Electronic Supplementary Material (ESI) for Green Chemistry.

Supporting Information

Phosphorous Acid – Assisted Electrochemical α-Tetrahydrofuranylation of Sulfonamides and Amides

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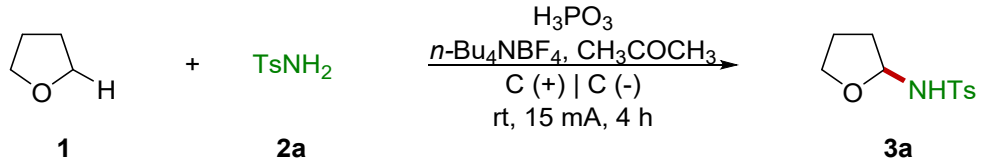
Table of Contents

1) General Information

Chemicals utilized in this work were directly purchased from commercial suppliers, and unless noted, without further purification before the usage. Silica gel plates (GF254, coating thickness 0.2-0.25 mm) were employed for thin-layer chromatography (TLC), and 200-300 mesh silica gel was used for flash column chromatography. ^{1}H, ^{13}C, ^{19}F and ^{31}P NMR data was obtained on Bruker Ultrashield 400 and Bruker Ascend 400 NMR spectrometers. Chemical shifts were reported in ppm with tetramethylsilane as an internal standard, and coupling constants (*J*) in Hz. High-resolution mass spectrometry (HRMS) data were obtained on an FTICR-MS instrument (Ionspec 7.0 T).

2) General Procedures for the electrolysis



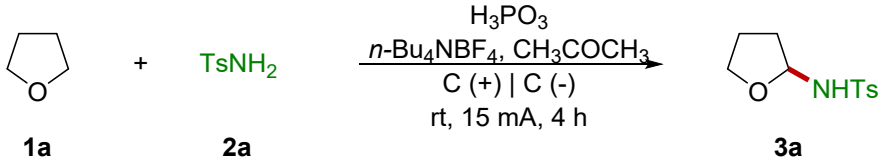
1 **2a** **3a**

$TsNH_2$ (0.5 mmol, 1 eq.), *n*-Bu_4NBF_4 (1 mmol, 2 eq.), H_3PO_3 (0.5 mmol, 1 eq.), acetone (4 mL), THF (1 mL) were subsequently added into a 25 mL undivided cell. Insert the graphite plate electrodes (1 cm×1 cm×2 mm, 1 cm distance) into the cell, and the electrolysis was carried out at room temperature using a constant current of 15 mA for 4 hours.

The solvent in the system was removed under reduced pressure, and the crude product was purified by flash column chromatography with ethyl acetate/petroleum ether and dichloromethane/acetone as the eluent.

3) Optimization of reaction conditions

Table S1. Optimization of reaction conditions[a]

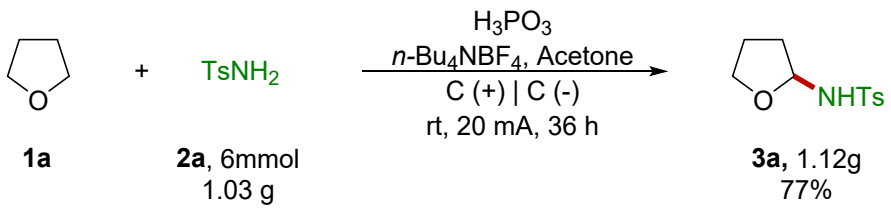


1a **2a** **3a**

Entry	Variation from the standard condition	Yield (%)
1	None	90 (83[b])
2	AcOH instead of H_3PO_3	43
3	PhCOOH instead of H_3PO_3	55
4	TFA instead of H_3PO_3	44
5	TsOH instead of H_3PO_3	37
6	H_3PO_4 instead of H_3PO_3	46
7	H_3PO_3 (0.25 mmol, 0.5 eq)	52
8	H_3PO_3 (0.75 mmol, 1.5 eq)	77
9	Pt plate as the anode	86
10	Ni plate as the cathode	14
11	Pt plate as the cathode	62
12	Pt plate as both the anode and cathode	82
13	*n*-Bu_4NPF_6 as the electrolyte	76
14	*n*-Bu_4NClO_4 as the electrolyte	74
15	Et_4NBF_4 as the electrolyte	84
16	NH_4BF_4 as the electrolyte	67
17	$LiClO_4$ as the electrolyte	25
18	LiOTf as the electrolyte	33
19	THF (0.5 mL) and CH_3COCH_3 (4.5 mL) as the solvent	65
20	THF (2.5 mL) and CH_3COCH_3 (2.5 mL) as the solvent	89
21	THF (5 mL) as the solvent	43
22	DCM as the co-solvent	77
23	DCE as the co-solvent	73
24	MeCN as the co-solvent	76
25	$MeNO_2$ as the co-solvent	14
26	DMF as the co-solvent	Trace
27	No H_3PO_3	14
28	No electric current	0
29	No electric current and electrolyte	0

[a]Standard condition: undivided cell, graphite plate as both the anode and the cathode, 1a (1 mL), 2a (0.5 mmol, 1 eq), H_3PO_3 (0.5 mmol, 1 eq), *n*-Bu_4NBF_4 (1 mmol, 2 eq), 4 mL of CH_3COCH_3, 15 mA, under an Ar atmosphere stirring for 4 h. Yields were determined by ^{1}HNMR using dibromomethane as the internal standard. [b]Isolated Yield.

4) Gram-scale synthesis

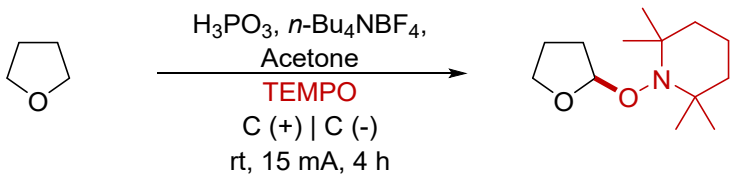


$TsNH_2$ (6 mmol, 1 eq.), *n*-Bu_4NBF_4 (12 mmol, 2 eq.), H_3PO_3 (6 mmol, 1 eq.), acetone (48 mL) and THF (12 mL) were subsequently added into a 250 mL undivided cell. Insert the graphite plate electrodes (3 cm×3 cm×2 mm, 3 cm distance) into the cell, and the electrolysis was carried out at room temperature using a constant current of 20 mA for 36 hours.

The solvent in the system was removed under reduced pressure, and the crude product was purified by flash column chromatography with ethyl acetate/petroleum ether and dichloromethane/acetone as the eluent.

5) Control experiments and mechanistic studies

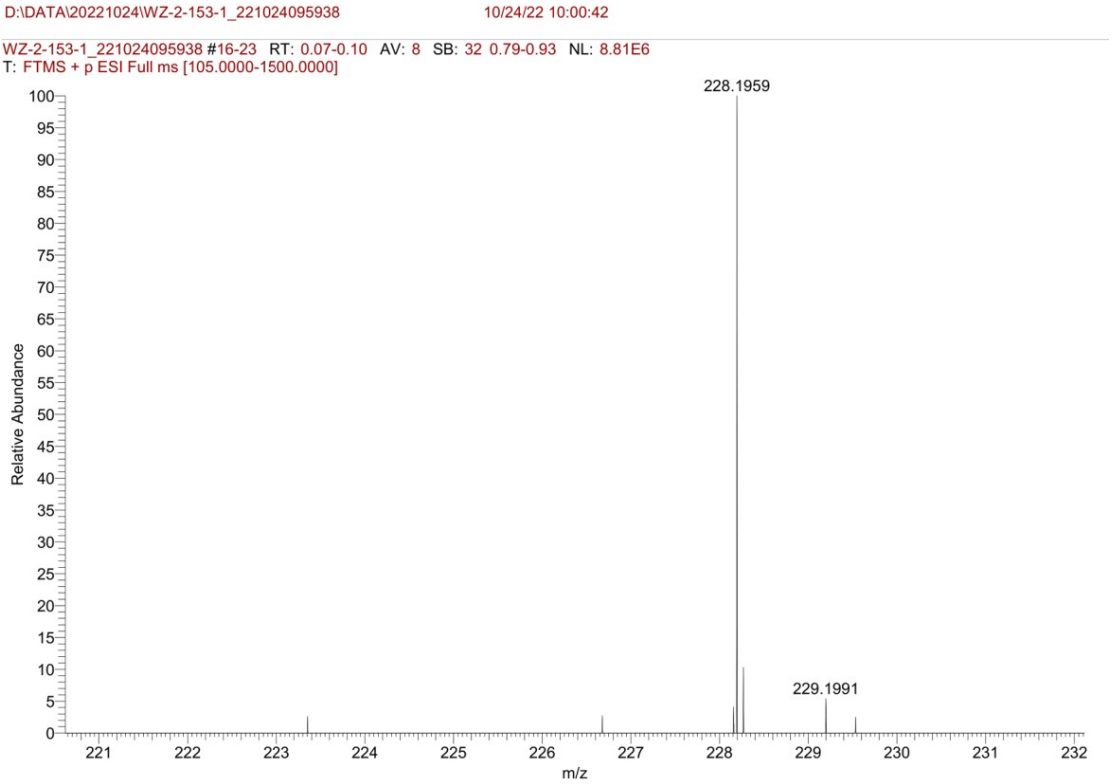
A) Radical-trapping experiment



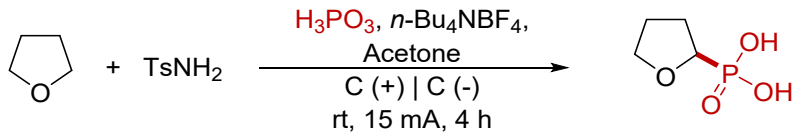
HRMS (ESI) m/z calcd for $C_{13}H_{26}NO_2^+$ $(M+H)^+$ 228.1958, found 228.1959

n-Bu_4NBF_4 (1 mmol, 2 eq.), H_3PO_3 (0.5 mmol, 1 eq.), TEMPO (1 mmol, 2 eq.), acetone (4 mL) and THF (1 mL) were subsequently added into a 25 mL undivided cell. Insert the graphite plate electrodes into the reaction tube, and the electrolysis was carried out at room temperature using a constant current of 15 mA for 4 hours.

We detected the radical trapping product by HRMS analysis. The HRMS spectrum of the product is illustrated as below.

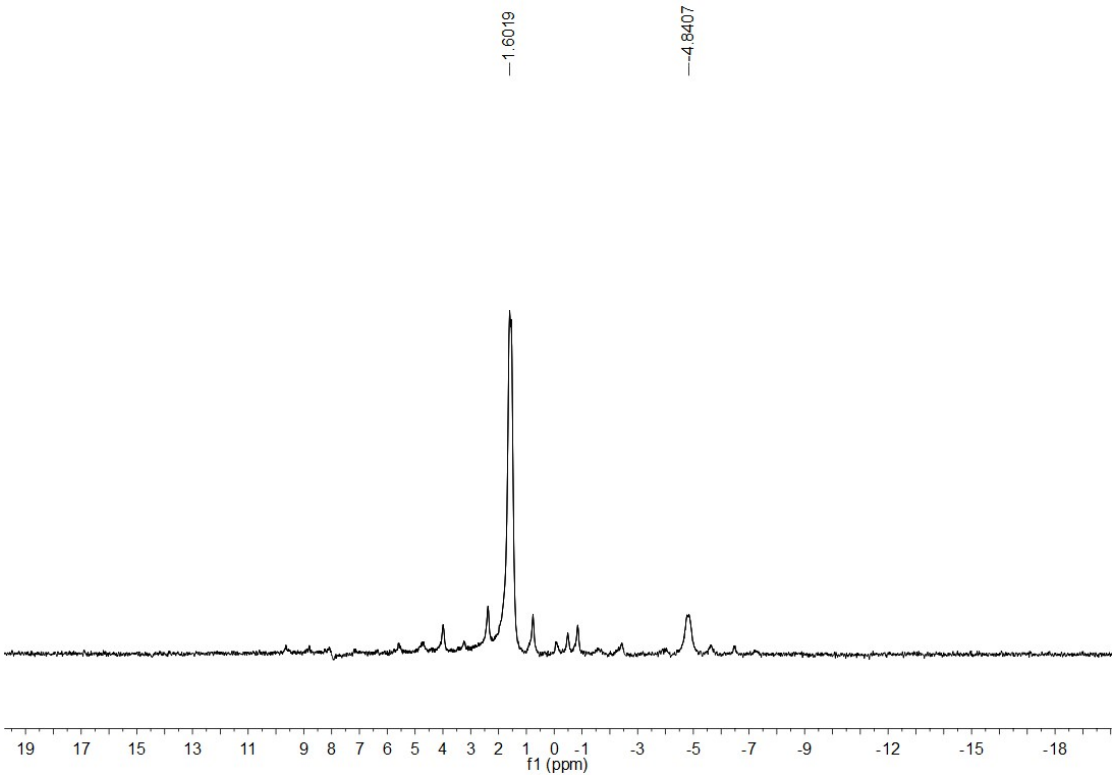


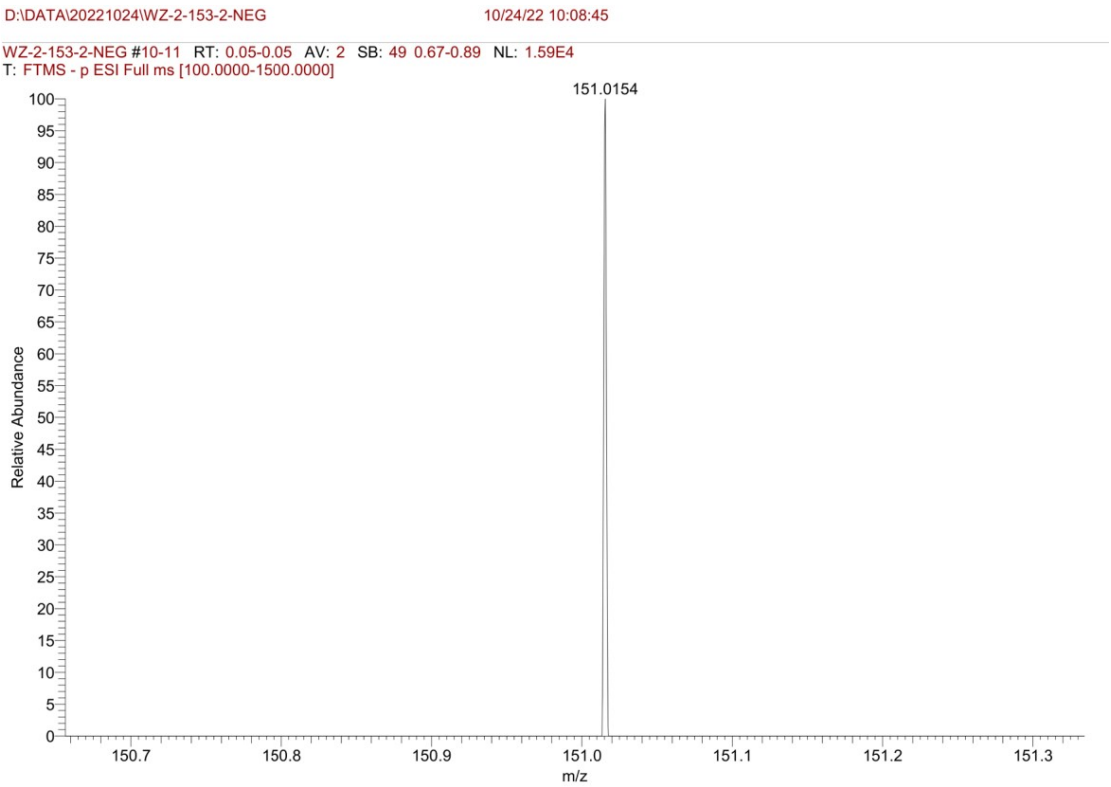
B) Detection of the tetrahydrofuranyl phosphonic acid



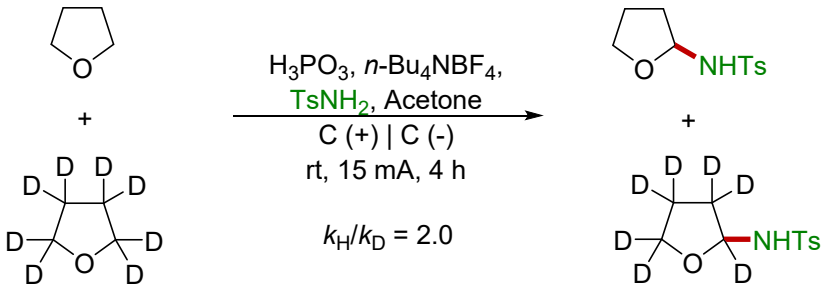
HRMS (ESI) m/z calcd for $C_4H_8O_4P^-$ $(M-H)^-$ 151.0166, found 151.0154

When the reaction was performed with the standard condition, the generation of tetrahydrofuranyl phosphonic acid was confirmed through ^{31}P NMR and HRMS, and the spectra are illustrated below.



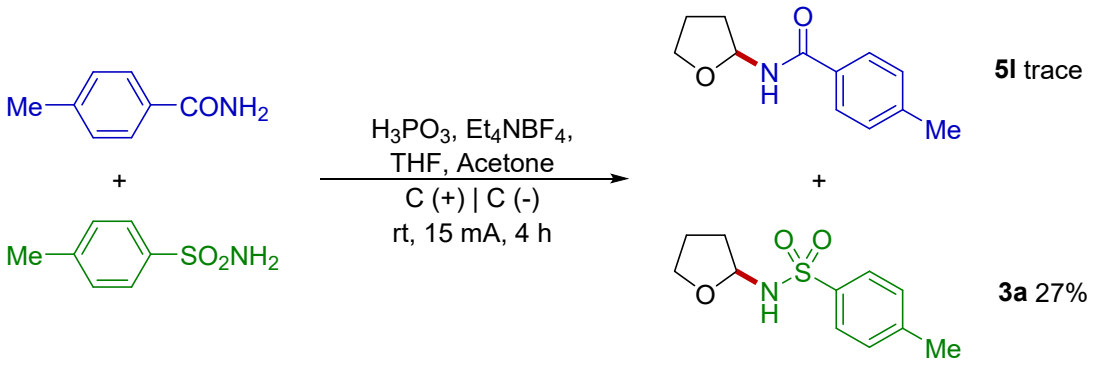


C) KIE Experiment



$TsNH_2$ (0.5 mmol, 1 eq.), *n*-Bu_4NBF_4 (1 mmol, 2 eq.), H_3PO_3 (0.5 mmol, 1 eq.), acetone (4 mL), THF (0.5 mL) and THF-d_8 (0.5 mL) were subsequently added into a 25 mL undivided cell. Insert the graphite plate electrodes into the reaction tube, and the electrolysis was carried out at room temperature using a constant current of 15 mA for 4 hours.

D) Competition Experiment

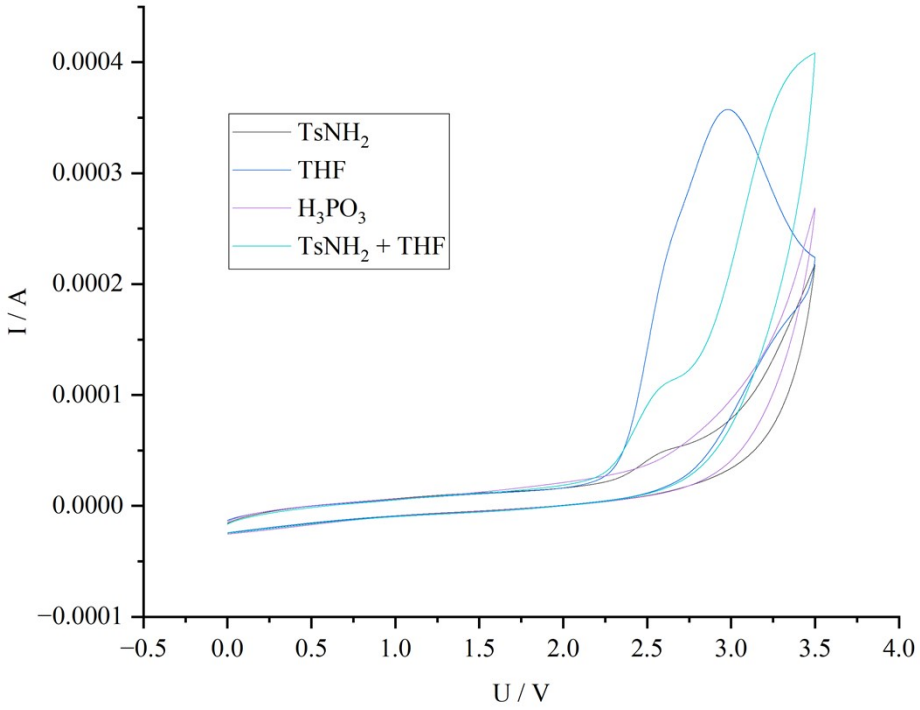


$TsNH_2$ (0.5 mmol, 1 eq.), *p*-$MePhCONH_2$ (0.5 mmol, 1 eq.), *n*-Bu_4NBF_4 (1 mmol, 2 eq.), H_3PO_3 (0.5 mmol, 1 eq.), acetone (4 mL), THF (1 mL) were subsequently added into a 25 mL undivided cell. Insert the graphite plate electrodes into the reaction tube, and the electrolysis was carried out at room temperature using a constant current of 15 mA for 4 hours.

E) Cyclic Voltammetry Experiment

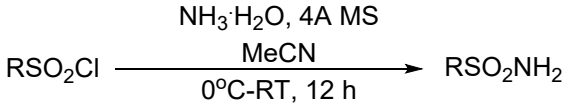
Cyclic voltammetry was performed in a three-electrode cell connected to a Schlenk line under air at room temperature. The working electrode was a glassy carbon electrode, the counter electrode was a platinum wire. The reference was an $Ag/AgNO_3$ electrode submerged in saturated aqueous $AgNO_3$ solution, and separated from reaction by a salt bridge. 10 mL of CH_3CN containing 0.1 M *n*-Bu_4NPF_6 were poured into the electrochemical cell in all experiments, and the concentration of all tested compounds was 2 mmol/L. The scan rate is 0.1 V/s, ranging from 0 V to 3.5 V.

Figure S1. Cyclic Voltammetry Experiment.


0.0004
0.0003
0.0002
0.0001
0.0000
−0.0001
I / A
−0.5
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
U / V
TsNH2
THF
H3PO3
TsNH2 + THF

6) Synthesis of the substrates

General Procedure for the preparation of sulfonamides (**2w**, **2y**)

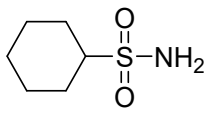


4A MS (15 g), dry MeCN (30 mL) and sulfonyl chloride (5 mmol, 1 eq) are added into a dry 100 mL flask subsequently. The reaction system is cooled in ice bath and stirs at 0 °C, then ammonia water (3 mL) is added dropwise. The mixture is stirred at room temperature for 12 h.

After the completion of reaction, the mixture is filtered and the precipitate is removed. The solution is concentrated in *vacuo* and purified with column chromatography with ethyl acetate/petroleum ether as the eluent to acquire the corresponding product.

7) Characterization data for the substrates and products

Cyclohexanesulfonamide (**2w**)[1]

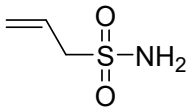


White Solid. mp 95–96 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 4.72 (s, 2H), 2.93 (tt, *J* = 12.0, 3.3 Hz, 1H), 2.24 (d, *J* = 11.7 Hz, 2H), 1.91 (d, *J* = 13.2 Hz, 2H), 1.73 (d, *J* = 12.3 Hz, 1H), 1.51 (qd, *J* = 12.4, 3.0 Hz, 2H), 1.39 – 1.12 (m, 3H).

The spectral data obtained were identical with those reported in literature.

Prop-2-ene-1-sulfonamide (**2y**)[2]

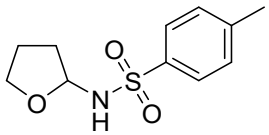


Colorless Oil.

^{1}H NMR (400 MHz, CDCl3) δ 6.02 – 5.88 (m, 1H), 5.53 – 5.45 (m, 2H), 5.17 (s, 2H), 3.86 (d, J = 7.4 Hz, 2H).

The spectral data obtained were identical with those reported in literature.

4-Methyl-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3a**)[3]

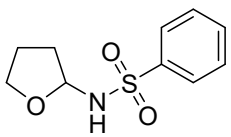


Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.80 (d, *J* = 8.3 Hz, 2H), 7.29 (d, *J* = 8.2 Hz, 2H), 5.49 (d, *J* = 8.9 Hz, 1H), 5.40 – 5.30 (m, 1H), 3.69 (td, *J* = 6.9, 3.6 Hz, 2H), 2.42 (s, 3H), 2.15 (ddd, *J* = 12.7, 8.0, 6.6 Hz, 1H), 1.96 – 1.71 (m, 3H).

The spectral data obtained were identical with those reported in literature.

N-(Tetrahydrofuran-2-yl)benzenesulfonamide (**3b**)[3]

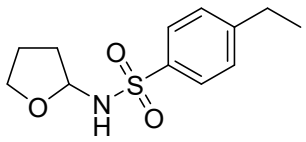


Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.93 (d, *J* = 7.4 Hz, 2H), 7.56 (t, *J* = 7.3 Hz, 1H), 7.49 (t, *J* = 7.5 Hz, 2H), 5.89 (d, *J* = 8.9 Hz, 1H), 5.40 – 5.33 (m, 1H), 3.66 (t, *J* = 6.6 Hz, 2H), 2.21 – 2.07 (m, 1H), 1.95 – 1.73 (m, 3H).

The spectral data obtained were identical with those reported in literature.

4-Ethyl-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3c**)



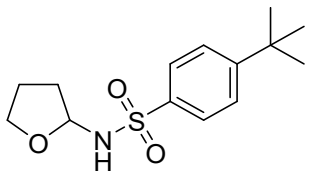
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, J = 7.9 Hz, 2H), 7.31 (d, J = 7.9 Hz, 2H), 5.70 (d, J = 8.6 Hz, 1H), 5.35 (s, 1H), 3.69 (d, J = 4.0 Hz, 2H), 2.72 (q, J = 7.4 Hz, 2H), 2.22 – 2.06 (m, 1H), 1.97 – 1.71 (m, 3H), 1.26 (t, J = 7.5 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 149.4, 138.7, 128.4, 127.1, 85.0, 67.2, 32.7, 28.8, 24.0, 15.1.

HRMS (ESI) m/z calcd for $C_{12}H_{17}NNaO_3S^+$ ($M+Na^+$): 278.0821, found: 278.0825.

4-(tert-Butyl)-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3d**)



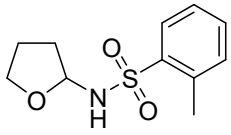
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (d, *J* = 8.4 Hz, 2H), 7.50 (d, *J* = 8.4 Hz, 2H), 5.82 (d, *J* = 8.8 Hz, 1H), 5.40 – 5.32 (m, 1H), 3.77 – 3.63 (m, 2H), 2.13 (dt, *J* = 12.1, 7.4 Hz, 1H), 1.95 – 1.77 (m, 3H), 1.34 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 156.2, 138.5, 126.8, 125.9, 85.0, 67.2, 35.1, 32.6, 31.1, 24.0.

HRMS (ESI) m/z calcd for $C_{14}H_{21}NNaO_3S^+$ ($M+Na^+$): 306.1134, found: 306.1138.

2-Methyl-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3e**)



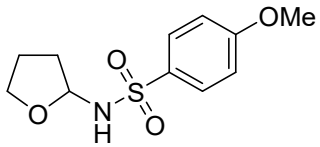
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 7.8 Hz, 1H), 7.44 (t, *J* = 7.3 Hz, 1H), 7.30 (q, *J* = 7.6 Hz, 2H), 5.63 (d, *J* = 8.6 Hz, 1H), 5.31 – 5.21 (m, 1H), 3.72 (qd, *J* = 14.8, 7.9 Hz, 2H), 2.65 (s, 3H), 2.14 (dt, *J* = 12.0, 7.1 Hz, 1H), 1.97 – 1.77 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 139.3, 137.0, 132.7, 132.4, 129.0, 126.2, 84.8, 67.4, 32.8, 24.1, 20.3.

HRMS (ESI) m/z calcd for $C_{11}H_{15}NNaO_3S^+$ ($M+Na^+$): 264.0665, found: 264.0670.

4-Methoxy-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3f**)



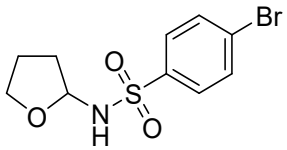
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (d, J = 8.8 Hz, 2H), 6.96 (d, J = 8.9 Hz, 2H), 5.42 – 5.30 (m, 2H), 3.87 (s, 3H), 3.70 (td, J = 6.8, 2.4 Hz, 2H), 2.22 – 2.11 (m, 1H), 1.95 – 1.71 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 162.8, 133.1, 129.2, 114.0, 85.0, 67.2, 55.6, 32.7, 24.0.

HRMS (ESI) m/z calcd for $C_{11}H_{15}NNaO_4S^+$ ($M+Na^+$): 280.0614, found: 280.0620.

4-Bromo-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3g**)[3]

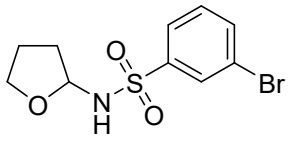


Colorless Oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, *J* = 8.6 Hz, 2H), 7.62 (d, *J* = 8.6 Hz, 2H), 5.87 (d, *J* = 8.8 Hz, 1H), 5.41 – 5.31 (m, 1H), 3.74 – 3.58 (m, 2H), 2.23 – 2.10 (m, 1H), 1.98 – 1.70 (m, 3H).

The spectral data obtained were identical with those reported in literature.

3-Bromo-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3h**)



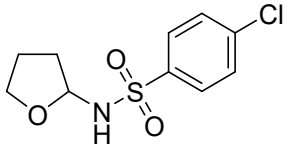
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (s, 1H), 7.86 (d, *J* = 7.9 Hz, 1H), 7.69 (d, *J* = 8.0 Hz, 1H), 7.38 (t, *J* = 8.0 Hz, 1H), 5.71 (d, *J* = 8.9 Hz, 1H), 5.42 – 5.34 (m, 1H), 3.69 (t, *J* = 6.8 Hz, 2H), 2.19 (ddd, *J* = 12.9, 11.6, 6.8 Hz, 1H), 1.99 – 1.72 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 143.3, 135.6, 130.5, 130.0, 125.6, 122.7, 85.0, 67.3, 32.6, 24.0.

HRMS (ESI) m/z calcd for $C_{10}H_{11}BrNO_3S^-$ ($M-H^-$): 303.9649, found: 303.9646.

4-Chloro-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3i**)[3]

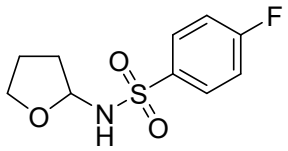


Colorless Oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (d, *J* = 8.6 Hz, 2H), 7.47 (d, *J* = 8.6 Hz, 2H), 5.63 (d, *J* = 9.0 Hz, 1H), 5.45 – 5.27 (m, 1H), 3.68 (t, *J* = 6.8 Hz, 2H), 2.27 – 2.10 (m, 1H), 1.95 – 1.72 (m, 3H).

The spectral data obtained were identical with those reported in literature.

4-Fluoro-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3j**)



Colorless oil.

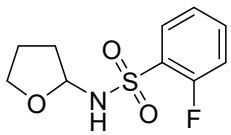
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 – 7.88 (m, 2H), 7.17 (t, *J* = 8.6 Hz, 2H), 5.69 (d, *J* = 8.9 Hz, 1H), 5.41 – 5.32 (m, 1H), 3.67 (t, *J* = 6.8 Hz, 2H), 2.24 – 2.12 (m, 1H), 1.96 – 1.78 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 165.0 (d, *J* = 254.4 Hz), 137.6 (d, *J* = 3.3 Hz), 129.8 (d, *J* = 9.3 Hz), 116.1 (d, *J* = 22.6 Hz), 85.0, 67.2, 32.6, 24.0.

^{19}F NMR (376 MHz, $CDCl_3$) δ -105.6.

HRMS (ESI) m/z calcd for $C_{10}H_{12}FNNaO_3S^+$ ($M+Na^+$): 268.0414, found: 268.0420.

2-Fluoro-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3k**)



Colorless oil.

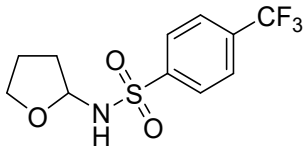
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.92 (td, *J* = 7.7, 1.6 Hz, 1H), 7.62 – 7.52 (m, 1H), 7.27 (t, *J* = 7.4 Hz, 1H), 7.24 – 7.16 (m, 1H), 5.75 (d, *J* = 9.4 Hz, 1H), 5.34 (ddd, *J* = 9.6, 6.9, 3.0 Hz, 1H), 3.78 – 3.57 (m, 2H), 2.25 – 2.10 (m, 1H), 2.01 – 1.74 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 160.2, 157.7, 134.9 (d, *J* = 8.6 Hz), 129.7, 124.4 (d, *J* = 3.8 Hz), 116.7 (d, *J* = 21.3 Hz), 85.1, 67.4, 32.5, 24.0.

^{19}F NMR (376 MHz, $CDCl_3$) δ -110.99.

HRMS (ESI) m/z calcd for $C_{10}H_{12}FNNaO_3S^+$ ($M+Na^+$): 268.0414, found: 268.0419.

N-(Tetrahydrofuran-2-yl)-4-(trifluoromethyl)benzenesulfonamide (**3l**)



Colorless oil.

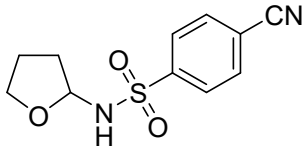
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (d, *J* = 8.2 Hz, 2H), 7.77 (d, *J* = 8.3 Hz, 2H), 5.52 – 5.37 (m, 2H), 3.68 (td, *J* = 6.9, 3.0 Hz, 2H), 2.29 – 2.16 (m, 1H), 1.95 – 1.84 (m, 2H), 1.84 – 1.74 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 145.0, 134.3 (q, *J* = 33.0 Hz), 127.7, 126.1 (q, *J* = 3.7 Hz), 123.3 (q, *J* = 273.0 Hz), 85.1, 67.4, 32.7, 24.1.

^{19}F NMR (376 MHz, $CDCl_3$) δ -63.09.

HRMS (ESI) m/z calcd for $C_{11}H_{11}F_3NO_3S^-$ ($M-H^-$): 294.0417, found: 294.0415.

4-Cyano-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3m**)



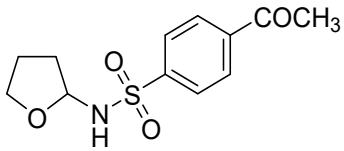
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.05 (d, *J* = 8.5 Hz, 2H), 7.81 (d, *J* = 8.6 Hz, 2H), 5.97 (d, *J* = 9.1 Hz, 1H), 5.48 – 5.29 (m, 1H), 3.74 – 3.54 (m, 2H), 2.21 (ddd, *J* = 13.1, 11.7, 7.2 Hz, 1H), 1.94 – 1.75 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 145.8, 132.7, 127.8, 117.5, 116.1, 85.1, 67.4, 32.5, 24.0.

HRMS (ESI) m/z calcd for $C_{11}H_{12}N_2NaO_3S^+$ ($M+Na^+$): 275.0461, found: 275.0463.

4-Acetyl-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3n**)



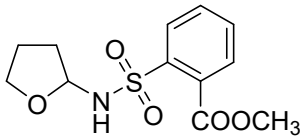
Colorless Oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (q, *J* = 8.7 Hz, 4H), 5.65 (d, *J* = 9.1 Hz, 1H), 5.45 – 5.37 (m, 1H), 3.67 (t, *J* = 7.0 Hz, 2H), 2.66 (s, 3H), 2.27 – 2.12 (m, 1H), 1.96 – 1.73 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 197.0, 145.4, 139.8, 128.8, 127.4, 85.1, 67.3, 32.7, 26.9, 24.0.

HRMS (ESI) m/z calcd for $C_{12}H_{15}NNaO_4S^+$ ($M+Na^+$): 292.0614, found: 292.0620.

Methyl 2-(N-(tetrahydrofuran-2-yl)sulfamoyl)benzoate (**3o**)



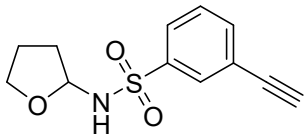
Colorless Oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 – 8.09 (m, 1H), 7.90 – 7.76 (m, 1H), 7.70 – 7.56 (m, 2H), 6.81 (d, *J* = 9.7 Hz, 1H), 5.42 (ddd, *J* = 9.3, 6.5, 2.7 Hz, 1H), 3.98 (s, 3H), 3.64 – 3.46 (m, 2H), 2.14 (tdd, *J* = 14.8, 7.8, 4.2 Hz, 1H), 1.99 – 1.79 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 168.3, 141.5, 132.1, 132.0, 130.5, 129.7, 129.4, 85.6, 67.1, 53.4, 32.3, 23.9.

HRMS (ESI) m/z calcd for $C_{12}H_{15}NNaO_5S^+$ ($M+Na^+$): 308.0563, found: 308.0568.

3-Ethynyl-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3p**)



Colorless Oil.

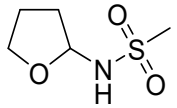
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (s, 1H), 7.90 (d, *J* = 6.9 Hz, 1H), 7.66 (d, *J* = 7.8 Hz, 1H), 7.47 (t, *J* = 7.8 Hz, 1H), 5.51 (d, *J* = 8.9 Hz, 1H), 5.42 – 5.34 (m, 1H), 3.69 (t, *J* = 6.8 Hz, 2H), 3.17 (s, 1H), 2.24 – 2.13 (m, 1H), 1.95 – 1.74 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 141.9, 135.9, 130.6, 129.0, 127.2, 123.2, 85.0, 81.9,

79.2, 67.3, 32.7, 24.0.

HRMS (ESI) m/z calcd for $C_{12}H_{13}NNaO_3S^+$ ($M+Na^+$): 274.0508, found: 274.0513.

N-(Tetrahydrofuran-2-yl)methanesulfonamide (**3q**)[3]

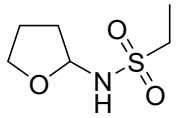


Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 5.73 (d, *J* = 9.6 Hz, 1H), 5.41 – 5.26 (m, 1H), 3.98 – 3.77 (m, 2H), 3.08 (s, 3H), 2.23 (ddt, *J* = 13.2, 8.8, 6.7 Hz, 1H), 2.07 – 1.70 (m, 3H).

The spectral data obtained were identical with those reported in literature.

N-(Tetrahydrofuran-2-yl)ethanesulfonamide (**3r**)



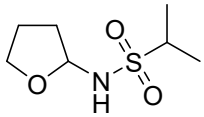
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 5.84 (d, *J* = 9.5 Hz, 1H), 5.38 – 5.24 (m, 1H), 3.97 – 3.77 (m, 2H), 3.18 (q, *J* = 7.4 Hz, 2H), 2.29 – 2.17 (m, 1H), 2.07 – 1.75 (m, 3H), 1.37 (t, *J* = 7.4 Hz, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 84.7, 67.3, 49.0, 32.1, 24.3, 8.1.

HRMS (ESI) m/z calcd for $C_6H_{13}NNaO_3S^+$ ($M+Na^+$): 202.0508, found: 202.0513.

N-(Tetrahydrofuran-2-yl)propane-2-sulfonamide (**3s**)



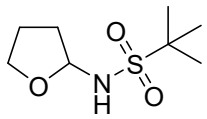
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 5.44 (d, *J* = 9.6 Hz, 1H), 5.35 – 5.26 (m, 1H), 3.96 – 3.77 (m, 2H), 3.32 (dt, *J* = 13.7, 6.8 Hz, 1H), 2.25 (ddd, *J* = 15.2, 13.1, 6.6 Hz, 1H), 2.06 – 1.78 (m, 3H), 1.39 (m, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 84.8, 67.3, 54.6, 32.5, 24.4, 16.9, 15.9.

HRMS (ESI) m/z calcd for $C_7H_{15}NNaO_3S^+$ ($M+Na^+$): 216.0665, found: 216.0670.

2-Methyl-N-(tetrahydrofuran-2-yl)propane-2-sulfonamide (**3t**)



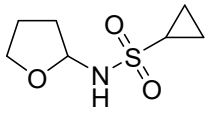
Colorless Oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 5.41 – 5.18 (m, 1H), 5.04 (d, *J* = 9.5 Hz, 1H), 3.94 (dd, *J* = 15.1, 7.1 Hz, 1H), 3.81 (dd, *J* = 14.1, 7.7 Hz, 1H), 2.31 – 2.19 (m, 1H), 1.94 (pd, *J* = 12.8, 6.2 Hz, 2H), 1.87 – 1.74 (m, 1H), 1.43 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 85.2, 67.1, 59.7, 33.2, 24.4, 24.2.

HRMS (ESI) m/z calcd for $C_8H_{17}NNaO_3S^+$ ($M+Na^+$): 230.0821, found: 230.0825.

N-(Tetrahydrofuran-2-yl)cyclopropanesulfonamide (**3u**)



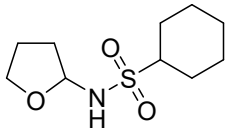
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 5.45 – 5.27 (m, 2H), 4.00 – 3.78 (m, 2H), 2.61 (tt, *J* = 8.1, 4.9 Hz, 1H), 2.24 (ddt, *J* = 12.9, 8.7, 6.4 Hz, 1H), 2.05 – 1.84 (m, 2H), 1.81 – 1.74 (m, 1H), 1.30 – 1.20 (m, 1H), 1.18 – 1.09 (m, 1H), 1.09 – 0.93 (m, 2H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 85.1, 67.2, 32.3, 32.0, 24.2, 6.1, 5.7.

HRMS (ESI) m/z calcd for $C_7H_{13}NNaO_3S^+$ ($M+Na^+$): 214.0508, found: 214.0513.

N-(Tetrahydrofuran-2-yl)cyclohexanesulfonamide (**3v**)



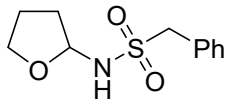
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 5.32 – 5.28 (m, 2H), 3.97 – 3.77 (m, 2H), 3.04 (tt, *J* = 12.1, 3.4 Hz, 1H), 2.32 – 2.18 (m, 2H), 2.13 (d, *J* = 12.3 Hz, 1H), 2.05 – 1.84 (m, 4H), 1.84 – 1.74 (m, 1H), 1.71 (d, *J* = 12.3 Hz, 1H), 1.51 (qd, *J* = 12.4, 3.4 Hz, 2H), 1.36 – 1.13 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 84.8, 67.3, 62.5, 32.5, 26.6, 25.8, 25.2, 25.2, 25.1, 24.4.

HRMS (ESI) m/z calcd for $C_{10}H_{19}NNaO_3S^+$ ($M+Na^+$): 256.0978, found: 256.0983.

1-Phenyl-N-(tetrahydrofuran-2-yl)methanesulfonamide (**3w**)[3]

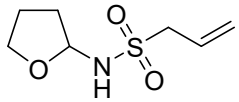


Colorless Oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 – 7.31 (m, 5H), 5.40 – 5.27 (m, 1H), 5.18 (d, *J* = 9.7 Hz, 1H), 4.34 (q, *J* = 13.8 Hz, 2H), 3.89 (dtd, *J* = 15.0, 8.2, 7.0 Hz, 2H), 2.27 – 2.13 (m, 1H), 1.96 – 1.82 (m, 2H), 1.76 – 1.63 (m, 1H).

The spectral data obtained were identical with those reported in literature.

N-(Tetrahydrofuran-2-yl)prop-2-ene-1-sulfonamide (**3x**)



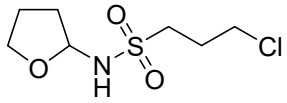
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 5.91 (ddt, *J* = 17.1, 9.6, 7.3 Hz, 1H), 5.56 (d, *J* = 9.7 Hz, 1H), 5.46 (s, 1H), 5.43 (d, *J* = 4.7 Hz, 1H), 5.39 – 5.29 (m, 1H), 3.95 – 3.79 (m, 4H), 2.24 (ddd, *J* = 15.3, 13.2, 6.7 Hz, 1H), 2.03 – 1.84 (m, 2H), 1.84 – 1.73 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 125.9, 124.2, 84.9, 67.3, 58.8, 32.1, 24.3.

HRMS (ESI) m/z calcd for $C_7H_{13}NNaO_3S^+$ ($M+Na^+$): 214.0508, found: 214.0514.

3-Chloro-N-(tetrahydrofuran-2-yl)propane-1-sulfonamide (**3y**)



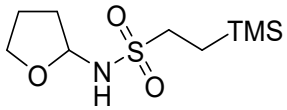
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 5.49 (d, *J* = 9.5 Hz, 1H), 5.38 – 5.28 (m, 1H), 3.96 – 3.80 (m, 2H), 3.73 – 3.62 (m, 2H), 3.41 – 3.26 (m, 2H), 2.38 – 2.21 (m, 3H), 2.04 – 1.86 (m, 2H), 1.83 – 1.73 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 84.8, 67.4, 52.1, 42.9, 32.3, 26.8, 24.3.

HRMS (ESI) m/z calcd for $C_7H_{14}ClNNaO_3S^+$ ($M+Na^+$): 250.0275, found: 250.0280.

N-(Tetrahydrofuran-2-yl)-2-(trimethylsilyl)ethane-1-sulfonamide (**3z**)



Colorless oil.

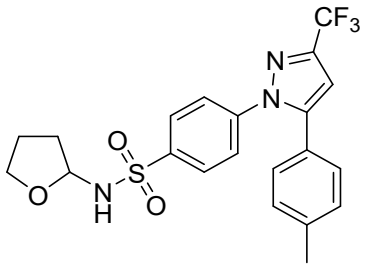
^{1}H NMR (400 MHz, $CDCl_3$) δ 5.46 (d, *J* = 9.8 Hz, 1H), 5.35 – 5.24 (m, 1H), 3.94 –

3.77 (m, 2H), 3.16 – 3.00 (m, 2H), 2.24 (ddd, *J* = 15.2, 13.1, 6.6 Hz, 1H), 2.07 – 1.83 (m, 2H), 1.83 – 1.72 (m, 1H), 1.12 – 0.91 (m, 2H), 0.06 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 86.8, 69.2, 52.8, 34.2, 26.3, 12.5, 0.0.

HRMS (ESI) m/z calcd for $C_9H_{21}NNaO_3SSi^+$ ($M+Na^+$): 274.0904, found: 274.0910.

N-(Tetrahydrofuran-2-yl)-4-(5-(p-tolyl)-3-(trifluoromethyl)-1H-pyrazol-1-yl)benzenesulfonamide (**3aa**)



Colorless oil.

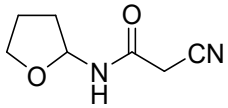
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 8.6 Hz, 2H), 7.44 (d, *J* = 8.6 Hz, 2H), 7.13 (dd, *J* = 22.7, 8.1 Hz, 4H), 6.74 (s, 1H), 5.85 (d, *J* = 9.0 Hz, 1H), 5.42 – 5.32 (m, 1H), 3.73 – 3.57 (m, 2H), 2.36 (s, 3H), 2.24 – 2.07 (m, 1H), 1.96 – 1.70 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 144.2, 142.9 (q, *J* = 38.6 Hz), 141.3, 140.0, 138.7, 128.7, 127.7, 127.1, 124.7, 124.3, 120.1 (q, *J* = 269.1 Hz), 105.2, 84.0, 66.2, 31.4, 23.0, 20.3.

^{19}F NMR (376 MHz, $CDCl_3$) δ -62.4.

HRMS (ESI) m/z calcd for $C_{21}H_{20}F_3N_3NaO_3S^+$ ($M+Na^+$): 474.1070, found: 474.1072.

2-Cyano-N-(tetrahydrofuran-2-yl)acetamide (**5a**)



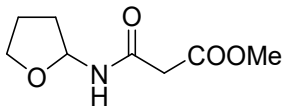
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 (d, *J* = 7.5 Hz, 1H), 5.65 (td, *J* = 7.2, 4.0 Hz, 1H), 3.93 (dd, *J* = 14.4, 7.3 Hz, 1H), 3.83 (dd, *J* = 14.5, 7.2 Hz, 1H), 3.52 (s, 2H), 2.19 (dt, *J* = 15.0, 6.9 Hz, 1H), 2.08 – 1.80 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 162.4, 114.9, 81.3, 67.8, 31.4, 26.2, 24.6.

HRMS (ESI) m/z calcd for $C_7H_{10}N_2NaO_2^+$ ($M+Na^+$): 177.0634, found: 177.0638.

Methyl 3-oxo-3-((tetrahydrofuran-2-yl)amino)propanoate (**5b**)



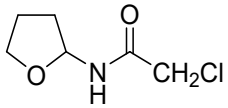
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 (d, J = 4.1 Hz, 1H), 5.74 (ddd, J = 7.8, 6.6, 4.3 Hz, 1H), 3.95 (dd, J = 14.4, 7.3 Hz, 1H), 3.82 (dd, J = 14.9, 7.1 Hz, 1H), 3.75 (s, 3H), 3.33 (s, 2H), 2.24 – 2.15 (m, 1H), 2.06 – 1.90 (m, 2H), 1.84 – 1.75 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 169.7, 165.0, 80.8, 67.5, 52.4, 41.1, 31.9, 24.5.

HRMS (ESI) m/z calcd for $C_8H_{13}NNaO_4^+$ ($M+Na^+$): 210.0737, found: 210.0740.

2-Chloro-N-(tetrahydrofuran-2-yl)acetamide (**5c**)



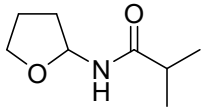
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 6.91 (s, 1H), 5.77 – 5.67 (m, 1H), 5.77 – 5.66 (m, 1H), 4.04 (d, *J* = 1.3 Hz, 2H), 3.98 (dd, *J* = 14.9, 6.7 Hz, 1H), 3.84 (dd, *J* = 15.2, 7.0 Hz, 1H), 2.30 – 2.18 (m, 1H), 2.06 – 1.93 (m, 2H), 1.87 – 1.78 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 165.9, 81.4, 67.9, 42.5, 32.1, 24.6.

HRMS (ESI) m/z calcd for $C_6H_{10}ClNNaO_2^+$ ($M+Na^+$): 186.0292, found: 186.0295.

N-(Tetrahydrofuran-2-yl)isobutyramide (**5d**)



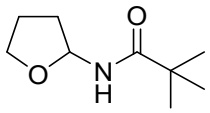
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 6.05 (s, 1H), 5.72 (ddd, *J* = 8.1, 6.3, 5.0 Hz, 1H), 3.94 (dd, *J* = 14.9, 6.8 Hz, 1H), 3.80 (dd, *J* = 15.1, 7.0 Hz, 1H), 2.40 – 2.28 (m, 1H), 2.19 (ddd, *J* = 14.8, 13.1, 6.6 Hz, 1H), 1.95 (tdd, *J* = 10.5, 6.7, 3.7 Hz, 2H), 1.79 – 1.68 (m, 1H), 1.15 (d, *J* = 6.9 Hz, 6H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 176.9, 81.0, 67.4, 35.6, 32.0, 24.7, 19.5, 19.3.

HRMS (ESI) m/z calcd for $C_8H_{15}NNaO_2^+$ ($M+Na^+$): 180.0995, found: 180.0998.

N-(tetrahydrofuran-2-yl)pivalamide (**5e**)



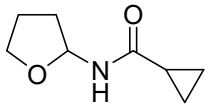
White Solid. mp 98–101 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 5.92 (s, 1H), 5.71–5.65 (m, 1H), 4.00 – 3.89 (m, 1H), 3.80 (q, *J* = 7.1 Hz, 1H), 2.20 (dd, *J* = 12.9, 6.7 Hz, 1H), 2.01 – 1.89 (m, 2H), 1.71 (dd, *J* = 12.1, 5.9 Hz, 1H), 1.19 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 178.2, 81.6, 67.5, 38.7, 32.3, 27.4, 24.6.

HRMS (ESI) m/z calcd for $C_9H_{17}ClNNaO_2^+$ ($M+Na^+$): 194.1151, found: 194.1153.

N-(tetrahydrofuran-2-yl)cyclopropanecarboxamide (**5f**)



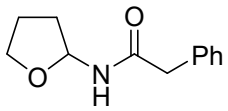
Colorless Oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 6.23 (s, 1H), 5.79 – 5.70 (m, 1H), 3.95 (dd, *J* = 14.8, 7.0 Hz, 1H), 3.81 (dd, *J* = 14.8, 7.2 Hz, 1H), 2.19 (ddd, *J* = 14.8, 13.1, 6.6 Hz, 1H), 2.01 – 1.91 (m, 2H), 1.74 (ddd, *J* = 12.8, 8.0, 5.9 Hz, 1H), 1.38 – 1.29 (m, 1H), 0.99 (dt, *J* = 6.6, 2.3 Hz, 2H), 0.75 (dd, *J* = 7.9, 3.0 Hz, 2H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 173.6, 80.9, 67.4, 32.0, 24.7, 14.8, 7.6, 7.5.

HRMS (ESI) m/z calcd for $C_8H_{13}NNaO_2^+$ ($M+Na^+$): 178.0838, found: 178.0843.

2-Phenyl-N-(tetrahydrofuran-2-yl)acetamide (**5g**)[4]

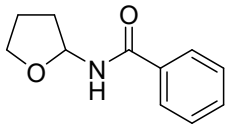


White Solid. mp 116–118 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 – 7.20 (m, 5H), 5.94 (s, 1H), 5.68 (ddd, *J* = 8.0, 6.4, 4.8 Hz, 1H), 3.88 – 3.70 (m, 2H), 3.55 (s, 2H), 2.17 – 2.06 (m, 1H), 1.92 – 1.78 (m, 2H), 1.60 (ddd, *J* = 12.6, 7.2, 4.8 Hz, 1H).

The spectral data obtained were identical with those reported in literature.

N-(tetrahydrofuran-2-yl)benzamide (**5h**)[4]

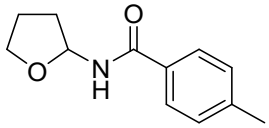


White Solid. mp 124–126 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (d, *J* = 7.5 Hz, 2H), 7.48 (t, *J* = 7.3 Hz, 1H), 7.40 (t, *J* = 7.5 Hz, 2H), 6.70 (d, *J* = 4.5 Hz, 1H), 5.90 (dd, *J* = 11.6, 6.8 Hz, 1H), 3.98 (dd, *J* = 14.3, 7.2 Hz, 1H), 3.84 (dd, *J* = 14.8, 7.0 Hz, 1H), 2.26 (td, *J* = 14.0, 6.7 Hz, 1H), 2.05 – 1.85 (m, 3H).

The spectral data obtained were identical with those reported in literature.

4-Methyl-N-(tetrahydrofuran-2-yl)benzamide (**5i**)[4]

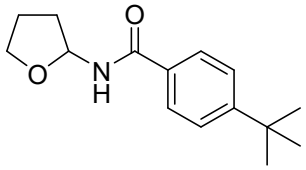


White Solid. mp 137–139 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, *J* = 8.0 Hz, 2H), 7.21 (d, *J* = 7.9 Hz, 2H), 6.54 (d, *J* = 5.1 Hz, 1H), 5.90 (dd, *J* = 11.7, 6.7 Hz, 1H), 3.99 (dd, *J* = 14.5, 7.0 Hz, 1H), 3.85 (dd, *J* = 14.9, 7.1 Hz, 1H), 2.38 (s, 3H), 2.27 (dd, *J* = 13.3, 6.8 Hz, 1H), 1.98 (dt, *J* = 11.0, 6.9 Hz, 2H), 1.88 (dt, *J* = 10.9, 5.4 Hz, 1H).

The spectral data obtained were identical with those reported in literature.

4-(tert-Butyl)-N-(tetrahydrofuran-2-yl)benzamide (**5j**)



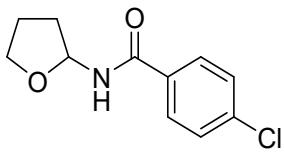
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.4 Hz, 2H), 7.43 (d, *J* = 8.4 Hz, 2H), 6.49 (d, *J* = 6.5 Hz, 1H), 5.91 (dd, *J* = 11.8, 6.7 Hz, 1H), 4.00 (dd, *J* = 14.9, 6.7 Hz, 1H), 3.86 (dd, *J* = 15.2, 7.0 Hz, 1H), 2.34 – 2.22 (m, 1H), 2.06 – 1.94 (m, 2H), 1.90 – 1.83 (m, 1H), 1.32 (s, 9H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 167.1, 155.2, 131.3, 126.9, 125.5, 81.8, 67.7, 35.0, 32.4, 31.2, 24.7.

HRMS (ESI) m/z calcd for $C_{15}H_{21}NNaO_2^+$ ($M+Na^+$): 270.1465, found: 270.1468.

4-Chloro-N-(tetrahydrofuran-2-yl)benzamide (**5k**)[4]

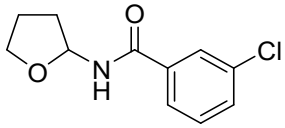


White Solid. mp 151–153 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.70 (d, *J* = 8.5 Hz, 2H), 7.33 (d, *J* = 8.5 Hz, 2H), 7.03 (d, *J* = 7.3 Hz, 1H), 5.86 (dd, *J* = 11.5, 7.0 Hz, 1H), 3.95 (dd, *J* = 14.5, 7.0 Hz, 1H), 3.83 (dd, *J* = 14.5, 7.0 Hz, 1H), 2.29 – 2.19 (m, 1H), 1.95 (ddd, *J* = 14.6, 10.6, 5.6 Hz, 3H).

The spectral data obtained were identical with those reported in literature.

3-Chloro-N-(tetrahydrofuran-2-yl)benzamide (**5l**)



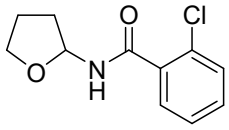
Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.74 (s, 1H), 7.64 (d, *J* = 7.7 Hz, 1H), 7.50 – 7.41 (m, 1H), 7.35 (t, *J* = 7.9 Hz, 1H), 6.60 (d, *J* = 5.7 Hz, 1H), 5.89 (dd, *J* = 11.5, 6.9 Hz, 1H), 4.00 (dd, *J* = 14.9, 6.7 Hz, 1H), 3.86 (dd, *J* = 15.0, 7.0 Hz, 1H), 2.35 – 2.22 (m, 1H), 2.06 – 1.84 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 165.9, 136.0, 134.7, 131.7, 129.9, 127.4, 125.2, 81.9, 67.8, 32.3, 24.7.

HRMS (ESI) m/z calcd for $C_{11}H_{12}ClNNaO_2^+$ ($M+Na^+$): 248.0449, found: 248.0455.

2-Chloro-N-(tetrahydrofuran-2-yl)benzamide (**5m**)



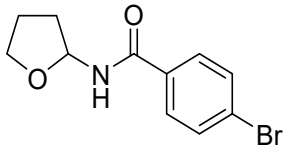
Colorless Oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62 (dd, *J* = 7.5, 1.4 Hz, 1H), 7.39 – 7.26 (m, 3H), 6.77 (d, *J* = 5.7 Hz, 1H), 5.87 (ddd, *J* = 7.8, 6.5, 3.8 Hz, 1H), 4.01 – 3.91 (m, 1H), 3.89 – 3.79 (m, 1H), 2.30 – 2.19 (m, 1H), 2.03 – 1.85 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 166.1, 134.7, 131.4, 130.6, 130.2, 130.1, 127.1, 81.6, 67.7, 32.1, 24.5.

HRMS (ESI) m/z calcd for $C_{11}H_{12}ClNNaO_2^+$ ($M+Na^+$): 248.0449, found: 248.0453.

4-Bromo-N-(tetrahydrofuran-2-yl)benzamide (**5n**)[4]

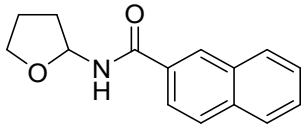


White Solid. mp 151–153 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.5 Hz, 2H), 7.55 (d, *J* = 8.5 Hz, 2H), 6.55 (d, *J* = 6.0 Hz, 1H), 5.88 (dd, *J* = 11.7, 6.9 Hz, 1H), 3.99 (dd, *J* = 14.9, 6.7 Hz, 1H), 3.86 (dd, *J* = 15.1, 7.0 Hz, 1H), 2.29 (td, *J* = 13.6, 6.9 Hz, 1H), 2.06 – 1.95 (m, 2H), 1.88 (dt, *J* = 12.6, 6.1 Hz, 1H).

The spectral data obtained were identical with those reported in literature.

N-(Tetrahydrofuran-2-yl)-2-naphthamide (**5o**)



White Solid. mp 170–175 °C.

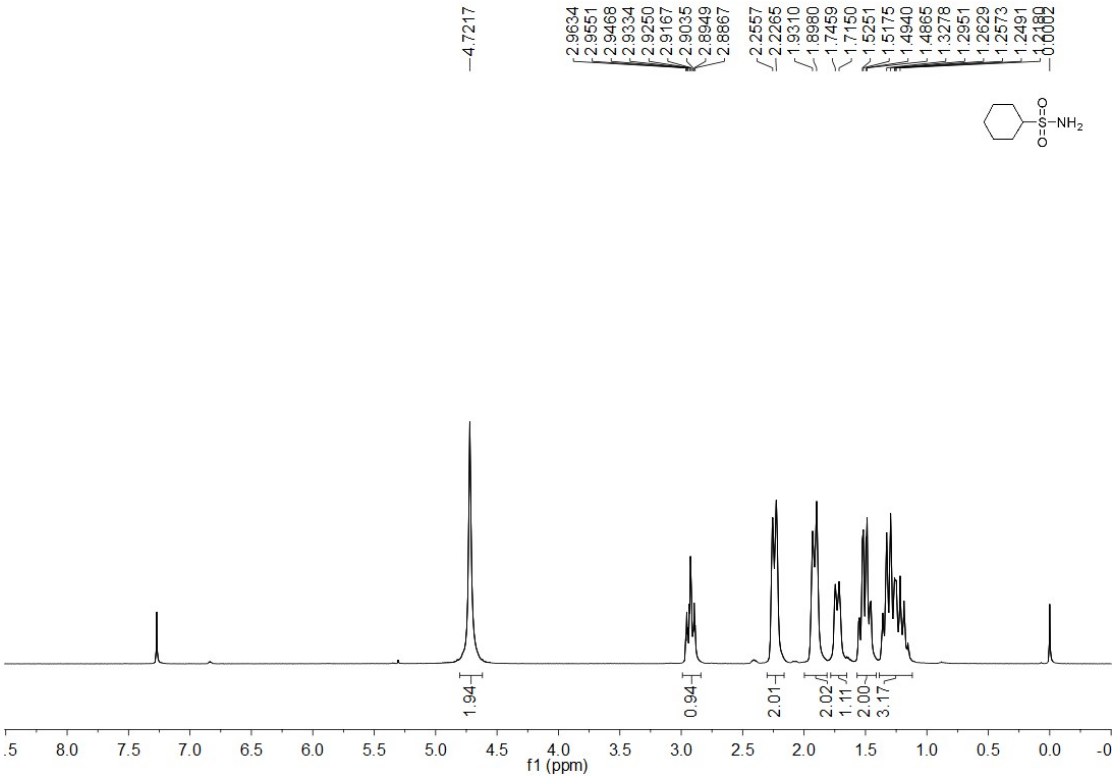
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.27 (s, 1H), 7.91 – 7.79 (m, 4H), 7.59 – 7.48 (m, 2H), 6.71 (d, *J* = 6.0 Hz, 1H), 5.97 (dd, *J* = 11.4, 6.9 Hz, 1H), 4.03 (dd, *J* = 14.4, 7.2 Hz, 1H), 3.91 – 3.83 (m, 1H), 2.36 – 2.25 (m, 1H), 2.09 – 1.88 (m, 3H).

^{13}C NMR (100 MHz, $CDCl_3$) δ 167.3, 134.9, 132.6, 131.4, 129.0, 128.5, 127.7, 127.6, 126.8, 123.7, 82.0, 67.8, 32.4, 24.8.

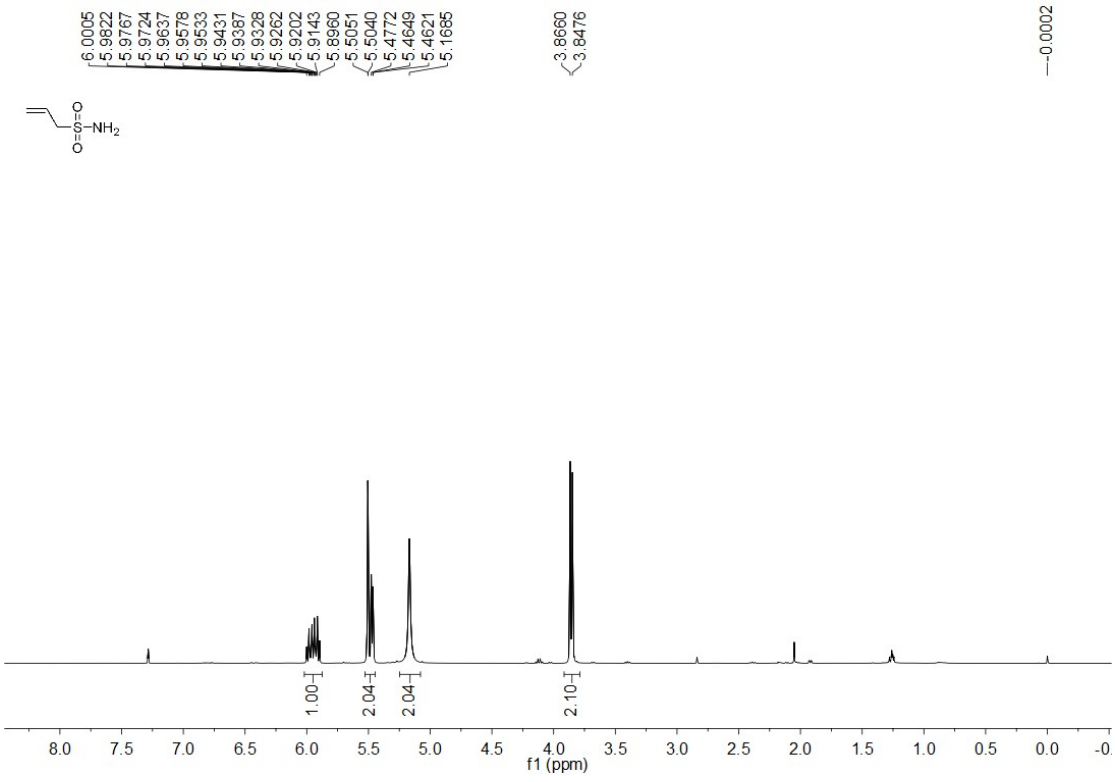
HRMS (ESI) m/z calcd for $C_{15}H_{15}NNaO_2^+$ ($M+Na^+$): 264.0995, found: 264.0998.

8) NMR spectra for the substrates and products

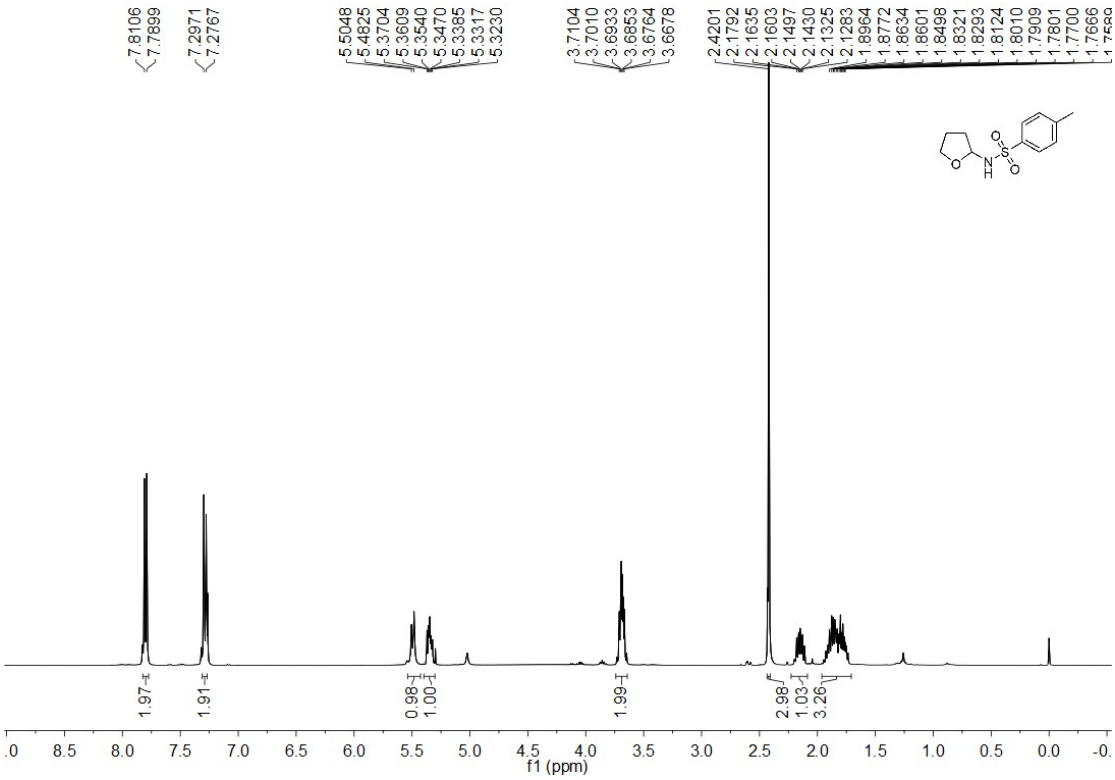
Cyclohexanesulfonamide (**2w**)



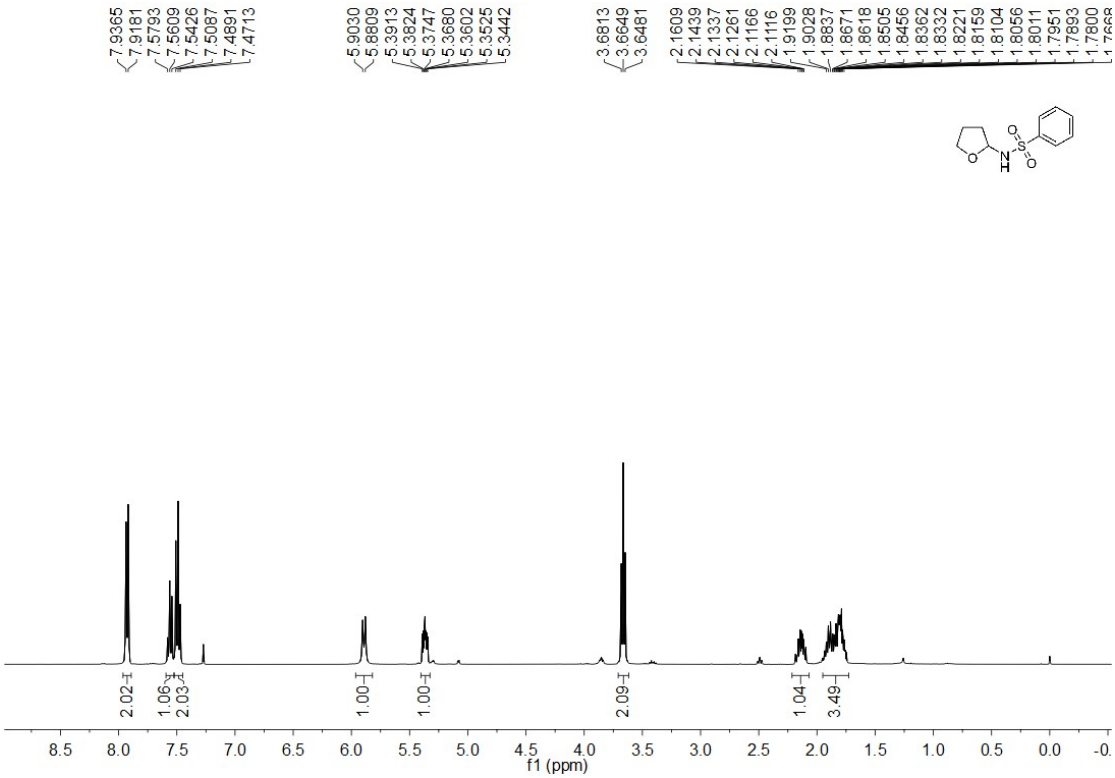
Prop-2-ene-1-sulfonamide (**2y**)



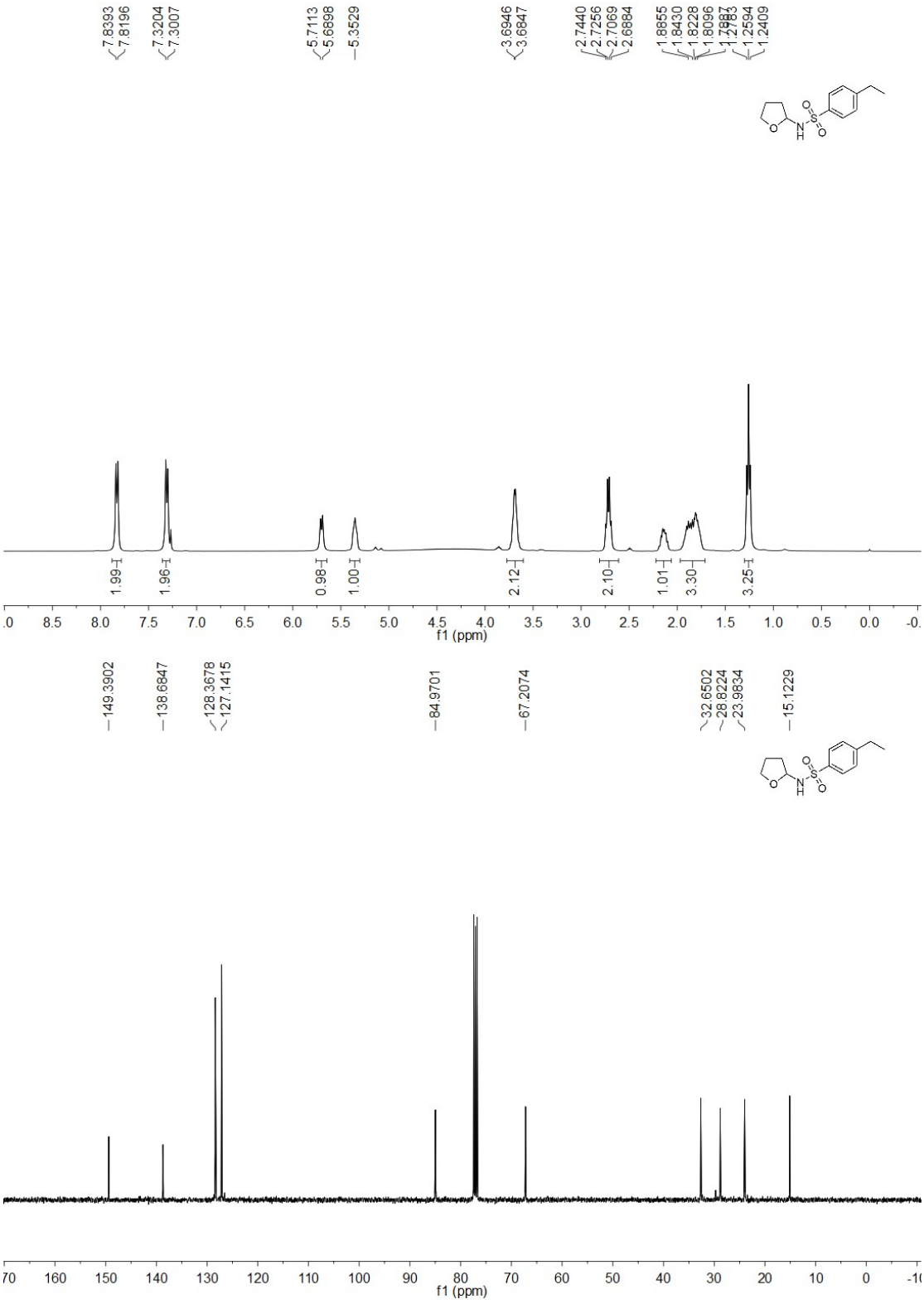
4-Methyl-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3a**)



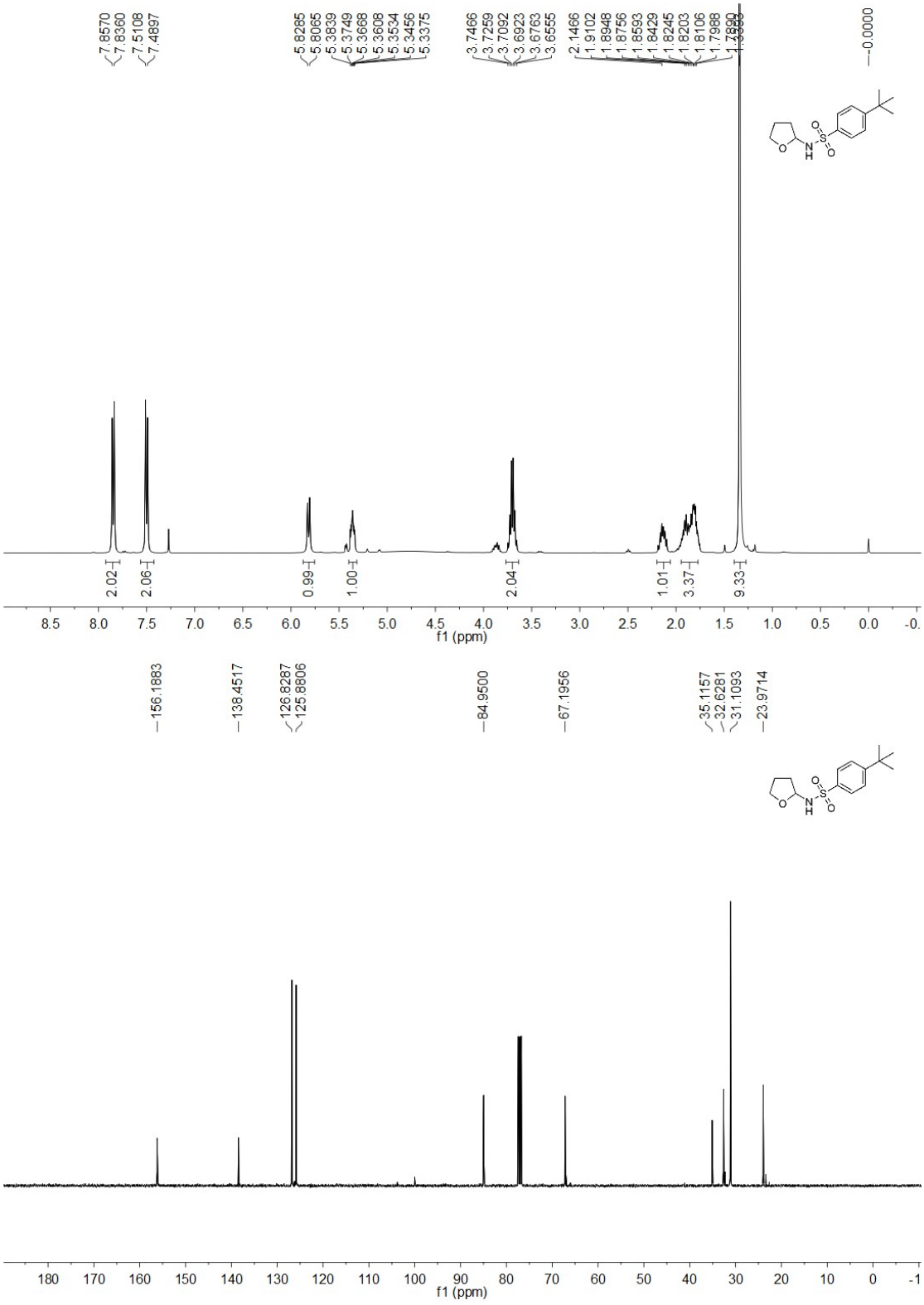
N-(Tetrahydrofuran-2-yl)benzenesulfonamide (**3b**)



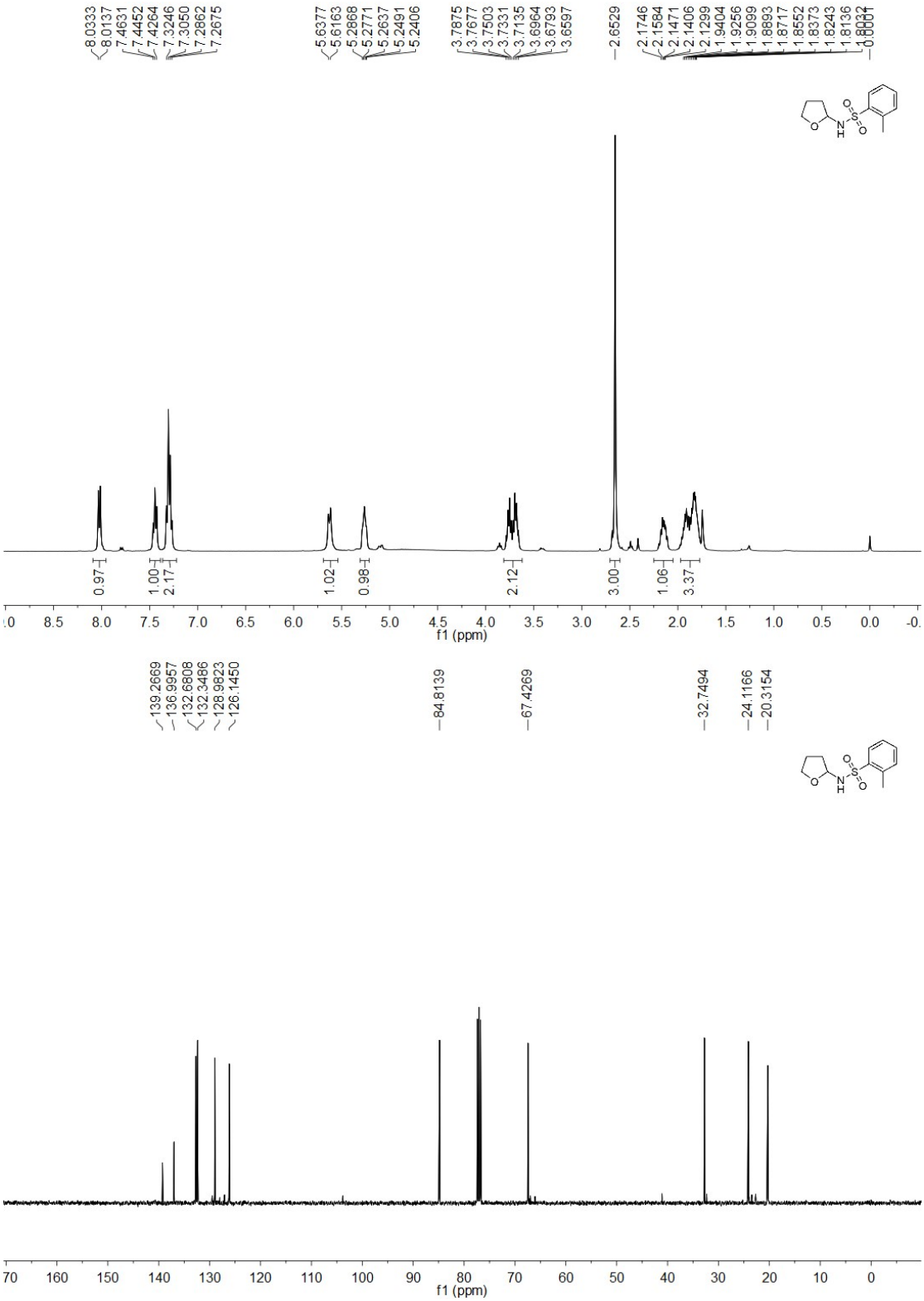
4-Ethyl-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3c**)



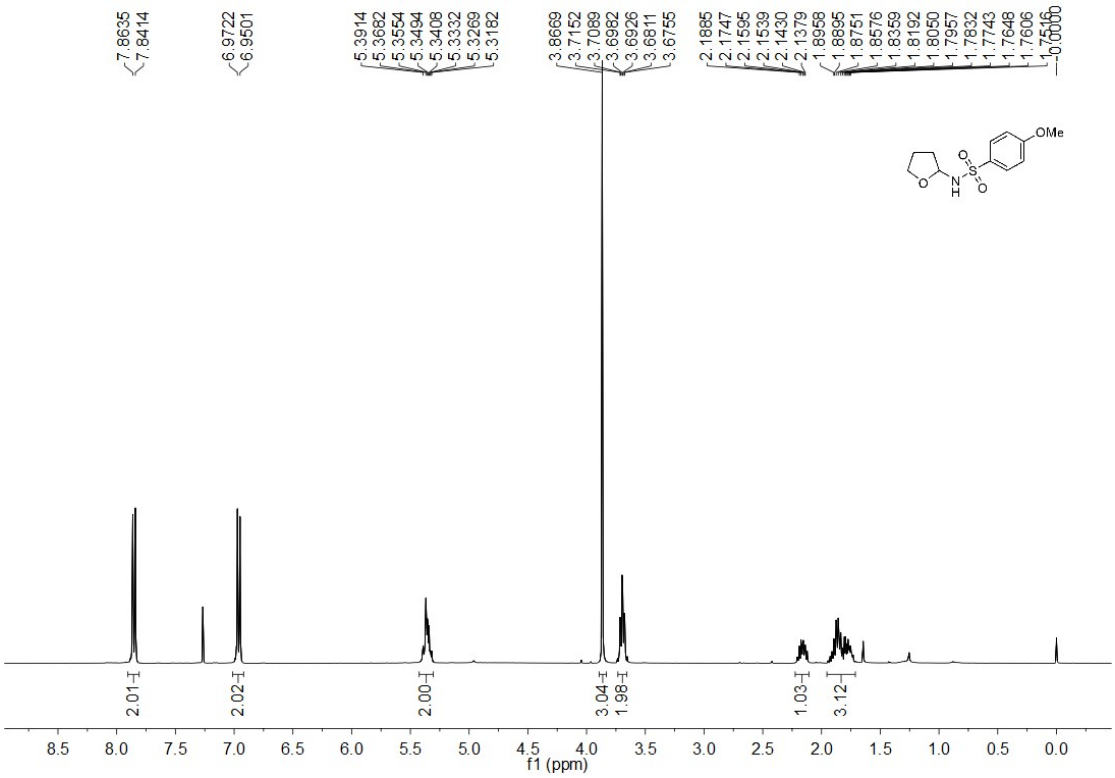
4-(tert-Butyl)-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3d**)

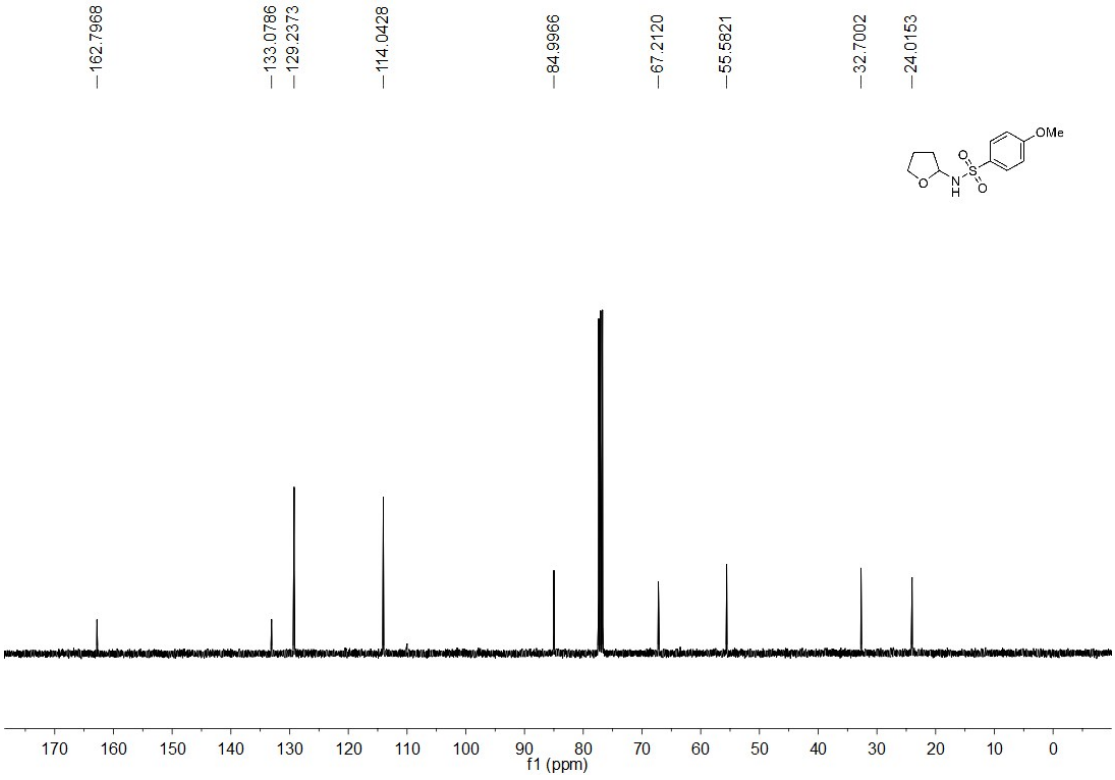


2-Methyl-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3e**)

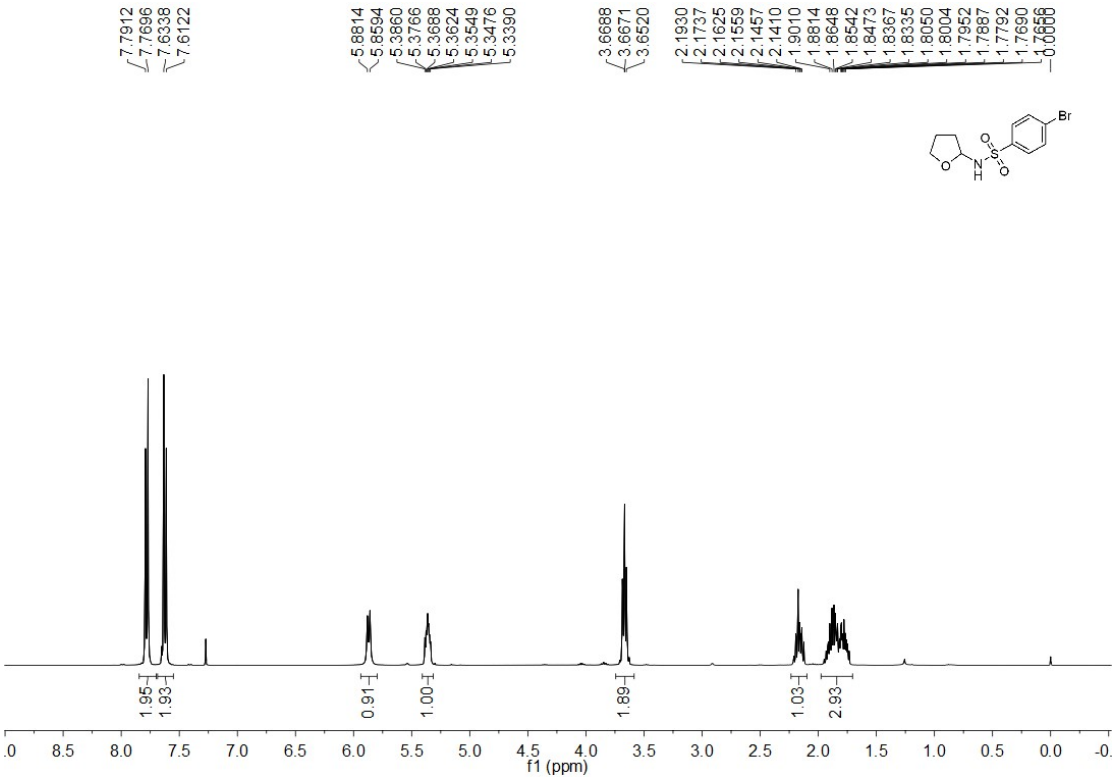


4-Methoxy-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3f**)

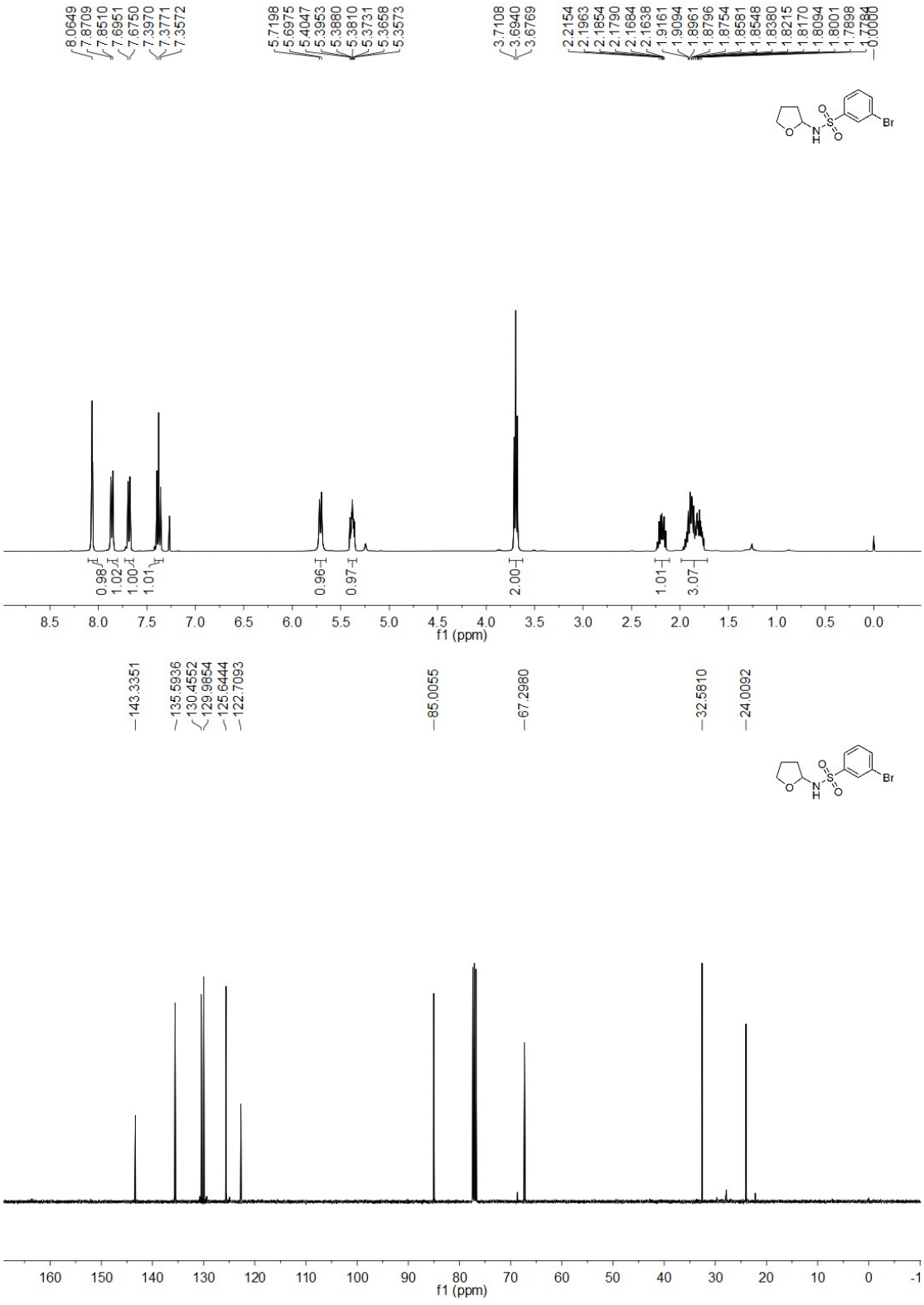




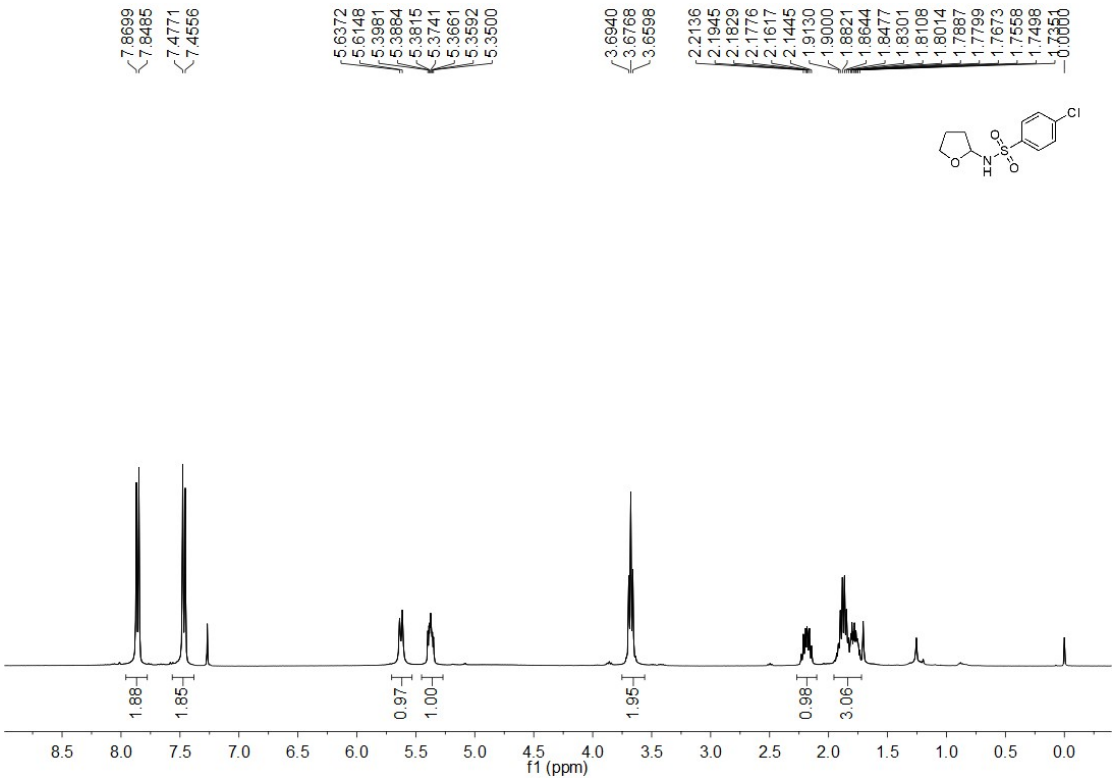
4-Bromo-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3g**)



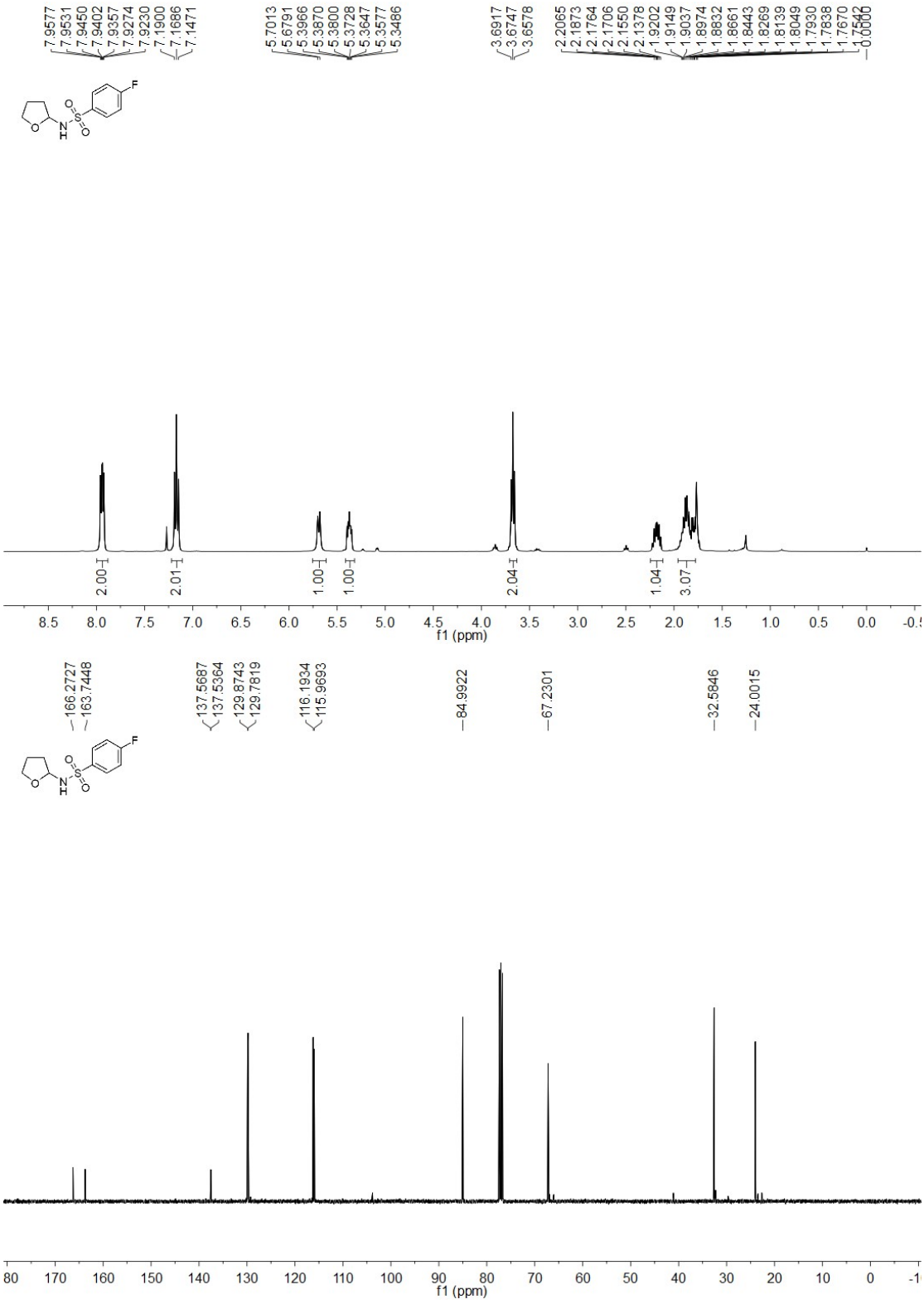
3-Bromo-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3h**)

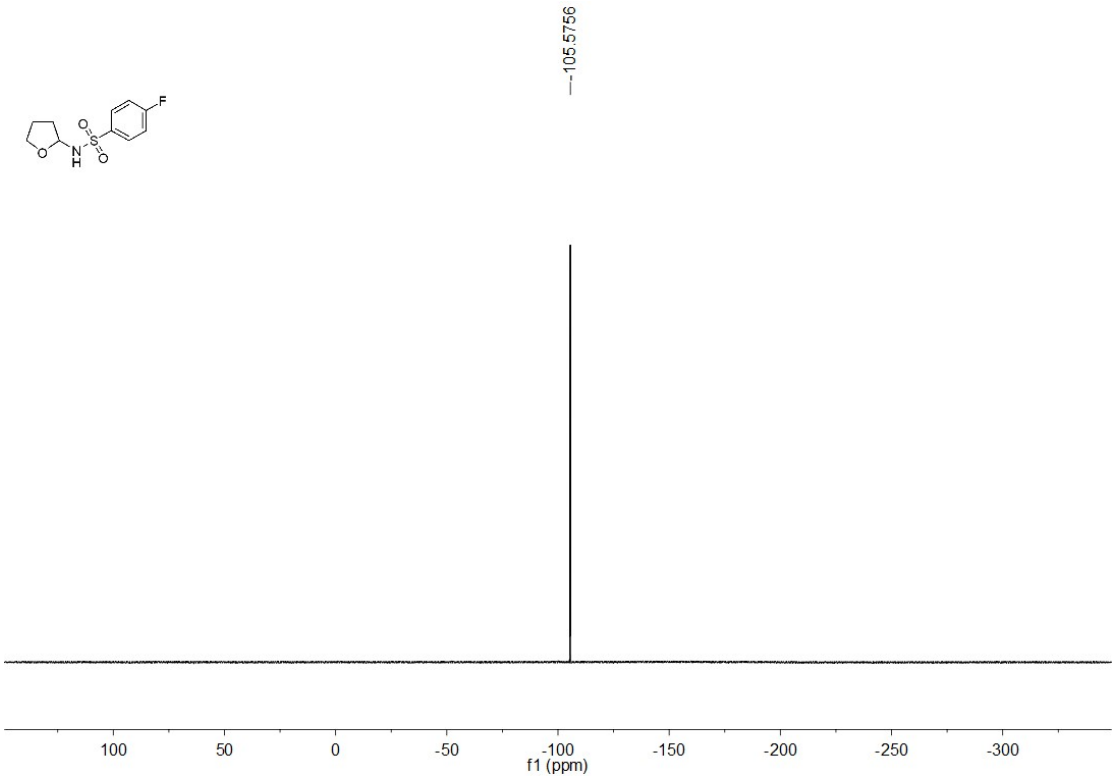


4-Chloro-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3i**)

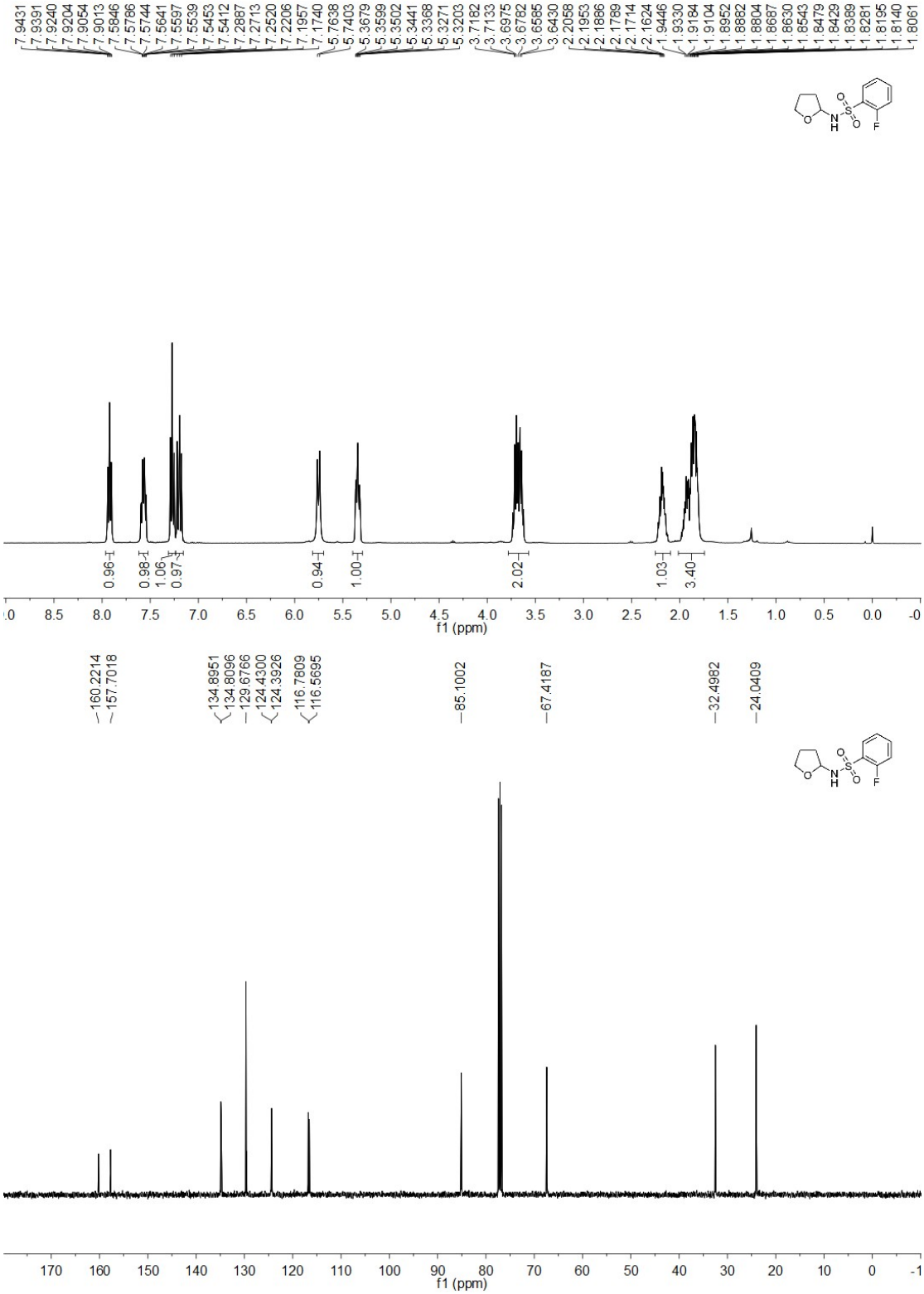


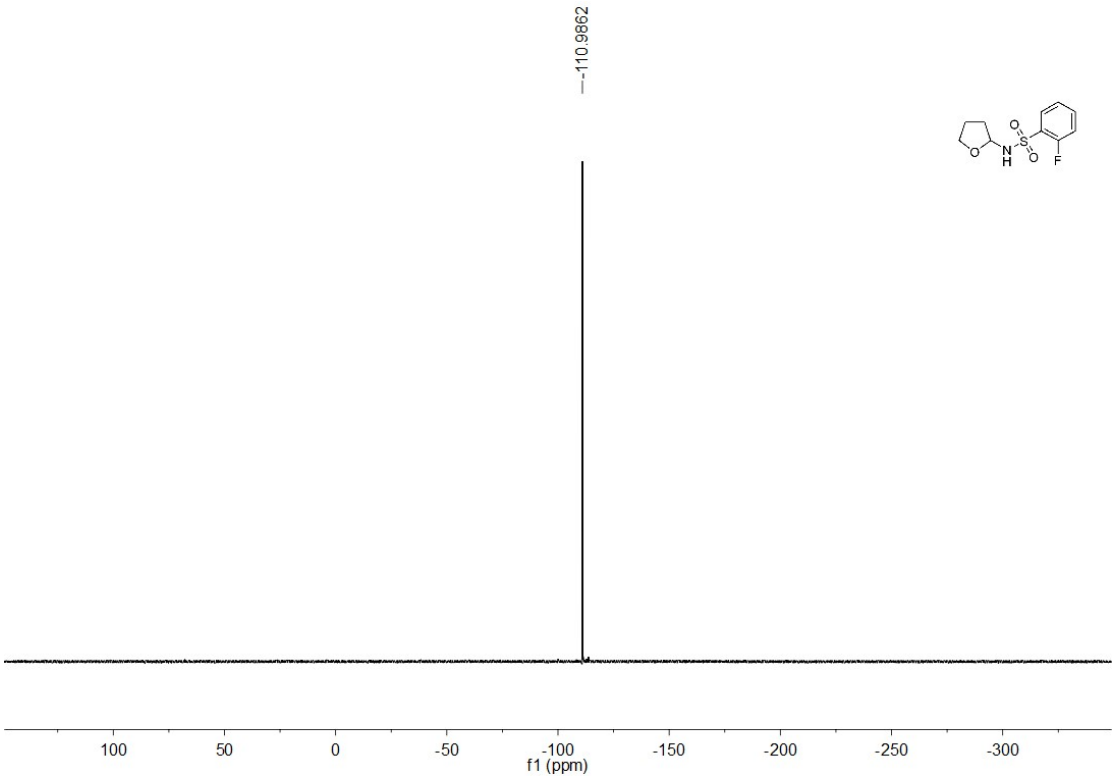
4-Fluoro-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3j**)



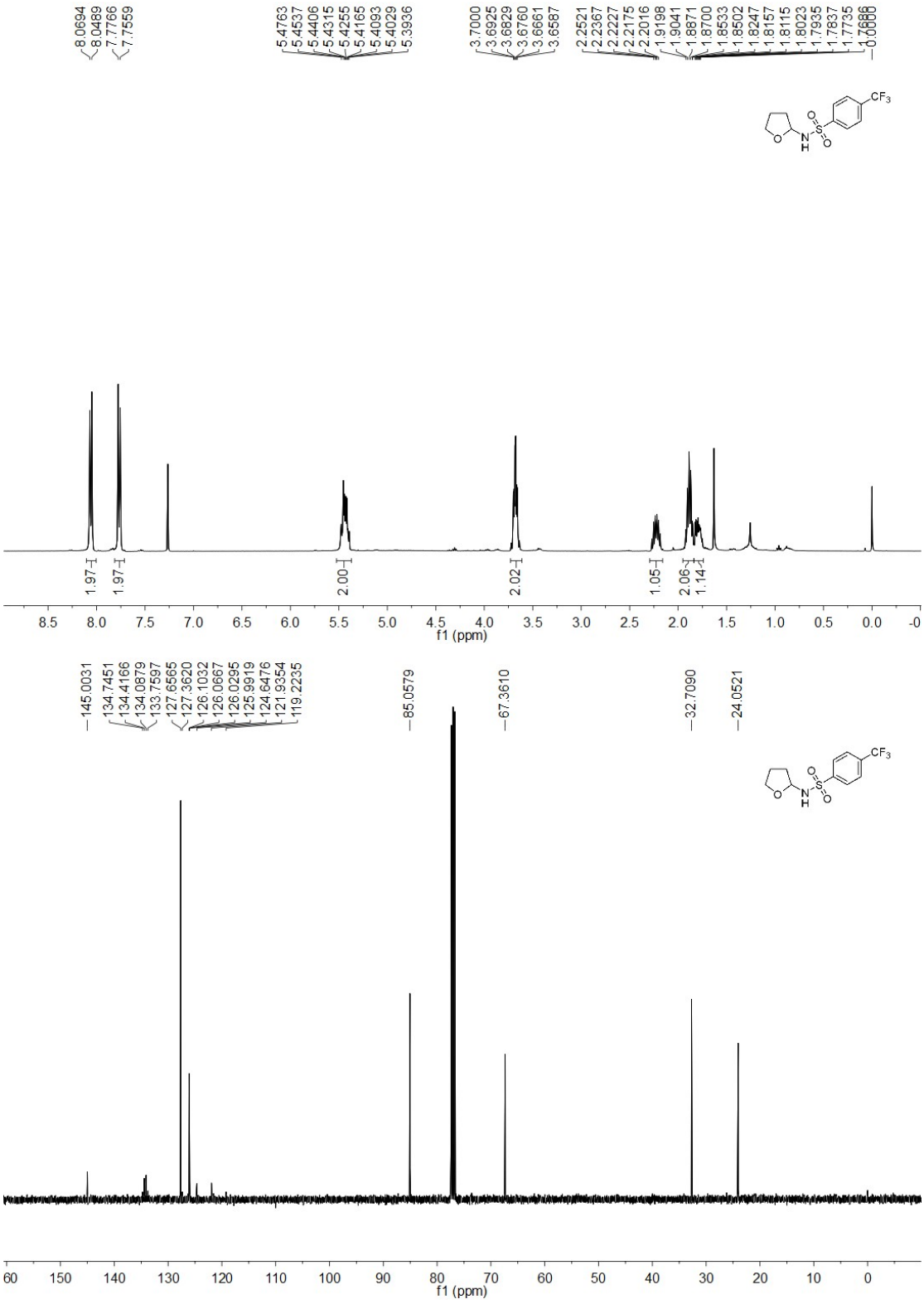

-105.5756
F
O
S
O
N
H
O
100
50
0
-50
-100
-150
-200
-250
-300
f1 (ppm)

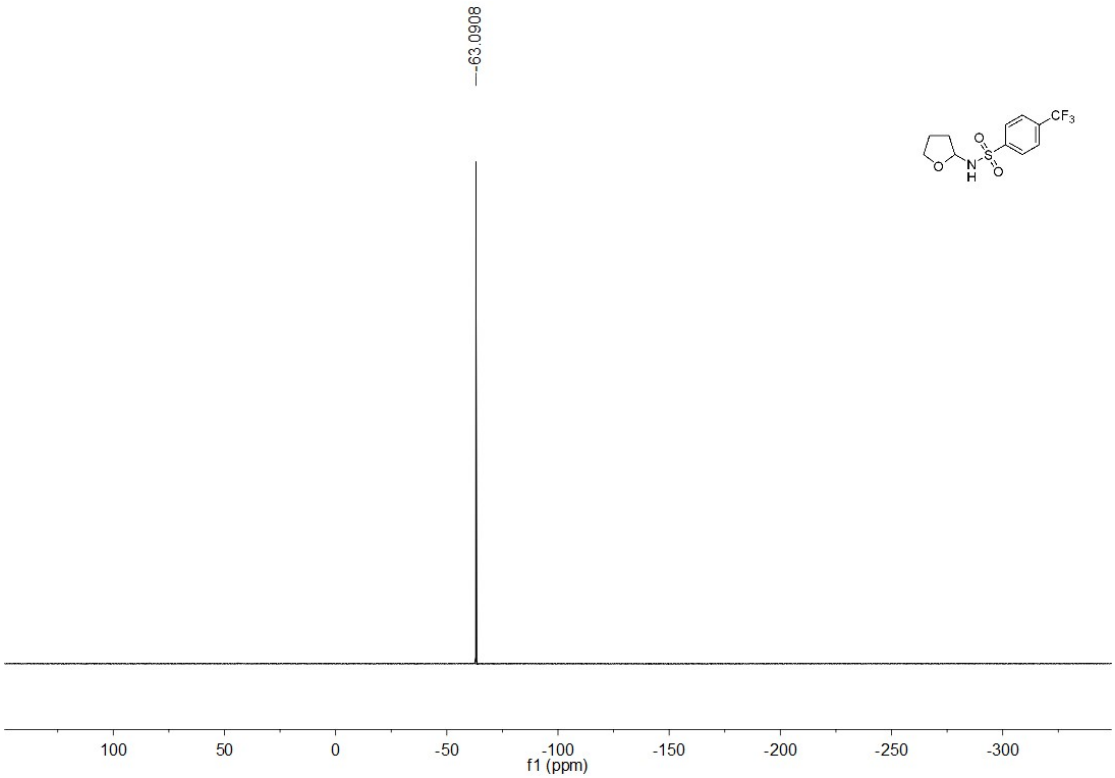
2-Fluoro-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3k**)



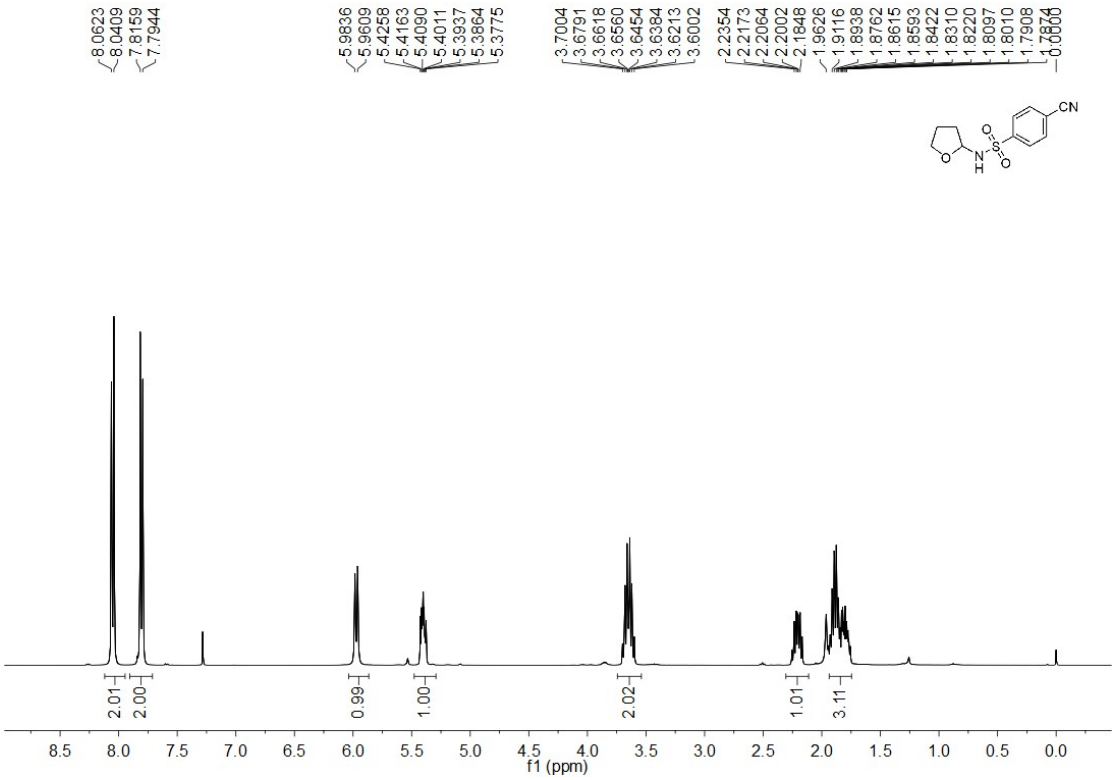

-110.9862
100
50
0
-50
-100
-150
-200
-250
-300
f1 (ppm)

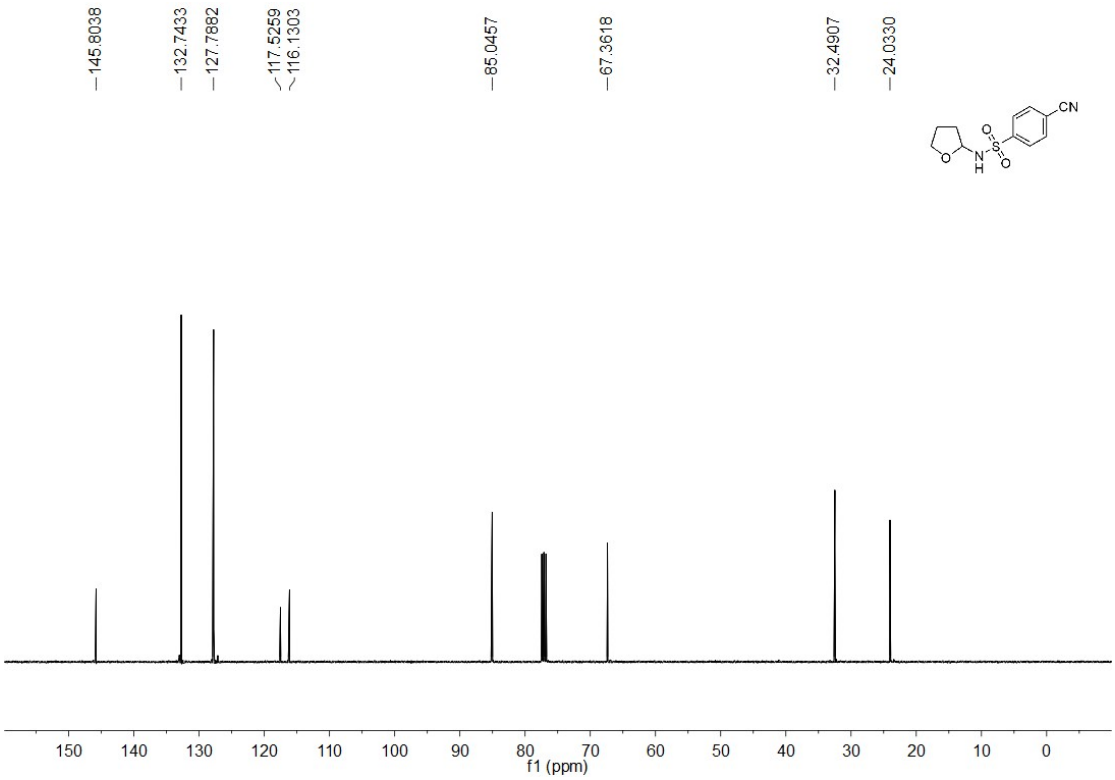
N-(Tetrahydrofuran-2-yl)-4-(trifluoromethyl)benzenesulfonamide (**3l**)



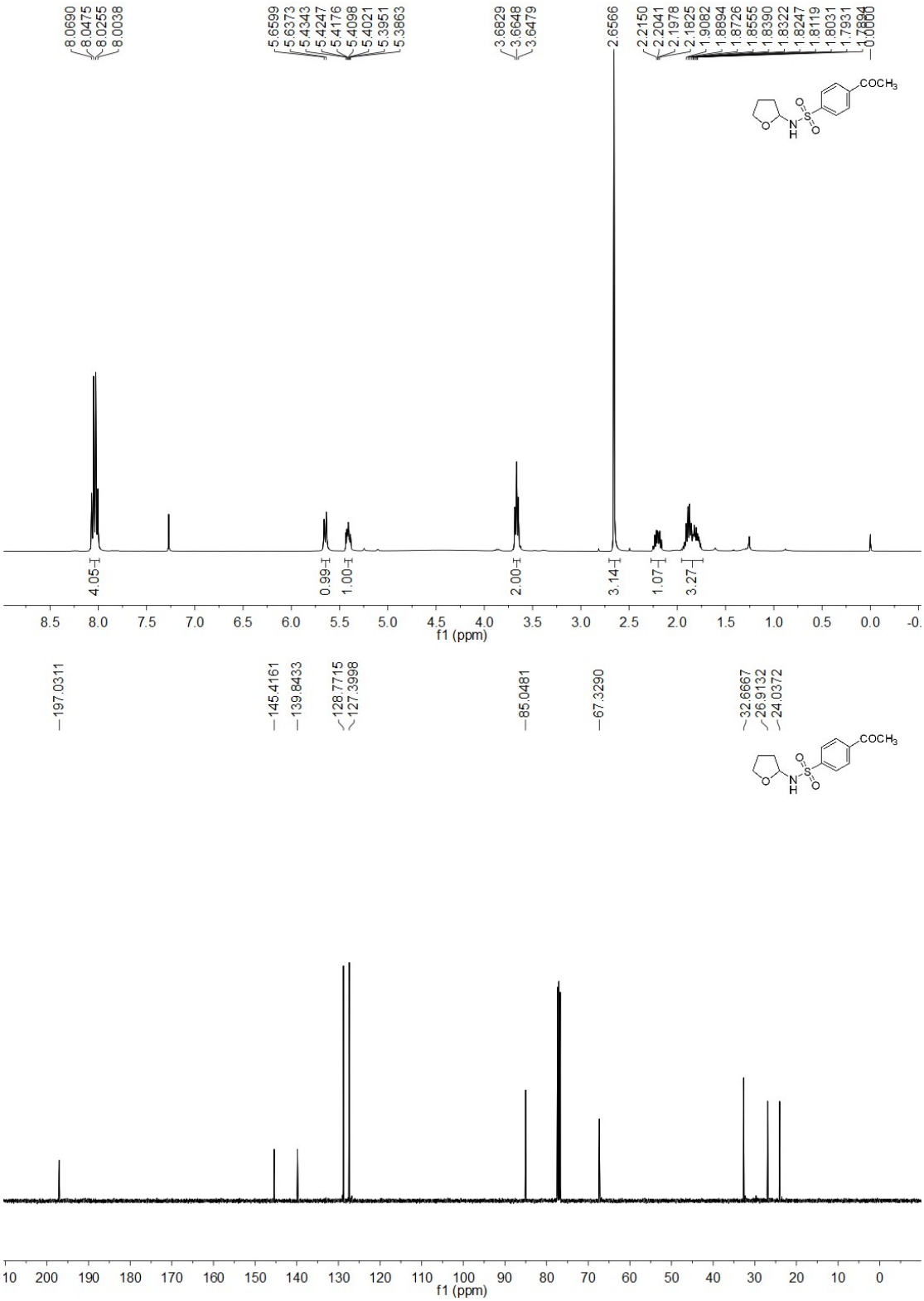

-63.0908
CF3
O
S
N
H
O
O
100
50
0
-50
-100
-150
-200
-250
-300
f1 (ppm)

4-Cyano-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3m**)

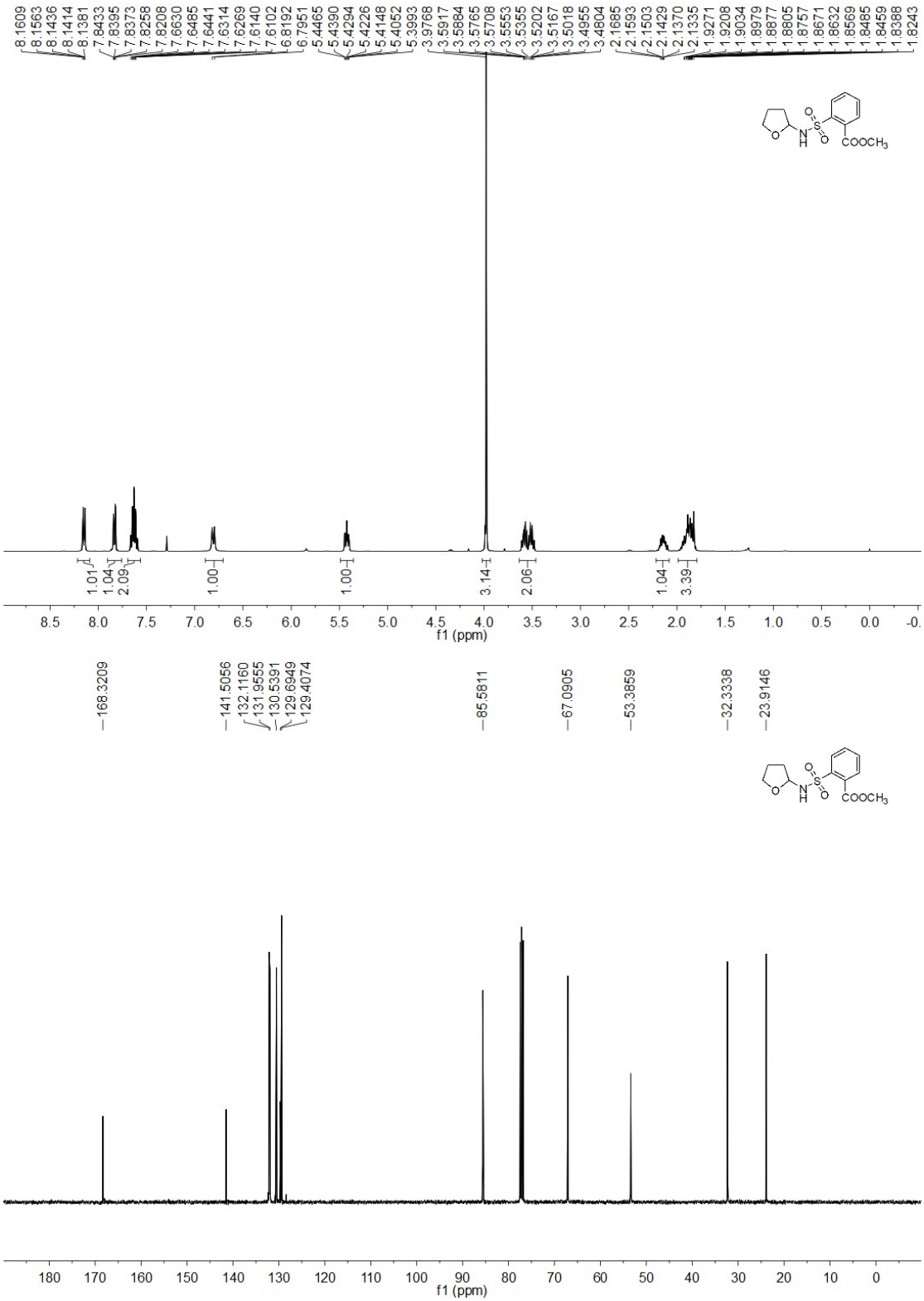




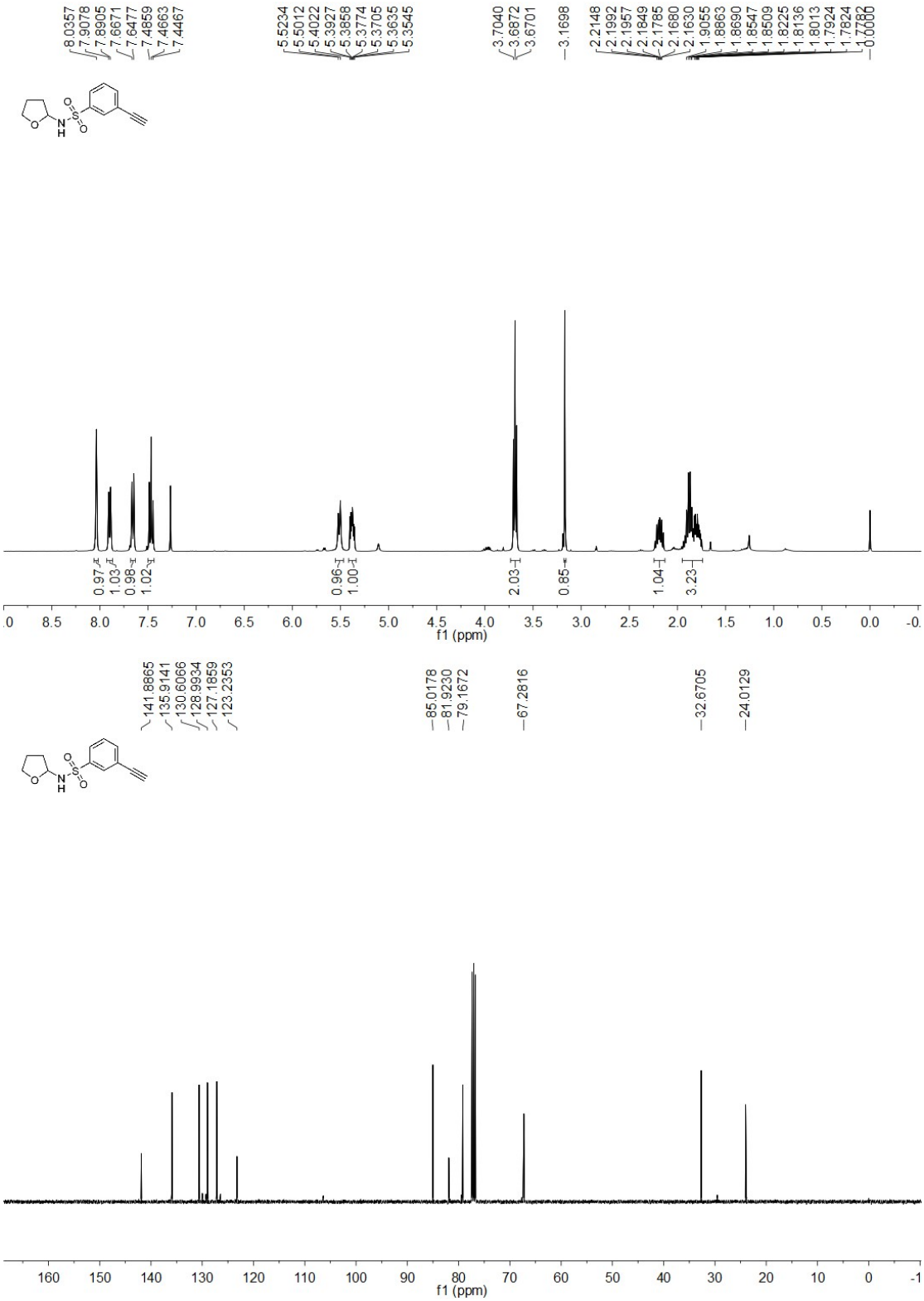
4-Acetyl-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3n**)



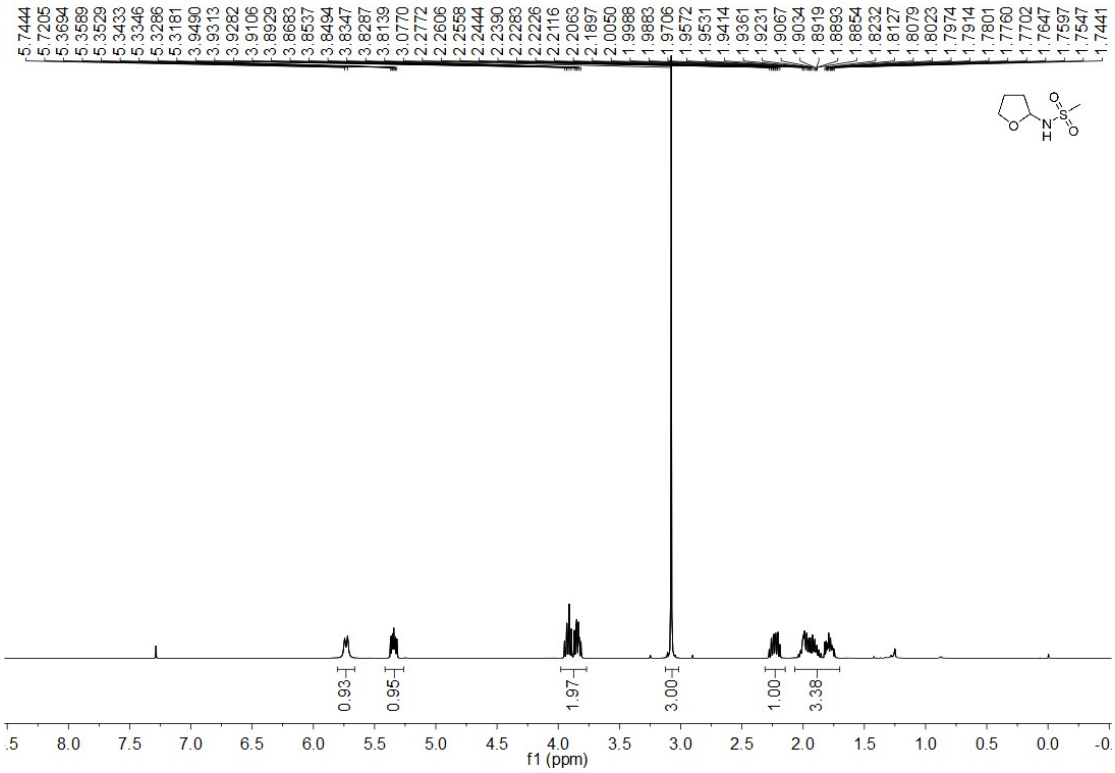
Methyl 2-(N-(tetrahydrofuran-2-yl)sulfamoyl)benzoate (**3o**)



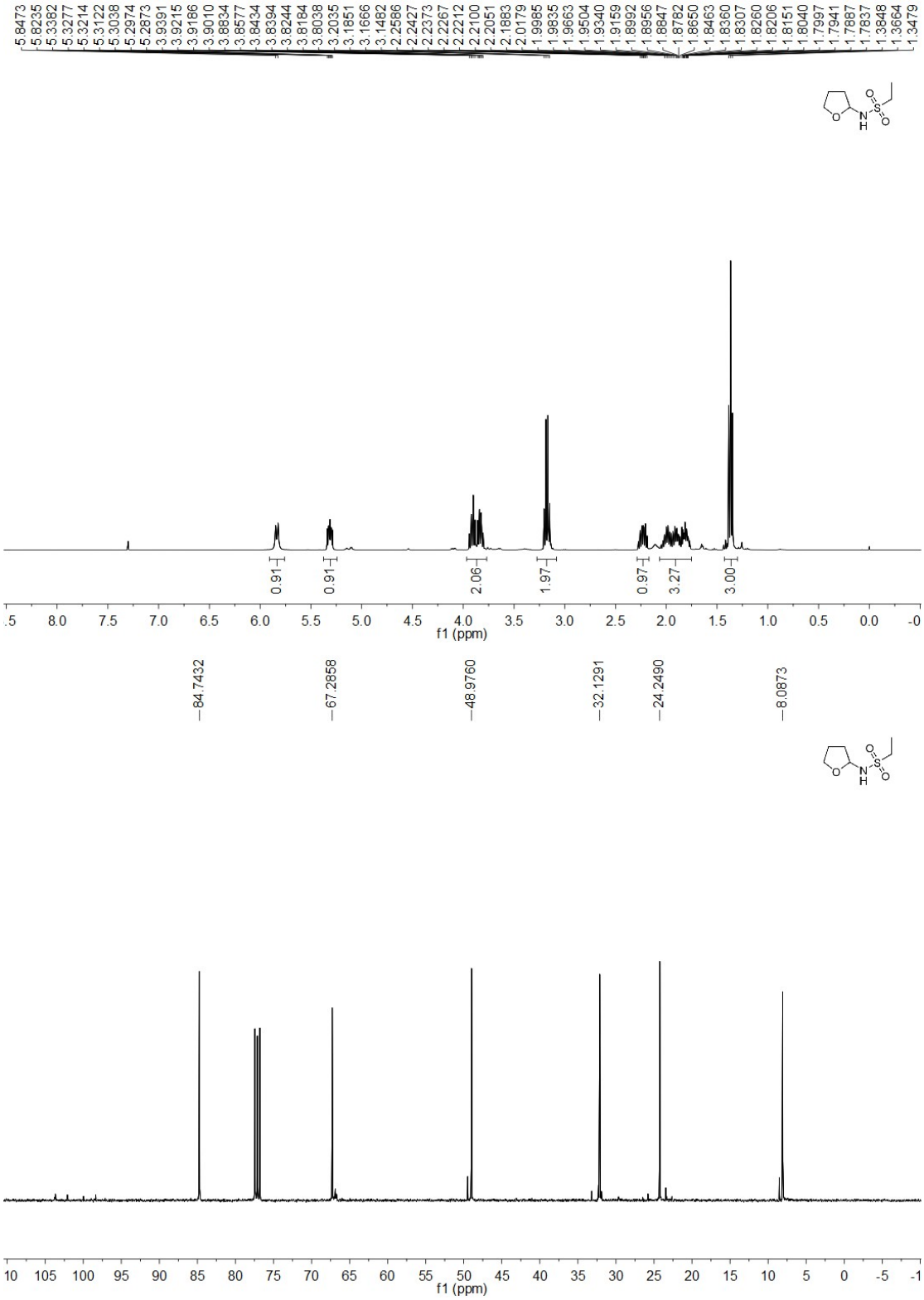
3-Ethynyl-N-(tetrahydrofuran-2-yl)benzenesulfonamide (**3p**)



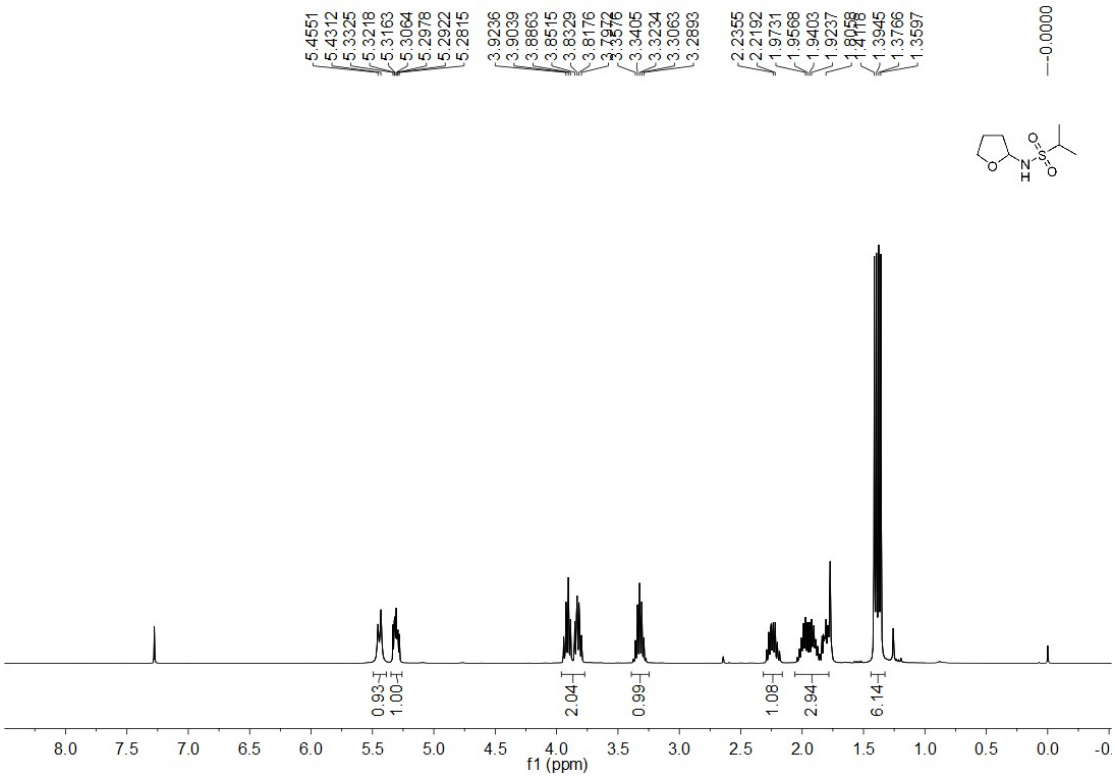
N-(Tetrahydrofuran-2-yl)methanesulfonamide (**3q**)

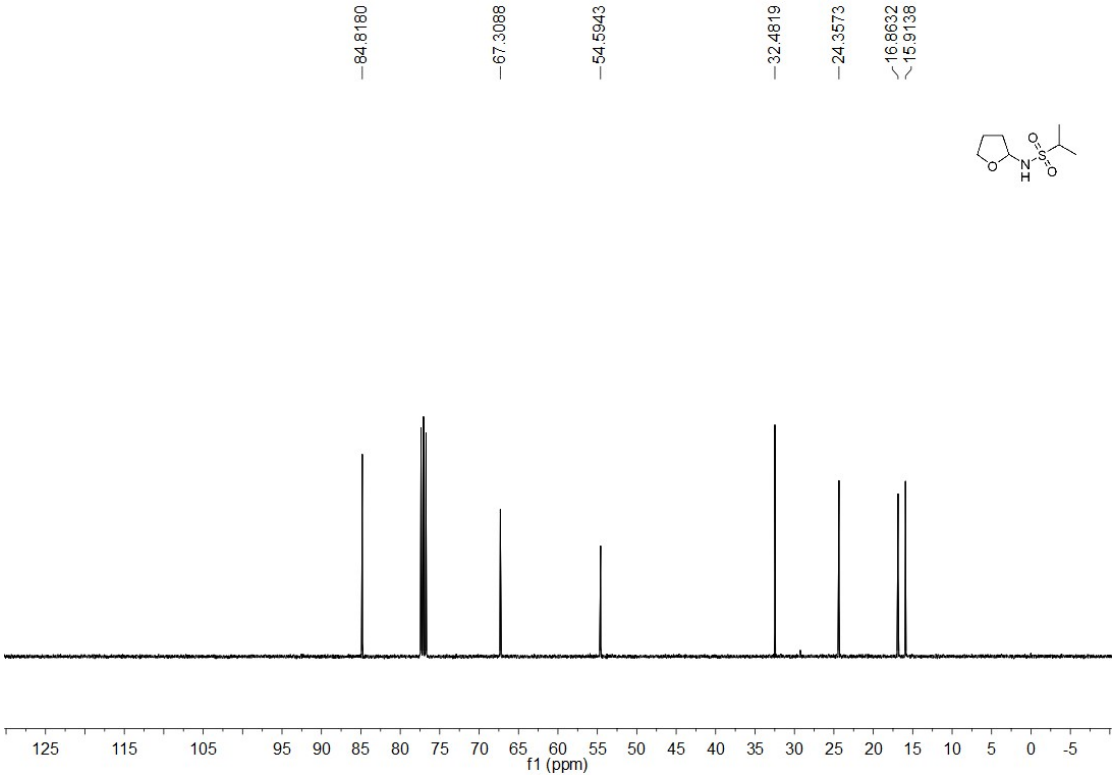


N-(Tetrahydrofuran-2-yl)ethanesulfonamide (**3r**)

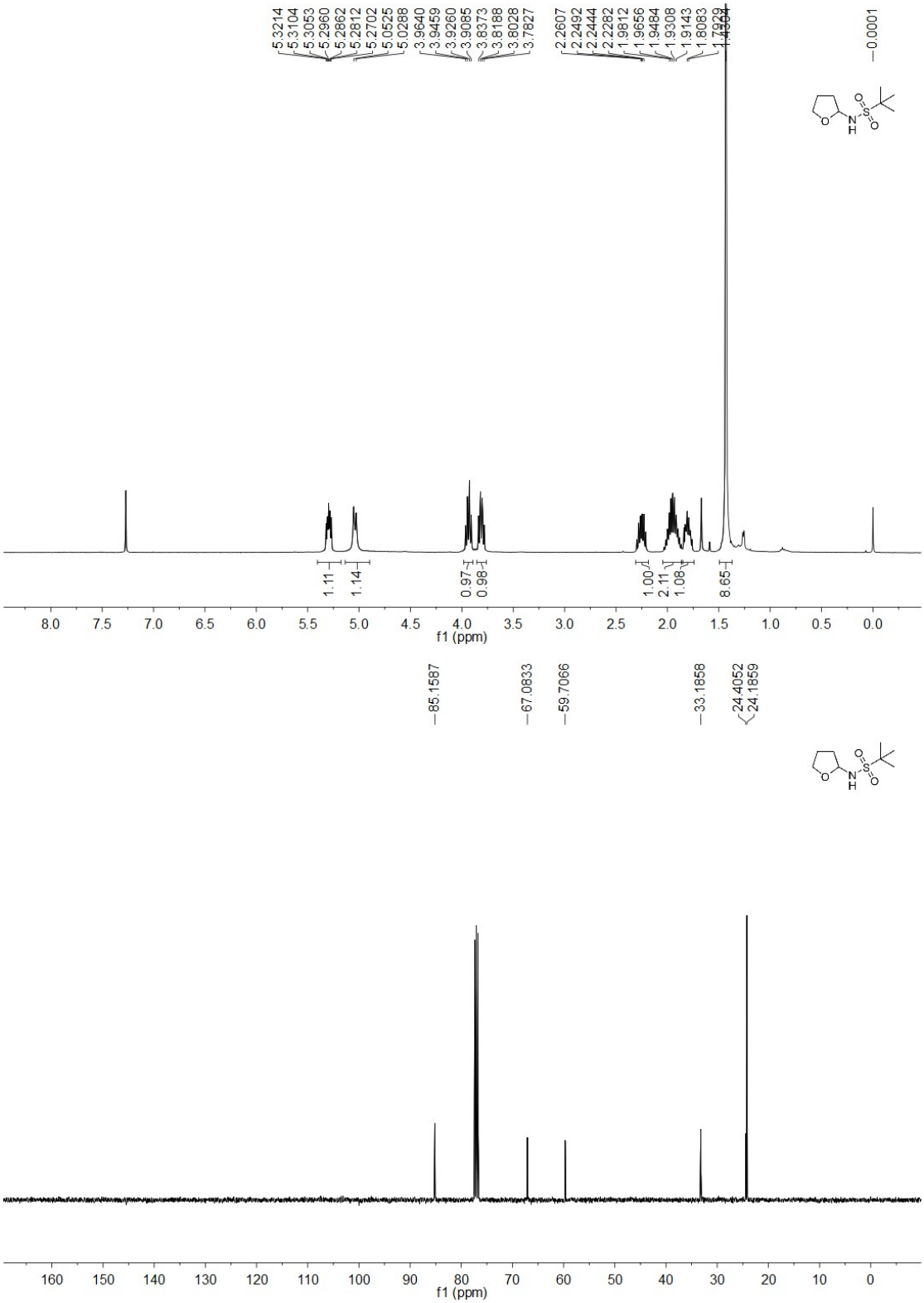


N-(Tetrahydrofuran-2-yl)propane-2-sulfonamide (**3s**)

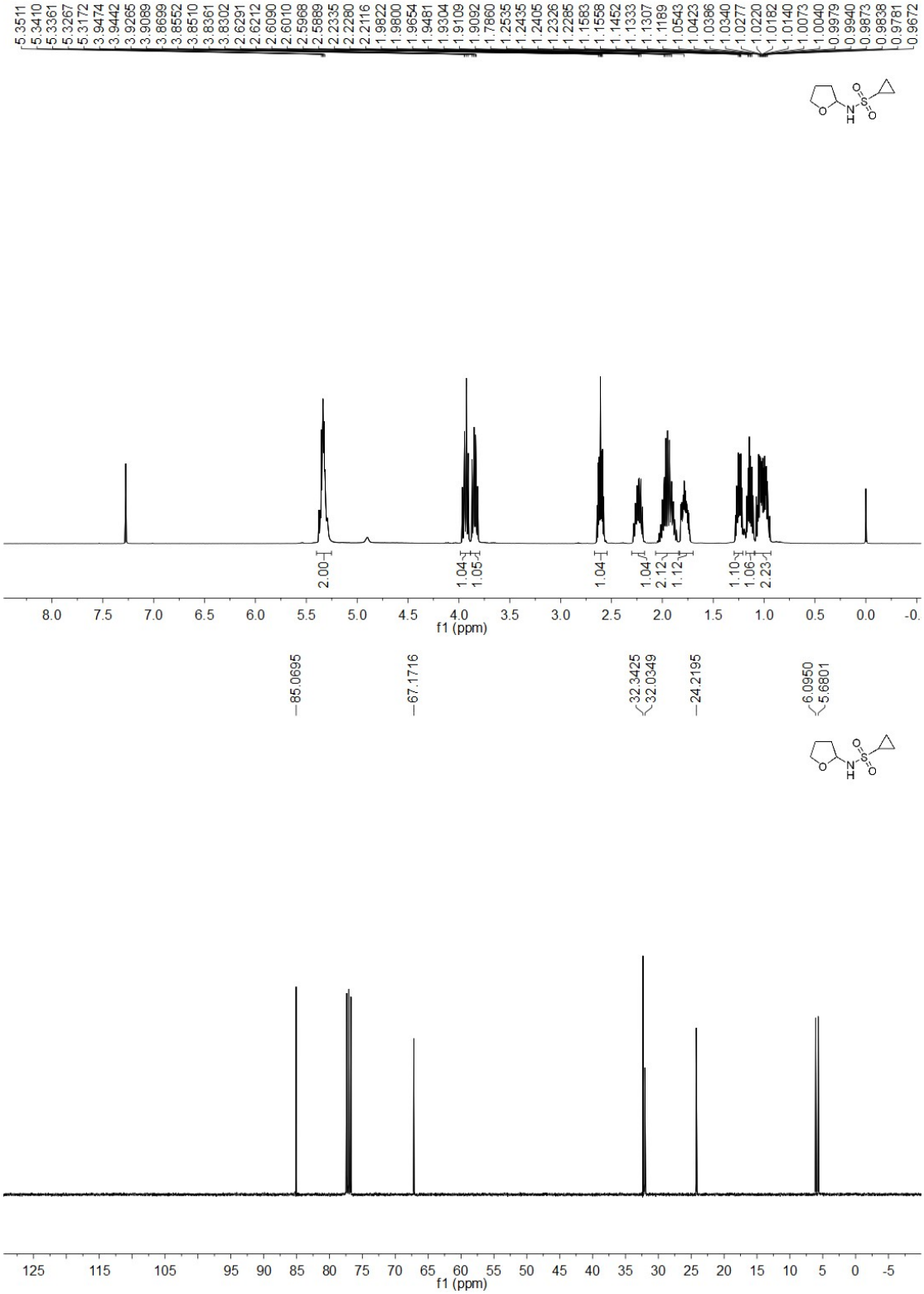




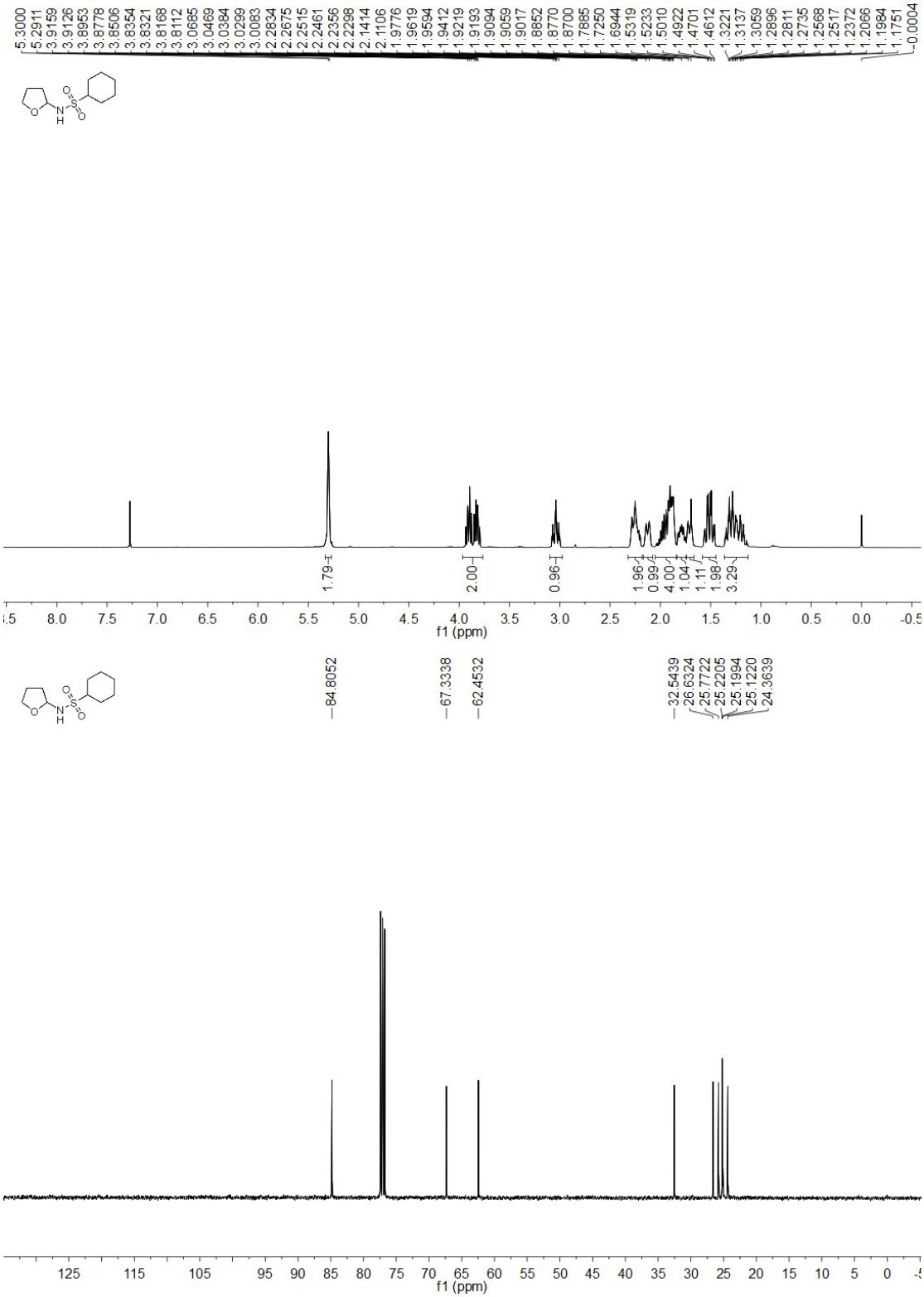
2-Methyl-N-(tetrahydrofuran-2-yl)propane-2-sulfonamide (**3t**)



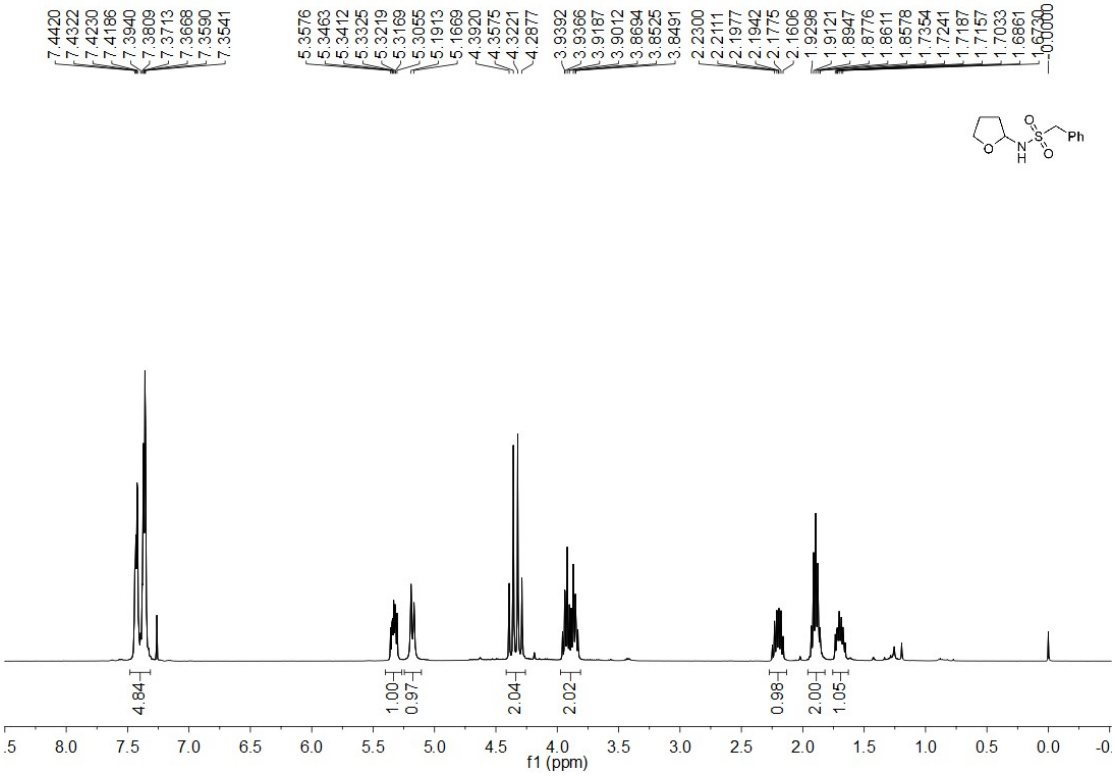
N-(Tetrahydrofuran-2-yl)cyclopropanesulfonamide (**3u**)



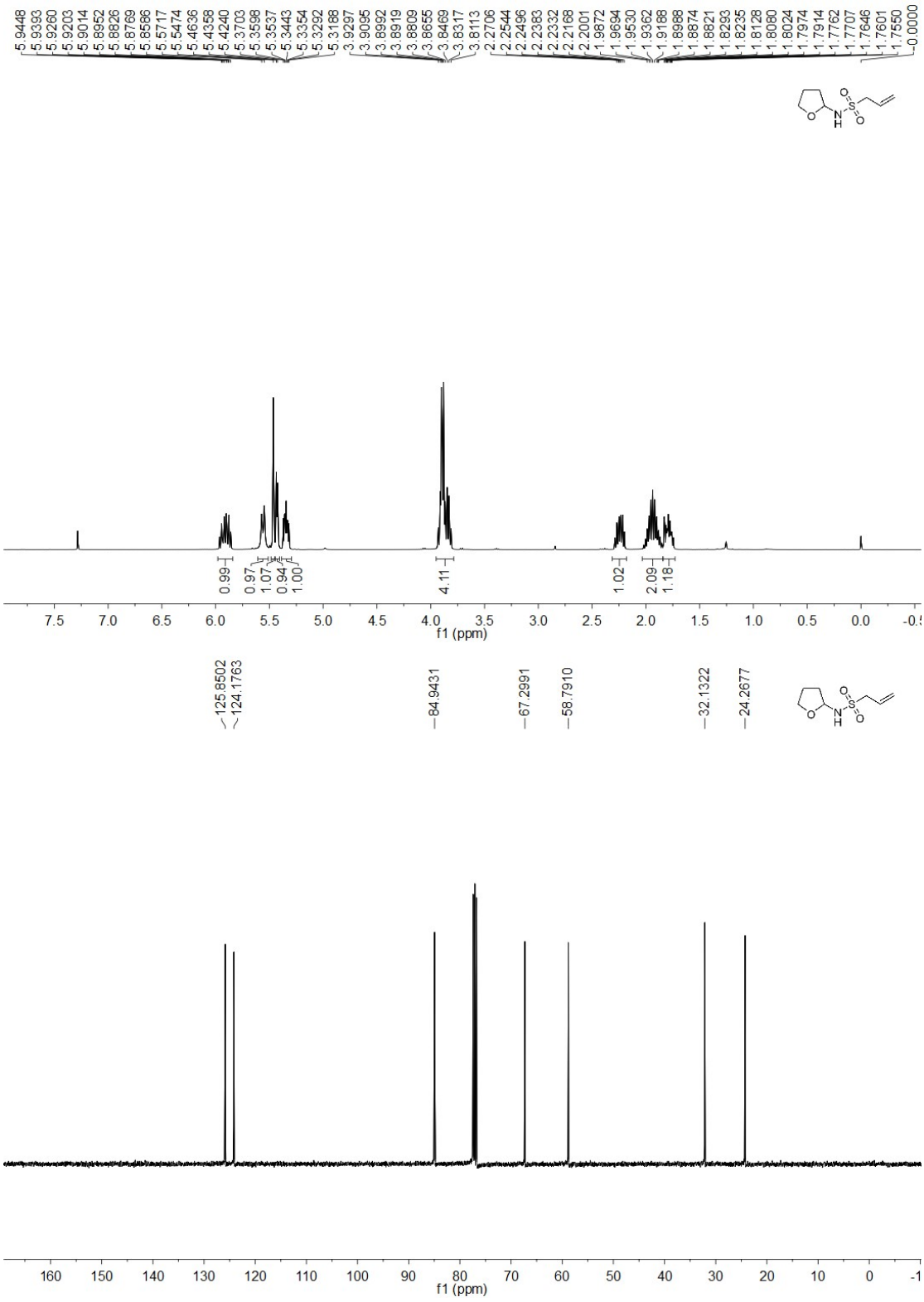
N-(Tetrahydrofuran-2-yl)cyclohexanesulfonamide (**3v**)



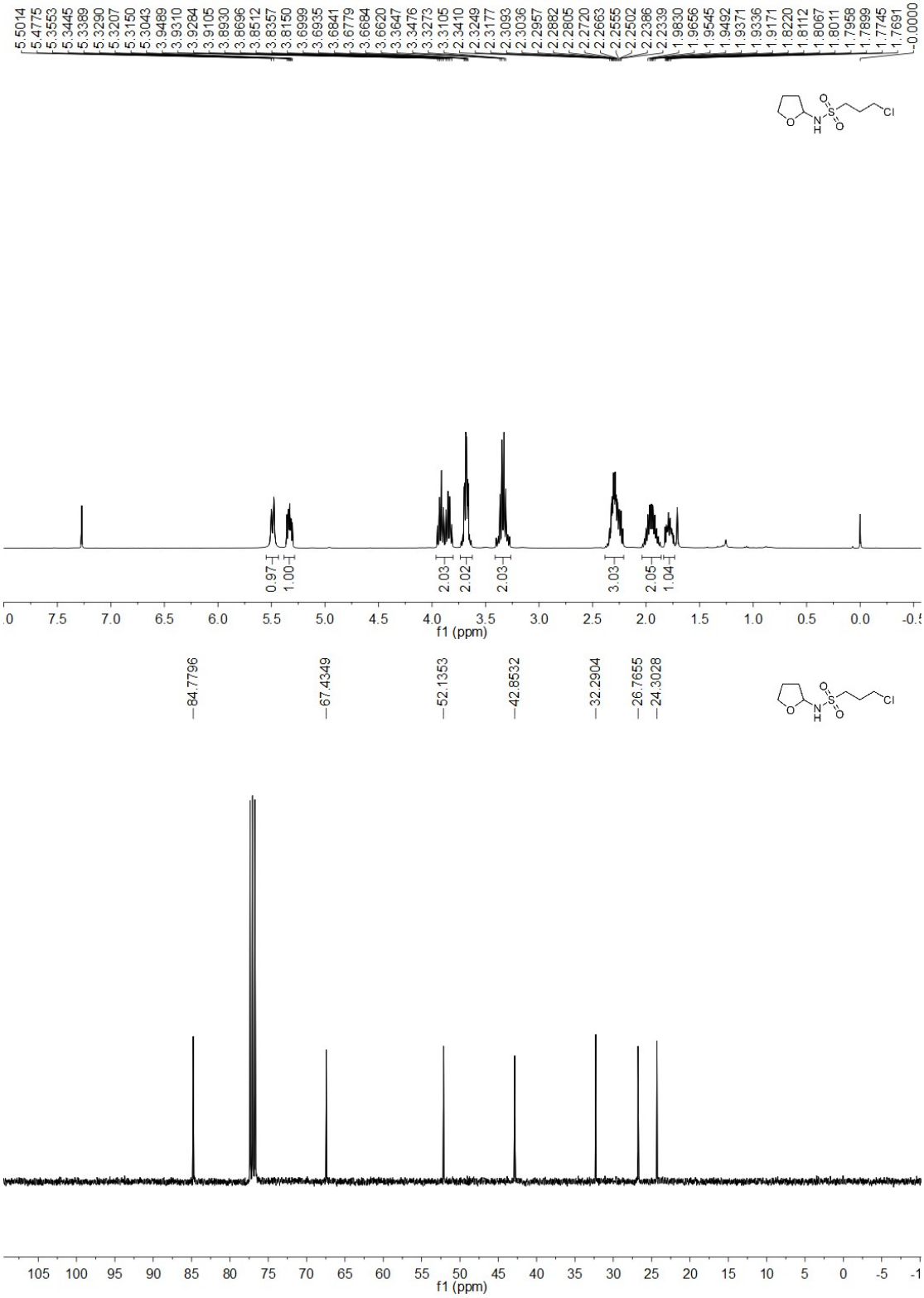
1-Phenyl-N-(tetrahydrofuran-2-yl)methanesulfonamide (**3w**)



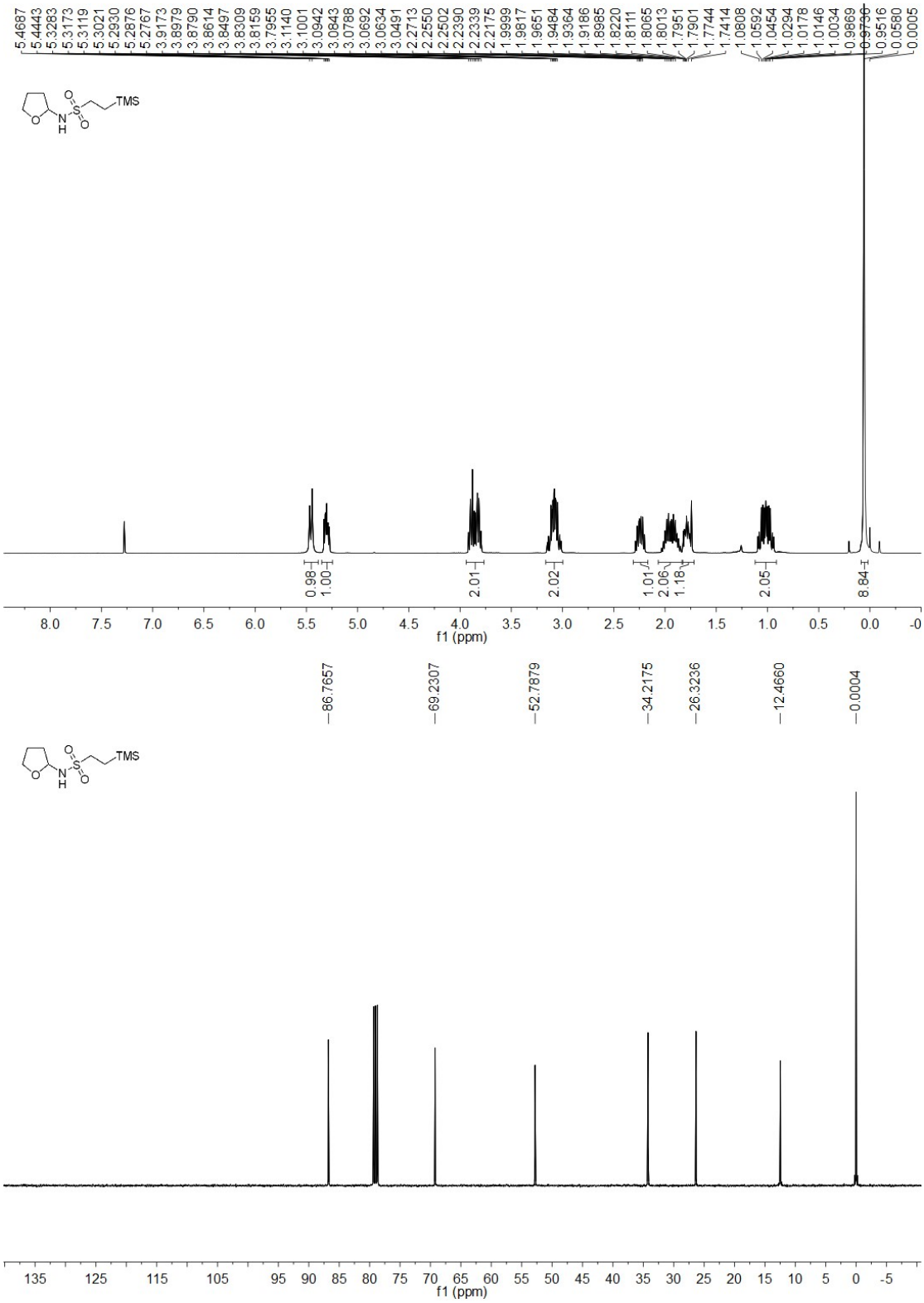
N-(Tetrahydrofuran-2-yl)prop-2-ene-1-sulfonamide (**3x**)



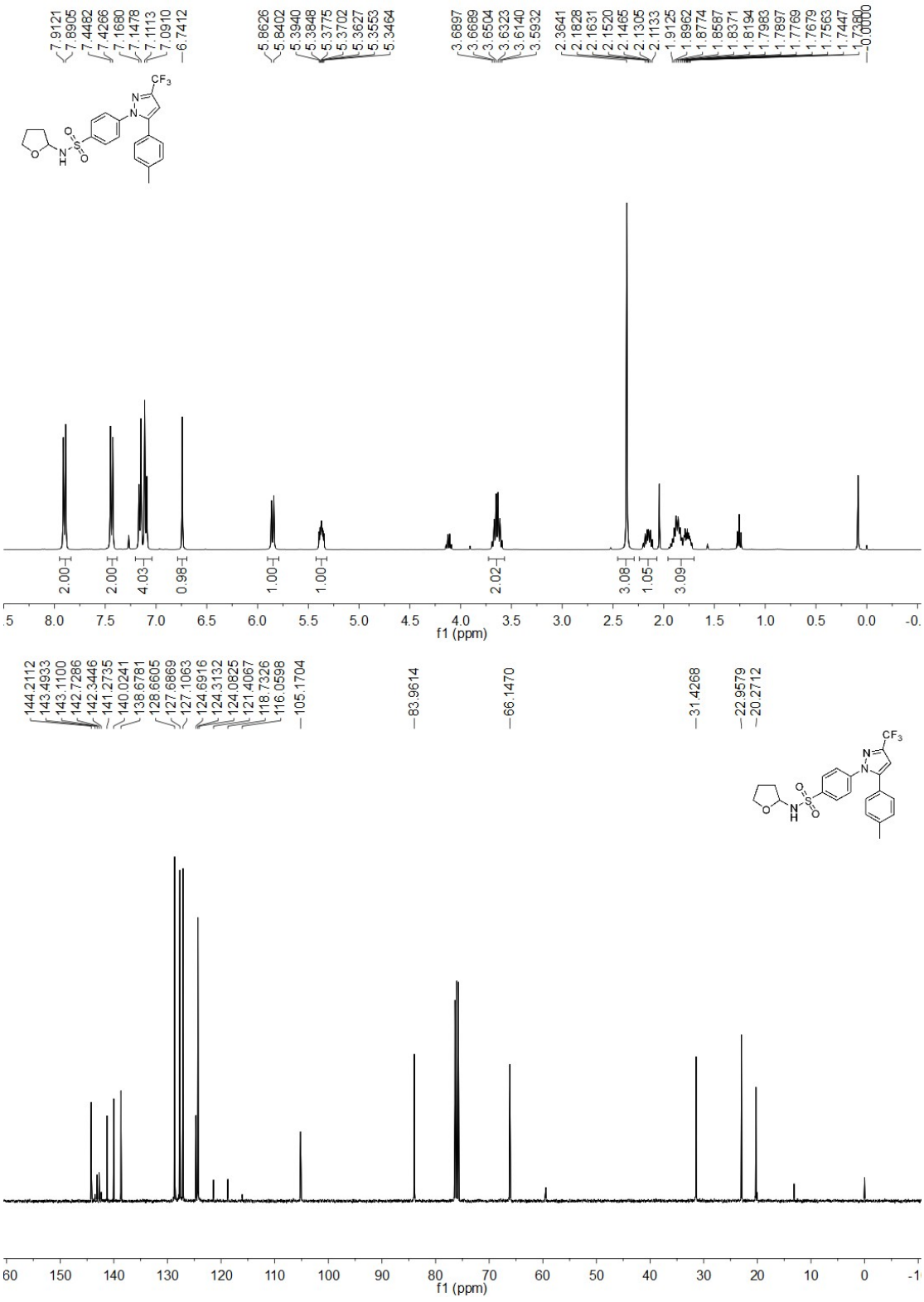
3-Chloro-N-(tetrahydrofuran-2-yl)propane-1-sulfonamide (**3y**)

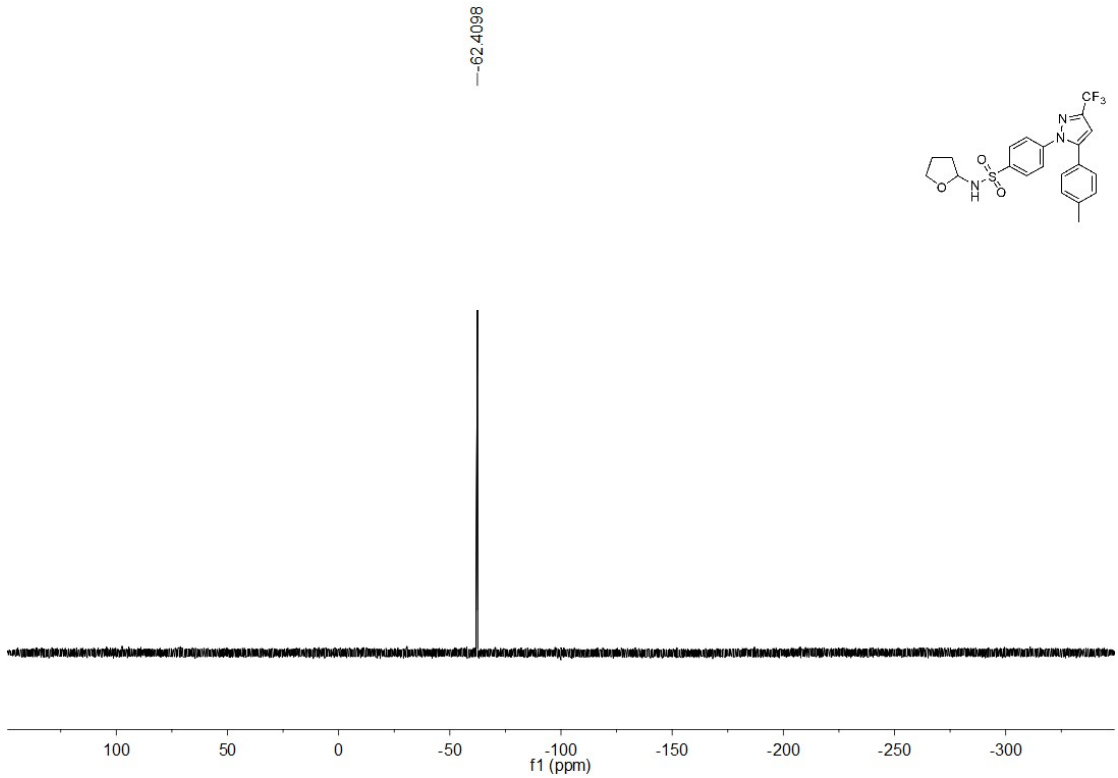


N-(Tetrahydrofuran-2-yl)-2-(trimethylsilyl)ethane-1-sulfonamide (**3z**)



N-(Tetrahydrofuran-2-yl)-4-(5-(p-tolyl)-3-(trifluoromethyl)-1H-pyrazol-1-yl)benzenesulfonamide (**3aa**)

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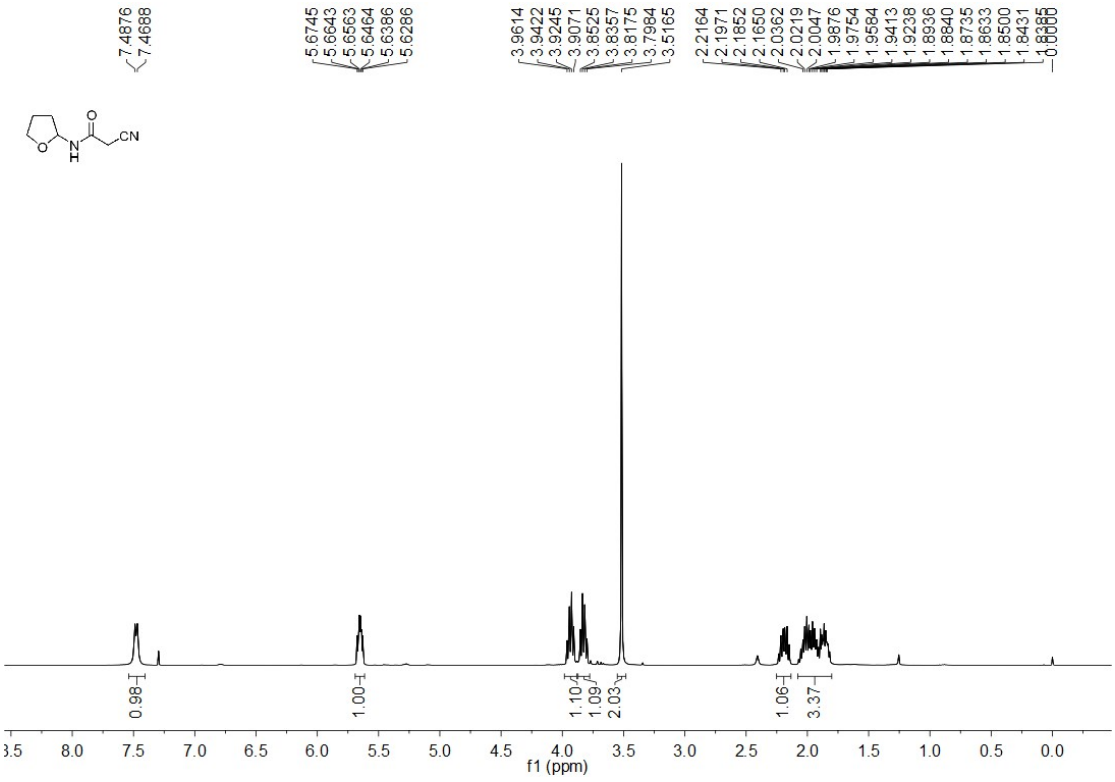
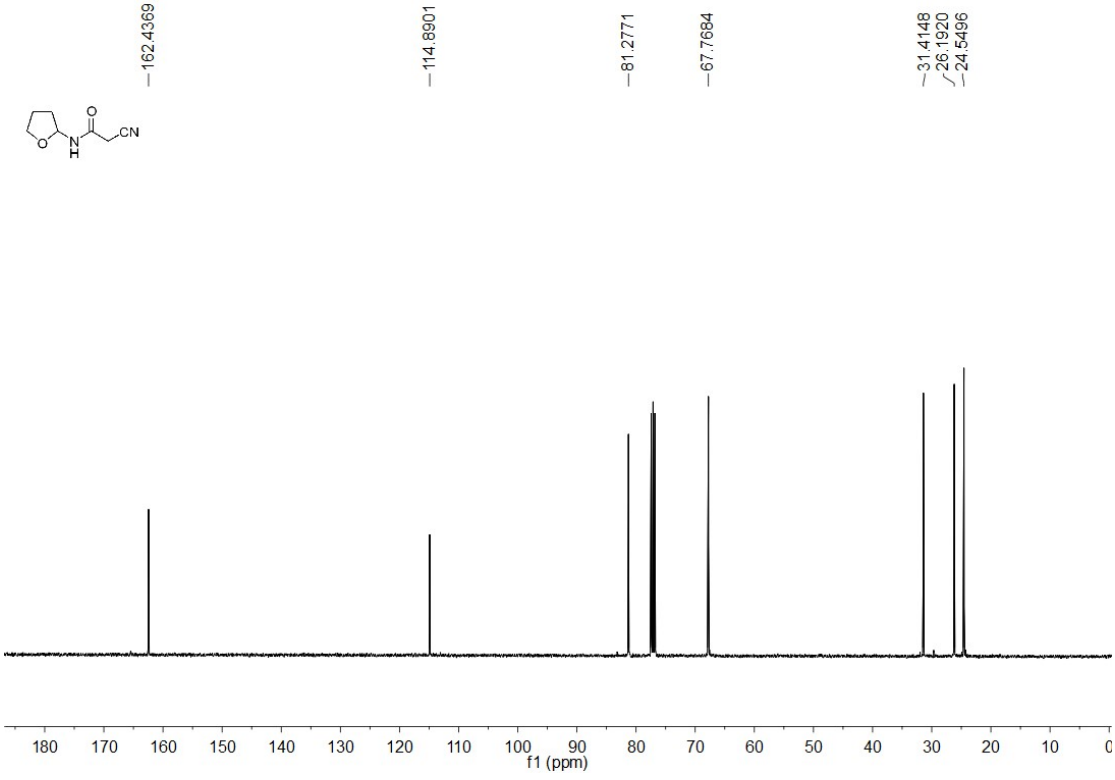
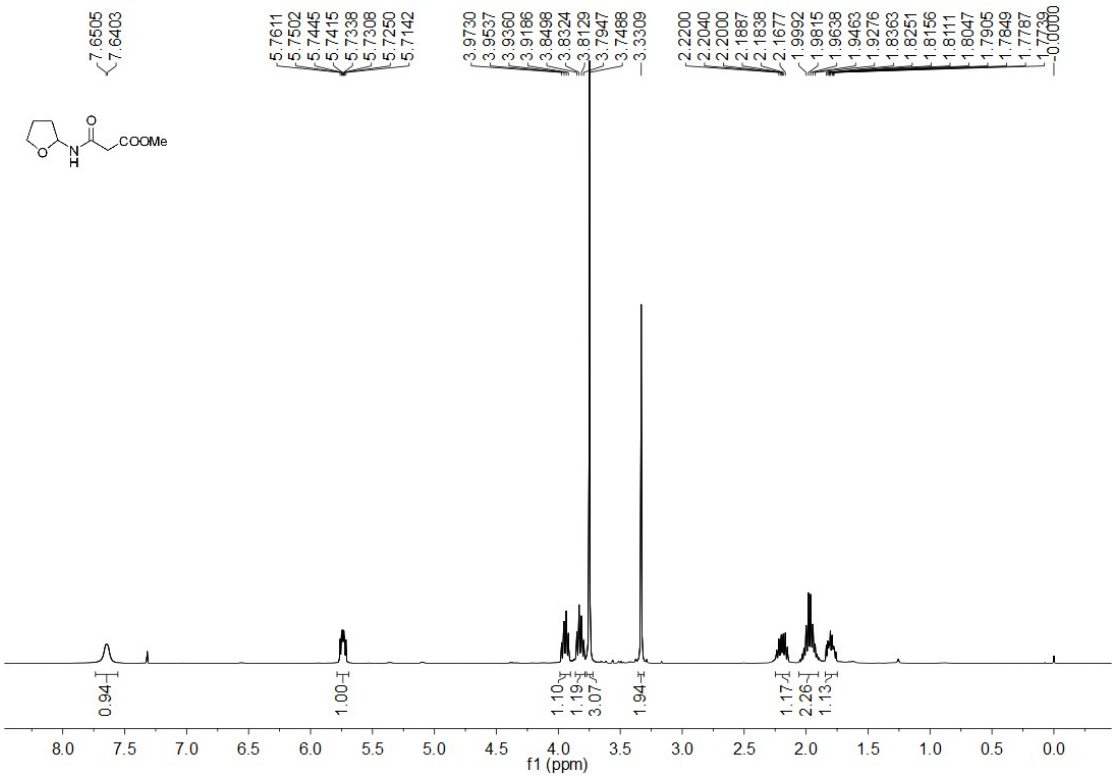
CF3
N
N
O
S
O
H
N
O
100
50
0
-50
-100
-150
-200
-250
-300
f1 (ppm)

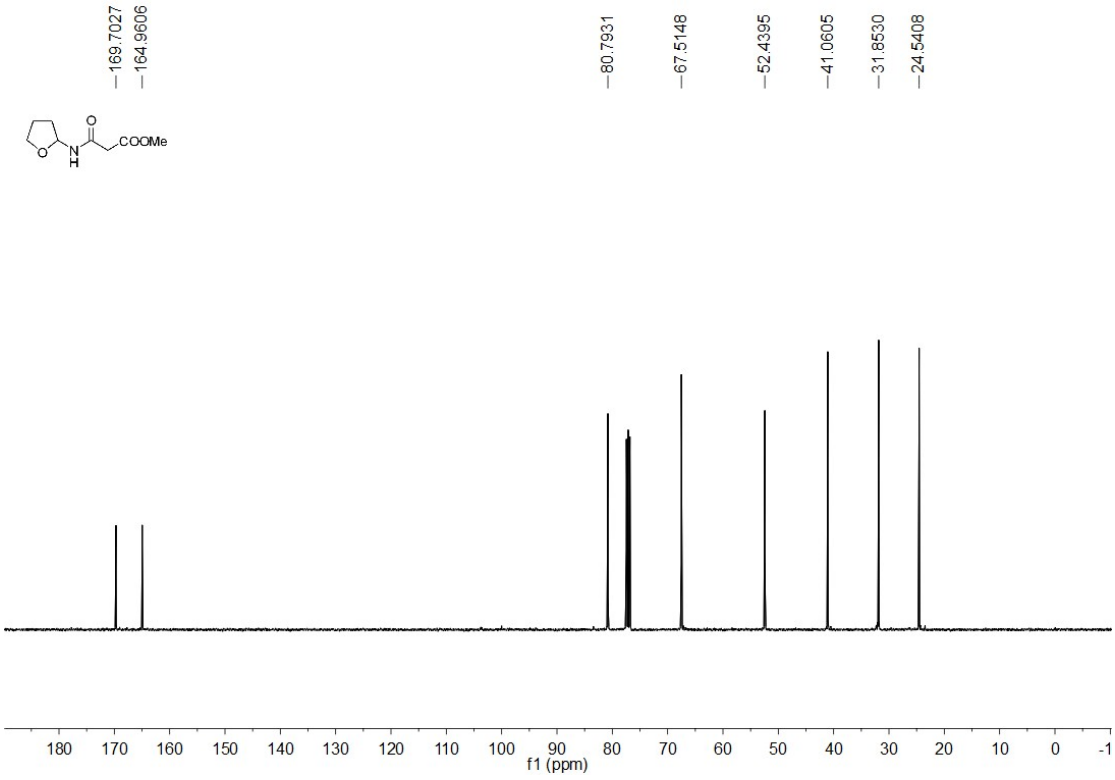
2-Cyano-N-(tetrahydrofuran-2-yl)acetamide (**5a**)



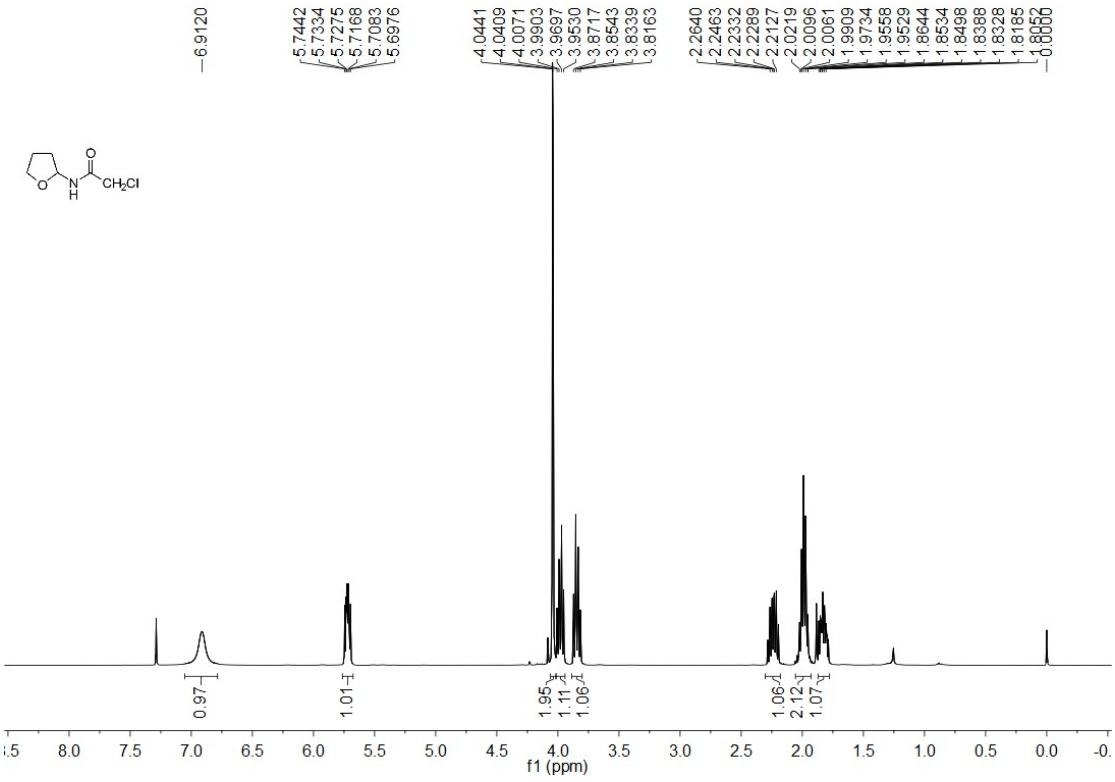


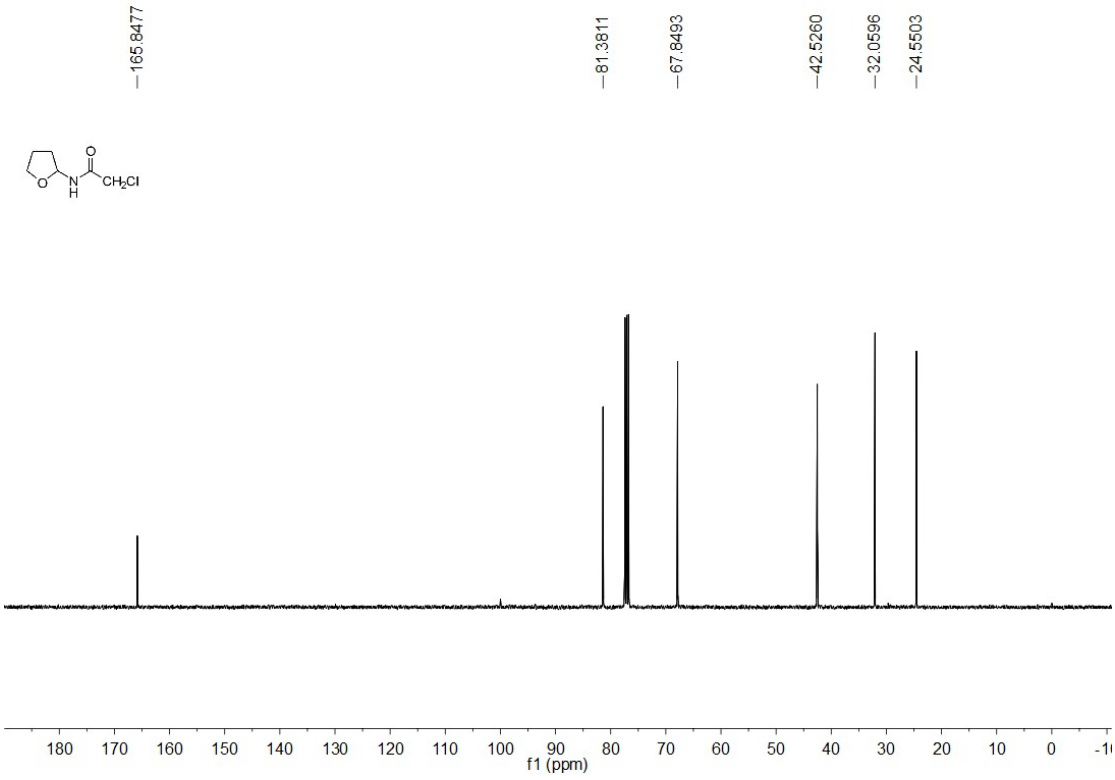
Methyl 3-oxo-3-((tetrahydrofuran-2-yl)amino)propanoate (**5b**)



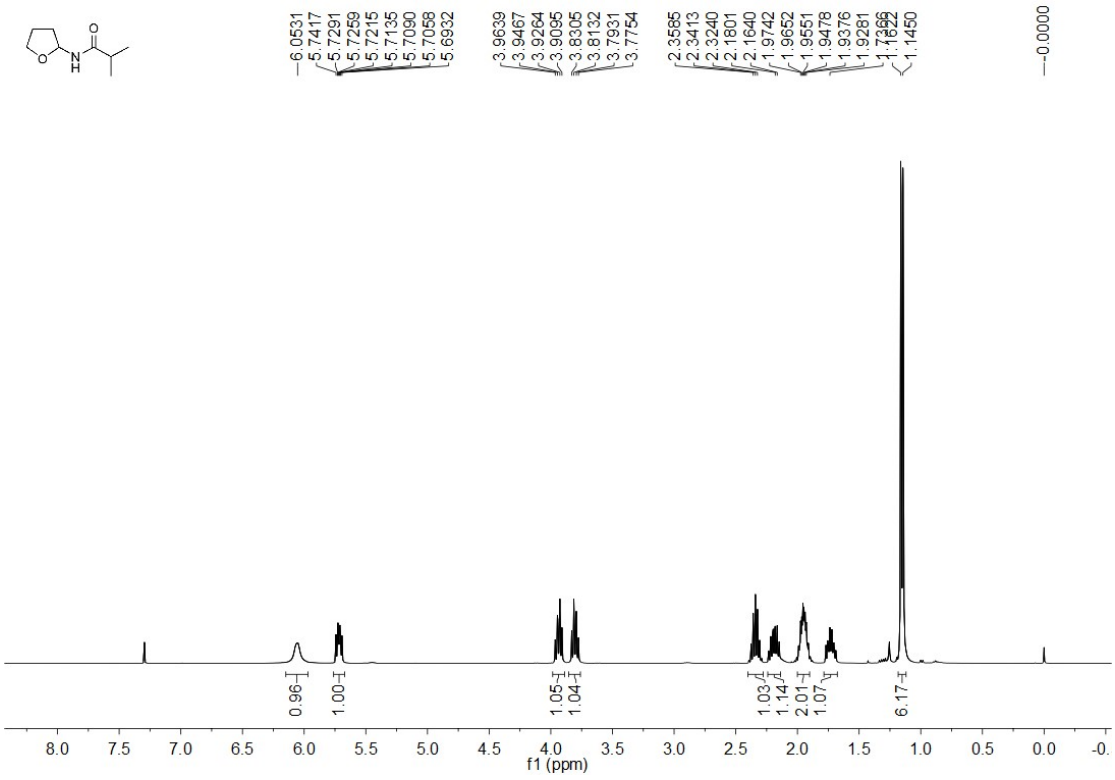


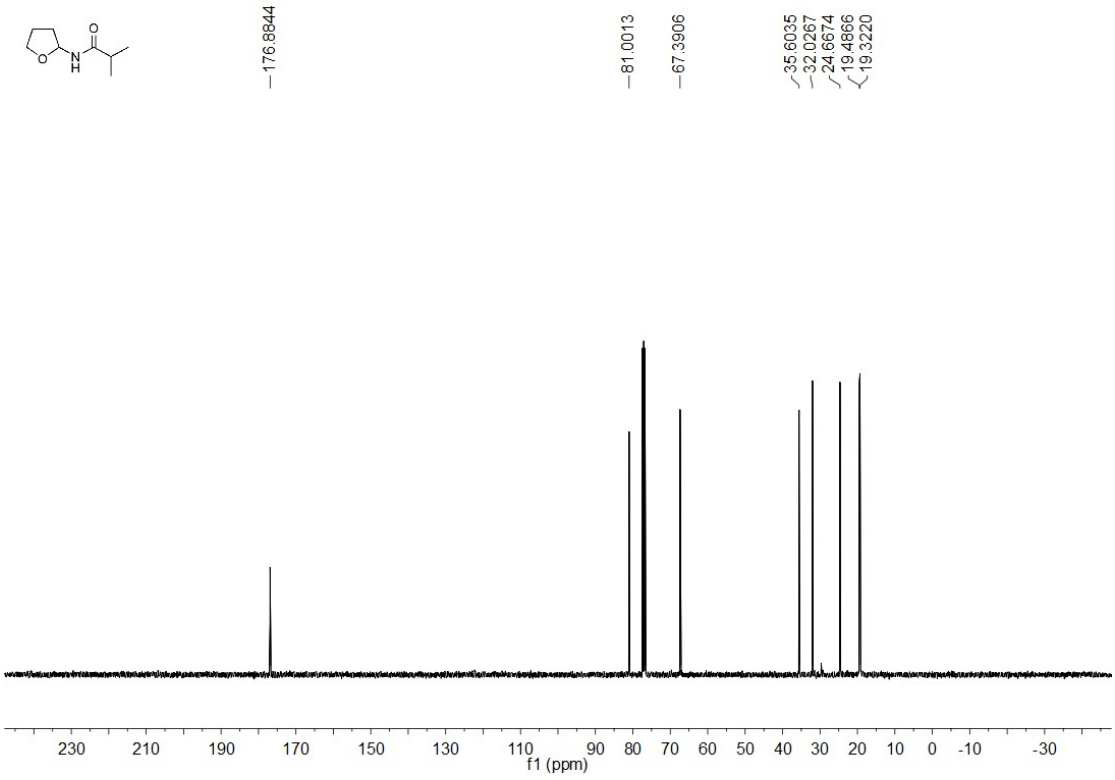
2-Chloro-N-(tetrahydrofuran-2-yl)acetamide (**5c**)



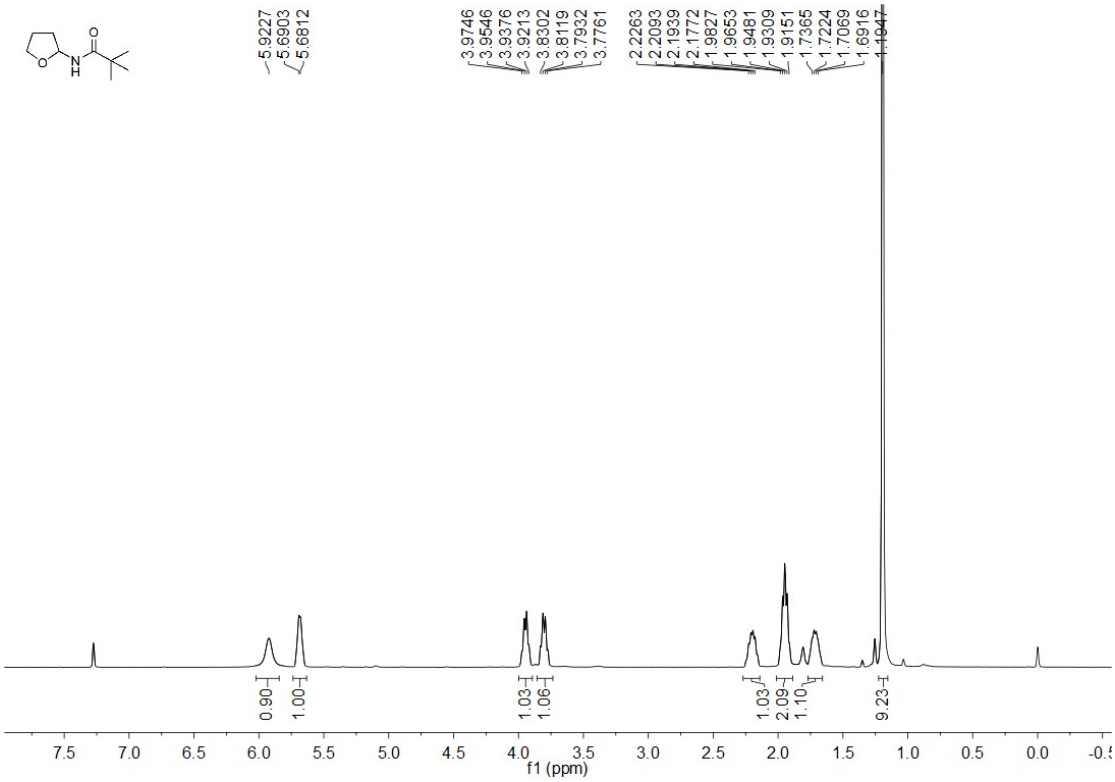


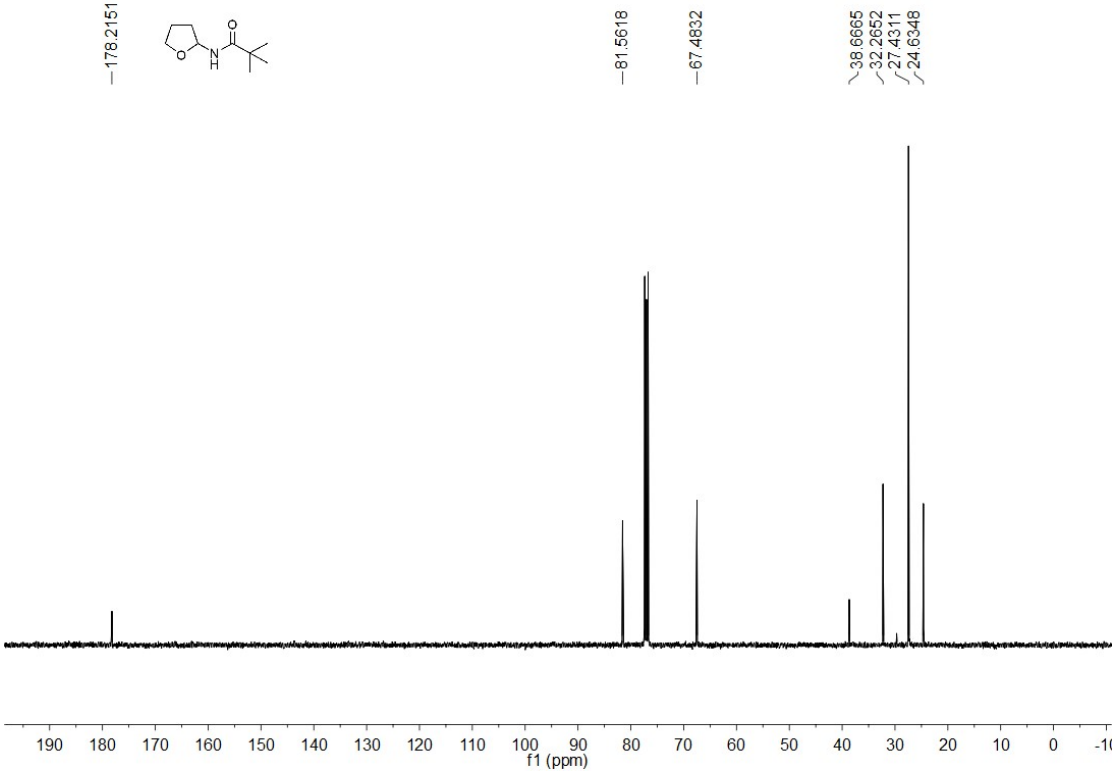
N-(Tetrahydrofuran-2-yl)isobutyramide (**5d**)



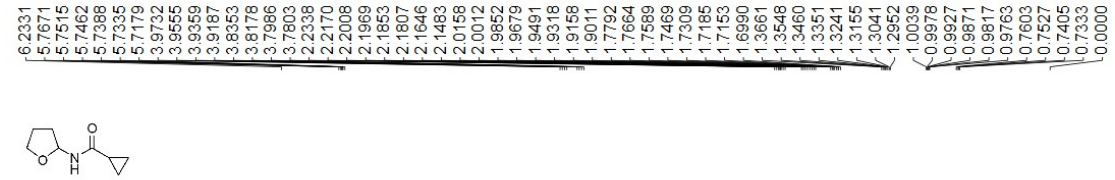


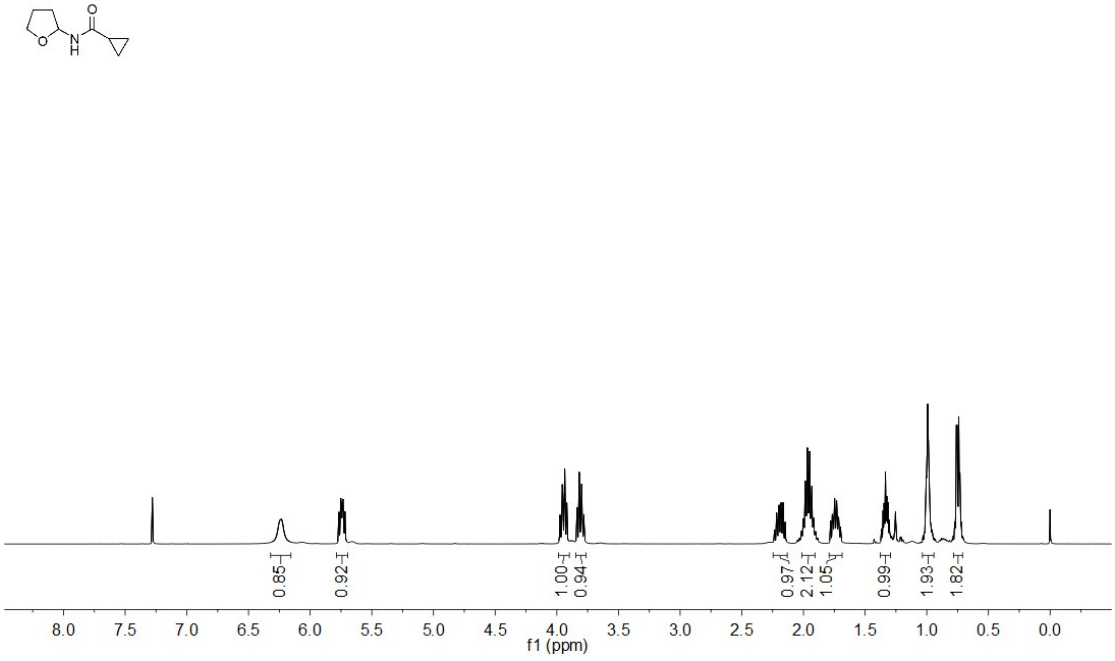
N-(tetrahydrofuran-2-yl)pivalamide (**5e**)

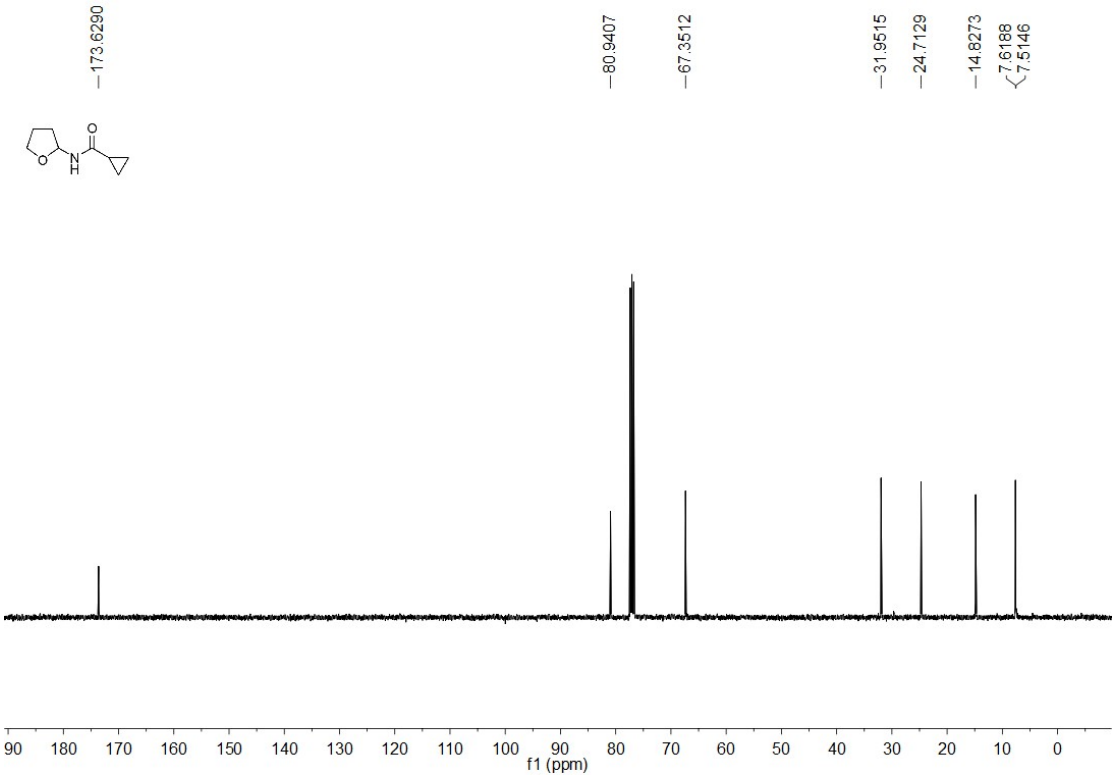




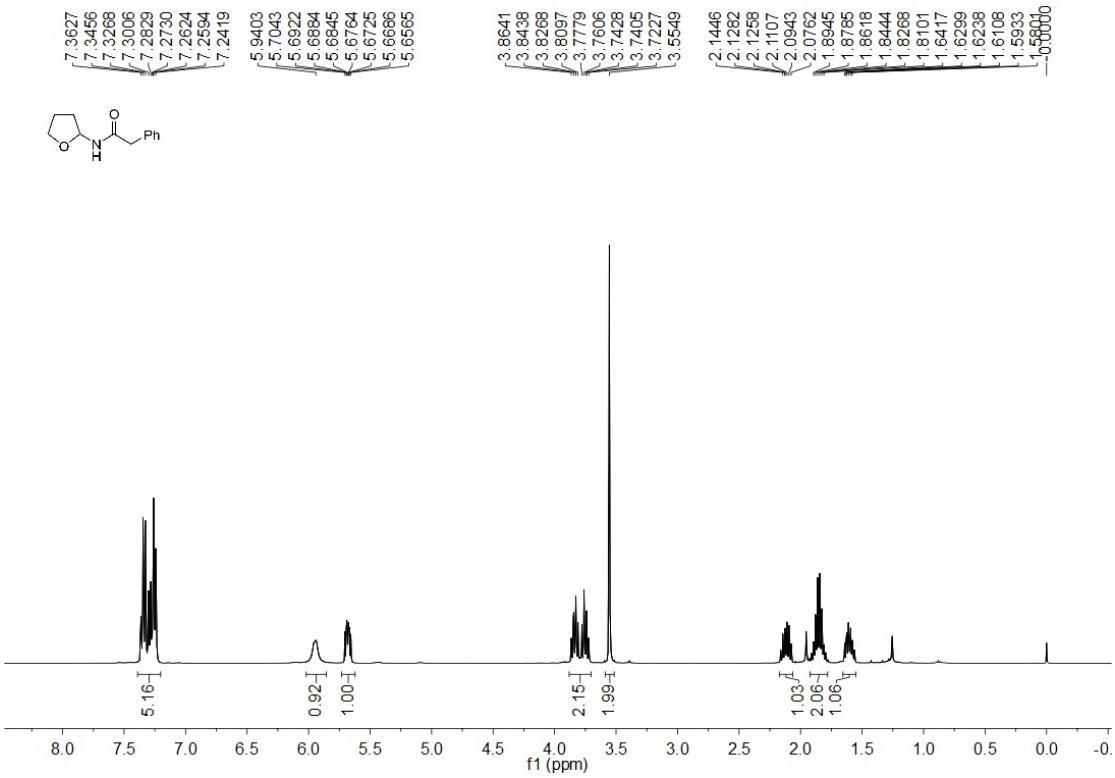
N-(tetrahydrofuran-2-yl)cyclopropanecarboxamide (**5f**)



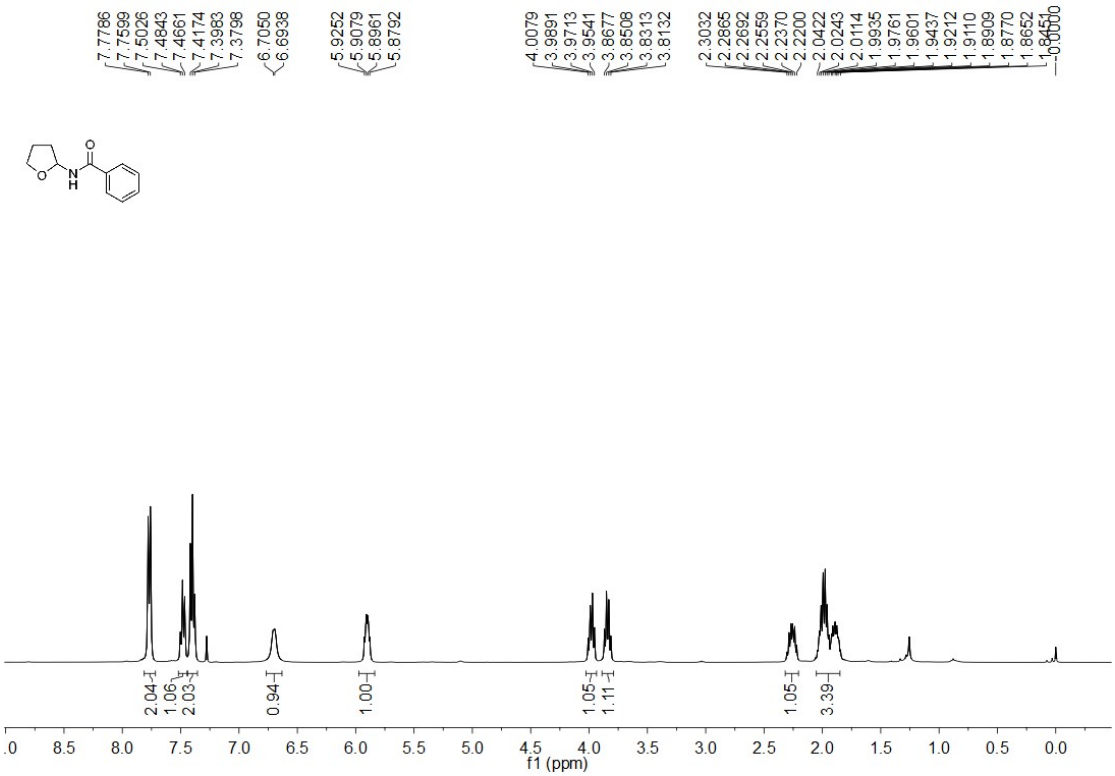




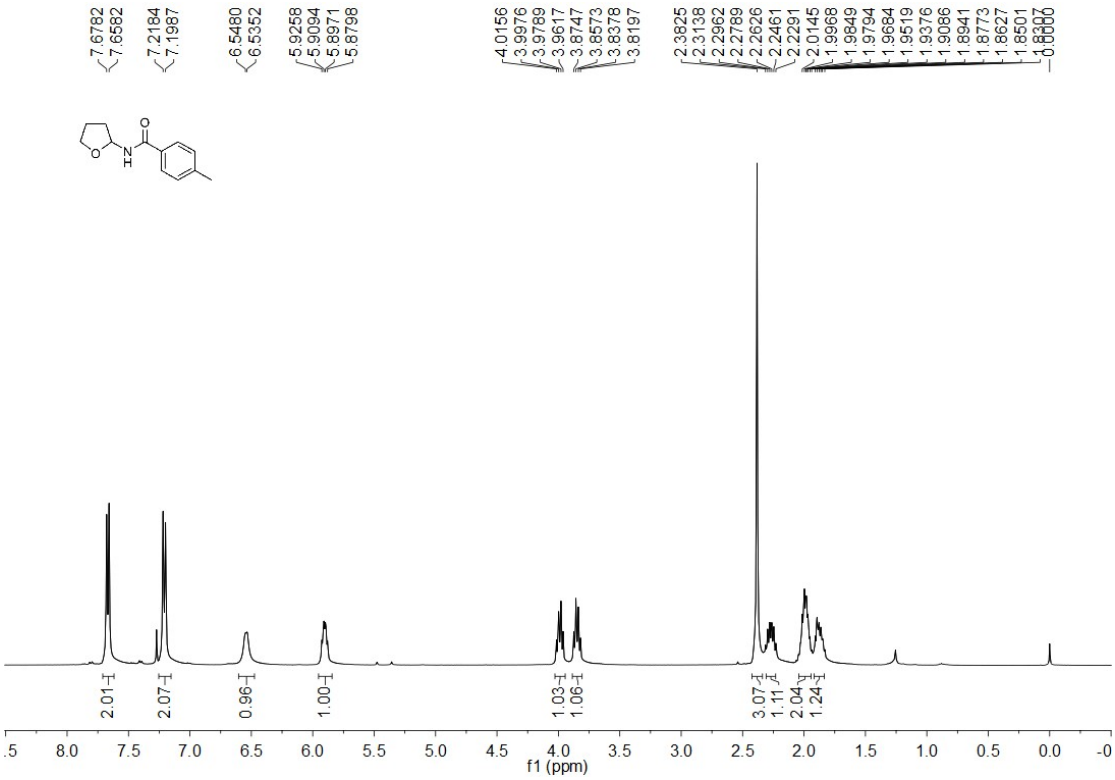
2-Phenyl-N-(tetrahydrofuran-2-yl)acetamide (**5g**)



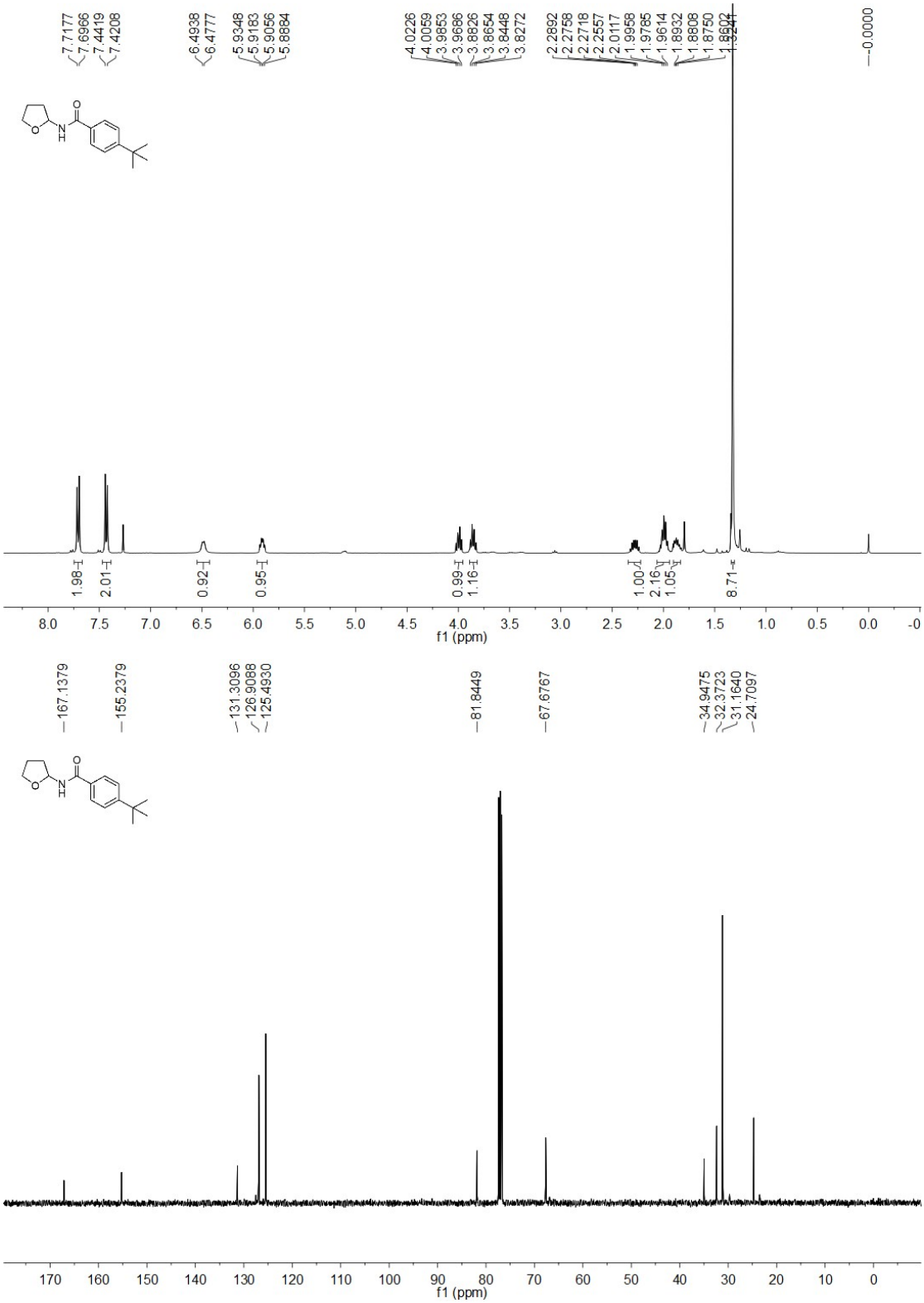
N-(tetrahydrofuran-2-yl)benzamide (**5h**)



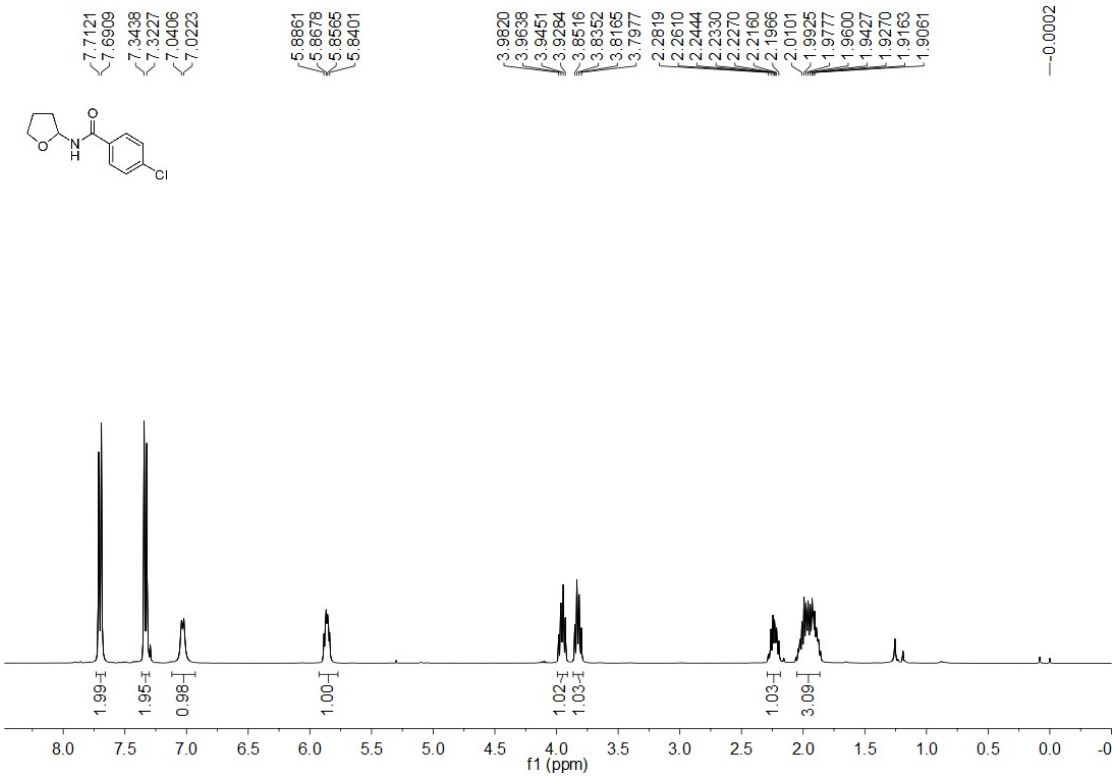
4-Methyl-N-(tetrahydrofuran-2-yl)benzamide (**5i**)



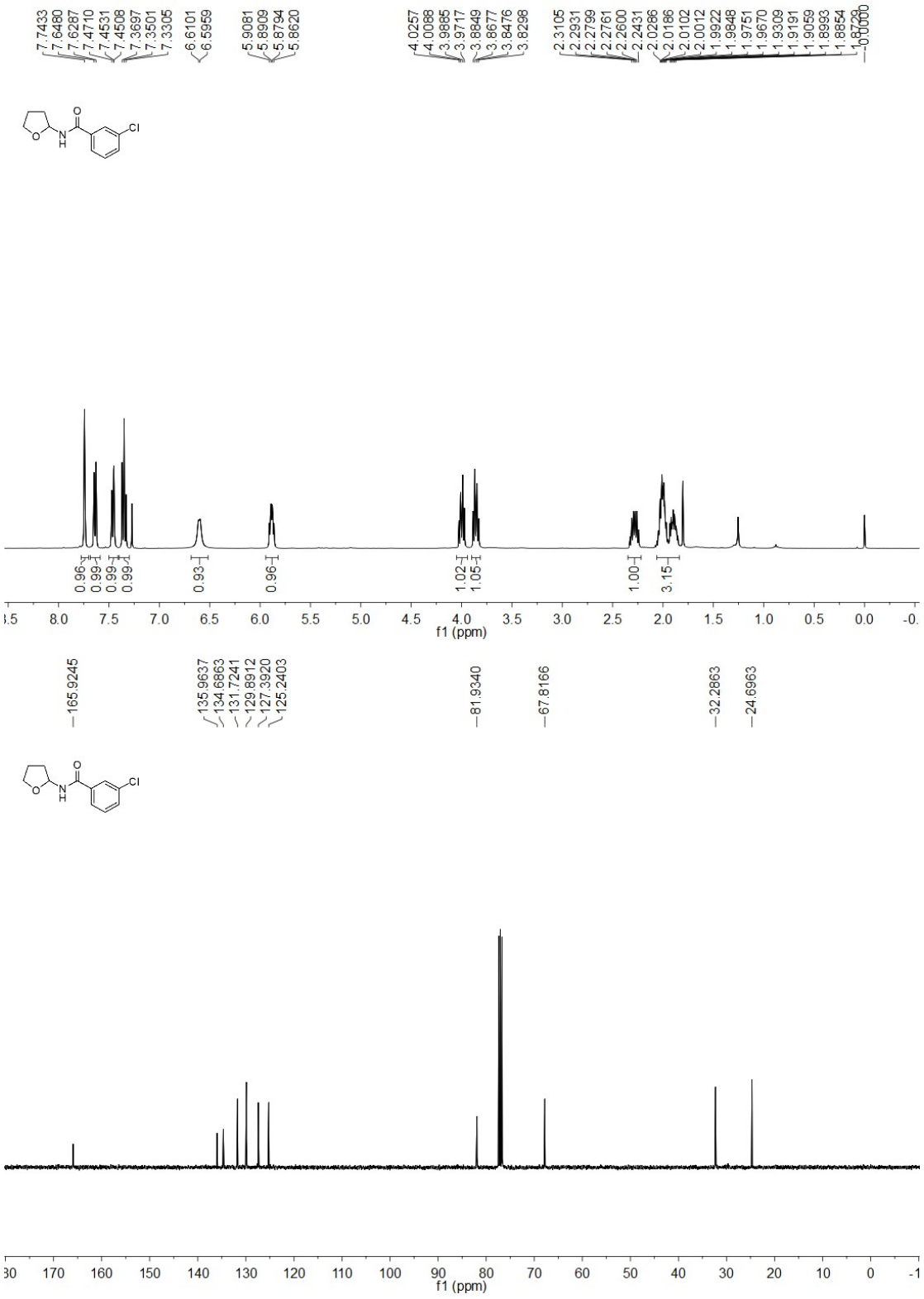
4-(tert-Butyl)-N-(tetrahydrofuran-2-yl)benzamide (**5j**)



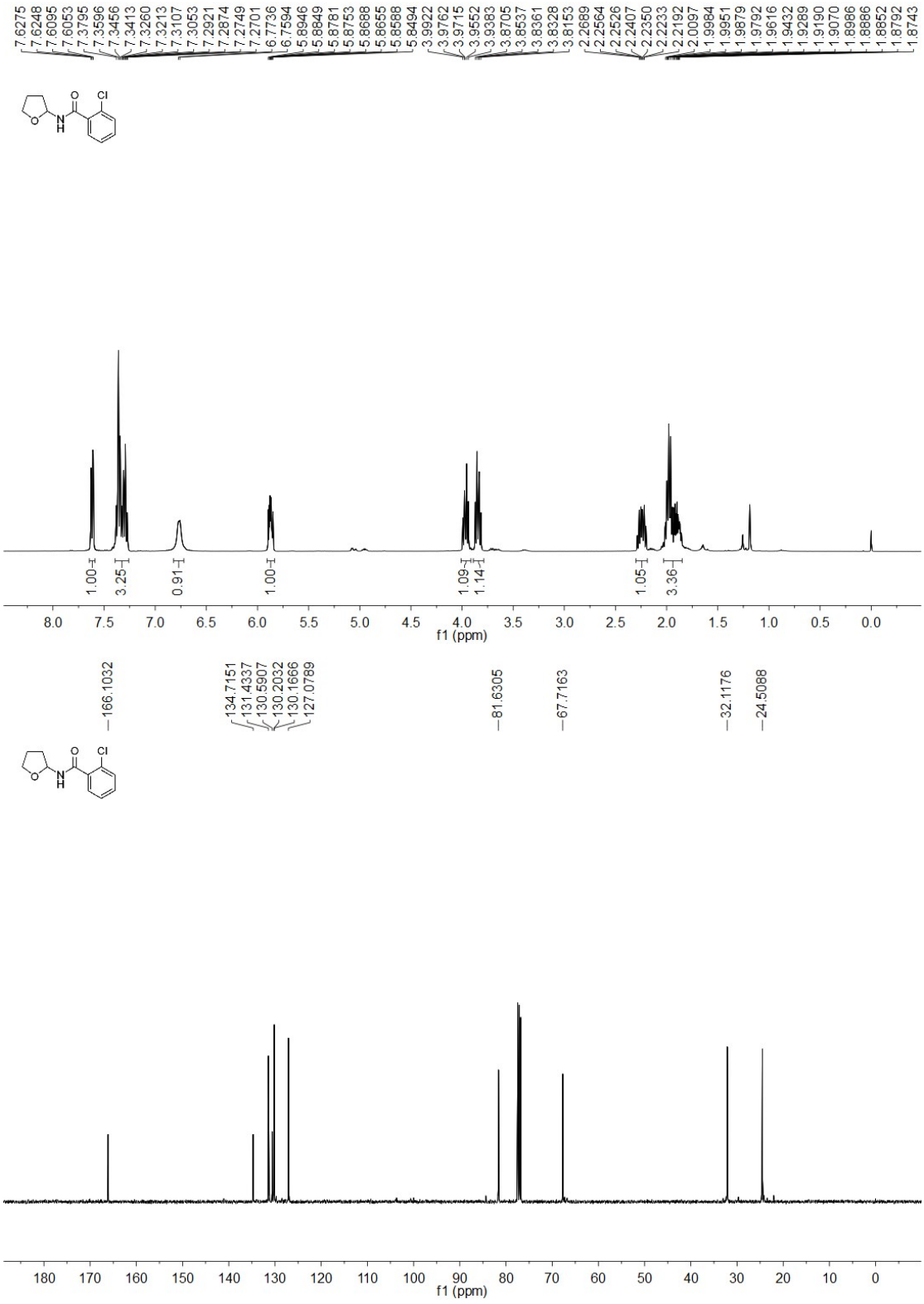
4-Chloro-N-(tetrahydrofuran-2-yl)benzamide (**5k**)



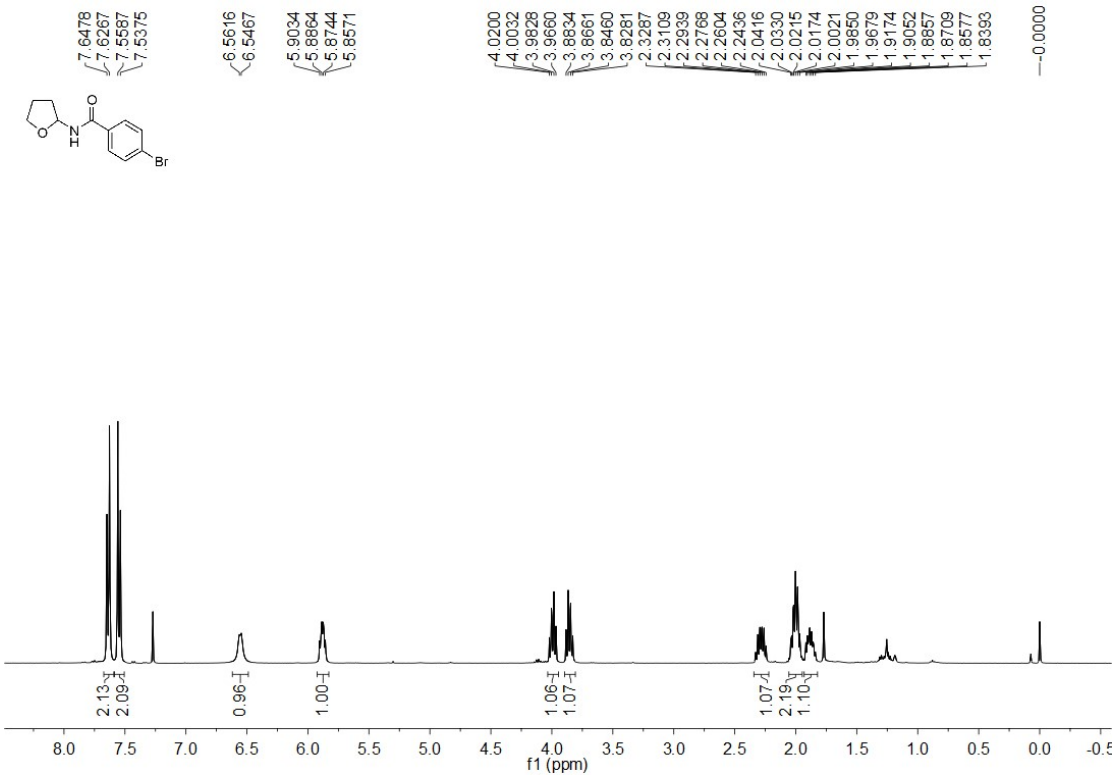
3-Chloro-N-(tetrahydrofuran-2-yl)benzamide (**5l**)



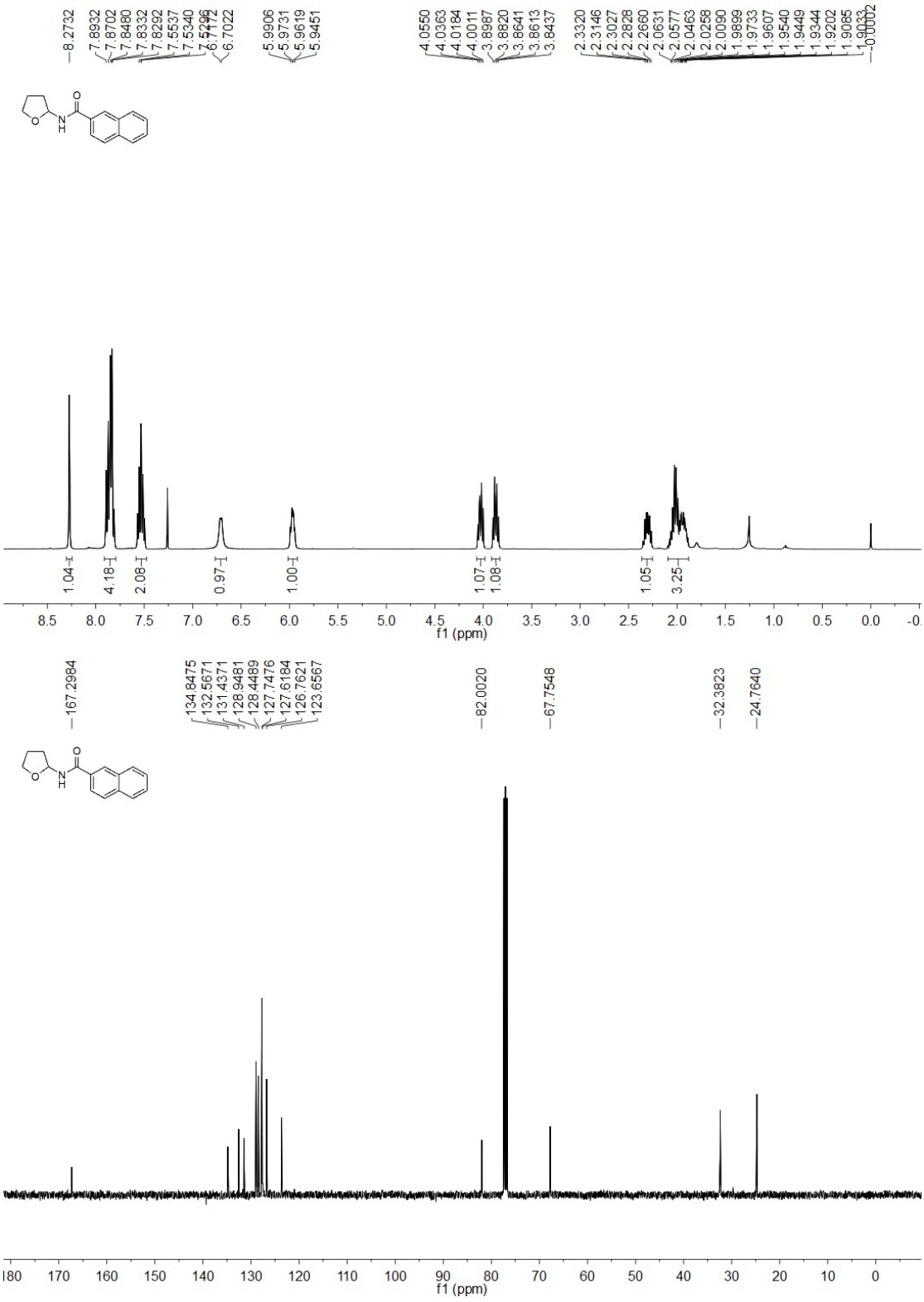
2-Chloro-N-(tetrahydrofuran-2-yl)benzamide (**5m**)



4-Bromo-N-(tetrahydrofuran-2-yl)benzamide (**5n**)



N-(Tetrahydrofuran-2-yl)-2-naphthamide (**5o**)



Reference

[1] Tilby, M. J.; Dewez, D. F.; Pantaine, L. R. E.; Hall, A.; Martinez-Lamenca, C.; Willis, M. C. *ACS Catal.* **2022**, *12*, 6060−6067.

[2] Davies, T. Q.; Tilby, M. J.; Skolc, D.; Hall, A.; Willis, M. C. *Org. Lett.* **2020**, *22*, 9495−9499.

[3] Campos, J.; Goforth, S. K.; Crabtree, R. H.; Gunnoe, T. B. *RSC Adv.*, **2014**, *4*, 47951–47957.

[4] Ni, H. C.; Li, C. M.; Shi, X. Z.; Hu, X. Y.; Mao, H. *J. Org. Chem.* **2022**, *87*, 9797–9805.