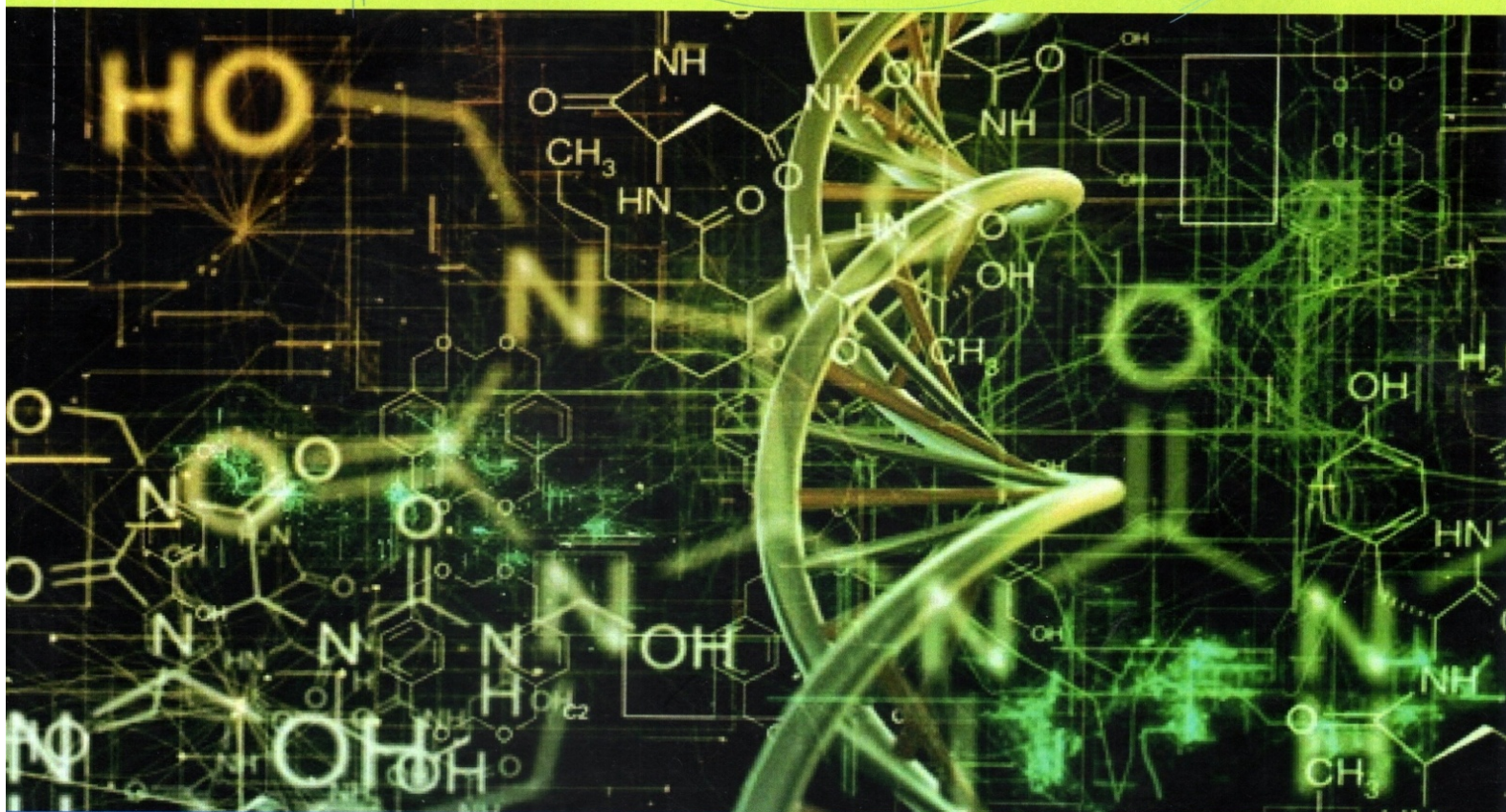


INTERNATIONAL SEMINAR (ICBS-2023)

BOOK OF ABSTRACTS

**INNOVATION, EXPANSION, IMPACTS
AND CHALLENGES IN CHEMICAL AND
BIOLOGICAL SCIENCES**

4th January, 2023



Surendranath College

24/2 M.G. Road, Kolkata-700009

West Bengal, India

Synthesis and Spectral characterizations of heterobinuclear complexes of Copper(II) Schiff base with alkali metals salts

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Abstract: During recent years coordination compounds of biologically active ligands [1,2] have received much attention. Current interest in developing the chemistry of binuclear transition and alkali metal complexes draws inspiration from two disparate fields such as chemistry of materials and bioinorganic chemistry. Schiff base metal complexes deserve a proper attention because they show antibacterial[3] and antifungal[4] activities because of their specific structure. In the continuation of our earlier work[5,6] we were prepared and characterized a number of binuclear alkali metal complexes of Cu (II) derived by the interaction of Schiff base of Cu(II) with alkali metal salt of organic acids. These complexes were characterized on the basis of elemental analysis, IR and UV-Vis spectral data and magnetic measurement. The low values of conductivity measurement show the non-electrolytic nature of the complexes. In the IR spectra of metal complex ligand there was disappearance of very sharp absorption peak, indicate the deprotonation of phenolic proton on complex formation. The ν_{C-O} (phenolic) have shifted towards higher energy side on complexation suggest the bonding between the Cu(II) metal chelate and alkali metal which appear by dative bond via oxygen atoms of C-O (phenolic). Electronic absorption bands have indicated the ligand to metal charge transfer transition and also d-d transition. A magnetic measurement study of metals complex as ligand and their binuclear complexes have been showed the square planar geometry with coordination number four.

Keywords: binuclear alkali metal complexes, Cu^{II} , Schiff base, spectral analysis.

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"The meeting of two personalities is like the contact of two chemical substances: if there is any reaction, both are transformed"- Carl Jung




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
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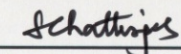
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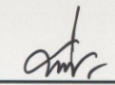


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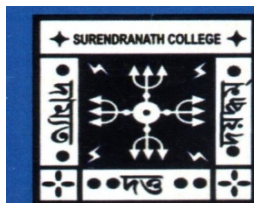

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Synthesis and Spectral Characterizations of Heterobinuclear complexes of Copper(II) Schiff base with alkali metals salts

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Introduction

Schiff base possesses strong ability to form metal complexes and they deserve a proper attention because of their biological properties. Binucleating Schiff bases have been extensively used for the preparation of homo and heterobinuclear complexes [1,2]. Schiff base complexes show biological activities and they have been found antibacterial [3] and antifungal [4] activities. Schiff base and the relevant transition metal complexes are still found to be of great interest in the inorganic chemistry. Binuclear complexes, in which ligand structures capable to holding two metal centers in close proximity, one of the metal is transition metal and other one is alkali metal. In the continuation of earlier work [5,6] we report here the synthesis and characterizations of heterobinuclear alkali metal complexes of Cu(II).

Synthesis

The Schiff base of OHAP and 1,2-propylenediamine were prepared by the refluxing these in 2:1 molar proportion respectively in ethanol for 10 min. The yellow Schiff base was filtered off, washed with ethanol and dried. An ethanolic solution of copper acetate hydrate (2.0g) added slowly with stirring to a hot solution of the Schiff base (3.1g). The solution, upon cooling, deposited purple copper complex which was filtered off, washed with ethanol and dried.

Heterobinuclear complexes containing Cu(II) metal and alkali metal:

N,N'-1,2-propylene-bis(2-hydroxyacetophenoniminato)copper(II) [CuPA] was taken in absolute alcohol in a conical flask and alkali metal salts of o-nitrophenol, dinitrophenol, trinitrophenol or were added to it in 1:1 molar proportion. The mixture was refluxed with stirring for 1-1½ hours. The characteristic colour adducts were precipitated in hot condition, which was filtered, washed with absolute ethanol, dried.

Result and Discussion

The Cu(II) chelate, and their alkali metal adducts are coloured solid (Table.1) & stable at room temp. The adducts are generally soluble in MeOH, acetone, benzene and DMF but insoluble in water. Molar conductivities of complexes in DMF at 30 (± 0.5)⁰C at conc. of 10⁻³M (Table 1) show low value (0.8-6.2 $\Omega^{-1}\text{cm}^2\text{mol}^{-1}$). This suggests the non-electrolytic [6] nature.

Table 1. Analytical, magnetic and molar conductance data of the complexes

Compounds MaPA.MbL	Colour	Melt.(m)/D ec.(d) temp.	Molar Cond.	μ_{eff}	Elemental Analysis Found (Calculated)					Yield %
					C	H	N	Ma	Mb	
CuPA.LiONP	Mercedes red	295m	0.9		57.9 (58.08)	4.58 (4.65)	8.07 (8.13)	12.19 (12.29)	1.31 (1.36)	75.02
CuPA.NaONP	Mercedes red	296m	1		56.25 (56.34)	4.43 (4.51)	7.74 (7.89)	11.85 (11.92)	4.28 (4.32)	76.02
CuPA.KONP	Mercedes red	298m	0.8	1.78	54.56 (54.69)	4.31 (4.38)	7.55 (7.66)	11.52 (11.58)	7.06 (7.11)	75.21
CuPA.LiDNP	Purple	280m	3.4	1.76	53.35 (53.43)	4.01 (4.10)	9.89 (9.97)	11.25 (11.31)	1.19 (1.25)	75.69
CuPA.NaDNP	Greenish Brown	251m	3.6		51.82 (51.95)	3.83 (3.98)	9.65 (9.70)	10.98 (11.00)	3.92 (3.98)	71.43
CuPA.KDNP	Brown	253m	5.5		50.5 (50.55)	3.82 (3.88)	9.38 (9.44)	10.62 (10.70)	6.51 (6.57)	68.24
CuPA.LiTNP	Golden brown	205m	5.6		49.36 (49.46)	3.54 (3.63)	11.46 (11.54)	10.42 (10.47)	1.11 (1.15)	74.2
CuPA.NaTNP	Golden brown	258m	6	1.73	48.12 (48.19)	3.47 (3.53)	11.11 (11.24)	10.13 (10.20)	3.62 (3.69)	74.7
CuPA.KTNP	Orange yellow	255m	6.2		46.85 (46.99)	3.37 (3.45)	10.88 (10.96)	9.91 (9.95)	6.02 (6.11)	72.44

IR spectra

The disappearance in the spectra of metal complex as ligand of very sharp absorption peak (3500 cm^{-1} ν_{OH}), indicate the deprotonation of phenolic proton on complex formation. The metal complex as ligand (CuPA) exhibits the $\nu_{\text{C-O}}$ (phenolic) at 1530 cm^{-1} , which shifts towards higher energy side (Table 2) on complexation, indicating the coordination through the phenolic O-atom [7]. The shift is expected due to maintenance of a ring current rising from electron delocalization in chelating ring. The major shift of $\nu_{\text{C-O}}$ (phenolic) to higher frequency by $\sim 60\text{ cm}^{-1}$ in complexes indicates the presence of phenoxobridge. It is therefore suggestive that the phenol C-O link attached a considerable amount of partial double bond character in these complexes. The bands in the far IR i.e., $463\text{-}480\text{ cm}^{-1}$ and $527\text{-}593\text{ cm}^{-1}$ in the binuclear complexes tentatively assigned by $\nu_{\text{M-O}}$ and $\nu_{\text{M-N}}$ modes respectively. These bands are not present in the Schiff base, while in metal chelates (CuPA) at region 462 cm^{-1} and 523 cm^{-1} .

These assignments are based on the assumption [8] that since oxygen atom is more electronegative than the nitrogen, the M-O bond tends to be more ionic than the M-N bond. Consequently M-O vibrations are expected to appear at lower frequencies. The above data confirm the coordination of oxygen atom of phenolic group and nitrogen atom of NO_2 to alkali metals in all the binuclear complexes.

Table 2. Spectral data of metal chelate and their metal complexes

Compound	Infrared spectra (cm ⁻¹)				UV-Vis spectra λ (nm)			
	ν (C-O)	(Phenolic)	ν (M-N)	ν (M-O)				
CuPA	1530		523	462	230	266	347	653
CuPA.KONP	1531	593	463	232	266	347		653
CuPA.LiDNP	1531	527	470	219	239	264	348	653
CuPA.NaTNP	1590	565	480	231	266	348		653

Electronic Spectra and magnetic studies:

Electronic absorption bands (Table 2) for the metal chelate and their binuclear complexes are observed between 230-266 nm indicating the formation of Π - Π^* transition in aromatic ring and C=N chromophore. The bands appearing near 348 nm due to ligand to metal charge transfer transition and band appearing near ~653 shows that there is d-d transition [9]. The magnetic moment value of CuPA is found to be 1.61 BM that correspond to the presence of one unpaired electron and square planar geometry with coordination number 4 and their adducts show μ^{eff} values between 1.73 to 1.78 BM. This suggest that the stereochemistry of CuPA unit in the adducts almost remains same.

Antimicrobial activity:

The heterobinuclear complexes were tested for their antibacterial activity against bacteria viz., *E. coli*, *S. aureus* and fungus viz., *C. albicans* in DMF in the conc. range 25-200 μgml^{-1} . The minimum inhibitory concentration (MIC) results of the some of the complexes are shown in Fig.1. The observations show that most of adducts have great degree of activity at higher concentration against test organism and also as the concentration of these adducts increases antimicrobial activity increase gradually [10].

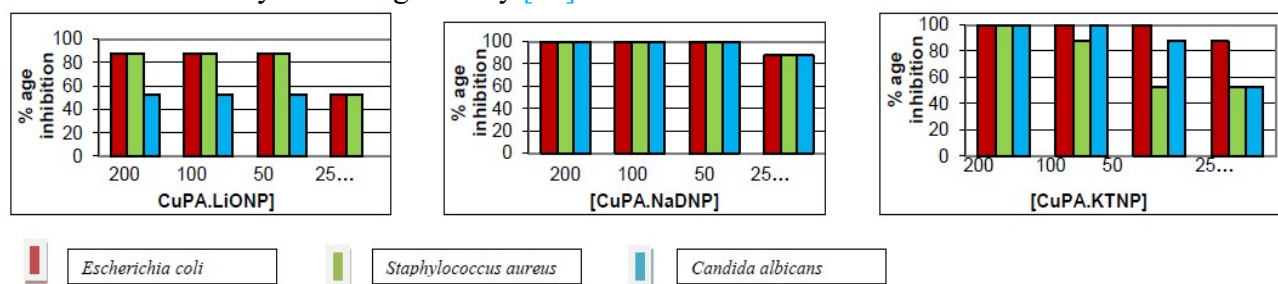


Fig. 1 MIC results

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