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Supporting Information

Catalyst-free One-Pot, Four-Component Approach for the Synthesis of di- and tri-substituted N-Sulfonyl formamidines

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Content

1. General Information:

All the solvents and commercial reagents were used without additional purification. Purification of the reaction products was carried out by flash column chromatography using 200-300 mesh silica gel. Visualization on TLC (analytical thin layer chromatography) was achieved by the use of UV light (254 nm). High-resolution mass spectra were recorded on a Bruker BIO TOF Q mass spectrometer. Proton and carbon magnetic resonance spectra (^{1}H NMR and ^{13}C NMR) were recorded on a Varian Inova 400 MHz (^{1}H NMR at 400 MHz and ^{13}C NMR at 100 MHz) spectrometer with solvent resonance as the internal standard (^{1}H NMR: $CDCl_3$ at 7.26 ppm, DMSO-*d*6 at 2.50ppm; ^{13}C NMR: $CDCl_3$ at 77.02 ppm, DMSO-d_6 at 39.52 ppm). ^{1}H NMR data are reported as follows: chemical shifts, multiplicity (s = singlet, br s = broad singlet, d = doublet, dd= doublet of doublet, t = triplet, q = quartet, m= multiplet), coupling constant(s) in Hz, integration. Single-crystal X-ray diffraction was carried out on a Agilent SuperNova, Dual, Cu at zero, AtlasS2 diffractometer with graphite monochromated Cu Kα radiation (λ = 0.71073 Å) at 100.00(10) K.

2. Experimental Section

2.1 Di-substituted *N*-sulfonyl formamidine

General procedure for the synthesis of di substituted sulfonyl formamidines 5a-5m;

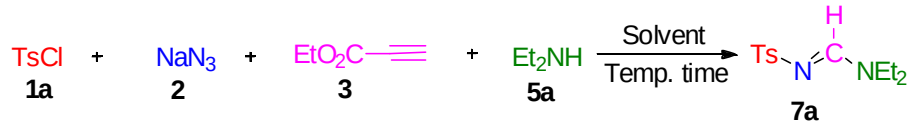
In a 5 mL screw cap vial with a stir bar, ethyl propiolate (0.5 mmol, 49.1mg) and primary amine (0.5 mmol) were dissolved in acetonitrile (1.0 mL) and stirred at room temperature for 1h, and then the NaN_3 (0.75 mmol, 48.8 mg) and sulfonyl chloride (0.75 mmol) solution (in 1.0 mL acetonitrile) were added gradually to reaction mixture and stirred at room temperature until the enaminoester intermediate was fully consumed (reaction was monitored with TLC). The reaction mixture was poured into 10 ml of water and extracted with 20 mL of dichloromethane (3 times) and the combined organic layer was dried over sodium sulfate. Organic solvents were removed under reduced pressure and the crude reaction mixture was purified by column chromatography on silica gel column (ethyl acetate /petroleum ether) to afford the desired products.

A gram-scale synthesis of *N*-butyl-*N'*-(phenylsulfonyl)formimidamide (**5b**)

A solution of ethyl propiolate (10 mmol, 0.98 g) and *n*-butyl amine (10 mmol, 0.73g) in acetonitrile (10 mL) was stirred at room temperature for 1h, and then the NaN_3 (15 mmol, 0.98 g) and benzene sulfonyl chloride (15 mmol, 1.77 g) solution (in 10 mL acetonitrile) were added gradually to reaction mixture and stirred at room temperature until the enaminoester intermediate was fully consumed (7 h). The reaction mixture was poured into 30 ml of water and extracted with 70 mL of dichloromethane (3 times) and the combined organic layer was dried over sodium sulfate. Organic solvents were removed under reduced pressure and the crude reaction mixture was purified by column chromatography on silica gel column (ethyl acetate /petroleum ether) to afford the desired products **5b** (74% yield, 1.78 g).

2.3 Tri-substituted sulfonyl formamidine

Table 1. Optimization of reaction conditions for tri- substituted *N*-sulfonyl formamidine [a]



Entry	Solvent(s)/(v : v)	Temp.	*t* (h)	Yield (%)[b]
1	MeCN	rt	12	38
2	H_2O	rt	12	46
3	H_2O/THF=3:1	rt	12	43
4	H_2O/Acetone=3:1	rt	12	55
5	H_2O/DMF=3:1	rt	12	50
6	H_2O/DMA=3:1	rt	12	48
7	H_2O/MeOH=3:1	rt	12	52
8	H_2O/EtOH=3:1	rt	12	57
9	H_2O/EtOH=1:1	rt	12	66
10	H_2O/EtOH=1:2	rt	12	70
11	EtOH	rt	12	74
12[c]	EtOH	rt	12	67
13	EtOH	30 °C	8	83
14	**EtOH**	**40 °C**	**6**	**91**
15	EtOH	50 °C	5	90
16[d]	EtOH	40 °C	5	65

[a] Reactions were performed with **1a** (1.5 mmol), **2** (1.5 mmol), **3** (1 mmol), **5a** (1 mmo) in 4 mL solvent in a 10 mL round-bottom flask at room temperature under open-air condition, unless otherwise noted. [b] Isolated yield after column chromatography. [c] **1a** and **2** were 1.2 mmol. [d] 3-Butyn-2-one was used instead of ethyl propiolate (3).

General procedure for the synthesis of tri-substituted *N*-sulfonyl formamidines 7a-7n;

In a 10 mL of round bottom flask with a stir bar, ethyl propiolate (1 mmol, 98.1mg) and secondary amine (1 mmol) were stirred at room temperature for 5 min, and then ethanol (4 mL), NaN_3 (1.5 mmol, 65.1 mg) and sulfonyl chloride (1.5 mmol) were added gradually and reaction temperature was increased to 40 °C and stirred until the enaminoester intermediate was fully consumed (reaction was monitored with TLC). After cooling to room temperature, the solvent was removed under reduced pressure and the crude reaction mixture was purified by column chromatography on silica gel column (ethyl acetate /petroleum ether) to afford the desired products.

3. Crystal Structure of Products 5c and 5r

The single crystals of **5c** *(E-syn)* and **5r** *(E-anti)* were obtained with suitable quality from their *E-syn/anti* mixture respectively (DCM was solvent), and analyzed by single crystal diffractometer (SuperNova, Dual, Cu at zero, AtlasS2). Atomic coordinates, bond lengths, bond angles, and thermal parameters have been deposited at the Cambridge Crystallographic Data Centre. CCDC deposit number are 2055587 (**5c**) and 2055586 (**5r**) respectively.

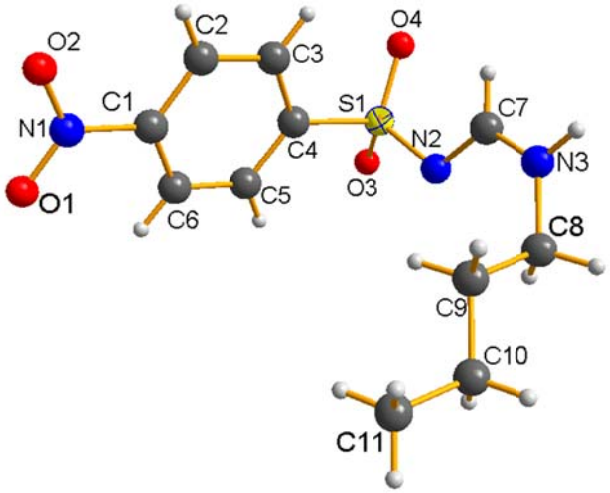


Figure S1: Crystal XRD image of **5c** (*E-syn*)

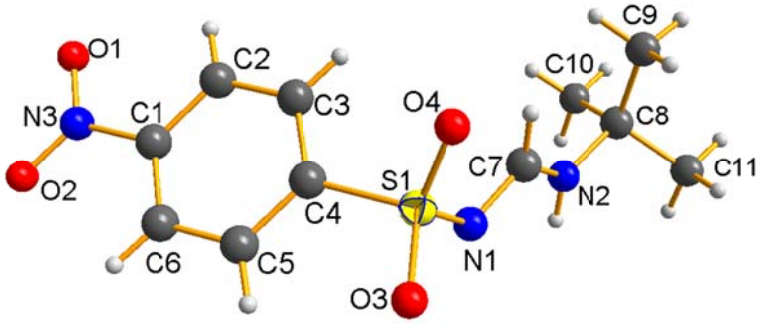


Figure S2: Crystal XRD image of **5r** (*E-anti*)

Table 1 Crystal data and structure refinement for compounds 5c and 5r.

Compound	**5c**	**5r**
Empirical formula	$C_{11}H_{15}N_3O_4S$	$C_{11}H_{15}N_3O_4S$
Formula weight	285.32	285.32
Temperature/K	150.00(10)	100.01(10)
Crystal system	monoclinic	orthorhombic
Space group	$P2_1/c$	Pccn
a/Å	6.2139(3)	9.2057(7)
b/Å	18.1514(10)	24.8117(16)
c/Å	12.4052(7)	12.0592(8)
α/°	90	90
β/°	97.612(5)	90
γ/°	90	90
Volume/Å^3	1386.86(13)	2754.4(3)
Z	4	8
ρ_{calc}g/cm^3	1.366	1.376
μ/mm^{-1}	0.247	0.249
F(000)	600.0	1200.0
Crystal size/mm^3	0.14 × 0.13 × 0.12	0.14 × 0.12 × 0.11
Radiation	Mo Kα (λ = 0.71073)	Mo Kα (λ = 0.71073)
2Θ range for data collection/°	4 to 49.994	4.72 to 49.992
Index ranges	$-5 \le h \le 7$, $-21 \le k \le 17$, $-14 \le l \le 12$	$-7 \le h \le 10$, $-29 \le k \le 23$, $-10 \le l \le 14$
Reflections collected	5763	7104
Independent reflections	2451 [R_{int} = 0.0246, R_{sigma} = 0.0346]	2427 [R_{int} = 0.0271, R_{sigma} = 0.0292]
Data/restraints/parameters	2451/7/173	2427/0/175
Goodness-of-fit on F^2	1.078	1.076
Final R indexes [I>=2σ (I)]	R_1 = 0.0413, wR_2 = 0.1061	R_1 = 0.0414, wR_2 = 0.0994
Final R indexes [all data]	R_1 = 0.0483, wR_2 = 0.1132	R_1 = 0.0482, wR_2 = 0.1044
Largest diff. peak/hole / e Å^{-3}	0.59/-0.38	0.25/-0.41

4. The Mechanistic Investigation

4.1. NMR monitoring study for the crude reaction mixture

In a 5mL screw cap vial with a stir bar tosyl azide (0.75 mmol) and ethyl 3-(butylamino) acrylate were dissolved in acetonitrile (2.0 mL) and stirred at room temperature for 4h, solvent was removed and then recorded the ^{1}H NMR spectra of cured reaction mixture.

From a crude ^{1}H NMR spectrum of the reaction mixture (Figure S3. section 2) we observed the desired product **5a** and *N*-butyltosyl amide as well as 4-ethoxycarbonyl-1H-1,2,3-triazole, this result attributed that this reaction could generate other by-products beside the ethyldiazoacetate .

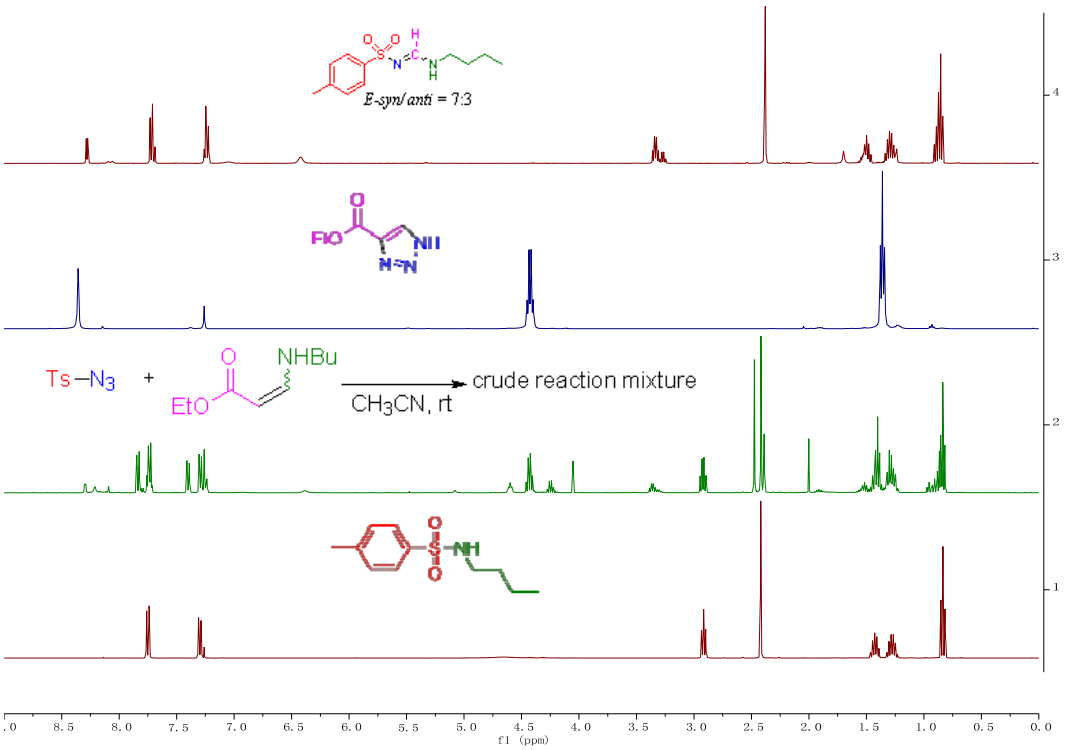
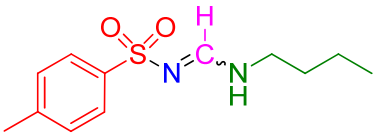
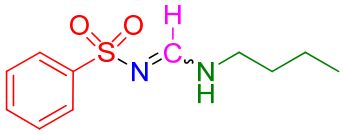


Figure S3: ^{1}**H NMR of crude reaction mixture**

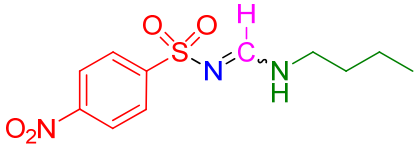
5. Characterization of the Products



***N*-butyl-*N'*-tosylformimidamide (E-*syn*/*anti*=7:3)** (**5a**): yellow oil, 41.4 mg, 67% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.28 (d, *J*=5.2 Hz, 0.70H), 8.07 (d, *J*=13.6 Hz, 0.3H), 7.71 (t, *J*=8.8 Hz, 2H), 7.25 (t, *J*=8.8 Hz, 2H), 7.05(bs, 0.3H), 6.42 (bs, 0.7H), 3.33 (q, *J*=6.8Hz, 1.4H), 3.6 (q, *J*=6.8 Hz, 0.6H), 2.38 (s, 3H), 1.70, 1.52-1.46 (m, 2H), 1.33-1.23 (m, 2H), 0.91-0.83 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.30, 157.90, 142.87, 142.53, 139.28, 138.90, 129.49, 129.33, 126.37, 126.34, 46.19, 41.55, 32.43, 30.43, 21.46, 19.84, 19.48, 13.58, 13.49. HRMS (ESI): calculated for $C_{12}H_{19}N_2O_2S$ $[M+H]^+$: 255.1162; found: 255.1166.

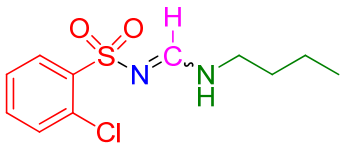


***N*-butyl-*N'*-(phenylsulfonyl)formimidamide (E-*syn*/*anti*=7:3)** (**5b**): yellow oil, 96.1 mg, 80% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.32(d, *J*=5.2 Hz, 0.7H), 8.13 (d, *J*=13.2 Hz, 0.3H), 7.85 (t, *J*=6.8 Hz, 2H), 7.55-7.44 (m, 3H), 7.28, 6.77 (bs, 0.7H), 3.39-3.31 (m, 2H), 1.56-1.48 (m, 2H), 1.60-1.50 (m, 2H), 1.35-1.26 (m, 2H), 0.93-0.85 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.37, 158.11, 142.26, 141.77, 132.26, 131.93, 128.95, 128.75, 126.36, 46.34, 41.62, 32.38, 30.45, 19.85, 19.50, 13.56, 13.47. HRMS (ESI): calculated for $C_{11}H_{17}N_2O_2S$ $[M+H]^+$: 241.1005; found: 241.1006.

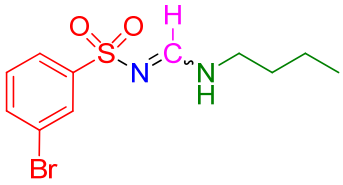


***N*-butyl-*N'*-((4-nitrophenyl)sulfonyl)formimidamide (E-*syn*/*anti*=7:3)** (**5c**): white solid, 114.1 mg, 80% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.31-8.29 (m, 2.7H), 8.12 (d, *J*=13.6 Hz, 0.3H), 8.06-8.01(m, 2H), 7.25, 6.76 (bs, 0.3H), 6.30 (bs, 0.7H),

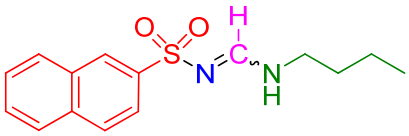
3.42-3.34 (m, 2H), 1,60-1.50 (m, 2H), 1.35-1.27 (m, 2H), 0.94-0.86 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.70, 158.16, 149.72, 149.64, 147.80, 147.51, 127.78, 124.14, 124.05, 46.39, 41.85, 32.32, 30.42, 19.81, 19.47, 13.53, 13.45. HRMS (ESI): calculated for $C_{11}H_{16}N_3O_4S$ $[M+H]^+$: 286.0856; found: 286.0869.



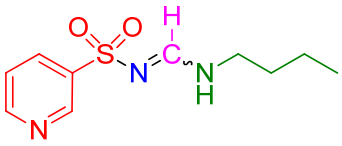
***N*-butyl-*N*'-((2-chlorophenyl)sulfonyl)formimidamide (E-*syn*/*anti*=7:3)** (**5d**): yellow oil, 127.6 mg, 93% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.43 (d, *J*= 5.2Hz, 0.7H), 8.19 (d, *J*= 15 Hz, 0.3H), 8.16 (d, *J*= 8 Hz, 0.7H), 8.11 (d, *J*= 8 Hz, 0.3H), 7.46-7.34 (m, 3H), 7.25, 6.74 (bs, 0.7H), 3.38-3.30 (m, 2H), 1.56-1.47 (m, 2H), 1.33-1.25 (m, 2H), 0.90-0.82 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.12, 159.91, 138.80, 138.58, 133.42, 133.18, 131.77, 131.63, 131.44, 130.27, 130.12, 127.07, 126.96, 46.35, 41.69, 32.37, 30.37, 19.77, 19.44, 13.54, 13.46. HRMS (ESI): calculated for $C_{11}H_{16}ClN_2O_2S$ $[M+H]^+$: 275. 0616; found: 275. 0610.



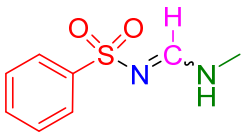
***N*'-((3-bromophenyl)sulfonyl)-*N*-butylformimidamide (E-*syn*/*anti*=7:3)** (**5e**): yellow oil, 144.2 mg, 90% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.28(d, *J*=5.2 Hz, 0.7H), 8.07(d, *J*=13.2 Hz, 0.3H), 7.98-7.94 (m, 1H), 7.78-7.73 (m, 1H), 7.64-7.61 (m, 1H), 7.35-7.30 (m, 1H), 7.25, 7.18 (bs, 0.3H), 6.69 (bs, 0.7H), 3.38-3.30 (m, 2H), 1.78, 1.55-1.48 (m, 2H), 1.34-1.27 (m, 2H), 0.92-0.84 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.65, 158.25, 143.99, 143.62, 135.20, 134.96, 130.49, 130.35, 129.34, 129.32, 124.96, 124.91, 122.79, 122.62, 46.38, 41.71, 32.32, 30.40, 19.83, 19.49, 13.57, 13.48. HRMS (ESI): calculated for $C_{11}H_{16}BrN_2O_2S$ $[M+H]^+$: 319.0110; found: 319.0102.



***N*-butyl-*N'*-(naphthalen-2-ylsulfonyl)formimidamide (E-*syn*/*anti*=7:3) (5f)**: white solid, 114.1 mg, 79% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.41(s, 1H), 8.40 (s, 0.7H), 8.17 (bs, 0.3H), 7.90-7.77 (m, 4H), 7.61-7.51(m, 2H), 7.35 (bs, 0.3H), 7.25, 6.80 (bs, 0.7H), 3.36-3.28 (m, 2H), 1.54-1.46 (m, 2H), 1.28-1.23 (m, 2H), 0.87-0.78 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.53, 158.26, 139.09, 138.69, 134.58, 134.49, 132.14, 129.25, 129.15, 129.03, 129.00, 128.54, 128.34, 127.85, 127.80, 127.41, 127.38, 127.24, 127.22, 127.04, 126.98, 122.30, 122.11, 46.31, 41.63, 32.38, 30.39, 19.83, 19.48, 13.54, 13.46. HRMS (ESI): calculated for $C_{15}H_{19}N_2O_2S$ $[M+H]^+$: 291.1162; found: 291.1171.

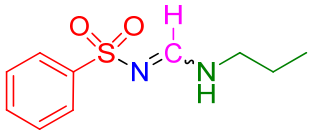


***N*-butyl-*N'*-(pyridin-3-ylsulfonyl)formimidamide (E-*syn*/*anti*=8:2) (5g)**: yellow oil, 90.0 mg, 75% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 9.03 (s, 1H), 8.71 (d, *J*= 4 Hz, 1H), 8.30 (d, *J*=5.2 Hz, 0.8H), 8.16-8.10 (m, 1.2H), 7.42-7.39 (m, 1H), 7.28 (bs, 0.2H), 6.85 (bs, 0.8H), 3.39-3.32 (m, 2H), 1.58-1.48 (m, 2H), 1.35-1.27 (m, 2H), 0.92-0.84 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.68, 158.12, 152.52, 152.33, 147.36, 138.82, 138.56, 134.30, 134.20, 123.59, 123.51, 46.34, 41.77, 32.34, 30.40, 19.82, 19.48, 13.53, 13.46. HRMS (ESI): calculated for $C_{10}H_{16}N_3O_2S$ $[M+H]^+$: 242.0958; found: 242.0972.

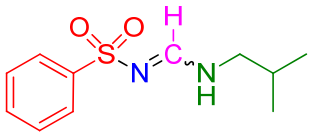


***N*-methyl-*N'*-(phenylsulfonyl)formimidamide (E-*syn*/*anti*=8:2) (5i)**: yellow oil, 54.5 mg, 55% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.28 (d, *J*=5.2 Hz, 0.8H), 8.07 (d, *J*=13.6 Hz, 0.2H), 7.85-7.80 (m, 2H), 7.52-7.42 (m, 3H), 7.10 (bs, 0.2H), 6.84 (bs, 0.8H), 3.04 (d, *J*=4.8 Hz, 0.4H), 2.91 (d, *J*=4.8 Hz, 2.6H).^{13}C NMR (100 MHz, $CDCl_3$)

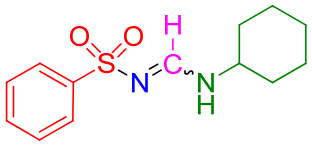
δ 161.44, 158.72, 141.97, 141.69, 132.25, 132.06, 128.93, 128.81, 126.36, 126.30, 28.45. HRMS (ESI): calculated for $C_8H_{11}N_2O_2S$ $[M+H]^+$: 199.0536; found: 199.0533.



***N'*-(phenylsulfonyl)-*N*-propylformimidamide (E-*syn*/*anti*=7:3)** (**5j**): yellow oil, 78.6 mg, 70% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.30 (d, *J*= 5.2 Hz, 0.7H), 8.09 (d, *J*=14 Hz, 0.3H), 7.83-7.79 (m, 2H), 7.53-7.41 (m, 3H), 7.30 (bs, 0.3H), 6.81 (bs, 0.7H), 3.32-3.22 (m, 2H), 1.60-1.49 (m, 2H), 0.91-0.84 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.59, 158.18, 142.16, 141.79, 132.19, 131.93, 128.91, 128.75, 126.28, 126.27, 48.15, 43.51, 23.68, 21.70, 11.18, 10.80. HRMS (ESI): calculated for $C_{10}H_{15}N_2O_2S$ $[M+H]^+$: 227.0849; found: 227.0840.

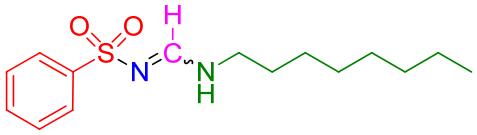


***N*-isobutyl-*N'*-(phenylsulfonyl)formimidamide (E-*syn*/*anti*=7:3)**(**5k**): yellow oil, 84.1 mg, 70% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.38(d, *J*=4.8 Hz, 0.7H), 8.10 (d, *J*=12.8Hz, 0.3H), 7.85 (t, *J*=7.2 Hz, 2H), 7.52-7.44 (m, 3H), 7.33 (bs, 0.3H), 6.68 (bs, 0.7H), 3.21 (t, *J*=6.4 Hz, 1.4H), 3.13 (t, *J*=6.4 Hz, 0.6H), 1.88-1.80 (m, 1H), 0.93-0.89 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.80, 158.36, 142.23, 141.79, 132.22, 131.91, 128.94, 128.74, 126.38, 53.95, 49.11, 29.27, 27.72, 19.96, 19.52. HRMS (ESI): calculated for $C_{11}H_{17}N_2O_2S$ $[M+H]^+$: 241.1005; found: 241.1009.

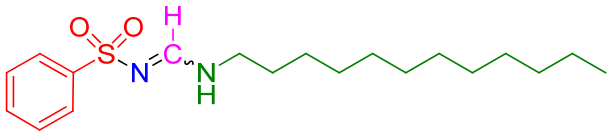


***N*-cyclohexyl-*N'*-(phenylsulfonyl)formimidamide (E-*syn*/*anti*=7:3)**(**5l**): yellow oil, 110.5 mg, 83% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.29 (d, *J*=4.4 Hz, 0.7H), 8.20(d, *J*=13.2 Hz, 0.3H), 7.87-7.86 (m, 2H), 7.54-7.45 (m, 3H), 7.19 (bs, 0.3H), 6.42 (bs, 0.7H), 3.86 (bs, 0.7H), 3.31 (bs, 0.3H), 1.91-1.61 (m, 5H), 1.35-1.19 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.82, 157.11, 142.37, 141.88, 132.18, 131.85, 128.92,

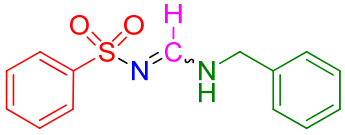
128.73, 126.40, 55.76, 50.66, 33.74, 32.00, 25.25, 24.77, 24.50, 24.40. HRMS(ESI): calculated for $C_{13}H_{19}N_2O_2S$ $[M+H]^+$: 267.1162; found: 267.1165.



***N*-octyl-*N'*-(phenylsulfonyl)formimidamide (E-*syn*/*anti*=7:3)** (**5m**): yellow oil, 94.6 mg, 64% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.29 (d, *J*=5.6 Hz, 0.7H), 8.08(d, *J*=13.6 Hz, 0.3H), 7.89-7.79 (m, 2H), 7.53-7.40 (m, 3H), 7.34 (bs, 0.3H), 6.86 (d, *J*=4.8 Hz, 0.7H), 3.34-3.24 (m, 2H), 1.55-1.45 (m, 2H), 1.22-1.17 (m, 10H), 0.86-0.81 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.54, 158.15, 142.21, 141.83, 132.17, 131.90, 128.90, 128.73, 126.27, 126.24, 46.56, 41.87, 31.69, 31.66, 30.38, 29.05, 28.96, 28.37, 26.65, 26.28, 22.56, 14.03. HRMS(ESI): calculated for $C_{15}H_{25}N_2O_2S$ $[M+H]^+$: 297.1631; found: 297.1634.

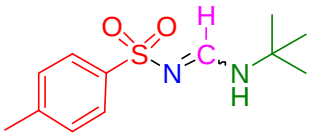


***N*-dodecyl-*N'*-(phenylsulfonyl)formimidamide (E-*syn*/*anti*=7:3)** (**5n**): yellow oil, 107.7 mg, 61% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.31 (d, *J*=5.2 Hz, 0.7H), 8.09 (d, *J*=13.6 Hz, 0.3H), 7.85-7.81 (m, 2H), 7.51-7.42 (m, 3H), 7.13 (bs, 0.3H), 6.51 (bs, 0.7H), 3.36-3.26 (m, 2H), 1.53-1.47 (m, 2H), 1.28-1.19 (m, 18H), 0.88-0.84 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.35, 157.98, 142.17, 141.78, 132.66, 132.17, 131.89, 129.08, 128.88, 128.71, 126.37, 126.34, 46.55, 41.91, 31.89, 31.88, 30.42, 29.58, 29.51, 29.48, 29.42, 29.40, 29.31, 29.11, 29.02, 28.46, 26.67, 26.30, 22.65, 14.09. HRMS (ESI): calculated for $C_{19}H_{33}N_2O_2S$ $[M+H]^+$: 353.2257; found: 353.2250.

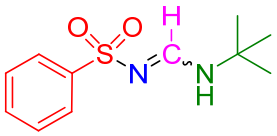


***N*-benzyl-*N'*-(phenylsulfonyl)formimidamide (E-*syn*/*anti*=8:2)** (**5o**): white solid, 76.4 mg, 53% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.35 (d, *J*=5.2 Hz, 0.8H),

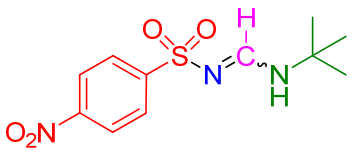
8.23(d, *J*=12.8 Hz, 0.2H), 7.82-7.75 (m, 2H), 7.50 (t, *J*=7.6 Hz, 1H), 7.42 (t, *J*=8 Hz, 2H), 7.34-7.20 (m, 5H), 6.56 (bs, 0.8H), 4.51 (d, *J*=5.6 Hz, 1.6H), 4.46 (d, *J*=6.4 Hz, 0.4H), ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.64, 157.68, 141.88, 141.48, 135.83, 135.70, 132.23, 132.02, 129.09, 128.74, 128.43, 128.08, 127.37, 126.41, 77.33, 77.22, 77.01, 76.70, 50.00, 45.86. HRMS (ESI): calculated for $C_{14}H_{15}N_2O_2S$ $[M+H]^+$: 275.0849; found: 275.0845.



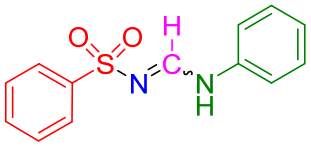
***N*-tert-butyl-*N'*-tosylformimidamide (E-*syn*/*anti*=3:7)** (**5p**): white solid, 82.4 mg, 65% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.36 (d, *J*=5.6 Hz, 0.3H), 8.23 (d, *J*=14 Hz, 0.7H), 7.70 (d, *J*=8.4 Hz, 2H), 7.24-7.19 (m, 2H), 6.95 (d, *J*=12.8 Hz, 0.7H), 6.56 (d, *J*=5.6 Hz, 0.3H), 3.37 (s, 3H), 1.76, 1.36 (s, 2.7H), 1.31 (s, 6.3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.46, 157.37, 142.63, 142.13, 139.80, 139.16, 129.41, 129.20, 126.36, 126.12, 53.52, 53.23, 30.02, 28.14, 21.44, 21.42. HRMS (ESI): calculated for $C_{12}H_{19}N_2O_2S$ $[M+H]^+$: 255.1162; found: 255.1156.



***N*-tert-butyl-*N'*-(phenylsulfonyl)formimidamide (E-*syn*/*anti*=3:7)** (**5q**): white solid, 82.6 mg, 69% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.36(d, *J*=6Hz, 0.3H), 8.25(d, *J*=14Hz, 0.7H), 7.83(d, *J*=7.2Hz, 2H), 7.52-7.40(m, 3H), 7.25, 6.89(bs, 0.7H), 6.48(bs, 0.3H), 1.71, 1.37(s, 2.7H), 1.33(s, 6.3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.59, 157.49, 142.58, 141.97, 132.03, 131.67, 128.83, 128.63, 126.35, 126.09, 77.35, 77.23, 77.03, 76.71, 53.64, 53.32, 30.06, 30.03, 28.16. HRMS (ESI): calculated for $C_{11}H_{17}N_2O_2S$ $[M+H]^+$: 241.1005; found: 241.1002.

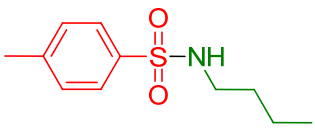


***N*-tert-butyl-*N'*-((4-nitrophenyl)sulfonyl)formimidamide (E-*syn*/*anti*=3:7)** (**5r**): white solid, 116.2 mg, 82% yield, ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.30-8.26 (m, 2.3H), 8.23 (s, 0.7H), 8.04-8.01 (m, 2H), 6.80 (d, *J*=13.6 Hz, 0.7H), 6.40 (bs, 0.3H), 1.68, 1.39 (s, 2.7H), 1.37 (s, 6.3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 157.76, 157.69, 149.65, 149.54, 148.17, 147.67, 127.75, 127.51, 124.10, 124.03, 54.17, 53.77, 30.07, 28.15. HRMS(ESI): calculated for $C_{10}H_{16}N_3O_2S$ $[M+H]^+$: 286.0856; found: 286.0852.



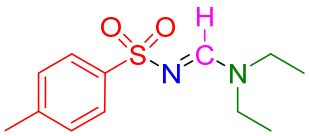
***N*-phenyl-*N'*-(phenylsulfonyl)formimidamide (E-*syn*/*anti*=1:1)(5t)**: white solid, 55.9 mg, 43% yield. ^{1}H-NMR (400 MHz, DMSO-d_6) δ 11.32 (bs, 0.5H), 11.09 (bs, 0.5H), 8.78 (s, 0.5H), 8.30 (s, 0.5H), 7.91-7.86 (m, 2H), 7.69-7.57 (m, 4H), 7.41-7.32 (m, 3H), 7.21-7.16 (m, 1H), ^{13}C NMR (100 MHz, DMSO-d_6) δ 157.75, 155.32, 142.39, 142.35, 138.52, 138.01, 132.78, 132.71, 130.07, 129.67, 129.55, 129.51, 126.77, 126.63, 125.73, 125.52, 121.25, 118.48. HRMS (ESI): calculated for $C_{13}H_{13}N_2O_2S$ $[M+H]^+$: 261.0692; found: 261.0691.

4-ethoxycarbonyl-1H-1,2,3-triazole[1]**:** white solid, 49.5 mg, 70%. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 14.49 (s, 1H), 8.35 (s, 1H), 4.44-4.40 (m, 2H), 1.35 (t, *J*=7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.14, 139.08, 131.40, 61.70, 14.14.

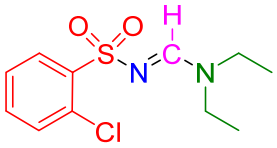


***N*-butyl-4-methylbenzenesulfonamide**[2]**:** white solid. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J*=8 Hz, 2H), 7.29 (d, *J*=8 Hz, 2H), 4.66 (bs, 1H), 2.91 (t, *J*=7.2 Hz,

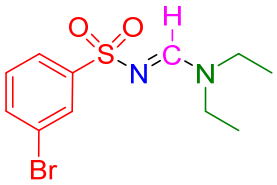
2H), 2.41 (s, 1H), 1.45-1.39 (m, 2H), 1.32-1.23 (m, 2H), 0.83 (t, *J*=7.2Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.27, 136.96, 129.64, 127.07, 42.88, 31.52, 21.48, 19.66, 13.49.



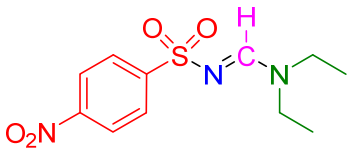
***N,N*-diethyl-*N'*-tosylformimidamide (7a)**[3]: white solid, 231.5 mg, 91% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.13 (s, 1H), 7.76 (d, *J*=8 Hz, 2H), 7.26-7.23 (m, 2H), 3.49-3.43 (m, 2H), 3.39-3.34 (m, 2H), 2.39 (s, 3H), 1.24 (t, *J*=7.2 Hz, 3H), 1.13 (t, *J*=7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.16, 142.36, 139.91, 129.37, 126.47, 47.15, 41.02, 29.80, 21.57, 14.62, 12.20



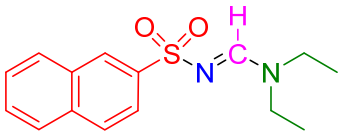
***N'*-((2-chlorophenyl)sulfonyl)-*N,N*-diethylformimidamide (7b)**[3]: white solid, 230.8 mg, 84% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.27 (s, 1H), 8.20 (d, *J*=7.6 Hz, 1H), 7.42-7.34 (m, 3H), 3.49-3.44 (m, 2H), 3.43-3.38 (m, 2H), 1.27 (t, *J*=7.2 Hz, 3H), 1.13 (t, *J*=7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.03, 139.14, 132.99, 131.60, 131.35, 130.35, 126.95, 47.20, 41.17, 14.58, 12.00.



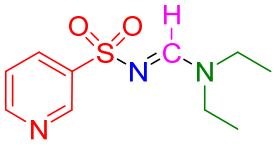
***N'*-((3-bromophenyl)sulfonyl)-*N,N*-diethylformimidamide (7c)**[4]: white solid, 257.6 mg, 81% yield. ^{1}H-NMR (400 MHz, DMSO-d_6) δ 8.19 (s, 1H), 7.81-7.80 (m, 1H), 7.49-7.48 (m, 1H), 7.09-7.07 (m, 1H), 3.50-3.44 (m, 2H), 3.39-3.34 (m, 2H), 1.13 (t, *J*=7.2 Hz, 3H), 1.05(t, *J*=7.2 Hz, 3H). ^{13}C NMR (100 MHz, DMSO-d_6) δ 160.50, 139.91, 134.05, 131.99, 130.97, 129.89, 128.02, 46.90, 41.00, 14.85, 12.23.



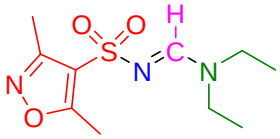
***N,N*-diethyl-*N'*-((4-nitrophenyl)sulfonyl)formimidamide** (**7d**)[5]: white solid, 251.2 mg, 88% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.32-8.29 (m, 2H), 8.16 (s, 1H), 8.08-8.05 (m, 2H), 3.52-3.47 (m, 2H), 3.45-3.40 (m, 2H), 1.29 (t, *J*=7.2 Hz, 3H), 1.16 (t, *J*=7.2Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.45, 149.65, 148.51, 127.81, 124.14, 47.55, 41.44, 14.59, 12.21.



***N,N*-diethyl-*N'*-(naphthalen-2-ylsulfonyl)formimidamide** (**7e**)[4]: white solid, 194.6 mg, 67% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.44 (s, 1H), 8.19 (s, 1H), 7.93-7.82 (m, 4H), 7.59-7.52 (m, 2H), 3.48-3.43 (m, 2H), 3.39-3.34 (m, 2H), 1.23(t, *J*=7.2 Hz, 3H), 1.11(t, *J*=7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.17, 139.49, 134.43, 132.17, 129.15, 128.91, 128.21, 127.78, 127.15, 126.87, 122.47, 47.12, 40.98, 14.45, 12.03.

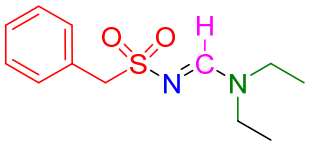


***N,N*-diethyl-*N'*-(pyridin-3-ylsulfonyl)formimidamide** (**7f**)[4]: yellow oil, 183.4 mg, 76% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 9.05 (d, *J*=2Hz, 1H), 8.70 (dd, *J*=6.4 Hz, 1.6 Hz, 1H), 8.17-8.15 (m, 2H), 7.40-7.37 (m, 1H), 3.50-3.45 (m, 2H), 3.42-3.36 (m, 2H), 1.26 (t, *J*=7.2 Hz, 3H), 1.14 (t, *J*=7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.24, 152.26, 147.46, 139.11, 134.04, 123.35, 47.28, 41.16, 14.41, 12.02.

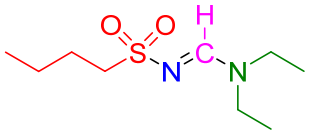


***N'*-((3,5-dimethylisoxazol-4-yl)sulfonyl)-*N,N*-diethylformimidamide** (**7g**)[4]: yellow oil, 243.8 mg, 94% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.08 (s, 1H), 3.48-3.42 (m, 2H), 3.40-3.35 (m, 2H), 2.59 (s, 3H), 2.36 (s, 3H), 1.25 (t, *J*=7.2 Hz,

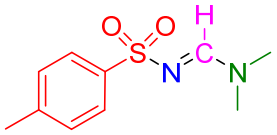
3H), 1.14 (t, *J*=7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 170.73, 157.72, 157.61, 118.65, 47.15, 41.06, 14.44, 12.49, 11.93, 10.85.



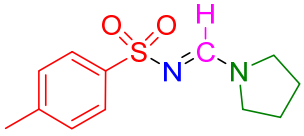
***N'*-(benzylsulfonyl)-*N*,*N*-diethylformimidamide (7h)**[4]: white solid, 185.6 mg, 73% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 7.41 (s, 1H), 7.33-7.29 (m, 5H), 4.25 (s, 2H), 3.44-3.39 (m, 2H), 3.15-3.09 (m, 2H), 1.14 (t, *J*=7.2 Hz, 3H), 1.03 (t, *J*=7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.42, 130.94, 130.45, 128.35, 128.19, 59.61, 46.74, 40.81, 14.40, 11.96.



***N'*-(butylsulfonyl)-*N*,*N*-diethylformimidamide (7i)**[6]: white solid, 196.2 mg, 89% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.03 (s, 1H), 3.50-3.45 (m, 2H), 3.39-3.34 (m, 2H), 3.02-2.98 (m, 2H), 1.78-1.71 (m, 2H), 1.46-1.40 (m, 2H), 1.25 (t, *J*=7.2 Hz, 3H), 1.18 (t, *J*=7.2 Hz, 3H), 0.92 (t, *J*=7.2 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.28, 53.63, 46.96, 40.83, 25.67, 21.56, 14.49, 13.60, 11.95.

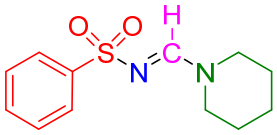


***N*,*N*-dimethyl-*N'*-tosylformimidamide (7j)**[6]: white solid, 226.4 mg, 85% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.14 (s, 1H), 7.78 (d, *J*=8 Hz, 2H), 7.27-7.25 (m, 2H), 3.12 (s, 3H), 3.02 (s, 3H), 2.40 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 158.20, 141.59, 138.71, 128.45, 125.68, 40.58, 34.66, 20.64.

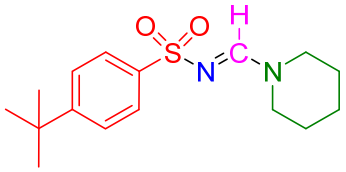


4-methyl-*N*-(pyrrolidin-1-ylmethylene)benzenesulfonamide (7k)[7]: white solid, 191.8 mg, 76% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.29 (s, 1H), 7.76 (d, *J*=8 Hz, 2H), 7.23 (d, *J*=8 Hz, 2H), 3.56 (t, *J*=6.4 Hz, 2H), 3.44 (t, *J*=6.4 Hz, 2H), 2.37 (s, 3H),

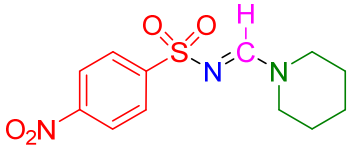
1.94-1.91 (m, 4H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 155.79, 142.33, 139.66, 129.26, 126.50, 49.93, 46.41, 24.99, 24.32, 21.44.



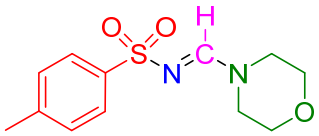
***N*-(piperidin-1-ylmethylene)benzenesulfonamide (7l)**[6]: white solid, 209.4 mg, 83% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.13 (s, 1H), 7.90-7.88 (m, 2H), 7.51-7.44 (m 3H), 3.61(t, *J*=5.6 Hz, 2H), 3.42 (t, *J*=5.6 Hz, 2H), 1.71-1.59 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.49, 142.71, 131.87, 128.81, 126.58, 52.08, 44.85, 26.58, 25.00, 24.11.



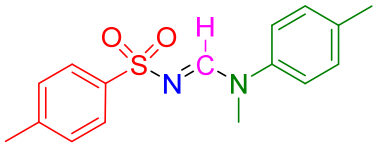
4-(tert-butyl)-*N*-(piperidin-1-ylmethylene)benzenesulfonamide (7m)[8]: white solid, 265 mg, 86% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.13 (s, 1H), 7.80 (d, *J*=8.4 Hz, 2H), 7.46(d, *J*=8.4 Hz, 2H), 3.60 (t, *J*=5.6 Hz, 2H), 3.40(t, *J*=5.6 Hz, 2H), 1.70-1.62 (m, 4H), 1.60-1.56 (m, 2H), 1.32 (s, 9H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.42, 155.41, 139.71, 126.35, 125.76, 51.99, 51.99, 44.75, 35.11, 31.24, 29.79, 26.52, 24.96, 24.07.



4-nitro-*N*-(piperidin-1-ylmethylene)benzenesulfonamide (7n)[9]: white solid, 252.8 mg, 85% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.32-8.29 (m, 2H), 8.14 (s, 1H), 8.08-8.05 (m, 2H), 3.63 (t, *J*=6.4 Hz, 2H), 3.48-3.45 (m, 2H), 1.72-1.70 (m, 4H), 1.65-1.60 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.56, 149.69, 148.46, 127.91, 124.16, 52.40, 45.14, 26.59, 25.03, 24.00.



4-methyl-*N*-(morpholinomethylene)benzenesulfonamide (**7o**)[6]: white solid, 158.4 mg, 59% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.17 (s, 1H), 7.75 (d, *J*=8.4Hz, 2H), 7.26-7.24 (m, 2H), 3.73 (t, *J*=4.8 Hz, 2H), 3.66 (s, 4H), 3.47 (t, *J*=4.8 Hz, 2H), 2.39 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.56, 142.67, 139.13, 129.36, 126.55, 66.78, 65.90, 50.27, 44.17, 21.47.



***N*-methyl-*N*-(p-tolyl)-*N'*-tosylformimidamide**(**7p**): white solid, 202.6 mg, 67% yield. ^{1}H-NMR (400 MHz, $CDCl_3$) δ 8.52 (s, 1H), 7.83 (d, *J*=8.4 Hz), 7.30-7.27 (m, 2H), 7.22 (d, *J*=8 Hz, 2H), 7.08 (d, *J*=8.4 Hz, 2H), 3.42(s, 3H), 2.40 (d, *J*=18.4 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 158.55, 142.98, 141.07, 139.33, 137.64, 130.58, 129.62, 126.96, 122.30, 36.40, 21.72, 21.10. HRMS (ESI): calculated for $C_{16}H_{19}N_2O_2S$ $[M+H]^+$: 303.1162; found: 303.1159.

6. References：

1. H. Cha, K. Lee, D. Y. Chi, *Tetrahedron.* 2017, **73**, 2878-2885.
2. P. Qu, C. Sun, J. Ma, F. Li, *Adv. Syn. Catal.* 2014. **356**, 447-459.
3. R. Ding, H. Chen, Y.-L. Xu, H.-T. Tang, Y.-Y. Chen, Y.-M. Pan, *Adv. Synth. Catal.* 2019, **361**, 3656-3660.
4. A. Rouzi, R. Hudabaierdi, A. Wusiman, *Tetrahedron.* 2018, **74**, 2475-2481.
5. S. Wang, Z. Wang, X. Zheng, *Chem. Commun.* 2009, **45**, 7372-7374.
6. W. Yang, D. Huang, X. Zeng, D. Luo, X. Wang, Y. Hu, *Chem. Commun.* 2018, **54**, 8222-8225.
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8. B. Huang, C. Yang, J. Zhou, W. Xia, *Chem. Commun.* 2020, **56**, 5010-5013.
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7. Copies of ^{1}H and ^{13}C NMR Spectra

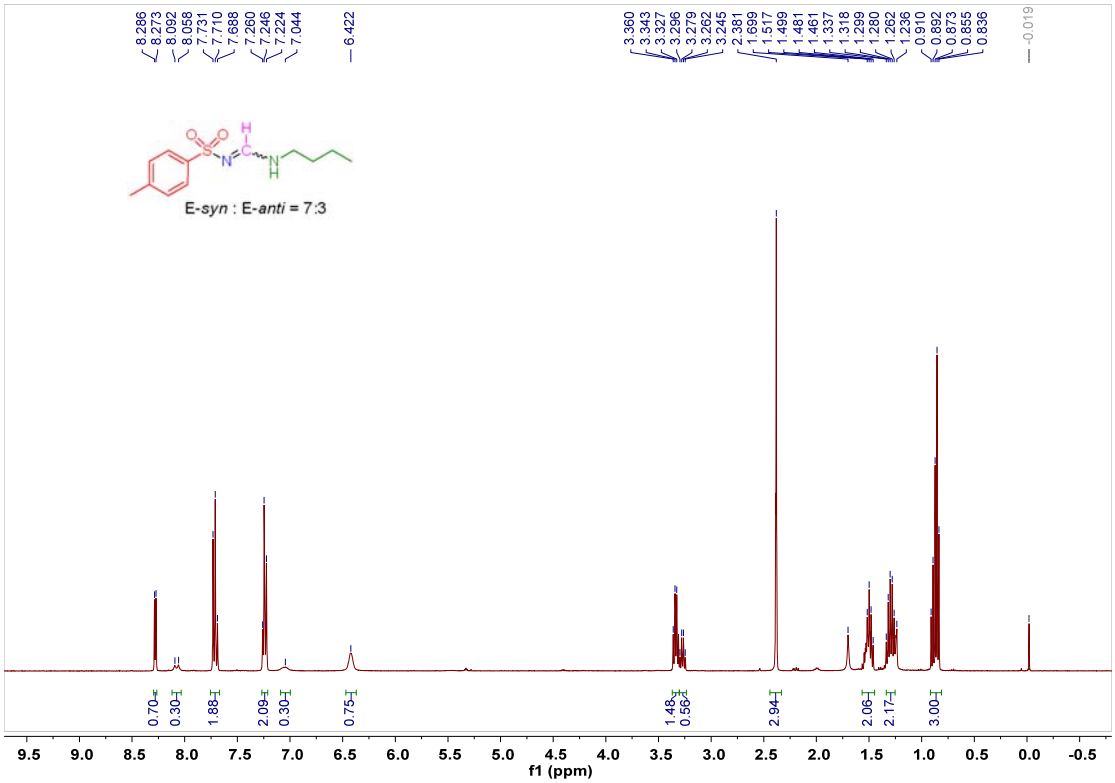

Figure S4: ^{1}H NMR of compound **5a**

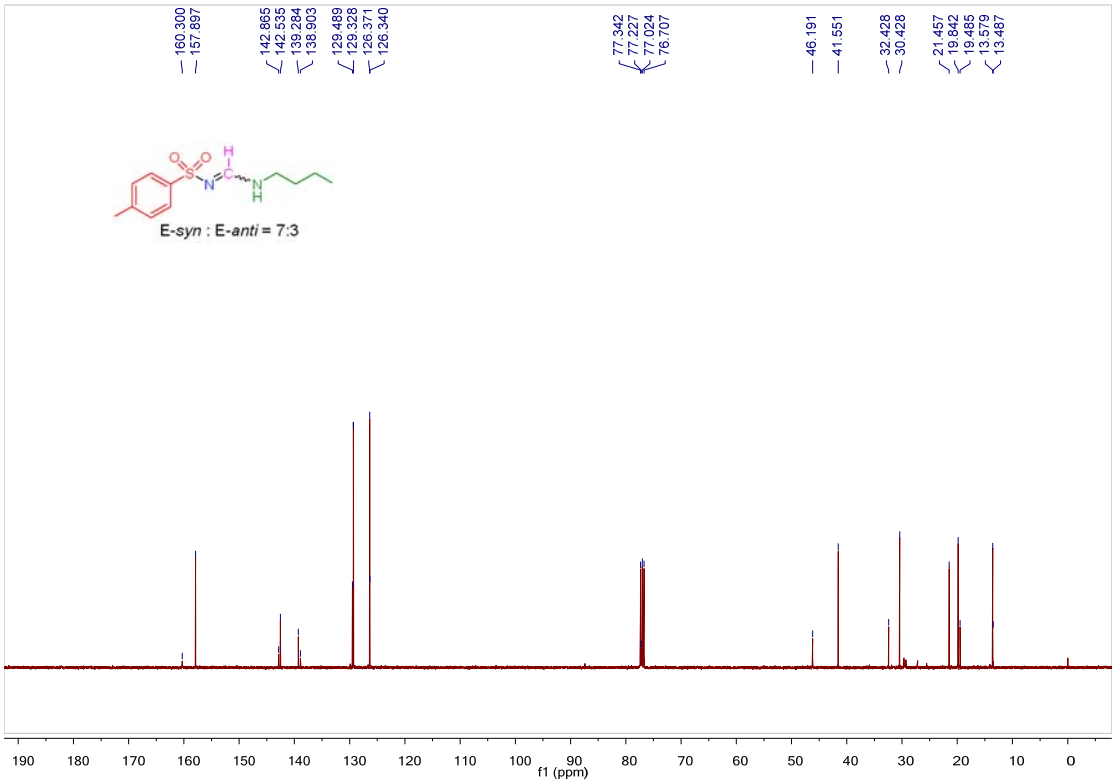

Figure S5: ^{13}C NMR of compound **5a**

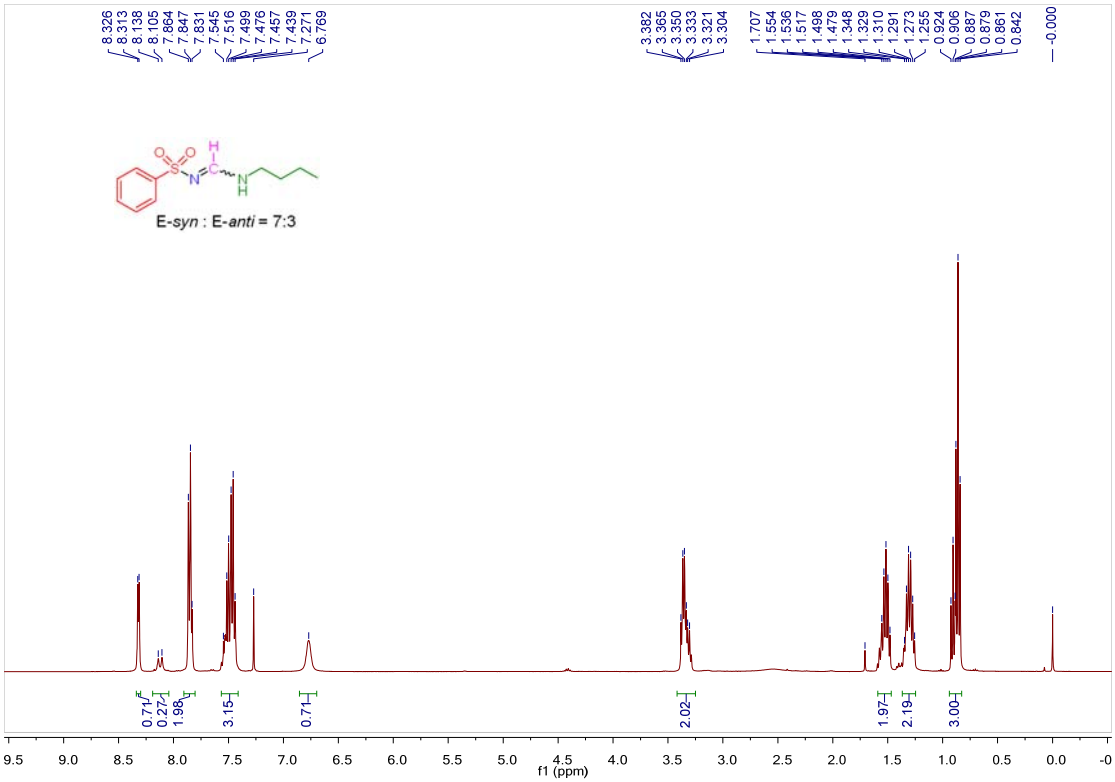

Figure S6: ^{1}H NMR of compound **5b**

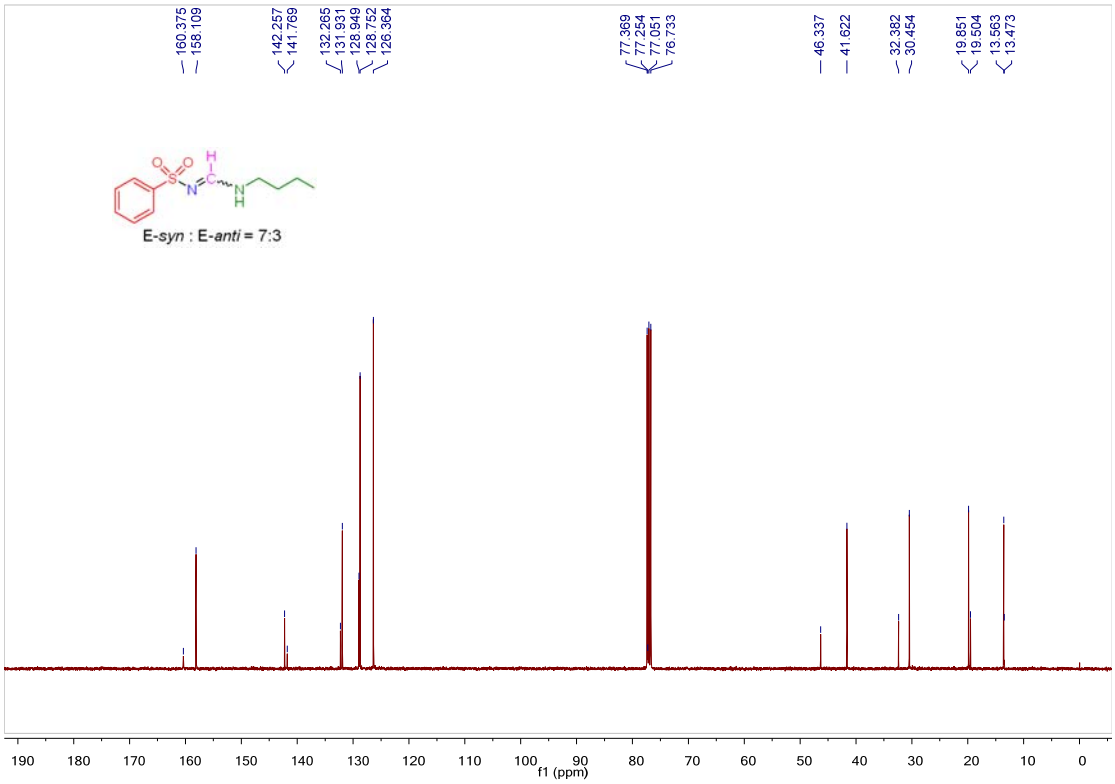

Figure S7: ^{13}C NMR of compound **5b**

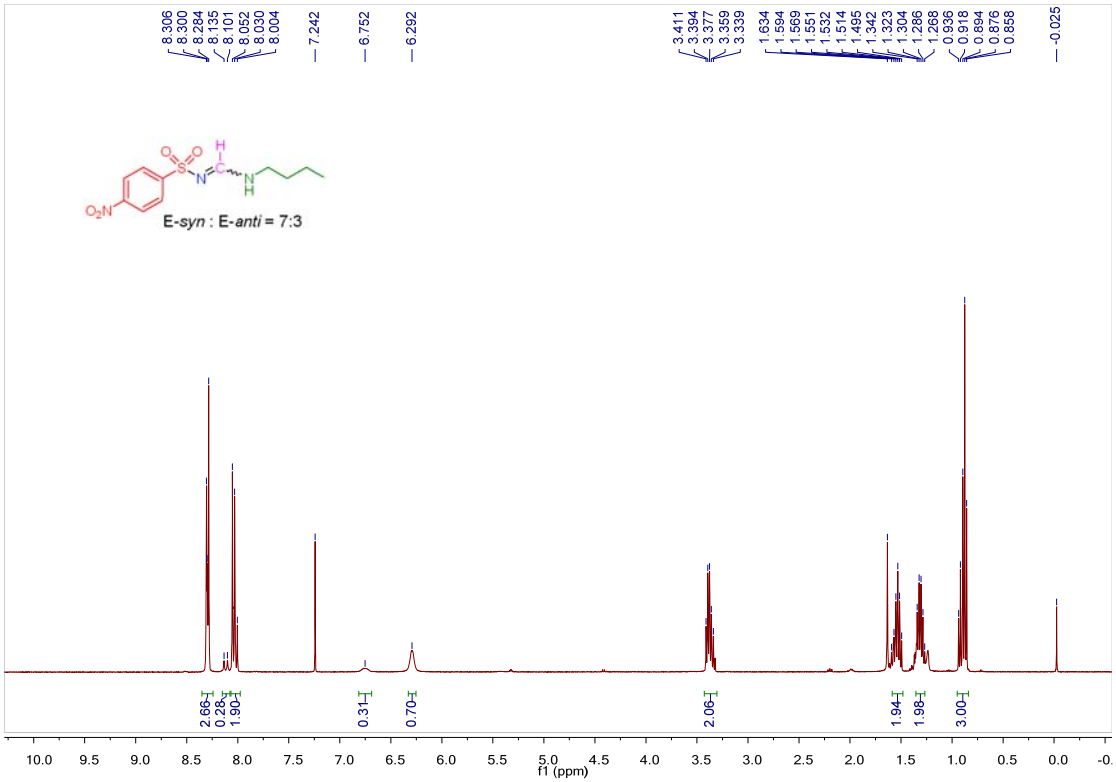

Figure S8: ^{1}H NMR of compound **5c**

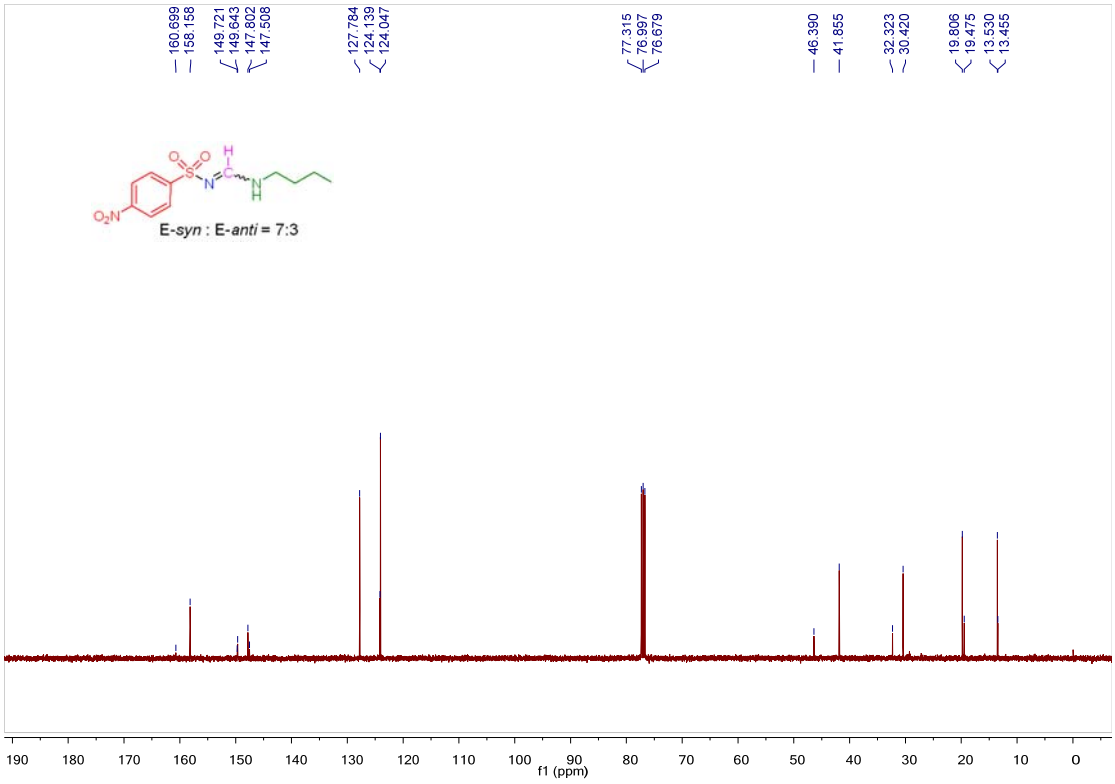

Figure S9: ^{13}C NMR of compound **5c**

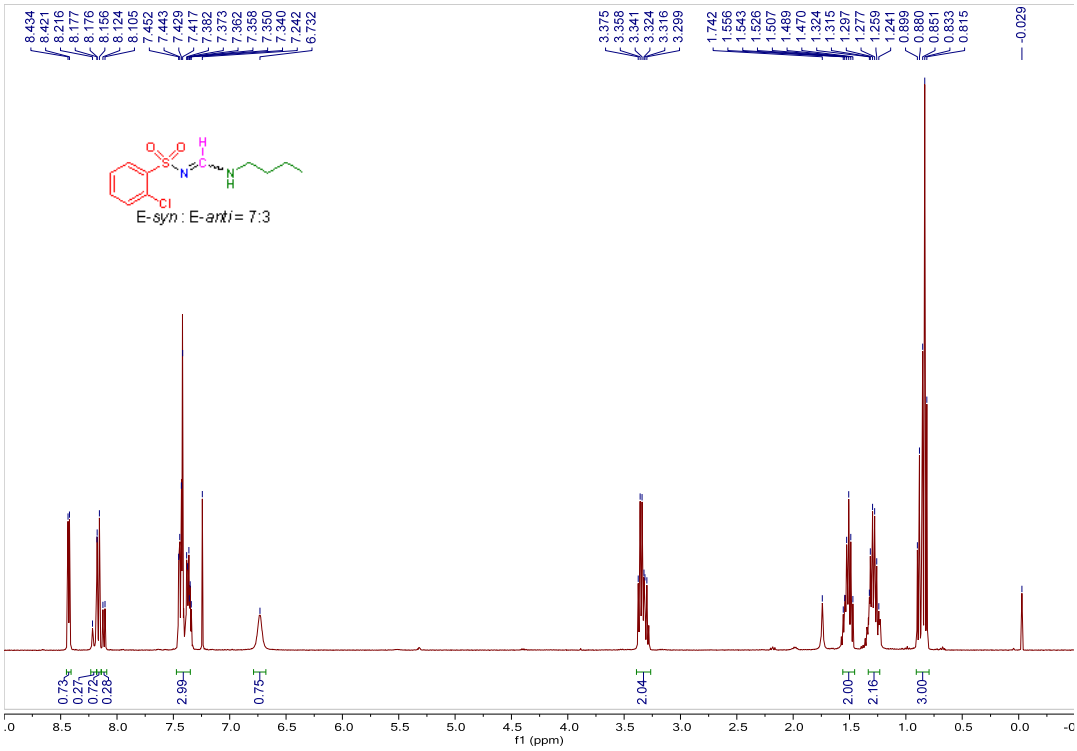

Figure S10: ^{1}H NMR of compound **5d**

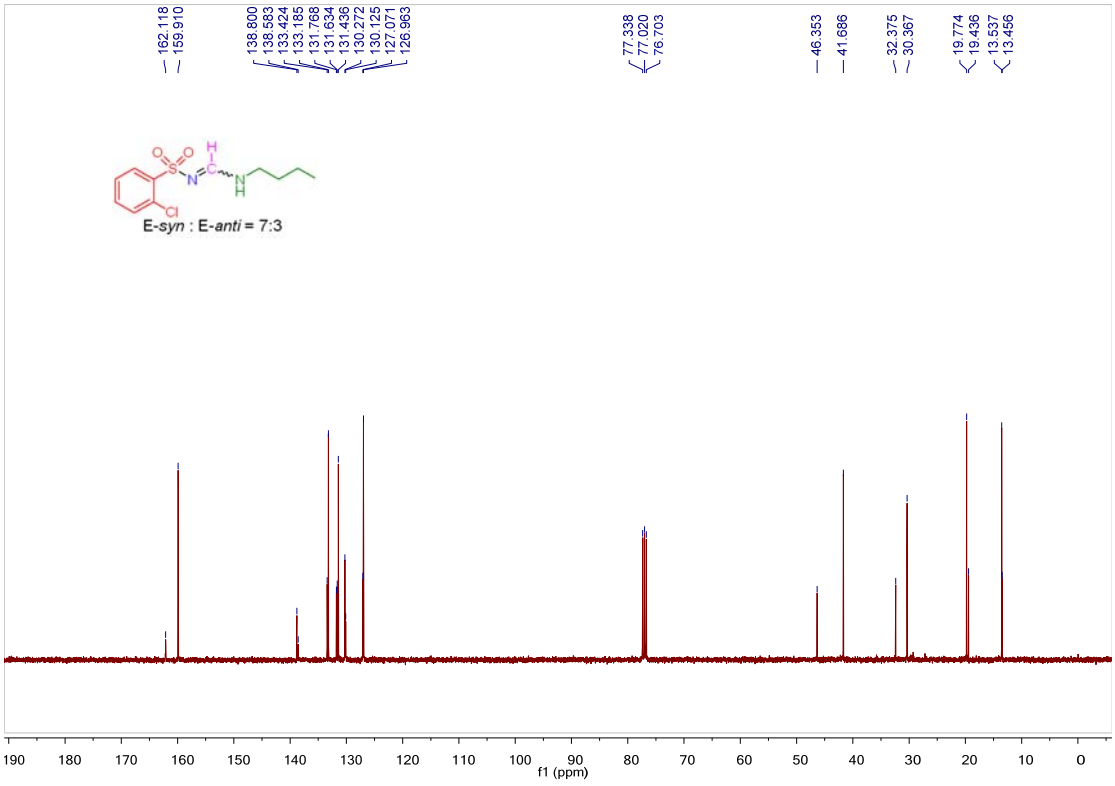

Figure S11: ^{13}C NMR of compound **5d**

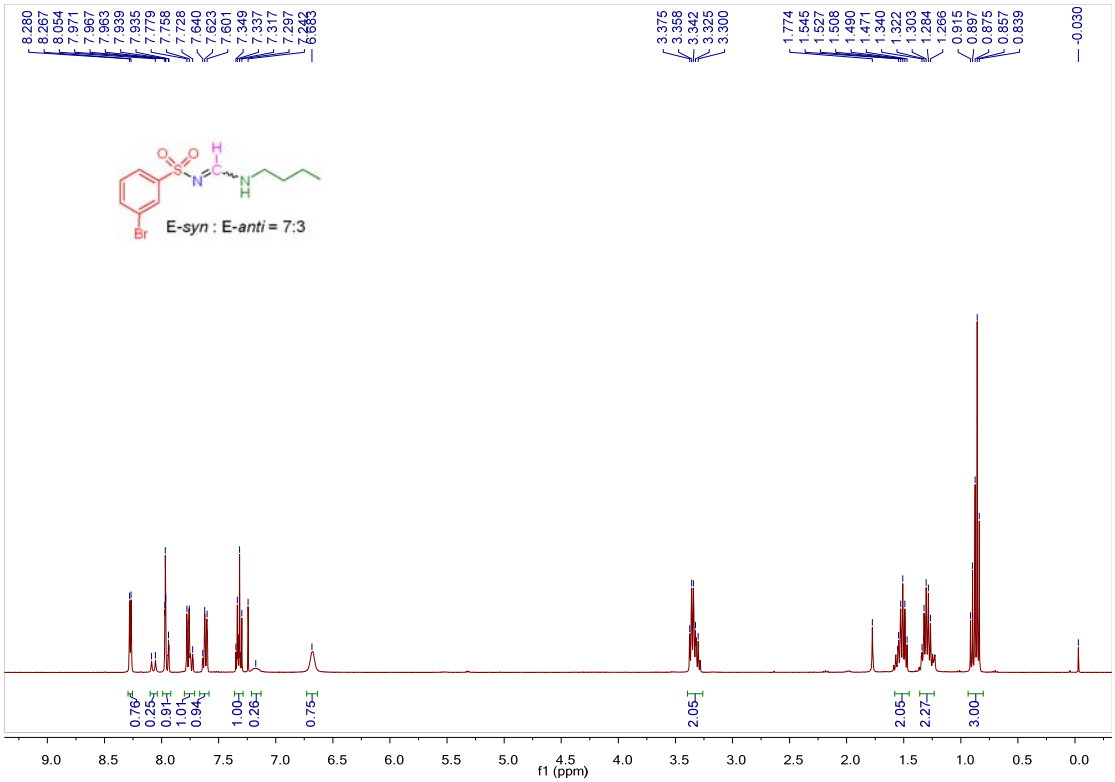

Figure S12: ^{1}H NMR of compound **5e**

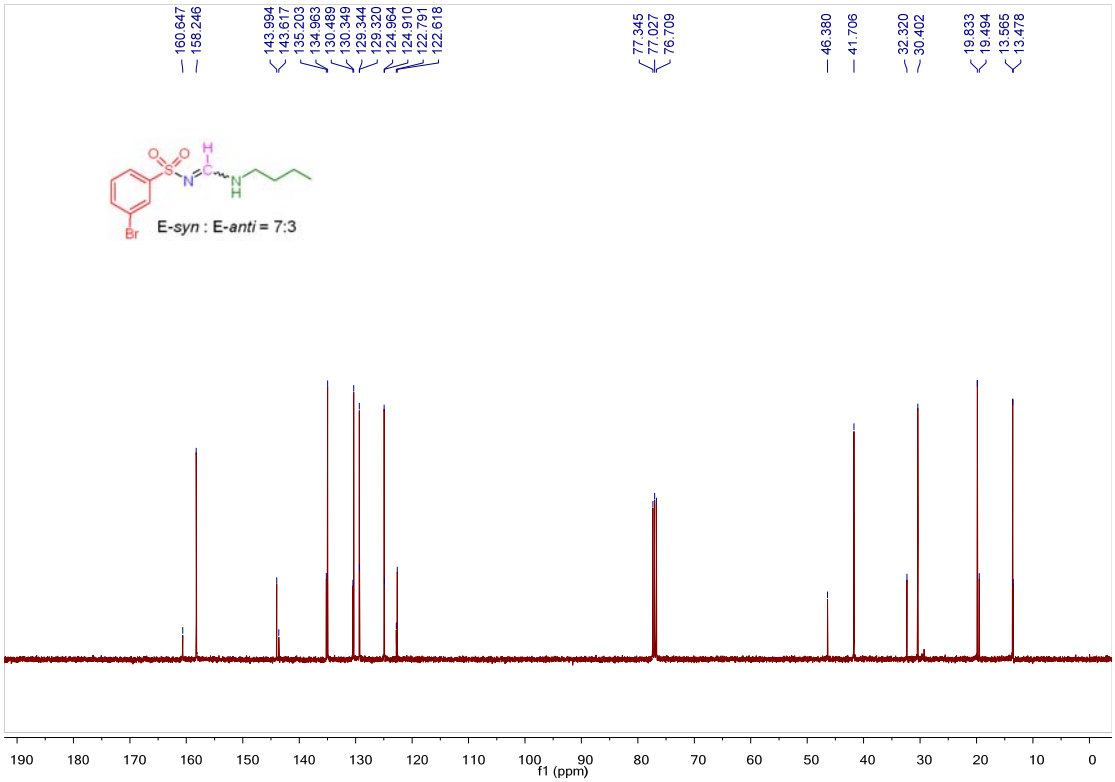

Figure S13: ^{13}C NMR of compound **5e**

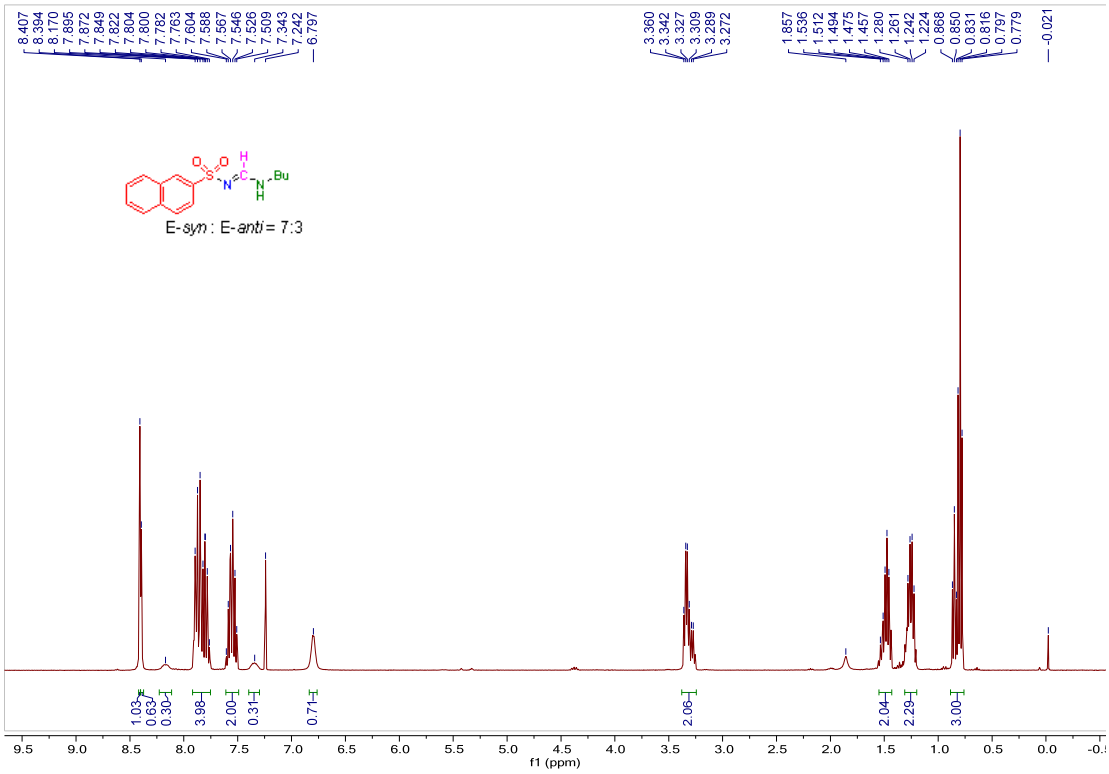

Figure S14: ^{1}H NMR of compound **5f**

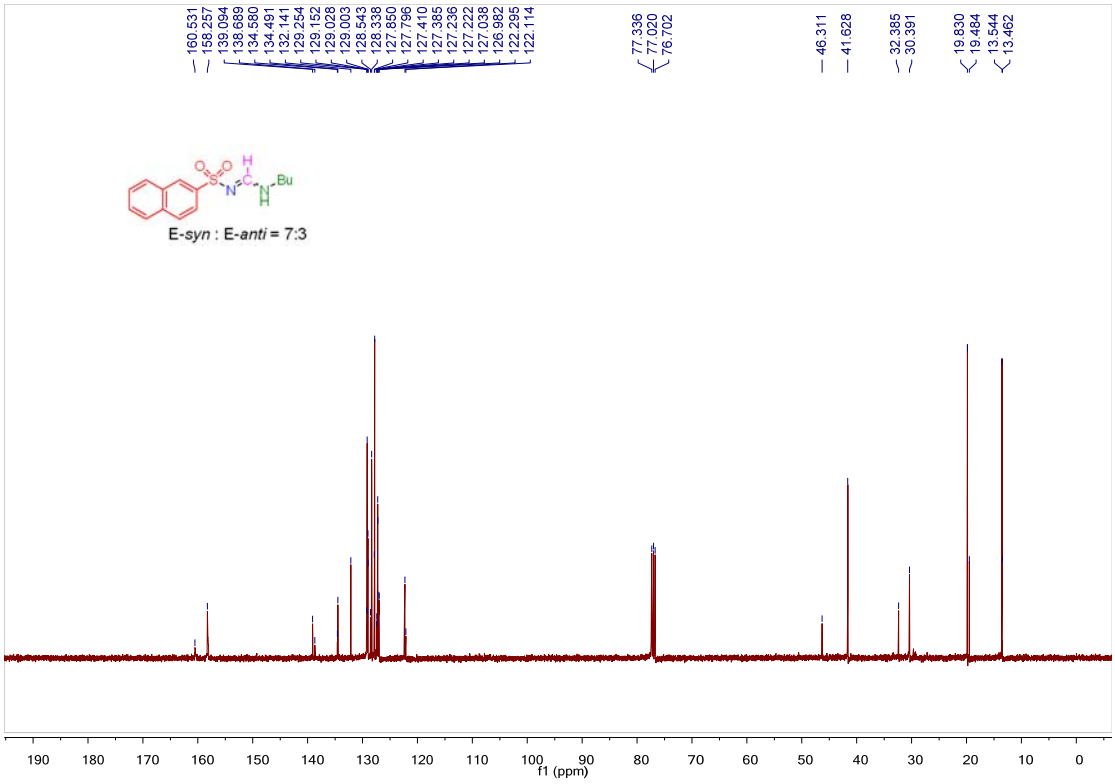

Figure S15: ^{13}C NMR of compound **5f**

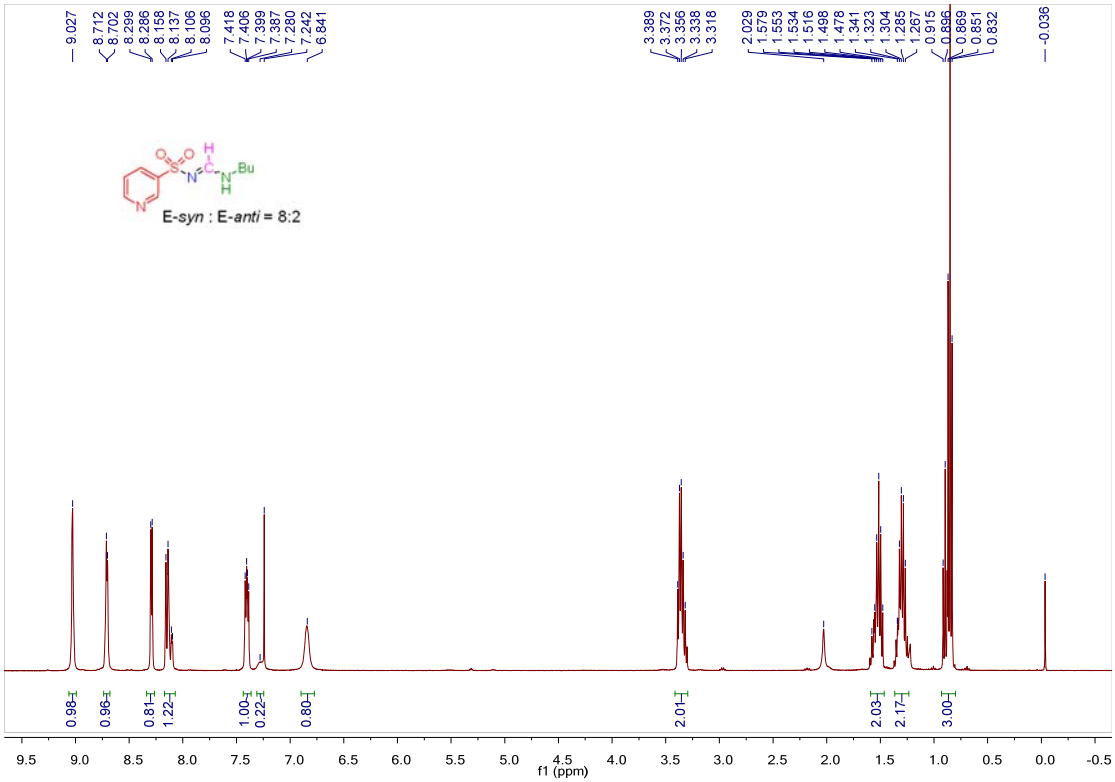

Figure S16: ^{1}H NMR of compound **5g**

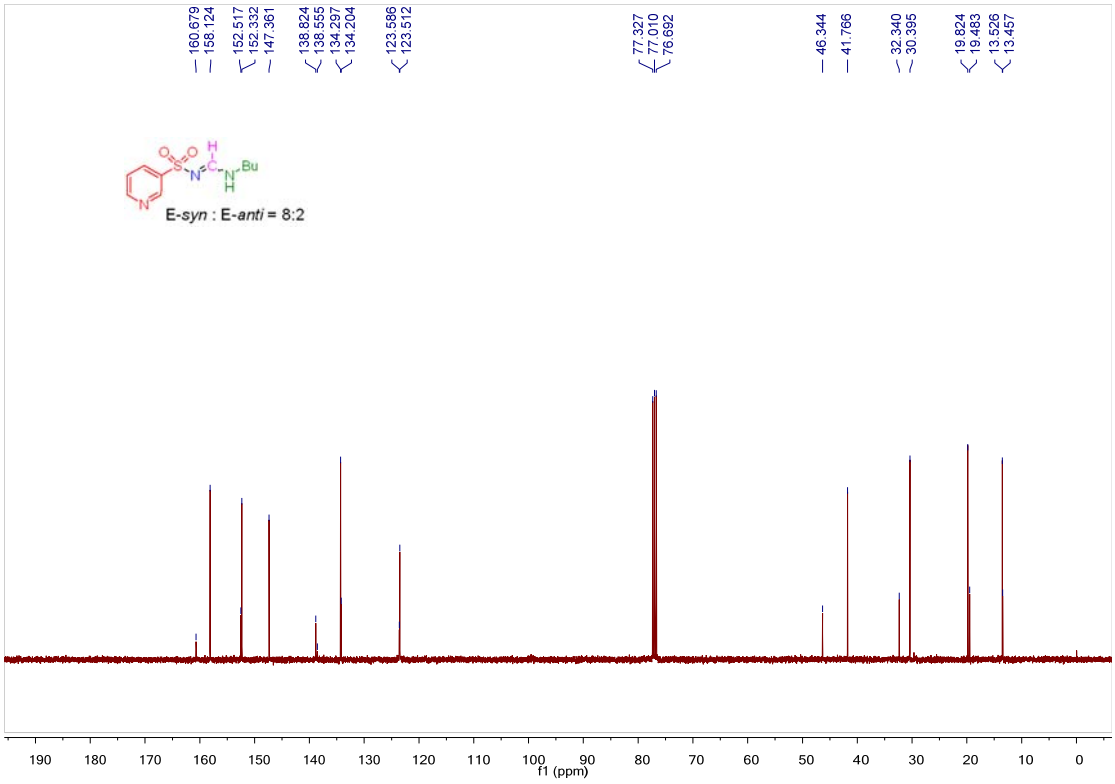

Figure S17: ^{13}C NMR of compound **5g**

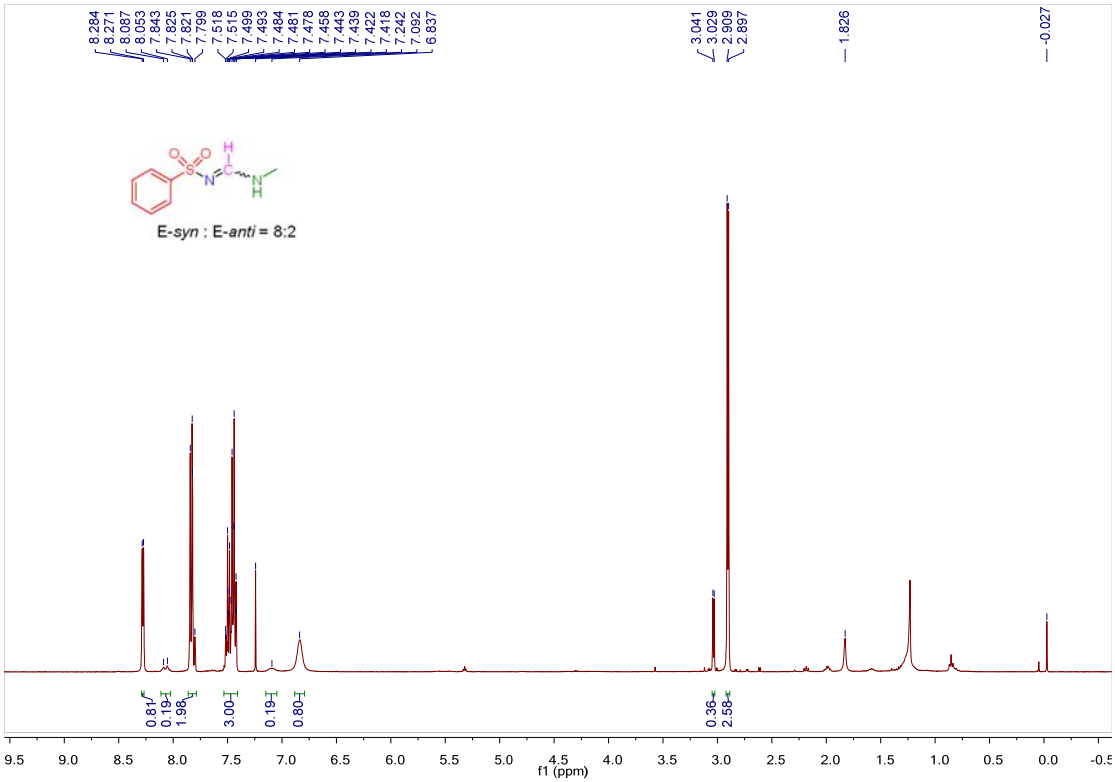

Figure S18: ^{1}H NMR of compound **5i**

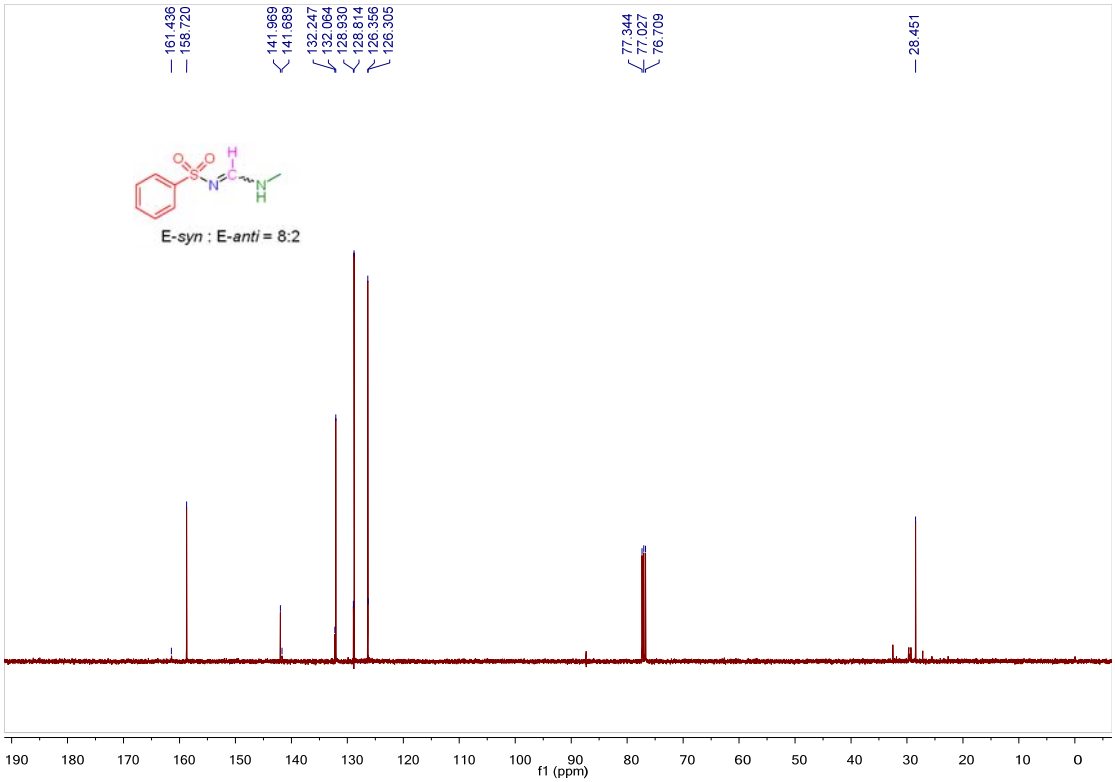

Figure S19: ^{13}C NMR of compound **5i**

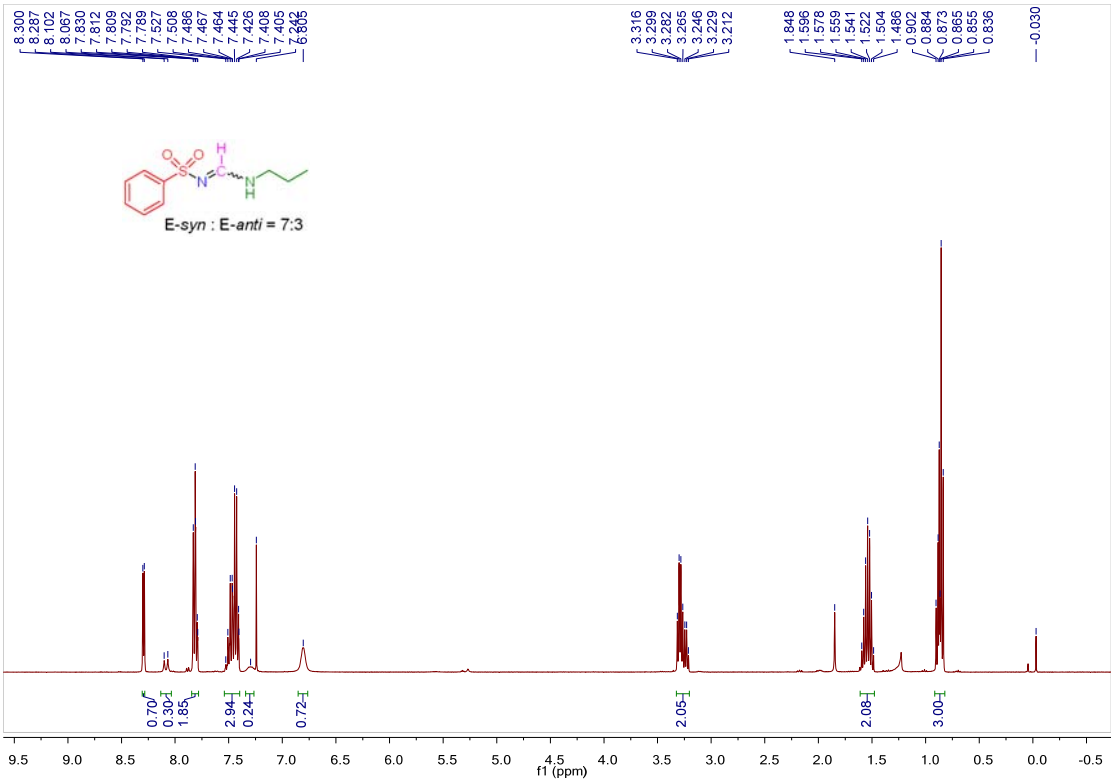

Figure S20: ^{1}H NMR of compound **5j**

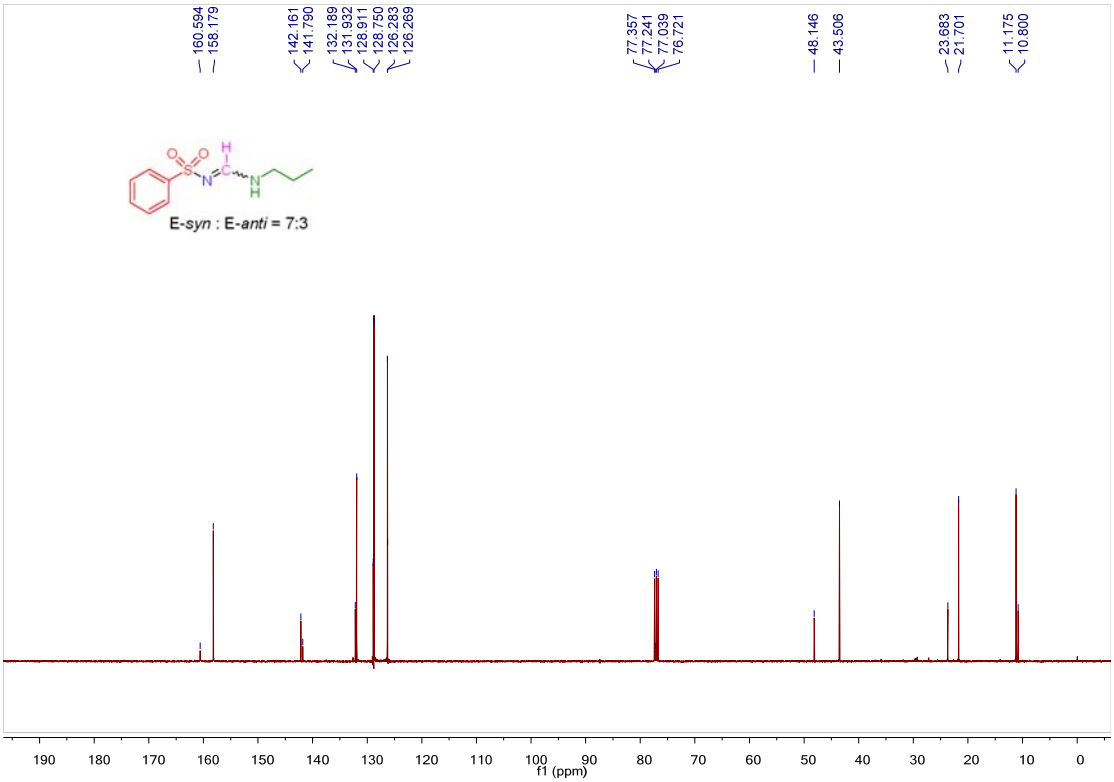

Figure S21: ^{13}C NMR of compound **5j**

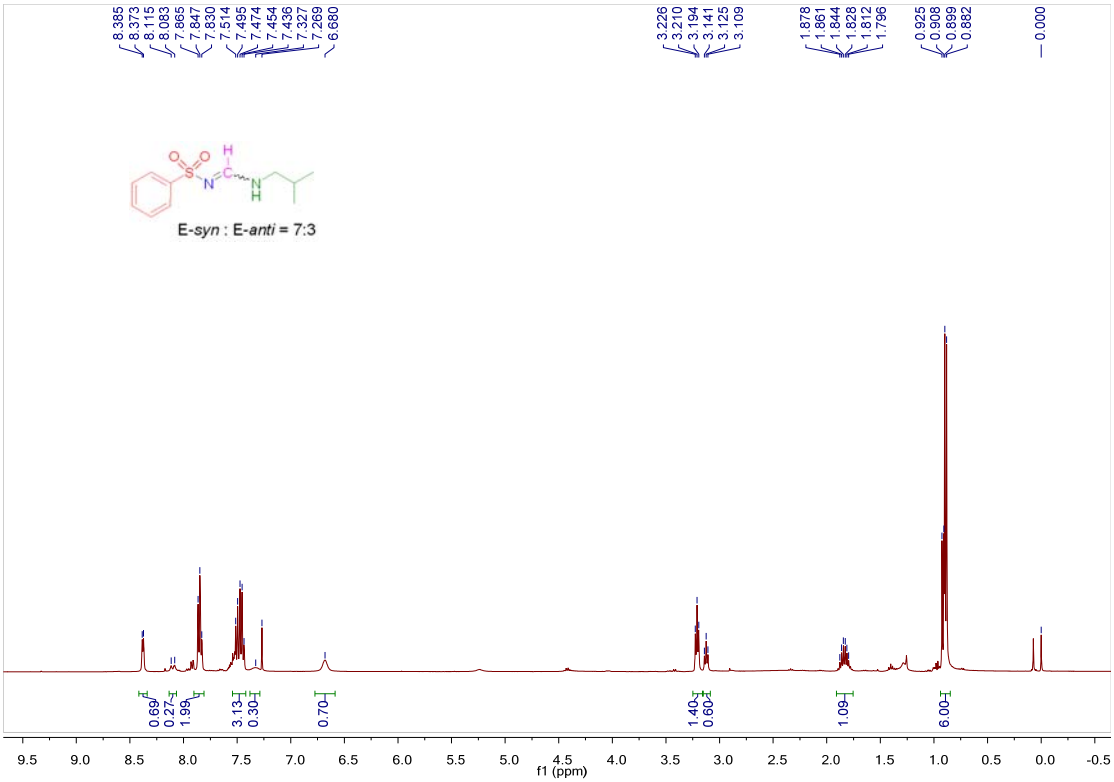

Figure S22: ^{1}H NMR of compound **5k**

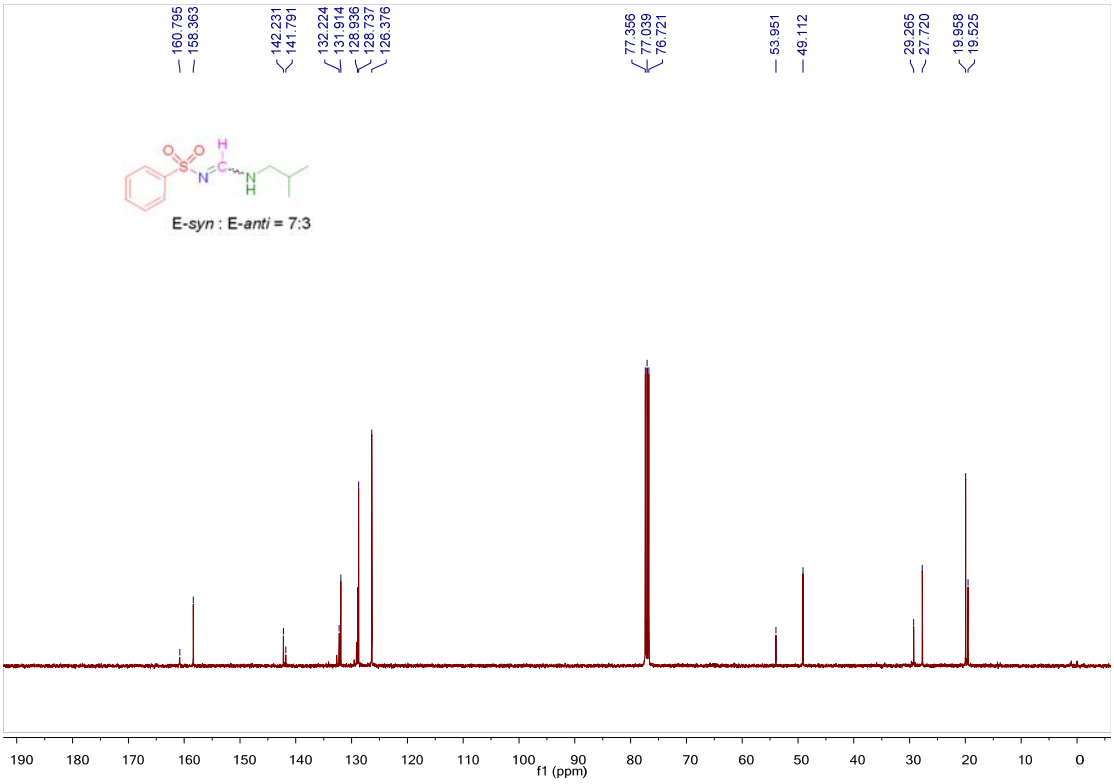

Figure S23: ^{13}C NMR of compound **5k**

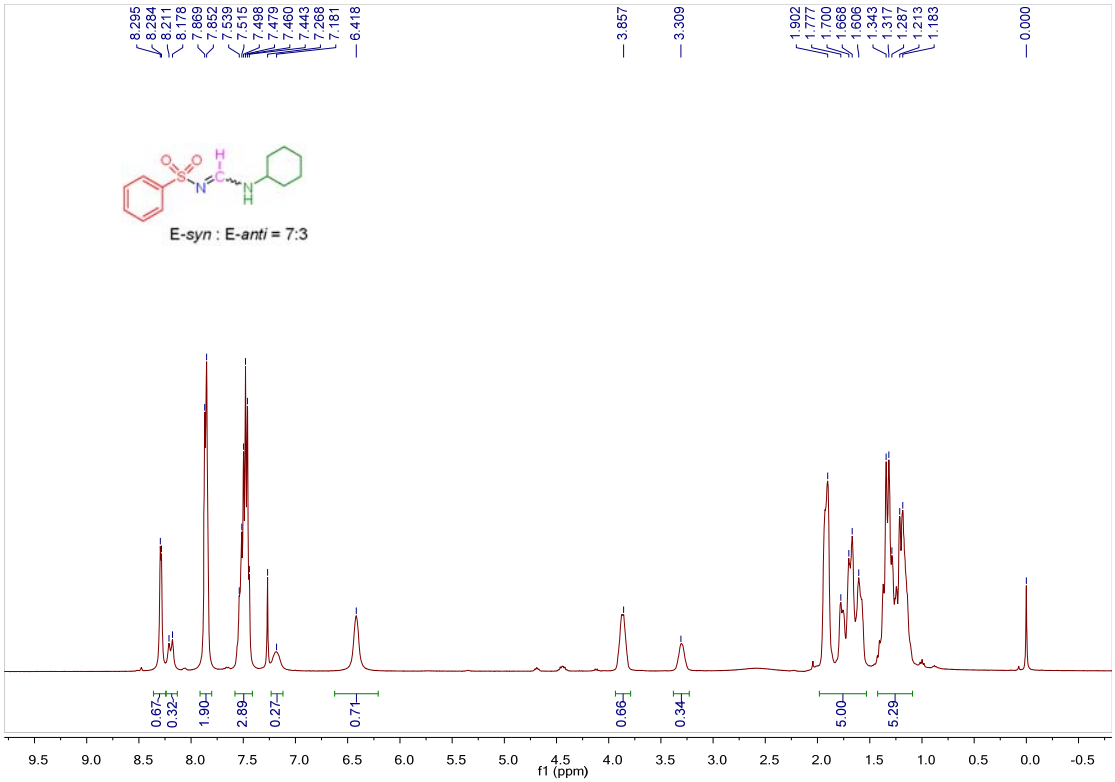

Figure S24: ^{1}H NMR of compound **5l**

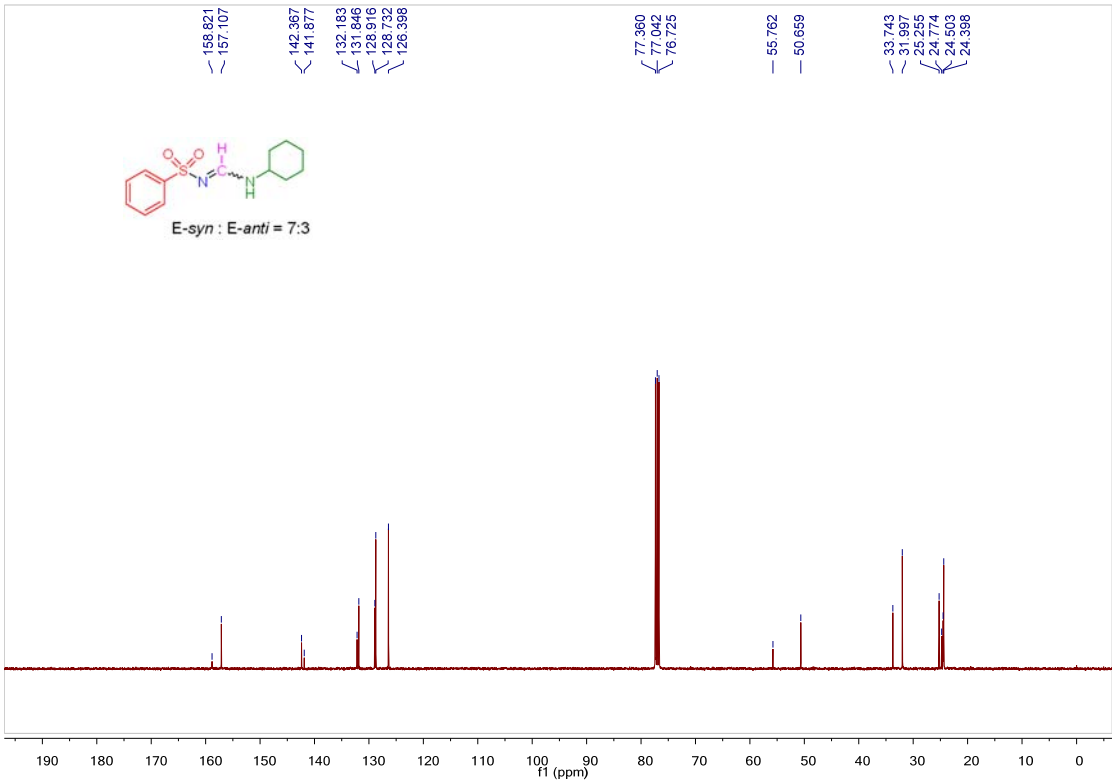

Figure S25: ^{13}C NMR of compound **5l**

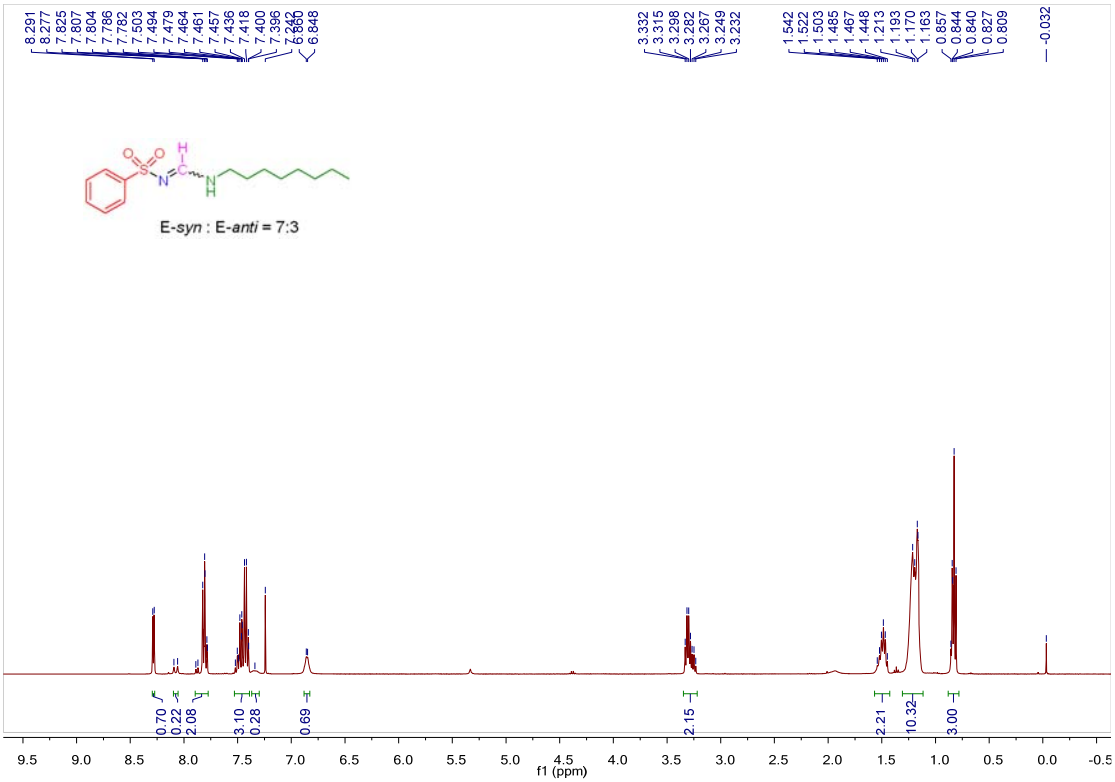

Figure S26: ^{1}H NMR of compound **5m**

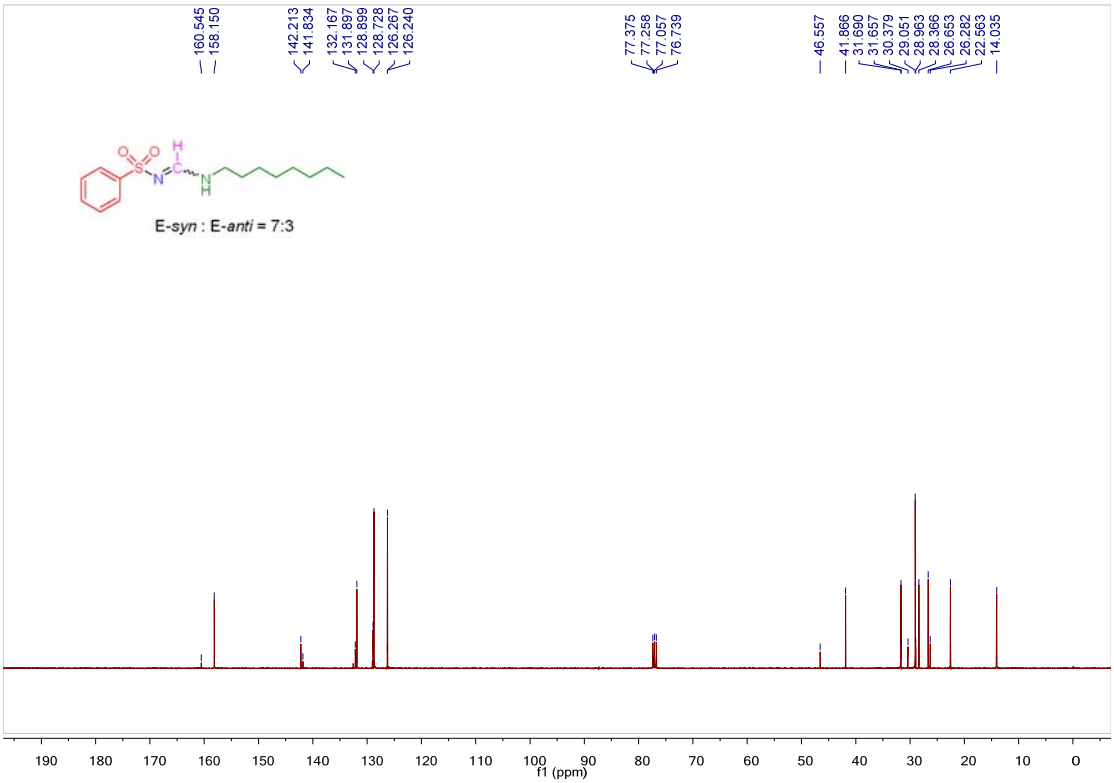

Figure S27: ^{13}C NMR of compound **5m**

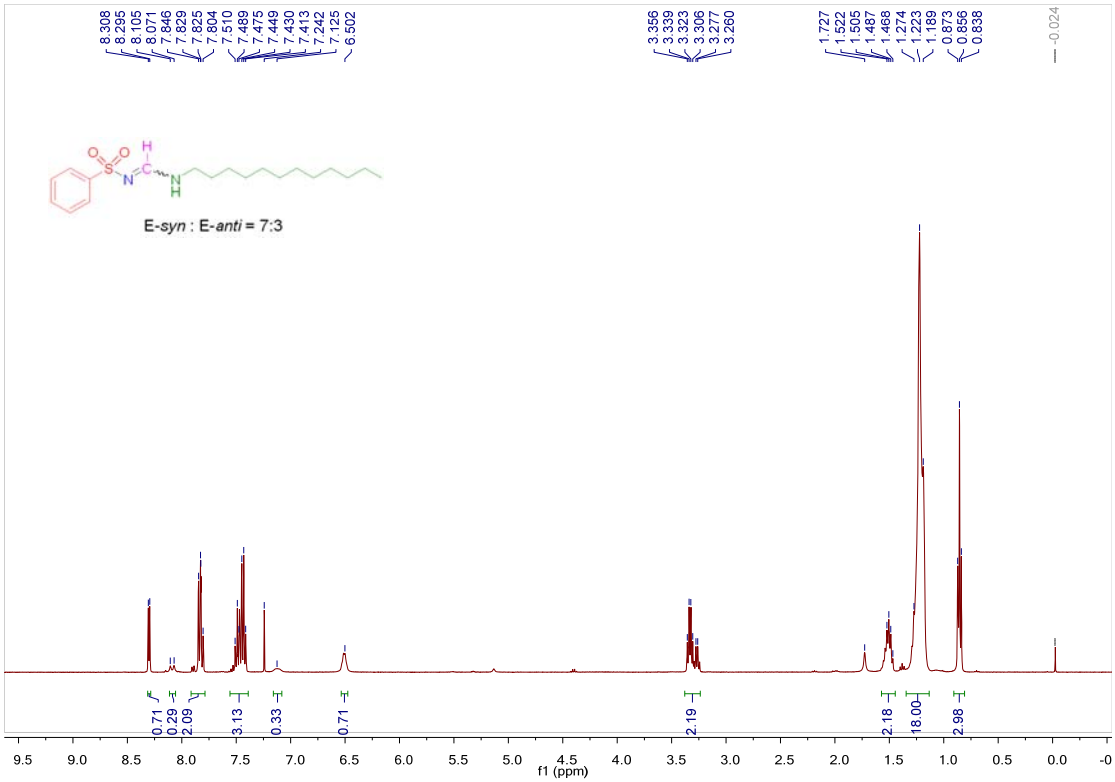

Figure S28: ^{1}H NMR of compound **5n**

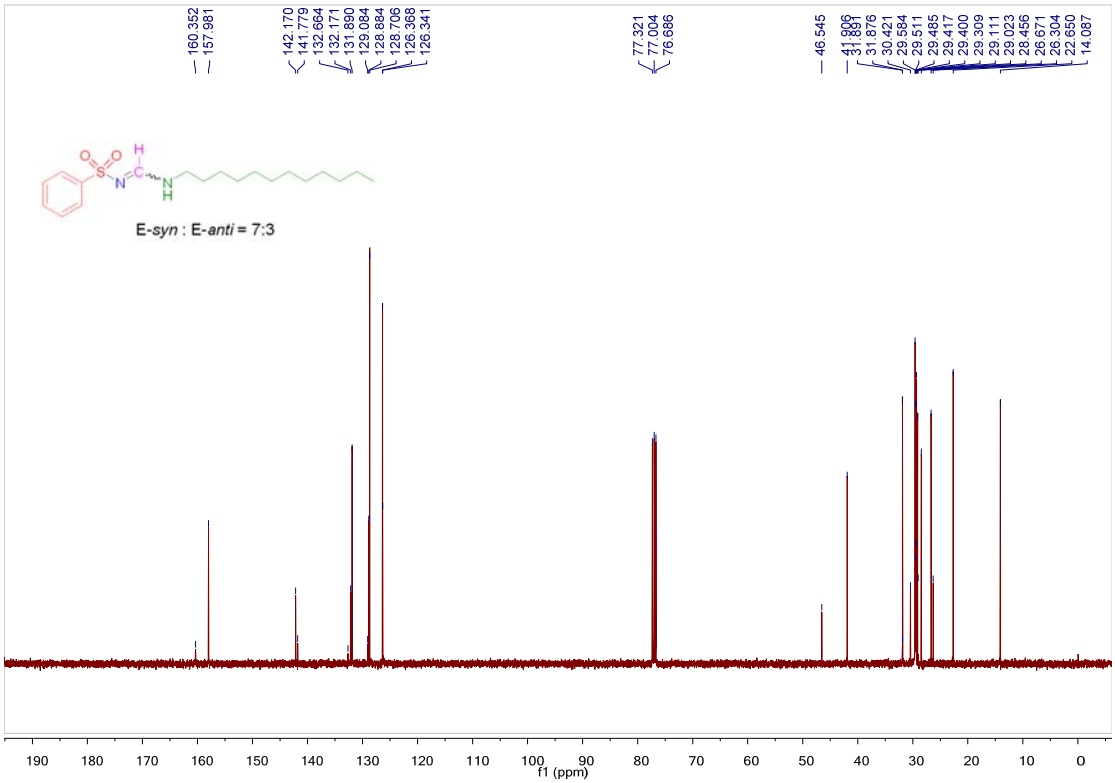

Figure S29: ^{13}C NMR of compound **5n**

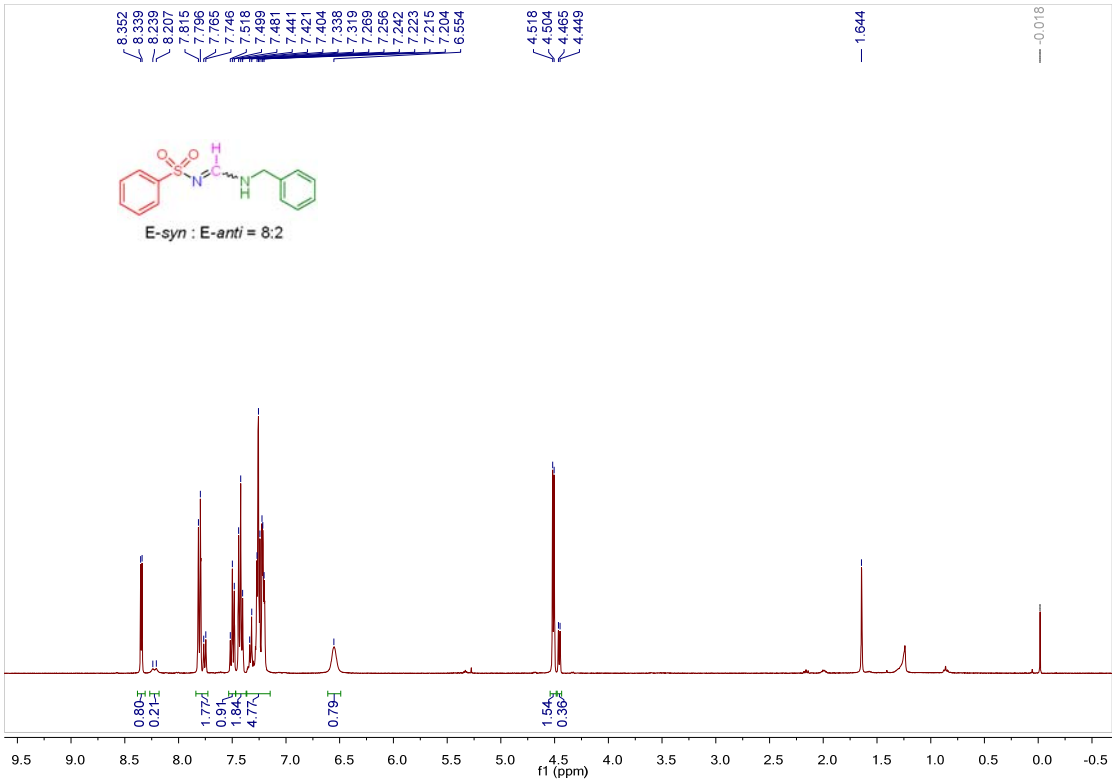

Figure S30: ^{1}H NMR of compound **5o**

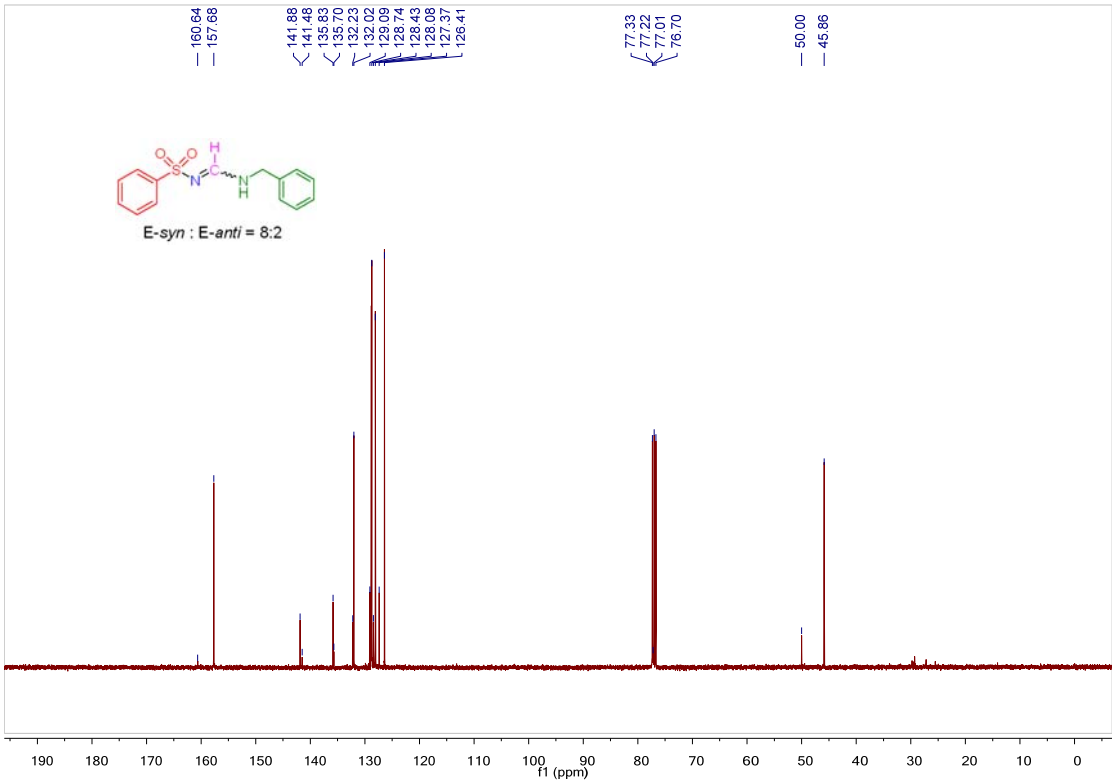

Figure S31: ^{13}C NMR of compound **5o**

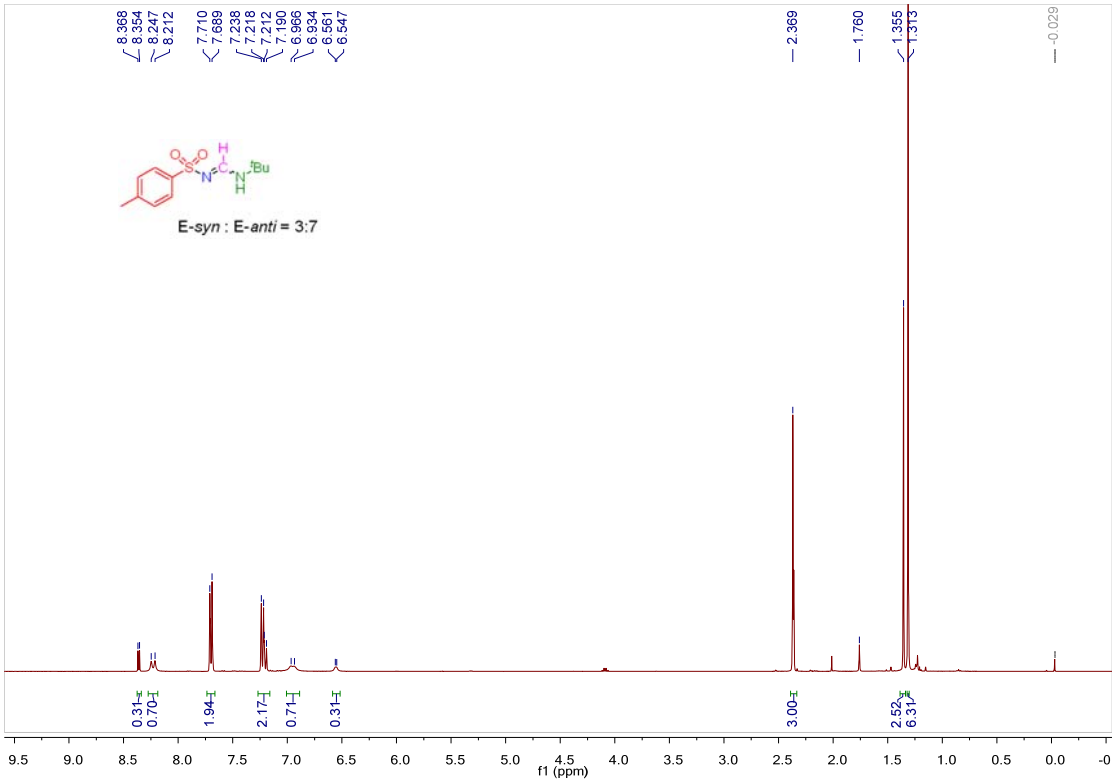

Figure S32: ^{1}H NMR of compound **5p**

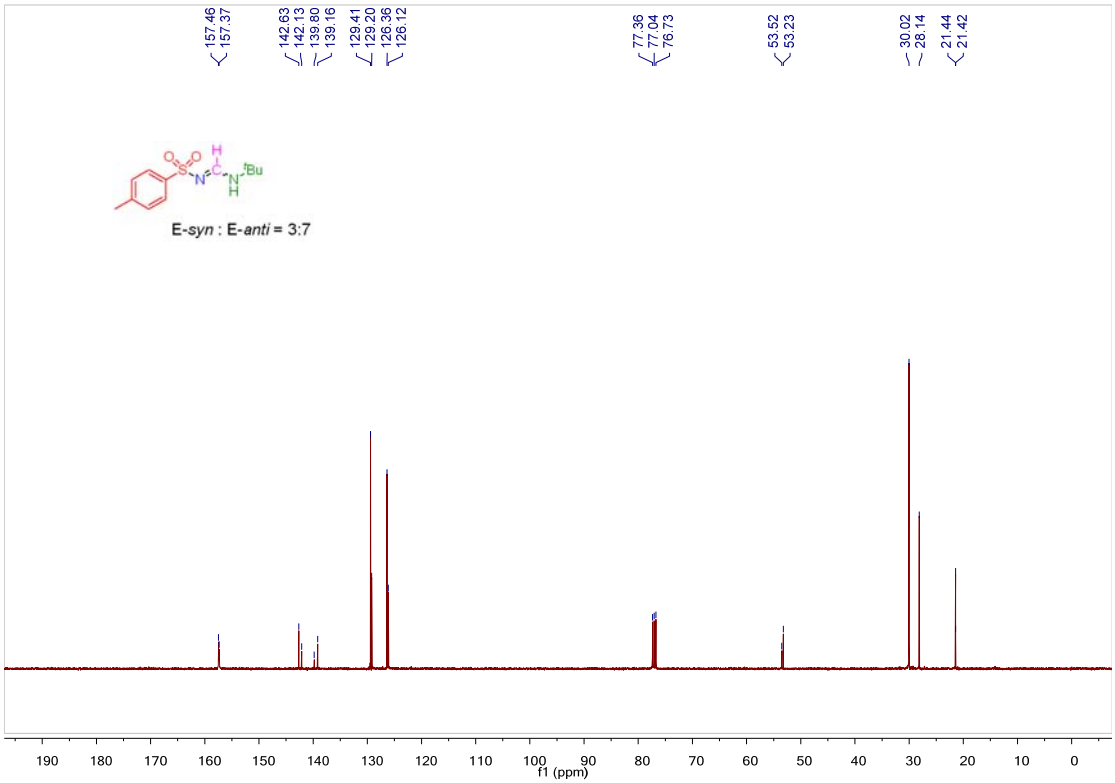

Figure S33: ^{13}C NMR of compound **5p**

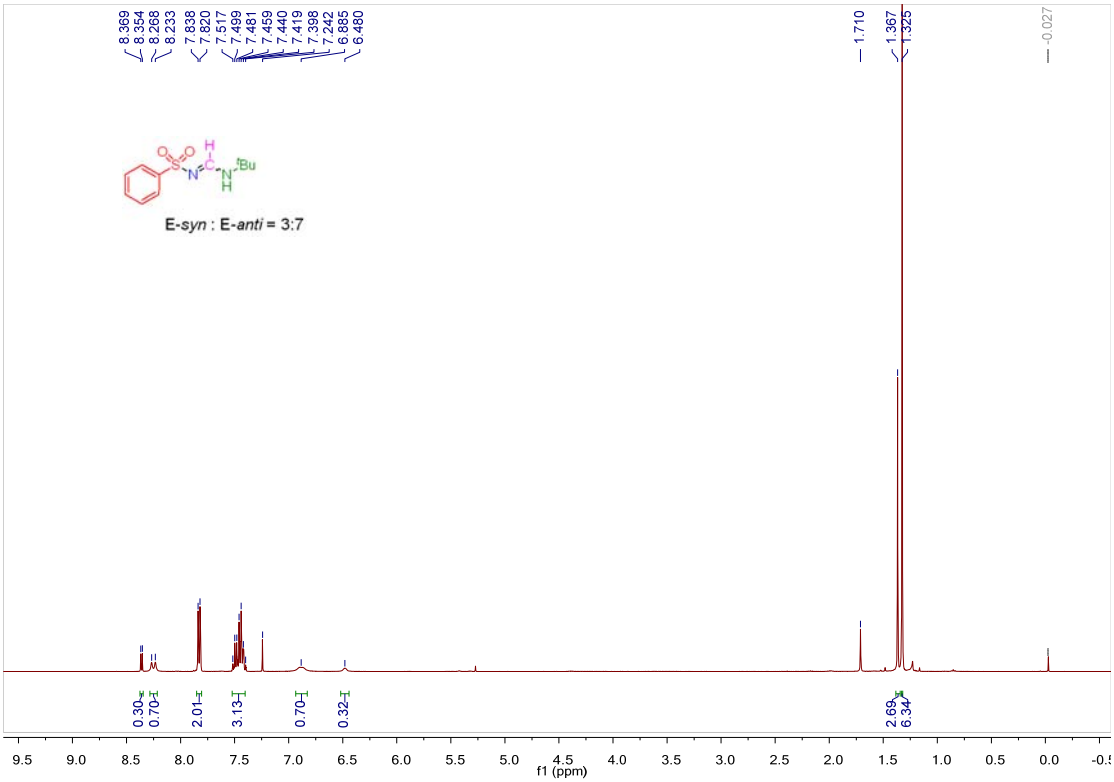

Figure S34: ^{1}H NMR of compound **5q**

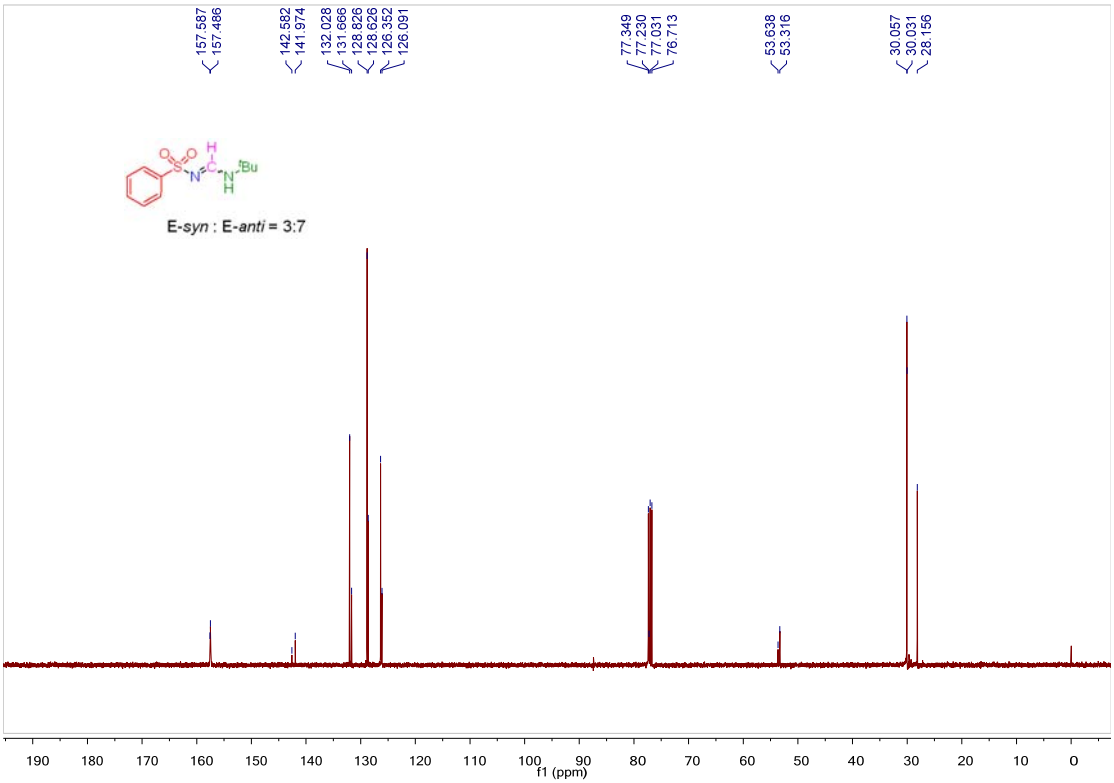

Figure S35: ^{13}C NMR of compound **5q**

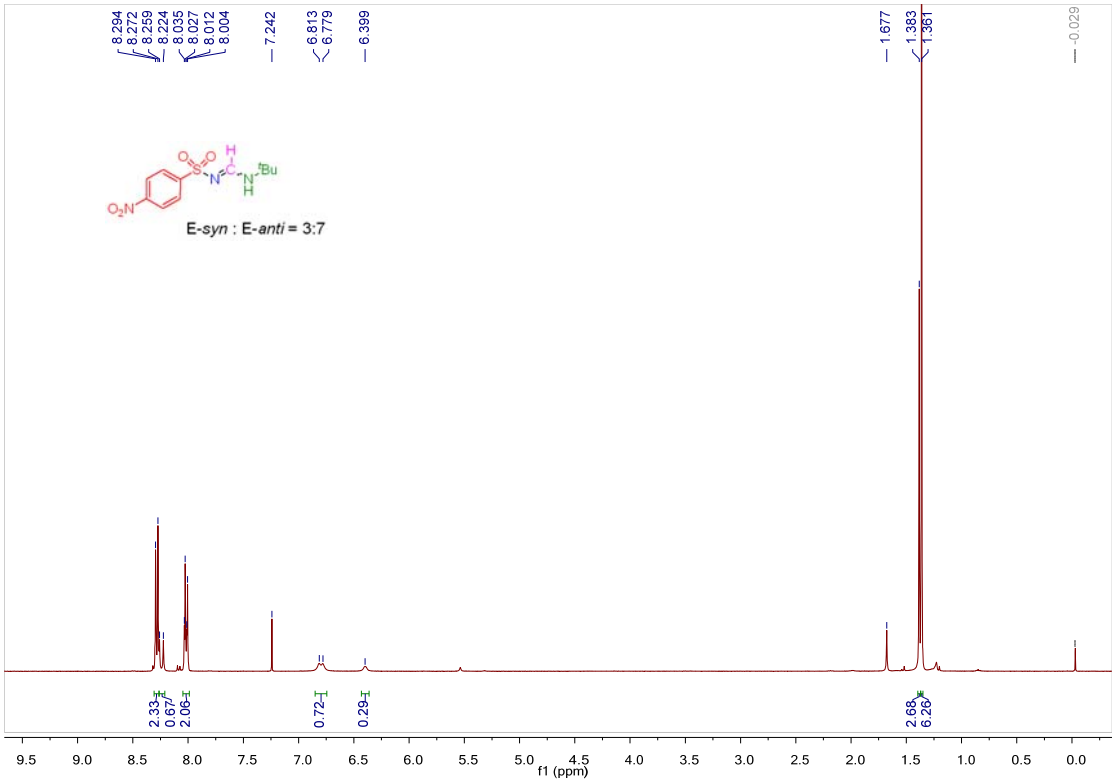

Figure S36: ^{1}H NMR of compound **5r**

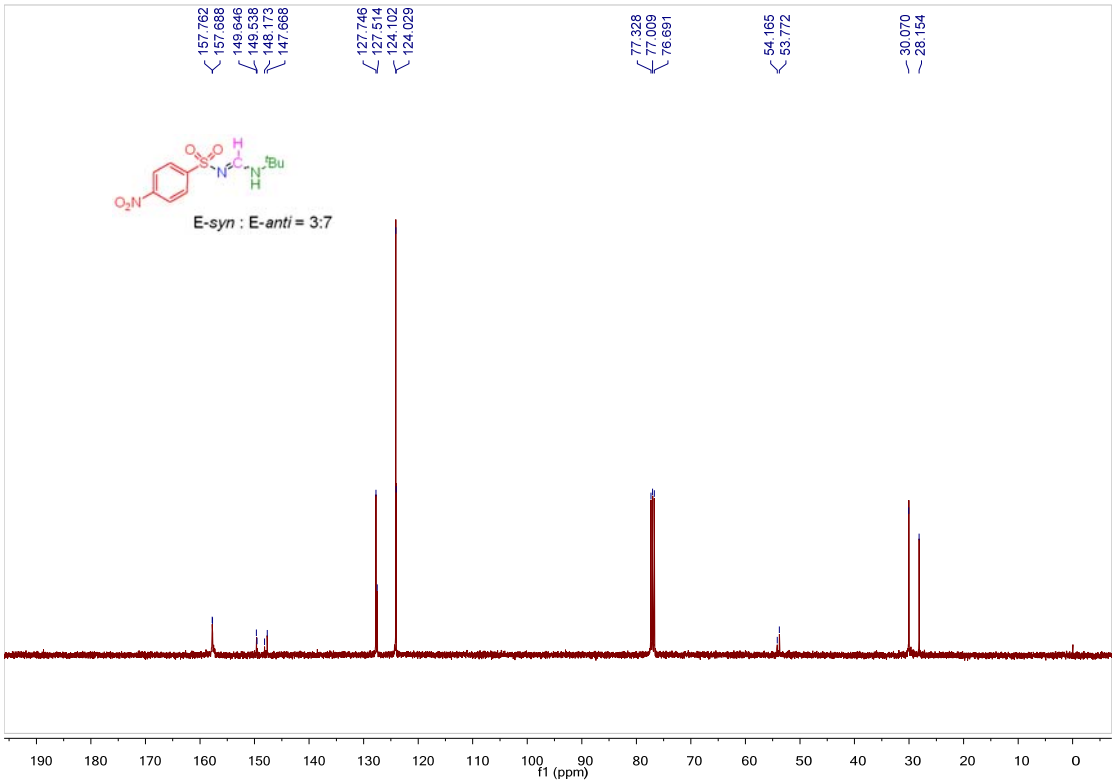

Figure S37: ^{13}C NMR of compound **5r**

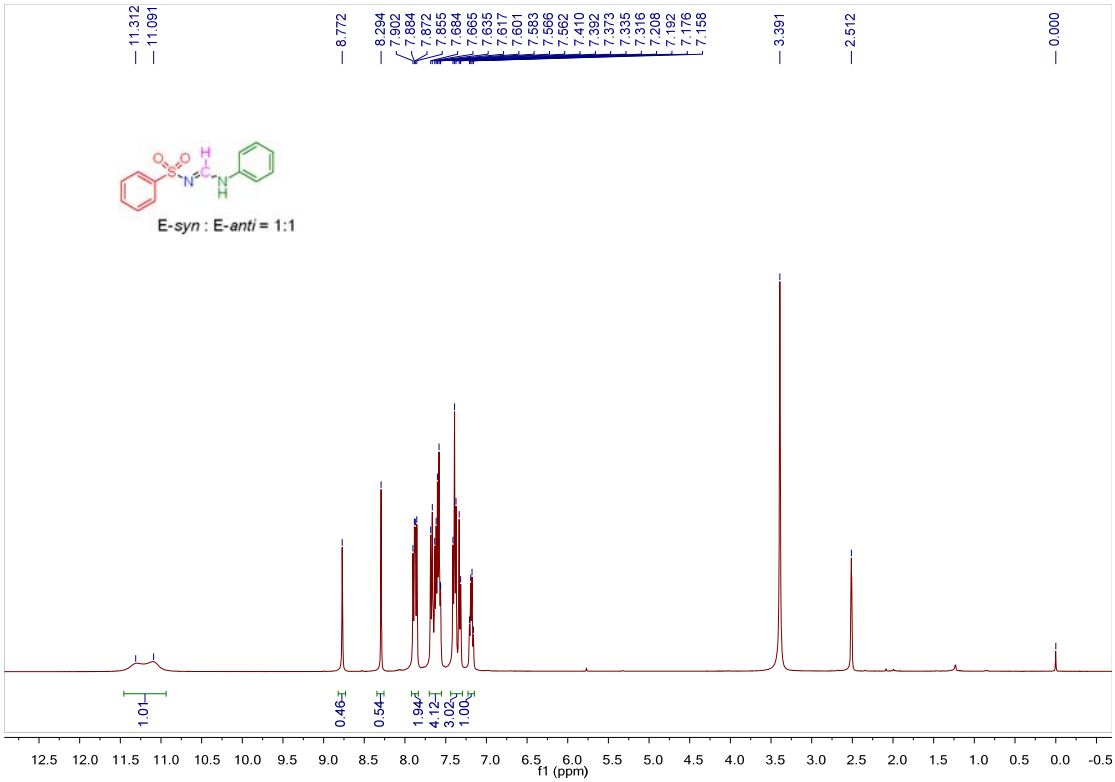

Figure S38: ^{1}H NMR of compound **5s**

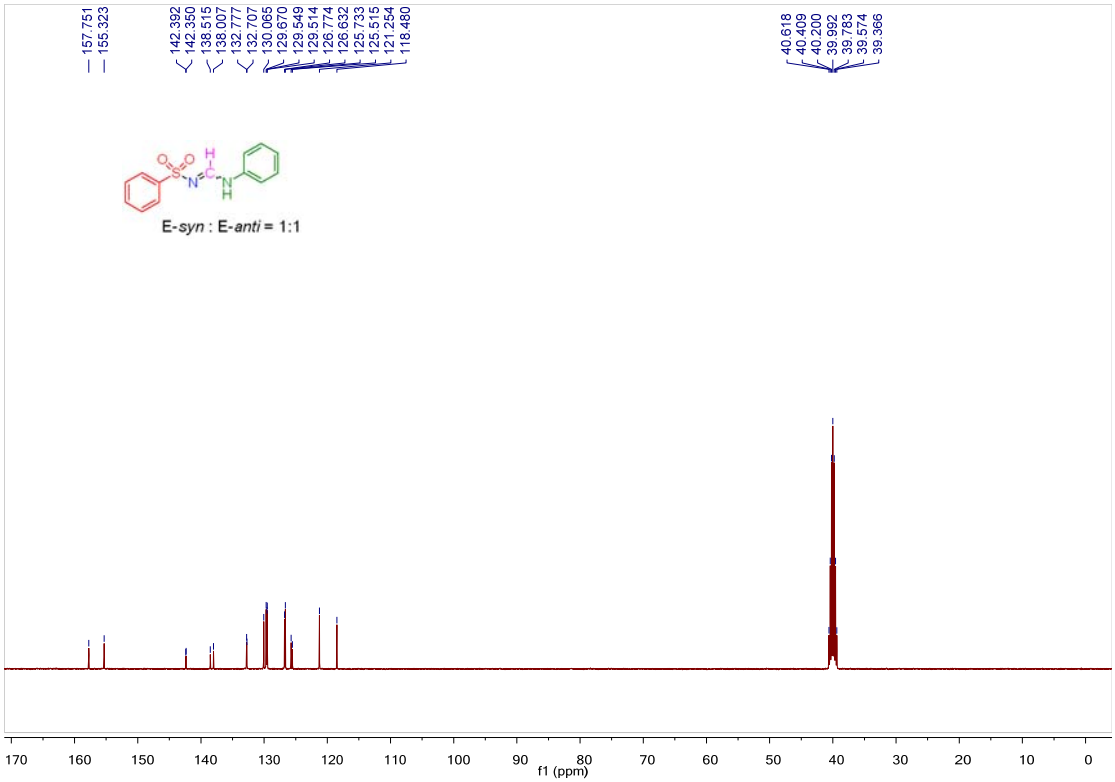

Figure S39: ^{13}C NMR of compound **5s**

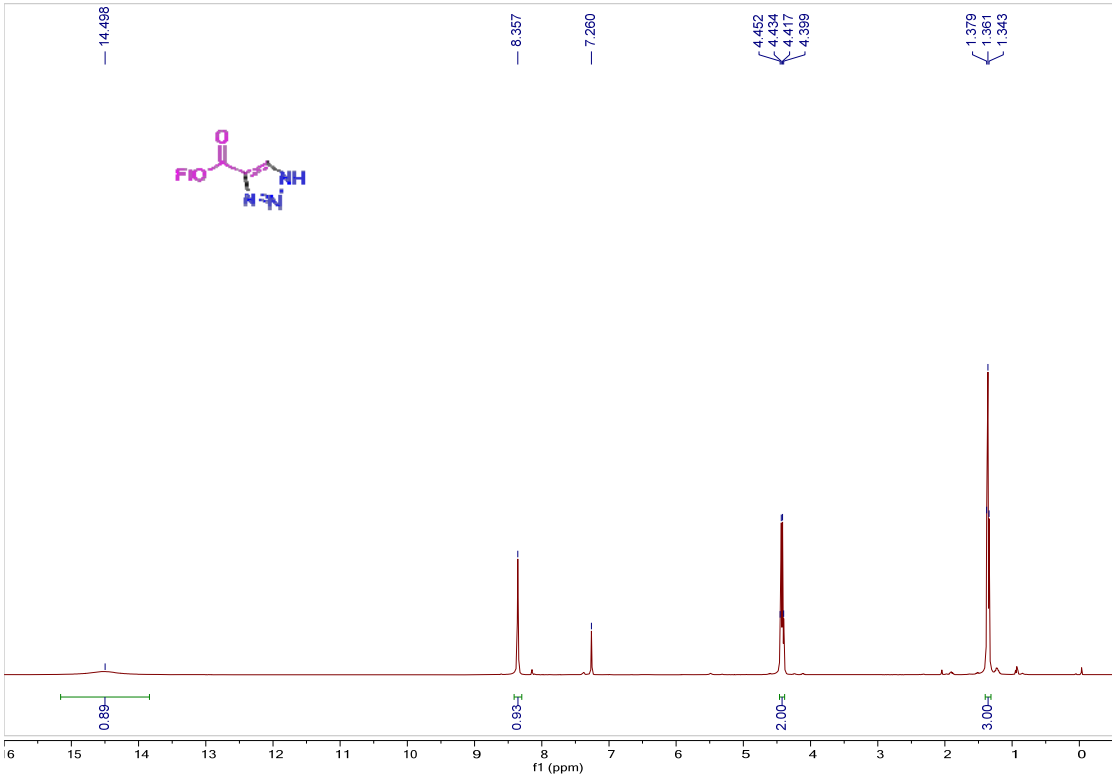

Figure S40: ^{1}H NMR of 4-ethoxycarbonyl-1H-1,2,3-triazole

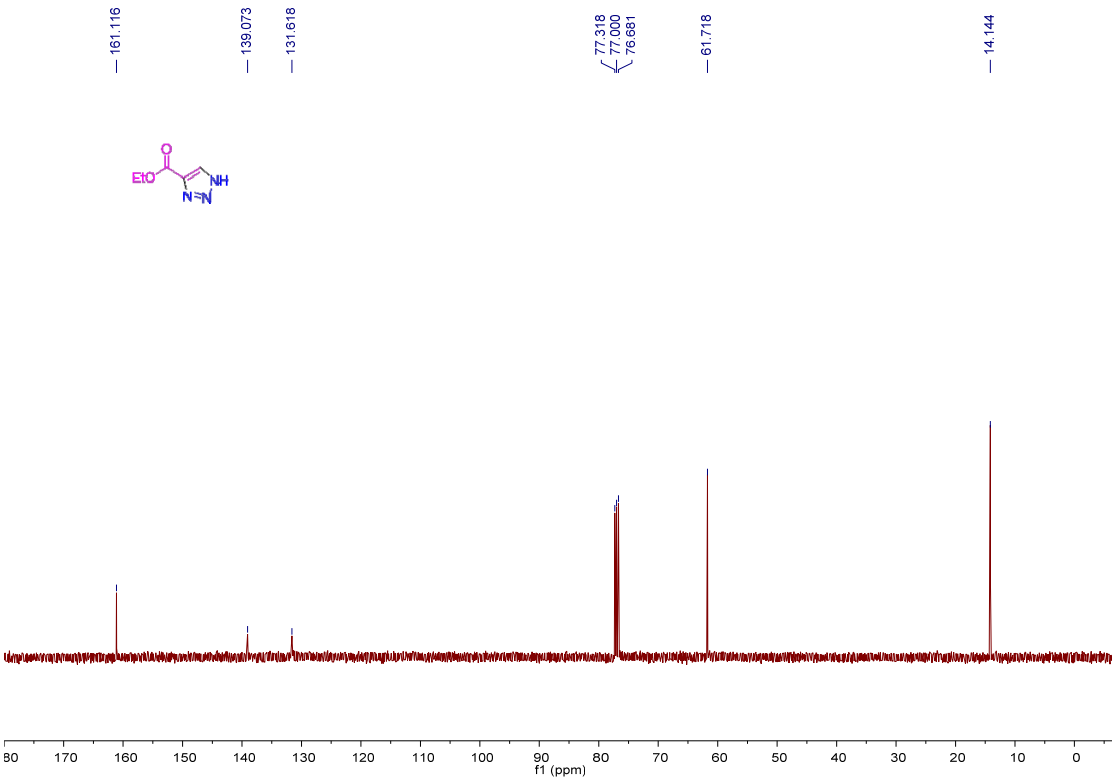

Figure S41: ^{13}C NMR of 4-ethoxycarbonyl-1H-1,2,3-triazole

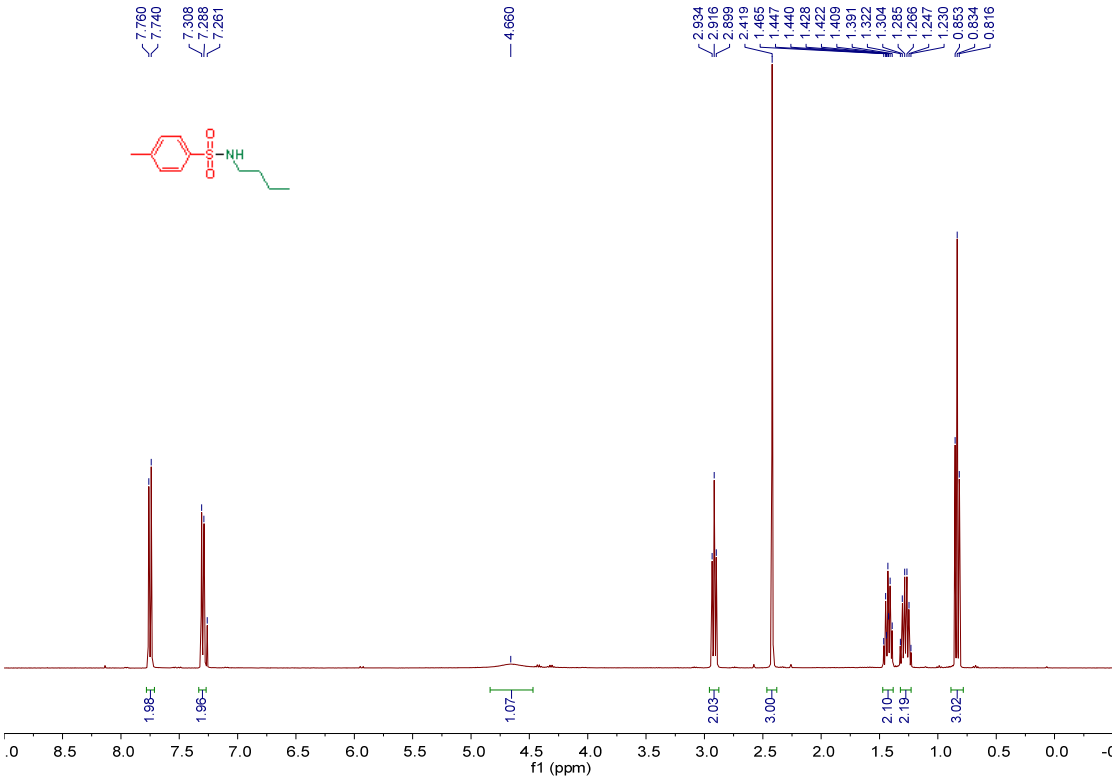

Figure S42: ^{1}H NMR of *N*-butyl-4-methylbenzenesulfonamide

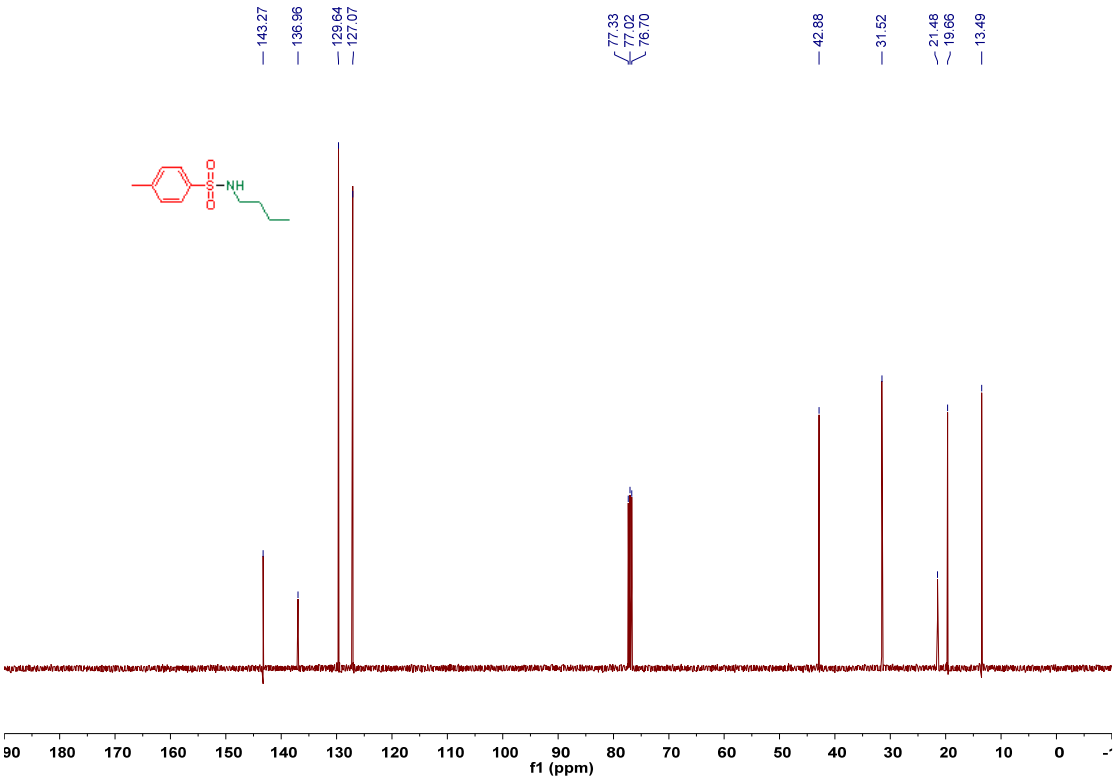

Figure S43: ^{13}C NMR of *N*-butyl-4-methylbenzenesulfonamide

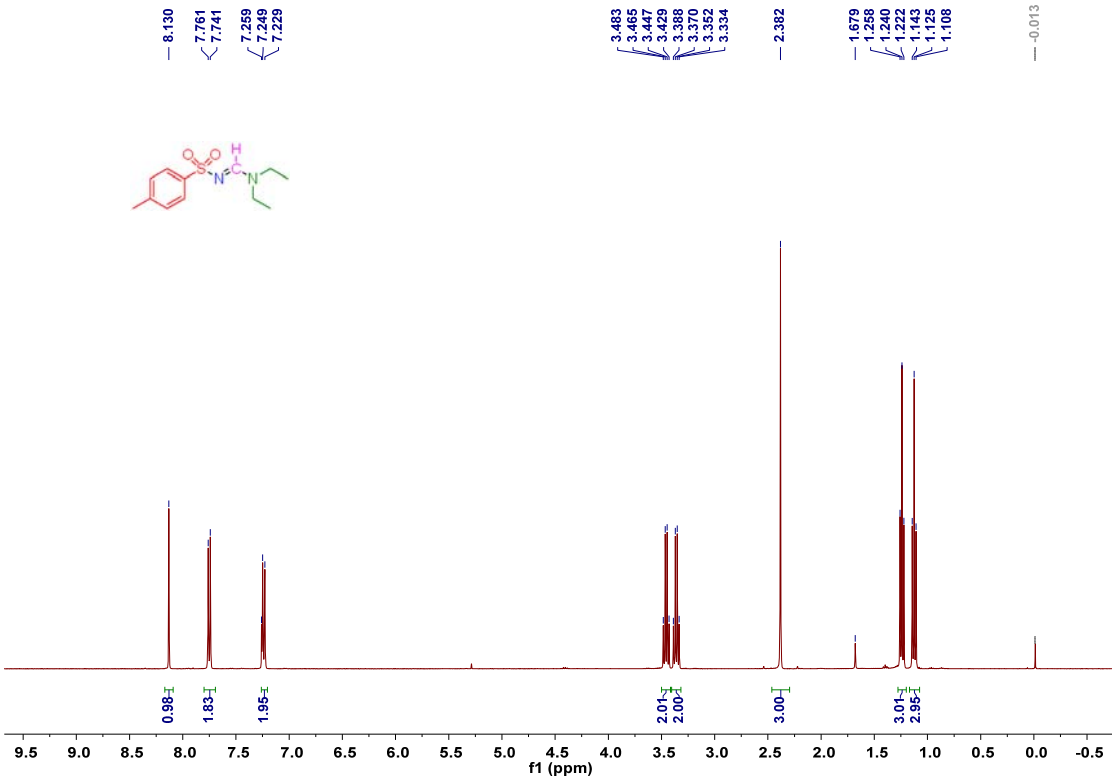

Figure S44: ^{1}H NMR of compound **7a**

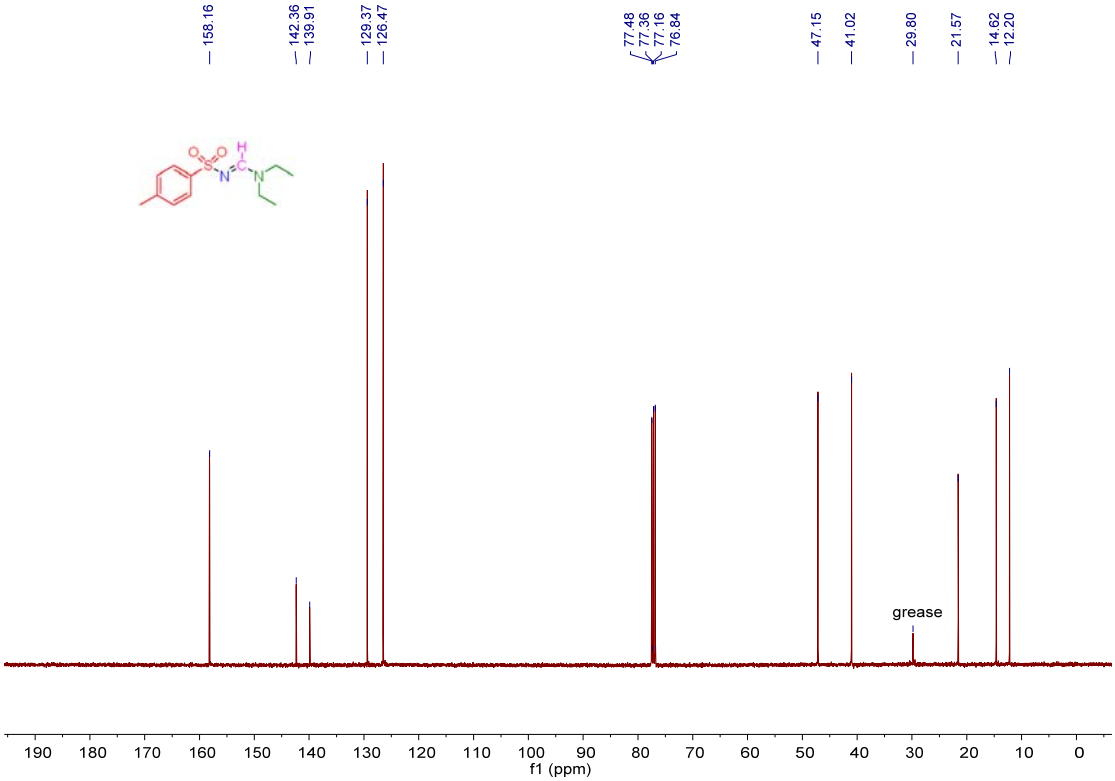

Figure S45: ^{13}C NMR of compound **7a**

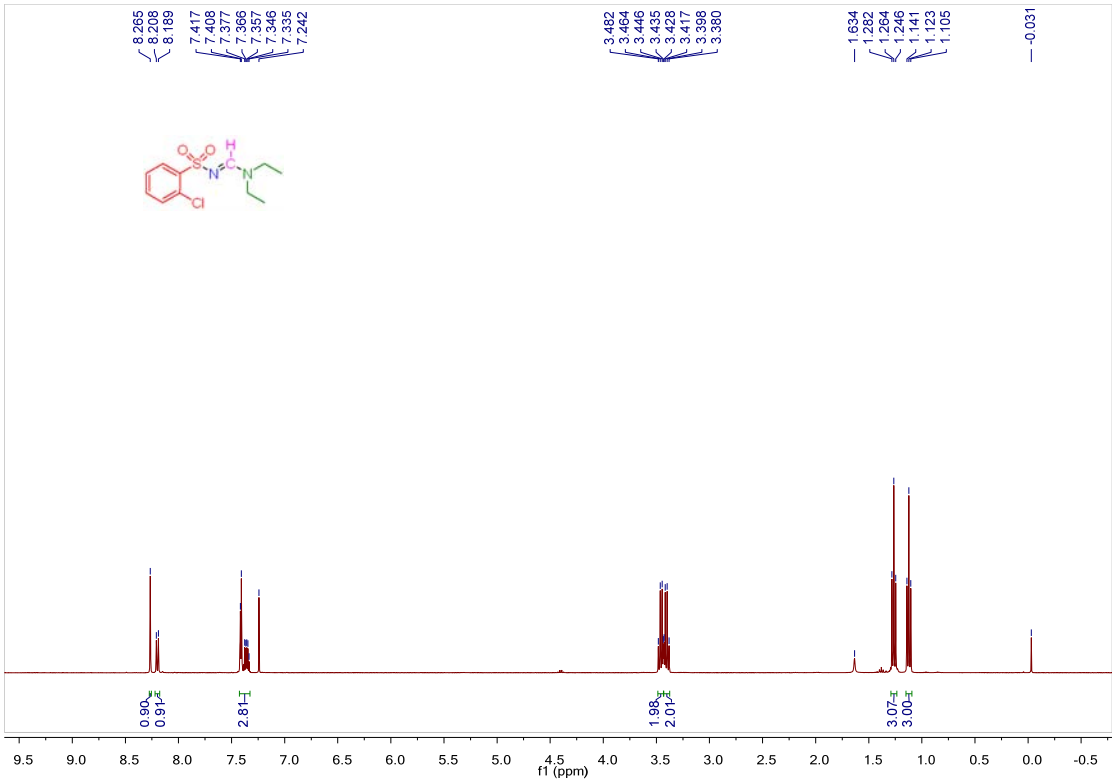

Figure S46: ^{1}H NMR of compound **7b**

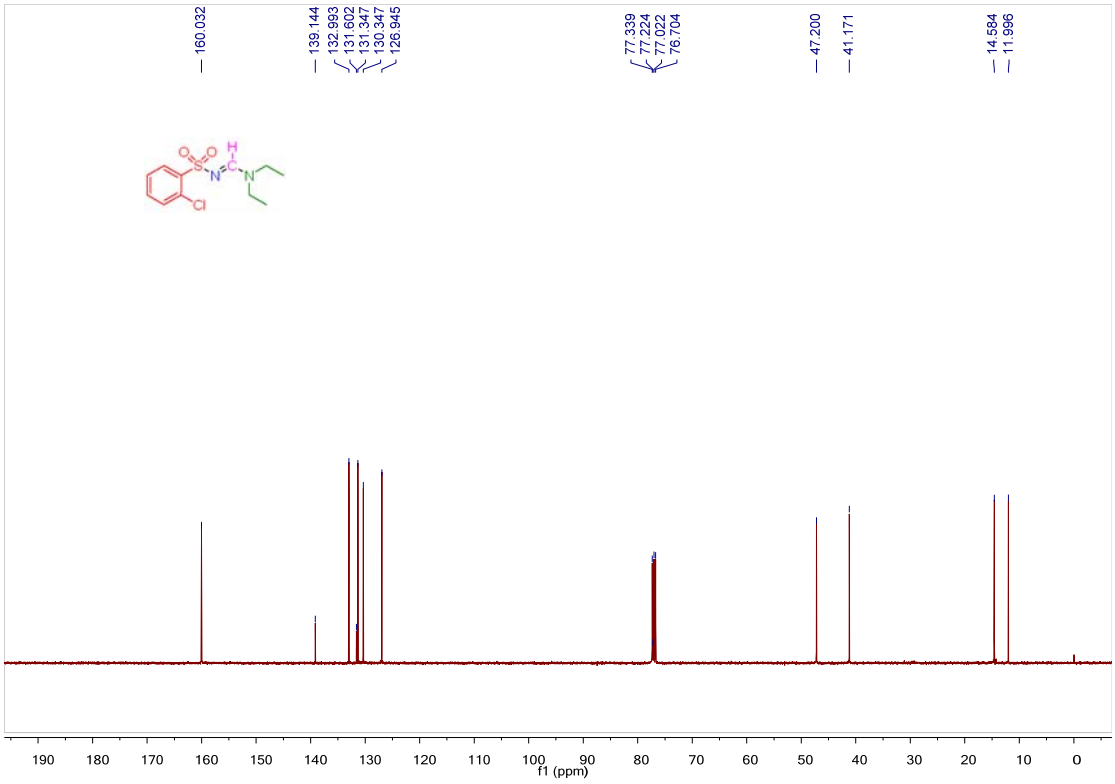

Figure S47: ^{13}C NMR of compound **7b**

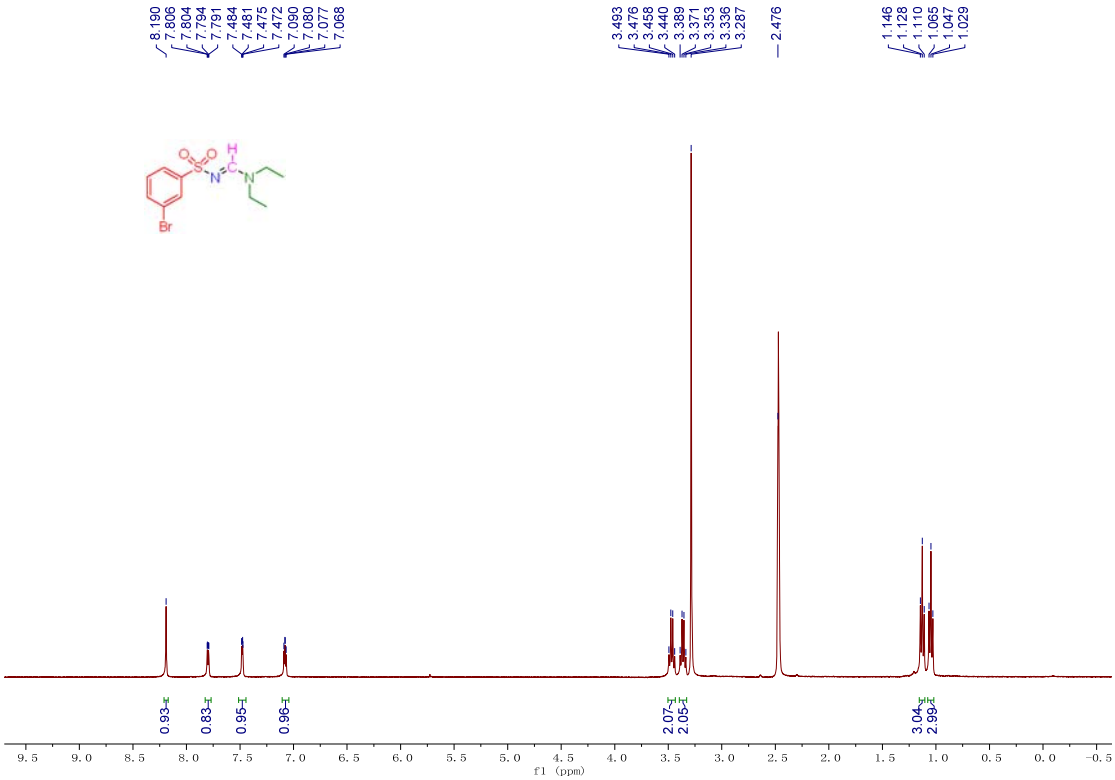

Figure S48: ^{1}H NMR of compound **7c**

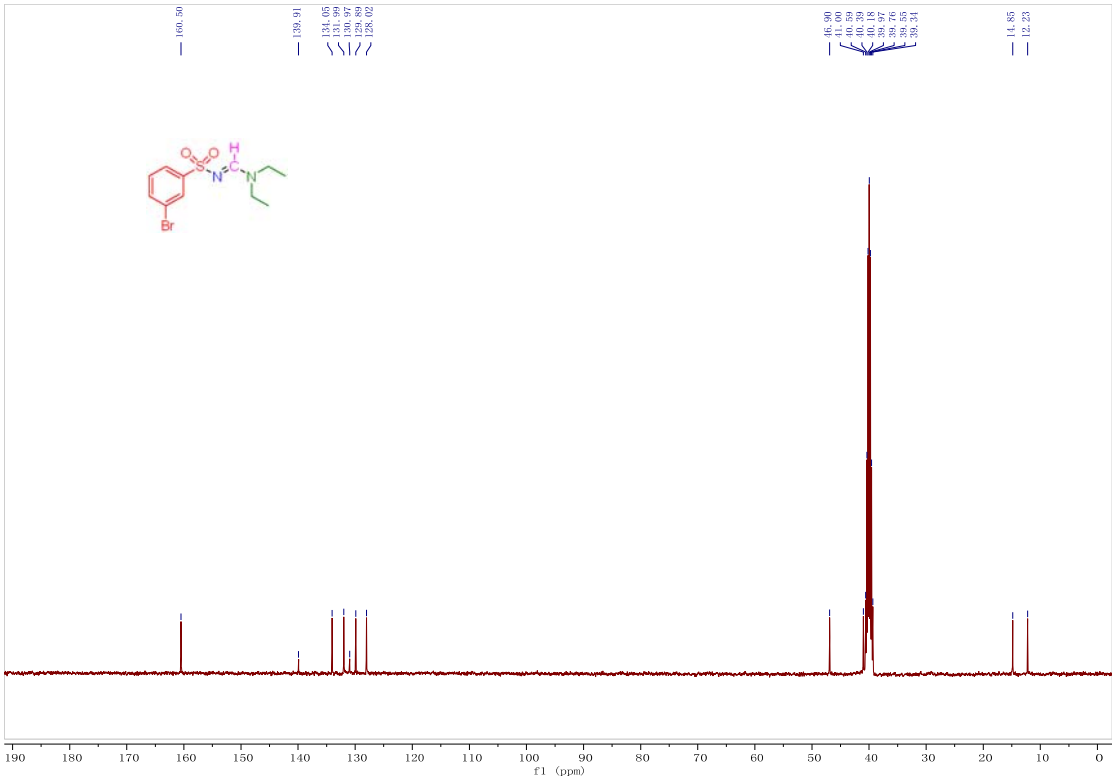

Figure S49: ^{13}C NMR of compound **7c**

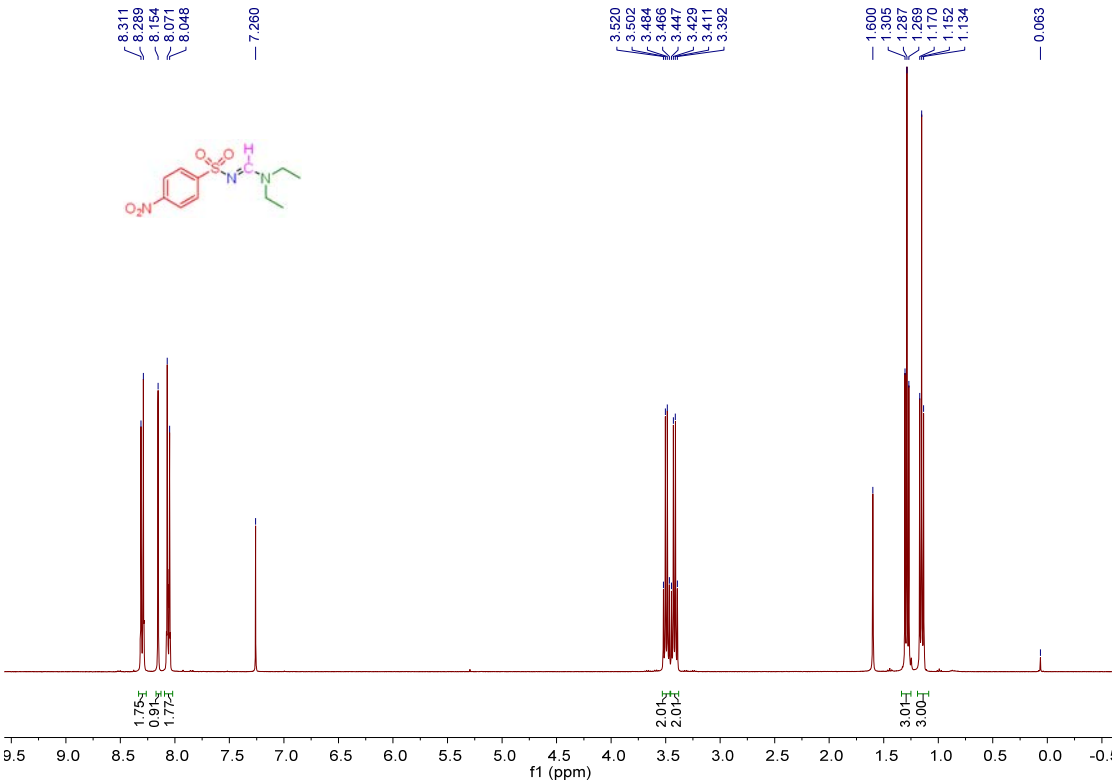

Figure S50: ^{1}H NMR of compound **7d**

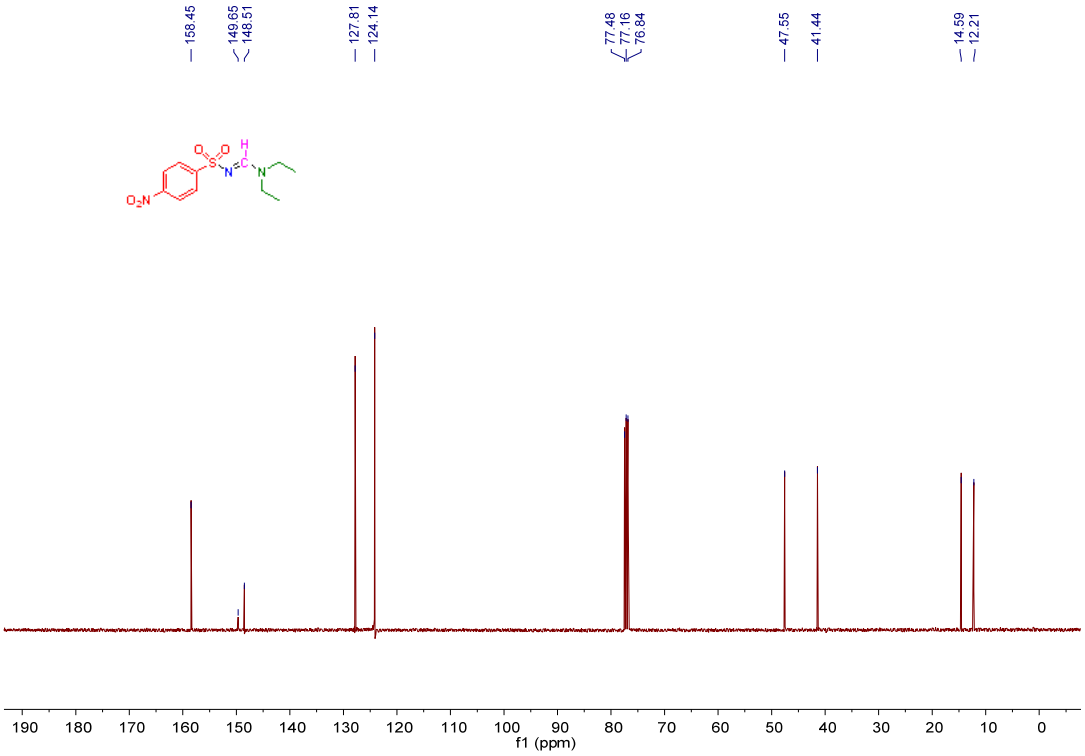

Figure S51: ^{13}C NMR of compound **7d**

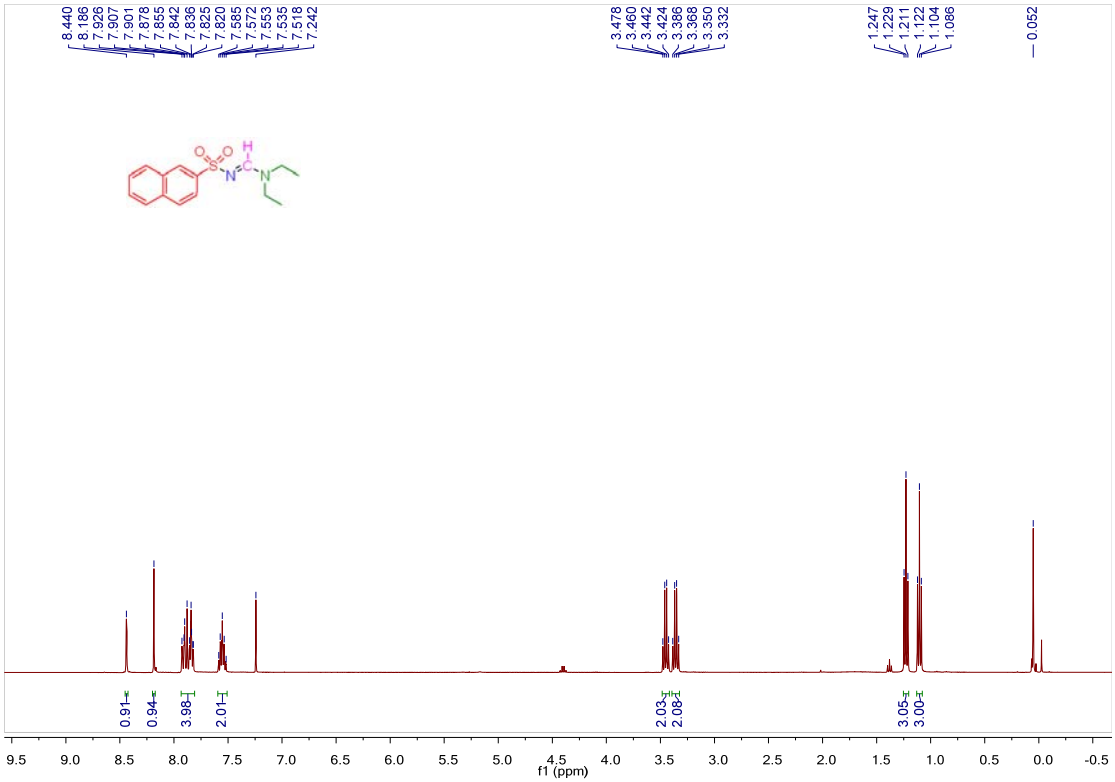

Figure S52: ^{1}H NMR of compound **7e**

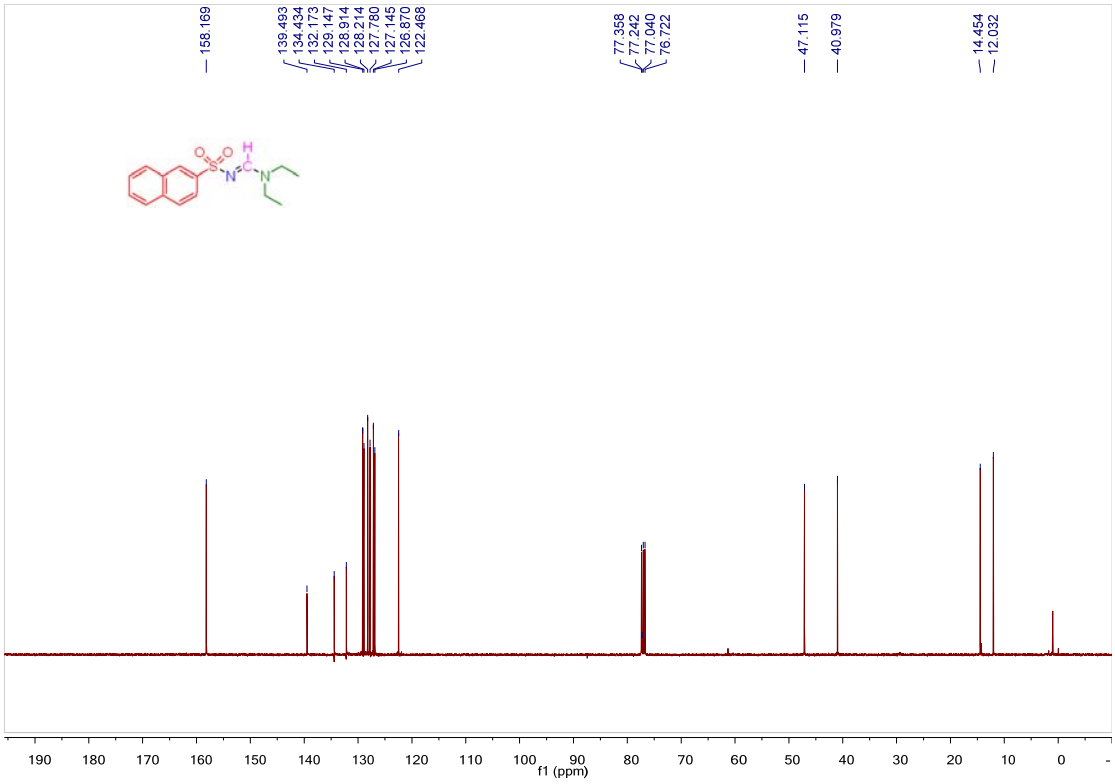

Figure S53: ^{13}C NMR of compound **7e**

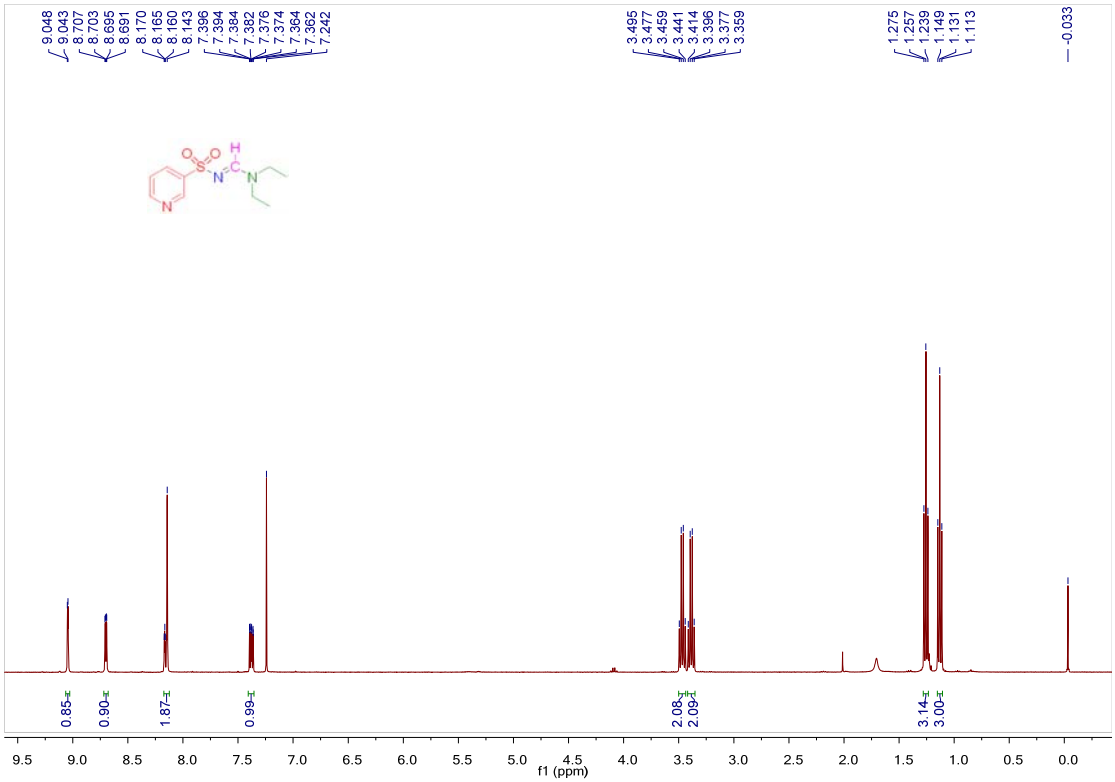

Figure S54: ^{1}H NMR of compound **7f**

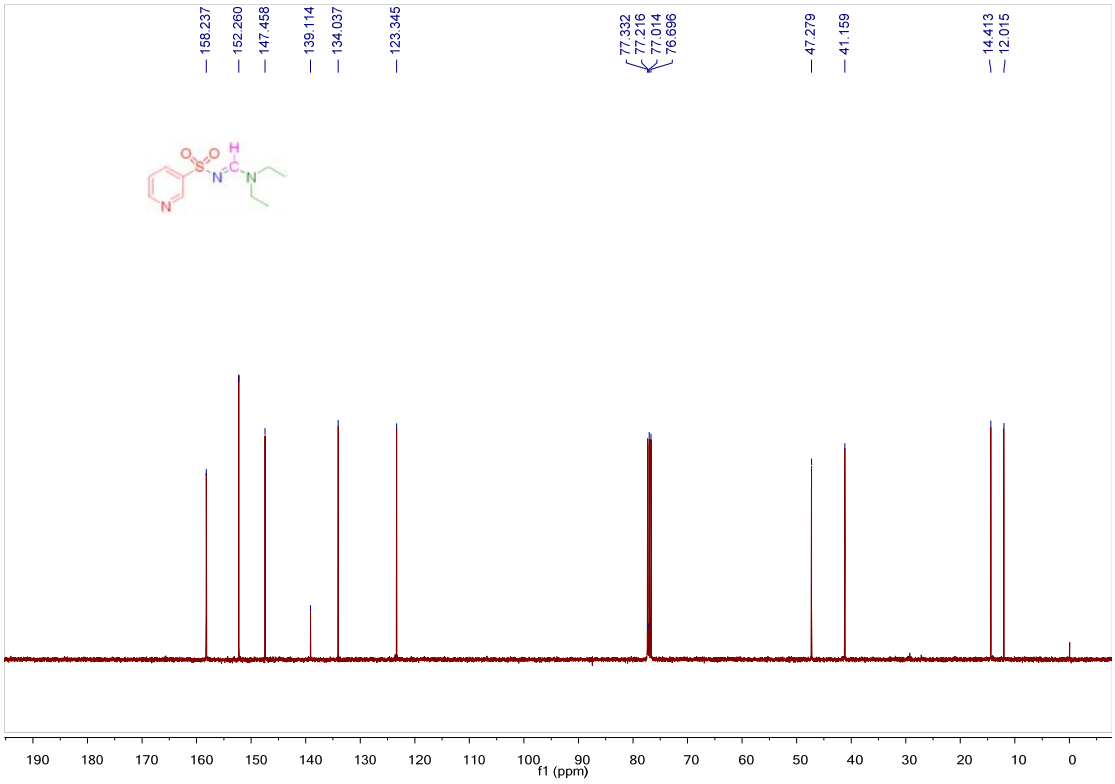

Figure S55: ^{13}C NMR of compound **7f**

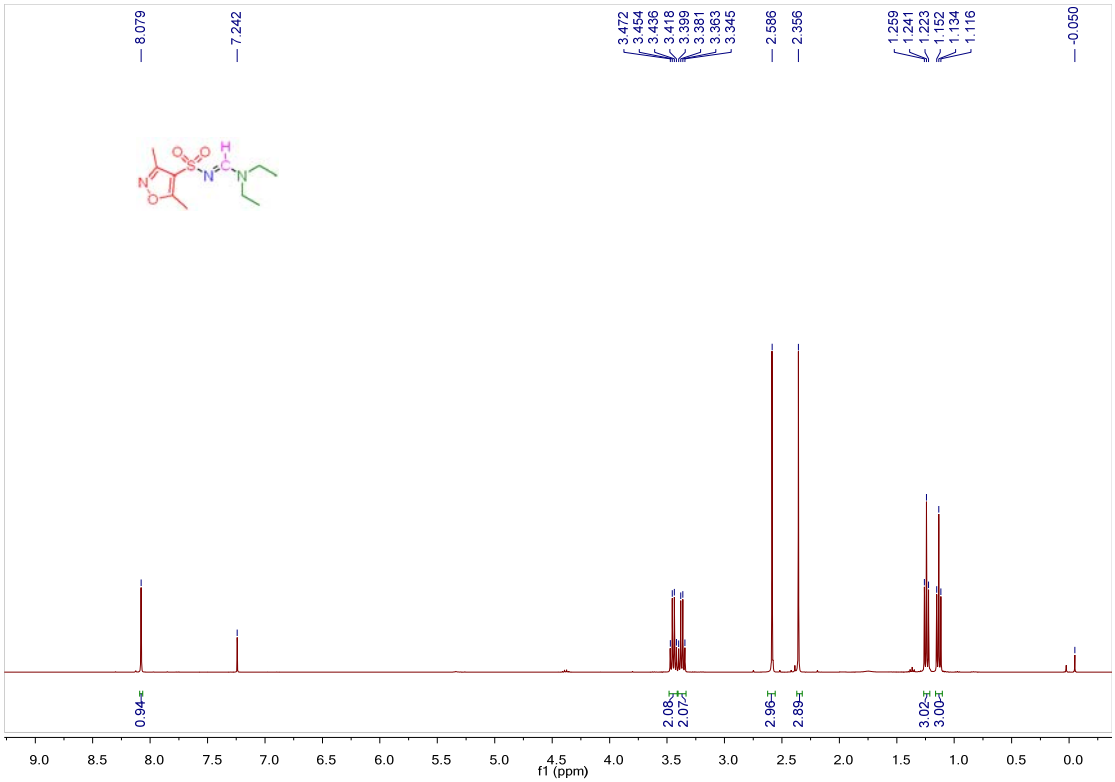

Figure S56: ^{1}H NMR of compound **7g**

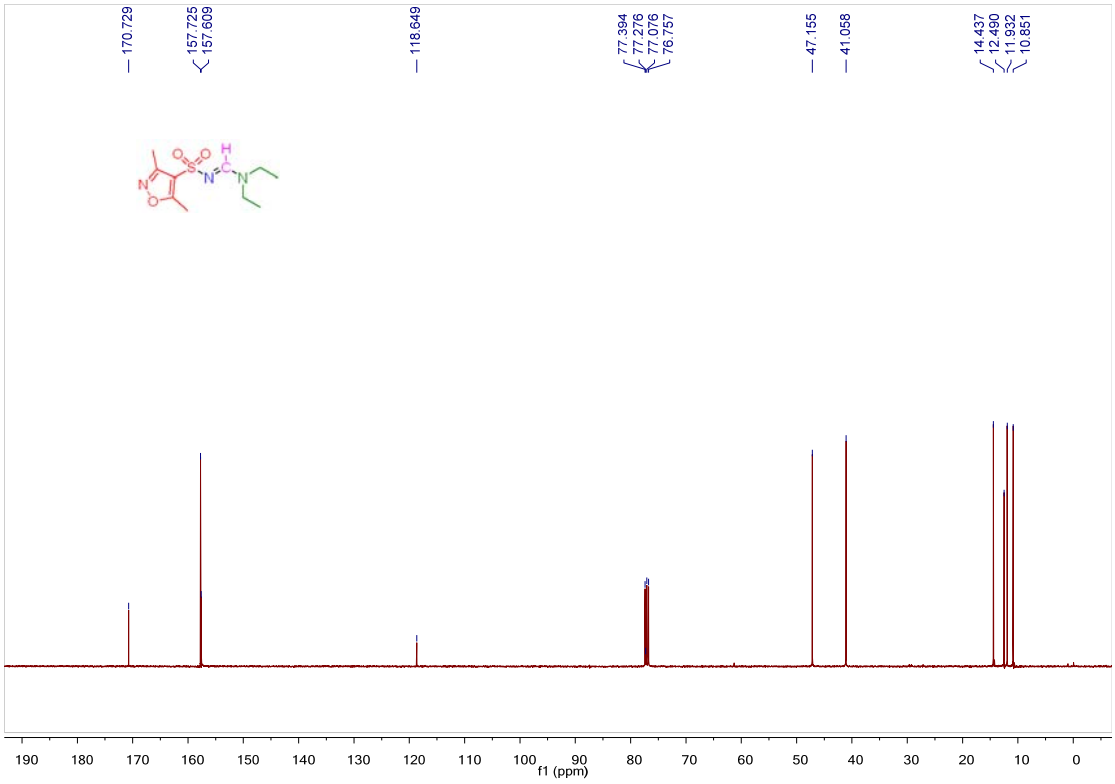

Figure S57: ^{13}C NMR of compound **7g**

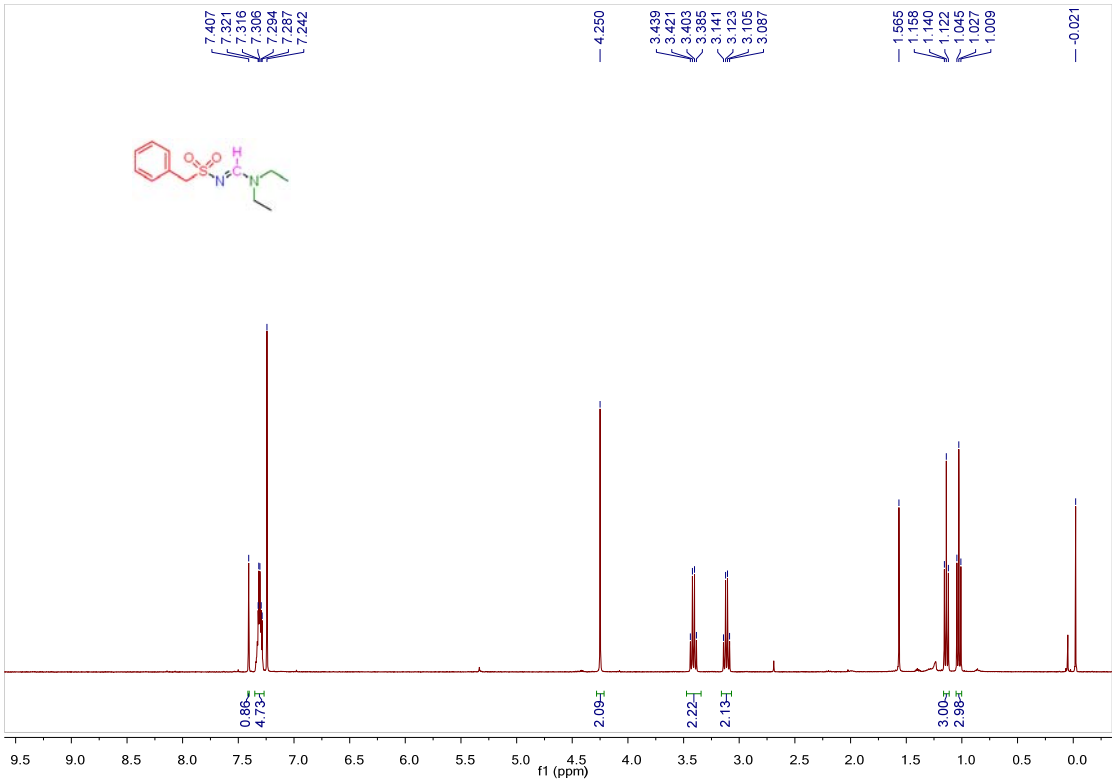

Figure S58: ^{1}H NMR of compound **7h**

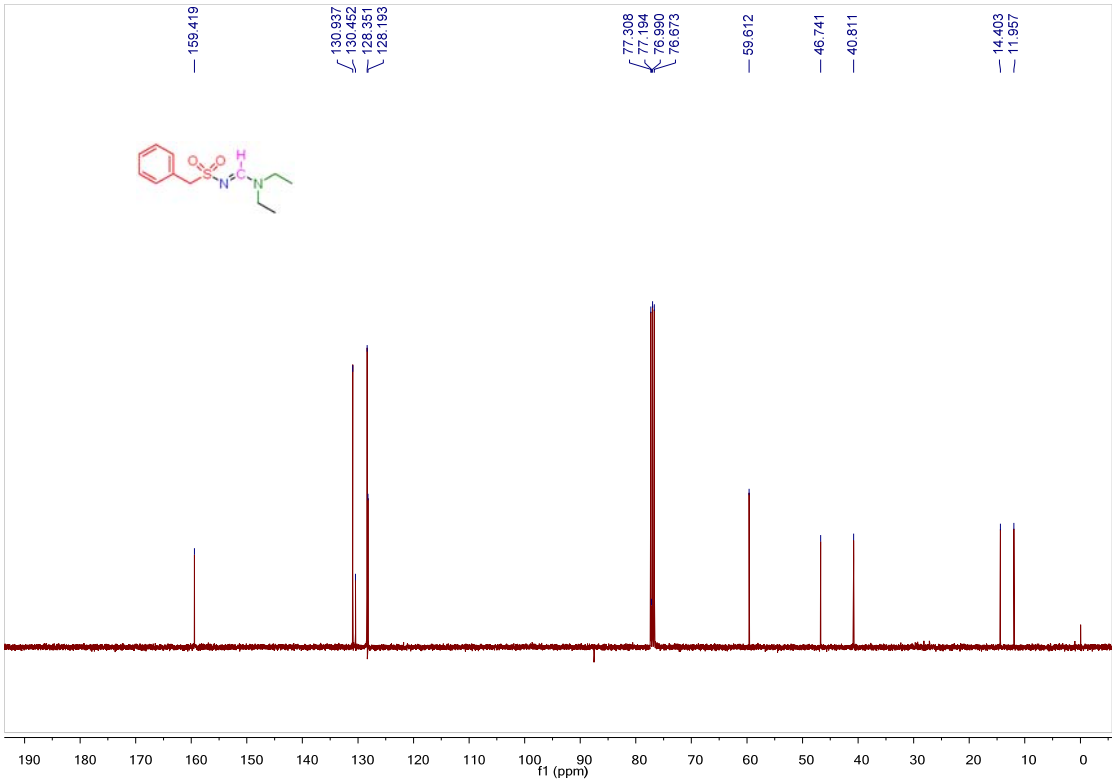

Figure S59: ^{13}C NMR of compound **7h**

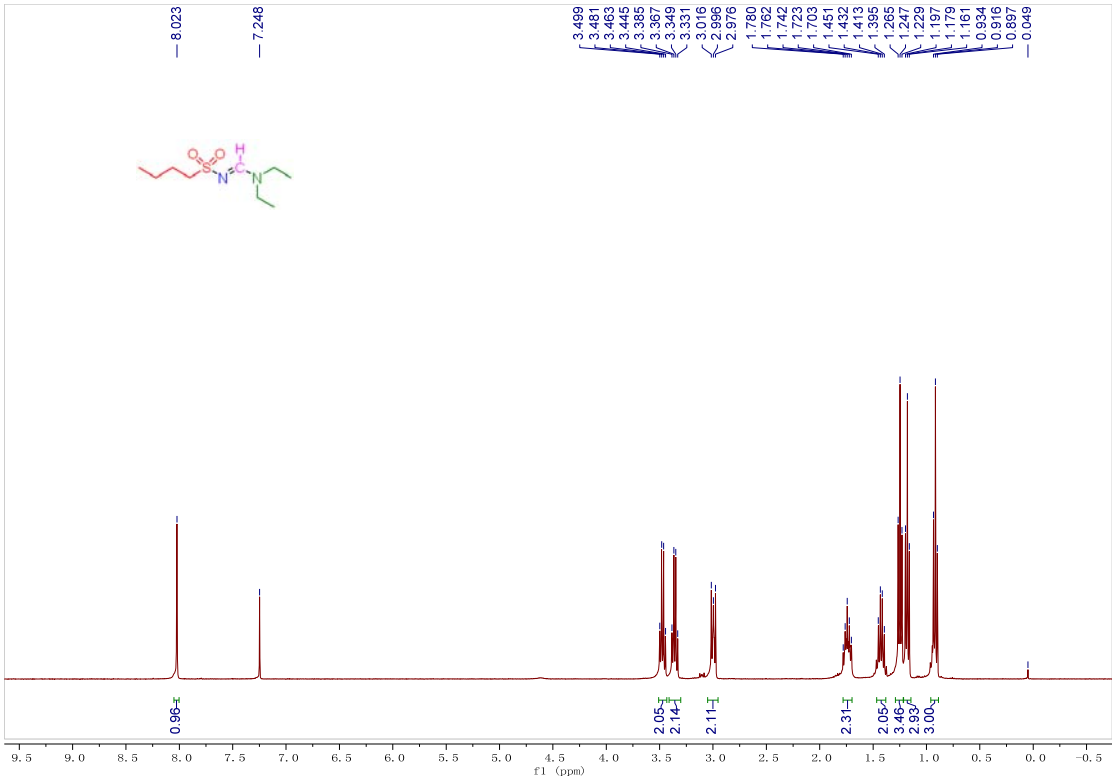

Figure S60: ^{1}H NMR of compound **7i**

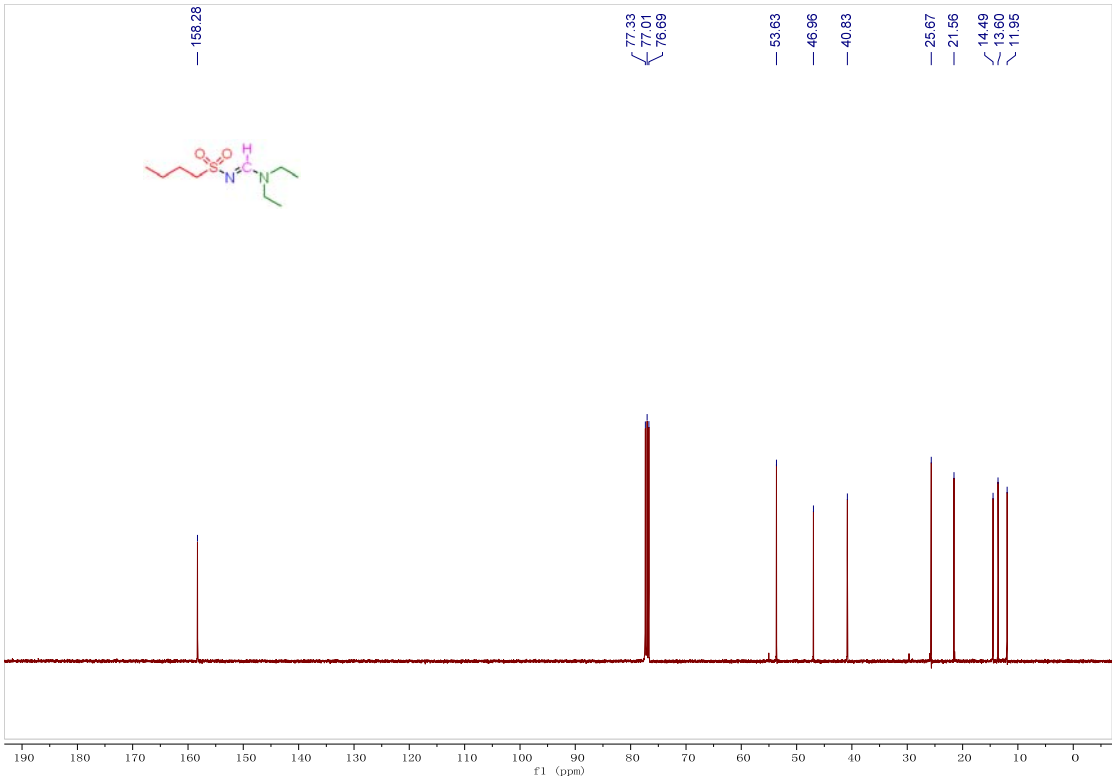

Figure S61: ^{13}C NMR of compound **7i**

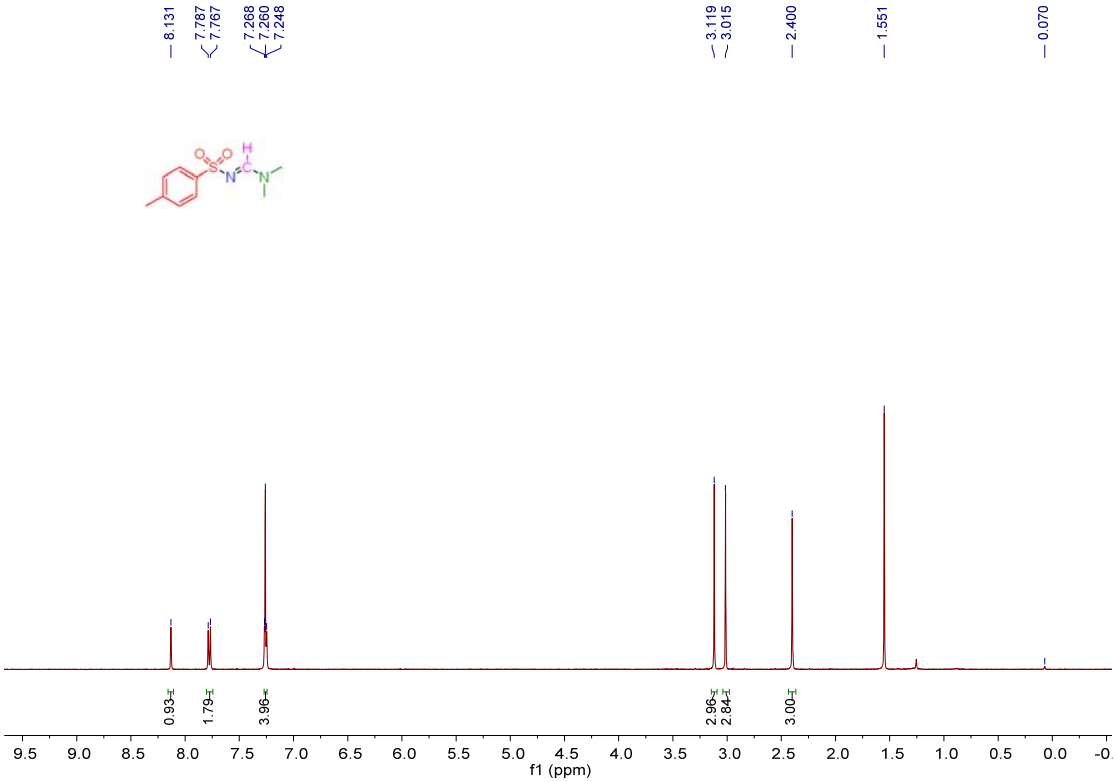

Figure S62: ^{1}H NMR of compound **7j**

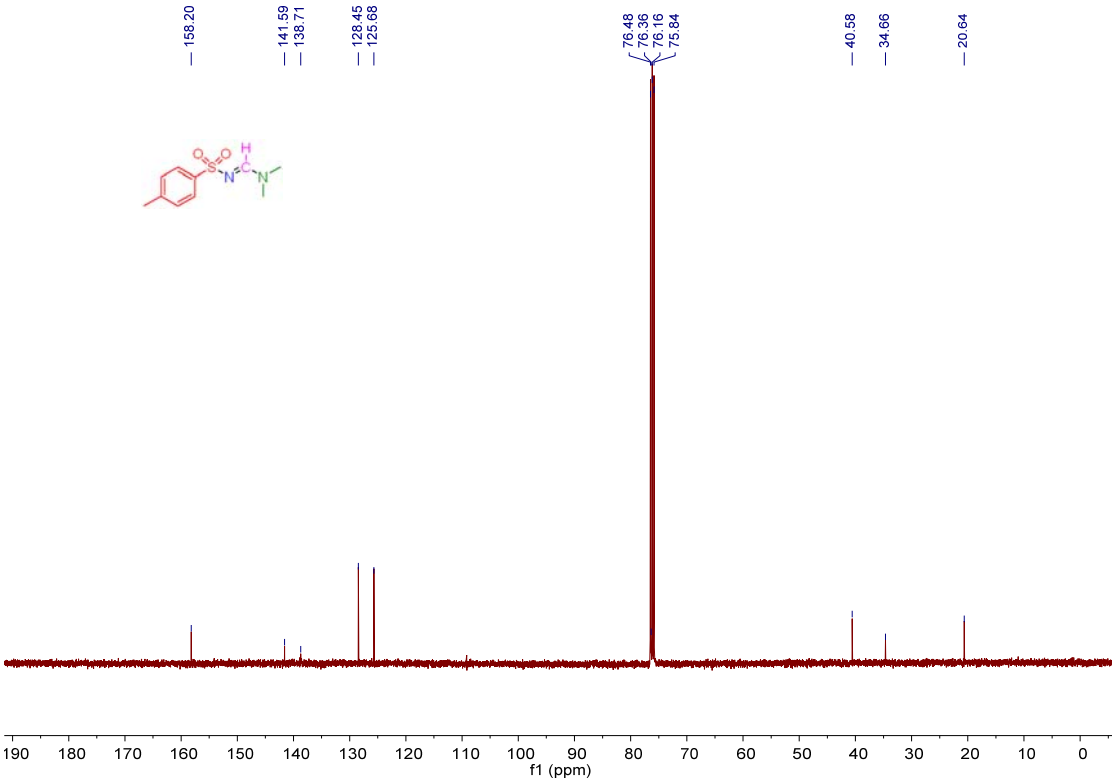

Figure S63: ^{13}C NMR of compound **7j**

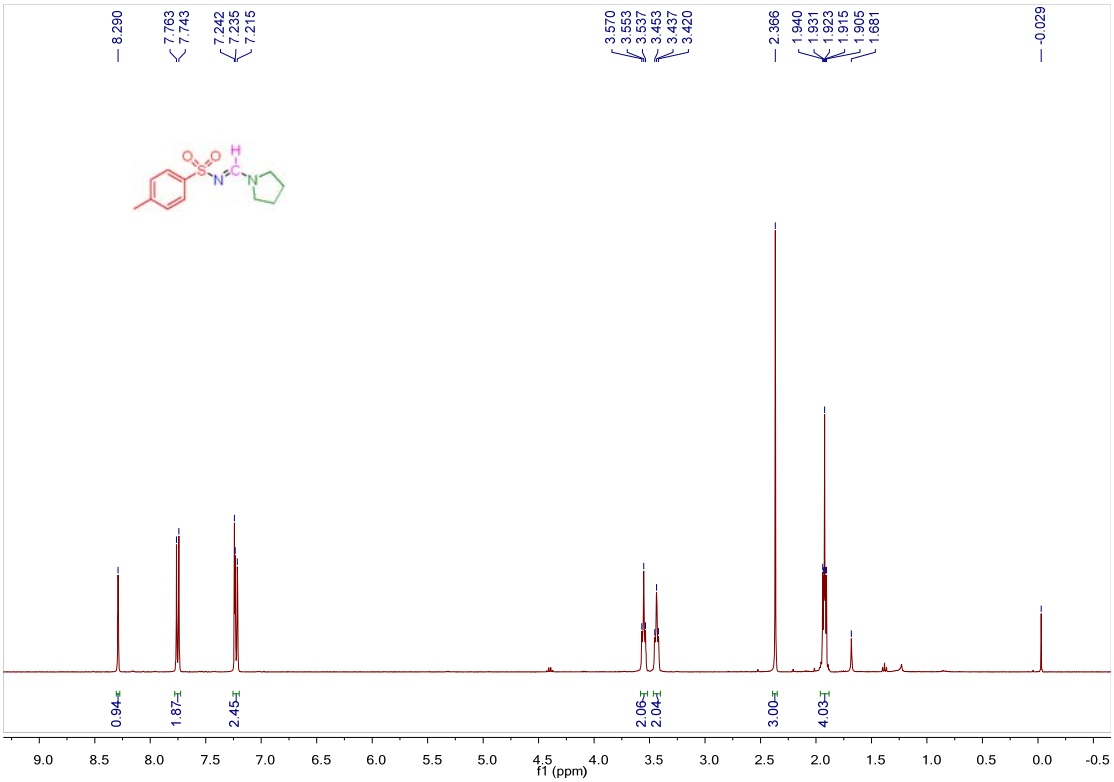

Figure S64: ^{1}H NMR of compound **7k**

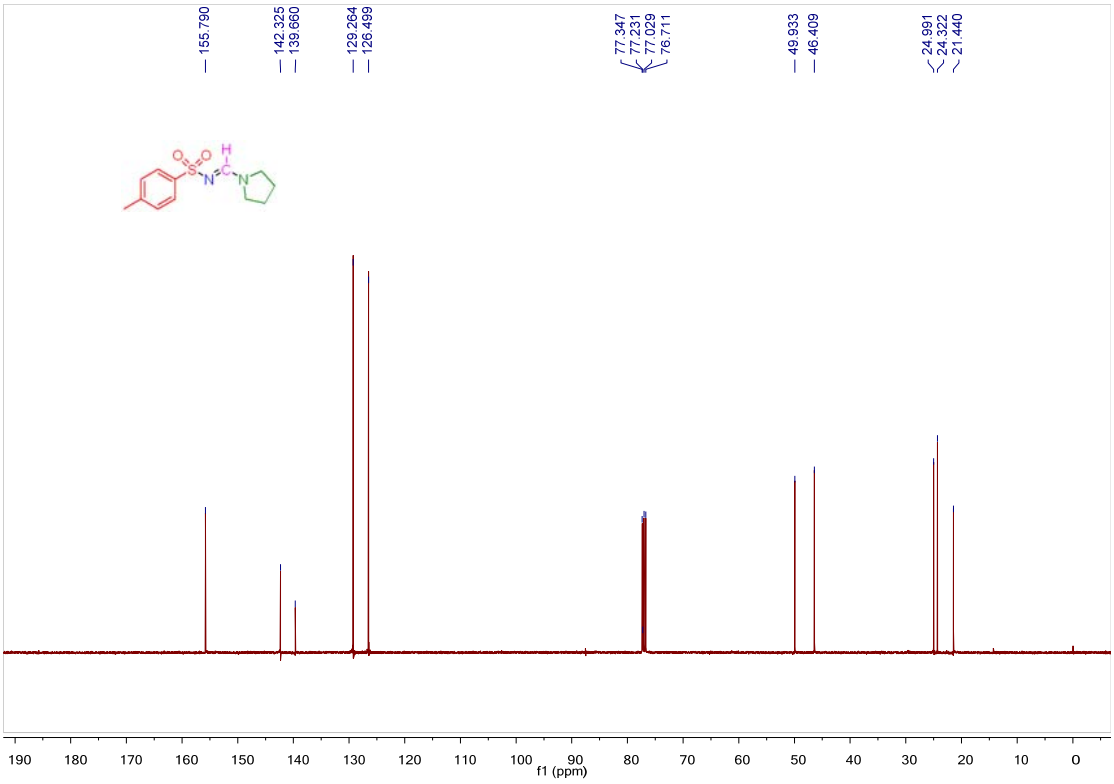

Figure S65: ^{13}C NMR of compound **7k**

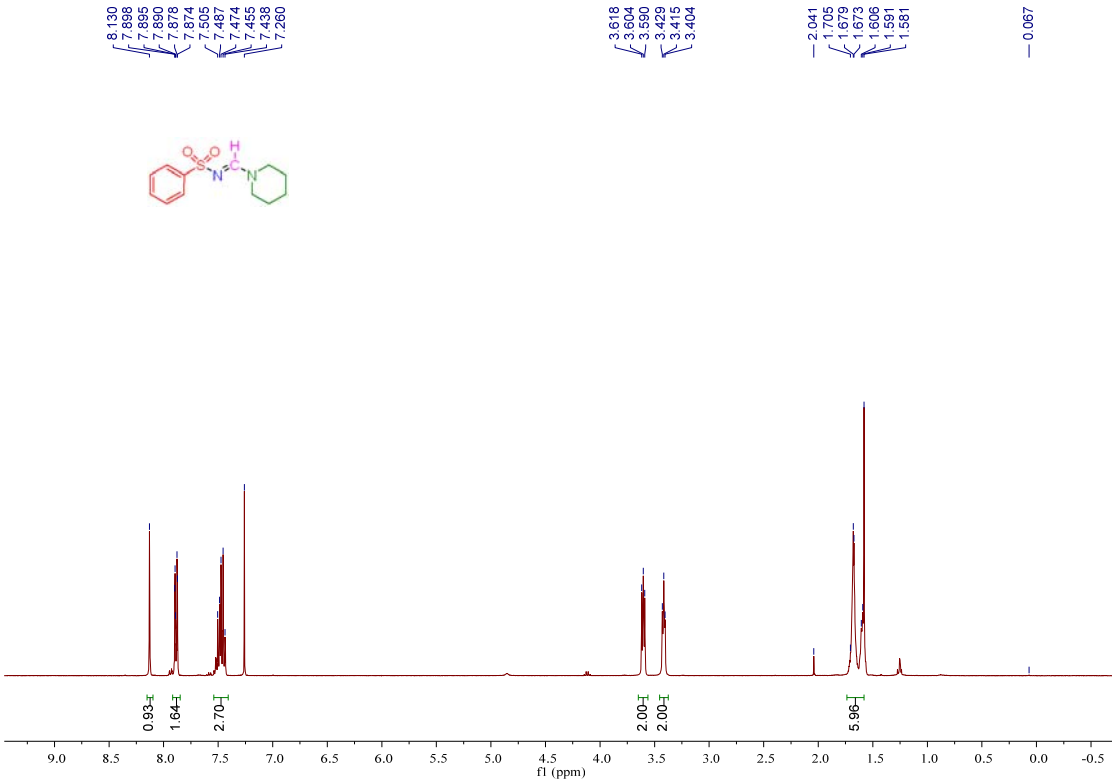

Figure S66: ^{1}H NMR of compound **7l**

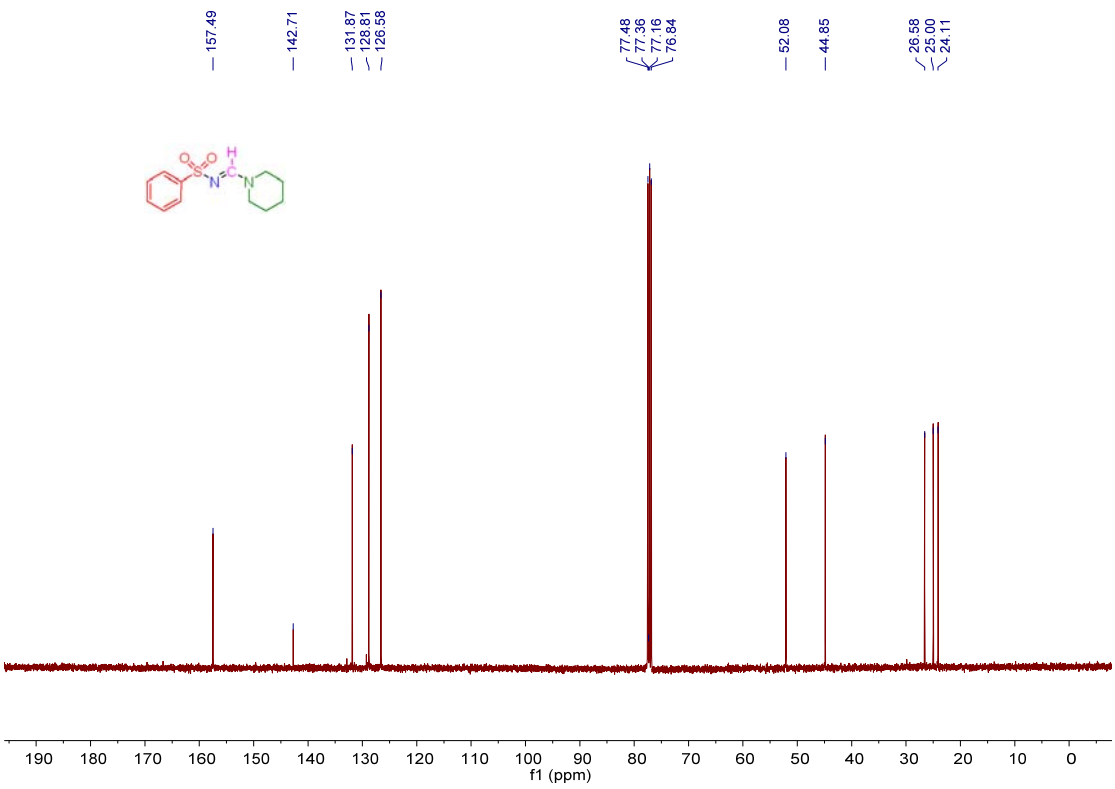

Figure S67: ^{13}C NMR of compound **7l**

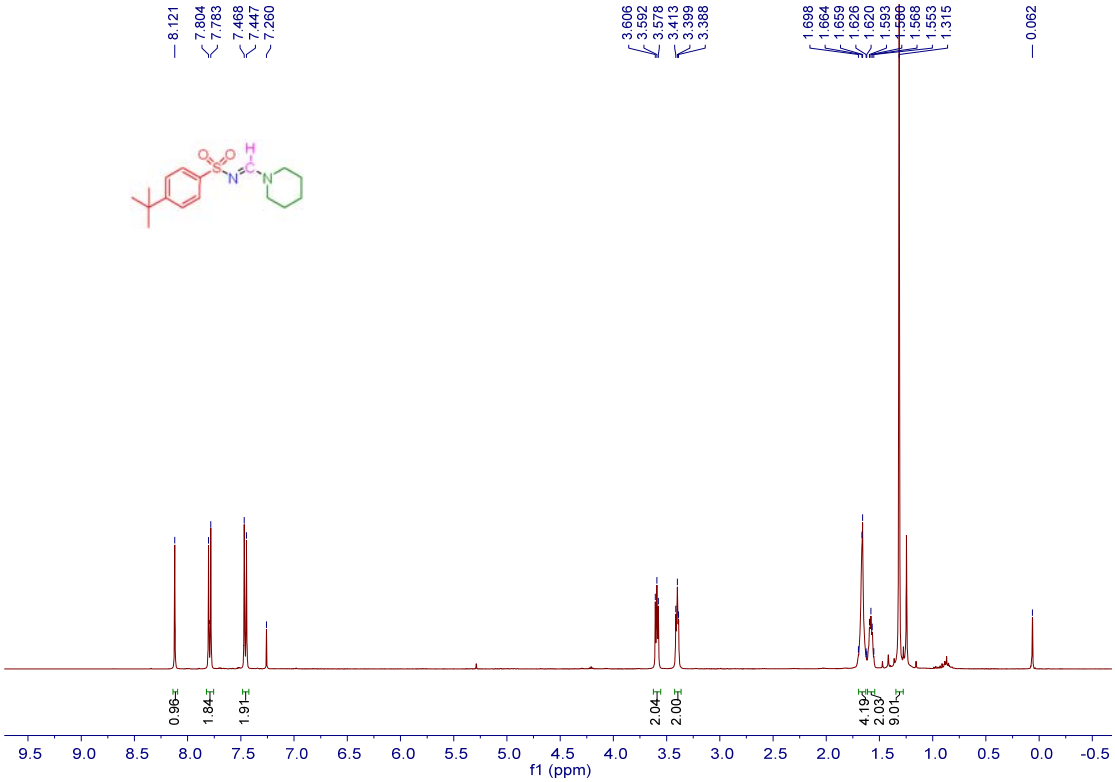

Figure S68: ^{1}H NMR of compound **7m**

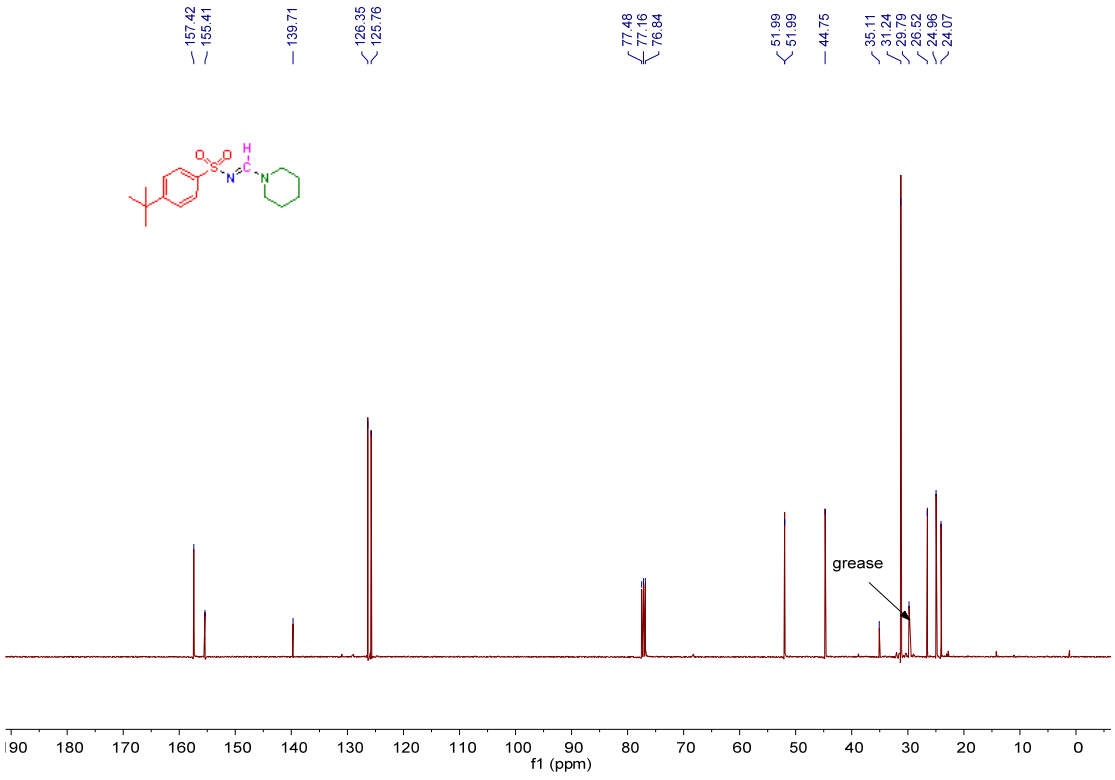

Figure S69: ^{13}C NMR of compound **7m**

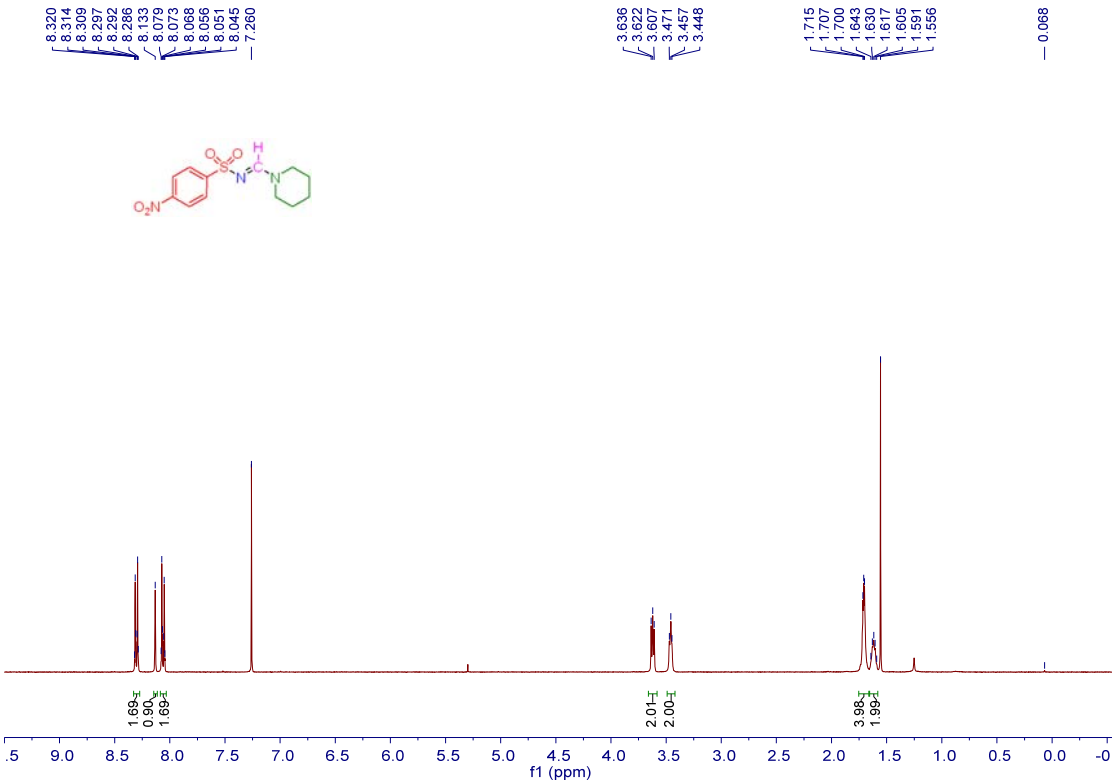

Figure S70: ^{1}H NMR of compound **7n**

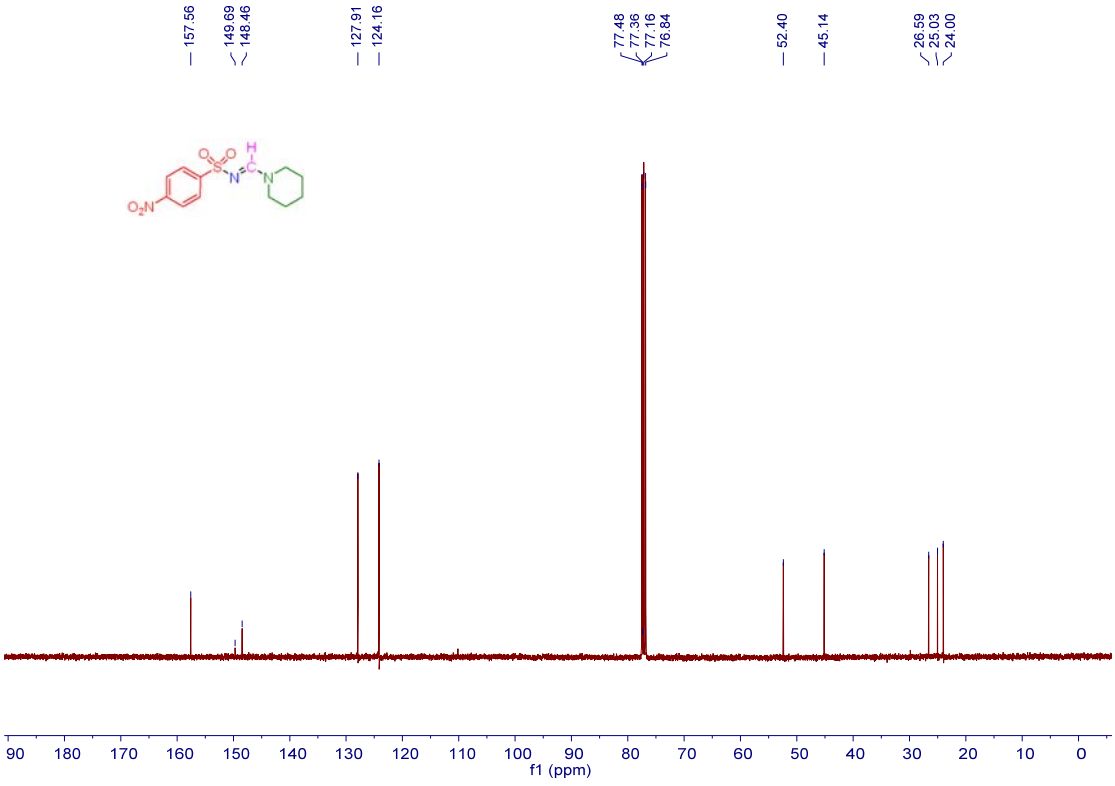

Figure S71: ^{13}C NMR of compound **7n**

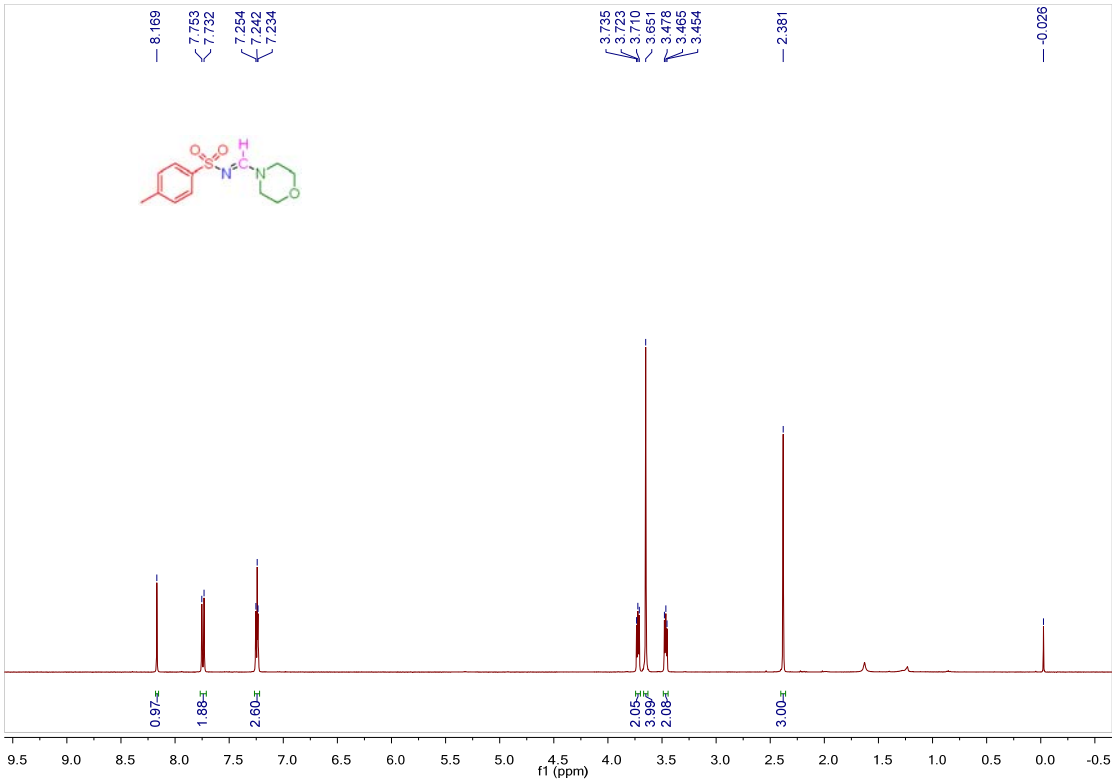

Figure S72: ^{1}H NMR of compound **7o**

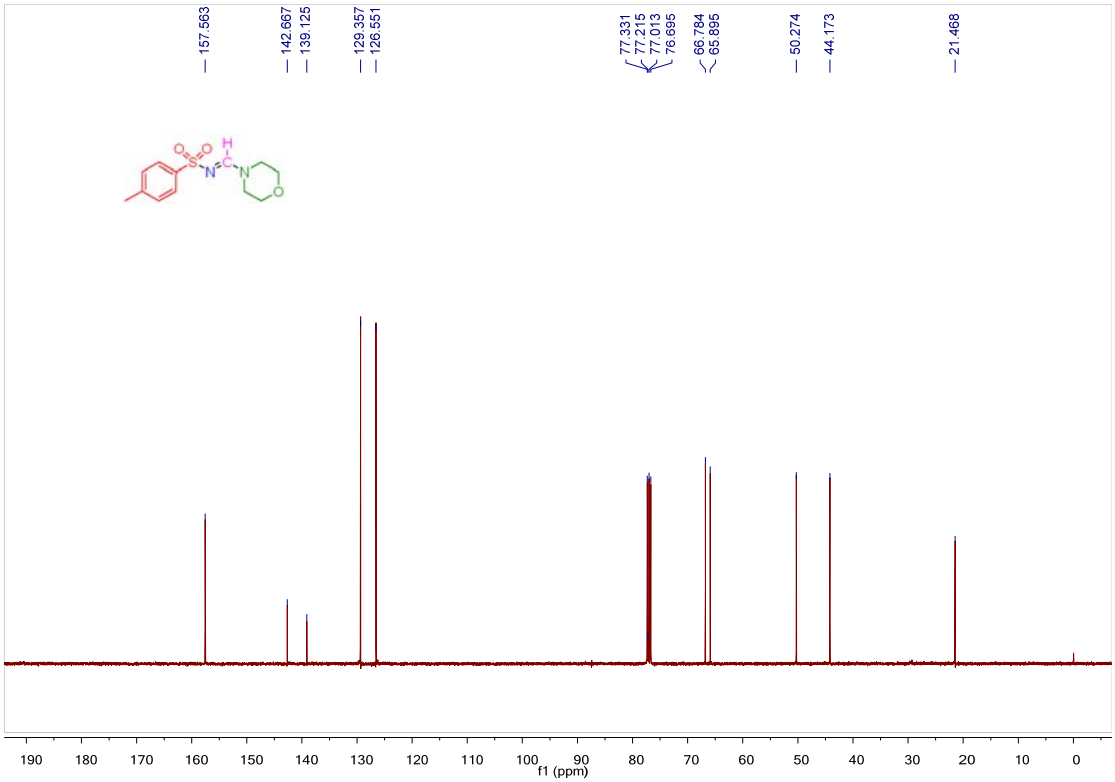

Figure S73: ^{13}C NMR of compound **7o**

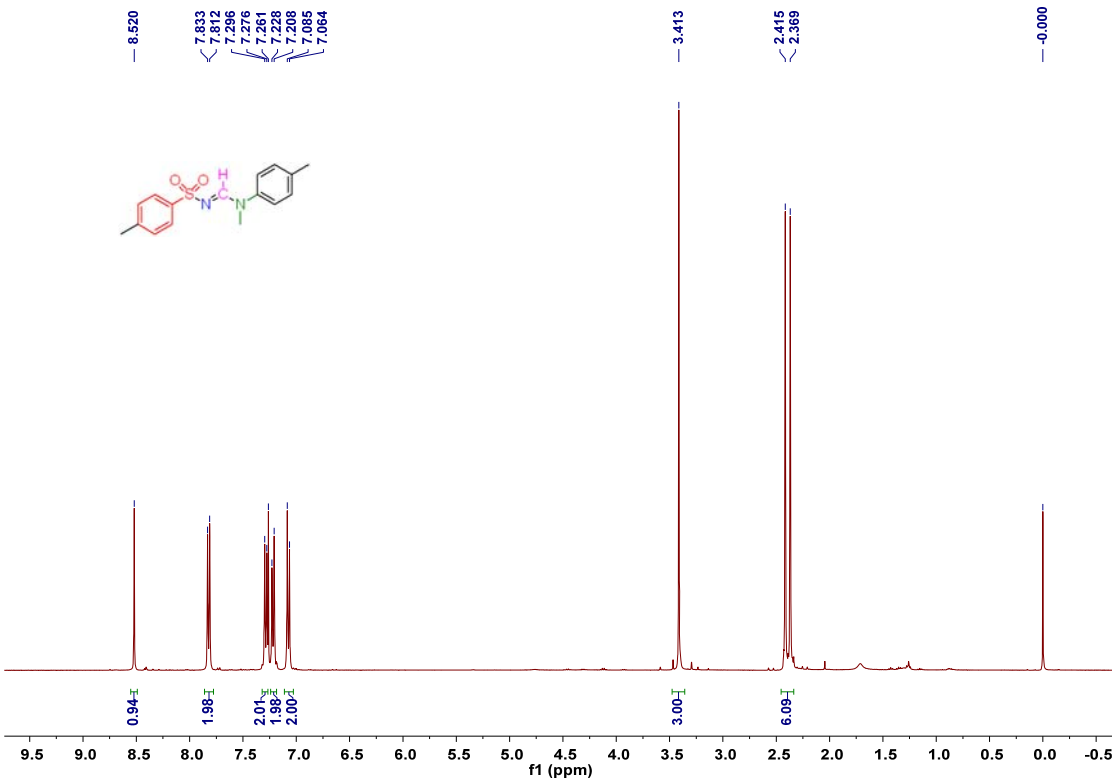

Figure S74: ^{1}H NMR of compound **7p**

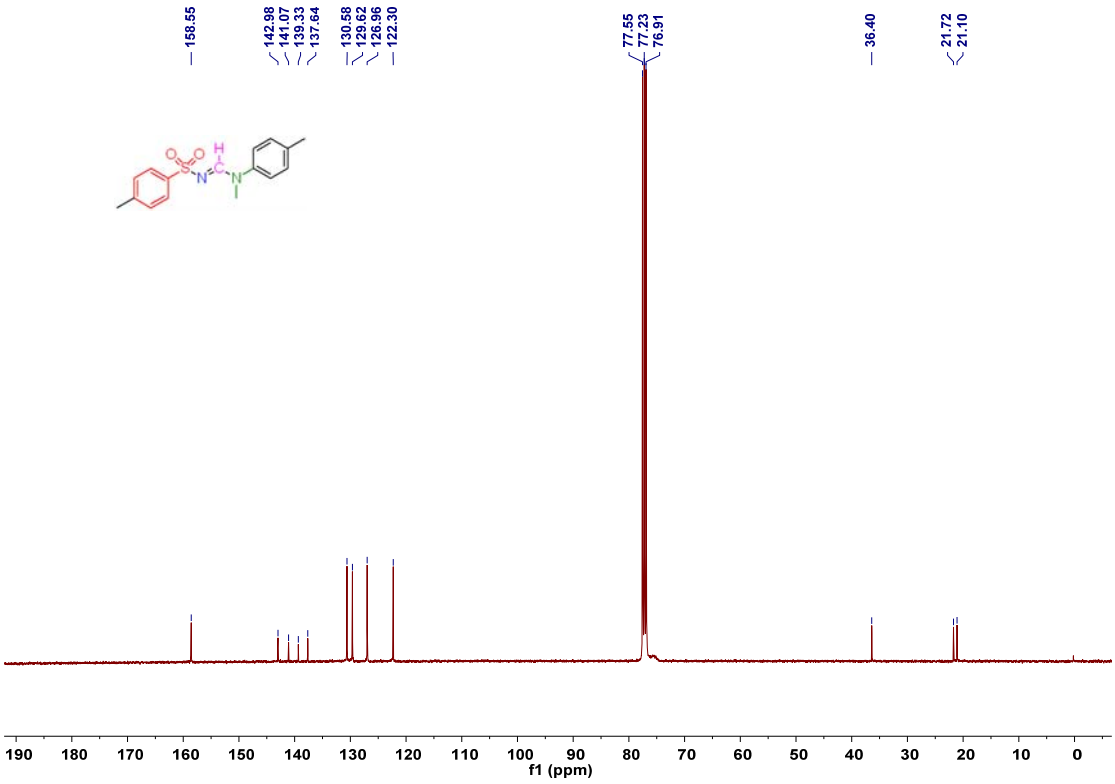

Figure S75: ^{13}C NMR of compound **7p**