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Reaction of Trimethyltin Chloride with Ethylenediamine

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Although the reactions of trimethyltin chloride and monodentate ligands have been well studied[1-7] there is a lack of information concerning the chemistry with bidentate ligands. The only bidentate ligand adduct of trimethyltin chloride we were able to find in the literature is the 1:1 hexacoordinated dipyridyl complex.[8] Therefore, it was of interest to initiate an investigation into other bidentate ligand systems to determine whether the hexacoordinated complex is favored over the more common pentacoordinated complex.[2] The reaction of trimethyltin chloride with n(ethylenediamine) where n = 0.5, 1 and 2 has been studied.

Elemental analyses of the products obtained confirm that the 1:1 adduct, $Me_3SnCl \cdot en$, is formed whether the molar ratio of Me_3SnCl to en used in the reaction is 2:1, 1:1, or 1:2. A typical elemental analysis is: found: C, 23.15; H, 6.80; Cl, 14.04; N, 10.65; Sn, 45.58%. Calc: C, 23.16; H, 6.61; Cl, 13.67; N, 10.80; Sn, 45.76%. The complexes decomposed above 158 °C.

The infrared tin–carbon symmetric and asymmetric as well as the tin–chlorine stretching frequencies have been used previously as the criteria in determining the structure of tin compounds.[1] In the present case, the infrared spectra were recorded in Nujol. The tin–carbon symmetric stretching vibration is absent in the complexes while the tin–carbon asymmetric stretching vibration appears at 556 cm^{-1}. The tin–chloride stretching frequency is shifted below 250 cm^{-1}. The complexes are also missing vibrations around 1160 cm^{-1} and 880 cm^{-1} which has been assigned as the ring skeletal vibrations in chelated ethylenediamine complexes.[9] These results would be consistent with those of a trigonal bipyramidal complex with coplanar methyl groups.

The complex was found to be insoluble in most organic solvent, therefore, it was necessary to record the nmr spectra in d_6-Acetone. The nmr spectra contain a singlet and three sets of multiplets. The singlet has been assigned as methyl protons and the downfield sets of multiplets were assigned as the methylene protons while the other set of multiplets was assigned as the amine protons. Unfortunately, no further analysis is possible for the multiplets since d_6-Acetone absorbs in the same region.

Using the Holmes and Kaesz correlated chart,[10] the observed $J(^{119}Sn{-}CH_3)$ coupling constant of 67.7 cps would indicate approximately 33 per cent *s*-character in the tin–carbon bond which is consistent with the proposed structure.

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