Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting information

Transamidation of Secondary Carboxamides and Amidation of Esters are Facilitated by Magnetic Co@NC Nanoparticles, as a Highly Efficient and Recyclable Catalyst Under Neat Conditions

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1. Experimental section

1.1 General information

All the chemicals were purchased from Sigma-Aldrich suppliers and used without further purification. Thin layer chromatography (TLC) was conducted with analytical thin layer percolated E. Merck 60 GF254 silica gel plates and spots were visualized using UV light and or iodine vapour and column chromatography was carried out using silica gel of 60-120 mesh size. The melting points were determined in open capillary melting point apparatus and are uncorrected. ^{1}H and ^{13}C NMR spectra were recorded on Bruker Avance 500 MHz spectrometer in $CDCl_3$ and DMSO-d_6 using TMS as the internal standard at 500 and 126 MHz frequency respectively. All products synthesised were confirmed by using melting point, ^{1}H, ^{13}C NMR, mass spectra and the reported compounds were compared with the literature data.

Materials for the synthesis of Co@NC

Merck, India, provided cobalt chloride hexa hydrated ($CoCl_2.6H_2O$), Sigma Aldrich provided the nitrilotriacetic acid (NTA), and SDFL, India provided the isopropanol. All the studies were carried out with deionized water that had been double-distilled.

1.2 General procedure for the synthesis of Co–NTA

0.002 mol $CoCl_2 \cdot 6H_2O$ was dissolved in 15 mL deionized water and agitated for 20 min to form a homogeneous solution. 0.005 mol of nitrilotriacetic acid (NTA) was distributed and swirled for 30 min in 15 mL of isopropyl alcohol. The NTA solution was added to the cobalt chloride solution and agitated for 30 min. The resultant mixture was transferred for 6 hours at 180 °C in a Teflon-lined autoclave (50 mL capacity). It was essential to let the autoclave drop to ambient temperature. The pink precipitate was collected, washed with deionized

water several times, and then centrifuged with ethanol at 8000 rpm for 10 min. In a hot air oven set to 60°C for overnight.[1]

1.3 General procedure for the synthesis of Co@NC

Co-NTA fine powder (100 mg) was placed in a crucible boat and pyrolyzed for 3 hours at 600 °C in an N_2 environment. The tubular furnace was let to cool naturally at ambient temperature. Co@NC was used to represent the black powder that was collected.

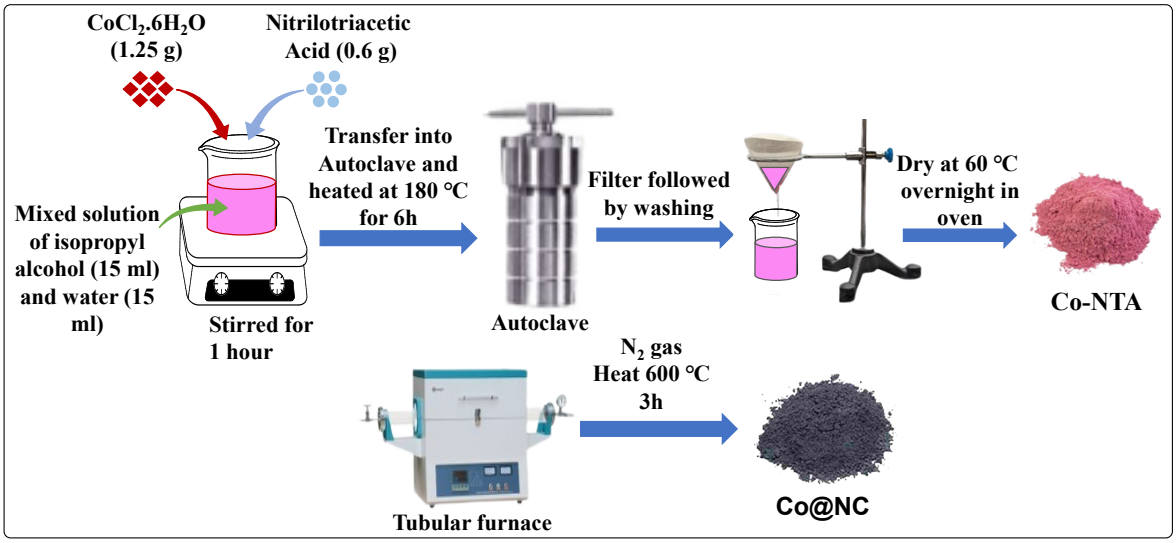


Fig. S1 Synthesis of Co@NC

1.4 General procedure for synthesis of amides

All amides used in the study were synthesized by previously reported methods.[2]

1.5 General procedure for the synthesis of *N*-Boc activated secondary amides

N-Boc-activated amides were synthesized according to the reported method.[3] To an oven-dried round bottom flask, amide (1.0 equiv.), DMAP (0.1 equiv.) and dichloromethane were added, the reaction temperature was maintained at 0 °C to this Boc anhydride (1.5 equiv.) was added dropwise. After the addition of Boc anhydride, the reaction mixture was stirred for 14-24 h at room temperature. The progress of the reaction was monitored with TLC, after the completion of the reaction, mixture was concentrated under reduced pressure and

purified by column chromatography and the product was obtained in excellent yield. Following the addition of Boc anhydride, the reaction mixture was stirred for 14-24 hours at room temperature. The reaction progress was tracked using TLC. Upon completion, the mixture was concentrated under reduced pressure and subjected to purification by column chromatography, yielding the product in excellent yield.

1.6 General procedure for Co@NC catalyzed transamidation

N-Boc activated amide (1.0 mmol), amine (1.5 mmol) and Co@NC (5 mg) were mixed in a round bottom flask. The mixture was heated at 60°C under solvent-free conditions, and the progress of reaction was monitored by TLC. Upon completion of the reaction, the mixture was diluted with ethyl acetate, and the catalyst was separated using an external magnet. Subsequently, the solvent was evaporated under vacuum, and the crude product was purified through column chromatography. All the products were confirmed using m.p., ^{1}H, ^{13}C NMR and HRMS spectral data.

2. Reusability graphs of Co@NC

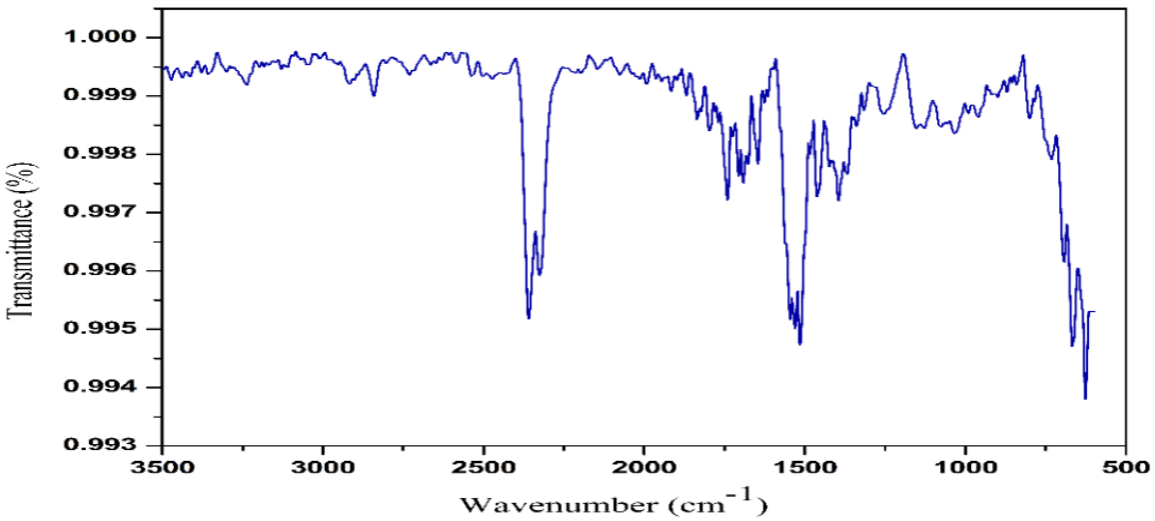


Fig. S2 IR data of Pure and Reused Co@NC

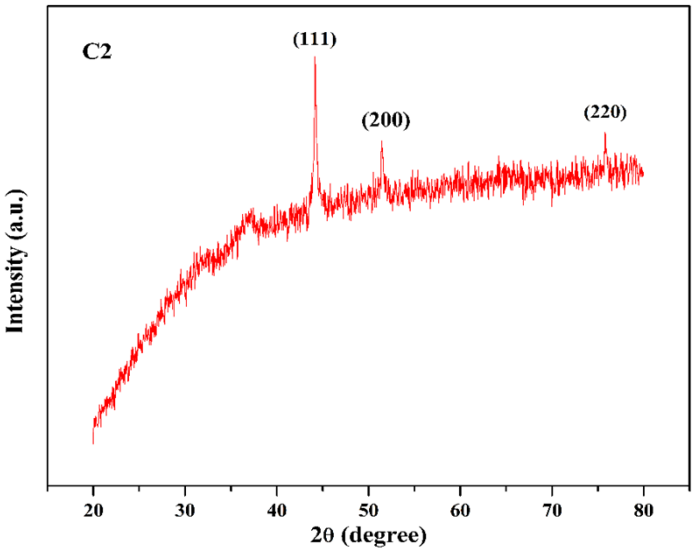


Fig. S3 XRD pattern of Co@NC

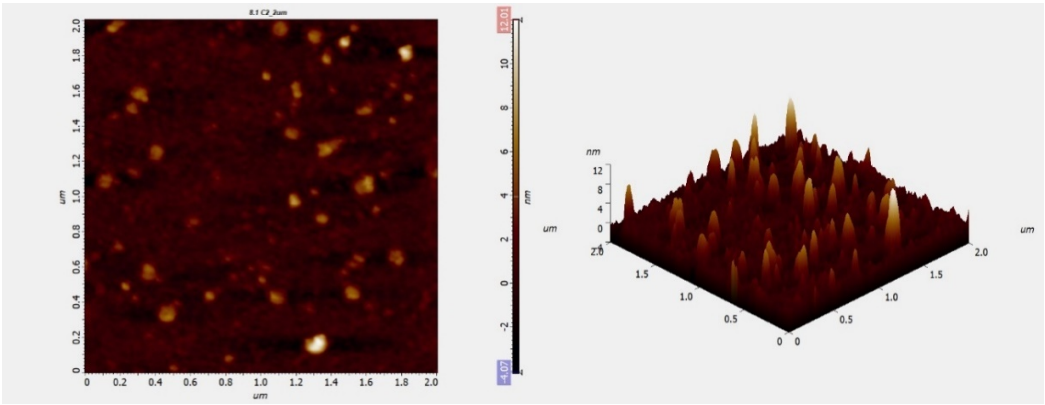


Fig. S4 AFM pattern of Co@NC

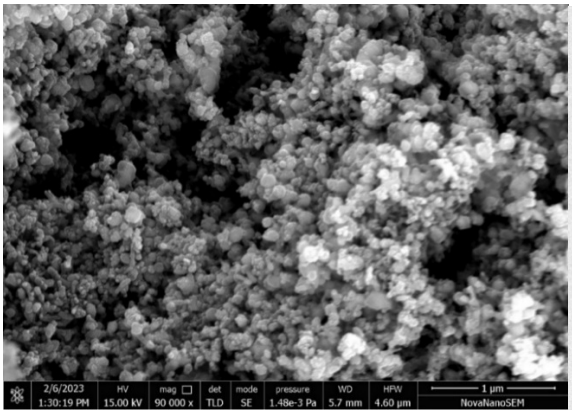


Fig. S5 SEM pattern of Co@NC

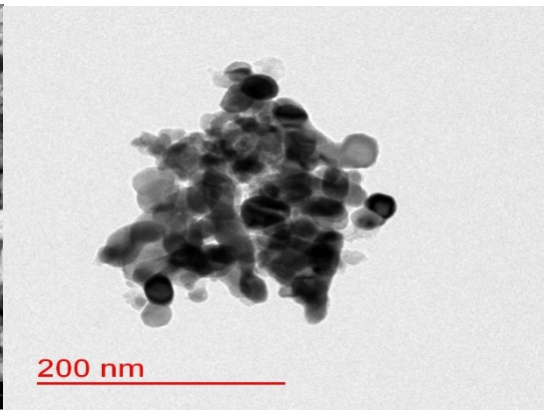
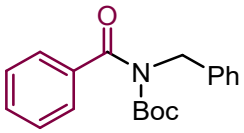


Fig. S6 TEM pattern of Co@NC

3. Compounds characterization

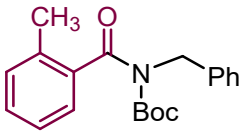
3.1 Characterization data of starting materials

***tert*-butyl benzoyl(benzyl)-carbamate (1a)**



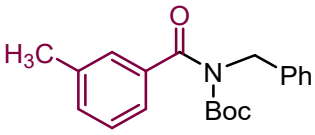
White solid; yield 94%; m.p. 72 °C; **1H NMR (500 MHz, CDCl3)** δ 7.46 (d, 2 H), 7.40–32. (m, 3 H), 7.30–7.25 (m, 4 H), 7.33 (t, 1 H), 7.20 (t, 1 H), 4.93 (d, 2 H), 1.06 (s, 9 H); **13C NMR (126 MHz, CDCl3)** δ 172.9, 153.4, 137.8, 137.6, 130.9, 128.3, 128.1, 127.9, 127.3, 127.2, 83.0, 48.8 27.2. HRMS (ESI) for $C_{19}H_{21}NO_3$ (m/z) $[M + H]^+$ calcd: 312.1521, found: 312.1511.

***tert*-butyl benzyl(2-methylbenzoyl)-carbamate (1b)**



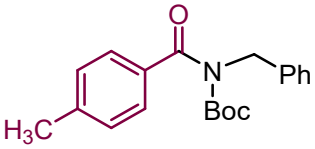
Yield 94%; white solid; m.p. 69–71 °C; **^{1}H NMR (500 MHz, $CDCl_3$)**: δ 7.82 (d, 1H), 7.53 (d, 1H), 7.44 (t, 2H), 7.40–7.28 (m, 5H), 4.54 (d, 2H), 2.86 (s, 3H), 1.40 (s, 9H); **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 173.5, 155.6, 139.8, 137.5, 136.9, 130.9, 130.5, 128.8, 128.5, 127.9, 127.8, 80.5, 41.8, 28.5, 20.1; HRMS (ESI) for $C_{20}H_{23}NO_3$ (m/z) $[M + H]^+$ calcd: 326.1678found: 326.1691.

***tert*-butyl benzyl(3-methylbenzoyl)-carbamate (1c)**



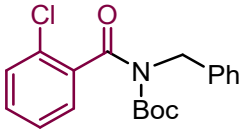
Yield 95%; white solid; m.p. 63 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.65 (s, 1H), 7.55 (d, 1H), 7.30 –7.23 (m, 2H), 7 .21 –7.16 (m, 5H), 4.52 (d, 2H), 2.85 (s, 3H,), 1.39 (s, 9H); **^{13}C NMR (126 MHz, $CDCl_3$)**: δ 173.5, 155.5, 139.7, 137.5, 133.3, 131.3, 129.5, 128.5, 127.6, 127.8, 80.4, 41.8, 28.4, 21.1; HRMS (ESI) for $C_{20}H_{23}NO_3$ (m/z) $[M + H]^+$ calcd: 326.1678 found: 326.1686.

***tert*-butyl benzyl (4-methylbenzoyl)-carbamate (1d)**



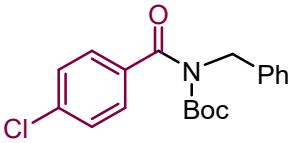
Yield 88%; white solid; m.p. 58-60 °C; **^{1}HNMR (500 MHz, $CDCl_3$)**: δ 8.96 (t, 1H), 7.81 (d, 2H), 7.33-724 (d, 6H), 4.48 (m, 2H), 3.36 (s, 9H), 2.36 (s, 3H). **^{13}C NMR (126 MHz, $CDCl_3$)** δ 172.8, 141.9, 138.2, 133.4, 130.2, 129.7, 128.5, 128.2, 127.4, 44.3, 27.5. 21.3; HRMS (ESI) for $C_{20}H_{23}NO_3$ (m/z) [M+H]+ calcd: 326.1678, found: 326.1684

***tert*-butyl benzyl(2-chlorobenzoyl)-carbamate (1e)**



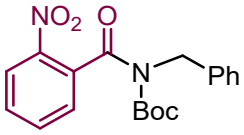
Yield 88%; white solid; m.p. 65 °C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 7.47-7.52 (m, 3H), 7.28–7.41 (m, 6H), 4.66 (d, 2H), 1.22 (s, 9H); **^{13}C NMR (125 MHz, $CDCl_3$)** δ 166.5, 137.8, 130.1, 131.5, 130.8, 130.4, 130.3, 128.9, 128.0, 127.8, 127.3, 81.9, 44.4, 28.4. HRMS (ESI) for $C_{19}H_{20}ClNO_3$ (m/z) [M + H]+ calcd: 346.1132, found: 346.1151.

***tert*-butyl benzyl(4-chlorobenzoyl)-carbamate (1f)**



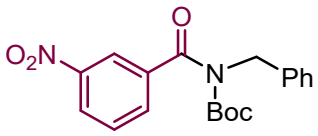
Yield 88%; white solid; m.p. 61 °C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 7.70 (d, 2H), 7.62 (d, 2H), 7.37 (t, 2H), 7.29 (d, 2 H), 7.12 (t, 1H), 4.01 (d, 2H), 1.21 (s, 9H); **^{13}C NMR (125 MHz, $CDCl_3$)** δ 172.6, 162.3, 153.7, 138.2, 130.0, 129., 128.5, 128.1, 127.4, 1.3.4, 73.2, 42.5, 27.5. HRMS (ESI) for $C_{19}H_{20}ClNO_3$ (m/z) [M + H]+ calcd: 346.1132, found: 346.1144.

***tert*-butyl benzyl(2-nitrobenzoyl)-carbamate (1g)**



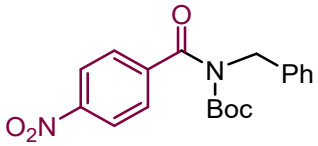
Yield 88%; white solid; m.p. 65-67 °C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.0-8.07 (d, 1H), 7.85-7.87 (d, 1H), 7.63-7.66 (m, 2H), 7.32-7.34 (d, 2H), 7.26-7.28 (m, 2H), 7.21 (t, 1H), 4.69 (s, 2 H), 1.27 (s, 9H); **^{13}C NMR (125 MHz, $CDCl_3$)** δ 174.4, 155.2, 148.1, 138.5, 135.3, 133.8, 129.7, 129.5, 128.5, 128.2, 126.1, 123.1, 84.5, 41.7, 28.3. HRMS (ESI) for $C_{19}H_{20}N_2O_5$ (m/z) [M+H]+ calcd: 357.1372, found: 357.1356.

***tert*-butyl benzyl(3-nitrobenzoyl)-carbamate (1h)**



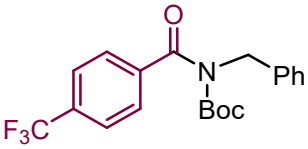
Yield 88%; white solid; m.p. 73 °C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.60 (s, 1H), 8.35 (d, 1H), 8.19 (d, 1H), 7.61-7.65 (m, 1H), 7.31-7.36 (d, 5H), 4.67 (d, 2H), 1.25 (s, 9H); **^{13}C NMR (125 MHz, $CDCl_3$)** δ 170.3, 152.9, 148.0, 138.5, 138.4, 133.8, 129.7, 129.5, 128.5, 128.2, 126.0, 123.1, 84.5, 44.5, 28.5, 27.7. HRMS (ESI) for $C_{19}H_{20}N_2O_5$ (m/z) [M + H]+ calcd: 357.1372 found: 357.1366.

***tert*-butyl benzyl(4-nitrobenzoyl)-carbamate (1i)**



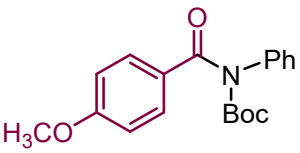
White solid; yield 94%; m.p. 78-79 °C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.17 (d, 2H), 7.83 (d, 2H), 7.34-7.27 (m, 5H), 4.65 (s, 2H) 1.24 (s, 9H); **^{13}C NMR (125 MHz, $CDCl_3$);** δ 170.4, 153.0, 148.1, 138.6, 138.6, 129.7, 129.6, 128.5, 128.2, 123.1, 84.60, 41.77, 27.79. HRMS (ESI) for $C_{19}H_{20}N_2O_5$ (m/z) $[M+H]^+$ calcd: 357.1372 found: 357.1379.

***tert*-butyl benzyl(4-(trifluoromethyl)benzoyl)-carbamate (1j)**



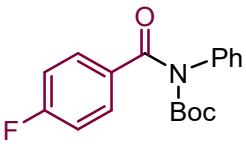
White solid; yield 94%; m.p. 79 °C; **^{1}H NMR** (500 MHz, CDCl3) δ 7.62 (d, 2H), 7.58 (d, 2 H), 7.39 (d, 2H), 7.32 (t, 2 H), 7.26 – 7.23 (t, 1H), 5.01 (s, 2H), 1.17 (s, 9H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 171.8, 153.0, 141.2, 137.6, 132.7 (q, JCF = 32.8 Hz) 128.6, 128.2, 127.7, 127.6, 125.2 (q, JCF = 3.7 Hz,), 124.8, (q, JCF = 272.1 Hz), 1C 84.02, 48.90, 27.52; ^{19}F NMR (471 MHz, $CDCl_3$) δ -62.89. HRMS (ESI) for $C_{20}H_{20}F_3NO_3$ (m/z) [M + H]+ calcd: 380.1395 found: 380.1377.

***tert*-butyl (4-methoxybenzoyl)(phenyl)-carbamate (1k)**



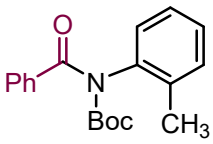
Yield 88%; white solid; m.p. 143-145 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.44 (d, 2H), 7.33 (d, 2H), 7.27 (d, 2H), 7.19 (t, 1H), 6.78 (d, 2H), 3.70 (s, 3H), 1.07 (s, 9H); **^{13}C NMR (126 MHz, $CDCl_3$);** δ 172.7, 162.3, 153.8, 138.1, 130.0, 129.6, 128.5, 128.1, 127.4, 113.4, 82.9, 55.4, 27.4; HRMS (ESI) for $C_{19}H_{21}NO_4$ (m/z) [M + H]+ calcd: 328.1471 found: 328.1467.

***tert*-butyl (4-fluorobenzoyl) (phenyl)-carbamate (1l)**



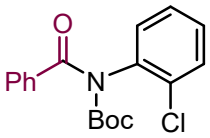
Yield 88%; white solid; m.p. 75 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.98 (d, 2H), 7.33-7.23 (m, 7H), 1.11 (s, 9H); **^{13}C NMR (126 MHz, $CDCl_3$);** δ 174.3, 165.0 (d, JCF = 248.22 Hz), 139.7, 130.0 (d, JCF = 3.75 Hz), 129.9 (d, JCF = 8.75 Hz), 128.4, 127.3, 126.8, 115.6 (d, JCF = 21.42 Hz), 81.1, 28.0; **^{19}F NMR (471 MHz, $CDCl_3$):** δ -63.2; HRMS (ESI) for $C_{18}H_{18}FNO_3$ (m/z) [M + H]+ calcd: 316.1271 found: 316.1254.

***tert*-butyl acetyl(phenyl)-carbamate (1m)**



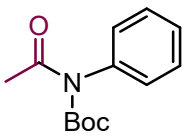
Yield 84%; white solid; m.p. 70 °C; **^{1}H NMR 500 MHz, $CDCl_3$):** δ 7.73 (d, 2H), 7.47-7.41 (m, 1H), 7.39 (t, 2H), 7.34 (d, 1H), 7.25 (t, 2H), 7.07 (t, 1H), 2.44 (s, 3H), 1.46 (s, 9H); **^{13}C NMR (126 MHz, $CDCl_3$);** δ 167.9, 151.4, 138.9, 134.7, 133.2, 132.4, 130.9, 129.9, 129.1, 128.8, 126.4, 81.3, 28.8, 18.8; HRMS (ESI) for $C_{19}H_{21}NO_3$ (m/z) $[M + H]^+$ calcd: 312.1521 found: 312.1531.

***tert*-butyl acetyl(phenyl)-carbamate (1n)**



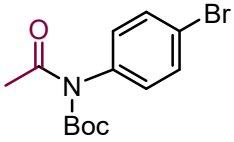
Yield 84%; white solid; m.p. 68 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.79 (d, 2H), 7.49 (t, 1H), 7.43 (t, 2H), 7.39 (d, 1H), 7.28-7.27 (m, 2H) 7.15 (t, 1H); 1.55 (s, 9H); **^{13}C NMR (126 MHz, $CDCl_3$):** δ 166.5, 152.3, 137.9, 135.1, 133.7, 132.2, 129.9, 128.9, 128.1 127.4, 83.6, 27.9; HRMS (ESI) for $C_{18}H_{18}ClNO_3$ (m/z) $[M+H]^+$ calcd: 332.0975 found: 332.0979.

***tert*-butyl acetyl(phenyl)-carbamate (1o)**



Yield 84%; white solid; m.p. 58 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.43-7.39 (m, 2H), 7.37-7.33 (m, 1H), 7.11-7.10 (m, 2H), 2.59 (s, 3H), 1.40 (s, 9H); **^{13}C NMR (126 MHz, $CDCl_3$):** δ 173.9, 152.8, 139.1, 129.1, 128.4, 128.0, 83.4, 28.0, 26.7; HRMS (ESI) for $C_{13}H_{17}NO_3$ (m/z) $[M+H]^+$ calcd: 236.1208 found: 236.1211.

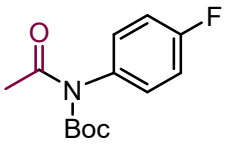
***tert*-butyl acetyl(4-bromophenyl)-carbamate (1p)**



Yield 84%; white solid; m.p. 122 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.54 (d, 2H), 6.98 (d, 2H), 2.61 (s, 3H), 1.41 (s, 9H); **^{13}C NMR (126 MHz, $CDCl_3$):** δ 172.8, 152.3, 137.9, 132.2, 129.9, 121.7,

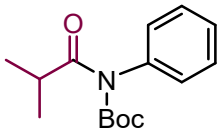
83.6, 27.9, 26.5; HRMS (ESI) for $C_{13}H_{16}BrNO_3$ (m/z) $[M+H]^+$ calcd: 314.0314 found: 314.0308.

***tert*-butyl acetyl(4-fluorophenyl)-carbamate (1q)**



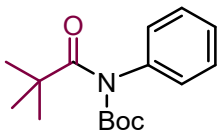
Yield 84%; white solid; m.p. 116 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 8.18 (d, 2H), 7.53 (d, 2H), 2.59 (s, 3H), 1.39 (s, 9H); **^{13}C NMR (126 MHz, $CDCl_3$):** δ 172.8, 152.7, 138.0, 132.3, 130.1, 121.8, 83.9, 27.9, 26.6; HRMS (ESI) for $C_{13}H_{16}FNO_3$ (m/z) $[M + H]^+$ calcd: 254.1114 found: 254.1118.

***tert*-butyl isobutyryl(phenyl)-carbamate (1r)**



Yield 82%; yellow oil; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.30 (t, 2H), 7.23 (d, 1H) 7.20-6.97 (m, 2H), 3.57-3.51 (m, 1H), 1.30 (s, 9H), 1.15 (d, 6H); **^{13}C NMR (126 MHz, $CDCl_3$):** δ 180.4, 152.7, 139.5, 128.9, 128.1, 127.6, 82.9, 34.8, 30.0, 20.4; HRMS (ESI) for $C_{15}H_{21}NO_3$ (m/z) $[M + H]^+$ calcd: 264.1521 found: 264.1513.

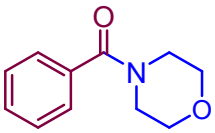
***tert*-butyl phenyl(pivaloyl)-carbamate (1s)**



Yield 84%; white solid; m.p. 88 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.30 (t, 2H), 7.27 (d, 1H), 6.99 (t, 1H), 1.51 (s, 9H), 1.30 (s, 9H); **^{13}C NMR (126 MHz, $CDCl_3$):** δ 180.5, 180.4, 152.8, 139.5, 129.0, 128.2, 127.7, 83.0, 40.2, 28.8 27.3; HRMS (ESI) for $C_{16}H_{23}NO_3$ (m/z) $[M + H]^+$ calcd: 278.1678 found: 278.1651.

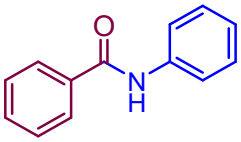
3.2 Characterization Data of Transamidation Products

Morpholino(phenyl)-methanone (3a)



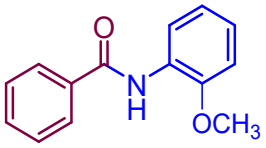
Yield 94%; Yellow solid; m.p. 73-75 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.42-7.41 (m, 5H), 3.77-3.44 (m, 8H), **^{13}C NMR (126 MHz, $CDCl_3$):** δ 170.4, 135.5, 129.7, 128.4, 127.3, 66.7, 48.5, 42.4; HRMS (ESI) for $C_{11}H_{13}NO_2$ (m/z) $[M+H]^+$ calcd: 192.0946 found: 192.0940.

***N*-phenylbenzamide (3b)**



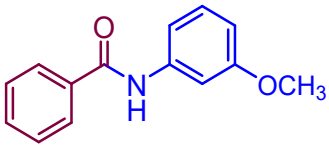
Yield 94%; white solid; m.p. 164 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.90 (d, 3H), 7.68 (d, 2H), 7.56 (t, 1H), 7.40 (t, 2H), 7.19 (t, 2H), 7.16 (t, 1H); **^{13}C NMR (126 MHz, $CDCl_3$):** δ 165.9, 137.8, 135.0, 131.8, 129.2, 128.8, 127.1, 124.5, 120.4; HRMS (ESI) for $C_{13}H_{11}NO$ (m/z) $[M + H]^+$ calcd: 198.0841 found: 198.0853.

***N*-(2-methoxyphenyl)-benzamide(3c)**



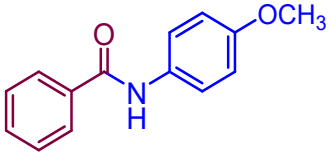
Yield 88%; White solid; m.p. 60 °C; **^{1}HNMR (500 MHz, $CDCl_3$):** δ 8.58 (t, 2H), 7.92 (m, 2H), 7.57-7.50 (m, 3H), 7.10 (m, 2H), 6.95-6.93 (d, 1H), 3.94 (s, 3H); **^{13}CNMR (125 MHz, $CDCl_3$):** δ 165.5, 148.4, 135.6, 131.9, 128.9, 128.0, 127.3, 124.1, 121.4, 120.0, 110.1, 56.0; HRMS (ESI) for $C_{14}H_{13}NO_2$ (m/z) $[M + H]^+$ calcd: 228.0946 found: 228.0935.

***N*-(3-methoxyphenyl)-benzamide(3d)**



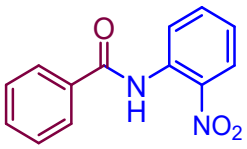
Yield 94%; White solid; m.p. 108 °C; **^{1}HNMR (500 MHz, $CDCl_3$):** δ 7.67 (d, 2H), 7.38 (s, 1H), 7.31-7.30 (d, 3H), 7.27-7.22 (m, 1H), 7.15-7.14 (m, 1H), 6.92-6.91 (m, 1H), 6.73-6.71 (d, 1H), 3.80 (s, 3H); **^{13}CNMR (126 MHz, $CDCl_3$):** δ 165.7, 156.7, 138.8, 135.0, 131.8, 129.3, 128.8, 127.1, 112.3, 110.1, 105.2, 55.6; HRMS (ESI) for $C_{14}H_{13}NO_2$ (m/z) $[M + H]^+$ calcd: 228.0946 found: 228.0955.

***N*-(4-methoxyphenyl)-benzamide(3e)**



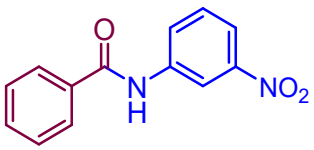
Yield 94%; Green solid; m.p. 153-154°C; **^{1}HNMR (500 MHz, $CDCl_3$):** δ 7.88-7.85 (m, 3H), 7.56-7.53 (m, 3H), 7.49-7.46 (m, 2H), 7.27-6.90 (d, 2H), 3.82 (s, 3H); **^{13}CNMR (126 MHz, $CDCl_3$):** δ 165.6, 156.6, 135.0, 131.6, 130.9, 128.7, 126.9, 122.1, 114.2 55.6; HRMS (ESI) for $C_{14}H_{13}NO_2$ (m/z) $[M + H]^+$ calcd: 228.0946 found: 228.0934.

***N*-(2-nitrophenyl)-benzamide(3f)**



Yield 84%; White solid; m.p. 96 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 8.60 (d, 1H), 8.58 (s, 1H), 8.47 (d, 2H), 7.95-7.94 (t, 1H), 7.62-7.54 (t, 2H), 7.44-7.42 (dd, 1H), 7.36-7.34 (m, 1H), 7.10-7.09 (m, 1H); **^{13}C NMR (126 MHz, $CDCl_3$):** δ 165.5, 134.9, 134.8, 132.4, 129.2, 129.1, 128.0, 127.3, 125.3, 124.9, 123.2 HRMS (ESI) for $C_{13}H_{10}N_2O_3$ (m/z) $[M + H]^+$ calcd: 243.0691 found: 243.0689.

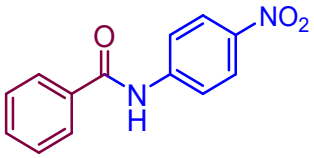
***N*-(3-nitrophenyl)-benzamide(3g)**



Yield 86%; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$); *δ* 11.09 (s, 1H), 8.77 (s, 1H), 8.60–8.59 (m, 1H), 8.45–8.44 (m, 1H), 8.38-8.37 (s,

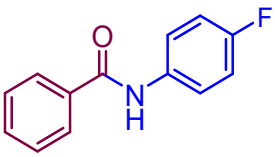
2H), 8.30-8.27 (m, 1H), 8.17-8.14 (m, 1H), 8.12-8.09 (m, 1H). ^{13}CNMR (126 MHz, $CDCl_3$); *δ* 165.5, 148.9, 138.3, 134.8, 132.4, 129.2, 129.1, 128.0, 127.3, 121.7, 116.5. HRMS (ESI) for $C_{13}H_{10}N_2O_3$ (m/z) $[M + H]^+$ calcd: 243.0691 found: 243.0685.

_N_-(4-nitrophenyl)-benzamide(3h)



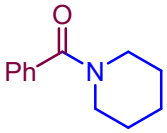
Yield 86%; White solid; m.p. 194°C; **^{1}HNMR (500 MHz, DMSO-d_6):** *δ* 10.83 (s, 1H), 8.28 (d, 2H), 8.08 (d, 2H), 7.99-7.97 (m, 2H), 7.66 (d, 1H), 7.63-7.56 (m, 2H); **^{13}CNMR (126 MHz, DMSO-d_6):** δ 166.4, 145.4, 142.6, 134.2, 132.4, 128.8, 128.0, 124.9, 120.0, 119.9. HRMS (ESI) for $C_{13}H_{10}N_2O_3$ (m/z) $[M + H]^+$ calcd: 243.0691 found: 243.0688.

_N_-(4-fluorophenyl)-benzamide(3i)



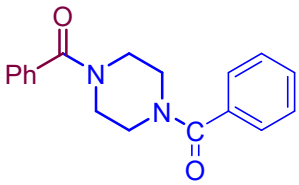
Yield 84%; White solid m.p. 184–186 °C; **^{1}H NMR** (500 MHz, DMSO-d_6): δ 10.32 (s, 1H), 7.96 (d, 2H), 7.81 (d, 2H), 7.62 (t, 1H), 7.56 (d, 2H), 7.21 (t, 2H); **^{13}C NMR** (126 MHz, DMSO-d_6): δ 165.8, 159.6 (d, JCF = 240.6 Hz), 135.9, 135.3 (d, JCF = 3.7 Hz), 132.0, 128.8, 128.0, 122.6 (d, JCF = 5.0 Hz), 115.7 (d, JCF = 22.6 Hz); ^{19}F NMR (471 MHz, $CDCl_3$): δ - 117.9; HRMS (ESI) for $C_{13}H_{10}FNO$ (m/z) $[M + H]^+$ calcd: 216.0746 found: 216.0736.

Phenyl(piperidin-1-yl)-methanone (3j)



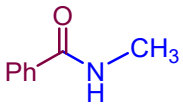
Yield 91%; Yellow solid; m.p.73–75°C; **^{1}HNMR (500 MHz, $CDCl_3$):** δ 7.41–7.42 (m, 5H), 3.78 –3.46 (m, 8H), **^{13}CNMR (126 MHz, $CDCl_3$):** δ 170.4, 135.5, 129.7, 128.4, 127.3, 66.7, 48.5, 42.4; HRMS (ESI) for $C_{11}H_{13}NO_2$ (m/z) $[M+H]^+$ calcd: 192.0942, found: 192.0950.

Piperazine-1,4-diylbis(phenylmethanone) (3k)



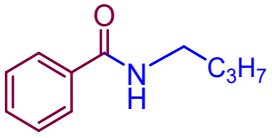
White solid; yield 93%; mp 194-95 ^{0}C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 7.42 (s, 10H), 3.75 (d, 8H); **^{13}C NMR (126 MHz, $CDCl_3$)** δ 170.8, 135.2, 130.2, 128.7, 127.1, 48.5, 43.3. HRMS (ESI) for $C_{18}H_{18}N_2O_2$ (m/z) $[M + H]^+$ calcd: 295.1368 found: 295.1385.

***N*-methylbenzamide (3l)**



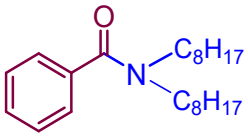
Yield 94%; yellow solid; m.p. 81-82°C; **^{1}HNMR (500 MHz, $CDCl_3$):** δ 7.76-7.74 (m, 2H), 7.48-7.45 (m, 1H), 7.41-7.38 (m, 2H), 6.42 (s, 1H), 2.98 (s, 3H); **^{13}CNMR (126 MHz, $CDCl_3$):** δ 168.5, 134.8, 131.5, 128.7, 127.0, 27.0; HRMS (ESI) for C_8H_9NO (m/z) $[M + H]^+$ calcd: 136.0684 found: 136.0675.

***N*-methylbenzamide (3m)**[7]



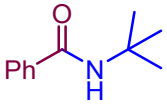
Yellow oil; yield 94%; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 7.78-7.76 (m, 2H), 7.51-7.48 (m, 1H), 7.45-7.42 (t, 2H), 6.17 (s, 1H), 3.49-3.45 (q, 2H), 1.66-1.58 (m, 2H), 1.46-1.39 (m, 2H), 0.98 (t, 3H); **^{13}C NMR (126 MHz, $CDCl_3$)** δ 167.7, 135.0, 131.4, 130.7, 128.7, 126.9, 39.9, 31.8, 20.3, 13.9. HRMS (ESI) for $C_{11}H_{15}NO$ (m/z) $[M + H]^+$ calcd: 178.1154 found:178.1165.

***N,N*-dioctylbenzamide (3n)**



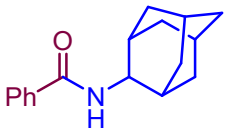
Yield 85%; Dark brown oil; **^{1}HNMR (500 MHz, $CDCl_3$)** δ 7.39-7.34 (m, 5H), 3.48 (s, 2H), 3.18 (s, 2H), 1.66 (d, 4H), 1.49-1.12 (m, 20H), 0.99 (s, 6H); **^{13}CNMR (126 MHz, $CDCl_3$);** δ 171.8, 137.6, 129.1, 128.5, 128.5, 126.6, 49.1, 44.9, 32.8, 30.0, 29.4, 28.2, 27.4, 26.9, 22.8, 19.3, 14.2. HRMS (ESI) for $C_{23}H_{39}NO$ (m/z) $[M + H]^+$ calcd: 346.3032 found: 346.3025.

***N*-(tert-butyl)-benzamide (3o)**



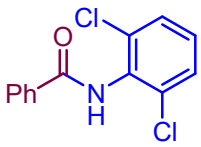
Yield 82%; White solid; m.p. 134-135 °C; **^{1}HNMR (500 MHz, $CDCl_3$)** δ 7.73-7.71 (d, 2H), 7.57-7.43 (m, 1H), 7.41-7.40 (m, 2H), 5.91 (s, 1H), 1.48 (s, 9H); **^{13}CNMR (126 MHz, $CDCl_3$);** δ 167.0, 136.0, 131.2, 128.6, 126.8, 51.7, 29.0. HRMS (ESI) for $C_{11}H_{15}NO$ (m/z) $[M + H]^+$ calcd: 178.1154, found: 178.1165.

***N*-(3s,5s,7s)-adamantan-1-yl)-benzamide (3p)**



Yield 81%; white solid; m.p. 141–142 °C; **^{1}HNMR (500 MHz, $CDCl_3$):** δ 7.74-7.72 (m, 2H), 7.50-7.46 (m, 1H), 7.44-7.21 (m, 2H), 5.82 (s, 1H), 2.15 (s, 9H), 1.75 (d, 6H); **^{13}C NMR (125 MHz, $CDCl_3$);** δ 166.9, 162.6, 136.3, 134.8, 131.3, 130.8, 129.1, 129.1, 128.7, 126.9, 52.5, 41.9, 36.6, 29.7; HRMS (ESI) for $C_{17}H_{21}NO$ (m/z) $[M + H]^+$ calcd: 256.1623 found: 256.1634.

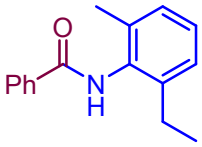
***N*-(2,6-dichlorophenyl)-benzamide (3q)**



Yield 85%; white solid; m.p. 115-117 °C; **^{1}HNMR (500 MHz, DMSO-d_6):** *δ* 10.11 (s, 2H), 8.00 (d, 2H), 7.74 (s, 1H), 7.65-7.63(d, 1H),

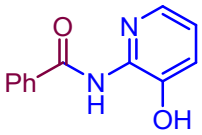
7.55-7.554 (m, 1H), 7.50-7.48 (m, 2H); **^{13}CNMR (126 MHz, DMSO-d_6);** δ 164.0, 139.2, 134.2, 131.6, 131.5, 130.6, 130.5, 129.5, 128.7, 128.1 HRMS (ESI) for $C_{13}H_9Cl_2NO$ (m/z) $[M+H]^+$ calcd: 266.0061 found: 266.0043.

***N*-(2-ethyl-6-methylphenyl)-benzamide (3r)**



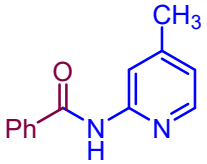
Yield 86%; White solid; mp, 167-168 0C; **^{1}HNMR (500 MHz, DMSO-d_6);** δ 9.77 (s, 1H), 8.01 (d, 2H), 7.61-7.59 (m, 1H), 7.55-7.52 (m, 1H), 7.20-7.17 (m, 1H), 7.15-7.14 (m, 1H), 2.59-2.51 (m, 2H), 2.18 (s, 3H), 1.19 (t, 3H**); ^{13}CNMR (126 MHz, DMSO-d_6)** δ 165.5, 141.5, 136.0, 134.8, 134.5, 131.5, 128.5, 127.7, 127.5, 127.0, 126.1, 24.5, 18.1, 14.6 HRMS (ESI) for C16H17NO (m/z) $[M + H]^+$ calcd: 240.1310 found: 240.1325.

***N*-(3-hydroxypyridin-2-yl)-benzamide (3s)**



Yield 86%; White solid; m.p. 93–96 °C; **^{1}HNMR (500 MHz, DMSO-d_6):** δ 7.97 (d, 1H), 7.72 (d, 2H), 7.39-7.35 (m, 1H), 7.30-7.29 (m, 2H,), 7.27 (s, 1H), 7.24 (d, 1H), 7.23 (m, 1H,) 4.54 (s, 1H,); **^{13}CNMR (126 MHz, DMSO-d_6):** δ 168.9, 146.7, 143.3, 138.9, 134.5, 131.4, 129.9, 129.5, 124.71, 120.0; HRMS (ESI) for $C_{12}H_{10}N_2O_2$ (m/z) $[M+H]^+$ calcd: 215.0742 found: 215.0748.

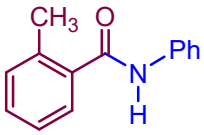
***N*-(4-methylpyridin-2-yl)-benzamide(3t)**



Yield 90%; White solid; m.p. 114-115 °C; **^{1}HNMR (500 MHz, DMSO-d_6);** δ 8.12 (d, 1H), 7.65 (d, 2H), 7.51 (s, 1H), 7.34-7.32 (m, 1H), 7.30-7.28 (m, 2H), 7.23 (s, 1H), 7.06 (s, 1H), 2.31 (s, 3H); **^{13}C NMR**

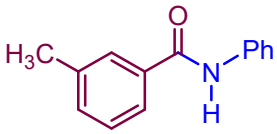
(126 MHz, DMSO-d_6); δ 165.8, 152.8, 152.3, 148.1, 133.1, 131.9, 129.4, 128.8, 127.7, 120.8, 19.2; HRMS (ESI) for $C_{13}H_{12}N_2O$ (m/z) [M + H]$^+$ calcd: 213.0945 found: 213.0938.

2-methyl-*N*-phenylbenzamide (4a)



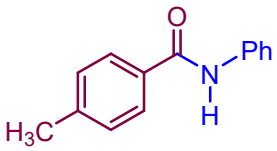
Yield 87%; yellow solid; m.p. 126-127 °C; **^{1}HNMR (500 MHz, DMSO-d_6);** δ 7.77 (d, 1H), 7.50-7.46 (m, 3H), 7.41-7.36 (d, 3H), 7.21-7.20 (m, 1H), 2.36 (s, 3H); **^{13}CNMR (126 MHz, DMSO-d_6);** δ 171.9, 138.4, 135.9, 134.7, 131.8, 128.7, 128.6, 127.5, 126.7, 124.4, 121.9, 20.1 HRMS (ESI) for $C_{14}H_{13}NO$ (m/z) [M+H]$^+$ calcd: 212.0997 found: 212.0975.

3-methyl-*N*-phenylbenzamide (4b)



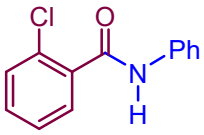
Yield 91%; white solid; m.p. 128-129 °C; **^{1}HNMR (500 MHz, $CDCl_3$);** δ 7.62 (d, 1H), 7.59 (s, 1H), 7.42-7.38 (m, 1H), 7.37-7.35 (m, 6H), 7.18 (t, 1H), 2.33 (s, 3H); **^{13}C NMR (126 MHz, $CDCl_3$);** δ 168.9, 139.2, 136.9, 134.9, 131.9, 129.4, 128.9, 127.8, 127.5, 124.6, 121.3, 24.5. HRMS (ESI) for $C_{14}H_{13}NO$ (m/z) [M+H]$^+$ calcd: 212.0997 found: 212.0984.

4-methyl-*N*-phenylbenzamide (4c)



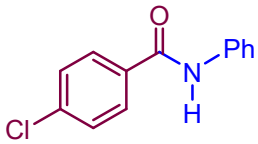
Yield 90%; White solid; M.p. 145-146 °C; **^{1}HNMR (500 MHz, DMSO-d_6):** δ 8.50 (s, 1H), 8.06 (d, 2H), 7.78 (d, 2H), 7.39-7.34 (m, 4H), 7.13 (t, 1H), 2.36 (s, 3H); **^{13}CNMR (126 MHz, DMSO-d_6)** δ 168.9, 141.6, 136.7, 132.5, 129.4, 128.9, 127.8, 124.6, 121.3, 24.5. HRMS (ESI) for $C_{14}H_{13}NO$ (m/z) [M+H]$^+$ calcd:212.0997 found: 212.0974.

2-chloro-*N*-phenylbenzamide (4d)



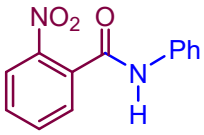
Yield 90%; yellow solid; m.p. 72-74 °C; **^{1}HNMR (500 MHz, $CDCl_3$):** δ 9.44 (s, 1H), 8.60 (d, 1H), 7.95 (t, 2H), 7.62 (m, 1H), 7.59-7.54 (m, 2H), 7.52 (t, 1H), 7.44-7.34 (m, 1H), 7.12-7.09 (m, 1H). **^{13}CNMR (126 MHz, $CDCl_3$);** δ 166.0, 134.8, 134.8, 132.3, 129.2, 129.0, 128.0, 127.2, 124.8, 123.2, 121.6. HRMS (ESI) for $C_{13}H_{10}ClNO$ (m/z) $[M+H]^+$ calcd:232.0451 found: 232.0455.

4-chloro-*N*-phenylbenzamide (4e)



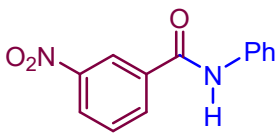
Yield 94%; yellow solid; m.p. 165 °C; **^{1}HNMR (500 MHz, DMSO-d_6):** δ 10.25 (s, 1H), 7.94 (d, 2H), 7.79 (d, 2H), 7.60-7.55 (t, 1H), 7.53-7.52 (m, 1H), 7.42-7.40 (m, 1H). **^{13}CNMR (126 MHz, DMSO-d_6);** δ 167.8, 138.1, 134.7, 133.7, 128.7, 128.6, 127.8, 127.4, 122.0, 121.9. HRMS (ESI) for $C_{13}H_{10}ClNO$ (m/z) $[M+H]^+$ calcd: 232.0451 found: 232.0467.

2-nitro-*N*-phenylbenzamide (4f)



Yield 90%; yellow solid; m.p. 137 °C; **^{1}HNMR (500 MHz, DMSO-d_6):** δ 8.73 (s, 1H), 8.13 (d, 1H), 7.96 (d, 1H), 7.72-7.69 (t, 1H), 7.67-7.65 (m, 1H), 7.42 (t, 2H), 7.36 (t, 2H), 7.13 (t, 1H), **^{13}CNMR (126 MHz, DMSO-d_6);** δ 166.0, 148.6, 136.4, 132.4, 129.2, 129.1, 128.0, 127.2, 124.9, 124.2, 123.2, 121.6. HRMS (ESI) for $C_{13}H_{10}N_2O_3$ (m/z) $[M+H]^+$ calcd: 243.0691, found: 243.0675.

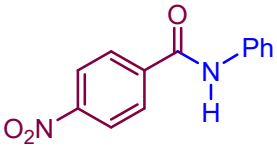
3-nitro-*N*-phenylbenzamide (4g)



Yield 92%; yellow solid; m.p. 72-74°C; **^{1}HNMR (500 MHz, $CDCl_3$):** δ 8.60 (s, 1H), 8.35 (d, 1H), 8.18 (d, 1H), 7.65 (t, 1H), 7.35-7.31 (m,

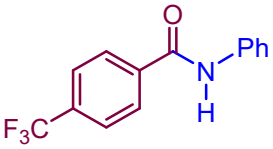
4H), 6.73 (d, 1H). **^{13}CNMR (126 MHz, $CDCl_3$);** δ HRMS (ESI) for $C_{13}H_{10}N_2O_3$ (m/z) $[M+H]^+$ calcd: 243.0691, found: 243.0695.

2-methyl-*N*-phenylbenzamide (4h)



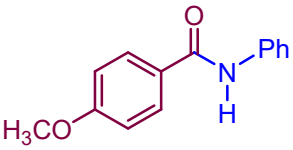
Yield 94%; yellow solid; m.p. 144-146 °C; **^{1}HNMR (500 MHz, DMSO-d_6):** δ 9.06 (s, 1H), 7.99 (d, 2H), 7.33-7.25 (m, 7H). **^{13}CNMR (126 MHz, DMSO-d_6)**; δ 165.6, 150.9, 140.1, 136.5, 128.7, 127.7, 127.2, 124.3, 122.5. HRMS (ESI) for $C_{13}H_{10}N_2O_3$ (m/z) $[M+H]^+$ calcd:243.0691, found: 243.0685.

2-methyl-*N*-phenylbenzamide (4i)



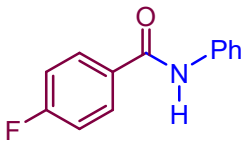
Yield 94%; White solid. M.p. 207 – 208 °C; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 7.66 (d, 2H), 7.49 (d, , 2H), 7.36 (s, 1H), 7.32 – 7.26 (m, 4H), 7.18 (t, 1H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 168.5, 140.8, 134.8, 132.6 (d, JCF = 32.8 Hz), 131.8, 129.5, 128.8 (q, JCF = 3.8 Hz), 128.1 (q, JCF = 273.4 Hz), 127.8, 127.0 HRMS (ESI) for $C_{14}H_{10}F_3NO$ (m/z) $[M+H]^+$ calcd: 266.0714, found: 266.0725.

2-methyl-*N*-phenylbenzamide (4j)



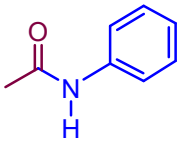
Yield 88%; White solid. M.p. 168–170 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 8.20 (d, 2H), 7.86 (d, 3H), 7.54–7.45 (m, 5H), 3.81 (s, 3H). **^{13}C NMR (126 MHz, $CDCl_3$)**; δ 165.8, 161.1, 135.1, 131.8, 131.1, 128.9, 127.1, 122.3, 114.4, 55.6 HRMS (ESI) for $C_{14}H_{13}NO_2$ (m/z) $[M+H]^+$ calcd: 228.0946, found: 228.0965.

4-fluoro-*N*-methyl-*N*-phenylbenzamide (4k)



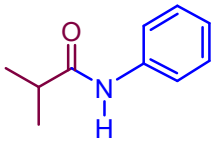
Yield 93%; White solid. M.p. 187 –188 °C.; **^{1}H NMR** (500 MHz, DMSO-d_6): δ 10.25 (s, 1H), 8.06 (d, 2H), 7.76 (d, 2H), 7.39 –7.34 (m, 4H), 7.11 (t, 1H); **^{13}C NMR** (126 MHz, DMSO-d_6) δ 165.5 (d, JCF = 253.3 Hz), 163.5, 139.5, 131.8 (d, JCF = 3.7 Hz), 130.8 (d, JCF = 8.8 Hz), 129.0, 124.2, 120.9, 115.8 (d, JCF = 21.4 Hz); HRMS (ESI) for $C_{13}H_{10}FNO$ (m/z) $[M+H]^+$ calcd: 216.0746, found: 216.0755.

tert-butyl acetyl(phenyl)-carbamate (4l)



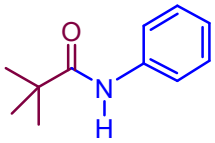
Yield 90%; white solid; m.p. 58 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.95 (s, 1H), 7.54 (d, 2H), 7.33 (d, 2H), 7.13 (d, 1H), 2.17 (s, 3H); **^{13}C NMR (126 MHz, $CDCl_3$):** δ 168.8, 138.0, 128.9, 124.3, 120.1, 24.4 HRMS (ESI) for C8H9NO (m/z) $[M + H]^+$ calcd: 136.0684, found: 136.0661.

2-methyl-*N*-phenylbenzamide (4m)



Yield 88%; yellow solid; m.p. 74 °C; **^{1}HNMR (500 MHz, $CDCl_3$):** δ 7.93 (s, 1H), 7.52 (t, 2H), 7.31 (d, 2H), 7.11 (d, 1H), 2.87 (q, 1H), 2.15 (d, 6H). **^{13}CNMR (126 MHz, $CDCl_3$);** δ 168.9, 138.1, 129.0, 124.4, 120.2, 33.8, 18.5. HRMS (ESI) for $C_{10}H_{13}NO$ (m/z) $[M+H]^+$ calcd: 164.0997, found: 164.0985.

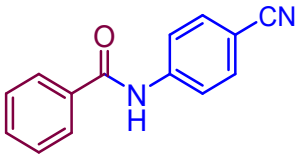
2-methyl-*N*-phenylbenzamide (4n)



Yield 86%; yellow solid; m.p. 72-74°C; **^{1}HNMR (500 MHz, $CDCl_3$):** δ 7.66 (s, 1H), 7.29 (t, 2H), 7.20 (s, 1H), 6.98 (d, 2H), 1.30 (s, 9H). **^{13}C NMR (125 MHz, $CDCl_3$);** δ 180.4, 136.7, 129.9, 124.5, 122.7, 40.2, 27.3. HRMS (ESI) for $C_{11}H_{15}NO$ (m/z) $[M+H]^+$ calcd: 178.1154,

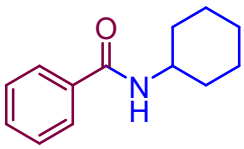
found: 178.1145.

***N*-(4-cynophenyl)-benzamide (5a)**



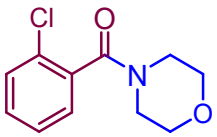
Yield 93%; yellow solid; m.p. 169–171 °C; **^{1}H NMR** (500 MHz, $CDCl_3$); δ 8.03 (s, 1H), 7.87 (t, 1H), 7.72 (d, 1H), 7.76–7.59 (m, 3H), 7.48 (d, 2H), 7.36 (t, 2H); **^{13}C NMR** (126 MHz, $CDCl_3$); δ 173.1, 142.1, 133.5, 133.9, 129.5, 129.1, 128.9, 127.2, 120.0; HRMS (ESI) for $C_{14}H_{10}N_2O$ (m/z) $[M+H]^+$ calcd: 223.0793, found: 223.0796.

***N*-cyclohexylbenzamide (5b)**



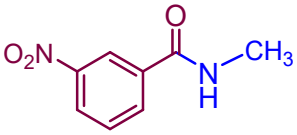
Yield 92%; white solid; m.p. 153–155 °C; **^{1}H NMR** (500 MHz, $CDCl_3$); δ 7.75 (d, 2H), 7.49 (t, 1H), 7.42 (t, 2H), 5.99 (s, 1H), 4.00–3.95 (m, 1H), 2.02 (q, 2H), 1.76–1.64 (m, 3H), 1.46–1.39 (m, 2H), 1.27–1.20 (m, 2H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 166.9, 135.4, 131.6, 128.9, 127.2, 49.0, 35.6, 25.9, 25.2. HRMS (ESI) for $C_{13}H_{17}NO$ (m/z) $[M + H]^+$ calcd: 204.1310, found: 204.1307.

2-chlorophenyl-(morpholino)-methanone (5c)



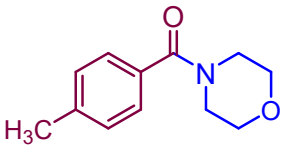
Yield 94%; white solid; m.p. 73 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.35-7.34 (m, 1H), 7.30-7.27 (m, 1H), 3.84-3.80 (m, 1H), 3.74-3.69 (m, 3H), 3.65-3.61 (m, 1H), 3.55-3.51 (m, 1H), 3.25-3.21 (m, 1H), 3.17-3.15 (m, 1H), 3.14-3.13 (m, 1H). **^{13}C NMR (126 MHz, $CDCl_3$);** δ 167.1, 135.5, 130.5, 130.4, 129.8, 128.0, 127.5, 66.9, 66.9, 47.3, 42.2. HRMS (ESI) for $C_{11}H_{12}ClNO_2$ (m/z) $[M + H]^+$ calcd:226.0557, found: 226.0530.

***N*-methyl-3-nitrobenzamide (5d)**



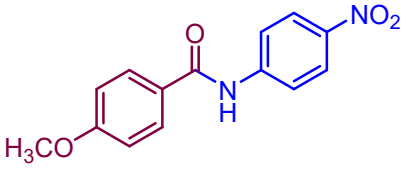
Yield 94%; white solid; m.p. 178-180 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 8.60 (s, 1H), 8.35 (d, 1H), 8.18 (d, 1H), 7.65-7.62 (m, 1H), 6.73 (s, 1H), 2.94 (s, 3H); **^{13}C NMR (126 MHz, $CDCl_3$);** δ 168.6, 148.3, 137.6, 133.4, 129.0, 126.3, 123.7, 26.6. HRMS (ESI) for $C_{14}H_{13}NO$ (m/z) $[M + H]^+$ calcd: 212.0997, found: 212.0998.

morpholino(p-tolyl)-methanone (5e)



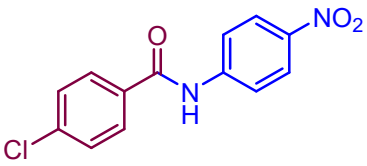
Yield 88%; white solid; m.p. 76 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 7.64 (d, 2H), 7.30 (d, 2H), 3.83 (t, 4H), 3.72 (d, 2H), 3.62 (t, 2H), 2.63 (s, 3H); **^{13}C NMR (126 MHz, $CDCl_3$);** δ 170.4, 140.6, 135.3, 128.6, 127.1, 66.9, 44.2, 21.3. HRMS (ESI) for $C_{12}H_{15}NO_2$ (m/z) $[M + H]^+$ calcd: 206.1103, found: 206.1117.

4-methoxy-*N*-(4-nitrophenyl)-benzamide (5f)



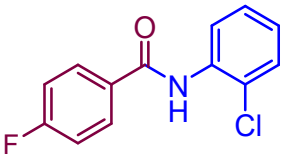
Yield 86%; Yellow solid; m.p. 183-184 °C; **^{1}H NMR (500 MHz, $CDCl_3$)**; δ 8.25 (d, 1H), 8.09-8.05 (m, 2H), 7.87-7.83 (m, 2H), 7.00-6.97 (m, 2H), 6.61 (m, 1H), 4.39 (d, 1H), 3.90 (s, 3H); **^{13}C NMR (126 MHz, $CDCl_3$);** δ 164.8, 163.3, 152.6, 144.3, 133.0, 129.3, 126.5, 125.3, 119.5, 114.4, 114.3, 113.5, 55.7. HRMS (ESI) for $C_{14}H_{12}N_2O_4$ (m/z) $[M + H]^+$ calcd: 273.0797, found: 273.0777.

4-chloro-*N*-(4-nitrophenyl)-benzamide (5g)



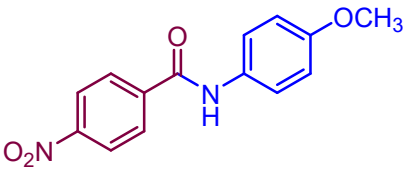
Yield 89%; Yellow solid; m.p 272-274 °C; **^{1}H NMR (500 MHz, DMSO-d_6)** δ 11.10 (s, 1H), 8.41-8.39 (m, 2H), 8.31-8.29 (m, 2H), 8.23 (d, 2H), 8.08 (d, 2H); **^{13}C NMR (126 MHz, DMSO-d_6);** δ 164.7, 149.4, 144.9, 142.9, 139.8, 129.5, 124.8, 123.6, 120.0. HRMS (ESI) for $C_{13}H_9ClN_2O_3$ (m/z) $[M + H]^+$ calcd:277.0302, found: 277.0312.

4-fluro-*N*-(2-chlorophenyl)-benzamide (5h)



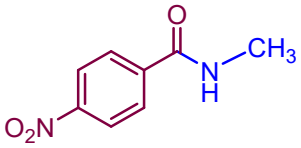
Yield 87%; white solid; m.p. 127 °C; **^{1}HNMR (500 MHz, DMSO-d_6)**: δ 9.43 (s, 1H), 7.85 (d, 2H), 7.56 (d, 1H), 7.44 (d, 1H), 7.36 (t, 1H), 7.29 (d, 2H), 7.17 (t, 1H); **^{13}CNMR (126 MHz, DMSO-d_6);** δ 165.1, 164.8, 162.9, 134.4, 130.8, 130.8, 129.9, 129.8, 128.3, 127.2, 126.7, 126.0, 115.3, 115.1. HRMS (ESI) for $C_{13}H_9ClFNO$ (m/z) $[M + H]^+$ calcd: 250.0357, found: 250.0334.

4-nitro-*N*-(4-methoxyphenyl)-benzamide (5i)



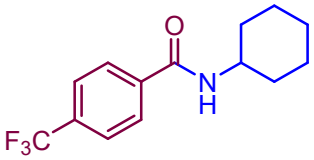
yield 95%; Green solid; m.p. 196-97 °C; **^{1}H NMR (500 MHz, $CDCl_3$)**; δ 8.35 (d, 2H), 8.05 (d, 2H), 7.80 (s, 1H), 7.56 (d, 2H), 6.95 (d, 2H), 3.84 (s, 3H); **^{13}C NMR (126 MHz, $CDCl_3$);** δ 167., 157.3, 150.0, 140.7, 130.3, 128.2, 124.0, 122.3, 114.4, 55.6. HRMS (ESI) for $C_{14}H_{12}N_2O4$ (m/z) $[M + H]^+$ calcd: 273.0798, found: 273.0784.

***N*-methyl-4-nitrobenzamide (5j)**



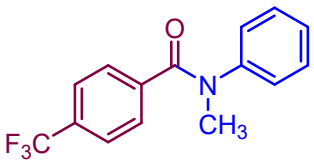
Yield 94%; White solid; m.p. 217-219 °C; **^{1}H NMR (500 MHz, $CDCl_3$):** δ 8.30 (d, 2H), 7.93 (d, 2H), 6.03 (s, 1H), 2.89 (s, 3H,); **^{13}C NMR (126 MHz, $CDCl_3$);** δ 168.7, 147.5, 140.4, 129.1, 123.8, 26.6. HRMS (ESI) for $C_8H_8N_2O_3$ (m/z) $[M+H]^+$ calcd: 181.0535, found: 181.0558.

***N*-cyclohexyl-4-(trifluoromethyl)-benzamide (5k)**



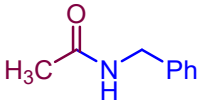
White solid; yield 94%; m.p. 182-183 °C; **^{1}H NMR (500 MHz,CDCl3)** *δ* 7.87 (d, 2H), 7.68 (d, 2H), 6.06 (s, 1 H), 4.02 – 3.96 (m, 1H), 2.06 (d, 2H), 1.79 (dd, 2H), 1.42 (dd, 2H), 1.48 – 1.40 (m, 2H); **^{13}C NMR (126 MHz, CDCl3)** *δ* 165.2, 138.2, 133.0, 132.8, 127.2, 125.4 (q, *JCF* = 3.7 Hz), 124.67, 122.5, 48.9, 33.0, 25.4, 24.7; 19F NMR (471 MHz, CDCl3) *δ* -65.7. HRMS (ESI) for $C_{14}H_{16}F_3NO$ (m/z) $[M + H]^+$ calcd: 272.1184, found: 272.1164.

***N*-methyl-N-phenyl-4-(trifluoromethyl)-benzamide (5l)**



Yield 90%; Yellow solid; m.p. 72-73 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.35–4.27 (m, 4H), 7.18 (t, 2H), 7.10 (t, 1H), 6.94 (d, 2H), 3.42 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$); δ 169.2, 144.3, 139.6, 131.5, 131.2, 129.5, 127.1, 124.9 (q, JCF = 3.7 Hz), 71.9, 38.4; HRMS (ESI) for $C_{15}H_{12}F_3NO$ (m/z) $[M + H]^+$ calcd: 280.0871, found: 280.0854.

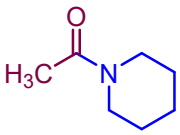
***N*-benzylacetamide (6a)**



Yield 90%; White solid; m.p. 61-62 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.25–7.18 (m, 5H), 6.26 (s, 1H), 4.30 (d, 2H), 1.90 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 170.2, 138.8, 128.7, 128.6, 127.8, 127.5, 43.7,

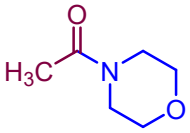
23.2; HRMS (ESI) for $C_9H_{11}NO$ (m/z) $[M + H]^+$ calcd: 150.0841, found: 150.0834.

1-(piperidin-1-yl)-ethan-1-one (6b)



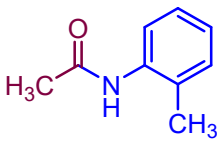
Yield 93%; colour less liquid; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 3.68 (t, 2H), 3.30 (t, 2H), 2.04 (s, 3H), 1.74–1.64 (m, 6H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 170.2, 43.0, 24.5, 23.6, 21.35; HRMS (ESI) for $C_7H_{13}NO$ (m/z) $[M + H]^+$ calcd: 128.0997, found: 128.0991.

1-morpholinoethan-1-one (6c)



Yield 92%; colour less liquid; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 3.79 (t, 4H), 3.73 (t, 2H), 3.50 (t, 2H), 2.07 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 170.4, 66.9, 45.4, 21.5; HRMS (ESI) for $C_6H_{11}NO_2$ (m/z) $[M + H]^+$ calcd:130.0790, found: 130.0781.

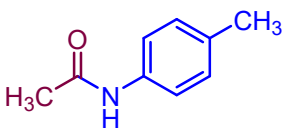
***N*-(2-methylphenyl)-acetamide (6d)**



Yield 90%; white solid; m.p. 136 °C; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 7.90 (d, 1H), 7.78 (s, 1H), 7.59 (t, 1H), 7.51 (t, 1H), 7.16 (d, 1H); 2.40 (s, 3H), 2.17 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 170.5, 137.8, 132.7, 130.3, 127.5, 124.9, 122.3, 23.2, 17.7; HRMS (ESI) for $C_9H_{11}NO$ (m/z) $[M + H]^+$ calcd: 150.0841, found: 150.0849.

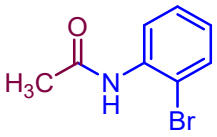
***N*-(4-methylphenyl)-acetamide (6e)**

Yield 92%; liquid; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 7.89 (s, 1H), 7.46 (d, 2H), 7.20 (d, 2H), 2.34 (s, 3H), 2.11 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$):δ 170.9, 138.1, 133.0, 130.3, 119.0, 23.7, 22.1;



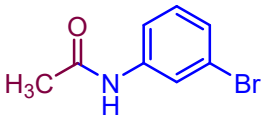
HRMS (ESI) for $C_9H_{11}NO$ (m/z) $[M + H]^+$ calcd: 150.0841, found: 150.0838.

***N*-(2-bromophenyl)-acetamide (6f)**



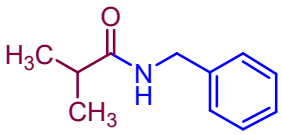
Yield 86%; white solid; m.p. 85–87°C; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 8.27 (d, 1H), 7.55 (s, 1H), 7.29 (d, 1H), 7.19 (t, 1H), 6.96 (t, 1H), 2.16 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 168.4, 134.7, 129.1, 127.9, 124.8, 122.7, 121.8, 25.0; HRMS (ESI) for C_8H_8BrNO (m/z) $[M + H]^+$ calcd: 213.9789, found: 213.9785

***N*-(3-bromophenyl)-acetamide (6g)**



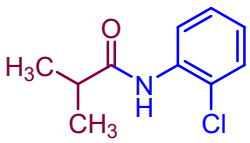
Yield 89%; white solid; m.p. 85 °C; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 8.57 (s, 1H), 8.08 (s, 1H), 7.72 (d, 1H), 7.54 (d, 1H), 7.31 (t, 1H), 2.17 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 168.9, 150.7, 138.0, 127.3, 124.3, 122.4, 120.1, 24.5; HRMS (ESI) for C_8H_8BrNO (m/z) $[M+H]^+$ calcd: 213.9789, found: 213.9785.

***N*-benzylisobutyramide (6h)**



Yield 89%; White solid; m.p. 91–92 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.32 (d, 2H), 7.27–7.26 (m, 3H), 5.82 (s, 1H), 4.44 (d 2H), 2.36–2.41 (m, 1H), 1.18 (d, 6H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 177.0, 138.7, 128.9, 127.9, 127.6, 43.6, 35.9, 19.8; HRMS (ESI) for $C_{11}H_{15}NO$ (m/z) $[M+H]^+$ calcd: 178.1154, found: 178.1146

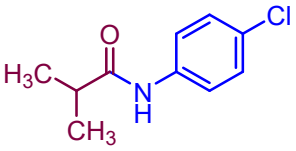
***N*-(2-chlorophenyl)-isobutyramide(6i)**



Yield 85%; White solid; m.p. 92-94 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.42 (d, 1H), 7.73 (s, 1H), 7.39 (d, 1H), 7.29 (t, 1H), 7.06 (t,

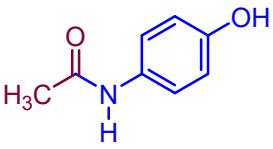
1H), 2.65–2.59 (m, 1H), 1.30 (d, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 175.3, 134.8, 129.0, 127.9, 124.6, 122.6, 121.7, 37.2, 19.4; HRMS (ESI) for $C_{10}H_{12}ClNO$ (m/z) $[M+H]^+$ calcd: 198.0607, found: 198.0626.

***N*-(2-chlorophenyl)-isobutyramide (6j)**



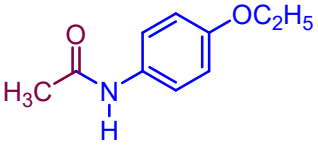
Yield 86%; White solid; m.p. 92–94 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.75 (s, 1H), 7.42–7.37 (m, 4H), 2.65–2.59 (m, 1H), 1.32 (d, 6H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 169.1, 138.2, 127.5, 124.5, 122.6, 120.3, 37.9, 19.6. HRMS (ESI) for $C_{10}H_{12}ClNO$ (m/z) $[M+H]^+$ calcd: 198.0607, found: 198.0604.

***N*-(4-hydroxyphenyl)-acetamide (6k)**



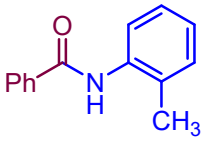
Yield 90%; white solid; m.p. 168 °C; **^{1}H NMR** (500 MHz, DMSO-d_6): δ 9.65 (s, 1H), 9.14 (s, 1H), 7.35 – 7.33 (m, 2H), 6.69 – 6.67 (m, 2H), 1.99 (s, 3H); **^{13}C NMR** (126 MHz, DMSO-d_6): δ 167.5, 153.1, 131.0, 120.8, 114.9, 23.7; HRMS (ESI) for $C_8H_9NO_2$ (m/z) $[M + H]^+$ calcd: 152.0633, found: 152.0641.

***N*-(4-ethoxyphenyl)-acetamide (6l)**



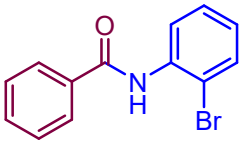
Yield 93%; white solid; m.p. 135 °C; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 6.48 (d, 2H), 7.05 (d, 2H), 5.57 (s, 1H), (t, 2H), 3.60 (q, 2H), 2.09 (s, 3H), 1.41 (t, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 170.5, 156.6, 131.9, 121.9, 115.5, , 63.5, 23.3, 13.9; HRMS (ESI) for $C_{10}H_{13}NO_2$ (m/z) $[M + H]^+$ calcd:180.0964, found: 180.0956.

***N*-(2-methylphenyl)-benzamide (8a)**



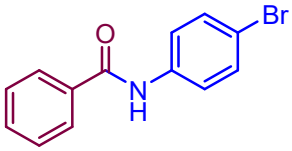
Yield 90%; green solid; m.p. 145 °C; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 7.92 (d, 3H), 7.78 (s, 1H), 7.58 (t, 1H), 7.51 (t, 2H), 7.26 (t, 2H), 7.15 (d, 1H) 2.35 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 165.7, 135.8, 135.0, 131.6, 130.6, 129.5, 128.8, 127.1, 126.9, 125.4, 123.3, 17.8; HRMS (ESI) for $C_{14}H_{13}NO$ (m/z) $[M + H]^+$ calcd: 212.0997, found: 212.0977.

***N*-(2-bromophenyl)-benzamide (8b)**



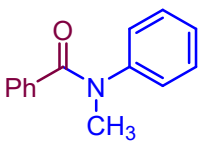
Yield 86%; white solid; m.p. 107 °C; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 8.57 (d, 1H), 8.46 (s, 1H), 7.93 (d, 2H), 7.59 (t, 1H), 7.53 (t, 2H), 7.42 (t, 1H), 7.34 (t, 1H), 7.08 (d, 1H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 165.4, 134.9, 134.8, 132.3, 129.1, 129.0, 128.0, 127.2, 124.8, 123.2, 121.7; HRMS (ESI) for $C_{13}H_{10}BrNO$ (m/z) $[M + H]^+$ calcd: 275.9946, found: 275.9939.

***N*-(4-bromophenyl)-benzamide (8c)**



Yield 88%; yellow solid; m.p. 205 °C; **^{1}H NMR** (500 MHz, DMSO-d_6): δ 9.00 (s, 1H), 7.94 (d, 2H), 7.80 (d, 2H), 7.60 (t, 1H), 7.53 (t, 2H), 7.42 (d, 2H), **^{13}C NMR** (126 MHz, DMSO-d_6): δ 165.7, 138.1, 134.7, 131.9, 128.7, 128.5, 127.8, 127.4, 122.0 HRMS (ESI) for $C_{13}H_{10}BrNO$ (m/z) $[M + H]^+$ calcd: 275.9946, found: 275.9955.

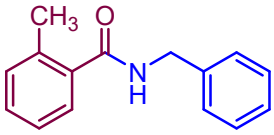
***N*-methyl-N-phenylbenzamide (8d)**



Yield 90%; yellow oil;(^{1}H NMR (500 MHz, $CDCl_3$): *δ* 7.30 (d, 2H), 7.27–7.19 (m, 3H), 7.16 –7.10 (m, 3H), 7.04 (d, 2H), 3.49 (s, 3H);

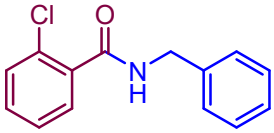
^{13}C NMR (126 MHz, $CDCl_3$): *δ* 170.6, 144.8, 135.9, 129.5, 129.0, 128.6, 127.7, 126.8, 126.4, 38.3; HRMS(ESI) for $C_{14}H_{13}NO$ (m/z) $[M + H]^+$ calcd: 212.0997, found: 212.0973.

***N*-benzyl-2-methylbenzamide (8e)**



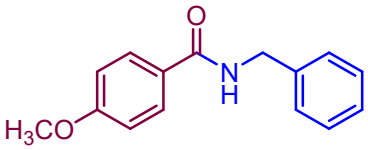
Yield 86%; white solid; m.p. 104 °C; **^{1}H NMR** (500 MHz, DMSO-d_6): δ 7.82 (d, 1H), 7.53 (t, 1H), 7.42 (t, 2H), 7.40–7.34 (m, 6H), 6.27 (s, 1H), 4.54 (d, 2H), 3.74 (s, 3H); **^{13}C NMR** (126 MHz, DMSO-d_6): δ 172.5, 138.9, 136.4, 132.2, 129.2, 129.1, 129.0, 128.0, 127.3, 124.9, 44.4, 20.6; HRMS (ESI) for $C_{15}H_{15}NO$ (m/z) $[M + H]^+$ calcd: 226.1153, found: 226.1168.

***N*-benzyl-2-chlorobenzamide (8f)**



Yield 90%; White solid; m.p. 103–105 °C; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 7.66 (d, 1H), 7.41–7.27 (m, 8H), 6.55 (s, 1H), 4.67 (d, 2H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 165.8, 152.6, 149.1, 144.9, 131.5, 129.2, 120.6, 99.1, 59.7, 53.6, 18.2, 14.7. HRMS (ESI) for $C_{14}H_{12}ClNO$ (m/z) $[M + H]^+$ calcd: 246.0607, found: 246.0603.

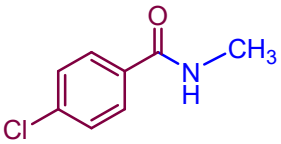
***N*-benzyl-4-methoxybenzamide (8g)**



Yield 88%; white solid; m.p. 125 °C; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 8.01 (d, 1H), 7.69 (d, 2H), 7.27–7.18 (m, 4H), 6.84 (d, 2H), 6.29 (s, 1H), 4.55 (d, 2H), 3.76 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 167.3, 162.4, 162.4, 138.6, 133.0, 129.0, 128.2, 127.8, 126.9, 114.4, 114.0, 55.6, 44.3; HRMS (ESI) for

$C_{15}H_{15}NO_2$ (m/z) $[M + H]^+$ calcd: 242.1103, found: 242.1093.

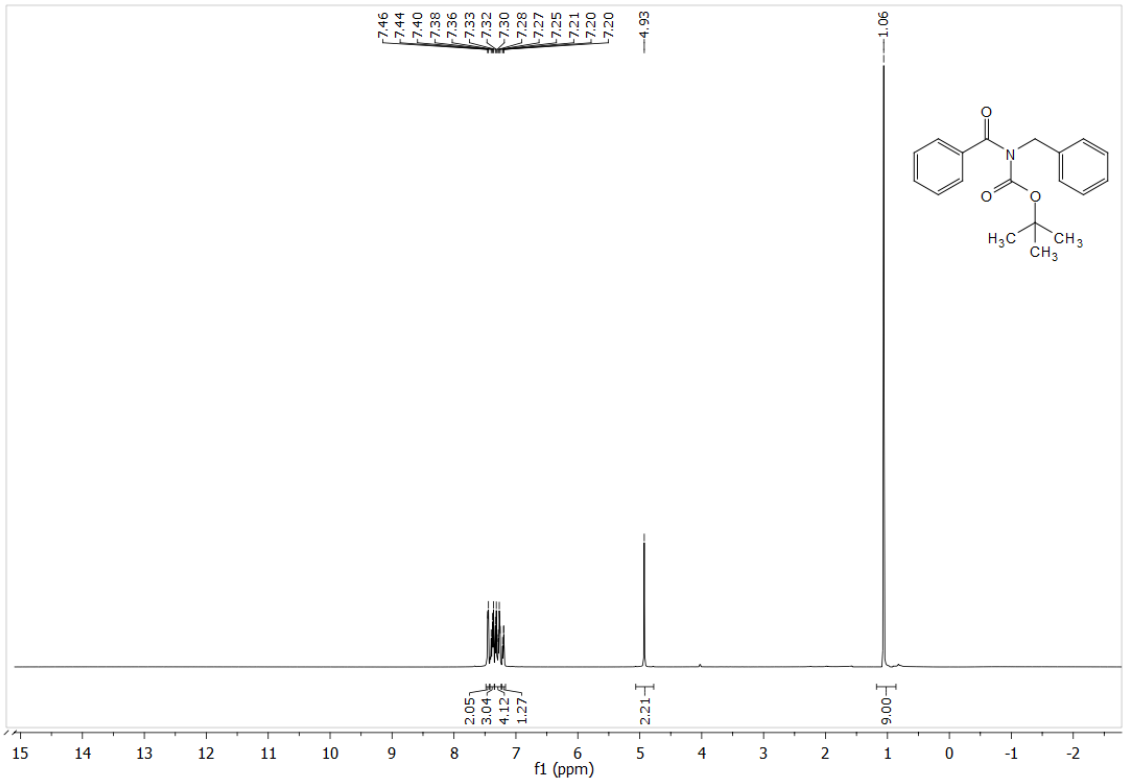
4-chloro-*N*-methylbenzamide (8h)

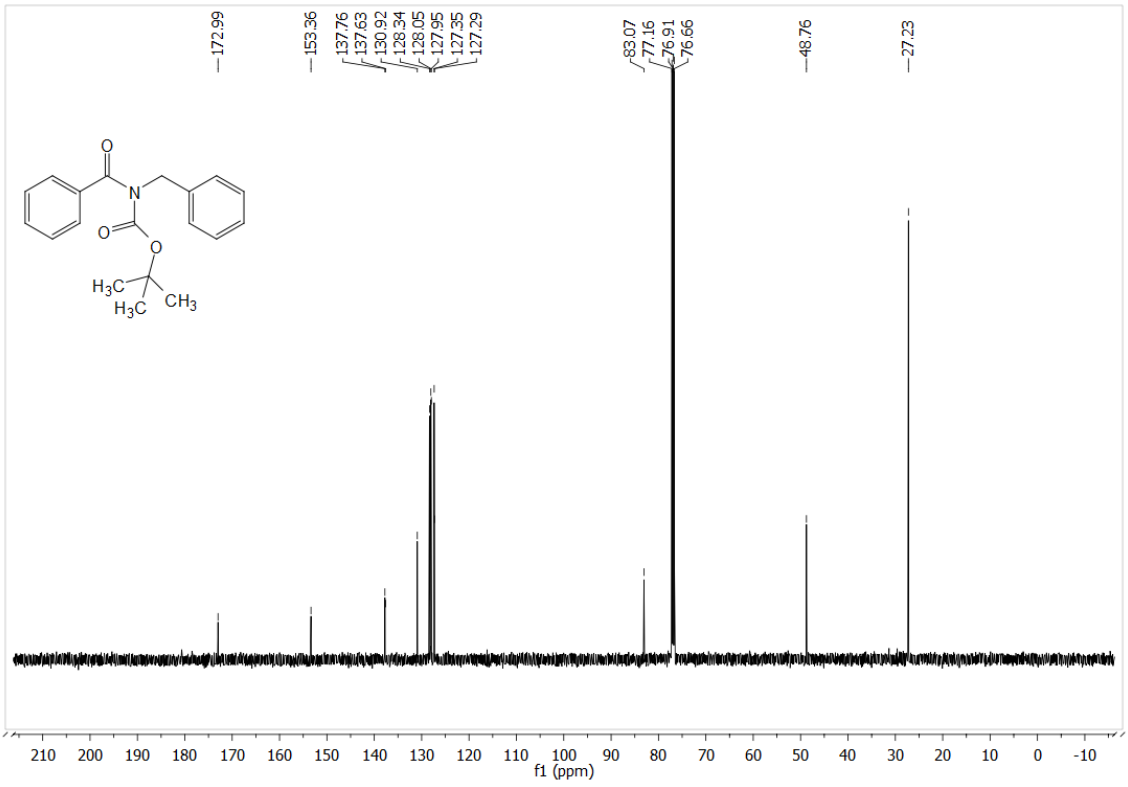


Yield 94%; white solid; m.p. 153 °C; **^{1}H NMR** (500 MHz, $CDCl_3$): δ 7.84 (d, 2H), 7.47 (d, 2H), 6.00 (s, 1H), 2.87 (d, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$): δ 168.7, 136.8, 136.6, 129.1, 128.8, 26.0; HRMS (ESI) for C_8H_8ClNO (m/z) $[M+H]^+$ calcd:170.0294, found: 170.0284.

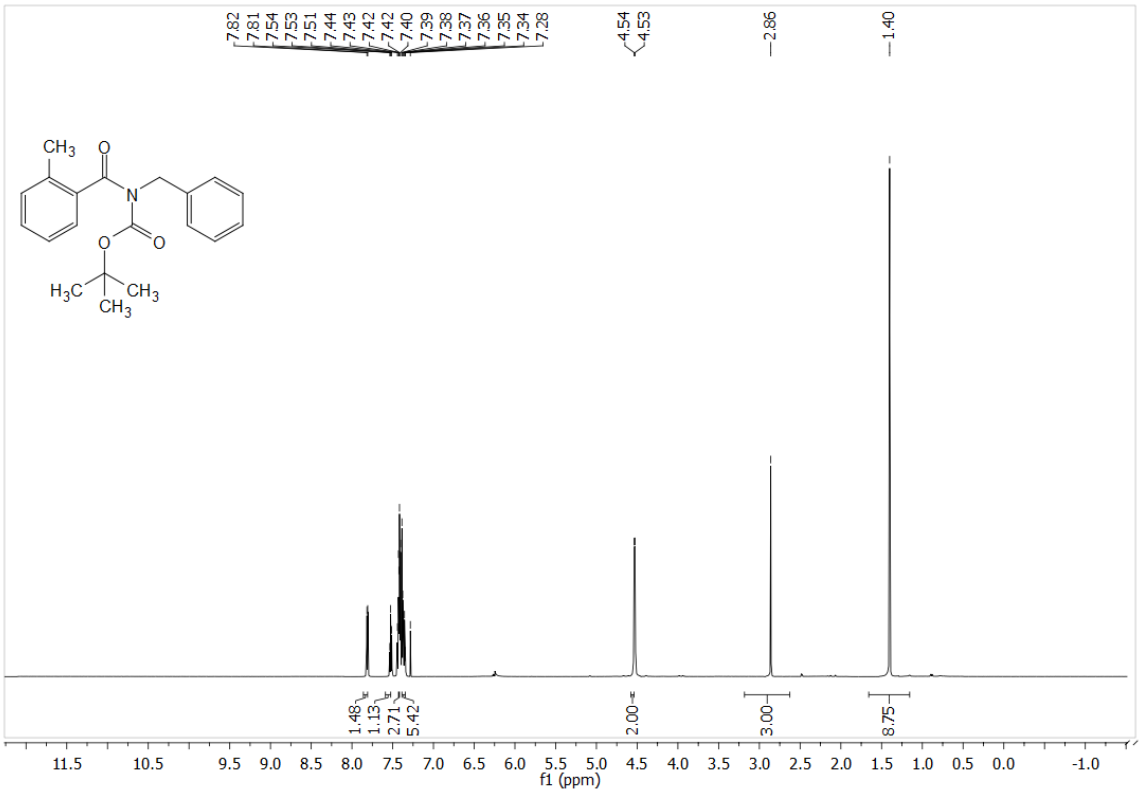
4. ^{1}H, ^{13}C, ^{19}F NMR and mass spectra of products

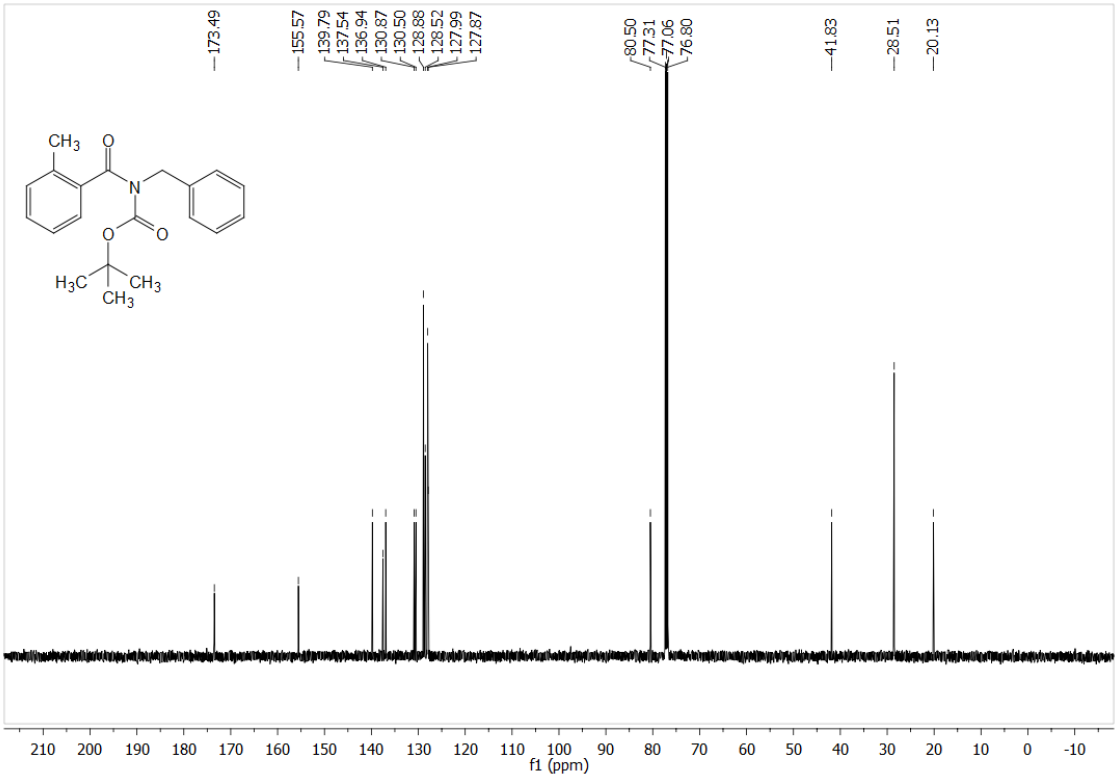
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzoyl(benzyl)-carbamate (1a)



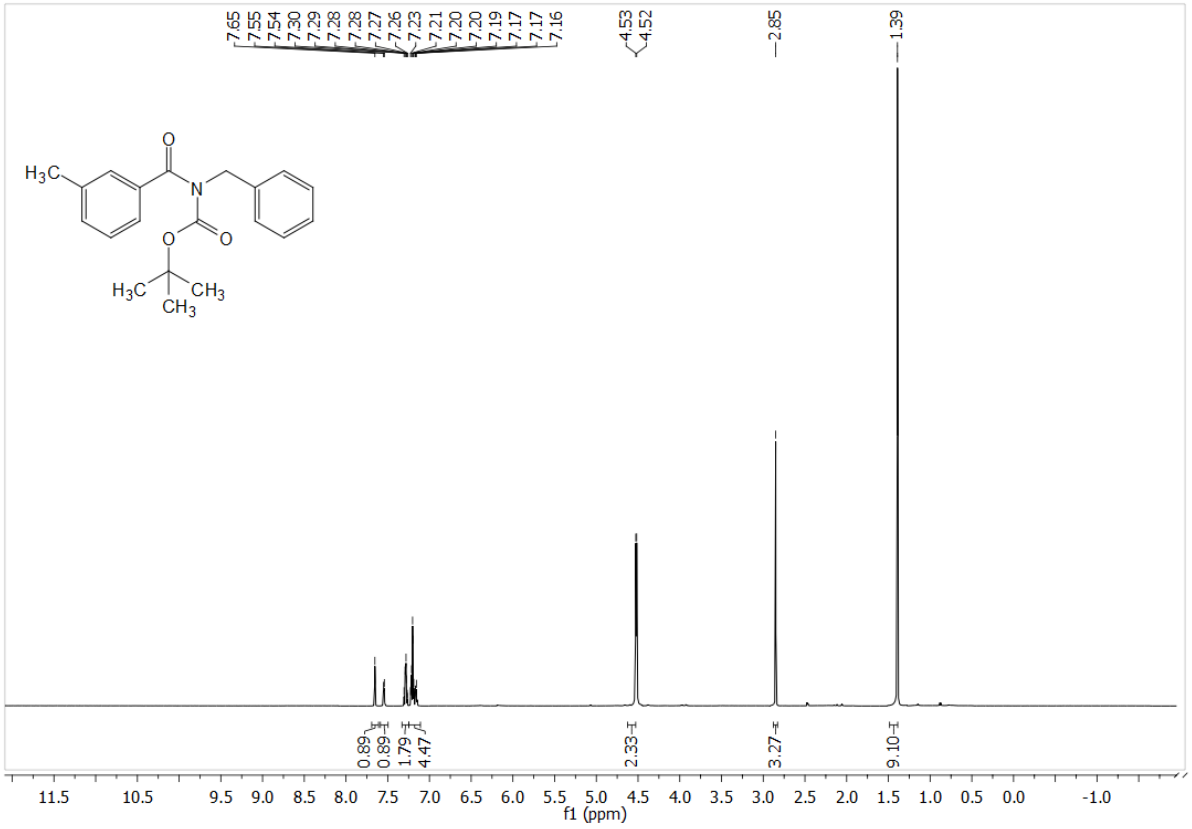


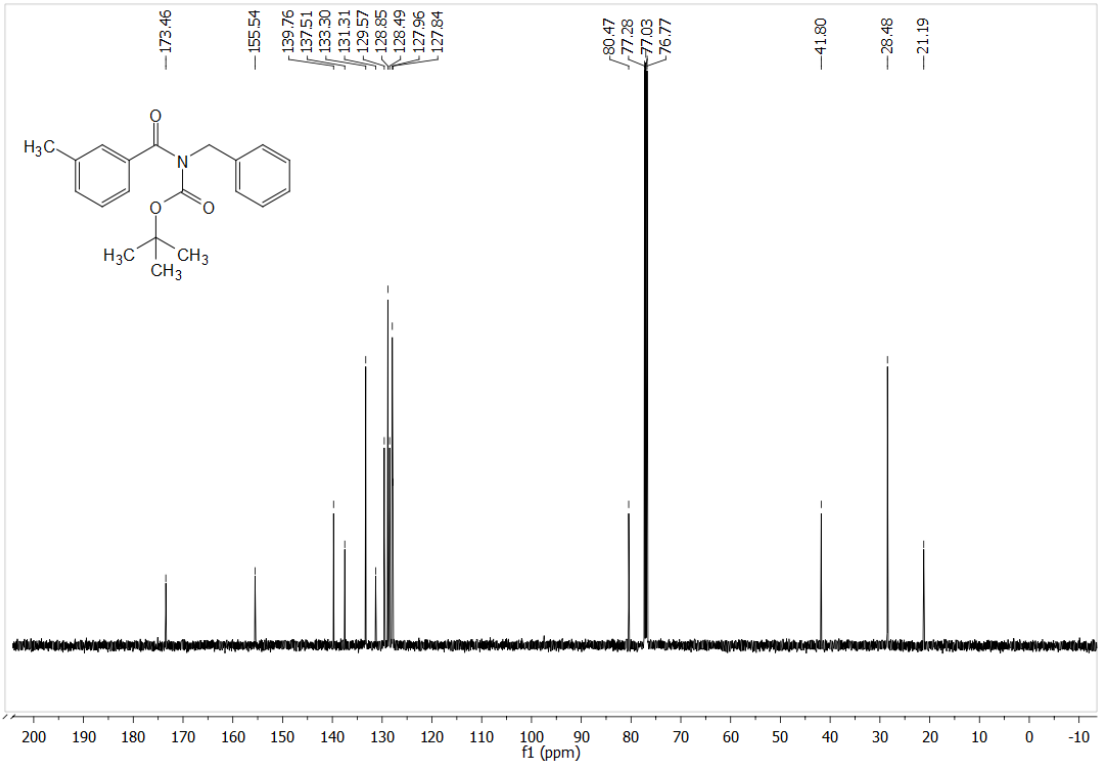
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzyl(2-methylbenzoyl)-carbamate (1b)



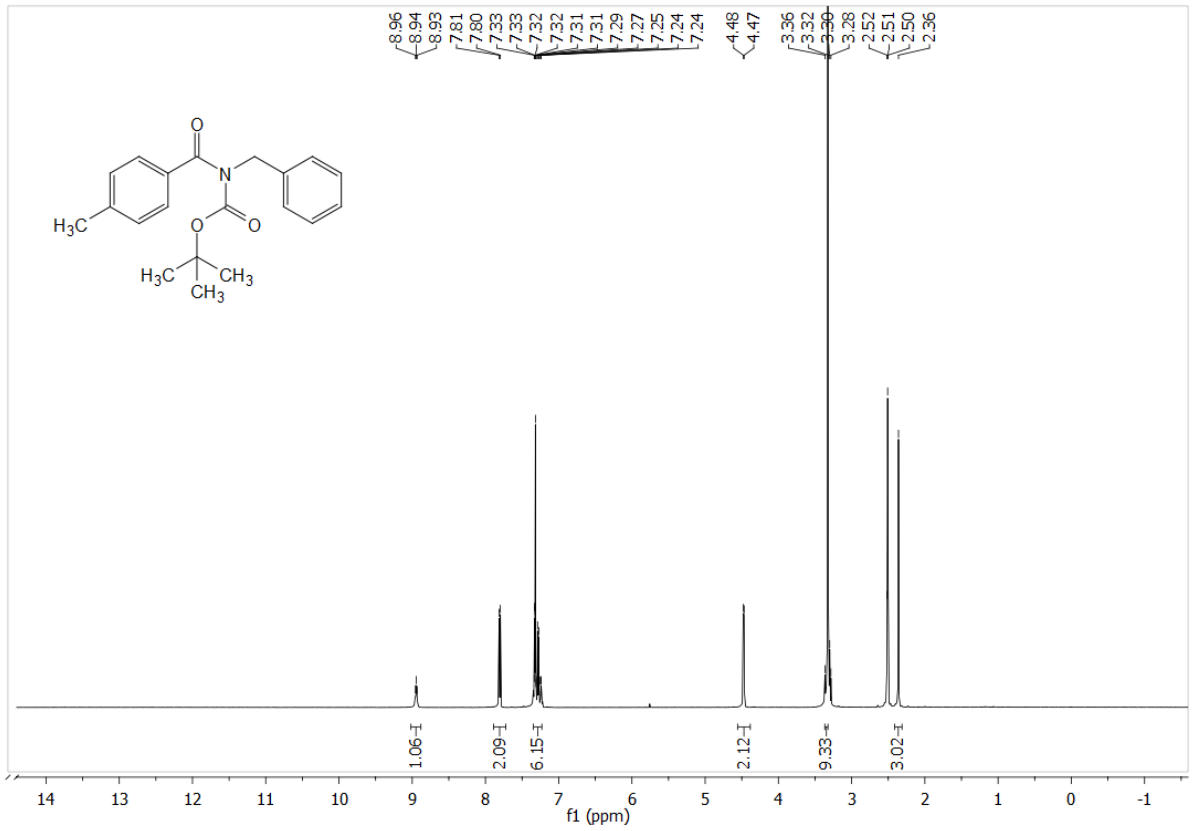


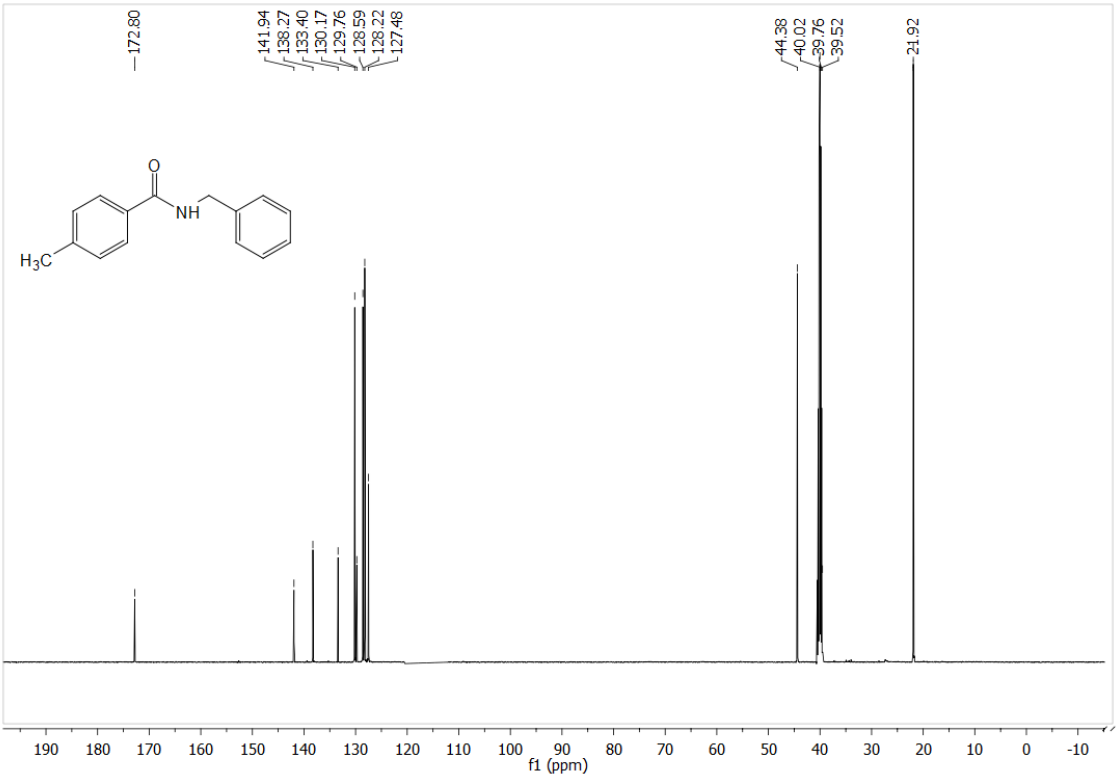
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzyl(3-methylbenzoyl)-carbamate (1c)



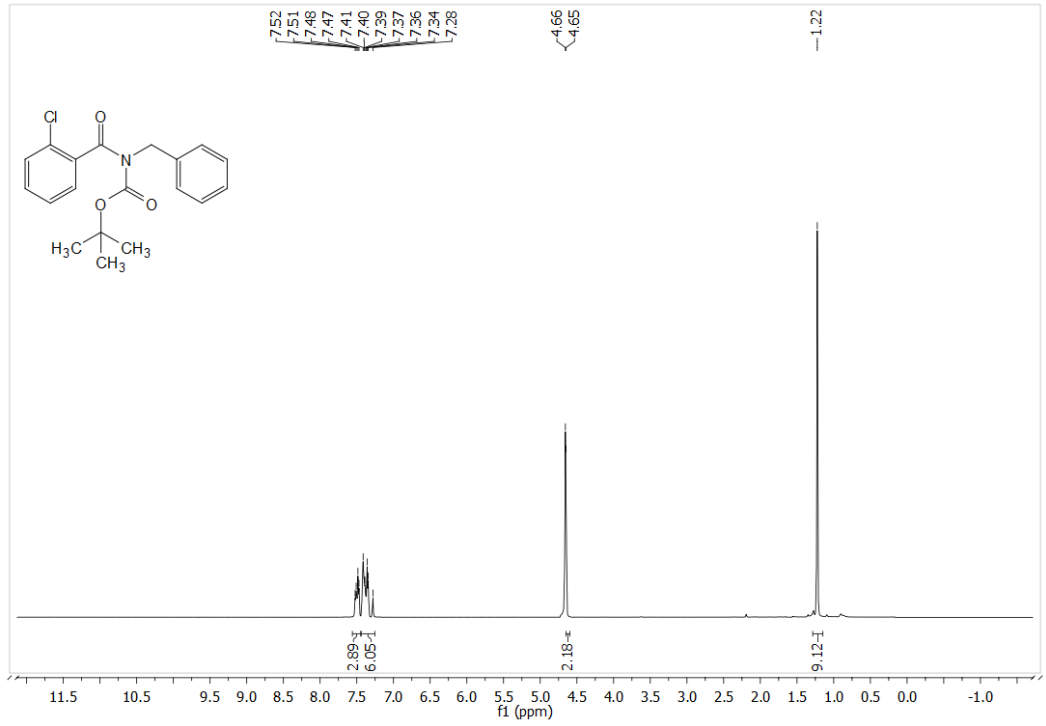


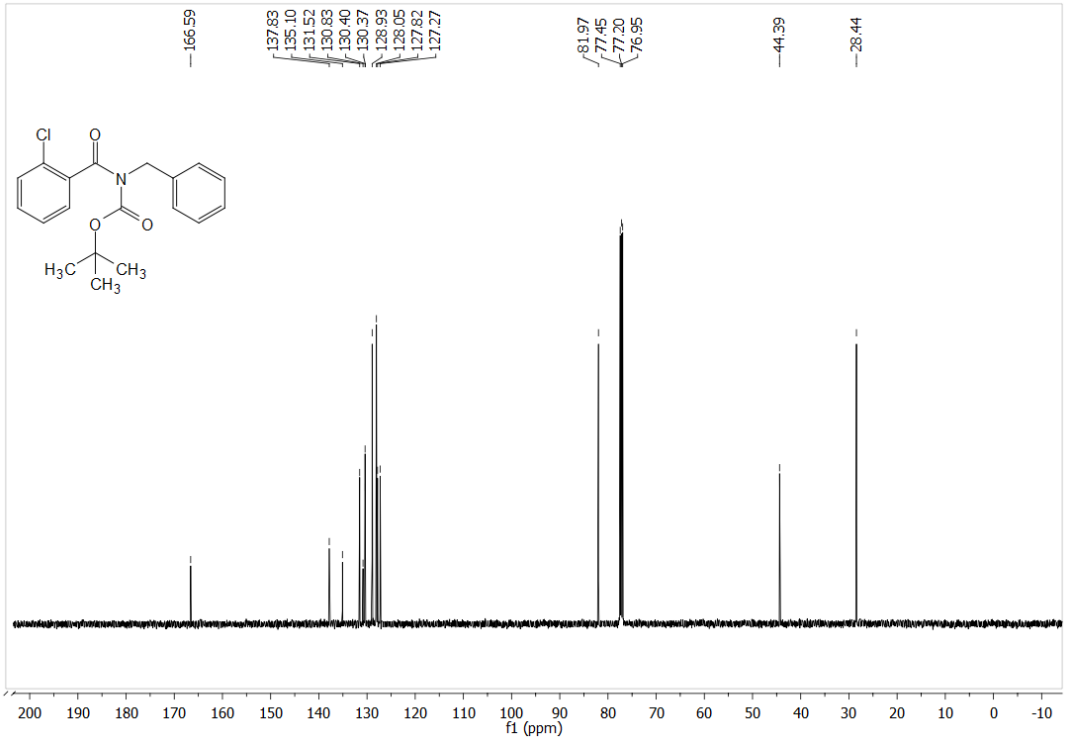
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzyl (4-methylbenzoyl)-carbamate (1d)



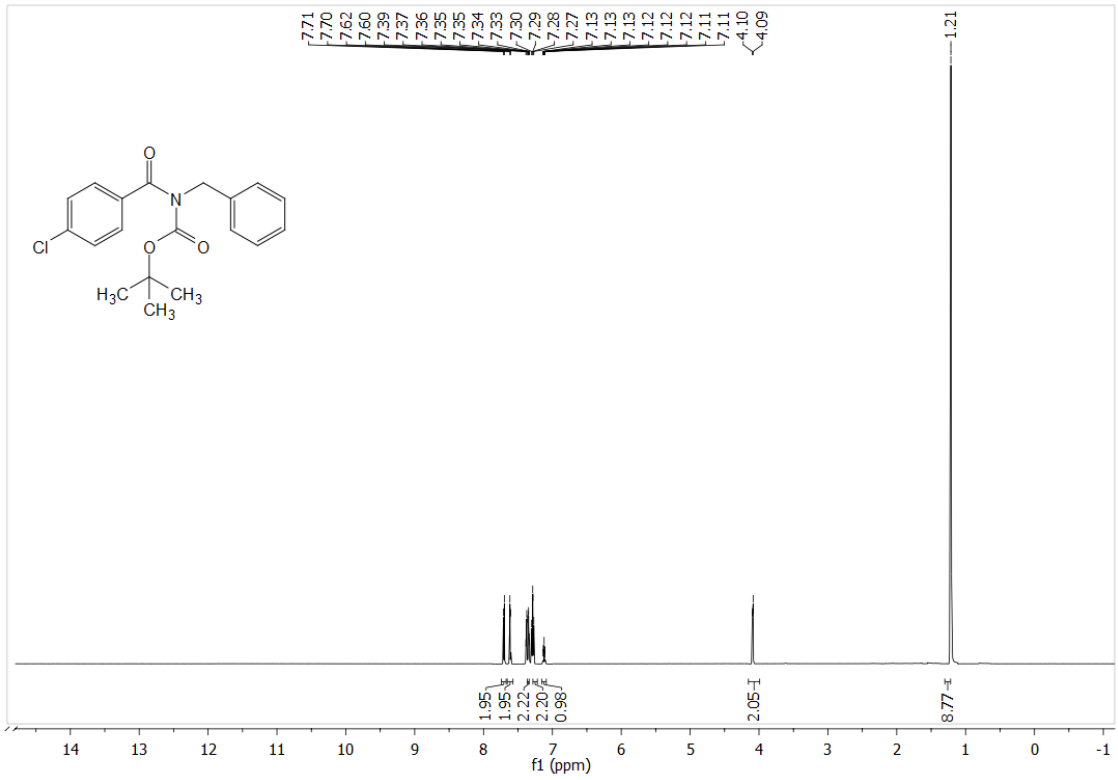


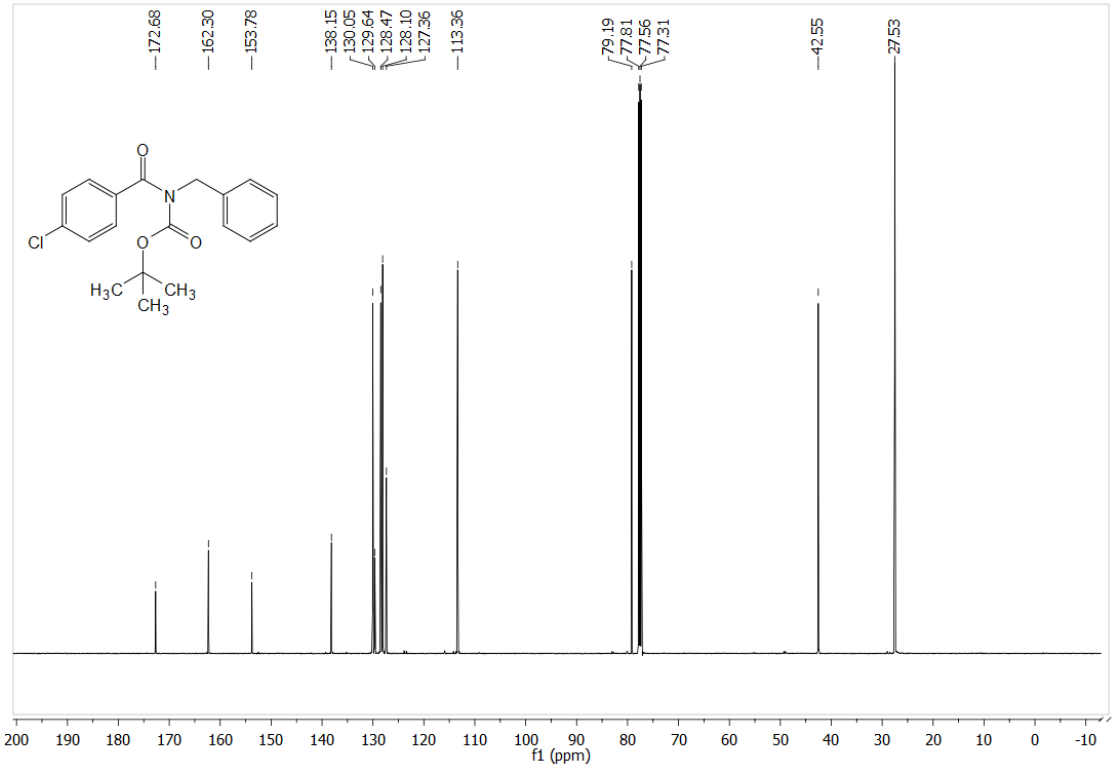
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzyl(2-chlorobenzoyl)-carbamate (1e)



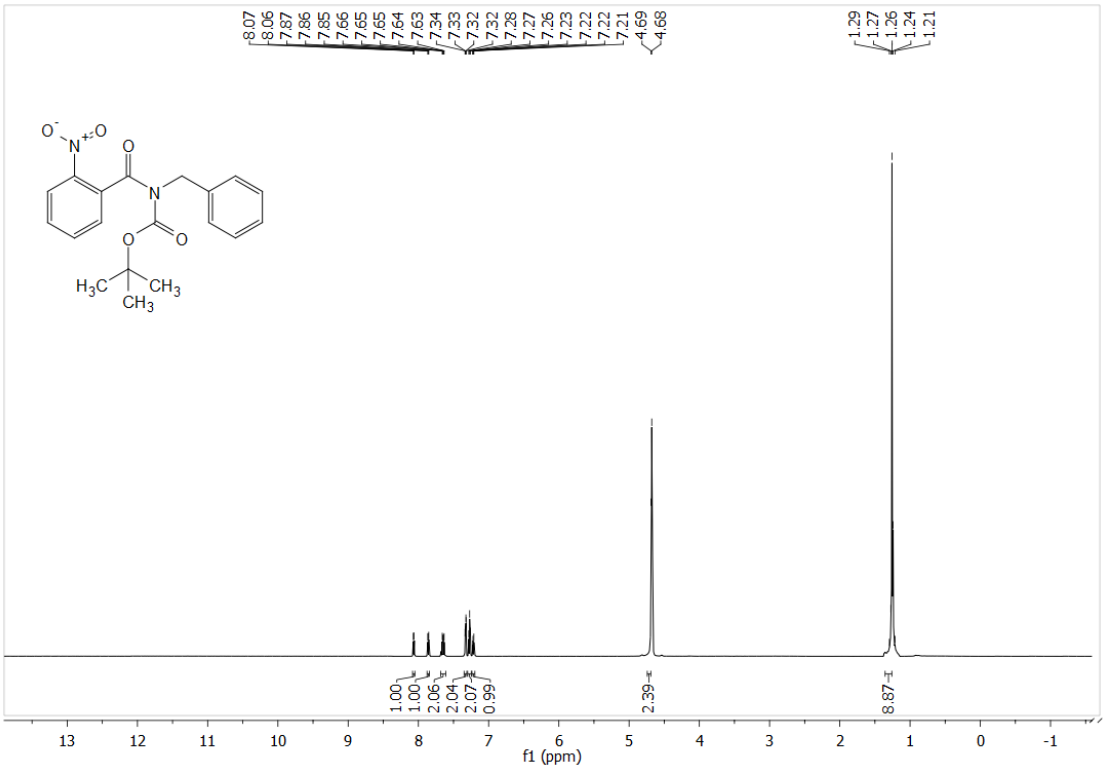


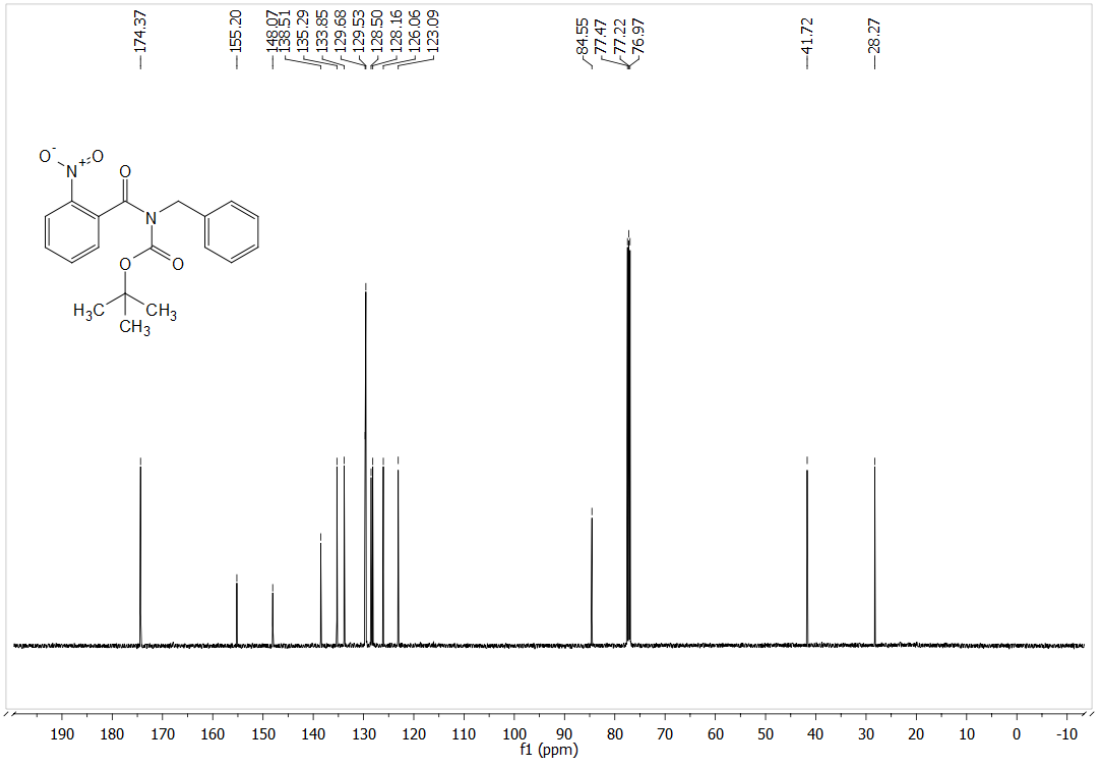
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzyl(4-chlorobenzoyl)-carbamate (1f)



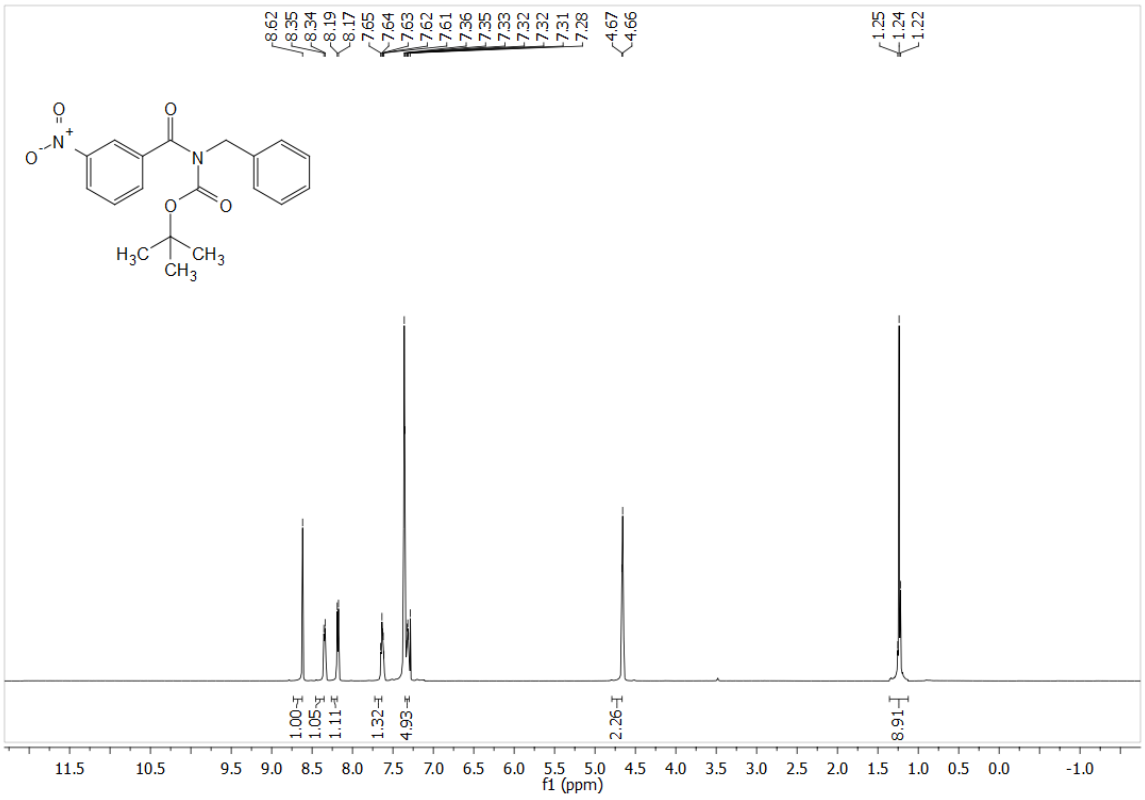


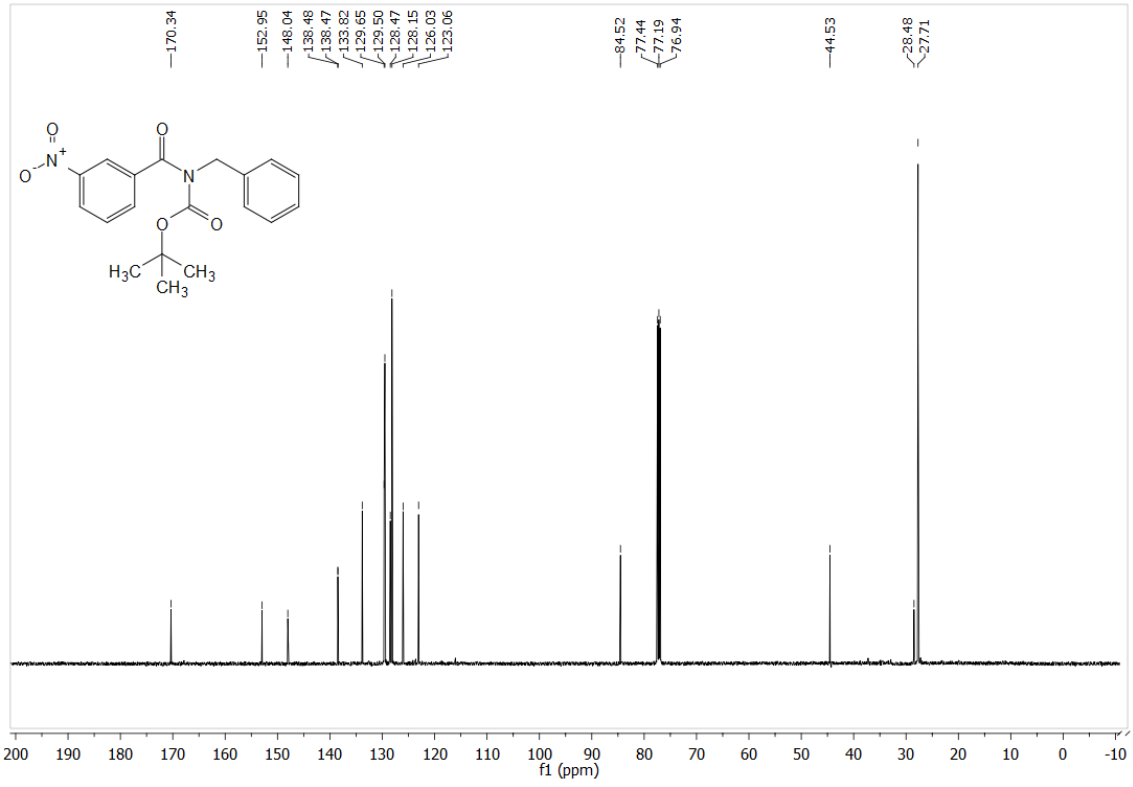
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzyl(2-nitrobenzoyl)-carbamate (1g)



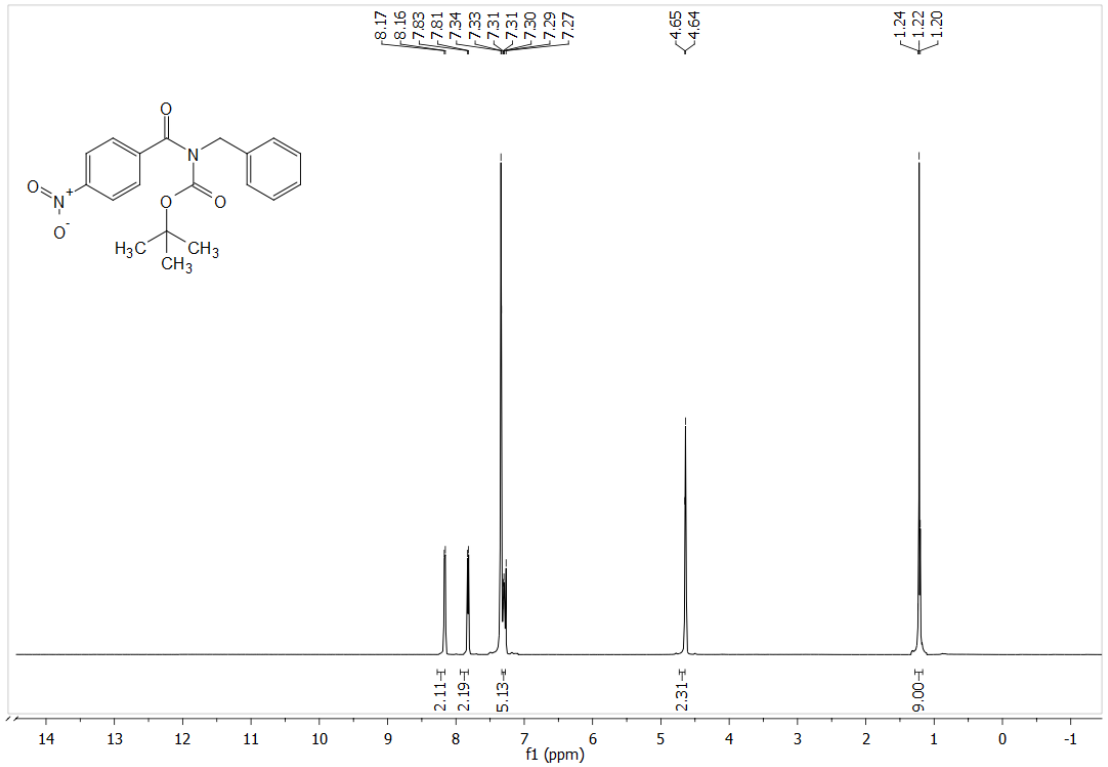


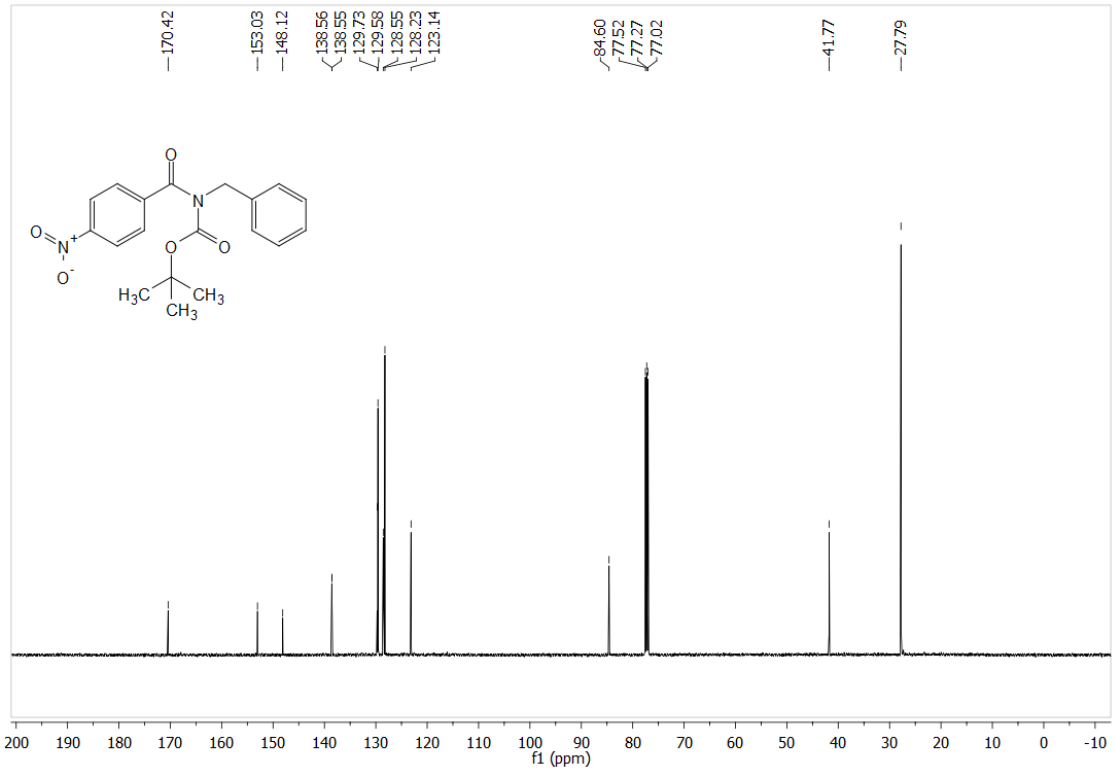
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzyl(3-nitrobenzoyl)-carbamate (1h)



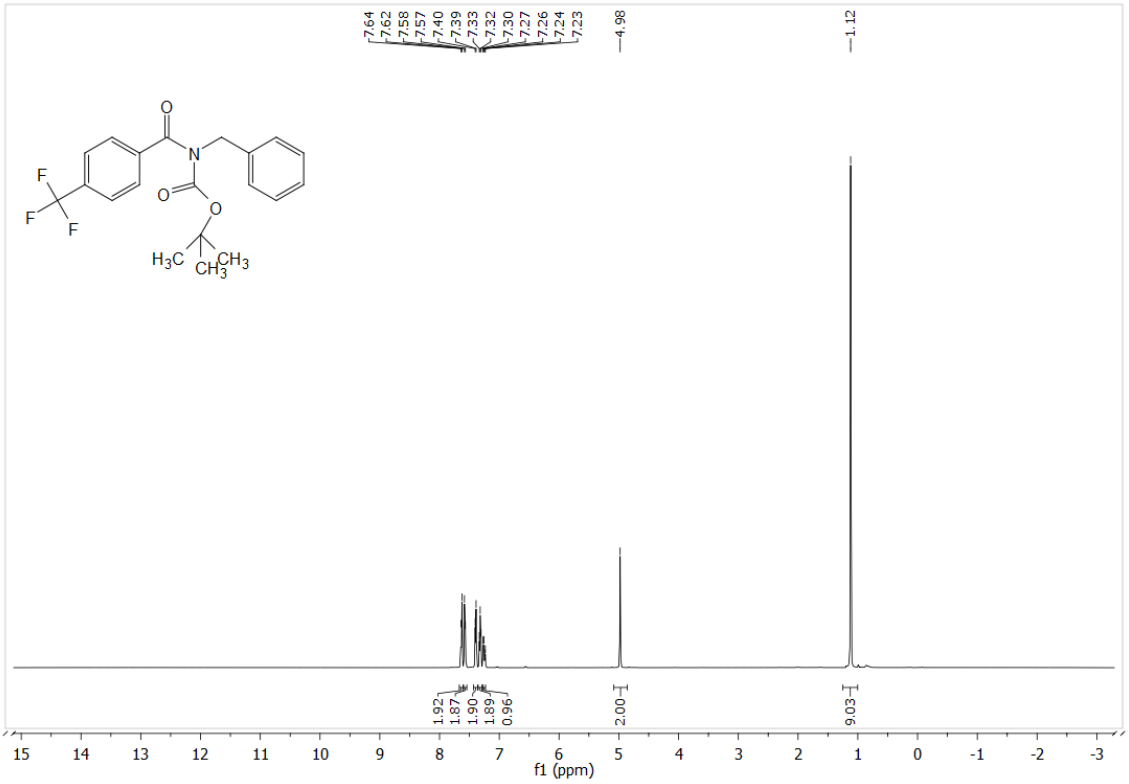


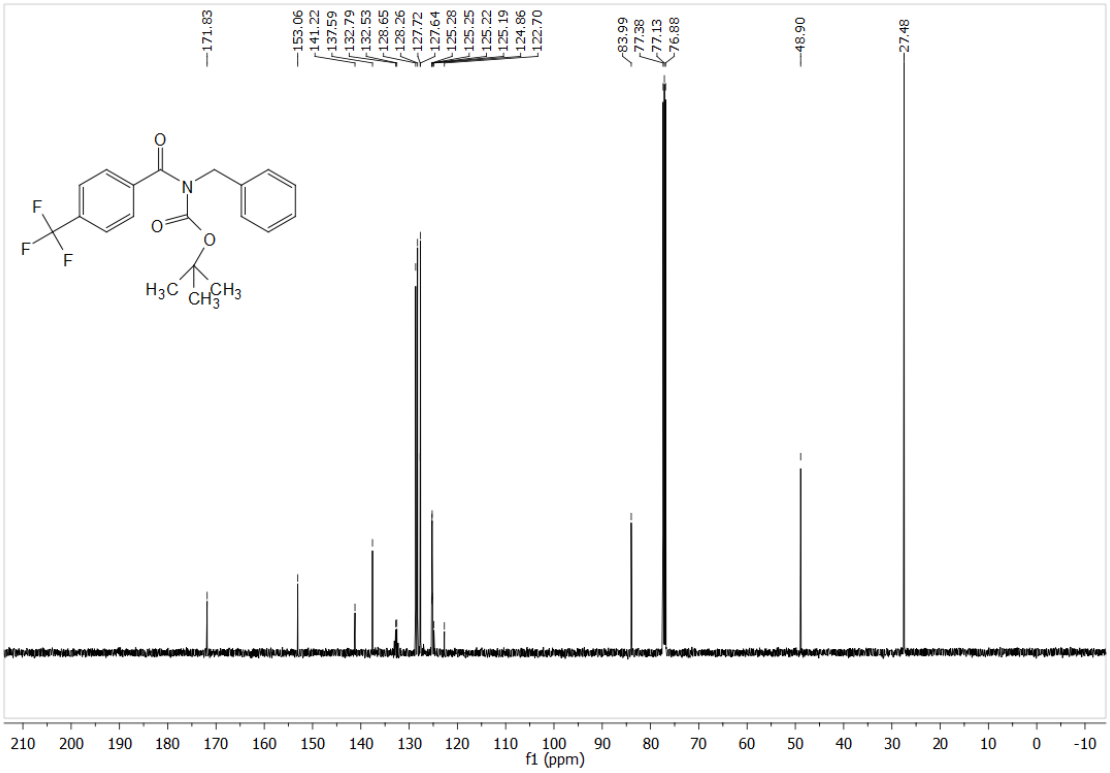
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzyl(4-nitrobenzoyl)-carbamate (1i)

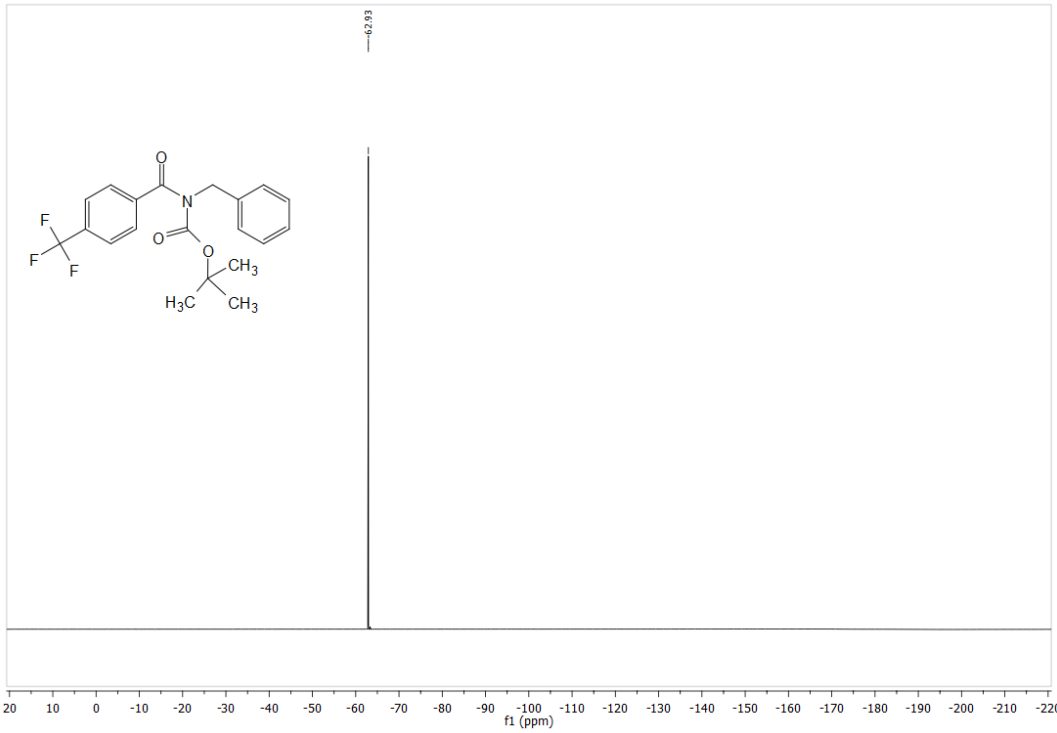




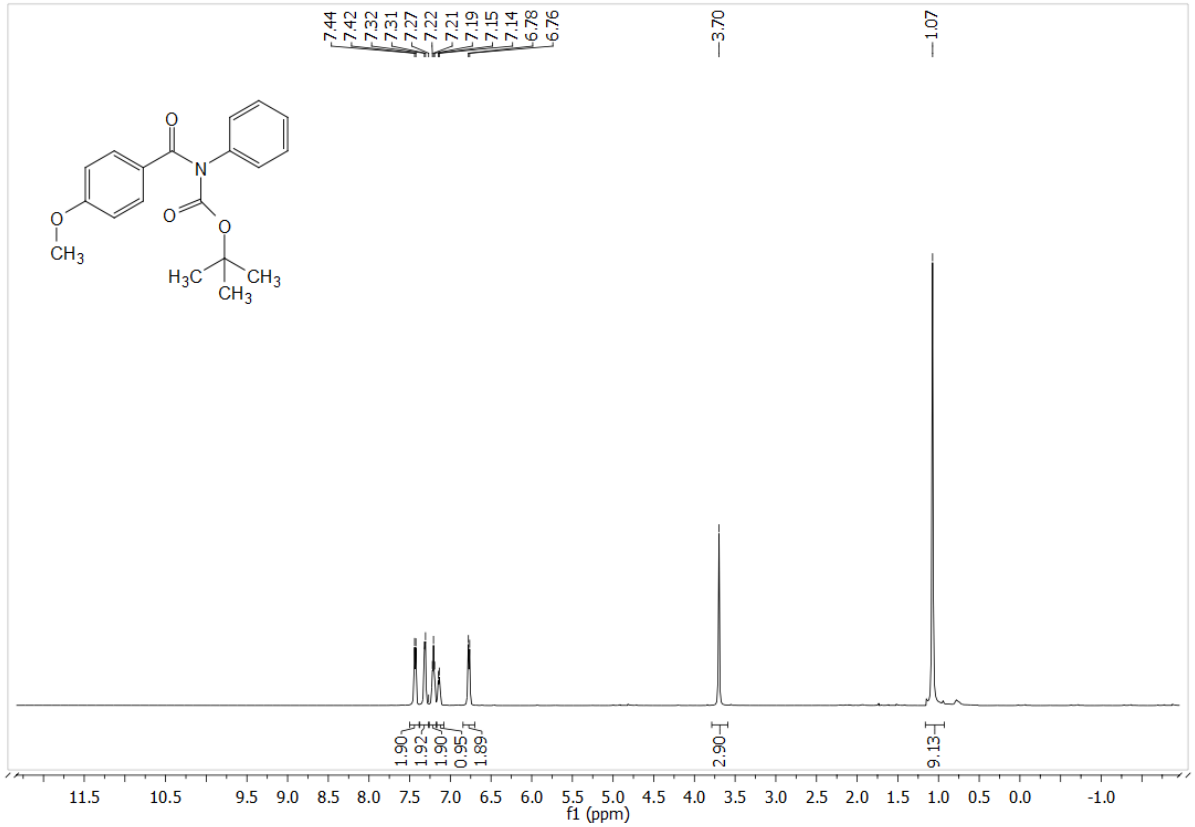
^{1}H, ^{13}C and ^{19} F NMR Spectra of *tert*-butyl benzyl(4-(trifluoromethyl)benzoyl)-carbamate (1j)

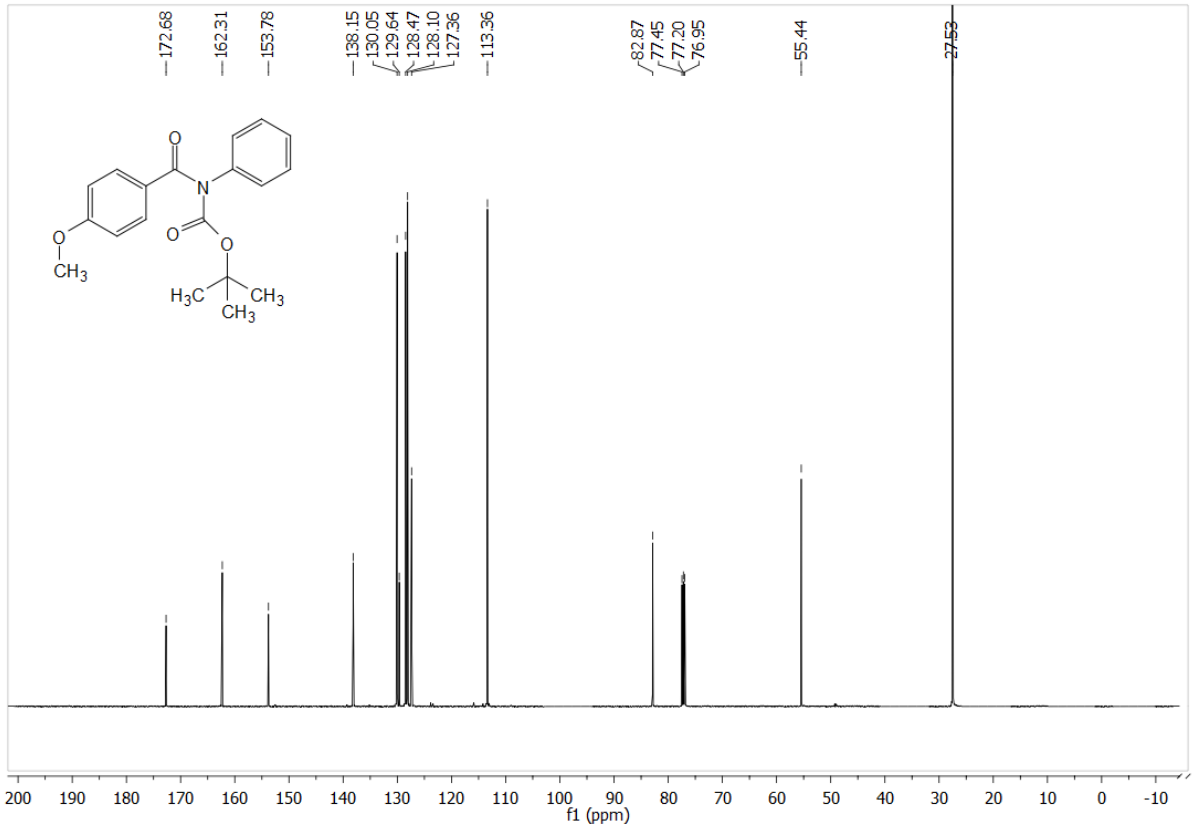




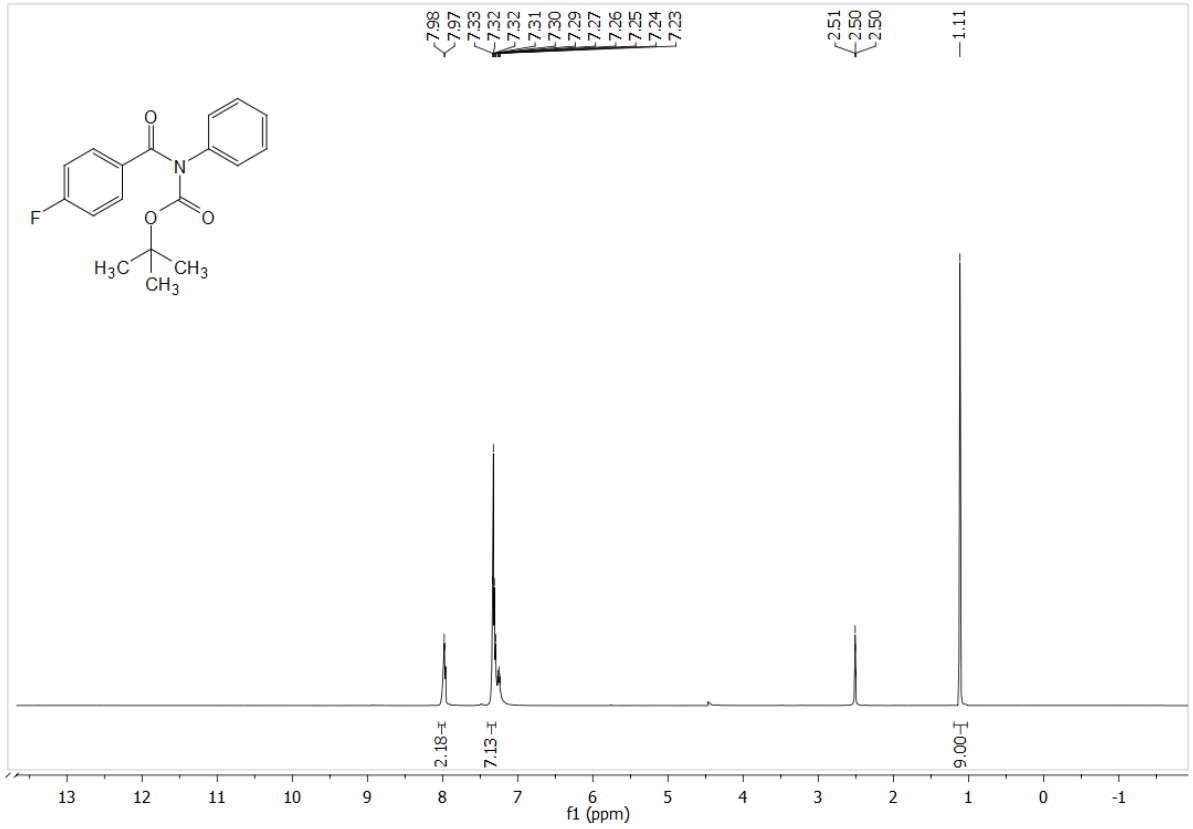

-62.93
O
N
O
O
F
F
F
CH3
H3C
CH3
20 10 0 -10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -200 -210 -220
f1 (ppm)

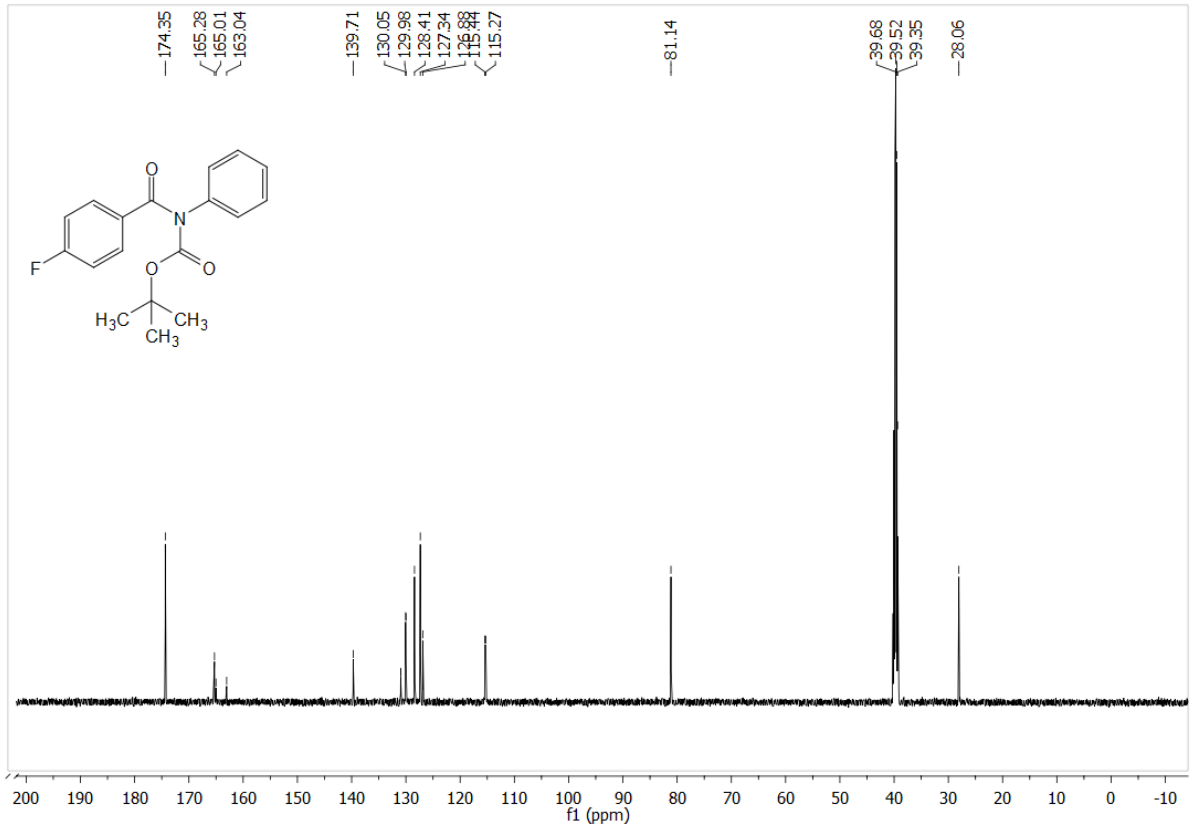
^{1}H and ^{13}C NMR Spectra of *tert*-butyl (4-methoxybenzoyl)(phenyl)-carbamate (1k)



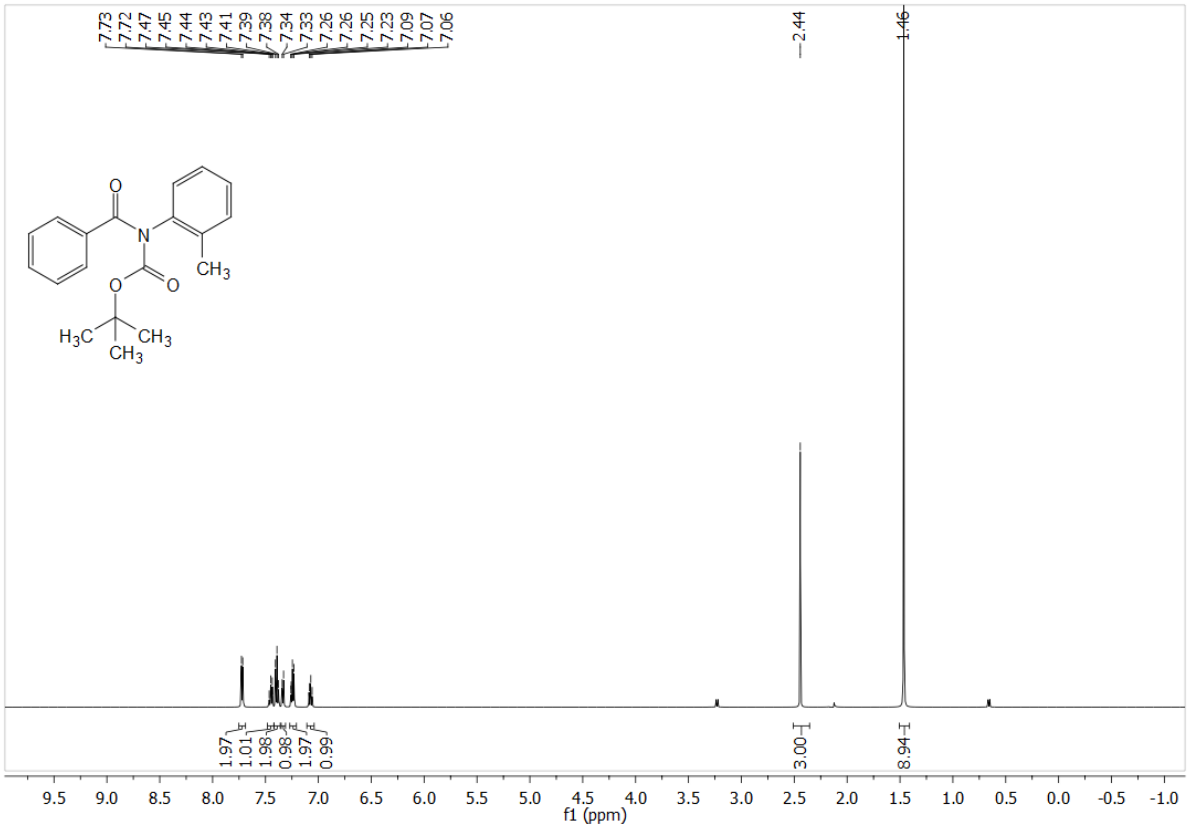


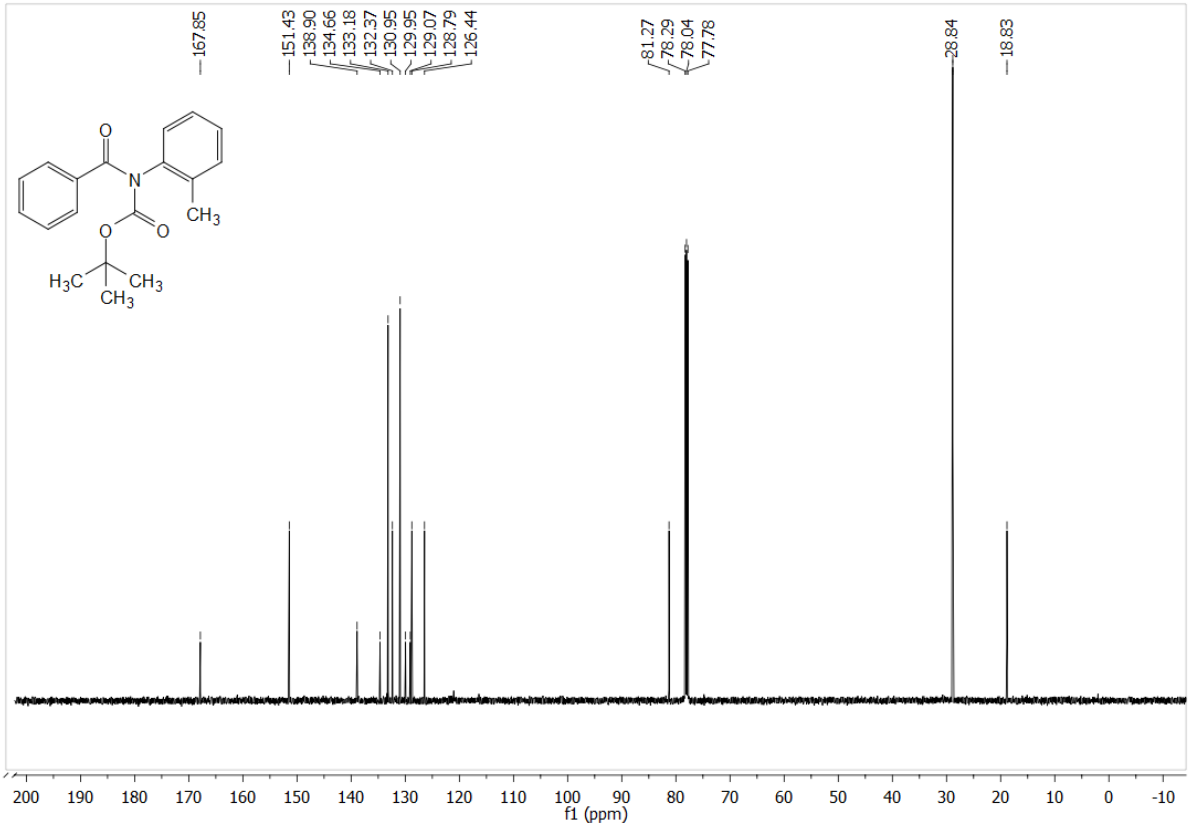
^{1}H and ^{13}C NMR Spectra of *tert*-butyl (4-fluorobenzoyl) (phenyl)-carbamate (1l)



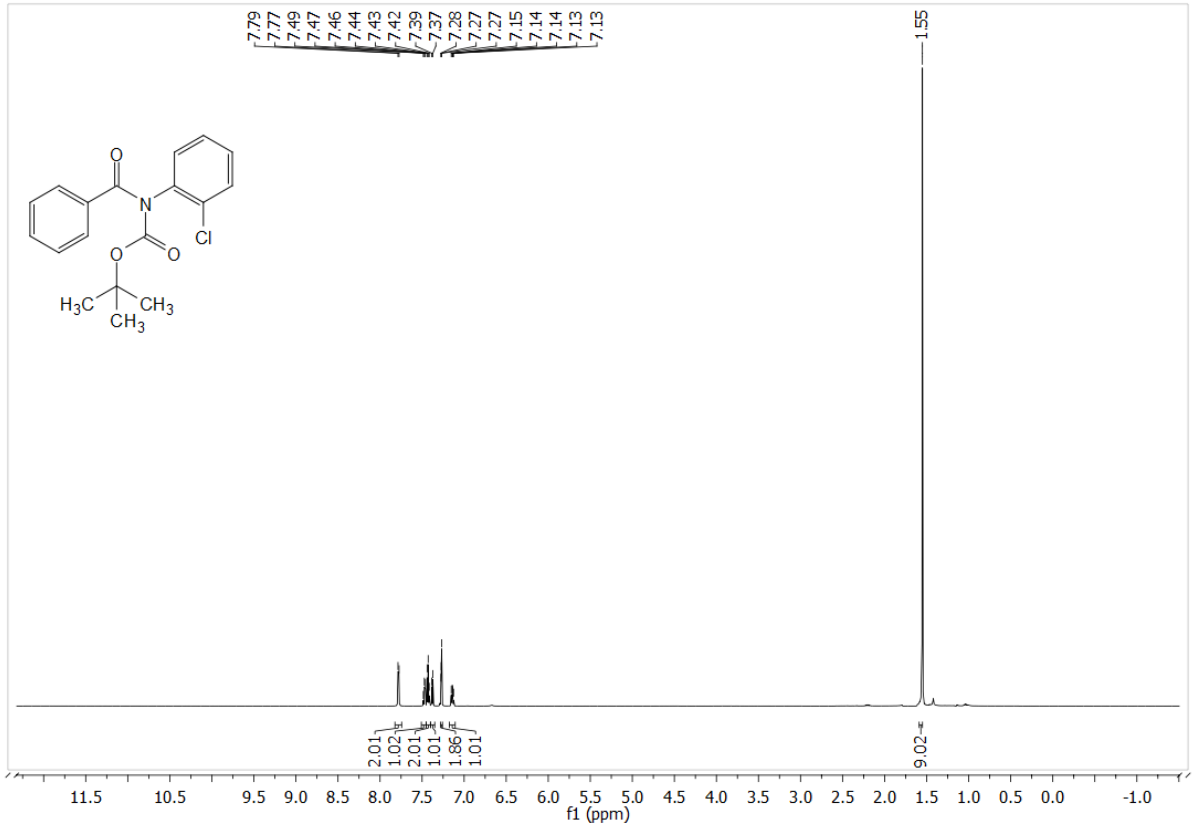


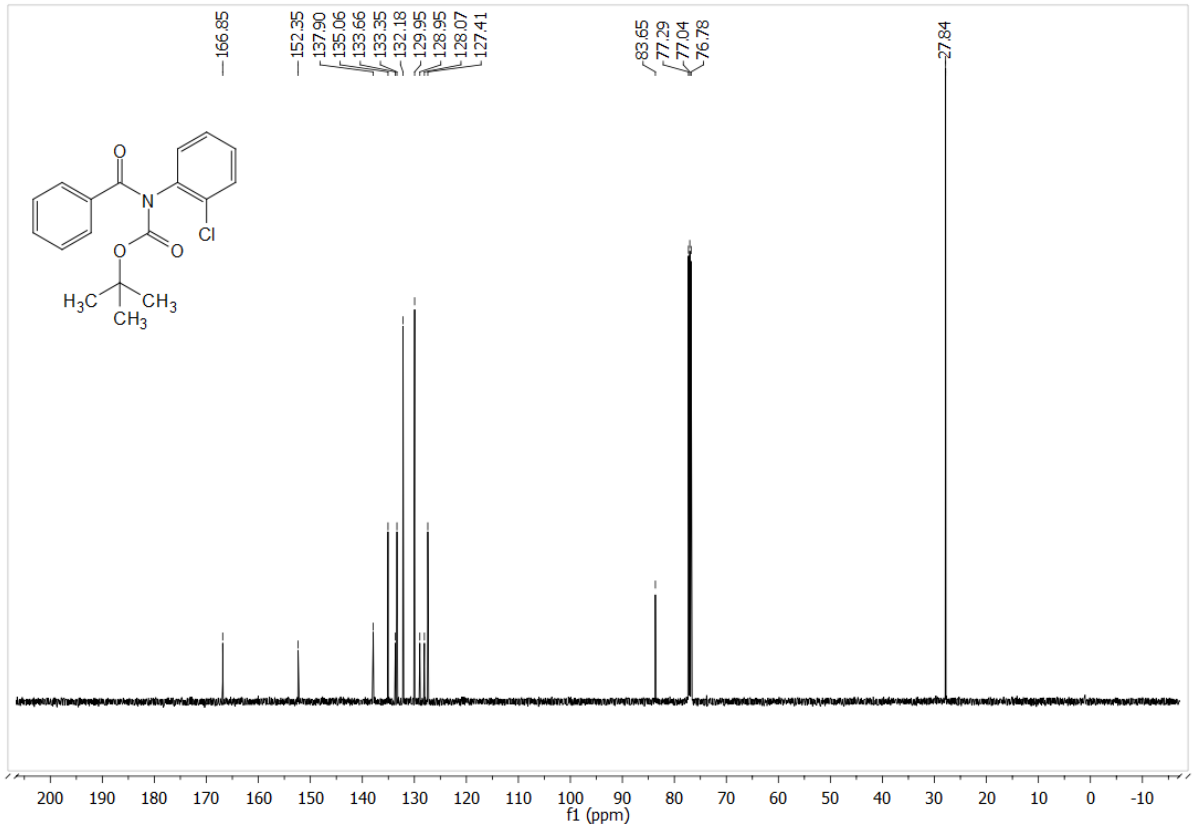
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzoyl(o-tolyl)-carbamate (1m)



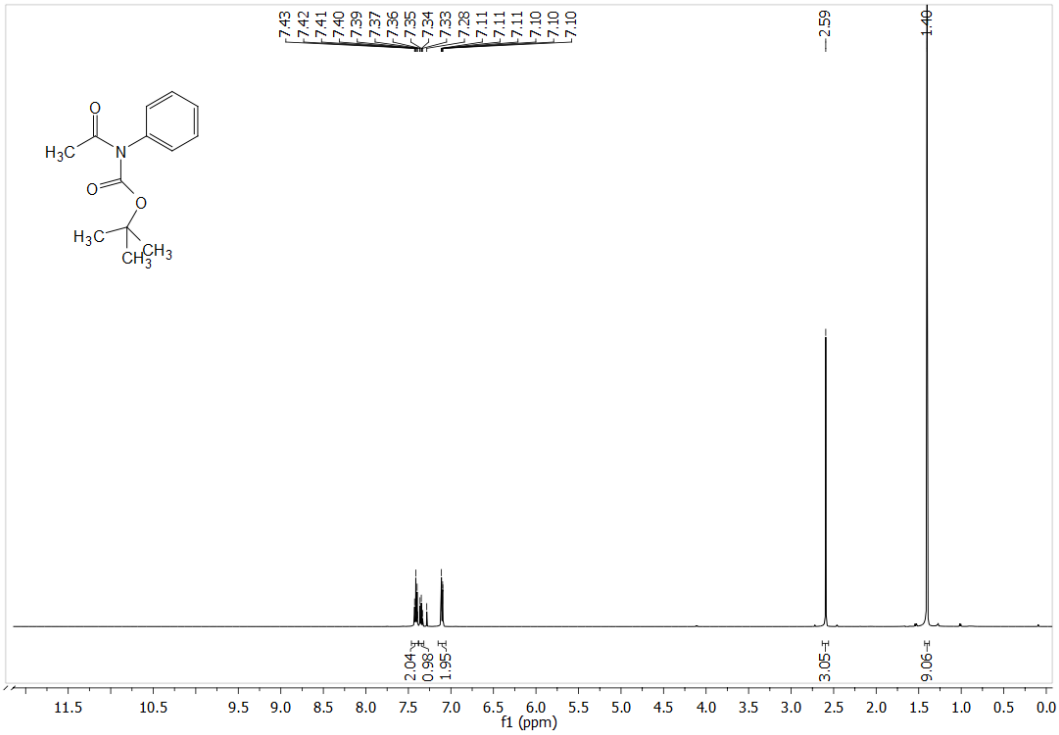


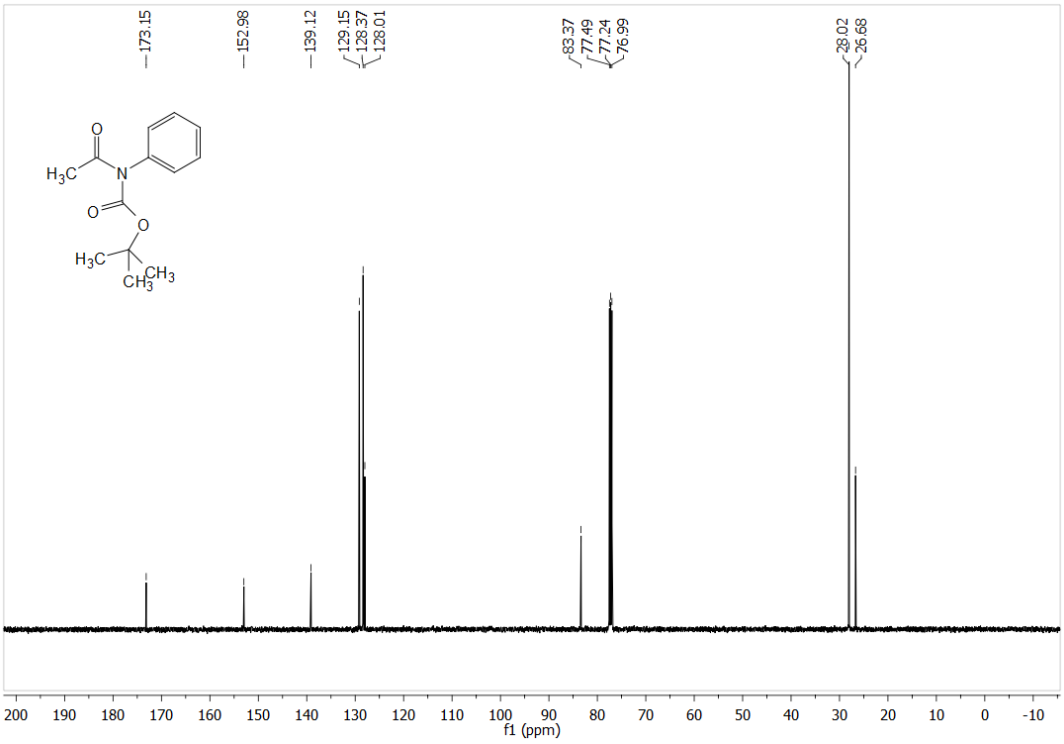
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzoyl(2-chlorophenyl)-carbamate (1n)



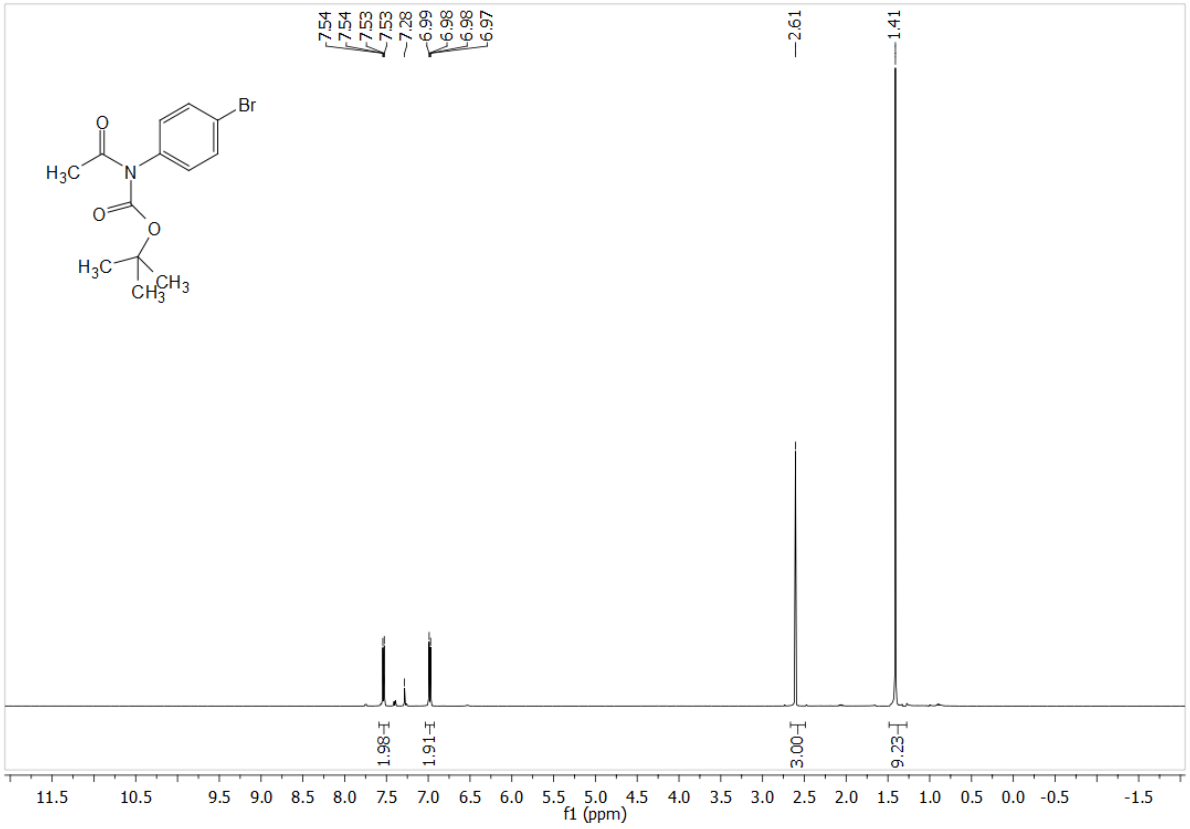


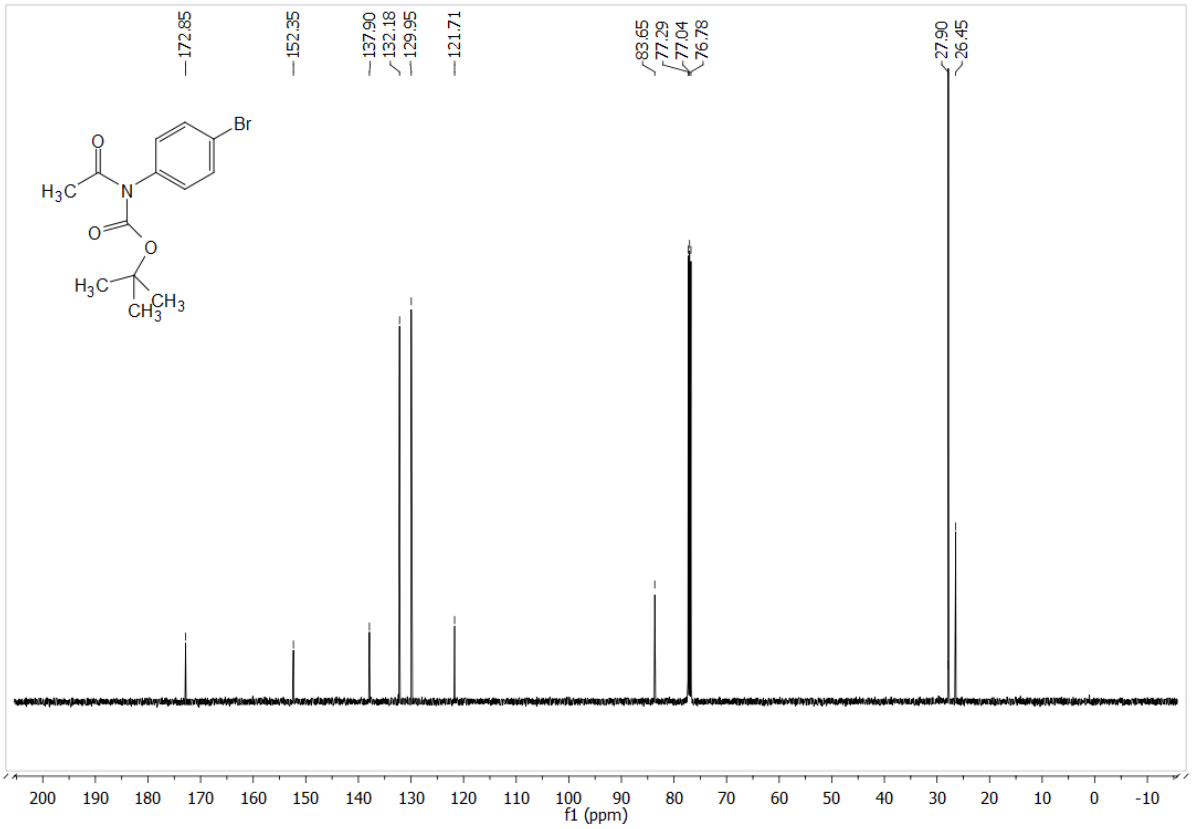
^{1}H and ^{13}C NMR Spectra of *tert*-butyl acetyl(phenyl)-carbamate (1o)



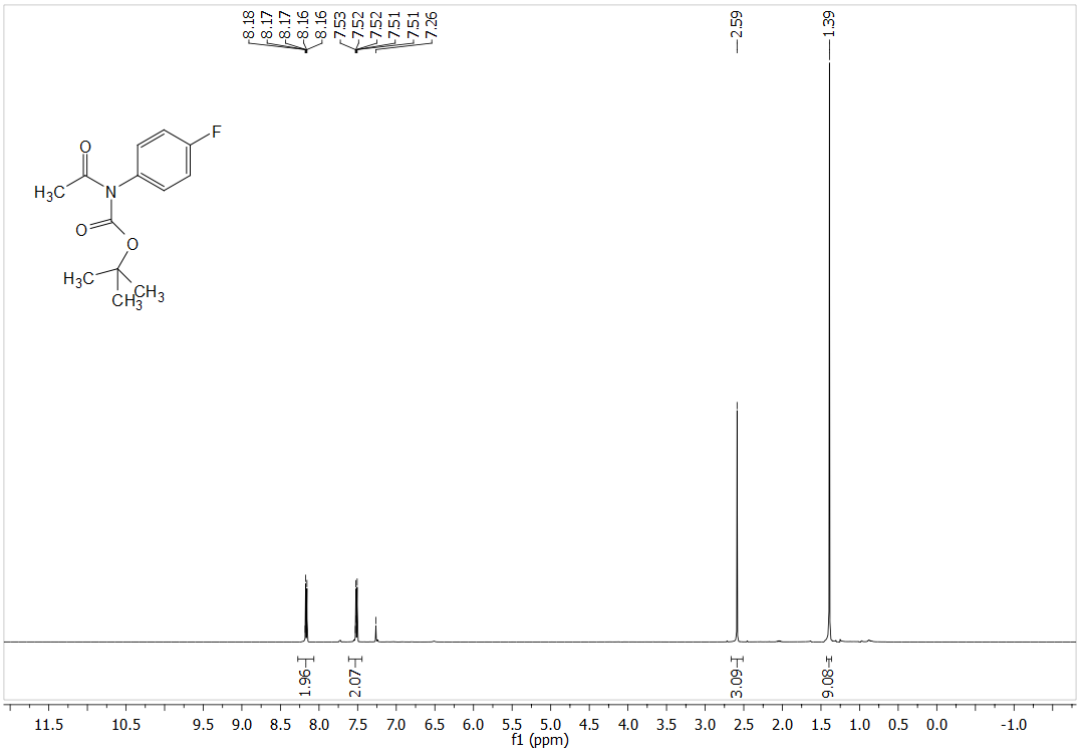


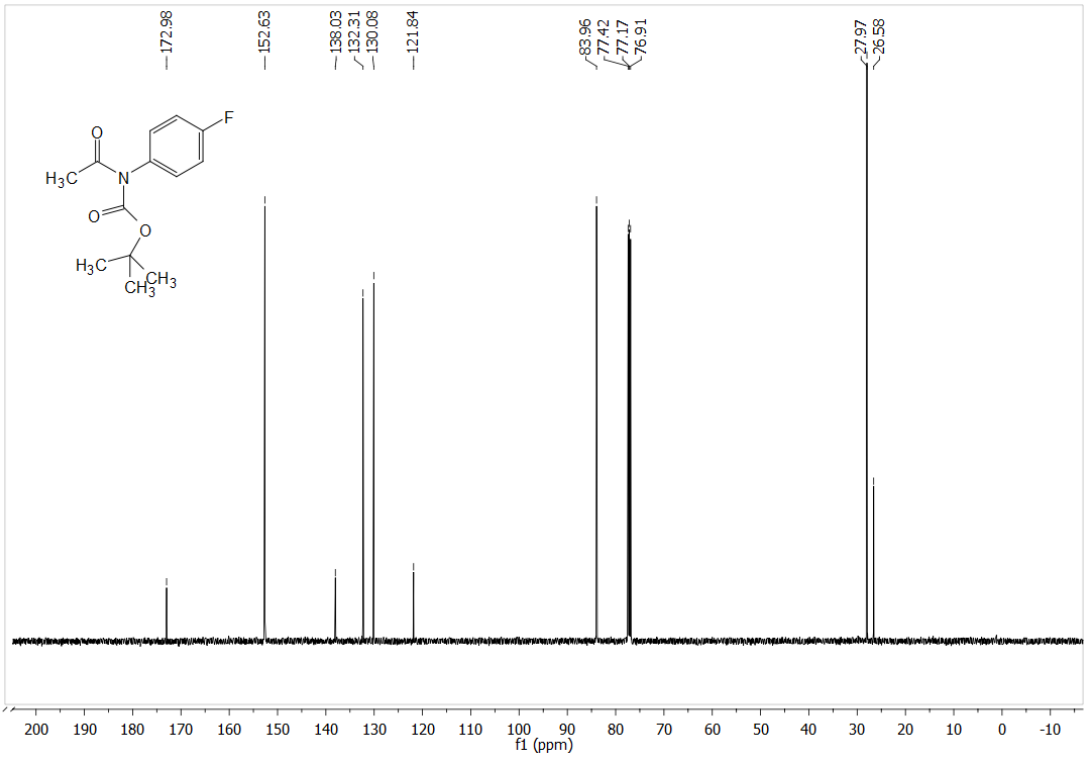
^{1}H and ^{13}C NMR Spectra of *tert*-butyl acetyl(4-bromophenyl)-carbamate (1p)



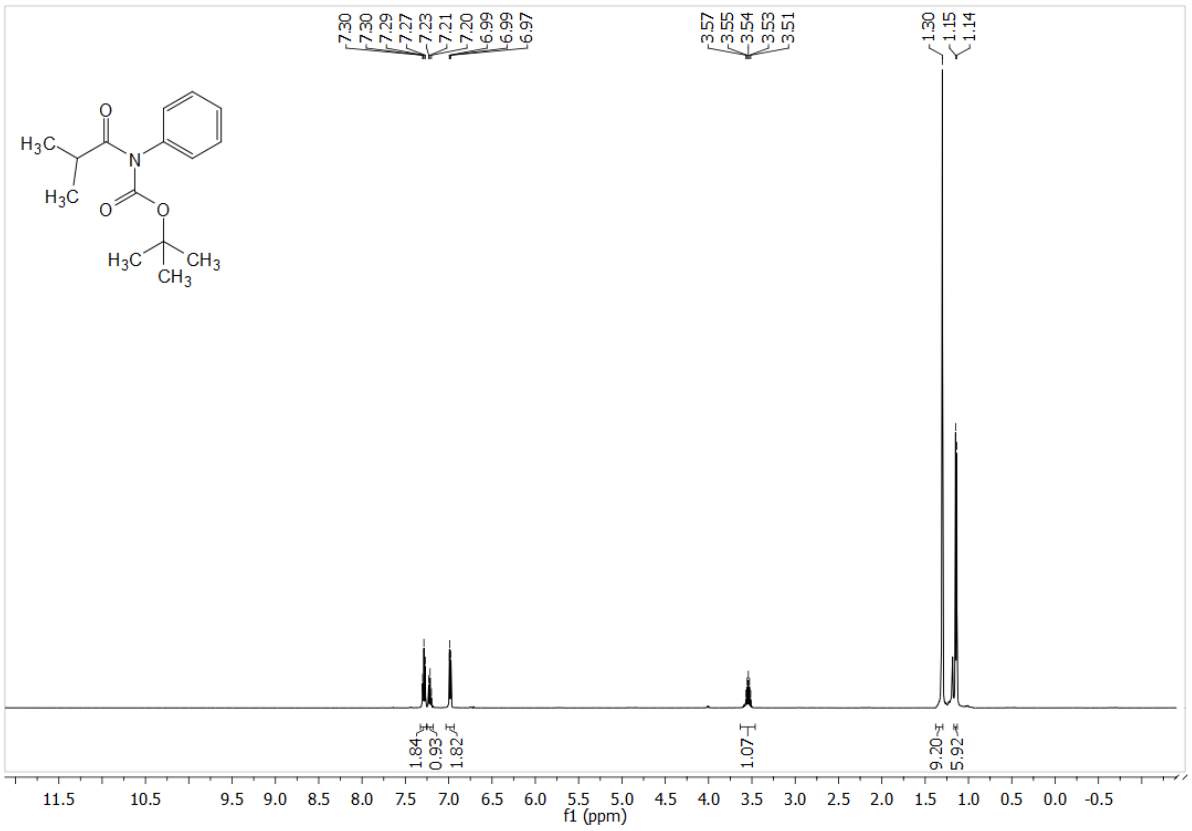


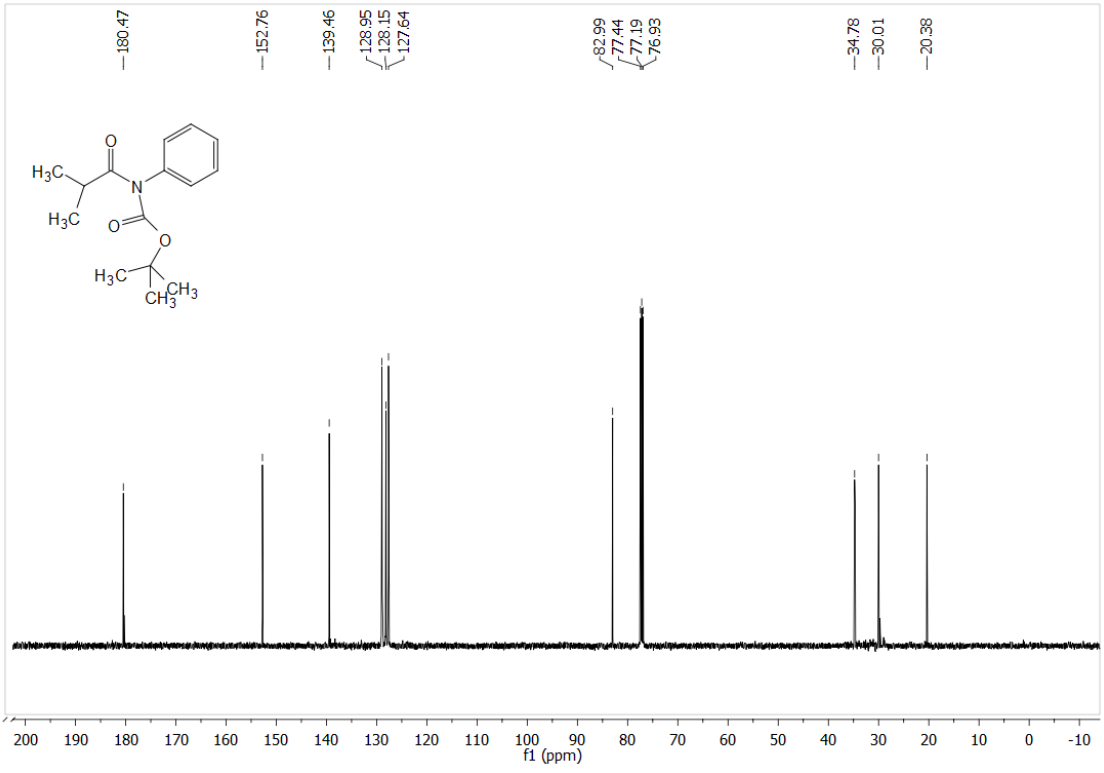
^{1}H and ^{13}C NMR Spectra of *tert*-butyl acetyl(4-fluorophenyl)-carbamate (1q)



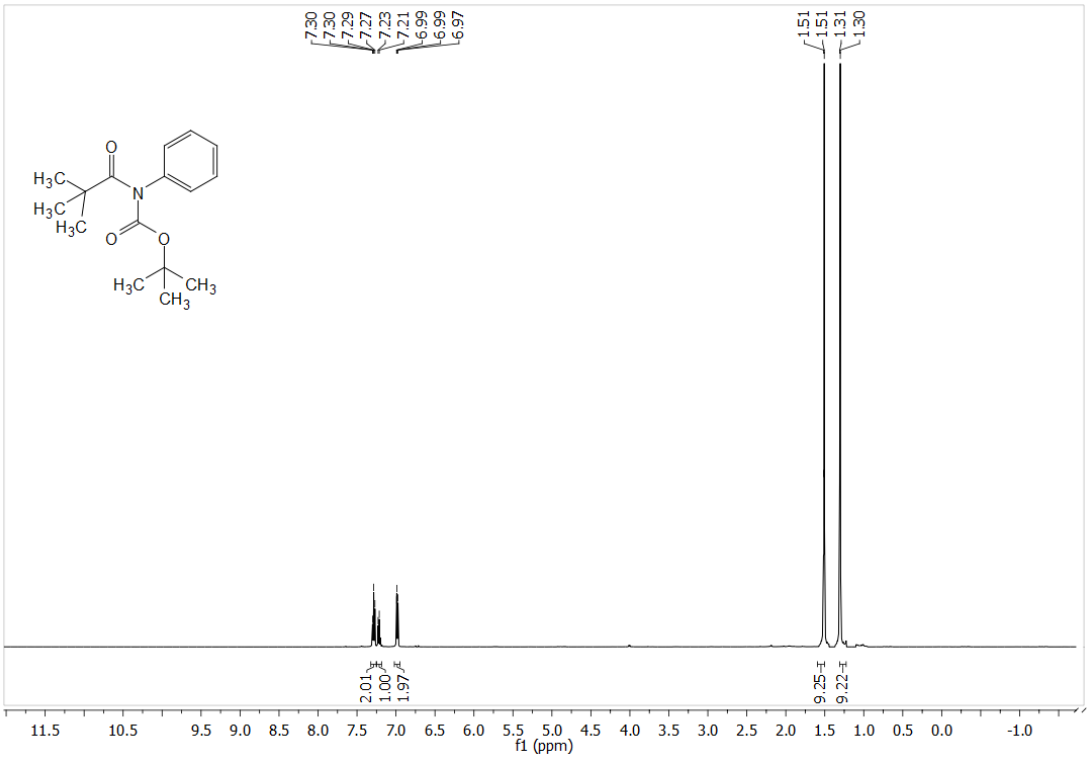


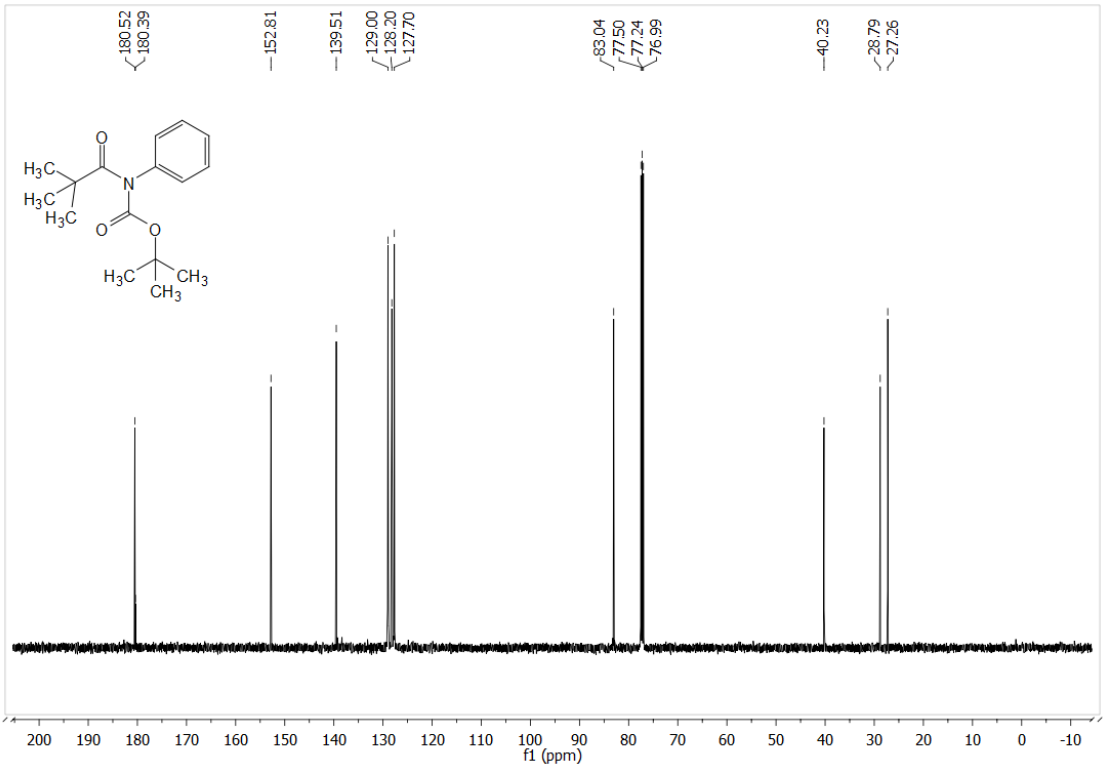
^{1}H and ^{13}C NMR Spectra of *tert*-butyl isobutyryl(phenyl)-carbamate (1r)



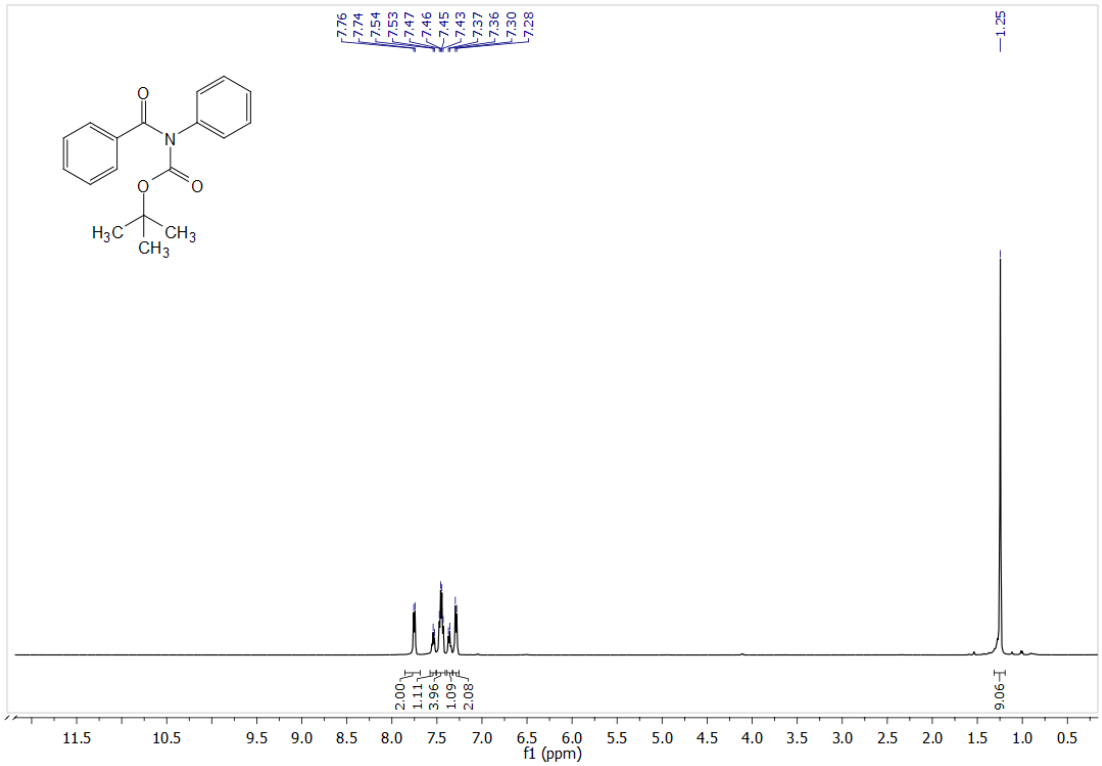


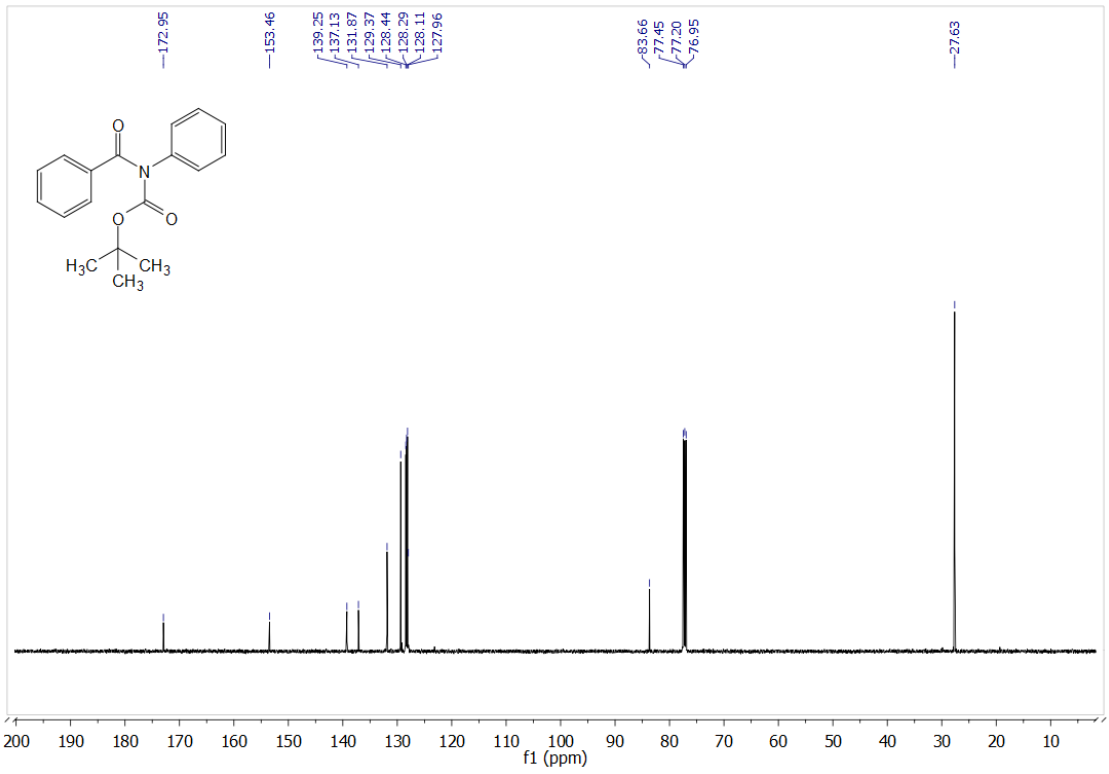
^{1}H and ^{13}C NMR Spectra of *tert*-butyl phenyl(pivaloyl)-carbamate (1s)



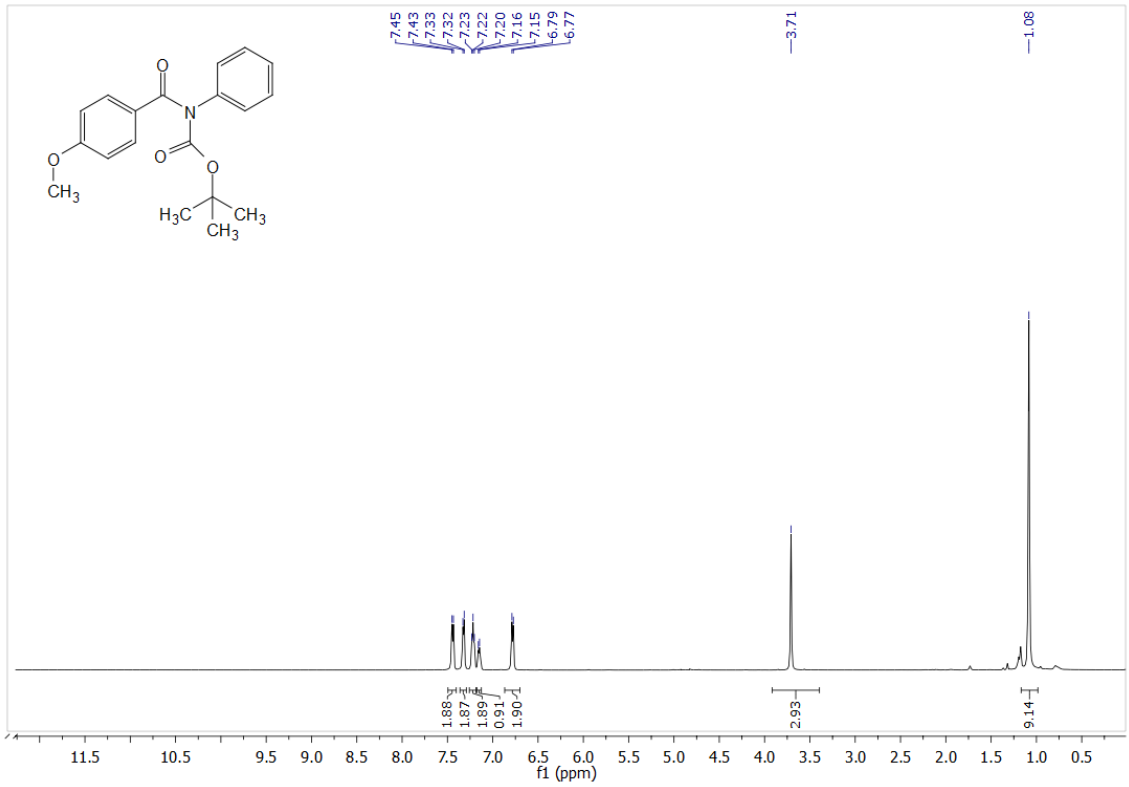


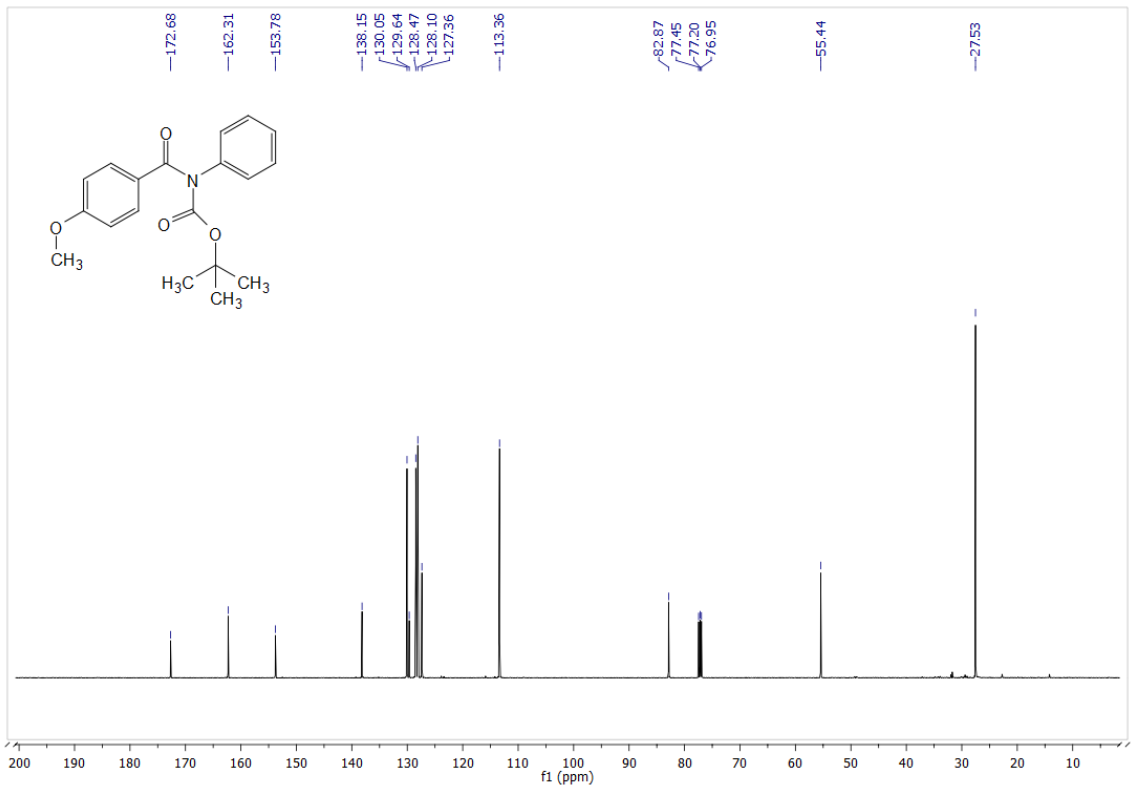
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzoyl(phenyl)-carbamate (1q)



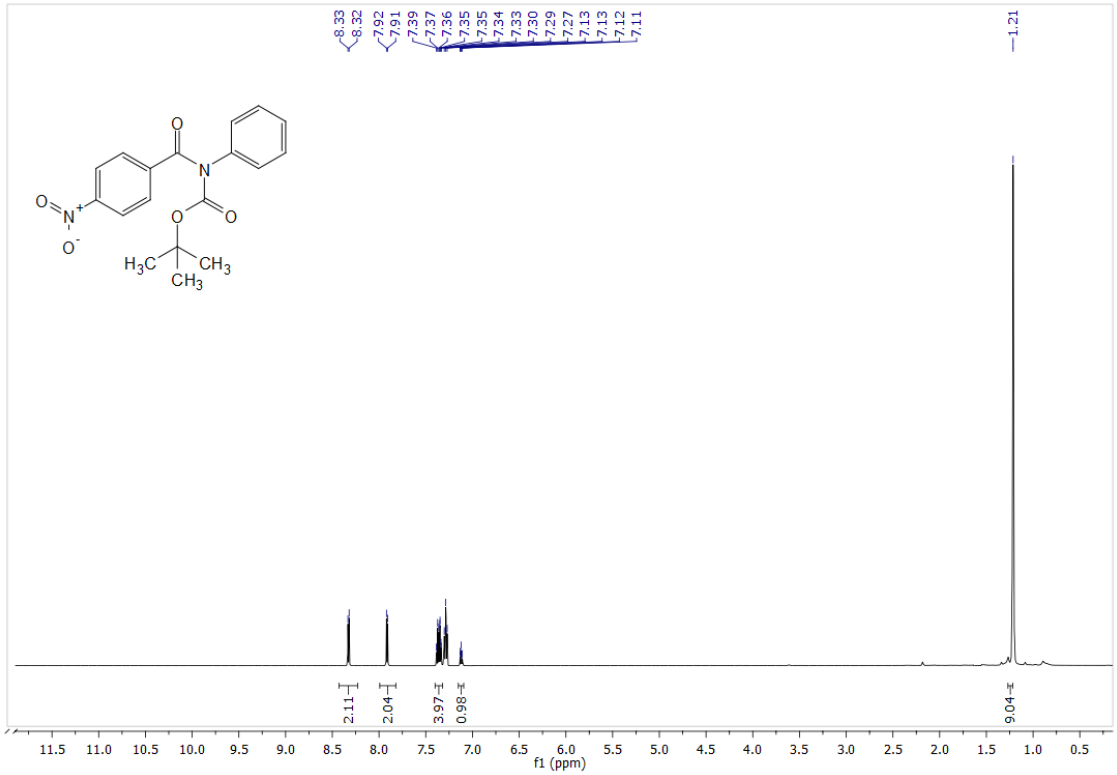


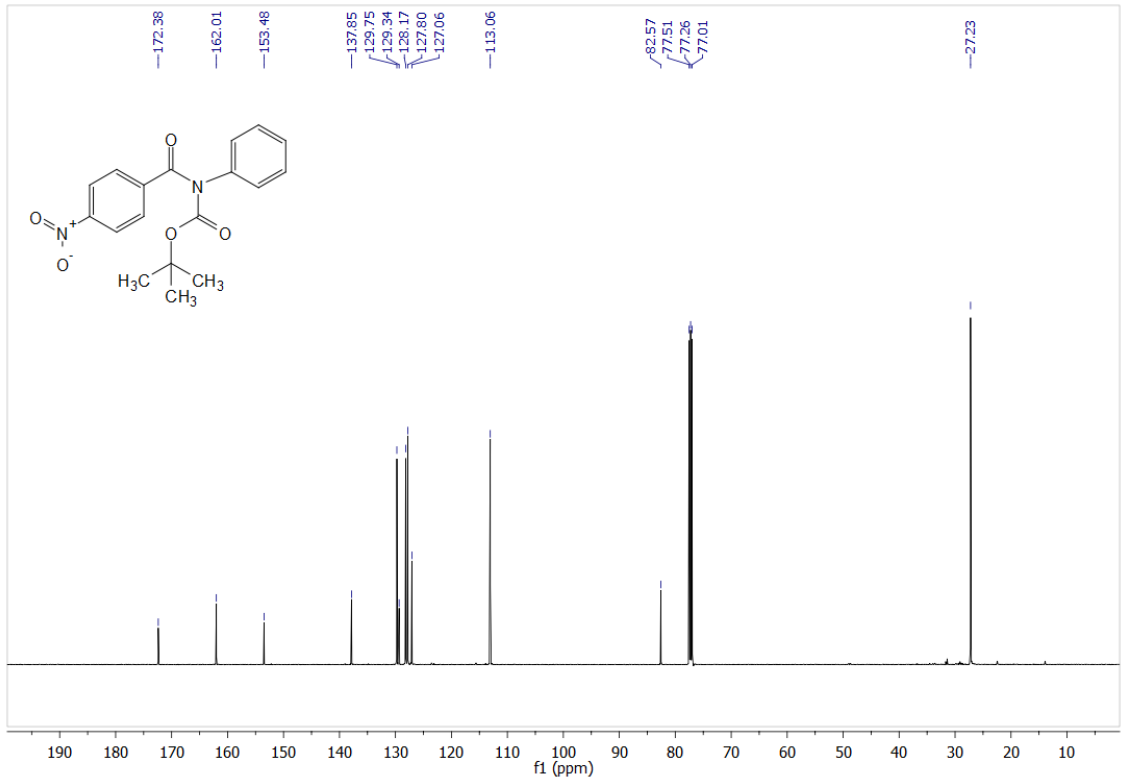
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzoyl(phenyl)-carbamate (1r)



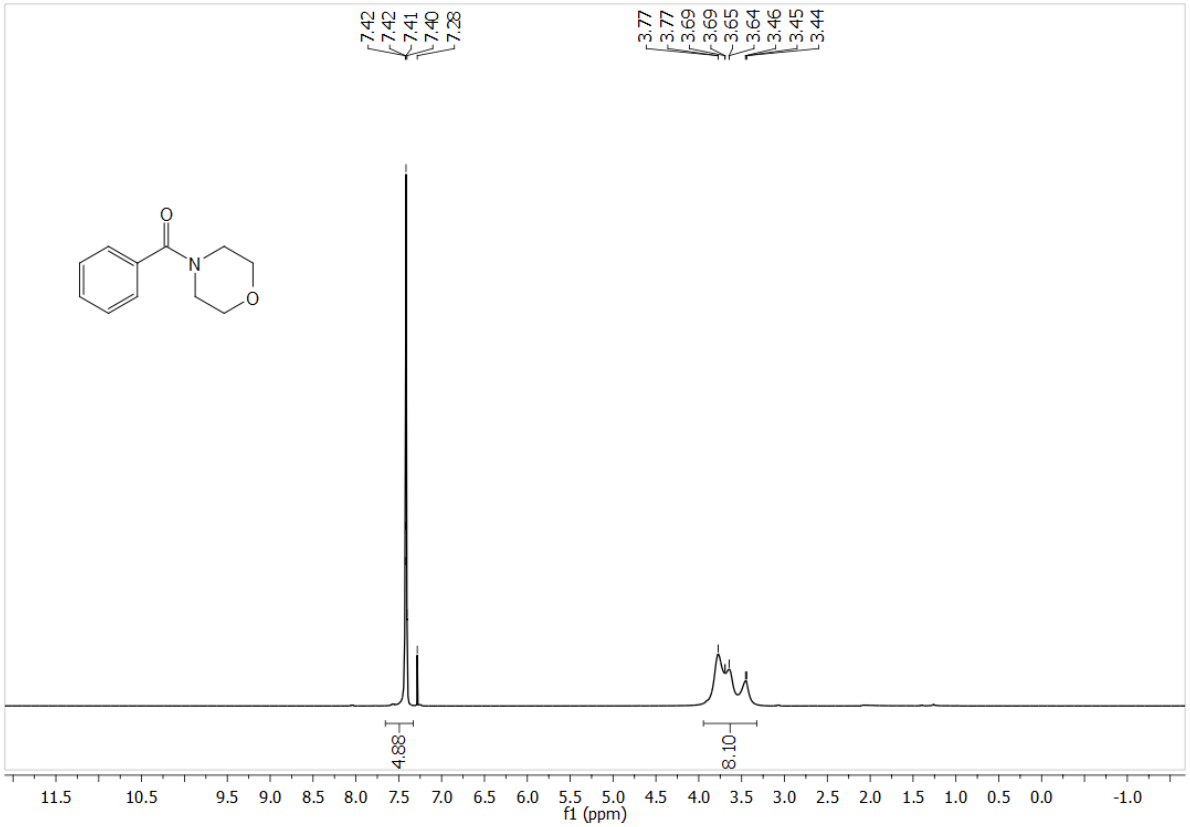


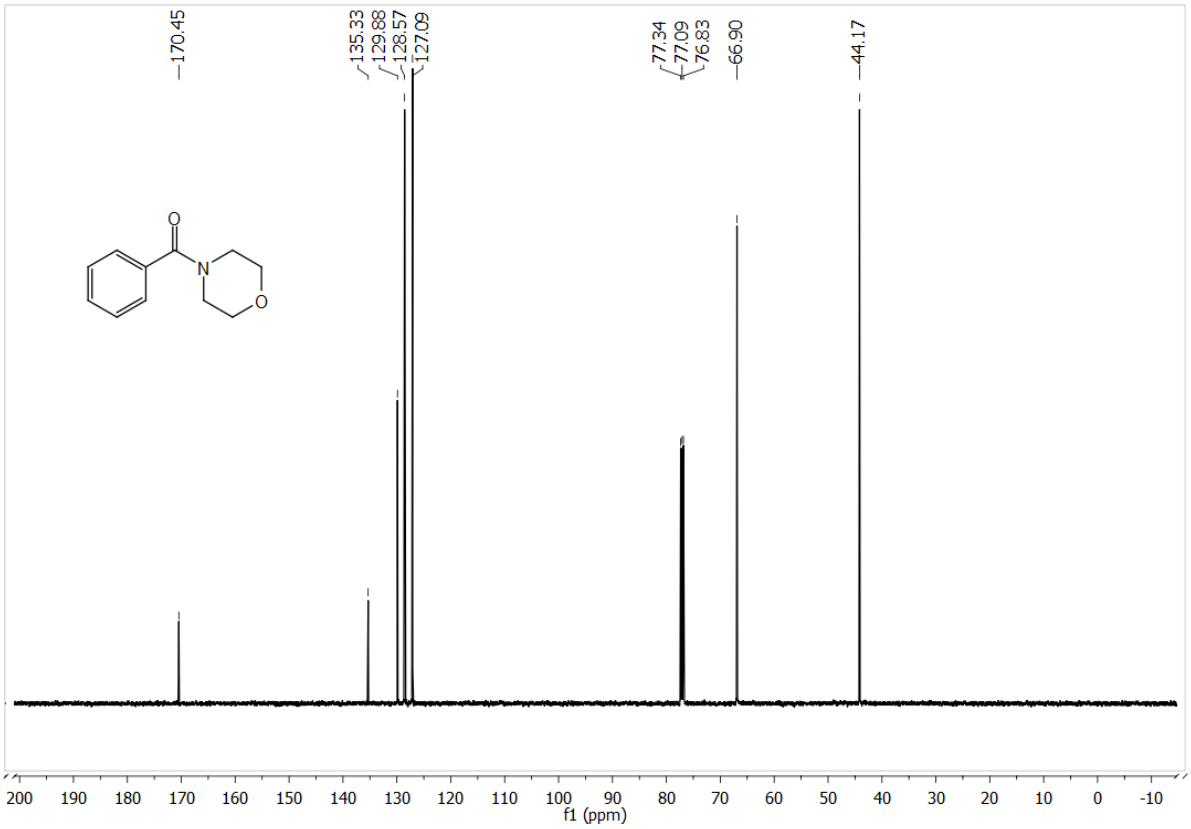
^{1}H and ^{13}C NMR Spectra of *tert*-butyl benzoyl(phenyl)-carbamate (1s)



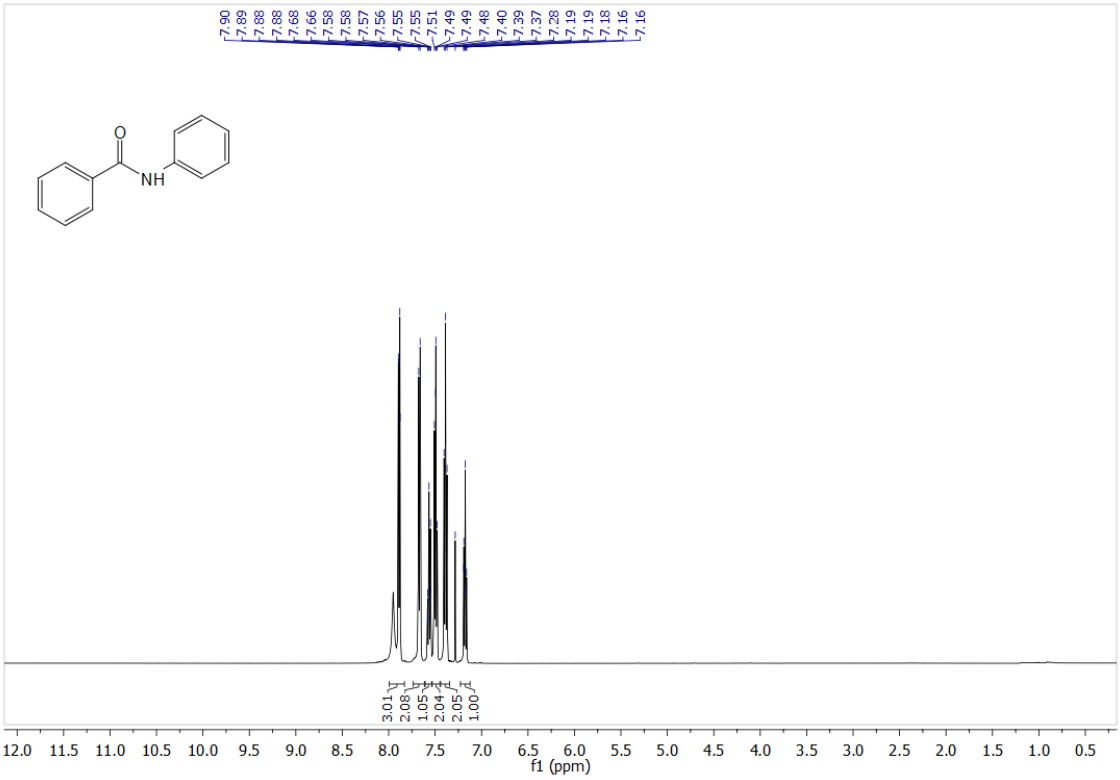


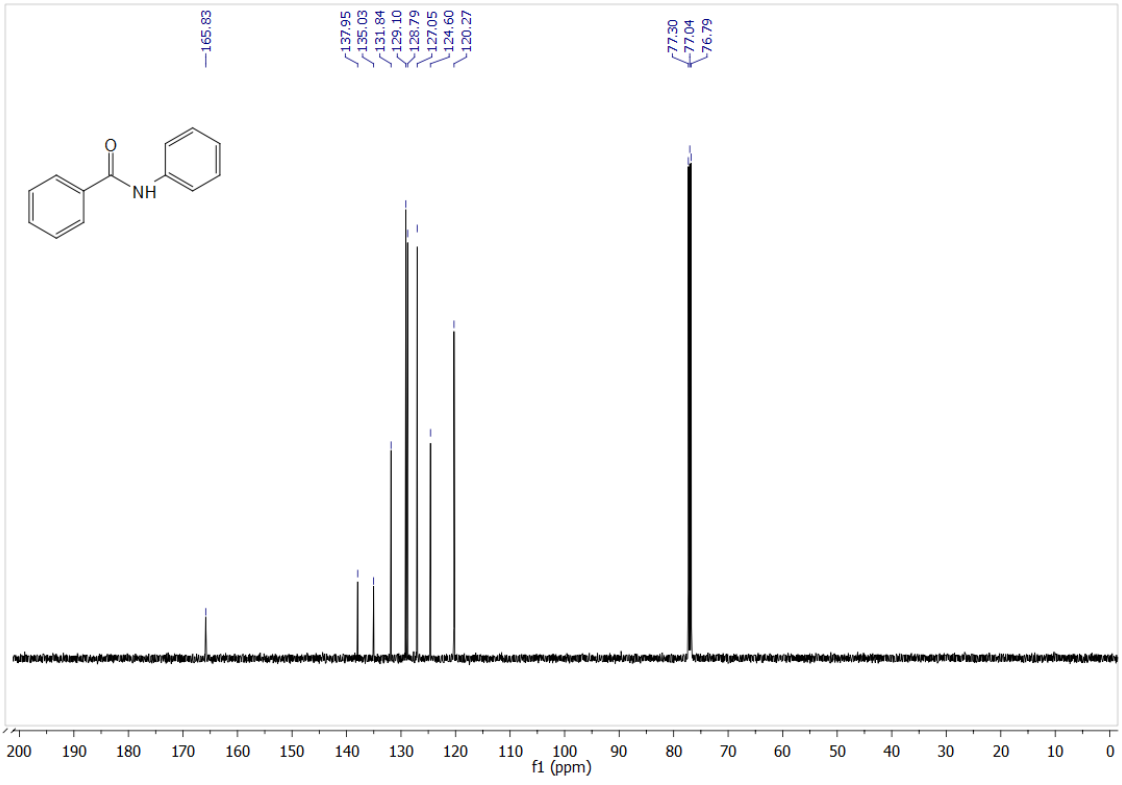
^{1}H and ^{13}C NMR Spectra of morpholino(phenyl)-methanone (3a)



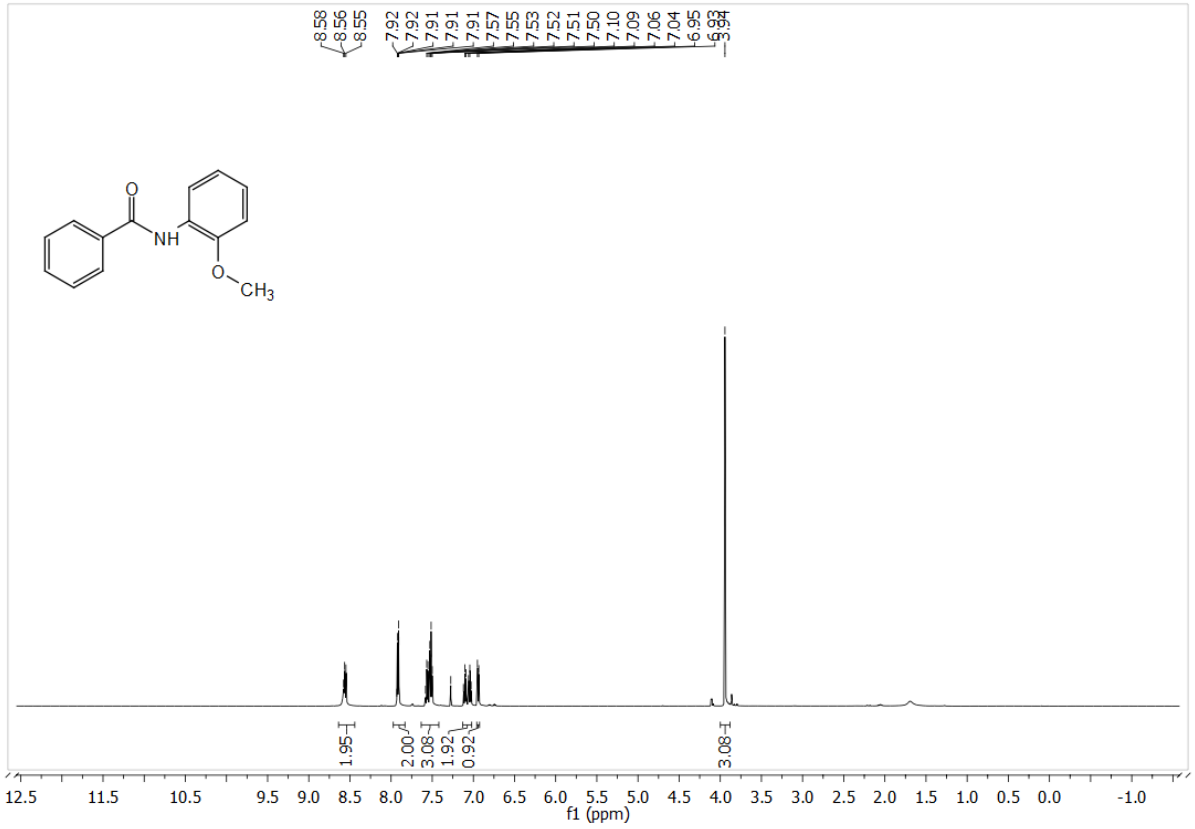


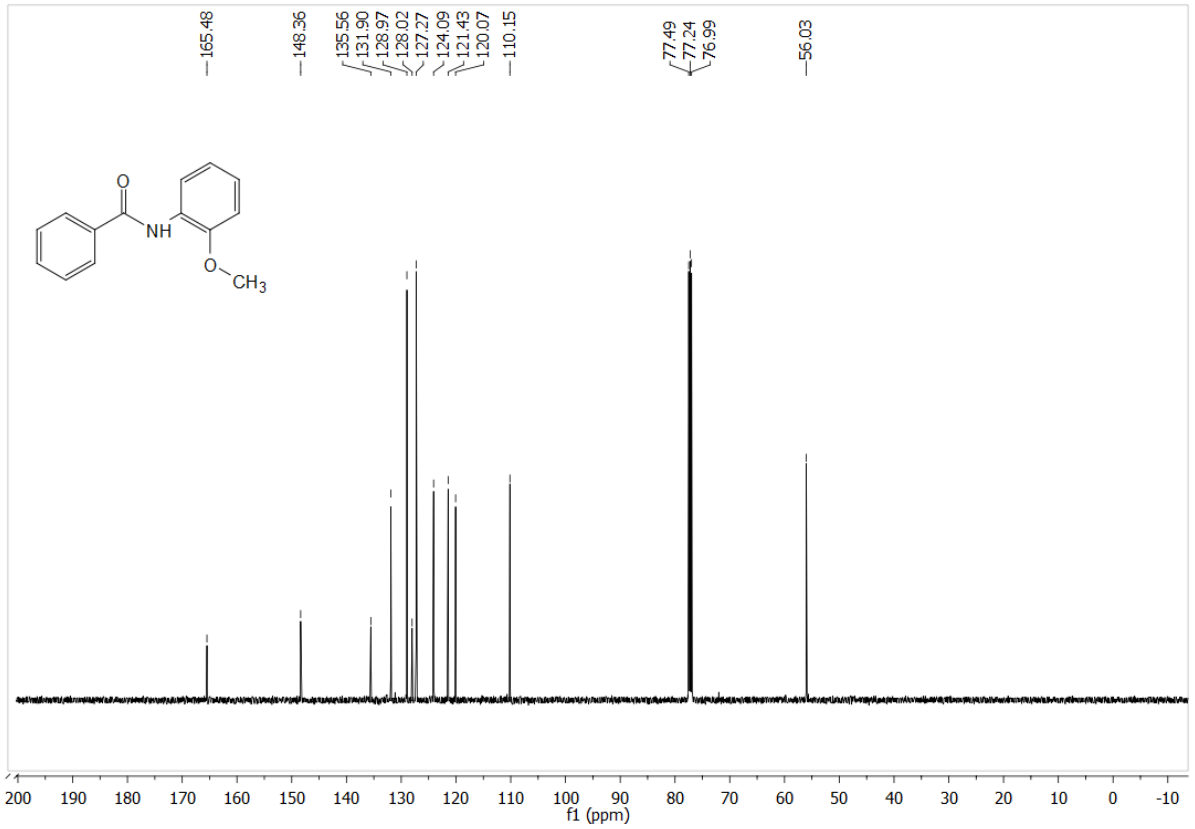
^{1}H and ^{13}C NMR Spectra of *N*-phenylbenzamide (3b)



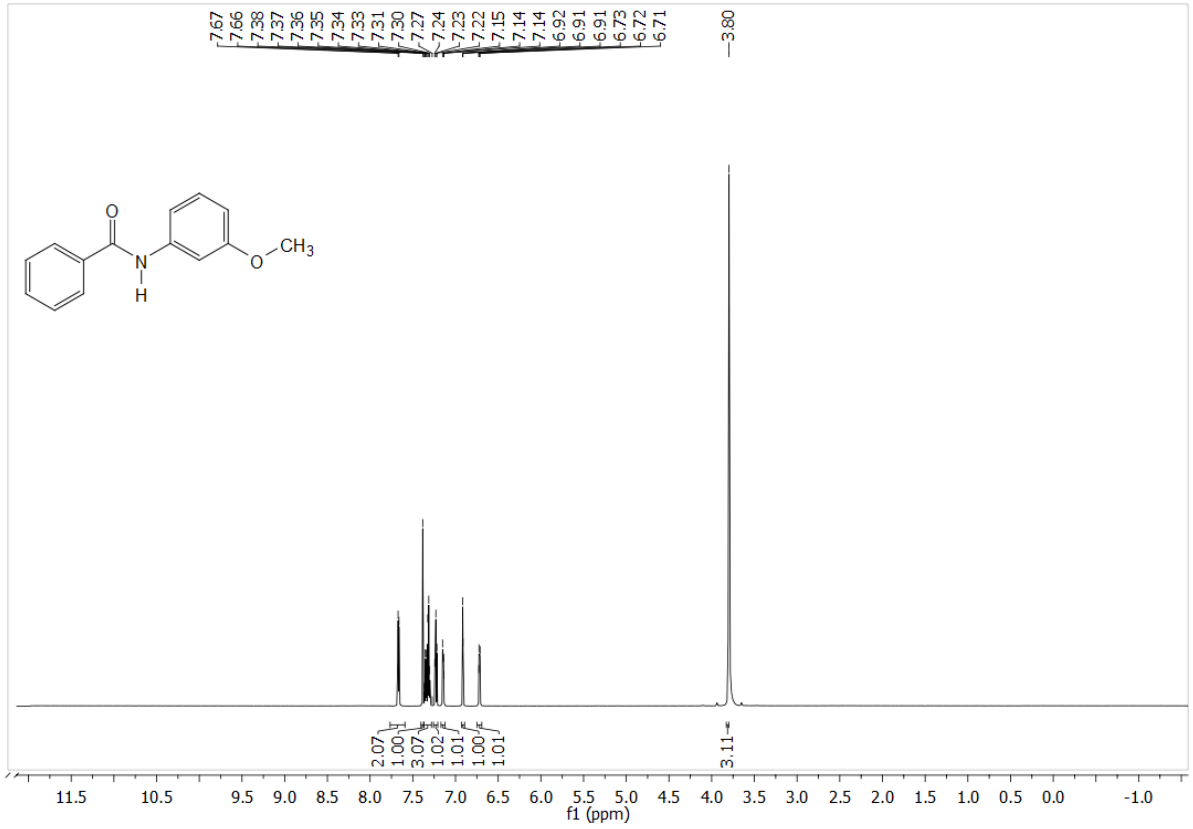


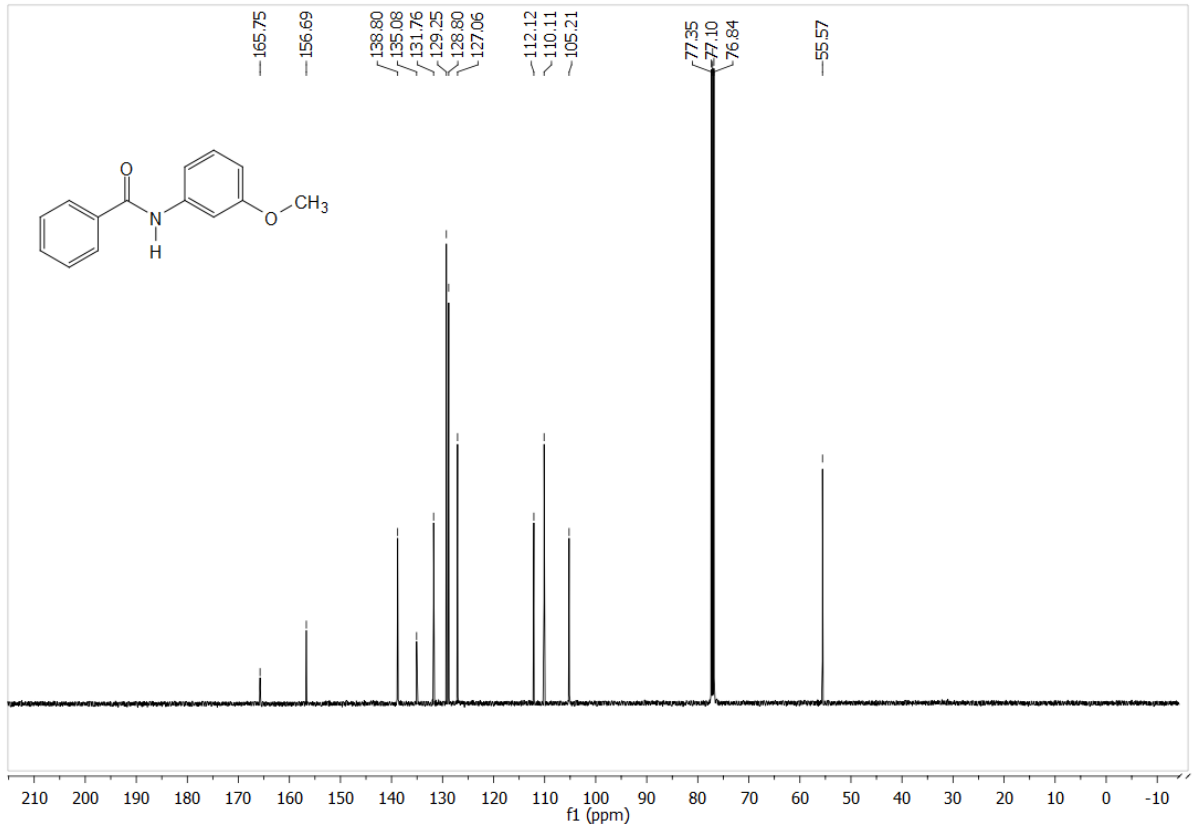
^{1}H and ^{13}C NMR Spectra of *N*-(2-methoxyphenyl)-benzamide (3c)



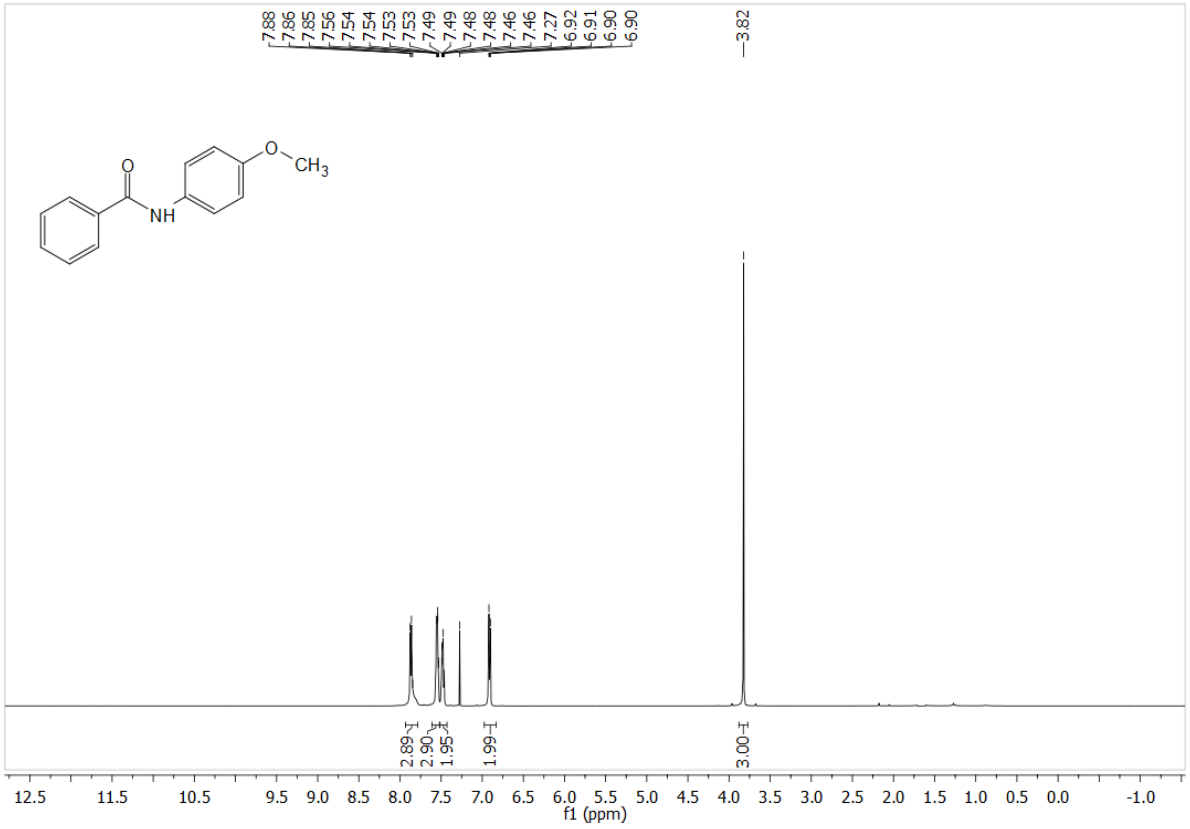


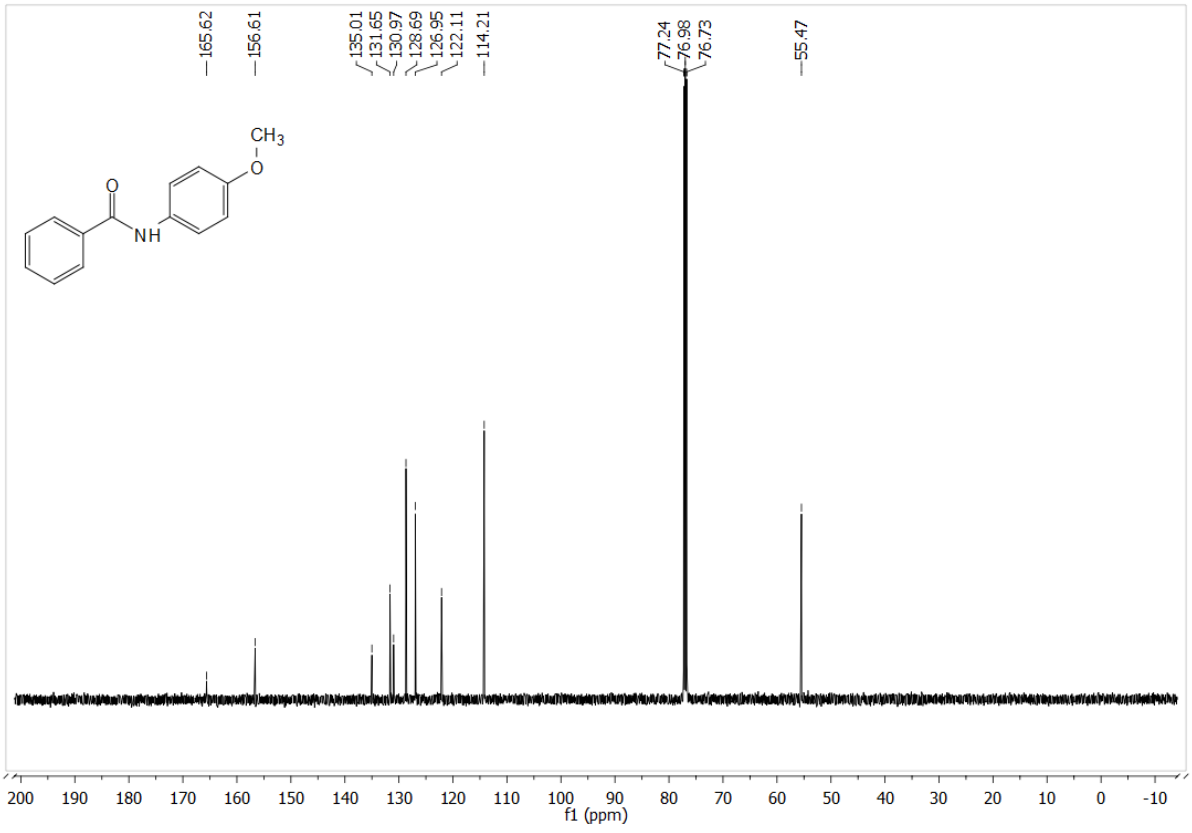
^{1}H and ^{13}C NMR Spectra of *N*-(3-methoxyphenyl)-benzamide (3d)



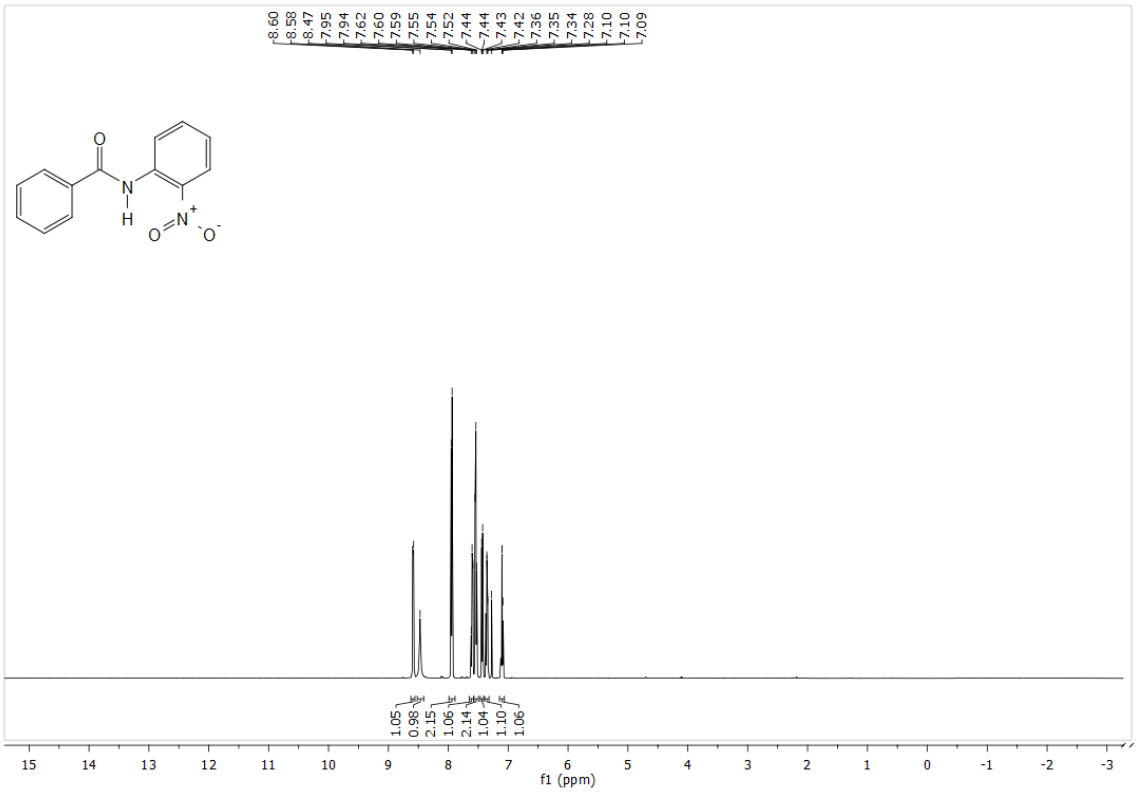


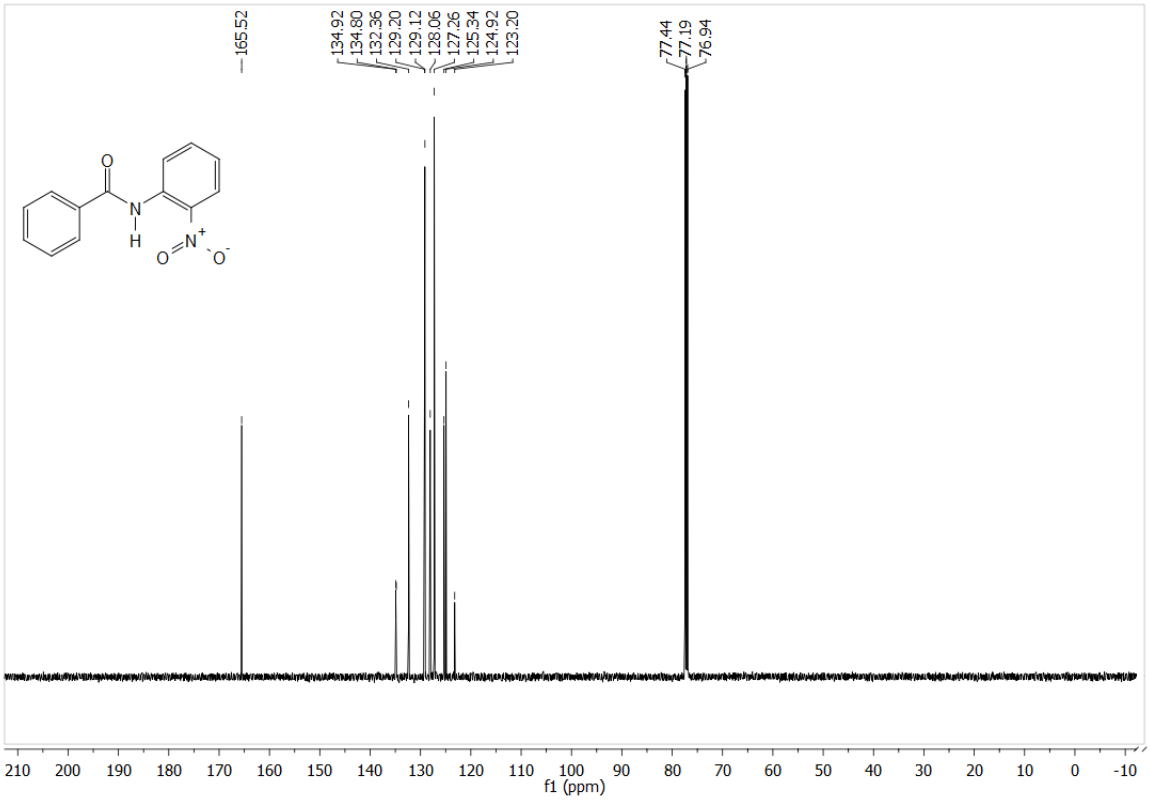
^{1}H and ^{13}C NMR Spectra of *N*-(4-methoxyphenyl)-benzamide (3e)



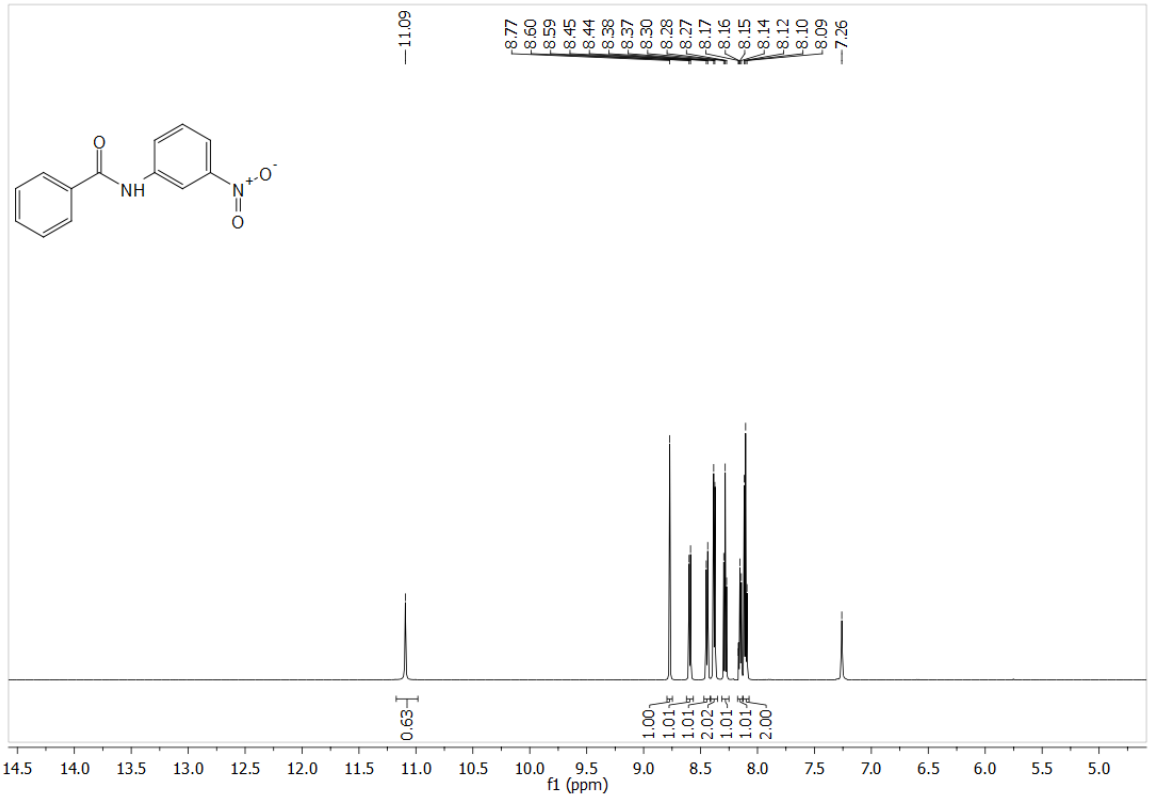


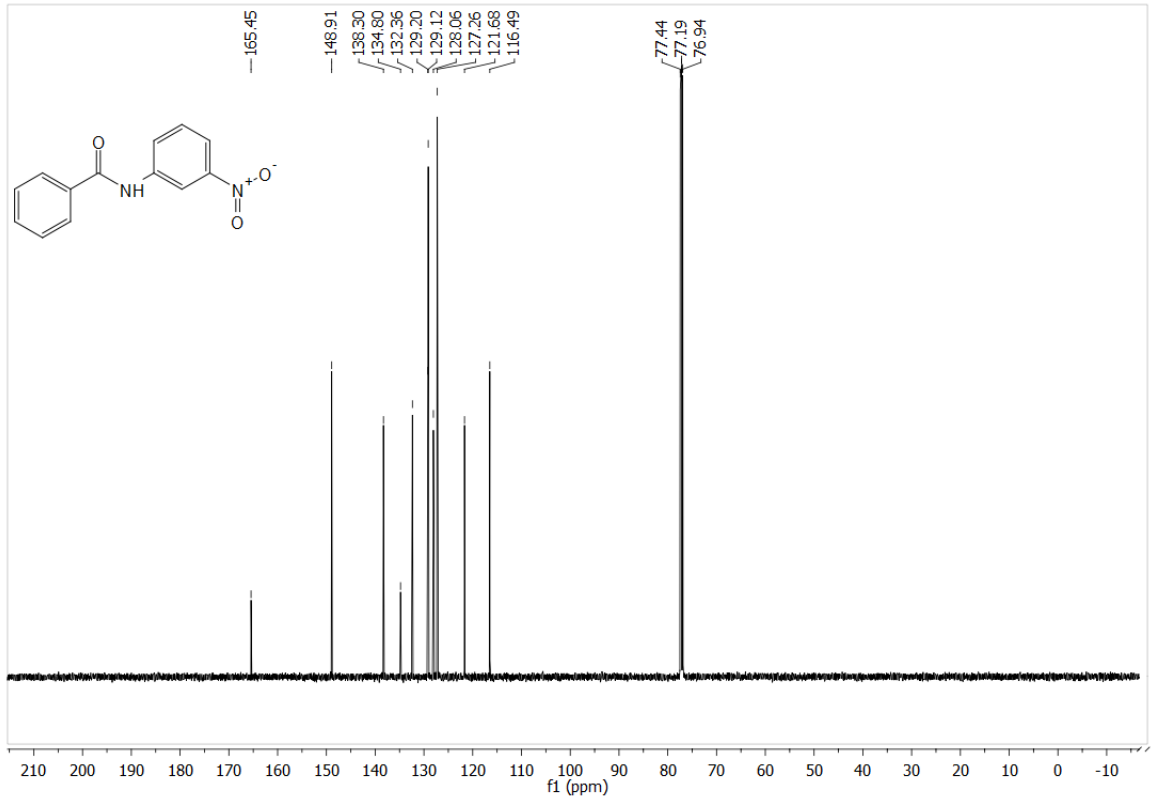
^{1}H and ^{13}C NMR Spectra of *N*-(2-nitrophenyl)-benzamide (3f)



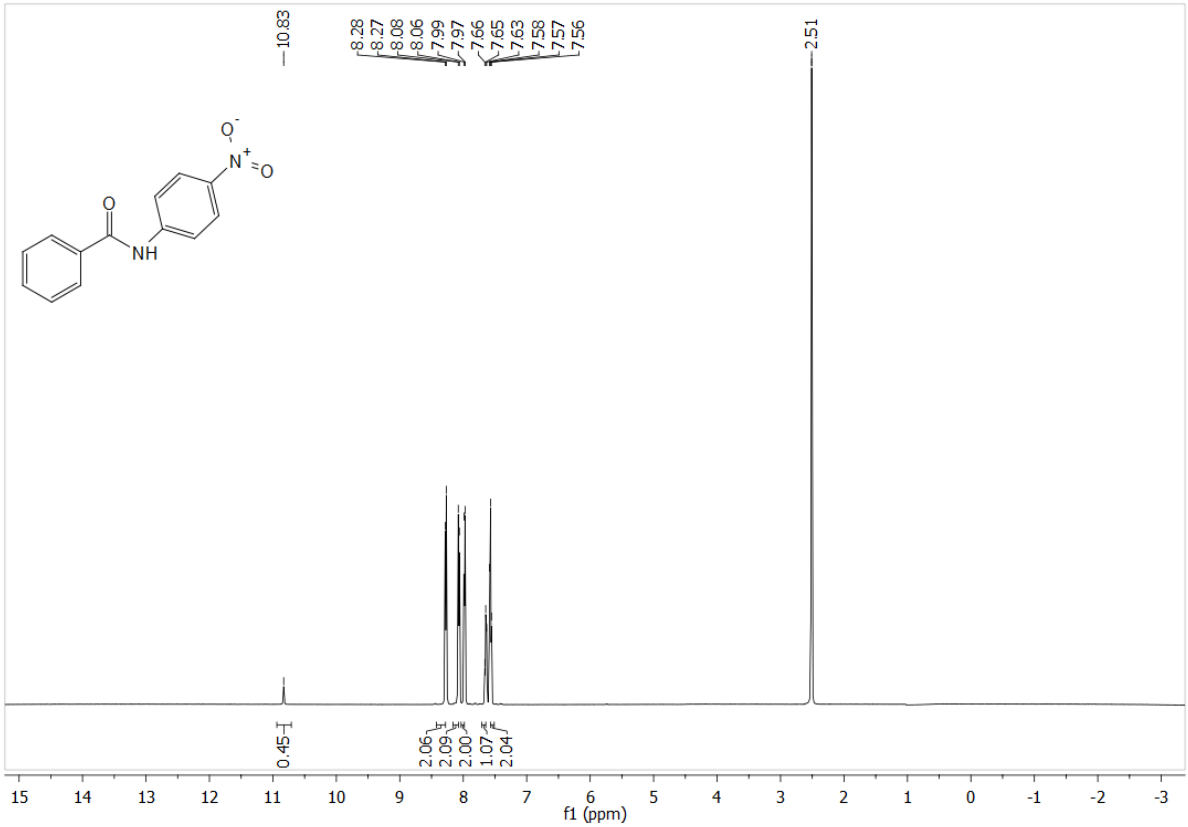


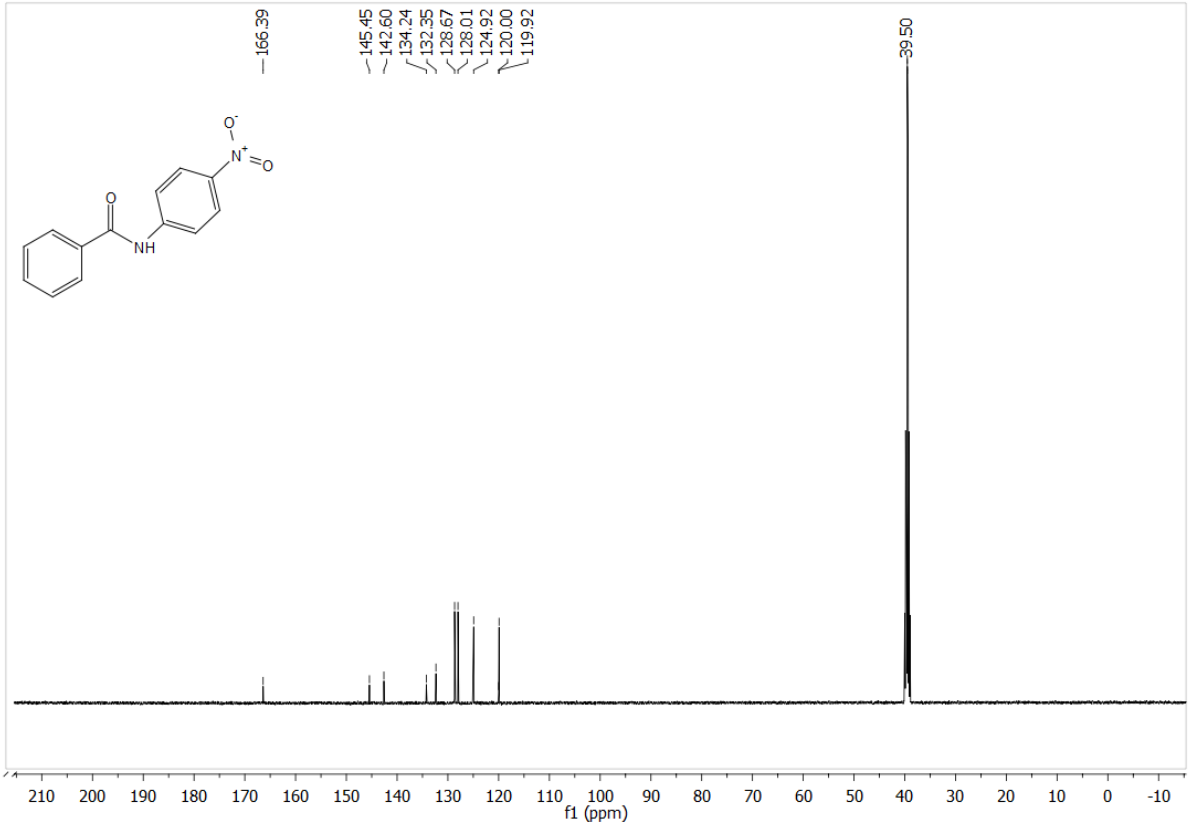
^{1}H and ^{13}C NMR Spectra of *N*-(3-nitrophenyl)-benzamide (3g)



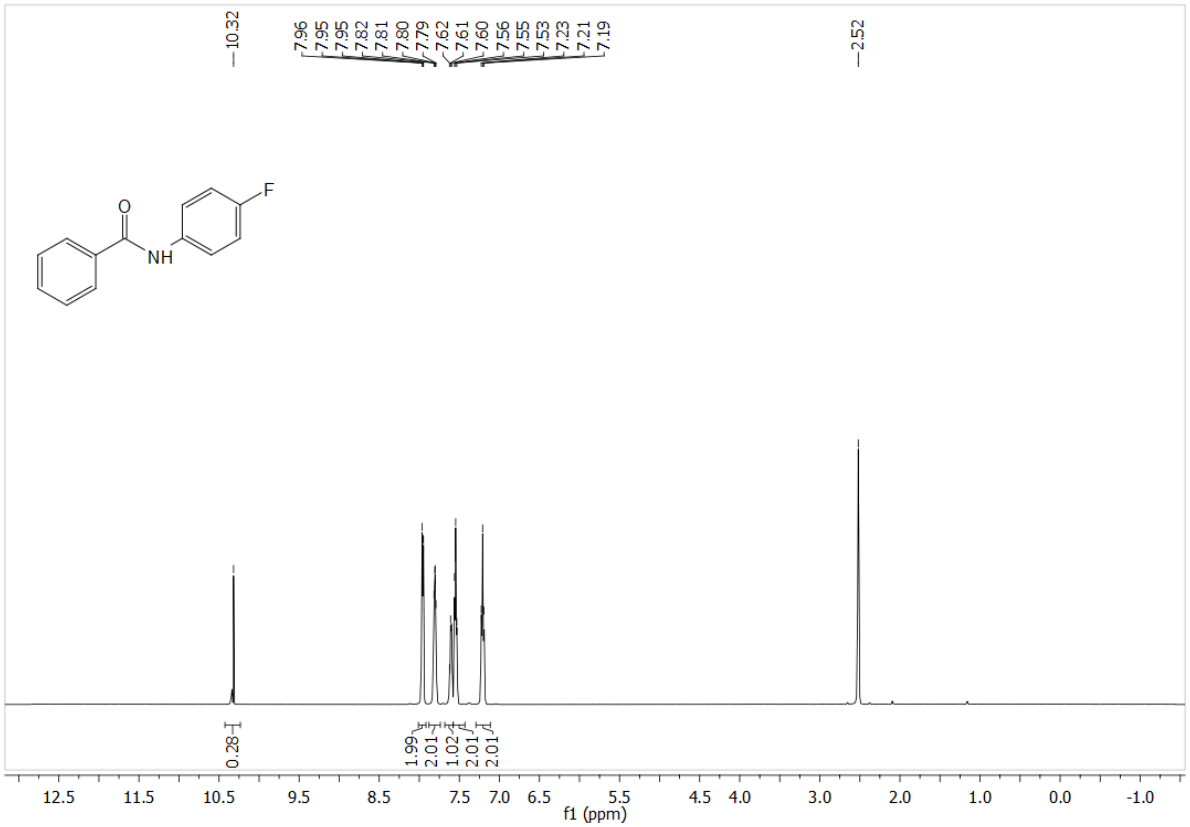


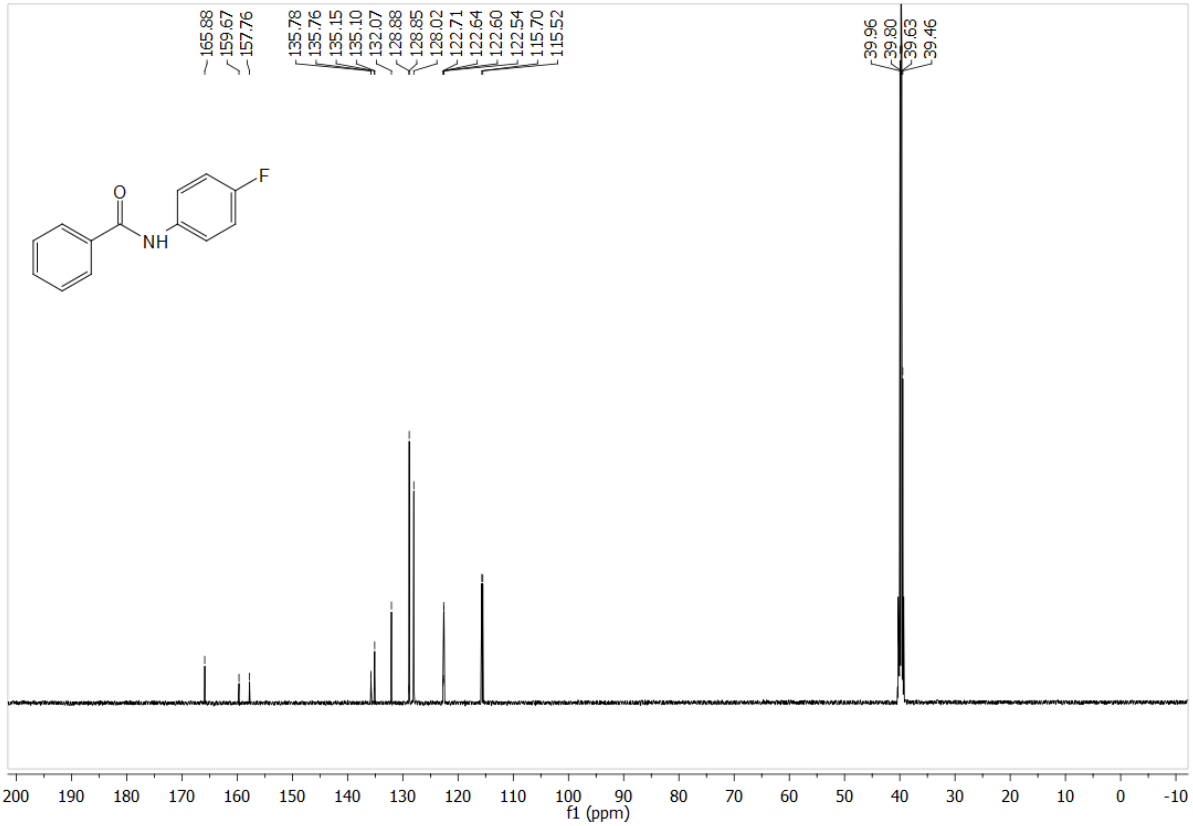
^{1}H and ^{13}C NMR Spectra of *N*-(4-nitrophenyl)-benzamide (3h)

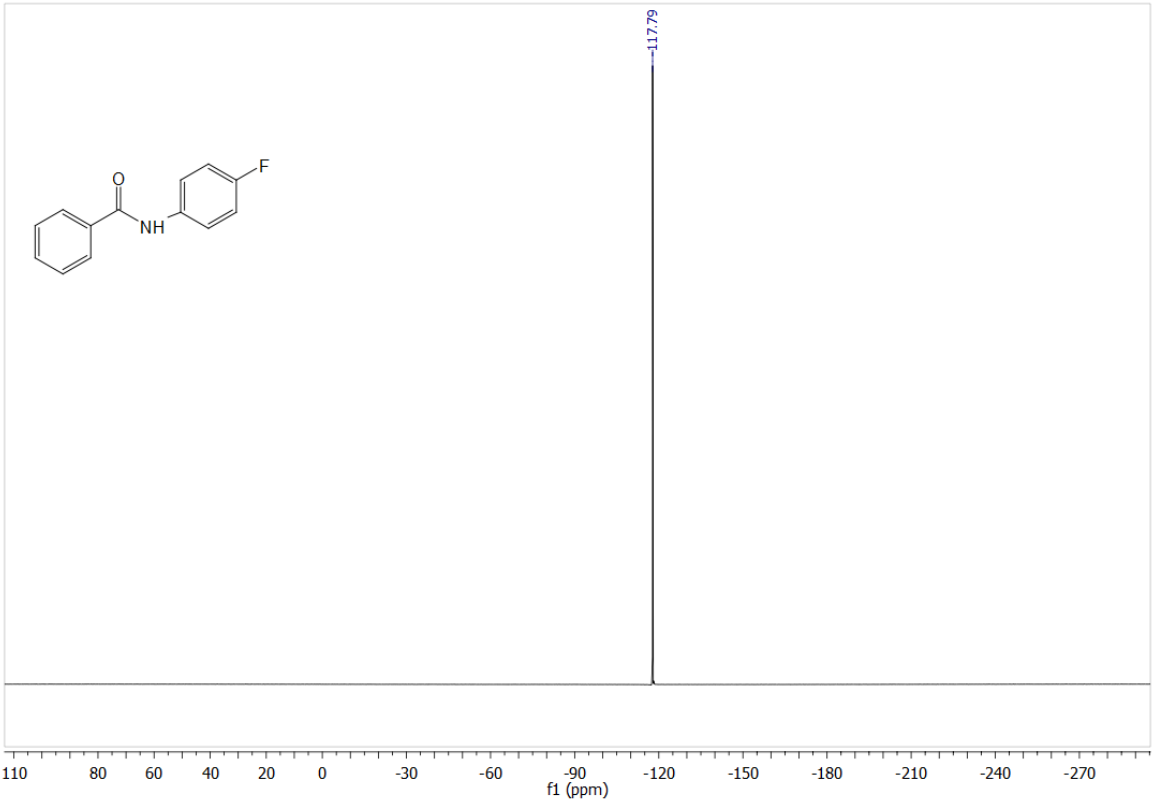




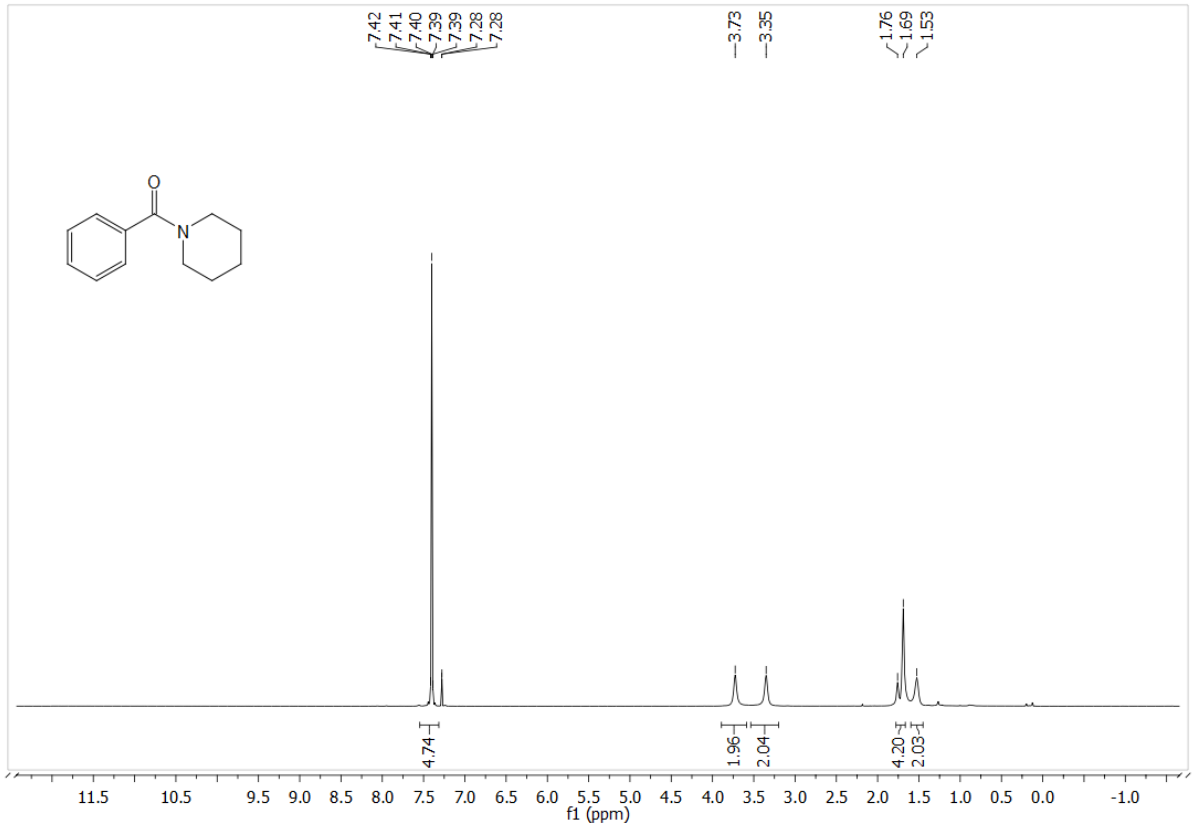
^{1}H and ^{13}C NMR Spectra of *N*-(4-fluorophenyl)-benzamide (3i)

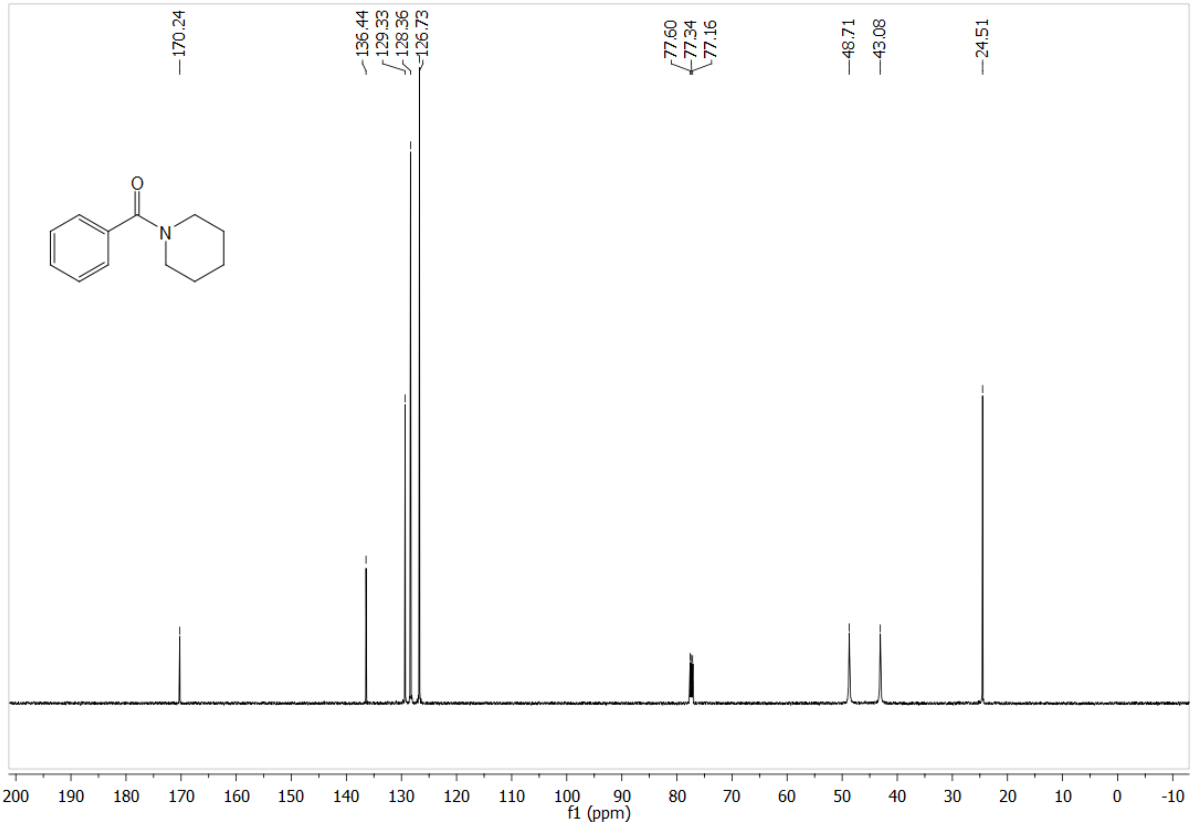




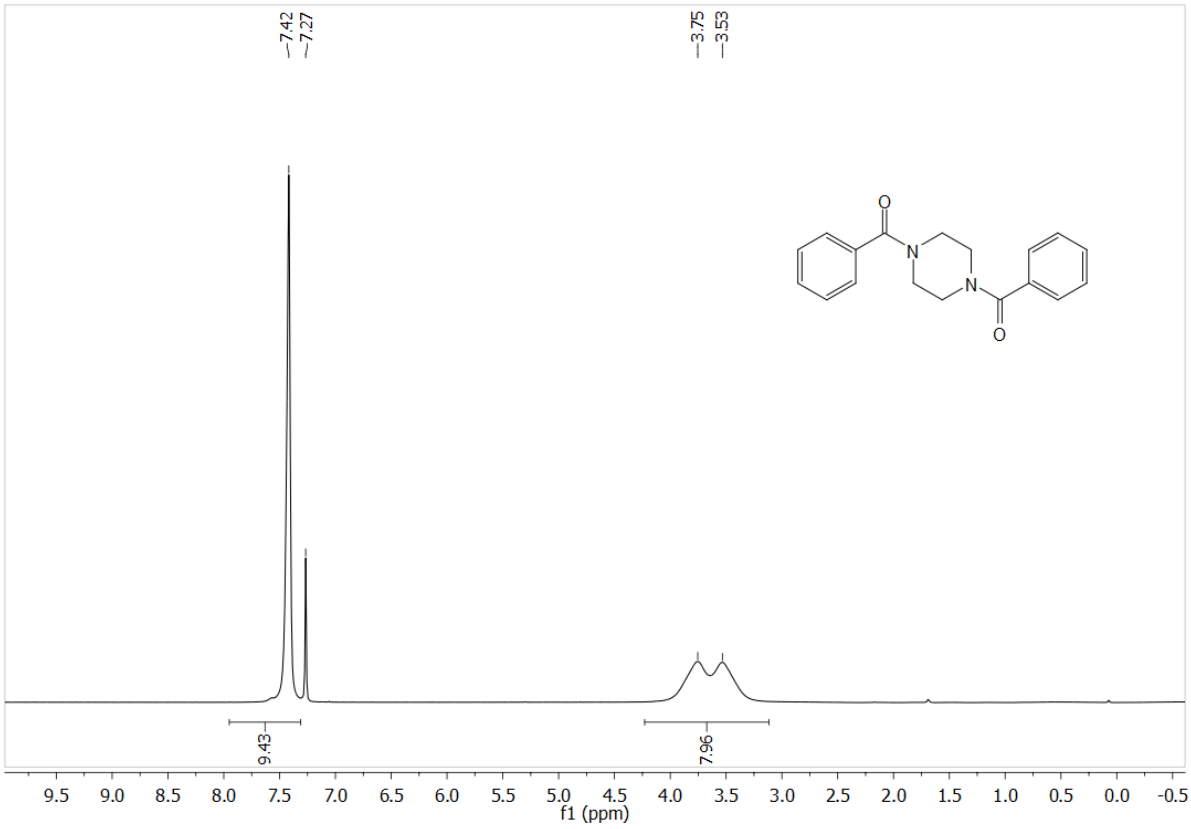

-117.79
O
NH
F
110
80
60
40
20
0
-30
-60
-90
-120
-150
-180
-210
-240
-270
f1 (ppm)

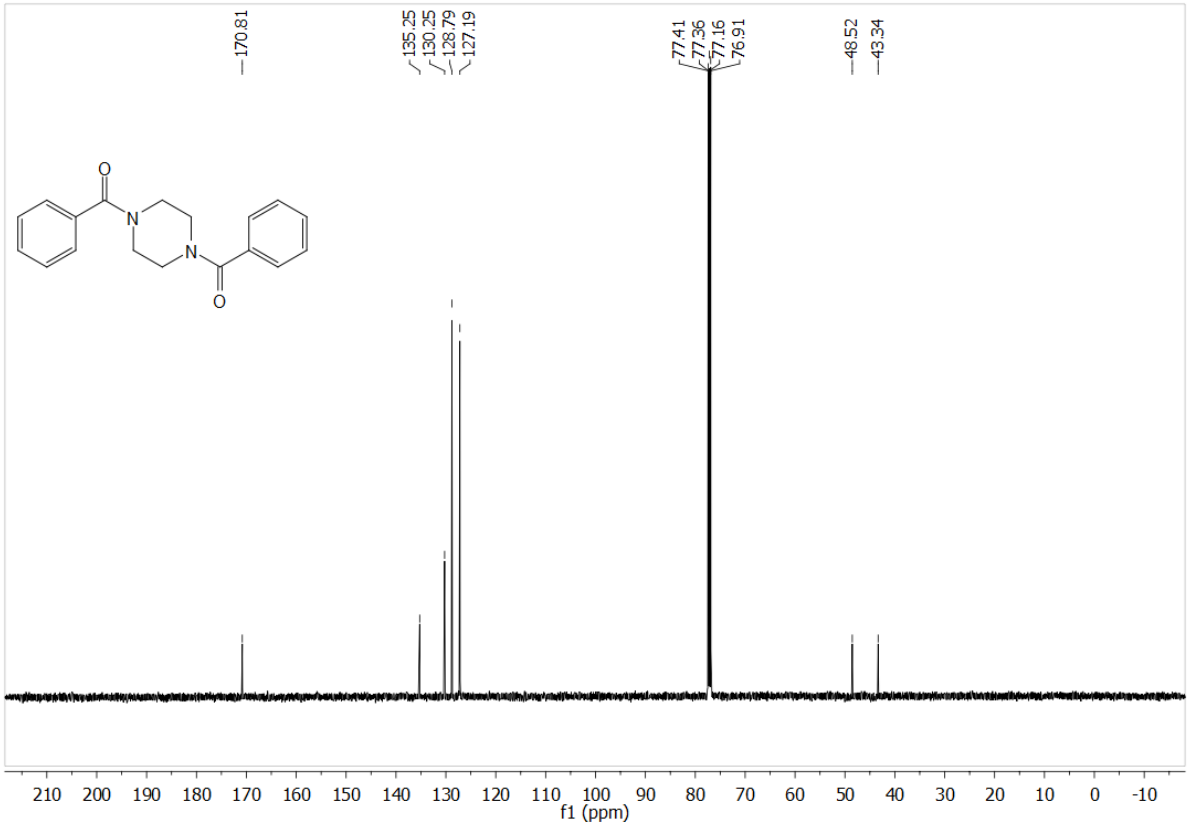
^{1}H and ^{13}C NMR Spectra of phenyl(piperidin-1-yl)-methanone (3j)



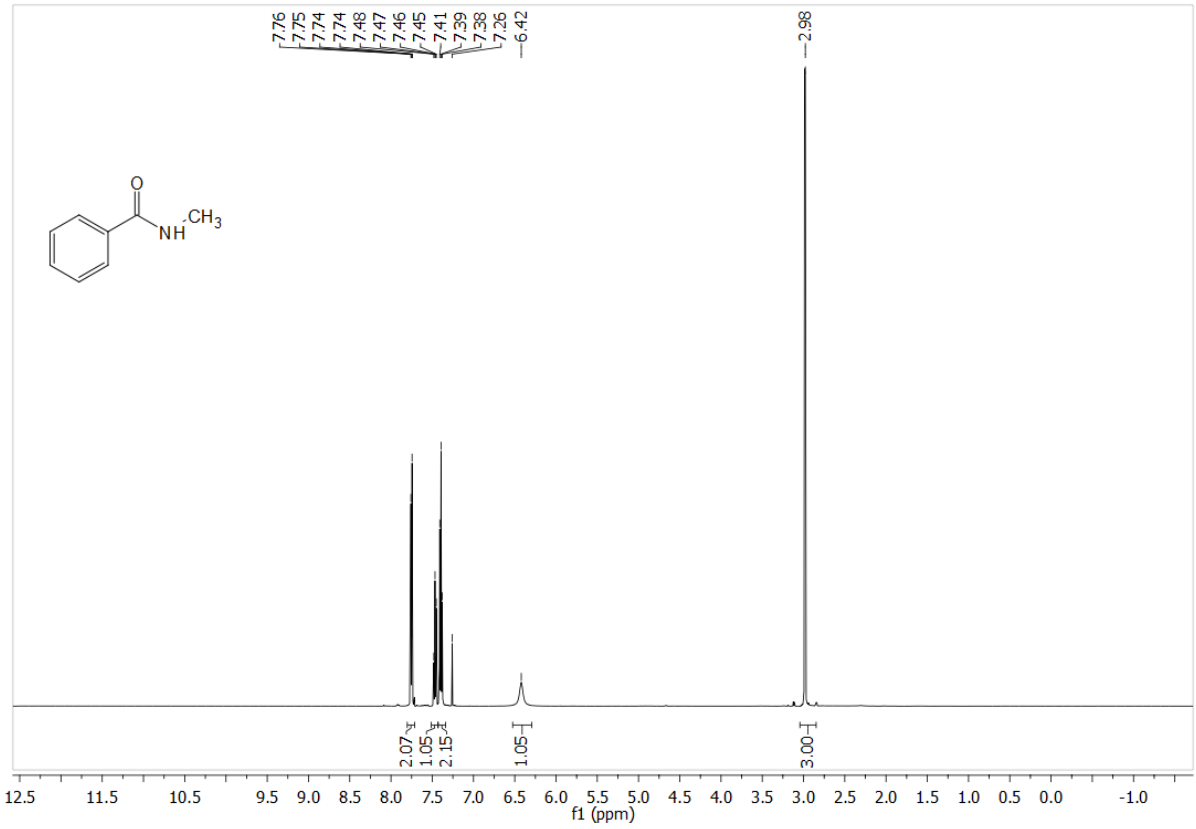


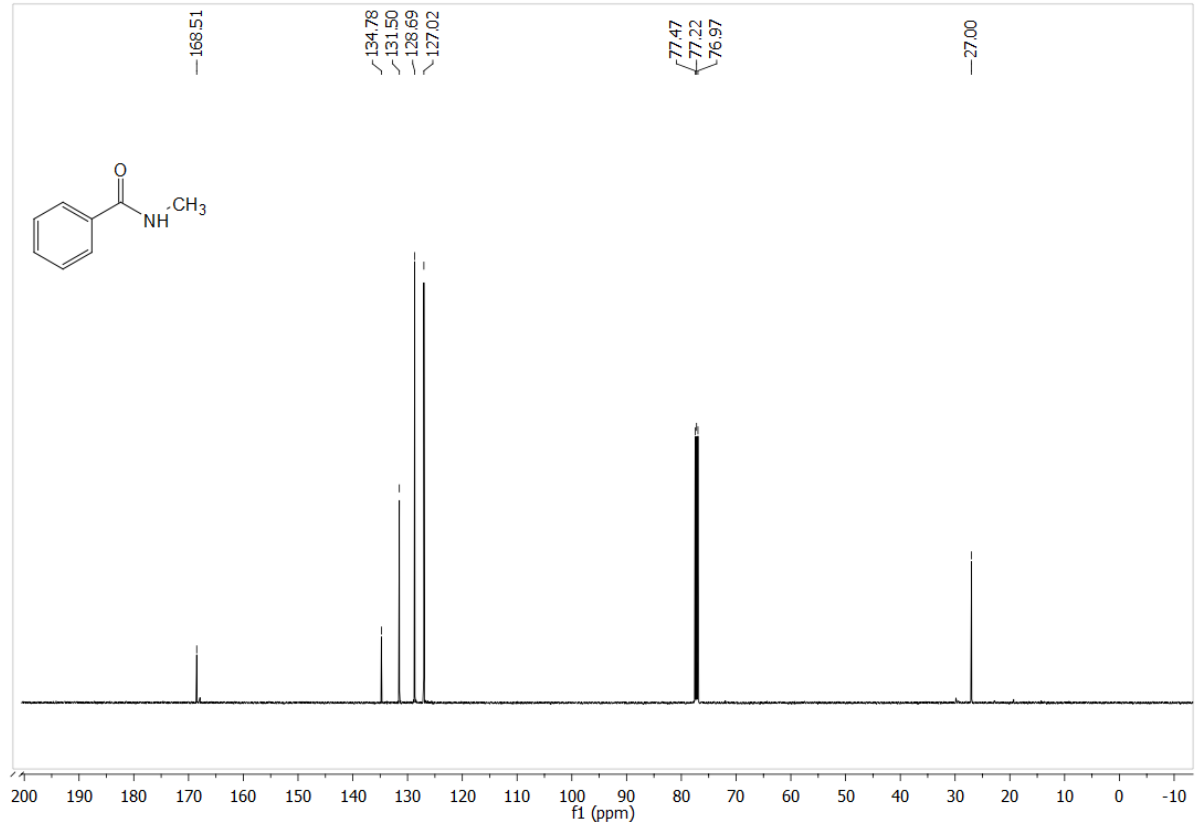
^{1}H and ^{13}C NMR Spectra of piperazine-1,4-diylbis(phenylmethanone) (3k)



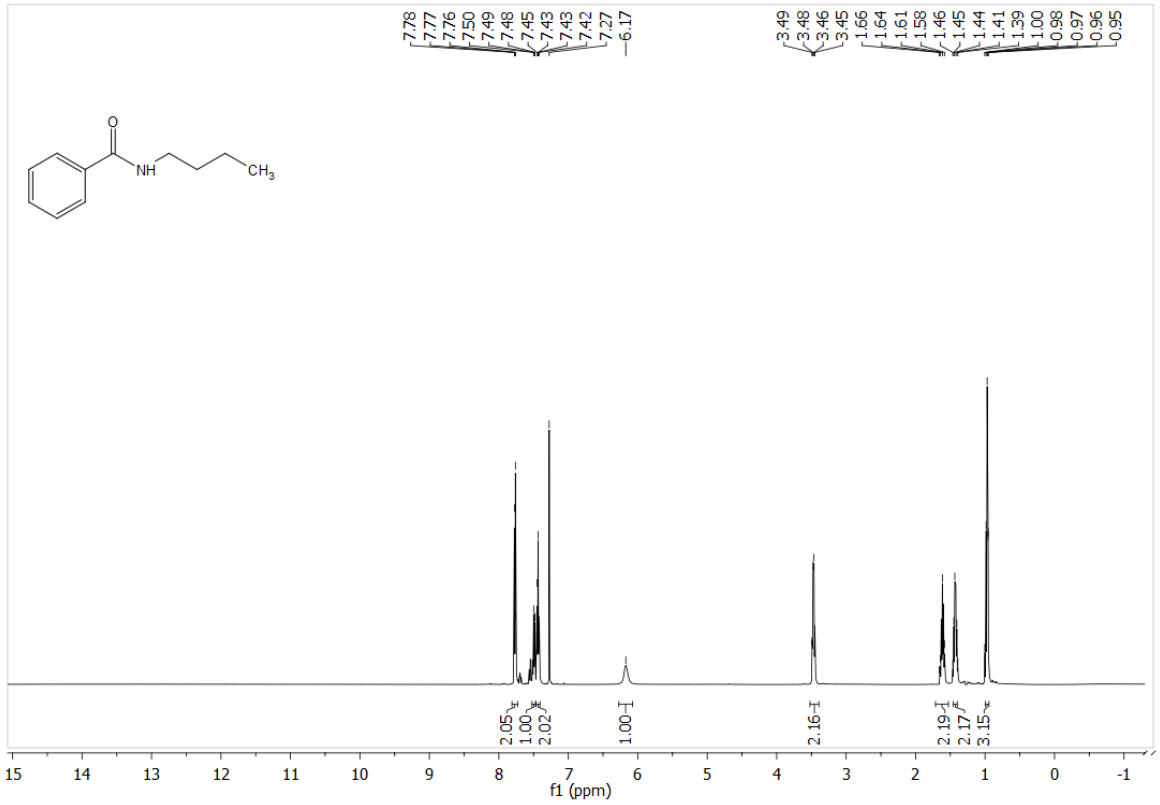


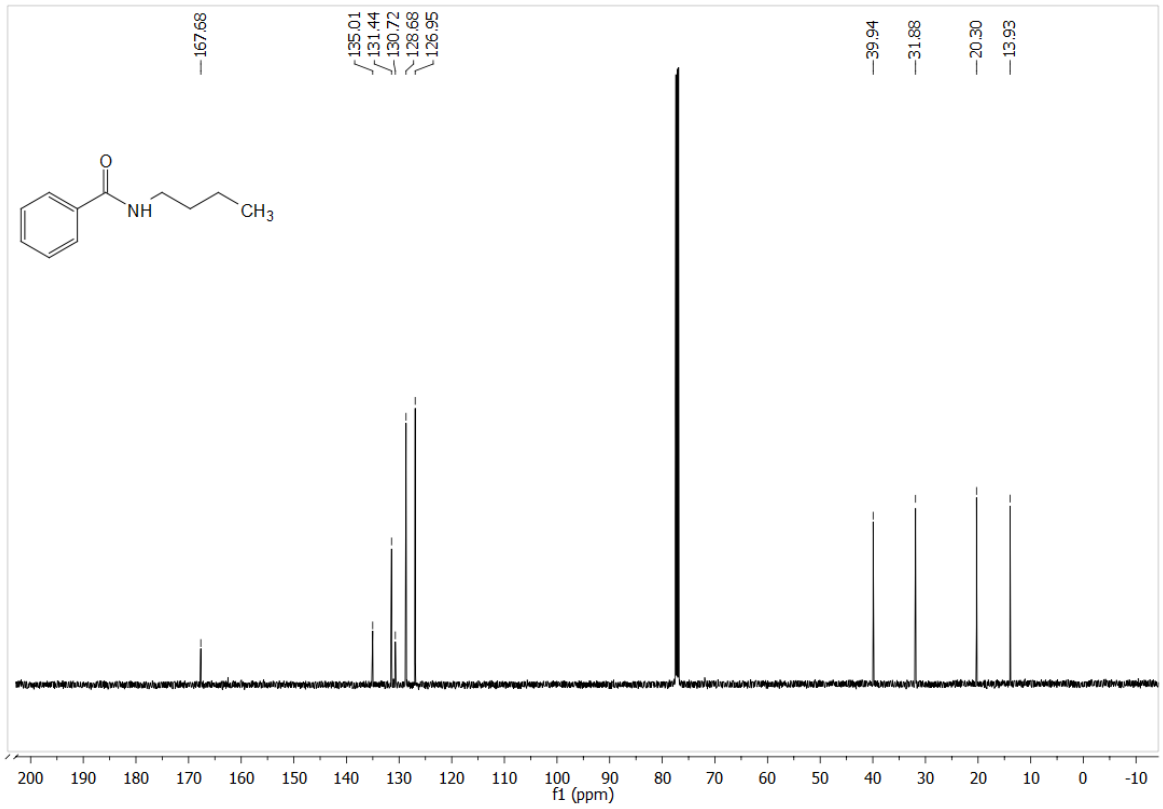
^{1}H and ^{13}C NMR Spectra of *N*-methylbenzamide (3l)



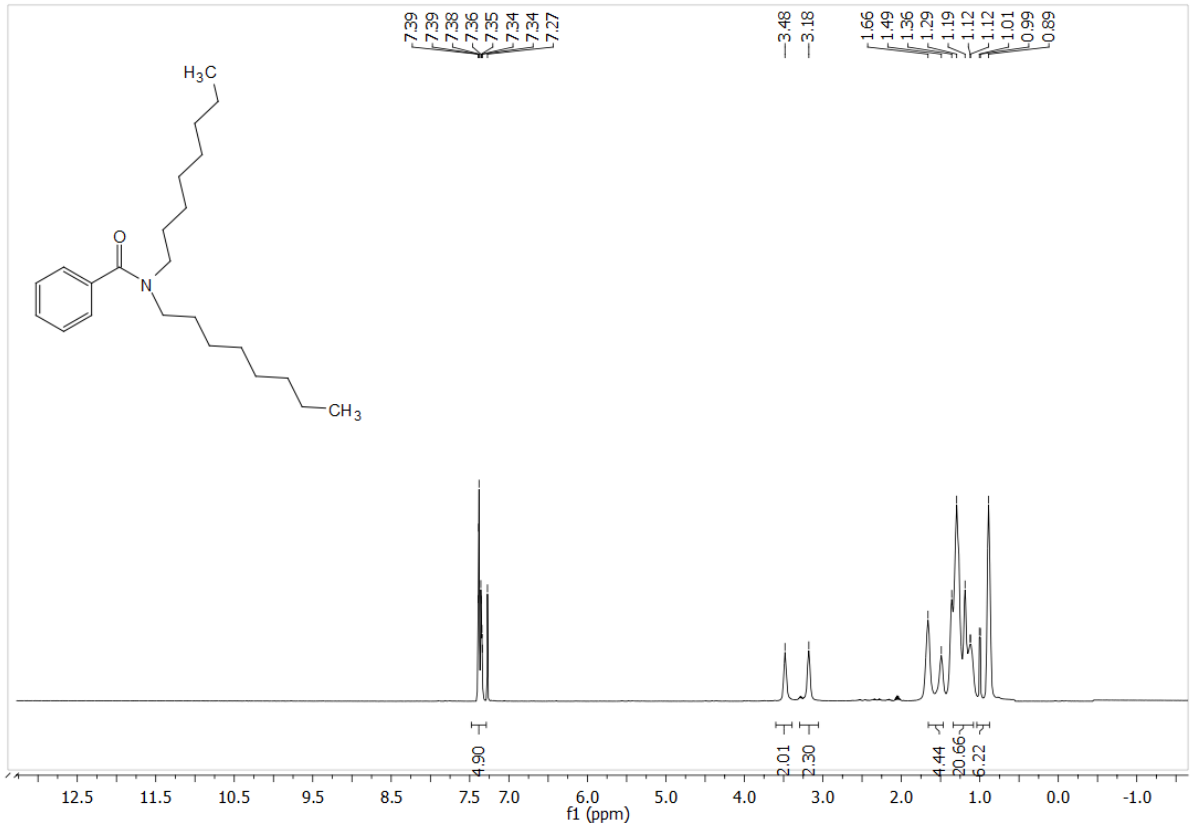


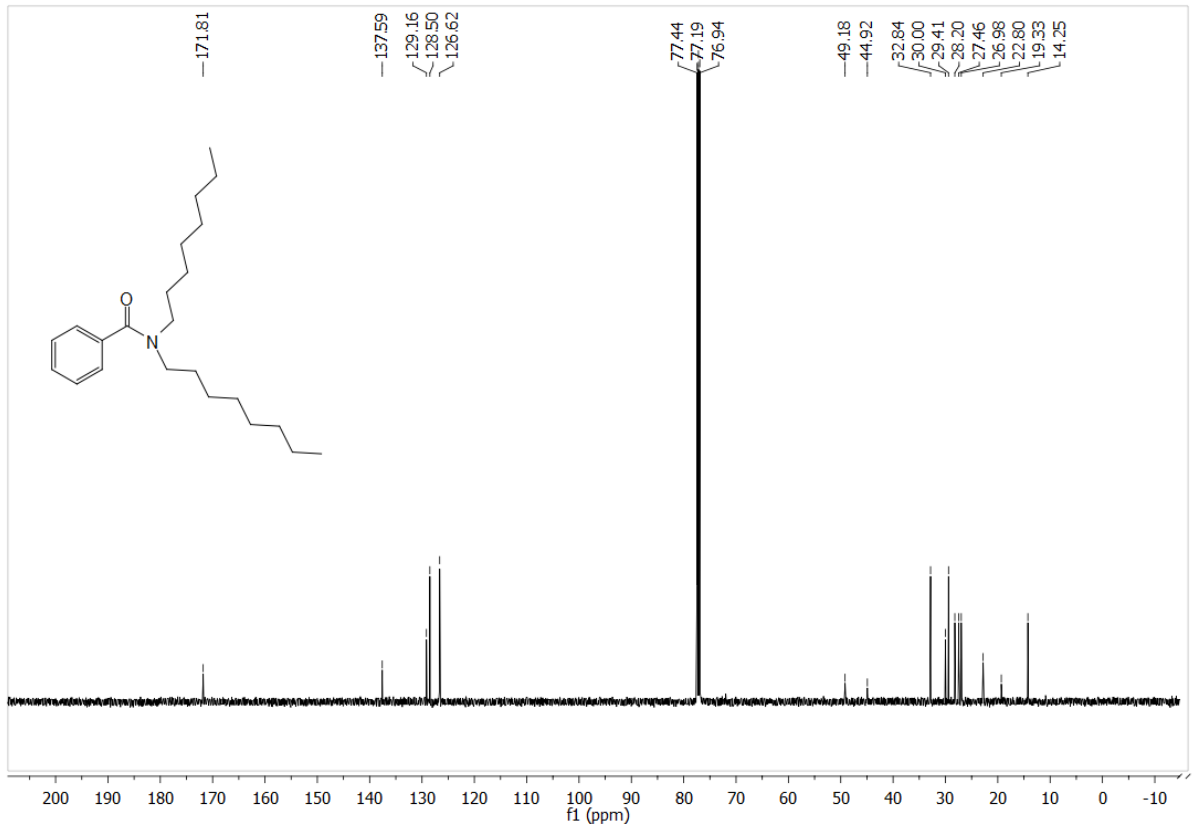
^{1}H and ^{13}C NMR Spectra of *N*-butylbenzamide (3m)



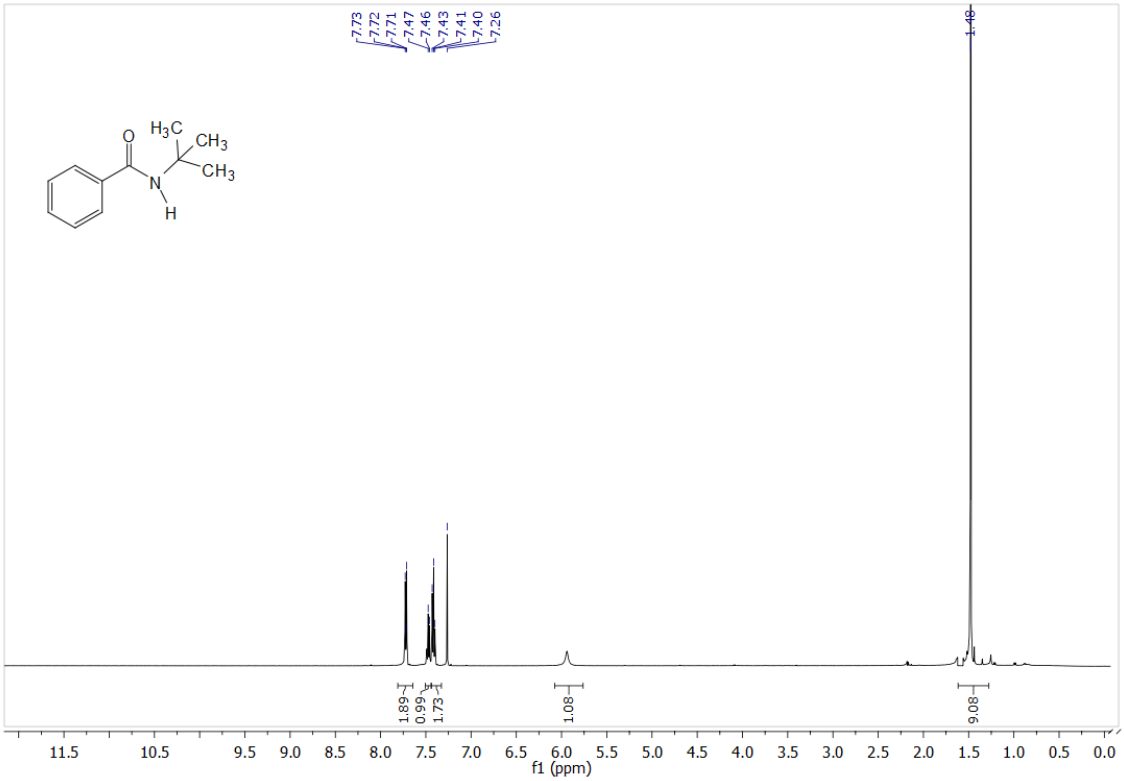


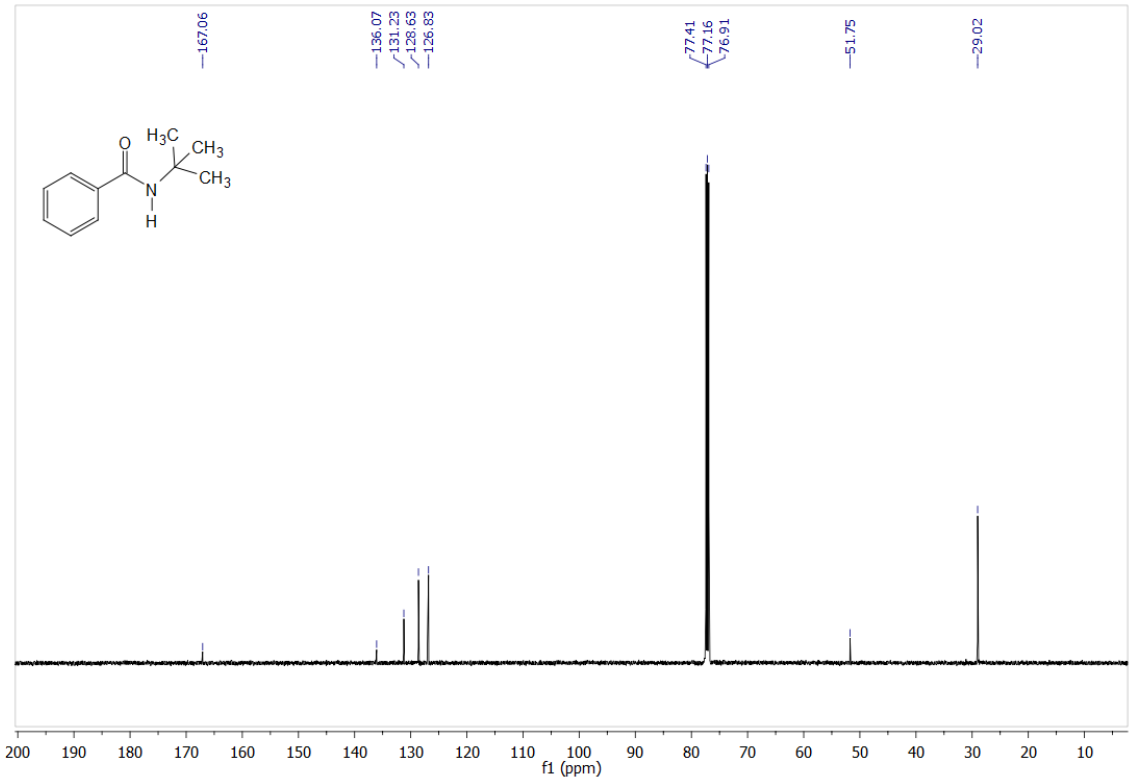
^{1}H and ^{13}C NMR Spectra of *N,N*-dioctylbenzamide (3n)



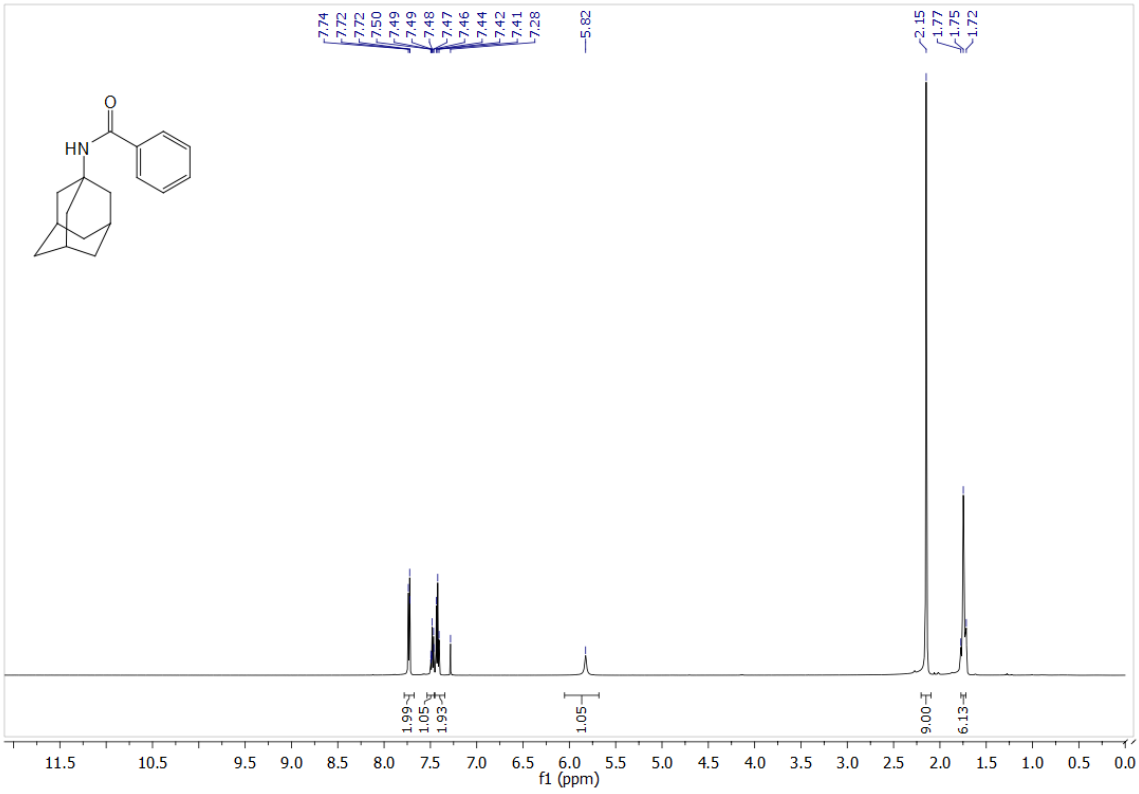


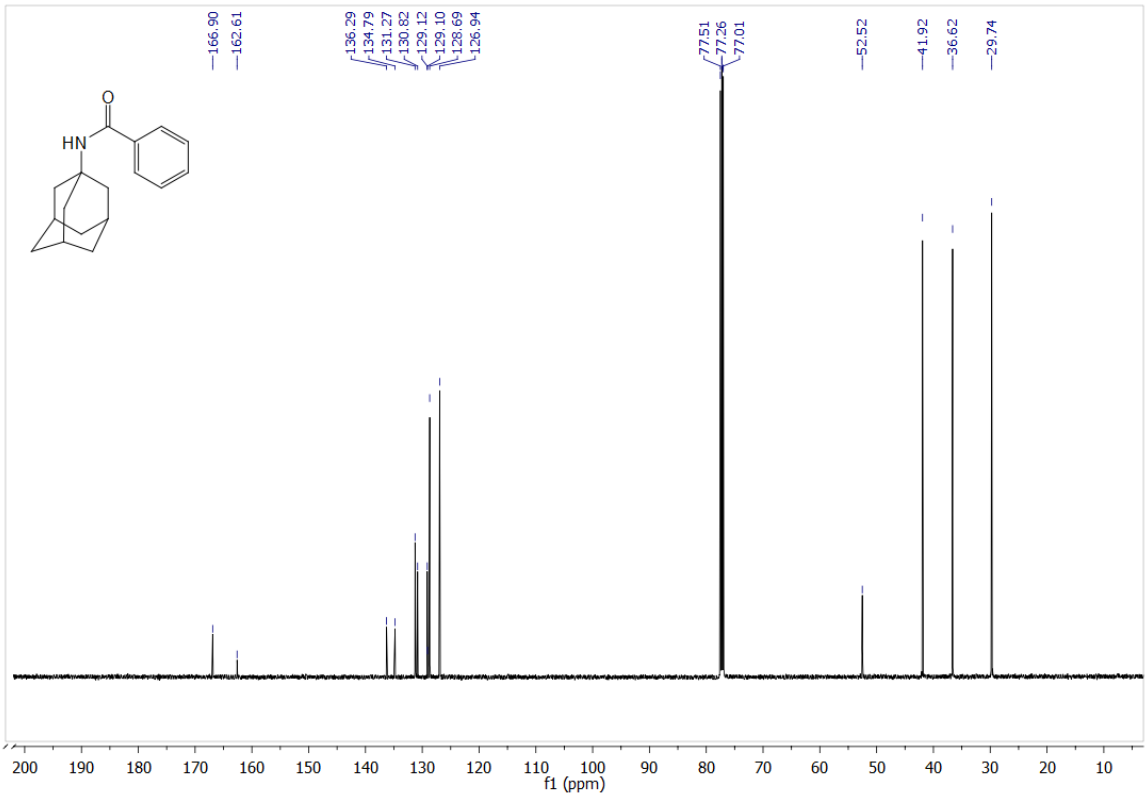
^{1}H and ^{13}C NMR Spectra of *N*-(tert-butyl)-benzamide (3o)



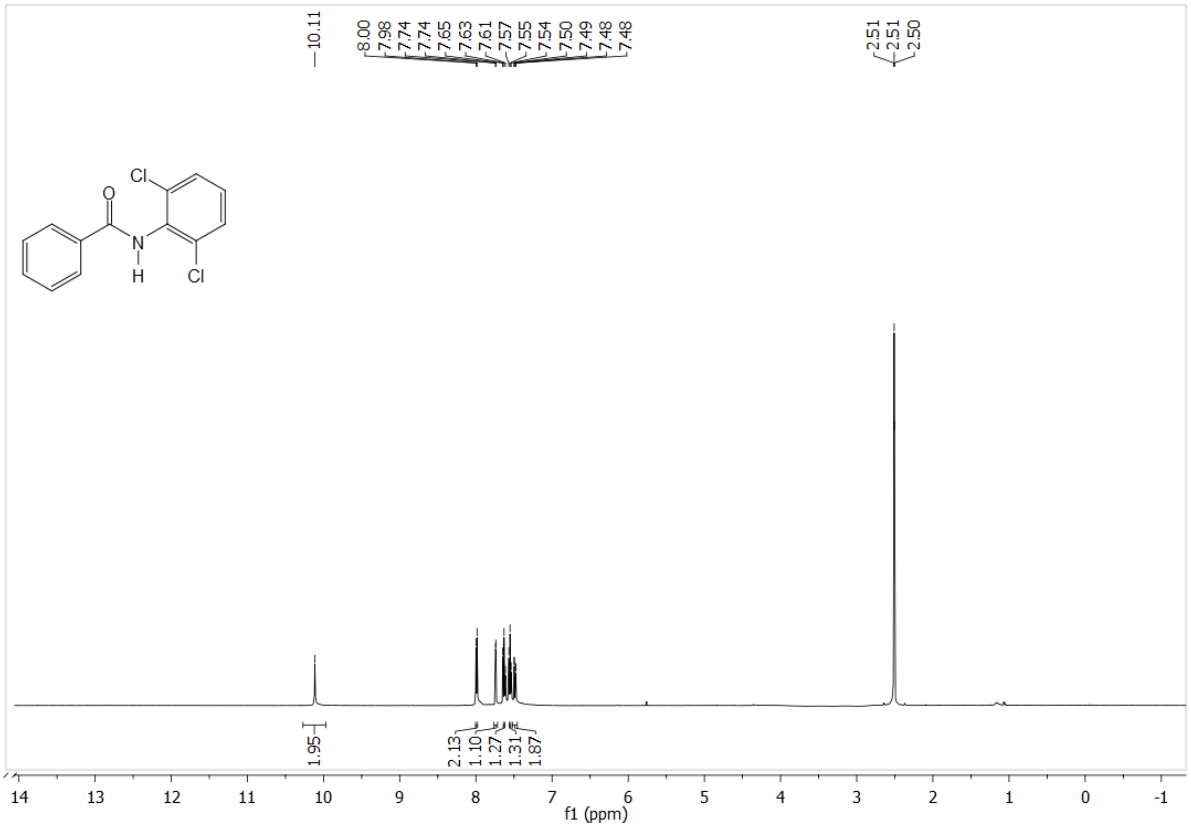


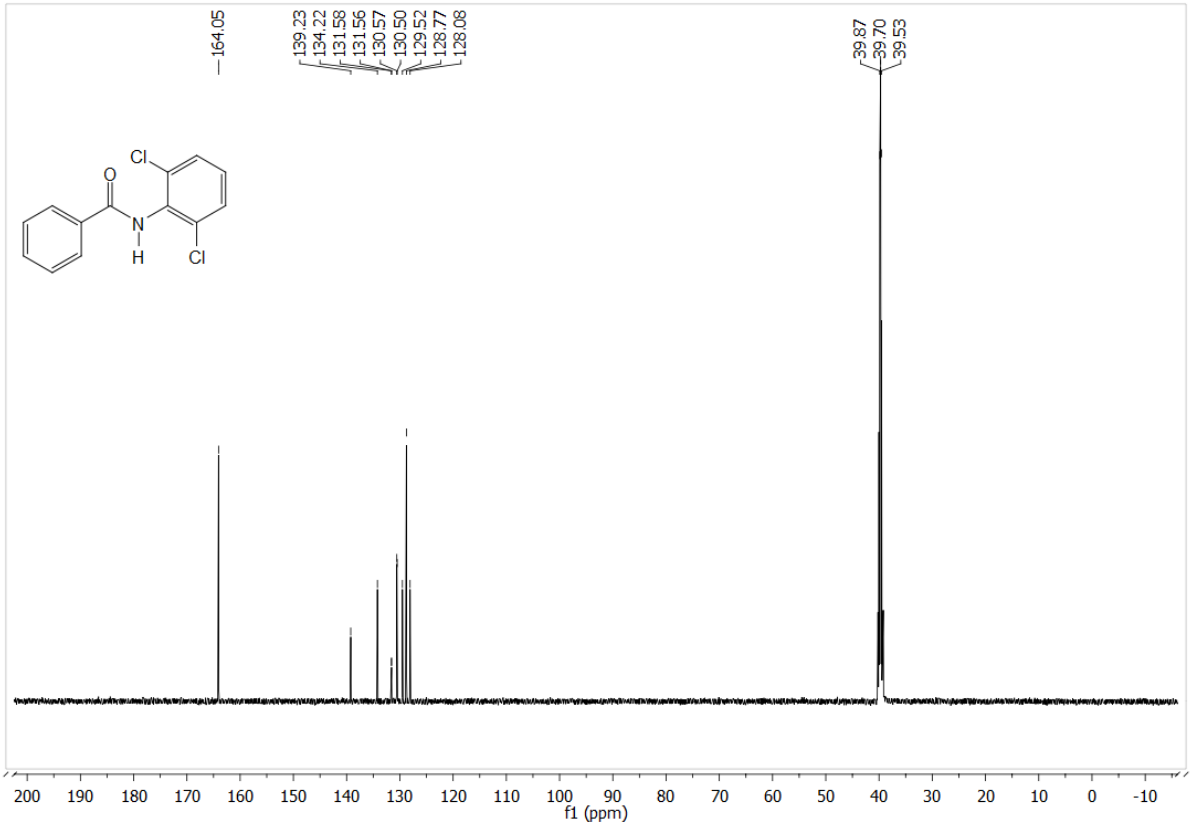
^{1}H and ^{13}C NMR Spectra of *N*-(3s,5s,7s)-adamantan-1-yl)-benzamide (3p)



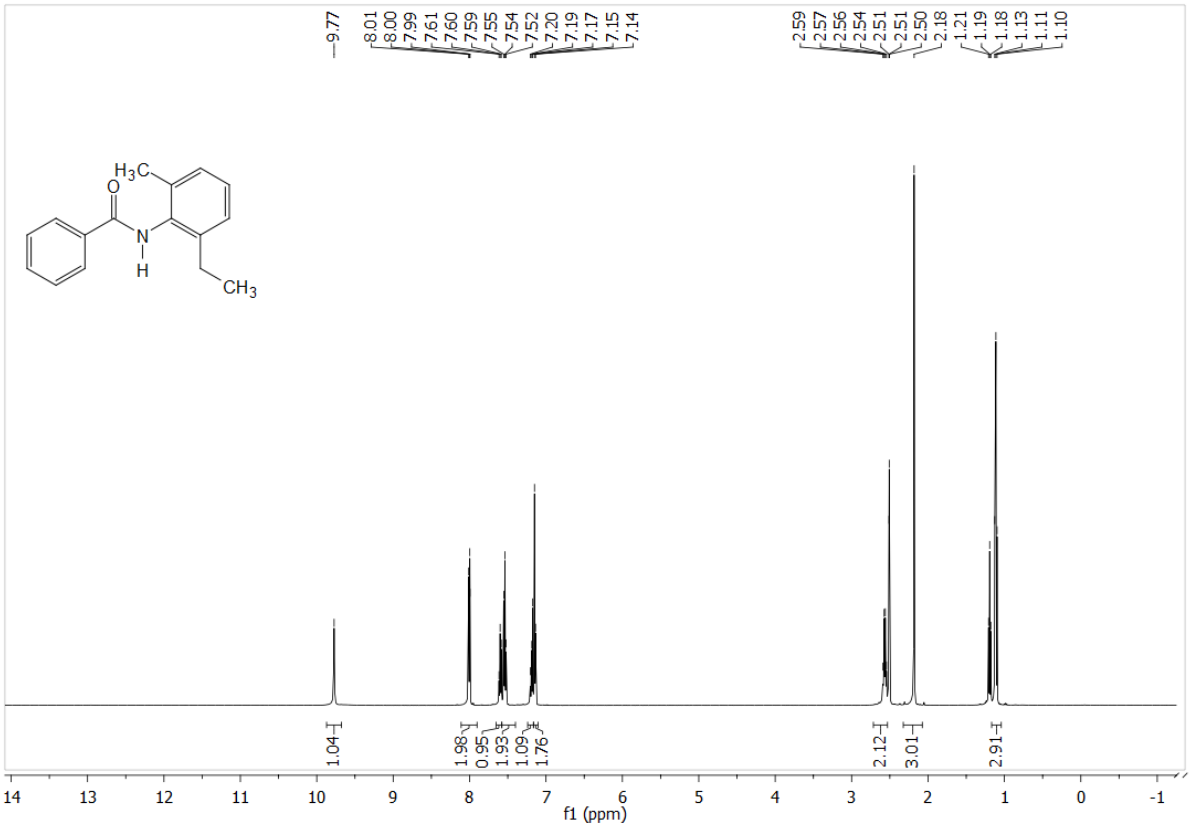


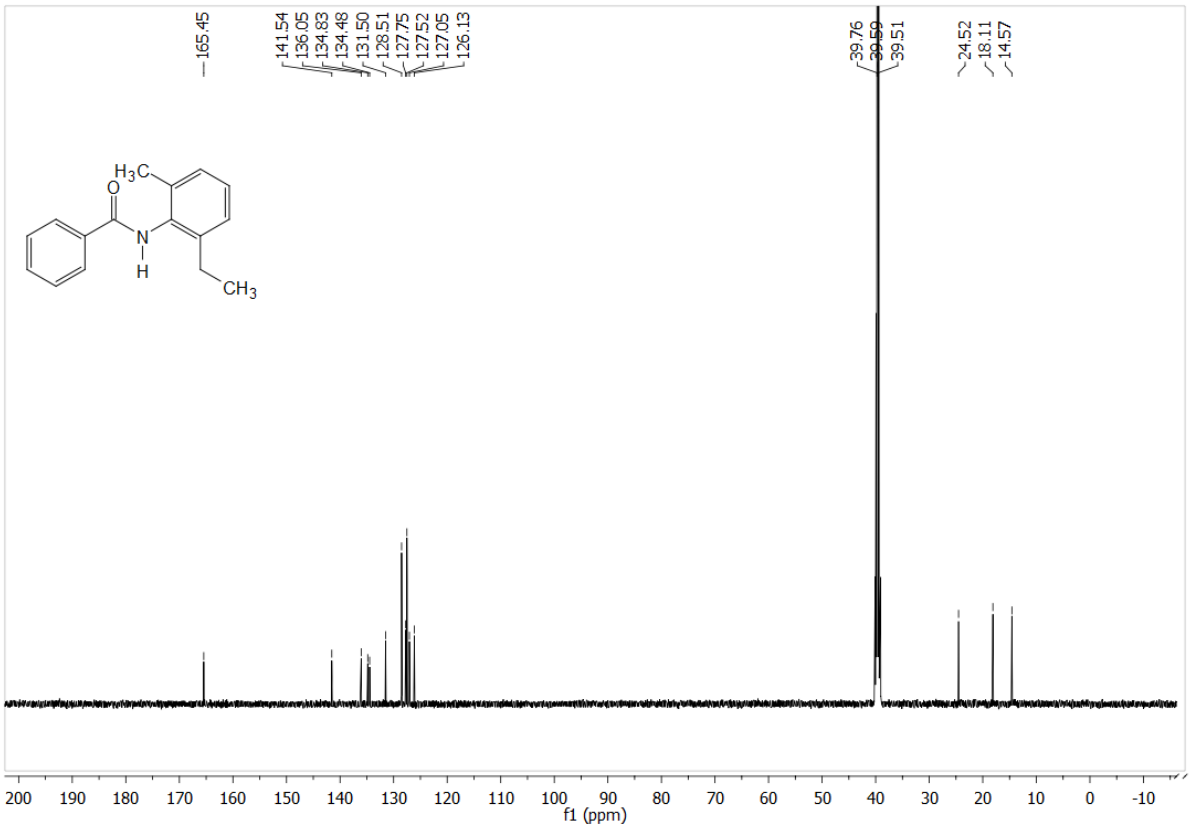
^{1}H and ^{13}C NMR Spectra of *N*-(2,6-dichlorophenyl)-benzamide (3q)



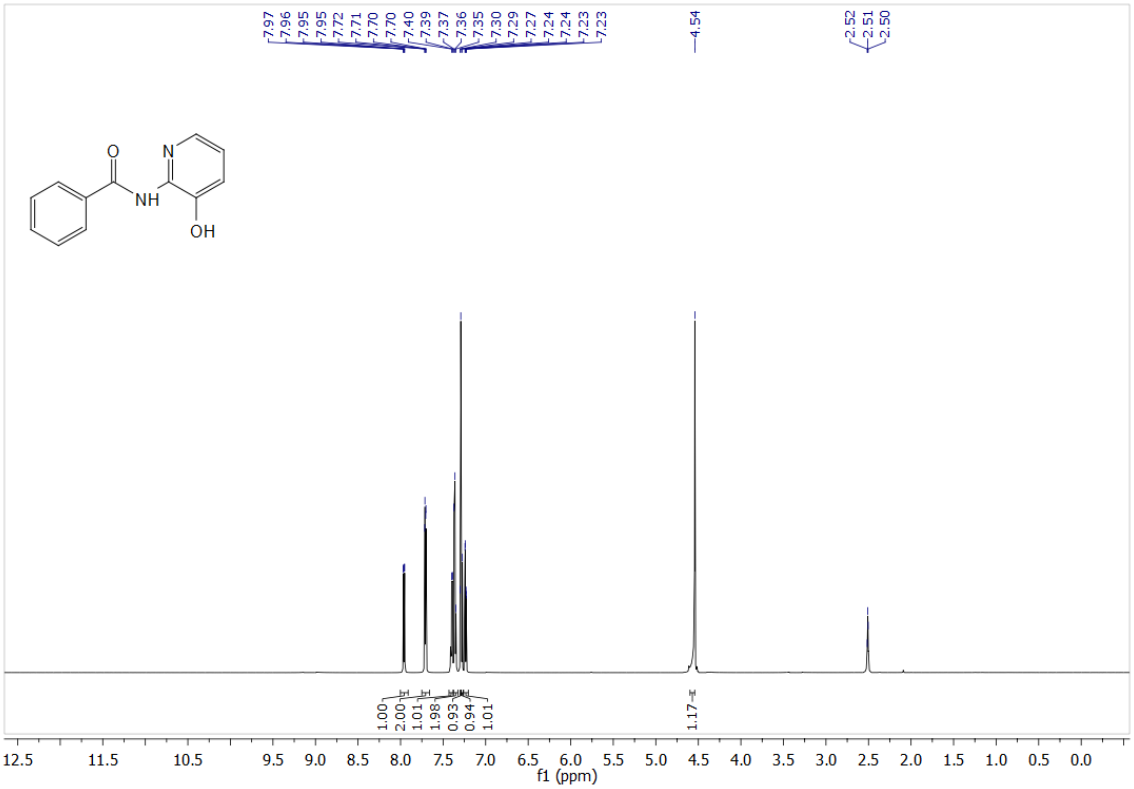


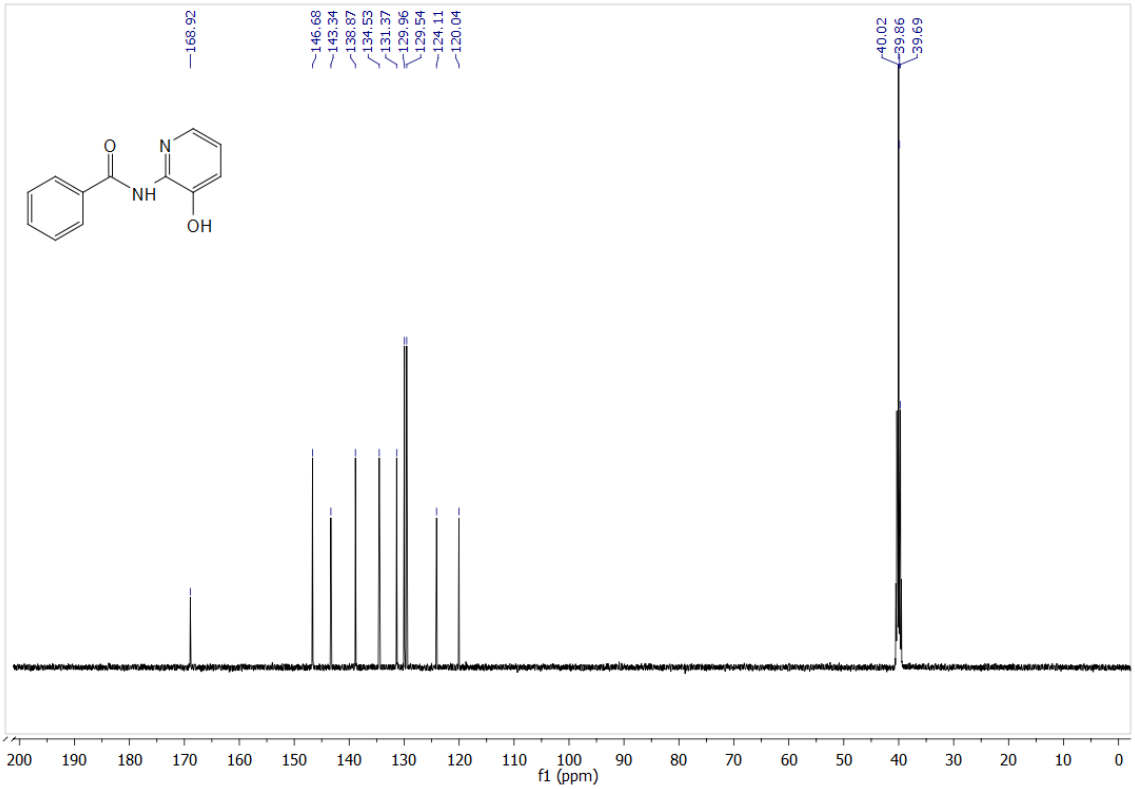
^{1}H and ^{13}C NMR Spectra of *N*-(2-ethyl-6-methylphenyl)-benzamide (3r)



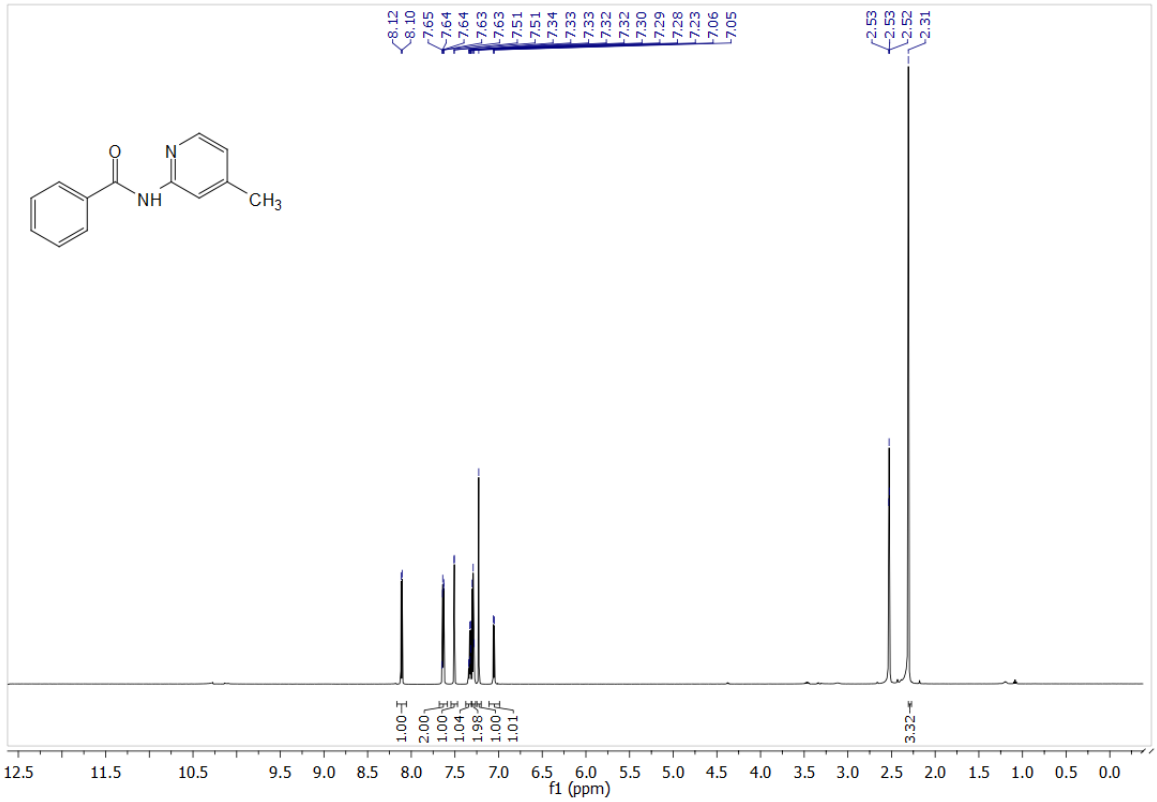


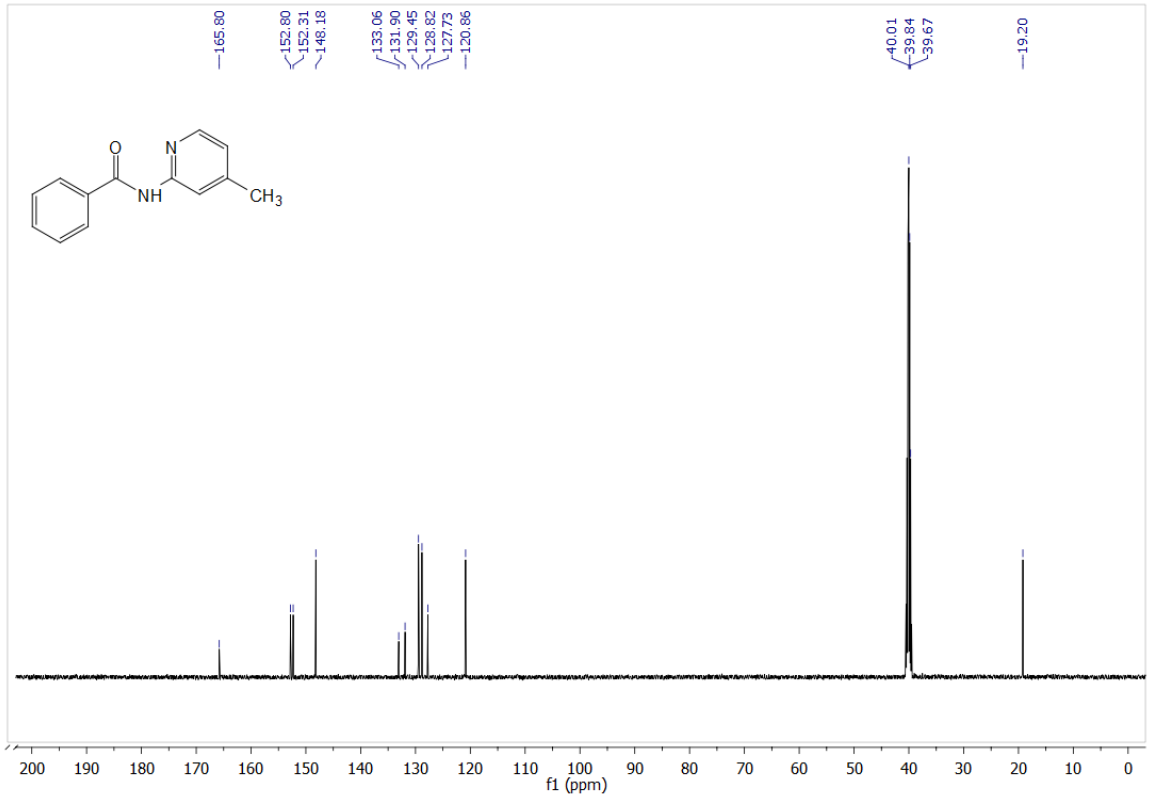
^{1}H and ^{13}C NMR Spectra of *N*-(3-hydroxypyridin-2-yl)-benzamide (3s)



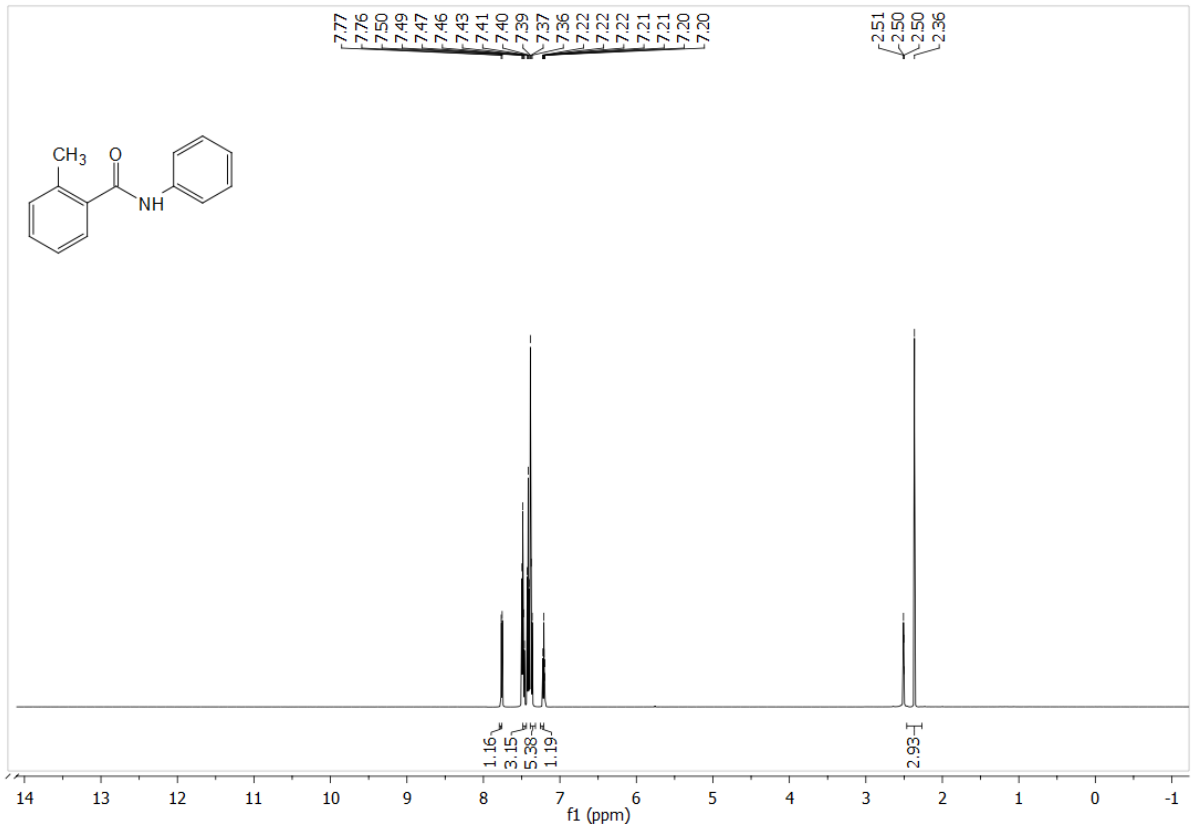


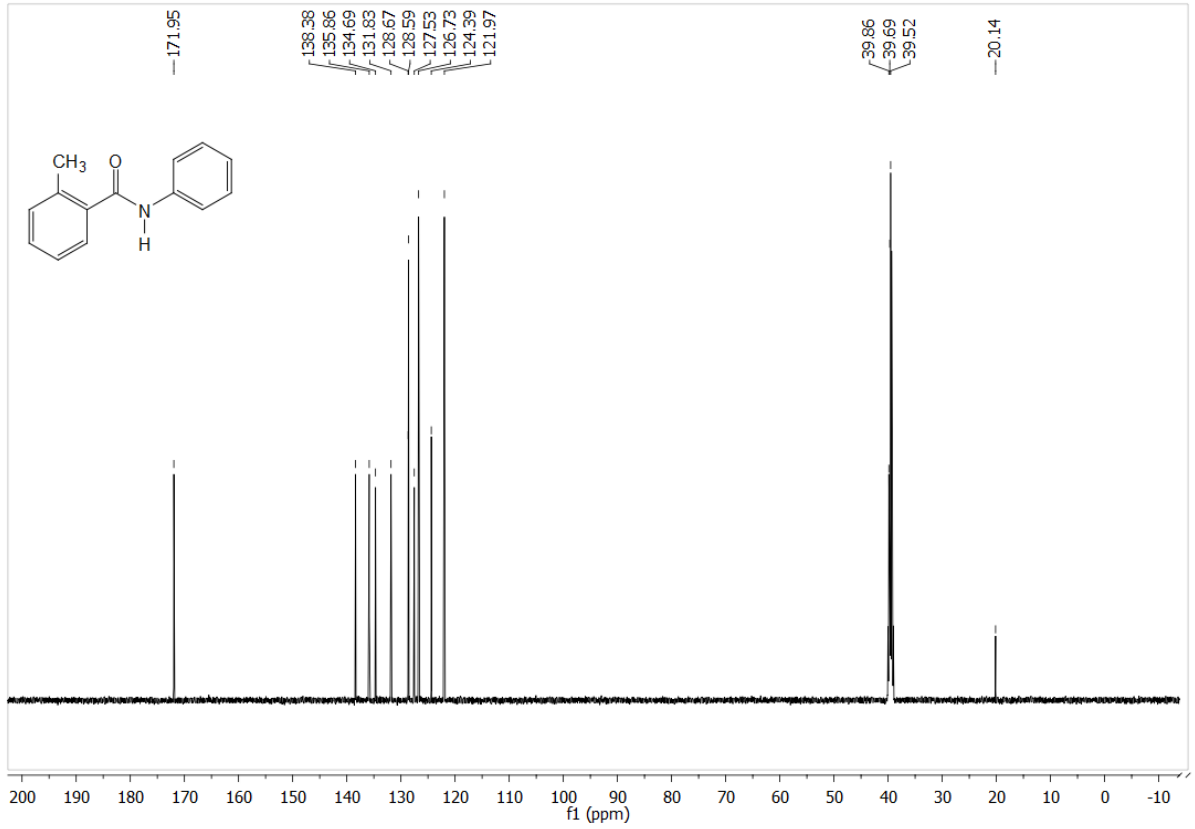
^{1}H and ^{13}C NMR Spectra of *N*-(4-methylpyridin-2-yl)-benzamide(3t)



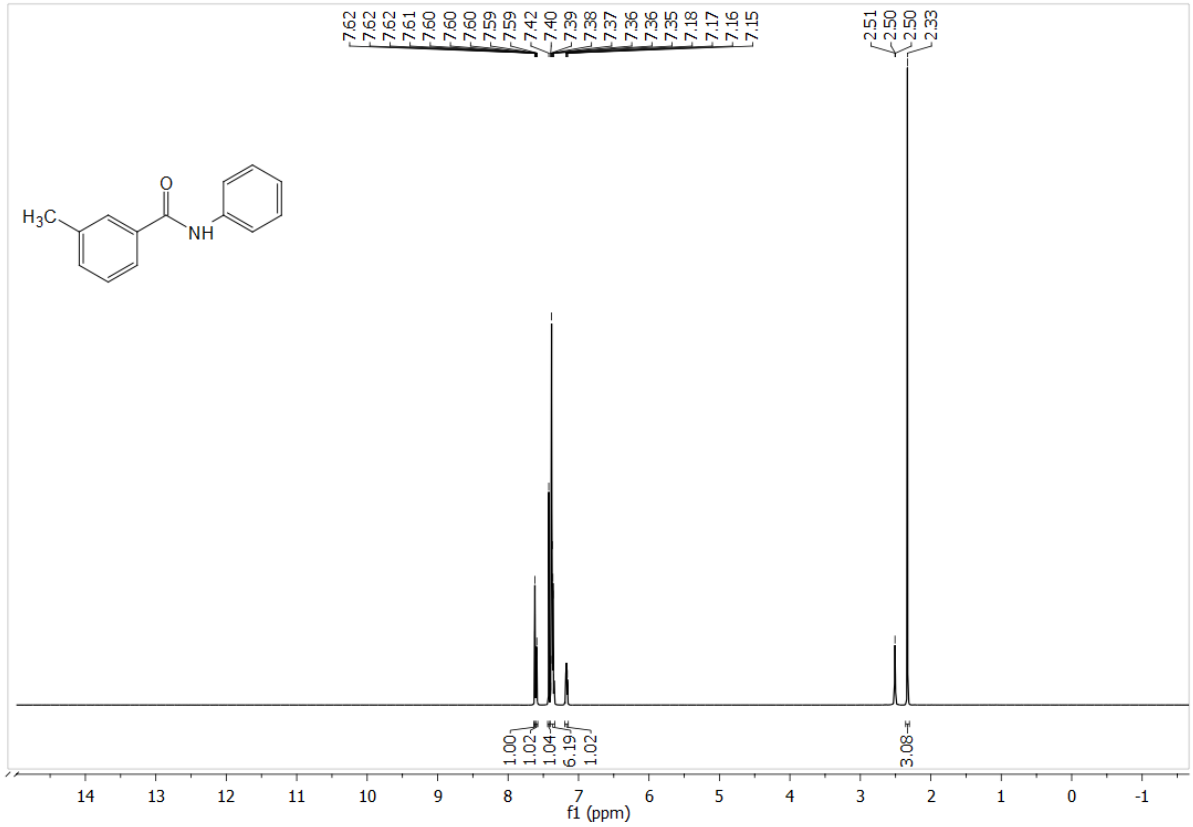


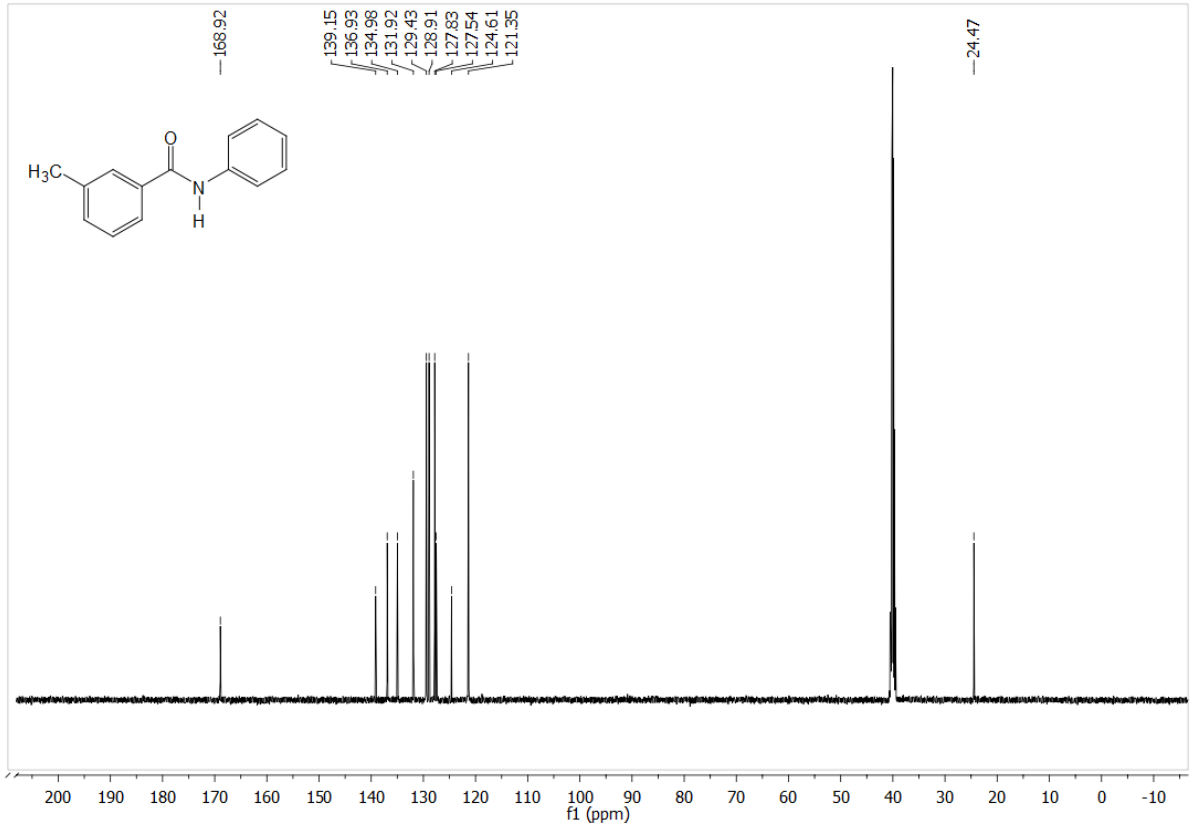
^{1}H and ^{13}C NMR Spectra of 2-methyl-*N*-phenylbenzamide (4a)



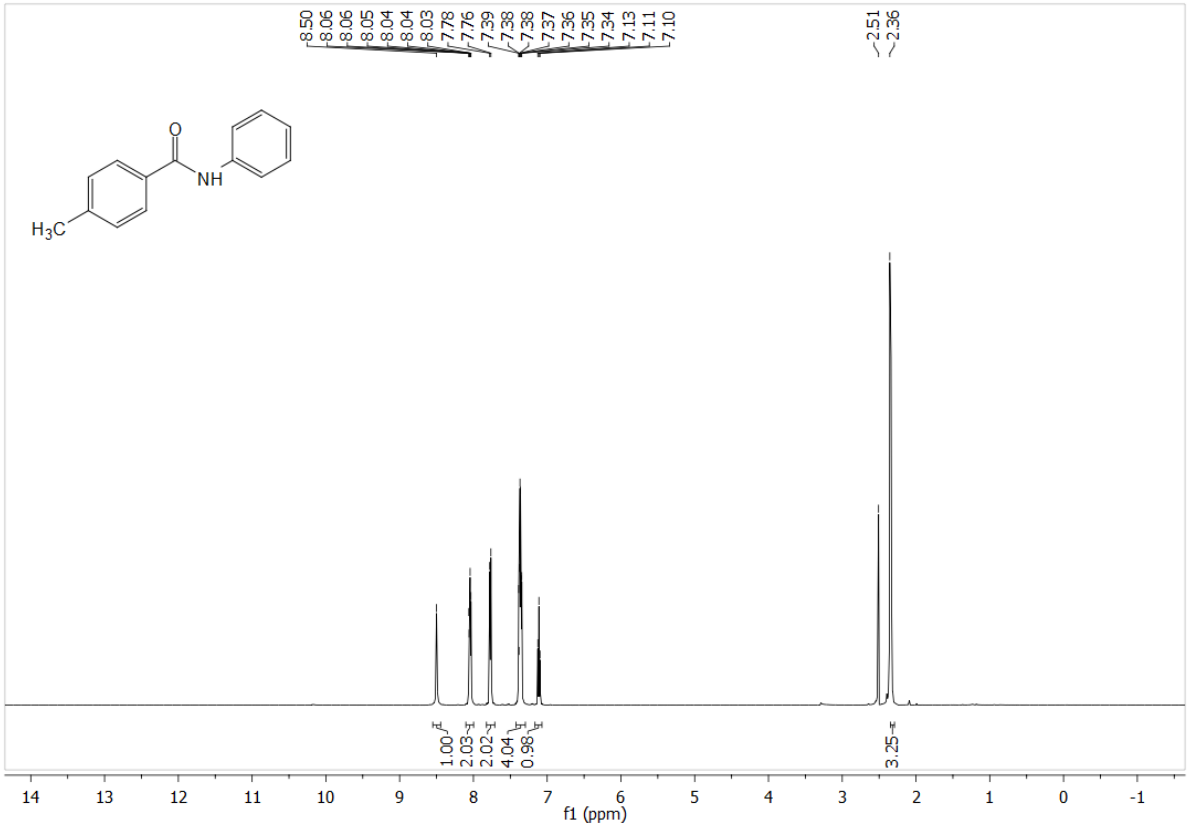


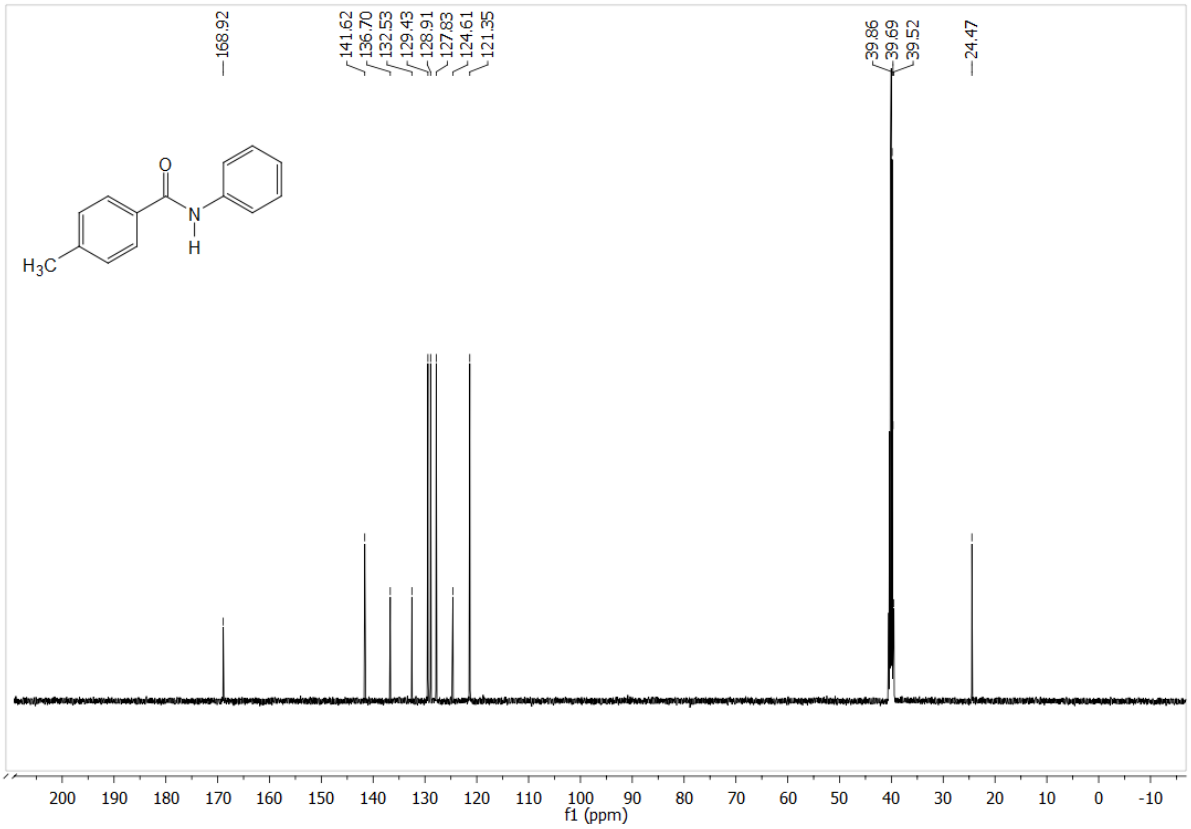
^{1}H and ^{13}C NMR Spectra of 3-methyl-*N*-phenylbenzamide (4b)



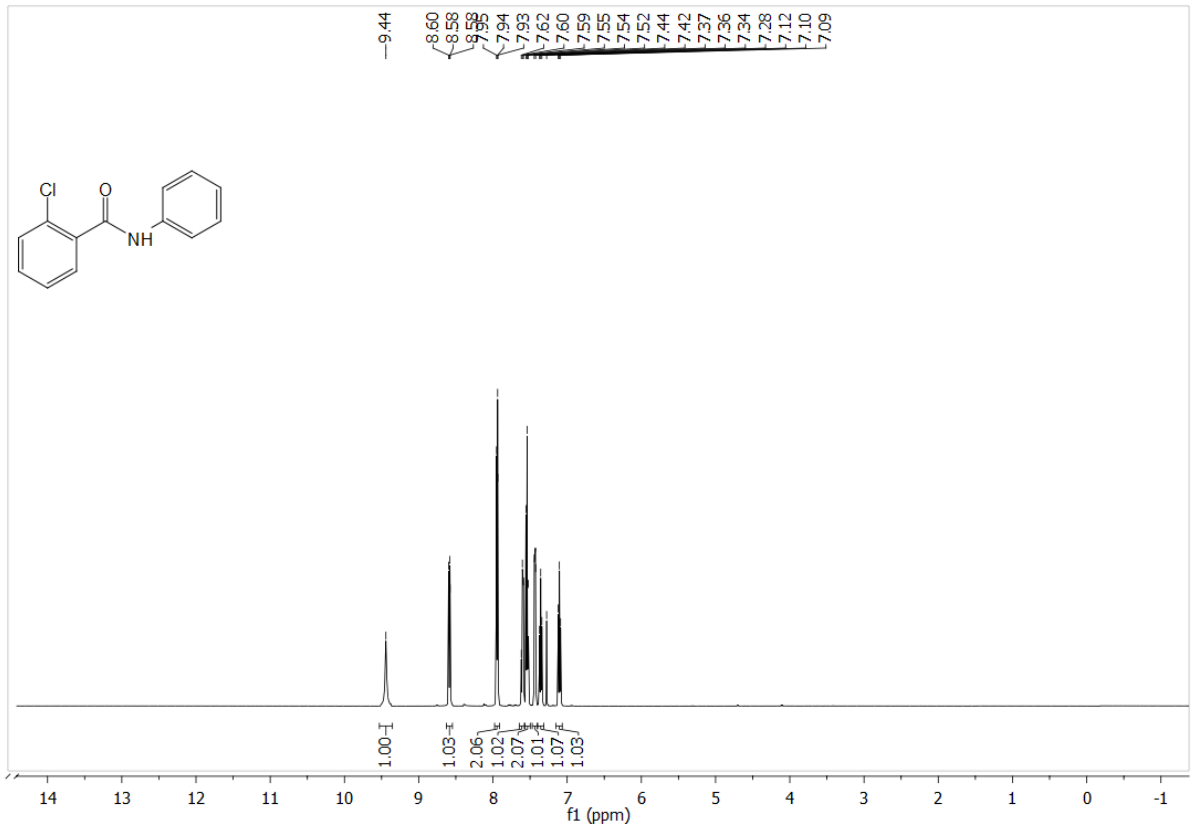


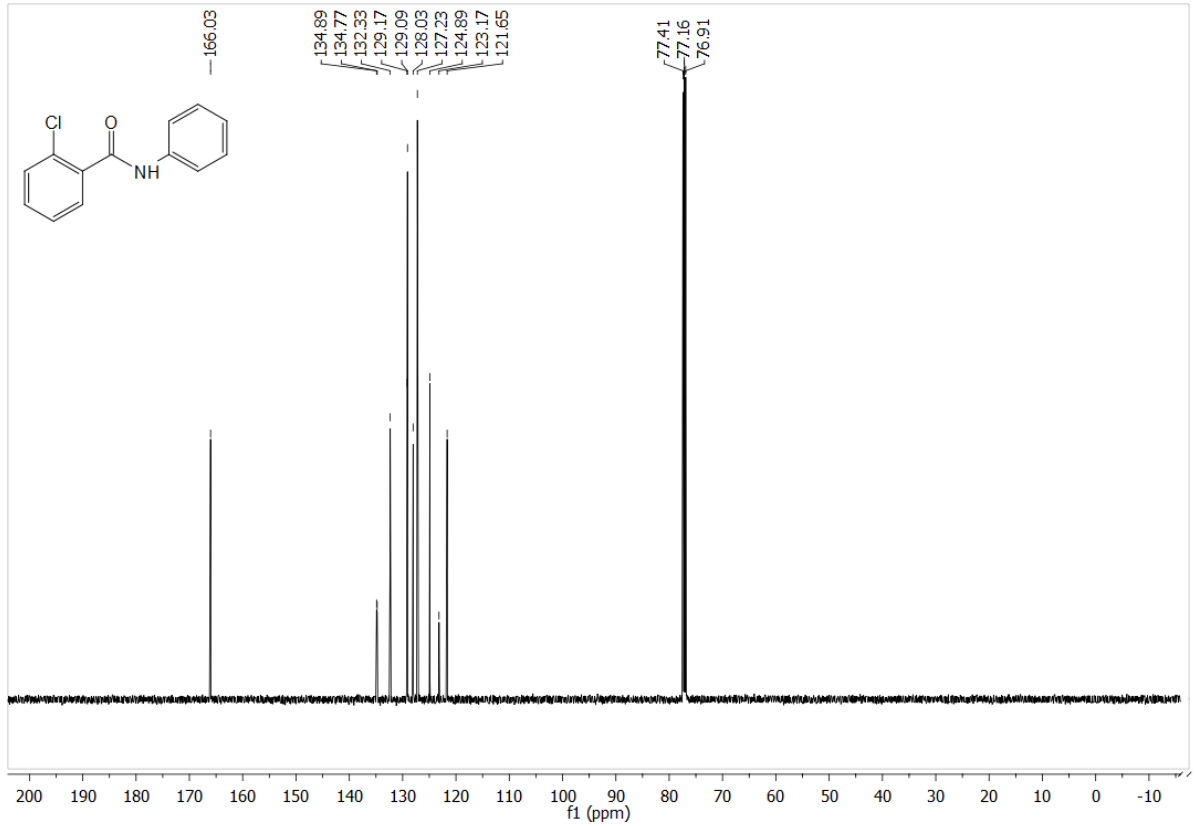
^{1}H and ^{13}C NMR Spectra of 4-methyl-*N*-phenylbenzamide (4c)



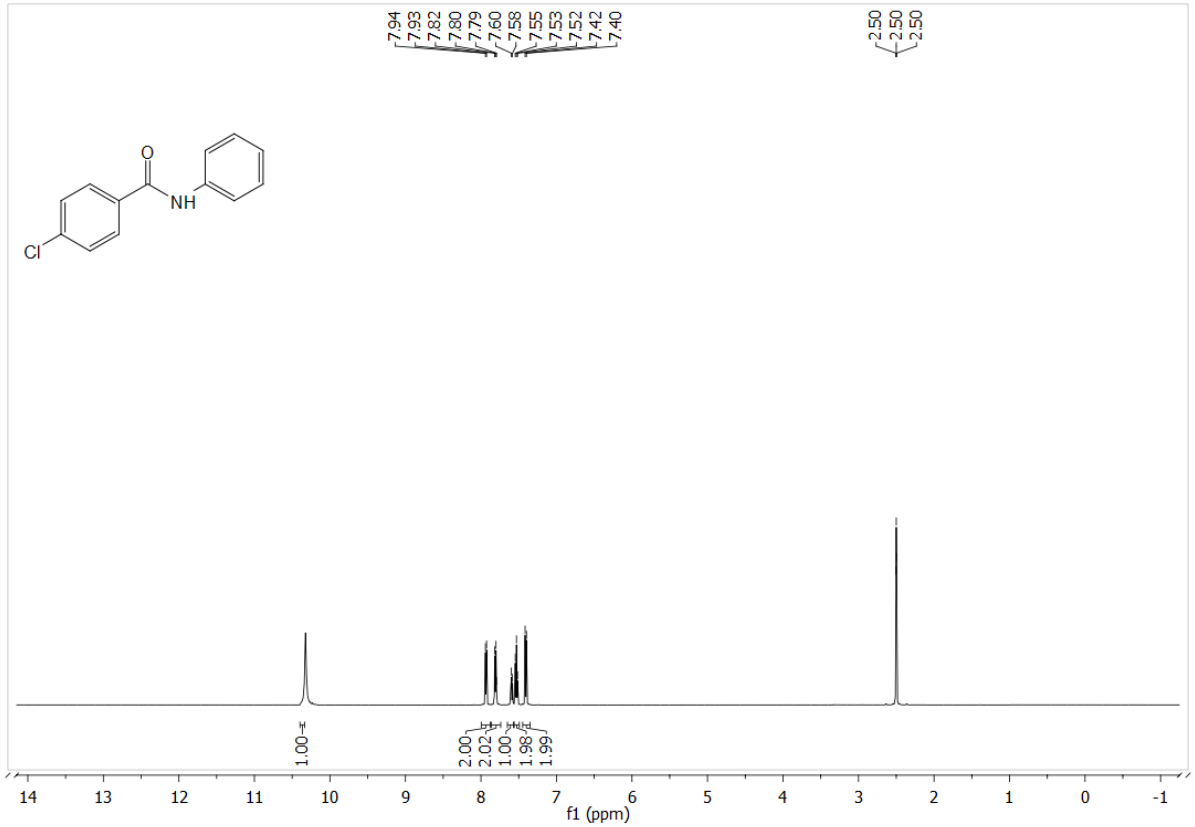


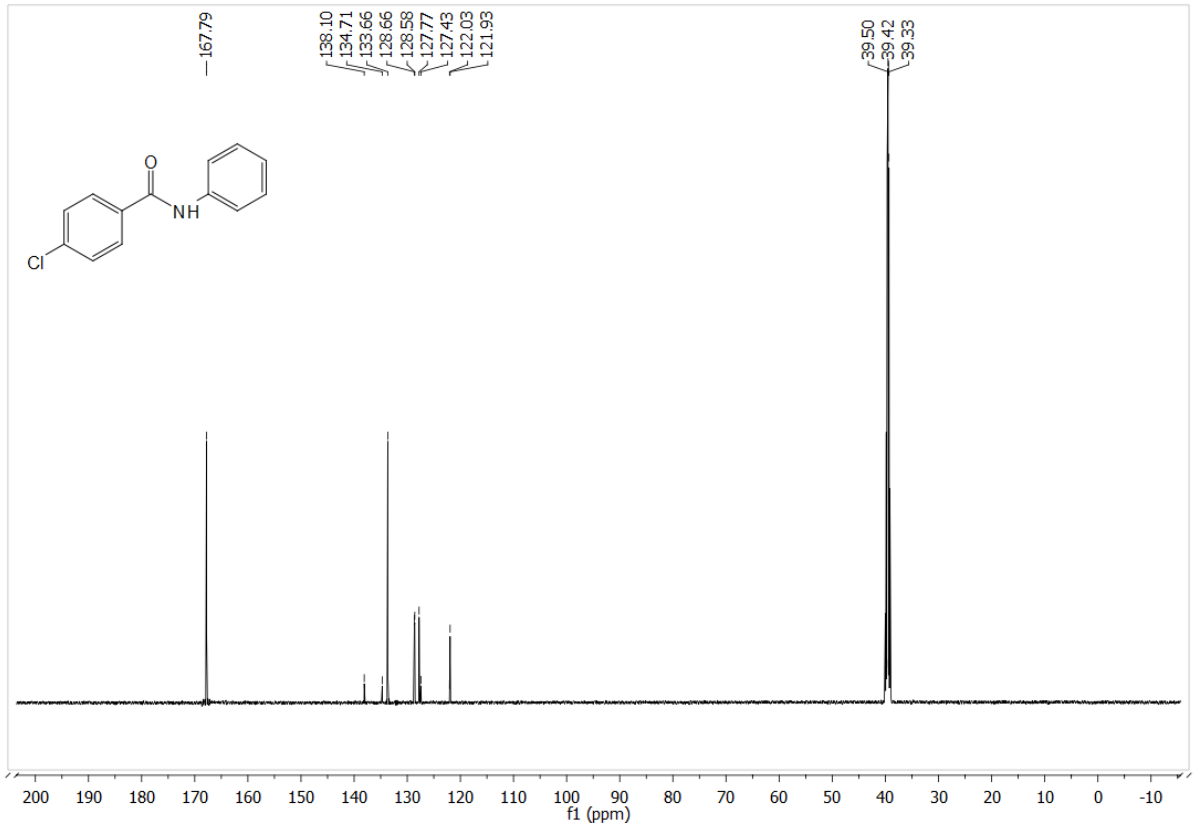
^{1}H and ^{13}C NMR Spectra of 2-chloro-*N*-phenylbenzamide (4d)



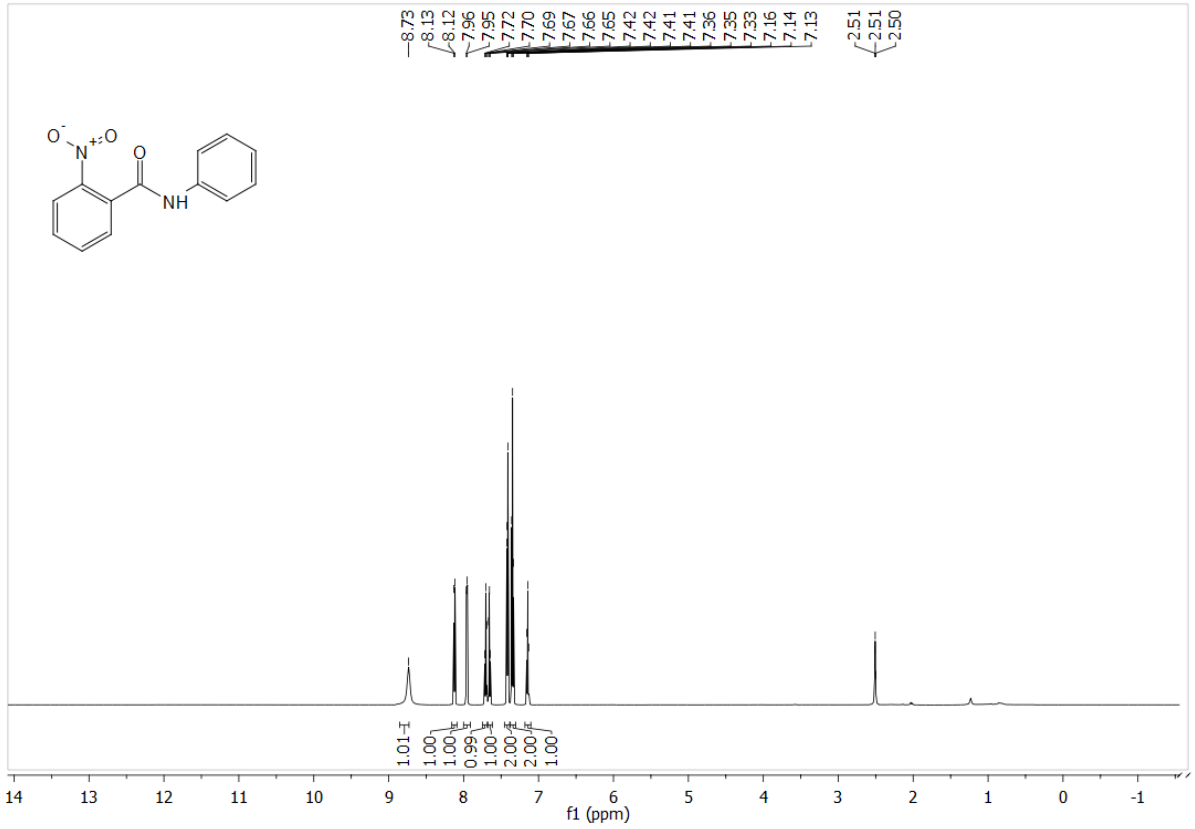


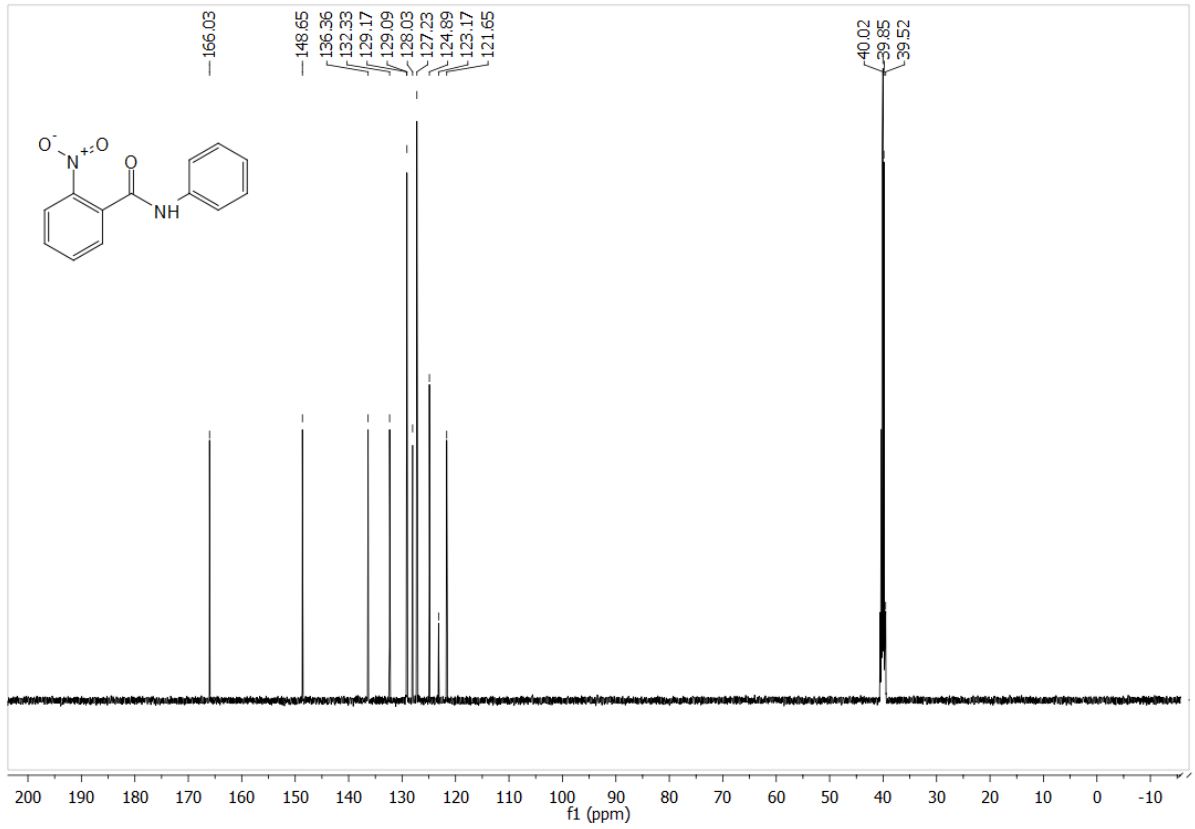
^{1}H and ^{13}C NMR Spectra of 4-chloro-*N*-phenylbenzamide (4e)



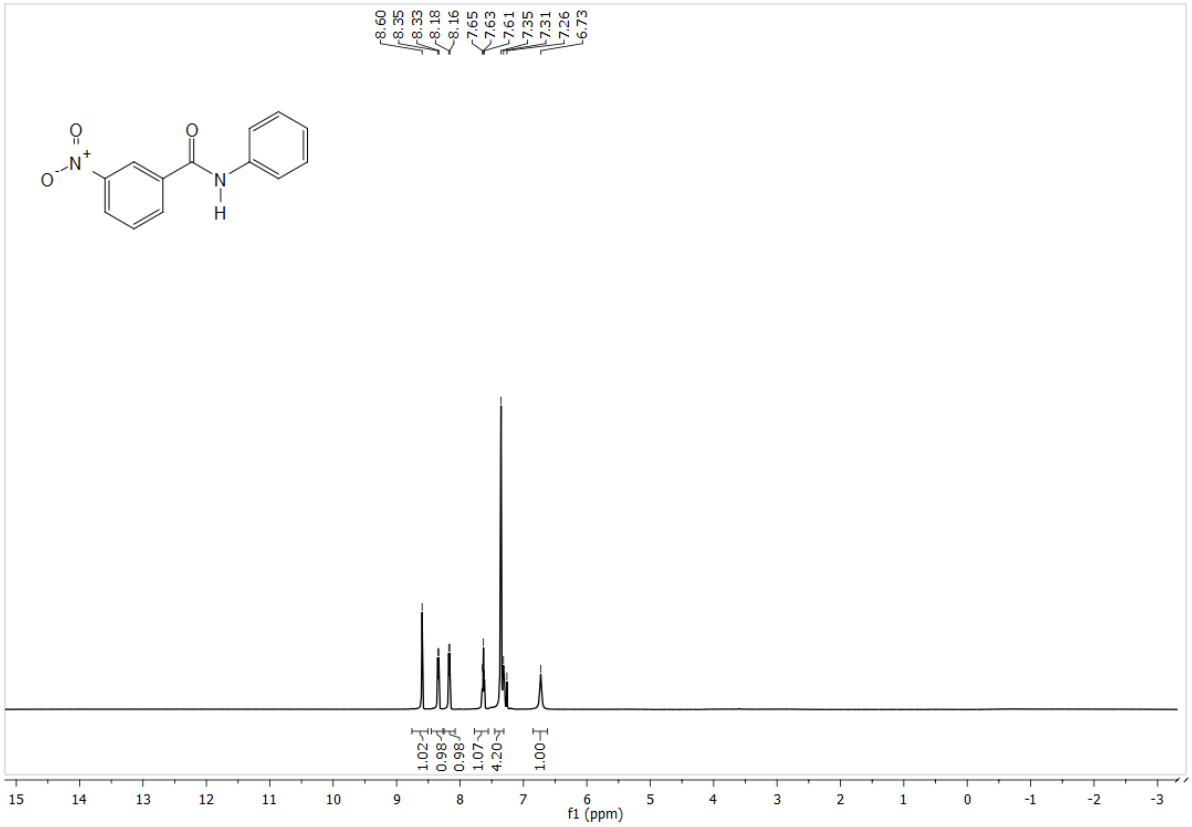


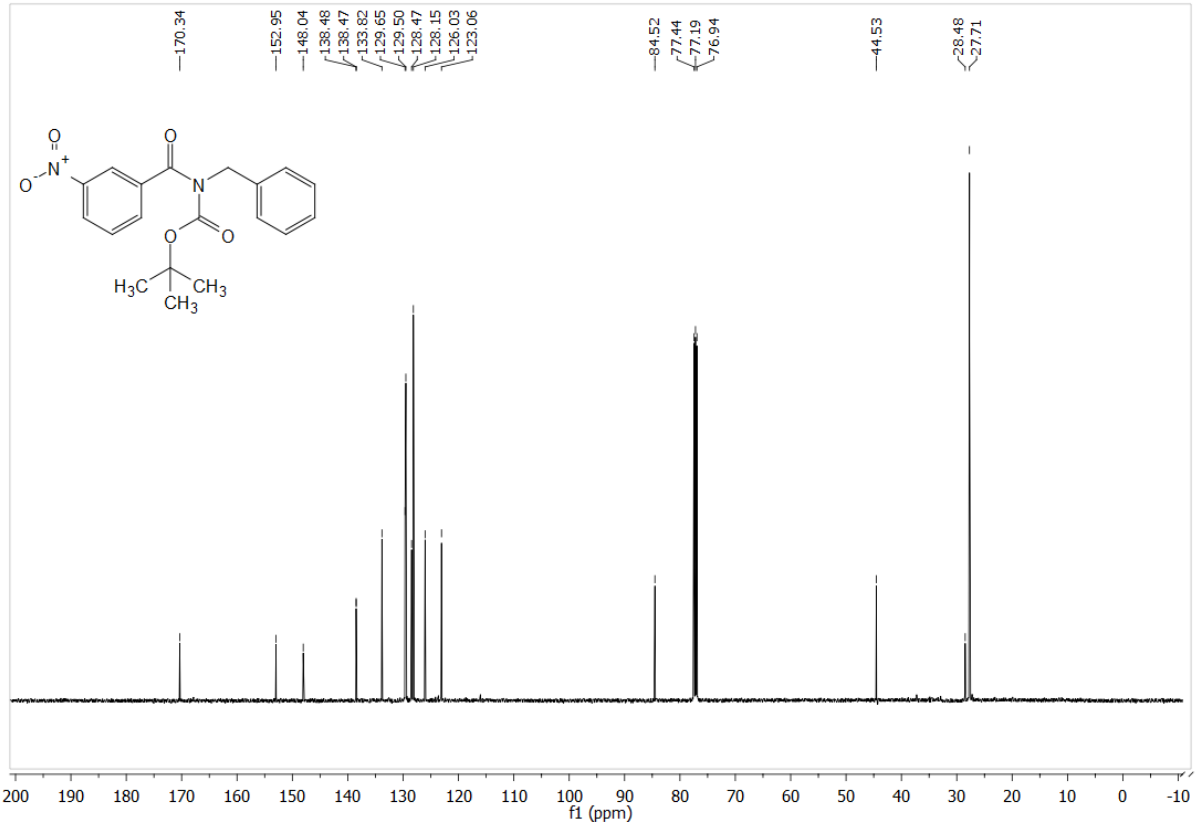
^{1}H and ^{13}C NMR Spectra of 2-nitro-*N*-phenylbenzamide (4f)



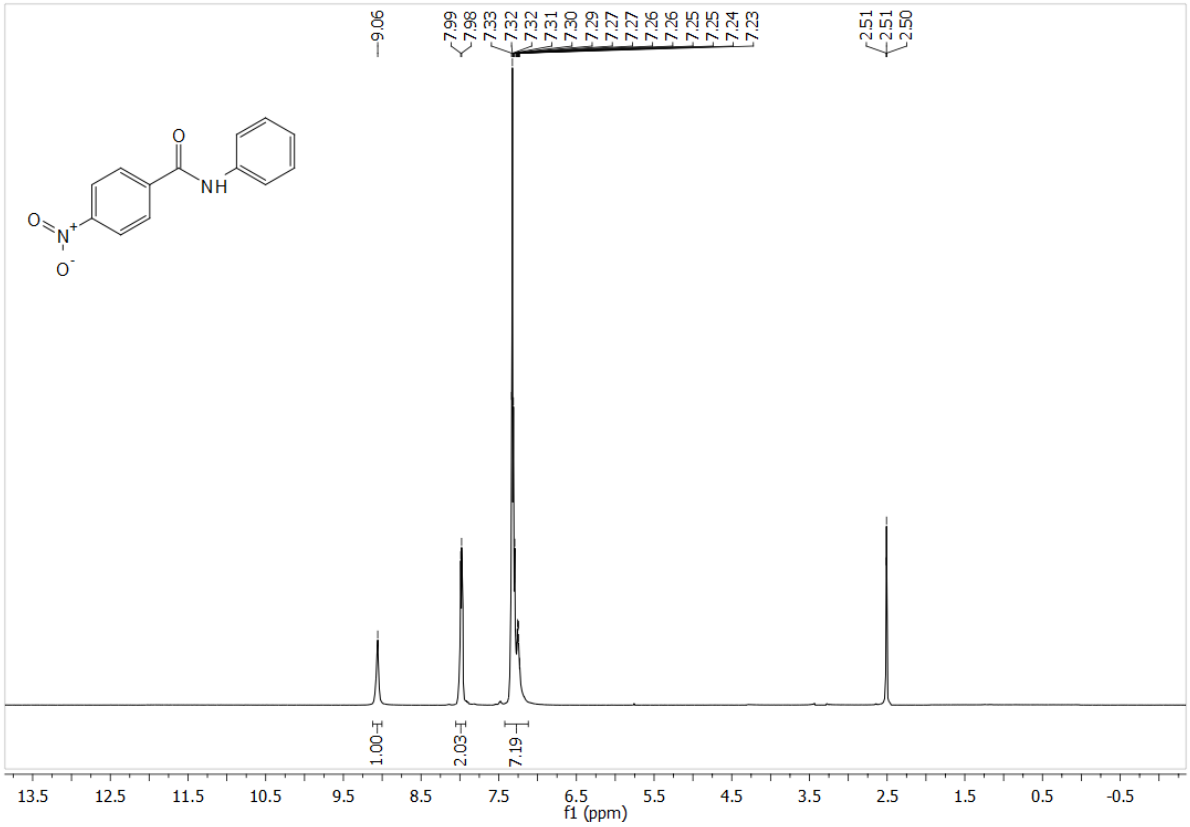


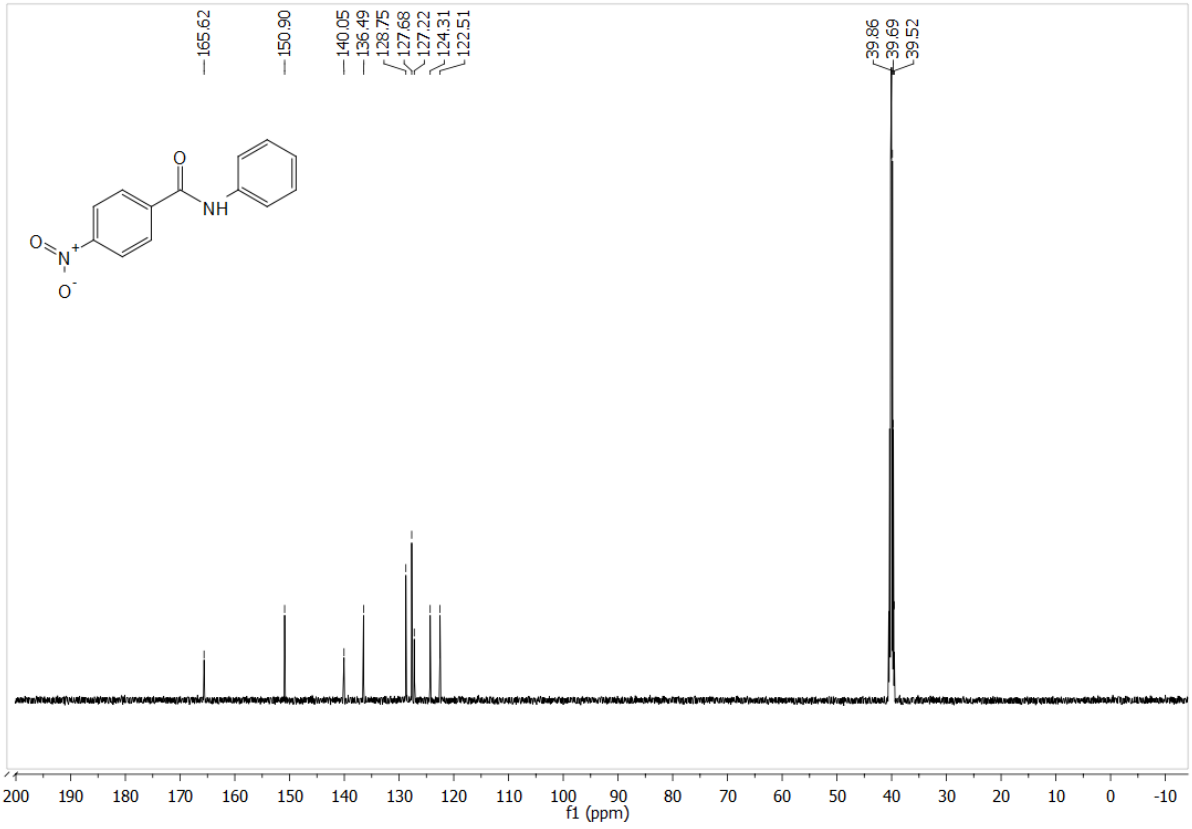
^{1}H and ^{13}C NMR Spectra of 3-nitro-*N*-phenylbenzamide (4g)



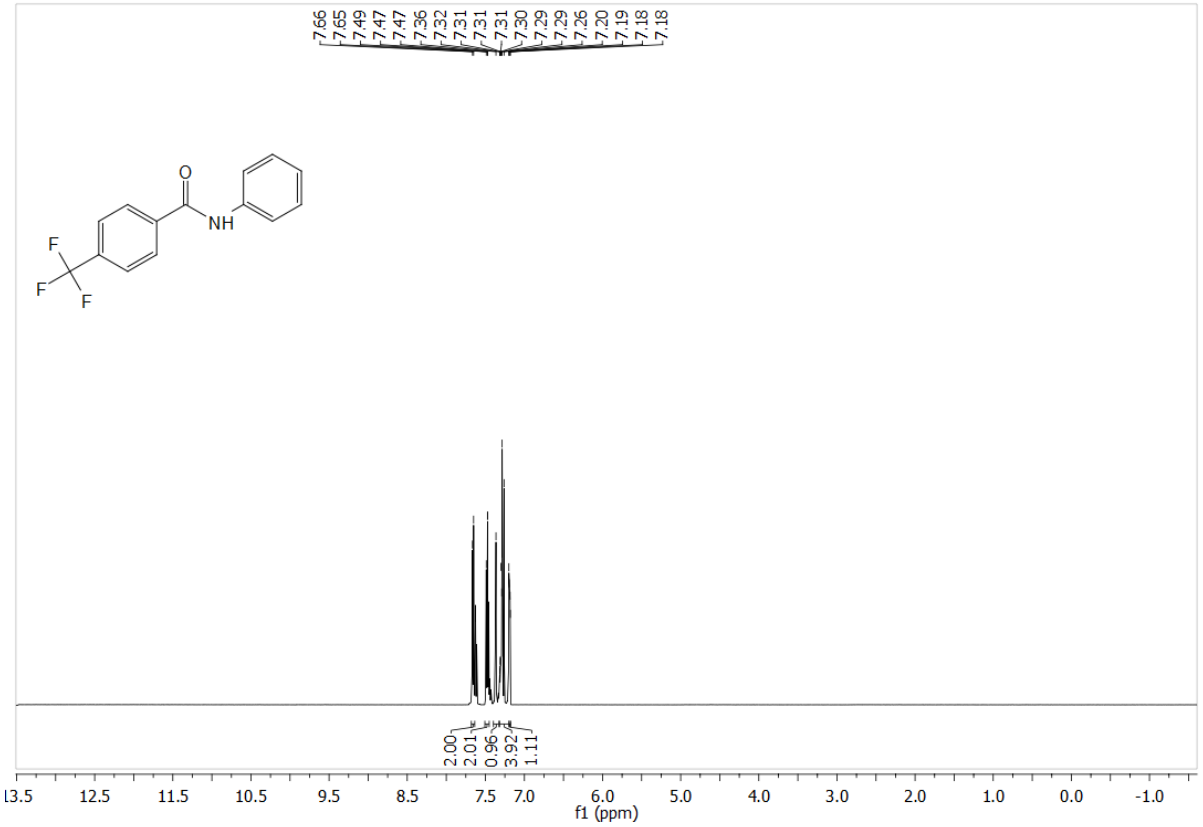


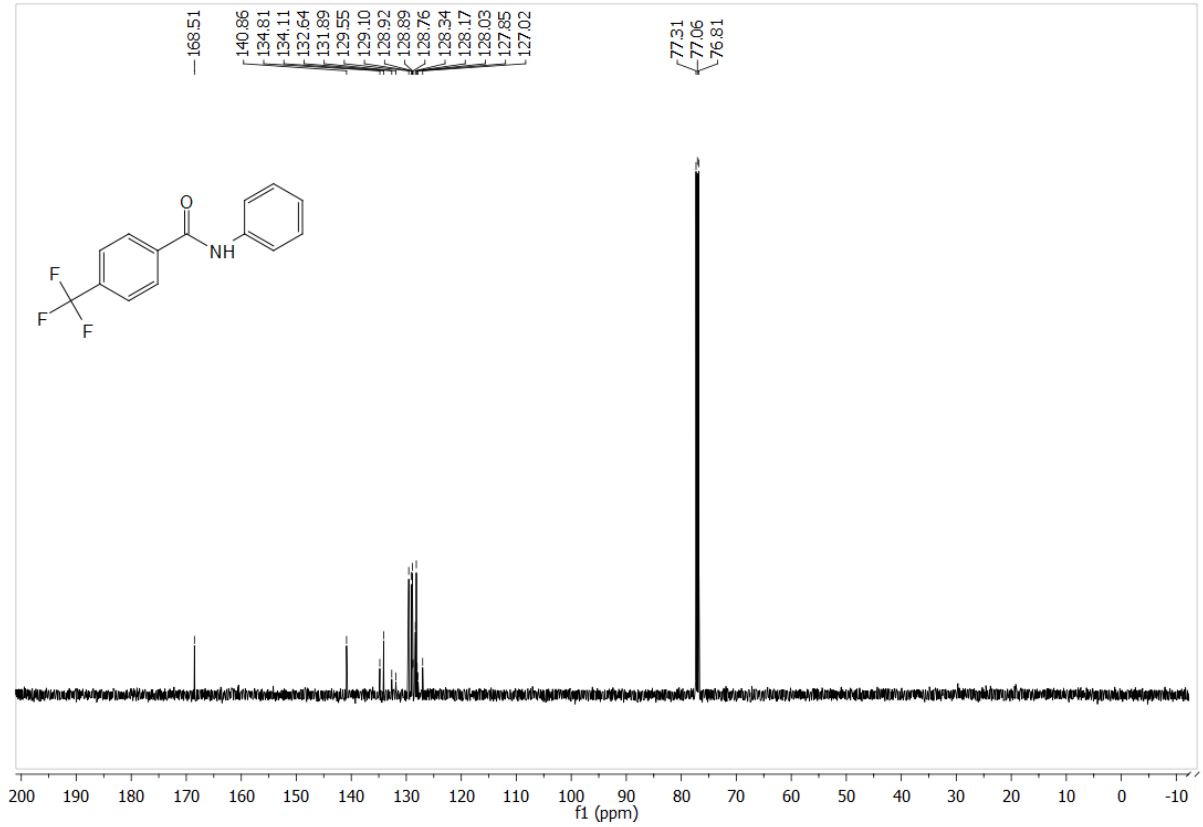
^{1}H and ^{13}C NMR Spectra of 4-nitro-*N*-phenylbenzamide (4h)



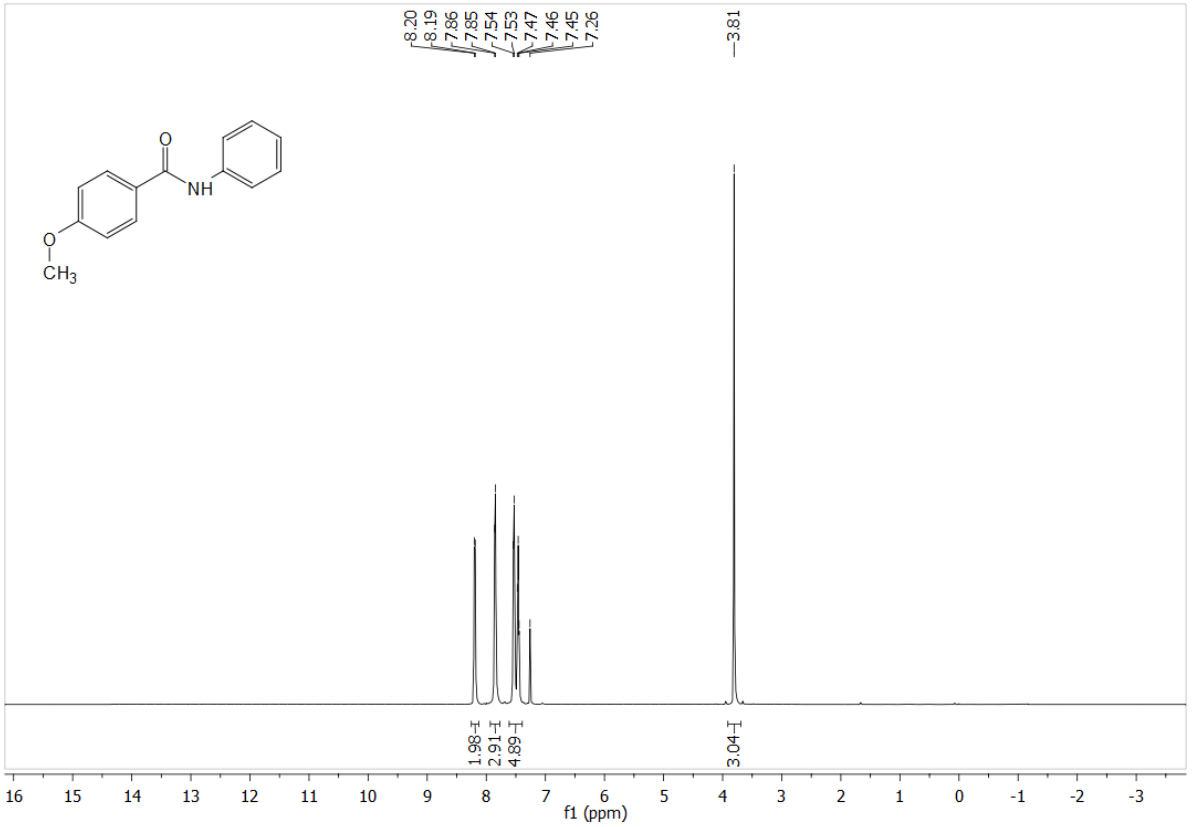


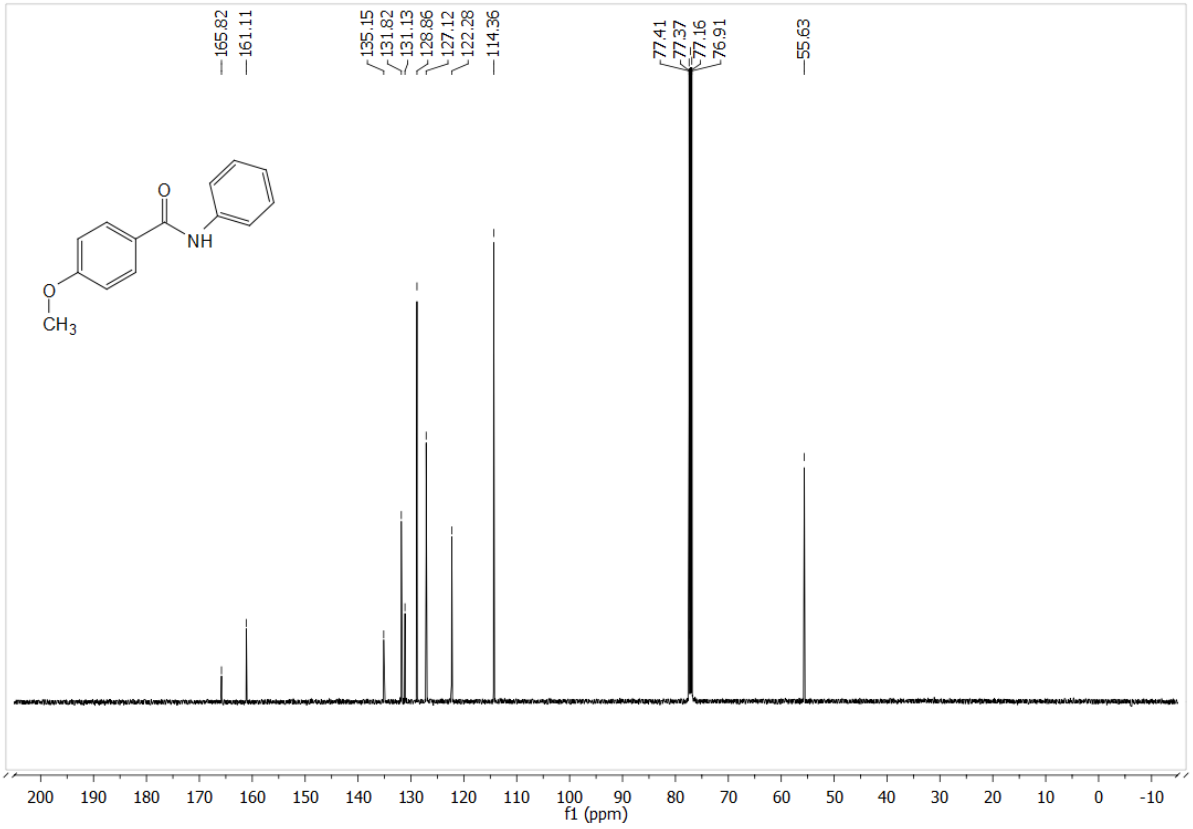
^{1}H and ^{13}C NMR Spectra of *N*-phenyl-4-(trifluoromethyl)benzamide (4i)



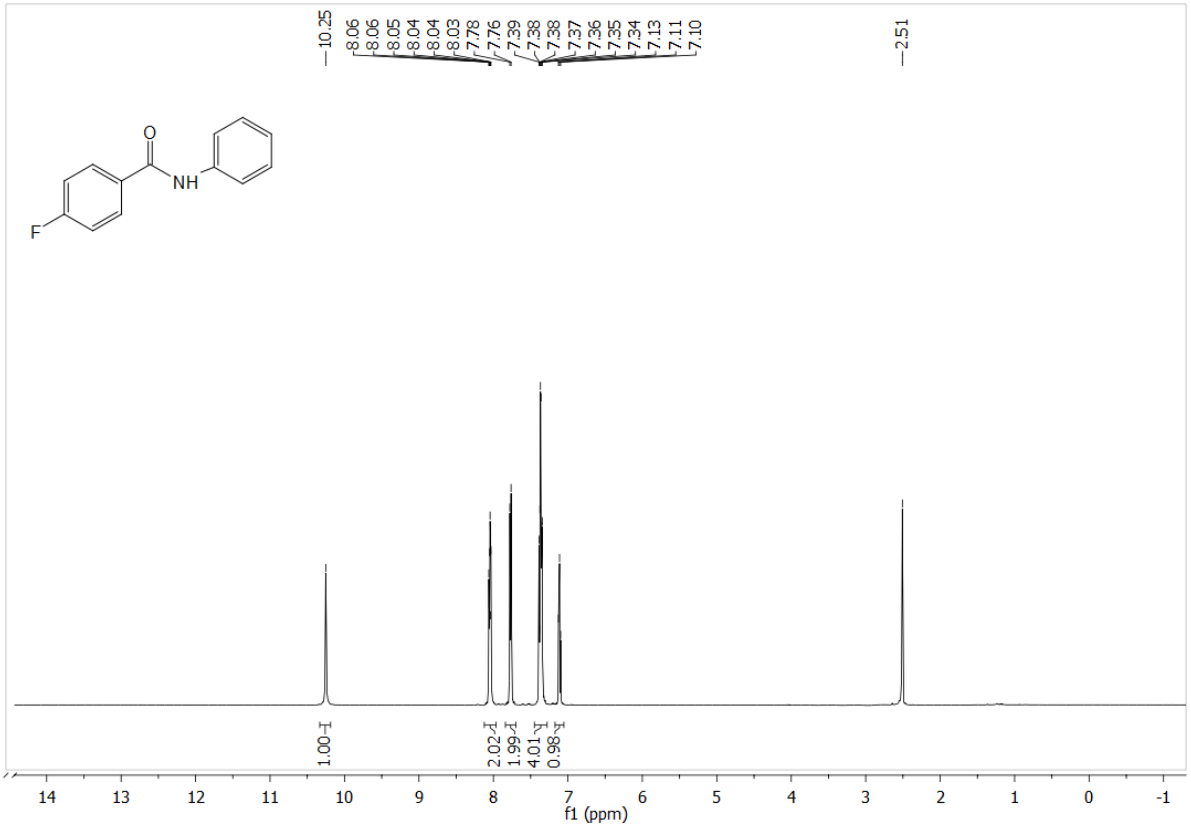


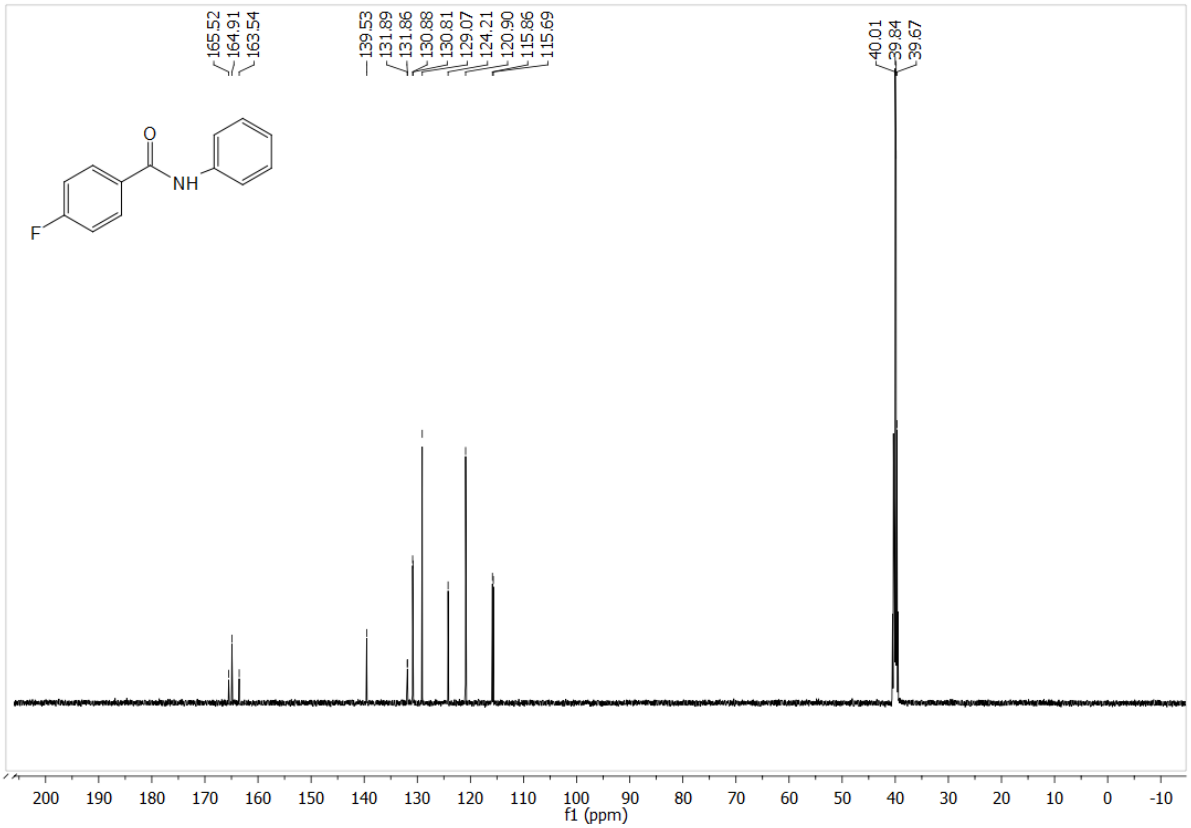
^{1}H and ^{13}C NMR Spectra of 4-methoxy-*N*-phenylbenzamide (4j)



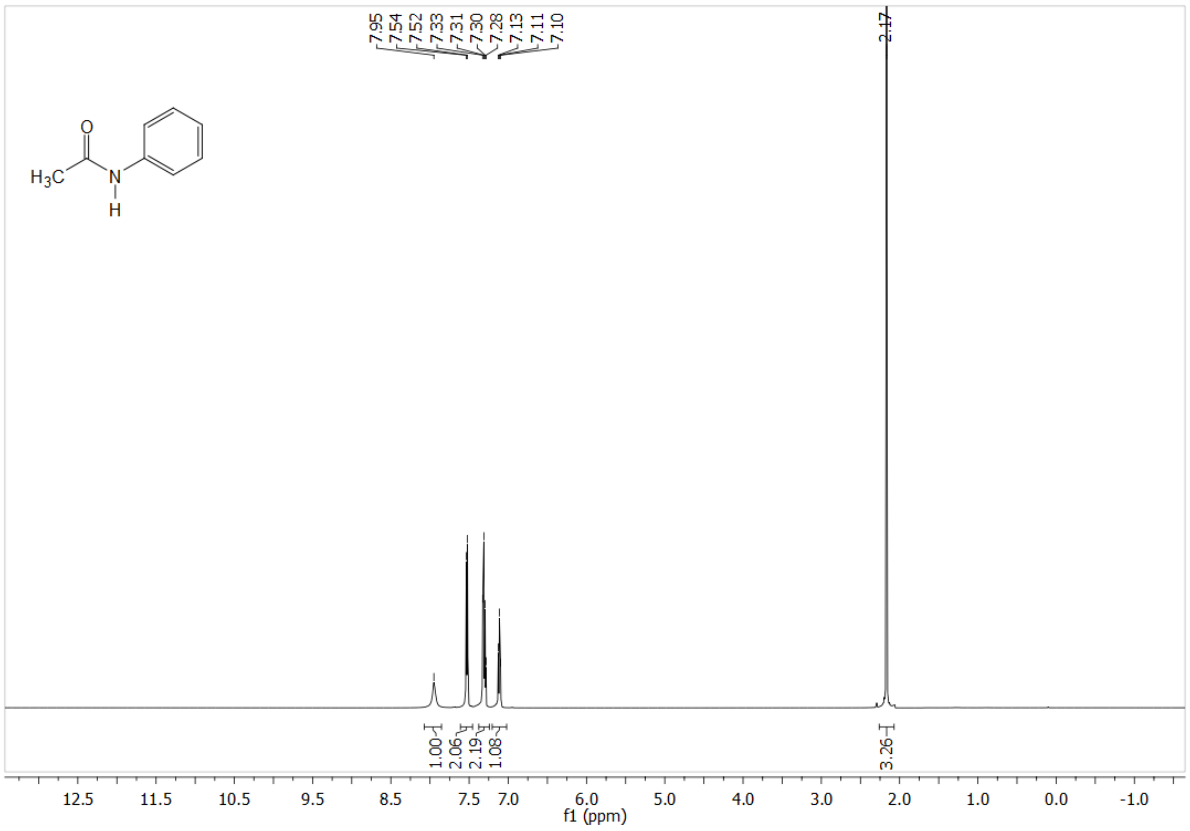


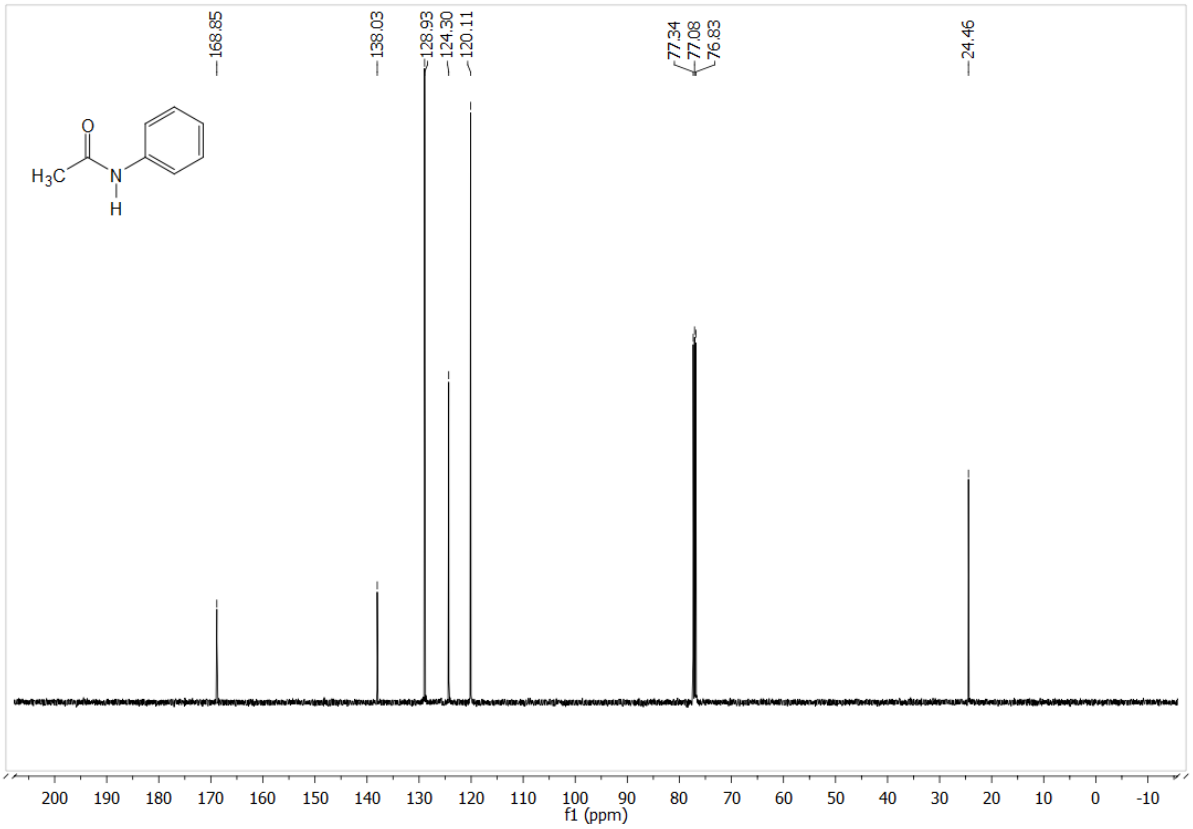
^{1}H and ^{13}C NMR Spectra of 4-fluoro-*N*-phenylbenzamide (4k)



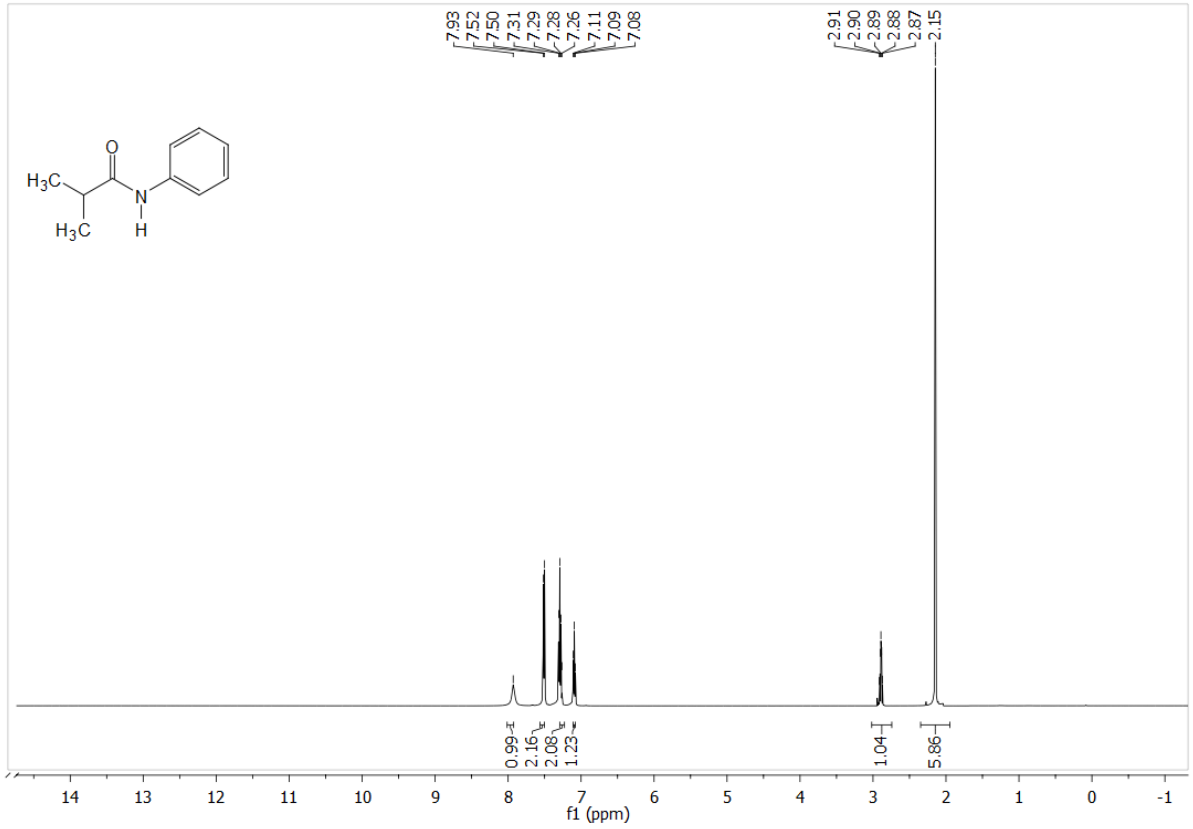


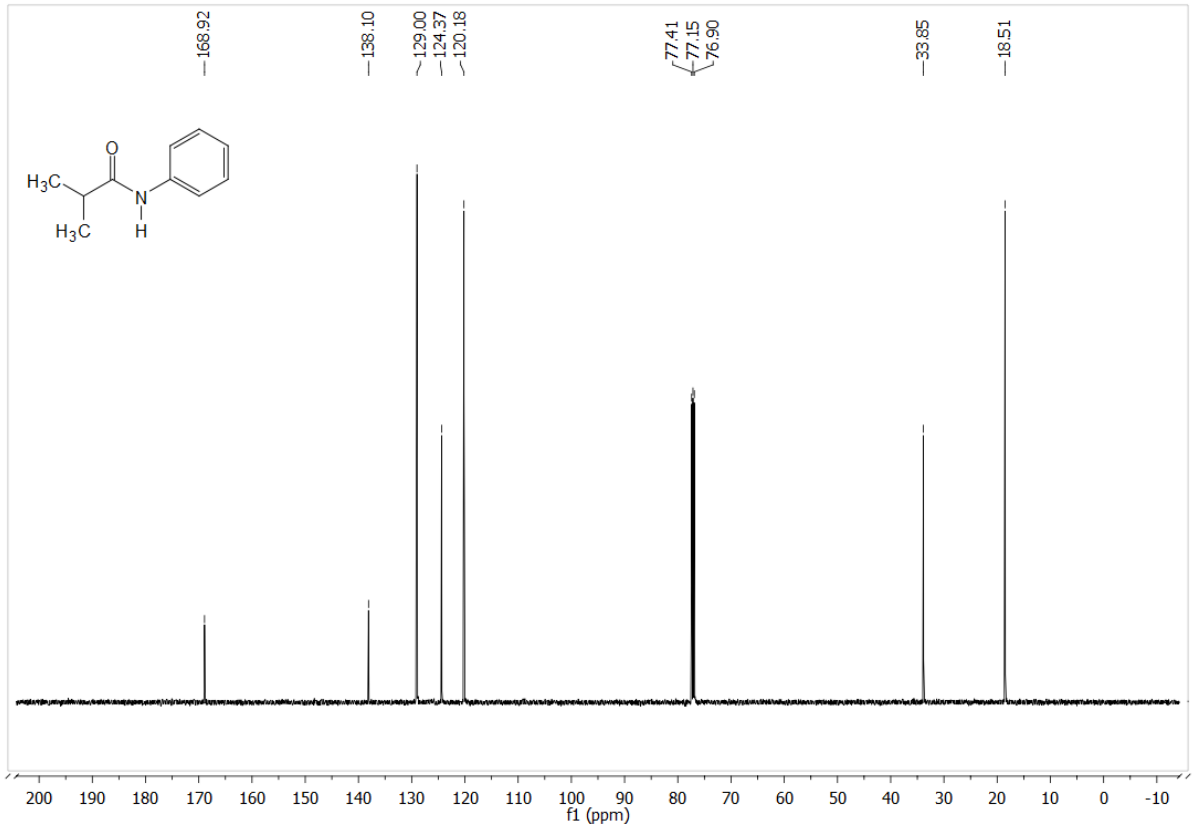
^{1}H and ^{13}C NMR Spectra of *N*-phenylacetamide (4l)



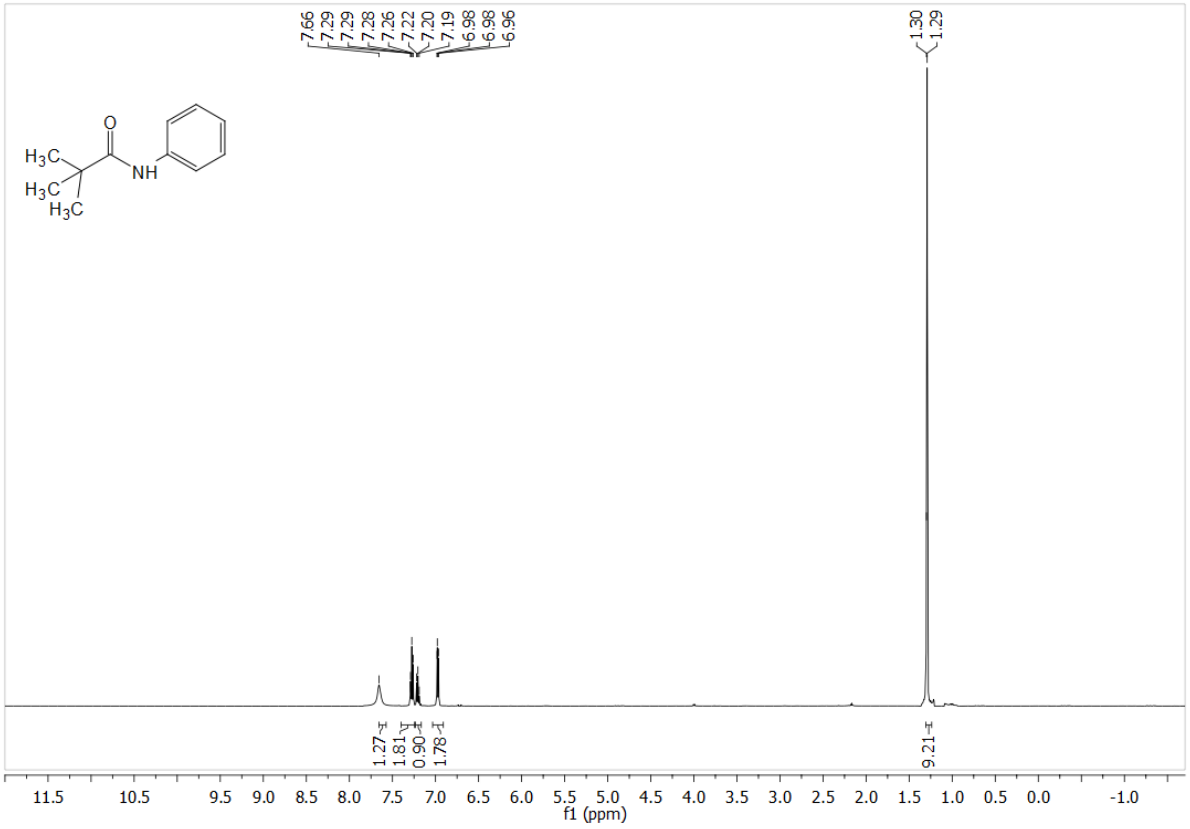


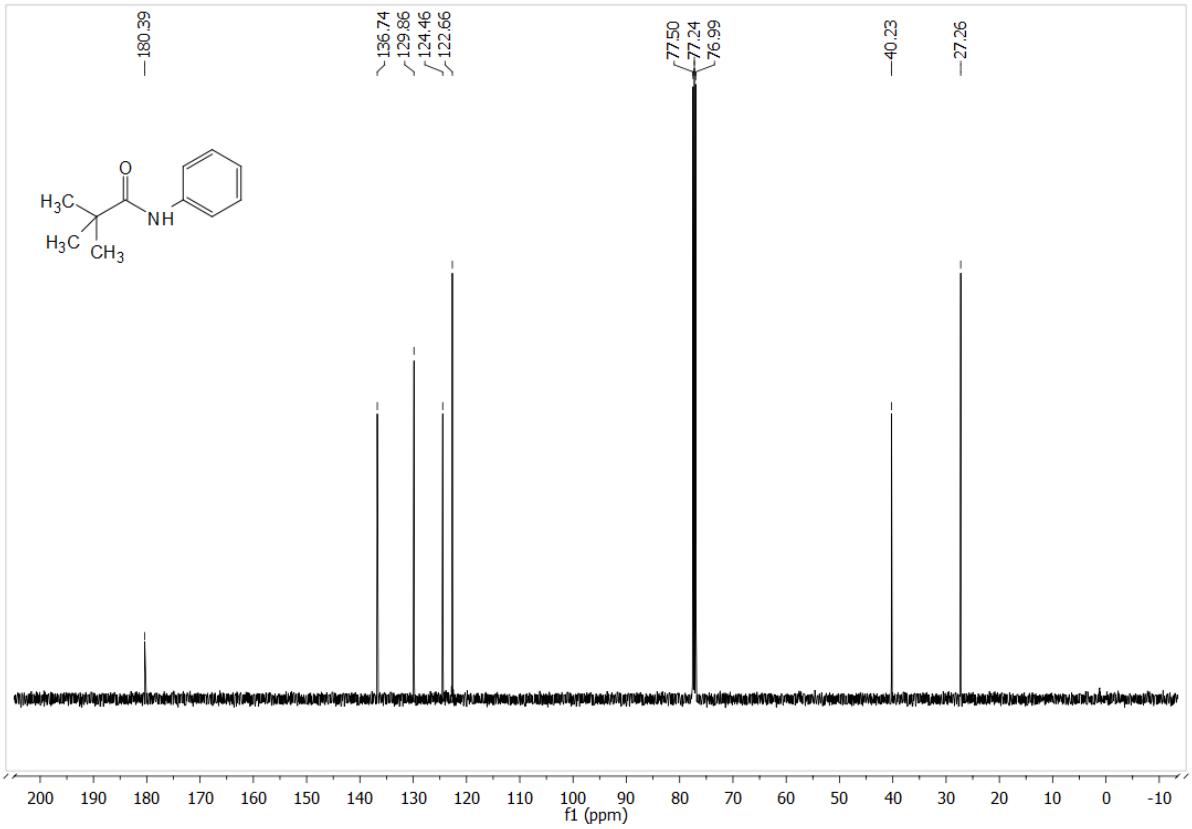
^{1}H and ^{13}C NMR Spectra of *N*-phenylisobutyramide (4m)



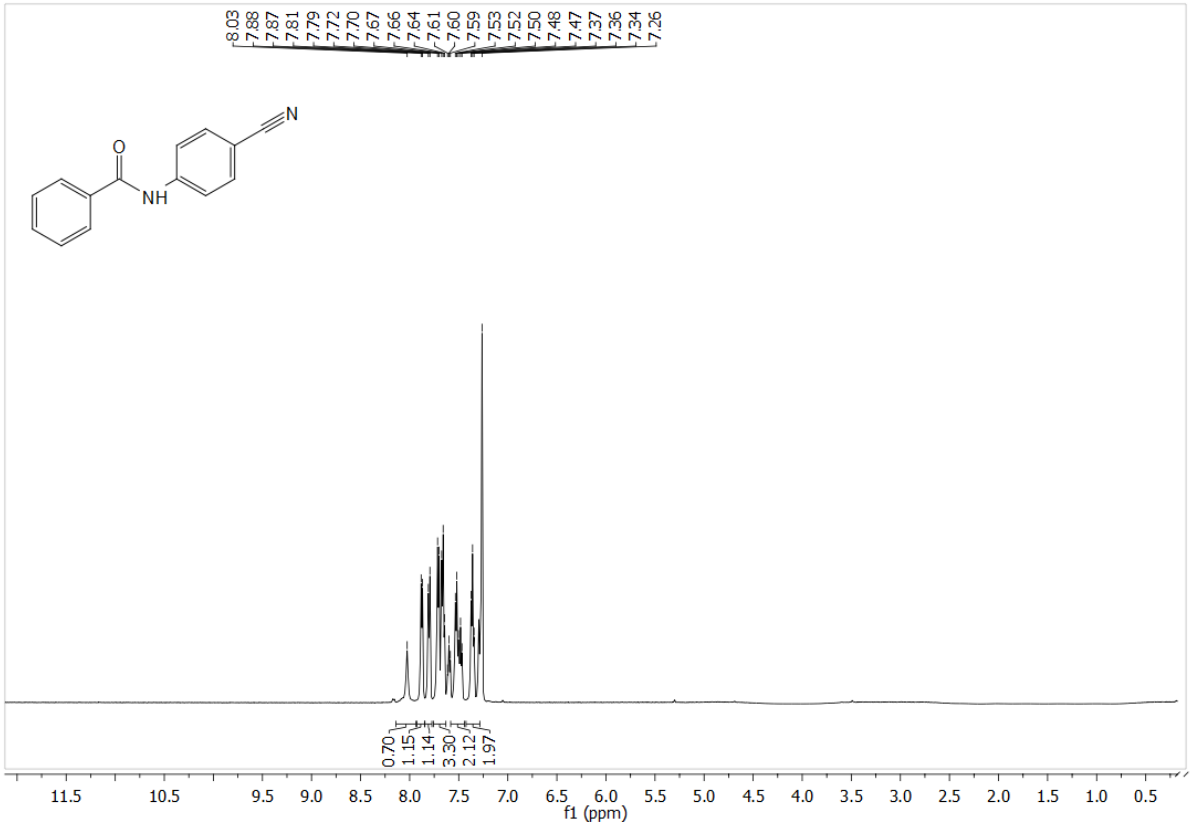


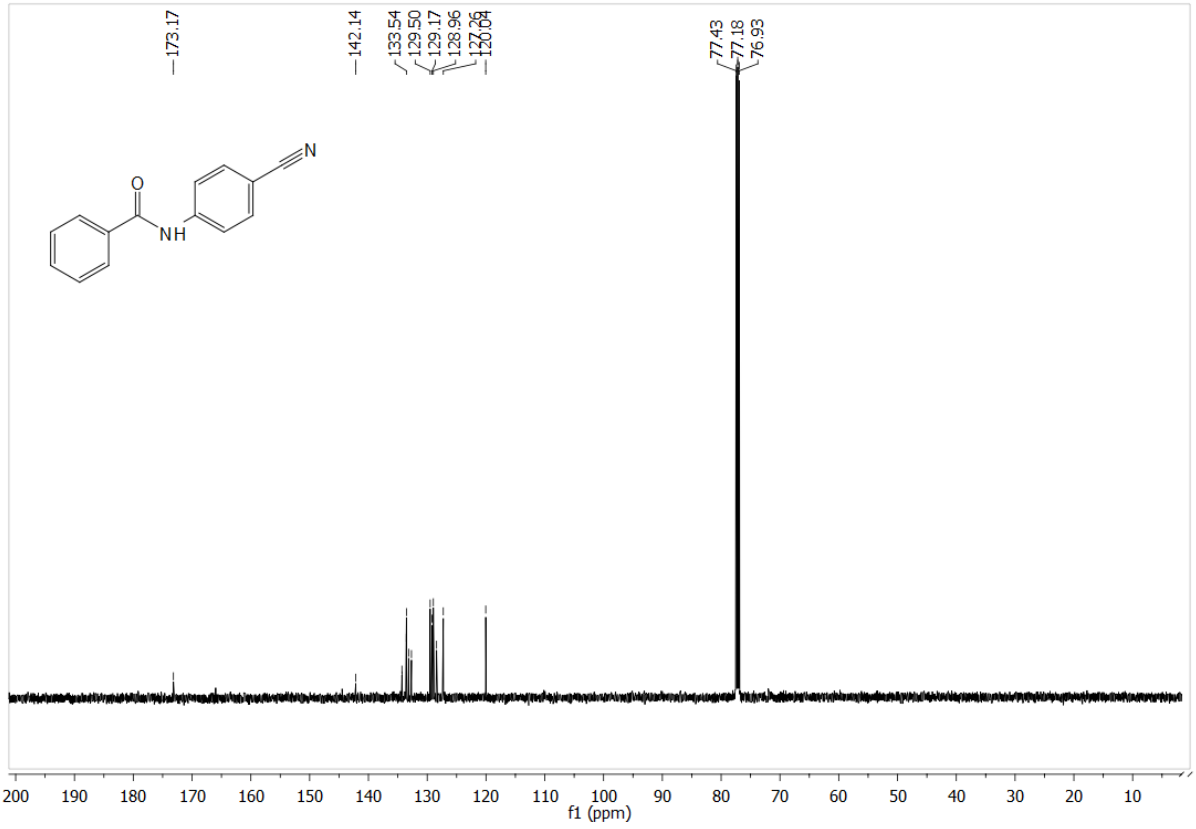
^{1}H and ^{13}C NMR Spectra of *N*-phenylpivalamide (4n)



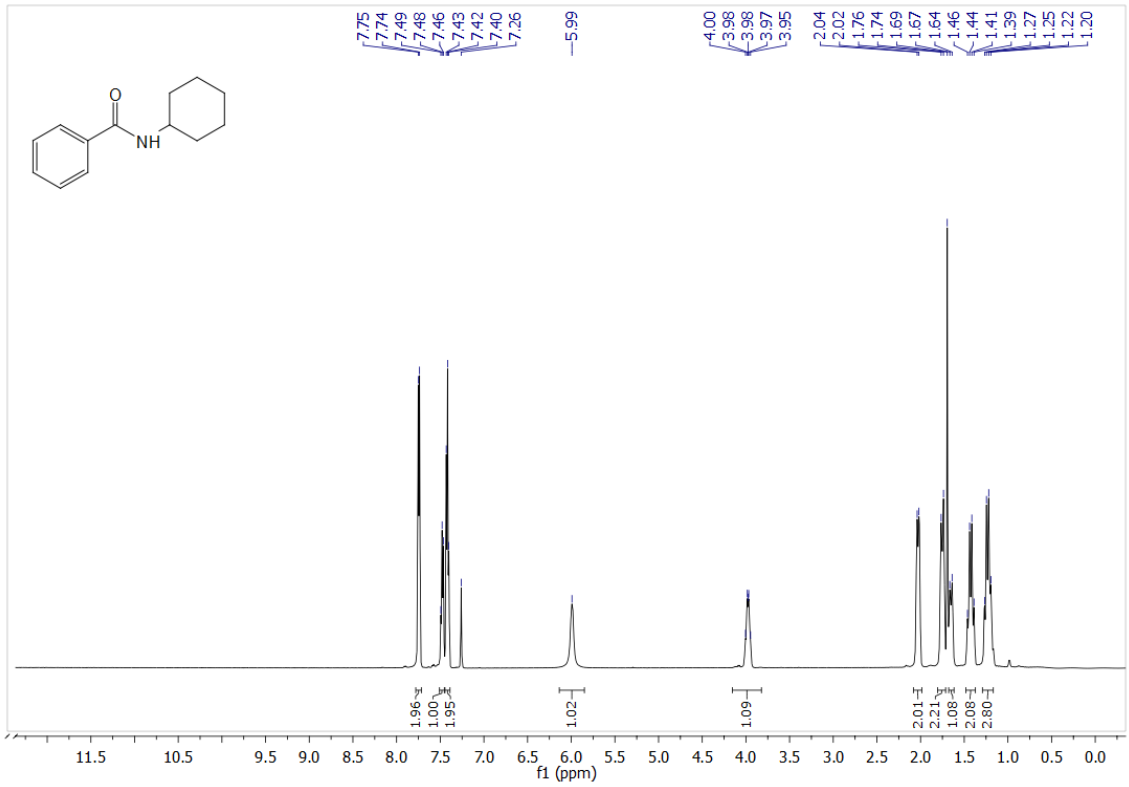


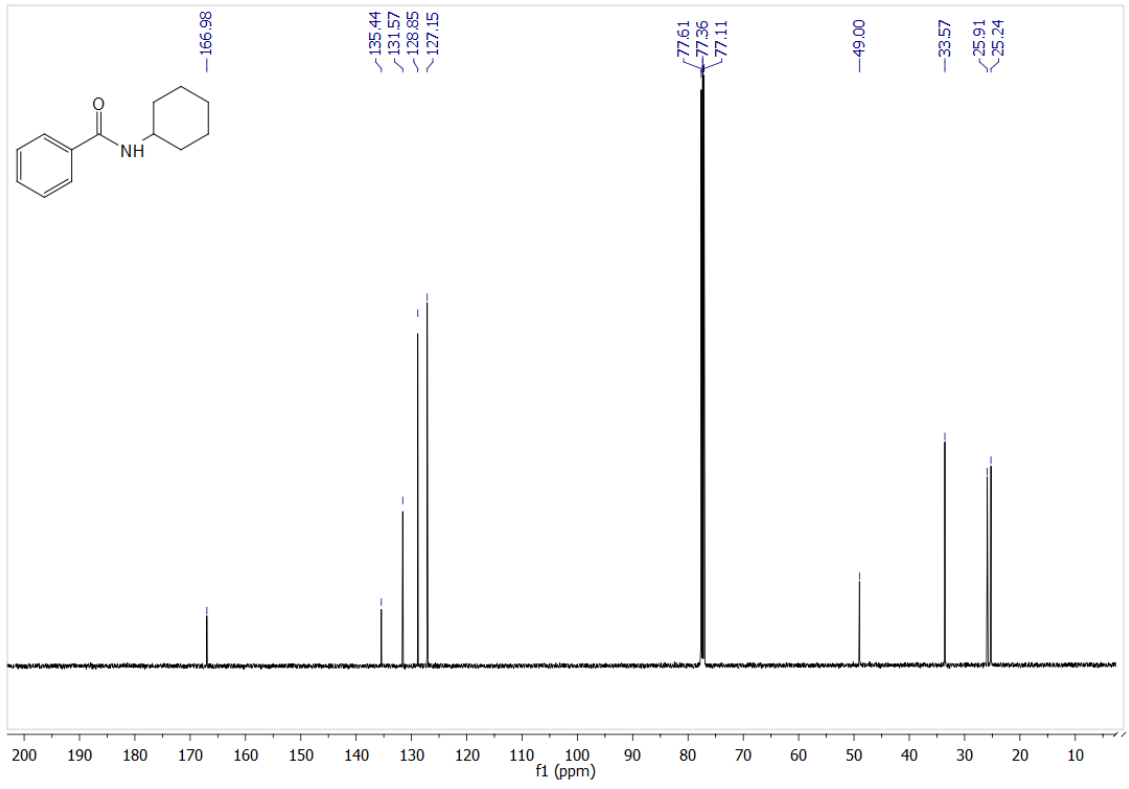
^{1}H and ^{13}C NMR Spectra of *N*-(4-cynophenyl)benzamide (5a)



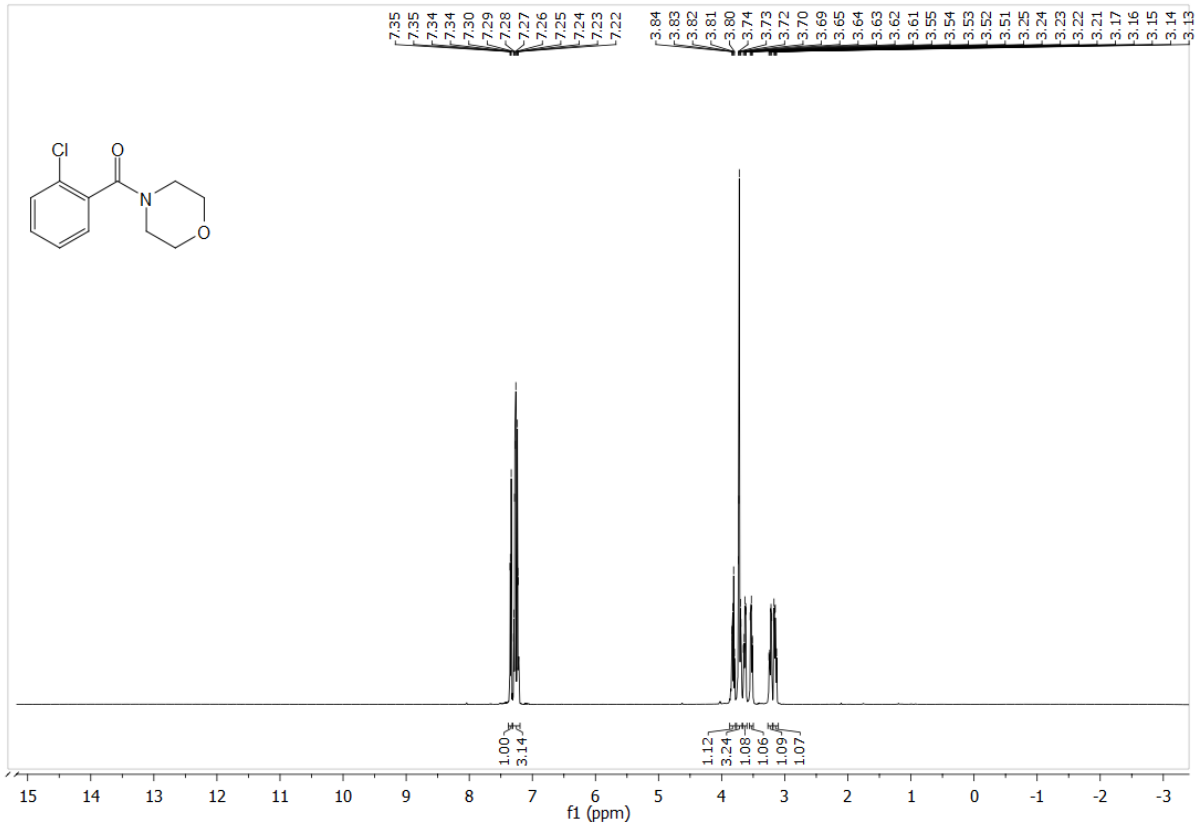


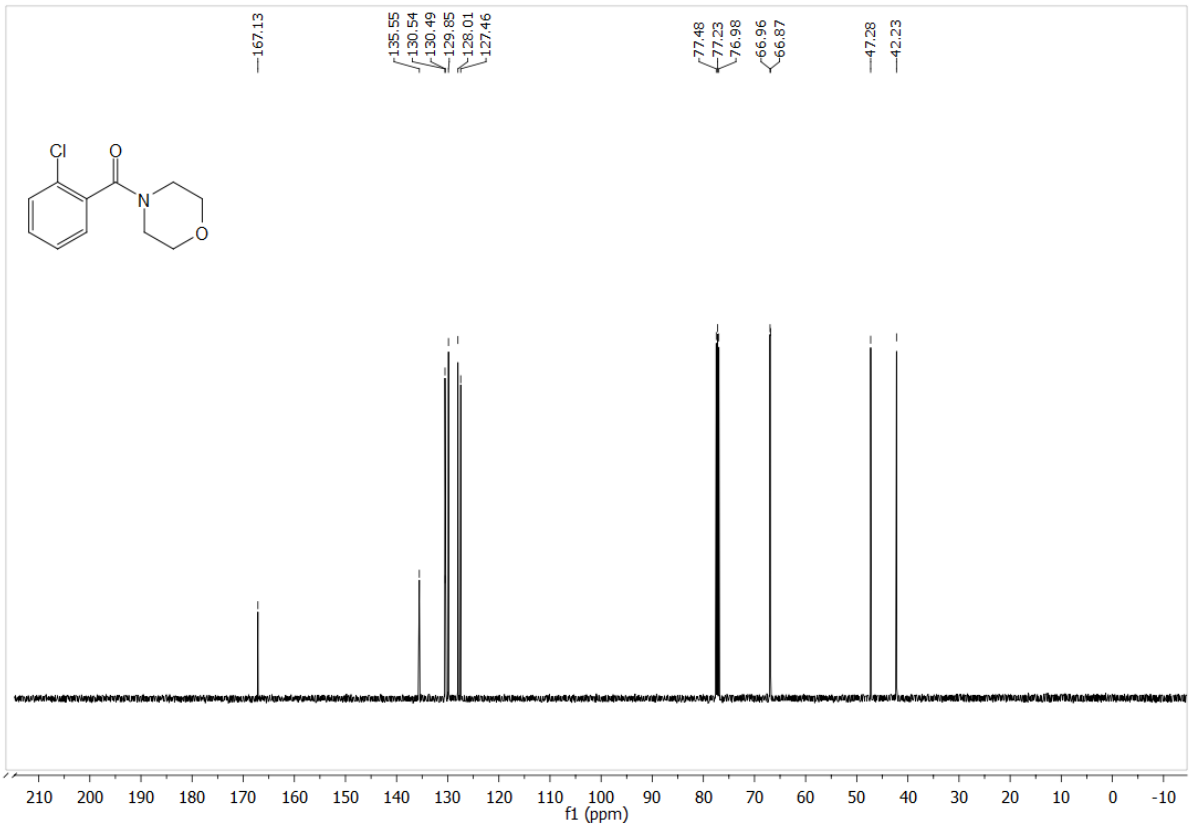
^{1}H and ^{13}C NMR Spectra of *N*-cyclohexylbenzamide (5b)



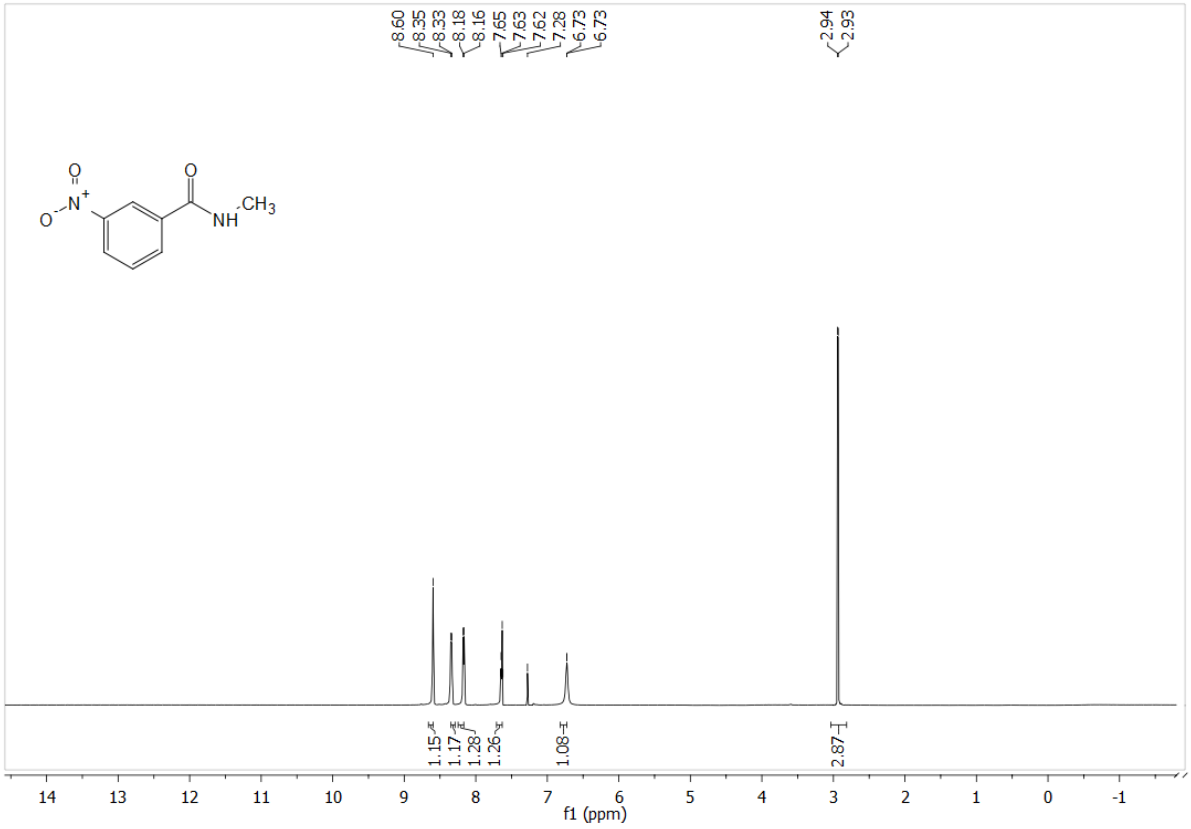


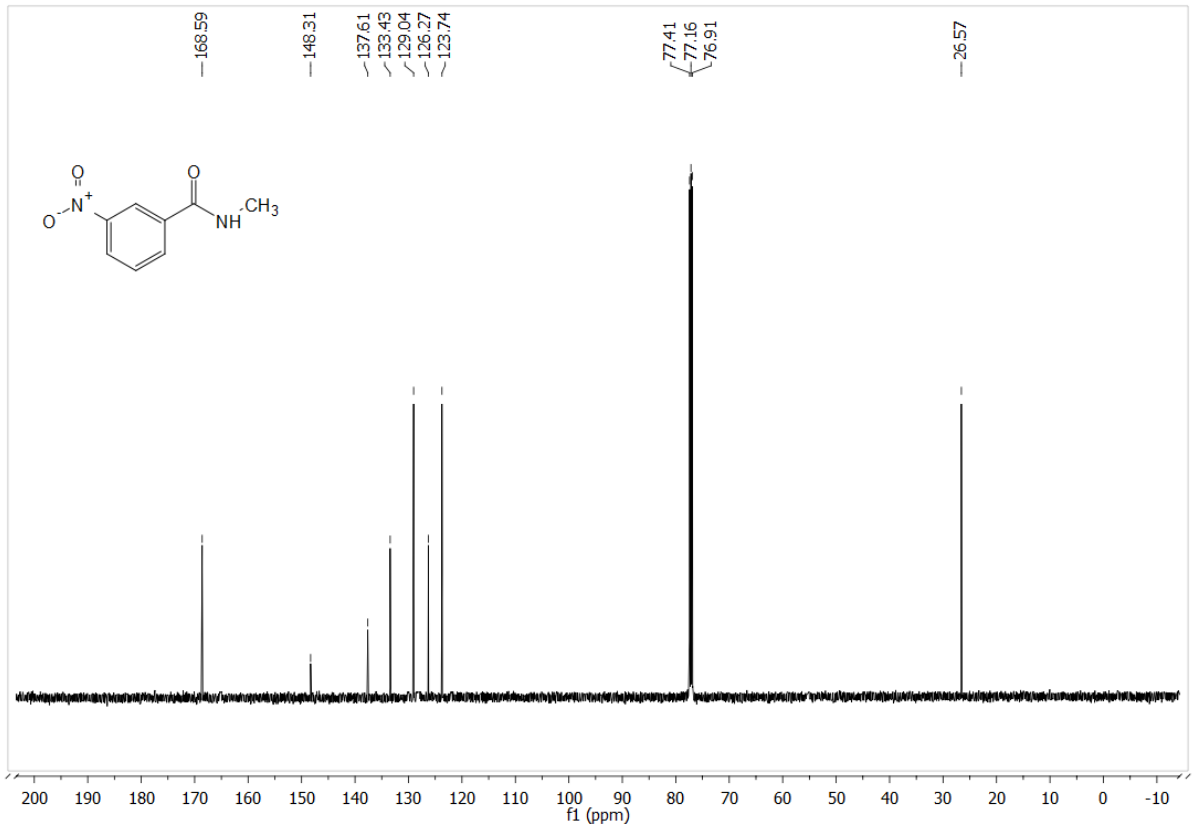
^{1}H and ^{13}C NMR Spectra of (2-chlorophenyl)(morpholino)methanone (5c)



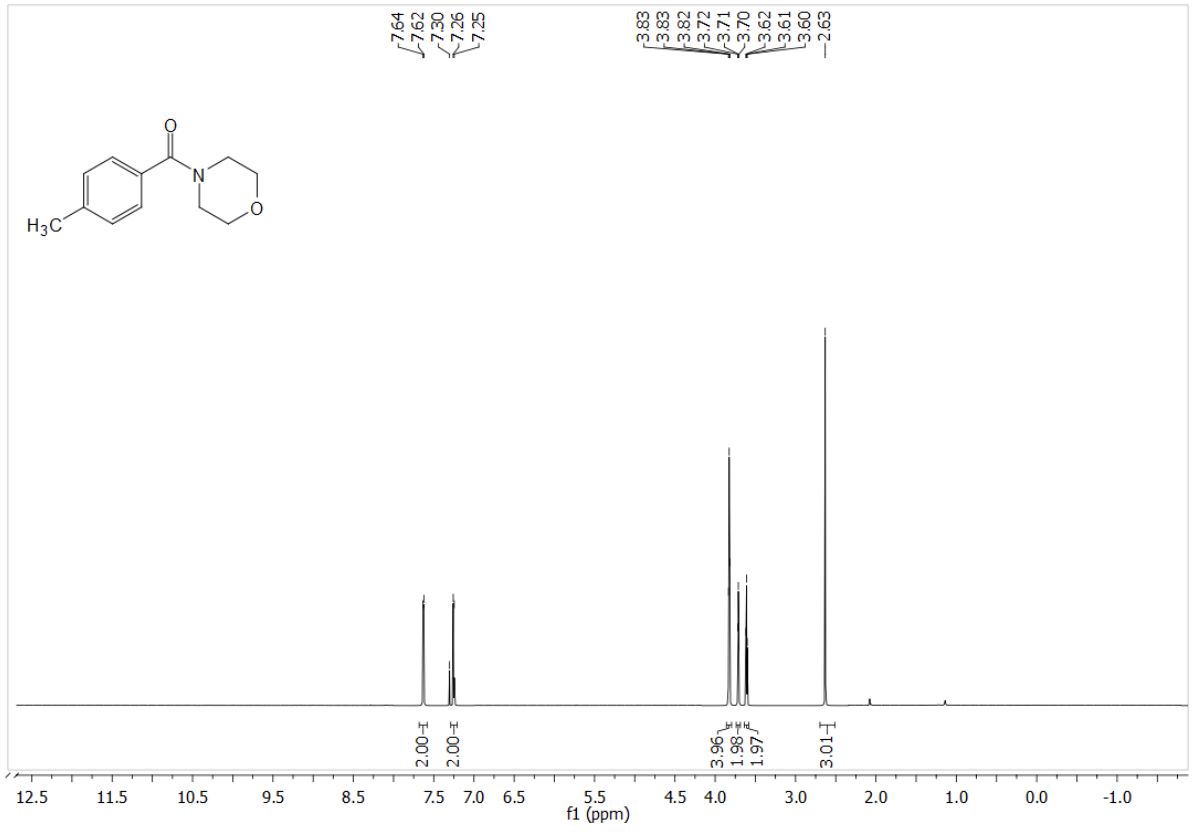


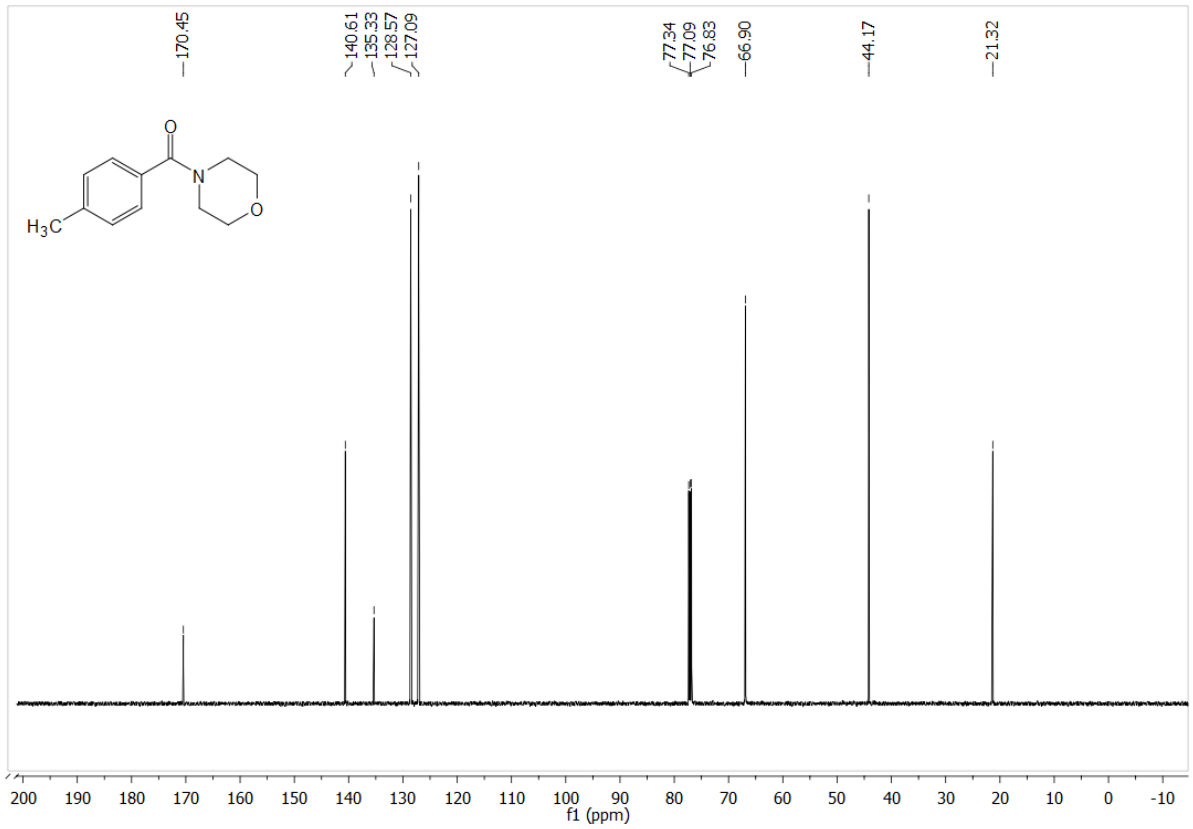
^{1}H and ^{13}C NMR Spectra of *N*-methyl-3-nitrobenzamide (5d)



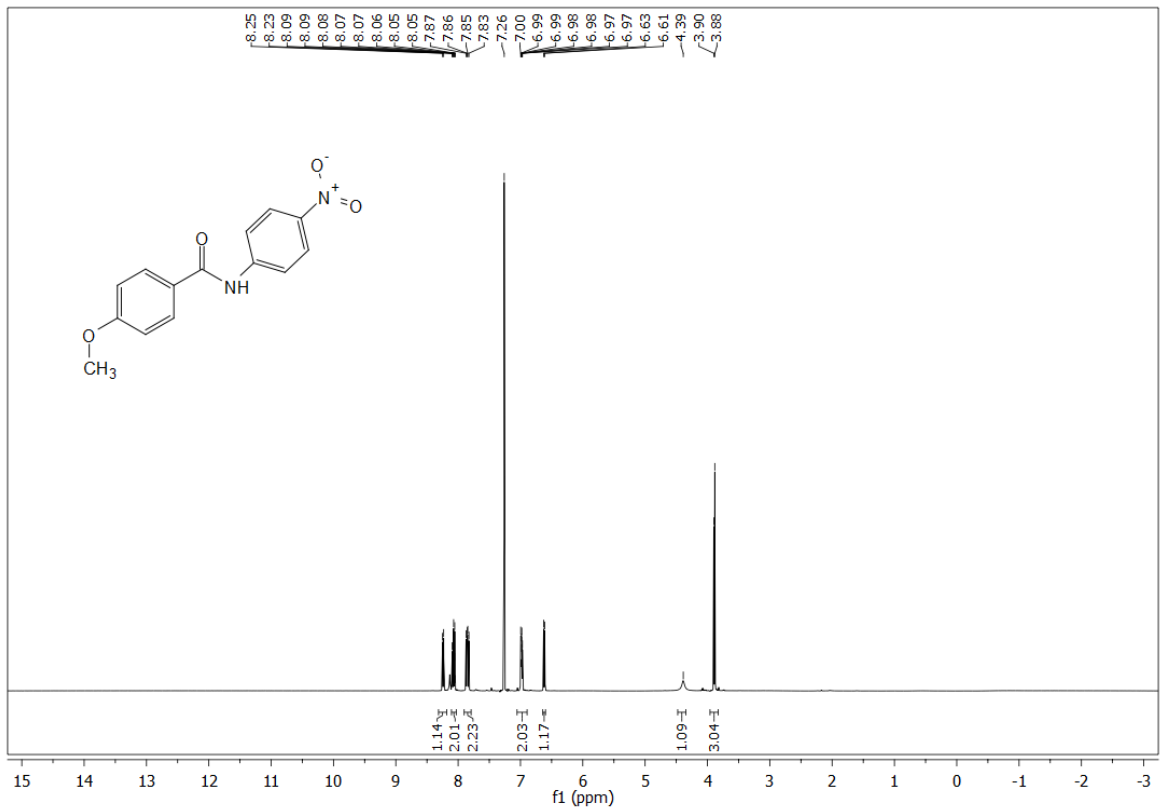


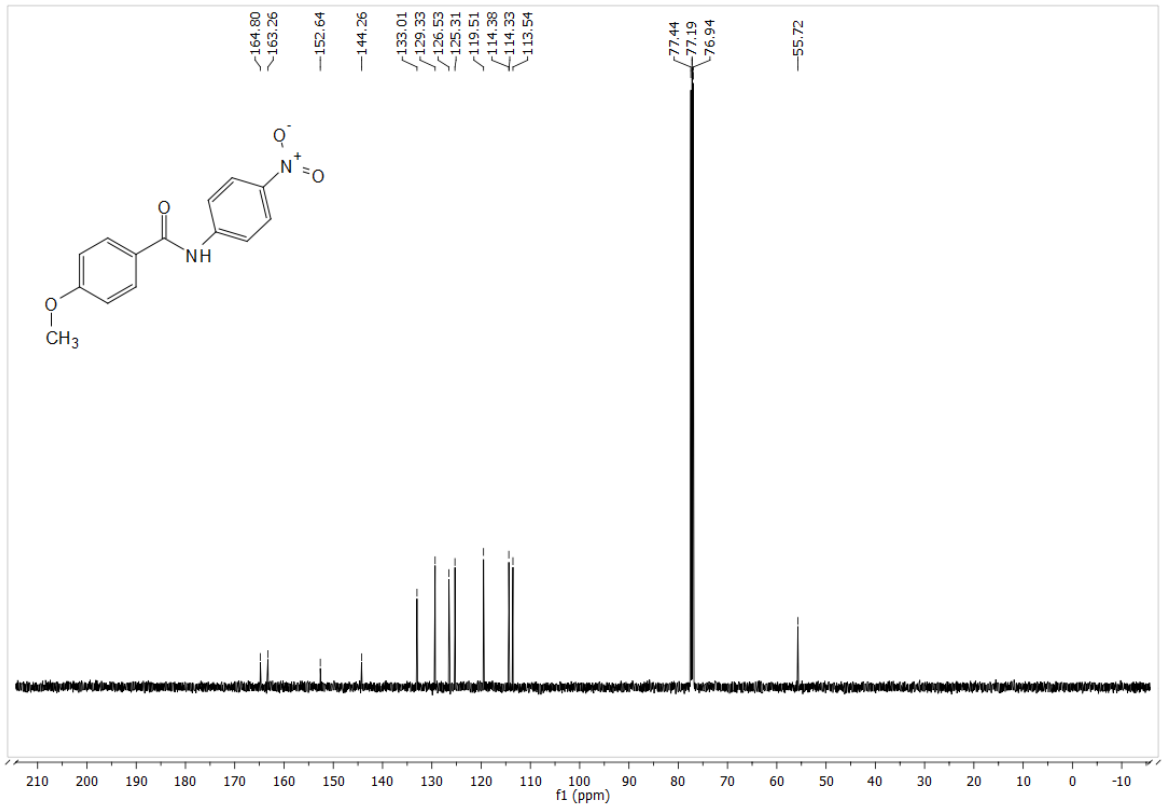
^{1}H and ^{13}C NMR Spectra of morpholino(p-tolyl)methanone (5e)



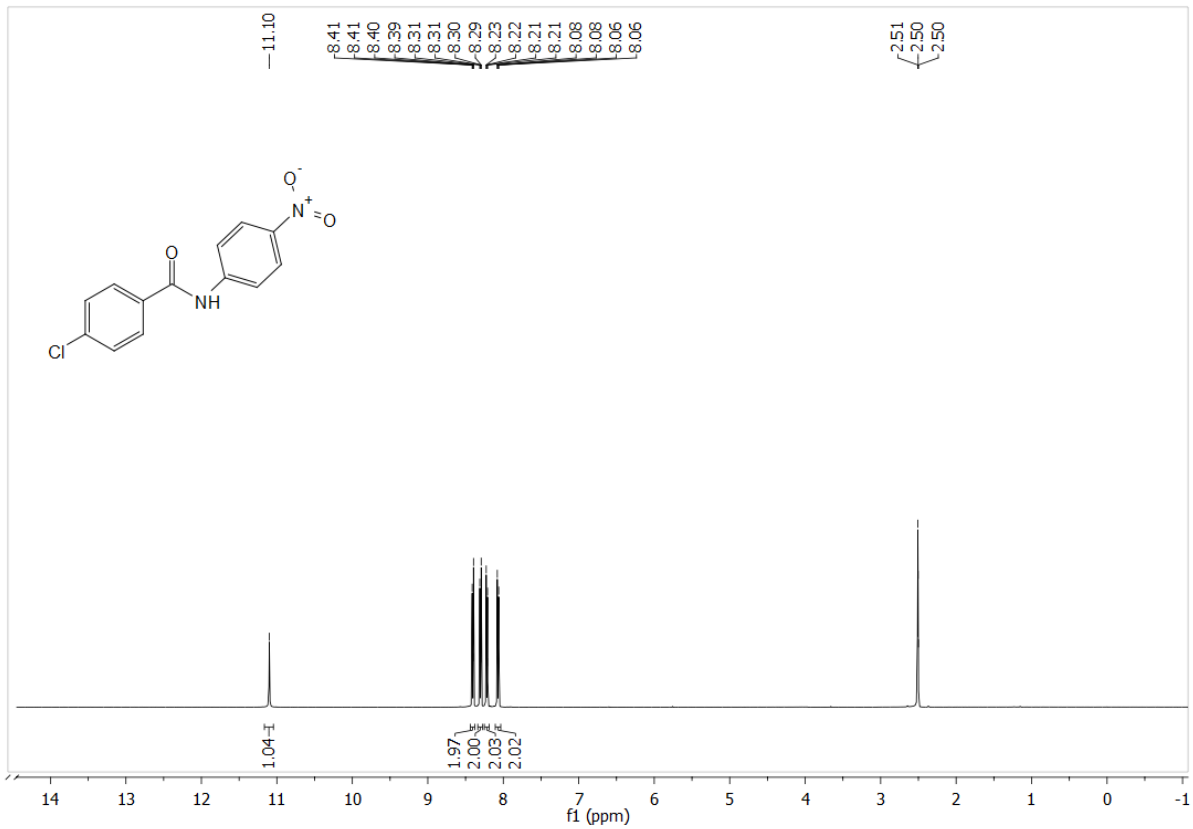


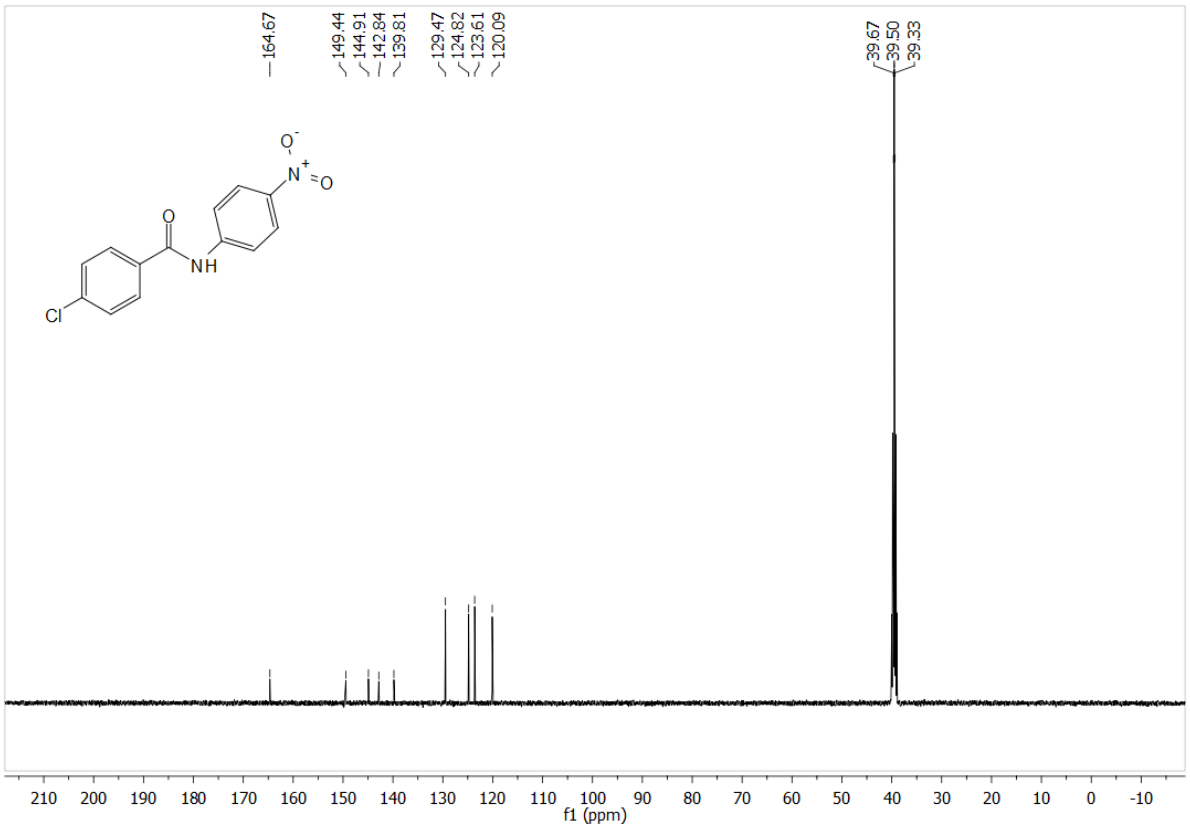
^{1}H and ^{13}C NMR Spectra of 4-methoxy-*N*-(4-nitrophenyl)-benzamide (5f)



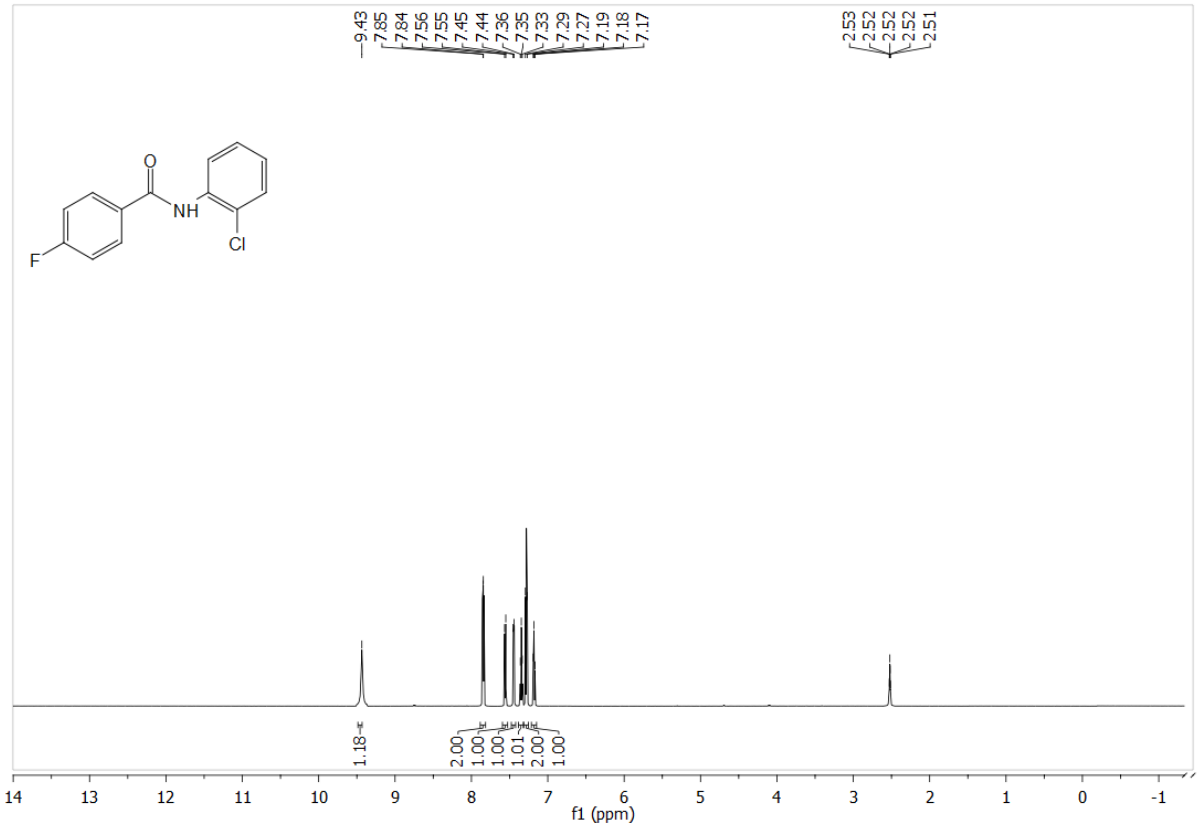


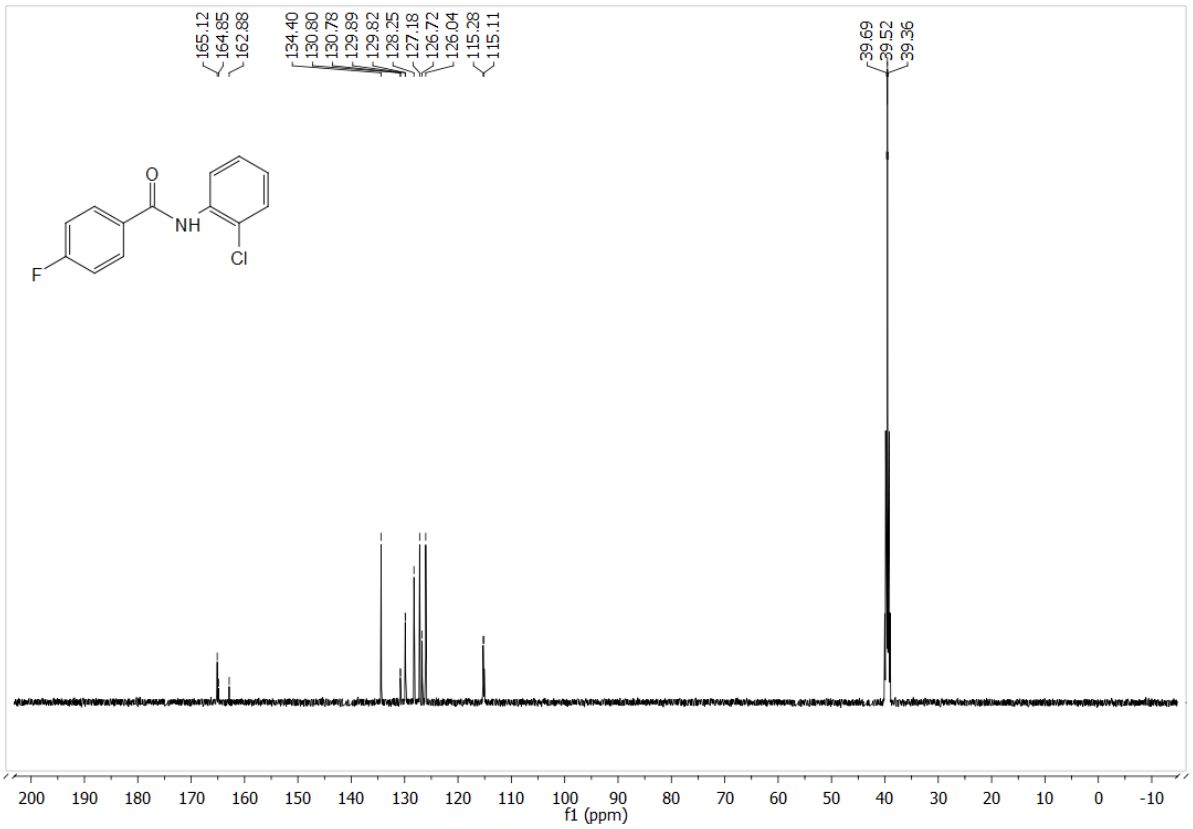
^{1}H and ^{13}C NMR Spectra of 4-chloro-*N*-(4-nitrophenyl)-benzamide (5g)



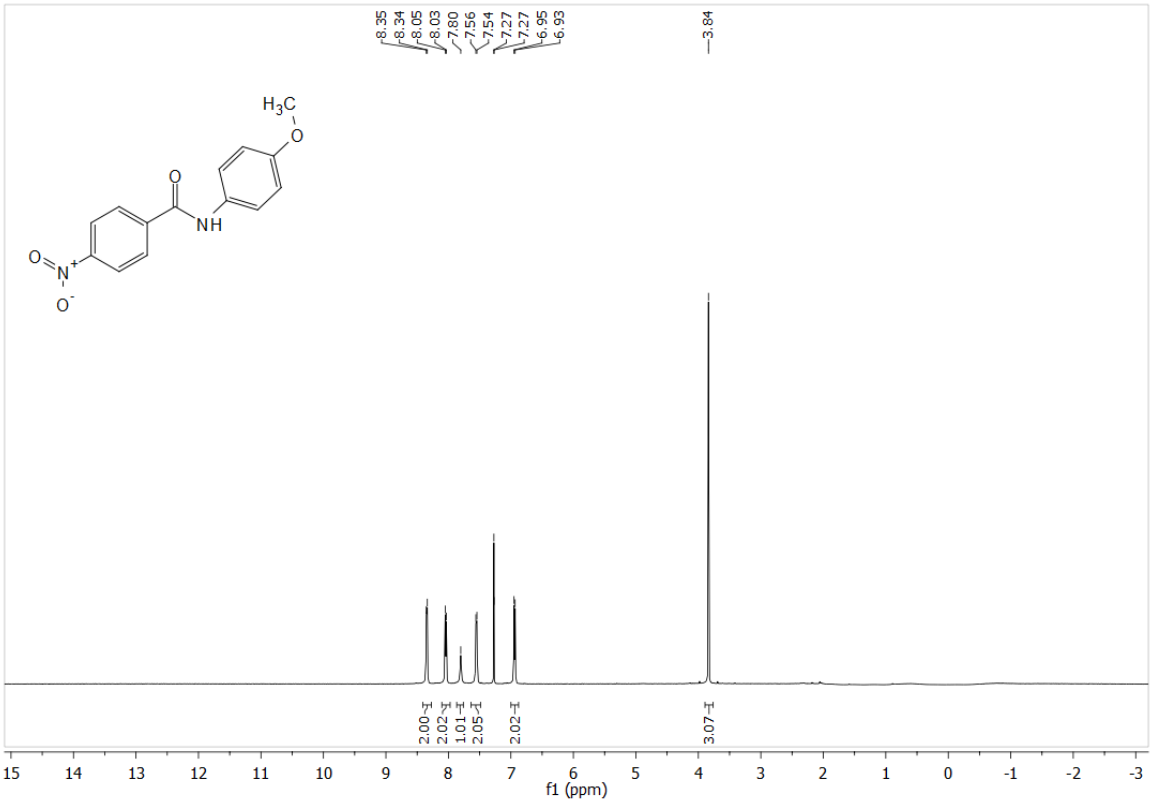


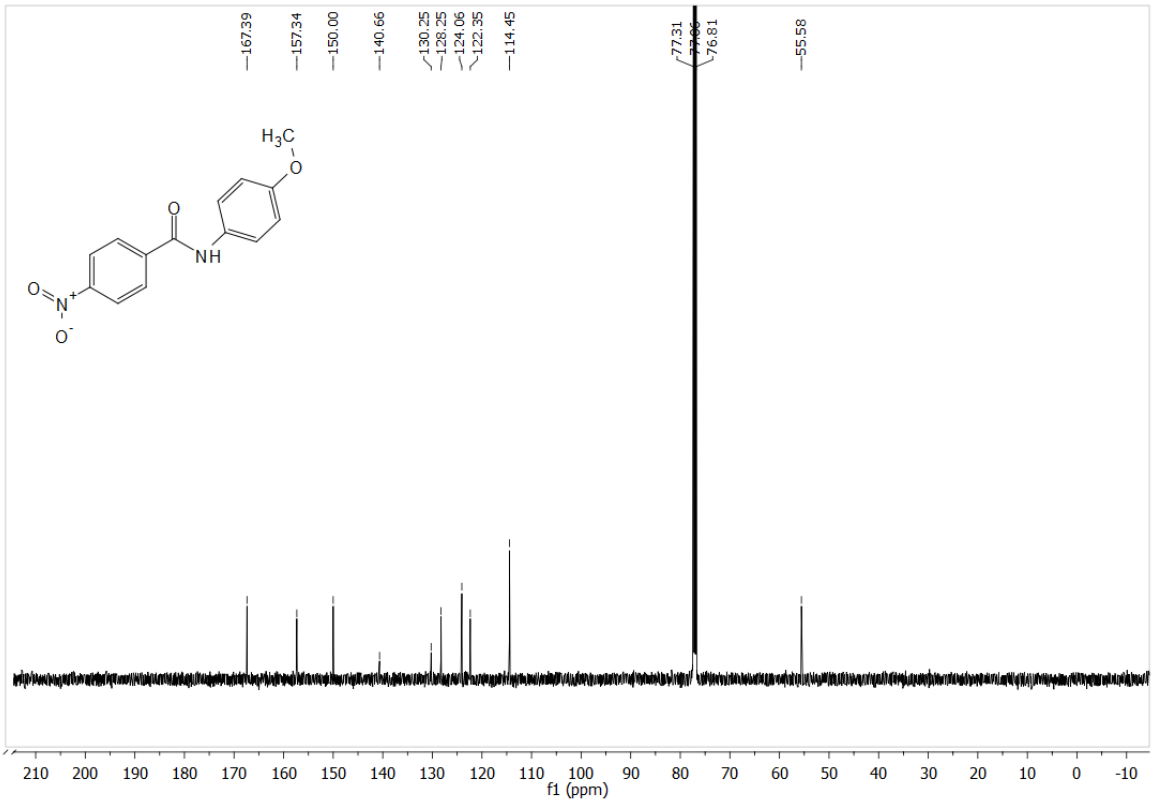
^{1}H and ^{13}C NMR Spectra of 4-fluro-*N*-(2-chlorophenyl)-benzamide (5h)



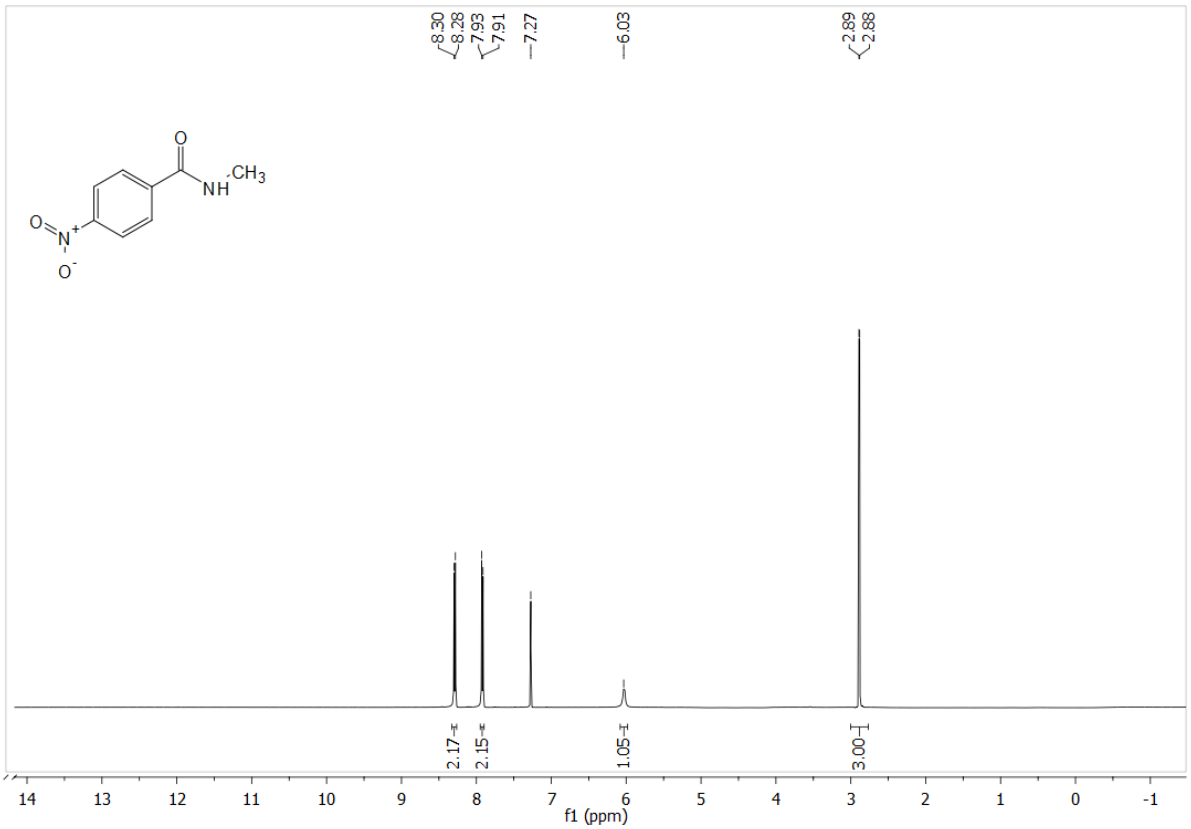


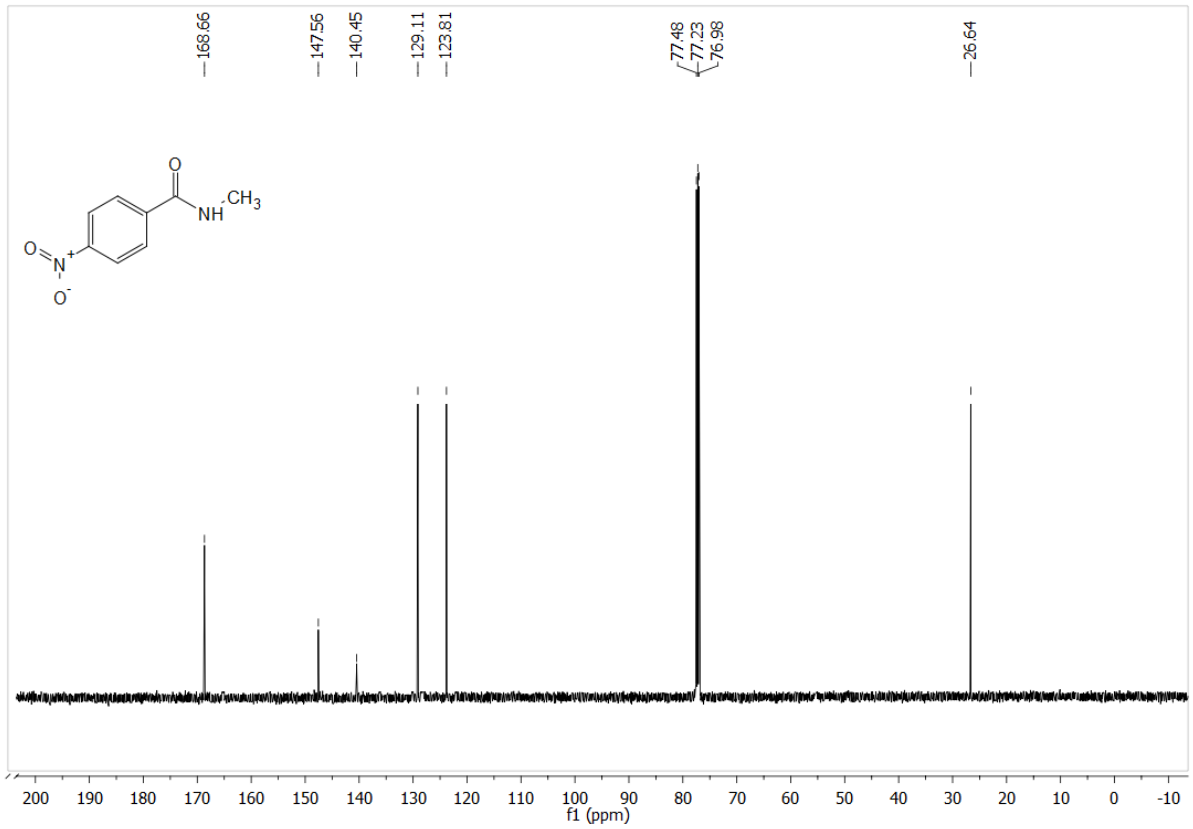
^{1}H and ^{13}C NMR Spectra of 4-nitro-*N*-(4-methoxyphenyl)-benzamide (5i)



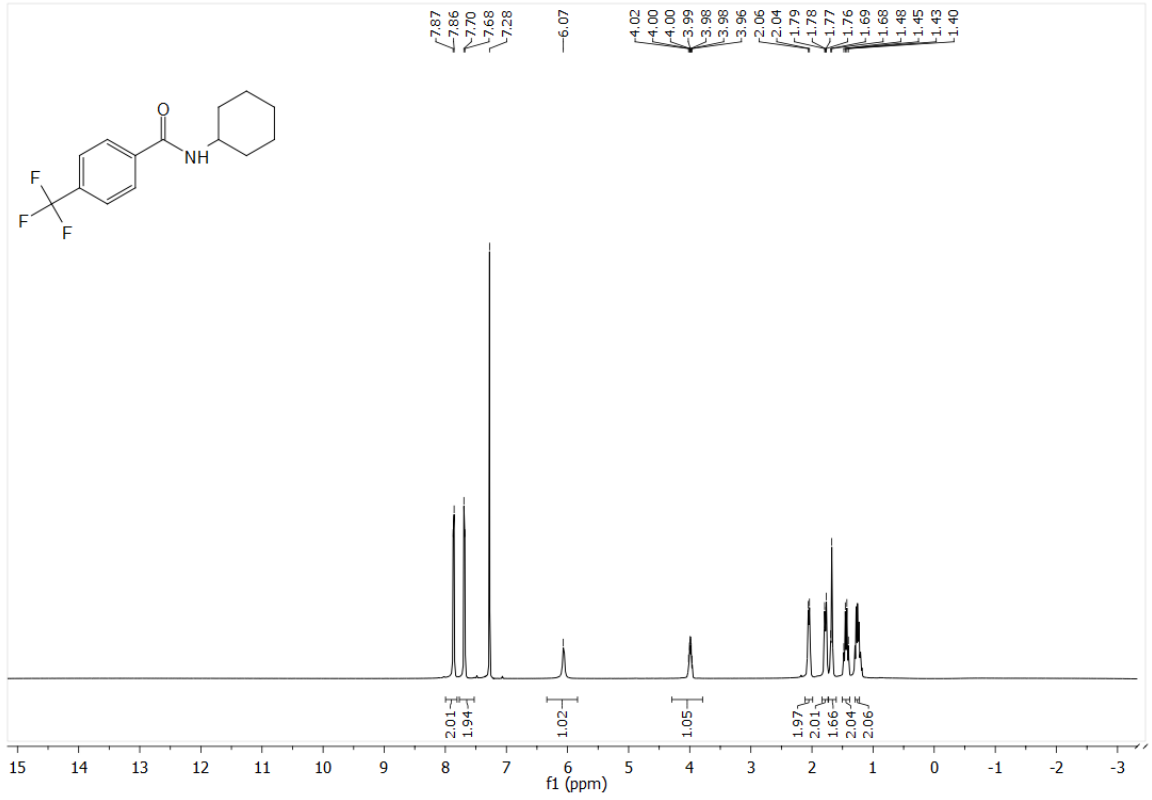


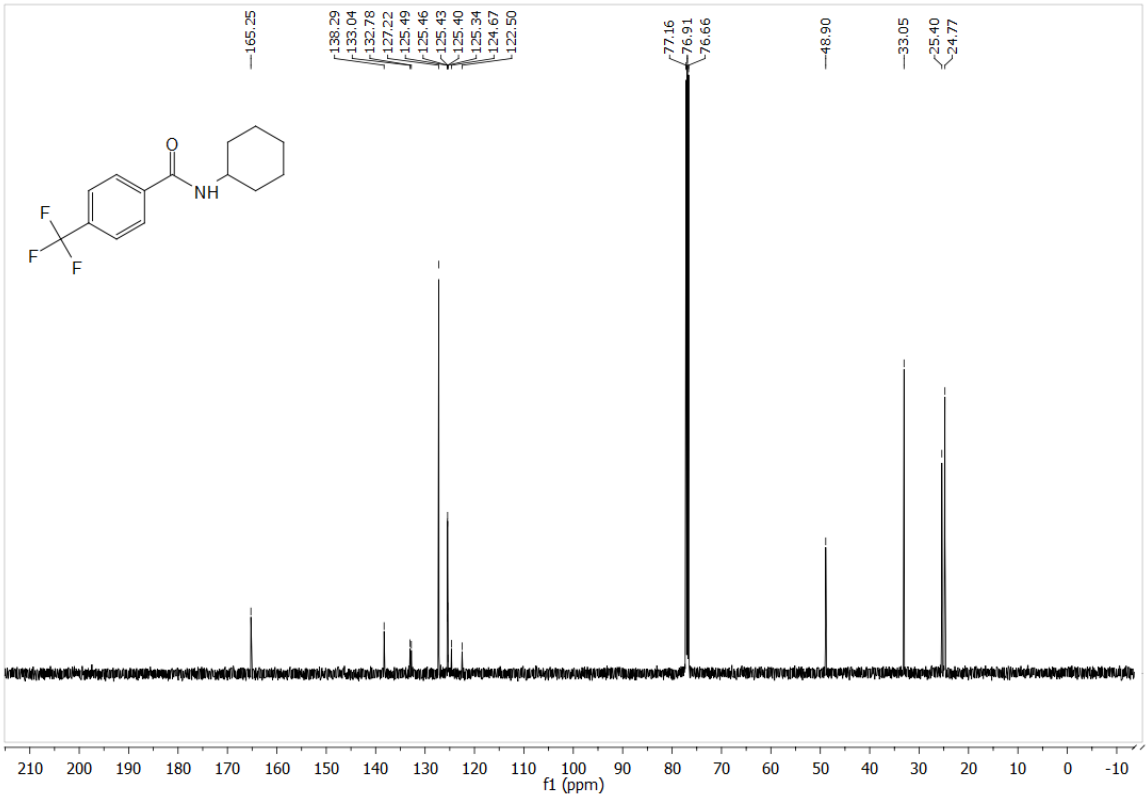
^{1}H and ^{13}C NMR Spectra of *N*-methyl-4-nitrobenzamide (5j)



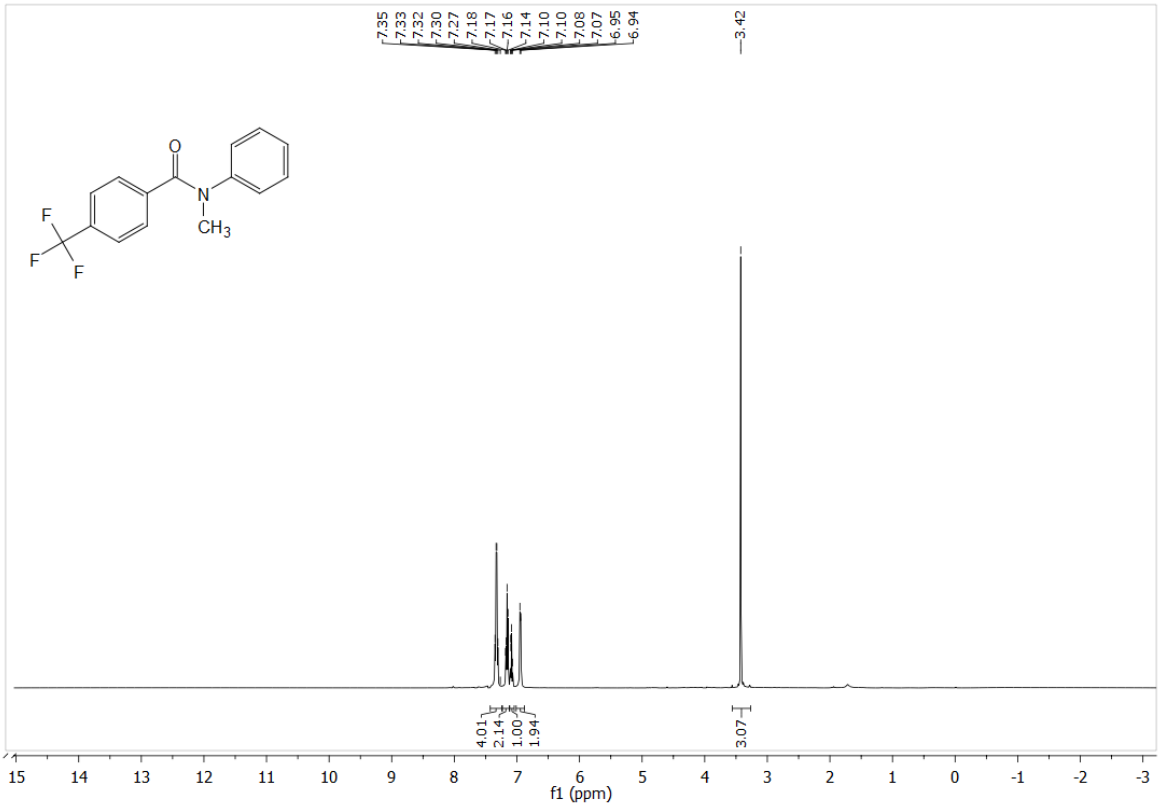


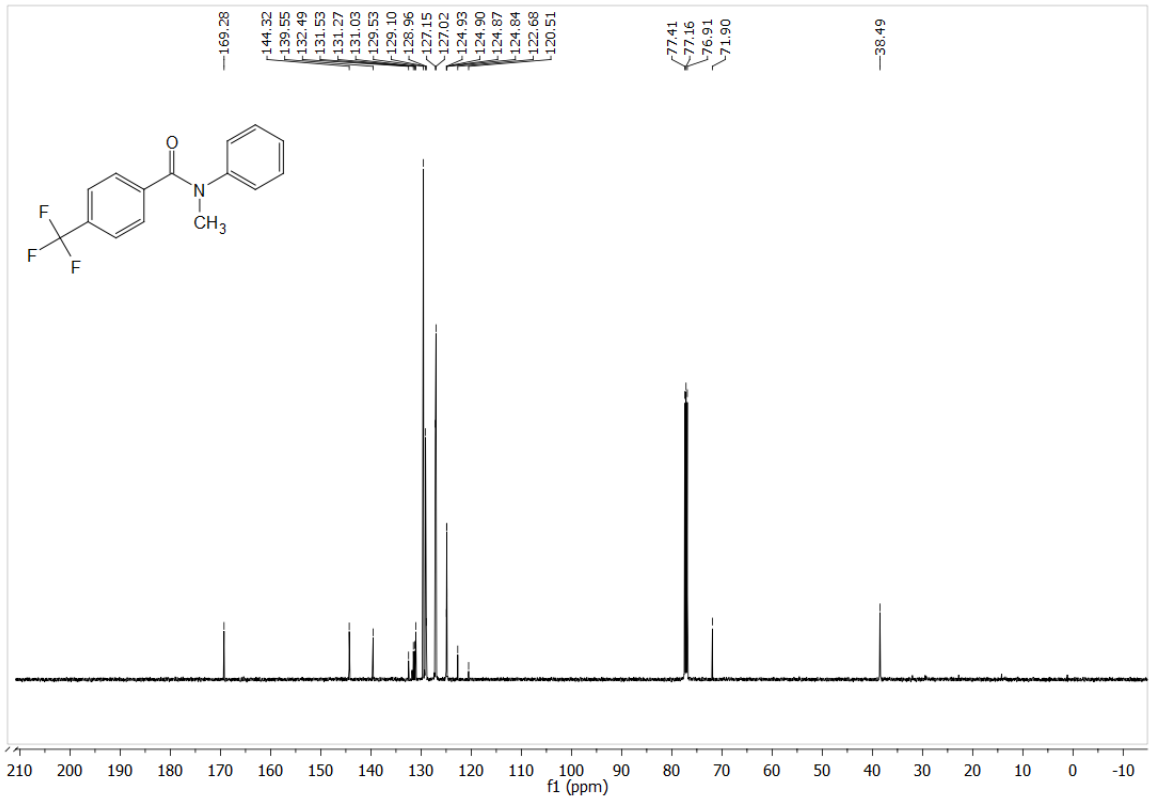
^{1}H and ^{13}C NMR Spectra of *N*-cyclohexyl-4-(trifluoromethyl)-benzamide (5k)



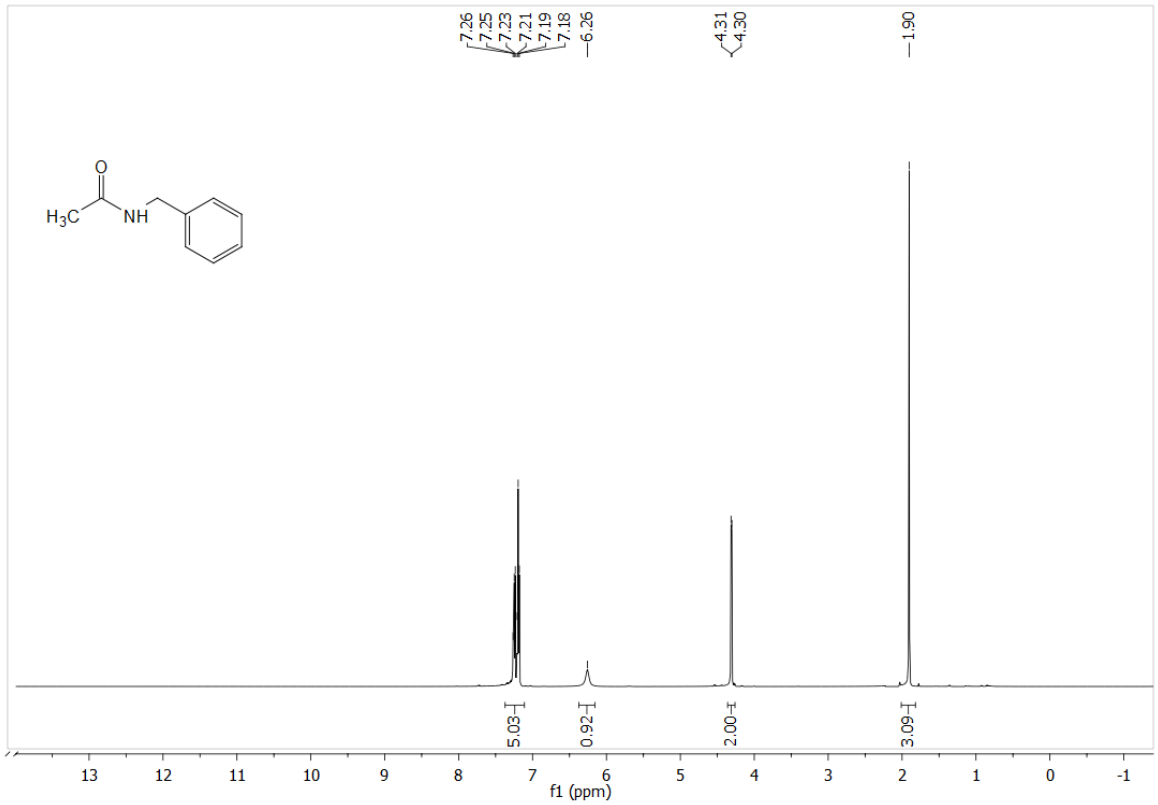


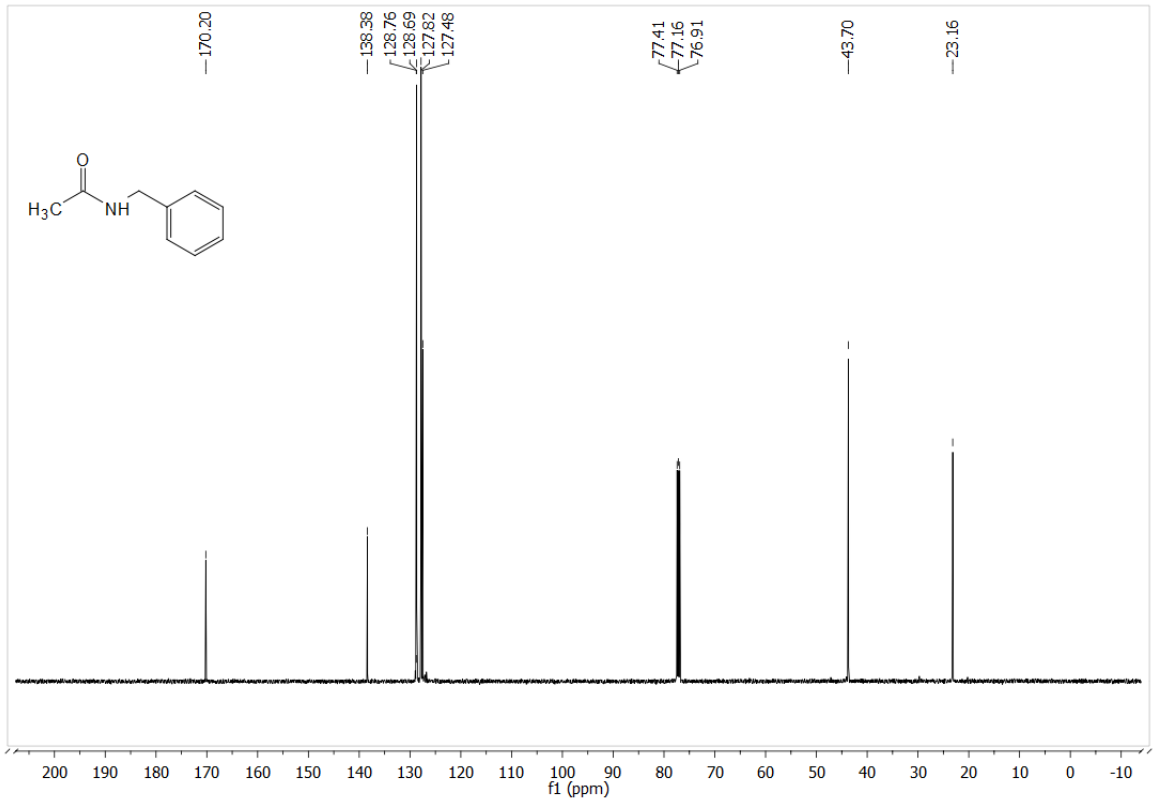
^{1}H and ^{13}C NMR Spectra of *N*-methyl-*N*-phenyl-4-(trifluoromethyl)-benzamide (5l)



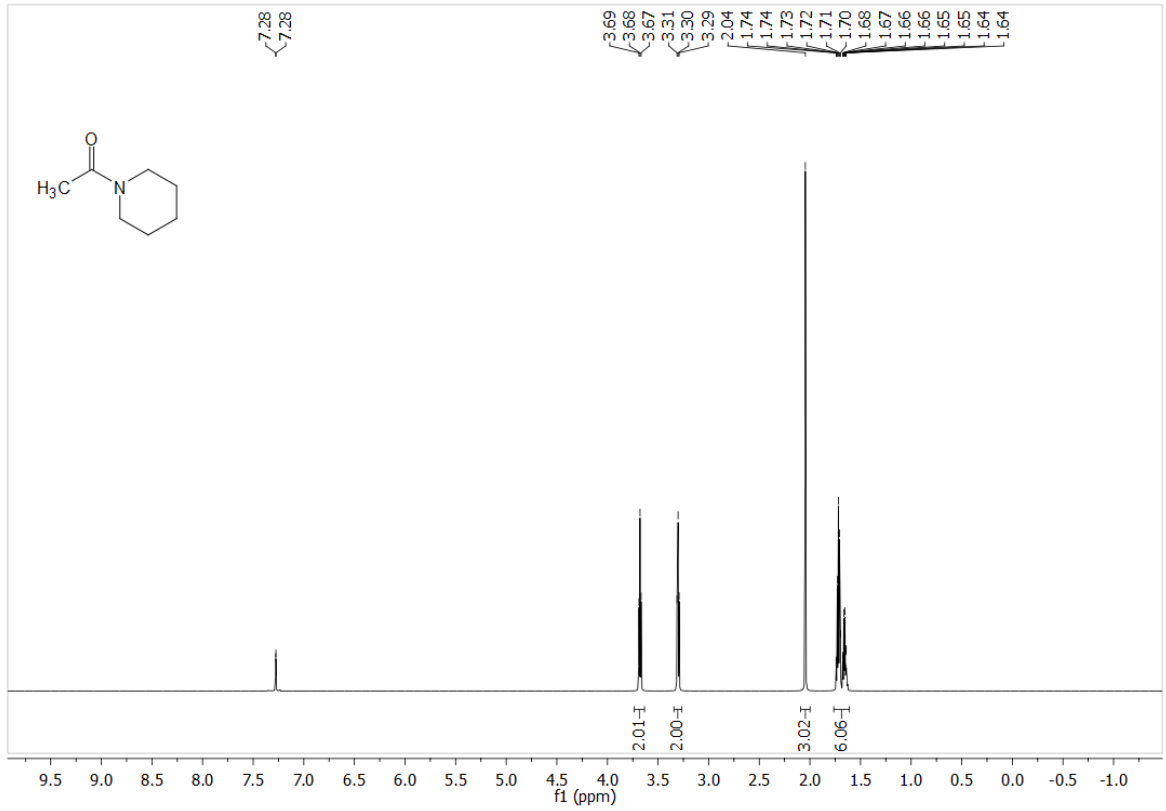


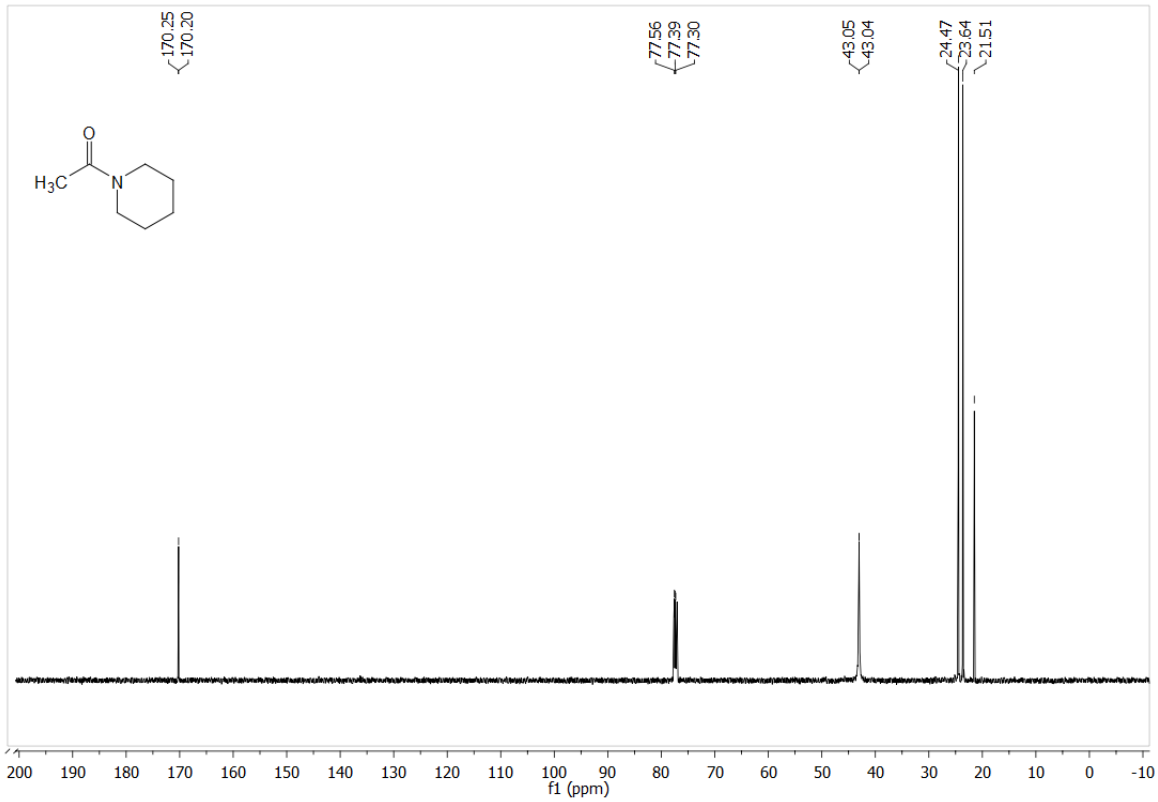
^{1}H and ^{13}C NMR Spectra of ^{1}H and ^{13}C NMR Spectra of *N*-benzylacetamide (6a)



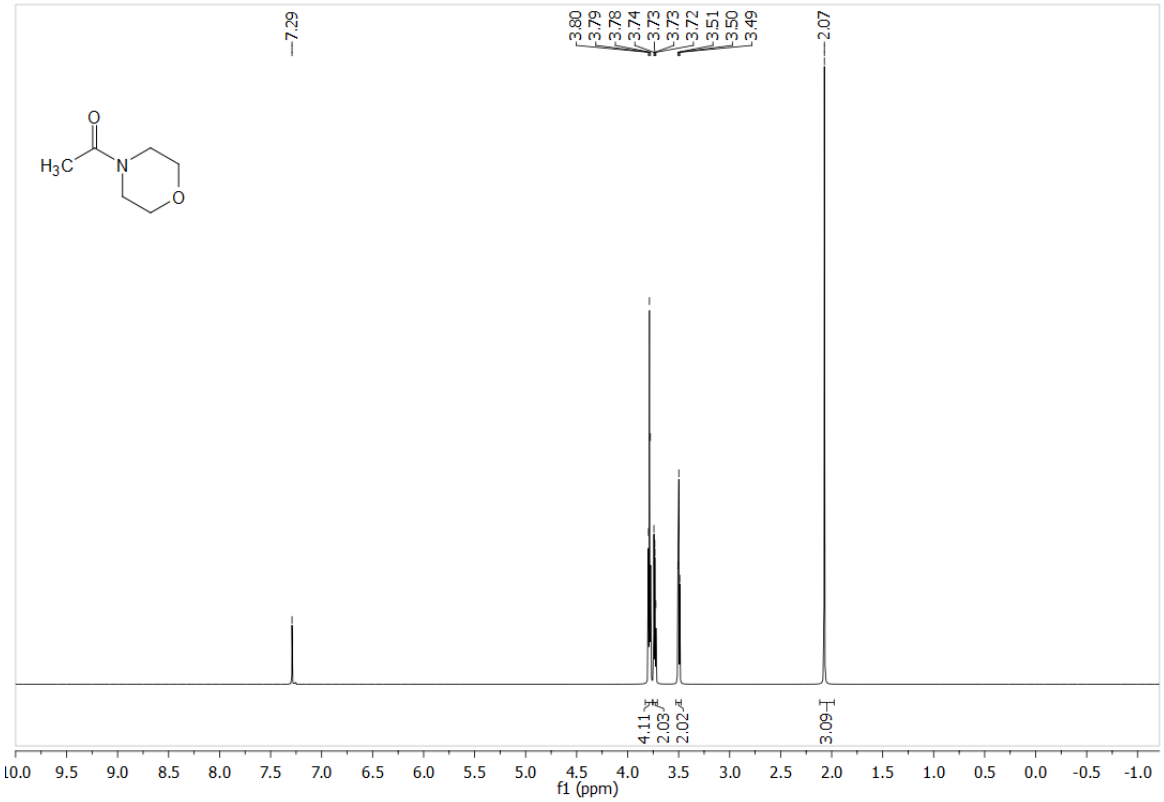


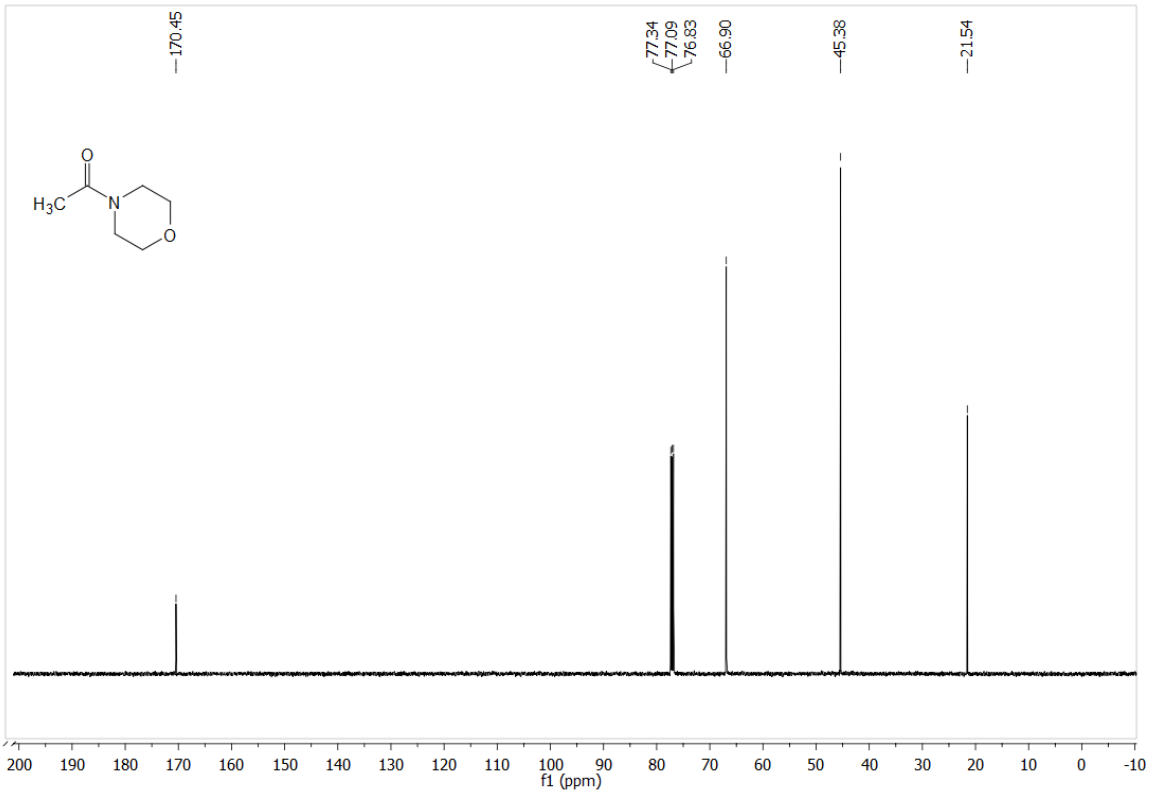
^{1}H and ^{13}C NMR Spectra of 1-(piperidin-1-yl)-ethan-1-one (6b)



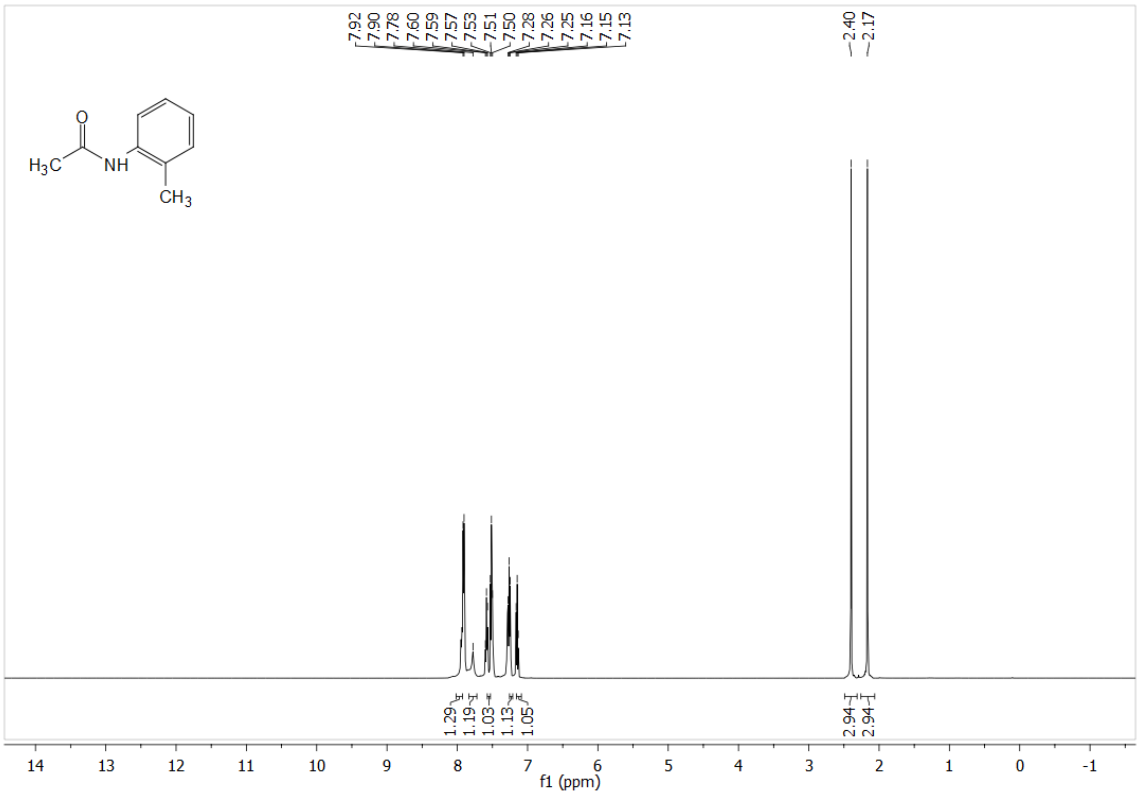


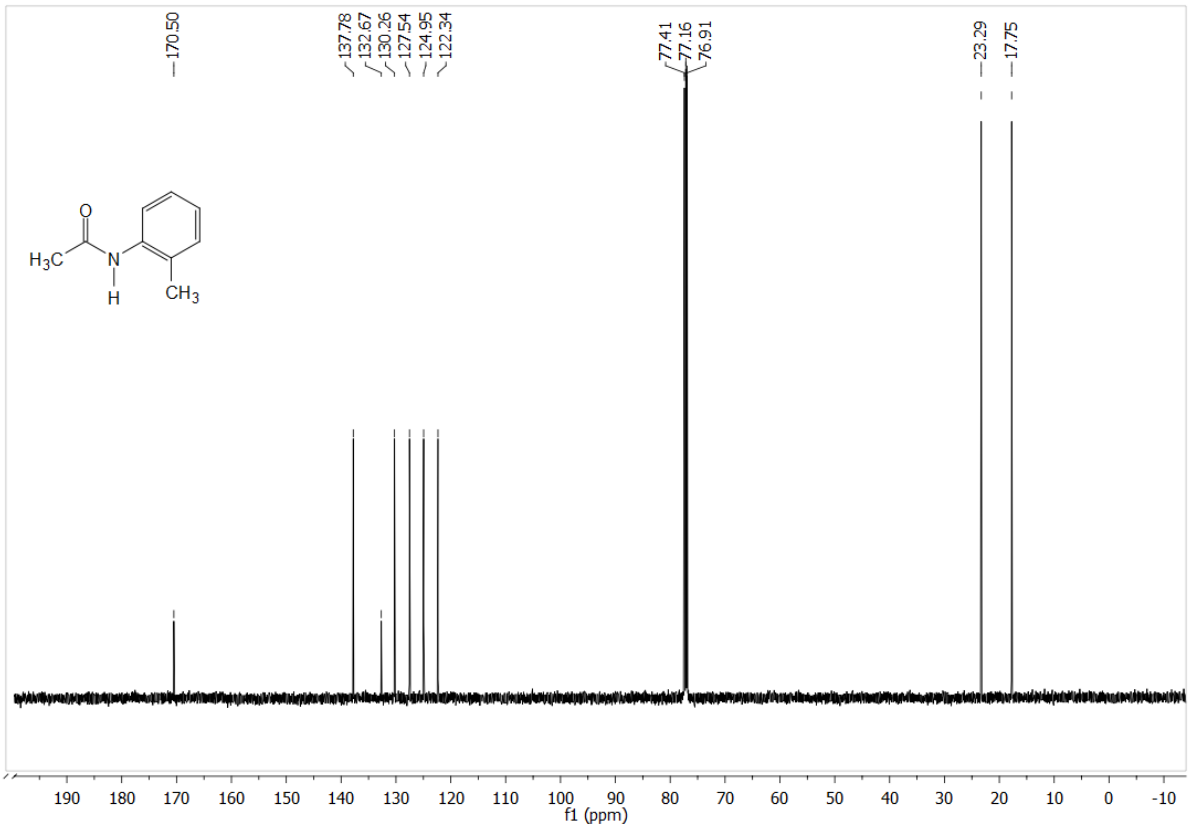
^{1}H and ^{13}C NMR Spectra of 1-morpholinoethan-1-one (6c)



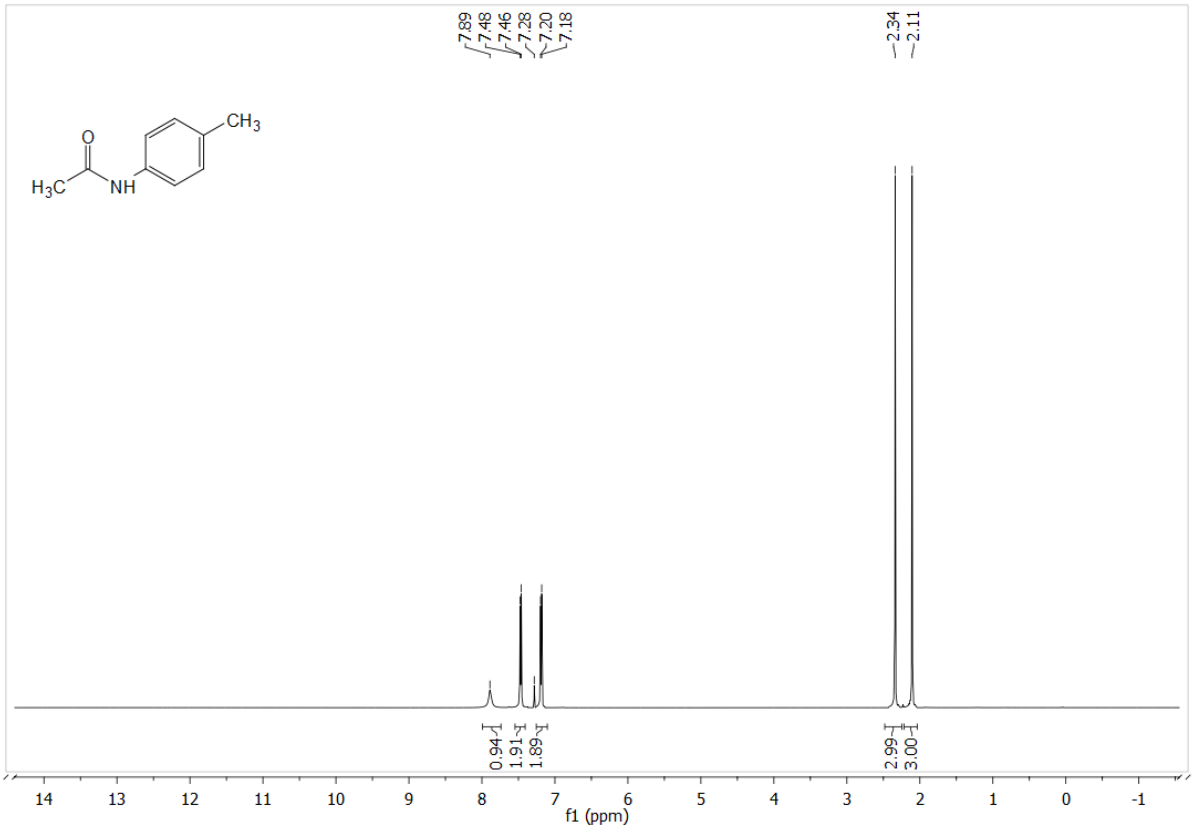


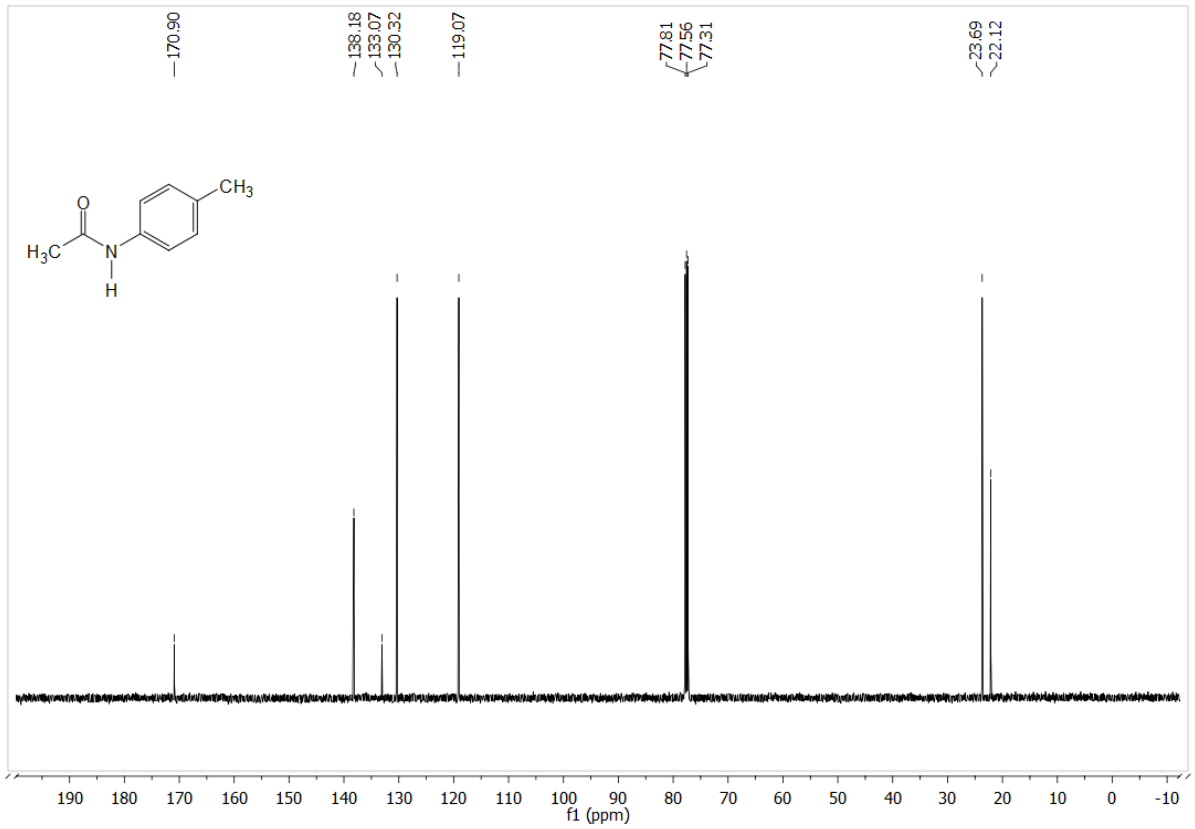
^{1}H and ^{13}C NMR Spectra of *N*-(2-methylphenyl)-acetamide (6d)



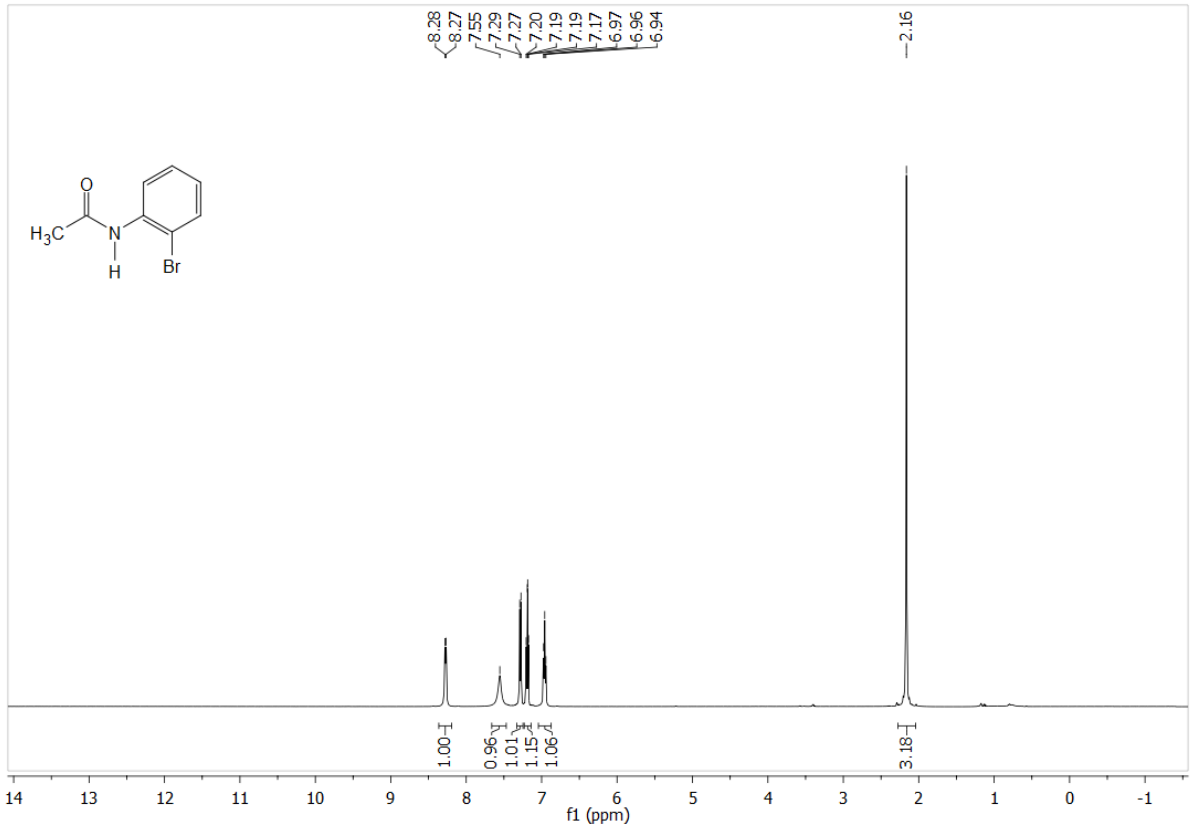


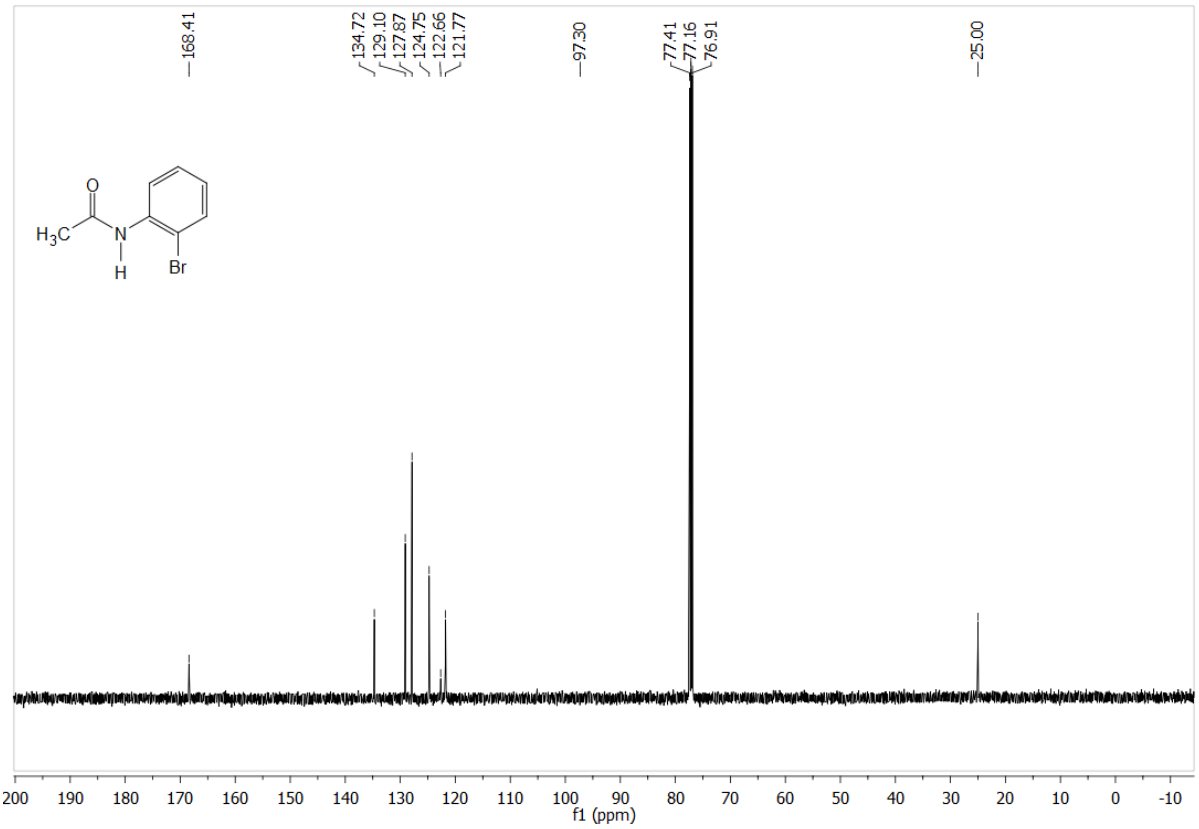
^{1}H and ^{13}C NMR Spectra of *N*-(4-methylphenyl)-acetamide (6e)



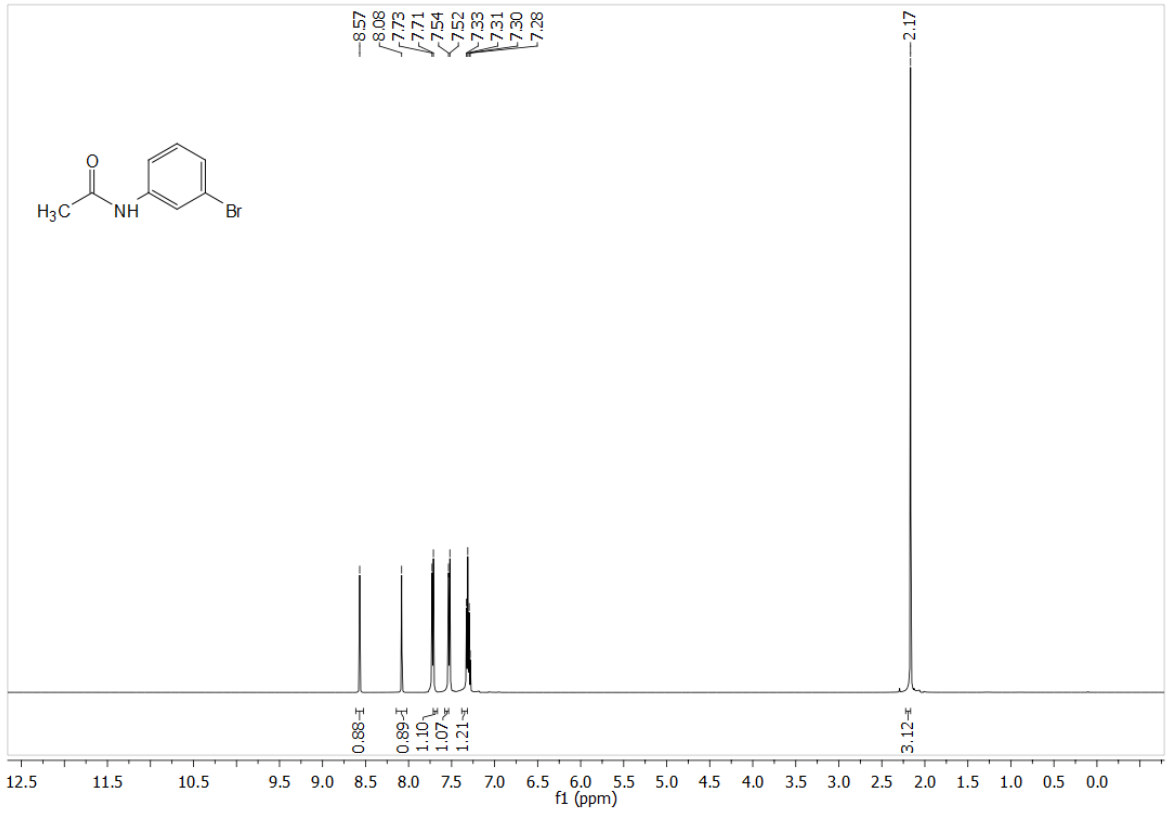


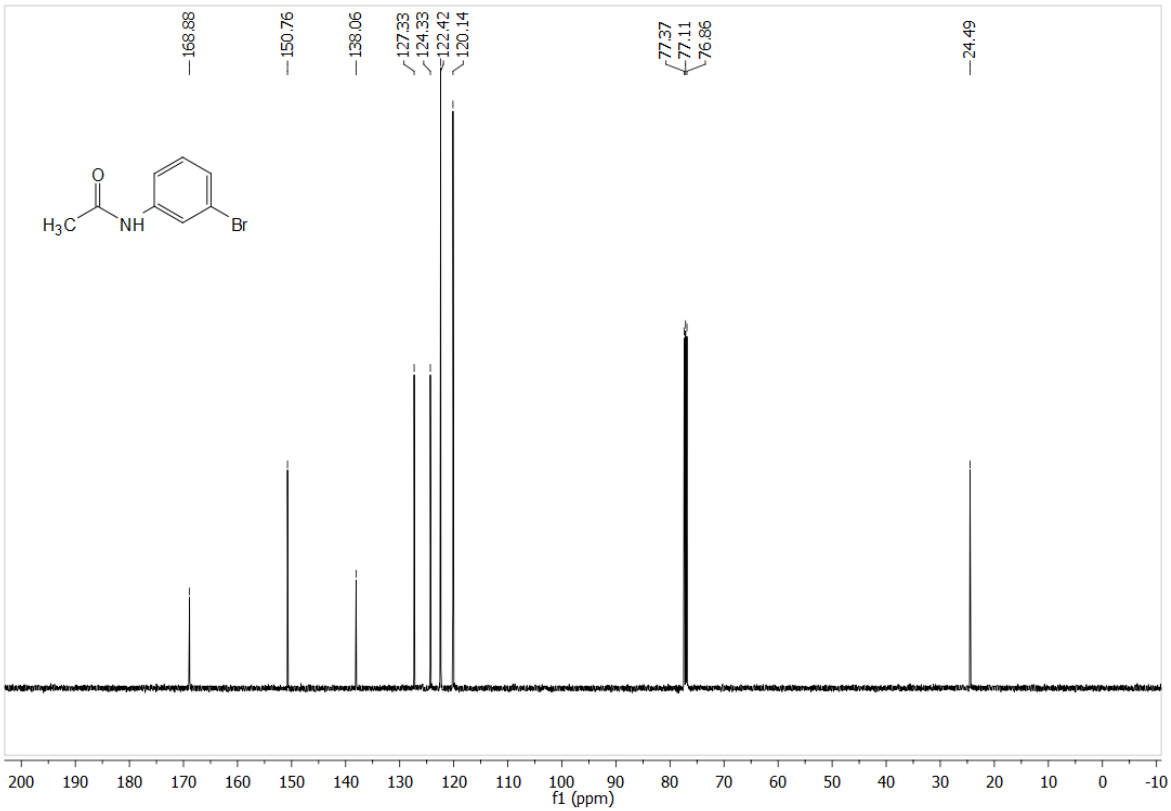
^{1}H and ^{13}C NMR Spectra of *N*-(2-bromophenyl)-acetamide (6f)



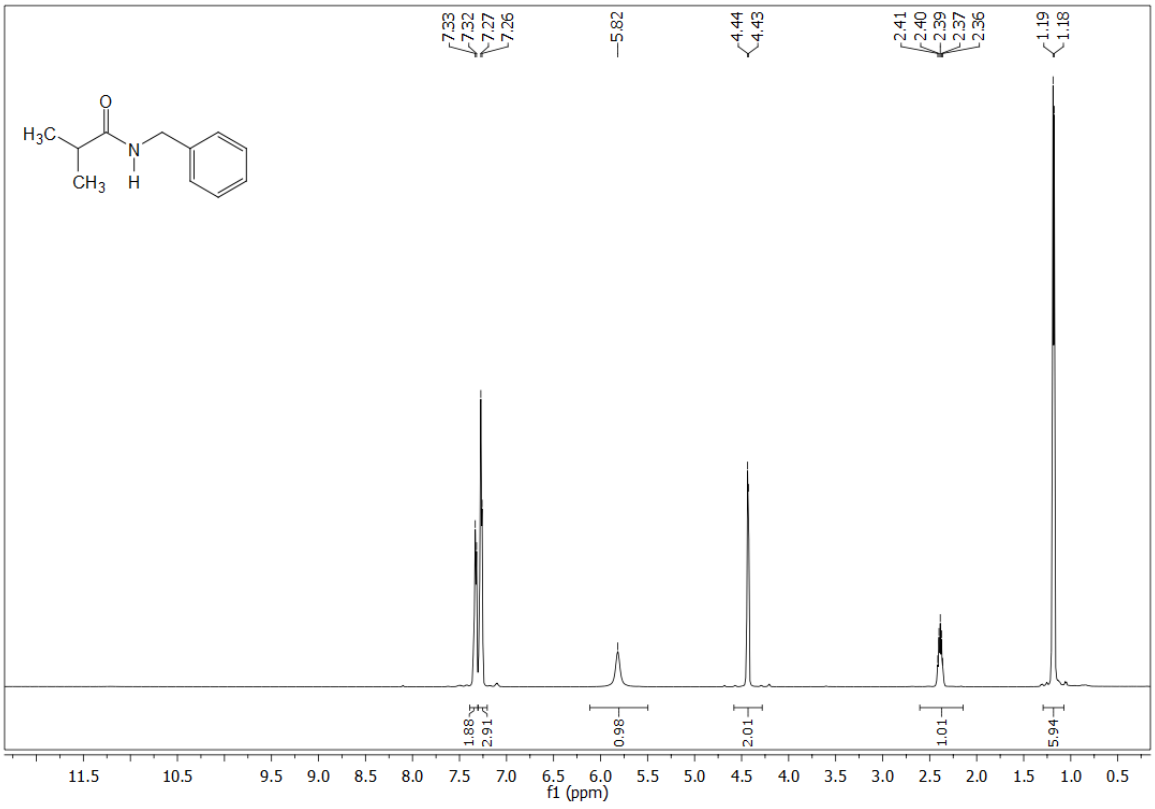


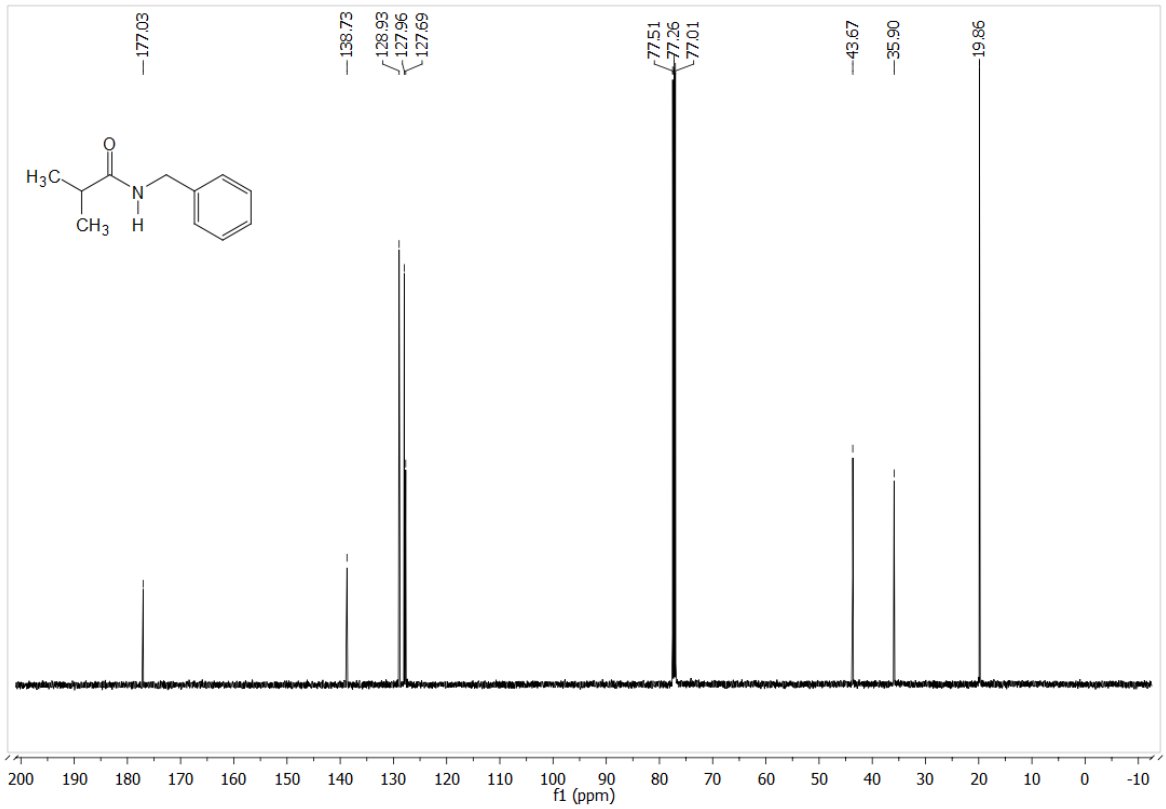
^{1}H and ^{13}C NMR Spectra of *N*-(3-bromophenyl)-acetamide (6g)



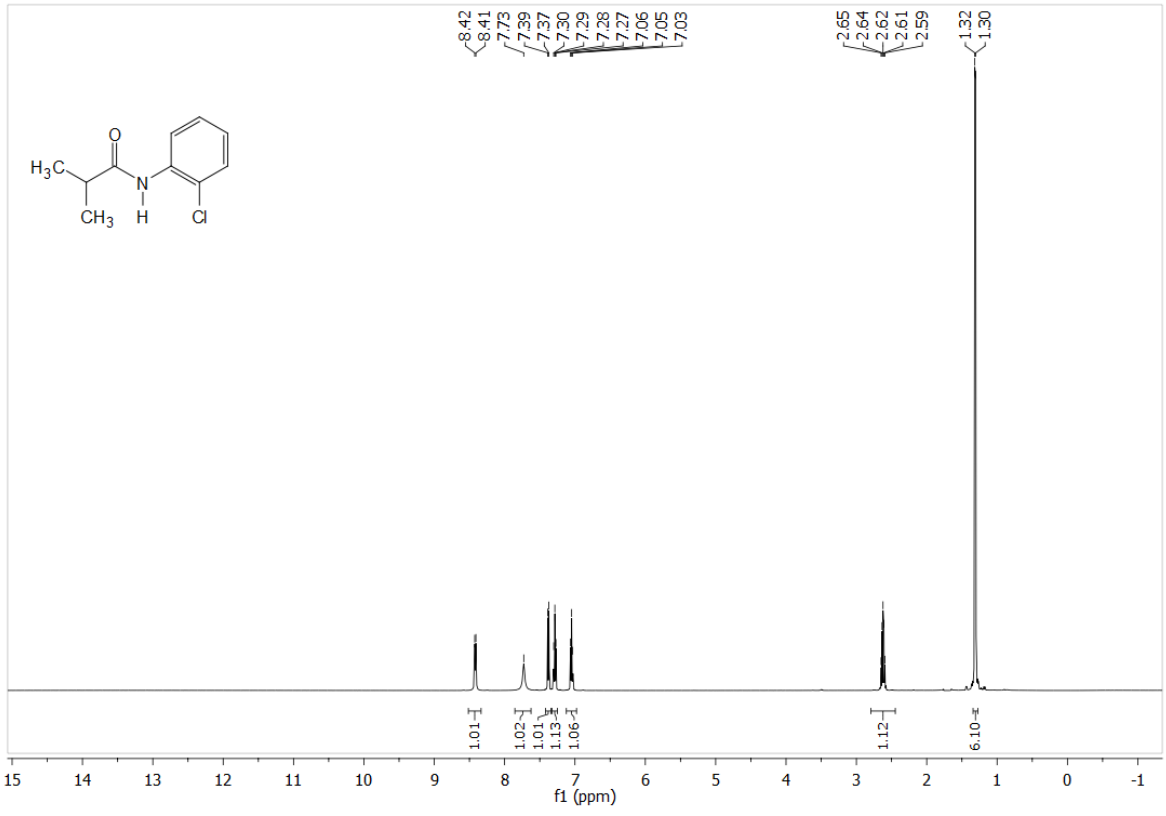


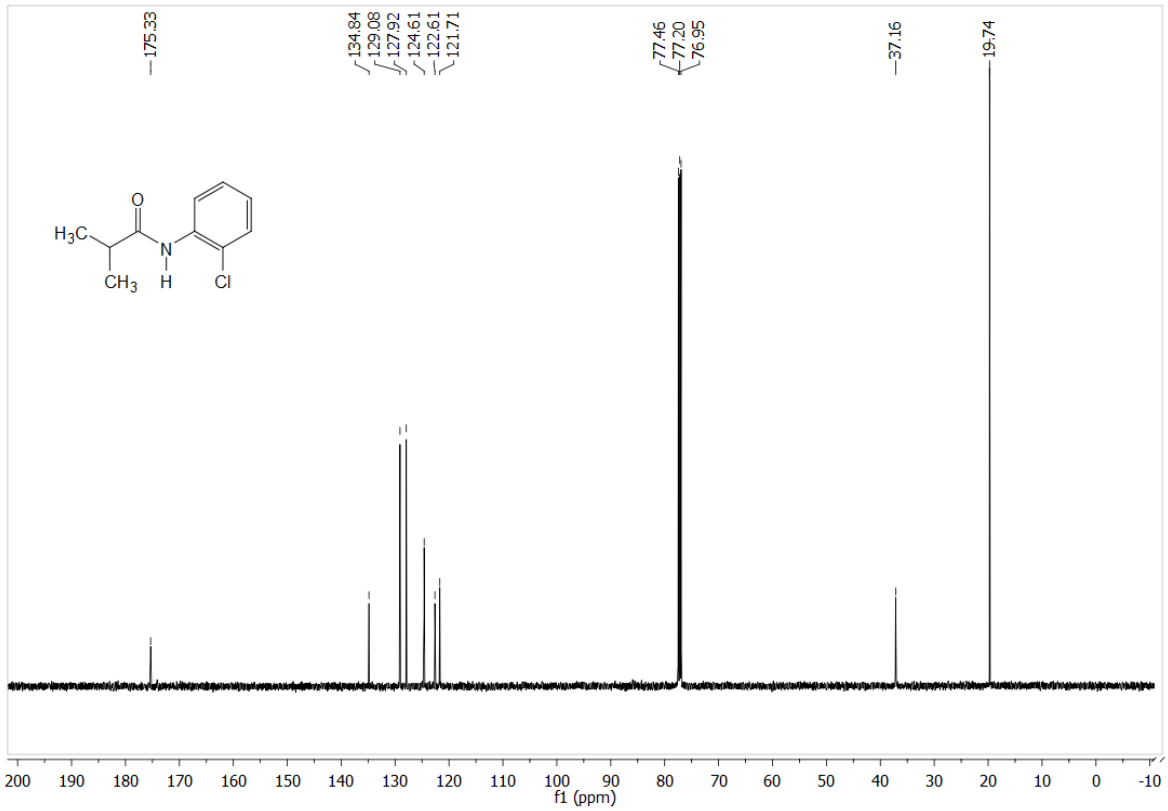
^{1}H and ^{13}C NMR Spectra of *N*-benzylisobutyramid*e* (6h)



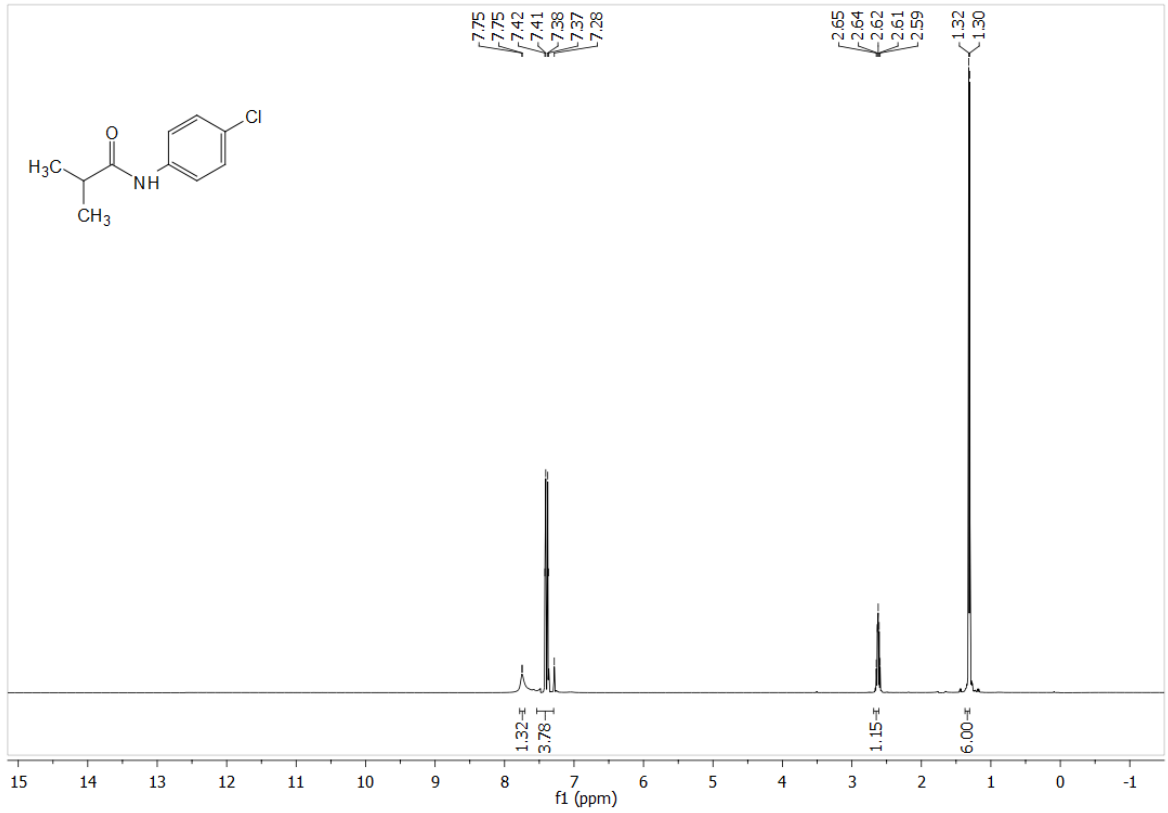


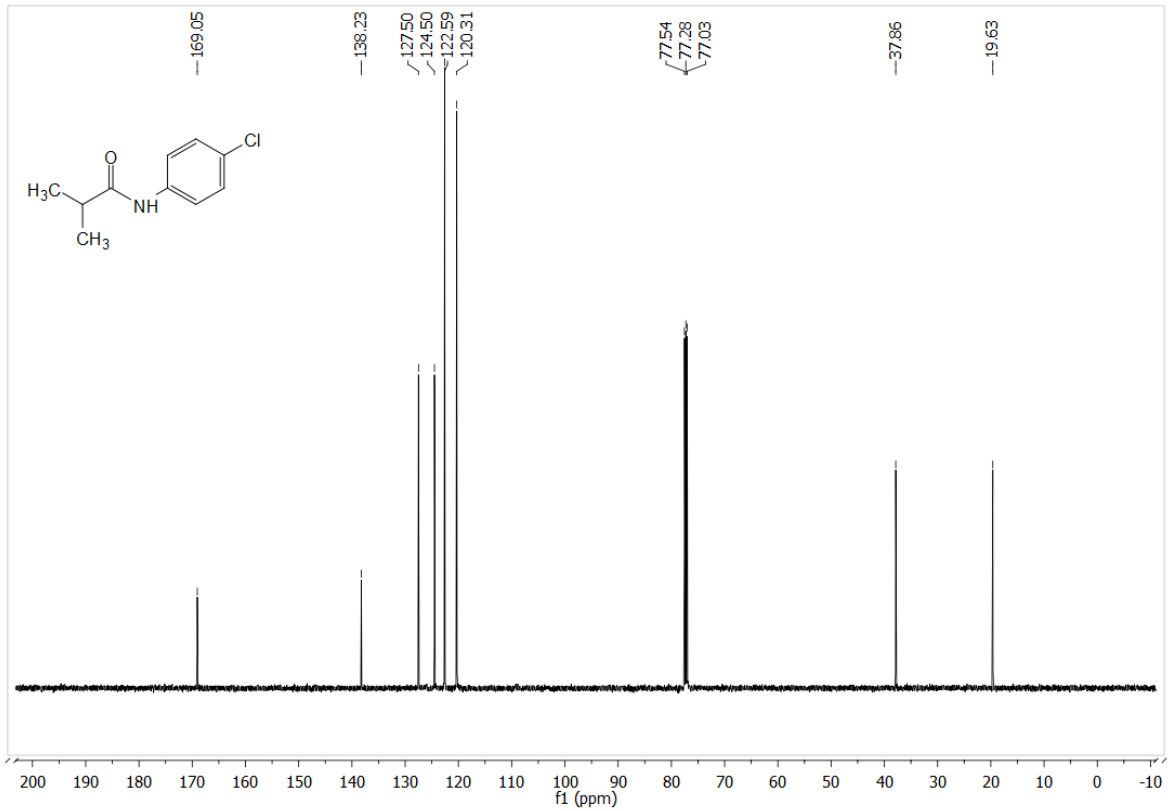
^{1}H and ^{13}C NMR Spectra of *N*-(2-chlorophenyl)-isobutyramide (6i)



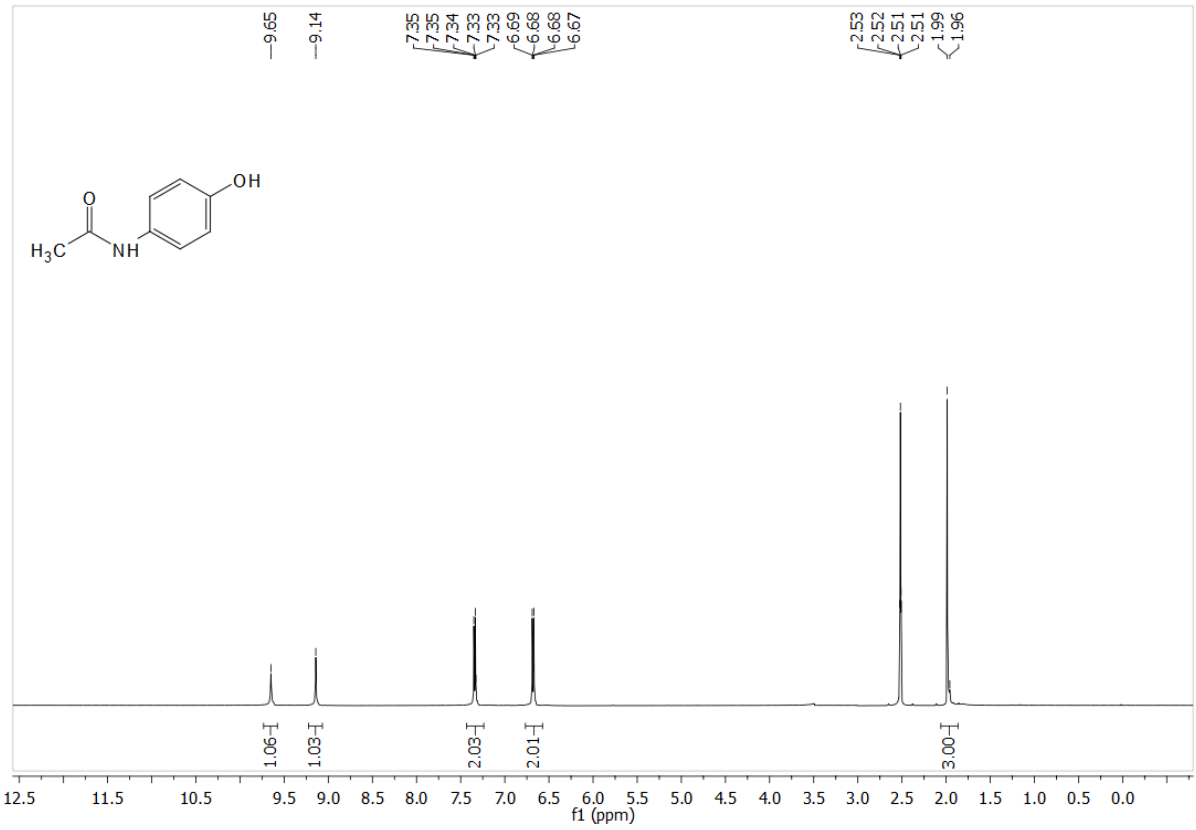


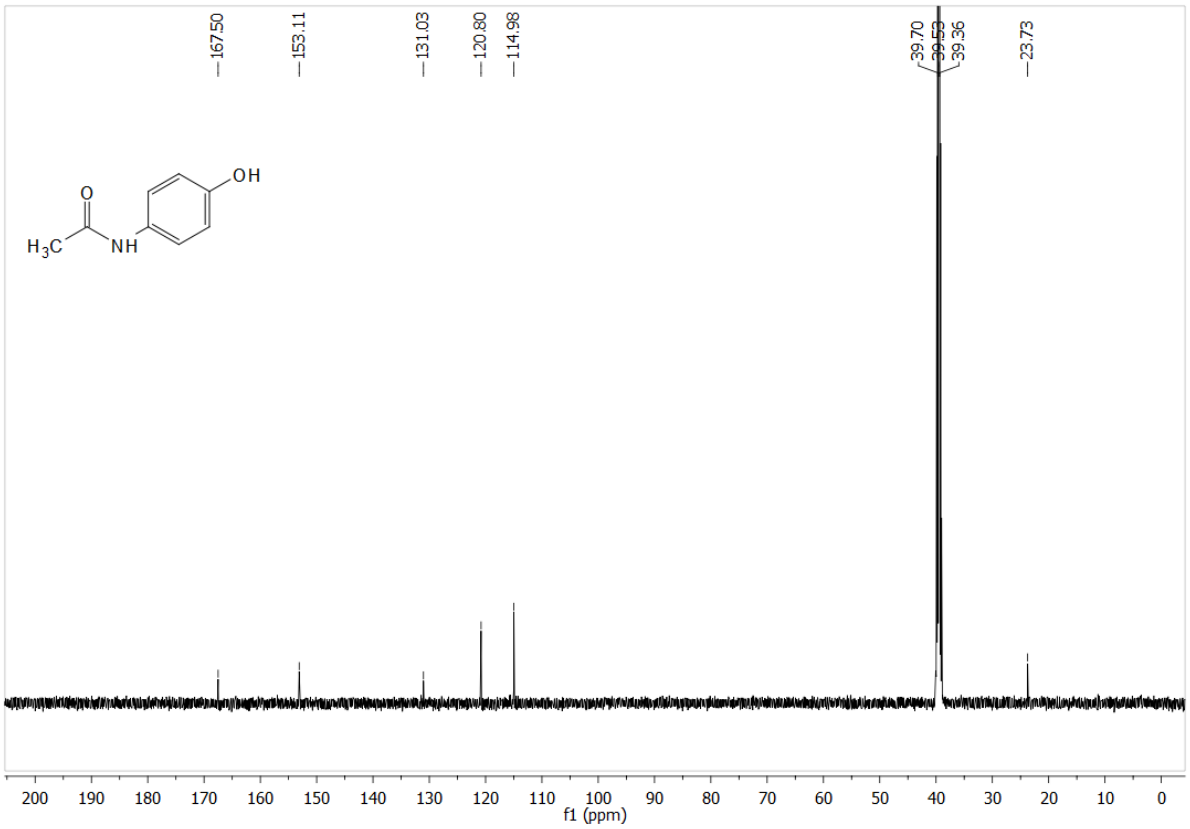
^{1}H and ^{13}C NMR Spectra of *N*-(4-chlorophenyl)-isobutyramide (6j)



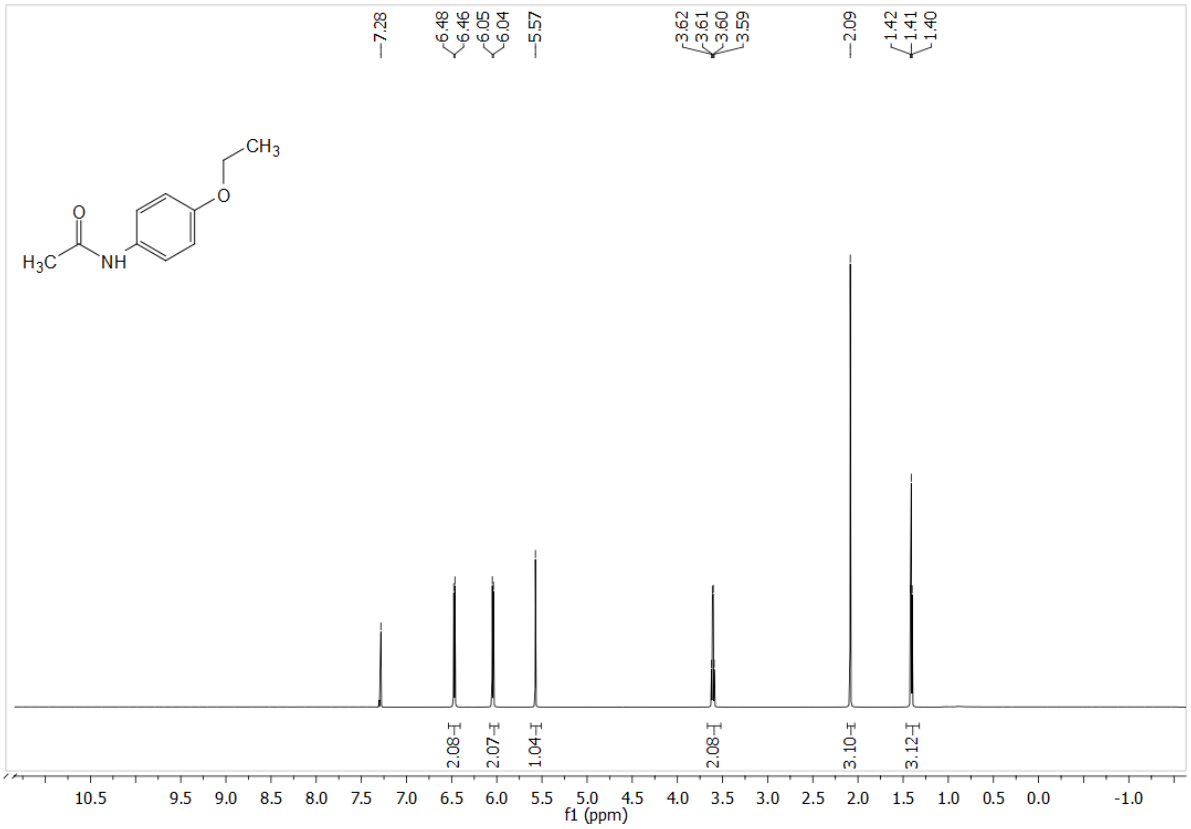


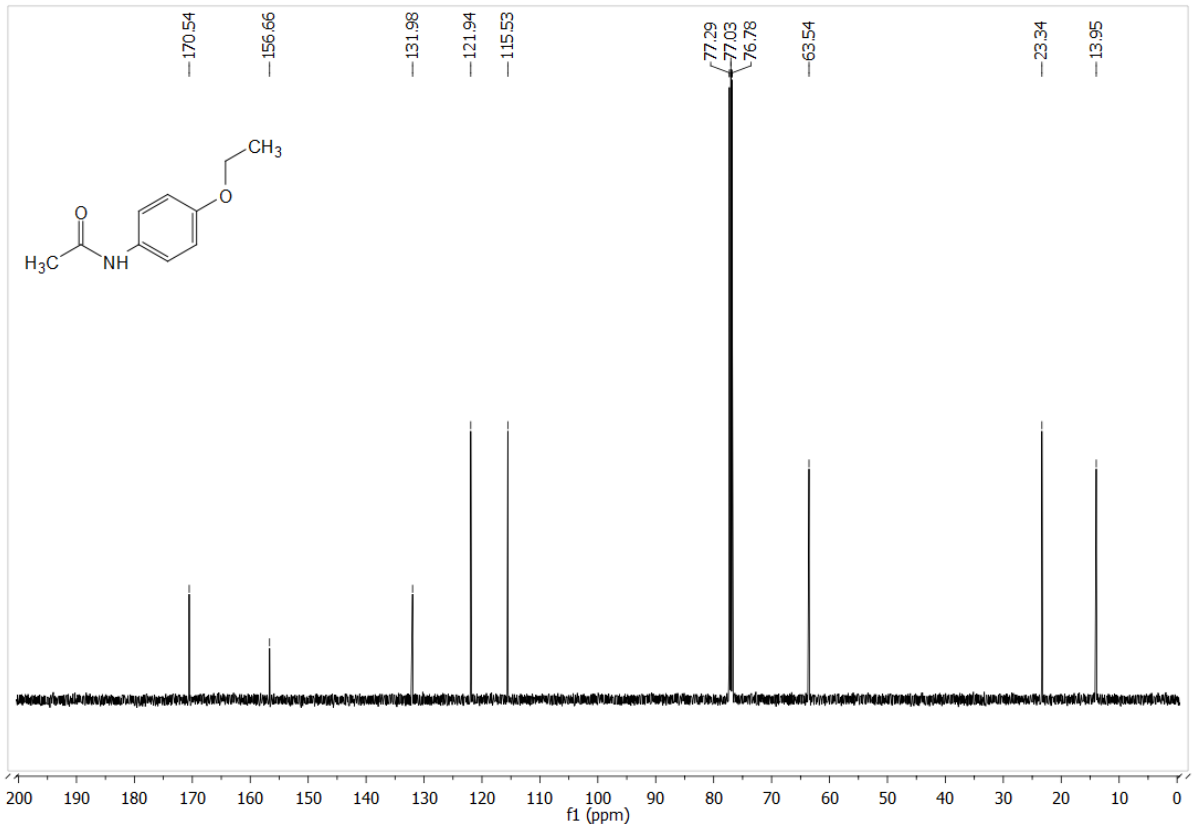
^{1}H and ^{13}C NMR Spectra of *N*-(4-hydroxyphenyl)-acetamide (6k)



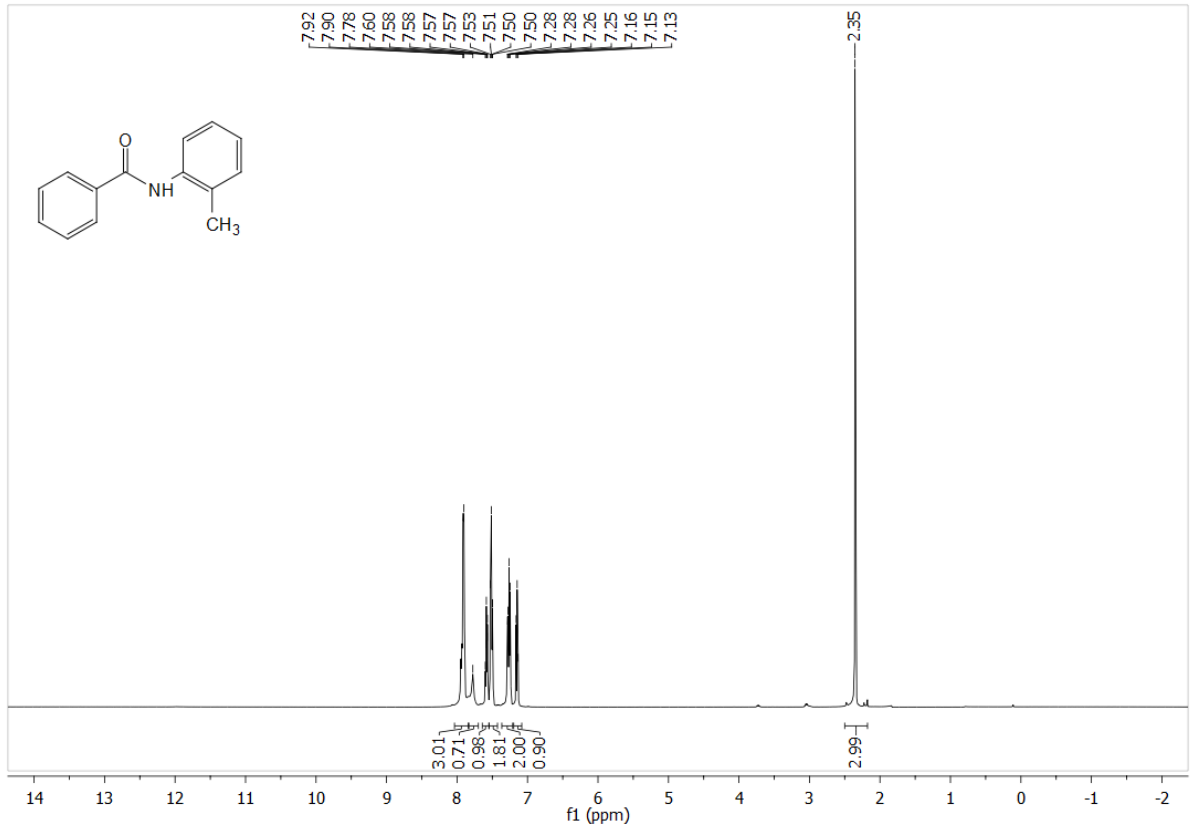


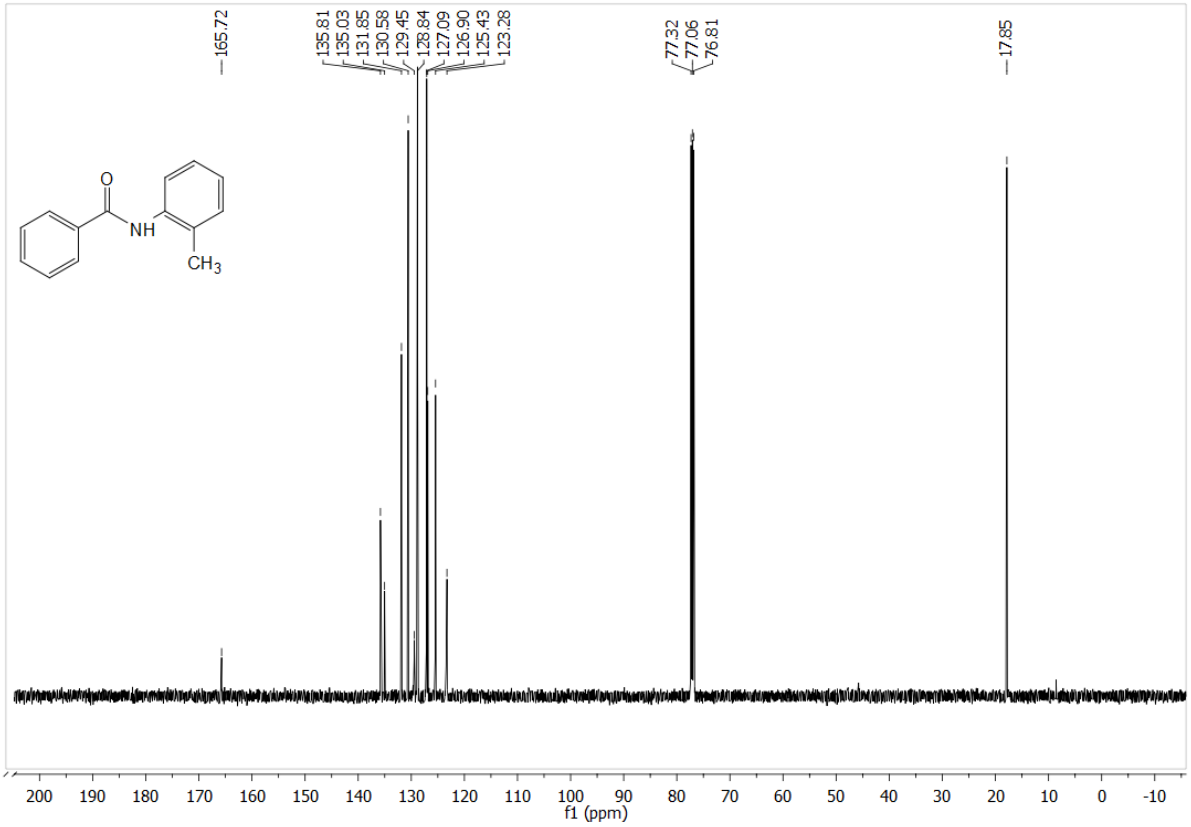
^{1}H and ^{13}C NMR Spectra of *N-(*4-ethoxyphenyl)-acetamide (6l)



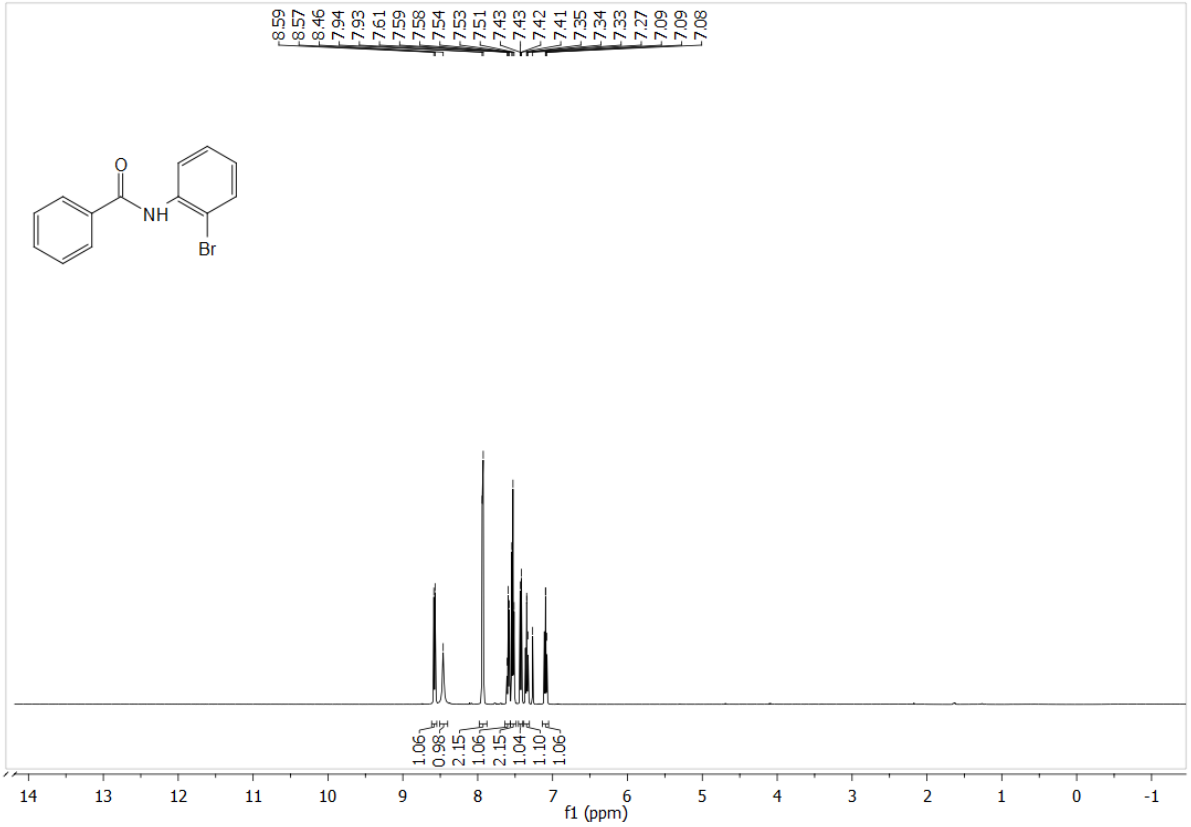


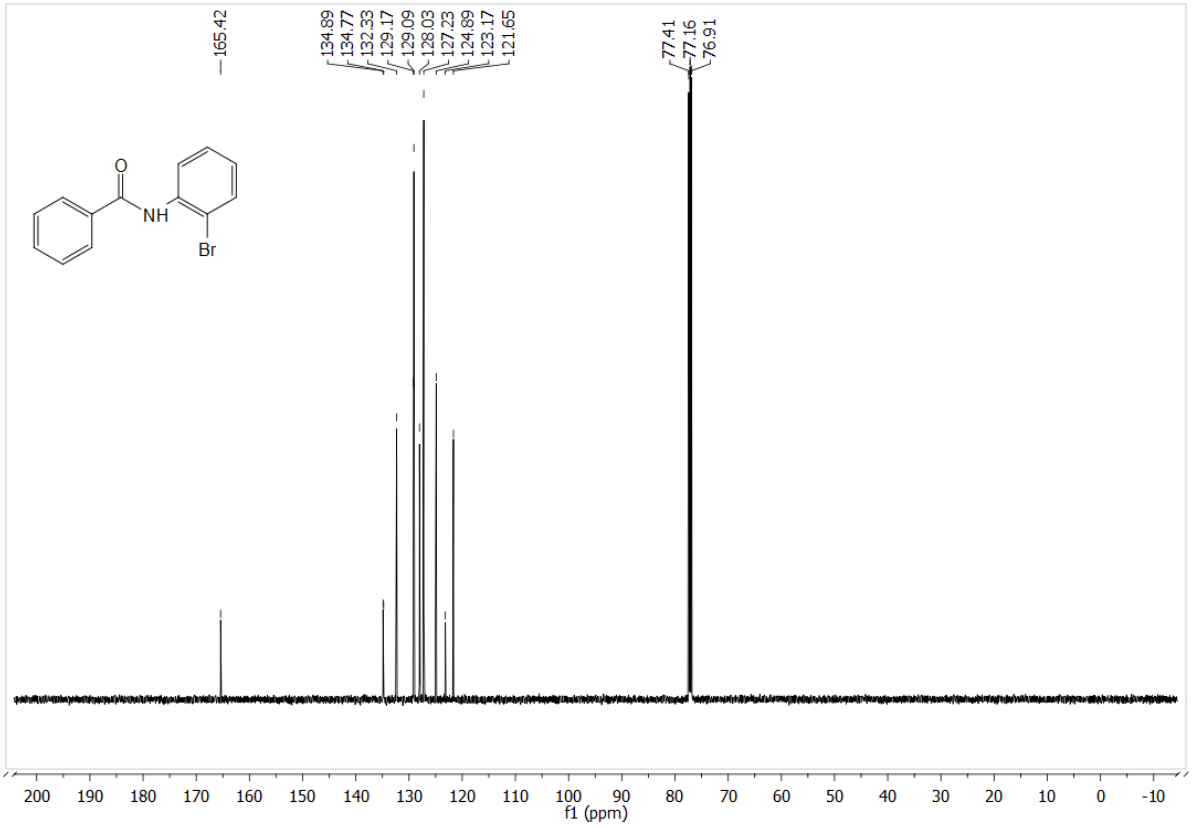
^{1}H and ^{13}C NMR Spectra of *N*-(2-methylphenyl)-benzamide (8a)



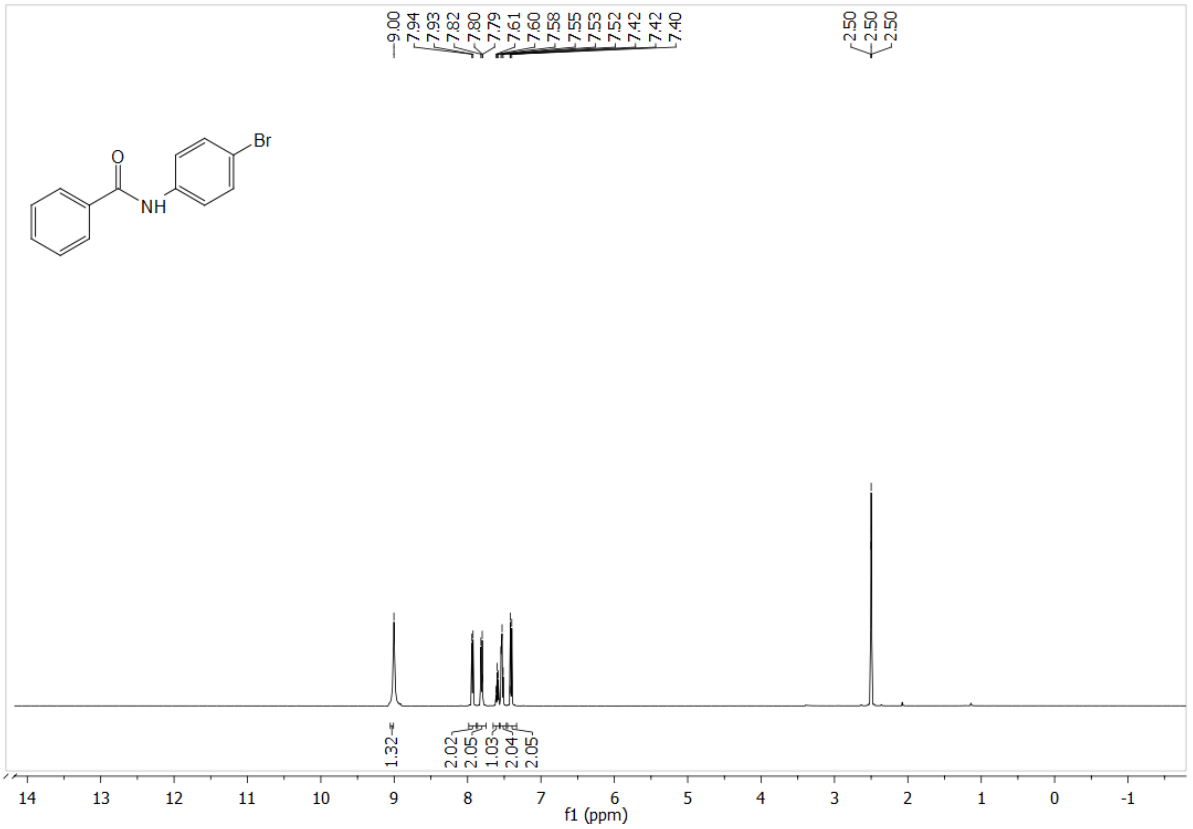


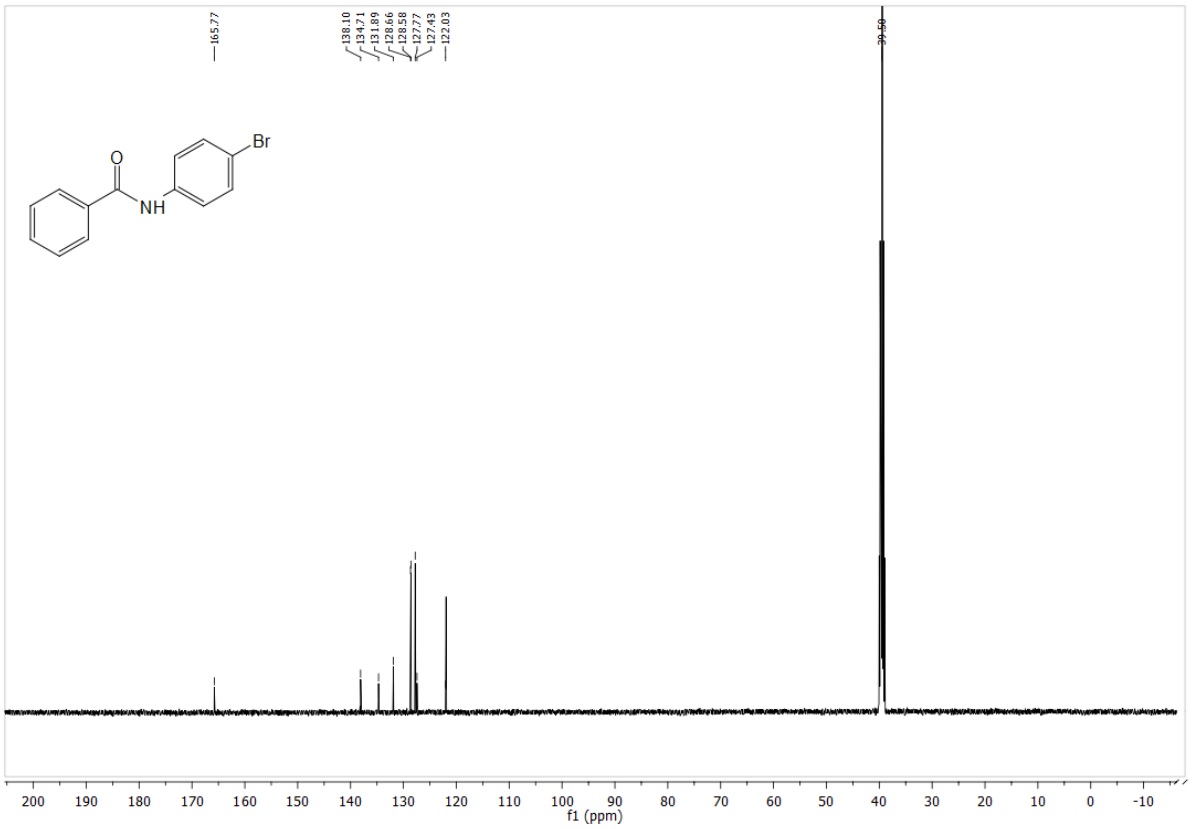
^{1}H and ^{13}C NMR Spectra of *N*-(2-bromophenyl)-benzamide (8b)



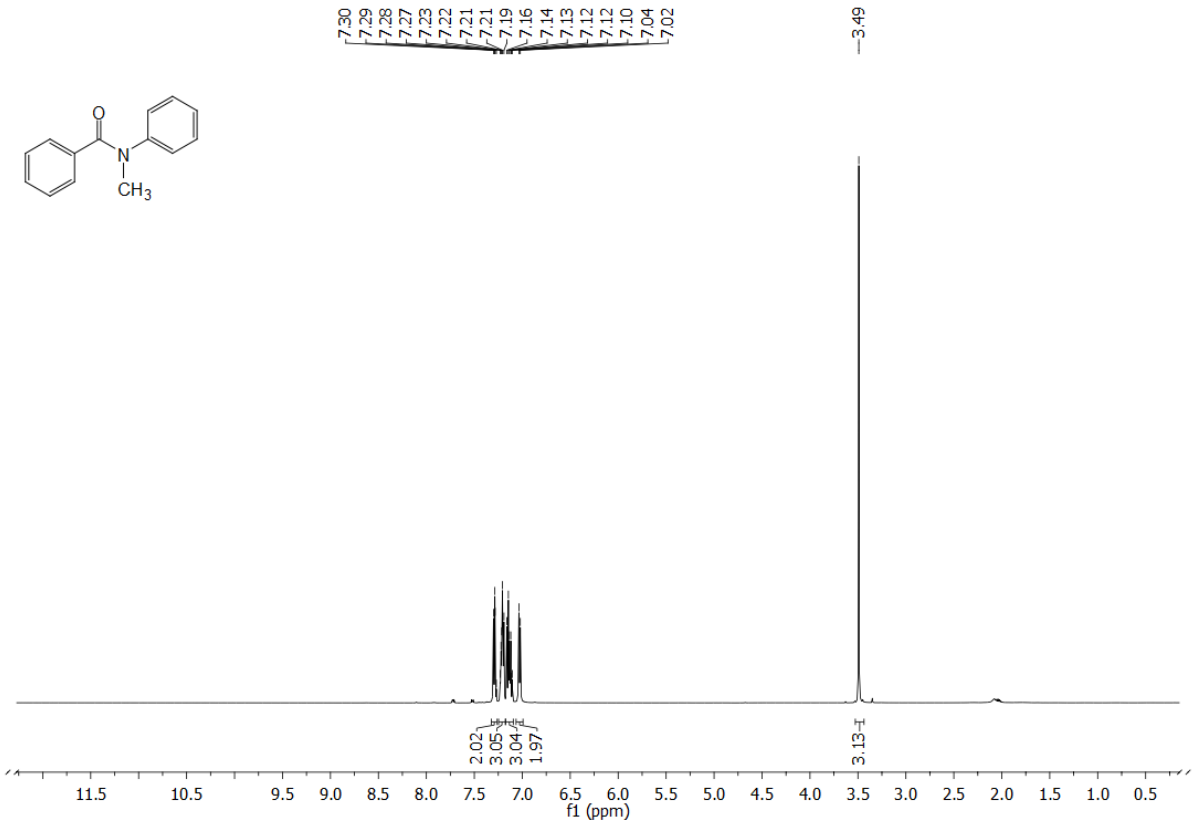


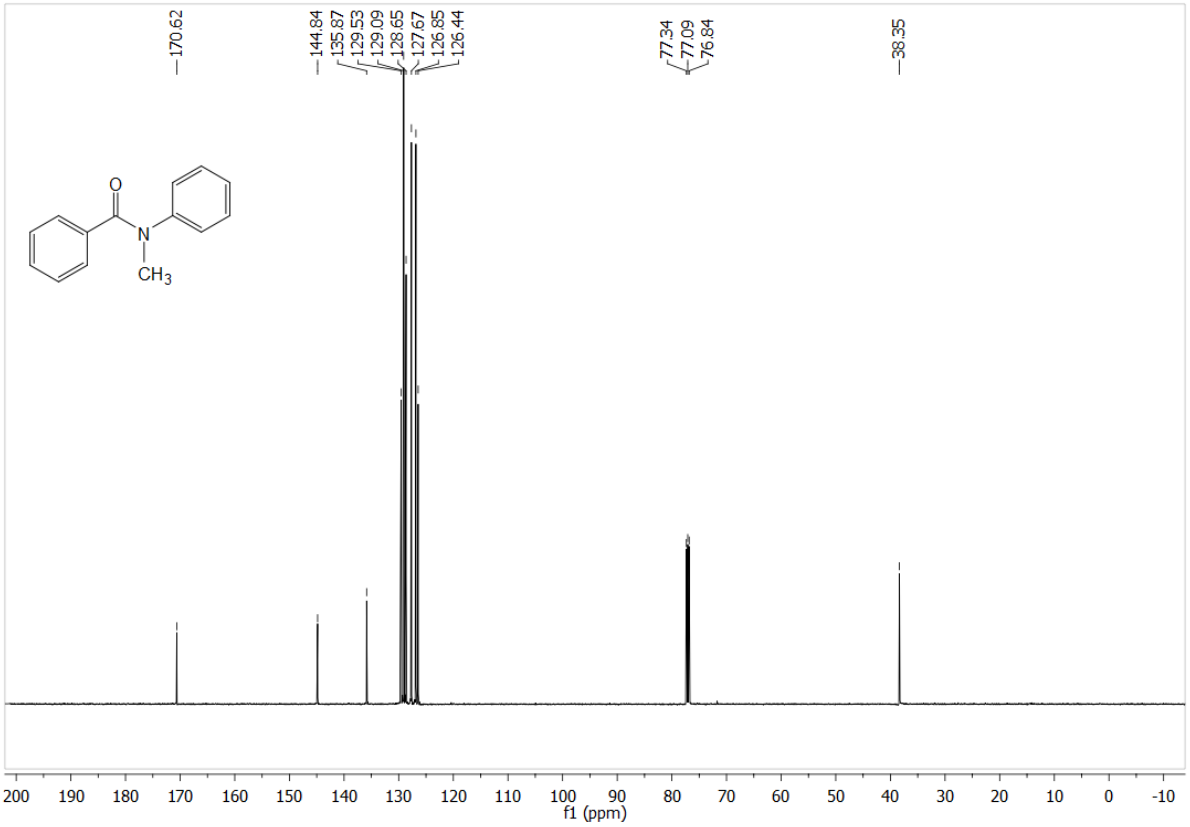
^{1}H and ^{13}C NMR Spectra of *N*-(4-bromophenyl)-benzamide (8c)



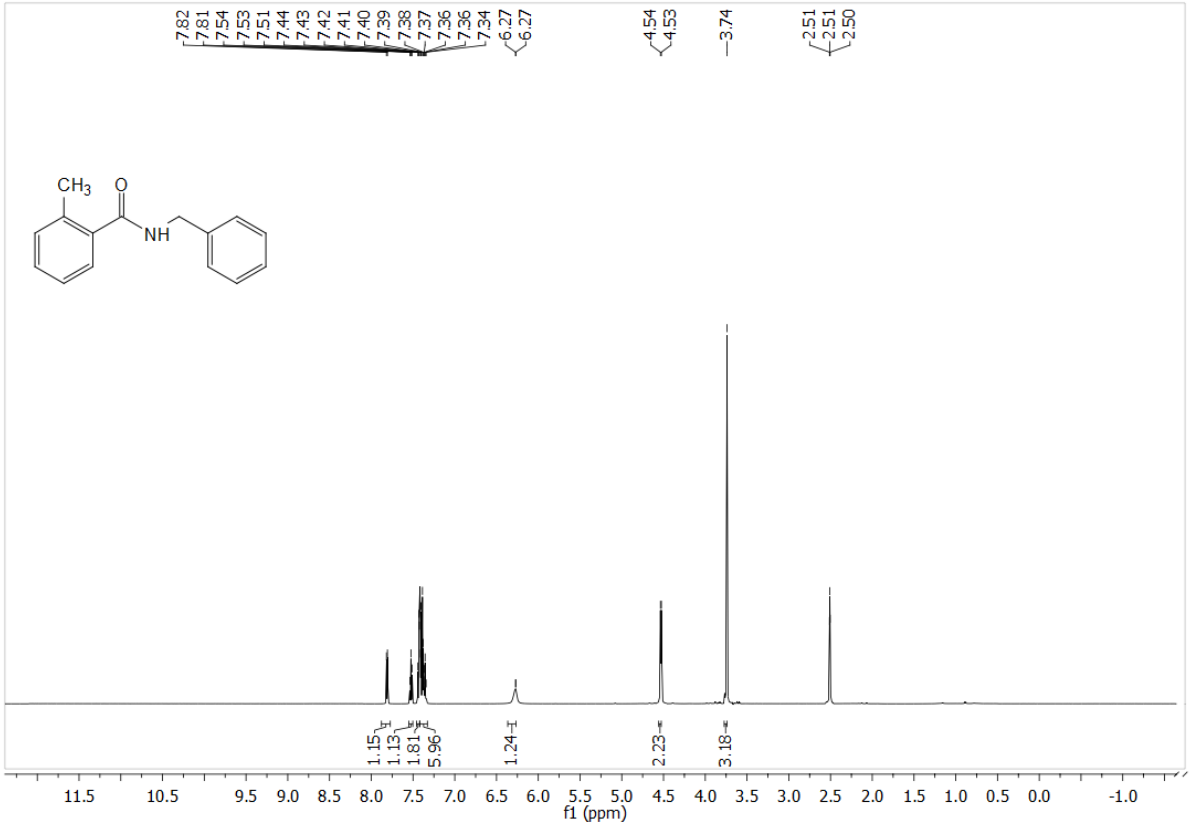


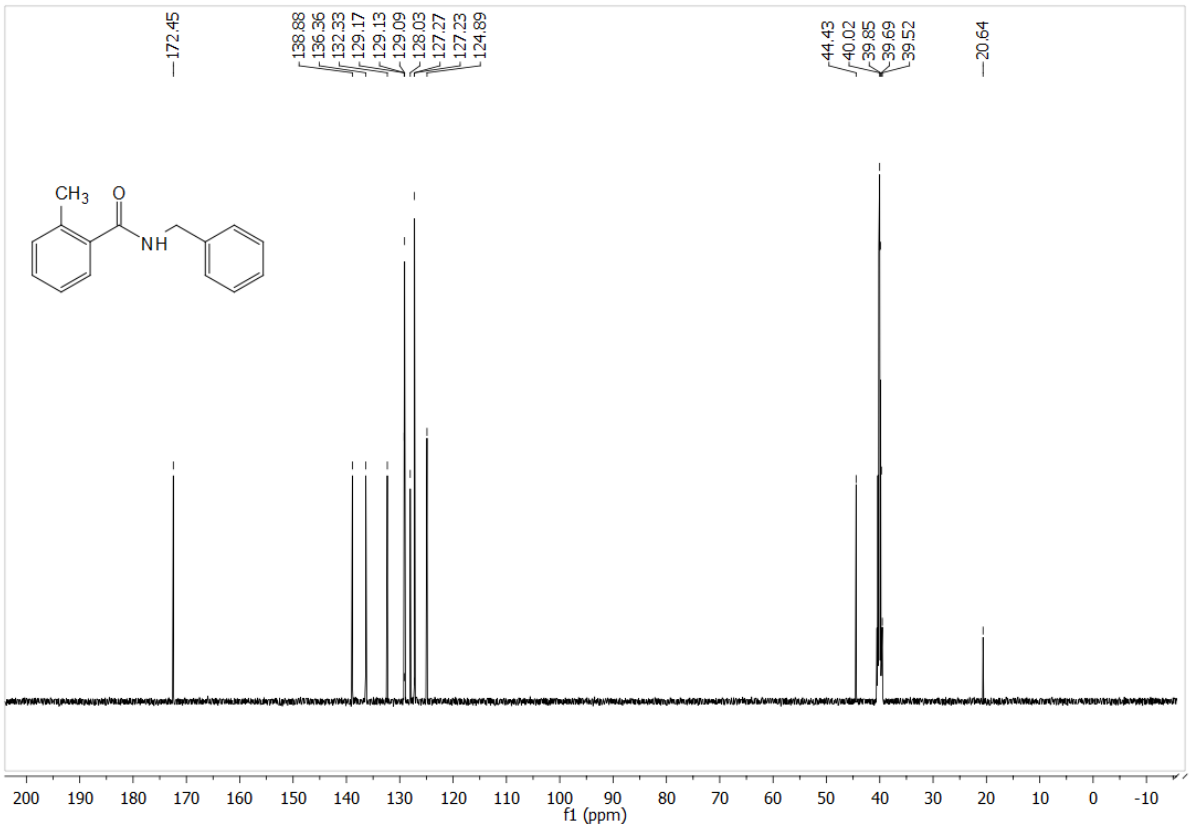
^{1}H and ^{13}C NMR Spectra of *N*-methyl-*N*-phenylbenzamide (8d)



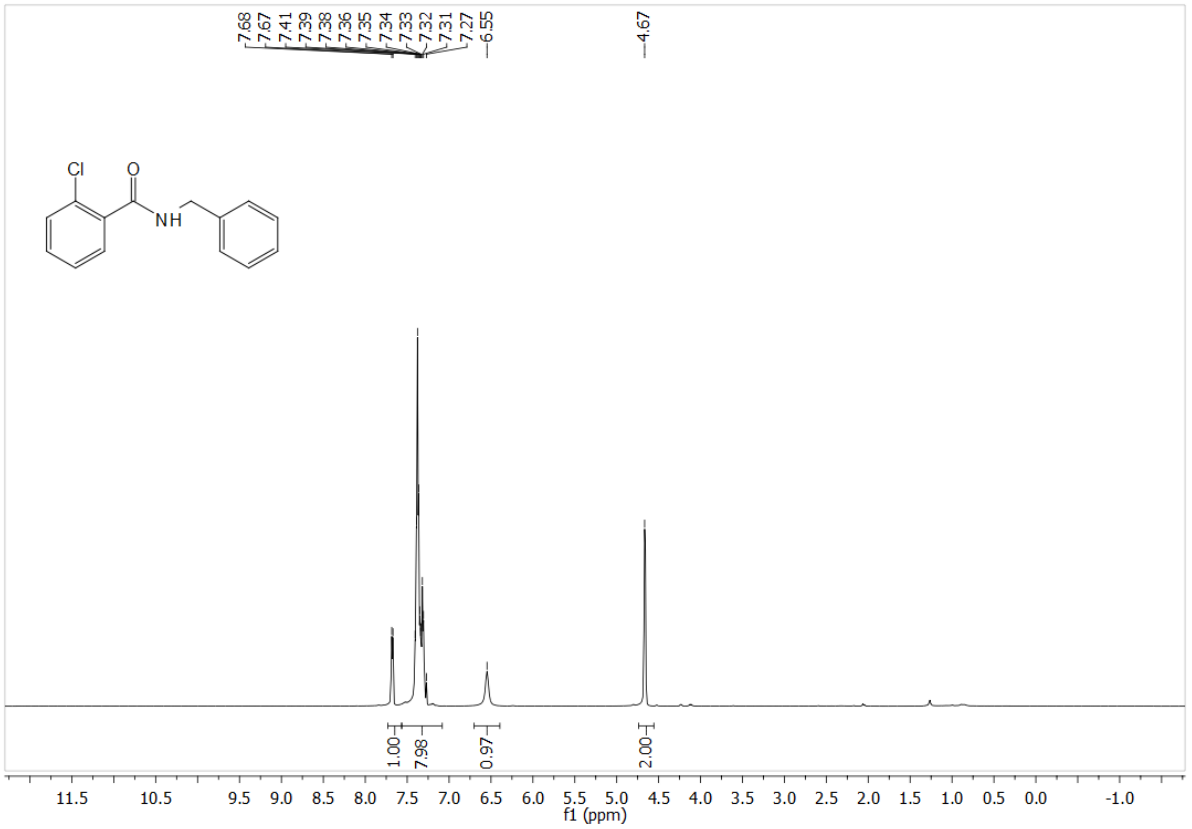


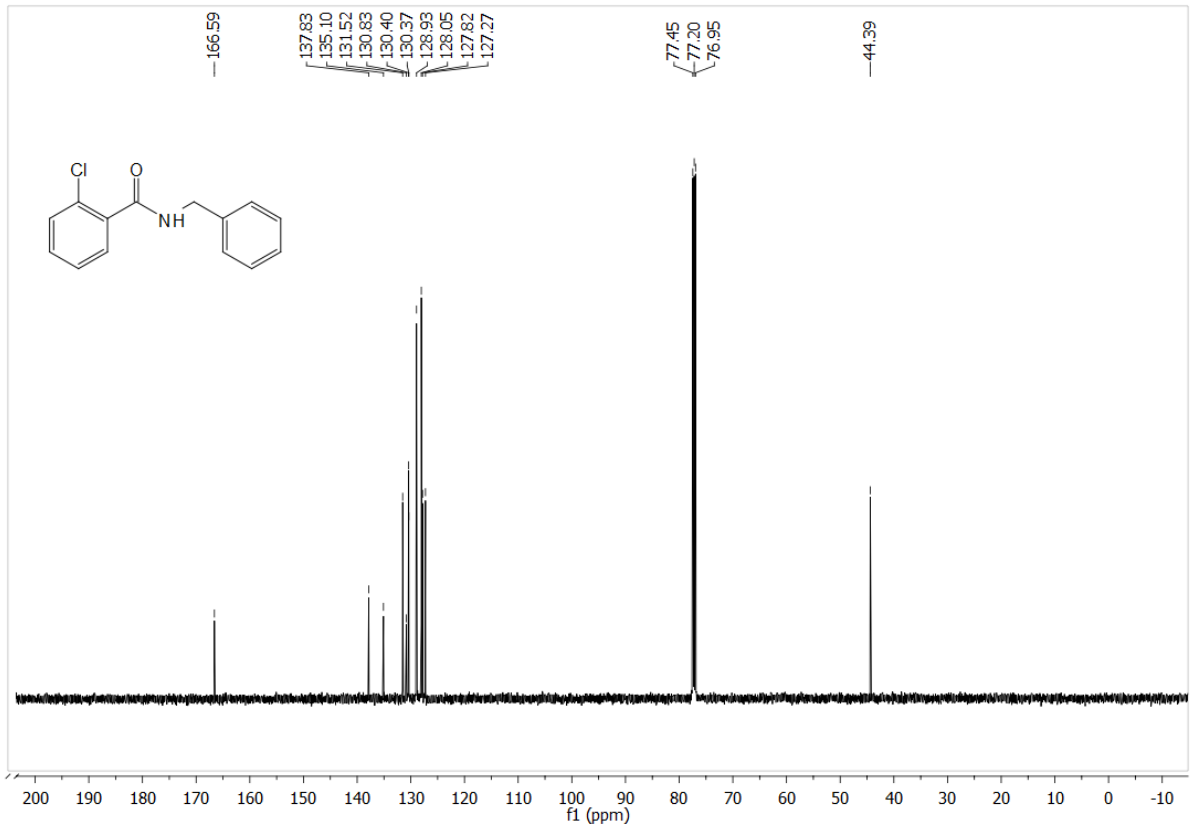
^{1}H and ^{13}C NMR Spectra of *N*-benzyl-2-methylbenzamide (8e)



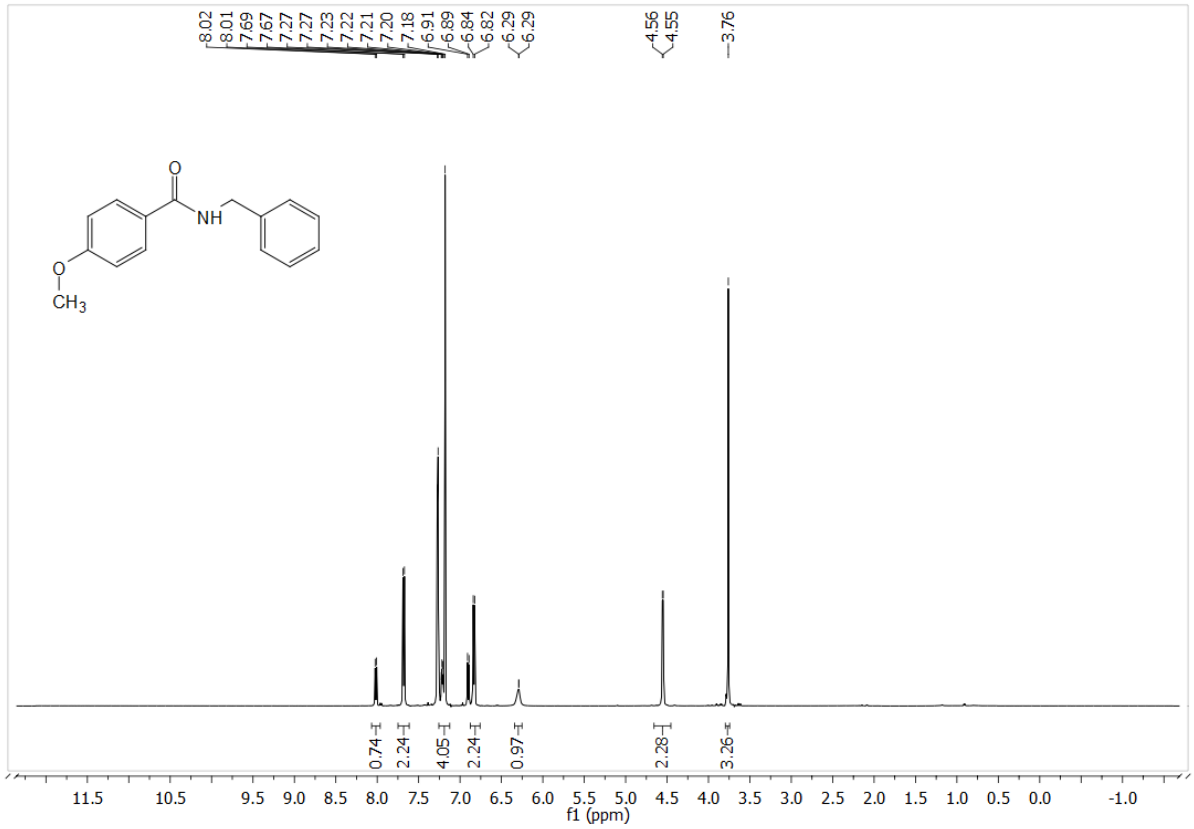


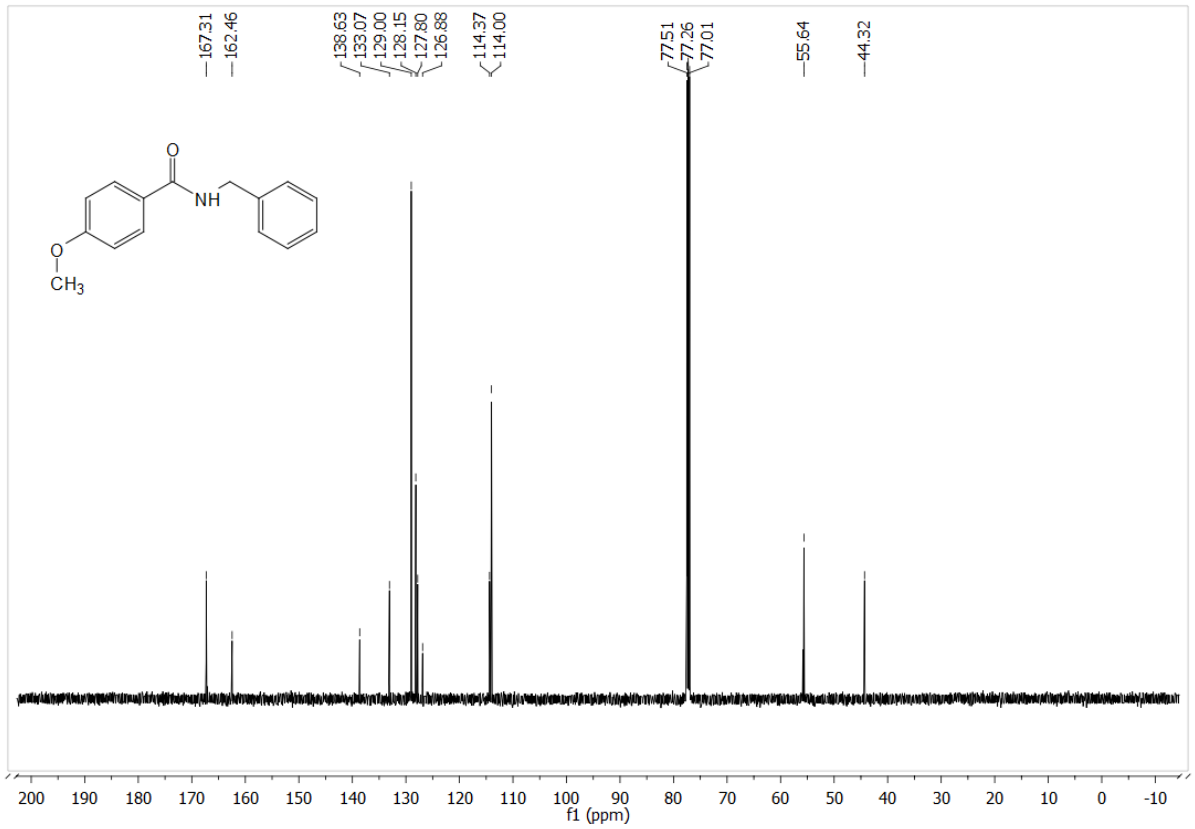
^{1}H and ^{13}C NMR Spectra of *N*-benzyl-2-chlorobenzamide (8f)



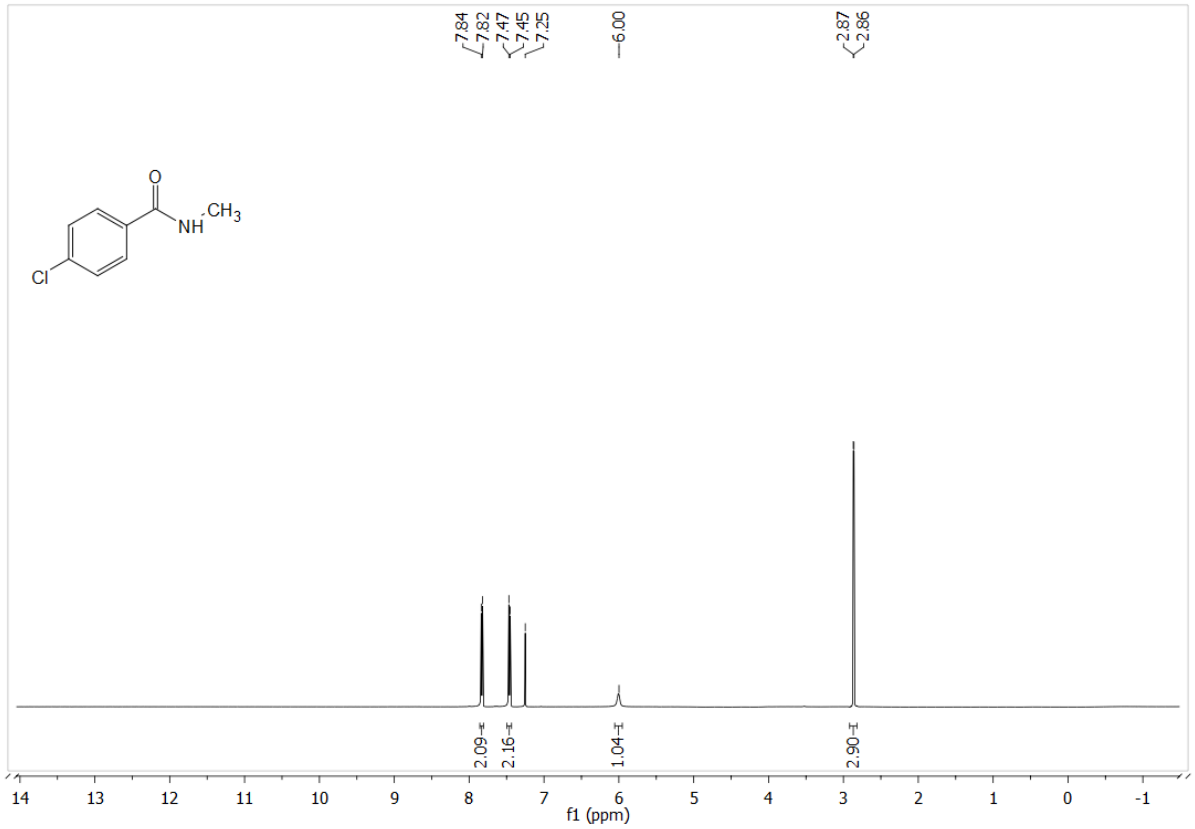


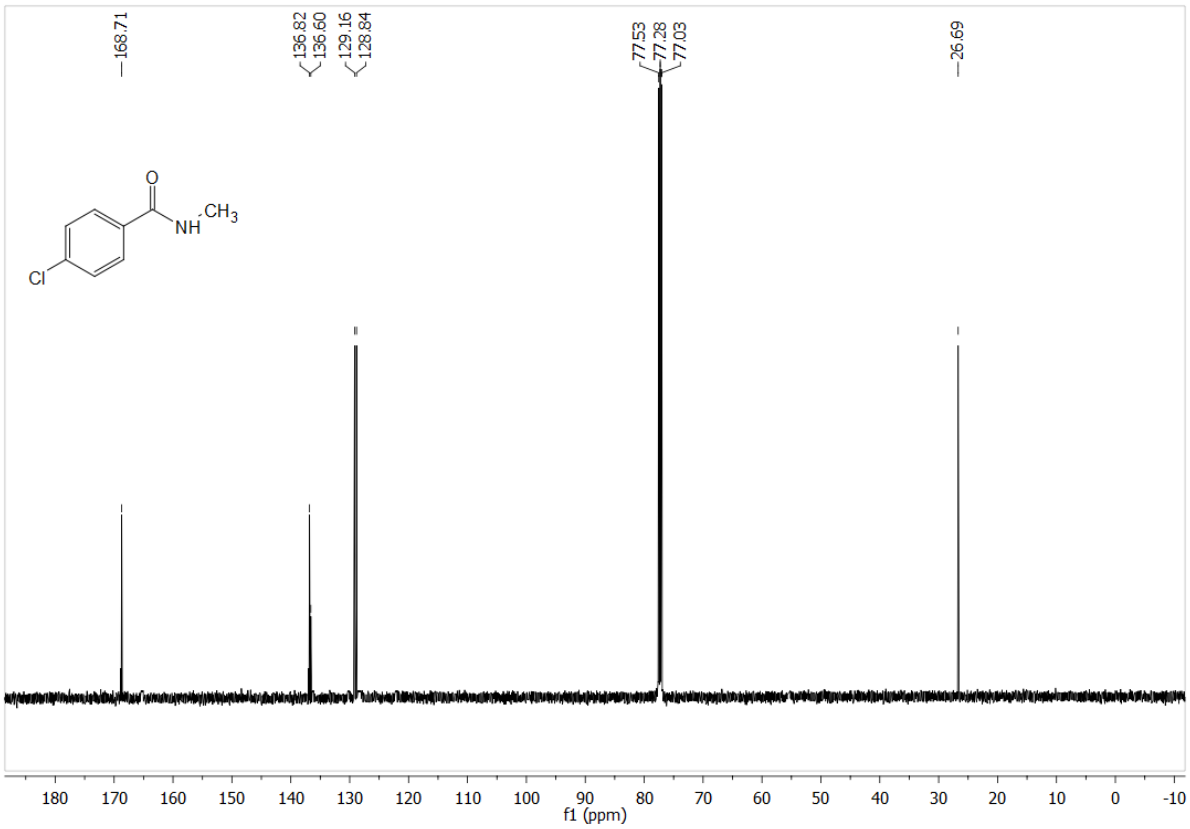
^{1}H and ^{13}C NMR Spectra of *N*-benzyl-4-methoxybenzamide (8g)





^{1}H and ^{13}C NMR Spectra of 4-chloro-*N*-methylbenzamide (8h)





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