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SEM & EDX INVESTIGATION OF COPPER (II) CONTAINING METAL COMPLEXES

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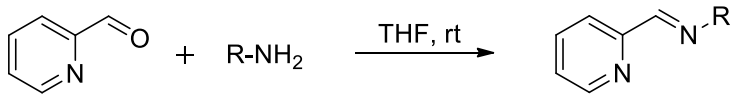
Abstract: The study of surface and subsurface interference chemistry of metals and similar systems is of immense technical importance. Molecular compounds of copper (II) metal are classified as coordination complexes, that is molecules or ions that contain copper linked to several ligands. Copper (II) complexes were synthesized by the condensation method. The synthesized material was investigated by SEM and EDX characterization. SEM shows details about the surface morphology to guide important of drug delivery and Energy dispersive X-ray spectroscopy (EDX) is characteristic of each element and allows the determination of elemental composition.

1. INTRODUCTION

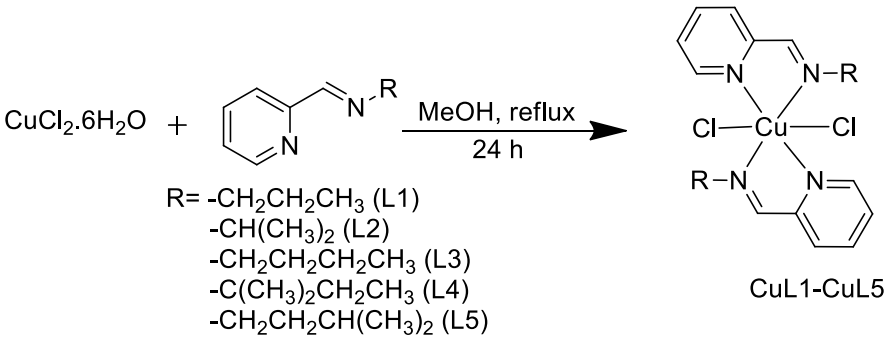
Recent years, the microbial infections have drastically increased and deployment of antibiotics causes a life treating infectious diseases and led to the emergence of resistance among the various strains of microorganisms. In the field of bioinorganic chemistry, designing molecules of biological interest is a 'hot area' of research. Proper design of organic ligands and chelation with appropriate metal ions also enhance biological efficacy. Metal ions such as platinum, titanium, ruthenium, gold, copper, silver and their complexes showed good biological activity such as antitumor, antiamoebic, antihistaminic, anthelmintic, antiulcer, antimicrobial, anticancer and antihypertensive agent. The aforecited studies and findings strongly motivate further research on the antibacterial copper metal complexes, We present here the synthesis, spectral, crystal structures of copper(II) complexes with different coordination numbers that reveal the geometric environment around the central copper(II) metal ion. Hirschfeld surface analysis was studied to understand the intermolecular interactions present in molecular crystals. Furthermore, the present work describes the evaluation of the complexes for in vitro antibacterial activities against methicillin-resistant Staphylococcus aureus.

2. SYNTHESIS OF METAL COMPLEX

Ligands L1-L5 is synthesized by condensation of pyridine-2-carbaldehyde and corresponding amine are dissolved in and stirred for 24 h at room temperature. Complexes CuL1-CuL5 were synthesised by treating N-substituted pyridylimine ligands **(L1-L5)** with the cupric chloride metal salts ($CuCl_2.6H2O$) in methanol under reflux conditions for 24 h.



R= $-CH_2CH_2CH_3$ (L1)
$-CH(CH_3)_2$ (L2)
$-CH_2CH_2CH_2CH_3$ (L3)
$-C(CH_3)_2CH_2CH_3$ (L4)
$-CH_2CH_2CH(CH_3)_2$ (L5)



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$-CH(CH_3)_2$ (L2)
$-CH_2CH_2CH_2CH_3$ (L3)
$-C(CH_3)_2CH_2CH_3$ (L4)
$-CH_2CH_2CH(CH_3)_2$ (L5)

Metal Complexes Name	Stoichiometric Formula	Names Used
Bis-(N-Propyl-1-(pyridine-2yl)methanimine) Copper(II)chloride	C18H24Cl2N4Cu	Cu –L1
Bis-(N-Isopropyl-1-(pyridine-2yl)methanimine) Copper(II) chloride	C18H24Cl2N4Cu	Cu-L2
Bis-(N-butyl-1-(pyridine-2yl)methanimine) Copper(II) chloride	C20H28Cl2N4Cu	Cu-L3
Bis-(N-tert-pentyl-1-(pyridine-2yl)methanimine) Copper(II) chloride	C22H32Cl2N4Cu	Cu-L4
Bis-(N-Isopentyl-1-(pyridine-2yl)methanimine) Copper(II) Chloride	C22H32Cl2N4Cu	Cu-L5

3. PHYSICAL MEASUREMENT

The structural assessment of these complexes has been carried out was examined by Field-Emission Scanning Electron Microscope (FE-SEM) Supra55 Zeiss. It is provides excellent imaging properties combined with analytical capabilities makes this high end FE-SEM suitable for a wide range of applications. Energy Dispersive Microanalysis (EDS/EDX) was also analysis provides elemental and chemical analysis of a sample. The Instruments provides a new and revolutionary materials characterization system that gathers accurate data at the micro- and nanoscales attached to FE-SEM.

4. Result Analysis

The Energy Dispersive Microanalysis (EDS) analysis confirmed the presence of Cu (II) in all Cu [L1-L5] complexes in the nanostructure. The Energy Dispersive Microanalysis (EDS) analysis of Cu[L1-L5] metal complexes was also performed; the composition of the metal & Carbon, Chloride Confirmed with percentages calculated. All Images below mentioned.

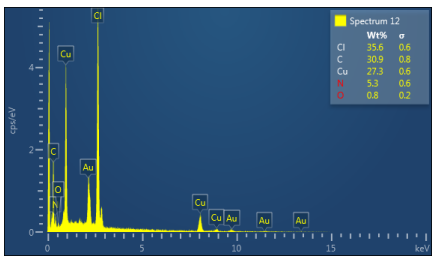

Fig -1 EDX Image Cu-L1

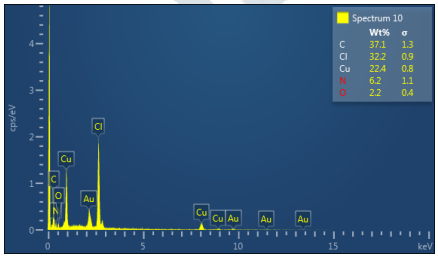

Fig –2 EDX Image Cu-L2

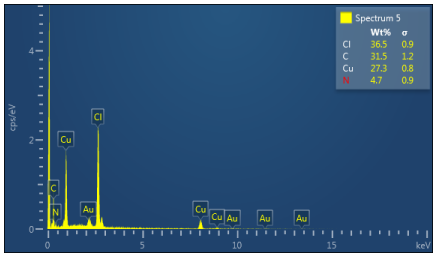

Fig -3 EDX Image Cu-L3

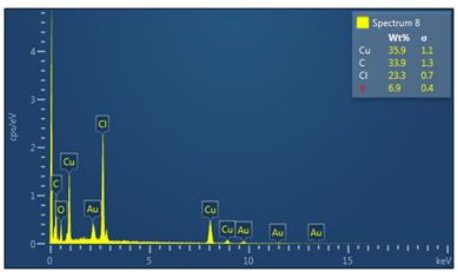

Fig -4 EDX Image Cu-L4

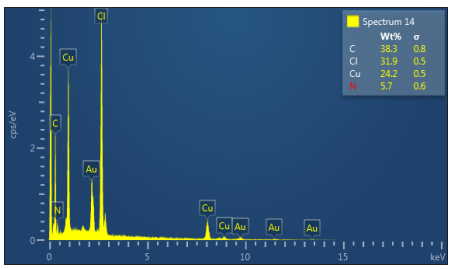

Fig -5 EDX Image Cu-L5

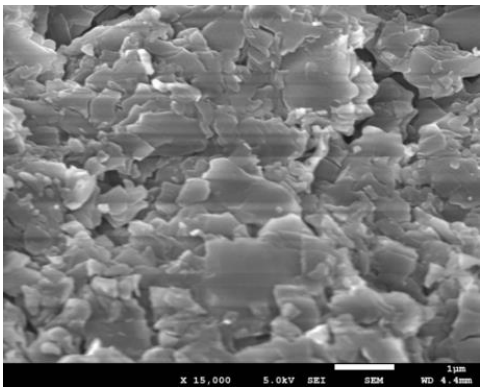

Figure 6. SEM image of Bis-(N-Propyl-1-(pyridine-2yl)methanimine) Copper(II)chloride

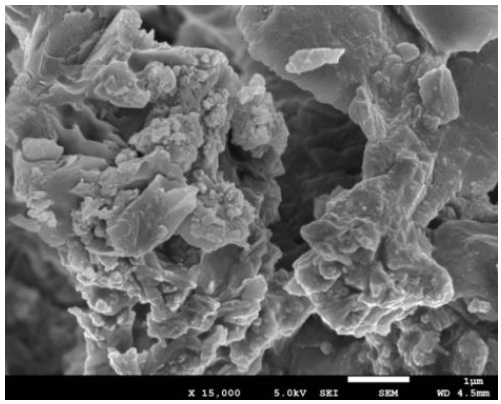

Figure 7. SEM image of Bis-(N-Isopropyl-1-(pyridine-2yl) methanimine)copper(II) chloride

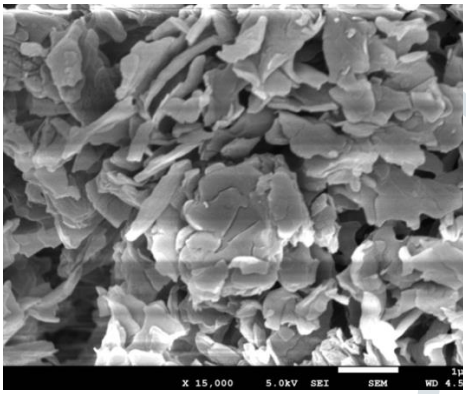

Figure 8. SEM image of Bis-(N-butyl-1-(pyridine-2yl)methanimine) Copper(II) chloride

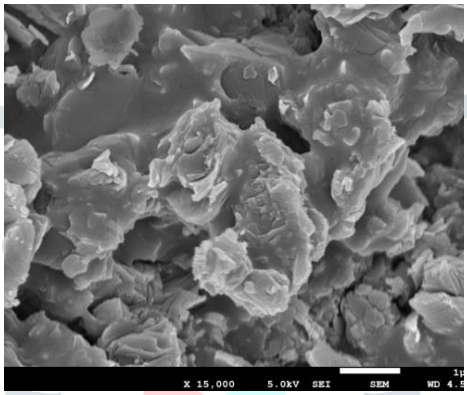

Figure 9. SEM image of Bis-(N-tert-pentyl-1-(pyridine-2yl)methanimine) Copper(II) chloride

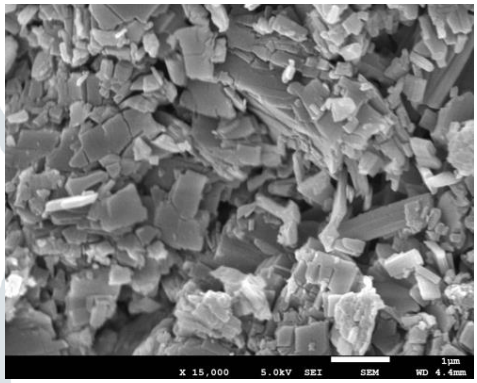

Figure 10. SEM image of Bis-(N-Isopentyl-1-(pyridine-2yl)methanimine) Copper(II) Chloride

In **Figures 6-10** are shown the scanning electron microscopy (SEM) images of the synthesized copper complexes. The ligands considered in the present study are derived from pyridine-2-carboxaldehyde and corresponding amines (L1-L5). The SEM images suggest that the length and the type of carbon (sec-, tert-, etc.) present in the ligand strongly affects morphology of the compounds. In **Figure 6** which corresponds to the Bis -(N-propyl-1-(pyridin-2-yl) methanimine), the emergence of flakes-like structure can be observed which are not distinct. However, in **Figure 7,** which is the SEM image of the compound containing a secondary (sec-) carbon attached after N- atom in the chain connected with pyridine molecule **(N-isopropyl-1-pyridin-2-ylmethyl),** the particles seem to be agglomerated, this not only reduced the flakes like emergence but also the dimensions of the visible flakes.

Further investigation has been considered with the ligands containing heavier carbonic group attached to pyridine. In that context, **Figure 8** shows the SEM image of the complex with ligand a simple chain of four-carbon atoms beyond the N-atom (N-butyl-1-(pyridine-2-yl)methanimine). The flakes can be observed distinctly as compared to that in the **Figure 6**. Furthermore, the attachment of a tert-carbon to the N-atom in the ligand molecule again deteriorates the emergence of the flakes like morphology as evident from the **Figure 9** that is the SEM image of (Bis-(N-tert-pentyl-1-(pyridine-2yl)methanimine) Copper(II) chloride).

For the final member of the synthesized series, the SEM image (**Figure 10**) advocates the distinctly visible flakes which have relatively smaller size. It is noticeable that the ligand contained in this complex compound constitutes of a longer carbon chain having a sec- carbon attached to the N-atom next to pyridine (N-isopentyl-1-(pyridin-2-yl)methanimine).

5. Conclusion

These observations suggest that presence and length of linear carbon chain attached to the N-atom next to pyridine (in the ligand) enhances the flakes like morphology of the synthesized Cu-complexes. However, presence of steric (sec-, tert-, etc.) carbon in this chain triggers the agglomeration of particles accompanied by reduction of the flak size, possibly due to altered intermolecular forces.

Since these complex compounds are useful for drug delivery purposes. the study of morphology of these complexes may have significance in understanding their surface properties. As it may be inferred that out of the series members, the one in **Figure 10** could be have better drug delivery potential due to its enhanced flakes like structure which lengthen up to few hundred nanometers.

6.Acknowledgment

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6. References

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