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GENERALISING ANTIFUNGAL AND ANTIMICROBIAL ACTIVITES OF SCHIFF BASE COMPLEXES WITH DIFFERENT METALS

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ABSTRACT

Coordination chemistry of transition metal complexes with Schiff base ligands is an important and fascinating branch of chemistry. The coordination compounds including Schiff base ligands are of significantly important and play a pivotal role in industry, technology and life processes. Due to their potential applications in various fields, it has always fascinated and inspired chemists in the world. This can be evidenced by the vast prolificacy and scope of research papers on the subject in recent times and also by the diversity in which it has found applications. A number of reviews have been published in coordination chemistry of Schiff base metal complexes. Schiff bases are those organic ligands which contain azomethine (>C=N-) group which play an important role in the coordination chemistry of many transition metals outstanding to the ease of their formation and versatility. Metal complexes of Schiff bases found use in bioinorganic chemistry as models for metalcontaining sites in metalloproteins, as catalysts for some organic reactions and in magneto chemistry. They can be readily synthesized by condensation of primary amines with carbonyl components and this general approach allows access to ligand systems of various concentrations.

Keywords: - Chemistry, Metal, Compound, Schiff, Ligand

I. INTRODUCTION

Coordination chemistry of transition metal complexes with Schiff base ligands is an important and fascinating branch of chemistry. The coordination compounds including Schiff base ligands are of significantly important and play a pivotal role in industry, technology and life processes. Due to their potential applications in various fields, it has always fascinated and inspired chemists in the world. This can be evidenced by the vast prolificacy and scope of research papers on the subject in recent times and also by the diversity in which it has found applications. A number of reviews have been published in coordination chemistry of Schiff base metal complexes. Schiff bases are

those organic ligands which contain azomethine (>C=N-) group which play an important role in the coordination chemistry of many transition metals outstanding to the ease of their formation and versatility. Metal complexes of Schiff bases found use in bioinorganic chemistry as models for metalcontaining sites in metalloproteins, as catalysts for some organic reactions and in magneto chemistry. They can be readily synthesized by condensation of primary amines with carbonyl components and this general approach allows access to ligand systems of various concentrations. The introduction of additional donor atoms increases the stability of the formed metal complexes and gives the possibility to combine different 'hard' and 'soft' donor atoms in one chelating system which allows the formation of stable complexes with transition metal ions.

II. GENERAL STRATEGIES OF SCHIFF'S BASE LIGAND

The Schiff bases are the organic ligands which contain azomethine group (RC=N-). The Schiff bases are generally prepared by condensation of primary amines (-NH2) with active carbonyl compounds like aldehydes and ketones (>C=O). They are also known as anils, imines, with general structure R.CH:N.R' where R and R' is alkyl, aryl, cyclohexyl or heterocyclic radical which may be differently substituted. The general reaction for formation of Schiff base can be represented as:

$$R\text{–}CHO + R' \text{–}NH2 \longrightarrow RHC = N\ R' + H2O$$

R, R' = alkyl, aryl, cyclohexyl or heterocyclic group

The Schiff bases are weak bases and are readily hydrolyzed by mineral acids but not by aqueous alkali. They form salts by co-ordination of the electrons on the nitrogen atom of azomethine group. The Schiff bases derived from lower aliphatic aldehydes are less stable than those derived from aromatic aldehydes. Aliphatic Schiff bases are difficult to isolate due to their tendency to polymerise. Schiff base derived from formaldehyde exhibit affinity to undergo polymerisation. Schiff bases which are effective as coordinating ligands bear a functional group usually (OH), satisfactorily near the site of condensation that a five or sixmembered chelate ring can be formed by the reaction with a metal ion. Because of great synthetic suppleness of Schiff base formation, many ligands of diverse structural type can be synthesized. The size of the chelate ring formed can be prescribed by changing the location of donor atoms and groups to explore the effect of substitution and steric factors.

III. ANTIFUNGAL ACTIVITIES

The chromium (III) and iron (III) complexes are more effective against Penicillium species than the standard drug. From the data it has been also observed that the activity depends upon the type of metal ion and varies in the following order of the metal ion: Cr > Fe >Mn [46]. Metal complexes copper (II), cobalt (II), nickel (II) and manganese (II) are synthesized with Schiff bases

derived from o-phthalaldehyde and amino acids viz, glycine L-alanine, Lphenylalanine, then tested against three fungi. It is clear that copper (II) and nickel (II) complexes exhibit inhibition towards all the studied microorganisms. However, cobalt (II) and manganese (II) complexes exhibit less inhibition and VO (II) complexes have no activity towards the microorganisms.

Neutral complexes of Co(II), Ni (II), Cu (II) and Zn (II) with Schiff bases synthesized from 3-nitrobenzylidene-4- amino antipyrine and aniline p-nitroanilinePmethoxyaniline showed antifungal activity. A comparative study of the highest inhibitory concentration values for the ligands and their complexes indicate that the complexes exhibit higher antifungal and antibacterial activity.

Such increased activity of the complexes can be explained on the basis of overtone's concept and Tweedy's chelation theory. Two bidentate Schiff base ligands2-benzaldehyde [4(3methyl-3-mesitylcyclobutyl) - 1,3-thiazol-2-yl] hydrazone, and their metal complexes were tested against a yeast-like fungus C.albicans. Co (II), Ni (II) and Cu (II) complexes with Schiff base 3, 3-thiodipropionic acid bis(4amino-5-ethyl imino2,3-dimethyl-1-phenyl-3-pyrazoline showed antifungal activity against Alternariabrassicae, Aspergillusniger and Fusariumoxysprum and results indicate that the complexes show the activity in comparison to free ligand.

IV. METAL COMPLEXES

Schiff bases The reason for the interest in transition metals and their complexes is their potential use as drugs and diagnostic tools to treat a variety of diseases. Many inorganic complexes show antitumor and antibacterial activity [59-61]. There are numerous copper (II) compounds that present biological activity as antiinflammatory, anticonvulsive, antifungal, antibacterial, and antimicrobial agents [62-66]. Many metal ions are known to play very prominent roles in biological processes in the human body [67]. For example; Cu (II) ions are the third most abundant transition metals in humans. They are found either at the active sites or as structural components of a good number of enzymes [68]. There has been much attention paid to copper because it is an essential element of life. It is associated with a number of copper-dependent enzymes that are keys in biological processes.

V. ANTIMICROBIAL ACTIVITY OF SCHIFF BASE COMPLEXES WITH LEAD

The geometry and stereochemistry of lead (II) complexes with oxygen donor ligands were explained by Davidovicha et al. Despite the resurgence of interest in the structural chemistry and stereochemistry of lead (II) complexes, there is a lack of systematic studies on this important class of compounds. The first review devoted to the structural chemistry of lead (II) compounds was published in 1976 by Harrison. Parr published a brief review of the coordination chemistry of lead (II) in 1997 followed by a more extensive review on lead complexes the comprehensive coordination chemistry II. In a detailed review by Claudio et al., devoted to the fundamental coordination chemistry, environmental chemistry, and biochemistry of lead (II), one of the

sections describes structural investigations on Pb(II) complexes. The stereochemistry of lead (II) complexes with aminopolycarboxylate ligands and the role of LP for this class of compounds were reviewed. Lead (II) derivatives of substituted diphenyldithiophosphates have been synthesized by reaction between lead dichloride and the sodium salt of disubstituteddiphenyldithiophosphates has good antimicrobial activity depicts that these compounds are active against bacteria gram-positive: Enterococcus faecalis and Bacillus cereus and gram negative Escherichia coli and Klebsiella pneumonia.

VI. ANTIMICROBIAL ACTIVITY OF SCHIFF BASE COMPLEXES WITH IRON

A series of new iron (II) Schiff base amino acid complexes derived from the condensation of amino acid and sodium 2- hydroxybenzaldehyde-5-sulfonate have been synthesized. The complexes were characterized by elemental, electronic, IR spectral analyses and conductance measurements. The stability and solubility of the prepared complexes were determined. The antibacterial activity of the prepared complexes has been tested against Bacillus cereus, P. aeruginosa and Micrococcus bacteria. Also a series of new iron(II) complexes based on Schiff bases amino acids ligands have been designed and synthesized from the condensation of 5-bromosalicylaldehyde (bs) and a-amino acids (L-alanine (ala), L-phenylalanine, L-aspartic acid (aspa), L-histidine (his) and L-arginine (arg)). The structure of the investigated iron (II) complexes was elucidated using elemental analyses. Moreover, the prepared compounds are screened for their in vitro antibacterial activity against three types of bacteria, E. coli, P. aeruginosa and B. cereus using disc diffusion method. The results of these studies indicated that the metal complexes exhibit a stronger antibacterial and antifungal efficiency than their corresponding Schiff base amino acid ligands [159]. A Schiff base ligand derived from 1,4-dicarbonyl-phenyl-dihydrazide and chromene-2,3-dione (2:2) formed complexes with chromium(III), manganese(III), and iron(III) metal salt in methanolic medium, then tested for their antimicrobial activities to assess their inhibiting potential. The antifungal experimental results of the compounds were compared with the standard antifungal drug (Miconazole) at the same concentration.

VII. CONCLUSION

Dealt about synthesis, characterization, deoxyribonucleic acid interaction and antimicrobial studies of Schiff base binuclear transition metal complexes. Metal complexes were prepared from 3, 3’-dihydroxy benzidiene and 3-amino coumarin. The geometry of the metal complexes was concluded from elemental analysis, molar conductivity, IR, UV, CV, EPR, magnetic and thermal studies. The molar conductance values indicated that complexes were non electrolytic in nature. The azomethine frequency of IR spectra obtained for all the complexes and it revealed that formation of metal complexes. The IR, electronic, EPR, magnetic studies of metal complexes were applied to conclude the coordination and geometries of the metal complexes. The electronic and magnetic measurement results confirmed that geometry of central metal was distorted

octahedral. The redox behaviour of metal complexes was discussed by cyclic voltametry. Thermal stability of the metal complexes was known by using thermogravimetricanalysis. DNA cleavage study was studied by Gel electrophoresis method. The prepared metal complexes certified more cleavage activity in presence of oxidant hydrogen peroxide. Cu and Ni complexes cleaved DNA fully. Anti microbial study was carried out by Disc diffusion method. Streptomycin was used as standard. The metal complexes were analyzed against microorganisms such as Klebsiellapneumoniae, Escherichia coli and Staphylococcus aureus. Action of Cu and Ni complexes was higher.

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