Study of Antibacterial and Toxic Behaviour of Complexes of Hepta Sulfur imide (S_7NH) with Tin (II) Chloride, Tin (IV) Iodide (SnI_4) and Silicon Tetra Chloride ($SiCl_4$)

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Abstract :

The complexes of S_7NH synthesized with $SnCl_2$, Sn I_4 and $SiCl_4$ are formulated as $[SnCl_2]_2$ $(S_7NH)_3$; [Sn I_4] $(S_7NH)_2$ and $[SiCl_4]_2$ $(S_7NH)_3$respectively on the basis of analysis of analytical data, mass, ir, uv, epr and nmr spectra. These compex compounds are found having antibacterial and toxic behaviour.

Key Words :S_7NH, antibacterial, toxic, S. albus, S. aureus, B. pumilus, E. Coli.

Introduction :

Due to presence of lone pair of electrons on sulfur atom, poly sulfur compounds are used as donor to form complexes with some transition metals[1-9]. Different [Metal-Sulfur-Nitrogen] Complexes of S_7NH were prepared and studied where metal is Copper, Nickel or Palladium[10-14]. Platinum, Palladium-Sulfur-nitrogen complexes of S_7NH were prepared using different metallic salts and their XRD crystallographs suggested that the metal is co-ordinated with two terminal sulfur atoms of bidentate S_3N chelate ligand[15-17]. Charge distribution on hepta sulfur imide-molecule was studied by its XRD[18]. About sixty five natural elements are considered to be involved in sustenance of life[19-20]. Antifungal activities of S_4N_4 in protection of seeds was studied by Oscar[21].Michael-Fiorenza[22] studied insecticidal behaviour of S_4N_4 .Heptasulfur imide was reported as fungitoxic agent[23]. Behaviour of complexes of Tin (II) Chloride [$SnCl_2$], Tin (IV) iodide [SnI_4] and Silicon tetra chloride ($SiCl_4$] prepared with hepta sulfur imide [S_7NH] is investigated against different bacteria and alvino rat and is presented here with. The complexes of S_7NH with $SnCl_2$, $SnI_4$and $SiCl_4$ are termed as U_1, U_2 and U_3 respectively.

Experimental :

Doubly distilled apparatus and A.R.; B.D.H.; S. Merck; Analar grade chemicals were used through out the research work.

Preparation of Ligand (S_7NH) and complexes :

Heptasulfur imide was prepared by passing dry ammonia gas into sulfur mono chloride dissolved in carbon tetra chloride (1:10)[24]. Complexes of hepta sulfur imide with Tin (II) chloride, Tin (IV) iodide and silicon tetra chloride were prepared by mixing equimolecular amount of each separately using ethanol as solvent and refluxing for

twentyfour hours at 150^0C. Different colouredmasses produced were separated, washed with ethanol, dried with ether and stored in vacuum over fused calcium chloride. On the basis of mass, infrared, ultra violet, electron paramagnetic resonance, and nuclear magnetic resonance spectral analysis the complexes of hepta sulfur imide (S_7NH) with Tin (II) Chloride ($SnCl_2$), Tin (IV) iodide (SnI_4) and Silicon tetra chloride ($SiCl_4$) have been formulated as $[SnCl_2]_2$ $(S_7NH)_3$; $[SnI_4]$ $(S_7NH)_2$ and $[SiCl_4]_2$ $(S_7NH)_3$ respectively.

Studies of Antibacterial Behaviour :

In the present work invivo tests have been employed. Four types of bacteria; staphylococcus albus (S. albus), Staphylococcus aureus (S. aureus), Bacillus pumilus (B. pumilus) which are gram-positive and Escherichia coli. (E. Coli), gram-negative, were collected from microbiology department of A.M.U., Aligarh. The pure complexes of S_7NH; U_1, U_2 and U_3 which were prepared, have been screened for invivo tests against these micro-organisms.

Petridishes, conical flasks, pipettes, test tubes were cleaned with chromic acid successively and finally rinsed with demineralized water. All the glass apparatus were then sterilized in an autoclave at pressure 20 lb/$(inch)^2$ and temperature 100^0C.

For the preparation of liquid media, the ingredients, peptone (2.5 gm), beef extract (0.75 gm), yeast extract (0.5 gm), sodium chloride (0.38 gm) and glucose (0.25 gm) were placed in one litre conical flask and shaked for five minutes in 250 ml distilled water. These ingredients were then dissolved by gentle heating and pH of the solution was adjusted at 7.5. This solution was filtered through whatman filter paper 42 to get a clear solution. Four rimless heat resistant hard glass tubes were marked with the name of the bacteria and 50 ml of media was transferred to each test tube (T.T.) and plugged with sterilized cotton. These tubes were placed in an autoclave at 100^0C temperature and 15 lb/$(inch)^2$ pressure for one hour for sterilization of media. The test tubes containing media then cooled down to 40^0C. Bacteria were inserted in each test tube separately as marked,

with the help of pt-wire loop and then incubated at 37^0C for 24 hours to grow the bacteria. To check the inhibition of grown bacteria, the media for petri plates was again prepared by mixing agar agar powder to peptone and treating them under similar process.

To prepare the test solutions, the complexes U_1, U_2 and U_3 were dissolved in dimethyl formamide (DMF) separately to make 5 mg/ml concentration of each solution.

Filter paper disc method was employed to test the antibacterial activities of the complexes. Circular discs of equal size (4 mm diameter) were cut from whatman filter paper 42 and sterilized in auto-clave. After one hour, the petri plates were taken out from the refrigerator and the area of media was divided into four equal parts and one hole of 4 mm diameter was made in each part with one hole at centre for the control. A thin layer of culture of test organism was added on the surface of peri plates. Di methyl formamide (DMF) is used as control and added in centre of all petri paltes. These petri plates were then placed for 24 hours in an incubator controlled at 37^0C. The area of zone inhibition was calculated with respect to the control. The results of antibacterial test of complexes have been represented by (+), (2+), (3+) and (4+) depending upon the diameter and the clarity of the zone inhibition. One plus '(+)' represents the increase in diameter of zone of inhibition by 0.2 cm. If there is no difference between the zone of inhibition of the test solution and that of control, the results have been represented by (-).

The results of antibacterial screening of the complexes have been given in the table -1.

Table-1

Antibacterial Screening of Complexes

Complexes	Gram-positive Bacteria			Gram-negative Bacteria
	S. Albus	S. aureus	B. pumilus	E. Coli
U_1	+1.902	+1.895	+0.600	(-)
U_2	+2.240	+2.060	+2.450	(-)
U_3	+1.732	+1.685	+0.020	(-)

Studies of Toxic Behaviour :

Toxic behaviour of a compound can usually be tested on rat, rabbit or guinea pig. In the present work only Albino rats were taken for the purpose. To prepare the test solutions, the complexes U_1, U_2 and U_3 were dissolved in dimethyl formamide (DMF) to make each solution of 5mg/ml concentration. Different doses of these solutions were applied intravenously on Albino rats of 60 gm weight each. The observations are noted in table-2.

Table-2

Toxic Behaviour of the complexes

S. No.	Complexes	Dose per 60 gm of rat	Observations
1	U_1	0.1 ml	(i) Mild dullness seen which increased after one minute. (ii) Respiration increased. (iii) Abdominal respiration started after 40 seconds. (iv) Abnormal movement seen for two minutes. (v) Recovered after five minutes.
2	U_1	0.2 ml	(i) Dullness increased to unconsciousness. (ii) Severe convulsions seen. (iii) Expired in 90 seconds.
3	U_2	0.1 ml	Expired in 60 seconds.
4	U_3	0.2 ml	(i) Dullness and respiration increased. (ii) Abnormal movement seen. (iii) Expired after 210 seconds.

Discussion :

For the biological estimations, complexes were treated against S. albus, S. aureus, B. pumilus gram-positive and E.coli gram negative bacteria with respect to DMF (vide table-1). It is found that the complex U_2 is more effective to S. albus, S. aurens and B. pumilus in comparative to the complexes U_1 and U_3 while all complexes are uneffective to E.coli.

The complexes of S_7NH with $SnCl_2$;SnI_4 and $SiCl_4$which are named as U_1 , $U_2$and U_3respectively, are used on albino rats in accordance to mili liters (ml) per sixty gram weight of albino rat. 0.1 ml dose of U_1 given to the rat shows mild dullness, increases respiration and unconsciousness for about two minutes. After that the rat recovers on standing for five minutes but use of 0.2 ml dose causes death of the rat after ninety seconds, expressing the toxicity of the complex U_1 of which higher dose is fatal within seconds. The complex-U_2 is found to be more toxic than U_1 while the complex-U_3 is found to be lesstoxic than the complex-U_1 (vide table-2).

Conclusion :

From the present investigations of the complexes of hepta sulfur imide (S_7NH) with Tin (II) chloride; Tin (IV) iodide and silicon tetra chloride ($SiCl_4$), these are found to have antibacterial and toxic character. Their less concentrations could be insecticidal behaviour which would be beneficial to farmers.

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