

Microbial Studies on some Coordination Compound of Metals with Tetracycline

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ABSTRACT: The present paper deals with the microbial studies of the complex Ni(II) & Zn(II) with antibiotic drug Tetracycline, a formula Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O and Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O has been suggested on the basis of elemental analysis and molar conductance for the newly synthesized complex. The microbial studies of synthesized complex were studied on pathogenic bacteria using gram +ve (Bacillus subtilis and Staphylococcus aureus) and gram -ve (Shigella flexneri, Salmonella typhosa, Escherichia coli) and some fungi (Aspergillus flavus, Fusarium oxysporum, Chrysosporium pannicale, Alternaria solani, Candida albicans).

KEY WORDS: Tetracycline, complex Ni(II) & Zn(II)

INTRODUCTION

In continuation of the work being carried out in our laboratory on the metal molybdate with organic ligand¹⁻⁵, the present communication describes microbial studies of Ni(II) & Zn(II) with antibiotic drug Tetracycline having molybdate as anion.

EXPERIMENTAL

Microbial studies of the synthesized complexes were performed at Department of Microbiology, Dr H.S. Gour University Sagar (M.P.) and Govt. Veterinary college Jabalpur (M.P.) using paper disc method Gupta et al^[6], on the following pathogenic bacteria using gram +ve (Bacillus subtilis and Staphylococcus aureus) and gram -ve (Shigella flexneri, Salmonella typhosa, Escherichia coli) and some fungi (Aspergillus flavus, Fusarium oxysporum, Chrysosporium pannicale, Alternaria solani, Candida albicans).

RESULT & DISCUSSIONS

The synthesized complexes were screened for the antibacterial and antifungal activity using standard paper disc method^[7-10] against gram positive bacterial viz. Bacillus subtilis and Staphylococcus aureus and gram negative bacteria viz. Escherichia coli and Salmonella typhosa and fungi Aspergillus flavus, Alternaria solani, Candida albicans, Fusarium oxysporum & Chrysosporium

pannicale. In general all the tested complexes showed higher toxicity against bacterial and fungi under study.

Table 1

Complexes of different metals were marked as S1, S2 as follows

S1-	Ni (C ₂₂ H ₂₄ N ₂ O ₈) MoO ₄ 3H ₂ O
S2-	Zn (C ₂₂ H ₂₄ N ₂ O ₈) MoO ₄ 3H ₂ O

ANTIBACTERIAL ACTIVITY

From the table 2 it is concluded that complex S1 has shown maximum zone of inhibition against Shigella flexneri at the concentration of 0.1 M even at the concentration of 0.01 M it has shown good zone of inhibition in comparison to other tested complexes.

Against Salmonella typhosa good antibacterial activity was observed against almost all the tested complexes. Complex S2 individually shown maximum zone of inhibition against this organism. Against Escherichia- coli maximum inhibitory effect were produced by complex S2

Bacillus subtilis was found to be more susceptible against complex S2 maximum zone of inhibition were recorded against these tested complexes.

Complexes S2 found to be more active and shown higher zone of inhibition against *Staphylococcus aureus* in comparison to S1

Table 2: Antibacterial activity of synthesized complexes

S · N ·	Bacteria	Concentration	Stain of Bacteria/ Zone of Inhibition (mm*)	
			S1	S2
1	<u><i>Shigella flexneri</i></u>	0.01 M	16	12
		0.5 M	21	20
		0.1 M	28	26
2	<u><i>Salmonella typhosa</i></u>	0.01 M	8	14
		0.5 M	11	20
		0.1 M	19	26
3	<u><i>Escherichia- coli</i></u>	0.01M	11	10
		0.5M	14	20
		0.1M	22	26
4	<u><i>Bacillus subtilis</i></u>	0.01M	10	12
		0.5 M	20	24
		0.1 M	22	27
5	<u><i>Staphylococcus aureus</i></u>	0.01 M	9	18
		0.5 M	17	25
		0.1 M	23	28
Including diameter of filter-paper disc (6mm) S1 = Ni (C ₂₂ H ₂₄ N ₂ O ₈) MoO ₄ 3H ₂ O, S2 = Zn (C ₂₂ H ₂₄ N ₂ O ₈) MoO ₄ 3H ₂ O				

On comparing the anti-bacterial efficacy of these tested complexes, it is concluded that though most of the complexes reported satisfactory results for their antibacterial property but complexes S2 in particular gave promising results. From the above study it is observed that complex of Ni(II) & Zn(II) with antibiotic drug Tetracycline found to most active against the tested microorganisms. It is found that all the tested complexes exhibit good antibacterial activity at the concentration of

0.1 M and. it is interesting to note that inhibitory power of complexes decrease with the increase of their concentration.

For the comparison of the antibacterial properties of these tested complexes against bacteria *Shigella flexneri*, *Salmonella typhosa*, *Escherichia- coli*, *Bacillus subtilis*, *Staphylococcus aureus* the zone of inhibition have been graphically represented in Graph 1 to 5

ANTI FUNGAL ACTIVITY

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

From the table 3 it is observed that at the concentration of 0.1M of complex S2 shown maximum zone of inhibition was recorded against *Aspergillus flavus* similarly good inhibitory efficacy was also observed at the same concentration of complexes S2 against *Aspergillus flavus*.

Against *Candida albicans* at the concentration of 0.1M complex S2 have shown maximum activity but similarly, considerable zone of inhibition were also recorded in case of complexes. It is evident from the result (Table 3) even at the concentration of 0.01 M all the complexes were found to be active against *Candida albicans*

Maximum zone of inhibition were recorded by all the complexes at the concentration of 0.1M against *Alternaria solani*. All the complexes at the concentration of 0.5 M have also gave promising results.

The complex S2 at the concentration of 0.1 M produced maximum zone of inhibition against *Fusarium oxysporum*.

Microorganism *Chrysosporium pannicale* was found susceptible against all the complexes tested at their concentration of 0.1M and 0.5 M. Complex S1 was found to possess good antifungal activity at 0.1 M concentration.

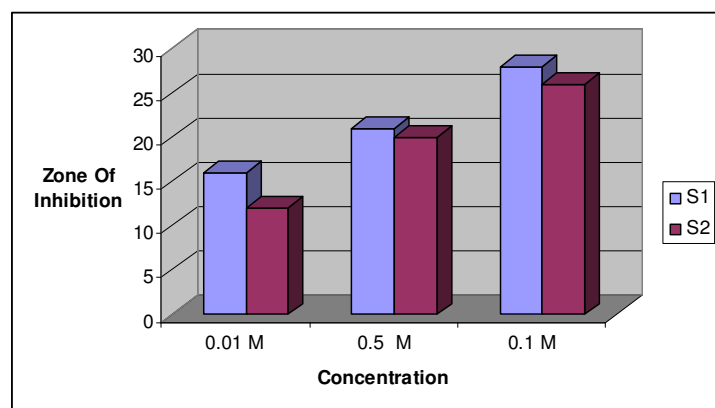
For the comparison of the antifungal properties of these tested complexes against bacteria *Aspergillus flavus*, *Candida albicans*, *Alternaria solani*, *Fusarium oxysporum* and *Chrysosporium pannicale* the zone of inhibition have been graphically represented in Graph 6-10

Antimicrobial properties of the original drug against selected microorganism were also compared. It could be observed that synthesized complex have shown promising result compared to commercial original drug Tetracycline.

Table 3:Antifungal activity of synthesized complexes

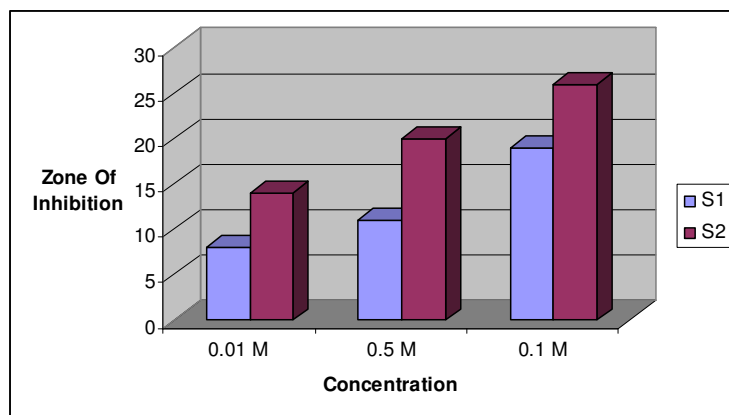
S. No	Fungi	Concentration	Stain of Fungi/ Zone of Inhibition (mm*)	
			S1	S2
1	<u>Aspergillus flavus</u>	0.01 M	8	9
		0.5 M	10	12
		0.1 M	14	18
2	<u>Candida albicans</u>	0.01 M	9	11
		0.5 M	15	16
		0.1 M	19	20
3	<u>Alternaria solani</u>	0.01M	10	9
		0.5M	14	12
		0.1M	21	19
4	<u>Fusarium oxysporum</u>	0.01M	8	10
		0.5 M	10	18
		0.1 M	15	22
5	<u>Chrysosporium pannicale</u>	0.01 M	9	7
		0.5 M	12	9
		0.1 M	18	14

Including diameter of filter-paper disc (6mm)
 S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O



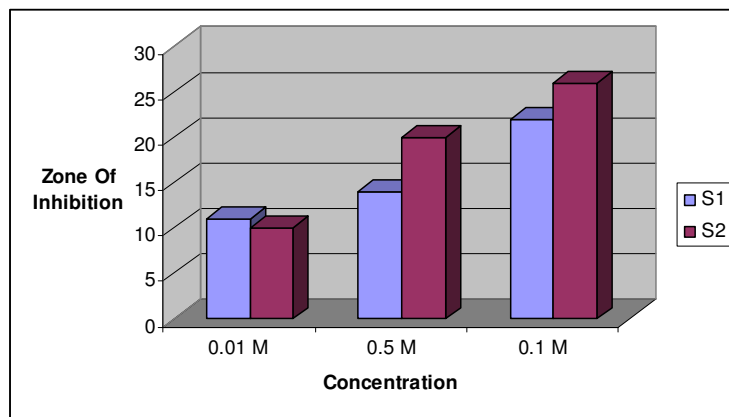
S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O

Graph 1- Comparative antibacterial activity of complexes against Shigella flexneri



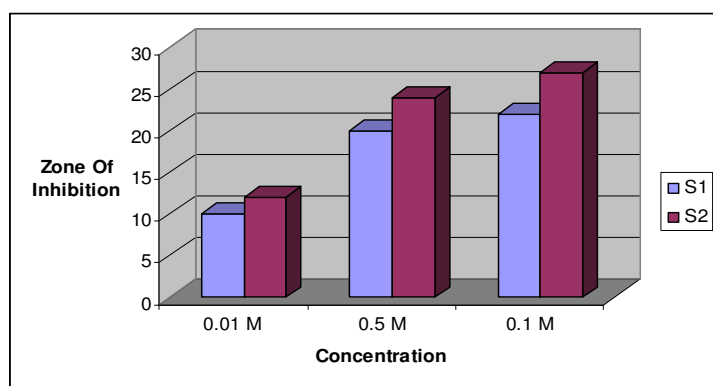
S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O

Graph 2- Comparative antibacterial activity of complexes against Salmonella typhosa



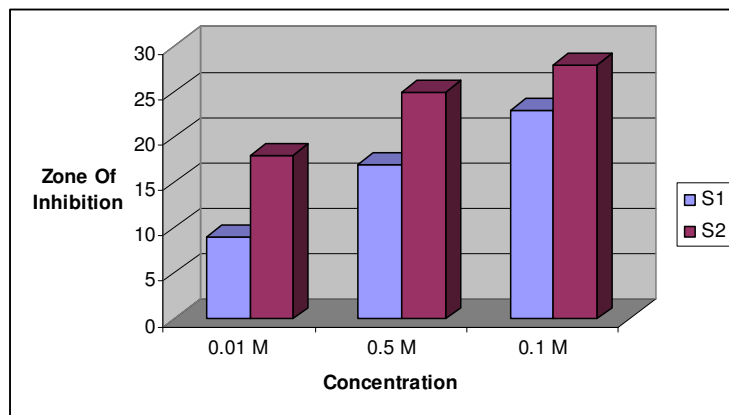
S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O

Graph 3- Comparative antibacterial activity of complexes against Eschechia-coli



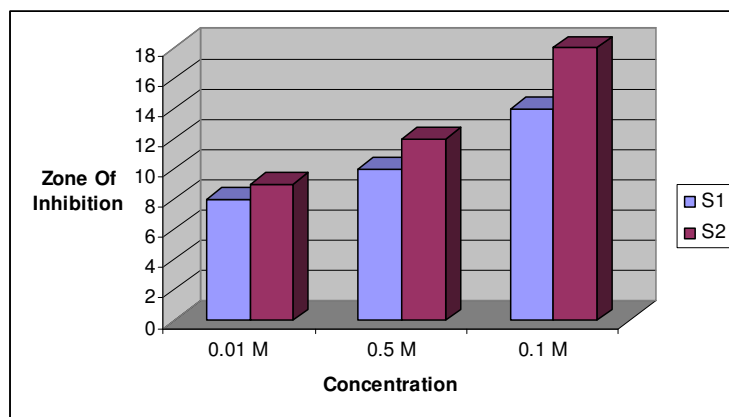
S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O

Graph 4- Comparative antibacterial activity of complexes against Bacillus subtilis



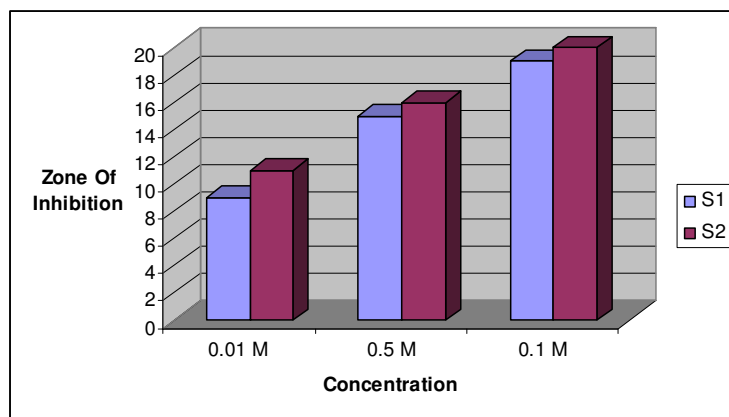
S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O

Graph 5- Comparative antibacterial activity of complexes against Staphylococcus aureus



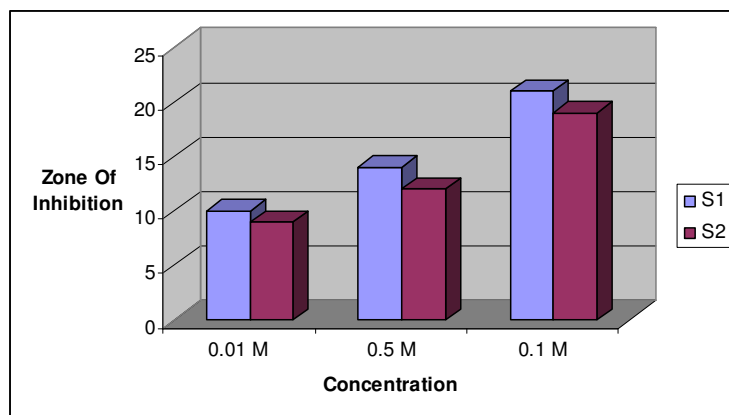
S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O

Graph 6- Comparative antifungal activity of complexes against Aspergillus flavus



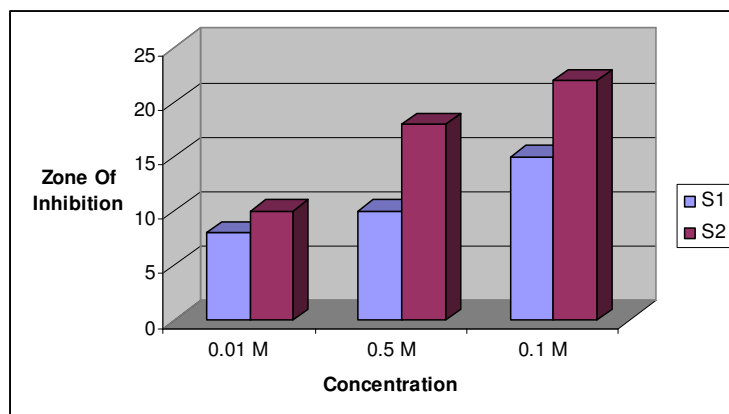
S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O

Graph 7- Comparative antifungal activity of complexes against Candida albicans



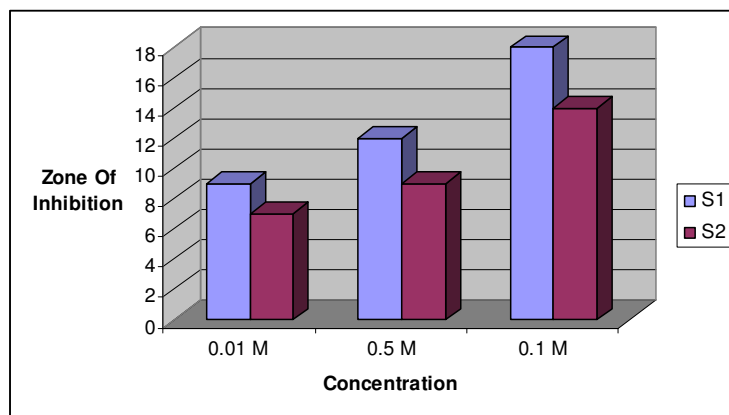
S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O

Graph 8- Comparative antifungal activity of complexes against Alternaria solani



S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O

Graph 9- Comparative antifungal activity of complexes against Fusarium oxysporum



S1 = Ni (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O, S2 = Zn (C₂₂ H₂₄ N₂ O₈) MoO₄ 3H₂O

Graph 10- Comparative antifungal activity of complexes against Chrysosporium pannicale

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