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SUPPORTING INFORMATION

Metal-free amidation of carboxylic acids with tertiary amines

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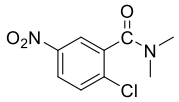
Experimental Procedure

1. Material and methods

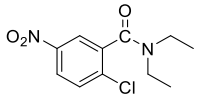
All reagents were purchased from Fluka and Aldrich and used without further purification. The reaction was monitored by thin-layer chromatography carried out on silica gel plates ($60F_{254}$, MERCK, Germany) and visualized under UV light (254 nm). Melting points were determined using Mettler Toledo DSC equipment at a heating rate of 6 ^{o}C/min and are uncorrected. NMR spectra were determined using a Bruker AVANCE^{TM} (400 MHz for ^{1}H). Chemical shifts were reported in parts per million (ppm, δ) downfield from TMS. Splitting patterns are described as singlet (*s*), doublet (*d*), triplet (*t*), quintet (*quin*), doublet of quartet (dq), (triplet of doublet (td), doublet of double doublet (ddd) multiplet (*m*), and doublet of doublet (*dd*). High resolution mass spectra (HRMS) were recorded using the LC-DAD-ESI-MS/MS system consisted of a Waters Alliance 2695 LC-DAD and a Q-TOF 2 (quadrupole mass filter-time-of-flight) mass spectrometer with a Z-spray ES source.

2. General procedure for the amidation of carboxylic acids with tertiary amines

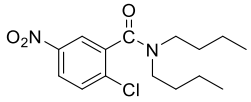
To a solution of PPh_3 (0.62 mmol) in dichloromethane (2 mL) was added I_2 (0.62 mmol) at 0 ^{o}C under N_2. The resulting solution was then added with tertiary amine (1.23 mmol) at 0^{o}C and continue stirring at this temperature for 10 min. After that, a carboxylic acid (0.41 mmol) was added to the mixture and the solution was allowed to warm up to room temperature and stirred until completion of the reaction. The crude material was purified by column chromatography using ethyl acetate/hexanes as the eluent to afford pure product.



2-Chloro-*N*,*N*-dimethyl-5-nitrobenzamide (Table 2, entry 1);[1] white solid (0.0863 g, 92% yield); mp 119-120 °C; R_f 0.36 (30% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (dd, *J* = 9.2, 2.4 Hz, 1H), 8.07 (s, 1H), 7.52 (d, *J* = 9.2 Hz, 1H), 3.05 (s, 3H), 2.79 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.7, 146.5, 137.5, 137.1, 130.7, 124.6, 123.0, 37.8, 34.6.

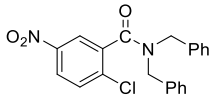


2-Chloro-*N*,*N*-diethyl-5-nitrobenzamide (Table 2, entry 2);[2] yellow oil (0.1003 g, 95% yield); R_f 0.37 (30% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.14 (d, *J* = 8.4 Hz, 1H), 8.13 (s, 1H), 7.57 (d, *J* = 8.4 Hz, 1H), 3.73 (br s, 1H), 3.40 (br s, 1H), 3.16 – 3.09 (m, 2H), 1.25 (t, *J* = 7.6 Hz, 2H), 1.07 (t, *J* = 7.6 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.3, 146.6, 138.0, 137.4, 130.9, 124.6, 122.7, 42.9, 39.3, 14.0, 12.6.

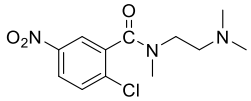


***N*,*N*-Dibutyl-2-chloro-5-nitrobenzamide** (Table 2, entry 3); white solid (0.0672 g, 52% yield); mp 189-190 °C; R_f 0.32 (20% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.15 (dd, *J* = 8.8, 2.8 Hz, 1H), 8.12 (d, *J* = 2.8 Hz, 1H), 7.57 (d, *J* = 8.8 Hz, 1H), 3.72 (br s, 1H), 3.28 (br s, 1H),

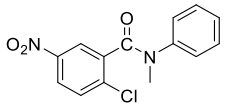
3.09 – 2.98 (m, 2H), 1.69 – 1.62 (m, 2H), 1.44 – 1.37 (m, 4H), 1.13 – 1.10 (m, 2H), 0.96 (t, *J* = 7.2 Hz, 3H), 0.75 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.7, 146.6, 138.1, 137.4, 130.9, 124.6, 123.1, 48.3, 44.6, 30.6, 29.4, 20.3, 19.8, 13.9, 13.6.



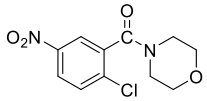
***N,N*-Dibenzyl-2-chloro-5-nitrobenzamide** (Table 2, entry 4); yellow oil; (0.1472 g, 94% yield); R_f 0.45 (20% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (d, *J* = 2.8 Hz, 1H), 8.15 (dd, *J* = 8.8, 2.8 Hz, 1H), 7.59 (d, *J* = 8.8 Hz, 1H), 7.41 – 7.26 (m, 8H), 7.08 (dd, *J* = 7.2, 1.6 Hz, 2H), 5.26 (d, *J* = 12.4 Hz, 1H), 4.28 (d, *J* = 12.4 Hz, 1H), 4.25 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.7, 146.6, 137.5, 137.3, 135.9, 135.2, 131.0, 129.1, 128.8, 128.5, 128.3, 128.2, 128.0, 127.2, 127.0, 124.9, 123.4, 51.0, 47.3.



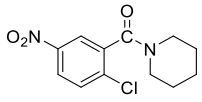
2-Chloro-*N*-(2-(dimethylamino)ethyl)-*N*-methyl-5-nitrobenzamide (Table 2, entry 5); yellow oil (0.0543 g, 46% yield) along with product of entry 1 (0.0226 g, 24% yield); R_f 0.26 (EtOAc); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.57 (d, *J* = 2.8 Hz, 1H), 8.12 (dd, *J* = 9.2, 2.8 Hz, 1H), 6.79 (d, *J* = 9.2 Hz, 1H), 3.59 – 3.57 (m, 2H), 3.55 – 3.52 (m, 2H), 3.18 (s, 3H), 2.98 (s, 3H), 1.24 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.2, 151.4, 132.1, 128.6, 128.5, 127.3, 116.6, 57.6, 47.6, 40.7, 35.3, 29.8.



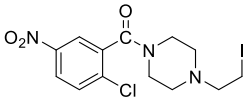
2-Chloro-*N*-methyl-5-nitro-*N*-phenylbenzamide (Table 2, entry 6); yellow oil (0.0300 g, 25% yield). R_f 0.54 (30% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.98 (d, *J* = 2.4 Hz, 1H), 7.91 (dd, *J* = 8.8, 2.4 Hz, 1H), 7.33 (d, *J* = 8.8 Hz, 1H), 7.19 – 7.08 (m, 6H), 3.48 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.6, 145.7, 137.8, 137.5, 130.6, 129.4, 127.9, 126.8, 124.4, 123.9, 37.2.



(2-Chloro-5-nitrophenyl)(morpholino)methanone (Table 2, entry 7);[3] yellow oil (0.0703 g, 63% yield); R_f 0.43 (30% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.19 (dd, *J* = 9.2, 2.4 Hz, 1H), 8.18 (s, 1H), 7.60 (d, *J* = 9.2 Hz, 1H), 3.89 – 3.80 (m, 4H), 3.72 – 3.60 (m, 2H), 3.30 – 3.19 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.64, 146.8, 137.4, 136.8, 131.0, 125.2, 123.4, 66.8, 66.7, 47.2, 42.4.

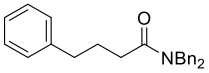


(2-Chloro-5-nitrophenyl)(piperidin-1-yl)methanone (Table 2, entries 8 and 9); yellow oil (0.1059, 96% yield, entry 8 and 0.0829, 75% yield, entry 9); R_f 0.28 (20% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.14 (dd, *J* = 8.4, 2.8 Hz, 1H), 8.13 (s, 1H), 7.57 (d, *J* = 8.4 Hz, 1H), 3.77 – 3.69 (m, 2H), 3.22 – 3.10 (m, 2H), 1.67 (s, 2H), 1.56 (br s, 2H), 1.52 (br s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.3, 146.7, 137.8, 137.4, 130.9, 124.7, 123.0, 48.0, 42.8, 26.4, 25.4, 24.4.

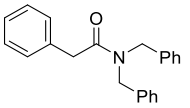


(2-Chloro-5-nitrophenyl)(4-(2-iodoethyl)piperazin-1-yl)methanone (Table 2, entry 10); yellow solid (0.0908 g, 52% yield); mp 158-159 ^{o}C ; R_f 0.26 (30% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.15 (dd, *J* = 8.8, 2.8 Hz, 1H), 8.12 (d, *J* = 2.8 Hz, 1H), 7.57 (d, *J* = 8.8 Hz, 1H), 3.80 (t, *J* = 5.2 Hz, 2H), 3.26 – 3.20 (m, 2H), 3.16 (t, *J* = 7.4 Hz, 2H), 2.73 (t, *J* = 7.4 Hz, 2H), 2.61 – 2.54 (m, 2H), 2.51 – 2.40 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.5, 146.7, 137.3, 136.9, 130.9, 125.0, 123.2, 60.0, 52.5, 51.8, 46.7, 41.8, 1.6; HRMS (ESI-TOF) m/z calcd for $C_{13}H_{16}ClIN_3O_3$ $[M+H]^+$ 423.9925, found 423.9929.

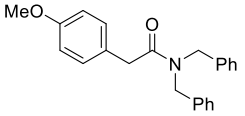
***N,N*-dibenzylacetamide** (**1**);[4] yellow oil (0.0620 g, 63% yield); R_f 0.31 (20% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 – 7.22 (m, 8H), 7.17 (d, *J* = 7.2 Hz, 2H), 4.61 (s, 2H), 4.44 (s, 2H), 2.22 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.3, 137.4, 136.5, 129.1, 128.7, 128.4, 127.8, 127.5, 126.5, 50.9, 48.1, 21.8.



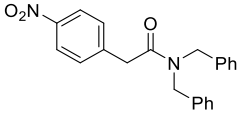
***N,N*-dibenzyl-4-phenylbutanamide** (**2**);[5] colorless oil (0.1060 g, 75% yield); R_f 0.34 (10% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.18 (m, 13H), 7.13 (d, *J* = 7.2 Hz, 2H), 4.65 (s, 2H), 4.41 (s, 2H), 2.71 (t, *J* = 7.6 Hz, 2H), 2.46 (t, *J* = 7.6 Hz, 2H), 2.09 (quin, *J* = 7.6 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 173.4, 141.8, 137.6, 136.7, 129.0, 128.7, 128.6, 128.43, 128.36, 127.7, 127.5, 126.5, 126.0, 50.0, 48.3, 35.4, 32.5, 26.9.



***N,N*-Dibenzyl-2-phenylacetamide** (**3**);[6] yellow oil (0.1053 g, 81% yield); R_f 0.46 (20% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 – 7.28 (m, 11H), 7.25 (d, *J* = 7.2 Hz, 2H), 7.15 (d, *J* = 7.2 Hz, 2H), 4.67 (s, 2H), 4.49 (s, 2H), 3.85 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.7, 137.3, 136.4, 135.1, 129.0, 128.9, 128.8, 128.6, 128.4, 127.7, 127.5, 127.0, 126.5, 50.3, 48.3, 41.0.

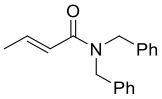


***N,N*-Dibenzyl-2-(4-methoxyphenyl)acetamide** (**4**);[7] colorless oil (0.0867 g, 61% yield); R_f 0.38 (20% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.20 (m, 8H), 7.20 (d, *J* = 8.8 Hz, 2H), 7.14 (d, *J* = 7.2 Hz, 2H), 6.88 (d, *J* = 8.8 Hz, 2H), 4.64 (s, 2H), 4.46 (s, 2H), 3.80 (s, 3H), 3.75 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 172.0, 158.6, 137.4, 136.5, 129.9, 129.0, 128.6, 128.3, 127.7, 127.4, 127.1, 126.5, 114.2, 55.3, 50.2, 48.3, 40.1.

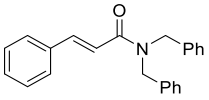


***N,N*-Dibenzyl-2-(4-nitrophenyl)acetamide** (**5**);[8] yellow oil (0.1232 g, 83% yield); R_f 0.32 (20% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.16 (d, *J* = 8.8 Hz, 2H), 7.39 (d, *J* = 8.8

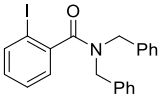
Hz, 2H), 7.35-7.29 (m, 6H), 7.23 (d, *J* = 7.2 Hz, 2H), 7.15 (d, *J* = 7.2 Hz, 2H), 4.66 (s, 2H), 4.50 (s, 2H), 3.86 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.3, 142.7, 137.0, 136.1, 130.2, 129.3, 128.8, 128.5, 128.3, 128.0, 127.8, 127.0, 126.3, 123.8, 50.5, 49.0, 40.3.



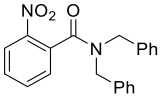
(*E*)-*N*,*N*-Dibenzylbut-2-enamide (**6**);[9] yellow oil (0.1003 g, 92% yield); R_f 0.39 (10% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39-7.24 (m, 8H), 7.18 (d, *J* = 7.2 Hz, 2H), 7.08 (dq, *J* = 14.8, 6.8 Hz, 1H), 6.31 (dd, *J* = 14.8, 1.6 Hz, 1H), 4.64 (s, 2H), 4.51 (s, 2H), 1.87 (dd, *J* = 6.8, 1.6 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.4, 143.1, 137.5, 136.9, 129.0, 128.7, 128.4, 127.7, 127.5, 126.7, 121.7, 49.9, 48.5, 18.4.



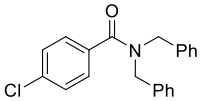
***N*,*N*-Dibenzylcinnamamide** (**7**);[10] yellow solid (0.1158 g, 86% yield); mp 128-129 °C (Lit.[10] 128-131 °C); R_f 0.44 (20% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (d, *J* = 15.4 Hz, 1H), 7.49-7.46 (m, 2H), 7.41 – 7.32 (m, 11H), 7.26 – 7.23 (m, 2H), 6.92 (d, *J* = 15.4 Hz, 1H), 4.73 (s, 2H), 4.62 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.3, 143.9, 137.5, 136.8, 135.3, 129.8, 129.1, 128.9, 128.7, 128.5, 128.0, 127.8, 127.6, 126.7, 117.4, 50.2, 48.9.



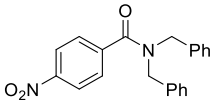
***N*,*N*-dibenzyl-2-iodobenzamide** (**8**); white solid (0.0845 g, 48% yield); mp 123-124 °C; R_f 0.36 (10% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 7.6 Hz, 1H), 7.43 – 7.26 (m, 10H), 7.14 (d, *J* = 6.8 Hz, 2H), 7.07 – 7.03 (m, 1H), 5.31 (d, *J* = 14.4 Hz, 1H), 4.32-4.13 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.3, 142.0, 139.5, 136.2, 130.4, 129.6, 128.9, 128.6, 128.4, 127.9, 127.8, 127.7, 127.6, 92.9, 51.0, 46.8.



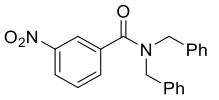
***N*,*N*-Dibenzyl-2-nitrobenzamide** (**9**);[11] white solid (0.1168 g, 82% yield); mp 110-111 °C (Lit.[11] 104-105 °C); R_f 0.43 (30% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (dd, *J* = 8.0, 1.0 Hz, 1H), 7.66 (td, *J* = 8.0, 1.0 Hz, 1H), 7.54 (td, *J* = 8.0, 1.0 Hz, 1H), 7.49 (dd, *J* = 8.0, 1.0 Hz, 1H), 7.38 – 7.27 (m, 8H), 7.12 (d, *J* = 8.0 Hz, 2H), 4.23 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 168.4, 145.3, 136.1, 135.4, 134.5, 133.1, 129.9, 129.2, 129.0, 128.8, 128.3, 128.0, 127.8, 127.5, 125.0, 51.1, 46.9.



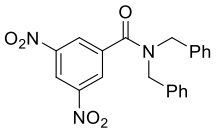
***N*,*N*-Dibenzyl-4-chlorobenzamide** (**10**);[12] white solid (0.1176 g, 85% yield); mp 103-104 °C (Lit[12] 103-104 °C); R_f 0.42 (10% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (d, *J* = 8.4 Hz, 2H), 7.39 – 7.29 (m, 10H), 7.14 (br s, 2H), 4.71 (s, 2H), 4.40 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 171.3, 135.9, 134.6, 129.0, 128.9, 128.5, 128.4, 127.8, 127.0, 51.6, 47.3.



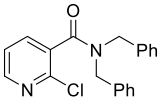
***N,N*-Dibenzyl-4-nitrobenzamide** (**11**);[13] yellow solid (0.1269 g, 89% yield); mp 133-134 ^{o}C ; R_f 0.29 (10% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (d, *J* = 8.2 Hz, 2H), 7.64 (d, *J* = 8.2 Hz, 2H), 7.38 – 7.13 (m, 10H), 7.13 (s, 1H), 4.74 (s, 2H), 4.35 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.1, 148.4, 142.4, 136.4, 135.7, 129.2, 128.9, 128.6, 128.1, 127.9, 127.8, 126.8, 124.0, 51.5, 47.4.



***N,N*-Dibenzyl-3-nitrobenzamide** (**12**);[14] white solid (0.1381 g, 97% yield); mp 98-99 °C; R_f 0.37 (20% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.43 – 8.31 (t, *J* = 2.0 Hz 1H), 8.24 (ddd, *J* = 7.6, 2.0, 0.8 Hz, 1H), 7.80 (d, *J* = 7.6 Hz, 1H), 7.57 (t, *J* = 7.6Hz, 1H), 7.40-7.31 (m, 8H), 7.14 (br s, 2H), 4.75 (s, 2H), 4.40 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 169.7, 148.1, 137.8, 136.4, 135.7, 132.6, 129.9, 129.1, 129.0, 128.6, 128.0, 126.8, 124.5, 122.1, 51.6, 47.6.



***N,N*-Dibenzyl-3,5-dinitrobenzamide** (**13**);[15] white solid (0.1416 g, 88% yield); mp 135-136 °C (Lit.[15] 135 ^{o}C); R_f 0.29 (10% EtOAc/hexanes); ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.02 (t, *J* = 2.0 Hz, 1H), 8.61 (d, *J* = 2.0 Hz, 2H), 7.44 – 7.13 (m, 8H), 7.13 (br s, 2H), 4.81 (s, 2H), 4.43 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.4, 148.4, 139.6, 135.9, 135.2, 129.4, 129.1, 128.7, 128.4, 128.3, 128.2, 127.1, 127.0, 126.6, 119.6, 51.8, 48.5.



***N,N*-dibenzyl-2-chloronicotinamide** (**14**); white solid (0.1192 g, 86% yield); mp 128-129 °C; R_f 0.29 (20% EtOAc/hexanes);^{1}H NMR (400 MHz, $CDCl_3$) δ 8.40 (dd, *J* = 4.8, 2.0 Hz, 1H), 7.68 (dd, *J* = 7.6, 2.0 Hz, 1H), 7.39 – 7.29 (m, 8H), 7.24 (dd, *J* = 7.6, 4.8 Hz, 1H), 7.07 (d, *J* = 6.4 Hz, 2H), 5.36 (d, *J* = 14.0 Hz, 1H), 4.31 – 4.20 (m, 2H), 4.13 (d, *J* = 14.4 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 167.3, 150.2, 147.3, 137.0, 136.0, 135.6, 132.5, 129.0, 128.80, 128.79, 128.1, 127.9, 127.2, 122.6, 50.9, 47.1.

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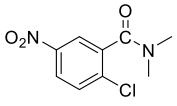
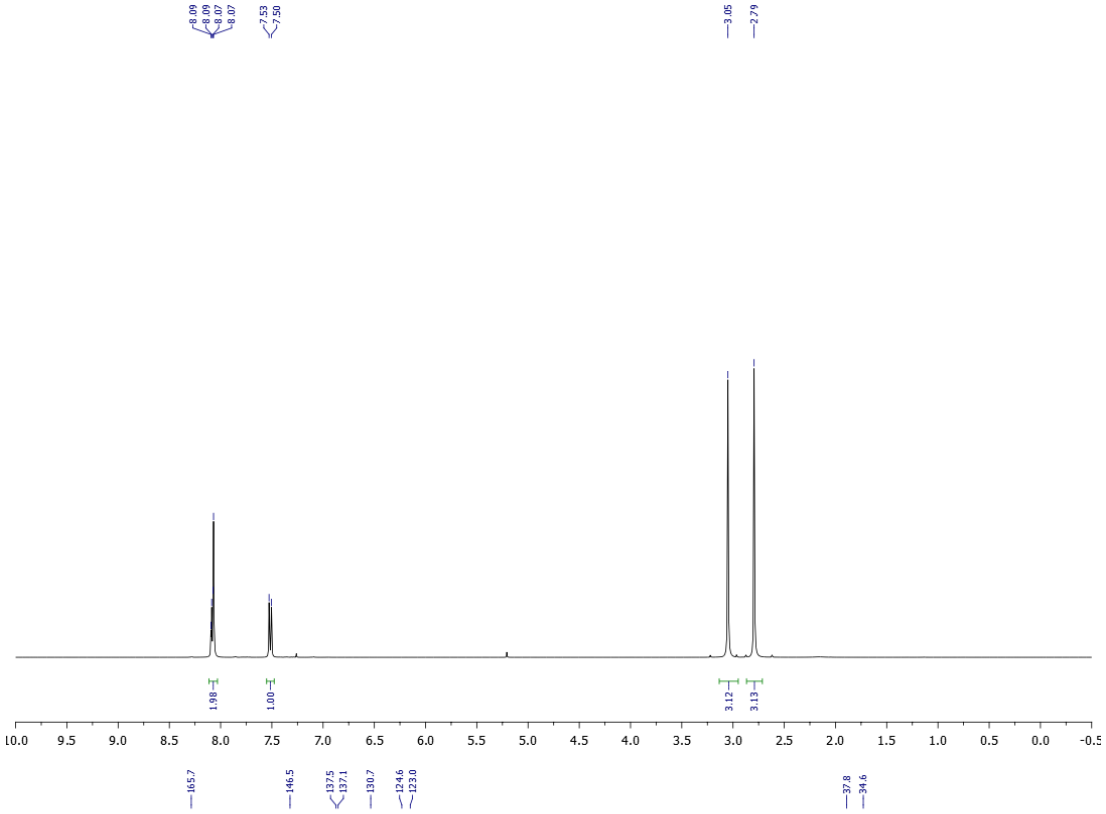
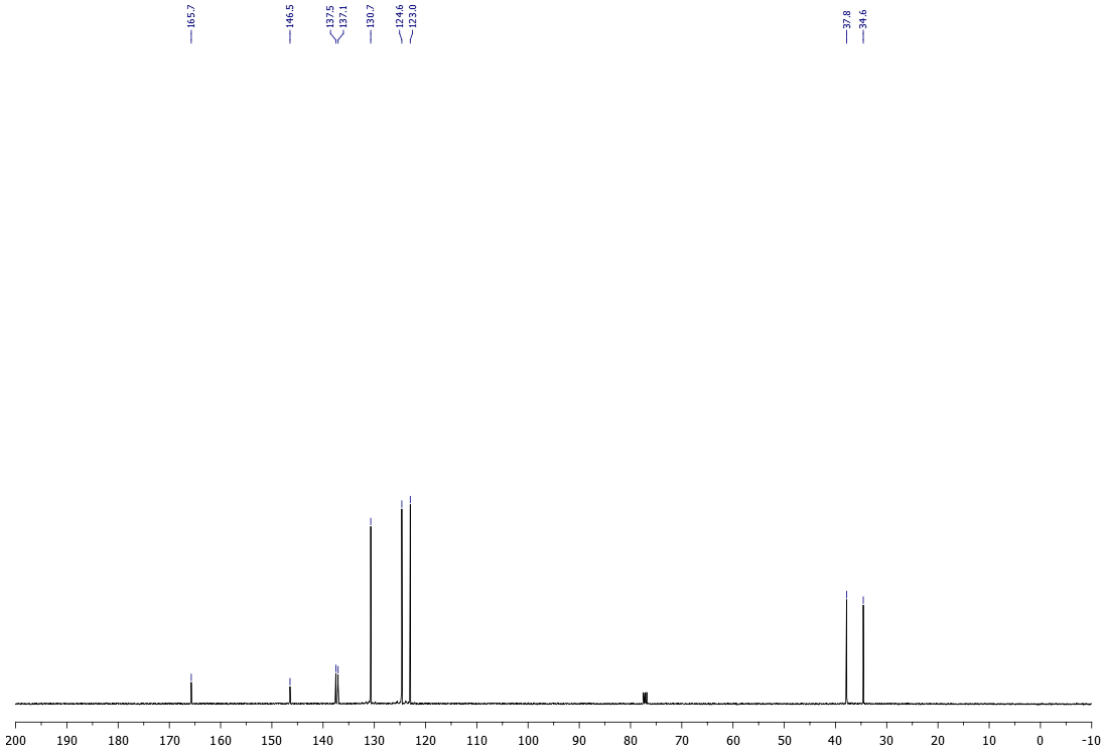
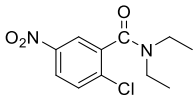
^{1}H and ^{13}C NMR spectra of all products



(Table 2, entry 1); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)







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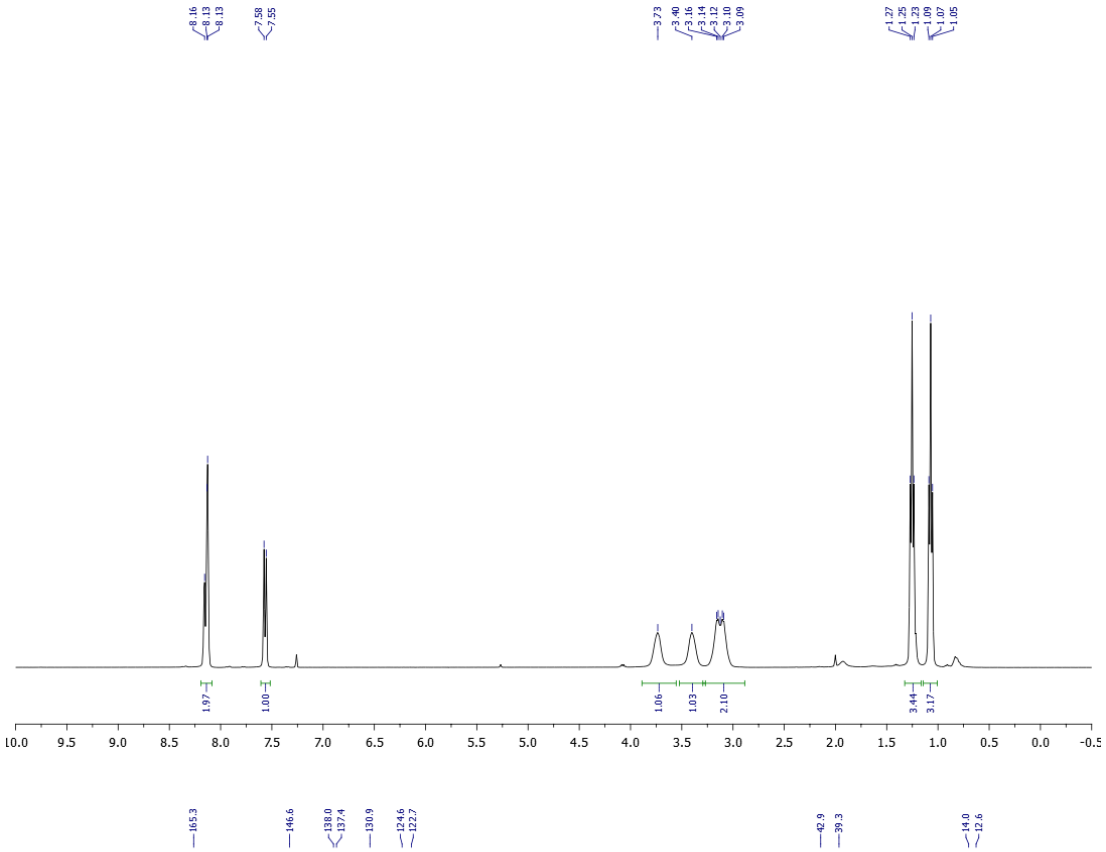
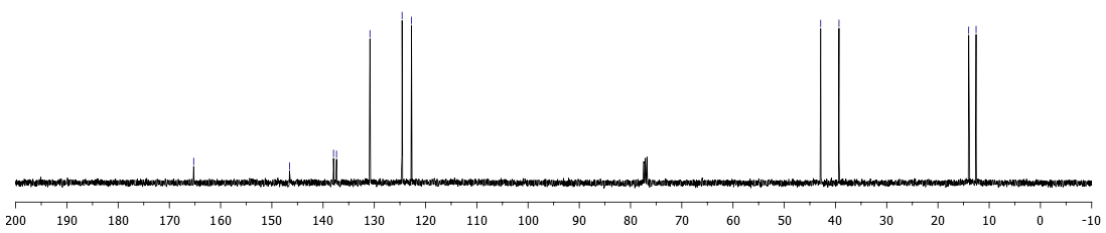
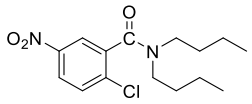
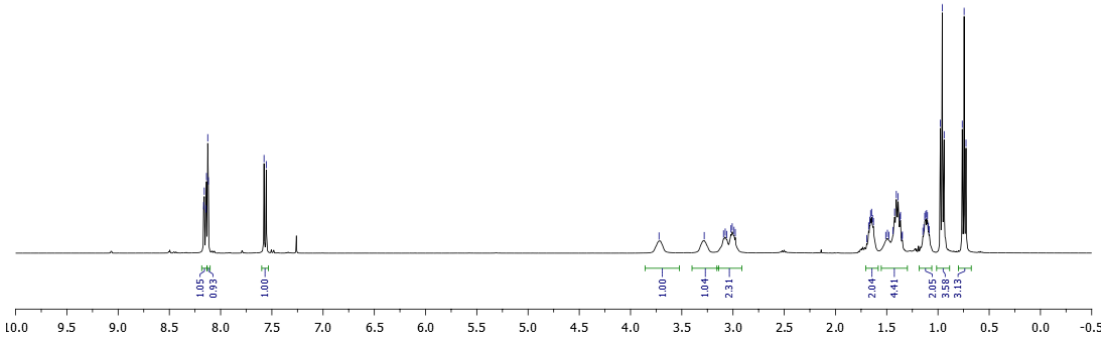
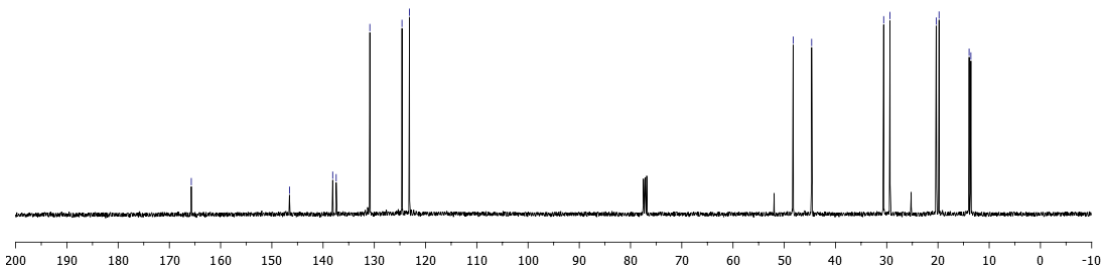


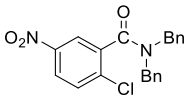




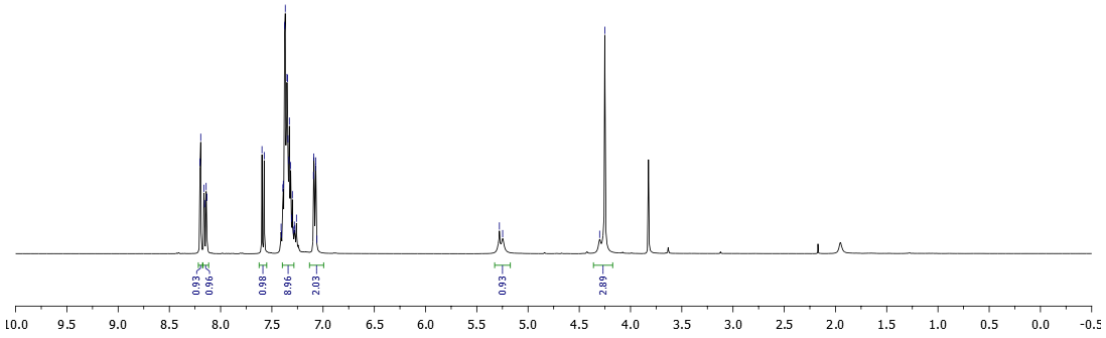
(Table 2, entry 3); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

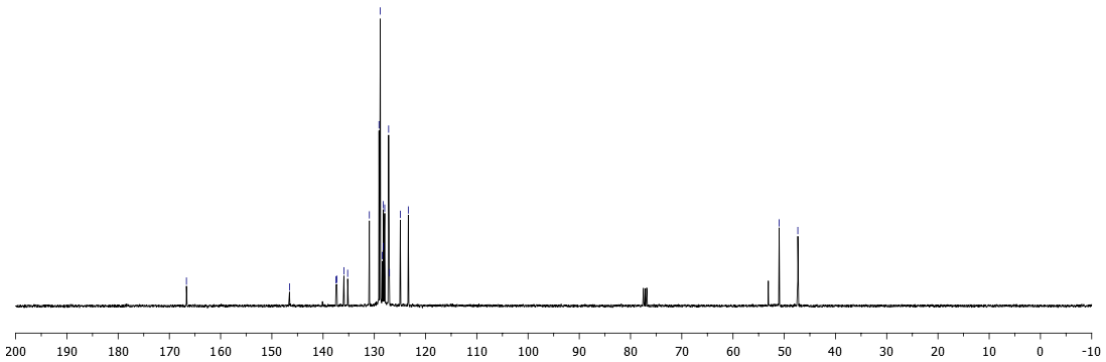


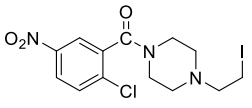




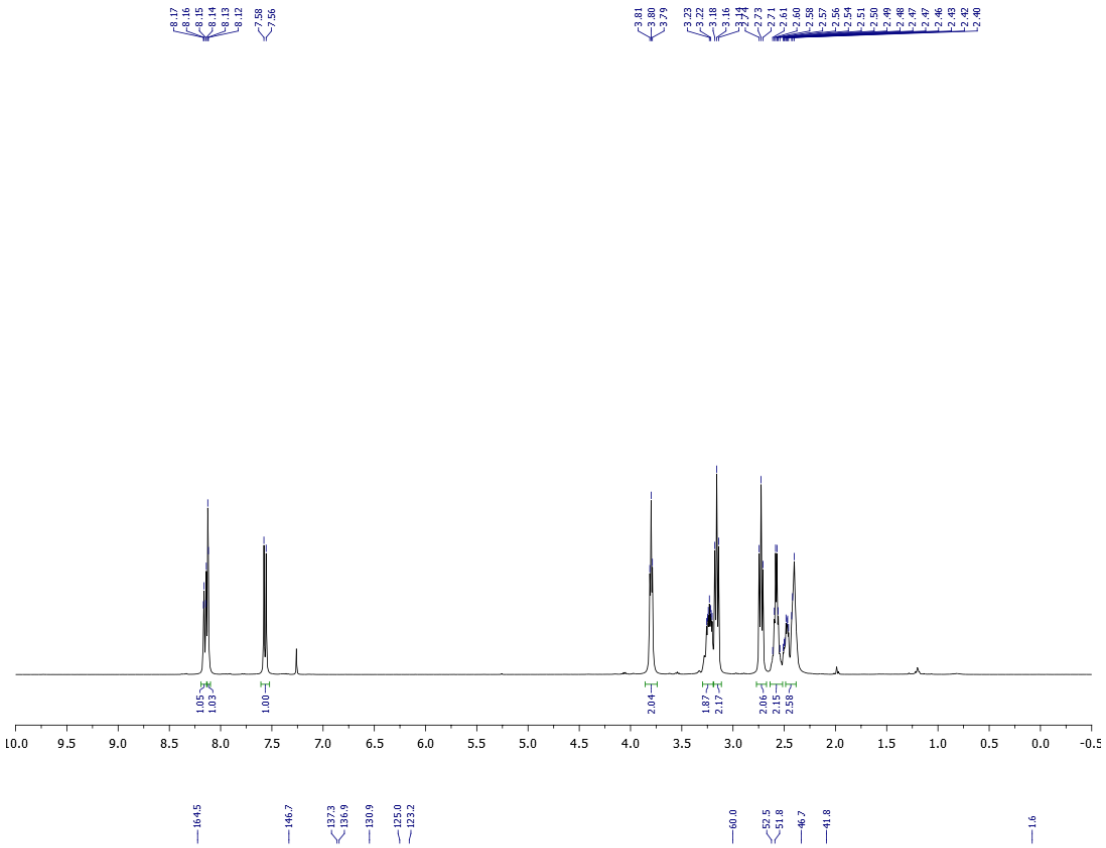
(Table 2, entry 4); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

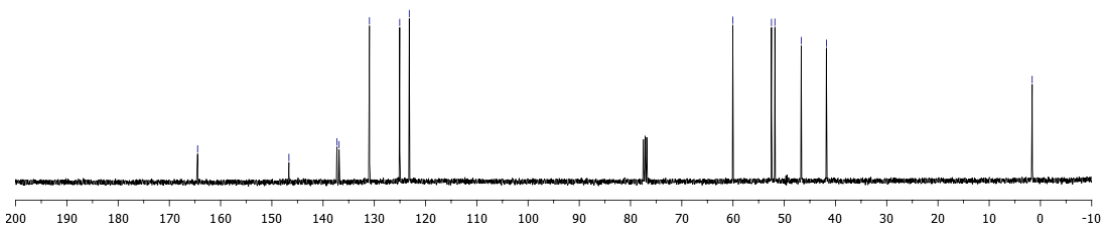


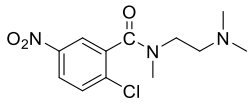




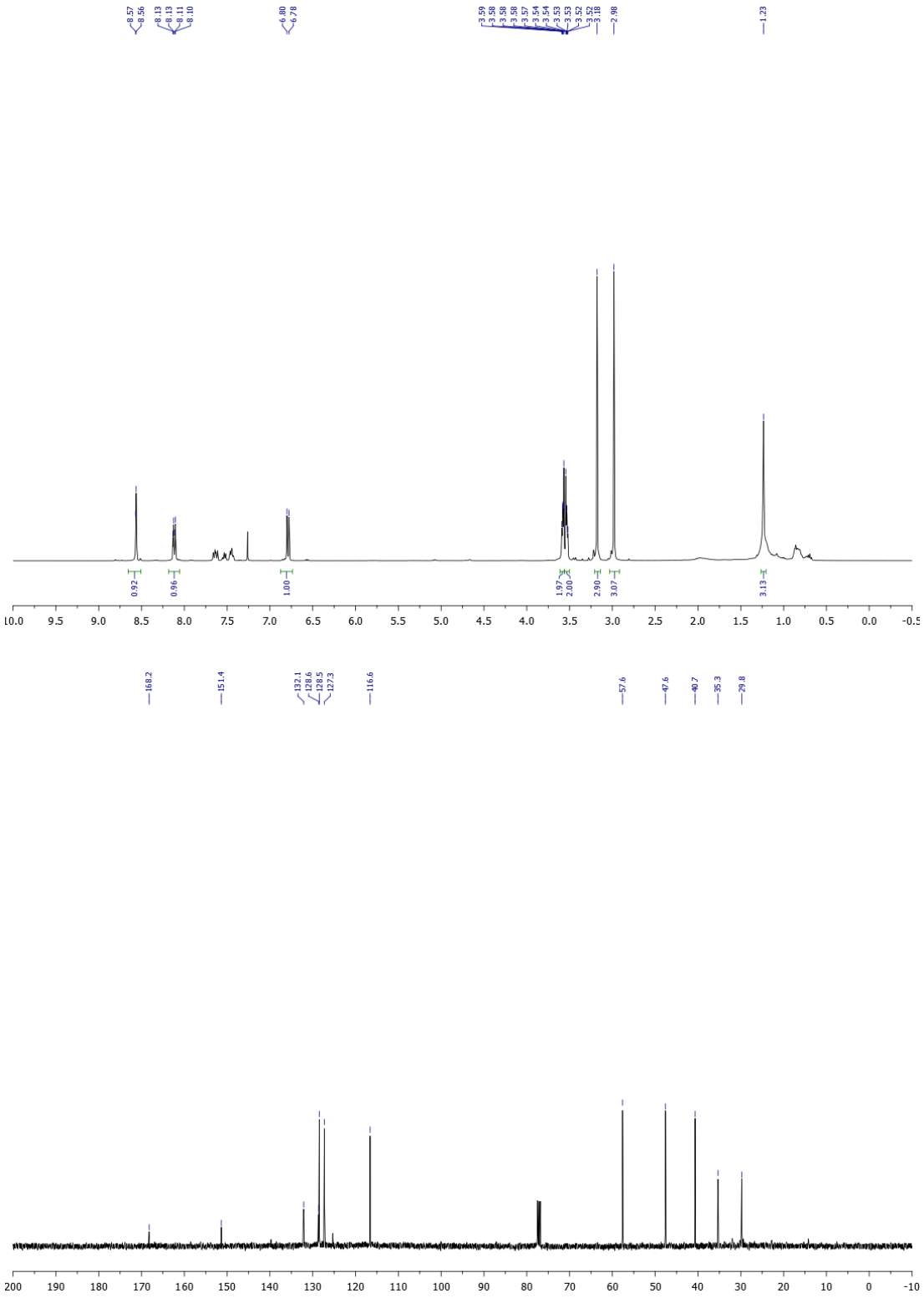
(Table 2, entry 5); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

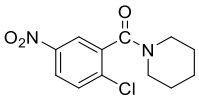




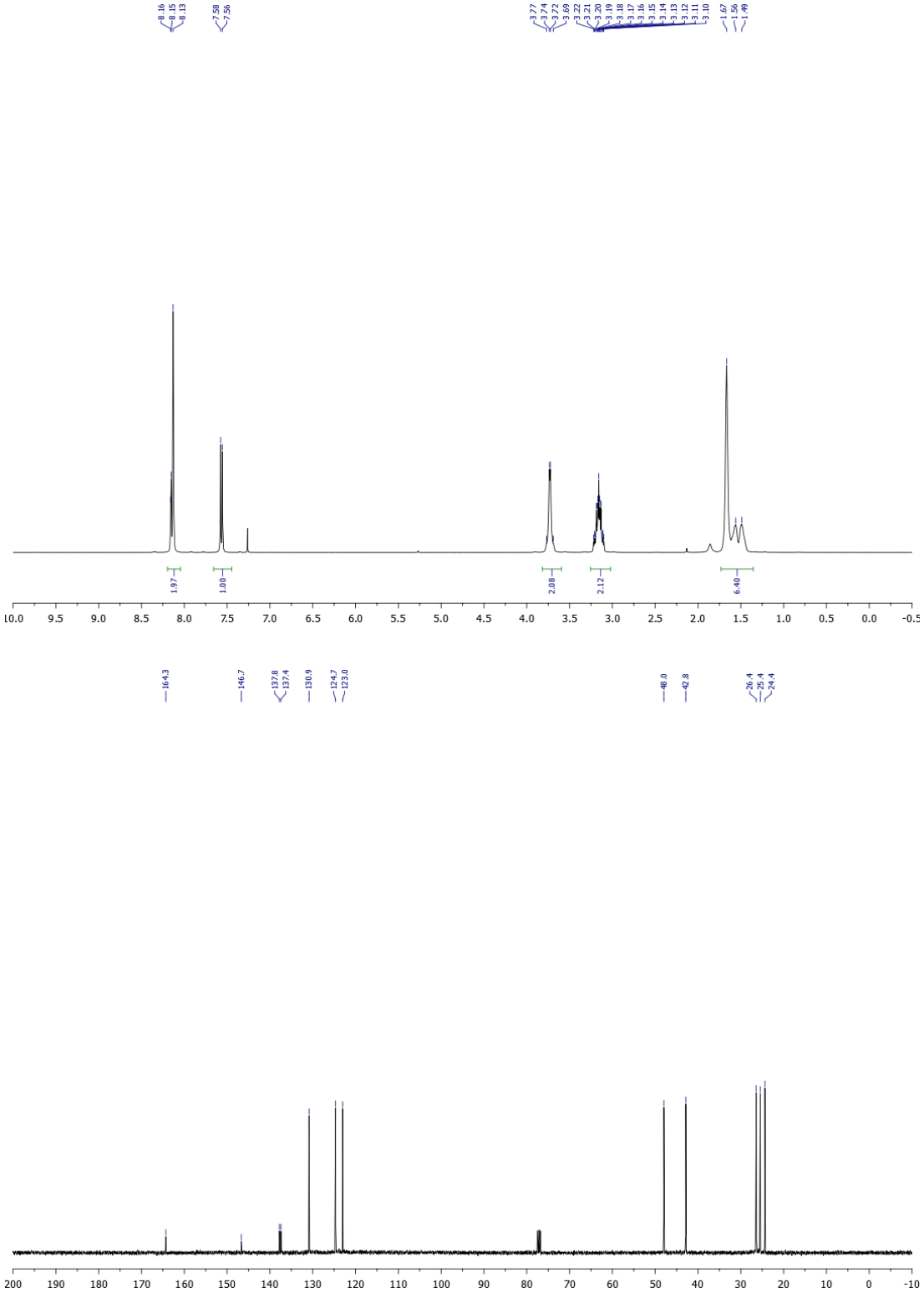


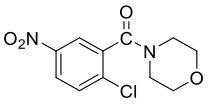
(Table 2, entry 6); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)



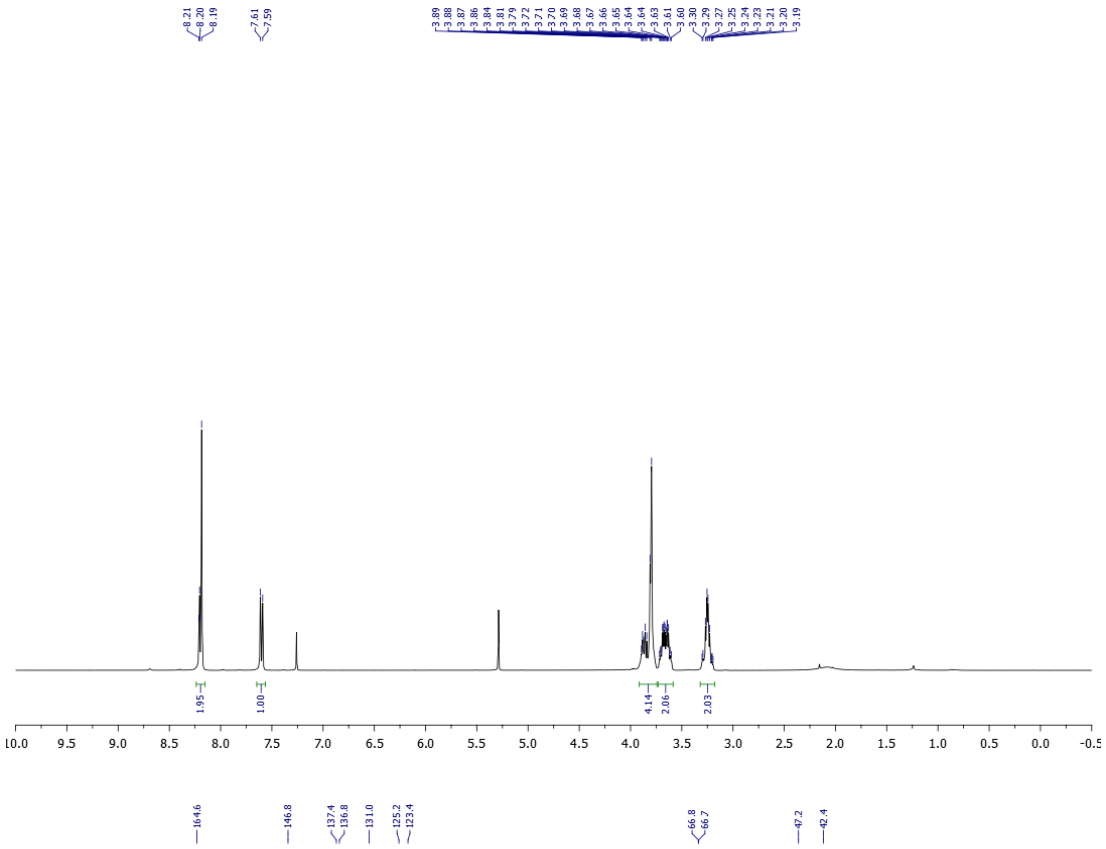


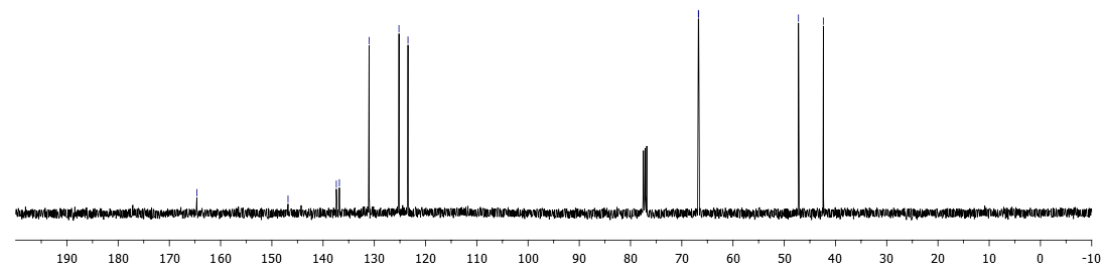
(Table 2, entries 7 and 8); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

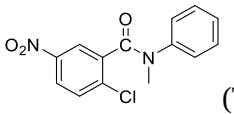




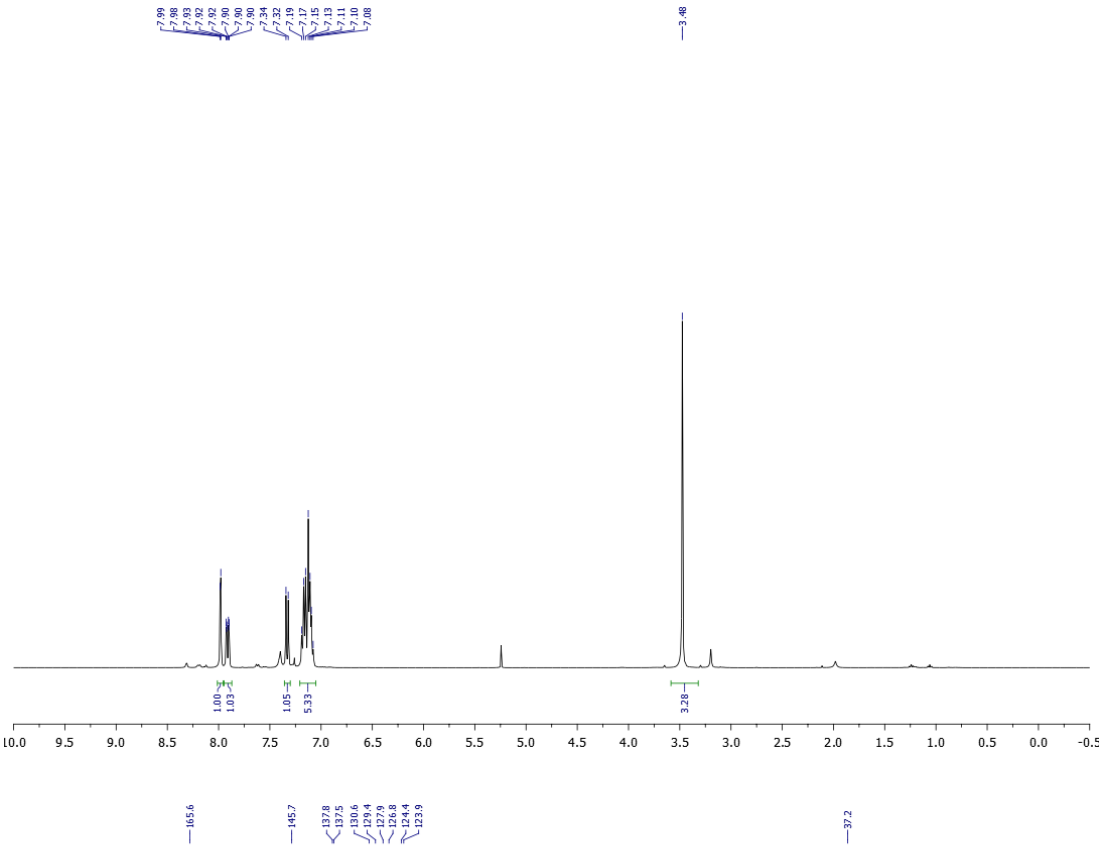
(Table 2, entry 9); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

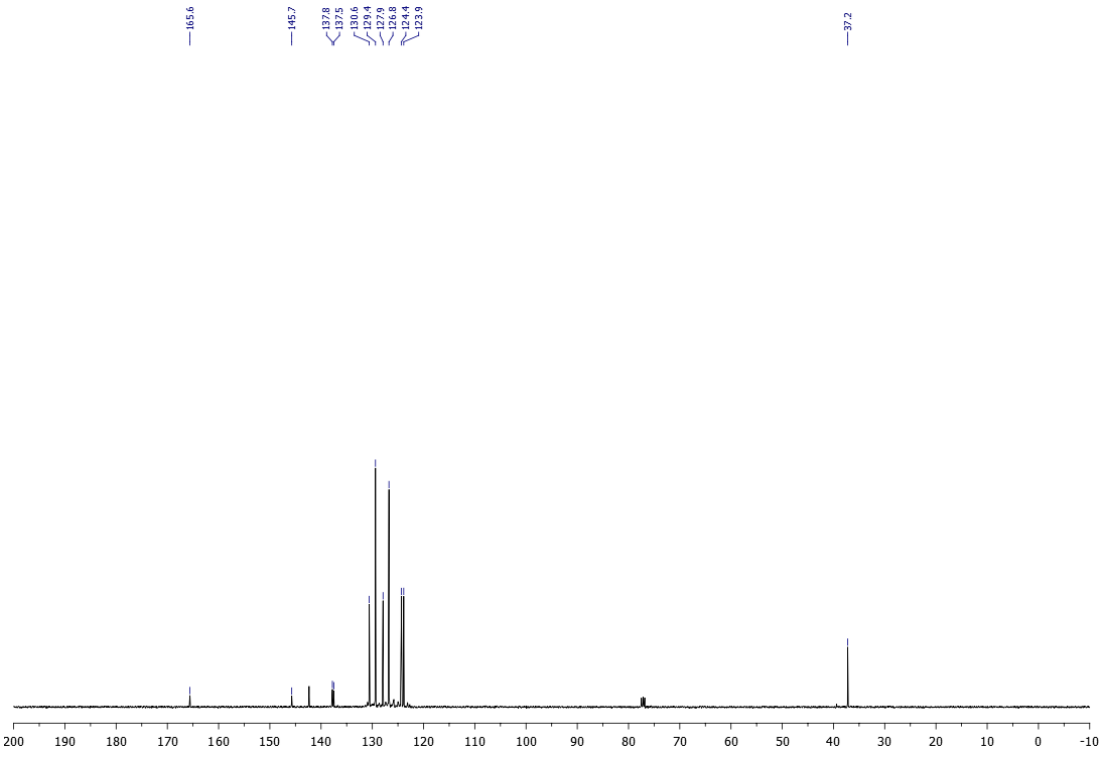




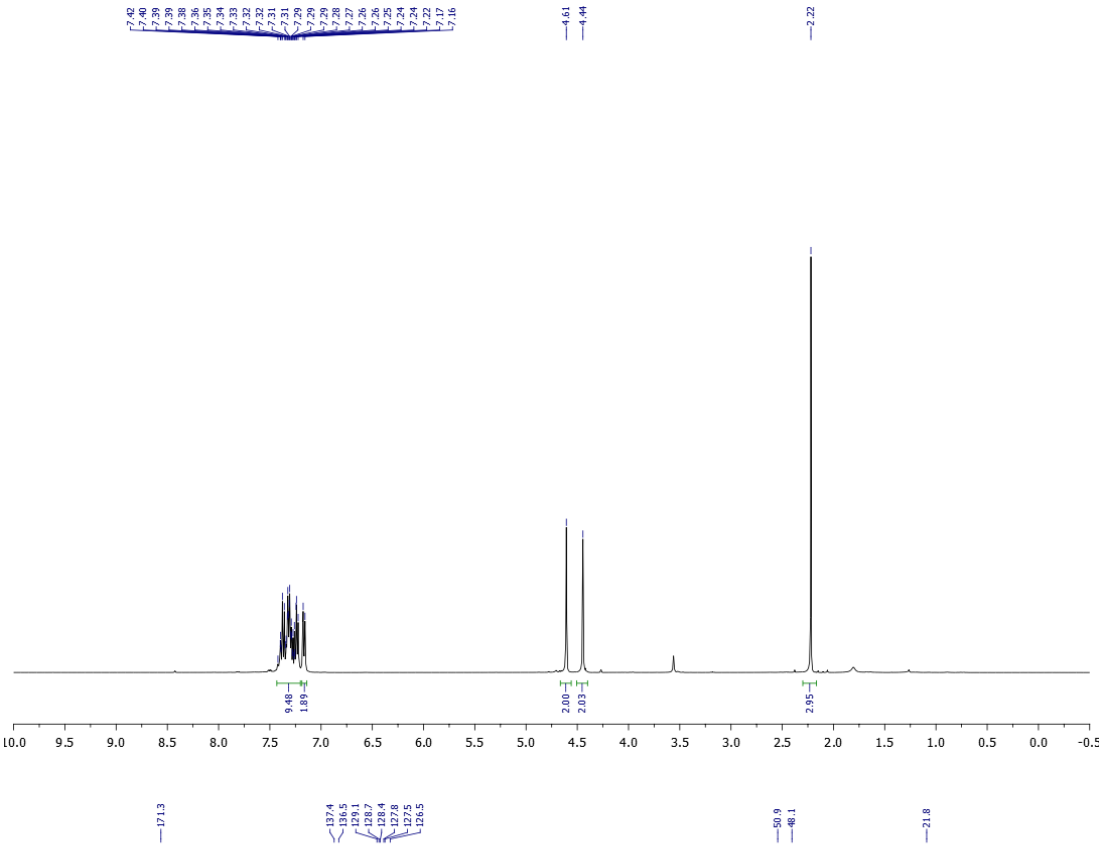


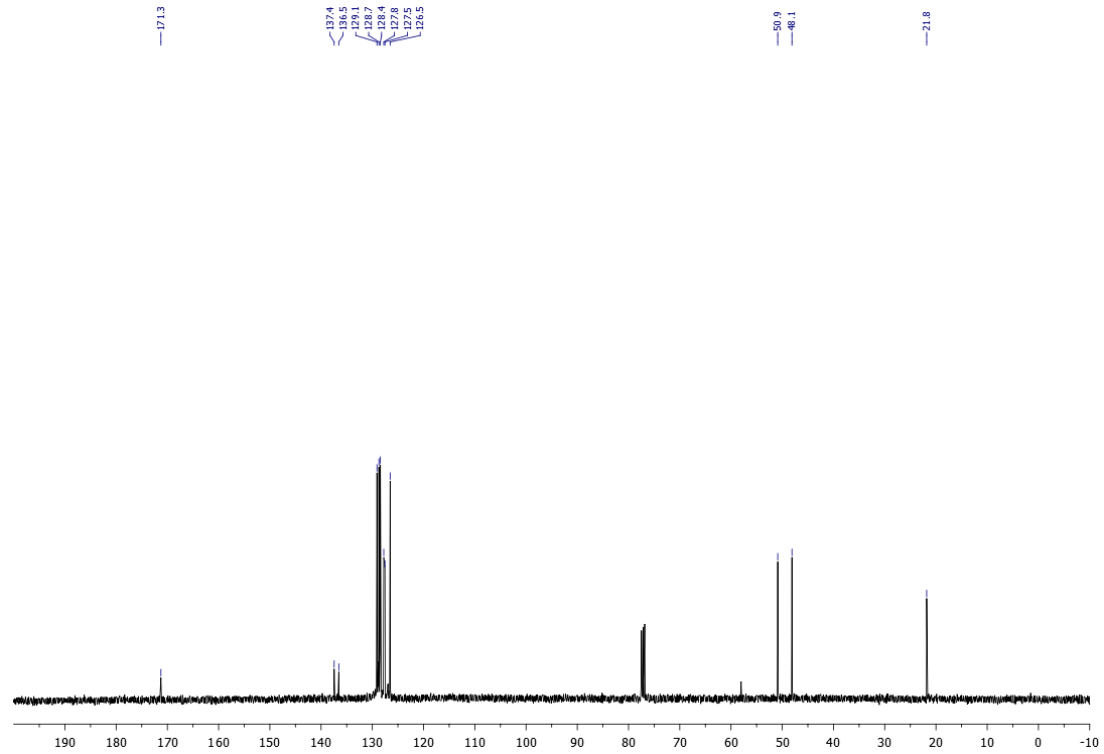
(Table 2, entry 10); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

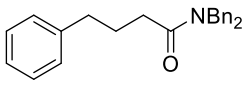




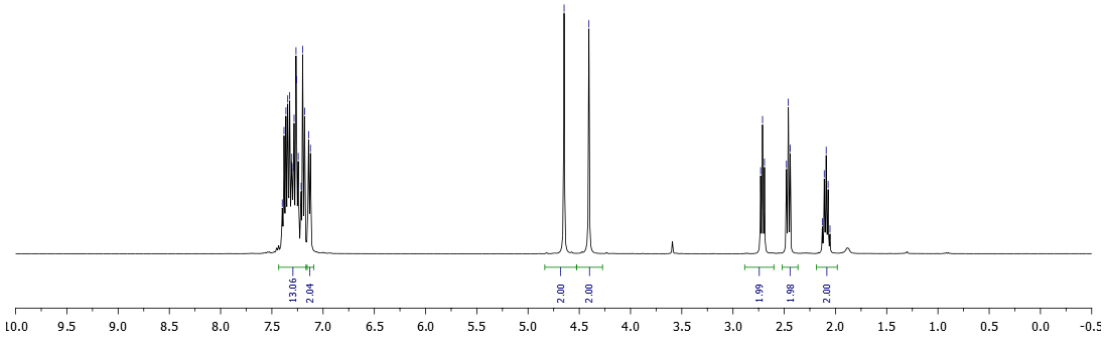
(Compound **1**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

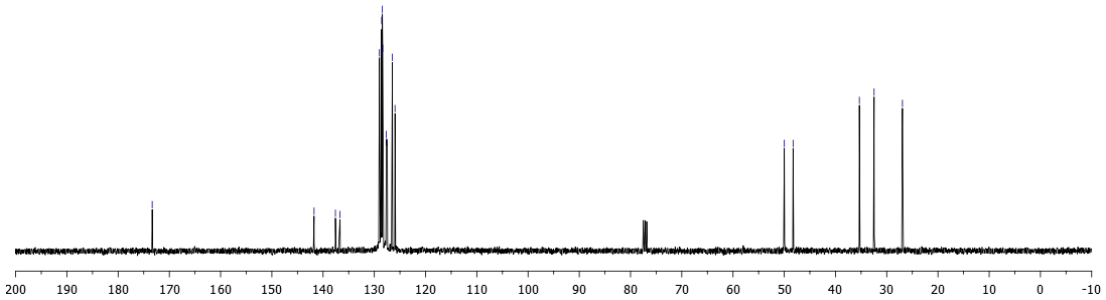


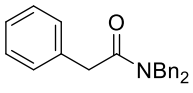




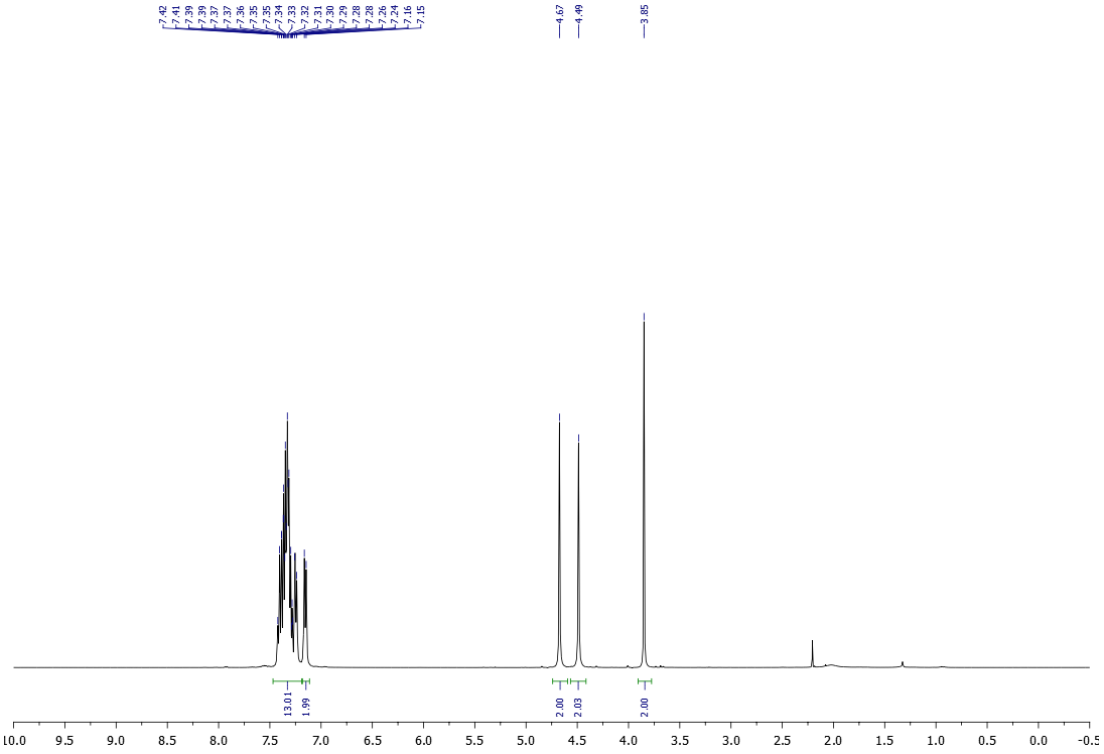
(Compound **2**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

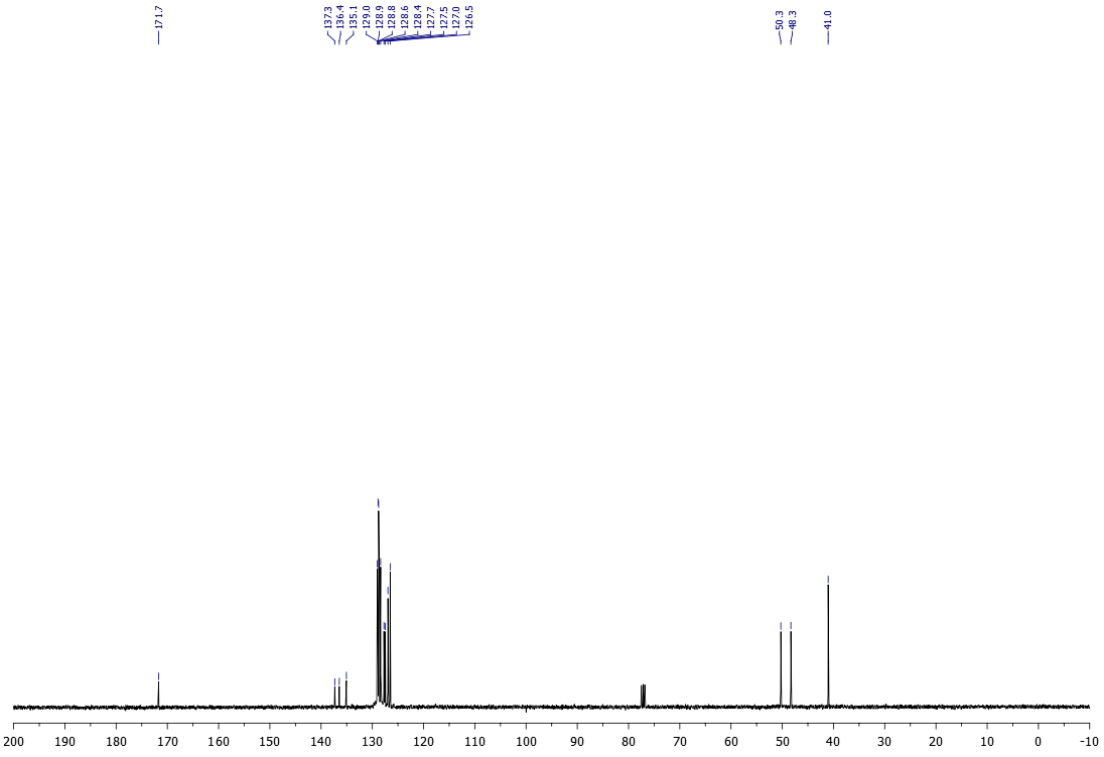


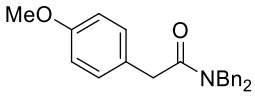




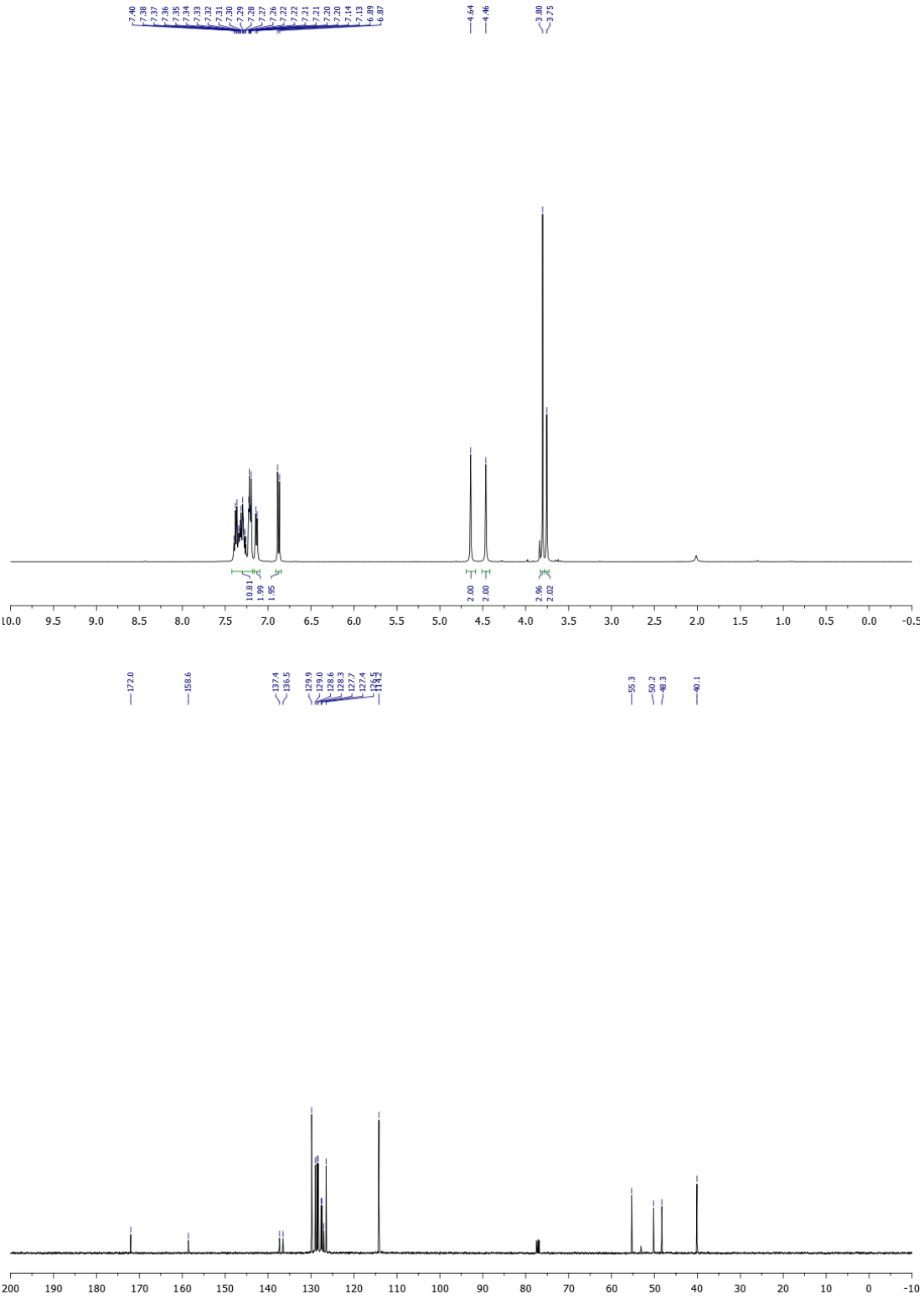
(Compound **3**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

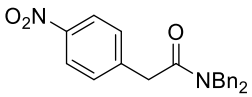




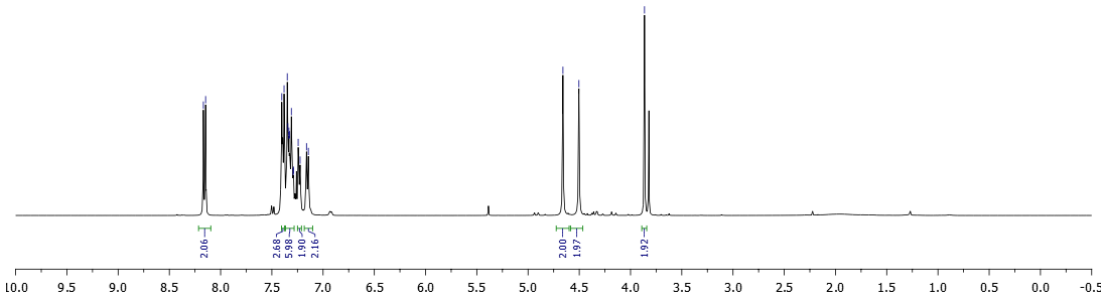


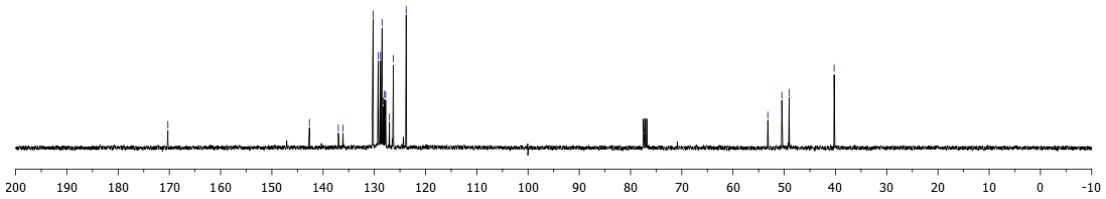
(Compound **4**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

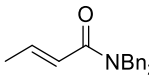




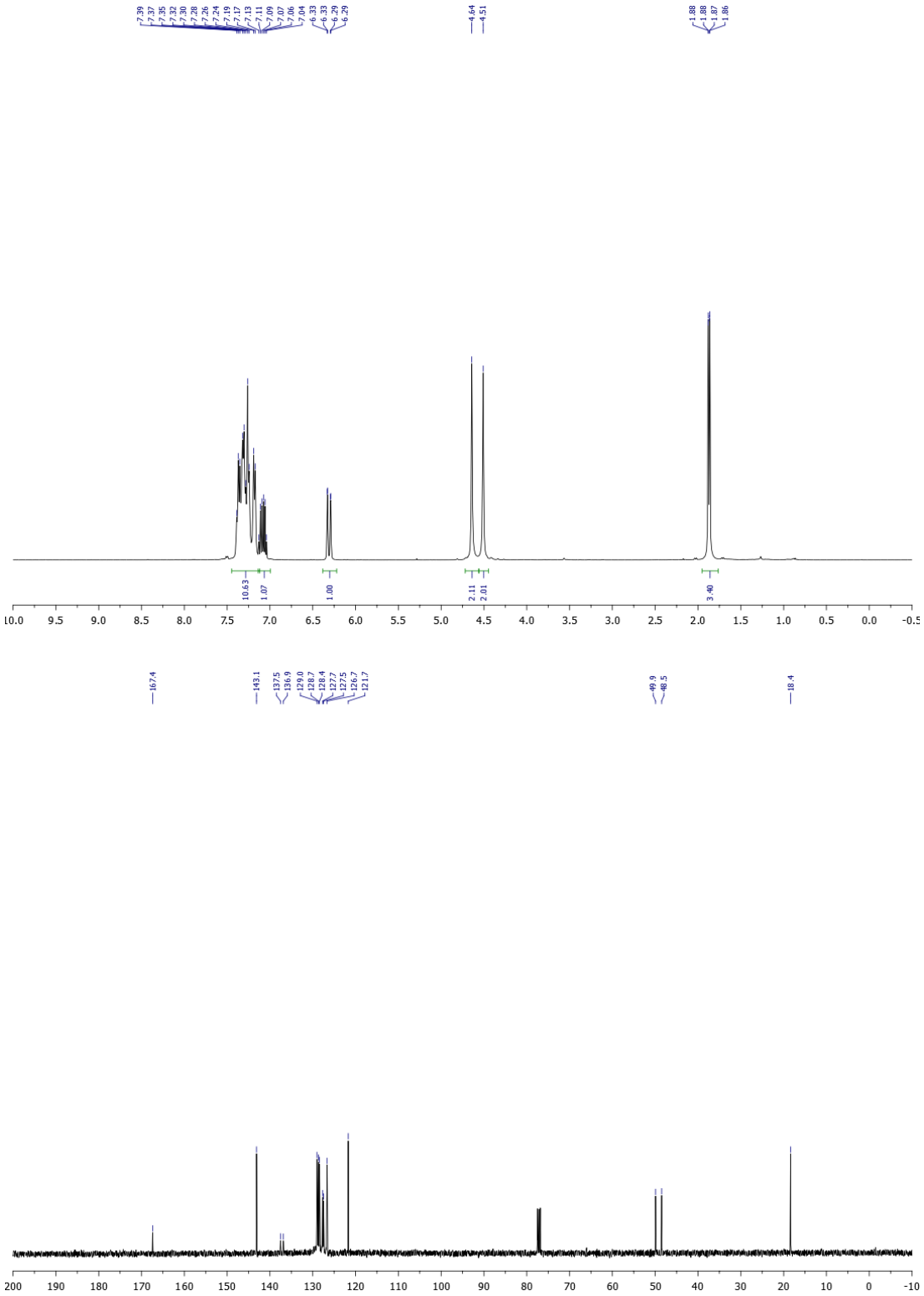
(Compound **5**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

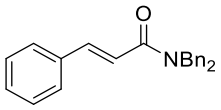




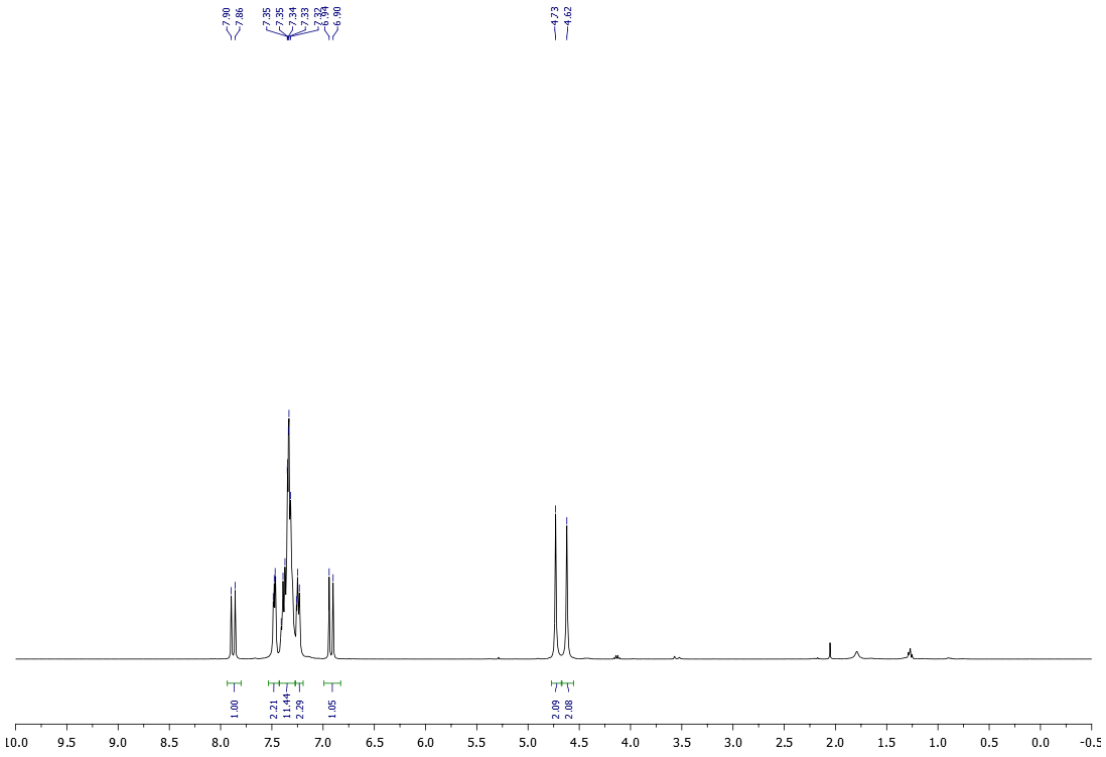


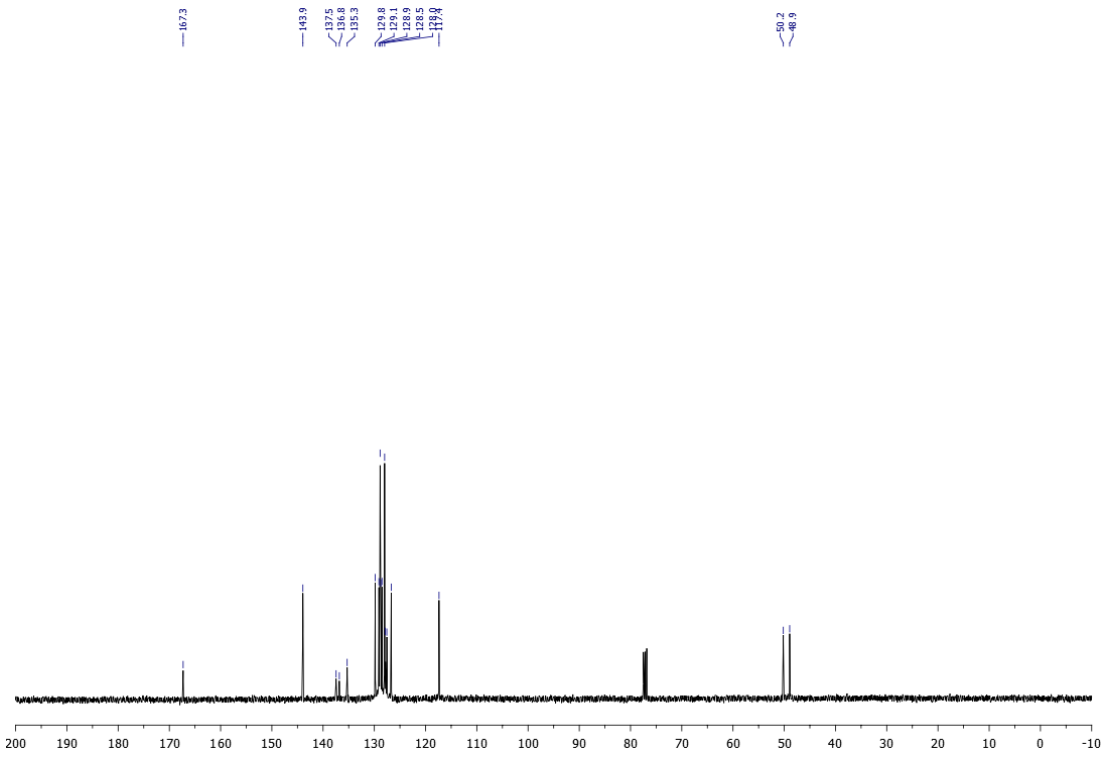
(Compound **6**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

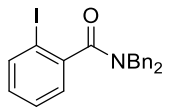




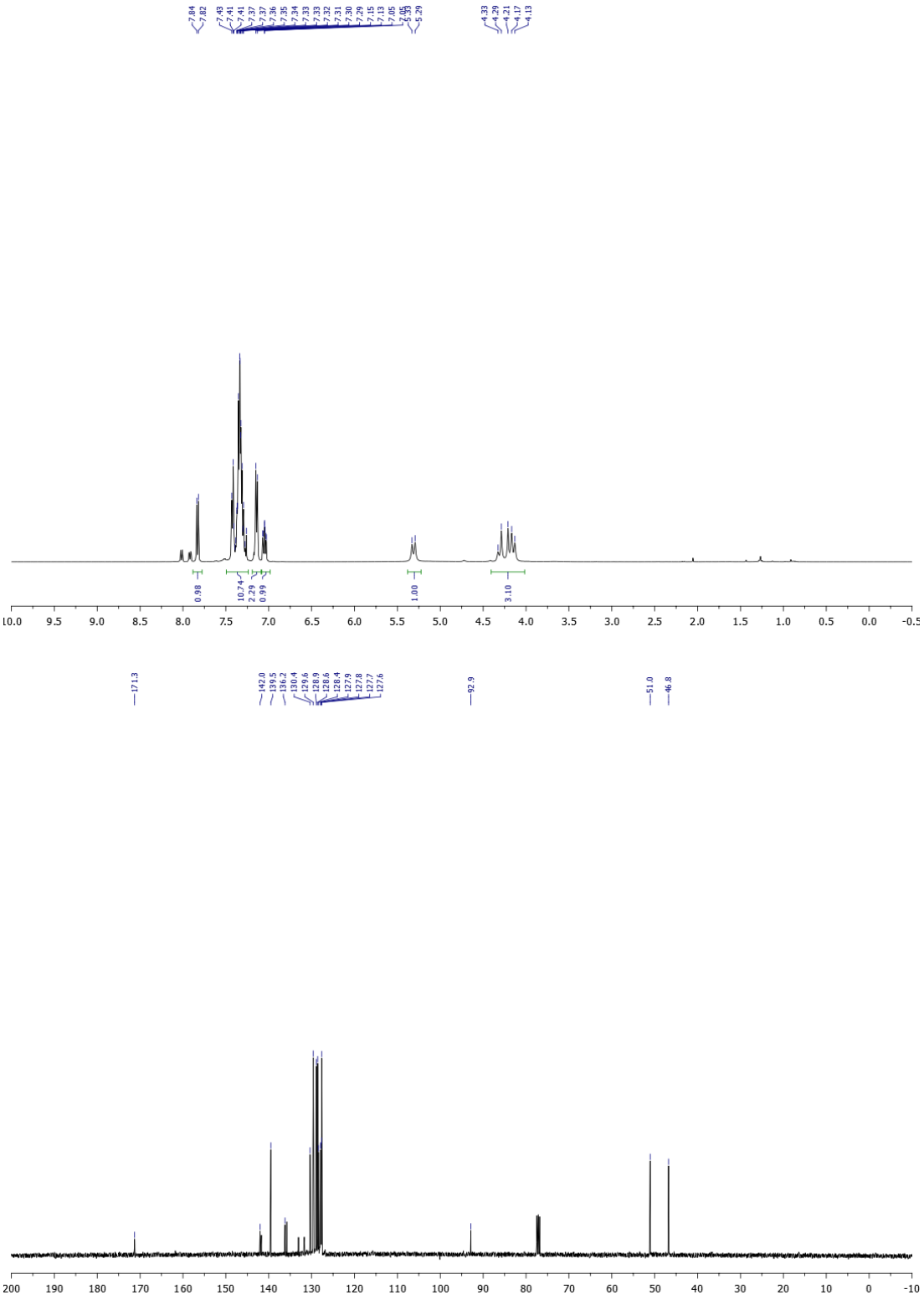
(Compound **7**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

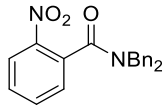




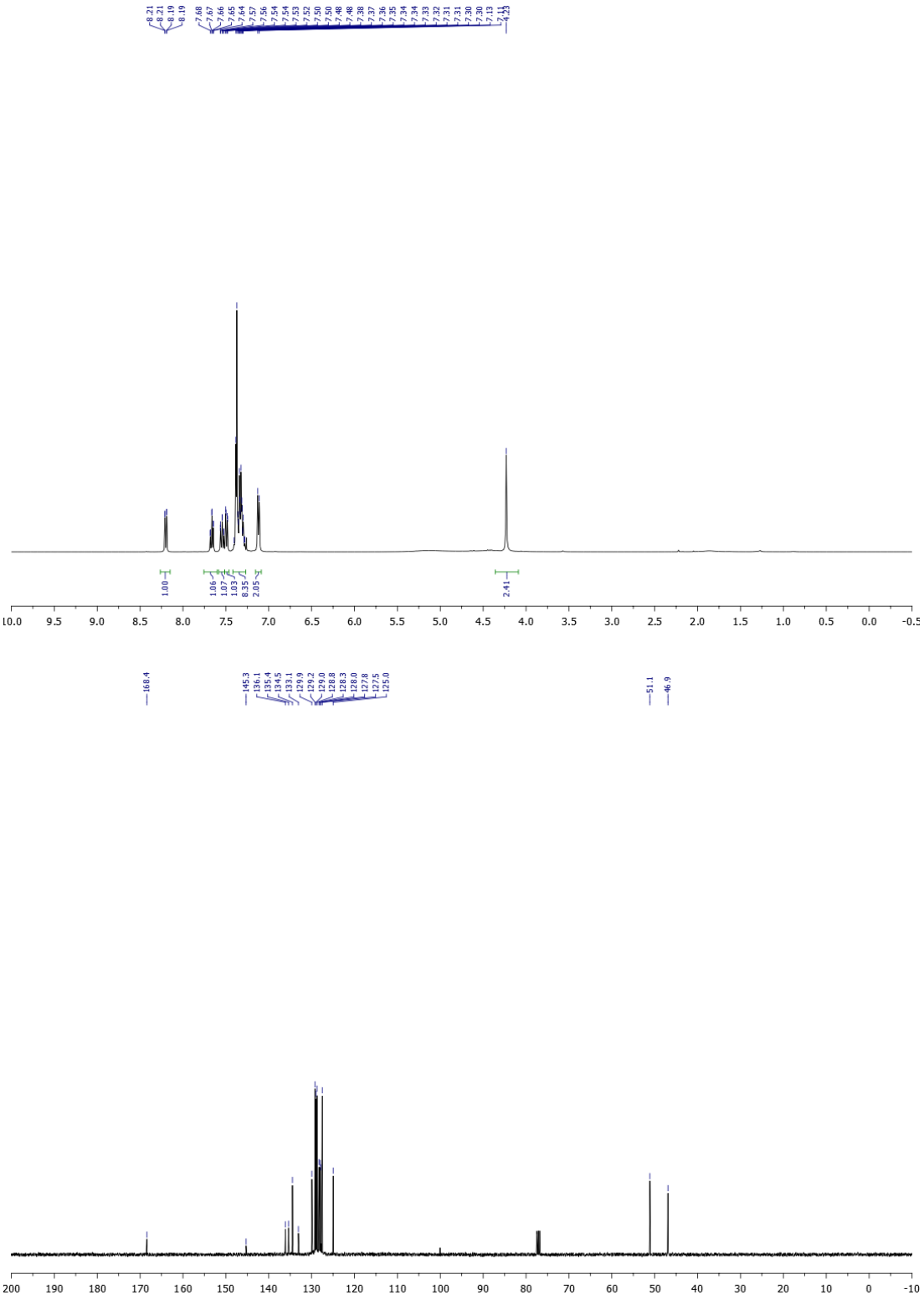


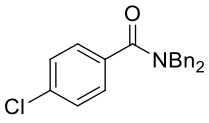
(Compound **8**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)



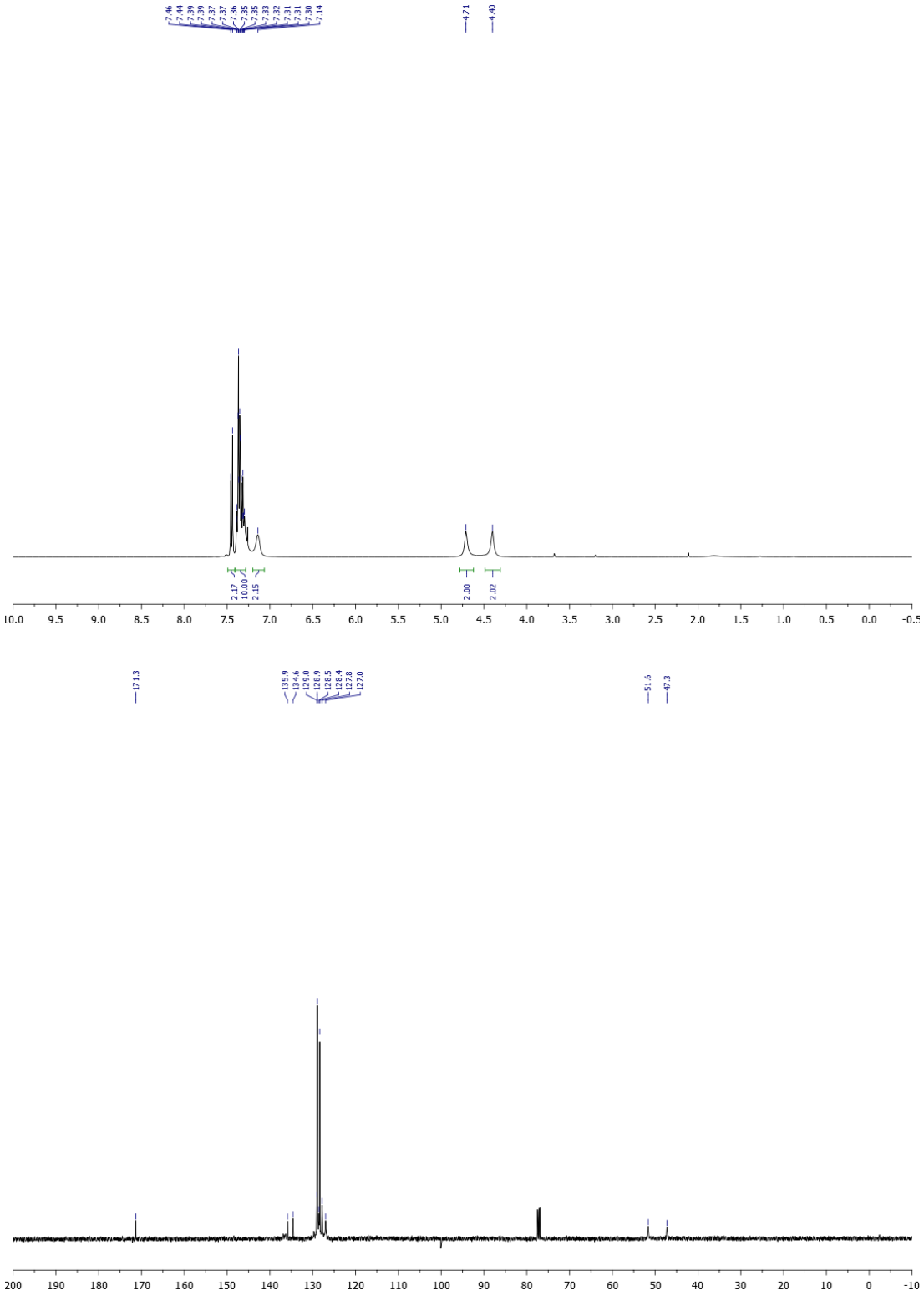


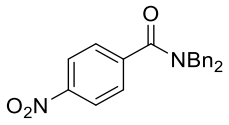
(Compound **9**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)



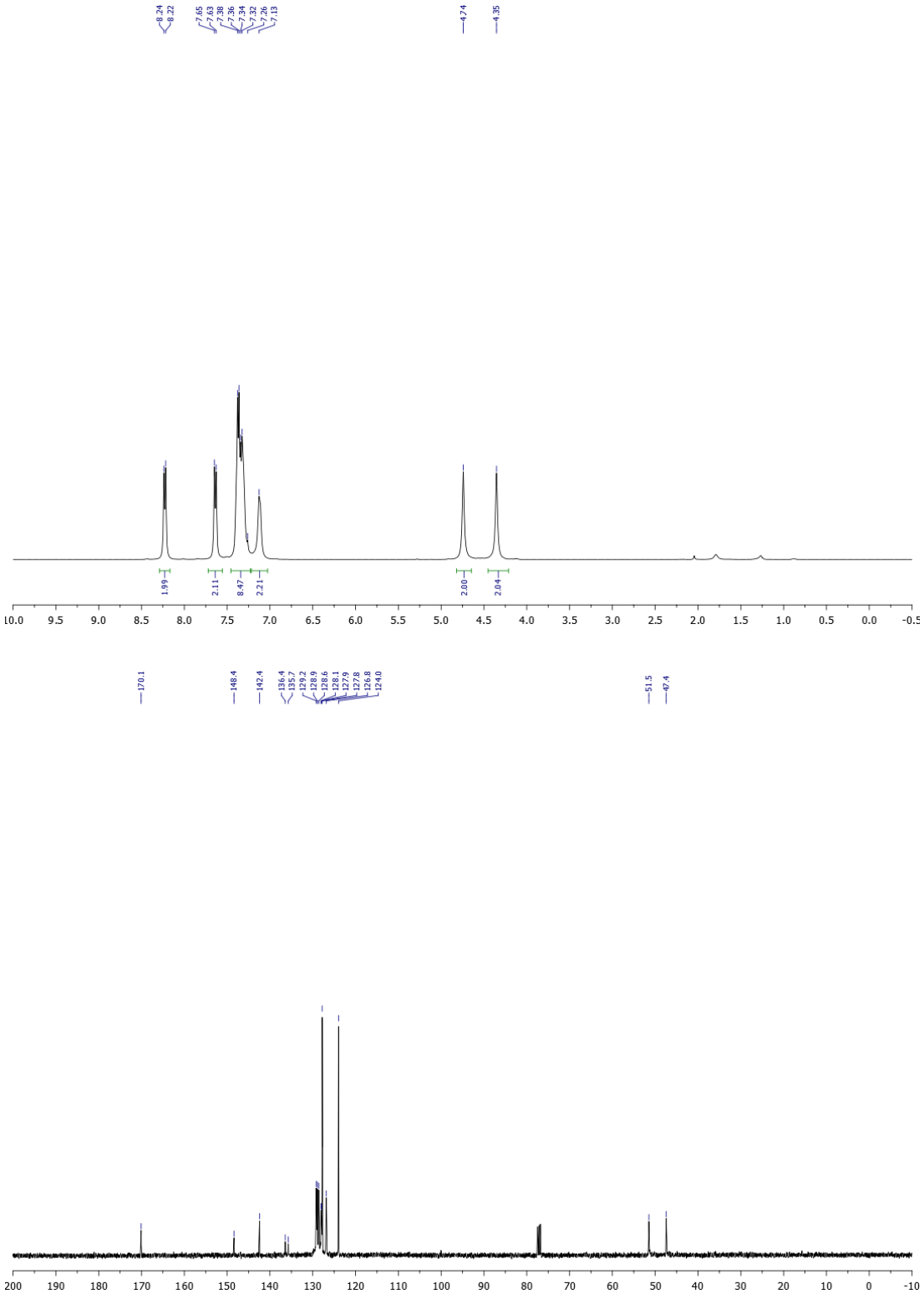


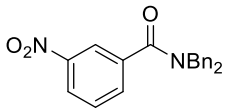
(Compound **10**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)



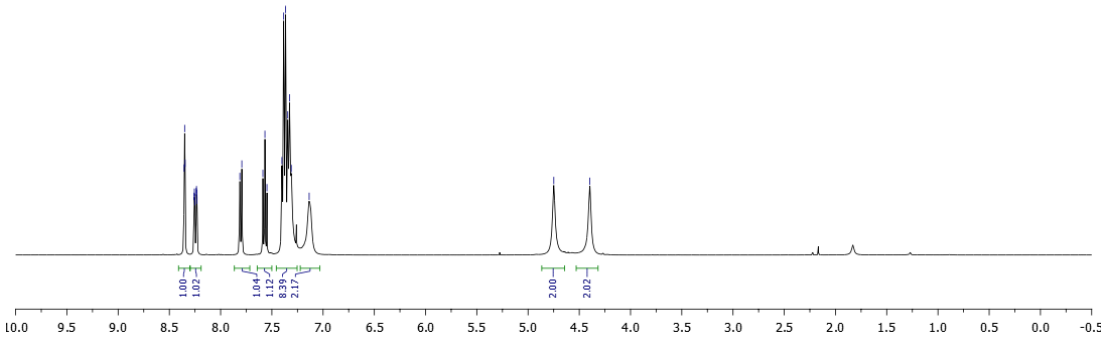


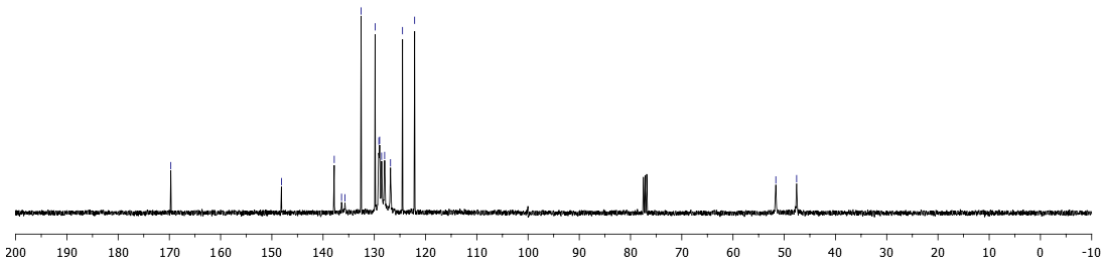
(Compound **11**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

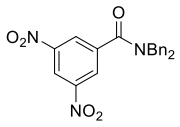




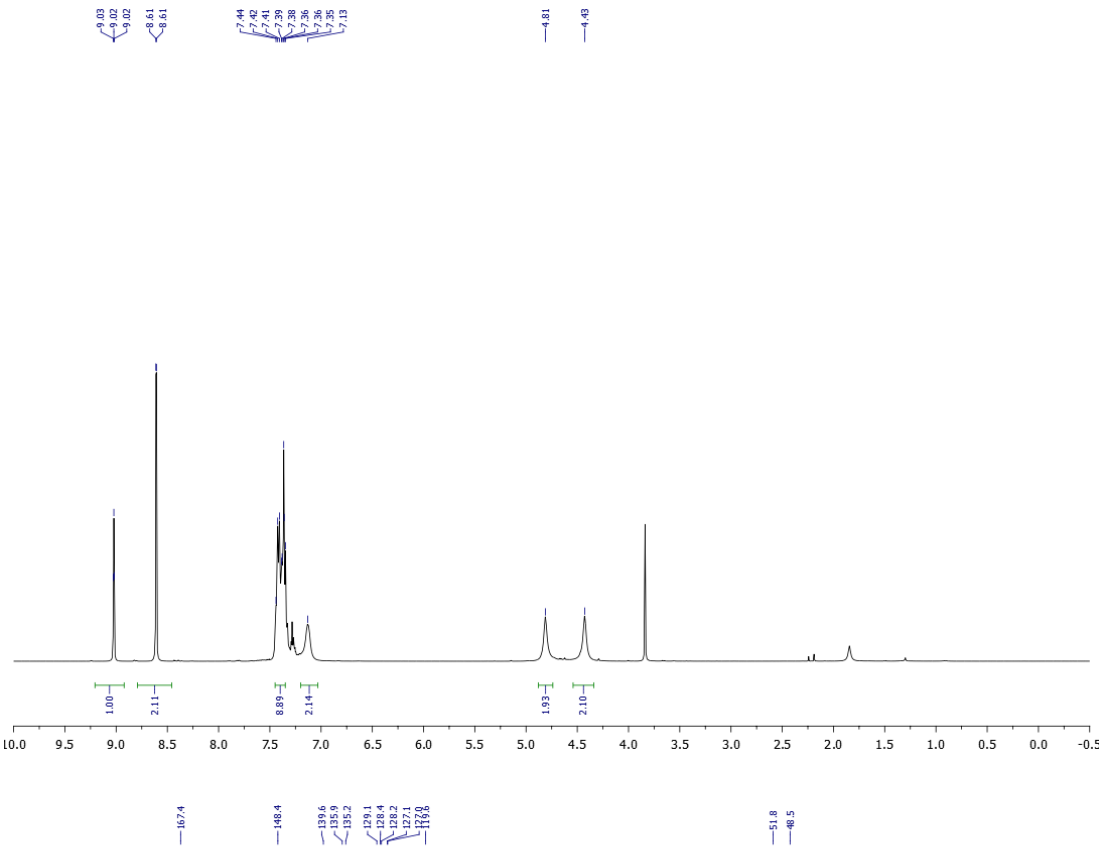
(Compound **12**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)

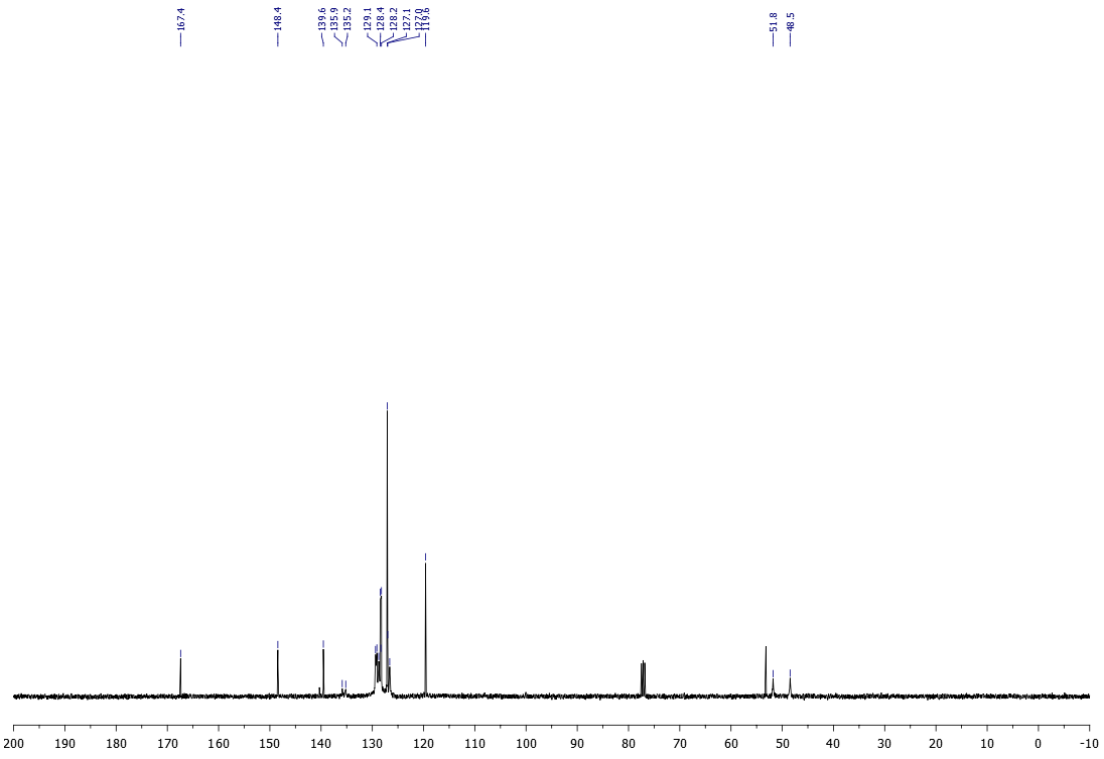


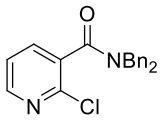




(Compound **13**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)







(Compound **14**); ^{1}H NMR (400 MHz, $CDCl_3$); ^{13}C NMR (100 MHz, $CDCl_3$)