Structural and Biological Insights into Metal Complexes of Acetaminophen (Paracetamol)

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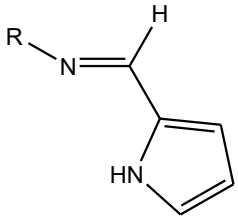
ABSTRACT

A concise overview is projects for bidentate ligand (PCM) with different metal and on their applications in various chemical transformations. Since the nature of ligand can be changed in a variety of ways, appealing routes for designing and preparing novel metal complexes can be foreseen in the future. This review critically summarizes the applications PCM drug as ligand for formation complex and its importance also offers a review of recent work on synthesis, in situ characterization, and applications of metal complex with the general formula $[M(L)_2].nH_2O.X_2$ where M is transition metal. compounds derived from Co, Zn, Fe, Cu and Ni.

***Key Words**: Schiff bases, Metal complexes, Paracetamol, Ligands.*

I. INTRODUCTION

Due to their rising potential as flexible catalysts for organic synthesis and Inorganic chemistry, metal complexes witnessed a spectacular growth during the last decade [1-26]. Several families of traction metal compounds have been prepared and extensively used in a variety of chemical transformations such as enol-ester synthesis, hydration, hydrogenation[26-29], oxidation[30-33] isomerization[34-35.], decarbonylation[36-37], epoxidation[38-39], cyclopropanation[40-42], Diels–Alder reaction[43-45], Kharasch addition [46], olefin metathesis[47-51]. The resultant imines (R_1HC= N–R_2) participate in binding with metal ions via nitrogen lone pair electrons. Like aldehydes, the ketones are also able to form ligands.



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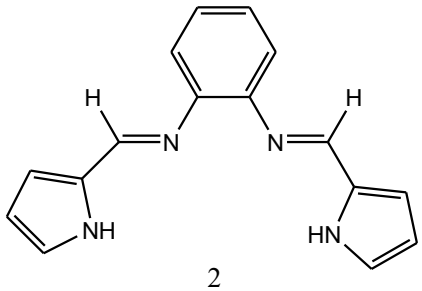

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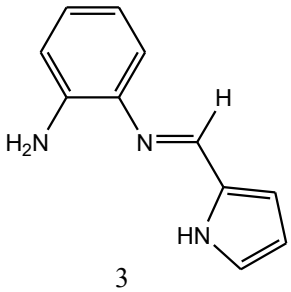

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The mono-**(1)**, di-**(2)**, tri-**(3)** and multi-dentate chelating Schiff base ligands were design according to the binding environments of metal ions. The metal complexes of chiral ligands showed stereoselectivity in organic transformation, hence the synthesis of chiral complexes become an important area of current research in coordination chemistry.

Amudat Lawal and Joshua A. Obaleye gave novel complexes of Co (II), Ni (II) and Fe (III) with aspirin and paracetamol have synthesized and characterized using spectral, melting point and conductivity measurements. The two ligands have been found to act as bidentate chelating agents. Aspirin complexes coordinate through the carbonyl oxygen of the carboxyl and the ester groups, while paracetamol complexes coordinate through the oxygen of the hydroxyl and the amide groups**[52].**

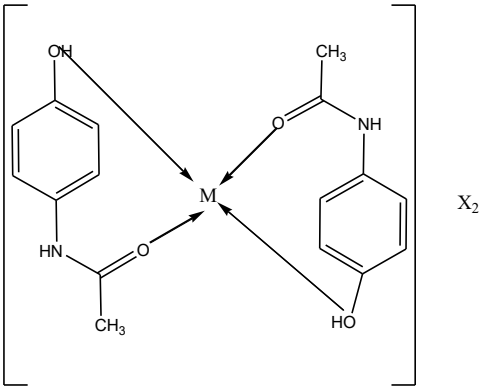

Figure 1: Structure of Paracetamol Meta Complex

A. Lawal, *et al* studied synthesizing copper(II) and zinc(II) complexes of mixed ascorbic acid and nicotinamide and physiochemically characterize by solubility test, melting point, conductivity test, infrared, electronic and proton nuclear magnetic resonance techniques[53].

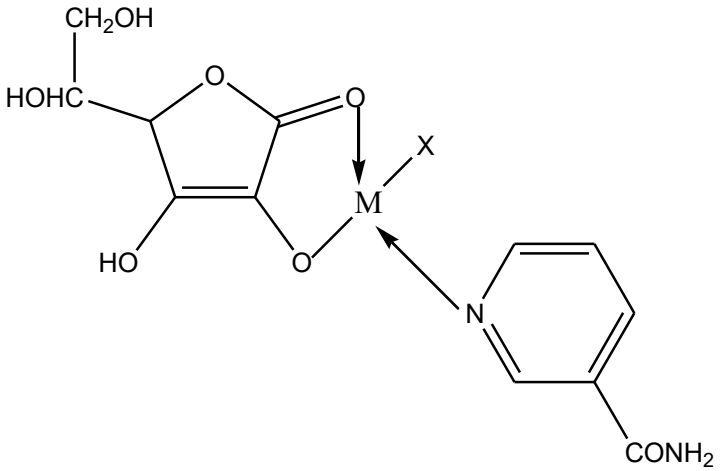

Figure 2: Structure for mixed Ascorbic acid- Nicotinamide metal Complexes

Ionut Ledeti *et al* studied Zn(II)-ACPH coordinative compound and synthesized and characterized by elemental analysis, FTIR spectroscopy and TG-DTG-HF technique. It was proven that the formation of complex occurs by both –OH and – C=O groups from ACPH.[54].

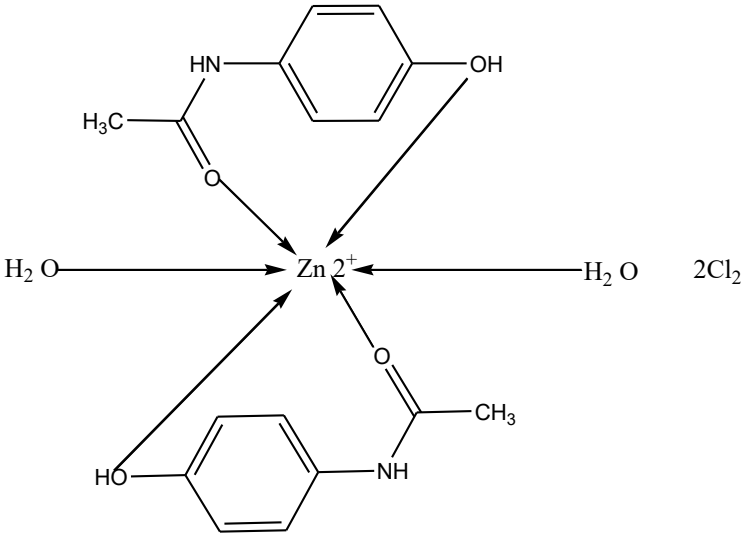

Figure: 3 The Structure of $[Zn(PCM)_2(OH_2)_2]^{2+}$ $2Cl^-$ Complex

Aderoju A. Osowole *et al* studied Heteroleptic metal(II) complexes of Paracetamol (HL) and Vanillin (HL1) mostly analyzed as $[M(L)(HL1)(H_2O)X]$, where X = Cl/NO_3; M = Mn, Co, Ni, Cu and Zn based on percentage metal and conductance measurements. Infrared and electronic spectroscopies, with room temperature magnetic moments indicated a monomeric, 6-coordinate octahedral geometry for all the complexes with the exception of the Cu(II) complex, which was dimeric[55]

Vanillin (4-hydroxy-3-methoxyphenol) is the largest use flavouring agent in foods and medicines. In addition, vanillin has very good antibacterial activity, which is exploited in perfumes and cleaning products [56-57.]. Detailed literature search shows that mixed drug metal complexes of o-vanillin and 4-methylthiosemicarbazone; Aspirin and Paracetamol; Paracetamol and Ibrufen; Aspirin, Paracetamol and Naproxen have been reported [58-60**].**

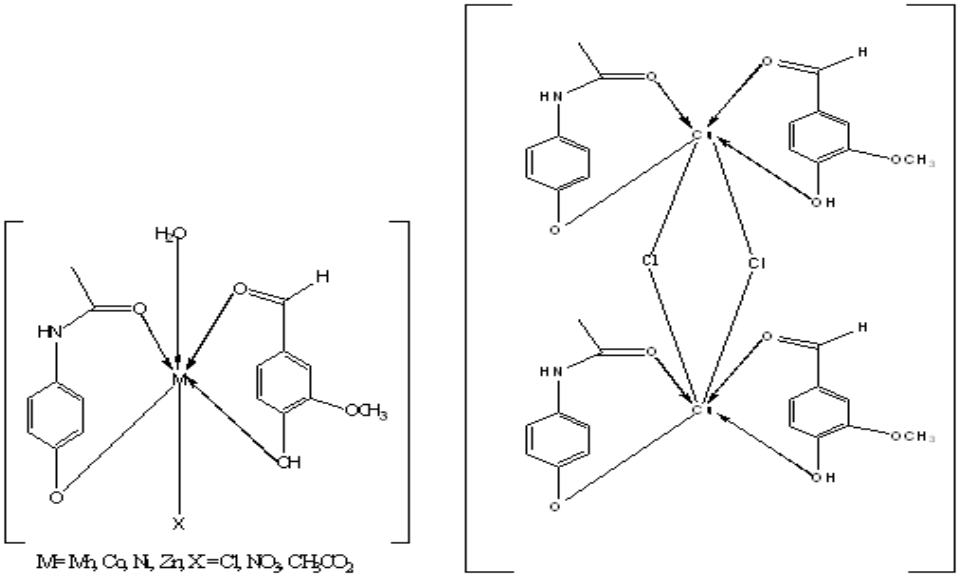

Figure 4: Propose structures for some of the Metal(II) complexes

Aderoju A *et al* in 2015 studied Mn(II), Fe(II), Co((II), Ni(II), Cu(II), Zn(II) mixed ligand complexes of Paracetamol (HL) and Benzoic acid (HL1) considering a six-coordinate octahedral geometry. The molar conductance measurements in DMSO solvent indicated that the metal(II) complexes were covalent. [61]

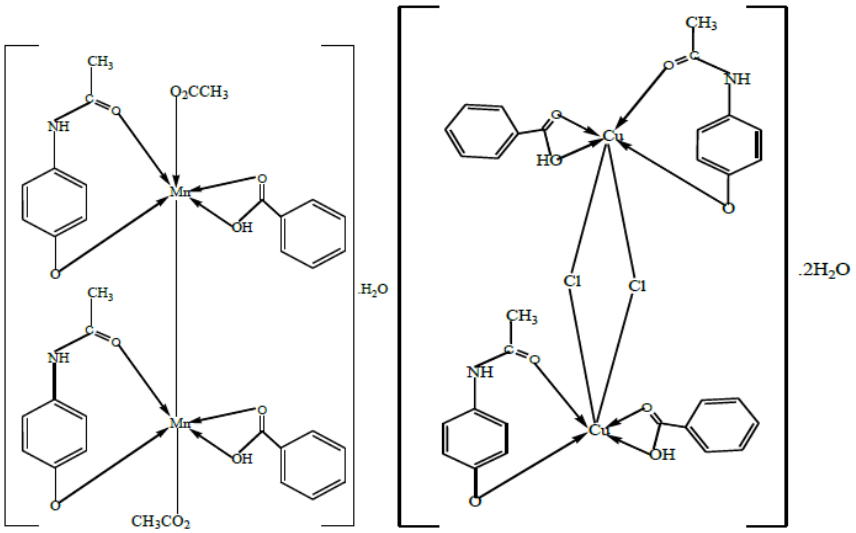

Figure 5: Structures for the Mn(II) and Cu(II) complexes

Organotin (IV) complex of paracetamol have been made in 2:1 ratio through azeotropic removal of H_2O. The spectral studies indicate tetrahedral geometry in metal ion in the paracetamol. In triorganotin complexes of Paracetamol trigonal bipyramidal geometry is observed by authors. They also investigated anti fungal activity of this complexes[62].

Transition metal ions are shows an key role in biological processes in the human body, for example, Nickel (II), Copper (II) and Zinc (II) ions are the most seen transition metals in humans. They are found either at the active sites or as structural components of a good number of enzymes. Metal complexes have been found to be particularly useful because of their potential to bind DNA via a multitude of interactions and to cleave the duplex by their intrinsic chemical, electrochemical and photochemical reactivity. Mixed ligand-metal complexes of Paracetamol and Ascorbic acid were synthesized using $FeCl_2.4H_2O$, $CuCl_2.2H_2O$, $NiCl_2.6H_2O$, $CoCl_2.6H_2O$ and $ZnSO_4$ salts based on two concentrations (3mmol and 5mmol). The complexes were characterized[63]

Antibiotic resistance by microorganisms has triggered the need to discover new antibiotics to replace the old ones. The study was designed to prepare copper-paracetamol complexes which will serve as lead compounds towards the discovery of novel antibiotics. Copper sulphate was reacted with paracetamol in the presence of sodium nitrate in borate buffer to give products which were separated into three layers when extracted with a set of organic solvents[64] and Heterocyclic compounds[65-68]. Authors follows the synthesis of copper paracetamol complex A 0.2 M borate buffer of p^H 8.2 was prepared and used to dissolve exactly 3.19, 1.38 and 3.02 g of $CuSO_4$, $NaNO_2$ and paracetamol in different beakers. All the mixtures were transferred into a dark conical flask and top up to 100 ml. The reaction was stirred at room temperature without heat for 2 h

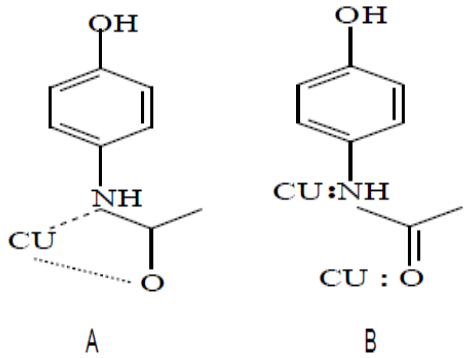

Figure 6. The possible constituents of copper paracetamol products in the yellow extract

II. CONCLUSION

The present paper offers a review of recent work on synthesis, in situ characterization, and applications of metal complex with the general formula $[M(L)_2].nH_2O.X_2$ where M is transition metal. compounds derived from Co, Zn, Fe, Cu and Ni with general introduction followed by synthesis, These types of ligands (PCM) have been widely utilized applications. However, the biological activity of this class of compounds deserves further investigation.

III. ACKNOWLEDGEMENTS

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