Synthetic and Biological evaluation of Cobalt Complex

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ABSTRACT

Synthesis of Schiff base metal complex of Co(II). The complex was analyzed by different physico-chemical techniques like Elemental analysis, FTIR, UV-VIS, EPR, NMR and Magnetic Studies. The data show complex has octahedral geometry. Antimicrobial activity and anticancerous studies of Co (II) chelate gave good result in the presence of metal ion in the ligand system

KEY WORDS: Synthesis, Spectra, Biocidal, Anticancerous

Schiff bases and their complexes have been are being employed to many reactions in Synthetic Chemistry. Schiff bases containing heteroatoms as donor atoms are of considerable interest due to their potential applications in catalysis, Medicines and material science [1-5]. The Transition Metal complexes with Schiff base ligand display varying configurations, structural lability and sensitivity to Molecular environment. The central metal ion in the complex act as active site for catalyzing chemical reactions. The Schiff based are able to inhibit the growth of several animal tumors and some Metals have shown good tumor activity against animal tumors. The interest in preparation of New Cobalt complex grained the tendency of Studying on the interaction of metal complexes with DNA For it applications in medicinal field.

The Novel complex of Cobalt with ligand, 2- furylglyoxal -2- aminophenol (FGAP) was synthesized and characterized by Physico- chemical studies. The Schiff base ligand and its complex was Further investigated for anticancer and antimicrobial Properties.

All the chemicals used were of analytical reagent grade and the solvent were dried and distilled before use according to a standard procedure C,H,N were analyzed on Carlo-Erba microangalyzer Model 1106. Metal content was estimated by standard Procedure. FTIR recorded on ThermonicoletAvater 370. The electronic spectra were recorded in the region 200-1100 nm on

a,Thermoelectron Nicolet evolution 300 UV-VIS spectrophotometer, EPR Spectra of complex in DMF recorded on variance E-112 X/Q band spectrophotometer at liquid nitrogen temperature and the standard used was tetracyanoethylene (TCNE) with a value of 2.0027. The conductance measurement carried out on a Model M-180 Flico digital conductivity meter, Magnetic studies was done by a Guoy balance using $Hg[Co(SCN)_4)]$ as the calibrant. The ^1H. NMR spectrarecorded in $CDCl_3$ at 300 MHz TMS as an internal reference. The antimicrobial activity of the compounds have been screened by using cup plate agar diffusion method. The anticancer activity evaluated against a panel of different cancer cell lines by using MTT(3-(4,5 dimethylthiazol-2-yl)-2,5 diphenyltetrazolium bromide) assay.

Synthesis of Co(II) FGAP Chelate:

An ethanolic solution of ligand (FGAP) prepared by dissolving 0.86 g ($4x10^{-3}M$) of FGAP in 52mL ethanol was added to 30-40 mL ethanolic solution of $2x10^{-3}M$ Manganese acetate (0.40g. $Co(OAC)_2.4H_2O$ in a round bottom flask. The resulting solution was refluxed over a water bath for about two and half hours on cooling separated coloured

product was Filtered through suction washed with ethanol followed by ether and dried in Vacuuo over anhydrous $CaCl_2$.

The Cobalt complex Co $(C_{12}H_8O_3N_2)_2$ was coloured non hygroscopic in Nature and stable at room temp. It was insoluble in common organic solvent but soluble in DMF and DMSO.

The Molar conductance value (Ω)8.27 ohm^{-1} cm^2 Mol^{-1} indicate its Non electrolytic Nature. $Co[FGAP]_2$ yield 68% m.p. 275ºC Black colour and Co $[C_{12}H_8O_3N_2]_2$(%): calcd C (55.50), H (3.08), N (5.40), Co (11.36); Found C (55.69), H (3.17), N (5.57), Co(11.27); IR (KBr Pallets cm^{-1})3055 υ(CH), 1600υ(>C=O), 1575 υ(> C= N) , 1258υ (C-O phenolic) ,560υ (M-O),466υ (M-N) Electronic spectra of the Schiff base and its complex were taken in methanol in the range of 50000-10000 cm^{-1}.The UV – visible spectrum of the Schiff base shows two strong bands at 42200 and 27500 cm^{-1}due to benzene π-π*, imino π-π* transitions respectively.

The Co (II) complex shows three bands at 8090, 15785 and 18900 cm^{-1}. These spectral bands are

assigned as the $^4T_{1g} \rightarrow {}^4T_{2g}(F)$ $4T_{1g} \rightarrow {}^4A_{2g}(F)$ and $^4T_{1g} \rightarrow {}^4T_{1g}$ (P) respectively towards octahedral structure around Co (II) ion. The Magnatic moment of Co(II) complex is 5.02BM suggesting octahedral geometry.

The EPR spectrum of Schiff base Co(II) metal complex at 77K in DMSO exhibits six hyperfine lines. The lines are poorly resolved which may be due to the poor glass formation.

^{1}H NMR spectra of free Schiff base he signals were appeared in the range of 8.18- 8.20 ppm due to (HC= N) proton however in the spectra of Schiff metal complex the signal

was observed in up-field regions of 8.21 – 8.42 ppm supporting the coordination of iminontrogen atom to Co(II) ion [6-7] while the free ligand NMR spectra has a characteristic NMR signal for carboxyl group proton in the 10.14-11.22 ppm range the disappearance of this signal in the ^{1}H NMR spectra of Co(II) complex indicating the involvement of carboxylate ion oxygen in chelation through deprotonation.

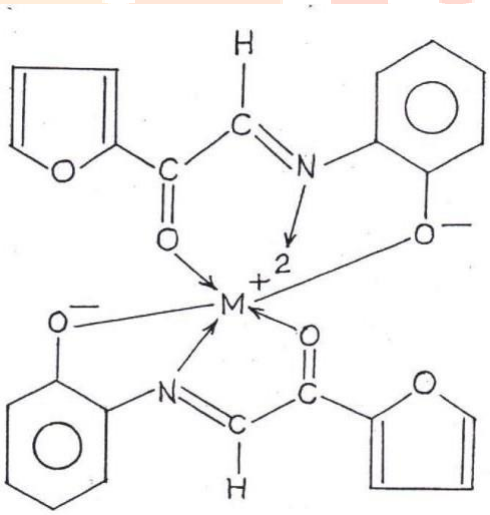

Fig- Structure of Co(II) Chelate

The result of the invitro antimicrobial activity of the ligand and Co(II) complex against bacteria staphylococcus aureus and Escherichia coli [8-9] determined by the paper disc plate method are presented in Table 1 in which the activity of a known antibiotic viz ciprofloxacin is included for comparison. From the result it is clear that the inhibition by the Metal chelate was higher than that of free ligand. Such enhanced activity of metal chelate is due to the lipophilic nature of the metal ion in the complex. The increase in activity with concentration is due the effect of Co(II) ion on the

Normal metabolic function of the cell. The action of compound may involve the formation of hydrogen

bonds with the active centre of cell constituents, resulting in the interference with the Normal function of the cell.

Table -1

Biocidal activity of the compound

Test Compound	Inhibition Zone, mm			
	E. Coli		S. aureus	
	500	1000	500	1000
Ciprofloxin	30	35	28	31
FGAP (L)	13	12	10	14
Co (II) FGAP Complex	19	18	20	16

Preliminary screening of the synthesized Co(II) chelate was carried out for cytotoxic activity against a panel of selected human cancer cell lines such as BT483(Breast) and HOP-62 (Lung) by using MTT assay. The result of this cytotoxicity testing, expressed as IC_{50} value is summarized in table 2 Doxorubicin was used as a positive control.

Table-2 Half Minimum Inhibitory conc. of Co (II) Chelate (IC_{50})[a] value expressed in μm

Compound	**BT483[b]**	**HOP-62[C]**
Co(II), FGAP Complexes	5,23	2.16
Doxorubicin	1.73	1.12

(a) 50% inhibitory concentration value are an average of these individual experiments

(b) Breast cancer (c) Lung Cancer

Co(II) metal chelate was found to be effective in all the cell lines examined [10-13]

CONCLUSION

In the present novel Schiff base Co(II) metal chelate was prepared and characterized by physico-chemical methods. The metal ion Co (II) was complexed with Nitrogen of imine group and presence of octahedral geometry around metal ion. The metal complex has higher antimicrobial activity than the ligand. The synthesized Metal chelate also showed the anticancer activity against a panel of selected human cancer cell lines.

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