Synthesis, Characterization and Biological Significance of Nickel (II) Schiff Base Complex

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ABSTRACT

The Schiff base metal complex of Ni (II) is synthesized with 2-furylglyoxal-2-aminophenol. The complex was further Characterized by different physico-chemical tecniques.. The result shows complex has octahedral geometry. Biological studies of Ni (II) Complex is much more active as compared to its ligand fragment.

KEY WORDS: Synthesis, characterization,Biochemical behaviour

Schiff bases and its Nickel complexex has variety of applications in biological,clinical,analytical and pharmacological areas. Chelating ligands containing N,S,O donor atoms show broad biological activity and are of special interest because of the ways in which they are bonded to the metal ion [1-5]. The It is known that existence of metal ion bonded to biologically active compound may enhance its activity.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 Nickel complex grained the tendency of Studying on the interaction of metal complexes with DNA For it applications in medicinal field.

The Novel complex of Ni (II) with ligand, 2- furylglyoxal -2- aminophenol (FGAP) was synthesized and characterized by Physico- chemical studies. The Schiff base ligand and its complex was Further studied for its biochemical behaviour.

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. 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 Ni(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 $2x10^{-3}M$ Nickel acetate (0.40g. $Ni(OAC)_2.4H_2O$ 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 Nickel complex Ni $(C_{12}H_8O_3N)_2$ was Brown in color, 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)11.42ohm^{-1} cm^2 Mol^{-1} indicate its Non electrolytic Nature. $Ni[FGAP]_2$ yield 71% m.p. 302^oC Brown colour and Ni $[C_{12}H_8O_3N]_2$(%): calcd C (49.40), H (2.74), N (4.80), Ni (10.05); Found C (48.20), H (2.51), N (4.00), Ni(9.80); IR (KBr Pallets cm^{-1})3100 υ(CH), 1680υ(>C=O), 1590 υ(> C= N) , 1385υ (C-O phenolic) ,545υ (M-O),435υ (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 Ni (II) complex shows three bands at 13000, 20000 and 27000 cm^{-1}. These spectral bands are assigned as the $^3A_{2g}\rightarrow{}^3T_{2g}(\nu_1)$ $^3A_{2g}\rightarrow{}^3T_1g(\nu_2)$ and $^3T_{2g}\rightarrow{}^3T_{1g}$ (ν_3) respectively towards octahedral structure around Ni (II) ion. The Magnatic moment of Ni(II) complex is 3.14 BM suggesting

octahedral geometry.

^{1}H NMR spectra of free Schiff base he signals were appeared in the range of 8.1- 8.34 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 Ni(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 Ni(II) complex indicating the involvement of carboxylate ion oxygen in chelation through deprotonation.

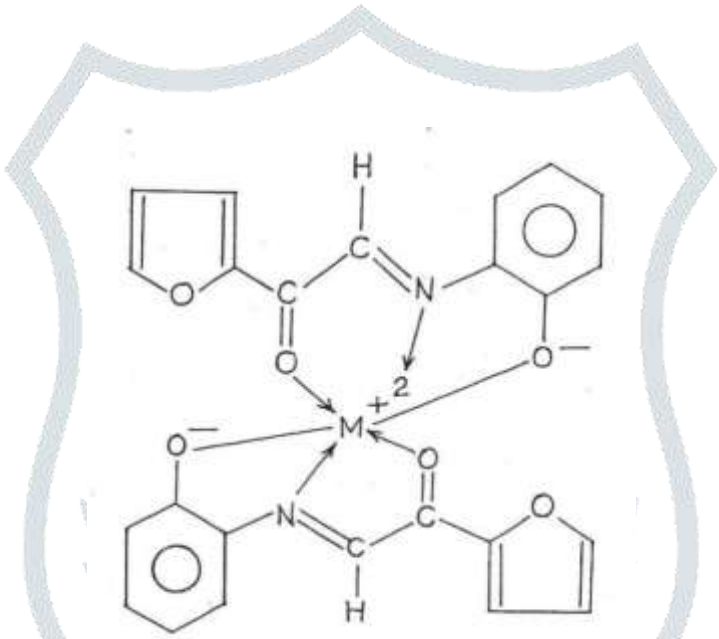

Fig- Structure of Ni (II) Chelate

The result of the invitro antimicrobial activity of the ligand and Ni(II) complex against bacteria P.aeruginosa and K.pneumonie [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 Ni(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

Antibacterial activity of the compound

Test Compound	Inhibition Zone, mm			
	P. auruginosa		K.pneumonie	
	500	1000	500	1000
Ciprofloxin	30	35	28	31
FGAP (L)	10	08	09	11
Ni (II) FGAP Complex	15	18	20	19

Preliminary screening of the Ni(II) chelate was carried out for cytotoxic activity against a panel of selected human cancer cell lines such as HT-29(Colon) and MCF-7 (Breast) 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 Ni (II) Chelate (IC_{50})[a]

value expressed in μm

Compound	**MCF-7[b]**	**HT-29[C]**
Ni(II), FGAP Complexes	4.29	2.17
Doxorubicin	1.73	1.12

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

(b) Breast cancer (c) Colon Cancer

Ni (II) metal chelate was found to be effective in all the cell lines examined [10-16]

CONCLUSION

In the present novel Schiff base Ni(II) metal chelate was prepared and characterized by physico-chemical methods. The metal ion Ni (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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