STUDY OF STRUCTURE, CHARACTERAZATION OF CO(II) NI(II), CU(II) COMPLEXES WITH SCHIFF BASE LIGAND, (E)-7-METHOXY- N1-(2,4,5-TRIMETHOXY BENZYLIDINE) BENZOFURAN-2- CARBOHYDRAZIDE.

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ABSTRACT:

This paper presents the schiff base ligands and their complexes of divalent transition metals such as cobalt, nickel and copper. The ligands and the metal complexes were synthesized carefully the ligands were L1 and L2, which coordinated to metal ion through the "O" of carbonyl group and the "N" of hydrazine group. On the basis of characterization of the ligands and the complexes which were substituted benzofuran derivatives, by elemental analysis, magnetic moment, measurement of electrical conductance, electronic transition and the infrared spectroscopy. Electronic data of the complexes suggested the octahedral geometry of the complexes. The complexes of transition metal (II) usually Co(II), Ni(II) and Cu(II) were highly active against all microbes.

L1 → (E)-7-methoxy N1-(2,4,5-trimethoxy benzylidine) benzofuran-2- carbohydrazide.

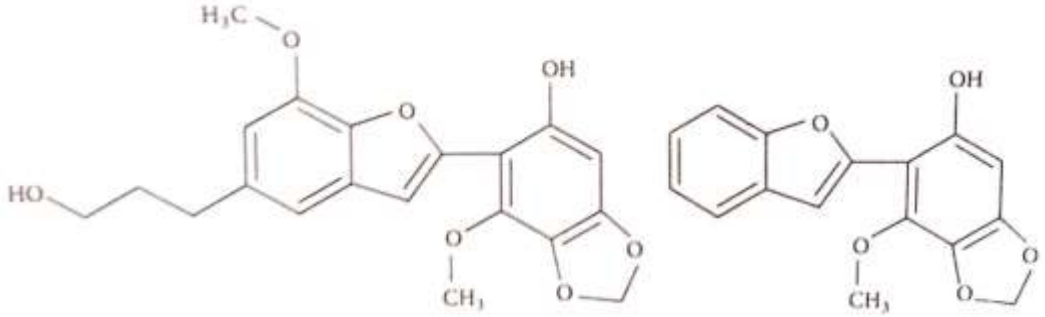
L2 → (E) – N1- (2,6-dichloro benzylide) 7-methoxy benzofuran -2-carbohydrazide.

Keywords :

Schiff base, Hydrazine group, Carbonyl group, Benzofuran derivatives, Infrared Spectroscopy, Octahedral geometry, Microbes.

Introduction:

The schiff base was named after Hugo schiff. The T.M.(II) complexes with well defined structures play an important role in various biological processes involving the reaction of electron transfer. Schiff base ligand were chelating ligand and useful in catalysis in organic synthesis as well as in medicines. Recently, benzofuran based fused hetrocycles have been of great intrest as they were abundent in nature and have wide phermacological activities 2-3. In the present investigation the amin interest of antimicrobial activities were observed due to presence of benzofuran were proposed as follows5 :



Structure(i) Structure (ii)

Structures of the benzofuran derivatives in (i) Egonoki plant and (ii) baker's yeast.

MATERIAL AND METHODS:

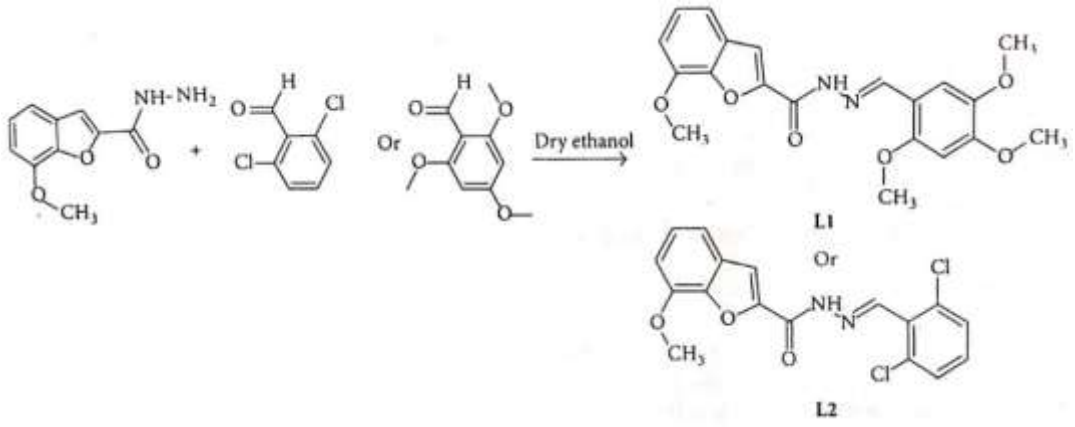
Material :

All the chemicals used ruthe from of AR grade or E. Merck Extra Pure quality. The regrants were puchased from sigma Alrich. Chemicals/ reagents used were; 7-methoxy-1-benzofuran-2-carbohydrazide,2,4,5-tri-methoxy benzaldehyde, 2,6-dichloro benzaldehyde.

EXPERIMENTAL:

Synthesis of ligands (L_1) :

To a solution (25ml) of 7-methoxy-1-bezofuran-2- carbohydrazide (2NG, 0.0mole), dry ethanol (25ml), a solution of 2,4,5-tri-methoxy benzaldehyde (2.37g, 0.01 mole) in dry ethanol (10ml) was added the reaction mixture was refluxxed on a water bath which result light yellow crystal in 7-8 hrs. The rky man was cooled, collected and filtered. The solid washed with hot water sevfal times and then in the di-methyl ether. Finally on drying the crystal of $C_{20}H_{20}N_2O_6$ obtained with M.W. 383.4 and M.P. 252 C. Similary, ligand, L2 were also synthesized having mol. Formula $C_{17}H_{12}N_2O_3$, M.W-363.2 and M.P. 130 C.



Synthesis of complex :

The ligand L1 was taken in calculated amount in ethanol and metal chloride (aqucom) were mixed in 2:1 molar ratio and refluzxed on water bath for 3-4 hrs. Completion of reaction was monitered by Then Layer Chromotography (TLC). About 56% of the solution was cooled at room temperature, which was then filtered, washed with hot water, ethanol and dried in deductor over anhydrown $cacl_2$. The general reaction of complexion shown under:

$$MCL_2 + L \rightarrow [MLCl_2]$$

Where, L=L_1 and L_2(ligands)

M= Metal ion (Co,Ni & Cu).

Physical measurement:

Elemental analysis were carried out using Vario El. CHNS analyzer. Magnetic susceptibility were carried out on a magnetic susceptibility balance (SWSCE) Molar conductance were mode on an Elico CM -82 conductivity bridge in DMF. The ESR spectrophotometer were recorded on a varian E-122 X- band spectrophotometer in DMSO

Ligands /complex	Molecular weight	Yield (%)	Colour	M.P °C	C	H	N	μ_{eff} (BM)	AM ($ohm^1cm^2mol^{-1}$)
L1[$C_{20}H_{20}O_6N_2$]	383.378	75	Yellow	252	62.52 (62.55)	5.0 (5.1)	7.35 (7.30)	-	-
[Cu($C_{20}H_{20}O_6N_2$)Cl_2]	517.858	80	Green	244	46.44 (46.33)	3.85 (3.76)	5.85 (5.40)	1.74	18.44
[Co($C_{20}H_{20}O_6N_2$)Cl_2]	513.211	78	Dark brown	238	46.95 (46.81)	3.84 (3.93)	5.81 (5.46)	4.68	15.951
[Ni($C_{20}H_{20}O_6N_{20}$)Cl_2]	512.968	72	Light brown	262	46.54 (46.83)	3.68 (3.93)	5.63 (5.46)	2.85	14.274

RESULT AND DISCUSSION:

a. Characteristics of ligand –

Both ligands were air stable crystalline solids. The analytical produced in table-1.

b. Characteristics of metal complexes:

The analytical data of the complexes indicated that all the complexeswere of stoichiometry, [M(L) Cln] where, M=Co(II), Ni (II) and Cu(II).

c. Magnetic Moment :

The magnetic Moment Measurements indicated paramagnetic natur for Co(II), Ni(II) and Cu(II) complexes and octahedral geometry.

μ for Co (II) → 4.68 to 4.87 BM

μ for Ni (II) → 2.85 to 2.92 BM

μ for Cu(II) → 1.74 to 1.79 BM.

d. I.R. spectra :

The IR spectra bonds observed reflects non participation of O- furan ring in bonding with metal ion.

Compounds	ν (NH)	ν (C=N)	ν(C=O)	ν(N-N)	ν(M-O)	ν(M-N)	ν(M-Cl)t	ν(M-Cl)b	ν(M-Cl)
$L_1[C_{20}H_{20}O_6N_2]$	3250	1650	1656	952	-	-	-	-	-
$[Cu(C_{20}H_{20}O_6N_2)Cl_2]$	3255	1556	1650	951	556	455	350	352	-
$[Co(C_{20}H_{20}O_6N_2)Cl_2]$	3257	1554	1650	958	552	452	350	358	-
$[Ni(C_{20}H_{20}O_6N_2)Cl_2]$	3259	1558	1656	959	557	455	351	352	-

e. Electronic specta:

The electronic specta of each of the three complexes of Co(II), Ni(II) and Cu(II). In the case of Co(II) and Ni (II). The high band energy range were found to be between 29,000- 30,000 cm^{-1}.For Co(II) the two electronic bands due L1 were 16,600,21,140 cm^{-1} while for Ni(II) they were 15,340,25,750 cm^{-1}. Band transition going to held as

$$GT_{1g}(F) \rightarrow 4A_{zg}(F)\ (U_2)$$

$$\&\quad 4T_{1g}(F) \rightarrow 4T_{zg}(F)\ (U_1)$$

Similarly for Ni(II) complexes:

$$3^{A}2_g \rightarrow 3T1g(F)\ (U2)$$

Ligand	Complexes	Transition in cm-1			Dq(cm^{-1})	B(cm^{-1})	β	β(%)	ν_2/ν_1	LFSE(k.cal)
		ν_1^a	ν_2^b	ν_3^b						
$L_1[C_{20}H_{20}O_6N_2]$	$[Co(C_{20}H_{20}O_6N_2)Cl_2]$	7545	16600	21140	800	950	0.950	1.32	2.20	14.5
	$[Ni(C_{20}H_{20}O_6N_2)Cl_2]$	9362	15340	25750	12355	860	0.680	12.12	1.63	31.33
	$[Cu(C_{20}H_{20}O_6N_2)Cl_2]$		16150							

For Cu (II) complexes, single broad asymmetric bond were absorbed in the range of 16,150, 12345cm^{-1}. Which indicated three transition:

On the besis of analytical data and spectra characterization the complexes were octahedral geometry and paramagnetic behaviour.

ANTIBICTERIAL ACTIVITY:

Antibacterial activity of substituted benzofuran derivatives and their metal complexes were tested in vitro against representative gram positives bacteria species like " Staphylococcus aereus," Staphylococcus citreus, Bacillus pihymix.

CONCLUSION:

This paper concludes stoichiometric and analytical data of the ligand as well as the complexes and observed that ligands were natural and bidentate in nature. These ligands were co ordinated through the "O" of the annicle and "N" of the azomethine group respectively. Each of the complexes were bridge polymeric and octahedral in geometry. The complexes of Co(II),Ni(II) and Cu(II) showed very good activity against bacteria.

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REFRENCES:

1. Y. Shibuya, K. Nabari, M. Kondo et al., " the Cu(II) complex with two didant Schiff base ligand. The unique rearrangement that proceeds under alcohol vapor in the solid state to construst noninclusion structure," chemistry letter vol. 37, no. 1, pp. 78-79, 2008.
2. B. J. Gangani and P.H Parsania," Microwave irradiated and classical synthesis of symmetric double Schiff base of 1,1- Bis ($-aminophynle) chlorohexine and their physicochemical characterization," Spectroscopy letter , vol.40, no. 1, pp. 97-112, 2007.
3. B. Sindhukumari, G. Rijulal And K. Mohnan ," Microwave assisted synthesis, spectroscopic, thermal, and biological studies of same lanthanide(III) chloride complexes with the hetrocyclic Schiff base's," synthesis and reactivity of in in-organic metal organic and nono-metal chemistry, vol. 39, p24, 2009.
3. C. Ryu, A. Song, J.S Lee.J.Hong J.H. Yoon and A. Kim "synthesis and anti fungal activity of benzofuran-5-ols," Bioorganic medicinal chemistry letters vol. 22 pp. 6777-6780, 2010.
4. X. jiang, W. Liu, W. Zhang et al. , " synthesis and antimicrobial evalution of new benzofuran derivatives," europian journal of medicinal chemistry, vol. 46, no.. 8, pp. 3526-3530,2011.
5. K. Manna and Y. K Agrawal," Degine ', Synthesis and anti tubecelar evaluation of novel series of 3- benzofuran-5aryl- 1- pyrajomethanone and 3- benzofuran-5-aryl-I-parazonilcarbonil -4-oxo napthiridam analogs," europian journal of medicinal chemistry , vol.45, no. 9. Pp, 3831-3839, 2010.
6. K. M Zabera " dronedrown: a new antiherrhythmic agent," Drugs of today, vol. 17, no. 2, pp. 75-86, 2006.
7. L.Alvey , S. Parado V. Huteu et al.., " A new synthesis access to furo [3,2-f] chromoine analogius of an antimycobacterial," borganic and medicinal chemistry vol. 16, no. 17,, pp. 8264-8272, 2008.
8. B. singh, P. sahi and P. K. Singh, Indian journal of chemistry A , vol. 35, p. 494, 1996.
9. N. N. Jha and A. P. Ray " magnetic studies on Co(II) and Ni(II) complexes of hydroganic acid," Asian journal of chemistry, vol. 12, no. 3 pp. 703-706, 2000.
10. Y. Z. Yang " synthesis, characterazitio, and biological activity of rare earth complexes of 1-phenyl-3methyle-4-benzily-5-pyrazoline benzalhydarzone," synthesis and reactivating in inorganic and metal organic chemistry, vol.32, no.5, pp. 903-912, 2002.
11. P. Rabitha, K- Laxma Reddy, Arab J. Chem. 2016, 9,640.
12. R.A Ammar, A.N.M.A Alaghaz. M.E. Zayed. L.A. Al-Beduir. Mol. Struct.2017,1141,368.
13. C. Demetgnl, N.Biyzit carbohydr. Polym 2018,1,812.
14. R. H. Taha, Z. A. El- Shefie, A.A. Salman, E. M. El- Fakharany, M. Mansor, J. MM. Struf. 2019, 1181, 536.