

Synthesis and Structural Characterization of Three New Tetraorganodistannoxanes

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Received: 31 May 2013 / Accepted: 4 August 2013 / Published online: 21 August 2013
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Abstract An efficient method was developed for the preparation of three tetraorganodistannoxane complexes, $(C_2H_5)_8Sn_4Cl_2(CH_3O)_2O_2$ (**1**), $(CH_3)_8Sn_4(C_3H_4N_3S)_2(CH_3O)_2O_2$ (**2**) and $(C_4H_9)_8Sn_4(C_3H_4N_3S)_2(CH_3O)_2O_2$ (**3**). All prepared complexes were characterized by infrared, 1H , ^{13}C and ^{119}Sn NMR spectroscopies and elemental analysis. The molecular structure of a representative complex (**1**) was determined by single-crystal X-ray diffraction. Results showed that **1** is a tetranuclear, centrosymmetric dimeric, and contains two endo-cyclic five-coordinated tin atoms and two exo-cyclic five-coordinated tin atoms. Compound **1** lies about a center of inversion and the tetranuclear molecule features a three-ring-staircase Sn_4O_4 core. The asymmetric unit of **1** contains two independent Sn(IV) atoms and a 2D infinite rigid chain structure forms via C–H...Cl interactions between tetranuclear units.

Keywords Triazole ligand · Organotin(IV) complexes · Spectral studies · Crystal structure

1 Introduction

There is continuous to be a great interest in combination of proper ligands and metal ions to produce supramolecular molecules, cage-like and extended network structures [1, 2]. This interest is not only for their intrinsic architectural

beauty or aesthetically structures, but also is for their potential applications in the fields of sorption, ion and molecular recognition, filtration, storage, transport, magnetic, medicine and catalysis [3, 4]. Additionally, non-covalent weak molecular forces such as van der Waals forces, hydrogen bonds and non-bonded contacts are able to link these metallic subunits into looser and more fascinating supramolecular structures. These non-covalent weak interactions have been greatly inspected in structural chemistry, structural biology and the pharmaceutical sciences [5–7]. A survey of the literature shows that these interactions have led to an extensive array of 1D coordination polymers, 2D grids and 3D lattices [8–10]. Recently, considerable effort has been devoted to the development of a novel area of organotin cluster chemistry based on an organostannoxane framework [11]. Stannoxane clusters have been found to exist in a variety of structural units containing tin nuclearities from 2 to 7. There are many reports of stannoxane clusters as tetraorganodistannoxane, O-capped clusters, cubes, tetranuclear cages and football cages. Many stannoxane clusters have been characterized by single-crystal structure determination [12, 13]. An important class of stannoxane clusters is organostannoxanes and has been subject of extensive studies because of their simple synthetic procedure [14, 15]. They contain $Sn_4O_2X_2Y_2$ ($X = Y = F, Cl, Br, I, OAc, OCH_3$) structural units with staircase or ladder arrangements, a central planar Sn_2O_2 four-member ring; and generally coordination geometry around the tin atom is octahedral or trigonal-bipyrimid [16, 17]. Organostannoxanes are usually crystalline and depending on the substituent pattern at the tin atoms are sharp-melting solids [18].

In our previous work, we used 2-quinolinecarboxylate ligand and obtained a tetranuclear organostannoxane cluster [19]; however, much less work has been carried out in

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organooxotin cluster with triazole derivatives [20, 21]. In continuation of our interest in this field, we selected the 4-methyl-4H-1,2,4-triazole-3-thiol ligand, and an efficient method was developed for preparation of ladder-shaped and N-bridged organooxotin clusters.

Herein, we report synthesis of three tetranuclear organooxotin clusters of the types: $(C_2H_5)_8Sn_4Cl_2(CH_3O)_2O_2$ (**1**), $(CH_3)_8Sn_4(C_3H_4N_3S)_2(CH_3O)_2O_2$ (**2**) and $(C_4H_9)_8Sn_4(C_3H_4N_3S)_2(CH_3O)_2O_2$ (**3**). All prepared complexes were structurally characterized by elemental analysis, and IR and NMR (1H , ^{13}C , ^{119}Sn) spectroscopies. The molecular structure of a representative complex (**1**) was determined by single-crystal X-ray diffraction. Complexes **2** and **3** showed similar structural features, containing a Sn_4O_4 ladder-shaped skeleton in which the N atom from triazole ligand coordinated to the exo tin atoms in monodentate chelating agent. Complex **1** showed a novel framework containing a Sn_2O_2 symmetrical core. Weak but significant intermolecular hydrogen bondings, C–H...Cl stackings or non-bonded S...S interactions lead to aggregation and self-assembly of these complexes into 1D, 2D or 3D supramolecular frameworks.

2 Experimental

2.1 Materials and Instrumentation

Dimethyltin(IV) dichloride and dibutyltin(IV) dichloride were purchased from Merck, and diethyltin(IV) dichloride and 4-methyl-4H-1,2,4-triazole-3-thiol were obtained from Aldrich and used without further purification. All solvents were dried and distilled under a nitrogen atmosphere prior to use according to a standard procedure [22]. Melting points were obtained with an Electrothermal 9200 melting point apparatus and are not corrected. Infrared spectra from 4,000 to 250 cm^{-1} were recorded on a Shimadzu 470 FT-IR instrument, using KBr pellets. 1H , ^{13}C , and ^{119}Sn NMR spectra were recorded at room temperature in $CDCl_3$ on a Bruker AVANCE 300-MHz operating at 300.3, 75.4, and 111.9 MHz, respectively. The NMR spectra are referenced to Me_4Si (1H and ^{13}C) or Me_4Sn (^{119}Sn) as external standards. Elemental analysis was performed with a Thermo Finnigan Flash-1112EA microanalyzer.

2.2 X-ray Crystallography

Single-crystal X-ray diffraction data were collected on a STOE IPDS-II at 100 K with graphite monochromated $Mo-K_{\alpha}$ radiation using Stoe X-Area software [23]. Cell constants and an orientation matrix for the data collection were obtained by least-squares refinement of diffraction data from 11,877 unique reflections. Data were collected to a maximum 2θ value of 29.21° . A numerical absorption

correction was applied using X-SHAPE software [24]. The structures were solved by direct methods, and refined on F^2 using a full-matrix least-squares procedure with anisotropic displacement parameters [25]. All refinements were performed using the SHELXL97 crystallographic software package [26].

2.3 Synthesis of Complexes

2.3.1 Preparation of $[(C_2H_5)_8Sn_4Cl_2(CH_3O)_2O_2](1)$

All manipulations were performed under an atmosphere of dry nitrogen using standard Schlenk line technique. Diethyltin(IV) dichloride (0.25 g, 1.0 mmol) was treated with sodium methoxide (0.1 g, 2.0 mmol) in methanol (10 ml) to produce diethyltin(IV) dimethoxide and sodium chloride. The sodium chloride precipitate was removed by filtration and the resulted solution was refluxed for 3 h. The solvent was removed under reduced pressure and the obtained white solid was loaded into a convection tube, and then the tube was filled with dry methanol, sealed, and kept at 65°C in oil bath. The colorless crystals were collected from the side arm of the glass tube after several days (yield 78 %, m.p. $153\text{--}155^\circ\text{C}$). Anal. Calc. for $C_{18}H_{46}Cl_2O_4Sn_4$: C, 24.78; H, 5.32. Found: C, 24.82; H, 5.35 %. IR (KBr, cm^{-1}): $\nu(\text{Sn-C})$, 556, 576; $\nu(\text{Sn-O})$, 462; $\nu(\text{Sn-O-Sn})$, 637; $\nu(\text{Sn-N})$, 440. 1H NMR ($CDCl_3$): δ 0.9, 1.18 (t, CH_3 , $^2J^{117/119}Sn-H = 74$), 1.67 (q, CH_2 , $^2J^{117/119}Sn-H = 80$), 1.72 (q, CH_2), 3.92 (s, $O-CH_3$). ^{13}C NMR ($CDCl_3$): δ 12.2, 12.8 (CH_3), 12.2 (CH_2 , $^1J^{119/117}Sn-^{13}C = 538$), 12.8 (CH_2 , $^1J^{119/117}Sn-^{13}C = 618$), 49.3 ($O-CH_3$). ^{119}Sn -NMR ($CDCl_3$), δ (ppm): -177.4 and -188.2 .

2.3.2 Preparation of $[(CH_3)_8Sn_4(C_3H_4N_3S)_2(CH_3O)_2O_2](2)$

Dimethyltin(IV) dichloride (0.22 g, 1.0 mmol) was treated with sodium methoxide (0.1 g, 2.0 mmol) in methanol (10 ml) to produce dimethyltin(IV) dimethoxide and sodium chloride. The sodium chloride precipitate was removed by filtration and then 4-methyl-4H-1,2,4-triazole-3-thiol (0.12 g, 1.0 mmol) in methanol (10 ml) was added to the filtrate. The reaction mixture was refluxed for 3 h, and then the solvent was removed under reduced pressure to give a white solid. The white solid was loaded into a convection tube, and then the tube was filled with dry methanol, sealed, and kept at 65°C in oil bath. The colorless crystals were collected from the side arm of the glass tube after several days (yield 85 %, m.p. $250\text{--}252^\circ\text{C}$). Anal. Calc. for $C_{16}H_{38}N_6O_4S_2Sn_4$: C, 20.95; H, 4.17; N, 9.16. Found: C, 20.98; H, 4.21; N, 9.14 %. IR (KBr, cm^{-1}): $\nu(\text{C=S})$, 1161; $\nu(\text{Sn-C})$, 552, 568; $\nu(\text{Sn-O})$, 451; $\nu(\text{Sn-O-Sn})$, 631; $\nu(\text{Sn-N})$, 448. 1H NMR ($CDCl_3$): δ 0.71 (s, $SnCH_3$, $^2J^{117/119}Sn-H = 87$), 1.21 (s, $SnCH_3$, $^2J^{117/119}$

Sn–H = 78), 3.81 (s, triazole CH₃), 4.21 (s, OCH₃), 7.8 (s, triazole–H). ¹³C NMR (CDCl₃): δ 10.12 (SnCH₃, ¹J^{119/117} Sn–¹³C = 732), 12.6 (SnCH₃, ¹J^{119/117} Sn–¹³C = 588), 38.8 (triazole–CH₃), 51.2 (OCH₃), 138.2, 183.3 (triazole–C). ¹¹⁹Sn NMR (CDCl₃), δ (ppm): –183.2 and –286.4.

2.3.3 Preparation of [(C₄H₉)₈Sn₄(C₃H₄N₃S)₂(CH₃O)₂O₂] (3)

Dibutyltin(IV) dichloride (0.30 g, 1.0 mmol) was treated with sodium methoxide (0.10 g, 2.0 mmol) in methanol (10 ml) to produce dibutyltin(IV) dimethoxide and sodium chloride. The sodium chloride precipitate was removed by filtration and then 4-methyl-4H-1,2,4-triazole-3-thiol (0.12 g, 1.0 mmol) in methanol (10 ml) was added to the filtrate. The reaction mixture was refluxed for 3 h, and then the solvent was removed under reduced pressure to give a white solid. The white solid was loaded into a convection tube, and then the tube was filled with dry methanol, sealed, and kept at 65 °C in oil bath. The colorless crystals were collected from the side arm of the glass tube after several days (yield 82 %, m.p. 258–260 °C). Anal. Calc. For C₄₀H₈₆N₆O₄S₂Sn₄: C, 38.31; H, 6.91; N, 6.70. Found: C, 38.35; H, 6.95; N, 6.67 %. IR (KBr, cm⁻¹): ν(C=S), 1165; ν(Sn–C), 554, 571; ν(Sn–O), 455; ν(Sn–O–Sn), 635; ν(Sn–N), 452. ¹H NMR (CDCl₃): δ 0.92, 1.17 (t, SnCH₃), 1.26–1.74 (m, CH₂CH₂CH₂), 3.12 (s, triazole CH₃), 3.41 (s, OCH₃), 7.91 (s, triazole–H). ¹³C NMR (CDCl₃): δ 26.4 (α-CH₂), 27.4 (α-CH₂), 26.2 (β-CH₂), 26.6 (β-CH₂), 25.2 (γ-CH₂), 24.8 (γ-CH₂), 13.3 (CH₃), 13.7 (CH₃), 39.2 (triazole–CH₃), 53.4 (OCH₃), 138.7, 183.1 (triazole–C). ¹¹⁹Sn NMR (CDCl₃), δ (ppm): –185.2 and –288.3.

3 Results and Discussion

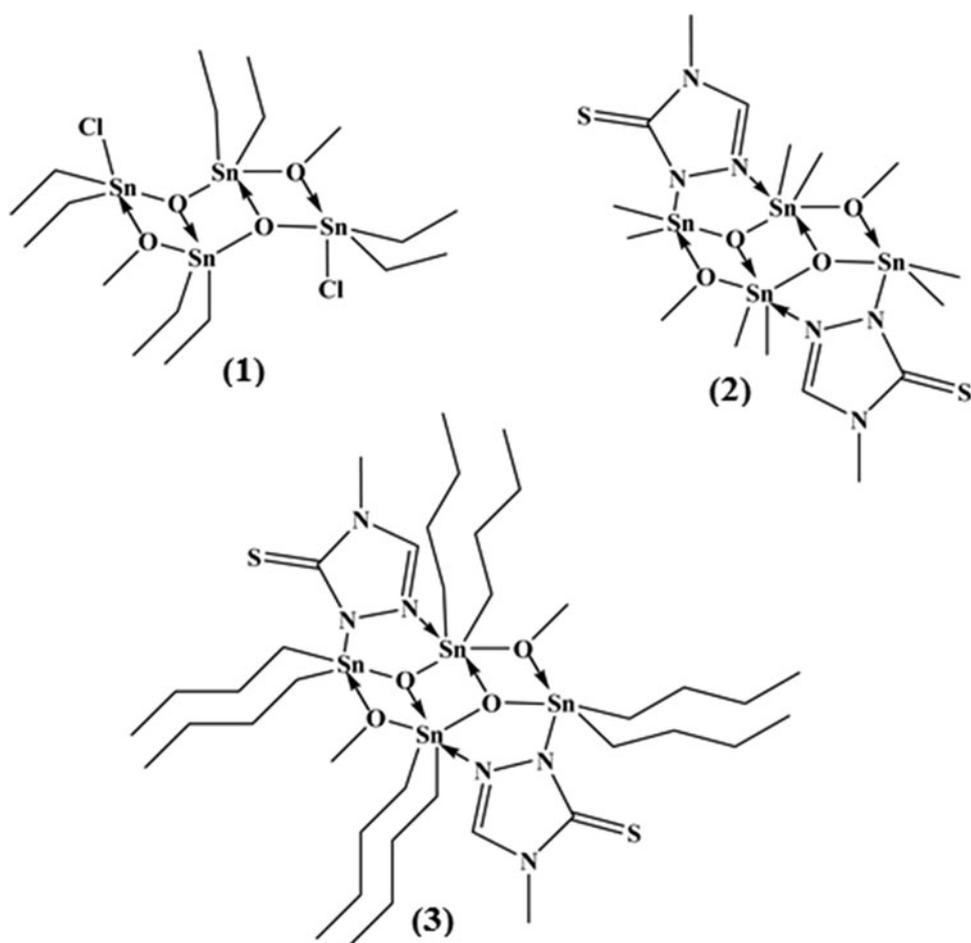
3.1 Synthesis

A new methodology was used to synthesize tetraorganodistannoxanes. Tetraorganodistannoxanes are usually prepared by controlled hydrolysis of diorganotin compounds (R₂SnX₂, X = electronegative substituent) [27, 28]. However, several authors have used various approaches for synthesis of tetraorganodistannoxanes including reacting diorganotin oxides with acids, oxidation of functional distannanes with oxygen, and treatment of diorganotin oxides with an equimolar quantity of diorganotin compounds (R₂SnX₂, X = electronegative substituent) [29–34]. In the present study, halogens of diorganotin were replaced with methoxide group by reacting them to sodium methoxide. Then diorganotin dimethoxide was isolated and reacted to 4-methyl-4H-1,2,4-triazole-3-thiol. This procedure provides a clean reaction for the preparation of

tetraorganodistannoxanes without any side product. Attempts for crystallization of the white precipitate that formed in three reactions by conventional crystallization methods for the single-crystal X-ray diffraction studies have not been successful. Therefore, the well-developed branched tube method was used to grow suitable crystals for X-ray analysis [35]. The new method is straightforward, simple, and trouble-free and can be used for the recrystallization of the wide range of coordination compounds. The elemental analyses of all compounds along with their IR and ¹H, ¹³C and ¹¹⁹Sn NMR spectra are in accordance with the proposed formula [R₈Sn₄X₂(CH₃O)₂O₂] (R = Me, Et, Bu; X = (C₃H₄N₃S), Cl) (Scheme 1). All prepared compounds are stable at room temperature and can be accumulated at room temperature for the indistinct period of times. Probably, because the overall molecule in all complexes is linked together by covalent Sn–O bonds, therefore, providing adequate thermodynamic stability for existence in the solid state.

3.2 General Characterization

In the IR spectra of **2** and **3**, the stretching vibration of triazole ligand S–H group at 3,110 and 2,930 cm⁻¹ is not observed, and a new peak appeared at about 1,160 cm⁻¹ (C=S), which indicates the deprotonation of N–H and formation of the thione form. A new band also observed at about 450 cm⁻¹ in the spectra of **2** and **3**, and assigned to the stretching vibration of Sn–N, and showing the nitrogen atom of the triazole moiety is coordinated to the central tin atom. In the spectra of all prepared organotin(IV) complexes, the presence of two Sn–C stretching vibrations at about 550 and 570 cm⁻¹ reveal a non-linear trans configuration of the C–Sn–C moiety, and this was confirmed by single-crystal structure determination of **1**. A strong band at about 635 cm⁻¹ is assigned to stretching vibration of Sn–O–Sn and illustrates a bridged structure. Notably, the Sn–Cl stretching vibration frequency of **1** is in the 250–256 cm⁻¹ region. This band is lower than that of observed in the IR spectrum of the diethyltin(IV) dichloride starting reagent [36]. For the determination of structural features of the prepared compounds in solution, ¹H, ¹³C and ¹¹⁹Sn NMR spectra were recorded. The ¹H NMR spectra of **1–3** in the 0.71–1.74 ppm region showed that there is two sets of methylene and methyl groups bound to tin atom (–CH₂Sn, CH₃Sn). This was confirmed by the appearance of two signals for tin atom in the ¹¹⁹Sn NMR spectrum. In the ¹H NMR spectra of **2** and **3**, the signals of the triazole ligand are generally displaced to lower fields. This is most likely due to the coordination of the nitrogen atom to tin center. The ¹³C NMR spectra of all complexes showed the expected aliphatic and/or aromatic signals. In the ¹³C NMR spectra of **2** and **3**, the signals of triazole ligands are shifted very slightly from their position in

Scheme 1 Line drawing structure of the complexes

the spectrum of free ligands, which could be attributed to the coordination of triazole ligand to tin and formation of Sn–N bonds. This shift is a consequence of an electron density transfer from the ligand to the acceptor. The ^{119}Sn NMR chemical shifts are very useful data for determining the coordination number of tin atom in organotin compounds and its molecular geometry. The ^{119}Sn NMR spectra of all three compounds (**1–3**) similar to other tetraorganodistannoxanes complexes display two well-resolved resonances and indicating that the dimeric structure of complexes in the solution is maintained [37–39]. The high- and low-field resonances are attributed to the exo- and endo-cyclic tin atoms, respectively [40]. The ^{119}Sn NMR spectrum of **1** in CDCl_3 reveals two equally intense ^{119}Sn resonances at -177.4 and -188.2 ppm, showing that there are two non-equivalent tin atoms in **1**, and suggests that the coordination number of two tin atoms should be five. In contrary, two signals in the ^{119}Sn NMR spectra of **2** and **3** at -183.2 , -286.4 ppm and -185.2 , -288.3 ppm showed that there are clearly two nonequivalent tin atoms in the molecules and suggest five- and six-coordinated tin atoms, respectively. The similar ^{119}Sn chemical shifts for **2** and **3** reveals similar bonding in both complexes.

3.3 Crystal Structure of **1**

Crystal data and refinement details and selected bond distances and angles for **1** are listed in Table 1 and Table 2, respectively. This compound crystallized in the monoclinic crystal system in the space group of $P2_1/n$. The molecular structure and its unit cell are established by single-crystal X-ray diffraction (Figs. 1, 2). The molecular structure of compound may be considered as a tetramer of Sn(IV) consisting of dimeric units with a building block of Sn_2O_2 . As shown in Fig. 1, in the overall structure, the dimeric units are further linked across a center of inversion to generate a ladder like structure. Tetranuclear distannoxane, $(\text{C}_2\text{H}_5)_8\text{Sn}_4\text{O}_2$ ($(\text{CH}_3\text{O})_2\text{Cl}_2$), lies about a center-of-inversion; the molecule features a three-ring-staircase Sn_4O_4 core. The oxo oxygen atoms are three-coordinate whereas the methoxy oxygen atoms are two-coordinate. Unexpectedly, triply-bridged (μ_3) oxygen that shares its electrons with three Sn center has smaller bond lengths and is in distorted tetrahedral configuration. The asymmetric unit of **1** contains two independent tin atoms. The molecular structure as elucidated in Fig. 1 exposes distorted trigonal bipyramidal geometry around each tin. The coordination geometry around the terminal Sn2

is distorted trigonal bipyramidal with the axial positions being occupied by one bridging methoxy oxygen, O2, and chlorine atom, Cl1, with bond lengths of Sn(2)–O(2) = 2.196(3) Å, Sn(2)–Cl(1) = 2.515(10) Å, respectively. The bond angles of O(2)–Sn(2)–Cl(1), 155.98°, somewhat is deviated from ideal value and the equatorial positions are occupied by the two carbons, C5 and C7, of the ethyl substituents with approximately identical bond length [Sn(2)–C(5) = 2.130(5) Å, Sn(2)–C(7) = 2.133(5) Å] and the bridging oxo group (O1) with bond length of Sn(2)–O(1) = 2.011(3) Å. The sum of angles between the Sn(1) atom and the equatorial atoms, 358.91°, is very close to the ideal value of 360°. In the case of central tin, Sn1, with the distorted trigonal bipyramidal geometry, the basal plane is occupied by the two carbon atoms, C1 and C3, of the two ethyl substituents with approximately identical bond lengths [Sn(1)–C(1) = 2.129(4) Å, Sn(1)–C(3) = 2.136(4) Å] and the oxo group O1 with bond length of Sn(1)–O(1) = 2.124(3). Triply-bridged (μ_3) oxygen O1 along with doubly-bridged (μ_2) oxygen O2 occupied the axial position, which the O(1)–Sn(1)–O(2) angle with value of 144.37° is somewhat is deviated from ideal value. The overall structure is a dimer with the two oxo groups O1 acting as μ -bridges

Table 1 Crystal data and refinement details for [(Et)₂Sn– μ -O– μ -(OCH₃)Sn(Et)₂(Cl)]₂

Molecular formula	C ₁₈ H ₄₆ Cl ₂ O ₄ Sn ₄
Formula weight	872.21
Crystal size (mm)	0.25 × 0.21 × 0.11
Crystal color	Colorless
Wavelength (Å)	0.71073
Crystal system	Monoclinic
Space group	P2 ₁ /n
a (Å)	9.5526(6)
b (Å)	15.1708(6)
c (Å)	10.3895(6)
α (°)	90.00
β (°)	99.818(5)
γ (°)	90.00
V (Å ³)	1,483.60(14)
Z	2
F(000)	840
Calculated density (mg/m ³)	1.952
Absorption coefficient (mm ⁻¹)	3.527
2 θ range (°)	2.40–29.21
Reflections collected	3,991
Unique reflections [R(int)]	11,877
Goodness of fit on F ²	1.067
Data/restraints/parameters	3,991/0/127
Final R indices [I > 2 σ (I)]	R1 = 0.0414, wR2 = 0.1134
R indices (all data)	R2 = 0.0455, wR2 = 0.1108

between the two tin units to generate a ladder like structure. As it can be seen, the central part of the molecule is occupied with tin atoms, which are completely surrounded with oxygen, chlorine, carbon, and hydrogen atoms. These structural features are accordance with its solubility in polar solvent such as chloroform and dichloromethane. All Sn–C bond lengths **1** almost are identical and they are in the typical range

Table 2 Selected bond distances and angles

Bond lengths (Å)			
Sn(1)–O(3)	2.049(2)	C(5)–C(6)	1.455(8)
Sn(1)–O(1)#1	2.050(3)	Sn(2)–O(1)	2.011(3)
Sn(1)–O(1)	2.124(3)	Sn(2)–C(5)	2.130(5)
Sn(1)–C(1)	2.129(4)	Sn(2)–C(7)	2.133(5)
Sn(1)–C(3)	2.136(4)	Sn(2)–O(2)#1	2.196(3)
Sn(1)–O(2)	2.171(3)	Sn(2)–Cl(1)	2.5151(10)
Bond angles (°)			
O(1)–Sn(1)–O(1)#1	72.84(12)	O(1)–Sn(2)–C(5)	119.7(2)
O(1)–Sn(1)–C(1)#1	114.01(15)	O(1)–Sn(2)–C(7)	114.26(16)
O(1)–Sn(1)–C(1)	99.40(14)	C(5)–Sn(2)–C(7)	125.3(3)
O(1)–Sn(1)–C(3)#1	112.78(14)	O(1)–Sn(2)–O(2)#1	71.74(11)
O(1)–Sn(1)–C(3)	98.88(15)	C(5)–Sn(2)–O(2)#1	93.14(18)
C(1)–Sn(1)–C(3)	132.91(17)	C(7)–Sn(2)–O(2)#1	95.78(16)
O(1)–Sn(1)–O(2)#1	71.54(10)	O(1)–Sn(2)–Cl(1)	84.30(8)
O(1)–Sn(1)–O(2)	144.38(11)	C(5)–Sn(2)–Cl(1)	97.58(18)
C(1)–Sn(1)–O(2)	95.41(15)	C(7)–Sn(2)–Cl(1)	95.40(14)
C(3)–Sn(1)–O(2)	94.25(15)	O(2)–Sn(2)–Cl(1)#1	156.00(8)

Symmetry transformations used to generate equivalent atoms:#1: 1 – x, 1 – y, 1 – z

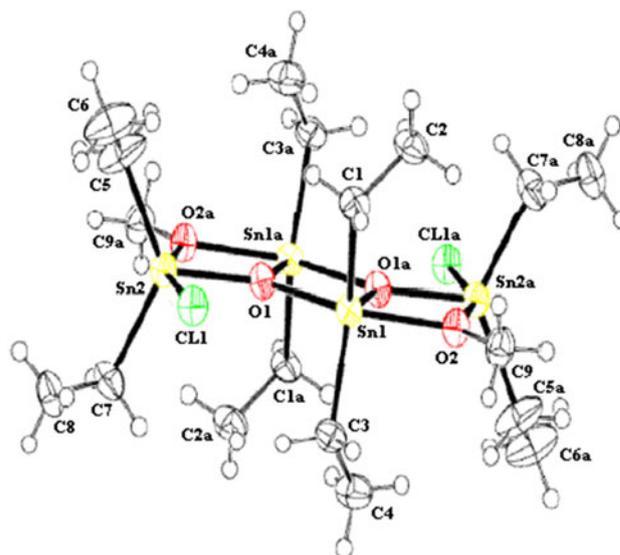


Fig. 1 An ORTEP view of [(Et)₂Sn– μ -O– μ -(OCH₃)Sn(Et)₂(Cl)]₂. Thermal ellipsoids are drawn with 40 % probability

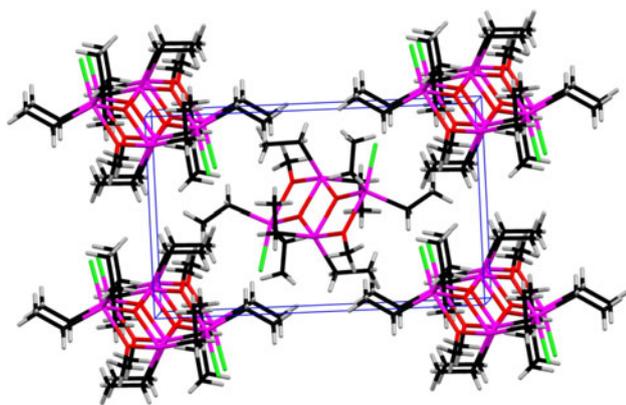


Fig. 2 Crystal packing in **1**

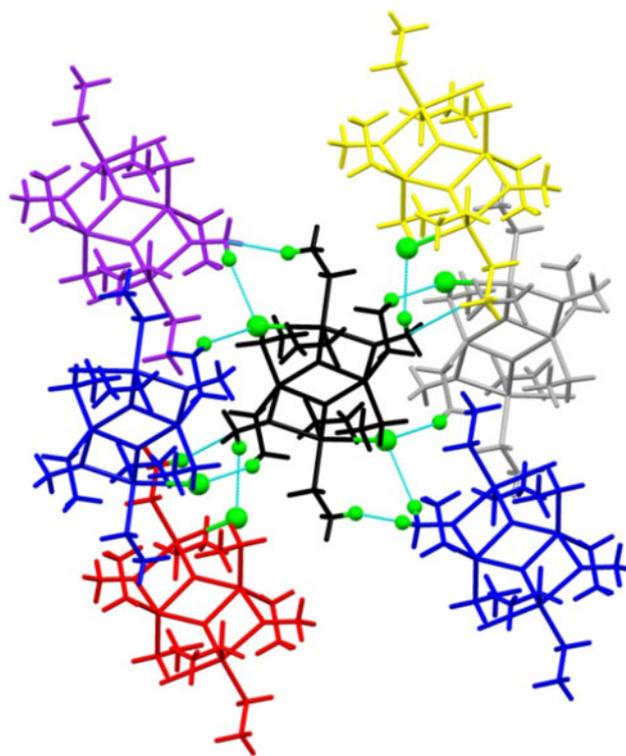


Fig. 3 A representation of part of a tetranuclear distannoxane **1** linked with *six adjacent ladders* like structures by cooperation of C–H...Cl hydrogen bonds. *Different colors* are shown for *different adjacent ladder* like structures. Hydrogen bonds are shown as *blue narrow lines* (Color figure online)

of such bond lengths found in organotin complexes. Apparently, the main factor that controls the packing in structure is the presence of weak intra- and intermolecular interactions. As it is clear from Fig. 3, each tetranuclear tin is linked with six adjacent ladders like structures by cooperation of C–H...Cl hydrogen bonds between aliphatic C–H from methyl groups and tin-coordinated chlorine atoms. The hydrogen bonding between the C–H and chloride atoms

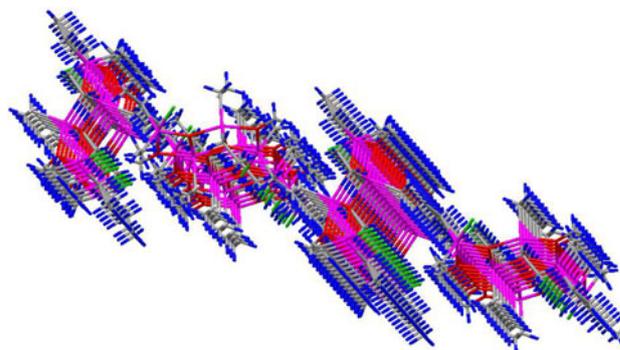


Fig. 4 View of a 2D network of complex $[(Et)_2Sn-\mu-O-\mu-(OCH_3)Sn(Et)_2(Cl)_2]_2$ constructed by hydrogen bonds

caused the structure of the compound to grow into a 2D supramolecular network (Fig. 4).

4 Conclusions

In summary, three new tin(IV) complexes were synthesized and their structures were established by several spectroscopic methods. The reaction details and features were described and discussed. This work shows that the diorganotin compounds in the presence of alkaline alkoxides results in the formation of diorganotin compounds, in which the structures are entirely different from the earlier reported compounds.

5 Supporting Information

Crystallographic data for **1** has been deposited with the Cambridge Crystallographic Data Centre, CCDC No. 937133. Copies may be obtained free of charge from The Director, CCDC, 12 Union Road, Cambridge, CB2 1EZ, UK (Fax: +44-1223-336033; E-mail: deposit@ccdc.cam.ac.uk or: <http://www.ccdc.cam.ac.uk>).

Acknowledgments The authors thank the Vice-President's Office for Research Affairs of Shahid Beheshti University and AJA University of medical Science of Iran for supporting this work.

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