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Effect of Some d-block metal chelates on Antibacterial and Antifungal activity

Jitendra H. Deshmukh[1], M. N. Deshpande[2] and D. K. Swami[3]

[1]Department of Chemistry, Yeshwant Mahavidyalaya, Nanded
[2]P.G. Department of Chemistry, NES, Science College, Nanded
[3]Department of Chemistry, P. N. College, Nanded

ABSTRACT

Various research papers indicates that the organic chelating agent and their metal chelates have Antibacterial and Antifungal activity. In this study various Fe(II), CO(II), Cu(II) metal chelates were synthesized and they were characterized by analytical, thermal, magnetic, Infrared, Electronic spectral study. The synthesized were screened against Antibacterial and Antifungal activities.

Key words: Antibacterial, Antifungal.

INTRODUCTION:

The chelating agent containing Nitrogen Sulphur and Oxygen donor were used to synthesize Fe (II), CO (II), Cu (II) metal chelates. Different methods were adopted to synthesize the metal chelates.After purification, the chelating agent and metal chelates were characterized by elemental analysis and spectral analysis. The synthesis and characterization of metal chelates is published in the research papers. Further chelating agent and metal chelates were used to study their effect on bacterial and fungal activities.

The following chelating agent and their respective Fe(II), CO(II), Cu(II) metal chelates were screened for Antibacterial and Antifungal activity –
1.7-[(R)2-amino-2-(4-hydroxyphenyl)acetamido]-3-methyl-3-cephem- 4- carboxylic acid mono hydrate(AMCC),
2.4-chloro-N-furfuryl-5-sulphamoylanthranilic acid (NFSA)

Literature survey indicates that organic compounds having chelating tendency and metal chelates have an antimicrobial[1], antifungal[2], antibacterial[3] Insecticidal[4] herbicidal[5] pharmaceutical agents[6].

In our studies we have conducted some microbial experiments to see whether chelating agent and metal chelates have any action on microbial activities. Bacteria species like Escherichia coli, salmonella typhi, staphylococcus aureus and Bacillus subtilis are selected to study the effect of metal chelates and chelating agent on their growth[7].

Antibacterial activity testing:

Experimentation: Antibacterial activity is carried out by agar cup method[8]. For the test nutrient agar is used. The standard antibiotic used for reference is penicillin. The standard disc having penicillin concentration 10 units per disc were used. Sample solution for the substance being examined is prepared by dissolving in DMSO to get the final concentration as 1%.The inhibitory effect of the compound is tested against four pathogenic bacteria. E. coli, S. aureus, B. subtilis and S. typhi. The organisms were maintained on 10 ml nutrient agar starts incubated at 37^0C for 24 hours. The culture is inoculated for 16 to 18 hours at 37^0C and is used as inoculate to prepare seeded agar plates. The sterile nutrient at 50^0C is inoculated with 2% inoculate of respective test organism. It was mixed thoroughly and poured into sterile Petri plates to obtain layer of 3-4 mm thickness.

After solidification the wells or cups i.e. holes of 8 mm in diameter were prepared with the help of cork borer. In a single plate four wells were prepared.0.1 ml of sample is added aseptically into the cup. Four wells in a cup were added with four different sample solutions the standard was prepared by placing the antibiotic disc on the agar surface. The blank was prepared by adding 0.1 ml of DMSO in one of cup for each organism. All the plates were kept into refrigeration for 15 minutes to allow the compound to diffuse into agar medium. After diffusion the plates were incubated at 37^0C for 24 hours. After incubation antibacterial activity is measured as the diameter of clear zone produced around the cup in the plate due to inhibition of bacterial growth.

Table No.1 Report for antimicrobial testing

Medium – Nutrient Agar Method – Agar Cup method.
Dose of compound – 1% Cup size – 8 mm

Sr. No.	Compound	*Escherishia coli*	*Salmonella typhi*	*Staphylococcus aureus*	*Bacillius subtilis*
	[Fe(II)AMCC]	-ve	15 mm	12 mm	-ve
	[Co(II)AMCC]	16 mm	12 mm	17 mm	-ve
	[Cu(II)AMCC]	18 mm	18 mm	19 mm	19 mm
	[Fe(II) NFSA]	-ve	-ve	-ve	-ve
	[Co(II)NFSA]	17 mm	11 mm	14 mm	16 mm
	[Cu(II)NFSA]	-ve	-ve	-ve	-ve
	NFSA	-ve	-ve	-ve	-ve
	AMCC	17 mm	38 mm	29 mm	19 mm
	Penicillin	12 mm	26 mm	40 mm	27 mm
	DMSO	-ve	-ve	-ve	-ve

-ve- No antibacterial activity, Zone of inhibition ---mm

Effect of NFSA and their metal complex: Research survey of indicates that NFSA do not have antibacterial activity. Surprising results are obtained for [Co(II)NFSA], metal chelate shows antibacterial activity of E.coli, S. Typhi, S. aureus and B. Subtilis and the zone inhibition is found to be 17 mm, 11 mm, 14 mm and 16 mm respectively. Antibacterial activity of cobalt

complex is more towards E.coli, B subtilis. Cobalt salt do not have antibacterial activity against above bacteria. [Fe(II)(NFSA)] and [Cu(II) (NFSA)] have no antibacterial activity.

Effect of AMCC ligand and their metal complexes:The results of antibacterial testing indicates that DMPS shows antibacterial activity and zone of inhibition for E.coli 17 mm S. typhi 38 mm, S. aureus 29 mm and B. subtilis 19 mm. It indicates that antibacterial activity is more for S. typhi.[Fe(II) AMCC] metal chelate shows antibacterial activity on S. typhi and S. aureus and zone inhibition is found to be 15 mm and 12 mm respectively. But it has no effect on the growth of E-coli and B. subtilis.[Co(II)AMCC] complex shows antibacterial property for E.coli. S. typhi S.aureus but it shows no effect on growth of B.Subtilis. Antibacterial activity shown by complex is less than chelating agent. [Cu(II)AMCC] shows antibacterial property on all four bacteria and the zone inhibition of E.coli 18 mm, S. typhi 18 mm. S. aureus 19 mm, B. subtilis 19 mm. Result indicates that zone inhibition of this complex for E.coli is more than penicillin standard.

Antifungal Activity:

Experimentation: The antifungal activity testing was carried out by poison plate method[9]. Potato depose agar is used to evaluate antifungal activity . The standard antibiotic used is gryseofluvin which is incorporated directly into the solidified media in 1% concentration i.e. 200 mg. of Gryseofluvin is incorporated in each plate containing 20 ml of PDA. The antifungal activity of the compound is tested against four fungi viz aspergillus niger, aspergillus flavus, pencillum chrysogenum, fusarium moneliforme. 20 ml of PDA is added with 1% i.e. 200 mg of the test sample. The content were thoroughly mixed and poured into sterile petridishes. The standard is prepared by incorporating gryseofluvin 1% in place of test sample. The blank is prepared by adding nothing in PDA. After solidification plates are used for antifungal activity.

The spore suspension is spot inoculated aseptically on the plate with compound with the help of sterile wire loop. All four fungi were inoculated in one plate at different spots. The plates are incubated at 28^0C for 28 hours and the results are interpreted by comparing growth of fungi (diameter of fungal colony) with that of the blank plate. The compound with antifungal activity inhibits the growth of fungi totally while growth is observed with inactive compound. Some of the sample shows reduction in fungal growth which means a higher does is required to inhibit the fungal growth. Different chelating agents and different metal complexes are used to study their effect on fungal growth. Report for Antifungal testing is given in the table No.2

Table No.2 Report for antifungal testing

Medium – Potato dextrose Agar Method – Poison plate method.

Sr. No.	Compound	*Aspergillus niger*	*Aspergillus flavus*	*Penicillium chrysogenum*	*Fusarium moneliforme*
	[Fe(II)AMCC]	+ve	-ve	+ve	RG
	[Co(II)AMCC]	RG	-ve	RG	RG
	[Cu(II)AMCC]	-ve	-ve	-ve	-ve
	[Fe(II) NFSA]	+ve	+ve	+ve	+ve
	[Co(II) NFSA]	-ve	-ve	-ve	-ve
	[Cu(II) NFSA]	+ve	RG	+ve	+ve
	NFSA	+ve	+ve	+ve	+ve
	AMCC	+ve	+ve	+ve	+ve
	Gresofulvin	-ve	-ve	-ve	-ve
	Control	+ve	+ve	+ve	+ve

+ve – Growth, No Antifungal activity
-ve – No growth, Antifungal activity observed
RG - reduced growth.

Effect of AMCC ligand and their metal chelates on fungal growth:
The experiment on antifungal activities indicates that this chelating agent do not show antifungal property to aspergillus niger, aspergillus flavus, pencillium chrysogenum and fusarium moneliforme. The metal complexes of this chelating agent acquires some antifungal activity. [Fe(II)AMCC] metal complex is acting as antifungal to aspergillus flavus. It retards the growth of fusarium moneliforme. But this complex in inactive for fungal growth to aspergillus niger and pencillium chrysogenum. Experimental results on antifungal study indicates that [Co(II) AMCC] metal complex acts as antifungal agent to the aspergillus flavus. This metal complex retards the growth of fusarium Moneliforme, aspergillus niger, pencillium chrysogenum.

[Cu(II)AMCC] metal chelate becomes very active as antifungal agent to aspergillus niger, aspergillus flavus, pencillium chrysogenum and fusarium moneliforme.

Effect of NFSA ligand and metal complexes on the fungal growth : Antifungal experiments after using NFSA organic molecule indicate that it is inactive to aspergillus niger, aspergillus flavus, penicillium chrysogenum and fusarium moneliforme. [Fe(II)NFSA] donot show any antifungal activity against fungi under study.

Interesting feature of [Co(II)NFSA] metal chelate it acts as antifungal agent to aspergillus niger, aspergillus flavus, pencillium chrysogenum and fusarium moneliforme.

[Cu(II)NFSA] complex do not acts as antifungal agent to aspergillus niger, penicillium chrysogenum, fusarium moneliforme. But it retard the growth of aspergillus flavus.

CONCLUSION

After conducting antifungal experiments towards aspergillus niger, aspergillus flavus, pencillium chrysogenum and fusarium moneliforme, it indicates that some newly prepared metal complexes acquires antifungal tendency than the chelating agents.

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