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COMPARITIVE STUDY OF ANTIMICROBIAL ACTIVITY OF METAL COMPLEXES OF VARIOUS SCHIFF BASES DERIVED FROM 2-AMINO METHYL BENZIMIDAZOLE

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***ABSTRACT*:** Schiff bases(BNTM,BCTM,BMOM) derived from 2-aminomethyl benzimidazole.2HCl and The metal ions proposed for the work include Mn(II), VO(II), Co(II), Ni(II), Cu(II) and Zn(IThe new Schiff base and the complexes were tested for in vitro antibacterial activity against Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa using diffusion method. The Schiff base and the complexes exhibited varying degrees of inhibitory effect on the growth of the tested bacterial species. The values reveal that the Schiff base became more effective when coordinated to the metal ions. Among all the metal complexes, Co(II)-BNTM exhibited higher inhibitory effect on the growth of the tested bacterial species.

***Index Words*: Schiff bases, Inhibitory effect, diffusion method**

1. INTRODUCTION

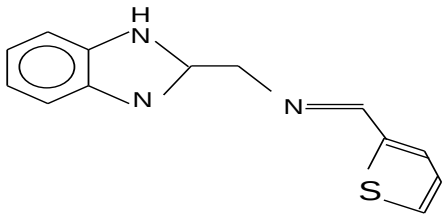
Metal complexes play an important and diversified role in biological systems. Studies of metal complexes are now part of the highly expanding field, bio-inorganic chemistry. Metal complexes have been used as diagnostic and therapeutic agents. Many metal complexes, especially those of Schiff bases, have been studied from the point of view of using them as antibacterial and anticancer drugs. Schiff bases have been playing an important role in the development of coordination chemistry. Schiff base metal complexes have been studied extensively because of their attractive chemical and physical properties and their wide range of applications in numerous scientific areas. Schiff base and their complexes have a wide range of applications. They are useful in biological field, as anticancer, antitumor, anti-tuberculosis, anti-malarial agents and also they are found to have analytical applications[1-4].

In the present study, metal complexes of ligands derived from the condensation of 2-Aminomethyl benzimidazole with thiophene-2-carbaxaldehyde, substituted benzaldehydes are synthesized and compared their antimicrobial activity.

METHODOLOGY

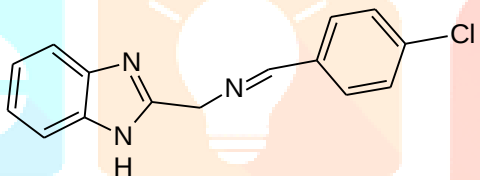
Schiff bases derived from 2-aminomethyl benzimidazole.2HCl and The metal ions proposed for the work include Mn(II), VO(II), Co(II), Ni(II), Cu(II) and Zn(II).The complexes were characterized on the basis of elemental analysis , melting/decomposition temperature, TGA, molar conductivity measurements, spectral (IR, UV–Vis, ESR) studies and magnetic susceptibility measurements. Finally, the application of the complexes was studied with respect to their antimicrobial activities.

Schiff bases derived from 2-aminomethyl benzimidazole.2HCl and Thiophene-2-Carbaxaldehyde is named as (1-(1*H*-benzimidazol-2-yl)-*N*-[(*E*) thiophenylmethylidene]methanamine-BNTM.



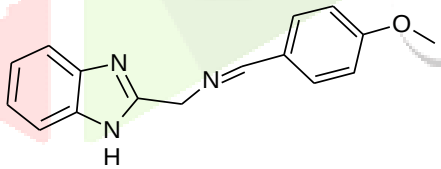
Schiff bases derived from 2-aminomethyl benzimidazole.2HCl and Chloro Benzaldehyde is named as

(1-(1H-benzimidazol-2-yl)-N-[4-chlorobenzylidene) methanamine-BCTM.



Schiff bases derived from 2-aminomethyl benzimidazole.2HCl and methoxy Benzaldehyde is named as

-(1*H*-benzimidazol-2-yl)-*N*-(4-methoxybenzylidene)methanamine-BMOM



The new Schiff base and the complexes were tested for in vitro antibacterial activity against Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa using diffusion method18. The diffusion method requires filter paper disks, the medium used is muller hinton agar with 2% of glucose and the diameter of inhibition zone is visually read at 24 h after incubation at 37ºC. The compounds were added on to the filter paper containing this medium. The antimicrobial activity was estimated on the basis of the size of inhibition zone formed around the paper disks on the seeded agar plates. Streptomycin was used as standard. DMSO was used as solvent control for antimicrobial activities.

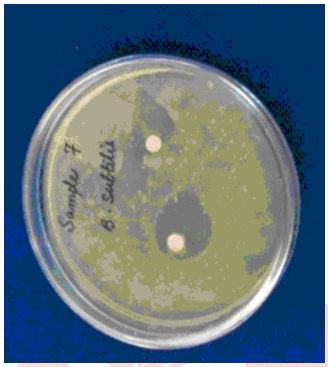
3. RESULTS AND DISCUSSION:

Antibacterial activity of the BNTM metal complexes were screened against pathogenic bacteria and the diameter of the zone is given in the table 1. Co(II)-BNTM complex has shown good activity against all the microorganisms. Zn(II)-BNTM is only active against S.Aureus.

Table 1-Antibacterial activity of BNTM metal complexes

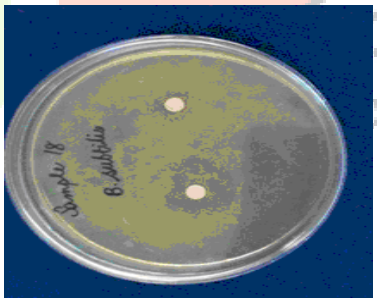
Compound(50µg)	B.Subtilis	E.Coli	P.Aerugunosa	S.Aureaus
BNTM	12mm	12mm	11mm	13mm
Cu(II)-BNTM	19mm	14mm	19mm	17mm
Co(II)-BNTM	22mm	25mm	24mm	25mm
Ni(II)-BNTM	20mm	16mm	16mm	16mm
VO(II)-BNTM	16mm	18mm	17mm	16mm
Mn(II)-BNTM	20mm	18mm	21mm	14mm
Zn(II)-BNTM	----	-----	-----	14mm

E.Coli of VO(II)-BNTM



B.Subtilis of Cu(II)-BNTM

S.Aureus of Zn(II)-BMOM



B.Subtilis of Mn(II)-BCTM

Antibacterial activity of the BCTM and the diameter of the zone is given in the table.2.VO(II)-BCTM complex has shown good activity against all the microorganisms. Co(II)-BCTM is inactive against all bacteria.

Table 2 Antibacterial activity of BCTM metal complexes:-

Compound(50µg)	B.Subtilis	E.Coli	P.Auregunosa	S.Aureaus
BCTM	0	14mm	16mm	14mm
Cu(II)-BCTM	12mm	13mm	10mm	12mm
Co(II)-BCTM	0	0	0	0
Ni(II)-BCTM	0	22mm	0	16mm
VOIV)-BCTM	18mm	22mm	14mm	16mm
Mn(II)-BCTM	20mm	12mm	12mm	10mm
Zn(II)-BCTM	16mm	17mm	19mm	18mm

Antibacterial activity of the BMOM and the diameter of the zone is given in the table 3. Cu(II)-BMOM complex has shown good activity against all the microorganisms except B.Subtilis. VO(II)-BMOM is only active against S.Aureus.

Table 3 Antibacterial activity of BMOM metal complexes

Compound(50µg)	B.Subtilis	E.Coli	P.Aeruginosa	S.Aureus
BMOM	8mm	8mm	8mm	7mm
Cu(II)-BMOM	0	20mm	25mm	24mm
Co(II)-BMOM	12mm	20mm	16mm	19mm
Ni(II)-BMOM	16mm	16mm	16mm	16mm
VO(II)-BMOM	0	20mm	0	0
Mn(II)-BMOM	16mm	17mm	18mm	
Zn(II)-BMOM	12mm	17mm	17mm	

Comparitive study of the growth inhibition zone of Schiff bases and their metal complexes indicate that metal complexes exhibit higher antibacterial activity than the free ligand and this is probably due to the greater lipophilic nature of the complexes. Such increased activity of the metal chelates can be explained on the basis of Overtone's concept[5] and Tweedy's chelation theory[6].According to Overtone's concept of cell permeability, the lipid membrane that surrounds the cell favours the passage of only lipid soluble materials due to which lipo solubility is considered to be an important factor that controls the antimicrobial activity.

According to Tweedy's chelation theory, On chelation , The polarity of the metal ion will be reduced to a greater extent due to the overlap of the ligand orbital and partial sharing of positive charge of the metal ion with donor groups[7].Further it increases the delocalization of the π electrons over the whole chelate ring and enhances the lipophilicity of the complex .The

increased lipopilicity enhances the penetration of the complexes into lipid membrane and thus blocks the metal binding sites of microorganisms[8].These metal complexes also disturb the respiration process of the cell and thus block the synthesis of proteins, which restricts further growth of the organism[9]. The variation in the activity of different complexes against different organisms depend either on the impermeability of the cells of the microbes or difference in ribosomes of microbial cells.

4. CONCLUSION:

In the present study, comparative study of antibacterial activity of 18 metal complexes derived from three different Schiff bases derived fron 2-Amino methyl benzimidazole against 4 different microbes is done. It was observed that Co (II)-BNTM has showed good activity against B.Subtilis, E.Coli and S.Aureus compared to all other metal complexes. Cu (II)-BMOM has shown notable activity against P.Aeruginosa compared to all other metal complexes.

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