Supporting information for:

Ruthenium(II)-Catalyzed Reductive N-O Bond Cleavage of *N*-OR (R = H, alkyl, or acyl) Substituted Amides and Sulfonamides

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I. General Information

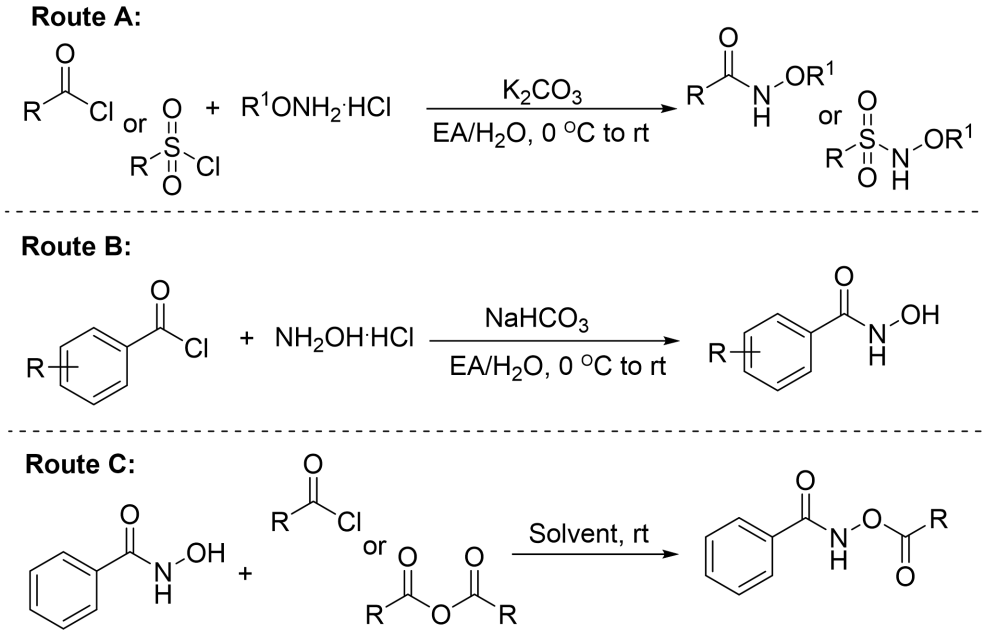
$[RuCl_2(p\text{-cymene})]_2$ (98%), $Ru(PPh_3)_3Cl_2$ (98%), $[RhCp^*Cl_2]_2$ (98%) were purchased from Energy Chemical and used as received. The other commercially available chemicals were used as received. Flash column chromatography was performed using 200−300 mesh silica with the proper solvent system according to thin layer chromatography (TLC) analysis using UV light to visualize the reaction components. NMR spectra were recorded on a Bruker-300 instrument or Bruker-500 instrument. ^{1}H NMR chemical shifts were referenced to tetramethylsilane (TMS) signal (0 ppm), ^{13}C NMR chemical shifts were referenced to the solvent resonance [77.00 ppm, $CDCl_3$; 40.45, $(CD_3)_2SO$]. The following abbreviations (or combinations thereof) were used to explain multiplicities: s = singlet, d = doublet, t = triplet, m = multiplet, br = broad, q = quadruplet. In this report, all the reactions that require heating were using oil bath as the heating source. High-resolution mass spectra were recorded on an ESI-Q-TOF mass spectrometer.

II. Procedures for the Synthesis of Starting Materials

General procedure for the synthesis of *N*-OR substituted amide:

1v and **1ac** were purchased from commercially available resources and used directly. Other *N*-OR substituted amides and sulfonamides were prepared following literature procedures and the analytical data of the known compounds are consistent with those data which have been previously reported. **1w** and **1x** were prepared according to Route B; **1y**, **1z** and **1aa** were prepared

according to Route C; all the others substrates were prepared according to Route A.



Route A[1]: A round-bottomed flask was charged with R^1O-NH_2·HCl (12 mmol, 1.2 equiv.), K_2CO_3 (20 mmol, 2.0 equiv.), ethyl acetate (EA) (50 mL) and H_2O (25 mL). Then the mixture was added with acyl chloride or sulfonyl chloride (10 mmol) at 0 °C, stirring at room temperature overnight. The reaction was quenched with brine (75 mL), extracted with EA (50 mL x 2). The combined organic layers were dried over anhydrous $NaSO_4$, filtered, concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel to afford the desired product.

Route B：A round-bottomed flask was charged with NH_2OH·HCl (12 mmol, 1.2 equiv.), $NaHCO_3$ (20 mmol, 2.0 equiv.), EA (50 mL) and H_2O (25 mL). Then the mixture was added with acyl chloride (10 mmol) at 0 °C, stirring at room temperature overnight. The reaction was quenched with brine (75 mL), extracted with EA (50 mL x 2). The combined organic layers were dried over anhydrous $NaSO_4$, filtered, concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel to afford the desired product.

Route C[2]：For detailed procedures, see reference.

***N*-Methoxybenzamide (1a).**[3] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.36 (bs, 1H), 7.75 (d, J = 7.6 Hz, 2H), 7.51 (t, J = 7.3 Hz, 1H), 7.41 (t, J = 7.4 Hz, 2H), 3.86 (s, 3H).

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[1] Guimond, N.; Gouliaras, C.; Fagnou, K. *J. Am. Chem. Soc.* **2010**, *132*, 6908.
[2] Guimond, N.; Gorelsky, S.; Fagnou, K. *J. Am. Chem. Soc.* **2011**, *133*, 6449.
[3] Wrigglesworth, J. W.; Cox, B.; Lloyd-Jones, G. C.; Booker-Milburn, K. I. *Org. Lett.* **2011**, *13*, 5326.

***N*-Methoxy-4-methylbenzamide (1b).**[3] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.16 (bs, 1H), 7.65 (d, *J* = 8.1 Hz, 2H), 7.21 (d, *J* = 7.9 Hz, 2H), 3.86 (s, 3H), 2.38 (s, 3H).

***N*,4-Dimethoxybenzamide (1c).**[1] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.10 (bs, 1H), 7.73 (d, *J* = 8.6 Hz, 2H), 6.90 (d, *J* = 8.6 Hz, 2H), 3.85 (s, 3H), 3.84 (s, 3H).

4-Fluoro-*N*-methoxybenzamide (1d).[4] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.38 (bs, 1H), 7.80-7.77 (m, 2H), 7.10 (t, *J* = 8.4 Hz, 2H), 3.85 (s, 3H).

4-Fhloro-*N*-methoxybenzamide (1e).[4] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.43 (bs, 1H), 7.70 (d, *J* = 8.0 Hz, 2H), 7.39 (d, *J* = 8.0 Hz, 2H), 3.85 (s, 3H).

3-Chloro-*N*-methoxybenzamide (1f).[5] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.33 (bs, 1H), 7.75 (t, *J* = 1.8 Hz, 1H), 7.64-7.62 (m, 1H), 7.49 (ddd, *J* = 8.0, 2.0, 1.0 Hz, 1H), 7.36 (t, *J* = 7.9 Hz, 1H), 3.87 (s, 3H).

***N*-Methoxy-2-methylbenzamide (1g).**[4] ^{1}H NMR (500 MHz, d_6-DMSO) δ 11.43 (bs, 1H), 7.36 (t, *J* = 7.4 Hz, 1H), 7.30-7.22 (m, 3H), 3.71 (s, 3H), 2.33 (s, 3H).

2-Ethoxy-*N*-methoxybenzamide (1h).[6] ^{1}H NMR (500 MHz, $CDCl_3$) δ 10.33 (bs, 1H), 8.20 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.45 (ddd, *J* = 8.4, 7.3, 1.9 Hz, 1H), 7.10-7.07 (m, 1H), 6.95 (d, *J* = 8.3 Hz, 1H), 4.22 (q, *J* = 7.0 Hz, 2H), 3.89 (s, 3H), 1.54 (t, *J* = 7.0 Hz, 3H).

***N*-Methoxy-[1,1'-biphenyl]-2-carboxamide (1i).**[7] ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.79 (bs, 1H), 7.69 (d, *J* = 7.5 Hz, 1H), 7.54 (td, *J* = 7.5, 1.5 Hz, 1H), 7.47-7.40 (m, 7H), 3.55 (s, 3H).

2-Hydroxy-*N*-methoxybenzamide (1j).[8] ^{1}H NMR (300 MHz, $CDCl_3$) δ 11.50 (bs, 1H), 9.20 (bs, 1H), 7.46-7.35 (m, 2H), 7.02 (d, *J* = 8.2 Hz, 1H), 6.86 (t, *J* = 7.5 Hz, 1H), 3.90 (s, 3H).

***N*-Methoxy-3,5-dimethylbenzamide (1k).**[6] ^{1}H NMR (500 MHz, d_6-DMSO) δ 11.63 (s, 1H), 7.35 (s, 2H), 7.17 (s, 1H), 3.69 (s, 3H), 2.30 (s, 6H).

2,6-Dichloro-*N*-methoxybenzamide (1l). ^{1}H NMR (500 MHz, d_6-DMSO) δ 11.82 (bs, 1H), 7.55-7.47 (m, 3H), 3.74 (s, 3H). ^{13}C NMR (125 MHz, d_6-DMSO) δ 159.8, 133.2, 132.0, 131.9, 128.2, 63.2. HRMS (ESI+) calcd for $C_8H_7Cl_2NNaO_2^+$ ($[M + Na]^+$) 241.9746, found 241.9752.

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[4] Rakshit, S.; Grohmann, C.; Besset, T.; Glorius, F. *J. Am. Chem. Soc.* **2011**, *133*, 2350.

[5] Zhong, H.; Yang, D.; Wang, S.; Huang, J. *Chem. Commun.* **2012**, *48*, 3236.

[6] Wang, G.; Yuan, T. *J. Org. Chem.* **2010**, *75*, 476.

[7] Wang, G.; Yuan, T.; Li, D. *Angew. Chem., Int. Ed.* **2011**, *50*, 1380.

[8] Kozlov, M. V.; Kleymenova, A. A.; Romanova, L. I.; Konduktorov K. A.; Smirnova, O. A.; Prasolov, V. S.; Kochetkov, S. N. *Bioorg. Med. Chem. Lett.* **2013**, *23*, 5936.

***N*-Methoxy-1-naphthamide (1m).**[4] ^{1}H NMR (500 MHz, d_6-DMSO) δ 11.69 (bs, 1H), 8.17 (d, *J* = 7.9 Hz, 1H), 8.05 (d, *J* = 8.0 Hz, 1H), 8.0-7.99 (m, 1H), 7.62-7.53 (m, 4H), 3.81 (s, 3H).

***N*-Methoxy-2-naphthamide (1n).**[4] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.36 (bs, 1H), 8.26 (s, 1H), 7.85 (t, *J* = 7.3 Hz, 3H), 7.78 (d, *J* = 8.3 Hz, 1H), 7.54 (dt, *J* = 14.8, 7.1 Hz, 2H), 3.91 (s, 3H).

***N*-Methoxyisonicotinamide (1o)**.[2] ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.50 (br s, 1H), 8.73 (br s, 4H), 7.63 (br s, 4H), 3.91 (s, 6H).

***N*-Methoxyfuran-2-carboxamide (1p).**[5] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.02 (bs, 1H), 7.45 (s, 1H), 7.21 (d, *J* = 3.4 Hz, 1H), 6.53-6.52 (m, 1H), 3.89 (s, 3H).

***N*-Methoxythiophene-2-carboxamide (1q).**[4] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.25 (bs, 1H), 7.71 (s, 1H), 7.54 (d, *J* = 4.8 Hz, 1H), 7.10 (dd, *J* = 4.8, 3.9 Hz, 1H), 3.86 (s, 3H).

***N*-Methoxy-2-phenylacetamide (1r).**[9] ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.82 (bs, 1H), 7.34-7.26 (m, 5H), 3.70 (s, 3H), 3.48 (s, 2H).

***N*-Methoxy-3-phenylpropanamide (1s).**[10] ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.79 (bs, 1H), 7.30-7.13 (m, 5H), 3.62 (s, 3H), 2.94 (t, *J* = 7.8 Hz, 2H), 2.40 (t, *J* = 7.6 Hz, 2H).

(3r,5r,7r)-*N*-Methoxyadamantane-1-carboxamide (1t).[11] ^{1}H NMR (500 MHz, d_6-DMSO) δ 10.74 (bs, 1H), 3.53 (s, 3H), 2.50-2.51 (m, 1H), 1.94 (s, 3H), 1.74 (d, *J* = 2.6 Hz, 5H), 1.68-1.61 (m, 6H).

***N*-Ethoxybenzamide (1u).**[3] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.18 (bs, 1H), 7.75 (d, *J* = 7.8 Hz, 2H), 7.50 (t, *J* = 7.3 Hz, 1H), 7.41 (t, *J* = 7.6 Hz, 2H), 4.08 (q, *J* = 6.9 Hz, 2H), 1.31 (t, *J* = 7.0 Hz, 3H).

***N*-(Benzyloxy)benzamide (1v).**[3] ^{1}H NMR (500 MHz, d_6-DMSO) δ 11.80 (bs, 1H), 7.75 (d, *J* = 7.5 Hz, 2H), 7.55 (t, *J* = 7.2 Hz, 1H), 7.49-7.35 (m, 7H), 4.93 (s, 2H).

3-Chloro-*N*-hydroxybenzamide (1x).[8] ^{1}H NMR (300 MHz, d_6-DMSO) δ 11.34 (bs, 1H), 9.17 (bs, 1H), 7.77 (s, 1H), 7.71 (d, *J* = 7.6 Hz, 1H), 7.59 (d, *J* = 7.6 Hz, 1H), 7.49 (t, *J* = 7.8 Hz, 1H).

***N*-Hydroxy-4-methoxybenzamide (1y).**[8] ^{1}H NMR (300 MHz, d_6-DMSO) δ 11.07 (bs, 1H), 8.90 (bs, 1H), 7.72 (d, *J* = 8.5 Hz, 2H), 6.98 (d, *J* = 8.6 Hz, 2H), 3.79 (s, 3H).

***N*-Acetoxybenzamide (1z).**[2] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.70 (bs, 1H), 7.82 (d, *J* = 8.0 Hz, 2H), 7.56 (t, *J* = 7.5 Hz, 1H), 7.45 (t, *J* = 7.7 Hz, 2H), 2.27 (s, 3H).

***N*-(Pivaloyloxy)benzamide (1aa).**[2] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.68 (bs, 1H), 7.80-7.78 (m,

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[9] Willwacher, J.; Rakshit S.; Glorius, F. *Org. Biomol. Chem.* **2011**, *9*, 4736.

[10] Miyata, O.; Koizumi, T.; Asai, H.; Iba R.; Naito, T. *Tetrahedron* **2004**, *60*, 3893.

[11] Yus, M.; Radivoy, G.; Alonso, F. *Synthesis* **2001**, 914.

2H), 7.53-7.51 (m, 1H), 7.43-7.40 (m, 2H), 1.33 (s, 9H).

***N*-(Benzoyloxy)benzamide (1ab).**[2] ^{1}H NMR (300 MHz, d_6-DMSO) δ 12.65 (bs, 1H), 8.10 (d, *J* = 7.3 Hz, 2H), 7.89 (d, *J* = 7.1 Hz, 2H), 7.78 (t, *J* = 7.4 Hz, 1H), 7.70-7.49 (m, 5H).

4-Nitro-*N*-(pivaloyloxy)benzamide (1ac).[2] ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.72 (s, 1H), 8.29 (d, *J* = 8.4 Hz, 2H), 7.98 (d, *J* = 8.4 Hz, 2H), 1.36 (s, 9H).

***N*-Methyl-*N*-(pivaloyloxy)benzamide (1ad).** ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.52 (d, *J* = 7.3 Hz, 2H), 7.42 (t, *J* = 7.3 Hz, 1H), 7.36 (t, *J* = 7.4 Hz, 2H), 3.37 (s, 3H), 1.03 (s, 9H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 175.4, 171.4, 133.4, 130.5, 127.8, 127.7, 37.8, 26.8, 26.3. HRMS (ESI+) calcd for $C_{13}H_{17}NNaO_3^+$ ($[M + Na]^+$) 258.1101, found 258.1122.

***N*-Methoxybenzenesulfonamide (3a).**[12] ^{1}H NMR (500 MHz, d_6-DMSO) δ 10.55 (bs, 1H), 7.86-7.85 (m, 2H), 7.74-7.71 (m, 1H), 7.66-7.62 (m, 2H), 3.66 (s, 3H).

***N*-Methoxy-2-methylbenzenesulfonamide (3b).**[13] ^{1}H NMR (500 MHz, d_6-DMSO) δ 10.54 (bs, 1H), 7.85 (d, *J* = 8.2 Hz, 1H), 7.59 (t, *J* = 7.4 Hz, 1H), 7.45-7.42 (m, 2H), 3.62 (s, 3H), 2.60 (s, 3H).

***N*-Methoxy-4-methylbenzenesulfonamide (3c).**[14] ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.82 (d, *J* = 7.9 Hz, 2H), 7.35 (d, *J* = 7.9 Hz, 2H), 7.07 (bs, 1H), 3.79 (s, 3H), 2.45 (s, 3H)

***N*-Methoxy-1-phenylmethanesulfonamide (3d).**[15] ^{1}H NMR (500 MHz, d_6-DMSO) δ 10.21 (bs, 1H), 7.41-7.36 (m, 5H), 4.44 (s, 2H), 3.71 (s, 3H).

III. N-O bond cleavage of *N*-OR substituted amides and sulfonamides:

General procedure for the N-O bond cleavage reaction: To a 10 mL dried Schlenk flask under air, *N*-OR substituted amide or sulfonamide (0.2 mmol), $[RuCl_2(p\text{-cymene})]_2$ (0.0031 g, 0.005 mmol), $HCOOH/Et_3N$ (molar ratio 1/1, 0.5 mL), and H_2O (0.5 mL) were added in sequence. After stirring at 100 °C for 12 hours, the mixture was quenched with saturated NH_4Cl (5 mL), extracted with EA (15 mL x 3). The combined organic layers were washed with brine, dried over Na_2SO_4, filtered and concentrated under reduced pressure. The residue was purified by flash chromatography on silica gel with PE/EA as the eluent to afford the desired product.

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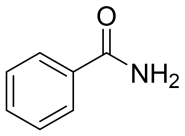
[12] Pu, X.; Li, Q.; Lu, Z.; Yang, X. *Eur. J. Org. Chem.* **2016**, 5937.

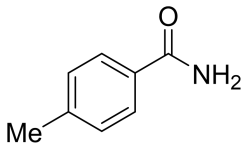
[13] Xu, L.; Shu, H.; Liu, Y.; Zhang, S.; Trudell, M. L. *Tetrahedron* 2006, 62, 7902.

[14] Xie, W.; Yang, J.; Wang, B.; Li, B. *J. Org. Chem.* **2014**, *79*, 8278.

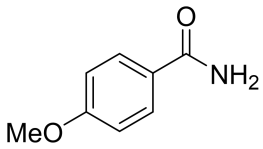
[15] Ishiwata, Y.; Suzuki, Y.; and Togo, H. *Heterocycles* **2010**, 82, 339.



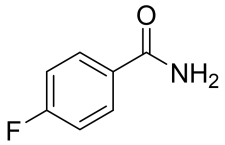
Benzamide (**2a**).[16] Prepared according to the general procedure using 0.0304 g of **1a** (0.2 mmol), and **2a** was obtained as a white solid (0.0225 g, 92% yield) after flash column chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.82 (d, *J* = 7.2 Hz, 2H), 7.52 (t, *J* = 7.4 Hz, 1H), 7.44 (t, *J* = 7.6 Hz, 2H), 6.29 (br, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 169.7, 133.5, 132.0, 128.6, 127.4.



4-Methylbenzamide (**2b**).[17] Prepared according to the general procedure using 0.0332 g of **1b** (0.2 mmol), and **2b** was obtained as a white solid (0.0249 g, 91% yield) after flash column chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.1 Hz, 2H), 7.24 (d, *J* = 8.0 Hz, 2H), 6.07 (br, 2H), 2.40 (s, 3H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 167.8, 141.0, 131.5, 128.7, 127.5, 20.9.



4-Methoxybenzamide (**2c**).[17] Prepared according to the general procedure using 0.0364 g of **1c** (0.2 mmol), and **2c** was obtained as a white solid (0.0269 g, 89% yield) after flash column chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.78 (d, *J* = 8.7 Hz, 2H), 6.94 (d, *J* = 8.7 Hz, 2H), 5.85 (bs, 2H), 3.86 (s, 3H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 167.5, 161.5, 129.3, 126.4, 113.3, 55.3.



4-Fluorobenzamide (**2d**).[17] Prepared according to the general procedure using 0.0342 g of **1d** (0.2 mmol), and **2d** was obtained as a white solid (0.0257 g, 91% yield) after flash column chromatography. ^{1}H NMR (500 MHz, d_6-DMSO) δ 8.01 (br, 1H), 7.98-7.94 (m, 2H), 7.41 (br,

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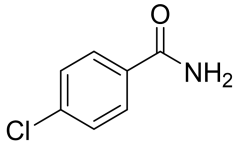
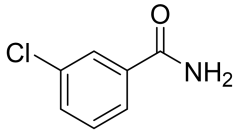
[16] Ramón, R. S.; Bosson, J.; Díez-González, S.; Marion, N.; Nolan, S. P. *J. Org. Chem*. **2010**, *75*, 1197.

[17] Nielsen, D. U.; Taaning, R. H.; Lindhardt, A. T.; Gøgsig, T. M.; Skrydstrup, T. *Org. Lett*. **2011**, *13*, 4454.

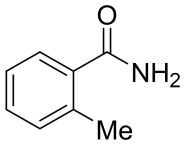
1H), 7.31-7.26 (m, 2H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 166.8, 163.9 (d, J = 248.3 Hz), 130.7 (d, J = 2.9 Hz), 130.1 (d, J = 9.0 Hz), 115.0 (d, J = 21.7 Hz).



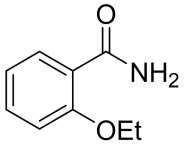
4-Chlorobenzamide (**2e**).[17] Prepared according to the general procedure using 0.0368 g of **1e** (0.2 mmol), and **2e** was obtained as a white solid (0.0268 g, 87% yield) after flash column chromatography. ^{1}H NMR (500 MHz, d_6-DMSO) δ 8.04 (br, 1H), 7.90 (d, J = 8.5 Hz, 2H), 7.53 (d, J = 8.4 Hz, 2H), 7.45 (br, 1H); ^{13}C NMR (125 MHz; d_6-DMSO) δ 166.8, 136.1, 133.1,129.4, 128.2.



3-Chlorobenzamide (**2f**).[18] Prepared according to the general procedure using 0.0344 g of **1f** (0.2 mmol), and **2f** was obtained as a white solid (0.0265 g, 85% yield) after flash column chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.82 (t, J = 1.8 Hz, 1H), 7.68 (dt, J = 7.8, 1.3 Hz, 1H), 7.50 (dq, J = 8.0, 1.0 Hz, 1H), 7.39 (t, J = 7.9 Hz, 1H), 6.18 (br, 2H); ^{13}C NMR (125 MHz; $CDCl_3$) δ 168.2, 135.2, 134.9, 132.1, 123.0, 127.8, 125.5.

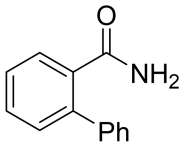


2-Methylbenzamide (**2g**).[18] Prepared according to the general procedure using 0.0334 g of **1g** (0.2 mmol), and **2g** was obtained as a white solid (0.0251 g, 92% yield) after flash column chromatography. ^{1}H NMR (300 MHz, d_6-DMSO) δ 7.69 (br, 1H), 7.37-7.28 (m, 3H), 7.23-7.18 (m, 2H), 2.37 (s, 3H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 171.0, 137.0, 135.1, 130.4, 129.1, 127.0, 125.4, 19.5.

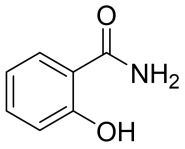


[18] Molander, G. A.; Cavalcanti, L. N. *J. Org. Chem*. **2011**, *76*, 7195.

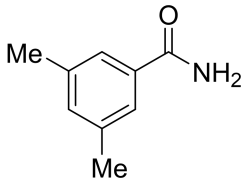
2-Ethoxybenzamide (**2h**).[19] Prepared according to the general procedure using 0.0393 g of **1h** (0.2 mmol), and **2h** was obtained as a white solid (0.0318 g, 96% yield) after flash column chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.22 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.88 (br, 1H), 7.45 (dt, *J* = 8.4, 1.8 Hz, 1H), 7.06 (t, *J* = 7.5 Hz, 1H), 6.96 (d, *J* = 8.3 Hz, 1H), 6.49 (br, 1H), 4.20 (q, *J* = 7.0 Hz, 2H), 1.51 (t, *J* = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 167.4, 157.3, 133.3, 132.5, 121.1, 120.9, 112.3, 64.7, 14.8.



[1,1'-Biphenyl]-2-carboxamide (**2i**).[20] Prepared according to the general procedure using 0.0450 g of **1i** (0.2 mmol), and **2i** was obtained as a white solid (0.0359 g, 92% yield) after flash column chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.75 (dd, *J* = 7.7, 1.1 Hz, 1H), 7.49 (dt, *J* = 7.5, 1.4 Hz, 1H), 7.45-7.34 (m, 7H), 5.92 (br, 1H), 5.31 (br, 1H); ^{13}C NMR (125 MHz, CDCl3) δ 171.4, 140.2, 139.9, 134.4, 130.5, 130.4, 129.1, 128.8, 128.7, 127.9, 127.6.



2-Hydroxybenzamide (**2j**).[21] Prepared according to the general procedure using 0.0300 g of **1j** (0.2 mmol), and **2j** was obtained as a white solid (0.0216 g, 73% yield) after flash column chromatography. ^{1}H NMR (500 MHz, d_6-DMSO) δ 13.02 (br, 1H), 8.39 (br, 1H), 7.88 (br, 1H), 7.85 (d, *J* = 7.9 Hz, 1H), 7.40 (dd, *J* = 11.3, 4.1 Hz, 1H), 6.87 (dd, *J* = 14.6, 7.8 Hz, 2H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 172.1, 161.1, 134.0, 128.1, 118.3, 117.4, 114.4.



3,5-Dimethylbenzamide (**2k**).[22] Prepared according to the general procedure using 0.0352 g of **1k** (0.2 mmol), and **2k** was obtained as a white solid (0.0243 g, 83% yield) after flash column

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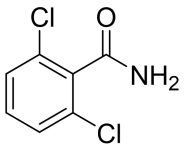
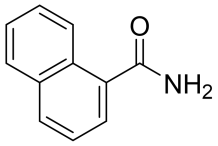
[19] Schade, M. A.; Manolikakes, G.; Knochel, P. *Org. Lett.* **2010**, *12*, 3648.
[20] Lauwagie, S.; Millet, R.; Pommery, J.; Depreux, P.; Hénichart, J.-P. *Heterocycle*s. **2006**, *68*, 1149.
[21] Owston, N. A.; Parker, A. J.; Williams, M. J. *Org. Lett*. **2007**, *9*, 3599.
[22] Al-Huniti, M. H.; Rivera-Chávez, J.; Colón, K. L.; Stanley, J. L.; Burdette, J. E.; Pearce, C. J.; Oberlies, N. H.; Croatt, M. P. *Org. Lett*. **2018**, *20*, 6046.

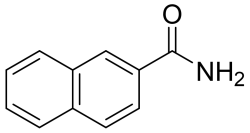
chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.42 (s, 2H), 7.15 (s, 1H), 6.24 (br, 2H), 2.35 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 170.1, 138.3, 133.5, 125.1, 125.1, 21.2 .



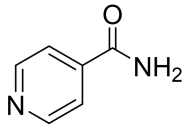
2,6-Dichlorobenzamide (**2l**).[20] Prepared according to the general procedure using 0.0439 g of **1l** (0.2 mmol), and **2l** was obtained as a white solid (0.0263 g, 69% yield) after flash column chromatography. ^{1}H NMR (500 MHz, d_6-DMSO) δ 8.08 (bs, 1H), 7.81 (bs, 1H), 7.48 (d, J = 7.9 Hz, 2H), 7.42-7.38 (m, 1H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 165.3, 137.0, 130.7, 130.6, 128.0.



1-Naphthamide (**2m**).[23] Prepared according to the general procedure using 0.0401 g of 1**m** (0.2 mmol), and **2m** was obtained as a white solid (0.0301 g, 88% yield) after flash column chromatography. ^{1}H NMR (500 MHz, d_6-DMSO) δ 8.31 (d, J = 8.5 Hz, 1H), 8.01-7.96 (m, 3H), 7.65-7.52 (m, 5H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 170.6, 134.5, 133.2, 129.7, 129.7, 128.1, 126.6, 126.1, 125.6, 125.1, 124.9.



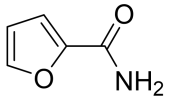
2-Naphthamide (**2n**).[23] Prepared according to the general procedure using 0.0398 g of **1n** (0.2 mmol), and **2n** was obtained as a white solid (0.0258 g, 76% yield) after flash column chromatography. ^{1}H NMR (500 MHz, d_6-DMSO) δ 8.52 (s, 1H), 8.15 (br, 1H), 8.03-7.97 (m, 4H), 7.63-7.58 (m, 2H), 7.48 (s, 1H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 168.0, 134.2, 132.1, 131.7, 128.8, 127.8, 127.7, 127.6, 127.5, 126.6, 124.4.



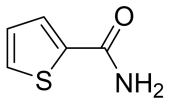
Isonicotinamide (**2o**).[24] Prepared according to the general procedure using 0.0308 g of **1o**

[23] Hanada, S.; Motoyama, Y.; Nagashima, H. *Eur. J. Org. Chem.* **2008**, 4097.
[24] Abu-Youssef, M. A. M.; Dey, R.; Gohar, Y.; Massoud, A. A.; Öhrström, L.; Langer, V. *Inorg. Chem*. **2007**, *46*, 5893.

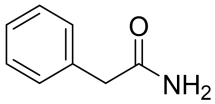
(0.2 mmol), and **2o** was obtained as a white solid (0.0081 g, 33% yield) after flash column chromatography. ^{1}H NMR (500 MHz, DMSO-d_6) δ 8.72 (d, J = 6.1 Hz, 2H), 8.25 (br s, 1H), 7.72 (d, J = 6.1 Hz, 2H), 7.73 (br s, 1H); ^{13}C NMR (126 MHz, DMSO-d_6) δ 166.3, 150.2, 141.2, 121.4.



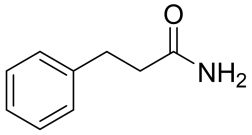
Furan-2-carboxamide (**2p**).[22] Prepared according to the general procedure using 0.0282 g of **1o** (0.2 mmol), and **2o** was obtained as a white solid (0.0187 g, 84% yield) after flash column chromatography. ^{1}H NMR (500 MHz, d_6-DMSO) 7.81 (s, 1H), 7.77 (bs, 1H), 7.38 (bs, 1H), 7.10 (d, J = 3.4 Hz, 1H), 6.61-6.60 (m, 1H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 159.4, 148.0, 145.0, 113.6, 111.7.



Thiophene-2-carboxamide (**2q**).[20] Prepared according to the general procedure using 0.0313 g of **1p** (0.2 mmol), and **2p** was obtained as a white solid (0.0251 g, 99% yield) after flash column chromatography. ^{1}H NMR (500 MHz, d_6-DMSO) δ 7.95 (br, 1H), 7.74 (dd, J = 9.7, 4.2 Hz, 2H), 7.36 (br, 1H), 7.13 (t, J = 4.2 Hz, 1H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 162.9, 140.3, 130.9, 128.6, 127.8.

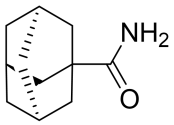


2-Phenylacetamide (**2r**).[24] Prepared according to the general procedure using 0.0331 g of **1q** (0.2 mmol), and **2q** was obtained as a white solid (0.0225 g, 83% yield) after flash column chromatography. ^{1}H NMR (500 MHz; $CDCl_3$) δ 7.37-7.34 (m, 2H), 7.31-7.26 (m, 3H), 5.90 (br, 1H), 5.44 (br, 1H), 3.57 (s, 2H); ^{13}C NMR (125 MHz; $CDCl_3$) δ 173.7, 134.9, 129.4, 129.1, 127.4, 43.3.



3-Phenylpropanamide (**2s**).[23] Prepared according to the general procedure using 0.0351 g of **1r** (0.2 mmol), and **2r** was obtained as a white solid (0.0244 g, 84% yield) after flash column chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30-7.26 (m, 2H), 7.21-7.17 (m, 3H), 5.84 (br,

1H), 5.50 (br, 1H), 2.95 (t, J = 7.8 Hz, 3H), 2.52 (t, J = 7.8 Hz,3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 174.8 140.7, 128.6, 128.3, 126.3, 37.5, 31.4.

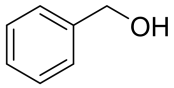


Adamantane-1-carboxamide (**2t**).[23] Prepared according to the general procedure using 0.0421 g of **1s** (0.2 mmol), and **2s** was obtained as a white solid (0.0289 g, 80% yield) after flash column chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 5.79 (br, 1H), 5.64 (br, 1H), 2.05 (d, J = 2.5 Hz, 3H), 1.88 (t, J = 4.4 Hz, 6H), 1.73 (q, J = 12.3 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 181.0, 40.6, 39.3, 36.5, 28.1.

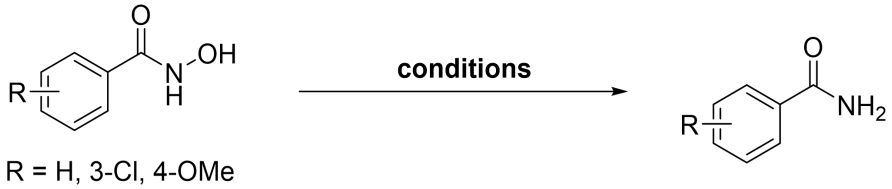
R = Et, Bn

Prepared according to the general procedure using 0.0330 g of **1u** (0.2 mmol), and **2u** was obtained as a white solid (0.0221 g, 91% yield) after flash column chromatography. NMR data is consistent with **2a**.

Prepared according to the general procedure using 0.0456 g of **1v** (0.2 mmol), **2v** was obtained as a white solid (0.0214 g, 88% yield) after flash column chromatography. NMR data is consistent with **2a**.



Phenylmethanol (2v').[25] Colorless oil, 67% yield (0.0154 g, 0.14 mmol). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41-7.26 (m, 5H), 4.68 (s, 2H), 1.82 (br s, 1H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.9, 128.6, 127.7, 127.0, 65.4.



R = H, 3-Cl, 4-OMe

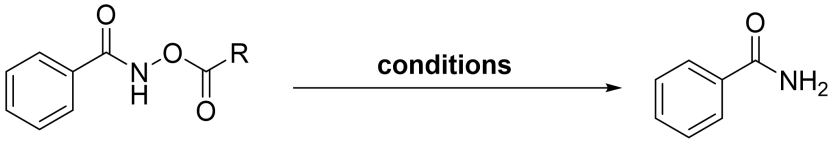
Prepared according to the general procedure using 0.0270 g of **1w** (0.2 mmol), and the molar ratio of HCOOH/Et_3N is 5/2. The desired product **2w** was obtained as a white solid (0.0198 g, 83%

[25] Cano, R.; Yus, M.; Ramón, D. J. *Tetrahedron* **2011**, *67*, 8079.

yield) after flash column chromatography. NMR data is consistent with **2a**.

Prepared according to the general procedure using 0.0344 g of **1x** (0.2 mmol), and the molar ratio of HCOOH/Et_3N is 5/2. The desired product **2x** was obtained as a white solid (0.0252 g, 82% yield) after flash column chromatography. NMR data is consistent with **2f**.

Prepared according to the general procedure using 0.0332 g of **1y** (0.2 mmol), and the molar ratio of HCOOH/Et_3N is 5/2. The desired product **2y** was obtained as a white solid (0.0235 g, 78% yield) after flash column chromatography. NMR data is consistent with **2c**.

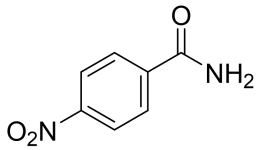


R = Me, *t*Bu, Ph

Prepared according to the general procedure using 0.0356 g of **1z** (0.2 mmol), and the molar ratio of HCOOH/Et_3N is 5/2. The desired product **2z** was obtained as a white solid (0.0155 g, 64% yield) after flash column chromatography. NMR data is consistent with **2a**.

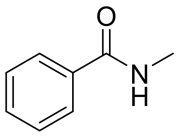
Prepared according to the general procedure using 0.0446 g of **1aa** (0.2 mmol), and the molar ratio of HCOOH/Et_3N is 5/2. The desired product **2aa** was obtained as a white solid (0.0191 g, 78% yield) after flash column chromatography. NMR data is consistent with **2a**.

Prepared according to the general procedure using 0.0484 g of **1ab** (0.2 mmol), and the molar ratio of HCOOH/Et_3N is 5/2. The desired product **2ab** was obtained as a white solid (0.0165 g, 68% yield) after flash column chromatography. NMR data is consistent with **2a**.

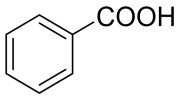


4-nitrobenzamide (**2ac**).[26] Prepared according to the general procedure using 0.0536 g of **1ac** (0.2 mmol), and **2ac** was obtained as a yellow solid (0.0224 g, 67% yield) after flash column chromatography. ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.36-8.25 (d, J = 8.9 Hz, 3H), 8.11 (d, J = 8.7 Hz, 2H), 7.74 (br s, 1H); ^{13}C NMR (101 MHz, DMSO-d_6) δ 166.7, 149.5, 140.5, 129.4, 123.9.

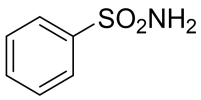
[26] Li, Y.-T.; Liao, B.-S.; Chen, H.-P.; Liu, S.-T. *Synthesis* **2011**, *16*, 2639.



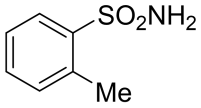
N-Methylbenzamide (**2ad**).[27] Prepared according to the general procedure using 0.0351 g of **1ad** (0.2 mmol), and the molar ratio of HCOOH/Et_3N is 5/2. The desired product **2ad** was obtained as a light yellow solid (0.0171 g, 64% yield) after flash column chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.77 (d, *J* = 7.6 Hz, 2H), 7.46 (t, *J* = 7.3 Hz, 1H), 7.39 (t, *J* = 7.5 Hz, 2H), 6.68 (s, 1H), 2.97 (d, *J* = 4.7 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 168.5, 134.6, 131.3, 128.5, 126.9, 26.8.



Benzoic acid (**2ae**).[28] Prepared according to the general procedure using 0.0436 g of **1ae** (0.2 mmol), and **2ae** was obtained as a white solid (0.0232 g, 96% yield) after flash column chromatography. ^{1}H NMR (500 MHz; $CDCl_3$) δ 10.89 (br, 1H), 8.13 (d, *J* = 7.6 Hz, 2H), 7.61 (t, *J* = 7.3 Hz, 1H), 7.47 (t, *J* = 7.4 Hz, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.3, 133.8, 130.2, 129.4, 128.5.



Benzenesulfonamide (**4a**).[29] Prepared according to the general procedure using 0.0373 g of **3a** (0.2 mmol), and **4a** was obtained as a white solid (0.0290 g, 93% yield) after flash column chromatography. ^{1}H NMR (500 MHz, d_6-DMSO) δ 7.84-7.82 (m, 2H), 7.62-7.55 (m, 3H), 7.36 (bs, 2H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 144.2, 131.7, 128.9, 125.6.



2-Methylbenzenesulfonamide (**4b**).[27] Prepared according to the general procedure using 0.0396 g of **3b** (0.2 mmol), and **4b** was obtained as a white solid (0.0311 g, 92% yield) after flash column chromatography. ^{1}H NMR (300 MHz, d_6-DMSO) δ 7.85 (d, J = 7.7 Hz, 1H), 7.49-7.46 (m, 1H), 7.37-7.35 (m, 4H), 2.59 (s, 3H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 142.1, 135.8, 132.1, 131.8,

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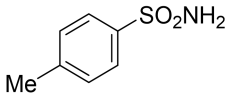
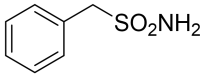
[27] Paul, B.; Panja, D.; Kundu, S. *Org. Lett*. **2019**, 21, 5843.
[28] Keshipour, S.; Khezerloo, M. *RSC Adv*. **2019**, 9, 17129.
[29] Tota, A.; John-Campbell, S. S.; Briggs, E. L.; Estévez, G. O.; Afonso, M.; Degennaro, L.; Luisi, R.; Bull, J. A. *Org. Lett*. **2018**, 20, 2599.

127.0, 126.0, 19.8.



4-Methylbenzenesulfonamide (**4c**).[27] Prepared according to the general procedure using 0.0398 g of **3c** (0.2 mmol), and **4c** was obtained as a white solid (0.0337 g, 99% yield) after flash column chromatography. ^{1}H NMR (300 MHz, d_6-DMSO) δ 7.72 (d, J = 8.2 Hz, 2H), 7.36 (d, J = 8.0 Hz, 2H), 7.27 (br, 2H), 2.37 (s, 3H); ^{13}C NMR (125 MHz, d_6-DMSO) δ 141.8, 141.4, 129.3, 125.6, 20.9.



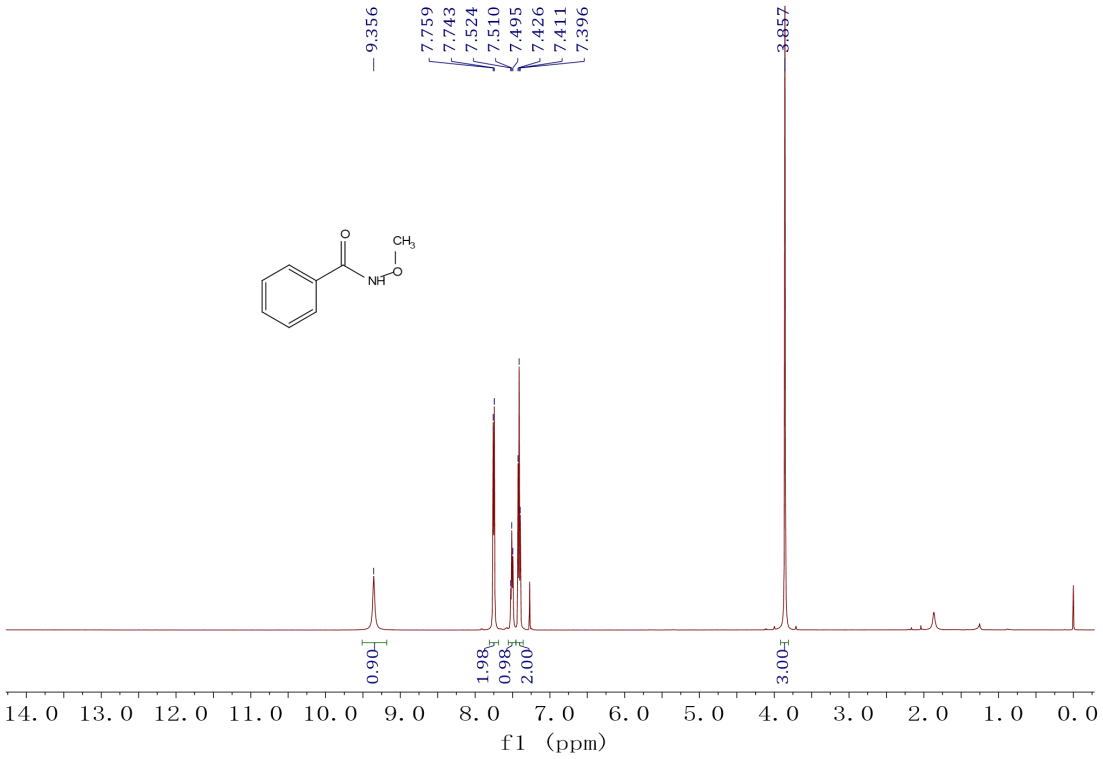
Phenylmethanesulfonamide (**4d**).[30] Prepared according to the general procedure using 0.0404 g of **3d** (0.2 mmol), and **4d** was obtained as a white solid (0.0317 g, 92% yield) after flash column chromatography. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.42-7.38 (m, 5H), 4.76 (br, 2H), 4.29 (s, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 130.8, 129.4, 128.9, 128.9, 61.0.

IV. Gram-scale Reaction

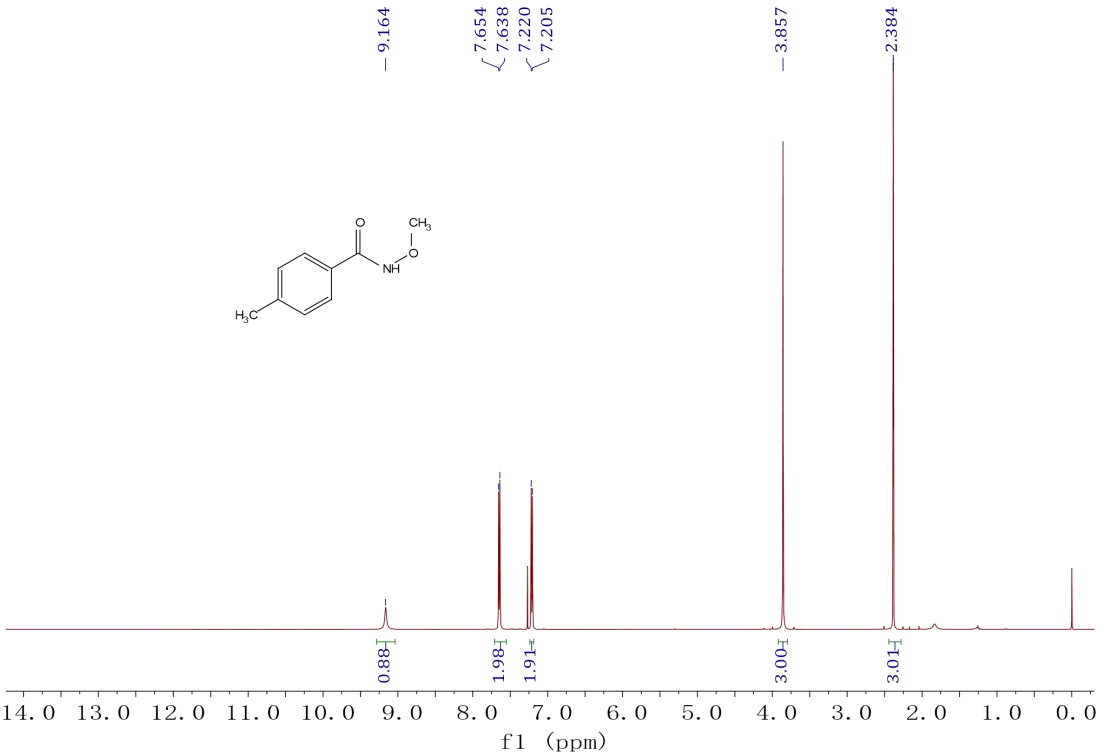
To a 100 mL dried Schlenk flask under air, 1.5340 g (10 mml) of **1a**, 0.1535 g (0.15 mmol) of $[RuCl_2(p\text{-cymene})]_2$, 12.5 mL of HCOOH/$Et_3N$ (molar ratio 1/1) and 12.5 mL of H_2O were added in sequence. After stirring at 100 °C for 12 hours, the mixture was quenched with saturated NH_4Cl (10 mL), extracted with EA (50 mL x 3). The combined organic layers were washed with brine, dried over Na_2SO_4, filtered and concentrated in vacuo. The residue was purified by flash chromatography on silica gel with PE/EA as the eluent to afford 1.1083 g (9.1 mmol, 91% yield) of **2a**.

[30] Bahrami, K.; Khodaei, M. M.; Soheilizad, M. *J. Org. Chem*. **2009**, *74*, 9287.

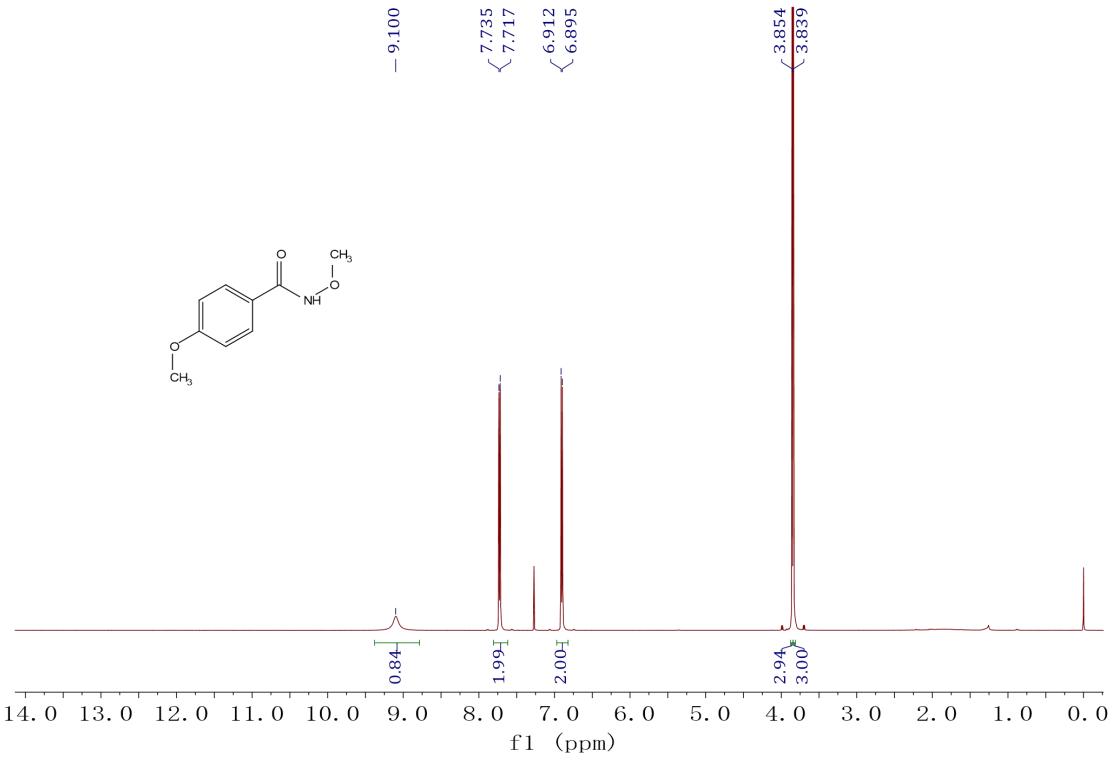
V. NMR Spectra



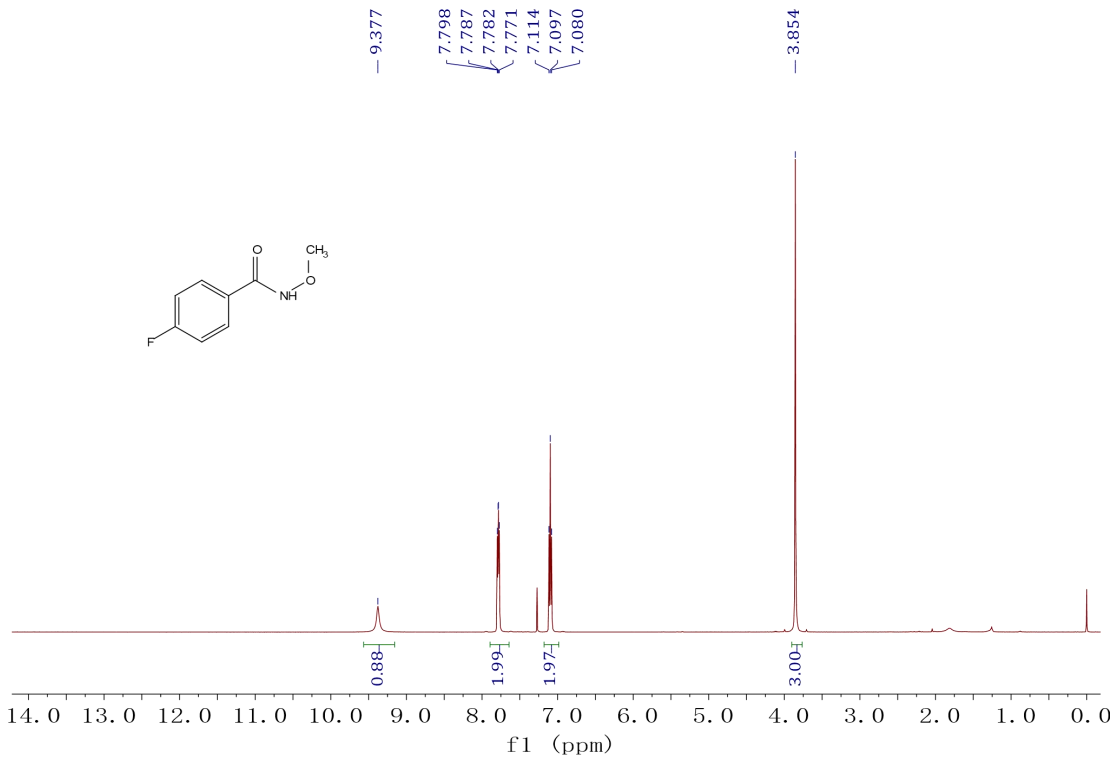
^{1}H NMR: *N-methoxybenzamide* (**1a**)



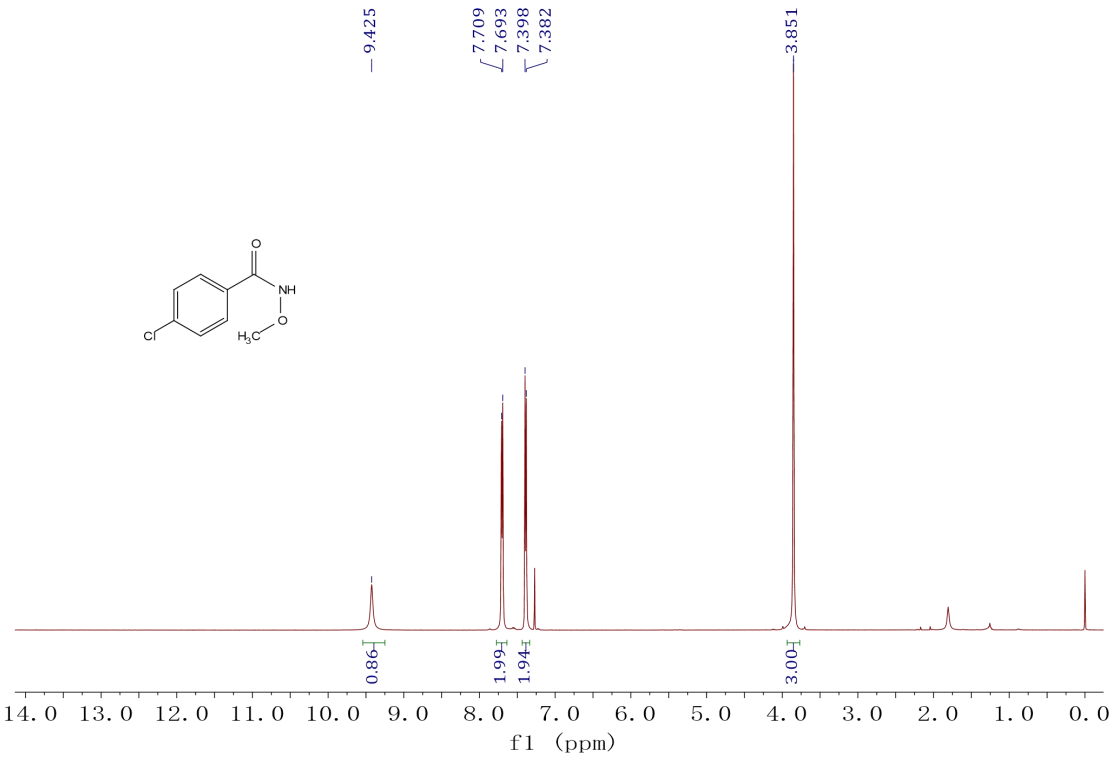
^{1}H NMR: *N-methoxy-4-methylbenzamide* (**1b**)



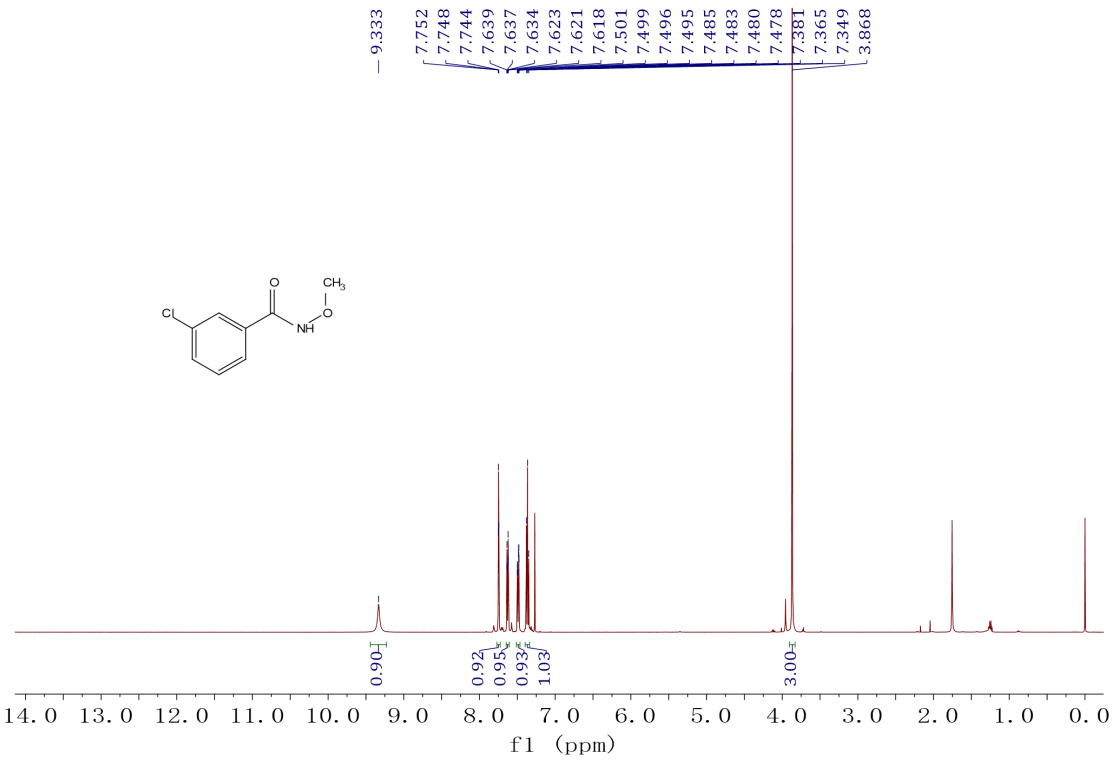
^{1}H NMR: *N,4-dimethoxybenzamide* (**1c**)



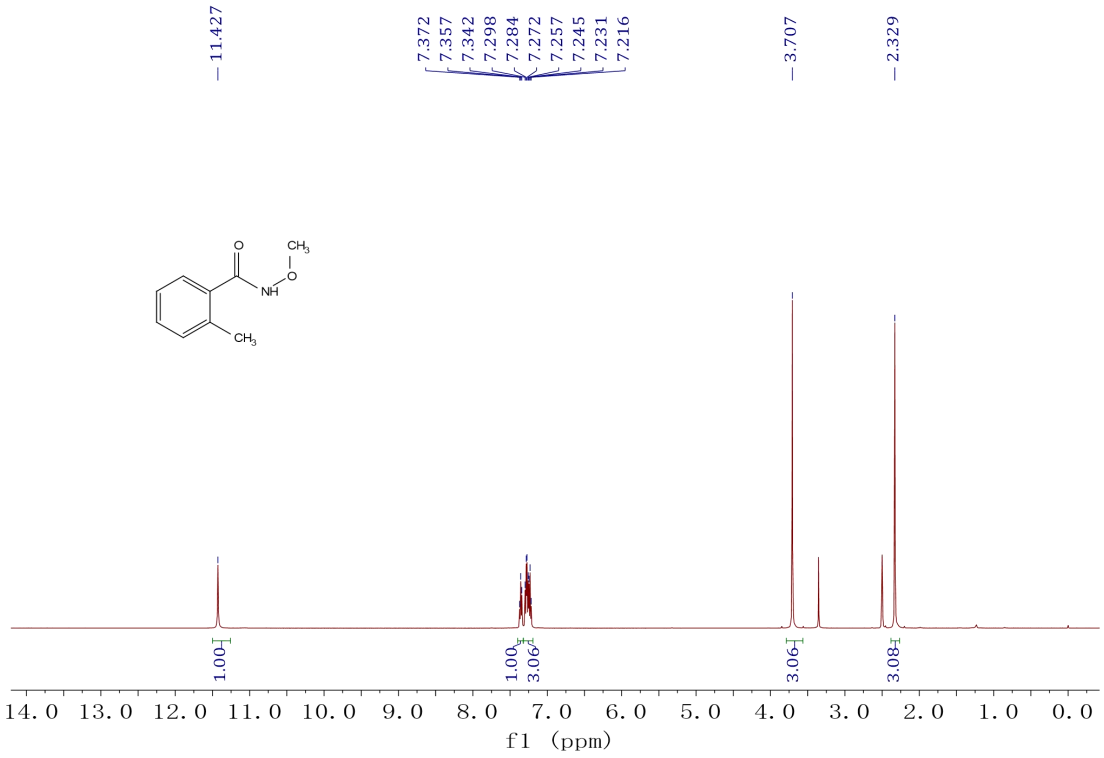
^{1}H NMR: *4-fluoro-N-methoxybenzamide* (**1d**)



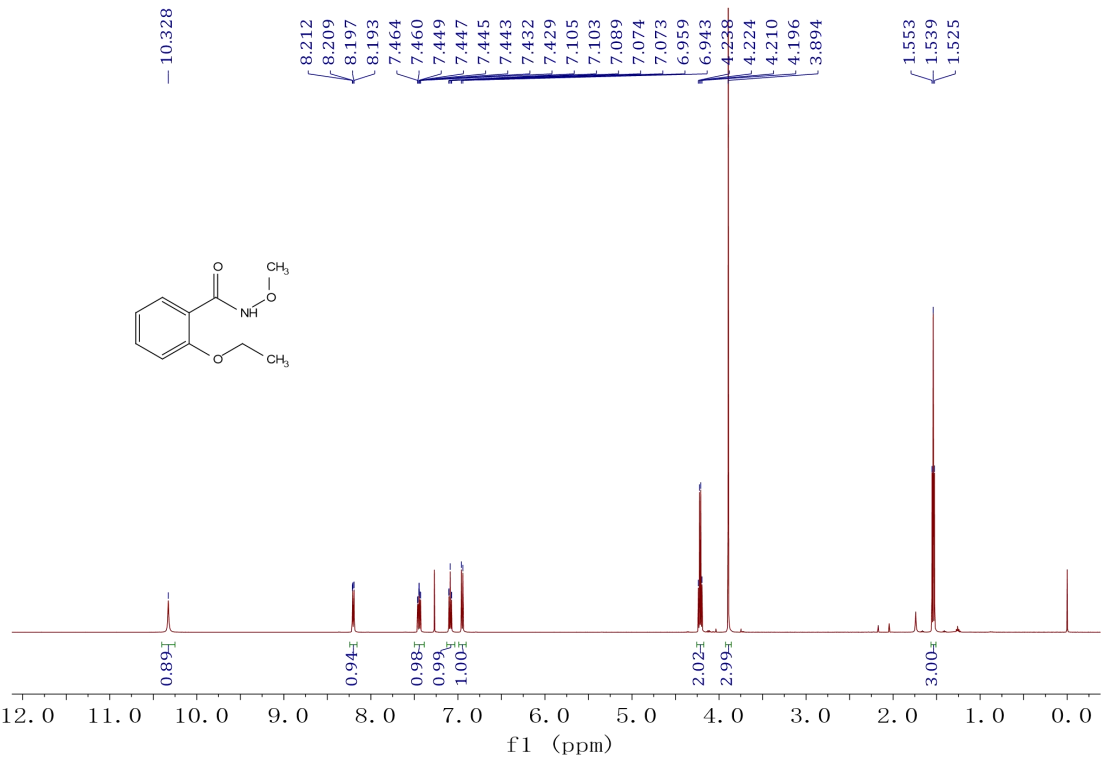
^{1}H NMR: *4-chloro-N-methoxybenzamide* (**1e**)



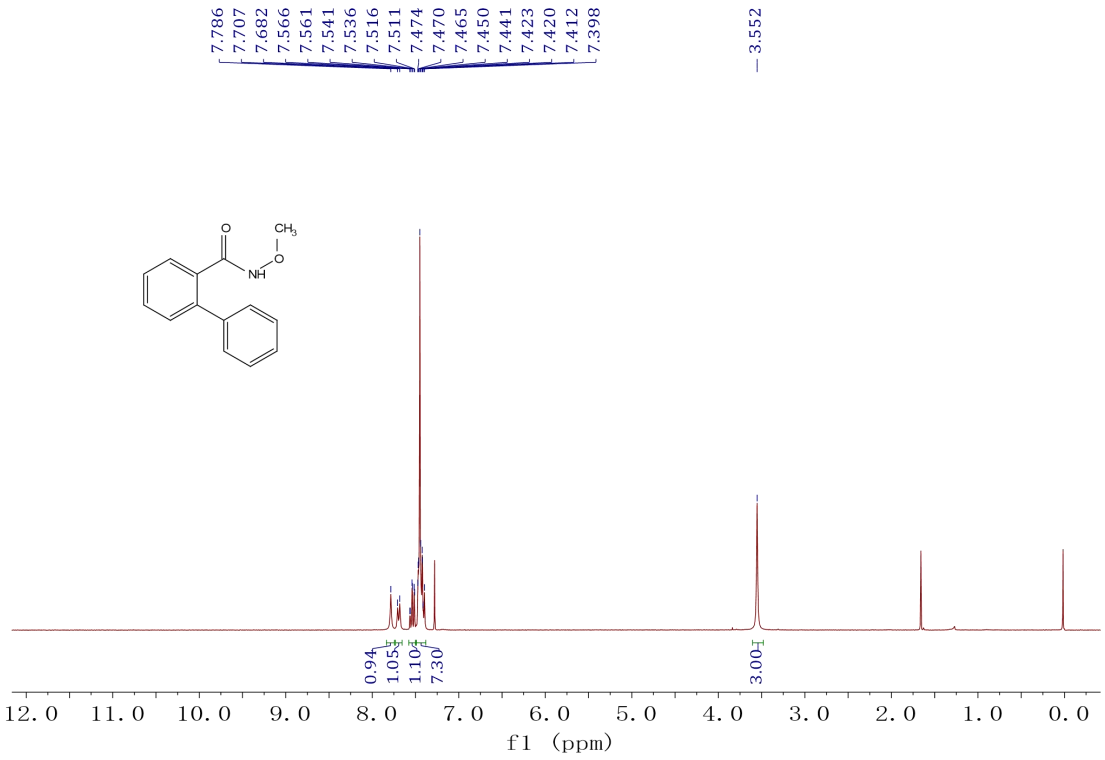
^{1}H NMR: *3-chloro-N-methoxybenzamide* (**1f**)



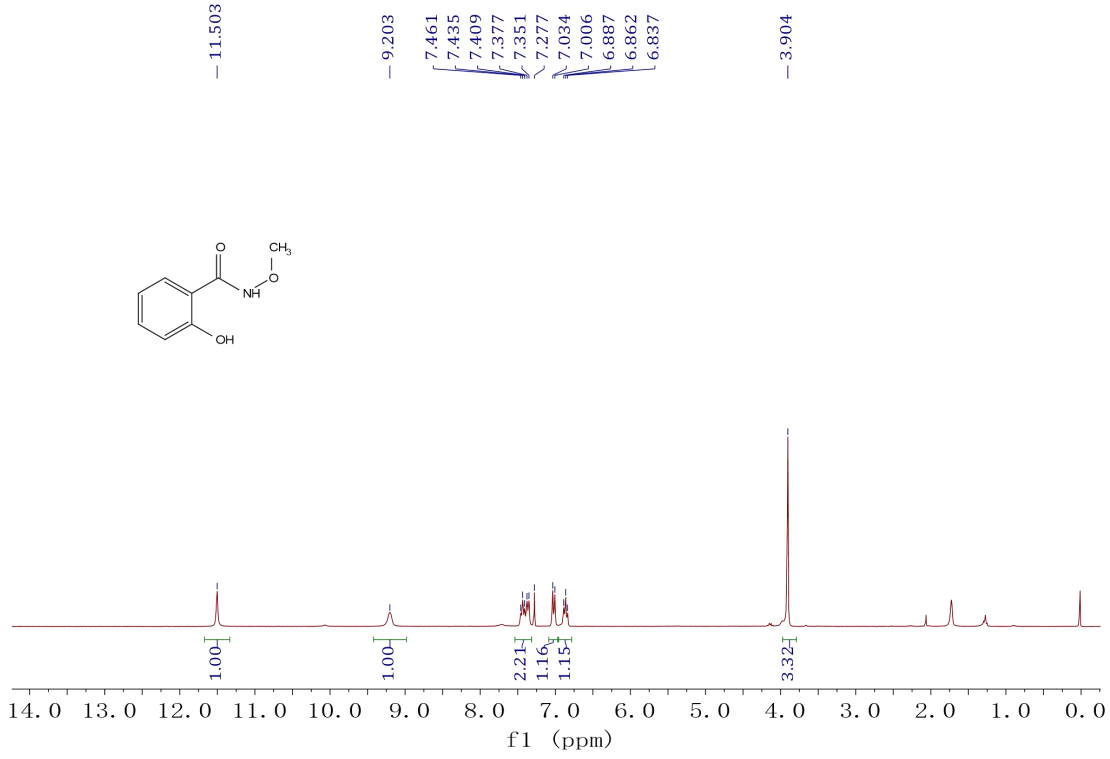
^{1}H NMR: *N-methoxy-2-methylbenzamide* (**1g**)



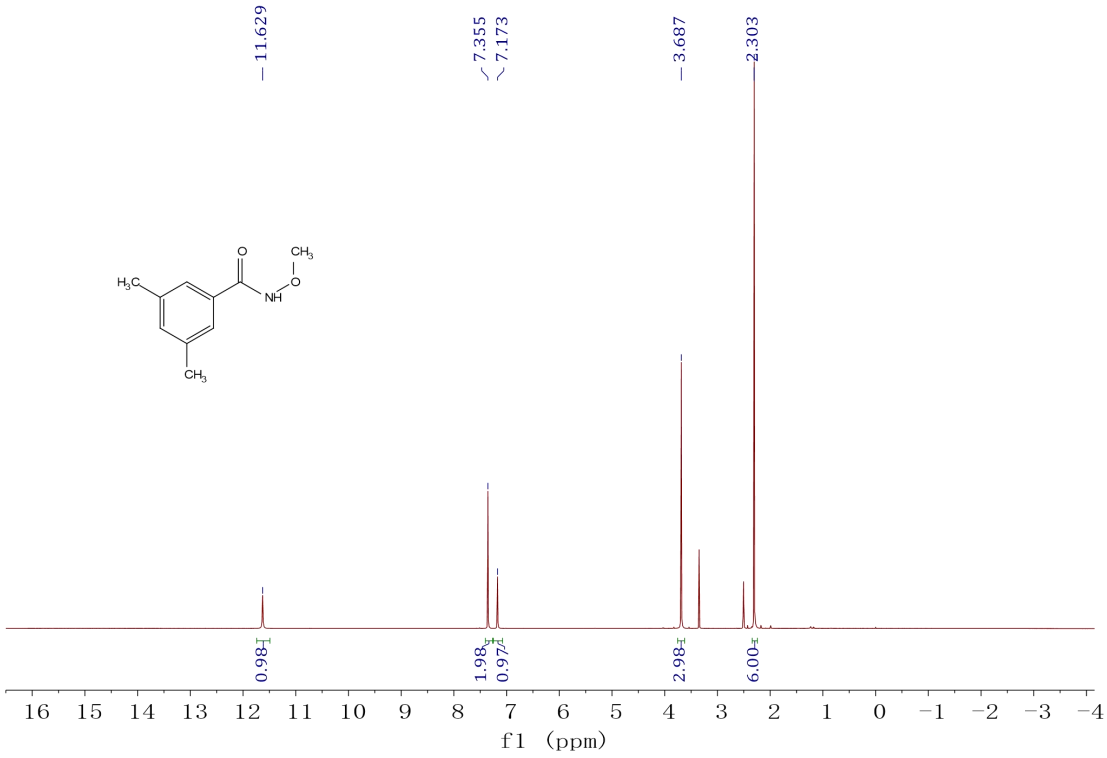
^{1}H NMR: *2-ethoxy-N-methoxybenzamide* **(1h)**



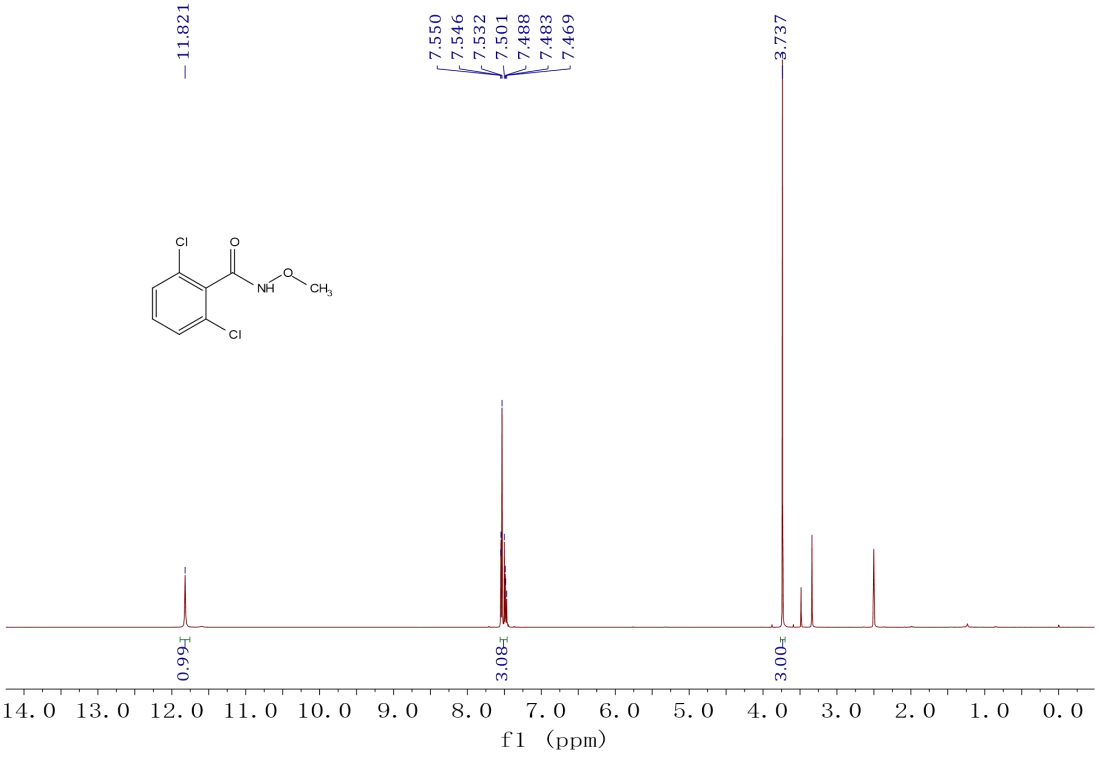
^{1}H NMR: *N-methoxy-[1,1'-biphenyl]-2-carboxamide* **(1i)**



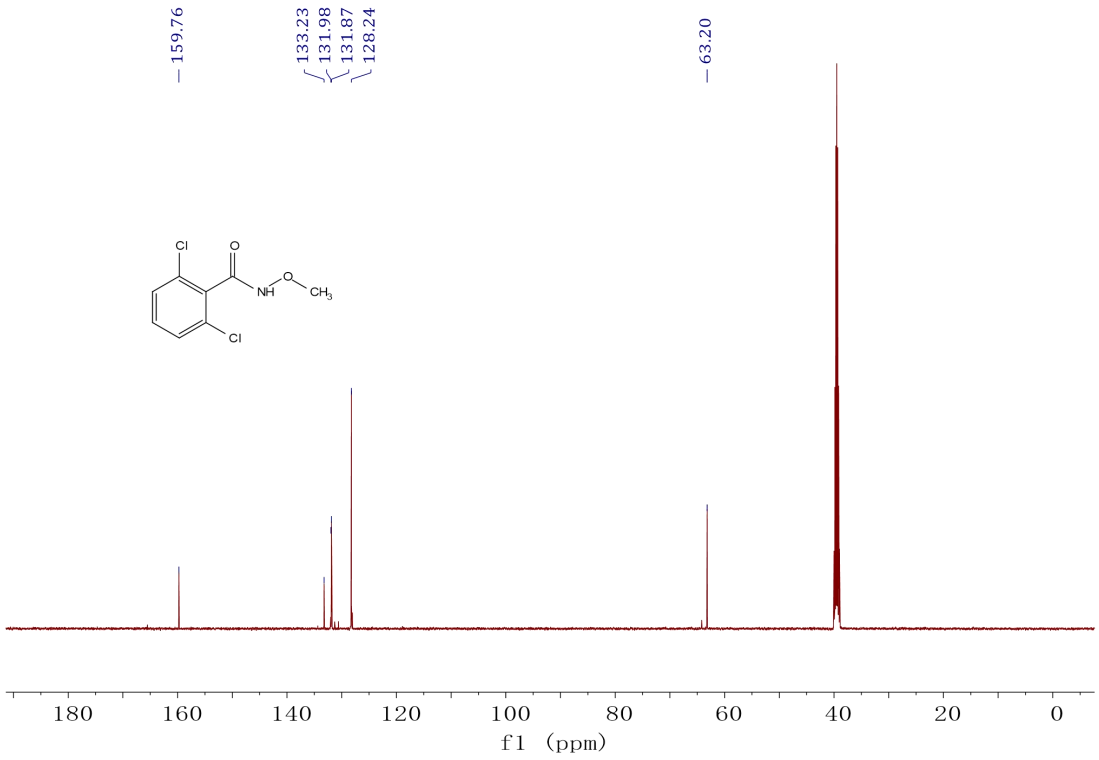
^{1}H NMR: *2-hydroxy-N-methoxybenzamide* **(1j)**



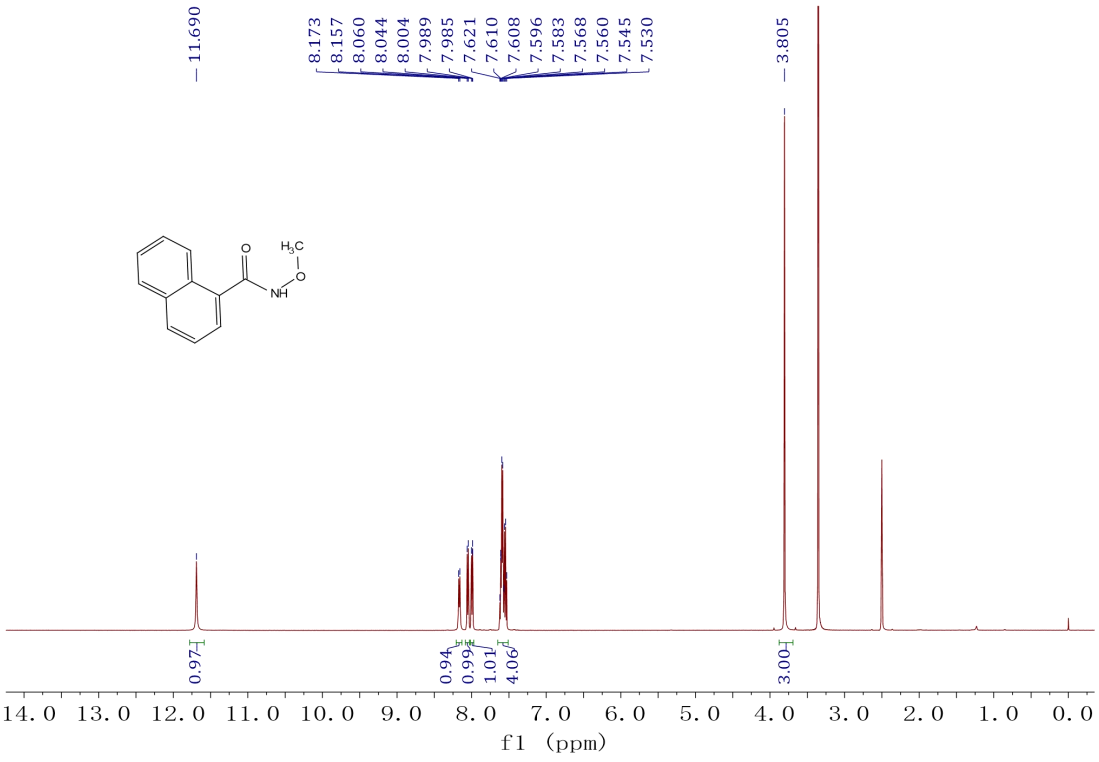
^{1}H NMR: *N-methoxy-3,5-dimethylbenzamide* **(1k)**



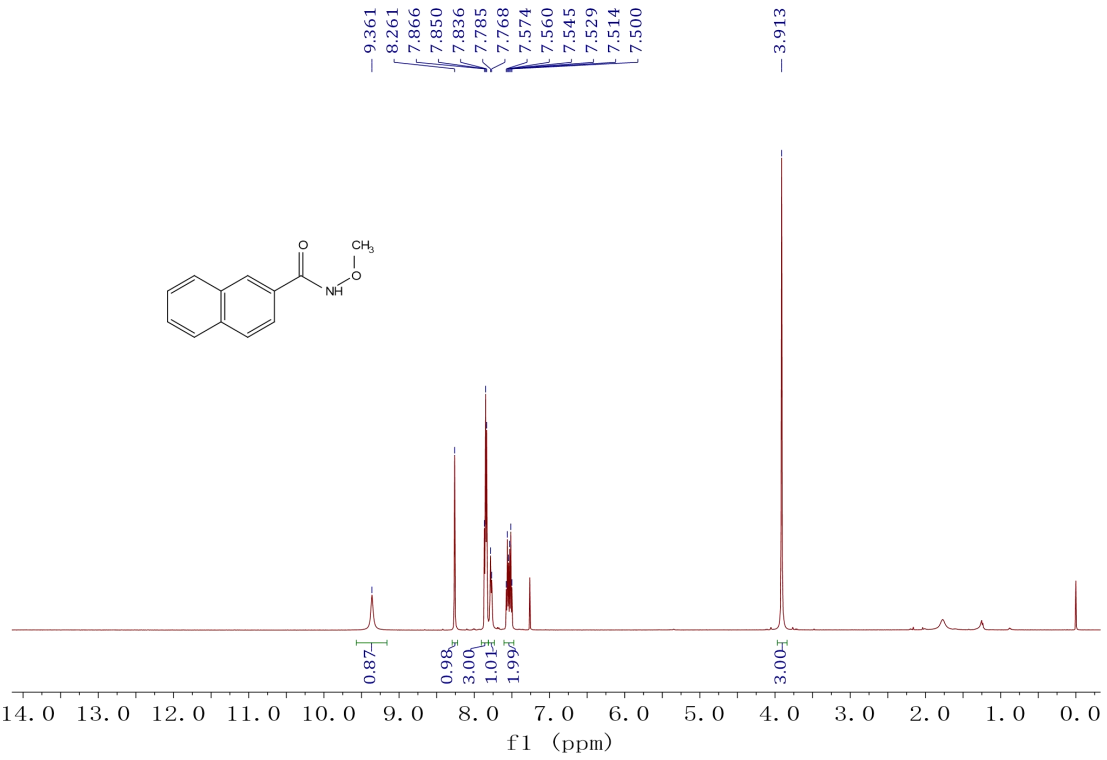
^{1}H NMR: *2,6-dichloro-N-methoxybenzamide* **(1l)**



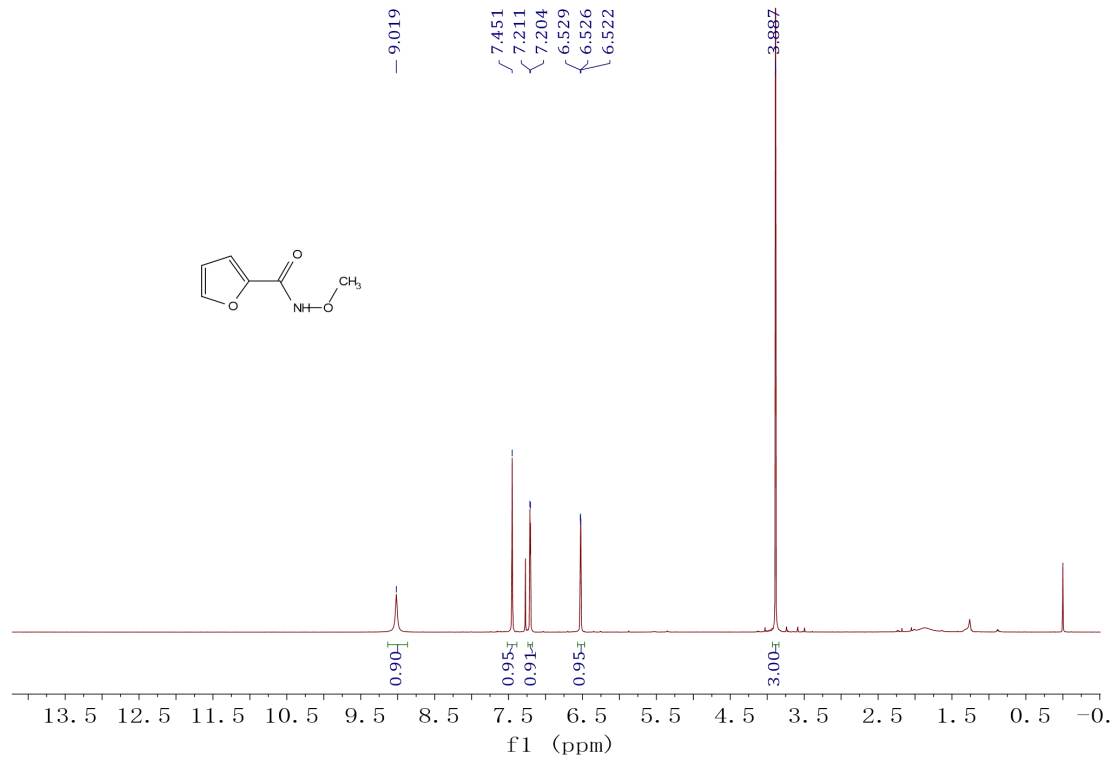
^{13}C NMR: *2,6-dichloro-N-methoxybenzamide* **(1l)**



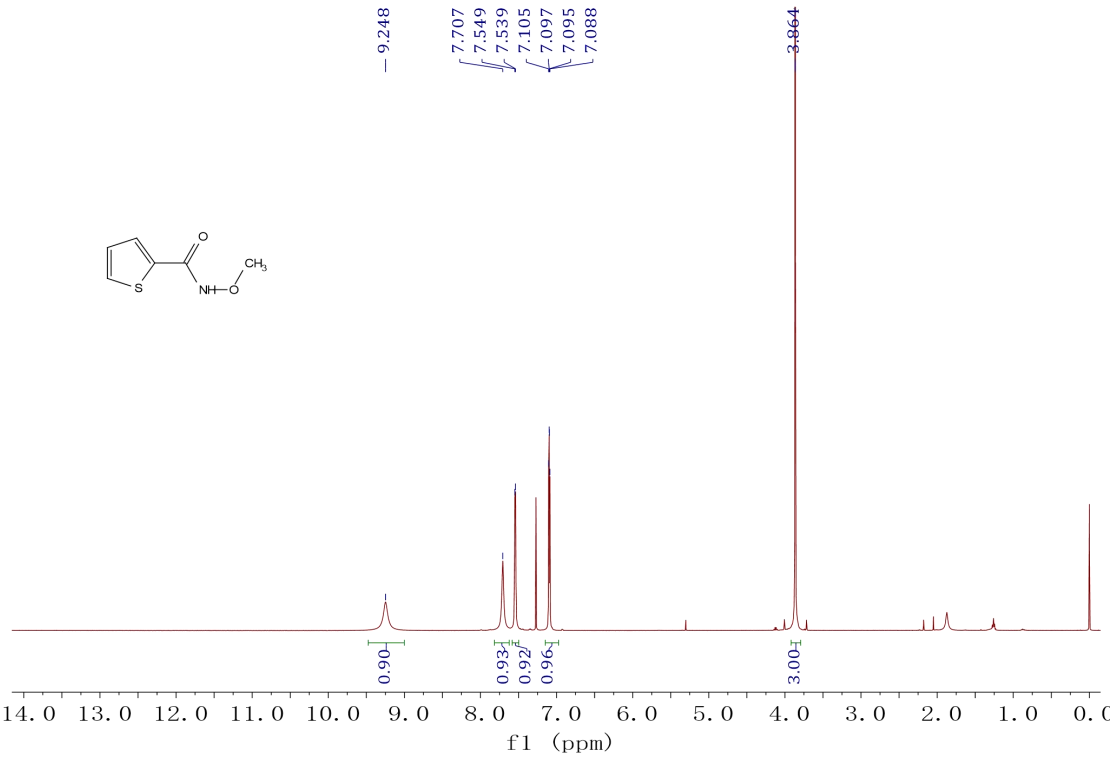
^{1}H NMR: *N-methoxy-1-naphthamide* **(1m)**



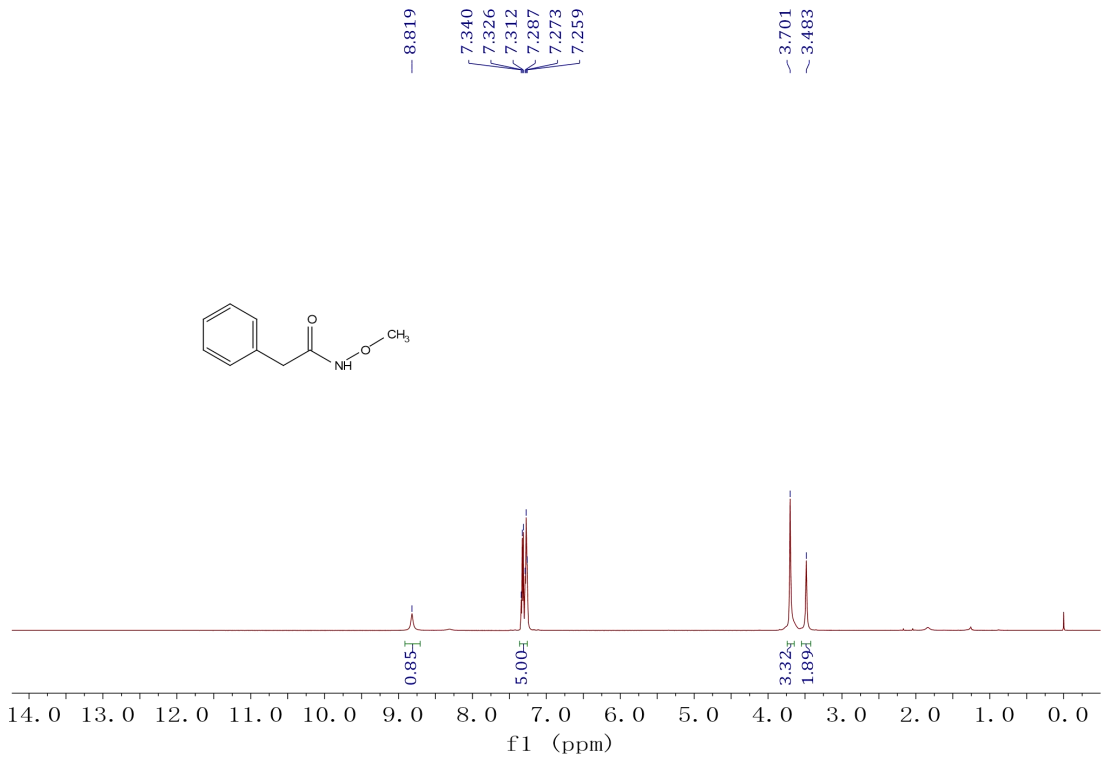
^{1}H NMR: *N-methoxy-2-naphthamide* **(1n)**



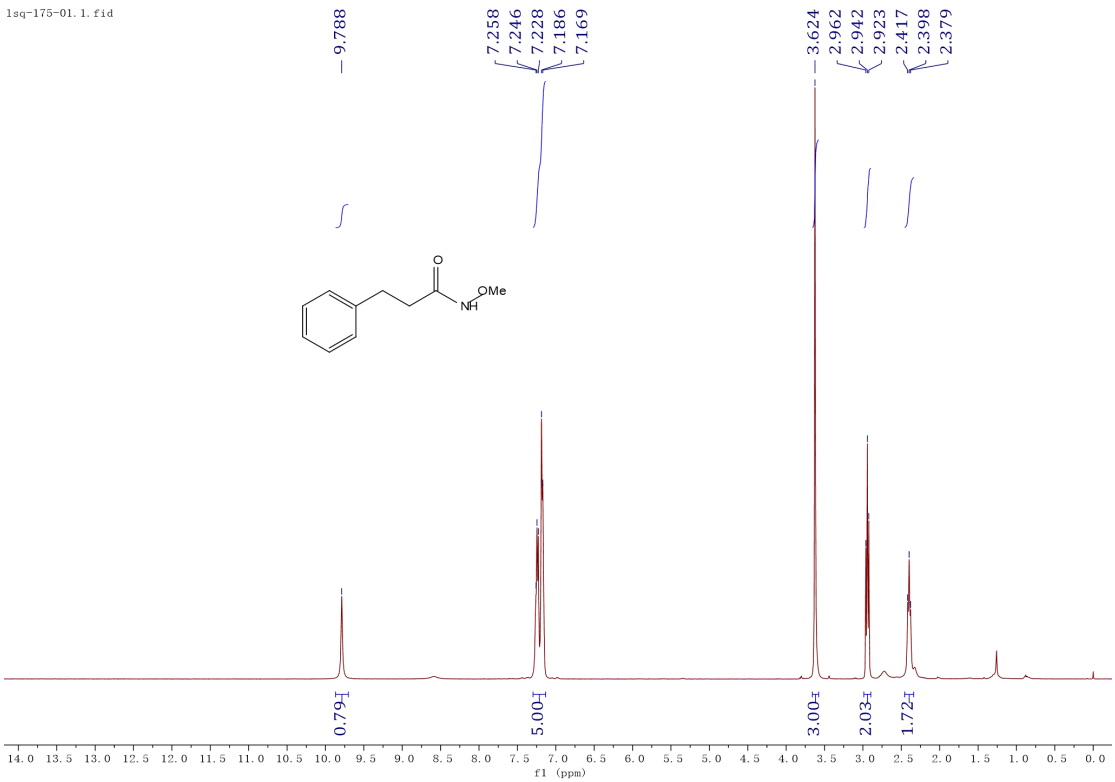
^{1}H NMR: *N-methoxyfuran-2-carboxamide* **(1p)**



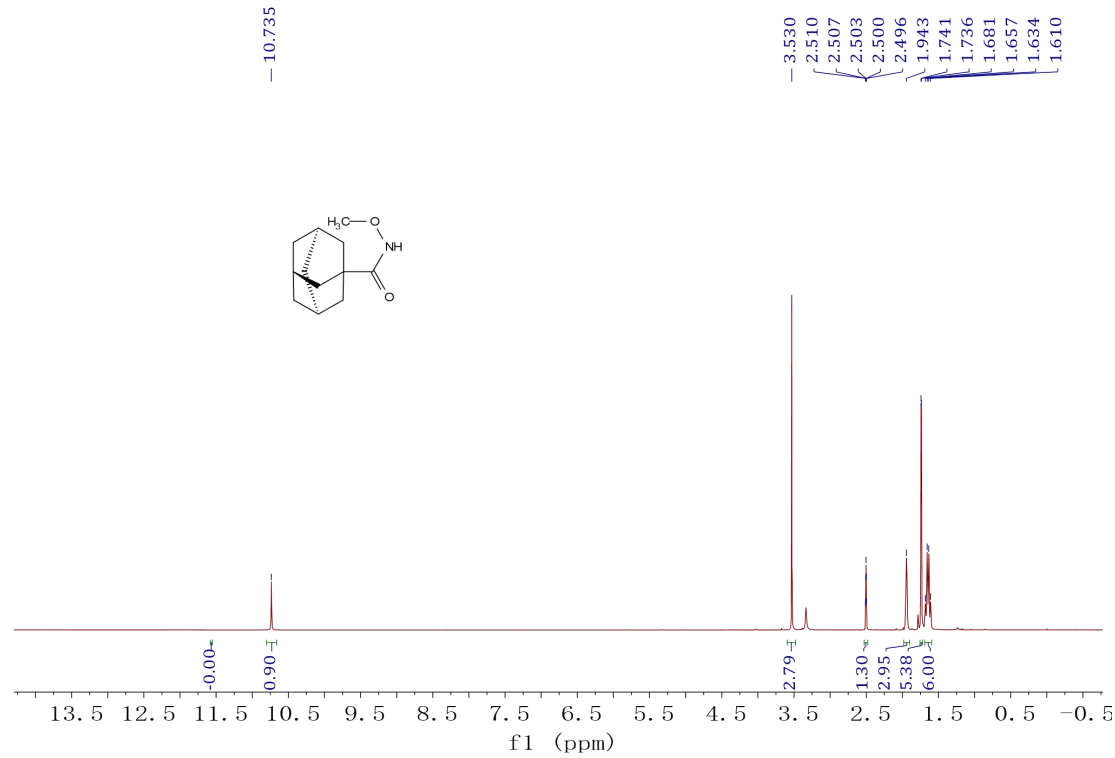
^{1}H NMR: *N-methoxythiophene-2-carboxamide* **(1q)**



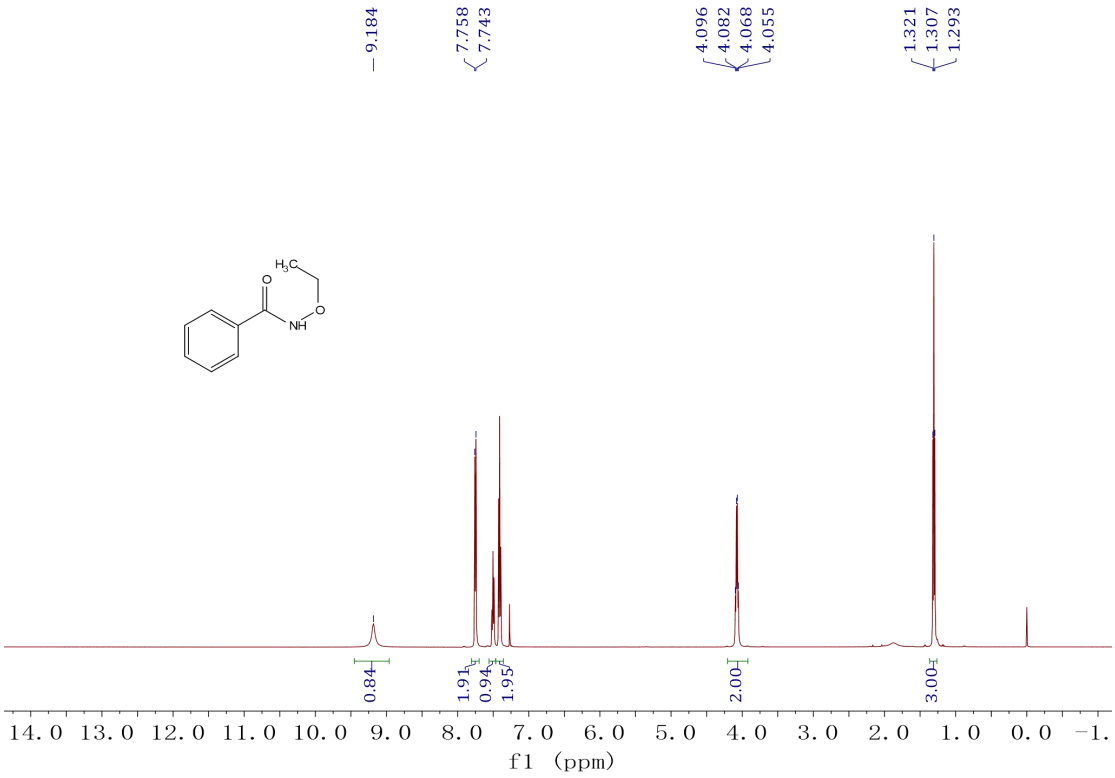
^{1}H NMR: *N-methoxy-2-phenylacetamide* **(1r)**



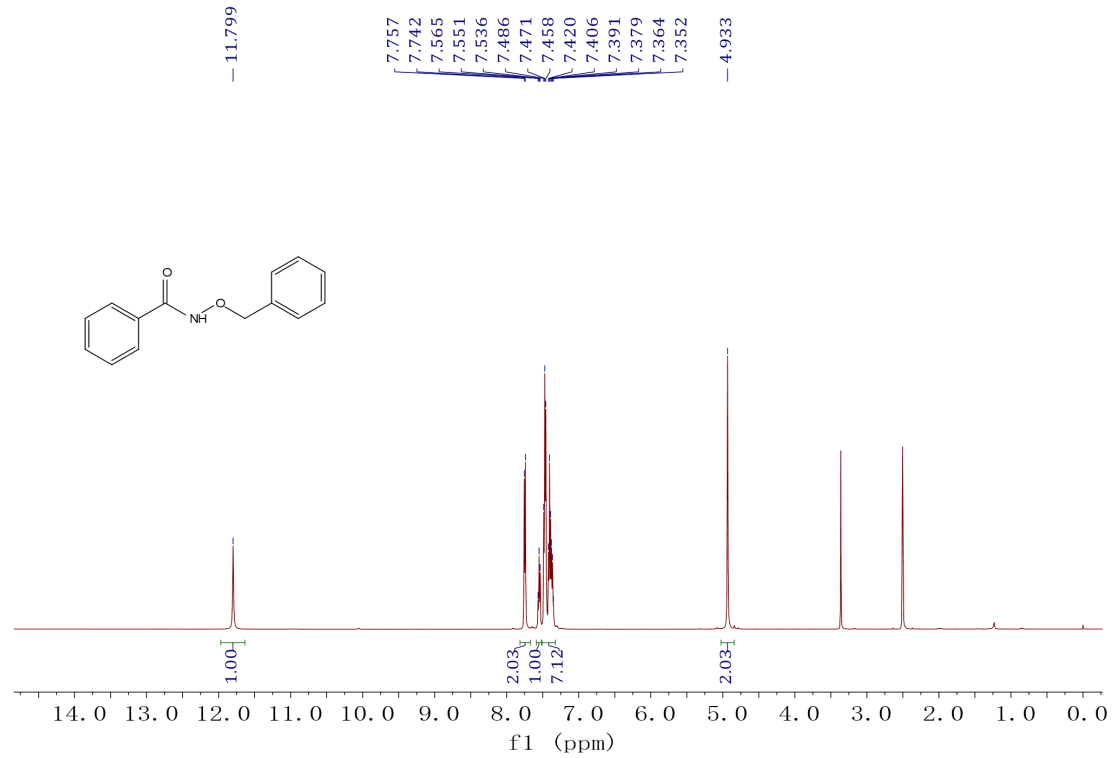
^{1}H NMR: *N-methoxy-3-phenylpropanamide* **(1s)**



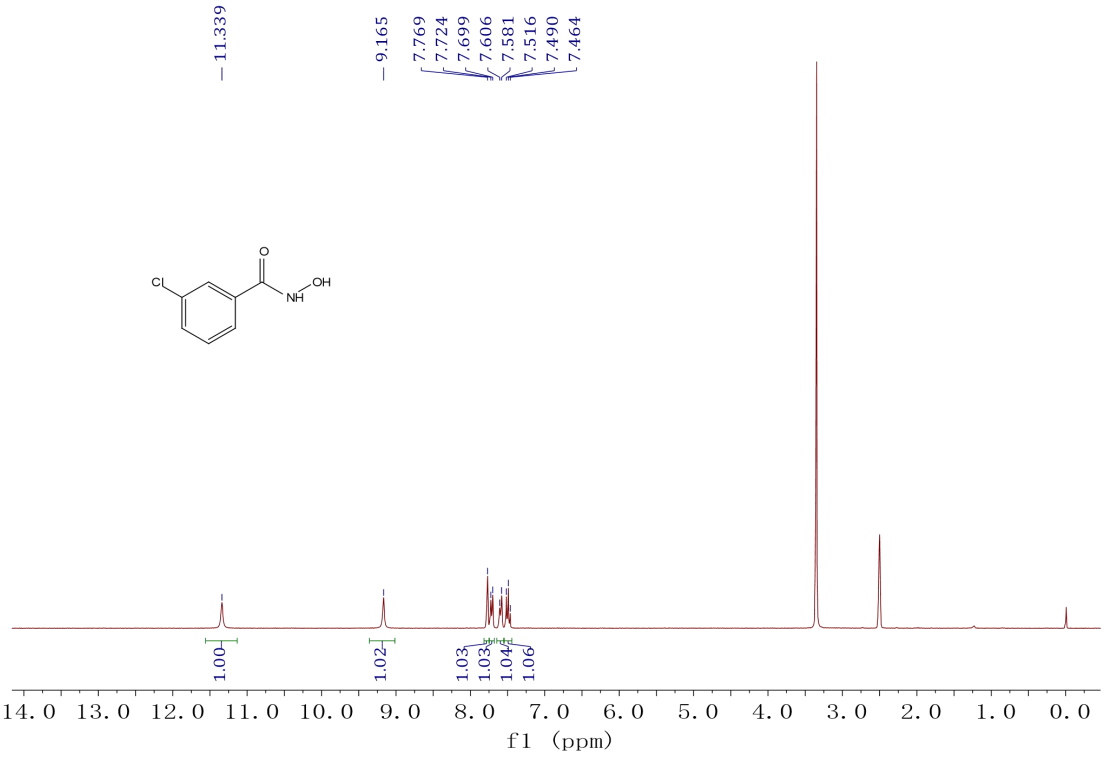
^{1}H NMR: *(3r,5r,7r)-N-methoxyadamantane-1-carboxamide* **(1t)**



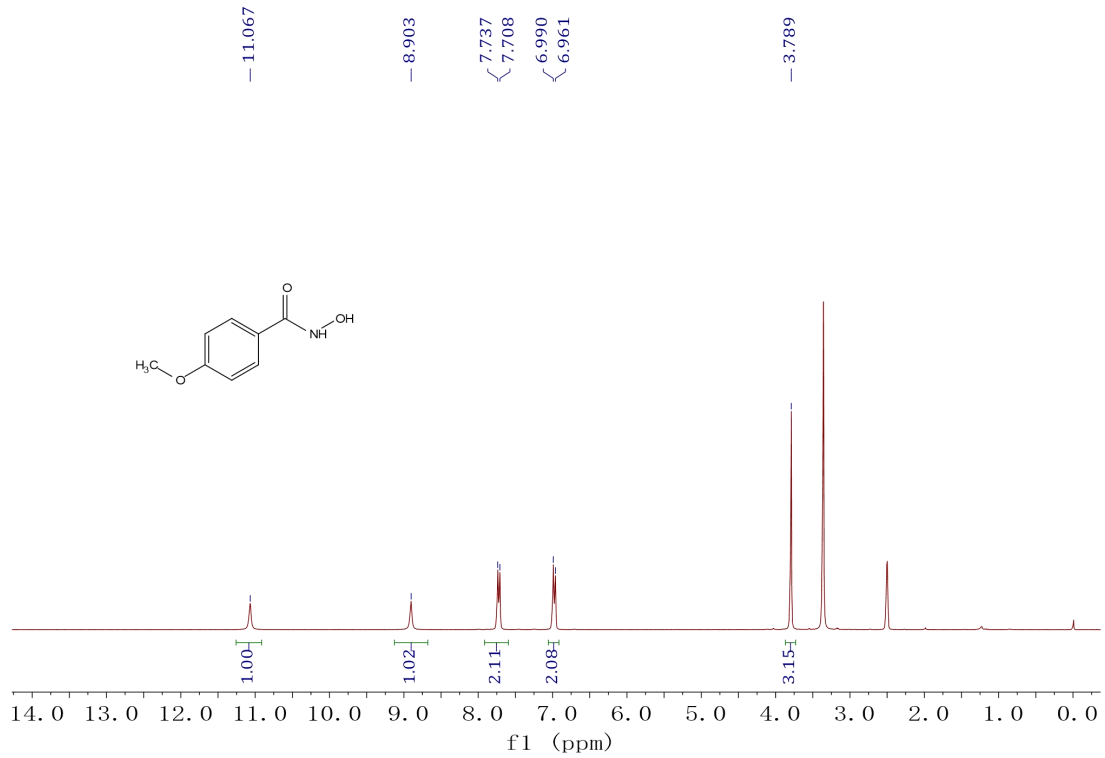
^{1}H NMR: *N-ethoxybenzamide* **(1u)**



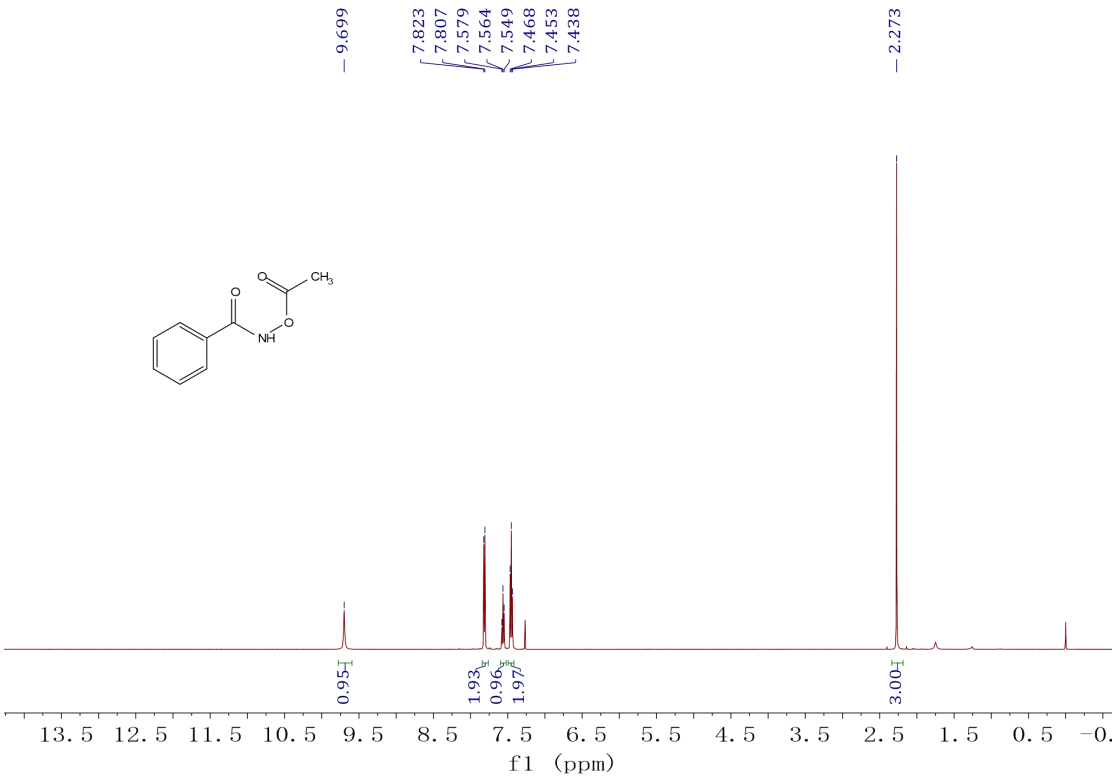
^{1}H NMR: *N*-(benzyloxy)benzamide **(1v)**



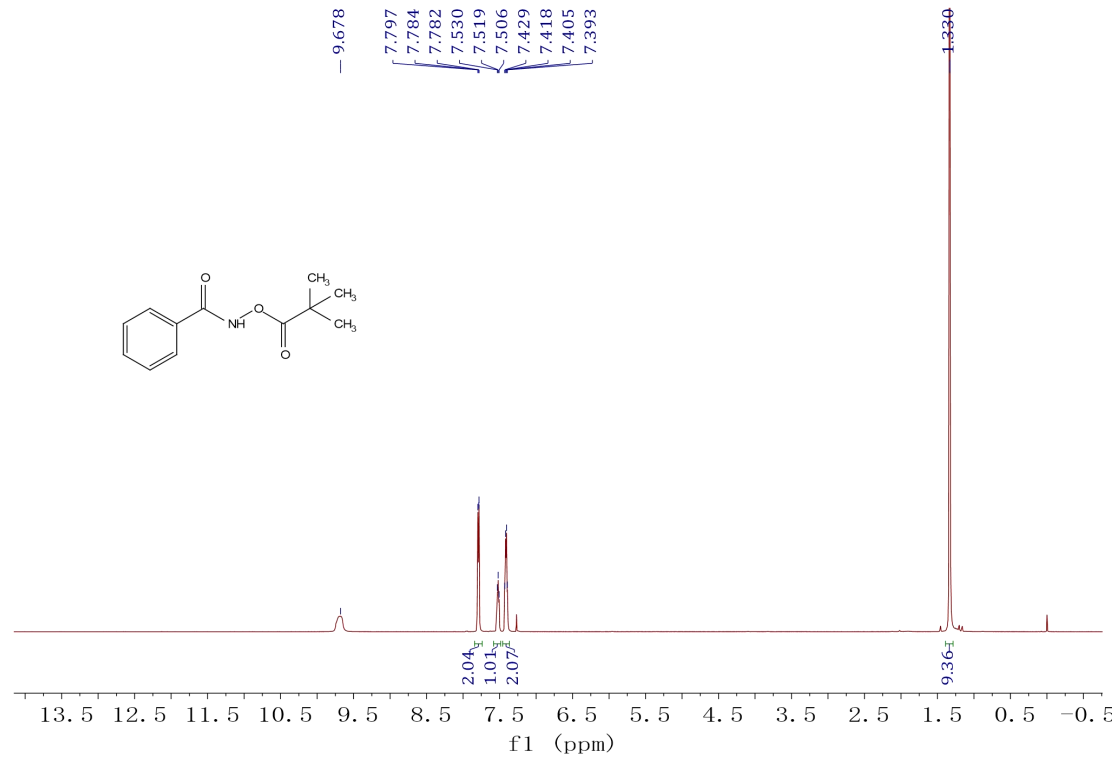
^{1}H NMR: *3-chloro-N-hydroxybenzamide* **(1x)**



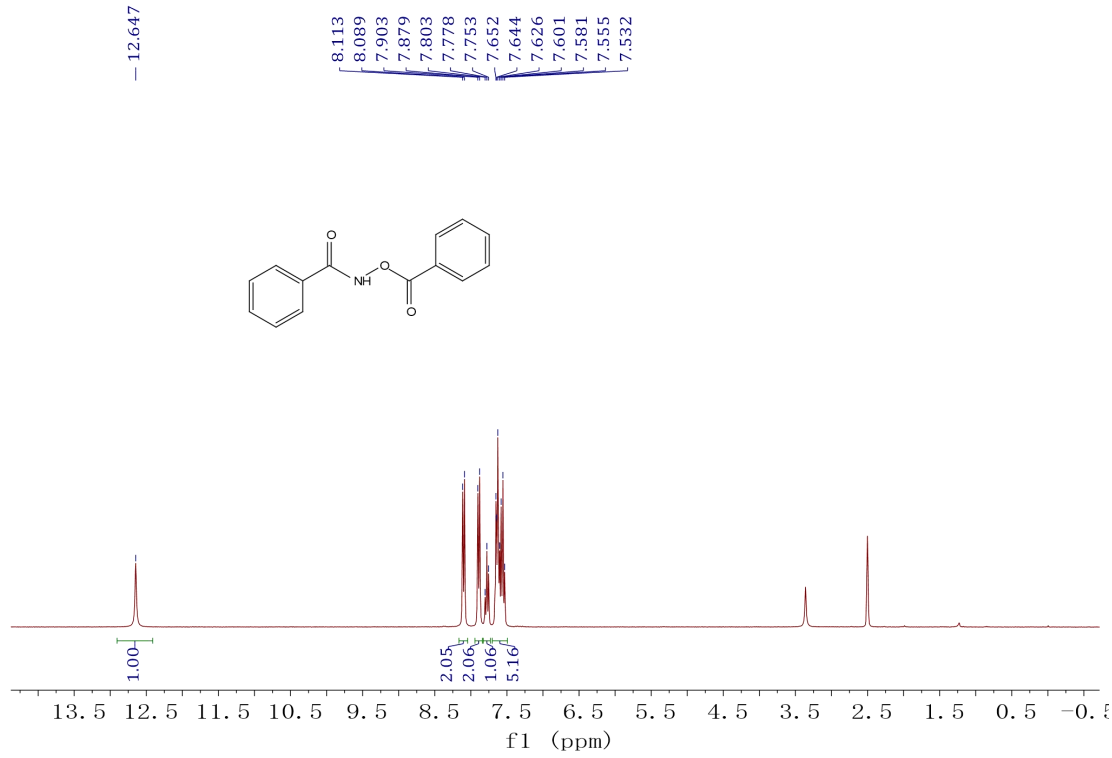
^{1}H NMR: *N-hydroxy-4-methoxybenzamide* **(1y)**



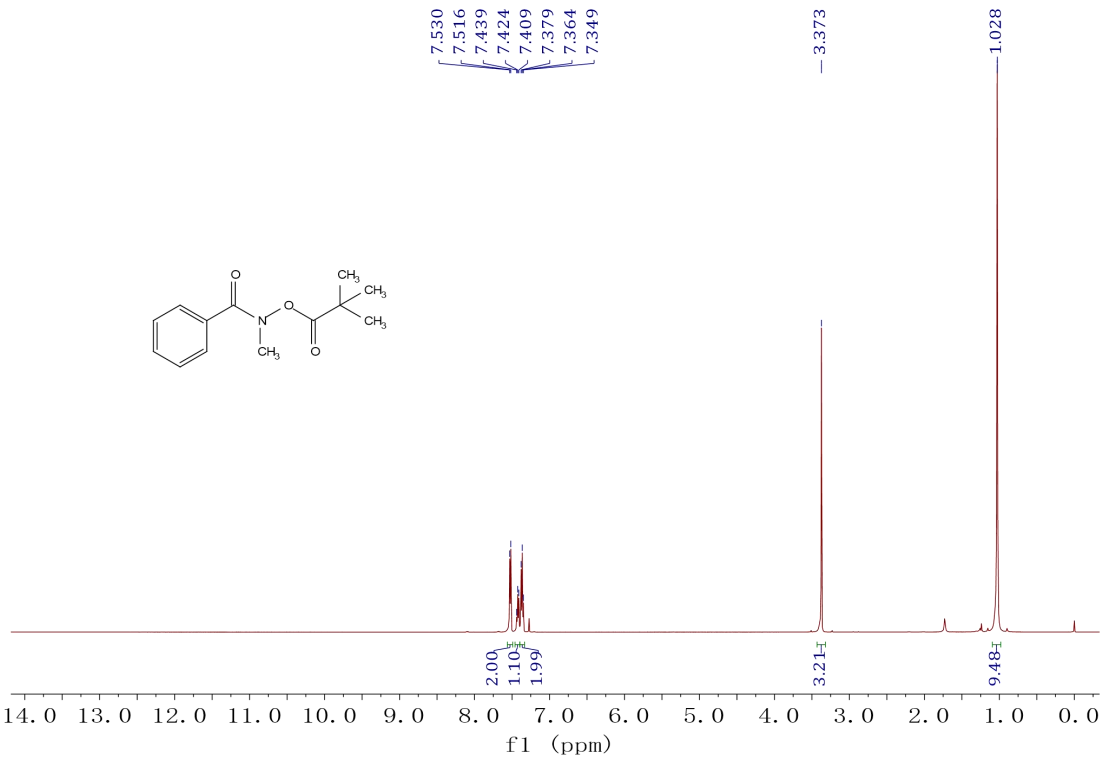
^{1}H NMR: *N*-acetoxybenzamide **(1z)**



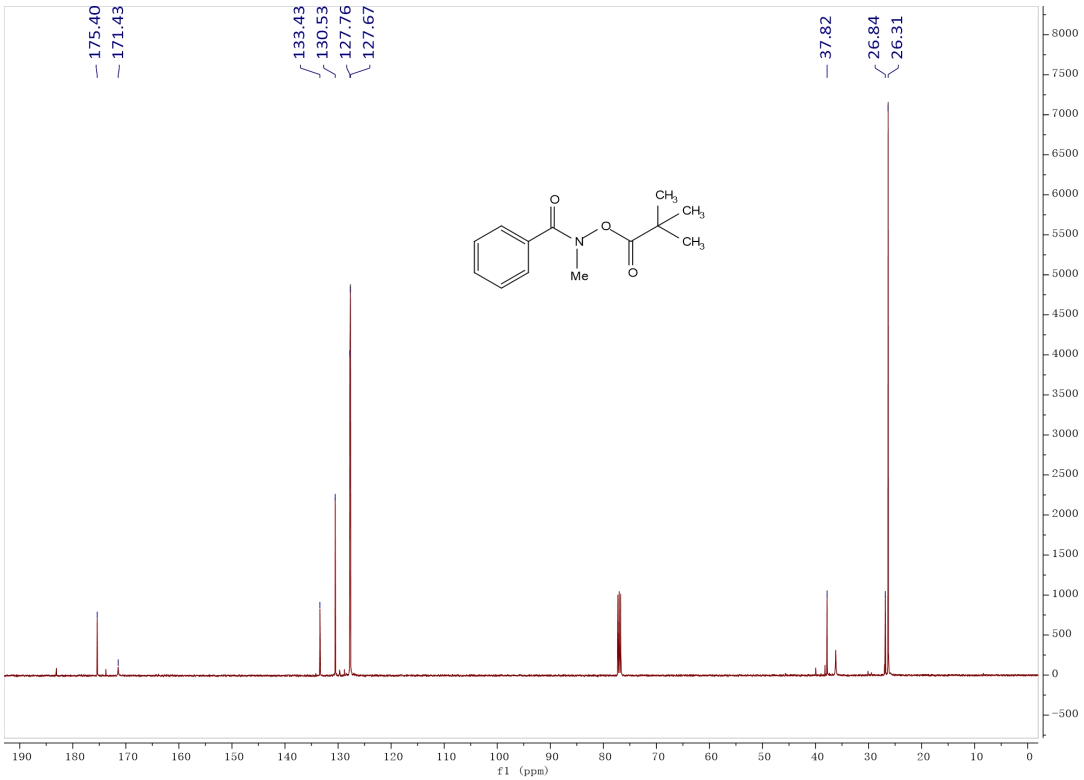
^{1}H NMR*: N-(pivaloyloxy)benzamide* **(1aa)**



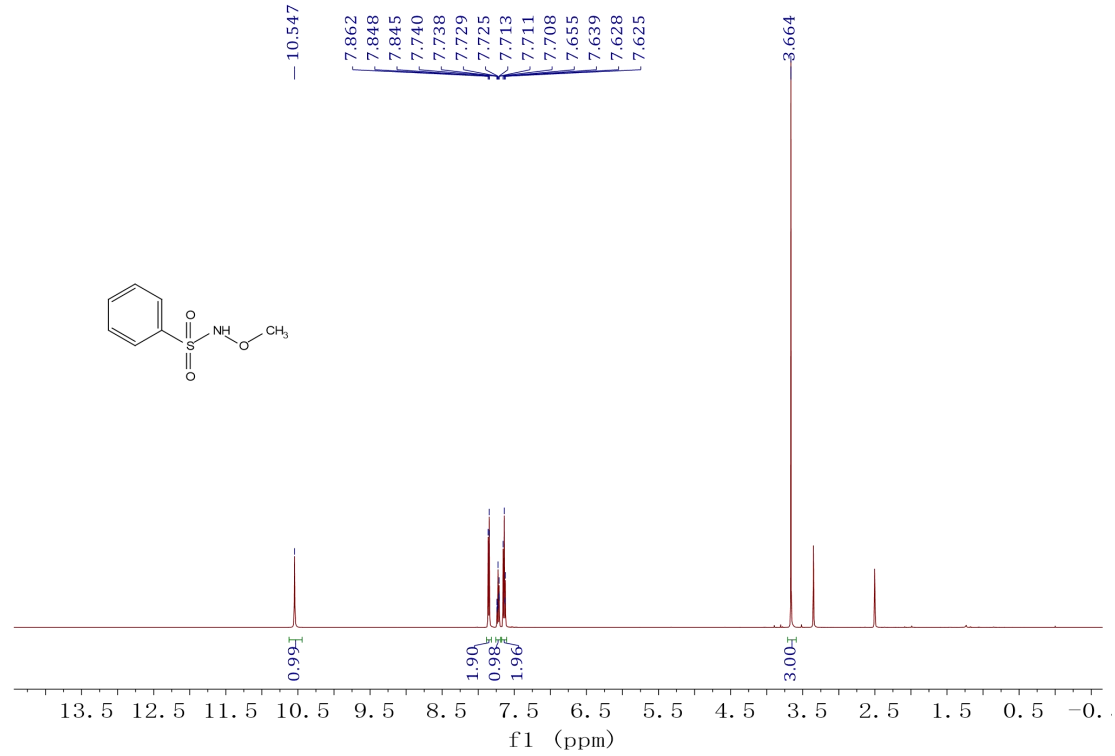
^{1}H NMR*: N-(benzoyloxy)benzamide* **(1ab)**



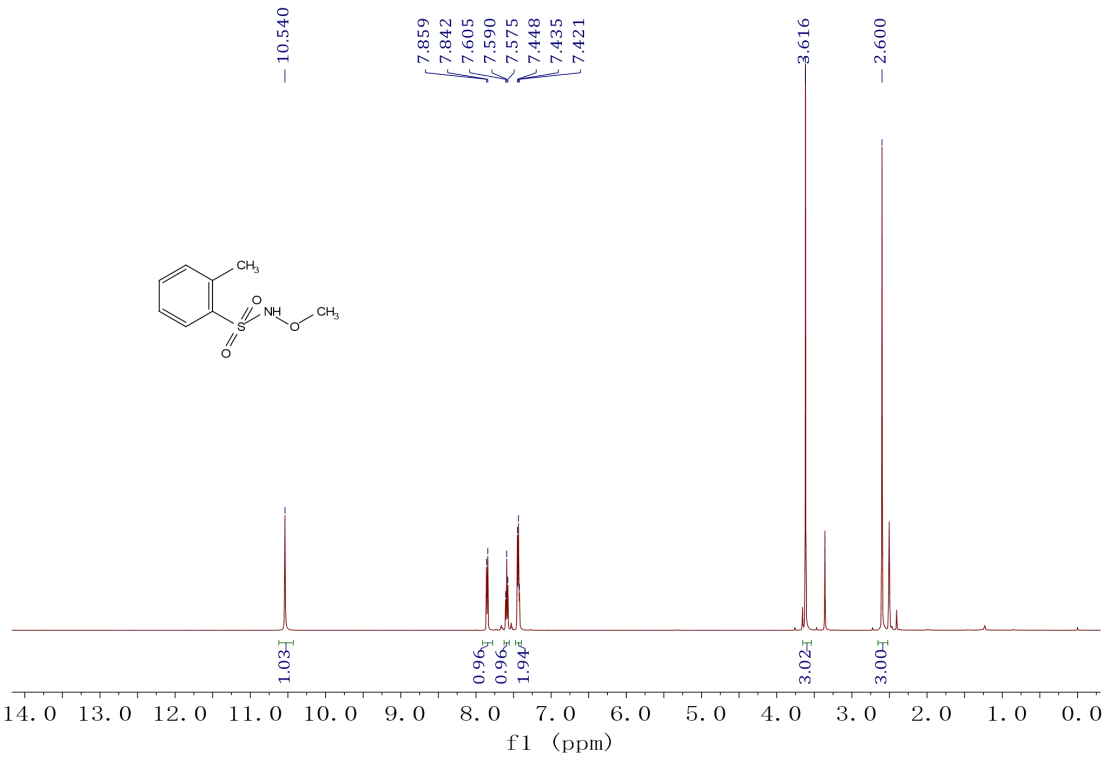
^{1}H NMR*: N-methyl-N-(pivaloyloxy)benzamide* **(1ad)**



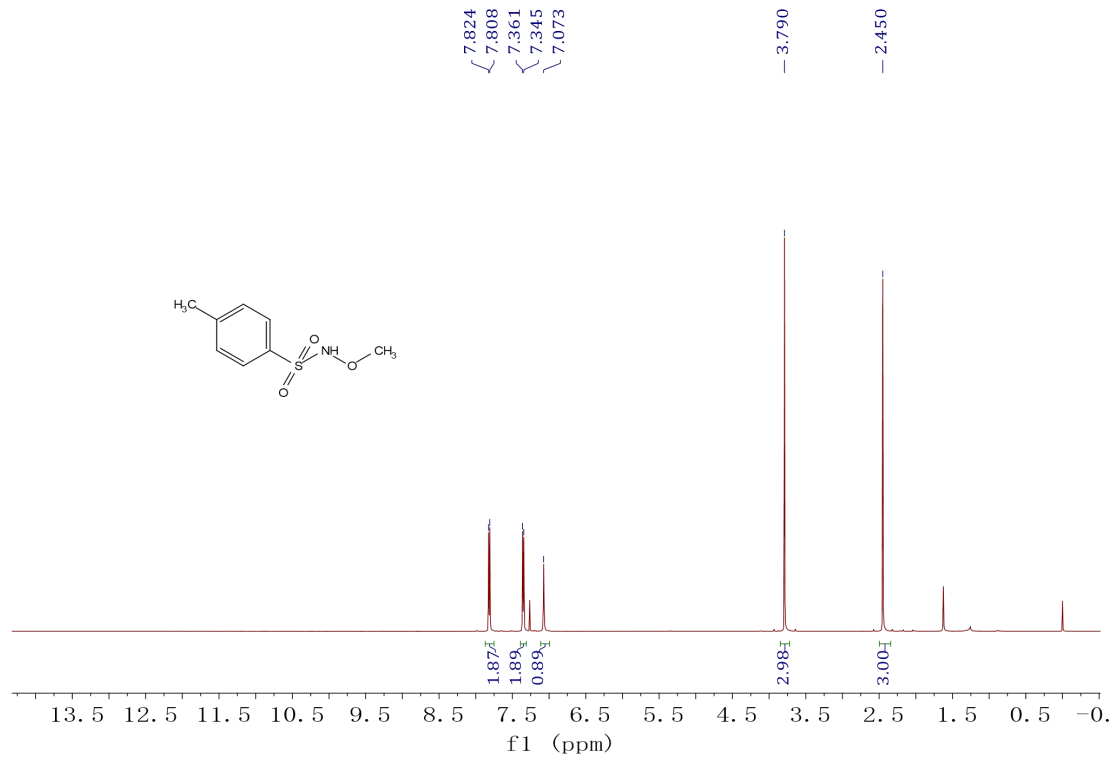
^{13}C NMR*: N-methyl-N-(pivaloyloxy)benzamide* **(1ad)**



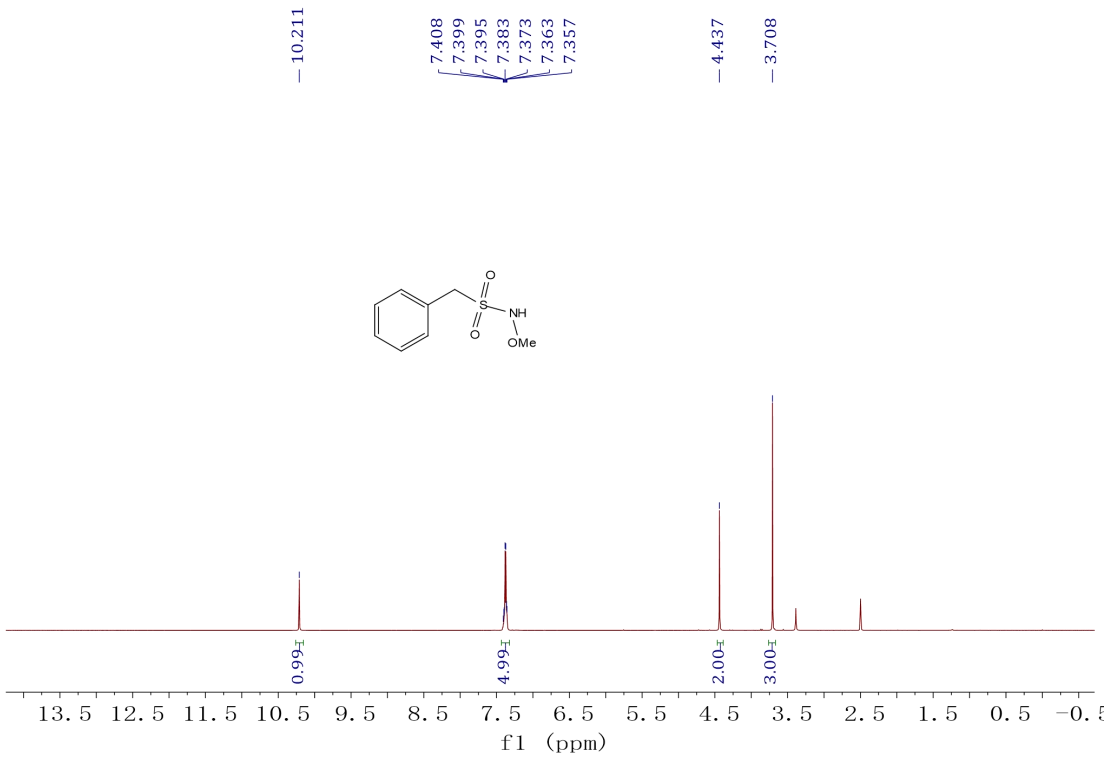
^{1}H NMR*: N-methoxybenzenesulfonamide* **(3a)**



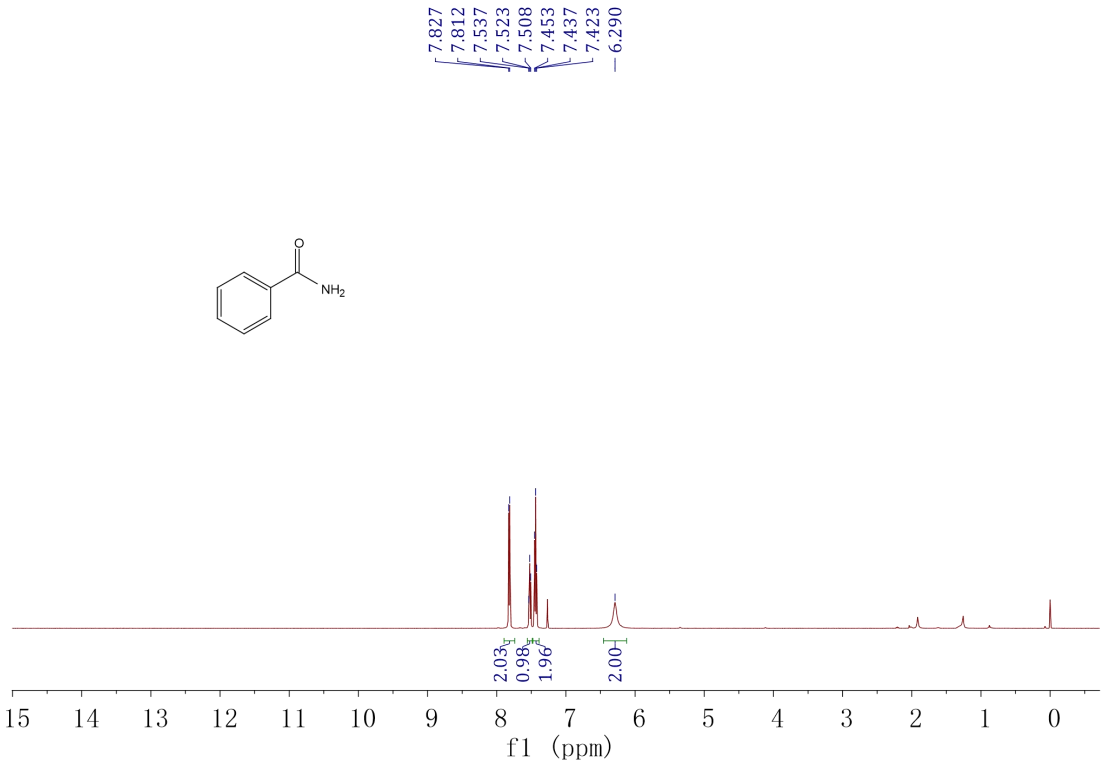
^{1}H NMR*: N-methoxy-2-methylbenzenesulfonamide* **(3b)**



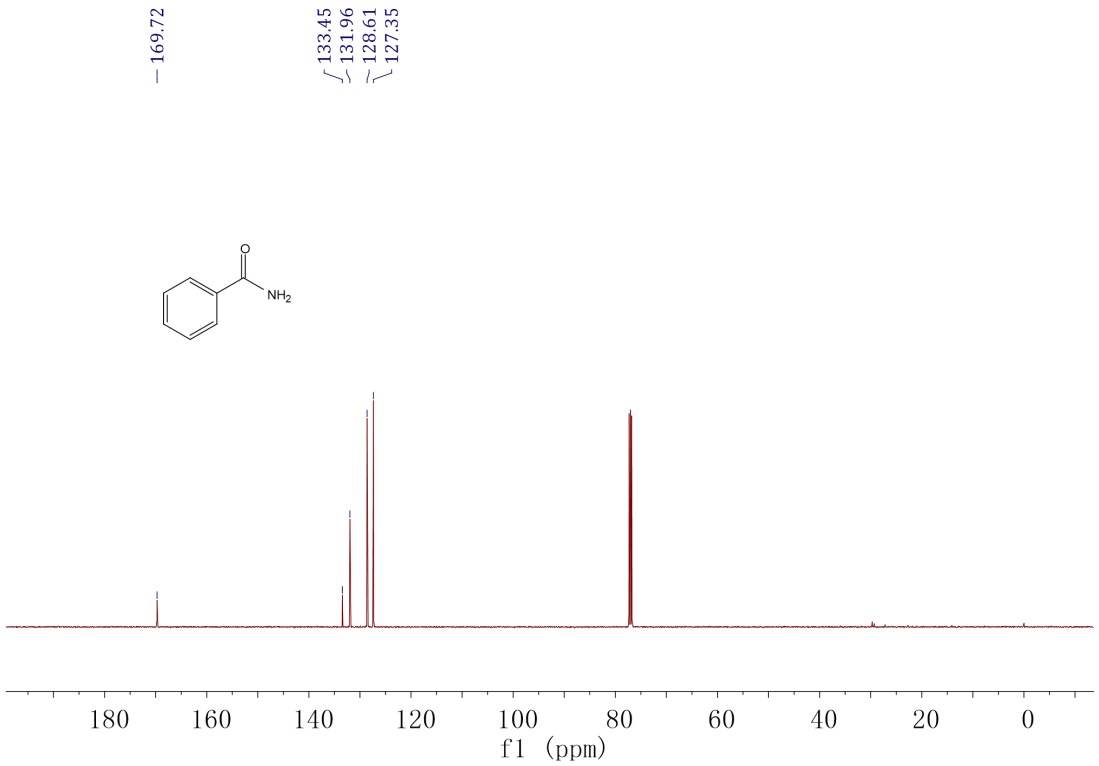
^{1}H NMR*: N-methoxy-4-methylbenzenesulfonamide* **(3c)**



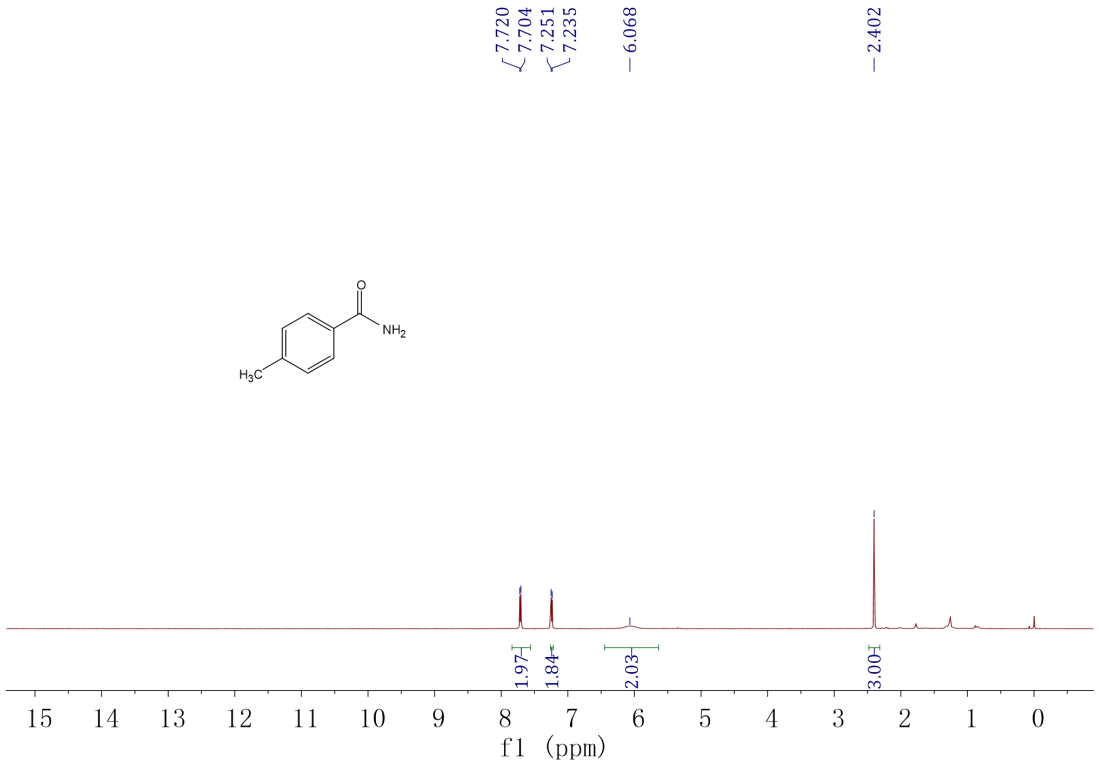
^{1}H NMR*: N-methoxy-1-phenylmethanesulfonamide* **(3d)**



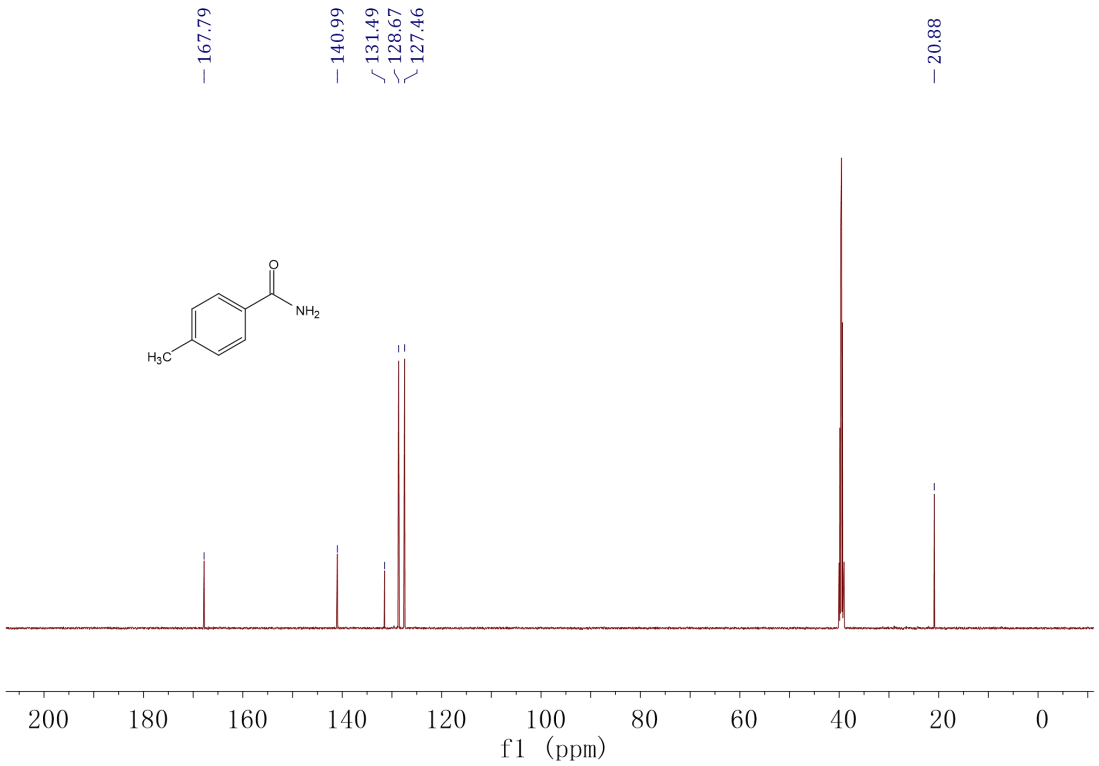
^{1}H NMR: *benzamide* (**2a**)



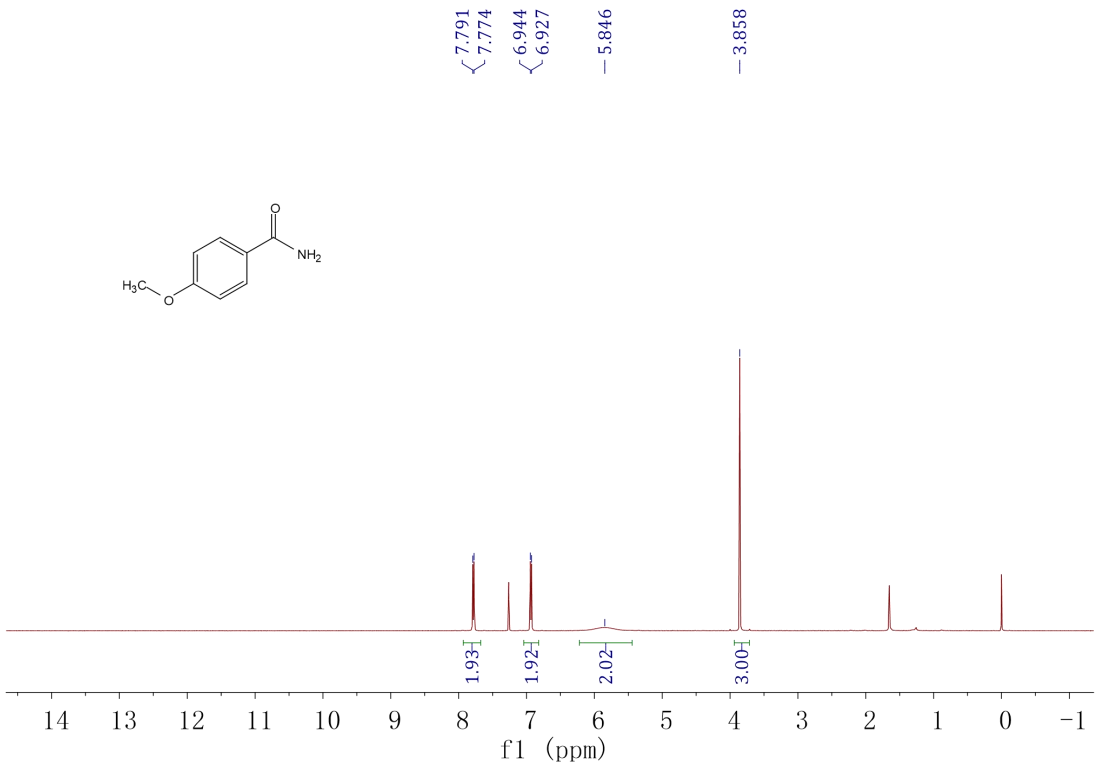
^{13}C NMR: *benzamide* (**2a**)



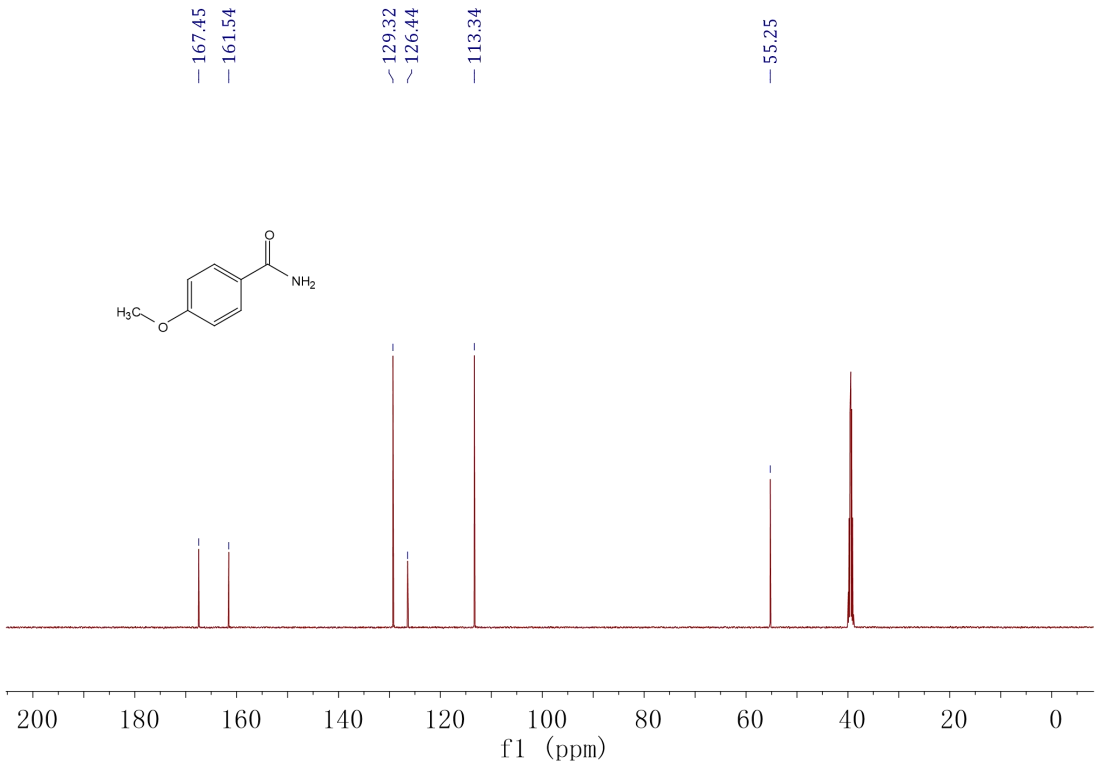
^{1}H NMR: *4-methylbenzamide* (**2b**)



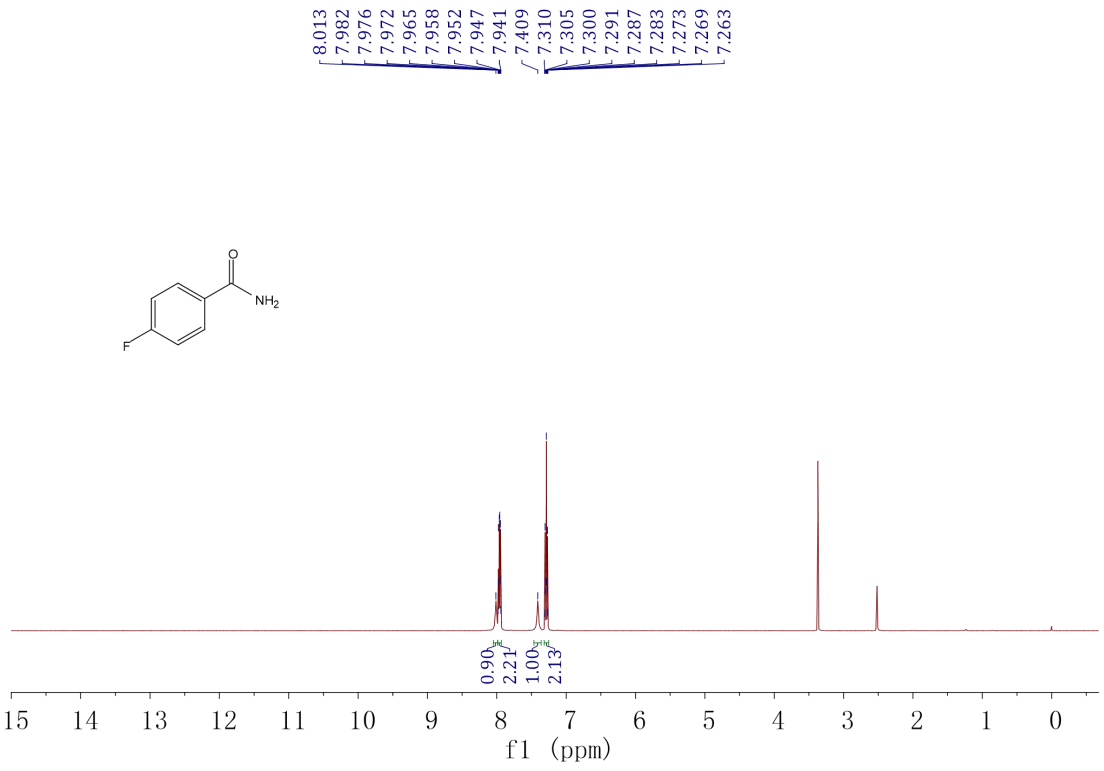
^{13}C NMR: *4-methylbenzamide* (**2b**)



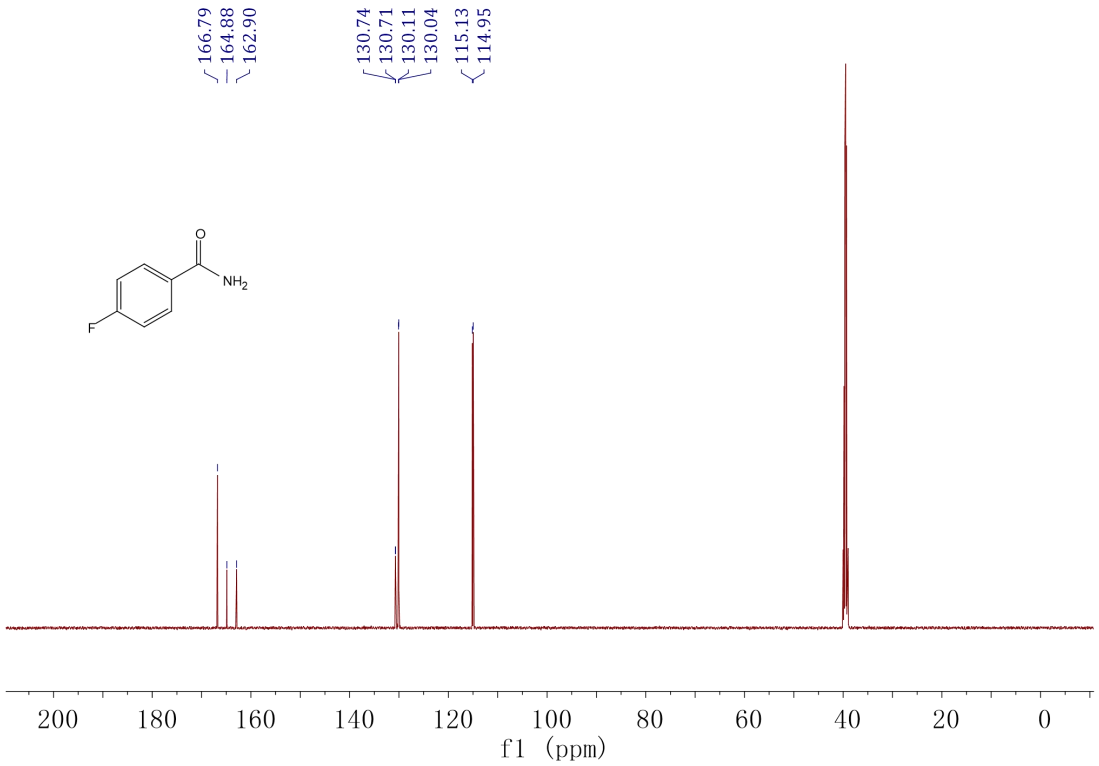
^{1}H NMR: *4-methoxybenzamide* (**2c**)



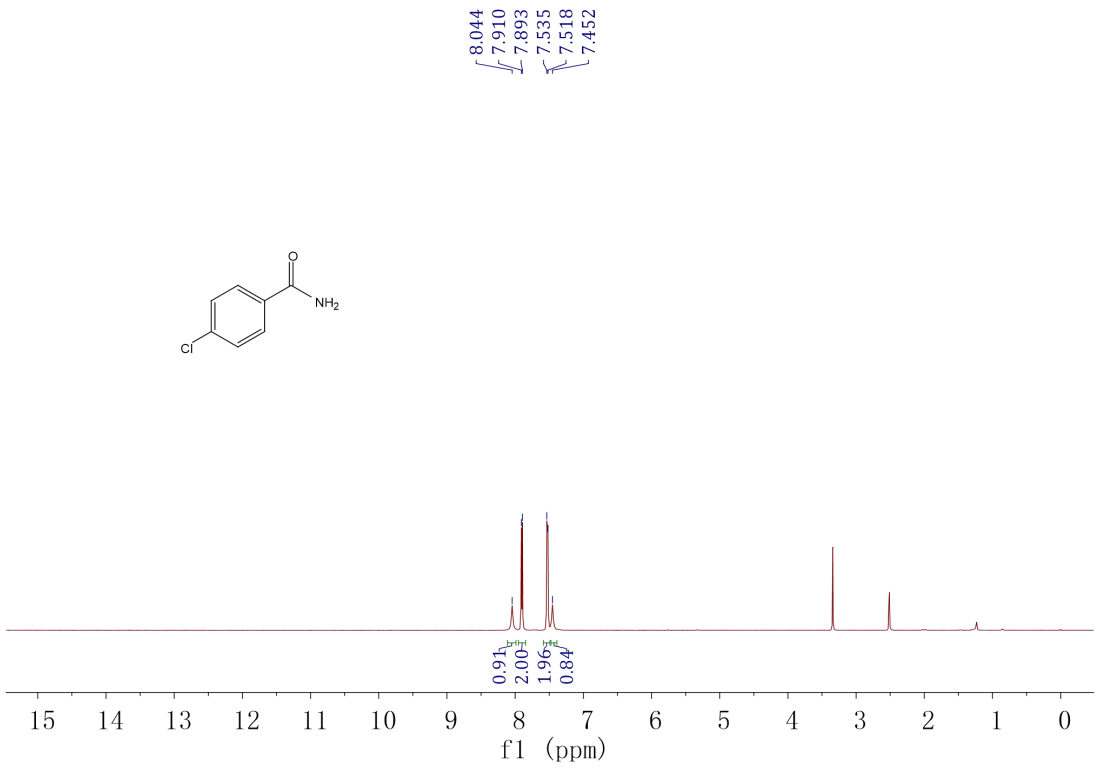
^{13}C NMR: *4-methoxybenzamide* (**2c**)



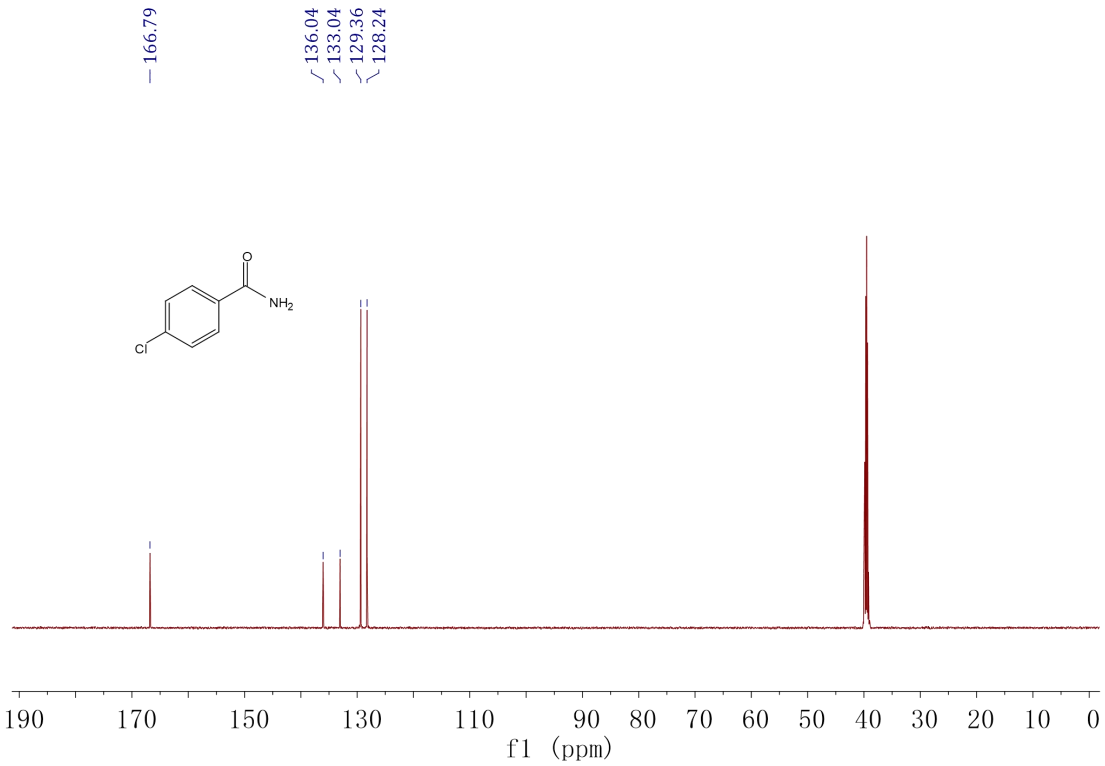
^{1}H NMR: *4-fluorobenzamide* (**2d**)



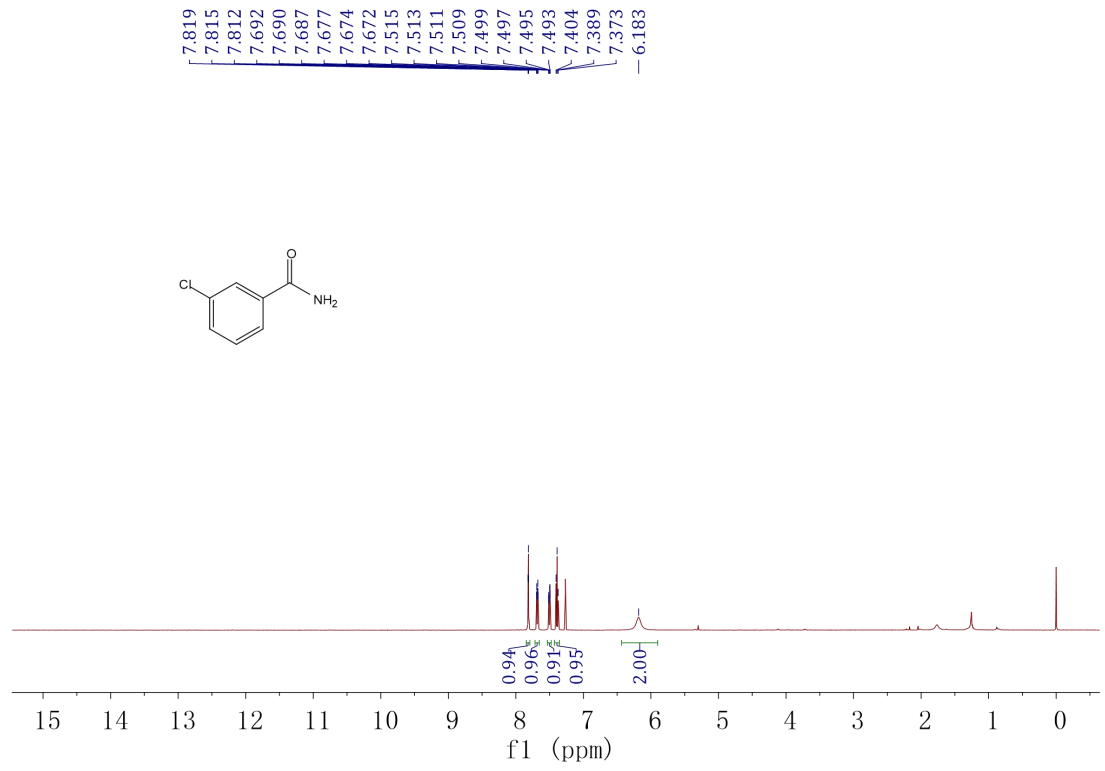
^{13}C NMR: *4-fluorobenzamide* (**2d**)



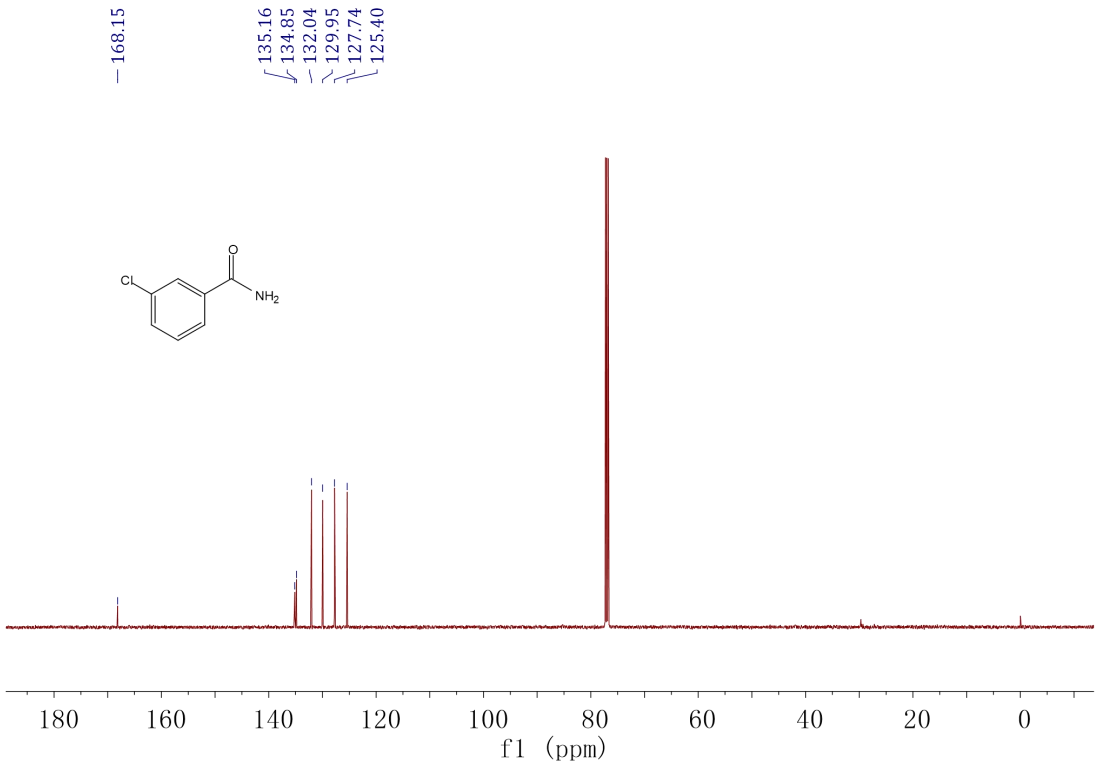
^{1}H NMR: *4-chlorobenzamide* (**2e**)



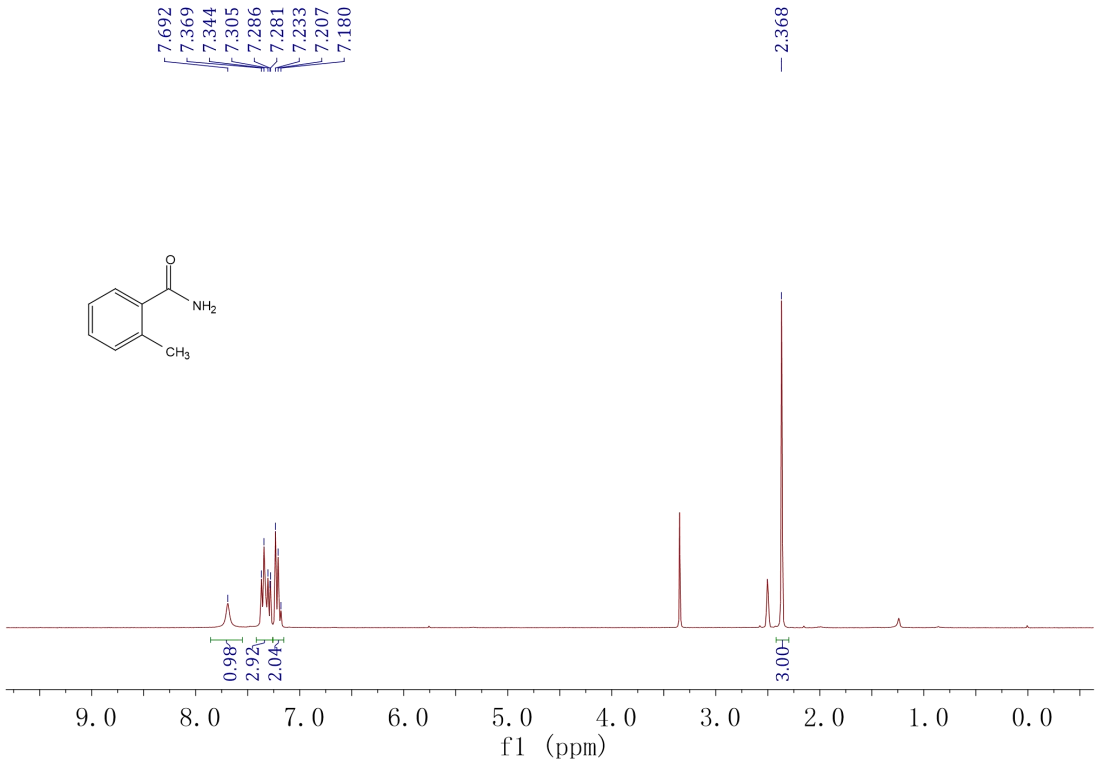
^{13}C NMR: *4-chlorobenzamide* (**2e**)



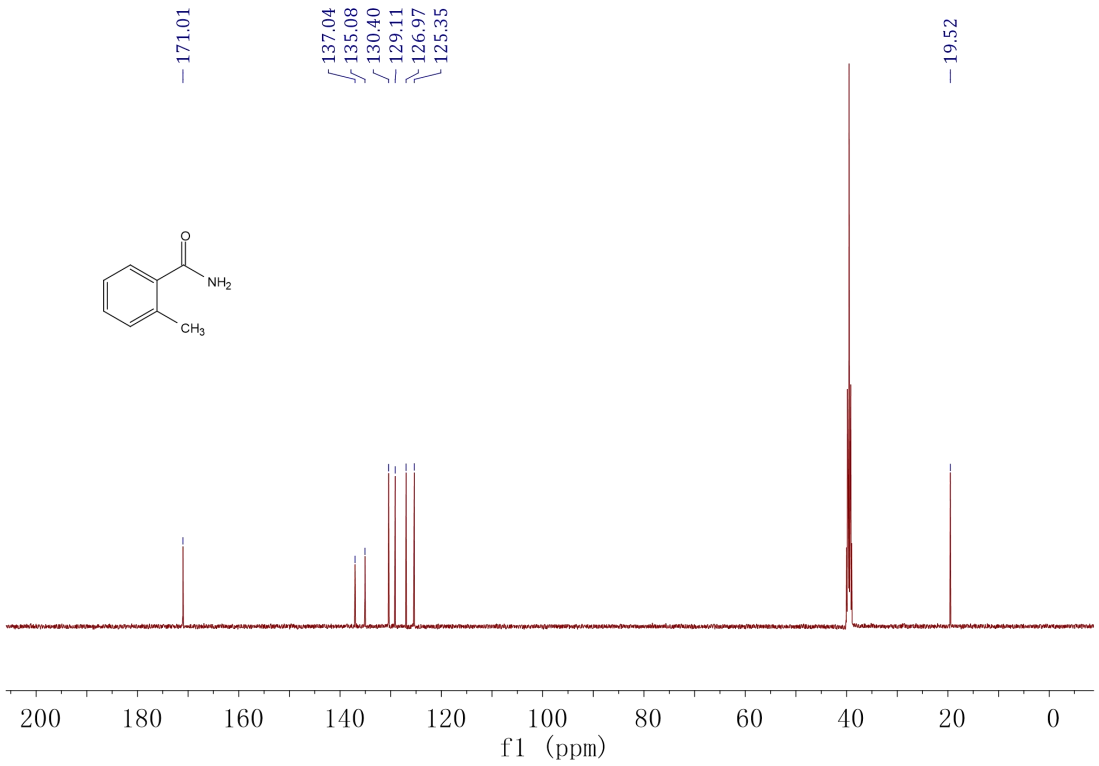
^{1}H NMR: *3-chlorobenzamide* (**2f**)



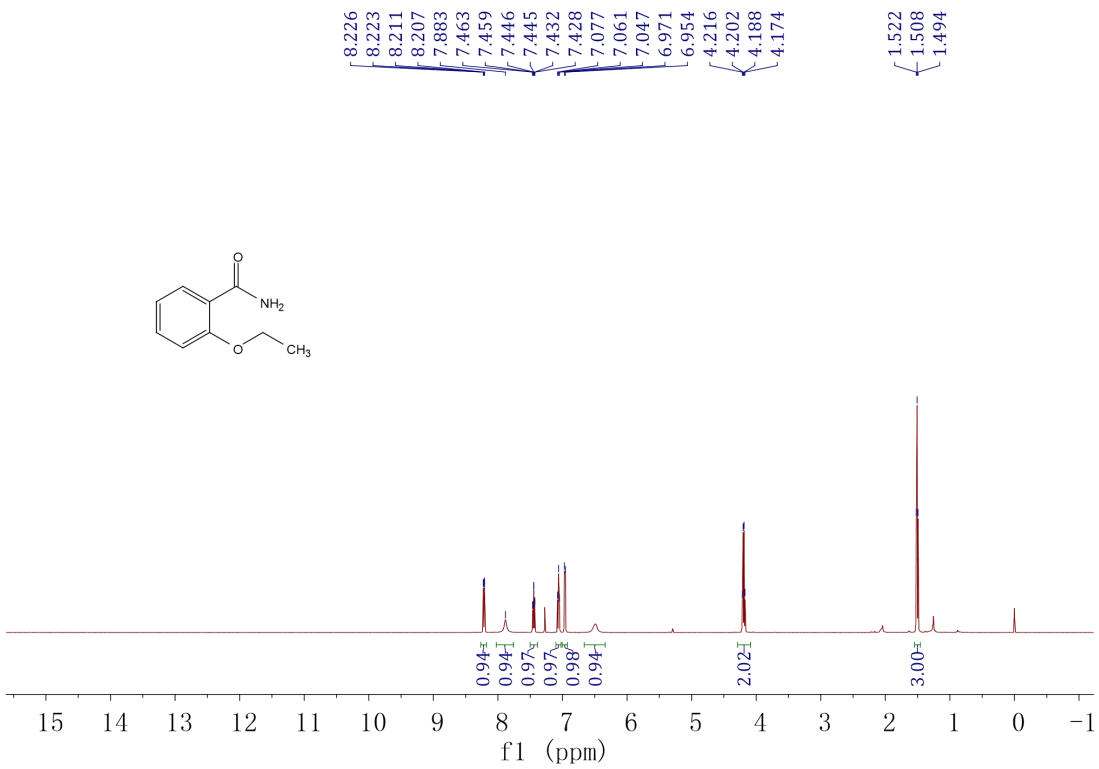
^{13}C NMR: *3-chlorobenzamide* (**2f**)



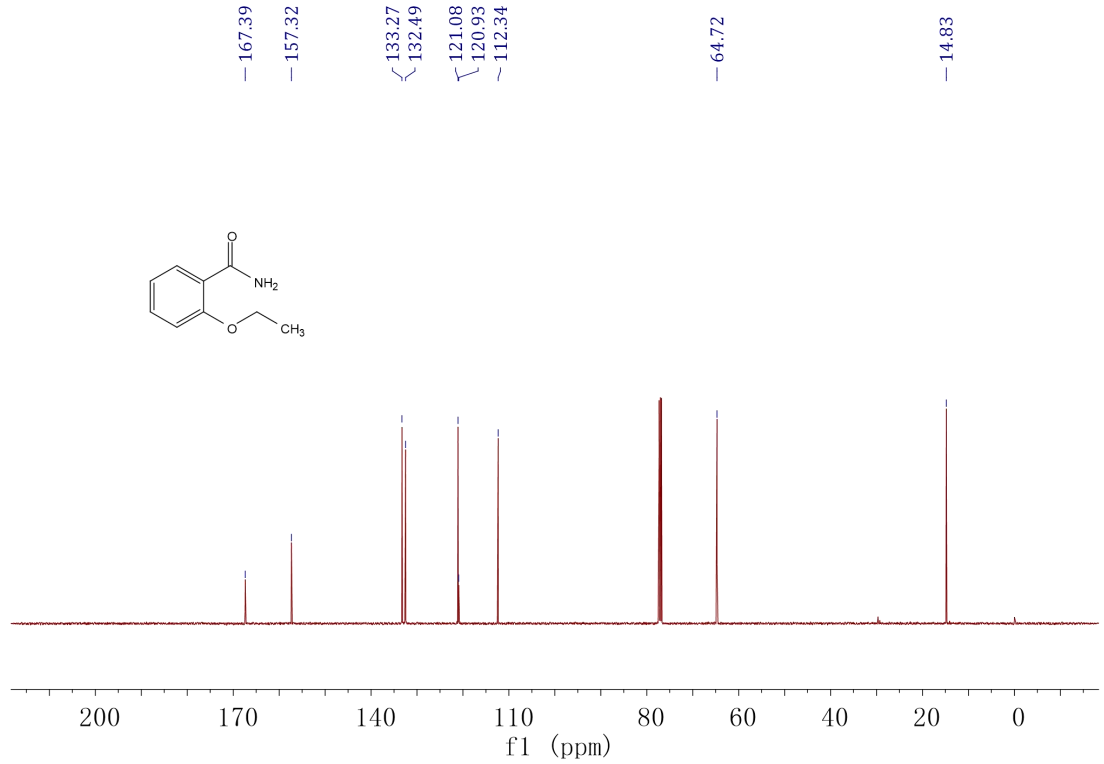
^{1}H NMR: *2-methylbenzamide* (**2g**)



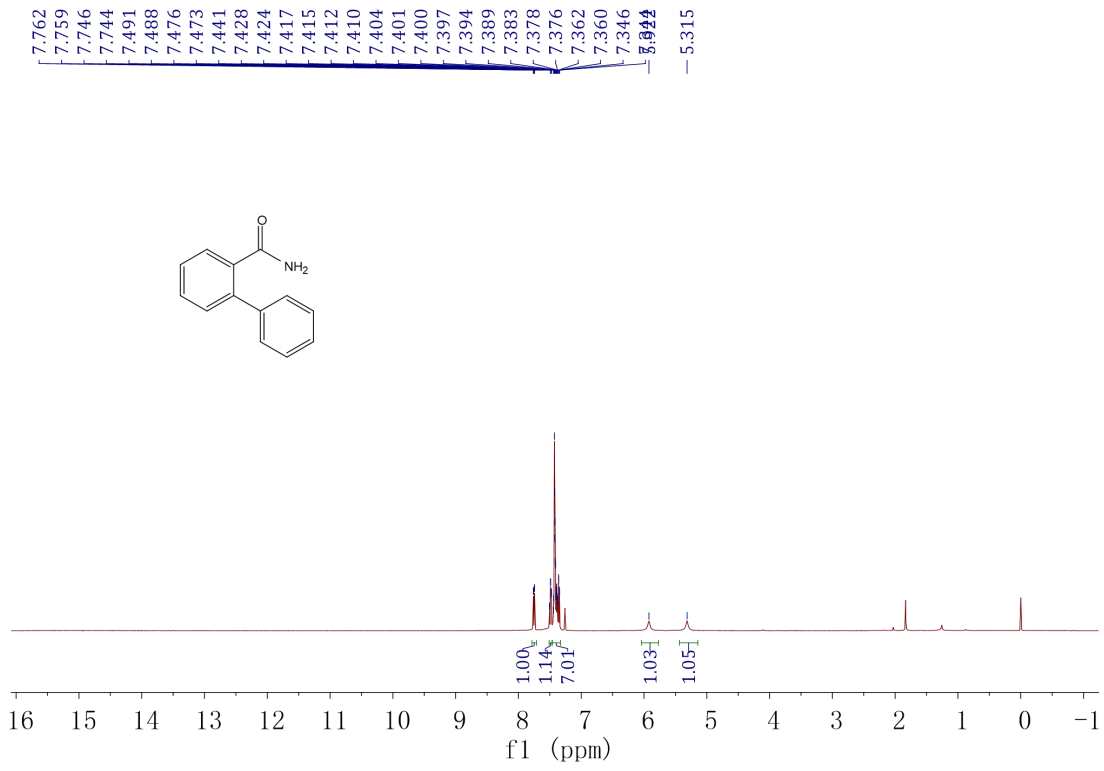
^{13}C NMR: *3-methylbenzamide* (**2g**)



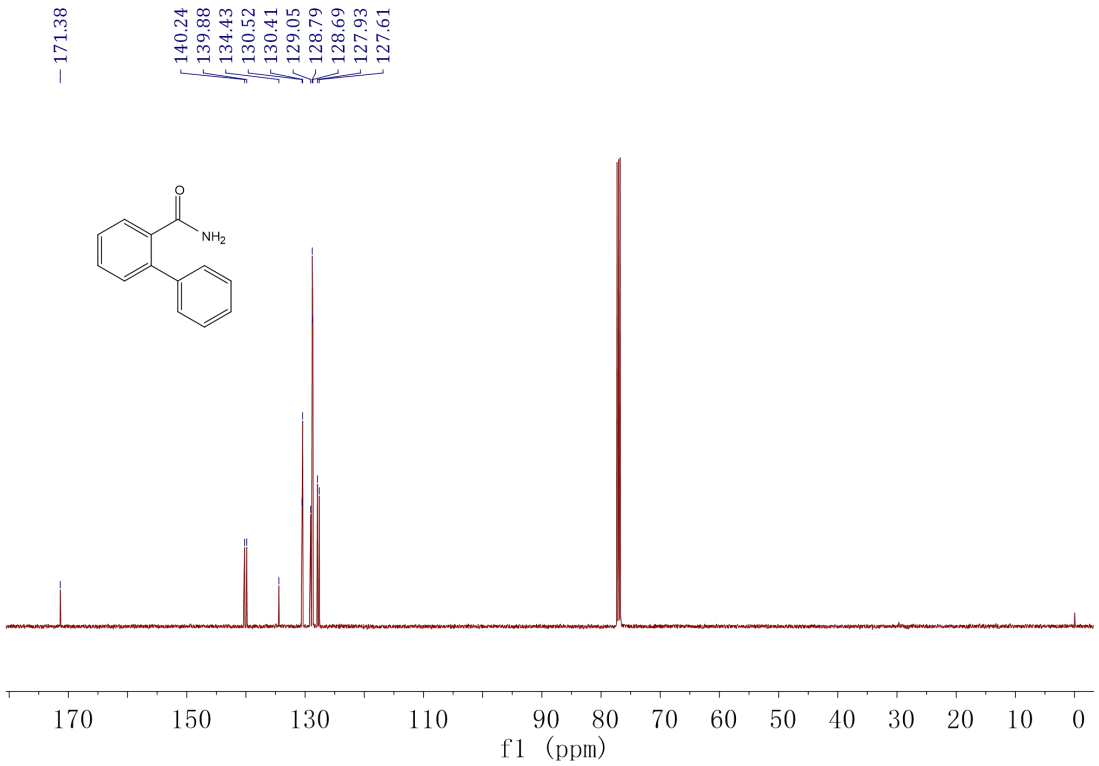
^{1}H NMR:*2-ethoxybenzamide* (**2h**)



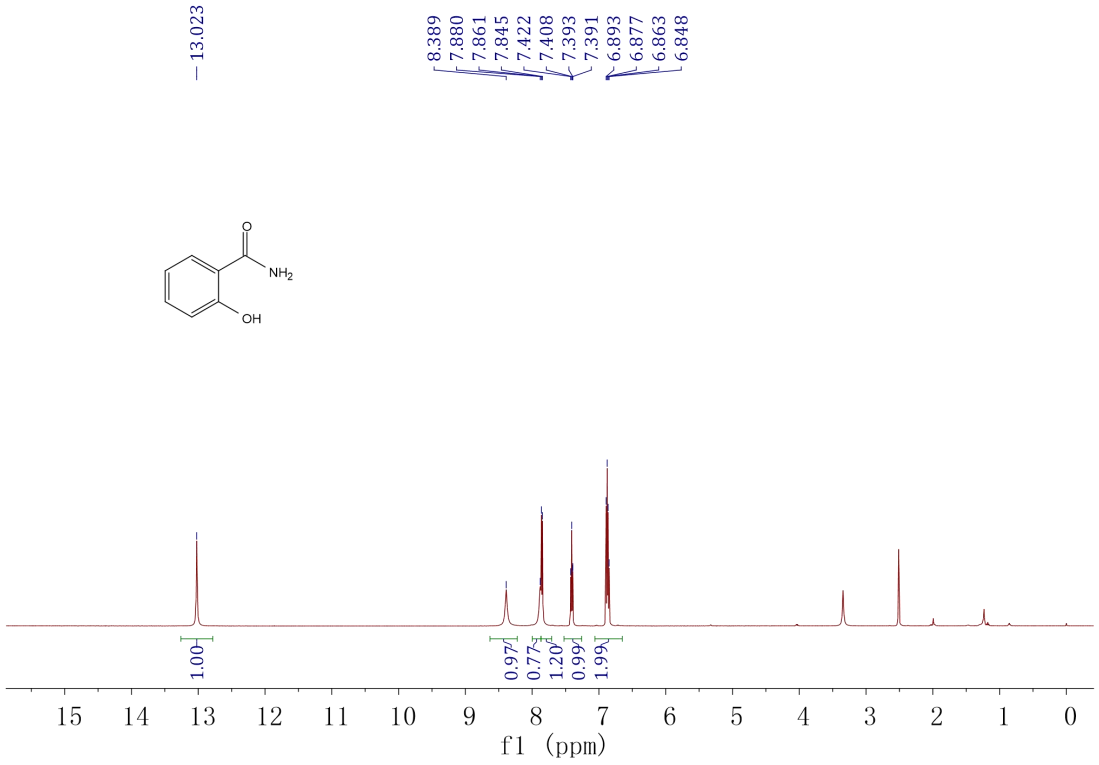
^{13}C NMR: *2-ethoxybenzamide* (**2h**)



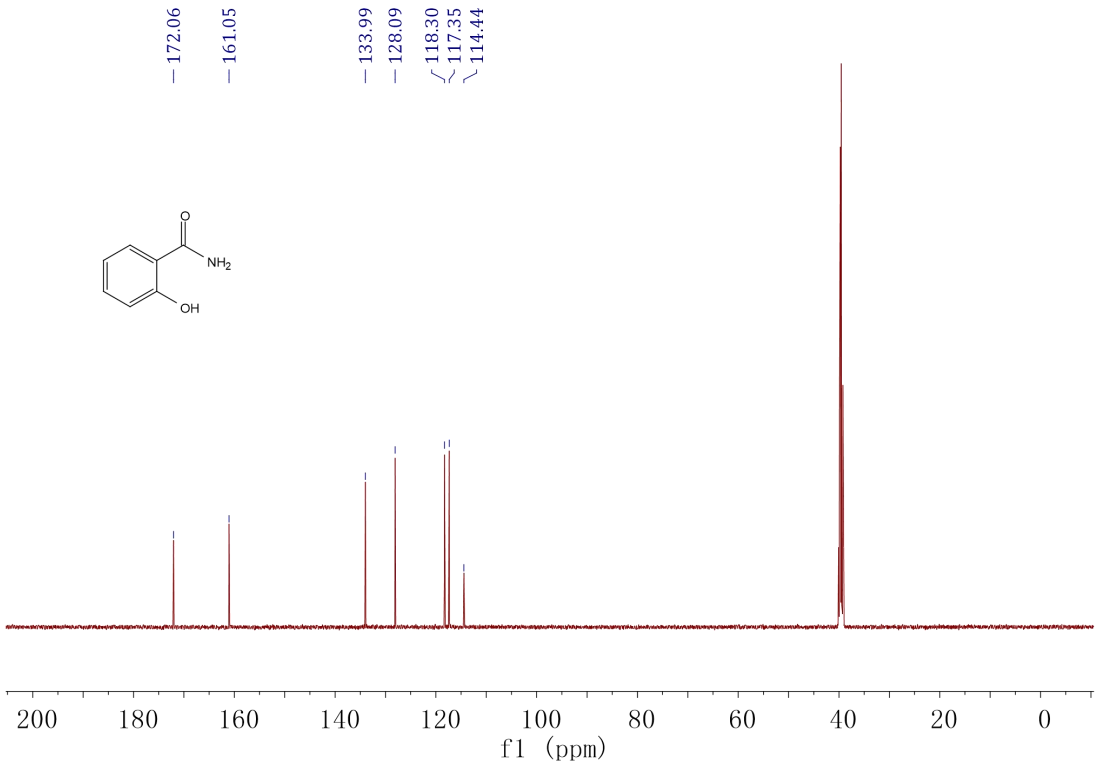
^{1}H NMR: *[1,1'-biphenyl]-2-carboxamide* (**2i**)



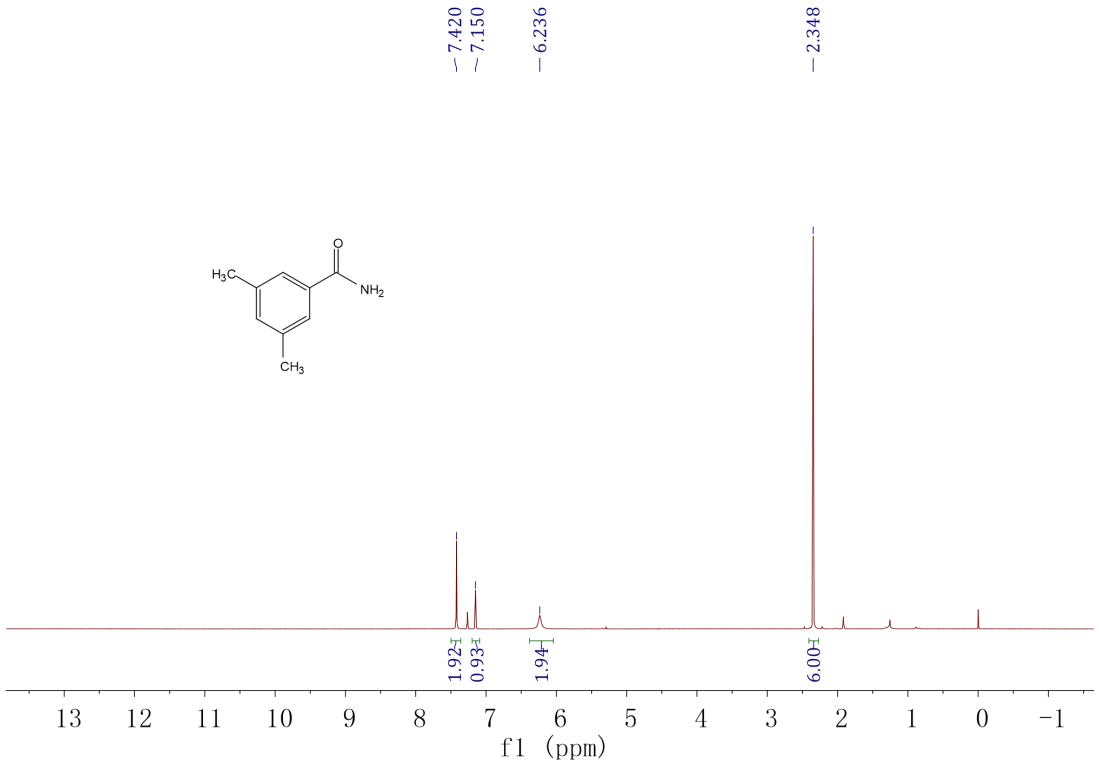
^{13}C NMR: *[1,1'-biphenyl]-2-carboxamide* (**2i**)



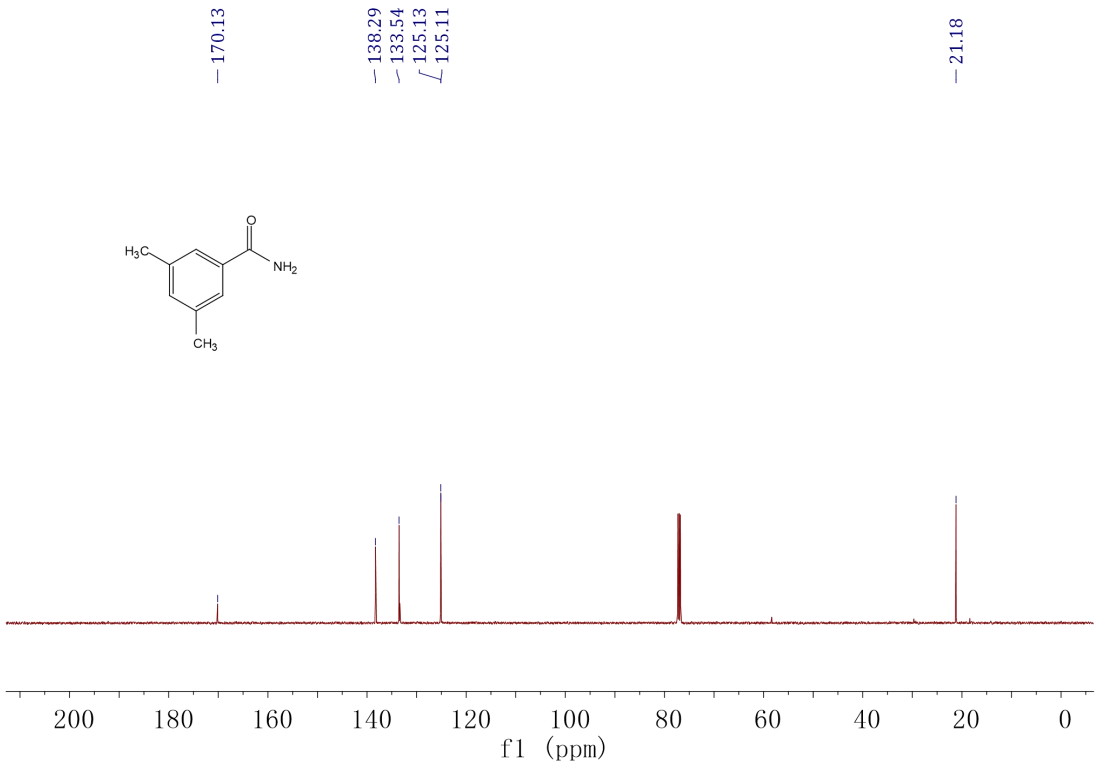
^{1}H NMR: *2-hydroxybenzamide* (**2j**)



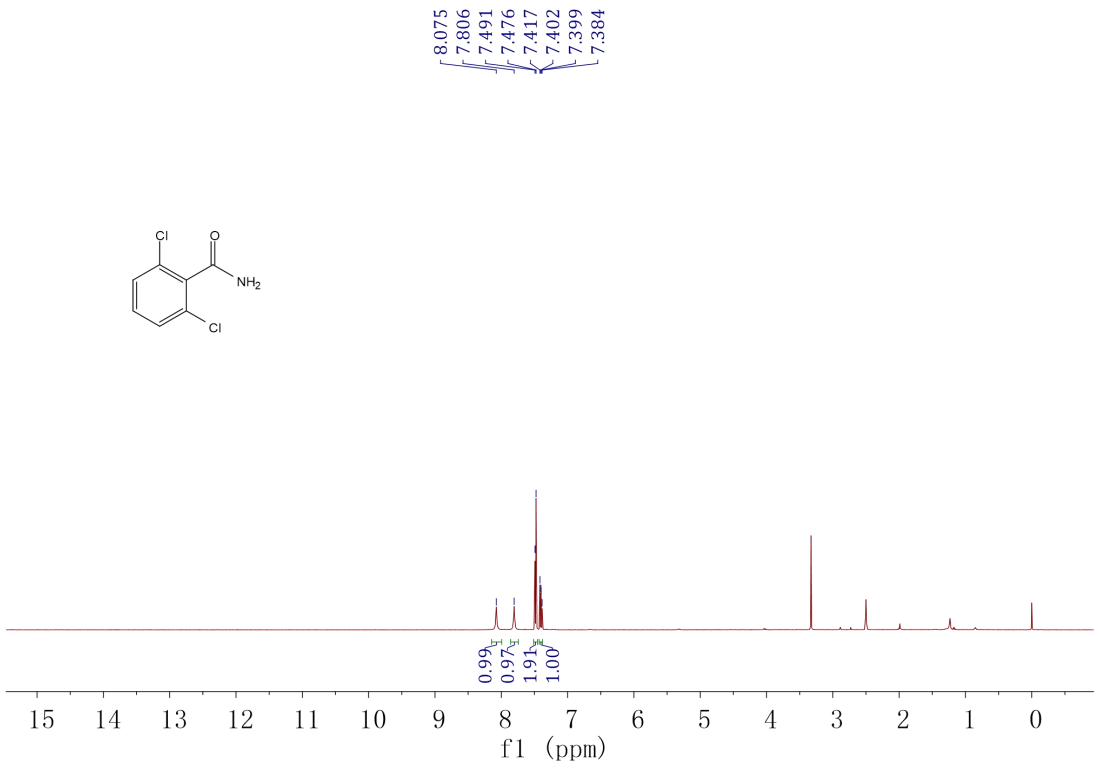
^{13}C NMR: *2-hydroxybenzamide* (**2j**)



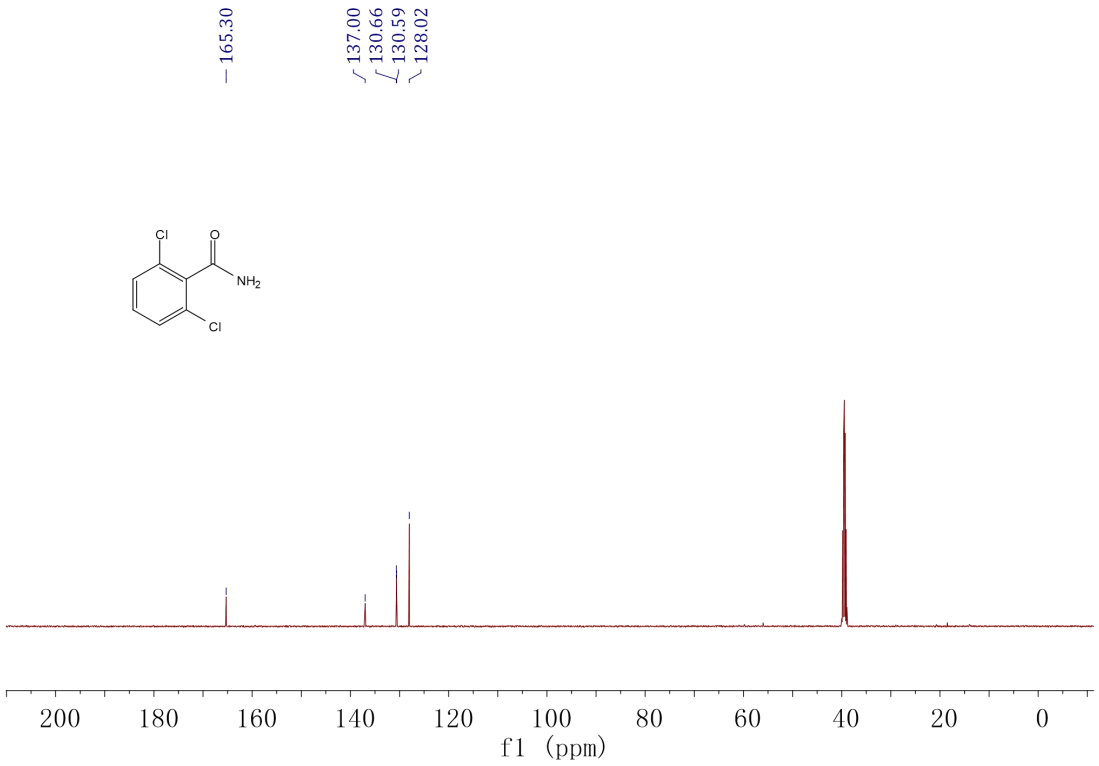
^{1}H NMR: *3,5-dimethylbenzamide* (**2k**)



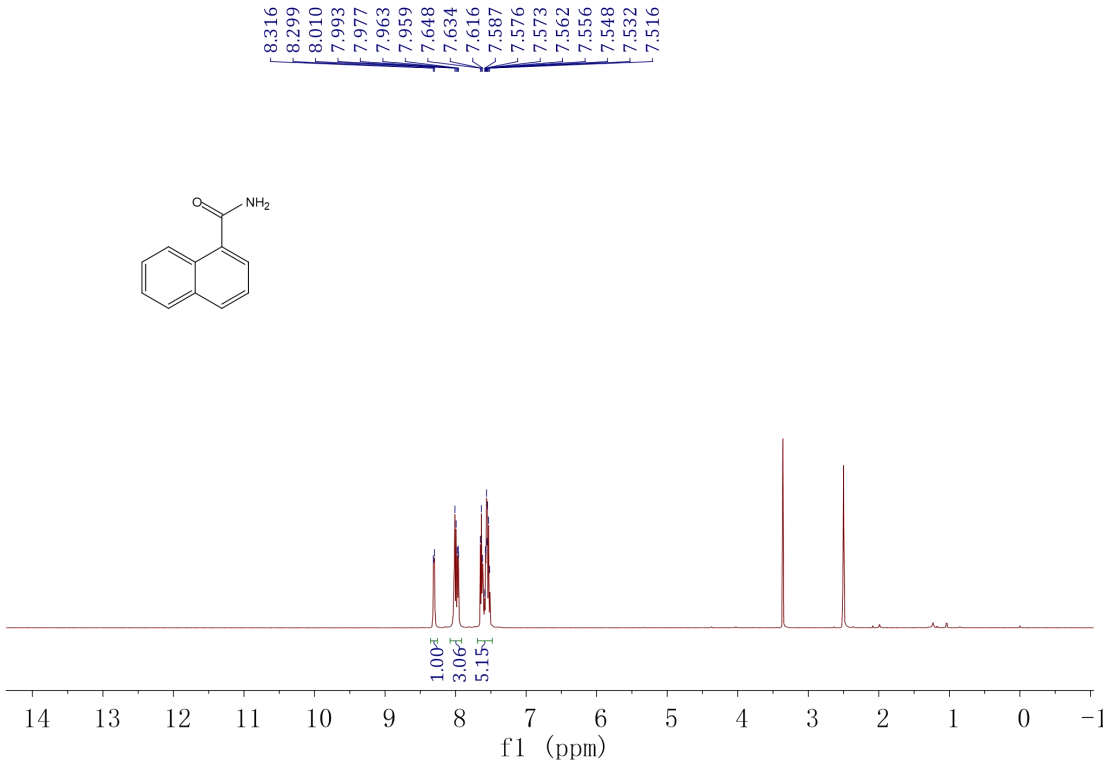
^{13}C NMR: *3,5-dimethylbenzamide* (**2k**)



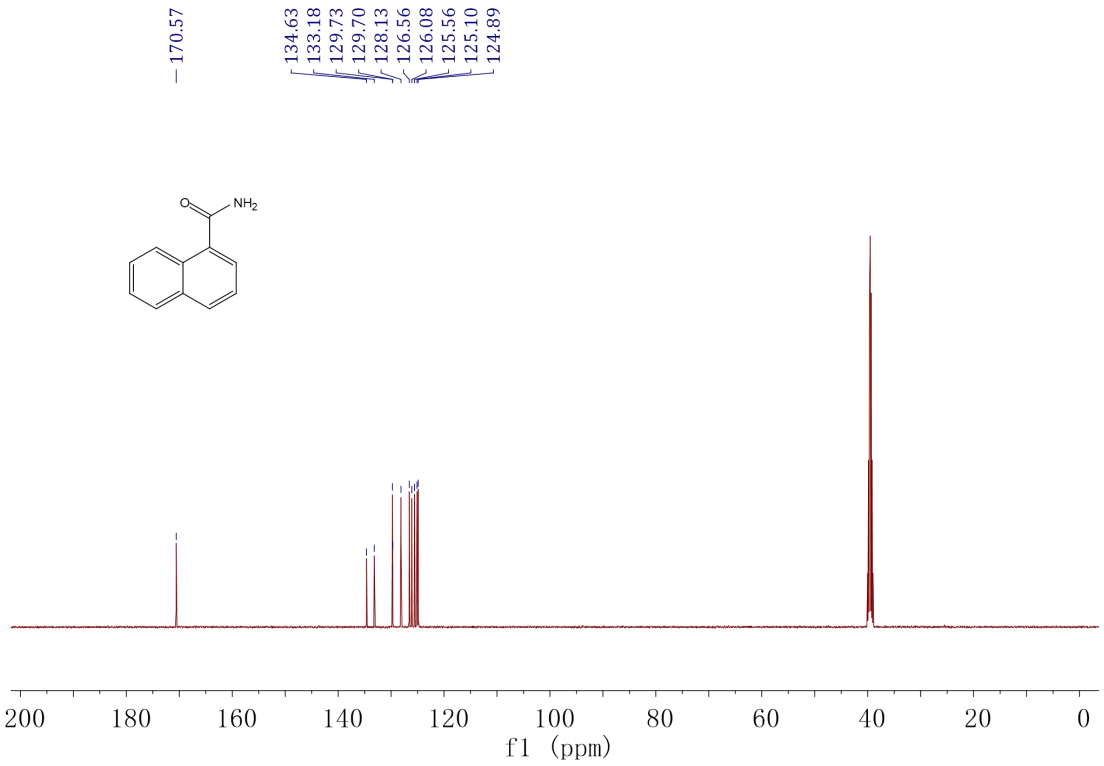
^{1}H NMR: *2,6-dichlorobenzamide* (**2l**)



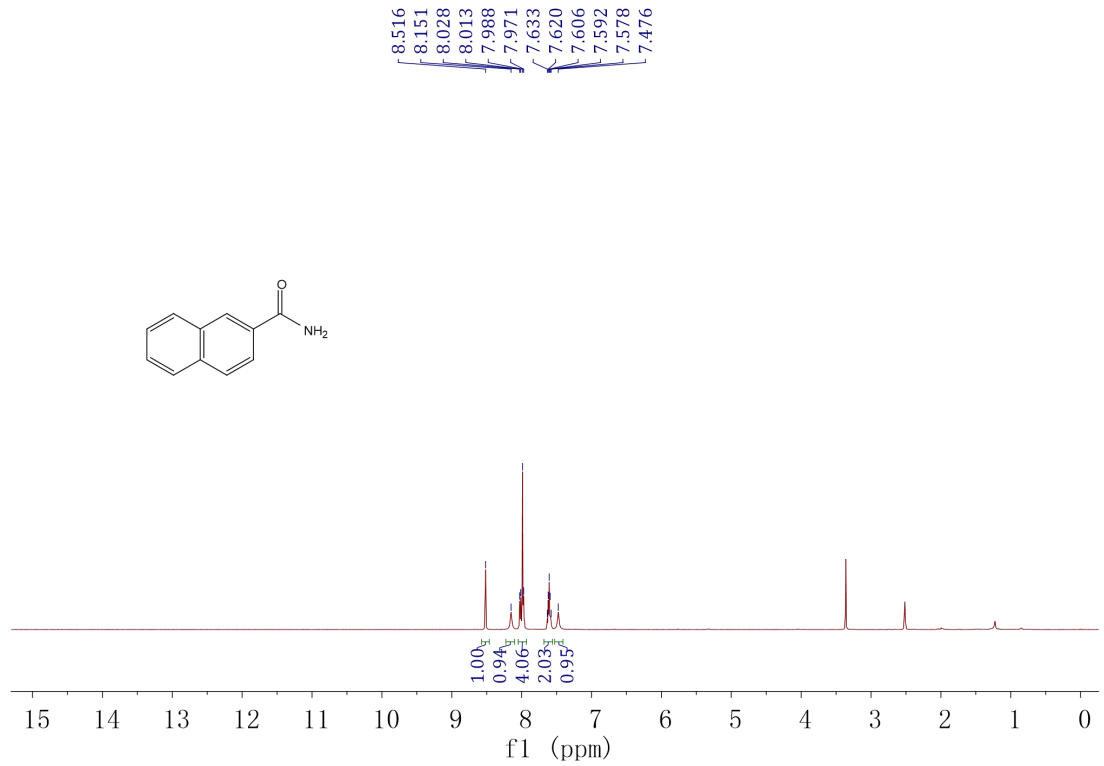
^{13}C NMR: *2,6-dichlorobenzamide* (**2l**)



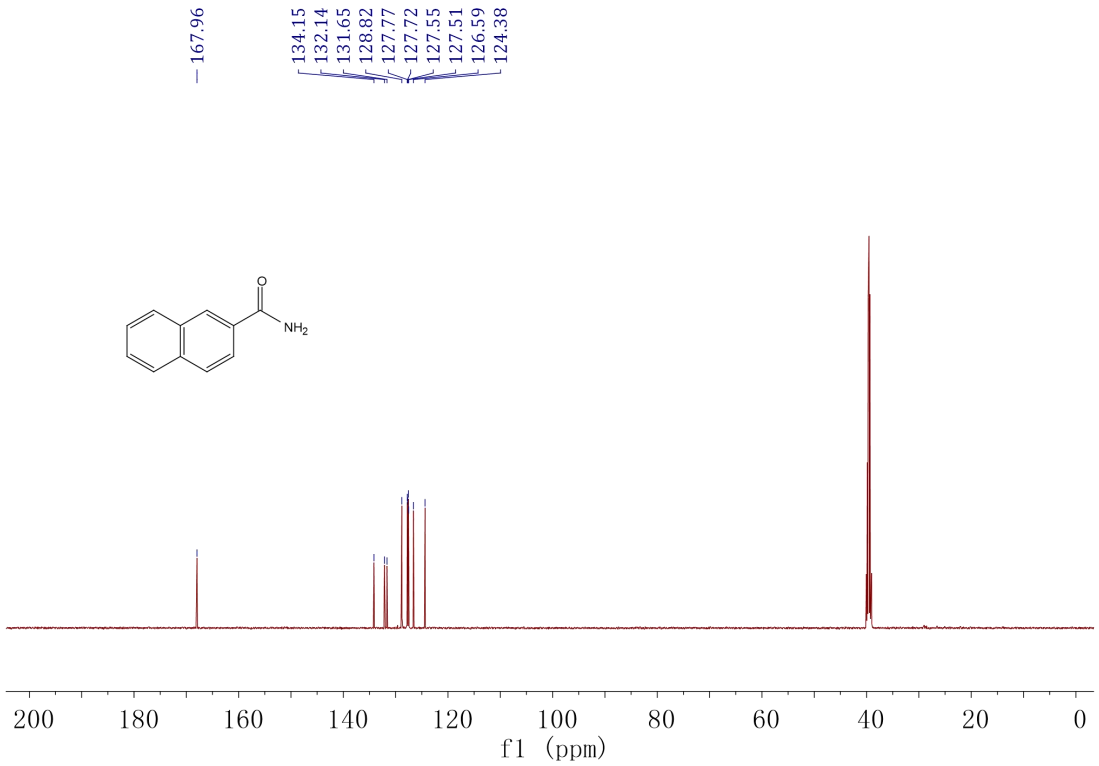
^{1}H NMR: *1-naphthamide* (**2m**)



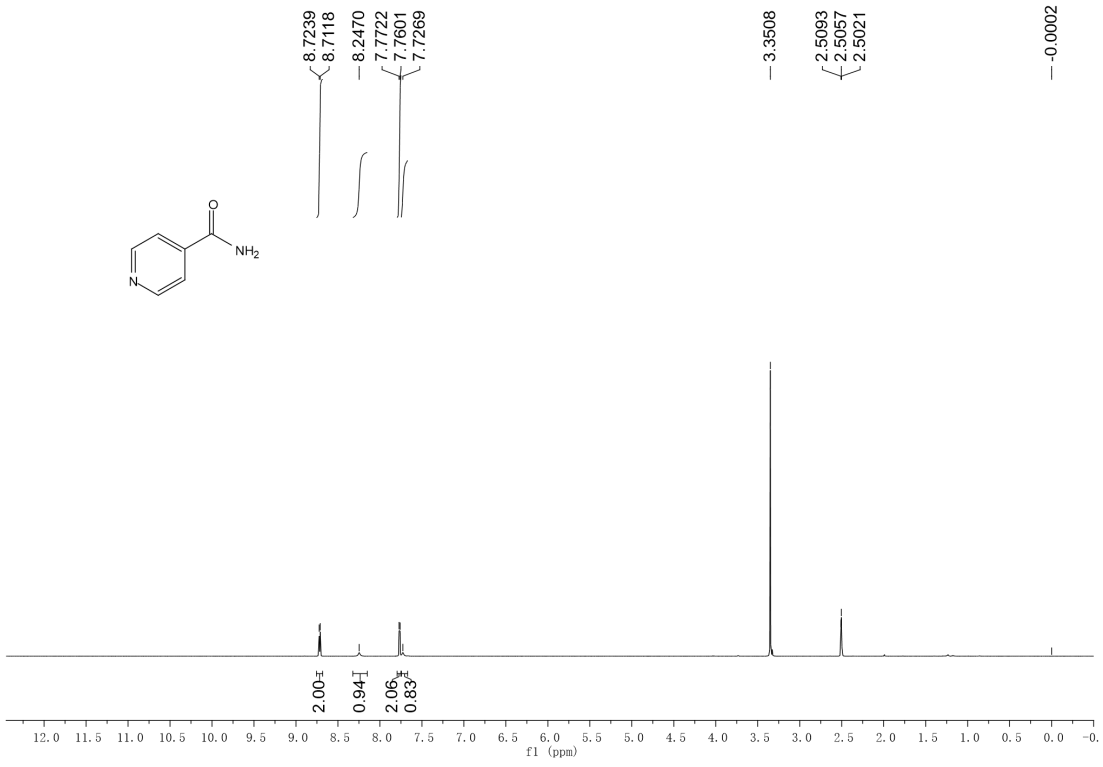
^{13}C NMR: *1-naphthamide* (**2m**)



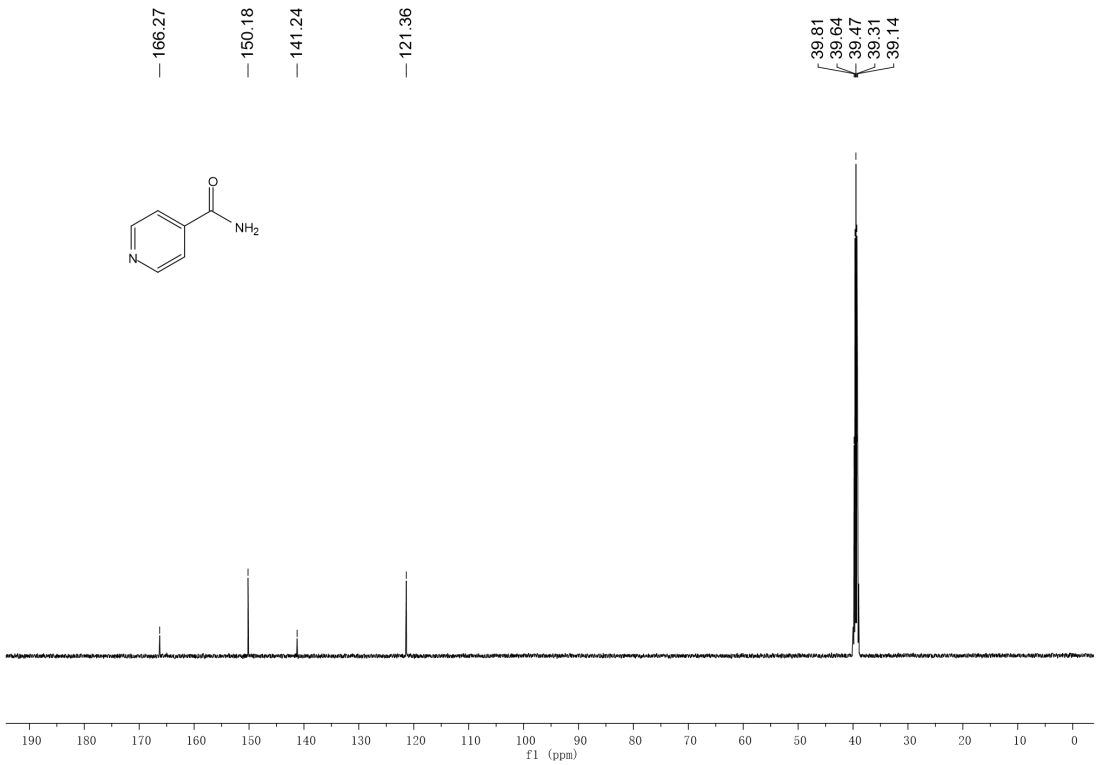
^{1}H NMR: *2-naphthamide* (**2n**)



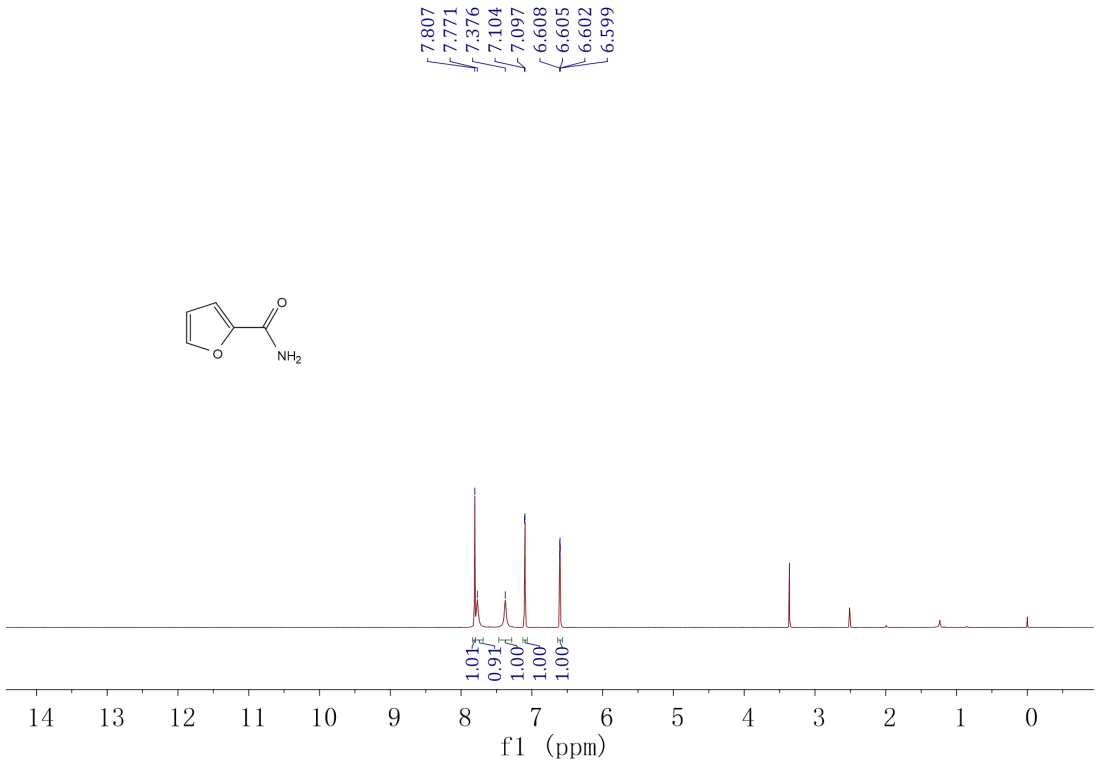
^{13}C NMR: *2-naphthamide* (**2n**)



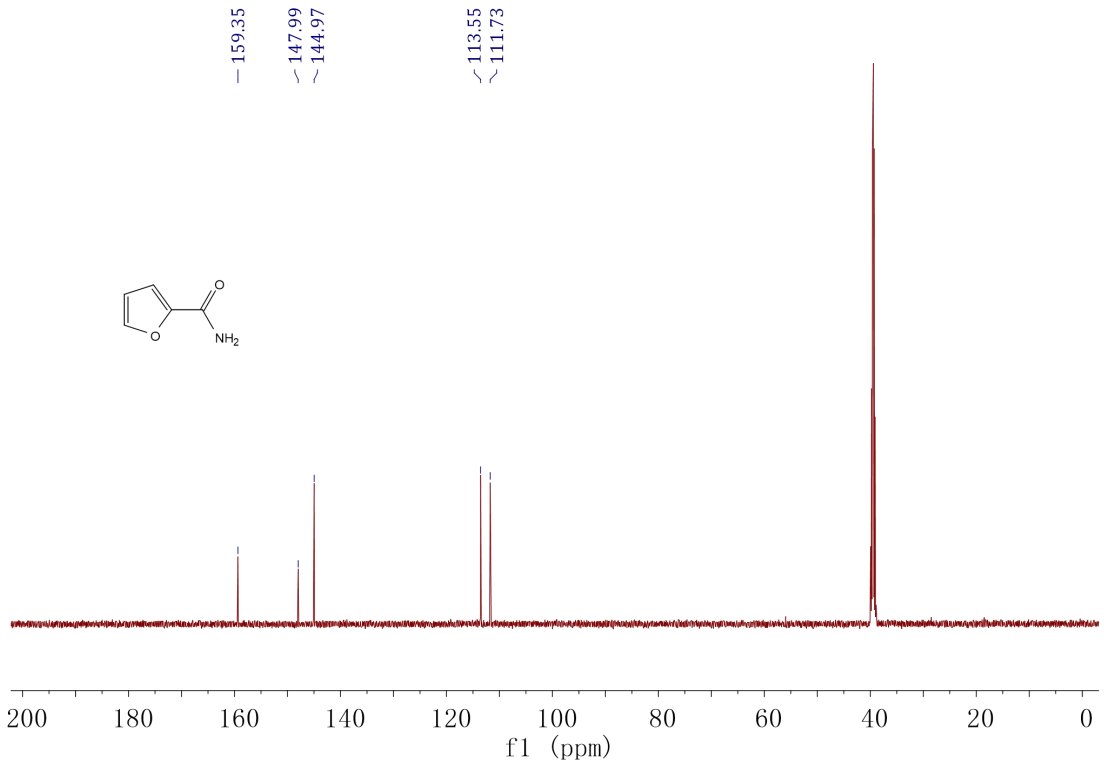
^{1}H NMR: *isonicotinamide* (**2o**)



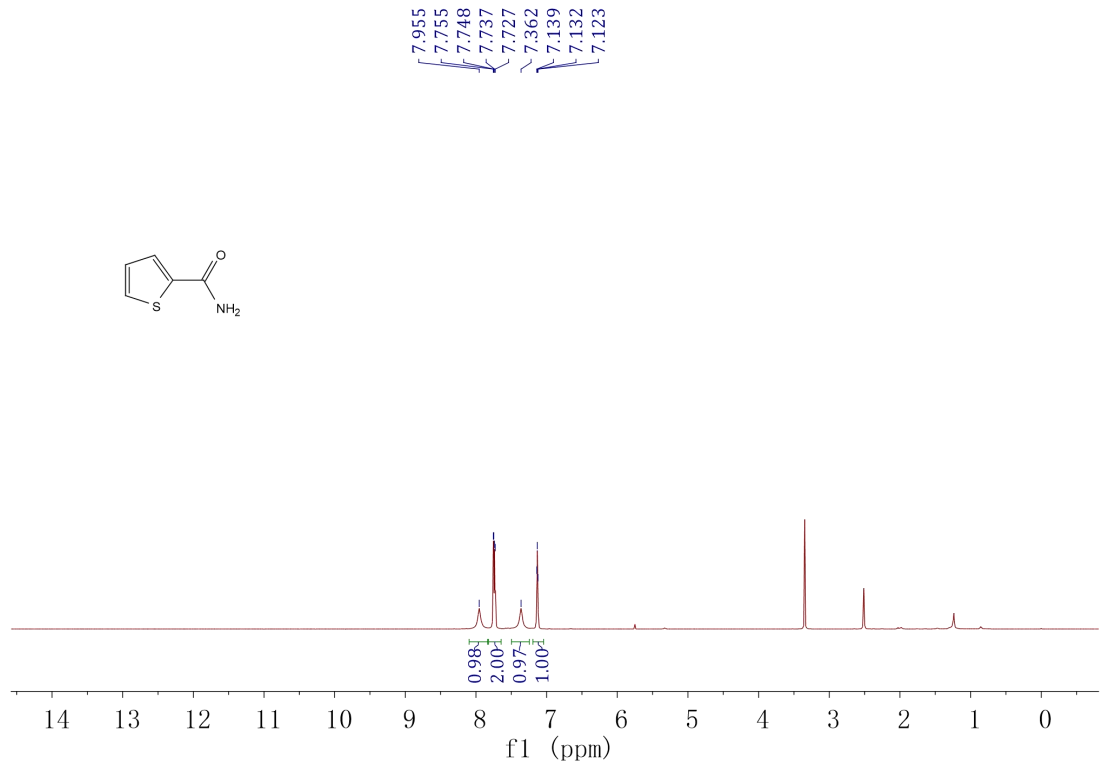
^{13}C NMR: *isonicotinamide* (**2o**)



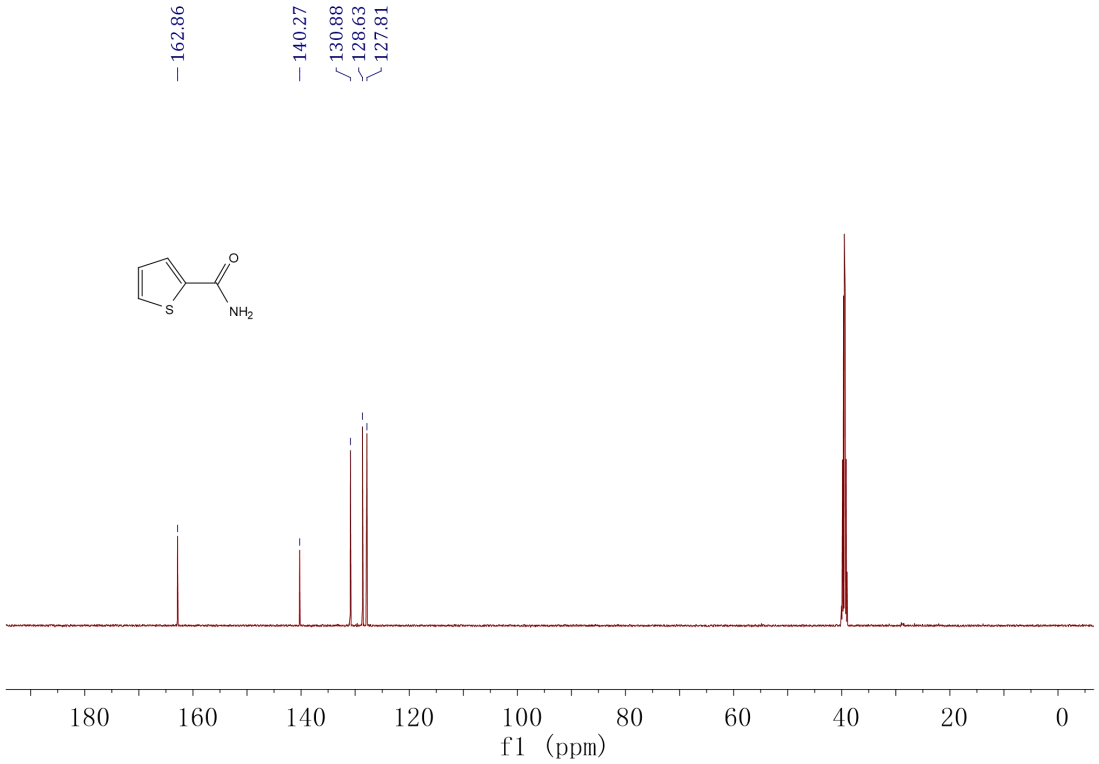
^{1}H NMR: *furan-2-carboxamide* (**2p**)



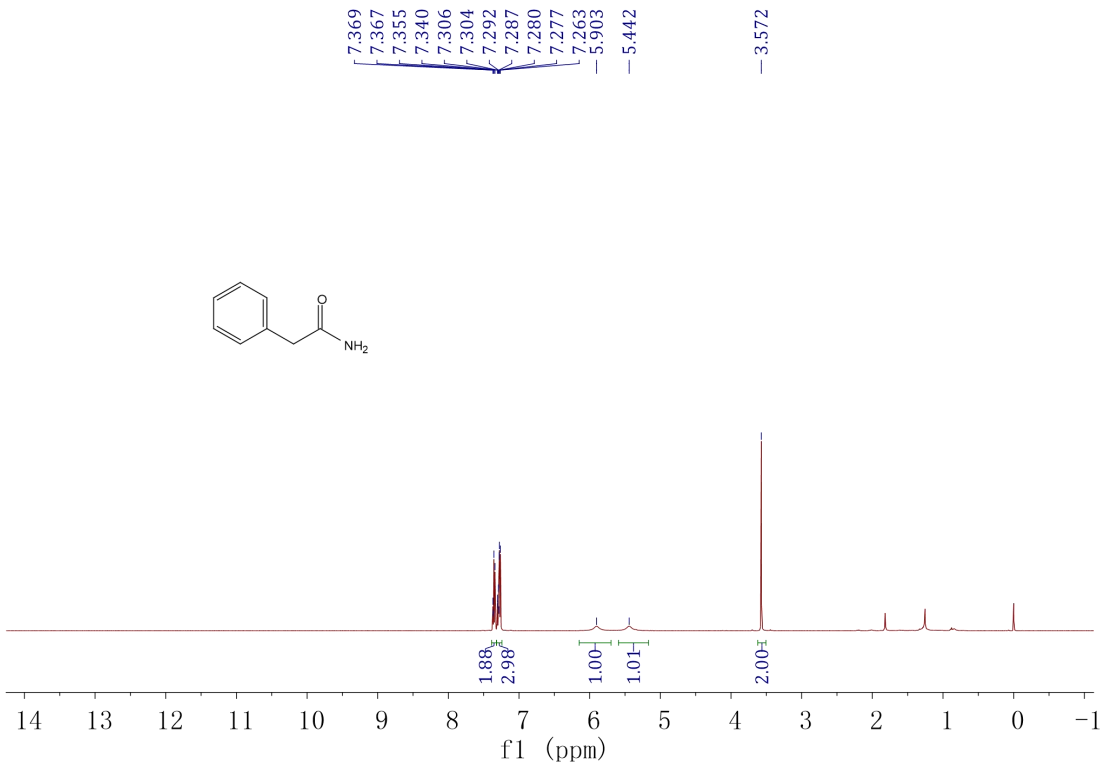
^{1}H NMR: *furan-2-carboxamide* (**2p**)



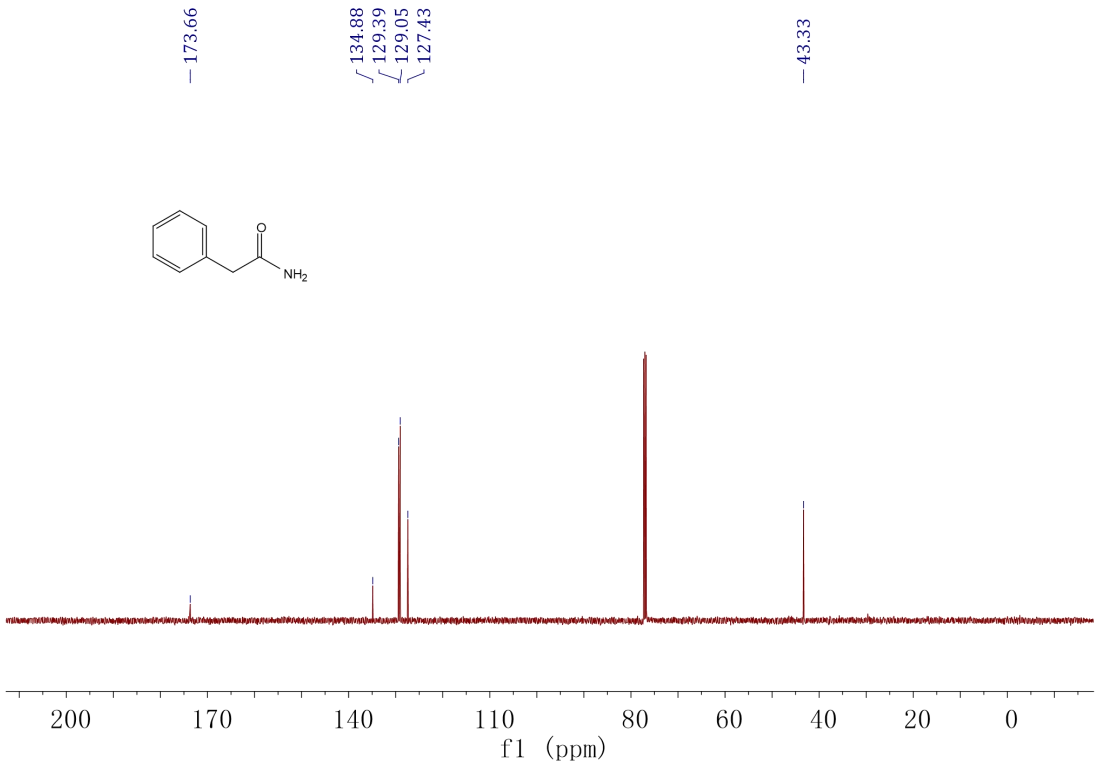
^{1}H NMR: *thiophene-2-carboxamide* (**2q**)



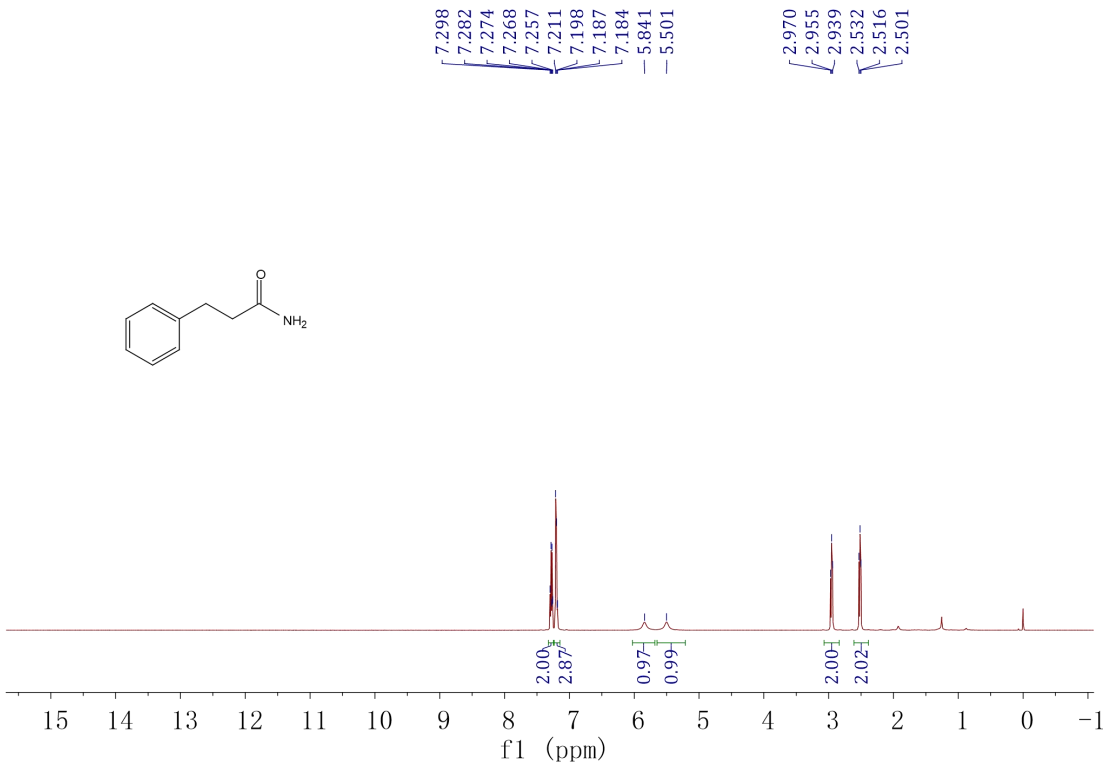
^{13}C NMR: *thiophene-2-carboxamide* (**2q**)



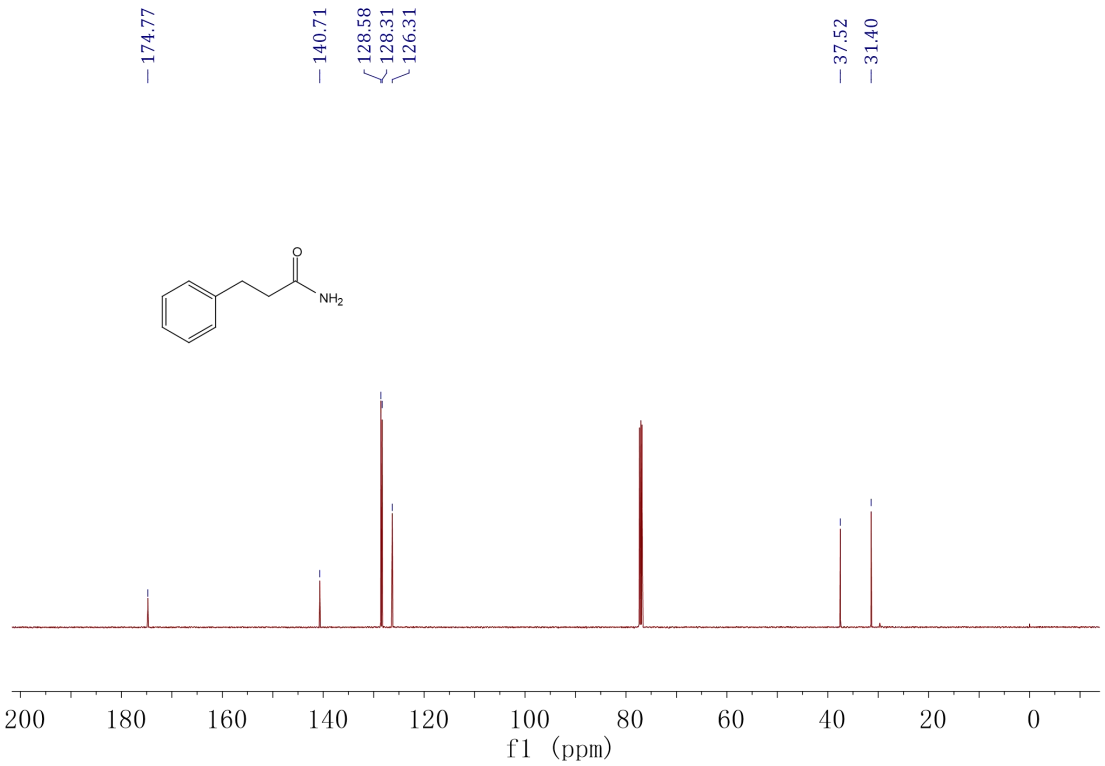
^{1}H NMR: *2-phenylacetamide* (**2r**)



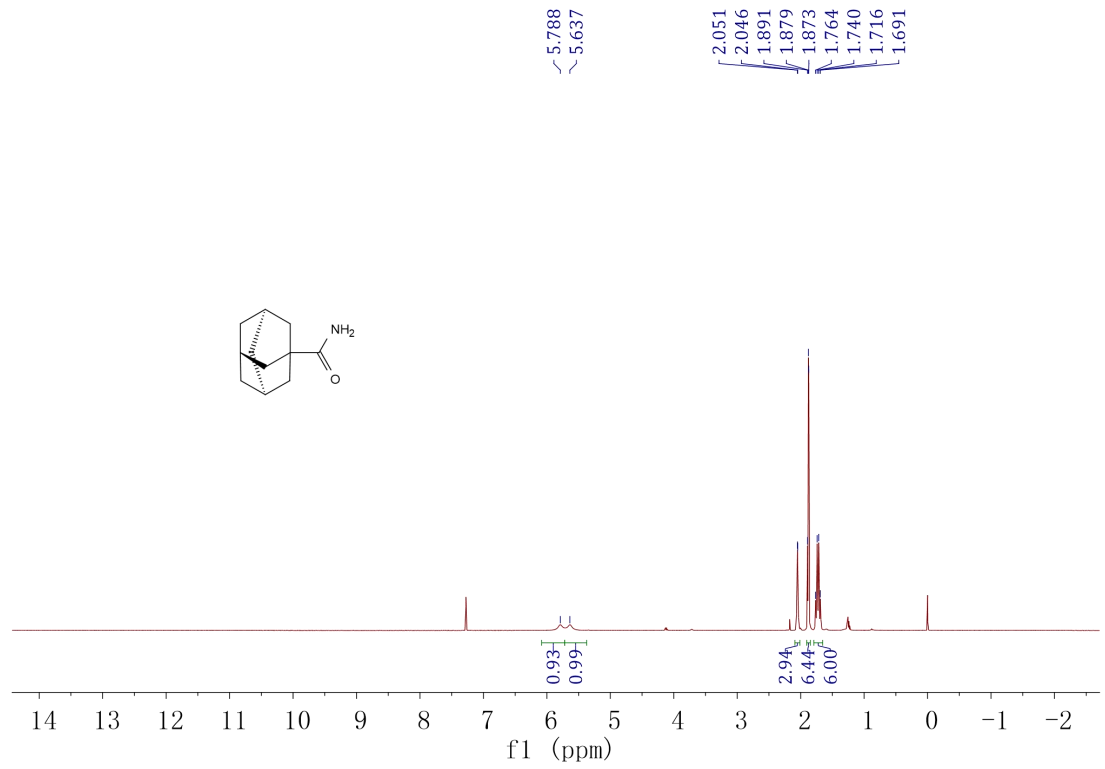
^{13}C NMR: *2-phenylacetamide* (**2r**)



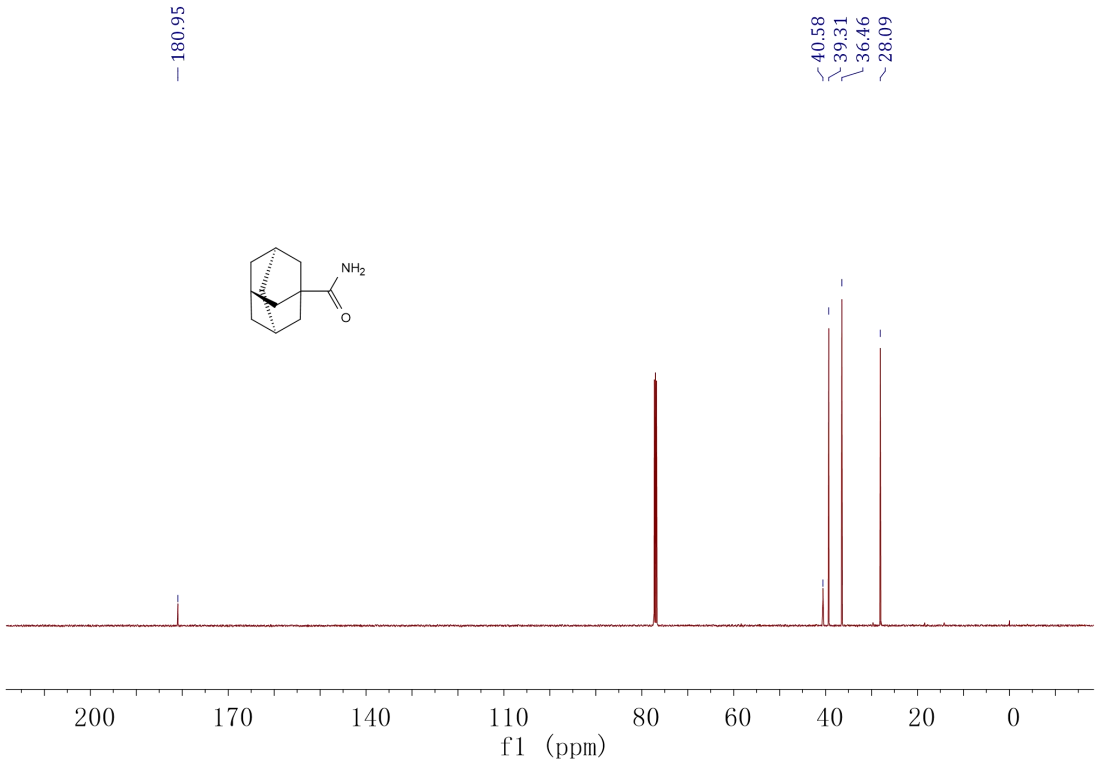
^{1}H NMR: *3-phenylpropanamide* (**2s**)



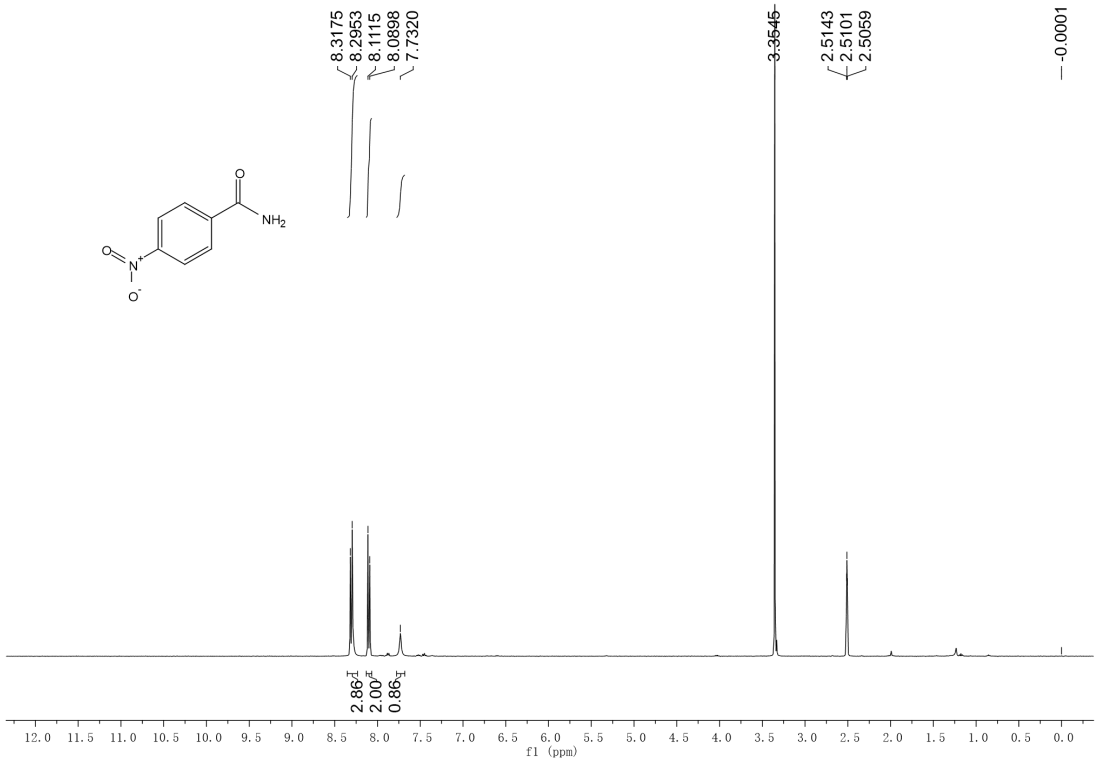
^{13}C NMR: *3-phenylpropanamide* (**2s**)



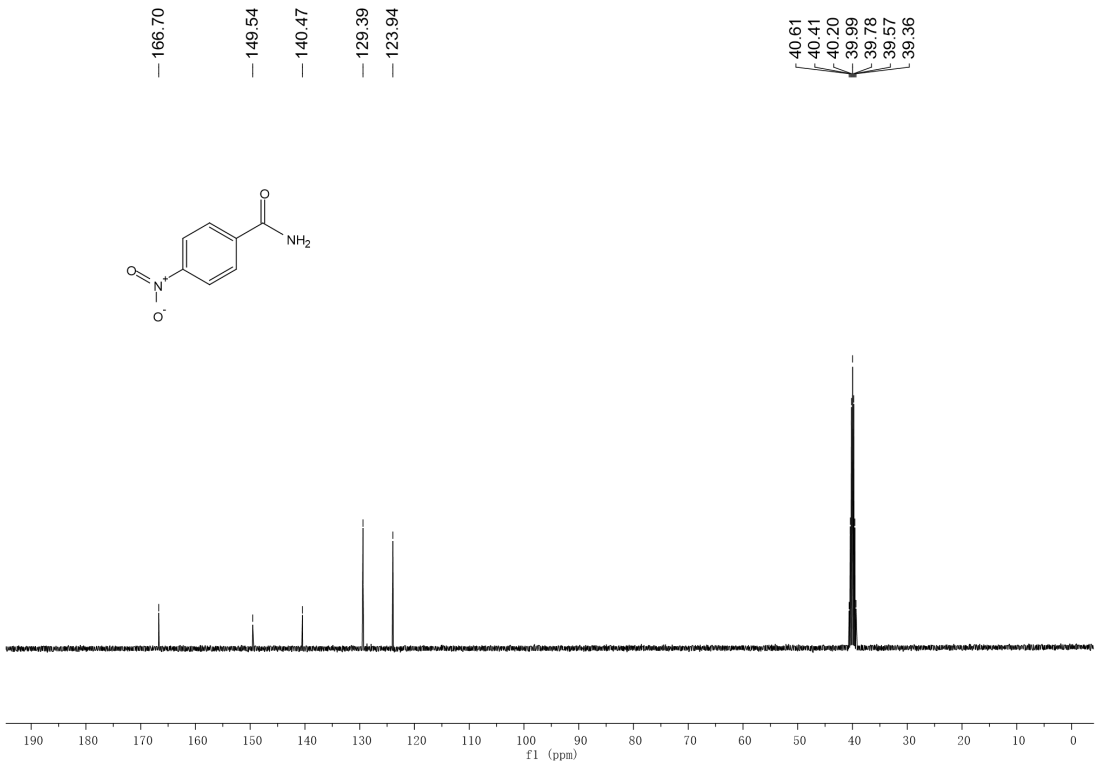
^{1}H NMR: *adamantane-1-carboxamide* (**2t**)



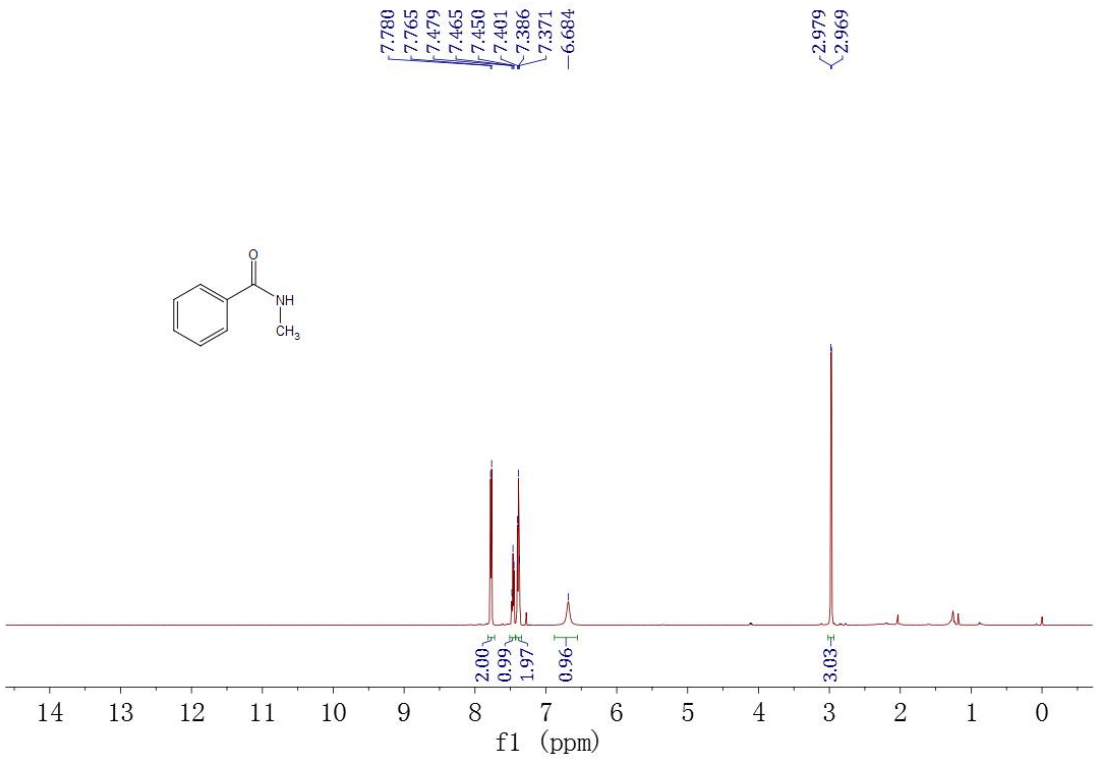
^{13}C NMR: *adamantane-1-carboxamide* (**2t**)



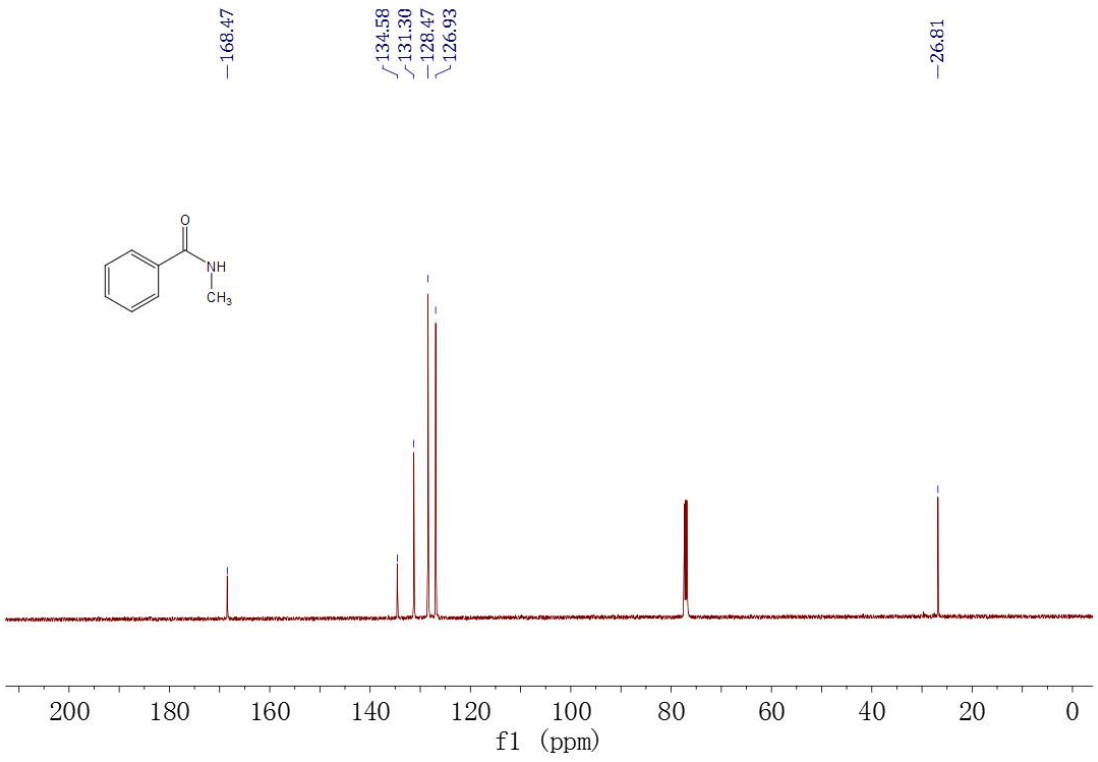
^{1}H NMR: *4-nitrobenzamide* (**2ac**)



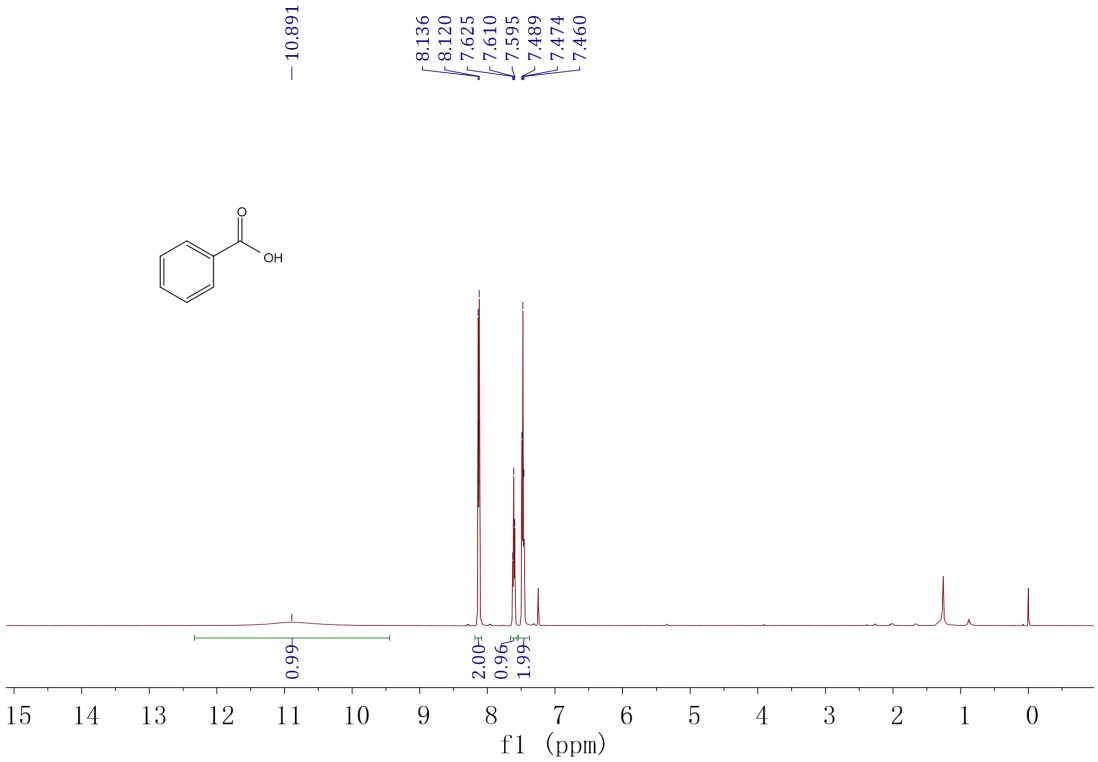
^{13}C NMR: *4-nitrobenzamide* (**2ac**)



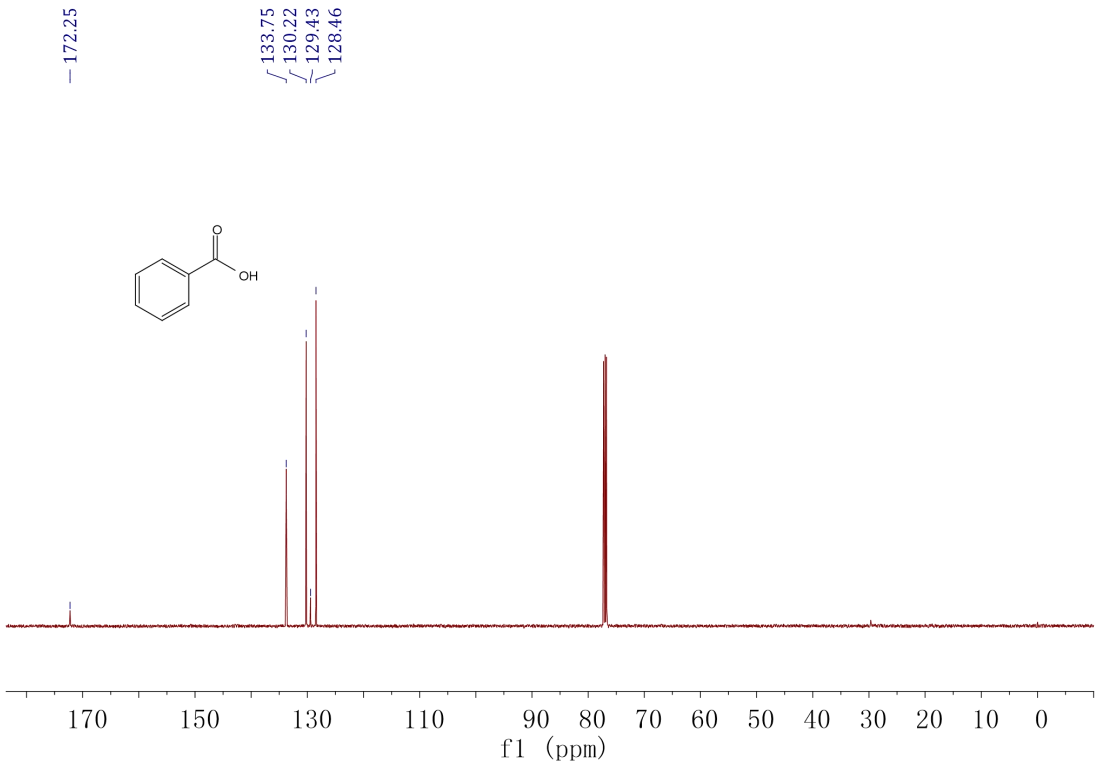
^{1}H NMR: *N*-methylbenzamide (**2ad**)



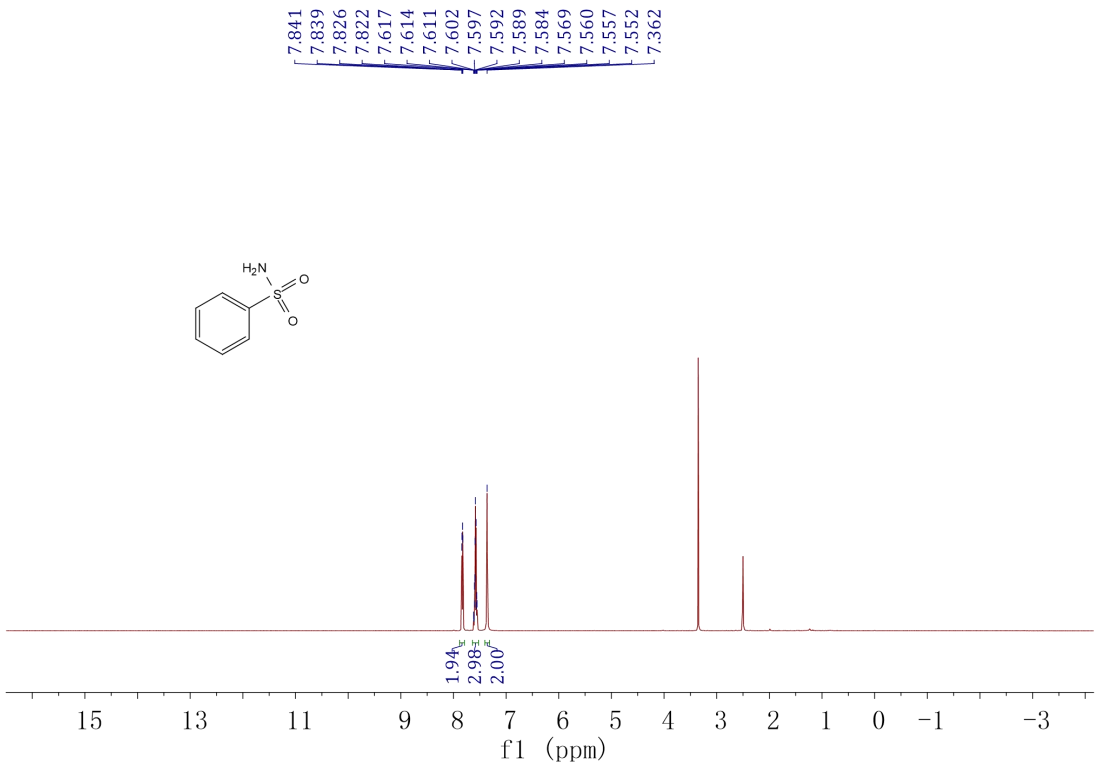
^{13}C NMR: *N*-methylbenzamide (**2ad**)



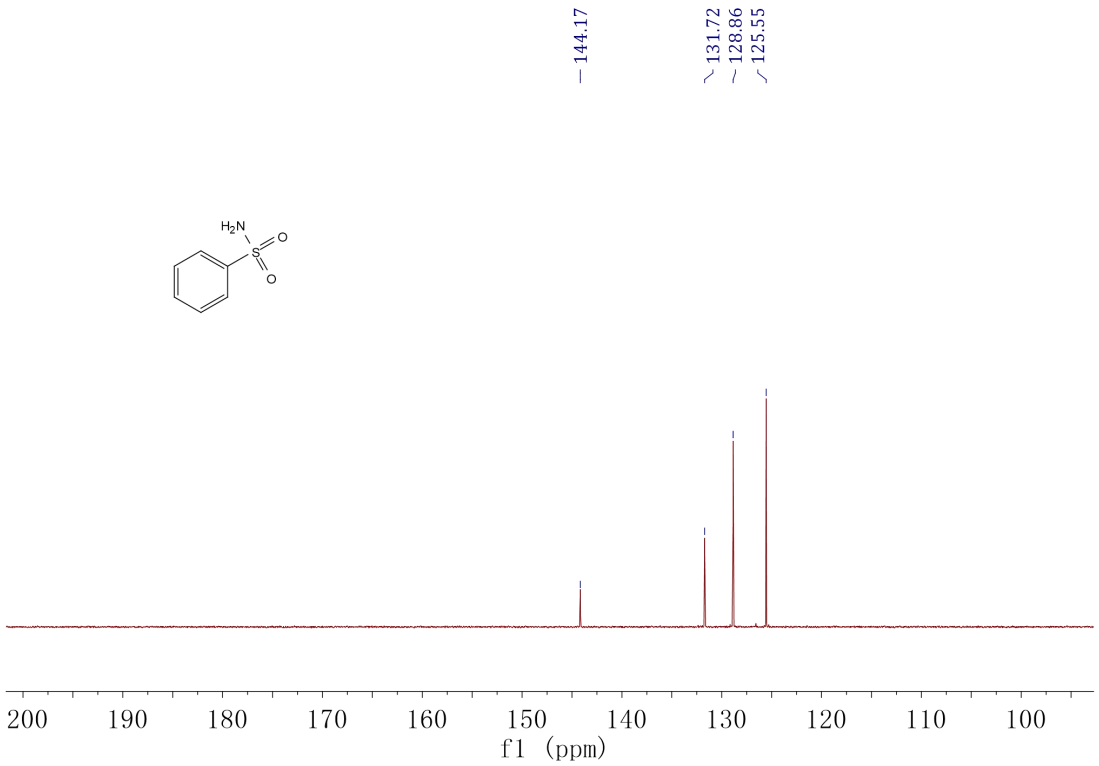
^{1}H NMR: *benzoic acid* (**2ae**)



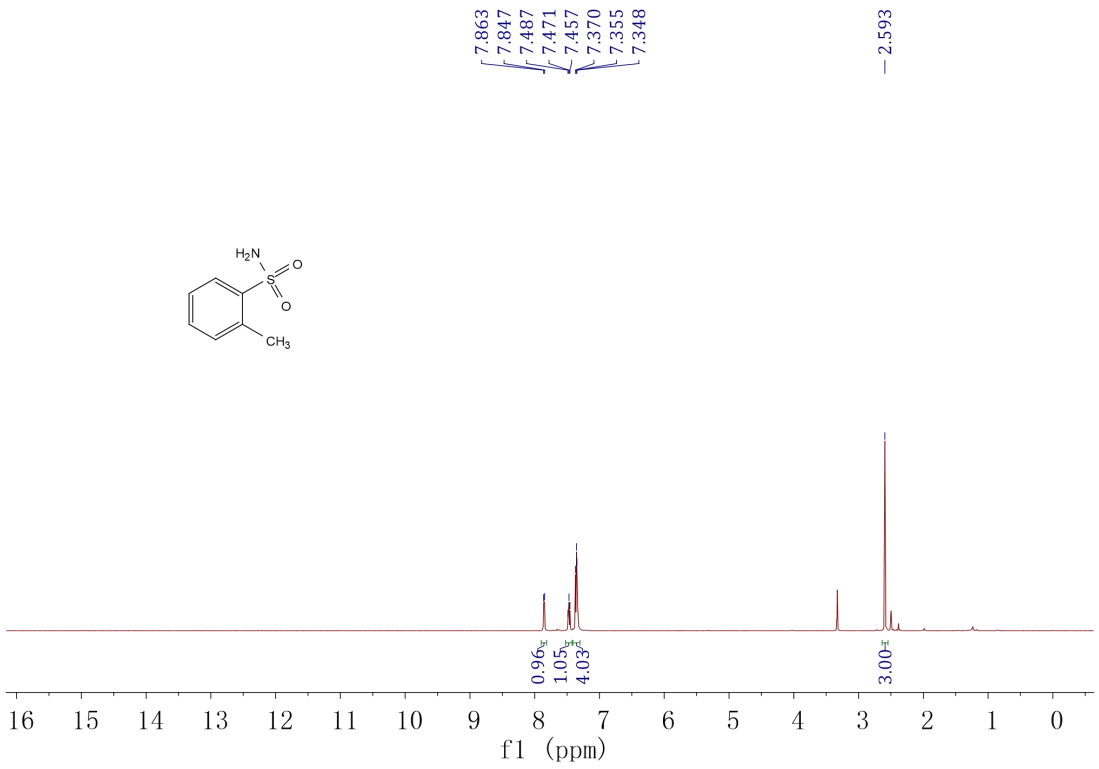
^{13}C NMR: *benzoic acid* (**2ae**)



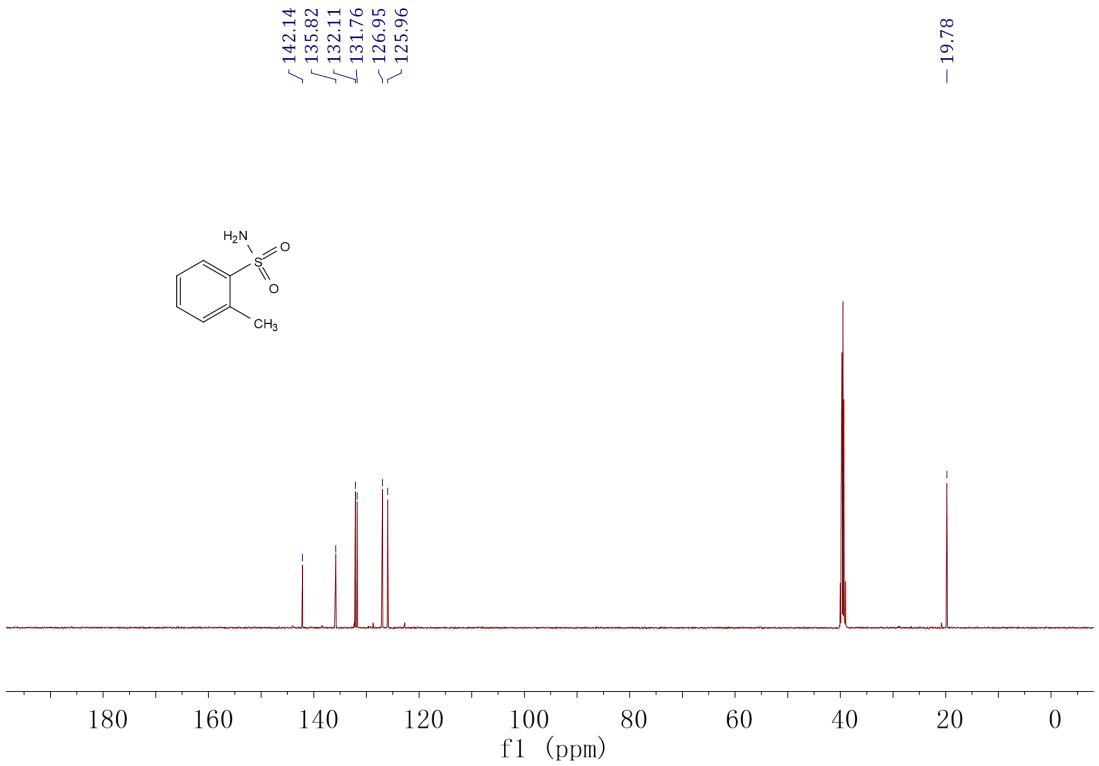
^{1}H NMR: *benzenesulfonamide* (**4a**)



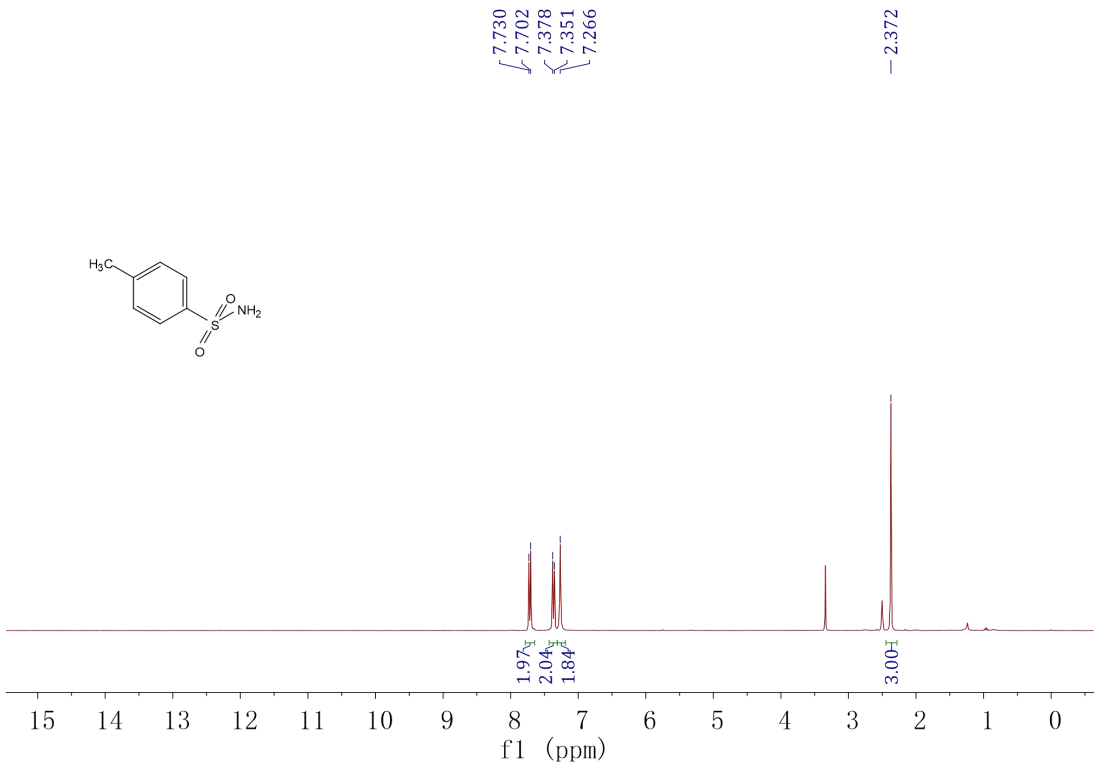
^{13}C NMR: *benzenesulfonamide* (**4a**)



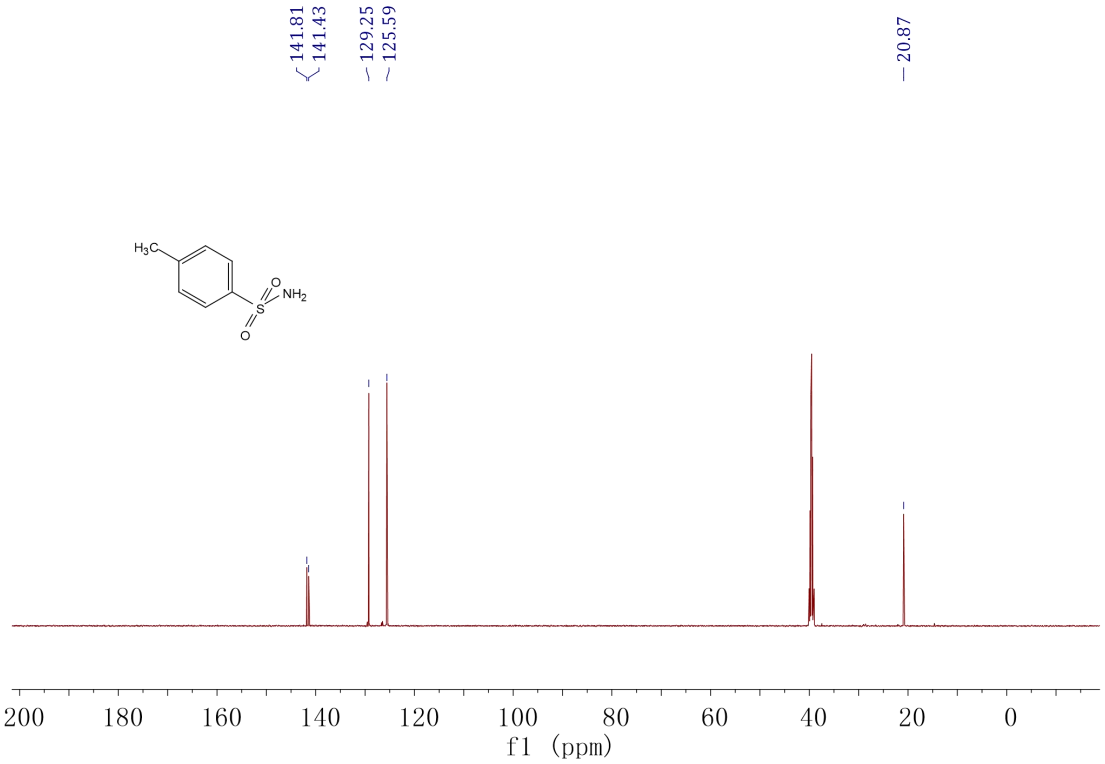
^{1}H NMR: *2-methylbenzenesulfonamide* (**4b**)



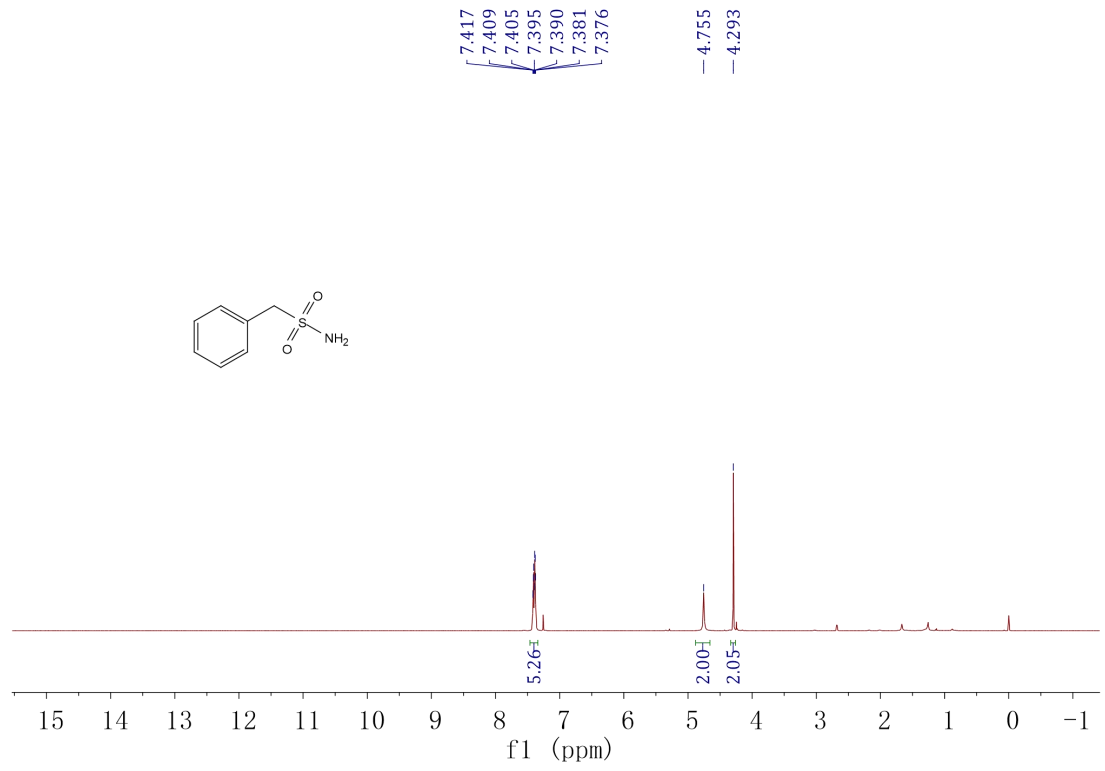
^{13}C NMR: *2-methylbenzenesulfonamide* (**4b**)



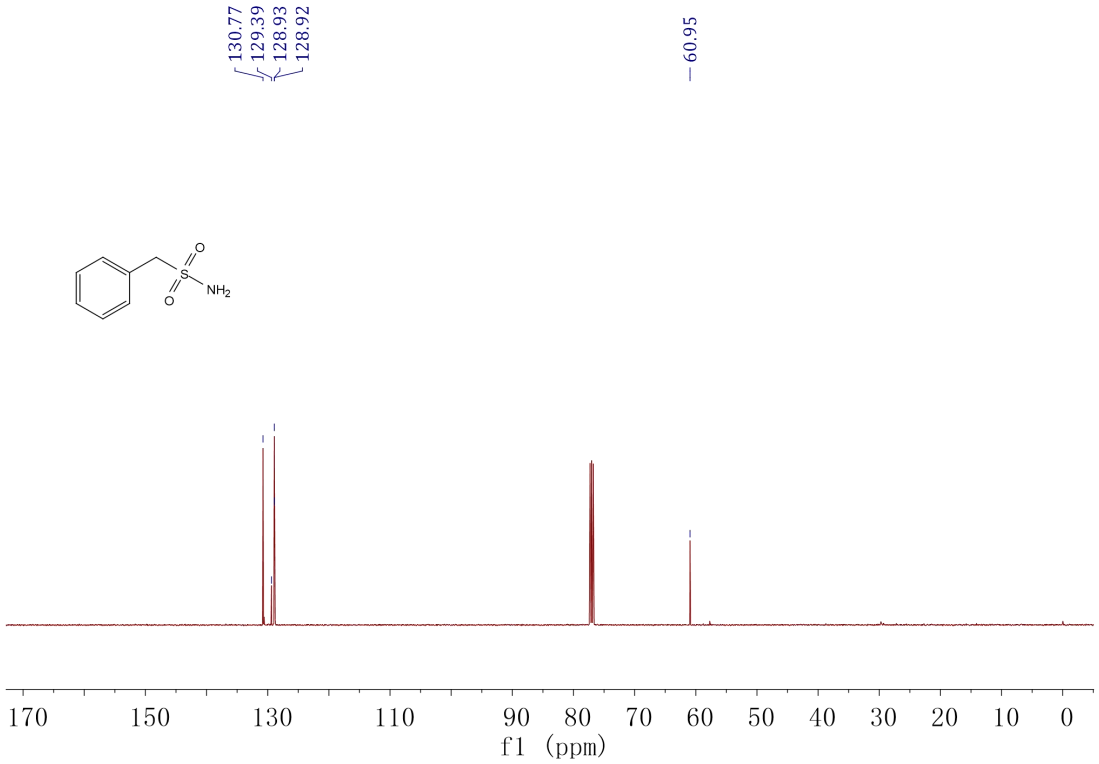
^{1}H NMR: *4-methylbenzenesulfonamide* (**4c**)



^{13}C NMR: *4-methylbenzenesulfonamide* (**4c**)



^{1}H NMR: *phenylmethanesulfonamide* (**4d**)



^{13}C NMR: *phenylmethanesulfonamide* (**4d**)