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Synthesis of the Complexes of $S_3N_3Cl_3$ with Cadmium(II) and Mercury(II)

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Complexes of trithiazyl trichloride, $S_3N_3Cl_3$, with $Cd(CH_3COO)_2$ and $HgCl_2$ were synthesized and analyzed. On the basis of its IR and X-ray powder spectra, it is revealed that both the complexes have tetragonal geometry.. The antibacterial and toxic effect of these complexes on the albino rats was also tested.

Key Words: Synthesis, Trithiazyl trichloride, Complexes, Cadmium(II), Mercury(II).

INTRODUCTION

The complexes of trithiazyl trichloride (TTTCl), $S_3N_3Cl_3$ with Al(II), Mo(VI), Cu(II), Th(IV) and Zr(IV) have been reported[1-5]. In continuation of our previous work[6], X-ray diffraction studies of the complexes of $S_3N_3Cl_3$ with Cd(II) and Hg(II) are being presented.

RESULTS AND DISCUSSION

On the basis of alalytical analysis, m.w. determination and mass spectra, the complexes of TTTCl, synthesised with Cd(II) and Hg(II), have been formulated as $(S_3N_3Cl_3)_4Cd(CH_3COO)_2$ and $S_3N_3Cl_3{\cdot}HgCl_2$ respectively. The IR spectra (Table-1) of the complexes possess two N—S → Cd and two S—N → Cd bands in $(S_3N_3Cl_3)_4{\cdot}Cd(CH_3COO)_2$ and only two S—N → Hg bands in $S_3N_3Cl_3{\cdot}HgCl_2$ inferring the quadridentated and bidentated linkage of $S_3N_3Cl_3$ to $Cd(CH_3COO)_2$ and $HgCl_2$ respectively.

To elucidate the geometrical structure of the complexes, from their X-ray diffraction spectra (Table-2), recorded in 2θ range (10–70°), unit cell parameters, 'hkl' and 'd' were calculated. The values of 'd' observed resembles with the theoretical ones inferring its structure. The axial ratios, a_0, b_0 and c_0, were determined as:

$$\frac{a_0}{b_0} = \frac{\sin\phi_1}{\sin\phi_2}, \quad \frac{c_0}{a_0} = \frac{\sin\phi_3}{\sin\phi_4}$$

TABLE-1
IR SPECTRAL DATA OF THE COMPLEXES

$TTTCl{\cdot}Cd(CH_3COO)_2$		$TTTCl.HgCl_2$	
Bands	Assignments	Bands	Assignments
410 s	S—Cl	408	S—Cl
449 b	N—S→M	5557	Hg—Cl
513 s	S—Cl	632	S—N→M
557 wb	N—S→M	671	S—N→M
615 b	S—N→M		
673 b	S—N→M		
715 s	S—N ring	736 s	S—N ring
		1043 s	N—S—Cl
1109 s	N—S—Cl	1103 s	N—S—Cl
1155 s	N—S—Cl	1157	N—S—Cl
1314	N—S—Cl	1300	N—S—Cl
1407 ws	N—S—Cl	1400	N—S—Cl
1571 b	CH_3COO^-		

The values $a_0 = b_0 = 7.5771$, $c_0 = 4.7254$ and $\alpha = \beta = 113.07°$ and $\gamma = 96.3°$ are according to tetragonal geometrical array of both the complexes. Both the complexes are found to be active against all bacteria, except *E. coli*, when they were treated on the *S. albus, S. aureus* (gram +ve), *B. pulminas* and *E. coli* (gram –ve) bacteria. Toxicity of the complexes was tested on albino rats by using 0.1 mL of test solution (5 mg/mL)/kg wt. and the complexes are found to be toxic in nature (Table-3).

EXPERIMENTAL

AnalaR grade chemicals were used throughout the present work. TTTCl was synthesized[3] by chlorination of S_4N_4 [8] dissolved in CS_2 kept at 0°C. The resulting blue solid, $S_3N_3Cl_3$ (500 mg) was mixed with 500 mg of $Cd(CH_3COO)_2$ and $HgCl_2$ in DMF separately and refluxed for 24 h. The resultant solids were separated, washed successively with DMF, ethanol and ether, dried and stored in vacuum desiccator over fused $CaCl_2$.

TABLE-2
XRD PATTERN OF THE COMPLEXES

S.No.	TTTCl·Cd$(CH_3COO)_2$			TTTCl·$HgCl_2$		
	2θ (°)	hkl	d(Å) obs. (cal.)	2θ (°)	hkl	d(Å) obs.(cal)
1.	12.0	100	7.3749 (7.3688)	10.6	100	8.3431 (8.3387)
2.	15.4	110	5.7572 (5.7487)	15.3	110	5.7919 (5.7861)
3.	20.5	111	4.3328 (4.3286)	17.0	111	5.2158 (5.2111)
4.	25.4	200	3.5070 (3.5038)	20.5	200	4.3328 (4.3286)
5.	27.0	210	3.3027 (3.2995)	25.5	210	3.4935 (3.4992)
6.	29.9	211	2.9887 (2.9857)	26.3	211	3.3515 (3.3857)
7.	33.9	220	2.6446 (2.6420)	29.7	220	3.0083 (3.0054)
8.	36.4	300	2.3444 (2.4461)	31.2	300	2.8670 (2.8642)
9.	39.1	310	2.3040 (2.3018)	35.6	311	2.5221 (2.5197)
10.	41.3	311	2.1863 (2.1842)	38.8	320	2.3212 (2.3189)
11.	44.0	320	2.0582 (2.0562)	43.7	400	2.0716 (2.0690)
12.	48.8	400	1.8664 (1.8645)	51.4	421	1.7779 (1.7767)
13.	52.4	411	1.7463 (1.7446)	54.4	422	1.6867 (1.6852)

TABLE-3
TOXIC AND ANTIBACTERIAL TEST OF THE COMPLEXES

Complexes	gram +ve Bacteria		gram –ve Bacteria		Toxicity	
	S. Albus	*S. Aureus*	*B. pulminas*	*E. coli*	doses	Inference
TTTCl·Cd$(CH_3COO)_2$	+2.16	+1.74	+2.72	—	0.1 mL	Expired after 1 min
	+2.10	+1.70	+2.70	—	0.2 mL	Expired after 30 s
TTTCl·$HgCl_2$	+2.60	+2.60	+1.85	—	0.1 mL	Expired at once
	+2.65	+2.65	+1.80	—	0.2 mL	Expired at once

The IR and X-ray diffraction spectra of the complexes were recorded subsequently on 820/P.C. (KBr) and ISO Deveflux 2002 X-ray powder diffractometer, using Cu filment as source of radiation (λ = 1.5418 Å).

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