

# ELECTRON SPIN RESONANCE STUDIES OF Cu(II) COMPLEX OF NOVEL SCHIFF BASE

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**Abstract :** Cu(II) complex obtained from Schiff base of 3-formyl-6-methylchromone and 3-aminoquinoline. ESR spectra have carried out at X-band i.e. at 9.1 GHz. Electron Spin Resonance spectral studies indicate presence of unpaired electron in the Cu(II) complex.

**Keywords:** ESR, Cu(II) ion, X-band

## I. INTRODUCTION

Electron spin resonance (ESR) spectroscopy is very significant and sensitive method to evaluate unpaired electron and electronic structure in the compounds. There is different types of ESR techniques, every technique have its own merits. In continuous wave ESR (CW-ESR), the sample is treated to continuous beam of microwave irradiation of fixed frequency and the magnetic field is swept. Different microwave frequencies may be used and are represented as S-band (3.5 GHz), X-band(9.25 GHz), K-band (20 GHz), Q-band (35 GHz) and W-band (95 GHz) [1].

## II. MATERIAL AND METHODS

Electron spin resonance spectral studies carried out at JEOL Japan model JES-FA200 ESR spectrometer with X and Q band at Indian institute technology Bombay.

Synthesis of Schiff base and its Cu(II) complex:

Schiff base was prepared by refluxing equivalent mole of 3-formyl-6-methylchromone with 3-aminoquinoline in ethanolic solution [2,3]. Cu(II) complex was synthesized by refluxing hot ethanolic solution of Schiff base with ethanolic solution of CuCl<sub>2</sub>.2H<sub>2</sub>O for 5 hours [2,3].

## III. RESULT AND DISCUSSION

Characterization of Schiff base and its Cu(II) complex:

Schiff base and its Cu(II) complex were characterized by IR, <sup>1</sup>H NMR, UV-Visible spectral techniques as per literature reported [3].

ESR Spectral Studies:

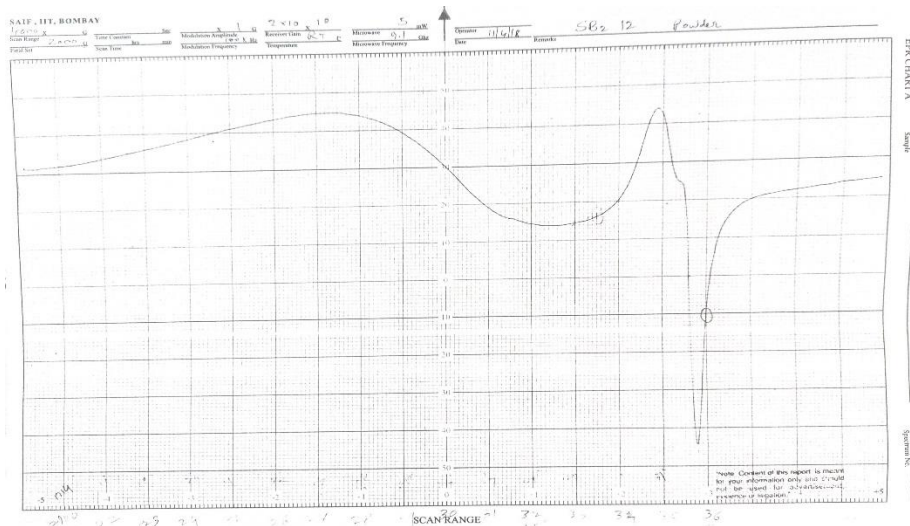
ESR spectra of Cu(II) complex was measured at room temperature in the solid state. ESR spectra have carried out at X-band i.e. at 9.1 GHz. In the current work, Cu(II) complex showed four well resolved hyperfine peaks with the Hamiltonian parameters  $g_{||} = 2.11$ ,  $g_{\perp} = 2.02$ ,  $A_{||} = 140 \times 10^{-4} \text{ cm}^{-1}$  and  $A_{\perp} = 31 \times 10^{-4} \text{ cm}^{-1}$ . Where  $g_{||} > g_{\perp} > 2.0023$  revealed that the unpaired electron in the ground state of Cu(II) predominantly lies in  $d_{x^2-y^2}$  orbital [4]. The ratio of  $g_{||} / A_{||}$  values also indicates the possible geometry of the Cu(II) complexes. The range of  $g_{||} / A_{||}$  is different for different geometry. For square planar complexes the range is 105-135  $\text{cm}^{-1}$  and for tetragonally distorted octahedral complexes the range is greater than 135-250  $\text{cm}^{-1}$ . In the present work, ( $g_{||} / A_{||} = 150.71 \text{ cm}^{-1}$ ), these value in the range to revealed Cu(II) complex have tetragonally distorted octahedral geometry [5]. According to Kivelson and Neiman, complex carried ionic environment if  $g$  is 2.3 or  $> 2.3$  but the  $g$  value is less than 2.3 then complex show covalent environment [6]. In the present work,  $g$  value for the Cu(II) complex is 2.11, consequently the environment is covalent.

One more bonding parameter  $G$  is calculated from the following equation;

$$G = \frac{g_{||} - 2.0023}{g_{\perp} - 2.0023} = \frac{4K_{||}^2 \Delta E_{xz}}{K_{\perp}^2 \Delta E_{xy}}$$

According to Hathway [7] if the value of  $G$  is greater than 4, exchange interaction between Cu(II) centers in the solid state is negligible. Whereas its value are less than 4, a considerable exchange interaction exists in the solid state. In the present work,  $G$  value of Cu(II) complex are greater than 4, proven the absence of exchange interaction between Cu(II) centers in the solid state.

The values obtained for hyperfine splitting and covalency parameters are in good agreement with other Cu(II) complexes reported in the literature.



**Figure 1: ESR Spectrum of Cu(II) Complex.**

#### IV. CONCLUSION

Electro resonance spectra revealed Cu(II) complex show distorted octahedral structure.

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