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SYNTHESIS AND STUDY OF BIO-POTENT SN (IV) METAL COMPLEX

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Abstract: A triorganotin (IV) complex [R3SnL: R=Ph] has been synthesized by the reaction of triphenyltin (IV) chloride with biological potent imidazol base ligand 2-(2-hydroxyphenyl)-4, 5-diphenyl imidazole (HL) derived from benzil, salicyladehyde and ammonium acetate. The geometry of the complex has been proposed on the basis of elemental analysis and spectroscopic techniques (IR, ^{1}H NMR, UV and Mass spectra).

On the basis of these studies it revealed that Imidazol ligand act as N/O donor system and coordinated to tin atom in bidentate fashion with trigonal pyramidal geometry around Tin atom. To compare the biopotency of the complex, Imidazol ligand and its complex were also tested for antimicrobial evaluation against bacteria and fungi. The activity data show that the metal complex is found to be more potent biocides than the parent ligand.

keywords – Triorganotin(IV) complex, Imidazol, Biopotency, Spectral studies**.**

I. INTRODUCTION

Organotin (IV) compounds are well known for their application in the chemical industry, agriculture and other human fields. It has been found that the biological activity of organotin (IV) derivatives is highly dependent on the coordination pattern between tin metal and ligand. Organotin (IV) complexes containing amino acid derivatives Sn-O, Sn-N and Sn-C bindings show important and vital biological activity.

Various biologically active synthetic compounds have five-member nitrogen-containing heterocyclic rings in their structure[1]. The imidazole nucleus exhibits various properties in the field of five-member heterocyclic structures[2-5]. Imidazole derivatives have a special place in the field of medicinal chemistry. Synthesis of imidazole nuclei is an important synthetic strategy in drug discovery. Imidazoles are well-known heterocyclic compounds that characterize and characterize a wide variety of pharmacological agents[6-8].

The pharmacological properties of imidazole include anticancer and b-lactamase inhibitors, 20-HT (20-hydroxy-5, 8, 11, 14-eicosatetraenoic acid) synthesis inhibitors, carboxypetidase inhibitors, and hemeoxygenase inhibitors and antiaging agents, anticoagulants, anti-inflammatory, antibacterial, Antifungal, antiviral, antitubercular, antidiabetic, antimalarial[9-11]. This group prevents the accumulation of methylated sterols in azoles antifungal and destroys the membrane lipid bilayer structure. Without the interaction of some concentrated drugs, high concentrations of sterols and sterol esters enhance the layer-direct inhibitory action[12].

Infectious microbial disease causes problems worldwide because germs are more resistant or resistant to treatment than any other lifestyle. In recent decades, the problems of multidrug-resistant microorganisms have reached alarming levels in many countries of the world. Resistance to lactam antibiotics and antimicrobial agents such as macrolides, quinolones, vancomycin, and a variety of bacteria exacerbates the global problem[13].

Formulae R_nSnX_{4-n} are biologically active in which alkyl group is important for measuring toxicity towards livings species[14,15] .This activity enhanced on coordination with Schiff base ligands [16,17]. Keeping these findings in mind and our interest in field of organotin complexes, this paper reports synthesis, spectral characterization and biological evaluation of organotin (IV) complex of Imidazol ligand in order to investigate the effect of organic group on antimicrobial evaluation of organotin (IV).

II. MATERIAL AND METHOD

All the reagents, viz., Benzil (Aldrich), salicyladehyde (Aldrich), ammonium acetate, Triphenytin (IV) chloride (Merck) were used as received. All the chemical and solvents used were dried and purified by standard methods and moisture was excluded from the glass apparatus using $CaCl_2$. The reaction were carried out under strict anhydrous conditions and sufficient care has been taken to keep the organotin complex, chemicals and glass apparatus free from moisture. The melting points were determined with electronic melting point apparatus.

Synthesis

1. Synthesis of 2-(2-hydroxyphenyl)-4, 5-diphenyl imidazole (HL)

The ligand was synthesized according to Scheme 1. A round-bottomed flask was charged with a mixture of benzil (1 mmol), salicyladehyde (1 mmol), ammonium acetate (3 mmol) and HOAc (0.5 ml). The mixture was heated at 140 ºC in oil bath for the appropriate time (120 min.).

After the completion of the reaction the reaction mixture was diluted with water. The solid imidazole products were filtered, washed with water and then recrystallized from ethanol. Yield=75%, M.P =215^{0}C.

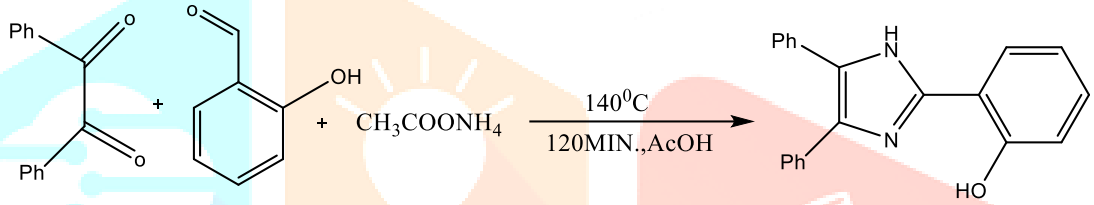
2. Synthesis of Sn (IV) complex (Ph_3SnL)

A solution of Triphenyl tin chloride (1 mmol) in benzene (20 ml) was added to a solution sodium salt of Imidazol ligand (synthesized by the reaction of ligand and freshly prepared sodium methoxide) (1 mmol) in benzene (10 ml). The mixture was refluxed for 4 hr under anhydrous condition at 50-60 °C temperature.NaCl formed during the reaction was filtered off and filtrate solid was dried in vacuo to give an off white solid. This solid was further purified by recrystallization. Yield 52 %; M.P =137 °C.

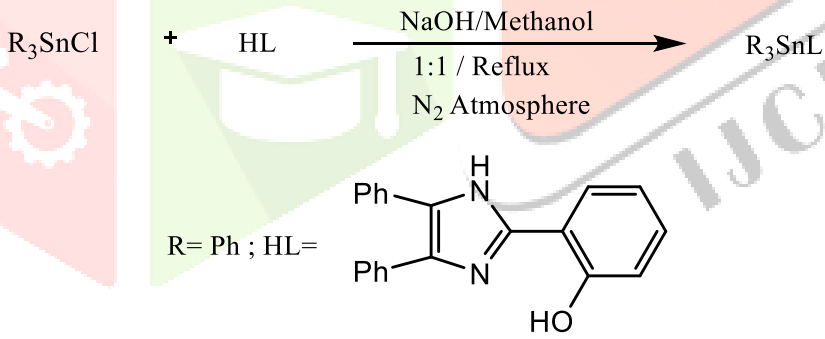
III.RESULT AND DISCUSSION

The imidazole ligand is yellow crystalline solid and soluble in organic solvents. The melting point of the ligand [2(2-hydroxyphenyl)-4, 5-diphenylimidazole] is 215 ^{0}C. The newly synthesized complex is white solid and soluble in organic solvents. The melting point of the complex is 137 ^{0}C.

The reaction of 2(2-hydroxyphenyl)-4, 5-diphenylimidazole ligand with tri-phenyl tin chloride in 1:1 molar ratio, result in the formation of five coordinated metal complex in which ligand behaves as bidentate.



Scheme 1



Scheme 2

The result of antimicrobial activity shows that the matel complex has good activity against bacterial strain (*Escherichia coli*) and fungal strain (*Aspergillus Niger*).

Elemental analysis

Experimental and calculated elemental composition of the ligand and complex are given in Table 1. The analytical data are in good agreement with the proposed stichiometry of the new complex.

Table-1: Physical Properties of ligand & metal complex

S.N.	Molecular Formula	Compound Code	M.P	Color	Analytical Data found/cal.%				Mol. Wt Found/cal.
					C	H	N	Sn	
1	$C_{15}H_{11}N_3O_2$	HL	215	White Solid	80.73 (80.75)	5.18 (5.16)	8.95 (8.97)	-	315.30 (312.37)
2	$C_{39}H_{30}N_2OSn$	R_3SnL	137	Off white	70.73 (70.82.)	4.65 (4.57)	4.31 (4.24)	18.02 (17.95)	662.10 (661.39)

Infrared Spectra

IR spectra of complex was compared with the ligand. Disappearance of strong band at 3235-3240 cm-1 due to v (O-H) of ligand and appearance of two bands at 415-432 cm^{-1} and 500-556 cm^{-1} indicating the formation of Sn-N and Sn-o bonds respectively. The IR spectrum of complex showed the C=N stretching frequency at 1530 cm^{-1} which is lower than expected 1550 cm^{-1} showing the coordination of N atom to Sn atom.

NMR Spectra

^1H NMR spectra of complex and its organotin(IV) complex were recorded in $CDCl_3$. Metal complex [Ph_3SnL] showed signal at δ 9.47 ppm due to NH proton. On comparison of ^1H NMR of ligand and its tin complex, absence of OH proton signal in complex showed deprotonation when attached to Sn atom. Chemical shift of phenyl group attached to Sn appeared at δ 6.93 – 7.98 ppm as multiplet.

MASS Spectra

The molecular ion peak of the ligand [2-(2-hydroxyphenyl)-4, 5-diphenylimidazole] and its organotin complex was observed at 312 (m-1) and at 663 (m+1) respectively.

UV Spectra

UV spectra's of ligand [2-(2-hydroxyphenyl)-4, 5-diphenylimidazole] and metal complex shows λ_{max} at 360 nm and 325 nm respectively.

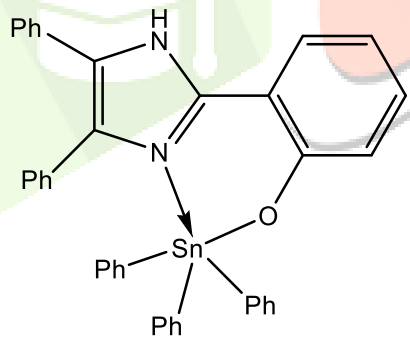


Figure 1: Probable structure of Triphenytin (IV) complex

PHARMACOLOGICAL STUDIES

Antimicrobial sensitivity was performed for metal complex on Muller Hinton Agar and SDA against *Escherichia coli* (ATCC 25922) (Antibacterial sensitivity) and *Aspergillus Niger* (Antifungal sensitivity) by well diffusion method, following were the results obtained using Sterptomycin (5 mg (w/v)) as antibiotic/Itraconazole (5 mg (w/v)) as antifungal agent as positive control (C) and for negative reference dimethyl sulphoxide (DMSO) (R).

Table 2: Antibacterial activity of the metal complex against test bacteria

S. No.	Microorganism	Zone of inhibition (mm)				Mean
		Positive Control (Streptomycin 5 mg/well)	Sample			
1	*Escherichia coli* (ATCC 25922)	37	24.00	24.50	25.00	24.50

Table 3: Antifungal activity of the metal complex against test fungi.

S. No.	Microorganism	Zone of inhibition (mm)				Mean
		Positive Control (Itraconzole 5 mg/well)	Sample			
1	*Aspergillus Niger*	27	22.00	22.00	22.00	22.00

RESULT INTERPRETATION OF PHARMACOLOGICAL ACTIVITY

If the zone of inhibition is:
13 = It means that the extract is inactive,
13-18 = It means that the extract is bioactive.
>18 = it means that the extract is highly active.
If activity is more than 1, then the sample is bioactive.

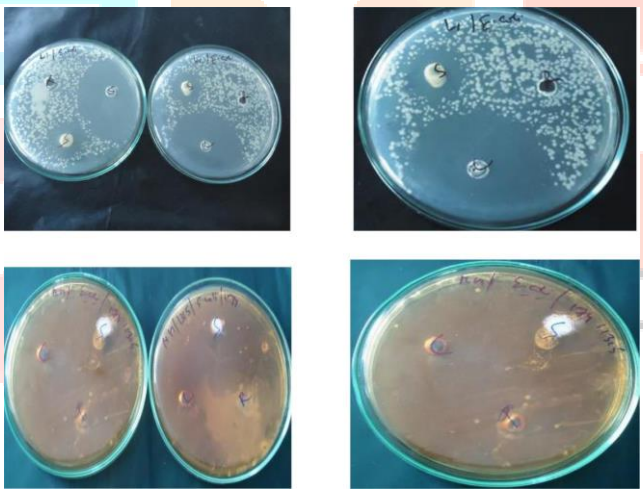


Figure 2: Antimicrobial activity of synthesized compound

The diameter of inhabitation zone around each disc was measured and recorded at the end of incubation period. The degree of activity of the newly synthesized compounds was expressed according to inhibition zone diameter. Bacterial and fungal test strains were cultured on Mueller-Hintone agar for 24 hours at 37 temperature and pH was maintained at 7.4.

The results of antimicrobial activity are given in Table 2 and 3. The antimicrobial data suggested that:

1. Triphenyltin (IV) complex was found to be more bio- potent compare to particular ligand. The increase of activity of tin complex consequences as a effect of coordination with metal ion on the basis of chelation theory[18].
2. The arrange of Inhibiting activity was Ph_3SnL > HL, the toxicity also depends on the properties of R group present in the region of Tin atom. The bigger and more lipophilic the R group, more toxic is the organotin complex[19].

IV. CONCLUSION

The imidazole ligand and its organotin (IV) were synthesized and characterized by various spectroscopic techniques. On the basis of various spectroscopic techniques it revealed that imidazole ligand acted as bidentate N, O system and coordinated to Sn atom through phenolic oxygen and azomethine Nitrogen with trigonal bipyramidal geometry. Triphenyltin (IV) complex was evaluated for invitro antibacterial and anti fungal evaluation and complex was found to be more potent biocides.

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