

Synthesis and Spectroscopic Characterization of Mn(II)-Benzoin Complex

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Abstract: Benzoin complex with Manganese (II) ion has been prepared and characterized by elemental analyses, infrared, electronic spectra, magnetic moment and molar conductivity. The elemental analysis data exhibited the presence of the metal ion as a part of the complex and show the formation of 1:1[M: L] ratio with formula $[Mn(B)(OH)(H_2O)_3].3H_2O$ in which B represents the Benzoin. Infrared spectral data showed that the chelation takes place through oxygen atoms of the carbonyl and hydroxyl groups of benzoin moiety. Electronic spectral data displayed the formation of the typical geometrical structure of Manganese (II) complex. The magnetic moment value exhibited a paramagnetic phenomenon. The molar conductance measurement revealed the existence of a non-electrolyte nature.

Keywords: Benzoin, Complex, Physiochemical tools.

Introduction

2-hydroxy-1,2-phenylethanone which is known as benzoin can be used in chemical industry and it has a soothing, sedative effect on the respiratory tract. Benzoin warms and relieves the inflammation of sore throats and laryngitis, benzoin used in steam inhalation, vaporization or in massage into the chest, back and throat. It is suited for healing cracked skin.⁽¹⁾ The Co(II), Ni(II) and Cu(II) complexes of mixed ligand derived from Salicylaldehyde and benzoin have been prepared and investigated by using different techniques, Such as elemental analyses, molar conductance measurements, infrared and electronic spectra. On the basis of the electronic spectral data, the prepared complexes have an octahedral geometry.⁽²⁾ The metal (II) ion complexes of benzoyl and benzointhiosemicarbazone have been characterized.⁽³⁾ A number of complexes of the type ML_2X_2 and ML_2 , where M represents Cr(III) or Cu(II) or Zn(II) ion and L is benzointhiosemicarbazone and X is nitrate or chloride have been prepared and investigated by molar conductance measurements, infrared and electronic spectra.⁽⁴⁾ Chromium (III) complexes with α -benzoin oxime have been synthesized and characterized.⁽⁵⁾ These complexes

have been characterized on the basis of the elemental analyses, infrared, electronic absorption and ¹HNMR spectra. The reaction of α -benzoin oxime leads to the formation of dimeric complex.

The aim of the present paper is to prepare and elucidate the geometrical structure of the complex formed between benzoin and manganese (II).

Experimental

All chemicals were pure (BDH or Aldrich). Doubly distilled water was always used.

Preparation of manganese (II) complex:

This complex was prepared by mixing a minimum amount of boiling ethanol with 2.12g (0.01mol) of benzoin with the same amount of ethanolic solution of 1.98g (0.01mol) of Mn(II) salt. Few drops of sodium hydroxide were added to adjust the pH of the reaction. The obtained mixture was refluxed two hours, filtered and washed several times with hot ethanol to remove traces of unreacted materials. The prepared complex has a brown color with a yield of 85%. The purity of the complex was confirmed by elemental analysis and TLC technique.

Physical measurements:

The microanalyses (carbon and hydrogen) were carried out at the Micro analytical center, Ras-Lanouf

Oil company-Libya. The molar conductance measurement was carried out in DMSO solvent using Conductivity meter model CMD650 digital.% Electronic spectrum was obtained by using Perkin-Elmer Lambda 4 β Spectrophotometer. Infrared spectrum was obtained by using IFS-25 DPUS/IR spectrometer(Bruker)1988Y using KBr disk. Both infrared and electronic spectra were done at the advanced laboratory of chemical analysis, Al-Fateh University- Tripoli-Libya.

Metal content determination:

The complex was subjected to a digestion technique in which the complex solution was titrated with 0.01M EDTA using Murexide as indicator and ammonia solution as a buffer. The Mn(II) content was found to be 14.80%.

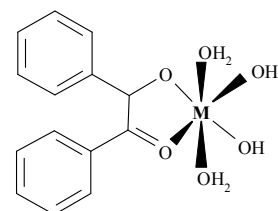
Results and Discussion

The elemental analysis data show that the found values as (%C= 42.83, %H= 6.37 and %Mn=14.80) are in a good agreement with those theoretical values calculated for the proposed tentative formula (%C= 42.12, %H= 5.38 and %Mn=15.49). The suggested formula of the complex is [Mn (Benzoin)(OH)(H₂O)₃].H₂O. The molar conductance value was 3.00 Ohm⁻¹cm²mol⁻¹ indicating the presence

of a non-electrolyte nature.⁽⁶⁾ According to the infrared spectrum, the vibrations of 3410 and 3350cm⁻¹ are attributed to ν_{OH} vibration of water molecules and –OH group, respectively.⁽⁷⁾ The band at 1690cm⁻¹ which is assigned to the carbonyl group of the free ligand (benzoin) has been shifted to lower frequency by 15cm⁻¹, indicating that the carbonyl group is coordinated to the Mn(II)ion.⁽⁸⁾ The ligand shows a band at 1200cm⁻¹ due to the phenolic C-O stretching,⁽⁹⁾ which is shifted to lower frequency by 24cm⁻¹. This complex displays a single band at 500cm⁻¹, assigned to ν_{M-O} vibration.⁽¹⁰⁾ For a high spin d⁵ ion, there is no d-d transitions and all such bands in the spectra of Mn(II) complexes are of low intensity. Most of bands are fairly broad, but those which resulted from charge transfer transitions are sharp. Such phenomenon was seen in the complex.⁽¹¹⁾ A band of 33557cm⁻¹(298nm) is attributed to a charge transfer transition for $p\pi$ of the phenolate oxygen to the partially filled $d\pi$ orbital on Mn(II) ion and the band at 28571cm⁻¹(350nm) is due to ${}^6A_1g \rightarrow {}^6T_1g(p)$ transition. The observed data confirmed the presence of an octahedral geometry.⁽¹²⁾ The magnetic moment value of the complex displays the presence of a high spin complex; this means that Mn (II) ion has five unpaired electrons.

Conclusion

From the obtained results, it can be concluded that the bonding of manganese (II) ion to the ligand (benzoin) leads to form five membered ring of an octahedral structure. The prepared complex showed a non electrolyte nature. The suggested structure of the prepared complex as shown:



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