Synthesis, Spectral Studies, *In Vitro* Antimicrobial and *In Vivo* Multi-infection Antifungal Activities in Mice of New Organotin(IV) Derivatives of Amino Acids

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Tri- and diorganotin(IV) complexes of L-tyrosine, DL-aspartic acid and L-glutamic acid have been found to show antimicrobial activity *in vitro* and slight activity *in vivo* against a multi-infection antifungal model in mice.

The biocidal properties of organotin compounds have been widely explored and, in general, the *in vitro* fungicidal and bactericidal properties of organotins have indicated the order of activity: $RSnX_3 < R_2SnX_2 < R_4Sn \ll R_3SnX$, together with the conclusion that the anionic X group exerts little influence on activity.[1] However, when the anions of amino acids[2,3] replace the polar group X in organotin(IV) compounds the activity is enhanced for example, tricyclohexyltin alaninate has been used both as a fungicide and bactericide for seeds and plants.[4] In view of this, we have synthesized new organotin complexes of amino acids. Their probable structures and biological activity are also reported in this paper.

The tri- and diorganotin(IV) derivatives of L-tyrosine (HL^1), DL-aspartic acid (H_2L^2) and L-glutamic acid (H_2L^3) have been synthesized according to the following equations:

$$R_nSnCl_{4-n} + m(NaL^1) \longrightarrow R_nSnCl_{4-n}L^1{}_m + mNaCl$$
$$(n = 3,\ m = 1,\ R = Me,\ Bu \text{ and } Ph;\ n = 2,\ m = 2,\ R = Ph) \quad (1)$$

$$Ph_2SnCl_2 + Na_2L \longrightarrow Ph_2SnL + 2NaCl \quad (2)$$

$$Bu_2SnO + 2HL^1/H_2L \longrightarrow Bu_2SnL^1{}_2/Bu_2SnL + H_2O$$
$$(L = \text{anion of } H_2L^2 \text{ and } H_2L^3) \quad (3)$$

The complexes have been characterized by elemental analysis, UV-VIS, IR, ^1H and ^{13}C NMR and ^{119}Sn Mössbauer spectral studies. Infrared studies indicate that amino acids are coordinated to tin through the amino and carboxyl oxygen atoms. The mode of coordination is further supported by the shifts observed in the multinuclear (^1H and ^{13}C) NMR spectra of the complexes. On the basis of ^{119}Sn Mössbauer studies, a distorted trigonal bipyramidal structure for R_3SnL^1 and R_2SnL^2/L^3, and a *cis*-distorted octahedral structure for $R_2SnL^1{}_2$ complexes, have been suggested. The complexes have been found to exhibit a greater degree of activity against a wide spectrum of bacteria and fungi. Both $Bu_2SnL^1{}_2$ and Ph_2SnL^2 have shown activity *in vivo* against a multi-infection antifungal model in mice.

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Techniques used: Elemental analysis, UV-VIS, IR, ^1H and ^{13}C NMR, ^{119}Sn Mössbauer, two-fold serial dilution method, a multi-infection model (mice) for rapid screening

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Fig. 1: Structure of triorganotin(IV) complexes of L-tryrosine

Fig. 2: Structures of diorganotin(IV) complexes of (a) DL-aspartic acid (b) L-glutamic acid

Fig. 3: The possible isomers of R_3SnL

Fig. 4: Structure of diorganotin(IV) complexes of L-tyrosine

Table 1: Analytical data of the complexes

Table 2: IR frequencies (cm^{-1}) of the complexes

Table 3: ^1H and ^{13}C NMR data of the complexes

Table 4: ^{119}Sn Mössbauer data (80 K) of the complexes

Table 5: Results of antimicrobial activity of the complexes

Table 6: *In vivo* evaluation of selected complexes against the multi-infection fungal model

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References cited in this synopsis

1 R. C. Poller, *The Chemistry of Organotin Compounds*, Academic Press, New York, 1970.
2 M. J. Koopmans, *Dutch Pat*. 96,805, 1961 (*Chem. Abstr*., 1961, **55**, 27756f).
3 D. A. Kochkin, S. G. Verenkina and I. B. Chekmareva, *Dokl. Akad. Nauk, SSSR*, 1961, **139**, 1375.
4 H. Brückner and K. Hartel, *Ger. Pat*. 1,061,561 (16 July 1959) (*Chem. Abstr*., 1961, **55**, 6772d).