International Journal of Advanced Research in Chemical Science (IJARCS)
Volume 1, Issue 1, March 2014, PP 60-69
www.arcjournals.org

Microbial Investigation on Some Coordination Compound of Metals with Ampicillin

Pranay Guru
Professor & HOD,
Department of Applied Sciences,
Bansal Institute of Research & Technology,
Bhopal (M.P.) India
pranayguru@rediffmail.com

Abstract: *The present paper deals with the microbial studies of the complex Ni(II) & Zn(II) with antibiotic drug ampicillin, a formula* $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ *and* $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$ *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)*

Keywords:*Bacillus subtilis, Staphylococcus aureus, Aspergillus flavus, Fusarium oxysporum, Chrysosporium pannicale, Alternaria solani, Candida albicans*

1. INTRODUCTION

In continuation of the work being carried out in our laboratory on the metal molybdate/tungstate/vanadate with organic ligand1-5, the present communication describes microbial studies of Ni(II) & Zn(II) with antibiotic drug ampicillin (C16H19N3O4S) having tungstate as anion.

2. 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).

3. RESULT & DISCUSSIONS

The synthesized complexes were screened for the antibacterial and antifungal activity using standard paper disc method[7-10] against gram posative bacterial viz. Bacillus subtils and Staphyloccus 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 bacteria and fungi under study.

Table 1. *Complexes of different metals were marked has S1, S2 as follows*

S1-	$Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$
S2-	$Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

4. ANTIBACTERIAL ACTIVITY

From the table 2 it is concluded that complex S2 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 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 S1 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

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) & Zn(II) with titled ampicillin 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

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 S1 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 S2. It is evident from the result 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 S1 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 S2 was found to posse's 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

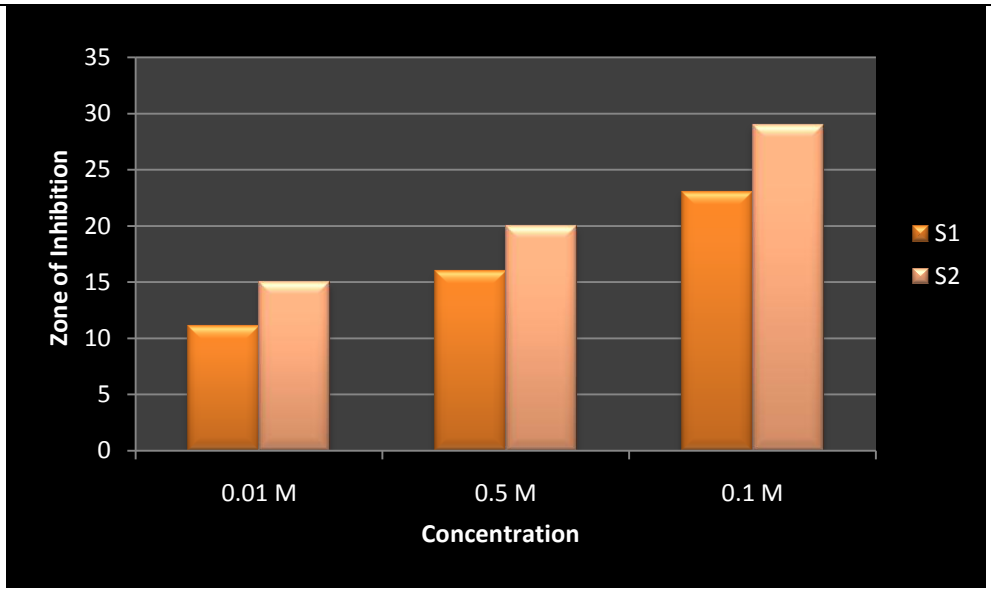
Antimicrobial properties of the original drug against selected microorganism were also compared. It could be observed that synthesized complex have shown promising result compared to commercial original drug Sulphadiazine11-46.

Table 2. *Antibacterial activity of synthesized complexes*

S. No	***Bacteria***	Concentration	Stain of Bacteria/ Zone of Inhibition (mm*)	
			S1	**S2**
1	***Shigella flexneri***	0.01 M	11	16
		0.5 M	18	20
		0.1 M	22	28
2	***Salmonella typhosa***	0.01 M	12	16
		0.5 M	19	23
		0.1 M	24	28
3	***Escherichia- coli***	0.01M	11	15
		0.5M	17	23
		0.1M	25	29
4	***Bacillus subtilis***	0.01M	13	11
		0.5 M	17	14
		0.1 M	27	23
5	***Staphylococcus aureus***	0.01 M	12	17
		0.5 M	19	24
		0.1 M	25	28
Including diameter of filter-paper disc (6mm) S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$				

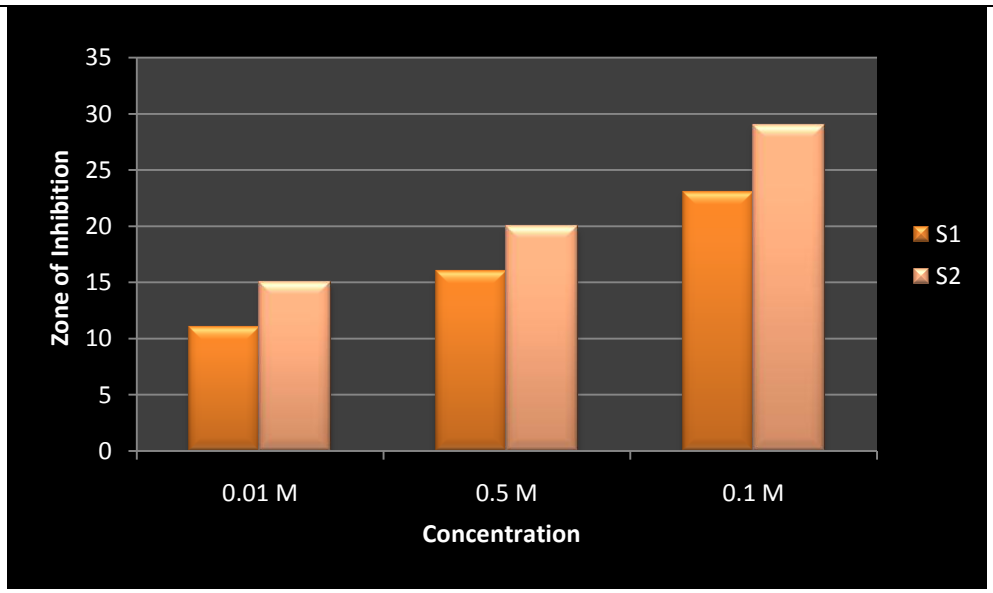
Table 3. *Antifungal activity of synthesized complexes*

S. No	Fungi	Concentration	Stain of Fungi/ Zone of Inhibition (mm*)	
			S1	**S2**
1	***Aspergillus flavus***	0.01 M	12	16
		0.5 M	18	22
		0.1 M	23	27
2	***Candida albicans***	0.01 M	12	15
		0.5 M	17	20
		0.1 M	24	27
3	***Alternaria solani***	0.01M	11	13
		0.5M	15	24
		0.1M	25	29
4	***Fusarium oxysporum***	0.01M	14	11
		0.5 M	19	13
		0.1 M	29	24
5	***Chrysosporium pannicale***	0.01 M	11	15
		0.5 M	16	20
		0.1 M	23	29
Including diameter of filter-paper disc (6mm) S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$				



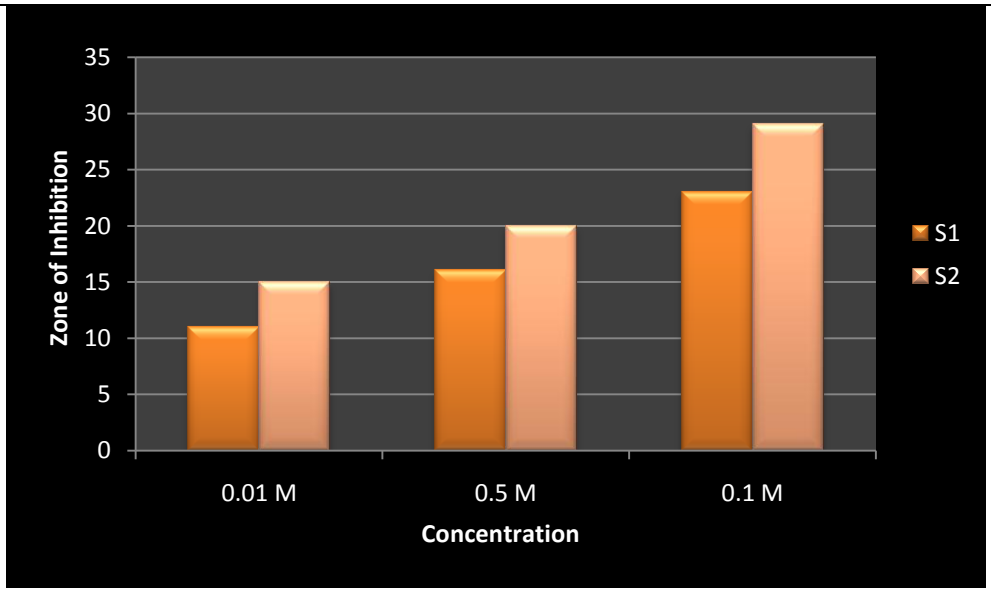
S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

Graph 1- *Comparative antibacterial activity of complexes against Shigella flexneri*



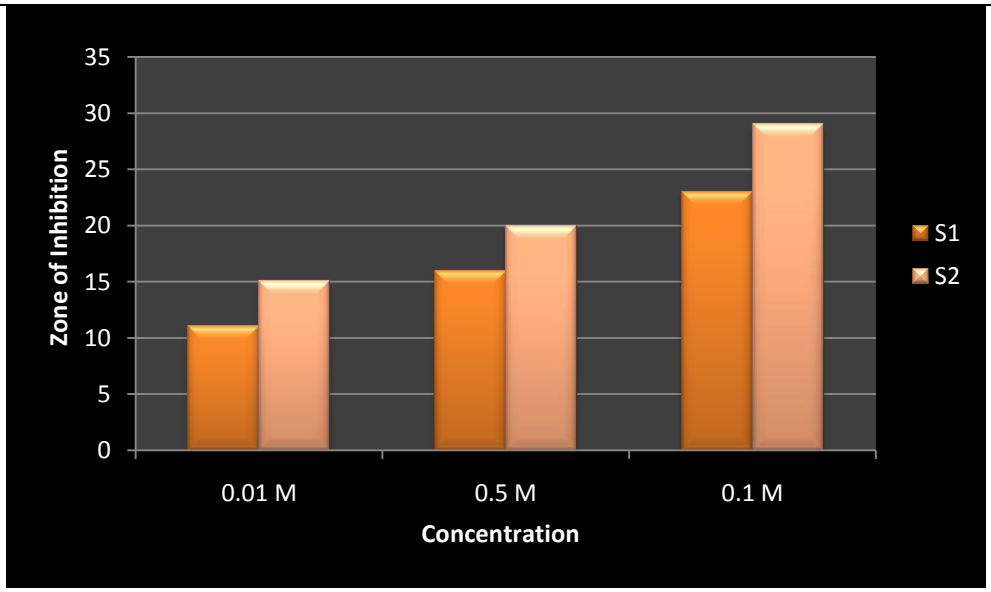
S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

Graph 2- *Comparative antibacterial activity of complexes against Salmonella typhosa*



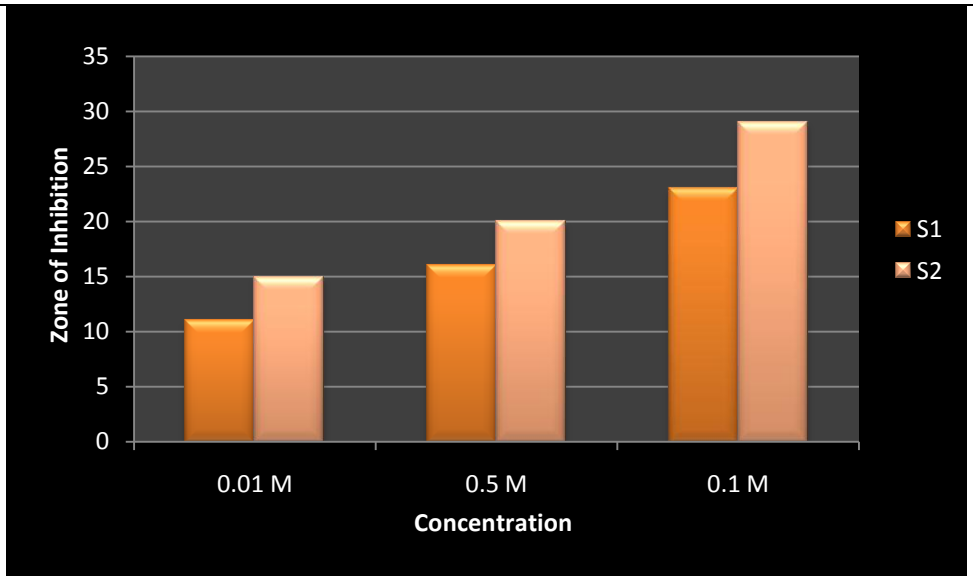
S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

Graph 3- *Comparative antibacterial activity of complexes against Escehrichia-coli*



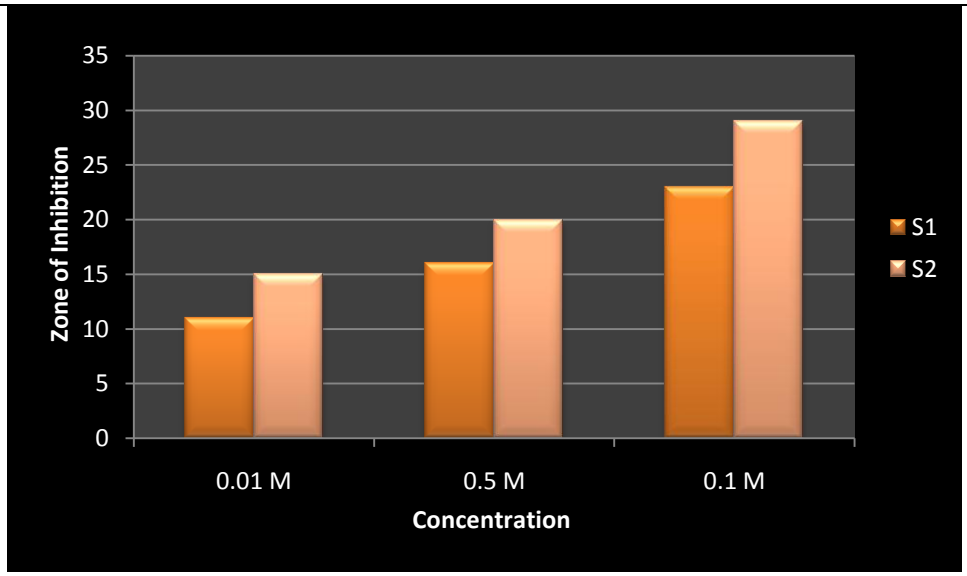
S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

Graph 4- *Comparative antibacterial activity of complexes against Bacillus subtilis*



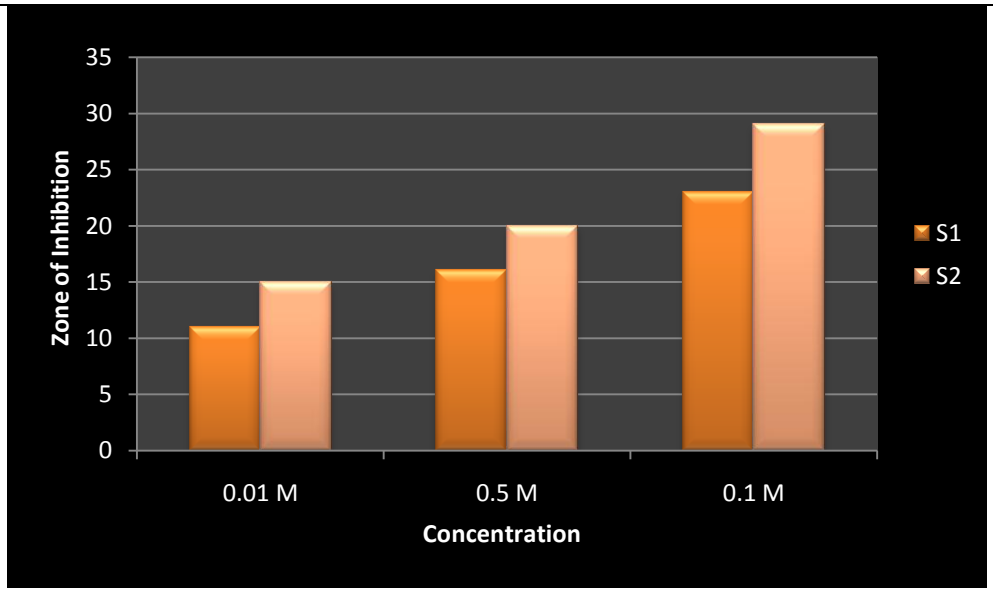
S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

Graph 5- *Comparative antibacterial activity of complexes against Staphylococcus aureus*



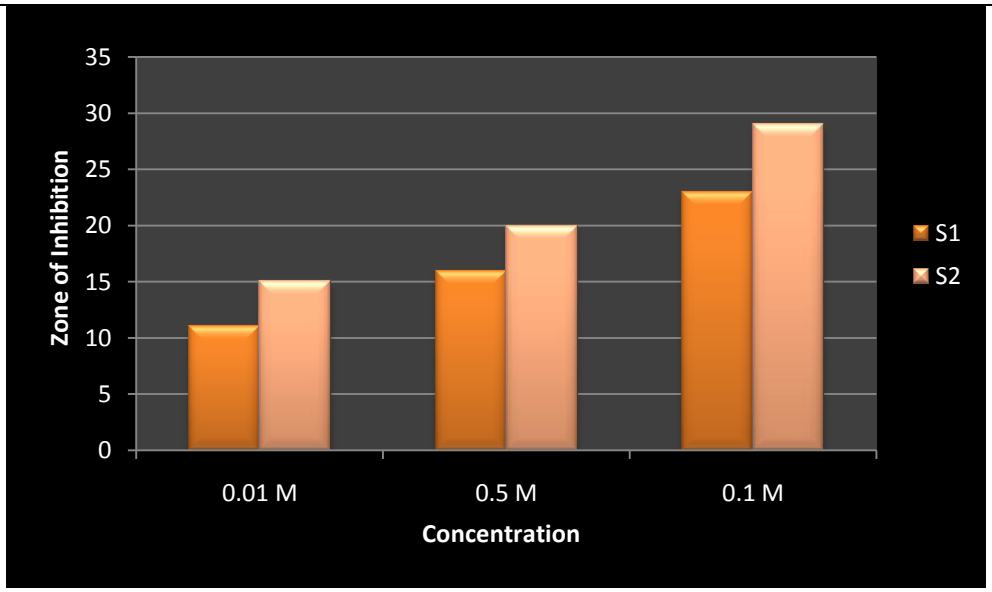
S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

Graph 6- *Comparative antifungal activity of complexes against Aspergillus flavus*



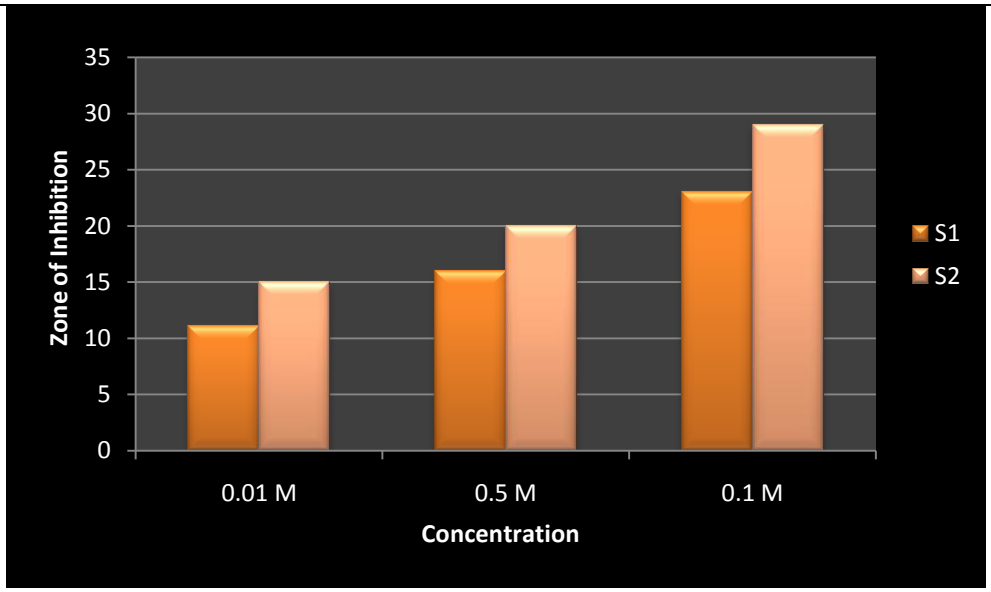
S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

Graph 7- *Comparative antifungal activity of complexes against Candida albicans*



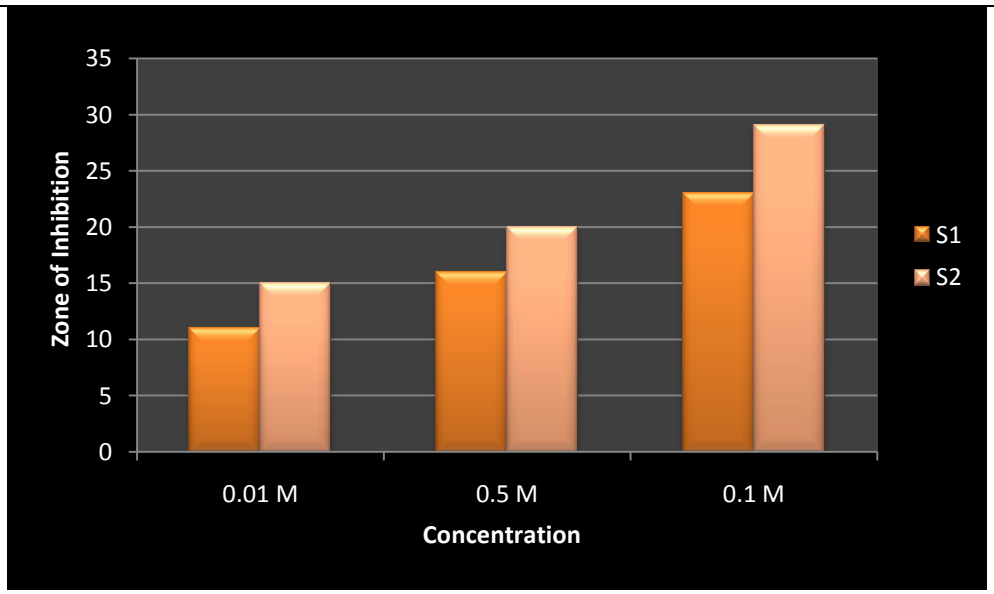
S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

Graph 8- *Comparative antifungal activity of complexes against Alternaria solani*



S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

Graph 9- *Comparative antifungal activity of complexes against Fusarium oxysporum*



S1 = $Ni(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 2H_2O$ S2 = $Zn(C_{16}H_{19}N_3O_4S)_2WO_4 \cdot 4H_2O$

Graph 10- *Comparative antifungal activity of complexes against Chrysporium pannicale*

ACKNOWLEDGMENT

The authors are thankful to Dr. A. K. Guru, Ex Director, State Forensic Science Laboratory, Sagar (M.P.), India and Head, Department of Chemistry & Head, Department of Microbiology Dr. H. S. Gour University, Sagar (M.P.) for providing necessary laboratory facilities and valuable suggestions. The authors are also thankful to HOD, Govt. veterinary college Jabalpur (M.P.)

REFERENCES

[1] P. Guru, International Journal of Chem-Tech Research Vol. 1(3), 552- 554 (2009)
[2] P. Guru, International Journal of Chem-Tech Research Vol. 1(3), 461- 463 (2009)
[3] P. Guru, Reviews in Inorganic Chemistry, Vol. 29 (3), 141-156 (2009).
[4] M Li-June, Medicinal Research Review, 23, 697-762 (2003).
[5] Mildred Redstrock "Medical Chemistry" 2ND Ed. Alfred Burges P 914.
[6] C. Gupta and R.K Gautam, Rev. Inorg. Chem. 20(3), 241–253 (2000).

[7] Jacquelyn G. Black " Microbiology principles and Exploration" Forth Edition John Wiley and sons, INC. Newyork, 1999 p 351
[8] P. Guru, Journal of Applied Chemical Research, Vol. 6(1) 24-33, (2008)
[9] P. Guru, M. P. Goutam and R.K. Gautam, Chemical Papers 58(5), 341-347 (2004).
[10] Samuel Brown M.D., "Medicinal Chemistry" 2nd Ed., 1986, 497-498
[11] Body William "A Text Book of Pathology Structure and Function in Disease", 8th Ed., 1970, 324.
[12] G.S. Willson, , and A.A Miles., "Topley and Willson's Principles of Bacteriology and Immmunity " 3rd Ed. , 1948, 1, 621, 685
[13] E. Robert Buchamam, and D. Estelle, Buchamam "Bacteriology" 5th ed. 1959, 324, 523, 531, 488.
[14] A.L. Smith "Principles of Microbiology", The L.V. Mosby Company – saint Louis, 1973, 7th ed.
[15] P. Guru, Journal of Applied Chemical Research, Vol. 12(4) 7-16, (2010)
[16] P. Guru, International Journal of Chem-Tech Research Vol. 2(1), 102-107 (2010)
[17] P. Guru, International Journal of Pure and Applied Chemistry, Vol. 5(1) 7-11 (2010)
[18] C. Gupta and R.K Gautam., Asian Journal of Chemistry, 10(3), 541-253 (1998).
[19] P. Guru, International Journal of Chem-Tech Research, 1(2), 291- 297 (2009)
[20] P. Guru, M. P. Goutam and R.K. Gautam, Reviews in Inorganic chemistry, 26(6), 521 -551 (2006)
[21] P. Guru, Asian J. Chem., 17 (2), 1322-1324, (2005).
[22] P. Guru, R. K. Gautam IJCC Silver Jublee Issue, 25, 115-120, (2004).
[23] M. K. Kathal, and R.K. Gautam, J Indian Chem., 67(2), 95(1990).
[24] C. Gupta and R.K Gautam, . Ind. J. Chem., 41(A), 763-766, (2002)
[25] Rebart Duguid J.P Cruickshank., B.P Marmian., and R.M.A Swain., "Medicinal Microbiology" T. and A. Constable Ltd. Edindurg Scotland 1973, 1, 236, 314, 341.
[26] S. Robert, Murray Bread, and R., smith Matham "Bergey's Manual of Determination Bacteriology" 1957, 7th edition, 492, 535, 537.
[27] "Martindale The Extra Pharmacopia" The Pharmaceutical Press London , 23rd ed. 1955, 2, 528.
[28] E.A.Rawlins, "Bentley's Text Book of Pharmaceutical " Baillire Tindall, London , 8rd ed. 1992, 516-518.
[29] G.J Tortora., B.R funke., C.L. Case "Microbiology an Introduction "2nd ed. The Banjamin/Cummings Published Company Inc., California, 1986, p 4 , 512.
[30] J.E.F Reynolds., "Martinadale The Extrra Pharmacopoeia " 28th ed. The Pharmaceutical Press London, 1982, 1076.
[31] S.A Walksman,., "Microbial Antagonium and Antibiotic Substance" 2nd ed. Commonwealth Fund New York 1947, 72.
[32] C.Robert, "Medical Microbiology" ELBS and E&S Livingstone Britain, 1970, 901.
[33] R.S. Varma and S.A Imann,., "Indian J Microbial' 1973, 13, 45.
[34] R. Guikshank , "Medical Microbiology" 1975, 12, 2.
[35] Sangal S.K., and Ashok Kumar, J Indian Chem soc., 1986, 63, 351.
[36] C.Krishna, , Joshi, R Jain., and V Sharma , J Indian Chem soc., 1986, 63, 430.
[37] K Vijayendra , K Mogilaiah, . R Sreenivasulu, J Indian Chem soc., 1986, 63, 443.
[38] R.K. Saxena, and S.K Shrivastava ., J Indian Chem soc., 1987, 64, 446.
[39] G.C. Kamdar, H Parikh, ., A R Parikh , J Indian Chem soc., 1987, 64, 420.
[40] G C Kamdar , A R Parikh, A C Chauda , J Indian Chem soc., 1987, 64, 298.
[41] F. Malekzadan, Appl. Microbial, 1968, 16, 663.
[42] J.C. Murruzella and P.A.Henry, J. AM. Pharm Assoc., 47, 471
[43] "Pharmacopoeia of India" Govt. of India Ministry of Health 2nd Ed., 1986, 1012
[44] E.A. Rawtins, "Microbiological Methods" Butter warths London, 1964.
[45] C.H. Collins, "Microbiological Methods" Butter warths London, 1964
[46] K.B. Raper, , D.F Alxander., "Bentleys text book of Pharmaceuticals" Bailliere Tindall, London, 8th Ed., 1992, 448-451

AUTHOR'S BIOGRAPHY

Dr Pranay Guru is working as Professor and Head of Department in the Department of Basic Sciences at Bansal Institute of Research & Technology, Bhopal (MP) India. He received his Ph.D. in Chemistry from the Dr H S Gour University (Central University) Sagar in 2003.

Dr Guru worked at Indra Gandhi Engineering College Sagar , Jai Narain College of Tecnology Bhopal, Peoples College of Research & Technology Bhopal .

Dr Guru is co-author of **Engineering Chemistry Theory & Practice,** (Vikas Publication & Distributor, 2011) & **Energy, Environment, Ecology & Society** (Vikas Publication & Distributor, 2012) .

Dr Guru is published Thirty Seven International/ National Research papers. He was Chair International Conference on **"Development and Prosperity of Nation through Young Minds"** & International Conference on **"Concurrent Techno and Enviro Search"** . He is a Chief editor of **People's Journal of Science and Technology** (*PJST) ISSN*-2249-5487**,** He is a editor of **International Journal of Chem-tech Applications** (INTJCA) & **Vikas International Journal of Management & Science**. He is a associate editor of Advancement in Science and Technology Research. Dr Guru is also part of ediotoital board in "**Journal of Advanced Scientific Research" (JASR)** & "**Journal of Innovative Trends in Science Pharmacy & Technology "**