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# TETRACYCLINE COORDINATION COMPOUND AS ANTIMICROBIAL AGENT

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## ABSTRACT

The present paper deals with the microbial studies of the complex Co(II) & Cu(II) with antibiotic drug Tetracycline, a formula Co ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $4H_2O$ and Cu ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$ 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 ).

**INTRODUCTION**: In continuation of the work being carried out in our laboratory on the metal molybdate with organic ligand [1-5], the present communication describes microbial studies of Co(II) & Cu(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 (MP) and Govt. Veterinary college Jabalpur (MP) using paper disc method Kathal *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 (**table 1**). *Bacillus subtils* and *S*taphyloccus aureus and gram negative bacteria viz. *Escherichia coli* and *Salmonella typhosa* and fungi *Aspergillus flavus, Alterneria solani, Candid albicans , Fusarium oxysporum & Chrysosporium pannicle*. In general all the tested complexes showed higher toxicity against bacterial and fungi under study.

**TABLE 1: COMPLEXES OF DIFFERENT METALS WERE MARKED HAS S1, S2**

| | |
|---|---|
| **S1-** | Co $(C_{22}H_{24}N_2O_8)$ $MoO_4\ 4H_2O$ |
| **S2-** | Cu $(C_{22}H_{24}N_2O_8)$ $MoO_4\ 3H_2O$ |

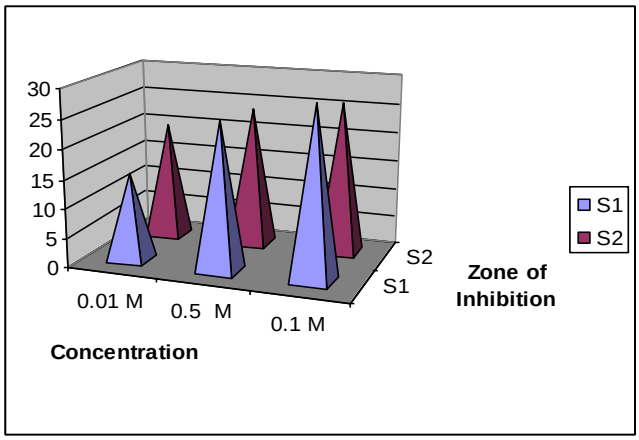
**Antibacterial activity:** From **table 2** it is concluded that complex S1 has shown maximum zone of inhibition against *Shigella flexneri* at the concentration of 0.1 M even at the concentration of 0.01 M it has shown good zone of inhibition in compression to other tested complexes. Against *Salmonella typhosa* good antibacterial activity was observed against almost all the tested complexes. Complex S1 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**

| Bacteria | Concentration | Stain of Bacteria/ Zone of Inhibition (mm*) | |
|---|---|---|---|
| | | **S1** | **S2** |
| *Shigella flexneri* | 0.01 M | 15 | 20 |
| | 0.5 M | 25 | 24 |
| | 0.1 M | 29 | 26 |
| *Salmonella typhosa* | 0.01 M | 14 | 8 |
| | 0.5 M | 24 | 19 |
| | 0.1 M | 28 | 23 |
| *Escherichia-coli* | 0.01M | 9 | 13 |
| | 0.5M | 10 | 16 |
| | 0.1M | 23 | 27 |
| *Bacillus subtilis* | 0.01M | 9 | 12 |
| | 0.5 M | 23 | 24 |
| | 0.1 M | 25 | 27 |
| *Staphylococcus aureus* | 0.01 M | 12 | 11 |
| | 0.5 M | 18 | 15 |
| | 0.1 M | 28 | 21 |

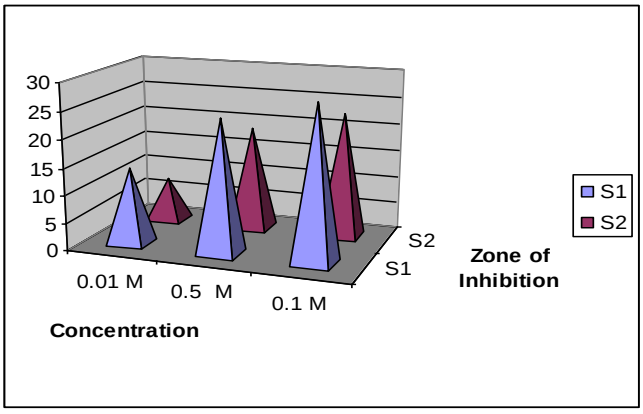
On comparing the anti-bacterial efficacy of these tested complexes, it is concluded that though most of the complexes reported satisfactory results for their antibacterial property but complexes S2 in particular gave promising results. From the above study it is observed that complex of Co(II) & Cu(II) 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.



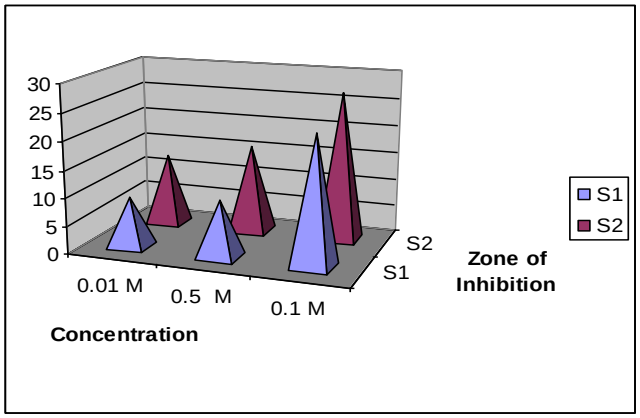

**GRAPH 1: COMPARATIVE ANTIBACTERIAL ACTIVITY OF COMPLEXES AGAINST *SHIGELLA FLEXNERI***

**S1**=Ni ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$, **S2** = Zn ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$



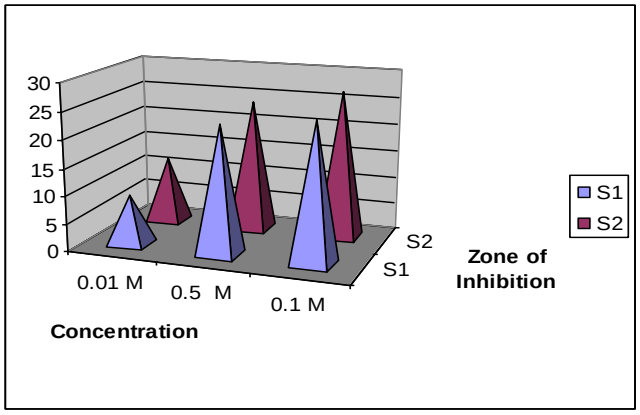

**GRAPH 2: COMPARATIVE ANTIBACTERIAL ACTIVITY OF COMPLEXES AGAINST *SALMONELLA TYPHOSA***

**S1**= Ni ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$, **S2**= Zn ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$



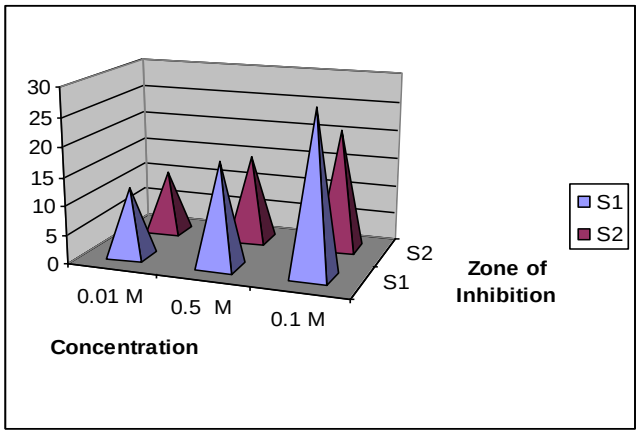

S1 = Ni ($C_{22}$ $H_{24}$ $N_2$ $O_8$) MoO4 $3H_2O$, S2 = Zn ($C_{22}$ $H_{24}$ $N_2$ $O_8$) MoO4 $3H_2O$

**GRAPH 3: COMPARATIVE ANTIBACTERIAL ACTIVITY OF COMPLEXES AGAINST *ESCEHRICHIA-COLI***




**GRAPH 4: COMPARATIVE ANTIBACTERIAL ACTIVITY OF COMPLEXES AGAINST *BACILLUS SUBTILIS***

S1 = Ni ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$, S2 = Zn ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$




**GRAPH 5: COMPARATIVE ANTIBACTERIAL ACTIVITY OF COMPLEXES AGAINST *STAPHYLOCOCCUS AUREUS***

S1 = Ni ($C_{22}$ $H_{24}$ $N_2$ $O_8$) MoO4 $3H_2O$, S2 = Zn ($C_{22}$ $H_{24}$ $N_2$ $O_8$) MoO4 $3H_2O$

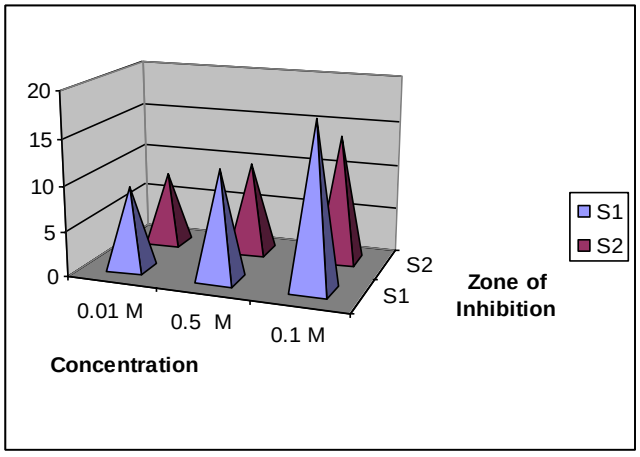
**Anti fungal activity:** Study of anti-fungal activity of complexes S1, S2 was carried out against selected five fungi namely *Aspergillus flavus, Candida albicans, Alternaria solani, Fusarium oxysporum* and *Chrysosporium pannicale.* at varying concentration of complexes 0.1M , 0.5 M and 0.01 M respectively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

**TABLE 3: ANTIFUNGAL ACTIVITY OF SYNTHESIZED COMPLEXES**

| Fungi | Concentration | Stain of Fungi/ Zone of Inhibition (mm*) | |
|---|---|---|---|
| | | S1 | S2 |
| *Aspergillus flavus* | 0.01 M | 9 | 8 |
| | 0.5 M | 12 | 10 |
| | 0.1 M | 18 | 14 |
| *Candida albicans* | 0.01 M | 8 | 11 |
| | 0.5 M | 10 | 17 |
| | 0.1 M | 15 | 21 |
| *Alternaria solani* | 0.01M | 11 | 9 |
| | 0.5M | 15 | 12 |
| | 0.1M | 23 | 18 |
| *Fusarium oxysporum* | 0.01M | 8 | 7 |
| | 0.5 M | 14 | 12 |
| | 0.1 M | 26 | 22 |
| *Chrysosporium pannicale* | 0.01 M | 9 | 7 |
| | 0.5 M | 16 | 9 |
| | 0.1 M | 23 | 14 |

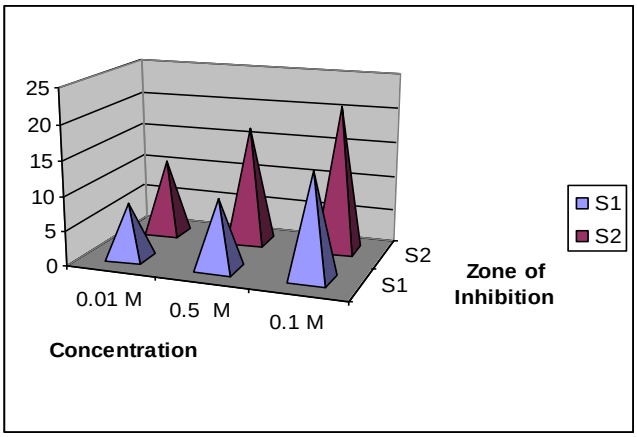
Against *Candida albicans* at the concentration of 0.1M complex S2 have shown maximum activity but similarly, considerable zone of inhibition were also recoded in case of complexes. It is evident from the result (Table 3) even at the concentration of 0.01 M all the complexes were found to be active against *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 given 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 Complex S1 was found to posses 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.



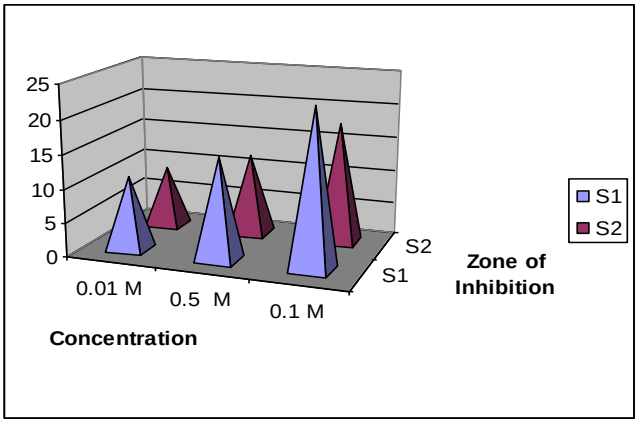

**GRAPH 6: COMPARATIVE ANTIFUNGAL ACTIVITY OF COMPLEXES AGAINST *ASPERGILLUS FLAVUS***

S1 = Ni ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$, S2 = Zn ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$



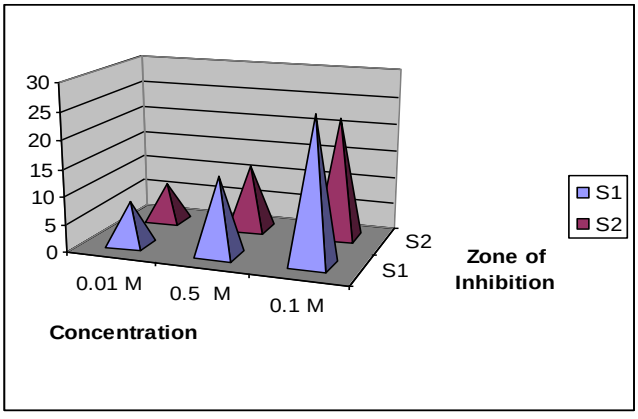

**GRAPH 7: COMPARATIVE ANTIFUNGAL ACTIVITY OF COMPLEXES AGAINST *CANDIDA ALBICANS***

S1 = Ni ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$, S2 = Zn ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$



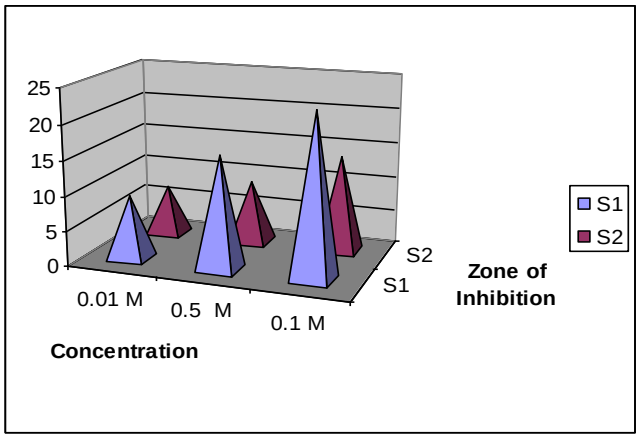

**GRAPH 8: COMPARATIVE ANTIFUNGAL ACTIVITY OF COMPLEXES AGAINST *ALTERNARIA SOLANI***

S1 = Ni ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$, S2 = Zn ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$




**GRAPH 9: COMPARATIVE ANTIFUNGAL ACTIVITY OF COMPLEXES AGAINST *FUSARIUM OXYSPORUM***

S1 = Ni ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$, S2 = Zn ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$




**GRAPH 10: COMPARATIVE ANTIFUNGAL ACTIVITY OF COMPLEXES AGAINST *CHRYSPORIUM PANNICALE***

S1 = Ni ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$, S2 = Zn ($C_{22}$ $H_{24}$ $N_2$ $O_8$) $MoO_4$ $3H_2O$

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.

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