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Pharmacological evolution of Co(II), Ni(II),Cu(II) and Zn(II) metal complexes of 2-Hydroxy-5- methyl acetophenone-N, N'-ethylenediimine Schiff base

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Abstract: The synthesized metal complexes Co(II), Ni(II), Cu(II) and Zn(II) of Schiff base have been condensing by 2-hydroxy-5-methyl acetophenone with ethylene diamine. The metal complexes were obtained as a result of interaction of Schiff base ligand. Schiff base have been synthesized and characterized on the basis of elemental analysis, Infrared and ^{1}H NMR, analysis. The Schiff base commonly coordinates through the oxygen atom of phenolic OH group and the nitrogen atom of azomethine group, which is confirmed by IR spectral data. Further conclusive evidence of the coordination of the Schiff bases with the metal ions was shown by the appearance of new bands due to v(M-N) and v(M-O) in the metal complexes. The metal complexes have been examined against the growth of bacteria to assess their Pharmacological evolution.

Key words: Schiff base, Spectral, Antimicrobial studies

Contents

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1. Introduction

Schiff bases are the compounds containing azimethine group (C=N-). They are condensation products of ketones or aldehydes with primary amines and were first studied by Hugo Schiff in 1864. Now Recently, Schiff bases are used as intermediates for the synthesis of amino acids or as ligands for preparation of metal complexes having a series of different structures with different metal. This research paper shows modals for biologically important species. Ophenylenediamine Schiff bases show clinical properties [1]. Day by day Schiff bases are more frequently applied and used for the human welfare. Schiff bases and their metal complexes are biologically active complexes have been studied extensively over the past decade [2]. These complexes have played an important role in the development of

coordination chemistry[3]. Metal complexes of Schiff bases show biological activities including antibacterial, antifungal, anticancer and herbicidal[4]. Hydrazones, heteroaroyl hydrazones ligands and their metal complexes are biologically active. Heteroaroyl hydrazones forms stable metal complexes with transition metal ions and inner transition metal ions due to complexing ability of ligand through keto-enol tautomerism and availability of other donar sites in the ligand i.e. isonicotinoyl hydrazide is one of the drug in chemotherapy of tuberculosis[5]. The aim of present investigation is to synthesize various transition metal complexes of Schiff base condensed from 2-hydroxy-5- methyl acetophenone with ethylene diamine.

2. Materials and Methods

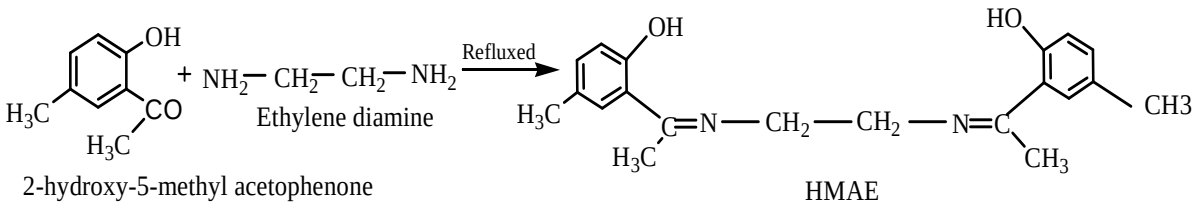
Experimental

All the chemicals were of A.R. grade and used as received ethylene diamine and 2-hydroxy-5- methyl acetophenone (HMA) was prepared by known methods [6-9]. The solvents were purified by standard methods[10].

Synthesis of 2-Hydroxy-5- methyl acetophenone-N, N'-ethylenediimine (HMAE):

A hot ethanolic solution of ethylene diamine (0.05 mol) was added to an ethanolic solution of respective acetophenone (0.05 mol). The reaction mixture was refluxed in a water-bath for 3-4 h. The colour product was filtered and recrystallised.

Yield 90%. M.P. 262^0C



2-hydroxy-5-methyl acetophenone HMAE

Scheme 1. Synthesis of HMAE

Table1. Analytical data of the Ligands

Sr. No	Ligand	Molecular Formula	Formula Weight	Color and nature	Elemental Analysis		
					C% found (Cal.)	H% Found (Cal.)	N% Found (Cal.)
1.	HMAE	$C_{20}H_{24}N_2O_2$	324	Yellow Crystalline	70.38 (74.07)	07.10 (07.40)	08.14 (08.64)

Preparation of complexes:

All the metal complexes were prepared in a similar way by following method. To a hot solution of ligand HMAE (0.02M) in 25ml of ethanol a suspension of respective metal salts was added drop wise with constant stirring. The reaction mixture was refluxed on a water bath for 4-6 h. The precipitated complexes were filtered, washed with ethanol followed by ether and dried over fused calcium chloride. Yield:45-50%. The complexes are soluble in DMSO and DMF but insoluble in water and common organic solvents. The metal chloride content of complexes were analyzed by standard methods [11]. The ^{1}H NMR spectra of ligand was recorded and obtained from RSIC Chandigarh. IR spectra of the compounds were recorded on Perkin Elmer 842 spectrophotometer in the region 400-4000cm^{-1}, Carbon, Hydrogen and Nitrogen analysis were carried out at RSIC, Punjab Universityand Chandigarh.

3. Result and Discussion

The Schiff base ligand HMAE and its complexes have been characterized on the basis of ^{1}H NMR, IR spectral data and elemental analysis. All these values and analytical data is consistent with proposed molecular formula of ligand. All the compounds are coloured solid and stable in air. They are insoluble in water but soluble in coordinating solvents like DMF and DMSO. The molar conductance values in DMF(10^{-3}M) solution at room temperature shows all the complexes are non electrolytes. The ^{1}H NMR spectra of ligand HMAE shows signals at 11.90 (1H, s, phenolic OH); 9.55 (1H, s, phenyl); 8.65 and 8.30(2H, m, phenyl), 3.14(4H, s, CH_2 CH_2); 2.22 ppm (3H, s, methyl)[12-19]. IR spectra of ligand and metal complexes summarized in table 2. As per observation ν(C=N) peaks at 1630cm^{-1} indicates the Schiff base formation [20-21].

Table.2 IR spectra of ligand and metal complexes

Compound	*v*(O-H) hydrogen bonded	*v*(C=N) Imine	*v*(C-O) phenolic	*v*(M-O)	*v*(M-N)
$C_{20}H_{24}N_2O_2$	2918	1630	1475	--	--
$[Co(LH)_2 2H2O]\ H_20$	--	1587	1442	518	452
$[Ni(L)H_2O]\ 2H_20$	--	1585	1455	512	495
$[Cu(LH)_2]\ 3H_20$	--	1594	1442	592	492
$[Zn(LH)_2 2H_2O]\ 2H_20$	--	1592	1444	590	488

Pharmacological evolution:

The inhibition of growth of microorganism by measuring the concentration of the sample to be examined with the known concentration of standard antibiotic. In this observation the ligand and their metal complexes were tested for their effect on certain human pathogenic bacteria such as Gram-positive. For the pharmacological antimicrobial analysis the agar diffusion method has been employed. The ligand HMAE and its complexes [22-23] are found to show considerable bacteriocidal activity against *E. coli, A. aerogenes, S. aureus* and *B. subtilis* and are almost inactive against *B. megatherium, P. vulgaris* and *P. fluorescen*. The ligand inhibits the growth of *S. aureus* more than all its complexes. The results reveal that the sensitivity of the ligand HMAE and its complexes is shows in Table 3.

Table.3 Pharmacological evolution activity

Ligand and its complexes	***B. subtilis* (mm)**	***P. vulgaris* (mm)**	***S. aureus* (mm)**	***E. coli* (mm)**	***P. fluorescen* (mm)**	***A. aerogenes* (mm)**	***B. megatherium* (mm)**
HMAE	S_{10}	S_6	R	R	R	S_7	R
Co- HMAE	R	S_{11}	S_{10}	S_{12}	R	S_{10}	S_8
Ni- HMAE	S_8	R	S_7	S_{10}	S_6	S_9	R
Cu- HMAE	S_7	R	S_{12}	R	R	R	S_7
Zn- HMAE	S_{10}	R	R	R	R	S_9	R

S-Sensitive
R-Resistant

4. Conclusion

The structural changes have marked effect on the sensitivity and sensitivity varies with organisms. However, the zone of inhibition of ligand varies with organisms as well as metal ions. Thus, it can be concluded that most of our ligands and their complexes possess pharmacological antimicrobial activities.

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