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Antifungal And Antibacterial Activities Of Some Tin(II) Schiff Base Complexes Of Sulpha Drugs

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ABSTRACT

The tin(II) schiff base complexes have been synthesized by the reaction of tin(II) methoxide with different schiff bases. An attempt has been made to assess their fungicidal and bactericidal properties *in vitro*. These complexes were found to be highly active-against all gram-positive bacteria but showed lesser activity on gram-negative ones. All the complexes showed high antifungal activity even at very low concentrations.

KEYWORDS

Schiff bases;
Tin(II) complexes;
Microorganisms;
Anti-microbial activity.

INTRODUCTION

The first important fungicides was discovered and developed in 1882 and since then a large number of fungicides have been synthesized and studied extensively. In last decade, sulphur and nitrogen containing compounds were the most important fungicides[1-3]. A part from these, a large number of schiff bases and other nitrogen or sulphur donors have been reported to poseurs fungicidal and bactericidal activities[4-9].

Further a small number of tin complexes have been described in the literature to show high antifungal and antibacterial activities[10-12]. The continuing interest and pressure for still better fungicides and bactericides, have led, us to prepare some tin(II) Schiff base complexes and study their bactericidal and fungi toxicity in vitro against some microorganisms. The following structural formula of the tin(II) complexes been given.

EXPERIMENTAL

Organism

Pure cultures of bacteria *Escherichia coli* (ATCC259222), *Staphylococcus aurchs* (ATCC25923), *Klebsiella pneumoniae*(ATCCIO031) and *Bacillus thuringiensis* (Kurastaki) (Obtained from the department of microbiology and immunology, S.M.S. Medical College, Jaipur) and fungi *Aspergillus niger, Aspergillus jlavus* and *Rhizoctonia phaseoli* (Obtained from the seed pathology laboratory, department of botany, university of Rajasthan, Jaipur) were used. The selected bacteria were grown as nutrient agar medium incubated at 37^0C for 48h and maintained by trans-

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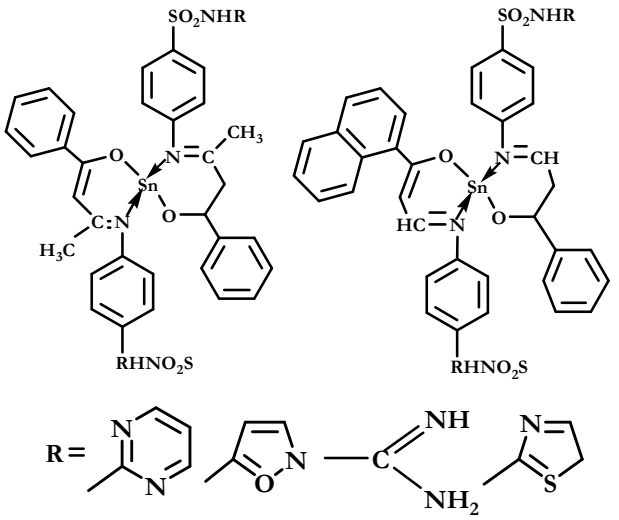

Figure 1 : Structure of the tin(II) complexes

ferring to fresh medium every 48h. However, fungi were grown as potato dextrose agar (PDA) medium by incubating at 27^{0}C for 48h and maintained by periodic subculturing to fresh medium.

Bioassay

(a) Agar-diffusion method

The bacteriological activities were evaluated by paper-disk plate method[13]. The nutrient agar medium(peptone beat extract NaCI agar-agar) and 5mm diameter paper disks of whatman paper no.1 were used. The compounds were dissolved in methanol in 200 mg/l concentration. The filter paper discs were soaked in the solutions of different compounds, dried and then placed in the petri-plates previously seeded with the test organisms*(Staphylococcus aurchs, Klebsiella pneumoniae* and *Bacillus thuringiensis).* The plates were incubated for 24-30h at 28^0± 2^{0}C and the inhibition zone around disc, if formed were measured.

(b) Radial growth method

In radial growth method the medium used was czapekes agar medium(sucrose 30g, KH_ZPO_4, $NaNO_3$, KCl, $FeSO_4$, $MgSO_4$ and agar-agar and water 100ml) and fungi were grown at 28±2^{0}C. The compounds were mixed in 200, 100, 50ppm concentration in the medium. The linear growth of the fungus was obtained by measuring the colony diameter after 96h and the average of three replicates of growth in mm was considered. The amount of growth inhibition was calculated by the equation

% Inhibition=C-T×100/C
C=diameter of fungus colony in control plate
T=diameter of fungus colony in test plate

Preparation of tin(II)schiff base complexes

The literature methods were used for preparing Schiff bases[14] and $Sn(OCH_3)_2$[15]. One mole of $Sn(OCH_3)_2$ and two moles of ligands i.e. HL^1(2-hydroxynapthaldehyde sulphadizine), HL^2(2-hydro xynapthaldehyde sulphixozale), HL^3(2hydroxy napthaldehyde sulpha-guanidine), HL^4(2-benzoy lacetone sulpha-diazine), and HL^5(2-benzoylacetone sulphathiazole) were refluxed in methanol for 6h.

The resulting compounds were dried in vacuum. In the same manner one mole of $Sn(OCH_3)_2$ and two moles of ligand(Schiff base) were refluxed for 12h to give tin(II) Schiff base complexes (TABLE 1). The resulting compounds were analyzed and characterized as described earlier[16].

RESULTS AND DISCUSSION

All the complexes were tested against gram positive and gram negative between(*S.aureus, P.syrinage, P.mirabily* and *E.coli).* The results enlisted in TABLE 2 and the results clearly indicated that all the complexes were highly active against gram-positive bacteria while lesser activity against gram negative.

The results further show that complexes having hydroxyl naphthalene nucleus were most active than their benzoyl acetone Schiff base counterparts. It is in accordance with the well-established view that the naphthalene nucleus possessing-OH group in-

TABLE 1 : Analytical characteristic of tin(II) complexes

Reactants	Ligands	Yield	Compound	M.P.	Elemental analysis % found (Caled)					Mol. wt.
Tin(II) methoxide		%	Colour and state	^{0}C	Sn	C	H	N	S	Found(Caled)
$Sn(OCH_3)_2$	HL^1	80	$Sn(L^1)_2$Yellow solid	179d	22.58(22.79)	48.03(48.38)	2.68(2.71)	10.68(10.75)	6.08(6.16)	510.3(520.8)
$Sn(OCH_3)_2$	HL^2	76	$Sn(L^2)_2$Dark yellow solid	209d	21.86(22.07)	48.95(49.08)	3.15(3.18)	7.70(7.81)	5.80(5.96)	509.5(537.8)
$Sn(OCH_3)_2$	HL^3	82	$Sn(L^3)_2$Dark yellow solid	208	24.37(24.48)	44.25(44.55)	2.80(2.91)	11.42(11.55)	6.50(6.61)	470.4(484.8)
$Sn(OCH_3)_2$	HL^4	78	$Sn(L^4)_2$Yellow solid	199d	23.00(23.23)	46.82(49.98)	3.12(3.16)	10.77(10.96)	6.12(6.27)	518.60(510.8)
$Sn(OCH_3)_2$	HL^5	75	$Sn(L^5)_2$Light yellow solid	106	22.77(23.01)	44.00(44.19)	2.85(2.93)	8.00(8.14)	12.32(12.43)	500.1(515.9)

TABLE 2 : Antibacterial activity of ligands and their corresponding metal complexes

S.No.	Compounds	Zone of inhibition in mm-organisms (mean±SD)							
		E.coli		*S.aureus*		*P.syringae*		*P.mirabilis*	
		(AZ)[a]	(AI)[b]	AZ	(AI)	AZ	(AI)	AZ	(AI)
1	L^1H	07 ±0.05	(0.87)	09±0.01	(1.20)	05±0.01	(1.31)	04±0.06	(1.00)
2	$Sn(L^1)_2$	10±0.07	(1.25)	12±0.06	(1.60)	06±0.02	(1.58)	07±0.01	(1.75)
3	L^2H	08±0.02	(1.00)	9.2±0.03	(1.22)	07± 0.06	(1.05)	03±0.04	(0.75)
4	$Sn(L^2)_2$	10±0.05	(1.25)	13±0.08	(1.73)	05±0.01	(1.31)	07± 0.03	(1.75)
5	L^3H	06±0.04	(0.75)	08±0.02	(1.60)	05±0.04	(1.31)	04±0.01	(1.00)
6	$Sn(L^3)_2$	08±0.04	(1.00)	17±0.05	(1.60)	08±0.06,	(2.10)	06±0.05	(1.50)
7	L^4H	09±0.02	(1.12)	9.8±0.03	(1.30)	03±0.05	(0.78)	03±0.04	(0.75)
8	$Sn(L^4)_2$	12±0.05	(1. 50)	14±0.03	(1.86)	06±0.01	(1.58)	05±0.01	(1.25)
9	L^5H	09±0.03	(1.12)	09±0.01	(1.20)	06±0.02	(1.58)	05±0.02	(1.25)
10	$Sn(L^5)_2$	11±0.06	(1.38)	14±0.05	(1.86)	09±0.01	(2.36)	08±0.03	(2.00)

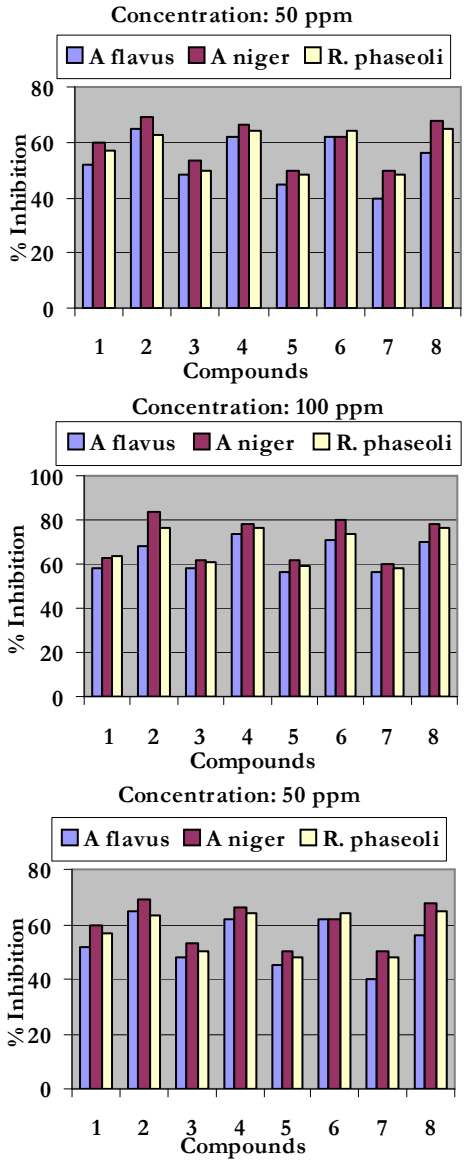

Figure : 2, 3 and 4 fungicidal activity of ligands and their tin(II) complexes

Compounds: 1=HL^1; 2=$Sn(L^1)_2$; 3=HL^2; 4=$Sn(L^2)_2$; 5=HL^3; 6=$Sn(L^3)_2$; 7=HL^4; 8=$Sn(L^4)_2$.

creases the activity of a compound.

The activity of the ligands in question may be due to the presence of the hydroxyl group at the ortho position in the naphthalene ring as well as the active sulphur atoms according to Horsfall[17] the hydrogen of the phenolic group is so reactive that it enables the toxicants to combine with the constituents of the living tissues and as a result the tissues lose their ability to function. On the other hand, the nitrogen of the azomethine group being active can also combine with the fungi cells thus easily arrest their growth.

Further the tin complexes are more active as compound to the ligands and which indicates that metallation increases the activity. The increase in the activity of tin(II) complexes as compared to the parent ligands may be due to the chelate formation in which the ligand is coordinated to the central tin atom through the phenolic oxygen and azomethine nitrogen leading to an increased fungitoxic action.

All the complexes tested were found to be highly active against all the microorganisms. Comparison of activity indices and % of inhibitions reveals that complexes $Sn(L^3)_2$ is more active than the other complexes against *P.syrinae* and complexes $Sn(L^1)_2$ was found to possess greater activity than the other compounds against *A.flavus, A.niger, R.phaseoli.*

The above studies clearly indicate that the tin complexes synthesised in the present studies are highly active against all these pathogens. The high activity of these complexes may also be explained as the basis of the fineries of their particles and which in an important factor for the biological activity. The detailed studies of these compounds in vitro are in progress and which might be useful for the

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commercial utilization of these compounds and as fungicides and bactericides.

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