Interaction of Dimethyltin(IV) Dichloride with Phenylalanine

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Organotin(IV) compounds have long been characterized to exhibit relatively high antitumour activity. The structures adopted by di- and trialkyltin(IV) ions in aqueous solutions appear to have linear C-Sn-C and planar skeletons, respectively. Information pertaining to the structure and behavior of these ions in solution at different pH has been the subject of many recent papers [1], [3]. These ions have rather unusual effects on the structure in water as solvent. There should be particularly pronounced ordering of water molecules in the equatorial plane of the dialkyltin(IV) ions because of the strong electrostatic field near the tin atom. In addition, the hydrophobic nature of the alkyl groups will tend to force more hydrogen bonding in the solvent around the axial positions.

All measurements were carried out at 25 °C. The ionic strength was maintained to 0.1 mol dm⁻³ with sodium perchlorate. An Eyela pH-meter, PHM 2000, was used for pH measurements. The hydrogen ion concentration was measured with an Ingold UO 3234 glass electrode and an Ingold UO 3236 calomel electrode. The pH-meter was calibrated for the relevant H⁺ concentration with a solution of 0.01 mol dm⁻³ perchloric acid containing 0.09 mol dm⁻³ sodium perchlorate (for adjusting the ionic strength to 0.1 mol dm⁻³). 50 cm³ acidic solution of dimethyltin(IV) dichloride (2.0 × 10⁻³ mol dm⁻³) was titrated with an alkali solution, 0.1 mol dm⁻³ NaOH, of the ligand (1.78 × 10⁻³ - 1.87 × 10⁻³ mol dm⁻³ of phenylalanine). The absorbance and −log[H⁺] were measured after addition of a few drops of titrant, and this procedure extended up to the required −log[H⁺]. To exclude carbon dioxide from the system, a stream of purified nitrogen was passed through a sodium chloride solution and then bubbled slowly through the reaction solution[2]. In all cases, the procedure was repeated at least three times and the resulting average values and corresponding deviations from the average are shown in the text and Tables.

Spectrophotometric measurements were performed on a UV-vis Shimadzu 2100 spectrophotometer with a Pentium 4 computer and using thermostated matched 10 mm quartz cells. The measurement cell was of flow type. A Masterflex pump allowed circulation of the solution under study from the potentiometric cell to the spectrophotometric cell, so the absorbance and −log[H⁺] of the solution could be measured simultaneously [2]. Using a combination of spectrophotometric and potentiometric methods different models including ML and MHL and several polynuclear and protonated species were tested by the computer program [3]. The models finally chosen, formed by MHL and ML for the ligand, besides the hydrolysis products of Me₂Sn(IV)²⁺ resulted in a satisfactory of numerical and graphical fitting. [2]

REFERENCES