$) . The lower conductance values indicating non-electrolyte nature of these complexes.⁶

The magnetic moment of the Co(II) complex is 3.55B.M. correspond to two unpaired electrons . Electronic spectra of the Co(II) complex shows three distinct bands appearing at 10601 cm^{-1} (\square_1) , 16100 cm^{-1} (\square_2), 25998 cm^{-1} (\square_3) The magnetic moment of the Ni(II) complex is 1.82 B.M. which indicates the presence of one unpaired electron .The electronic spectra of the complex shows one broad band in the region 15695 cm^{-1}

Interpretation of IR bands of the complex have been carried out by comparing with the IR spectrum of Chloramphenicol¹¹⁻¹⁹ . The NH stretching frequency a bond sifted lower side at 3340 cm^{-1} .In the present case asymmetrical and symmetrical bands due to NH or NH₂ group in drug and the complex were observed at 3260 cm^{-1} . In complex near band appearing near 1695 cm^{-1} of strong intensity may be due to strong shifted frequency of this carbonyl group . The band which is due to stretching vibration of hydroxy OH also remained unchanged . The stretching bond observation of Nitro group in free ligand appears at 1530 and 1310 but after complexation these bands are shifted lower side appears at 1515 and 1315 .

The thermo gravimetric data shows the decomposition of complexes in two steps. First step weight loss 300-430 K, which indicates the loss of loosely, bound water of crystallization. The second step in the thermogram shows the loss of ligand molecules of the complex. Which occurs between 440-910 K . The metal oxide are formed in the both cases.

The X ray pattern by trial and error method²⁰⁻²⁹ . The unit cell parameters were calculated from indexed data. It is also clear from the data that Co(II) complex posses Tetragonal symmetry, whereas Ni(II) complex posses square-planar geometry. The calculated and experimental values of density of the complexes are good agreement within the limits of experimental error. On the basis of above studies Fig 2 are suggested for the studied complexes.

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REFERENCES

- Guru P., Goutam M. P. and Gautam R.K., chemical papers, 2004, 58(5), 341-347.
- Gupta C., Gautam R.K. Reviews in Inorganic Chemistry, 2000, 20 (3), 241.
- Guru P., Goutam M. P., and Gautam R.K Main Group Metal Chemistry, 2000 26(2), 141.
- Guru P Journal of Applied Chemical Research , 2008, Vol. 6(1) 24-33.
- Guru P Inorganic chemistry – An Indian Journal, 2007 Vol. 2 (2), 105- 109.
- Guru P, Research Hunt, 2006, Vol 1.(1), 144-146.
- Clark E.C.G., Introduction and Identification of Drugs, The Pharmaceutical Press London , 1974, Vol(1) , p 443.
- Florey K. Analytical Profile of Drug Substances, Academic press, New York , 1975, Vol. 4, pp 61,62.
- Sunshine ICRC Handbook of Spectrophotometric Data of Drug, CRC Press Boca Raton, Florida, 2000, pp 167-187.
- Henery NFM, Lipson H., Wooster W A, X-ray Diffraction Photograph, 1st Ed. McMillan, London, 1959, p179.
- Peiser H.S., Rooksky H.P, Wilson. A.J.C X-ray Diffraction by Polycrystalline Materials 1st Ed., Institute of Physics London, 1955, p344.
- Woolfson M.M , An Introduction to X-ray Crystallography, 4th Ed, Cambridge University Press Cambridge, 1980, p125.
- Guru P. , International Journal of Chem-Tech Research, 2010, Vol. 2(1), 102-107
- Guru P. , Journal of Applied Chemical Research, 2010 Vol. 12(4) 7-16,
- Guru P. International Journal of Pure and Applied Chemistry, 2009 Vol. 4(4)
- Guru P. International Journal of Chem-Tech Research, 2009 Vol. 1(3), 552- 554.
- Guru P. International Journal of Chem-Tech Research Vol. 1(3), 2009, 461- 463
- Ramachandra A, Nirdosh patil, Fazlur Rahaman, Kulkarni V. H., S. Angadi D (Inorganic Chemistry An Indian Journal, 2009, Vol. 4(4)
- Guru P. Reviews in Inorganic Chemistry, 2009 Vol. 29 (3), 141-156.
- Guru P. International Journal of Chem-Tech Research, 2009, Vol. 1(2), 291- 297
- Kashar Tahani, Inorganic Chemistry An Indian Journal, 2010 Vol. 5(3)
- Manikshete H. and Sarsamkar S K Inorganic Chemistry An Indian Journal 2010, Vol. 5(3)
- Patharkar, S. M. Jadhav, A. S. Munde, S.G. Shankarwar and T. K. Chondhekar Inorganic Chemistry An Indian Journal 2009, Vol. 4(4)
- Reddy Pulimamidi Saritha, Anantha Lakshmi P.V. and V. Jayatyaga raju “International Journal of Chem-Tech Research” 2010 Vol. 2(3), 1494 – 1500
- Bhimrao C. Khade Pragati M. Deore and Balasaheb R. Arbad “International Journal of Chem-Tech Research” 2010, Vol. 2(2), 1036 – 1041.
- Dubey Raj Kumar and Baranwal Pragya “Main group metal chemistry” 2009, Vol 32 (6), 321-340.
- Fikriye Tuncel Elmali, Nebahat Demirhan, Hakan Duman & Ulvi Avciata “Main group metal chemistry” 2009, Vol 32 (6), 321-340.
- Agarwal R. K., Modi H. R., Sandhu S. K., Journal of Applied Chemical Research, 2010, 13, 60-71.
- SINGH DHARAM PAL, RAMESH KUMAR, Kamboj Monika & Jain Kiran, Acta Chim. Slov. 2009, 56, 780–785
