Studii şi Cercetări Ştiinţifice 2016, **17** (1), pp. 095 – 099
Chimie şi Inginerie Chimică, Biotehnologii, Industrie Alimentară

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

SHORT COMMUNICATION

NEW HALOTIN (IV) WITH EDTA: SYNTHESIS AND INFRARED STUDY

Serigne Cissé, Ibrahima Cissé, Libasse Diop*

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

*Corresponding author: dlibasse@gmail.com

Received: June, 06, 2015
Accepted: February, 26, 2016

Abstract: Tri acidic or neutral ethylenediaminetetraacetato [H_3Y^- or Y^{4-}] containing adducts and derivatives have been synthesized and studied by infrared. The suggested structures are discrete with octahedral environments around the tin centres, the ethylenediaminetetraacetic anion behaving as a tridentate, pentachelating and bidentate, pentachelating and tridentate ligand. For the last structure when intermolecular hydrogen bonds involving OH group are considered, a supramolecular architecture may be obtained.

Keywords: *discrete structures, ethylenediaminetetraacetic anion, hydrogen bonds, pentachelating and bidentate, pentachelating and tridentate, supramolecular architectures*

© 2016 ALMA MATER Publishing House, "VASILE ALECSANDRI" University of Bacău. All rights reserved.

INTRODUCTION

The interesting structural aspects and applications in organotin (IV) chemistry-medicine, agriculture, industry- explain the interest of various research groups worldwide [1- 4]. In the framework of our research work in the coordinating ability of oxyanions towards organotin(IV) molecules, our group has yet published some papers [5-10] and report here the study of the interactions between $[Me_4N][H_3Y]\cdot H_2O$ or $[BzNMe_3]_2[H_2Y]\cdot H_2O$ and $SnCl_2$ which has yielded tri new compounds, infrared study of which have been carried out then structures suggested on the basis of spectroscopic data.

MATERIALS AND METHODS

$[Me_4N][H_3Y]\cdot H_2O$ (L_2) and $[BzNMe_3]_2[H_2Y]\cdot H_2O$($L_5$) have been obtained as powders after the water evaporation of the solution obtained on dissolving ethylenediaminetetraacetic acid (EDTA) in aqueous solutions of Me_4NOH or $BzNMe_3OH$ in 1:4 ratio. The analytical data % calculated (% found): (L_2): C = 43.86 (43.14), H = 7.62 (7.27), N = 10.96 (10.33); (L_5): C = 59.19 (59.07), H = 7.95 (7.87), N = 9.20 (9.23) have allowed to suggest the above formulae for (L_2) and (L_5).

When $SnCl_2$ are allowed to react with (L_2) and (L_5) in ethanol in specific ratios, white precipitates are obtained which are stirred around two hours and washed with ethanol:

- $SnCl_2$ with L_2 in 3:1 ratio gives (**A**);
- $SnCl_2$ with L_5 in 3:1 ratio gives (**B**);
- $SnCl_2$ with L_5 in 6:1 ratio gives (**C**);

The analytical data have allowed to suggest the following formulae for the three new compounds (Table 1):

Table 1. *Suggested formulae of the synthesized compounds*

Comp	Suggested formulae	Chemical composition [% mass]					
		C		H		N	
		Calc.	Found	Calc.	Found	Calc.	Found
A	$(Me_4N)_4Y\cdot 2SnCl_4\cdot SnCl_5Me_4N\cdot 2H_2O$	23.83	23.72	5.07	4.70	6.48	6.35
B	$SnY\cdot 3/2SnCl_2(OH)_2\cdot H_2O$	16.14	16.23	2.25	2.32	3.68	3.42
C	$SnY\cdot 5/2SnCl_2(OH)_2\cdot EtOH\cdot 2H_2O$	13.75	13.54	2.60	2.87	2.67	2.35

The infrared spectra were recorded with a Bruker FTIR (4400 -350 cm^{-1}) spectrometer at Saint Boniface College, Winnipeg-Canada. The elemental analyses have been performed at the laboratory of Microanalyses at the University of Bath (UK). Infrared data are given in cm^{-1} [IR abbreviations: (br) broad, (vs) very strong, (s) strong, (m) medium, (sh) shoulder]. All the chemicals are from Aldrich Company (Germany) and were used without any further purification.

RESULTS AND DISCUSION

Let us consider the infrared data of the studied derivatives based on assignments in [11]:

A: $\nu(OH_2)$ = 2925 s; $\nu_{as}(COO)$ = 1500 s; $\delta(CH_2) + \nu_s(COO)$ = 1458 s, 1376 s; $\nu(CC)$ = 774 s;

B: $\nu(OH_2)$ = 3066 sh; $\nu_{as}(COO)$ = 1626 s, 1599 s; $\delta(CH_2) + \nu_s(COO)$ = 1457 s, 1305 sh; $\nu(CC)$ = 722 m;

C: $\nu(OH_2)$ = 3064 s; vas(COO) = 1667 s, 1621 s; $\delta(CH_2) + \nu_s(COO)$ = 1377 m; $\nu(CC)$ = 774 m.

From these data we suggest three discrete structures with the ethylenediaminetetraacetic anion behaving as a tridentate, pentachelating and bidentate, pentachelating and tridentate the environments around the tin centres being octahedral.

For **A** a discrete structure with octahedral Sn centres, the anion behaving as a tridentate ligand is suggested (Figure 1).

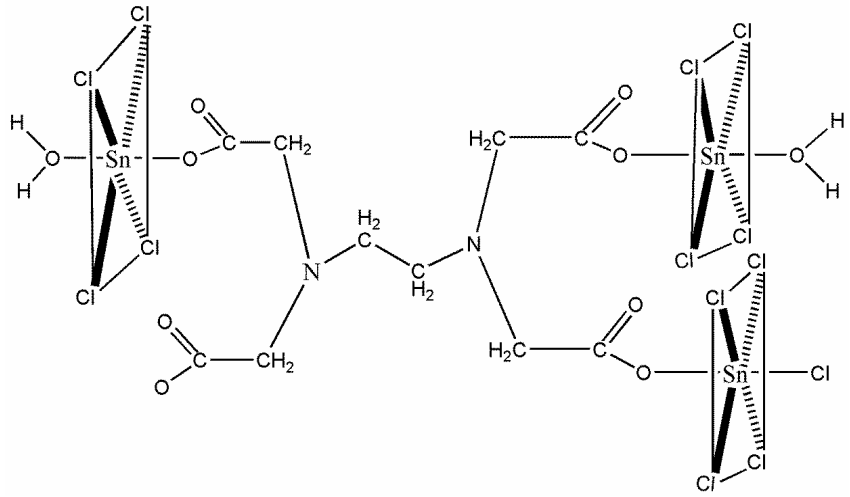

Figure 1. *Proposed structure for the compound* ***A***

For **B** a dimeric structure is suggested with a octahedral environment around Sn centres**,** the anion behaving as a pentachelating and bidentate ligand, the water molecules as coordinated ones (Figure 2).

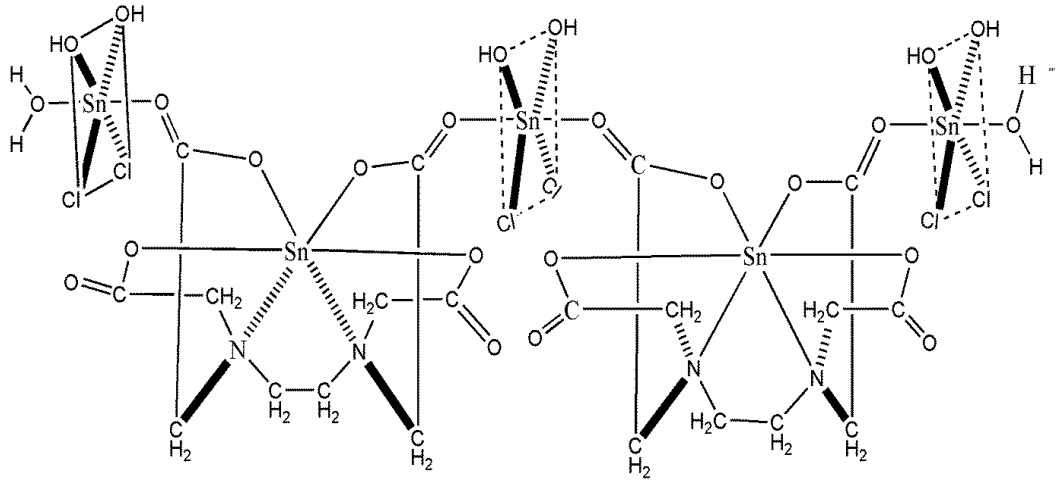

Figure 2. *Proposed structure for the compound* ***B***

For **C** a dimeric structure is suggested with a octahedral environment around Sn centres, the anion behaving as a pentachelating and tridentate ligand, the water molecules as coordinated ones and two EtOH molecules being connected to $[2SnY{\cdot}5SnCl_2(OH)_2{\cdot}4H_2O]$ trough OH---O hydrogen bonds (Figure 3).

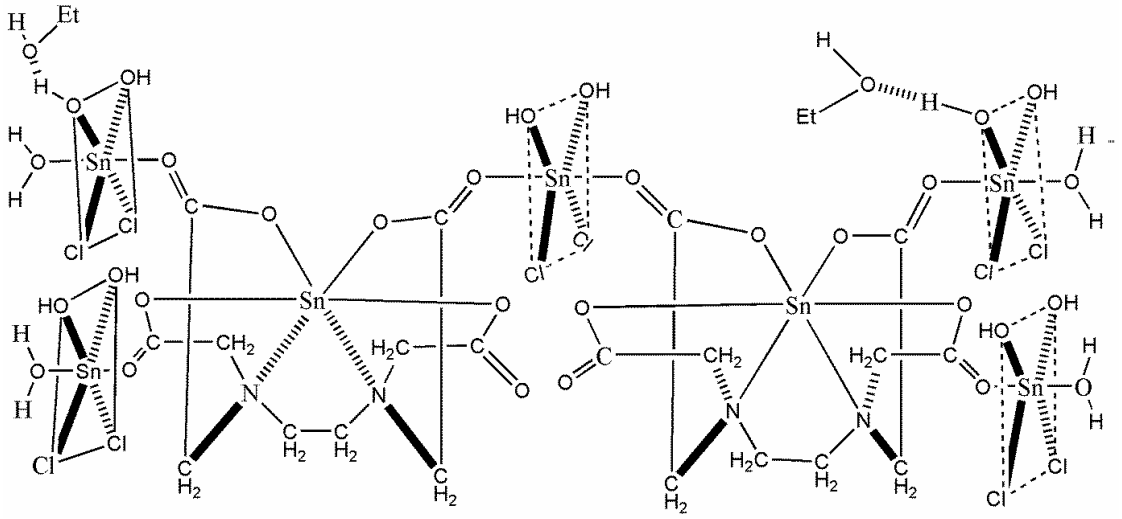

Figure 3. *Proposed structure for the compound* ***C***

For the last structure when extra hydrogen bonds are considered supramolecular architectures may be obtained.

CONCLUSIONS

The structures of three compounds studied in this work have a discrete structure with octahedral environments around the tin centres, the anion behaving as a tridentate, pentachelating and bidentate, pentachelating and tridentate ligand. For the last structure when intermolecular hydrogen bonds are considered involving OH group, a supramolecular architecture may be obtained.

ACKNOWLEDGEMENTS

We thank Professor K.C. Molloy (University of Bath, UK) for performing the elemental analyses and Professor L.A. Diop (College Saint Boniface-Saint Boniface, Winnipeg Canada) for running the IR spectra.

REFERENCES

1. Gielen, M., De Clercq, L., Willem, R., Joosen, E.: New developments in anti-tumour active organotin compounds, in: *Tin and Malignant cell. Growth* (Editor: Zuckerman, J.J.), CRC Press Inc., Boca Raton, FL, **1988**;

2. Koch, B., Basu Baul, T.S., Chatterjee, A.: Cell proliferation inhibition and antitumor activity of novel alkyl series of diorganotin (IV) compounds, *Journal of Applied Toxicology*, **2008**, **28** (4), 430-438;
3. Haiduc, I., Silvestru, C.: Main Group Metal Compounds (volume 1), in: *Organometallics in Cancer Chemotherapy*, 1st edition, CRC Press, Boca Raton, FL, **1989**;
4. Gielen, M.: Antitumor Active Organotin Compounds (Chapter 13) in: *Tin as a Vital Nutrient: Implications in Cancer Prophylaxis and Other Physiological Processes* (Editor: Cardelli, N.F.), CRC Press, Boca Raton, FL, **1986**;
5. Okio, K.Y.A., Diop, L., Russo, U.: $[Cy_2NH_2SO_4(SnPh_3)_2X]_2$ (X = F, Cl): synthesis and spectroscopic studies, *Scientific Study & Research – Chemistry & Chemical Engineering, Biotechnology, Food Industry*, **2009**, **10** (1), 11-14;
6. Diallo, W., Okio, K.Y.A., Diop, C.A.K., Diop, L., Diop, L.A., Russo, U.: New selenito $SnPh_3$ residue containing complexes and adducts: Synthesis and spectroscopic studies, *Main Group Metal Chemistry* **2009**, **32** (2), 93-100;
7. Diallo, W., Diassé-Sarr, A., Diop, L., Mahieu, B., Biesemans, M., Willem, R., Kociok-Köhn, G., Molloy, K.C.: X-Ray structure of tetrabutylammonium chlorotrimethyltin hydrogenosulphate: the first cyclic dimer hydrogenosulphato hydrogen bonded adduct, *Scientific Study & Research – Chemistry & Chemical Engineering, Biotechnology, Food Industry*, **2009**, **10** (3), 207-212;
8. Qamar Kane, H., Okio, K.A., Fall, A., Diop, L., Russo, U., Mahieu, B.: $Et_4NC_2O_4SnPh_3.2SnPh_3Cl$ and $Cy_2NH_2C_2O_4SnPh_3.2SnPh_3Cl$: Synthesis and spectroscopic characterization, *Main Group Metal Chemistry*, **2009**, **32** (4), 229-233;
9. De Barros, D., Diop, L., Mahieu, B.: On the existence of « tetrahedral » $SnMe_2(PhCO_2)_2$ and $[SnMe_2(PhCO_2)_3]^-$ in new benzoato adducts: Synthesis and spectroscopic studies, *Main Group Metal Chemistry*, **2009**, **32** (6), 341-346;
10. De Barros, D., Diop, L., Mahieu, B.: $Me_4NHWO_4SnPh_3X$ (X=Cl, Br), $R_4NWO_4SnPh_3$ (R=Me, Et) and $(Snbu_3)_2WO_4$: Synthesis and spectroscopic studies, *Main Group Metal Chemistry*, **2010**, **33** (1-2), 91-95;
11. Nakamoto, K.: *Infrared and Raman Spectra of Inorganic and Coordination Compounds*, 4th edition, John Wiley and Sons, New York, **1986**.