Studii şi Cercetări Ştiinţifice 2014, **15** (1), pp. 075 – 079
Chimie şi Inginerie Chimică, Biotehnologii, Industrie Alimentară

Scientific Study & Research
Chemistry & Chemical Engineering, Biotechnology, Food Industry *ISSN 1582-540X*

ORIGINAL RESEARCH PAPER

PHOSPHATO AND PHOSPHONATO ADDUCTS: SYNTHESIS AND SPECTROSCOPIC STUDY

Mouhamadou Birame Diop, Libasse Diop*

Université Cheikh Anta Diop, Faculté des Sciences et Techniques, Département de Chimie, Laboratoire de Chimie Minérale et Analytique, Dakar, Sénégal

*Corresponding author: dlibasse@gmail.com

Received: May, 05, 2014
Accepted: May, 30, 2014

Abstract: Two new adducts have been synthesized and studied by infrared and NMR spectroscopy. The suggested structures are discrete or of infinite chain type with a phosphate behaving as a bidentate ligand, a phosphonate acting as a monodentate ligand, the environments around the tin centre being tetrahedral or trigonal bipyramidal. In all the studied compounds, supramolecular architectures are obtained when hydrogen bonds are considered.

Key words: *discrete structures, hydrogen bonds, monodentate and bidentate, phosphate, phosphonate, supramolecular architectures, tetrahedral and trigonal bipyramidal environments*

INTRODUCTION

The powerful coordinating ability of oxyanions is well known and has brought Hathaway to summarize the main published data on this topic [1]. Our group has yet published some papers dealing with [2-5] and initiate here the study of the interactions between ethylenediamine, H_3PO_4 and $SnPh_3OH$ or diethylentriamine, H_2O_3PPh and $SnPh_3Cl$ which have yielded two new adducts, infrared study of which have been carried out then structures suggested on the basis of infrared data.

MATERIALS AND METHODS

A 1/1/1 ratio mixture of ethylenediamine (en), H_3PO_4 and $SnPh_3OH$ or a 1/1/1 ratio mixture of diethylentriamine, H_2O_3PPh and $SnPh_3Cl$ in ethanol are the processes to obtain (**1**) and (**2**) respectively. All the mixtures were stirred around two hours then filtered before being submitted to a slow solvent evaporation. The analytical data calculated (found) have allowed to suggest the following formulae (Table 1).

Table 1. *Suggested formulae of synthetized compounds*

Comp	Suggested formulae	Chemical composition (% mass)					
		C		H		N	
		Calc.	Found	Calc.	Found	Calc.	Found
1	$(enH_2)_3(PO_4)_2.HPO_4(SnPh_3)_2.6H_2O$	39.71	39.15	5.08	5.64	6.62	6.96
2	$DETAH_3.3PhPO_3H.SnPh_3Cl$	49.88	49.61	5.09	6.09	4.36	4.46

The elemental analyses have been obtained from the "Laboratoire de Mesures Physiques" Montpellier II University-France. The IR spectra were performed at the University of Saint Boniface-Winnipeg Canada. IR abbreviations: vs (very strong); s (strong); m (medium), w (weak).
The ^1H NMR spectra were performed at the "Laboratoire de Mesures Physiques" at Montpellier II University. NMR spectra were recorded as saturated $CDCl_3$ or DMSO at room temperature, using a Bruker 300 MHz spectrometer. The ^1H NMR was measured at 300.13 MHz.^1H chemical shifts NMR are given in ppm and are referred respectively to TMS. ^1H NMR abbreviations: m (multiplet), t (triplet), s (singulet). All the chemicals were purchased from QLDRIH Company-Germany and used as such.

RESULTS AND DISCUSSION

Let us consider the:
- IR data in $cm^{-1}$of the two adducts:

1: ν (NH_3): 3045 (broad); ($\nu_{as}+\nu_s$) (PO_4): 1100 (vs), 1077 (vs), 1000 (vs), 970 (vs); ($\delta_{as}+\delta_s$) (PO_4): 728 (s), 696 (m), 550 (m);

2: ν (NH_3): 3046 (broad), 2990 (broad), 2848 (broad); υ (PO_3): 1123 (vs), 1069 (m), 1015 (vs), δ (PO_3): 693 (vs).

- ^{1}H NMR ($CDCl_3$ or DMSO, ppm):

1: δ 7.08-7.82 (m, Ar-H), δ 4.26-4.28 (m, CH_2-NH_3);

2: δ 7.06-7.71 (m, Ar-H).

For **1** we suggest a cyclic structure with a bidentate bridging hydrogenophosphate connecting two $SnPh_3$ residues and monodentate phosphates linked by three enH_2^{2+}, the environment around the tin centres being trigonal bipyramidal (Figure 1).

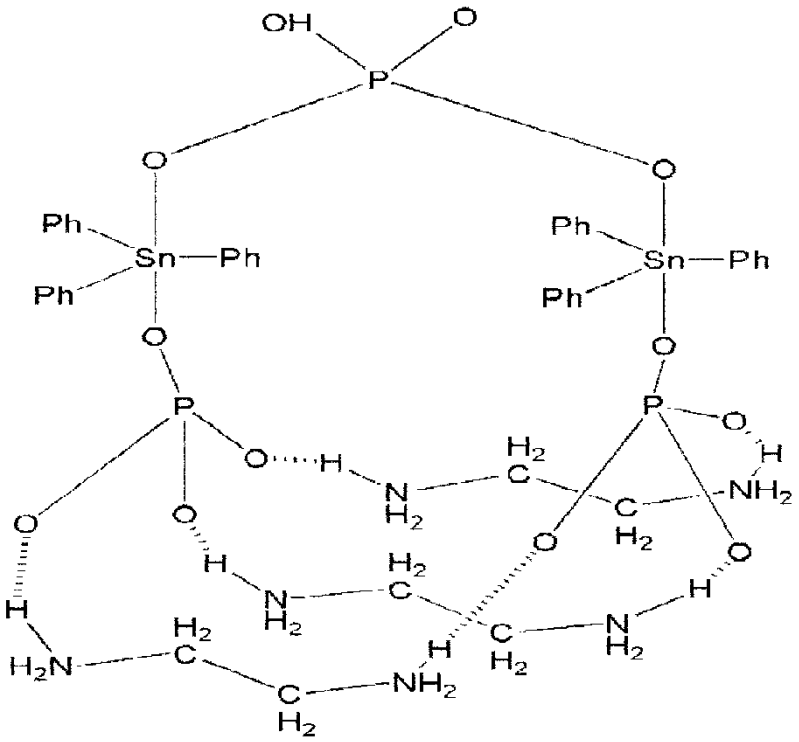
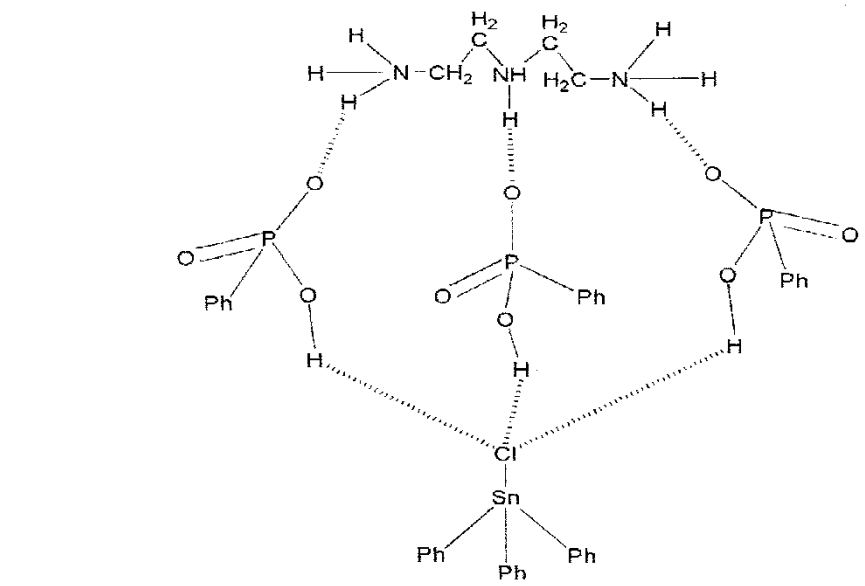
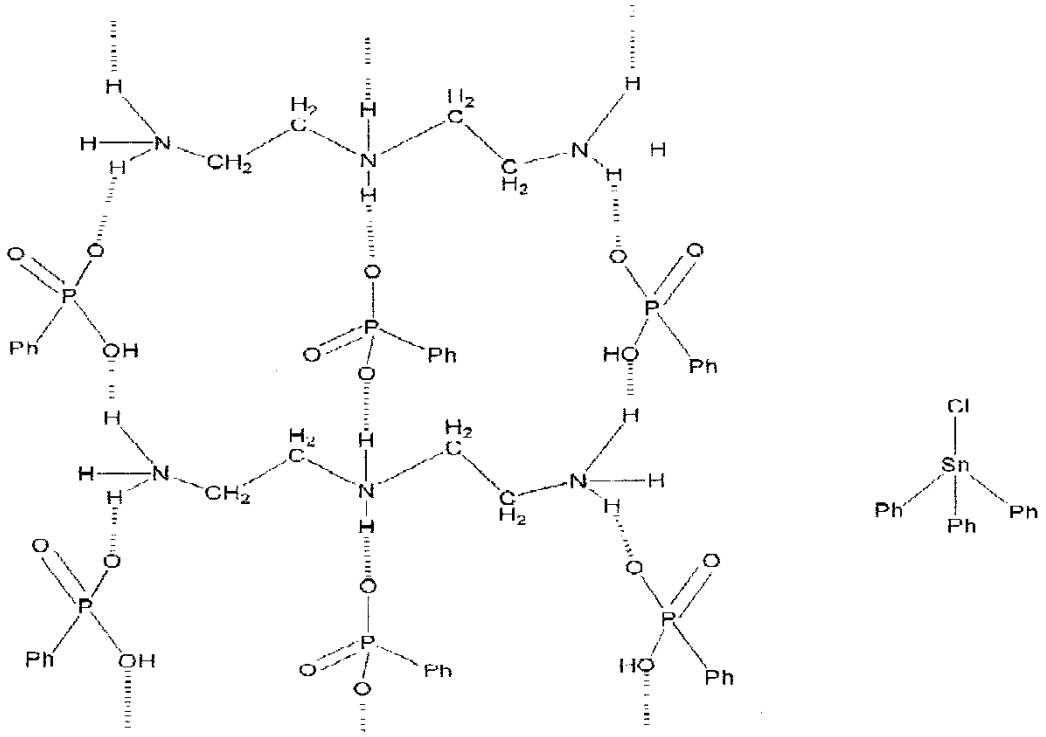


Figure 1. *Proposed structure for the compound* ***1***

For **2** the suggested structure is monomeric or of infinite chain type. In the monomeric one (Figure 2a), involved (in hydrogen bonds with the cation) $PhPO_3H^-$ anions are linked to the $SnPh_3Cl$ through OH…Cl hydrogen bonds, the environment around the tin centre being tetrahedral. For the infinite chain (Figure 2b), $DETAH_3.3PhPO_3H$ molecules are linked through NH…O hydrogen bonds involving the cations, the $SnPh_3Cl$ being lattice and tetrahedral.



a.



b.

Figure 2. *Proposed structure for the compound* ***2***

For all these compounds the cations can interact via hydrogen bonds leading to a supramolecular architecture.

CONCLUSION

The studied adducts have a discrete or an infinite chain structure, the phosphate behaving as a bidentate ligand, the environment around the tin centre being tetrahedral or trigonal bipyramidal. When extra intermolecular hydrogen bonds are considered supramolecular architectures are obtained.

ACKNOWLEDGEMENTS

We thank Professor L. A. DIOP (Saint-Boniface College –Winnipeg, Canada) for equipment support.

REFERENCES

1. Hathaway, B.J.: *Comprehensive Coordination Chemistry* (Editors: Wilkinson, G., Gillard, R.D., McCleverty, J.A.), 1st ed., volume **5**, Chapter 53, Pergamon Press, Oxford, **1987**, 413;
2. Diallo, W., Diop, L., Molloy, K.C., Kociok-Köhn, G.: X-ray Structure of $HSeO_3$ $SnMe_2Cl$, *Main Group Metal Chemistry*, **2011**, **34** (3-4), 55–56;
3. Diallo, W., Okio, K.Y.A., Diop, C.A.K., Diop, L., Diop, L.A., Russo, U.: New Selenito Residues Containing Complexes and Adducts: Synthesis and Spectroscopic Studies, *Main Group Metal Chemistry*, **2009**, **32** (2), 93-99;
4. Allouch, H., Diop, L.: Synthesis and infrared study of some new $SnC_2O_4Cl_2$ adducts and complexes *Scientific Study & Research - Chemistry & Chemical Engineering, Biotechnology, Food Industry*, **2012**, **13** (3), 317-323;
5. Gueye, N., Diop, L., Diop, L.: New R_2NH_2OH (R = Cy, Bu) adducts of MX_2, MX_3 orMX_5: Synthesis and infrared study, *Scientific Study & Research - Chemistry & Chemical Engineering, Biotechnology, Food Industry*,**2012**, **13** (4), 399–403.