Supporting Information

Electrochemical oxygenation of sulfides with water or molecular oxygen: switchable preparation of sulfones and sulfoxides

Qi Xue, [‡a] Qing Sun, [‡a] Ting-Ting Zhang, [a] Yang Li,*[a,b] and Jin-Heng Li*[abc]

[a.]Key Laboratory of Jiangxi Province for Persistent Pollutants Control and Resources Recycle, Nanchang Hangkong University, Nanchang 330063, China
[b.]State Key Laboratory of Applied Organic Chemistry, Lanzhou University, Lanzhou 730000, China
[c.]School of Chemistry and Chemical Engineering, Henan Normal University, Xinxiang, 453007, China
[‡] These authors contributed equally to this work.

E-mail: liyang8825490@126.com and jhli@hnu.edu.cn

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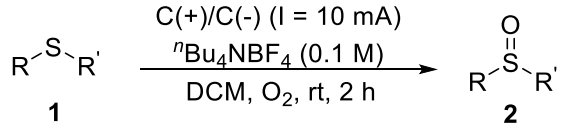
(A) Typical Experimental Procedure

(a) General

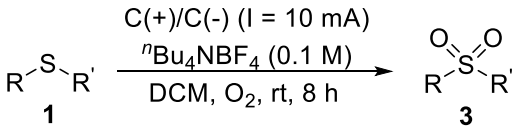
The ^{1}H and ^{13}C NMR spectra were recorded in $CDCl_3$ solvent on a NMR spectrometer using TMS as internal standard. HRMS was measured on an electrospray ionization (ESI) apparatus using time-of-flight (TOF) mass spectrometry. Melting points are uncorrected. The instrument for electrolysis is DC power source (PM3005B) (made in China). Cyclic voltammograms were obtained on a CHI 605E potentiostat. The anode electrode is graphite electrodes (Φ6mm×80mm) and cathode electrode is graphite electrodes (Φ6mm×80mm).

(b) General procedures for electrochemical oxidation of sulfides to prepare sulfoxides



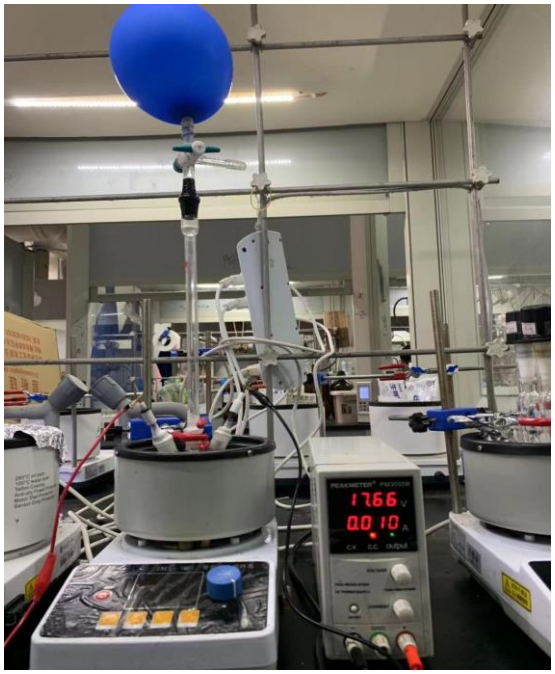
To an undivided three-necked bottle (10 mL) were added **1** (0.2 mmol), $^{n}Bu_4NBF_4$ (0.1 M) and DCM (4 mL). The bottle was equipped with graphite rod electrode as cathode and graphite rod electrode as anode under oxygen . The reaction mixture was stirred and electrolyzed at a constant current of 10 mA at room temperature for 2 h until complete consumption of **1** as monitored by TLC and/or GC-MS analysis. After the reaction was finished, the solution was extracted with EtOAc (3×10 mL). The combined organic layer was dried with Na_2SO_4, filtered and concentrated in vacuum. The resulting residue was purified by silica gel column chromatography (hexane/ethyl acetate) to afford the desired products **2**.

(c) General procedures for electrochemical oxidation of sulfides to prepare sulfones

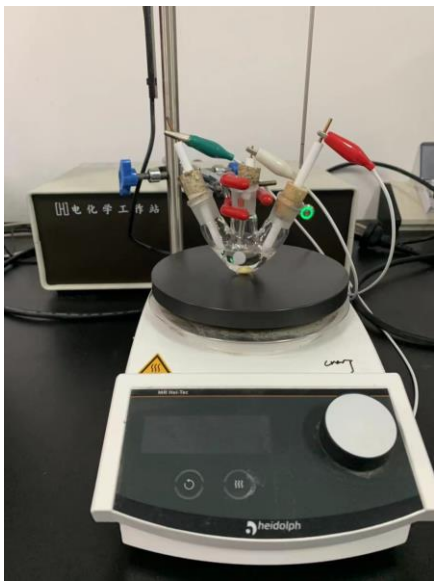


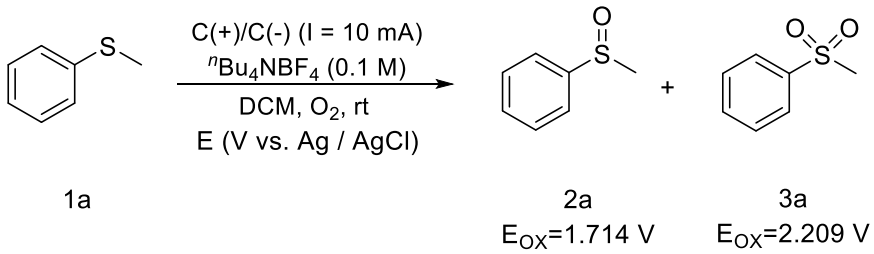
To an undivided three-necked bottle (10 mL) were added **1** (0.2 mmol), $^{n}Bu_4NBF_4$ (0.1 M) and DCM (4 mL). The bottle was equipped with graphite rod electrode as cathode and graphite rod electrode as anode under oxygen. The reaction mixture was stirred and electrolyzed at a constant current of 10 mA at room temperature for 8 h until complete consumption of **1** as monitored by TLC and/or GC-MS analysis. After the reaction was finished, the solution was extracted with EtOAc (3×10 mL). The combined organic layer was dried with Na_2SO_4, filtered and concentrated in vacuum. The resulting residue was purified by silica gel column chromatography (hexane/ethyl acetate) to afford the desired products **3**.

(d) Experimental device



(e)Cyclicvoltammograms device and Cyclic voltammogram analysis





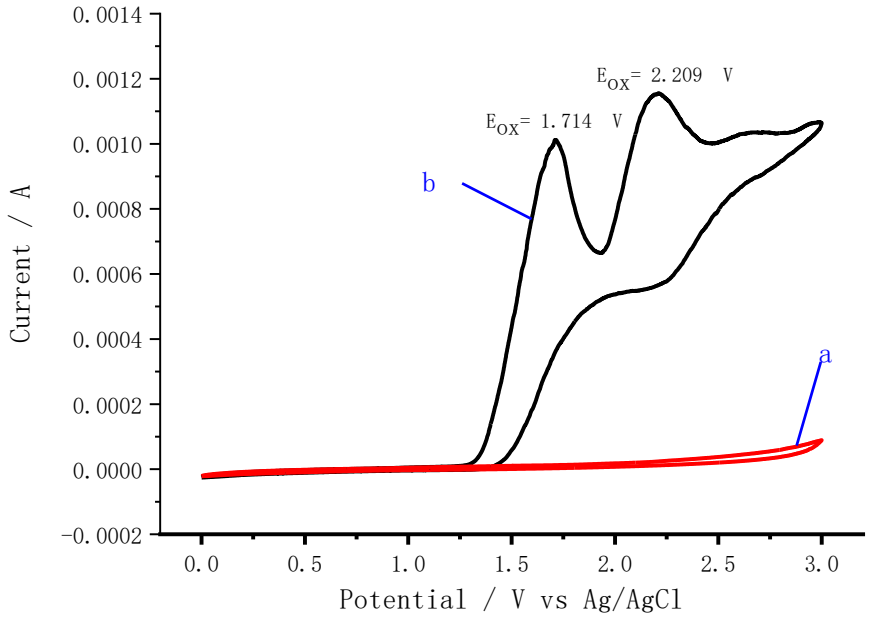
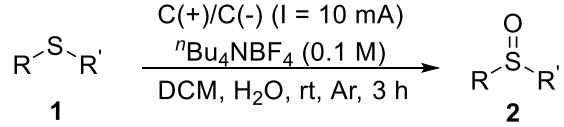


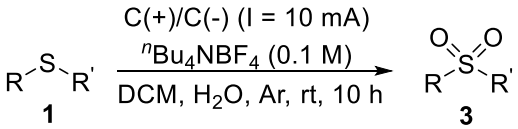
Figure S1. Cyclic voltammogram curves. Using GC disk as working electrode, Pt slice, and Ag/AgCl as counter and reference electrode at 100 mV/s scan rate. **Curve a**: $^{n}Bu_4NBF_4$ (0.1 M) and CH_3CN (6 mL); **Curve b**: 1a (0.05 M), $^{n}Bu_4NBF_4$ (0.1 M) and CH_3CN (6 mL).

(B) Water as oxygen source for selective synthesis of sulfoxides and sulfones



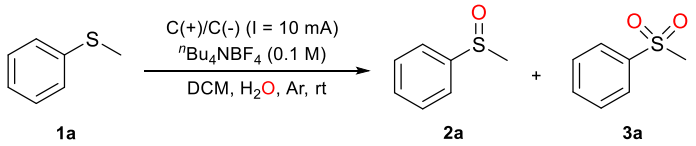
To an undivided three-necked bottle (10 mL) were added **1** (0.2 mmol), H_2O (30eq), ^{n}Bu$_4$NBF$_4$ (0.1 M) and DCM (4 mL). The bottle was equipped with graphite rod electrode as cathode and graphite rod electrode as anode under argon. The reaction mixture was stirred and electrolyzed at a constant current of 10 mA at room temperature for 3 h until complete consumption of **1** as monitored by TLC and/or GC-MS analysis. After the reaction was finished, the solution was extracted with EtOAc (3×10 mL). The combined organic layer was dried with Na_2SO_4, filtered and concentrated in vacuum. The resulting residue was purified by silica gel column chromatography (hexane/ethyl acetate) to afford the desired products **2**.

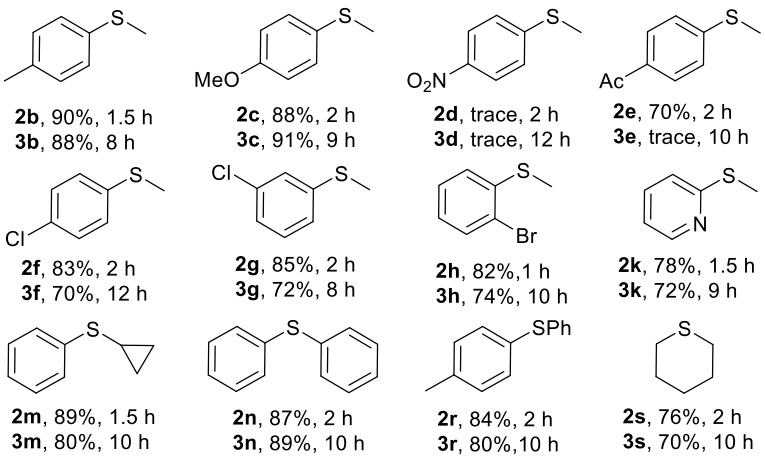
(c) General procedures for electrochemical oxidation of sulfides to prepare sulfones



To an undivided three-necked bottle (10 mL) were added **1** (0.2 mmol), H_2O (30eq), ^{n}Bu$_4$NBF$_4$ (0.1 M) and DCM (4 mL). The bottle was equipped with graphite rod electrode as cathode and graphite rod electrode as anode under argon. The reaction mixture was stirred and electrolyzed at a constant current of 10 mA at room temperature for 10 h until complete consumption of **1** as monitored by TLC and/or GC-MS analysis. After the reaction was finished, the solution was extracted with

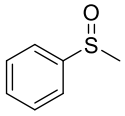
EtOAc (3×10 mL). The combined organic layer was dried with Na_2SO_4, filtered and concentrated in vacuum. The resulting residue was purified by silica gel column chromatography (hexane/ethyl acetate) to afford the desired products **3**.





Reaction conditions: undivided cell, graphite rod anode, graphite plate cathode, constant current= 10 mA, **1a** (0.2 mmol), H_2O (30 equiv.), ^{n}Bu$_4$NBF$_4$ (0.1 M), DCM (4 ml), Ar (1 atm), room temperature.

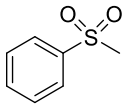
(C) Analytical data



(methylsulfinyl)benzene(2a)[5]

26.0 mg, 93% yield; Yellow oil;

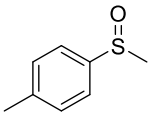
^{1}H NMR (500 MHz, CDCl3) δ: 7.66 (d, J = 7.5 Hz, 2H), 7.55-7.51 (m, 3H), 2.73 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 145.7, 131.0, 129.3, 123.5, 43.9; LRMS (EI, 70eV) (*m/z*, %) 140 (M^+, 90), 125 (100), 97 (77), 81 (8).



(methylsulfonyl)benzene (3a) [5]

28.1 mg, 90% yield; Yellow soild;

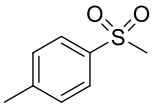
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.96 (d, J = 7.5 Hz, 2H), 7.67 (t, J = 7.5 Hz, 1H), 7.58 (t, J = 7.5 Hz, 2H), 3.06 (s, 3H); ^{13}C NMR (125 MHz, CDCl3) δ: 140.5, 133.6, 130.9, 129.39, 127.3, 44.4; LRMS (EI, 70eV) (*m/z*, %) 156 (M^+, 56), 141 (60), 94 (100), 89 (28).



1-methyl-4-(methylsulfinyl)benzene (2b) [6]

30.2 mg, 98% yield; Yellow soild;

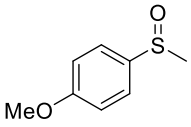
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.54 (d, J = 8.0 Hz, 2H), 7.33 (d, J = 8.0 Hz, 2H), 2.71 (s, 3H), 2.42 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 142.5, 141.5, 130.0, 123.5, 43.9, 21.3; LRMS (EI, 70eV) (*m/z*, %) 154 (M^+, 63), 139 (100), 111 (16), 91 (38).



1-methyl-4-(methylsulfonyl)benzene (3b) [6]

32.6 mg, 96% yield; Yellow soild;

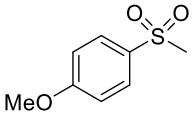
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.82 (d, J = 8.5 Hz, 2H), 7.37 (d, J = 8.0 Hz, 2H), 3.04 (s, 3H), 2.45 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 144.5, 137.6, 129.8, 127.2, 44.5, 21.5; LRMS (EI, 70eV) (*m/z*, %) 170 (M^+, 30), 155 (28), 107 (29), 91 (100).



1-methoxy-4-(methylsulfinyl)benzene (2c) [3]

29.9 mg, 88% yield; White soild;

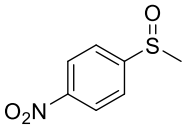
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.87 (d, J = 8.5 Hz, 2H), 7.03 (d, J = 8.5 Hz, 2H), 3.89 (s, 3H), 3.03 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 163.7, 132.3, 129.6, 114.5, 55.7, 44.9; LRMS (EI, 70eV) (*m/z*, %) 170 (M^+, 26), 155 (100), 123 (13), 92 (8).



1-methoxy-4-(methylsulfonyl)benzene (3c) [2]

33.5 mg, 90% yield; Colorless soild;

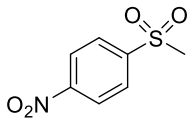
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.87 (d, J = 8.5 Hz, 2H), 7.03 (d, J = 9.0 Hz, 2H), 3.89 (s, 3H), 3.04 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 163.6, 132.1, 129.4, 114.39, 55.6, 44.7; LRMS (EI, 70eV) (*m/z*, %) 186 (M^+, 78), 171 (100), 123 (64) 107 (70).



1-(methylsulfinyl)-4-nitrobenzene (2d) [5]

35.2mg, 95% yield; Colorless solid;

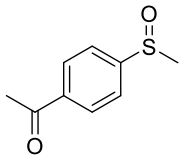
^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.40 (d, J = 8.5 Hz, 2H), 7.85 (d, J = 8.5 Hz, 2H), 2.81 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 153.2, 149.5, 124.6, 124.4, 43.8; LRMS (EI, 70eV) (*m/z*, %) 185 (M^+, 100), 170 (44), 140 (34), 112 (20).



1-(methylsulfonyl)-4-nitrobenzene (3d) [5]

35.0 mg, 87% yield; Colorless soild;

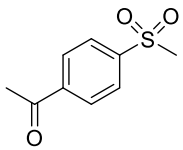
^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.44 (d, J = 9.0 Hz, 2H), 8.17 (d, J = 9.0 Hz, 2H), 3.13 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ:150.8, 145.9, 128.9, 124.6, 44.3; LRMS (EI, 70eV) (*m/z*, %) 201 (M^+, 18), 186 (24), 139 (100), 122 (54).



1-(4-(methylsulfinyl)phenyl)ethan-1-one (2e) [3]

29.1 mg, 80% yield; White solid;

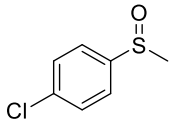
^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.11 (d, J = 8.0 Hz, 2H), 7.75 (d, J = 8.0 Hz, 2H), 2.77 (s, 3H), 2.66 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 197.0, 150.9, 139.0, 129.1, 123.7, 43.8, 26.8; LRMS (EI, 70eV) (*m/z*, %) 182 (M^+, 66), 167 (100), 152 (76), 139 (27).



1-(4-(methylsulfonyl)phenyl)ethan-1-one (3e) [2]

32.9 mg, 83% yield; Colorless soild;

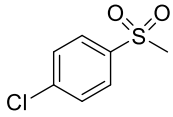
^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.10 (m, 4H), 3.10 (s, 3H), 2.68 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 196.6, 144.1, 140.8, 129.1, 127.7, 44.2, 26.9; LRMS (EI, 70eV) (*m/z*, %) 198 (M^+,15), 183 (100), 121 (54), 91 (12).



1-chloro-4-(methylsulfinyl)benzene (2f)[3]

29.9 mg, 86% yield; Yellow solid;

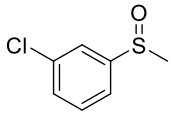
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.60 (d, J = 8.5 Hz, 2H), 7.52 (d, J = 9.0 Hz, 2H), 2.72 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 144.2, 137.2, 129.6, 124.9, 44.02, . LRMS (EI , 70eV) (*m/z*, %) 176 (M^++2, 48), 174 (M^+, 58), 159 (100), 131 (46), 111 (26).



1-chloro-4-(methylsulfonyl)benzene (3f) [2]

30.4 mg, 80% yield; Colorless soild;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.89 (d, J = 8.5 Hz, 2H), 7.56 (d, J = 8.5 Hz, 2H), 3.07 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 140.2, 138.9, 129.5, 128.7, 44.3; LRMS (EI, 70eV) (*m/z*, %) 192 (M^++2, 36) 190 (M^+, 40), 175 (48), 127 (48), 111 (100).

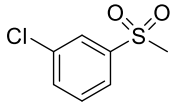


1-chloro-3-(methylsulfinyl)benzene (2g) [2]

31.3 mg, 90% yield; Yollow oil;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.67 (s, 1H), 7.51-7.49 (m, 1H), 7.47 (d, J = 5.0 Hz,

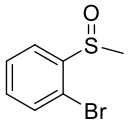
2H), 2.75 (s, 3H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ: 147.8, 135.7, 131.2, 130.5, 123.6, 121.6, 44.0; LRMS (EI, 70eV) (*m/z*, %) 176 (M^++2, 60) 174 (M^+, 80), 159 (100), 131 (71) 111 (45).



1-chloro-3-(methylsulfonyl)benzene (3g) (2)

29.6 mg, 78% yield; Yollow Soild;

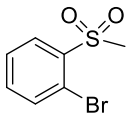
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.94 (s, 1H), 7.84 (d, J = 8.0 Hz, 1H), 7.64 (d, J = 7.5 Hz, 1H), 7.54 (t, J = 7.5 Hz, 1H), 3.08 (s, 3H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ: 142.1, 135.5, 133.8, 130.7, 127.4, 125.4, 44.3; LRMS (EI, 70eV) (*m/z*, %) 190 (M^+, 43), 175 (36), 128 (54), 111 (100).



1-bromo-2-(methylsulfinyl)benzene (2h) (2)

34.9 mg, 80% yield; Yollow oil;

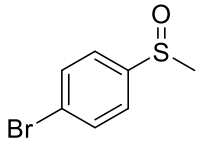
H NMR (500 MHz, $CDCl_3$) δ: 7,95 (d, J =7.5 Hz 1H), 7.61-7.56 (m, 2H), 7.39 (t, J = 6.5 Hz 1H), 2.83 (s, 3H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ: 145.3, 132.9, 132.2, 128.7, 125.6, 118.4, 41.9; LRMS (EI, 70eV) (*m/z*, %) 220 (M^++2, 88) 218 (M^+, 68), 205 (100), 139 (52), 96 (74).



1-bromo-2-(methylsulfonyl)benzene (3h) (2)

36.5 mg, 78% yield; Yollow Soild;

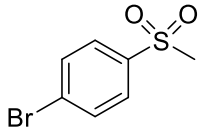
^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.20 (d, J = 7.5 Hz, 1H), 7.78 (d, J = 7.5 Hz, 1H), 7.52 (m, 2H), 3.29 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 139.6, 135.4, 134.7, 131.1, 128.1, 120.6, 42.3; LRMS (EI, 70eV) (*m/z*, %) 236 (M^++2, 56) 234 (M^+,74), 172 (52), 155 (100), 143 (22).



1-bromo-4-(methylsulfinyl)benzene (2i) (3)

36.6 mg, 84%; White solid;

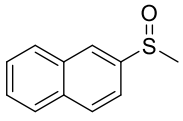
H NMR (500 MHz, $CDCl_3$) δ: 7.67 (d, J = 8.5 Hz, 2H), 7.53 (d, J = 8.0 Hz, 2H), 2.73 (s, 3H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ: 144.7, 132.5, 125.4, 125.1, 43.8; LRMS (EI, 70eV) (*m/z*, %) 220 (M^++2, 38) 218 (M^+, 54), 205 (100), 175 (17), 96 (48).



1-bromo-4-(methylsulfonyl)benzene (3i) (2)

37.4 mg, 80% yield; White solid ;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.82 (d, J = 8.5 Hz, 2H), 7.72 (d, J = 8.5 Hz, 2H), 3.06 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 139.5, 132.6, 128.9, 128.9, 44.4. LRMS (EI , 70eV) (*m/z*, %) 236 (M^++2, 48) 234 (M^+,54), 221 (52), 173 (56), 143 (100).

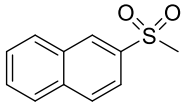


2-(methylsulfinyl)naphthalene (2j) (3)

31.9 mg, 84% yield; Yollow soild;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.22 (s, 1H), 7.99 (d, J = 8.5 Hz, 1H), 7.94 (t, J = 5.5

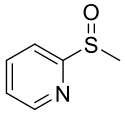
Hz 1H), 7.91 (t, J =4.0 Hz 1H), 7.62-7.58 (m, 3H), 2.79 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 142.7, 134.4, 132.9, 129.6, 128.5, 128.0, 127.7, 127.3, 124.0, 119.4, 43.7; LRMS (EI, 70eV) (*m/z*, %) 190 (M^+, 62), 175 (100), 147 (45), 115 (50).



2-(methylsulfonyl)naphthalene (3j) (6)

21.4 mg, 52% yield; Yollow Soild;

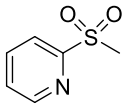
^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.52 (s, 1H), 7.99 (t, J = 9.0 Hz, 2H), 7.93-7.89 (m, 2H), 7.67 (t, J = 7.0 Hz, 1H), 7.62 (t, J = 7.0 Hz, 1H), 3.12 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 137.4, 135.3, 132.2, 129.8, 129.4, 129.3, 129.0, 128.0, 127.8, 122.13, 44.6; LRMS (EI, 70eV) (*m/z*, %) 206 (M^+,54), 191 (18), 127 (100), 115 (30).



2-(methylsulfinyl)pyridine (2k) (3)

21.3 mg, 76% yield; Yollow oil;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.63 (d, J = 4.0 Hz, 1H), 8.04 (d, J = 8.0 Hz, 1H), 7.96 (t, J = 7.5 Hz, 1H), 7.41-7.38 (m, 1H), 2.86 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 165.9, 149.5, 138.1, 124.6, 119.2, 41.3; LRMS (EI , 70eV) (*m/z*, %) 141 (M^+, 53), 125 (24), 93 (100), 80 (8).

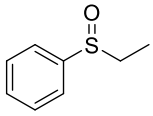


2-(methylsulfonyl)pyridine (3k) (4)

23.4 mg, 75% yield; Yellow oil;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.75 (d, J = 4.5 Hz, 1H), 8.10 (d, J = 7.5 Hz, 1H), 7.99

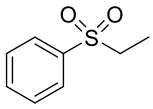
(t, J = 7.5 Hz, 1H), 7.60-7.57 (m, 1H), 3.25 (s, 3H). δ: 157.7, 149.9, 138.2, 127.4, 120.9, 39.9; LRMS (EI, 70eV) (*m/z*, %) 157 (M^+, 2), 95 (80), 93 (100), 80 (2).



(ethylsulfinyl)benzene (2l) [3]

27.1 mg, 88% yield; Colorless oil;

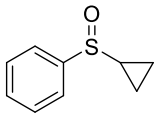
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.61 (d, J = 7.0 Hz, 2H), 7.52 (d, J = 9.0 Hz, 3H), 2.93-2.75 (m, 2H), 1.19 (d, J = 7.5 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 143.2, 130.8, 129.1, 124.1, 50.2, 5.9; LRMS (EI, 70eV) (*m/z*, %) 154 (M^+, 302), 126 (100), 97 (23), 81 (3).



(ethylsulfonyl)benzene (3l) [5]

28.9 mg, 85% yield; Yellow oil;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.91 (d, J = 7.5 Hz, 2H), 7.67 (t, J = 7.5 Hz, 1H), 7.58 (t, J = 8.0 Hz, 2H), 3.15-3.10 (m, 2H), 1.28 (t, J = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 138.4, 133.6, 129.2, 128.1, 50.5, 7.3; LRMS (EI, 70eV) (*m/z*, %) 170 (M^+, 53), 141 (35), 94 (100), 81 (1).

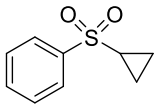


(cyclopropylsulfinyl)benzene (2m) [3]

31.5 mg, 95% yield; Yellow oil;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.68-7.66 (m, 2H), 7.54-7.50 (m, 3H), 2.29-2.24 (m, 1H), 1.27-1.22 (m, 2H), 1.06-1.01 (m, 1H), 0.98-0.92 (m, 1H); ^{13}C NMR (125 MHz,

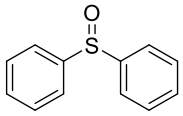
$CDCl_3$) δ: 144.8, 130.9, 129.1, 123.9, 33.7, 3.3, 2.7; LRMS (EI, 70eV) (*m/z*, %) 166 (M^+, 26), 125 (100), 117 (40), 97 (27).



(cyclopropylsulfonyl)benzene (3m) [2]

31.3 mg, 86% yield; Yellow oil;

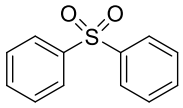
^1H NMR (500 MHz, $CDCl_3$) δ: 7.91-7.89 (m, 2H), 7.64 (t, J = 7.5 Hz, 1H), 7.56 (t, J = 8.0 Hz, 2H), 2.50-2.45 (m, 1H), 1.36-1.32 (m, 2H), 1.0-1.01 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 140.6, 133.3, 129.1, 127.4, 32.8, 5.8; LRMS (EI, 70eV) (*m/z*, %) 182 (M^+, 55), 141 (100), 117 (46), 91 (16).



Sulfinyldibenzene (2n) [2]

37.2 mg, 92% yield; Yellow soild;

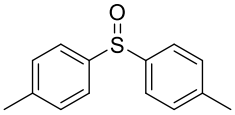
^1H NMR (500 MHz, CDCl3) δ: ^1H NMR (500 MHz, CDCl3) δ: 7.64 (d, J = 7.5 Hz, 4H), 7.43 (d, J = 6.5 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 145.4, 130.9, 129.2, 124.6; LRMS (EI, 70eV) (*m/z*, %) 202 (M^+, 100), 173 (21), 154 (72), 109 (82).



Sulfonyldibenzene (3n) [1]

39.2 mg, 90% yield; Yellow soild;

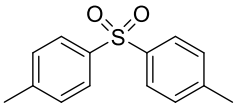
^1H NMR (500 MHz, CDCl3) δ: 7.95 (d, J = 7.5 Hz, 4H), 7.56 (t, J = 7.0 Hz, 2H), 7.50 (t, J = 7.5 Hz, 4H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 141.5, 133.1, 129.2, 127.6; LRMS (EI, 70eV) (*m/z*, %) 218 (M^+, 24), 152 (5), 125 (100), 97 (22).



4,4'-sulfinylbis(methylbenzene) (2o)[2]

41.4 mg, 90% yield; White solid;

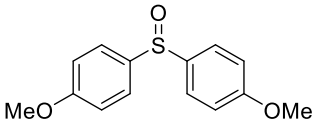
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.51 (d, J = 8.0 Hz, 4H), 7.24 (d, J = 8.0 Hz, 4H), 2.34 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 142.6, 141.3, 129.8, 124.7, 21.3; LRMS (EI, 70eV) (*m/z*, %) 230 (M^+, 64), 182 (100), 123 (86), 91 (52).



4,4'-sulfonylbis(methylbenzene) (3o) [1]

39.4 mg, 80% yield; White solid;

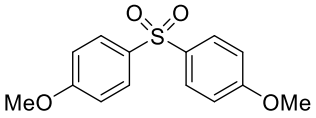
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.81 (d, J = 8.0 Hz, 4H), 7.28 (d, J = 8.0 Hz, 4H), 2.38 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ:143.9, 139.0, 129.8, 127.5, 21.5; LRMS (EI, 70eV) (*m/z*, %) 246 (M^+, 32), 139 (100),107 (12), 91 (35).



4,4'-sulfinylbis(methoxybenzene) (2p) [2]

46.3 mg, 89% yield; Yellow soild;

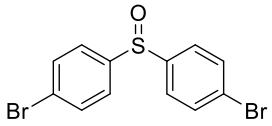
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.53 (d, J = 8.5 Hz, 4H), 6.95 (d, J = 8.5 Hz, 4H), 3.80 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 161.7, 136.8, 126.7, 114.6, 55.4; LRMS (EI, 70eV) (*m/z*, %) 262 (M^+, 17), 214 (100), 199 (48), 123 (68).



4,4'-sulfonylbis(methoxybenzene) (3p) [1]

43.4 mg, 78% yield; Yollow soild;

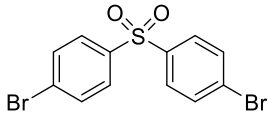
^{1}H NMR (500 MHz, $CDCl_3$) δ: 8.10 (d, J = 39.5 Hz, 4H), 3.10 (s, 3H), 2.68 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 196.6, 144.1, 140.8, 129.1, 127.7, 44.2, 26.9; LRMS (EI, 70eV) (*m/z*, %) 278 (M^+, 60), 155 (96), 123 (100), 107 (17).



4,4'-sulfinylbis(bromobenzene) (2q) (2)

60.9 mg, 85% yield; White solid;

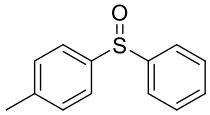
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.60-7.59 (m, 4H), 7.51-7.49 (m, 4H); ^{13}C NMR (125 MHz, CDCl3) δ: 144.3, 1326, 126.0, 125.8; LRMS (EI, 70eV) (*m/z*, %) 360 (M^+, 38), 312 (88), 281 (82), 108 (100).



4,4'-sulfonylbis(bromobenzene) (3q) (1)

62.8 mg, 84% yield; Colorless soild;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.80-7.77 (m, 4H), 7.65 (d, J = 8.5 Hz, 4H); ^{13}C NMR (125 MHz, CDCl3) δ: 140.2, 132.7, 129.2, 128.8; LRMS (EI, 70eV) (*m/z*, %) 376 (M^+, 28), 205 (100), 167 (22), 149 (12).

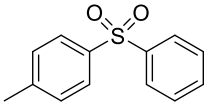


1-methyl-4-(phenylsulfinyl)benzene (2r) (2)

37.2 mg, 86% yield; White soild;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.63-7.61 (m, 2H), 7.53 (d, J = 8.5Hz, 2H), 7.44-7.39

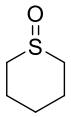
(m, 3H), 7.23 (d, J = 8.0 Hz, 2H), 2.33 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 145.6, 142.3, 141.4, 130.7, 129.8, 129.1, 124.7, 124.4; LRMS (EI, 70eV) (*m/z*, %) 216 (M^+, 100), 168 (92), 123 (70), 107 (74).



1-methyl-4-(phenylsulfonyl)benzene (3r) (1)

38.5 mg, 83% yield; Colorless soild;

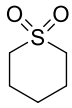
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.94-7.92 (m, 2H), 7.83 (d, J = 8.0 Hz, 2H), 7.54 (t, J = 7.5 Hz, 1H), 7.49 (t, J = 7.5 Hz, 2H), 7.29 (d, J = 8.0 Hz, 2H), 2.39 (s, 3H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ: 144.1, 142.0, 138.6, 133.0 129.9, 129.2, 127.7, 127.5, 21.5; LRMS (EI, 70eV) (*m/z*, %) 232 (M^+,76), 139 (96), 107 (100), 91 (38).



tetrahydro-2H-thiopyran 1-oxide (2s) (5)

18.4mg, 78% yield; Yollow Soild;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 2.89 (t, J = 11.0 Hz, 2H), 2.78-2.74 (m, 2H), 2.26-2.23 (m, 2H), 1.68-1.65 (m, 2H), 1.61-1.58 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 48.8, 24.5, 18.9; LRMS (EI, 70eV) (*m/z*, %) 118 (M^+, 100), 101 (34), 90 (24), 82 (2).

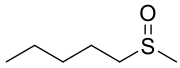


tetrahydro-2H-thiopyran 1,1-dioxide (3s) (5)

18.2 mg, 68% yield; White soild;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 3.0 (t, J =6.0 Hz 4H), 2.12-2.07 (m, 4H), 1.67-1,64 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 52.1, 24.2, 23.7; LRMS (EI, 70eV) (*m/z*, %) 134

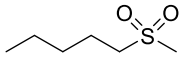
(M^+, 100), 118 (38), 106 (32), 80 (14).



2-(methylsulfonyl)pyridine (2t)

14.6 mg, 62% yield; Yellow oil;

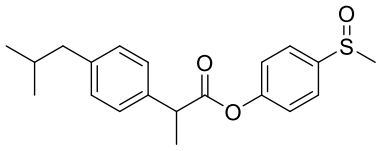
^{1}H NMR (500 MHz, $CDCl_3$) δ: 2.77-2.72 (m, 1H), 2.67-2.61 (m, 1H), 2.57 (s, 3H), 1.80-1.73 (m, 2H), 1.48-1.42 (m, 2H), 1.40-1.37 (m, 2H), 0.92 (t, J = 7.0 Hz, 3H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ: 54.7, 38.5, 30.8, 22.2, 22.2, 13.7; LRMS (EI, 70eV) (*m/z*, %) 135(M^+, 2), 117 (100), 103 (2), 80 (1); HRMS *m/z* (ESI) for calcd $C_6H_{14}OS$ $[M+H]^+$ 135.0838, found 135.0838.



1-(methylsulfonyl)pentane (3t)

16.0 mg, 60% yield; Yellow oil;

^{1}H NMR (500 MHz, $CDCl_3$) δ: ^{1}H NMR (500 MHz, CDCl3) : 3.03-3.00 (m, 2H), 2.90 (s, 3H), 1.88-1.82 (m, 2H), 1.47-1.41 (m, 2H), 1.40-1.34 (m, 2H), 0.93 (t, J = 7.5 Hz, 3H).; ^{13}C NMR (125 MHz, CDCl3) : 54.6, 40.3, 30.3, 22.0, 22.0, 13.6; LRMS (EI, 70eV) (*m/z*, %) 151 (M^+, 2), 135 (13), 94 (16), 81 (100); HRMS *m/z* (ESI) for calcd $C_6H_{14}O_2S$ $[M+H]^+$ 151.0787, found 151.0787.

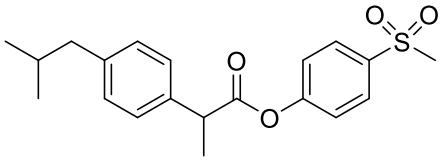


4-(methylsulfinyl)phenyl 2-(4-isobutylphenyl)propanoate (4a)

51.6 mg, 75% yield; Yellow soild; mp: 169.0-171.2 °C (uncorrected);

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.63 (d, J = 8.0 Hz, 2H), 7.29 (d, J = 8.0 Hz, 2H),

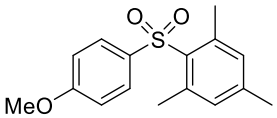
7.18-7.14 (m, 4H), 3.97-3,93 (m, 1H), 2.70 (s, 3H), 2.47 (d, J = 7.0 Hz, 2H), 1.89-1.84 (m, 1H), 1.61 (d, J = 7.0 Hz, 3H), 0.91 (d, J = 6.5 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 172.8, 152.9, 142.6, 141.0, 136.7, 129.6, 127.1, 124.8, 122.6, 45.2, 45.0, 44.0, 30.1, 22.3, 18.4; LRMS (EI, 70eV) (*m/z*, %) 344 (M^+, 8), 188 (32), 161 (100), 140 (24); HRMS *m/z* (ESI) for calcd $C_{20}H_{24}O_3S$ $[M+H]^+$ 345.1519, found 345.1518.



4-(methylsulfonyl)phenyl 2-(4-isobutylphenyl)propanoate (4b)

29.5 mg, 41% yield; White soild; mp; 193.2-195.0 °C (uncorrected);

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.63 (d, J = 8.0 Hz, 2H), 7.29 (d, J = 8.0 Hz, 2H), 7.18-7.14 (m, 4H), 3.97-3,93 (m, 1H), 2.70 (s, 3H), 2.47 (d, J = 7.0 Hz, 2H), 1.89-1.84 (m, 1H), 1.61 (d, J = 7.0 Hz, 3H), 0.91 (d, J = 6.5 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 172.8, 152.9, 142.6, 141.0, 136.7, 129.6, 127.1, 124.8, 122.6, 45.2, 45.0, 44.0, 30.1, 22.3, 18.4; LRMS (EI, 70eV) (*m/z*, %) 360 (M^+, 1), 161 (100), 117 (16), 91 (10); HRMS *m/z* (ESI) for calcd $C_{20}H_{24}O_4S$ $[M+H]^+$ 361.1468, found 361.1464.

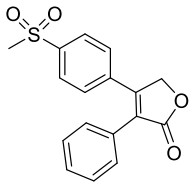


2-((4-methoxyphenyl)sulfonyl)-1,3,5-trimethylbenzene (4c)

37.7 mg, 65% yield; Yellow oil;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.73 (d, J = 8.5 Hz, 2H), 6.93 (d, J = 7.0 Hz, 4H), 3.83 (s, 3H), 2.60 (s, 6H), 2.28 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 162.7, 143.0,

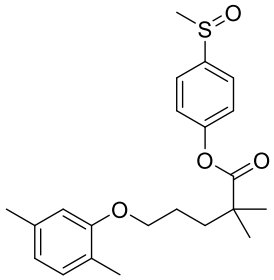
139.7, 135.2, 134.5, 132.1, 128.4, 114.0, 55.6, 22.8, 20.9; LRMS (EI, 70eV) (*m/z*, %) 290 (M^+, 46), 272 (84), 165 (100), 91 (82).



4-(4-(methylsulfonyl)phenyl)-3-phenylfuran-2(5H)-one (4d)[4]

35.8 mg, 57% yield; White soild;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.92 (d, J = 8.0 Hz, 2H), 7.52 (d, J = 8.0 Hz, 2H), 7.40 (s, 5H), 5.20 (s, 2H), 3.08 (s, 3H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ: 172.5, 153.4, 141.9, 136.2, 129.5, 129.1, 129.1, 129.0, 129.0, 128.5, 128.1, 70.3, 44.3; LRMS (EI, 70eV) (*m/z*, %) 314 (M^+,48), 257 (68), 131 (100), 103 (30).

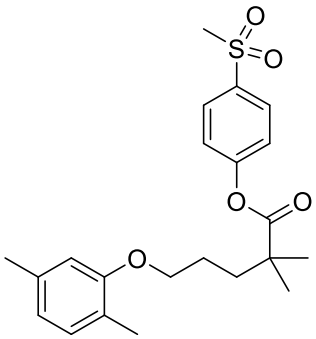


4-(methylsulfinyl)phenyl5-(2,5-dimethylphenoxy)-2,2-dimethylpentanoate (4e)

47.3 mg, 61% yield; Brown oil;

^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.65 (d, J = 8.5 Hz, 2H), 7.20 (d, J = 8.0 Hz, 2H), 7.00 (d, J = 7.0 Hz, 1H), 6.67 (d, J = 7.0 Hz, 1H), 6.62 (s, 1H), 3.99 (t, J = 5.5 Hz, 2H), 2.72 (s, 3H), 2.30 (s, 3H), 2.17 (s, 3H), 1.92-1.86 (m, 4H), 1.38 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ: 176.0, 156.8, 153.1, 142.7, 136.5, 130.4, 124.9, 123.6, 122.8, 120.9, 112.0, 67.6, 44.2, 42.6, 37.1, 25.3, 25.1, 15.8; LRMS (EI, 70eV) (*m/z*, %) 388 (M^+, 1), 272 (13), 233 (15), 83 (100); HRMS *m/z* (ESI) for calcd $C_{22}H_{28}O_4S$ $[M+H]^+$

389.1781, found 389.1786.



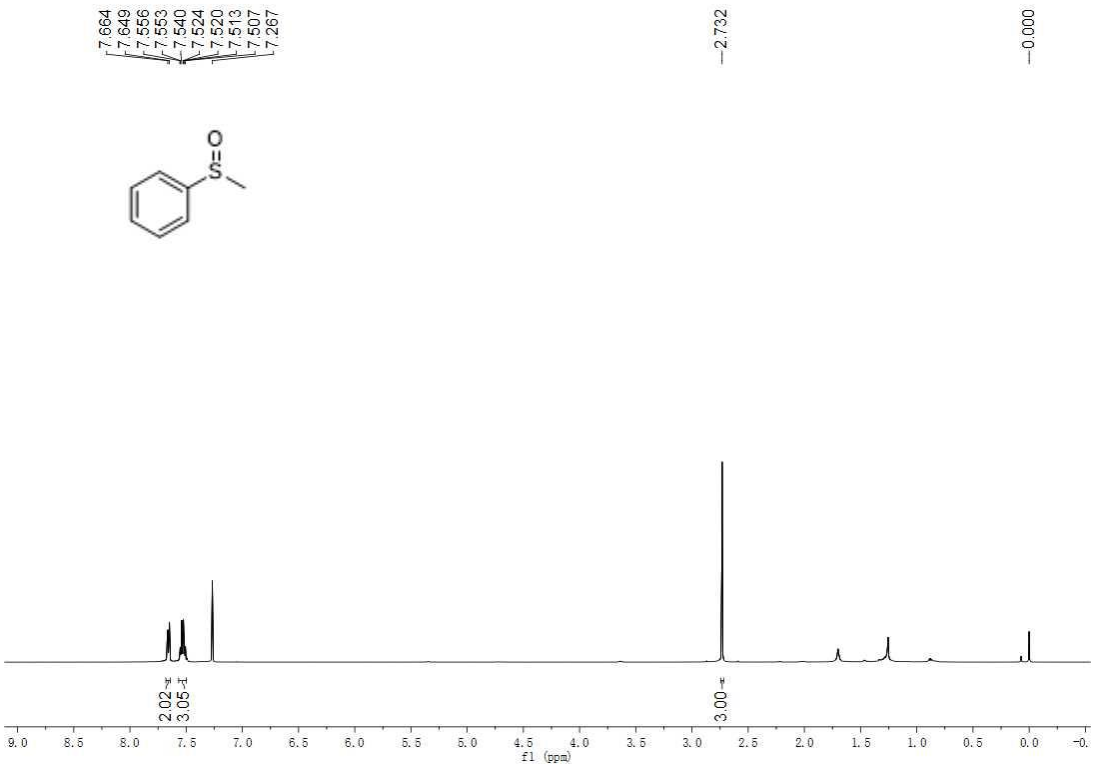
4-(methylsulfonyl)phenyl5-(2,5-dimethylphenoxy)-2,2-dimethylpentanoate (4f)

29.1 mg, 36% yield, Brown oil;

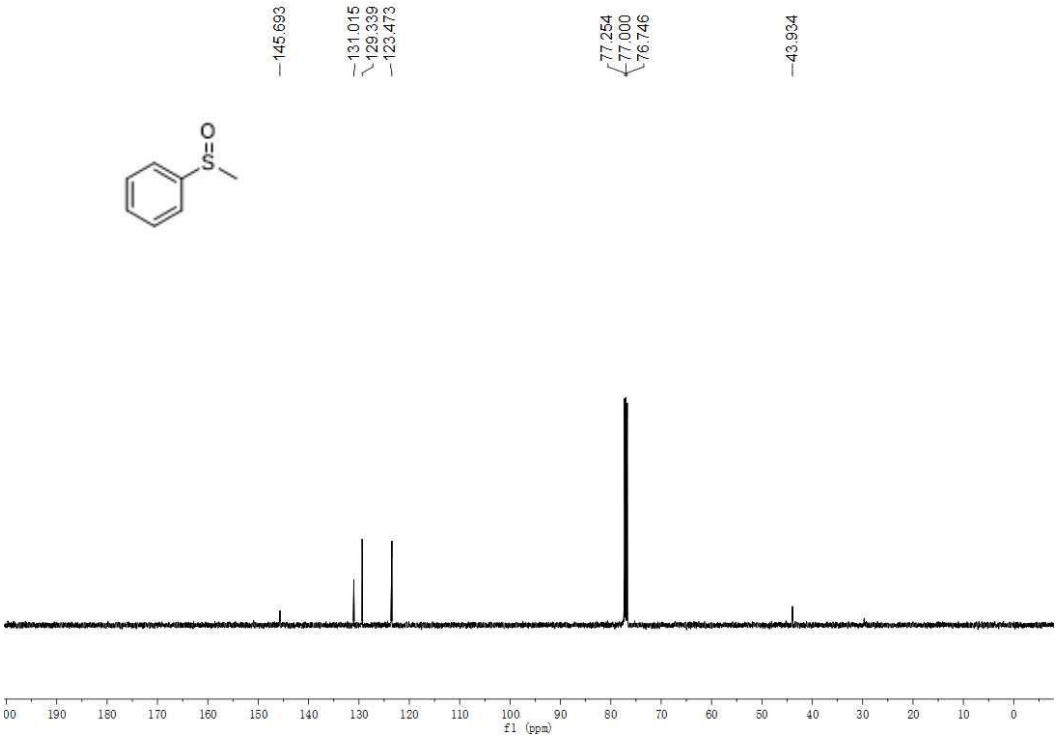
^{1}H NMR (500 MHz, $CDCl_3$) δ: 7.95 (d, J = 8.0 Hz, 2H), 7.23 (d, J = 8.5 Hz, 2H), 7.00 (d, J = 7.5 Hz, 1H), 6.67 (d, J = 7.5 Hz, 1H), 6.62 (s, 1H), 3.99 (t, J = 5.5 Hz, 2H), 3.05 (s, 3H), 2.30 (s, 3H), 2.16 (s, 3H), 1.92-1.84 (m, 4H), 1.39 (s, 6H).; ^{13}C NMR (125 MHz, $CDCl_3$) δ: 175.6, 156.66, 155.06, 137.6, 136.4, 130.3, 129.0, 123.4, 122.6, 120.8, 111.8, 67.4, 44.5, 42.6, 36.9, 25.1, 25.0, 21.3, 15.7; LRMS (EI, 70eV) (*m/z*, %) 404 (M^+, 1), 283 (30), 122 (11), 83 (100); HRMS *m/z* (ESI) for calcd $C_{22}H_{28}O_5S$ $[M+H]^+$ 405.1730, found 405.1728.

(D) Spectra

(methylsulfinyl)benzene (2a)

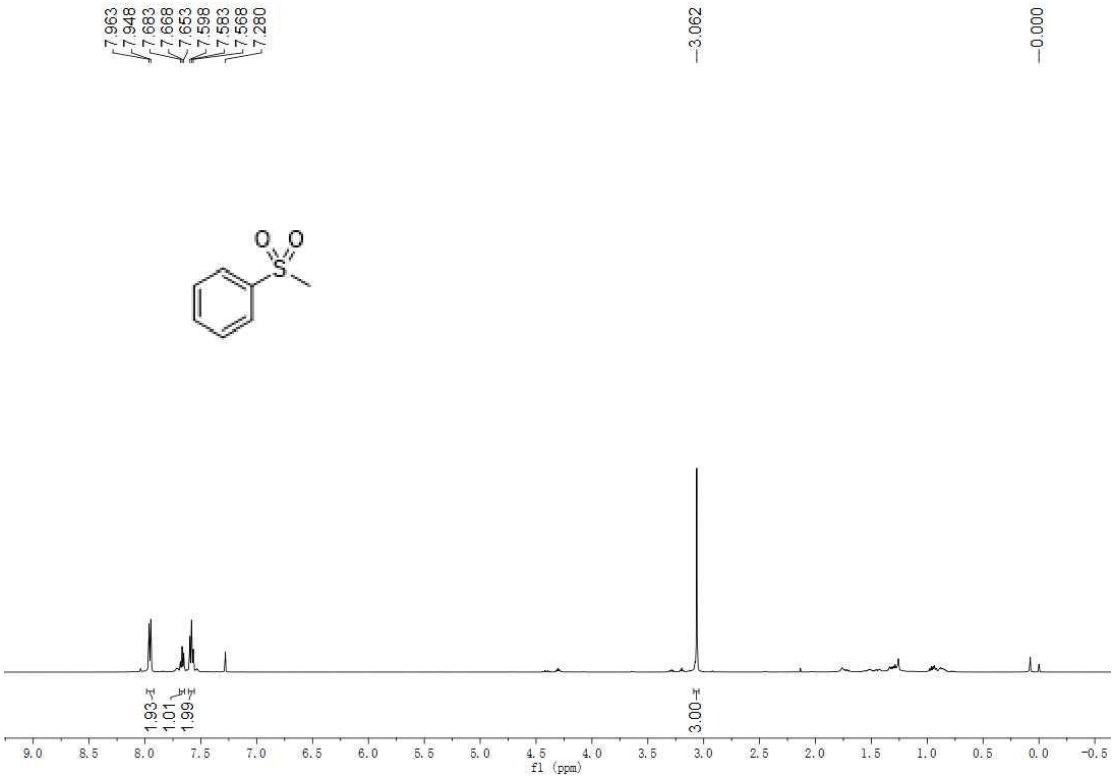


^{1}H NMR (500 MHz, CDCl3)

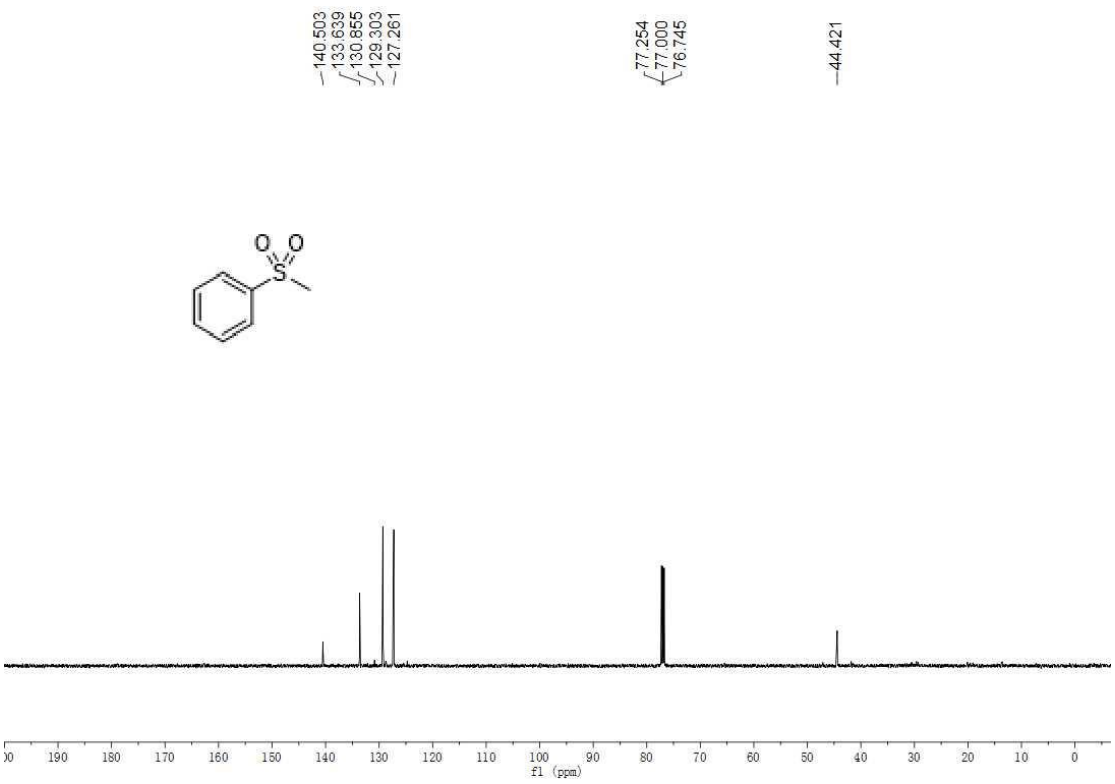


^{13}C NMR (125 MHz, $CDCl_3$)

(methylsulfonyl)benzene (3a)

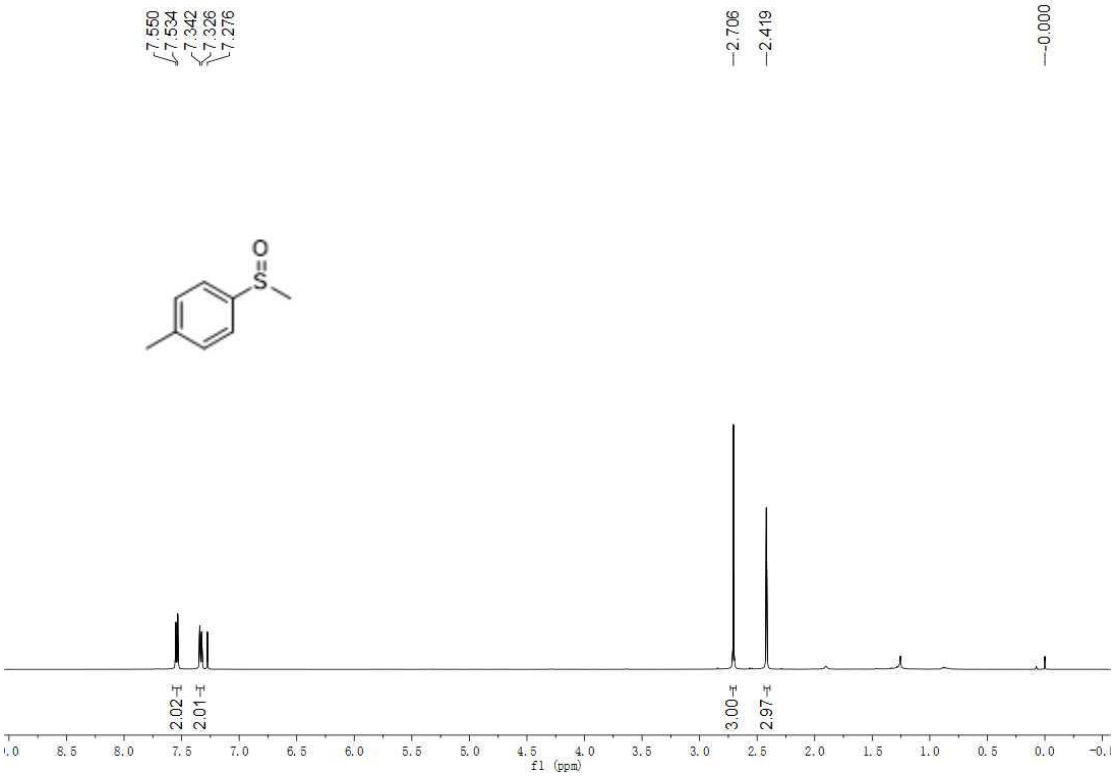


^{1}H NMR (500 MHz, $CDCl^{3}$)

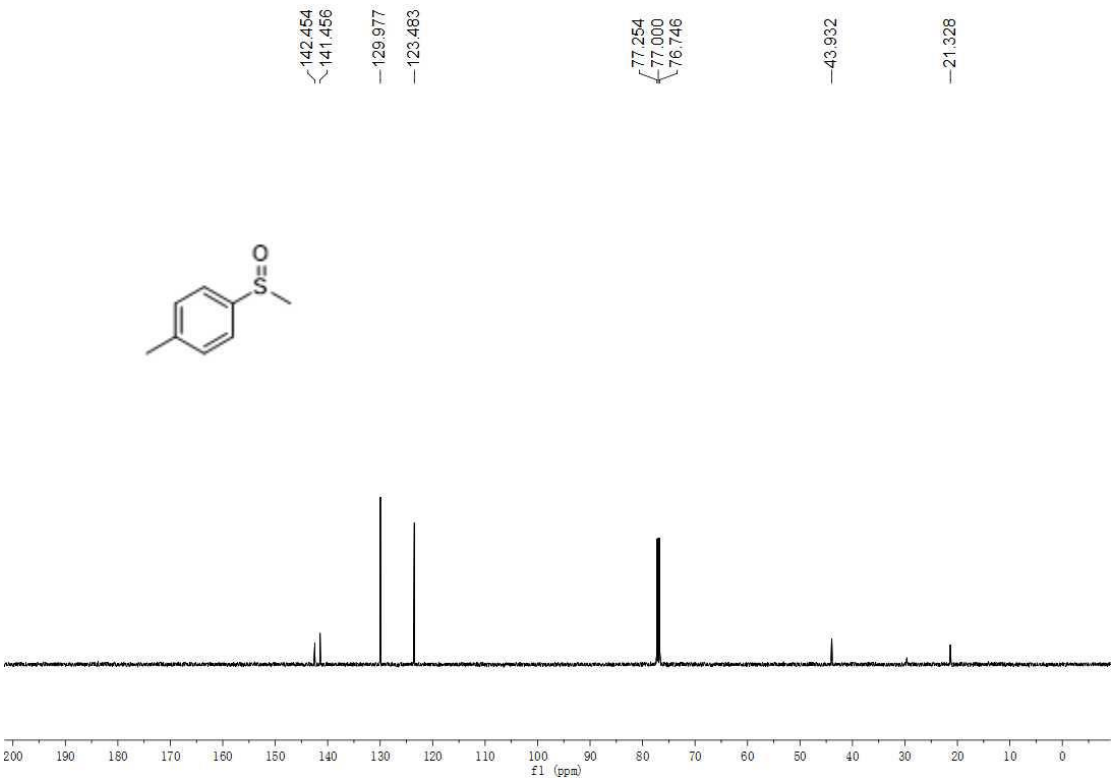


^{13}C NMR (125 MHz, $CDCl_3$)

1-methyl-4-(methylsulfinyl)benzene (2b)

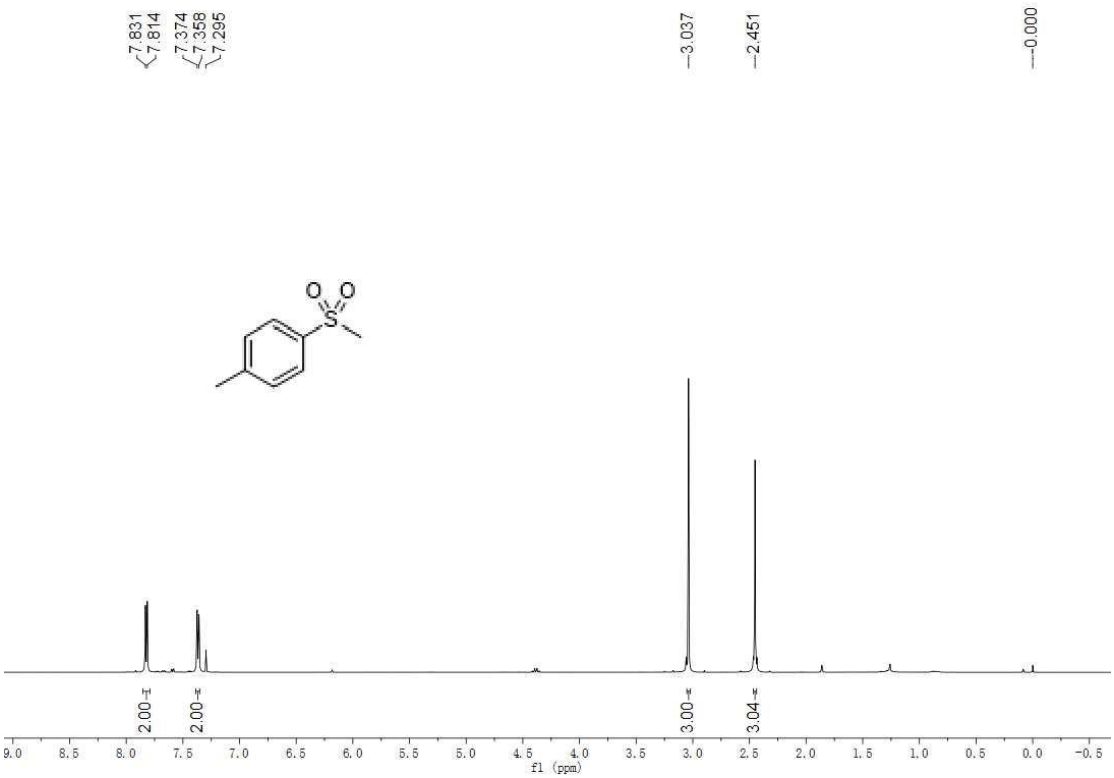


^{1}H NMR (500 MHz, $CDCl^{3}$)

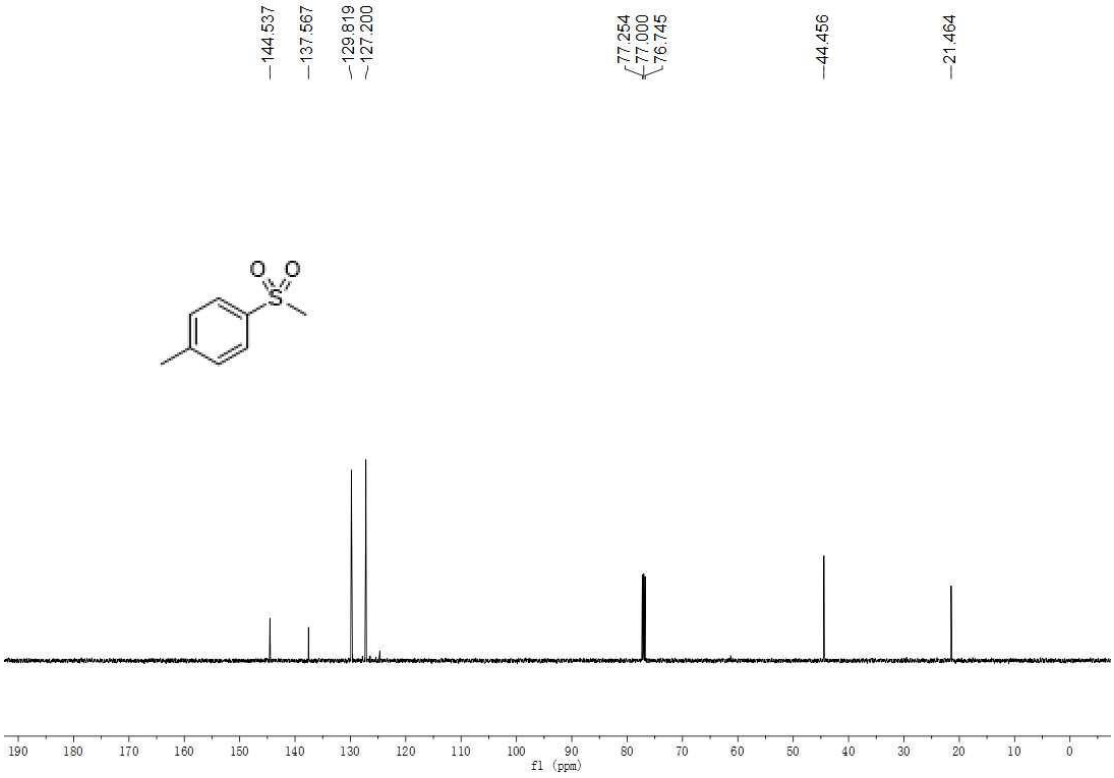


^{13}C NMR (125 MHz, $CDCl_3$)

1-methyl-4-(methylsulfonyl)benzene (3b)



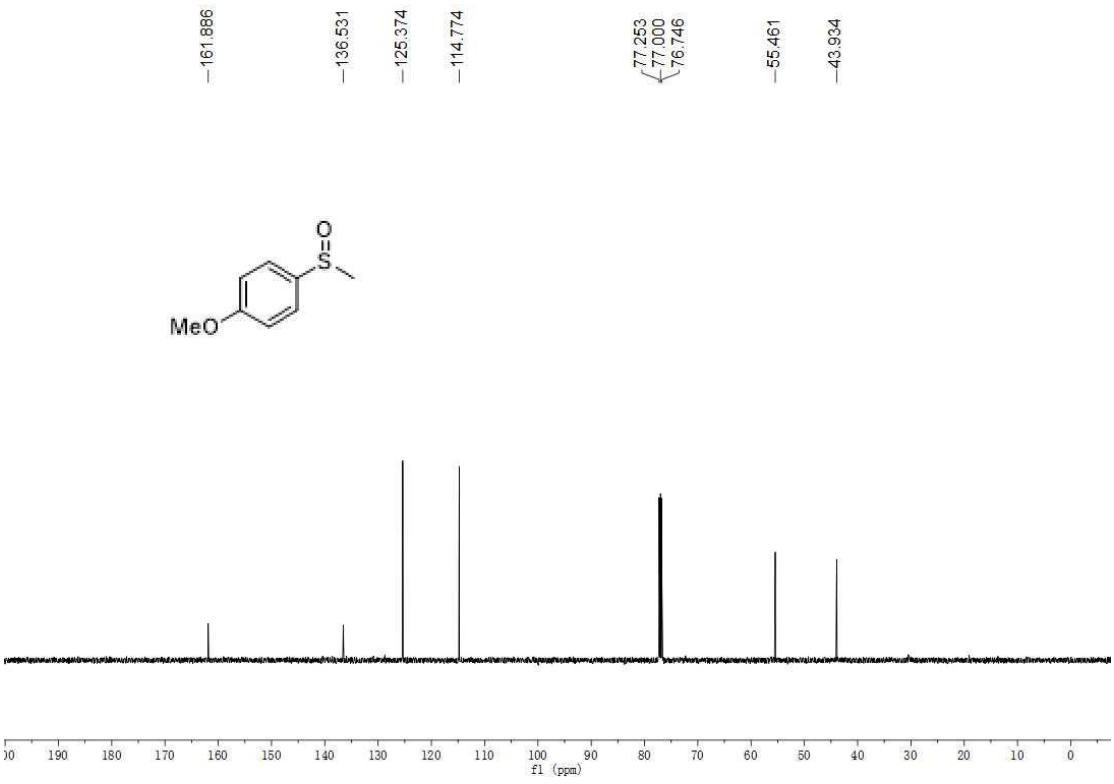
^{1}H NMR (500 MHz, $CDCl_3$)



^{13}C NMR (125 MHz, $CDCl_3$)

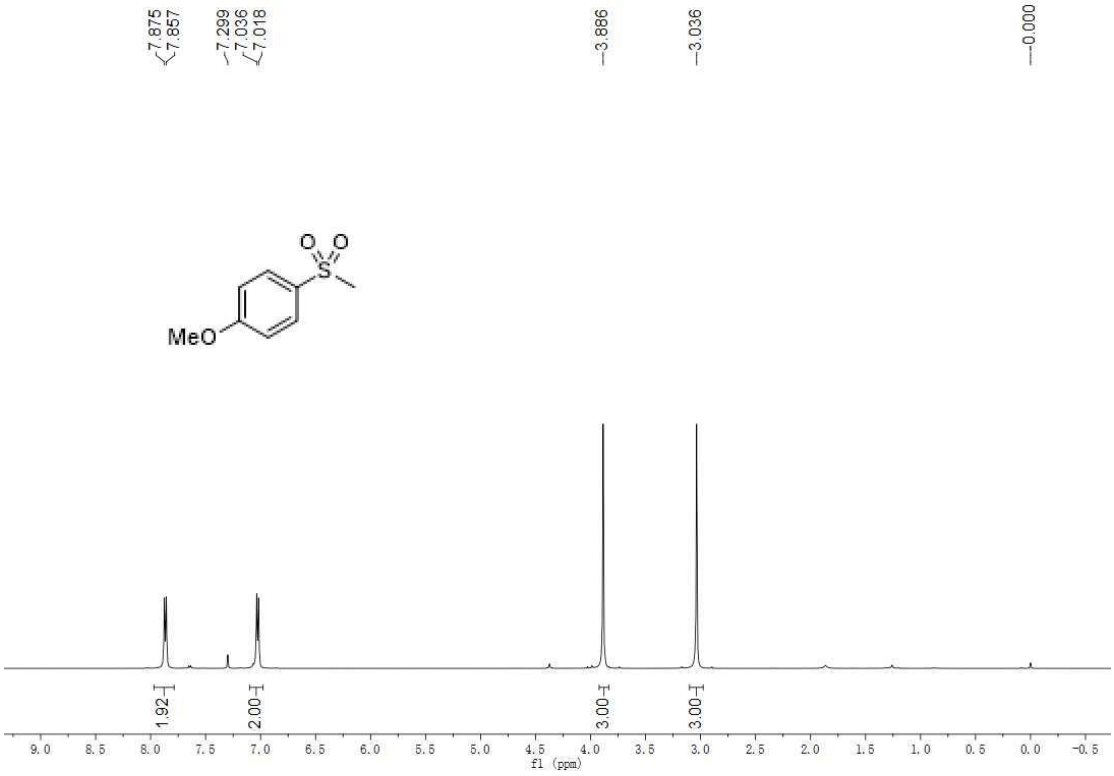
1-methoxy-4-(methylsulfinyl)benzene (2c)

^{1}H NMR (500 MHz, $CDCl_3$)

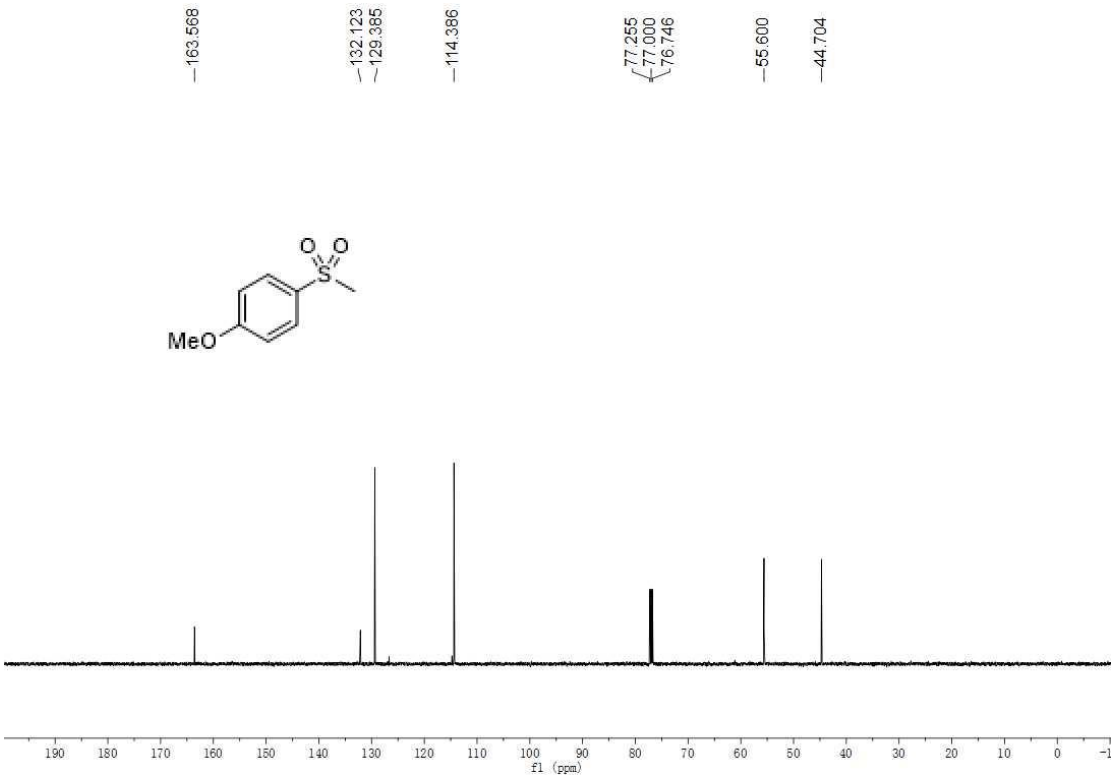


^{13}C NMR (125 MHz, $CDCl_3$)

1-methoxy-4-(methylsulfonyl)benzene (3c)



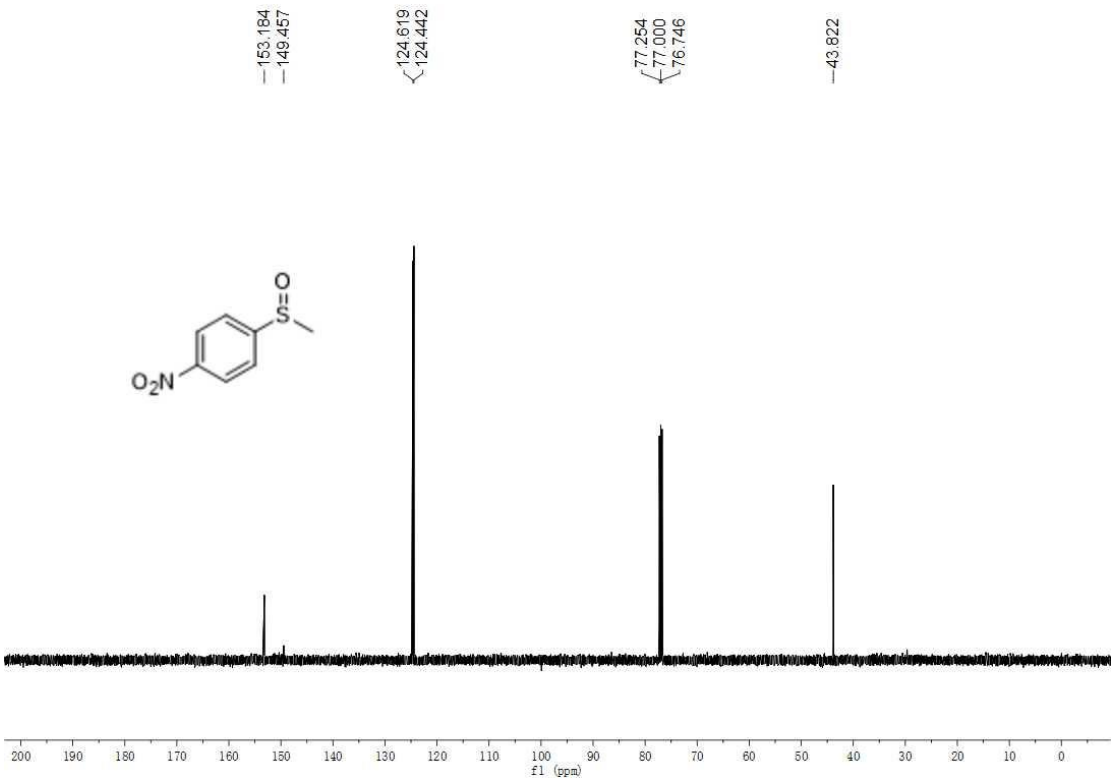
^{1}H NMR (500 MHz, $CDCl_3$)



^{13}C NMR (125 MHz, $CDCl_3$)

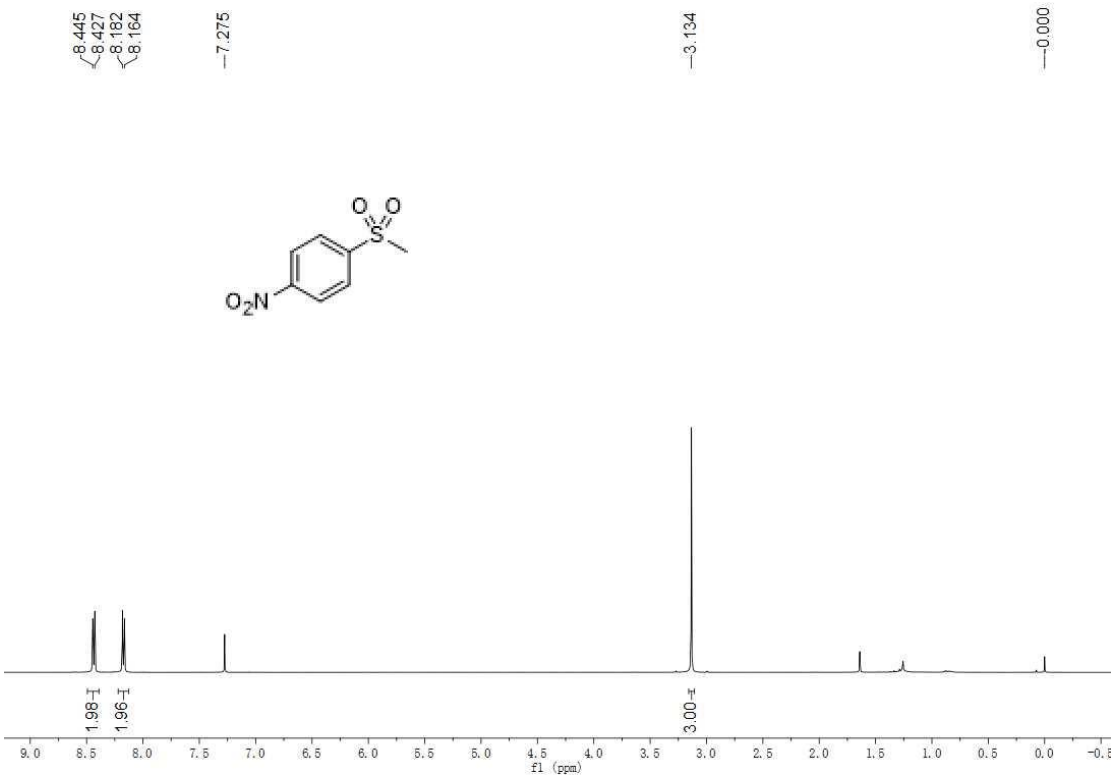
1-(methylsulfinyl)-4-nitrobenzene (2d)

^{1}H NMR (500 MHz, $CDCl_3$)

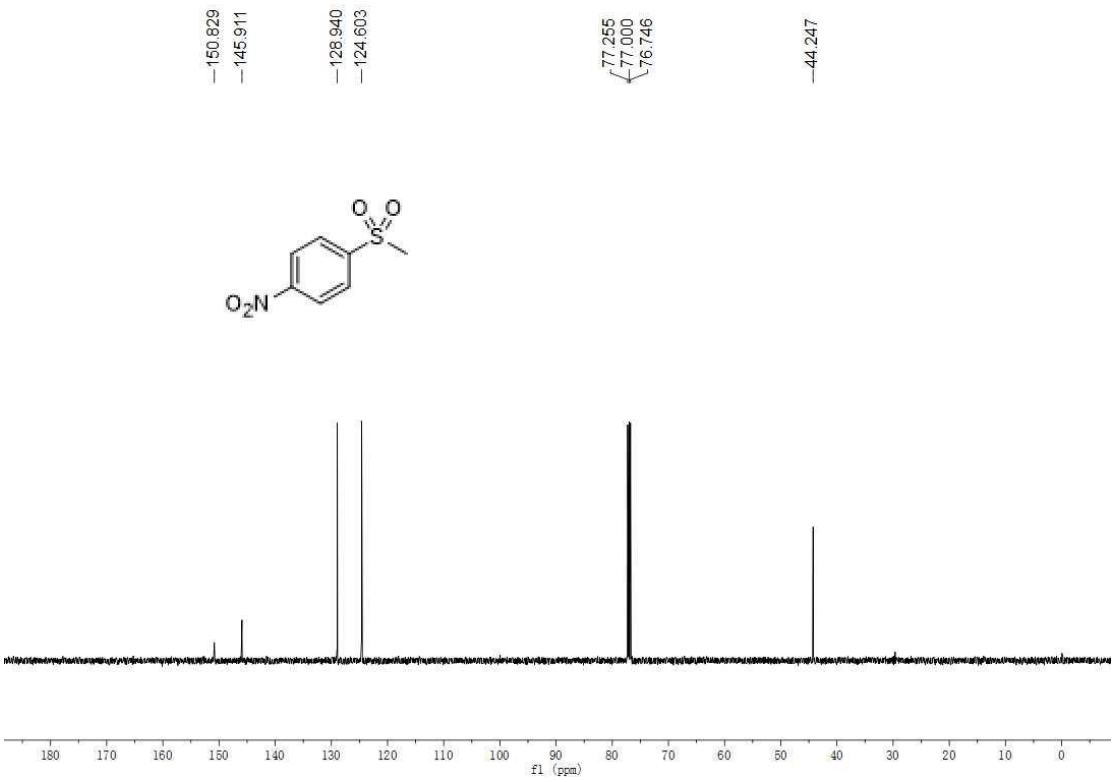


^{13}C NMR (125 MHz, $CDCl_3$)

1-(methylsulfonyl)-4-nitrobenzene (3d)

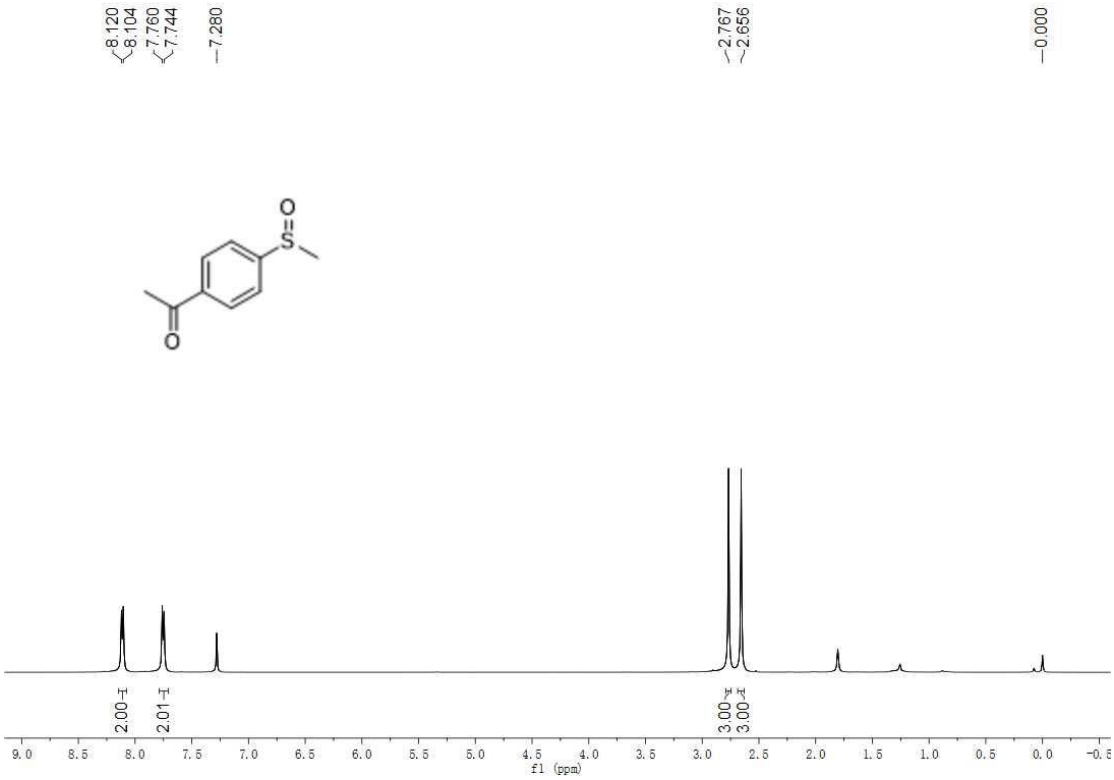


^{1}H NMR (500 MHz, $CDCl_3$)

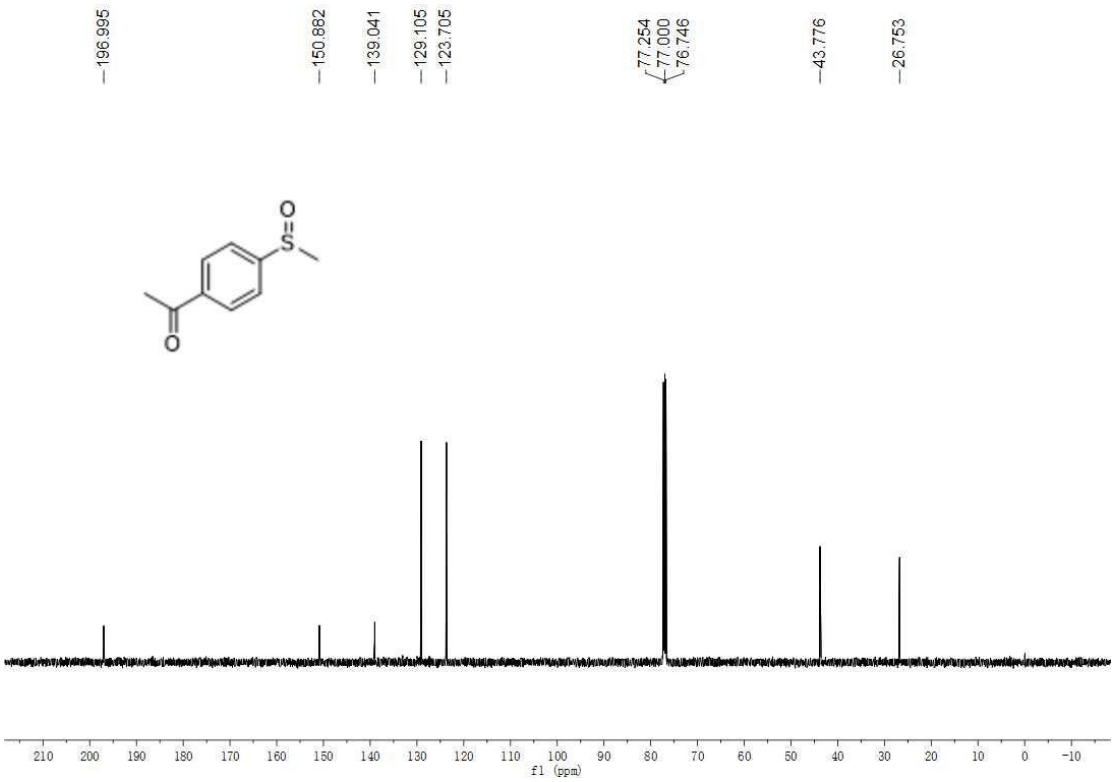


^{13}C NMR (125 MHz, $CDCl_3$)

1-(methylsulfonyl)-4-nitrobenzen (2e)

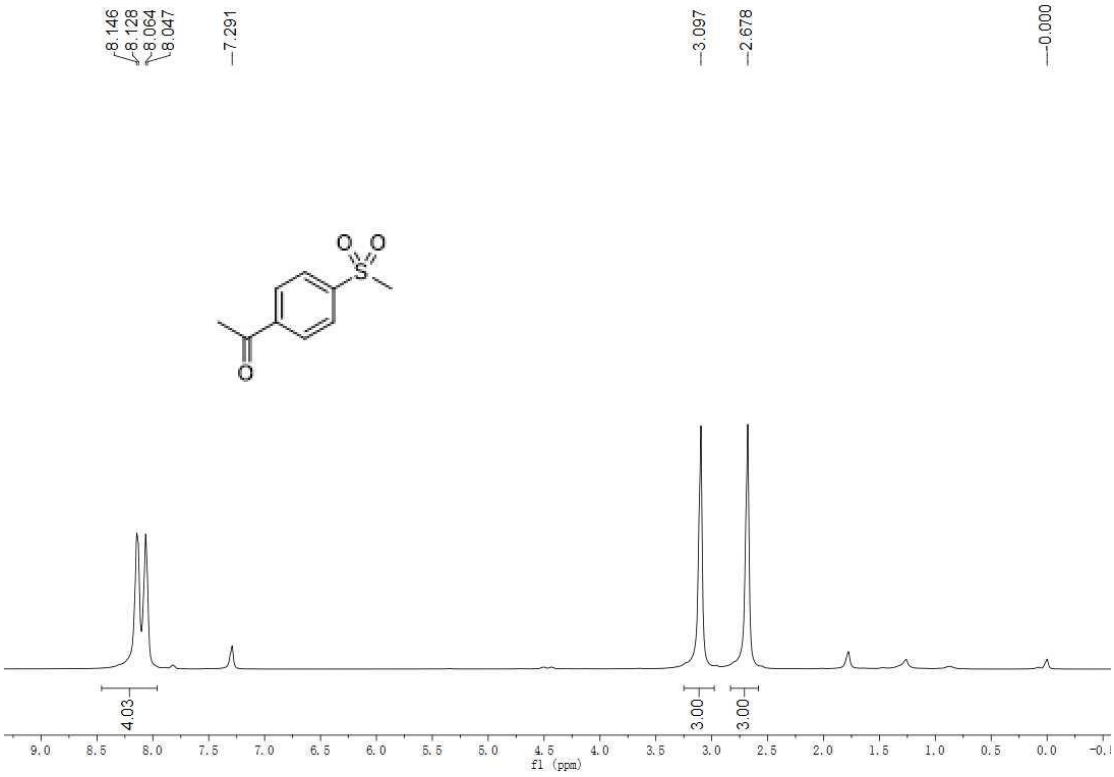


^{1}H NMR (500 MHz, $CDCl_3$)

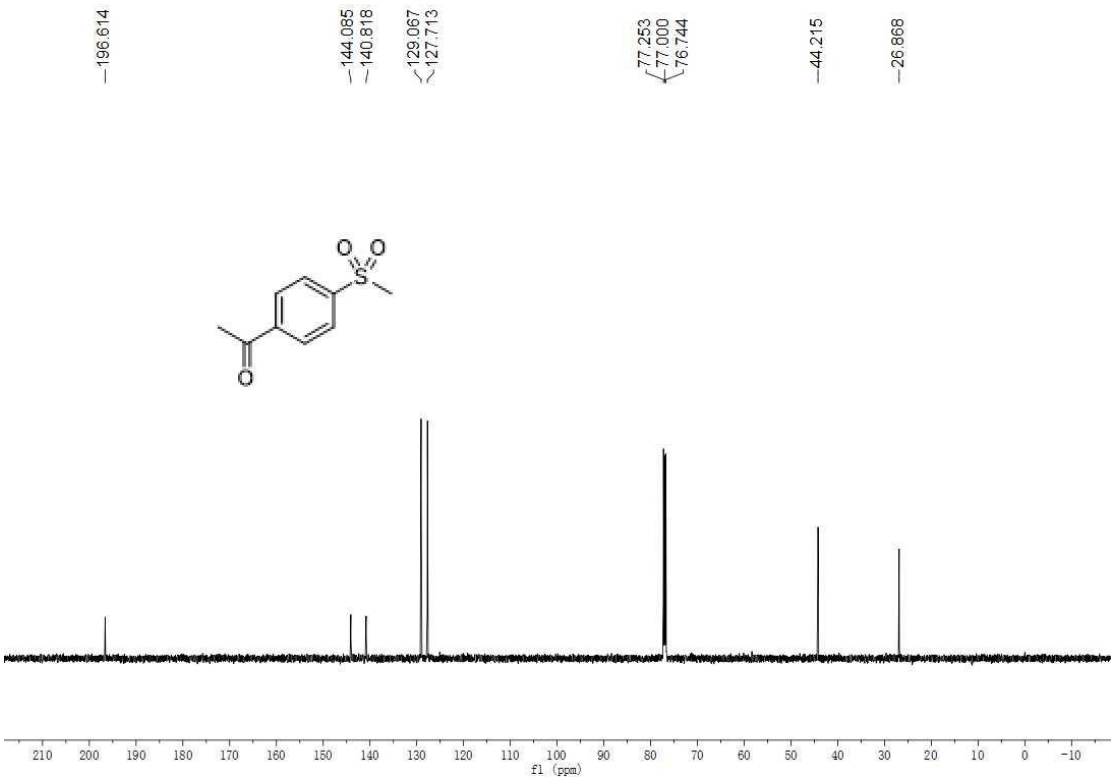


^{13}C NMR (125 MHz, $CDCl_3$)

1-(4-(methylsulfonyl)phenyl)ethan-1-one (3e)

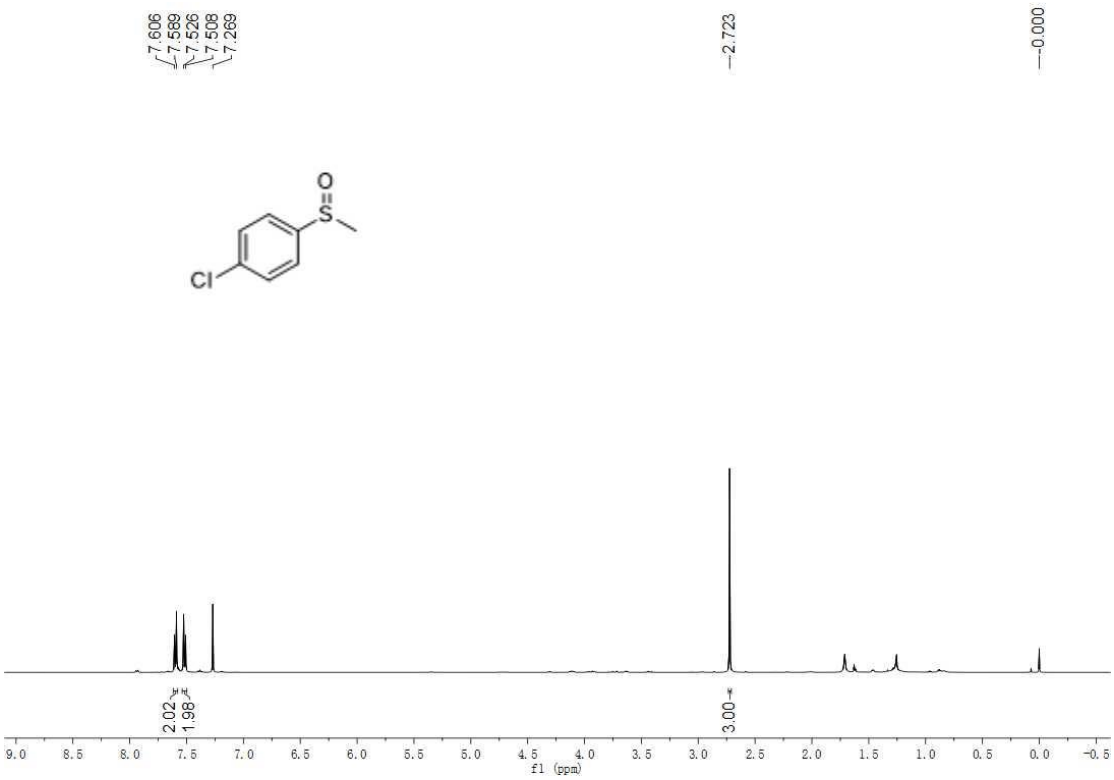


^{1}H NMR (500 MHz, $CDCl_3$)

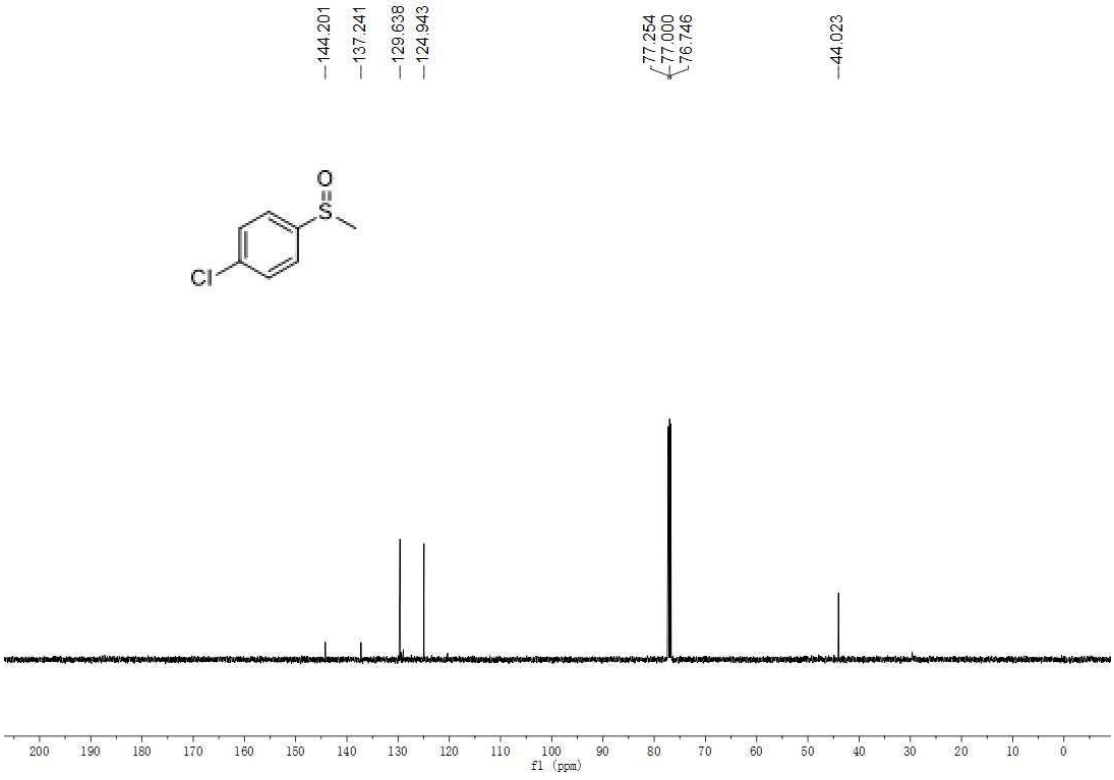


^{13}C NMR (125 MHz, $CDCl_3$)

1-chloro-4-(methylsulfinyl)benzene (2f)

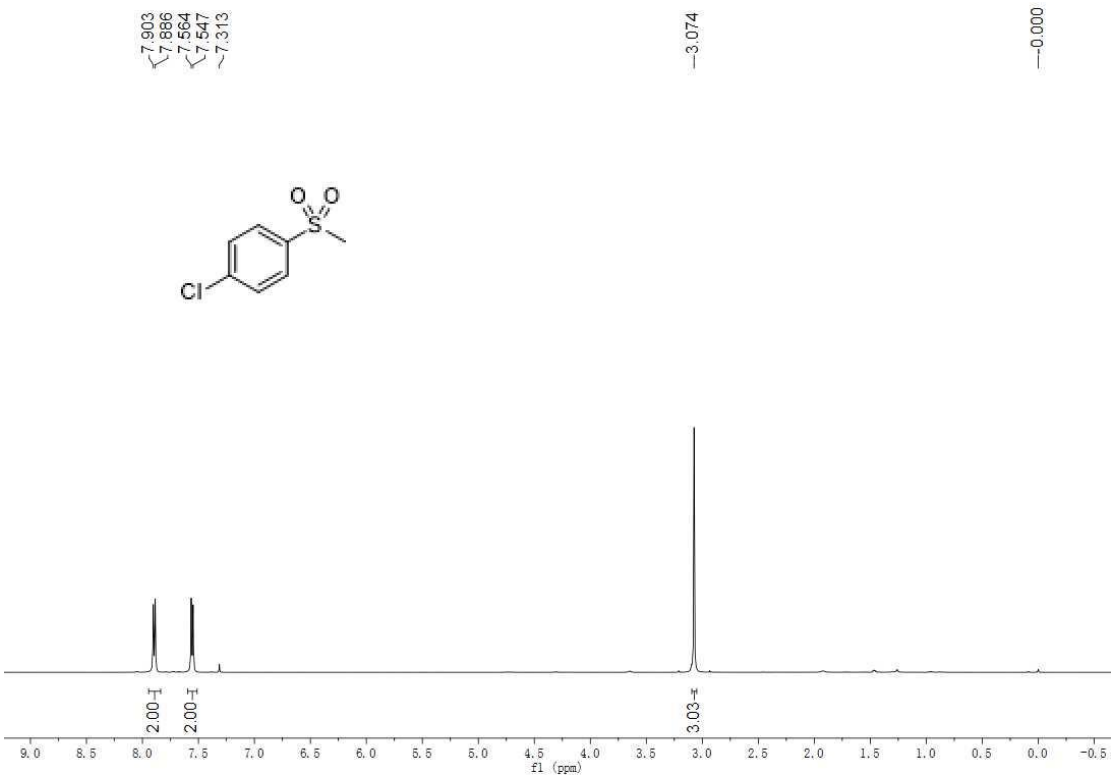


^{1}H NMR (500 MHz, $CDCl_3$)

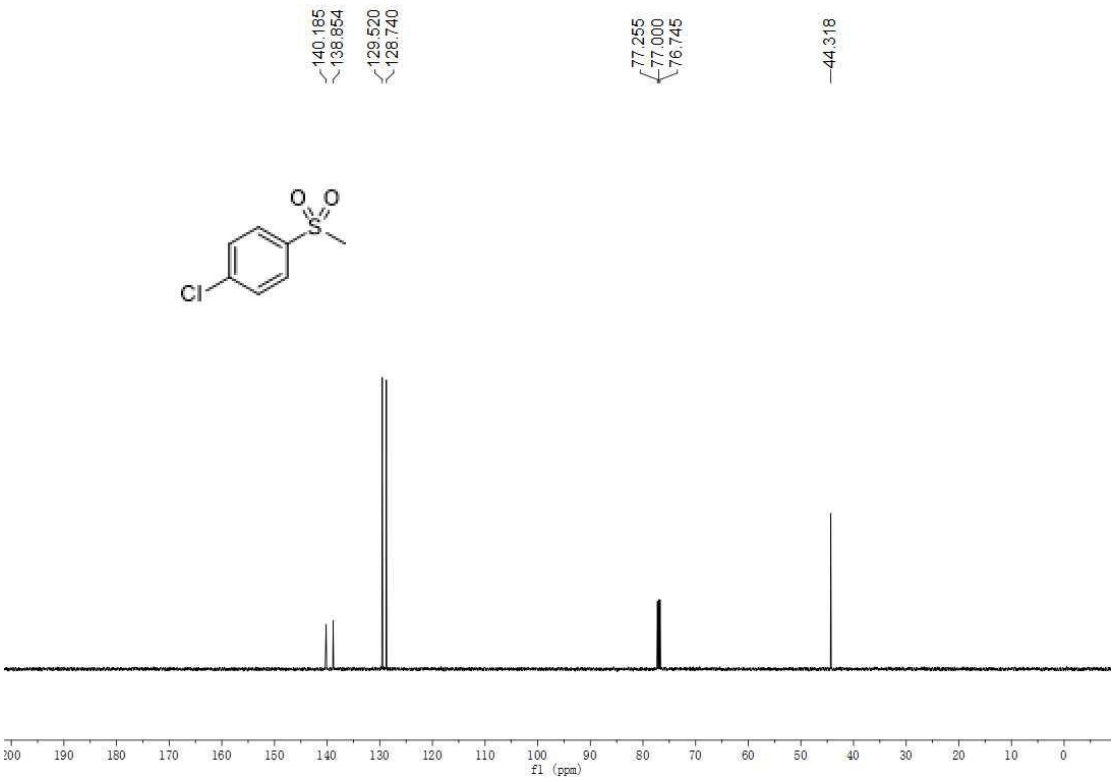


^{13}C NMR (125 MHz, $CDCl_3$)

1-chloro-4-(methylsulfonyl)benzene (3f)

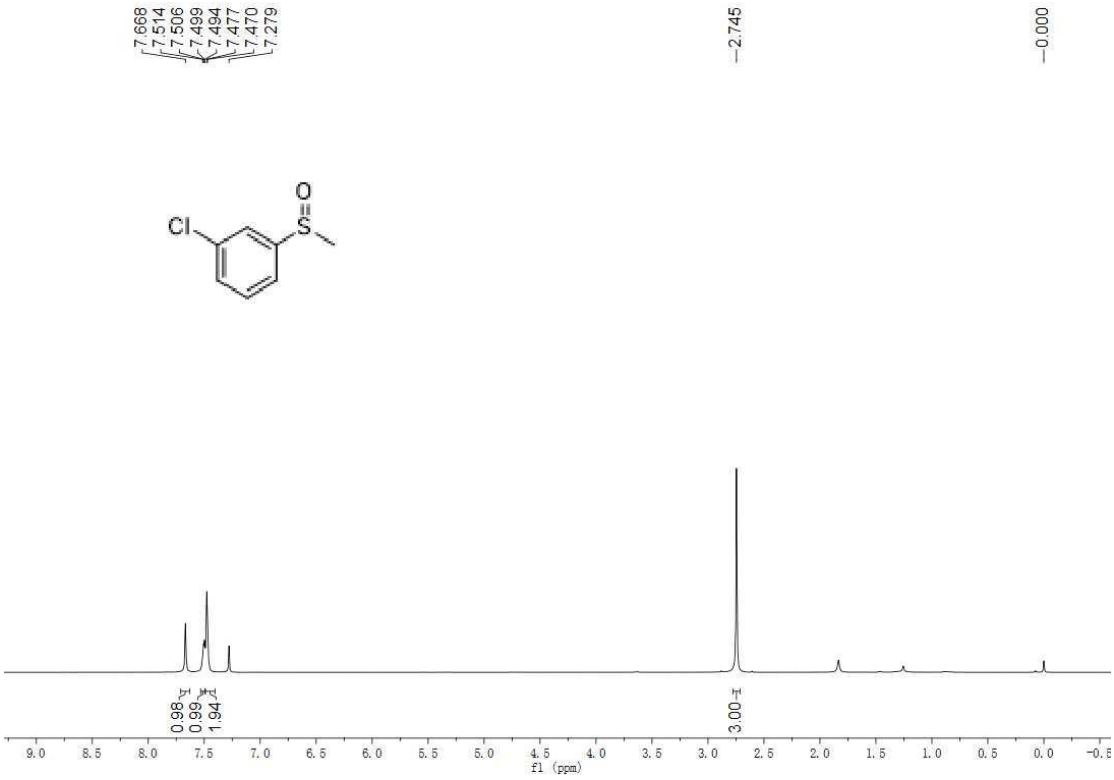


^{1}H NMR (500 MHz, $CDCl_3$)



^{13}C NMR (125 MHz, $CDCl_3$)

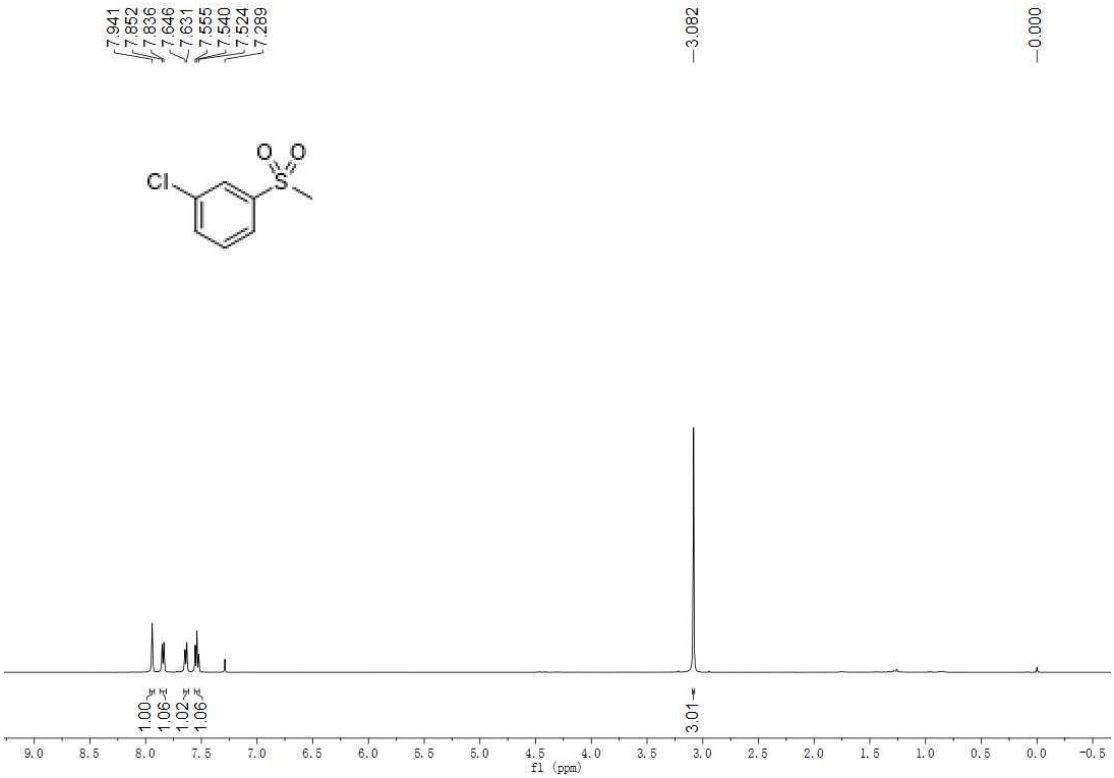
1-chloro-3-(methylsulfinyl)benzene (2g)



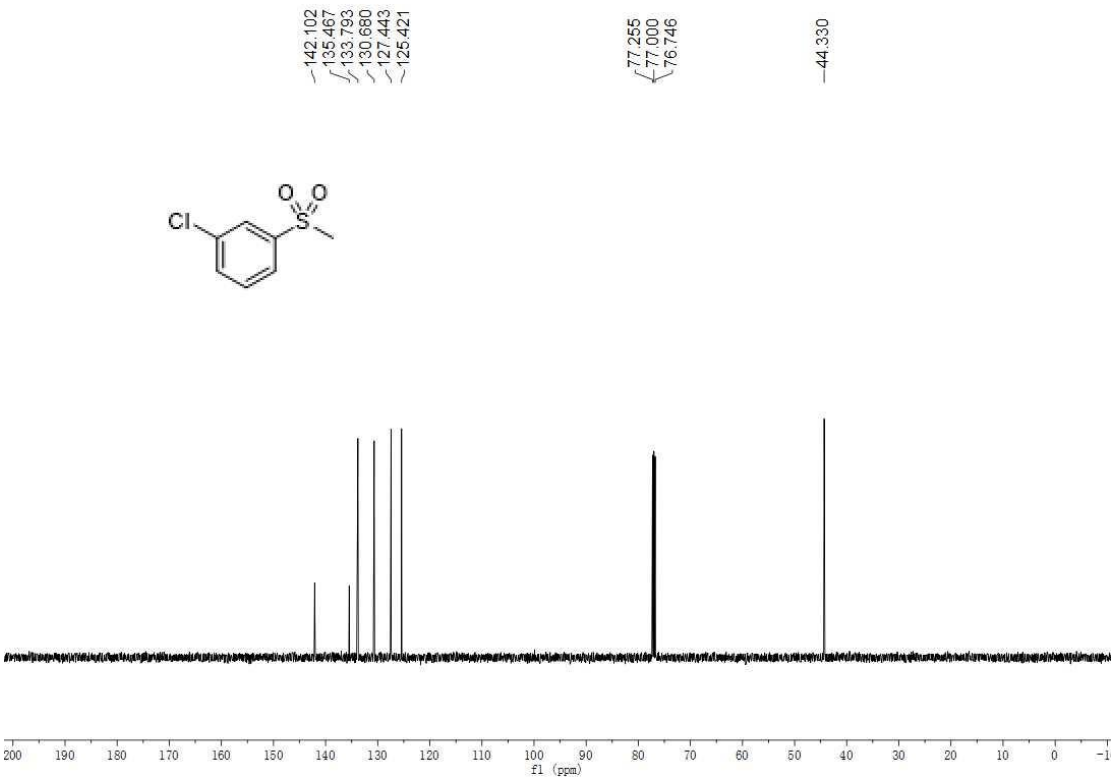
^{1}H NMR (500 MHz, $CDCl_3$)

^{13}C NMR (125 MHz, $CDCl_3$)

1-chloro-3-(methylsulfonyl)benzene (3g)

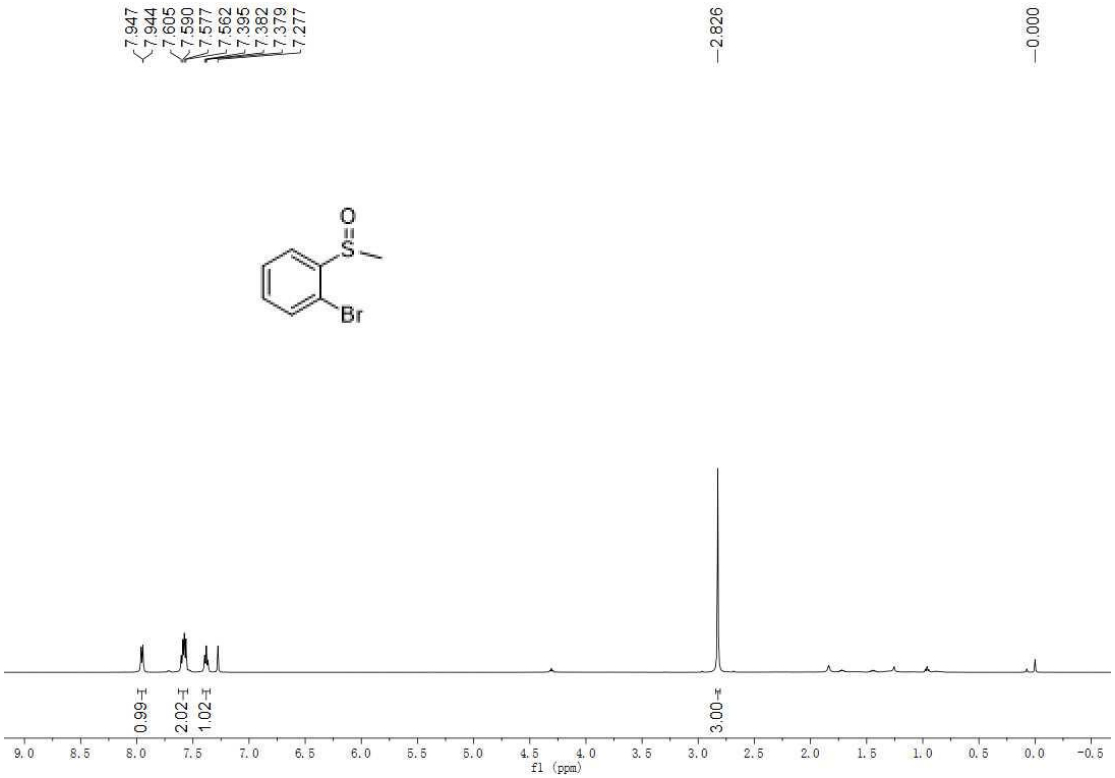


^{1}H NMR (500 MHz, $CDCl_3$)

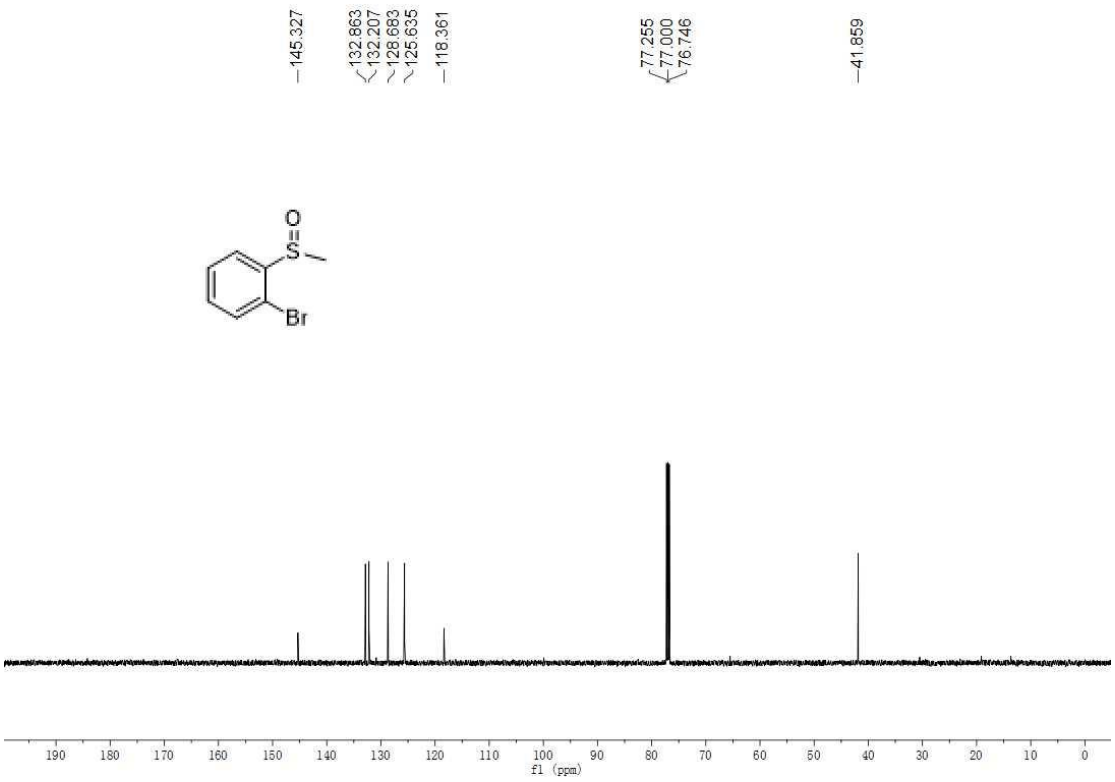


^{13}C NMR (125 MHz, $CDCl_3$)

1-bromo-2-(methylsulfinyl)benzene (2h)

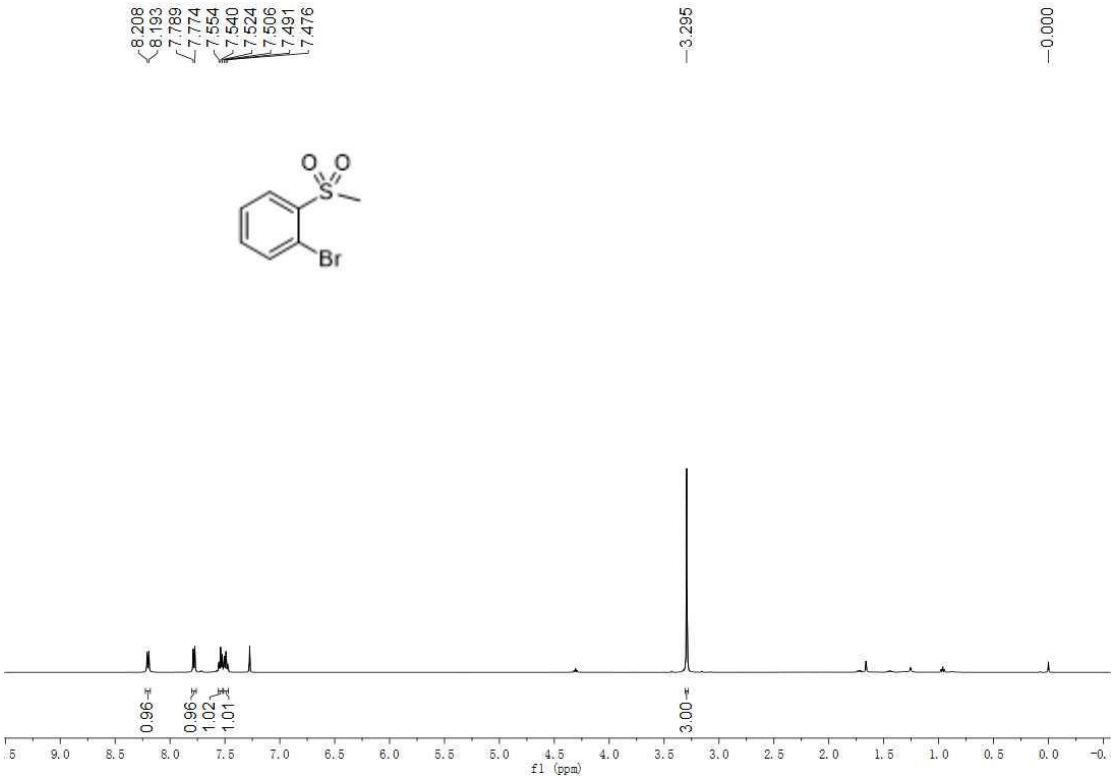


^{1}H NMR (500 MHz, $CDCl_3$)

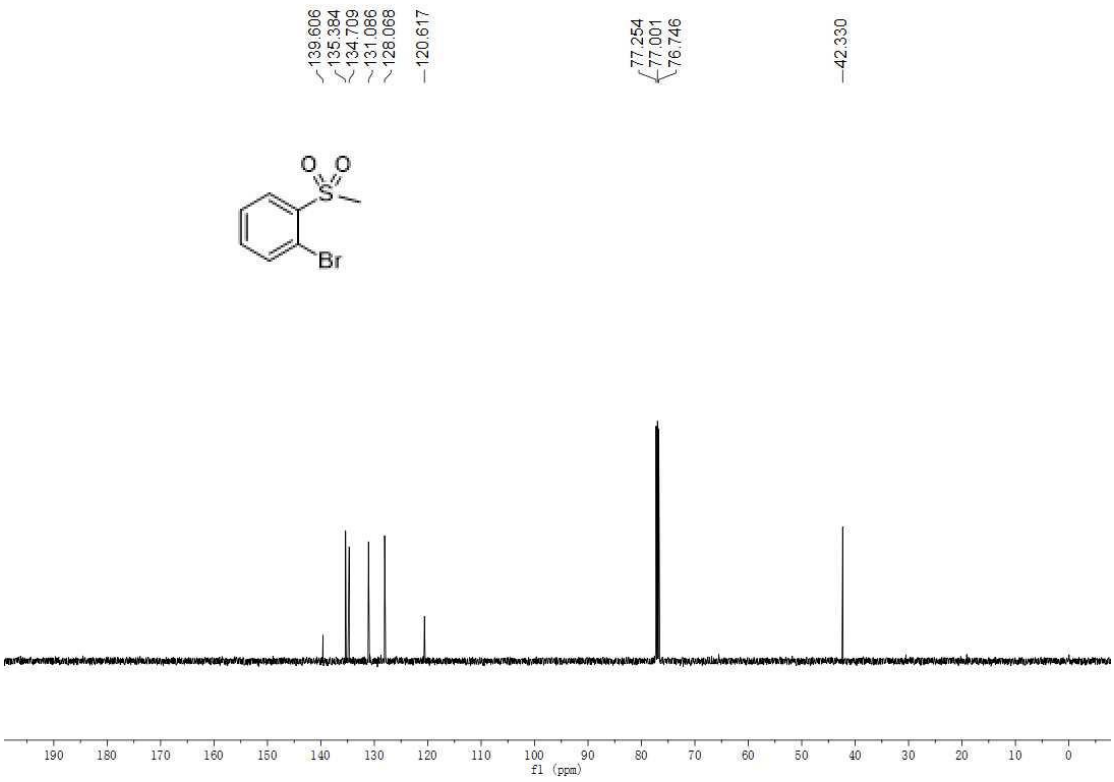


^{13}C NMR (125 MHz, $CDCl_3$)

1-bromo-2-(methylsulfonyl)benzene (3h)

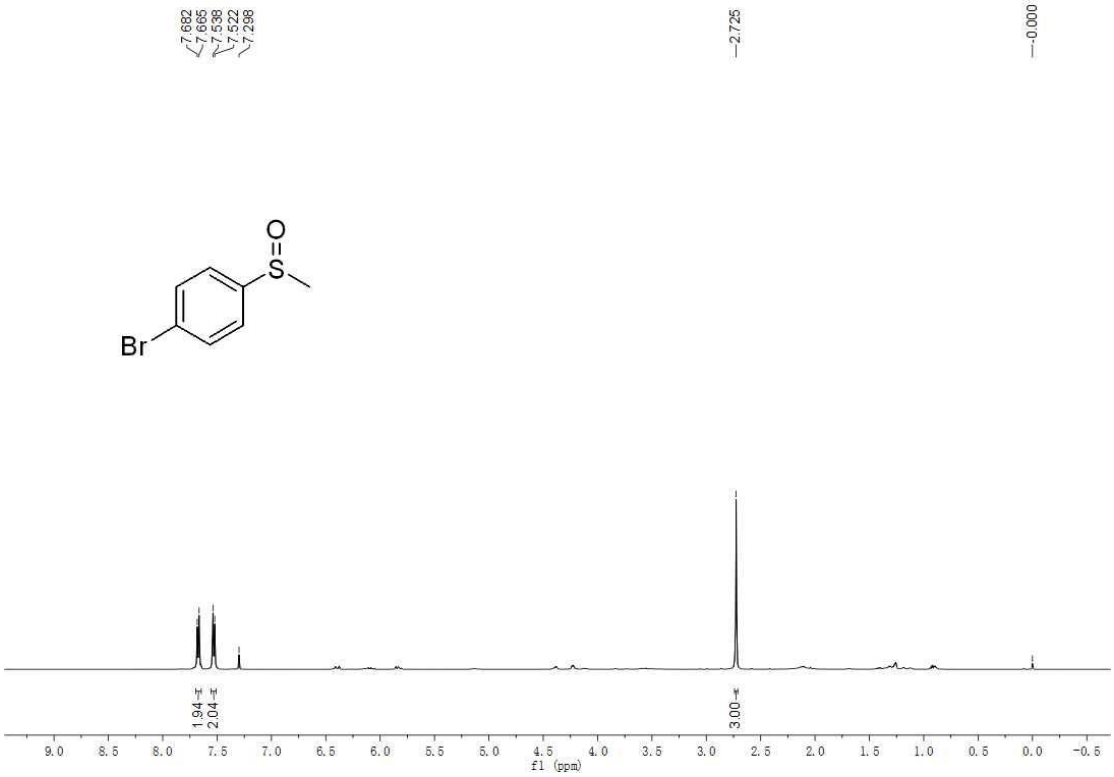


^{1}H NMR (500 MHz, $CDCl_3$)

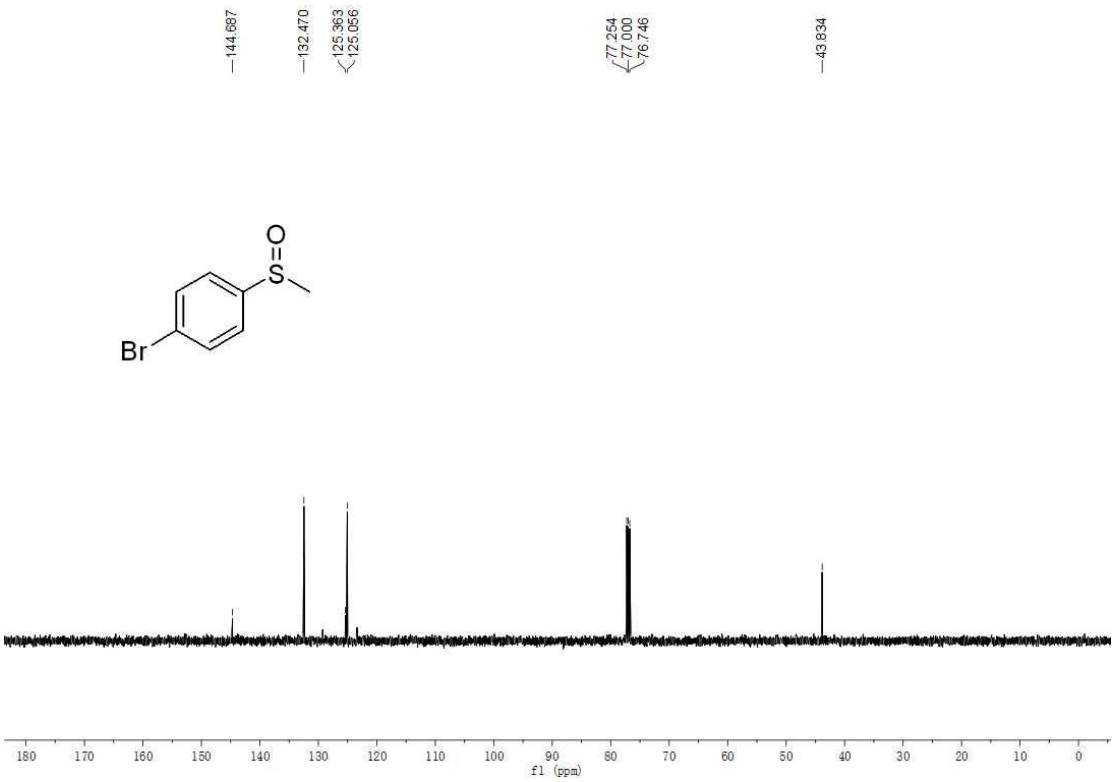


^{13}C NMR (125 MHz, $CDCl_3$)

1-bromo-4-(methylsulfinyl)benzene (2i)

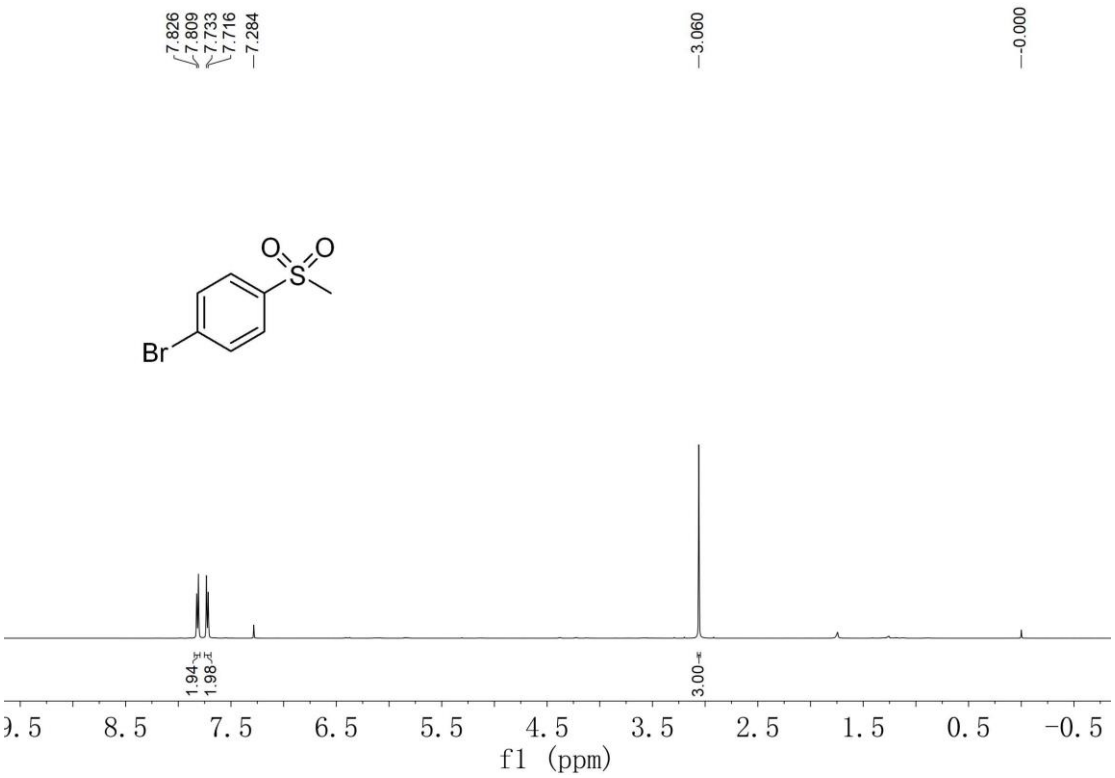


^{1}H NMR (500 MHz, $CDCl_3$)

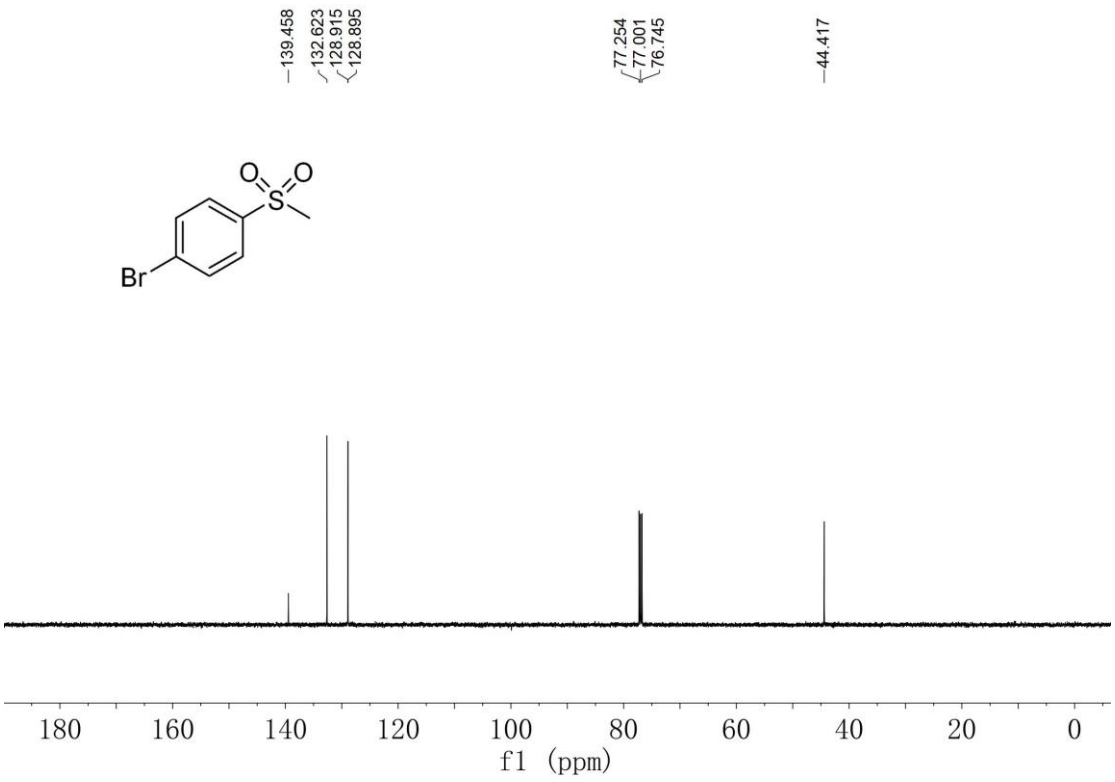


^{13}C NMR (125 MHz, $CDCl_3$)

1-bromo-4-(methylsulfonyl)benzene (3i)

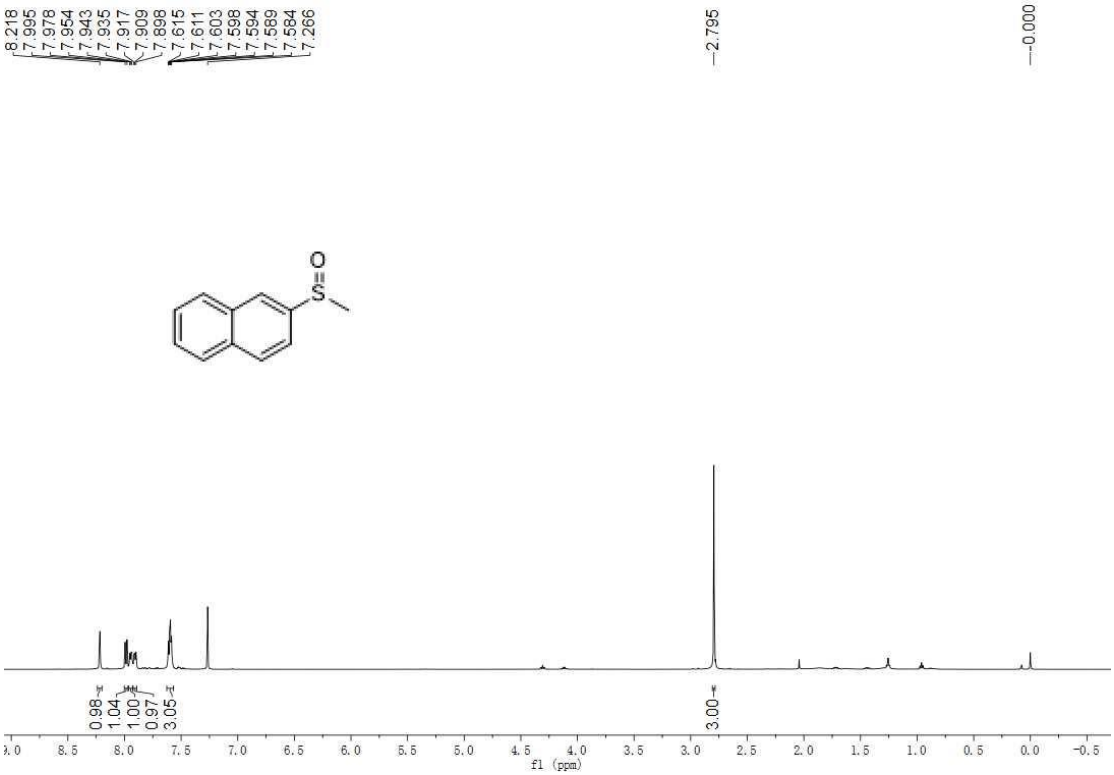


^{1}H NMR (500 MHz, $CDCl_3$)

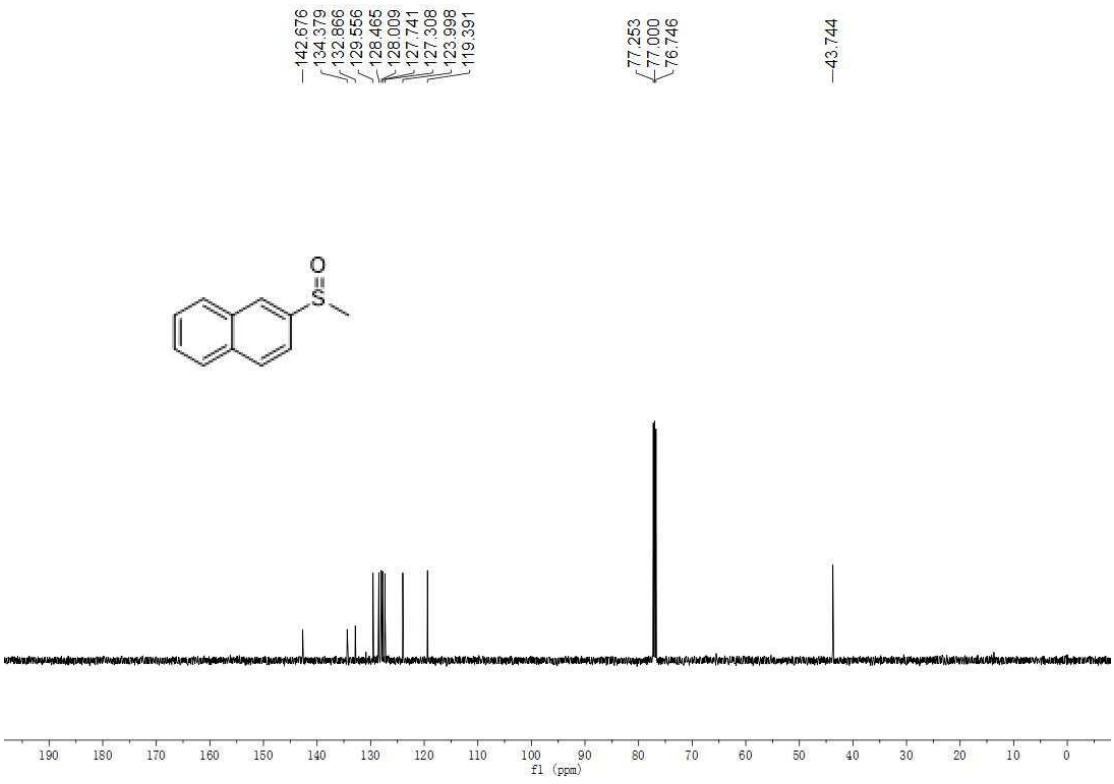


^{13}C NMR (125 MHz, $CDCl_3$)

2-(methylsulfinyl)naphthalene (2j)

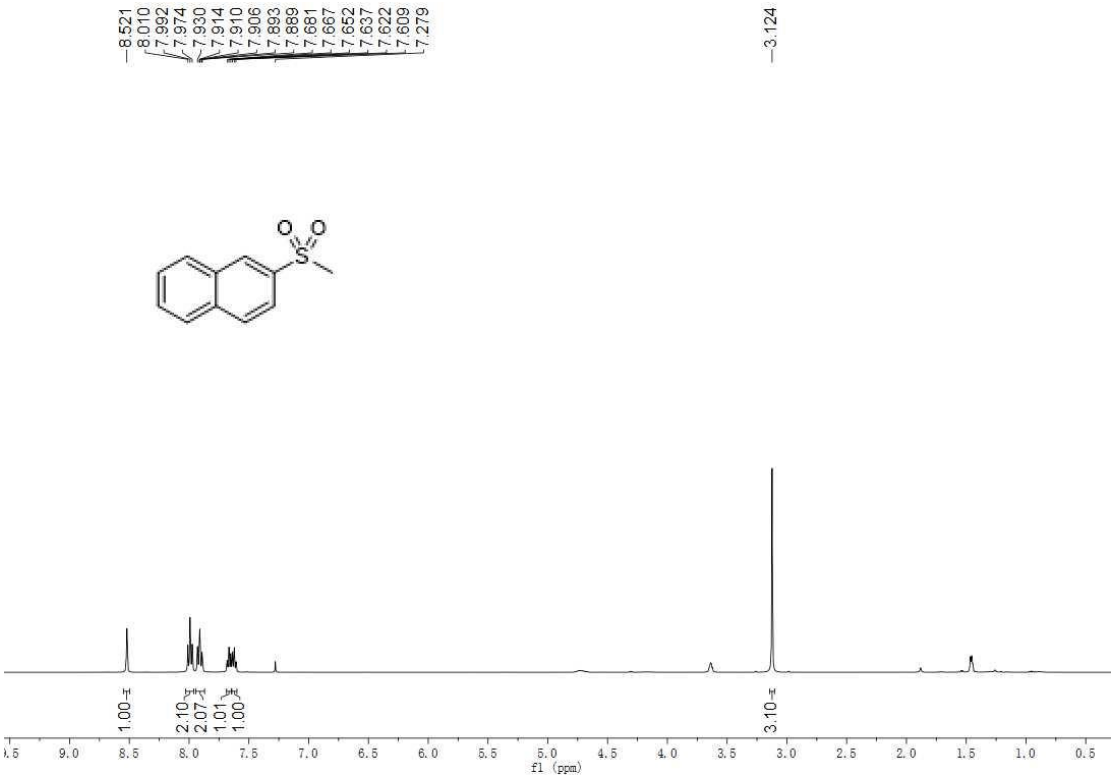


^{1}H NMR (500 MHz, $CDCl_3$)

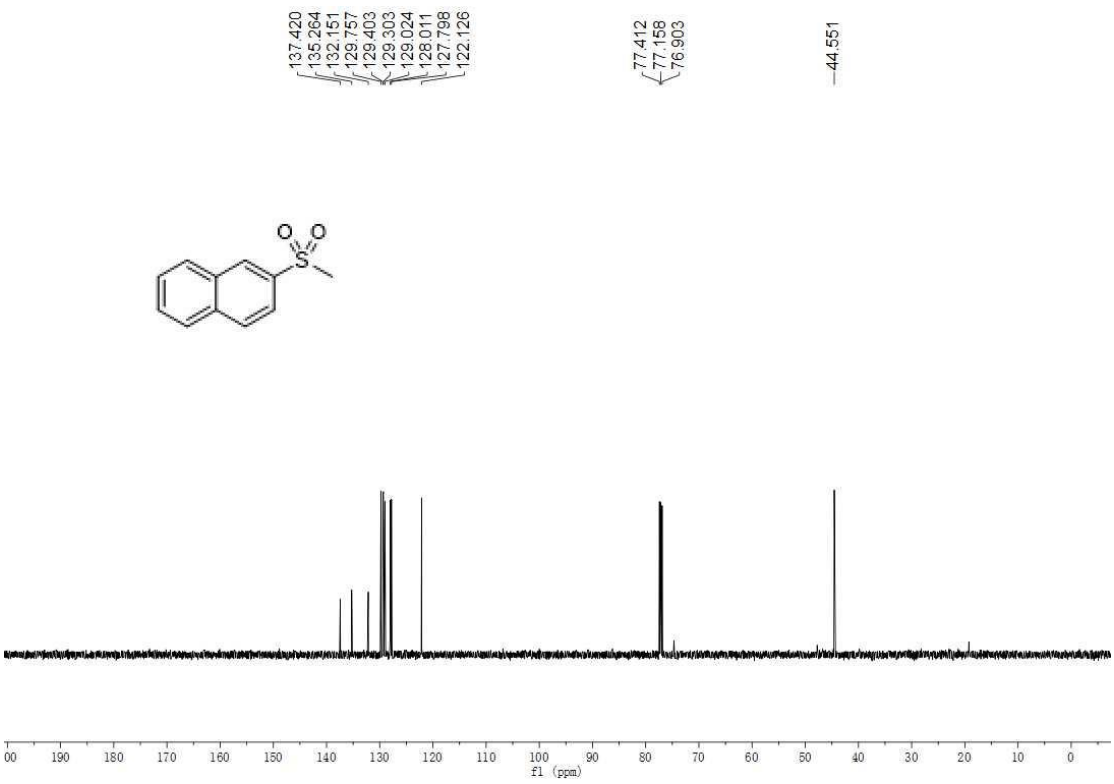


^{13}C NMR (125 MHz, $CDCl_3$)

2-(methylsulfonyl)naphthalene (3j)

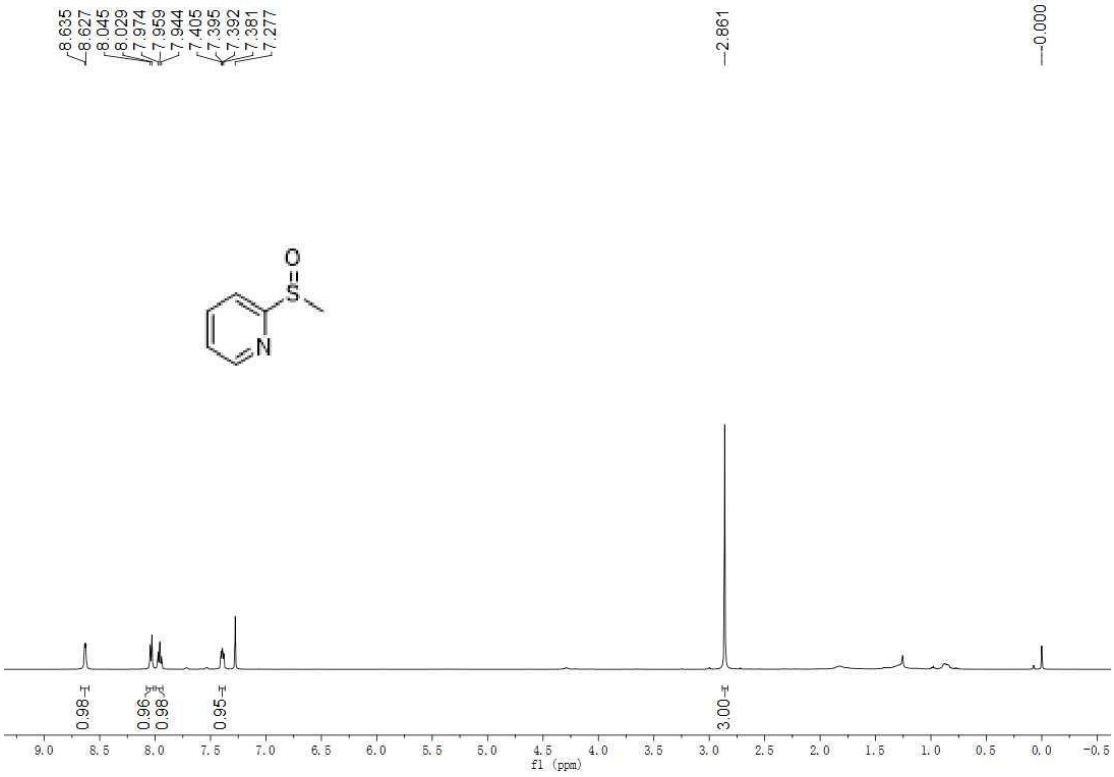


^{1}H NMR (500 MHz, $CDCl_3$)

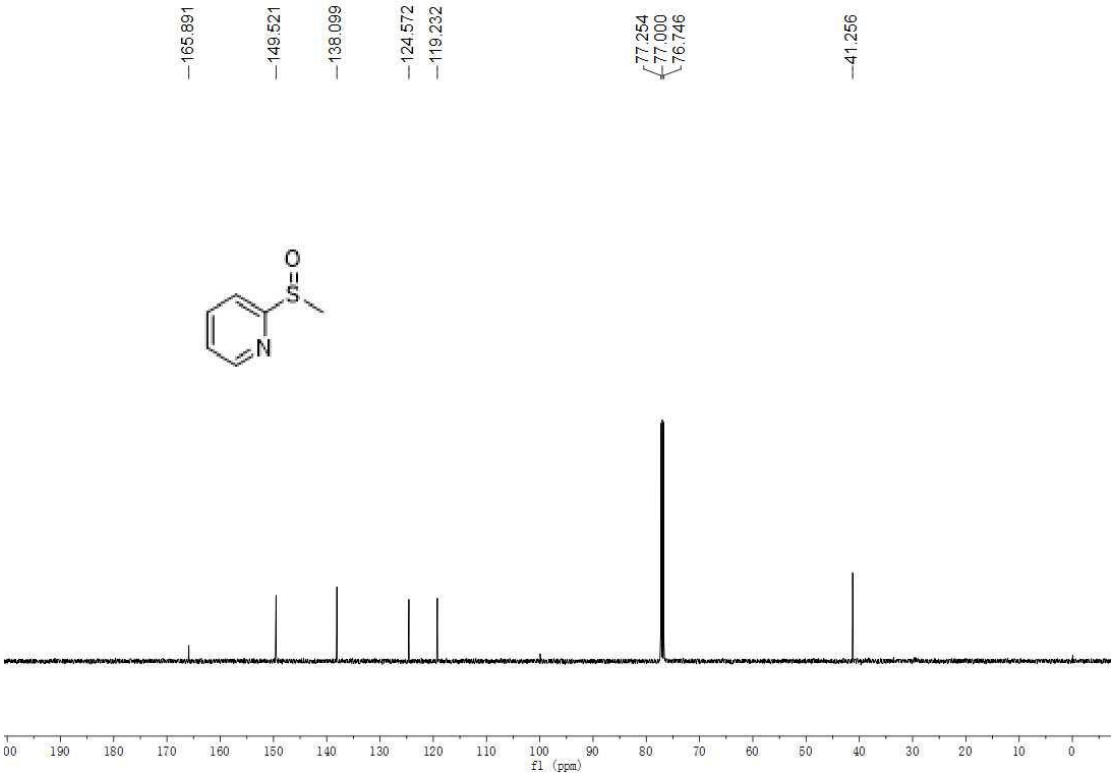


^{13}C NMR (125 MHz, $CDCl_3$)

2-(methylsulfinyl)pyridine (2k)

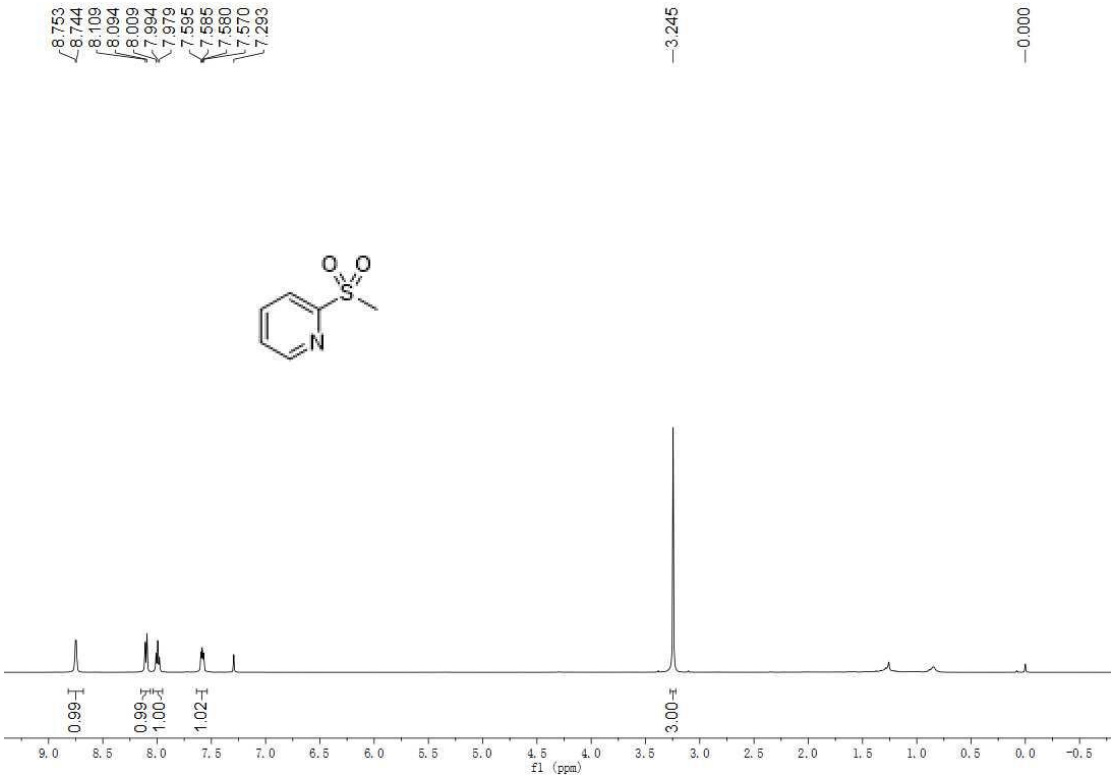


^{1}H NMR (500 MHz, $CDCl_3$)

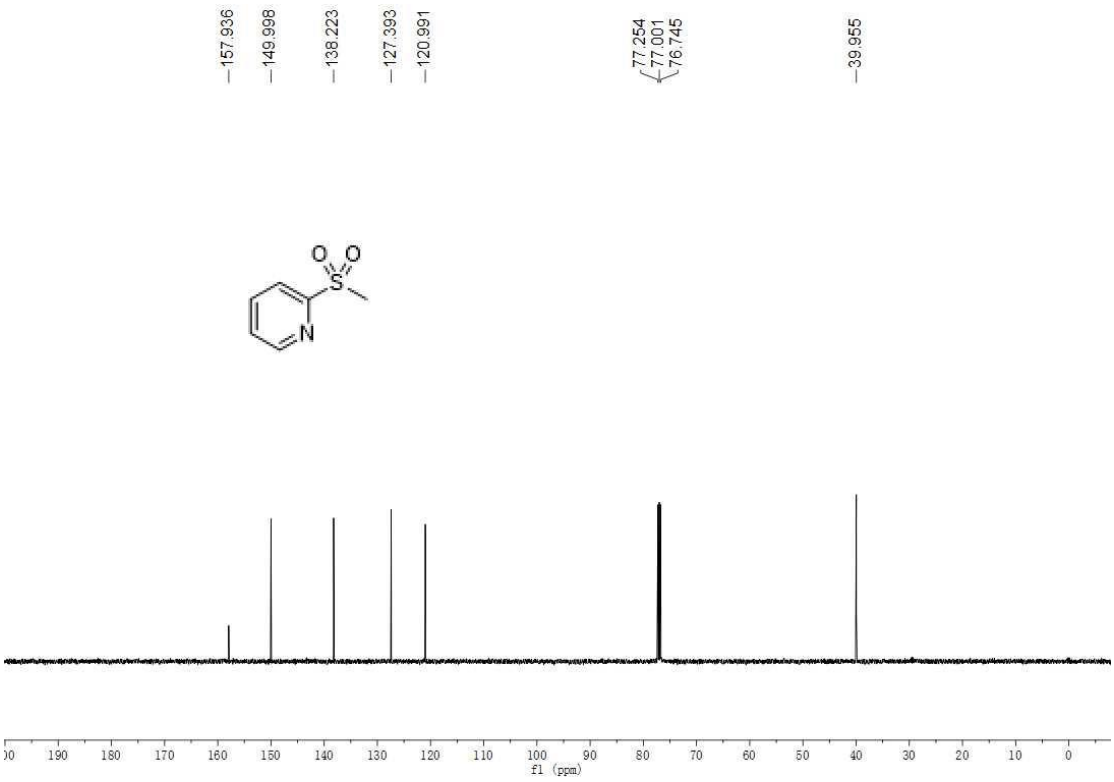


^{13}C NMR (125 MHz, $CDCl_3$)

2-(methylsulfonyl)pyridine (3k)

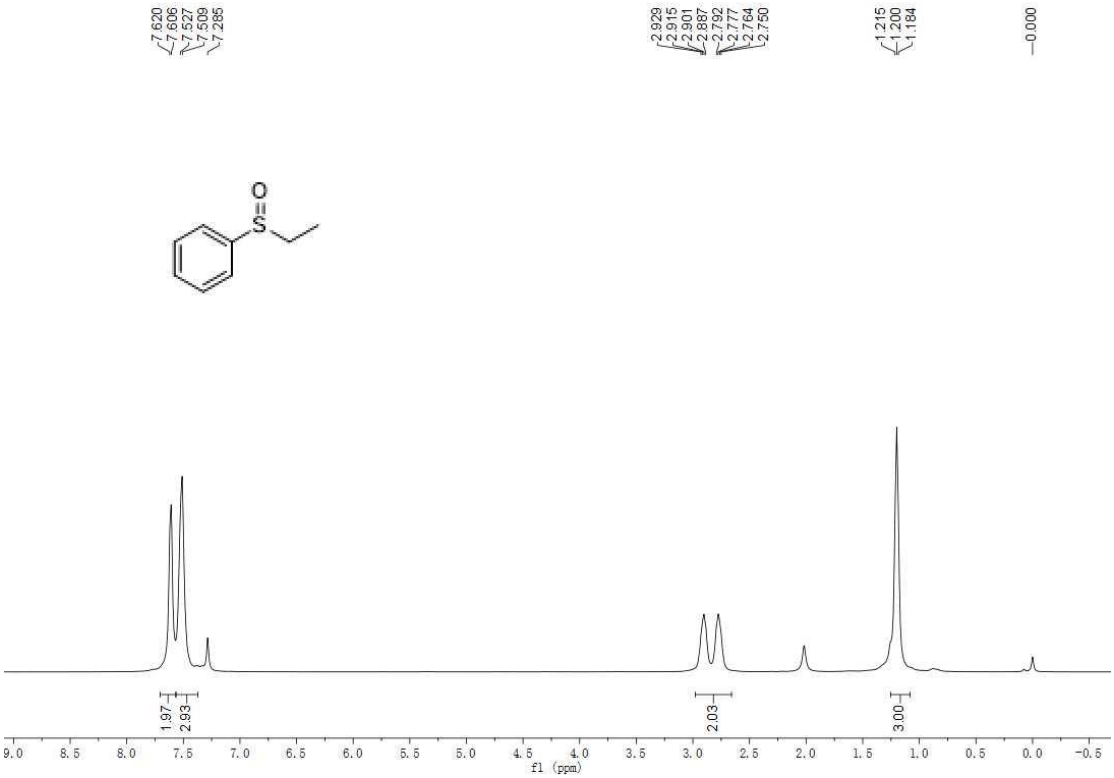


^{1}H NMR (500 MHz, $CDCl_3$)

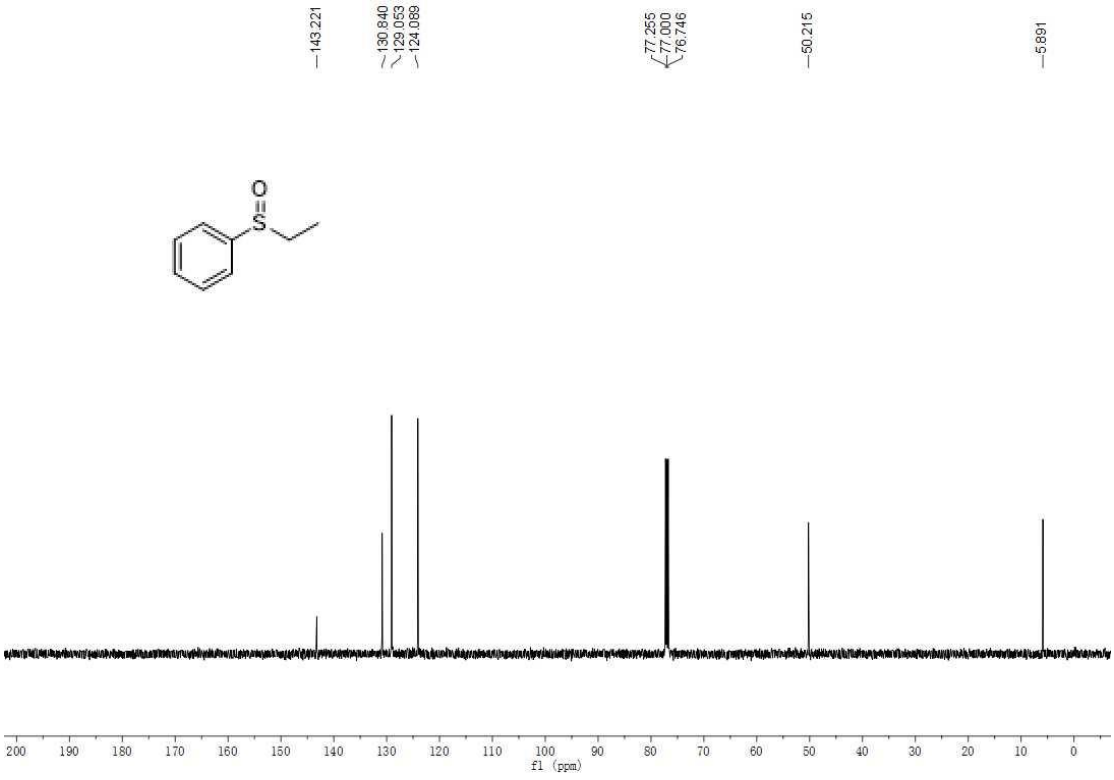


^{13}C NMR (125 MHz, $CDCl_3$)

(ethylsulfinyl)benzene (2l)

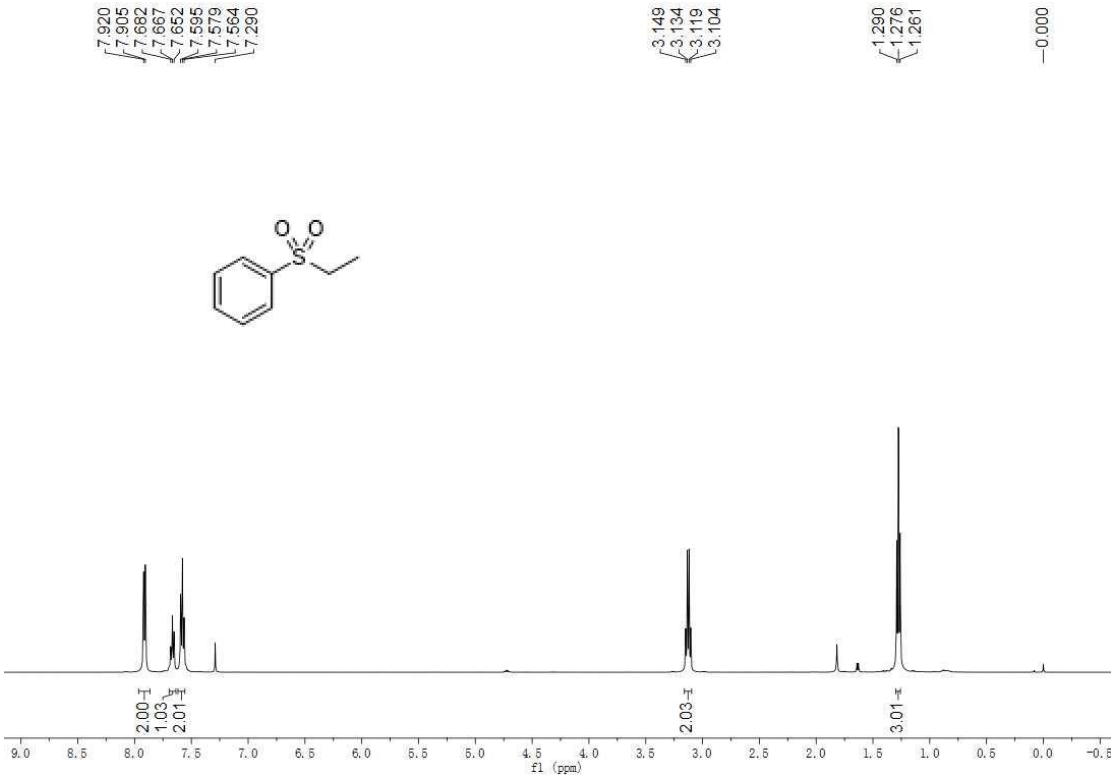


^{1}H NMR (500 MHz, $CDCl_3$)

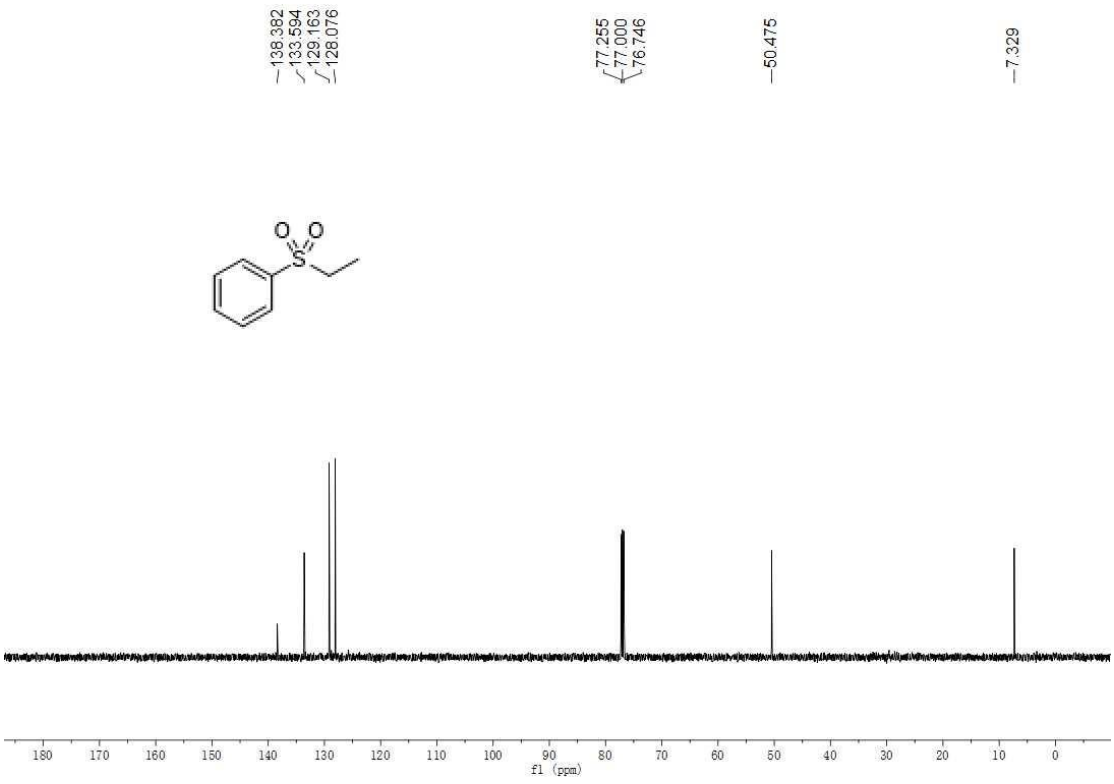


^{13}C NMR (125 MHz, $CDCl_3$)

(ethylsulfonyl)benzene (3l)

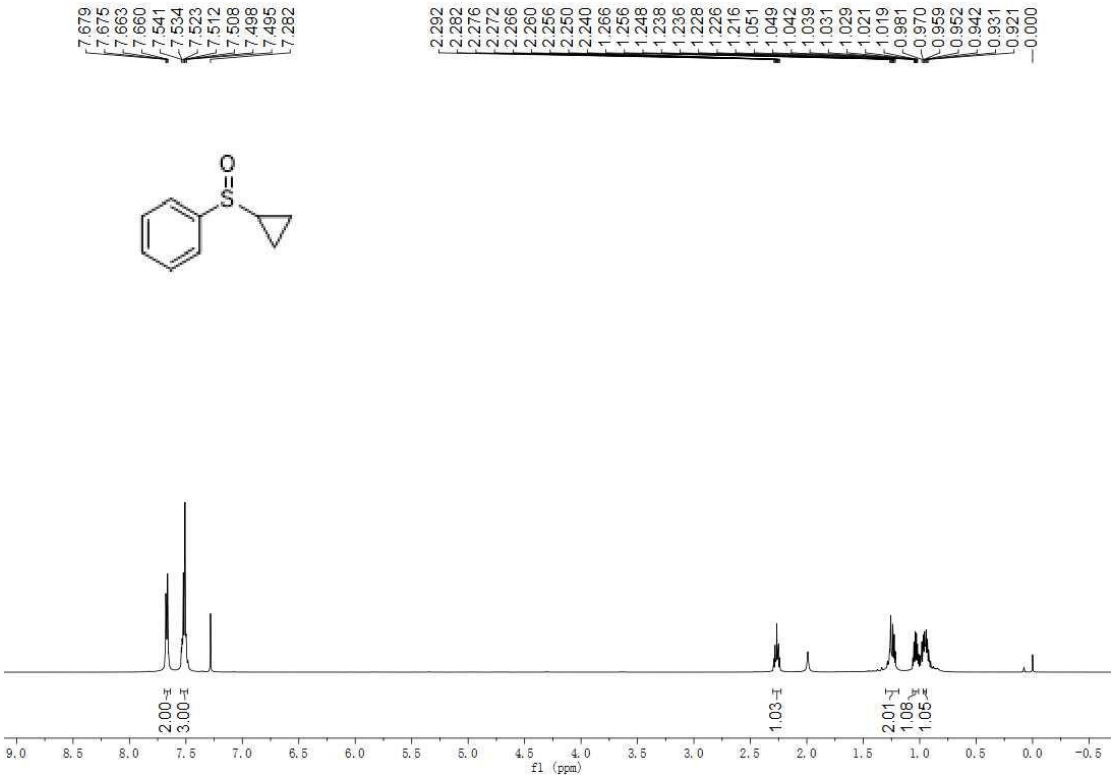


^{1}H NMR (500 MHz, $CDCl_3$)

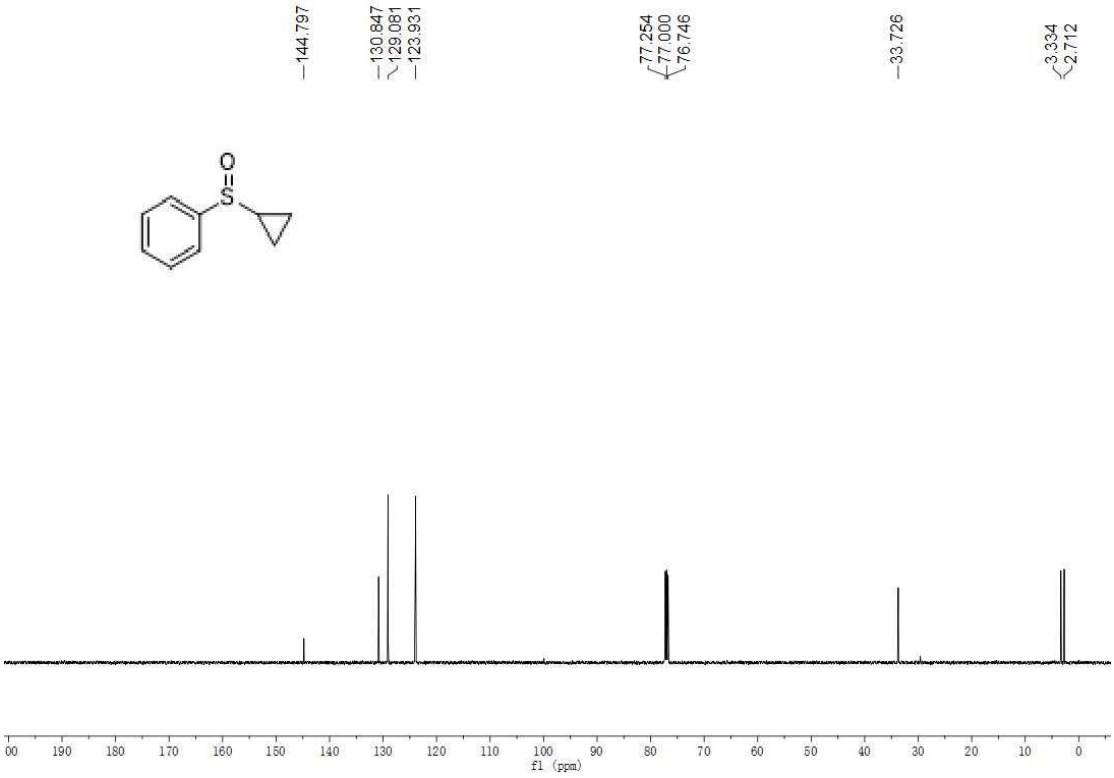


^{13}C NMR (125 MHz, $CDCl_3$)

(ethylsulfonyl)benzene (2m)

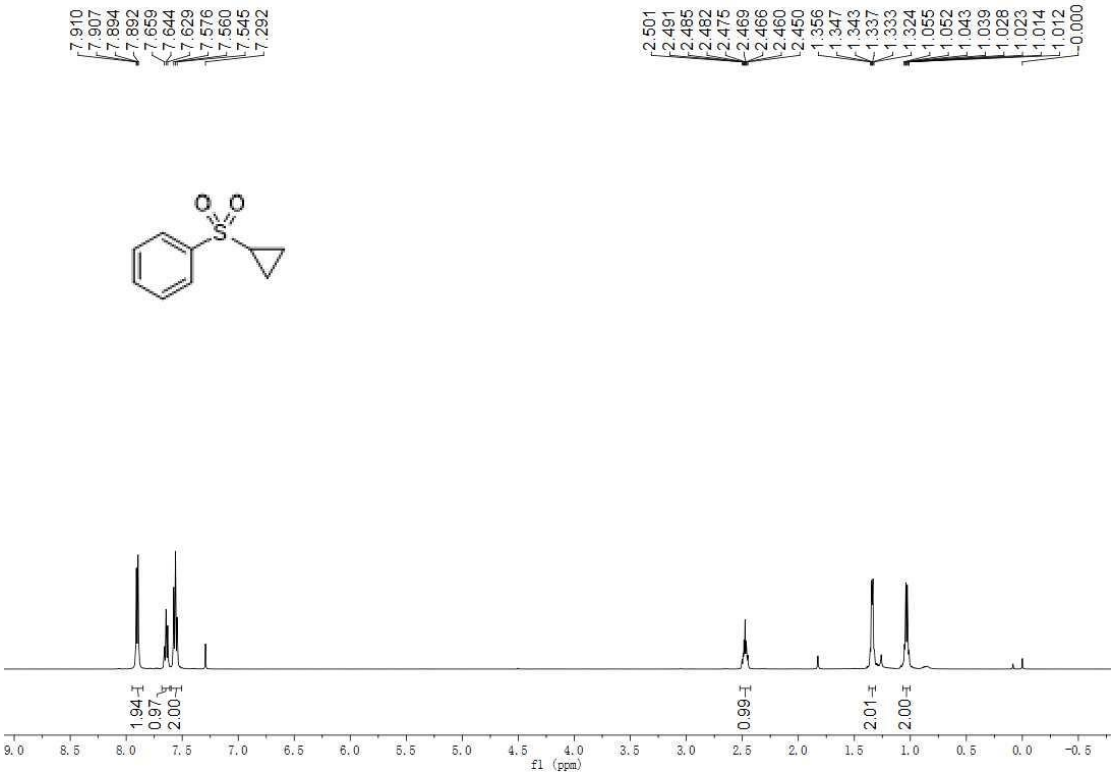


^{1}H NMR (500 MHz, $CDCl_3$)

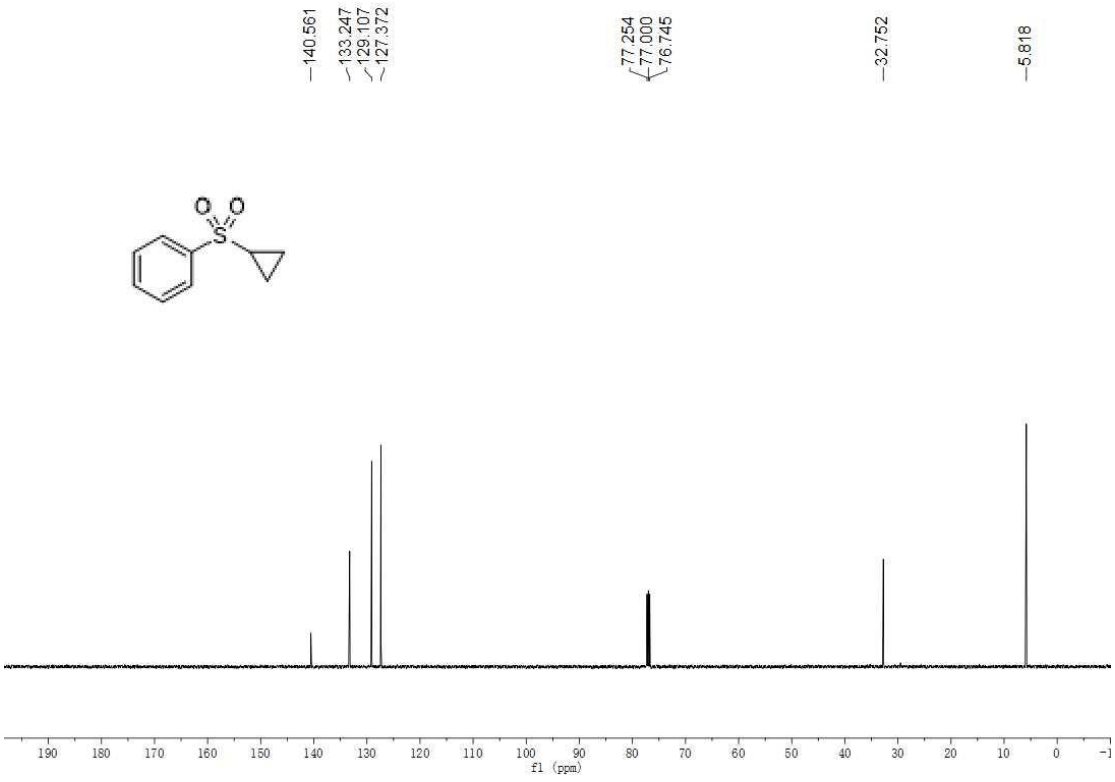


^{13}C NMR (125 MHz, $CDCl_3$)

(cyclopropylsulfonyl)benzene (3m)

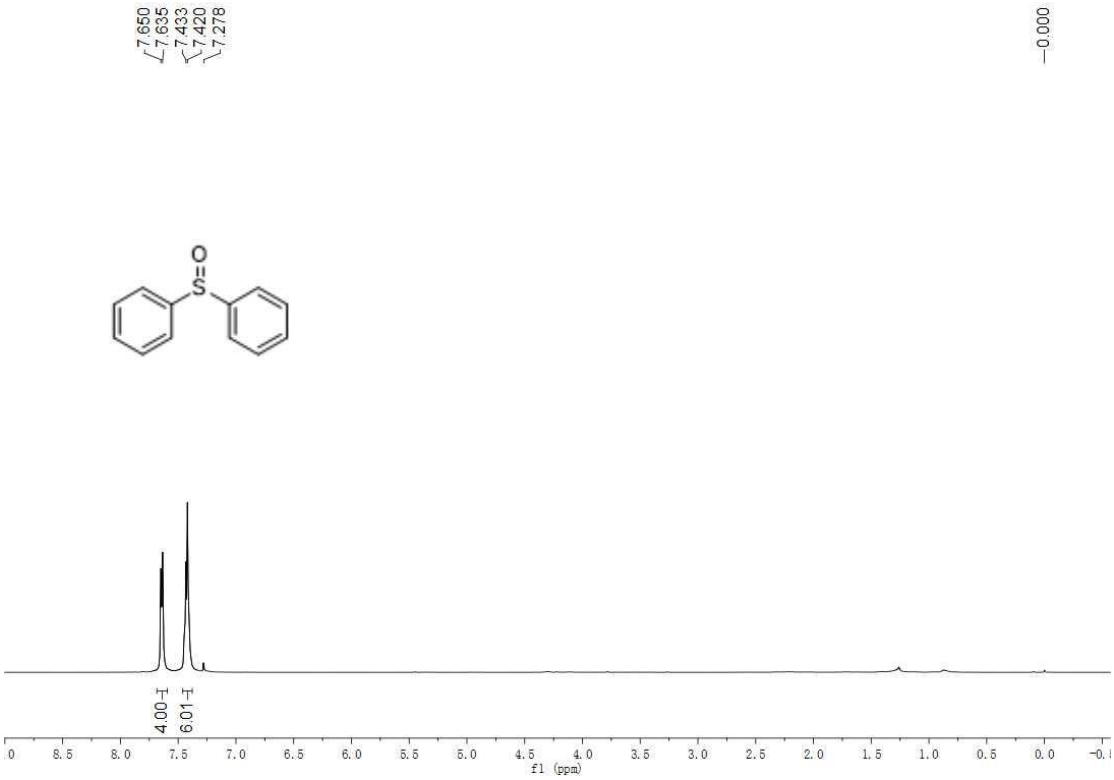


^{1}H NMR (500 MHz, $CDCl_3$)

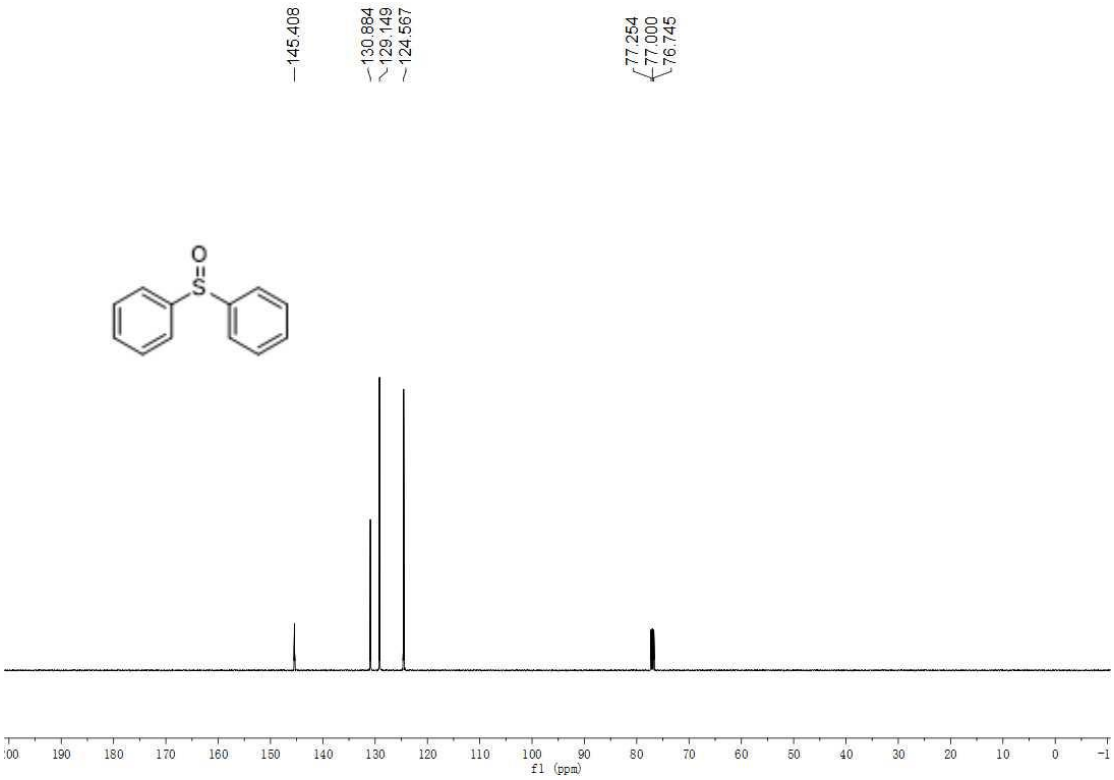


^{13}C NMR (125 MHz, $CDCl_3$)

Sulfinyldibenzene (2n)

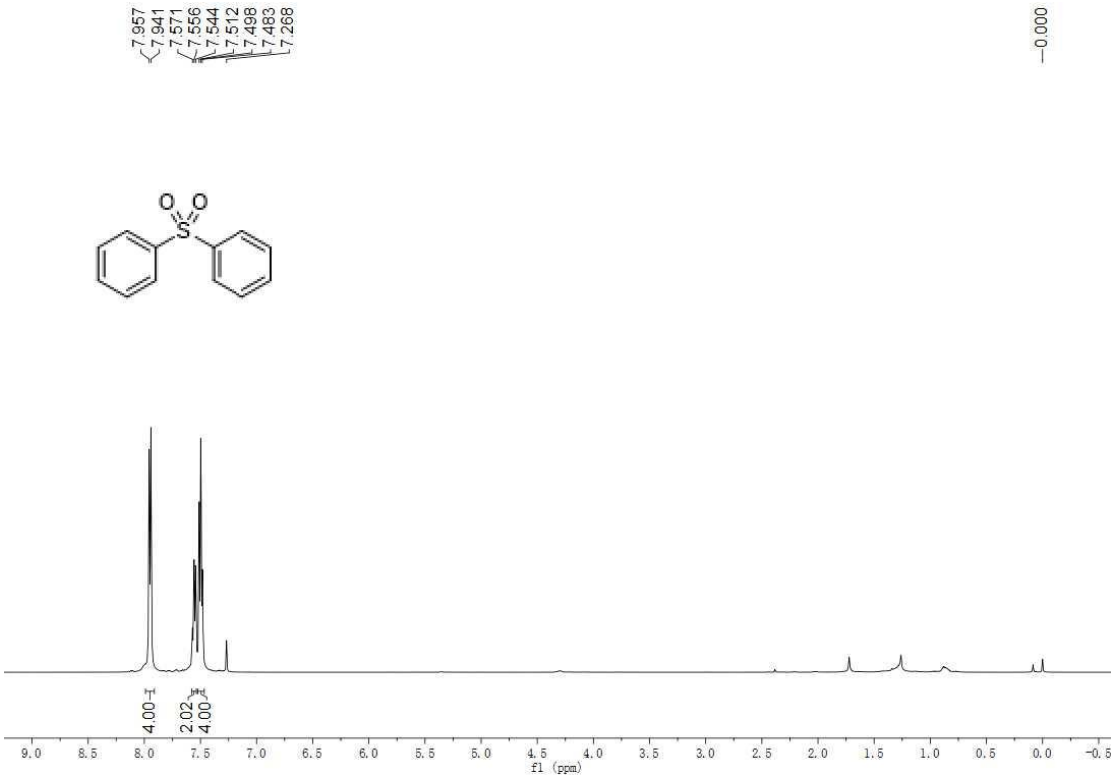


^{1}H NMR (500 MHz, $CDCl_3$)

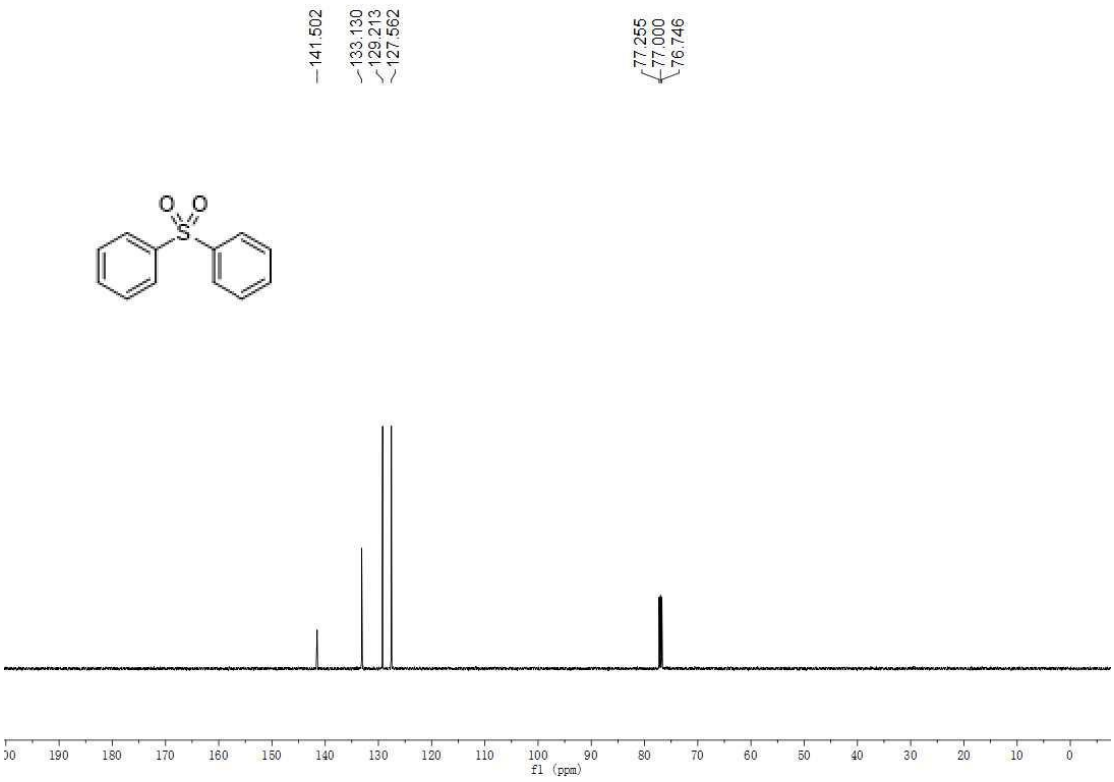


^{13}C NMR (125 MHz, $CDCl_3$)

Sulfonyldibenzene (3n)

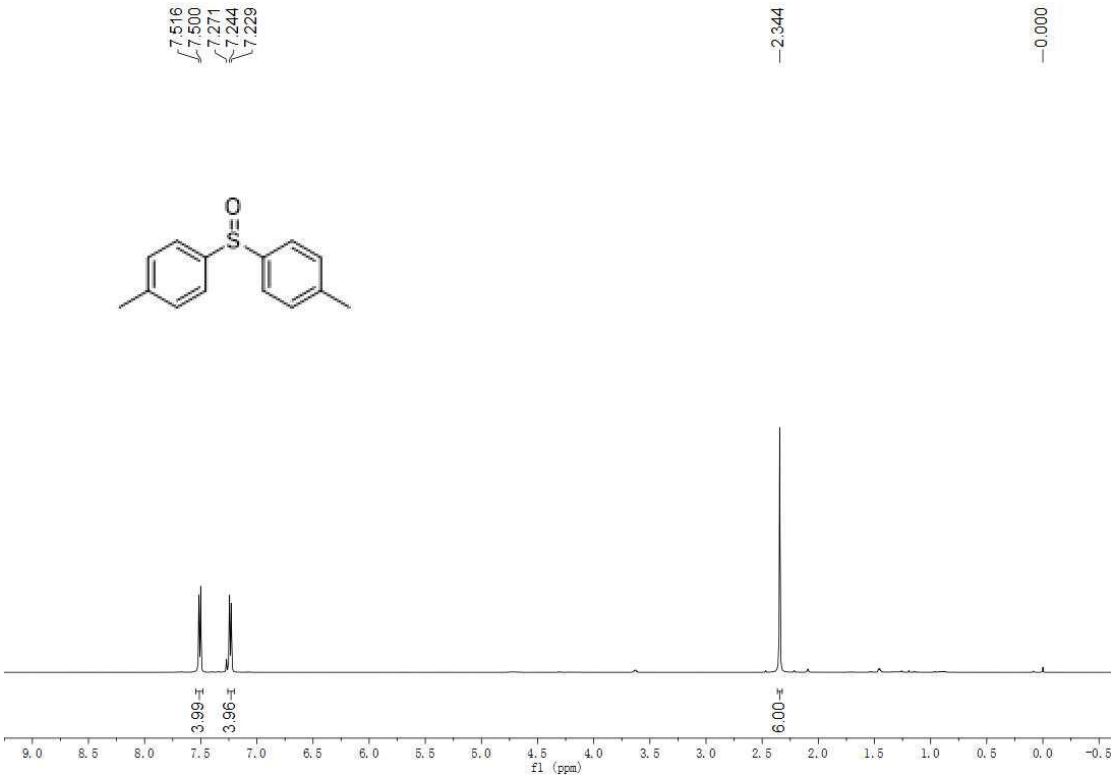


^{1}H NMR (500 MHz, $CDCl_3$)



^{13}C NMR (125 MHz, $CDCl_3$)

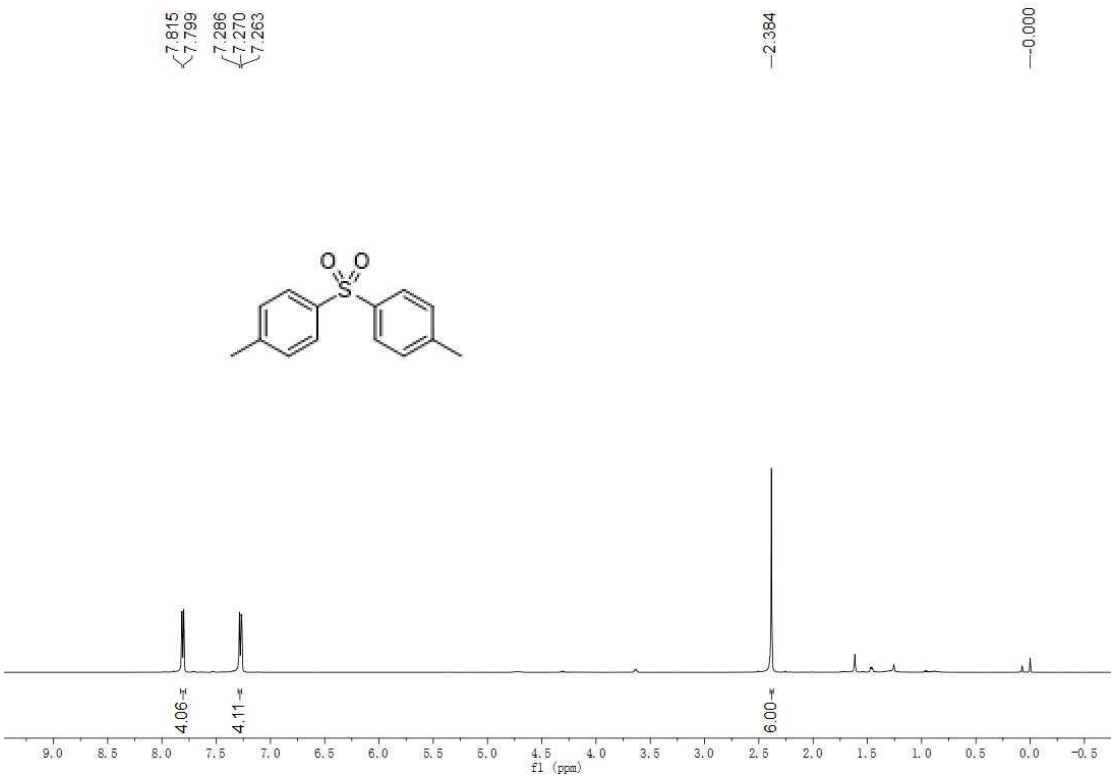
4,4'-sulfinylbis(methylbenzene) (2o)



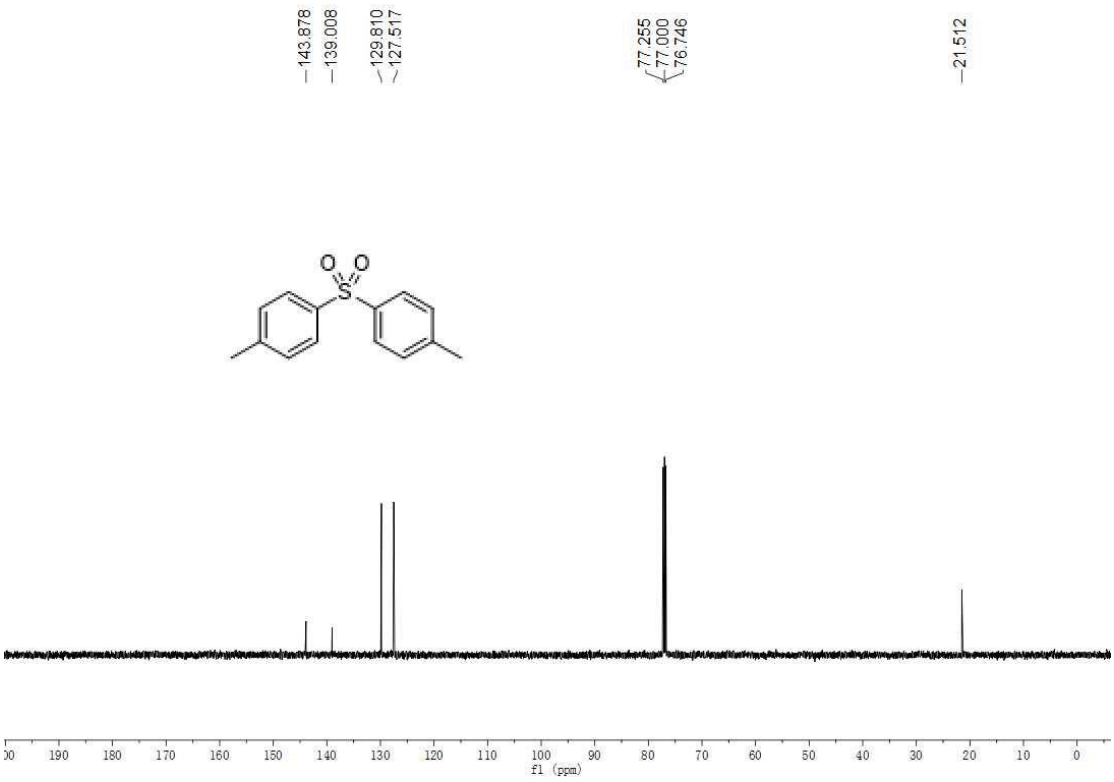
^{1}H NMR (500 MHz, $CDCl_3$)

^{13}C NMR (125 MHz, $CDCl_3$)

4,4'-sulfonylbis(methylbenzene) (3o)

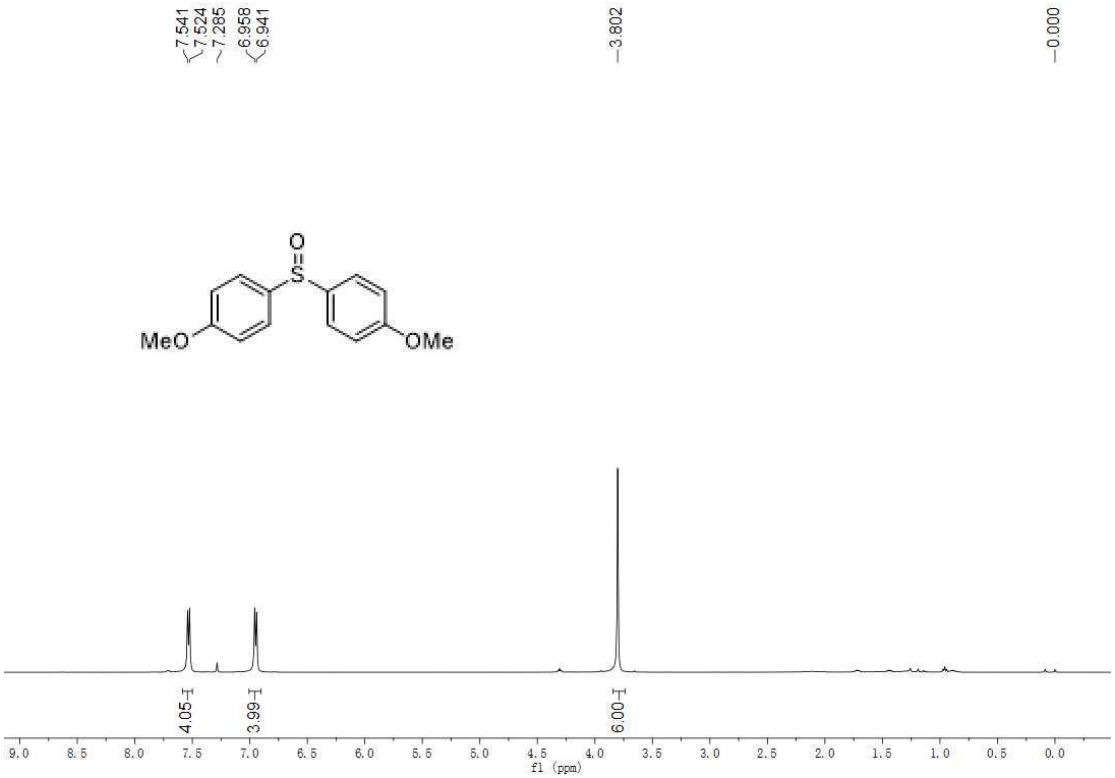


^{1}H NMR (500 MHz, $CDCl_3$)

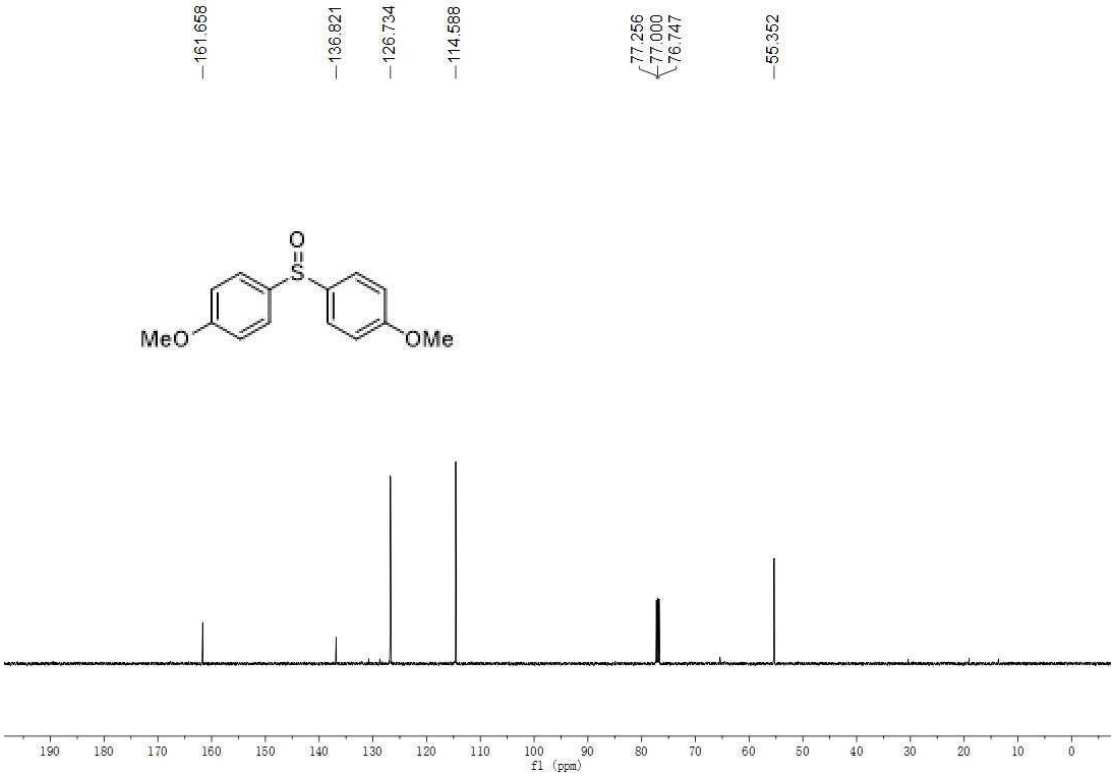


^{13}C NMR (125 MHz, $CDCl_3$)

4,4'-sulfinylbis(methoxybenzene) (2p)

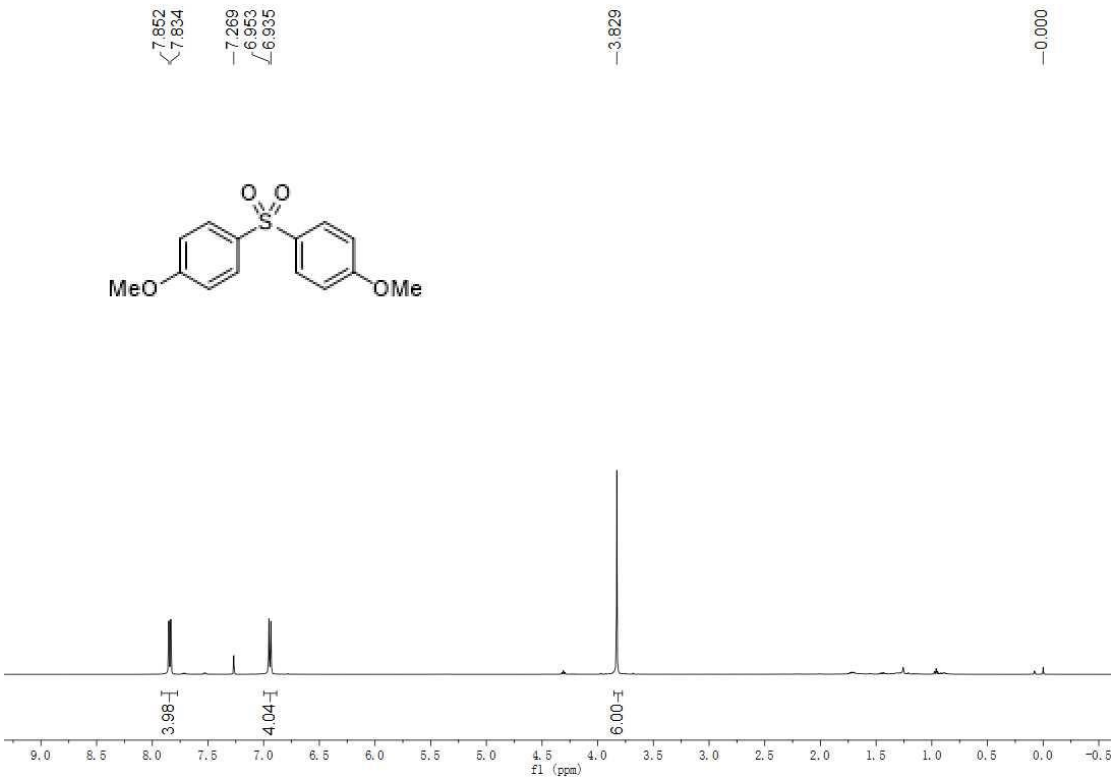


^{1}H NMR (500 MHz, $CDCl_3$)

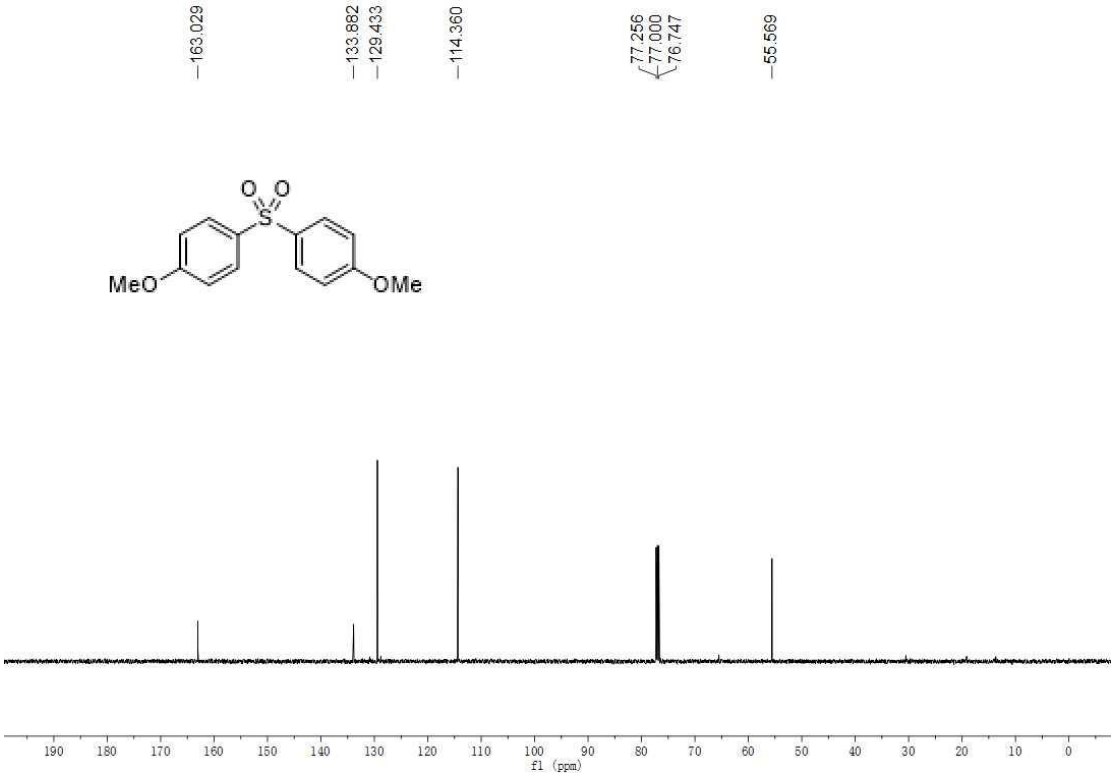


^{13}C NMR (125 MHz, $CDCl_3$)

4,4'-sulfonylbis(methoxybenzene) (3p)

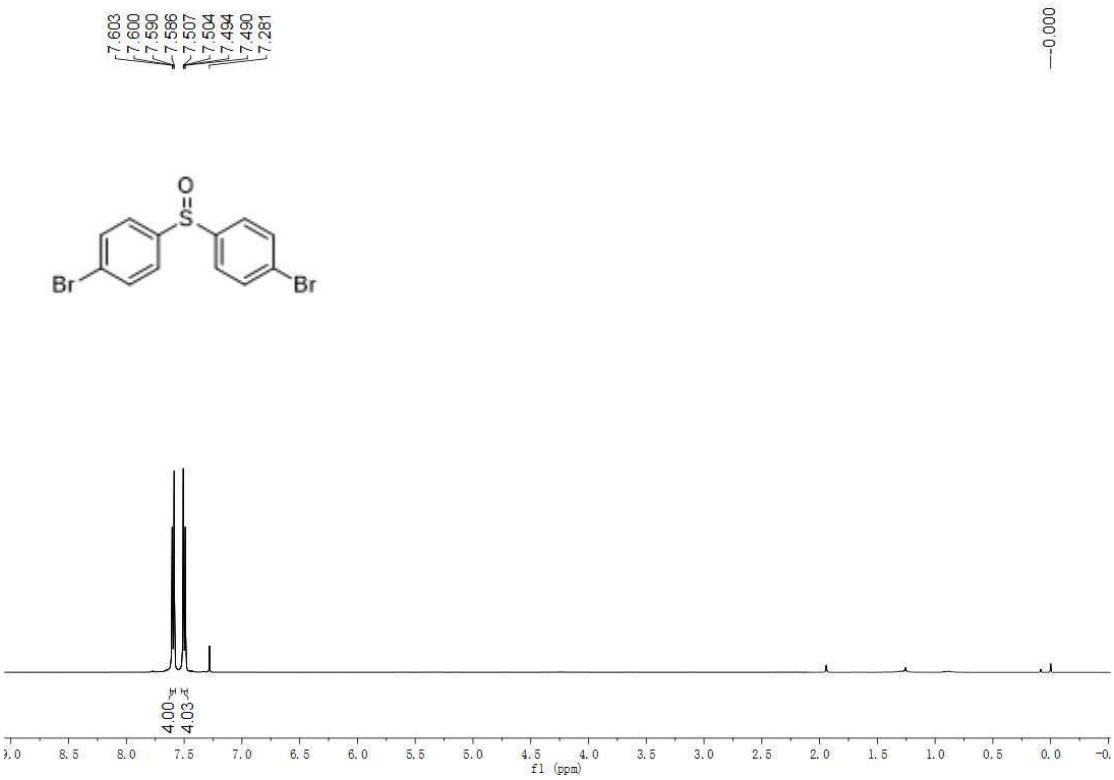


^{1}H NMR (500 MHz, $CDCl_3$)

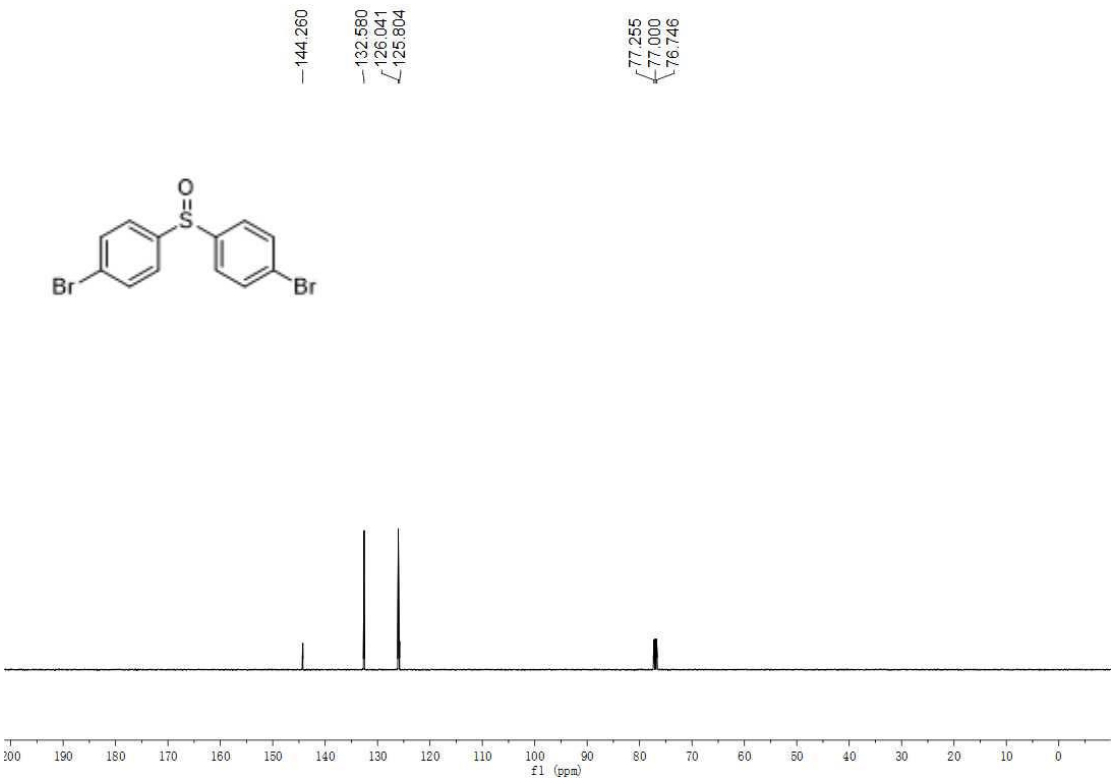


^{13}C NMR (125 MHz, $CDCl_3$)

4,4'-sulfinylbis(bromobenzene) (2q)



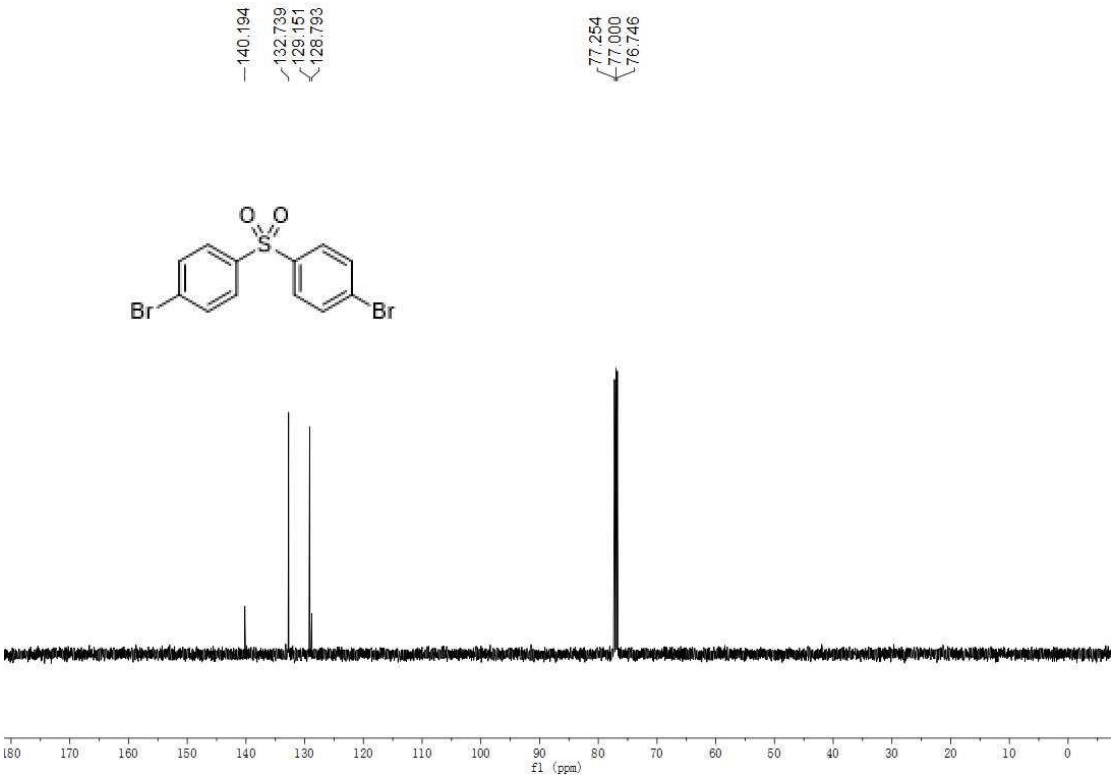
^{1}H NMR (500 MHz, $CDCl_3$)



^{13}C NMR (125 MHz, $CDCl_3$)

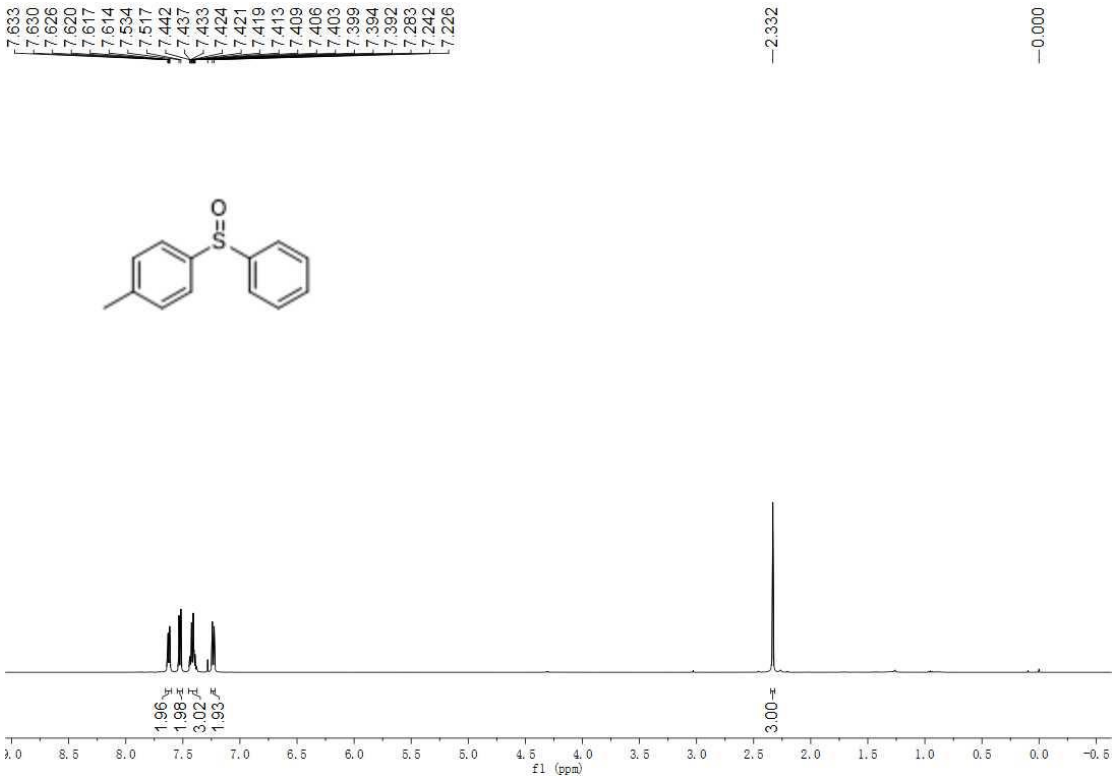
4,4'-sulfonylbis(bromobenzene) (3q)

^{1}H NMR (500 MHz, $CDCl_3$)

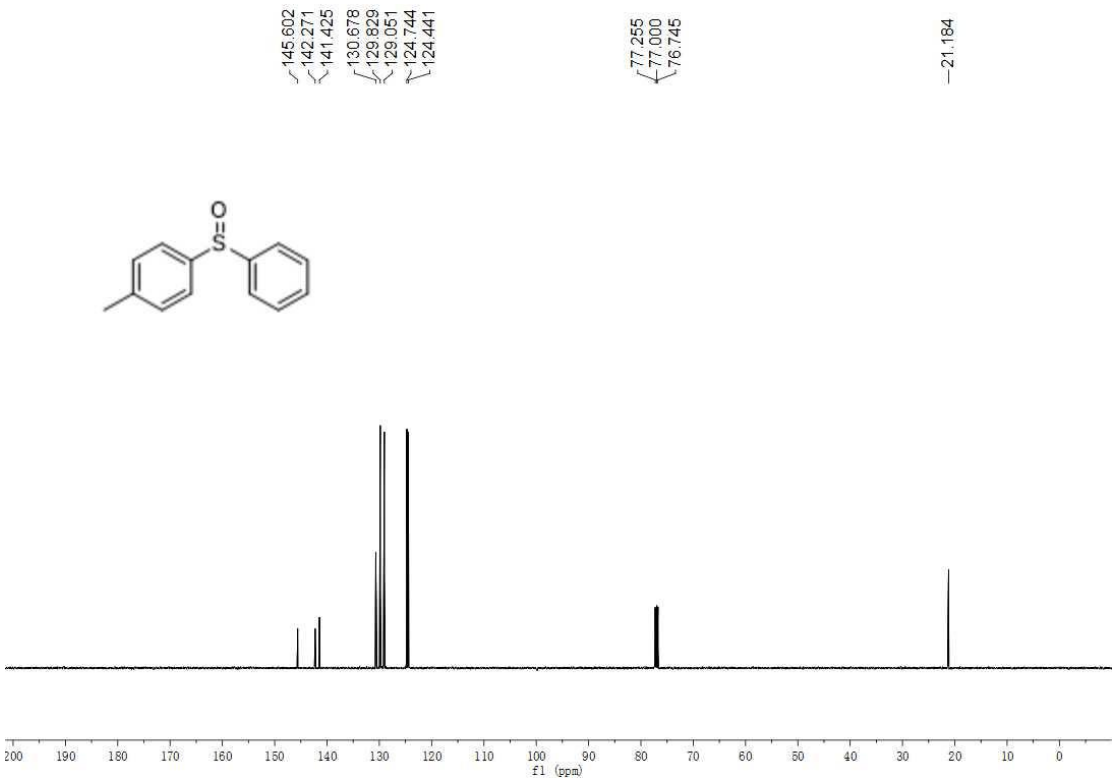


^{13}C NMR (125 MHz, $CDCl_3$)

1-methyl-4-(phenylsulfinyl)benzene (2r)



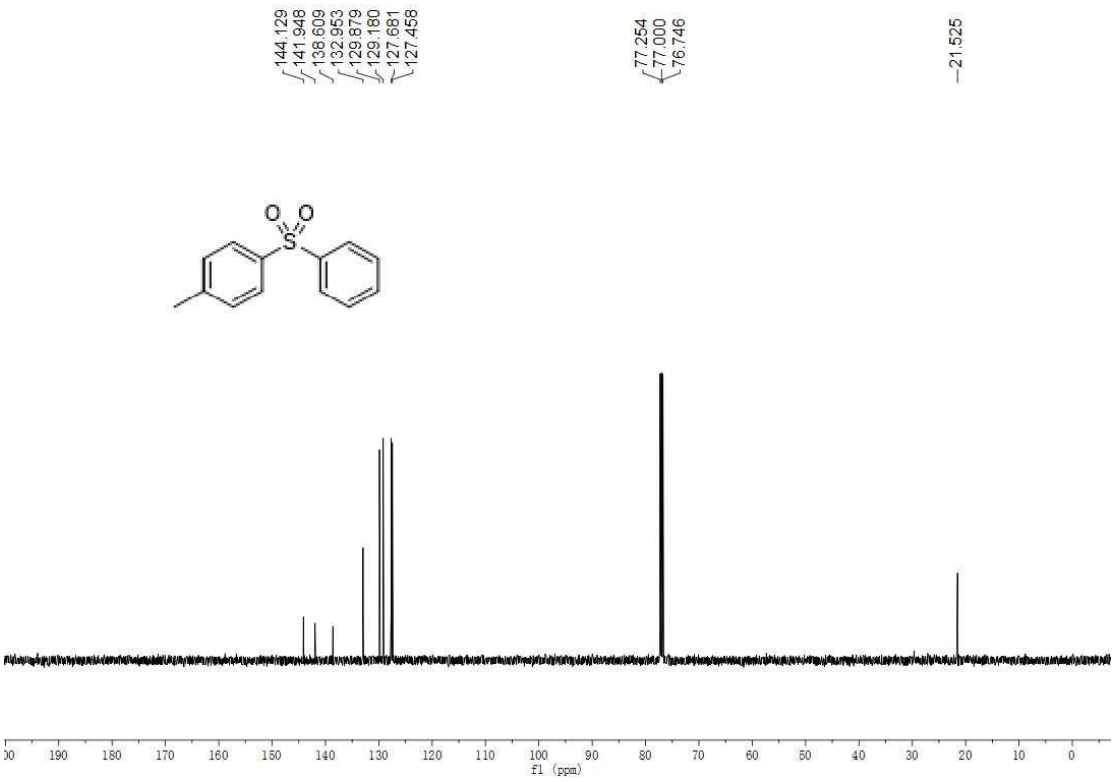
^{1}H NMR (500 MHz, $CDCl_3$)



^{13}C NMR (125 MHz, $CDCl_3$)

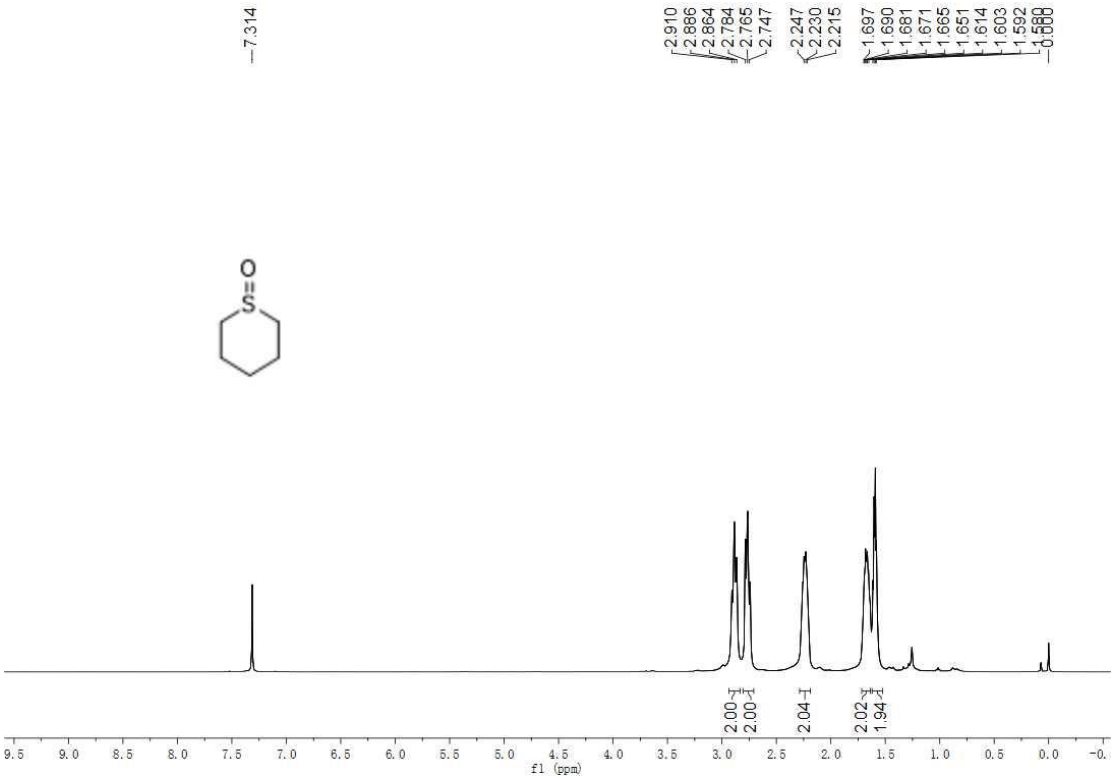
1-methyl-4-(phenylsulfonyl)benzene (3r)

^{1}H NMR (500 MHz, $CDCl_3$)

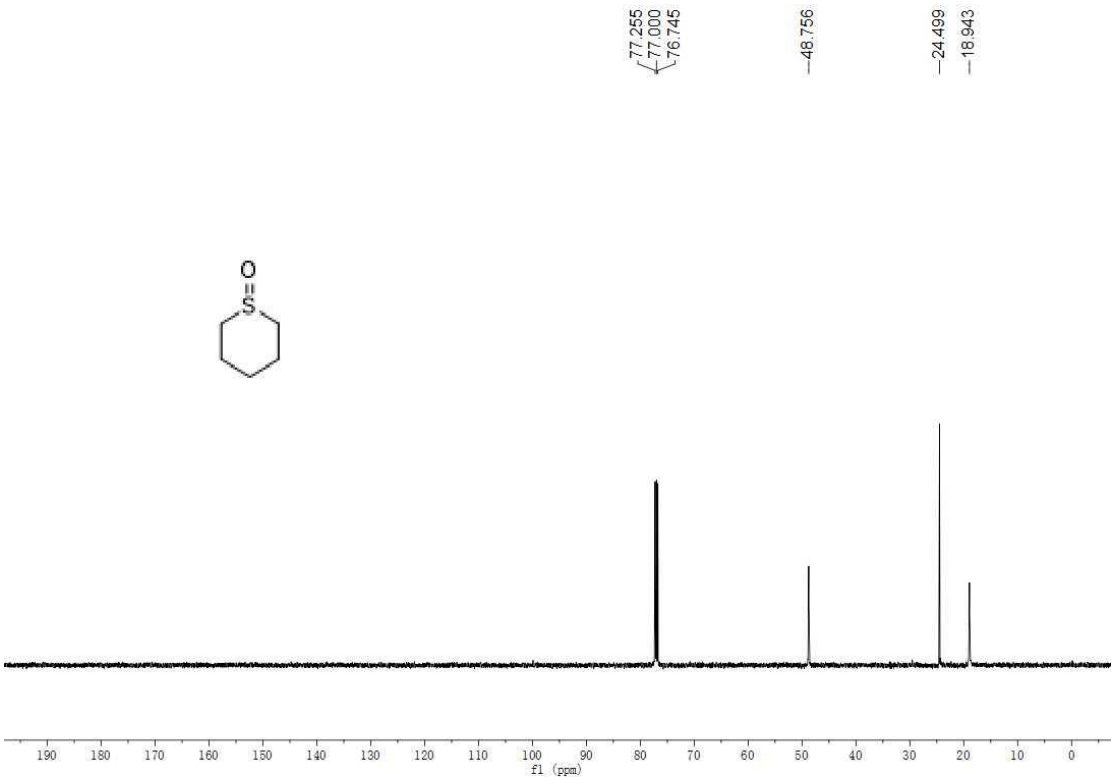


^{13}C NMR (125 MHz, $CDCl_3$)

tetrahydro-2H-thiopyran 1-oxide (2s)

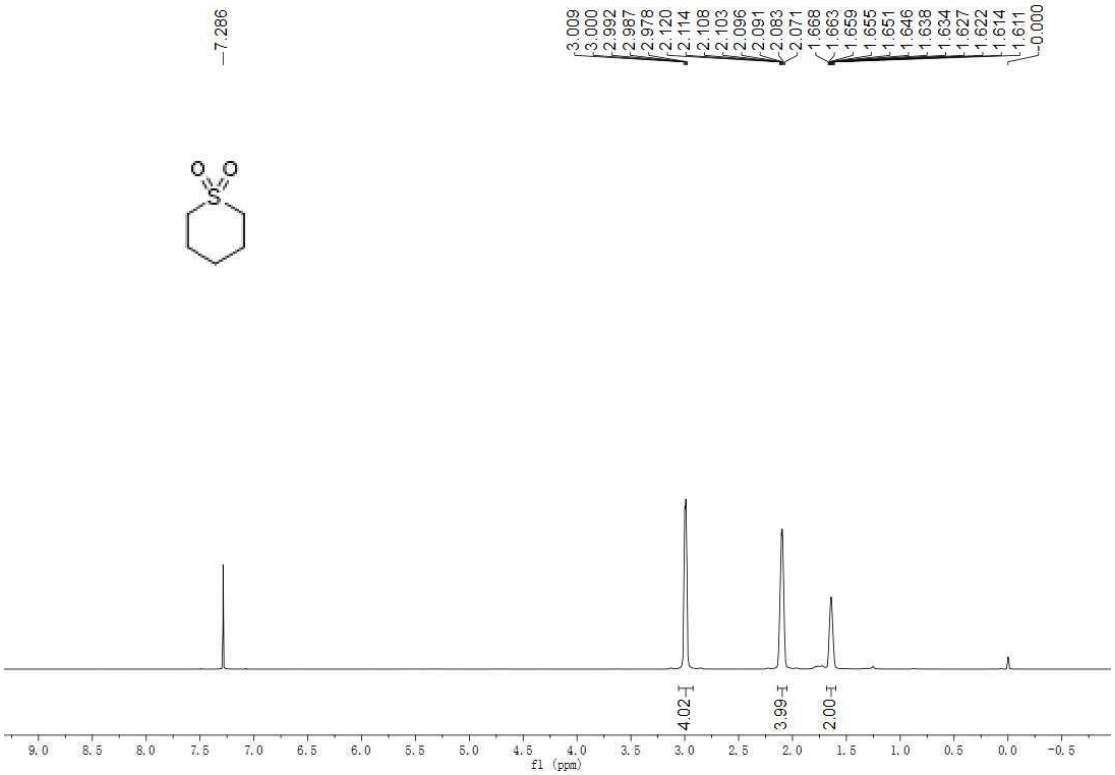


^{1}H NMR (500 MHz, $CDCl_3$)

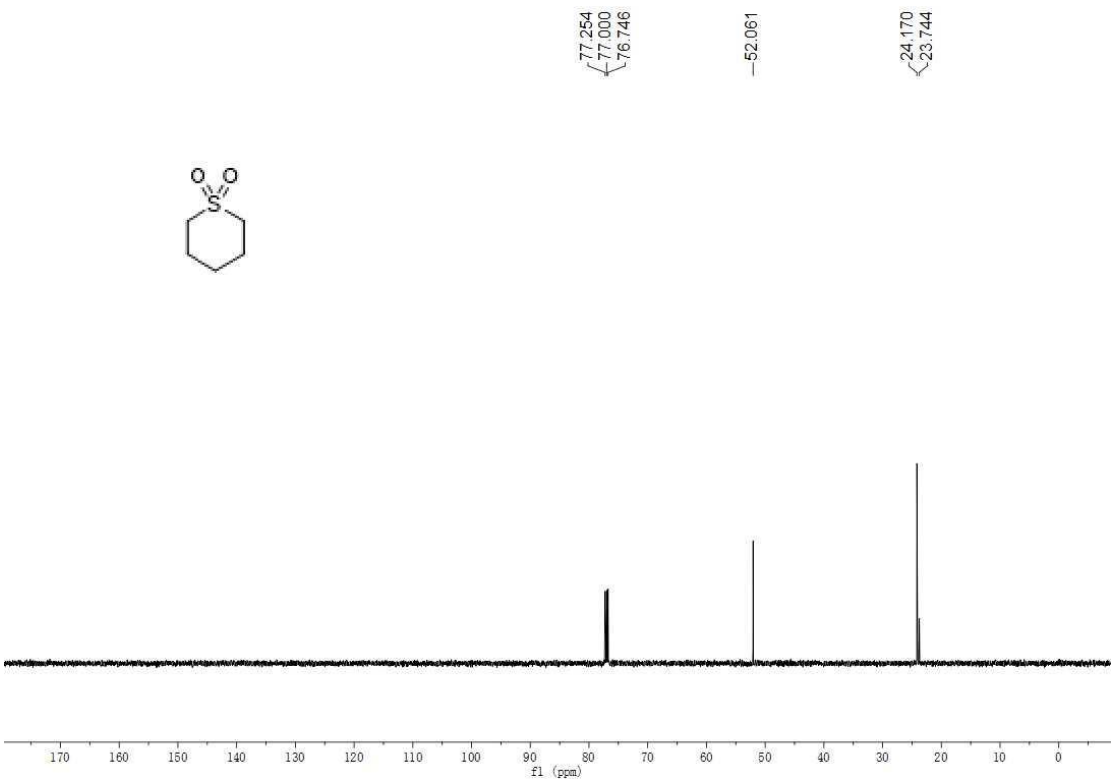


^{13}C NMR (125 MHz, $CDCl_3$)

tetrahydro-2H-thiopyran 1,1-dioxide (3s)

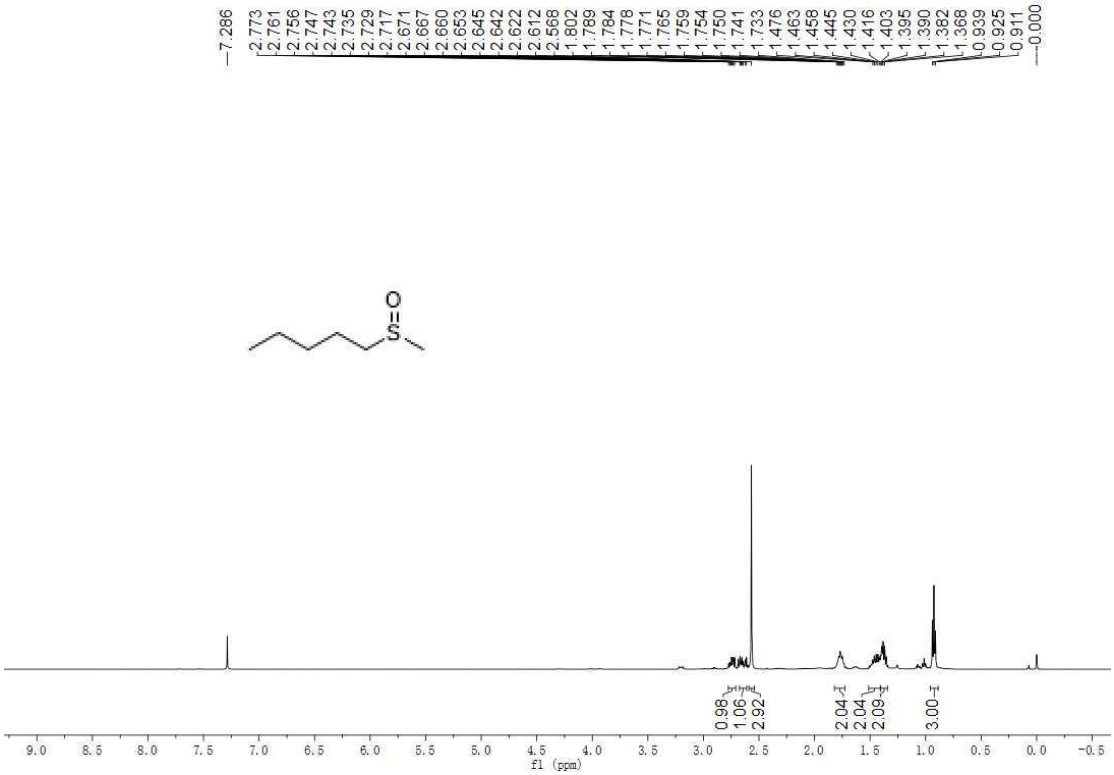


^{1}H NMR (500 MHz, $CDCl_3$)

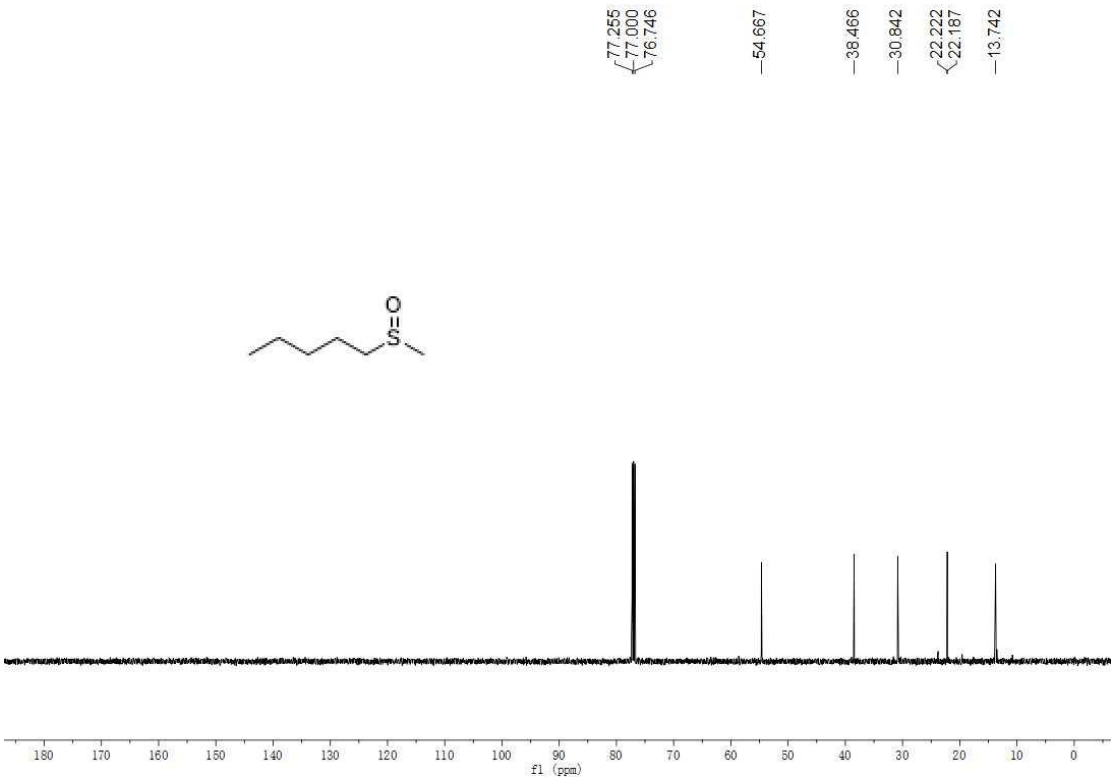


^{13}C NMR (125 MHz, $CDCl_3$)

2-(methylsulfonyl)pyridine (2t)

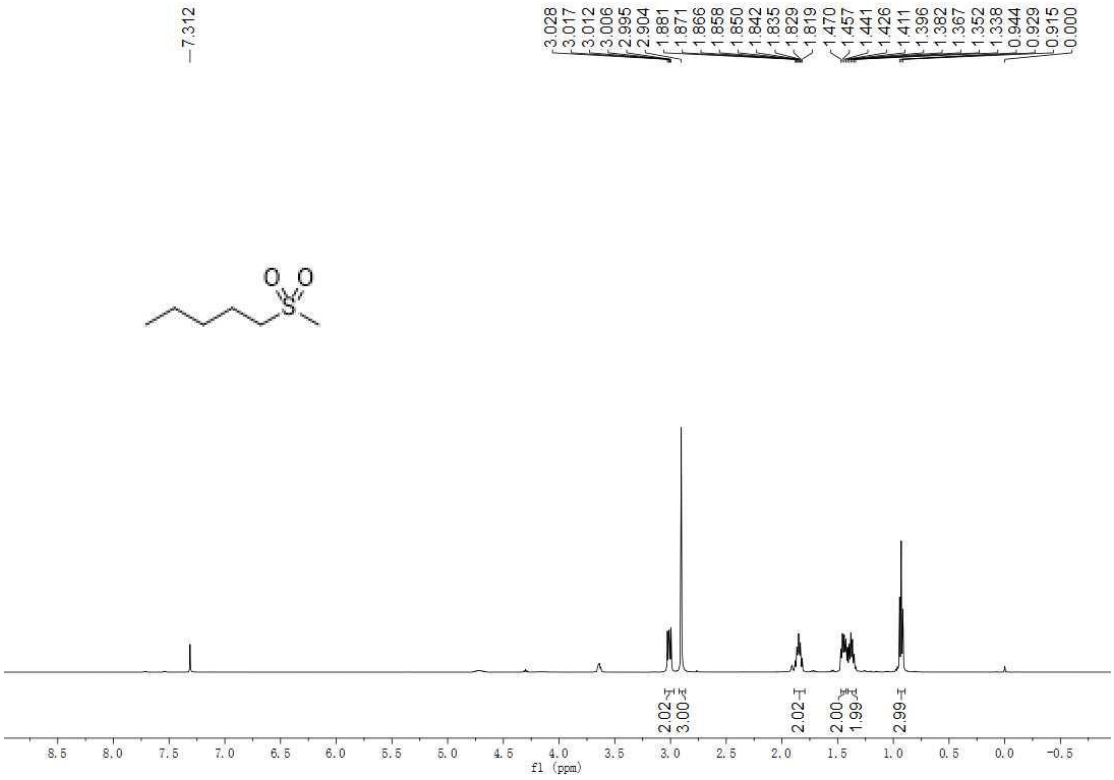


^{1}H NMR (500 MHz, $CDCl_3$)

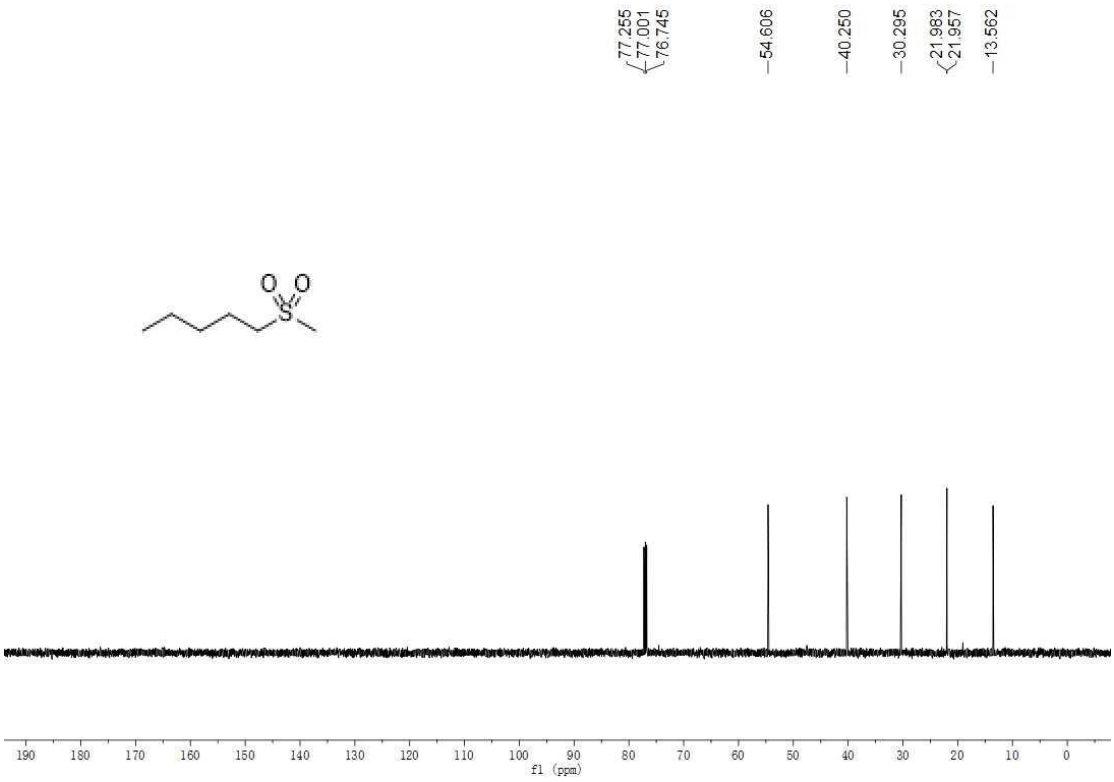


^{13}C NMR (125 MHz, $CDCl_3$)

1-(methylsulfonyl)pentane (3t)

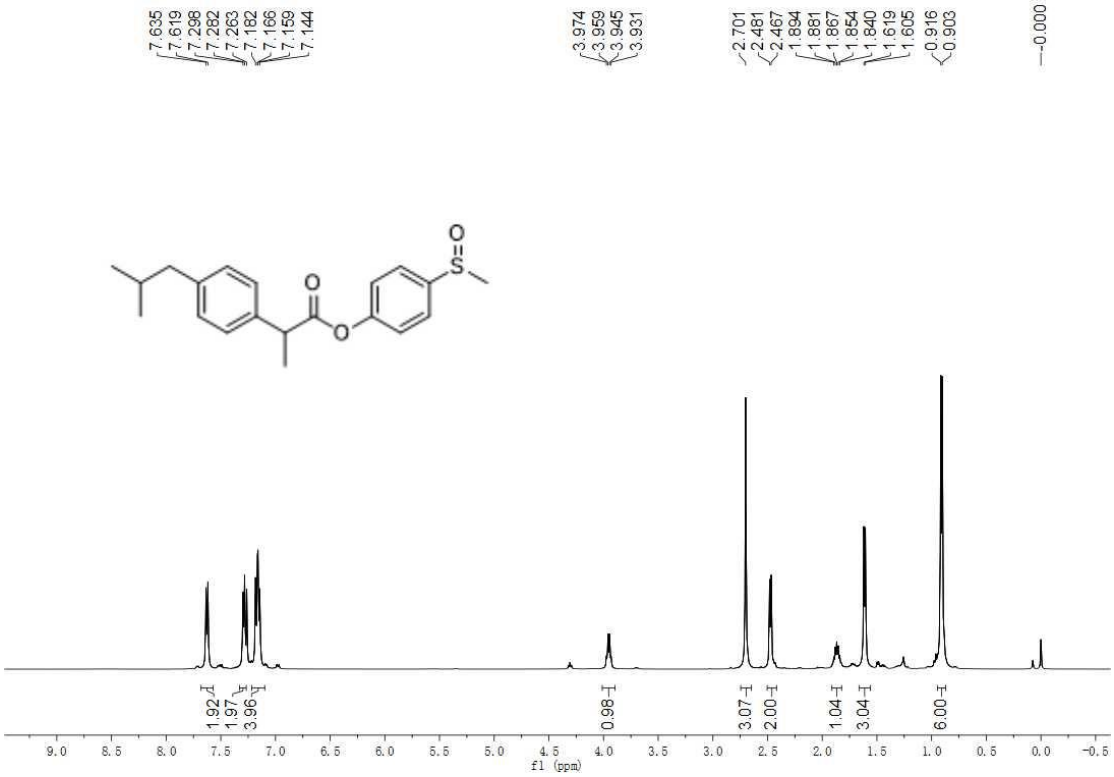


^{1}H NMR (500 MHz, $CDCl_3$)

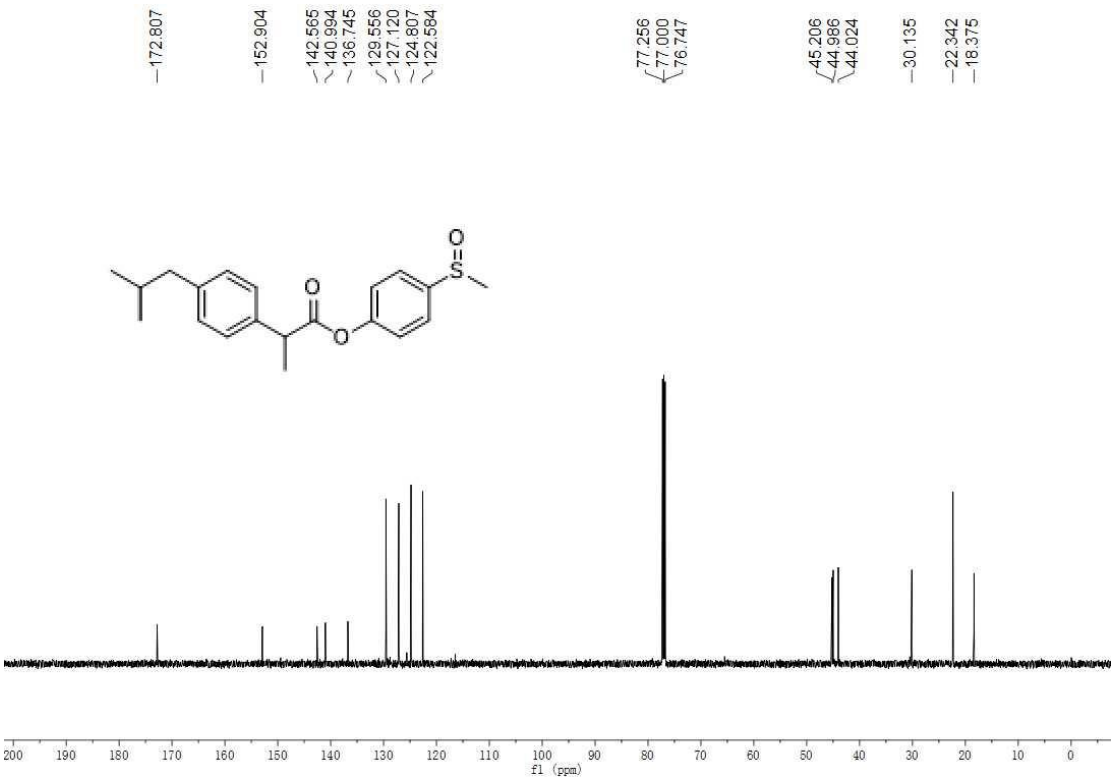


^{13}C NMR (125 MHz, $CDCl_3$)

4-(methylsulfinyl)phenyl 2-(4-isobutylphenyl)propanoate (4a)

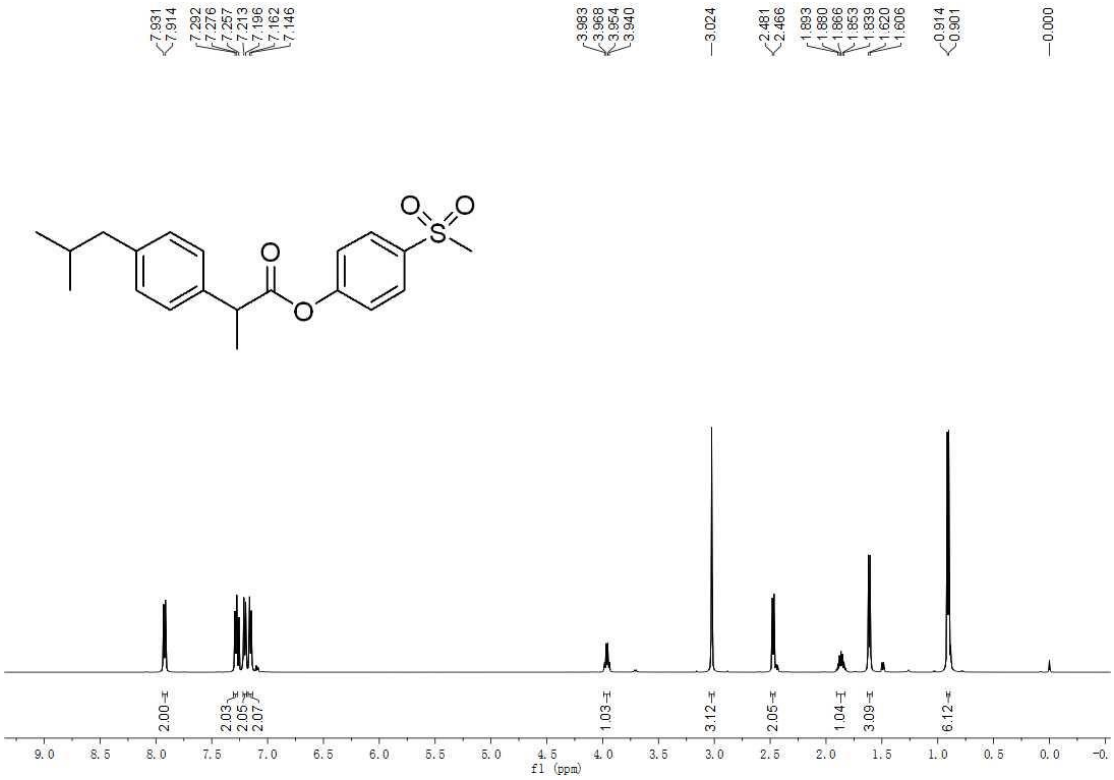


^{1}H NMR (500 MHz, $CDCl_3$)

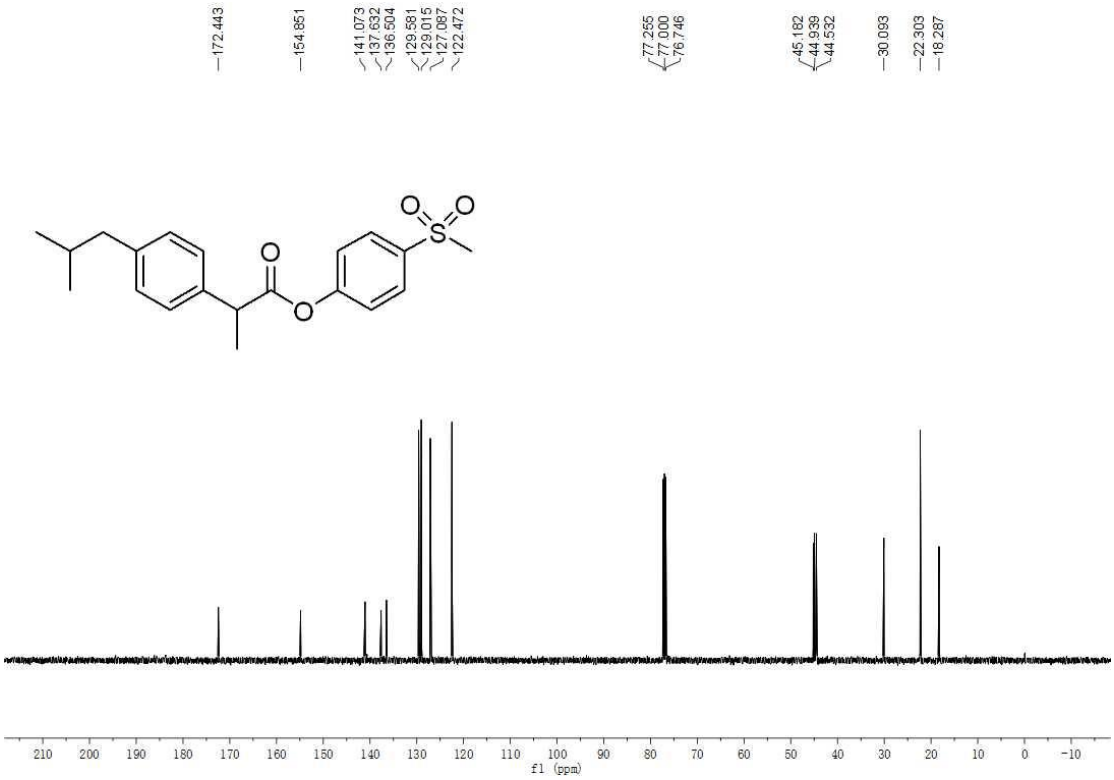


^{13}C NMR (125 MHz, $CDCl_3$)

4-(methylsulfonyl)phenyl 2-(4-isobutylphenyl)propanoate (4b)

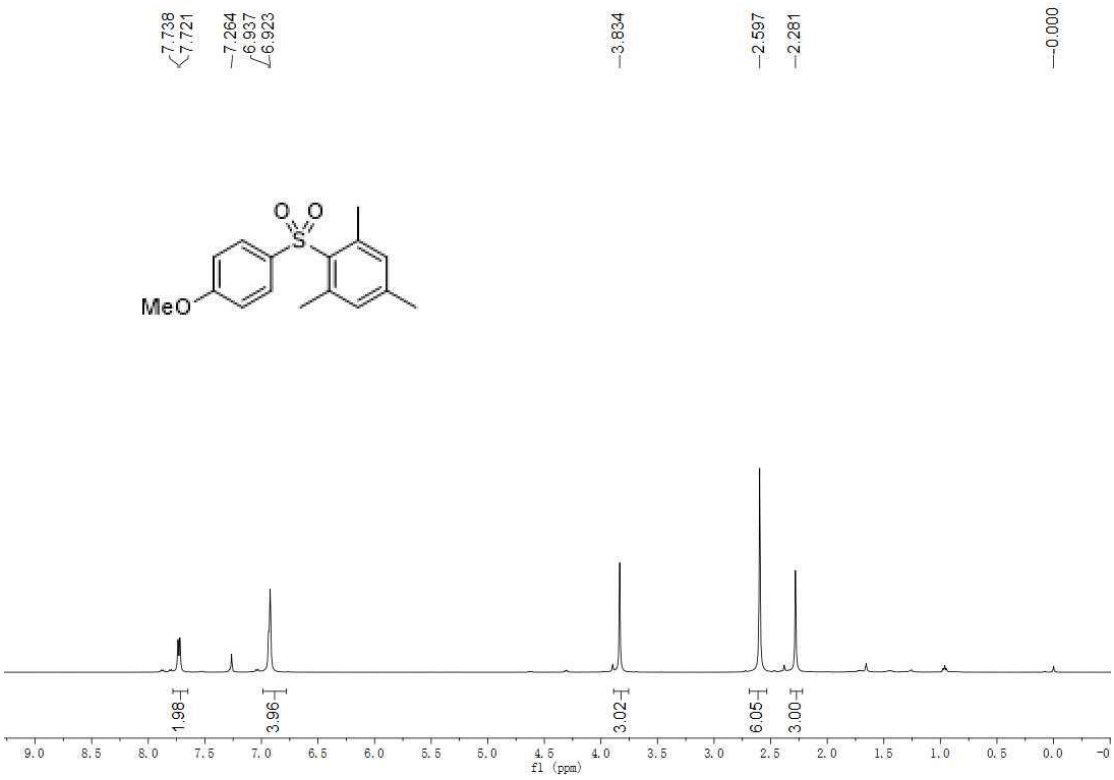


^{1}H NMR (500 MHz, $CDCl_3$)

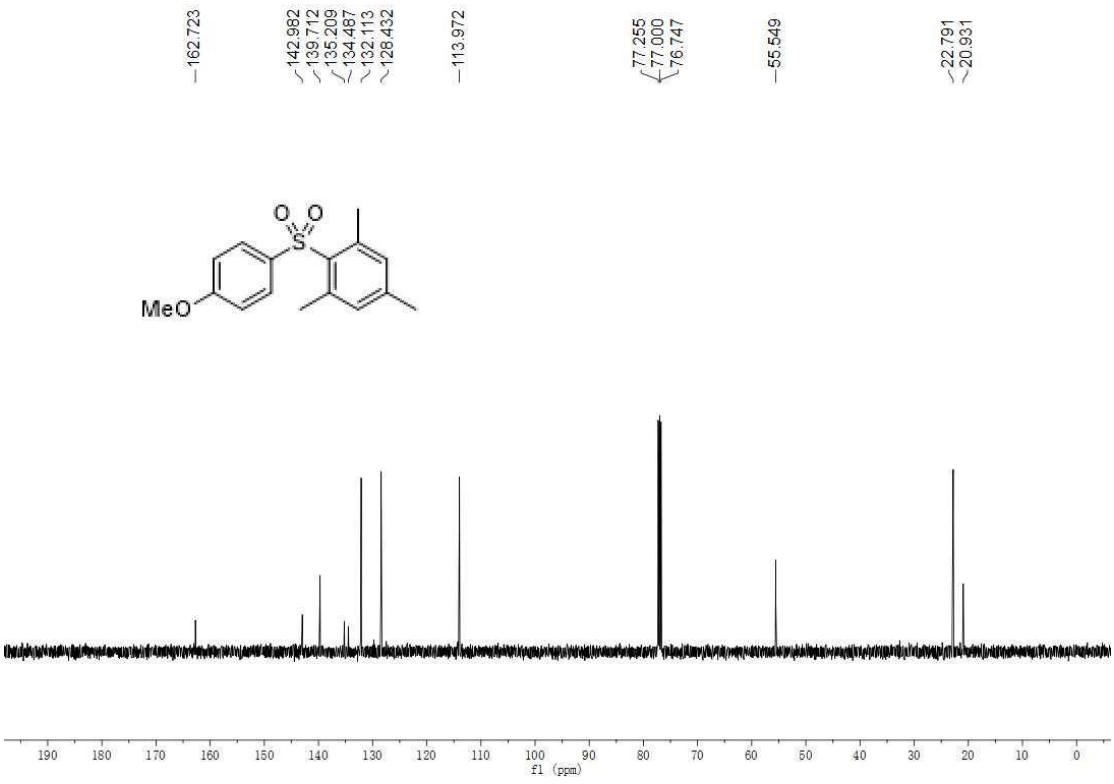


^{13}C NMR (125 MHz, $CDCl_3$)

2-((4-methoxyphenyl)sulfonyl)-1,3,5-trimethylbenzene (4c)



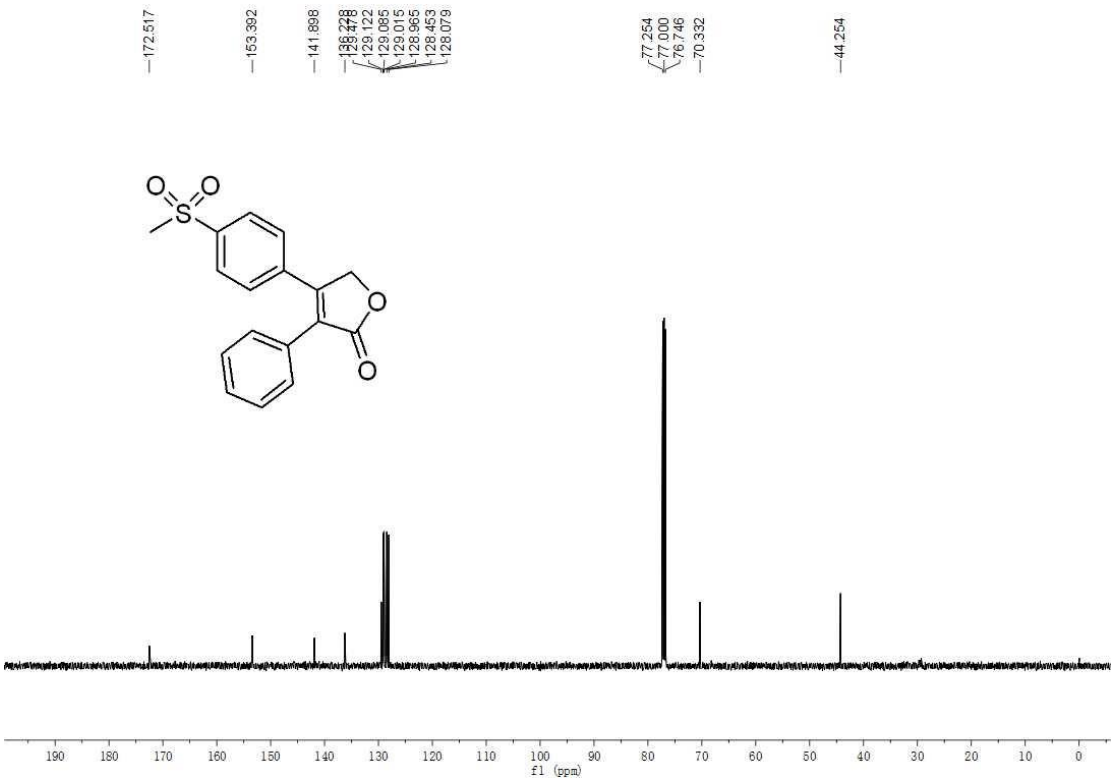
^{1}H NMR (500 MHz, $CDCl_3$)



^{13}C NMR (125 MHz, $CDCl_3$)

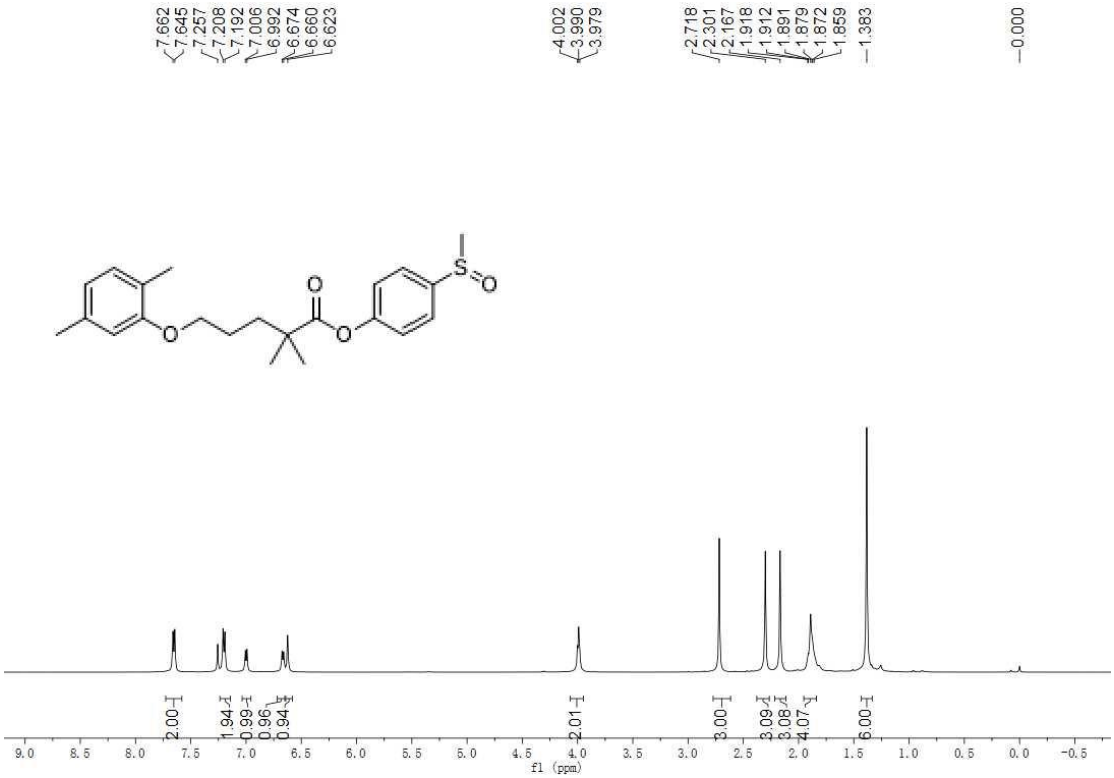
4-(4-(methylsulfonyl)phenyl)-3-phenylfuran-2(5H)-one (4d)

^{1}H NMR (500 MHz, $CDCl_3$)

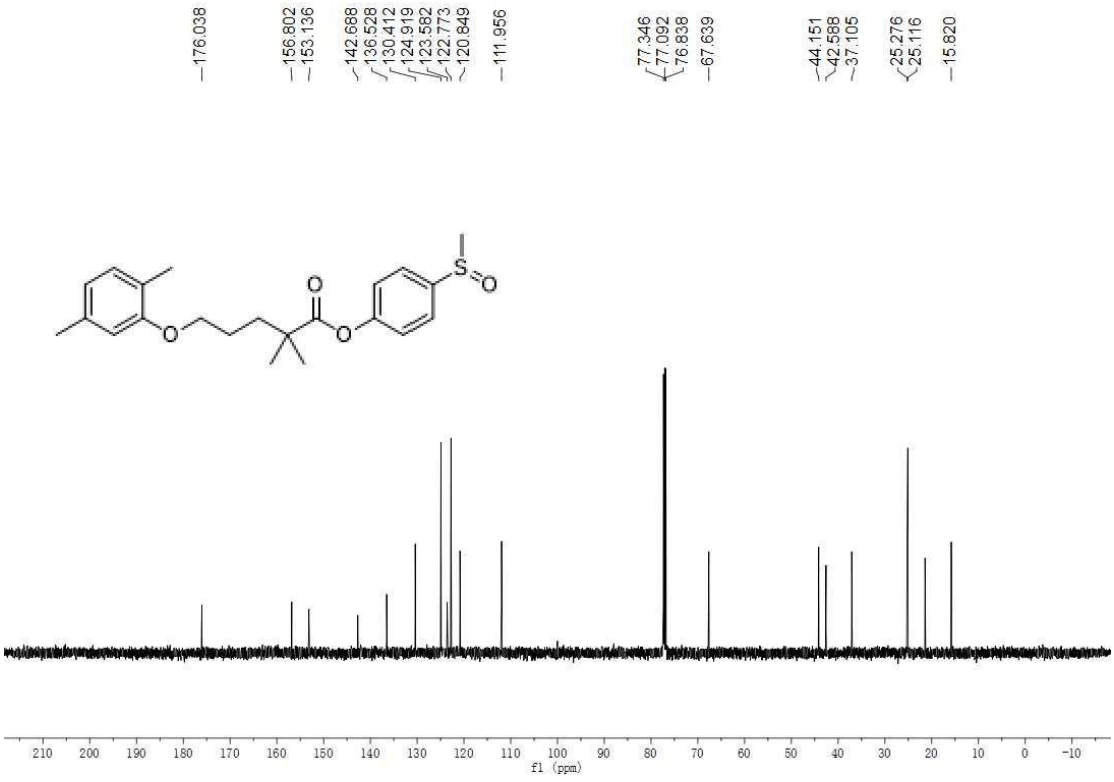


^{13}C NMR (125 MHz, $CDCl_3$)

4-(methylsulfinyl)phenyl5-(2,5-dimethylphenoxy)-2,2-dimethylpentanoate (4e)

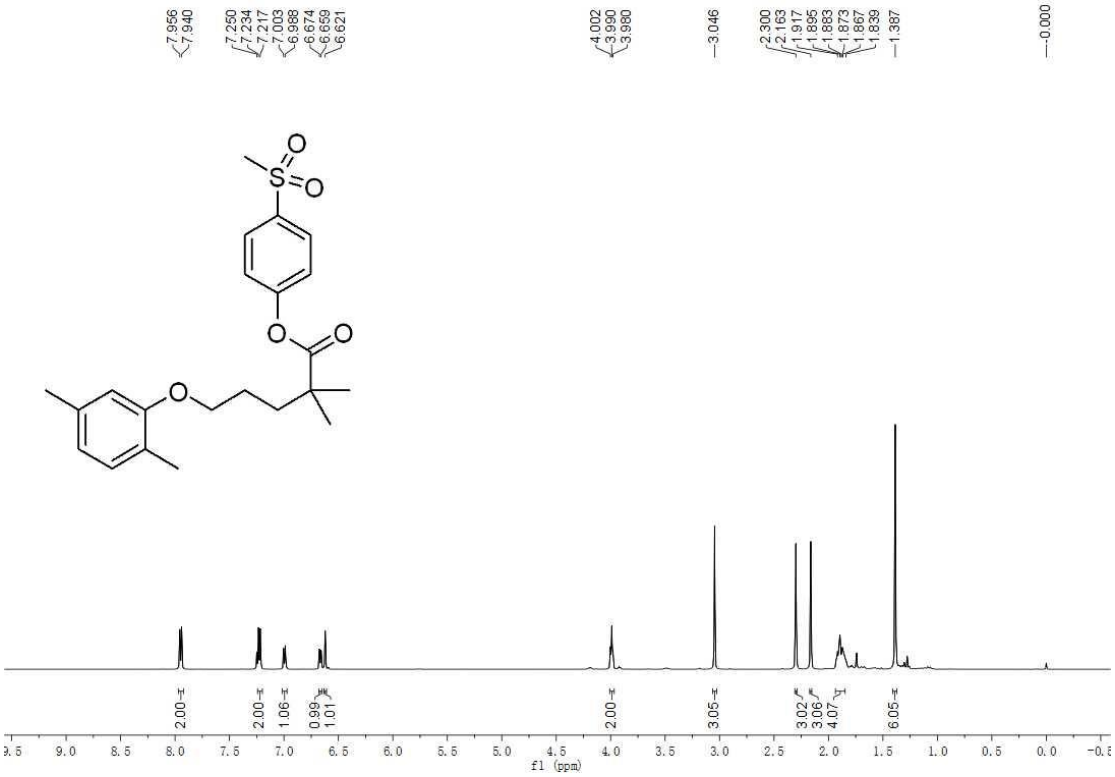


^{1}H NMR (500 MHz, $CDCl_3$)

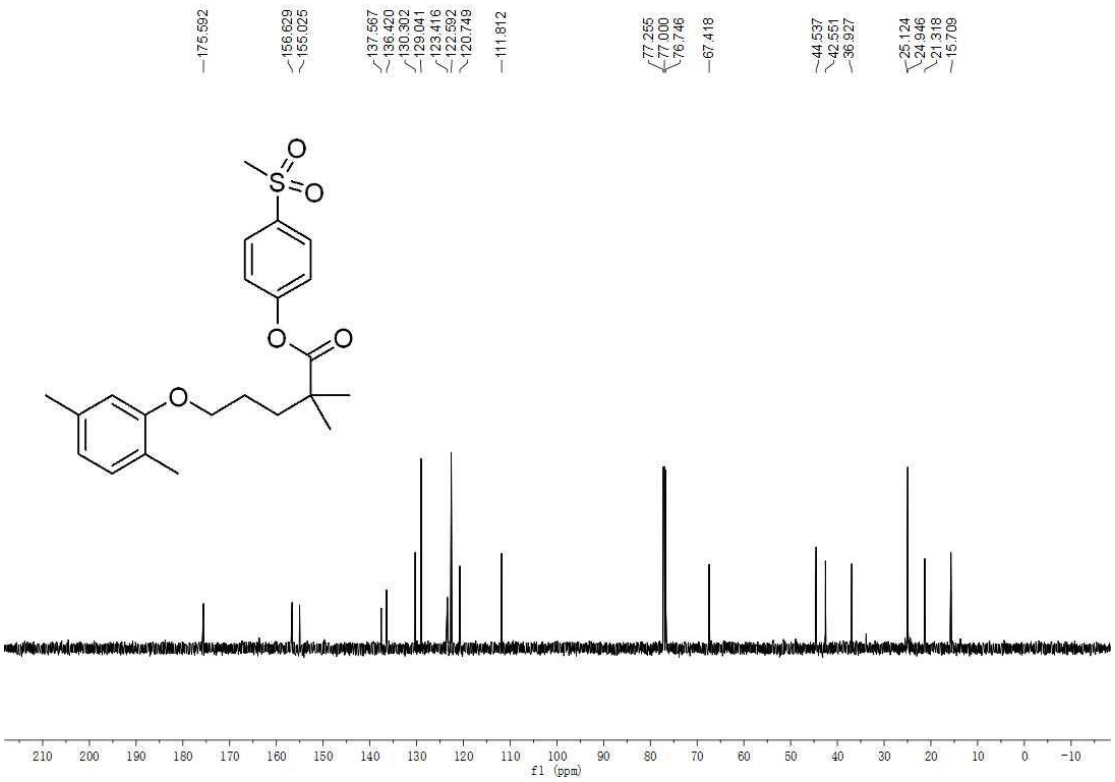


^{13}C NMR (125 MHz, $CDCl_3$)

4-(methylsulfonyl)phenyl5-(2,5-dimethylphenoxy)-2,2-dimethylpentanoate (4f)



^{1}H NMR (500 MHz, $CDCl_3$)



^{13}C NMR (125 MHz, $CDCl_3$)

(E) References

(1) Y. Yang, Z. Chen and Y. Rao, The Synthesis of Diarylsulfones with Simple Arenes and $K_2S_2O_8$ through Double C–S Bond Formation, *Chem. Commun.*, 2014, **50**, 15037-15040.

(2) Z. Cheng, P. Sun, A. Tang, W. Jin and C. Liu, Switchable Synthesis of Aryl Sulfones and Sulfoxides through Solvent-Promoted Oxidation of Sulfides with O2/Air, *Org. Lett.*, 2019, **21**, 8925-8929.

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(6) K.-J. Liu, Z. Wang, L.-H. Lu, J.-Y. Chen, F. Zeng, Y.-W. Lin, Z. Cao, X. Yu and W.-M. He, Synergistic Cooperative Effect of CF_3SO_2Na and Bis(2-butoxyethyl)ether Towards Selective Oxygenation of Sulfides with Molecular Oxygen under Visible-Light Irradiation, *Green Chem.*, 2021, **23**, 496-500.