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NOTE

Microbial Studies of Tetrathioazoic Acid and Its Complexes with Cu(I), Cu(II) and Si(IV) Compounds

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Tetrathioazoic acid (L) and its complexes synthesized with Cu(I), Cu(II), Si(IV) were treated against *E. coli* and *S. typhimurium* gram negative bectria and *C. albicans* and *C. neoformans* fungi. The ligand is found effective against *E. coli* and *C. neoformans*, while the complexes Cu(I) L_2 and Cu(II) L_1 show better effectiveness against all except *C. albicans*. The complex of Si(IV) is best bactericidal and fungicidal.

Key Words: Complexes, Tetrathioazoic acid, Antimicrobial.

S_4N_4[1] shows antimicrobial properties, as its some adduct[2-5], such as $S_4N_4H_4$ and $S_4N_4H_2Pt_2$. It is assumed that tetrathioazoic acid and its complexes possess antibacterial and antifungal characteristics, hence their antimicrobial investigations are being reported herewith.

Tetrathioazoic acid, prepared by reduction of S_4N_3Cl and its complexes with cu(I) and Cu(II) were synthesized as reported[6,7]. The complexes of S_4N_3H with $SiCl_4$ was prepared by refluxing equimolar quantity of each in DMF for 24 h. Light brownish coloured mass precipitated, was separated, washed with DMF, alcohol and either successively, dried and stored for their studies.

For antibacterial and antifungal investigations, well sterilized glass wares were used. The bacteria and fungi collected from Microbiology Department, Aligarh Muslim University, Aligarh, India were incubated at 37 ºC in agar-agar-pepton media for their growth. A media, prepared by same process using yeast (0.5 mg), NaCl (30 mg) and glucose (0.25 g), was placed in sterilized petri-dishes and divided into four equal parts alongwith a hole at centre for the control. A thin layer of test organism after their growth, was coated on the surface of petridish media after that paper disc soaked in ligand and complexes solution was place on each hole alongwith paper disc soaked in DMF on centre as reference.

These petri-dishes were again kept in incubator at 37 ºC to check the inhibition. After 24 h the inhibition was measured in millimeters.

The electronic spectra of ligand and complexes were got recorded on UV/Vis, Perkin-Elmer Lambd-15 spectrophotometer in the range of 850-200 nm from CDRI, Lucknow.

The screening of micro-organism reveals that ligand and Cu(I) complexes are ineffective to *S. typhimurium* and *C. albicans*, while Cu(II), complexes is less effective to *C. albicans* (Table-1). All the complexes and ligand show effectiveness to rest microbial and inhibition increase with the increase of concentration. The S_4N_3H is most effective against *E. coli* than the complexes. The activeness of the ligand and its complexes is equal (approximately) to *C. neoformans* which is secondary cause for AIDS. Cu(I) complex is more active 16 mm againsts *S. tryphimurium* and *E. coli* and 17 mm against *C. neoformans.* Cu(II) and Si(IV) complexes are effective to all to 100 μg conc.

TABLE-1
ZONE OF INHIBITION OF BACTERIAL AND FUNGI AT DIFFERENT CONC.

Ligand/ complexes	Conc. (μg)	Gram negative bacterial		Fungi	
		E. coli	*S. typhimurium*	*C. albicans*	*C. neoformans*
Ligand	10	7	0	0	5
	50	10	0	0	9
	100	18	0	0	17
C_1	10	8	9	0	8
	50	10	13	0	10
	100	16	16	0	17
C_2	10	6	7	0	5
	50	12	9	6	12
	100	13	15	8	18
C_3	10	11	5	4	4
	50	12	7	6	5
	100	13	8	15	17

The values of absorbity and Dq are determined form observed band in their electronic spectra[8] (Table-2). The former bands (4.7-4.545 ev) in all spectra are according to ionic environment in them. The low values of band gap energy (ΔE_g) and high values of number of conducting electrons (η_c) determined as

$$\eta_c = 2.52 \times 10^{19} \times \Delta E_g/KT$$

found of the order of 10^{17} expounding the semiconductive character of ligand as well as of the complexes. The values of conductivity (σ) calculated as, $\sigma = \mu \times \eta_c$, where μ is transition mobility of the order 10^8 also supports this view. The conductivity decreases from ligand to Si(IV) complex, except Cu(II) complex. The result of the conductivity suggest that effectiveness of and the ligand and the complexes increases as their conductivity decreases.

TABLE-2
UV SPECTRA OF THE LIGAND/COMPLEXES

Ligand/ complex	Band nm (cm^{-1})	Oscillator strength $f \times 10^{-5}$	Band gap energy $\Delta E_{\frac{1}{2}}$ (ergs) $\times 10^{-12}$	No. of conducting electron $\eta_c \times 10^{17}$	Conductivity $\sigma \times 10^4$ mho cm^{-1}
L	262.2 (37707.39) ν_1 375.6 (36284.47) ν_2	0.2138	0.2826	6.1800	1.4200
C_1	272.8 (36656.89) ν_1 353.2 (28312.57) ν_2	7.1780	1.6572	1.9890	2.5756
C_2	262.6 (38080.73) ν_1 334.14 (29904.31) ν_2	1.0110	1.6238	2.0568	1.0190
C_3	265.18 (37710.23) ν_1 280.7 (35625.22) ν_2	0.1483	0.4141	1.6595	0.3133

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