Synthesis and Characterization of Antimicrobial Organotin(IV) Derivatives

THESIS

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By

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Chapter 1 deals the introduction of organotin compounds and organotin compounds are substances in which at least one tin-carbon bond is present. The first compound was reported in 1852 by lowing and subsequently many contributions were made in this field during the last few decades. These compounds have a wide range of pharmacological application. The use of organotin(IV) halide as anti-inflammatory agents against different types of oedema in mice of fundamental interest. Compounds such as Bu_2Sn (IV)Cl_2 can inhibit oedema as effectively as hydrocortisones. Organotin (IV) complexes with shiff bases are of potential use as amoebicidal agent, displaying activity against axenically grown *Entamoeba histolytica* and *tropozoites*. Organotin(IV) complexes also used in agriculture. Six triorganotin compounds are currently marketed although these complexes have broad spectrum activity, in practice their uses are restricted to a limited area. These compounds consider as green pesticides because they can dissociated in soil at present of sunlight with duration of three weak. Organotin (IV) compounds are also powerful insecticides. A large number of organotin compounds are now a days using in Madison.

Chapter 2 dealt with synthesis, Spectral and Biological studies of Organotin(IV) complexes of a heteroscorpionate ligand (potassium hydrobis(benzoato)(salicylaldehyde)borate) have been synthesized. The ligand was formed by the displacement of hydrogen of potassium borohydride with the benzoic acid and salicyaldehyde. This unique ligands was converted into organotin complexes R_2SnL_2 and R_3SnL (L = Ligand) complexes by mixing and stirring with a methanolic solution/suspension of organotin chloride. The ligand and its all organotin(IV) complexes were characterized by elemental analyses and spectral studies (IR, ^{1}H NMR, ^{13}C NMR, ESI Mass spectra and TGA). Spectral data of the compounds also shows their structure and geometry. The di and tri organotin(IV) derivatives of this ligands having octahedral geometry in the complexes. Antibacterial and antifungal studies of these compounds were evaluated by the disc diffusion method at variable concentration against bacteria (*Staphylococcus aureus, Klebsiella pneumonia* and *Bacillius subtillis*) and fungi (*Asperjillius fiavus* and *Candida albicans*). It was found that

triorganotin derivatives (R_3SnL) of the ligand were more effective as compare to diorganotin derivatives (R_2SnL_2). The organotin complexes of borates were tested for their algicidal activity on the cyanobacterial strains (*Aulosira fertilissma, Anabaena species, Anabaena variabilis* and *Nostoc muscorum),* they shown high to moderate toxicity towards the above species and they were also tested for its pH effect on soil in vitro for a duration of more than one month and it has been found that, they are able to kill pest without hampering the soil quality.

The chapter 3 deals with organotin(IV) oxo-homoscorpionate preparation, biological, spectral studies and their effects on the soil quality. Neutral complexes of organotin(IV) chloride namely R_2SnCl_2 and R'_3SnCl (R= methyl, Butyl and R'= Phenyl and Butyl) with oxo-homoscorpionate ligand [potassium bis(phthalato)borate] have been prepared. The complexes are formed by the replacement of chloride in R_2SnCl_2 and R'_3SnCl. Tin triogganotin(IV) complexes of this oxo-homoscorpinate complexes, tin atom shows the hexa coordinated nature and therefore it must be octahedral. The compounds have been found to exhibit antibacterial, antifungal and algicidal activity in vitro. It has been observed that triorganotin derivatives (R'_3SnL) of the ligand were more effective as compare to diorganotin derivatives (R_2SnL_2). It is also noteworthy that their algicidal activity on the cyanobacterial strains (***Aulosira fertilissma, Anabaena variabilis, Anabaena species*** and ***Nostoc muscorum)*** have shown high to moderate toxicity towards the mentioned species.

Chapter 4 deals with organotin(IV) mercapto-borate complexes: Syntheses, Characterization, Antimicrobial studies and effects on soil fertility. Dihydrobis(2-mercaptothiazolyl)borate ligand was formed by the solid state reaction of potassium borohydride and 2-mercaptothiazoline. All the compounds were screened against antimicrobial activity on some of the selected bacterial and fungal strains. The results proved that triorganotin complexes exhibit better inhibition as compare to diorganotin(IV) complexes. Ligand and its all organotin(IV) complexes considered for their toxic effects on the cyanobacterial strains. Here all the complexes were found highly active and showed inhibition from very low concentration. Algaecidal effects observed by visualizing the colour change of the cyanobacterial strains. These compounds were tested on the soil (in vitro) to check their impact on the soil quality such as soil pH, soil organic matter and soil salinity. It was revealed from the experiment that compounds retain the fertility of soil and do not leave any harmful effects on it.

Chapter five deals with Syntheses, characterization and antimicrobial properties of hydrotris(2-mercaptobenzothiazolyl) borate containing nitrogen, sulfur and oxygen as donor atom, and its di and tri organotin(IV) complexes. The ligand was formed by the solid state reaction of reaction potassium borohydride and 2-mercaptobenzoxzthiazoline. The diorganotin(IV) derivatives of this ligands having the linear trans octahedral geometry while the triorganotin(IV) complexes are distorted octahedral in nature. Antibacterial and antifungal studies of these compounds were evaluated by the disc diffusion method at variable concentration against bacteria and fungi. The ligand have comparatively higher amtimicrobial activity to the other synthesized ligands, it is due to the presence of nitrogen, oxygen and sulphur as donor atoms, which can easily bind with the genetic material material of microbes and inhibit their growth of multiplications.