Supporting Information

Synthesis of symmetrically and unsymmetrically substituted *S,S*-dialkyl phosphonodithioates.

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General: Tetrahydrofuran (THF) was distilled prior to use from sodium/benzophenone. Triethylamine was distilled from calcium hydride. ^{1}H, ^{13}C and ^{31}P NMR spectra were recorded on a Bruker Avance 400 NMR spectrometer at 20 ^{o}C in $CDCl_3$ using tetramethylsilane (TMS) as an internal standard and 85% aq. phosphoric acid as an external standard. Chemical shifts are expressed in parts per million (ppm) relative to the reference peak. Coupling constants are expressed in Hz. 3-Mercaptopropionitrile[1] and ((tosyloxy)methyl)phosphonic dichloride[2] were prepared as reported previously in the literature. **CAUTION:** Low molecular weight alkanethiols are extremely malodorous and their odour may be mistaken for natural gas.

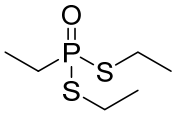
1. Klose, J.; Reese, C. B.; Song, Q. *Tetrahedron* **1997**, *53*, 14411

2. Tichy, T. *et al.*, *Eur. J. Med. Chem.*, **2012,** 55, 307-314

3. Gough, S. T. D.; Ap., U. P., Ed. **1989**; Vol. US4810698 A.

Symmetrical Phosphonodithioates

S,S-Diethyl ethylphosphonodithioate (1)



Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 1.20 (3H, dt, *J* = 22.06 Hz, 7.51 Hz, $PCH_2C\underline{\mathbf{H_3}}$), 1.34 (6H, t, *J* = 7.21 Hz, $SCH_2C\underline{\mathbf{H_3}}$), 2.14 (2H, dq, *J* = 12.06 Hz, 7.51 Hz, $PC\underline{\mathbf{H_2}}CH_3$), 2.83-2.95 (4H, m, $SC\underline{\mathbf{H_2}}CH_3$). δ_C (100 MHz, $CDCl_3$, ppm): 7.03 (d, *J* = 6.00 Hz, $PCH_2\underline{\mathbf{C}}H_3$), 12.05 (d, *J* = 3.73 Hz, $SCH_2\underline{\mathbf{C}}H_3$), 24.97 (d, *J* = 3.37 Hz, $S\underline{\mathbf{C}}H_2CH_3$), 31.05 (d, *J* = 74.30 Hz, $P\underline{\mathbf{C}}H_2CH_3$). δ_C (175 MHz, $CDCl_3$, ppm): 70.26. IR ν_{max} (NaCl, cm^{-1}): 2965, 1455, 1288, 1132, 1031, 765, 543. HRMS (ESI^+): Calc. mass for $C_6H_{16}OPS_2$ [M+H] = 199.0375; Found = 199.0374.

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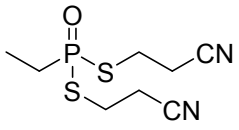
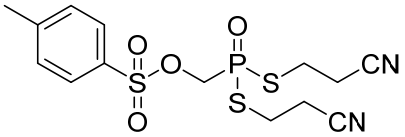
***S,S*-Di(2-cyanoethyl) ethylphosphonodithioate** (**2**)



Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 1.24 (C**H**$_3$-CH_2-P(=O), 3H, dt, $J_{H\text{-}P}$ = 24.29 Hz, $J_{H\text{-}H}$ = 7.61 Hz), 2.23 (CH_3-C**H**$_2$-P(=O), 2H, dq, $J_{H\text{-}P}$ = 12.61 Hz, $J_{H\text{-}H}$ = 7.61 Hz), 2.75-2.88 (CN-C**H**$_2$, 4H, m) 3.07 – 3.21 (S-C**H**$_2$, 4H, m). δ_C (100 MHz, $CDCl_3$, ppm): 6.95 (**C**H_3-CH_2-P(=O), d, $J_{P\text{-}C}$ = 6.10 Hz), 20.19 (CN-**C**H_2, d, $J_{P\text{-}C}$ = 2.12 Hz) , 26.12 (S-**C**H_2, d, $J_{P\text{-}C}$ = 3.26 Hz), 32.44 (CH_3-**C**H_2-P(=O), d, $J_{P\text{-}C}$ = 73.27 Hz), 117.74 (CN). δ_P (175 MHz, $CDCl_3$, ppm): 71.45. IR ν_{max} (NaCl, cm^{-1}): 2985, 2935, 2251, 1640, 1457, 1418, 1289, 1193, 1032, 742, 708, 559 HRMS (ESI^+): Calc. mass for $C_8H_{14}N_2OPS_2$ [M+H] = 249.0280; Found = 249.0283

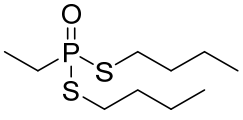
***S,S*-Di(2-cyanoethyl) ((tosyloxy)methyl)phosphonodithioate (3)**



Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 2.41 (3H, s, C**H**$_3$), 2.77-2.82 (4H, m SCH_2C**H**$_2$CN), 3.12-3.20 (4H, m, SC**H**$_2$$CH_2$CN), 4.44 (2H, d, *J* = 3.81 Hz, C**H**$_2$P), 7.34 (2H, d, *J* = 8.17 Hz, *m*Ar**H**), 7.76 (2H, d, *J* = 8.17 Hz, *o*Ar**H**). δ_C (100 MHz, $CDCl_3$, ppm): 20.23 (d, *J* = 2.24 Hz, SCH_2**C**H_2CN), 21.73 (**C**H_3), 26.18 (d, *J* = 91.35 Hz, S**C**H_2CH_2CN), 117.31 (**C**N), 128.29 (Ar**C**H), 130.18 (ArC**H**), 131.26 (Ar**C**), 146.29 (Ar**C**). δ_P (175 MHz, $CDCl_3$, ppm): 57.09. IR ν_{max} (NaCl, cm^{-1}): 2969, 2928, 2872, 2253, 1672, 1597, 1451, 1370, 1190, 1177, 1094, 1001, 817, 746, 663. HRMS (ESI^+): Calc. mass for $^{23}NaC_{14}H_{17}N_2O_4PS_3$ [M+Na] = 426.9981; Found = 426.9969.

***S,S*-Dibutyl ethylphosphonodithioate (4)**

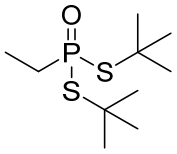


Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 0.87 (C**H**$_3$$CH_2CH_2CH_2$-S, 6H, t, *J* = 7.38 ppm) 1.37 (CH_3C**H**$_2$$CH_2CH_2$-S 2H, sext., *J* = 7.50 Hz) 1.30 (C**H**$_3$$CH_2$-P(=O), 3H, dt, $J_{H\text{-}P}$ = 23.14 Hz, $J_{H\text{-}H}$ = 7.61 Hz), 1.64 (CH_3CH_2C**H**$_2$$CH_2$-S 4H, quint., *J* = 7.45 Hz), 2.12 (CH_3C**H**$_2$-P(=O), 2H, dq, $J_{H\text{-}P}$ = 12.74 Hz, $J_{H\text{-}H}$ = 7.61 Hz), 2.81 – 2.93 ($CH_3CH_2CH_2$C**H**$_2$-S, 4H, m). δ_C (100 MHz, $CDCl_3$, ppm): 7.12 (**C**H_3CH_2-P(=O), d, $J_{P\text{-}C}$ = 5.81 Hz),

14.9(**C**$H_3CH_2CH_2CH_2$-S), 21.1(CH_3**C**$H_2CH_2CH_2$-S), 30.2 (CH_3CH_2**C**H_2CH_2-S, d, J_{P-C} = 3.21 Hz), 32.8 (CH_3**C**H_2-P(=O),d, J_{P-C} =74.31), 33.4 ($CH_3CH_2CH_2$**C**H_2-S, d, J_{P-C} = 4.5 Hz). δ_P (175 MHz, $CDCl_3$, ppm): 70.14. IR ν_{max} (NaCl, cm^{-1}): 2965, 1455, 1288, 1132, 1031, 765, 543. HRMS (ESI^+): Calc. Mass for $C_{10}H_{24}OPS_2$ [M+H] = 255.1001; Found = 255.1007.

***S,S*-Di(*tert*-butyl) ethylphosphonodithioate (5)**

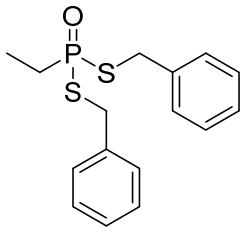


Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 1.21 (3H, dt, *J* = 22.10 Hz, 7.84 Hz, PCH_2C**H**$_3$), 1.60 (18H, s, $SC(C$**H**$_3)_3$), 2.25 (2H, dq, *J* = 10.33 Hz, 7.84 Hz, PC**H**$_2CH_3$). δ_C (100 MHz, $CDCl_3$, ppm): 7.12 (d, *J* = 5.81 Hz, PCH_2**C**H_3), 11.32 (d, *J* = 3.11 Hz, C(**C**$H_3)_3$), 18.69 (d, *J* = 4.11 Hz, **C**$(CH_3)_3$), 32.81 (d, *J* = 74.31 Hz, P**C**H_2CH_3). δ_P (175 MHz, $CDCl_3$, ppm): 65.03. IR ν_{max} (NaCl, cm^{-1}): 2965, 1455, 1288, 1132, 1031, 765, 543. HRMS (ESI^+): Calc. Mass for $C_{10}H_{24}OPS_2$ [M+H] = 255.1001; Found = 255.1006.

Data consistent with those reported previously.[3]

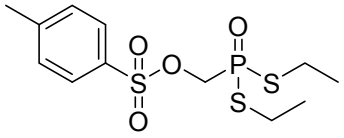
***S,S*-Dibenzyl ethylphosphonodithioate (6)**



Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 1.03 (3H, dt, *J* = 23.66 Hz, 7.61 Hz, PCH_2C**H**$_3$), 1.88 (2H, dq, *J* = 12.80 Hz, 7.61 Hz, PC**H**$_2CH_3$), 3.97-4.11 (4H, m, SC**H**$_2$Ph), 7.16-7.29 (10H, m, Ar**H**). δ_C (100 MHz, $CDCl_3$, ppm): 7.04 (d, *J* = 5.96 Hz, **C**H_3), 31.70 (d, *J* = 72.95, P**C**H_2CH_3), 34.52 (d, *J* = 3.02 Hz, S**C**H_2Ph), 127.68 (Ar**C**H), 128.76 (Ar**C**H), 129.14 (Ar**C**H), 137.24(d, *J* = 3.45 Hz, *ipso*Ar**C**). δ_P (175 MHz, $CDCl_3$, ppm): 69.34. IR ν_{max} (NaCl, cm^{-1}): 2965, 1597, 1455, 1451, 1370, 1288, 1132, 1031, 765, 543. HRMS (ESI^+): Calc. Mass for $C_{16}H_{20}OPS_2$ [M+H] = 323.0688; Found = 323.0699.

***S,S*-Diethyl ((tosyloxy)methyl)phosphonodithioate (7)**

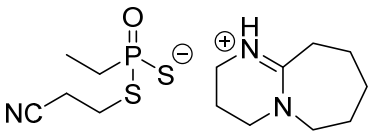


Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 1.29 (6H, t, J = 7.44 Hz, $SCH_2C\underline{\mathbf{H_3}}$), 2.39 (3H, s, Ar-$C\underline{\mathbf{H_3}}$), 2.88 (4H, overlapping dq, $J_{H\text{-}P}$ = 13.36 Hz, $J_{H\text{-}H}$ = 7.44 Hz, $SC\underline{\mathbf{H_2}}CH_3$), 4.31 (2H, d, $J_{H\text{-}P}$ = 4.40 Hz, $C\underline{\mathbf{H_2}}P$), 7.30 (2H, d, J = 7.84 Hz, *m*-Ar**H**), 7.74 (2H, d, J = 7.84 Hz, *o*-Ar**H**). δ_C (100 MHz, $CDCl_3$, ppm): 16.55 (d, $J_{C\text{-}P}$ = 5.14 Hz, $SCH_2\underline{\mathbf{C}}H_3$), 21.70 (Ar-$\underline{\mathbf{C}}H_3$), 22.25 (d, $J_{C\text{-}P}$ = 3.53 Hz), 68.51 (d, $J_{C\text{-}P}$ = 90.46 Hz, $O\underline{\mathbf{C}}H_2P$), 128.25 (*m*-Ar**C**), 130.08 (*o*-Ar**C**), 131.59 (*p*-Ar**C**), 145.74 (*i*-Ar**C**). δ_P (175 MHz, $CDCl_3$, ppm): 55.84. IR ν_{max} (NaCl, cm^{-1}): 2969, 2928, 2872, 1672, 1597, 1451, 1370, 1190, 1177, 1094, 1001, 817, 746, 663. HRMS (ESI^+): Calc. Mass for $C_{12}H_{20}O_4PS_3$ [M+H] = 355.0261; Found = 355.0277.

Unsymmetrical Phosphonodithioates

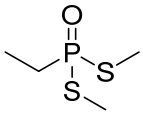
DBU Salt (8)



Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 1.23 (3H, dt, $J_{H\text{-}P}$ = 22.10 Hz, $J_{H\text{-}H}$ = 7.41 Hz), 1.75 (6H, m), 2.00-2.15 (4H, m), 2.81-2.93 (4H, m), 2.98-3.09 (2H, m), 3.47-3.53 (6H, m), 6.29 (bs). δ_C (100 MHz, $CDCl_3$, ppm): 8.78 (d, $J_{C\text{-}P}$ = 5.01 Hz), 21.42 (d, $J_{P\text{-}C}$ = 2.71 Hz), 24.11, 26.25, 26.82, 28.49 (d, $J_{C\text{-}P}$ = 2.98 Hz), 29.00, 32.21, 32.43, 36.63 ($J_{C\text{-}P}$ = 79.83 Hz), 48.66, 54.33, 119.11 (**C**N), 165.92 (N-**C**(=N)). δ_p (175 MHz, $CDCl_3$, ppm): 85.38. IR ν_{max} (NaCl, cm^{-1}): 3375, 2920, 2847, 2134, 1961, 1647, 1403, 1384, 1101. HRMS (ESI^-): Calc. mass for $C_5H_9NOPS_2^-$ = 193.9831; Found = 193.9814.

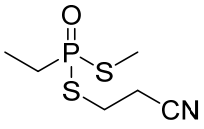
***S,S*-Dimethyl ethylphosphonodithioate (9)**



Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 1.23 (3H, dt, *J* = 22.95 Hz, 7.65 Hz, $PCH_2C\underline{\mathbf{H_3}}$), 2.15 (2H, dq, *J* = 12.41 Hz, 7.65 Hz, $PC\underline{\mathbf{H_2}}CH_3$), 2.31 (6H, d, *J* = 12.92 Hz, $SC\underline{\mathbf{H_3}}$). δ_C (100 MHz, $CDCl_3$, ppm): 6.36 (d, *J* = 3.75 Hz, $PCH_2\underline{\mathbf{C}}H_3$), 17.75 (d, *J* = 78.85, $P\underline{\mathbf{C}}H_2CH_3$), 52.43 (d, *J* = 3.99 Hz, $S\underline{\mathbf{C}}H_3$).)). δ_p (175 MHz, $CDCl_3$, ppm): 72.72. IR ν_{max} (NaCl, cm^{-1}): 2961, 1455, 1288, 1136, 1031, 765. HRMS (ESI^+): Calc. Mass for $C_4H_{12}O_4PS_2$ [M+H] = 171.0062; Found = 171.0066.

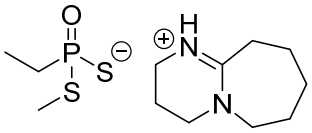
***S*-Methyl-*S*-(2-cyanoethyl) ethylphosphonodithioate (10).**



Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 1.23 (3H, dt, $J_{H\text{-}P}$ = 23.63 Hz, $J_{H\text{-}H}$ = 7.48 Hz, $CH_2C\underline{\mathbf{H_3}}$), 2.19 (2H, dq, $J_{H\text{-}P}$ = 12.50 Hz, $J_{H\text{-}H}$ = 7.48 Hz, $C\underline{\mathbf{H_2}}CH_3$), 2.33 (3H, d, $J_{H\text{-}P}$ = 13.37 Hz, $SC\underline{\mathbf{H_3}}$), 2.82 (2H, td, $J_{H\text{-}H}$ = 6.91 Hz, $J_{H\text{-}P}$ = 3.26 Hz $SCH_2C\underline{\mathbf{H_2}}CN$), 3.10 (2H, dt, $J_{H\text{-}P}$ = 14.38 Hz, $J_{H\text{-}H}$ = 6.91 Hz, $SC\underline{\mathbf{H_2}}CH_2CN$). δ_C (100 MHz, $CDCl_3$, ppm): 6.94 (d, $J_{C\text{-}P}$ = 6.13 Hz, $\underline{\mathbf{C}}H_3CH_2$), 12.14 (d, $J_{C\text{-}P}$ = 4.38 Hz, $S\underline{\mathbf{C}}H_3$), 20.41 (d, $J_{C\text{-}P}$ = 3.11 Hz, $\underline{\mathbf{C}}H_2CN$), 25.90 (d, $J_{C\text{-}P}$ = 3.55 Hz, $\underline{\mathbf{C}}H_2S$), 31.36 (d, $J_{C\text{-}}$ = 72.18 Hz, $\underline{\mathbf{C}}H_2P$), 117.14 ($\underline{\mathbf{C}}N$). δ_P (175 MHz, $CDCl_3$): 71.94. IR ν_{max} (NaCl, cm^{-1}): 2986, 2937, 2251, 1640, 1453, 1422, 1276, 1173, 1032, 742, 728, 555. HRMS (ESI^+): Calc. Mass for $C_6H_{13}NOPS_2^+$[M+H] = 210.0071; Found = 210.0097.

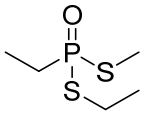
DBU Salt (11)



Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 1.16 (3H, dt, *J* = 21.84 Hz, 7.53 Hz, $PCH_2C\underline{\mathbf{H_3}}$), 1.61-1.62 (m, DBU), 1.75-1.81 (m, DBU), 1.90-2.20 (2H, m, $PC\underline{\mathbf{H_2}}CH_3$), 2.18 (d, *J* = 11.34 Hz, $SC\underline{\mathbf{H_3}}$), 2.43-2.44 (m, DBU), 3.20-3.26 (m, DBU). 5.90 (bs, DBU$\underline{\mathbf{H^+}}$). δ_C (100 MHz, $CDCl_3$, ppm): 8.79 (d, *J* = 4.45, $PCH_2\underline{\mathbf{C}}H_3$), 15.35 (d, *J* = 3.25 Hz, $S\underline{\mathbf{C}}H_3$), 19.68, 24.20, 27.02, 29.16, 32.42, 34.51, 34.90 (d, *J* = 78.58, $P\underline{\mathbf{C}}H_2CH_3$), 35.29, 38.26, 48.71, 54.31, 166.22 (N-**C**=NH^+). δ_P (175 MHz, $CDCl_3$): 84.50. IR ν_{max} (NaCl, cm^{-1}): 3375, 2920, 2847, 1961, 1647, 1542, 1403, 1384, 1101. HRMS (ESI^-): Calc. Mass for $C_3H_8OPS_2^-$ = 154.9760; Found = 154.9755.

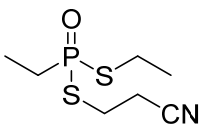
***S*-Methyl-*S*-ethyl ethylphosphonodithioate (12**)



Appearance: Yellow oil.

δ_H (400 MHz, $CDCl_3$, ppm): 1.29 (3H, dt, *J* = 22.03 Hz, 7.54 Hz, $PCH_2\underline{\mathbf{C}}H_3$), 1.41 (3H, t, *J* = 7.43, $SCH_2C\underline{\mathbf{H_3}}$), 2.20 (2H, dq, *J* = 12.76, 7.69, $PC\underline{\mathbf{H_2}}CH_3$), 2.37 (d, *J* = 12.89 Hz, $SC\underline{\mathbf{H_3}}$), 2.90-3.02 (2H, m, $SC\underline{\mathbf{H_2}}CH_3$). δ_C (100 MHz, $CDCl_3$, ppm): 7.03 (d, *J* = 6.00 Hz, $PCH_2\underline{\mathbf{C}}H_3$), 12.05 (d, *J* = 3.73 Hz, $SCH_2\underline{\mathbf{C}}H_3$), 16.58 (d, *J* = 4.70 Hz, $SC\underline{\mathbf{H_3}}$), 24.95 (d, *J* = 3.37 Hz, $SC\underline{\mathbf{H_2}}CH_3$), 31.05 (d, *J* = 74.30 Hz, $P\underline{\mathbf{C}}H_2CH_3$). δ_P (175 MHz, $CDCl_3$): 71.11. IR ν_{max} (NaCl, cm^{-1}): 2986, 2937, 2251, 1640, 1453, 1422, 1276, 1173, 1032, 742, 728, 555. HRMS (ESI^+): Calc. mass for $C_5H_{14}OPS_2$ [M+H] = 185.0219 Found = 185.0221.

***S*-Ethyl-*S*-(2-cyanoethyl) ethylphosphonodithioate (13).**



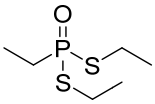
Appearance: Yellow oil.

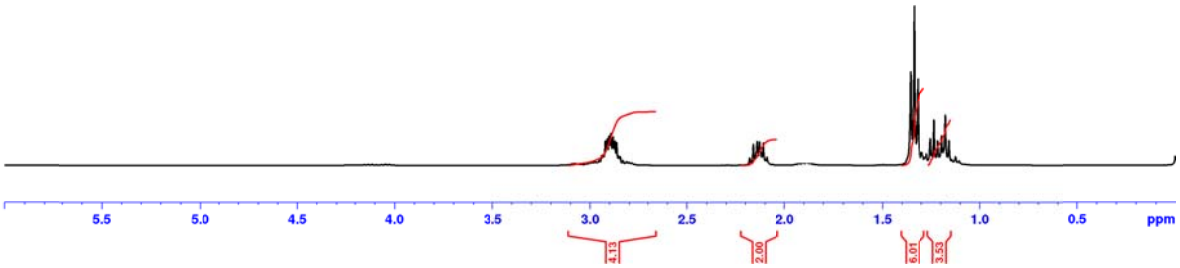
δ_H (400 MHz, $CDCl_3$, ppm): 1.29 (3H, dt, $J_{H\text{-}P}$ = 23.90 Hz, $J_{H\text{-}H}$ = 7.46 Hz, $C\underline{\mathbf{H_3}}CH_2P$), 1.43 (3H, t, *J* = 7.38 Hz, $C\underline{\mathbf{H_3}}CH_2S$), 2.20-229 (2H, m, $CH_3C\underline{\mathbf{H_2}}P$), 2.86-3.03 (4H, multiplet containing $CH_3C\underline{\mathbf{H_2}}S$ and $S\text{-}CH_2C\underline{\mathbf{H_2}}CN$), 3.13-3.21 (2H, m, $S\text{-}C\underline{\mathbf{H_2}}CH_2CN$). δ_C (100 MHz, $CDCl_3$, ppm): 7.05 (d, $J_{C\text{-}P}$ = 5.88 Hz, $\underline{\mathbf{C}}H_3CH_2P$),

16.58 (d, $J_{C\text{-}P}$ = 4.86 Hz, **C**H_3CH_2S), 20.37 (CH_3**C**H_2S), 25.31 (d, $J_{C\text{-}P}$ = 3.72 Hz, **C**H_2CN), 25.97 (d, $J_{C\text{-}P}$ = 3.11 Hz, S**C**H_2CH_2CN), 32.16 (d, $J_{C\text{-}P}$ = 73.75 Hz, CH_3**C**H_2P), 117.76 (**C**N). δ_P (175 MHz, $CDCl_3$): 70.78. IR ν_{max} (NaCl, cm^{-1}): 2986, 2937, 2251, 1640, 1453, 1422, 1276, 1173, 1032, 742, 728, 555. HRMS (ESI^+): Calc. mass for $C_7H_{15}NOPS_2$ [M+H] = 224.0328. Found = 224.0338.

2.1. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 1

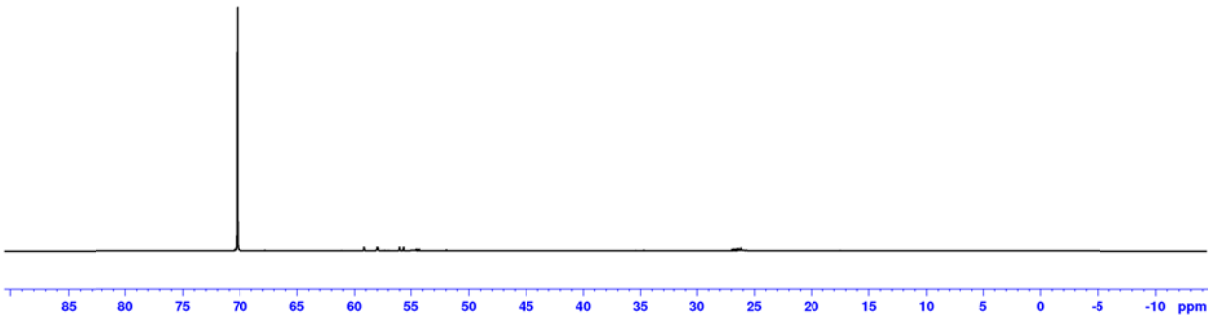
S,S-diethyl ethylphosphonodithioate;





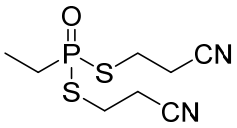
2.2. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 1

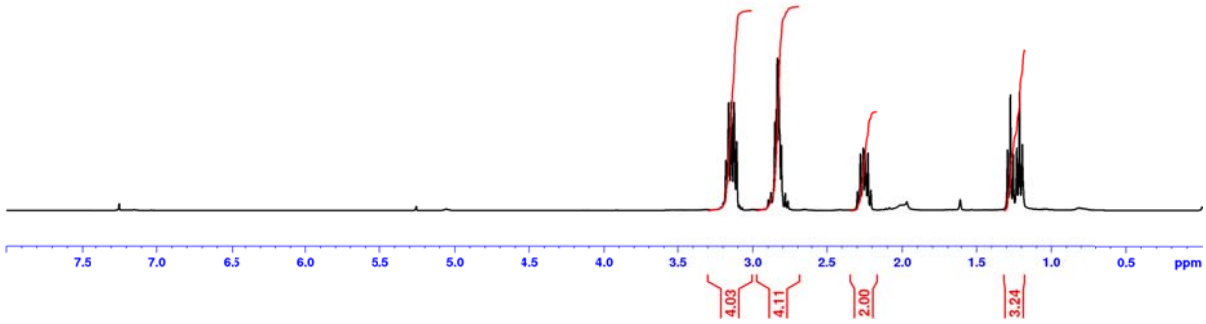
S,S-diethyl ethylphosphonodithioate;



2.3. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 2

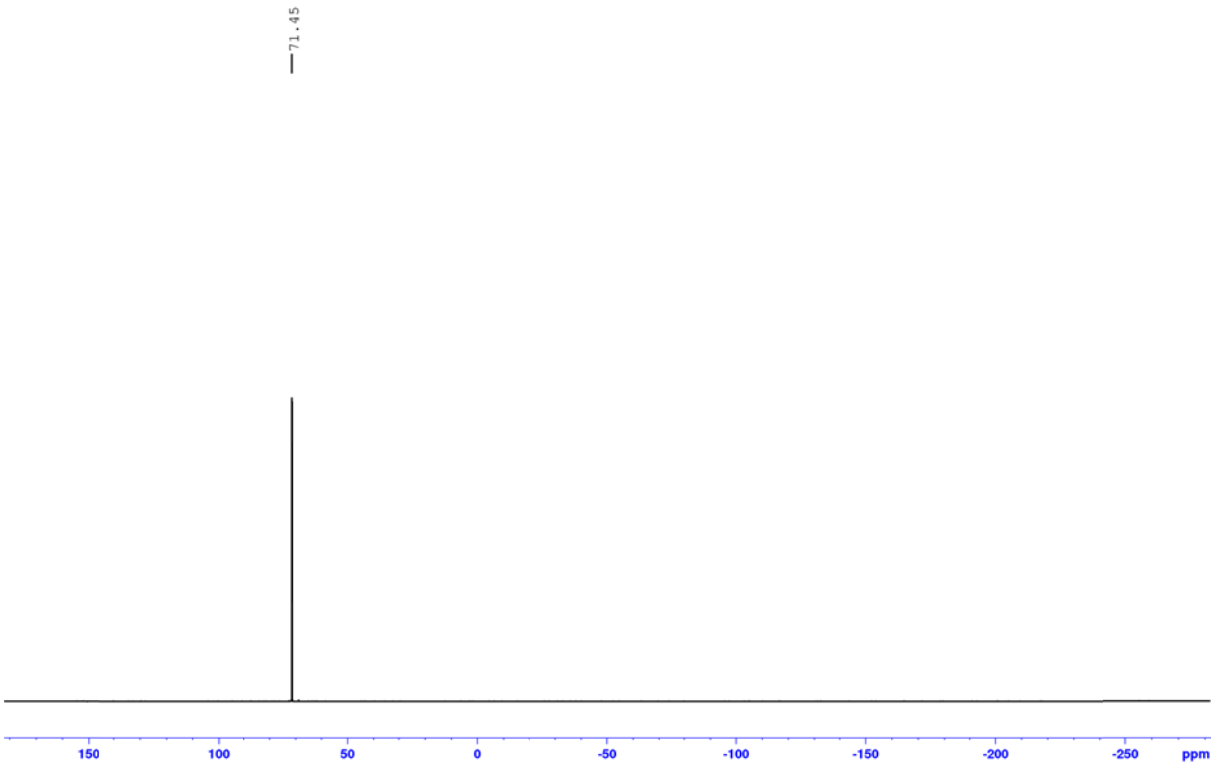
S,S-di(2-cyanoethyl) ethylphosphonodithioate (2)





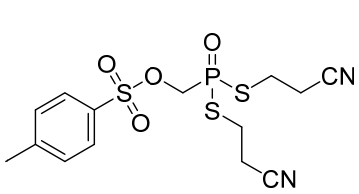
2.4. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 2

S,S-di(2-cyanoethyl) ethylphosphonodithioate (2)



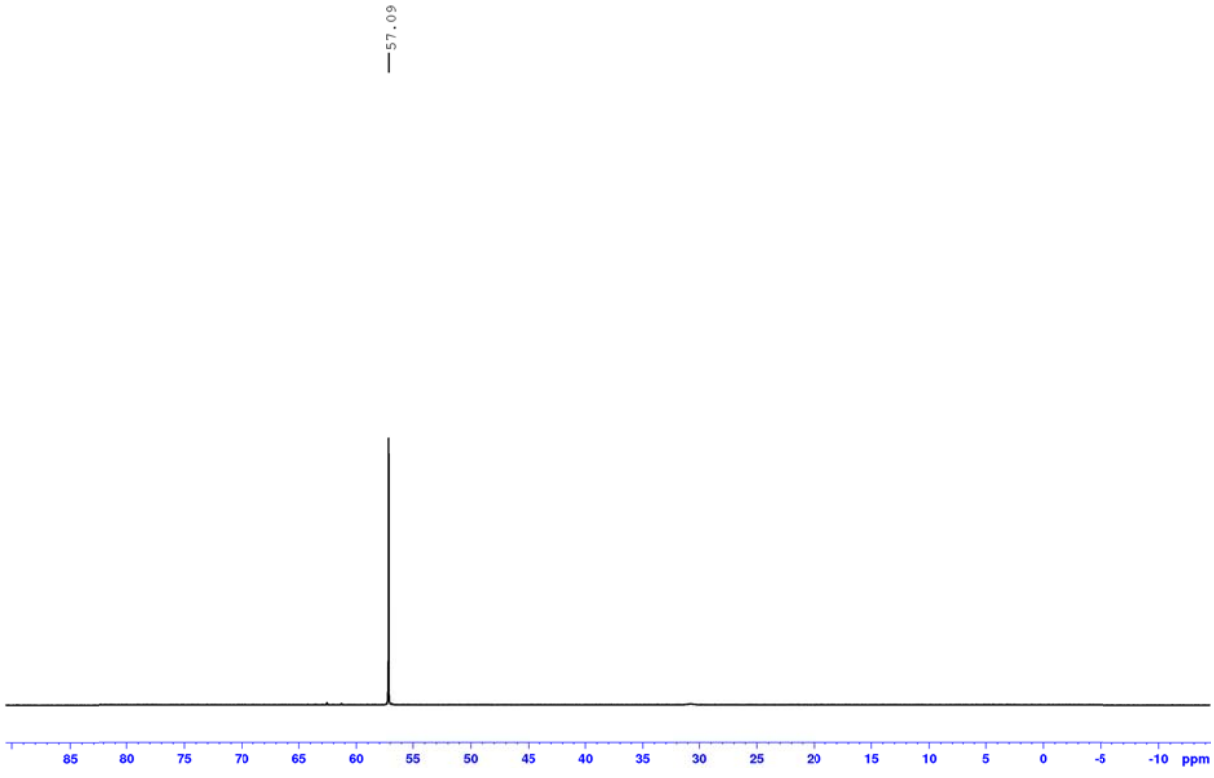
2.5. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 3

S,S-di(2-cyanoethyl) ((Tosyloxy)methylphosphonodithioate



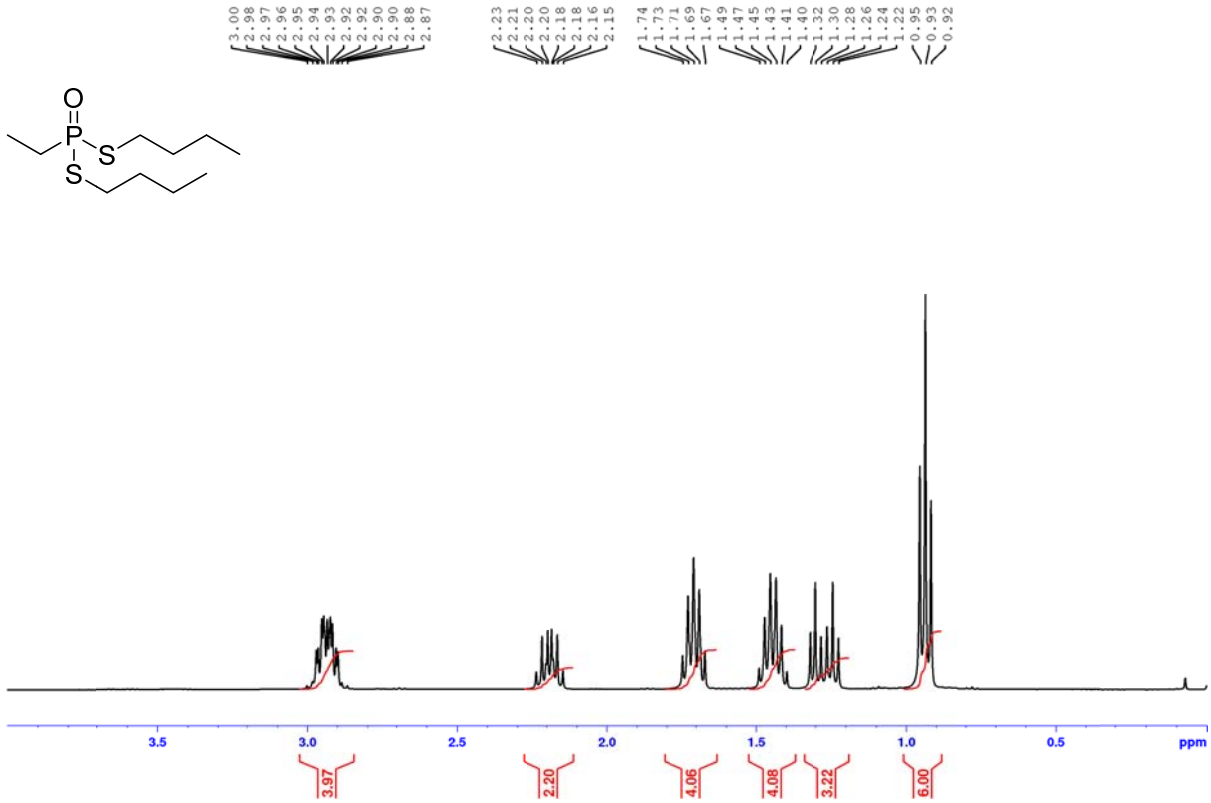
2.6. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 3

S,S-di(2-cyanoethyl) ((Tosyloxy)methylphosphonodithioate



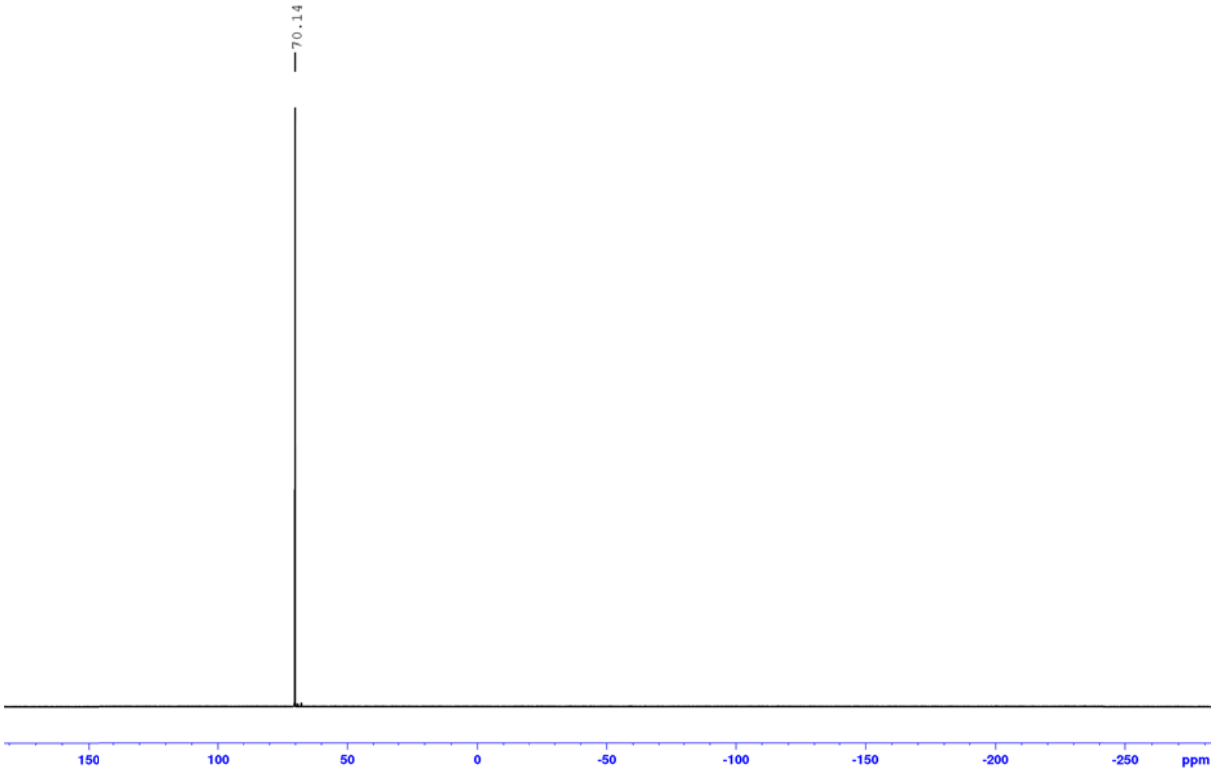
2.7. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 4

S,S-dibutyl ethylphosphonodithioate (4)



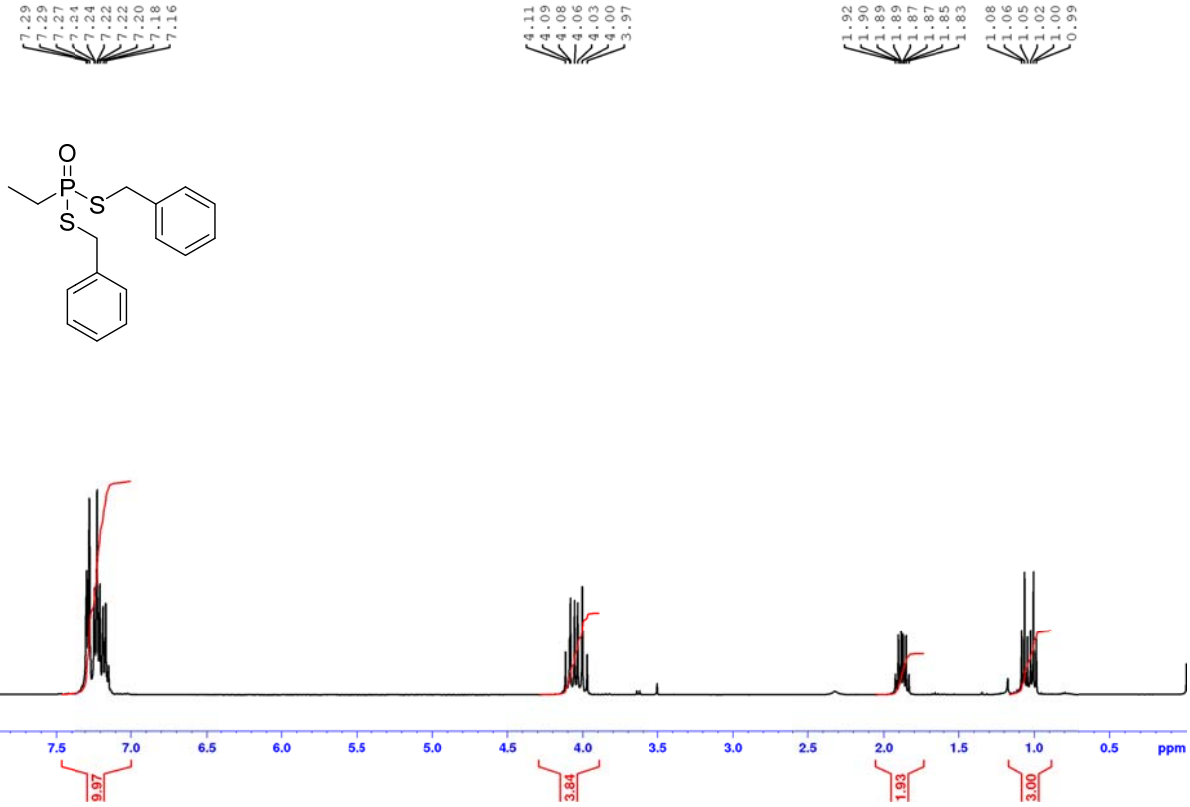
2.8. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 4

S,S-dibutyl ethylphosphonodithioate (4)



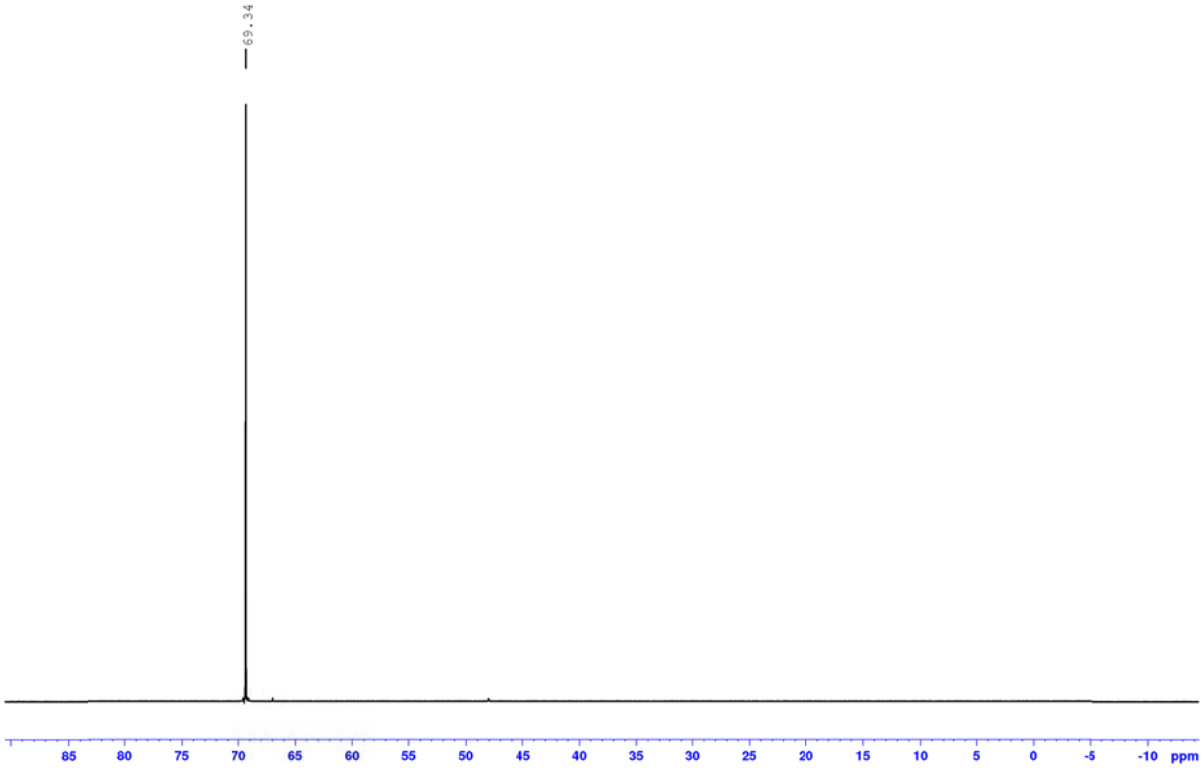
2.9. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 6

S,S-dibenzyl ethylphosphonodithioate



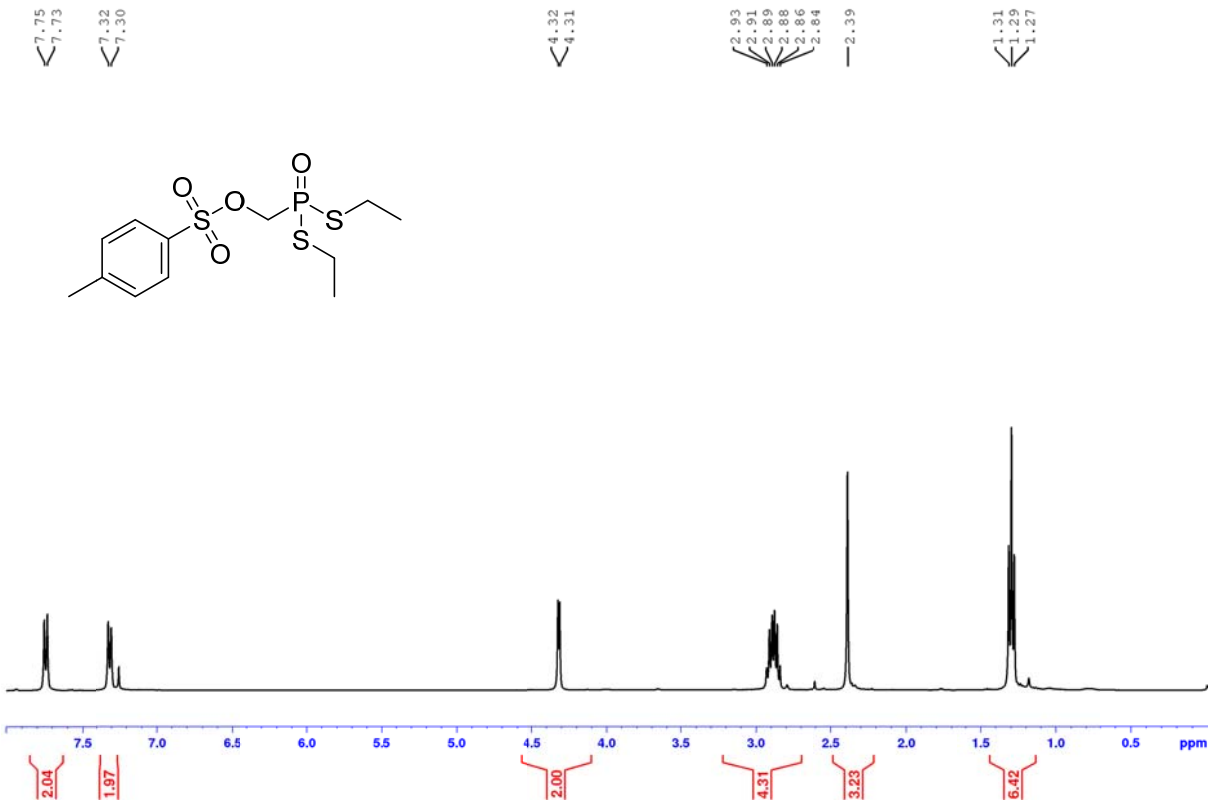
2.10. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 6

S,S-Dibenzyl Ethylphosphonodithioate



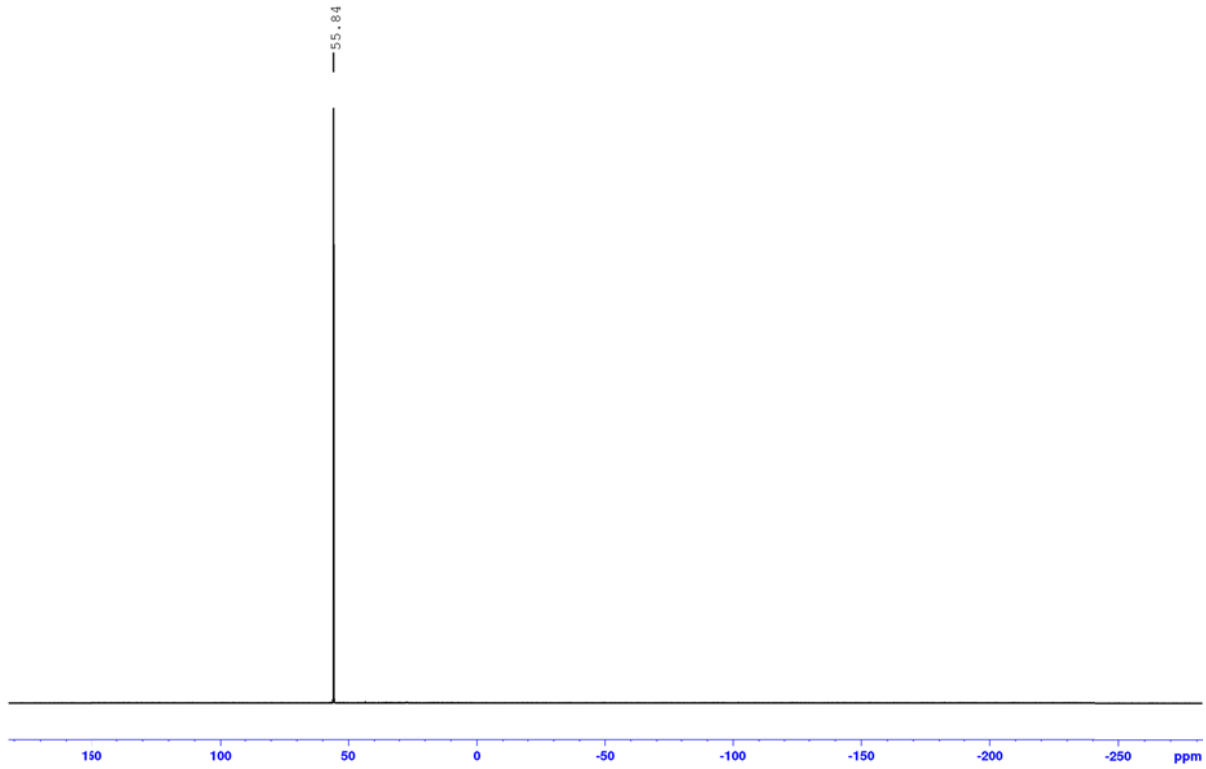
2.11. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 7

S,S-diethyl ((tosyloxy)methyl)phosphonodithioate (7)

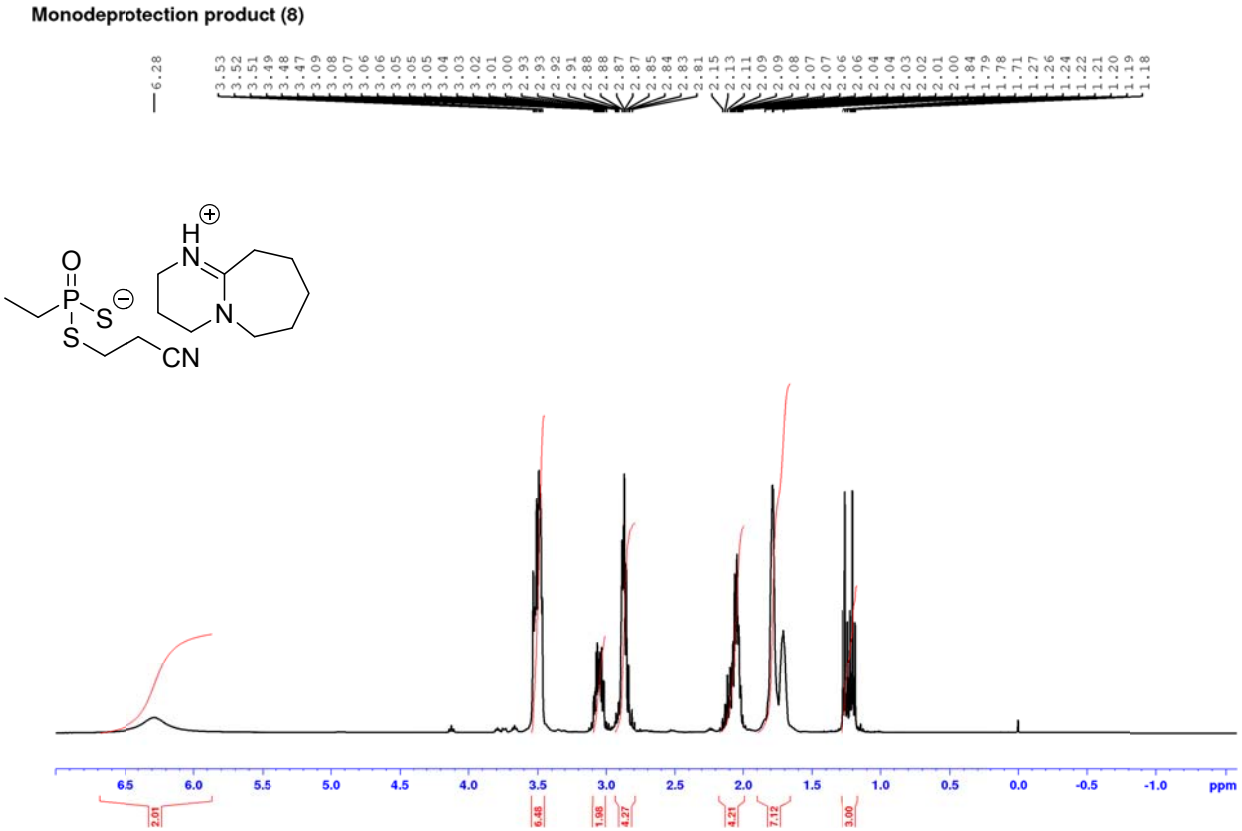


2.12. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 7

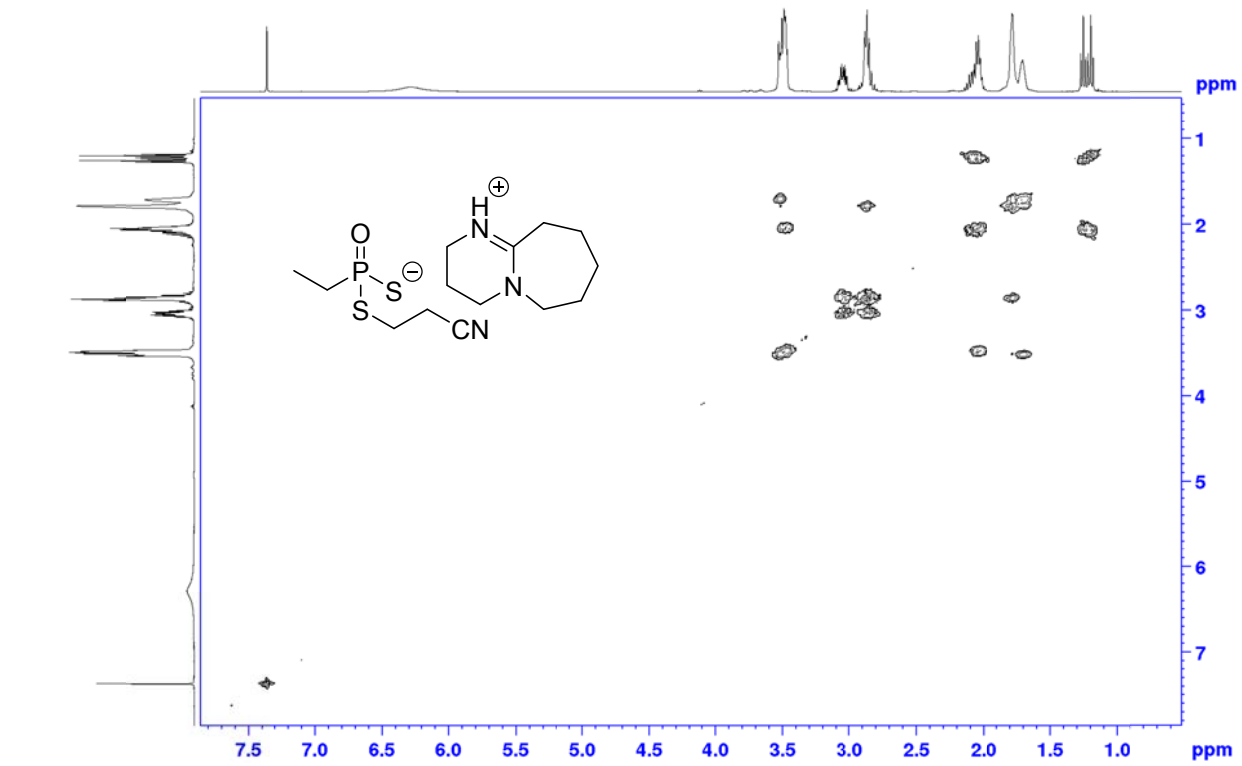
S,S-diethyl ((tosyloxy)methyl)phosphonodithioate (7)



2.13. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 8

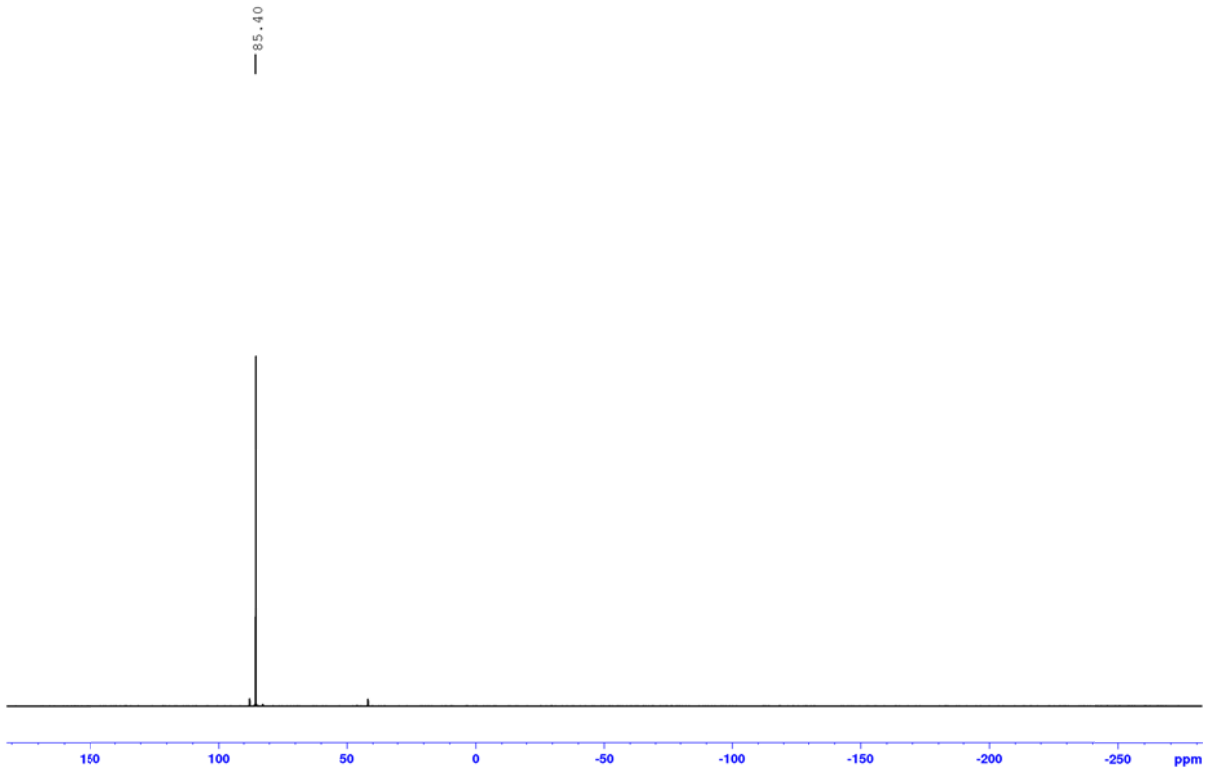


2.14. ^{1}H-^{1}H Correlation Spectrum (400 MHz, $CDCl_3$) spectrum of 8



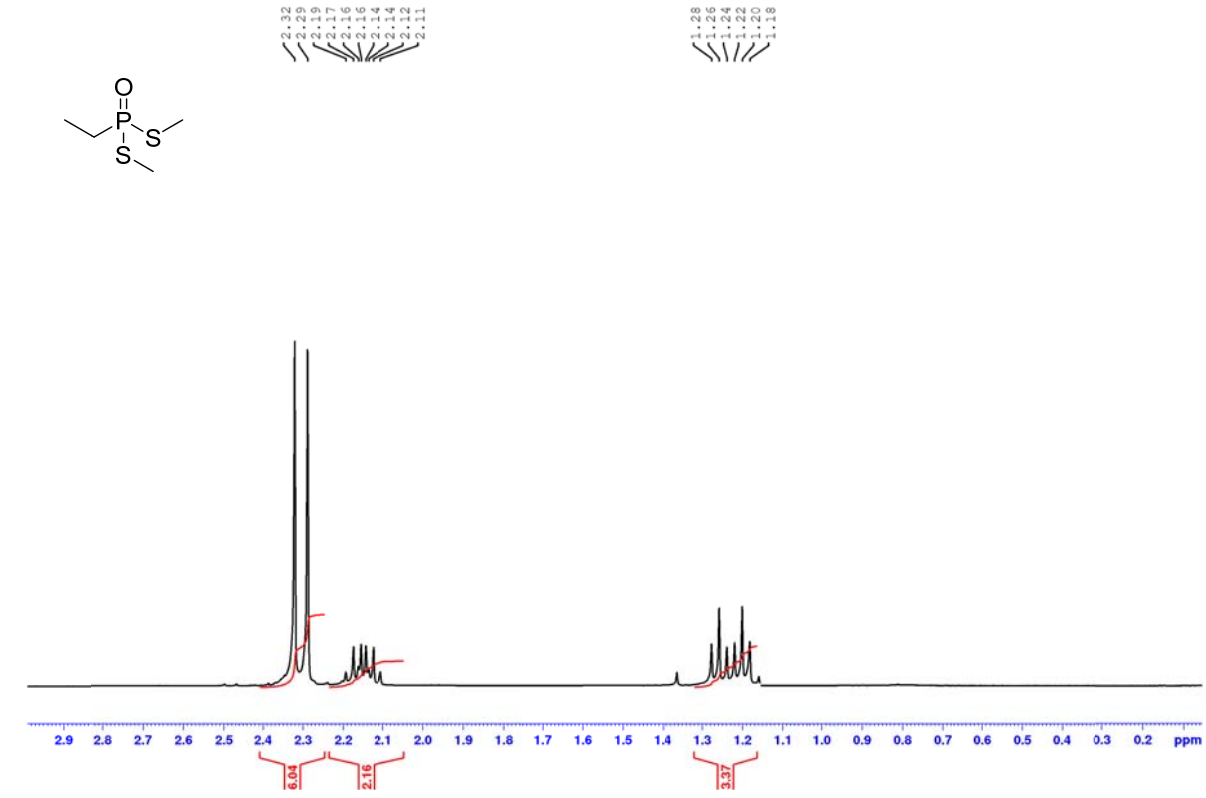
2.15. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 8

Monodeprotection product (8)



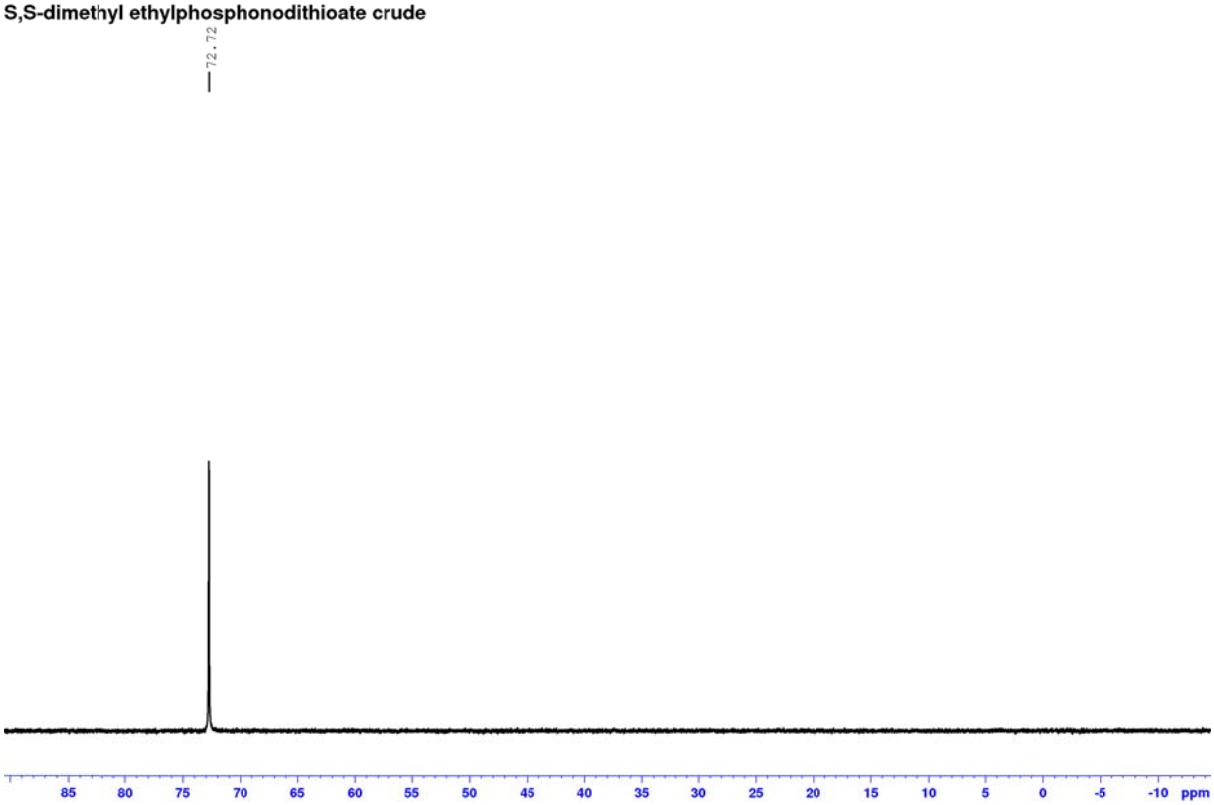
2.16. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 9

S,S-dimethyl ethylphosphonodithioate



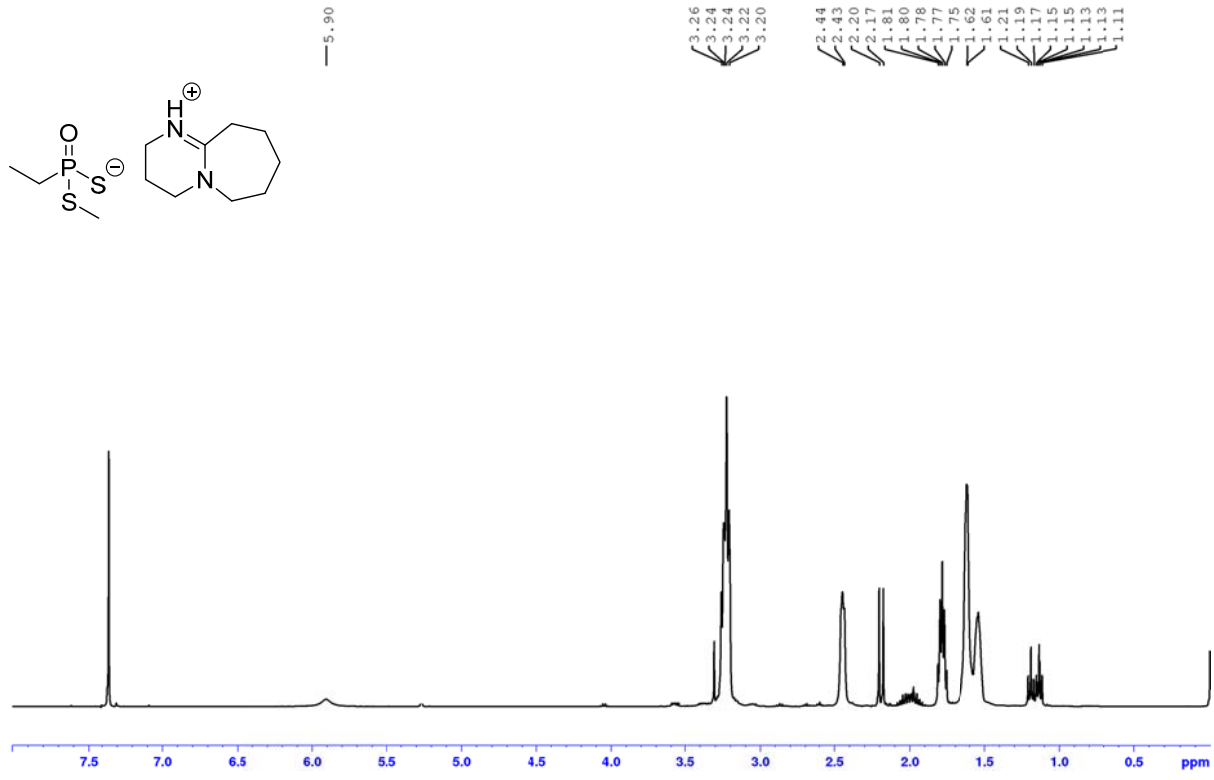
2.17. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 9

S,S-dimethyl ethylphosphonodithioate crude



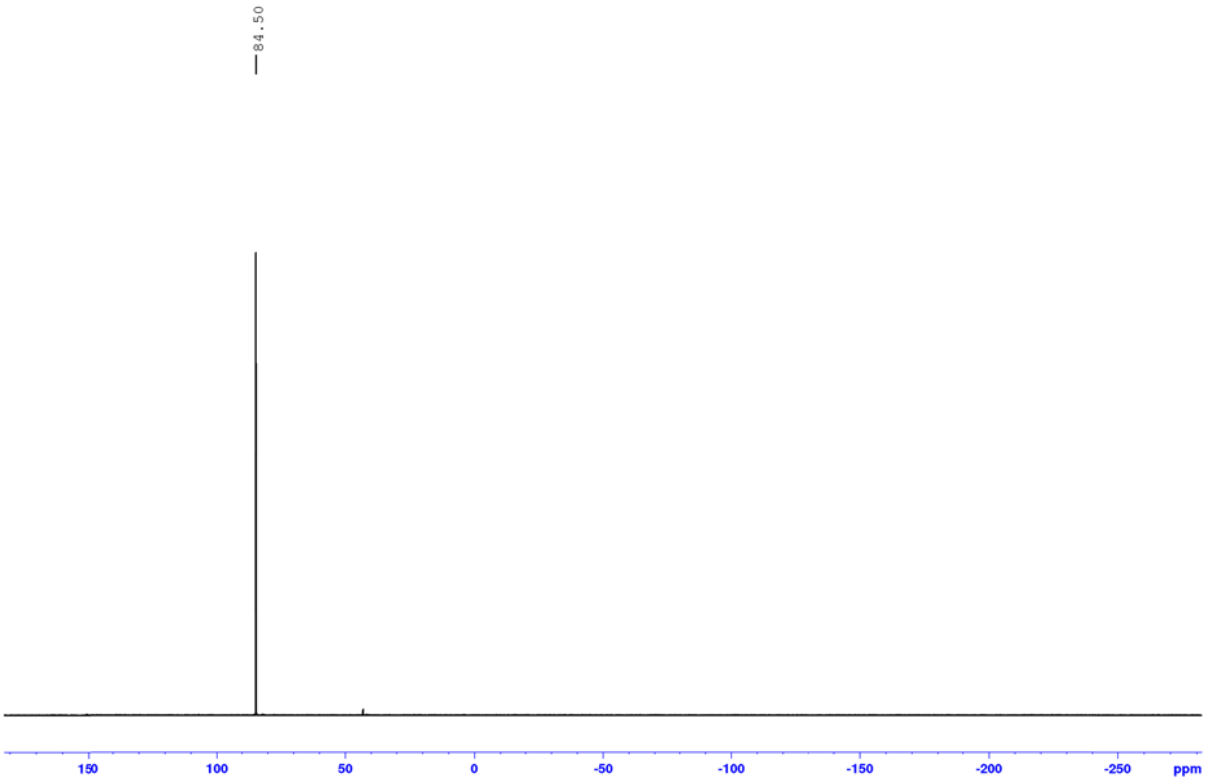
2.18. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 11

DJ - S-Methyl-S-(Diazabicycloundecyl) ethylphosphonodithioate crude



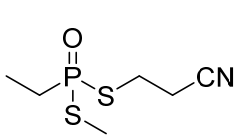
2.19. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 11

S-Methyl-S-(Diazabicycloundecyl) ethylphosphonodithioate



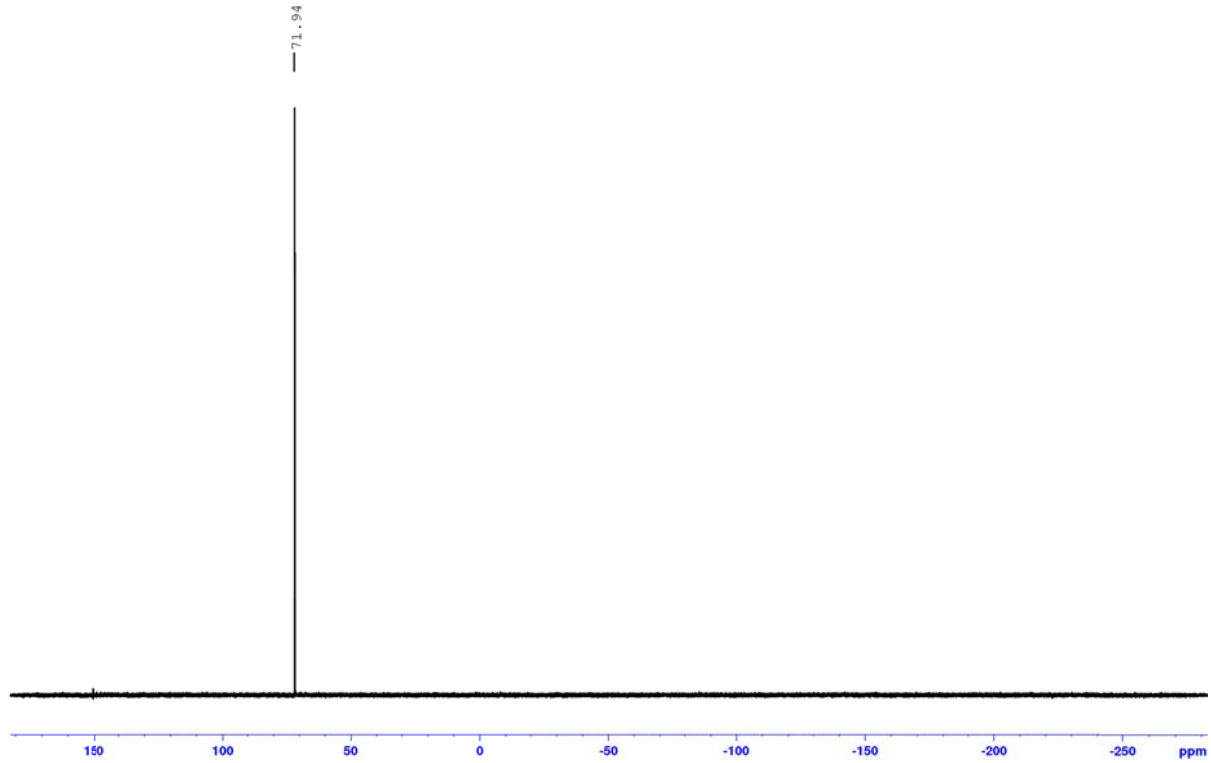
2.20 ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 10

S-Methyl-S-(2-cyanoethyl) ethylphosphonodithioate



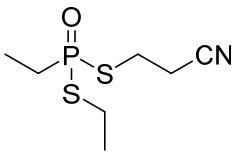
2.21 ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 10

S-Methyl-S-(2-cyanoethyl) ethylphosphonodithioate (11)



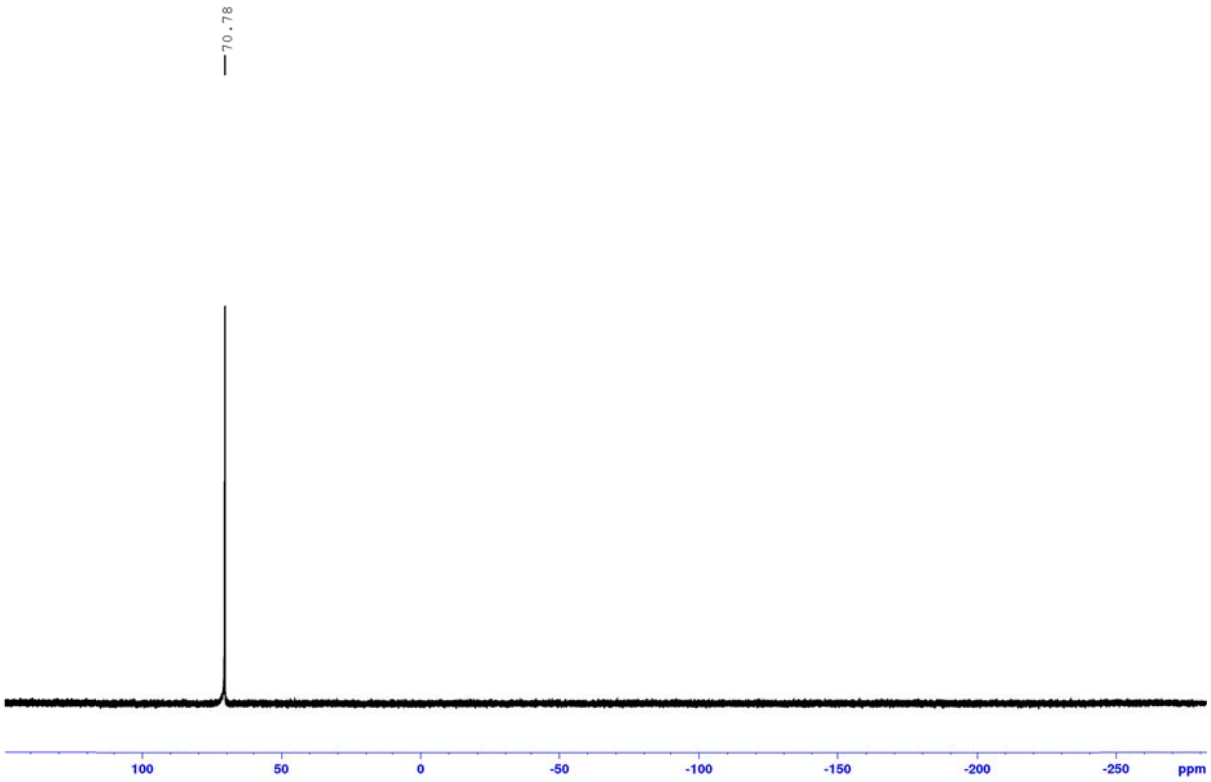
2.22 ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 13

S-Ethyl-S-(2-Cyanoethyl) ethylphosphonodithioate (13)



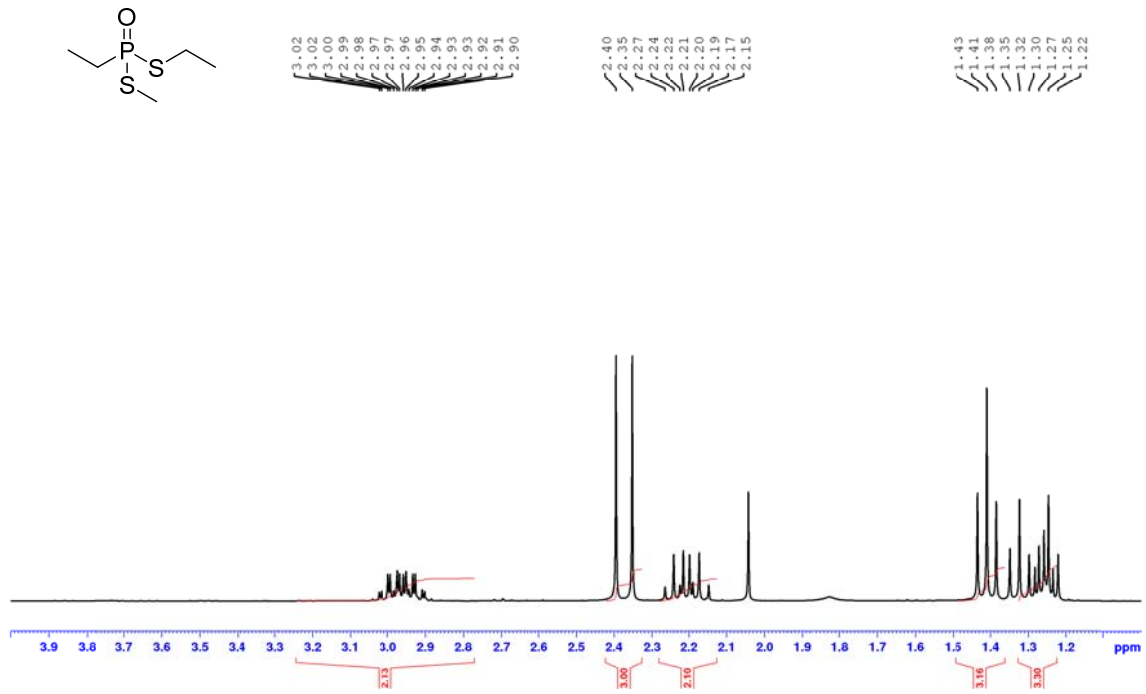
2.23. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 13

S-Ethyl-S-(2-cyanoethyl) ethylphosphonodithioate (13)



2.24. ^{1}H NMR (400 MHz, $CDCl_3$) spectrum of 12

S-Methyl S-Ethyl ethylphosphonodithioate



2.25. ^{31}P NMR (175 MHz, $CDCl_3$) spectrum of 12

S-Methyl S-Ethyl Ethylphosphonodithioate