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Preparation, spectroscopic study of schiff base complexes of Dy (III) and evaluation of antimicrobial activity

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Abstract
Schiff base complexes of dysprosium derived from alpha napthyl amine with different aldehydes *viz*.4 methoxy benzaldehyde, 4 hydroxy benzaldehyde. Schiff bases were prepared by condensation alpha napthyl amine with different aldehydes. The prepared Schiff bases and their dysprosium complexes have been characterized by elemental analysis, IR,^{1}H NMR spectral studies. The ligands and their dysprosium complexes have been screened for their biological activity against the bacteria, S. aureus, E.coli and the fungi Penicillium crysogenum and Aspergillus Niger. The Schiff bases and their dysprosium complexes show variable activity of inhibition on the growth of bacteria and fungi.

Keywords: Dy (III), antimicrobial activity, alpha napthyl amine, Schiff base

1. Introduction
Coordination chemistry of lanthanide metals is one of impulsive research in inorganic chemistry [1]. A schiff base ligand represents one of the most widely used families of polydentate ligands in coordination chemistry [2]. The reaction of an amine with an aldehydes or a ketone in specific conditions produces schiff base ligands [3]. Metal complexes of schiff base have played a fundamental role in the advancement of coordination chemistry [4]. Schiff base ligands and their metal complexes have a variety of applications in biological, clinical, analytical and industrial field [5]. Due to paramagnetic properties of lanthanides and their complexes these compounds are generally used in medicine as a different media for MRI [6]. Schiff base metal complexes have been used in optical and electrochemical sensors [7].
Schiff base complexes of lanthanide possess a wide range of biological antianalgesicl [8], antioxidant [9], antitumor [10], antifungal [11l], antipyretic [12], antibacterial [13], antiviral [14].

2. Experimental
Material and Methods
All the chemicals and solvents used were of A.R. grade. All chemicals used were of Merck and S.D. fine Ltd.

Synthesis of Schiff base ligands
The Schiff base ligands were prepared by refluxing equimolar mixture of aldehyde (0.01mol) and alpha napthyl amine (0.01mol) in ethanol for 4-5 hrs. The reaction mixture was poured in ice cold water, on cooling the obtained crystalline precipitates were filtered, washed with ethanol and recrystallized from ethanol and dried. They are light coloured crystalline solids.
The following Schiff base ligands obtained and characterized.

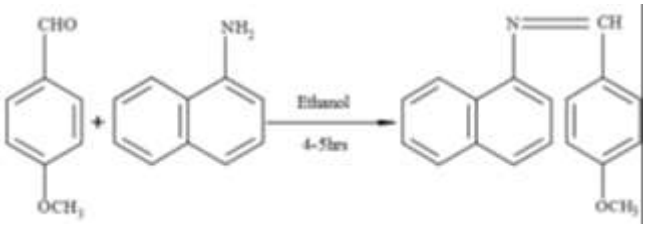

Fig 1: 1- (4-methoxy benzylidene) napthyl amine (MBNA)

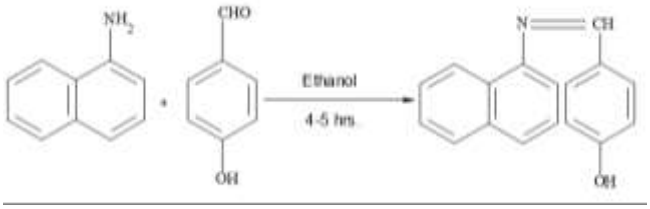

Fig 2: 1-(4-hydroxy benzylidene) napthyl amine (HBNA)

Synthesis of Dysprosium (III) complexes
Dysprosium (III) complexes were prepared by the following method
To a hot solution of ligand (0.01) moles in 40ml of ethanol 0.01 moles of Dy (III) nitrate Salt dissolved in 25ml of ethanol was added drop wise. The reaction mixture was refluxed for four hours. The precipitated complex was further digested for one hour. The complex formed was filtered and washed with alcohol.. It was dried in vacuum desiccators over calcium chloride.

3. Results and discussion
It is well know that lanthanide ions have high affinity to hard donor atoms such as nitrogen and oxygen atoms. The result presented here show that, on the basis of IR and

^{1}HNMR spectral analysis indicates that the complexes have 1:1 (lanthanide: ligand) stoichiometry. The lanthanide Complexes are stable and coloured. Ligands and their Lanthanide complexes are soluble in soluble in ethanol, DMSO, DMF.

Elemental analysis

The analytical data for the Complexes are given in Table 1. The data agree with the suggested molecular formula of the Complexes

Table 1: Elemental Analysis of Schiff Base and Dysprosium (Iii) Complexes

Compound	Molecular Formula	Molecular weight	Cal.(Exp.)%			
			C	H	N	M
MBNA	$C_{18}H_{15}NO$	261	82.64 (82.66)	5.74 (5.77)	5.36 (5.37)	-
$[DyL_1(NO_3)_2]$ NO_3	$C_{36}H_{30}N_5O_{11}Dy$	870	49.65 (49.73)	3.44 (3.52)	8.04 (8.15)	18.69 (18.63)
HBNA	$C_{17}H_{13}NO$	247	82.59 (84.67)	5.26 (5.44)	5.66 (5.76)	-
$[DyL_2(NO_3)_2]$ NO_3	$C_{34}H_{26}N_5O_{11}$ Dy	842	48.45 (48.54)	3.08 (3.16)	8.31 (8.43)	19.23 (19.29)

IR spectral studies

The IR spectra of the complexes were compared with those of the free ligand in order to determine the coordination sites that may be involved in coordination. Upon comparison it this band shifted to lower wave numbers in the complexes indicating the participation of nitrogen in coordination.

Table 2: Ir Spectral Data of Schiff Base and Dysprosium (Iii) Complexes

Compound	(Ar-H)	(CH=N))	(C=C)	(NO_3)	(M-N)	(M-O)
MBNA	3034	1622	1603	-	-	-
$[DyL_1(NO_3)_2]$ NO_3	3042	1603	1623	1306	510	467
HBNA	3055	1620	1592	-	-	-
$[DyL_2(NO_3)_2]$ NO_3	3055	1622	1603	1398	516	463

^{1}HNMR spectral data

^{1}H–NMR spectral studies of ligands and their lanthanum complexes were recorded in DMSO d6. The data are summarized in Table 3.

Table 3: ^{1}hnmr Spectra Data of Schiff Base and Dysprosium (Iii) Complexes.

Compound	Aromatic H	(C-H azomethine	(-OCH_3)	(-OH)
MBNA	7.28	8.35	3.36	-
$[DyL_1(NO_3)_2]$ NO_3	7.4-7.9	8.57	-	-
HBNA	7.93	8.49	-	10.08
$[DyL_2(NO_3)_2]$ NO_3	7.1-7.8	8.67	-	-

4. Antimicrobial activity

The ligand and some of their corresponding metal complexes were screened invitro for their antibacterial and antifungal activity against bacterial strains S.aureus, E.coli and the fungi Penicillium crysogenum and Aspergillus niger using agar well diffusion method using Streptomycin as standard. The results of antibacterial studies are presented in Table 4 comparative study of the ligand and their metal complexes indicates that most of the metal complexes exhibit higher antimicrobial activity than that of the free ligand. Hence complexation increases antimicrobial activity.

Table 4: Antimicrobial Activity Tests of Schiff Bases and Their Dysprosium (Iii) Complexes.

Compound	Antibacterial		Antifungal	
	E.coli	S.aureus	Aspergillus niger	Penicillium crysogenum
MBNA	19	20	18	16
$[DyL_1(NO_3)_2]$ NO_3	22	20	22	20.2
HBNA	16	20	15	16
$[DyL_2(NO_3)_2]$ NO_3	26	22	18	20.6

(Diameter of inhibition zone in mm)

5. Conclusion

In this paper, the synthesis of novel Schiff base ligand and its dysprosium metal complexes derived from condensation of alpha napthyl amine with 4 methoxy benzaldehyde and 4 hydroxy benzaldehyde have been described. The complexes are in ML composition, non-electrolytes and paramagnetic in nature. The biological activity of ligand is lower than the metal complexes. This means that metal chelation is significantly effective than the antimicrobial activity of Schiff base.

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