

## Synthesis, Characterization and Antimicrobial Activity of Transition Metal Complexes of Schiff Base Derivatives from Isonicotinic Acid Hydrazide

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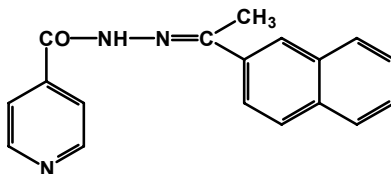
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The transition metal complexes of hydrazones of isonicotinic acid hydrazide, viz., 1NH-AN of the type M-3 (1NH-AN) (M = Mn, Fe, Co and Ni) have been synthesized and characterized by infrared and magnetic susceptibility measurements and probable structures assigned.

**Key Words:** Isonicotinic acid hydrazide, Metal complexes, Schiff base, 2-Acetyl naphthalene.

### INTRODUCTION

The chemical and pharmacological properties of isonicotinic acid (isoniacin) and its hydrazide (isoniazid) have been investigated recently owing to their potential application as antineoplastic, antiviral, antiinflammatory and antitubercular agents<sup>1-5</sup>. The activity of drug is observed to increase when administered as metal complexes and several metal chelates have been used as antitumour agents<sup>6,7</sup>. Some complexes of transition metals with Schiff bases derived from this hydrazide have been mentioned in the literature<sup>8-10</sup>. The present work deals with the synthesis and characterization of the transition metal complexes of Schiff base derived from isonicotinic acid hydrazide. The coordination compounds of aroyl-hydrazones have been reported to act as enzyme inhibitors<sup>11</sup> and are useful due to their pharmacological applications<sup>12-14</sup>. In view of the increasing interest in hydrazones, on account of the structural, analytical and pharmacological importance of their metal complexes, the synthesis of hydrazone (1NH-AN) (**I**) and its transition metal complexes are reported.



(I) 1NH-AN

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## EXPERIMENTAL

All the chemicals used were of either BDH or NICE. Solvents and the metal salts were used without further purification.

Isonicotinic acid hydrazide (1 mmol) and 2-acetyl naphthalene (1 mmol) were refluxed together for 3 h in the presence of a drop of conc. HCl. The volume of the mixture was reduced to half. It was then cooled in a refrigerator, when light yellow crystals separated, it was filtered, washed several times with cold ethanol and finally dried.

**Preparation of the complexes:** The complexes were prepared by two methods. (i) By reacting stoichiometric amounts of the Schiff base and the metal salts. (ii) By carrying out the *in situ* reaction of amine, 2-acetyl naphthalene and the metal salts. However, in both the cases, complexes of the same stoichiometry were isolated. We have adopted the *in situ* reaction in the present investigation as exemplified below.

Isonicotinic acid hydrazide (1 mmol) and 2-acetyl naphthalene (1 mmol) were taken together in ethanol (30 mL) and refluxed for 0.5 h after which manganese sulphate (1 mmol) in ethanol was added and reflux continued for another 3 h. Upon cooling, microcrystalline manganese complex precipitated. It was filtered, washed thoroughly with ethanol and dried. All other complexes were prepared in an identical manner.

The IR spectra in KBr pellets were recorded on a Perkin Elmer spectrophotometer. Magnetic susceptibility was measured by Gouy method.

**Antimicrobial activity of the ligand and its complexes:** The main characteristics of the medium were to support the growth of the organisms normally tested and not contain antagonist of antimicrobial activity. The medium must allow free diffusion of plant extract from the well.

The sterilized medium was poured into a Petri dish in a uniform thickness and kept aside for solidification. Using sterilized swabs, even distribution of lawn culture was prepared using bacteria and fungi chosen in Muller Hinton Agar (MHA) plates and Sabouraud's dextrose (SDA) agar, respectively.

**Well method:** Mueller Hinton agar (MHA) and Sabouraud's dextrose (SDA) agar were prepared with lawn culture using desired test organisms. The inoculated plates were kept aside for few minutes. Using well cutter 2 wells are made in those plates at required distance. In each step of well cutting, the well cutter was thoroughly wiped with alcohol. Using sterilized micropipette, 20  $\mu$ L of compound extract was added in to one well and in another well the same volume of corresponding controls (solvent without chemical extract) were added.

After diffusion, the plates were incubated at 37 °C for 24 h. After incubation, the inhibition of growth was analyzed and results were recorded.

## RESULTS AND DISCUSSION

The reaction of non-aqueous solutions of metal salts with 1NH-AN resulted in the formation of complexes of the composition M-3L (L = 1NH-AN; M = Mn, Fe, Co and Ni). The complexes are highly stable under laboratory conditions and can be stored for a long time in a desiccator. They are coloured solids and have high melting point.

A comparison of the IR spectra of the ligand and its complexes (Table-1) imply that the ligand is bidentate with imine nitrogen and exocyclic azomethine nitrogen as the two coordination sites.

TABLE-1  
IR DATA (cm<sup>-1</sup>) OF THE LIGAND AND ITS COMPLEXES

Ligand	Complex				Assignment	Ref.
	Mn(II)	Fe(II)	Co(II)	Ni(II)		
3330	3335	3332	3326	3329	v(N-H)	15-18
1664	1665	1667	1660	1666	v(C=O)	18,19
1612	1600	1595	1573	1589	v(C=N)	15,18-20

The NH stretching absorption of free ligand occurs at 3330 cm<sup>-1</sup> which remains unaffected after complexation. This precludes<sup>15-18</sup> the possibility of coordination through the imine nitrogen atom. The ligand band due to C=O stretching frequency remains unaffected after complexation, suggesting<sup>18,19</sup> coordination of the carbonyl oxygen is absent in the complex.

The band due to C=N mode undergo a shift to lower frequency and is observed as a strong peak in the region 1600 suggesting<sup>15,18-20</sup> participation of exocyclic azomethine nitrogen in the complex formation. A sharp peak at 745 cm<sup>-1</sup> is characteristic of C-H stretching absorption. All other complexes exhibit an identical pattern suggesting them to be isostructural.

The magnetic moments of the present complexes at room temperature have been calculated<sup>19,21,22</sup> and the values are given in Table-2 and expected for six coordinated spin free species.

TABLE-2  
MAGNETIC MOMENT DATA OF COMPLEXES

Magnetic moment value (BM)	Mn (II)	Fe (II)	Co (II)	Ni (II)
$\mu_{\text{eff}}$	5.82 (5.9)	5.44 (5.1-5.5)	5.00 (4.1-5.2)	3.10 (2.8-4.0)

**Antimicrobial activity:** The complexes have been screened as possible fungitoxides and bacteria. The susceptibility of a certain bacterial and fungal strains towards an antibacterial and antifungal drug can be measuring the

diameter shows some of the complexes are high sensitive against bacteria and fungal pathogen chosen. The results are summarized in Table-3.

TABLE-3  
ANTIMICROBIAL ACTIVITY DATA OF LIGAND AND ITS COMPLEXES

Name of the organism	Zone of inhibition (mm)				Ligand
	Mn(II)	Fe(II)	Co(II)	Ni(II)	
<i>S. aureus</i>	–	–	–	–	6
<i>E.coli</i>	–	–	–	–	–
<i>Pseudomonas</i>	7	13	7	19	9
<i>A. niger</i>	5	10	8	18	14
<i>C. albicans</i>	5	–	–	12	10
<i>Pencillium</i>	–	–	–	13	9

– = No zone of inhibition.

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