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Antimicrobial study of Novel salen type 2,2'-(ethane-1,2-diyldinitrilo)bis(phenylacetic acid) complexes of Zn and Cd

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ABSTRACT

The Cd^{II} , Zn^{II}, of salen type complexes of Schiff base were studied for their Antimicrobial activity. For that the borth dilution method is used. Both the synthesized compounds were screened for their in-vitro antibacterial activity against Gram-positive, Gram-negative bacteria. The investigation of antibacterial screening data revealed that most of the compounds tested have demonstrated congruent activity against E.Coli, P.Aeruginosa, S. Aureus and S.Pyogenus as compared with the standard Ampicillin. Among the series, both compounds exhibited excellent an antibacterial activity profile as compared with the standard. In summary, preliminary results indicate that some of the newly synthesized title compounds exhibited promising antibacterial activities and they warrant more consideration as prospective antimicrobials.

Keywords: Salen type Complexes, Antimicrobial activity. eddpa**(**2,2'-(ethane-1,2-diyldinitrilo)bis -(phenylacetic acid)

INTRODUCTION

The free Schiff bases and their complexes have been screened for antimicrobial activities and the results show that the free Schiff bases are more potent antibacterials than the complexes.[1] Metal complexes of salen derivatives have become increasingly valuable as reagents and catalysts of many reactions including electrochemical reduction hydroxylation and Diels-Alder transformation.[2] Salen is a schiff base derived from the condensation of salicylaldehyde and Ethylene diamine. It is symmetrical molecule and exhibits chiral properties. Schiff base are frequently studied due to their biological activity[3] as well as their optical[4] and catalytic activity. [5] Chiral N, N^1 bis (salicylidene) ethylene diamine (salen) compounds are very popular ligands because of their easy formation and rich coordination chemistry with a large variety of metal ions that has allowed a symmetric reactions. [5] The incorporation of "Salen" moieties in to macro cyclic structures gives rise to supramolecular interactions and the synthesis of salen compounds bearing Lewis acid or Lewis base activating groups are currently investigated for the development of more active catalysts. [6] The antimicrobial studies of these complexes on five different gram (+)/(−) bacteria and three different fungal organisms showed selective inhibition of the growth of gram (+) bacteria and were not affective against gram (−) and fungal organisms.[7]

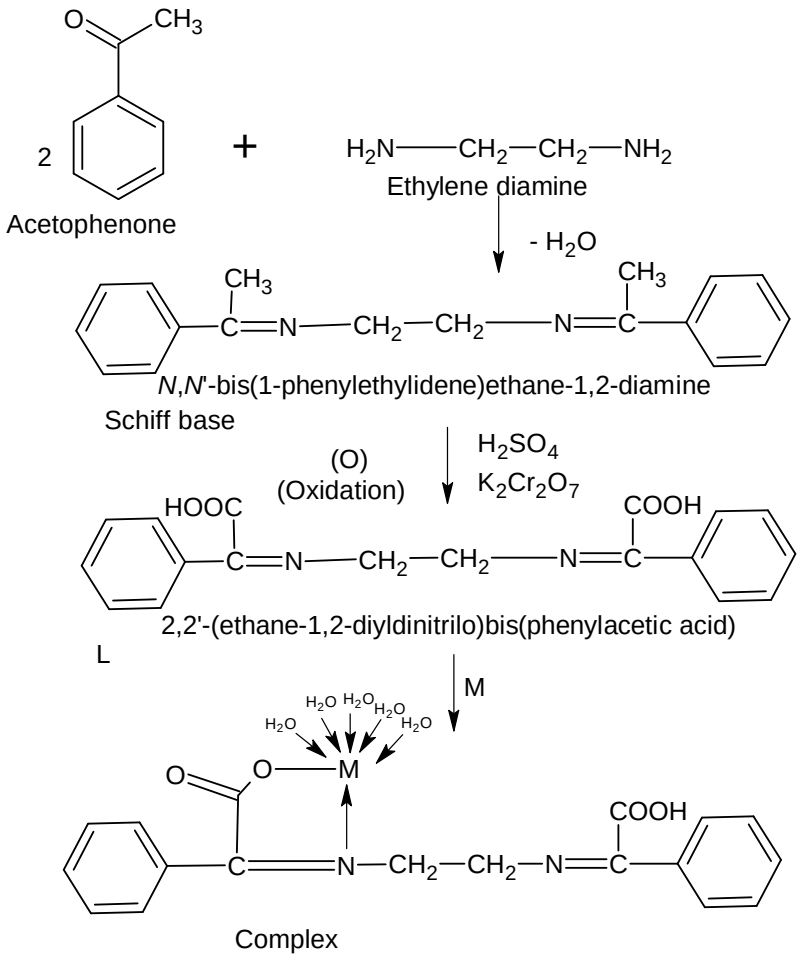
MATERIALS AND METHODS

Experimental

All the chemicals used throughout the course of experimental work were of analytical grade. spectroscopic grade solvents were employed for recording the soectra. Zn(II), Cd(II) perchlorates were prepared.

Preparation of schiff base N,N-bis(1-phenylethylidene)ethane1,2-diamine

The synthesis of the schiff base was carried out by mixing a (0.12 mole) 7.2 gm ethylene diamine and (0.24 mole) 28.8 gm acetophenone and (The mole ratio is 1:2) in a 500ml round bottom flask 20ml methanol was added in a mixture. The reaction mixture was refluxed for 1.5 hour. Yellow coloured solution was observed. It was kept overnight and the solid product separated out from solution.



M=Zn and Cd

Preparation of ligand 2, 2'-(ethane-1, 2-diyldinitrilo)bis(phenylaceticacid)

The synthesis of ligand was carried out by mixing a (0.03 mole) 6.6gm schiff base and 13gm potassium dichromate and 27ml distilled water in 500ml round bottom flask. 24gm of H_2SO_4 was added dropwise in reaction mixture within 30 minutes with stirring. The heat of dilution of the acid causes the schiff base to melt and oxidation take place.[10,11] When all the sulphuric acid was consumed, and the temperature of the mixture commences to fall, a reflux condensor was attached to the flask and heated to gentle boiling for 45 to 60 min. The reaction mixture was cooled and poured in to 50ml distilled water. Green precipitates were observed, filtered and washed with 20ml of distilled water. The precipitates were transferred in a 500ml beaker and 5 percent 25ml H_2SO_4 solution (0.7ml + 24.3ml

water) was added and digested on a water bath with agitation in order to remove the chromium salt for 20 minutes. The reaction mixture was allowed to cool and filtered again. The precipitates are transferred in a beaker and any lumps of material were broken. Then it was treated with 5 percent NaOH solution untill the liquid remained alkaline.

Preparation of complex:-

The synthesis of complex was carried out by mixing 25ml 0.2M metal perchlorate solution and 25ml 0.2M ligand alcoholic solution. The mole ratio of ligand and metal was (1:1). The reaction mixture was refluxed for 2.5 to 3 hours at 90°C temperature. After 3.0 hours the reaction mixture was cooled. There was no immediate precipitation. The pH of the above solution was then raised to 6.0 using 0.1M sodium hydroxide solution which resulted in the precipitation of the solid. The complex thus obtained was washed well with 1:2 mixture of absolute alcohol and water to remove unreacted metal salt and ligand.

RESULTS AND DISCUSSION

Antimicrobial activity :

The synthesized Zn eddpa and Cd eddpa were tested for their antibacterial activity against bacteria viz. Escherichia coli, Staphylococcus aureus, Streptococcus Pyogenus ,and Pseudomonas Aeruginosa and antifungal activity against fungus viz.Candida albicans Aspergillus Niger and Aspergillus Clavatus. It was observed that the antibacterial activity of the ligand increased when it was complexed with either zinc or cadmium metal ion. Five standard antibiotics were selected for comparison with respect to activity against E. Coli Zinc complex was found to be more active than ampicilin. The antibacterial activity of zinc and cadmium complexes against S.Aureus was found to be equal compared to ampicilin. Against P.Auroginasa and S.Pyogenus the complexes showed less activity compared to the standard antibiotics. The antifungal activity of cadmium complex was higher compared to the ligand against A. Clavatus. The antifungal activity of ligand as well as cadmium complex against C. Alibcans are same as the standard drug gressifulvin however against A. Niger and A.Clavatus the antifungal activity of both the complexes is less than both antibiotics selected.

Table No. 1

compound	**color**	**m.w.**	**m.p.**	**RF value**	**λ max**	Magnetic moment
Schiff base	yellow	264	101°C	0.61	_	-
Ligand	white	324	116°C	0.70	200	-
Zn eddpa	white	388	128°C	0.85	227	Dimagnetic
Cd eddpa	white	435	126°C	0.82	227	Dimagnetic

Table – 2

Antibacterial Activity					
Minimal Inhibition Concentration					
S. No.	Code No.	E.Coli MTCC 443	P.Aeruginosa MTCC 441	S. Aureus MTCC 96	S.Pyogenus MTCC 442
Microgram /ml					
1	Ligand	250	500	500	500
2	$[Zn(C_{18}H_{14}O_4N_2).5H_2O]$	62.5	250	250	250
3	$[Cd(C_{18}H_{14}O_4N_2).4H_2O]$	125	200	250	200

Table –3

Minimal Inhibition Concentration				
Drug	E. Coli	P.Aeruginosa	S.Aureus	S.Pyogenus
--	MTTC 443	MTCC 441	MTCC 96	MTCC 442
	Microgramme / ml			
Gentamycin	0.05	1	0.25	0.5
Ampicillin	100	100	250	100
Chloramphenicol	50	50	50	50
Ciprofloxacin	25	25	50	50
Norfloxacin	10	10	10	10

Table –4

Antifungal Activity				
Minimal fungicidal Concentration				
SR. No.	Code No.	C. Albicans MTCC 227	A. Niger MTCC 282	A. Clavatus MTCC 132
Microgram /Ml				
1	Ligand	500	1000	1000
2	$[Zn(C_{18}H_{14}O_4N_2).5H_2O]$	1000	500	1000
3	$[Cd(C_{18}H_{14}O_4N_2).4H_2O]$	500	500	500

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