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Cluster Chemistry of Organotin Compounds

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Research Article

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ABSTRACT

Organotin compounds or stannanes are chemical compounds based on tin with hydrocarbon substituents. Organotin chemistry is part of the wider field of organometallic chemistry. The first organotin compound was diethyltin diiodide, discovered by Edward Frankland in 1849. Organotin compounds are widely applied as pesticides; as preservatives of wood, paper, textiles, leather, and glass; in heat/light protection of PVC plastics; and in antifouling paints. The use of dialkyltin compounds can cause hepatotoxicity, whereas trialkyltin compounds can cause neurotoxicity. Cluster chemistry of Organotin Compounds are usually neutral, hybrid inorganic/organic compounds that consist of an inorganic core comprising tin and chalcogen atoms, which is protected by organic substituents at the tin atoms.

INTRODUCTION

A rich bunch science of organotin mixes has as of late developed dependent on Sn-O-Sn and Sn-S-Sn holding shaped in responses of stannonic acids with carboxylic and phosphorus-based acids as partaking ligands. In the advancement of the basic science, it was found that a few individuals show synergist movement on transesterification and conceivably in polymerization measures. Further, as new group organizations were revealed, analogies got clear with other bunch sciences, especially those including aluminum-nitrogen and iron-sulfur frameworks. What follows is a portrayal of the developing group science of these fascinating new classes of organotin aggravates, their interconversions, and potential applications.

At this point of time, the most rapidly developing families of tin (Sn) compounds to be obtained and analyzed in condensed phase are Sn clusters, displaying their wide range of chemical and physical properties. While some clusters give satisfactory answers to fundamental aspects of bonding and complex inorganic reaction mechanisms, other clusters point to novel opportunities for nonlinear optical properties or for semiconductor applications. Moreover, molecular clusters with organic ligands allow for better fine-tuning of the biological activity of these Sn complexes through variations in the organic moieties.

For organotin compounds, it is well known that subtle changes of ligand types and numbers greatly affect their bioactivity and toxicity, with monoorganotin species being relatively benign with respect to Sn compounds with more than one organic ligand. Inorganic Sn compounds, like Sn chalcogenides have semiconducting properties and are significantly less harmful concerning their biological impact. Hence, owing to their wide applications, a thorough investigation on the Sn complexes can be essential in nearly all fields of chemistry^[1].

Chalcogenido stannate clusters can be considered as heavier homologues of molecular silicate anions. They have notable structural differences from these silicate anions, as a consequence of larger ionic radii and longer metal-ligand bonds, and smaller HOMO–LUMO gaps, that leads to differences in photophysical properties. Expansion of the clusters' compositions towards ternary chalcogenido metalate clusters look like the step from silicates to metalate- silicates, like zeolites, with similar differences as indicated above, and the additional difference is that the zeolites never form discrete molecular clusters^[2].

Most recent development for the synthesis of chalcogenido stannate and metalate clusters is the application of uncommon reaction media, like surfactants, hydrazine, or ionic liquids. Ionothermal reaction conditions (reaction in ionic liquids under slightly elevated temperatures) provide numerous advantages, like being the large adjustability of the properties of the reaction media. At the same time, reaction conditions, including slightly elevated temperatures, provoke the formation of non-classical, highly exceptional structural geometries. The products with extended anionic substructures featuring new network topologies as well as new molecular cluster motifs are obtained.

DISCUSSION AND CONCLUSION

Sn clusters belong to the most contemporary family of these compounds and exhibit a high degree of structural and property variability, owing to a large range of potential oxidation states to be adopted by this group 14 (semi-)metal, and also its potential to bind to other ligand atoms. Hence, further developments are to be expected in each of the discussed areas of research, and also in novel directions of chemistry.

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