

Synthesis and Spectroscopic Characterization of Cr (II) –2-hydroxy-1, 2-phenylethanone Complex

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ABSTRACT: The complex of benzoin with chromium (II) ion was prepared and was characterized by infrared, electronic spectra and elemental analysis. The spectroscopic analysis showed the presence of metal ion in the complex and showed the formation of complex in a 1:1 [M: L] ratio with formula as $[Cr(L)(OH)(H_2O)_3] \cdot 3H_2O$, where L represents the Benzoin. The IR spectral analysis showed that the complex formation takes place via oxygen atoms of the carbonyl and hydroxyl groups of 2-hydroxy-1, 2-phenylethanone moiety. The Electronic spectral data showed that the complex formation showed a typical geometrical structure of Cr (II) complex, and the magnetic moment analysis showed the paramagnetic behaviour of the complex, however the molar conductance values so obtained reveals the non-electrolyte nature of the complex.

Keywords: 2-hydroxy-1, 2-phenylethanone, Chromium, Spectroscopy.

I. INTRODUCTION

2-hydroxy-1, 2-phenylethanone possess many important application in chemical and medical industries. The complexes of 2-hydroxy-1, 2-phenylethanone are being used as anti-inflammatory medicine, which have direct link for throat and larynx physiology, and the compounds have inhalation and evaporation technique and thus relieves respiratory distress. The compounds of Benzoin are used also in dermatological related to effects so helps in the skin restoration (1). The compounds of Salicylaldehyde and Benzoin derivatives of Nickel (II) and Copper (II) complexes are known to have octahedral geometry, with the help of analytical elemental analyses and molar conductance measurements, infrared and electronic spectra (2). The Complexes of the type ML_2X_2 and ML_2 , with M as Cu (II) or Zn (II) ion and benzointhiosemicarbazone as L, with nitrate or chloride as X have been identified and characterized by conductance, IR and electronic measurements (4). Similarly the Chromium (III) α -benzoin oxime complexes have been prepared and characterized by infrared, elemental and electronic, 1H NMR absorption techniques (5). The study in reference may further show some expand on the formation of 2-hydroxy-1, 2-phenylethanone ligand metal complex with chromium (II).

II. EXPERIMENTAL

All chemicals used are of analytical grade and were (BDH or Aldrich). Deionized water was used in complete study.

Preparation of Chromium (II) complex:

The complex in reference was prepared by adding a small amount of ethanol (Hot) with 2g (0.01mol) of 2-hydroxy-1, 2-phenylethanone with same amount of ethanolic solution of 2g (0.01mol) of Cr (II) salt. A small amount of NaOH solution was added for the adjustment of pH of the reaction. The total mixture was refluxed for about 2 hours, which was then filtered and washed many times with redistilled ethanol in order to remove traces of unreacted materials. The complex prepared was found to be black brown in color with a percentage yield of 79%. The complex purity was confirmed by elemental analysis and TLC technique.

Physical measurements:

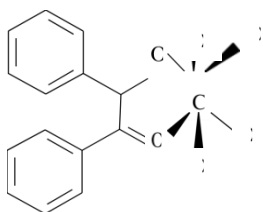
The elemental analysis in the form (carbon and hydrogen) were done using a Micro analytical center at IIT-Roorkee. The molar conductivity measurement was performed using DMSO as solvent with the help of Conductivity meter model CMD750 digital. The percentage of electronic spectrum was obtained with the help of Perkin- Elmer Lambda Spectrophotometer. The IR- spectrum was performed with the help of DPUS/IR spectrometer (Bruker) using KBr disk.

Metal content determination:

The complex so far obtained were subjected to digestion technique where the complex solution have been titrated with 0.01M EDTA, with the help of Murexide indicator and NH_4 solution as a buffer. The Chromium content in the complex have been found to be 13.50%.

III. RESULTS AND DISCUSSION

The elemental analysis data obtained so for the concerned coordination complex was found in percentage value of (Carbon = 41.91, Hydrogen = 7.14 and Chromium =15.67) and these values run parallel to those of theoretical values as calculated for the proposed formula (Carbon = 40.11, Hydrogen = 6.12 and Chromium =14.29). The formula suggested for the complex is supposed to be [Cr (2-hydroxy-1, 2-phenylethanone) (OH) (H₂O)₃]. H₂O. The molar conductance value for the complex was observed to be 3.5 Ohm⁻¹ cm² mol⁻¹ indicating the non-electrolytic nature of the complex (6). The infrared spectral values shows that the vibrations observed so for the complex are found to be 3415 and 3351cm⁻¹ which correspond to ν_{OH} vibrations of H₂O and – OH group, respectively (7). The band observed at 1695 cm⁻¹ correspond to C=O group of free ligand (2-hydroxy-1, 2-phenylethanone) which gets shifted to lower frequency values by about 20cm⁻¹, which shows that the carbonyl group is directly linked to Cr(II)ion (8). The phenolic C-O group stretching vibrations (9) of the free ligand (2-hydroxy-1, 2-phenylethanone) shows a band at 1210cm⁻¹, but the value gets shifted to lower value by about 25cm⁻¹. This complex also shows absorption at 500cm⁻¹ corresponding to single band, which can be assigned to νM-O vibration (10). The transitions for high spin d⁵ system, no d-d transitions is observed for such type are observed in Cr(II) complexes, as these are of low value. Maximum transitions are broad, and are observed for charge transfer transitions and these transitions seems to be sharp and are observed in Cr(II) complex (11). The band value of 33558cm⁻¹(299nm) was seen in the charge transfer transition with respect to pπ oxygen belonging to phenolate ion to partially filled dπ orbital on the Cr(II) ion, and also ⁶A_{1g} → ⁶T_{1g}(p) transition was observed corresponding to a band value of 28569 cm⁻¹ (349nm). The data so for observed confirms the assignment of an octahedral geometry (12) to the respective complex ion. Also the magnetic moment data of the synthesized complex shows high spin complex, making it clear that Cr(II) have large no of unpaired electrons.



The expected complex of [Cr(2-hydroxy-1, 2-phenylethanone)]

IV. CONCLUSION

As per the results of the above synthesized complex it could be concluded that the complex is Chromium (II) with ligand (2-hydroxy-1, 2-phenylethanone) makes a five membered octahedral complex. The formula suggested for the complex is supposed to be [Cr (2-hydroxy-1, 2-phenylethanone) (OH) (H₂O)₃] H₂O. The magnetic moment data of the synthesized complex shows high spin complex, making it clear that complex is associated with large no of unpaired electrons

REFERENCES

- [1]. A.A. Maihub, M.M. El-ajaily, M.A. Abouzweida, H.F. El-amari and E.S. Ahmed, "Synthesis Of Some Mixed Ligand Complexes Derived From Catechol And 2- Aminopyridine And Their Biological Activity" journal of basic and applied Sciences, **15**(1), 41-49(2005).
- [2]. Offing O.E., Martelli S. Antibacterial Activity of Metal Complexes of Benzil and Benzoin Thiosemicarbazones, *IL Farmaco.*, **49** (1994) 513-518.
- [3]. B.K. Mohanty, R.M. Mohapatra, N. Millick and B.K. Mohapatra; synthesis and the characterization of the iron-benzoin complexes, *Indian Journal of Chemistry*, **26A**, 1069(1987).
- [4]. Londa Borerpis, Linda Thalken, Christopher Ceccarelli, Synthesis and characterization of a hydroxyl-bridged iron(III) dimer of N,N'-ethylenebis(salicylamine). *Inorg. Chem.* **22**(12), 1983, 1719–1724.
- [5]. Vogels, "Textbook of practical Organic Chemistry", 5th Ed., Longmans. London (1989).
- [6]. F. Karipein and E. Kabalcilar, "Spectroscopic and thermal studies on solid complexes of 4-(2-pyridylazo) resorcinol with some transition metals", *Acta. Chim. Slov.* **54**, 2007, 242-247.
- [7]. M. Robert, Silverstein, *Spectrometric identification of organic compounds* 7th edition, John
- [8]. Willey and Son, inc., 2005, p 174.
- [9]. M.J.K. Al-Assadi, "Synthesis and Characterization of Ni²⁺ and Cu²⁺ Schiff-base complexes and their study for electrical properties", *Journal of Basrah Researches (Sciences)*, 37(3A) 2011.
- [10]. A.N. Al-Shareefi, S.H. Kadhim, and W.A. Jawad. Synthesis and study of Fe (III), Co(II), Ni(II) and Cu(II) complexes of new Schiff's base ligand derived from 4-amino antipyrine. *Journal of Applicable Chemistry*, **2**(3), 2013, 438–446.
- [11]. D.K. Dey, A. Lycka, S. Mitra. Simplified synthesis, ¹H, ¹³C, ¹⁵N, ¹¹⁹Sn NMR spectra and X-ray structures of diorganotin (IV) complexes containing the 4-phenyl-2, 4-butanedione benzoylhydrazone (2-) ligand. *Journal*

- Organometallic Chemistry, **689**, 2004, 88-95.
- [12]. J. Sanmartin, M.R. Bermejo, A.M. Garcia-Deibe, I.M. Rivas and A.R. Fernandez, “Zinc and
- [13]. Cadmium complexes with versatile hexadentate Schiff base ligands. The supramolecular self-assembly of a 3-D cage-like complex”, J. Chem. Soc. Dalton Trans, (**22**), 2000, 4174-4181.
- [14]. B.S. Parajon-Costa, E.J. Baran, O.E. Piro, Polyhedron **16 (19)**, 1997, 3379.