



Antimicrobial Study of 4-Chloro-2-(2-oxo-1, 2-dihydro-indol-3-ylideneamino)-benzoic acid (ACBAI) and their Ti(IV), Zr(IV), Cd(II) and Hg(II) metal chelates

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ABSTRACT

Various research paper indicates that the Schiff base and their metal chelates have Antibacterial and Antifungal activity. In this study of Ti(IV), Zr(IV), Cd(II) and Hg(II) metal chelates were synthesized and they were characterized by analytical, magnetic, Infrared, Electronic, ¹HNMR and X-ray spectral study. The synthesized Schiff base ligand and its metal chelates were screened against Antibacterial and Antifungal activities.

Keywords: Antibacterial, Antifungal.

INTRODUCTION

The Schiff base containing ONO donor groups were used to synthesize Ti (IV), Zr (IV), Cd (II) and Hg (II) metal chelates. The preparative method was adopted to synthesize the Schiff base^[1] and their metal chelates^[2]. After purification, the Schiff base and metal chelates were characterized by elemental analysis and spectral analysis. The synthesis and characterization of Schiff base ligand and their metal complexes are published in the research papers. Further chelating agent and metal chelates were used to study their effect on bacterial and fungal activities.

The Schiff base as chelating agent and its respective Ti(IV), Zr(IV), Cd(II) and Hg(II) metal chelates were screened for Antibacterial and Antifungal activity 4-Chloro-2-(2-oxo-1,2-dihydro-indol-3-ylideneamino)-benzoic acid(ACBAI). Literature survey indicates that isatin (1H-indol-2, 3-dione) is a synthetically versatile substrate. It stemmed from the interest in biological and pharmacological properties from isatin derivatives^[3, 4]. Schiff bases derived from isatin have shown different antimicrobial activity due to different nature of the carbonyl and amino components as well as its substitution^[5-7]. Schiff base metal complexes of isatin with various aromatic amines were studied for microbial activity^[8]. In our research studies we have conducted some microbial experiments to see whether Schiff base ligand and metal chelates have any action on microbial activities. Bacterial species like Escherichia coli, Bacillus subtilis and antifungal species are Aspergillus flavus, Aspergillus niger were selected to study the effect of Schiff base and their metal chelates on growth.

EXPERIMENTAL SECTION

The antimicrobial tests were performed by the standard disc diffusion method^[9].

Antibacterial activity study:

The antibacterial activity of the ligand and their metal complexes was studied against Gram- positive bacteria *Bacillus subtilis* and Gram- negative bacteria *Escherichia coli*. The Schiff base ligand and metal complex compound dissolved in DMSO at a concentration of 0.1 mg/ml was prepared. Paper disc of Whatmann filter paper no.1 were cut and sterilized in an autoclave. The paper discs were saturated with 10 μ l of the ligand and metal complex compounds dissolved in DMSO solution or DMSO as negative control and placed aseptically in the Petri dishes containing Nutrient agar media inoculated with the above mentioned two bacteria separately. The Petri dishes were incubated at 37°C and the inhibition zones were recorded after 24 hour of incubation. Inhibition zones were measured and compared with streptomycin as a standard drug.

Table No.1 Result of antibacterial study of transition metal chelates

Medium – Nutrient Agar Method – Disc Diffusion
Dose of compound – 0.1 mg/ml Disc size – 4mm

Sr.No.	Compound	<i>Escherichia Coli</i>	<i>Bacillus Subtilis</i>
1	[Ti(IV) ACBAI]	-ve	8 mm
2	[Zr(IV) ACBAI]	-ve	6 mm
3	[Cd(II) ACBAI]	5 mm	6 mm
4	[Hg(II) ACBAI]	-ve	21 mm
5	ACBAI	15 mm	-ve
6	Streptomycin	24 mm	30 mm
7	DMSO (Control)	10 mm	14 mm

-ve – No antibacterial activity, zone of inhibition ----mm

Effect of ACBAI and their metal complex:

[Ti(IV)4-Chloro-2-(2-oxo-1,2-dihydro-indol-3-ylideneamino)-benzoic acid (ACBAI)] and [Zr(IV) ACBAI] metal ion complexes produce zone of inhibition 8mm and 6mm for *Bacillus subtilis*. [Cd (II) ACBAI]metal ion complex produce very weak zone of inhibition i.e., 5mm and 6mm for *Escherichia coli* and *Bacillus subtilis*. But [Hg(II) ACBAI] metal ion complex produce negative zone of inhibition towards *Escherichia coli* while the same complex produces 21mm zone of inhibition towards *Bacillus subtilis*.

Table No.2 Result of Antifungal study of transition metal chelates

Medium – Potato dextrose Agar Method – Disc diffusion

Sr.No.	Compound	<i>Aspergillus Flavus</i>	<i>Aspergillus niger</i>
1	[Ti(IV) ACBAI]	-ve	-ve
2	[Zr(IV) ACBAI]	-ve	10 mm
3	[Cd(II) ACBAI]	-ve	-ve
4	[Hg(II) ACBAI]	40 mm	25 mm
5	ACBAI	10 mm	10 mm
6	Fluconazole	15 mm	10 mm
7	DMSO (Control)	-ve	-ve

-ve – No antifungal activity, zone of inhibition ----mm

Antifungal activity study:

The Schiff base (ACBAI) and their Ti(IV), Zr(IV), Cd(II) and Hg(II) metal chelates were screened for their antifungal activity against viz. *Aspergillus flavus* and *Aspergillus niger*. These fungal species were isolated from the infected parts of the host plants i.e., potato dextrose agar. The cultures of fungi were purified by single spore isolation technique. A concentration of 0.1 mg/ml of each ligand and metal complex compounds in DMSO solution was prepared for testing against spore germination of each fungus. Filter paper discs of 4mm in size, prepared by using whatmann filter paper no.1 (Sterilized in an autoclave) were saturated with 10 μ l of the ligand and complex compounds dissolved in DMSO solution or DMSO as negative control. The plates were then observed and the diameters of the inhibition zones (in mm) were measured and compared with control and Fluconazole as standard.

Effect of ACBAI ligand and their metal chelates on fungal growth:

4-Chloro-2-(2-oxo-1,2-dihydro-indol-3-ylideneamino)-benzoic acid (ACBAI) forms inhibition zones are 10mm each. [Ti(IV) ACBAI] and [Cd(II) ACBAI] metal chelates do not form zone of inhibition towards *Aspergillus flavus* and *Aspergillus niger* indicating negative antifungal activity. But [Zr(IV) ACBAI] metal chelates produces zone of inhibition 10mm for *Aspergillus niger*. [Hg(II) ACBAI] metal complex produces much more zone of inhibition as compared to standard Fluconazole.

CONCLUSION

After conducting antifungal experiments towards as *Aspergillus niger*, *Aspergillus flavus*, it indicates that [Hg(II) ACBAI] metal complex acquires fungal activity than the Schiff base ligand.

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