Electronic Supplementary Material (ESI) for Green Chemistry.

Sustainable organophosphorus-catalysed Staudinger reduction

Supporting information

Danny C. Lenstra, Peter Lenting, and Jasmin Mecinović*

Institute for Molecules and Materials, Radboud University Nijmegen, Heyendaalseweg 135, 6525 AJ Nijmegen, The Netherlands

* E-mail: j.mecinovic@science.ru.nl; Fax: +31 243653393; Tel: +31243652381

Table of Contents

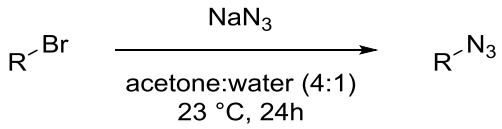
1. General experimental

All chemicals and solvents were obtained from commercial suppliers and used without further purification. Polymethylhydrosiloxane (PMHS, average M_n 1700-3200, product number 176206), 4-azidoanisole solution in MTBE (CAS 2101-87-3), and 1-azidoadamantane (CAS 24886-73-5) were purchased from Sigma-Aldrich. 1-Azido-2-fluoroethane (CAS 894792-94-0) was purchased from Fluorochem. Reactions were carried out with constant magnetic stirring under air using a Radleys carousel (Carousel 12 Plus Reaction Station™). All compounds were transferred using standard syringe techniques. After cooling to room temperature, a screening for product was performed using thin-layer chromatography (TLC) with a 5% methanol in dichloromethane containing 0.1% triethylamine solvent mixture on EMD Silica Gel 60 F_{254} glass plates. Visualisation of the developed plates was performed under UV light (254 nm) and/or staining with ninhydrin.

Nuclear magnetic spectroscopy (NMR) data were recorded at ambient temperature on a Bruker Avance III 400 (400 MHz), or Bruker Avance III 500 (500 MHz, equipped with a Prodigy cryoprobe) spectrometer in the indicated solvents. ^{1}H NMR chemical shifts are reported as δ in units of parts per million (ppm) relative to the internal standard tetramethylsilane (TMS, δ = 0 ppm). ^{13}C NMR shifts are reported as δ in units of parts per million (ppm) and the spectra were internally referenced to the residual solvent signal ($CHCl_3$ δ = 77.0 ppm, MeOH δ = 49.0 ppm). Multiplicities are given as: s (singlet), bs (broad singlet), d (doublet), t (triplet), q (quartet), hept (heptet), m (multiplet), app. (apparent). Coupling constants are reported as *J*-values in Hertz (Hz). Mass spectra (MS, *m/z*) were recorded on a LCQ Advantage MAX (Finnigan) mass spectrometer. Purity was assessed on a Shimadzu HPLC system containing a reverse phase C18 Prodigy ODS3 column (Phenomenex).

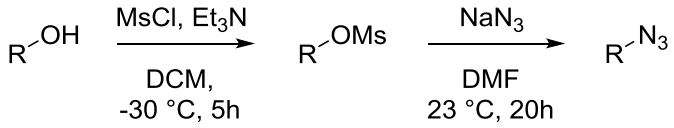
2. General procedures

2.1. General procedure I (GPI) for the synthesis of azides from alkyl bromides.[1]



To a 20 mL mixture of acetone and water (4:1) were subsequently added alkyl bromide (4 mmol, 0.2 M final concenntration, 1.0 equiv.) and NaN_3 (4.8 mmol, 1.2 equiv.). The mixture was stirred at room temperature (23 °C) until TLC analysis showed the reaction was complete. After this, water (20 mL) was added and the product was extracted with dichloromethane (3x20 mL). The combined organic layer was washed with a saturated $NaHCO_3$ solution (1x50 mL), brine (1x50 mL), dried over $MgSO_4$, and filtered. After evaporation of the solvent, ^{1}H NMR was taken and if necessary the crude azide was purified by flash column chromatography.

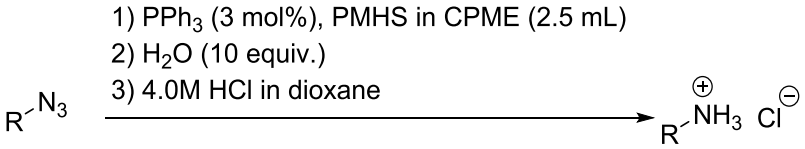
2.2. General procedure II (GPII) for the synthesis of azides from alcohols.[2]



In a dried reaction flask under a protected atmosphere, the respective alcohol (1.0 equiv.) was dissolved in dry dichloromethane to obtain a 0.1 M solution. The mixture was cooled to -30 °C followed by the addition of triethylamine (1.5 equiv.) and methanesulfonyl chloride (1.3 equiv.). The reaction mixture was allowed to stir at -30 °C for 5 hours after which it was allowed to warm to room temperature. After additional stirring at room temperature for 30 minutes the solvent was removed *in vacuo*. The obtained solid was redissolved in dimethylformamide (DMF, 0.1 M) followed by the addition of NaN_3 (2.0 equiv.). The reaction was left to stir at room temperature for 20 h. The reaction

mixture was diluted by the addition of water (50 mL) and extracted with diethyl ether (3x20 mL). The combined organic layers were washed with brine (1x50 mL), dried over $MgSO_4$, and filtered. The solvent was removed *in vacuo*, and the crude azide was purified by flash column chromatography.

2.3. General procedure III (GPIII) for the catalytic Staudinger reduction.



In a Radleys reaction tube equipped with a magnetic stir bar triphenylphosphine (3.9 mg, 0.03 equiv., 0.015 mmol) and azide (1.0 equiv., 0.5 mmol) were dissolved in 2.5 mL of cyclopentyl methyl ether (CPME), followed by the addition of polymethylhydrosiloxane (196 µL, 0.08 mmol, 6 Si-H equiv.). The mixture was stirred at 110 °C for 20 hours, after which it was quenched by the addition of a few drops (typically 3 drops added with a Pasteur pipette, ~ 10 equiv.) of water, and left to stir for an additional 15 minutes at 110 °C before cooling to room temperature. The reaction mixture was diluted with Et_2O (5 mL) and 4.0 M HCl in dioxane was added to precipitate the corresponding amine hydrochloride salt. The resulting suspension was filtered, the solid residue washed with diethyl ether (20 mL), and dried to obtain pure amine hydrochloride salt. No column chromatography was required.

3. Characterisation of compounds.

3.1. Characterisation of azides.

4-Nitrophenethyl azide (4.5 g, 79% isolated yield, pale yellow oil) was prepared according to GPII starting from 4-nitrophenethyl alcohol (5.0 g, 30 mmol). The crude azide was purified by column chromatography (0-5% EtOAc in *n*-heptane). R_f = 0.18 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.19 (d, *J* = 8.7 Hz, 2H), 7.40 (d, *J* = 8.7 Hz, 2H), 3.59 (t, *J* = 6.9 Hz, 2H), 3.00 (t, *J* = 6.9 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 147.0, 145.8, 129.7, 123.9, 51.7, 35.2.

Phenethyl azide (348 mg, 59% isolated yield. colourless oil) was prepared according to GPI starting from phenethyl bromide (736 mg, 4 mmol). R_f = 0.21 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36 – 7.29 (m, 2H), 7.28 – 7.20 (m, 3H), 3.51 (t, *J* = 7.3 Hz, 2H), 2.90 (t, *J* = 7.3 Hz, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 138.0, 128.7, 128.7, 126.8, 52.5, 35.4.

2-Nitrophenethyl azide (0.72 g, 63% isolated yield, pale yellow oil) was prepared according to GPII starting from 2-nitrophenethyl alcohol (0.87 mL, 6 mmol). The crude azide was purified by column chromatography (0-10% EtOAc in *n*-heptane). R_f = 0.31 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.99 (dd, *J* = 8.1, 1.3 Hz, 1H), 7.58 (td, *J* = 7.6, 1.3 Hz, 1H), 7.43 (m, 2H), 3.63 (t, *J* = 6.9 Hz, 2H), 3.18 (t, *J* = 6.9 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 149.3, 133.3, 133.1, 132.9, 128.1, 125.1, 51.5, 33.0.

3-Chlorophenethyl azide (1.1 g, 97% isolated yield, pale yellow oil) was prepared according to GPII starting from 3-chlorophenethyl alcohol (0.65 mL, 6.4 mmol). R_f = 0.47 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.27-7.18 (m, 3H), 7.10 (dt, *J* = 6.7, 1.9 Hz, 1H), 3.50 (t, *J* = 7.1 Hz, 2H), 2.86 (t, *J* = 7.1 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 140.1, 134.4, 129.9, 128.9, 127.0, 126.9, 52.1, 35.0.

3-Methoxyphenethyl azide (0.43 g, 52% isolated yield, pale yellow oil) was prepared according to GPI starting from 3-methoxyphenethyl bromide (0.73 mL, 4.7 mmol). R_f = 0.42 (EtOAc/*n*-heptane =

1:9). ^{1}H NMR (500 MHz, $CDCl_3$)*:* δ 7.26-7.21 (m, 1H), 6.83-6.75 (m, 3H), 3.80 (s, 3H), 3.50 (t, *J* = 7.3 Hz, 2H), 2.87 (t, *J* = 7.3 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$)*:* δ 159.8, 139.6, 129.6, 121.1, 114.6, 112.0, 55.2, 52.4, 35.4.

Benzyl azide (8.0 g, 80% isolated yield, colourless oil) was prepared according to GPI starting from benzyl bromide (8.9 mL, 75 mmol) and NaN_3 (7.3 g, 113 mmol). R_f = 0.53 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.38-7.26 (m, 5H), 4.28 (s, 2H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 135.4, 128.9 128.3, 128.2, 54.8.

1-(Azidomethyl)-naphthalene (0.9 g, 93% isolated yield, brown oil) was prepared according to GPII starting from 1-naphthalene methanol (0.8 g, 5.0 mmol). The crude azide was purified by flash column chromatography (0-10% EtOAc in *n*-heptane). R_f = 0.50 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.02-7.99 (m, 1H), 7.89-7.82 (m, 2H), 7.53 (dddd, J = 21.8, 8.1, 6.8, 1.4 Hz, 2H), 7.46-7.40 (m, 2H), 4.73 (s, 2H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 133.9, 131.3, 130.9, 129.4, 128.8, 127.3, 126.7, 126.1, 125.2, 123.5, 53.0.

4-Bromo-2-fluorobenzyl azide (1.1 g, 74% isolated yield, colourless oil) was prepared according to GPII starting from 4-bromo-2-fluorobenzyl alcohol (1.0 g, 4.9 mmol). R_f = 0.53 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.34-7.20 (m, 3H), 4.36 (s, 2H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.5 (d, *J* = 252.3 Hz), 131.3 (d, *J* = 4.4 Hz), 127.8 (d, *J* = 3.8 Hz), 122.7 (d, *J* = 9.4 Hz), 122.0 (d, *J* = 15.4 Hz), 119.4 (d, *J* = 24.6 Hz), 48.0 (d, *J* = 3.0 Hz).

3,4-(Methylenedioxy)benzyl azide (piperonyl azide) (1.0 g, 87% isolated yield, pale yellow oil) was prepared according to GPII starting from piperonyl alcohol (1.1 g, 6.7 mmol). The crude azide was purified by flash column chromatography (0-10% EtOAc in *n*-heptane). R_f = 0.40 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): δ 6.83-6.74 (m, 3H), 5.98 (s, 2H), 4.23 (s, 2H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 148.1, 147.7, 129.0, 122.0, 108.8, 108.4, 101.3, 54.8.

(2-Azidoethyl) phenyl sulfide (0.85 g, 79% isolated yield, pale yellow oil) was prepared according to GPII starting from 1-bromo-2-phenylthioethane (0.90 ml, 6.0 mmol). R_f = 0.43 (EtOAc/*n*-heptane = 1:9). ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.43-7.36 (m, 2H), 7.34-7.28 (m, 2H), 7.26-7.19 (m, 1H), 3.44 (t, *J* = 7.0 Hz, 2H), 3.08 (t, *J* = 7.0 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 134.5, 130.5, 129.2, 127.0, 50.3, 33.6.

4-Benzyloxybenzyl azide (1.1 g, 98% isolated yield, white solid) was prepared according to GPII starting from 4-benzyloxybenzyl alcohol (1.0 g, 4.7 mmol). The crude azide was purified by flash column chromatography (0-10% EtOAc in *n*-heptane). R_f = 0.15 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.45-7.30 (m, 5H), 7.24 (dd, *J* = 7.3, 1.7 Hz, 2H), 7.01-6.96 (m, 2H), 5.07 (s, 2H), 4.26 (s, 2H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 158.8, 136.8, 129.7, 128.6, 128.0, 127.7, 127.5, 115.1, 70.1, 54.4.

3-Cyanobenzyl azide (626 mg, 99% isolated yield, pale yellow oil) was prepared according to GPI starting from 3-cyanobenzyl bromide (780 mg, 4 mmol). R_f = 0.25 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66 – 7.61 (m, 2H), 7.59 – 7.55 (m, 1H), 7.54 – 7.48 (m, 1H), 4.43 (s, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 137.1, 132.2, 131.9, 131.4, 129.7, 118.3, 113.1, 53.8.

Cinnamyl azide (0.98 g, 82% isolated yield, pale yellow oil) was obtained according to GPII starting from cinnamyl alcohol (1.0 g, 7.6 mmol). R_f = 0.53 (EtOAc/*n*-heptane = 1:9). ^{1}H NMR (500 MHz, $CDCl_3$*):* δ 7.41-7.22 (m, 5H), 6.61 (dt, *J* = 15.8, 1.4 Hz, 1H), 6.20 (dt, *J* = 15.8, 6.6 Hz, 1H), 3.89 (dd, *J* = 6.6, 1.4 Hz, 2H); ^{13}C NMR (126 MHz, $CDCl_3$*):* δ 136.0, 134.5, 128.6, 128.2, 126.6, 122.4, 53.0.

4-Methylsulfonylbenzyl azide (334 mg, 74% isolated yield, colourless oil) was prepared according to GPII starting from 4-methylsulfonylbenzyl alcohol (401 mg, 2.0 mmol). The crude azide was purified by flash column chromatography (10-30% EtOAc in *n*-heptane). R_f = 0.15 (EtOAc/*n*-heptane = 1:4); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (d, *J* = 8.4 Hz, 2H), 7.53 (d, *J* = 8.4 Hz, 2H), 4.49 (s, 2H), 3.07 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.7, 140.4, 128.7, 128.0, 53.9, 44.5.

Methyl 4-(azidomethyl) benzoate (770 mg, 99% isolated yield, pale yellow oil) was prepared according to GPI starting from methyl (4-bromomethyl)benzoate (912 mg, 4.0 mmol). R_f = 0.45 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (d, *J* = 8.4 Hz, 2H), 7.39 (d, *J* = 8.4 Hz, 2H), 4.42 (s, 2H), 3.93 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 166.6, 140.4, 130.1, 130.1, 127.9, 54.3, 52.2.

Methyl 6-(azidomethyl) nicotinate (262 mg, 68% isolated yield, pale yellow oil) was prepared according to GPII starting from methyl 6-(hydroxymethyl)nicotinate (334 mg, 2.0 mmol). The crude azide was purified by flash column chromatography (0-10% EtOAc in *n*-heptane). R_f = 0.20 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.19 (dd, *J* = 2.2, 0.7 Hz, 1H), 8.33 (dd, *J* = 8.1, 2.2 Hz, 1H), 7.45 (dd, *J* = 8.1, 0.7 Hz, 1H), 4.58 (s, 2H), 3.97 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 165.4, 160.0, 150.8, 138.2, 125.3, 121.3, 55.4, 52.5; MS (ESI) *m/z* 193.1 $[M+H]^+$.

4-Benzoylbenzyl azide (930 mg, 98% isolated yield, colourless oil) was prepared according to GPI starting from 4-benzoylbenzyl bromide (1.1 g, 4.0 mmol). R_f = 0.30 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 – 7.77 (m, 4H), 7.65 – 7.57 (m, 1H), 7.52 – 7.42 (m, 4H), 4.46 (s, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 196.1, 139.9, 137.5, 137.4, 132.6, 130.6, 130.0, 128.4, 127.9, 54.3.

4-Acetamidobenzyl azide (210 mg, 60% isolated yield, off-white solid) was prepared according to GPII starting from 4-acetamidobenzyl alcohol (302 mg, 1.8 mmol). R_f = 0.1 (EtOAc/*n*-heptane = 3:7); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (d, *J* = 8.5 Hz, 2H), 7.38 (bs, 1H), 7.27 (d, *J* = 8.5 Hz, 2H), 4.29 (s, 2H), 2.18 (s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 168.5, 138.1, 131.1, 129.0, 120.1, 54.3, 21.1.

(4-Hydroxymethyl)benzyl bromide (1.67 g, 84% isolated yield, white solid): to a stirred solution of methyl (4-bromomethyl)benzaldehyde (2.3 g, 10 mmol) in anhydrous DCM (50 mL) was added DIBAL-H (1.0 M in toluene, 20 mL, 20 mmol) at -78 °C. After 1 h at -78 °C the reaction was quenched by the dropwise addition of MeOH (5 mL), after which it was allowed to warm to room

temperature. Next, aqueous potassium sodium tartrate (50 mL, 10% *w/v*) was added and the suspension was left to stir until two distinct layers were visible. The solution was diluted with DCM (50 mL) and washed with water (2x50 mL), brine (2x50 mL), dried ($MgSO_4$), filtered and concentrated *in vacuo*. The crude alcohol was purified by flash column chromatography (10-30% EtOAc in *n*-heptane). Rf = 0.5 (EtOAc/*n*-heptane = 1:1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (d, *J* = 8.2 Hz, 2H), 7.32 (d, *J* = 8.2 Hz, 2H), 4.67 (s, 2H), 4.49 (s, 2H), 1.84 (bs, 1H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.2, 137.1, 129.2, 127.3, 64.8, 33.3.

(4-Hydroxymethyl)benzyl azide (590 mg, 91% isolated yield, colourless oil) was prepared according to GPI starting from (4-hydroxymethyl)benzyl bromide (796 mg, 4.0 mmol). R_f = 0.6 (EtOAc/*n*-heptane = 1:1); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 (d, *J* = 8.2 Hz, 2H), 7.31 (d, *J* = 8.2 Hz, 2H), 4.70 (s, 2H), 4.33 (s, 2H), 1.85 (bs, 1H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 141.0, 134.7, 128.5, 127.4, 64.9, 54.5.

5-(Azidomethyl) thiazole (138 mg, 49% isolated yield, colourless oil) was prepared according to GPII starting from 5-(hydroxymethyl) thiazole (115 mg, 2.0 mmol). The crude azide was purified by flash column chromatography (10-20% EtOAc in *n*-heptane). R_f = 0.15 (EtOAc/*n*-heptane = 1:4); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.83 (d, *J* = 0.9 Hz, 1H), 7.85 (d, *J* = 0.9 Hz, 1H), 4.59 (s, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 154.3, 142.8, 132.3, 46.4.

2-Fluoro-3-(azidomethyl)pyridine (206 mg, 68% isolated yield, colourless oil) was prepared according to GPII starting from 2-fluoro-3-(hydroxymethyl)pyridine (254 mg, 2.0 mmol). The crude azide was purified by flash column chromatography (5-15% EtOAc in *n*-heptane). R_f = 0.30 (EtOAc/*n*-heptane = 1:4); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.24 – 8.17 (m, 1H), 7.86 – 7.76 (m, 1H), 7.24 (ddd, *J* = 7.3, 4.9, 1.7 Hz, 1H), 4.46 (s, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 161.3 (d, *J* = 239.6 Hz), 147.5 (d, *J* = 14.7 Hz), 140.4 (d, *J* = 4.8 Hz), 121.7 (d, *J* = 4.4 Hz), 118.0(d, *J* = 30.4 Hz), 48.1 (d, *J* = 2.2 Hz); ^{19}F NMR (377 MHz, $CDCl_3$) δ -71.4.

3-(2-Azidoethyl) indole (690 mg, 99% isolated yield, pale yellow oil) was prepared according to GPI starting from 3-(2-bromoethyl)indole (844 mg, 4 mmol). R_f = 0.30 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (bs, 1H), 7.60 (ddt, *J* = 7.8, 1.4, 0.8 Hz, 1H), 7.38 (dt, *J* = 8.1, 1.0 Hz, 1H), 7.21 (ddd, *J* = 8.2, 7.0, 1.2 Hz, 1H), 7.14 (ddd, *J* = 8.0, 7.0, 1.1 Hz, 1H), 7.09 – 7.07 (m, 1H), 3.57 (t, *J* = 7.2 Hz, 2H), 3.07 (td, *J* = 7.2, 0.8 Hz, 2H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 136.2, 127.1, 122.2, 122.2, 119.6, 118.5, 112.4, 111.3, 51.7, 25.1.

1-Azidooctane (0.87 g, 55% isolated yield, colourless oil) was prepared according to GPI starting from 1-bromooctane (1.34 mg, 10.4 mmol). R_f = 0.8 (EtOAc/*n*-heptane = 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): δ 3.25 (t, *J* = 7.0 Hz, 2H), 1.60 (p, *J* = 7.0 Hz, 2H), 1.40 - 1.22 (m, 10H), 0.92 - 0.86 (m, 3H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 51.5, 31.8, 29.2, 29.1, 28.9, 26.7, 22.7, 14.1.

1-Phenyl-2-azidopropane (0.49 g, 51% isolated yield, pale yellow oil) was prepared according to GPII starting from 1-phenyl-2-propanol (0.85 mL, 6.0 mmol). R_f = 0.55 (EtOAc/*n*-heptane = 1:9). ^{1}H NMR (500 MHz, $CDCl_3$): δ 7.34-7.18 (m, 5H), 3.68 (app. hept., *J* = 6.6 Hz, 1H), 2.88 – 2.69 (m, 2H), 1.26 (d, *J* = 6.5 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$): δ 137.8, 129.3, 128.5, 126.7, 59.0, 42.6, 19.1.

1-Phenyl-1-azidopropane (150 mg, 47% isolated yield, colourless oil) was prepared according to GPII starting from 1-phenyl-1-propanol (272 mg, 2.0 mmol). The crude azide was purified by column chromatography (0-10% EtOAc in *n*-heptane). R_f = 0.7 (EtOAc/*n*-heptane = 3:7); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 – 7.26 (m, 5H), 4.34 (t, *J* = 7.1 Hz, 1H), 1.94 – 1.72 (m, 2H), 0.93 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 139.7, 128.7, 128.1, 126.9, 67.9, 29.3, 10.8.

Ethyl (*S*)-2-azido-4-phenylbutanoate (195 mg, 42% isolated yield, colourless oil) was prepared according to GPII starting from ethyl (*R*)-2-hydroxy-4-phenylbutanoate (417 mg, 2.0 mmol). The crude azide was purified by column chromatography (0-10% EtOAc in *n*-heptane). R_f = 0.7 (EtOAc/*n*-heptane = 3:7); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 – 7.27 (m, 2H), 7.25 – 7.18 (m, 3H), 4.23 (q, *J* = 7.1 Hz, 2H), 3.81 (dd, *J* = 8.8, 5.0 Hz, 1H), 2.86 – 2.61 (m, 2H), 2.22 – 1.98 (m, 2H), 1.31

(t, J = 7.1 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.4, 140.1, 128.6, 128.5, 126.4, 61.8, 61.2, 32.9, 31.8, 14.2.

1-Azidoindane (0.84 g, 88% isolated yield, colourless oil) was prepared according to GPII starting from 1-indanol (0.82 mL, 6.0 mmol). The crude azide was purified by flash column chromatography (5-15% EtOAc in *n*-heptane). R_f = 0.20 (EtOAc/*n*-heptane = 1:9). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 – 7.37 (m, 1H), 7.32 – 7.23 (m, 3H), 4.87 (dd, J = 7.2, 4.6 Hz, 1H), 3.08 (ddd, J = 16.1, 8.3, 6.2 Hz, 1H), 2.88 (ddd, J = 16.1, 8.4, 5.4 Hz, 1H), 2.45 (dddd, J = 13.6, 8.4, 7.2, 6.2 Hz, 1H), 2.12 (dddd, J = 13.6, 8.3, 5.4, 4.6 Hz, 1H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 143.6, 140.6, 128.8, 126.8, 125.1, 124.5, 65.9, 32.5, 30.4.

3.2. Characterisation of amines.

4-Nitrophenethylamine hydrochloride (Compound **1**, 92 mg, 91% isolated yield) was prepared according to GPIII starting from 4-nitrophenethyl azide (96 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 8.23 (d, *J* = 8.8 Hz, 2H), 7.59 (d, *J* = 8.8 Hz, 2H), 3.29 (t, *J* = 8.0 Hz, 2H), 3.15 (t, *J* = 8.0 Hz, 2H); ^{13}C NMR (101 MHz, MeOD) δ 134.9, 131.6, 130.4, 128.3, 39.7, 32.0. MS (ESI) *m*/*z* 167.2 $[M+H]^+$.

Phenethylamine hydrochloride (Compound **2**, 76 mg, 97% isolated yield) was prepared according to GPIII starting from phenethylazide (74 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.41 – 7.34 (m, 2H), 7.32 – 7.27 (m, 3H), 3.20 (t, *J* = 8.3 Hz, 2H), 2.98 (t, *J* = 8.3 Hz, 2H); ^{13}C NMR (101 MHz, MeOD) δ 137.9, 130.0, 129.8, 128.3, 42.0, 34.6; MS (ESI) *m*/*z* 122.2 $[M+H]^+$.

2-Nitrophenethylamine hydrochloride (Compound **3**, 89 mg, 88% isolated yield, off-white solid) was prepared according to GPIII starting from 2-nitrophenethyl azide (96 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.86 (dd, *J* = 8.5, 1.3 Hz, 1H), 7.55 – 7.46 (m, 1H), 7.41 – 7.33 (m, 2H), 3.11 – 3.01 (m, 4H); ^{13}C NMR (101 MHz, MeOD) δ 133.6, 132.3, 131.3, 128.5, 124.9, 39.8, 30.6; MS (ESI) *m*/*z* 167.3 $[M+H]^+$.

3-Chlorophenethylamine hydrochloride (Compound **4**, 98 mg, 99% isolated yield, off-white solid) was prepared according to GPIII starting from 3-chlorophenethyl azide (91 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.39 – 7.30 (m, 3H), 7.27 – 7.23 (m, 1H), 3.21 (t, *J* = 7.5 Hz, 2H), 2.98 (t, *J* = 7.5 Hz, 2H); ^{13}C NMR (101 MHz, MeOD) δ 140.2, 135.7, 131.5, 129.9, 128.4, 128.3, 41.6, 34.1; MS (ESI) *m*/*z* 156.3 $[M+H]^+$.

3-Methoxyphenethylamine hydrochloride (compound **5**, 89 mg, 95% isolated yield) was prepared according to GPIII starting from 3-methoxyphenethyl azide (89 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.27 (t, *J* = 8.1 Hz, 1H), 6.90 – 6.83 (m, 3H), 3.81 (s, 3H), 3.20 (t, *J* = 7.8 Hz, 2H), 2.97 (t, *J*

= 7.8 Hz, 2H); ^{13}C NMR (101 MHz, MeOD) δ 161.6, 131.0, 121.9, 115.5, 113.7, 55.7, 41.9, 34.5; MS (ESI) *m/z* 152.2 $[M+H]^+$.

Benzylamine hydrochloride (Compound **6**, 68 mg, 94% isolated yield) was prepared according to GPIII starting from benzyl azide (67 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.56 – 7.39 (m, 5H), 4.16 (s, 2H); ^{13}C NMR (101 MHz, MeOD) δ 134.4, 130.1, 130.1, 130.1, 44.3; MS (ESI) *m/z* 108.1 $[M+H]^+$.

1-Naphthylmethylamine hydrochloride (Compound **7**, 76 mg, 78% isolated yield) was prepared according to GPIII starting from 1-(azidomethyl)naphthalene (92 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.97 (dq, *J* = 8.4, 0.9 Hz, 1H), 7.83 (d, *J* = 8.6 Hz, 2H), 7.55 – 7.37 (m, 4H), 4.49 (s, 2H); ^{13}C NMR (101 MHz, MeOD) δ 135.4, 132.3, 131.1, 130.2, 130.1, 128.8, 128.3, 127.5, 126.5, 123.6, 41.3; MS (ESI) *m/z* 158.1 $[M+H]^+$.

4-Bromo-2-fluorobenzylamine hydrochloride (Compound **8**, 115 mg, 96% isolated yield) was prepared according to GPIII starting from 4-bromo-2-fluorobenzylazide (115 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.59 – 7.44 (m, 3H), 4.21 (d, *J* = 1.2 Hz, 2H); ^{13}C NMR (101 MHz, MeOD) δ 160.9 (d, *J* = 252.0 Hz), 132.5 (d, *J* = 3.8 Hz), 128.1 (d, *J* = 4.0 Hz), 123.6 (d, *J* = 9.8 Hz), 119.6 (d, *J* = 14.6 Hz), 119.1 (d, *J* = 24.7 Hz), 36.1 (d, *J* = 4.3 Hz); MS (ESI) *m/z* 204.3 $[M+H]^+$.

3,4-(Methylenedioxy)benzylamine (piperonylamine) (Compound **9**, 80 mg, 85% isolated yield, off-white solid) was prepared according to GPIII starting from 3,4-(methylenedioxy)benzyl azide (89 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.00 – 6.95 (m, 2H), 6.89 (d, *J* = 8.3 Hz, 1H), 6.01 (s, 2H), 4.05 (s, 2H); ^{13}C NMR (101 MHz, MeOD) δ 148.4, 148.3, 126.5, 122.7, 108.8, 108.2, 101.5, 42.9; MS (ESI) *m/z* 152.1 $[M+H]^+$.

(2-Aminoethyl) phenyl sulfide hydrochloride (Compound **10**, 77 mg, 88% isolated yield) was prepared according to GPIII starting from (2-azidoethyl) phenyl sulfide (83 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.51 – 7.46 (m, 2H), 7.40 – 7.35 (m, 2H), 7.33 – 7.27 (m, 1H), 3.25 (t, *J* = 6.9

Hz, 2H), 3.12 (t, *J* = 6.9 Hz, 2H); ^{13}C NMR (101 MHz, MeOD) δ 134.9, 131.6, 130.4, 128.3, 39.7, 32.0; MS (ESI) *m/z* 154.2 $[M+H]^+$.

4-Benzyloxybenzylamine hydrochloride (Compound **11**, 111 mg, 89% isolated yield) was prepared according to GPIII starting from 4-benzyloxybenzyl azide (120 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.24 – 7.03 (m, 7H), 6.88 – 6.80 (m, 2H), 4.89 (s, 2H), 3.82 (s, 2H); ^{13}C NMR (101 MHz, MeOD) δ 159.4, 137.0, 130.2, 128.1, 127.5, 127.2, 125.2, 115.2, 69.6, 42.5; MS (ESI) *m/z* 214.0 $[M+H]^+$.

3-Cyanobenzylamine hydrochloride (Compound **12**, 56 mg, 66% isolated yield) was prepared according to GPIII starting from 3-cyanobenzyl azide (79 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.87 – 7.83 (m, 1H), 7.83 – 7.76 (m, 2H), 7.65 (td, *J* = 7.8, 0.6 Hz, 1H), 4.20 (s, 2H); ^{13}C NMR (101 MHz, MeOD) δ 136.1, 134.8, 133.9, 133.7, 131.4, 119.1, 114.3, 43.5; MS (ESI) *m/z* 133.3 $[M+H]^+$.

Cinnamyl amine hydrochloride (Compound **13**, 78 mg, 93% isolated yield, white solid) was prepared according to GPIII starting from cinnamyl azide (80 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.51 – 7.45 (m, 2H), 7.39 – 7.25 (m, 3H), 6.84 (d, *J* = 15.9 Hz, 1H), 6.35 (dt, *J* = 15.9, 6.9 Hz, 1H), 3.75 (d, *J* = 6.9 Hz, 2H); ^{13}C NMR (101 MHz, MeOD) δ 137.8, 137.1, 129.7, 129.6, 127.8, 121.2, 42.5; MS (ESI) *m/z* 134.1 $[M+H]^+$.

4-Methylsulfonylbenzylamine hydrochloride (Compound **14**, 106 mg, 96% isolated yield, white solid) was prepared according to GPIII starting from 4-methylsulfonylbenzyl azide (105 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 8.06 (d, *J* = 8.3 Hz, 2H), 7.75 (d, *J* = 8.3 Hz, 2H), 4.28 (s, 2H), 3.16 (s, 3H); ^{13}C NMR (101 MHz, MeOD) δ 142.9, 140.4, 131.0, 129.2, 44.2, 43.6; MS (ESI) *m/z* 186.2 $[M+H]^+$.

Methyl 4-(aminomethyl)benzoate hydrochloride (Compound **15**, 81 mg, 81% isolated yield, white solid) was prepared according to GPIII starting from methyl (4-azidomethyl)benzoate (96 mg, 0.5

mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.87 (d, *J* = 8.4 Hz, 2H), 7.37 (d, *J* = 8.4 Hz, 2H), 3.99 (s, 2H), 3.70 (s, 3H); ^{13}C NMR (101 MHz, MeOD) δ 167.8, 139.5, 132.1, 131.2, 130.1, 52.8, 43.9; MS (ESI) *m/z* 166.2 $[M+H]^+$.

Methyl 6-(aminomethyl)nicotinate hydrochloride (Compound **16**, 112 mg, 94% isolated yield, yellow solid) was prepared according to GPIII starting from methyl (6-azidomethyl)nicotinate (96 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 9.19 (dd, *J* = 2.2, 0.9 Hz, 1H), 8.42 (dd, *J* = 8.2, 2.2 Hz, 1H), 7.60 (dd, *J* = 8.2, 0.9 Hz, 1H), 4.39 (s, 2H), 3.96 (s, 3H); ^{13}C NMR (101 MHz, MeOD) δ 166.5, 157.8, 151.1, 139.5, 127.4, 123.4, 53.1, 43.9; MS (ESI) *m/z* 167.3 $[M+H]^+$.

4-Benzoylbenzylamine hydrochloride (Compound **17**, 121 mg, 98% isolated yield, white solid) was prepared according to GPIII starting from 4-benzoylbenzyl azide (82 mg, 0.5 mmol). ^{1}H NMR (500 MHz, MeOD) δ 7.86 (d, *J* = 8.2 Hz, 2H), 7.81 – 7.77 (m, 2H), 7.71 – 7.64 (m, 3H), 7.59 – 7.53 (m, 2H), 4.27 (s, 2H); ^{13}C NMR (126 MHz, MeOD) δ 196.3, 138.0, 137.5, 137.1, 132.7, 130.2, 129.6, 128.6, 128.2, 42.5; MS (ESI) *m/z* 211.9 $[M+H]^+$.

4-Acetamidobenzylamine hydrochloride (Compound **18**, 79 mg, 85% isolated yield, yellow solid) was prepared according to GPIII starting from 4-acetamidobenzyl azide (96 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.61 (d, *J* = 8.6 Hz, 2H), 7.38 (d, *J* = 8.6 Hz, 2H), 4.04 (s, 2H), 2.11 (s, 3H); ^{13}C NMR (126 MHz, MeOD) δ 170.5, 139.4, 129.3, 128.3, 120.0, 42.5, 22.5; MS (ESI) *m/z* 164.8 $[M+H]^+$.

(4-Hydroxymethyl)benzylamine hydrochloride (Compound **19**, 78 mg, 89% isolated yield, white solid) was prepared according to GPIII starting from (4-hydroxymethyl)benzyl azide (82 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.37 – 7.28 (m, 4H), 4.50 (s, 2H), 3.99 (s, 2H); ^{13}C NMR (101 MHz, MeOD) δ 142.7, 131.8, 128.7, 127.2, 127.2, 63.2, 42.7; MS (ESI) *m/z* 137.9 $[M+H]^+$.

5-(Aminomethyl)thiazole hydrochloride (Compound **20**, 78 mg, 84% isolated yield, white solid) was obtained according to GPIII starting from 5-(azidomethyl)thiazole (70 mg, 0.5 mmol). ^{1}H NMR

(400 MHz, D_2O) δ 9.60 (d, *J* = 1.1 Hz, 1H), 8.22 (d, *J* = 1.1 Hz, 1H), 4.53 (s, 2H); ^{13}C NMR (101 MHz, D_2O) δ 158.9, 138.9, 132.0, 34.5; MS (ESI) *m/z* 115.2 $[M+H]^+$.

2-Fluoro-3-(aminomethyl)pyridine hydrochloride (Compound **21**, 76 mg, 93% isolated yield, off-white solid) was prepared according to GPIII starting from 2-fluoro-3-(azidomethyl)pyridine (76 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 8.28 (ddd, *J* = 5.0, 1.9, 1.1 Hz, 1H), 8.09 (ddd, *J* = 9.9, 7.5, 2.0 Hz, 1H), 7.41 (ddd, *J* = 7.4, 5.0, 1.9 Hz, 1H), 4.23 (s, 2H); ^{13}C NMR (101 MHz, MeOD) δ 163.0 (d, *J* = 239.2 Hz), 149.7 (d, *J* = 14.6 Hz), 143.9 (d, *J* = 4.4 Hz), 123.6 (d, *J* = 4.4 Hz), 116.9 (d, *J* = 29.9 Hz), 37.8 (d, *J* = 0.7 Hz); MS (ESI) *m/z* 127.2 $[M+H]^+$.

3-(2-Aminoethyl)indole hydrochloride (Compound **22**, 45 mg, 61% isolated yield, off-white solid) was prepared according to GPIII starting from 3-(2-azidoethyl) indole (86 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.59 (dt, *J* = 8.1, 1.1 Hz, 1H), 7.40 (dt, *J* = 8.1, 0.9 Hz, 1H), 7.20 (bs, 1H), 7.17 – 7.12 (m, 1H), 7.09 – 7.04 (m, 1H), 3.26 (t, *J* = 7.3 Hz, 2H), 3.15 (t, *J* = 7.3 Hz, 2H); ^{13}C NMR (101 MHz, MeOD) δ 138.4, 128.2, 124.3, 122.8, 120.0, 118.9, 112.6, 110.2, 41.3, 24.5; MS (ESI) *m/z* 161.1 $[M+H]^+$.

1-Aminooctane hydrochloride (Compound **23**, 35 mg, 43% isolated yield, white solid) was prepared according to GPIII starting from octyl azide (78 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 2.97 – 2.90 (m, 2H), 1.78 – 1.60 (m, 2H), 1.53 – 1.24 (m, 10H), 1.01 – 0.85 (m, 3H); ^{13}C NMR (101 MHz, MeOD) δ 39.4, 31.5, 28.8, 28.8, 27.2, 26.1, 22.3, 13.0.

2-Fluoroethylamine hydrochloride (Compound **24**, 37 mg, 75% isolated yield, white solid) was prepared according to GPIII starting from 1-azido-2-fluoroethane (48 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 4.82 – 4.75 (m, 1H), 4.71 – 4.63 (m, 1H), 3.35 (t, *J* = 4.8 Hz, 1H), 3.29 (t, *J* = 4.8 Hz, 1H); ^{13}C NMR (101 MHz, MeOD) δ 81.2 (d, *J* = 167.2 Hz), 41.2 (d, *J* = 20.0 Hz); MS (ESI) *m/z* 64.1 $[M+H]^+$.

1-Phenyl-2-aminopropane hydrochloride (Compound **25**, 9 mg, 10% isolated yield, off-white solid) was prepared according to GPIII starting from 1-phenyl-2-azidopropane (81 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.20 – 7.14 (m, 2H), 7.12 – 7.05 (m, 3H), 3.41 – 3.27 (m, 1H), 2.82 (dd, *J* = 13.5, 6.1 Hz, 1H), 2.62 (dd, *J* = 13.5, 8.4 Hz, 1H), 1.07 (d, *J* = 6.6 Hz, 3H); ^{13}C NMR (101 MHz, MeOD) δ 137.3, 130.3, 130.0, 128.4, 50.3, 41.8, 18.3; MS (ESI) *m/z* 136.3 $[M+H]^+$.

1-Phenyl-1-aminopropane hydrochloride (Compound **26**, 21 mg, 25% isolated yield, white solid) was prepared according to GPIII starting from 1-phenyl-1-azidopropane (79 mg, 0.5 mmol) and 10 mol% triphenylphosphine. ^{1}H NMR (400 MHz, MeOD) δ 7.44 – 7.31 (m, 5H), 4.09 (dd, *J* = 9.4, 5.8 Hz, 1H), 2.08 – 1.82 (m, 2H), 0.81 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (101 MHz, MeOD) δ 136.7, 128.9, 128.9, 127.0, 56.9, 27.3, 9.1; MS (ESI) *m/z* 135.9 $[M+H]^+$.

Ethyl (*S*)-2-amino-4-phenylbutanoate hydrochloride (Compound **27**, 81 mg, 68% isolated yield, white solid) was prepared according to GPIII starting from ethyl (*S*)-2-azido-4-phenylbutanoate (115 mg, 0.5 mmol) and 10 mol% triphenylphosphine. ^{1}H NMR (400 MHz, MeOD) δ 7.36 – 7.30 (m, 2H), 7.29 – 7.20 (m, 3H), 4.32 (q, *J* = 7.1 Hz, 2H), 4.05 (t, *J* = 6.4 Hz, 1H), 2.90 – 2.70 (m, 2H), 2.31 – 2.11 (m, 2H), 1.35 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (101 MHz, MeOD) δ 169.0, 139.7, 128.3, 128.0, 126.2, 62.3, 52.2, 32.1, 30.6, 13.0; MS (ESI) *m/z* 208.1 $[M+H]^+$.

1-Aminoindane hydrochloride (Compound **28**, 15 mg, 18% isolated yield, off-white solid) was prepared according to GPIII starting from 1-azidoindane (80 mg, 0.5 mmol). ^{1}H NMR (400 MHz, MeOD) δ 7.56 – 7.50 (m, 1H), 7.40 – 7.30 (m, 3H), 4.81 (dd, *J* = 7.9, 5.0 Hz, 1H), 3.27 – 3.15 (m, 1H), 3.08 – 2.93 (m, 1H), 2.70 – 2.57 (m, 1H), 2.18 – 2.05 (m, 1H); ^{13}C NMR (101 MHz, MeOD) δ 145.4, 139.7, 130.7, 128.3, 126.4, 125.5, 56.9, 31.6, 31.0; MS (ESI) *m/z* 134.1 $[M+H]^+$.

4-Methoxyaniline hydrochloride (Compound **30**, 27 mg, 34% isolated yield, brown solid) was prepared according to GPIII starting from azido-4-methoxybenzene (0.5 M solution in MTBE). ^{1}H NMR (500 MHz, MeOD) δ 7.35 (d, *J* = 9.0 Hz, 2H), 7.08 (d, *J* = 9.0 Hz, 2H), 3.85 (s, 3H); ^{13}C NMR (126 MHz, MeOD) δ 160.1, 123.8, 122.9, 114.9, 54.7; MS (ESI) *m/z* 108.3 $[M+H]^+$.

4. Supporting figures.

4.1. Time course for the catalytic Staudinger reduction.

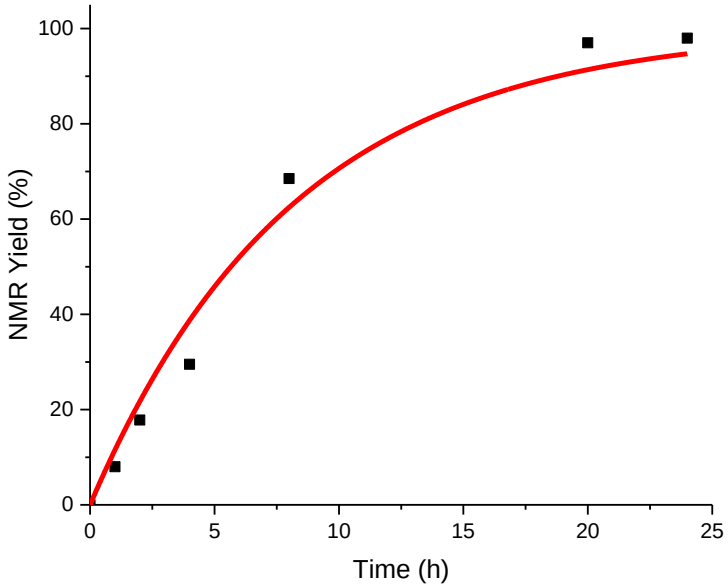
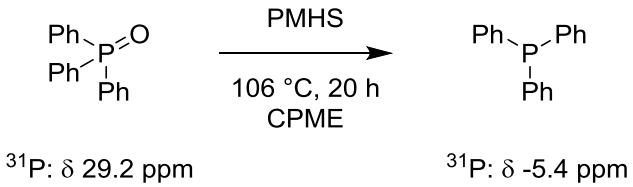


Figure S1:Time course experiment for the catalytic Staudinger reduction. Conditions: 4-nitrophenethyl azide (1.0 mmol), triphenylphosphine (3 mol%), PMHS (6 Si-H equiv., 0.16 mmol) in CPME (5.0 mL) containing 1,3,5-trimethoxybenzene as an internal standard. Aliquots (100 µL) were taken and diluted with $CDCl_3$ (500 µL) at the indicated times and measured by ^1H NMR.

4.2. PMHS-mediated reduction of triphenylphosphine oxide



In order to investigate whether PMHS is able to reduce triphenylphosphine oxide to triphenylphosphine the following reaction was performed and followed by ^{31}P NMR: triphenylphosphine oxide (27.8 mg, 0.1 mmol, corresponding to 10 mol%) was dissolved in 5 mL CPME and to this was added PMHS (392 µL, 0.16 mmol). The reaction mixture was heated at 106 °C for 20 hours, after which it was cooled to room temperature. After removal of the solvent *in vacuo*, the crude mixture was taken into $CDCl_3$ and the ^{31}P NMR was recorded (Figure S2c)

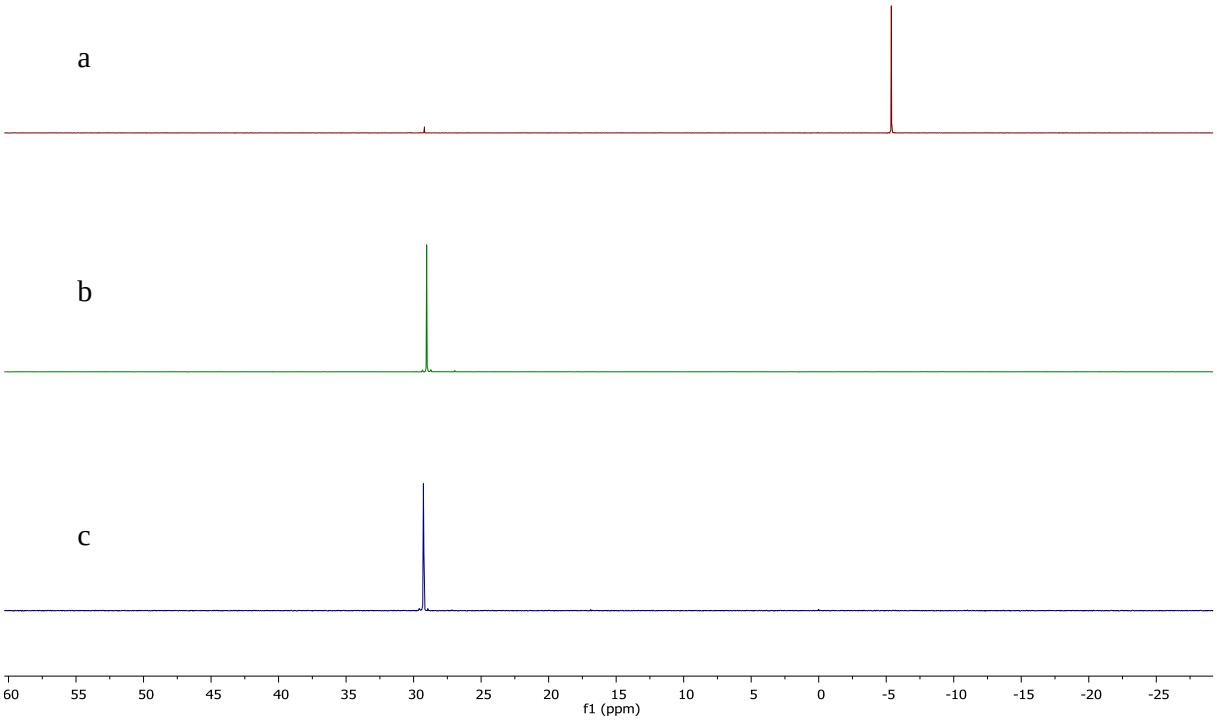
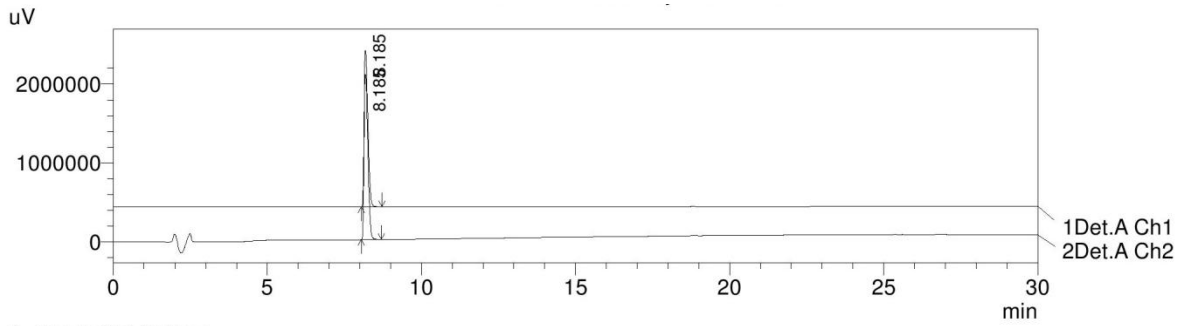


Figure S2: a) Reference ^{31}P NMR spectrum for triphenylphosphine (δ -5.4 ppm) recorded in $CDCl_3$ at 400 MHz; b) Reference ^{31}P NMR spectrum for triphenylphosphine oxide (δ 29.2 ppm); c) ^{31}P NMR of the crude reaction mixture at t = 20h.

4.3. Analytical HPLC data for gram scale production of 4-nitrophenethylamine and phenethylamine.



1 Det.A Ch1/254nm
2 Det.A Ch2/215nm

PeakTable

Detector A Ch1 254nm

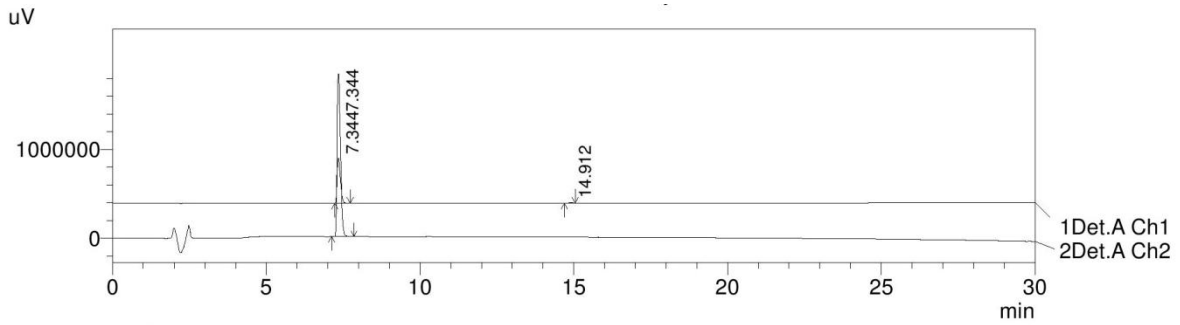
Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.185	17057210	1962108	100.000	100.000
Total		17057210	1962108	100.000	100.000

PeakTable

Detector A Ch2 215nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	8.185	18149756	2078521	100.000	100.000
Total		18149756	2078521	100.000	100.000

Figure S3 Analytical HPLC trace for 4-nitrophenethylamine (t = 8.18; >99.9% purity).



1 Det.A Ch1/254nm
2 Det.A Ch2/215nm

PeakTable

Detector A Ch1 254nm

Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.344	3785106	499430	98.367	98.540
2	14.912	62845	7399	1.633	1.460
Total		3847951	506829	100.000	100.000

PeakTable

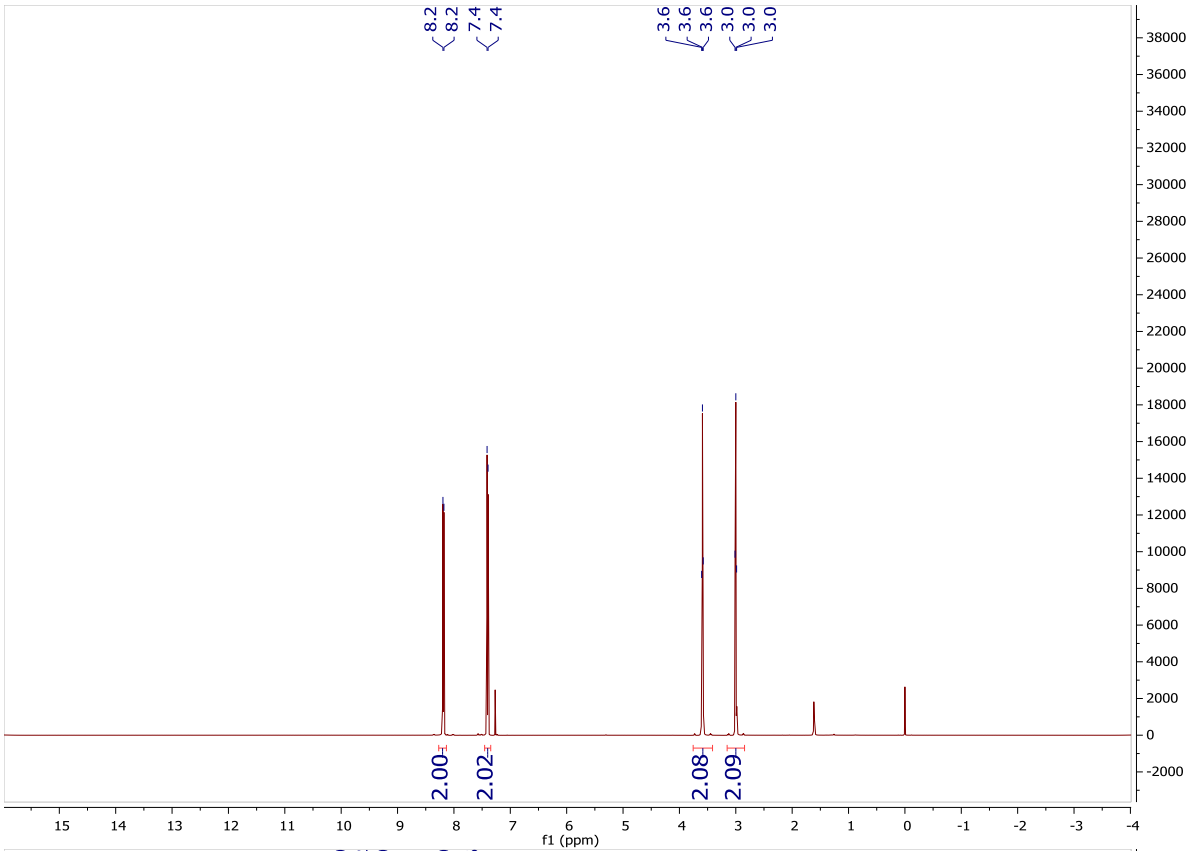
Detector A Ch2 215nm

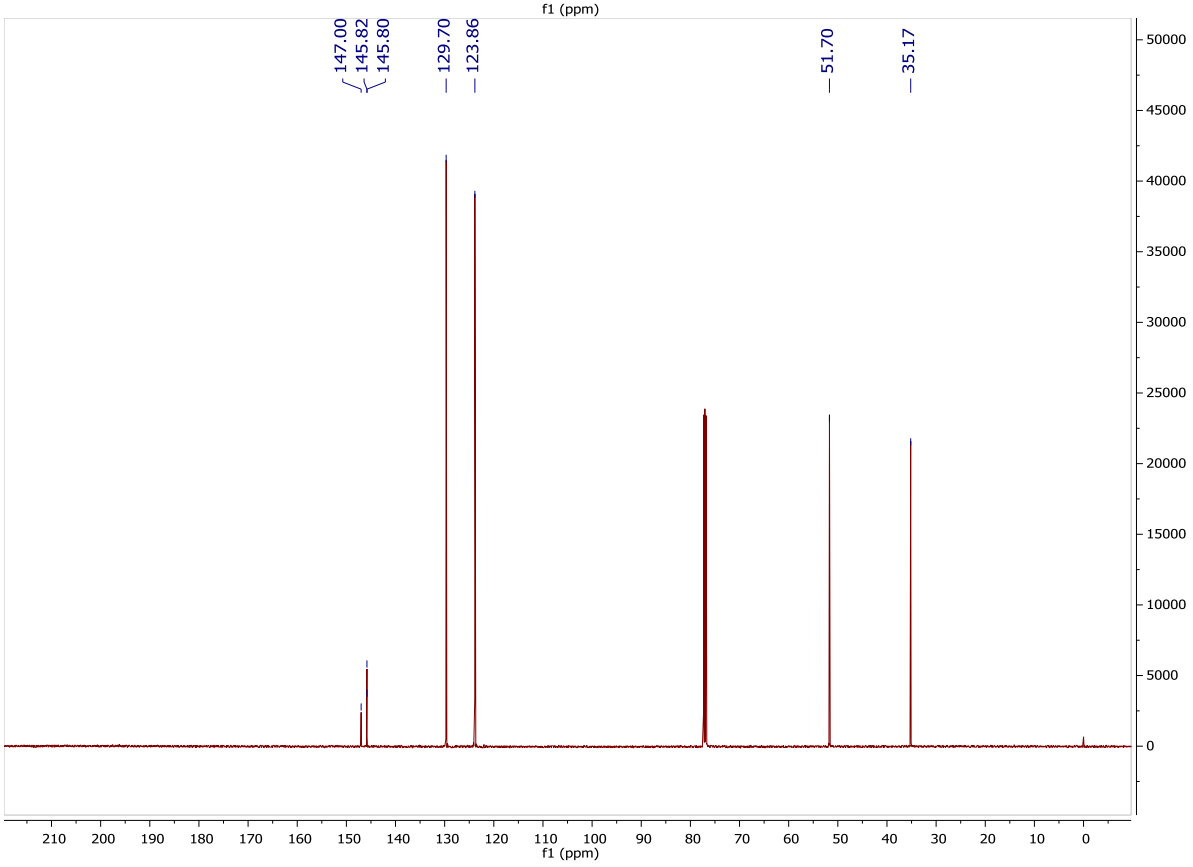
Peak#	Ret. Time	Area	Height	Area %	Height %
1	7.344	14184719	1813023	100.000	100.000
Total		14184719	1813023	100.000	100.000

Figure S4 Analytical HPLC trace for phenethylamine (t = 7.34; 98.4% purity).

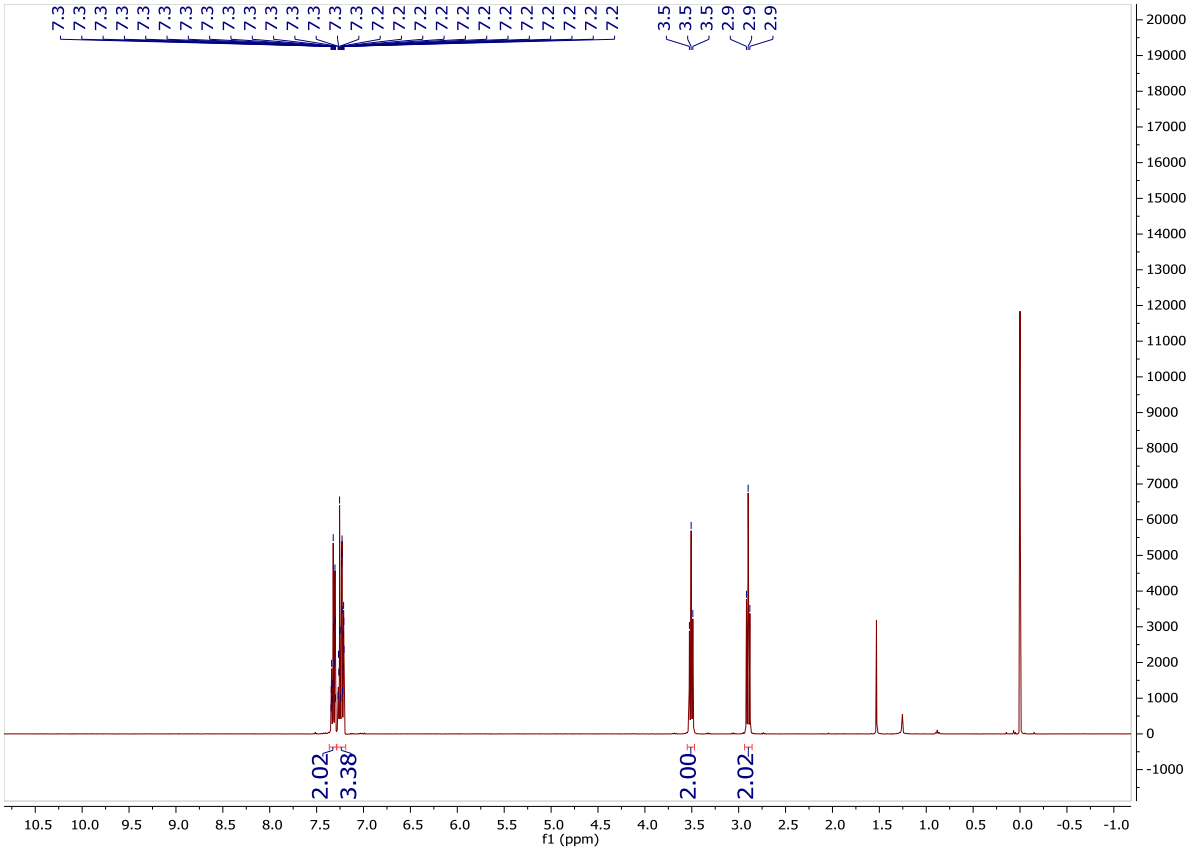
5. ^{1}H and ^{13}C NMR spectra

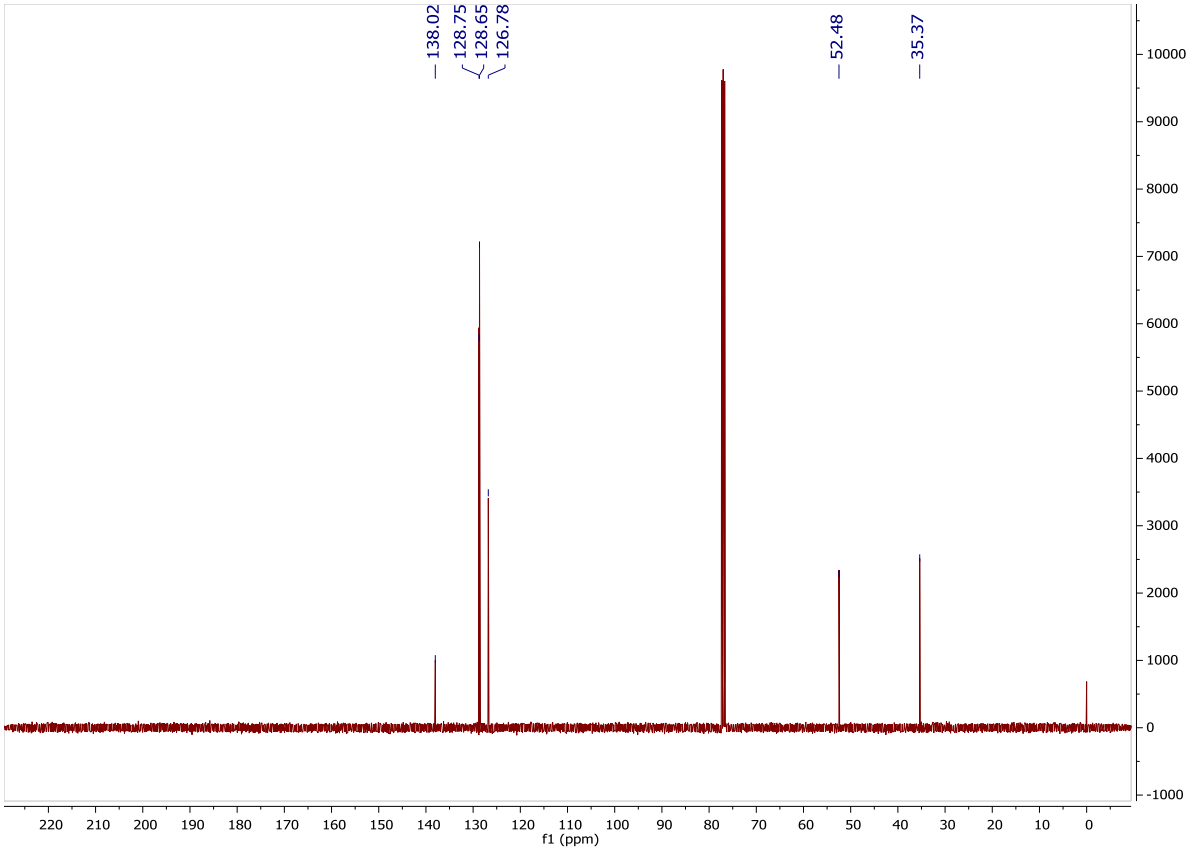
4-Nitrophenethyl azide



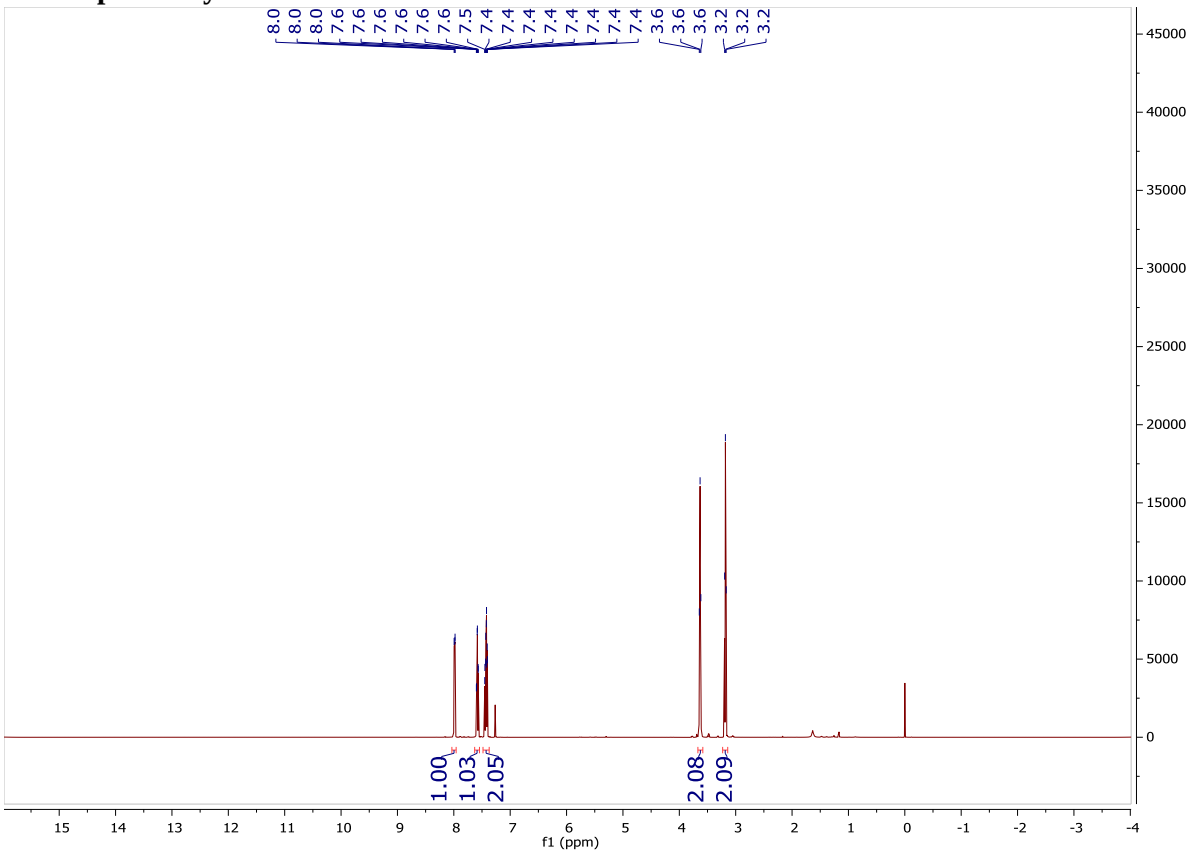


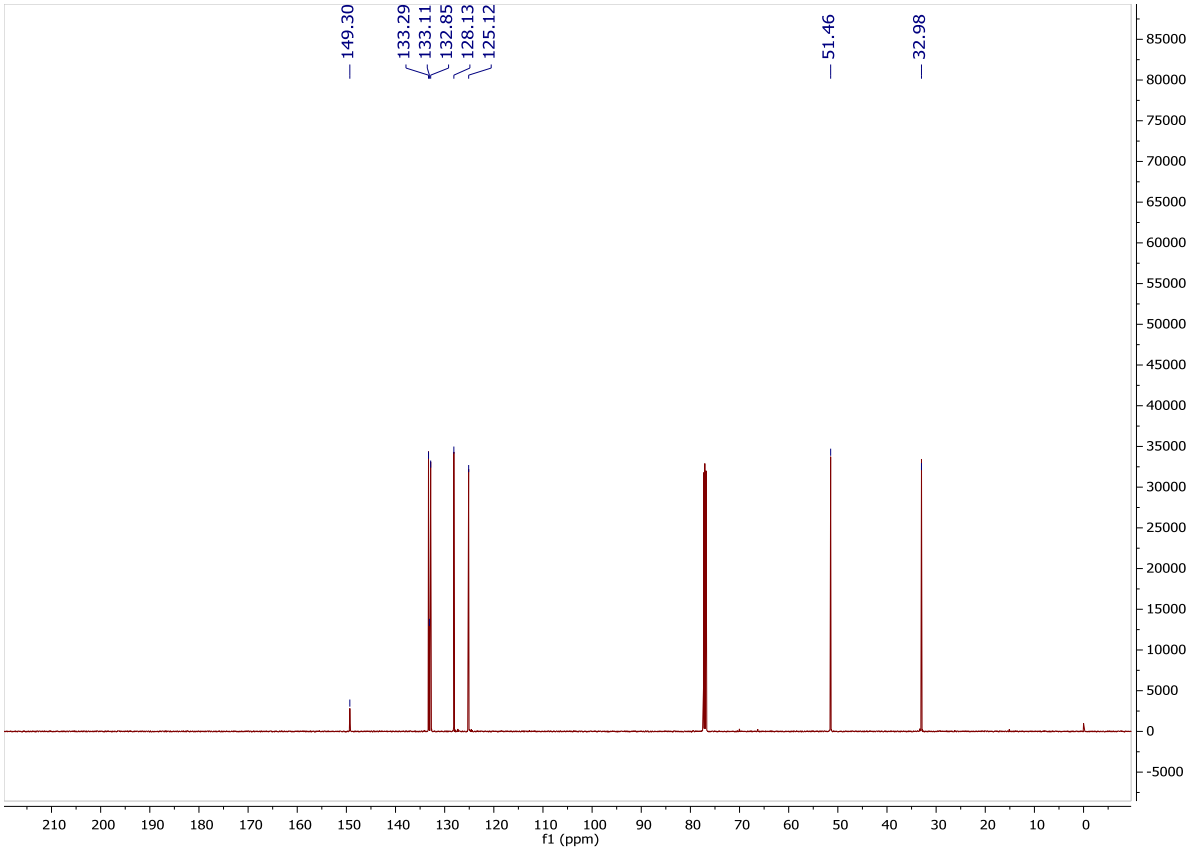
Phenethyl azide


7.3
7.2
3.5
2.9
2.02
3.38
2.00
2.02
f1 (ppm)

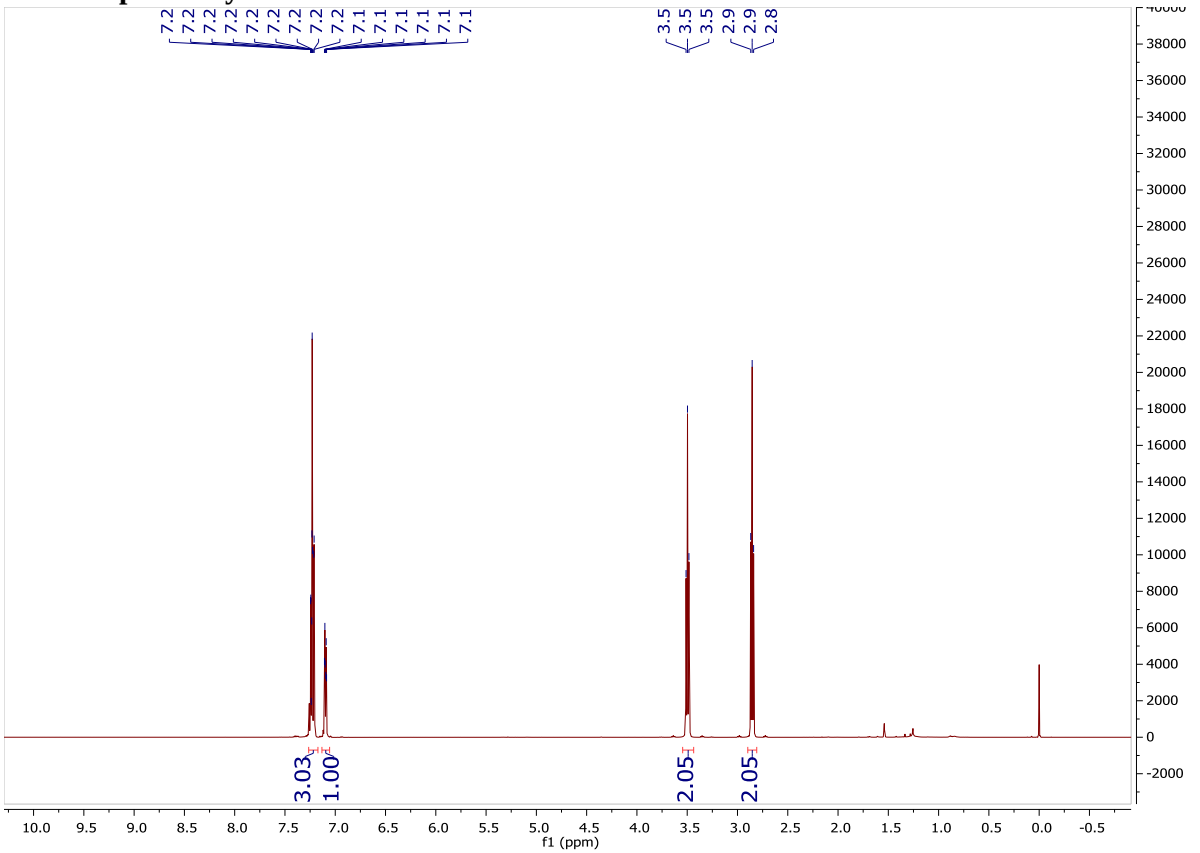

138.02
128.75
128.65
126.78
52.48
35.37
f1 (ppm)

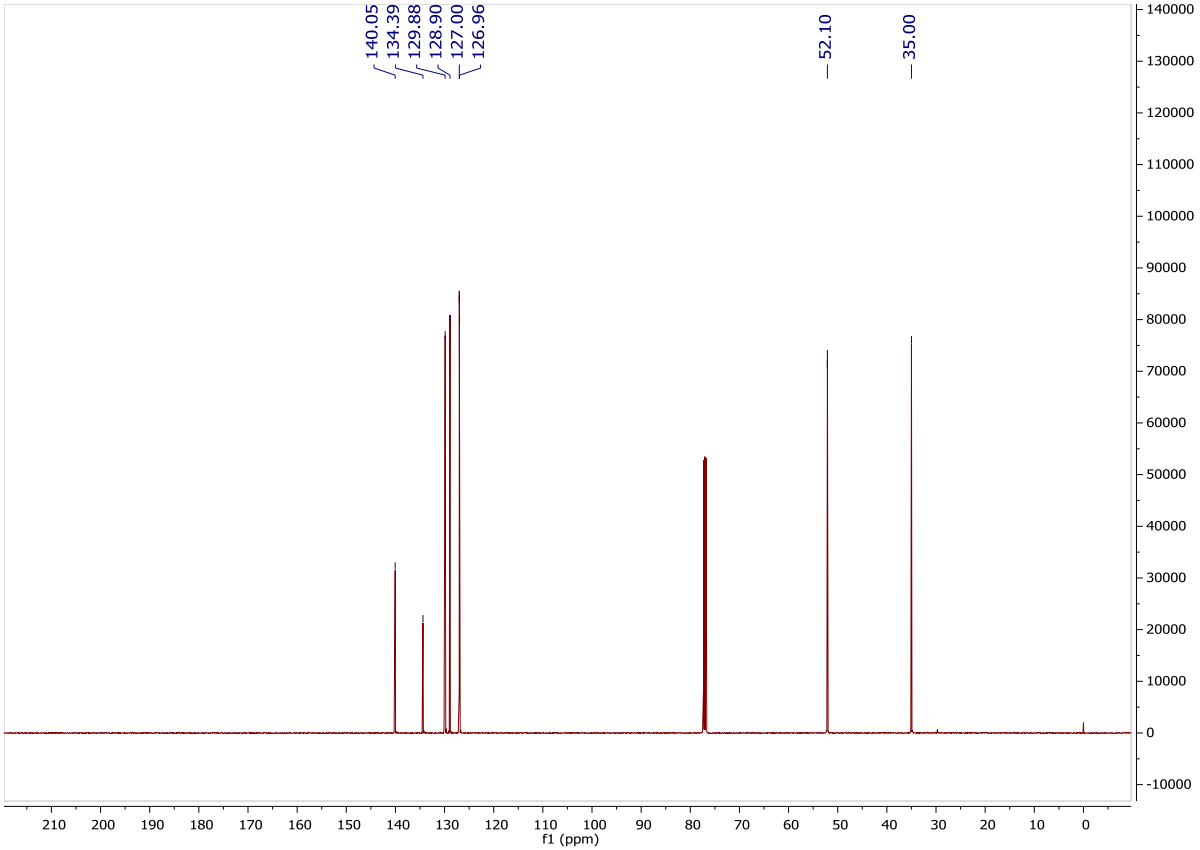
2-Nitrophenethyl azide



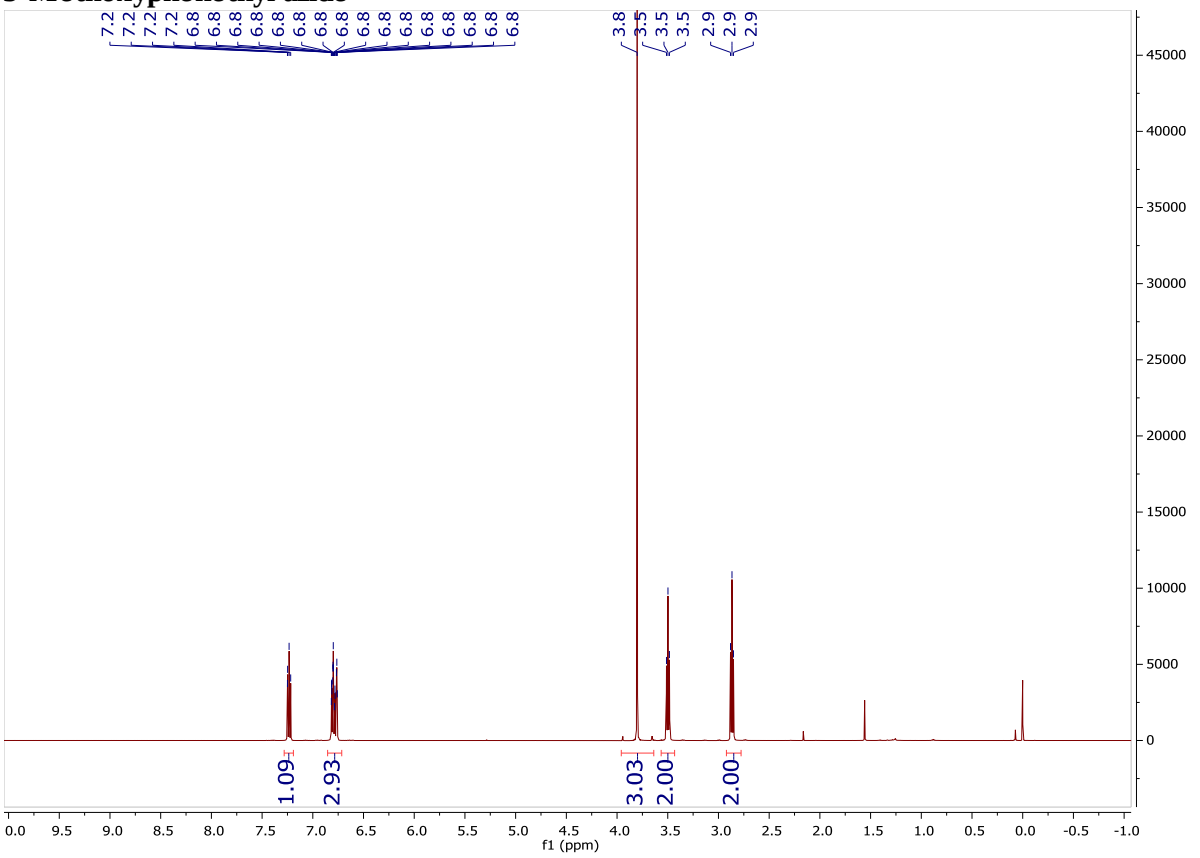


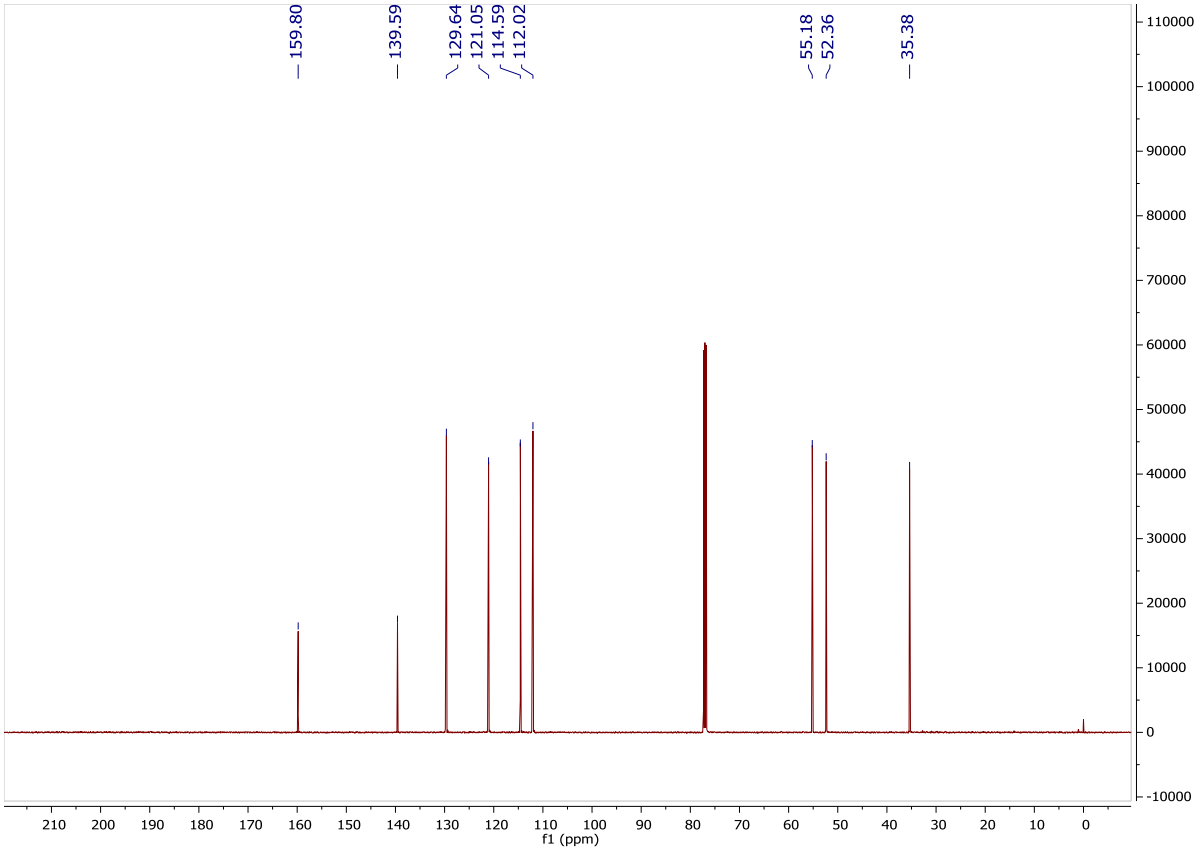
3-Chlorophenethyl azide



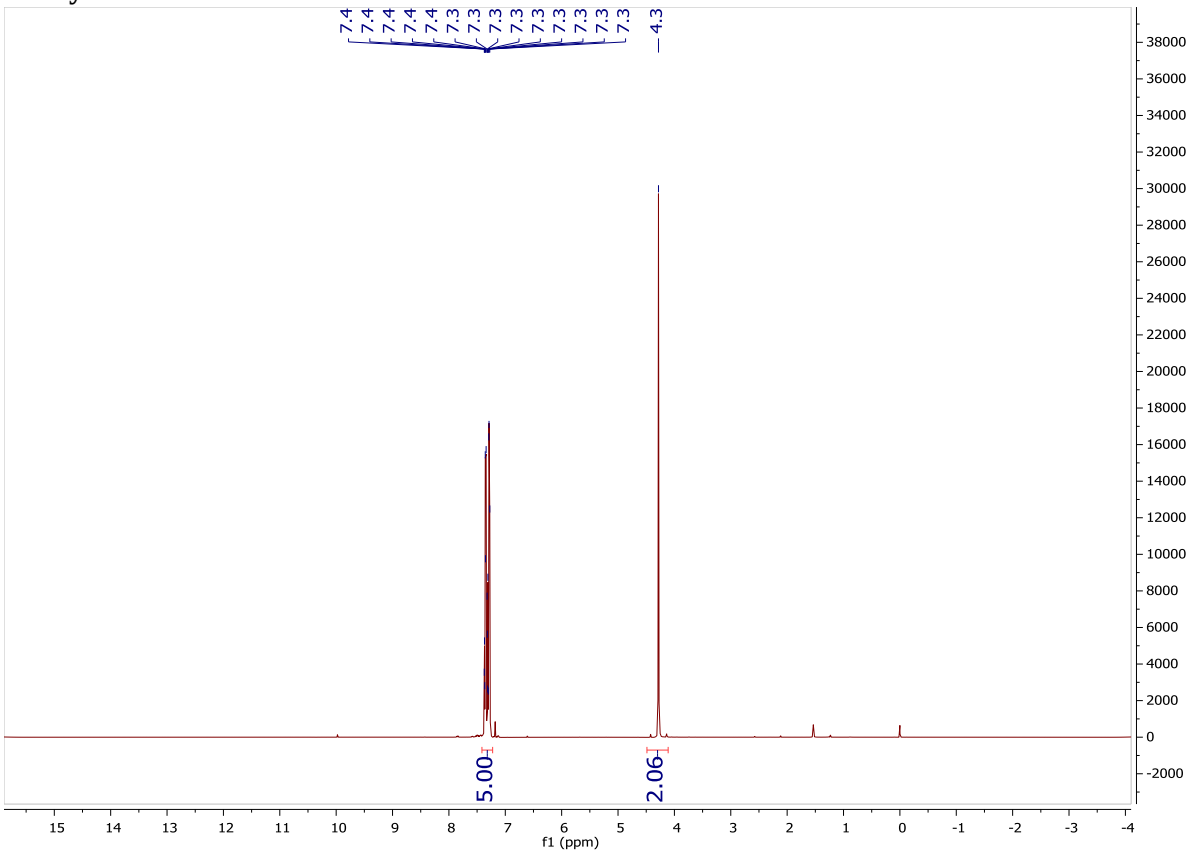


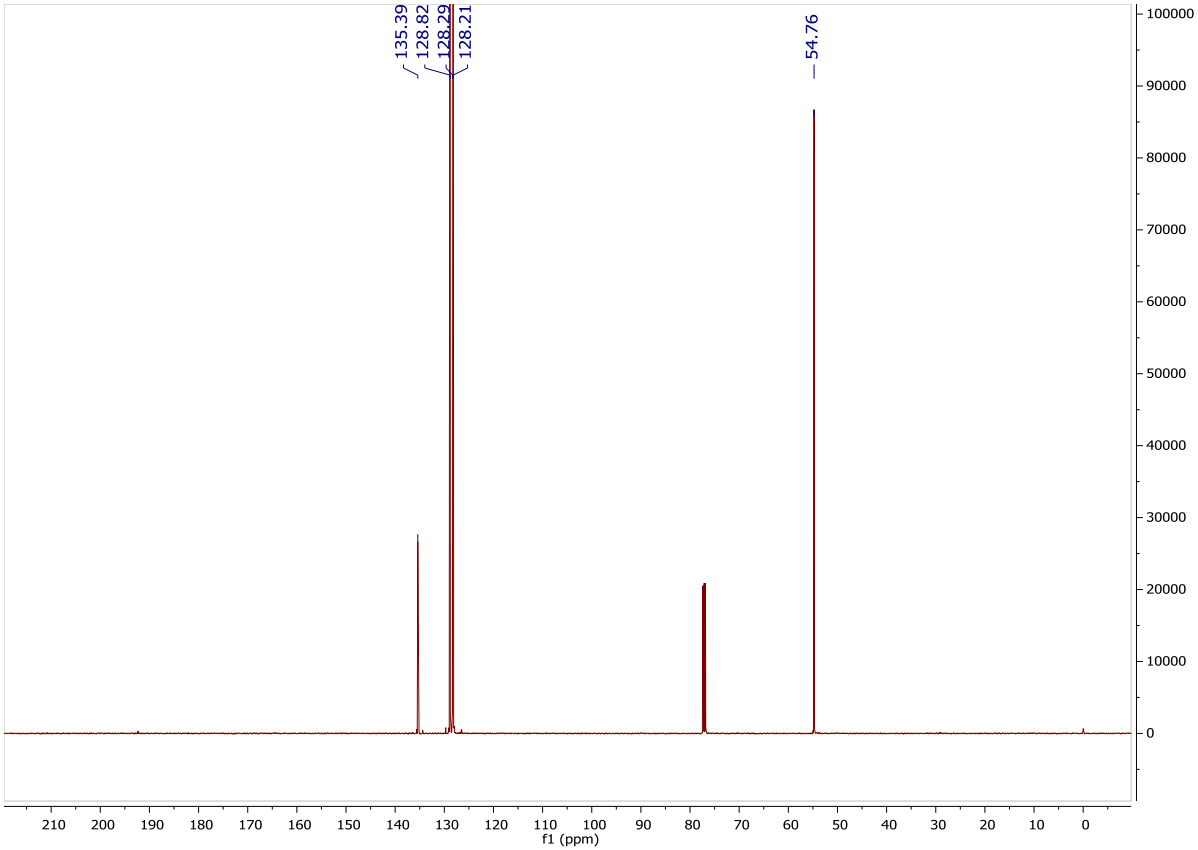
3-Methoxyphenethyl azide



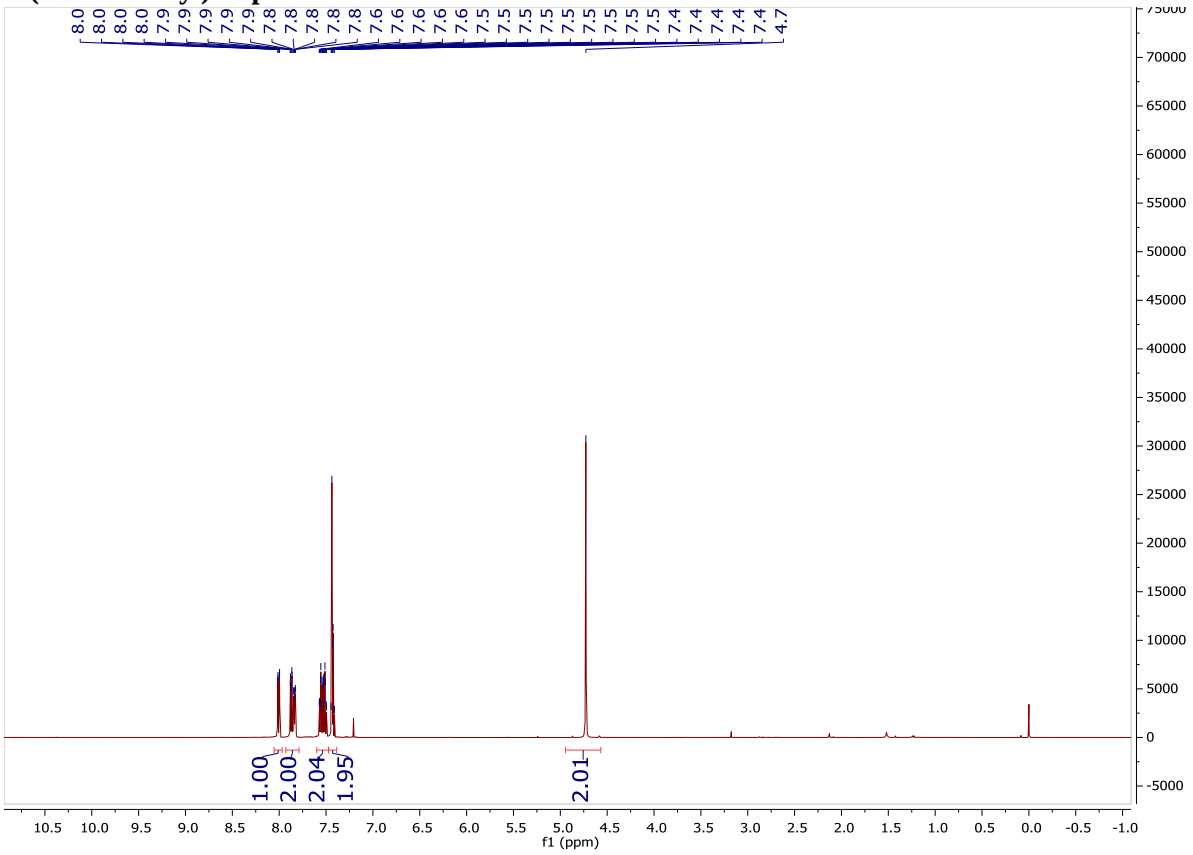


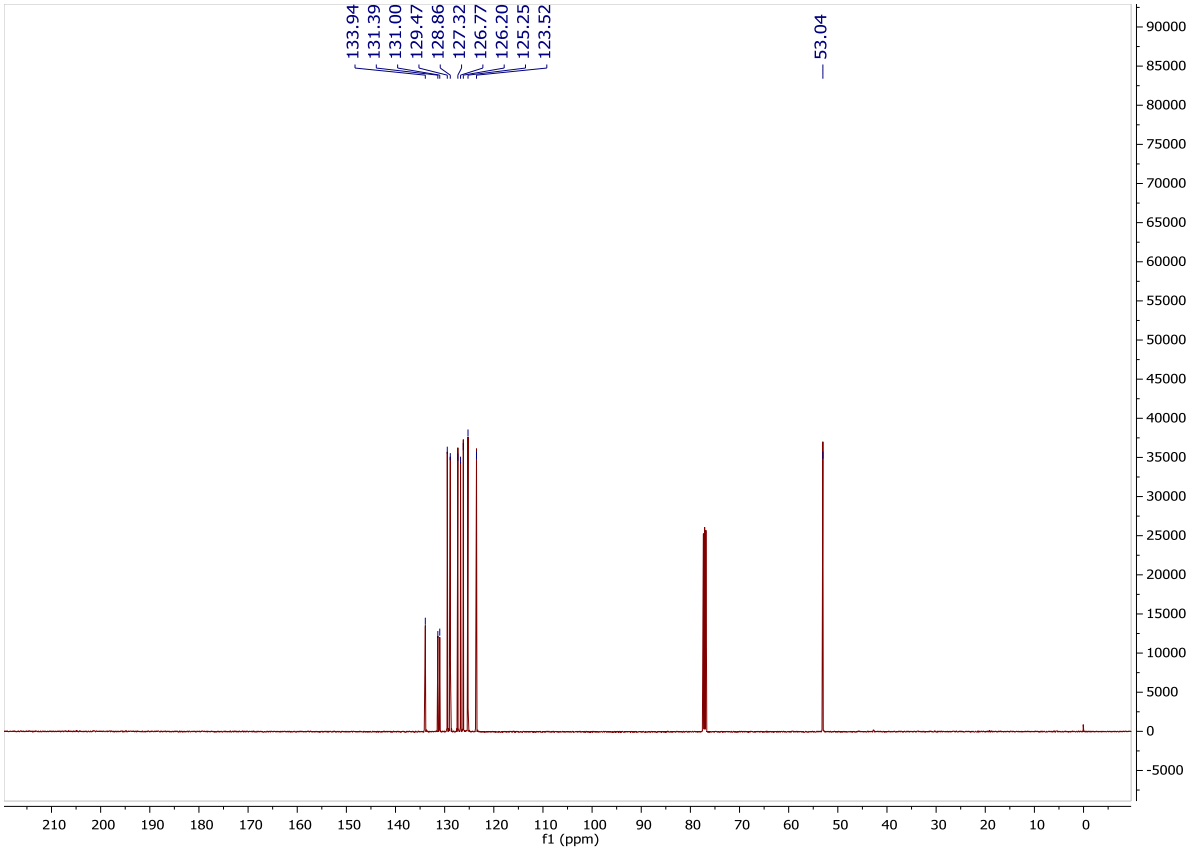
Benzyl azide



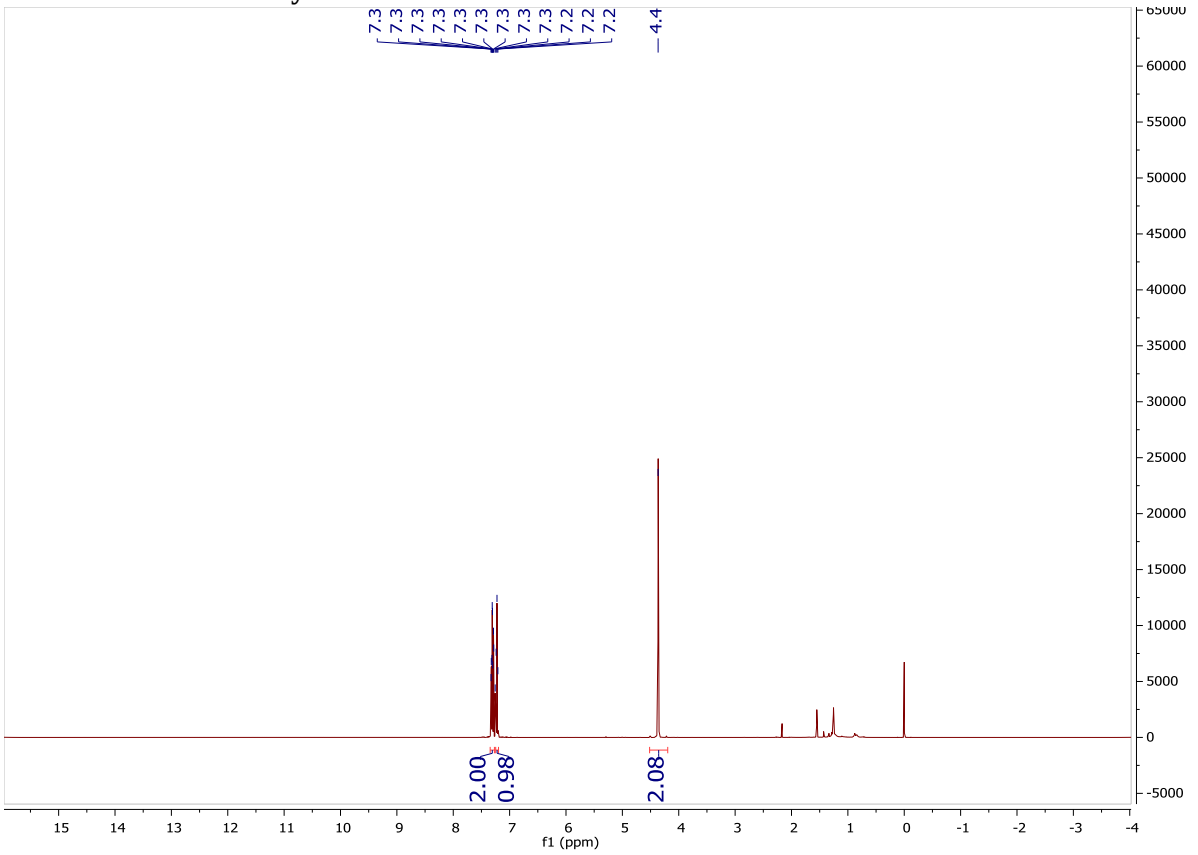


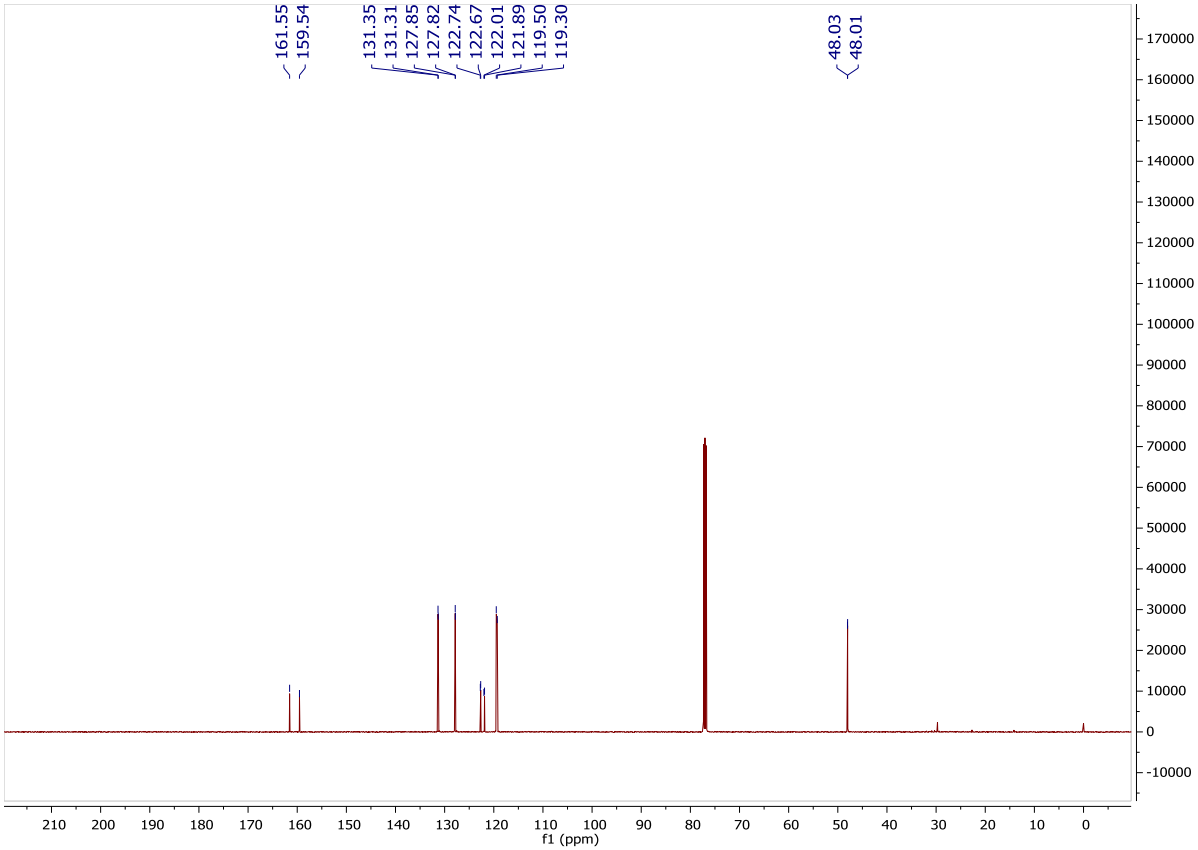
1-(Azidomethyl)-naphthalene



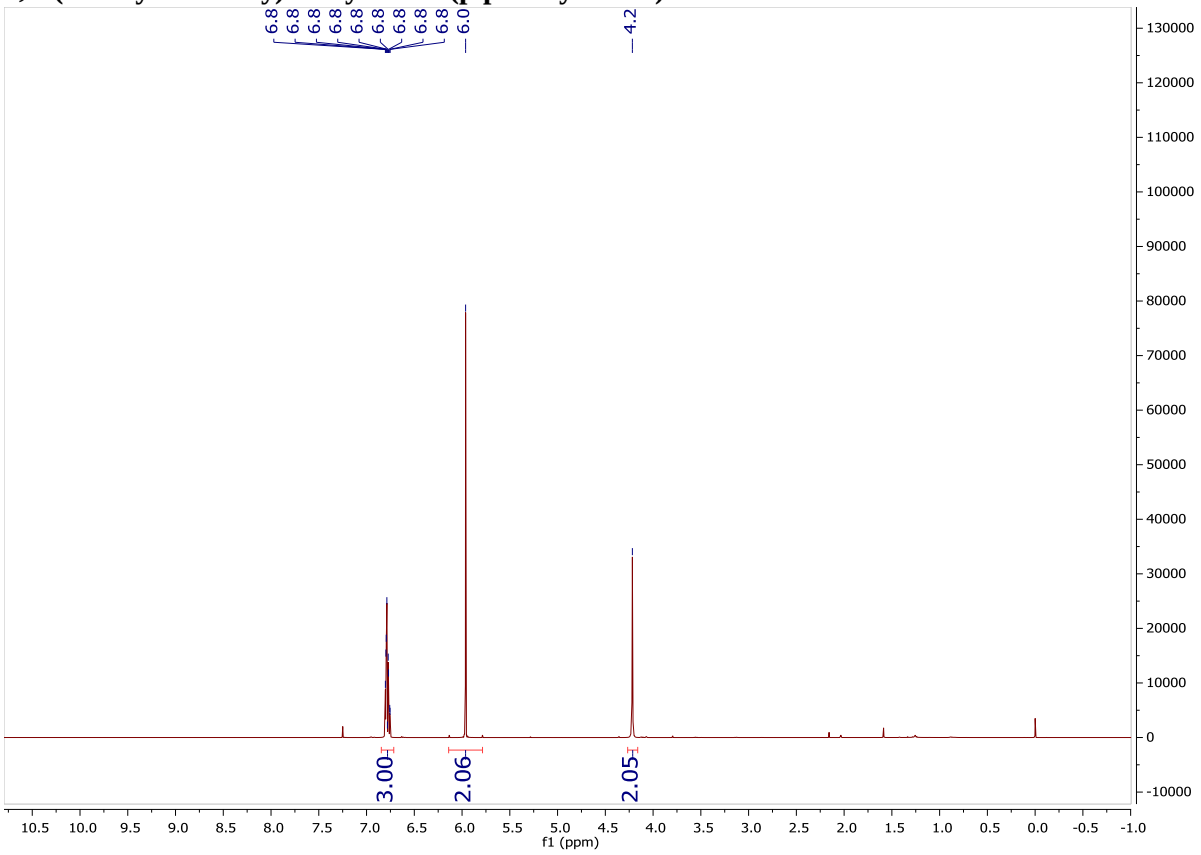


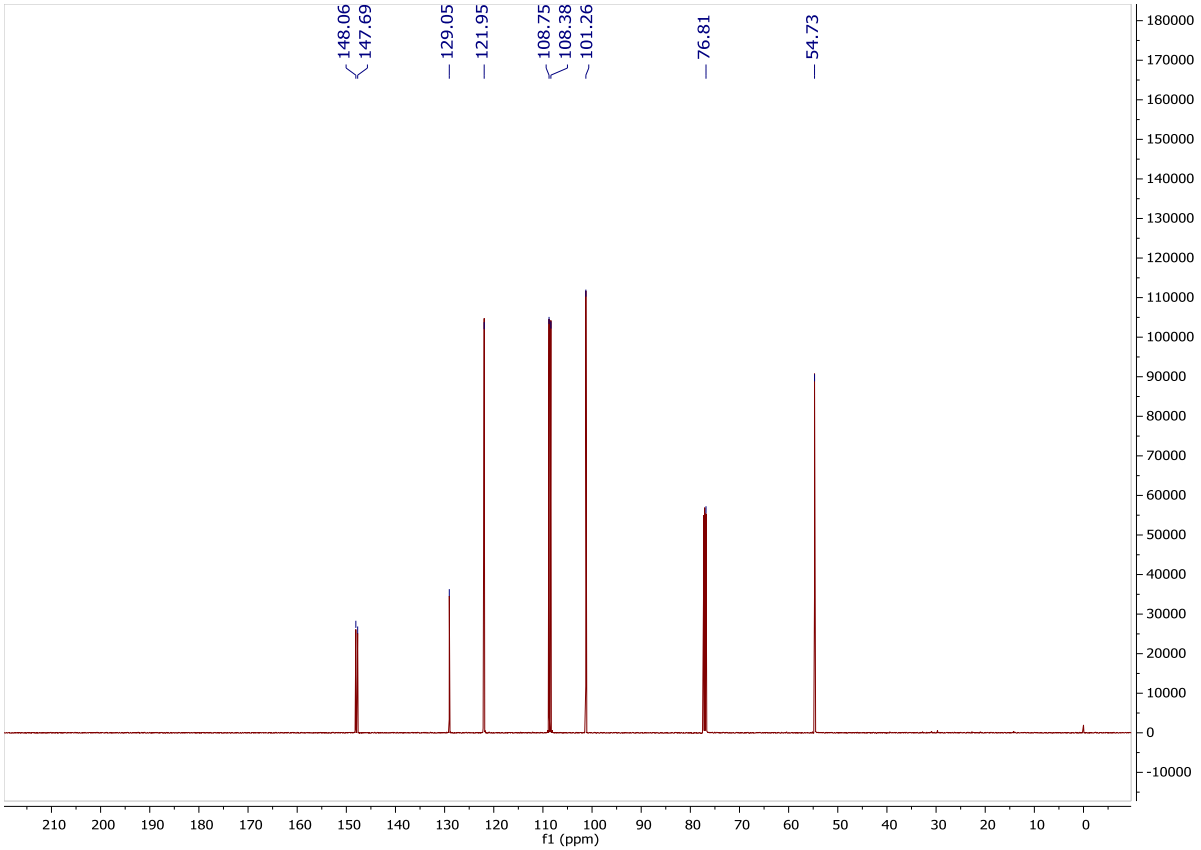
4-Bromo-2-fluorobenzyl azide



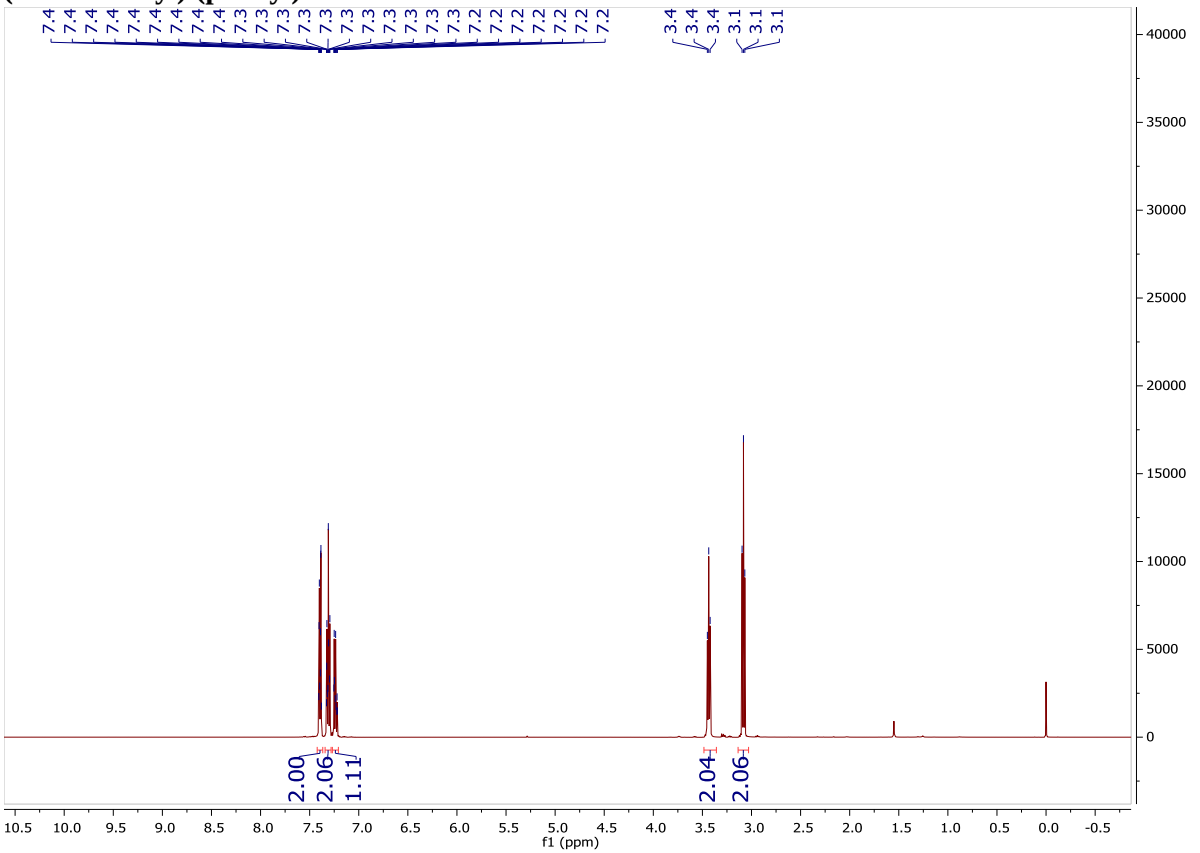


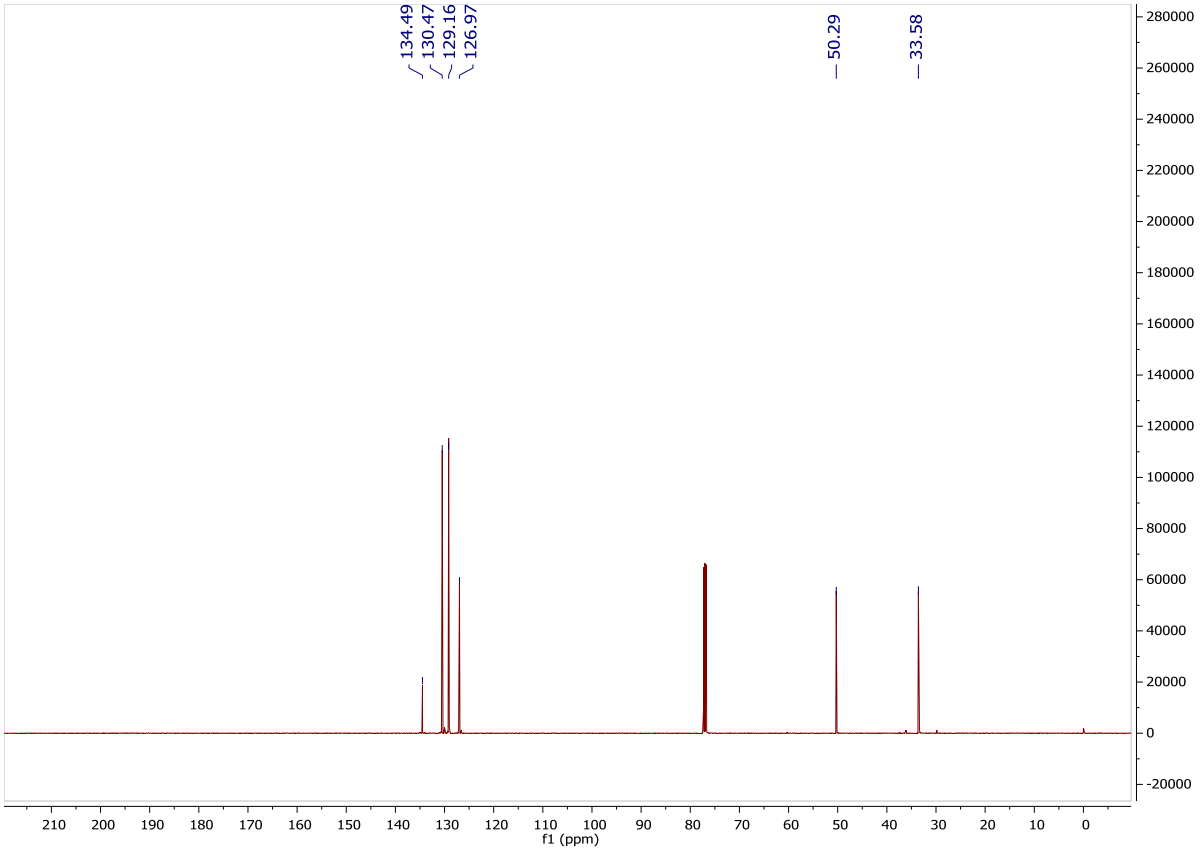
3,4-(Methylenedioxy)benzyl azide (piperonyl azide)



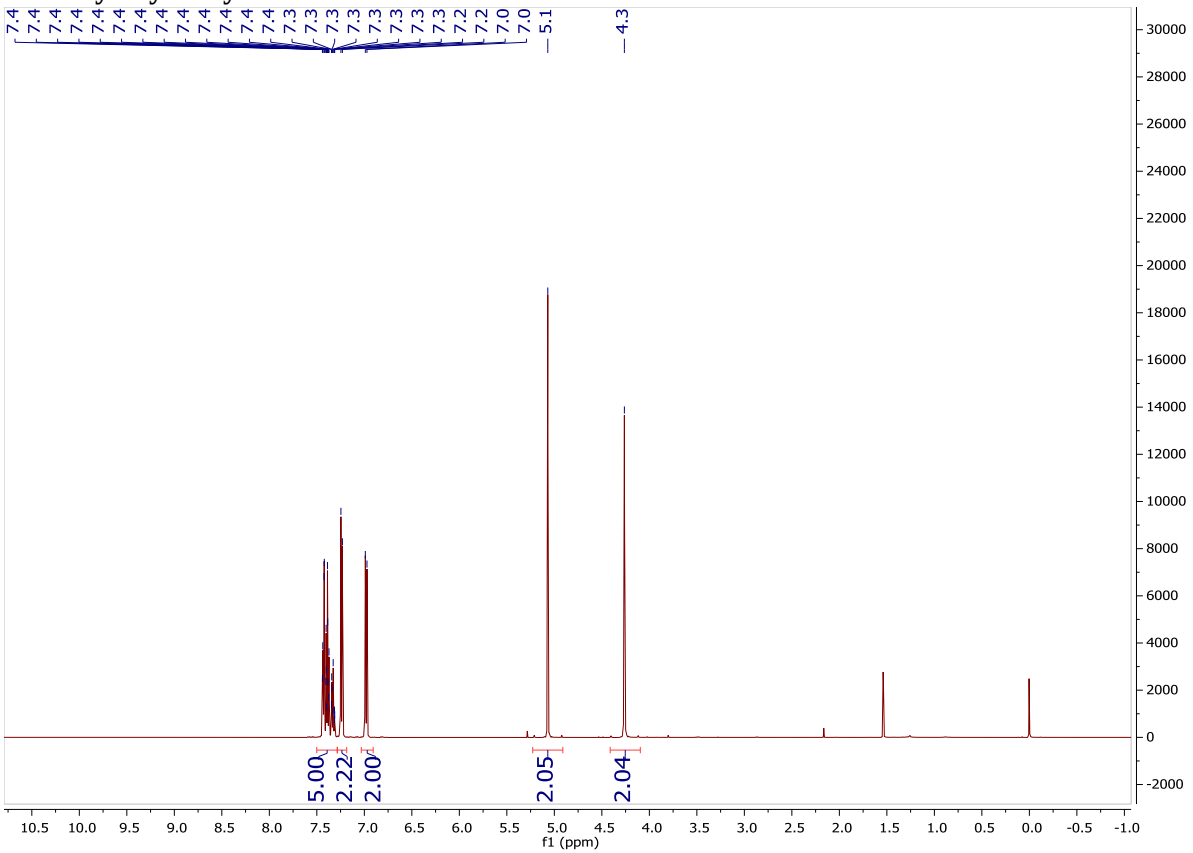


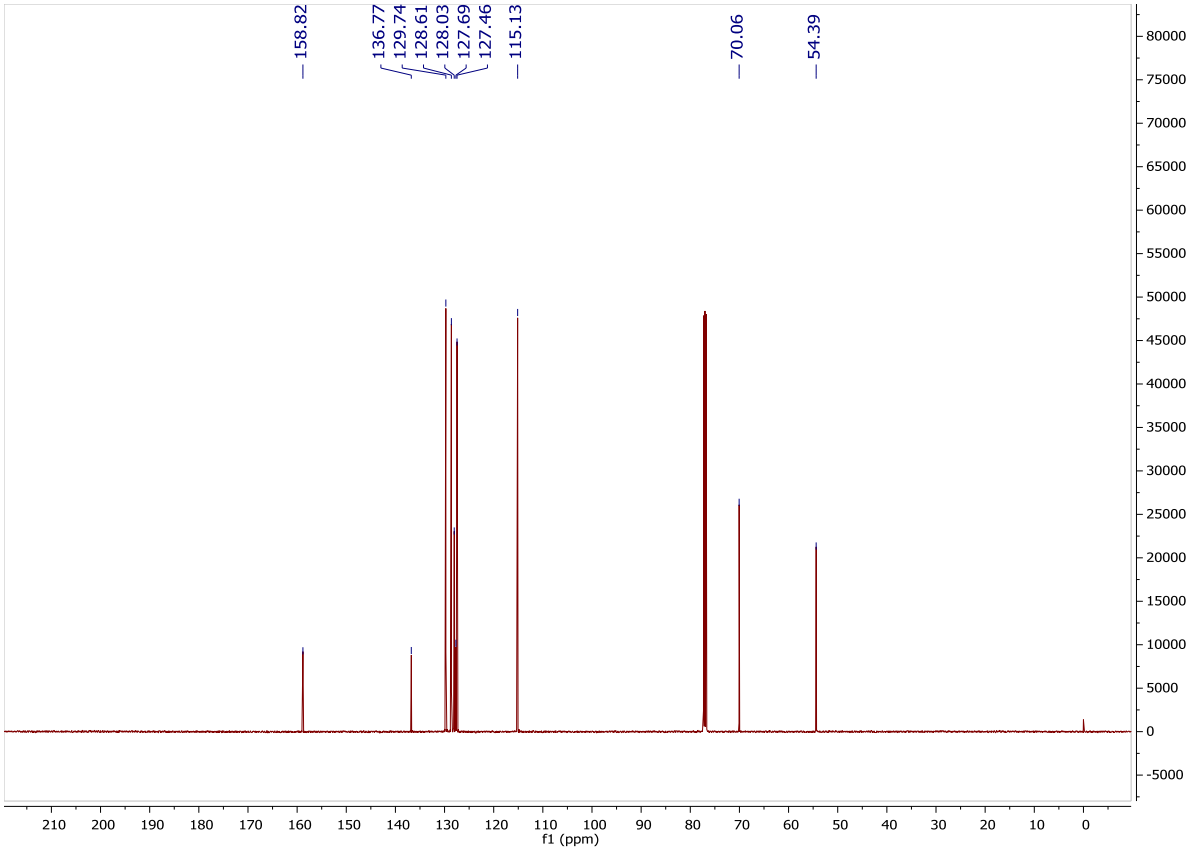
(2-Azidoethyl) (phenyl) sulfide



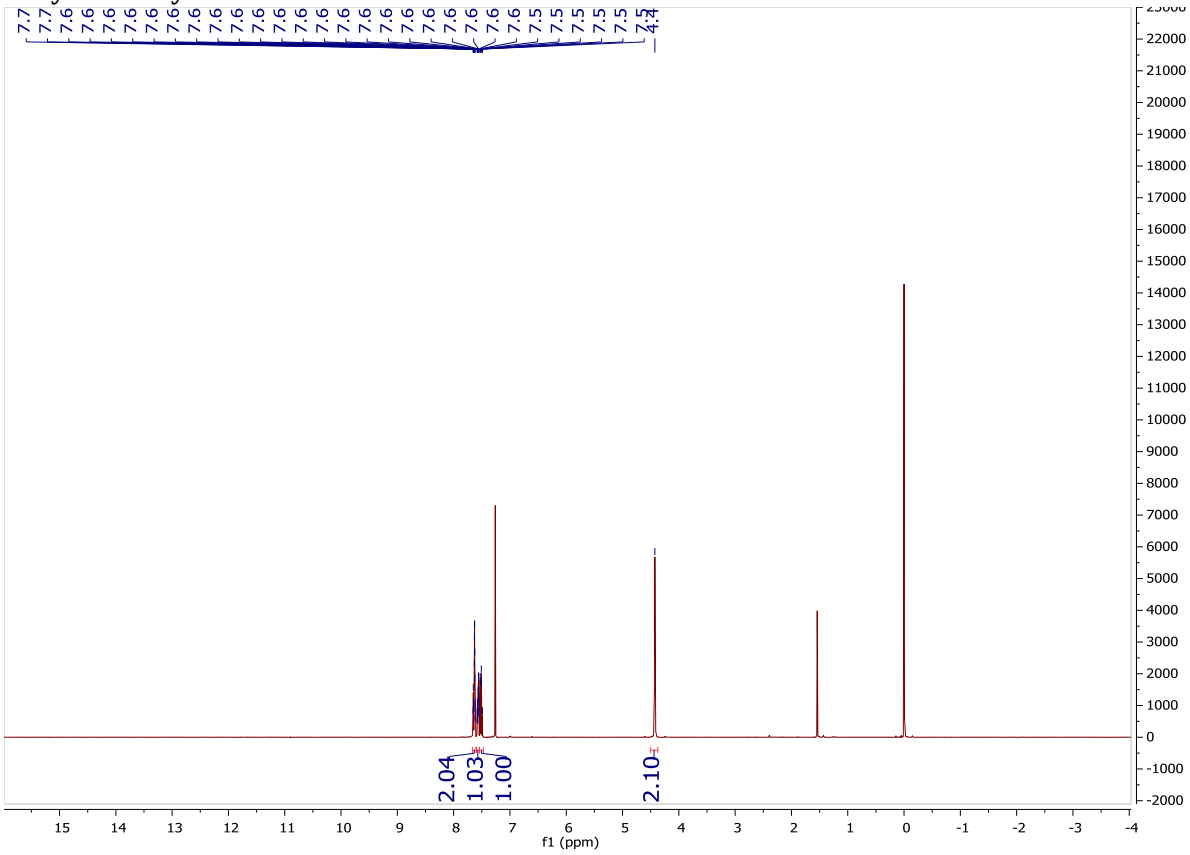


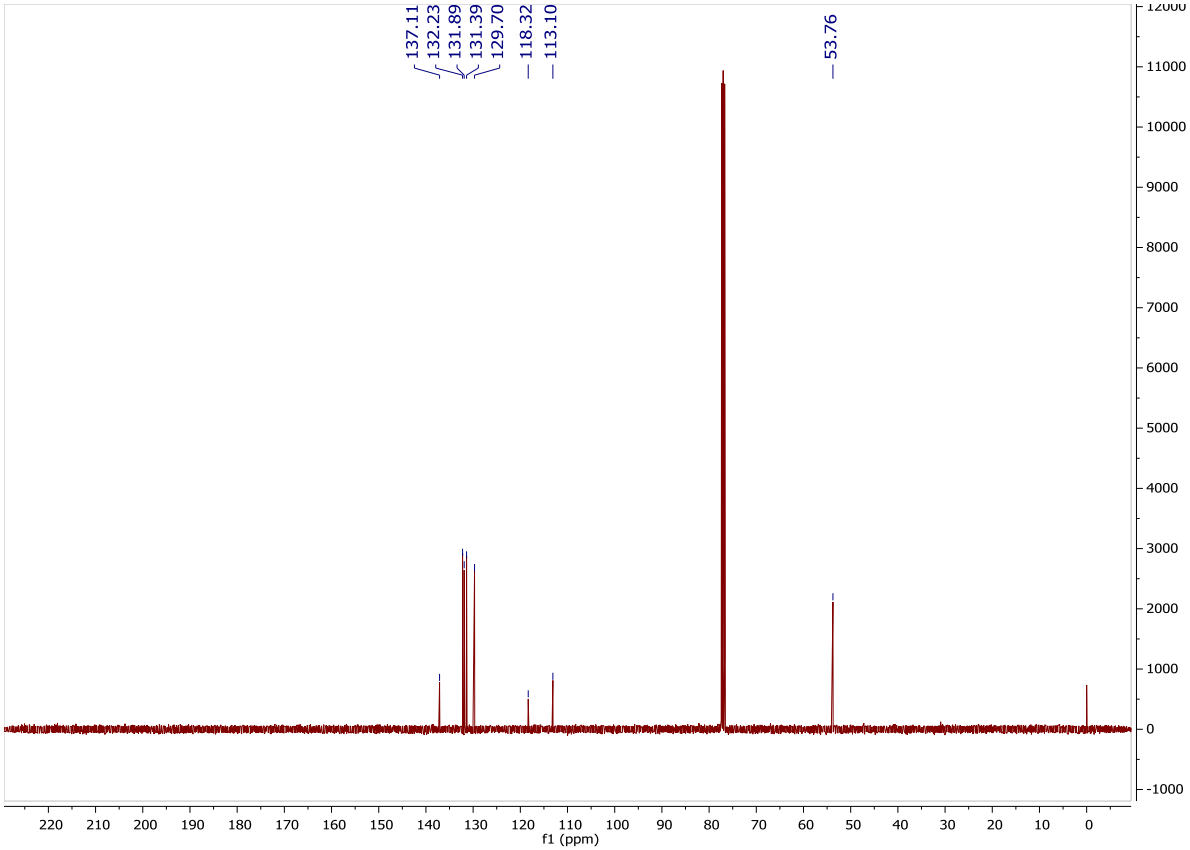
4-Benzyloxybenzyl azide



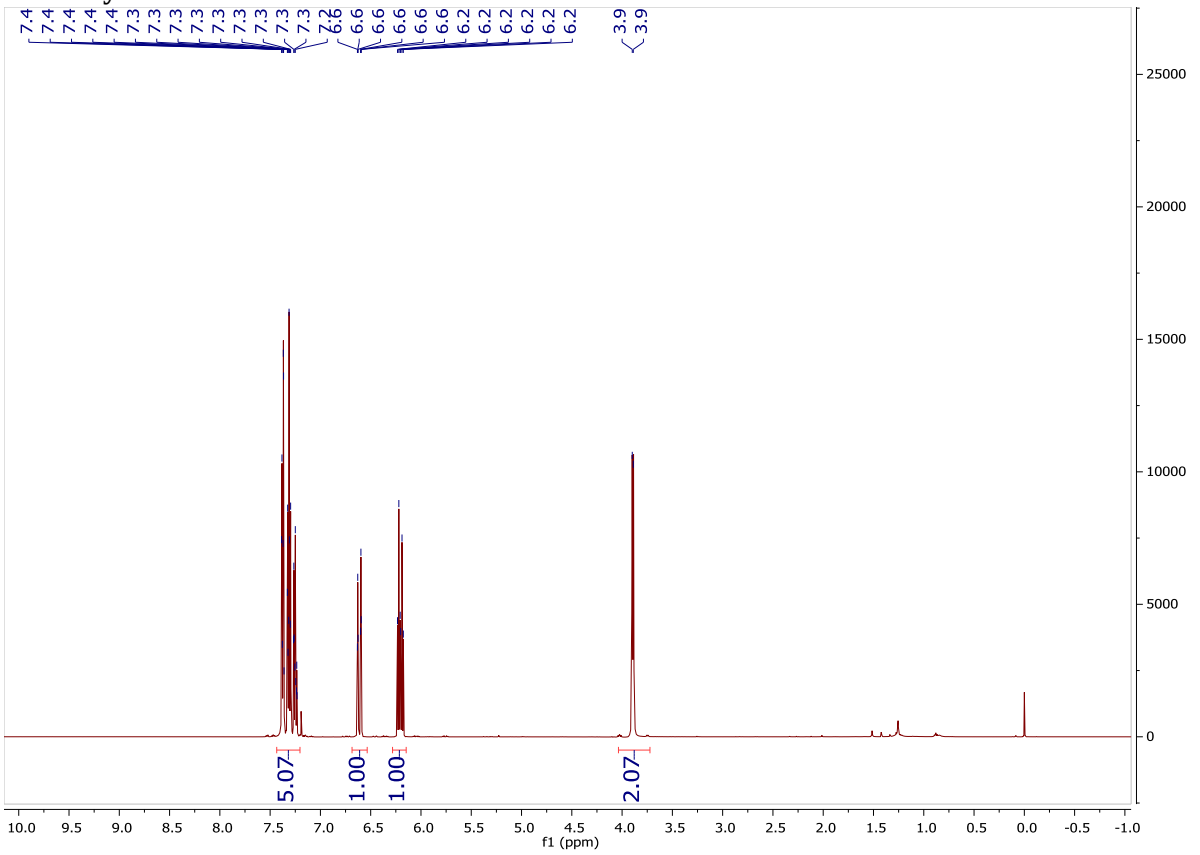


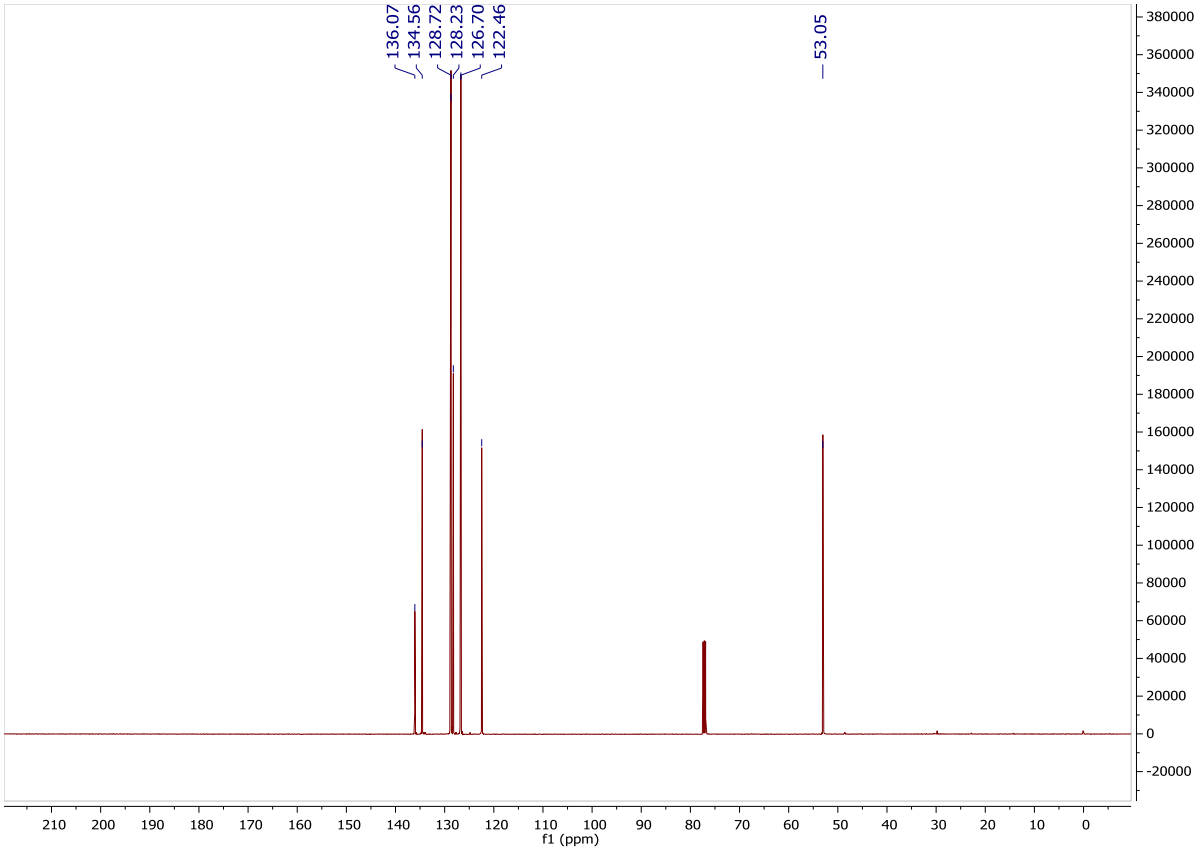
3-Cyanobenzyl azide



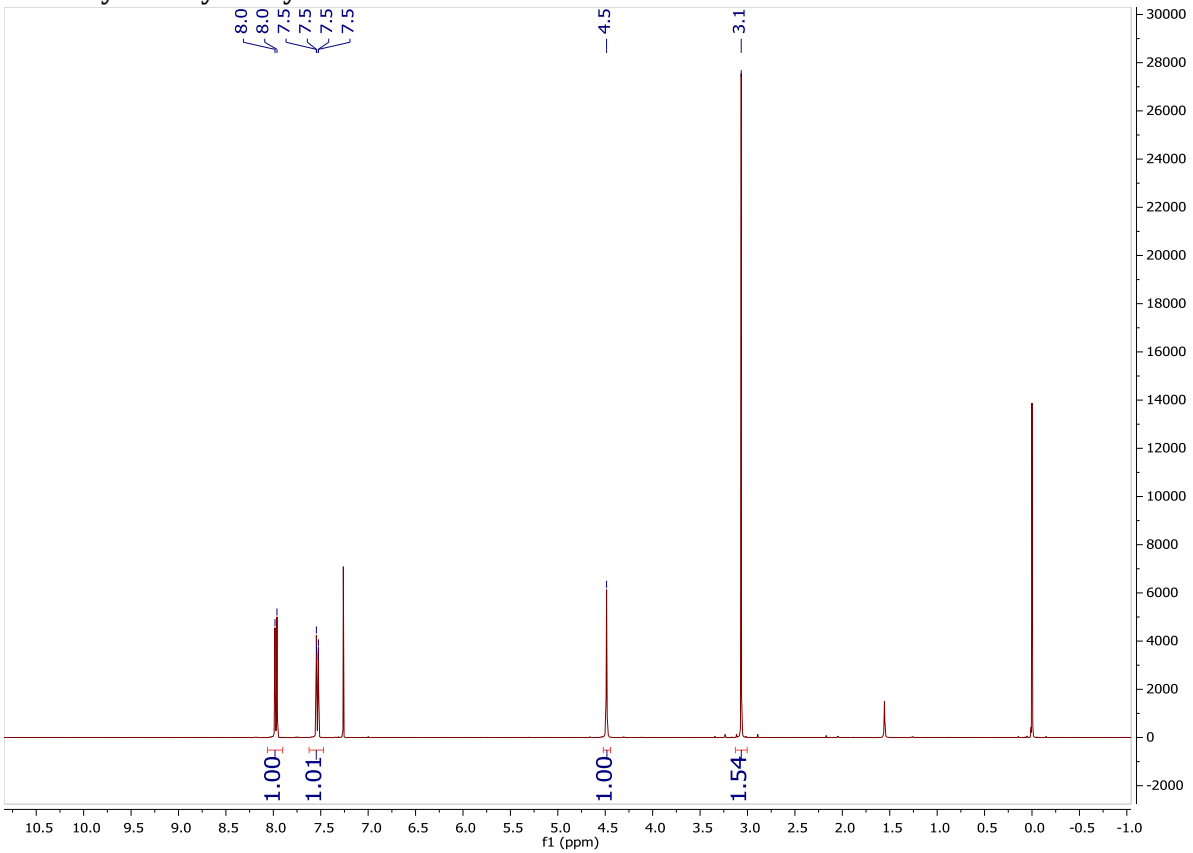


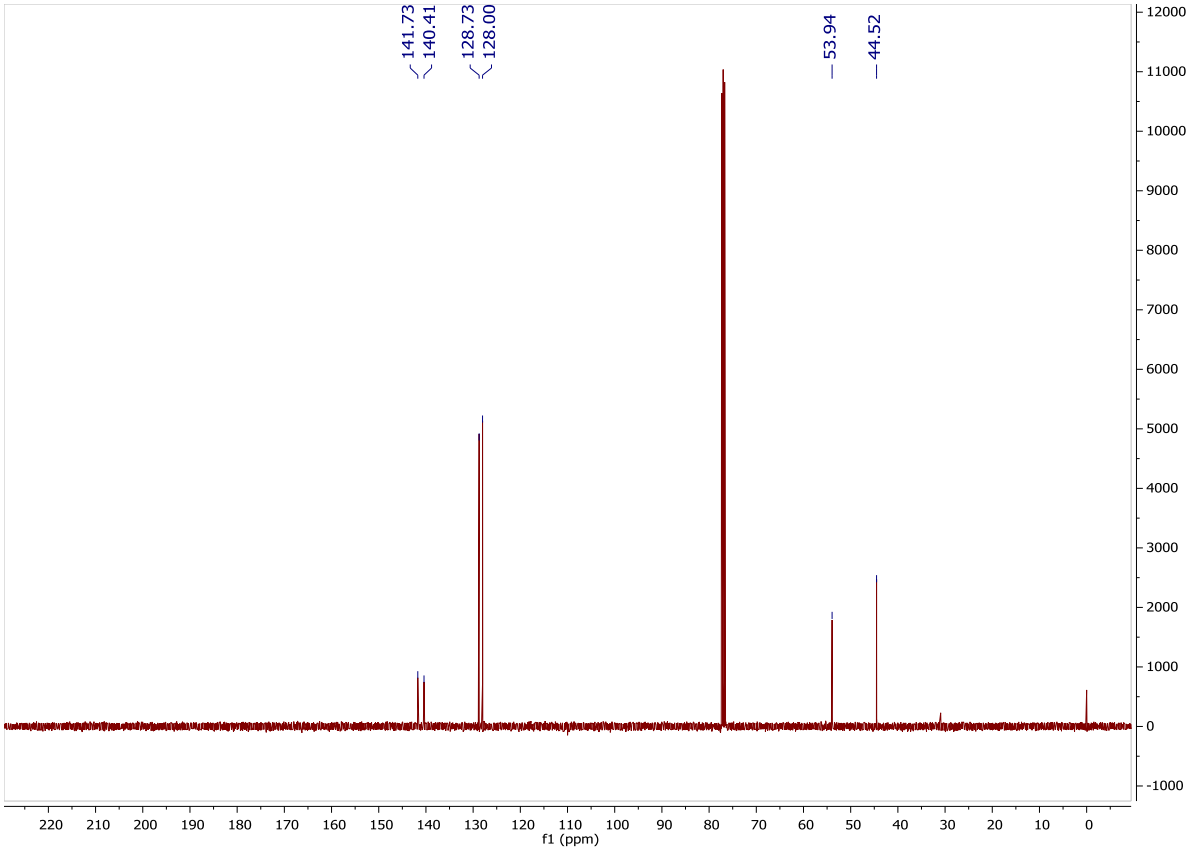
Cinnamyl azide



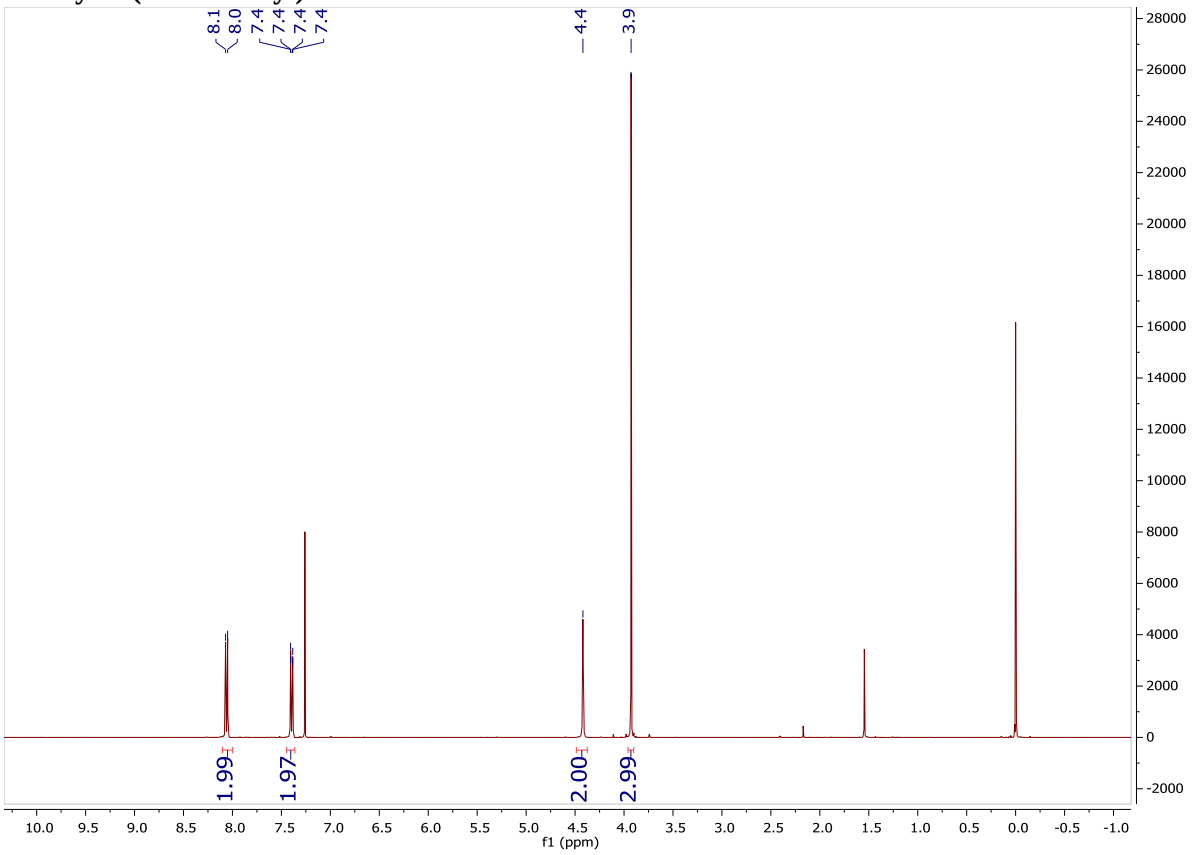


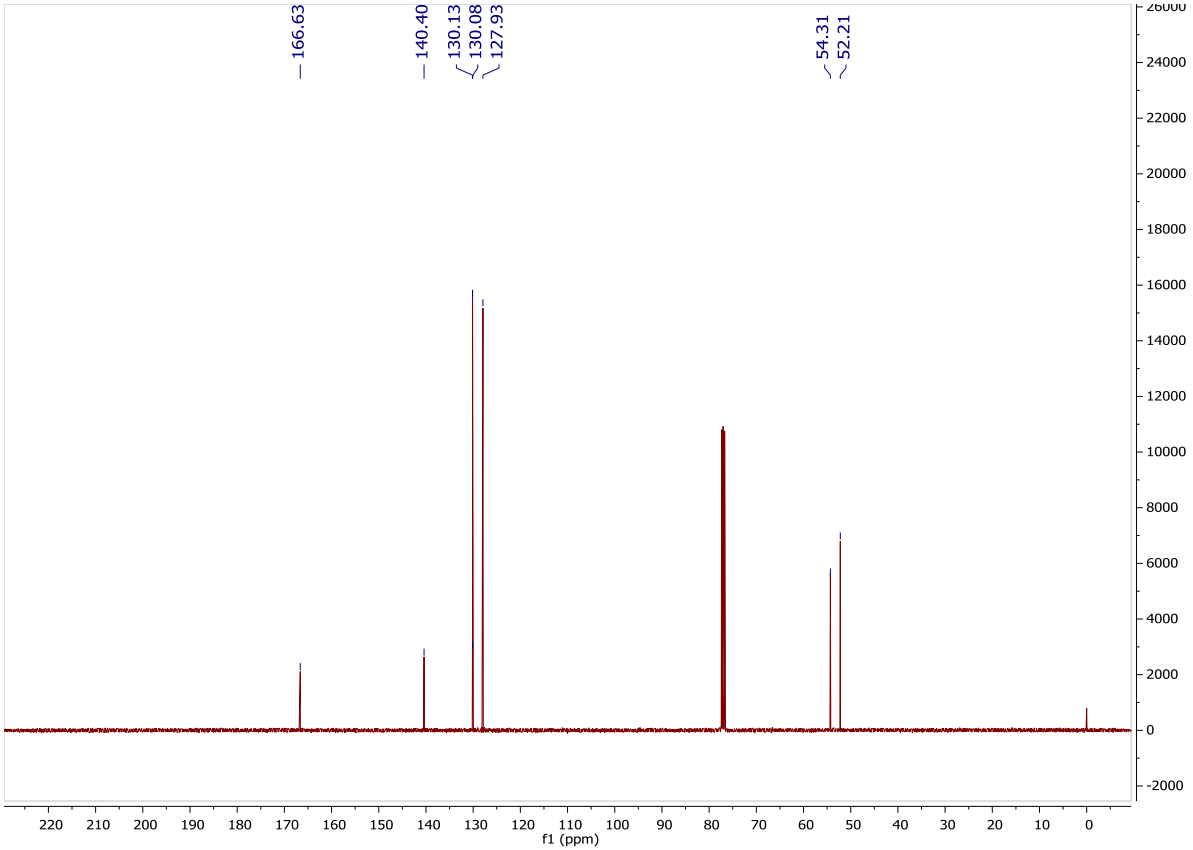
4-Methylsulfonylbenzyl azide



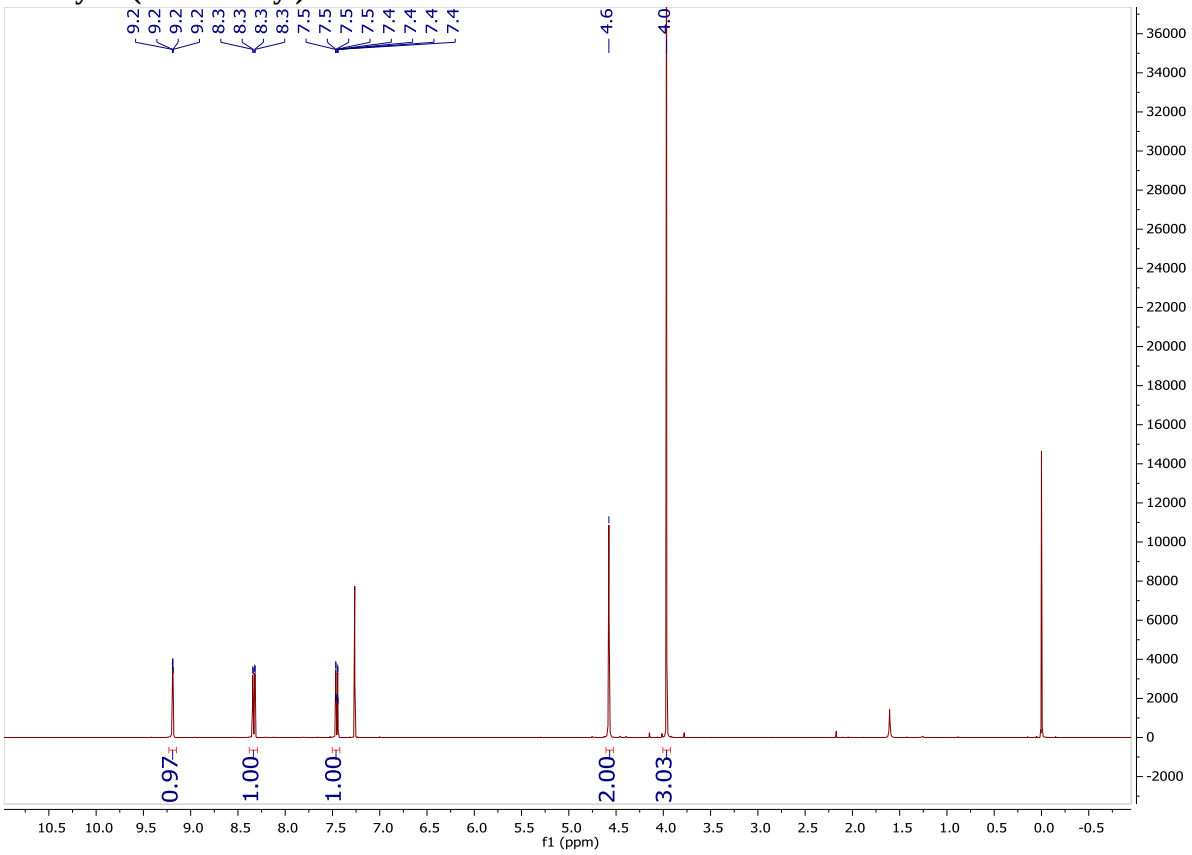


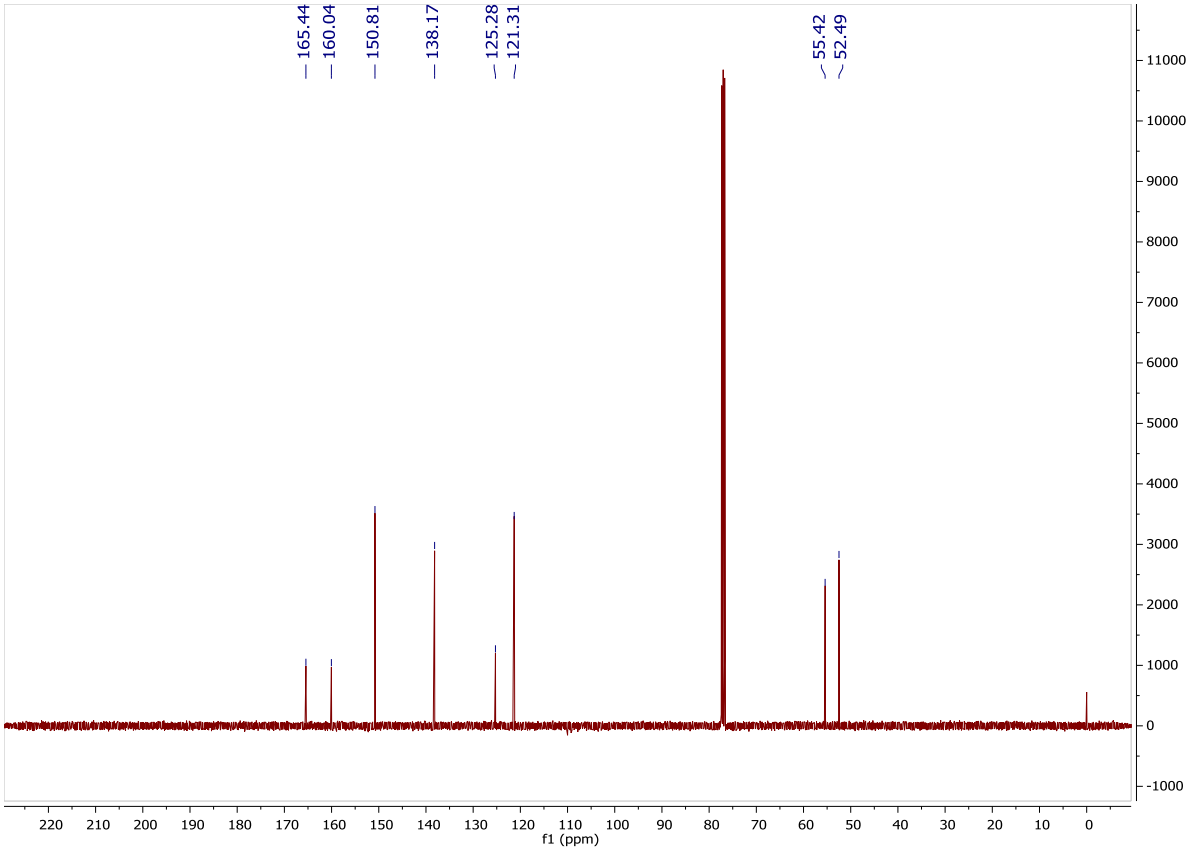
Methyl 4-(azidomethyl) benzoate



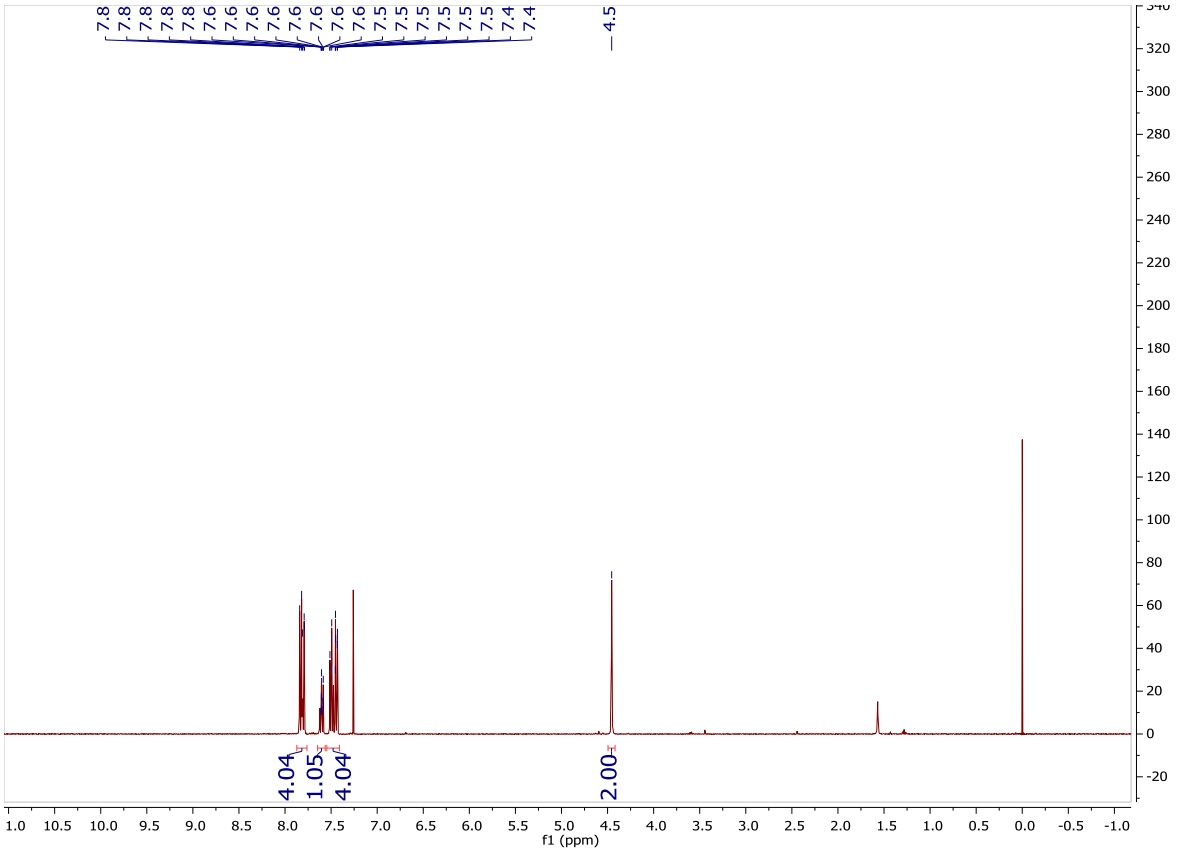


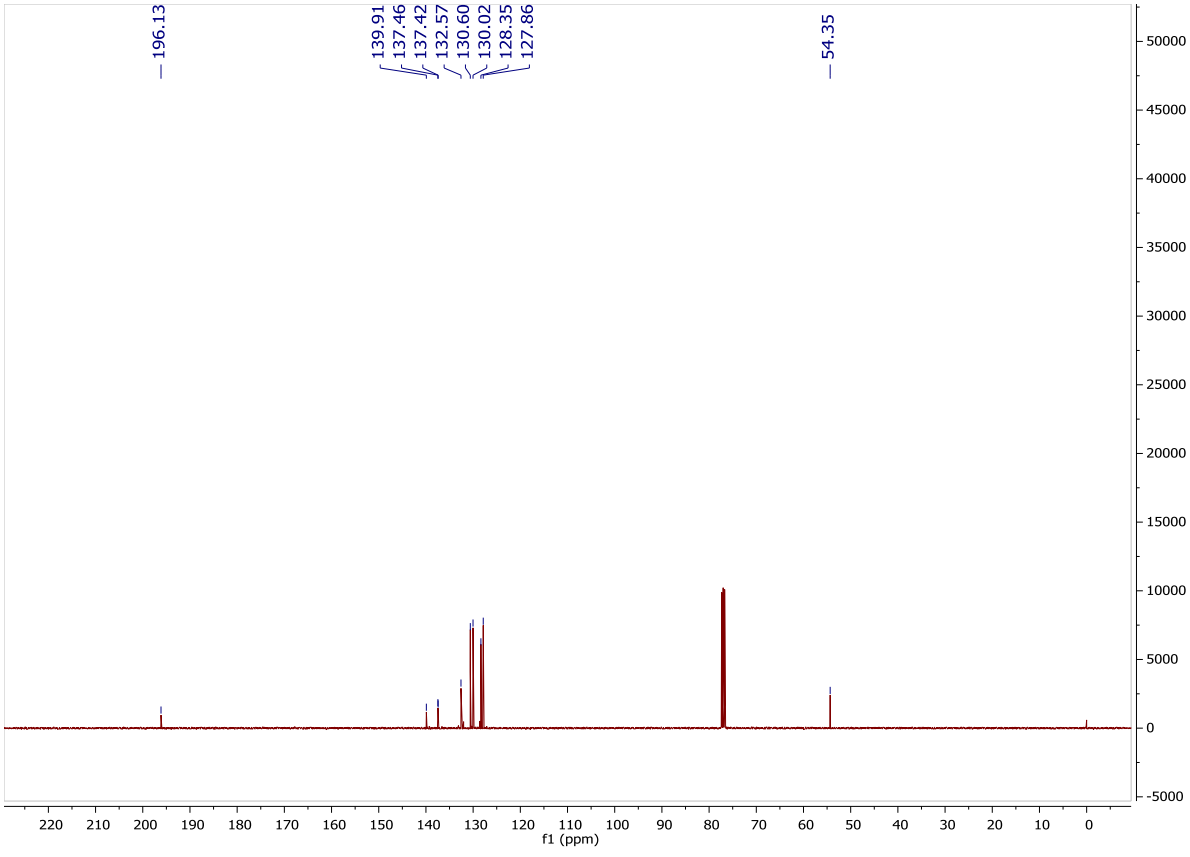
Methyl 6-(azidomethyl) nicotinate



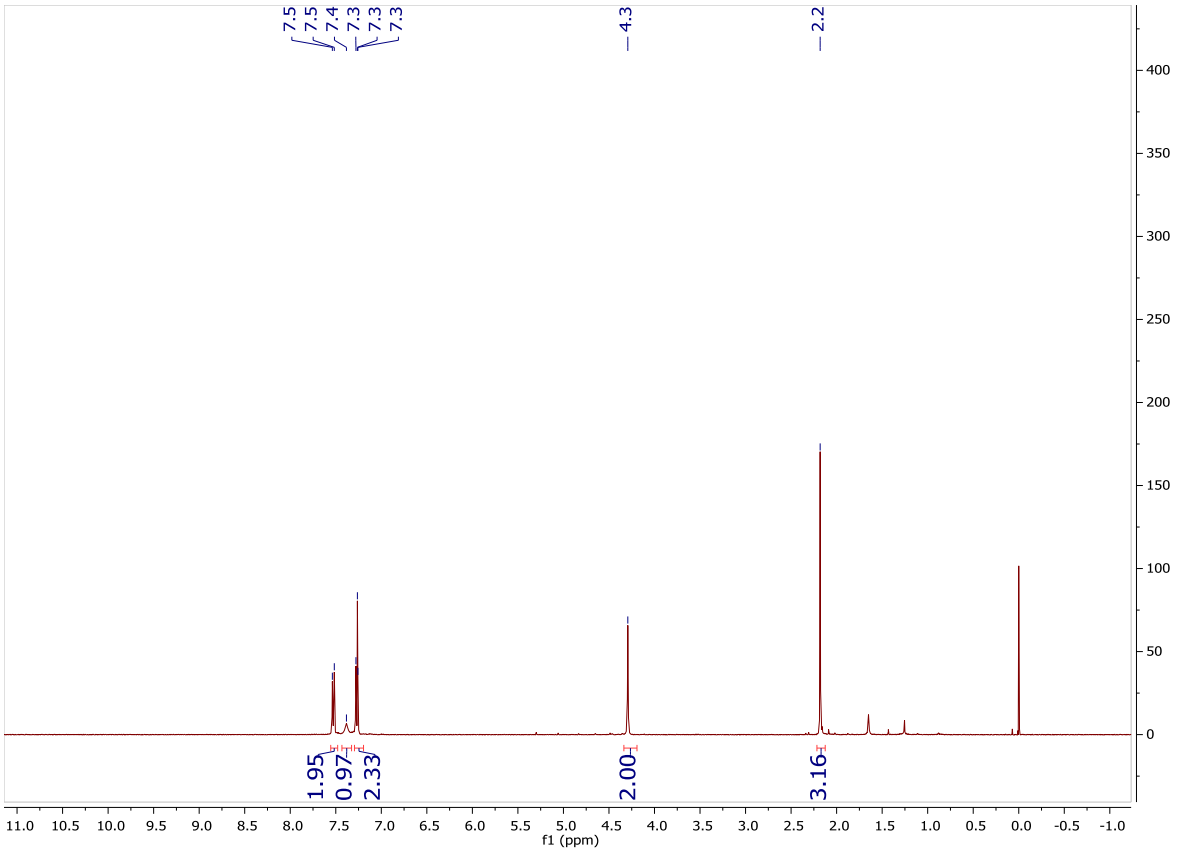


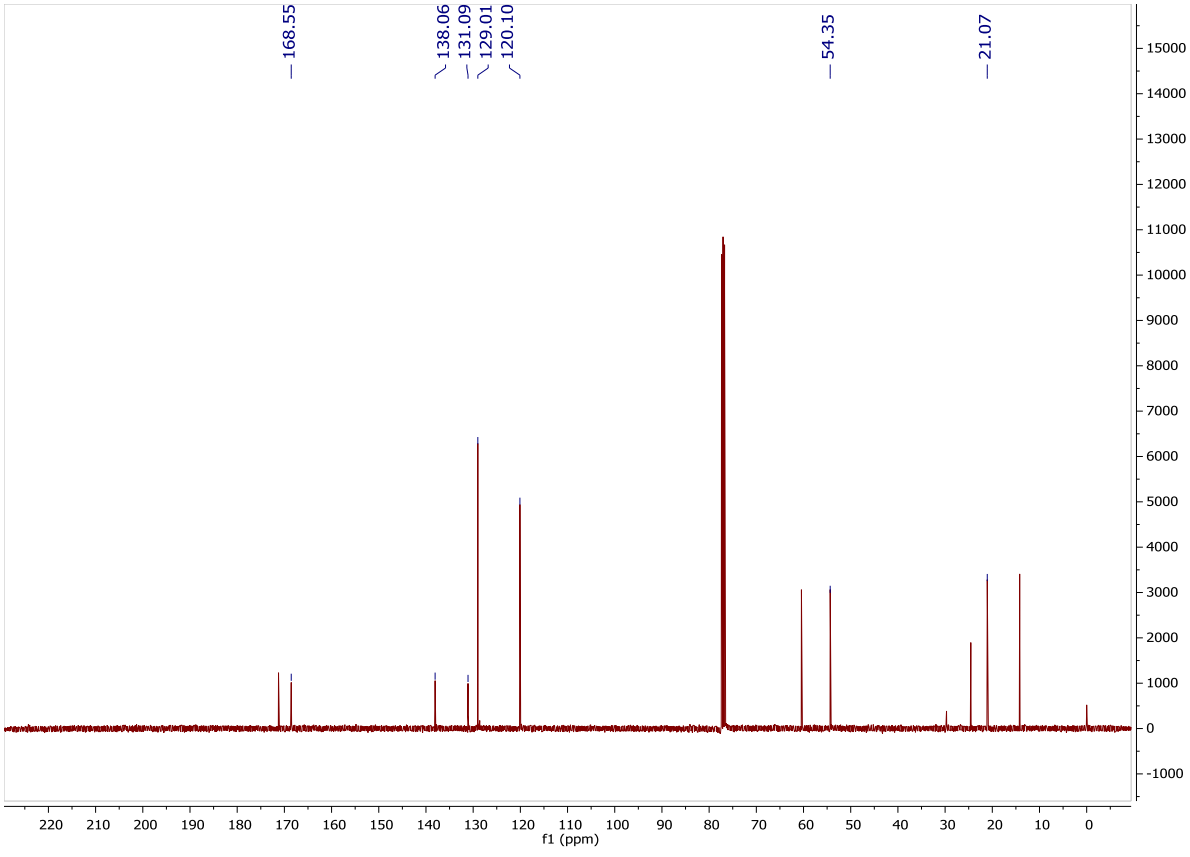
4-Benzoylbenzyl azide



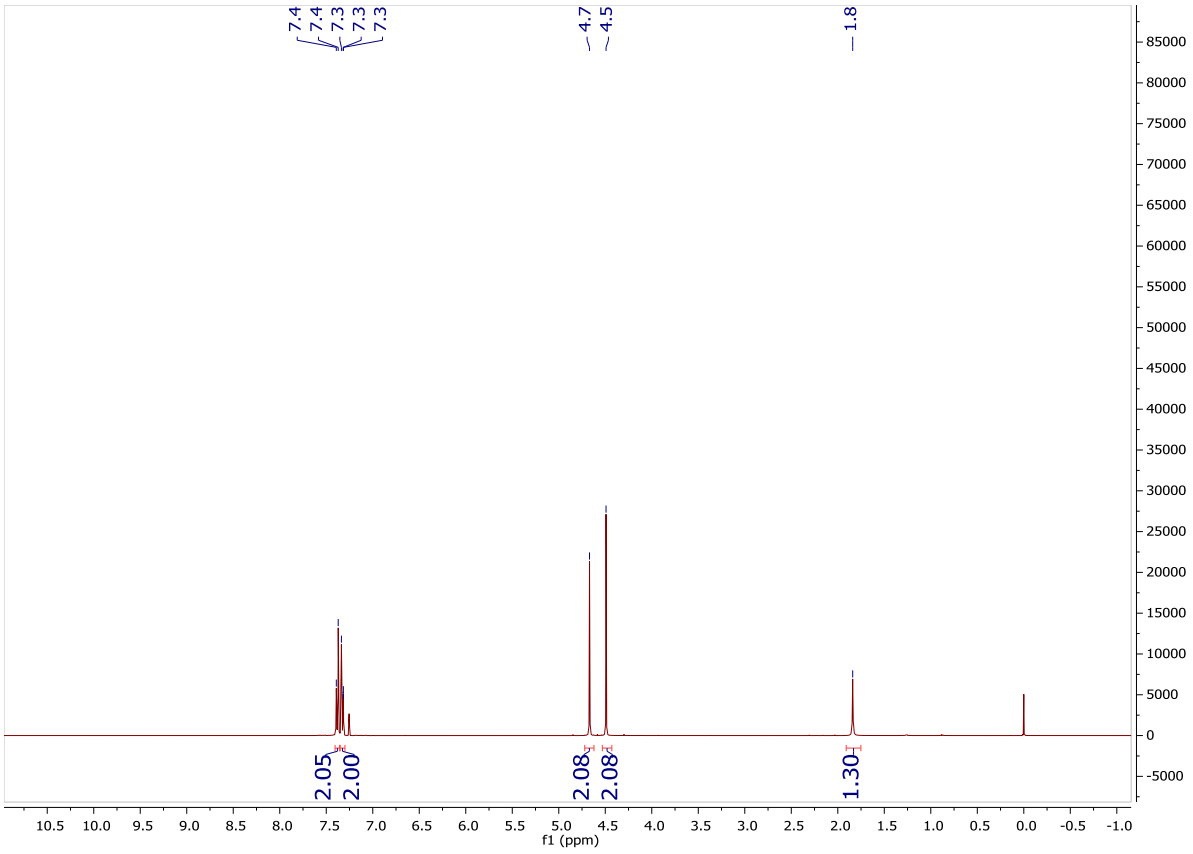


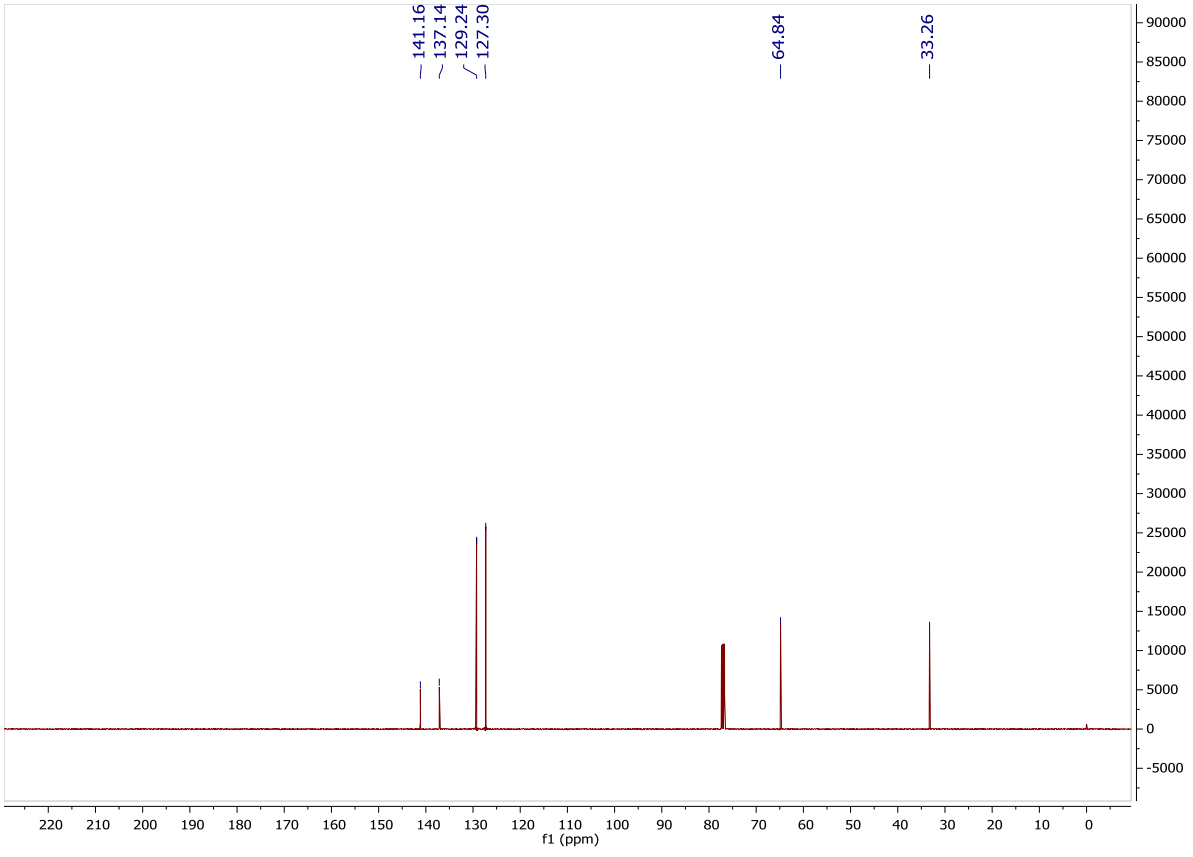
4-Acetamidobenzyl azide



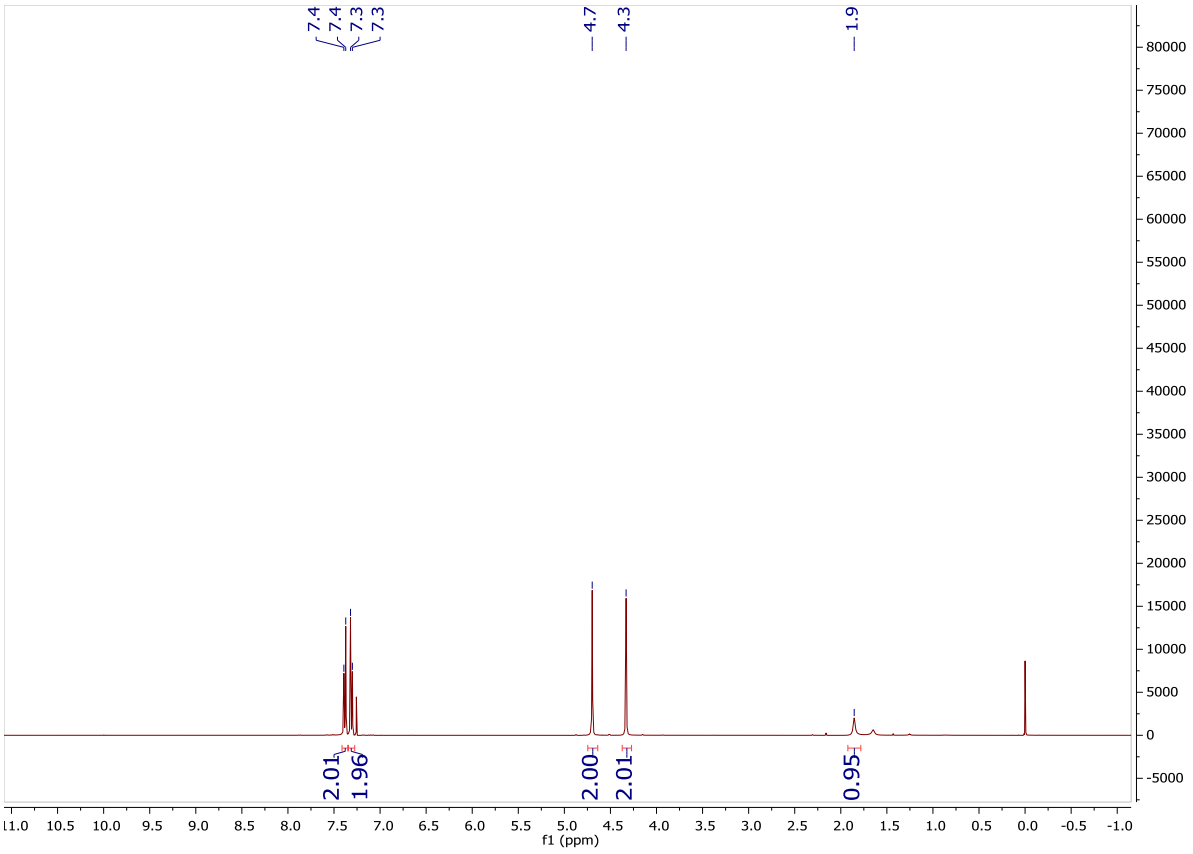


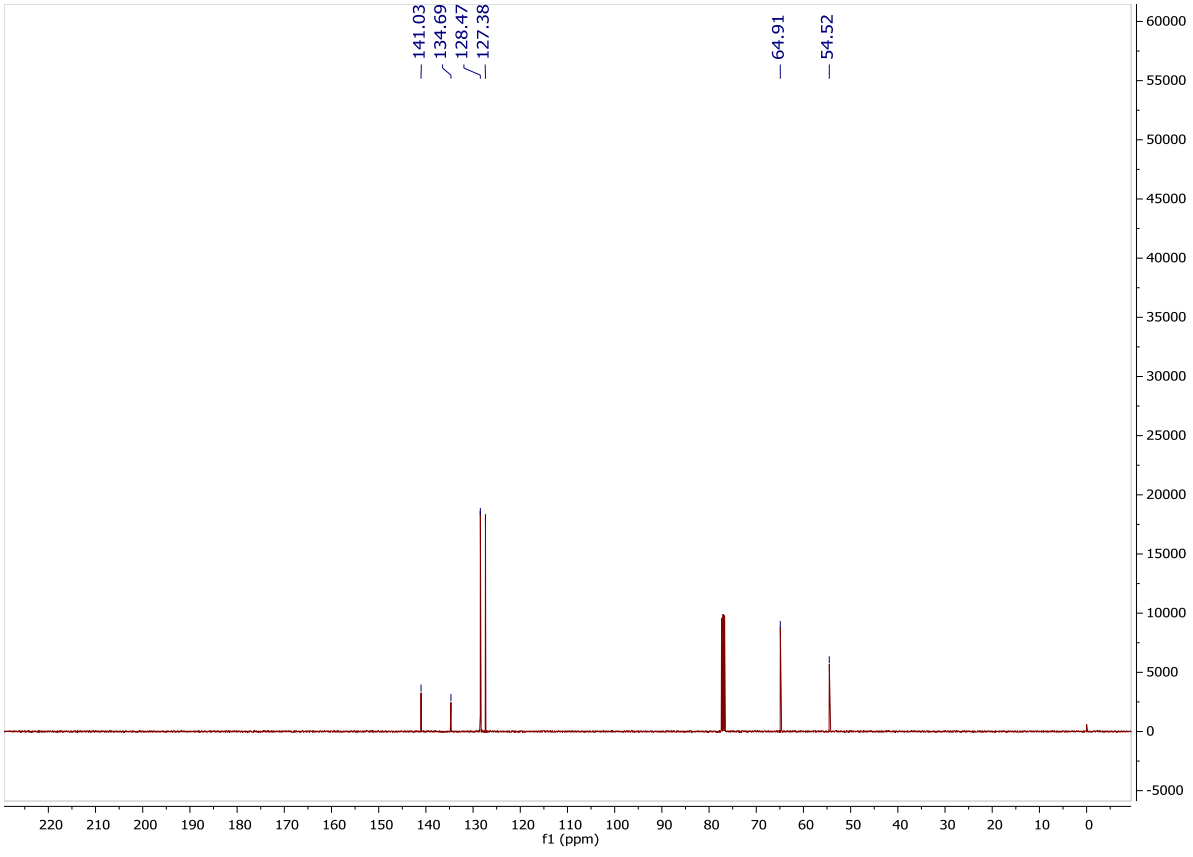
(4-Hydroxymethyl)benzyl bromide



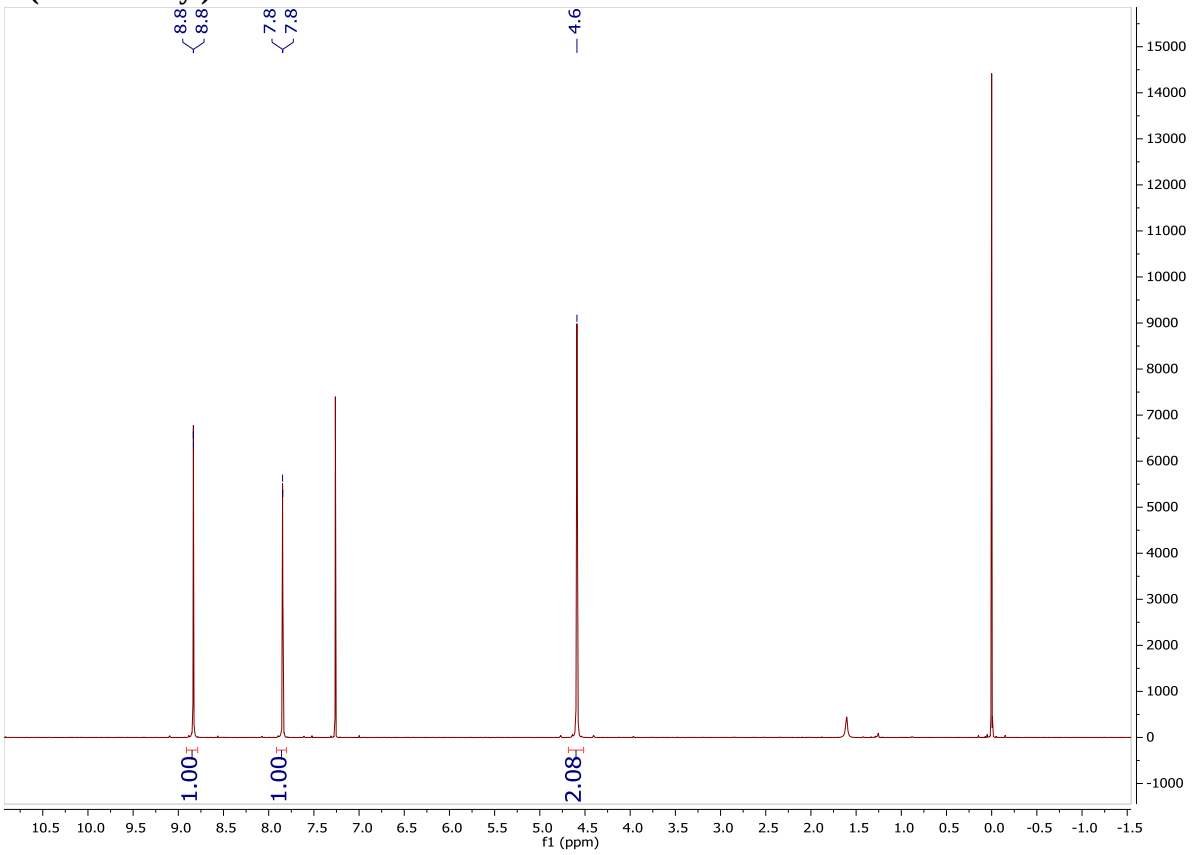


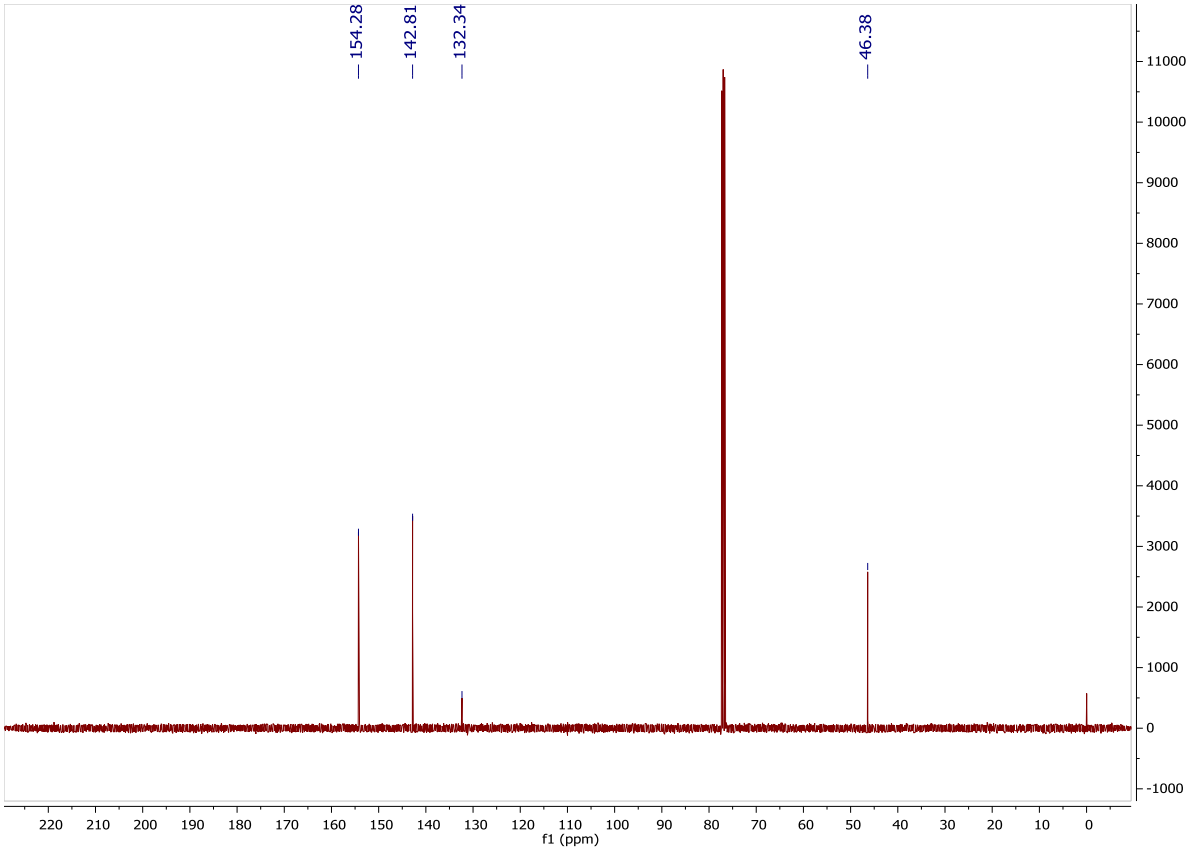
(4-Hydroxymethyl)benzyl azide



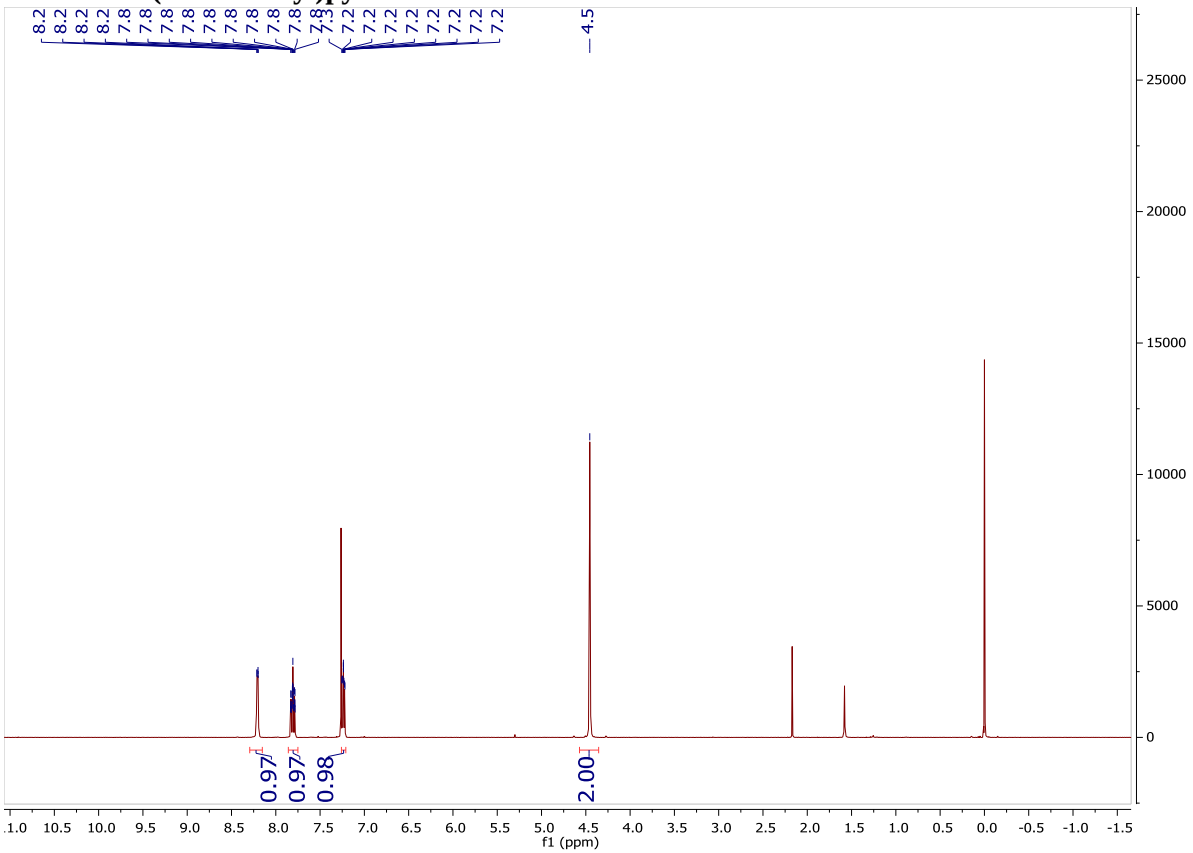


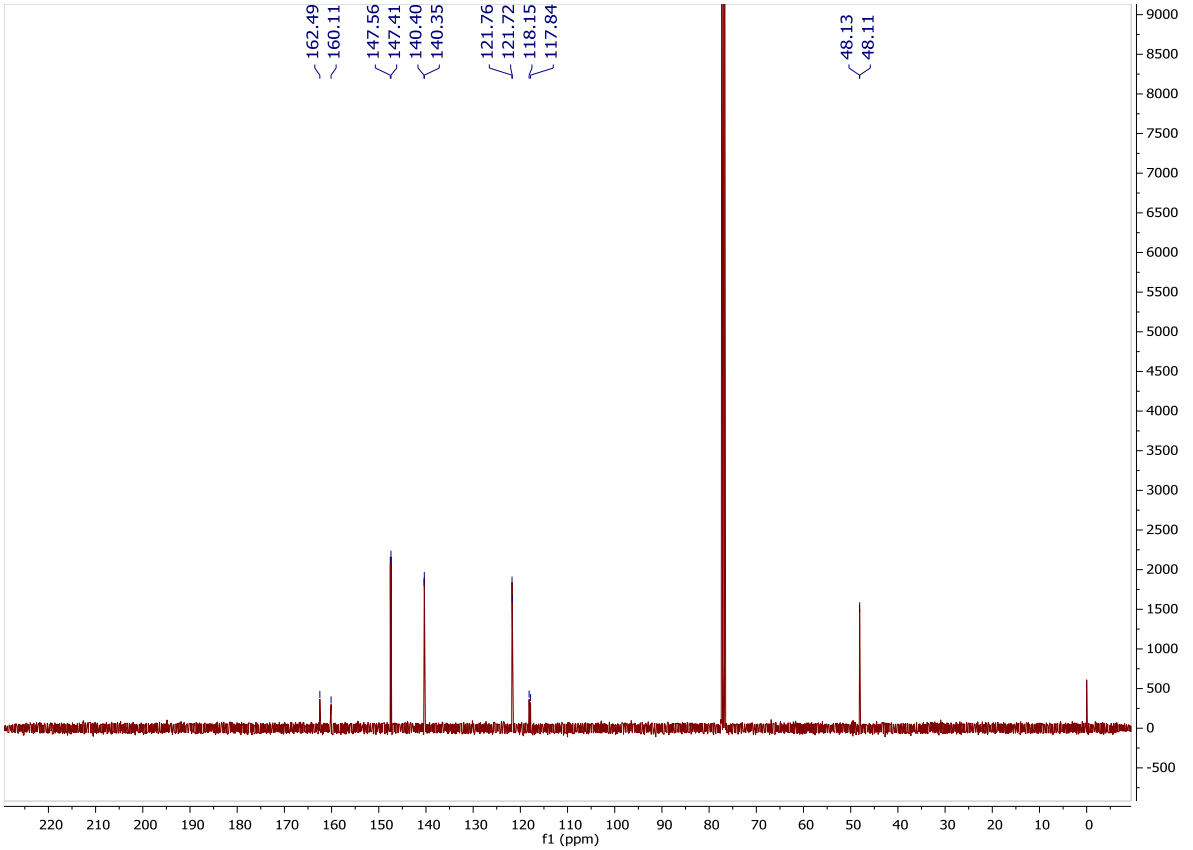
5-(Azidomethyl) thiazole



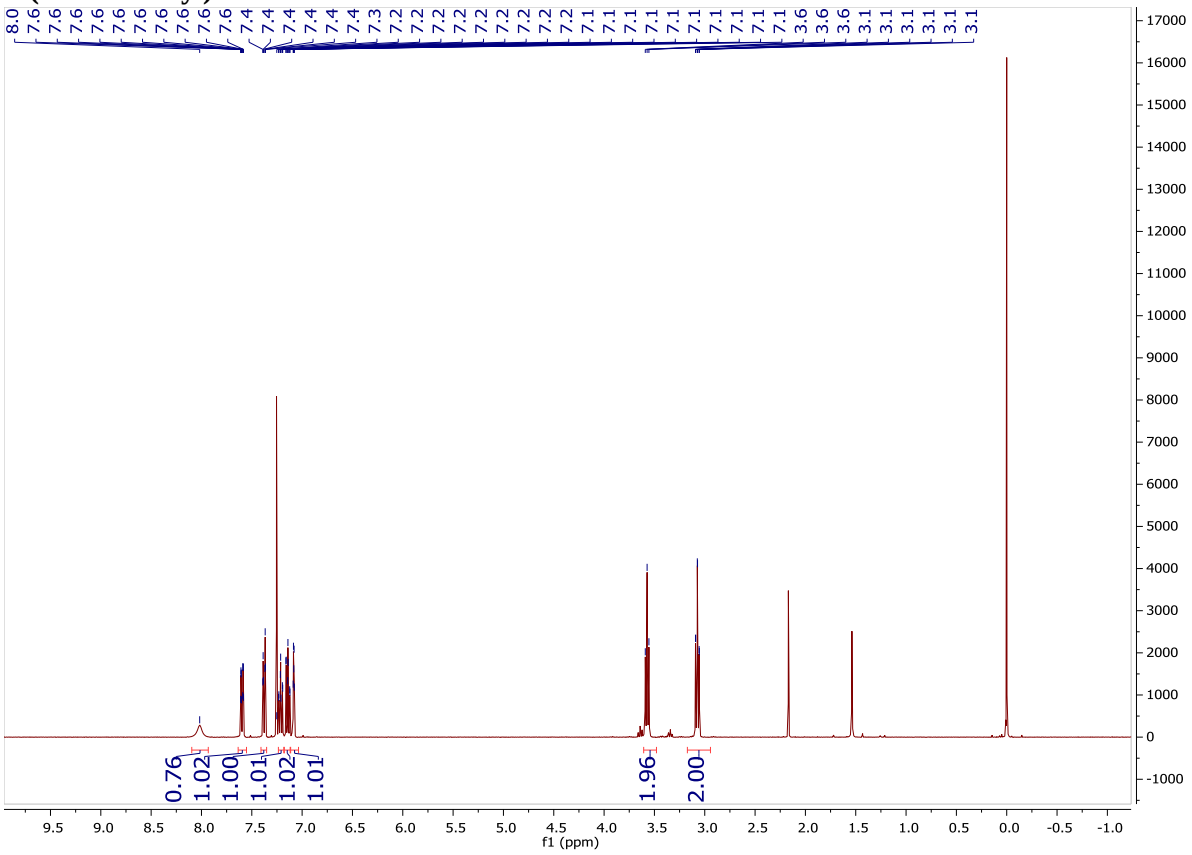


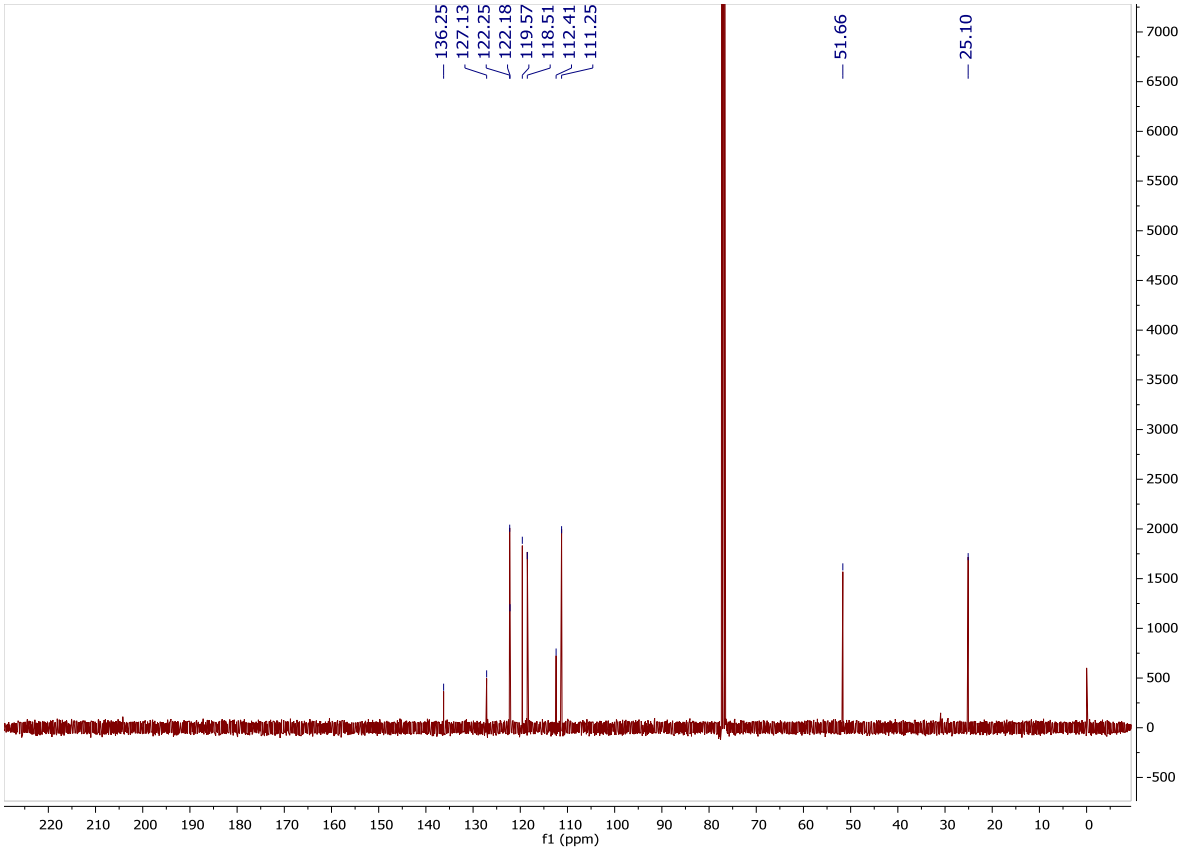
2-Fluoro-3-(azidomethyl)pyridine



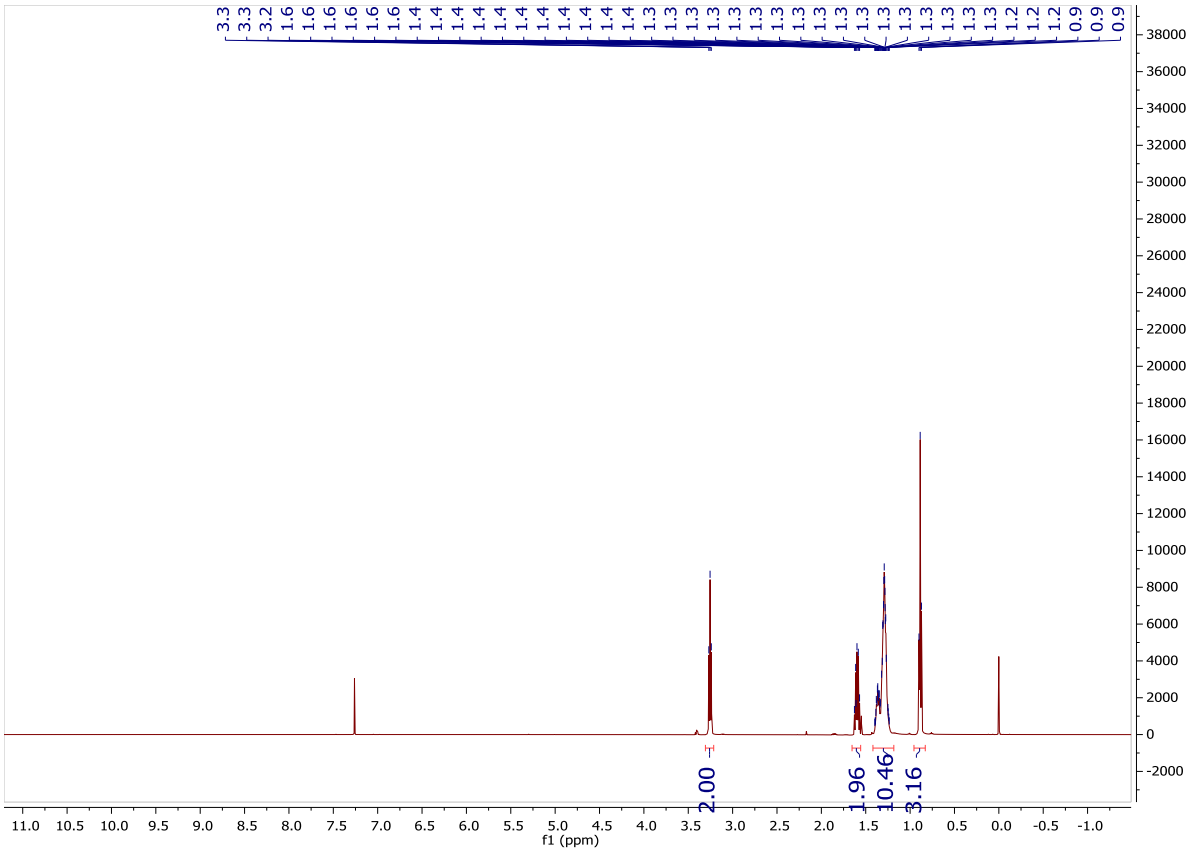


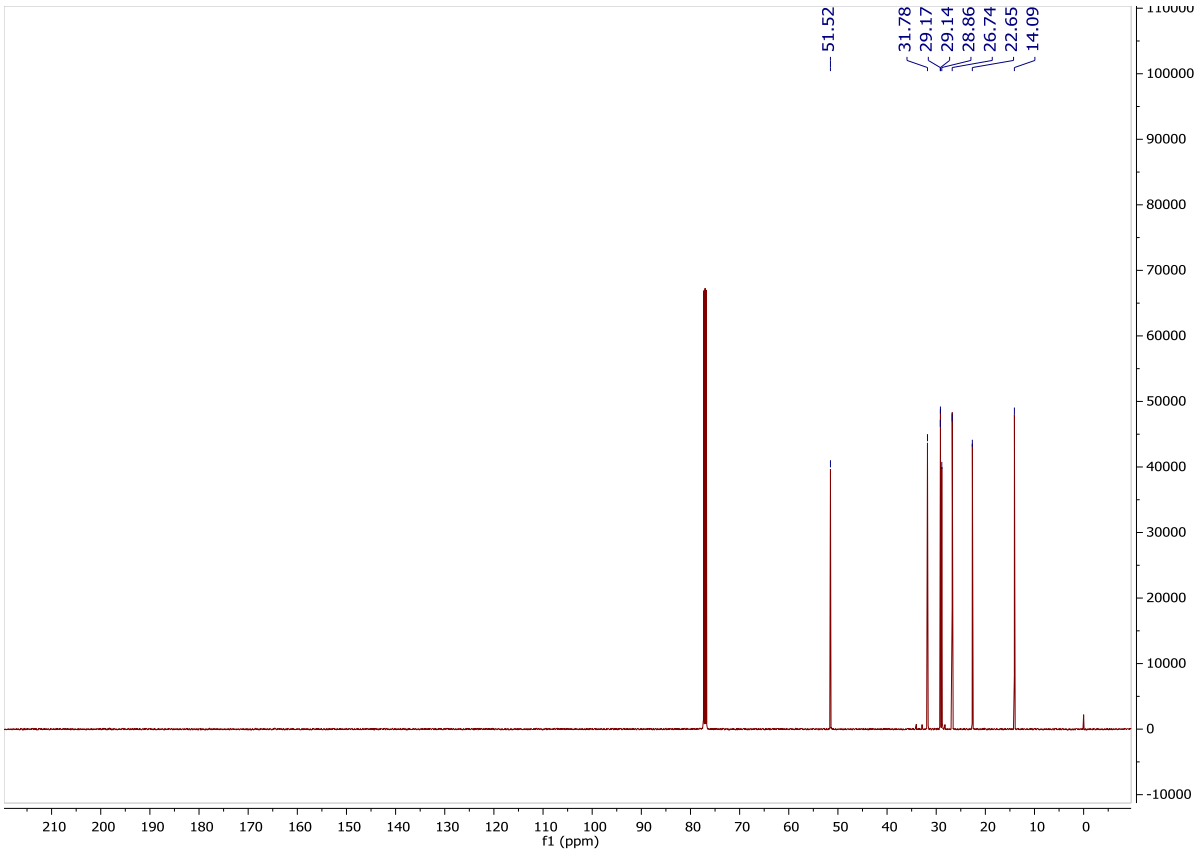
3-(2-Azidoethyl) indole



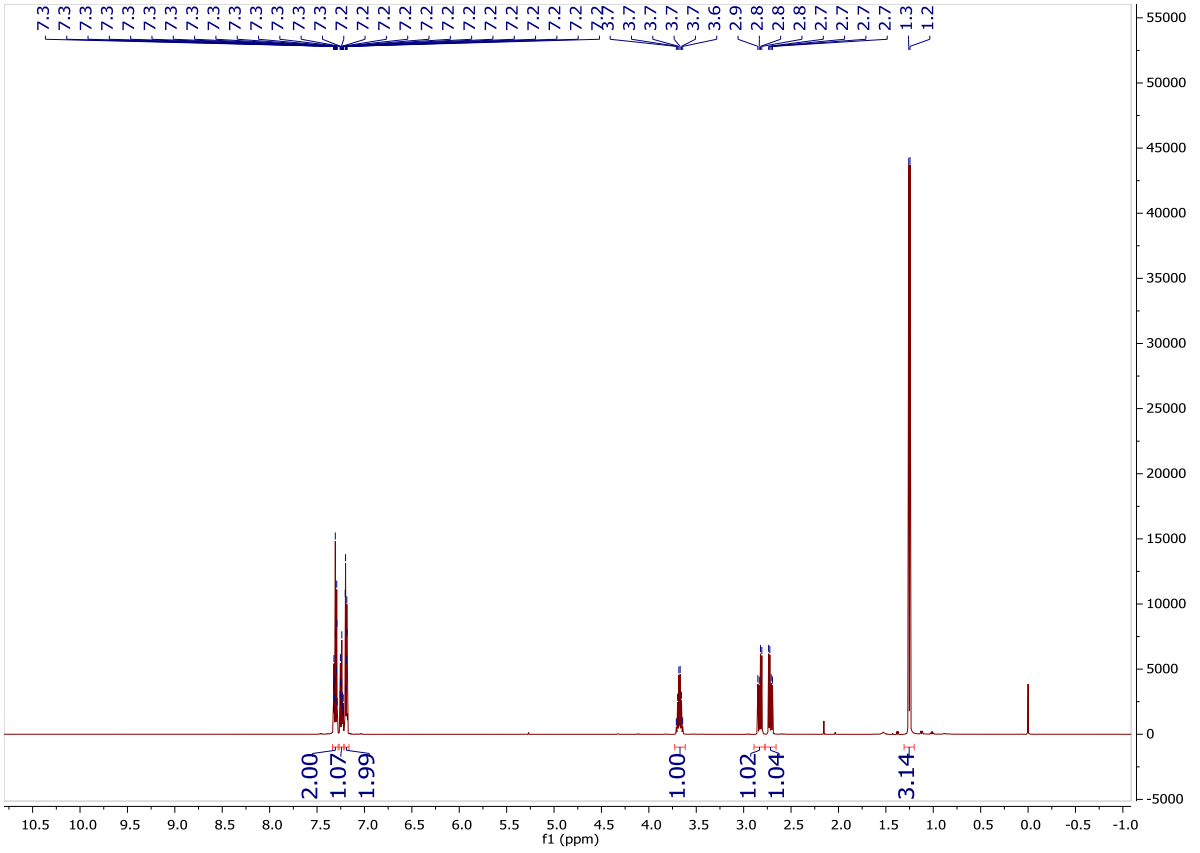


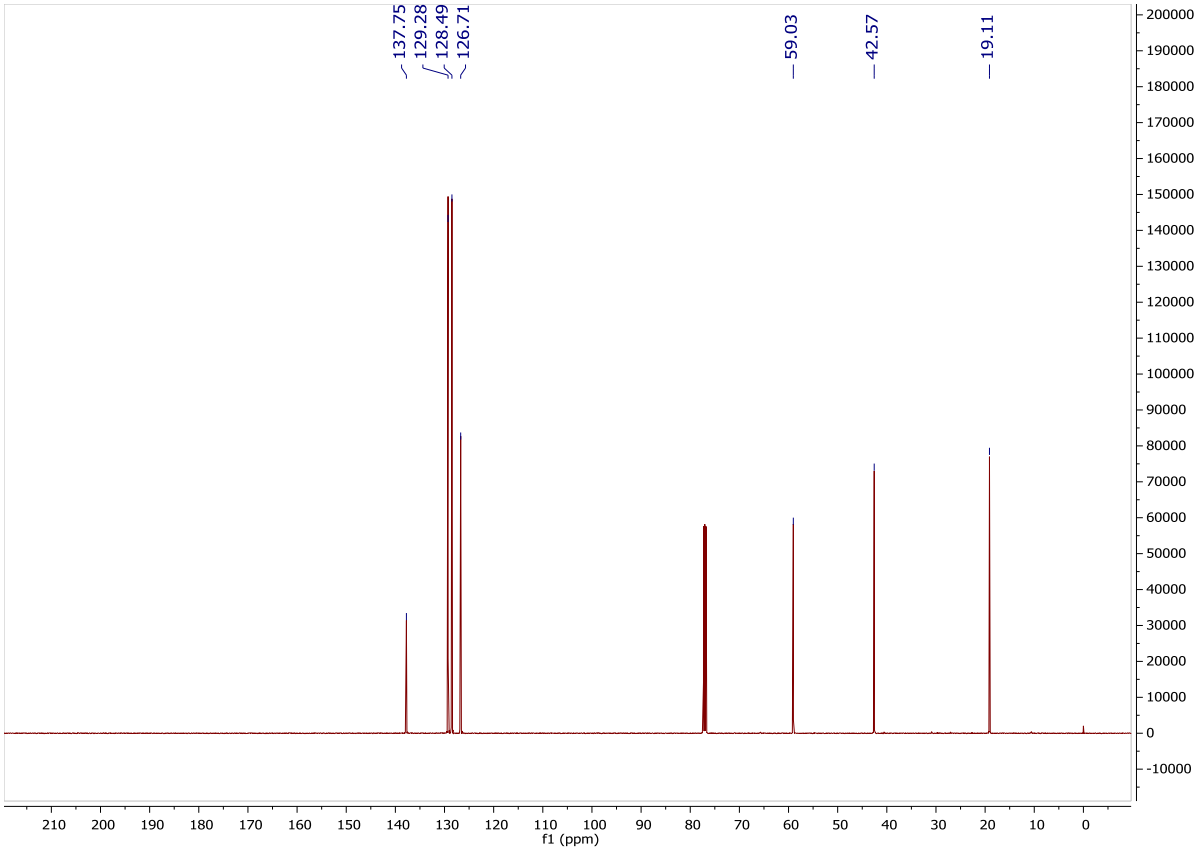
1-Azidooctane



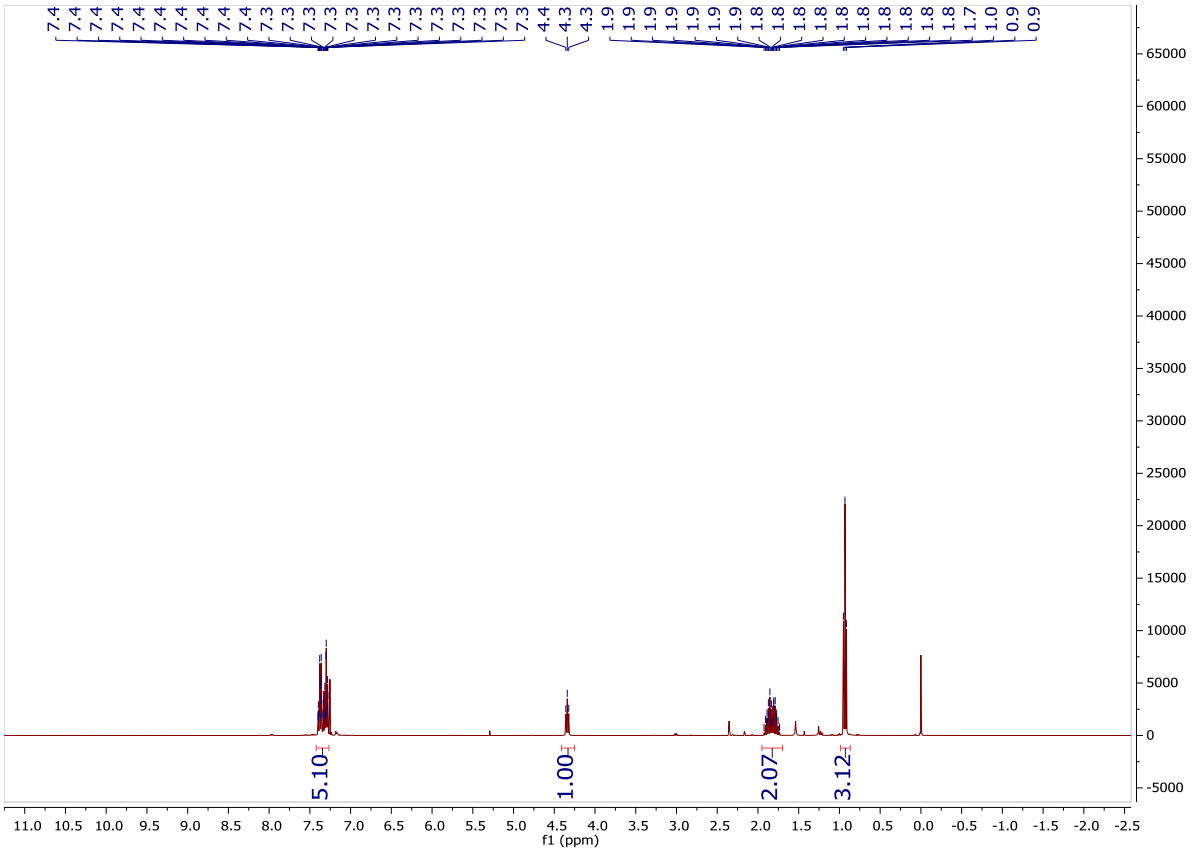


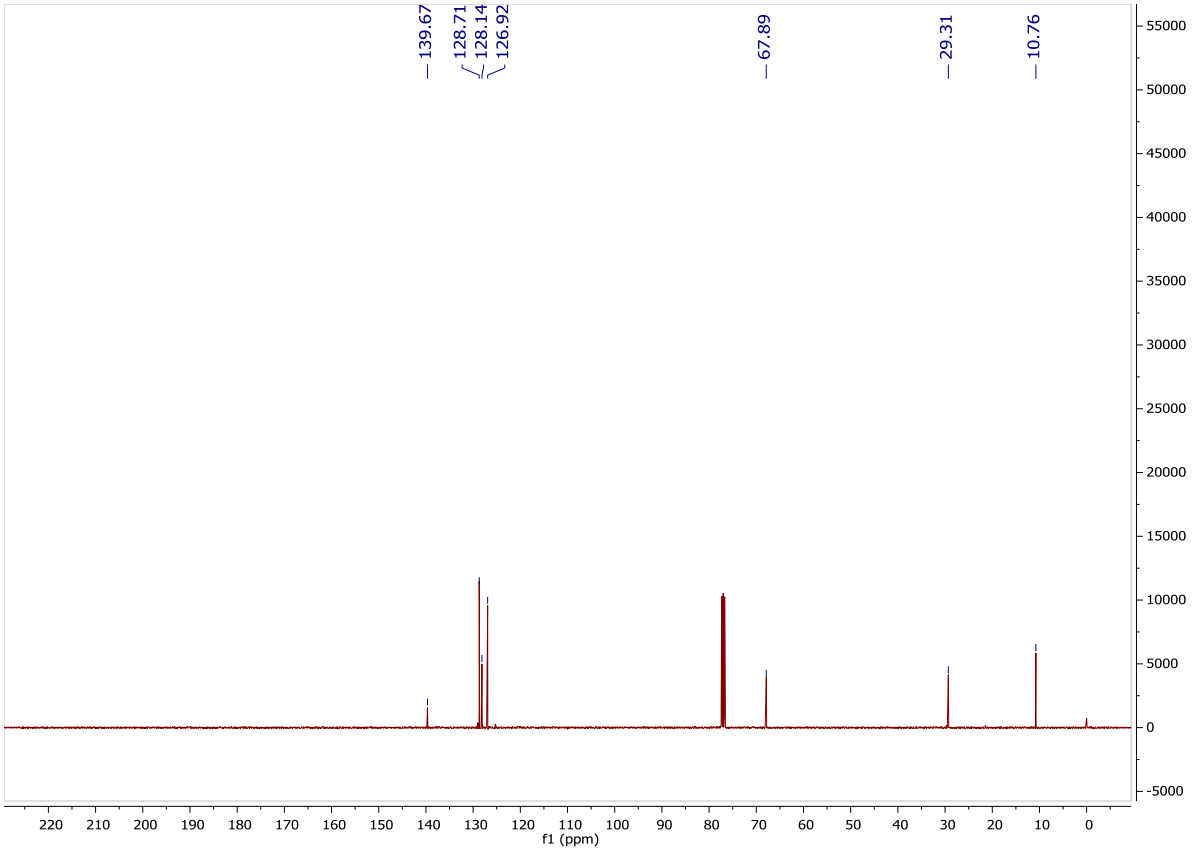
1-Phenyl-2-azidopropane



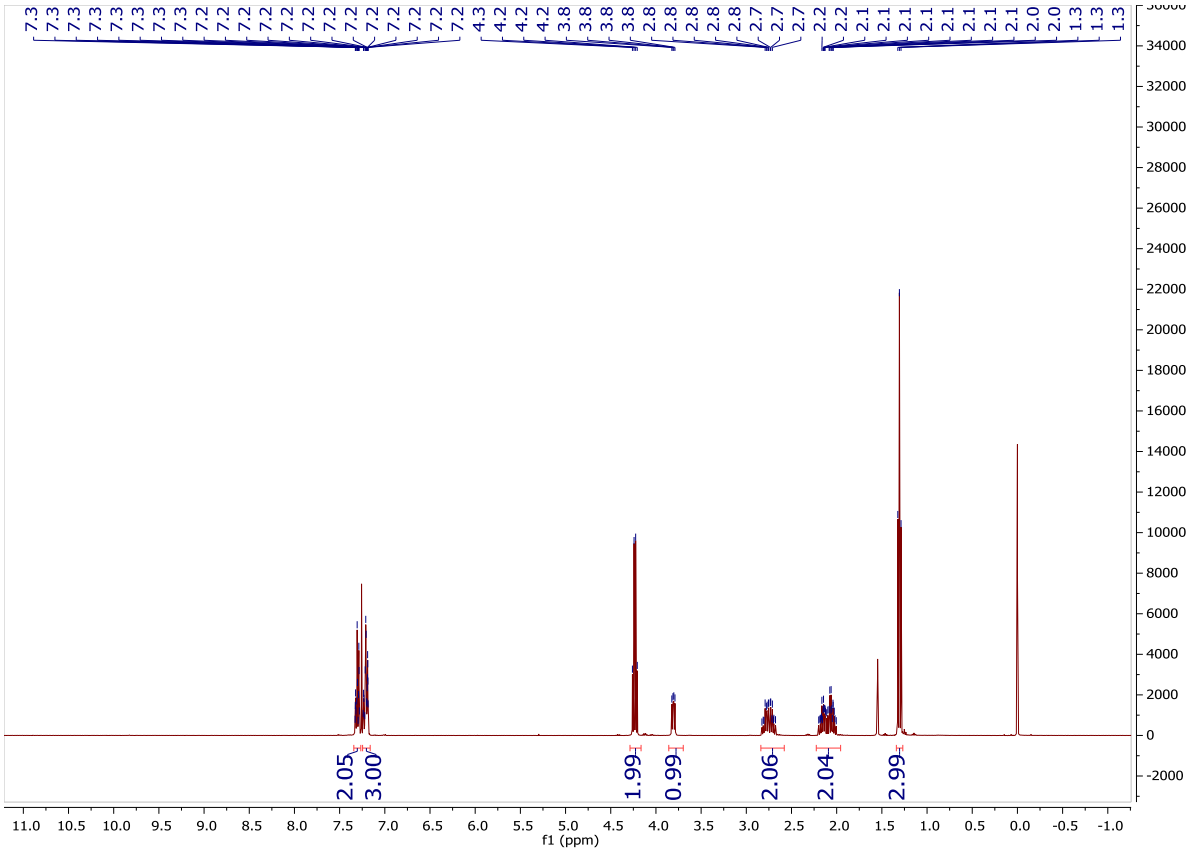


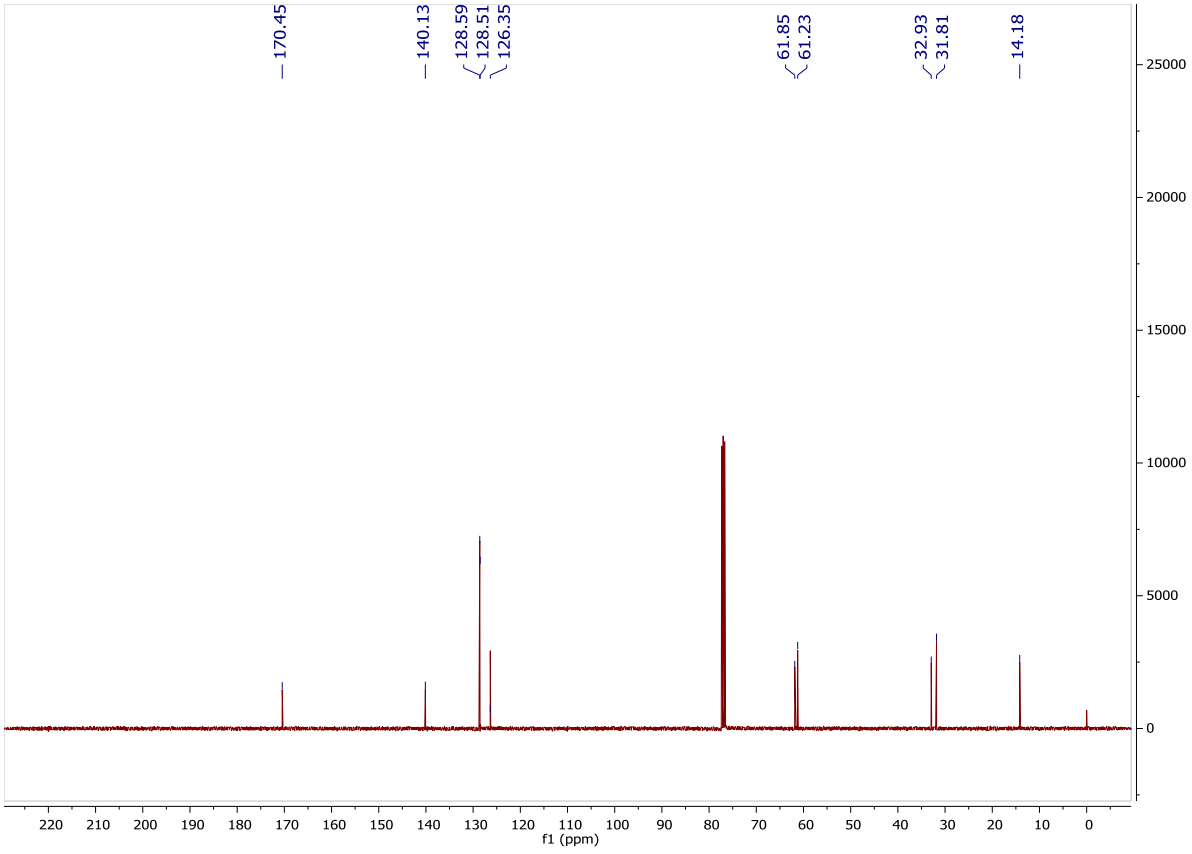
1-Phenyl-1-azidopropane



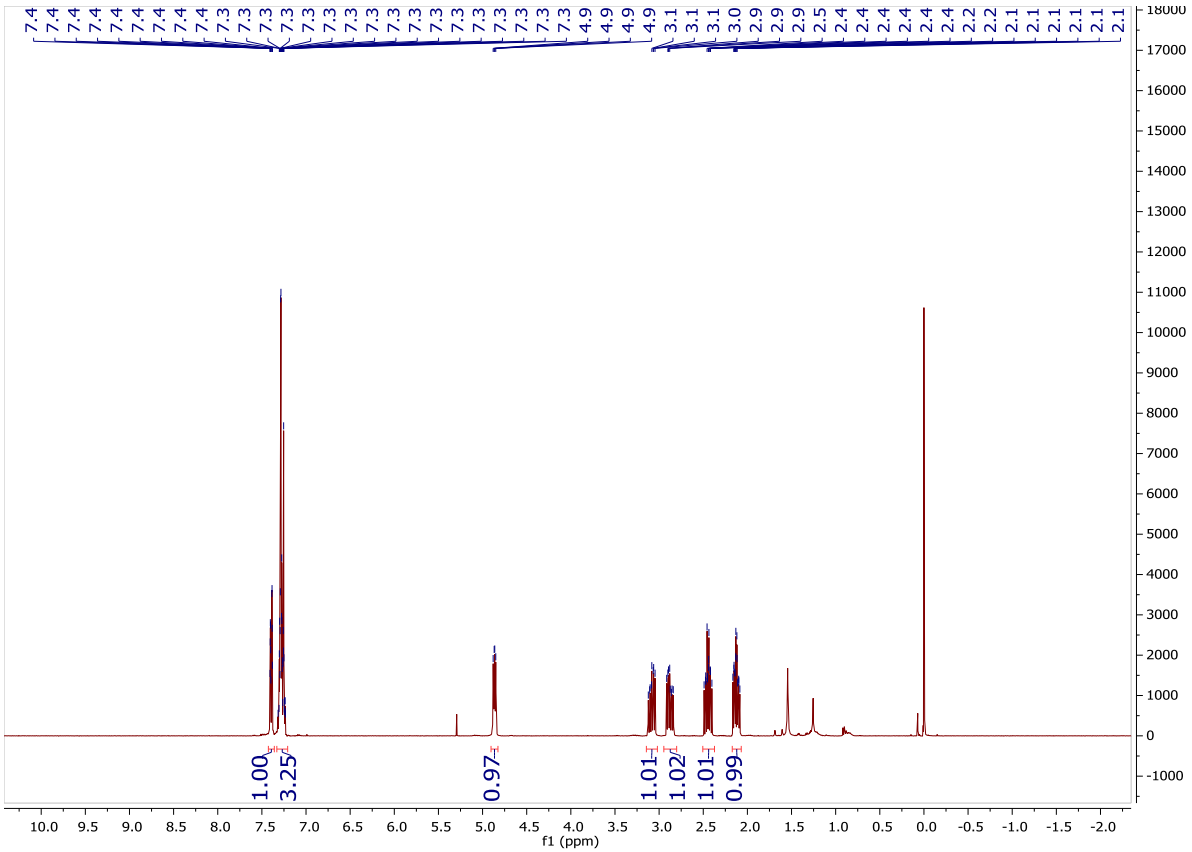


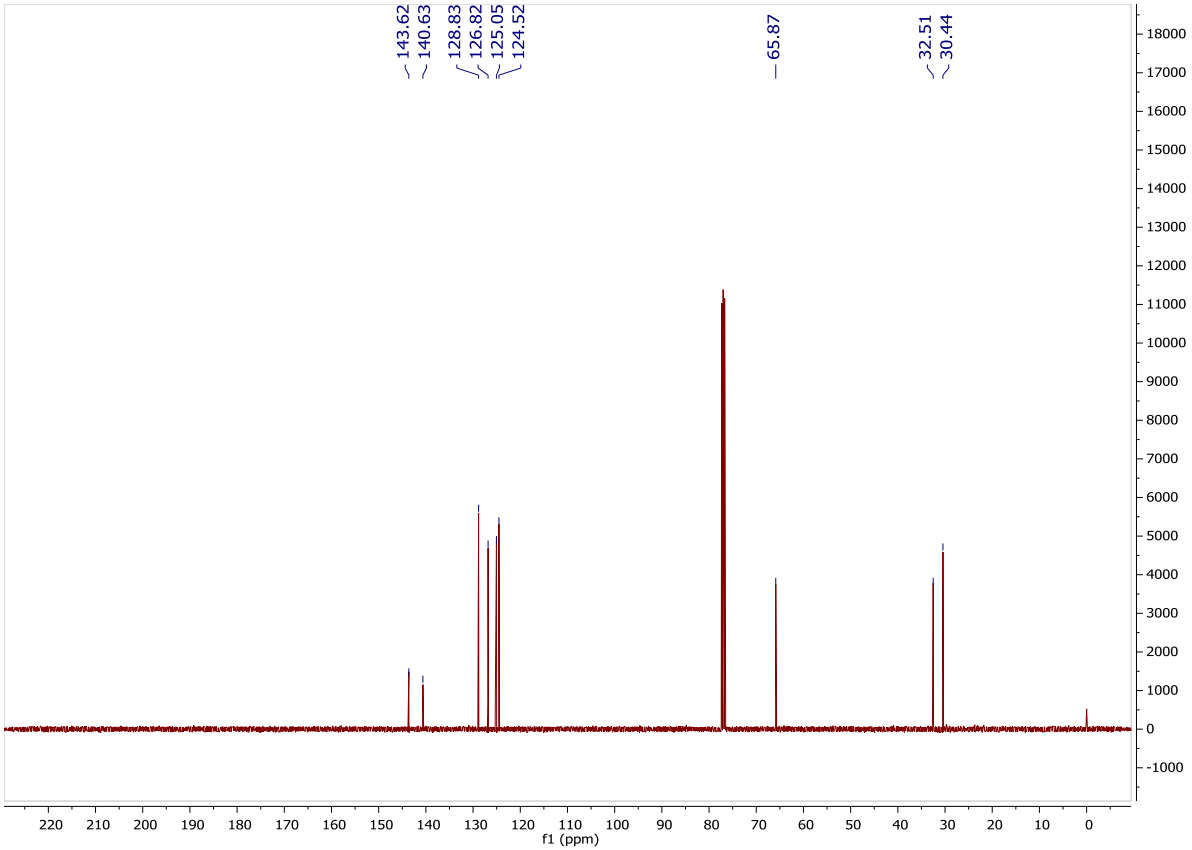
Ethyl (*S*)-2-azido-4-phenylbutanoate



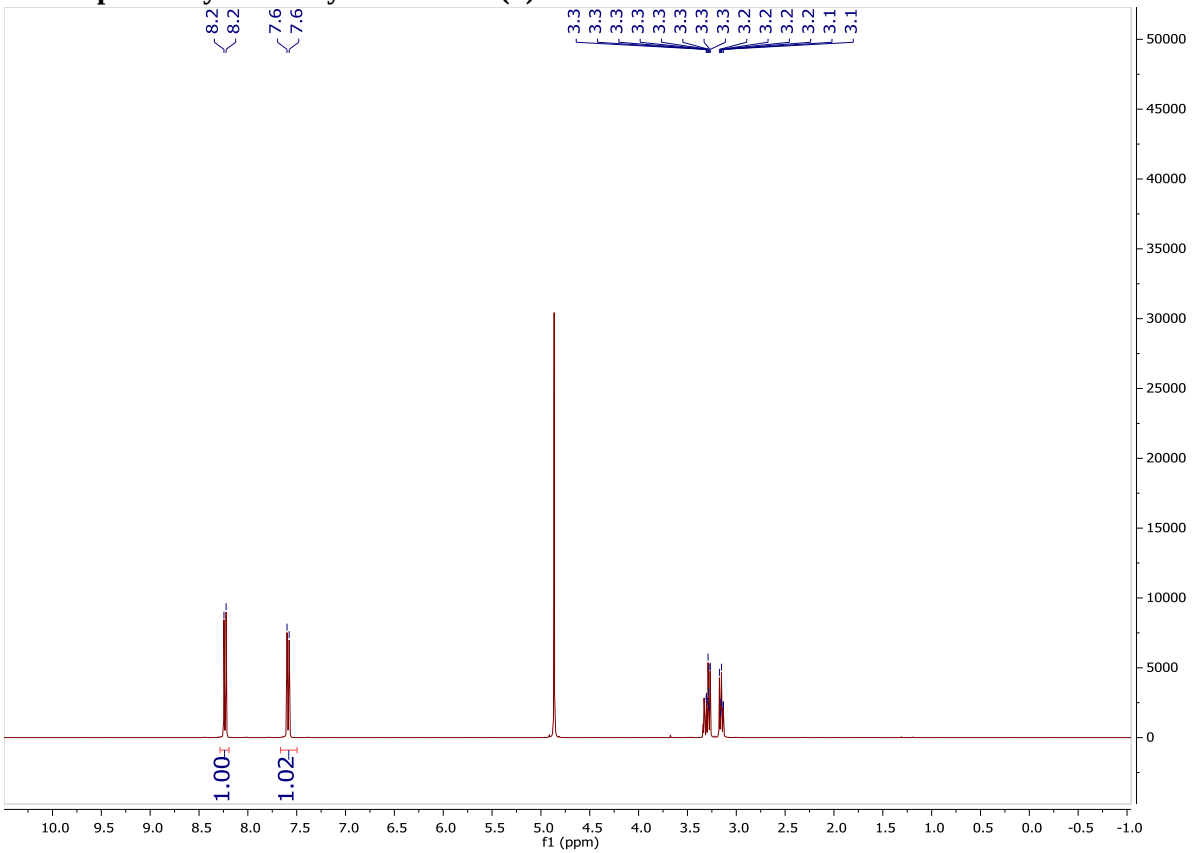


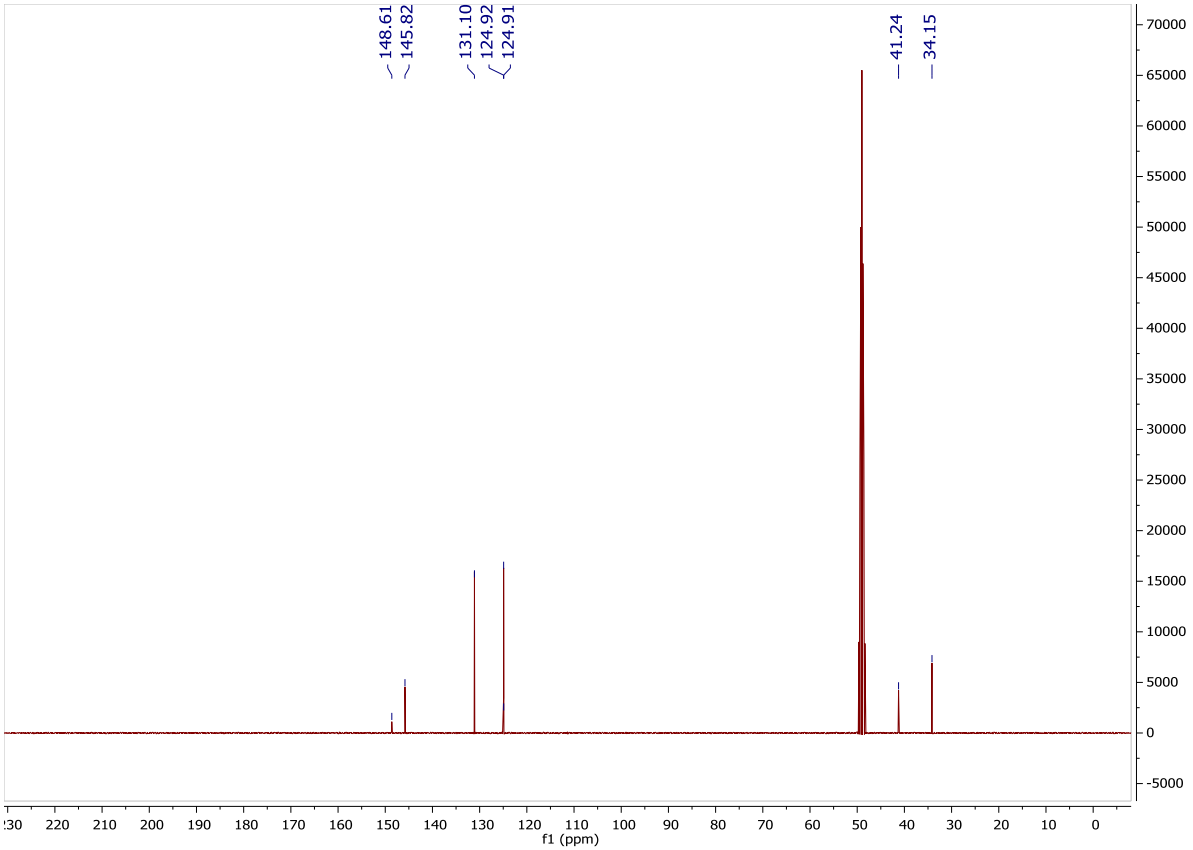
1-Azidoindane



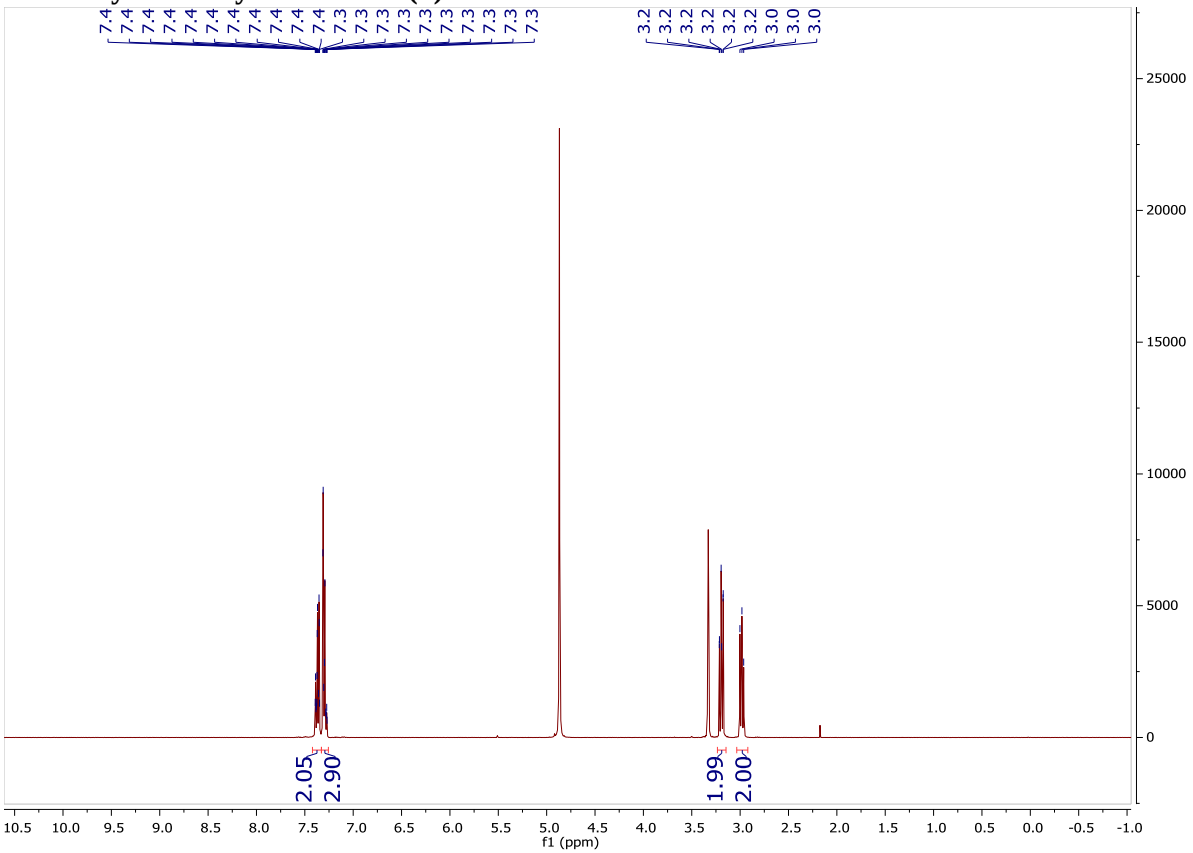


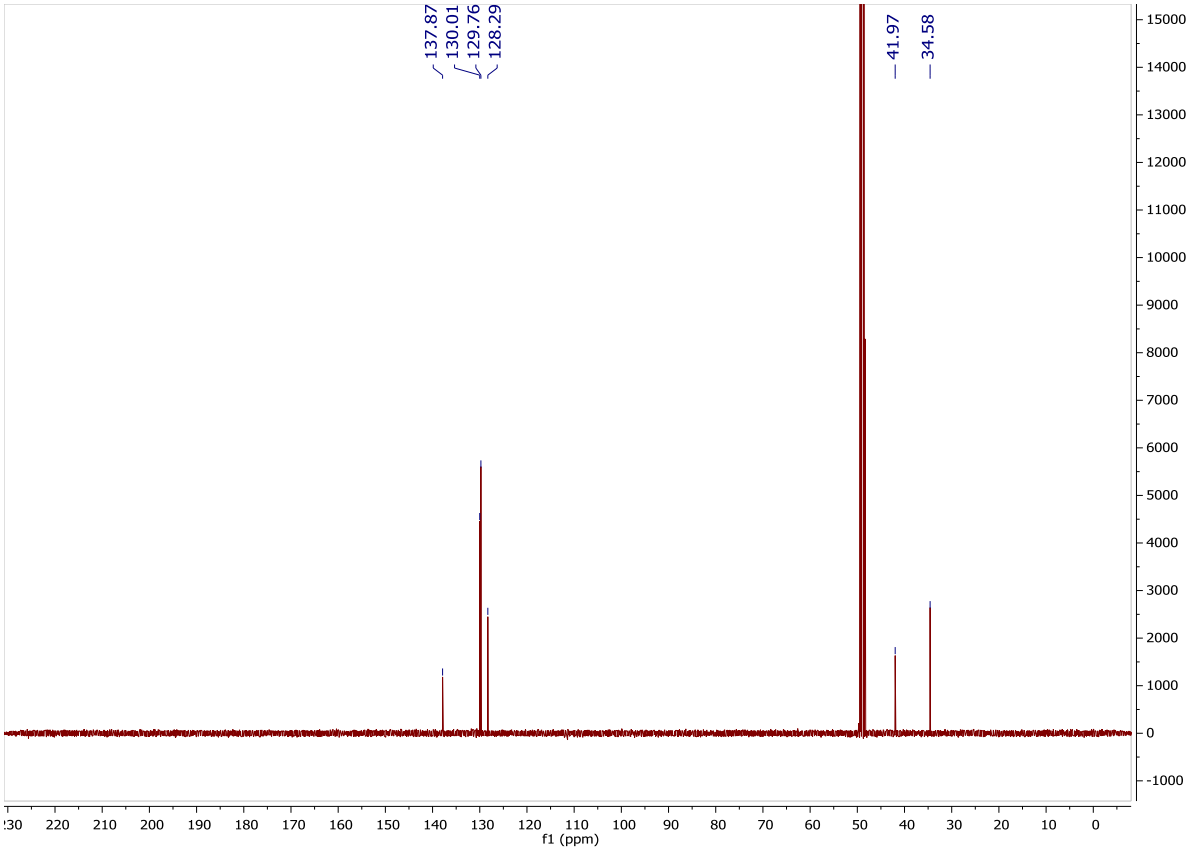
4-Nitrophenethylamine hydrochloride (1)



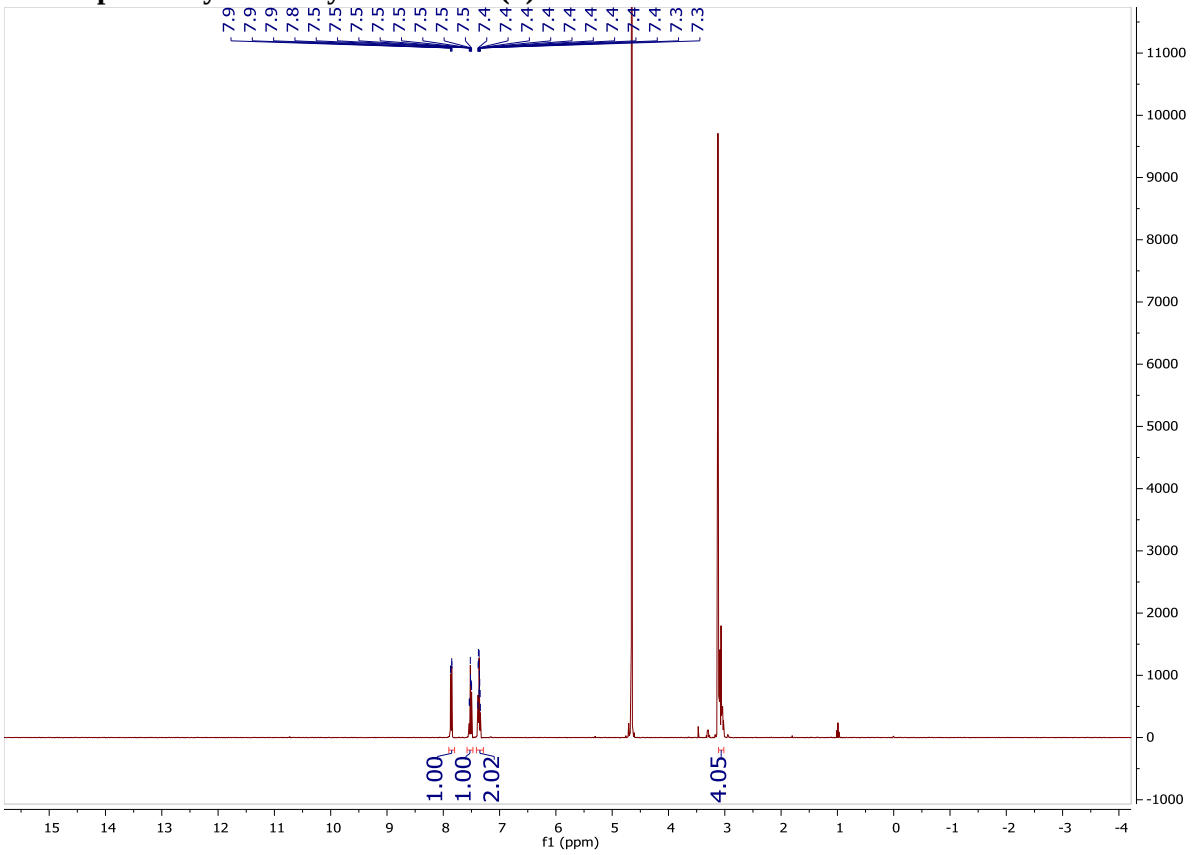


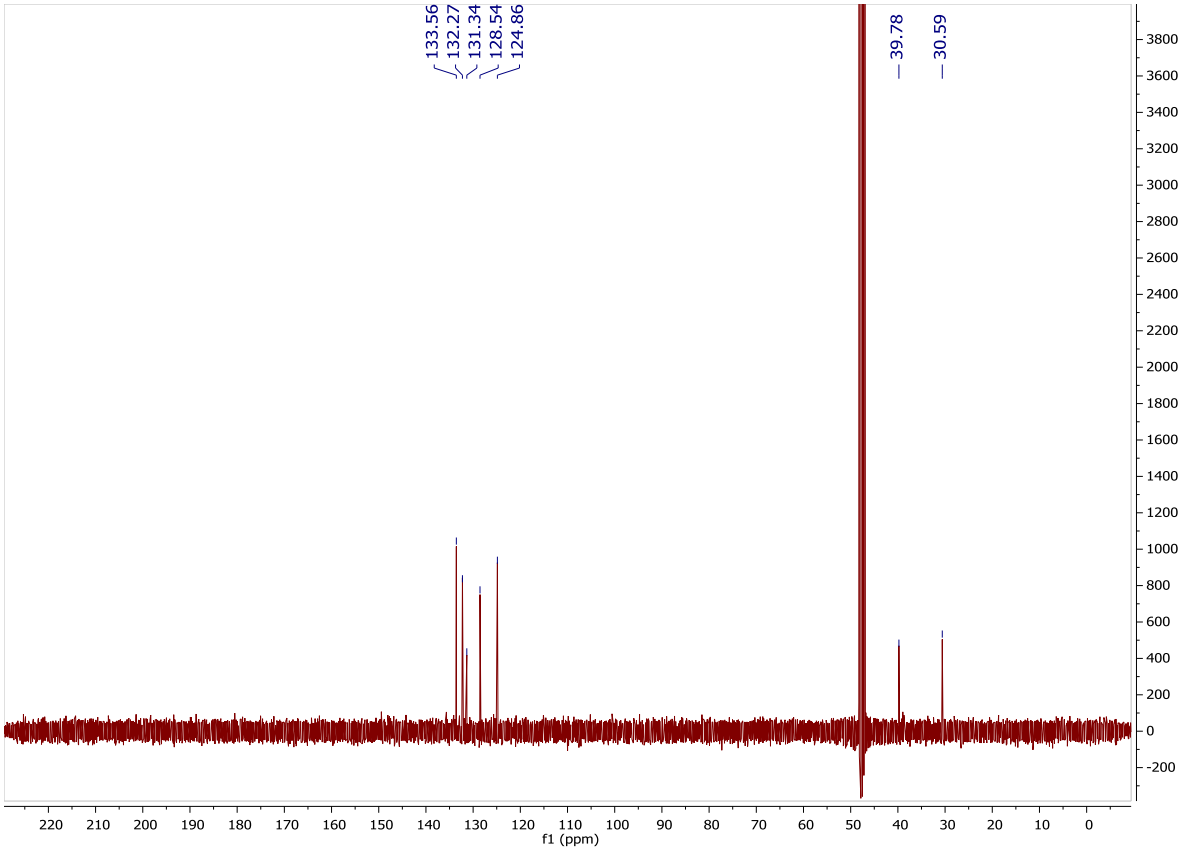
Phenethylamine hydrochloride (2)



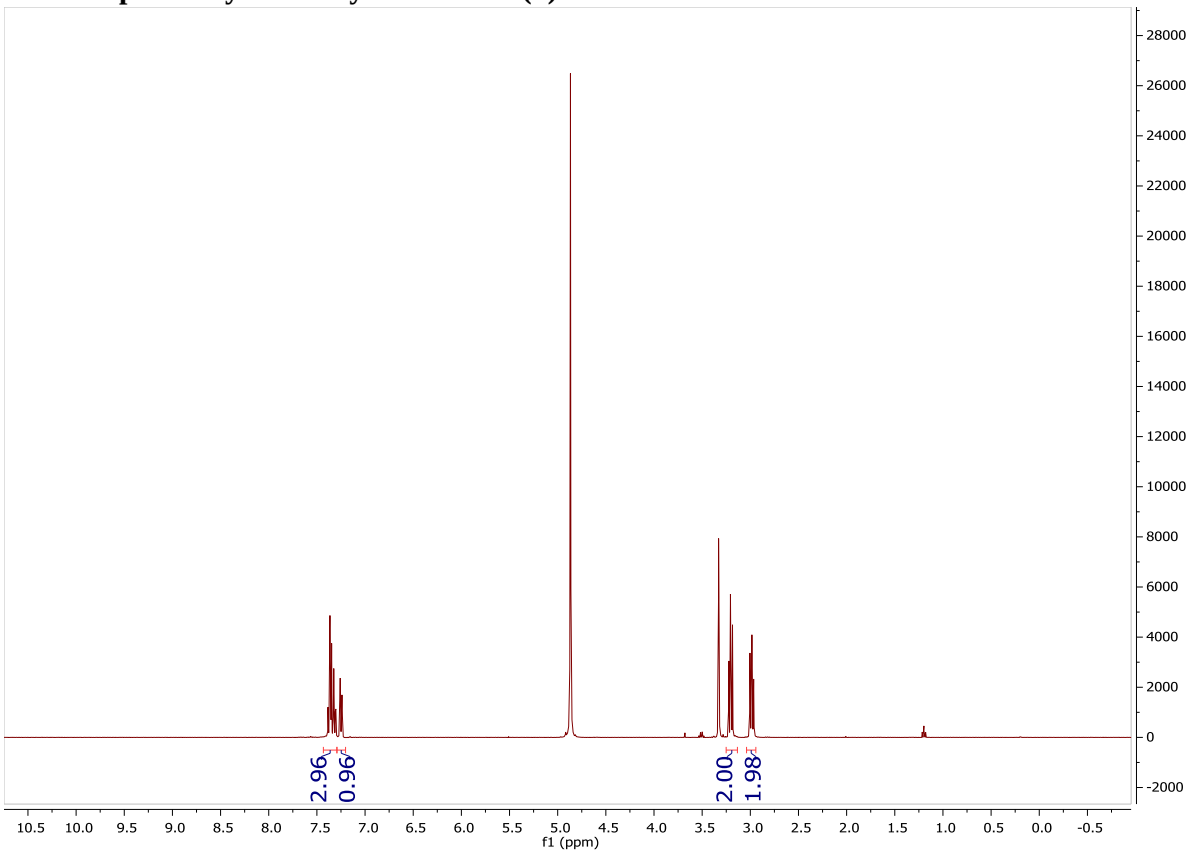


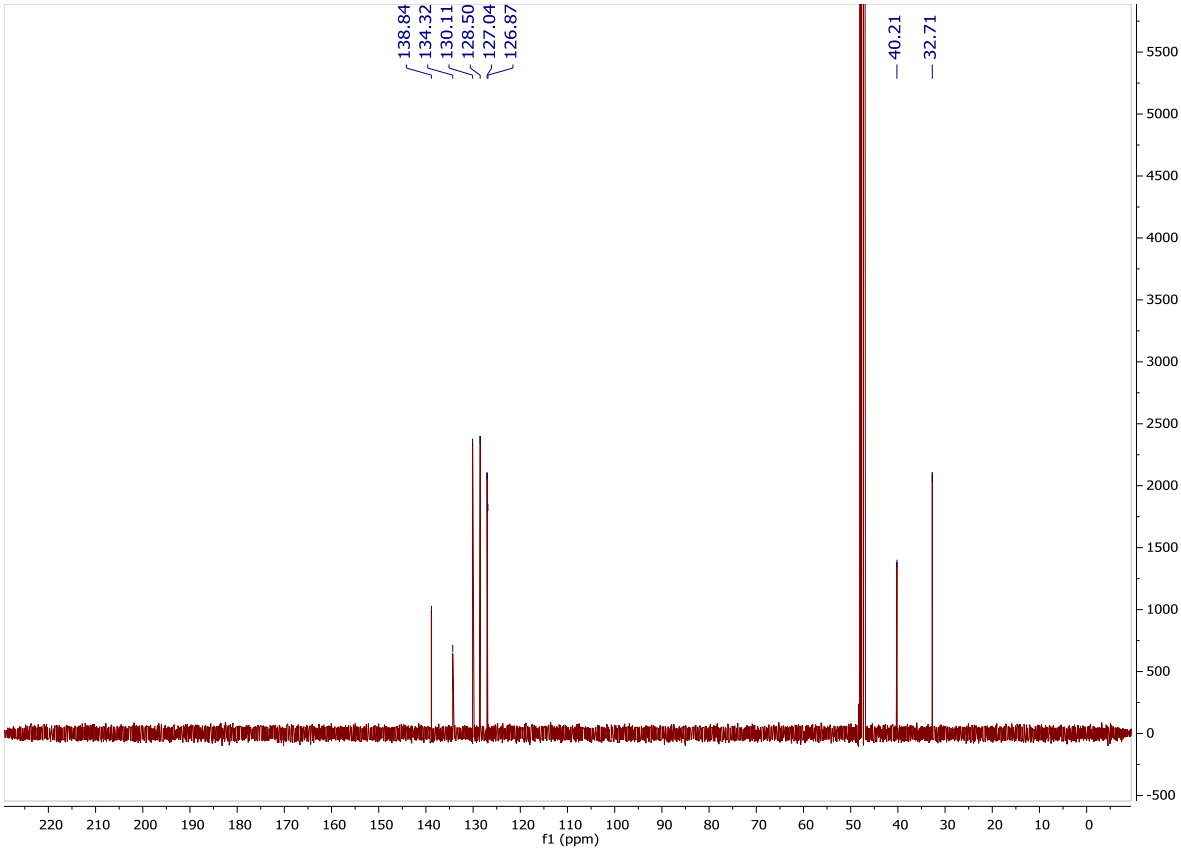
2-Nitrophenethylamine hydrochloride (3)



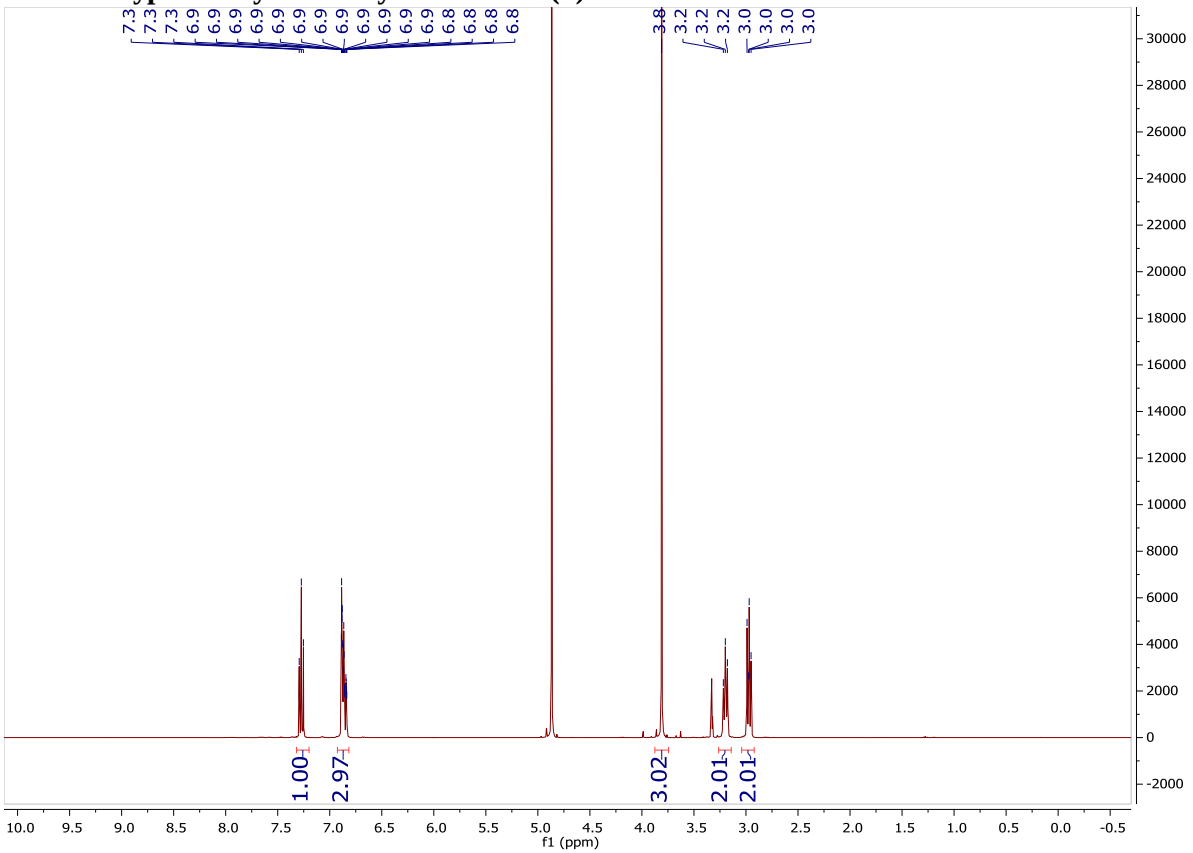


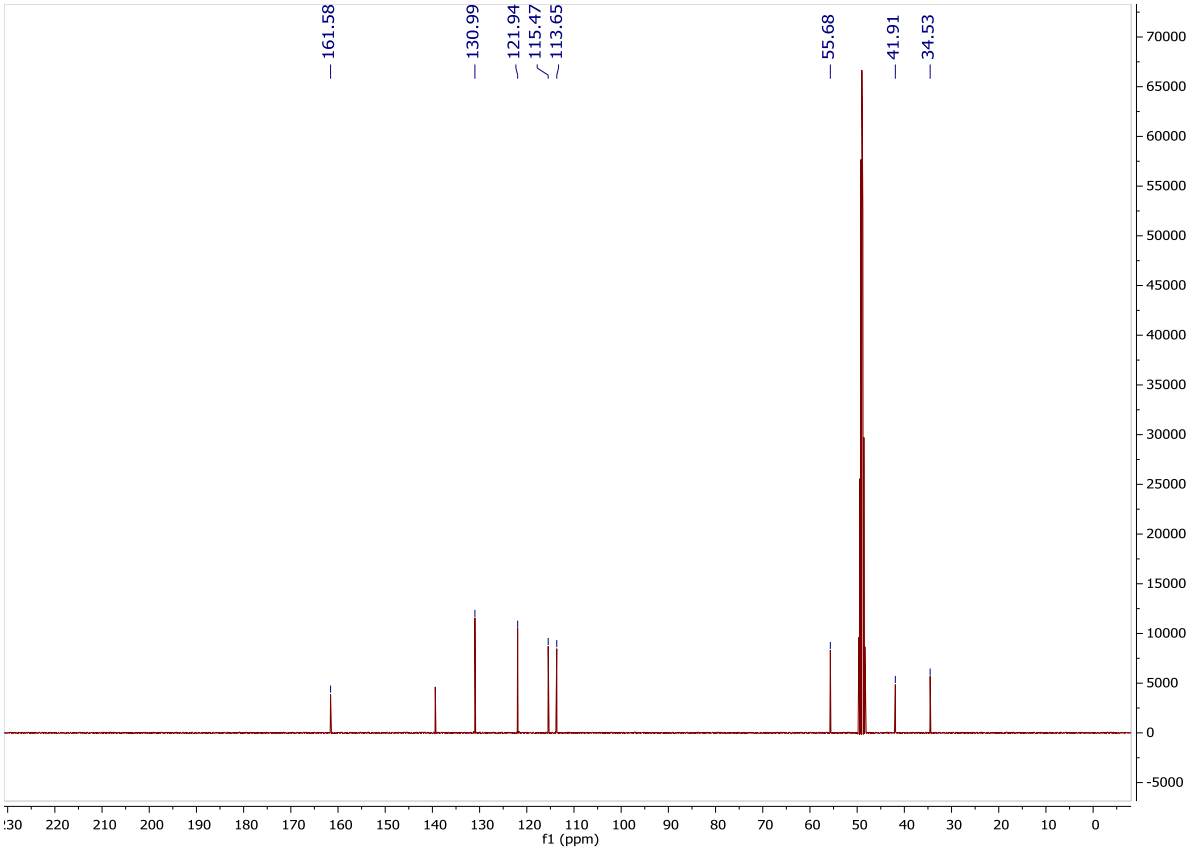
3-Chlorophenethylamine hydrochloride (4)



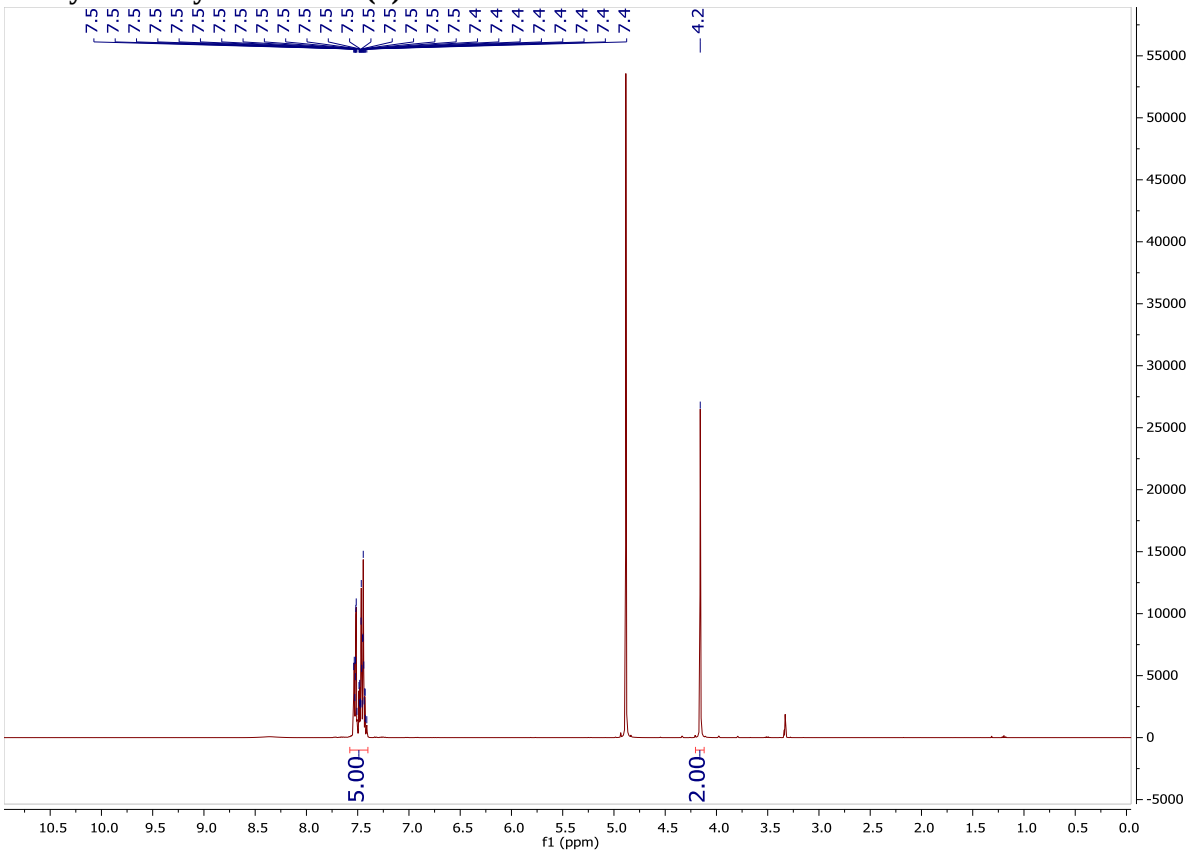


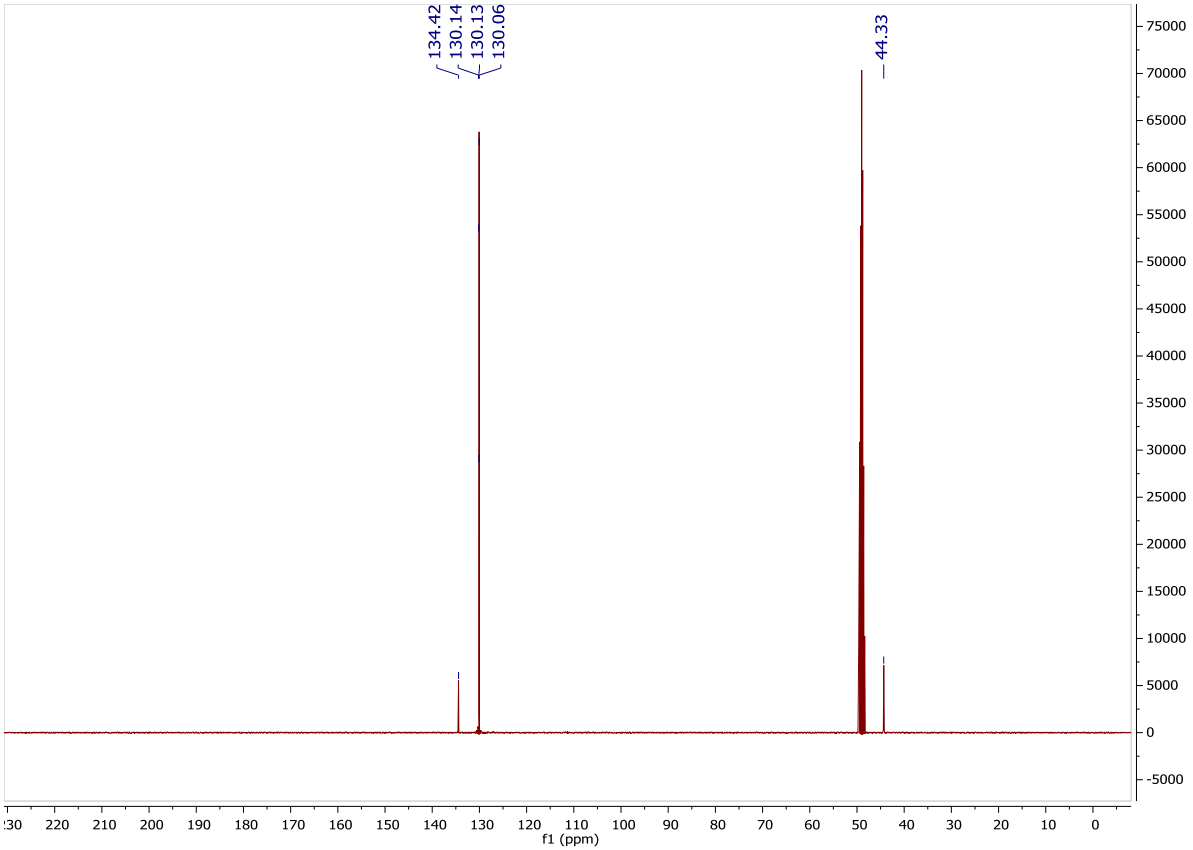
3-Methoxyphenethylamine hydrochloride (5)



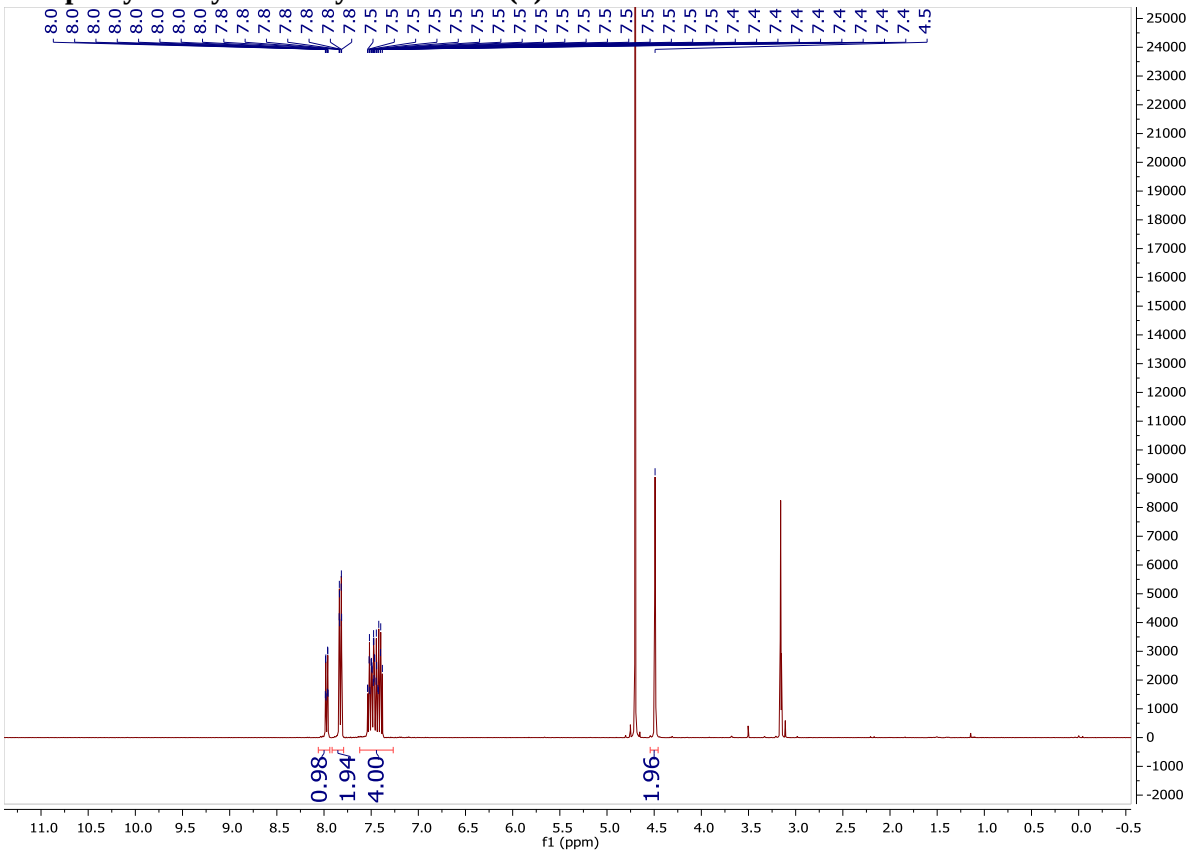


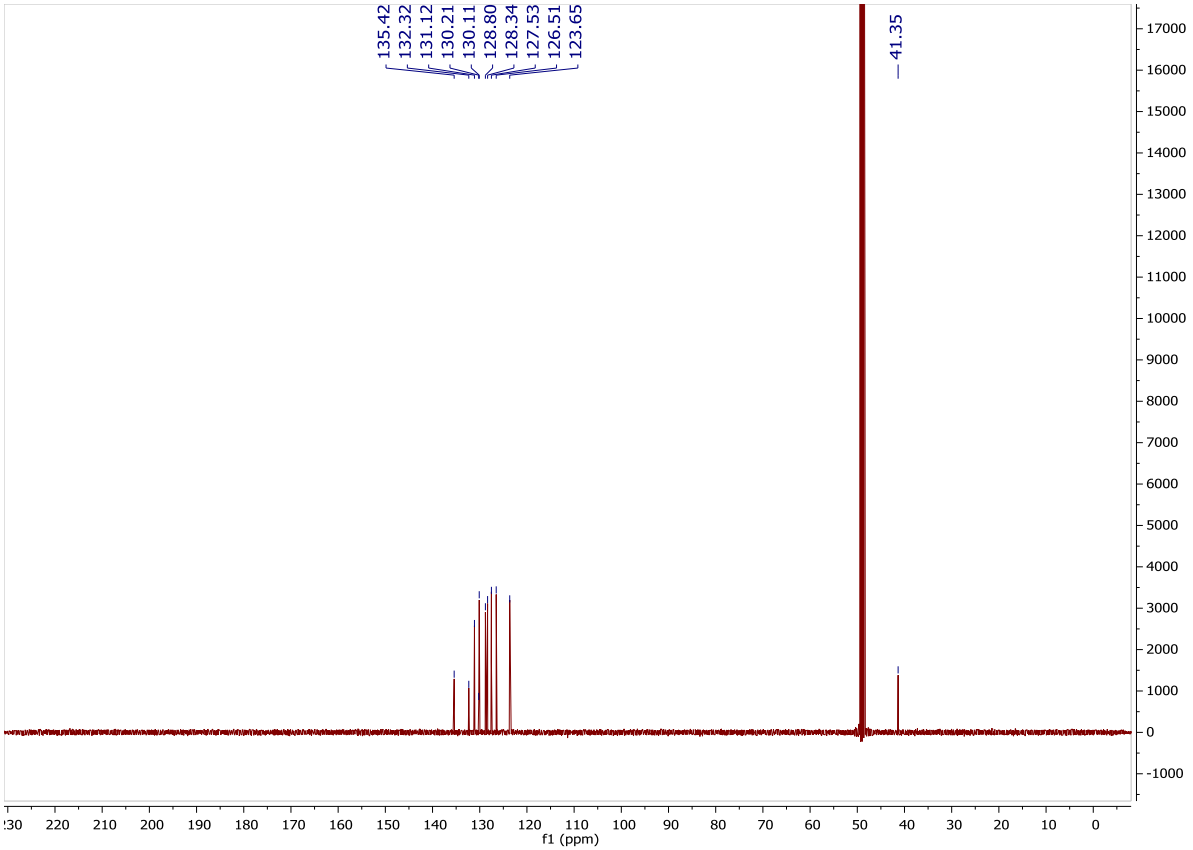
Benzylamine hydrochloride (6)



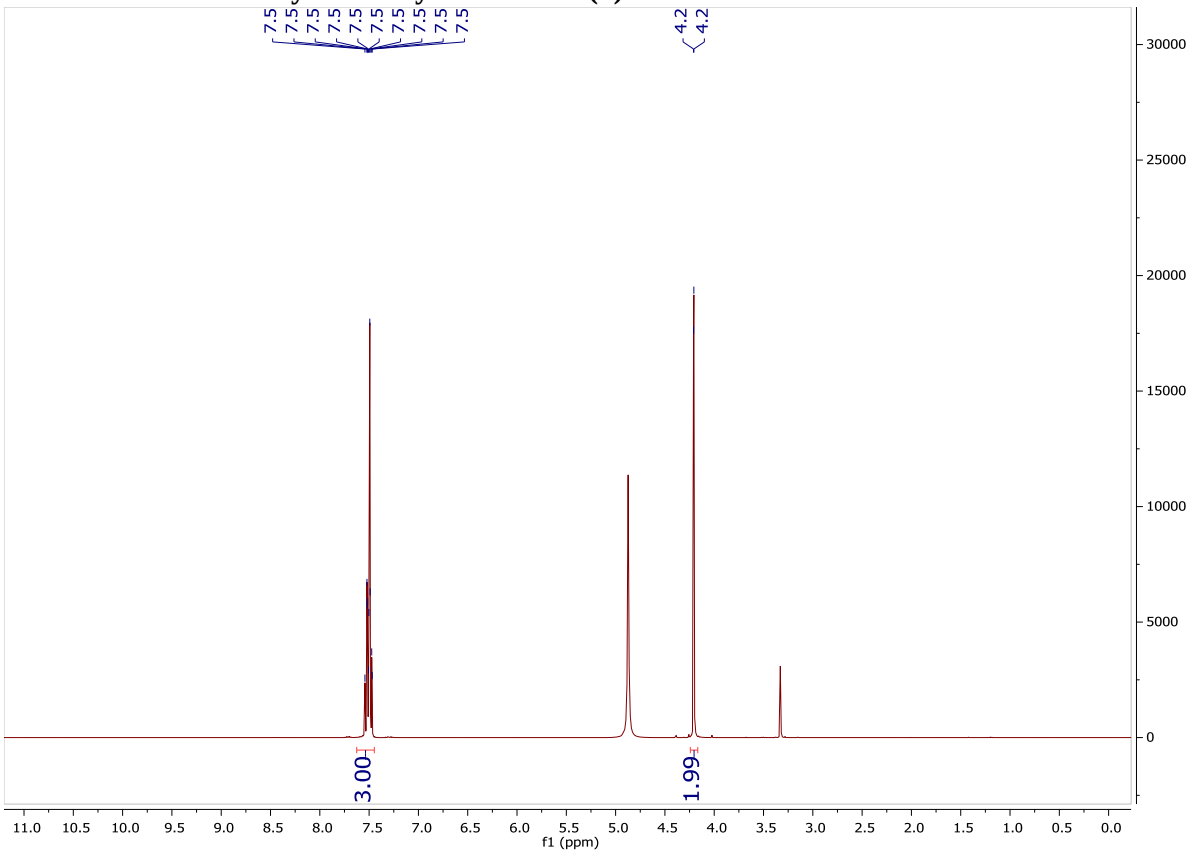


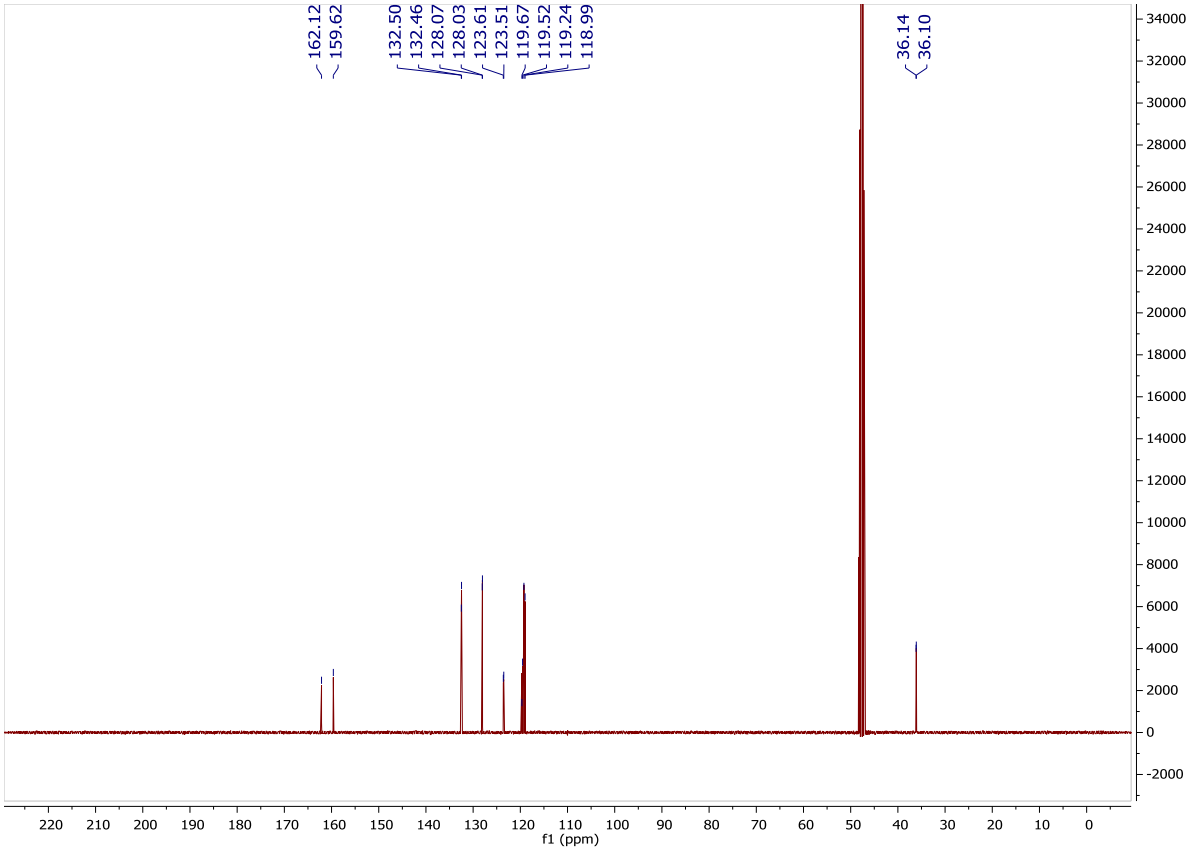
1-Naphthylmethylamine hydrochloride (7)



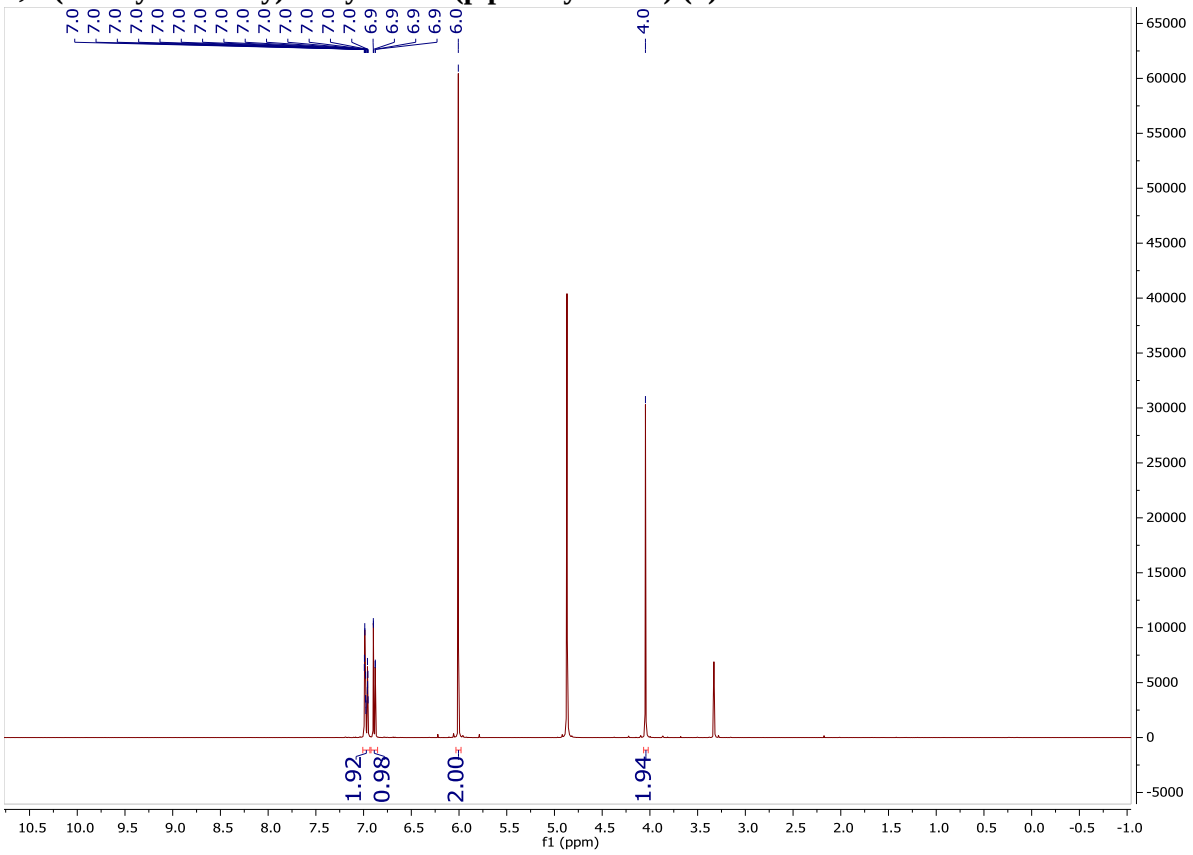


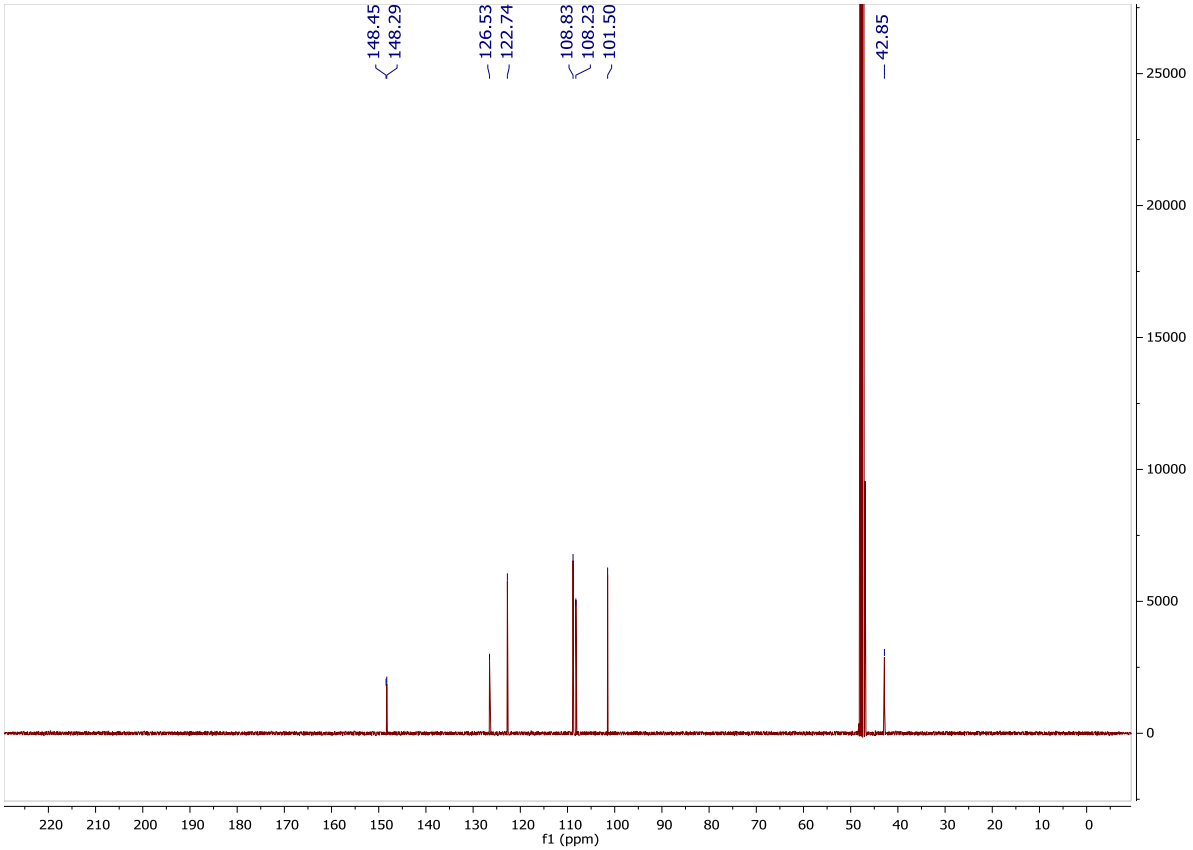
4-Bromo-2-fluorobenzylamine hydrochloride (8)



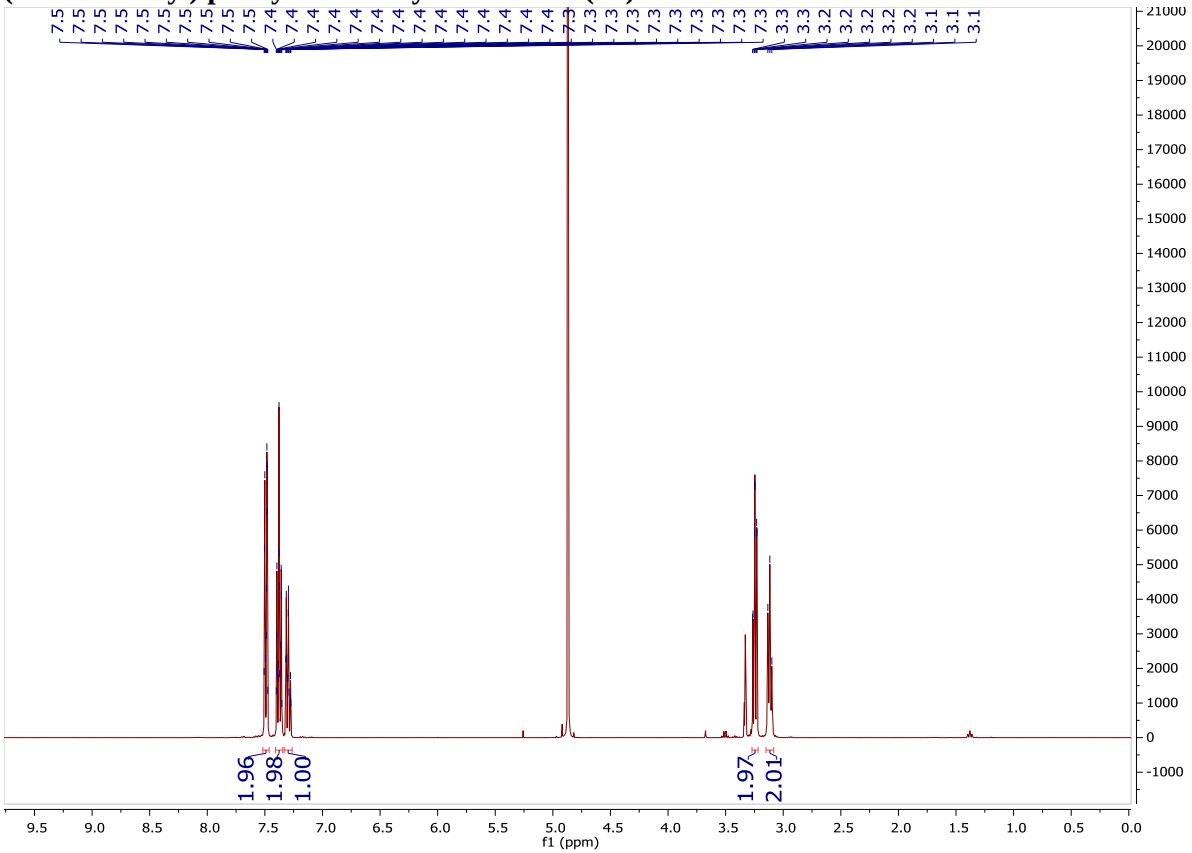


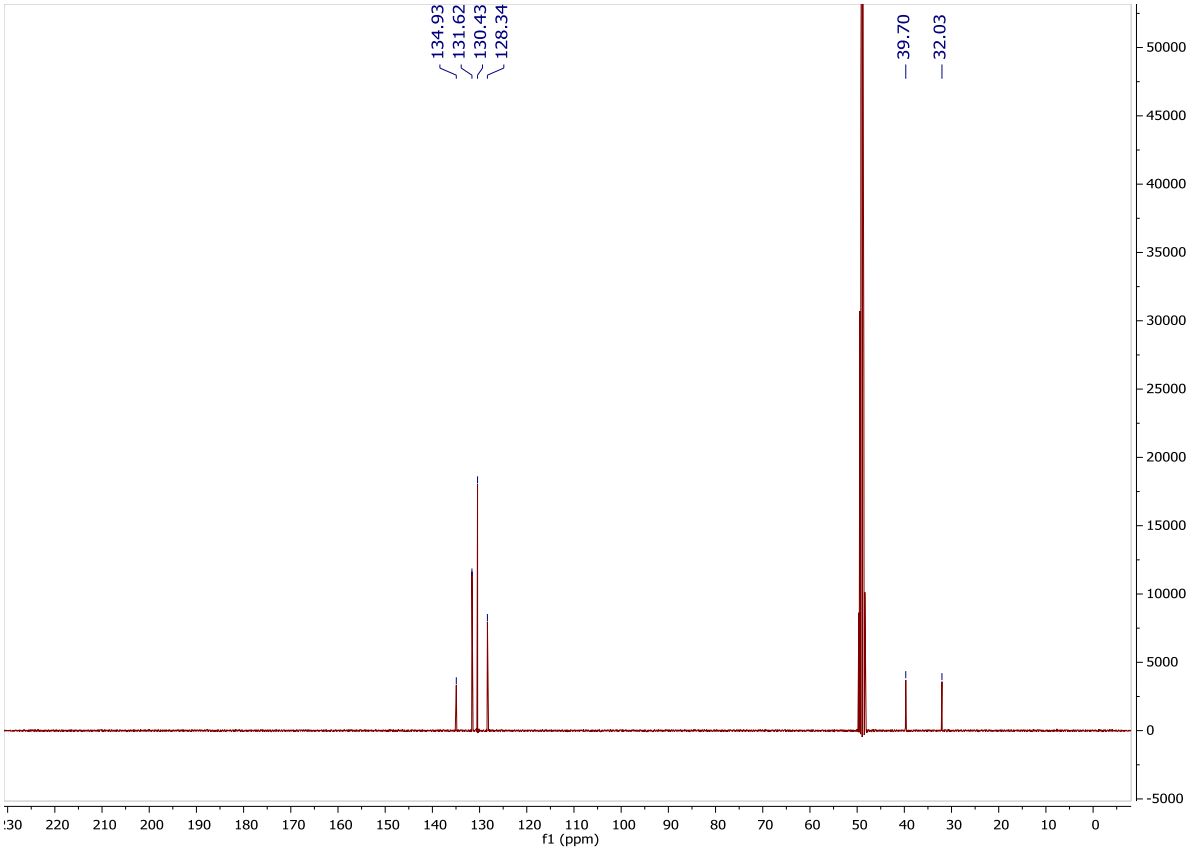
3,4-(Methylenedioxy)benzylamine (piperonylamine) (9)



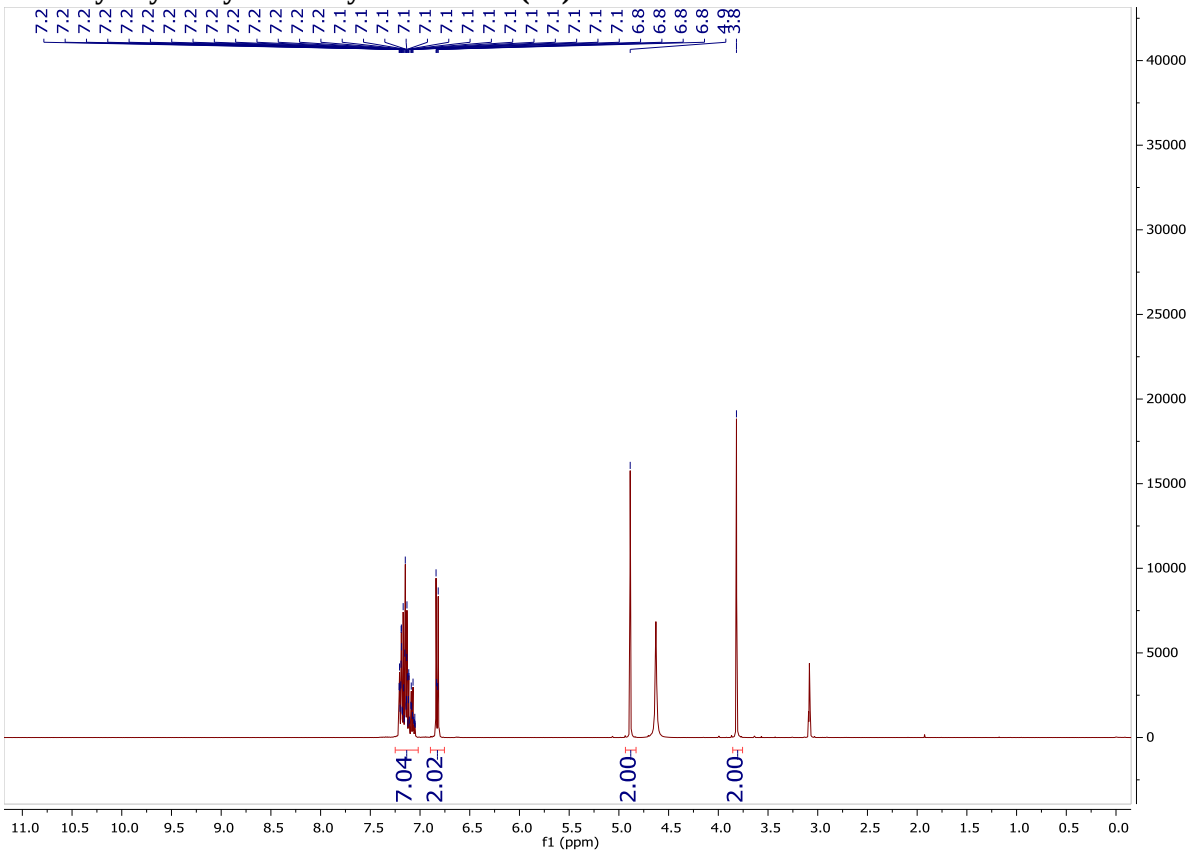


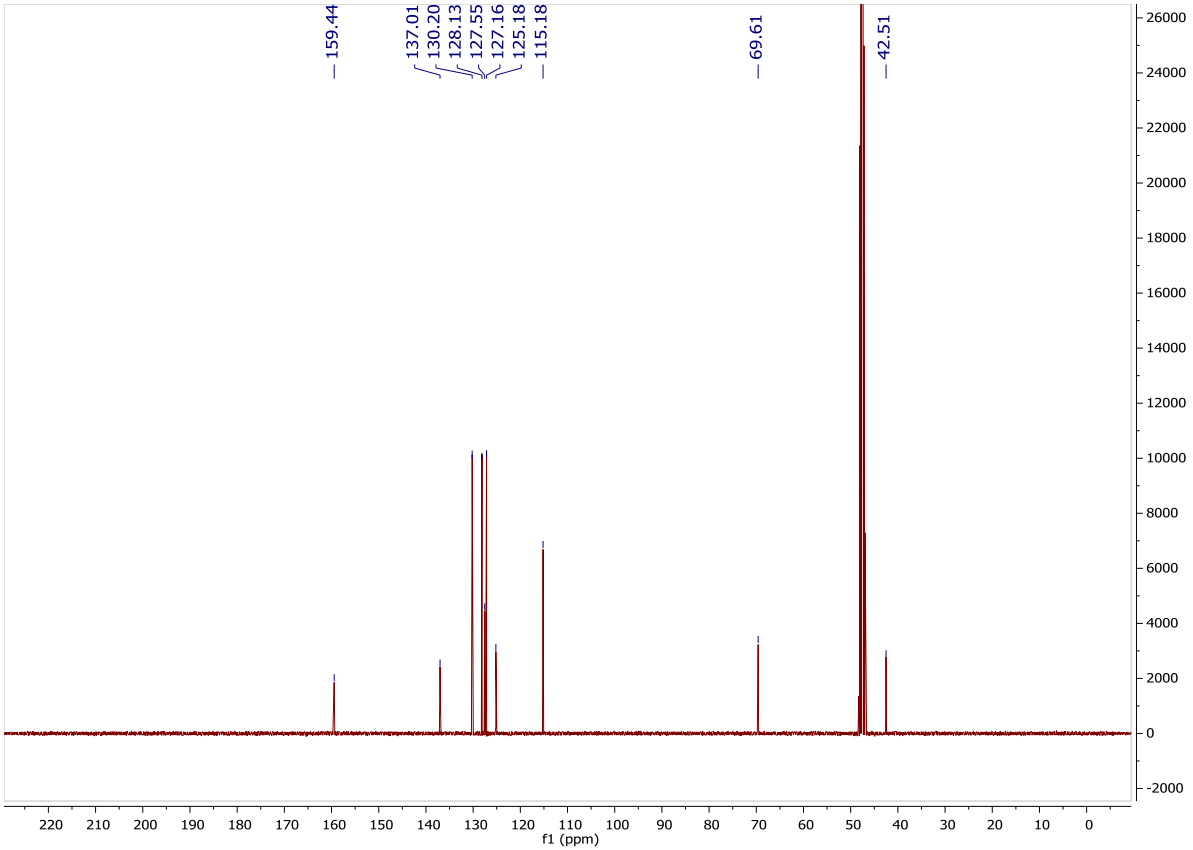
(2-Aminoethyl) phenyl sulfide hydrochloride (10)



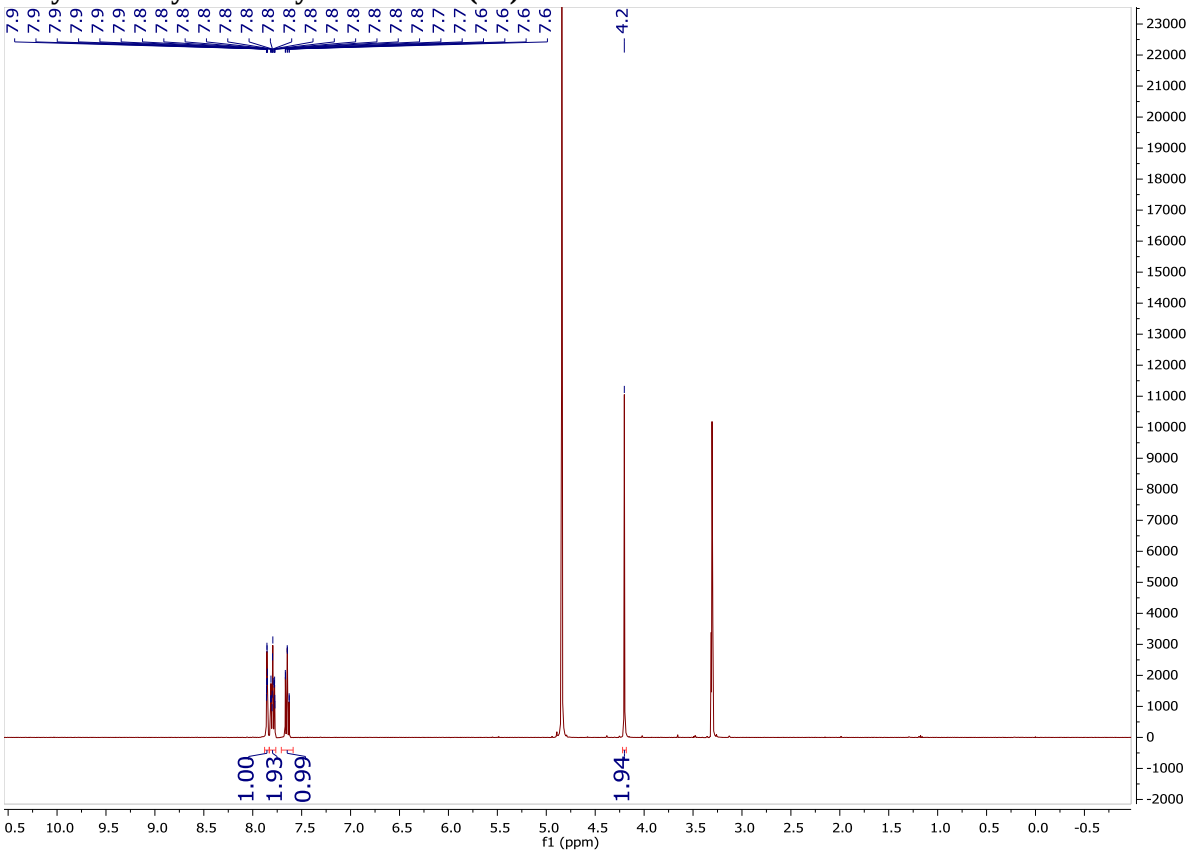


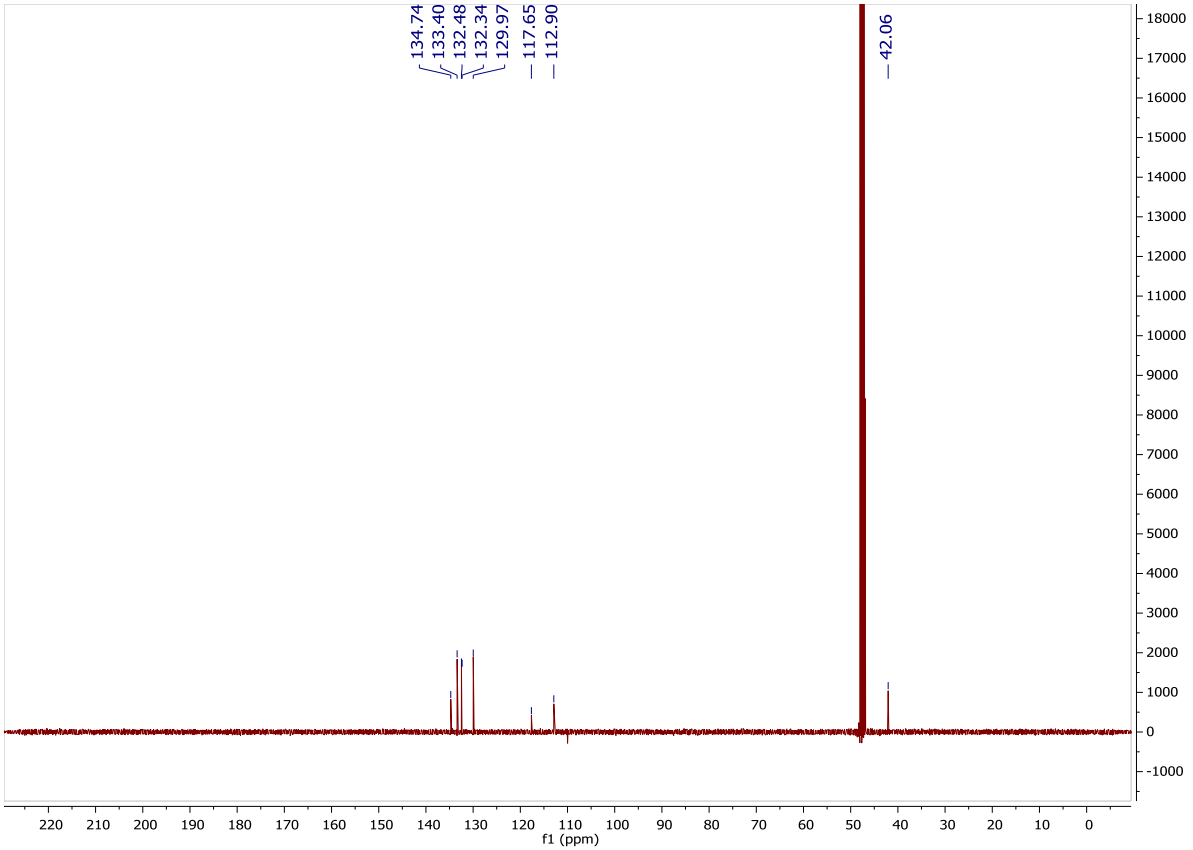
4-Benzyloxybenzylamine hydrochloride (11)



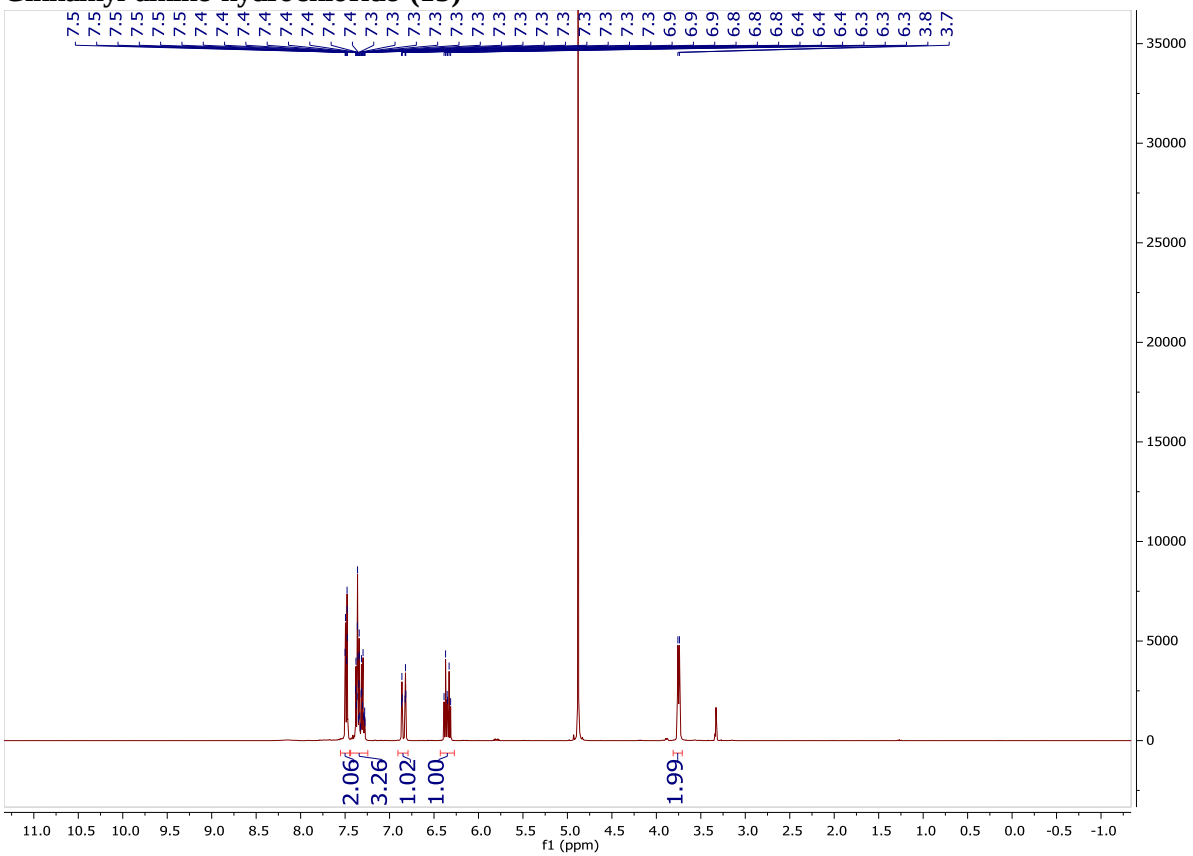


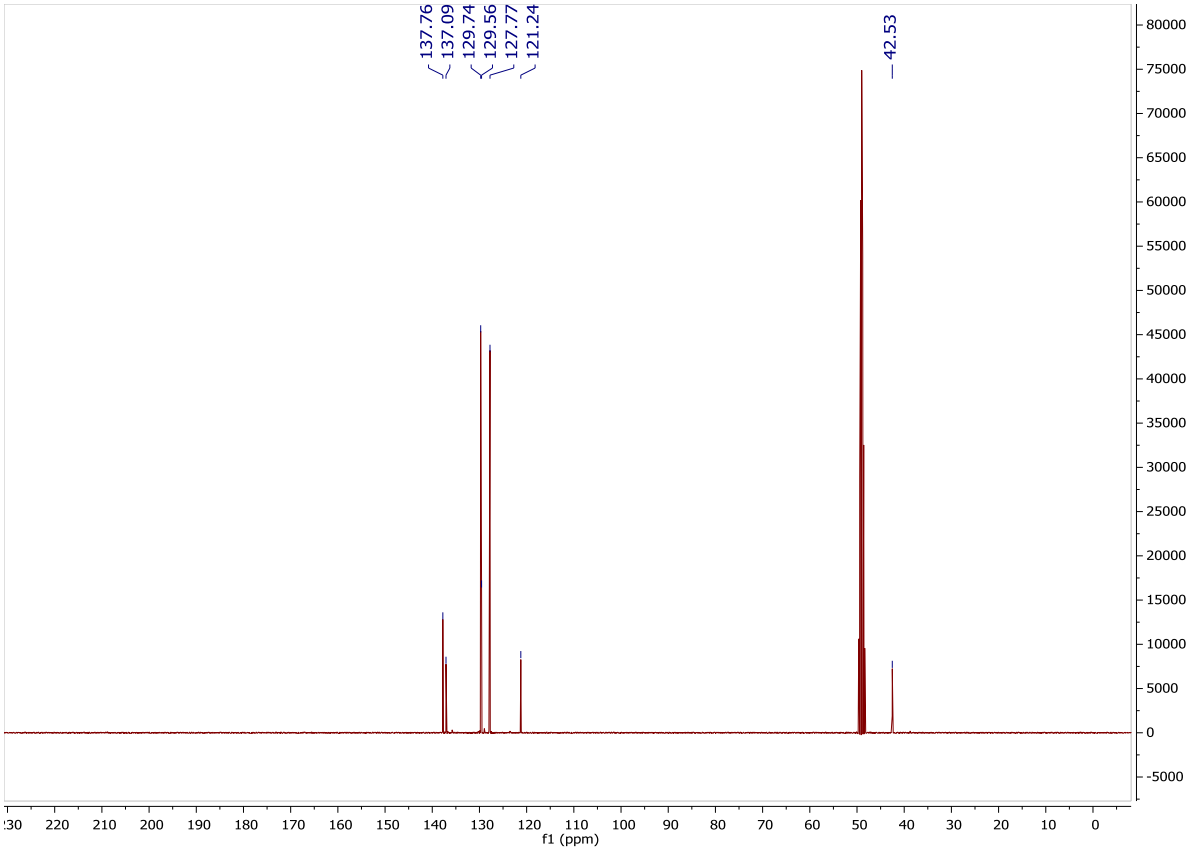
3-Cyanobenzylamine hydrochloride (12)



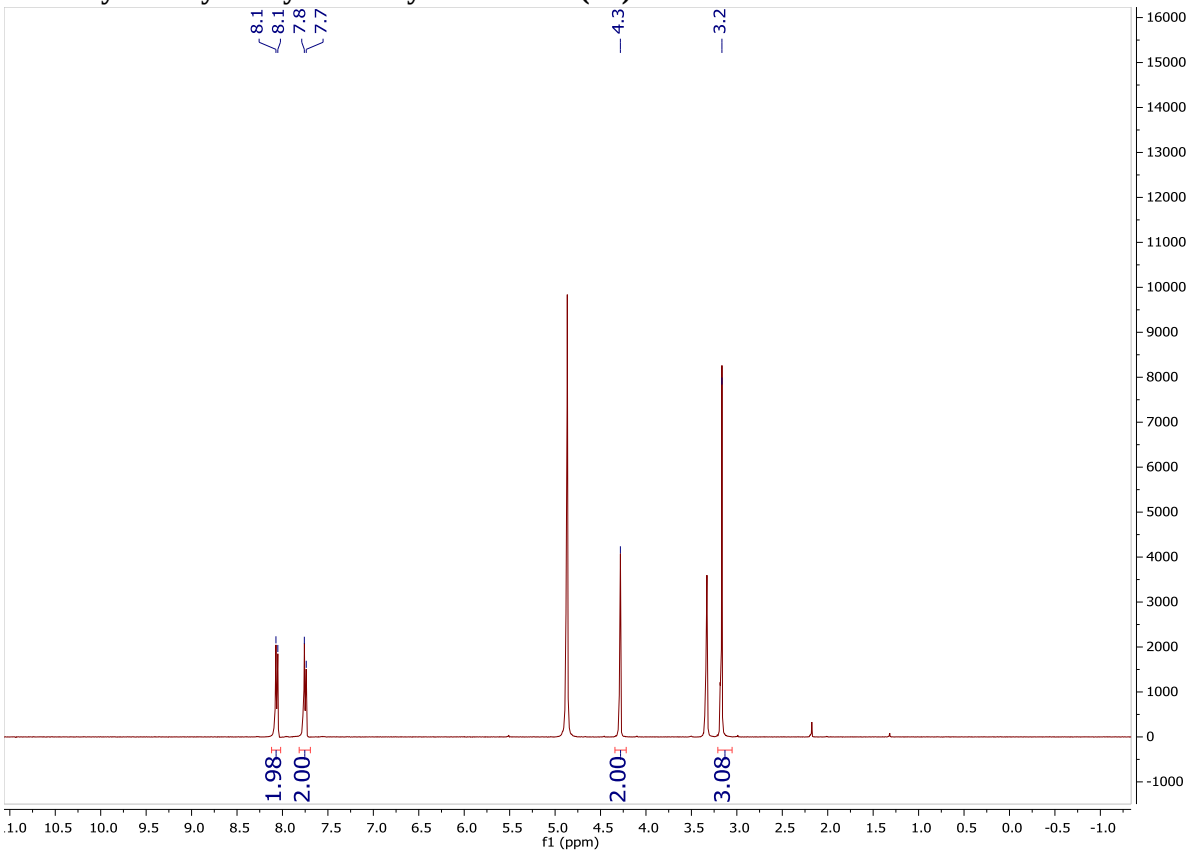


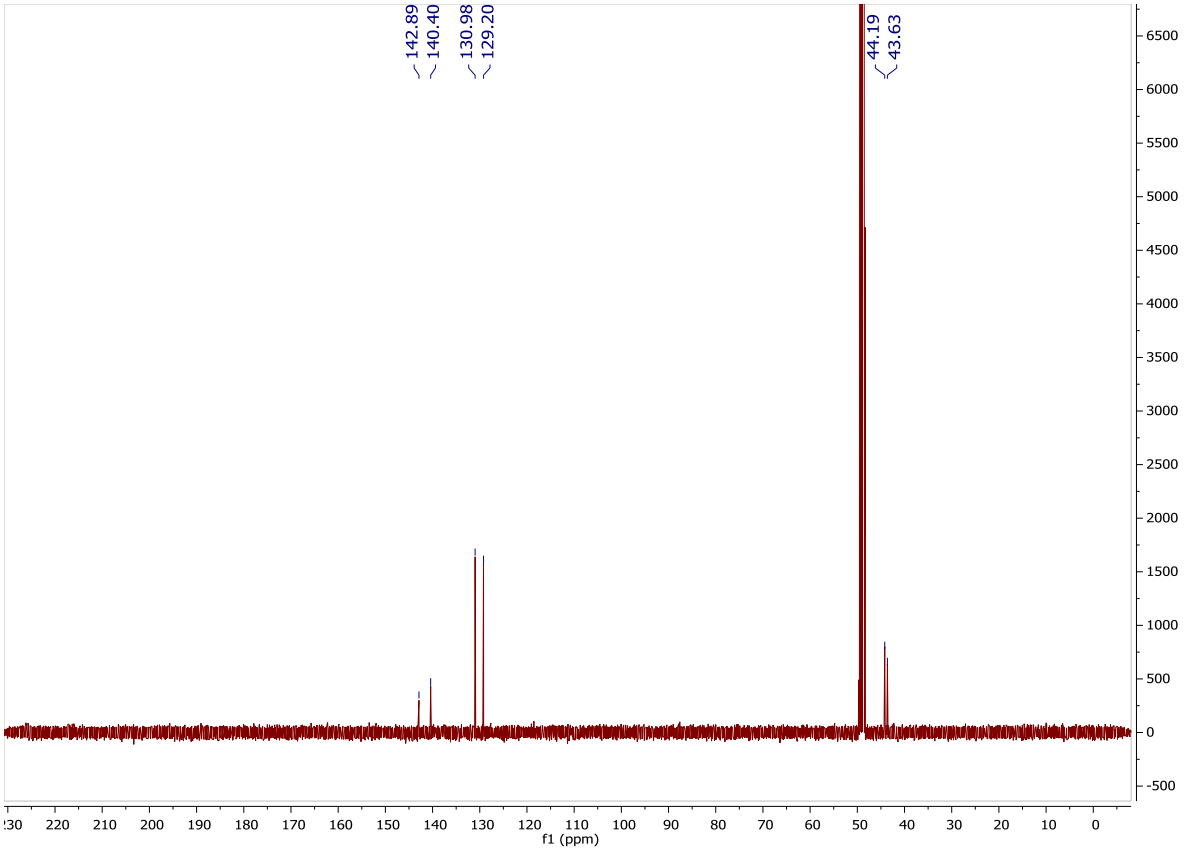
Cinnamyl amine hydrochloride (13)



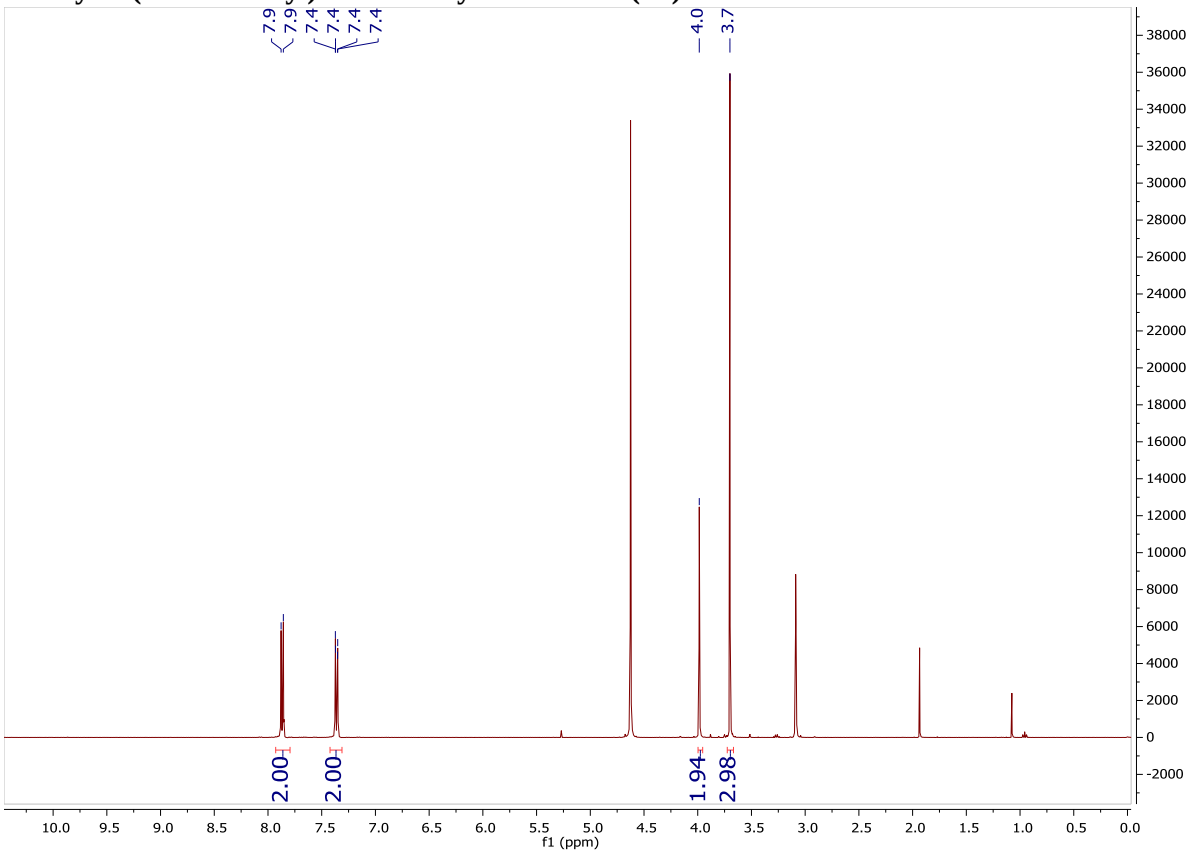


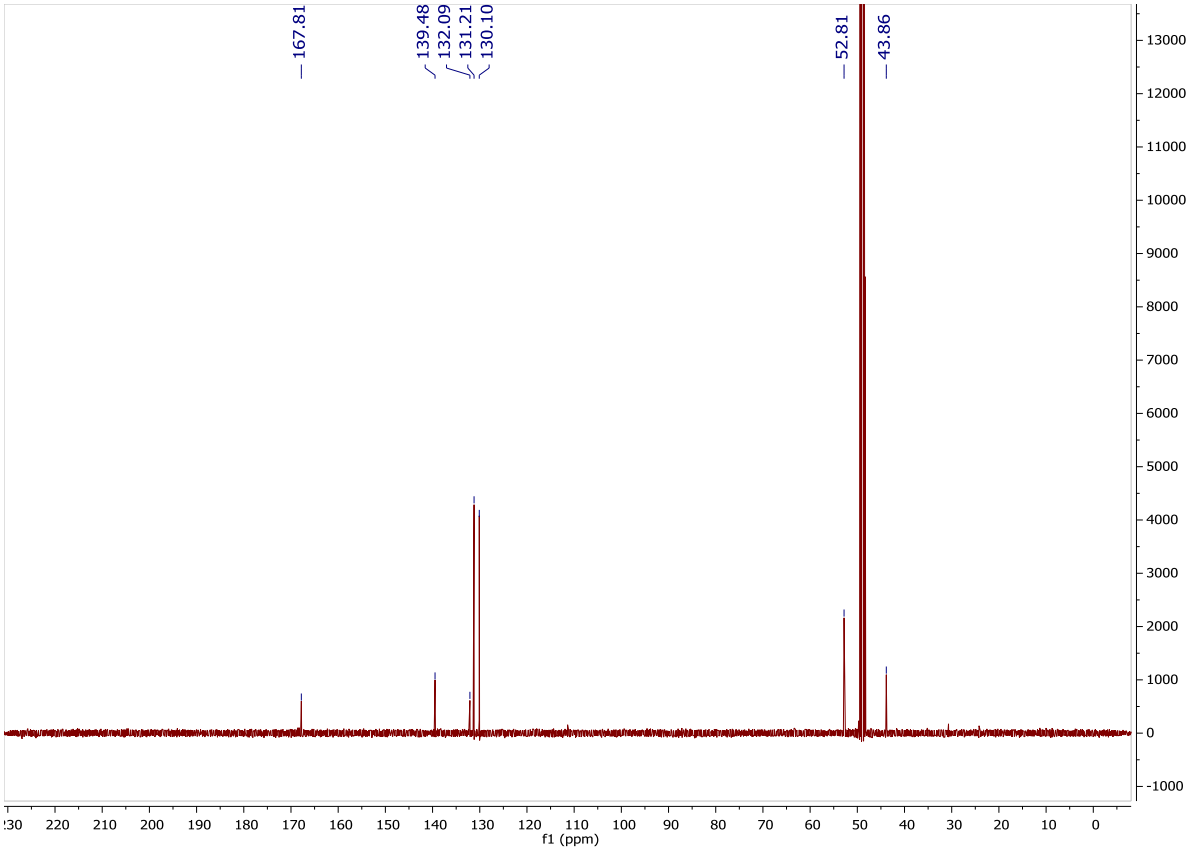
4-Methylsulfonylbenzylamine hydrochloride (14)



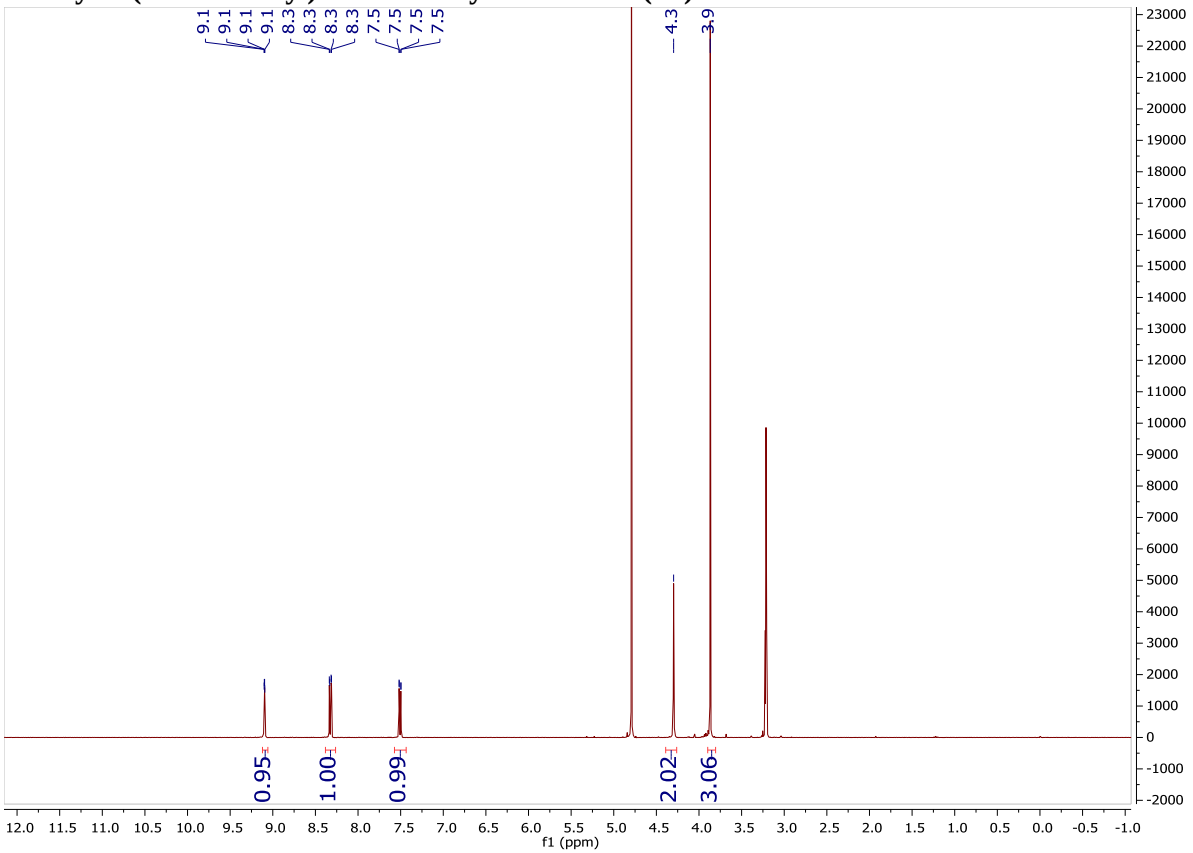


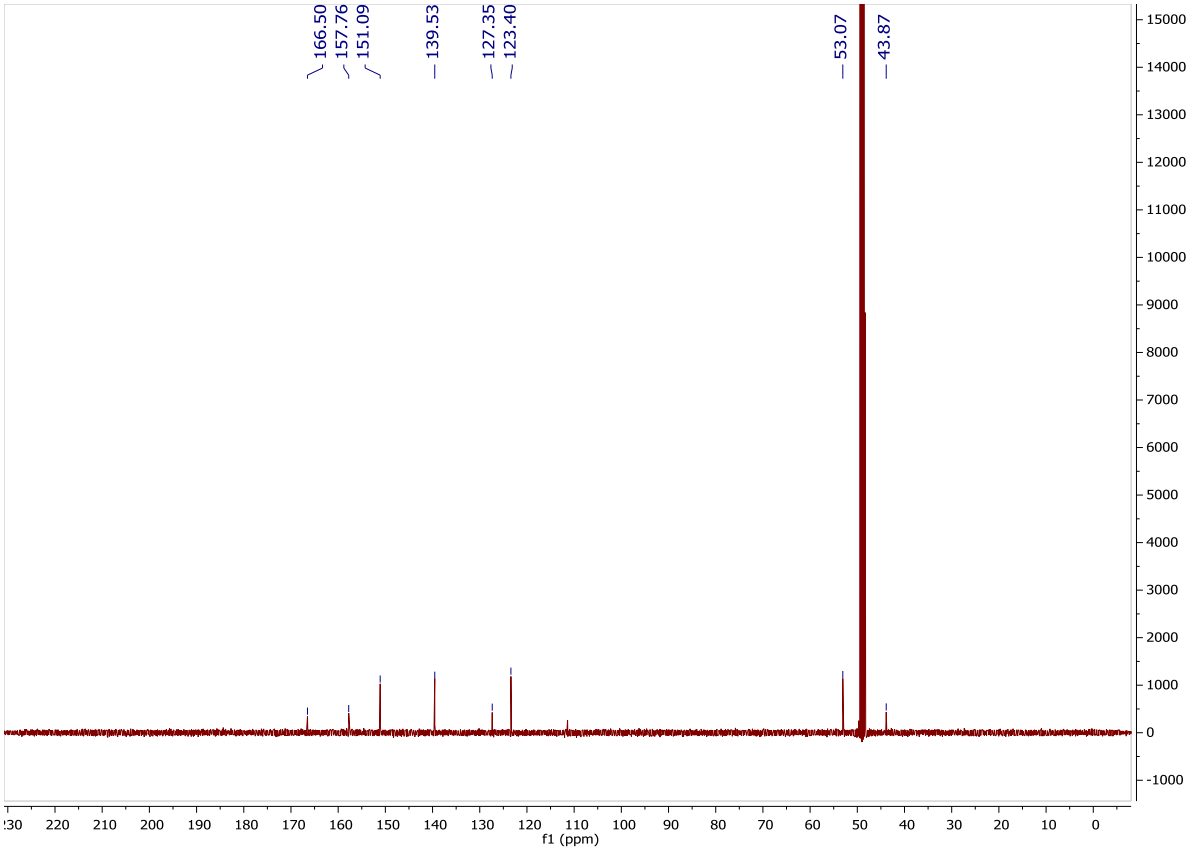
Methyl 4-(aminomethyl)benzoate hydrochloride (15)



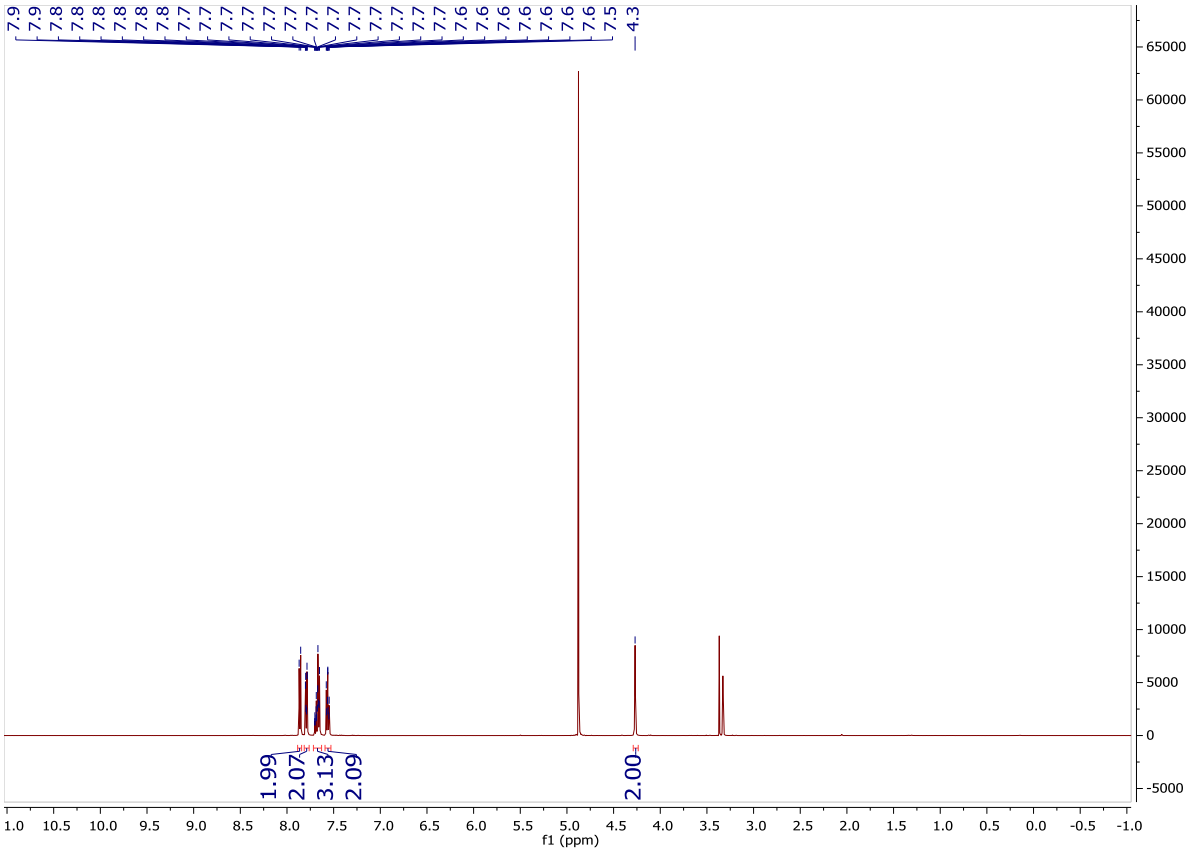


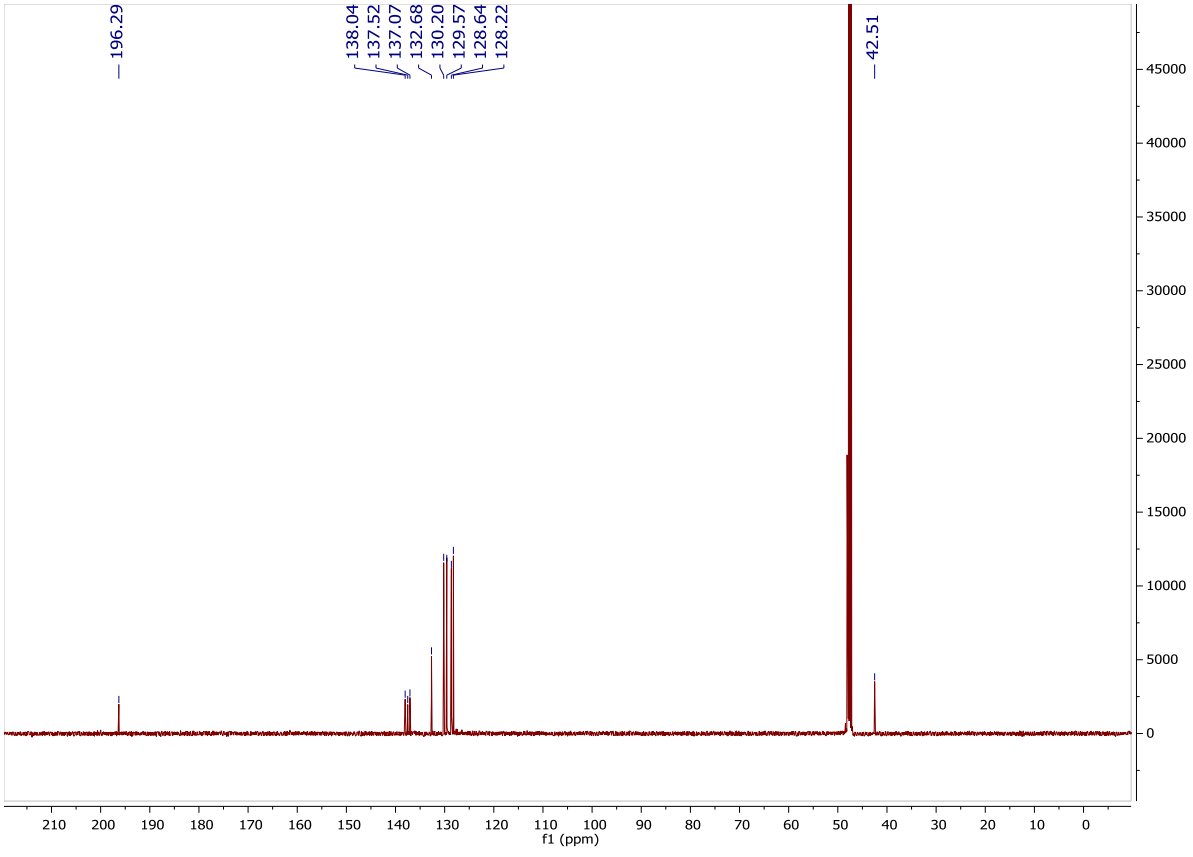
Methyl 6-(aminomethyl)nicotinate hydrochloride (16)



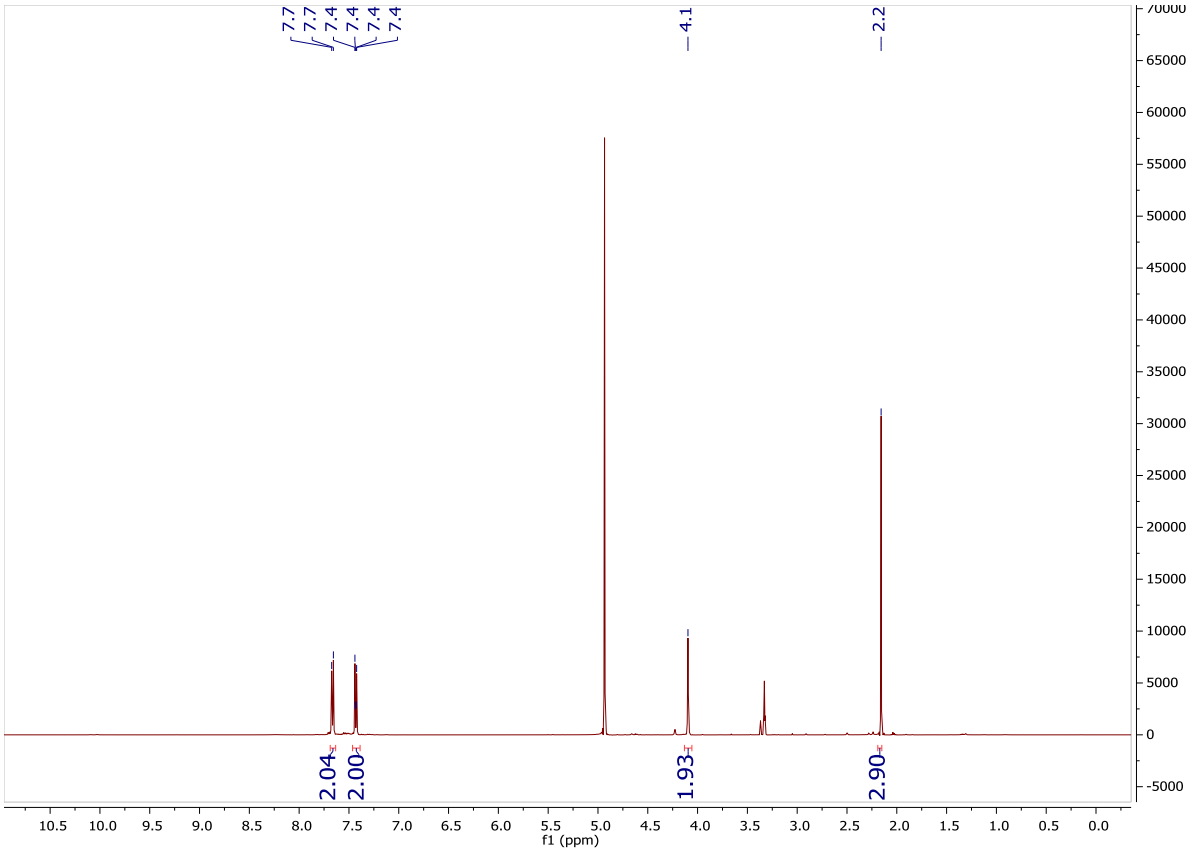


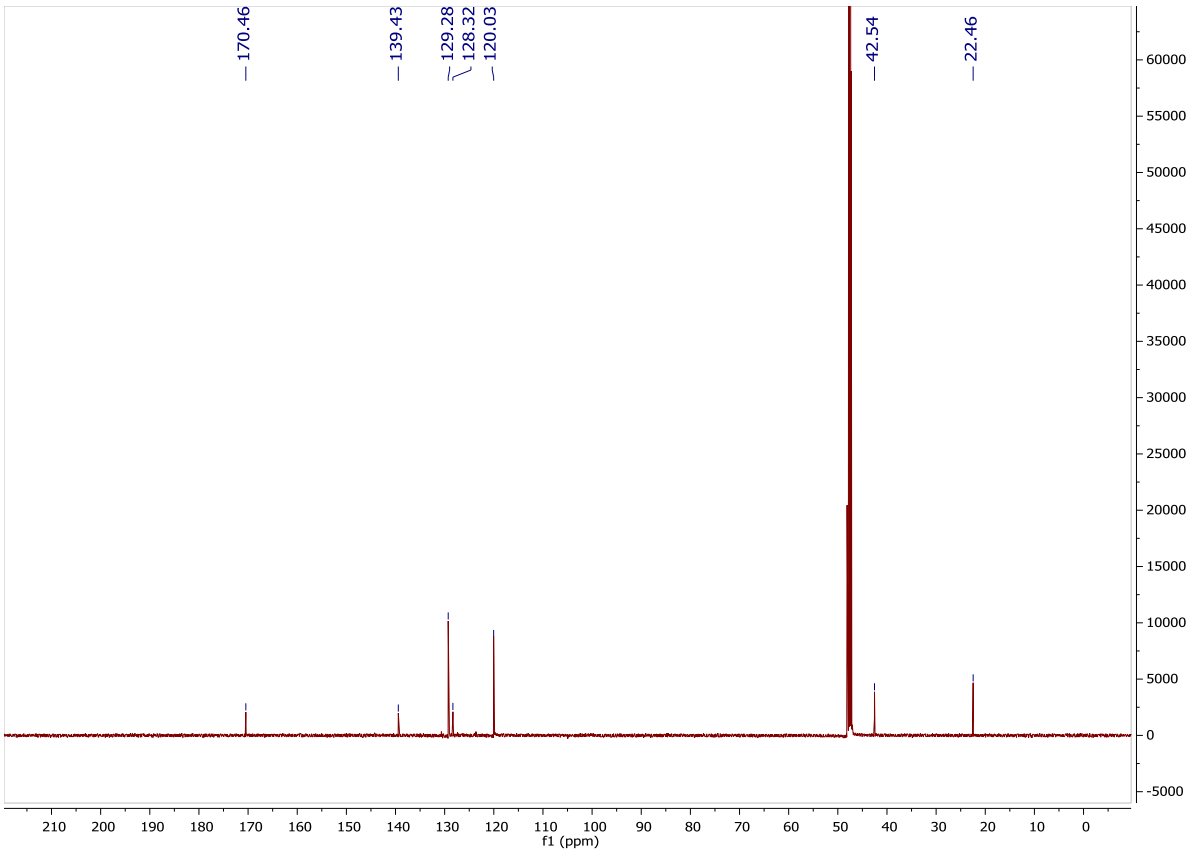
4-Benzoylbenzylamine hydrochloride (17)



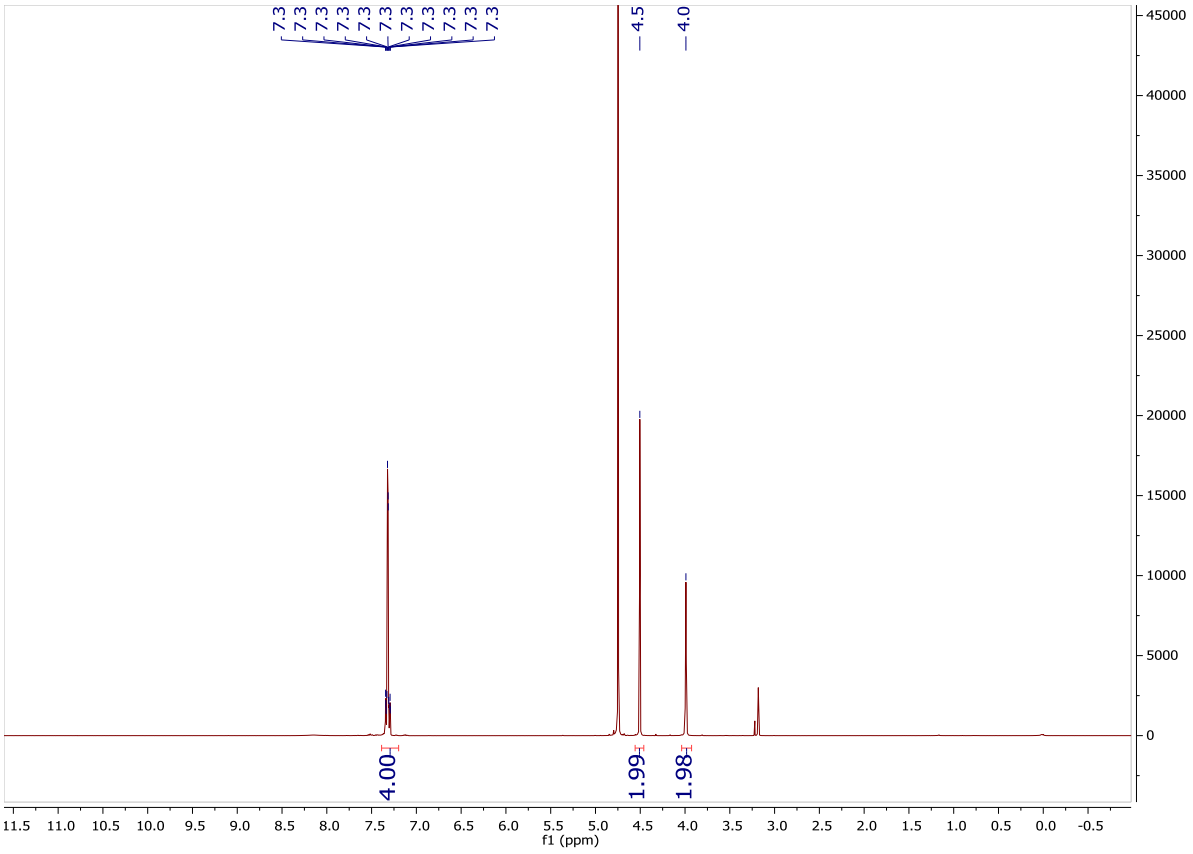


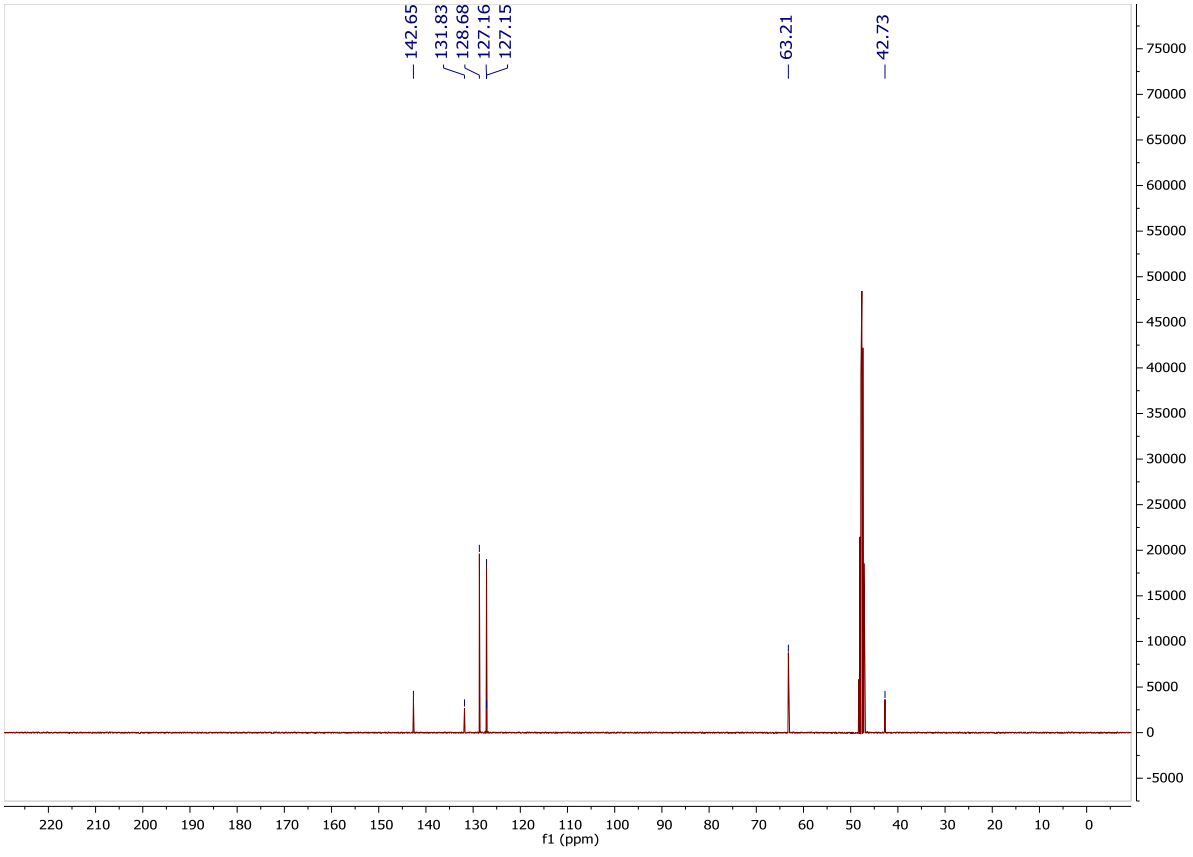
4-Acetamidobenzylamine hydrochloride (18)



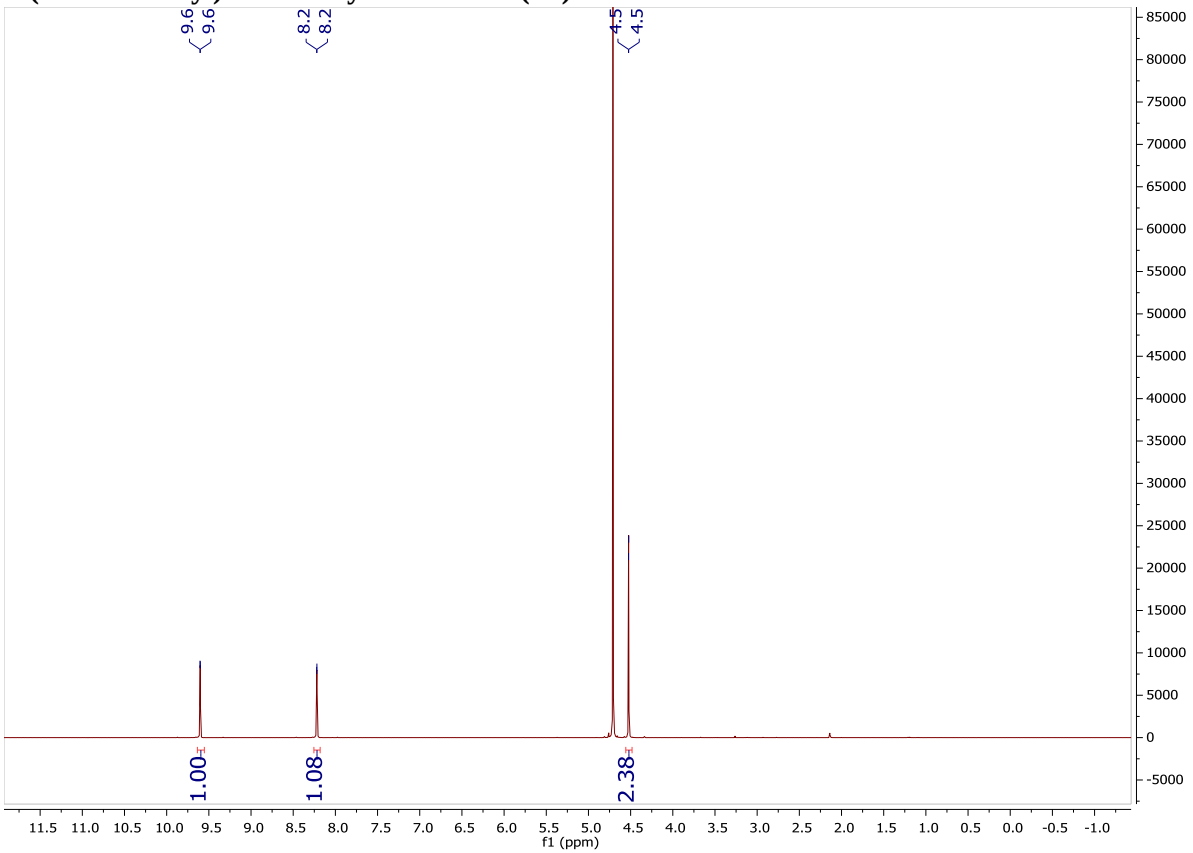


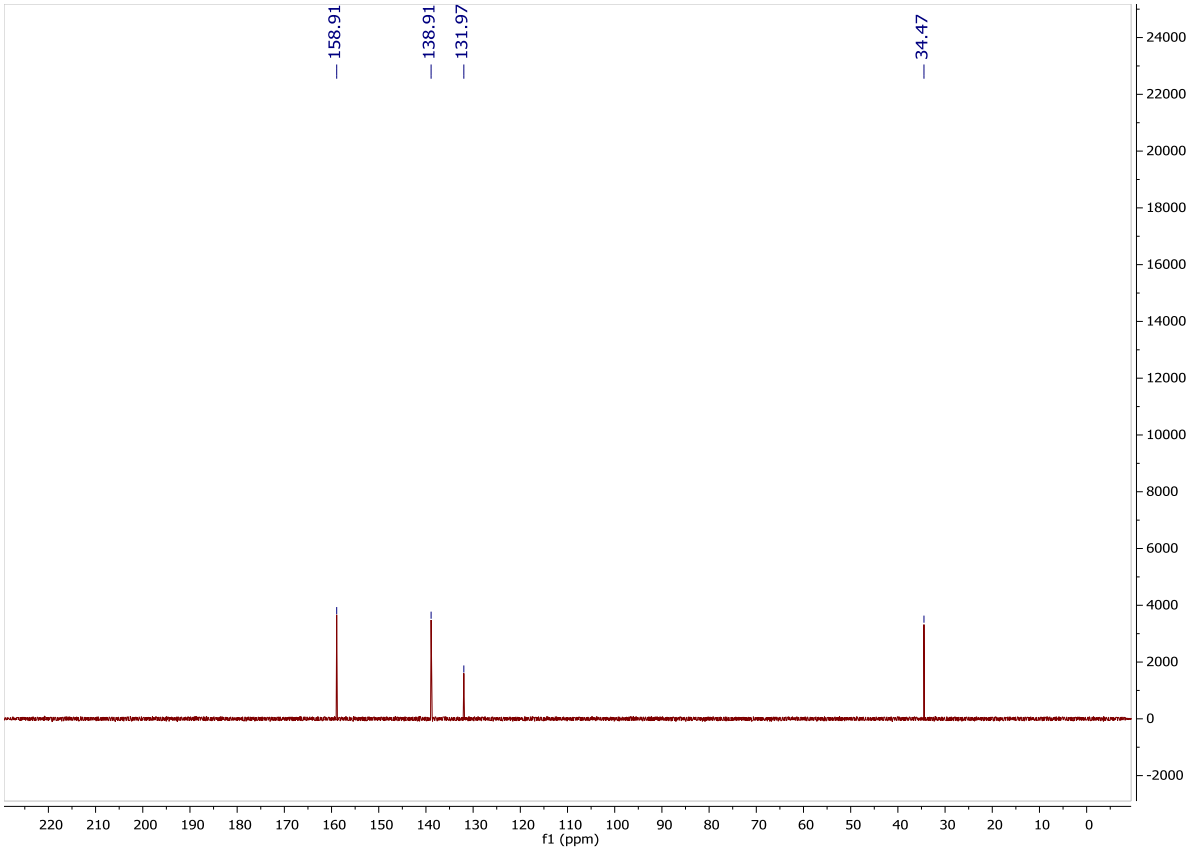
(4-Hydroxymethyl)benzylamine hydrochloride (19)



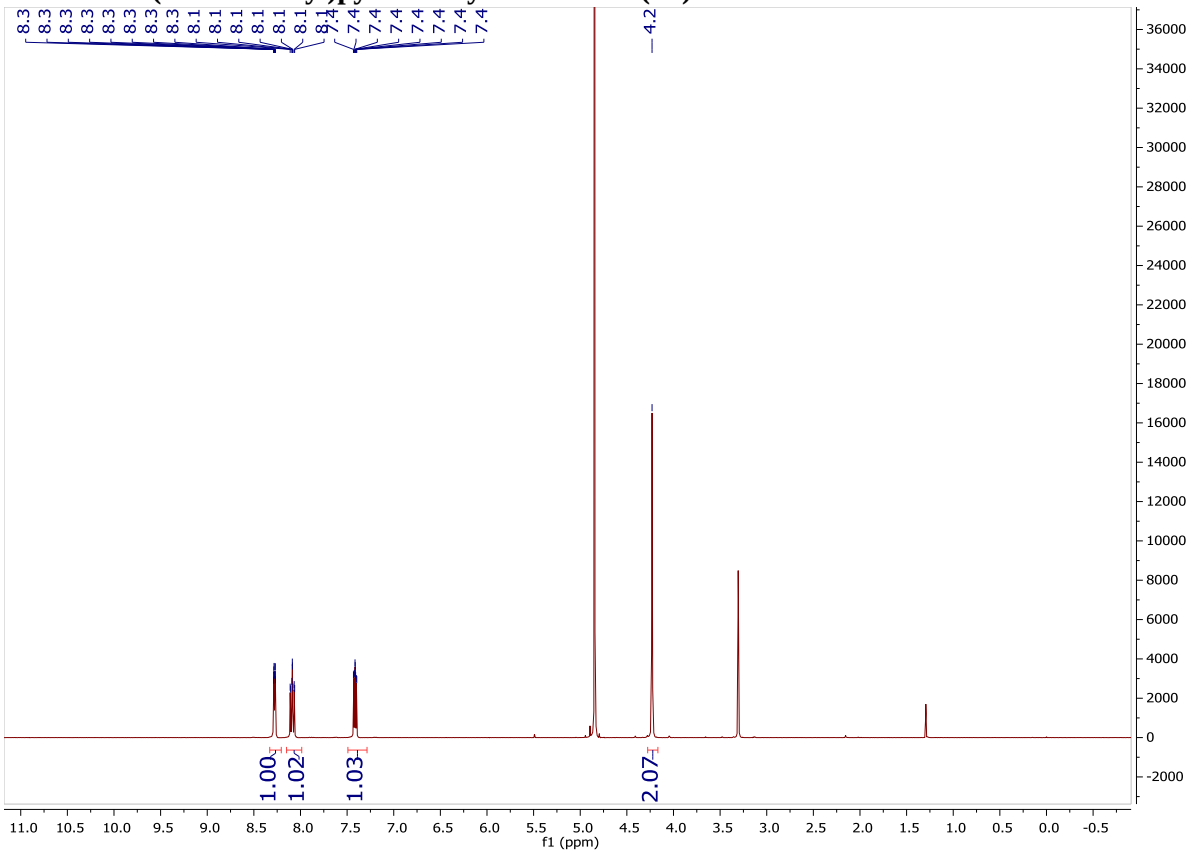


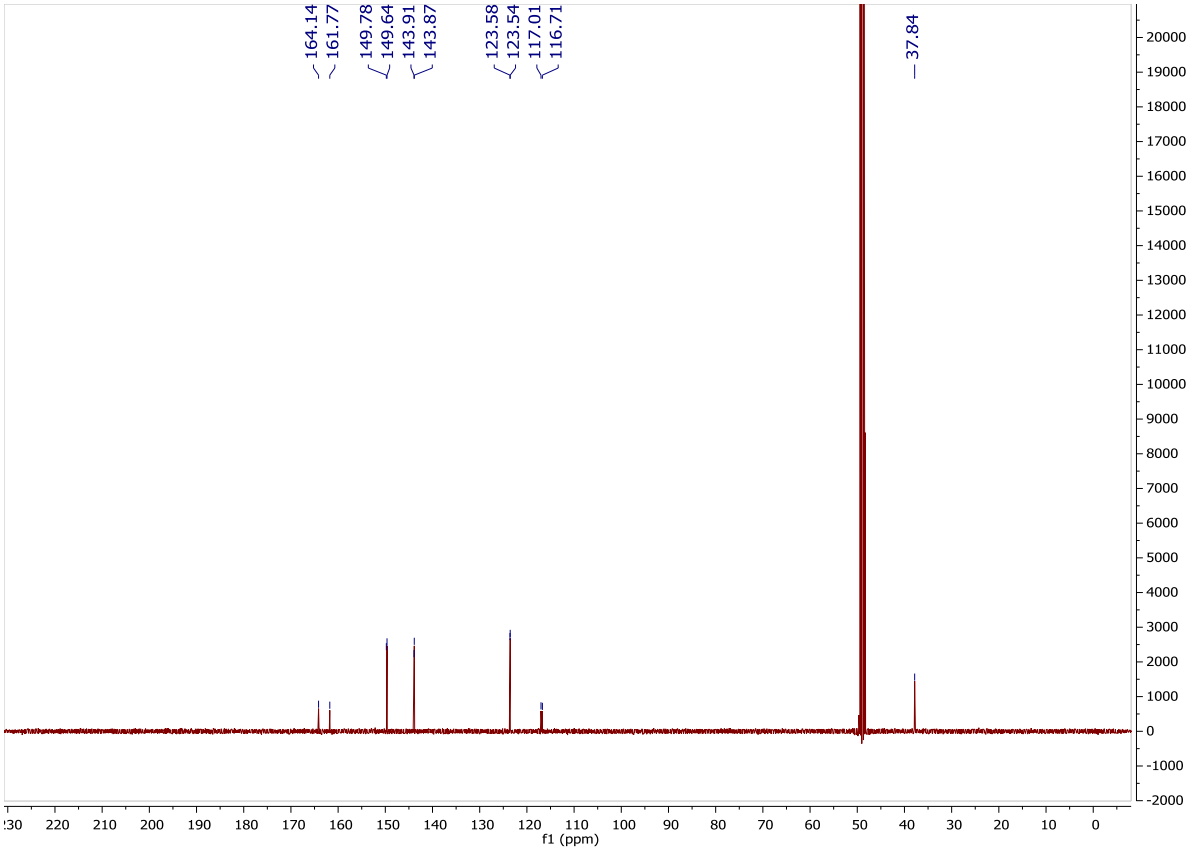
5-(Aminomethyl)thiazole hydrochloride (20)



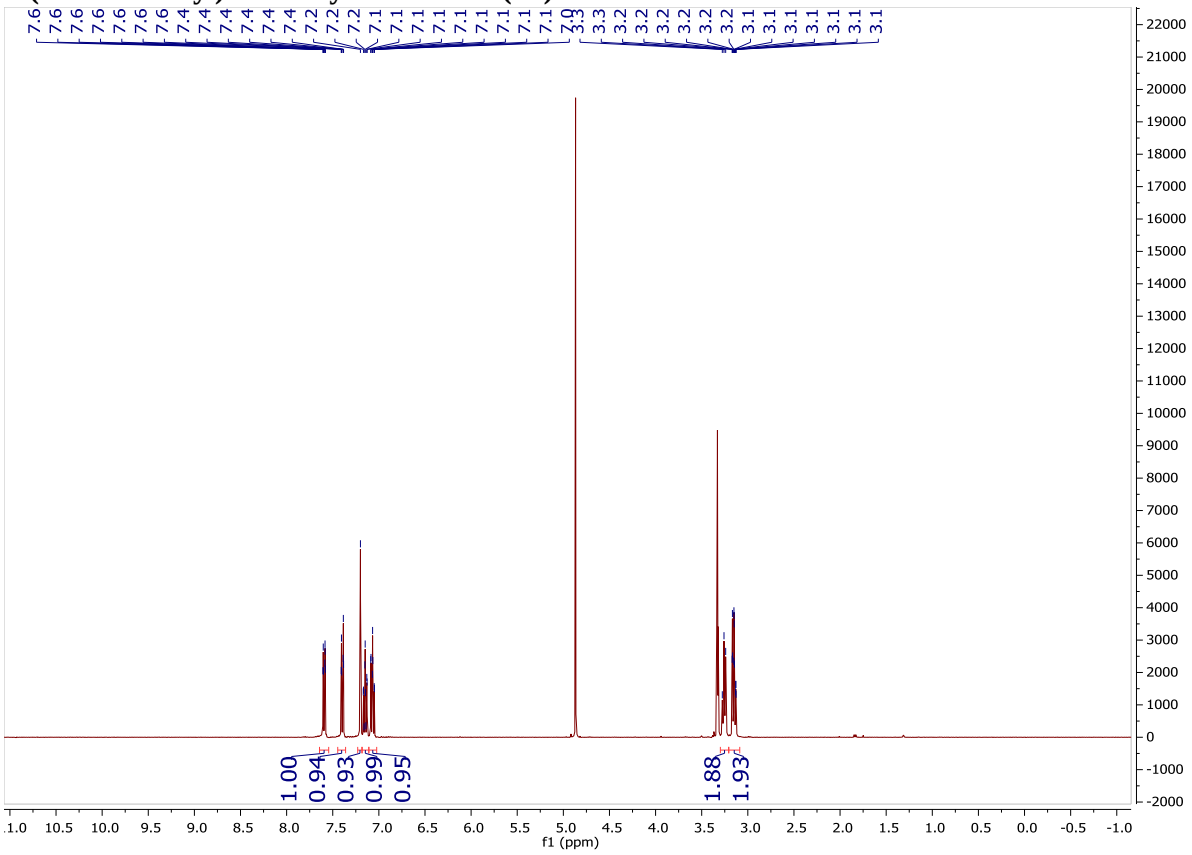


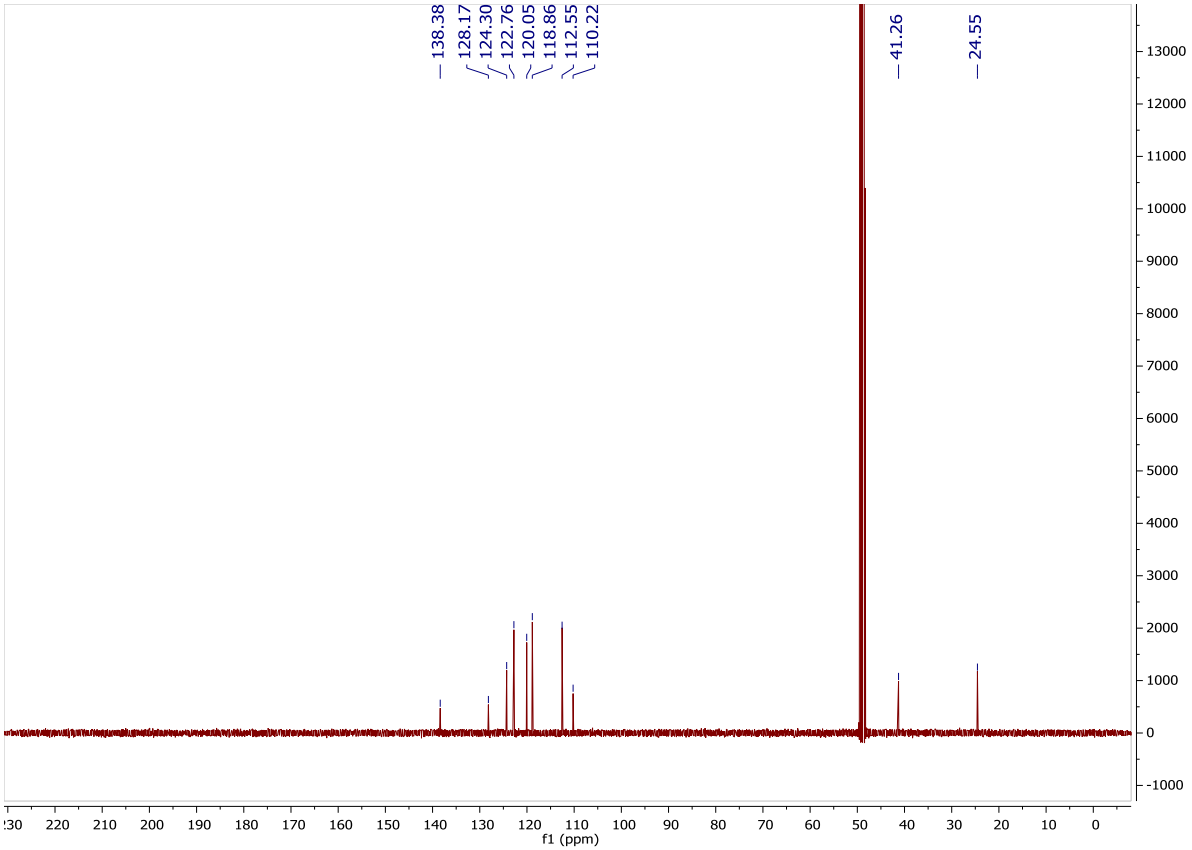
2-Fluoro-3-(aminomethyl)pyridine hydrochloride (21)



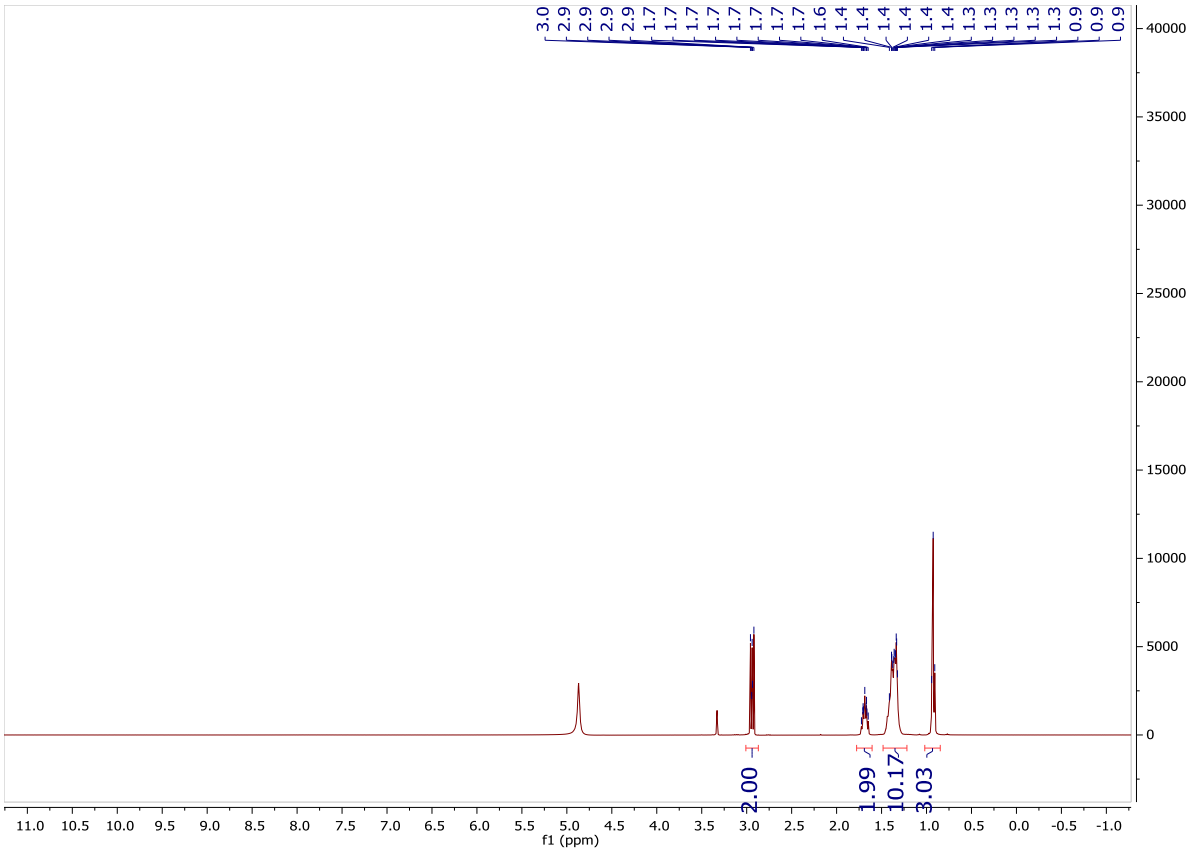


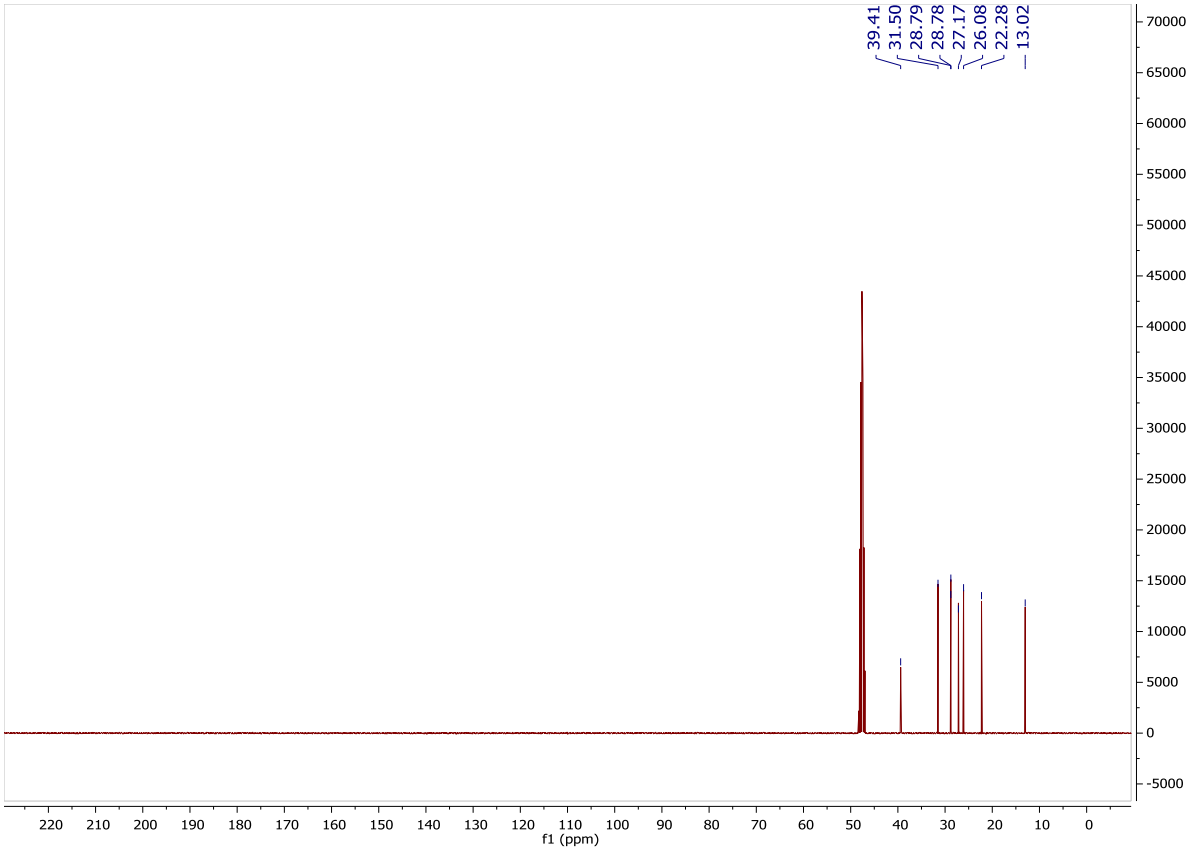
3-(2-Aminoethyl)indole hydrochloride (22)



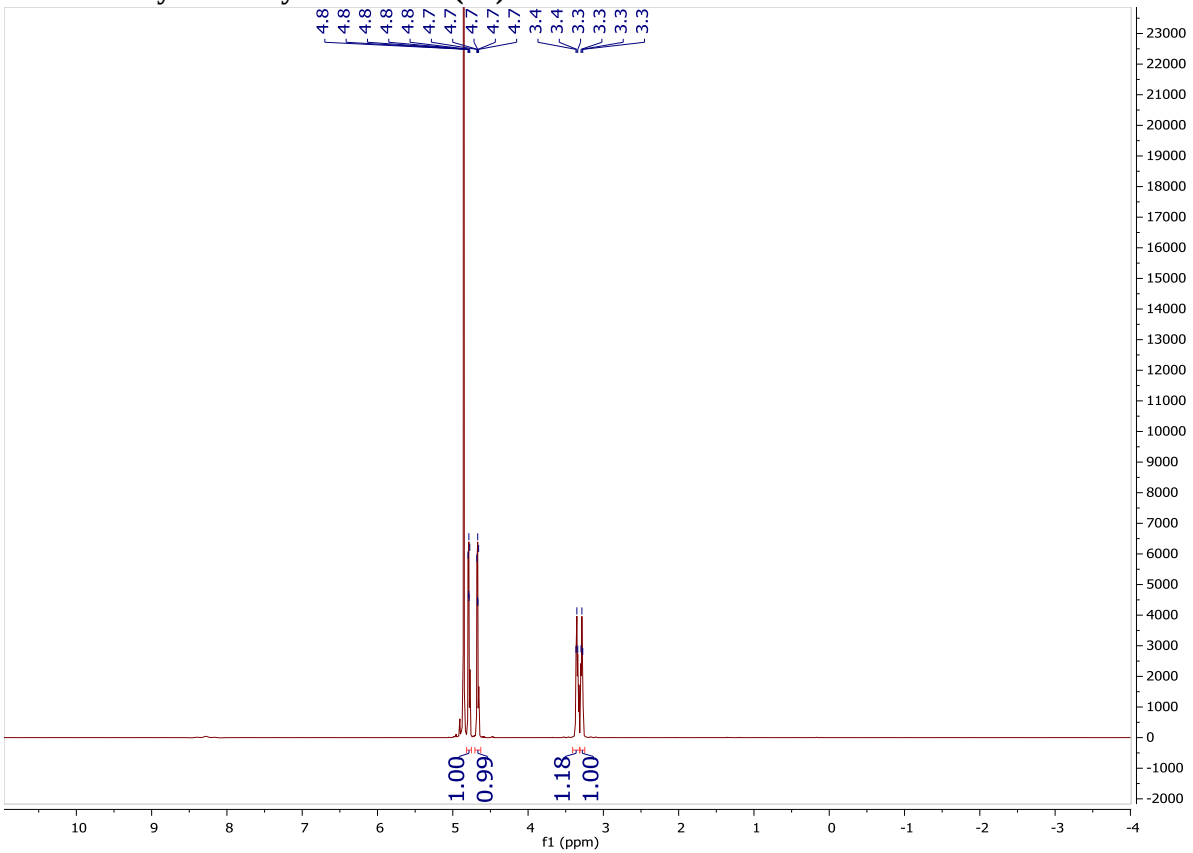


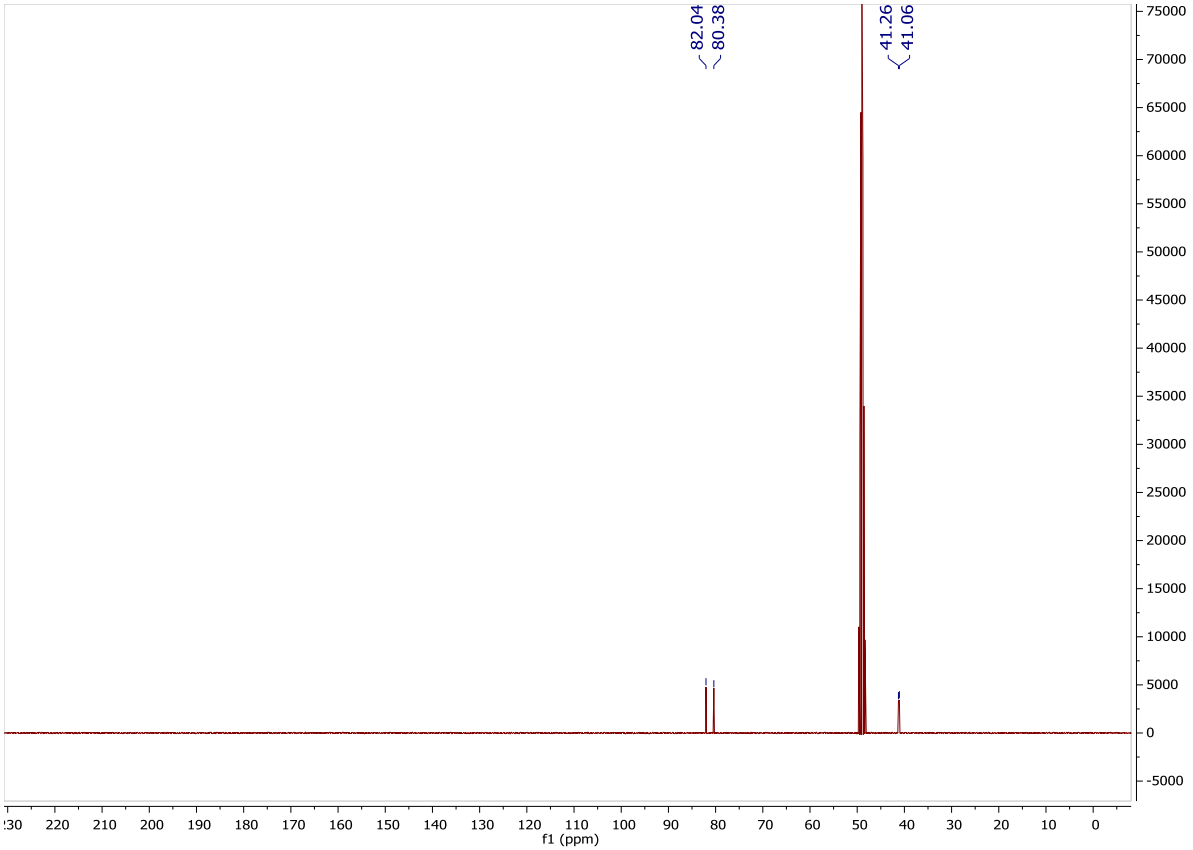
1-Aminooctane hydrochloride (23)



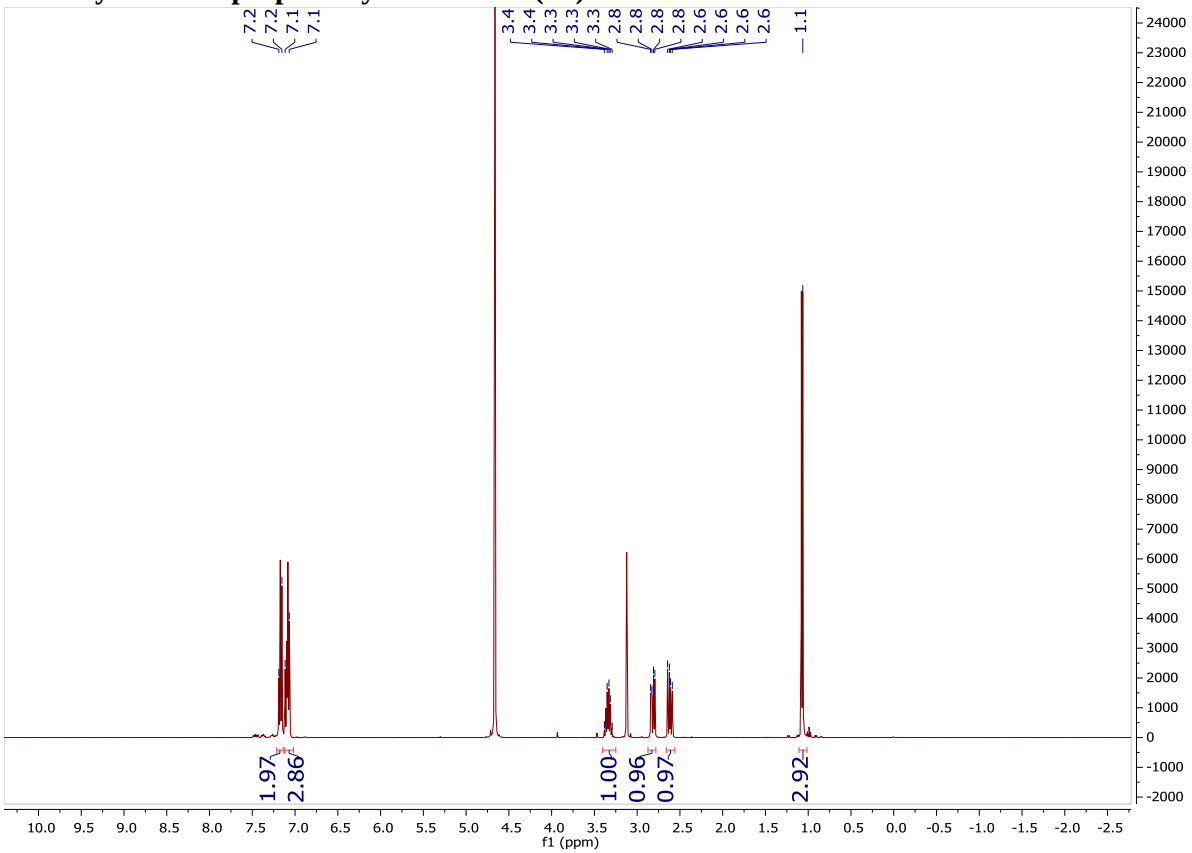


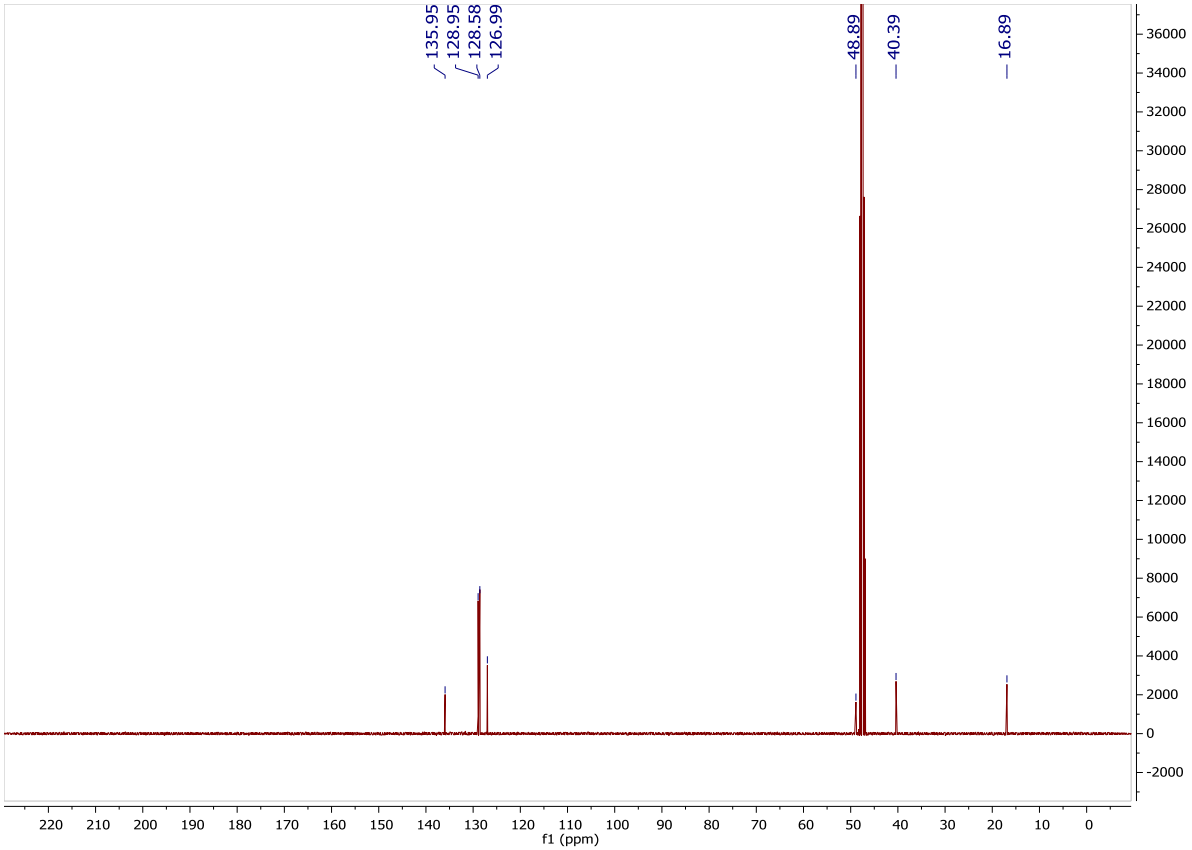
2-Fluoroethylamine hydrochloride (24)



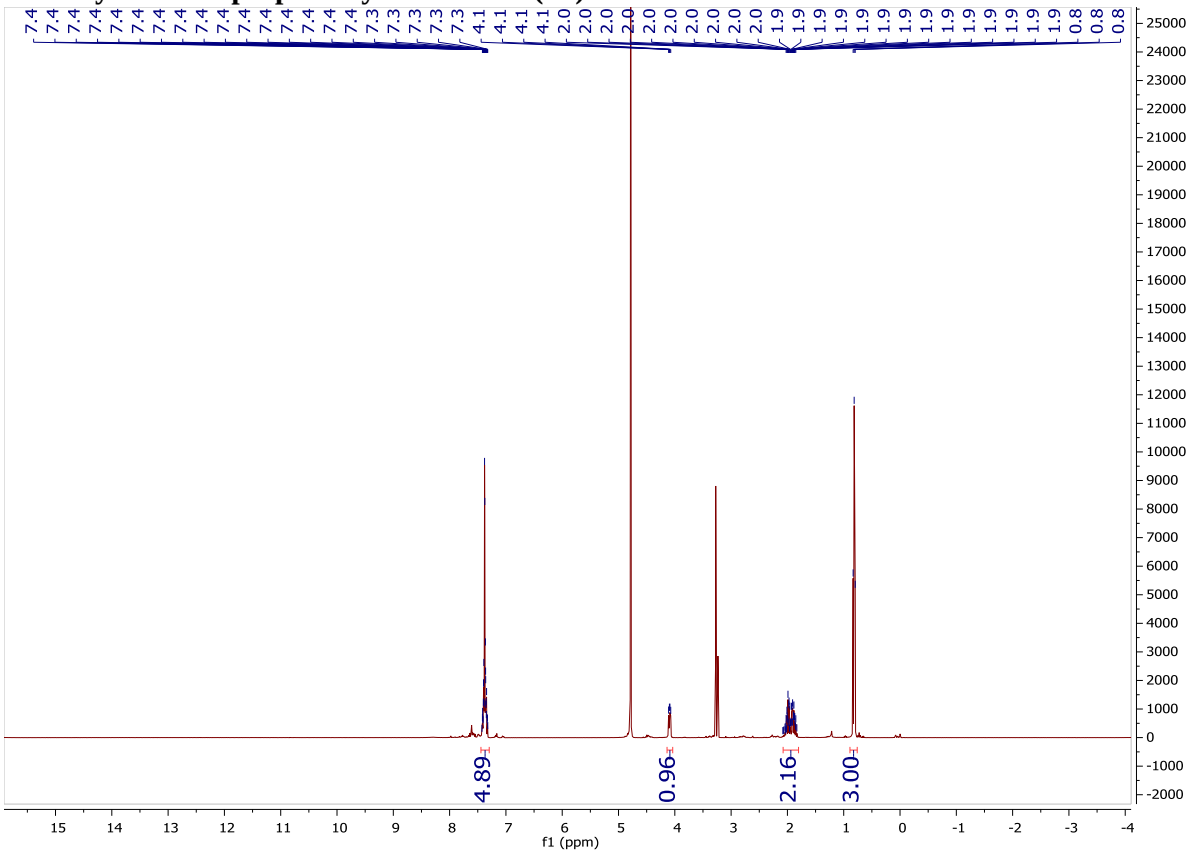


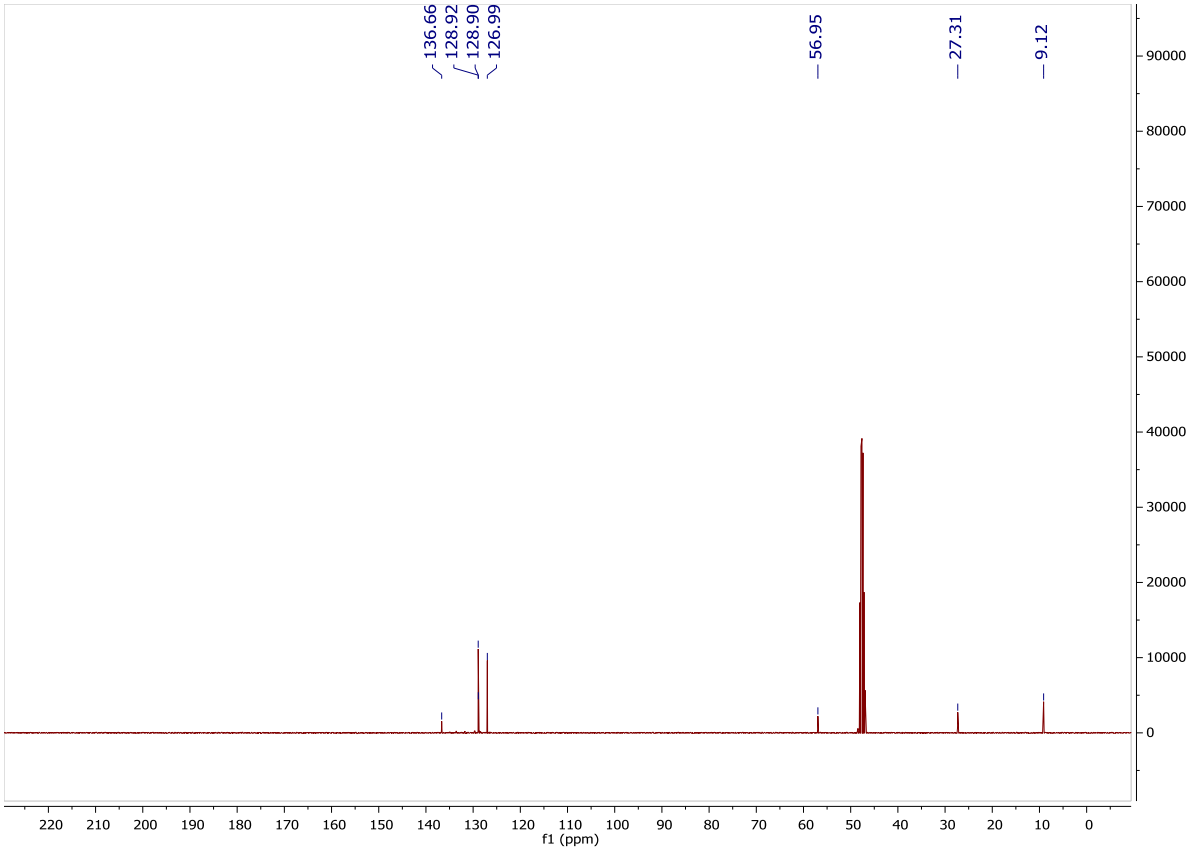
1-Phenyl-2-aminopropane hydrochloride (25)



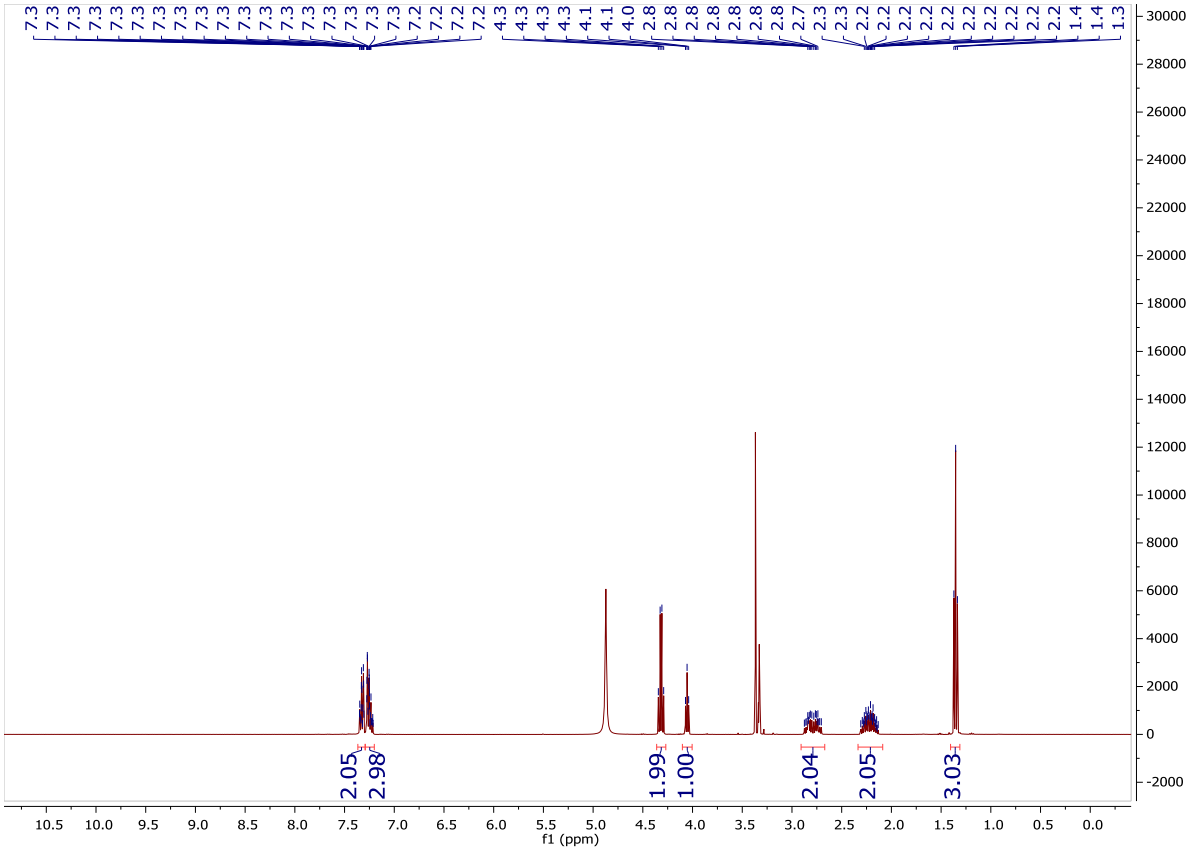


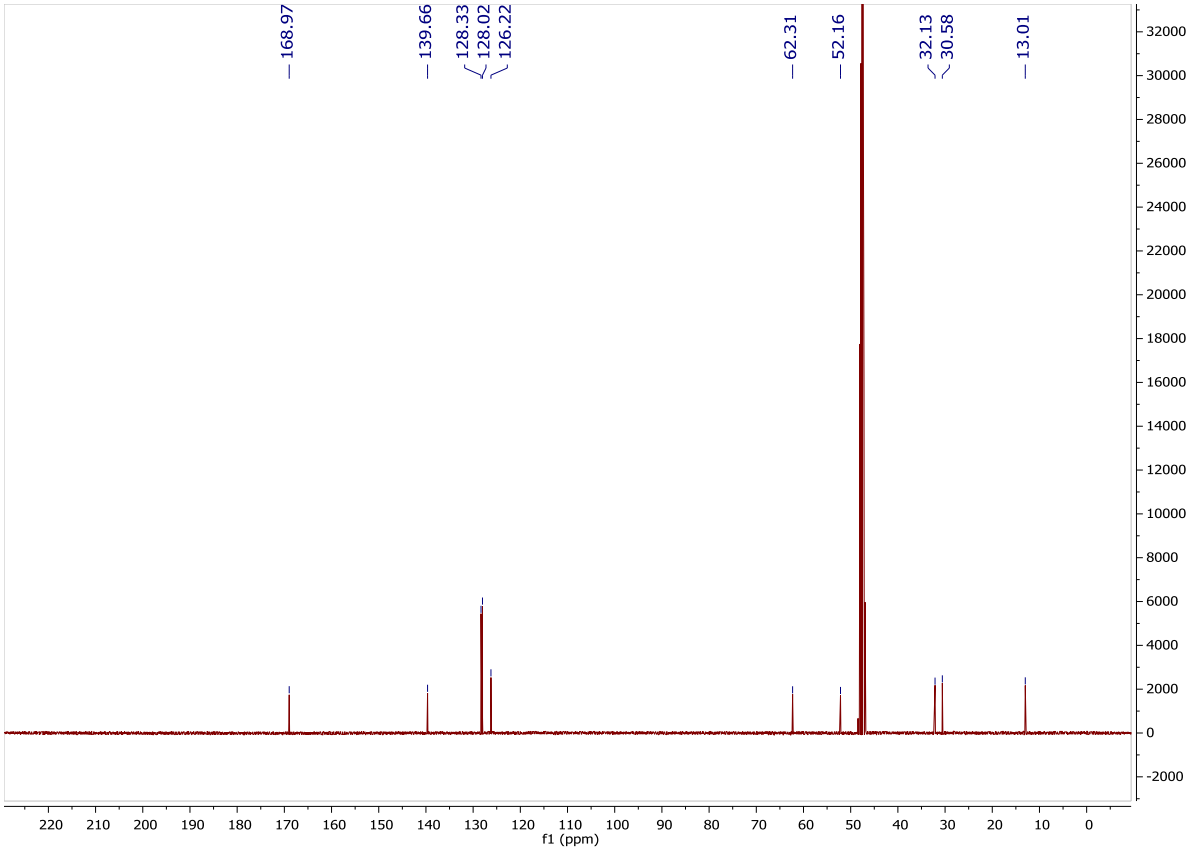
1-Phenyl-1-aminopropane hydrochloride (26)



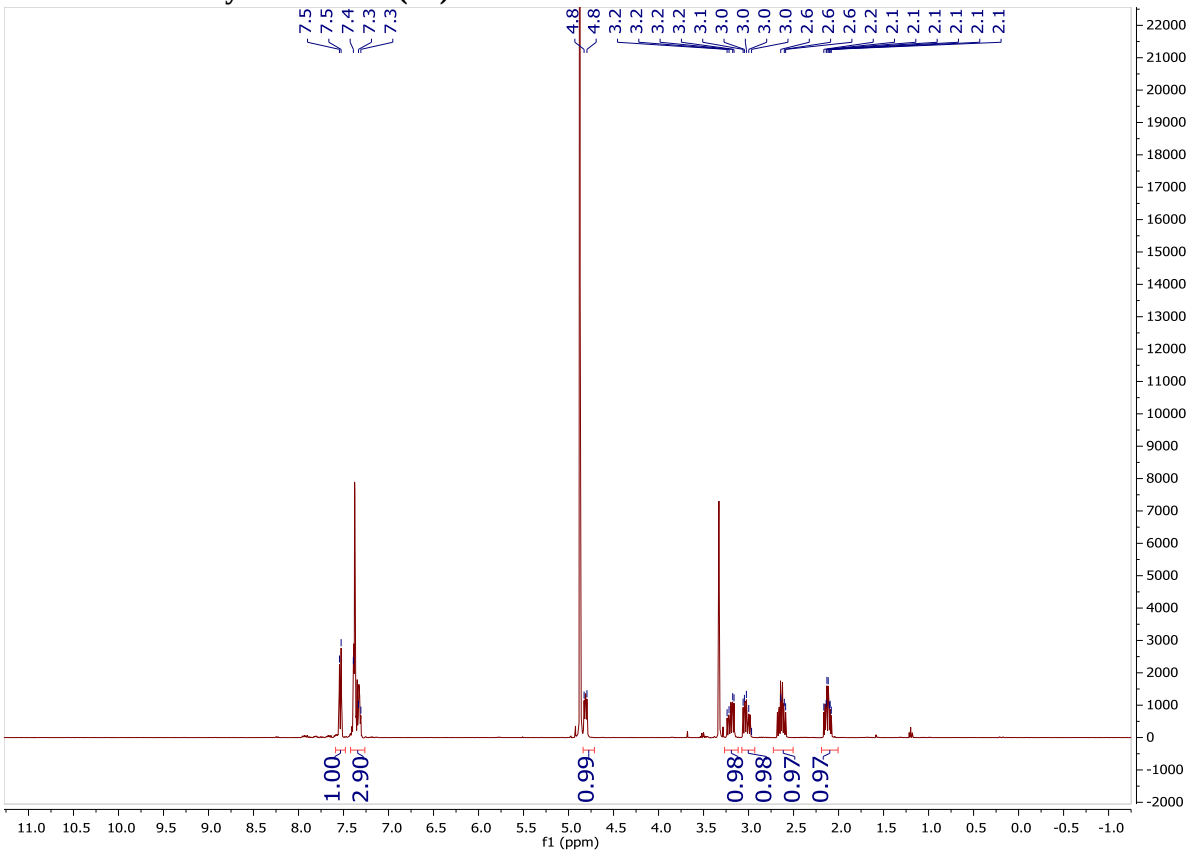


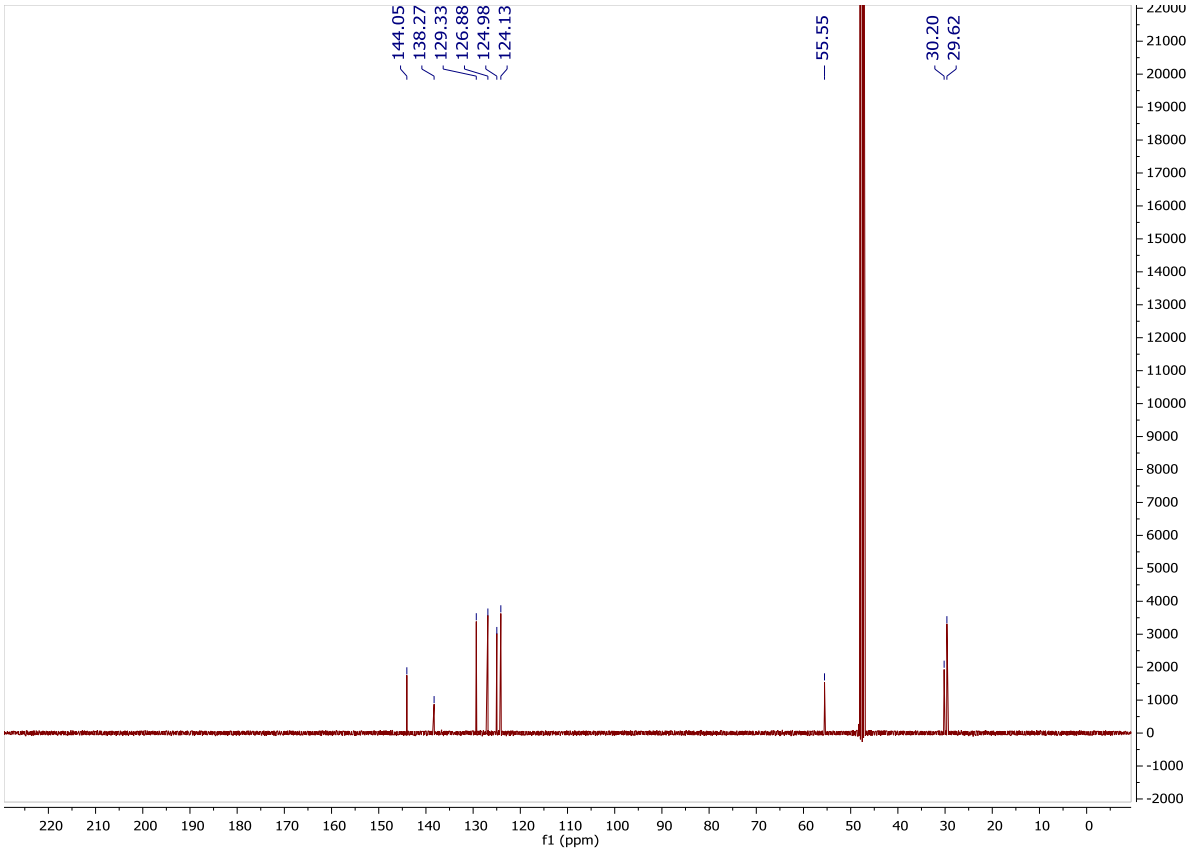
Ethyl (*S*)-2-amino-4-phenylbutanoate hydrochloride (27)



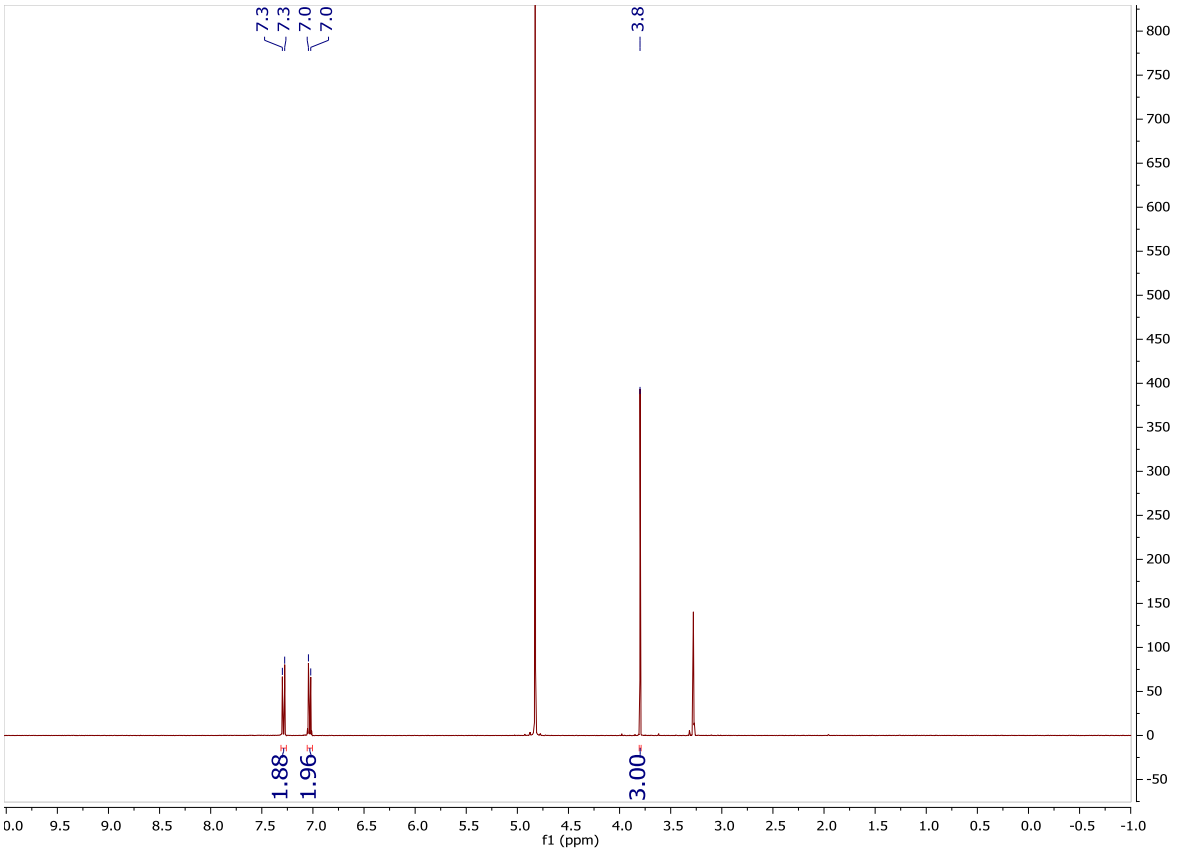


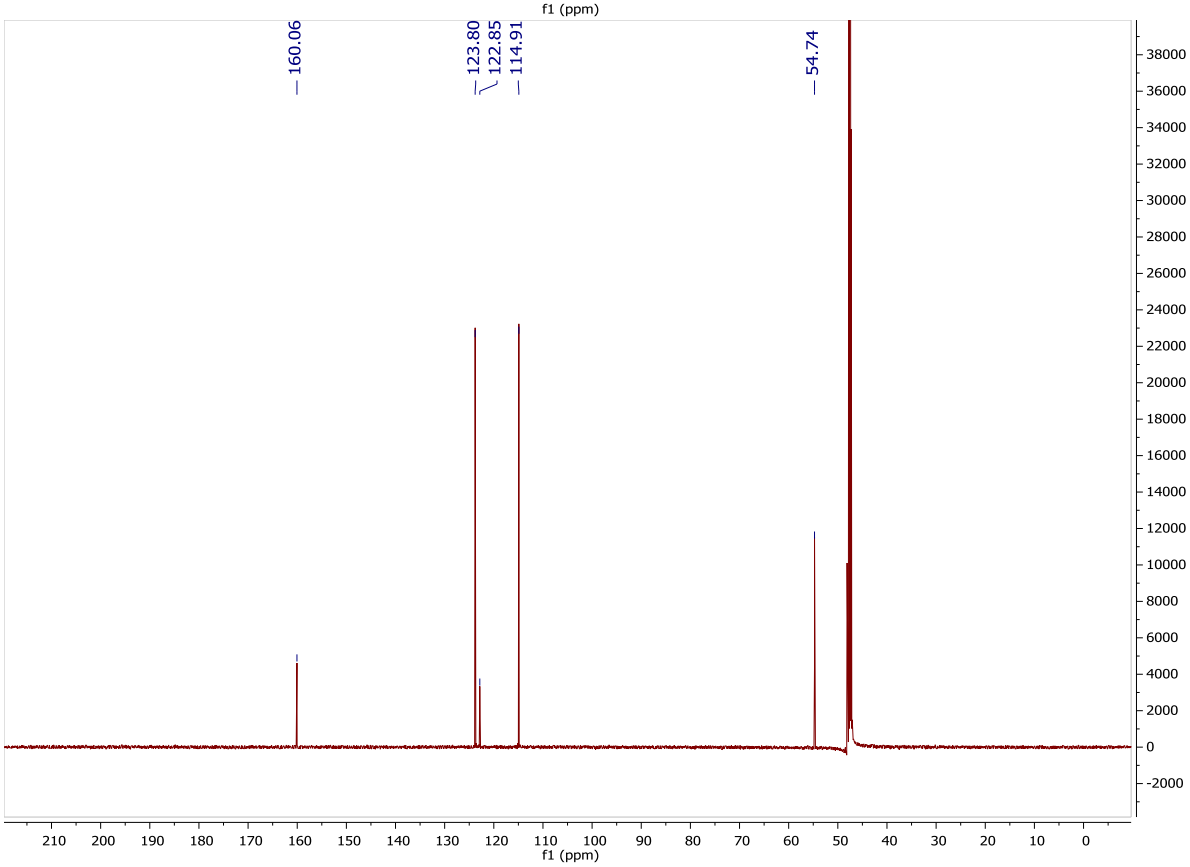
1-Aminoindane hydrochloride (28)





4-Methoxyaniline hydrochloride (30)


7.3
7.3
7.0
7.0
3.8
1.88
1.96
3.00
f1 (ppm)


160.06
123.80
122.85
114.91
54.74
f1 (ppm)

6. References

1. M. H. Ngai, P. Y. Yang, K. Liu, Y. Shen, M. R. Wenk, S. Q. Yao and M. J. Lear, *Chem. Commun.*, 2010, **46**, 8335.

2. A. W. Gann, J. W. Amoroso, V. J. Einck, W. P. Rice, J. J. Chambers and N. A. Schnarr, *Org. Lett.*, 2014, **16**, 2003.