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Biological Studies on Some Coordination Compound of Metals with Tetracycline

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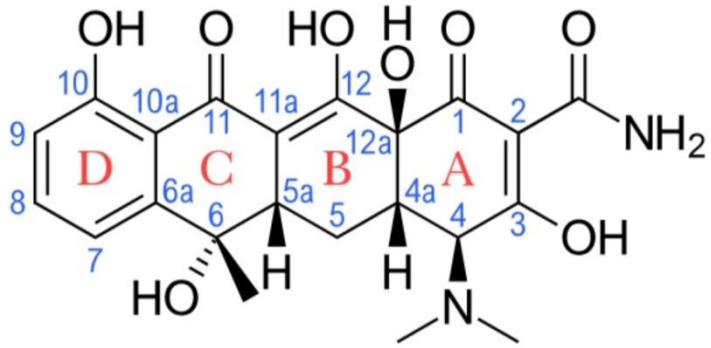
Abstract: *The present paper deals with the microbial studies of the complexes NI(2),Cu(2) with antibiotic drug Tetracycline,a formula NI(II)[$C_{20}H_{21}N_5O_4$]$(BF_4)_2$ &Cu(II)[$C_{20}H_{21}N_5O_4$]$(BF_4)_2$has been suggested on the basis of elemental analysis and molar conductance for the newly synthesized complexes. The transition metal complexes have been reported tobe associated with antifungal antibacterial activity.The microbial studieds of synthesized complexes were examined on pathogenic bacteria using gram+ve (Staphylococcus aureus) & gram- ve(Esherichia coli) and some fungi (Aspergillus flavus Candida Albicans).*

Keywords: Gram Positive bacterial, Gram negative bacterial, Aspergillus Flavus

I. INTRODUCTION

In the view of continued researches in the field of macrocyclic chemistry, which have opened wider areas in the areas of coordination chemistry. Metal ions play importance roles in biological processes and the field of knowledge concerned with the application of inorganic chemistry to therapy or diagnosis of disease in medicinal inorganic chemistry[1]. In the era of emerging drug resistance mainly by bactria, designing potent and successful novel therapeutic agents has become a major concorn in the area of bioinorganic chemistry. Among the ligand systems, hydrazide and hydrazones occupy special place because transition metal complexes of these ligands developed due to their chelating capability, structural flexibility, interesting electrical as well as magnetic properties[2] The ancient man used raw extract of plants for the amelioration of human pains without knowing their chemical constitute and active components. The importance of plant products and their utility encouraged human mind.to find out the mysteries and marvels of biological processes for attaining this aim. The use of any drug in the treatment of disease may be discussed under two subjects. The first of these include the drugs that are used in the treatment and cure of specific disease and the second category in the one which has characteristic effect upon the animals and organism but are not the specific remedies for the particular disease for example morphine, cocaine etc.



Skeletal formula of tetracycline with atoms and four rings numbered and labeled.

REF-[11]

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In the present age, a large number of common diseases of man and animals which are caused by bacterial infections are treated by antimicrobial drug and may require a long treatment period for their cure. However the present research paper has shown that some complexes could be of better use, against these diseases because these complexes can easily be metabolized into man/animal systems along-with their quick curing effect. Transition metals play vital role for living organisms. Metallo-drugs are becoming an important and interesting research area. Many complexes have been synthesized and tested on a no. Of biological systems[3-5]. In continuation of the work being carried out in our laboratory on the metal tung state with organic ligand[6-10], the present paper describes microbial studies of NI(II)&Cu(II) with antibiotic drug Tetracycline having$(BF_4)_2$ anion.

II. EXPERIMENT

The chemicals and solvents were purchased from Aldrich chemical& Co., & the solvents were purified by standard methods. Elemental analyses were carried out using a Perkin –Elmer 2400II elemental analyzer. In this well-known procedure agar plates are inoculated with a standardized inoculums of the test microorganism. Then,filter paper discs (about 6nm in diameter),containing the test compound at a desireded concentration, are placed on the agar surfacr. The Petri dishes are incubated under suitable conditions. Generally antimicrobial agent diffuses into the agar and inhibits germination and growth of the test microorganism and then the diameters of inhibition growth zones are measured(fig-1)According to Diffusion Methods[12].

Microbial studies of the synthesized complexes (Table-1) were performed at Gupta et al[13] was applied on the following pathogenic bacteria using gram+ve (Staphylococcus aureus) and gram-ve (Escherichia coli) and some fungi (Asperfillus flavus,Candida albicans).The serial dilution method[14]] is treated as one of the best result oriented and convenient method for the evaluation of "MIC" values.

TABLE

Complexes of different metals were marked has s1,s2 as follows

S1-NI(II)$[C_{20}H_{21}N_5O_4](BF_4)_2$

S2(Cu(II)$[C_{20}H_{21}N_5O_4](BF_4)_2$

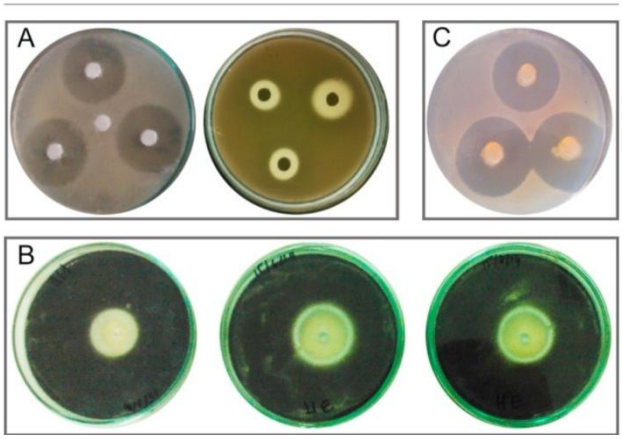

Fig. 1. Agar diffusion methods: (A) disk-diffusion method of microbial extract using C. *albicans* as test microorganism, (B) agar well diffusion method of essential oil using *Aspergillus niger* as test microorganism, and (C) agar plug diffusion method of *Bacillus* sp. against C. *albicans.*

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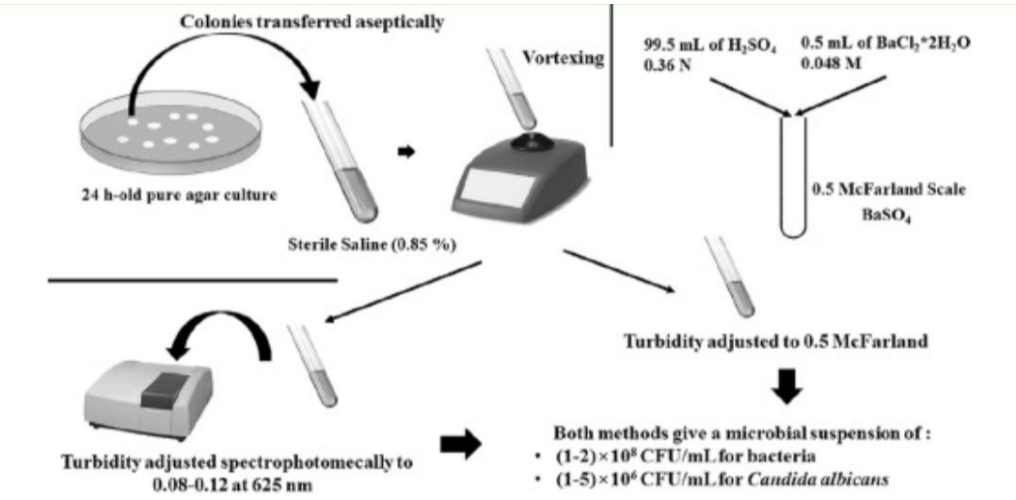

Fig. 2. Broth microdilution method of plant extract against *B. subtilis* using resazurin as growth indicator.

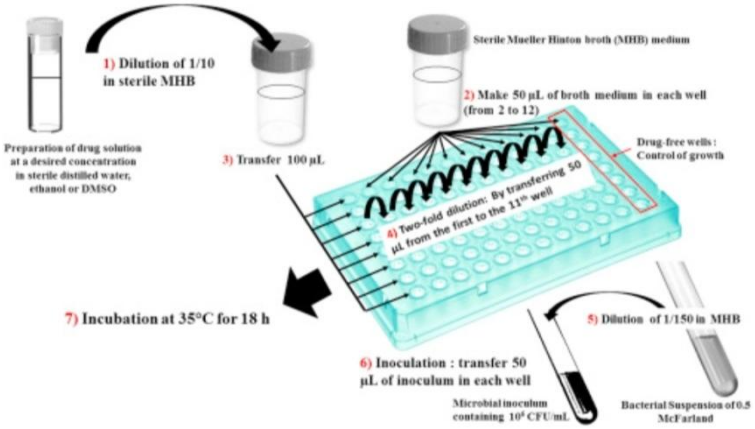

Fig. 4. Broth microdilution for antibacterial testing as recommended by CLSI protocol.

III. RESULTS AND DISCUSSION

The biological activity of a potentially active molecule is altered on its coordination with a suitable metal ion form a complex,Okunuti et al[15] have reported that Cu^{2+} is bonded tightly to cytochrome oxidases which is the terminal enzyme for cellular respiration. It is essential for overall mettaloenzymes e.g. Aldolase in Aspergillus niger, D.N.A., Polymerases Carbonic anhydrase and carboxy peptidase in Escherichia Coli.The synthesized complexes were screened for the antibacterial and antifungal activity using serial dilute method,against gram +ve bacterial viz Staphylloccus aureus and Escherichia Coli and fungi Aspergillus Flavus,Candida albicans. In general all the tested complexes showed higher toxicity against bacterial and fungi under study.

ANTIBACT ERIAL ACTIVITY

Anything that destroys bacteria or suppresses their growth or their ability to reproduce, heat, chemicals such as chlorine & antibiotic drugs all have antibacterial properties. Many antibacterial products for cleaning and hand washing are sold today. Such products do not reduce the risk for symptoms of viral infactious diseases in otherwise healthy persond. This does not preclude the potential contribution of antibacterial products to reducing symptoms of bacterial diseases in the home[16]From the table 2 it is concluded that complex S1 has exhibited maximum zone of inhibition against Escherichia Coli at the concentration of 0.1M.Even at the concentration of 0.01M it activity order at dihydrazides has shown good zone of inhibition in comparison to other tested complexes [TDADH]>[DTPDH]>[ODADH]>[IDADH]>[TDPDH].

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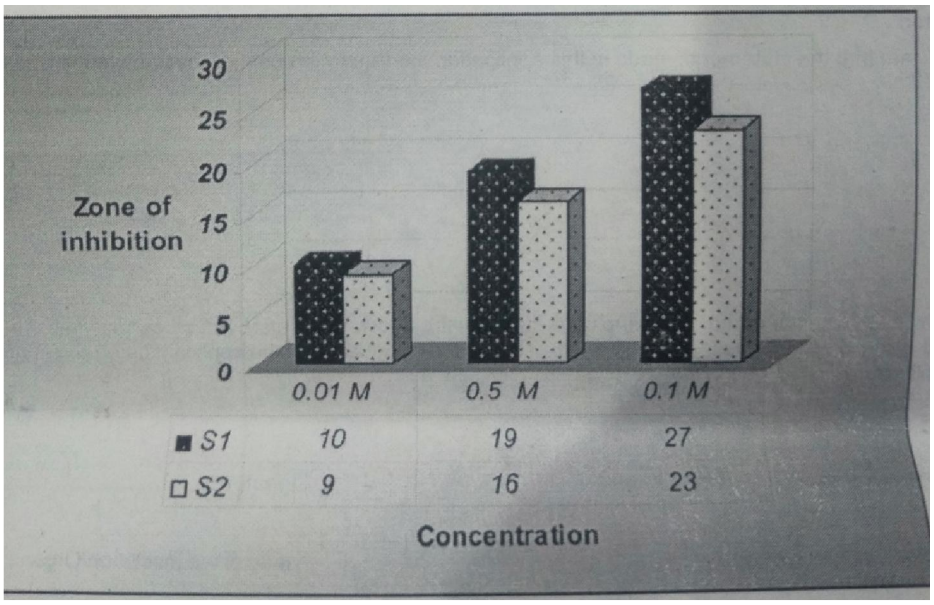
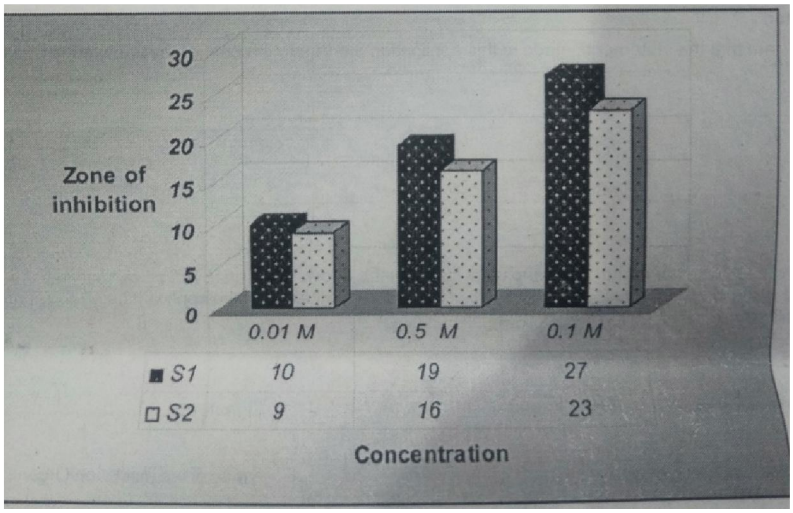
Tables 2. Antibacterial activity of synthesized complexes.

S. No.	Bacteria	Concentration	Stain of Bacteria/ Zone of Inhibition (mm*)	
			S1	S2
1	*Escherichia- coli*	0.01M	10	8
		0.5M	14	12
		0.1M	28	25
2	*Staphylococcus aureus*	0.01 M	10	9
		0.5 M	19	16
		0.1 M	27	23

Including diameter of filter-paper disc (6mm)





ANTIFUNGAL ACTIVITY

Study on anti-fungal activity of complexes S1,S2 was carried out against five selected fungi namely Aspergillus flavus ,Candida albicans, at varying concentration of complexes 0.5M,0.1M&0.01M and the result are recorded in terms of zone of inhibition which also includes the diameter of filter paper disc (6mm).

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From the Table 3,it is observed that at the concentration of 0.1M of complex S1 shown maximum zone of inhibition was recorded against Aspergillus flavus similarly good inhibitory efficacy was also observed at the same concentration of complexes S1 against Aspergillus flavus.

At concentration of 0.1M Complex S1 maximum activity was shown on candida albicans but similarly,considerable zone of inhibition were also recorded in case of other complex,it is evident

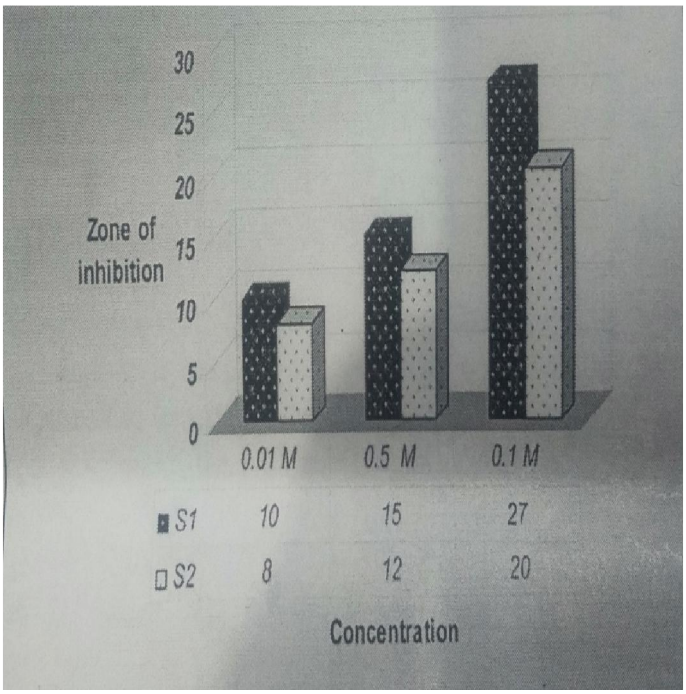
From the result (Table-3) that even at the concentration of 0.01M,all the complexes were found to be active against Candida albicans.

Table 3. Antifungal activity of synthesized complexes.

S. No.	Fungi	Concentration	Stain of Fungi/ Zone of Inhibition (mm*)	
			S1	S2
1	Aspergillus flavus	0.01 M	10	8
		0.5 M	15	12
		0.1 M	27	20
2	*Candida albicans*	0.01 M	12	10
		0.5 M	19	15
		0.1 M	26	22

Including diameter of filter-paper disc (6mm)

For the comparison of the antifungal properties of tested complexes against bacteria Aspergillus flavus,Candida albicans,the zone of inhibition have been graphically respresented in graph-3,4



Graph3 comparative antigungal activity of complexes against Aspergillus flavus.

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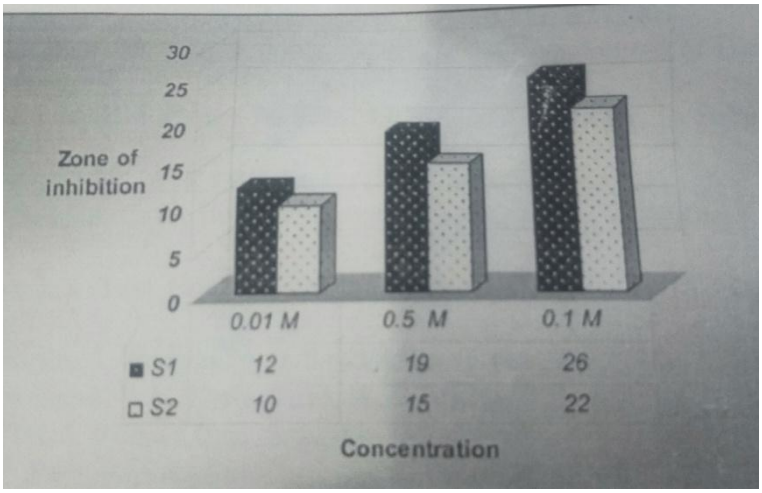
The significant importance of coordination chemistry of pyrazole derivative primarily due to bio-implications of these ligands has been well authenticated by recent review article by Trofimenko.



Graph 4 comparative antifungal activity of complexes against candida albicans.Antimicrobial behaviour of the original drug against selectected microorganism was also compared.It could be observed that synthesized complex have shown promising result compared to commercial original drug Tetracycline.

REFERENCES

[1]. Muthusamy selvaganapathy[1] &Natarajan Raman[2"], "Pharmacological Activity of a Few Transition Metal complexes: A Short Review ",J Chem Biol Ther vol1(2): 108.Doi:10.4172/2572-0406.1000108 published 07 Jul (2016)

[2]. C.Anitha1,S.Sumathi[1],P.Tharmaraj[1]& C.D.Sheela[2,],"Synthesis,Characterization and biological activity of some Transition Metal complexes Derived from Novel Hydrazone Azo Schiff Base ligand" https://dpi.org/10.1155/2011/ volume2011,article ID493942,Published 24 Jan(2012)

[3]. A.P. Mishra ,R.K. Mishra ,S.P.Shrivastava ,J.Serb. chem..Soc.,74(5),523(2009)

[4]. R.K.Crouch,T.W.Kensler,T.W.Oberley.J.R.J Sorenson,In possible medicinal use of copper complexes:Biological and Inorganic copper chemistry,Adenine Press,NT(1986)

[5]. P.Guru,Int .J.Chem.Tech.Res,1(2),291(2009).

[6]. P.Guru,M.P. Gautam,R.K. Gautam,Reviews in Inorganic chemistry26(6),521(2006)

[7]. P.Guru,Inorganic Chemistry,An Indian Journal2(2),105(2007)

[8]. M.G.El-Wahed,M.S.Refat,S.M.El-Megharbel,chem.,Pharm,Bull,(Tokyo),56(11,1585(2008).

[9]. P.Guru.,Asian J. Chem..,17(2)1322(2005)

[10]. P.Guru,R.k.Gautam,I.J.C.C.,Silver jublee Issue,25,115(2004).

[11]. abcde"Tetracycline" Encyclopedia Britannica,Retrieved 1 October(2018)

[12]. Mounyr Balouiri,Methods for in vitro evaluating antimicrobial activity:A review,Journal of Pharmaceutical Analysis volume6 Issue2,pages 71-79,April(2016).

[13]. C.Gupta ,R.K.Gautam,Ind.J.chem41(A),763,(2002)

[14]. Donald C.G.,Williams A.R..Assaymethod of antibiotics ,A Laboratory,Mannal 188,Medical and Encyclopedia INC(1955).

[15]. Okunuki K ,Sekhur ,A.L. Yonctani T . and Takeni ,S.J. ,Bio chem.,Tokyo 45-847(1958)

[16]. Medical Defination of antibacterial,medicinenet.com,Reviewed on 29 March(2021).