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Short Communication

SPECTROPHOTOMETRIC COMPLEXATION STUDY OF Cd^{2+} METAL ION WITH SCHIFF BASE LIGAND

Santosh M. Chavan*

Department of Chemistry PhulsingNaik College Pusad, India

**Corresponding author: santoshchavan.78@rediffmail.com*

ABSTRACT

Schiff base Cd^{2+} complex was synthesized and characterized by IR and NMR spectroscopy. The analytical data confirmed 1:1 stoichiometry between complexes. Vibrational study in the solid state of ligand and its new cadmium (II) complexes was performed by ^{1}H-NMR, IR spectroscopy, UVspectral techniques.

Keywords: Schiff base Cd^{2+} complex, Vibrational study, Spectroscopy

1. INTRODUCTION

Schiff base are the condensation product of amine and carbonyl compounds and exhibits the biological activities including antibacterial [1-2], antifungal [3-5], antimalarial etc. Schiff base ligands and its metal complexes have been used in number of areas such as analytical, chemical and pharmaceutical industries, agricultural, material and bioinorganic chemistry etc. [6–10]. Coordination of metal with C=N linkage of ligand have been extensively studied [11-14]. Transition metal complex synthesis and characterization containing Schiff bases as ligands attract researchers due to their importance as catalysts in many reactions [15-19]. Owing to importance of transition metal ion due to their role in organic reaction as a catalyst also their toxic effects on environment it is important to trace out the metal ions from the various sources. In present study complexation of Cd^{2+} metal ion with Schiff base has been established.

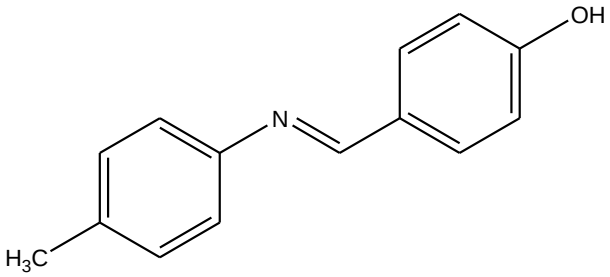

Fig.1: 4- (Methyl phenyl)imino methyl phenol

2. EXPERIMENTAL

All the chemicals and solvents were of AR grade. Metal salts were purchased from SD Fine Chemical Mumbai, India.IR spectroscopy analyses were recorded on Schimadzu spectrometer in 4000-200 cm^{-1} range using KBr pellet. The UV visible spectra were recorded on a Single Beam UV-Visible spectrophotometer on Bioera spectrometer range 200-800 nm. The Schiff base was prepared according to literature.

3. RESULT AND DISCUSSION

3.1. UV-Visible Study of ligand and its complex

TheUV–Visible study were studied upon UV-visible spectro photometer using(10mm)quartz cell the were chacterized by UV-Visible spectroscopic technique. The spectrum of an ethanolic solution of the ligand(5×10^{-4} M) and coper nitrate in water by adding some conc. nitric acid (5×10^{-5} M). From the graph (Fig.2) it was observed that the ligand shows the maximum absorbance at 440 nm., which is responsible for n-π*. However, upon complexation with copper metal ion there is slight blue shift indicates the complex formation.

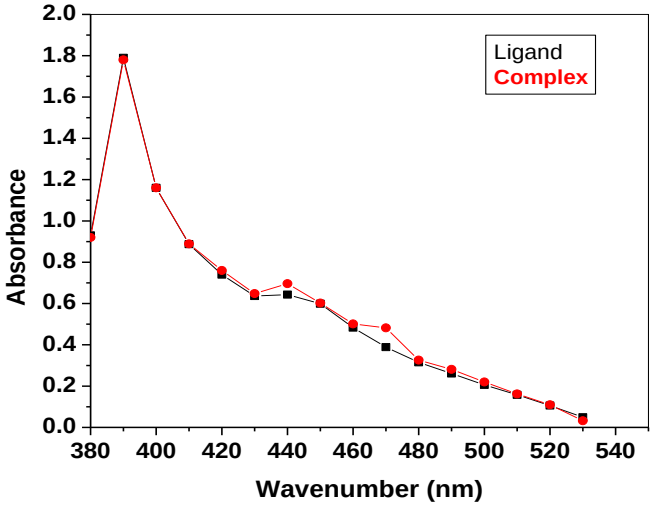

Fig. 2: UV-Visible spectra of ligand and its Cd^{2+}complex

3.2. Metal to ligand stoichiometry

The Jobs method is used to determine the stoichiometry of complex, solutions of Schiff base and metal ion Cd^{2+} were mixed in same mole ratios keeping the same of SB and metal ion concentration constant and the absorbance were measured at 340 nm of wavelength. The plot of absorbance versus mole fractions is shown in Fig.3. The maximum absorption was observed for the mole ratio of 0.5 therefore it indicates the reaction Stoichiometry between SB and $Cd^{2+}$is 1:1.

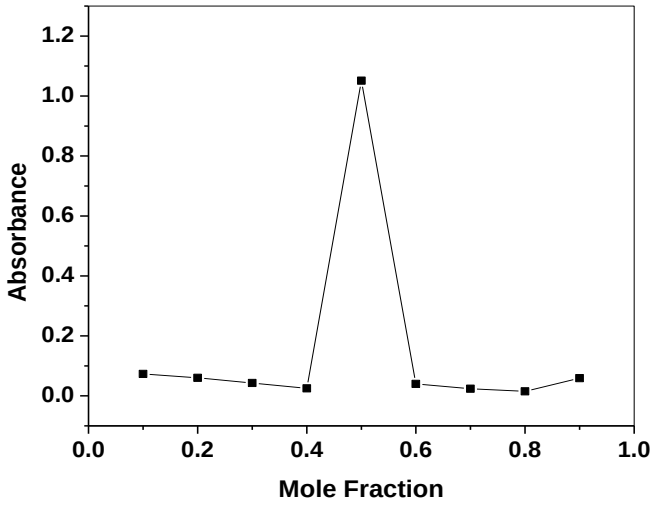

Fig. 3: Jobs plot of Complex for the stoichiometry

3.3. Effect of pH on Complexation

The effect of pH on complexation has been studied for the Schiff Base and copper ion by varrying the pH from 1 to 10. From the graph (Fig.4) it is clear that the effect of at acidic condition i.e.pH-1 comlex formation is maximum. However, with increasing the pH decreases the absorbance and therefore pH-1 and pH-2 is suitable for the complex formation and used fo further condition.

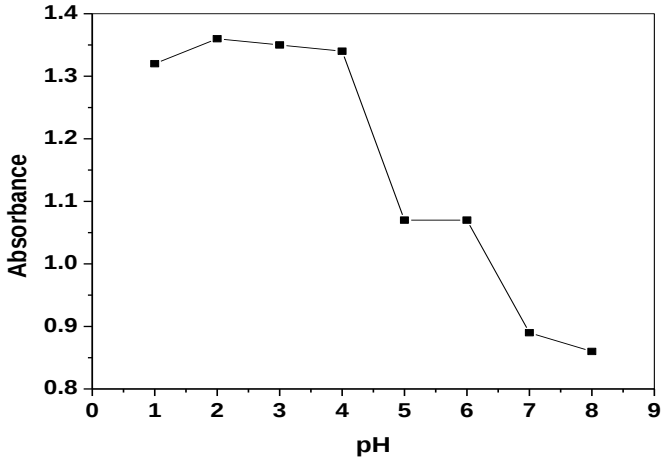

Fig.4: Effect of pH on Cd^{2+} Effect on complexion

3.4. IR Study of ligand and its complex

The IR spectra of SB ligand shows stretching and out-of-plane bending vibration for (sp2=C-H hydrogen) at 3062 and 646.15 cm^{-1} respectively, showing the presence of aromatic ring in the Schiff base ligand [12].The IR spectra (Fig.5) of the ligand and its complexes were compared to know the possible interaction between them. The Stretching frequency due to OH of free ligand 3263cm^{-1} is shifted to 3541cm^{-1} in complex. The 1029cm^{-1} is due to M-O bond.

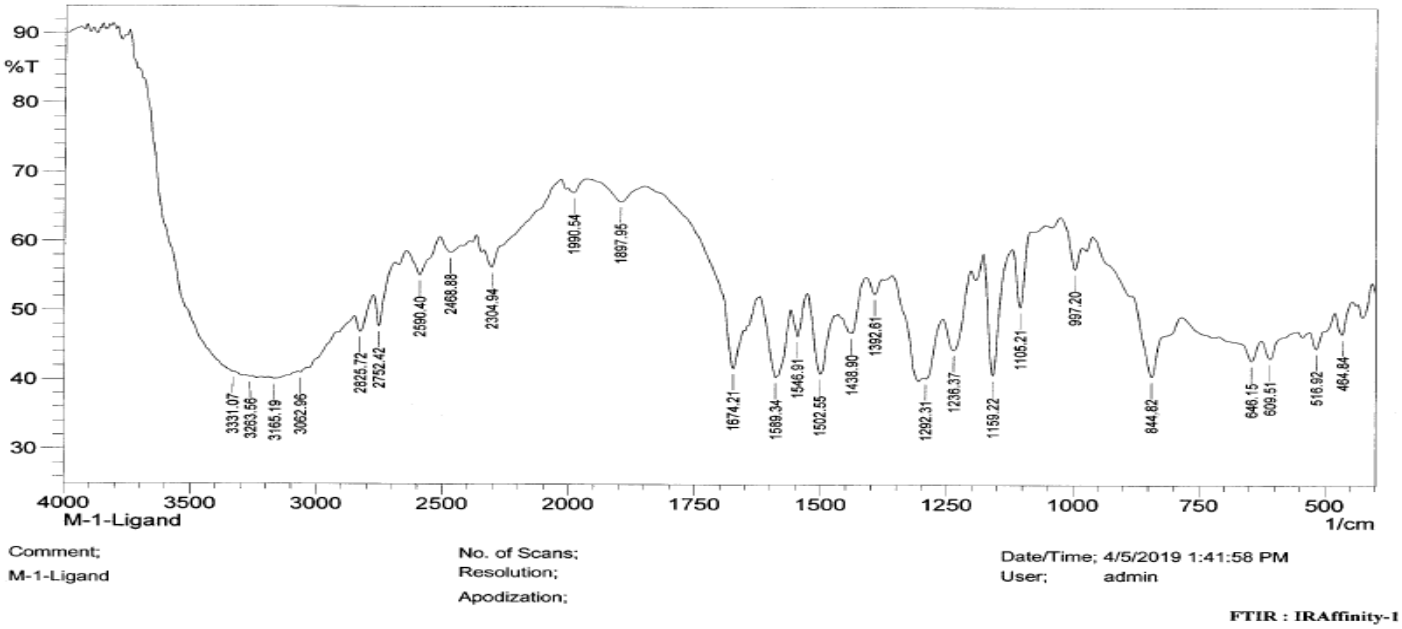

Fig.5(a): IR Spectra of Schiff base

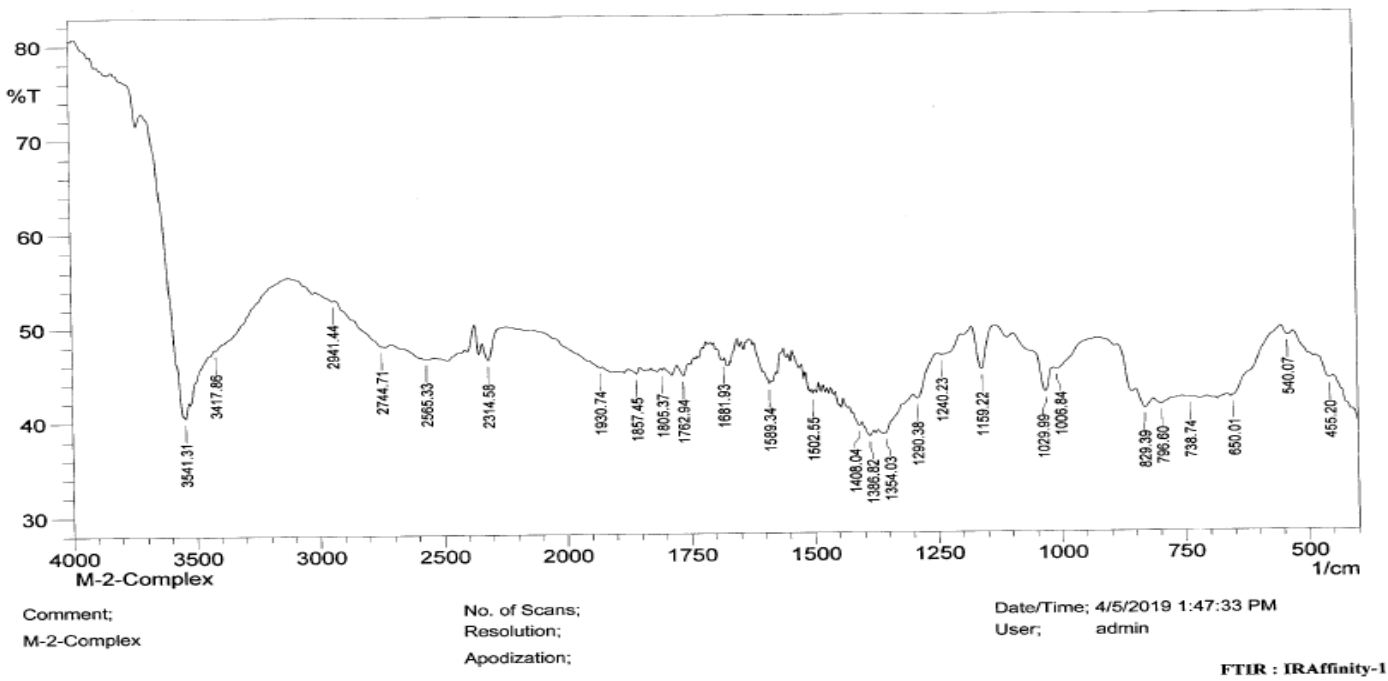

Fig.5 (b): IR Spectra of Schiff base and its Cd^{2+} Complex.

3.5. NMR Study

^{1}H NMR spectrum of the Schiff base shows highly de-shielded singlet absorption at δ (9.276 ppm, 1H) which can be attributed to the azomethine proton (H-C=N-). However, upon the complexation the chemical shift due to this peak is more shifted to downfield region 9.716 ppm. The absorption of signal in the region 6 to 8ppm is due to aromatic protons of ligand shows the slight upfiled region upon complexation with metal ion.

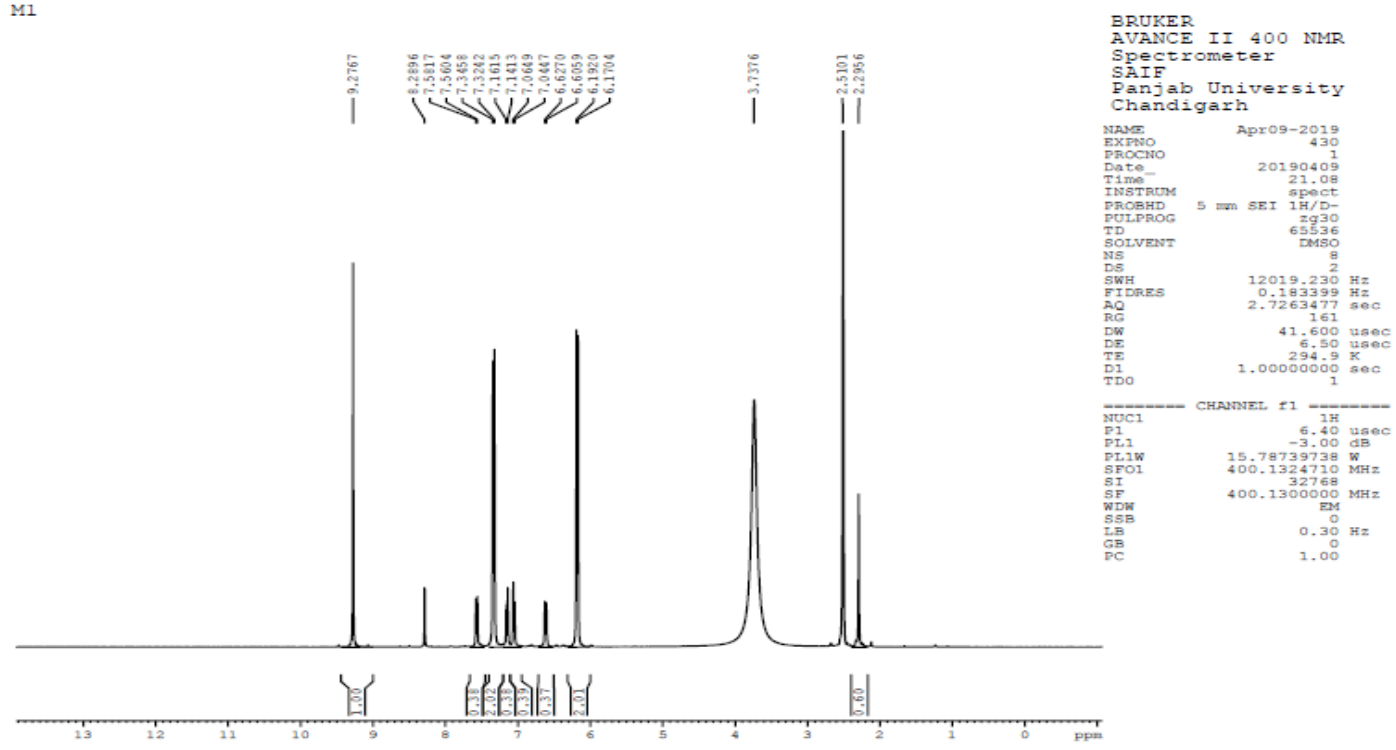

Fig.6 (a): 1H NMR spectra of Schiff base

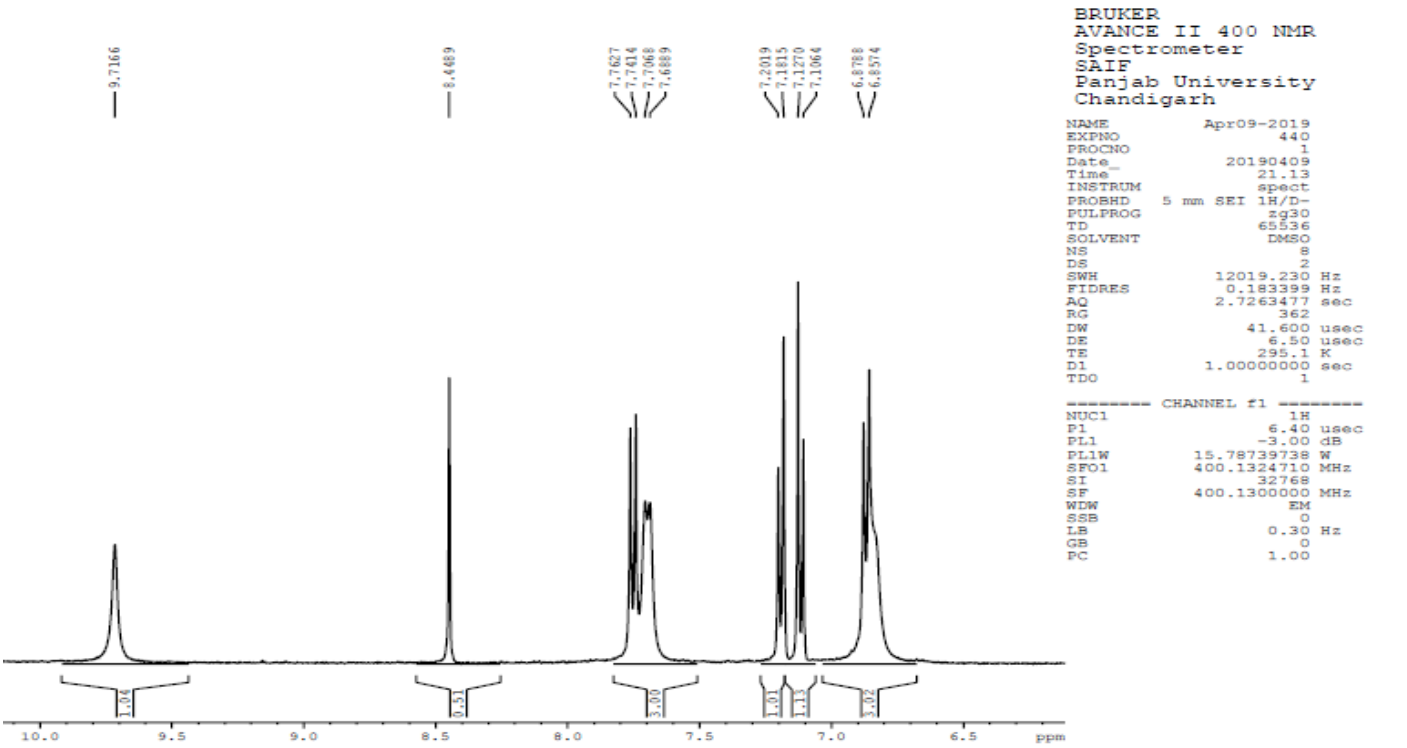

Fig. 6 (b): ^{1}H NMR spectra of Complex

4. CONCLUSIONS

In summary, we have undertaken the study of complex of Schiff Base with Cd^{2+} metal investigated their bindingbehaviors using UV-Visible Spectroscopies Study. The effect of pH on complexation, stoichiometry of complex 1:1, IR and NMR study helps to understand complexation among the Cd^{2+} and Schiff Base.

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