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Preparation and Photochemical Studies of Schiff Base Metal Complexes

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ABSTRACT

Fe (III) and Cu (II) metal complexes of Schiff base derived from ethylenediamine, succinic acid and formaldehyd. The newly synthesized Schiff base complexes were characterized by elemental analysis, Melting point, conductivity, IR and UV-VIS spectral methods. The absorption spectrum of CrL displayed only one low energy transition centered at 488 nm, which was attributed to $^2A_{1g} \rightarrow {}^2E_g$ transition indicating its square planer geometry.

Keywords: Schiff base, element analysis

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INTRODUCTION

German chemist Hugo Schiff developed a new class of organic compounds [1, 2,] these groups of compounds, imines, are often referred to as Schiff bases in his honour. The preparations of these compounds are simple and smart. They are prepared by condensing a carbonyl compound with an amine, generally in refluxing alcohol. The active and well-designed Schiff base ligands are considered as privileged ligands‘‘by Cozzi [3]. In fact, Schiff bases are able to stabilize many different metals in various oxidation states, controlling the performance of metals in a large variety of useful catalytic transformations. Several studies [3-7] showed that the presence of a lone pair of electrons in a sp2 hybridised orbital of nitrogen atom of the azomethine group is of considerable chemical and biological importance. Ligands containing sp^2 hybridized nitrogen atoms, particularly those in which the N-atom is a part of the aromatic system, show very extensive coordination chemistry [8-10]

Schiff bases are generally bi, tri or tetradentate ligands capable of forming very stable complexes with transition metals. Schiff base reactions are useful in making carbon-nitrogen bonds (2), Schiff bases and their co-ordination compounds have gained importance recently because of their application as models in biological, biochemical, analytical, antimicrobial and anticancer activities. Studies of new kinds of chemotherapeutic Schiff bases are attracted the biochemists [11]. A large number of Schiff bases and their complexes have been studied for their important properties eg. Their ability to reversibly bind oxygen (4), catalytic activity in hydrogenation of olefins [12] and transfer of an amino group[13]. Schiff bases of o-phenylenediamine and its complexes have a variety of applications including biological [14] clinical [15] and analytical [16]. Some drugs showed increased activity when administered as metal chelates rather than as organic compounds.

MATERIALS AND METHOD

All chemicals used were of analytical grade (AR) reagents and of the highest purity available. They included ferric chloride anhydrous (fisher scientific), (RANKEM), chromium (II) chloride dihydrate (fisher scientific), ethylenediamine (MERCK), succinic acid (sd.finechem ltd.) and formaldehyde (MERCK). Elemental analyses were performed using an elemental analyser. The conductance of the complexes was measured on a conductometer at 25^0C. The IR spectra were recorded in a spectrometer (4000-400 cm^{-1}). The UV –VIS electronic spectra (200-800 nm) were recorded using double beam spectrophotometer. The geometries of the metal complexes were evaluated using the molecular calculation.

Template synthesis of Schiff base metal complexes

An ethanolic solution of MXn (0.00105 moles) [M=Cr (II),Fe(III)]is added slowly to an ethanolic solution of ethylenediamine (0.0021 moles) with constant stirring. The mixture is refluxed for one hour at 80^{0}C. Then an ethanolic solution of succinic acid (0.00105 moles) is added dropwise and the mixture is refluxed for about 6 hours at 80^{0}C. Finally an ethanolic solution of formaldehyde (0.0021 moles) is added dropwise and the reaction mixture is refluxed for about 3 hours at 80^{0}C.The mixture is then filtered, washed with ethanol and dried the residue. Fig.1

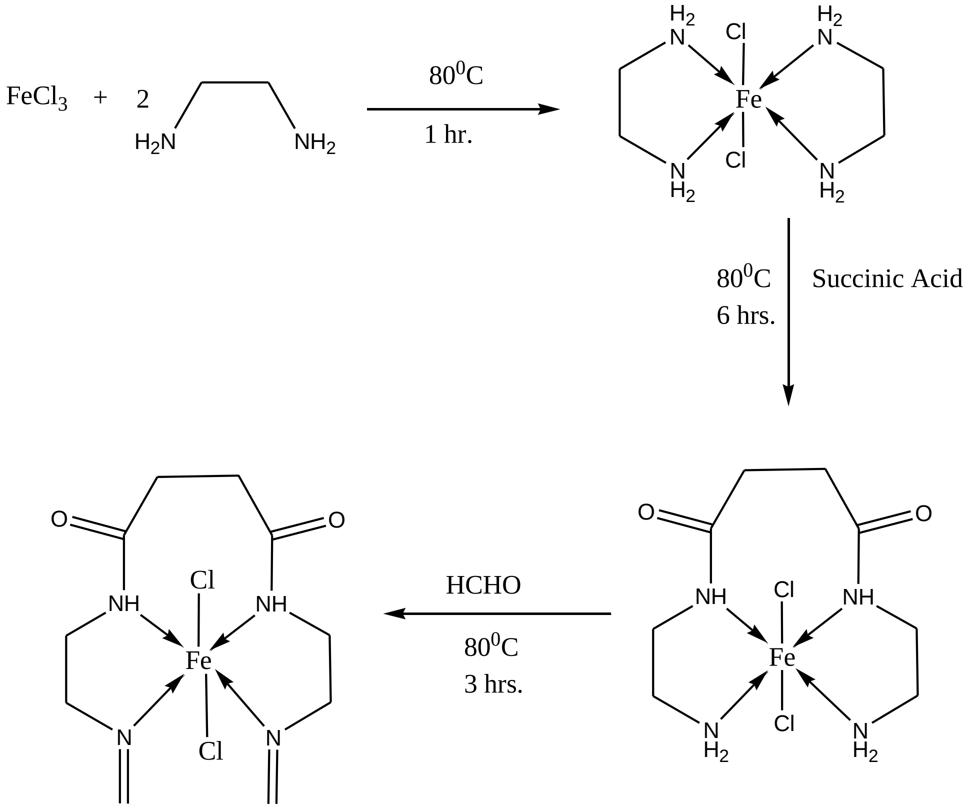

Figure 1: Synthesis of iron metal complex

RESULTS AND DISCUSSION

Elemental analysis and molar conductance

The metal complexes CrSAF is soluble in water while FeSAF is insoluble in water but soluble in DMSO. The analytical data and physical properties of the complexes are presented below. The data are consistent with the calculated results from the empirical formula of each compound.

Specific conductance of Cr-complex=0.39 mS/cm at 25^{0}C

Specific conductance of Fe-complex =0.18mS/cm at 25^{0}C

The above conductance values indicates that the complexes are electrolytes

IR Spectra

The significant IR bands for the complexes are complied and presented. The IR spectrum of the complexes, a sharp band observed at 1616 cm^{-1} is assigned to the (C=N) mode of the azomethine group. This shifts to lower wave number 1606- 1609 cm^{-1} in all the complexes suggesting the co-ordination of the azomethine nitrogen to the metal centres. A strong band observed at 1640-1690 cm-1 is assigned to (C=O, amide) of the ligand.(figure 2)

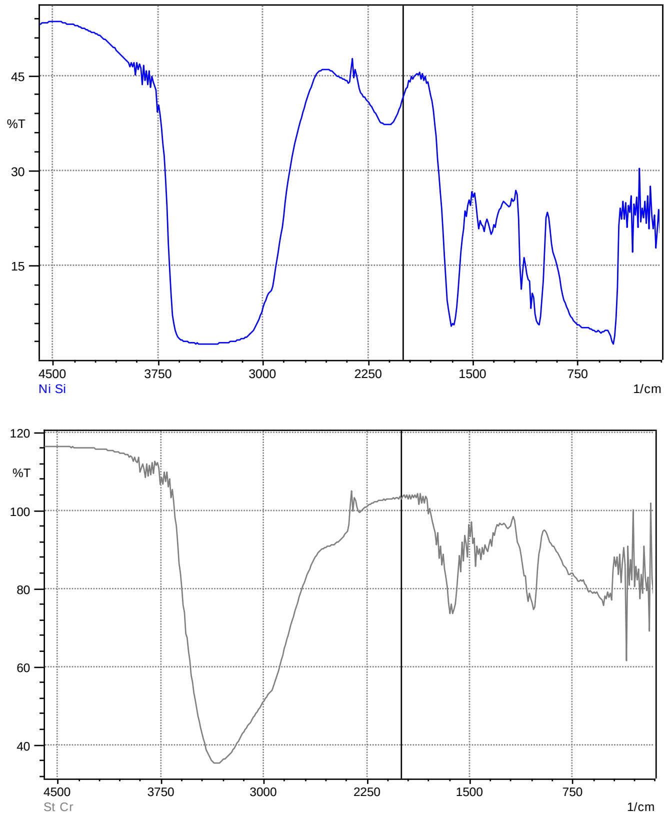

Figure 2: FT-IR Spectra of metal complex

UV-Vis Electronic spectra

The UV-VIS spectral data of the complexes shows electronic absorption spectra of the complexe of Cr were recorded in double distilled water while that of Fe-complex was recorded in DMSO in the range 200-700 nm. For the complex of iron absorption peak was found at 644.5 nm, 463.0 nm, 446.5 nm, 363.5 nm and209.0 nm. For the complex of Chromium absorption peak was found at 236.4 nm and 213.0 nm.

In order to predict the geometries of CrL and FeL, their UV-Vis absorption spectra were scanned from 200-800 nm in double distilled water. The absorption spectrum of FeL displayed high energy transitions centered at 215, 255 and 337 nm attributed to n→σ*, π→π*, n→π* transitions, respectively. The n→π* transition might be assigned to the amide carbonyl group. Besides, it exhibited a broad low energy transition centered at 677 nm corresponding to $^2B_{1g}\rightarrow{}^2B_{2g}$ transition indicating its square pyramidal geometry. The absorption spectrum of CrL displayed only one low energy transition centered at 488 nm, which was attributed to $^2A_{1g} \rightarrow {}^2E_g$ transition indicating its square planer geometry [17,18.]

CONCLUSION

In this paper, we have reported the synthesis of Fe (III) and Cr (II) metal complexes of Schiff base derived from ethylenediamine, succinic acid and formaldehyde .The complexes Cr (II) were characterized by spectral methods and analytical data. Based on these an octahedral geometry. Has been assigned for and Fe (III) complex has square planner geometry. The n→π* transition might be assigned to the amide carbonyl group. Besides, it exhibited a broad low energy transition centered at 677 nm corresponding to $^2B_{1g} \rightarrow {}^2B_{2g}$ transition indicating its square pyramidal geometry.

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