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"Metal complexes of schiff base: preparation. Characterization and biological activity": a review

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ABSTRACT

A total of five metal complex derivatives of 2N-salicylidene-5-(p-nitro phenyl)-1,3,4- thiadiazole, HL with the metal ions Vo(II), Co(II), Rh(III), Pd(II) and Au(III) have been successfully prepared in alcoholic medium. The complexes obtained are characterized quantitatively and qualitatively by using micro elemental analysis, FTIR spectroscopy, UV–Vis spectroscopy, mass spectroscopy. ^{1}H & 13C NMR, magnetic susceptibility and conductivity measurements. From the spectral study, all the complexes obtained as monomeric structure and the metals center moieties are four-coordinated with square planar geometry except VO(II) and Co complexes which existed as a square pyramidal and tetrahedral geometry respectively. The preliminary in vitro antibacterial screening activity revealed that complexes 1–5 showed moderate activity against tested bacterial strains and slightly higher compared to the ligand, HL.

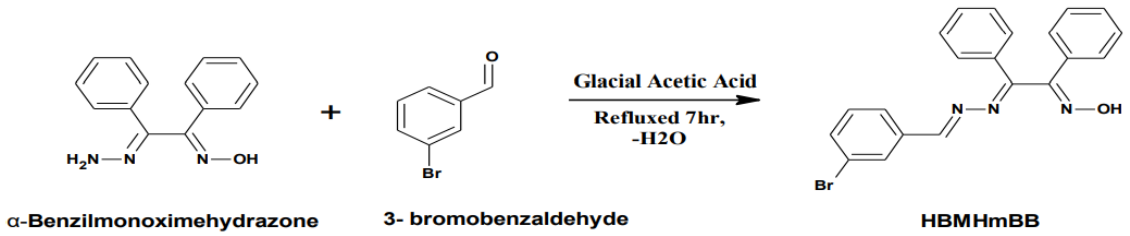
Key works: Schiff base complexes, Biological activities, Azomethine nitrogen

INTRODUCTION

In view of this, many literature surveys have been done for Schiff base derived from the reaction of carbonyl compounds with amino acids are an excellent class of ligands, which have a variety of applications including biological, clinical, industrial, analytical as well as in catalysis and organic synthesis. In azomethine derivatives, the C,N linkage is essential for biological activity, several azomethine have been reported to possess remarkable antibacterial, antifungal, anticancer and antimalarial activities. The purpose of this review is to study the literature and to understand further scope for Inner transition metal complexes of Schiff base and its biological importance.

DISCUSSION

1. In the paper 'Preparation and Characterization of Novel α-Benzilmonoximhydrazide m-Bromo benzaldehyde and its Metal Complexes with Cobalt, Nickel and Copper Chlorides' C. The α-Benzilmonoximehydrazide m-Bromobenzaldehyde ligand was prepared by the previous reported work as:



α-Benzilmonoximehydrazone 3- bromobenzaldehyde HBMHmBB

The results were obtained as follows:

FTIR Spectra:

The FTIR Spectra of α-Benzilmonoximehydrazide m-Bromobenzaldehyde shows bands at 3229, 3154 and 3110 cm^{-1} assignable to ν(-OH), Ar C=C and Ar C-H respectively. The free ligand α-Benzilmonoximehydrazone-m-bromobenzaldehyde show very strong vibrational band at 1605 cm^{-1} region in the individual FT(IR) spectrum which is representative of the azomethine group. Another strong vibration band at 1545 cm^{-1} was observed which is assigned as oximino group of the Benzil monoximehydrazone-m-bromobenzaldehyde A medium band confirming to phenolic bromine was identified at 749 cm^{-1} of ligand Benzilmonoximehydrazone-m-bromobenzaldehyde. Another two bands observed at the 1067 and 1154cm-1, which may be assigned as νN-O and νN-N bands respectively of the ligand Benzilmonoximehydrazone-m-bromobenzaldehyde.

PMR Spectra:

The PMR spectrum of α-Benzilmonoximehydrazone-m-bromobenzaldehyde ligand in deuturated DMSO was recorded using tetramethylsilane as the internal standard. The oximino using tetramethylsilane as the internal standard. The oximino protons appears as a multiplet in the range δ7.0 to δ7.7 ppm. In addition to this, aliphatic protons present as a bridge between azomethine (>C=NN-) groups appears at δ 8.5ppm.

Magnetic susceptibility Measurements of metal Complexes:

The Brown colored, [Co(BHMmBB)2] complex shows magnetic moment of 3.12 B.M. at room temperature, which is in the range for square Co(II) complexes. The green colored [Ni(HBHmBB)2] complex shows magnetic moment of 3.22 BM room temperature. High spin Ni(II) complexes to be paramagnetic properties due to the two unpaired electrons. The high spin Ni(II) octahedral complexes are expected to show magnetic moments in the range 3.0 to 3.3 BM.

2. In the paper 'Metal complexes of Schiff base: Preparation, characterization and antibacterial activity, α-benzilmonoximehydrazone-m-bromobenzaldeyde (ligand) is highly thermal stable and strong metal-ligand bond. Ligand moiety is coordinated through oxygen and nitrogen atoms to the metal ions in the complexes.

The results obtained were as follows:

FTIR Spectra:

The infrared spectrum of ligand, HL showed some characteristic stretching bands at 1635 and 1116 cm assigned to (C,N) and (C–O) respectively which could be found in complexes. The exceptional case is that the (C,N) of complexes were found to be shifted to a lower wavelength number compared to the ligand, HL signifying that the coordination took place via the nitrogen atom of the ligand, HL. In addition, the stretching of metal–oxygen and metal–nitrogen bands of the complexes appeared in the lower wavelength region in the range of 556–500 and 488–432 cm-1 also signifying the complexation through nitrogen and oxygen atoms from the ligand.

UV-Vis Spectra:

The ultraviolet visible electronic spectrum of the ligand, HL showed three bands at 47,620, 39,370 and 28,901 cm^{-1} attributed to $\pi \rightarrow \pi^*$, $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$ respectively.

NMR Spectra:

In the ^{1} H NMR spectra of ligand, HL showed a sharp peak, d(OH) at 9.90 ppm which was absent in the spectra of the complexes indicating deprotonation and complexation of ligand anion to metal ions.

Antibacterial activity:

The preliminary screening results revealed that complexes showed a significant activity compared to the ligand, HL. Overall, the activities of all the complexes obtained were found to be moderate even though higher concentrations were applied. This may be due to the bulkiness of the molecule with a complicated structure which in turn restricts their mobility to the target cell or active site although all the complexes were obtained as a monomeric and four-coordinated metal(II) and metal(III) moieties.

3. In the paper, Synthesis and characterization of Transition Metal Complexes with pyrimidine based ligand derivative, Both the complexes were prepared in a similar way by the usual diazotization process. [2] 6-Methyl-5-arylhydrazono-2thio-4-oxo-pyrimidine (ligand) were prepared by dissolving (0.01mol) of Aniline in a mixture of concentrated hydrochloric acid (3ml) and water (4ml) and cooled to 0-5°C in ice bath. To it a cold aqueous solution of sodium nitrite (0.01mol) was then added. The Diazonium salt so obtained was filtered into a cold mixture of sodium acetate (7gms) and ethyl aceto acetate (0.01mol) in ethanol (25ml) the resulting solid is 1-ethoxy-2-arylhydrezono-butene-1, 3dione was washed with water and dry it. Now 1-ethoxy-2-arylhydrezono-butene-1, 3dione of (0.01mol) and thiourea (0.01mol) dissolved in (10ml) Sodium ethoxide mixture (freshly prepared) in a 1 liter round bottomed flask. Then fit a reflux condensers to the flask, introduced a few fragments of broken porcelain pieces for boiling the mixture for 30mins, few crystals are appear after 15 minutes and gradually increase in amount as the refluxing is continued. Cool the flask in ice and filter the solution and dry it.

4. In the paper, Synthesis, Characterization and Mutagenic Evaluation of Novel Bromobenzaldehyde derivatives of α- Bezilmonoxime hydrazone, Novel α-Benzil monoximehydrazone-o-bromo benzaldehyde [HBMHoBB], Novel α-Benzil monoximehydrazone-m-bromo benzaldehyde [HBMHmBB], Novel α-Benzil monoximehydrazone-p- bromo benzaldehyde [HBMHpBB], were synthesized and all synthesized Novel compounds can act as good bidented ligands and can be further used for complex formation with metals.

5. In the paper, Transition metal complexes of a Schiff base: synthesis, characterization and antibacterial studies, The ligand HMAGLY coordinates in 1 : 1 and 1 : 2 metal : ligand ratio as a dibasic tridentate (ONO) donor towards all the complexes except Zn(II), where it is a monobasic bidentate (OO) donor.

6. In the paper, Synthesis, Characterization and Biological activity of some Schiff base complexes, The spectral data show that the Schiff base exist as tetradentate ligand by bonding to the metal ion through the phenolic nitrogen and azomethine nitrogen.

7. The paper entitled with 'C3-Benzylation of Indole and Synthesis of Bis (indolyl) methane Catalyzed by Schiff Base Transition Metal Complexes', Schiff base transition metal complexes [M(L2)X2] (C1-C4), [M(L)(PPh3)2X2] (C5-C8) and [M(L)(Phen)X2] (C9-C12) where M= Co (II), Ni(II), Cu(II) and Zn(II), X= Cl, L= 2-Phenyl 3-benzylamino, 1,2 -dihydroquinazolin-4(3H)-one (PBADQ) were synthesized, and all were characterized by IR, 1H NMR, 13C NMR, TGA, BET, ESR and XRD analysis.

Conclusion:

From the above discussion, it is learnt that,

1. Schiff bases have often been used as chelating ligands in coordination chemistry [1, 2], useful in catalysis, medicine as antibiotics and anti-inflammatory agents, and industry for anticorrosion properties. Amino acid-based Schiff bases are very effective metal chelators and their metal complexes are models for a number of important biological systems.

2. All Transition metal complexes were characterized by IR, UV, GC, 1H NMR, 13C NMR, TGA, BET, ESR and XRD analysis.

3. A total of five new metal complex derivatives of 2N-salicylidene-5-(p-nitro phenyl)-1,3,4-thiadiazole, HL with the metal ions Vo(II), Co(II), Rh(III), Pd(II) and Au(III) have been successfully prepared in alcoholic medium. The complexes obtained are characterized quantitatively and qualitatively. spectral study, all the complexes obtained as monomeric structure and the metals center moieties are four-coordinated with square planar geometry except VO(II) and Co complexes which existed as a square pyramidal and tetrahedral geometry respectively.

4. Coordination of a biomolecules to the metal ions significantly alters the effectiveness of the biomolecules. In view of the antimicrobial activity ligand [bis-(2-aminobenzaldehyde)] malonoyl dihydrazone], metal complexes with Cu(II), Ni(II), Zn(II) and oxovanadium(IV) have been synthesized and found to be potential antimicrobial agents.

5. The Novel ligand and its colored metal complexes are having applications in Dyes and Pigment industry.

6. All synthesized novel compounds can act as good bidented ligands and can be further used for complex formation with metals. The pharmaceutical activities of these synthesized compounds such as antibacterial, antimalerial, antifungal, antimicrobial and anticonvulsant can be explored.

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