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REVIEW ARTICLE

A Mini Review on Synthesis and Antimicrobial Activities of Schiff Base Derivatives of Thiazole and their Complexes

Garima Shrivastava*, Manjul Shrivastava

Government M.H. College Jabalpur, M.P., India.

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ABSTRACT

Schiff bases are the most widely used organic compounds. Schiff bases are synthesized from the condensation of primary amines with carbonyl groups. Schiff bases derived from Thiazole act as good ligands to transition metal ions and they exhibit several coordination modes. These moieties and their derivatives have long been used as precursors for the synthesis of biologically active molecules since they possess wide spectrum of activity. This review summarizes the synthesis and biological activities of thiazole containing Schiff bases and its complexes.

KEYWORDS

Nematicidal, Potentiometrically, Schiff Bases, Significant Activity , Biologically Active

INTRODUCTION

Compounds containing an azomethine group (-CH=N-), known as Schiff bases are formed by the condensation of a primary amine with a carbonyl compound. Schiff bases of aliphatic aldehydes are relatively unstable and are readily polymerizable while those of aromatic aldehydes, having an effective conjugation system, are more stable[1].

Some Schiff bases bearing aryl groups or heterocyclic residues possess excellent biological activities, which has attracted many researchers' attention in recent year[2]. They have been reported to use as analgesic[3-4], antibacterial[5-8], antituberculer[9-12], arthritis[13], anti-viral[14-15], antiinflammatory[16-19], anti-hypertensive[20-21], and anticancer[22-25]. They also serve as a back bone for the synthesis of various heterocyclic compounds. Schiff Bases are good chelating agents;

***Address for Correspondence:**
Garima Shrivastava,
Government M.H. College Jabalpur,
M.P., India.
E-Mail Id: garima19shrivastava@gmail.com

Generally bi- or tri- dentate ligands are more capable of forming very stable complexes with transition metals[26].

Thiazole and its derivatives as Schiff base ligands with potential sulphur and nitrogen bands are interesting and have gained special attention not only the structural chemistry of their multifunctional coordination modes but also of their importance in medicinal and pharmaceutical field.

Schiff bases represent an important class of compounds because they are utilized as starting materials in the synthesis of industrial products[27].

This review concentrates on the synthesis and biological activity of Schiff bases of thiazole and its complexes.

S. V. Rajmane et al have reported the synthesis and characterization of a new Schiff base ligand .The free schiff base ligand were screened for their *in vitro* nematicidal and molluscicidal activities. The results indicated that the Schiff base Ligand show significant activity[28].

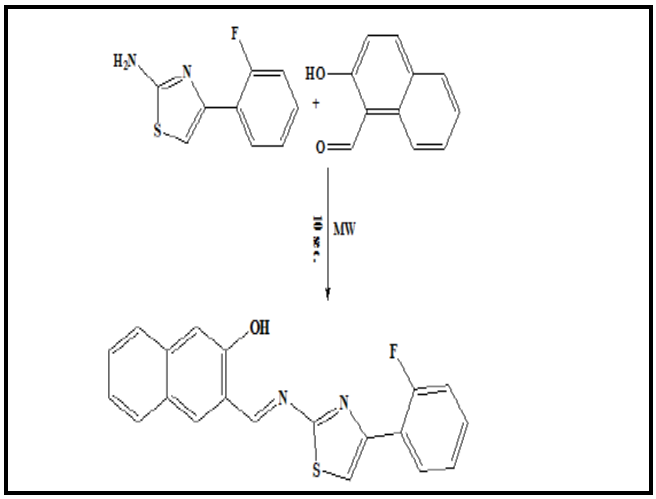

Figure 1

The metal complexes of Schiff base Ligand salicylidene–4–chlorophenyl–2–aminothiazole, have been prepared and characterized by different spectral and physical techniques. The Protonation constants of Schiff base and stability constants of their binary metal complexes have been determined by potentiometrically[29].

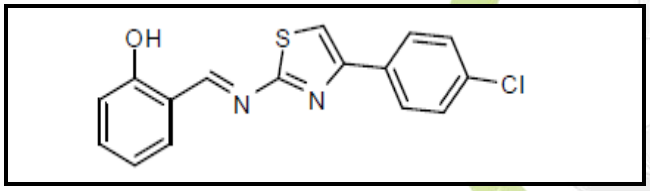

Figure 2

A series of biologically active thiazole derived tridentate Schiff-base Ligands have been synthesized by the condensation of 2-Aminothiazole with substituted salicylaldehyde. Then their Ni(II),Cu (II),Zn(II),complexes have been prepared.

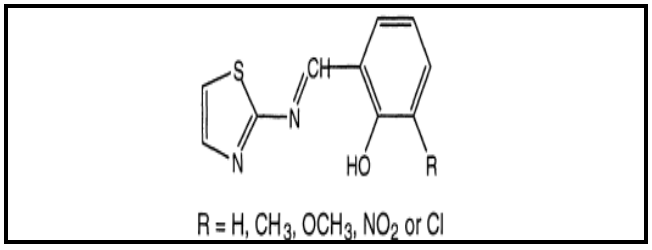

Figure 3

The biological evaluation of the Schiff-bases and their metal chelates have been determined against Escherichia coli, Staphylococcus aureous, Pseudomonas aeruginosa and Klebsiella pneumonae and in comparison, the metal chelates have been shown to possess more antibacterial activity than the free Schiff-bases[30].

A. S. Thakar et al have studied the synthesis and antibacterial activity of some Schiff base complexes. The schiff base metal complexes shows moderate antibacterial activity[31].

The transitional metal complexes of Cu(II), Co(II), Ni(II) and Zn(II) with a new Schiff base, N-(4-phenylthiazol-2-yl)-2- (thiophen-2-ylmethylene) hydrazinecarboxamide formed by the condensation of N-(4-phenylthiazol-2-yl) hydrazinecarboxamide with thiophene-2-carboxaldehyde was synthesized and characterized by elemental analysis, FT-IR, 1H NMR, mass, UV-visible and ESR spectral techniques. All the new prepared compounds have been tested against antioxidant activity. The results shows that Schiff base ligand (L), Cu(II) and Co(II) complexes have significant antioxidant activity[32].

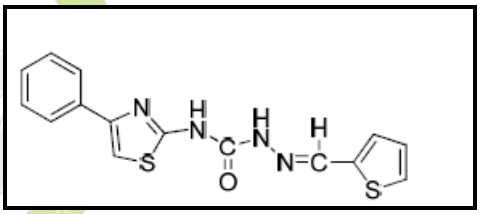

Figure 4

Jafar Attar Gharamaleki et al, have reported the synthesis of schiff base metal complexes of Co(II), Cu(II) in etanol using schiff base derived from bis-[2-amino-4-pheny1-5-thiazolyl] disulfide with 5-nitro-salicylaldehyde. FT-IR, 1H NMR, 13C NMR, UV-Vis, elemental analysis and single crystal X-ray diffraction were used to confirm the structure of the compounds. Spectral data shows that Co(II) complex in which two 5-nitro-salicylaldehyde and two DMSO molecules were coordinated to the central metal in an octahedral fashion[33].

Preparation, physical characterization and anticancer activity of Co^{II}, Ni^{II}, Cu^{II}, and Zn^{II} Schiff base complexes was reported by Mokhles M et al[34].

J. Senthil Kumaran et al have reported the synthesis of a series of transitional metal

Schiff base complexes. Several physical in particular elemental analyses, molar conductance values, magnetic moments, FT-IR, 1H-NMR, Mass and electronic absorption data were used to investigate the chemical structure of the complexes. The results indicate that Schiff base is found to act as tridentate ligand leading to an octahedral geometry of the complexes.DNA study shows that cobalt and copper complexes are bound to the "Minor groove" and nickel and zinc complexes are bound to the "Major groove". The all prepared compounds were assayed for antibacterial activities against Pseudomonas auroginosa and Proteus vulgaris by well-diffusion method .The results shows that the metal complexes exhibited higher activity than the Ligand[35].

Synthesis and pharmacological studies of novel Schiff bases of 3-(5-nitrothiazol-2-ylimino) methyl)-4-methoxyphenol and 3-(5-ethyl-1,3,4-thiadiazol- 2-ylimino)methyl)-4-methoxyphenol was reported by Vinusha HM et al[36].

Saleh A.Ahmed and coworker have reported here in the synthesis of cobalt (II), nickel(II)and copper(II)complexes of bidentate Schiff bases and also establish Octahedral structures for metal complexes[37].

R. Karki1 et al have reported the synthesis of a series of novel Schiff base derived by the condensation of 2-amino-4-(o-chloro anilino)-1, 3-thiazole with various substituted aromatic aldehydes in presence of sodium methoxide. These new compound characterized by UV, IR, 1H NMR, mass spectra and elemental analysis. These compounds were screened for in vitro antibacterial and antifungal activity against Staphylococcus aureus, Bacillus subtilis and Gram negative bacteria like Escherichia coli and Klebsiella pneumonia, Candida albicans and Aspergillus niger. The result shows that compound 3e show significant activity[38].

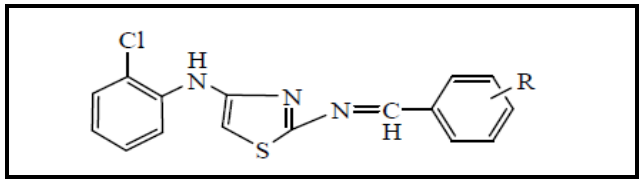

Figure 5

The complexes of CoII, NiII, CuII and Zn II with Schiff bases N-bis-(salicylidene)-2-4-diamino-5-chlorothiazole and N-bis-(5- methylsalicylidene)-2-4 diamino-5-chloro-thiazole was synthesized and characterized by elemental analysis, UV-visible and infrared spectra, magnetic susceptibility and conductivity measurement. Biological screening of the complexes reveals that the Metal complexes show antibacterial, antifungal and pesticidal activities higher than free ligand[39].

Co (II) and Zn (II) Metal Complexes of the Schiff base derived from the reaction of Benzoinoxime primary ligand with heterocyclic compounds such as 2-aminothiazole and 8-hydroxyquinoline. .the schiff base Ligand and their complexes were characterized by IR, UV-Vis, and XRD data. The results obtained indicate that the complex shows a distorted octahedral geometry to mononuclear Co (II) complexes of mixed ligands, while square planner geometry to mononuclear Co (II) complexes of oximes. Zn (II) complexes of mixed ligands shows a distorted octahedral geometry, while square planner geometry to mononuclear Zn (II) complexes of oximes. The Schiff base and most of the metal complexes display antimicrobial activity[40].

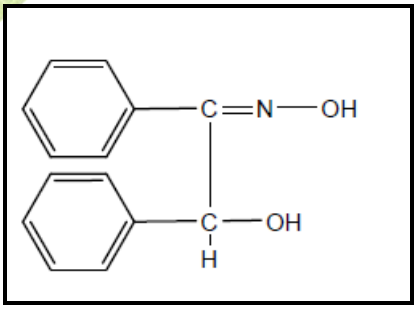

Figure 6

A.P.mishra et al have reported the synthesis of new Co(II), Ni(II) and Cu(II) complexes formed by the reaction of 2-acetonaphthone with 2-Amino-4-chlorophenol, 2-amino-4-methylbenzothiazole and 2-aminothiazole .The free Schiff base and their complexes have been screened for antimicrobial activities and the results shows that the complexes are more potent than their Schiff base ligands[41].

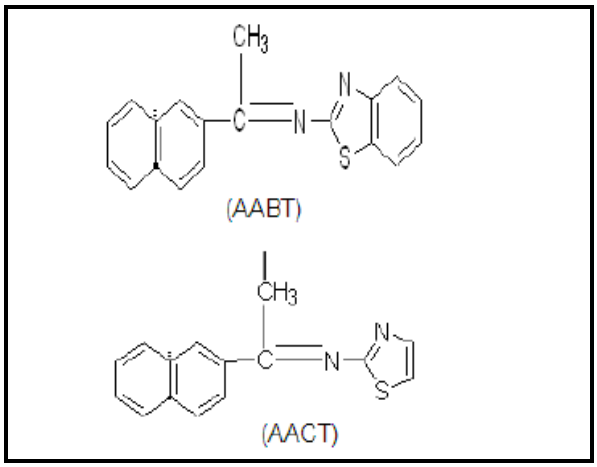

Figure 7

Rajendra Jain have reported the microwave synthesis of Cr(III), Co(II), Ni(II) and Cu(II) complexes of bidentate Schiff bases ligands derived from N- (4-chlorobenzylidene)-5-methyl-1,3-thiazol-2-amine and N-[4-(dimethylamino)benzylidene]-6-nitro-1,3-benzothiazol-2-amine .the all prepared compounds assayed tof antibactiril (Gram-positive bacteria; Staphylococcus aureus and Gram-negative bacteria; Escherichia coli) and antifungal (Aspergillus niger and Candida albicans)activities by disc diffusion method .the results shows that biological screening of the complexes reveals that the Schiff base metal complexes show significant against all microorganism[42].

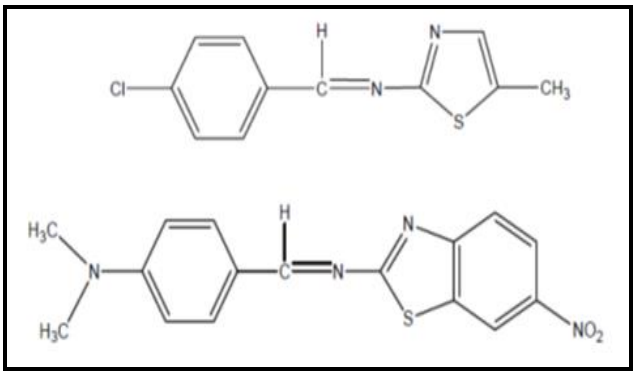

Figure 8

A. P. Mishra et al have reported the synthesis, characterization and biological studies of Cr (III), Co(II), Ni(II) and Cu(II) derived from 5-bromosalicylaldehyde with 2-amino-5-nitrothiazole and 4-dimethylaminobenzaldehyde with 2-amino-3-hydroxypyridine[43].

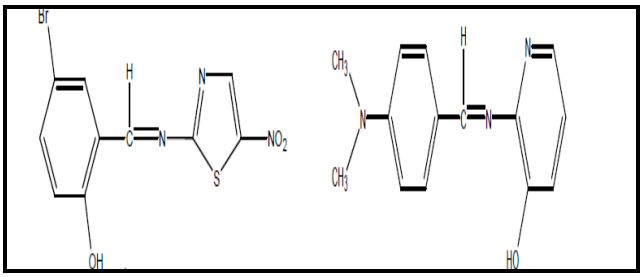

Figure 9

Zeki A. et al have studied the synthesis and antibacterial activity of mefenamic acid with hydrazine hydrate[44].

Saalman M. have reported the synthesis of schiff base ligands containing a trifunfunctional SNO-donor systems and their Co, Ni, Cu and Zn complexes[45].

Schiff base ligands (containing –S-S linkage) and their complexes of Co(ll), Cu(ll) have been reported and characterized by various spectroscopic methods such are FT-IR, H NMR, 13C NMR, UV-Vis, elemental analysis and single crystal X-ray diffraction[46].

Niranjan La et al, have reported the synthesis of metal complexes of Mn (II), Co (II), Ni (II) and Zn (II) from Schiff base Ligand derived from 4-dimethyl amino benzylidene with 2 - Amino - 4 - p- ethoxy phenyl thiazole. These compounds were screened for in vitro antibacterial and antifungal activity against E.Coli, B.subtilis, S.typhi, S.aureus and A.niger. All the compounds were reported to exhibit moderate to good antibacterial and antifungal activity[47].

Zahid H. et al, have reported the synthesis of tridentate Schiff bases and their complexes .the author observed that the complexes synthesized by them show good antimicrobial activity than free Ligand[48].

R. P. Saini et al have reported the synthesis of complexes of a tetradentate Schiff base from the condensation of malonyl hydrazide with dehydroacetic acid. These complexes have been characterized by elemental analysis and spectral analysis, UV–Visible, ^{1}H and ^{13}C NMR, IR spectroscopy and mass spectrometry. The antibacterial properties of the compounds were

investigated against gram-positive and gram-negative bacteria[49].

Mokhles M et al, have studied the synthesis and anticancer activity of some Schiff base complexes. The results shows that Zn complexes are potent than other[50].

M. A. Neelakantan and coworkers have studied the synthesis and antimicrobial activity of some Schiff base complexes. The Schiff bases and their complexes showed greater activity[51].

CONCLUSION

Thiazoles are a unique moiety that is responsible for various biological activities. This article highlighted research work of many researchers reported in literature for different pharmacological activities on synthesized Schiff base of thiazole and their metal complexes. More investigations must be carried out to evaluate more activities of Schiff base of thiazole for many diseases whose treatment are difficult in the medical sciences. This has been noticed so far, that modifications on thiazole moiety results in the formation of compounds with valuable biological activities. It will be interesting to observe that these modifications can be utilized as potent therapeutic agents in future. Thus many more modifications on thiazole moiety can be possible and needs to be continued for the use of mankind. In this review, the biological activities of thiazole Schiff base and their complexes are summarized from 2000-2016.

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