STRUCTURAL DETERMINATION OF METAL- LIGAND (THIOUREA DERIVATIVE) COMPLEXES AND ANTIMICROBIAL ACTIVITY STUDIES (S. AUREUS, S. TYPHI)

S.Z.Jadhao and M.S.Rathod*
Department of chemistry Rajaram CollegeKolhapur-416004
Maharashtra, India.

Abstract:
Studies of the complexes of metal ion with thiourea derivatives. Complexes has been carried out on the basis of IR, NMR, electronic spectra etc. Thiourea derivatives used as ligand and their Metal Complexes have been synthesized (Diethyl Benzoyl thiourea derivative). Studies of Antimicrobial Activity(S.aureus,S.typhi) The metal complexes and ligand show potential activities.

Keywords:
Spectral Metal complexes Diethyl Benzoyl thiourea derivative. Antimicrobial activity Studies(S.aureus,S.typhi)

1.Introduction:

Industrial production and the use of Fe, Co, Ni, Ag, Pb elesments can cause environmental pollutions. On the other hand, some of these metals are present in trace amount as essential elements for the biological systems and these metal ions also play an important role in bio-inorganic chemistry. In order to understand the role of these metal ions in biological systems, structural studies of the biological compounds and their metal complexes are extremely important. Compound containing carbonyl and thiocarbonyl groups occupy an important position among organic reagents as potential donor ligands for transition metal ions, among these thio derivatives are potentially very versatile ligand, able to coordinate to range of metal centre as a neutral ligands, mono ions or dianions .The oxygen, nitrogen and sulphur donor atoms of thiourea derivative provide multitude of bonding possibilities. Both the ligands and their metal complexes display a wide range of biological activities[6].

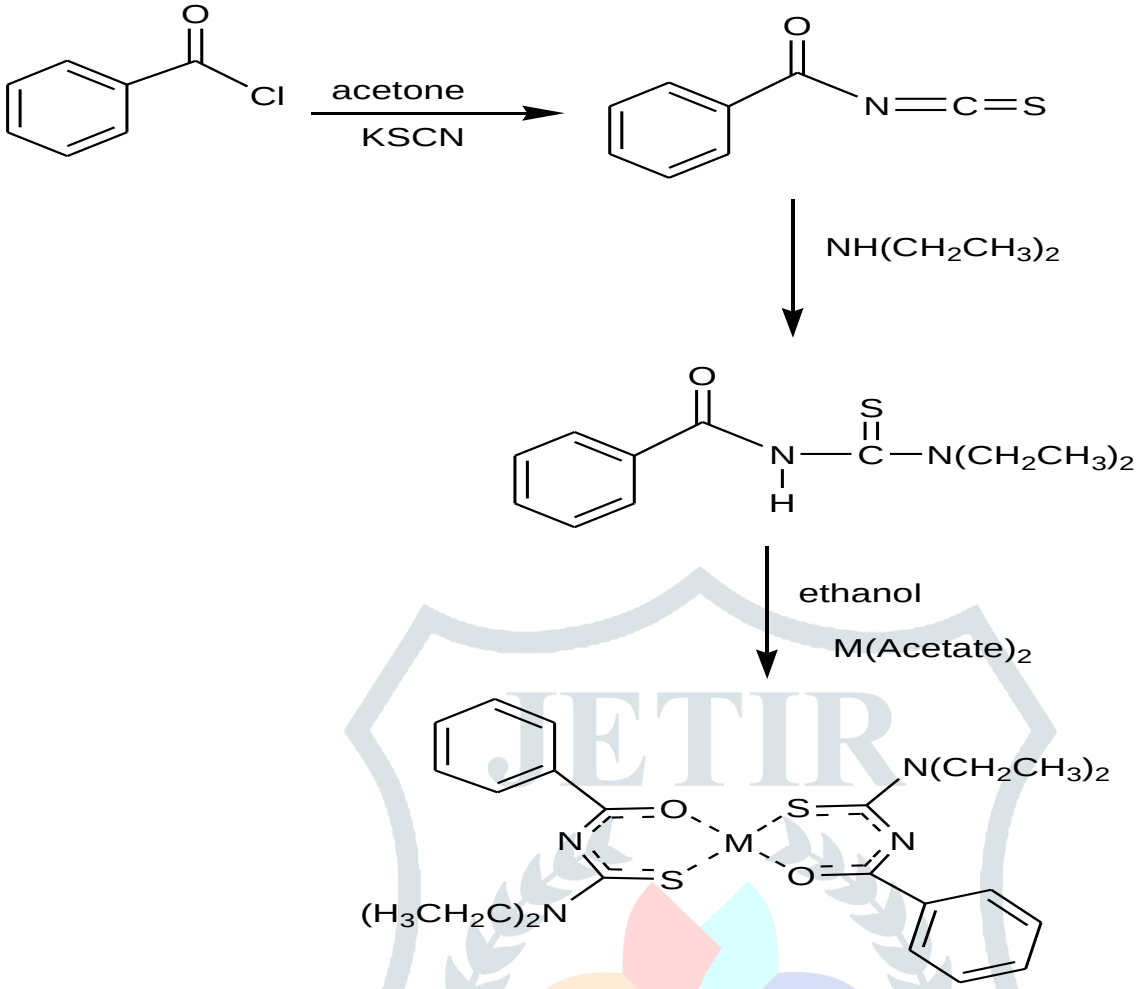
In view of this, we focused on synthesis, charactersition of complexes on the basis ofelectronic spectra[19], magnetic measurements and spectral analysis. Infra red spectra of complexes indicate that bonding through, oxygen and sulphur Antimicrobial activity Studies(S.aureus,S.typhi)

2.Materials and Methods

2.1Synthesis:

The ligands were prepared by procedure to that reported in the literature[1].A solution of benzoyl chloride (0.05 mole) in acetone (30 ml) was added dropwise to a suspension of potassium thiocyanate (0.05 mole) in acetone (30 ml). The reaction mixture was heated(30 ^{0}C) under reflux for 30 min., and then cooled to room temp.A solution of secondary amine (0.05 mole) in acetone (30 ml) was added and the resulting mixture was stirred for 2 hour, hydrochloric acid (0.1N , 100 ml) was added and the solution is filtered. The solid product was washed with water and purified by recrystallisation from an ethanol–dichloromethanol mixture (1:2). Metallic complexes were prepared according to the method described in the literature[2].
A solution of metallic acetate (0.05 mole) in ethanol (30 ml) was added dropwise to a solution of the ligand in ethanol (30 ml), 1:2 ratio for all metal with a small excess of ligand at room temp. And the resulting mixture was stirred 30 min. The solid complexes were filtered and re-crystallized from a 1:2 ethanol– dichloromethane mixture.(during preparation pH control)

Structure Determination



M= Co^{2+}, Cu^{2+} ,Ni^{2+}

The molar conductance values for the complexes in DMF and DMFSO at 10^{-3} m dilution are in the range of 3.2 -6.8 ohm^{-1} cm^2 mol^{-1}[8] suggesting non electronic nature of these complexes. Ligand has four co-ordinating sites[3]. The result showed that two ligand and molecules might co-ordinate to the metal ion[13]. In order to identify the structure of complexes, IR, NMR, Spectra were also investigated[4].

3.RESULT AND DICSUSSION: IR spectra of the ligands showed strong band at 1715-1730 cm^{-1},which is the characteristic peak of carbonyl group(C=O).while in complexes this band shifted to the region 1650-1670 cm^{-1}, indicating the co-ordination of carbonyl oxygen atom of ligand with metal ion. Meanwhile strong band at 820-840cm^{-1} in the free ligand, which was assigned to the C=S gp, significantly disappeared in the complexes, indicating that sulphur, atom contributed to the formation of the complexes[17].

.The spectra of complexes showed only the peak at δ 11.73 ppm for NH, while peak at δ 12.81 ppm for NH between C=S, C=O group disappeared, indicating the removal of this proton and formation of C=N group. Aromatic skeleton vibration at 1424cm^{-1}[14].C-O stretching at 1307 cm^{-1}[15]. Symmetrical six member ring stretching [16].

Aromatic C-H,3060(w) Aromatic C-H,710(m) Aromatic skeleton vibration,1425(w) C-N,1274(M), C=N 1610(m),C-O 1307 (m),C=S 1850(m) ,M-O 536(m) t(CH_3),1.1,q(CH_2),1.8.

3.1 ELECTRONIC SPECTRAL DATA OF METAL COMLEXES

Complex	**Absorption spectra**	**Wave no (k k)**
M (diethyl thiourea deriva.)$_2$	224.	43.30
	291	33.30
	388	25.76

The electron spectra complexes shows very broad band in 43.30KKrigions[12] and two band in the25-76KK range this region screened by intense charge transfer band exhibited broad band maxima at 25.76KK._electronic spectra resembles with most of complex in octahedral environment [9,10].

3.2FUNDAMENTAL INFRARED BANDS (cm^{-1}) of METAL COMPLEX

Assignment	Ligand (in cm^{-1})	ML_2(in cm^{-1})
Aromatic C-H	3060cm-1	3064cm-1
Aromatic (monosubstituted benzene)	690cm^{-1} -750 cm^{-1}	710cm^{-1}
Aromatic skeletal vibration	1425cm^{-1}	1445cm^{-1}
C=N stretching	1610cm^{-1}	-
Amide (N-H stretching)	3425cm^{-1}	-
C=O Amide	1670-1725cm^{-1}	-
C-N stretching	1425cm^{-1}	1420cm^{-1}
C=S(asymmetric stretching)	1850cm^{-1}	-
C-H Stretching	2950cm^{-1}-3000cm^{-1}	3100cm^{-1}
C-O Stretching	1307cm^{-1}	1300cm^{-1}
M-O stretching	-	538cm^{-1}

3.3NMR SPECTRA FOR METAL LIGAND COMPLEX

Assignment	Ligand	ML_2
Benzene (m)	δ 8.5 ppm	δ 8.2 ppm
N-H(amide proton)	δ 11.73 ppm	-
$-CH_2$-(t)	-	δ 1.8 ppm
$-CH_3$ (q)	-	δ 1.1 ppm

3.4Antimicrobial Studies:

In antimicrobial activity of the three complexes and one ligand by the standard disc diffusion method [24]. The microbial activities performed against overnignt grown cultures of five selected bacteria namely,.,S.aureas.,S.typhi, on agar media .Overnight grown microbial were speread on agar petriplates and kept for about half an hour. The disc were placed and test solutaion was ioaded. Dilution were made in DMA 15mg concentration . After addition of each of the test solutions, the inoculated plates were kept at room tempture, for about an hour to enable diffusion of the test solutions and subsequently incubated at 37^{0c} . Microbial growth inhibition was determined by measuring the diameter of zone of inhibitions which was assessed at the end of 24 hrs incubation.

From the zone of inhibitions test(table-1) it has found that when agar plates were supplemented with antibiotics e.g. S.aureas.the inhibition areas was 15mm.When the same agar plates were supplemented with fungal species it has been observed that the zone of inhibitions was less. From the above results it is seen that these complexes and ligand posses antimicrobial activity .The antimicrobial activity increased on the concentrations of compound increased.

It is known that in a complexe the positive charge of the metal is partially shared with donor atoms present in the ligand and there may be pi electron delocalization over the whole chealating ring .This increases lipophilic character of the complex and favors its permeations through the lipid layer of the bacterial membrane.

Table-1

3.5Antimicrobial activity of complex and ligand.

Test complex	Diameter zone of inhibition	
	S.aureas	S.typhi
Thioureadrivatives	18mm	15mm
Ni(thioureadrivatives)$_2$	No zone	No zone
Co(thioureadrivatives)$_2$	15mm	12mm
Cu(thioureadrivatives)$_2$	15mm	No zone

Fig.(1)Zone of inhibition of complex and ligand with S.aureas.

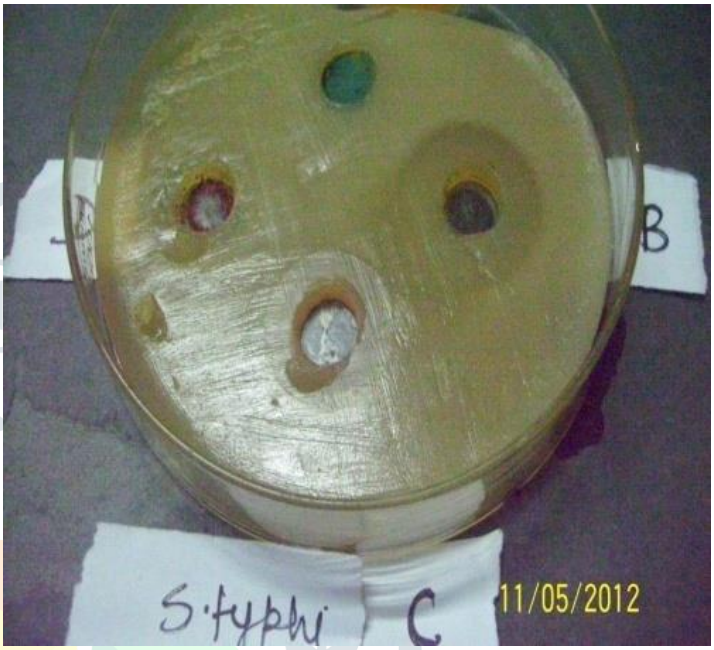
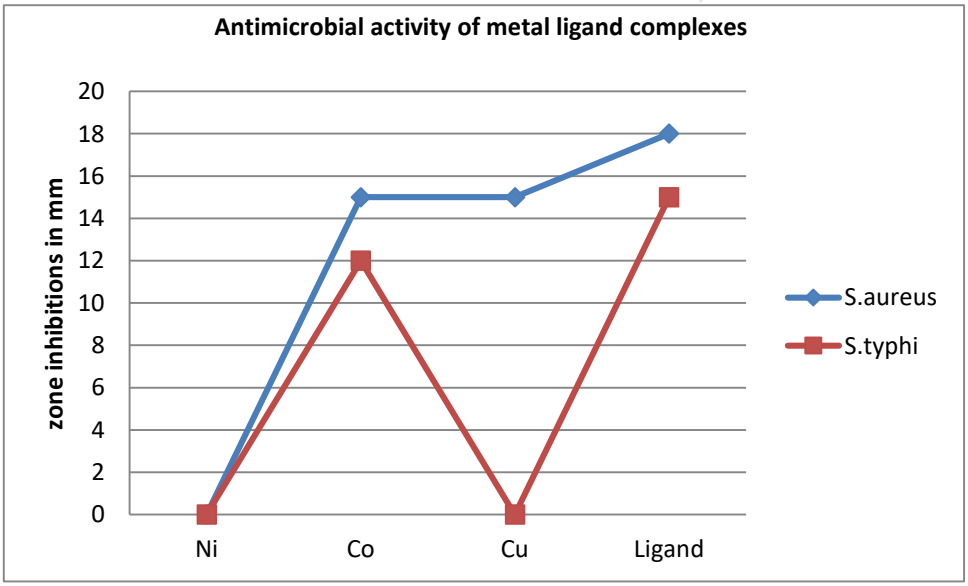
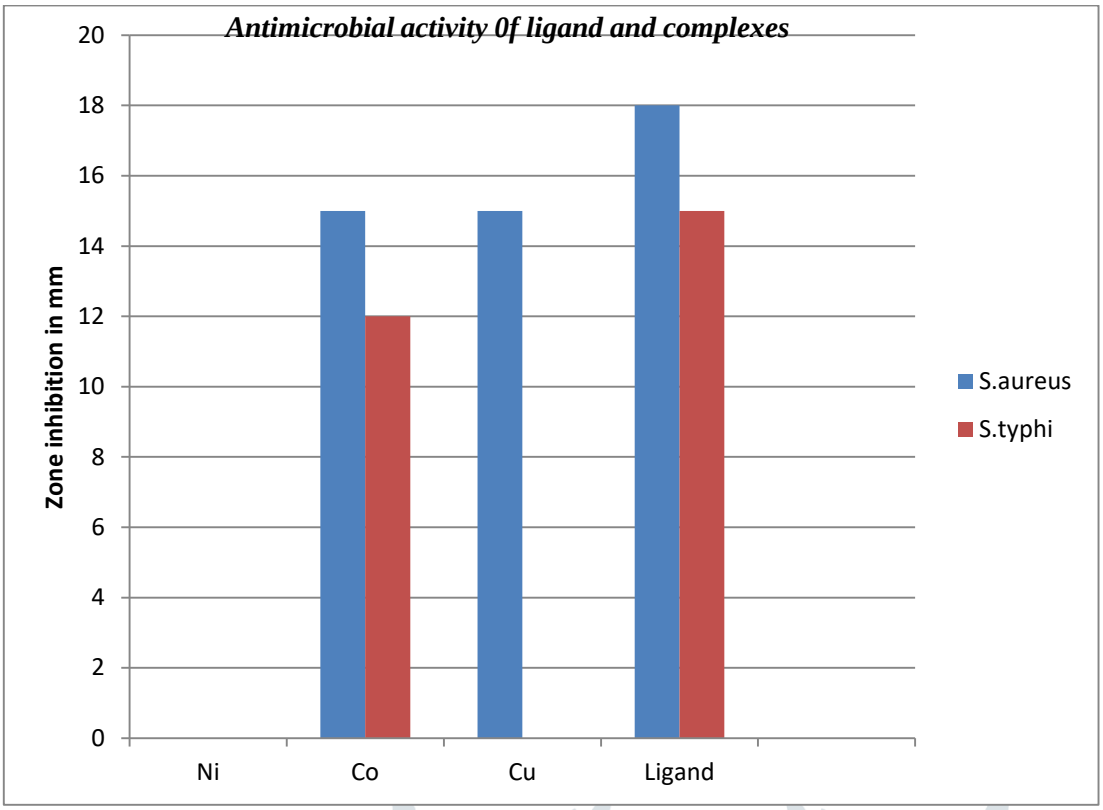


Fig.(2)Zone of inhibition of complex and ligand with S.typ

3.6



3.7



4.Conclusions:

Above the N.M.R ,I.R data shows that successfully synthesized Metal Ligand (Thiourea Derivative) Complexes

This study has been of preliminary nature with the objective of establishing the N.M.R,I.R electronic spectra. Biological activity of complex and ligand studied

Metal complexes and ligand shows superior activity,these complexes and ligand used as chemotherapeutic agent and hold much promise in the field drug discovery.

5.Acknowledgements:

The authors wish to acknowledge that this work was supported by Director, Institute of Science, Nagpur & Head of the Dept. of Chemistry, Institute of Science, Nagpur**.**

The authors also wish to acknowledge that NMR,IR,XRD,Spectra was given by,The Head,Sophisticated Analytical Instrumentfacility,Indian Institute Of Technology Madras Chennai-600036.For microbial studies ,authers thanks to Director Rajiv Gandhi Biotechnology Centre ,RTM Nagpur University Nagpur.

References:

[1]Nizami,Duran,GulayBoreki,CemalKorayozer,CevdetAkbay, USA.14,519-427(2009)

[2] Sheldrik,G.M.Acta.Cryst.A64,112-122 (2008)

[3] V.D. Burhate and M. R. Patil , Curr. Sci. (India) 58 ,291 (1989).

[4] N. J. Pale and B. C. Haldar Inorg.Nucl. chem. 29, 1037 (1967).

[5]H.A.Mahajan&M.R.Patil,India J.Chemica Analityczna,1992,37,239-242.

[6] V D bhandarkkkar O P Chimankar & N R Pawar, J Chem. Pharm.Res..2010.2(4)873-877

[7] A I Vogel.Text book of Quantitative Inorganic Analysis,third edition,Longman Green and Co limited London,1961.

[8] W J Geary,Coord Chem Rev. 1971,7,81-85

[9] A Z Werner,Inorganic Chem. 3,267,1893.

[10] G N Lewis,J.Am.Chem.Soc.1962,38,762-765.

[11] A B P Lever,Inorganic Chem electronic spectroscopy,Elsevier,New York,1968.

[12] H J Hurst and JC Taylor,Acta Cryst.1970,B26,2136-2140.

[13] R G Deshmukh and NY Thakkar,Indian J.Chem 1985 23A,1066-1070.

[14] TWJ Taylor and EK Ewbank,J Chem Soc 1926,2811-2815.

[15] U B Talwar and B C Haldar,J Chem Soc.1962,38,762-765.

[16] NV Thakkar and R G Deshmukh,Indian J Chem.1994,33A. 224-230.

[17] P L Pathak and B C Haldar,J md.Chem.Soc.1972,49, 743-748.

[18] R.Shakru,N j p Subhashini, S. Kumar, K. Shikvraj J Chem. J Chem. Pharm.Res.Pharm.Res.2010.2(1)38-46

[19] N S Dixit and C C Patel,J Indian Chem. Soc.1997,54,176-180.

[20] A.P.Mishra, R.K. Jain J Chem. Pharm.Res.2010.2(6)51-61

[21] J.H.Deshmukh, M.N.Deshpande J Chem. Pharm.Res.2011.3(3)206-212

[22] S.Z.Jadhao and M.S.Rathod J Chem. Pharm.Res. 2012,4(3) 1562-1565

[23] M.S.Rathod and S.Z.Jadhao J Chem. Pharm.Res.2012, 4(3)1644-1646

[24] Bauer,Kirby,Sheris and Turck,1966,Am.j.clin.path.45:493

[25] Pragati Jogi, J Chem. Pharm.Res.2012 4(2):1389-1397

[26] Satayanarayna S. J Chem. Pharm.Res. 2010. 2(6): 369-380

[27] Deepak Sharma JETIR 2019 5(2) 840-842

[28] R Sathya JETIR 2019 6(3) 490-503