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Synthesis and Characterization of Vanillin Schiff Base With Cu(II) complexes

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Abstract
A new complex of vanillin schiff base of were used to mononuclear Cu(II) coordination compounds. The complexes were characterized by the spectral and physical studies are discussed below. The purity and composition of the Schiff bases and the metal(II) complexes were established by elemental analysis which suggests a metal: ligand ratio of 1:2. The IR spectra revealed that the complexes coordinated through azomethine nitrogen and methoxy oxygen of the ligands. Further conclusive evidence of the coordination of the Schiff bases with the metal ions was shown by the appearance of new bands due to ν(M-N) and ν(M-O) in the metal complexes. Based on the electronic spectral transitions, an octahedral structure has been assigned

Keywords: *Cu(II)* Schiff base, Metal complex

1. Introduction
Schiff bases have a chelating structure and are in demand because they are straightforward to prepare and are moderate electron donors with easily-tunable electronic and steric effects. The synthesis and application of Schiff bases and their coordination compounds have been highly considered in inorganic and bioinorganic fields, since their structural properties similar to some of the biological systems [1-4]. Many Schiff bases and their complexes have been widely studied because of their industrial and biological applications.5-7 Schiff base compounds (–RC=N–) are usually formed by the condensation of a primary amine with an active carbonyl. The crosslinking agents can also be derived from metal complexes with O, N or S ligands.

Experimental
All the chemicals and solvents used were of AR grade and were used without further purification.

Preparation of Schiff base ligand (L)
The Schiff base ligand (L) was prepared as described by Raman *et al.* [8].

Preparation of the Schiff base metal (II) complexes
An ethanolic (10 ml) solution of schiff base ligand (20mmol, 0.055g) was added drop wise to 10ml of the metal(II) salts [10mmol, 0.02g of of Cu(CH3COO)2.H2O in boiling ethanol (78.30C). The reactions took place in 1:2 mole ratio of metal(II):L. The reaction mixture was refluxed for 3h on a water bath and the volume of the solution was reduced to half of the initial volume.

Results and Discussion
The analytical data along with some physical properties are summarized in Table 1. The Schiff base ligand (L) on interaction with Cu(II) formed complexes with moderate yields(28-49%). All the complexes are air stable and have sharp melting points (130-190oC) except the ligand (L) which melted above 3500C. The sharp melting point indicates that the complexes are probably pure.

Table 1: Physical characteristics and analytical data for the Schiff base ligand and the metal(II) complexes

Compound	Molecular formula	Molar mass	Colour	Melting point (0C)	Yield (%)
Cu(L- L)X2	Cu(C14H13NO3)2	550.07	Brown	187	49

Table 2: The microanalysis and metal estimation data of the Schiff base ligands and their metal complexes

Compounds	Molecular formula	Molar mass	Microanalysis, % found (calc.)			
			C	H	N	M
Cu(L- L)X2	Cu(C14H13NO3)2	550.07	42.77 (61.14)	3.75 (4.08)	6.85 (5.09)	09.08 (10.59)

Microanalysis

The microanalysis of the ligands and their metal(II) complexes are presented in Table 2. The results revealed that the % C, H and N are in good agreement with the proposed structures. From the data obtained, it appears that the compounds analyzed as [M(L-L)X2] indicating a 1:2 mole ratio (M:L).

IR spectra of Schiff base ligand (HL)

The selected vibrational frequencies for the Schiff base ligand and its metal complexes are presented in Table 3. Very strong band at 1569cm-1 is characteristics of the azomethine nitrogen present in the Schiff base ligand (L) [8]. This was shifted to 1546-1632 cm-1 in the complexes, which indicates the coordination of the metal to the azomethine nitrogen. The metal complexes showed broad bands at 3212-3386 cm-1 which is characteristic of v(OH). This indicates that the phenolic –OH group does not participate in bond formation with the metals. The infrared spectrum of the Schiff base ligand showed strong bands at 1486, which was assigned to v(C-N) stretching. This was shifted to 1432-1545 cm-1 region in all the complexes. The spectral bands of the complexes at 1286-1291 were assigned to v(C-O) which did not show considerable shift from the region 1290 cm1of the ligand. Thus it is suggested that the oxygen atoms of terminal methoxy and hydroxyl group are not coordinated to the metal ions. V(M-N) and v(M-O) were observed in the far infrared region. These bands are absent in the spectra of the ligand.

Electronic spectra

UV-VIS spectra of the Cu(II) complexes were recorded at 200 – 600nm using methanol as a solvent. The absorption regions, band assignment and the proposed geometries of the complexes are

given in Table 4. The orgel diagram for d5 configuration for Mn(II) shows the three bands at 22935, 23901 and 2823cm-1 assigned for 6A1g→4T1g, 6A1g→4T2g, and 6A1g→4A2g.

Table 3: Relevant infrared frequencies (cm-1) of the Schiff base ligands and their metal(II) complexes.

Compound	v(OH)phenolic	v(C-O)	v(C-N)	v(C=N)	v(O-CH3)	v(M-N)	v(M-O)
Cu(L-L) X2	3261m	1291vs	1492vs	1553w	3190w	525s	439m

Table 4: Electronic absorption spectral data for the metal complexes

Compounds Band	Absorption (cm-1)	assignment	Geometry
Cu(L- L)X2	23753 3	A2g→ 3T2g	Octahedral

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