Supporting Information for

An RCM Strategy to Stereodiverse δ-Sultam Scaffolds

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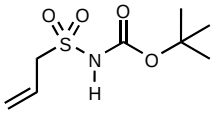
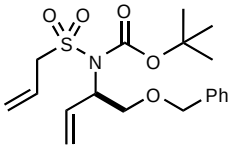
General Experimental:

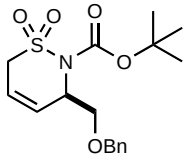
All reactions were carried out in flame-dried glassware under argon. Toluene, THF, Et_2O, and CH_2Cl_2 were purified by passage through a purification system (Solv-Tek) employing activated Al_2O_3. Et_3N was distilled from CaH_2. Flash column chromatography was performed with Merck silica gel (EM-9385-9, 230–400 mesh). Thin layer chromatography (TLC) was performed on silica gel 60F254 plates (EM-5715-7, Merck). ^1H and ^{13}C NMR spectra were recorded in $CDCl_3$, MeOD or Acetone-d_6 on either a Bruker DRX-400 or a Bruker AM-500 spectrometer operating at 400/100 MHz and 500/125 MHz, respectively. High-resolution mass spectrometry (HRMS) and FAB spectra were obtained on a VG Instrument ZAB double-focusing mass spectrometer. Infrared data was obtained on a Nicolet 320 Fourier Transform Infrared Spectrophotometer. Melting points were obtained on a Thomas Hoover capillary melting point apparatus. Optical rotations were carried out on a Rudolph Automatic Polarimeter (AUTOPOL IV).



***tert*-butyl allylsulfonylcarbamate (9):** To a solution of allyl sulfonamide **8** (500 mg, 4.13 mmol) in CH_2Cl_2 (5.2 mL) was added DMAP (50 mg, 0.41 mmol) and Et_3N (459 mg, 4.53 mmol, 0.63 mL), followed by the dropwise addition of a solution of Boc_2O (1.04 g, 4.75 mmol, 1.09 mL) in CH_2Cl_2 (8.3 mL) over 15 min with stirring. The reaction was stirred at rt for 2.5 h after which the solvent was removed. To the crude mixture was added 1N HCl (25 mL) and the solution extracted with EtOAc (4 × 50 mL). The organic layer was washed with water (25 mL) and brine (25 mL), dried over $MgSO_4$, filtered and the solvent removed under reduced pressure. Flash chromatography (SiO_2, 3:1 Heptane/EtOAc) afforded 851 mg (93%) of carbamate **9** as a yellow oil, which solidified to a crystalline yellow solid upon standing in the fridge overnight. A small amount of the bisprotected product (46 mg, 4%) was also isolated. TLC R_f = 0.32 (1:1 Heptane/EtOAc); Mp = 43-45 °C; ^1H NMR (400 MHz, $CDCl_3$) δ 6.97 (s, 1H, N-H), 5.90 (dddd, J = 17.4, 10.1, 7.4, 7.4 Hz, 1H), 5.49 (dd, J = 10.1, 1.0 Hz, 1H), 5.44 (dd, J = 17.0, 1.2 Hz, 1H), 4.11 (d, J = 7.4 Hz, 2H), 1.51 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 149.8, 124.8, 124.5, 84.1, 56.6, 27.7; FTIR (neat) 3242, 3094, 2982, 1742, 1641 cm^{-1}; HRMS ($M+Na^+$) calcd for $C_8H_{15}NO_4SNa$ 244.0619, found 244.0610.

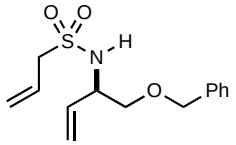


(*R*)-*tert*-butyl allylsulfonyl(1-(benzyloxy)but-3-en-2-yl)carbamate (12): To a solution of allylic alcohol **11** (120 mg, 0.67 mmol), sulfamoyl carbamate **9** (149 mg, 0.67 mmol) and PPh_3 (228 mg, 0.87 mmol) in THF (13.4 mL) at rt was added DEAD (152 mg, 0.87 mmol, 0.14 mL) dropwise via syringe and the reaction stirred at rt until complete by TLC (usually < 1 h). Flash chromatography (SiO_2, 6:1 Hexane/EtOAc) afforded 219 mg (79%) of sulfonamide **12** as a yellow oil. TLC R_f = 0.63 (2:1 Heptane/EtOAc); $[\alpha]_D^{25}$ = -9.7 (*c* 1.12, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27-7.19 (m, 5H), 5.92 (ddd, *J* = 17.2, 10.4, 6.5 Hz, 1H), 5.78 (dddd, *J* = 17.4, 10.1, 7.4, 7.4 Hz, 1H), 5.29 (dd, *J* = 9.9, 1.0 Hz, 1H), 5.26 (dd, *J* = 17.1, 1.0 Hz, 1H), 5.23 (dd, *J* = 17.3, 1.0 Hz, 1H), 5.16 (dd, *J* = 10.4, 1.0 Hz, 1H), 4.96-4.90 (m, 1H), 4.52 (d, *J* = 11.8 Hz, 1H), 4.44 (d, *J* = 11.8 Hz, 1H), 4.16 (dd, *J* = 13.8, 7.6 Hz, 1H), 4.05 (dd, *J* = 13.7, 7.2 Hz, 1H), 3.84 (dd, *J* = 9.6, 8.8 Hz, 1H), 3.59 (dd, *J* = 9.7, 6.2 Hz, 1H), 1.43 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 151.0, 137.8, 134.0, 128.4, 127.7, 127.7, 124.7, 124.6, 118.5, 84.6, 73.0, 69.9, 59.3, 58.4, 28.0; FTIR (neat) 3088, 3030, 2978, 2930, 2868, 1726, 1639, 1497 cm^{-1}; HRMS ($M+Na^+$) calcd for $C_{19}H_{27}NO_5SNa$ 404.1508, found 404.1527.

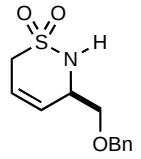


1,2-thiazine-*N*-carboxylic acid-3,6-dihydro-3*R*-[(phenylmethoxy)methyl]-1,1-dimethyl-ethyl ester-1,1-dioxide (13): To a solution of diene **12** (2.5 g, 6.55 mmol) in degassed toluene (655 mL) was added Grubbs second generation catalyst (278 mg, 0.328 mmol) in one portion and the reaction heated at reflux for 3 h. The solvent was removed under reduced pressure, CH_2Cl_2 (50 mL) added and the residual ruthenium removed by addition of DMSO (1.28 g, 16.4 mmol, 1.16 mL), followed by stirring at rt for 12 h. Flash chromatography (SiO_2, 3:1 Hexane/EtOAc) afforded 2.0 g (87 %) of sultam **13** as an ivory solid. TLC R_f = 0.33 (2:1 Heptane/EtOAc); Mp = 68-73 °C; $[\alpha]_D^{25}$ = + 120.4 (*c* 0.95, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34-7.27 (m, 5H), 6.01 (dddd, *J* = 10.8, 4.0, 1.6, 1.6 Hz, 1H), 5.78 (dddd, *J* = 10.4, 5.6, 2.8, 1.6 Hz, 1H), 5.27-5.24

(m, 1H), 4.55 (s, 2H), 3.92 (dddd, *J* = 16.4, 2.4, 2.4, 2.4 Hz, 1H), 3.78 (d, *J* = 6.4 Hz, 2H), 3.77-3.72 (m, 1H), 1.49 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 150.5, 137.8, 128.3, 127.6, 127.6, 126.8, 118.3, 84.6, 73.2, 70.7, 60.0, 50.3, 27.8; FTIR (neat) 2980, 2928, 2866, 1722, 1454 cm^{-1}; HRMS (M+Na$^+$) calcd for $C_{17}H_{23}NO_5SNa$ 376.1195, found 376.1212.

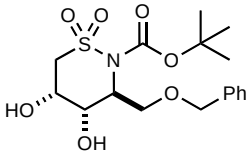


(*R*)-*N*-(1-(benzyloxy)but-3-en-2-yl)prop-2-ene-1-sulfonamide (14): To a solution of diene **12** (330 mg, 0.87 mmol) in CH_2Cl_2 (3 mL) was added an excess of TFA (1 mL) dropwise via syringe and the reaction stirred at rt until all starting material was consumed (~30 min) by TLC analysis. The reaction mixture was quenched with 15 mL of saturated $NaHCO_3$ and extracted with CH_2Cl_2 (4 × 25 mL). The organic layers were combined, dried over Na_2SO_4, filtered and concentrated under reduced pressure. Flash chromatography (SiO_2, 3:1 Heptane/EtOAc) afforded 227 mg (93%) of sulfonamide **14** as a light yellow oil. TLC R_f = 0.70 (1:1 Heptane/EtOAc); $[\alpha]_D^{25}$ = +4.6 (*c* 0.81, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-7.28 (m, 5H), 5.90 (dddd, *J* = 17.2, 10.0, 7.2, 7.2 Hz, 1H), 5.83 (ddd, *J* = 17.2, 10.4, 6.8 Hz, 1H), 5.38 (dd, *J* = 10.8, 1.0 Hz, 1H), 5.37 (dd, *J* = 17.2, 1.0 Hz, 1H), 5.35 (dd, *J* = 17.2, 1.0 Hz, 1H), 5.26 (dd, *J* = 10.4, 1.0 Hz, 1H), 4.81 (d, *J* = 7.5 Hz, 1H), 4.56 (d, *J* = 11.9 Hz, 1H), 4.51 (d, *J* = 11.8 Hz, 1H), 4.17-4.11 (m, 1H), 3.73 (dd, *J* = 6.7, 6.0 Hz, 2H), 3.60 (dd, *J* = 9.5, 4.1 Hz, 1H), 3.50 (dd, *J* = 9.5, 5.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.3, 135.4, 128.4, 127.8, 127.7, 125.7, 123.7, 117.7, 73.2, 72.3, 57.9, 56.1; FTIR (neat) 3283, 3086, 3030, 2921, 2862, 1641 cm^{-1}; HRMS (M+Na$^+$) calcd for $C_{14}H_{19}NO_3SNa$ 304.0983, found 304.1003.

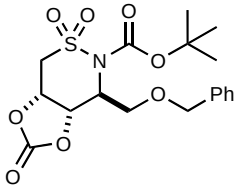


(*R*)-2H-1,2-thiazine-3,6-dihydro-3-[(phenylmethoxy)methyl]-1,1-dioxide (15): In a procedure similar to the preparation of sultam **13**, a solution of sulfonamide **14** (217 mg, 0.77 mmol) in degassed CH_2Cl_2 (154 mL) was treated with Grubbs second generation catalyst (33 mg, 0.039 mmol) and the mixture subjected to the RCM reaction. Removal of the residual ruthenium with

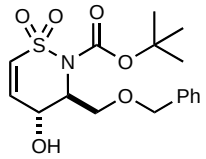
DMSO, followed by purification via flash chromatography (SiO_2, 3:1 Heptane/EtOAc) afforded 180 mg (92%) of sultam **15** as an ivory solid. TLC R_f = 0.12 (2:1 Heptane/EtOAc); Mp = 79-83 °C; $[\alpha]_D^{25}$ = + 41.7 (*c* = 1.19, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39-7.29 (m, 5H), 5.86-5.76 (m, 2H), 4.81, (d, *J* = 7.1 Hz, 1H), 4.57 (d, *J* = 12.0 Hz, 1H), 4.53 (d, *J* = 12.0 Hz, 1H), 4.31-4.26 (m, 1H) 3.74-3.68 (m, 1H), 3.64 (d, *J* = 4.4 Hz, 2H), 3.63-3.58 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.1, 128.5, 128.0, 127.8, 127.2, 120.9, 73.3, 70.2, 56.8, 47.5; FTIR (neat) 3252, 3032, 2922, 2866, 1653, 1498 cm^{-1}; HRMS (M+NH_4^+) calcd for $C_{12}H_{19}N_2O_3S$ 271.1116, found 271.1108.



1,2-thiazine-*N*-carboxylicacid-3,4,5,6-tetrahydro-(3*S*)-[(phenylmethoxy)methyl]-(4*R*,5*S*)-dihydroxy-1,1-dimethylethyl ester-1,1-dioxide (16): To a solution of sultam **13** (566 mg, 1.60 mmol), NMO (255 mg, 1.92 mmol) and citric acid (504 mg, 2.40 mmol) in acetone (3 mL) and water (1 mL) was added a 4 % aqueous solution of OsO_4 (0.016 mmol, 40 μL) and the reaction stirred at rt for 12 h. The reaction was quenched with a 10% aqueous solution of $Na_2S_2O_3$ (15 mL), extracted with CH_2Cl_2 (4 × 15 mL), the organic layers combined, dried over $MgSO_4$, filtered and concentrated under reduced pressure. Flash chromatography (SiO_2, 1:1 Hexanes/EtOAc) afforded 598 mg (96%) of diol **16** as a white crystalline solid. TLC R_f = 0.11 (1:1 Hexane/EtOAc); Mp = 105-110°C; $[\alpha]_D^{25}$ = + 14.0 (*c* 1.65, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37-7.28 (m, 5H), 4.83 (ddd, *J* = 9.2, 6.0, 3.2 Hz, 1H), 4.56 (d, *J* = 11.6 Hz, 1H), 4.50 (d, *J* = 12.0 Hz, 1H), 4.33-4.28 (m, 1H), 4.18 (bs, 1H), 3.76 (dd, *J* = 9.6, 9.2 Hz, 1H), 3.66 (dd, *J* = 10.0, 6.0 Hz, 1H), 3.52 (dd, *J* = 12.8, 10.4 Hz, 1H), 3.33 (dd, *J* = 12.8, 4.4 Hz, 1H), 2.65 (s, 2H, O-H), 1.49 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 151.8, 137.4, 128.5, 128.1, 128.0, 85.3, 73.4, 68.5, 66.4, 65.8, 60.5, 52.3, 27.9; FTIR (neat) 3477 (O-H), 3030, 2982, 2932, 2872, 1724 cm^{-1}; HRMS (M+Na^+) calcd for $C_{17}H_{25}NO_7SNa$ 410.1250, found 410.1254.

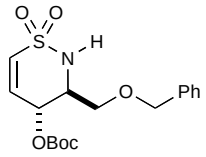


1,2-thiazine-1,1-dioxide-*N*-carboxylicacid-3,4,5,6-tetrahydro-(3*S*)-[(phenylmethoxy)-methyl]-cyclic-(4*R*,5*S*)-cyclocarbonate-1,1-dimethylethyl ester (16a): To a solution of *cis*-diol **16** (525 mg, 1.36 mmol) in CH_2Cl_2 (38 mL) at -78 °C was added pyridine (3.22 g, 40.8 mmol) and triphosgene (604 mg, 2.03 mmol) in one portion. After stirring for 10 min at -78 °C the temperature was raised to 0 °C and the reaction stirred at that temperature for 1 h. The crude mixture was quenched with 10 % HCl (15 mL) and extracted with CH_2Cl_2 (4 × 25 mL), dried over $MgSO_4$, filtered and concentrated under reduced pressure. Flash chromatography (SiO_2, 1.5:1 Hexanes/EtOAc) afforded 544 mg (97%) of the carbonate as a white fluffy solid. TLC R_f = 0.35 (1:1 Hexane/EtOAc); Mp = 55-65 °C; $[\alpha]_D^{25}$ = + 6.2 (*c* 1.40, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40-7.28 (m, 5H), 5.17 (ddd, *J* = 8.8, 4.4, 2.0 Hz, 1H), 5.07 (dd, *J* = 8.8, 2.0 Hz, 1H), 4.99 (app q, *J* = 2.8 Hz, 1H), 4.56 (d, *J* = 11.6 Hz, 1H), 4.47 (d, *J* = 11.6 Hz, 1H), 4.14 (dd, *J* = 15.6, 4.4 Hz, 1H), 3.86 (dd, *J* = 10.8, 2.8 Hz, 1H), 3.77 (dd, *J* = 10.8, 3.6 Hz, 1H), 3.47 (dd, *J* = 15.2, 2.0 Hz, 1H), 1.55 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 152.2, 151.1, 136.1, 128.9, 128.6, 128.0, 86.2, 74.0, 73.8, 72.4, 70.5, 59.0, 51.6, 27.9; FTIR (neat) 2982, 2939, 1819, 1730, 1454 cm^{-1}; HRMS ($M+Na^+$) calcd for $C_{18}H_{23}NO_8SNa$ 436.1042, found 436.1043.

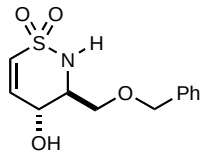


1, 2thiazine-*N*-carboxylic acid-3, 4-dihydro-(3*S*)-[(phenylmethoxy)methyl]-(4*S*)-hydroxy-1, 1- dimethylethyl ester-1, 1-dioxide (18): To a solution of the carbonate obtained in the previous reaction (70 mg, 0.174 mmol) in CH_2Cl_2 (1.7 mL) was added Et_3N (19.3 mg, 0.19 mmol) and the reaction heated at reflux for 1 h. Flash chromatography (SiO_2, 2:1 Hexanes/EtOAc) afforded 56.6 mg (91%) of γ-hydroxy sultam **18** as a white solid. TLC R_f = 0.32 (1:1 Hexanes/EtOAc); Mp = 85-87 °C; $[\alpha]_D^{25}$ = -64.4 (*c* 1.03, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36-7.29 (m, 5H), 6.47 (ddd, *J* = 10.4, 4.8, 1.2 Hz, 1H), 6.43 (d, *J* = 10.8 Hz, 1H), 4.92-4.87 (m, 1H), 4.58 (d, *J* =

11.6 Hz, 1H), 4.49 (d, *J* = 11.6 Hz, 1H), 4.39-4.35 (m, 1H), 3.70 (dd, *J* = 8.8, 4.8 Hz, 2H), 2.47 (d, *J* = 8.5 Hz, 1H), 1.53 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 151.1, 137.3, 133.9, 129.4, 128.4, 127.9, 127.8, 85.7, 73.3, 68.3, 61.4, 61.4, 27.9; FTIR (neat) 3493, 3059, 3035, 2982, 2927, 2872, 1732, 1641 cm^{-1}; HRMS (M+Na$^+$) calcd for $C_{17}H_{23}NO_6SNa$ 392.1144, found 392.1150.

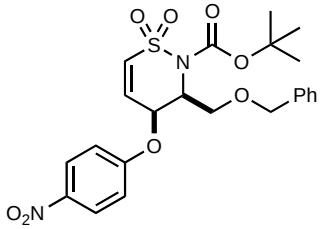


1,2-thiazine-1,1-dioxide-3,4-dihydro-(3*S*)-[(phenylmethoxy)methyl]-(4*S*)-tert-butyl-carbonate (19): To a solution of sultam **18** (25 mg, 0.067 mmol) in THF (0.67 mL) was added Cs_2CO_3 (24 mg, 0.074 mmol) and the reaction stirred at 60 °C for 1 h. The crude product was filtered and purified by flash chromatography (SiO_2, 4:1 Hexanes/ EtOAc) to afford 17.9 mg (71%) of sultam **19** as a clear oil. TLC R_f = 0.64 (2:1 Hexanes/EtOAc); $[\alpha]_D^{25}$ = -75.9 (*c* 0.20, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-7.29 (m, 5H), 6.63 (dd, *J* = 11.2, 2.0 Hz, 1H), 6.36 (dd, *J* = 11.2, 2.0 Hz, 1H), 5.48 (ddd, *J* = 12.0, 4.0, 2.0 Hz, 1H), 4.98 (d, *J* = 12.4 Hz, 1H), 4.58 (d, *J* = 11.6 Hz, 1H), 4.50 (d, *J* = 11.6 Hz, 1H), 4.00 (dddd, *J* = 12.5, 5.0, 2.5, 2.5 Hz, 1H), 3.68 (dd, *J* = 10.0, 1.6 Hz, 1H), 3.59 (dd, *J* = 10.0, 2.8 Hz, 1H), 1.50 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 153.3, 137.0, 136.3, 130.3, 128.6, 128.2, 128.0, 83.9, 73.7, 66.7, 66.0, 56.0, 27.7; FTIR (neat) 3285, 3063, 2982, 1743, 1618, 1456, 1369, 1151 cm^{-1}; HRMS (M+Na$^+$) calcd for $C_{17}H_{23}NO_6SNa$ 392.1144, found 392.1138.

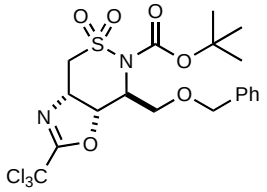


(3*S*,4*R*)-2H-1,2-thiazine-3,4-dihydro-3[(phenylmethoxy)methyl]-4-hydroxy-1,1-dioxide (20): In a procedure similar to the preparation of sulfonamide **14**, γ-hydroxy sultam **18** (75.0 mg, 0.20 mmol) in CH_2Cl_2 (1.0 mL) was treated with TFA (0.1 mL) and the solution stirred at rt for 30 min. Flash chromatography (SiO_2, 1:1 Hexanes/EtOAc) afforded 49.3 mg (91%) of sultam **20** as a white crystalline solid. TLC R_f = 0.30 (1:1.5 Hexanes/EtOAc); Mp = 115-125 °C; $[\alpha]_D^{25}$ =

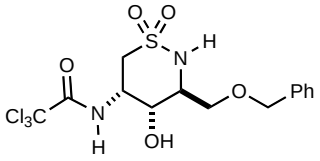
-15.7 (*c* 0.25, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-7.30 (m, 5H), 6.55 (dd, *J* = 10.8, 2.4 Hz, 1H), 6.37 (dd, *J* = 10.8, 2.0 Hz, 1H), 4.78 (d, *J* = 12.4 Hz, 1H), 4.58 (d, *J* = 11.6 Hz, 1H), 4.53 (d, *J* = 11.6 Hz, 1H), 4.55-4.50 (m, 1H), 3.91 (dd, *J* = 9.6, 2.0 Hz, 1H), 3.84-3.77 (m, 1H), 3.61 (dd, *J* = 9.6, 3.6 Hz, 1H), 2.17 (d, *J* = 7.2 Hz, 1H); ^{13}C NMR (125 MHz, Acetone-d_6) δ 141.6, 138.5, 128.8, 128.2, 127.5, 127.4, 72.9, 68.4, 62.8, 59.2; FTIR (neat) 3518, 3240, 3060, 2920, 1623, 1406 cm^{-1}; HRMS ($M+NH_4^+$) calcd for $C_{12}H_{19}N_2O_4$ 287.1066, found 287.1078.



1,2-thiazine-*N*-carboxylic acid-3,4-dihydro-(3*S*)-[(phenylmethoxy)methyl]-(4*R*)-(*p*-nitro-phenoxy)-1,1-dimethylethyl ester-1, 1-dioxide (21): To a solution of sultam **18** (50 mg, 0.14 mmol) in THF (0.70 mL) was added *p*-nitrophenol (19.0 mg, 0.14 mmol) and PPh_3 (40 mg, 0.15 mmol), followed by the dropwise addition of DEAD (26.0 mg, 0.15 mmol, 24 μL) at rt. The reaction was stirred at rt until complete consumption of sultam **18** (less than 1 h) by TLC analysis. Flash chromatography (SiO_2, 2:1 Heptane/EtOAc) afforded 30 mg (45 %) of **21** as an ivory solid. TLC R_f = 0.69 (1:1 Hexanes/EtOAc); Mp = 148-155 °C; $[\alpha]_D^{25}$ = +2.4 (*c* 0.20, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 (d, *J* = 9.2 Hz, 2H), 7.33-7.27 (m, 5H), 7.00 (d, *J* = 9.2 Hz, 2H), 6.47 (dd, *J* = 11.2, 2.4 Hz, 1H), 6.40 (ddd, *J* = 11.2, 1.6, 1.6 Hz, 1H), 5.50-5.48 (m, 1H), 5.27-5.21 (m, 1H), 4.55 (d, *J* = 11.2 Hz, 1H), 4.49 (d, *J* = 11.2 Hz, 1H), 4.05 (dd, *J* = 10.0, 10.0 Hz, 1H), 3.89 (dd, *J* = 10.4, 4.4 Hz, 1H), 1.52 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 160.5, 150.8, 142.7, 137.6, 133.6, 129.5, 128.2, 127.8, 127.7, 126.3, 115.2, 85.9, 73.5, 70.0, 65.5, 57.1, 27.8; FTIR (neat) 2980, 2932, 2874, 1732, 1610, 1518, 1342 cm^{-1}; HRMS ($M+NH_4^+$) calcd for $C_{23}H_{30}N_3O_8S$ 508.1754, found 508.1729.

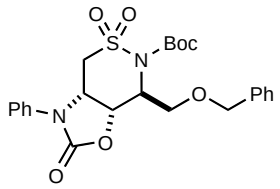


Trichlorooxazole-containing sultam (22): To a cold solution (-50 °C) of sultam **18** (50 mg, 0.135 mmol) in CH_2Cl_2 (1.35 mL) was added Cl_3CCN (20 μL) and DBU (4.1 mg, 0.027 mmol, 4.0 μL). The reaction was stirred until it slowly reached rt. The reaction was quenched with saturated NH_4Cl (15 mL) and extracted with CH_2Cl_2 (4 × 15 mL). The organic layers were combined, dried over $MgSO_4$, filtered and concentrated under reduced pressure. Flash chromatography (SiO_2, 2:1 Hexanes/EtOAc) afforded 66 mg (96 %) of **22** a white solid. TLC R_f = 0.58 (1:1 Hexanes/EtOAc); Mp = 49-54 °C; $[\alpha]_D^{25}$ = +28.4 (*c* = 0.67, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40-7.30 (m, 5H), 5.27 (dd, *J* = 10.4, 2.0 Hz, 1H), 5.18 (ddd, *J* = 4.4, 4.4, 2.0 Hz, 1H), 4.91 (ddd, *J* = 10.0, 5.6, 2.4 Hz, 1H), 4.59 (d, *J* = 11.6 Hz, 1H), 4.51 (d, *J* = 11.6 Hz, 1H), 4.04 (dd, *J* = 14.8, 5.6 Hz, 1H), 3.79 (d, *J* = 4.4 Hz, 2H), 3.53 (dd, *J* = 14.8, 2.4 Hz, 1H), 1.52 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) 163.1, 151.2, 136.5, 128.7, 128.4, 128.0, 85.6, 80.5, 80.5, 73.9, 70.1, 63.6, 58.9, 51.2, 27.9; FTIR (neat) 2982, 2935, 2972, 1728, 1666, 1454, 1369, 1346 cm^{-1}; HRMS ($M+H^+$) calcd for $C_{19}H_{24}Cl_3N_2O_6S$ 513.0421, found 513.0417.

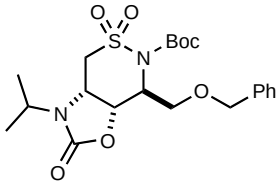


1,2-thiazine-1,1-dioxide-3,4,5,6-tetrahydrohydro-(3*S*)-[(phenylmethoxy)methyl]-(4*S*)-hydroxy-(5*S*)-(2,2,2-trichloro)acetamide (23): To a solution of sultam **22** (24.0 mg, 0.047 mmol) in CH_2Cl_2 (0.5 mL) was added TFA (0.47 mmol, 35 μL) and the reaction stirred at rt for 1 h. Flash chromatography (SiO_2, 1:1 Hexanes/EtOAc) afforded 19.4 mg (97%) of trichloroacetimidate **23** as a white solid. TLC R_f = 0.45 (1:1.5 Hexanes/EtOAc); Mp = 56-64 °C; $[\alpha]_D^{25}$ = -41.5 (*c* 0.54, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.51 (d, *J* = 8.8 Hz, 1H), 7.40-7.30 (m, 5H), 4.99 (d, *J* = 9.6 Hz, 1H), 4.90 (dddd, *J* = 8.0, 4.0, 4.0, 4.0 Hz, 1H), 4.56 (d, *J* = 12.0 Hz, 1H), 4.53 (d, *J* = 12.0 Hz, 1H), 4.13 (dd, *J* = 10.4, 4.0 Hz, 1H), 3.92 (dd, *J* = 9.6, 2.4 Hz, 1H), 3.63-3.60 (m, 2H), 3.45 (dd, *J* = 14.0, 4.0 Hz, 1H), 3.37 (dd, *J* = 14.0, 4.0 Hz, 1H), 2.70 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.9, 137.1, 128.6, 128.2, 128.0, 92.0, 73.7, 67.2, 67.1, 55.1,

51.1, 50.3; FTIR (neat) 3470-3447, 3362, 3064, 3032, 2935, 1713, 1630, 1454 cm^{-1}; HRMS ($M+H^+$) calcd for $C_{14}H_{18}Cl_3N_2O_5S$ 431.0002, found 431.0026.

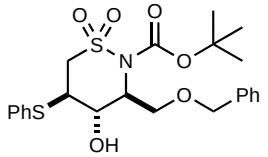


1,2-thiazine-*N*-carboxylic acid-3,4,5,6-tetrahydro-(3*S*)-[(phenylmethoxy)methyl]-*N*'-phenyl-(4*S*,5*S*)-oxazolidinone-1,1-dimethylethyl ester-1,1-dioxide (24): To a solution of γ-hydroxy sultam **18** (6.0 mg, 0.016 mmol) in DCE (0.16 mL) was added phenyl isocyanate (2.9 mg, 0.024 mmol) and Et_3N (0.16 mg, 0.016 mmol). The reaction was stirred in a pressure tube at reflux (83 °C) until complete by TLC. Flash chromatography (SiO_2, 4:1 Hexanes/EtOAc) afforded 5 mg (64%) of bicyclic sultam **24** as a white solid. TLC R_f = 0.55 (1:1 Hexane/EtOAc); Mp= 160-164 °C; $[\alpha]_D^{25}$ = -52.9 (*c* 0.17, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 7.45-7.30 (m, 10H), 5.09 (dd, *J* = 9.2, 2.0 Hz, 1H), 5.03-5.01 (m, 1H), 4.93 (ddd, *J* = 9.2, 4.8, 2.0 Hz, 1H), 4.59 (d, *J* = 11.6 Hz, 1H), 4.53 (d, *J* = 11.6 Hz, 1H), 3.93 (dd, *J* = 14.8, 4.0 Hz, 1H), 3.89 (dd, *J* = 10.4, 3.6 Hz, 1H), 3.83 (dd, *J* = 10.8, 3.6 Hz, 1H), 3.22 (dd, *J* = 15.2, 2.0 Hz, 1H), 1.55 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 153.5, 151.2, 136.5, 134.7, 129.7, 128.9, 128.5, 128.0, 126.7, 123.7, 85.9, 74.1, 71.0, 70.5, 59.6, 55.4, 48.0, 28.0; FTIR (neat) 3063, 2928, 1765, 1724, 1630, 1599, 1456 cm^{-1}; HRMS ($M+NH_4^+$) calcd for $C_{24}H_{32}N_3O_7S$ 506.1961, found 506.1973.

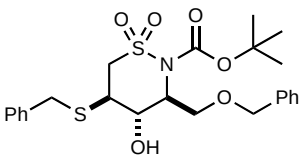


1,2-thiazine-*N*-carboxylic acid-3, 4, 5, 6-tetrahydro-(3*S*)-[(phenylmethoxy)methyl]-*N*'-isopropyl-(4*S*,5*S*)-oxazolidinone-1,1-dimethylethyl ester-1,1-dioxide (25): To a solution of γ-hydroxy sultam **18** (41.0 mg, 0.11 mmol) in DCM (0.78 mL) was added isopropyl isocyanate (14.0 mg, 0.166 mmol, 16μL) and Et_3N (3.9 mg, 0.039 mmol, 8μL). The reaction was heated at 50 °C in a pressure tube until complete by TLC (~24 h). Flash chromatography (SiO_2, 2:1 Hexanes/EtOAc) afforded 39.1 mg (78%) of bicyclic sultam **25** as an ivory solid. TLC R_f = 0.14

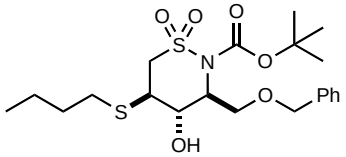
(1:1 Hexanes/EtOAc); Mp = 132-135 °C; $[\alpha]_D^{25}$ =-34.5 (*c* 0.52, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 7.40-7.29 (m, 5H), 4.96 (ddd, *J* = 4.0, 4.0, 2.4 Hz, 1H), 4.79 (dd, *J* = 8.4, 2.0 Hz, 1H), 4.56 (d, *J* = 11.6 Hz, 1H), 4.52 (d, *J* = 11.6 Hz, 1H), 4.33 (ddd, *J* = 8.4, 4.8, 3.2 Hz, 1H), 3.94 (dd, *J* = 15.2, 5.2 Hz, 1H), 3.88-3.85 (m, 1H), 3.85 (dd, *J* = 10.8, 4.4 Hz, 1H), 3.76 (dd, *J* = 10.4, 3.6 Hz, 1H), 3.26 (dd, *J* = 14.8, 3.2 Hz, 1H), 1.54 (s, 9H), 1.34 (d, *J* =7.2 Hz, 3H), 1.32 (d, *J* = 6.8 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 155.1, 151.0, 136.7, 128.8, 128.4, 128.0, 85.7, 73.9, 71.5, 70.3, 59.1, 52.9, 50.6, 46.5, 28.0, 21.5, 20.0; FTIR (neat) 3109, 2980, 1755, 1634, 1520, 1454 cm^{-1}; HRMS ($M+NH_4^+$) calcd for $C_{21}H_{34}N_3O_7S$ 472.2117, found 472.2112.



1,2-thiazine-*N*-carboxylic acid-3,4,5,6-tetrahydro-(3*S*)-[(phenylmethoxy)methyl]-(4*R*)-hydroxy-(5*R*)-phenylthio-1,1-dimethylethyl ester-1,1-dioxide (26): To a solution of γ-hydroxy sultam **18** (32 mg, 0.087 mmol) in CH_2Cl_2 (0.87 mL) was added PhSH (10.5 mg, 0.095 mmol, 10 μL) and DMAP (2.0 mg, 0.0174 mmol). The reaction was stirred at rt for 12 h and the solvent removed under reduced pressure. Flash chromatography (SiO_2, 4:1 Hexanes/EtOAc) afforded 35 mg (84%, 6:1 mixture of inseparable diastereomers) **26** as a clear oil. **(Major diastereomer)** TLC R_f = 0.59 (1:1 Hexanes/EtOAc); ^1H NMR (400 MHz, $CDCl_3$) δ 7.44 (dd, *J* = 6.0, 3.0 Hz, 2H), 7.35-7.28 (m, 6H), 7.22 (dd, *J* = 8.0, 1.5 Hz, 2H), 4.95 (ddd, *J* = 9.0, 6.0, 2.5 Hz, 1H), 4.52 (d, *J* = 12.0 Hz, 1H), 4.42 (d, *J* = 11.5 Hz, 1H), 4.19 (d, *J* = 2.0 Hz, 1H), 3.87 (ddd, *J* = 13.0, 3.5, 2.0 Hz, 1H), 3.74 (dd, *J* = 10.0, 9.0 Hz, 1H), 3.67 (dd, *J* = 13.5, 12.5 Hz, 1H), 3.64 (dd, *J* = 10.5, 5.5 Hz, 1H), 3.22 (dd, *J* = 13.0, 3.5 Hz, 1H), 2.61 (d, *J* = 3.0 Hz, 1H), 1.50 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 151.5, 137.5, 132.9, 129.7, 129.7, 128.8, 128.5, 127.9, 127.7, 85.1, 73.3, 68.2, 64.6, 61.7, 50.5, 46.0, 27.9; FTIR (neat) 3504, 3061, 2982, 2932, 1728, 1583, 1454 cm^{-1}; HRMS ($M+NH_4^+$) calcd for $C_{23}H_{33}N_2O_6S_2$ 497.1780, found 497.1778.

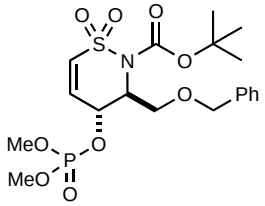


1,2-thiazine, *N*-carboxylic acid-3,4,5,6-tetrahydro-(3*R*)-[(phenylmethoxy)methyl]-(4*R*)-hydroxy-(5*R*)-benzylthio-1,1-dimethylethyl ester-1,1-dioxide (27): In a procedure similar to the preparation of sultam **26**, a solution of γ-hydroxy sultam **18** (29 mg, 0.078 mmol) in CH_2Cl_2 (0.78 mL) was treated with $PhCH_2SH$ (10.7 mg, 0.086 mmol, 10 μL) and Et_3N (1.6 mg, 0.0156 mmol, 2.2 μL). The reaction was stirred at rt for 12 h and the solvent removed under reduced pressure. Flash chromatography (SiO_2, 3:1 Hexanes/EtOAc) afforded 38.5 mg (100%) of **27** as a separable mixture of diastereomers (dr ~10:1) as clear oils. (**Major diastereomer)** TLC R_f = 0.50 (1:1 Hexanes/EtOAc); $[\alpha]_D^{25}$ = + 57.7 (*c* 0.73, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36-7.25 (m, 10H), 4.88 (ddd, *J* = 8.0, 6.8, 2.4 Hz, 1H), 4.52 (d, *J* = 12.0 Hz, 1H), 4.44 (d, *J* = 12.0 Hz, 1H), 4.00-3.98 (m, 1H), 3.80 (d, *J* = 13.6 Hz, 1H), 3.76 (d, *J* = 13.6 Hz, 1H), 3.58 (dd, *J* = 8.0, 1.2 Hz, 1H), 3.57 (d, *J* = 13.2 Hz, 1H), 3.54 (d, *J* = 13.2 Hz, 1H) , 3.39 (ddd, *J* = 13.2, 3.2, 2.0 Hz, 1H), 3.01 (dd, *J* = 13.2, 3.2 Hz, 1H), 2.57 (s, 1H), 1.48 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 150.4, 136.6, 135.7, 127.9, 127.8, 127.4, 126.9, 126.8, 126.7, 83.9, 72.1, 67.3, 63.7, 60.4, 49.5, 40.7, 34.8, 26.9; FTIR (neat) 3504, 2980, 2930, 1726, 1602, 1454, 1138 cm^{-1}; HRMS ($M+NH_4^+$) calcd for $C_{24}H_{35}N_2O_6S_2$ 511.1937, found 511.1939.

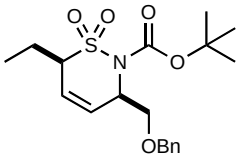


1,2-thiazine-*N*-carboxylic acid-3,4,5,6-tetrahydro-(3*S*)-[(phenylmethoxy)methyl]-(4*R*)-hydroxy-(5*R*)-butylthio-1,1-dimethylethyl ester-1,1-dioxide (28): In a procedure similar to the preparation of sultam **27**, a solution of γ-hydroxy sultam **18** (27 mg, 0.073 mmol) in CH_2Cl_2 (0.73 mL) was treated with BuSH (7.2mg, 0.080 mmol, 10 μL) and Et_3N (2.2 mg, 0.0219 mmol, 3.0 μL). The reaction was stirred at rt for 12 h and the solvent removed under reduced pressure. Flash chromatography (SiO_2, 3:1 Hexanes/EtOAc) afforded 29.6 mg (88%) of **28** as an inseparable mixture of diastereomers (dr ~4.5:1) as a clear oil. **(Major diastereomer)** TLC R_f = 0.50 (1:1 Hexanes/EtOAc); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35-7.29 (m, 5H), 4.97 (ddd, *J* = 9.0, 5.5, 2.5 Hz, 1H), 4.60 (d, *J* = 12.0 Hz, 1H), 4.47 (d, *J* = 12.0 Hz, 1H), 4.12 (app q, *J* = 2.0 Hz, 1H), 3.80 (dd, *J* = 9.5, 9.5 Hz, 1H), 3.67 (dd, *J* = 10.0, 6.0 Hz, 1H), 3.56 (dd, *J* = 13.0, 13.0 Hz, 1H), 3.46 (ddd, *J* = 13.0, 3.0, 2.0 Hz, 1H), 3.17 (dd, *J* = 13.0, 3.0 Hz, 1H), 2.61 (d, *J* = 2.5 Hz,

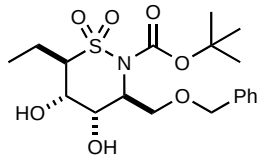
1H), 2.57 (ddd, J = 7.5, 7.5, 2.0 Hz, 2H), 1.57-1.54 (m, 2H), 1.50 (s, 9H), 1.42-1.37 (m, 2H), 0.92 (t, J = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 151.4, 137.6, 128.5, 127.9, 127.8, 85.0, 73.2, 68.2, 64.6, 61.3, 50.7, 42.6, 31.6, 31.3, 27.9, 21.9, 13.6; FTIR (neat) 2959, 2932, 1728, 1624, 1607, 1497, 1454 cm^{-1}; HRMS (M+Na$^+$) calcd for $C_{21}H_{33}NO_6S_2Na$ 482.1647, found 482.1638.



1,2-thiazine-1,1-dioxide-*N*-carboxylic acid-3, 4-dihydro-(3*S*)-[(phenylmethoxy)- methyl]-1,1-dimethylethyl ester-(4*S*)-dimethylphosphate (29): To a solution of γ-hydroxy sultam **18** (144 mg, 0.39 mmol) in CH_2Cl_2 (4 mL) at 0 °C was added *N*-methylimidazole (96 mg, 1.17 mmol, 84 μL) and $(MeO)_2P(O)Cl$ (112.6 mg, 0.78 mmol, 84 μL). The ice bath was removed and the reaction stirred at rt for 1 h. The reaction was quenched with a saturated solution of NH_4Cl (15 mL) and extracted with CH_2Cl_2 (4 × 15 mL). The organic layers were combined, dried over $MgSO_4$, filtered and concentrated under reduced pressure. Flash chromatography (SiO_2, 1:2 hexanes/EtOAc) afforded 159 mg (85%) of sultam **29** as a clear oil. TLC R_f = 0.37 (1:2.5 Heptane/EtOAc); $[\alpha]_D^{25}$ = -83.9 (*c* 1.35, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31-7.23 (m, 5H), 6.46 (d, J = 10.6 Hz, 1H), 6.43 (ddd, J = 10.6, 5.3, 1.5 Hz, 1H), 5.06-5.02 (m, 1H), 4.93 (ddd, J = 7.7, 5.4, 2.0 Hz, 1H), 4.51 (d, J = 11.8 Hz, 1H), 4.43 (d, J = 11.7 Hz, 1H), 3.72 (d, J_{HP} =11.3 Hz, 3H), 3.69 (d, J_{HP} = 11.3 Hz, 3H), 3.62 (dd, J = 8.4, 1.3 Hz, 2H), 1.46 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 150.6, 137.2, 131.6, 129.7 (d, J_{CP} = 15.0 Hz), 128.5, 128.0, 127.8, 85.8, 73.4, 67.5, 65.2 (d, J_{CP} = 20.0 Hz), 59.4 (d, J_{CP} = 20.0 Hz), 54.8 (d, J_{CP} = 25.0 Hz), 54.8 (d, J_{CP} = 20.0 Hz), 27.9; ^{31}P NMR (400 MHz, $CDCl_3$) δ 1.77; FTIR (neat) 3833, 2981, 2959, 1736, 1647, 1456 cm^{-1}; HRMS (M+NH_4^+) calcd for $C_{19}H_{32}N_2O_9PS$ 495.1566, found 495.1560.

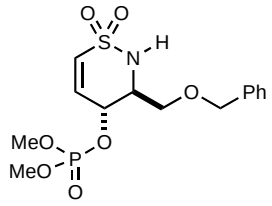


1,2-thiazine-*N*-carboxylic acid-3,6-dihydro-(3*R*)-[(phenylmethoxy)methyl]-(6*R*)-ethyl- 1,1-dimethylethyl ester-1,1-dioxide (30): To a solution of CuCN·2 LiCl (1 M, 0.56 mmol) at -78° C was added Et_2Zn (1 M, 0.56 mmol) and the mixture stirred at that temperature for 1.5 h. A solution of phosphate **29** (26.5 mg, 0.056 mmol) in THF (0.56 mL) was added to the diethyl cuprate mixture and the solution stirred until it warmed up to -20 °C. The reaction was quenched with a saturated solution of NH_4Cl (10 mL) and extracted with CH_2Cl_2 (4 × 10 mL), the organic layers combined, dried over $MgSO_4$, filtered and concentrated. Flash chromatography (SiO_2, 7:1 Hexanes/EtOAc) afforded 15.5 mg (74%) of sultam **30** as a white solid. TLC R_f = 0.69 (2:1 Hexanes/EtOAc); Mp = 60-65 °C; $[\alpha]_D^{25}$ = + 85.7 (*c* 0.68, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.34-7.27 (m, 5H), 5.93 (ddd, *J* = 10.8, 3.2, 3.2 Hz, 1H), 5.60 (ddd, *J* = 10.8, 2.0, 1.6 Hz, 1H), 5.28-5.22 (m, 1H), 4.48 (s, 2H), 3.74-3.67 (m, 3H), 2.11-2.05 (m, 1H), 1.69-1.60 (m, 1H), 1.42 (s, 9H), 1.07 (t, 7.4 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 150.7, 137.9, 128.1, 127.6, 127.6, 125.8, 122.7, 84.4, 73.1, 70.9, 60.5, 59.9, 27.9, 21.7, 10.9; FTIR (neat) 2978, 2935, 1716, 1616, 1456, 1169 cm^{-1}; HRMS ($M+NH_4^+$) calcd for $C_{19}H_{31}N_2O_5S$ 399.1954, found 399.1953.

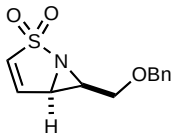


1,2-thiazine-*N*-carboxylic acid-3,4,5,6-tetrahydro-(3*R*)-[(phenylmethoxy)methyl]-(4*R*,5*S*)-dihydroxy-(6*R*)-ethyl- 1,1-dimethylethyl ester-1,1-dioxide (31): To a stirring solution of **s**ultam **30** (10.8 mg, 0.028 mmol) in acetone (1.5 mL) and water (0.5 mL) was added citric acid (9.0 mg, 0.042 mmol), NMO (6.0 mg, 0.033 mmol) and 1 drop of OsO_4 (4 % solution in water) via pipet. The reaction was stirred at rt for 12 h, then quenched with a 10% aqueous solution of Na_2SO_3 and extracted with CH_2Cl_2 (4 × 15 mL). The organic layers were combined, dried over $MgSO_4$, filtered and concentrated under reduced pressure. Flash chromatography (SiO_2, 1:1 Hexanes/EtOAc) afforded 9.1 mg (78%) of diol **31** as an ivory solid. TLC R_f = 0.16 (1:1 Hexanes/EtOAc); Mp = 100-105 °C; $[\alpha]_D^{25}$ = + 50.8 (*c* 0.13, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37-7.30 (m, 5H), 4.72 (ddd, *J* = 9.6, 5.6, 4.0 Hz, 1H), 4.56 (d, *J* = 12.0 Hz, 1H), 4.51 (d, *J* = 11.6 Hz, 1H), 4.27 (bs, 1H), 3.98 (dd, *J* = 6.8, 6.0 Hz, 1H), 3.82 (dd, *J* = 9.6, 9.2 Hz, 1H), 3.72 (dd, *J* = 9.6, 5.6 Hz, 1H), 3.38 (ddd, *J* = 8.0, 6.0, 6.0 Hz, 1H), 2.74 (bs, 1H), 2.51 (d, *J* = 7.6 Hz, 1H), 2.04 (ddd, *J* = 13.6, 7.6, 7.6 Hz, 2H), 1.50 (s, 9H), 1.20 (t, *J* = 7.6 Hz, 3H); ^{13}C NMR

(125 MHz, $CDCl_3$) δ 151.9, 137.4, 128.5, 128.0, 127.9, 84.9, 73.5, 70.3, 69.7, 68.0, 63.9, 59.8, 27.9, 18.8, 11.9; FTIR (neat) 3479, 2979, 2933, 2879, 1722, 1367, 1055 cm^{-1}; HRMS ($M+Na^+$) calcd for $C_{19}H_{29}NO_7SNa$ 438.1563, found 438.1551.

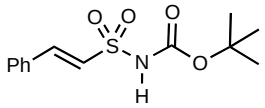


1,2-thiazine-1,1-dioxide-3,4-dihydro-(3*S*)-[(phenylmethoxy)methyl]-(4*R*)-dimethyl-phosphate (32): To a stirring solution of **s**ultam **29** (12.0 mg, 0.25 mmol) in CH_2Cl_2 (0.25 mL) was added $FeCl_3$ (4.0 mg, 0.025 mL) in one portion and the reaction stirred at rt for 30 min. The crude mixture was quenched with water (10 mL) and extracted with CH_2Cl_2 (4 × 15 mL), dried over $MgSO_4$, filtered and concentrated under reduced pressure. Flash chromatography (SiO_2, 1:2 Hexane/EtOAc) afforded 5.6 mg (60%) of sultam **32** as a white solid. TLC R_f = 0.14 (1:2 Hexanes/EtOAc); Mp = 80-84° C; $[\alpha]_D^{25}$ = -49.6 (*c* 1.11, $CHCl_3$); ^1H NMR (400 MHz, $CDCl_3$) δ 7.37-7.32 (m, 5H), 6.64 (dd, *J* = 10.8, 2.0 Hz, 1H), 6.52 (dd, *J* = 10.8, 2.0 Hz, 1H), 5.18 (dddd, *J* = 9.2, 9.2, 2.0, 2.0 Hz, 1H), 5.00 (d, *J* = 12.0 Hz, 1H), 4.59 (d, *J* = 11.6 Hz, 1H), 4.55 (d, *J* = 11.6 Hz, 1H), 4.00-3.95 (m, 1H), 3.87 (dd, *J* = 9.6, 2.0 Hz, 1H), 3.79 (d, J_{HP}= 11.2 Hz, 3H), 3.75 (d, J_{HP} = 11.2 Hz, 3H), 3.65 (dd, *J* = 9.6, 2.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.1, 136.7, 130.4, 128.6, 128.2, 128.0, 73.7, 67.2 (d, J_{CP} = 20.0 Hz), 66.9, 57.1 (d, J_{CP} = 35.0 Hz), 54.9 (d, J_{CP} = 30.0 Hz), 54.8 (d, J_{CP} = 30.0 Hz); ^{31}P NMR (400 MHz, $CDCl_3$) δ 1.60; FTIR (neat) 3232, 3119, 2957, 1610, 1454, 1155, 1092 cm^{-1}; HRMS ($M+Na^+$) calcd for $C_{14}H_{20}NO_7PSNa$ 400.0596, found 400.0578.

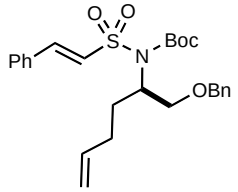


Aziridine-Containing Sultam (34): To a solution of sultam **32** (21.7 mg, 0.0575 mmol) in THF (0.58 mL) was added Cs_2CO_3 (56 mg, 0.173 mmol) and the reaction stirred at 60 °C for 1 h. The

product was filtered and purified by flash chromatography (SiO_2, 1:1 Hexanes/EtOAc) to afford 15 mg (100%) of aziridine **34** as a light-yellow oil. TLC R_f = 0.43 (1:2 Hexanes/EtOAc); $[\alpha]_D^{25}$ = -38.6 (*c* 0.35, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-7.31 (m, 5H), 6.96 (ddd, *J* = 6.0, 1.0, 1.0 Hz, 1H), 6.40 (d, *J* = 6.0 Hz, 1H), 4.60 (d, *J* = 12.4 Hz, 1H), 4.56 (d, *J* = 12.8 Hz, 1H), 3.80 (dd, *J* = 11.6, 4.4 Hz, 1H), 3.68 (m, 1H), 3.58 (dd, *J* = 11.2, 4.8 Hz, 1H), 2.78 (q, *J* = 4.0 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 136.8, 136,2, 127.6, 127.0, 126.9, 125.0, 72.6, 66.8, 55.5, 46.2; FTIR (neat) 3080, 2920, 1609 cm^{-1}; HRMS ($M+Na^+$) calcd for $C_{12}H_{13}NO_3SNa$ 274.0514, found 274.0515.

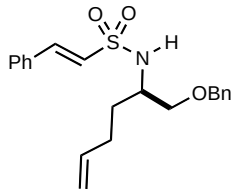


(*E*)-*tert*-butyl styrylsulfonylcarbamate (36): To a solution of (*E*)-2-phenylethenesulfonamide (1.0 g, 5.46 mmol) in CH_2Cl_2 (6.8 mL) containing DMAP (66 mg, 0.55 mmol) and Et_3N (607 mg, 6.0 mmol, 0.84 mL) at rt was added a solution of Boc_2O (1.37 g, 6.27 mmol, 1.44 mL) in CH_2Cl_2 (10.9 mL) dropwise with stirring over 20 min. The reaction was stirred for 2 h at rt, followed by removal of the solvent under reduced pressure. The crude product was treated with EtOAc (80 mL) and 1N HCl (53 mL) and the organic layer washed successively with water (50 mL) and brine (50 mL). The water layer was washed with CH_2Cl_2 (4 × 50 mL), the organic layers combined, dried over Na_2SO_4, filtered and concentrated under reduced pressure. The product was heated in heptane (20 mL), cooled down to rt and filtered to give 1.46 g (94%) of styrylsulfonylcarbamate **36** as an ivory solid. TLC R_f = 0.51(1:1 Hexanes/EtOAc); Mp = 160-166 °C; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (d, *J* = 15.4 Hz, 1H), 7.54-7.52 (m, 2H), 7.46-7.41 (m, 3H), 7.20 (s, 1H, N-H), 7.00 (d, *J* = 15.4 Hz, 1H), 1.48 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 149.3, 144.6, 132.1, 131.5, 129.2, 128.7, 123.9, 84.3, 28.0; FTIR (neat) 3246, 1736, 1614, 1576 cm^{-1}; HRMS ($M+Na^+$) calcd for $C_{13}H_{17}NO_4SNa$ 306.0776, found 306.0769.

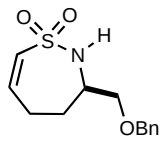


(*R*,*E*)-*tert*-butyl 1-(benzyloxy)hex-5-en-2-yl(styrylsulfonyl)carbamate (38): In a procedure similar to the preparation of sulfonamide **12**, a solution of sulfamoyl carbamate **36** (1.42 g, 5.01

mmol) in THF (3.2 mL) was subjected to the Mitsunobu reaction in the presence of secondary alcohol **37** (1.03 g, 5.01 mmol), PPh_3 (1.71g, 5.51 mmol) and DIAD (1.11 g, 5.51 mmol, 1.07 mL) to yield after flash chromatography (SiO_2, 10:1 Hexane/EtOAc) 1.93 g (82%) of sulfamoyl carbamate **38** as a yellow oil. TLC R_f = 0.49 (3:1 Hexanes/EtOAc); $[\alpha]_D^{25}$ = -9.1 (*c* 1.06, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, *J* = 15.5 Hz, 1H), 7.41-7.37 (m, 1H), 7.33-7.27 (m, 7H), 7.20 (d, *J* = 7.4 Hz, 2H), 6.98 (d, *J* = 15.5 Hz, 1H), 5.86 (dddd, *J* = 16.8, 10.2, 6.5, 6.3 Hz, 1H), 5.08 (dd, *J* = 17.2, 1.6 Hz, 1H), 5.01 (dd, *J* = 10.2, 1.0 Hz, 1H), 4.74-4.66 (m, 1H), 4.58 (d, *J* = 11.6 Hz, 1H), 4.46 (d, *J* = 11.6 Hz, 1H), 3.96 (dd, *J* = 9.8, 9.8 Hz, 1H), 3.56 (dd, *J* = 9.8, 5.1 Hz, 1H), 2.28-2.16 (m, 2H), 2.14-2.03 (m, 1H), 1.73-1.63 (m, 1H), 1.47 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.7, 142.2, 137.7, 137.2, 132.1, 130.5, 128.7, 128.1, 127.9, 127.3, 127.2, 125.2, 114.9, 83.7, 72.7, 69.9, 58.0, 30.2, 29.1, 27.7; FTIR (neat) 3070, 2980, 1726, 1639, 1616, 1578, 1450, 1353, 1145 cm^{-1}; HRMS ($M+H^+$) calcd for $C_{26}H_{34}NO_5S$ 472.2158, found 472.2159.



(*R*,*E*)-*N*-(1-(benzyloxy)hex-5-en-2-yl)-2-phenylethenesulfonamide (39): In a procedure similar to the preparation of sulfonamide **14**, a solution of sulfamoyl carbamate **38** (115 mg, 0.24 mmol) in CH_2Cl_2 (2.0 mL) was treated with TFA (0.5 mL) to yield after aqueous workup and flash chromatography (SiO_2, 2:1 Heptane/EtOAc) 91 mg (100%) of sulfonamide **39** as an ivory solid. TLC R_f = 0.45 (2:1 Hexanes/EtOAc); Mp = 40-43 °C; $[\alpha]_D^{25}$ = +18.0 (*c* 1.13, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 (d, *J* = 15.4 Hz, 1H), 7.39-7.27 (m, 10H), 6.67 (d, *J* = 15.4 Hz, 1H), 5.77 (dddd, *J* = 16.8, 10.2, 6.6, 6.6 Hz, 1H), 5.00 (dd, *J* = 17.1, 1.6 Hz, 1H), 4.96 (dd, *J* = 10.2, 1.3 Hz, 1H), 4.62 (d, *J* = 8.3 Hz, 1H), 4.50 (s, 2H), 3.53 (dd, *J* = 8.8, 3.4 Hz, 1H), 3.49-3.42 (m, 2H), 2.22-2.06 (m, 2H), 1.69 (q, J = 7.4 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 140.5, 137.6, 137.5, 132.6, 130.5, 129.0, 128.4, 128.1, 127.8, 127.7, 126.2, 115.3, 73.2, 71.7, 53.3, 31.9, 29.8; FTIR (neat) 3279, 3063, 2928, 1622, 1448, 1363, 1150 cm^{-1}; HRMS ($M+H^+$) calcd for $C_{21}H_{26}NO_3S$ 372.1633, found 372.1643.



1,2-thiazepin-3,4,5-trihydro-(3*R*)-[(phenylmethoxy)methyl]-1,1-dioxide (40): A solution of **s**ulfonamide **39** (361 mg, 0.97 mmol) in refluxing DCE (194 mL) was subjected to RCM with Grubbs second generation catalyst (5 mol %, 41 mg, 0.049 mmol) and the reaction stirred for 3-6 hrs to afford after flash chromatography (SiO_2, 3:1 Heptane/EtOAc) 224 mg (86%) of vinylic sultam **40** as a yellow oil. TLC R_f = 0.28 (1:1 Hexanes/EtOAc); $[\alpha]_D^{25}$ = -1.7 (*c* 0.92, $CHCl_3$); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-7.29 (m, 5H), 6.61 (dd, *J* = 11.1, 1.9 Hz, 1H), 6.36 (ddd, *J* =11.1, 7.2, 5.5 Hz, 1H), 4.89 (d, *J* = 7.9 Hz, 1H), 4.55 (d, *J* = 11.8 Hz, 1H), 4.50 (d, *J* = 11.8 Hz, 1H), 3.80-3.73 (m, 1H), 3.64-3.55 (m, 2H), 2.65-2.57 (m, 2H), 2.04-1.99 (m, 1H), 1.94-1.87 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 139.2, 137.4, 135.0, 128.2, 127.6, 127.5, 73.0, 72.5, 53.8, 28.5, 25.9; FTIR (neat) 3265, 3059, 3030, 2926, 1624, 1496, 1452, 1363 cm^{-1}; HRMS ($M+Na^+$) calcd for $C_{13}H_{17}NO_3SNa$ 290.0827, found 290.0829.

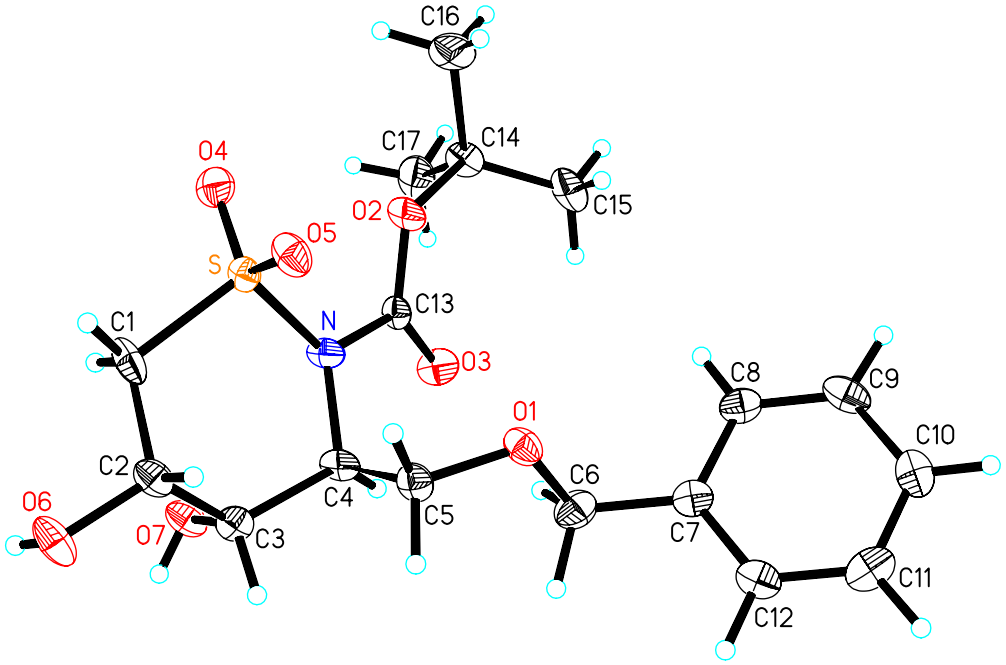


Figure S1. Thermal ellipsoid diagram for compound **16**. Ellipsoids are drawn at the 50% probability level.

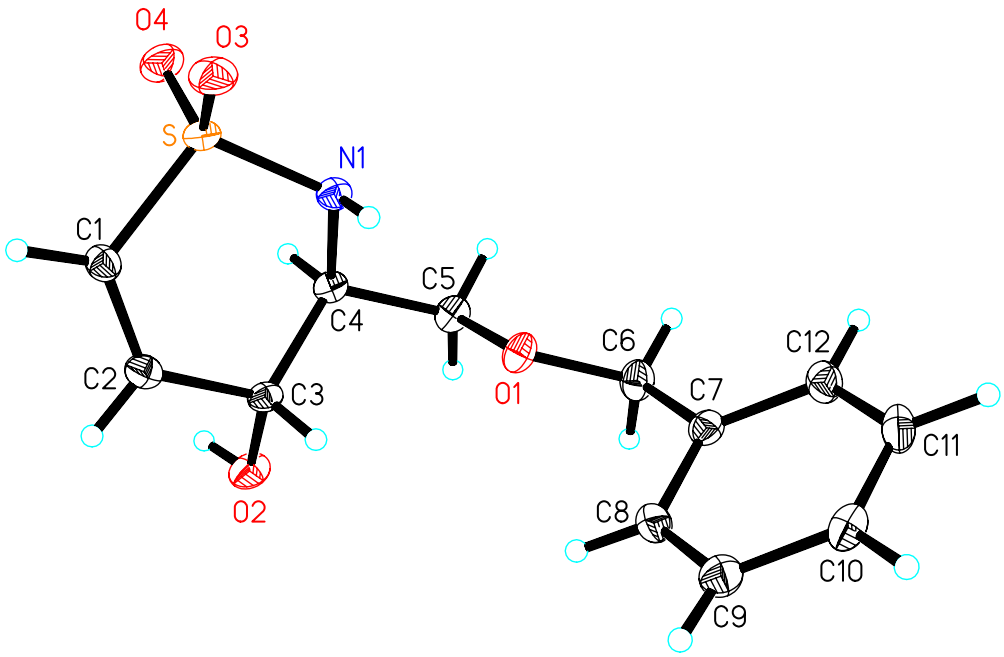
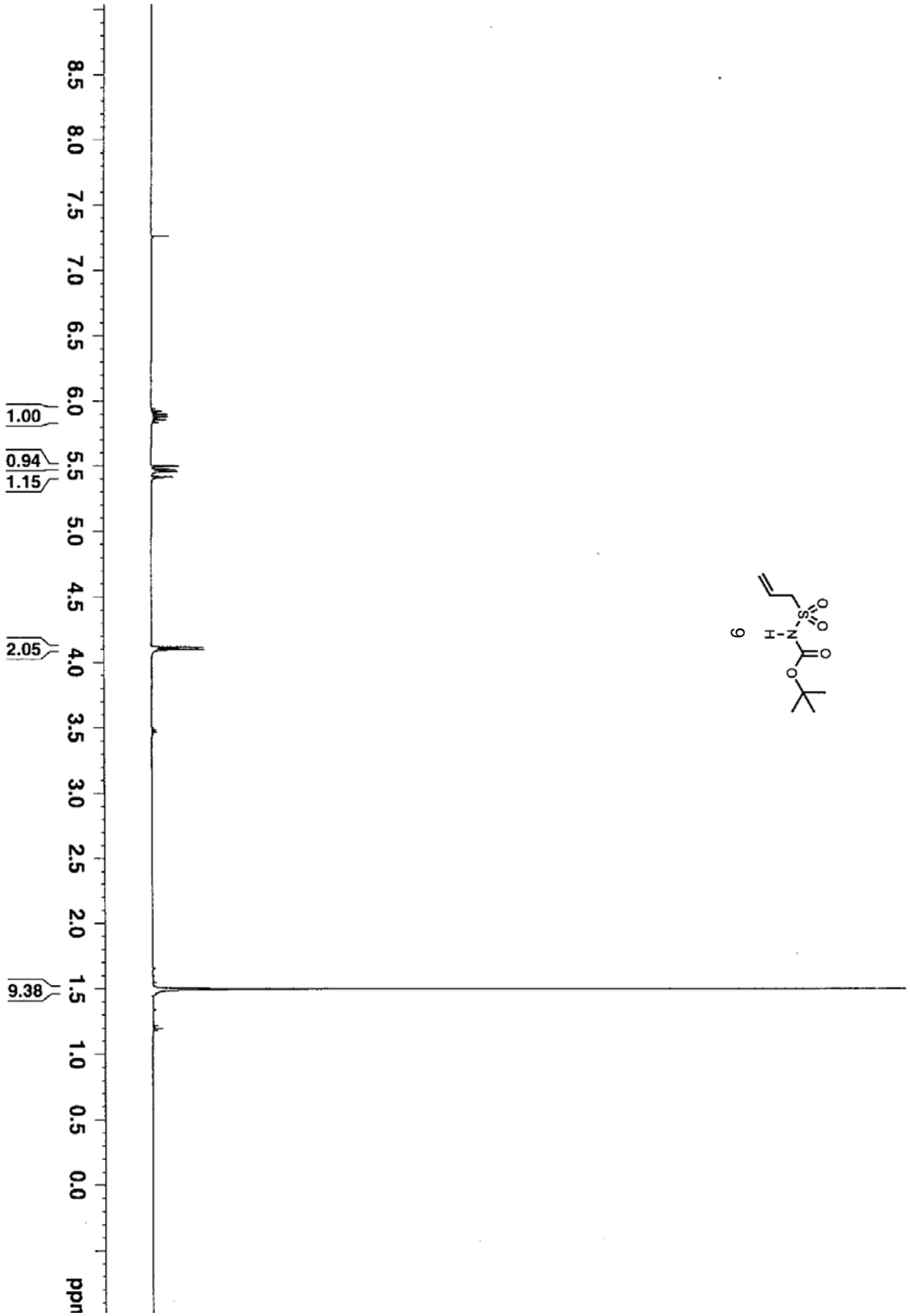


Figure S2. Thermal ellipsoid diagram for compound **20**. Ellipsoids are drawn at the 50% probability level.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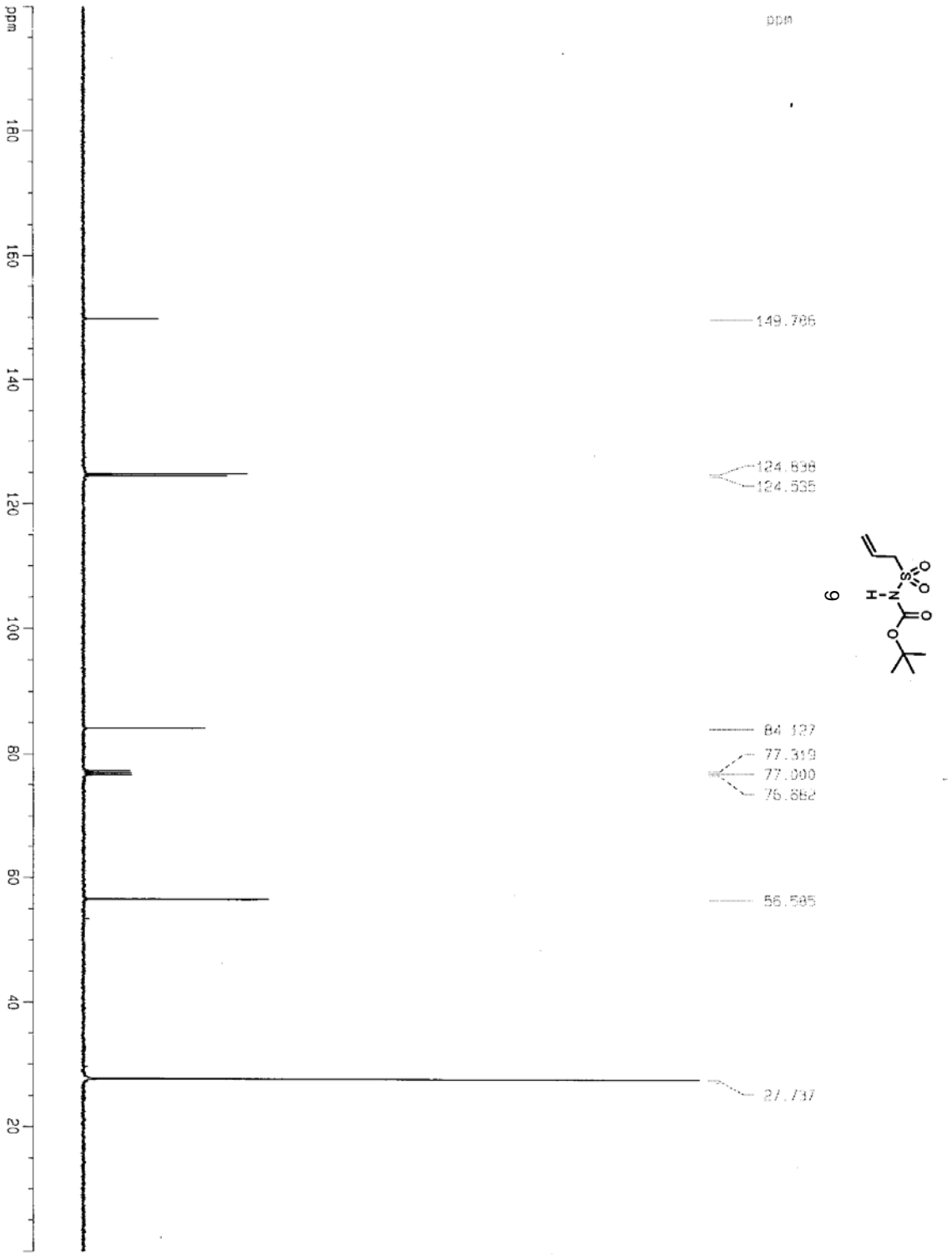
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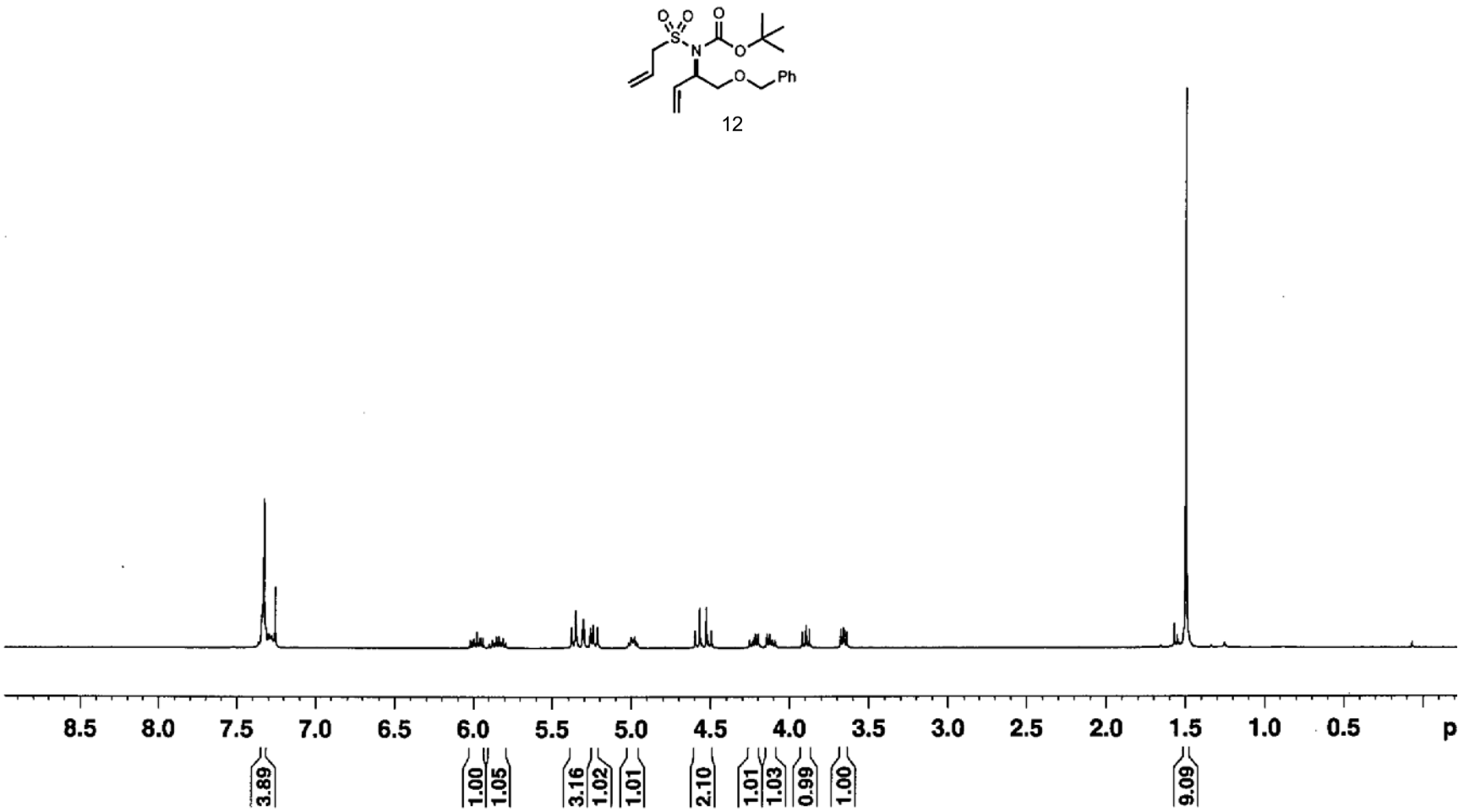
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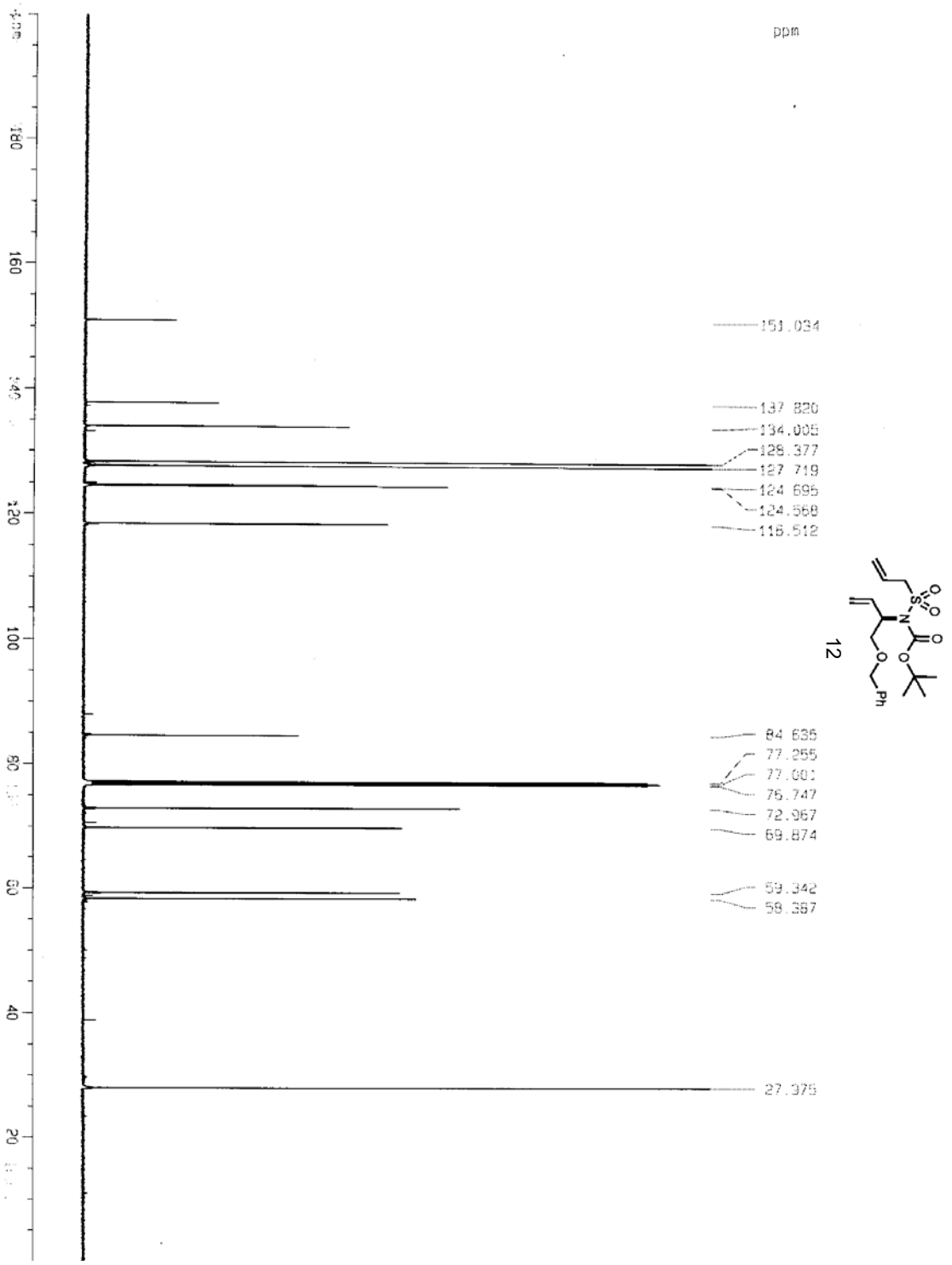
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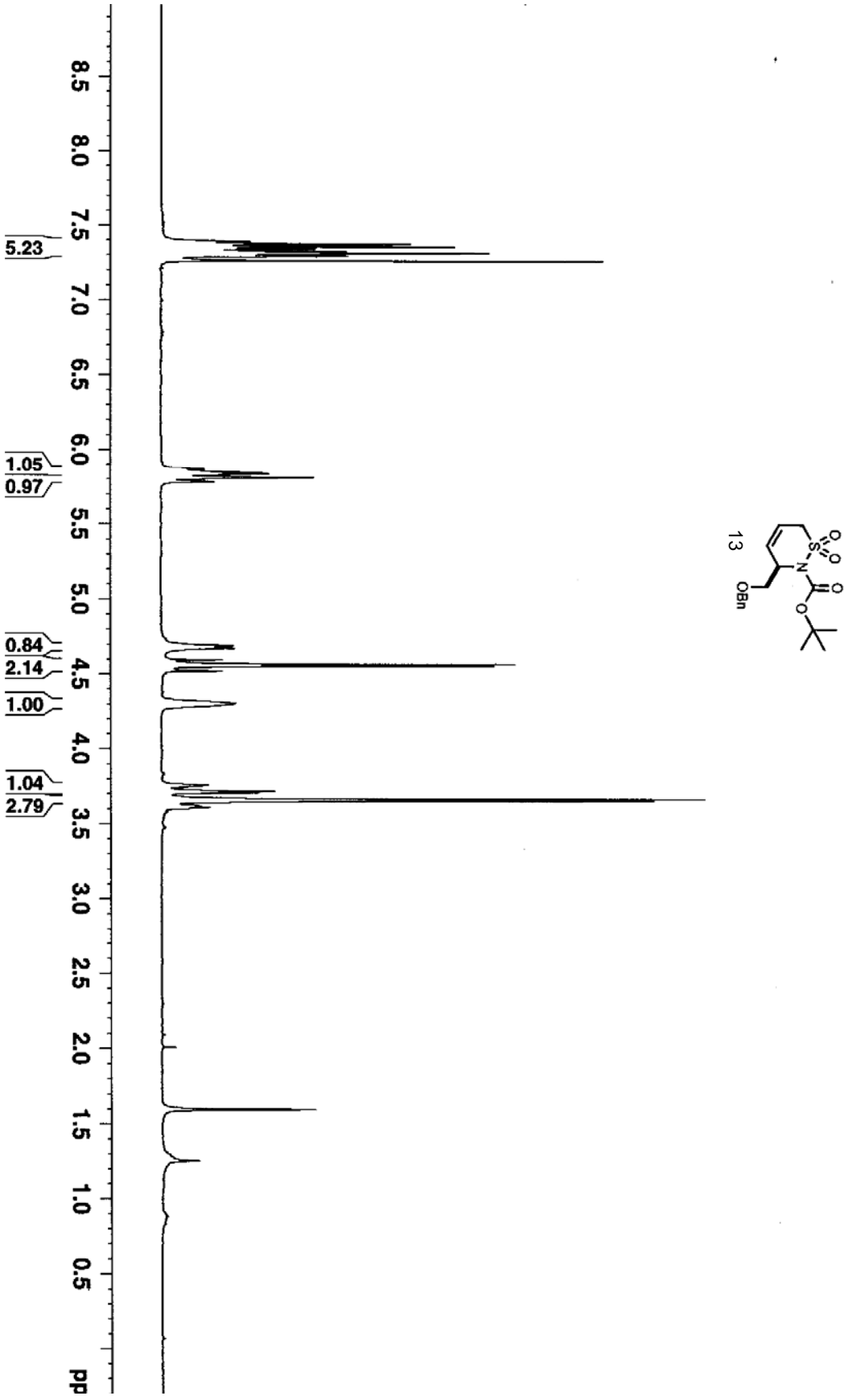
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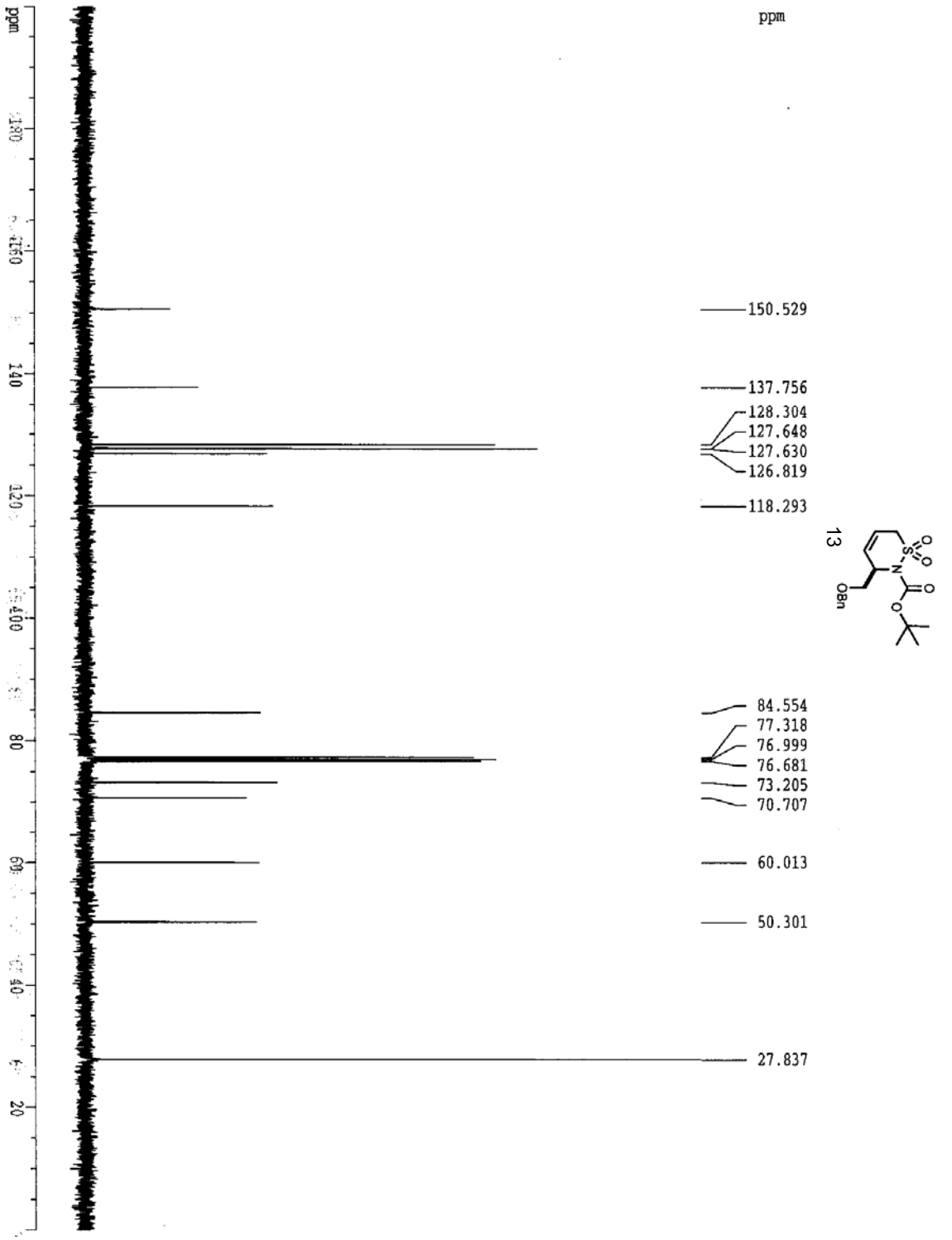
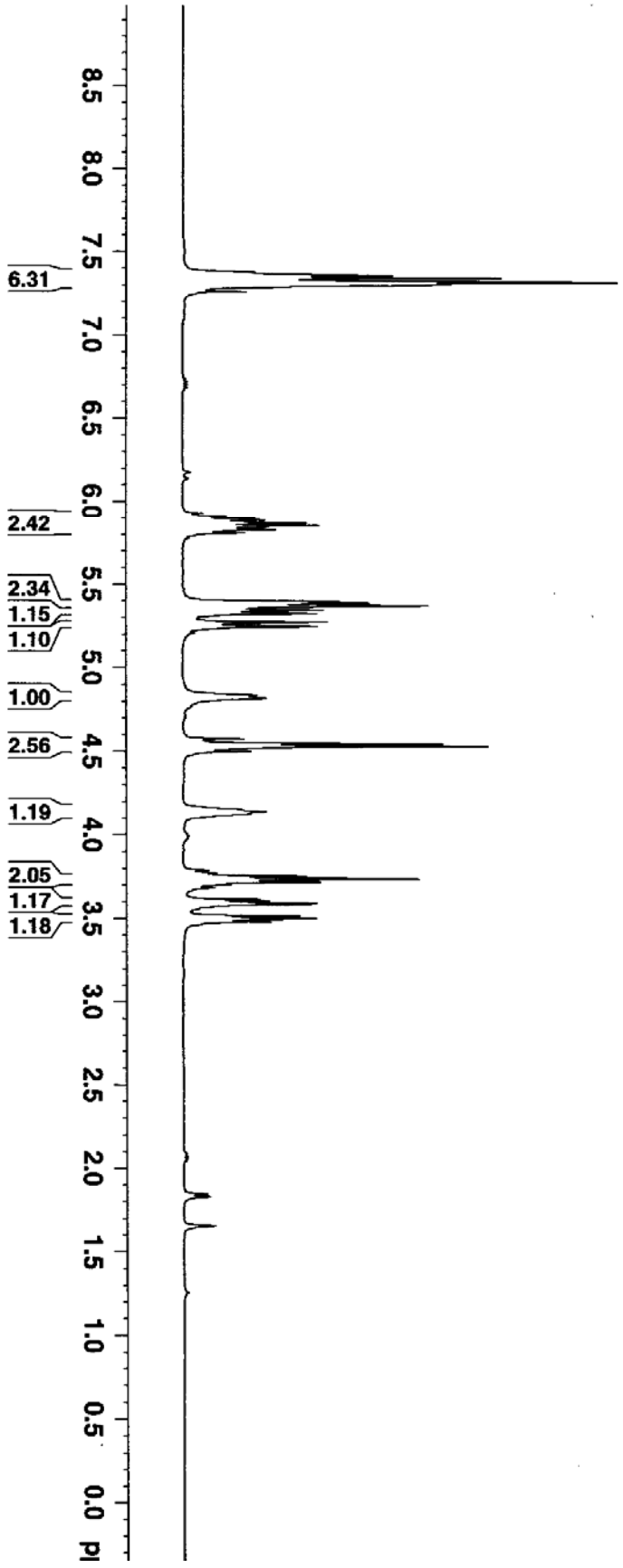
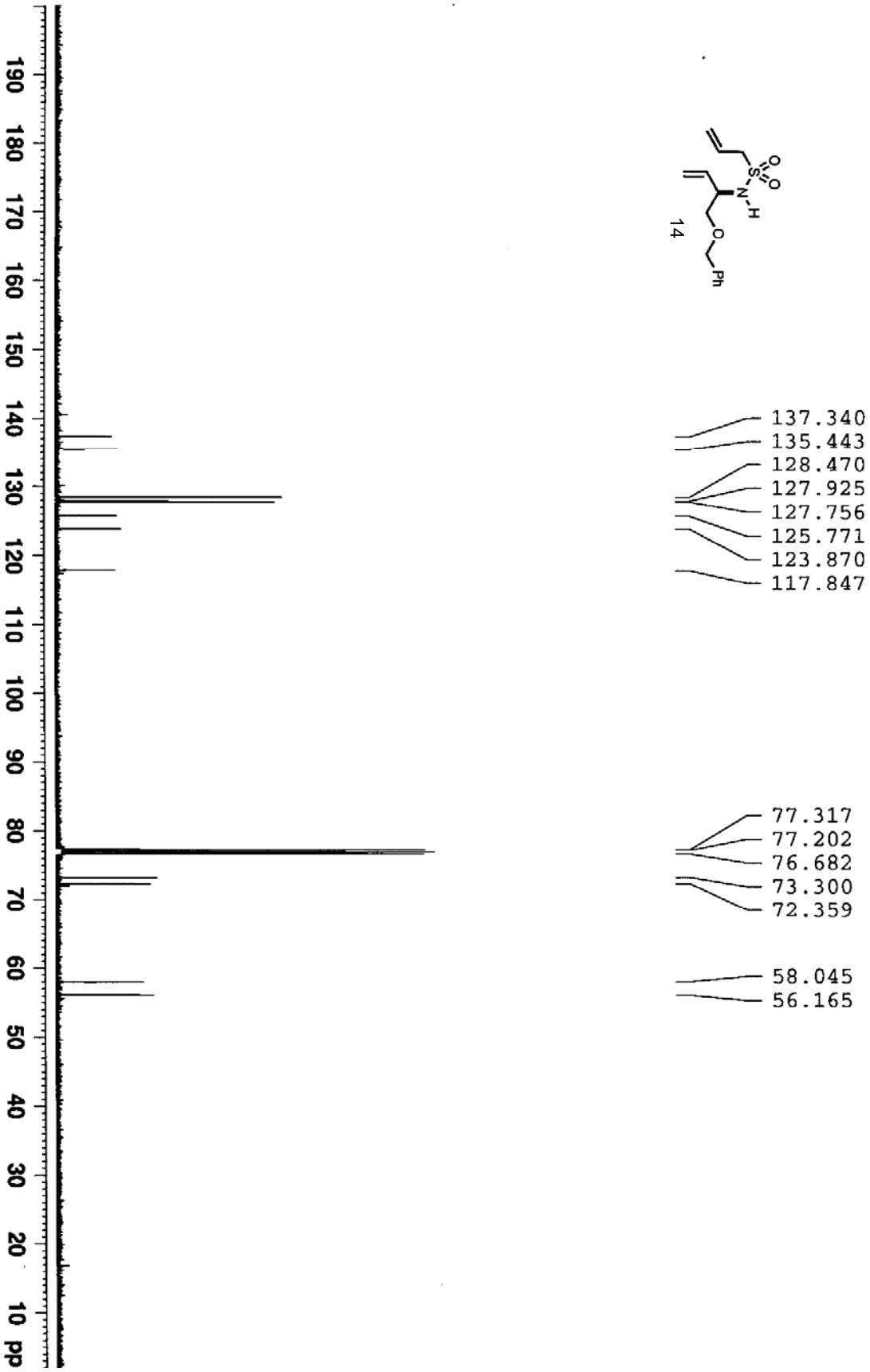
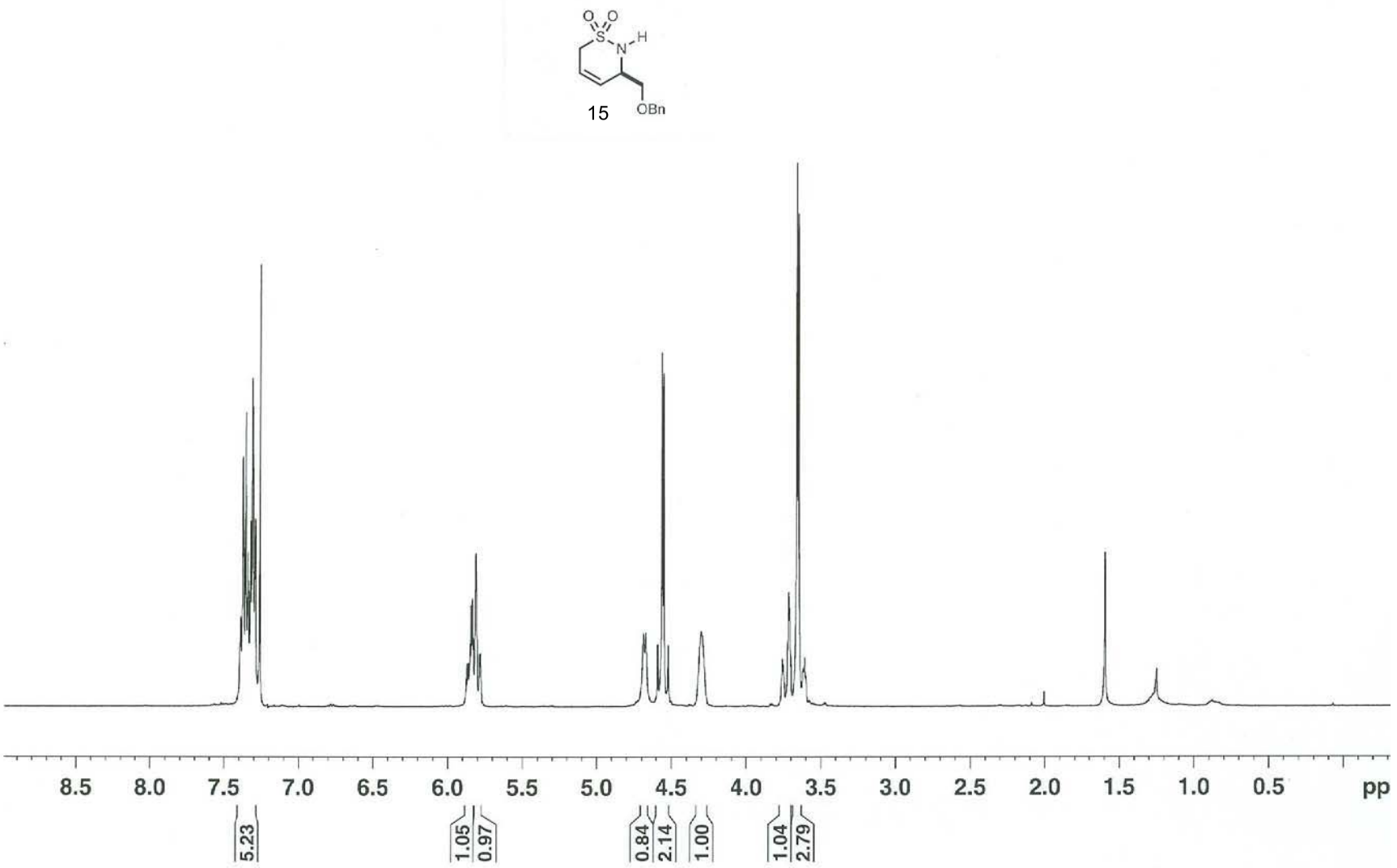
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
pp
13
OBn

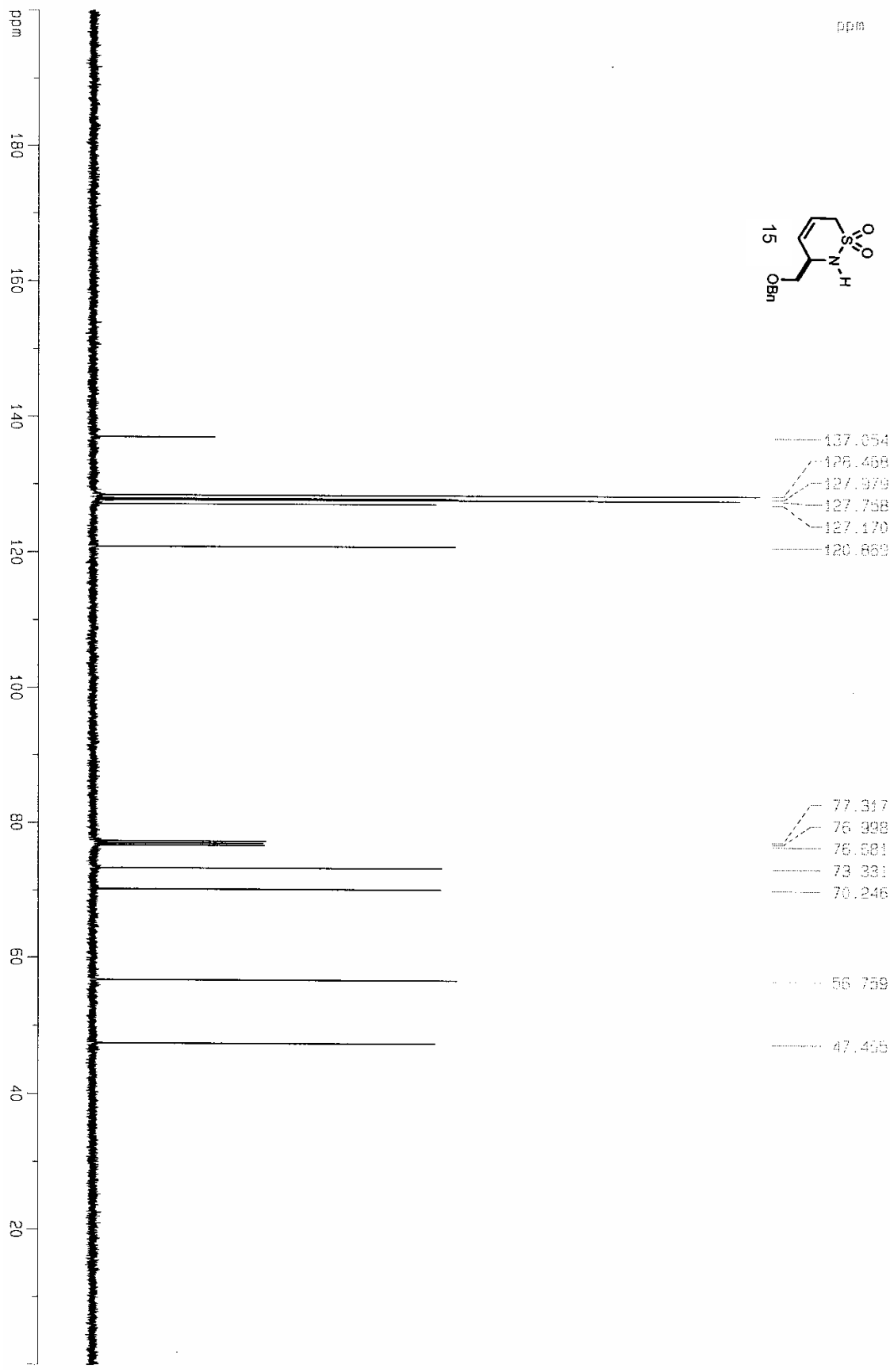

ppm
ppm
180
160
140
120
100
80
60
40
20
150.529
137.756
128.304
127.648
127.630
126.819
118.293
84.554
77.318
76.999
76.681
73.205
70.707
60.013
50.301
27.837
13
OBn

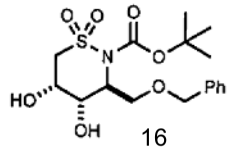

6.31
2.42
2.34
1.15
1.10
1.00
2.56
1.19
2.05
1.17
1.18
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
O
O
S
N
H
O
Ph

14

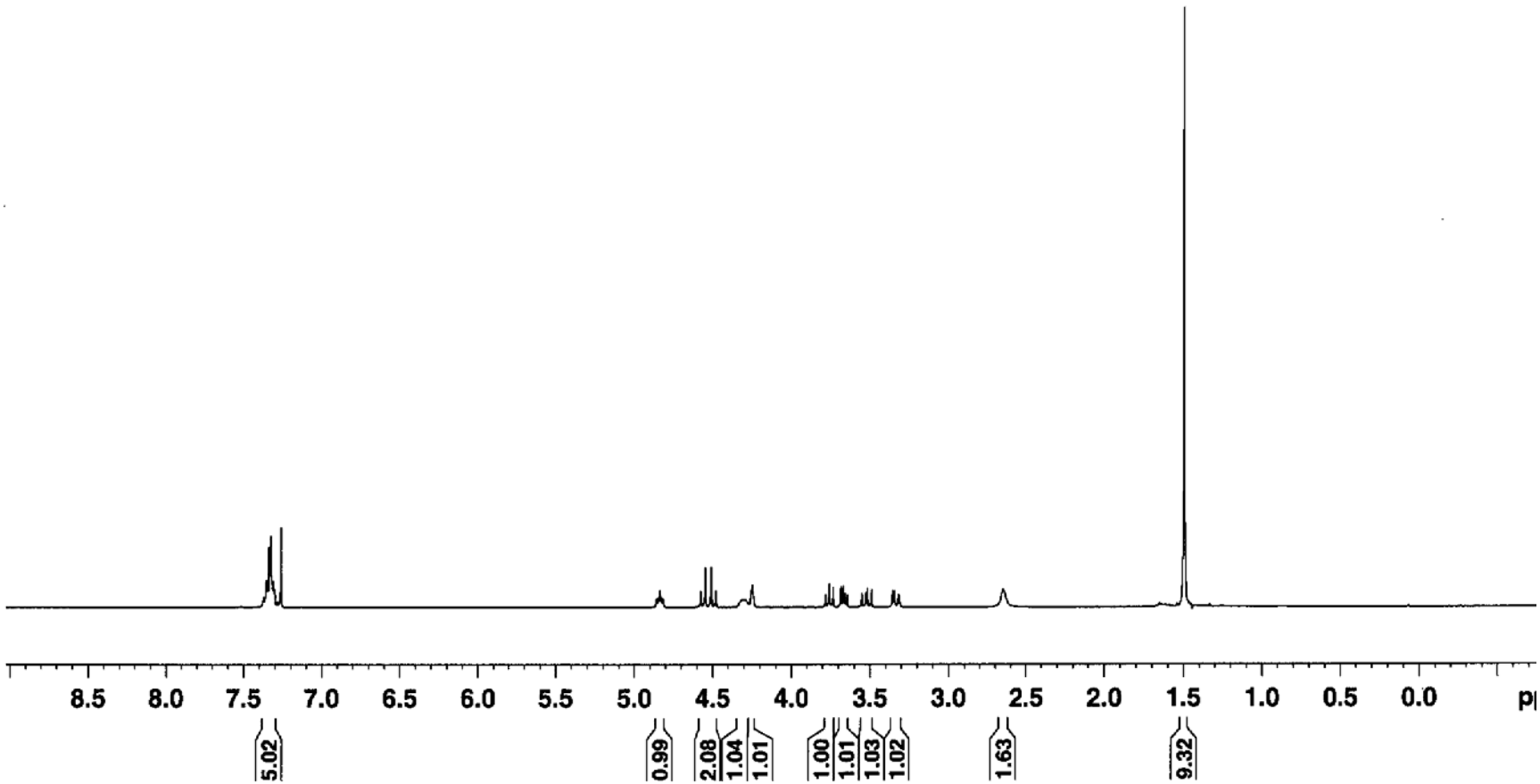

190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
pp
14
Ph
137.340
135.443
128.470
127.925
127.756
125.771
123.870
117.847
77.317
77.202
76.682
73.300
72.359
58.045
56.165

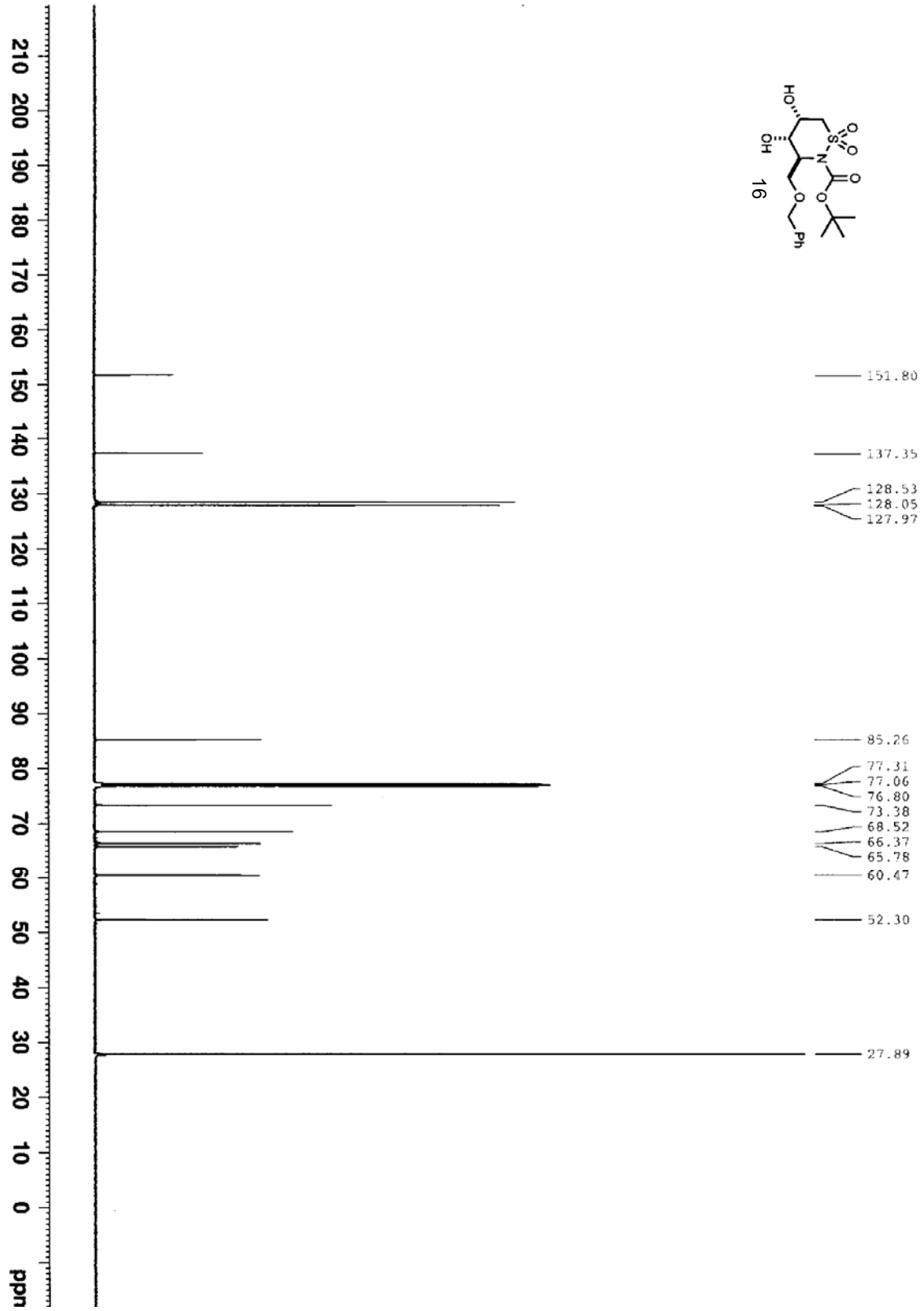

O
O
S
N
H
OBn
15
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
pp
5.23
1.05
0.97
0.84
2.14
1.00
1.04
2.79

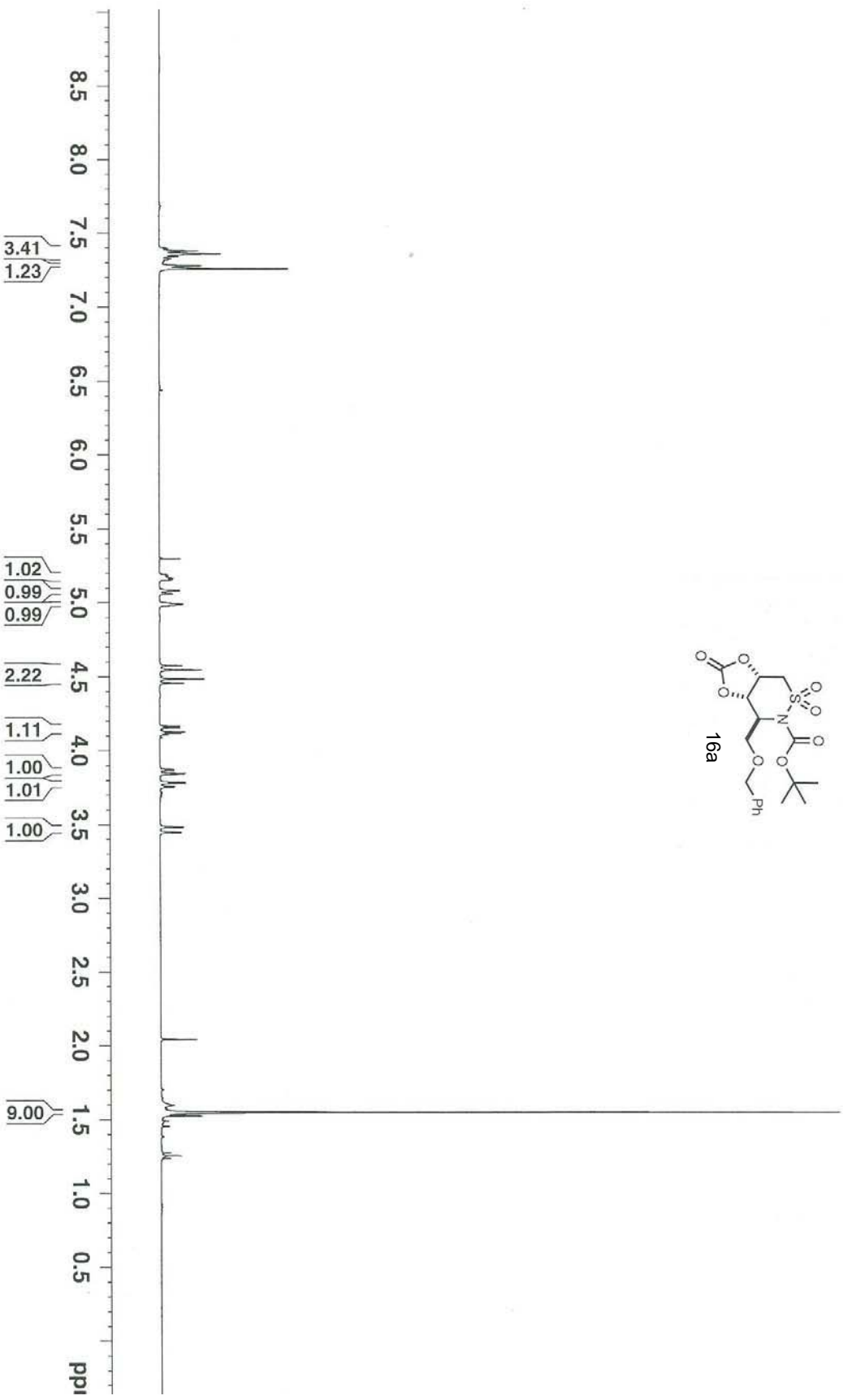

ppm
180
160
140
120
100
80
60
40
20
ppm
15
OBn
137.654
128.468
127.979
127.758
127.170
120.869
77.317
76.998
76.681
73.331
70.246
56.759
47.435

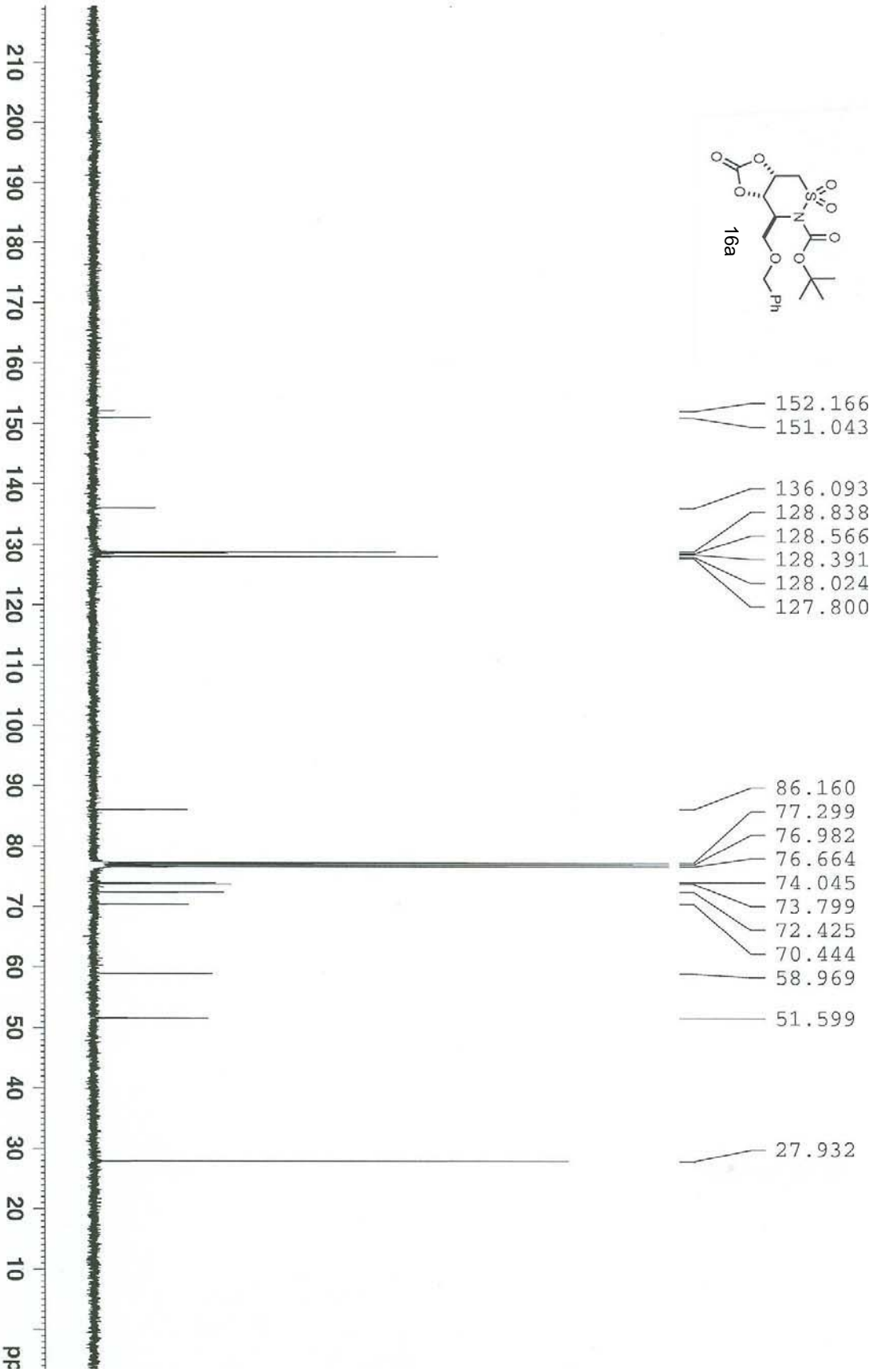

O
O
S
N
O
O
HO
OH
O
Ph

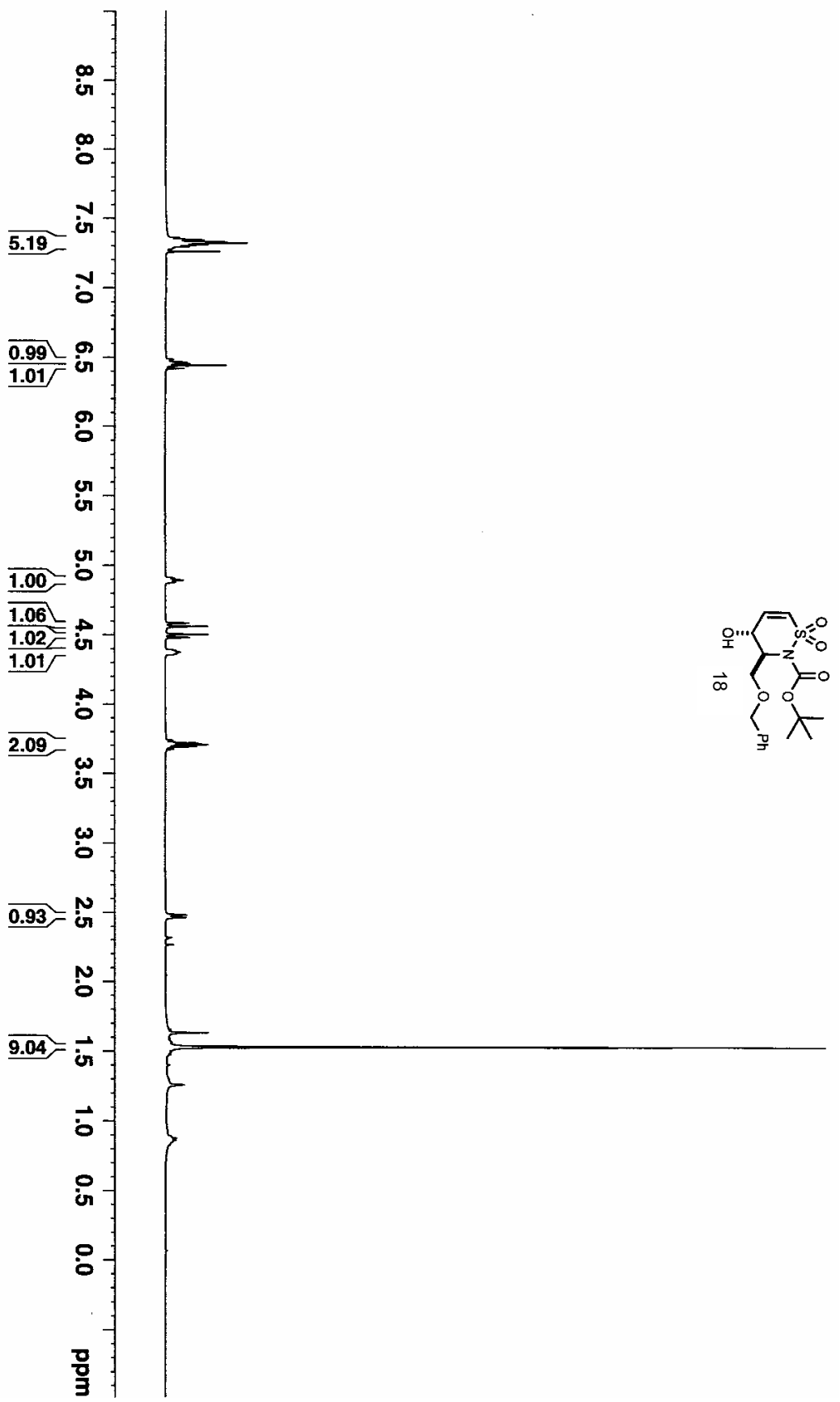
16

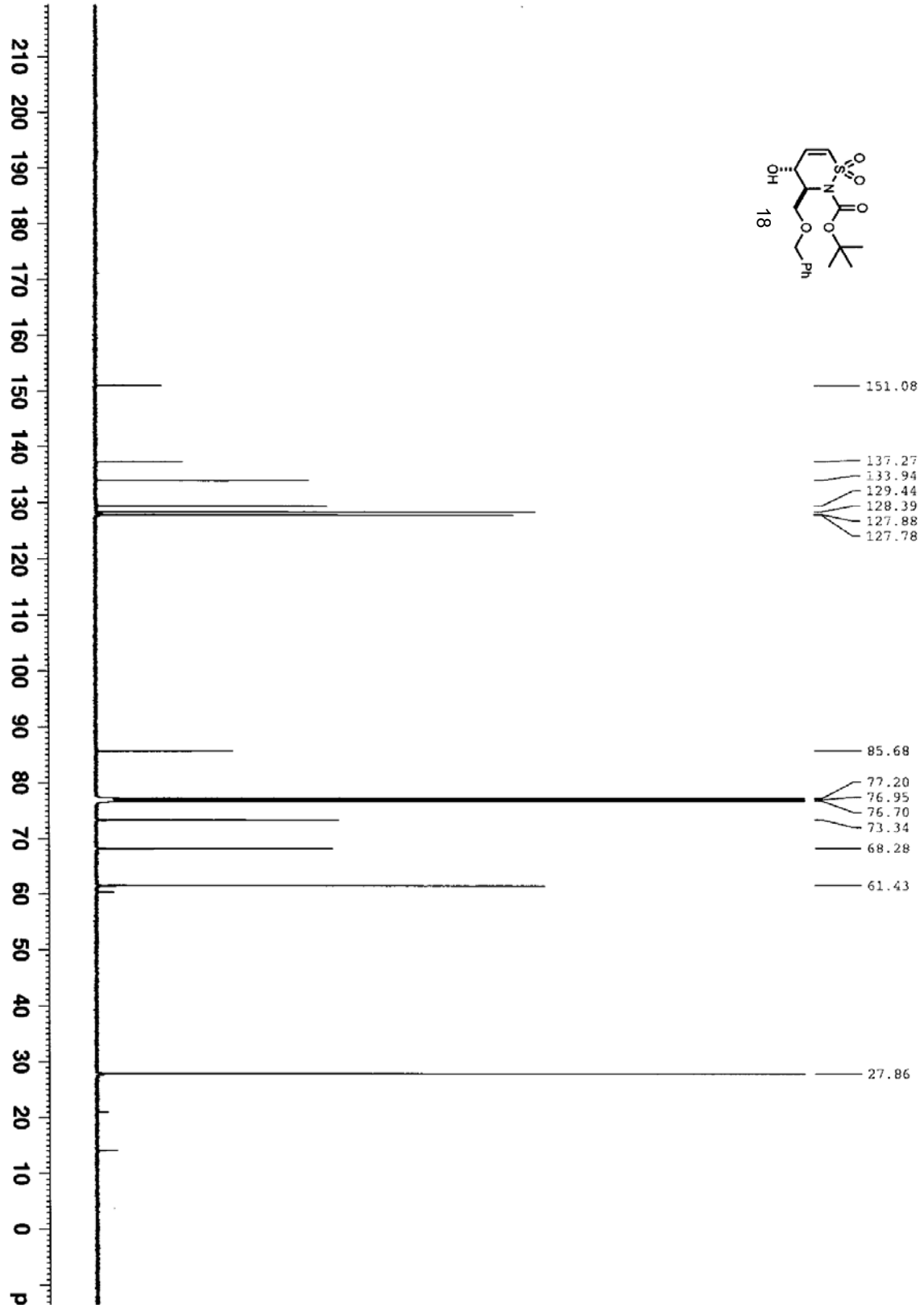

8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
5.02
0.99
2.08
1.04
1.01
1.00
1.01
1.03
1.02
1.63
9.32

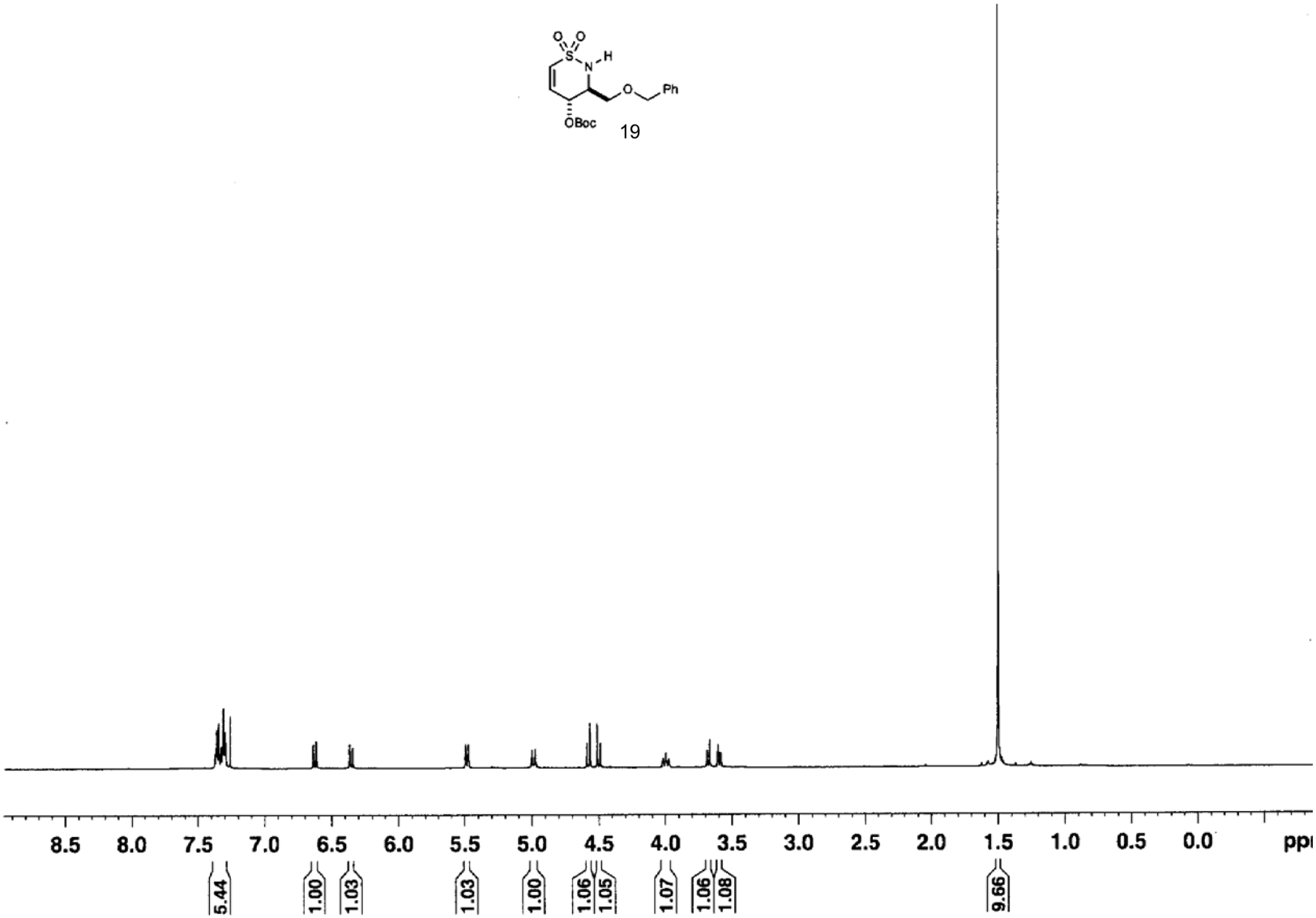

16
151.80
137.35
128.53
128.05
127.97
85.26
77.31
77.06
76.80
73.38
68.52
66.37
65.78
60.47
52.30
27.89
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

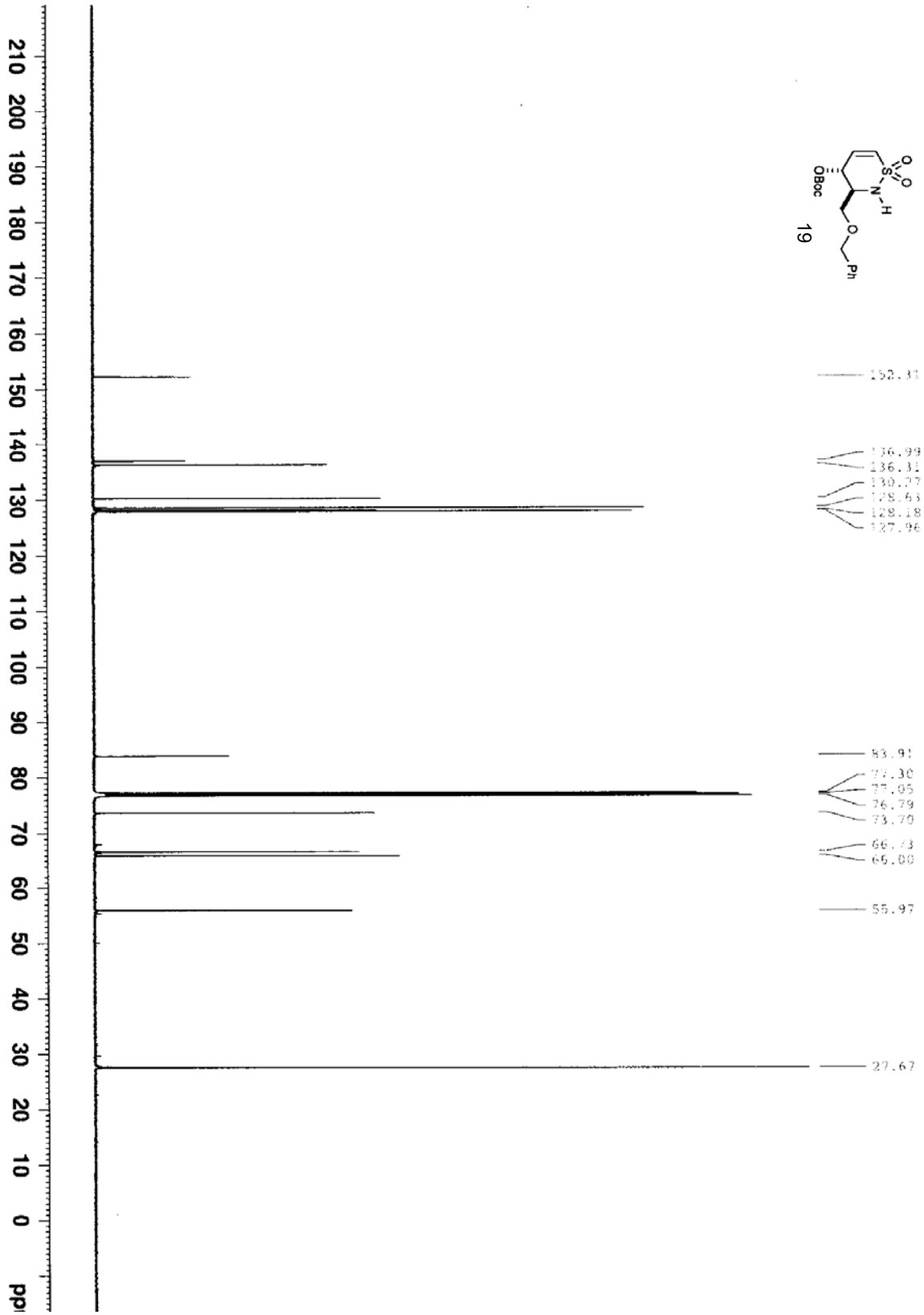

8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
ppm
3.41
1.23
1.02
0.99
0.99
2.22
1.11
1.00
1.01
1.00
9.00
16a

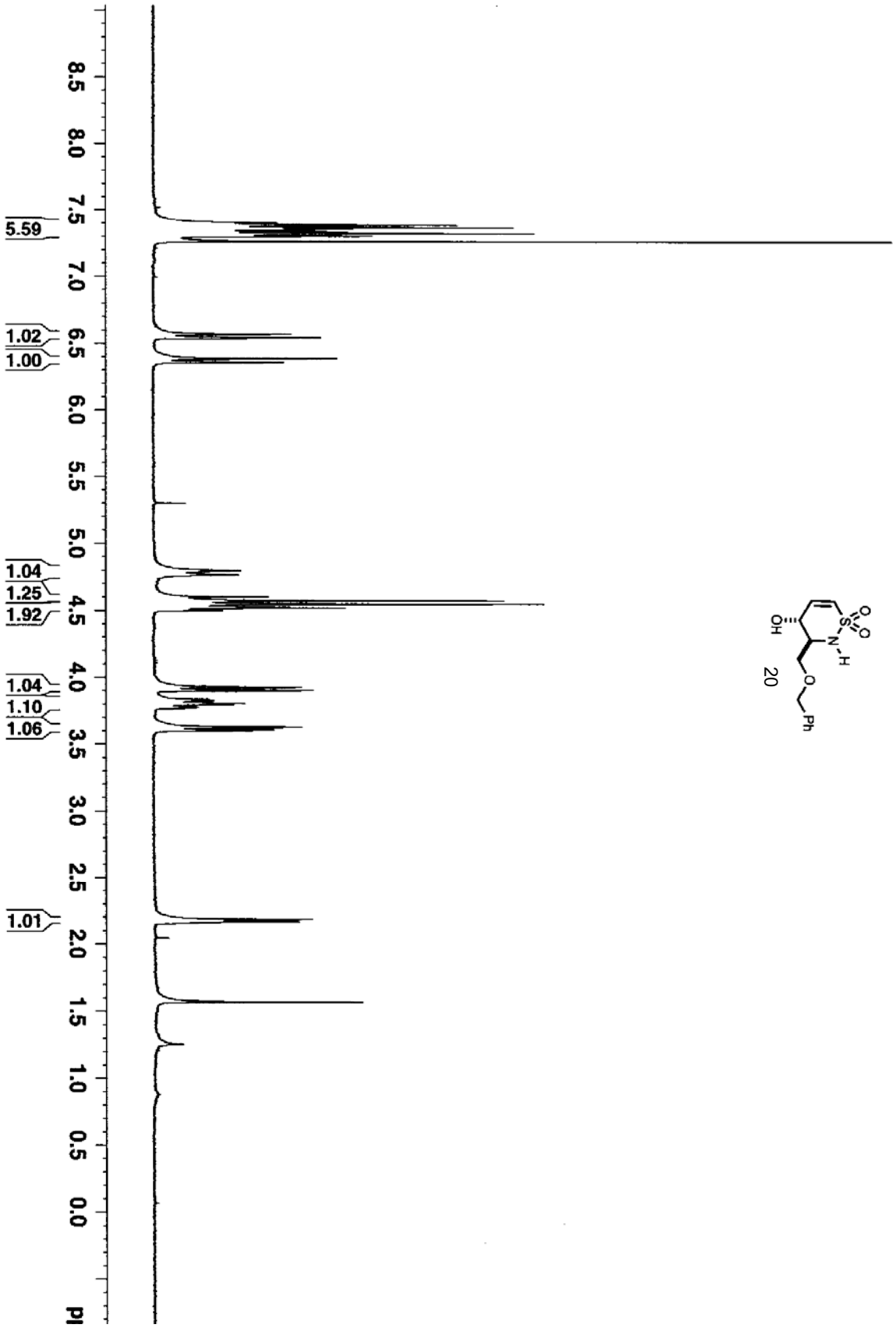

16a
Ph
152.166
151.043
136.093
128.838
128.566
128.391
128.024
127.800
86.160
77.299
76.982
76.664
74.045
73.799
72.425
70.444
58.969
51.599
27.932
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

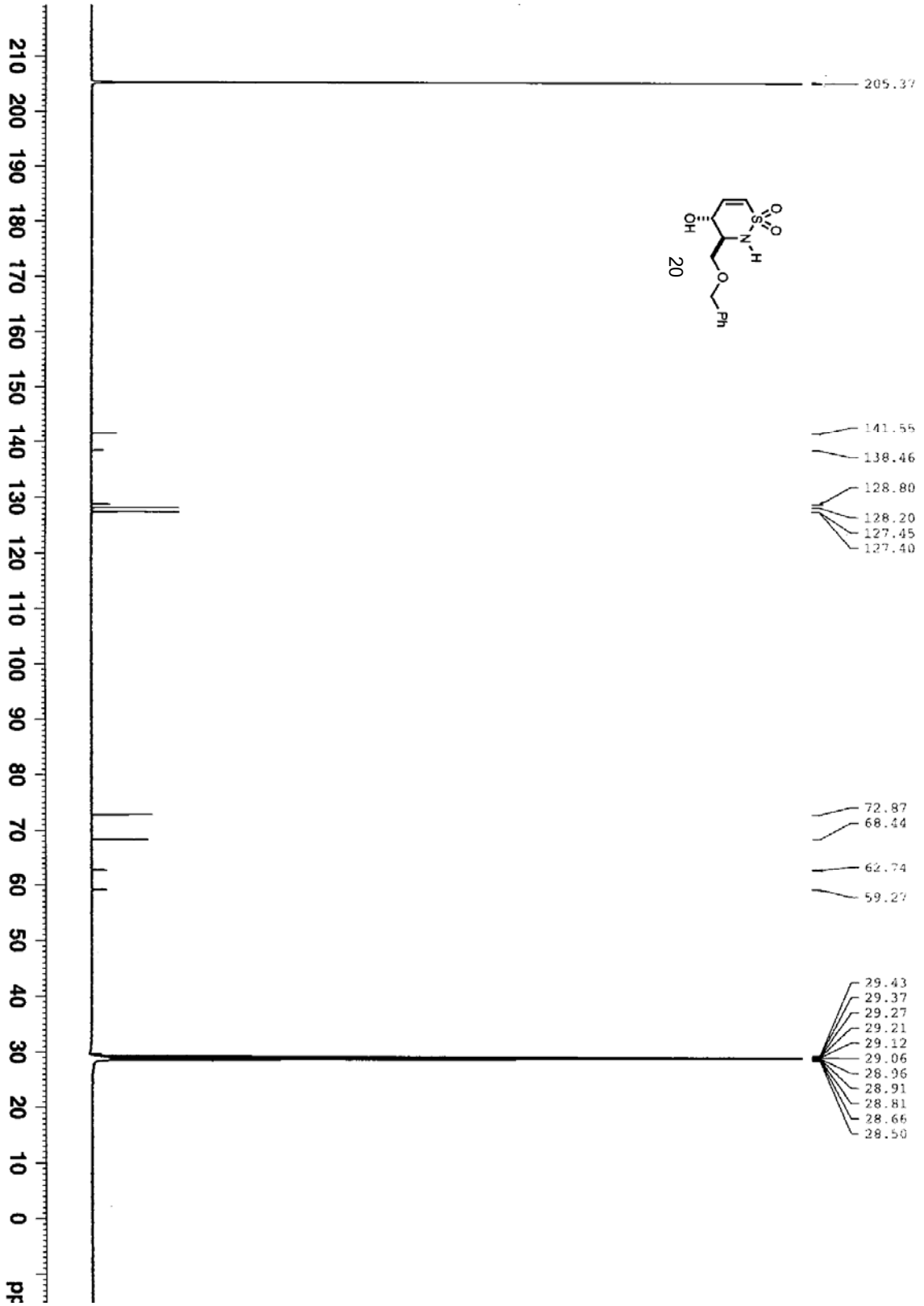

5.19
0.99
1.01
1.00
1.06
1.02
1.01
2.09
0.93
9.04
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
OH
18
Ph

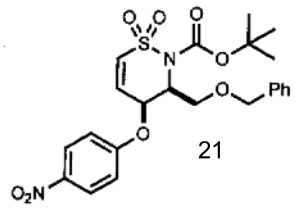

18
151.08
137.27
133.94
129.44
128.39
127.88
127.78
85.68
77.20
76.95
76.70
73.34
68.28
61.43
27.86


19
8.5
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
0.5
0.0
5.44
1.00
1.03
1.03
1.00
1.06
1.05
1.07
1.06
1.08
9.66

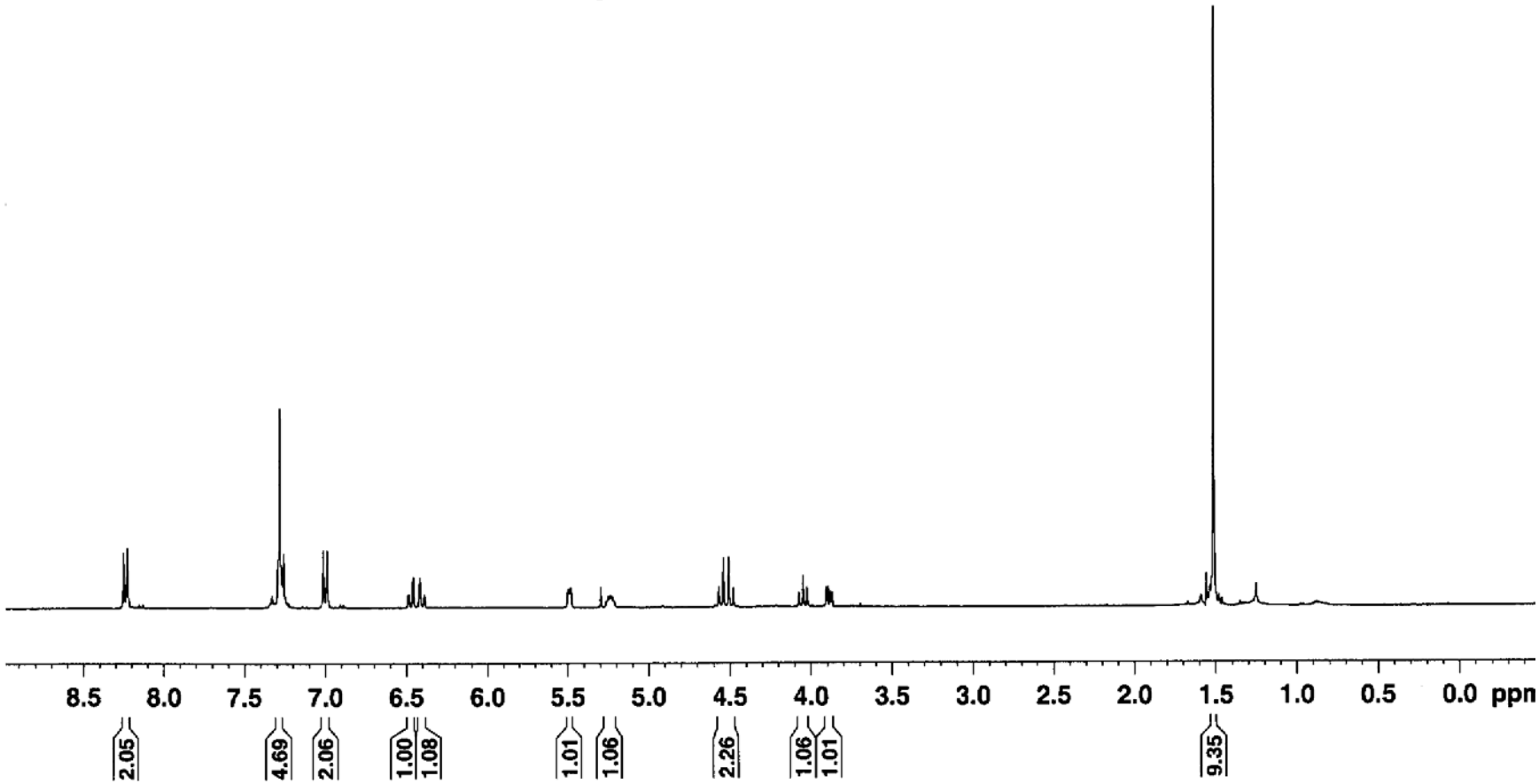

OBoc
Ph
19
152.31
136.99
136.31
130.27
128.63
128.18
127.96
83.91
77.30
77.05
76.79
73.70
66.73
66.00
55.97
27.67
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

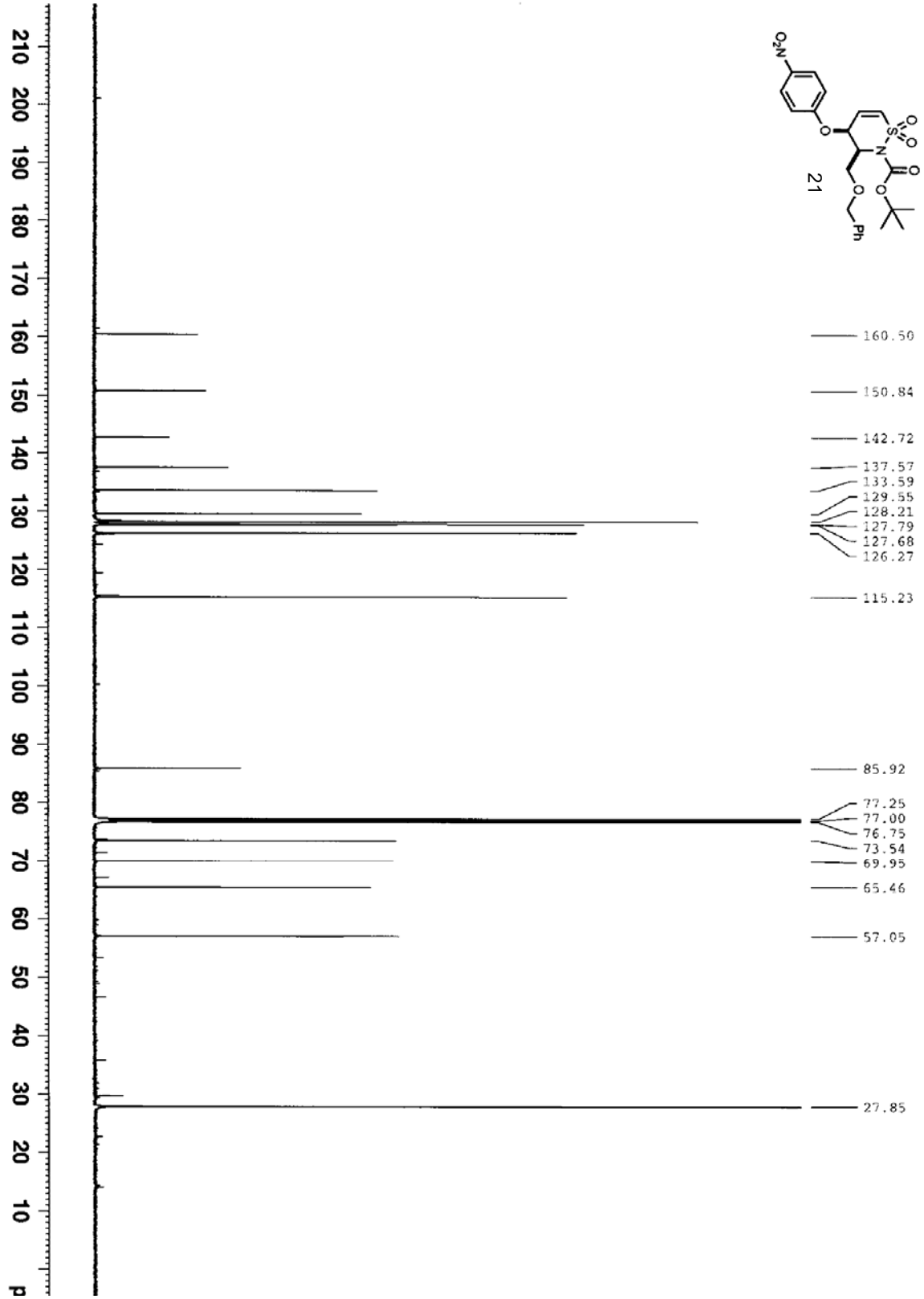

5.59
1.02
1.00
1.04
1.25
1.92
1.04
1.10
1.06
1.01
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
OH
20
Ph

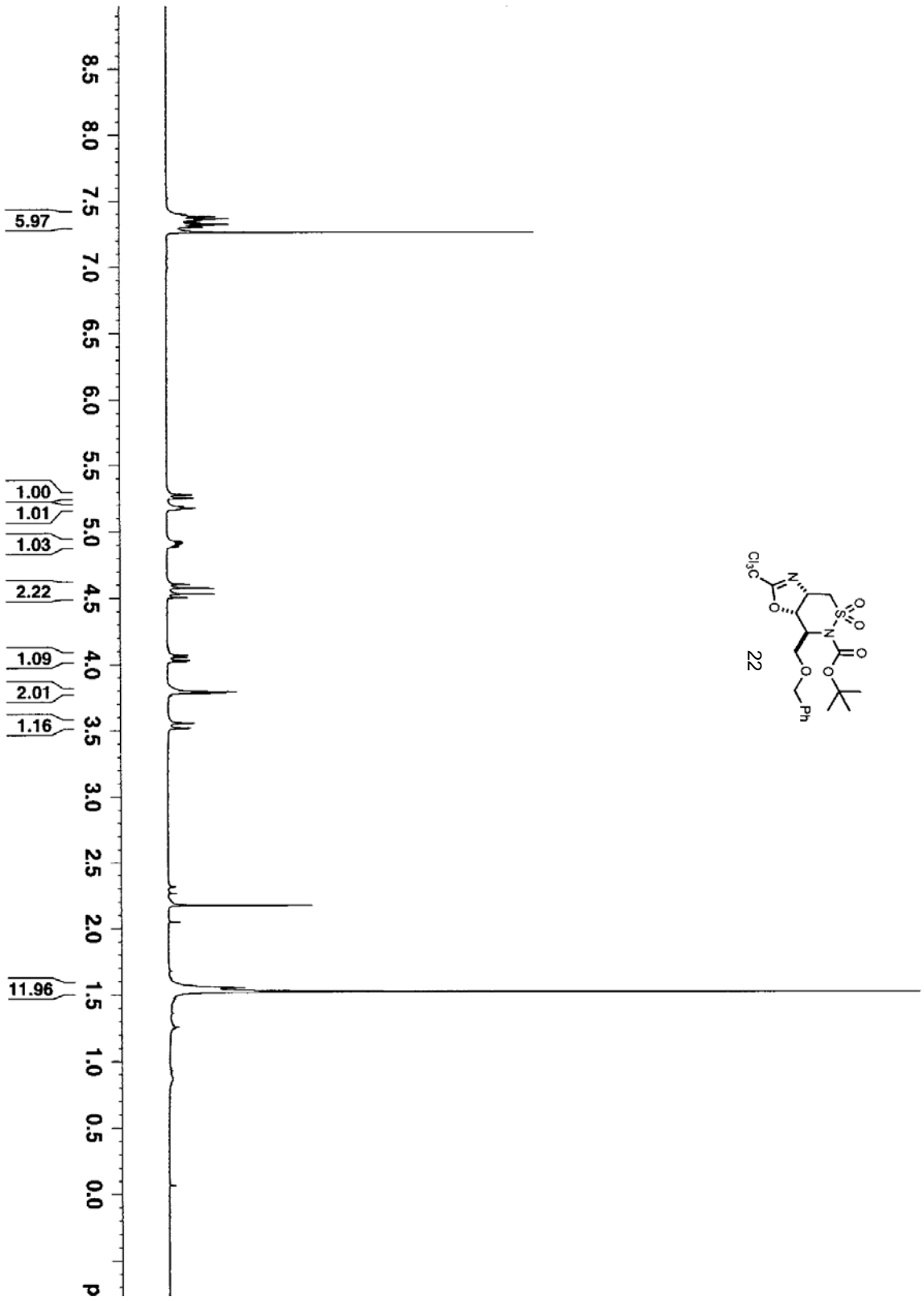

205.37
141.55
138.46
128.80
128.20
127.45
127.40
72.87
68.44
62.74
59.27
29.43
29.37
29.27
29.21
29.12
29.06
28.96
28.91
28.81
28.66
28.50
20
OH
Ph
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0


O
O
S
N
O
O
Ph
O
O2N

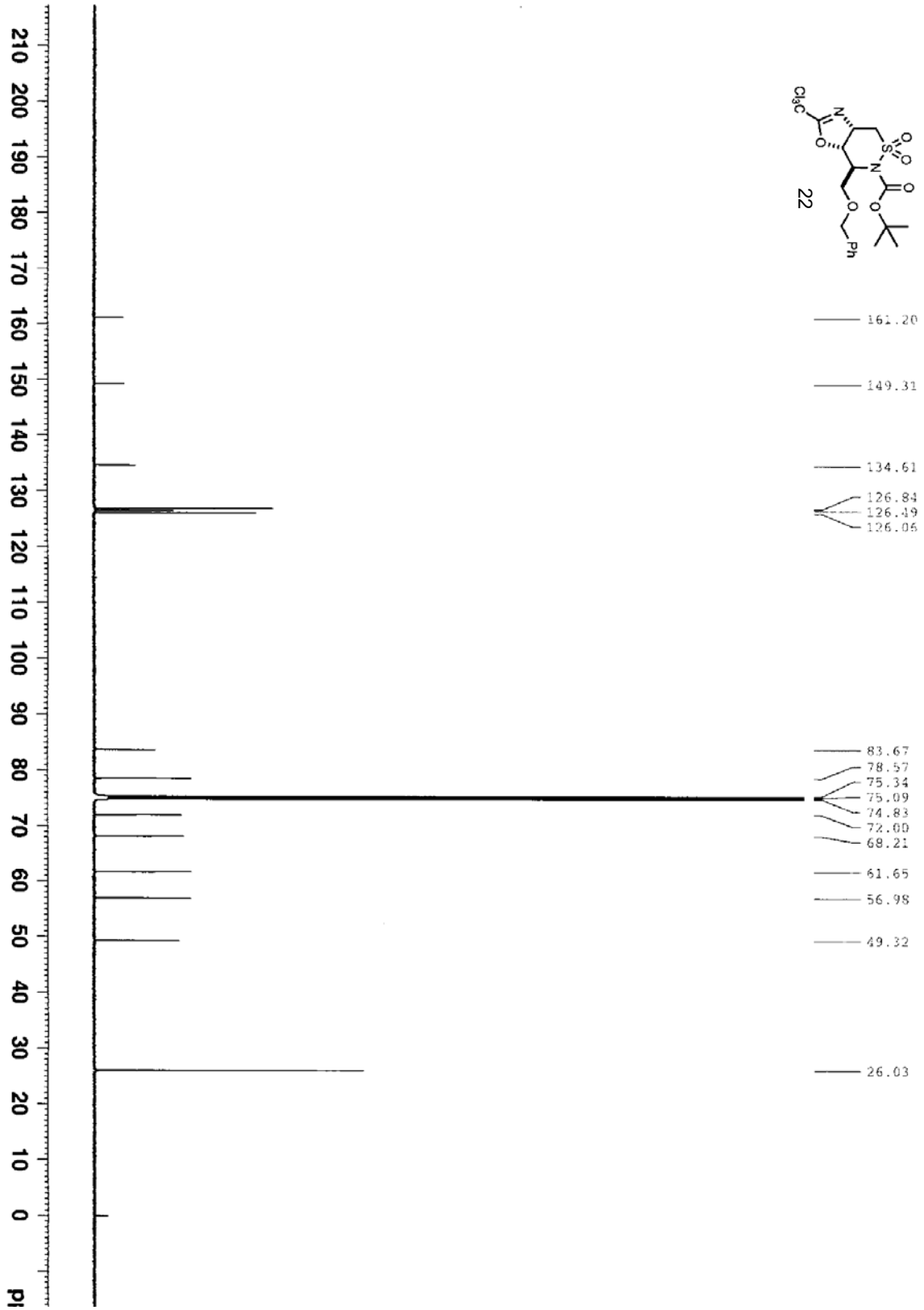
21

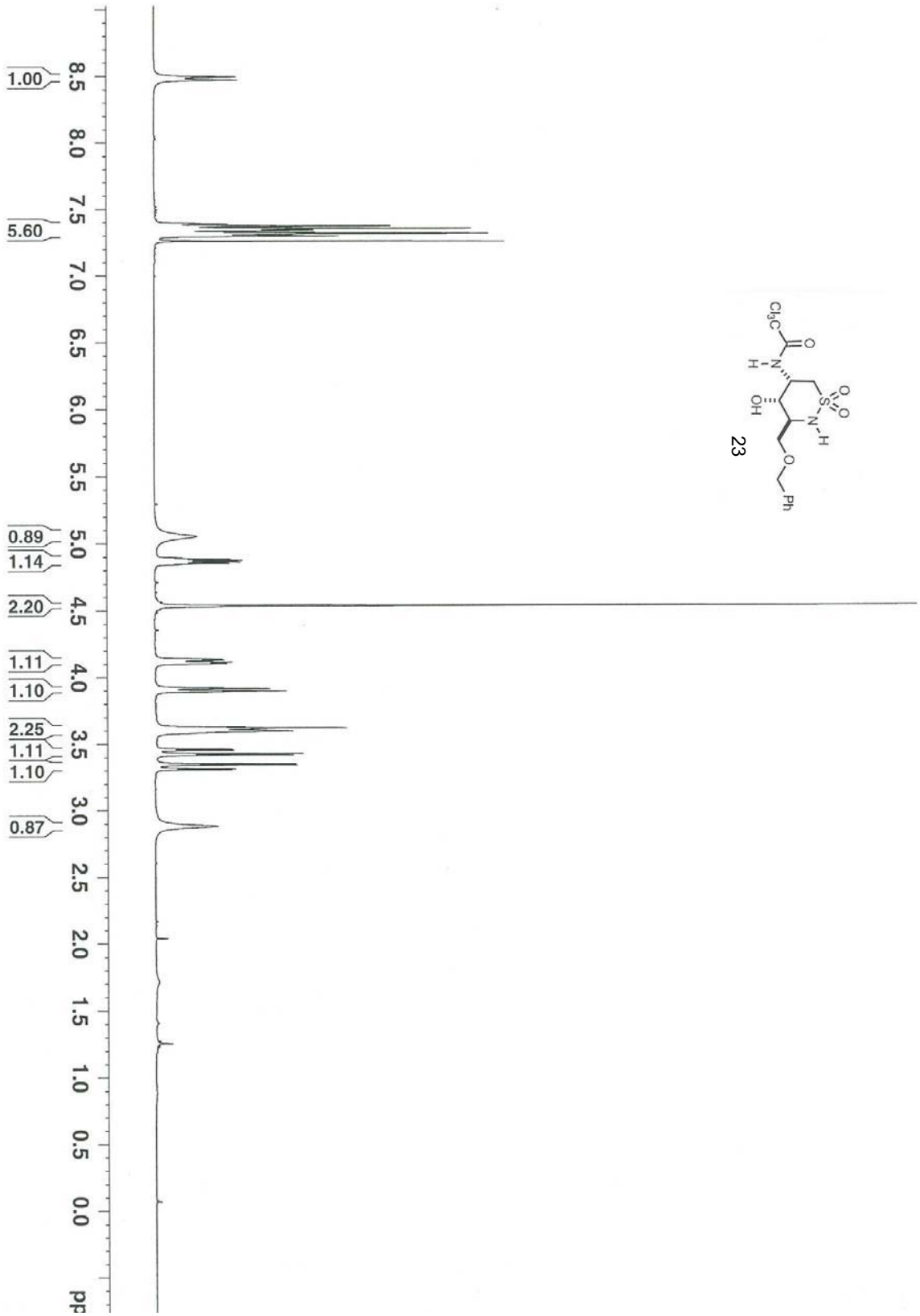

8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
2.05
4.69
2.06
1.00
1.08
1.01
1.06
2.26
1.06
1.01
9.35


21
160.50
150.84
142.72
137.57
133.59
129.55
128.21
127.79
127.68
126.27
115.23
85.92
77.25
77.00
76.75
73.54
69.95
65.46
57.05
27.85

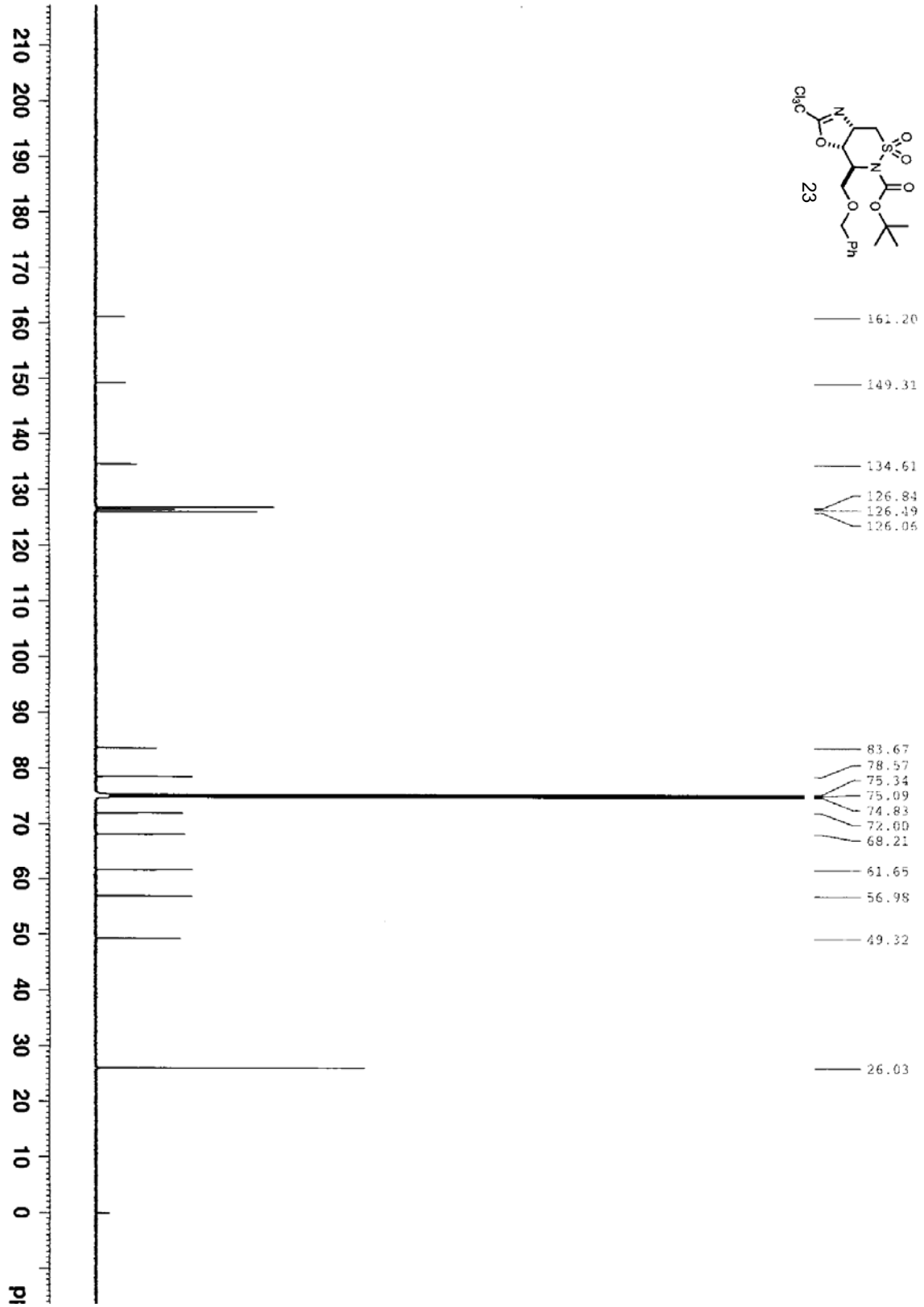

5.97
1.00
1.01
1.03
2.22
1.09
2.01
1.16
11.96
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
p
Cl3C
N
O
S
O
O
N
O
O
O
Ph

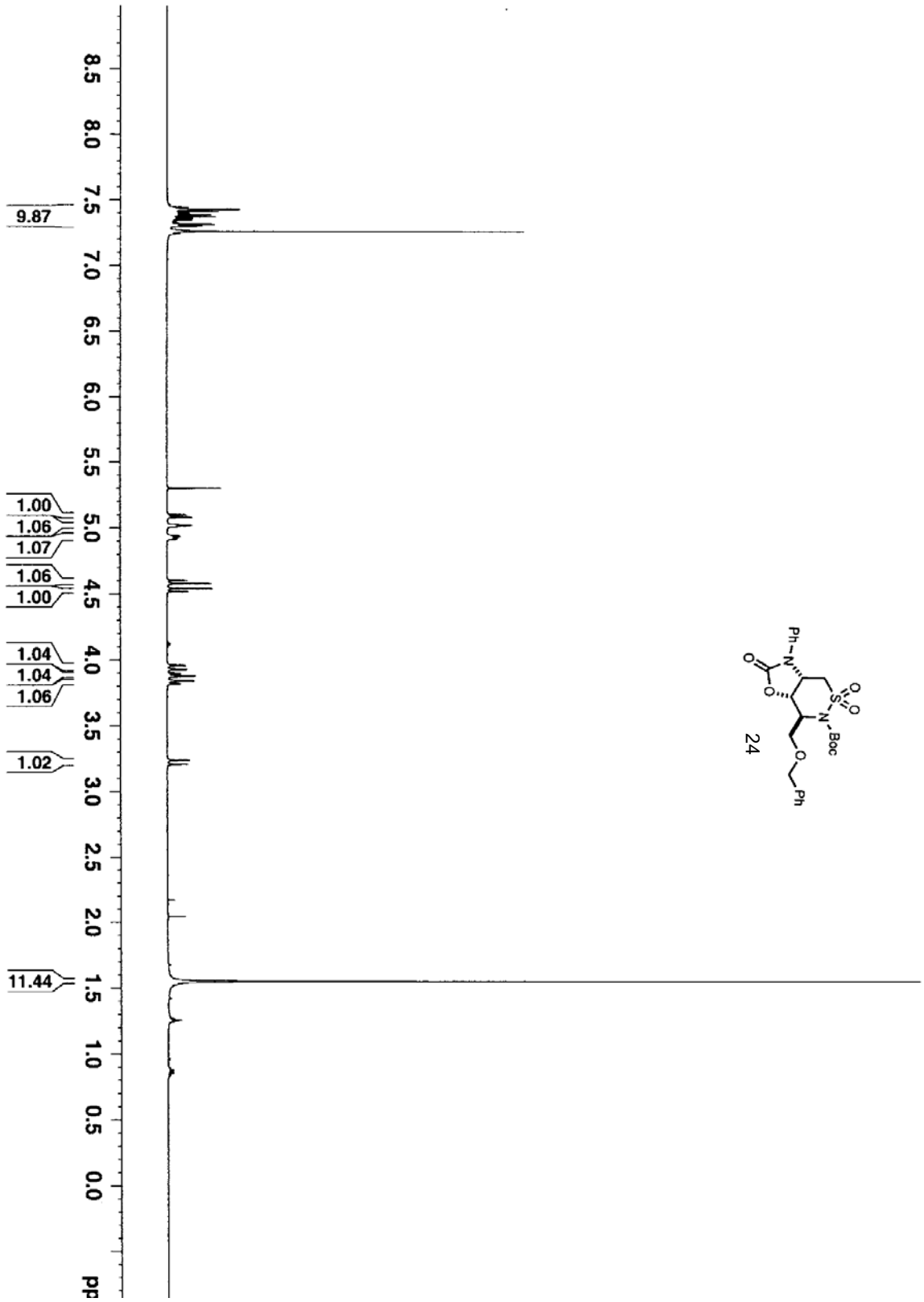
22

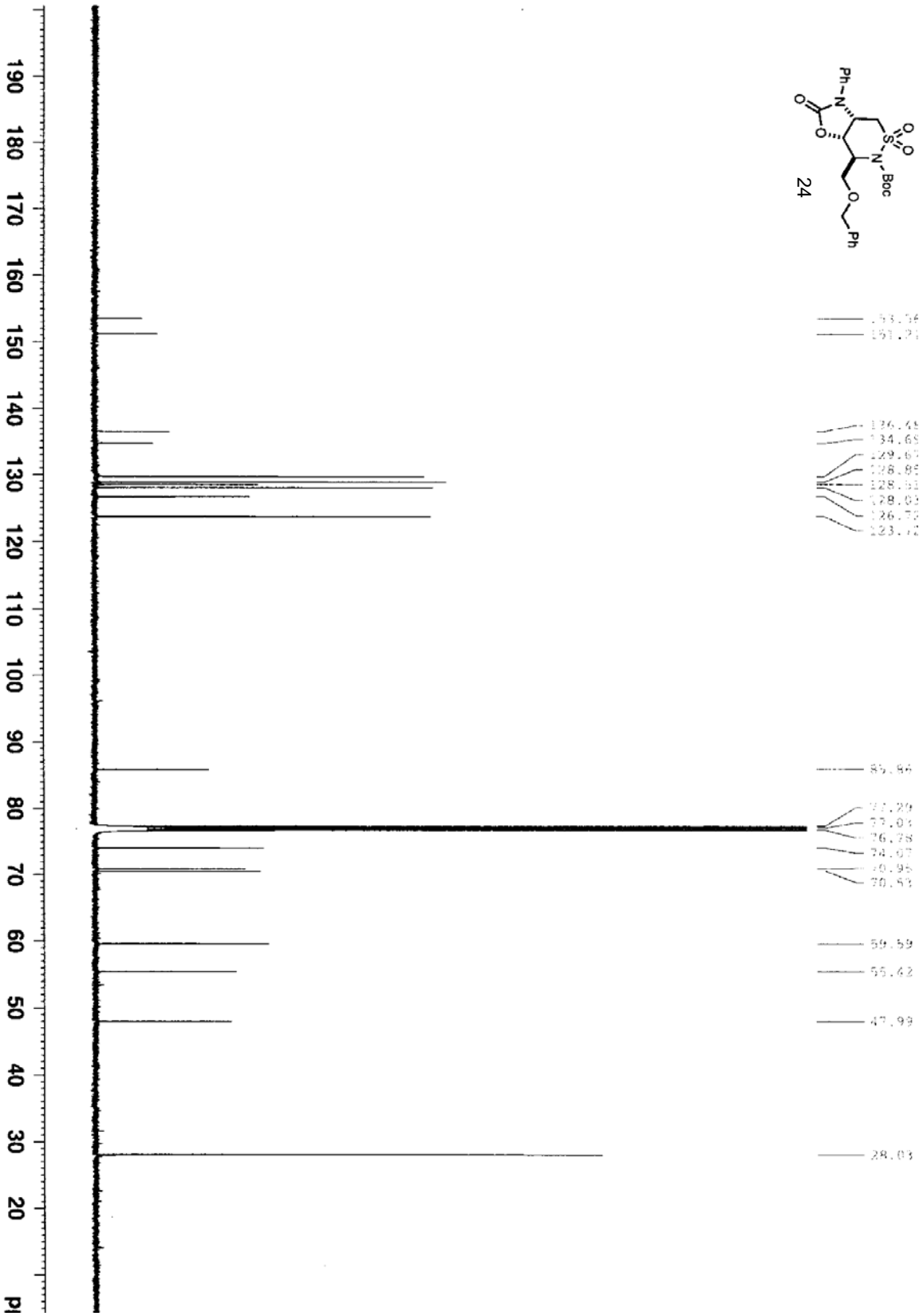

22
161.20
149.31
134.61
126.84
126.49
126.06
83.67
78.57
75.34
75.09
74.83
72.00
68.21
61.65
56.98
49.32
26.03
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm

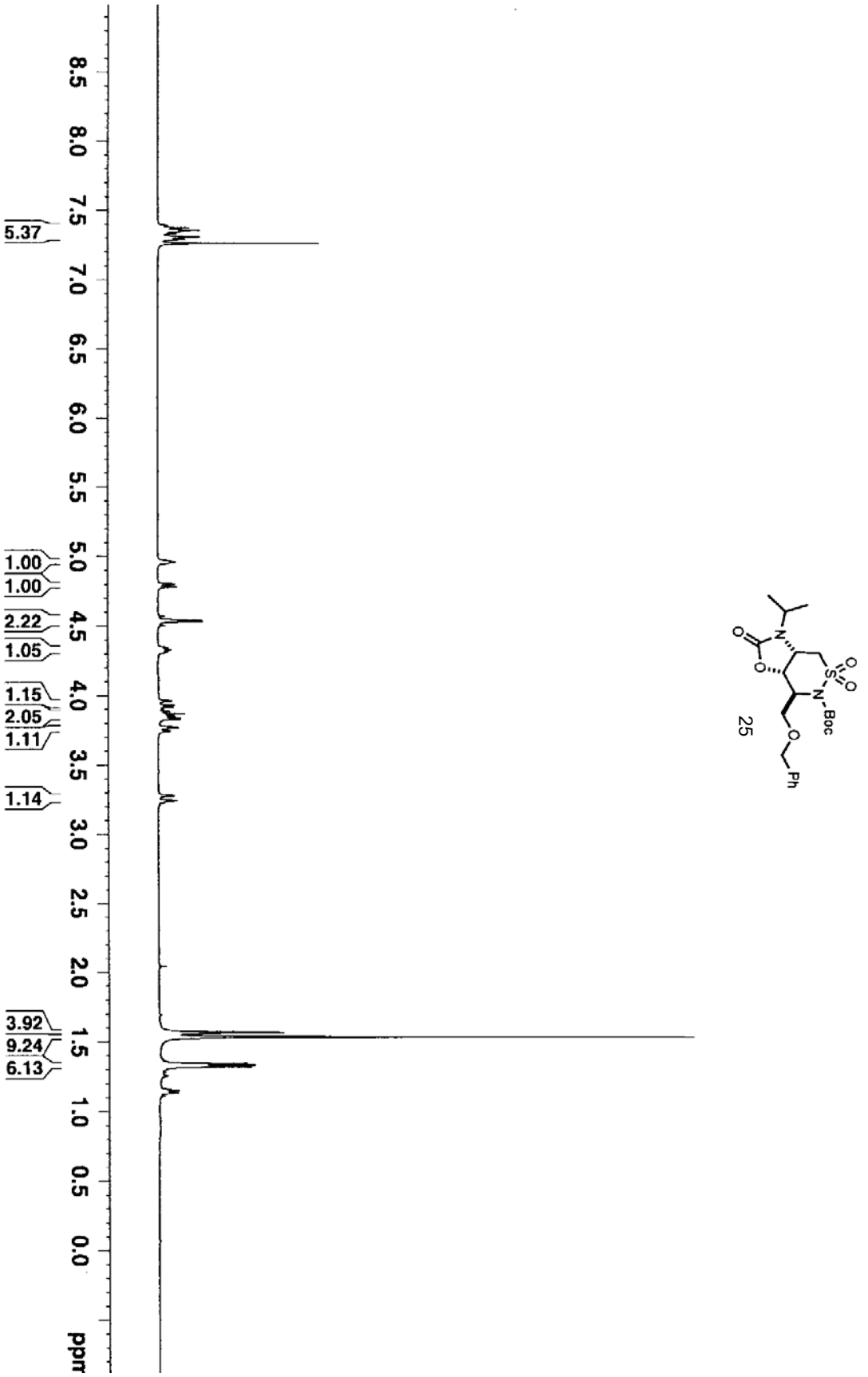

1.00
5.60
0.89
1.14
2.20
1.11
1.10
2.25
1.11
1.10
0.87
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Cl3C
O
N
H
OH
S
O
O
N
H
O
Ph

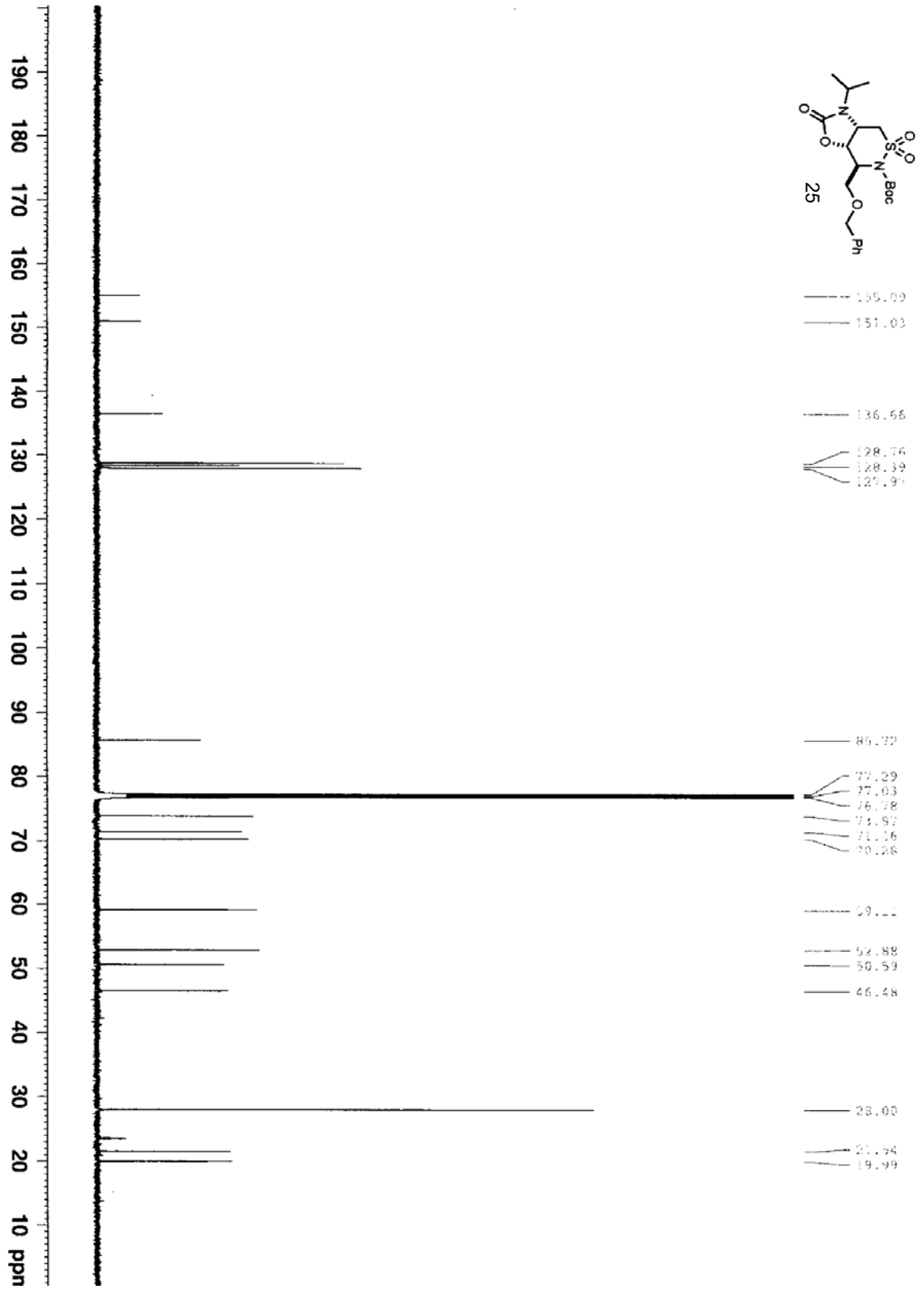
23

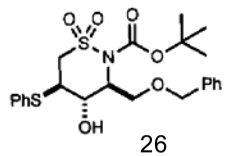

23
161.20
149.31
134.61
126.84
126.49
126.06
83.67
78.57
75.34
75.09
74.83
72.00
68.21
61.65
56.98
49.32
26.03
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm


9.87
1.00
1.06
1.07
1.06
1.00
1.04
1.04
1.06
1.02
11.44
8.5
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
0.5
0.0
Ph
N
O
O
S
N
Boc
O
Ph
24


Ph
N
O
O
O
S
O
O
N
Boc
O
O
Ph
24
85.86
59.59
55.62
47.99
28.03

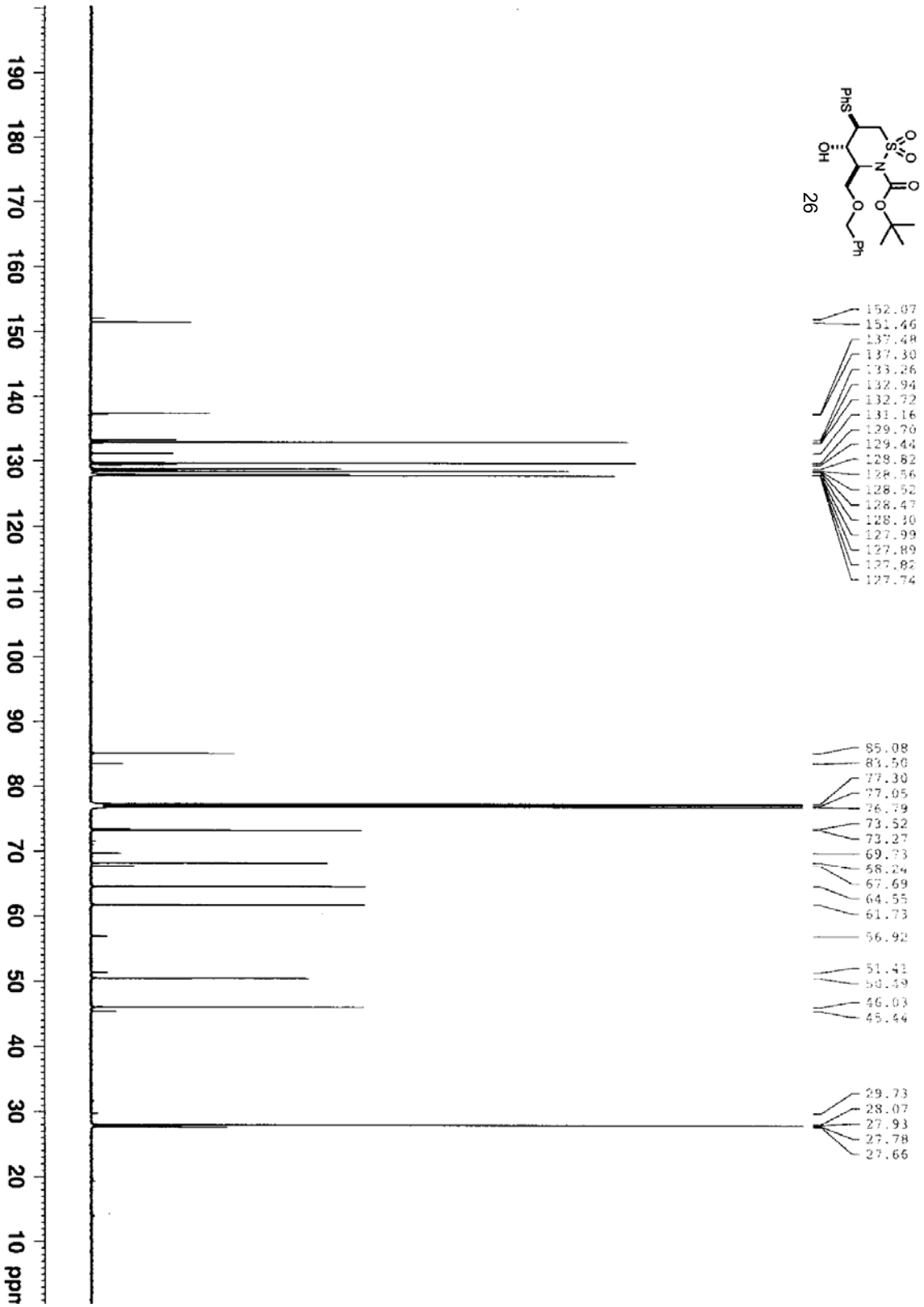

8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
ppm
5.37
1.00
1.00
2.22
1.05
1.15
2.05
1.11
1.14
3.92
9.24
6.13
Boc
Ph
25

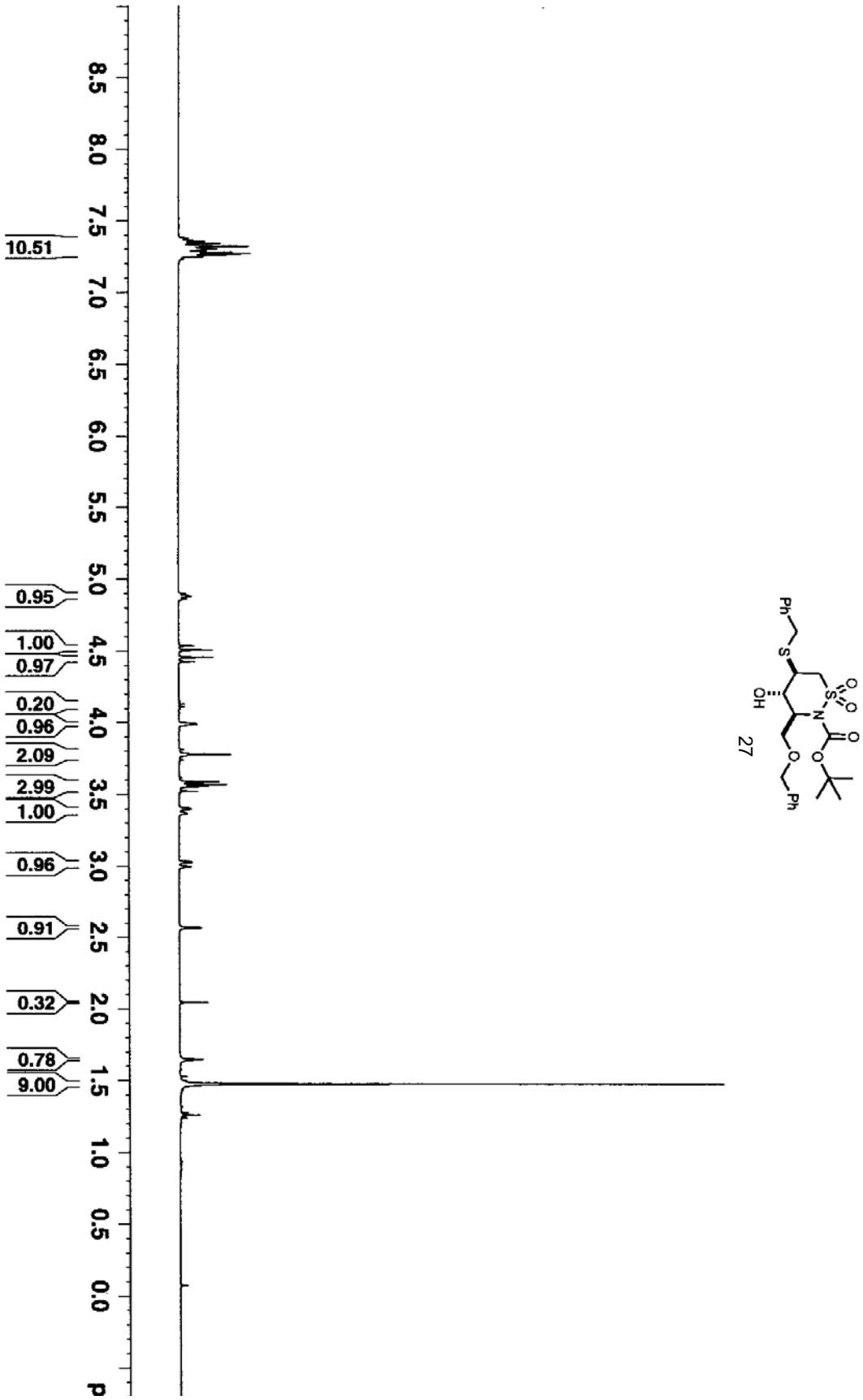

25
Boc
Ph
155.09
151.03
136.66
128.76
128.39
127.97
85.22
77.29
77.03
76.78
74.82
71.16
70.28
59.11
52.88
50.59
46.48
28.00
21.54
19.99
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm

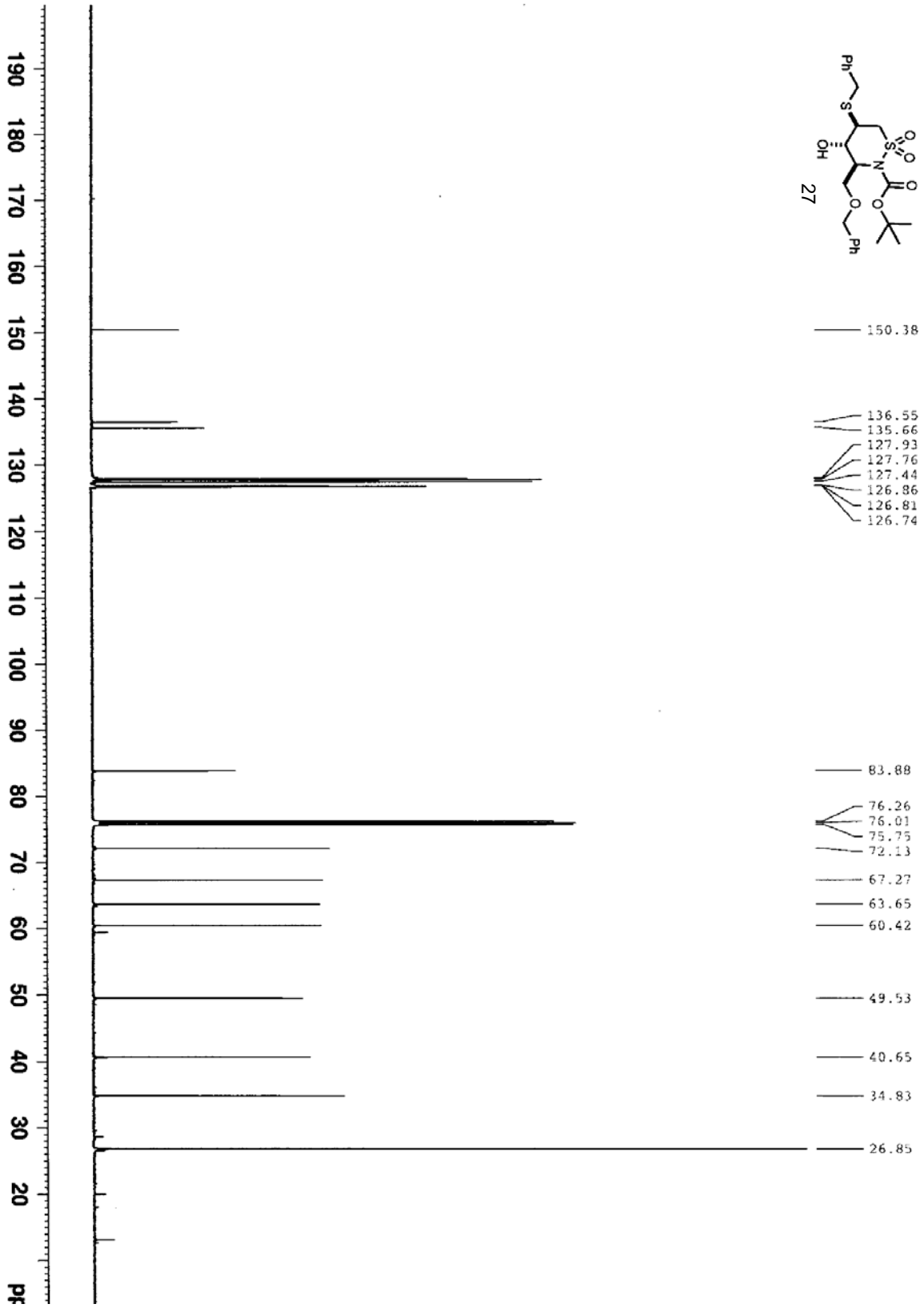

PhS
OH
O
Ph

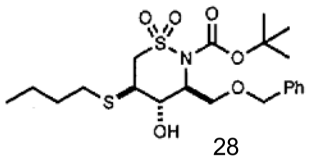
26

8.5
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
0.5
0.0
pp
1.91
6.91
2.14
0.17
1.00
0.16
1.17
0.20
1.01
1.01
1.10
1.58
1.78
1.00
0.86
0.51
8.92
1.61

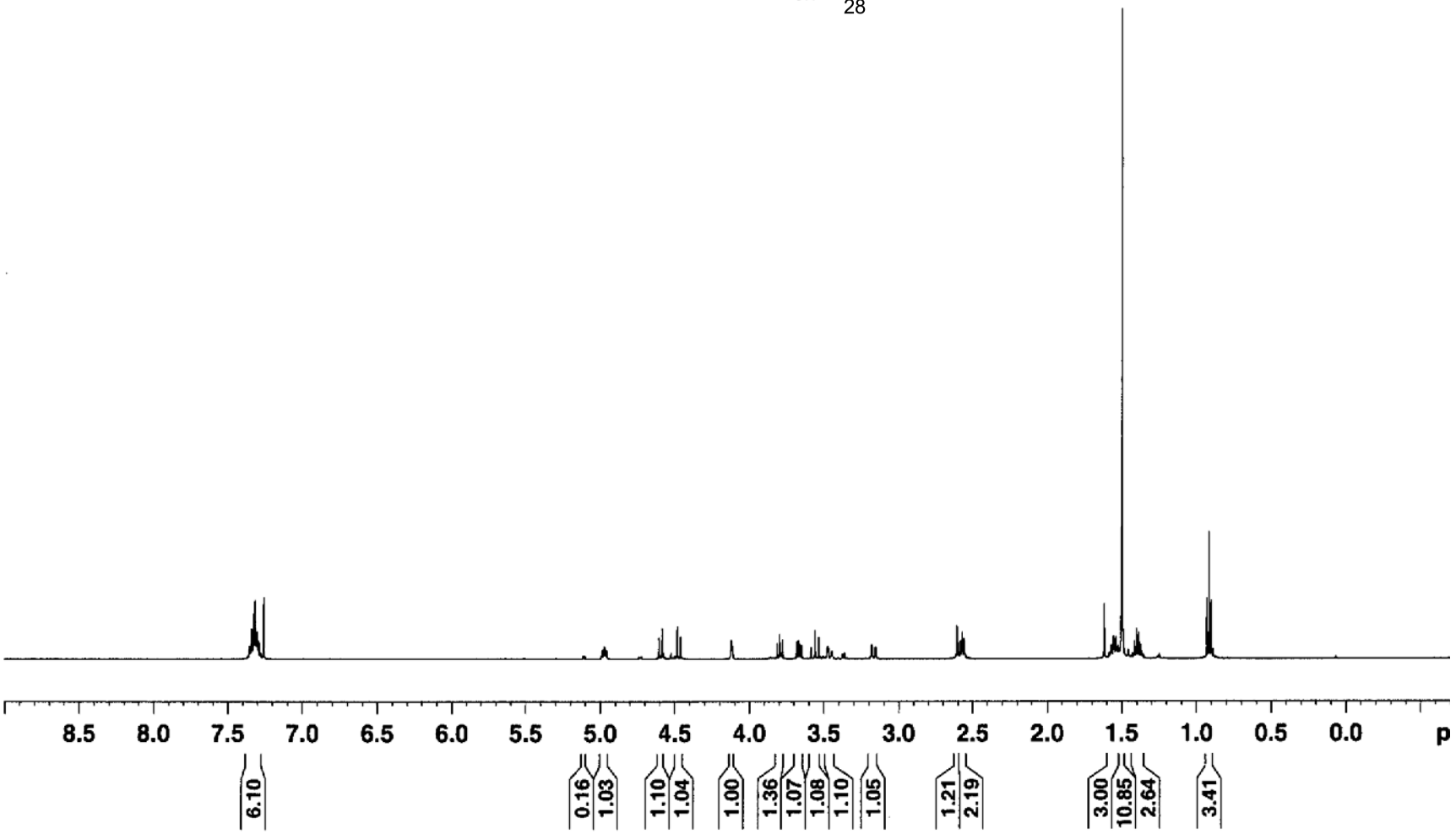

26
PhS
OH
O
S
N
O
O
O
O
Ph
152.07
151.46
137.48
137.30
133.26
132.94
132.72
131.16
129.70
129.44
128.82
128.56
128.52
128.47
128.30
127.99
127.89
127.82
127.74
85.08
83.50
77.30
77.05
76.79
73.52
73.27
69.73
68.24
67.69
64.55
61.73
56.92
51.41
50.49
46.03
45.44
29.73
28.07
27.93
27.78
27.66
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

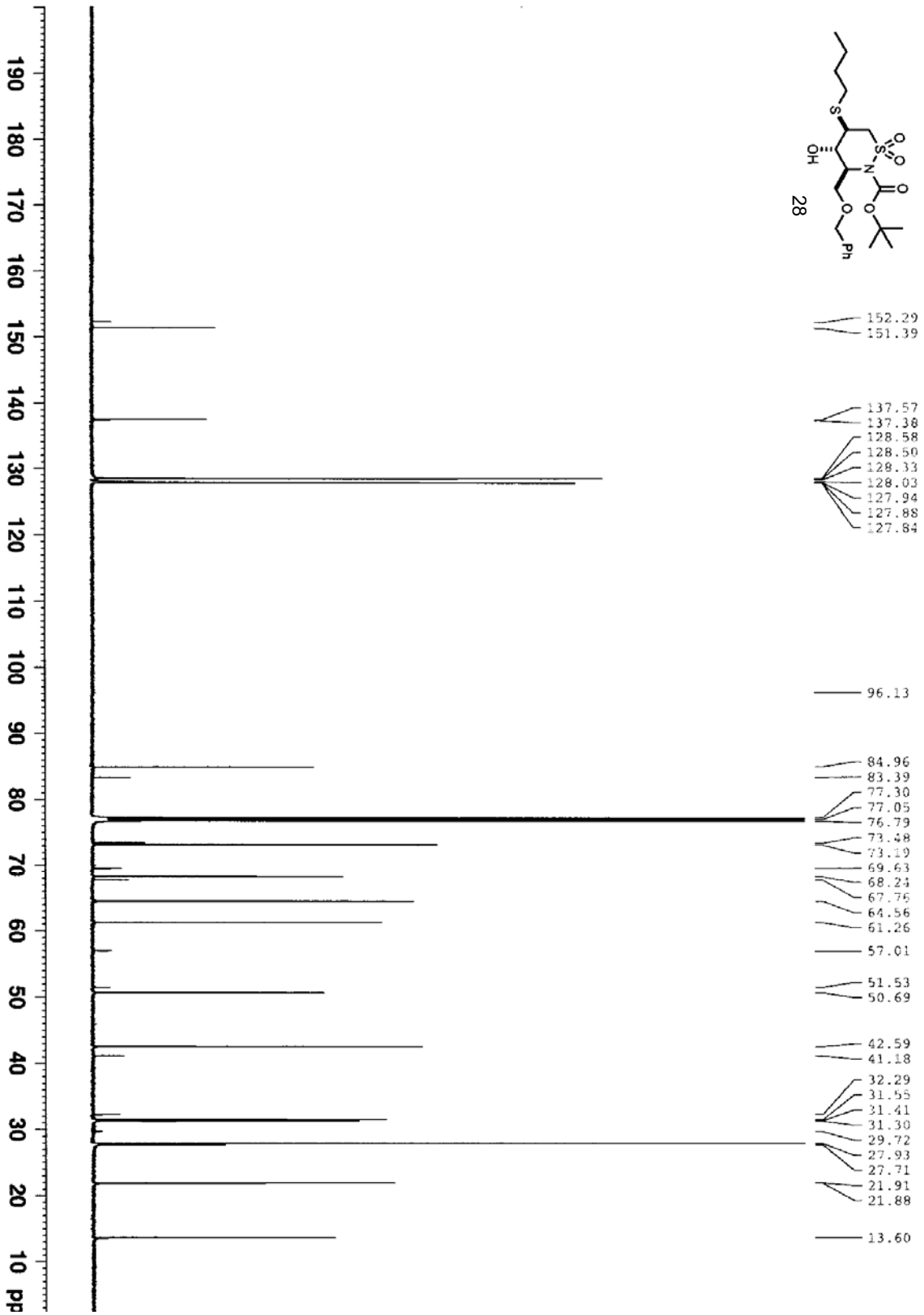

10.51
0.95
1.00
0.97
0.20
0.96
2.09
2.99
1.00
0.96
0.91
0.32
0.78
9.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
p
Ph
S
OH
N
O
O
O
O
O
Ph
27

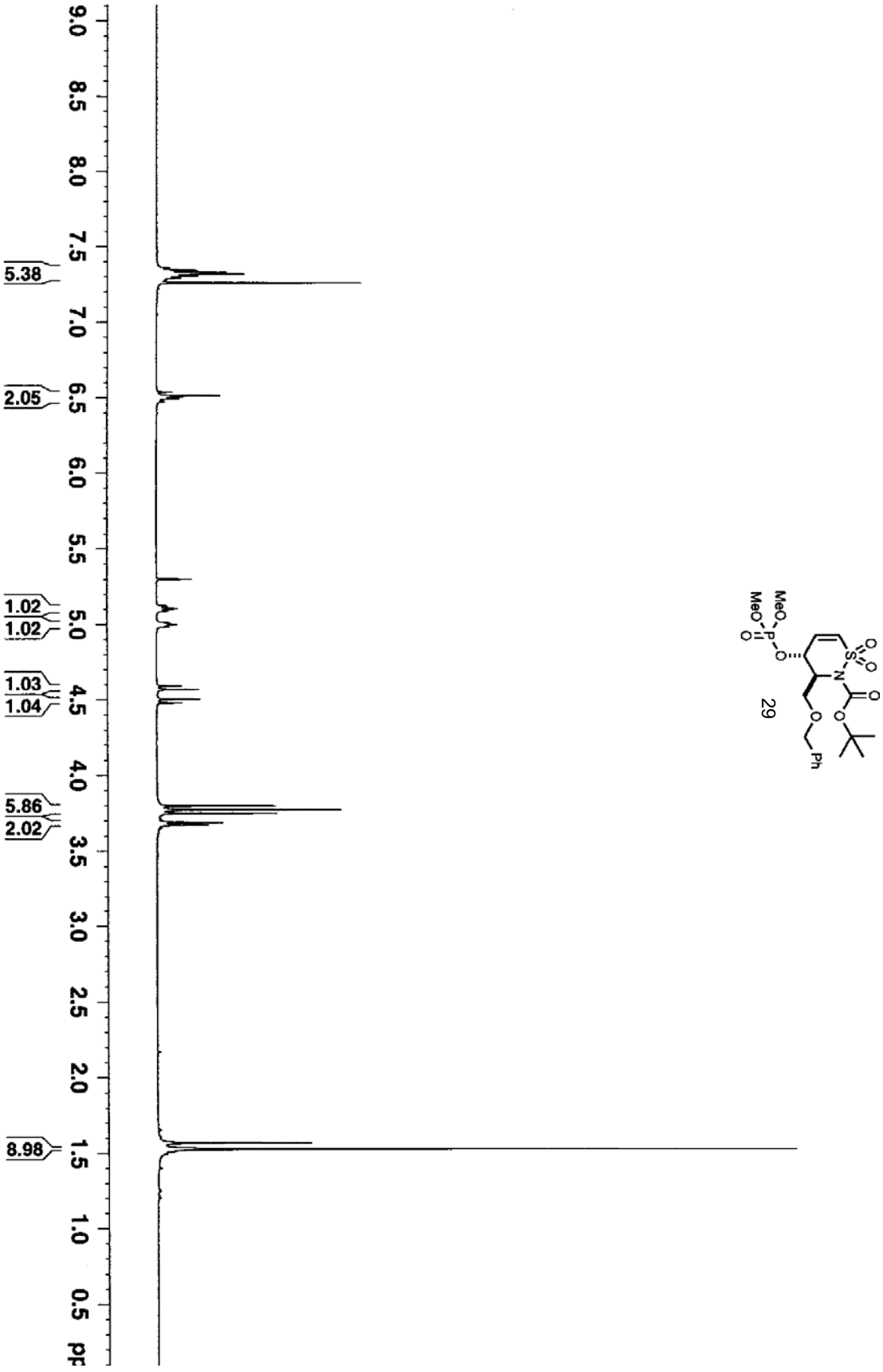

27
150.38
136.55
135.66
127.93
127.76
127.44
126.86
126.81
126.74
83.88
76.26
76.01
75.75
72.13
67.27
63.65
60.42
49.53
40.65
34.83
26.85

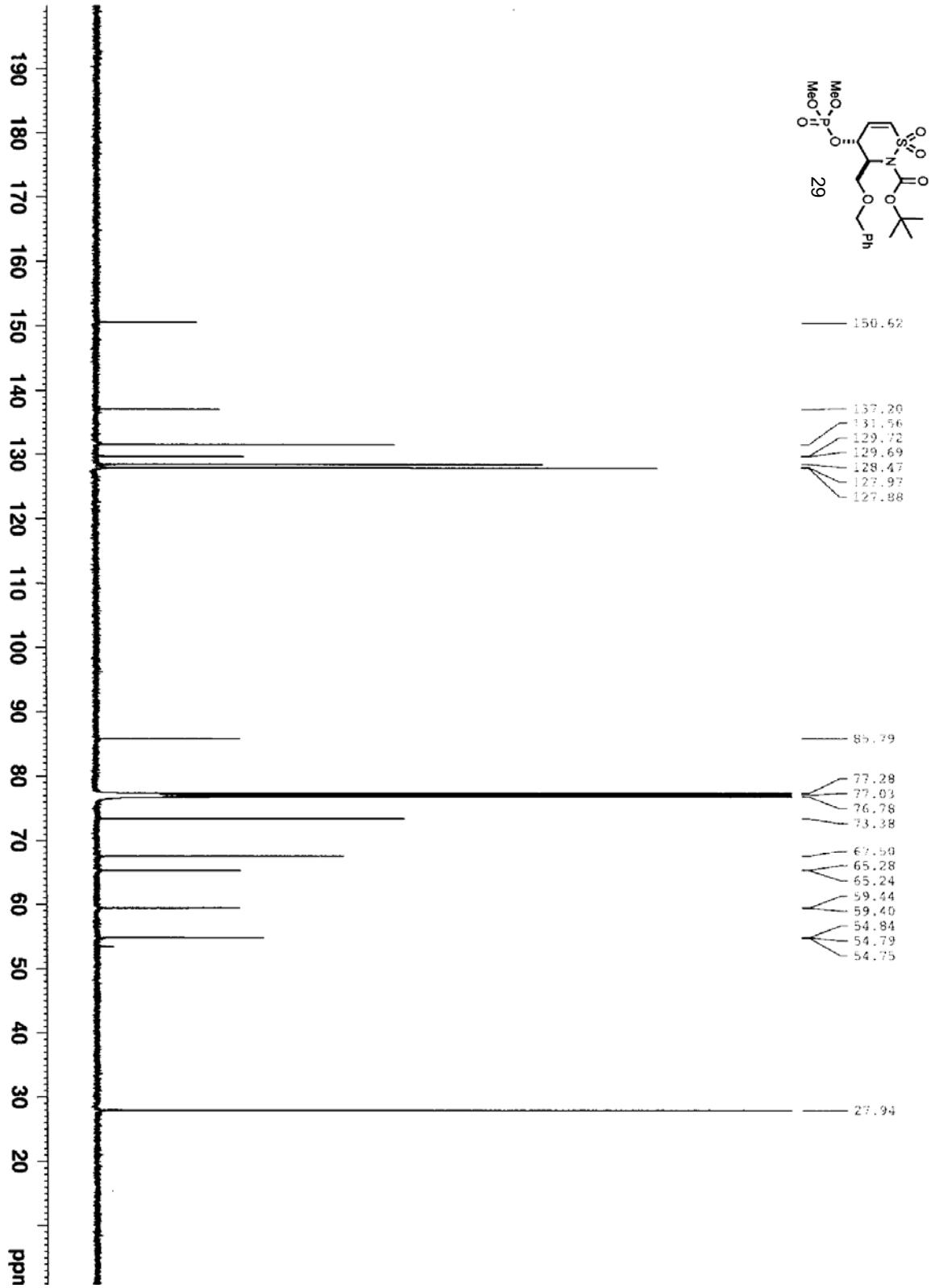


28

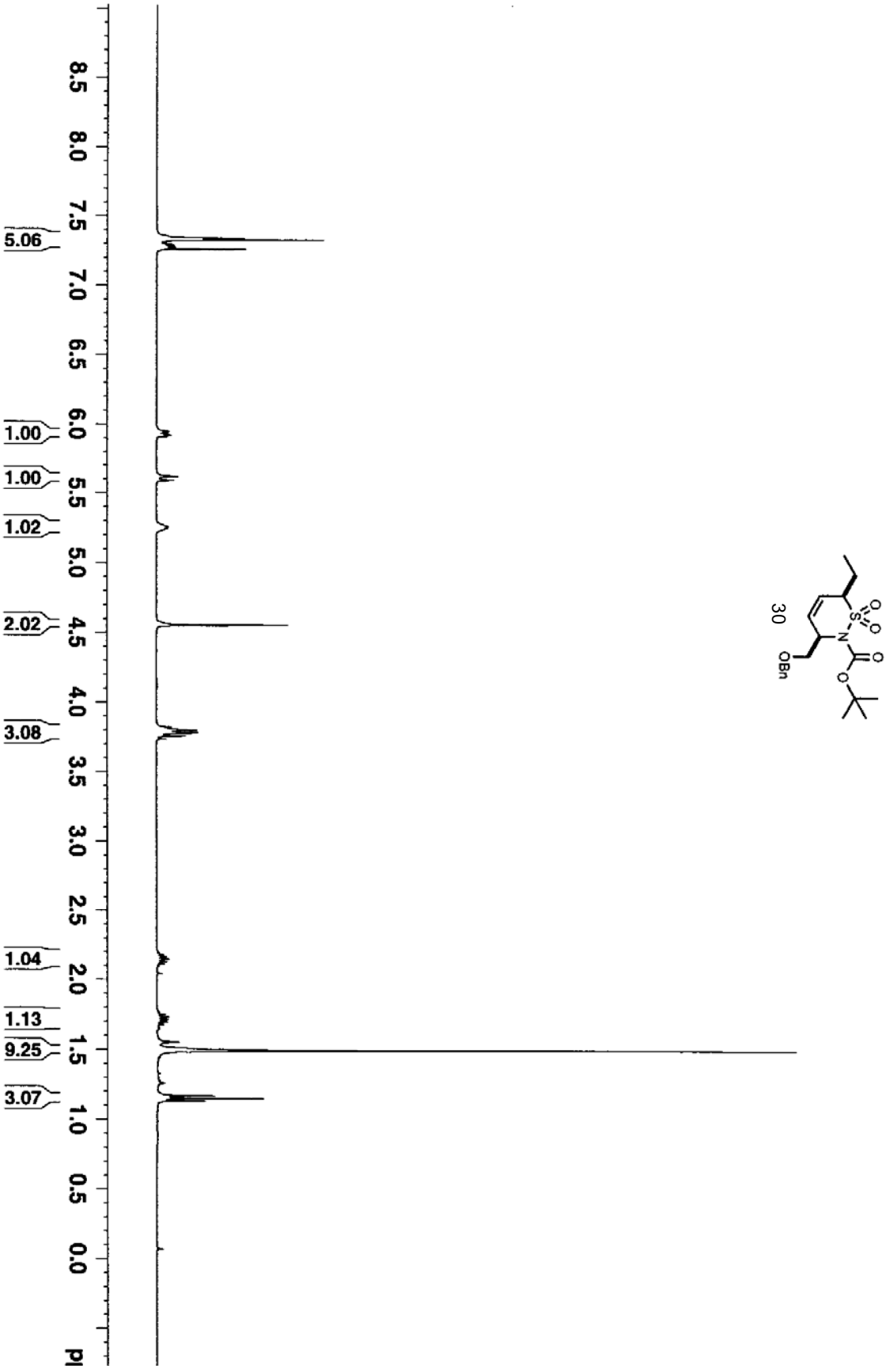

8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
p
6.10
0.16
1.03
1.10
1.04
1.00
1.36
1.07
1.08
1.10
1.05
1.21
2.19
3.00
10.85
2.64
3.41

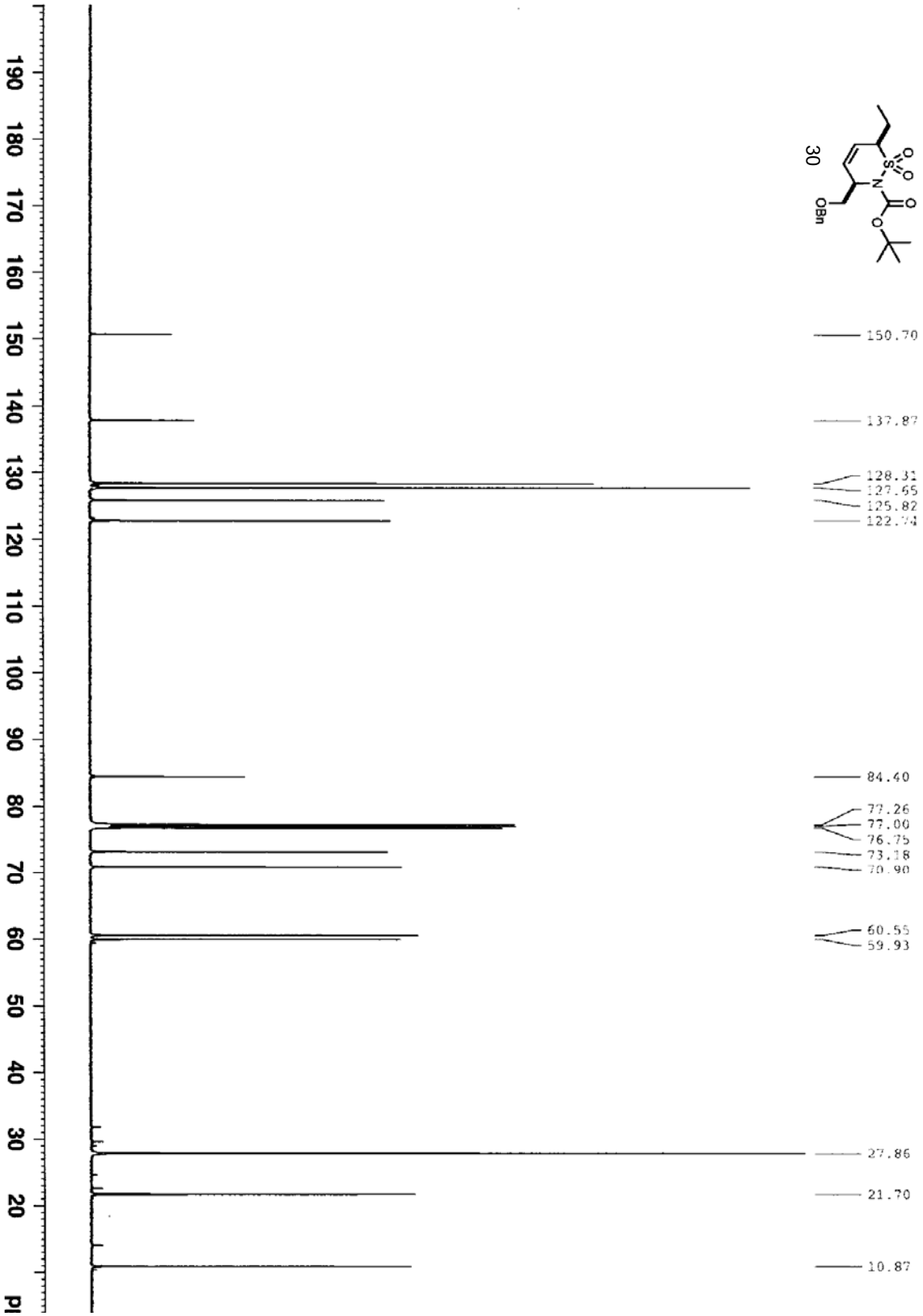

28
152.29
151.39
137.57
137.38
128.58
128.50
128.33
128.03
127.94
127.88
127.84
96.13
84.96
83.39
77.30
77.05
76.79
73.48
73.19
69.63
68.24
67.75
64.56
61.26
57.01
51.53
50.69
42.59
41.18
32.29
31.55
31.41
31.30
29.72
27.93
27.71
21.91
21.88
13.60

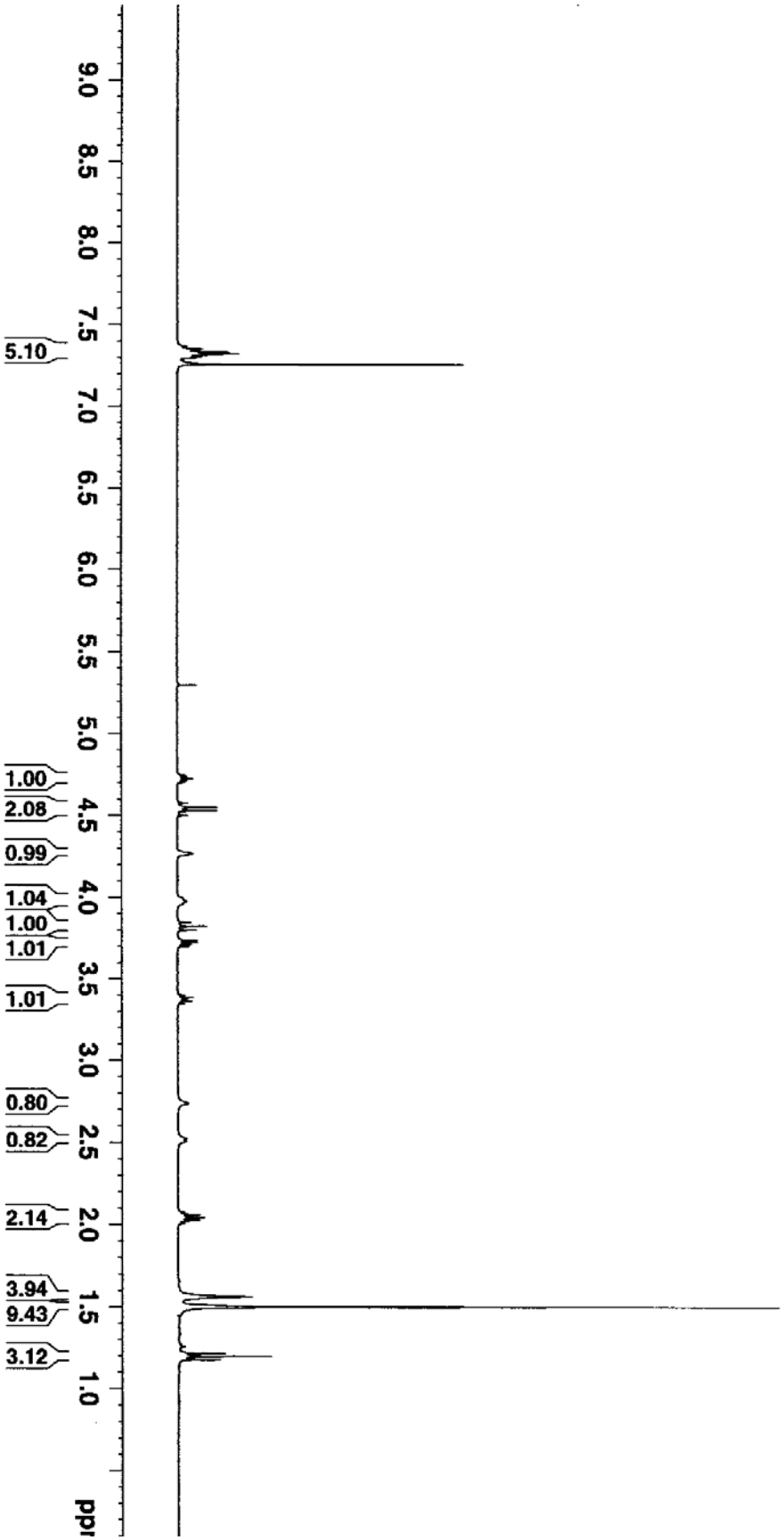

9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
5.38
2.05
1.02
1.02
1.03
1.04
5.86
2.02
8.98
MeO
MeO
P
O
O
O
O
O
S
O
O
N
O
O
Ph
29


29
150.62
137.20
131.56
129.72
129.69
128.47
127.97
127.88
85.79
77.28
77.03
76.78
73.38
67.59
65.28
65.24
59.44
59.40
54.84
54.79
54.75
27.94
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
ppm

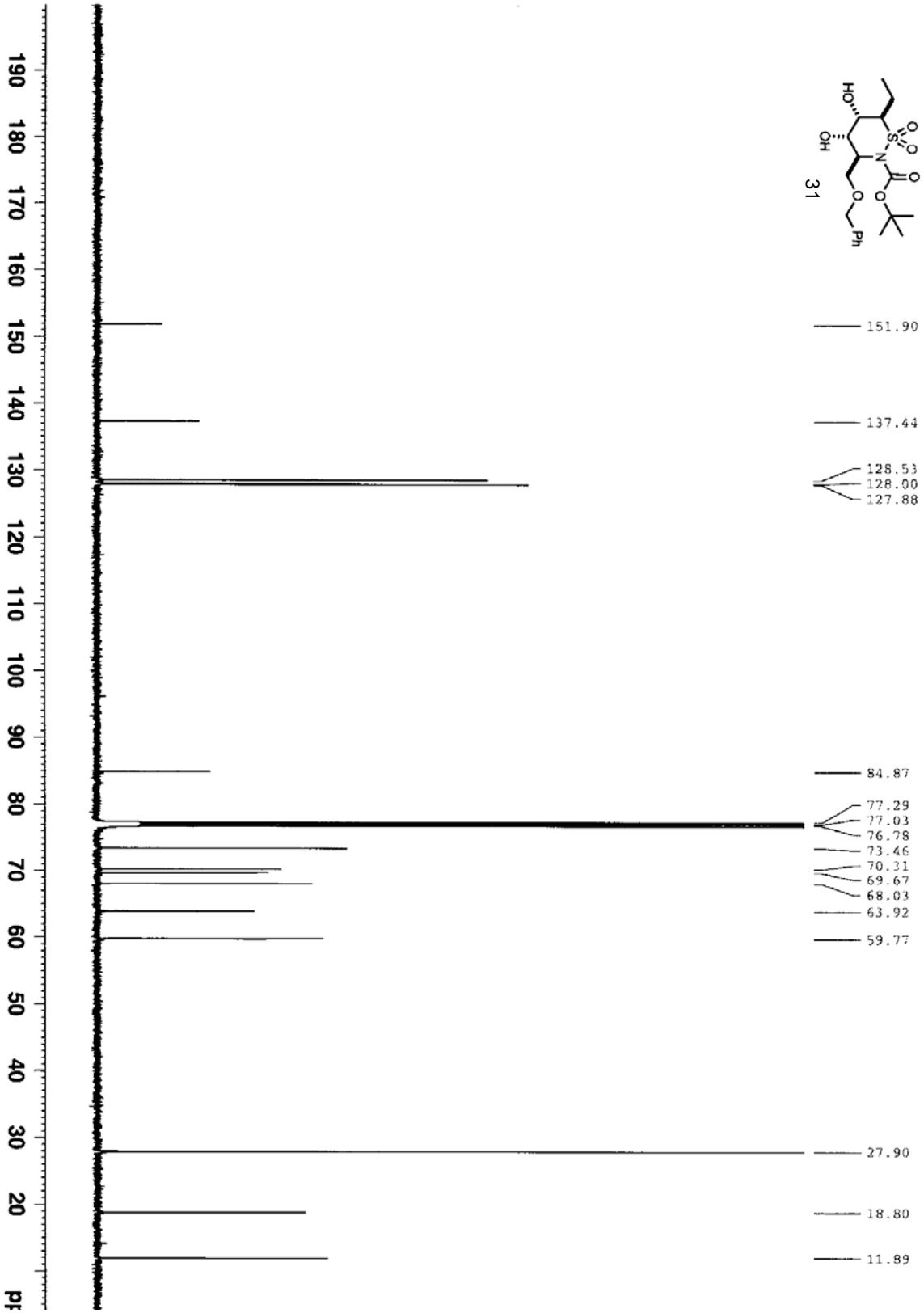
100
50
0
-50
-100
-150
-200
ppm
1.00
MeO
MeO
O
O
O
O
O
O
O
Ph
29

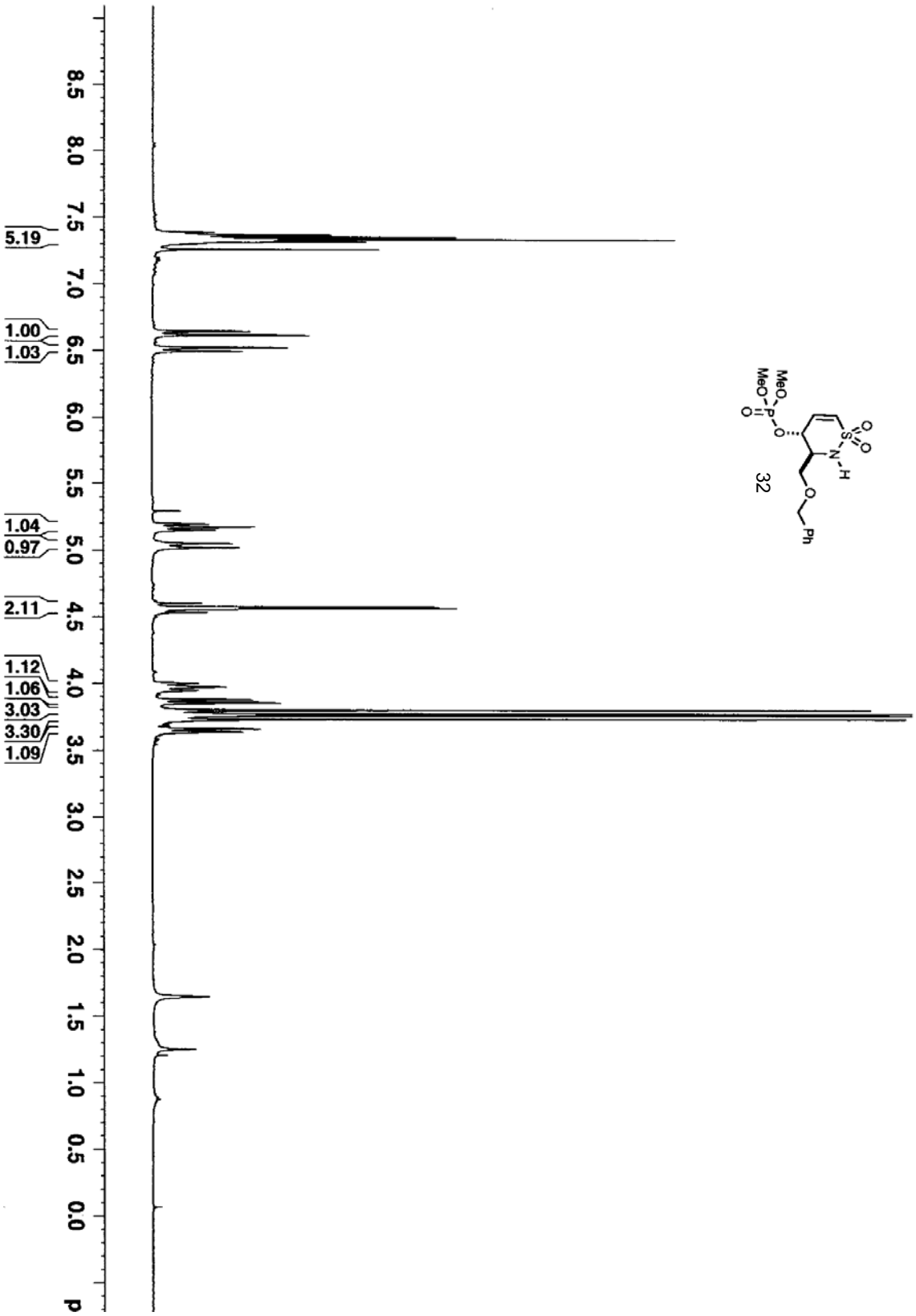

8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
5.06
1.00
1.00
1.02
2.02
3.08
1.04
1.13
9.25
3.07
30
OBn

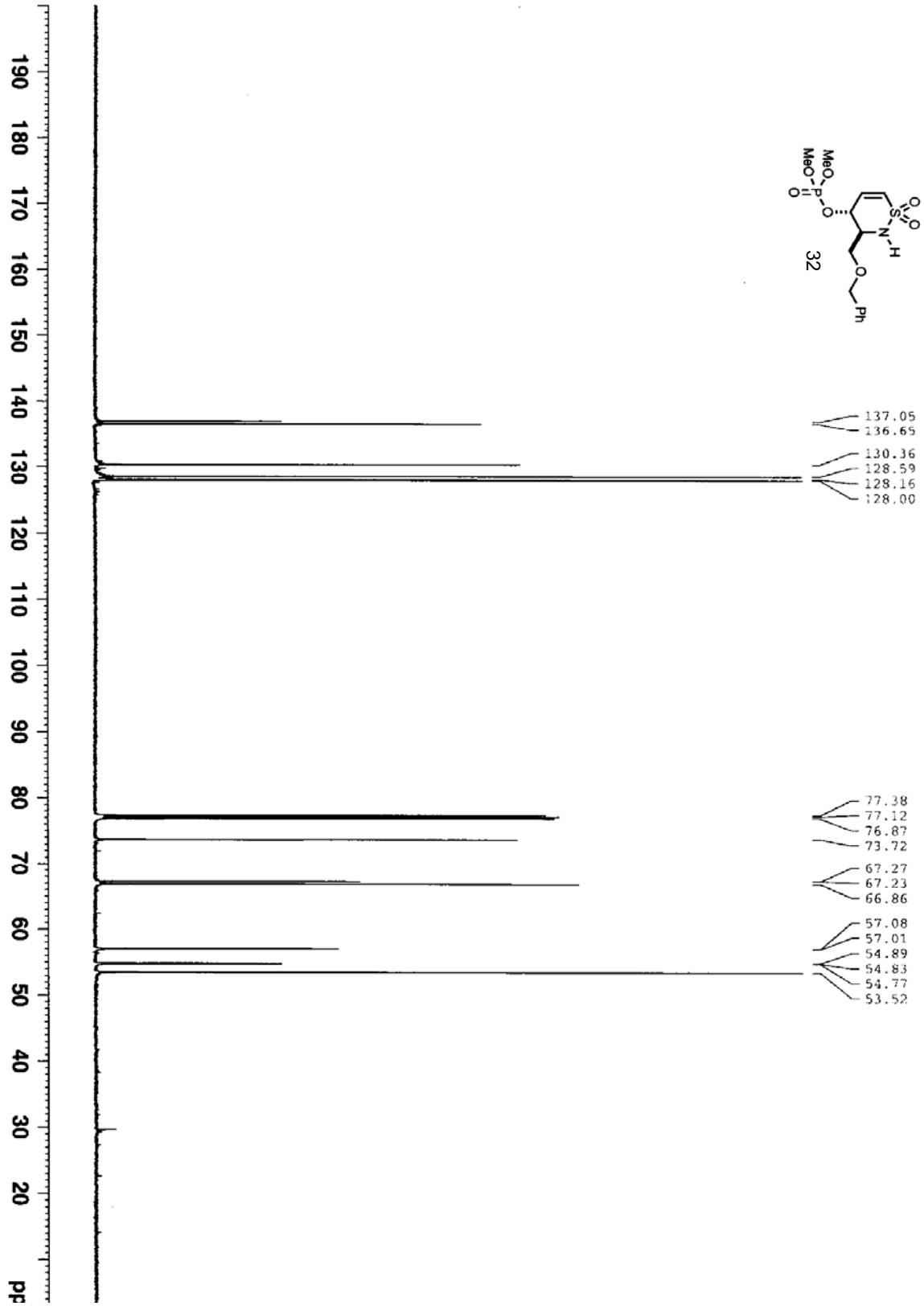

30
OBn
150.70
137.87
128.31
127.65
125.82
122.74
84.40
77.26
77.00
76.75
73.18
70.90
60.55
59.93
27.86
21.70
10.87
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20

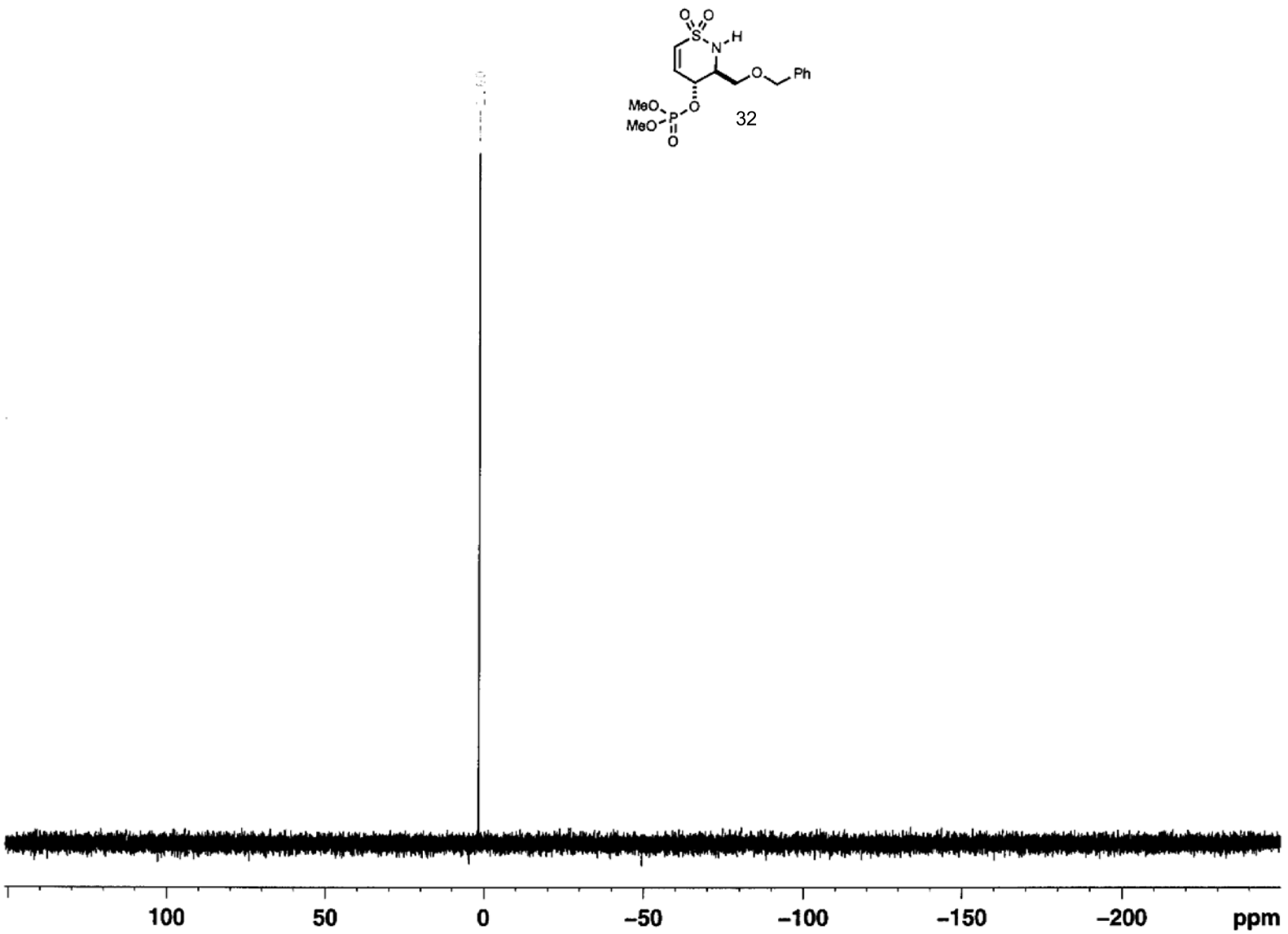

9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
ppm
5.10
1.00
2.08
0.99
1.04
1.00
1.01
1.01
0.80
0.82
2.14
3.94
9.43
3.12
HO
OH
O
O
S
N
O
O
O
Ph

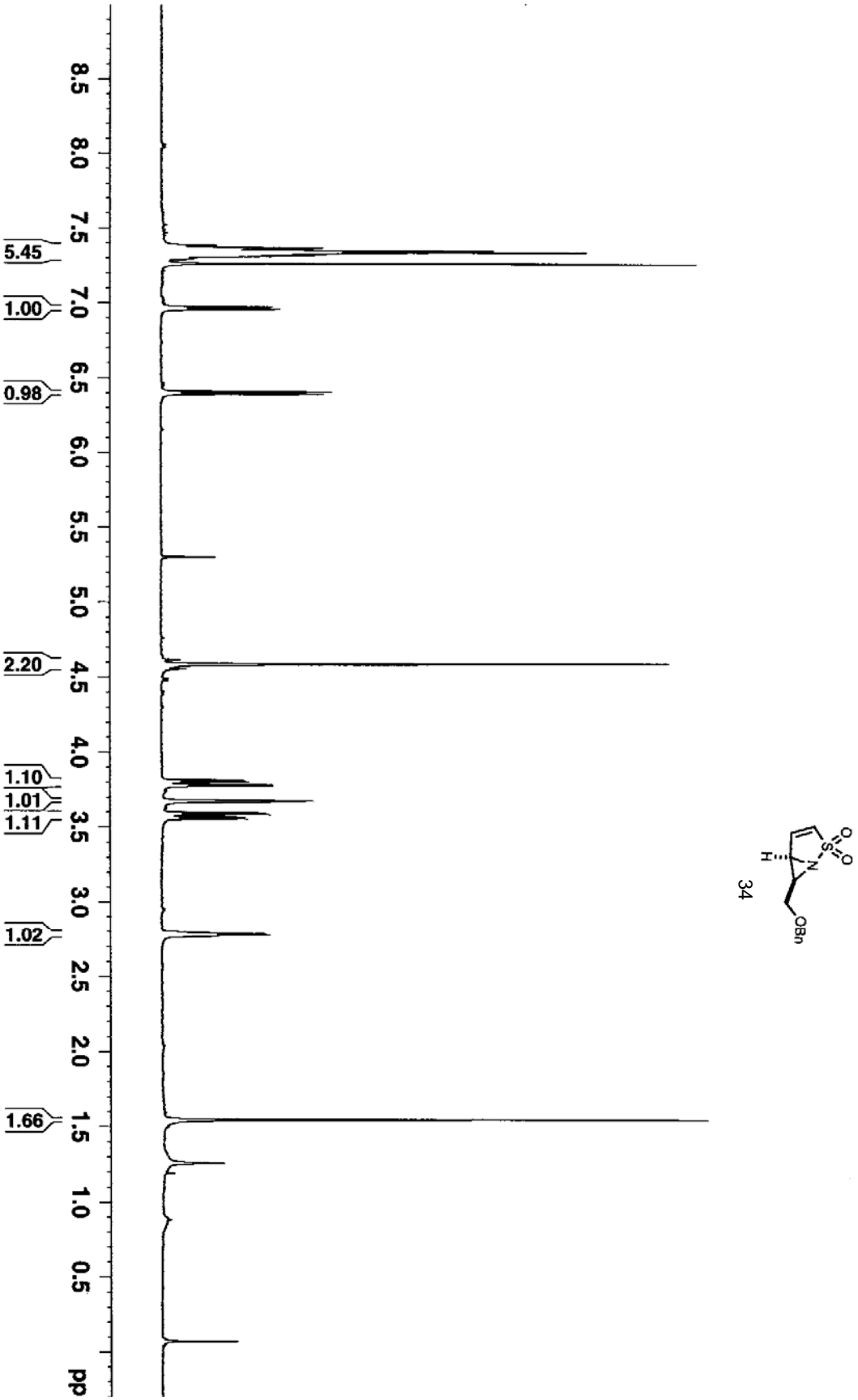
31

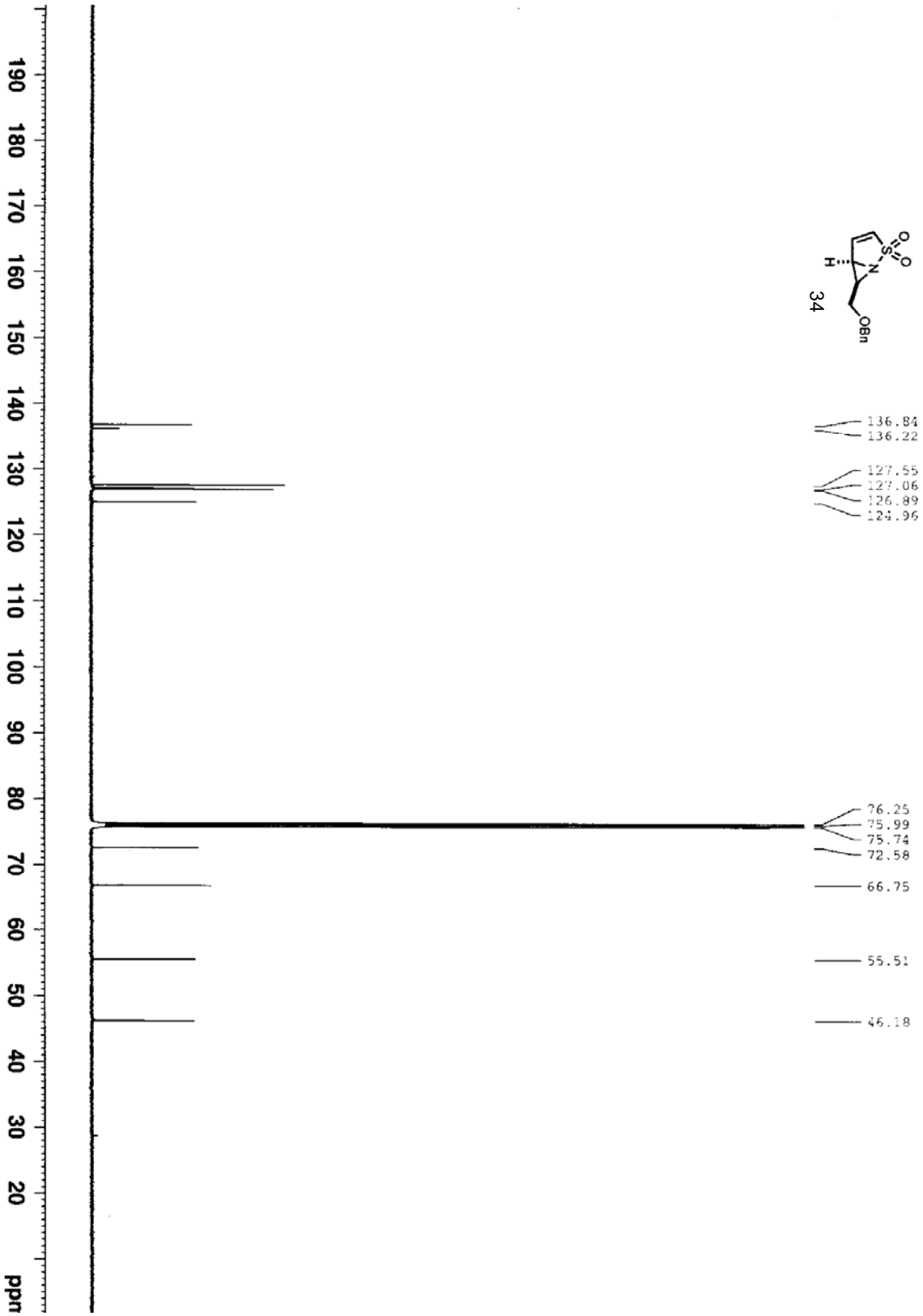

31
151.90
137.44
128.53
128.00
127.88
84.87
77.29
77.03
76.78
73.46
70.31
69.67
68.03
63.92
59.77
27.90
18.80
11.89

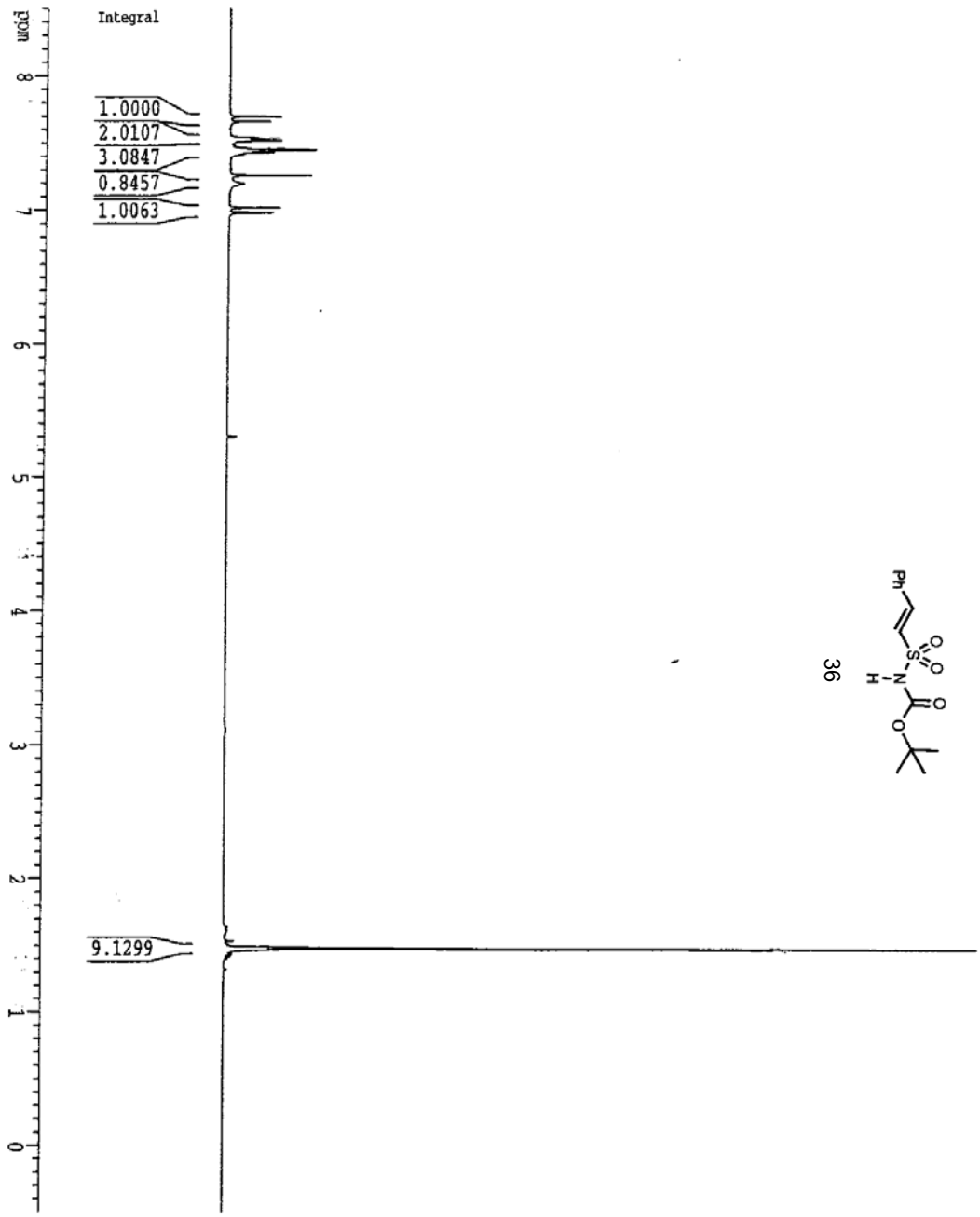

5.19
1.00
1.03
1.04
0.97
2.11
1.12
1.06
3.03
3.30
1.09
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
p
MeO
MeO
O
O
O
S
N
H
O
Ph
32


32
137.05
136.65
130.36
128.59
128.16
128.00
77.38
77.12
76.87
73.72
67.27
67.23
66.86
57.08
57.01
54.89
54.83
54.77
53.52

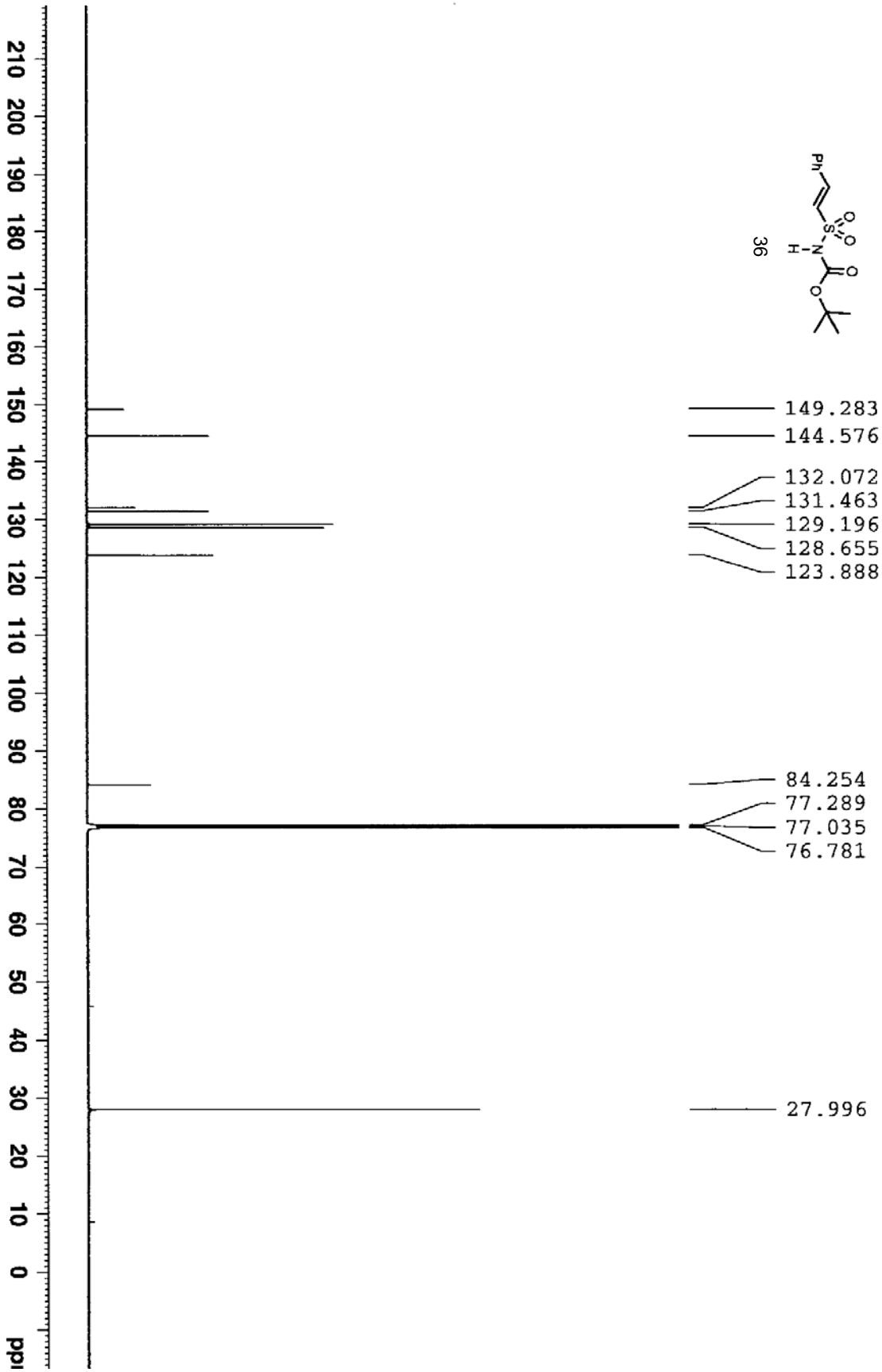

MeO
MeO
P
O
O
O
S
O
N
H
O
Ph
32
100
50
0
−50
−100
−150
−200
ppm

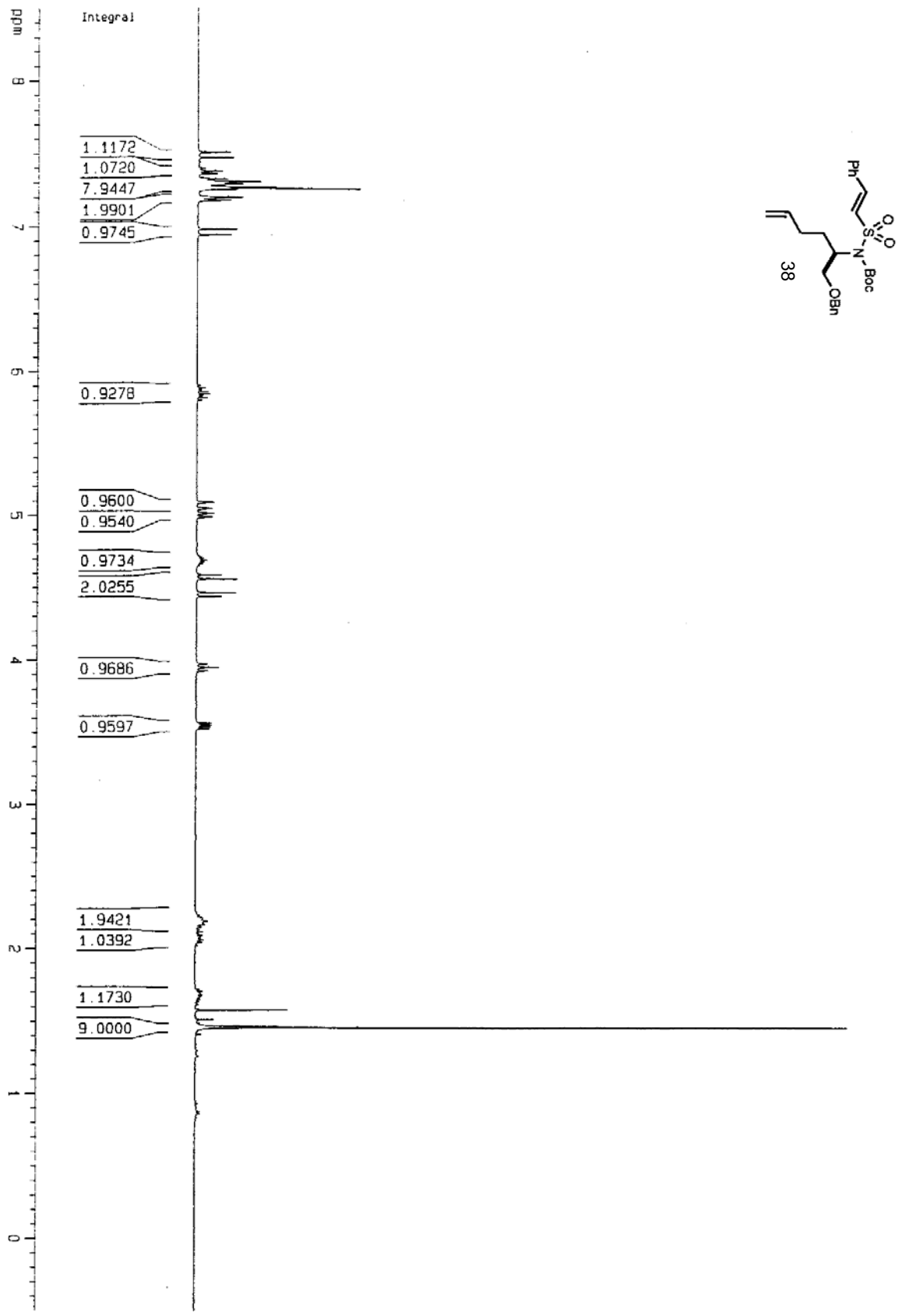

5.45
1.00
0.98
2.20
1.10
1.01
1.11
1.02
1.66
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
pp
34
OBn

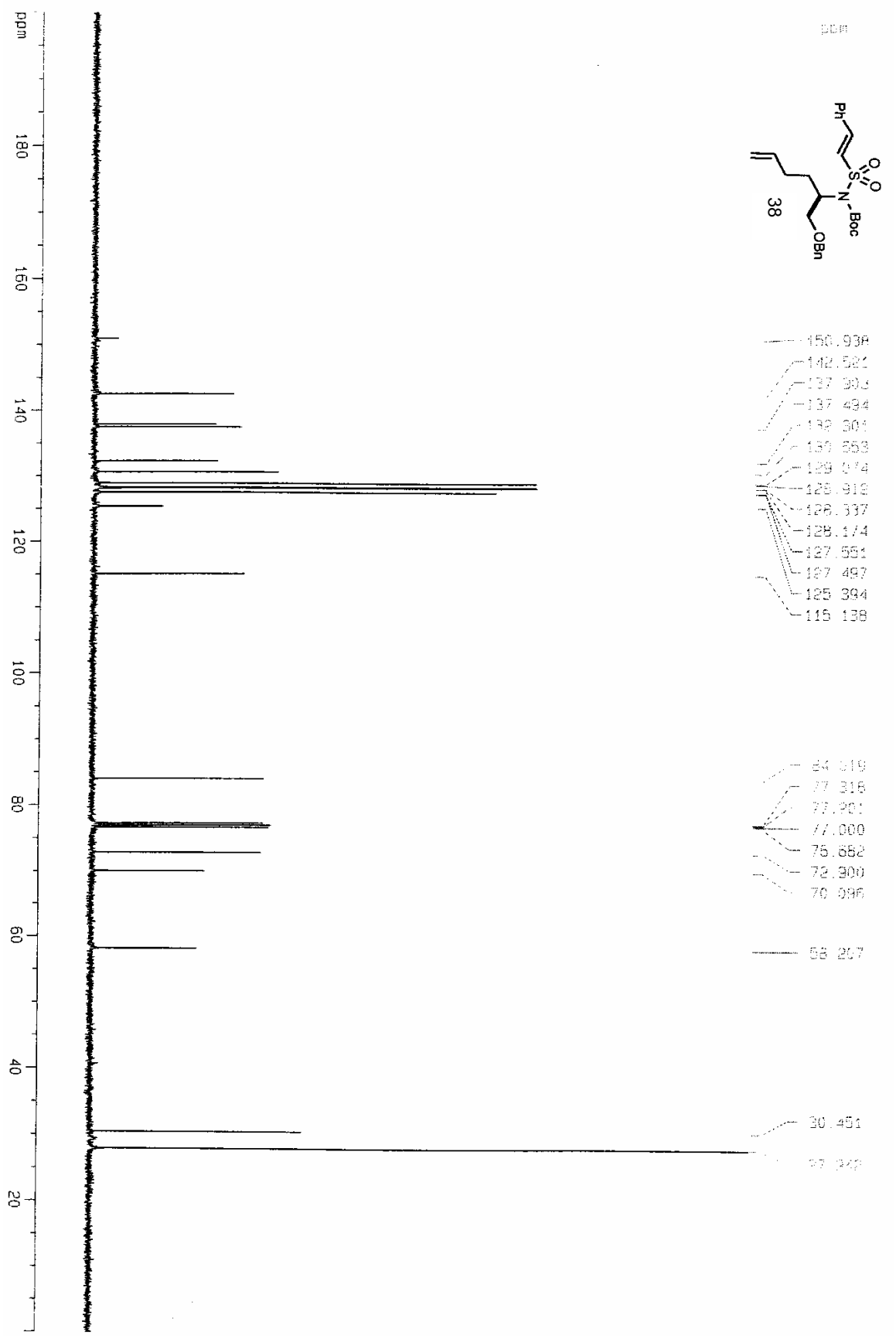

34
136.84
136.22
127.55
127.06
126.89
124.96
76.25
75.99
75.74
72.58
66.75
55.51
46.18
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
ppm

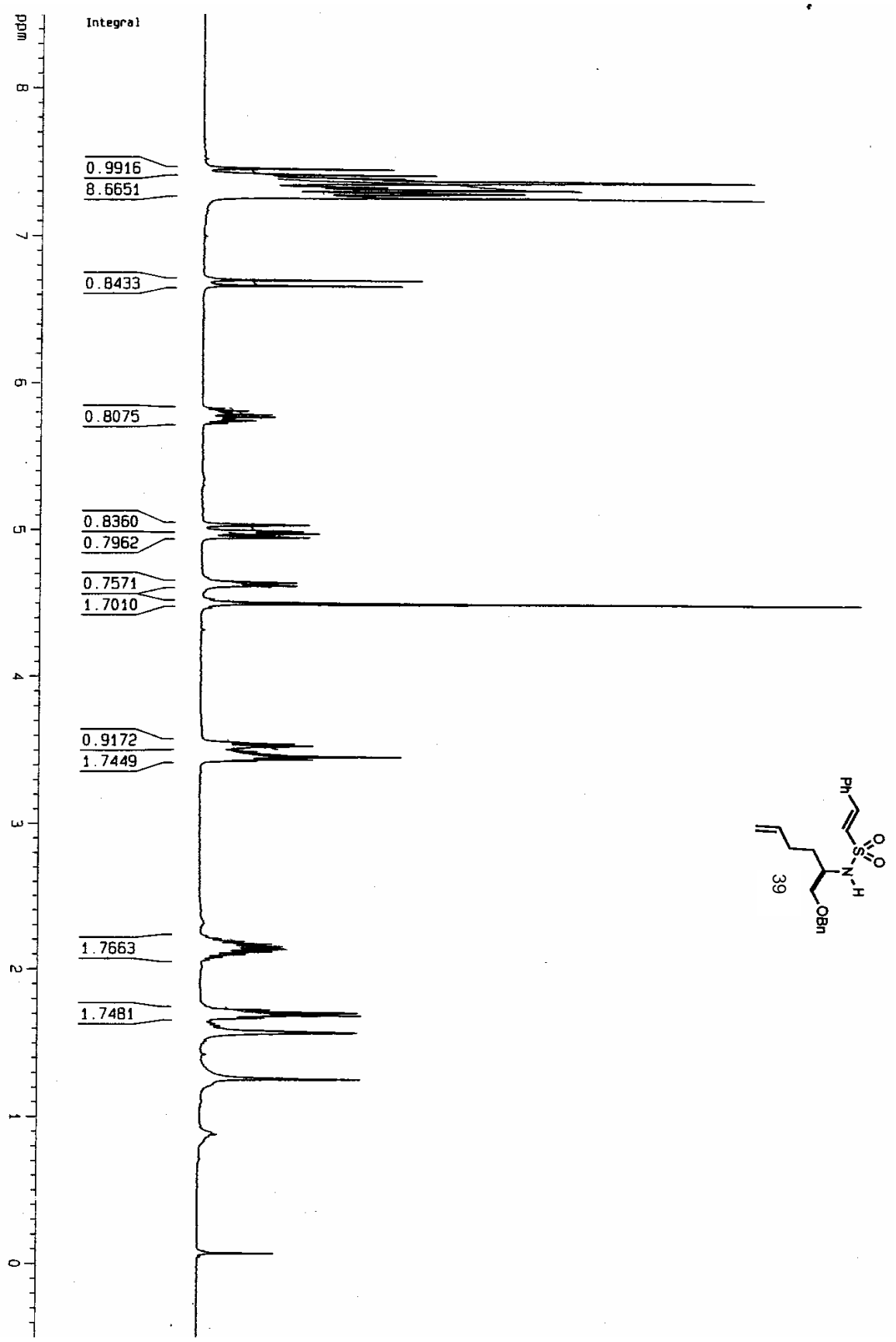

Integral
1.0000
2.0107
3.0847
0.8457
1.0063
9.1299
ppm
0
1
2
3
4
5
6
7
8
Ph
O
O
S
N
H
O
O

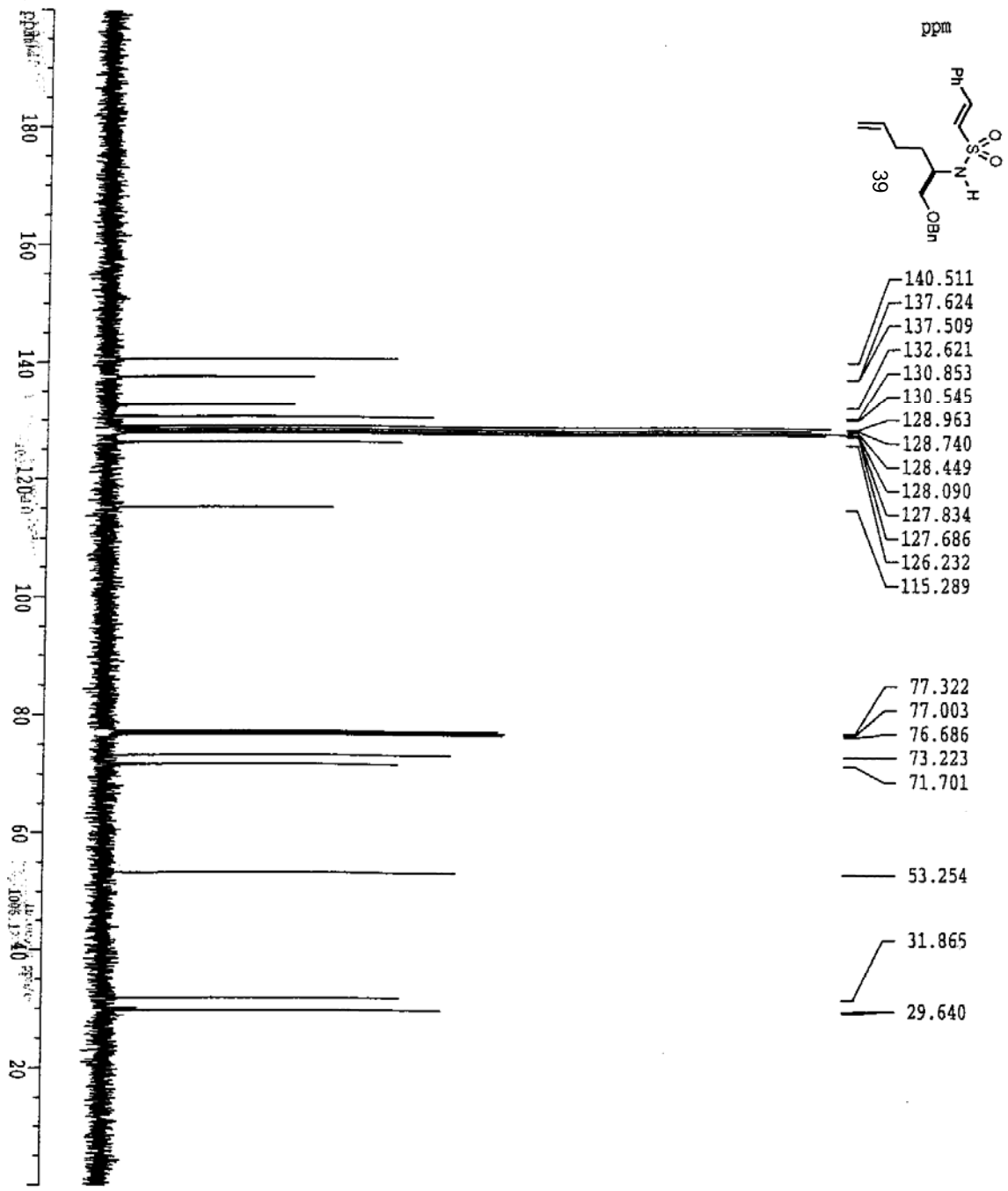
36

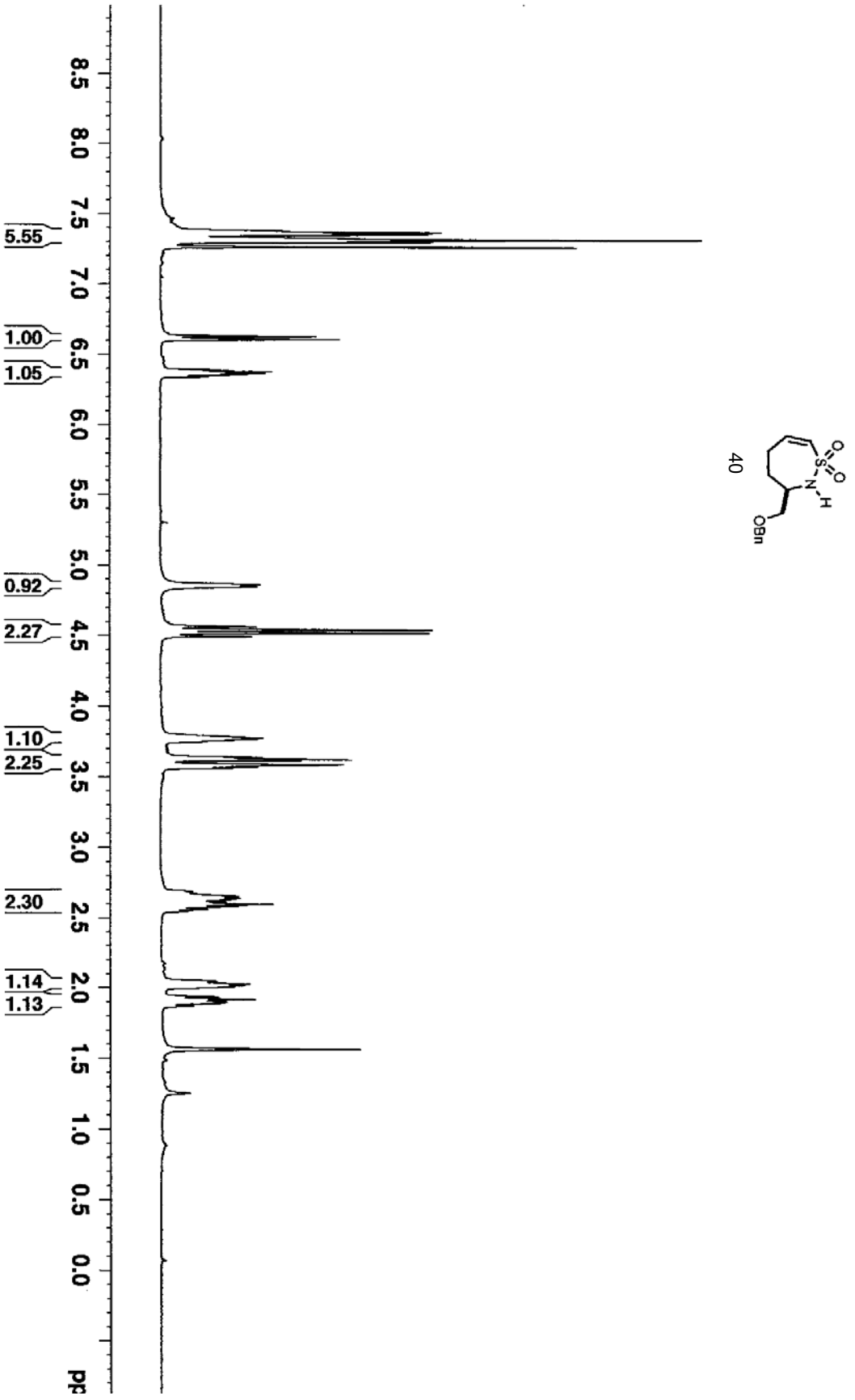

210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 ppm
36
Ph
O
O
S
H
N
O
O
149.283
144.576
132.072
131.463
129.196
128.655
123.888
84.254
77.289
77.035
76.781
27.996


Integral
1.1172
1.0720
7.9447
1.9901
0.9745
0.9278
0.9600
0.9540
0.9734
2.0255
0.9686
0.9597
1.9421
1.0392
1.1730
9.0000
Ph
O
O
S
N
Boc
OBn
38

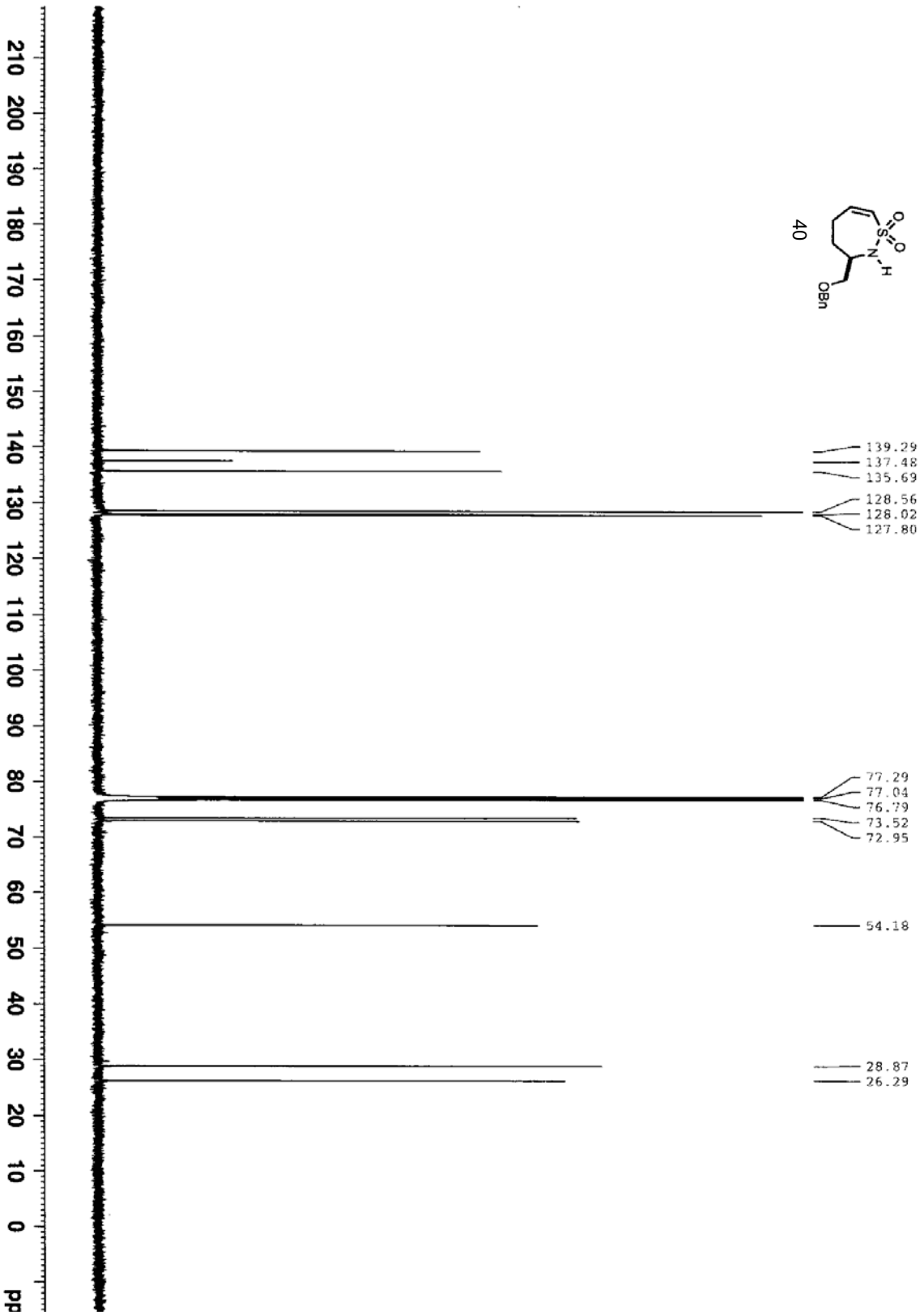

ppm
180
160
140
120
100
80
60
40
20
Ph
O
O
S
N
Boc
OBn
38
150.938
142.582
137.494
128.916
126.337
128.174
127.551
127.497
125.394
115.138
84.519
77.315
77.000
75.662
72.300
70.096
68.257
30.451


Integral
ppm
0.9916
8.6651
0.8433
0.8075
0.8360
0.7962
0.7571
1.7010
0.9172
1.7449
1.7663
1.7481
Ph
O
O
S
N
H
OBn
39


ppm
Ph
O
O
S
N
H
39
OBn
140.511
137.624
137.509
132.621
130.853
130.545
128.963
128.740
128.449
128.090
127.834
127.686
126.232
115.289
77.322
77.003
76.686
73.223
71.701
53.254
31.865
29.640


5.55
1.00
1.05
0.92
2.27
1.10
2.25
2.30
1.14
1.13
8.5
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
0.5
0.0
O
S
O
N
H
OBn

40


40
OBn
139.29
137.48
135.69
128.56
128.02
127.80
77.29
77.04
76.79
73.52
72.95
54.18
28.87
26.29
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 pp