



A Review on Biological Activities of Schiff bases and their Metal Complexes

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ABSTRACT

Metal complexes are plays crucial role in chemical sciences and widely used for industrial applications. They are also exhibit a broad range of biological activities including antifungal, antibacterial, anticancer and anti-inflammatory. Generally metal complexes are synthesized using ligands, here literature survey reveals that Schiff base is one of the bioactive key intermediates used for generation of metal complexes. Schiff bases were synthesized by condensation of amino compound with carbonyl compounds and have displayed several biological activities. Additionally Schiff bases are used for industrial application and exhibit several biological activity. In recent days efforts are directed towards the development of a new chemotherapeutic Schiff bases and their metal complexes.

Keywords: Complex, schiff base, metal, biological activites.

I. INTRODUCTION

The chemistry of the carbon-nitrogen double bond plays a vital role in the progresses of chemical science¹. Azomethine group (-C=N-) containing compounds typically known as Schiff bases. Schiff bases form a significant class of compounds in medicinal and pharmaceutical chemistry with several biological applications that include antibacterial²⁻⁶, antifungal³⁻⁶, antitumor^{7,8}, anticonvulsant⁹, anti HIV¹⁰ and anti-inflammatory¹¹ activities. Another important role of Schiff base structure is in transmination¹².

Conventionally Schiff bases have been prepared by refluxing mixture of the amines and the carbonyl compounds in organic solvent for example, ethanol or methanol¹³. The conventional method has been modified to obtain high yields of the Schiff bases by using aprotic non-polar solvents^{14, 15}, azotropic removal of water in a Dean-Stark apparatus, trace of acid¹⁶ and or by adding suitable dehydrating agents^{17,18}.

Schiff bases is one of the bioactive key intermediate and have been studied extensively as a class of ligands¹⁹⁻²¹ and are known to coordinate with metal ions through the azomethine nitrogen atom. Schiff base complexes related to synthetic and natural oxygen carriers²². Metal complexes make these compounds effective as stereo specific catalysts towards oxidation, reduction, hydrolysis, biological activity and other transformations of organic and inorganic chemistry²³. Moreover, the incorporation of transition metal into Schiff bases enhances the biological activity of the ligand and decreases the cytotoxic effects of both the metal ion and ligand on the

host²⁴. Literature reveals that Schiff bases continue to occupy an important position as ligands in metal coordination chemistry^{25, 26} even almost a century since their discovery.

In view of the synthetic and therapeutic utilities of Schiff bases and their metal complexes, now days effort are directed towards the synthesis and biological activities of metal complexes using Schiff bases as ligand.

Biological Importance of Metal Complexes

A large number of metal complexes of Schiff bases have been displayed wide range of biological activities. Four Platinum(II) Schiff bases complexes containing of salicylaldehyde and 2-furaldehyde with *o*- and *p*-phenylenediamine Gaballa et al.²⁷ were reported as antibacterial against *E. coli*, *Bacillus subtilis*, *P. aeruginosa*, *Staphylococcus aureus*. The activity data show that Platinum(II) complex are more potent antimicrobials than the parent. El-Sherif and Eldebss²⁸, have been reported 2-Aminomethylthiophenyl-4-bromosalicylaldehyde Schiff base and its metal complexes have been screened for their antimicrobial activities using the disc diffusion method against bacteria, the results of antimicrobial activity show that the metal complexes exhibit antimicrobial properties and they show enhanced inhibitory activity compared to the parent ligand under experimental conditions.

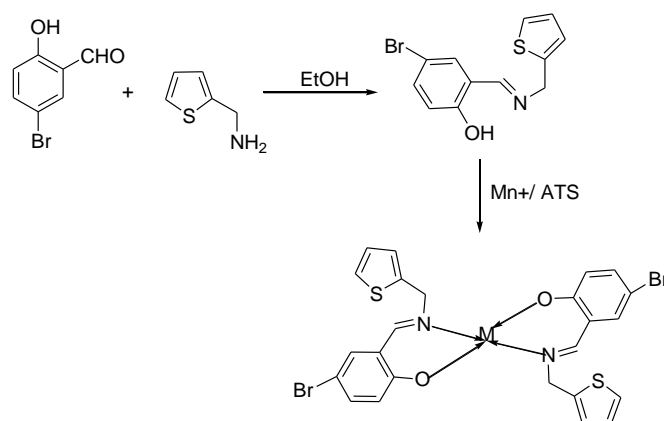


Fig:- 1

Raman et al.²⁹ Prashanthi et al.³⁰ have been studied the fungal activity of metal complexes of Cu(II), Ni(II) and Co(II) with Schiff bases of 3-(2-hydroxy-3-ethoxybenzylideneamino)-5-methyl isoxazole and 3-(2-hydroxy-5-nitrobenzylidene amino)-5-methyl isoxazole the complexes gave better results against growth of fungi. platinum(II) complexes of reduced amino acid Schiff bases as potential anticancer agents and characterized them by ¹H NMR, EA, MS, IR, and molar conductivity. These compounds were tested for their DNA interaction with salmon sperm DNA, and their in vitro anticancer activities have been validated against HL-60, KB, BGC-823, and Bel-7402 cell lines by the MTT assay. The cytotoxicity of one complex (5g) is better than that of cisplatin against BGC-823 and HL-60 cell lines, and show close cytotoxic effect against Bel-7402 cell line. Li et al.³¹

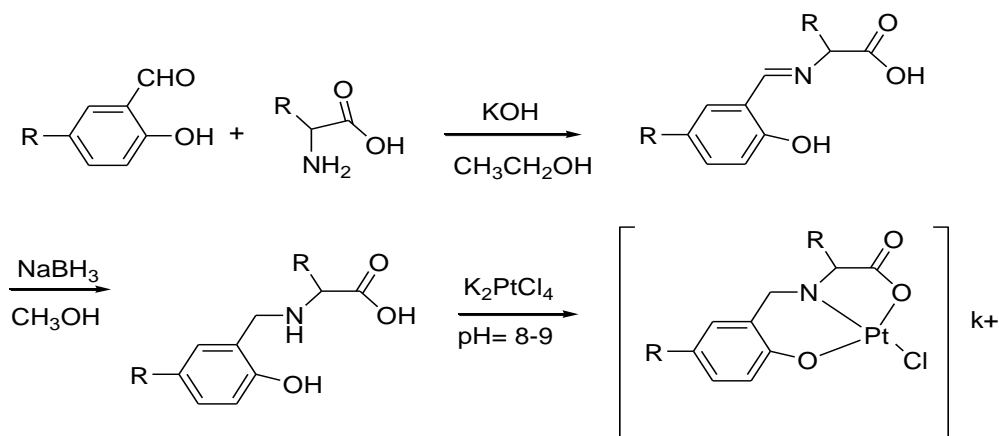


Fig:- 2. In 2014, Nura Suleiman et al.³² were reported anticancer activities of morpholine Schiff bases and their metal complexes.

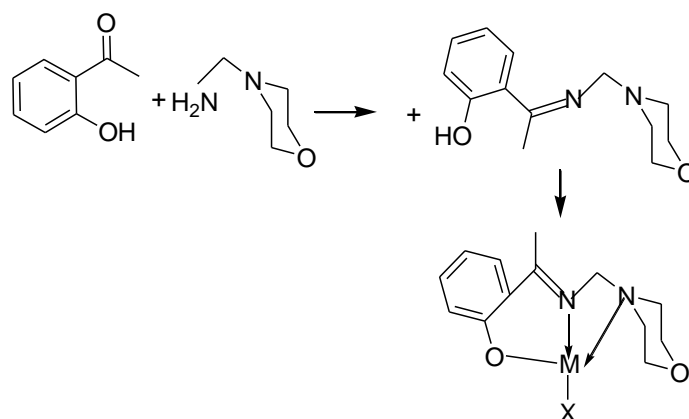


Fig:- 3

In 2010 Nirmal et al.³³ were synthesized A series of novel 3-(4-(benzylideneamino) phenylimino) 4-fluoroindolin-2-one derivatives The title compounds (N₁-N₁₀) were evaluated for analgesic, anti-inflammatory, and ulcerogenic index activities. Results displayed that compound N₃ exhibited significant analgesic activity. Among the title compounds studied, N₂, N₃, and N₈ exhibited significant anti-inflammatory activity comparable to reference standard. Antimicrobial studies of transition metal complexes of N-amino quinolone derivatives has been studied by Redha I. et al.³⁴

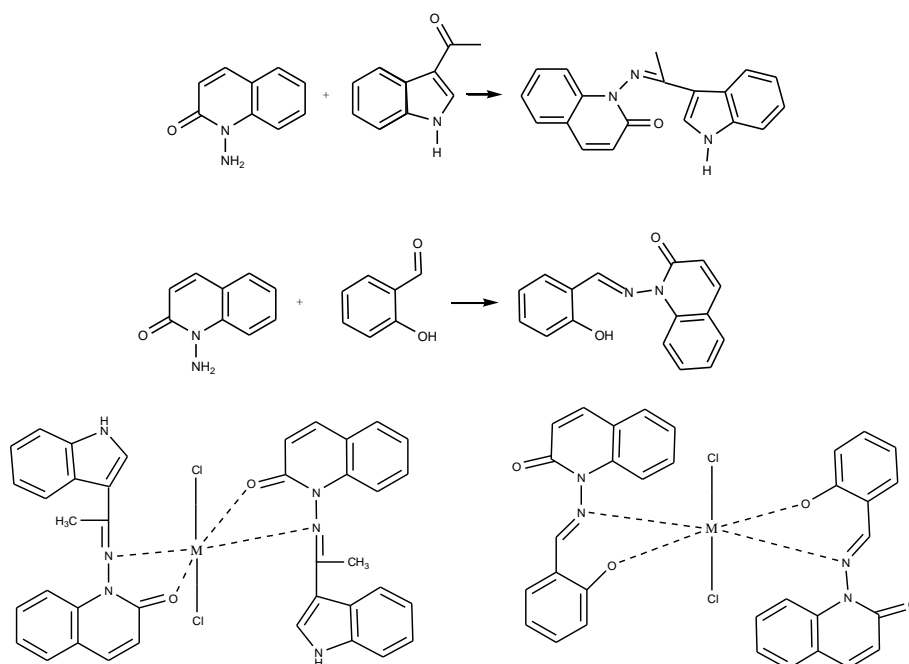


Fig:- 4

A.S. Thakar, H.B. Friedrich and K.T. Joshi³⁵ were reported novel Schiff bases derived from sulfadoxine and studied their antibacterial activity. The metal complexes had a higher antibacterial activity than the free ligand. Such increased activity of the metal complexes can be explained on the basis of the overtone concept³⁶ and chelation theory³⁷.

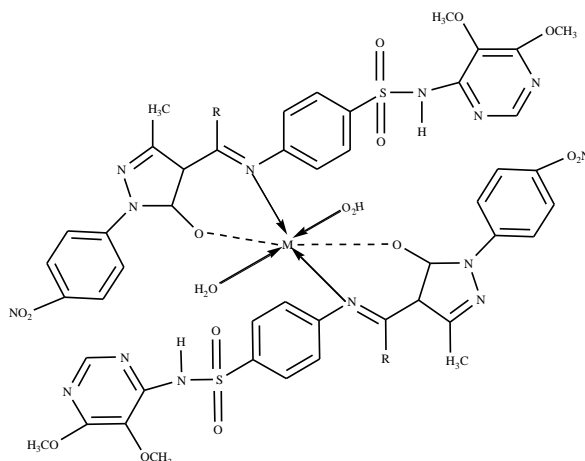


Fig:- 5

In 2014, Abhay Nanda Srivastava, Netra pal Singh and Chandra Kiran Shrivastaw³⁸ synthesized bioactive binuclear transition metal complexes of a Schiff bases ligand derived from 4-amino-1h-pyrimidine-2-one, diacetyl and glycine and some of the complexes displayed antibacterial and antifungal activities.

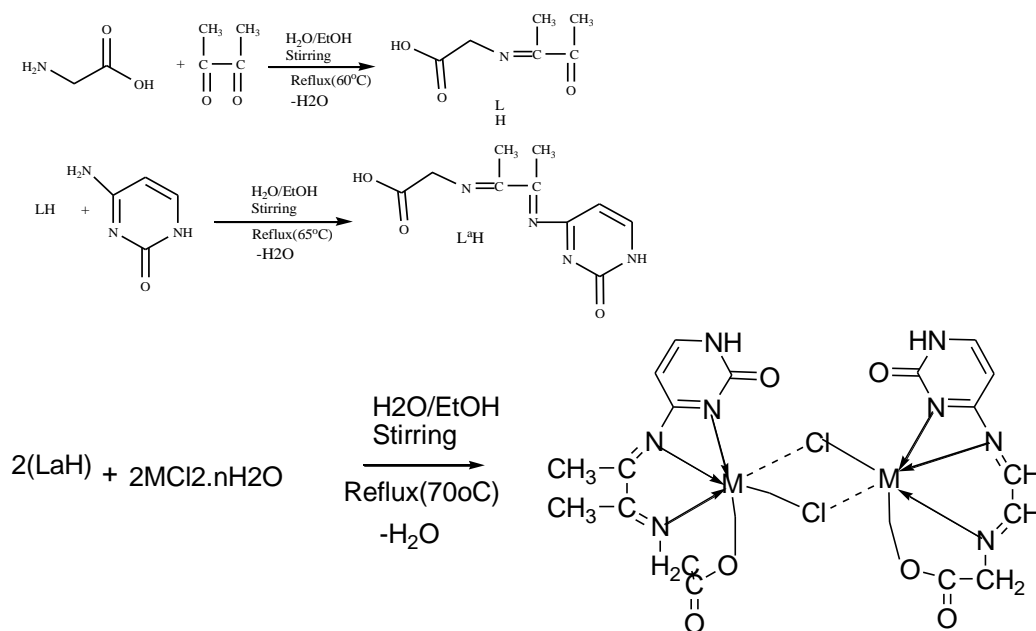


Fig:- 6

EmadYousif, MAhmed Majeed³⁹ and other co-researches reported metal complexes with antibacterial activity and indicated that all the complexes obtained showed a moderate activity against the tested bacterial strains and slightly higher activity compared to the ligand.

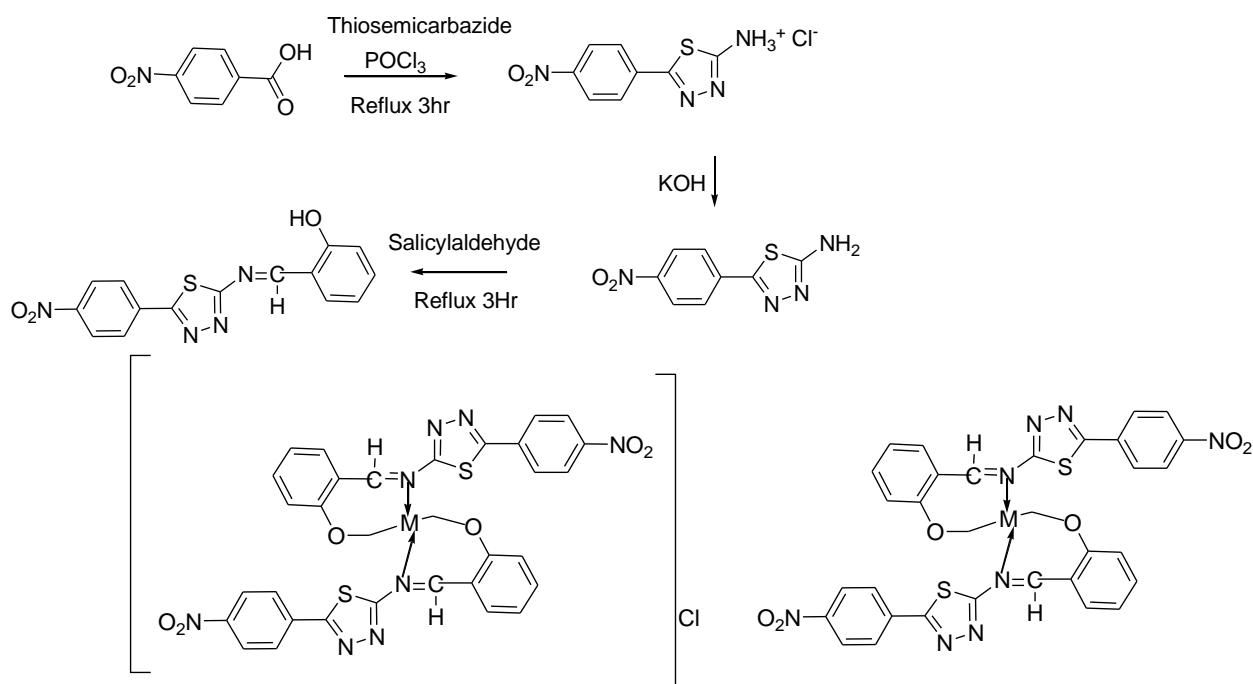


Fig:- 7

K. Babu and P. Amutha⁴⁰ reported the new Cu(II) and Ni(II) complexes of Schiff bases⁴⁹ showed good antibacterial activity.

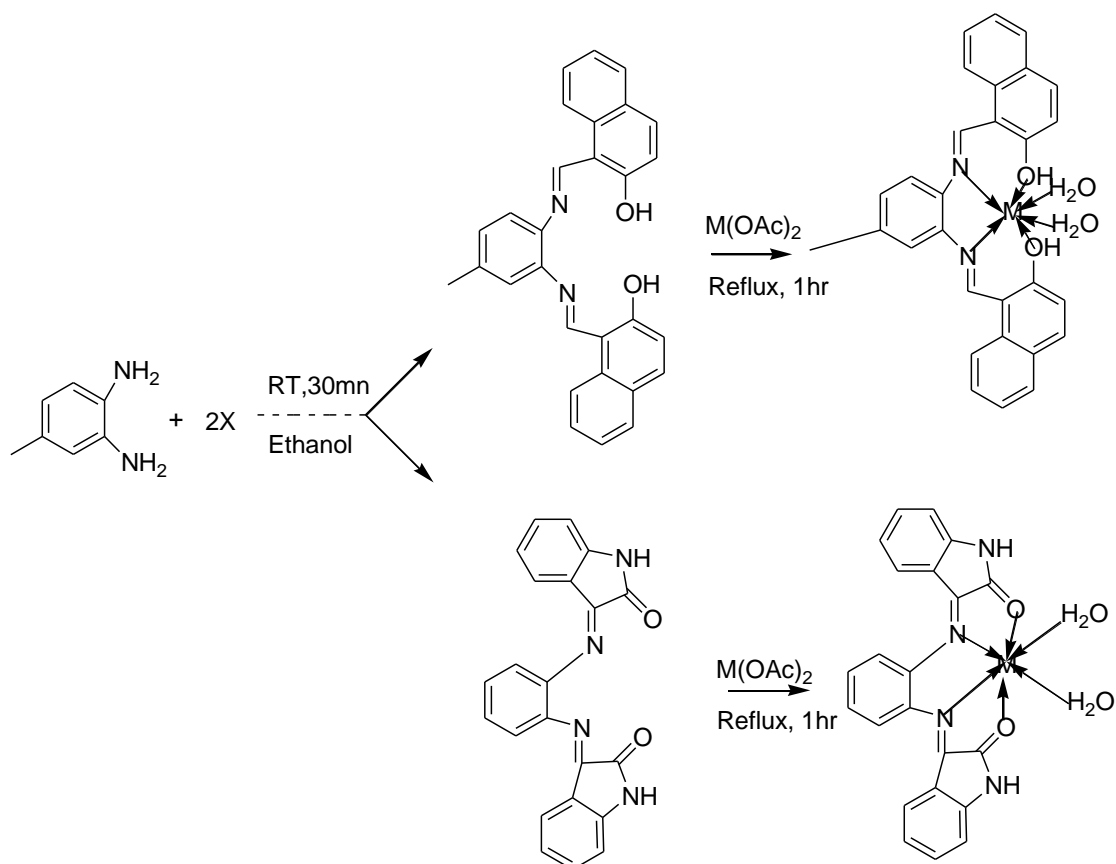


Fig:- 8

Conclusions:

The incorporation of transition metal into Schiff base have been studied extensively as a class of ligand, enhance the biological activities of the ligand and decreases the cytotoxic effects of both the metal ion and ligand on the host. Therefore recently more attention has been directed on the synthesis of metal complexes using bioactive Schiff base.

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