Applied Organometallic Chemistry 2018 vol.32 N5

Chiral S-stannyl dithiophosphates and dithiophosphonates on the basis of monoterpenols

Nizamov I., Terenzhev D., Ivshin K., Kataeva O., Shulaeva M., Pozdeev O., Batyeva E., Cherkasov R.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Copyright © 2018 John Wiley & Sons, Ltd. Chiral S-tributylstannyl dithiophosphates and dithiophosphonates were obtained by the reactions of optically active dithiophosphoric and dithiophosphonic acids containing (S)-(–)-menthyl and (R)-(+)-menthyl substituents with gaseous ammonia and tributyl chlorostannane. The reactions of chiral ammonium dithiophosphate containing (1R)-endo-(+)-fenchyl substituent with tributyl chlorostannane or tetrachlorostannane result in corresponding S-tributylstannyl dithiophosphate or tetrakis(dithiophosphato)stannane. Molecular structure of ammonium O,O-di-(-)-menthyldithiophosphate was studied by X-ray single crystal diffraction. Bactericidal activity of S-tributylstannyl dithiophosphates was tested.

http://dx.doi.org/10.1002/aoc.4320

Keywords

bactericidal activity, dithiophosphates, dithiophosphonates, monoterpenyl alcohols, stannyl derivatives

References

[1] R. J. Rao, G. Srivastava, R. C. Mehrotra, Inorg. Chim. Acta 1986, 111, 163.

[2] J. S. Yadav, R. K. Mehrotra, G. Srivastava, Sulfur, Silicon 1991, 62, 169. https://doi.org/10.1080/10426509108034472

[3] B. P. Singh, G. Srivastava, R. C. Mehrotra, J. Organomet. Chem. 1979, 171, 35.

[4] J. L. Lefferts, K. C. Molloy, J. J. Zuckerman, I. Haiduc, C. Guta, D. Ruce, Inorg. Chem. 1980, 19, 1662. https://doi.org/10.1021/ic50208a046%20and%20references%20therein

[5] R. J. Rao, G. Srivastava, R. C. Mehrotra, J. Organomet. Chem. 1983, 258, 155.

[6] R. J. Rao, G. Srivastava, R. C. Mehrotra, B. S. Saraswat, J. Mason, Polyhedron 1984, 3, 485. https://doi.org/10.1016/S0277-5387(00)84523-4

[7] R. J. Rao, G. Srivastava, R. C. Mehrotra, Sulfur 1985, 25, 183. https://doi.org/10.1080/03086648508072733

[8] A. Chaturvedi, P. N. Nagar, G. Srivastava, Sulfur, Silicon 1992, 70, 303. https://doi.org/10.1080/10426509208049179

[9] J. E. Drake, C. Gurnani, M. B. Hursthouse, M. E. Light, M. Nirwan, R. Ratnani, Appl. Organometal. Chem. 2007, 21, 539. https://doi.org/10.1002/aoc.1265

[10] S. K. Srivastava, S. Tomar, R. Rastogi, R. Saxena, Phosphorus, Sulfur, Silicon 2010, 185, 634. https://doi.org/10.1080/10426500902894959

[11] F. Yuan, Y. Huang, Q. Xie, Appl. Organometal. Chem. 2002, 16, 660. https://doi.org/10.1002/aoc.358

[12] Y.-Q. Huang, Z.-G. Zhang, Q.-L. Xie, Sulfur, Silicon 2002, 177, 1271. https://doi.org/10.1080/10426500211726

[13] P. Garcia y Garcia, M. del C. Perez-Redondo, P. Roman-Bravo, M.-A. Reyes-Gonzalez, I. Linzaga-Elizalde, M. Lopez-Cardoso, P. Martinez-Salas, G. Vargas-Pineda, A. M. Cotero-Villegas, R. Cea-Olivares, Main Group Chem 2012, 11, 165. https://doi.org/10.3233/MGC-2012-0070

[14] G. K. Rustagi, J. Sharma, G. Srivastava, Y. Singh, J. Coord. Chem. 2010, 63, 353. https://doi.org/10.1080/00958970903370191

[15] A. A. S. El-Khaldy, Synth. React. Inorg. Met. Org. Chem. 1999, 29, 653. https://doi.org/10.1080/00945719909349478

[16] M. Mohsin, M. Nagar, A. Choudhary, Phosphorus, Sulfur Silicon Relat. Elem. 2012, 187, 1331.

[17] J. L. Lefferts, K. C. Molloy, J. J. Zuckerman, I. Haiduc, C. Guta, D. Ruse, Inorg. Chem. 1980, 19, 2861. https://doi.org/10.1021/ic50212a001

[18] B. P. Singh, G. Srivastava, R. C. Mehrotra, Synth. React. Inorg. Met.-Org. Chem. 1980, 10, 359. https://doi.org/10.1080/00945718008058247

[19] C. S. Parulekar, V. K. Jain, T. Kesavadas, Sulfur, Silicon 1989, 46, 145. https://doi.org/10.1080/10426508909412060

[20] A. A. S. El-Khaddy, R. K. Mehrotra, G. Srivastava, Sulfur, Silicon 1992, 69, 137. https://doi.org/10.1080/10426509208036862

[21] A. A. S. El-Khaddy, R. K. Mehrotra, G. Srivastava, Synth. React. Inorg. Metal.-Org. Chem. 1992, 22, 997. https://doi.org/10.1080/15533179208016607

[22] W. E. van Zyl, J. D. Woollins, Coord. Chem. Rev. 2013, 257, 718. https://doi.org/10.1016/j.ccr.2012.10.010

[23] I. S. Nizamov, V. A. Kuznetzov, E. S. Batyeva, V. A. Alfonsov, A. N. Pudovik, Heteroatom Chem. 1993, 4, 379. https://doi.org/10.1002/hc.520040411

[24] I. S. Nizamov, V. A. Kuznetzov, E. S. Batyeva, V. A. Alfonsov, A. N. Pudovik, Heteroatom Chem. 1994, 5, 107. https://doi.org/10.1002/hc.520050205

[25] L. Maier, Preparation, structure and properties of thionophosphine sulfides and oxides (dithiophosphonic and monothiophosphonic anhydrides), in Topics in phosphorus Chemistry, (Eds: M. Grayson, E. J. Griffith) Vol. 10, John Wiley and Sons: New York, Chichester, Brisbane, Toronto 1980 129.

[26] Bruker, APEX2 Software Suite for Crystallographic Programs, Bruker AXS, Inc., Madison, WI, USA 2009.

[27] Bruker, Area detector control and integration software. Version 5.x. In: SMART and SAINT, Bruker Analytical X-ray Instruments Inc., Madison, Wisconsin (USA) 1996.

[28] G. M. Sheldrick, Acta Crystallogr 2008, A64, 112. https://doi.org/10.1107/S0108767307043930

[29] L. Krause, R. Herbst-Irmer, G. M. Sheldrick, D. Stalke, J. Appl. Crystallogr. 2015, 48, 3. https://doi.org/10.1107/S1600576714022985

[30] http://dezr.ru/preparat/slayt (Slayt (1%) involves 2-phenoxyethanol 1%, N,N-bis(3-aminopropyl) dodecylamine 1.5%, alkyl dimethylbenzylammonium chloride and didecyldimethylammonium chloride 2%, propanol-2 1%, lipase, copolymer of N,N-1,6-hexanediylbis(N-cyanoguanidine) with 1,6-hexadiamine hydrochloride 1%, and protease).

[31] http://dezr.ru/instruktsiya/nika-politsid (Politsid (1%) involves didecyldimethylammonium chloride didecyldimethylammonium chloride, orthophosphoric acid, and synthanol 1%).

[32] I. S. Nizamov, A. V. Sofronov, L. A. Almetkina, R. Z. Musun, R. A. Cherkasov, Russ. J. Gen. Chem. 2010, 80, 1722. https://doi.org/10.1134/S1070363210080268

[33] I. S. Nizamov, D. A. Terenzhev, E. S. Batyeva, G. G. Shumatbaev, R. F. Faskhetdinov, R. A. Cherkasov, Russ. J. Gen. Chem. 2014, 84, 2467. https://doi.org/10.1134/S1070363214120238

[34] L. A. Almetkina, I. S. Nizamov, A. V. Sofronov, G. T. Gabdullina, R. A. Cherkasov, P. A. Gurevich, B. P. Strunin, L. F. Sattarova, V. A. Antipov, Himija Rastitelnogo Syrja (Russ.) (Chem. Plant Raw Materials) 2011, 57.

[35] I. S. Nizamov, G. T. Gabdullina, D. A. Terenzhev, A. R. Nurmukhametov, I. D. Nizamov, R. A. Cherkasov, Relat. Elem. 2014, 189, 1354. https://doi.org/10.1080/10426507.2013.860531