Supporting information

A regio- and stereoselective synthesis of trisubstituted alkenes *via* gold(I)-catalyzed hydrophosphoryloxylation of haloalkynes

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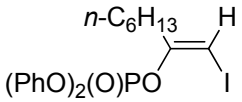
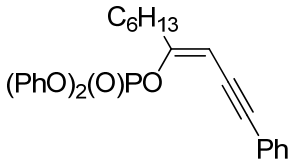
List of Contents

General procedure of Au-catalyzed addition reactions



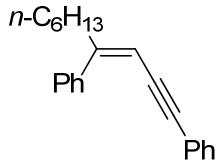
(*Z*)-1-iodooct-1-en-2-yl diphenyl phosphate (2a): To a suspension of Ph_3PAuCl (114.0 mg, 0.23 mmol), AgOTf (59.0 mg, 0.23 mmol) and diphenyl phosphate (1373 mg, 5.5 mmol) in toluene (22 mL) was added 1-iodooct-1-yne (1.080 g, 4.57 mmol) at room temperature. After being stirred at room temperature for 4 h, the solvent was removed under reduced pressure. The crude product was purified by silica gel column chromatography (EtOAc:hexane = 1:10) to give **2a** (159.0 mg, 80%) as a yellowish oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.19-7.38 (m, 10H), 5.65 (s, 1H), 2.49 (t, J = 7.6 Hz, 2H), 1.50-1.47 (m, 2H), 1.29-1.19 (m, 6H), 0.86 (t, J = 6.9 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 156.9, 150.6, 130, 125.8, 120.5 (d, J_{cp} = 4.8 Hz), 62.1 (d, J_{cp} = 10.5 Hz), 35.3, 31.6, 28.6, 26.7, 22.7, 14.2; IR (film) 2954, 2929, 1591, 1490, 1189, 963, 772, 687, 514 cm^{-1}; HRMS (EI) calcd. for $C_{20}H_{24}IO_4P$: m/z 486.0457 [M^+], found: m/z 486.0460.

General procedure of Pd-catalyzed cross-coupling reactions

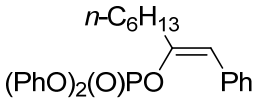


Diphenyl (*Z*)-1-phenyldec-3-en-1-yn-4-yl phosphate (3a): To a suspension of $Pd(PPh_3)_4$ (13.86 mg, 0.012 mmol) and CuI (5.71 mg, 0.03 mmol) in 1.4-dioxane (1.5 mL) was added (*Z*)-1-iodooct-1-en-2-yl diphenyl phosphate (145.8 mg, 0.3 mmol) at room temperature. After 15 min, Et_3N (91.07 mg, 0.9 mmol) and phenylacetylene (36.76 mg, 0.36 mmol) was added. After being stirred for 2 h at room temperature, the reaction mixture was quenched with saturated aqueous $NaHCO_3$. The aqueous layer was extracted with ether (3 × 20 mL), dried with $MgSO_4$, filtered, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (EtOAc:hexane = 1:10) to give **3a** (116.0 mg, 84%) as a brown oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30-7.19 (m, 13H), 7.16-7.12 (m, 2H), 5.33 (s, 1H), 2.42 (t, J = 7.6 Hz, 2H), 1.49 (quint, J = 7.5 Hz, 2H), 1.32-1.20 (m, 6H), 0.87 (t, J = 6.9 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.0 (d, J_{cp} = 8.8 Hz), 151.0 (d, J_{cp} = 7.7 Hz), 131.9,

130.2, 128.6, 125.8, 123.7, 120.6, 96.7, 96.6, 94.6, 83.6 (d, J_{cp} = 2.9 Hz), 34.8, 31.9, 28.9, 26.8, 22.9, 14.5; IR (film) 3061, 2930, 1489, 1188, 1160, 1010, 961, 689 cm^{-1}; HRMS (EI) calcd. for $C_{28}H_{29}O_4P$: *m*/*z* 460.1803 [M^+], found: *m*/*z* 460.1803.

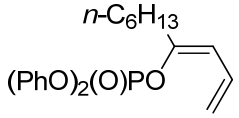


(*Z*)-1,4-diphenyldec-3-en-1-yne (4a): To a suspension of $PdCl_2$ (1.773 mg, 0.010 mmol) and (*Z*)-diphenyl 1-phenyldec-3-en-1-yn-4-yl phosphate (92.1 mg, 0.2 mmol) in THF (1.0 mL) was added phenyl magnesium bromide 1.0 M in THF (39.9 mg, 0.22 mmol) at room temperature. After being stirred for 15 min at room temperature, the reaction mixture was filtered and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (hexane) to give **4a** (37.0 mg, 70%) as a yellowish oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 (d, *J* = 8.0 Hz, 2H), 7.38 (t, *J* = 7.4 Hz, 2H), 7.33-7.29 (m, 1H), 7.28-7.22 (m, 5H), 5.80 (s, 1H), 2.55(td, *J* = 7.5 Hz, *J* = 1.0 Hz, 2H), 1.43-1.37 (m, 2H), 1.34-1.22 (m, 6H), 0.86 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 154.3, 140.0, 131.7, 128.6, 128.5, 128.3, 128.14, 128.11, 124.3, 106.2, 91.5, 89.1, 38.3, 32.0, 29.3, 28.8, 23.0, 14.5; IR (film) 2025, 2855, 1489, 755, 690, 441, 427 cm^{-1}; HRMS (EI) calcd. for $C_{22}H_{24}$: *m*/*z* 288.1878 [M^+], found: *m*/*z* 288.1880.

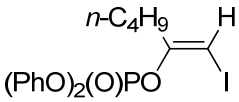


diphenyl (*Z*)-1-phenyloct-1-en-2-yl phosphate (5a): To a suspension of $Pd(PPh_3)_4$ (11.56 mg, 0.010 mmol) in 1.4-dioxane (1.0 mL) was added (*Z*)-1-iodooct-1-en-2-yl diphenyl phosphate (97.26 mg, 0.2 mmol) at room temperature. After 15 min, Et_3N (40.48 mg, 0.4 mmol), 3.0 M K_3PO_4 (138.6 mg, 0.6 mmol) and phenylboronic acid (29.27 mg, 0.24 mmol) was added. After being stirred for 1 h at 70 ^{o}C, the reaction mixture was quenched with saturated aqueous $NaHCO_3$. The aqueous layer was extracted with ether (3 × 20 mL), dried with $MgSO_4$, filtered and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (EtOAc:hexane = 1:10) to give **5a** (55.0 mg, 63%) as a brown oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 (d, *J* = 8.4 Hz, 2H), 7.28 (t, *J* = 7.9 Hz, 4H),

7.22-7.11 (m, 9H), 5.81 (s, 1H), 2.54 (t, J = 7.5 Hz, 2H), 1.61 (quint, J = 7.5 Hz, 2H), 1.38-1.24 (m, 6H), 0.87 (t, J = 6.8 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.9 (d, J_{cp} = 6.9 Hz), 149.3 (d, J_{cp} = 8.7 Hz), 134.2, 130.1, 129.2, 128.6, 127.4, 125.7, 120.4 (d, J_{cp} = 4.9 Hz), 114.5 (d, J_{cp} = 8.6 Hz), 35.4, 32.0, 29.0, 27.4, 22.9, 14.5; IR (film) 2954, 2929, 1591, 1290, 1190, 1010, 776, 402 cm^{-1}; HRMS (EI) calcd. for $C_{26}H_{29}O_4P$: m/z 436.1803 [M^+], found: m/z 436.1806.

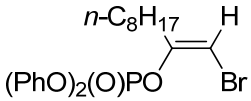


(*Z*)-deca-1,3-dien-4-yl diphenyl phosphate (7c): To a suspension of $PdCl_2(PPh_3)_2$ (10.52 mg, 0.015 mmol) and (*Z*)-1-iodooct-1-en-2-yl diphenyl phosphate (145.8 mg, 0.3 mmol) in DMF (1.5 mL) was added tributyl(vinyl)tin (142.6 mg, 0.45 mmol) at room temperature. After being stirred for 16 h at room temperature, the reaction mixture was quenched with saturated aqueous $NaHCO_3$. The aqueous layer was extracted with ether (3 × 20 mL), dried with $MgSO_4$, filtered and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (EtOAc:hexane = 1:10) to give **7c** (110.0 mg, 95%) as a yellow oil. ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.35 (t, J = 7.9 Hz, 4H), 7.25 (d, J = 7.9 Hz, 4H), 7.20 (t, J = 7.4 Hz, 2H), 6.53 (td, J = 10.5 Hz, J = 7.1 Hz, 1H), 5.58 (d, J = 10.7 Hz , 1H), 5.15 (d, J = 17.1 Hz, 1H), 4.97 (d, J = 10.4 Hz, 1H), 2.36 (t, J = 7.5 Hz, 2H), 1.47 (quint, J = 7.5 Hz, 2H), 1.28-1.20 (m, 6H), 0.86 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 151.0 (d, J_{cp} = 7.6 Hz), 149.6 (d, J_{cp} = 9.4 Hz), 130.2, 130.0, 125.9, 120.6 (d, J_{cp} = 4.9 Hz), 117.3, 116.3 (d, J_{cp} = 7.9 Hz), 34.6, 31.9, 29.0, 26.9, 22.9, 14.4; IR (film) 2956, 2929, 2857, 1490, 1188, 1009, 955, 632 cm^{-1}; HRMS (EI) calcd. for $C_{22}H_{27}O_4P$: m/z 386.1647 [M^+], found: m/z 386.1646.

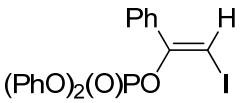


(*Z*)-1-iodohex-1-en-2-yl diphenyl phosphate (2b): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37-7.18 (m, 10H), 5.64 (s, 1H), 2.49 (t, J = 7.8 Hz, 2H), 1.49-1.43 (m, 2H), 1.31-1.25 (m, 2H), 0.85 (t, J = 6.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 157 (d, J_{cp} = 6.7 Hz), 150.6 (d, J_{cp} = 7.7

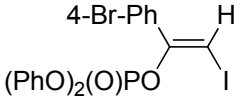
Hz), 129.9, 125.8, 120.4 (d, J_{cp} = 4.8 Hz), 62.1 (d, J_{cp} = 11.5 Hz), 34.9, 28.7, 22.0, 13.8; IR (film) 3012, 2958, 2931, 1637, 1591, 1489, 1296, 1188, 1122, 966; HRMS (EI) calcd for $C_{18}H_{20}IO_4P$: *m*/*z* 459.0222 [M^+], found: *m*/*z* 459.0218.



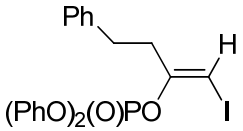
(*Z*)-1-bromodec-1-en-2-yl diphenyl phosphate (2c): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37-7.19 (m, 10H), 5.66 (s, 1H), 2.38 (t, *J* = 7.6 Hz, 2H), 1.47-1.44 (m, 2H), 1.27-1.22 (m, 10H), 0.87 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 152.5, 150.6, 129.9, 125.7 (d, J_{cp} = 10.5 Hz), 120.4, 91.79, 34.4, 32.0, 29.3, 28.9, 26.4, 22.8, 14.3; IR (film) 3018, 2927, 2856, 1653, 1591, 1489, 1296, 1215, 1188, 1139, 1010, 968, 756, 667 cm^{-1}; HRMS (EI) calcd for $C_{22}H_{28}BrO_4P$: *m*/*z* 467.0987 [M^+], found: *m*/*z* 467.0981.



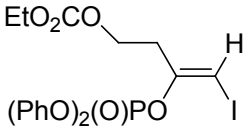
(*Z*)-2-iodo-1-phenylvinyl diphenyl phosphate (2d): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49-7.47 (m, 2H), 7.35-7.25 (m, 7H), 7.18-7.13 (m, 6H), 6.38 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 155.0 (d, J_{cp} = 8.6 Hz), 150.6 (d, J_{cp} = 7.7 Hz), 133.9, 129.9 (d, J_{cp} = 13.4 Hz), 128.6, 125.6, 120.3 (d, J_{cp} = 4.8 Hz), 66.4 (d, J_{cp} = 9.6 Hz); IR (film) 3018, 1591, 1489, 1298, 1215, 1188, 1053, 1024, 966, 756 cm^{-1}; HRMS (EI) calcd for $C_{20}H_{16}IO_4P$: *m*/*z* 477.9831 [M^+], found: *m*/*z* 477.9834.



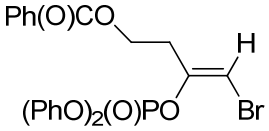
(*Z*)-1-(4-bromophenyl)-2-iodovinyl diphenyl phosphate (2e): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43-7.41 (m, 2H), 7.34-7.19 (m, 6H), 7.18-7.16 (m, 6H), 6.42 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 154.0 (d, J_{cp} = 8.6 Hz), 150.5 (d, J_{cp} = 7.6 Hz), 132.9, 131.9, 129.9, 128.0, 125.8, 124.2, 120.3 (d, J_{cp} = 4.8 Hz), 67.2 (d, J_{cp} = 9.5 Hz); IR (film) 3068, 3014, 1589, 1487, 1394, 1307, 1215, 1188, 1043, 947, 754 cm^{-1}; HRMS (EI) calcd for $C_{20}H_{15}IO_4PBrNa$: *m*/*z* 578.8834 [M^+], found: *m*/*z* 578.8836.



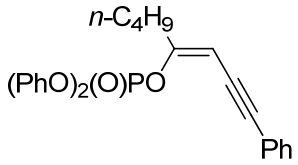
(*Z*)-1-iodo-4-phenylbut-1-en-2-yl diphenyl phosphate (2f): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-7.30 (m, 8H), 7.28-7.17 (m, 5H), 7.10 (d, J = 6.9 Hz, 2H), 5.63 (s, 1H), 2.82 (s, 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 155.7 (d, J_{cp} = 7.1 Hz), 150.4 (d, J_{cp} = 7.6 Hz), 139.9, 129.9, 128.5, 128.4, 126.3, 125.7, 120.3 (d, J_{cp} = 4.8 Hz), 63.1 (d, J_{cp} = 10.5 Hz), 37.0, 32.9; IR (film) 3075, 1590, 1488, 1297, 1185, 960, 688, 639 cm^{-1}; HRMS (EI) calcd. for $C_{22}H_{20}IO_4P$: *m*/*z* 506.0144 [M^+], found: *m*/*z* 506.0145.



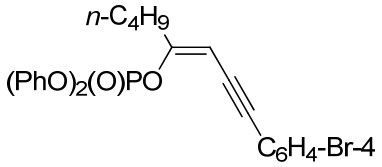
(*Z*)-3-(diphenoxyphosphoryloxy)-4-iodobut-3-enyl ethyl carbonate (2g): ^{1}H NMR (400 MHz, $CDCl_3$) 7.37-7.19 (m, 10H), 5.85 (s, 1H), 4.24-4.15 (m, 4H), 2.90-2.89 (m, 2H), 1.31-1.26 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 154.9, 152.4 (d, J_{cp} = 7.6 Hz), 150.4 (d, J_{cp} = 7.6 Hz), 130.0, 125.9, 120.4 (d, J_{cp} = 4.8 Hz), 65.2, 64.4, 63.5, 34.7, 14.4; IR (film) 3076, 2981, 1735, 1641, 1589, 1487, 1384, 1367, 1184, 1120, 1070, 763, 638 cm^{-1}; HRMS (EI) calcd for $C_{19}H_{20}IO_7P$: *m*/*z* 519.0070 [M^+], found: *m*/*z* 519.0071.



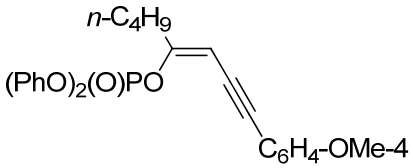
(*Z*)-4-(benzoyloxy)-1-bromobut-1-en-2-yl diphenyl phosphate (2h): ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01-7.98 (m, 2H), 7.45-7.19 (m, 15H), 5.85 (s, 1H), 4.39 (t, J = 6.6 Hz, 2H), 2.89-2.86 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.7, 151.0, 148.1, 133.3, 130.0, 128.5, 125.9, 120.2, 94.1, 60.6, 33.9; IR (film) 3070, 2962, 1732, 1678, 1589, 1487, 1454, 1382, 1070, 773, 711 cm^{-1}; HRMS (EI) calcd for $C_{23}H_{21}O_6BrP$: *m*/*z* 503.0259 [M^+], found: *m*/*z* 503.0255.



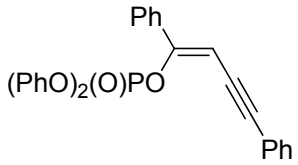
Diphenyl (*Z*)-1-phenyloct-3-en-1-yn-4-yl phosphate (3b): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34-7.14 (m, 15H), 5.34 (s, 1H), 2.43 (t, J = 7.8 Hz, 2H), 1.49-1.45 (m, 2H), 1.35-1.29 (m, 2H), 0.87 (t, J = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.6, 150.8, 131.7, 129.9, 128.3, 125.6, 120.4 (d, J_{cp} = 4.8 Hz), 96.4, 94.9, 84.1, 34.2, 28.7, 22.2, 13.9; IR (film) 3053, 2958, 2872, 1653, 1591, 1489, 1296, 1265, 1219, 1188, 1161, 1008, 688 cm^{-1}; HRMS (EI) calcd for $C_{26}H_{25}O_4P$: m/z 433.1569 [M^+], found: m/z 433.1566.



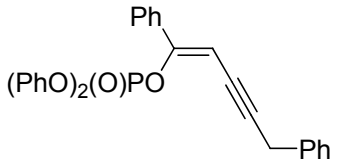
(*Z*)-1-(4-bromophenyl)oct-3-en-1-yn-4-yl diphenyl phosphate (3c): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35-7.09 (m, 14H), 5.31 (s, 1H), 2.40 (t, J = 7.8 Hz, 2H), 1.49-1.45 (m, 2H), 1.34-1.28 (m, 2H), 0.87 (t, J = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.1, 150.6, 133.1, 131.6, 129.9, 125.7, 122.4 (d, J_{cp} = 14.4 Hz), 96.3 (d, J_{cp} = 7.7 Hz), 93.2, 84.5, 34.3, 28.6, 22.1, 13.9; IR (film) 3018, 2399, 1591, 1489, 1294, 1215, 1161, 1010, 966, 767, 669 cm^{-1}; HRMS (EI) calcd for $C_{26}H_{25}O_4PBr$: m/z 511.0674 [M^+], found: m/z 511.0668.



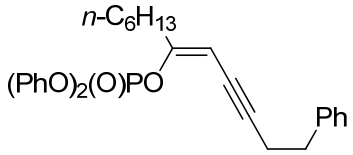
(*Z*)-1-(4-methoxyphenyl)oct-3-en-1-yn-4-yl diphenyl phosphate (3d): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31-7.12 (m, 12H), 6.76-6.73 (m, 2H), 5.32 (s, 1H), 3.77 (s, 3H), 2.40 (t, J = 7.8 Hz, 2H), 1.49-1.43 (m, 2H), 1.33-1.28 (m, 2H), 0.86 (t, J = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.7, 157.9 (d, J_{cp} = 9.6 Hz), 150.7 (d, J_{cp} = 7.7 Hz), 133.1, 129.9, 125.6, 120.3 (d, J_{cp} = 4.8 Hz), 115.6, 113.9, 96.6 (d, J_{cp} = 8.6 Hz), 82.0, 55.4, 34.2, 28.7, 22.1, 13.9; IR (film) 3016, 2960, 2399, 1602, 1508, 1489, 1292, 1247, 1215, 1026, 966, 771, 667 cm^{-1}; HRMS (EI) calcd for $C_{27}H_{28}O_5P$: m/z 463.1674 [M^+], found: m/z 463.1666.



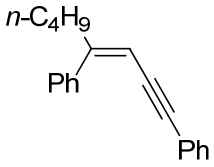
Diphenyl (*Z*)-1,4-diphenylbut-1-en-3-ynyl phosphate (3e): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.57-7.55 (m, 2H), 7.36-7.557.09 (m, 18H), 6.08 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 154.5, 150.7 (d, J_{cp} = 7.7 Hz), 133.6, 131.8, 129.9, 128.7, 128.3, 125.6 (d, J_{cp} = 16.3 Hz), 120.3 (d, J_{cp} = 4.8 Hz), 97.7 (d, J_{cp} = 8.6 Hz), 84.2; IR (film) 3016, 2399, 1593, 1489, 1294, 1215, 1070, 1010, 966, 771, 669 cm^{-1}; HRMS (EI) calcd for $C_{28}H_{22}O_4P$: *m*/*z* 453.1256 [M^+], found: *m*/*z* 453.1262.



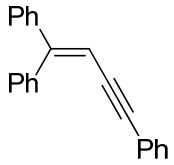
Diphenyl (*Z*)-1,5-diphenylpent-1-en-3-ynyl phosphate (3f): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52-7.50 (m, 2H), 7.33-7.12 (m, 18H), 5.88 (s, 1H), 3.58 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 155.0, 150.8 (d, J_{cp} = 7.6 Hz), 136.5, 133.8, 129.8 (d, J_{cp} = 4.8 Hz), 128.7 (d, J_{cp} = 5.7 Hz), 120.3 (d, J_{cp} = 5.7 Hz), 98.1 (d, J_{cp} = 6.7 Hz), 96.4, 26.2; IR (film) 3053, 2985, 2252, 1489, 1421, 1265, 1219, 910, 771, 650 cm^{-1}; HRMS (EI) calcd for $C_{29}H_{24}O_4P$: *m*/*z* 467.1412 [M^+], found: *m*/*z* 467.1418.



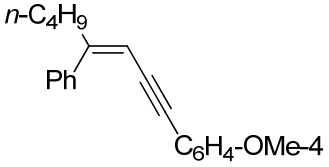
Diphenyl (*Z*)-1-phenyldodec-5-en-3-yn-6-yl phosphate (3g): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35-7.24 (m, 10H), 7.18 (t, *J* = 6.8 Hz, 3H), 7.12 (d, *J* = 7.1 Hz, 2H), 5.09 (s, 1H), 2.70 (t, *J* = 7.8 Hz, 2H), 2.43 (t, *J* = 7.2 Hz, 2H), 2.32 (t, *J* = 7.6 Hz, 2H), 1.43(quint, *J* = 7.0 Hz, 2H), 1.30-1.17 (m, 6H), 0.86 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.6 (d, J_{cp} = 9.5 Hz), 150.6 (d, J_{cp} = 7.5 Hz), 140.7, 129.8 (d, J_{cp} = 8.3 Hz), 128.3 (d, J_{cp} = 2.7 Hz), 126.2, 125.4, 120.2(d, J_{cp} = 4.9 Hz), 96.5 (d, J_{cp} = 7.8 Hz), 94.7, 74.4, 35.0, 34.2, 31.4, 28.5, 26.3, 22.5, 21.7, 14.0; IR (film) 2953, 2928, 1591, 1490, 1010, 961, 774, 415 cm^{-1}; HRMS (EI) calcd. for $C_{30}H_{33}O_4P$: *m*/*z* 488.2116 [M^+], found: *m*/*z* 488.2115.



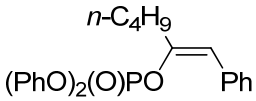
(*Z*)-1,4-diphenyloct-3-en-1-yne (4b): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61-7.59 (m, 2H), 7.40-7.22 (m, 8H), 5.80 (s, 1H), 2.56 (t, J = 7.5 Hz, 2H), 1.42-1.26 (m, 4H), 0.88 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 154.0, 139.7, 131.4, 128.4, 128.3, 128.0, 127.9, 124.1, 106.0, 91.3, 88.9, 37.8, 30.7, 22.5, 14.1; IR (film) 3078, 3014, 2956, 2194, 1591, 1489, 1440, 1377, 1215, 1068, 914, 839, 767, 690 cm^{-1}; HRMS (EI) calcd for $C_{20}H_{20}$: m/z 261.1643 [M^+], found: m/z 261.1653.



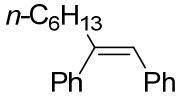
1,1,4-triphenylbut-1-en-3-yne (4c): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.60-7.00 (m, 15H), 6.23 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 152.9, 141.6, 139.4, 131.6, 130.4, 128.7, 128.5, 128.5, 128.0, 127.5, 107.3, 93.9, 89.4; IR (film) 3053, 2985, 2252, 1265, 1219, 910, 771, 734, 650 cm^{-1}; HRMS (EI) calcd for $C_{22}H_{16}$: m/z 281.1330 [M^+], found: m/z 281.1336.



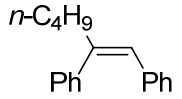
1-methoxy-4-((*Z*)-4-phenyloct-3-en-1-ynyl)benzene (4d): ^{1}H NMR (400MHz, $CDCl_3$) δ 7.60-7.58 (m, 2H), 7.39-7.19 (m, 6H), 6.79-6.77 (m, 2H), 5.77 (s, 1H), 3.77 (s, 3H), 2.54 (t, J = 7.5 Hz, 2H), 1.38-1.26 (m, 4H), 0.88 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.4, 152.9, 139.9, 132.9, 128.3, 128.0, 127.8, 116.3, 114.1, 106.2, 91.5, 87.5, 55.5, 37.7, 30.8, 22.5, 14.1; IR (film) 3012, 2956, 1604, 1508, 1463, 1247, 1170, 1035, 831, 756, 667 cm^{-1}; HRMS (EI) calcd for $C_{21}H_{23}O$: m/z 291.1749 [M^+], found: m/z 291.1752.



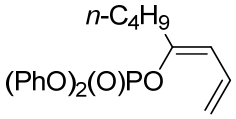
Diphenyl (*Z*)-1-phenylhex-1-en-2-yl phosphate (5b): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42-7.39 (m, 2H), 7.29-6.78 (m, 13H), 5.81 (s, 1H), 2.54 (t, J = 7.3 Hz, 2H), 1.61-1.57 (m, 2H), 1.39-1.33 (m, 2H), 0.89 (t, J = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 156.4, 150.6 (d, J_{cp} = 7.7 Hz), 149.0 (d, J_{cp} = 8.6 Hz), 133.9, 129.9, 129.6, 129.0, 128.4, 127.2, 125.6, 120.2 (d, J_{cp} = 4.8 Hz), 115.5, 114.4 (d, J_{cp} = 8.6 Hz), 34.9, 29.3, 22.2, 14.0; IR (film) 3059, 2956, 2870, 1672, 1591, 1489, 1296, 1188, 1095, 960, 754, 688 cm^{-1}; HRMS (EI) calcd for $C_{24}H_{25}O_4P$: m/z 409.1569 [M^+], found: m/z 409.1563.



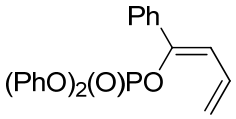
(*Z*)-1,2-diphenyloct-1-ene (6a): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 (d, J = 7.5 Hz, 1H), 7.44 (t, J = 7.5 Hz, 1H), 7.36-7.21 (m, 3H), 7.14 (d, J = 6.6 Hz, 2H), 7.09.-7.01 (m, 2H), 6.91 (d, J = 6.5 Hz, 1H), 6.42 (s, 1H), 2.48 (t, J = 7.2 Hz, 2H), 1.50-1.21 (m, 8H), 0.87 (t, J = 6.8 Hz, 3H); ^{13}C NMR (400 MHz, $CDCl_3$) δ 144.0, 141.9, 138.0, 129.4, 129.0, 128.9, 128.2, 127.6, 127.2, 126.4, 41.2, 32.1, 29.3, 28.3, 23.1, 14.5; IR (film) 2928, 1593, 1439, 1187, 962, 693, 541 cm^{-1}; HRMS (EI) calcd. for $C_{20}H_{24}$: m/z 264.1878 [M^+], found: m/z 264.1874.



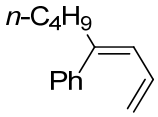
(*Z*)-1,2-diphenylhex-1-ene (6b): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 (d, J = 7.3 Hz, 1H), 7.42 (t, J = 7.8 Hz, 1H), 7.30-7.04 (m, 6H), 6.90 (d, J = 6.4 Hz, 2H), 6.43 (s, 1H), 2.49 (t, J = 6.7 Hz, 2H), 1.41-1.25 (m, 4H), 0.88 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.6, 141.6, 137.5, 129.0, 128.8, 128.6, 127.9, 127.2, 126.1, 40.5, 30.2, 22.4, 14.0, 139.7, 131.4, 128.4, 128.3, 128.0, 127.9, 124.1, 106.0, 91.3, 88.9, 37.8, 30.7, 22.5, 14.1; IR (film) 3153, 2958, 2252, 1791, 1548, 1379, 1219, 906, 732, 650 cm^{-1}; HRMS (EI) calcd for $C_{18}H_{20}Na$: m/z 259.1463 [M^+], found: m/z 259.1466.



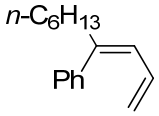
(*Z*)-octa-1,3-dien-4-yl diphenyl phosphate (7a): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36-7.17 (m, 10H), 6.57-6.48 (m, 1H), 5.57 (d, J = 11 Hz, 1H), 5.15 (d, J = 17.4 Hz, 1H), 4.96 (d, J = 10.5 Hz, 1H), 2.36 (t, J = 7.3 Hz), 1.49-1.42 (m, 2H), 1.34-1.22 (m, 2H), 0.86 (t, J = 7.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.7 (d, J_{cp} = 7.7 Hz), 149.4, 129.9, 129.8, 125.7, 120.4, 120.3, 117.1, 116.1 (d, J_{cp} = 7.7 Hz), 34.0, 28.8, 22.2, 13.9; IR (film) 2956, 2929, 1668, 1591, 1489, 1417, 1290, 1217, 1188, 960, 771, 688 cm^{-1}; HRMS (EI) calcd for $C_{20}H_{23}O_4PNa$: m/z 381.1232 [M^+], found: m/z 381.1235.



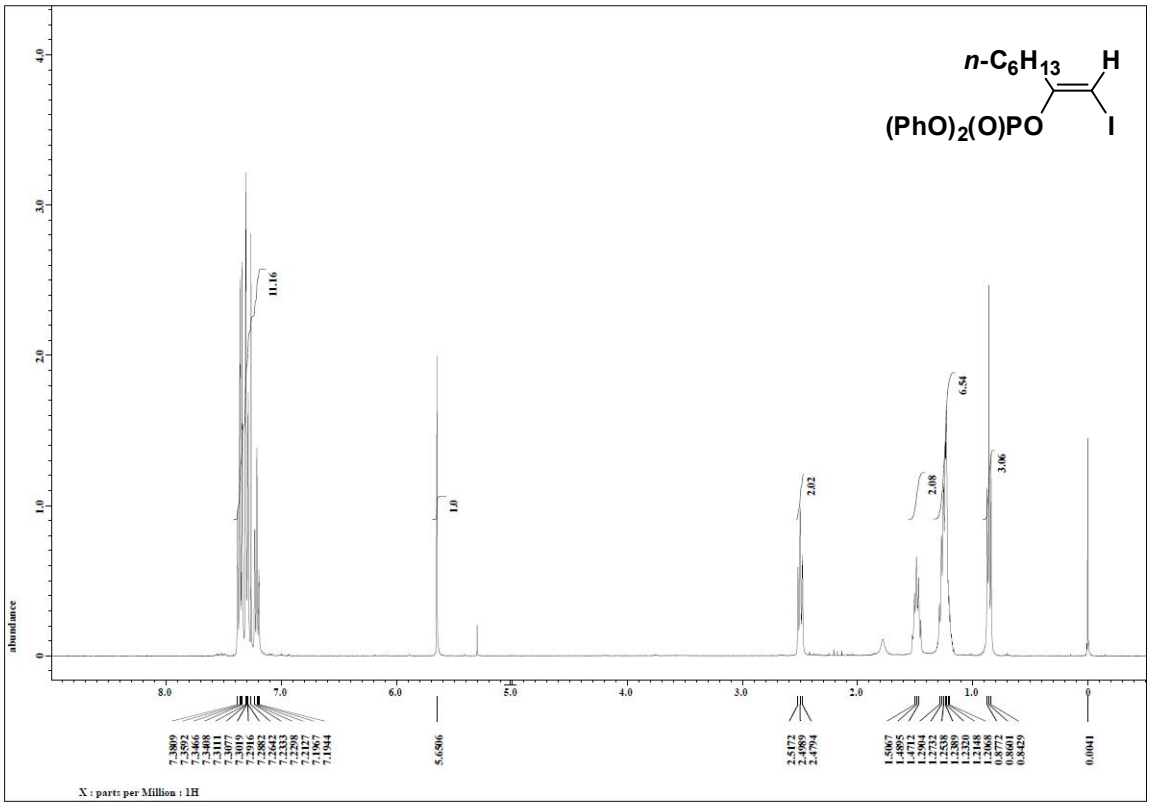
Diphenyl (*Z*)-1-phenylbuta-1,3-dienyl phosphate (7b): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54-7.51 (m, 2H), 7.34-7.11 (m, 13H), 6.86-6.35 (m, 1H), 6.33 (d, J = 1.8 Hz, 1H), 5.38 (d, J = 17.4 Hz, 1H), 5.19 (d, J = 10. 5Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.7 (d, J = 6.7 Hz), 145.9, 134.5, 130.3, 129.9, 129.1, 128.6, 125.7 (d, J = 10.5 Hz), 120.3 (d, J = 4.8 Hz), 117.6 (d, J = 6.7 Hz); IR (film) 3043, 2926, 1732, 1643, 1591, 1487, 1456, 1415, 1296, 1217, 1045, 960, 769, 688, 648 cm^{-1}; HRMS (EI) calcd for $C_{22}H_{19}O_4P$: m/z 379.1099 [M^+], found: m/z 379.1105.

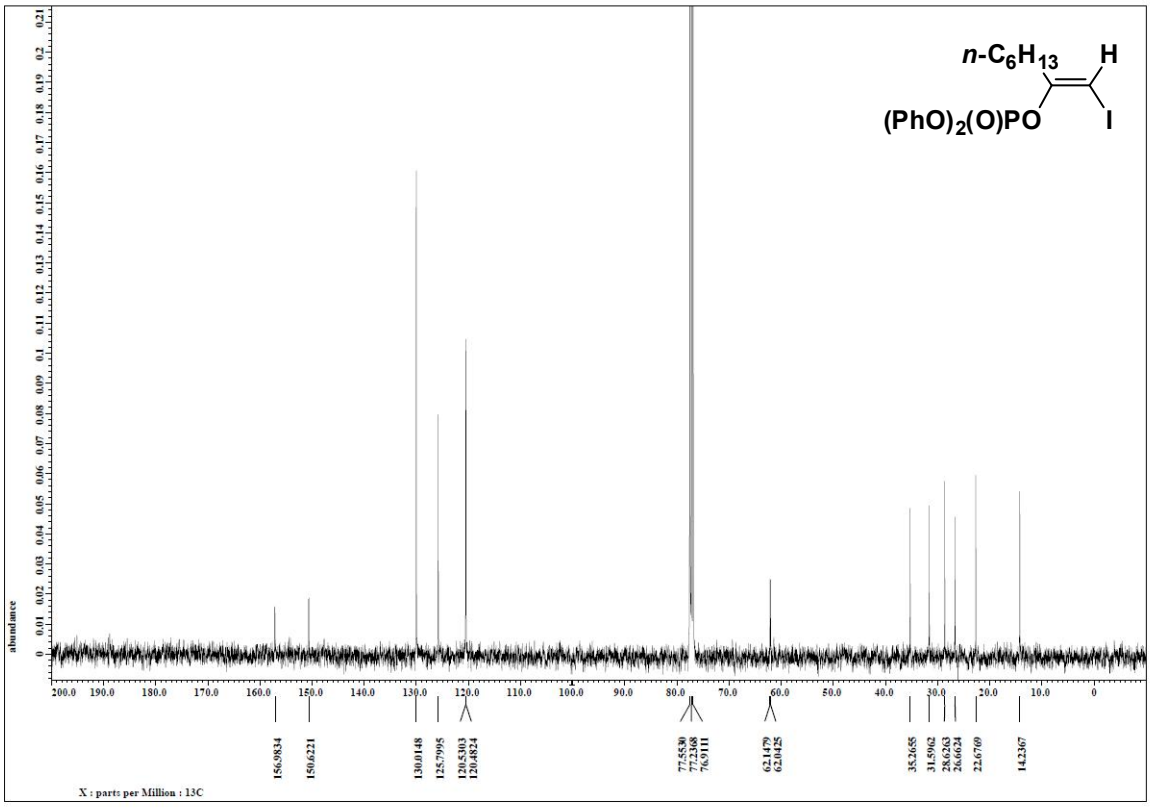


1-((*Z*)-octa-1,3-dien-4-yl)benzene (8a): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37-7.18 (m, 5H), 6.38-6.28 (m, 1H), 6.12 (d, J = 11.4 Hz, 1H), 5.16 (d, J = 17.4 Hz, 1H), 4.94 (d, J = 10.4 Hz, 1H), 2.42 (t, J = 7.1 Hz, 2H), 1.34-1.25 (m, 4H), 0.88 (t, J = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.7, 140.9, 134.8, 128.8, 128.4, 127.4, 127.0, 126.8, 116.1, 39.0, 30.5, 22.5, 14.1; IR (film) 2925, 1642, 1415, 1217, 961, 769, 688, 647 cm^{-1}; HRMS (EI) calcd for $C_{14}H_{18}$: m/z 187.1490 [M^+], found: m/z 187.1490.



1-((*Z*)-deca-1,3-dien-4-yl)benzene (8b): ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36-7.16 (m, 5H), 6.37-6.28 (m, 1H), 6.12 (d, J = 10.9 Hz, 1H), 5.18 (dd, J = 16.9 Hz, J = 1.9 Hz , 1H), 4.94 (dd, J = 10.1 Hz, J = 1.9 Hz , 1H), 2.41 (t, J = 7.1 Hz , 2H), 1.52-1.21 (m, 8H), 0.85 (t, J = 6.9 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 144.6, 140.8, 134.6, 128.6, 128.0, 127.2, 126.8, 115.9, 39.1, 31.7, 28.9, 28.1, 22.6, 14.1; IR (film) 3061, 3034, 2926, 1477, 1429, 1005, 725, 693 cm^{-1}; HRMS (EI) calcd. for $C_{16}H_{22}$: m/z 214.1722 [M^+], found: m/z 214.1722.


n-C6H13
H
(PhO)2(O)PO
I
abundance
11.16
1.0
2.02
2.08
6.54
3.06
X : parts per Million : 1H


n-C6H13
H
(PhO)2(O)PO
I
abundance
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130.0148
125.7995
120.5303
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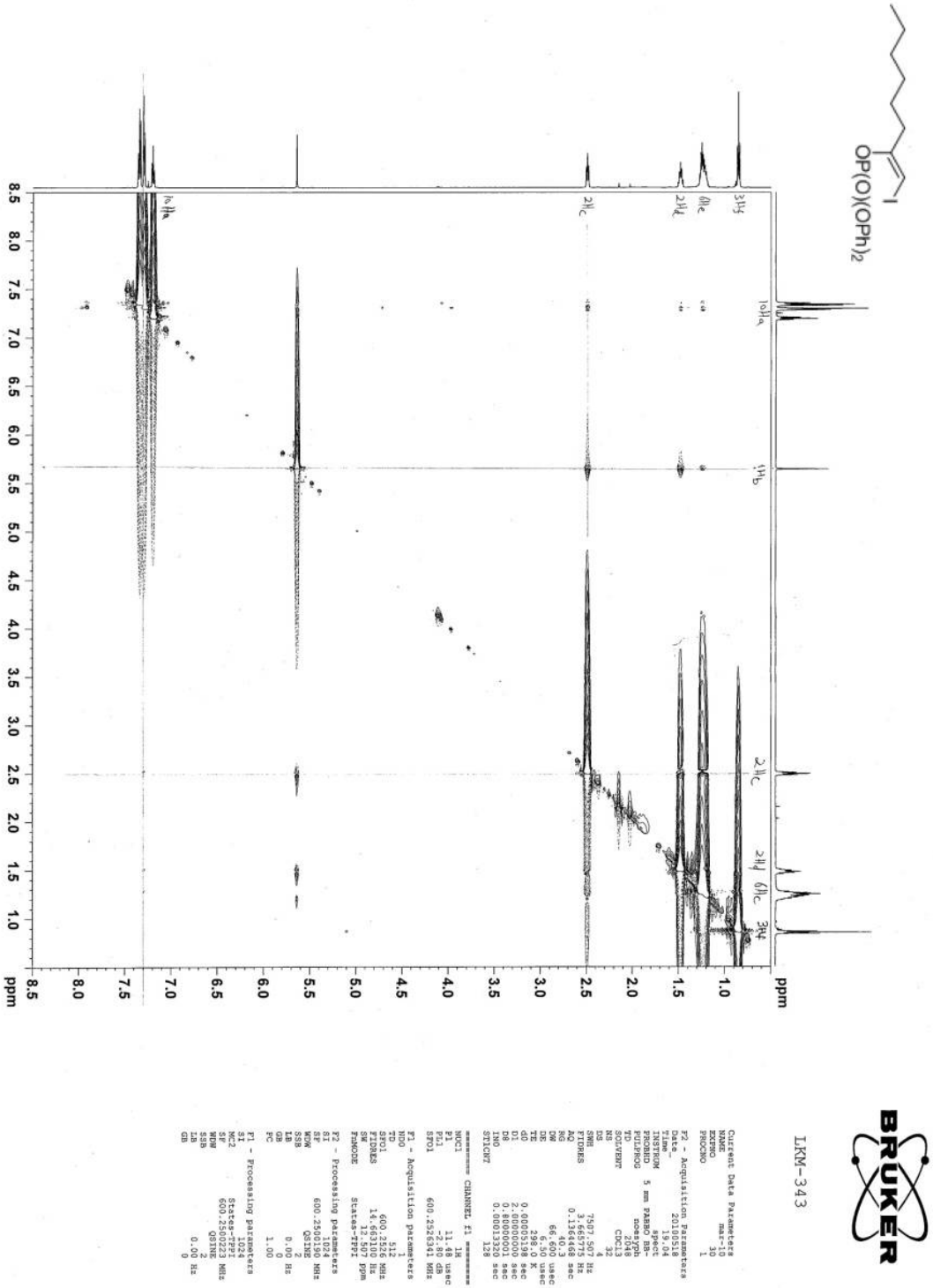
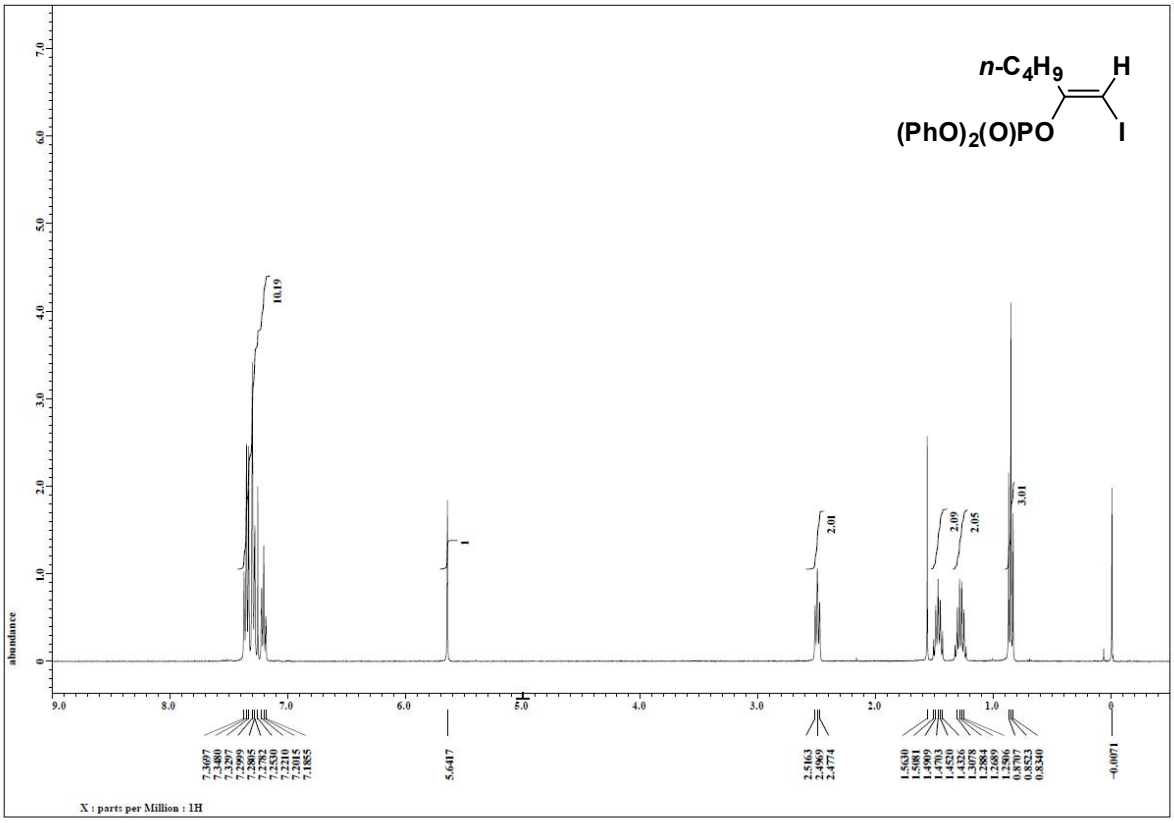
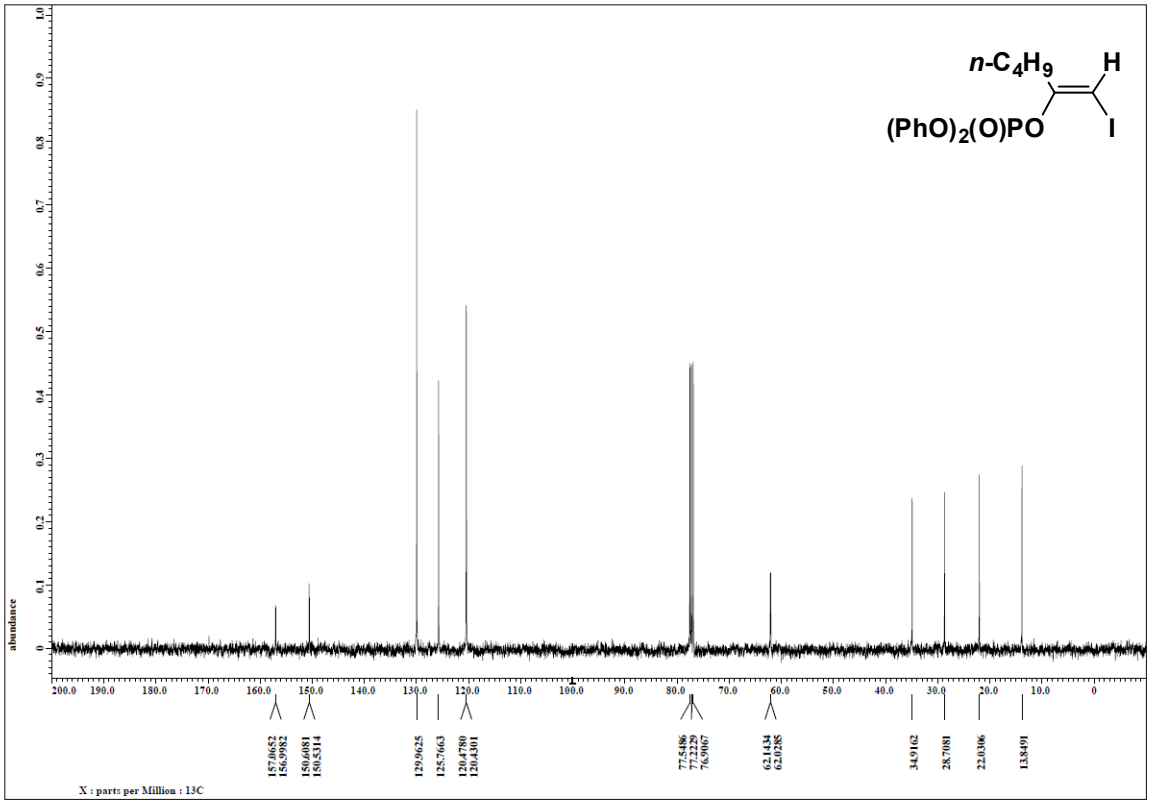
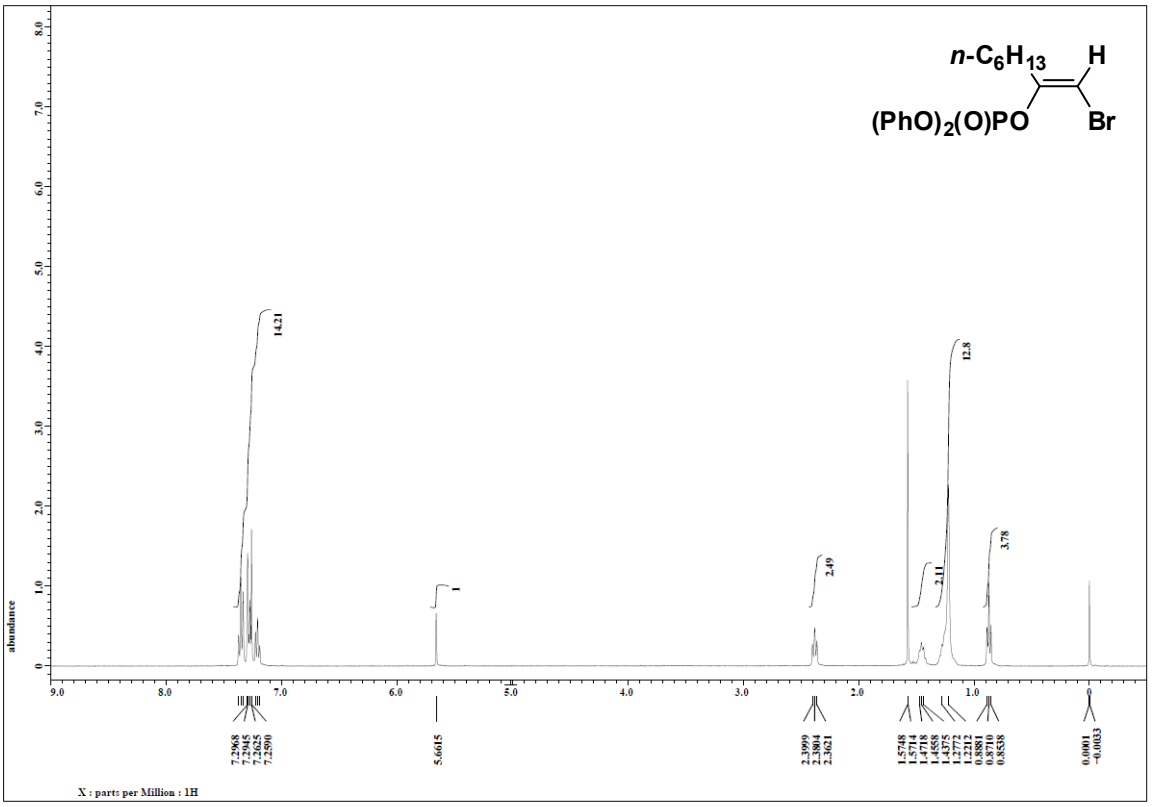
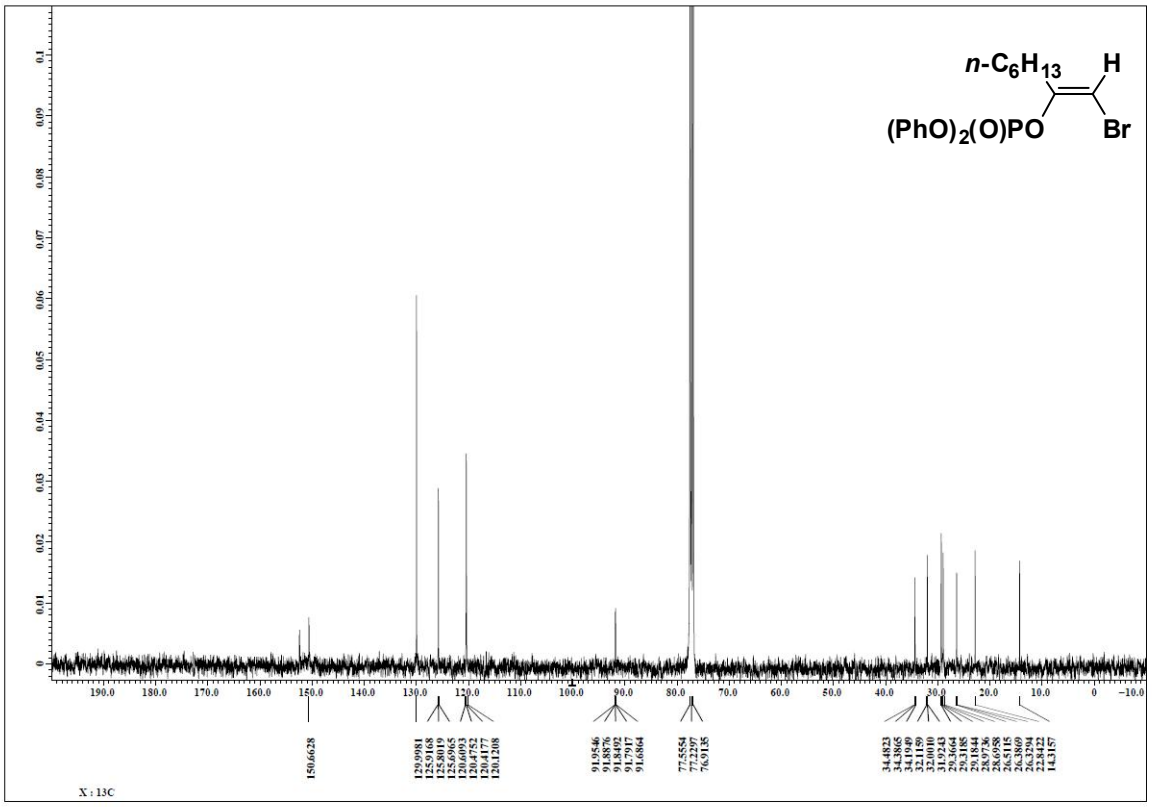
77.5530
77.2368
76.9111
62.1479
62.0425
35.2655
31.5962
28.6263
26.6624
22.6769
14.2367
X : parts per Million : 13C

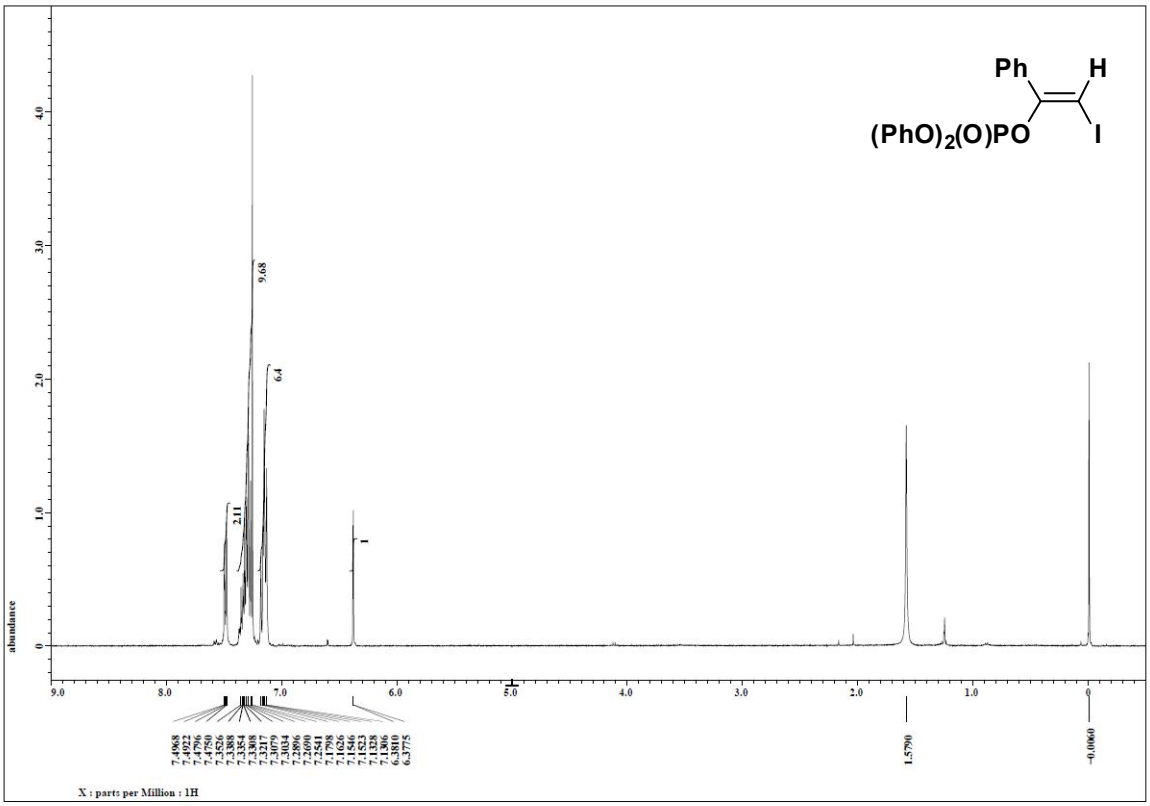

OP(O)(OPh)2
ppm
LKM-343
BRUKER

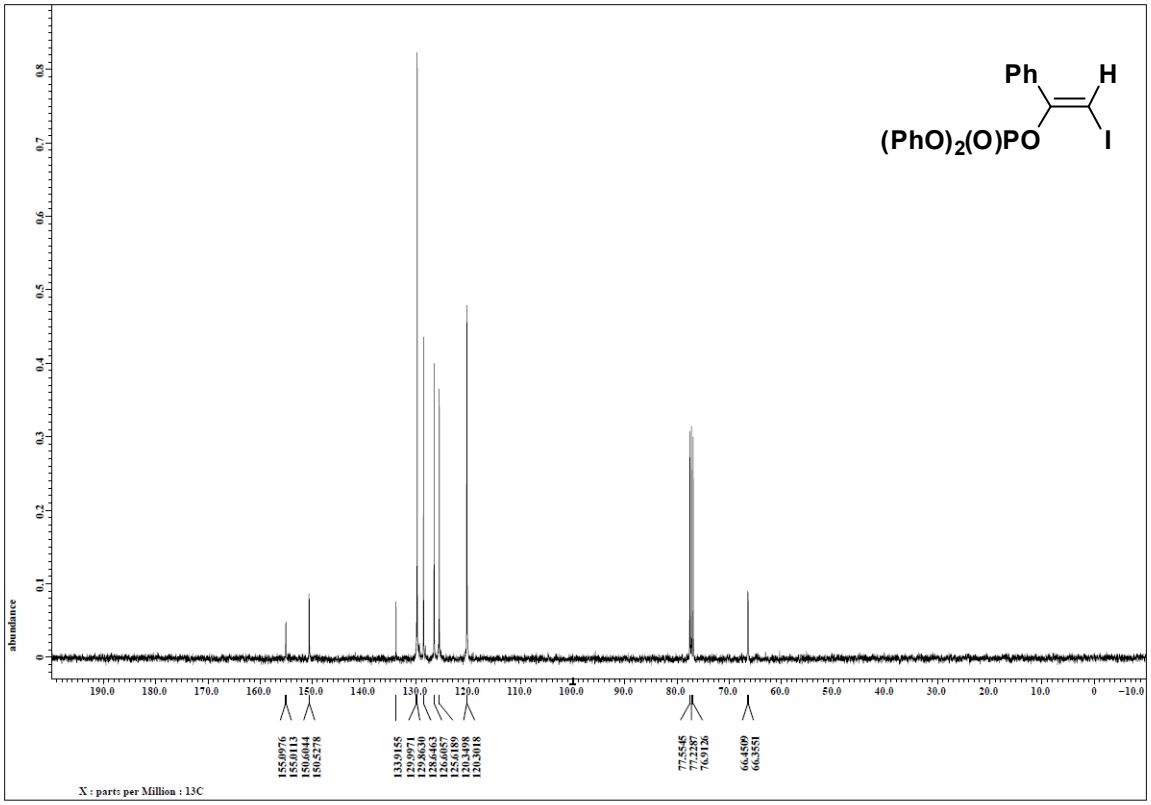

n-C4H9
H
(PhO)2(O)PO
I
abundance
10.19
1
2.01
2.09
2.05
3.01
X : parts per Million : 1H

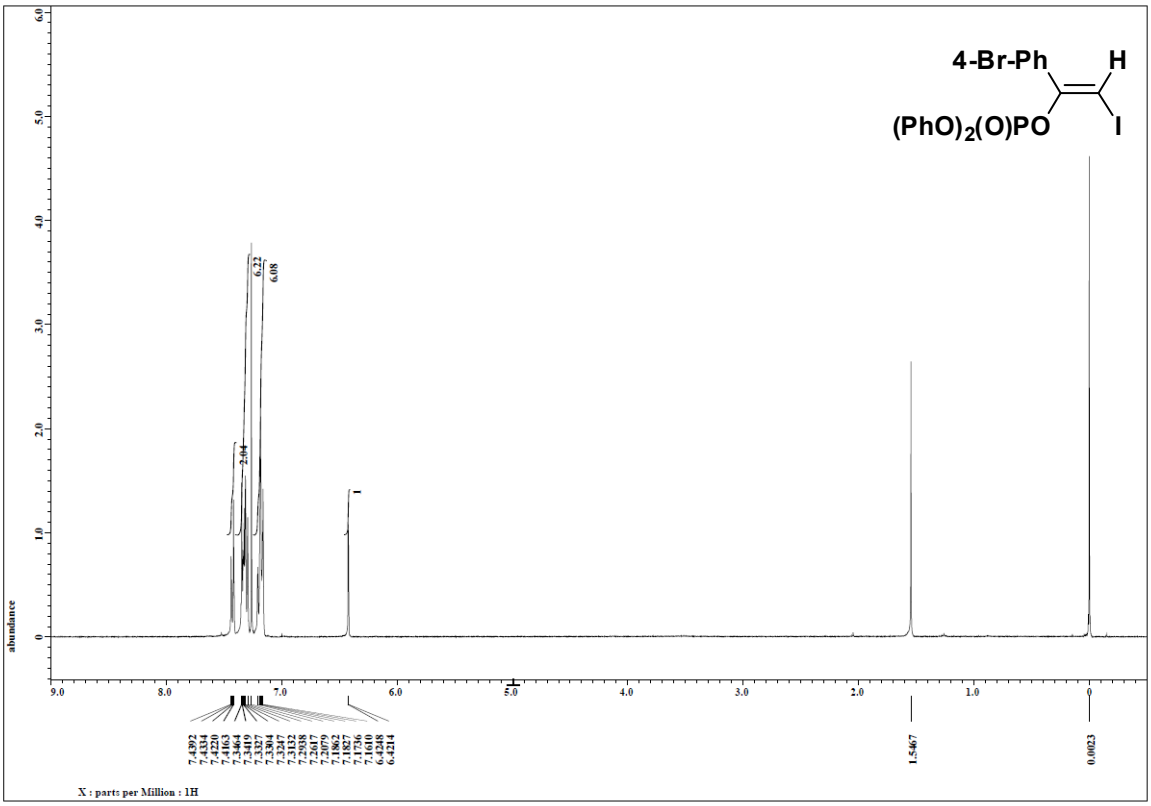

n-C4H9
H
(PhO)2(O)PO
I
abundance
X : parts per Million : 13C

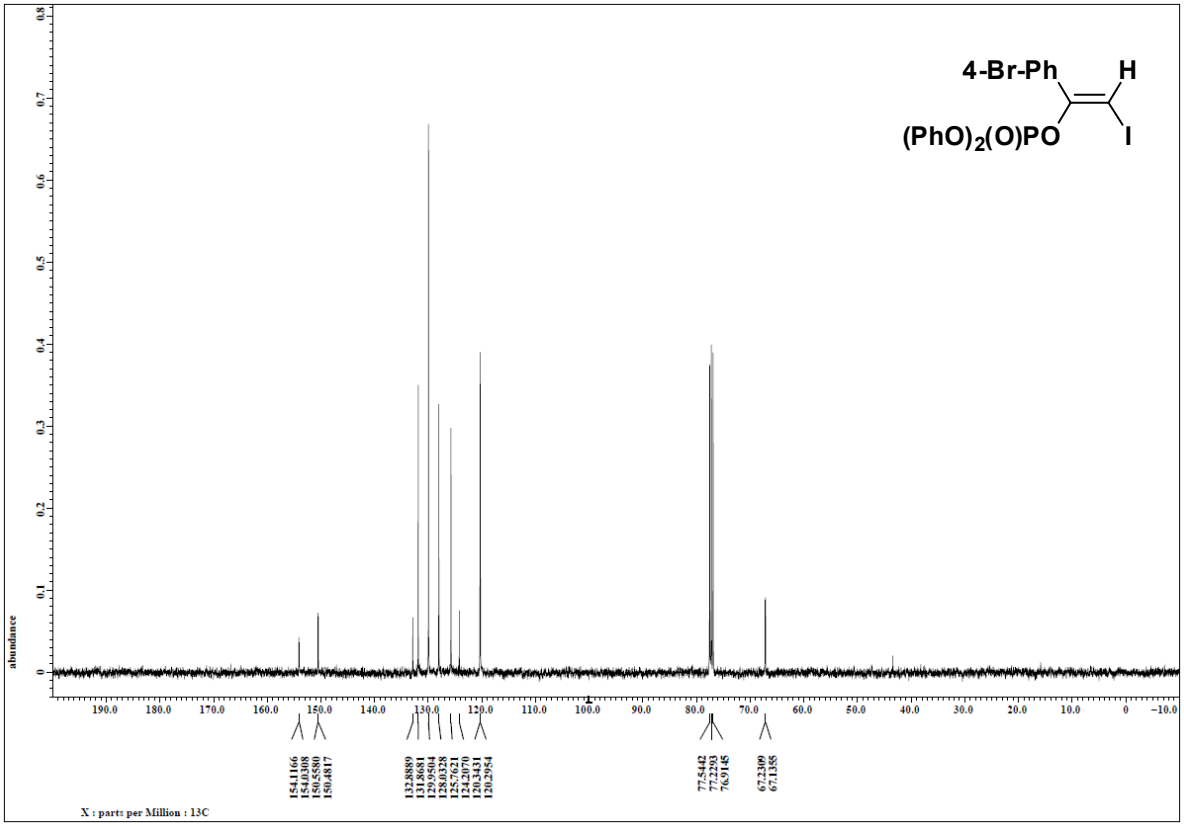

n-C6H13
H
(PhO)2(O)PO
Br
abundance
14.21
1
2.49
2.11
12.8
3.78
X : parts per Million : 1H

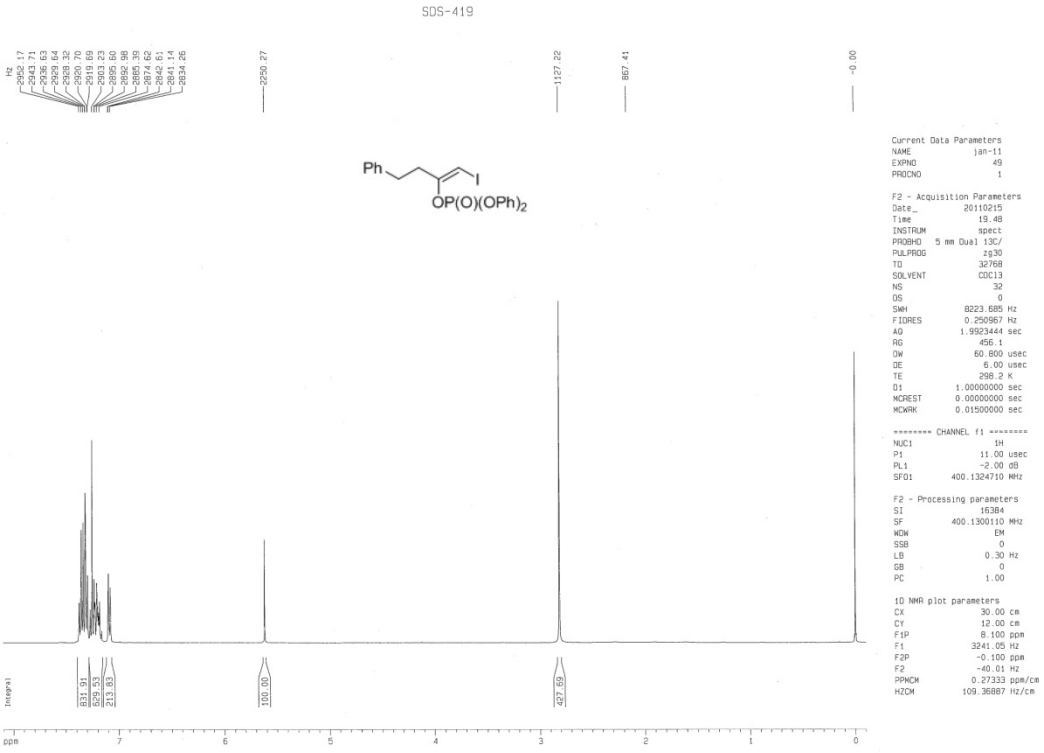

n-C6H13
H
(PhO)2(O)PO
Br
X : 13C

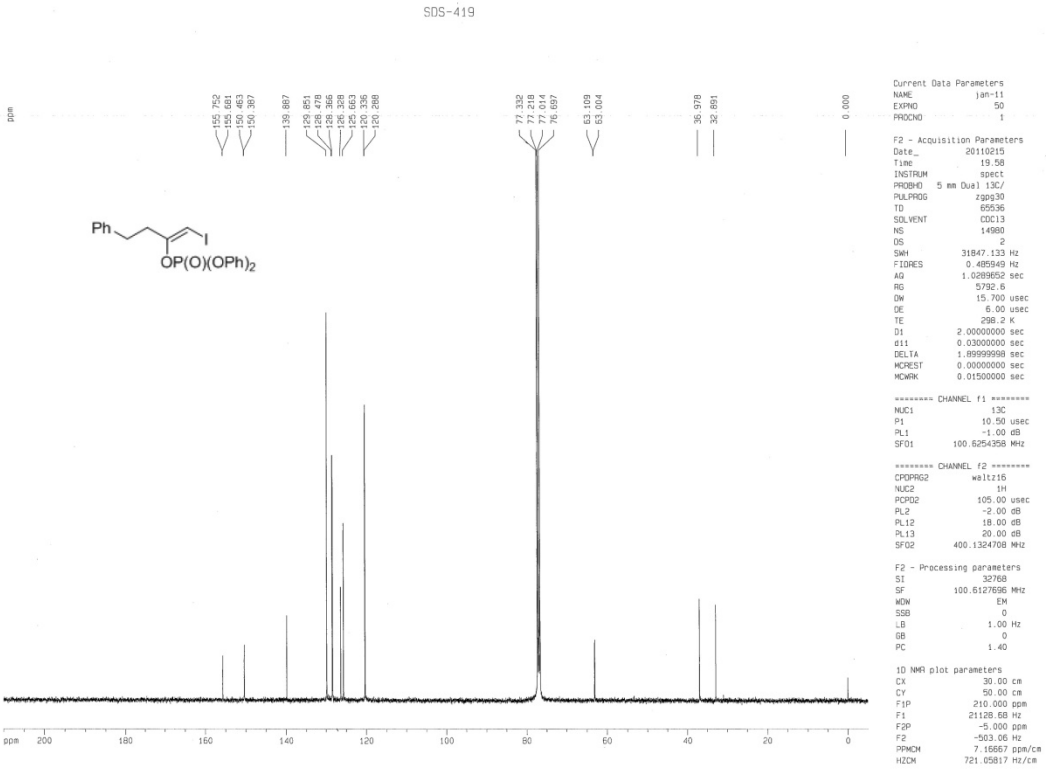

Ph
H
(PhO)2(O)PO
I
abundance
9.68
6.4
2.11
1
1.5790
-0.0060
X : parts per Million : 1H

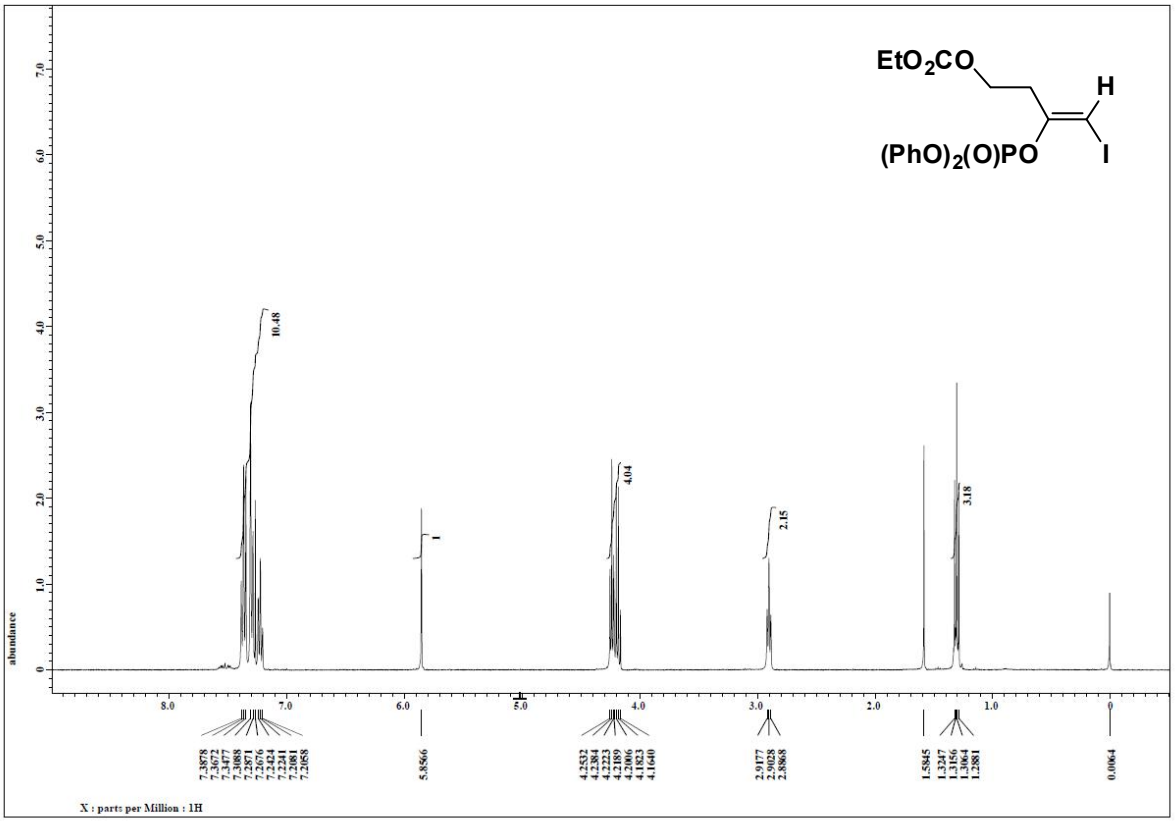

Ph
H
(PhO)2(O)PO
I
abundance
X : parts per Million : 13C

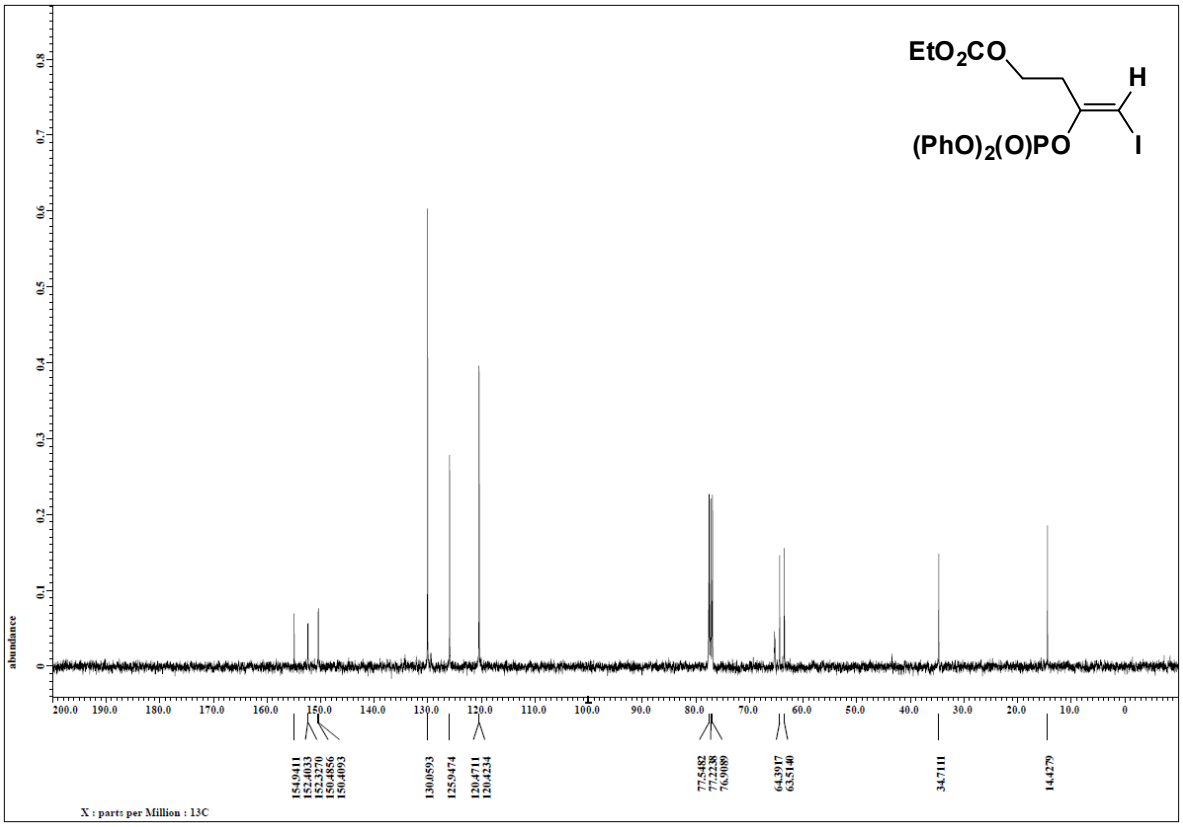

4-Br-Ph
H
(PhO)2(O)PO
I
abundance
6.22
6.08
2.04
1
1.5467
0.0023
X : parts per Million : 1H

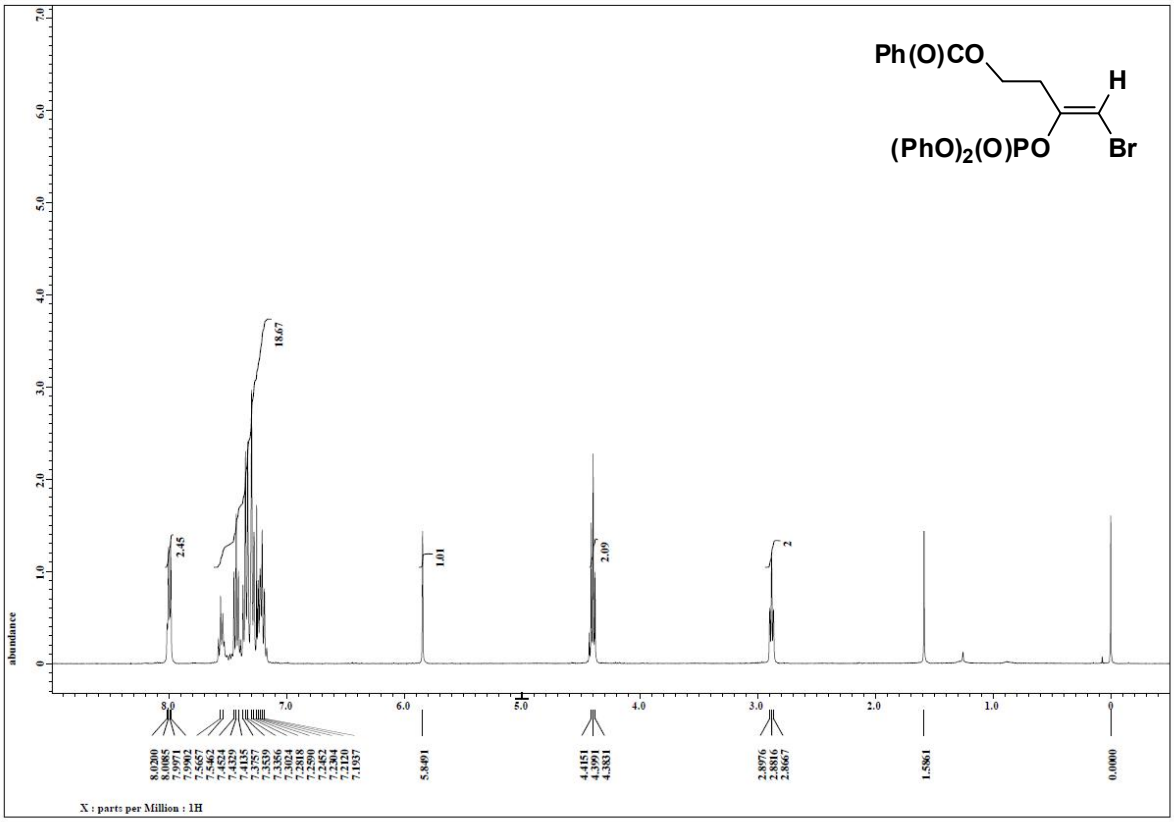

4-Br-Ph
H
(PhO)2(O)PO
I
abundance
X : parts per Million : 13C

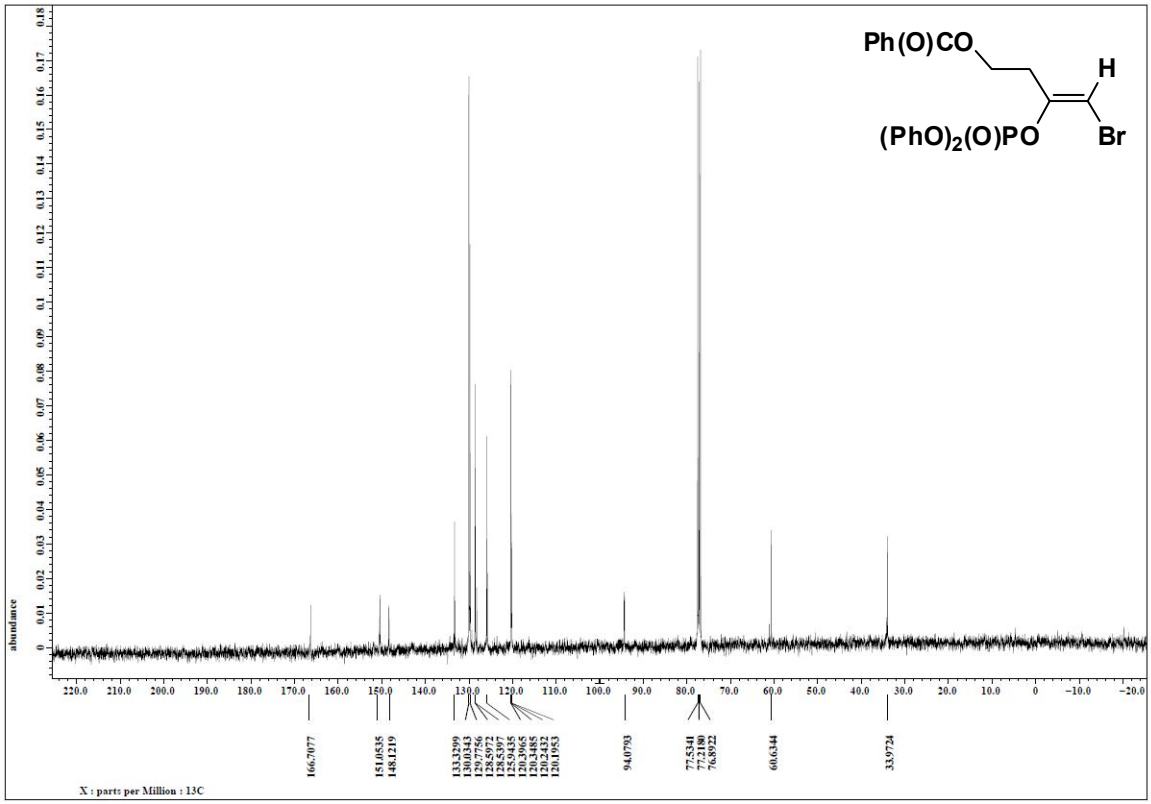

SDS-419
Ph
I
OP(O)(OPh)2
Current Data Parameters
NAME jan-11
EXPNO 49
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110215
Time 19.48
INSTRUM spect
PROBHD 5 mm Dual 13C/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 32
DS 0
SWH 8223.685 Hz
FIDRES 0.250967 Hz
AQ 1.9923444 sec
RG 456.1
DW 60.800 usec
DE 6.00 usec
TE 298.2 K
D1 1.00000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 11.00 usec
PL1 -2.00 dB
SFO1 400.1324710 MHz
F2 - Processing parameters
SI 16384
SF 400.1300110 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 30.00 cm
CY 12.00 cm
F1P 8.100 ppm
F1 3241.05 Hz
F2P -0.100 ppm
F2 -40.01 Hz
PPMCM 0.27333 ppm/cm
HZCM 109.36887 Hz/cm

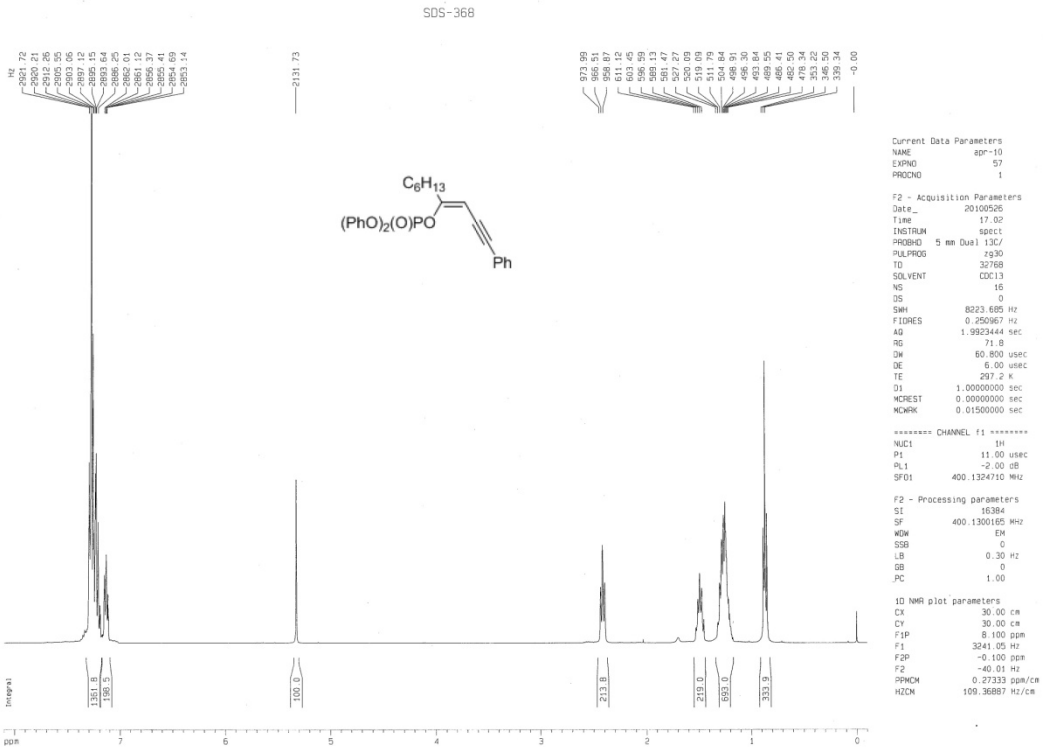

SDS-419
Ph
I
OP(O)(OPh)2
Current Data Parameters
NAME jan-11
EXPNO 50
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110215
Time 19.58
INSTRUM spect
PROBHD 5 mm Dual 13C/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 14980
DS 2
SWH 31847.133 Hz
FIDRES 0.485949 Hz
AQ 1.0289852 sec
RG 5792.6
DW 15.700 usec
DE 6.00 usec
TE 298.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 10.50 usec
PL1 -1.00 dB
SFO1 100.6254358 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 105.00 usec
PL2 -2.00 dB
PL12 18.00 dB
PL13 20.00 dB
SFO2 400.1324708 MHz
F2 - Processing parameters
SI 32768
SF 100.6127696 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
1D NMR plot parameters
CX 30.00 cm
CY 50.00 cm
F1P 210.000 ppm
F1 21128.68 Hz
F2P -5.000 ppm
F2 -503.06 Hz
PPMCM 7.16667 ppm/cm
HZCM 721.05817 Hz/cm

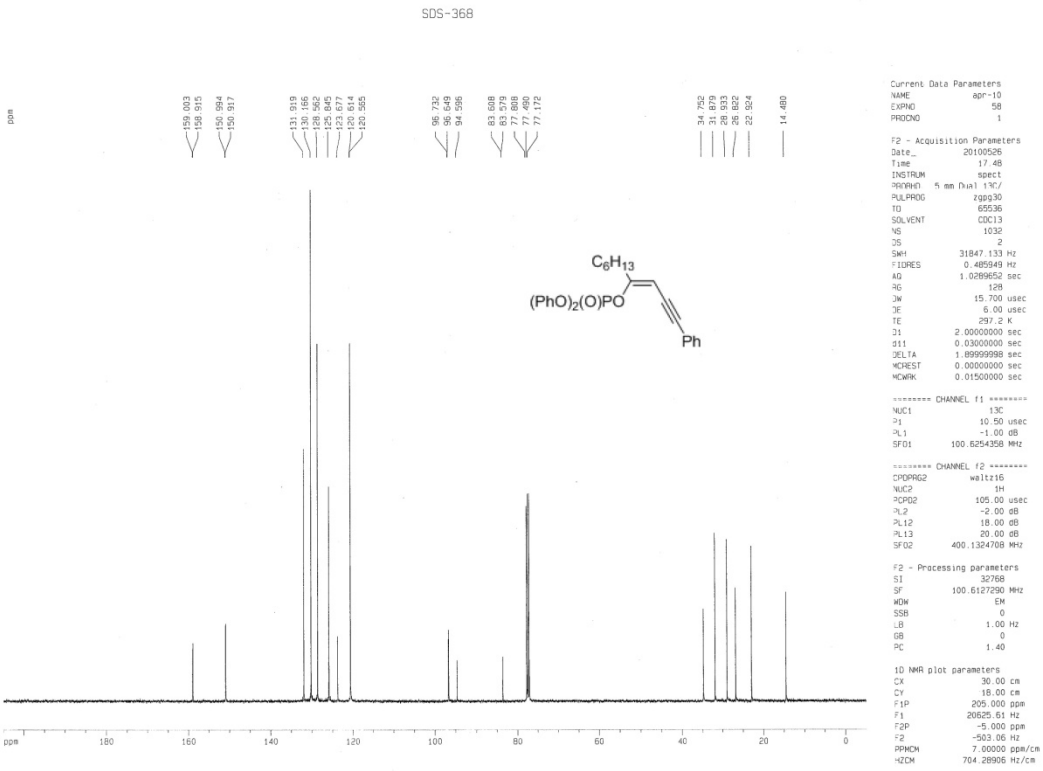

EtO2CO
H
(PhO)2(O)PO
I
abundance
10.48
1
4.04
2.15
3.18
X : parts per Million : 1H

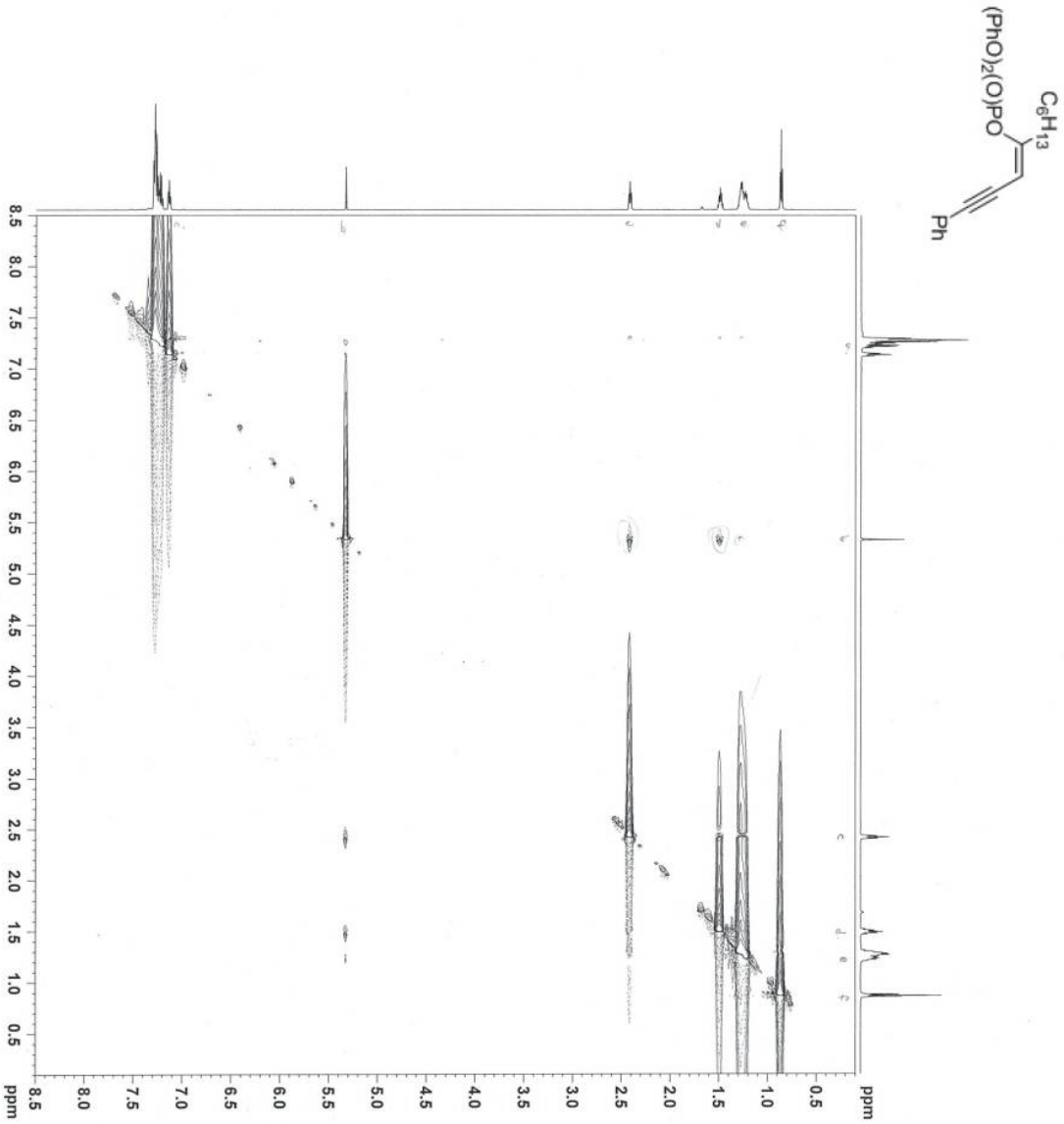

EtO2CO
H
(PhO)2(O)PO
I
abundance
X : parts per Million : 13C

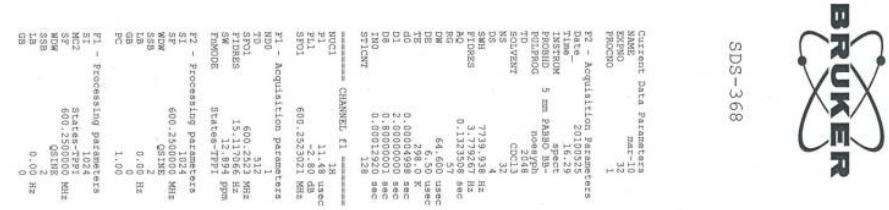

Ph(O)CO
H
(PhO)2(O)PO
Br
abundance
18.67
2.45
1.01
2.09
2
X : parts per Million : 1H

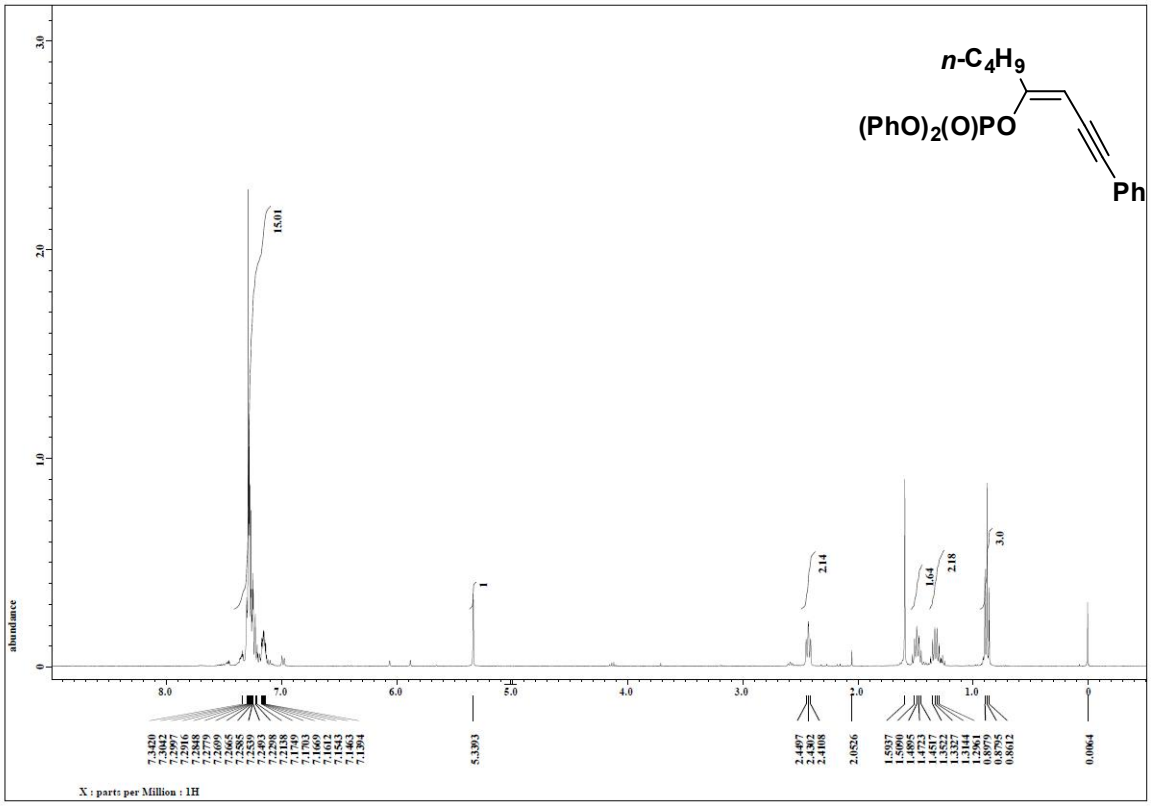

Ph(O)CO
H
(PhO)2(O)PO
Br
abundance
X : parts per Million : 13C

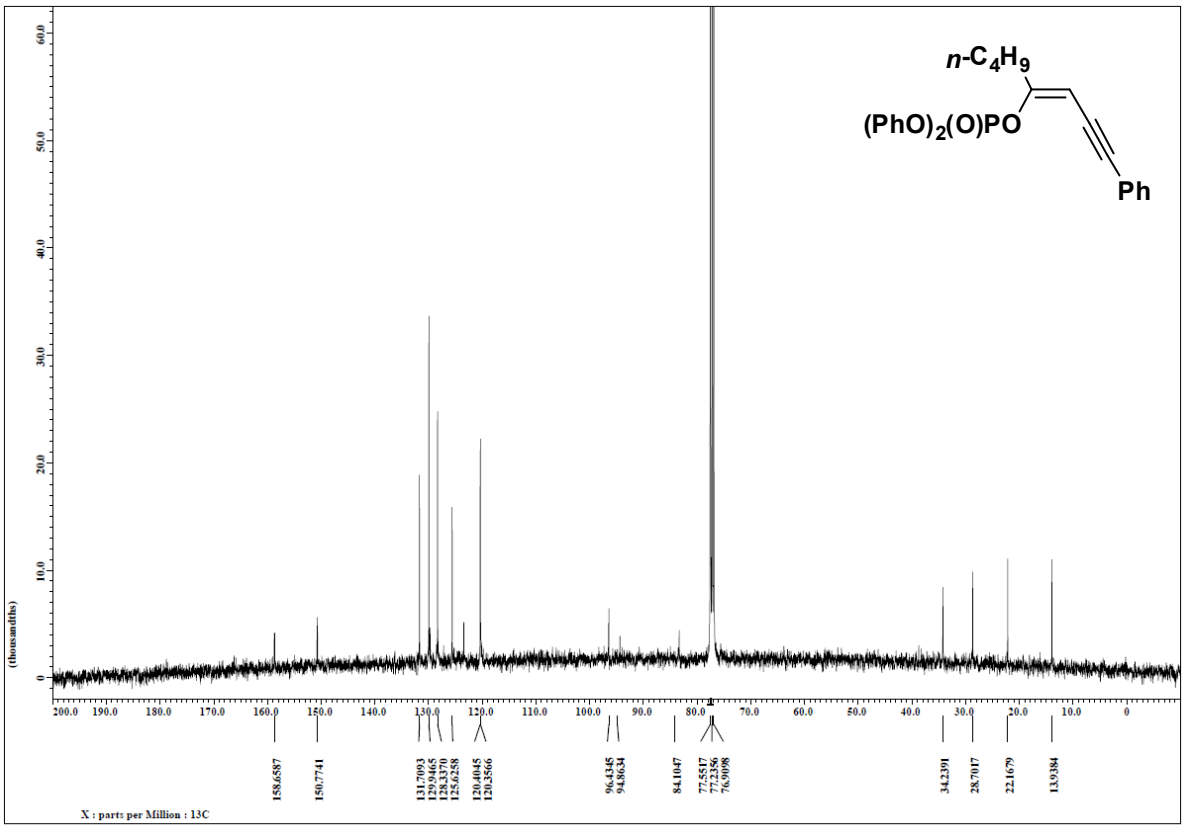

SDS-368
C_6H_{13}
$(PhO)_2(O)PO$
Ph
Integral
ppm

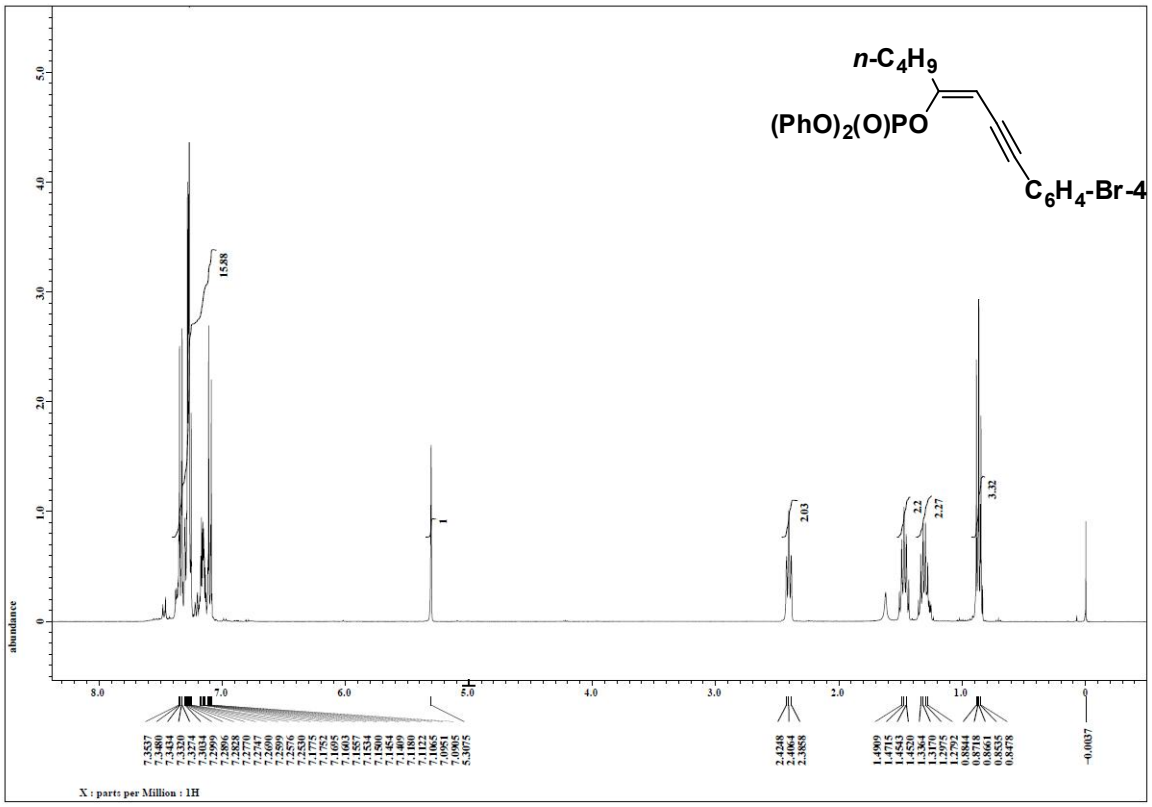

SDS-368
C_6H_{13}
$(PhO)_2(O)PO$
Ph
ppm

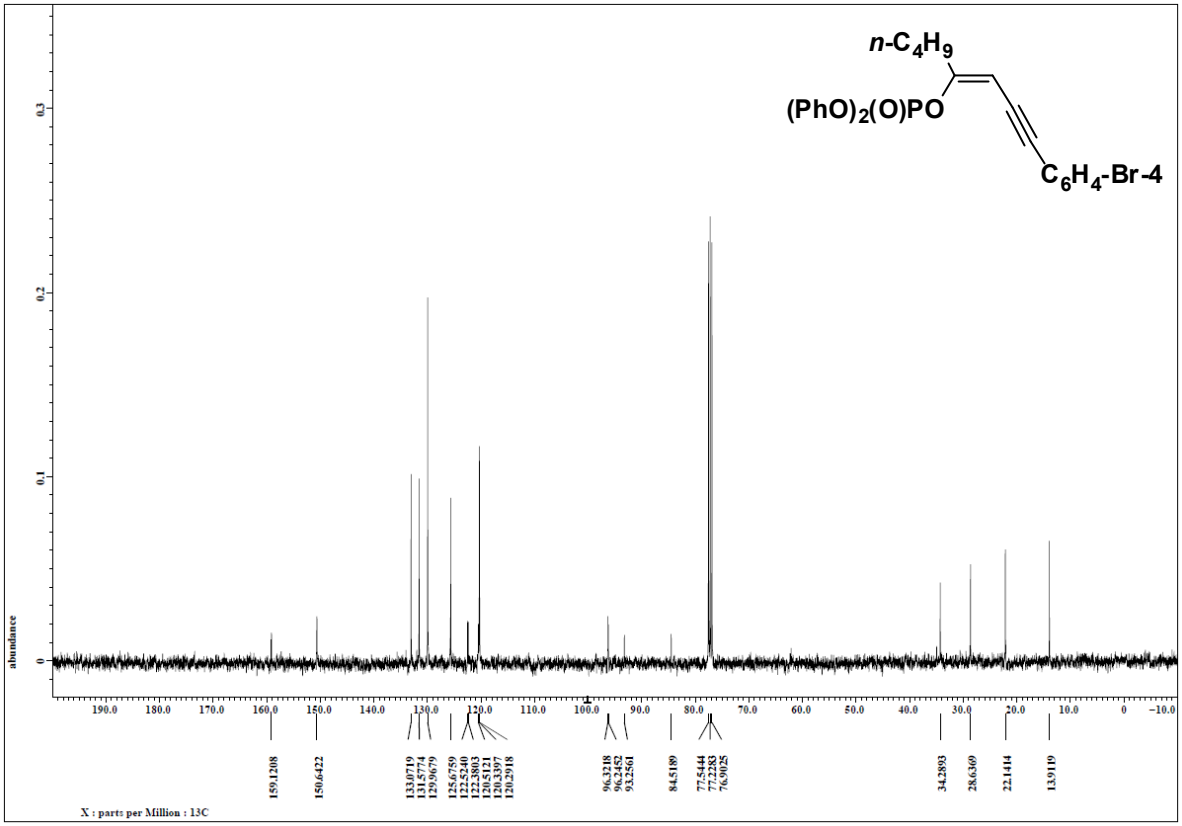

(PhO)2(O)PO
C6H13
Ph
ppm
ppm

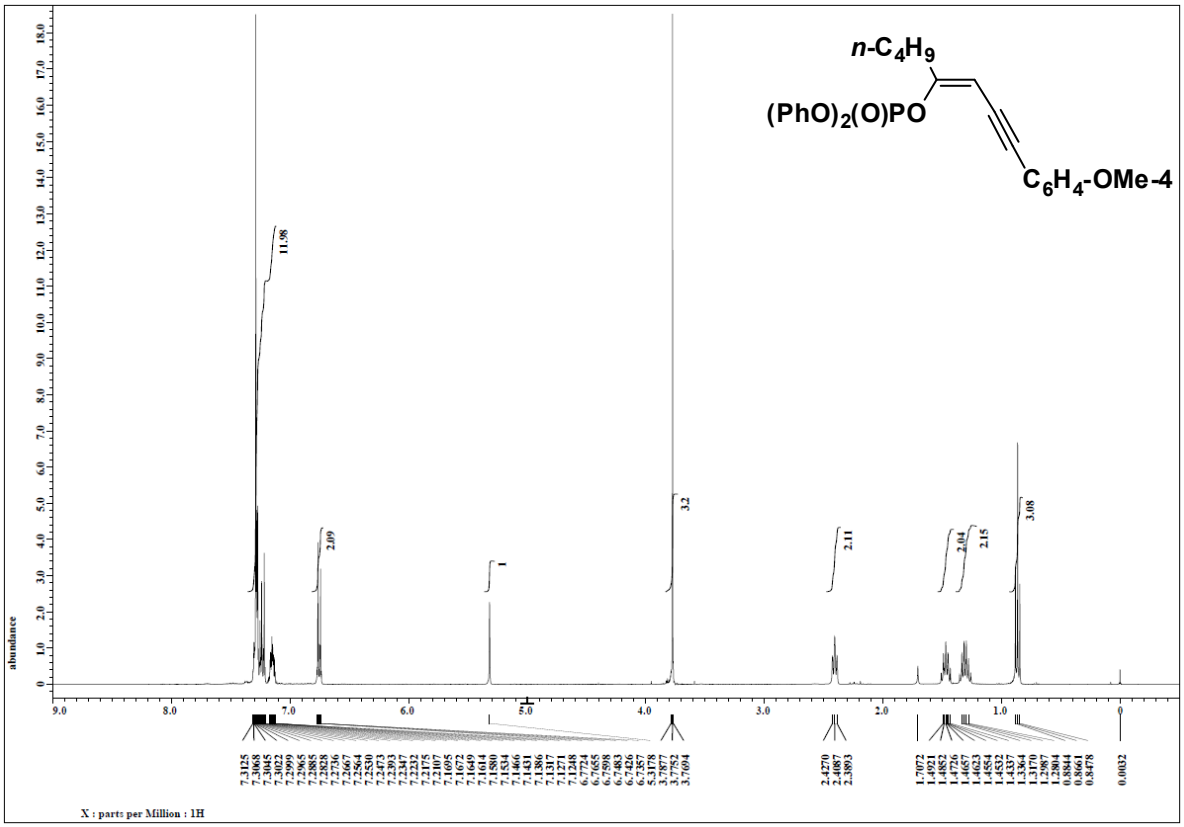

SDS-368

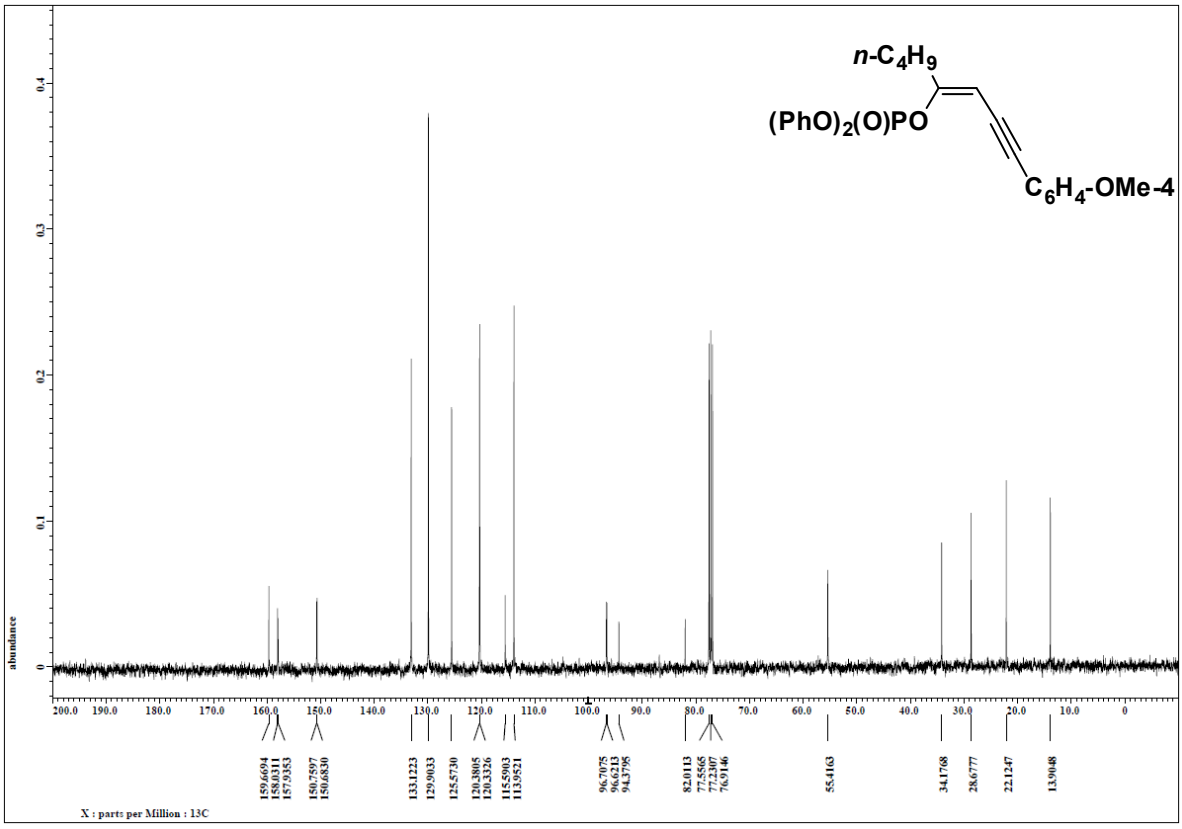

n-C4H9
(PhO)2(O)PO
Ph
abundance
15.01
1
2.14
1.64
2.18
3.0
X : parts per Million : 1H

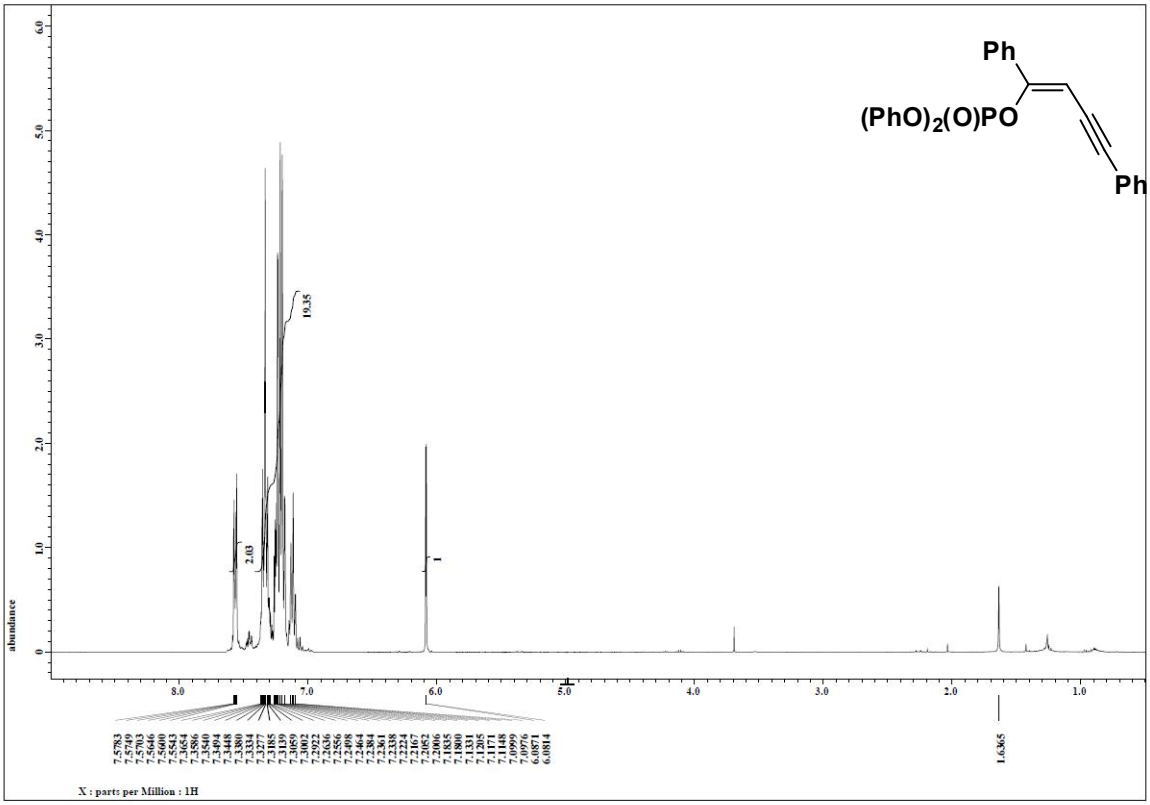

n-C4H9
(PhO)2(O)PO
Ph
(thousandths)
X : parts per Million : 13C

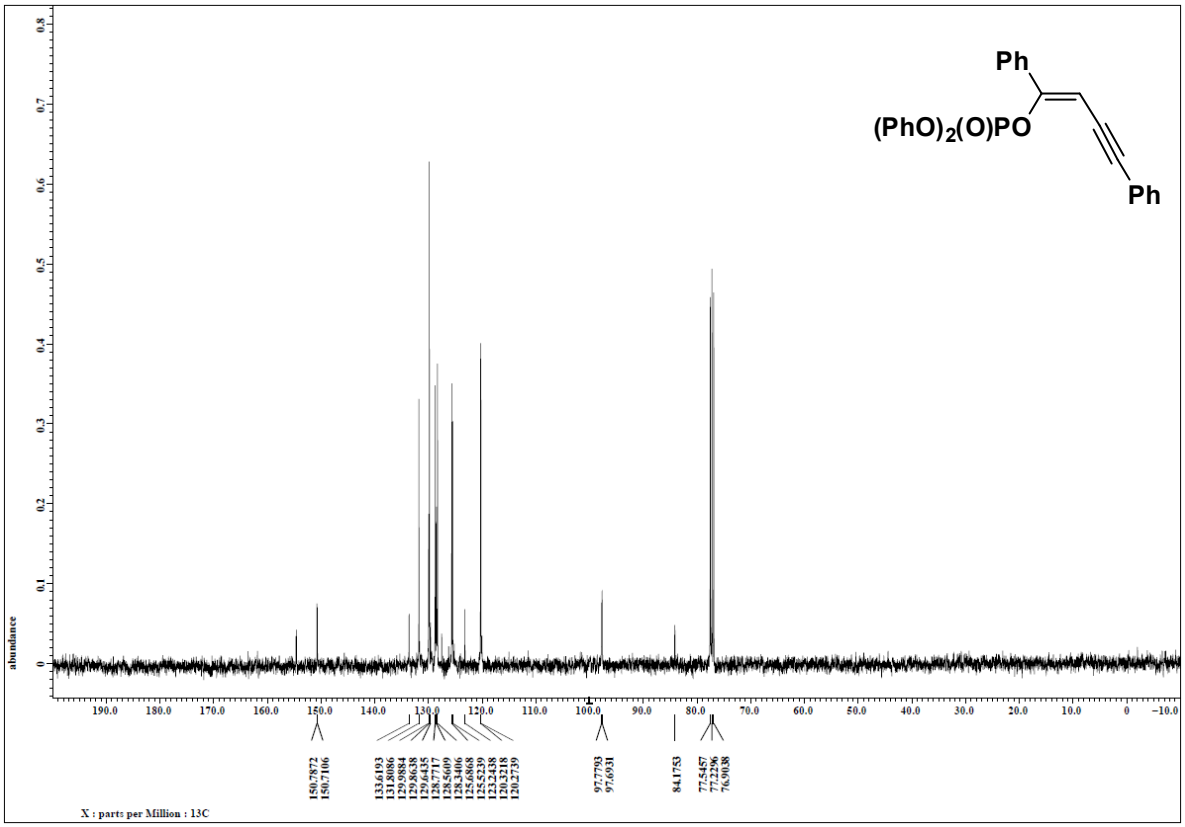

n-C4H9
(PhO)2(O)PO
C6H4-Br-4
abundance
X : parts per Million : 1H

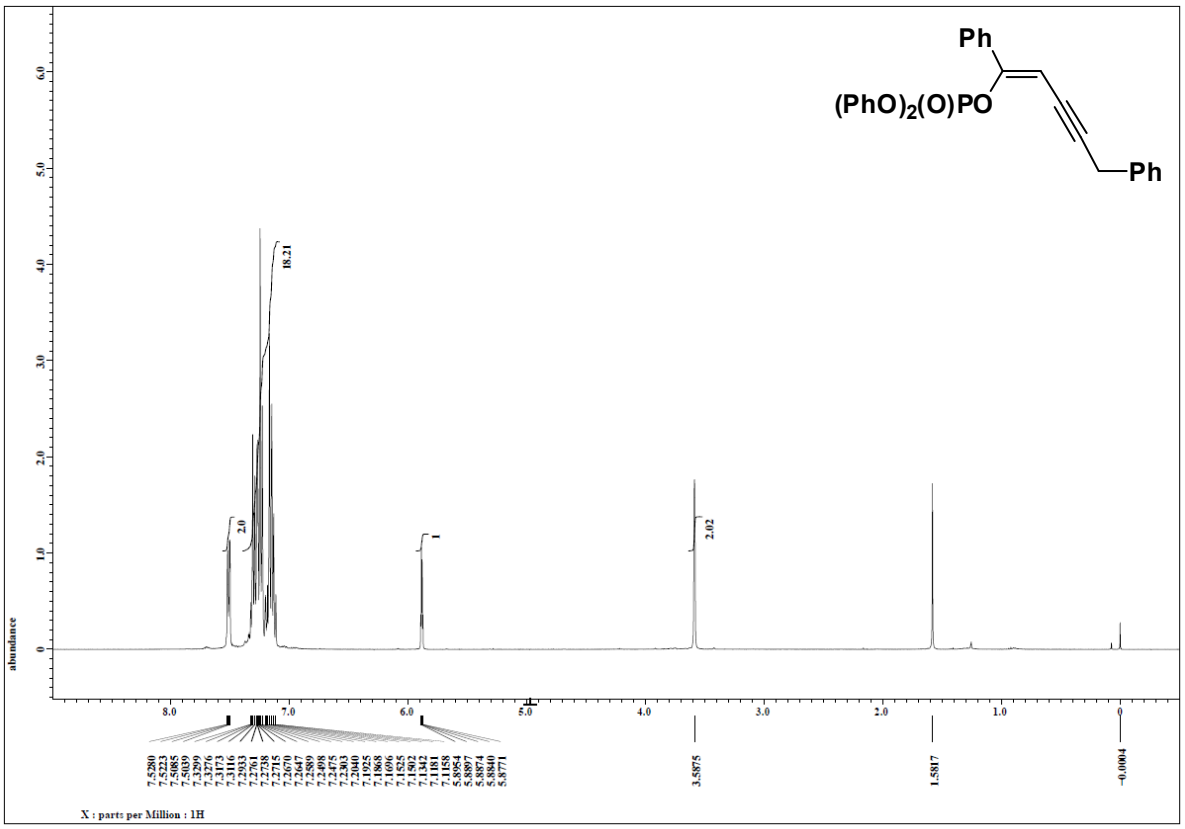

n-C4H9
(PhO)2(O)PO
C6H4-Br-4
abundance
X : parts per Million : 13C

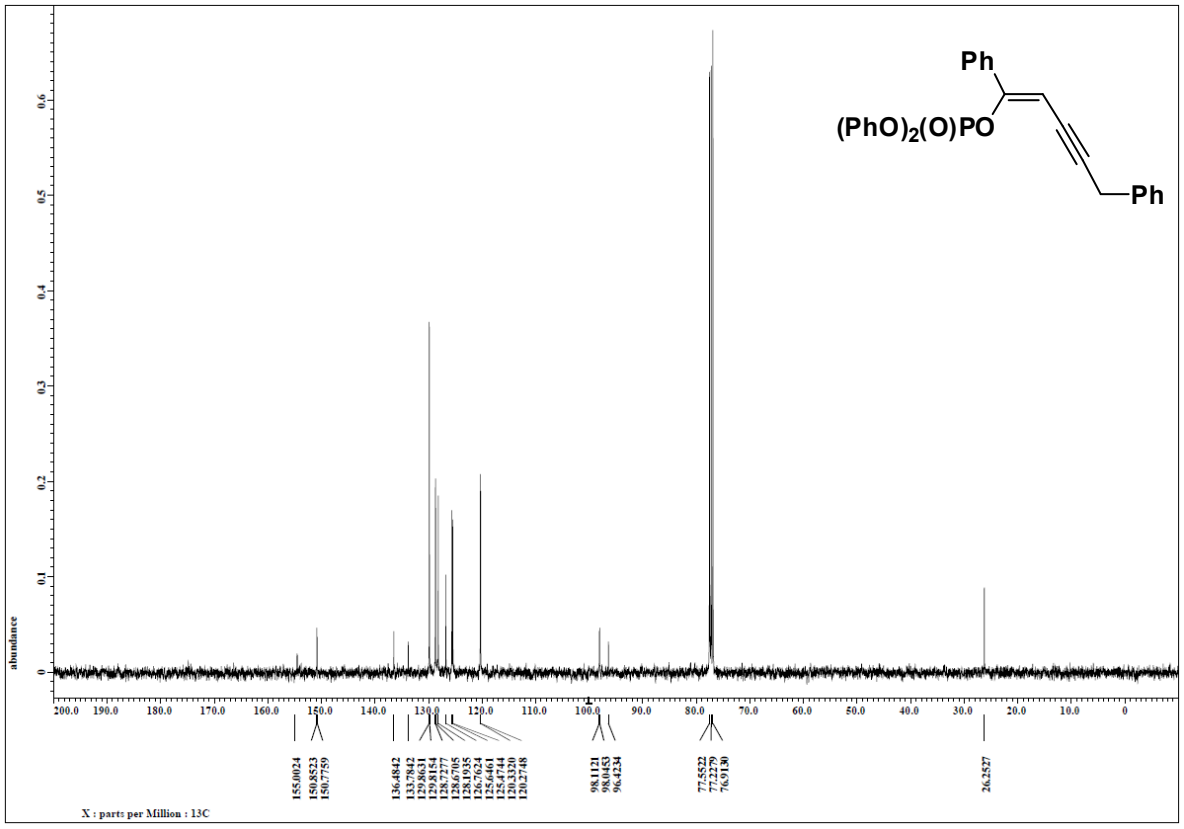

n-C4H9
(PhO)2(O)PO
C6H4-OMe-4
abundance
11.98
2.09
1
3.2
2.11
2.04
2.15
3.08
X : parts per Million : 1H

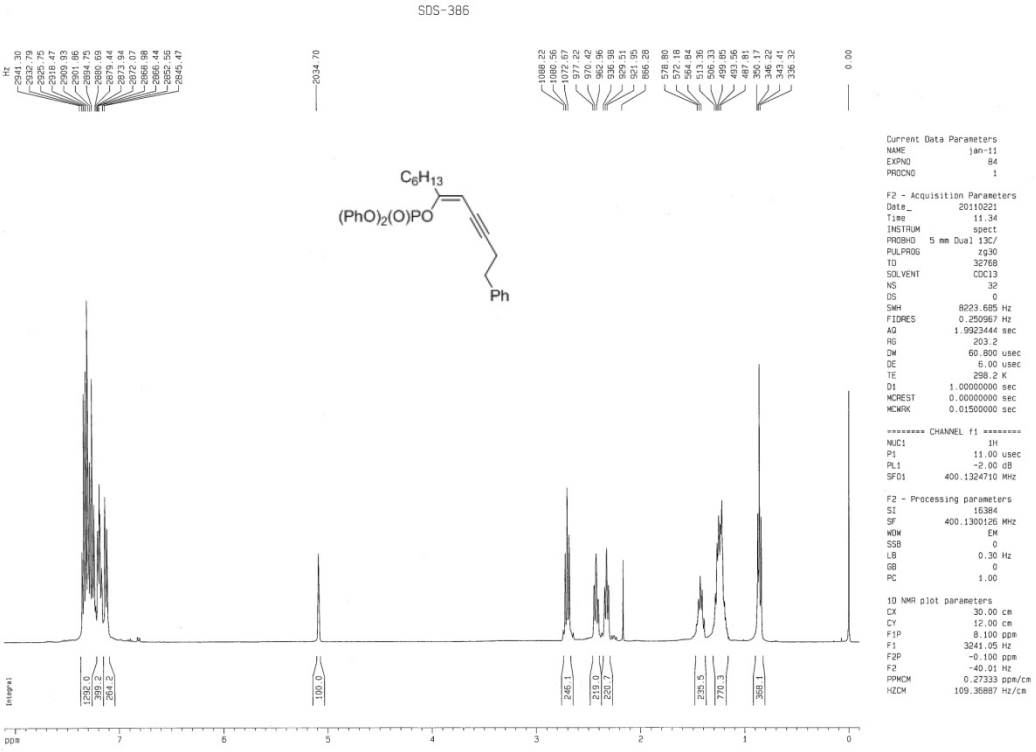

n-C4H9
(PhO)2(O)PO
C6H4-OMe-4
abundance
X : parts per Million : 13C

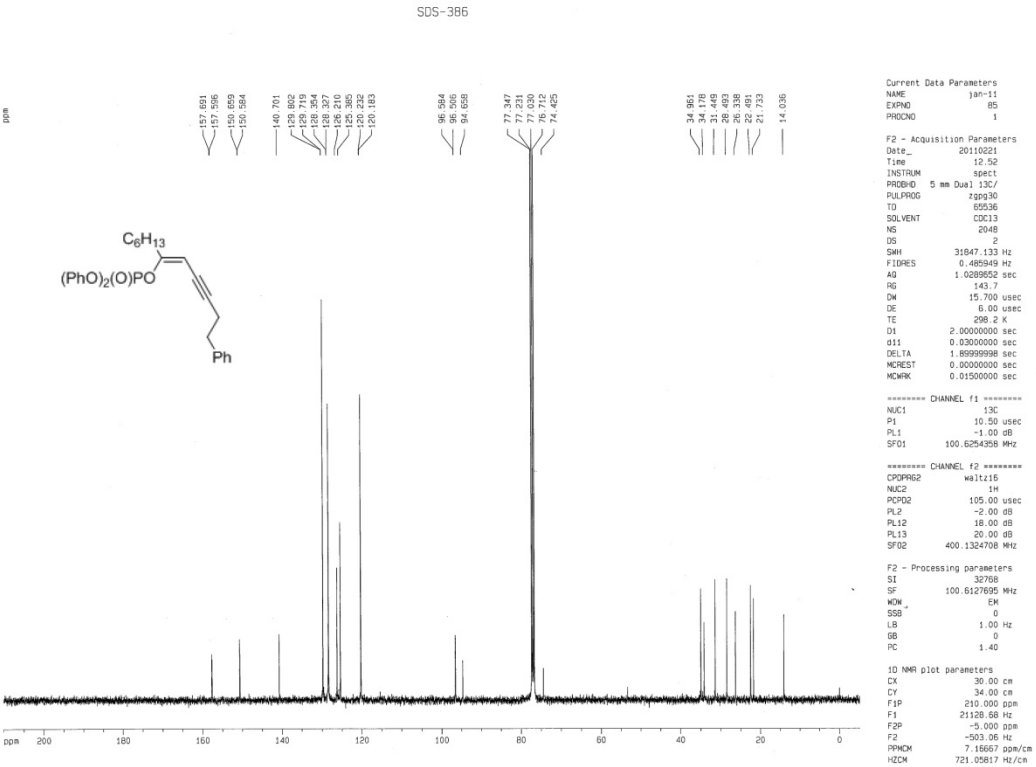

Ph
(PhO)2(O)PO
Ph
abundance
19.35
2.03
1
1.6365
X : parts per Million : 1H

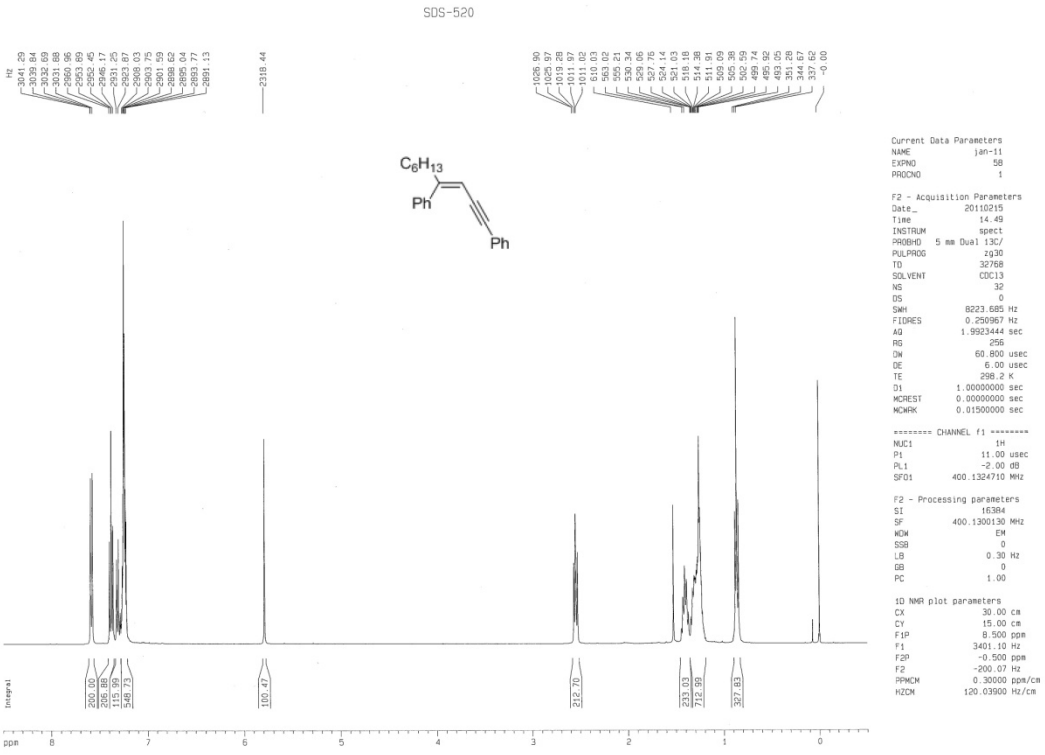

Ph
(PhO)2(O)PO
Ph
abundance
X : parts per Million : 13C

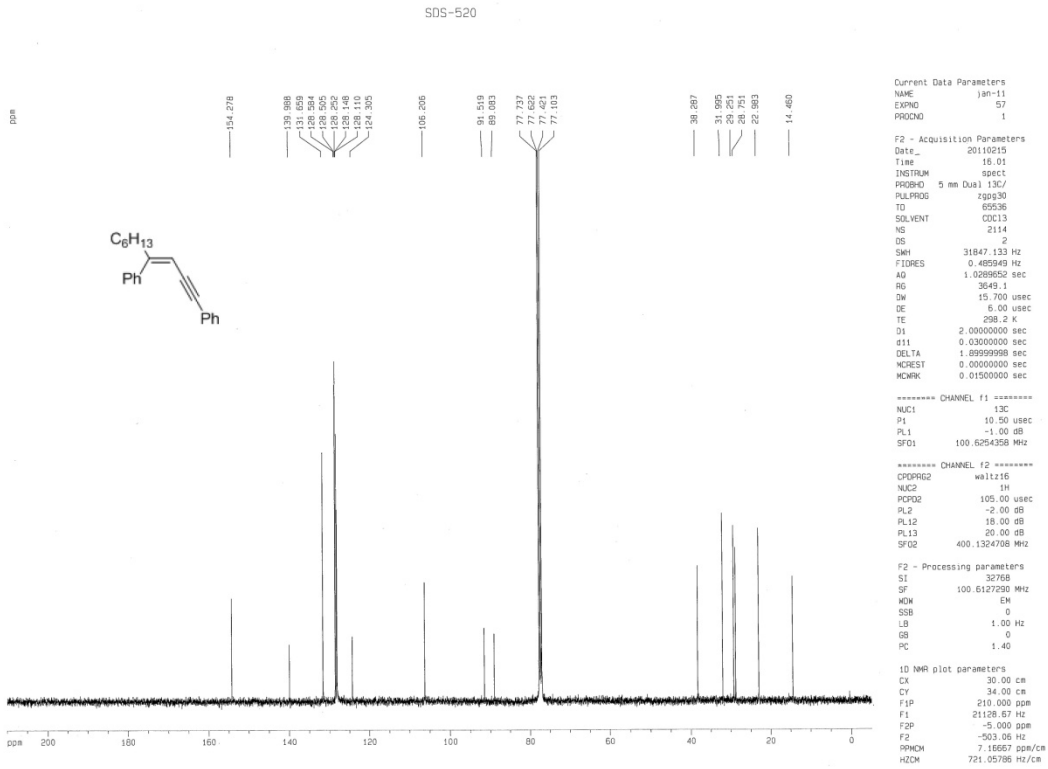

Ph
(PhO)2(O)PO
Ph
abundance
18.21
2.0
1
2.02
3.5875
1.5817
-0.0004
X : parts per Million : 1H

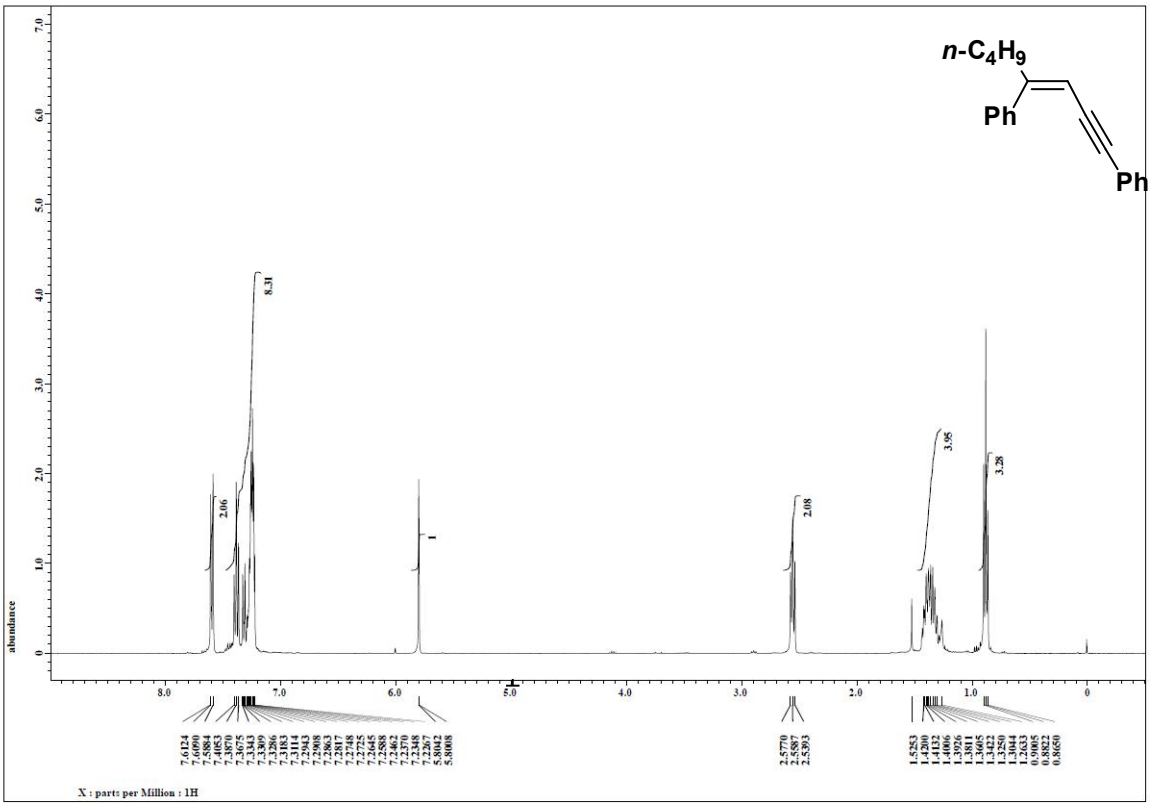

Ph
(PhO)2(O)PO
Ph
abundance
X : parts per Million : 13C

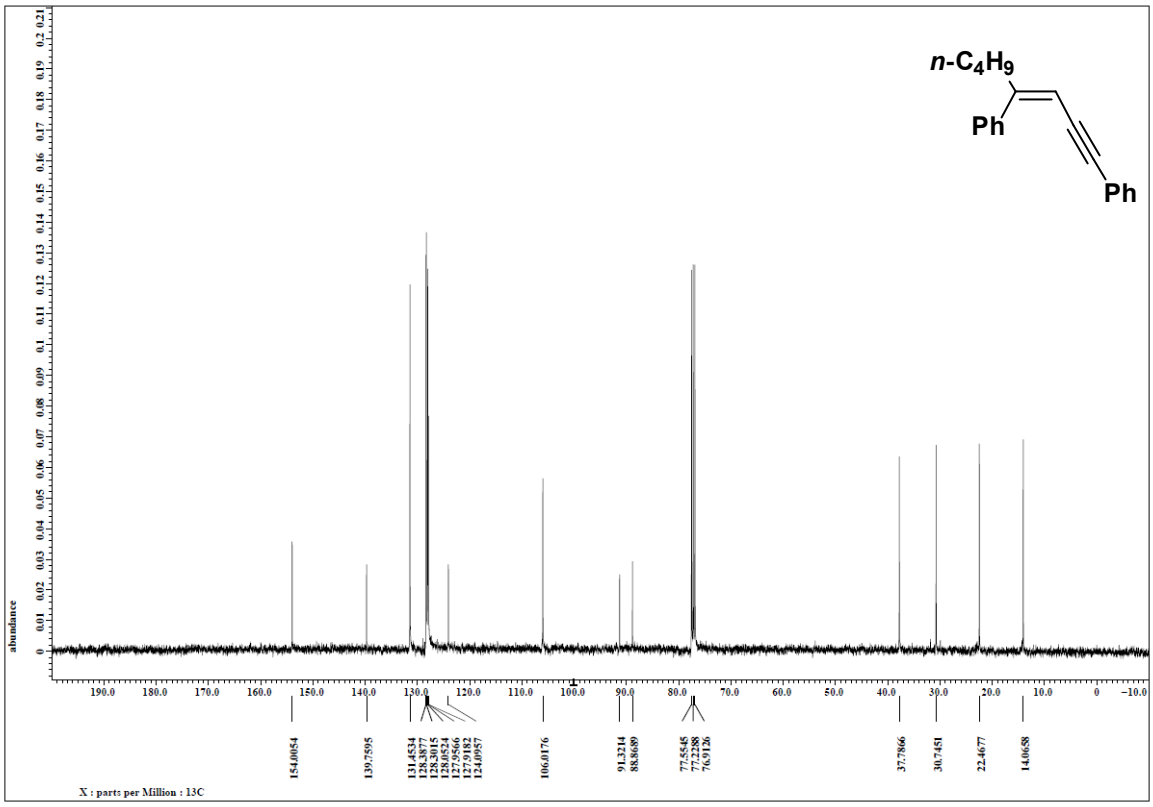

SDS-386
C_6H_{13}
$(PhO)_2(O)PO$
Ph
ppm

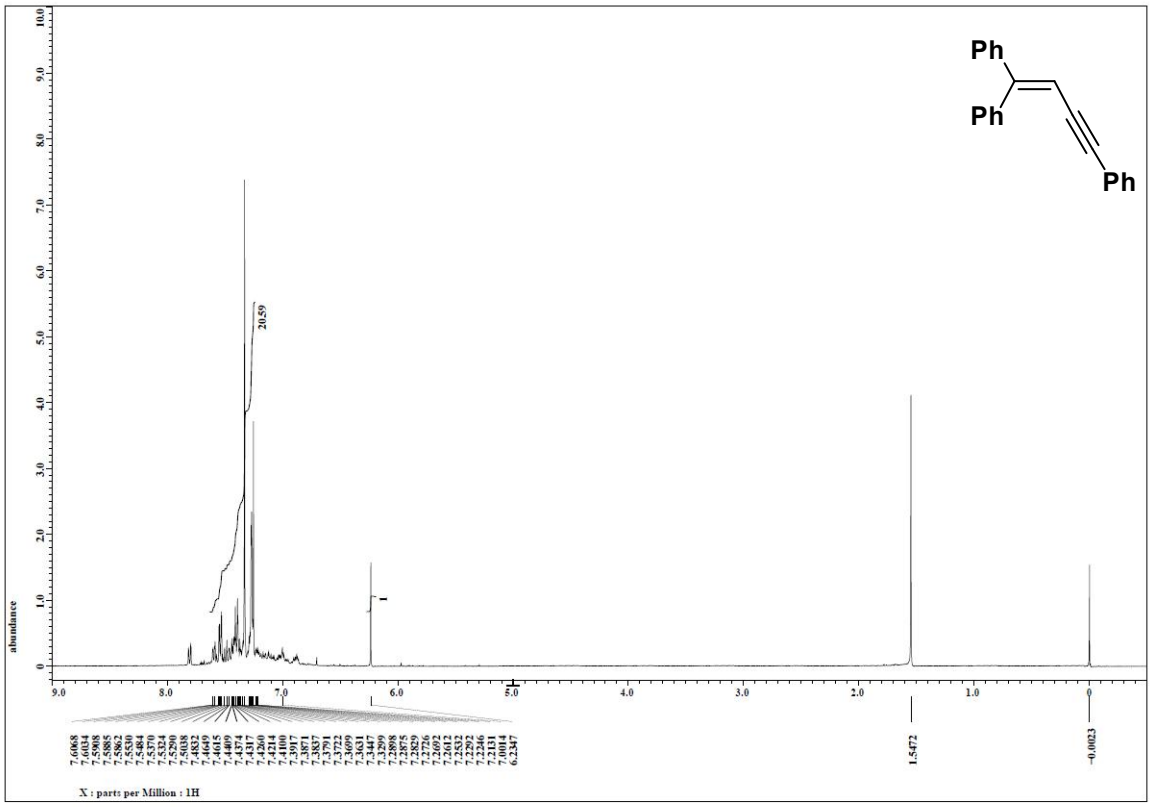

SDS-386
C_6H_{13}
$(PhO)_2(O)PO$
Ph
ppm

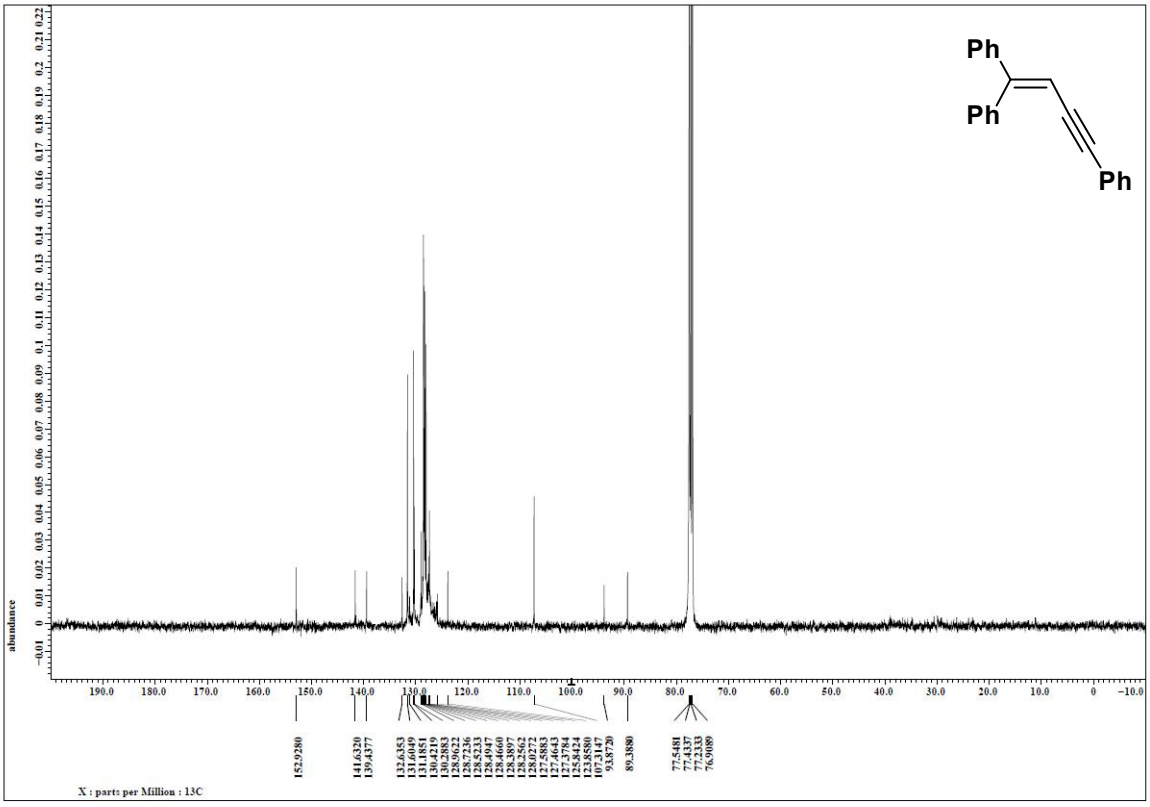

SDS-520
Hz
3041.29
3039.84
3032.69
3031.88
2960.96
2953.89
2952.45
2946.17
2933.67
2928.67
2900.03
2903.75
2901.59
2898.62
2895.44
2883.77
2891.13
2318.44
1025.90
1025.97
1013.28
1011.97
1011.02
610.03
563.02
559.71
530.54
529.66
527.76
524.14
521.03
516.18
514.38
511.91
509.09
505.38
501.59
498.74
495.92
493.05
351.28
344.67
337.52
-0.00
C6H13
Ph
Ph
Current Data Parameters
NAME jan-11
EXPNO 58
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110215
Time 14.49
INSTRUM spect
PROBHD 5 mm Dual 13C/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 32
DS 0
SWH 8223.685 Hz
FIDRES 0.250967 Hz
AQ 1.9923444 sec
RG 256
DW 60.800 usec
DE 6.00 usec
TE 298.2 K
D1 1.00000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 11.00 usec
PL1 -2.00 dB
SFO1 400.1324710 MHz
F2 - Processing parameters
SI 16384
SF 400.1300130 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 30.00 cm
CY 15.00 cm
F1P 8.500 ppm
F1 3401.10 Hz
F2P -0.500 ppm
F2 -200.07 Hz
PPMCM 0.30000 ppm/cm
HZCM 120.03900 Hz/cm
Integral
200.00
206.88
115.99
148.73
100.47
212.70
233.03
72.99
327.83
ppm
8
7
6
5
4
3
2
1
0

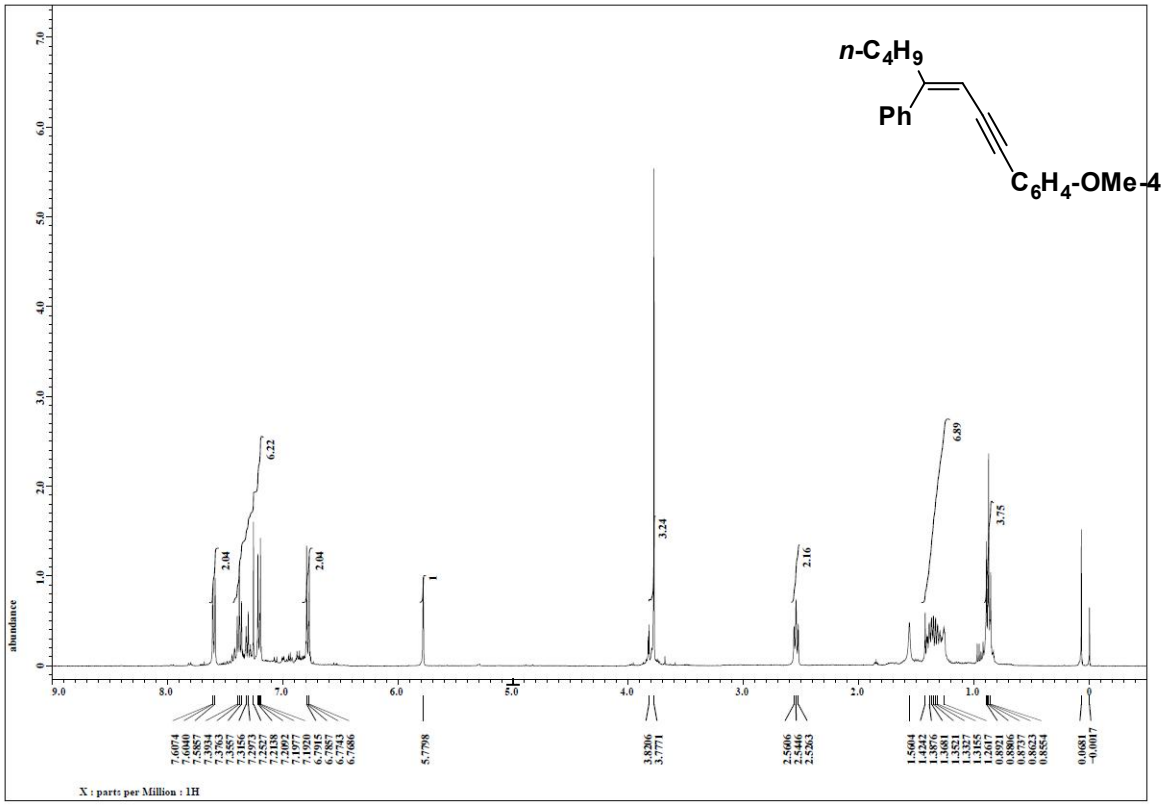

SDS-520
ppm
154.278
139.988
131.659
128.584
128.505
128.252
128.148
128.110
124.305
106.206
91.519
89.083
77.737
77.632
77.421
77.103
38.287
31.995
29.251
28.931
22.983
14.460
C6H13
Ph
Ph
Current Data Parameters
NAME jan-11
EXPNO 57
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110215
Time 16.01
INSTRUM spect
PROBHD 5 mm Dual 13C/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 2114
DS 2
SWH 31847.133 Hz
FIDRES 0.485949 Hz
AQ 1.0289652 sec
RG 3649.1
DW 15.700 usec
DE 6.00 usec
TE 298.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 10.50 usec
PL1 -1.00 dB
SFO1 100.6254358 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 105.00 usec
PL2 -2.00 dB
PL12 16.00 dB
PL13 20.00 dB
SFO2 400.1324708 MHz
F2 - Processing parameters
SI 32768
SF 100.6127290 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
1D NMR plot parameters
CX 30.00 cm
CY 34.00 cm
F1P 210.000 ppm
F1 21128.67 Hz
F2P -5.000 ppm
F2 -503.06 Hz
PPMCM 7.16667 ppm/cm
HZCM 721.05786 Hz/cm
ppm
200
180
160
140
120
100
80
60
40
20
0

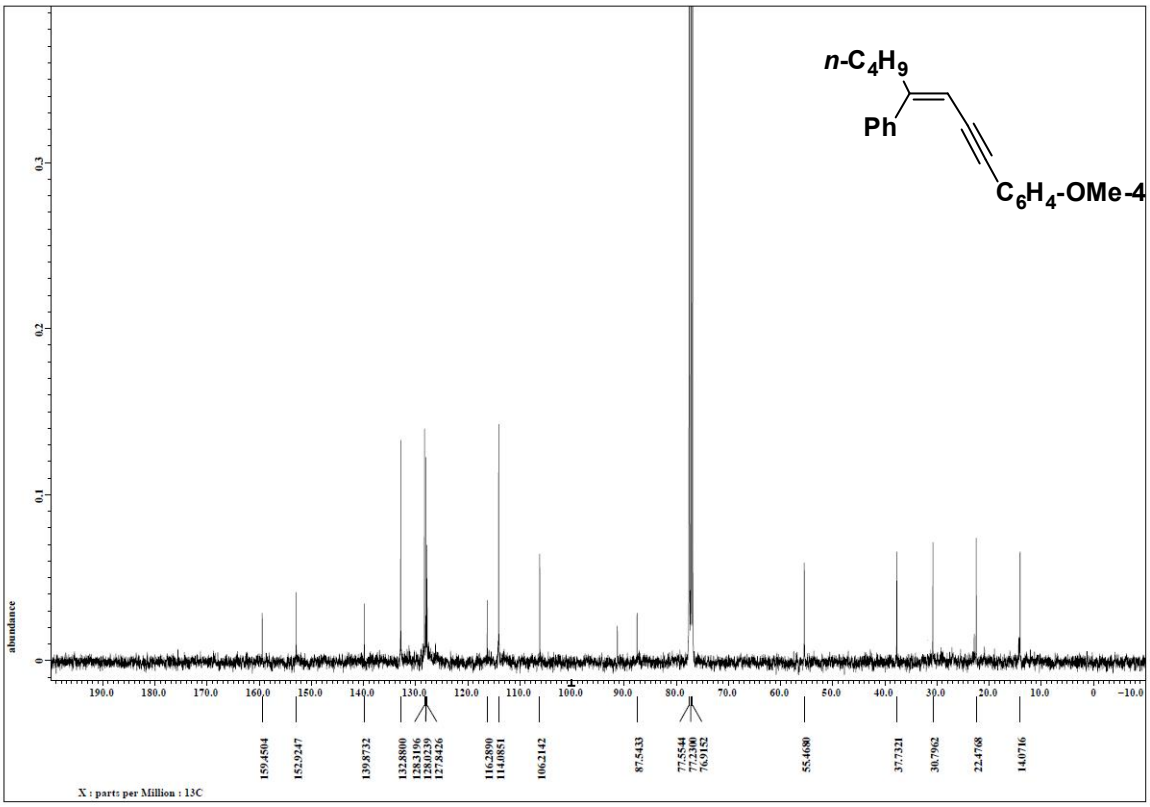

n-C4H9
Ph
Ph
abundance
X : parts per Million : 1H

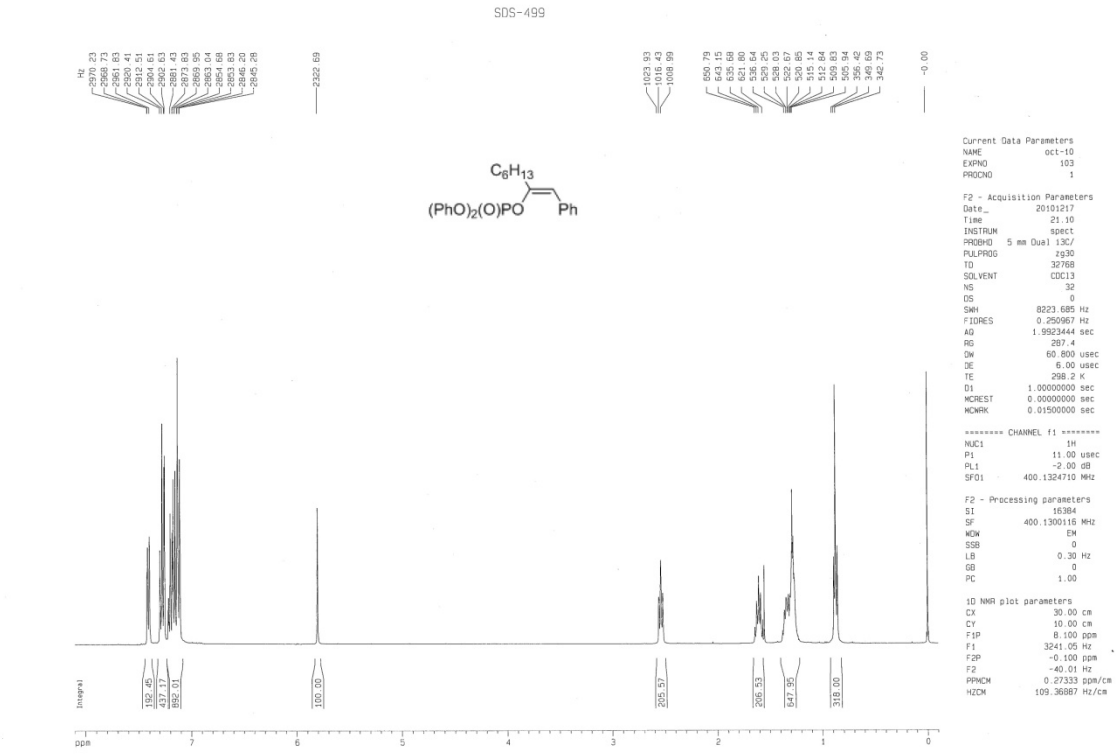

n-C4H9
Ph
Ph
abundance
X : parts per Million : 13C

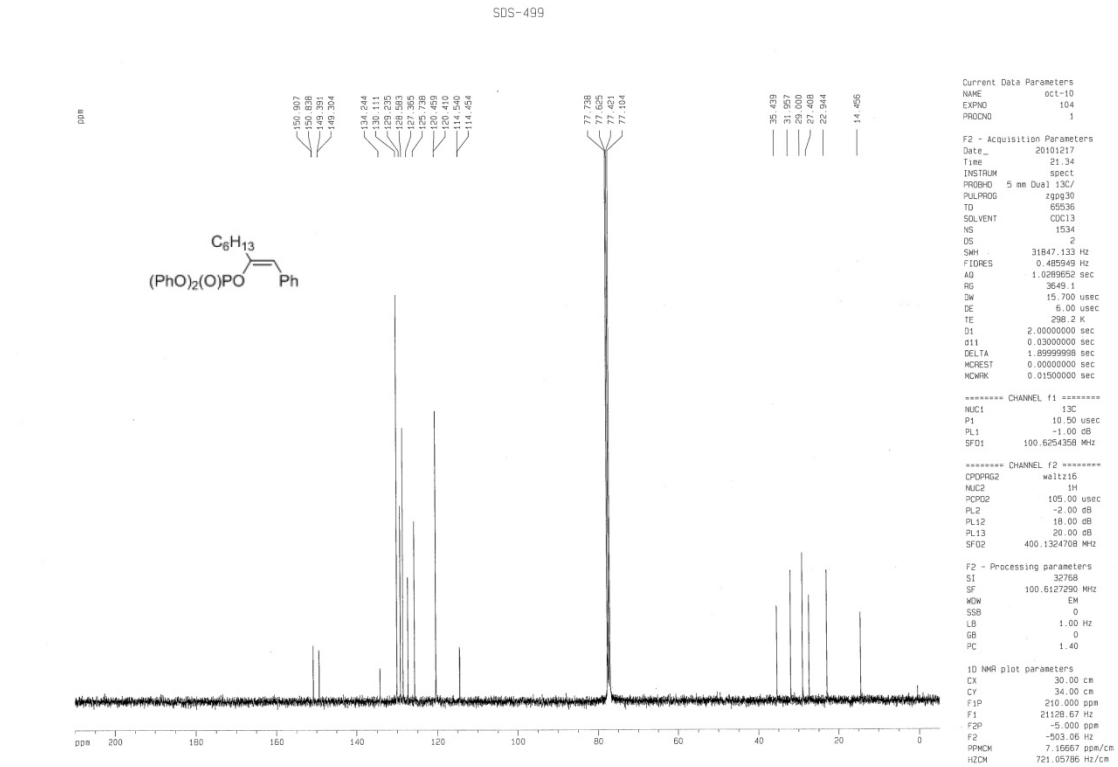

Ph
Ph
Ph
abundance
20.59
1.5472
-0.0023
X : parts per Million : 1H

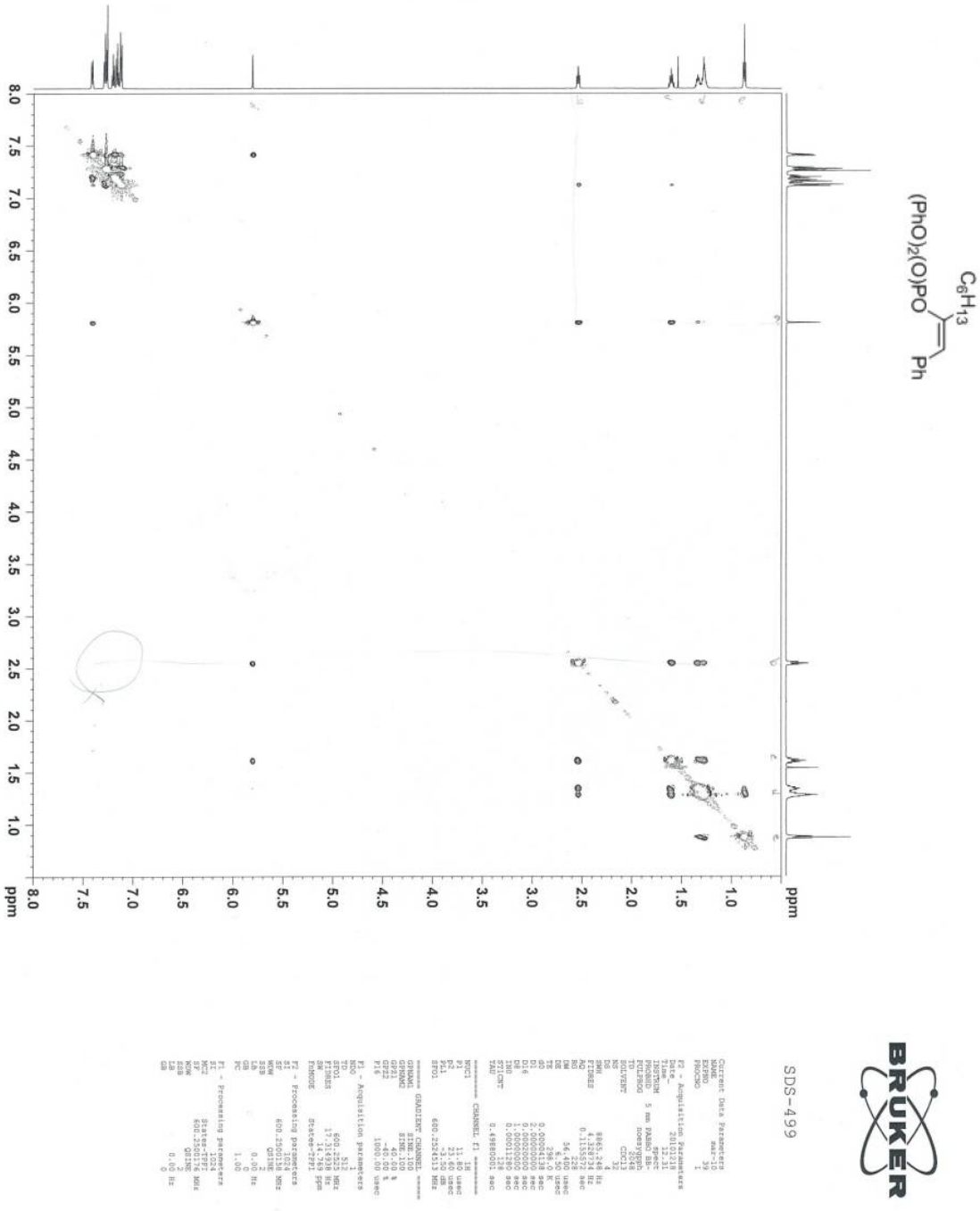

Ph
Ph
Ph
abundance
X : parts per Million : 13C

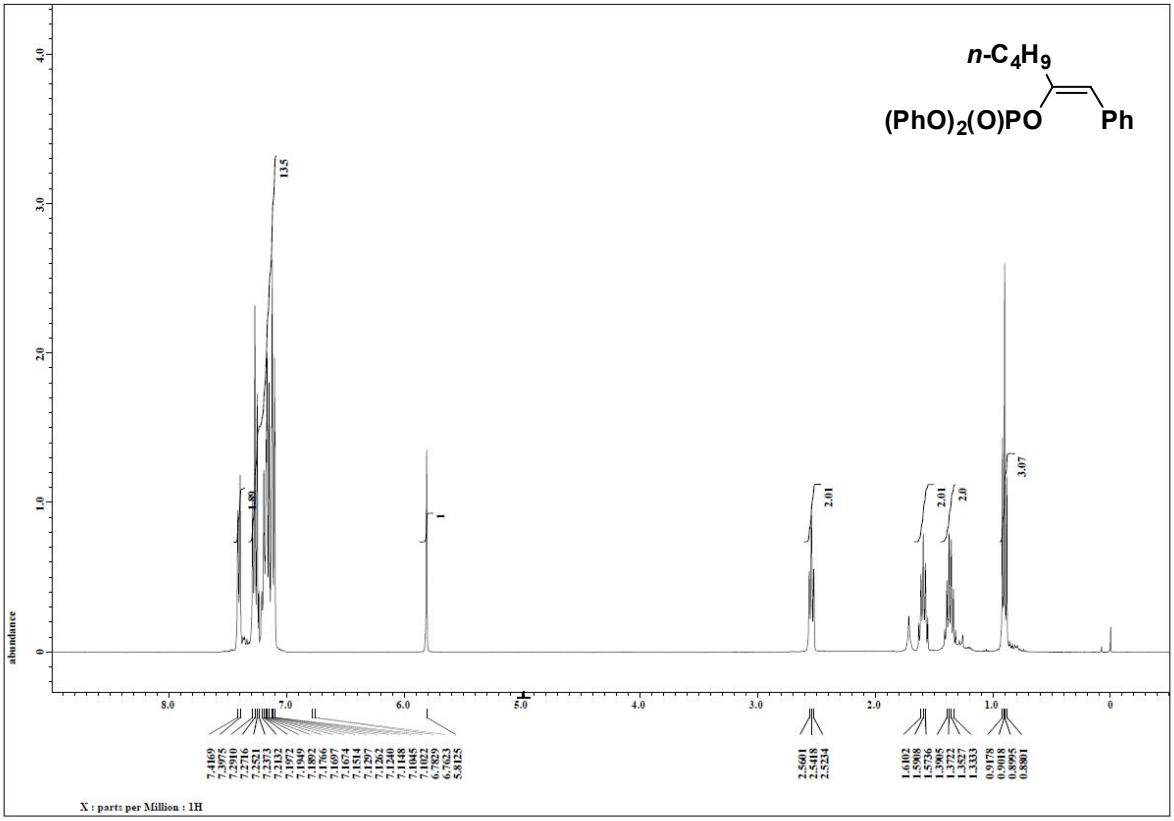

n-C4H9
Ph
C6H4-OMe-4
abundance
X : parts per Million : 1H

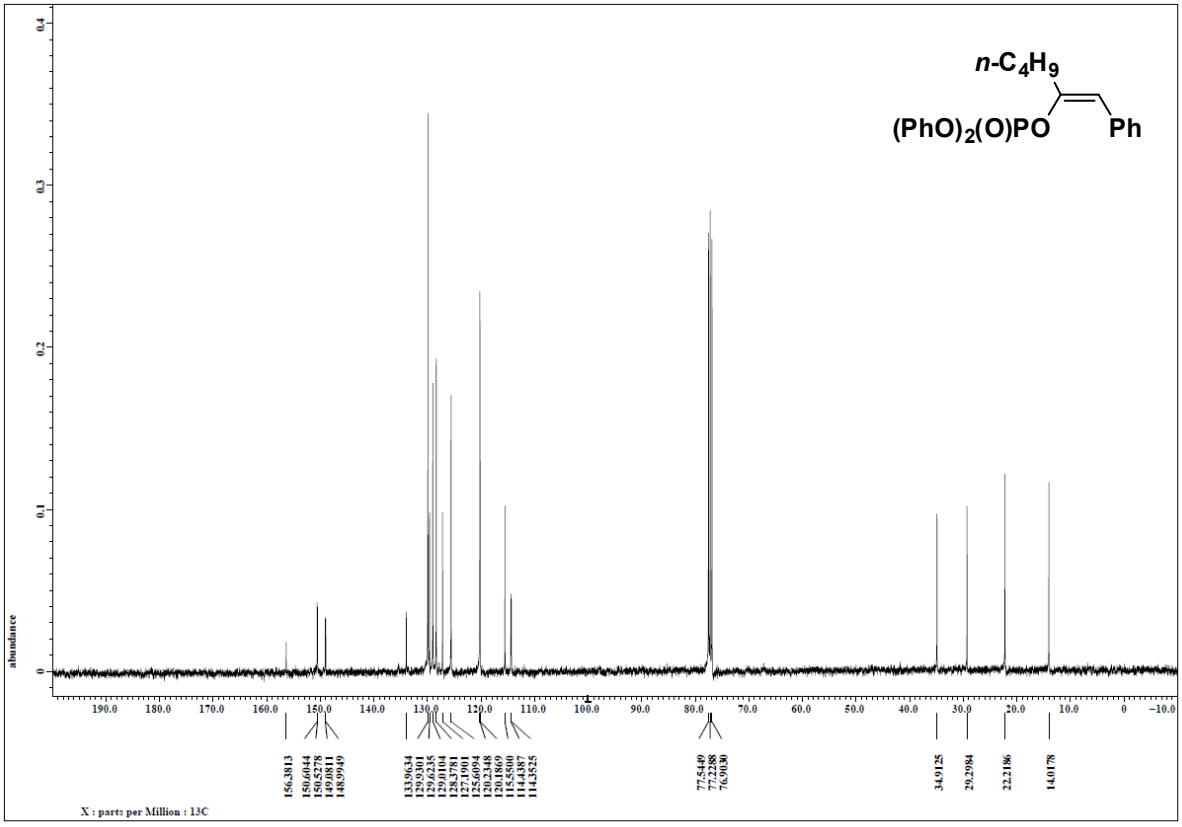

n-C4H9
Ph
C6H4-OMe-4
abundance
X : parts per Million : 13C


SDS-499
C_6H_{13}
$(PhO)_2(O)PO$
Ph
ppm
Integral

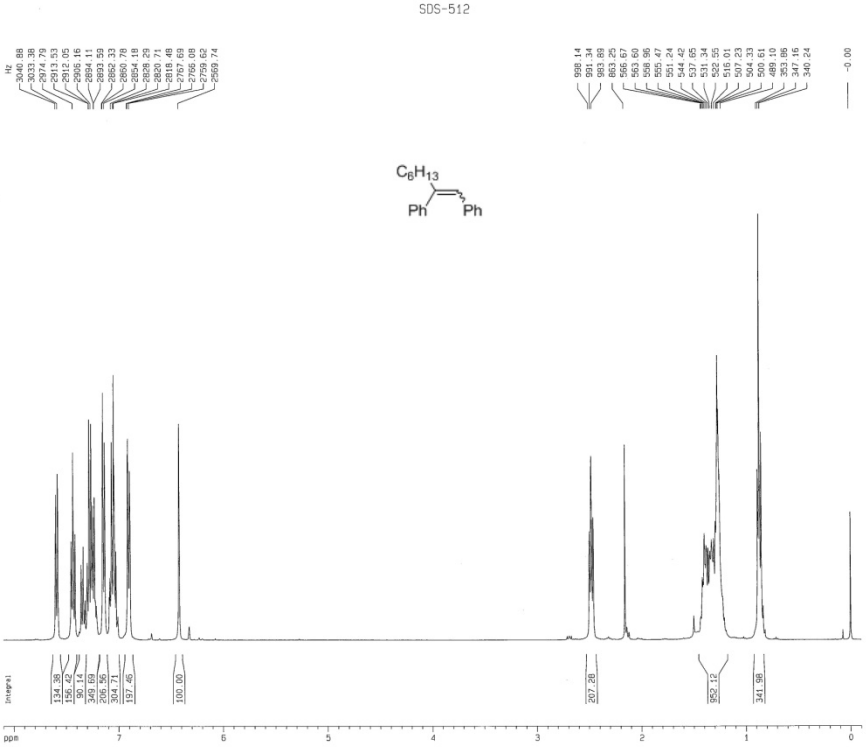

SDS-499
C_6H_{13}
$(PhO)_2(O)PO$
Ph
ppm


C6H13
(PhO)2(O)PO
Ph
ppm
SDS-499
BRUKER


n-C4H9
(PhO)2(O)PO
Ph
abundance
X : parts per Million : 1H

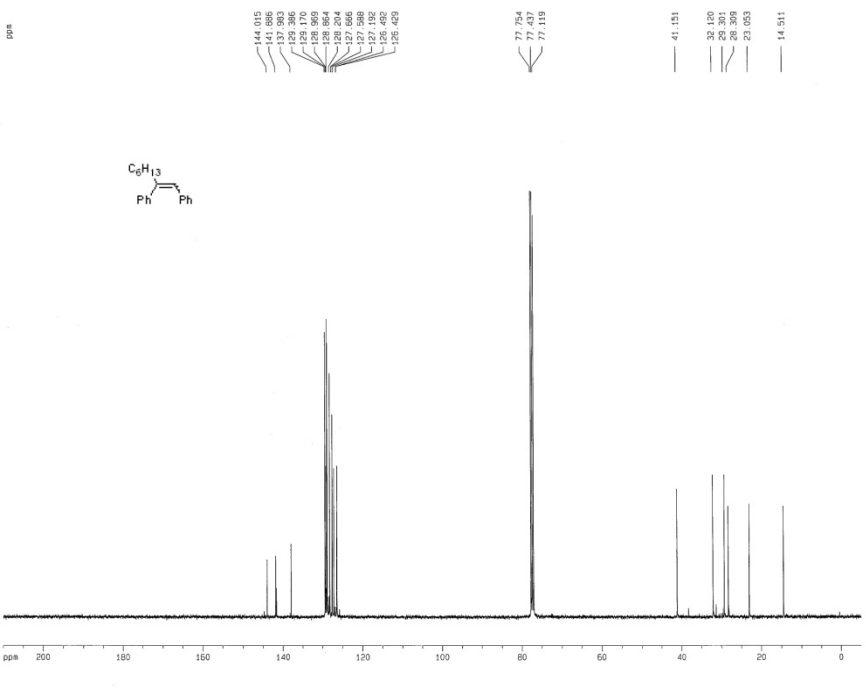

n-C4H9
(PhO)2(O)PO
Ph
abundance
X : parts per Million : 13C

SDS-512

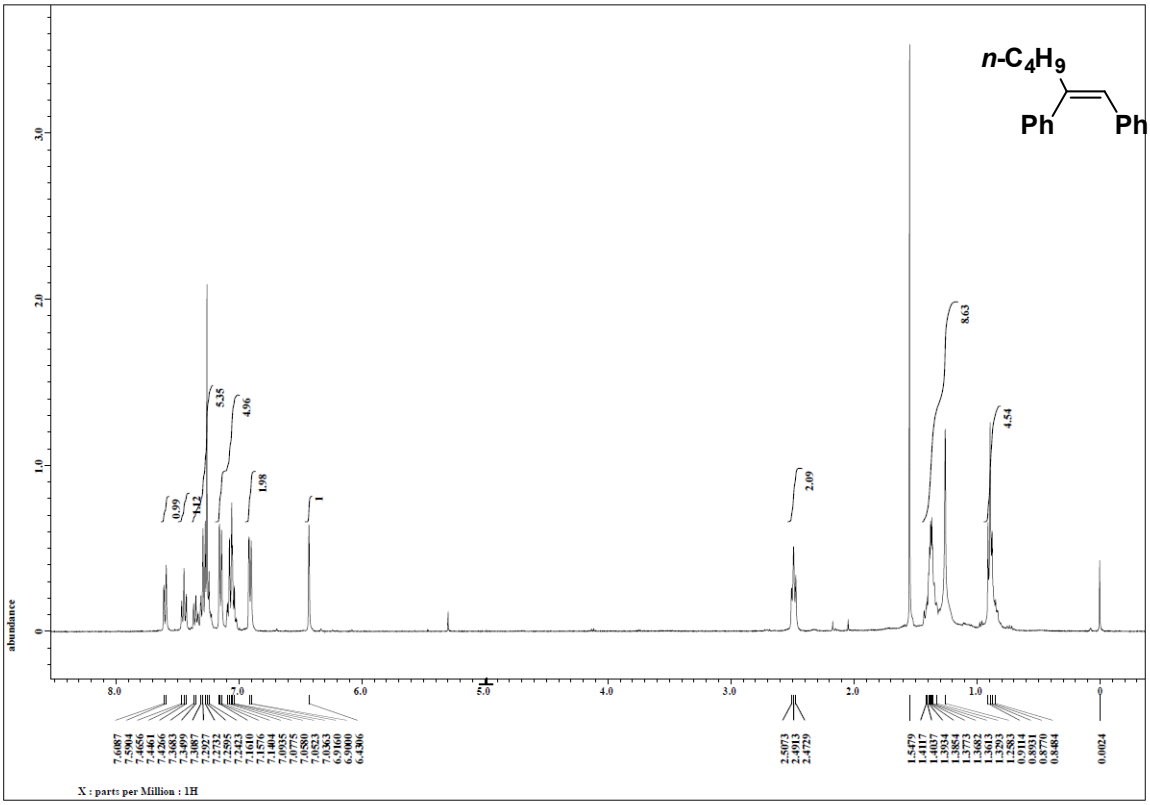


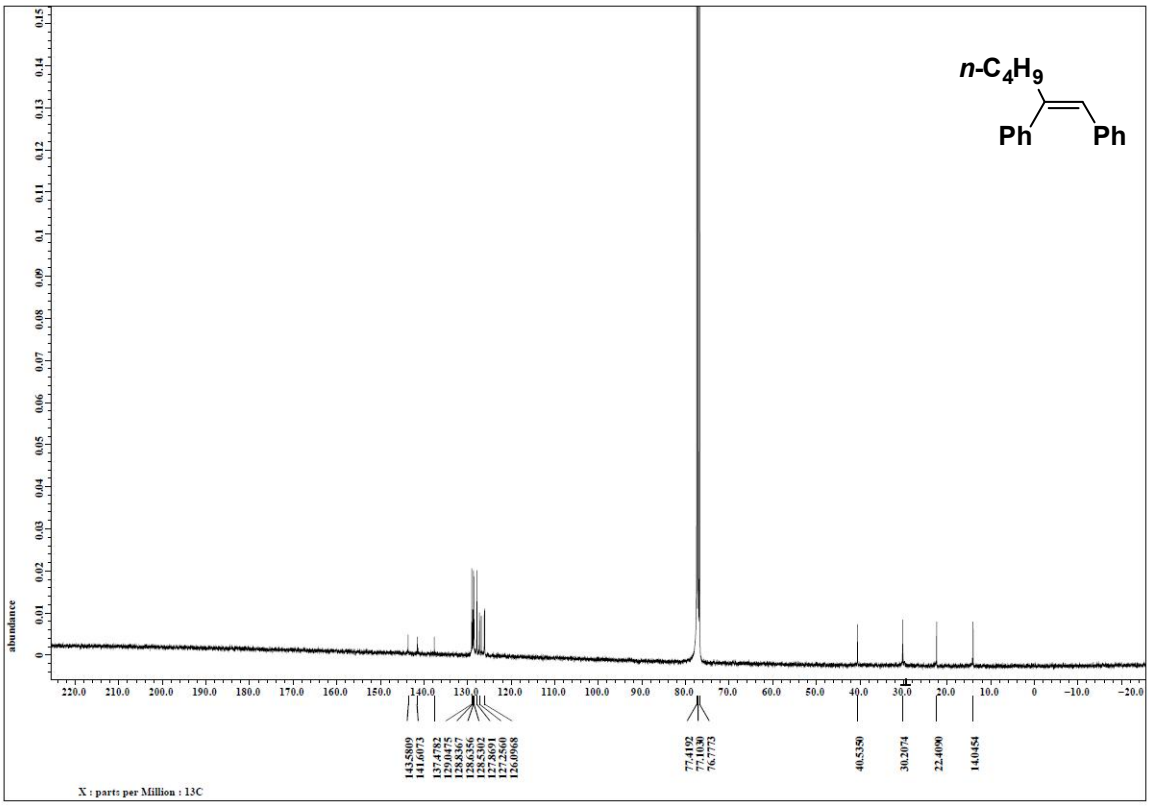

```
Current Data Parameters
NAME                  jan-11
EXPNO                     82
PROCNO                     1

F2 - Acquisition Parameters
Date_              20110221
Time                   9.29
INSTRUM               spect
PROBHD   5 mm Dual 13C/
PULPROG                zg30
TD                    32768
SOLVENT               CDCl3
NS                       32
DS                        0
SWH                8223.685 Hz
FIDRES             0.250987 Hz
AQ                 1.9923444 sec
RG                      128
DW                   60.800 usec
DE                    6.00 usec
TE                  298.2 K
D1                 1.00000000 sec
MCREST             0.00000000 sec
MCWRK              0.01500000 sec

======== CHANNEL f1 ========
NUC1                      1H
P1                     11.00 usec
PL1                    -2.00 dB
SFO1              400.1324710 MHz

F2 - Processing parameters
SI                       16384
SF                400.1300198 MHz
WDW                        EM
SSB                         0
LB                       0.30 Hz
GB                          0
PC                       1.00

1D NMR plot parameters
CX                      30.00 cm
CY                      15.00 cm
F1P                      8.100 ppm
F1                    3241.05 Hz
F2P                     -0.100 ppm
F2                     -40.01 Hz
PPMCM                 0.27333 ppm/cm
HZCM                109.36887 Hz/cm
```

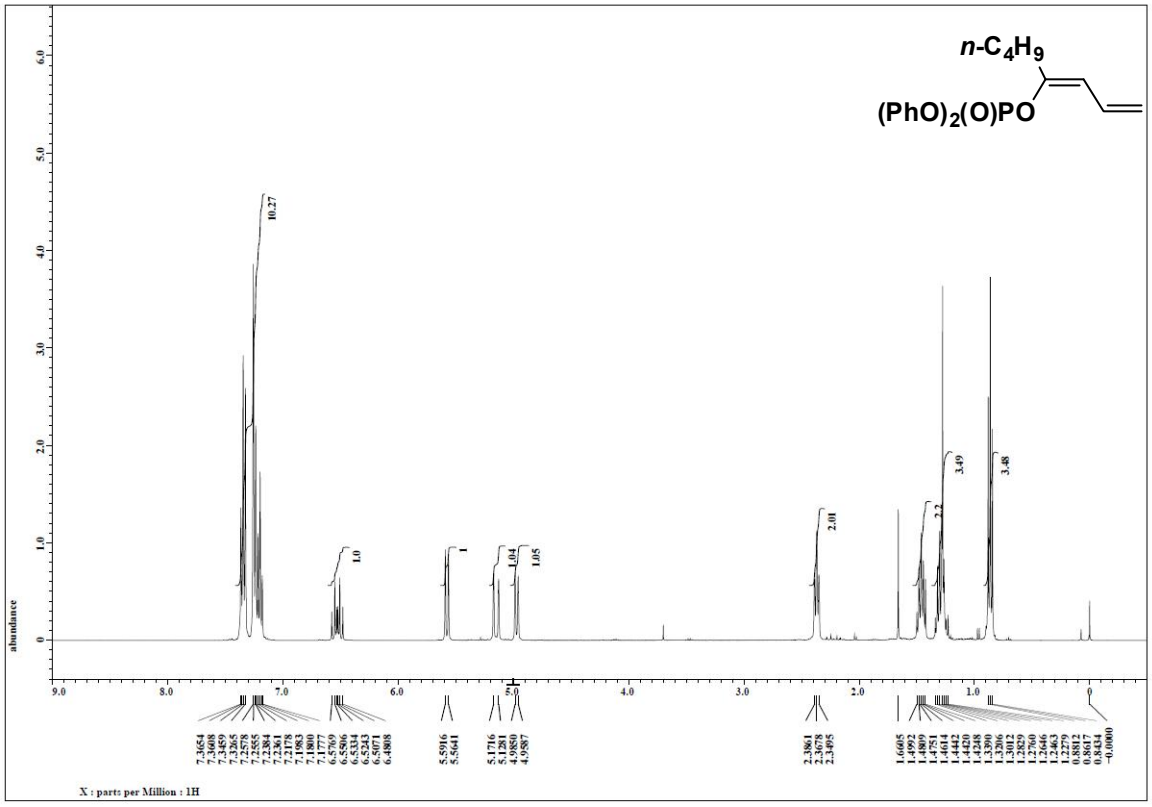
SDS-512

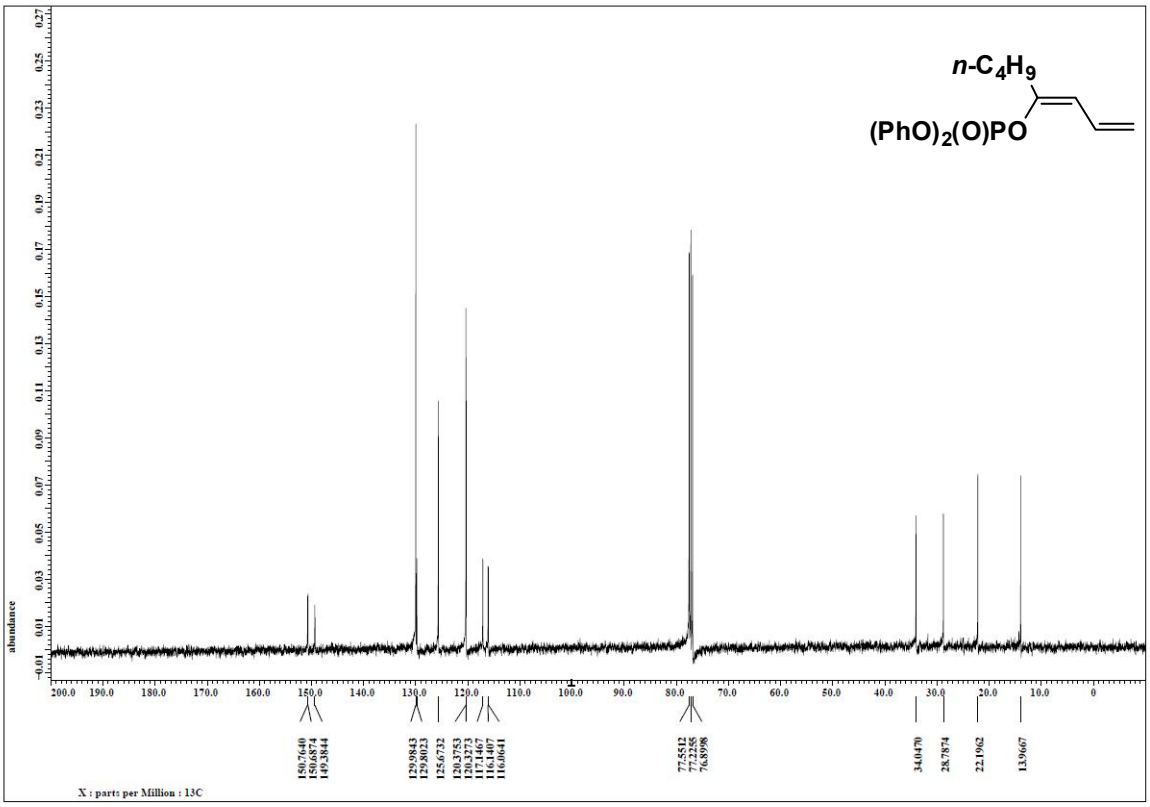


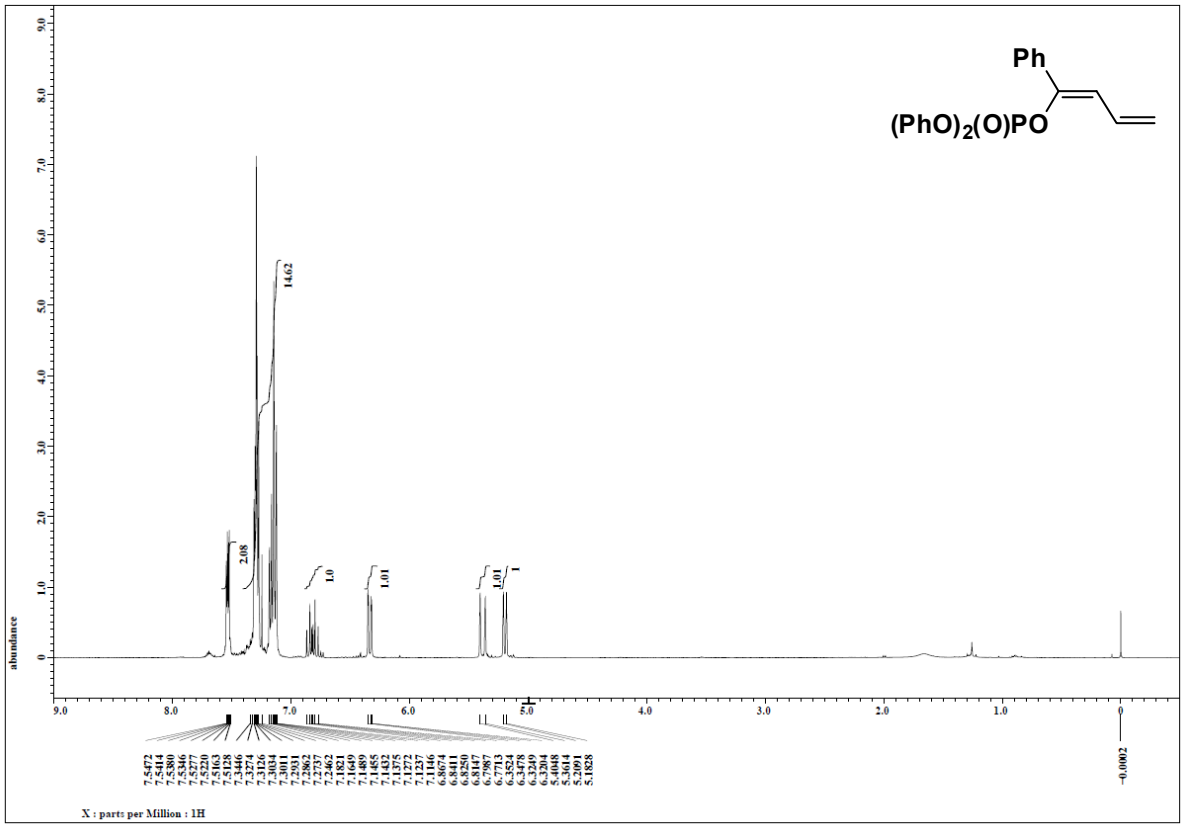

```
Current Data Parameters
NAME                  jan-11
EXPNO                     83
PROCNO                     1

F2 - Acquisition Parameters
Date_              20110221
Time                  11.01
INSTRUM               spect
PROBHD   5 mm Dual 13C/
PULPROG             zgpg30
TD                    65536
SOLVENT               CDCl3
NS                     2048
DS                        2
SWH               31847.133 Hz
FIDRES             0.485949 Hz
AQ                 1.0289652 sec
RG                    3649.1
DW                   15.700 usec
DE                    6.00 usec
TE                  298.2 K
D1                 2.00000000 sec
d11                0.03000000 sec
DELTA              1.89999998 sec
MCREST             0.00000000 sec
MCWRK              0.01500000 sec

======== CHANNEL f1 ========
NUC1                     13C
P1                     10.50 usec
PL1                    -1.00 dB
SFO1              100.6254358 MHz

======== CHANNEL f2 ========
CPDPRG2              waltz16
NUC2                      1H
PCPD2                 105.00 usec
PL2                    -2.00 dB
PL12                   18.00 dB
PL13                   20.00 dB
SFO2              400.1324708 MHz

F2 - Processing parameters
SI                       32768
SF                100.6127290 MHz
WDW                        EM
SSB                         0
LB                       1.00 Hz
GB                          0
PC                       1.40

1D NMR plot parameters
CX                      30.00 cm
CY                      15.00 cm
F1P                   210.000 ppm
F1                  21128.67 Hz
F2P                    -5.000 ppm
F2                   -503.05 Hz
PPMCM                 7.16667 ppm/cm
HZCM                721.05786 Hz/cm
```

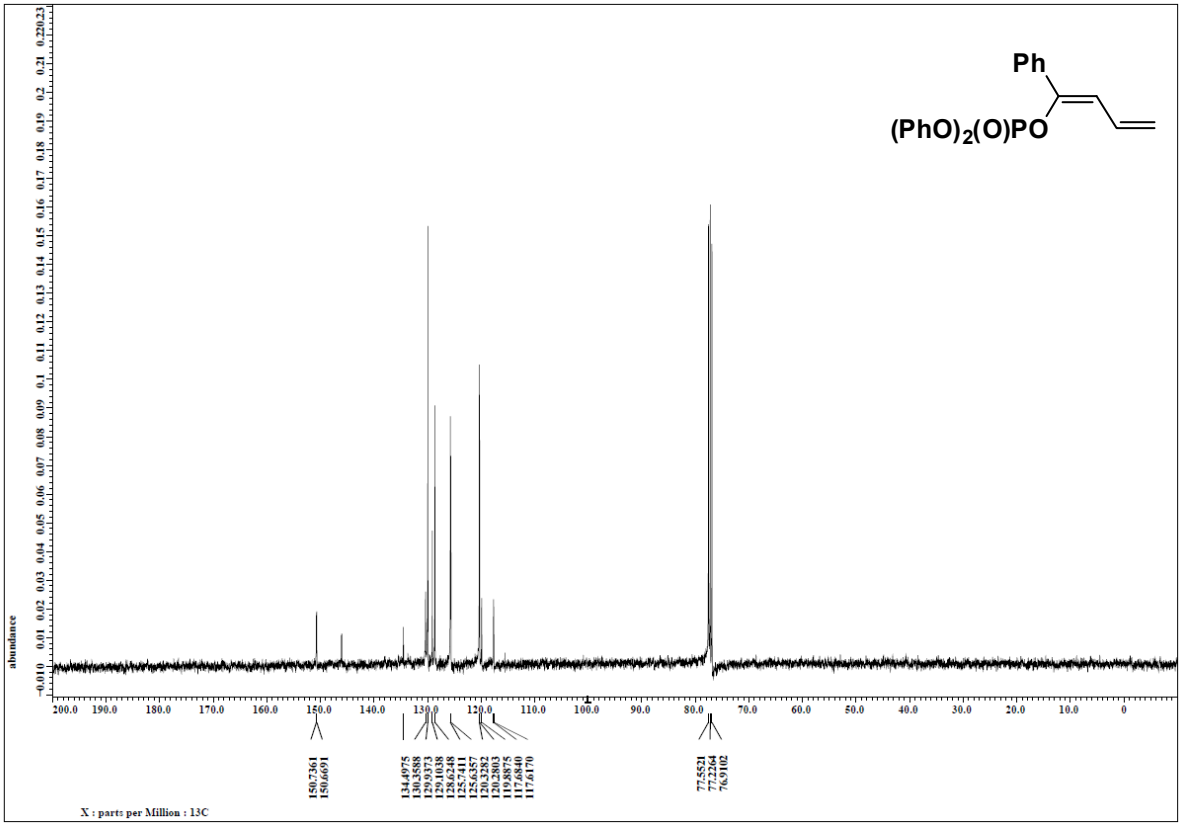

n-C4H9
Ph
Ph
abundance
X : parts per Million : 1H

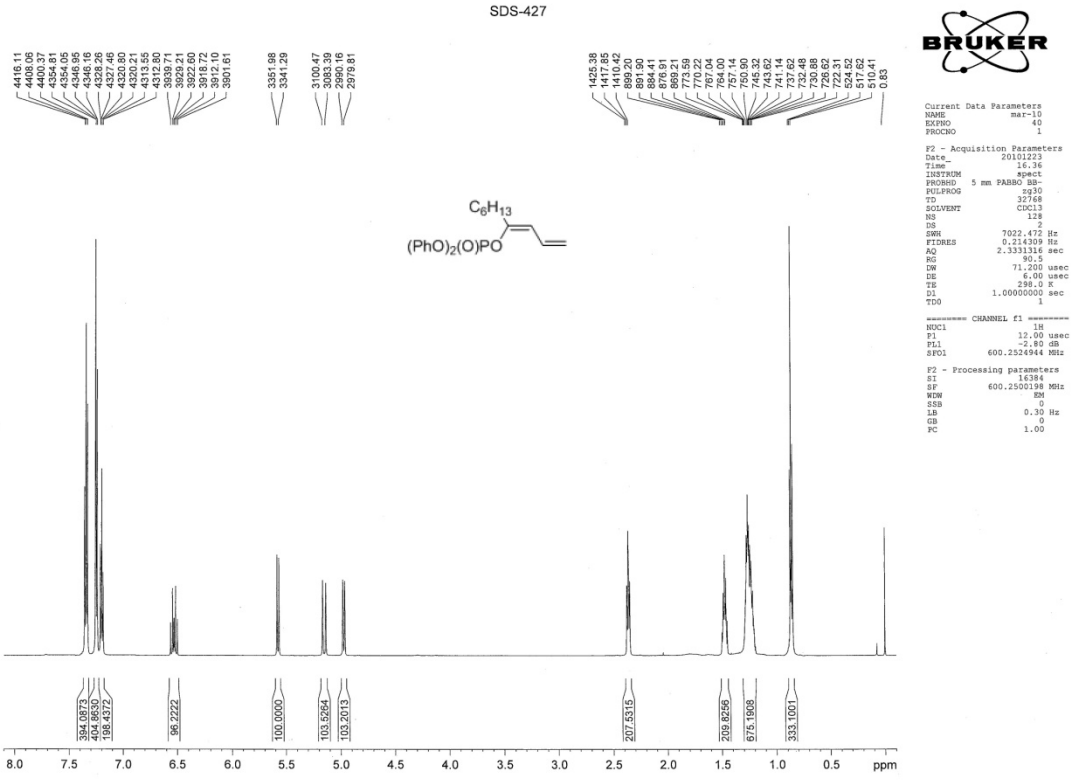

n-C4H9
Ph
Ph
abundance
X : parts per Million : 13C

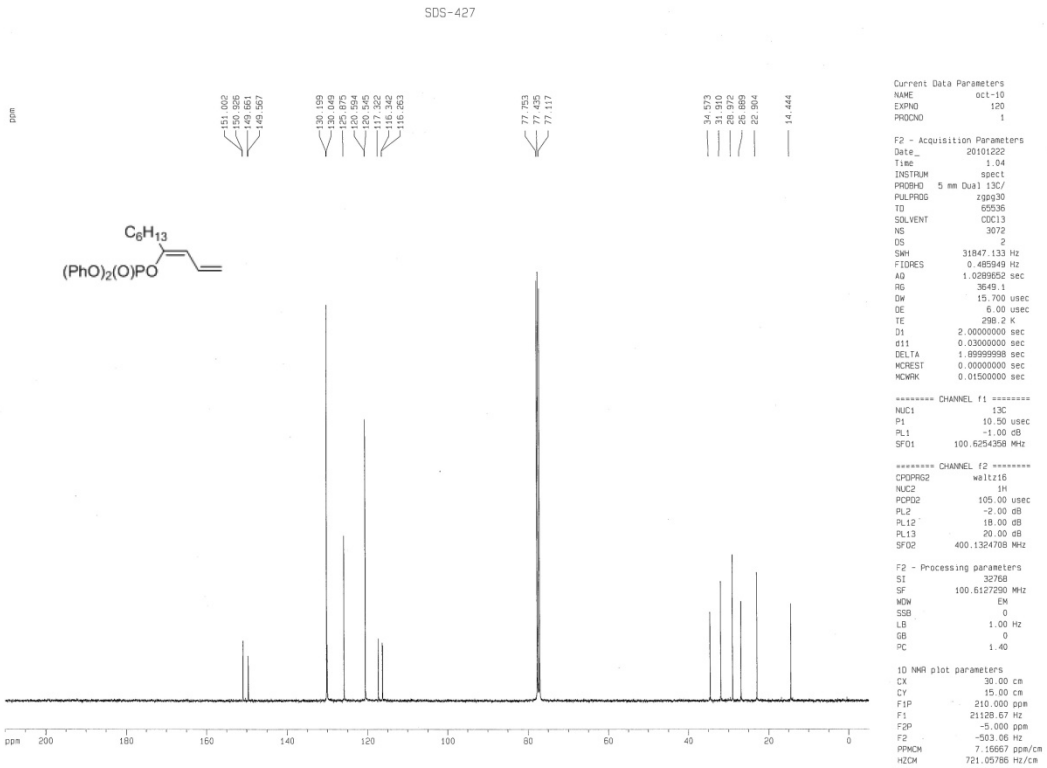

n-C4H9
(PhO)2(O)PO
abundance
10.27
1.0
1
1.04
1.05
2.01
2.2
3.49
3.48
X : parts per Million : 1H

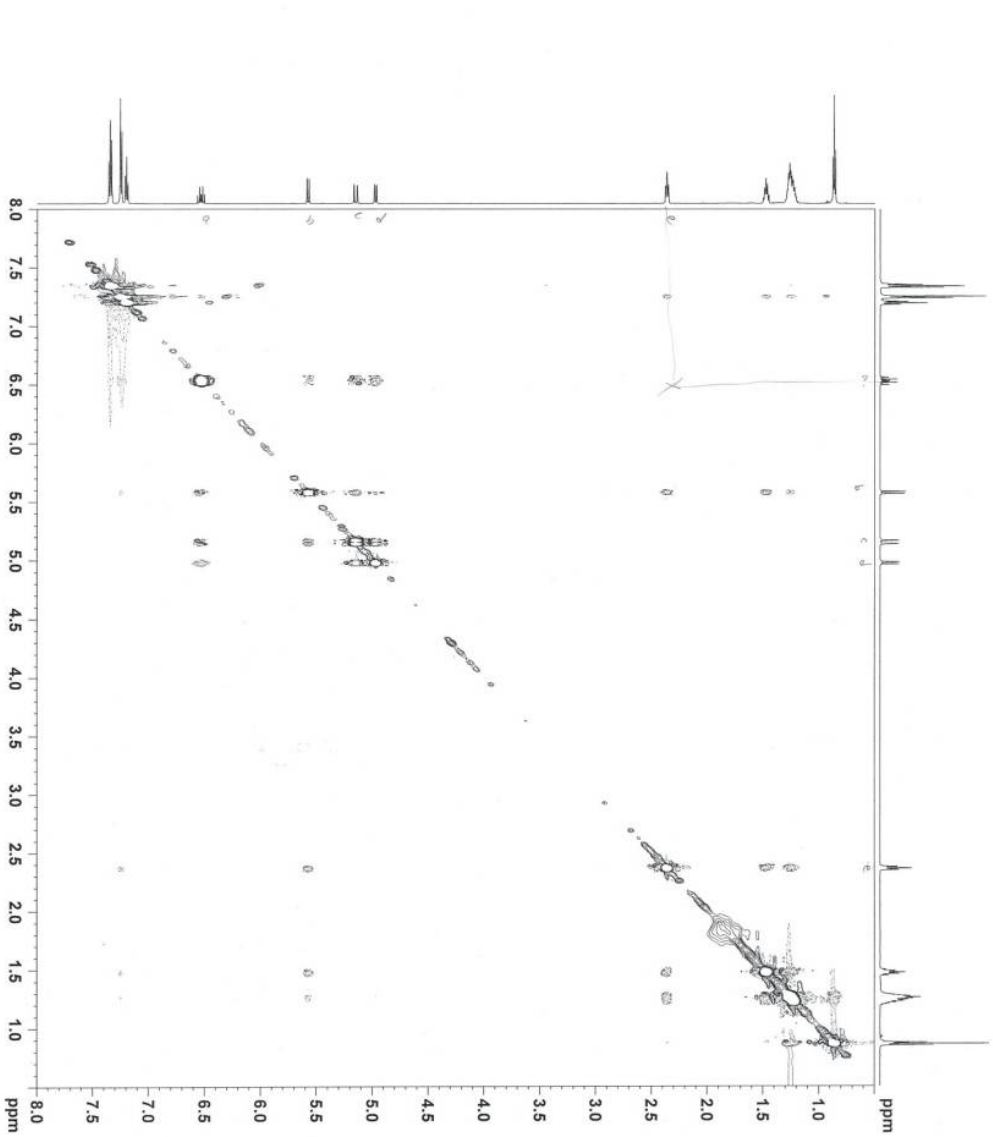

n-C4H9
(PhO)2(O)PO
abundance
X : parts per Million : 13C

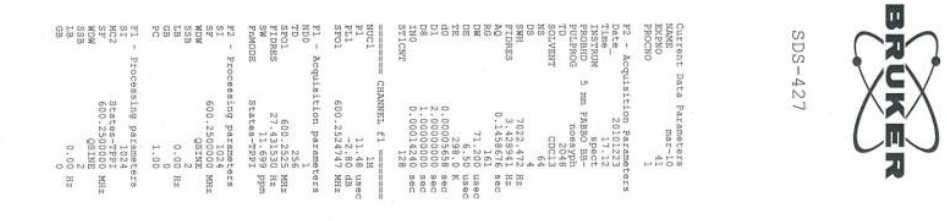

Ph
(PhO)2(O)PO
abundance
14.62
2.08
1.0
1.01
1.01
1
-0.0002
X : parts per Million : 1H

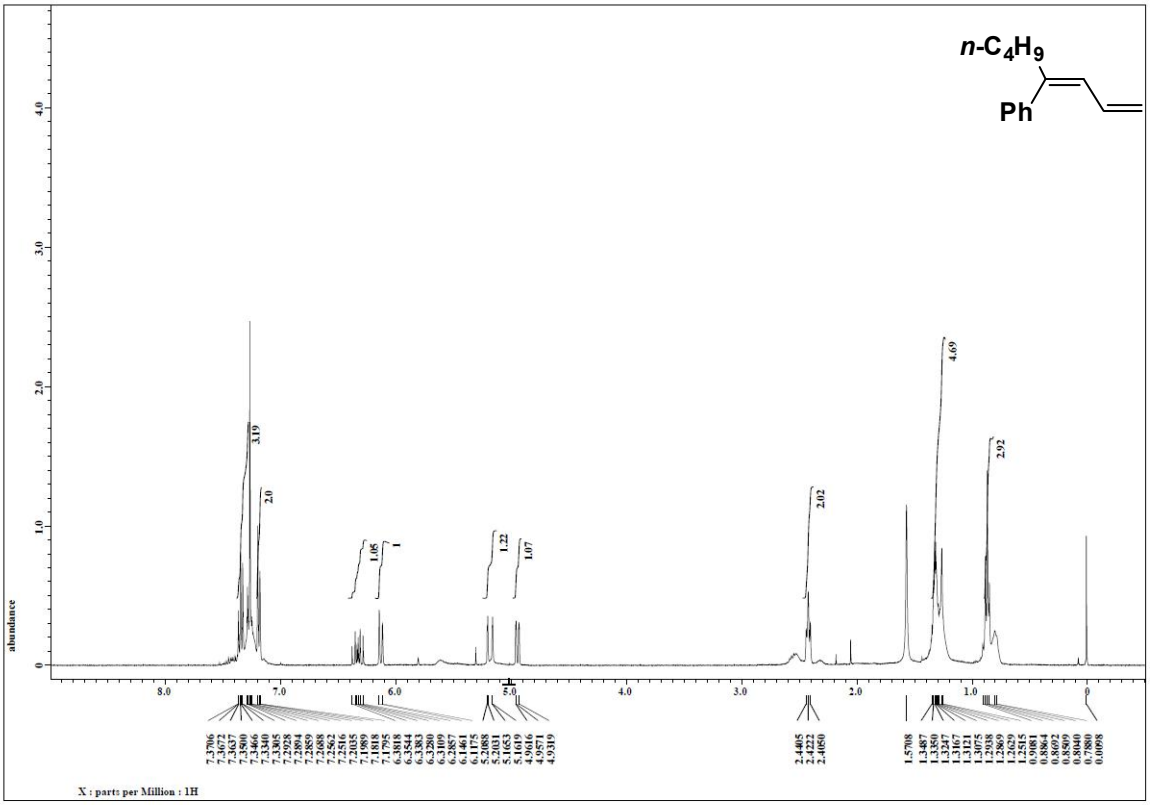

Ph
(PhO)2(O)PO
abundance
150.7361
150.6691
134.4975
130.3588
129.9373
129.1038
128.6248
125.7411
125.6357
120.3282
120.2803
119.8875
117.6840
117.6170
77.5521
77.2264
76.9102
X : parts per Million : 13C

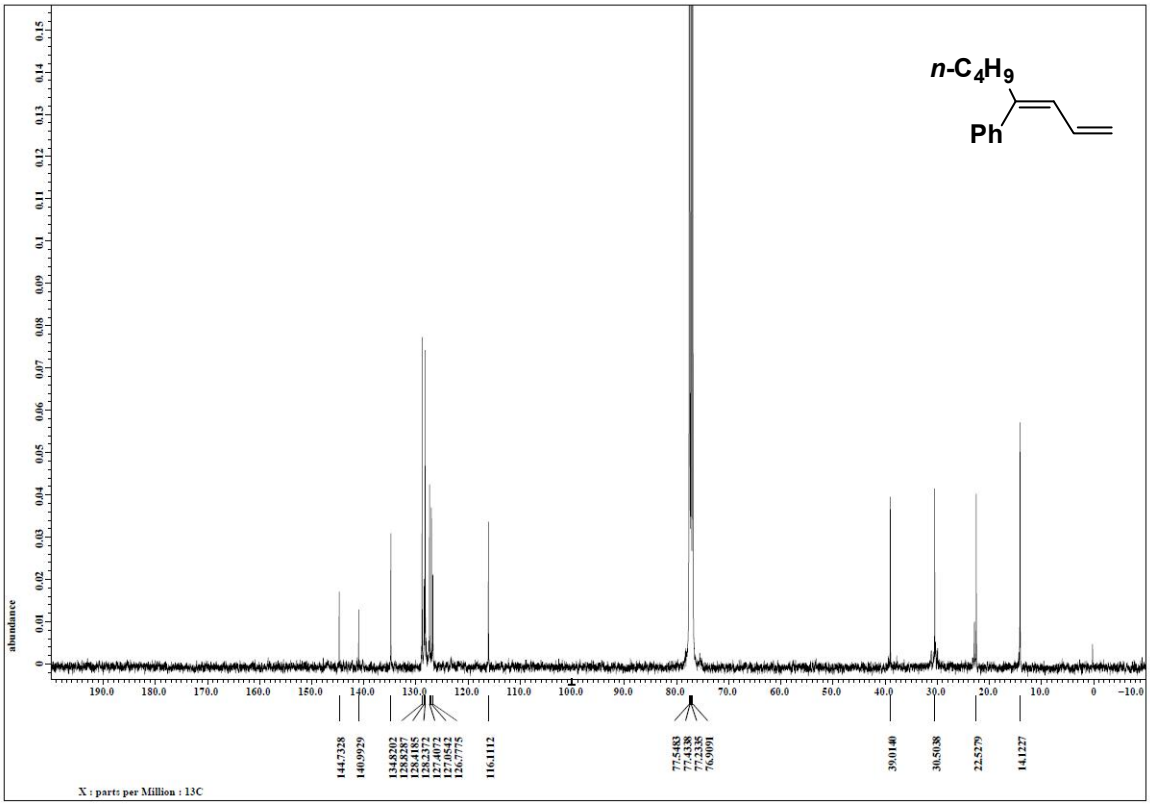

SDS-427
C_6H_{13}
$(PhO)_2(O)PO$
ppm

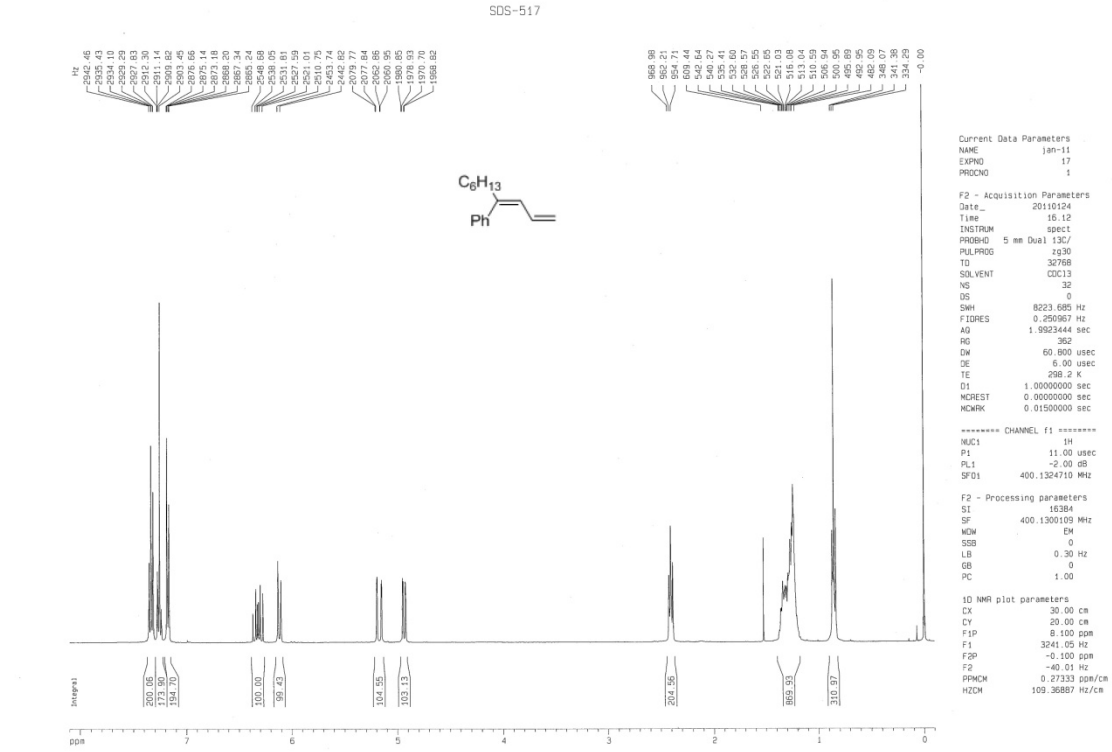

SDS-427
C_6H_{13}
$(PhO)_2(O)PO$
ppm

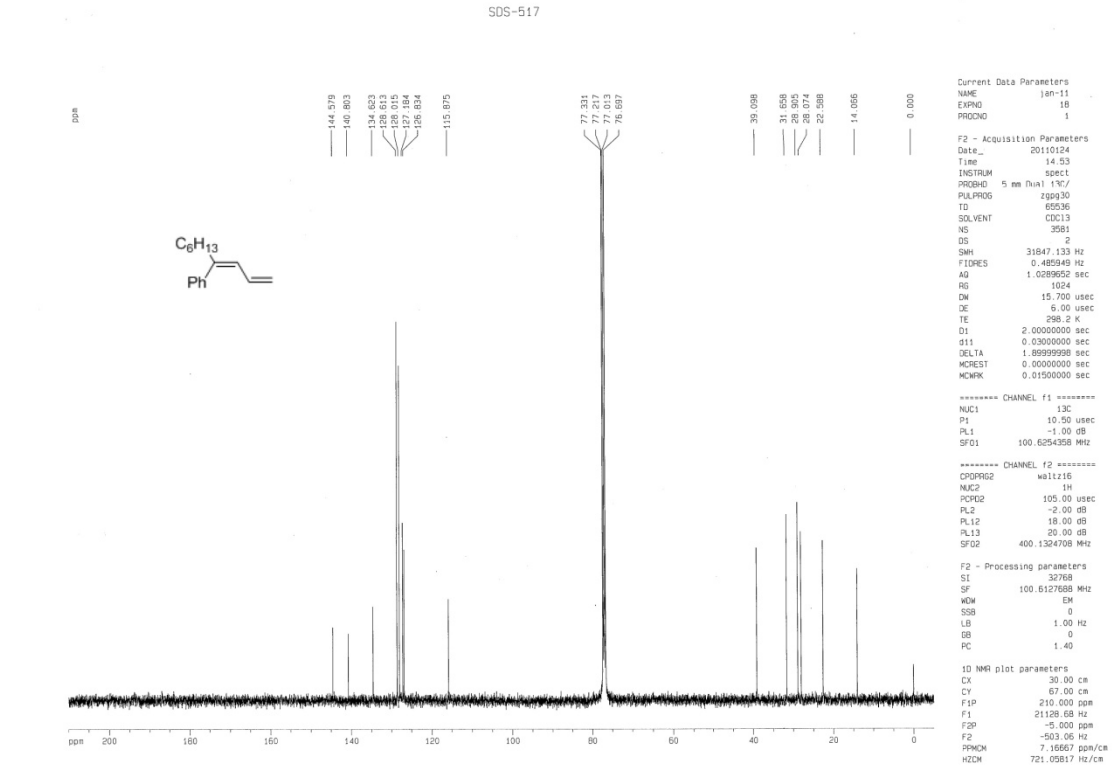

(PhO)2(O)PO
C6H13
ppm
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0

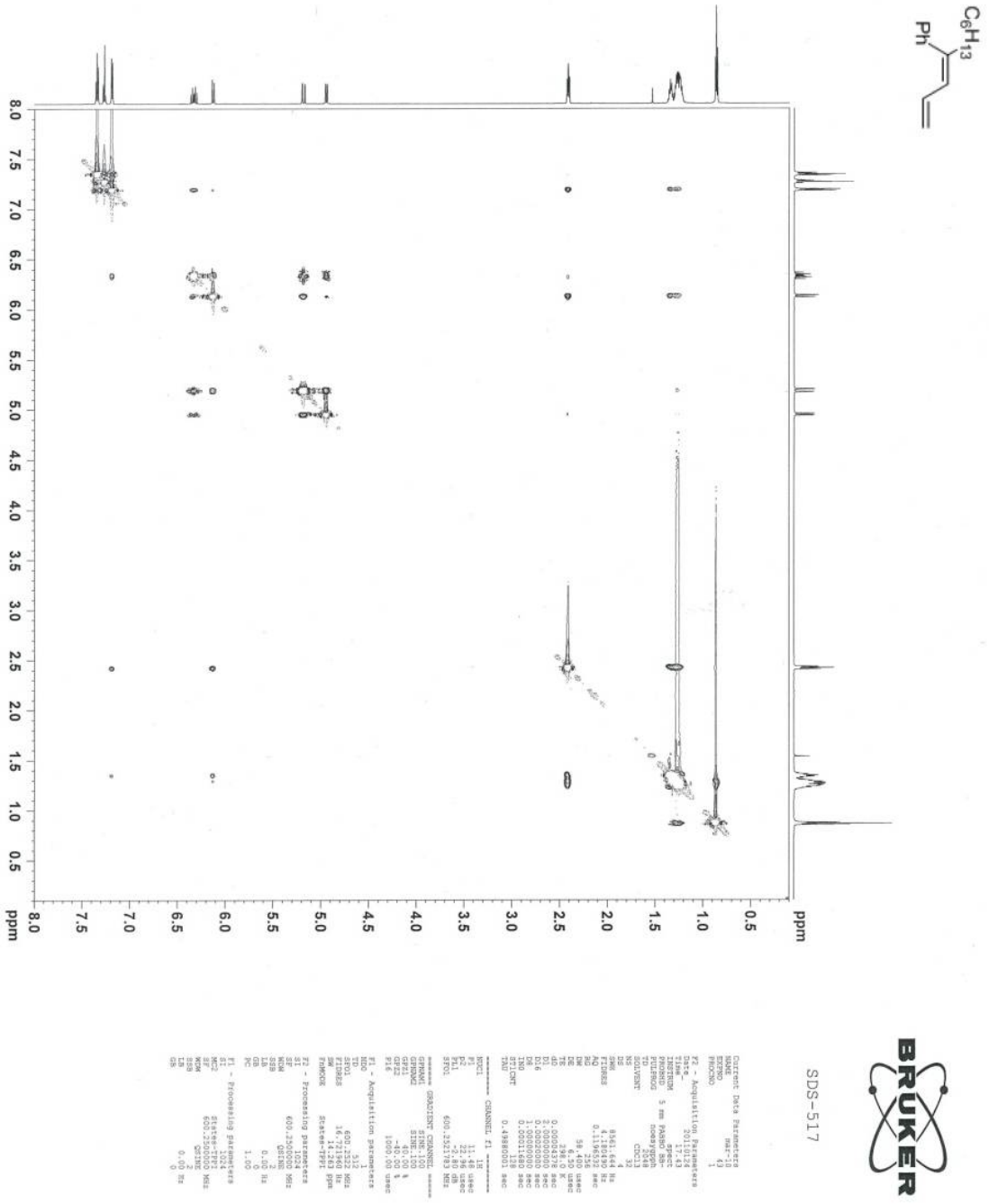

BRUKER
SDS-427


n-C4H9
Ph
abundance
X : parts per Million : 1H


n-C4H9
Ph
abundance
X : parts per Million : 13C


SDS-517
Hz
2942.46
2935.43
2934.10
2928.39
2927.83
2912.30
2911.14
2909.82
2903.46
2876.66
2875.14
2873.18
2868.20
2867.24
2858.24
2546.68
2538.05
2531.81
2527.59
2521.75
2510.75
2453.74
2442.82
2079.77
2077.84
2072.86
2065.95
1980.85
1978.93
1970.70
1968.82
968.98
962.21
954.71
809.44
545.64
540.27
535.41
532.60
528.57
525.55
523.65
521.03
516.08
513.04
510.59
508.94
506.95
495.89
492.95
482.09
348.07
341.43
334.39
-0.00
Integral
200.06
173.90
164.70
100.00
99.43
164.55
163.13
264.56
869.93
310.97
ppm
Current Data Parameters
NAME jan-11
EXPNO 17
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110124
Time 16.12
INSTRUM spect
PROBHD 5 mm Dual 13C/
PULPROG zg30
TD 32768
SOLVENT CDCl3
NS 32
DS 0
SWH 8223.685 Hz
FIDRES 0.250967 Hz
AQ 1.9923444 sec
RG 362
DW 60.800 usec
DE 6.00 usec
TE 298.2 K
D1 1.00000000 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 1H
P1 11.00 usec
PL1 -2.00 dB
SFO1 400.1324710 MHz
F2 - Processing parameters
SI 16384
SF 400.1300109 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00
1D NMR plot parameters
CX 30.00 cm
CY 20.00 cm
F1P 8.100 ppm
F1 3241.05 Hz
F2P -0.100 ppm
F2 -40.01 Hz
PPMCM 0.27333 ppm/cm
HZCM 109.36887 Hz/cm


SDS-517
ppm
144.579
140.803
134.623
128.613
128.015
127.184
126.834
115.875
77.331
77.217
77.013
76.697
39.098
31.658
29.905
28.074
22.588
14.066
0.000
Current Data Parameters
NAME jan-11
EXPNO 18
PROCNO 1
F2 - Acquisition Parameters
Date_ 20110124
Time 14.53
INSTRUM spect
PROBHD 5 mm Dual 13C/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 3581
DS 2
SWH 31847.133 Hz
FIDRES 0.485949 Hz
AQ 1.0289652 sec
RG 1024
DW 15.700 usec
DE 6.00 usec
TE 298.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
MCREST 0.00000000 sec
MCWRK 0.01500000 sec
======== CHANNEL f1 ========
NUC1 13C
P1 10.50 usec
PL1 -1.00 dB
SFO1 100.6254358 MHz
======== CHANNEL f2 ========
CPDPRG2 waltz16
NUC2 1H
PCPD2 105.00 usec
PL2 -2.00 dB
PL12 18.00 dB
PL13 20.00 dB
SFO2 400.1324708 MHz
F2 - Processing parameters
SI 32768
SF 100.6127688 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
1D NMR plot parameters
CX 30.00 cm
CY 67.00 cm
F1P 210.000 ppm
F1 21128.68 Hz
F2P -5.000 ppm
F2 -503.06 Hz
PPMCM 7.16667 ppm/cm
HZCM 721.05817 Hz/cm


C6H13
Ph
ppm
SDS-517
BRUKER