Metal-free C-H Amination of Arene with *N*-Fluorobenzenesulfonimide Catalysed by Nitroxyl Radical at Room Temperature

Qi Miao,[†] Zhong Shao,[†] Cuiying Shi,[†] Lifang Ma,[†] Fang Wang,[†]
Ruoqi Fu,[†] Haochen Gao,[†] and Ziyuan Li,*[,†]

[†]Department of Pharmaceutical and Biological Engineering, School of Chemical Engineering, Sichuan University, No. 24 South Section 1, Yihuan Road, Chengdu 610065, China
E-mail: liziyuan@scu.edu.cn Fax: (+86) 28-8540-5221

Supporting Information

Table of Contents

General Remarks

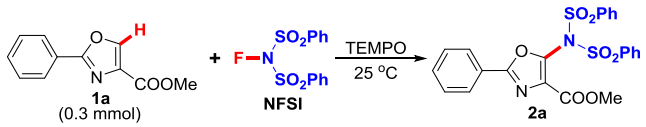
All commercially available compounds were purchased from TCI, Alfa-Aesar, Acros, J&K Chemicals, and Adamas-beta. TEMPO was purchased from TCI (98.0% purity, CAS No. 2564-83-2). *N*-fluorobenzenesulfonimide (NFSI) (97.0% purity, CAS No. 133745-75-2) and Deterated water (D_2O) (99.90% purity, CAS No. 7789-20-0) were purchased from Adamas-beta. Ethyl acetate (EtOAc) (99.8%, SafeDry, water < 50 ppm), 1,4-dioxane (99.7%, SafeDry, water < 50 ppm) and acetonitrile (MeCN) (99.9%, SafeDry, water < 50 ppm) were also purchased from Adamas-beta. 1,2-Dichloroethane (DCE) (99.5%, SuperDry) were purchased from J&K chemicals. Unless otherwise noted, materials obtained from commercial suppliers were used without further purification. Oxazole and thiazole substrates **1** were prepared from corresponding nitriles by our previous reported methods.[1] Furans, thiophenes, flavone and mesitylene were acquired from Adamas-beta and TCI, and were employed directly. Products were purified by flash chromatography on silica gel using petroleum ether and ethyl acetate as the effluents. ^{1}H-NMR spectra were recorded on Bruker AVANCE III-400 spectrometers. Chemical shifts (in ppm) were referenced with TMS in $CDCl_3$ or DMSO (0 ppm). ^{13}C-NMR spectra were obtained by using the same NMR spectrometers and were calibrated with $CDCl_3$ (δ = 77.00 ppm) or DMSO (δ = 40.00 ppm). High resolution mass spectra were obtained from an Agilent 6520B Q-TOF mass spectrometer with electron spray ionization (ESI) as the ion source.

References

[1] For the preparation of various oxazole-4-carboxylic derivative substrates, see (a) Wang, Y.; Li, Z.; Huang, Y.; Tang, C.; Wu, X.; Xu, J.; Yao, H. *Tetrahedron* **2011**, *67*, 7406; (b) Li, Z.; Ma, L.; Xu, J.; Kong, L.; Wu, X.; Yao, H. *Chem. Commun.* **2012**, *48*, 3763; (c) Wang, X.; Lei, B.; Ma, L.; Jiao, H.; Xing, H.; Chen, J.; Li, Z. *Adv. Synth. Catal.* **2017**, *359*, 4284; (d) Lei, B.; Wang, X.; Ma, L.; Jiao, H.; Zhu, L.; Li, Z. *Org. Biomol. Chem.* **2017**, *15*, 6084; (e) Wang, X.; Lei, B.; Ma, L.; Zhu. L.; Zhang, X.; Zuo, H.; Zhuang, D.; Li, Z. *Chem. Asian J.* **2017**, *12*, 2799.

Optimization of the Reaction Conditions

Table S1 Optimization of the reaction conditions[a]



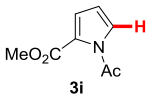
Entry	TEMPO (mol%)	Solvent (2 mL)	Time (h)	Yield (%)[b]
1	40	TCE	12	84
2	20	TCE	12	62
3	20	DCE	12	58
4	20	MeCN	12	trace
5	20	EtOAc	12	52
6	20	TCE	24	81
7	20	MeCN	24	48
8	20	EtOAc	24	88
9	**15**	**EtOAc**	**24**	**90**
10	10	EtOAc	24	59
11	0	EtOAc	24	0
12[c]	15	EtOAc	24	76

[a] The reaction was performed with **1a** (0.3 mmol), NFSI (1.2 mmol) and TEMPO in solvent (2 mL) at 25 °C under argon (1 atm) for 12 h or 24 h. [b] Isolated yields of **3a** after column chromatography on silica gel. [c] Loading of NFSI was decline to 0.9 mmol.

Preperation of Pyrrole and Indole Substrates 3i-r

Typical Procedure: To a solution of *N*-unsubstituted pyrrole or indole (5 mmol) in DCE (25 mL) was added DMAP (1 mmol, 0.2 eq) and TEA (10 mmol, 2 eq) at 0 °C. After stirring for 25 minutes, acetic anhydride (Ac_2O, 20 mmol, 4 eq) was added slowly, and then the reaction mixture was stirred at 60 °C overnight. The mixture was then cooled to room temperature, quenched with saturated NH_4Cl (aq.), extracted with EtOAc, washed with water, and dried over Na_2SO_4. After removel of Na_2SO_4 by filtration, the organic phase was concentrated *in vacuo* to give dark residue, which was purified by flash chromatography on silica gel, using petroleum ether and ethyl acetate as the effluent, to afford the corresponding pyrrole and indole substrates **3i-r**.

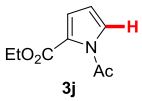
Methyl 1-Acetyl-1*H*-pyrrole-2-carboxylate (3i):



3i

Light yellow oil. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 7.34-7.33 (m, 1H), 6.96-6.95 (m, 1H), 6.23-6.21 (m, 1H), 3.85 (s, 3H), 2.60 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 169.01, 161.39, 126.17, 124.73, 122.57, 110.79, 51.91, 24.60 ppm; **HRMS** *m/z* (ESI) calcd for $[C_8H_9NO_3+Na]^+$ 190.0475, found 190.0475.

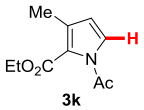
Ethyl 1-Acetyl-1*H*-pyrrole-2-carboxylate (3j):



3j

Light yellow oil. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 7.34-7.33 (m, 1H), 6.96-6.94 (m, 1H), 6.23-6.21 (m, 1H), 4.32 (q, 2H, *J* = 7.1 Hz), 2.60 (s, 3H), 1.35 (t, 3H, *J* = 7.1 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 169.16, 161.13, 126.12, 125.23, 122.44, 115.08, 110.85, 61.02, 24.73, 14.17 ppm; **HRMS** *m/z* (ESI) calcd for $[C_9H_{11}NO_3+Na]^+$ 204.0631, found 204.0635.

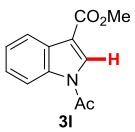
Ethyl 1-Acetyl-3-methyl-1*H*-pyrrole-2-carboxylate (3k):



3k

Colorless oil. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 7.14 (d, 1H, *J* = 3.2 Hz), 6.08 (d, 1H, *J* = 3.2 Hz), 4.33 (q, 2H, *J* = 7.1 Hz), 2.51 (s, 3H), 2.22 (s, 3H), 1.35 (t, 3H, *J* = 7.1 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 168.46, 162.32, 132.51, 124.03, 114.33, 61.10, 24.14, 14.33, 12.50 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{10}H_{13}NO_3+Na]^+$ 218.0788, found 218.0791.

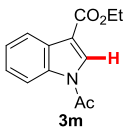
Methyl 1-Acetyl-1*H*-indole-3-carboxylate (3l):



3l

White solid, m.p. 112-113 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.44-8.41 (m, 1H), 8.15-8.11 (m, 2H), 7.41-7.37 (m, 2H), 3.95 (s, 3H), 2.68 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 168.79, 164.40, 135.90, 131.28, 127.28, 125.97, 124.83, 121.54, 116.51, 113.69, 51.68, 23.90 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{12}H_{11}NO_3+Na]^+$ 240.0631, found 240.0632.

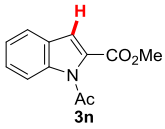
Ethyl 1-Acetyl-1*H*-indole-3-carboxylate (3m):



3m

White solid, m.p. 82-83 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.45-8.43 (m, 1H), 8.16-8.12 (m, 2H), 7.43-7.36 (m, 2H), 4.43 (q, 2H, *J* = 7.1 Hz), 2.70 (s, 3H), 1.45 (t, 3H, *J* = 7.1 Hz) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 168.87, 164.12, 136.02, 131.25, 127.42, 126.00, 124.86, 121.67, 116.57, 114.17, 60.69, 24.00, 14.55 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{13}H_{13}NO_3+Na]^+$ 254.0788, found 254.0793.

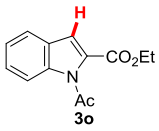
Methyl 1-Acetyl-1*H*-indole-2-carboxylate (3n):



3n

White solid, m.p. 48-49 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.12 (d, 1H, *J* = 8.5 Hz), 7.63 (d, 1H, *J* = 7.9 Hz), 7.47-7.43 (m, 1H), 7.32-7.27 (m, 2H), 3.94 (s, 3H), 2.61 (s, 3H) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 171.06, 162.21, 138.52, 129.44, 128.08, 127.20, 123.90, 122.57, 118.47, 115.30, 52.67, 27.27 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{12}H_{11}NO_3+H]^+$ 218.0812, found 218.0819.

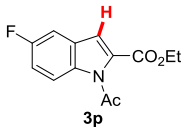
Ethyl 1-Acetyl-1*H*-indole-2-carboxylate (3o):



3o

White solid, m.p. 49-50 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.11 (d, 1H, *J* = 8.5 Hz), 7.58 (d, 1H, *J* = 7.8 Hz), 7.43-7.39 (m, 1H), 7.28-7.23 (m, 2H), 4.38 (q, 2H, *J* = 7.1 Hz), 2.59 (s, 3H), 1.39 (t, 3H, *J* = 7.1 Hz) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 171.10, 161.81, 138.51, 129.86, 127.99, 127.22, 123.86, 122.50, 118.28, 115.32, 61.79, 27.31, 14.34 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{13}H_{13}NO_3+H]^+$ 254.0788, found 254.0793.

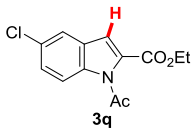
Ethyl 1-Acetyl-5-fluoro-1H-indole-2-carboxylate (3p):



3p

White solid, m.p. 50-51 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.13 (dd, 1H, *J* = 9.2 Hz, 4.5 Hz), 7.27-7.25 (m, 2H), 7.17 (td, 1H, *J* = 9.2 Hz, 2.6 Hz), 4.41 (q, 2H, *J* = 7.1 Hz), 2.61 (s, 3H), 1.42 (t, 3H, *J* = 7.1 Hz) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 170.89, 161.53, 160.80, 158.40, 134.97, 131.21, 127.94, 127.83, 117.58, 117.54, 116.85, 116.77, 116.28, 116.03, 107.52, 107.29, 62.00, 27.21, 14.32 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{13}H_{12}FNO_3+H]^+$ 272.0693, found 272.0696.

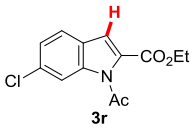
Ethyl 1-Acetyl-5-chloro-1H-indole-2-carboxylate (3q):



3q

White solid, m.p. 68-69 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.08 (d, 1H, *J* = 9.0 Hz), 7.58 (d, 1H, *J* = 2.0 Hz), 7.38 (dd, 1H, *J* = 9.0 Hz, 2.0 Hz), 7.23 (s, 1H), 4.41 (q, 2H, *J* = 7.1 Hz), 2.60 (s, 3H), 1.42 (t, 3H, *J* = 7.1 Hz) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 170.93, 161.50, 136.84, 130.97, 129.47, 128.27, 128.21, 121.79, 117.07, 116.66, 62.08, 27.27, 14.35 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{13}H_{12}ClNO_3+H]^+$ 288.0398, found 288.0399.

Ethyl 1-Acetyl-6-chloro-1H-indole-2-carboxylate (3r):



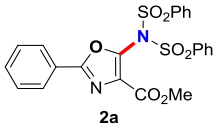
3r

Light yellow solid, m.p. 38-39 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.19-8.18 (m, 1H), 7.52 (d, 1H, *J* = 8.4 Hz), 7.28 (s, 1H), 7.25 (dd, 1H, *J* = 8.4 Hz, 1.8 Hz), 4.40 (q, 2H, *J* = 7.1 Hz), 2.60 (s, 3H), 1.41 (t, 3H, *J* = 7.1 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 171.01, 161.45, 138.81, 134.10, 130.30, 125.57, 124.72, 123.20, 117.91, 115.65, 61.96, 27.27, 14.34 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{13}H_{12}ClNO_3+H]^+$ 288.0398, found 288.0398.

Experimental Procedure and Characterization Data

Typical Procedure: To a reaction tube charged with NFSI (378 mg, 1.2 mmol) was added a solution of arene substrate **1** or **3** (0.3 mmol) in solvent (1 mL) under argon (1 atm). The reaction mixture was stirred at 25 °C, and then a solution of TEMPO (7.0 mg, 0.045 mmol, 15 mol%) in solvent (1 mL) was added. After stirring at 25 °C for 24 hours, the mixture was concentrated *in vacuo* to give dark residue, which was purified by flash chromatography on silica gel, using petroleum ether and ethyl acetate as the effluent, to afford the corresponding aminated arene products **2** or **4**.

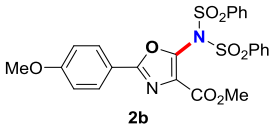
Methyl 2-Phenyl-5-(*N*, *N*-diphenylsulfonylamino)oxazole-4-carboxylate (2a):



2a

The reaction of 0.3 mmol of methyl 2-phenyloxazole-4-carboxylate (**1a**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 90% of **2a** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 191-193 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.09-8.06 (m, 6H), 7.75 (t, 2H, *J* = 7.5 Hz), 7.61 (t, 4H, *J* = 7.5 Hz), 7.56-7.49 (m, 3H), 3.46 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 161.25, 159.74, 140.86, 138.90, 134.66, 132.11, 132.02, 129.16, 129.05, 128.98, 127.12, 125.84, 52.04 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{23}H_{18}N_2O_7S_2+Na]^+$ 521.0448, found 521.0454.

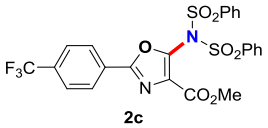
Methyl 2-(4-Methoxylphenyl)-5-(*N*, *N*-diphenylsulfonylamino)oxazole-4-carboxylate (2b):



2b

The reaction of 0.3 mmol of methyl 2-(4-methoxylphenyl)oxazole-4-carboxylate (**1b**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 95% of **2b** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 182-184 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.05-7.97 (m, 6H), 7.72 (t, 2H, *J* = 7.5 Hz), 7.61-7.57 (m, 4H), 6.98 (d, 2H, *J* = 8.9 Hz), 3.86 (s, 3H), 3.42 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 162.53, 161.25, 159.72, 140.11, 138.76, 134.49, 131.88, 128.99, 128.87, 128.79, 118.26, 114.27, 55.36, 51.85 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{24}H_{20}N_2O_8S_2+Na]^+$ 551.0553, found 551.0551.

Methyl 2-(4-Trifluoromethylphenyl)-5-(*N*, *N*-diphenylsulfonylamino)oxazole-4-carboxylate (2c):

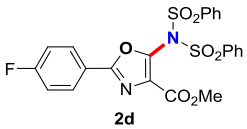


2c

The reaction of 0.3 mmol of methyl 2-(4-trifluoromethylphenyl)oxazole- 4-carboxylate (**1c**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 51% of **2c** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 192-193 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.18 (d, 2H, *J* = 8.1 Hz), 8.06-8.03 (m, 4H), 7.77-7.73 (m, 4H), 7.63-7.59 (m, 4H), 3.44 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 159.67, 159.42, 141.53, 138.71, 134.72, 133.46 (q, *J* = 32.7 Hz),

132.23, 129.14, 129.00, 128.91, 127.37, 125.98 (q, *J* = 3.7 Hz), 123.52 (q, *J* = 270.8 Hz), 52.09 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{24}H_{17}F_3N_2O_7S_2+Na]^+$ 589.0321, found 589.0325.

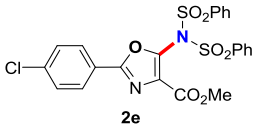
Methyl 2-(4-Fluorophenyl)-5-(*N*, *N*-diphenylsulfonylamino)oxazole-4-carboxylate (2d):



2d

The reaction of 0.3 mmol of methyl 2-(4-fluorophenyl)oxazole-4-carboxylate (**1d**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 79% of **2d** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 194-196 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.06-8.03 (m, 6H), 7.75-7.71 (m, 2H), 7.62-7.58 (m, 4H), 7.18 (t, 2H, *J* = 8.7 Hz), 3.42 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 164.93 (d, *J* = 252.3 Hz), 160.29, 159.55, 140.80, 138.72, 134.60, 131.99, 129.34 (d, *J* = 9.0 Hz), 129.06, 128.92, 122.08 (d, *J* = 3.1 Hz), 116.22 (d, *J* = 22.1 Hz), 51.96 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{23}H_{17}FN_2O_7S_2+Na]^+$ 539.0353, found 539.0356.

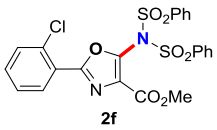
Methyl 2-(4-Chlorophenyl)-5-(*N*, *N*-diphenylsulfonylamino)oxazole-4-carboxylate (2e):



2e

The reaction of 0.3 mmol of methyl 2-(4-chlorophenyl)oxazole-4-carboxylate (**1e**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 63% of **2e** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 216-217 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.05-8.02 (m, 4H), 7.99 (d, 2H, *J* = 8.6 Hz), 7.73 (t, 2H, *J* = 7.5 Hz), 7.62-7.58 (m, 4H), 7.47 (d, 2H, *J* = 8.6 Hz), 3.43 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 160.24, 159.52, 140.97, 138.73, 138.30, 134.63, 132.08, 129.30, 129.09, 128.96, 128.29, 124.22, 52.01 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{23}H_{17}ClN_2O_7S_2+Na]^+$ 555.0058, found 555.0061.

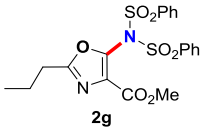
Methyl 2-(2-Chlorophenyl)-5-(*N*, *N*-diphenylsulfonylamino)oxazole-4-carboxylate (2f):



2f

The reaction of 0.3 mmol of methyl 2-(2-chlorophenyl)oxazole-4-carboxylate (**1f**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 67% of **2f** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. Light yellow solid, m.p. 137-138 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.11 (dd, 1H, *J* = 7.8 Hz, 1.5 Hz), 8.07-8.05 (m, 4H), 7.72 (t, 2H, *J* = 7.5 Hz), 7.61-7.57 (m, 4H), 7.52-7.37 (m, 3H), 3.44 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 159.52, 159.44, 141.20, 138.81, 134.58, 133.00, 132.51, 131.75, 131.22, 129.10, 129.01, 128.93, 126.96, 124.82, 52.02 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{23}H_{17}ClN_2O_7S_2+Na]^+$ 555.0058, found 555.0060.

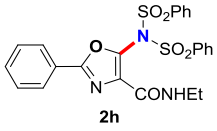
Methyl 2-^{n}Propyl-5-(*N*, *N*-diphenylsulfonylamino)oxazole-4-carboxylate (2g):



2g

The reaction of 0.3 mmol of methyl 2-*n*propyloxazole-4-carboxylate (**1g**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 66% of **2g** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 131-132 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.01-7.99 (m, 4H), 7.72-7.70 (t, 2H, *J* = 7.5 Hz), 7.61-7.57 (m, 4H), 3.40 (s, 3H), 2.80 (t, 2H, *J* = 7.6 Hz), 1.81 (h, 2H, *J* = 7.6 Hz), 1.00 (t, 3H, *J* = 7.6 Hz) ppm; **^{13}C NMR ($CDCl_3$, 150 MHz)**: δ = 165.24, 159.64, 140.70, 138.81, 134.52, 130.69, 129.05, 128.90, 51.86, 30.32, 20.12, 13.45 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{20}H_{20}N_2O_7S_2+Na]^+$ 487.0604, found 487.0612.

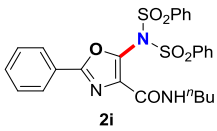
_N_-Ethyl 2-Phenyl-5-(*N'*, *N'*-diphenylsulfonylamino)oxazole-4-formamide (2h):



2h

The reaction of 0.3 mmol of *N*-ethyl 2-phenyloxazole-4-formamide (**1h**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 77% of **2h** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 167-168 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.07-8.05 (m, 4H), 7.96-7.94 (m, 2H), 7.69 (t, 2H, *J* = 7.5 Hz), 7.58-7.44 (m, 7H), 6.96 (t, 1H, *J* = 5.5 Hz), 3.26 (p, 2H, *J* = 7.2 Hz), 1.12 (t, 3H, *J* = 7.2 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 160.06, 157.95, 138.55, 137.82, 134.44, 134.26, 131.72, 129.06, 128.91, 128.88, 126.76, 125.92, 33.88, 14.66 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{24}H_{21}N_3O_6S_2+Na]^+$ 534.0764, found 534.0766.

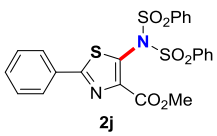
_N_-*n*Butyl 2-Phenyl-5-(*N'*, *N'*-diphenylsulfonylamino)oxazole-4-formamide (2i):



2i

The reaction of 0.3 mmol of *N*-*n*butyl 2-phenyloxazole-4-formamide (**1i**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 81% of **2i** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 160-161 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.07-8.05 (m, 4H), 7.96-7.94 (m, 2H), 7.69 (t, 2H, *J* = 7.5 Hz), 7.57-7.44 (m, 7H), 6.97 (t, 1H, *J* = 5.7 Hz), 3.22 (q, 2H, *J* = 7.0 Hz), 1.50-1.43 (m, 2H), 1.36-1.31 (m, 2H), 0.93 (t, 3H, *J* = 7.2 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 160.01, 157.99, 138.53, 137.75, 134.39, 134.27, 131.67, 129.02, 128.87, 128.84, 126.73, 125.89, 38.70. 31.40. 19.94. 13.66 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{24}H_{21}N_3O_6S_2+H]^+$ 540.1258, found 540.1258.

Methyl 2-Phenyl-5-(*N*, *N*-diphenylsulfonylamino)thiazole-4-carboxylate (2j):

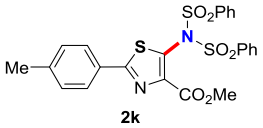


2j

The reaction of 0.3 mmol of methyl 2-phenylthiazole-4-carboxylate (**1j**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 65% of **2j** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 169-171 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.06-8.00 (m, 6H), 7.74 (t, 2H, *J* = 7.5 Hz), 7.63-7.59 (m, 4H), 7.53-7.47 (m, 3H), 3.44 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 168.21, 159.61, 145.71, 138.49, 134.19, 132.11, 131.29, 128.85, 128.80, 128.76, 126.61, 51.66

ppm; **HRMS** *m/z* (ESI) calcd for $[C_{23}H_{18}N_2O_6S_3+Na]^+$ 537.0219, found 537.0228.

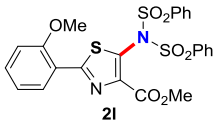
Methyl 2-(4-Methylphenyl)-5-(*N*, *N*-diphenylsulfonylamino)thiazole-4-carboxylate (2k):



2k

The reaction of 0.3 mmol of methyl 2-(4-methylphenyl)thiazole-4-carboxylate (**1k**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 81% of **2k** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 138-139 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.03-8.01 (m, 4H), 7.86 (d, 2H, *J* = 8.0 Hz), 7.70 (t, 2H, *J* = 7.5 Hz), 7.59-7.55 (m, 4H), 7.26 (d, 2H, *J* = 8.0 Hz), 3.39 (s, 3H), 2.40 (s, 3H) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 168.63, 159.87, 145.81, 142.07, 138.75, 134.35, 133.94, 129.72, 129.68, 129.02, 128.96, 126.74, 51.83, 21.46 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{24}H_{20}N_2O_6S_3+Na]^+$ 551.0376, found 551.0375.

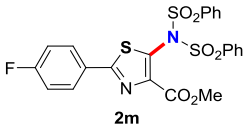
Methyl 2-(2-Methoxylphenyl)-5-(*N*, *N*-diphenylsulfonylamino)thiazole-4-carboxylate (2l):



2l

The reaction of 0.3 mmol of methyl 2-(2-methoxylphenyl)thiazole-4-carboxylate (**1l**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 91% of **2l** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 179-180 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.51 (dd, 1H, *J* = 7.9 Hz, 1.5 Hz), 8.02-8.00 (m, 4H), 7.69 (t, 2H, *J* = 7.5 Hz), 7.58-7.54 (m, 4H), 7.46-7.42 (m, 1H), 7.12-7.08 (m, 1H), 7.02 (d, 1H, *J* = 8.3 Hz), 3.99 (s, 3H), 3.38 (s, 3H) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 162.07, 160.28, 156.63, 143.84, 138.88, 134.48, 134.17, 132.17, 128.95, 128.90, 128.34, 121.06, 121.02, 111.05, 55.55, 51.65 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{24}H_{20}N_2O_7S_3+H]^+$ 545.0505, found 545.0504.

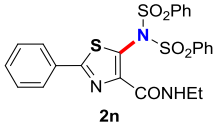
Methyl 2-(4-Fluorophenyl)-5-(*N*, *N*-diphenylsulfonylamino)thiazole-4-carboxylate (2m):



2m

The reaction of 0.3 mmol of methyl 2-(4-fluorophenyl)thiazole-4-carboxylate (**1m**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 62% of **2m** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 152-154 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.03-7.96 (m, 6H), 7.73-7.69 (m, 2H), 7.61-7.56 (m, 4H), 7.18-7.13 (m, 2H), 3.39 (s, 3H) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 167.13, 164.68 (d, *J* = 251.5 Hz), 159.77, 145.97, 138.70, 134.50, 134.43, 129.08, 128.98, 128.92, 128.72 (d, *J* = 3.1 Hz), 116.24 (d, *J* = 22.0 Hz), 51.90 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{23}H_{17}FN_2O_6S_3+Na]^+$ 555.0125, found 555.0127.

***N*-Ethyl 2-Phenyl-5-(*N'*, *N'*-diphenylsulfonylamino)thiazole-4-formamide (2n):**

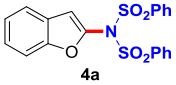


2n

The reaction of 0.3 mmol of *N*-ethyl 2-phenylthiazole-4-formamide (**1n**) with 1.2 mmol of NFSI in 2

mL of EtOAc afforded 61% of **2n** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. Light yellow solid, m.p. 207-208 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.05-8.03 (m, 4H), 7.92-7.90 (m, 2H), 7.67 (t, 2H, *J* = 7.5 Hz), 7.56-7.52 (m, 4H), 7.48-7.46 (m, 3H), 7.19 (t, 1H, *J* = 5.4 Hz), 3.17 (p, 2H, *J* = 7.2 Hz), 1.07 (t, 3H, *J* = 7.2 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 167.46, 158.36, 148.07, 138.60, 134.20, 132.41, 131.37, 131.02, 129.13, 129.06, 128.86, 126.57, 33.88, 14.71 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{24}H_{21}N_3O_5S_3+Na]^+$ 550.0536, found 550.0546.

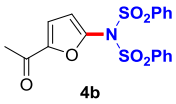
***N*-(Benzofuran-2-yl)-*N*-(phenylsulfonyl)benzenesulfonamide (4a):**



4a

The reaction of 0.3 mmol of 2,3-benzofuran (**3a**) with 0.6 mmol of NFSI in 2 mL of DCE afforded 91% of **4a** after flash chromatography on silica gel using petroleum ether and ethyl acetate (10:1, *v*/*v*) as the effluent. Colorless solid, m.p. 144-145 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.06-8.03 (m, 4H), 7.72-7.68 (m, 2H), 7.60-7.56 (m, 5H), 7.46 (dd, 1H, *J* = 8.3 Hz, 0.6 Hz), 7.37 (td, 1H, *J* = 8.3 Hz, 1.2 Hz), 7.29-7.24 (m, 1H), 6.59 (d, 1H, *J* = 0.8 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 153.67, 141.65, 138.90, 134.39, 129.13, 128.68, 127.18, 126.27, 123.43, 121.89, 111.77, 109.02 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{20}H_{15}NO_5S_2+Na]^+$ 436.0284, found 436.0290.

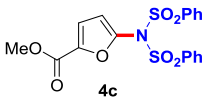
***N*-(5-Acetylfuran-2-yl)-*N*-(phenylsulfonyl)benzenesulfonamide (4b):**



4b

The reaction of 0.3 mmol of 1-(furan-2-yl)ethan-1-one (**3b**) with 1.2 mmol of NFSI in 2 mL of MeCN afforded 90% of **4b** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. Colorless solid, m.p. 156-157 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.00-7.98 (m, 4H), 7.71 (t, 2H, *J* = 7.5 Hz), 7.60-7.56 (m, 4H), 7.15 (d, 1H, *J* = 3.6 Hz), 6.37 (d, 1H, *J* = 3.6 Hz), 2.37 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 186.47, 151.75, 141.73, 138.58, 134.58, 129.17, 128.59, 117.05, 114.10, 25.88 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{18}H_{15}NO_6S_2+Na]^+$ 428.0233, found 428.0239.

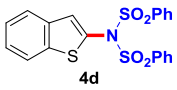
Methyl 5-(*N*-(phenylsulfonyl)phenylsulfonamido)furan-2-carboxylate (4c):



4c

The reaction of 0.3 mmol of methyl furan-2-carboxylate (**3c**) with 0.6 mmol of NFSI in 2 mL of MeCN afforded 76% of **4c** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. Colorless solid, m.p. 176-177 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.01-7.99 (m, 4H), 7.72-7.68 (m, 2H), 7.60-7.56 (m, 4H), 7.17 (d, 1H, *J* = 3.5 Hz), 6.31 (d, 1H, *J* = 3.5 Hz), 3.88 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 158.18, 144.11, 142.00, 138.60, 134.52, 129.17, 128.68, 118.75, 113.66, 52.14 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{18}H_{15}NO_7S_2+Na]^+$ 444.0182, found 444.0187.

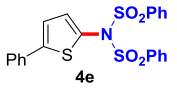
***N*-(Benzo[b]thiophen-2-yl)-*N*-(phenylsulfonyl)benzenesulfonamide (4d):**



4d

The reaction of 0.3 mmol of benzo[b]thiophene (**3d**) with 0.6 mmol of NFSI in 2 mL of EtOAc afforded 62% of **4d** after flash chromatography on silica gel using petroleum ether and ethyl acetate (10:1, *v*/*v*) as the effluent. Colorless solid, m.p. 111-112 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.04-8.02 (m, 4H), 7.75-7.68 (m, 4H), 7.59-7.55 (m, 4H), 7.41-7.34 (m, 2H), 7.02 (s, 1H) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 140.27, 138.72, 136.72, 134.32, 134.17, 129.10, 128.79, 128.73, 126.09, 124.76, 124.75, 122.38 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{20}H_{15}NO_4S_3+Na]^+$ 452.0055, found 452.0063.

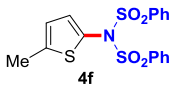
***N*-(Phenylsulfonyl)-*N*-(5-phenylthiophen-2-yl)benzenesulfonamide (4e):**



4e

The reaction of 0.3 mmol of 2-phenylthiophene (**3e**) with 0.6 mmol of NFSI in 2 mL of 1,4-dioxane afforded 87% of **4e** after flash chromatography on silica gel using petroleum ether and ethyl acetate (10:1, *v*/*v*) as the effluent. Colorless solid, m.p. 108-109 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.04-8.02 (m, 4H), 7.69 (t, 2H, *J* = 7.5 Hz), 7.59-7.53 (m, 6H), 7.39-7.30 (m, 3H), 7.12 (d, 1H, *J* = 3.9 Hz), 6.70 (d, 1H, *J* = 3.9 Hz) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 147.64, 138.76, 134.23, 133.49, 132.59, 132.45, 129.07, 128.98, 128.75, 128.46, 125.93, 121.36 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{22}H_{17}NO_4S_3+Na]^+$ 478.0212, found 478.0220.

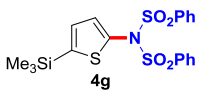
***N*-(5-Methylthiophen-2-yl)-*N*-(phenylsulfonyl)benzenesulfonamide (4f):**



4f

The reaction of 0.3 mmol of 2-methylthiophene (**3f**) with 0.6 mmol of NFSI in 2 mL of EtOAc afforded 82% of **4f** after flash chromatography on silica gel using petroleum ether and ethyl acetate (10:1, *v*/*v*) as the effluent. Colorless solid, m.p. 111-112 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.00-7.98 (m, 4H), 7.69-7.65 (m, 2H), 7.56-7.53 (m, 4H), 6.58 (dd, 1H, *J* = 3.7 Hz, 1.0 Hz), 6.51 (d, 1H, *J* = 3.7 Hz), 2.45 (d, 3H, *J* = 0.7 Hz) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 143.78, 138.79, 134.10, 131.67, 130.66, 128.96, 128.65, 123.90, 15.99 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{17}H_{15}NO_4S_3+Na]^+$ 416.0055, found 416.0057.

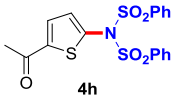
***N*-(Phenylsulfonyl)-*N*-(5-(trimethylsilyl)thiophen-2-yl)benzenesulfonamide (4g):**



4g

The reaction of 0.3 mmol of trimethyl(thiophen-2-yl)silane (**3g**) with 1.2 mmol of NFSI in 2 mL of 1,4-dioxane afforded 72% of **4g** after flash chromatography on silica gel using petroleum ether and ethyl acetate (10:1, *v*/*v*) as the effluent. Colorless solid, m.p. 103-104 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 7.99-7.97 (m, 4H), 7.68 (t, 2H, *J* = 7.5 Hz), 7.57-7.53 (m, 4H), 7.04 (d, 1H, *J* = 3.6 Hz), 6.75 (d, 1H, *J* = 3.6 Hz), 0.30 (s, 9H) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 145.63, 138.79, 138.16, 134.12, 132.10, 128.97, 128.72, -0.33 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{19}H_{21}NO_4S_3Si+Na]^+$ 474.0294, found 474.0302.

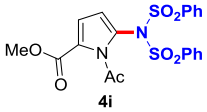
***N*-(Phenylsulfonyl)-*N*-(5-(trimethylsilyl)thiophen-2-yl)benzenesulfonamide (4h):**



4h

The reaction of 0.3 mmol of 1-(thiophen-2-yl)ethan-1-one (**3h**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 57% of **4h** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. Colorless solid, m.p. 155-156 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 7.99-7.97 (m, 4H), 7.71 (t, 2H, *J* = 7.5 Hz), 7.60-7.56 (m, 4H), 7.51 (d, 1H, *J* = 4.0 Hz), 6.77 (d, 1H, *J* = 4.0 Hz), 2.53 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 190.27, 146.14, 141.02, 138.34, 134.53, 132.38, 130.26, 129.22, 128.71, 26.39 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{18}H_{15}NO_5S_3+Na]^+$ 444.0005, found 444.0013.

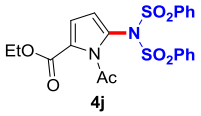
Methyl 1-Acetyl-5-(*N*-(phenylsulfonyl)phenylsulfonamido)-1*H*-pyrrole-2-carboxylate (4i):



4i

The reaction of 0.3 mmol of methyl 1-acetyl-1*H*-pyrrole-2-carboxylate (**3i**) with 0.6 mmol of NFSI in 2 mL of EtOAc afforded 78% of **4i** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. White solid, m.p. 109-110 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.01-7.99 (m, 4H), 7.70 (t, 2H, *J* = 7.5 Hz), 7.58-7.54 (m, 4H), 6.88 (d, 1H, *J* = 3.9 Hz), 5.88 (d, 1H, *J* = 3.9 Hz), 3.86 (s, 3H), 2.48 (s, 3H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 170.62, 160.35, 137.71, 134.47, 129.56, 128.71, 125.17, 124.78, 117.75, 114.28, 52.17, 28.14 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{20}H_{18}N_2O_7S_2+Na]^+$ 485.0448, found 485.0445.

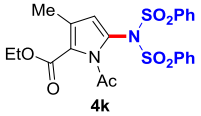
Ethyl 1-Acetyl-5-(*N*-(phenylsulfonyl)phenylsulfonamido)-1*H*-pyrrole-2-carboxylate (4j):



4j

The reaction of 0.3 mmol of ethyl 1-acetyl-1*H*-pyrrole-2-carboxylate (**3j**) with 0.6 mmol of NFSI in 2 mL of EtOAc afforded 82% of **4j** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1, *v*/*v*) as the effluent. Colorless solid, m.p. 96-97 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.01-7.99 (m, 4H), 7.70 (t, 2H, *J* = 7.5 Hz), 7.57-7.53 (m, 4H), 6.88 (d, 1H, *J* = 3.9 Hz), 5.86 (d, 1H, *J* = 3.9 Hz), 4.32 (q, 2H, *J* = 7.1 Hz), 2.48 (s, 3H), 1.35 (t, 3H, *J* = 7.1 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 170.69, 159.95, 137.72, 135.80, 134.46, 129.59, 128.70, 125.18, 124.98, 117.55, 114.24, 61.32, 28.22, 14.17 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{21}H_{20}N_2O_7S_2+Na]^+$ 499.0604, found 499.0609.

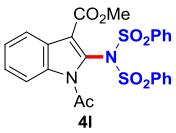
Ethyl 1-Acetyl-3-methyl-5-(*N*-(phenylsulfonyl)phenylsulfonamido)-1*H*-pyrrole-2-carboxylate (4k):



4k

The reaction of 0.3 mmol of ethyl 1-acetyl-3-methyl-1*H*-pyrrole-2-carboxylate (**3k**) with 0.6 mmol of NFSI in 2 mL of EtOAc afforded 90% of **4k** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1, *v*/*v*) as the effluent. Colorless solid, m.p. 131-132 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.01-7.99 (m, 4H), 7.69 (t, 2H, *J* = 7.5 Hz), 7.57-7.53 (m, 4H), 5.73 (s, 1H), 4.32 (q, 2H, *J* = 7.2 Hz), 2.39 (s, 3H), 2.26 (s, 3H), 1.35 (t, 3H, *J* = 7.2 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 170.47, 160.73, 137.81, 134.41, 129.72, 129.52, 128.66, 123.57, 122.29, 116.71, 61.09, 28.07, 14.16, 13.00 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{22}H_{22}N_2O_7S_2+Na]^+$ 513.0761, found 513.0757.

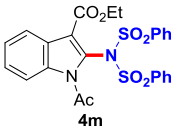
Methyl 1-Acetyl-2-(*N*-(phenylsulfonyl)phenylsulfonamido)-1*H*-indole-3-carboxylate (4l):



4l

The reaction of 0.3 mmol of methyl 1-acetyl-1*H*-indole-3-carboxylate (**3l**) with 0.6 mmol of NFSI in 2 mL of EtOAc afforded 87% of **4l** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. Light yellow oil. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.31 (d, 1H, *J* = 7.9 Hz), 8.06-8.04 (m, 4H), 7.77 (d, 1H, *J* = 8.4 Hz), 7.68 (t, 2H, *J* = 7.5 Hz), 7.56-7.52 (m, 4H), 7.46-7.36 (m, 2H), 3.19 (s, 3H), 2.46 (s, 3H) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 169.46, 162.33, 138.92, 134.25, 134.04, 129.92, 128.76, 128.60, 126.69, 125.47, 124.17, 122.82, 114.28, 113.27, 50.64, 26.66 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{24}H_{20}N_2O_7S_2+Na]^+$ 535.0604, found 535.0604.

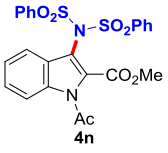
Ethyl 1-Acetyl-2-(*N*-(phenylsulfonyl)phenylsulfonamido)-1*H*-indole-3-carboxylate (4m):



4m

The reaction of 0.3 mmol of ethyl 1-acetyl-1*H*-indole-3-carboxylate (**3m**) with 0.6 mmol of NFSI in 2 mL of EtOAc afforded 95% of **4m** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. Colorless oil. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.30 (d, 1H, *J* = 7.9 Hz), 8.06-8.04 (m, 4H), 7.76 (d, 1H, *J* = 8.4 Hz), 7.68 (t, 2H, *J* = 7.5 Hz), 7.56-7.53 (m, 4H), 7.46-7.36 (m, 2H), 3.73 (q, 2H, *J* = 7.1 Hz), 2.46 (s, 3H), 1.09 (t, 3H, *J* = 7.1 Hz) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 169.46, 162.02, 139.03, 134.21, 134.03, 129.90, 128.75, 128.60, 126.63, 125.53, 124.10, 123.00, 114.26, 113.72, 60.48, 26.71, 13.88 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{25}H_{22}N_2O_7S_2+Na]^+$ 549.0761, found 549.0756.

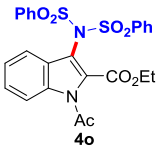
Methyl 1-Acetyl-3-(*N*-(phenylsulfonyl)phenylsulfonamido)-1*H*-indole-2-carboxylate (4n):



4n

The reaction of 0.3 mmol of methyl 1-acetyl-1*H*-indole-2-carboxylate (**3n**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 71% of **4n** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. Light yellow solid, m.p. 158-159 °C. **^{1}H NMR (CDCl$_3$, 400 MHz)**: δ = 8.05-7.98 (m, 5H), 7.66 (t, 2H, *J* = 7.5 Hz), 7.53-7.49 (m, 4H), 7.40 (t, 1H, *J* = 7.5 Hz), 7.10 (t, 1H, *J* = 7.5 Hz), 6.99 (d, 1H, *J* = 8.0 Hz), 3.44 (s, 3H), 2.59 (s, 3H) ppm; **^{13}C NMR (CDCl$_3$, 100 MHz)**: δ = 170.04, 160.08, 139.21, 135.41, 134.12, 129.16, 129.11, 128.76, 128.16, 125.89, 124.09, 120.75, 120.57, 114.76, 52.39, 27.01 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{24}H_{20}N_2O_7S_2+Na]^+$ 535.0604, found 535.0604.

Ethyl 1-Acetyl-3-(*N*-(phenylsulfonyl)phenylsulfonamido)-1*H*-indole-2-carboxylate (4o):

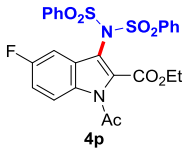


4o

The reaction of 0.3 mmol of ethyl 1-acetyl-1*H*-indole-2-carboxylate (**3o**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 83% of **4o** after flash chromatography on silica gel using petroleum ether and ethyl acetate

(6:1 to 3:1, *v*/*v*) as the effluent. Light yellow solid, m.p. 145-146 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.02-7.98 (m, 5H), 7.65 (t, 2H, *J* = 7.5 Hz), 7.51-7.47 (m, 4H), 7.39-7.35 (m, 1H), 7.07 (t, 1H, *J* = 7.5 Hz), 6.92 (d, 1H, *J* = 8.0 Hz), 3.96 (q, 2H, *J* = 7.2 Hz), 2.59 (s, 3H), 1.08 (t, 3H, *J* = 7.2 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 170.04, 159.86, 139.25, 135.23, 134.09, 129.65, 129.14, 128.73, 127.95, 125.88, 123.95, 120.73, 120.07, 114.68, 62.26, 27.00, 13.67 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{25}H_{22}N_2O_7S_2+Na]^+$ 549.0761, found 549.0773.

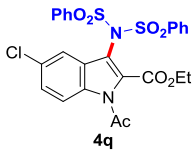
Ethyl 1-Acetyl-5-fluoro-3-(*N*-(phenylsulfonyl)phenylsulfonamido)-1*H*-indole-2-carboxylate (4p):



4p

The reaction of 0.3 mmol of ethyl 1-acetyl-5-fluoro-1*H*-indole-2-carboxylate (**3p**) with 0.6 mmol of NFSI in 2 mL of EtOAc afforded 62% of **4p** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1, *v*/*v*) as the effluent. Light yellow solid, m.p. 142-143 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.05 (dd, 1H, *J* = 9.0 Hz, 4.2 Hz), 8.01-7.98 (m, 4H), 7.68 (t, 2H, *J* = 7.5 Hz), 7.55-7.51 (m, 4H), 7.11 (td, 1H, *J* = 9.0 Hz, 2.5 Hz), 6.52 (dd, 1H, *J* = 8.3 Hz, 2.5 Hz), 3.98 (q, 2H, *J* = 7.2 Hz), 2.58 (s, 3H), 1.09 (t, 3H, *J* = 7.2 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 169.89, 159.66, 159.59 (d, *J* = 241.8 Hz), 139.17, 134.30, 131.36 (d, *J* = 68.4 Hz), 129.19, 128.85, 126.96 (d, *J* = 9.9 Hz), 119.68 (d, *J* = 4.7 Hz), 116.54 (d, *J* = 25.5 Hz), 116.53 (d, *J* = 8.8 Hz), 105.81 (d, *J* = 24.9 Hz), 62.54, 26.92, 13.72 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{25}H_{21}FN_2O_7S_2+Na]^+$ 567.0666, found 567.0662.

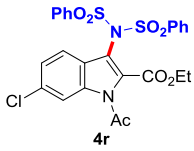
Ethyl 1-Acetyl-5-chloro-3-(*N*-(phenylsulfonyl)phenylsulfonamido)-1*H*-indole-2-carboxylate (4q):



4q

The reaction of 0.3 mmol of ethyl 1-acetyl-5-chloro-1*H*-indole-2-carboxylate (**3q**) with 0.6 mmol of NFSI in 2 mL of EtOAc afforded 63% of **4q** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1, *v*/*v*) as the effluent. Light yellow solid, m.p. 143-144 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.00-7.98 (m, 5H), 7.69 (t, 2H, *J* = 7.5 Hz), 7.55-7.51 (m, 4H), 7.31 (dd, 1H, *J* = 9.0 Hz, 2.1 Hz), 6.74 (d, 1H, *J* = 1.7 Hz), 3.99 (q, 2H, *J* = 7.2 Hz), 2.58 (s, 3H), 1.09 (t, 3H, *J* = 7.2 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 169.84, 159.60, 139.06, 135.79, 134.36, 133.59, 130.76, 129.98, 129.21, 128.83, 128.33, 127.00, 120.03, 119.20, 116.21, 62.57, 26.92, 13.71 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{25}H_{21}ClN_2O_7S_2+Na]^+$ 583.0371, found 583.0364.

Ethyl 1-Acetyl-6-chloro-3-(*N*-(phenylsulfonyl)phenylsulfonamido)-1*H*-indole-2-carboxylate (4r):

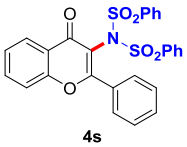


4r

The reaction of 0.3 mmol of ethyl 1-acetyl-6-chloro-1*H*-indole-2-carboxylate (**3r**) with 1.2 mmol of NFSI in 2 mL of EtOAc afforded 76% of **4r** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1, *v*/*v*) as the effluent. White solid, m.p. 167-168 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.13 (d, 1H, *J* = 1.6 Hz), 8.00-7.98 (m, 4H), 7.68 (t, 2H, *J* = 7.5 Hz), 7.54-7.50 (m, 4H), 7.06 (dd, 1H, *J* = 8.5 Hz, 1.6 Hz), 6.82 (d, 1H, *J* = 8.5 Hz), 3.96 (q, 2H, *J* = 7.2 Hz), 2.57 (s, 3H), 1.08 (t, 3H, *J* = 7.2 Hz) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 169.97, 159.63, 139.18, 135.80, 135.60, 134.25, 129.99, 129.17, 128.87, 124.97, 124.40, 121.62, 120.05,

115.15, 62.52, 27.01, 13.71 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{25}H_{21}ClN_2O_7S_2+Na]^+$ 583.0371, found 583.0370.

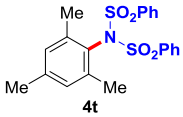
***N*-(4-Oxo-2-phenyl-4*H*-chromen-3-yl)-*N*-(phenylsulfonyl)benzenesulfonamide (4s):**



4s

The reaction of 0.3 mmol of 2-phenyl-4*H*-chromen-4-one (**3s**) with 0.6 mmol of NFSI in 2 mL of DCE afforded 58% of **4s** after flash chromatography on silica gel using petroleum ether and ethyl acetate (6:1 to 3:1, *v*/*v*) as the effluent. Colorless solid, m.p. 205-206 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.14 (dd, 1H, *J* = 7.9 Hz, 1.3 Hz), 7.91-7.89 (m, 2H), 7.84-7.81 (m, 4H), 7.74-7.70 (m, 1H), 7.55-7.51 (m, 3H), 7.43 (t, 2H, *J* = 7.5 Hz), 7.37-7.32 (m, 6H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 174.53, 168.24, 155.54, 139.18, 134.41, 133.74, 131.37, 130.85, 129.58, 129.02, 128.33, 128.23, 126.37, 125.81, 123.47, 119.25, 118.05 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{27}H_{19}NO_6S_2+Na]^+$ 540.0546, found 540.0548.

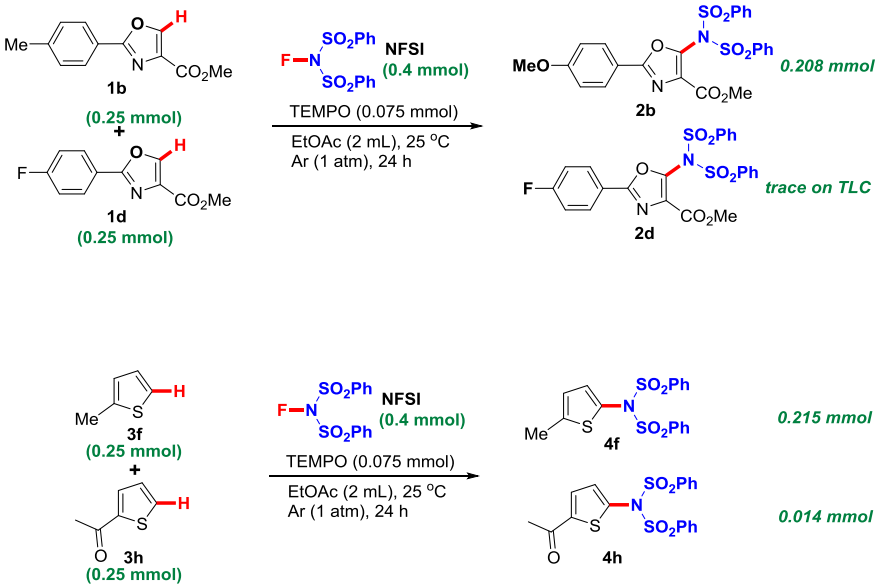
***N*-Mesityl-*N*-(phenylsulfonyl)benzenesulfonamide (4t):**



4t

The reaction of 0.3 mmol of mesitylene (**3t**) with 0.6 mmol of NFSI in 2 mL of EtOAc afforded 41% of **4t** after flash chromatography on silica gel using petroleum ether and ethyl acetate (10:1, *v*/*v*) as the effluent. White solid, m.p. 165-166 °C. **^{1}H NMR ($CDCl_3$, 400 MHz)**: δ = 8.05-8.03 (m, 4H), 7.68-7.65 (m, 2H), 7.56-7.52 (m, 4H), 6.87 (s, 2H), 2.28 (s, 3H), 1.81 (s, 6H) ppm; **^{13}C NMR ($CDCl_3$, 100 MHz)**: δ = 140.38, 139.81, 139.74, 133.98, 130.00, 129.29, 128.84, 128.11, 126.62, 21.04, 19.04 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{21}H_{21}NO_4S_2+Na]^+$ 438.0804, found 438.0808.

Competition Experiments between Electron-rich/deficient Arenes

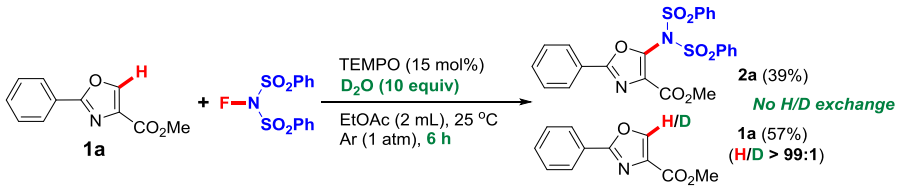


Scheme S1. Competitive experiments

Typical Procedure: To a reaction tube charged with NFSI (126 mg, 0.4 mmol) was added a solution of oxazole **1b** (0.25 mmol) and **1d** (0.25 mmol) in EtOAc (1 mL) under argon (1 atm). The reaction mixture was stirred at 25 °C, and then a solution of TEMPO (11.7 mg, 0.075 mmol, 15 mol%) in EtOAc (1 mL) was added. After stirring at 25 °C for 24 hours, the electron-rich product **2b** was generated predominantly, while only trace **2d** was observed on TLC. Then the mixture was concentrated *in vacuo* to give dark residue, which was purified by flash chromatography using petroleum ether and ethyl acetate as the effluent (6:1 to 3:1, *v*/*v*) on silica gel to afford 109.7 mg of aminated oxazole **2b** (0.208 mmol, 83.2%), and its structure was proved by ^{1}H NMR, ^{13}C NMR and HRMS.

To a reaction tube charged with NFSI (126 mg, 0.4 mmol) was added a solution of thiophene **3f** (0.25 mmol) and **3h** (0.25 mmol) in EtOAc (1 mL) under argon (1 atm). The reaction mixture was stirred at 25 °C, and then a solution of TEMPO (11.7 mg, 0.075 mmol, 15 mol%) in EtOAc (1 mL) was added. After stirring at 25 °C for 24 hours, the electron-rich product **4f** was generated predominantly, while only trace **4h** was observed on TLC. Then the mixture was concentrated *in vacuo* to give dark residue, which was purified by flash chromatography using petroleum ether and ethyl acetate as the effluent (15:1 to 6:1 to 3:1, *v*/*v*) on silica gel to afford 84.4 mg of aminated thiophene **4f** (0.215 mmol, 86.0%) and 5.9 mg of aminated thiphene **4h** (0.014 mmol, 5.6%). Their structures were proved by ^{1}H NMR, ^{13}C NMR and HRMS.

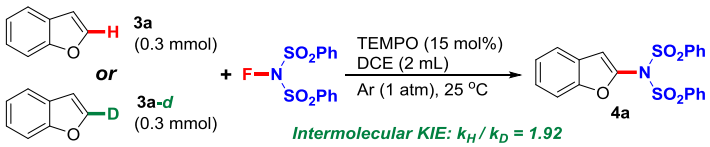
Deuterium Exchange Experiment



Scheme S2. Deuterium exchange experiment on oxazole **1a**

Typical Procedure: To a reaction tube charged with NFSI (378 mg, 1.2 mmol) was added a solution of oxazole **1a** (0.3 mmol) and deuterated water D_2O (60 mg, 3 mmol) in EtOAc (1 mL) under argon (1 atm). The reaction mixture was stirred at 25 °C, and then a solution of TEMPO (7.0mg, 0.045 mmol, 15 mol%) in EtOAc (1 mL) was added. After stirring at 25 °C for 6 hours, the mixture was concentrated *in vacuo* to give dark residue, which was purified by flash chromatography using petroleum ether and ethyl acetate as the effluent (6:1 to 3:1, *v*/*v*) on silica gel to afford 58.5 mg of aminated oxazole **2a** (0.117 mmol, 39.2%), and its structure was proved by ^{1}H NMR, ^{13}C NMR and HRMS. Meanwhile, 34.4 mg of unreacted oxazole **1a** (0.169 mmol, 56.5%) was recovered, and its ^{1}H NMR spectrum suggested that no H/D exchange occurred.

Independent Kinetic Isotope Effect (KIE) Experiments



Scheme S3. Parallel KIE experiments between benzofuran **3a** and *C2*-deuterated benzofuran **3a-*d***

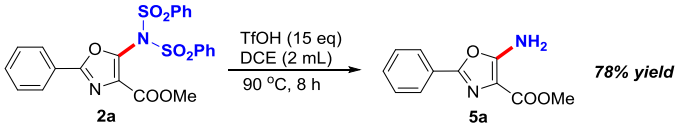
Typical Procedure: To a reaction tube charged with NFSI (378 mg, 1.2 mmol) was added a solution of benzofuran **3a** or *C2*-deuterated benzofuran **3a-*d*** (0.3 mmol) in EtOAc (1 mL) under argon (1 atm). The reaction mixture was stirred at 25 °C, and then a solution of TEMPO (7.0mg, 0.045 mmol, 15 mol%) in EtOAc (1 mL) was added. After stirring at 25 °C for indicate time as shown in Table S1, the mixture was concentrated *in vacuo* to give dark residue, which was analyzed with ^{1}H NMR in $CDCl_3$ to determine the yields of aminated benzofuran **4a** for each reaction, using CH_2Br_2 as an internal standard. Thus, the corresponding slope, intercept and R^2 were calculated as shown in Table S2. Accordingly, the equations for these two reactions were acquired, and the KIE were determined to be 1.92.

Table S2. Results of parallel KIE experiments

Time (min)	**30**	**60**	**90**	**120**	**150**	**180**	**Slope**	**Intercept**	**RSQ**
Yield of **4a** from **3a** (%)	13.23	20.19	26.06	32.10	41.03	46.50	**0.2237**	**6.3607**	0.9964
Yield of **4a** from **3a-*d*** (%)	7.38	11.92	14.34	18.84	21.87	25.02	**0.1167**	**4.3067**	0.9947
Equation for **4a** from **3a**:		**y = 0.2237x+6.3607**				R^2 = 0.9964		y = yield (%)	
Equation for **[D]-4a** from **3a-*d***:		**y = 0.1167x+4.3067**				R^2 = 0.9947		x = time (min)	

k_H/k_D = 0.2237 / 0.1167 = 1.9169

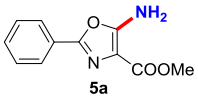
Deprotection Experiment



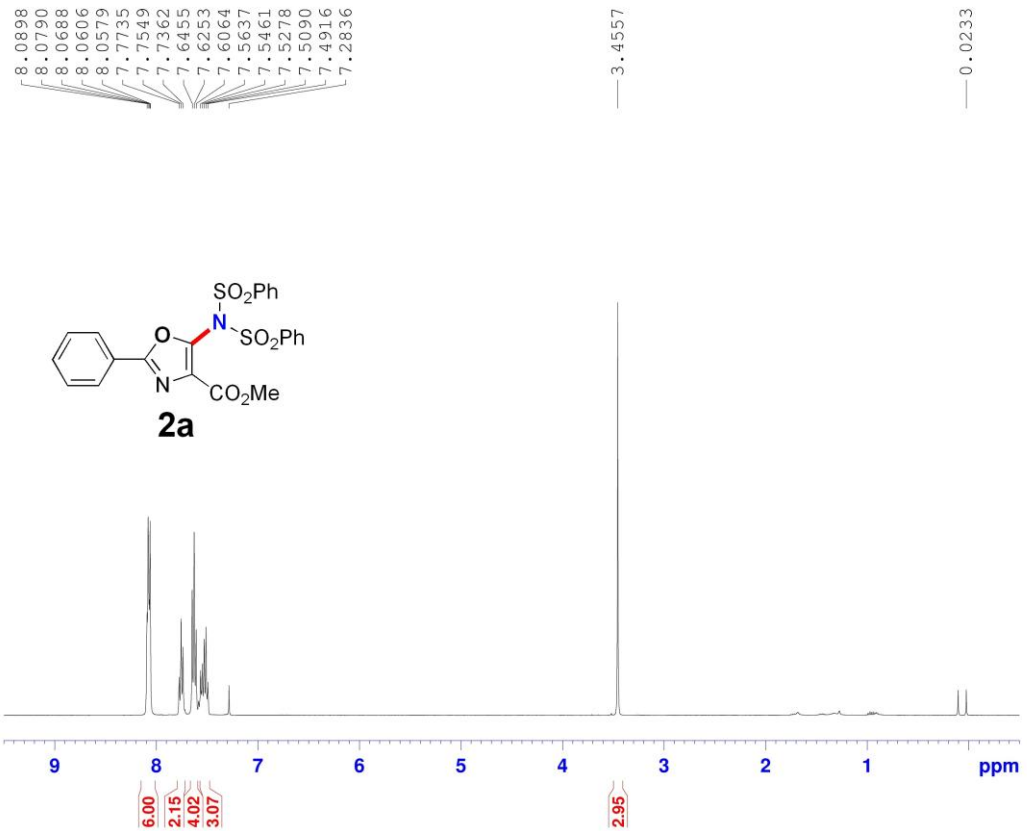
Scheme S4. Deprotection experiment of **2a**

Typical Procedure: To a reaction tube charged with a solution of aminated oxazole **2a** (149.4 mg, 0.3 mmol) in DCE (1 mL) was slowly added a solution of TfOH (4.5 mmol) in DCE (1 mL) at room temperature. The reaction mixture was stirred at 90 °C for 8 hours, the mixture was cooled to room temperature, quenched with saturated $NaHCO_3$ (aq.), and concentrated *in vacuo* to give dark residue, which was purified by flash chromatography using petroleum ether and ethyl acetate as the effluent (3:1, *v*/*v*) on silica gel to afford 51.2 mg of 5-amino oxazole **5a** (0.235 mmol, 78.3%).

Methyl 5-amino-2-phenyloxazole-4-carboxylate (5a):

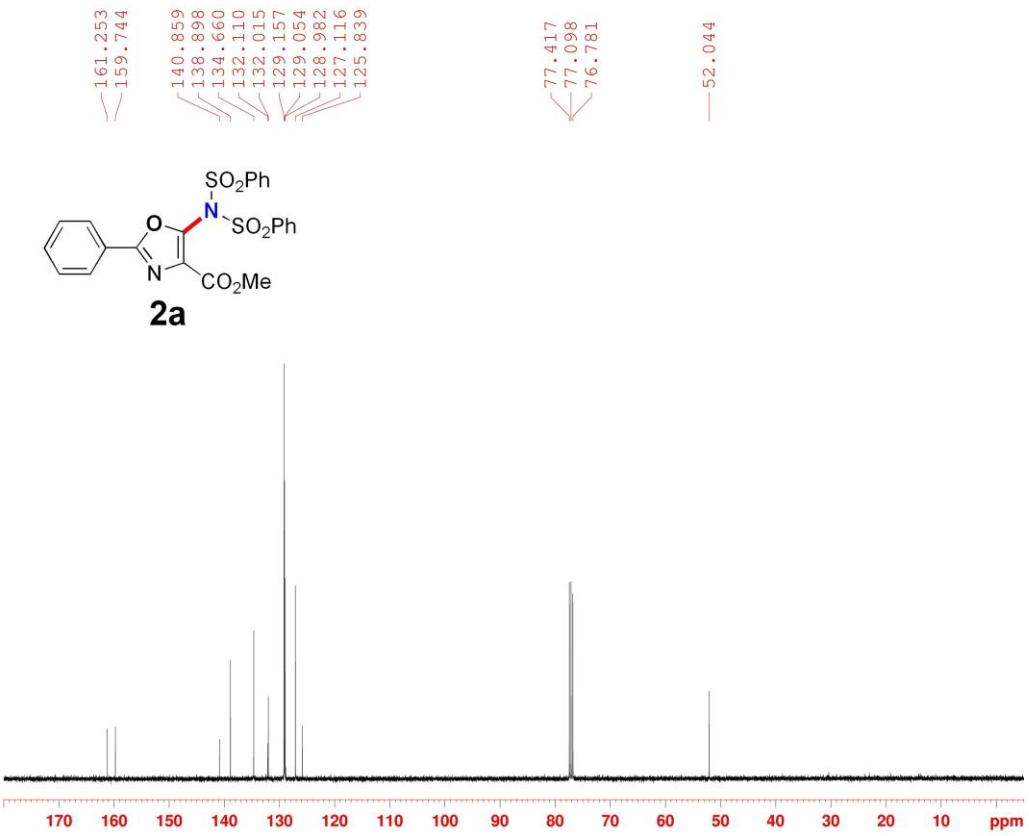


White solid, m.p. 185-186 °C. **^{1}H NMR (DMSO, 400 MHz)**: δ = 7.81-7.79 (m, 2H), 7.52-7.43 (m, 5H), 3.75 (s, 3H) ppm; **^{13}C NMR (DMSO, 100 MHz)**: δ = 163.23, 161.07, 149.05, 130.02, 129.51, 127.10, 125.28, 103.80, 50.94 ppm; **HRMS** *m/z* (ESI) calcd for $[C_{11}H_{10}N_2O_3+H]^+$ 219.0764, found 219.0766.



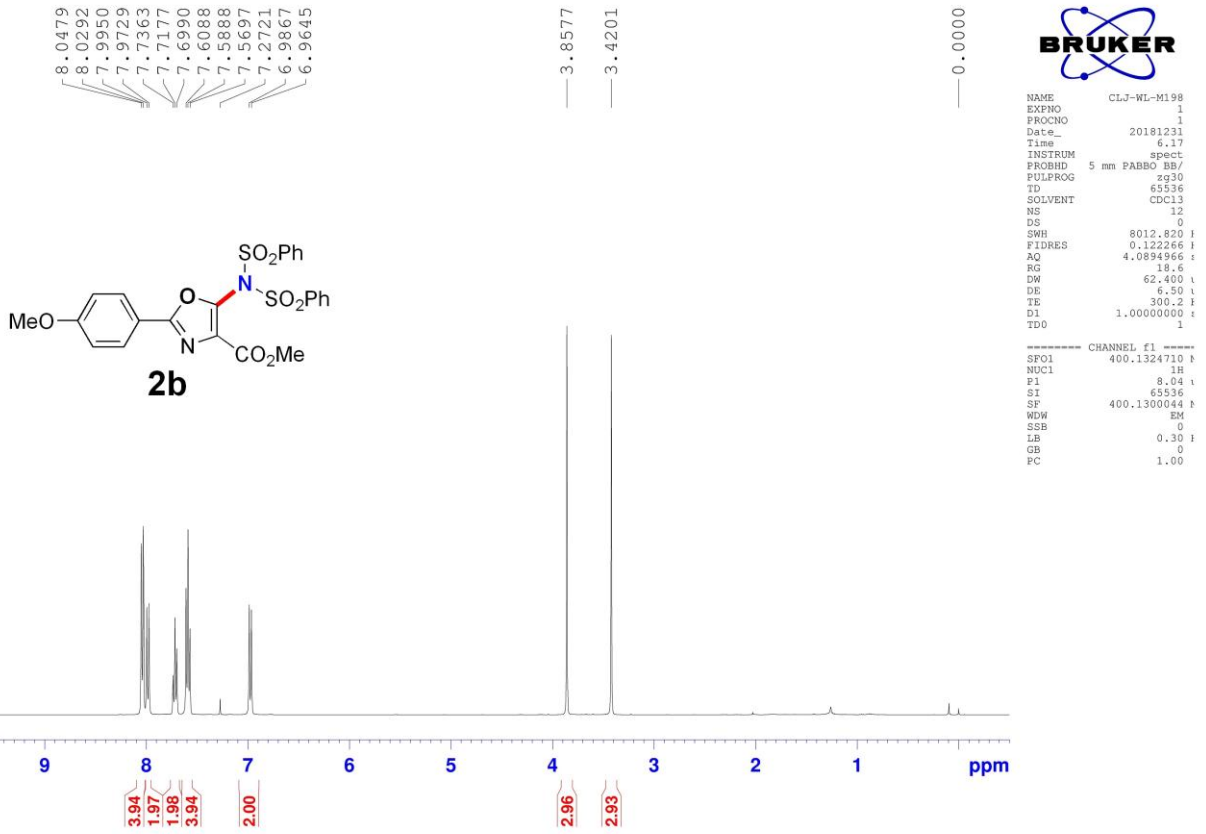
BRUKER

NAME	CLJ-WL-M160
EXPNO	1
PROCNO	1
Date_	20181119
Time	13.07
INSTRUM	spect
PROBHD	5 mm PABBO BB/
PULPROG	zg30
TD	65536
SOLVENT	CDCl3
NS	12
DS	0
SWH	8012.820
FIDRES	0.122266
AQ	4.0894966
RG	47.53
DW	62.400
DE	6.50
TE	300.2
D1	1.00000000
TD0	1
======== CHANNEL f1 =======	
SFO1	400.1324710
NUC1	1H
P1	8.04
SI	65536
SF	400.1300000
WDW	no
SSB	0
LB	0.00
GB	0
PC	1.00

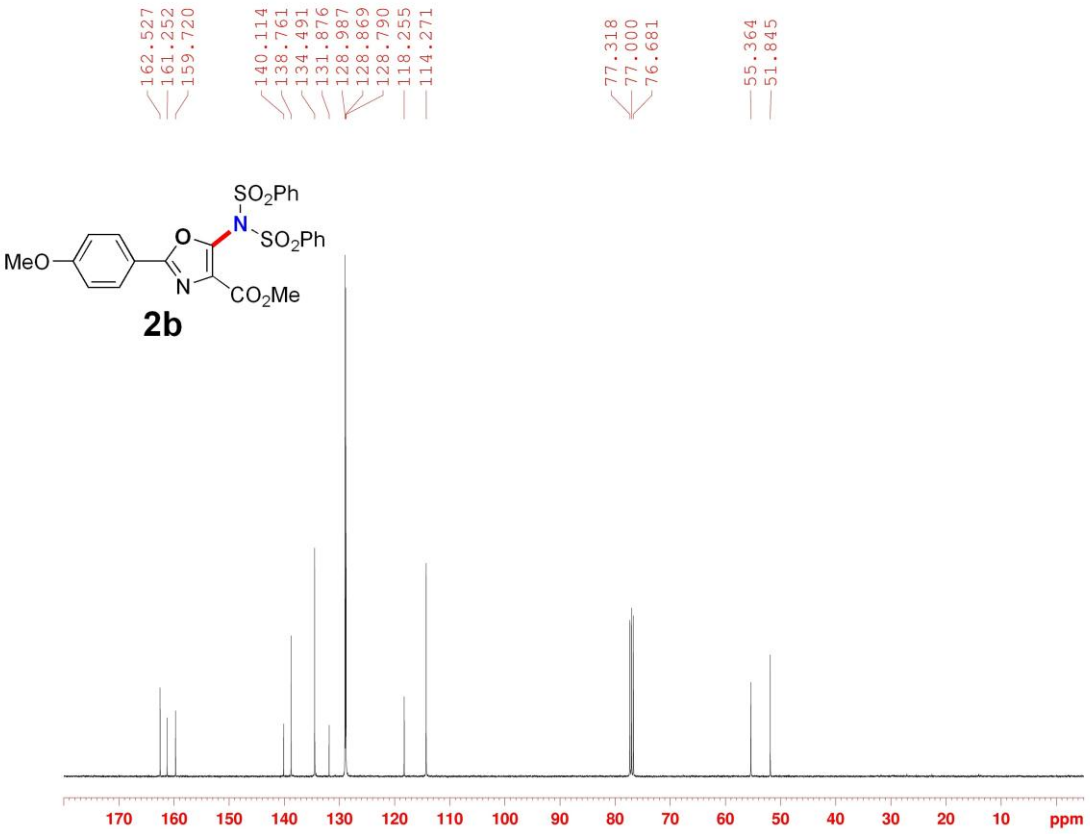


BRUKER

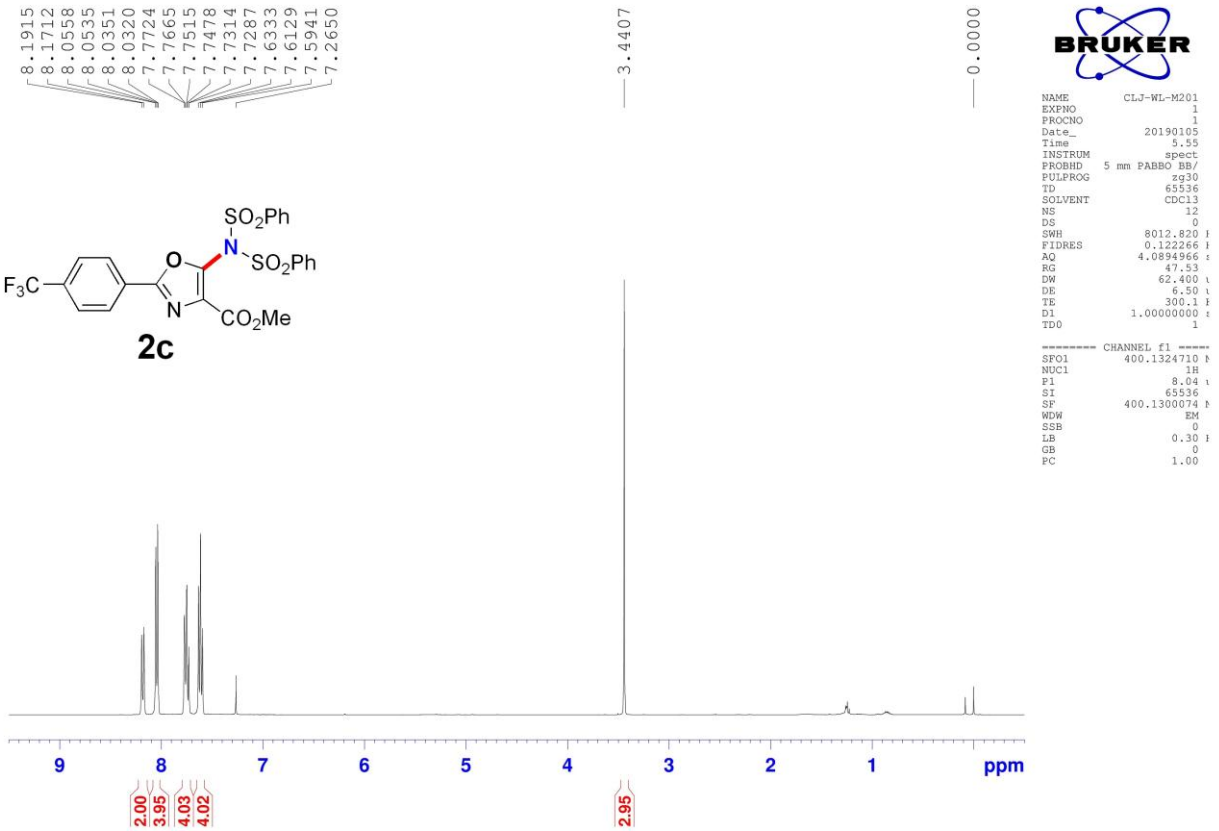
NAME	CLJ-WL-M160
EXPNO	2
PROCNO	1
Date_	20181119
Time	13.22
INSTRUM	spect
PROBHD	5 mm PABBO BB/
PULPROG	zgpg30
TD	65536
SOLVENT	CDCl3
NS	256
DS	0
SWH	24038.461 Hz
FIDRES	0.366798 Hz
AQ	1.3631988 sec
RG	194.26
DW	20.800 usec
DE	6.50 usec
TE	300.2 K
D1	2.00000000 sec
D11	0.03000000 sec
TD0	1
======== CHANNEL f1 =======	
SFO1	100.6228293 MHz
NUC1	13C
P1	8.54 usec
SI	32768
SF	100.6127685 MHz
WDW	no
SSB	0
LB	0.00 Hz
GB	0
PC	1.40



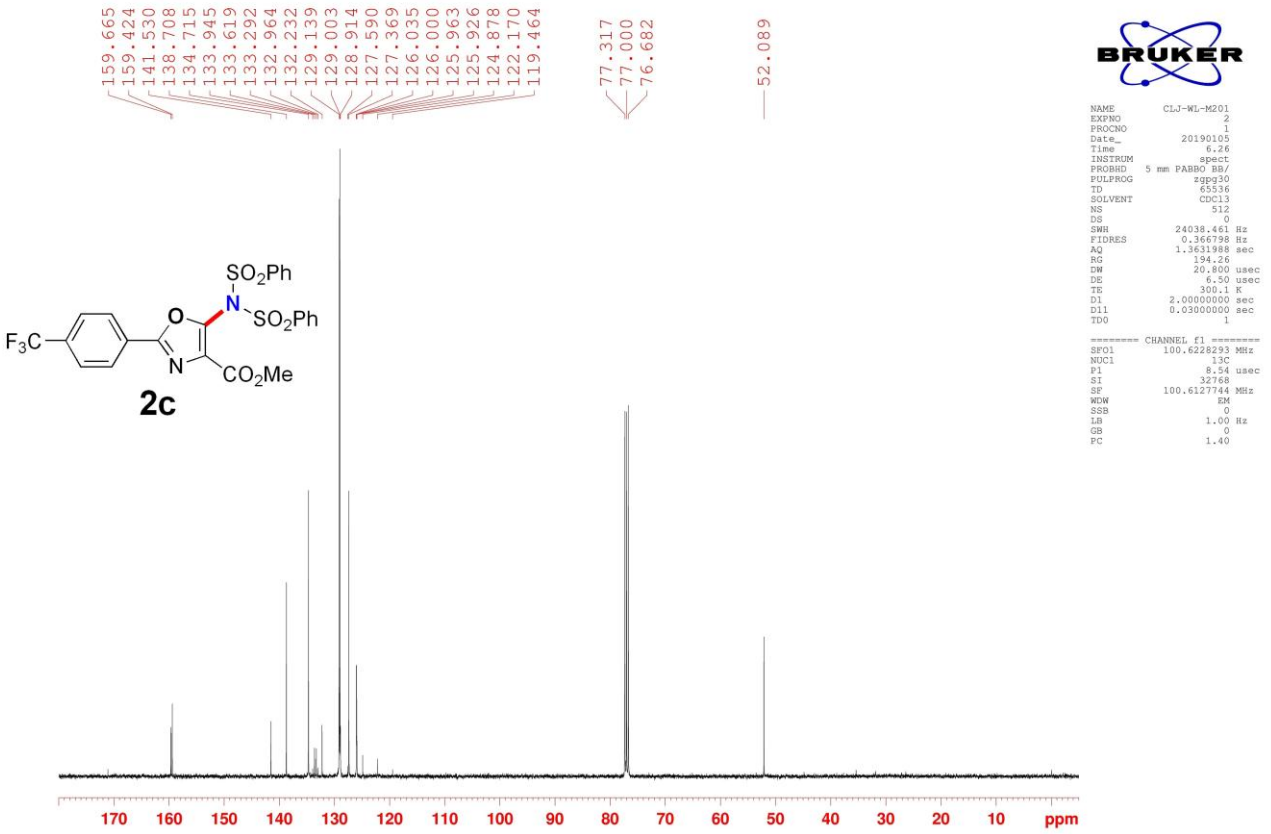

```
NAME            CLJ-WL-M198
EXPNO                     1
PROCNO                    1
Date_            20181231
Time                  6.17
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                      12
DS                       0
SWH              8012.820 H
FIDRES           0.122266 H
AQ               4.0894966 s
RG                    18.6
DW                  62.400 u
DE                    6.50 u
TE                  300.2 K
D1               1.00000000 s
TD0                       1

======== CHANNEL f1 =======
SFO1            400.1324710 M
NUC1                    1H
P1                    8.04 u
SI                   65536
SF              400.1300044 M
WDW                     EM
SSB                      0
LB                    0.30 H
GB                       0
PC                    1.00
```



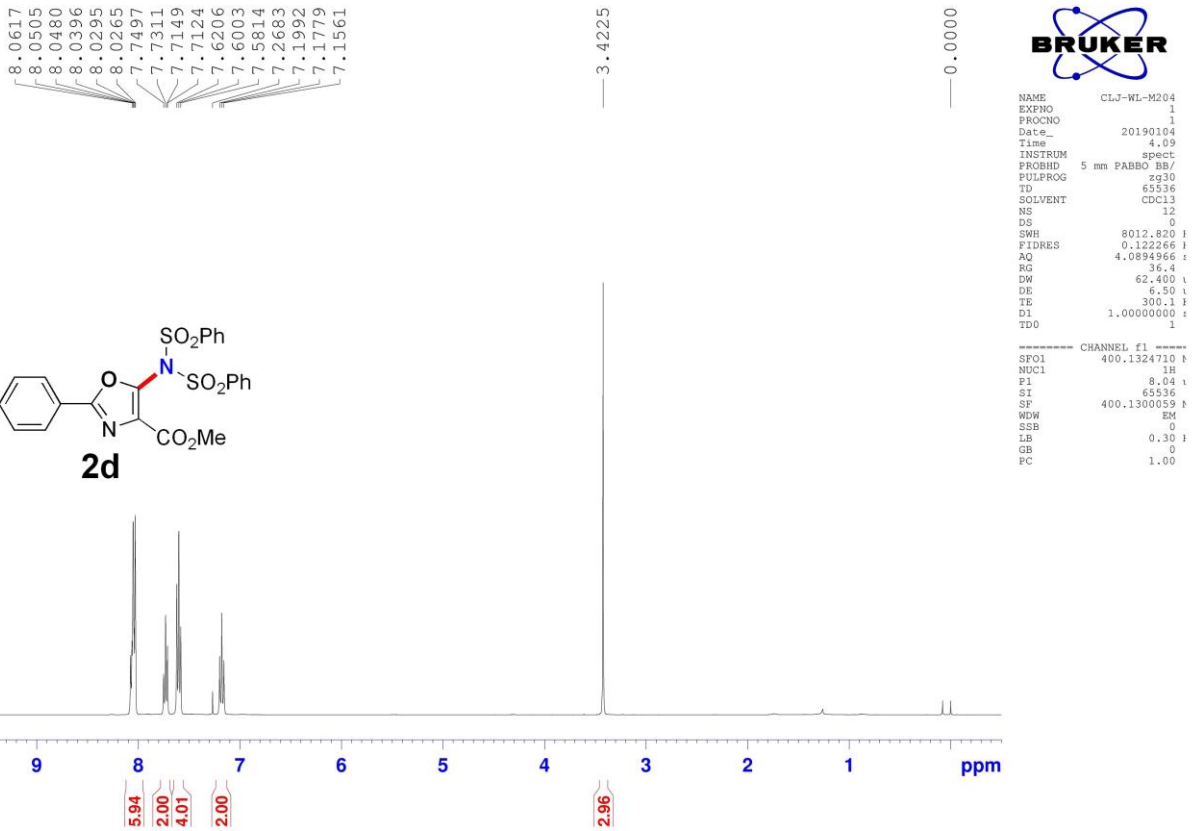

```
NAME            CLJ-WL-M198
EXPNO                     2
PROCNO                    1
Date_            20181231
Time                  6.47
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG            zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     512
DS                       0
SWH             24038.461 Hz
FIDRES           0.366798 Hz
AQ               1.3631988 sec
RG                   194.26
DW                20.800 usec
DE                 6.50 usec
TE                  300.1 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                       1

======== CHANNEL f1 =======
SFO1            100.6228293 MHz
NUC1                    13C
P1                 8.54 usec
SI                   32768
SF              100.6127834 MHz
WDW                     EM
SSB                      0
LB                    1.00 Hz
GB                       0
PC                    1.40
```



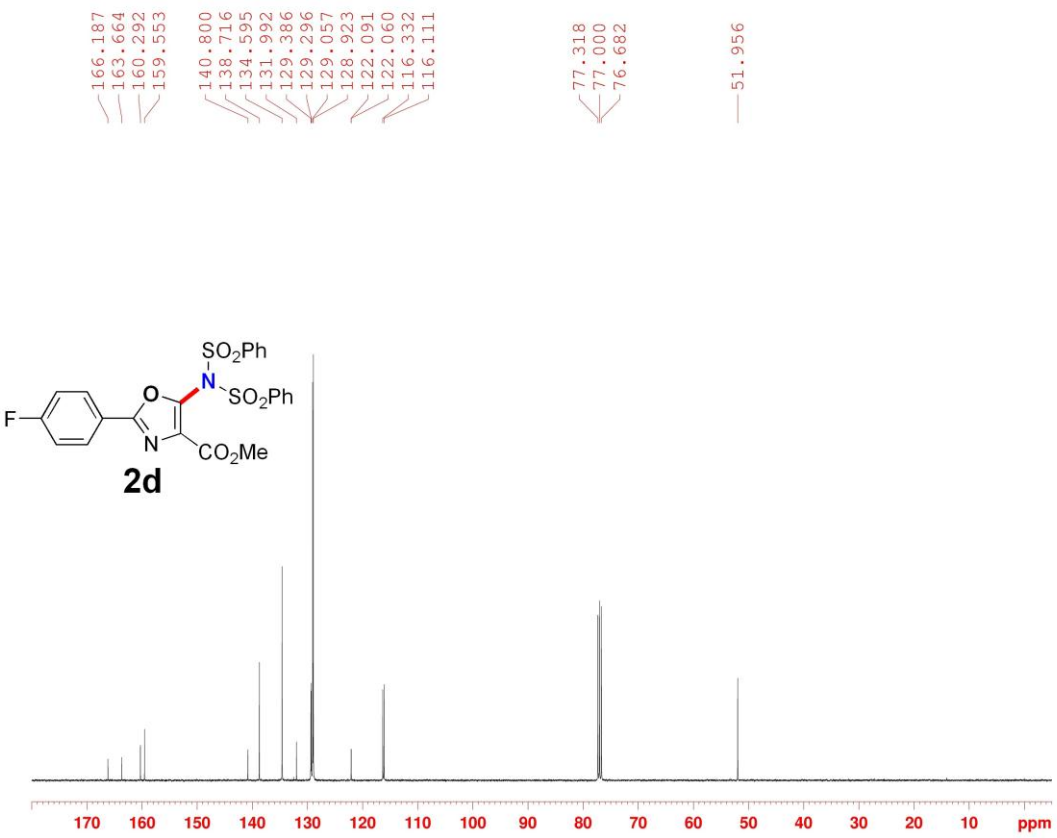

```
NAME          CLJ-WL-M201
EXPNO                   1
PROCNO                  1
Date_          20190105
Time               5.55
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG           zg30
TD               65536
SOLVENT          CDC13
NS                  12
DS                   0
SWH          8012.820 H
FIDRES       0.122266 H
AQ           4.0894966 s
RG                47.53
DW               62.400 u
DE                6.50 u
TE               300.1 K
D1           1.00000000 s
TD0                  1

======== CHANNEL f1 =====
SFO1       400.1324710 M
NUC1                1H
P1                8.04 u
SI               65536
SF         400.1300074 M
WDW                 EM
SSB                  0
LB                0.30 H
GB                   0
PC                1.00
```



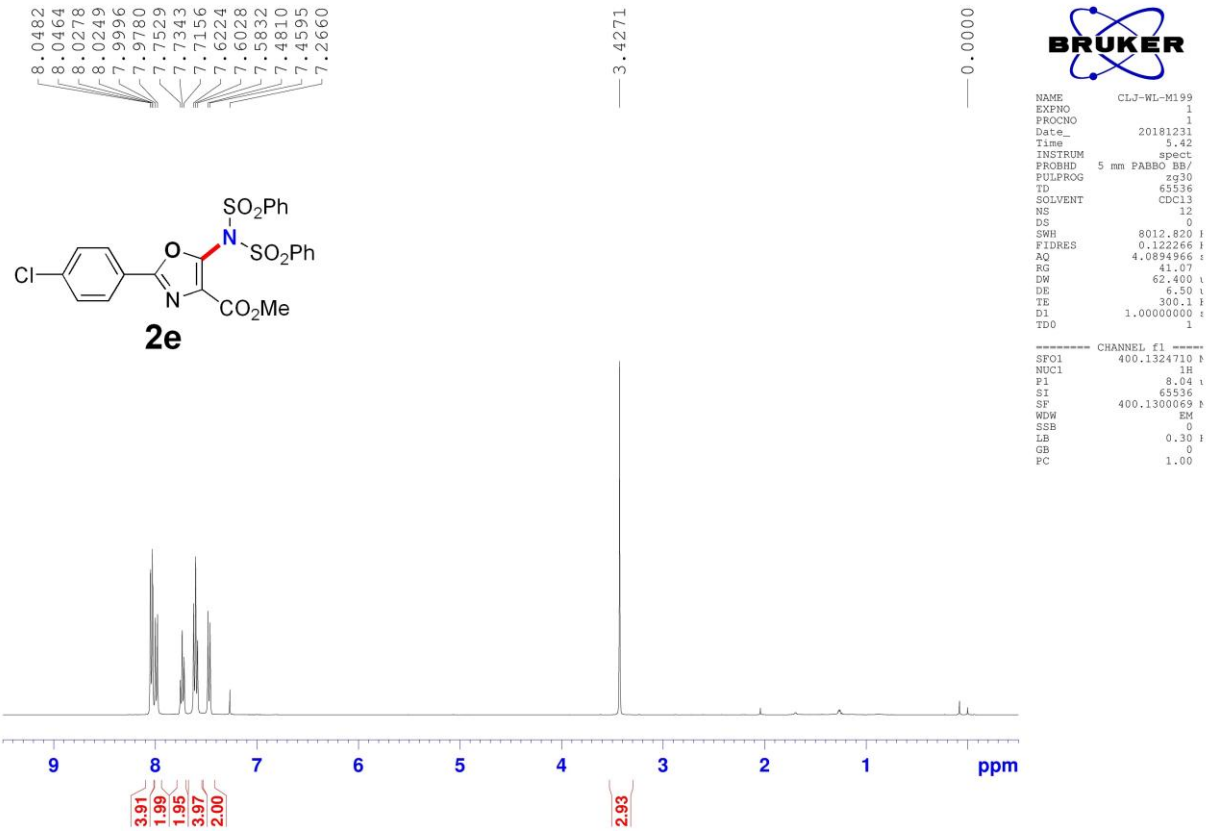

```
NAME          CLJ-WL-M201
EXPNO                   2
PROCNO                  1
Date_          20190105
Time               6.26
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD               65536
SOLVENT          CDC13
NS                 512
DS                   0
SWH         24038.461 Hz
FIDRES       0.366798 Hz
AQ           1.3631988 sec
RG                194.26
DW            20.800 usec
DE             6.50 usec
TE               300.1 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1      100.6228293 MHz
NUC1                13C
P1               8.54 usec
SI                32768
SF        100.6127744 MHz
WDW                 EM
SSB                  0
LB                1.00 Hz
GB                   0
PC                1.40
```

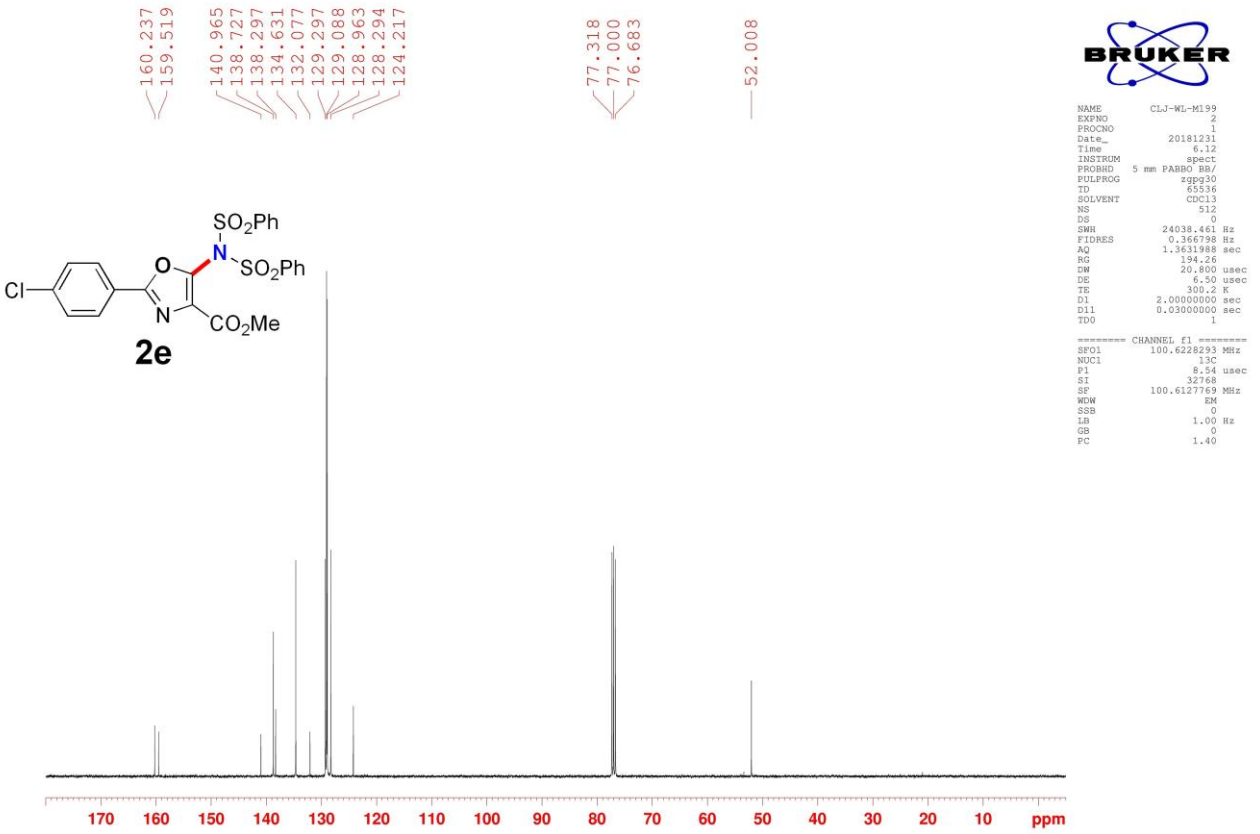

8.0617
8.0505
8.0480
8.0396
8.0295
8.0265
7.7497
7.7311
7.7149
7.7124
7.6206
7.6003
7.5814
7.2683
7.1992
7.1779
7.1561
3.4225
0.0000
SO2Ph
N
SO2Ph
O
F
N
CO2Me
2d
9
8
7
6
5
4
3
2
1
ppm
5.94
2.00
4.01
2.00
2.96

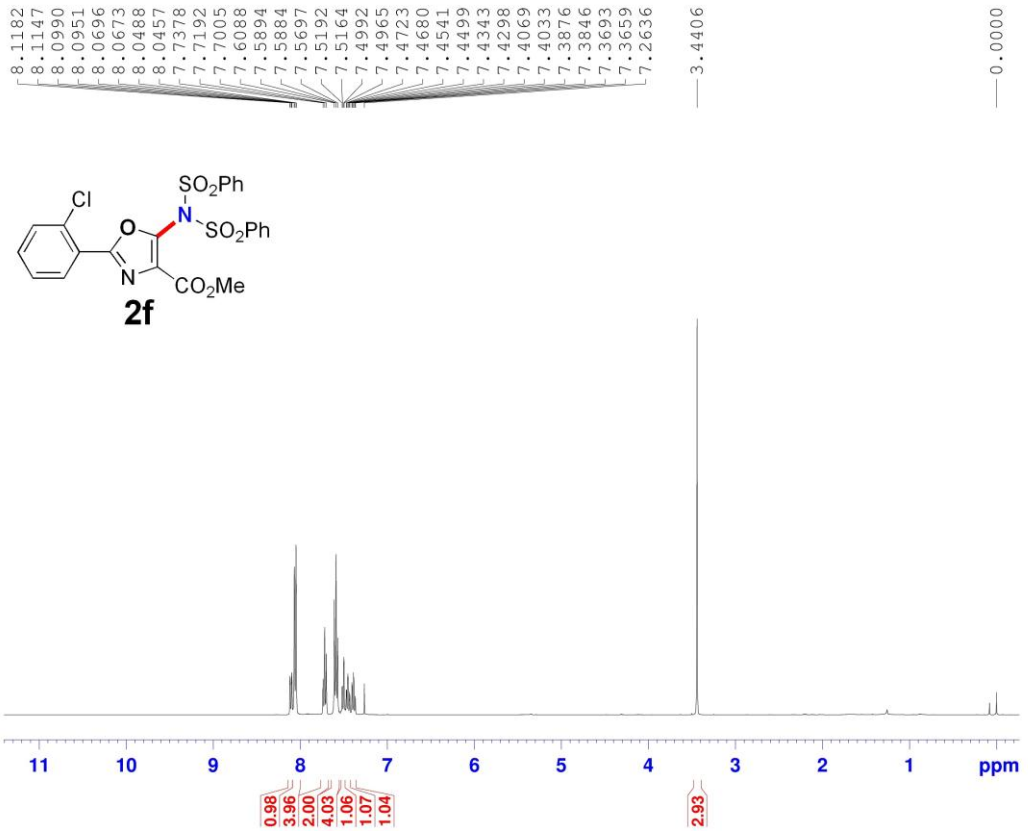
BRUKER
NAME CLJ-WL-M204
EXPNO 1
PROCNO 1
Date_ 20190104
Time 4.09
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 36.4
DW 62.400
DE 6.50
TE 300.1
D1 1.00000000
TD0 1
CHANNEL f1
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300059
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00


166.187
163.664
160.292
159.553
140.800
138.716
134.595
131.992
129.386
129.296
129.057
128.923
122.091
122.060
116.332
116.111
77.318
77.000
76.682
51.956
SO2Ph
N
SO2Ph
O
F
N
CO2Me
2d
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

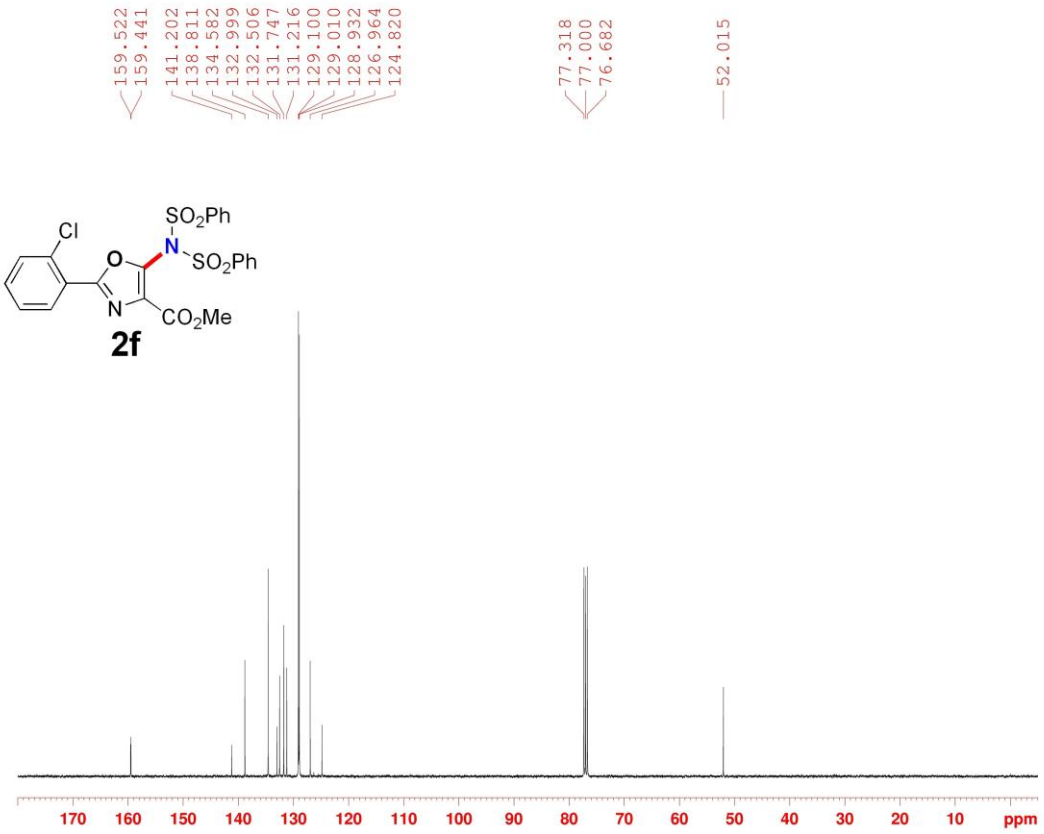

BRUKER
NAME CLJ-WL-M204
EXPNO 2
PROCNO 1
Date_ 20190104
Time 4.39
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127797 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40


8.0482
8.0464
8.0278
8.0249
7.9996
7.9780
7.7529
7.7343
7.7156
7.6224
7.6028
7.5832
7.4810
7.4595
7.2660
3.4271
0.0000
BRUKER
NAME CLJ-WL-M199
EXPNO 1
PROCNO 1
Date_ 20181231
Time 5.42
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDC13
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 41.07
DW 62.400
DE 6.50
TE 300.1
D1 1.00000000
TD0 1
CHANNEL f1
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300069
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00
SO2Ph
N
SO2Ph
O
Cl
N
CO2Me
2e
9
8
7
6
5
4
3
2
1
ppm
3.91
1.99
1.95
3.97
2.00
2.93

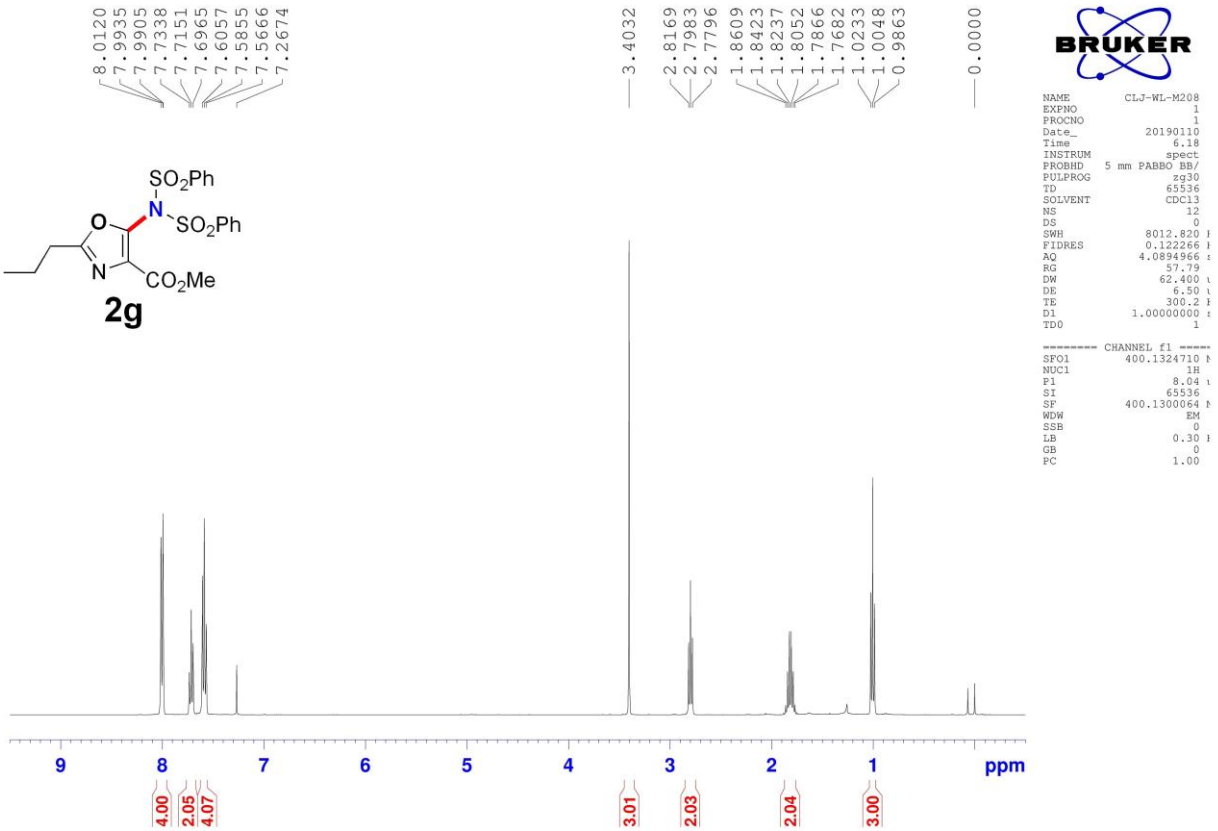

160.237
159.519
140.965
138.727
138.297
134.631
132.077
129.297
129.088
128.963
128.294
124.217
77.318
77.000
76.683
52.008
BRUKER
NAME CLJ-WL-M199
EXPNO 2
PROCNO 1
Date_ 20181231
Time 6.12
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDC13
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127769 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
SO2Ph
N
SO2Ph
O
Cl
N
CO2Me
2e
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm



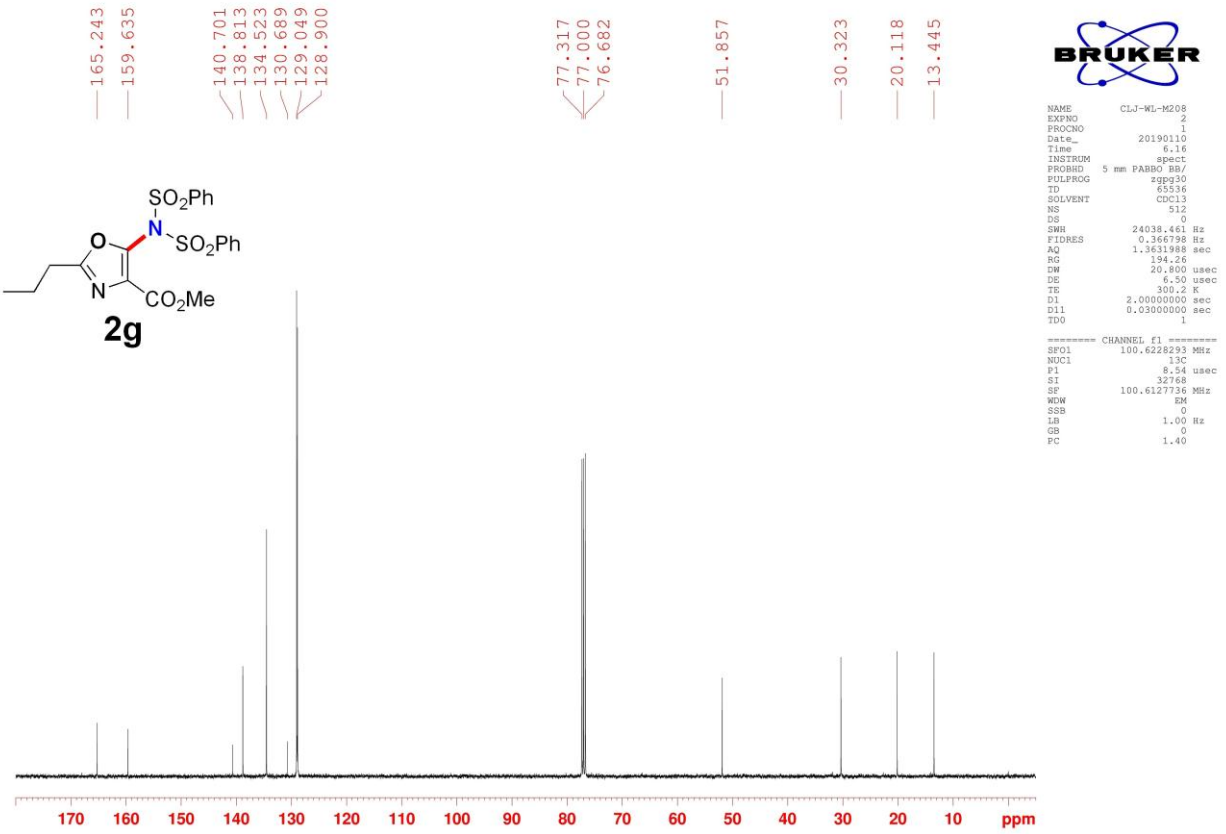

```
NAME            CLJ-WL-M207
EXPNO                     1
PROCNO                    1
Date_              20190110
Time                   5.43
INSTRUM               spect
PROBHD    5 mm PABBO BB/
PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                      12
DS                       0
SWH                8012.820 Hz
FIDRES             0.122266 Hz
AQ                 4.0894966 sec
RG                     51.19
DW                    62.400 usec
DE                     6.50 usec
TE                    300.1 K
D1                 1.00000000 sec
TD0                       1

======== CHANNEL f1 =======
SFO1              400.1324710 MHz
NUC1                      1H
P1                     8.04 usec
SI                    65536
SF                400.1300080 MHz
WDW                      EM
SSB                       0
LB                     0.30 Hz
GB                        0
PC                     1.00
```



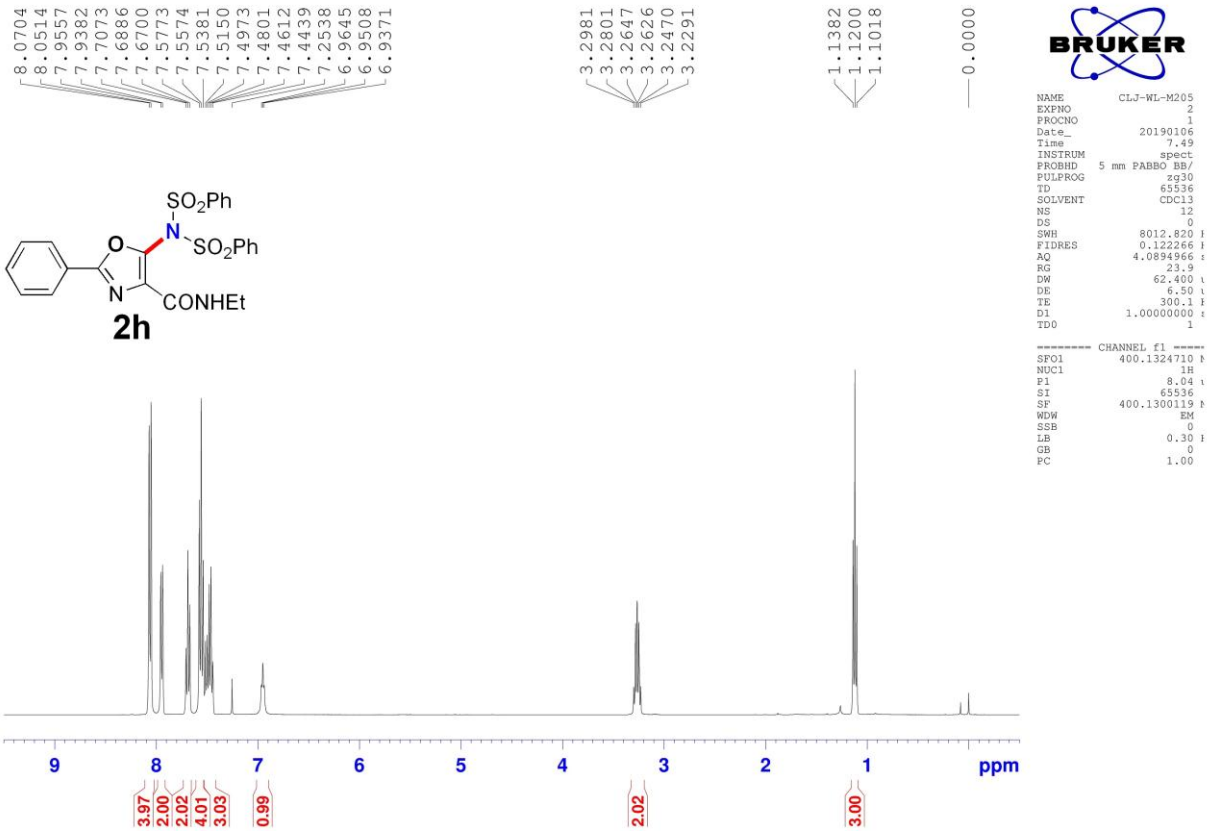

```
NAME            CLJ-WL-M207
EXPNO                     2
PROCNO                    1
Date_              20190110
Time                   5.41
INSTRUM               spect
PROBHD    5 mm PABBO BB/
PULPROG            zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     512
DS                       0
SWH               24038.461 Hz
FIDRES             0.366798 Hz
AQ                 1.3631988 sec
RG                    194.26
DW                    20.800 usec
DE                     6.50 usec
TE                    300.1 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                       1

======== CHANNEL f1 =======
SFO1              100.6228293 MHz
NUC1                      13C
P1                     8.54 usec
SI                    32768
SF                100.6127757 MHz
WDW                      EM
SSB                       0
LB                     1.00 Hz
GB                        0
PC                     1.40
```



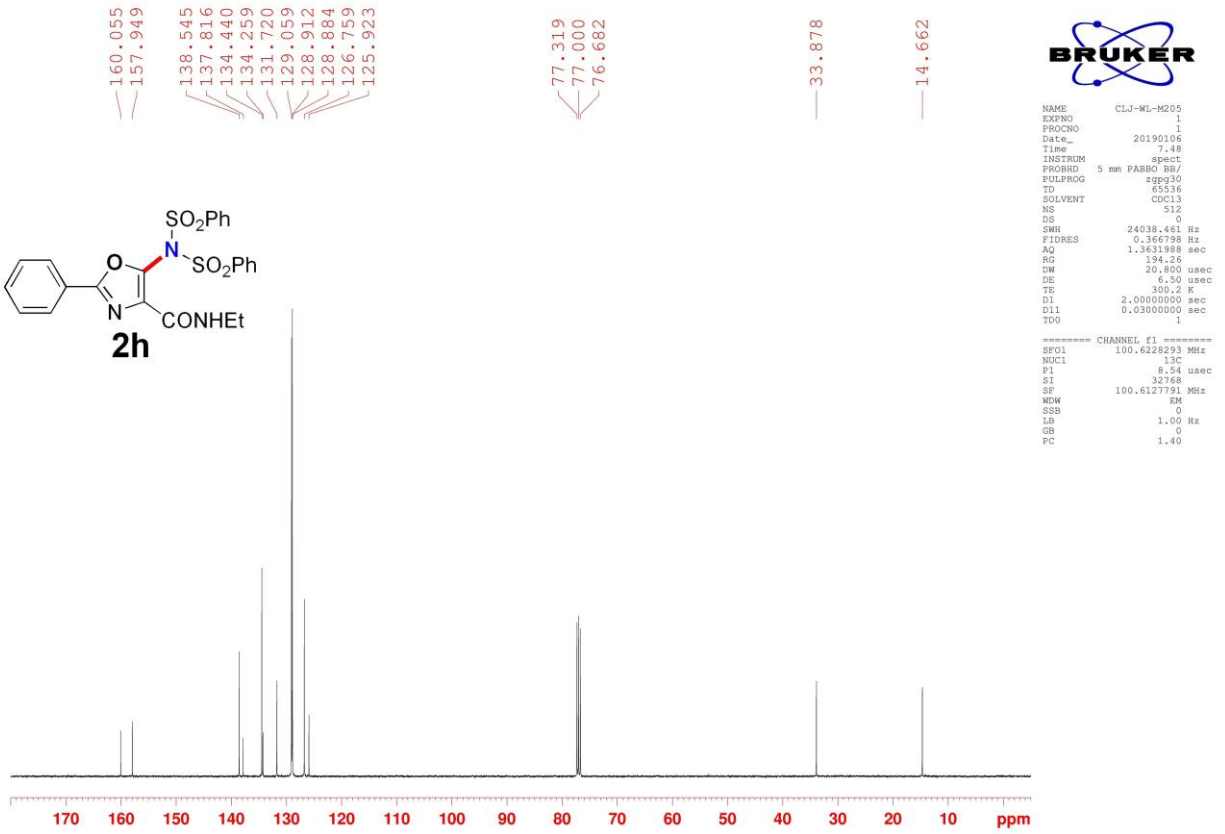

```
NAME          CLJ-WL-M208
EXPNO                   1
PROCNO                  1
Date_          20190110
Time               6.18
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG           zg30
TD               65536
SOLVENT          CDCl3
NS                 12
DS                  0
SWH          8012.820 Hz
FIDRES       0.122266 Hz
AQ           4.0894966 sec
RG                57.79
DW               62.400 usec
DE                6.50 usec
TE               300.2 K
D1           1.00000000 sec
TD0                 1

======== CHANNEL f1 ========
SFO1        400.1324710 MHz
NUC1                1H
P1                8.04 usec
SI               65536
SF          400.1300064 MHz
WDW                EM
SSB                 0
LB                0.30 Hz
GB                  0
PC                1.00
```



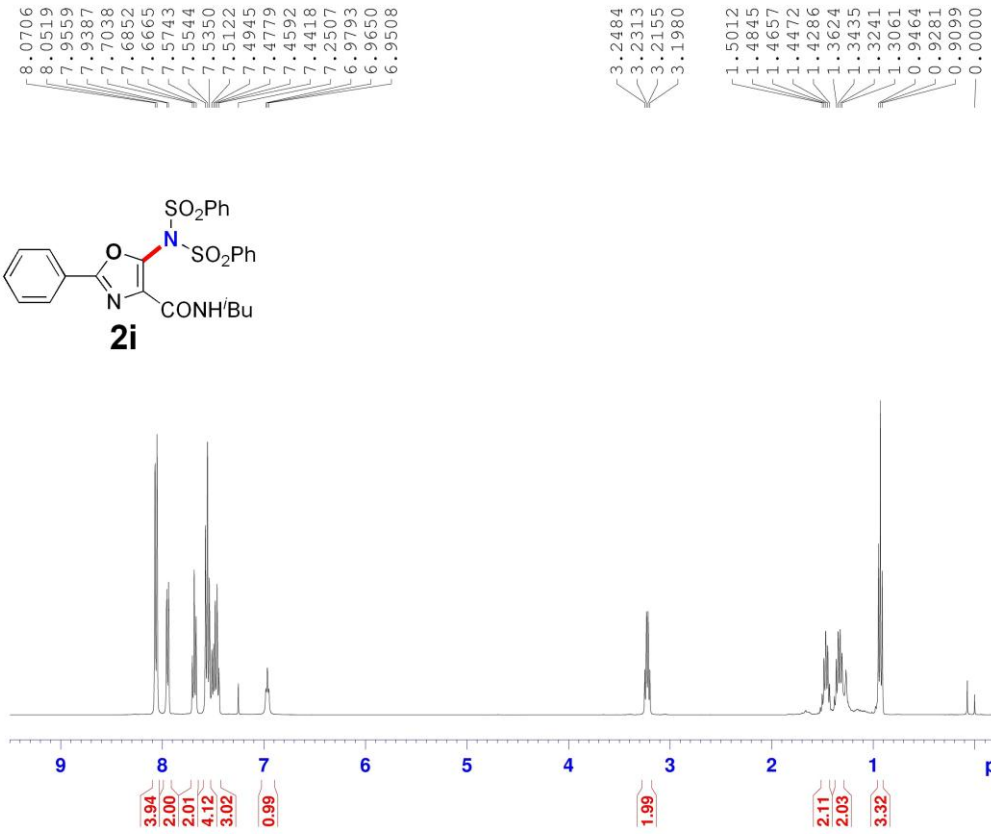

```
NAME          CLJ-WL-M208
EXPNO                   2
PROCNO                  1
Date_          20190110
Time               6.16
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD               65536
SOLVENT          CDCl3
NS                512
DS                  0
SWH         24038.461 Hz
FIDRES       0.366798 Hz
AQ           1.3631988 sec
RG                194.26
DW               20.800 usec
DE                6.50 usec
TE               300.2 K
D1           2.00000000 sec
D11          0.03000000 sec
TD0                 1

======== CHANNEL f1 ========
SFO1        100.6228293 MHz
NUC1                13C
P1                8.54 usec
SI               32768
SF          100.6127736 MHz
WDW                EM
SSB                 0
LB                1.00 Hz
GB                  0
PC                1.40
```


8.0704
8.0514
7.9557
7.9382
7.7073
7.6886
7.6700
7.5773
7.5574
7.5381
7.5150
7.4973
7.4801
7.4612
7.4439
7.2538
6.9645
6.9508
6.9371
3.2981
3.2801
3.2647
3.2626
3.2470
3.2291
1.1382
1.1200
1.1018
0.0000
SO2Ph
N
SO2Ph
O
N
CONHEt
2h
9
8
7
6
5
4
3
2
1
ppm
3.97
2.00
2.02
4.01
3.03
0.99
2.02
3.00

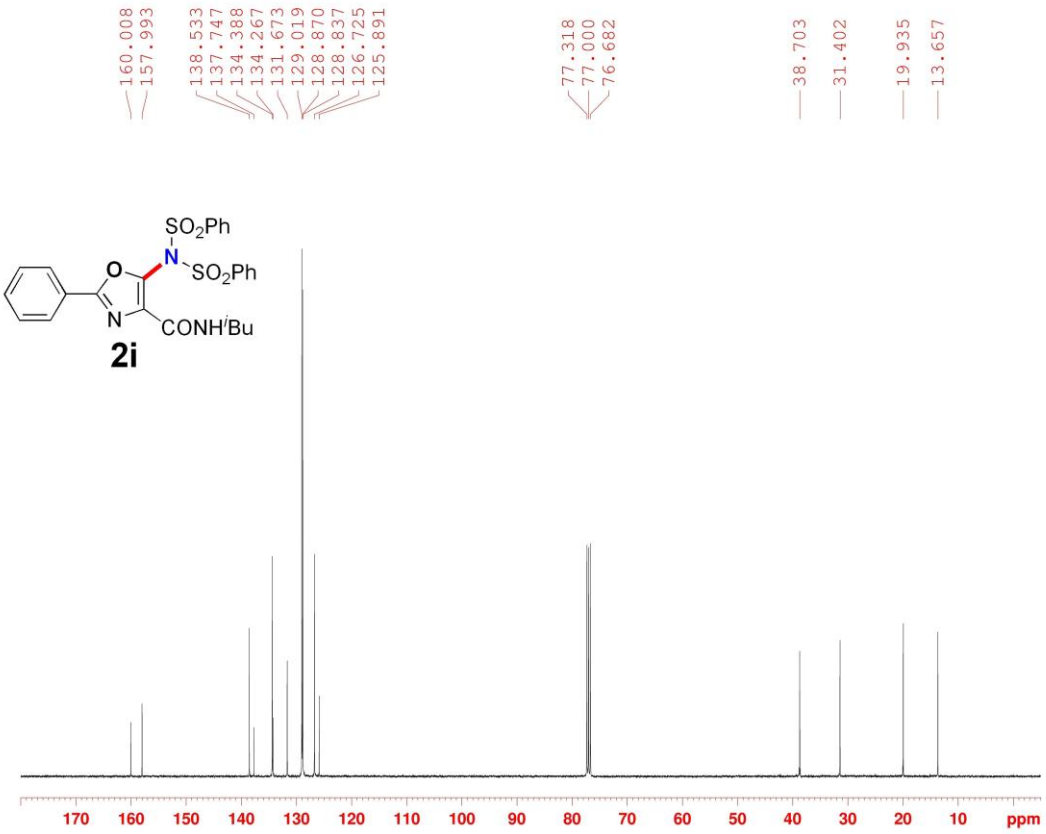
BRUKER
NAME CLJ-WL-M205
EXPNO 2
PROCNO 1
Date_ 20190106
Time 7.49
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 23.9
DW 62.400
DE 6.50
TE 300.1
D1 1.00000000
TD0 1
======== CHANNEL f1 ========
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300119
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00


160.055
157.949
138.545
137.816
134.440
134.259
131.720
129.059
128.912
128.884
126.759
125.923
77.319
77.000
76.682
33.878
14.662
SO2Ph
N
SO2Ph
O
N
CONHEt
2h
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

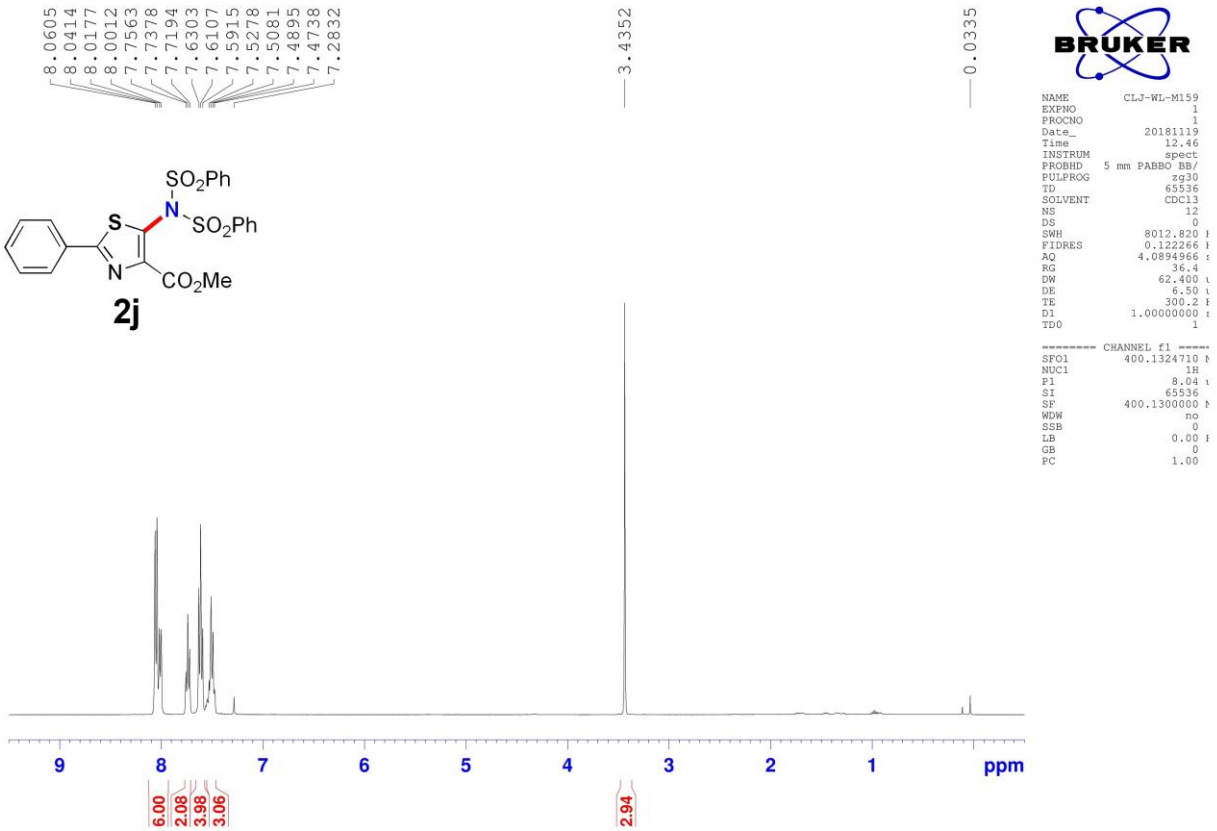
BRUKER
NAME CLJ-WL-M205
EXPNO 1
PROCNO 1
Date_ 20190106
Time 7.48
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127791 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



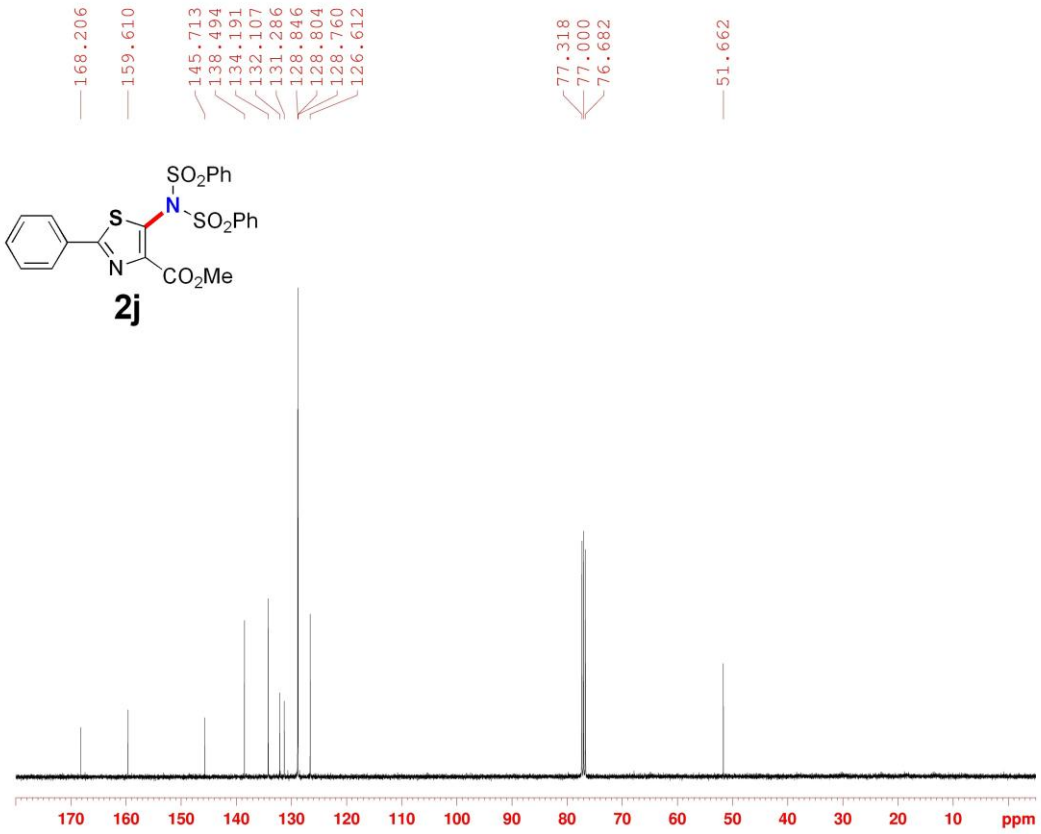

```
NAME          CLJ-WL-M206
EXPNO                   2
PROCNO                  1
Date_            20190106
Time                 8.24
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                    12
DS                     0
SWH             8012.820 H
FIDRES          0.122266 H
AQ              4.0894966 s
RG                  18.6
DW                 62.400 u
DE                  6.50 u
TE                 300.1 K
D1              1.00000000 s
TD0                    1

======== CHANNEL f1 =====
SFO1          400.1324710 M
NUC1                   1H
P1                  8.04 u
SI                 65536
SF            400.1300132 M
WDW                   EM
SSB                    0
LB                  0.30 H
GB                     0
PC                  1.00
```

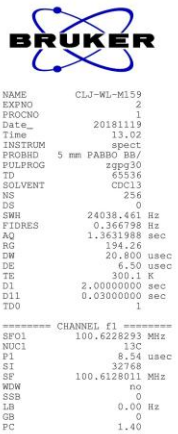


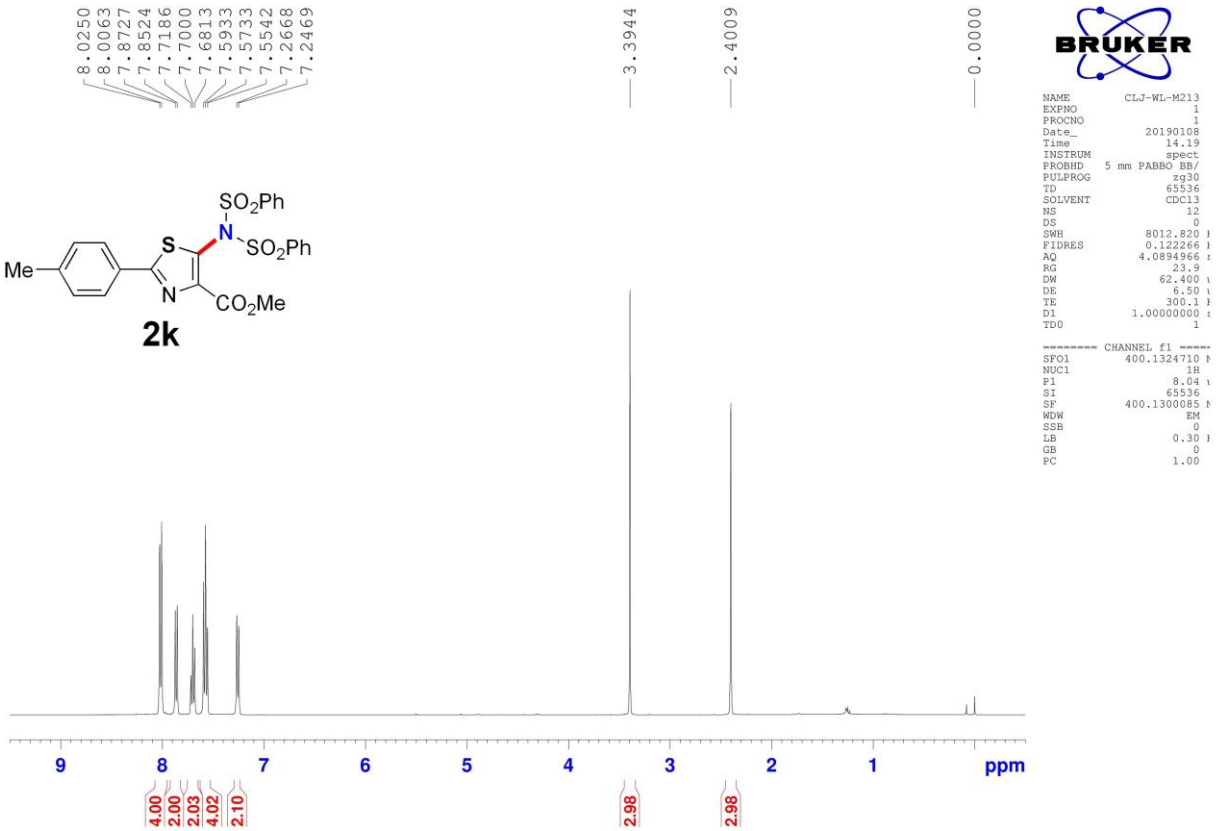

```
NAME          CLJ-WL-M206
EXPNO                   1
PROCNO                  1
Date_            20190106
Time                 8.22
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   512
DS                     0
SWH            24038.461 Hz
FIDRES          0.366798 Hz
AQ              1.3631988 sec
RG                 194.26
DW                20.800 usec
DE                 6.50 usec
TE                 300.1 K
D1              2.00000000 sec
D11             0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1          100.6228293 MHz
NUC1                   13C
P1                 8.54 usec
SI                 32768
SF            100.6127831 MHz
WDW                   EM
SSB                    0
LB                  1.00 Hz
GB                     0
PC                  1.40
```


8.0605
8.0414
8.0177
8.0012
7.7563
7.7378
7.7194
7.6303
7.6107
7.5915
7.5278
7.5081
7.4895
7.4738
7.2832
3.4352
0.0335
SO2Ph
N
SO2Ph
S
N
CO2Me
2j
9
8
7
6
5
4
3
2
1
ppm
6.00
2.08
3.98
3.06
2.94

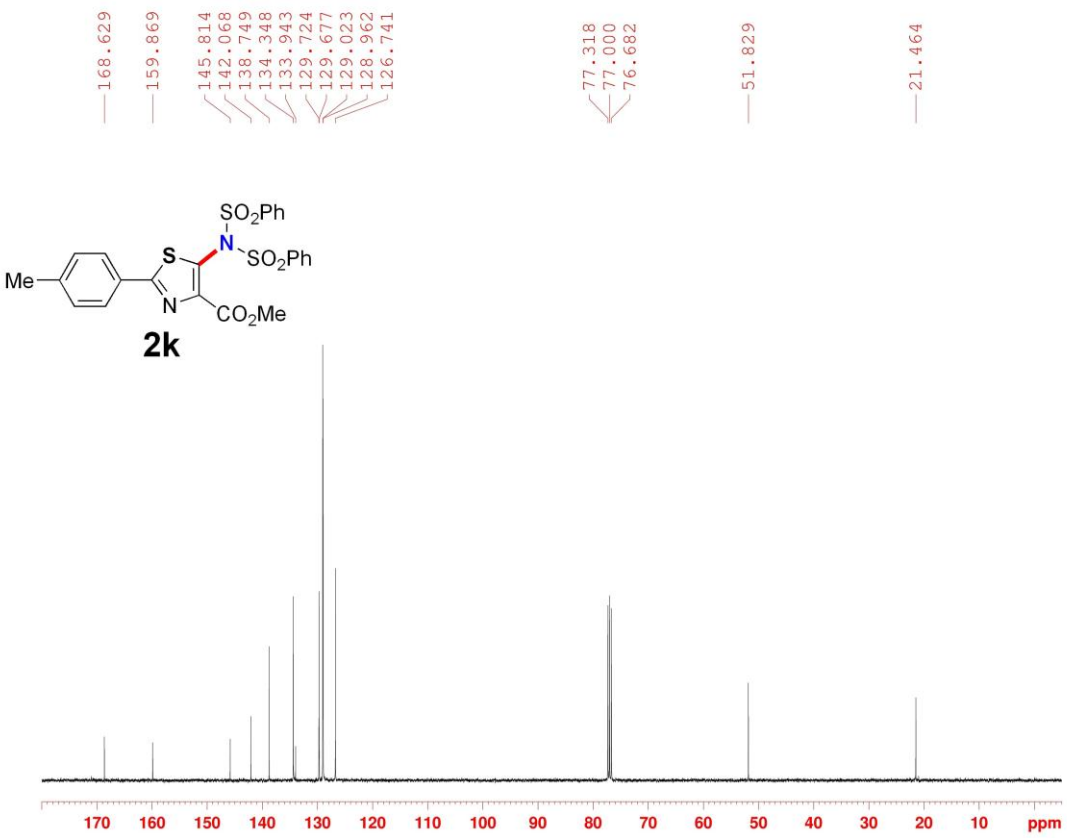
BRUKER
NAME CLJ-WL-M159
EXPNO 1
PROCNO 1
Date_ 20181119
Time 12.46
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 36.4
DW 62.400
DE 6.50
TE 300.2
D1 1.00000000
TD0 1
======== CHANNEL f1 ======
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300000
WDW no
SSB 0
LB 0.00
GB 0
PC 1.00


168.206
159.610
145.713
138.494
134.191
132.107
131.286
128.846
128.804
128.760
126.612
77.318
77.000
76.682
51.662
SO2Ph
N
SO2Ph
S
N
CO2Me
2j
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

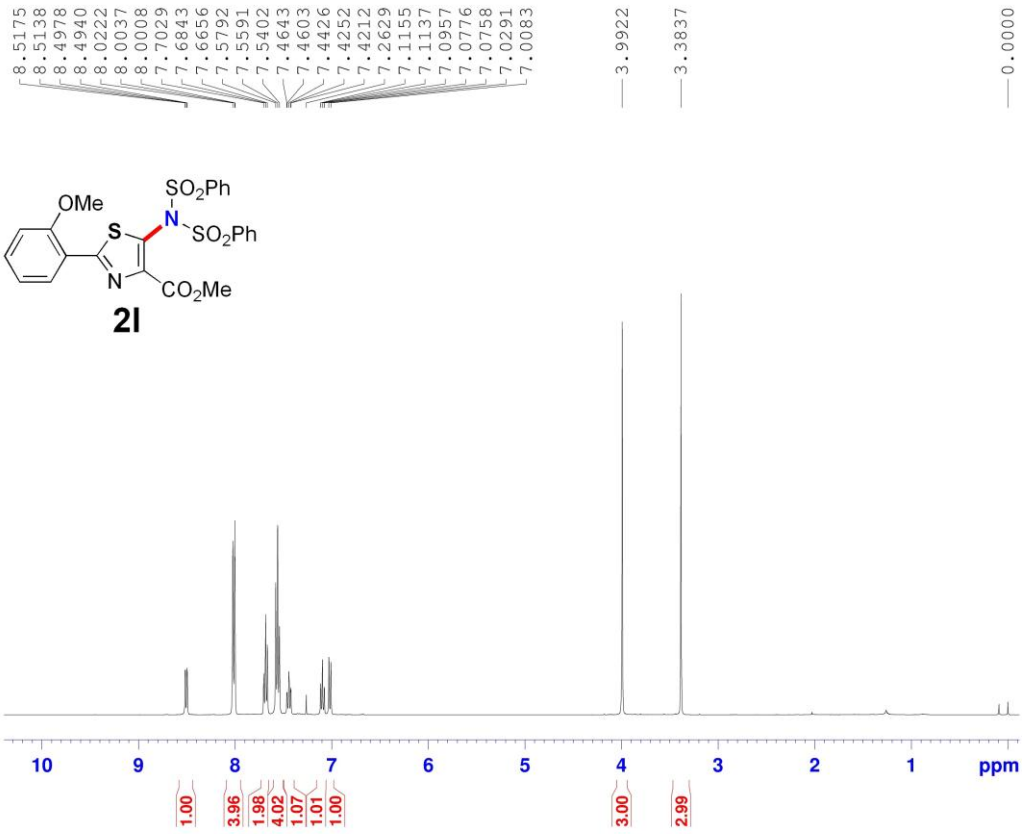

BRUKER
NAME CLJ-WL-M159
EXPNO 2
PROCNO 1
Date_ 20181119
Time 13.02
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 256
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6128011 MHz
WDW no
SSB 0
LB 0.00 Hz
GB 0
PC 1.40



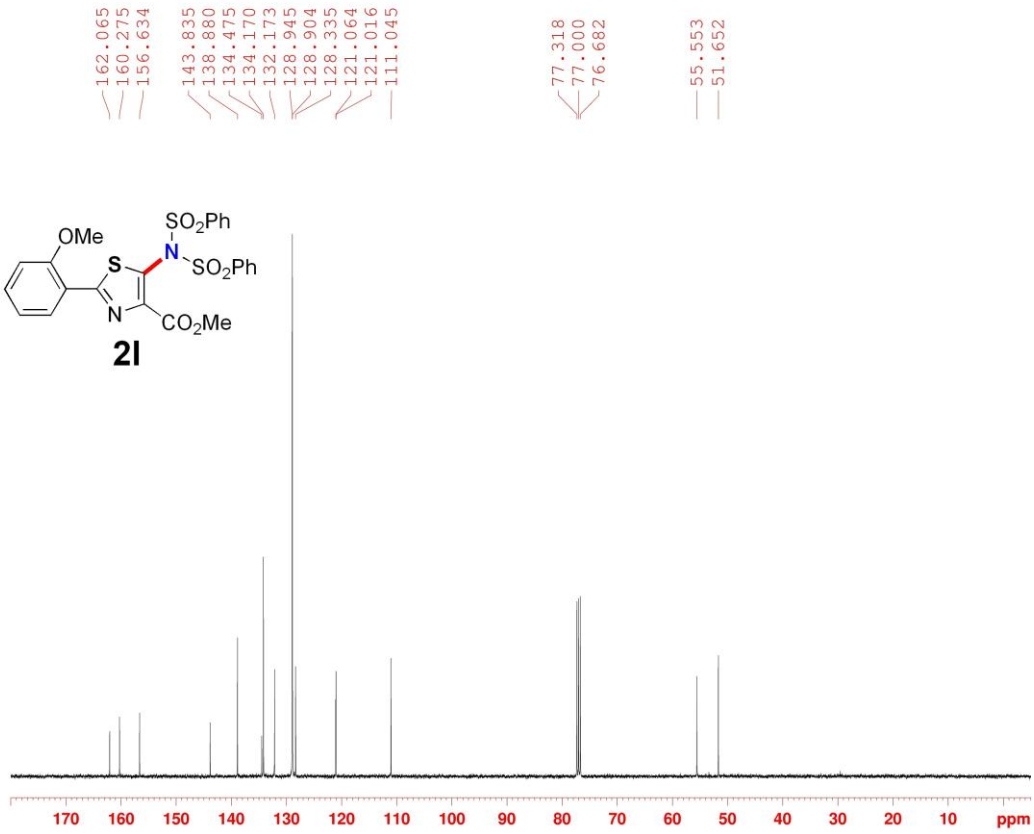

```
NAME            CLJ-WL-M213
EXPNO                     1
PROCNO                    1
Date_              20190108
Time                 14.19
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                      12
DS                       0
SWH               8012.820 Hz
FIDRES               0.122266 Hz
AQ                4.0894966 sec
RG                      23.9
DW                   62.400 usec
DE                    6.50 usec
TE                   300.1 K
D1                1.00000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1             400.1324710 MHz
NUC1                     1H
P1                    8.04 usec
SI                   65536
SF               400.1300085 MHz
WDW                     EM
SSB                      0
LB                    0.30 Hz
GB                       0
PC                    1.00
```



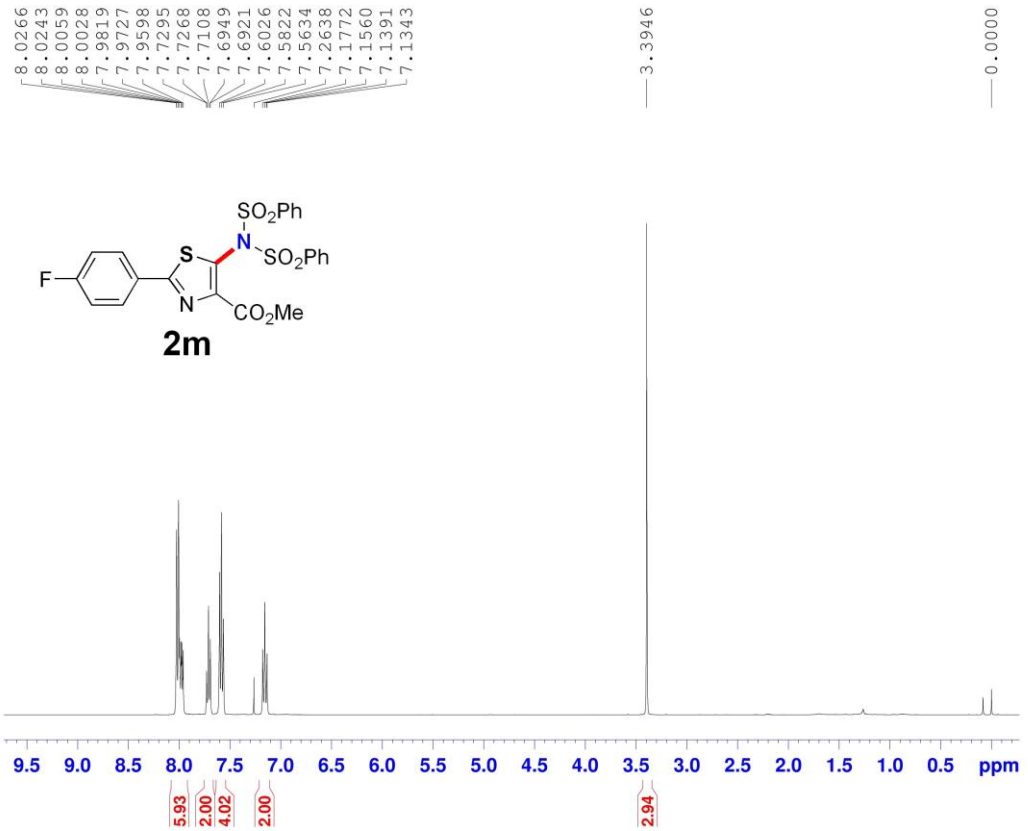

```
NAME            CLJ-WL-M213
EXPNO                     2
PROCNO                    1
Date_              20190108
Time                 14.30
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     200
DS                       0
SWH              24038.461 Hz
FIDRES               0.366798 Hz
AQ                1.3631988 sec
RG                     194.26
DW                   20.800 usec
DE                    6.50 usec
TE                   300.1 K
D1                2.00000000 sec
D11               0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1             100.6228293 MHz
NUC1                     13C
P1                    8.54 usec
SI                   32768
SF               100.6127783 MHz
WDW                     EM
SSB                      0
LB                    1.00 Hz
GB                       0
PC                    1.40
```


8.5175
8.5138
8.4978
8.4940
8.0222
8.0037
8.0008
7.7029
7.6843
7.6656
7.5792
7.5591
7.5402
7.4643
7.4603
7.4426
7.4252
7.4212
7.2629
7.1155
7.1137
7.0957
7.0776
7.0758
7.0291
7.0083
3.9922
3.3837
0.0000
OMe
S
N
SO2Ph
SO2Ph
CO2Me
2l
10
9
8
7
6
5
4
3
2
1
ppm
1.00
3.96
1.98
4.02
1.07
1.01
1.00
3.00
2.99

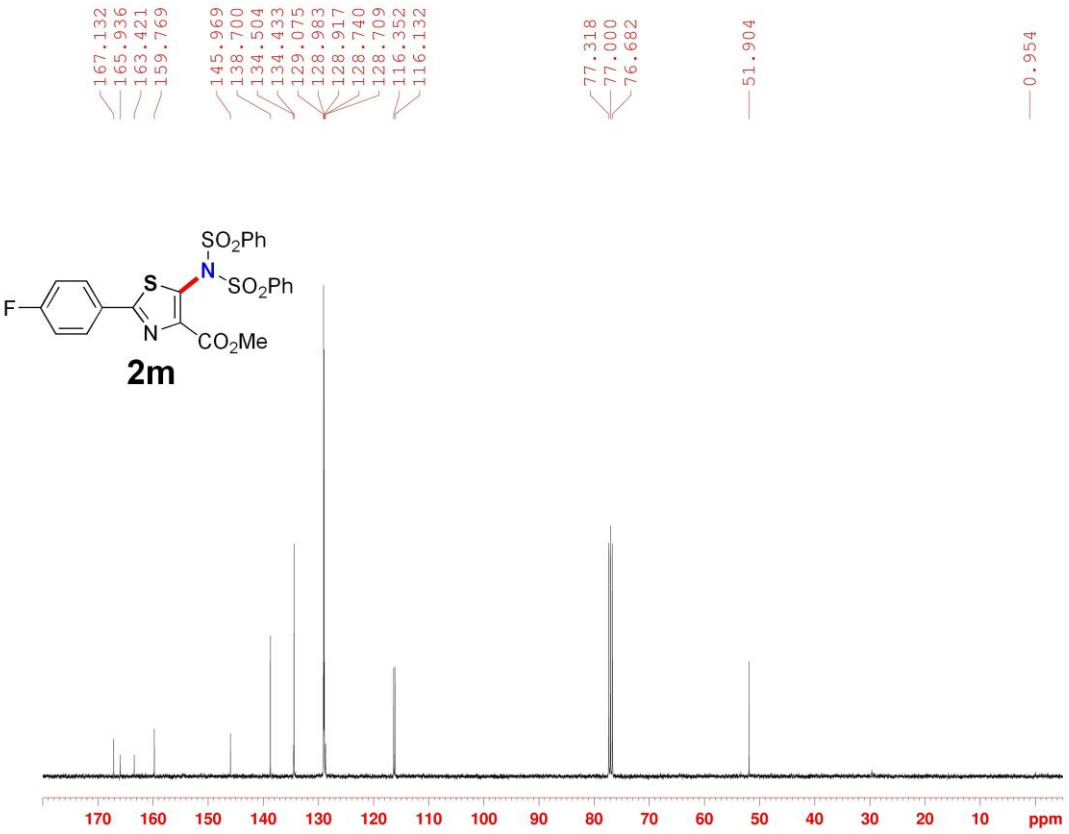

BRUKER
NAME CLJ-WL-M210
EXPNO 1
PROCNO 1
Date_ 20190109
Time 9.03
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDC13
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 21.11
DW 62.400
DE 6.50
TE 300.1
D1 1.00000000
TD0 1
======== CHANNEL f1 ======
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300083
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00


162.065
160.275
156.634
143.835
138.880
134.475
134.170
132.173
128.945
128.904
128.335
121.064
121.016
111.045
77.318
77.000
76.682
55.553
51.652
OMe
S
N
SO2Ph
SO2Ph
CO2Me
2l
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

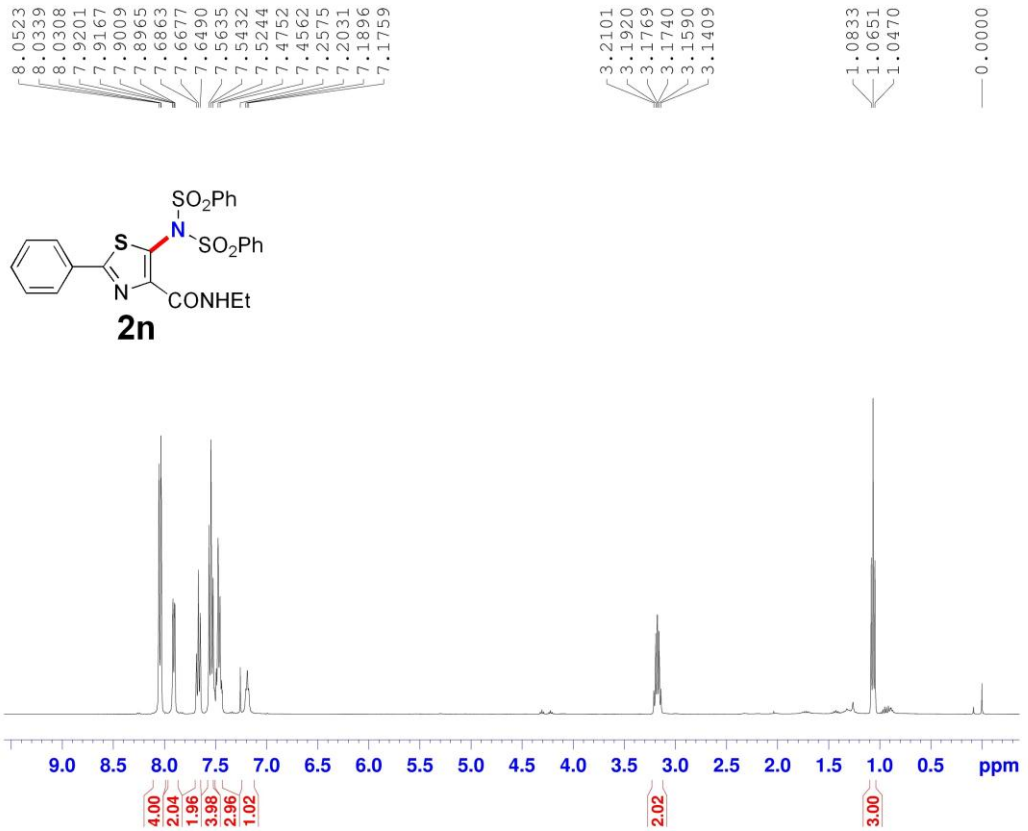

BRUKER
NAME CLJ-WL-M210
EXPNO 2
PROCNO 1
Date_ 20190109
Time 9.12
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDC13
NS 150
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127825 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40


8.0266
8.0243
8.0059
8.0028
7.9819
7.9727
7.9598
7.7295
7.7268
7.7108
7.6949
7.6921
7.6026
7.5822
7.5634
7.2638
7.1772
7.1560
7.1391
7.1343
3.3946
0.0000
SO2Ph
N
SO2Ph
S
F
N
CO2Me
2m
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm
5.93
2.00
4.02
2.00
2.94

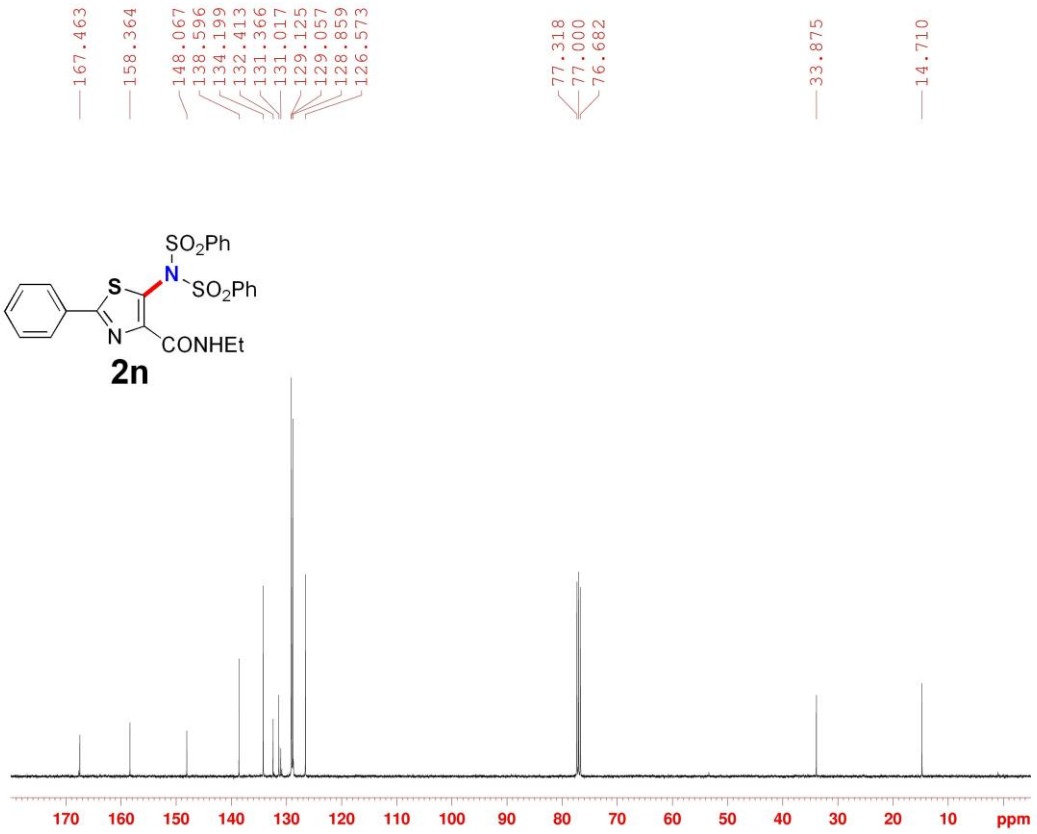

BRUKER
NAME CLJ-WL-M209
EXPNO 1
PROCNO 1
Date_ 20190109
Time 9.17
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 47.53
DW 62.400
DE 6.50
TE 300.1
D1 1.00000000
TD0 1
CHANNEL f1
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300079
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00


167.132
165.936
163.421
159.769
145.969
138.700
134.504
134.433
129.075
128.983
128.917
128.740
128.709
116.352
116.132
77.318
77.000
76.682
51.904
0.954
SO2Ph
N
SO2Ph
S
F
N
CO2Me
2m
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm

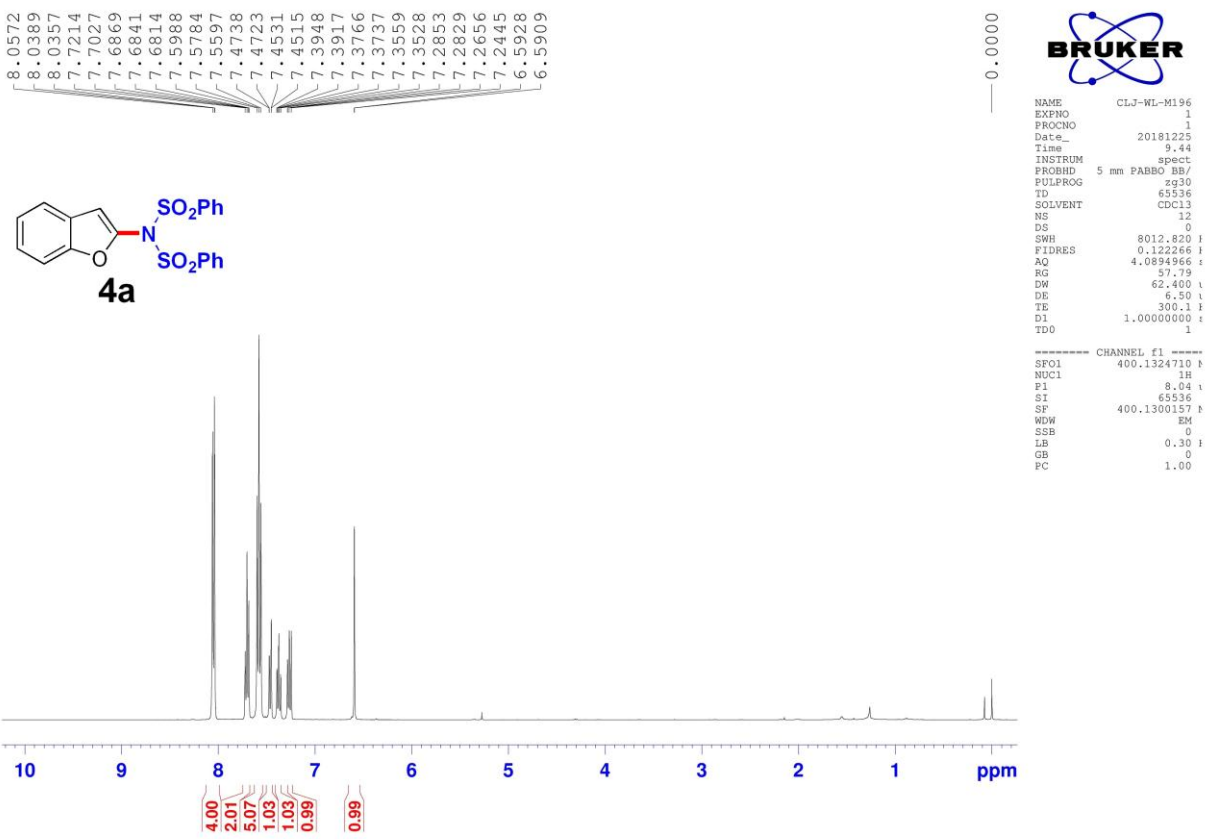

BRUKER
NAME CLJ-WL-M209
EXPNO 2
PROCNO 1
Date_ 20190109
Time 9.23
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 200
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127761 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

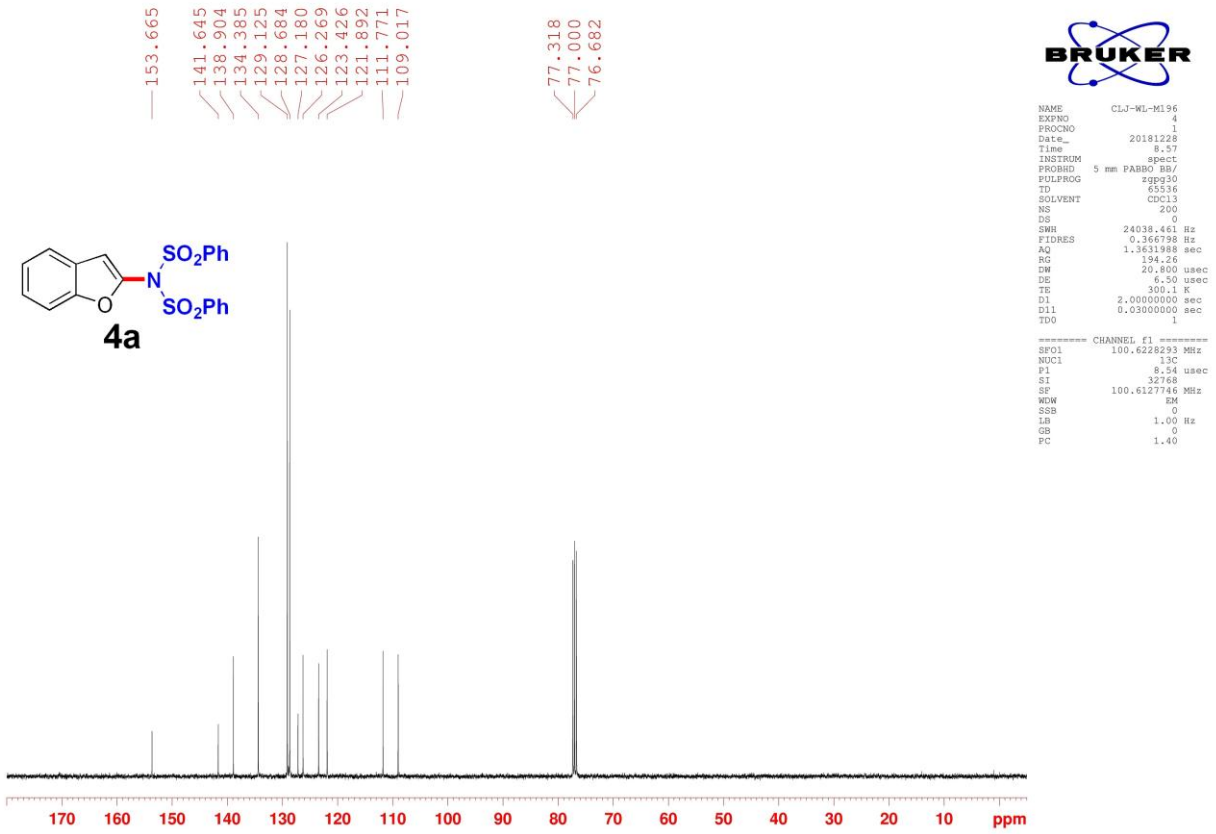

8.0523
8.0339
8.0308
7.9201
7.9167
7.9009
7.8965
7.6863
7.6677
7.6490
7.5635
7.5432
7.5244
7.4752
7.4562
7.2575
7.2031
7.1896
7.1759
3.2101
3.1920
3.1769
3.1740
3.1590
3.1409
1.0833
1.0651
1.0470
0.0000
SO2Ph
N
SO2Ph
S
N
CONHEt
2n
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm
4.00
2.04
1.96
3.98
2.96
1.02
2.02
3.00

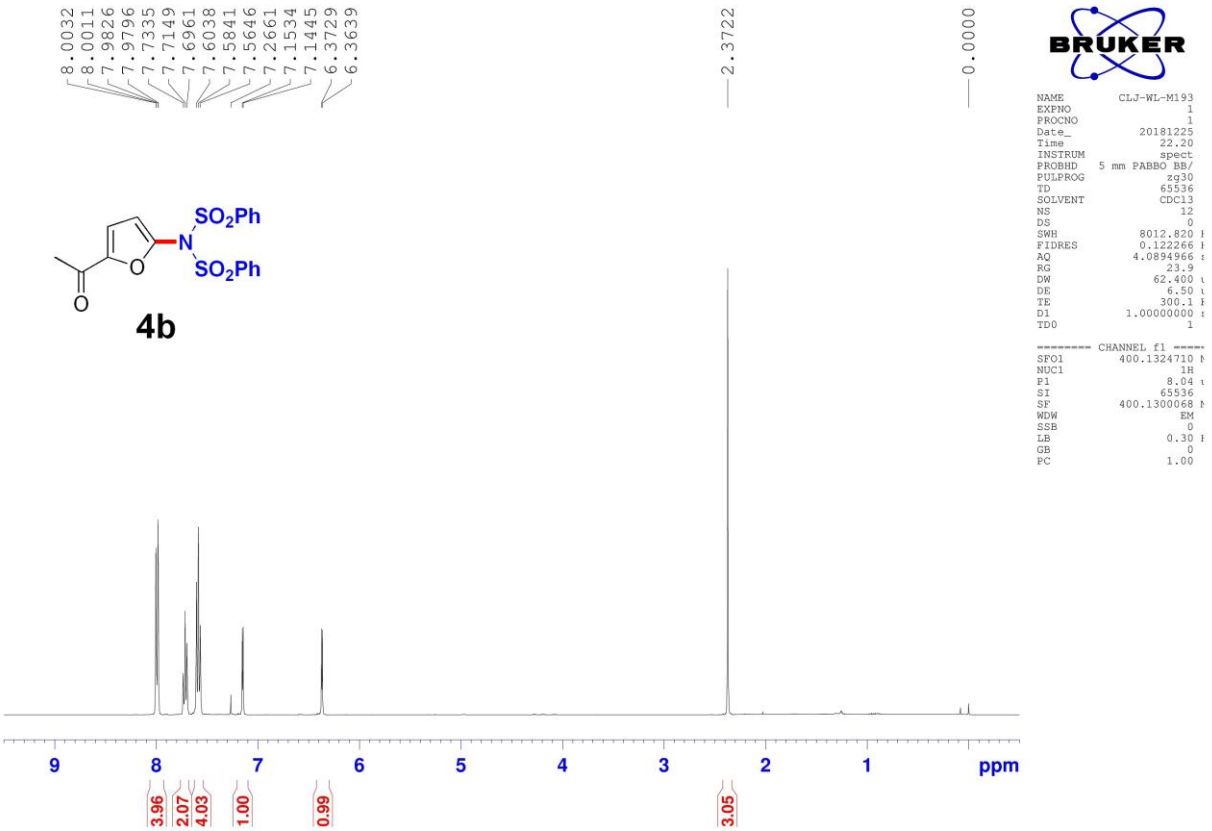

BRUKER
NAME CLJ-WL-M176
EXPNO 1
PROCNO 1
Date_ 20181209
Time 15.02
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 23.9
DW 62.400
DE 6.50
TE 300.1
D1 1.00000000
TD0 1
======== CHANNEL f1 ======
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300106
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00


167.463
158.364
148.067
138.596
134.199
132.413
131.366
131.017
129.125
129.057
128.859
126.573
77.318
77.000
76.682
33.875
14.710
SO2Ph
N
SO2Ph
S
N
CONHEt
2n
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm

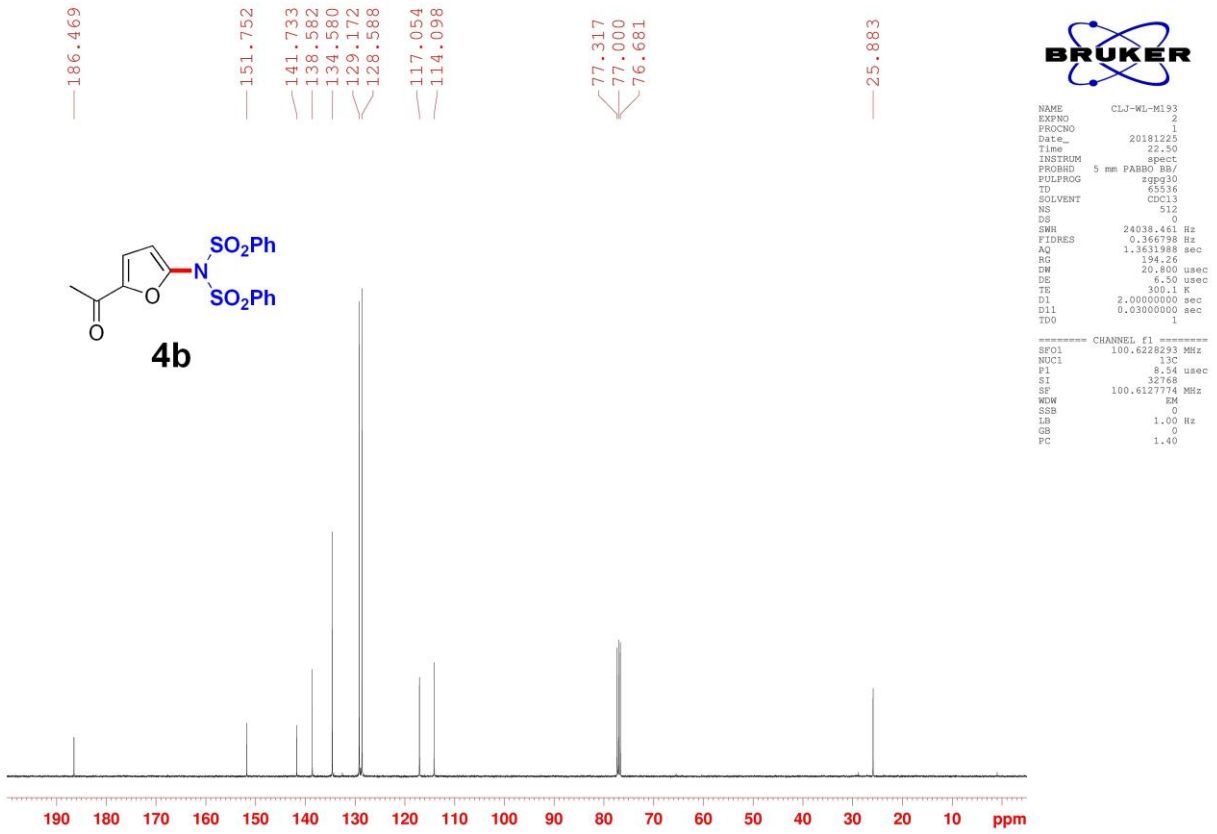

BRUKER
NAME CLJ-WL-M176
EXPNO 2
PROCNO 1
Date_ 20181209
Time 15.22
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 339
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127776 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40


8.0572
8.0389
8.0357
7.7214
7.7027
7.6869
7.6841
7.6814
7.5988
7.5784
7.5597
7.4738
7.4723
7.4531
7.4515
7.3948
7.3917
7.3766
7.3737
7.3559
7.3528
7.2853
7.2829
7.2656
7.2445
6.5928
6.5909
0.0000
SO2Ph
N
SO2Ph
O
4a
10
9
8
7
6
5
4
3
2
1
ppm
4.00
2.01
5.07
1.03
1.03
0.99
0.99
BRUKER
NAME CLJ-WL-M196
EXPNO 1
PROCNO 1
Date_ 20181225
Time 9.44
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDC13
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 57.79
DW 62.400
DE 6.50
TE 300.1
D1 1.00000000
TD0 1
CHANNEL f1
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300157
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00

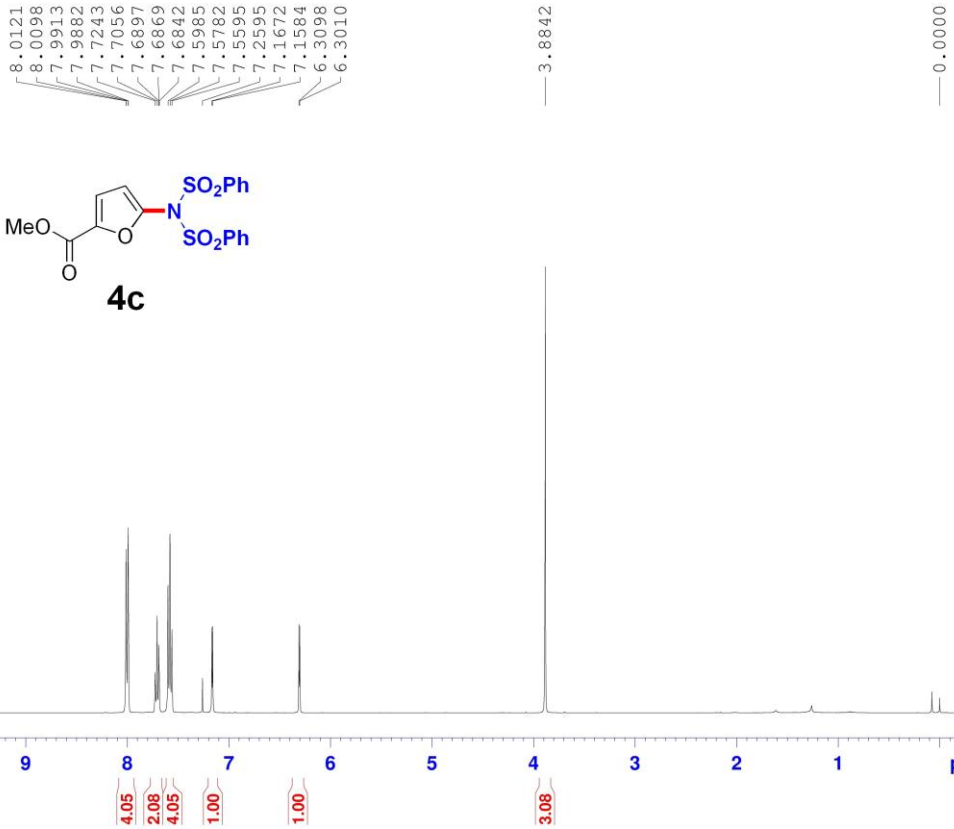

153.665
141.645
138.904
134.385
129.125
128.684
127.180
126.269
123.426
121.892
111.771
109.017
77.318
77.000
76.682
SO2Ph
N
SO2Ph
O
4a
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm
BRUKER
NAME CLJ-WL-M196
EXPNO 4
PROCNO 1
Date_ 20181228
Time 8.57
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDC13
NS 200
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127746 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

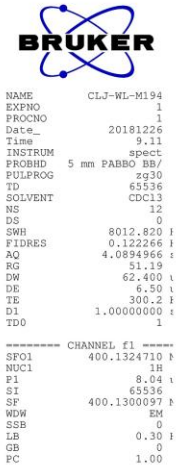


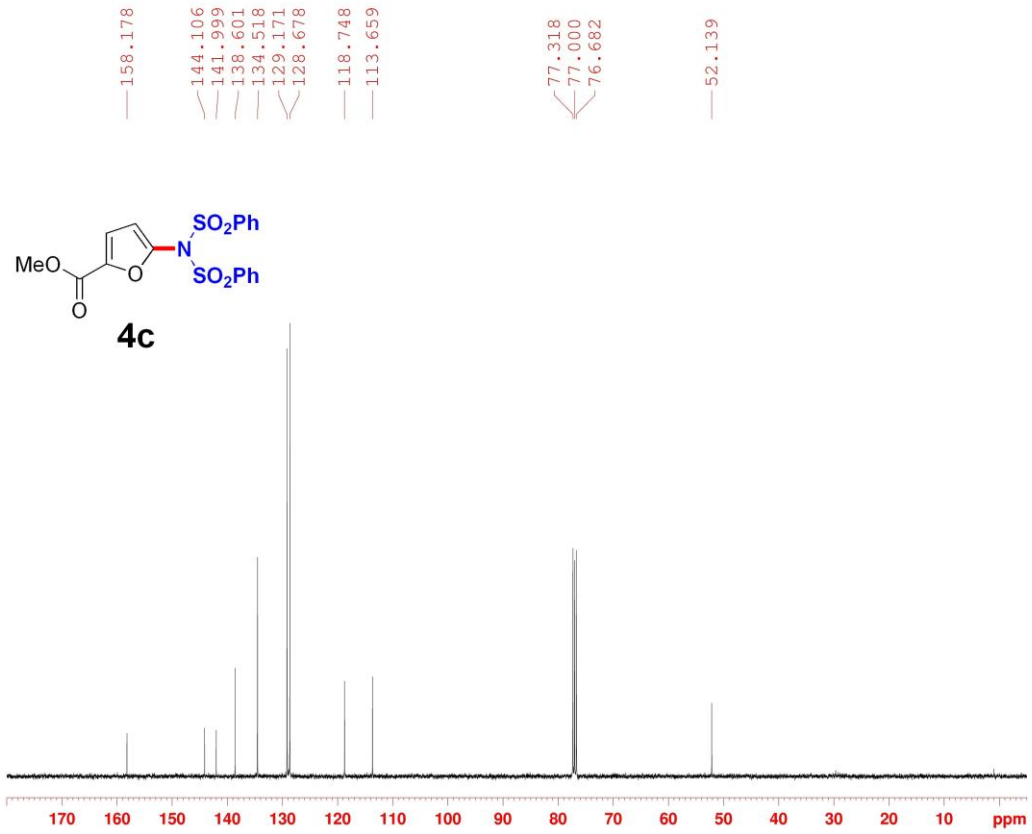

```
NAME            CLJ-WL-M193
EXPNO                     1
PROCNO                    1
Date_            20181225
Time                 22.20
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG              zg30
TD                  65536
SOLVENT             CDCl3
NS                     12
DS                      0
SWH              8012.820 Hz
FIDRES           0.122266 Hz
AQ               4.0894966 sec
RG                   23.9
DW                  62.400 usec
DE                   6.50 usec
TE                  300.1 K
D1               1.00000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1            400.1324710 MHz
NUC1                    1H
P1                    8.04 usec
SI                   65536
SF              400.1300068 MHz
WDW                    EM
SSB                     0
LB                   0.30 Hz
GB                      0
PC                   1.00
```



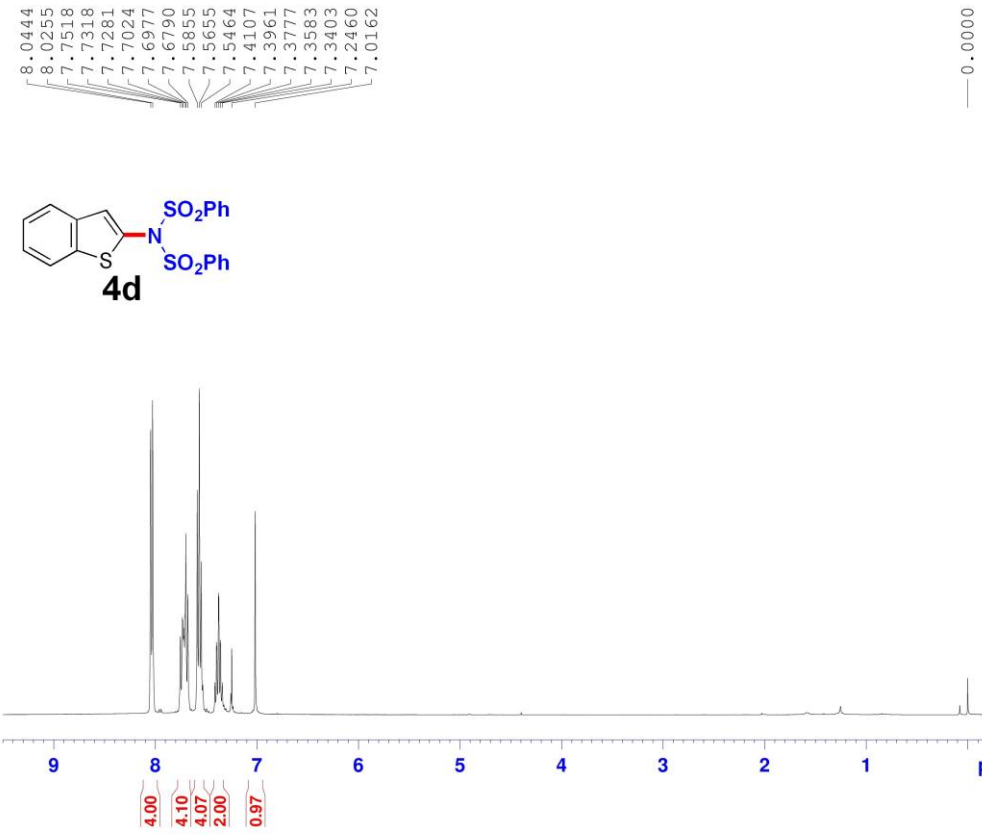

```
NAME            CLJ-WL-M193
EXPNO                     2
PROCNO                    1
Date_            20181225
Time                 22.50
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG           zgpg30
TD                  65536
SOLVENT             CDCl3
NS                    512
DS                      0
SWH             24038.461 Hz
FIDRES           0.366798 Hz
AQ               1.3631988 sec
RG                  194.26
DW                  20.800 usec
DE                   6.50 usec
TE                  300.1 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1            100.6228293 MHz
NUC1                    13C
P1                    8.54 usec
SI                   32768
SF              100.6127774 MHz
WDW                    EM
SSB                     0
LB                   1.00 Hz
GB                      0
PC                   1.40
```


8.0121
8.0098
7.9913
7.9882
7.7243
7.7056
7.6897
7.6869
7.6842
7.5985
7.5782
7.5595
7.2595
7.1672
7.1584
6.3098
6.3010
3.8842
0.0000
MeO
O
N
SO2Ph
SO2Ph
4c
9
8
7
6
5
4
3
2
1
ppm
4.05
2.08
4.05
1.00
1.00
3.08


BRUKER
NAME CLJ-WL-M194
EXPNO 1
PROCNO 1
Date_ 20181226
Time 9.11
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 51.19
DW 62.400
DE 6.50
TE 300.2
D1 1.00000000
TD0 1
CHANNEL f1
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300097
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00

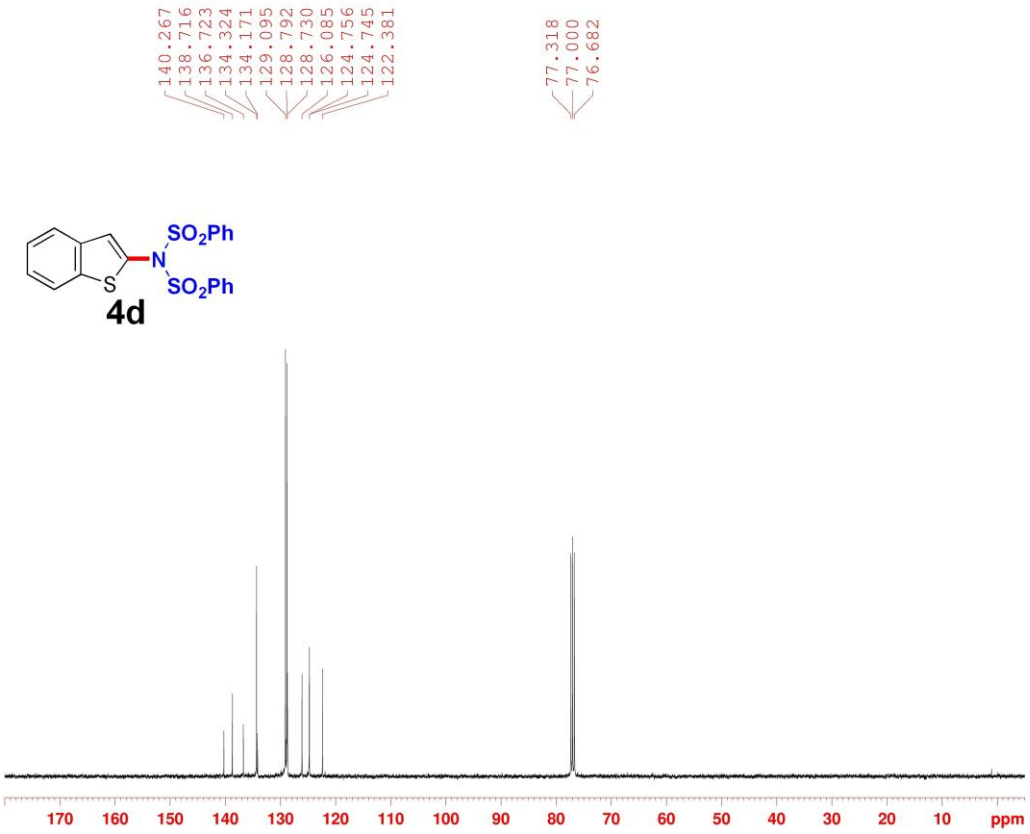

158.178
144.106
141.999
138.601
134.518
129.171
128.678
118.748
113.659
77.318
77.000
76.682
52.139
MeO
O
N
SO2Ph
SO2Ph
4c
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm


BRUKER
NAME CLJ-WL-M194
EXPNO 2
PROCNO 1
Date_ 20181226
Time 9.14
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 154
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127742 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



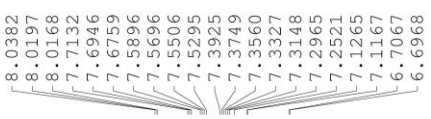
BRUKER

```
NAME            CLJ-WL-M255
EXPNO                     1
PROCNO                    1
Date_              20190310
Time                   4.53
INSTRUM               spect
PROBHD    5 mm PABBO BB/
PULPROG                zg30
TD                    65536
SOLVENT               CDC13
NS                        8
DS                        0
SWH                8012.820
FIDRES             0.122266
AQ                 4.0894966
RG                    70.36
DW                    62.400
DE                      6.50
TE                     300.7
D1                 1.00000000
TD0                       1

======== CHANNEL f1 =======
SFO1              400.1324710
NUC1                      1H
P1                      8.04
SI                     65536
SF                400.1300150
WDW                       EM
SSB                        0
LB                      0.30
GB                         0
PC                      1.00
```



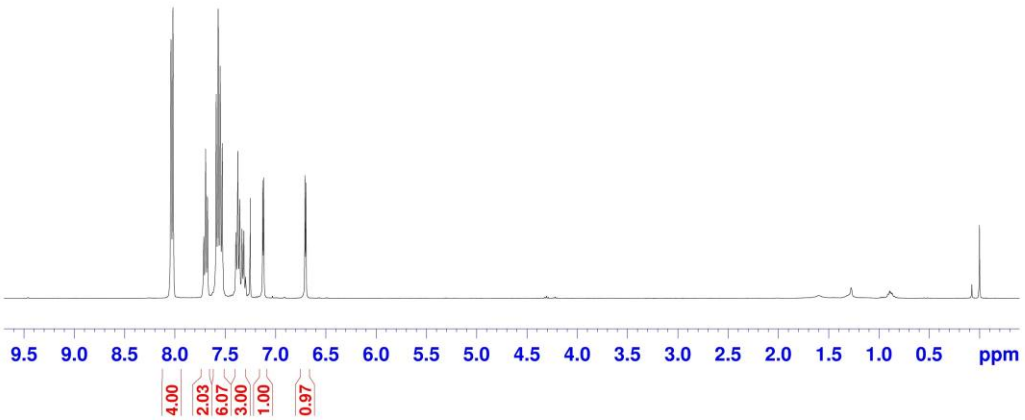
BRUKER

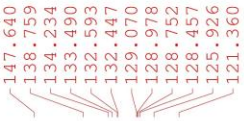
```
NAME            CLJ-WL-M255
EXPNO                     2
PROCNO                    1
Date_              20190310
Time                   5.23
INSTRUM               spect
PROBHD    5 mm PABBO BB/
PULPROG             zgpg30
TD                    65536
SOLVENT               CDC13
NS                      512
DS                        0
SWH               24038.461 Hz
FIDRES             0.366798 Hz
AQ                 1.3631988 sec
RG                    194.26
DW                   20.800 usec
DE                      6.50 usec
TE                     300.6 K
D1                 2.00000000 sec
D11                0.03000000 sec
TD0                       1

======== CHANNEL f1 =======
SFO1              100.6228293 MHz
NUC1                      13C
P1                     8.54 usec
SI                     32768
SF                100.6127739 MHz
WDW                       EM
SSB                        0
LB                      1.00 Hz
GB                         0
PC                      1.40
```


8.0382
8.0197
8.0168
7.7132
7.6946
7.6759
7.5896
7.5696
7.5506
7.5295
7.3925
7.3749
7.3560
7.3327
7.3148
7.2965
7.2521
7.1265
7.1167
7.7067
6.6968


SO2Ph
N
SO2Ph
Ph
S

4e

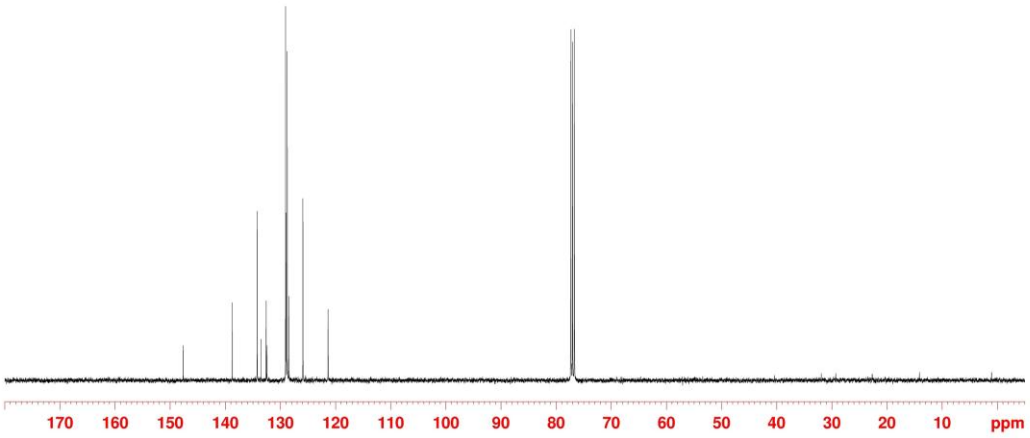

9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm
4.00
2.03
6.07
3.00
1.00
0.97

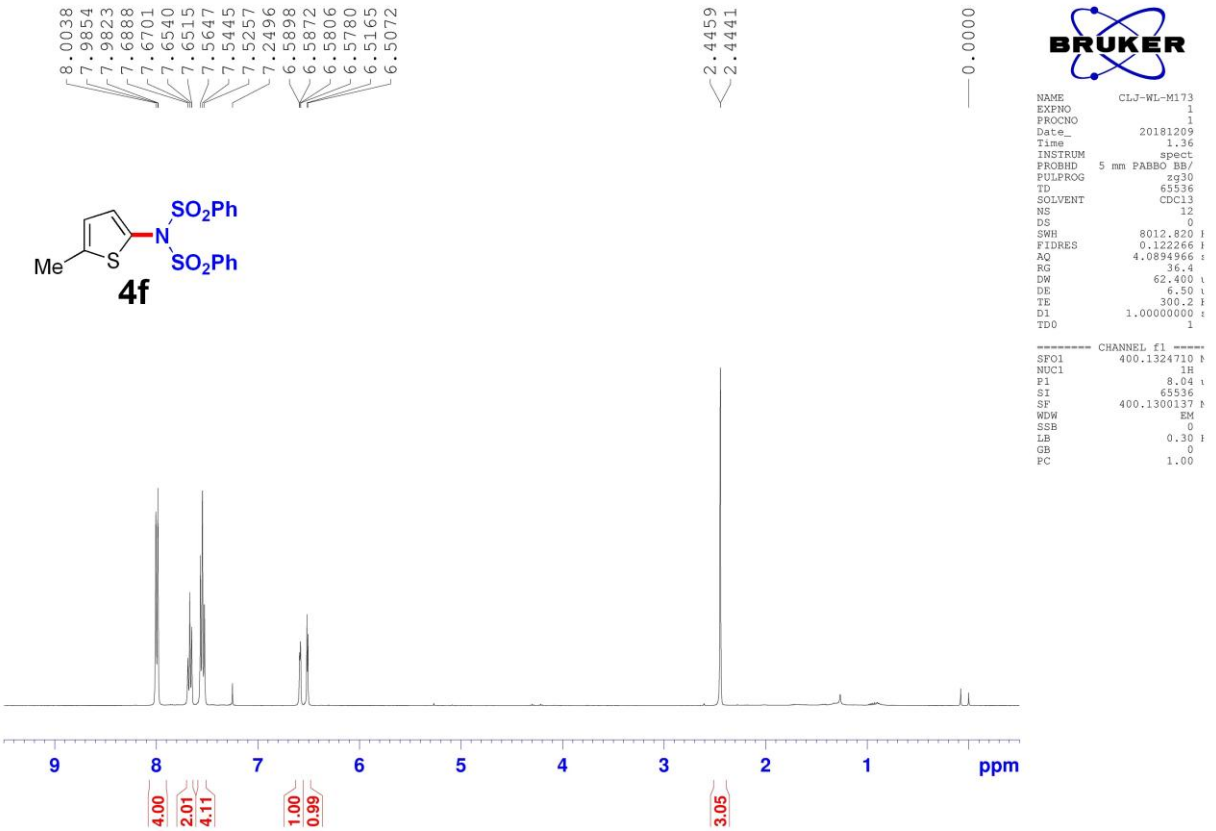

147.640
138.759
134.234
133.490
132.593
132.447
129.070
128.978
128.752
128.457
125.926
121.360

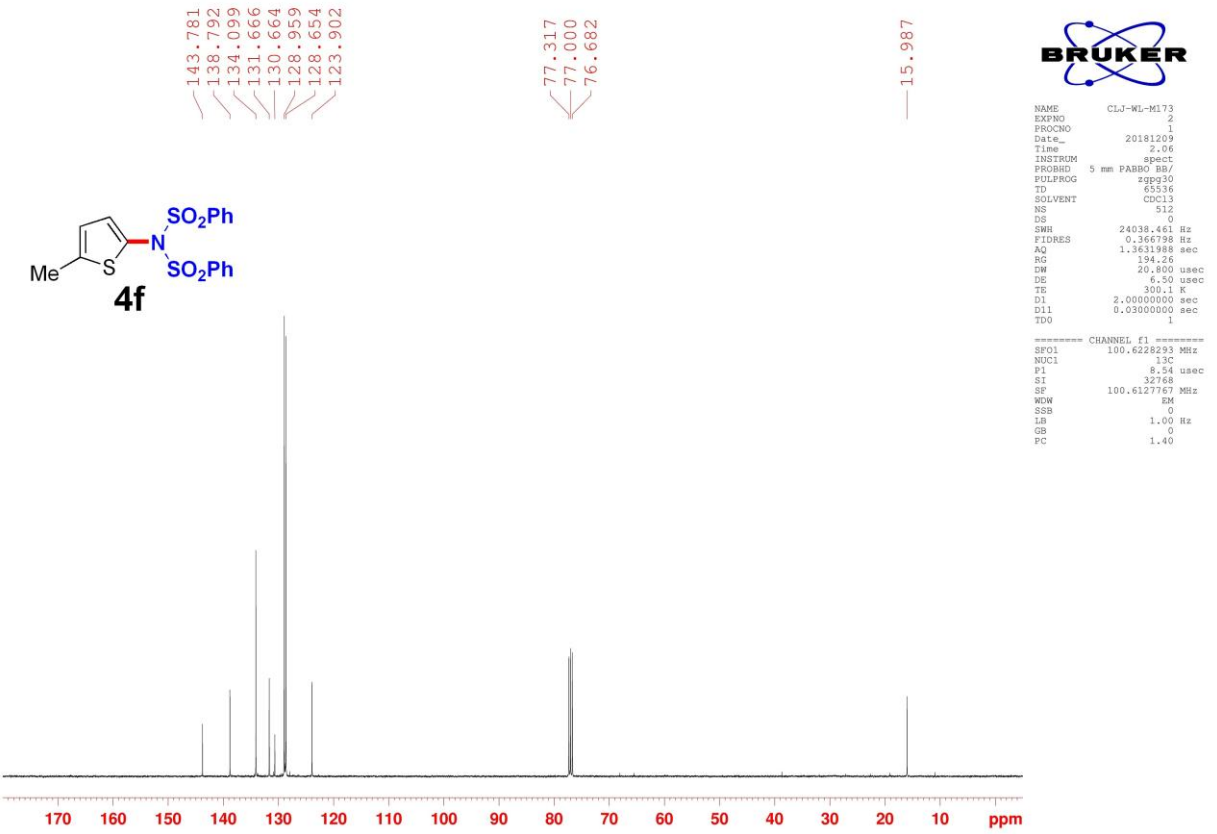
77.317
77.000
76.682

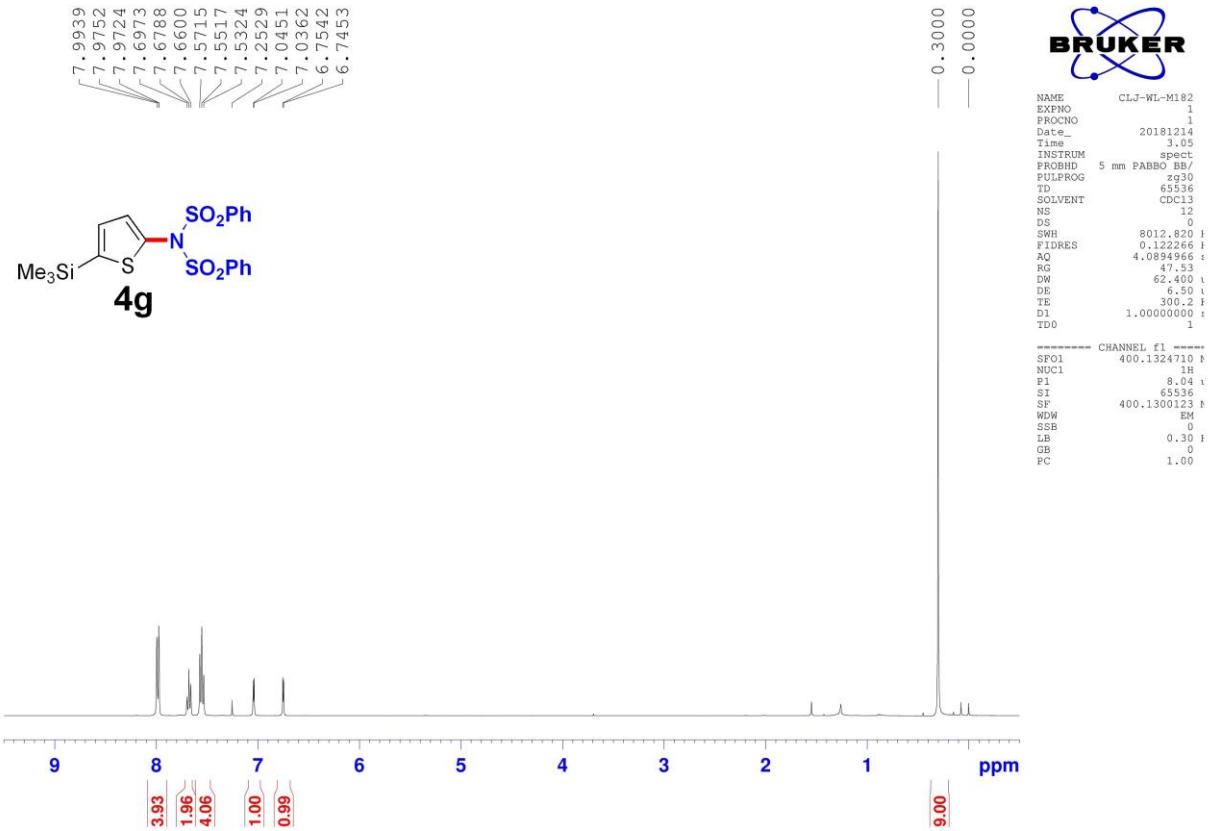

SO2Ph
N
SO2Ph
Ph
S

4e

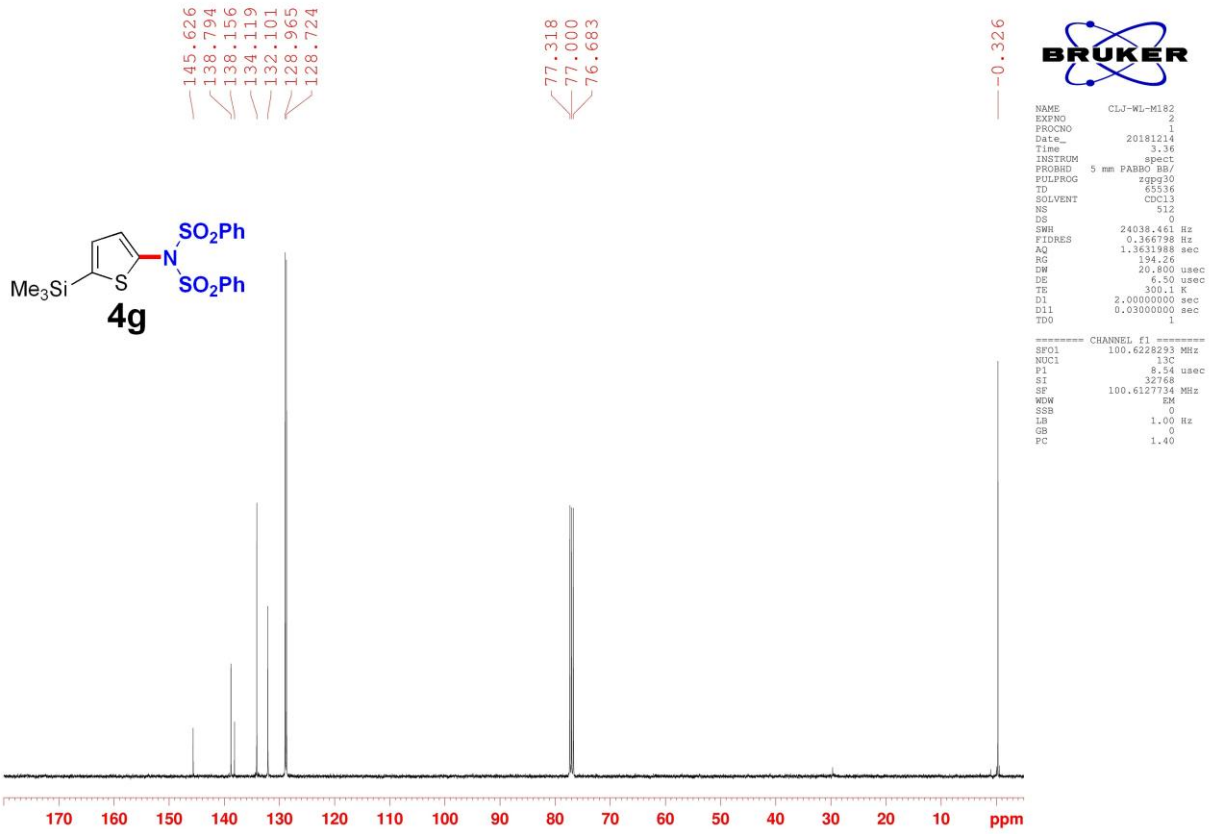

170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm


8.0038
7.9854
7.9823
7.6888
7.6701
7.6540
7.6515
7.5647
7.5445
7.5257
7.2496
6.5898
6.5872
6.5806
6.5780
6.5165
6.5072
2.4459
2.4441
0.0000
SO2Ph
N
SO2Ph
Me
S
4f
BRUKER
NAME CLJ-WL-M173
EXPNO 1
PROCNO 1
Date_ 20181209
Time 1.36
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 36.4
DW 62.400
DE 6.50
TE 300.2
D1 1.00000000
TD0 1
CHANNEL f1
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300137
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00
9
8
7
6
5
4
3
2
1
ppm
4.00
2.01
4.11
1.00
0.99
3.05

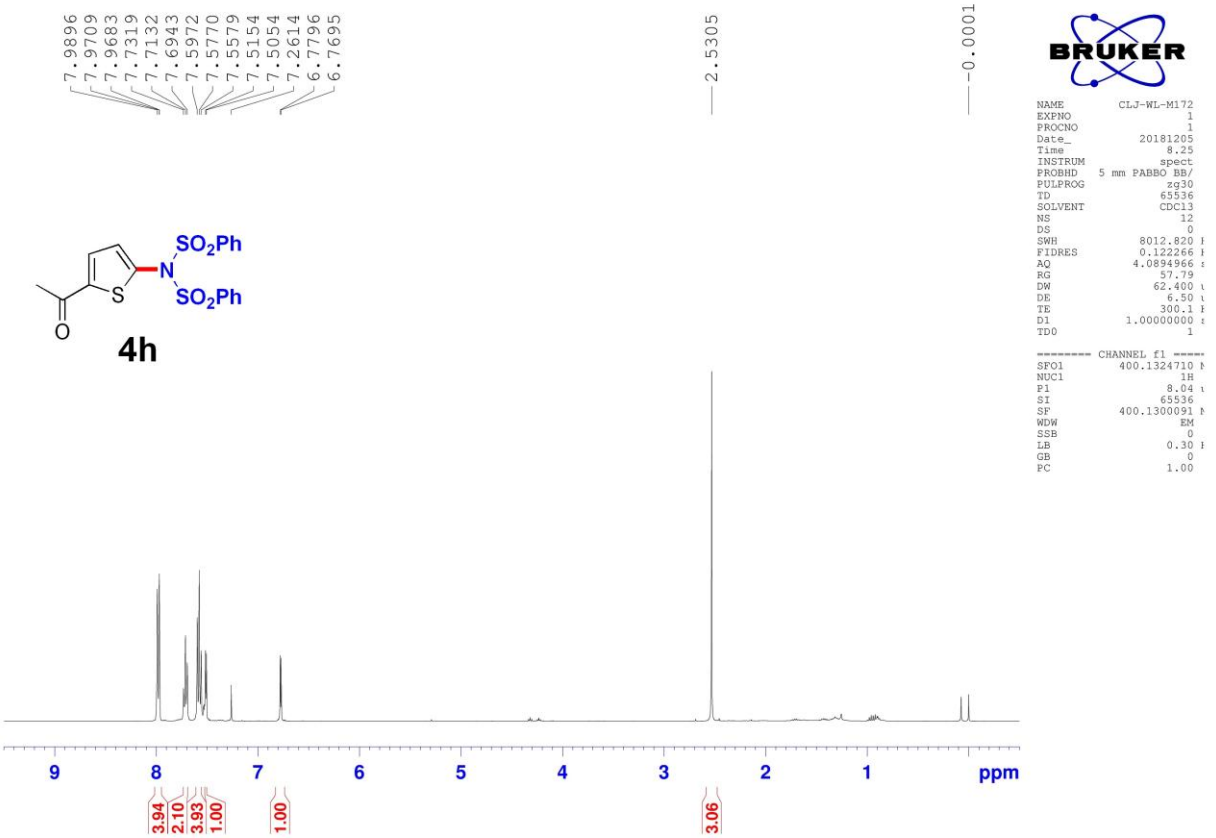

143.781
138.792
134.099
131.666
130.664
128.959
128.654
123.902
77.317
77.000
76.682
15.987
SO2Ph
N
SO2Ph
Me
S
4f
BRUKER
NAME CLJ-WL-M173
EXPNO 2
PROCNO 1
Date_ 20181209
Time 2.06
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127767 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm



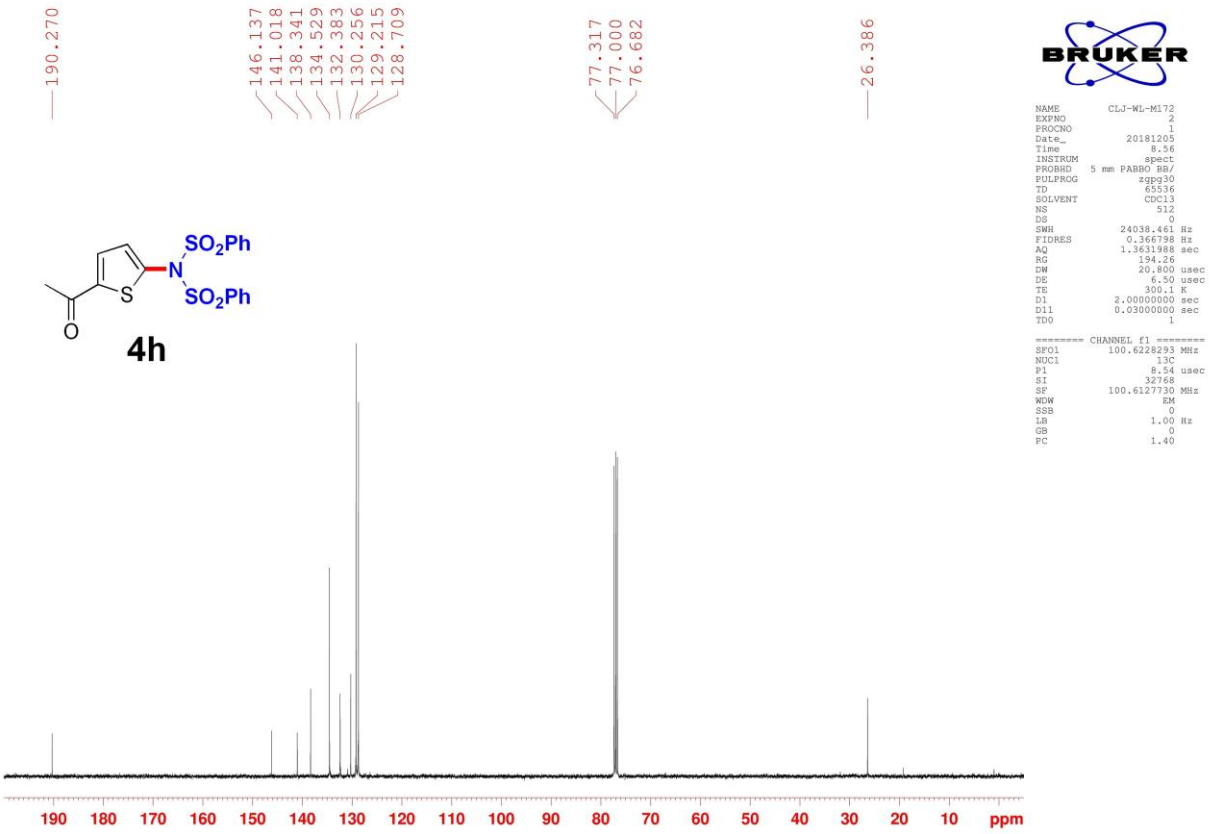

```
NAME            CLJ-WL-M182
EXPNO                     1
PROCNO                    1
Date_            20181214
Time                  3.05
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                      12
DS                       0
SWH              8012.820 H
FIDRES           0.122266 H
AQ               4.0894966 s
RG                   47.53
DW                  62.400 u
DE                    6.50 u
TE                  300.2 K
D1               1.00000000 s
TD0                      1

======== CHANNEL f1 =======
SFO1            400.1324710 M
NUC1                    1H
P1                    8.04 u
SI                   65536
SF              400.1300123 M
WDW                     EM
SSB                      0
LB                    0.30 H
GB                       0
PC                    1.00
```



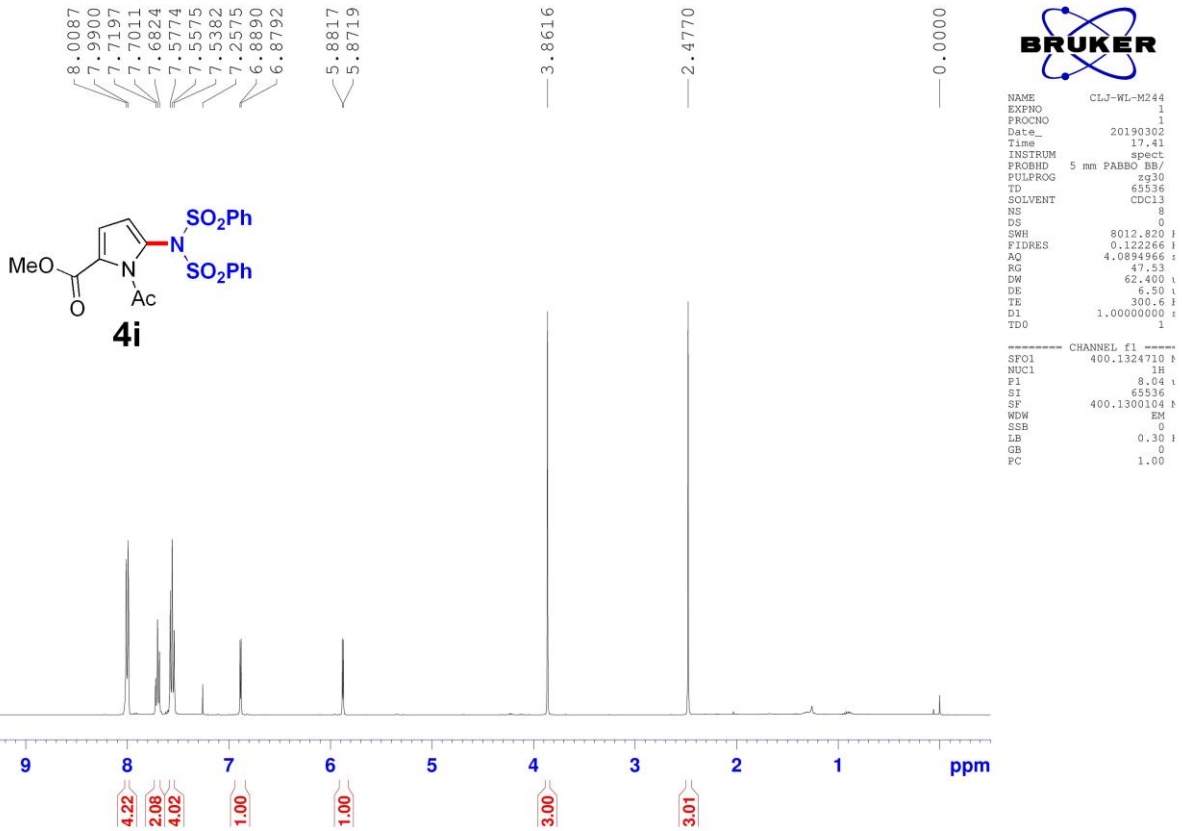

```
NAME            CLJ-WL-M182
EXPNO                     2
PROCNO                    1
Date_            20181214
Time                  3.36
INSTRUM              spect
PROBHD   5 mm PABBO BB/
PULPROG             zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     512
DS                       0
SWH             24038.461 Hz
FIDRES           0.366798 Hz
AQ               1.3631988 sec
RG                  194.26
DW                 20.800 usec
DE                  6.50 usec
TE                  300.1 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                      1

======== CHANNEL f1 =======
SFO1            100.6228293 MHz
NUC1                    13C
P1                   8.54 usec
SI                   32768
SF              100.6127734 MHz
WDW                     EM
SSB                      0
LB                    1.00 Hz
GB                       0
PC                    1.40
```


7.9896
7.9709
7.9683
7.7319
7.7132
7.6943
7.5972
7.5770
7.5579
7.5154
7.5054
7.2614
6.7796
6.7695
2.5305
0.0001
SO2Ph
N
SO2Ph
S
O
4h
9
8
7
6
5
4
3
2
1
ppm
3.94
2.10
3.93
1.00
1.00
3.06

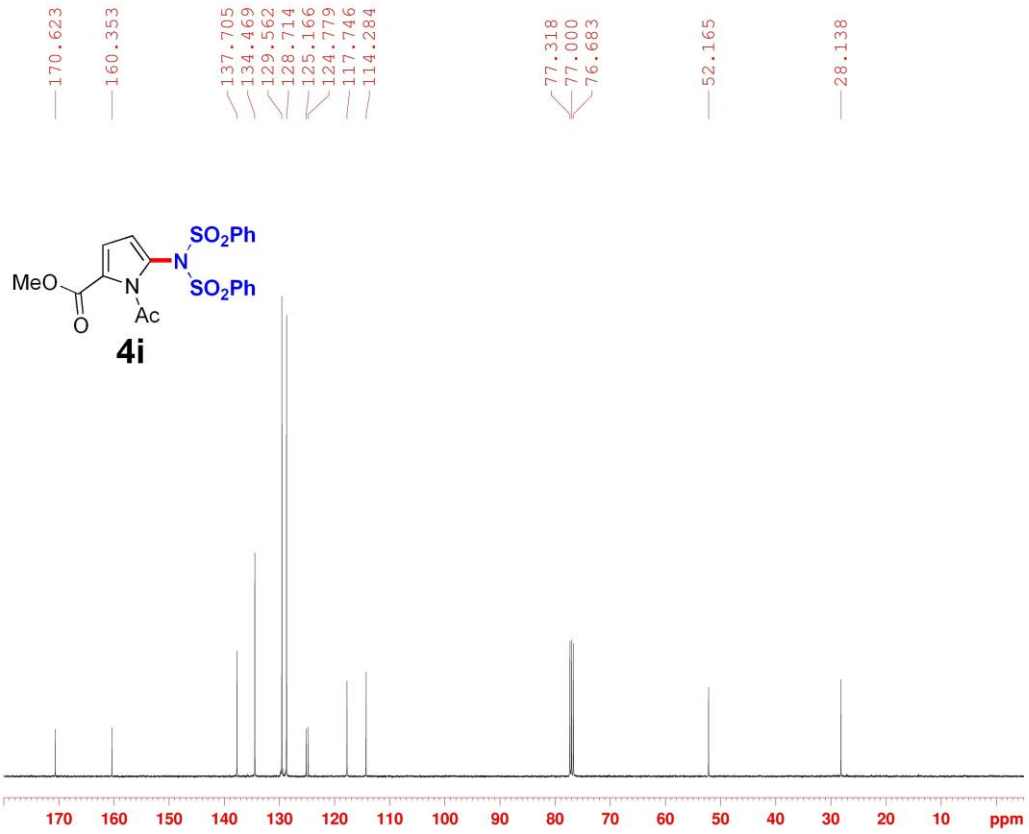
BRUKER
NAME CLJ-WL-M172
EXPNO 1
PROCNO 1
Date_ 20181205
Time 8.25
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 12
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 57.79
DW 62.400
DE 6.50
TE 300.1
D1 1.00000000
TD0 1
======== CHANNEL f1 ======
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300091
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00


190.270
146.137
141.018
138.341
134.529
132.383
130.256
129.215
128.709
77.317
77.000
76.682
26.386
SO2Ph
N
SO2Ph
S
O
4h
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

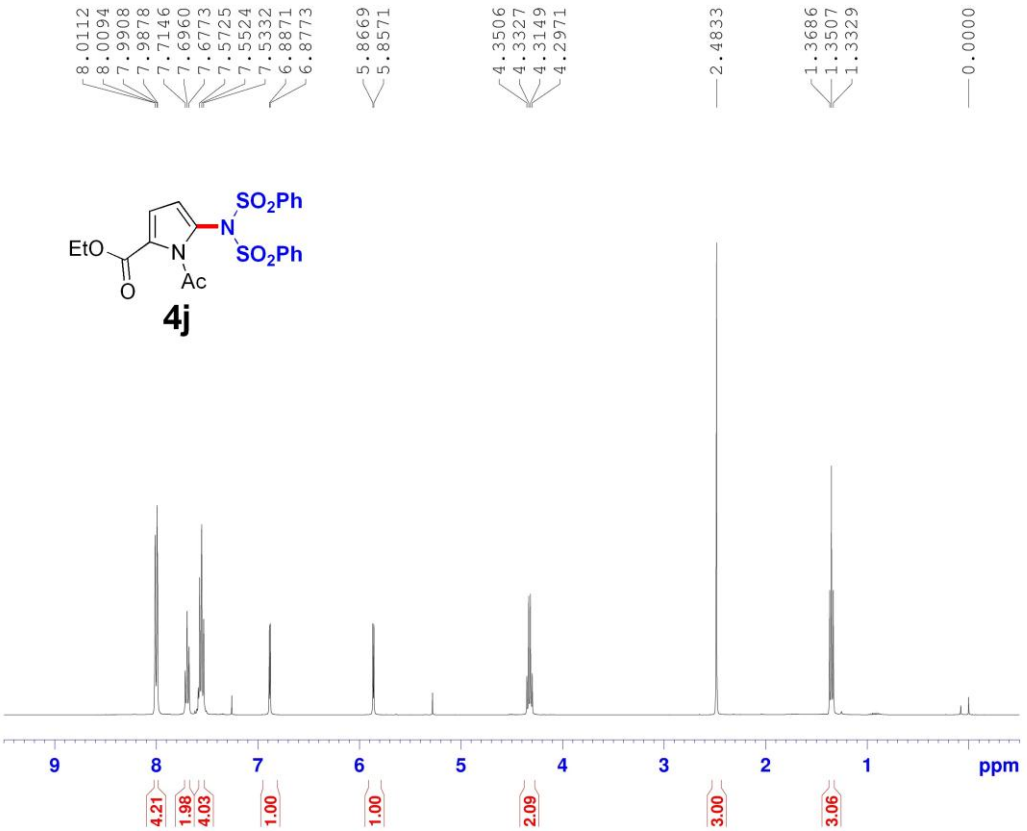
BRUKER
NAME CLJ-WL-M172
EXPNO 2
PROCNO 1
Date_ 20181205
Time 8.56
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127730 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40


8.0087
7.9900
7.7197
7.7011
7.6824
7.5774
7.5575
7.5382
7.2575
6.8890
6.8792
5.8817
5.8719
3.8616
2.4770
0.0000
MeO
N
Ac
O
SO2Ph
N
SO2Ph
4i
9
8
7
6
5
4
3
2
1
ppm
4.22
2.08
4.02
1.00
1.00
3.00
3.01

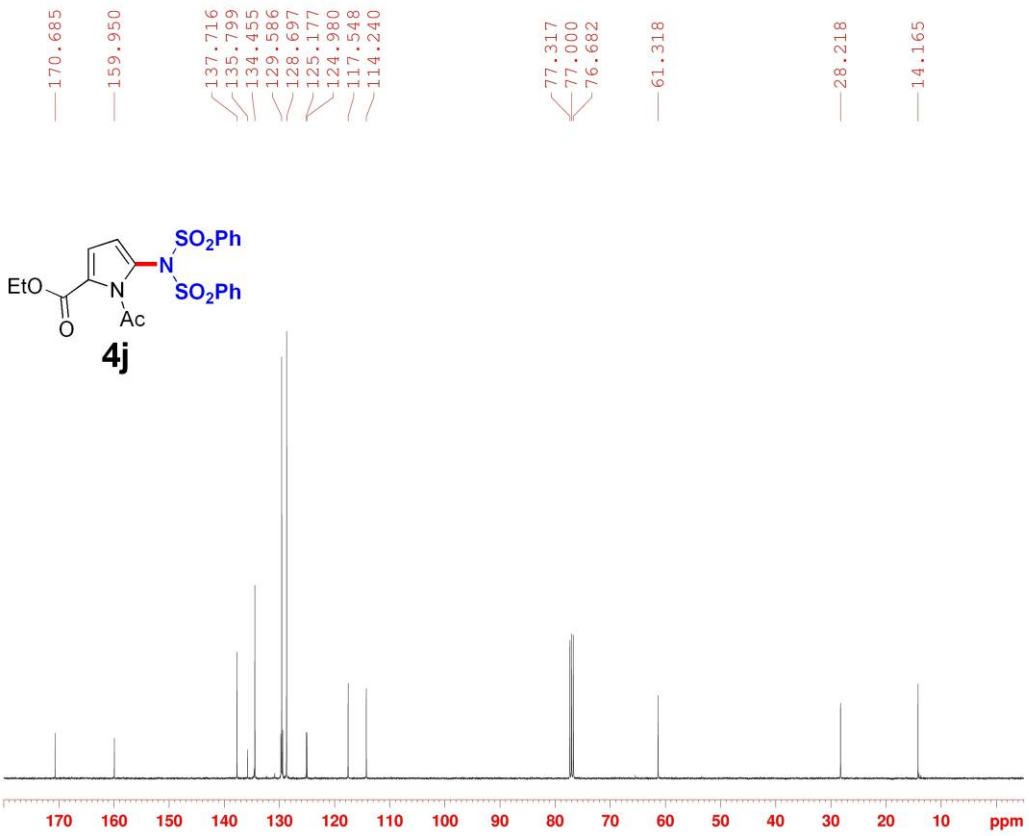
BRUKER
NAME CLJ-WL-M244
EXPNO 1
PROCNO 1
Date_ 20190302
Time 17.41
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 47.53
DW 62.400
DE 6.50
TE 300.6
D1 1.00000000
TD0 1
======== CHANNEL f1 ========
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300104
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00


170.623
160.353
137.705
134.469
129.562
128.714
125.166
124.779
117.746
114.284
77.318
77.000
76.683
52.165
28.138
MeO
N
Ac
O
SO2Ph
N
SO2Ph
4i
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

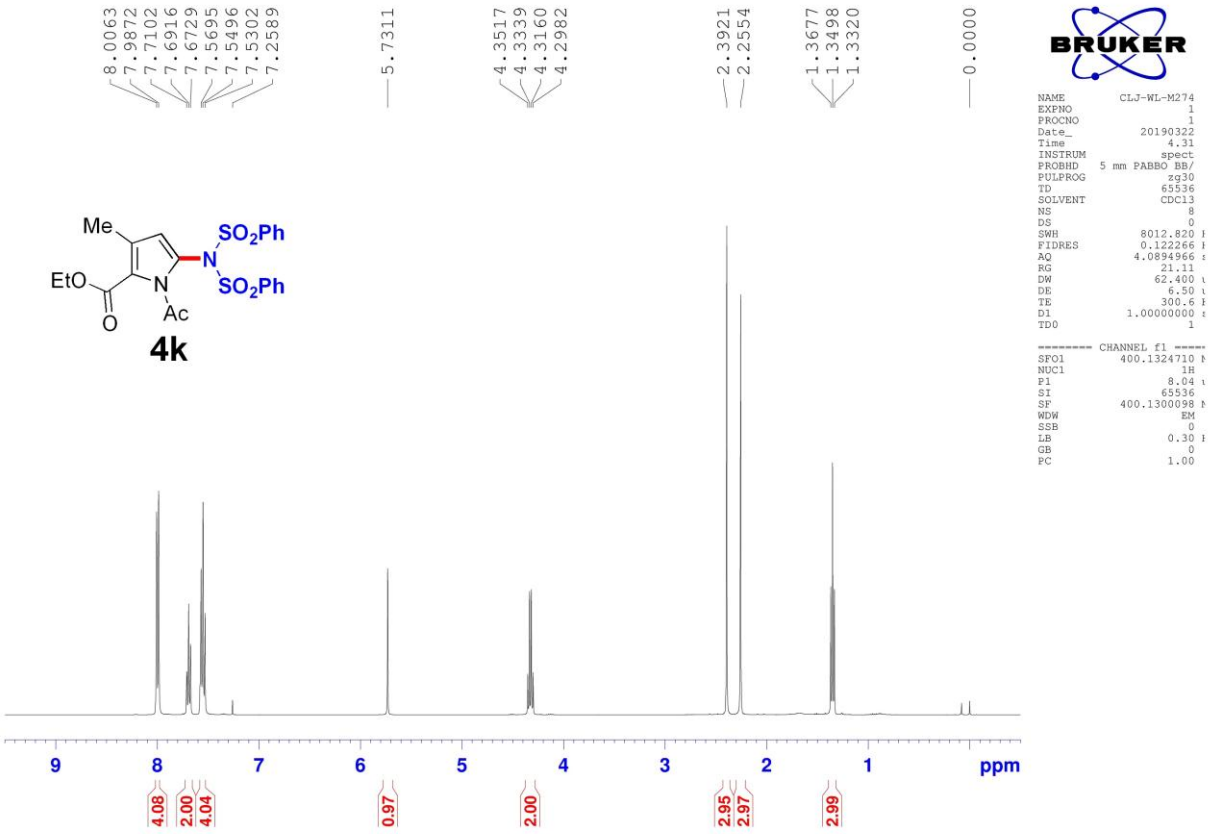

BRUKER
NAME CLJ-WL-M230
EXPNO 2
PROCNO 1
Date_ 20190124
Time 5.49
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.2 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127770 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40


8.0112
8.0094
7.9908
7.9878
7.7146
7.6960
7.6773
7.5725
7.5524
7.5332
6.8871
6.8773
5.8669
5.8571
4.3506
4.3327
4.3149
4.2971
2.4833
1.3686
1.3507
1.3329
0.0000
SO2Ph
N
SO2Ph
EtO
N
Ac
O
4j
9
8
7
6
5
4
3
2
1
ppm
4.21
1.98
4.03
1.00
1.00
2.09
3.00
3.06

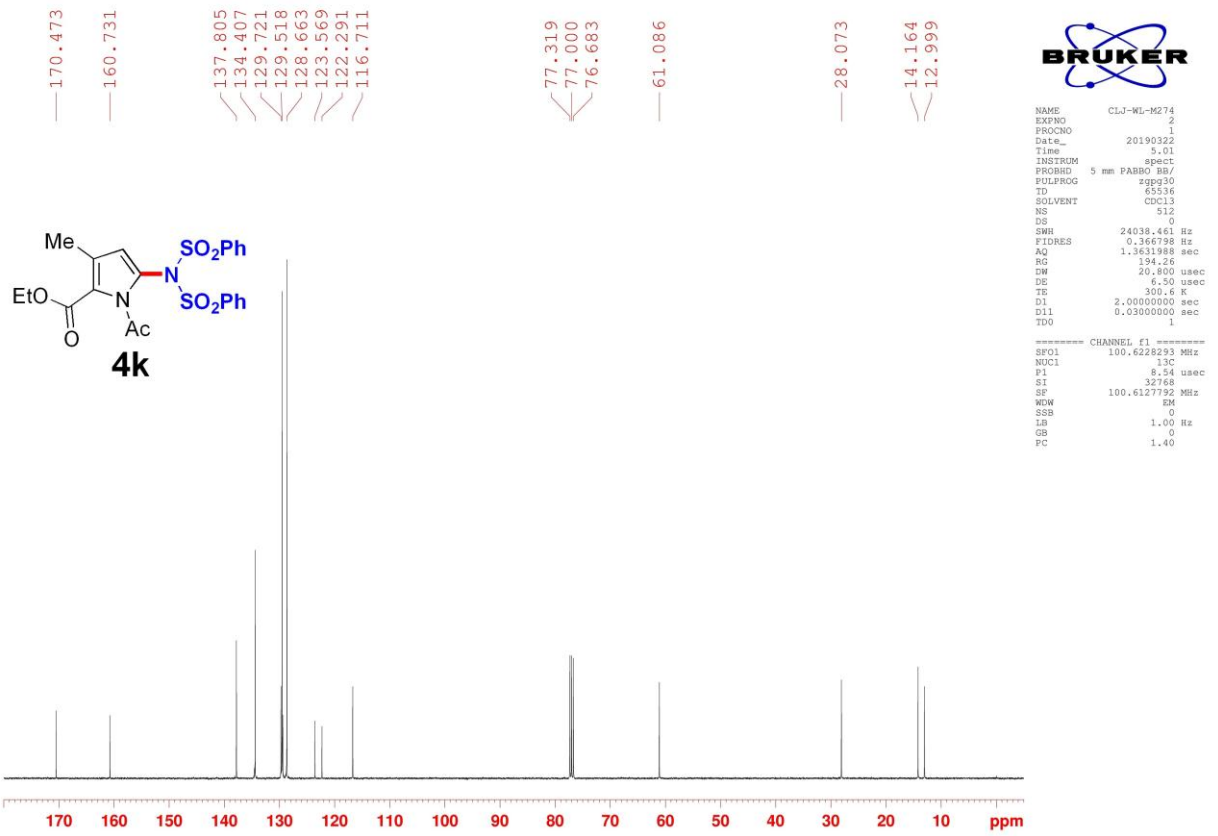

BRUKER
NAME CLJ-WL-M272
EXPNO 1
PROCNO 1
Date_ 20190320
Time 2.36
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 32.77
DW 62.400
DE 6.50
TE 300.6
D1 1.00000000
TD0 1
CHANNEL f1
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300107
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00


170.685
159.950
137.716
135.799
134.455
129.586
128.697
125.177
124.980
117.548
114.240
77.317
77.000
76.682
61.318
28.218
14.165
SO2Ph
N
SO2Ph
EtO
N
Ac
O
4j
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

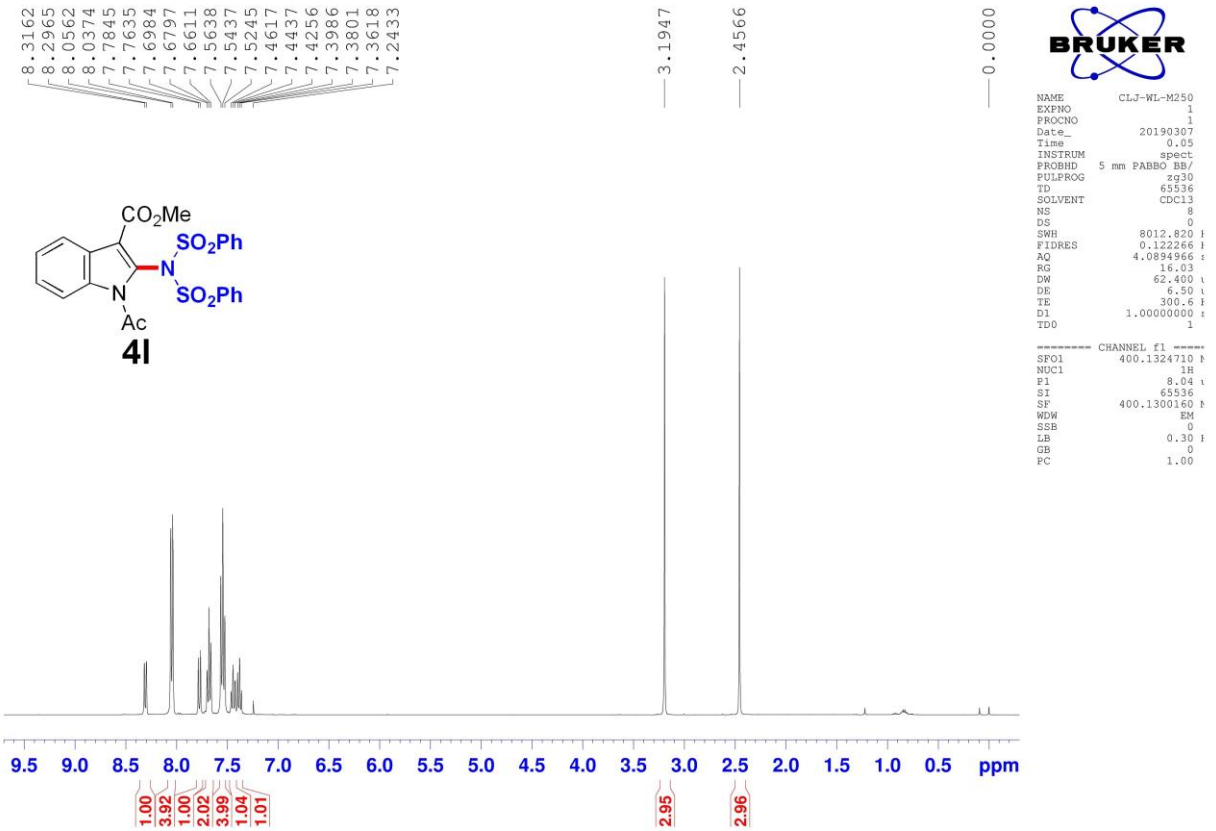

BRUKER
NAME CLJ-WL-M272
EXPNO 2
PROCNO 1
Date_ 20190320
Time 3.06
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.7 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127766 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40


8.0063
7.9872
7.7102
7.6916
7.6729
7.5695
7.5496
7.5302
7.2589
5.7311
4.3517
4.3339
4.3160
4.2982
2.3921
2.2554
1.3677
1.3498
1.3320
0.0000
Me
SO2Ph
N
SO2Ph
EtO
N
Ac
O
4k
9
8
7
6
5
4
3
2
1
ppm
4.08
2.00
4.04
0.97
2.00
2.95
2.97
2.99

BRUKER
NAME CLJ-WL-M274
EXPNO 1
PROCNO 1
Date_ 20190322
Time 4.31
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 21.11
DW 62.400
DE 6.50
TE 300.6
D1 1.00000000
TD0 1
CHANNEL f1
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300098
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00

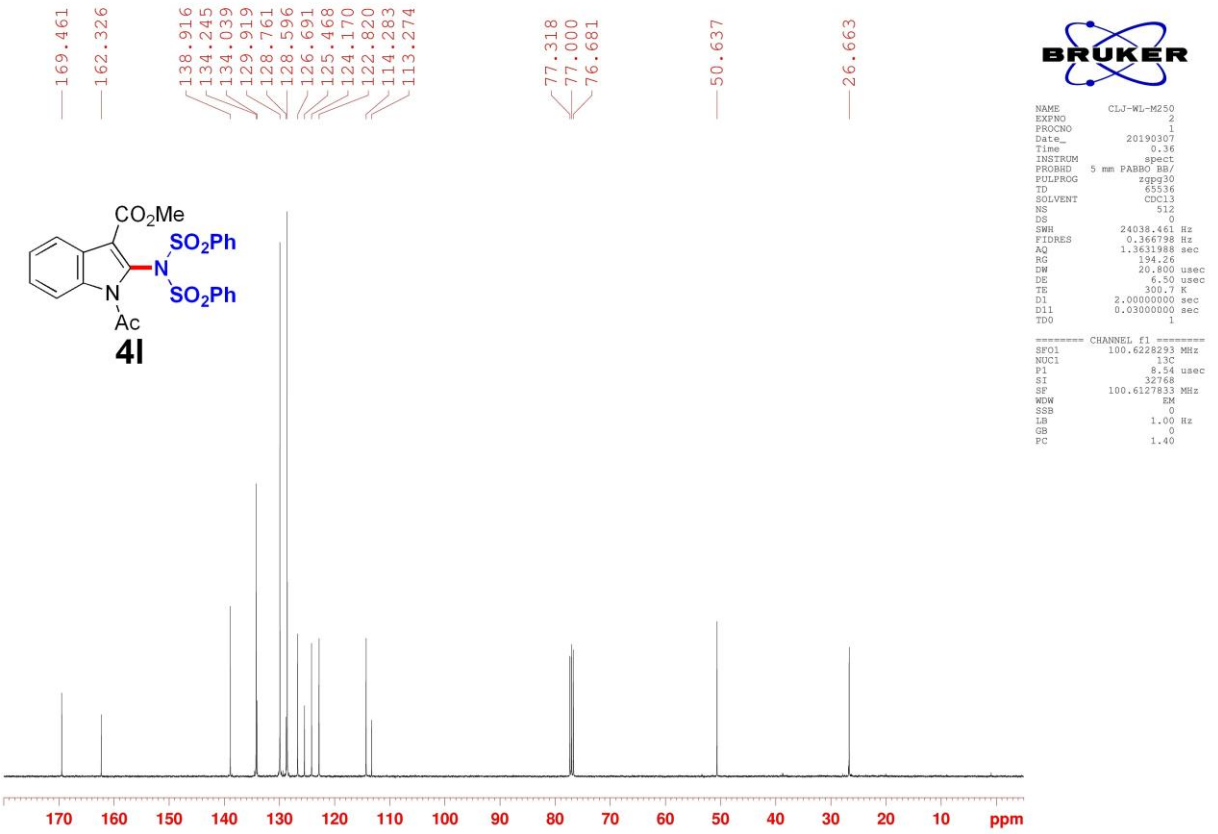

170.473
160.731
137.805
134.407
129.721
129.518
128.663
123.569
122.291
116.711
77.319
77.000
76.683
61.086
28.073
14.164
12.999
Me
SO2Ph
N
SO2Ph
EtO
N
Ac
O
4k
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

BRUKER
NAME CLJ-WL-M274
EXPNO 2
PROCNO 1
Date_ 20190322
Time 5.01
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127792 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



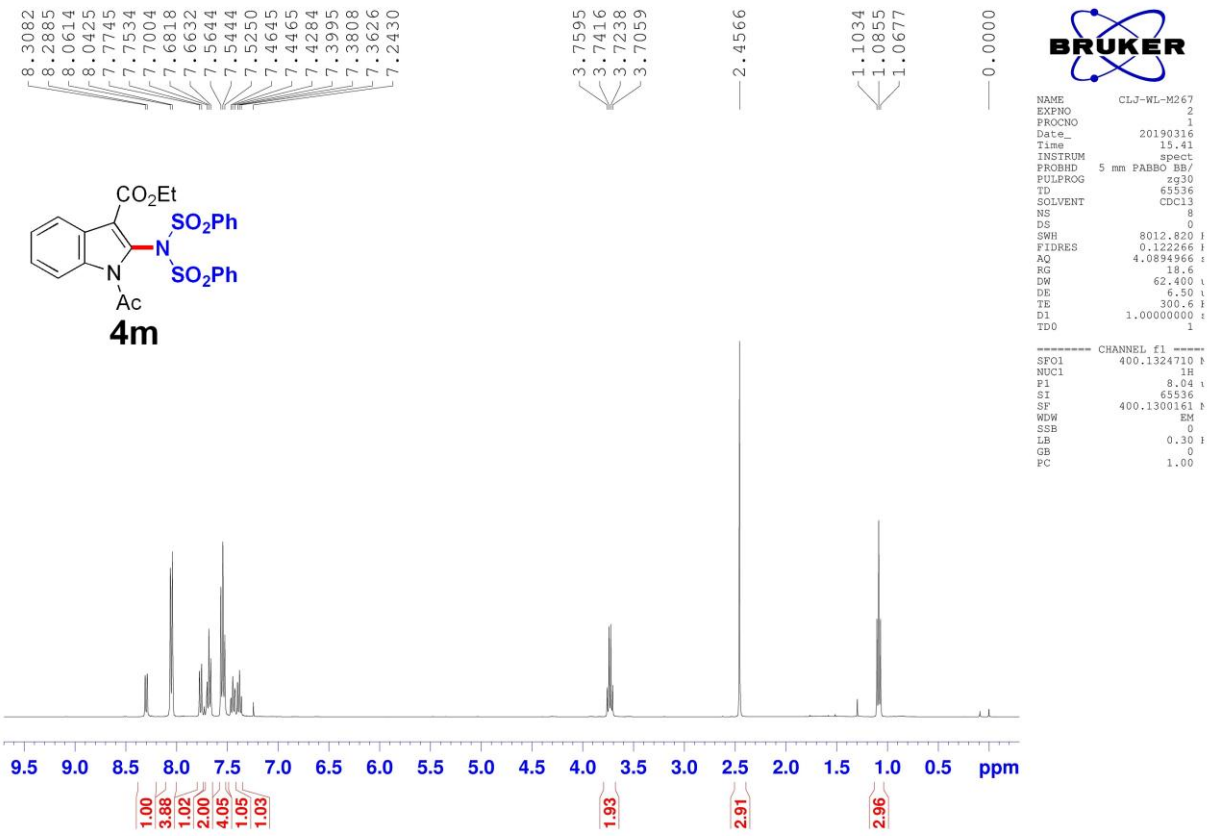
BRUKER

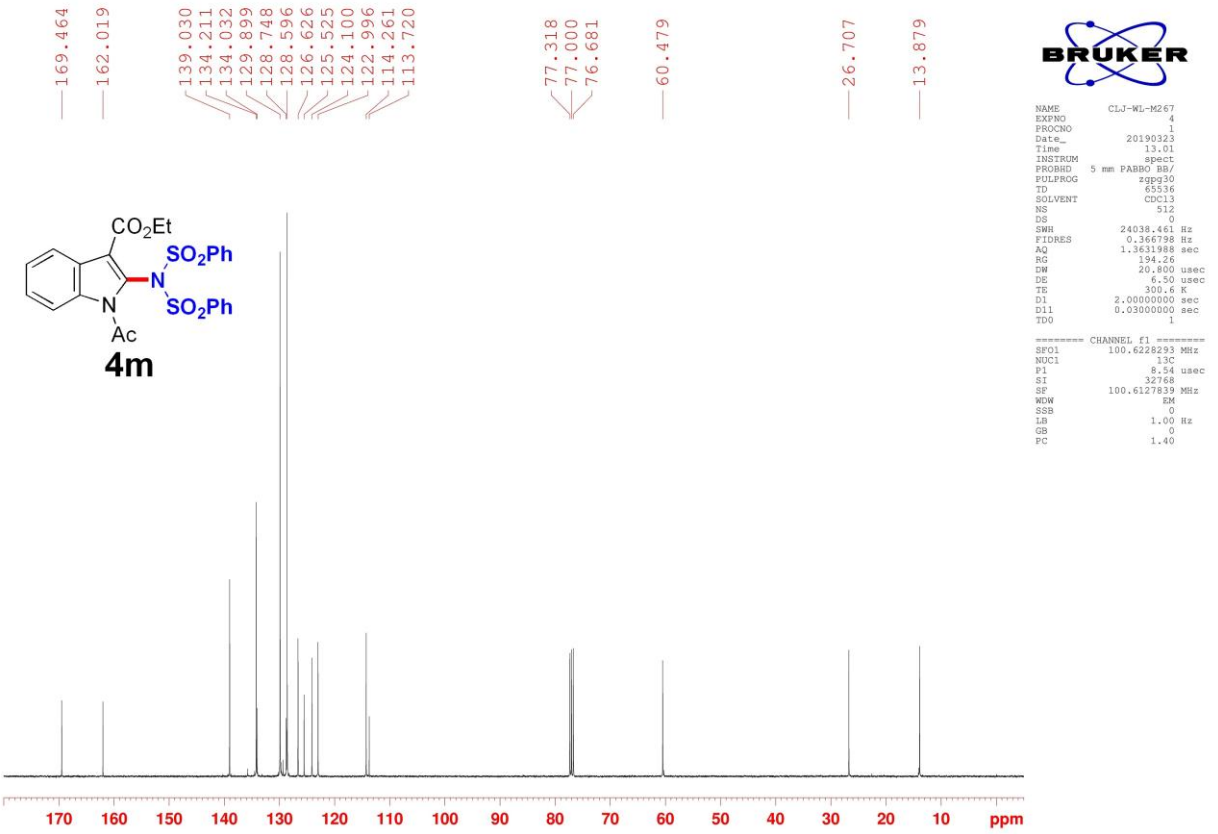
```
NAME          CLJ-WL-M250
EXPNO                   1
PROCNO                  1
Date_            20190307
Time                 0.05
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                      8
DS                      0
SWH            8012.820 H
FIDRES         0.122266 H
AQ             4.0894966 s
RG                  16.03
DW                 62.400 u
DE                  6.50 u
TE                 300.6 K
D1             1.00000000 s
TD0                     1

======== CHANNEL f1 =====
SFO1        400.1324710 M
NUC1                 1H
P1                 8.04 u
SI                65536
SF          400.1300160 M
WDW                  EM
SSB                   0
LB                 0.30 H
GB                    0
PC                 1.00
```

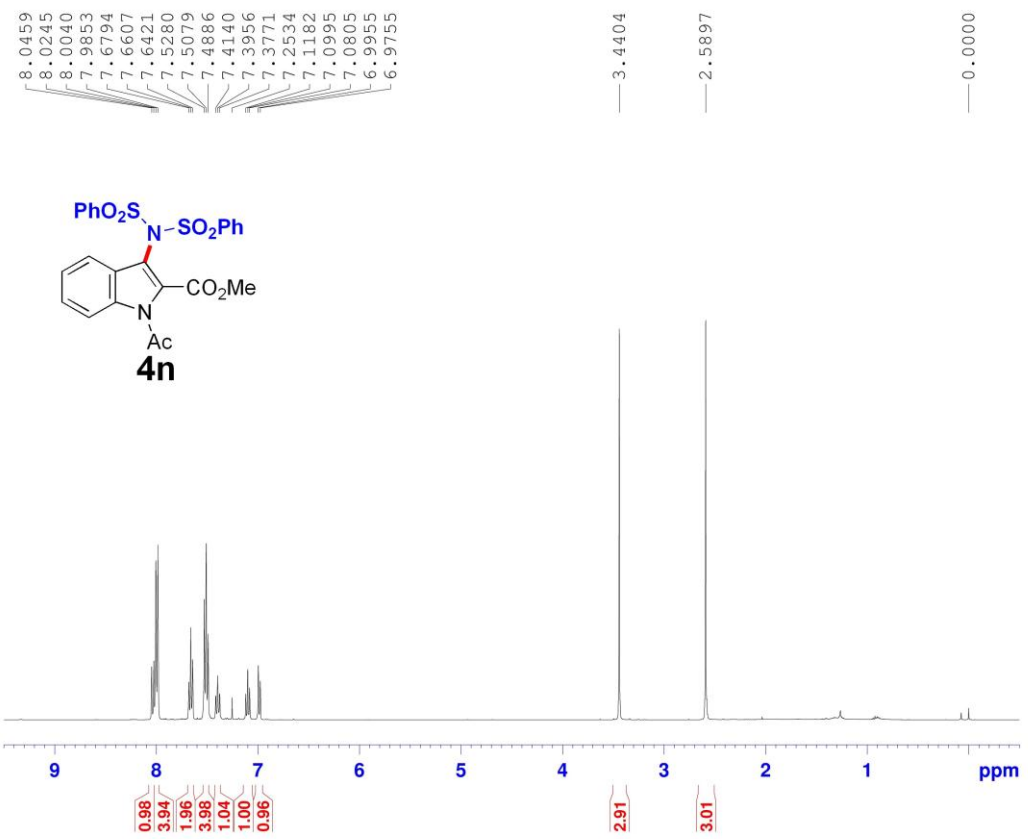


BRUKER

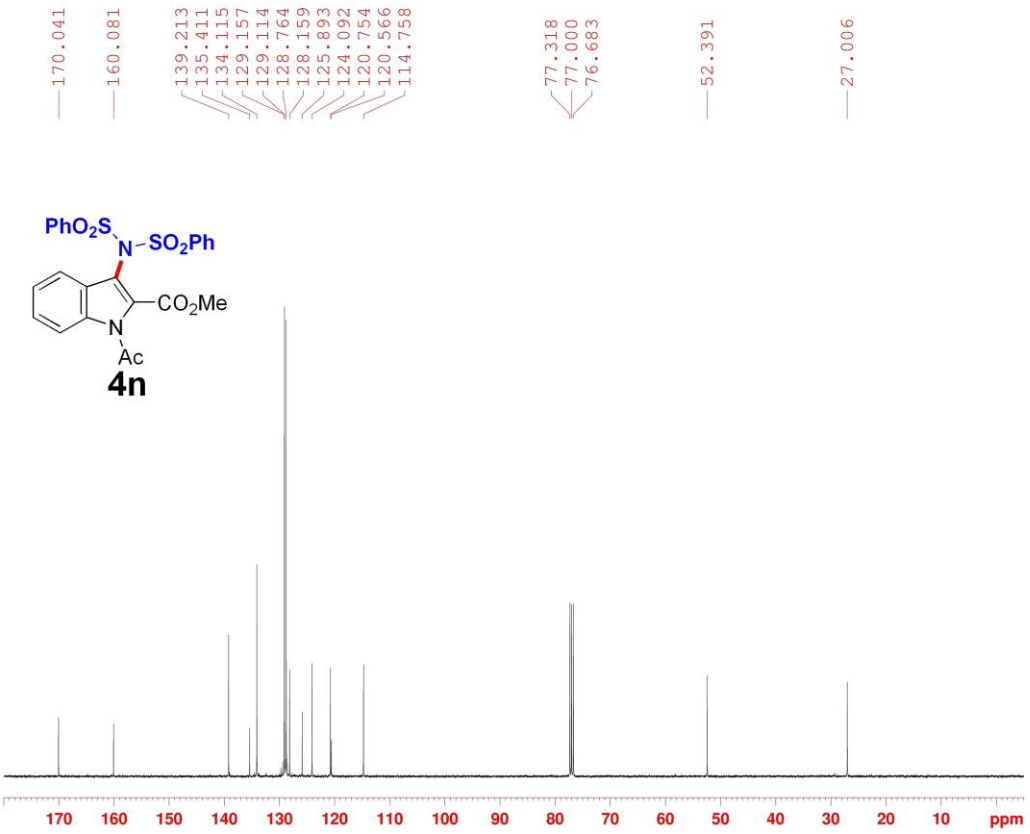
```
NAME          CLJ-WL-M250
EXPNO                   2
PROCNO                  1
Date_            20190307
Time                 0.36
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                    512
DS                      0
SWH           24038.461 Hz
FIDRES         0.366798 Hz
AQ             1.3631988 sec
RG                 194.26
DW                20.800 usec
DE                 6.50 usec
TE                 300.7 K
D1             2.00000000 sec
D11            0.03000000 sec
TD0                     1

======== CHANNEL f1 ========
SFO1        100.6228293 MHz
NUC1                 13C
P1                 8.54 usec
SI                32768
SF          100.6127833 MHz
WDW                  EM
SSB                   0
LB                 1.00 Hz
GB                    0
PC                 1.40
```


8.3082
8.2885
8.0614
8.0425
7.7745
7.7534
7.7004
7.6818
7.6632
7.5644
7.5444
7.5250
7.4645
7.4465
7.4284
7.3995
7.3808
7.3626
7.2430
3.7595
3.7416
3.7238
3.7059
2.4566
1.1034
1.0855
1.0677
0.0000
BRUKER
NAME CLJ-WL-M267
EXPNO 2
PROCNO 1
Date_ 20190316
Time 15.41
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 18.6
DW 62.400
DE 6.50
TE 300.6
D1 1.00000000
TD0 1
CHANNEL f1
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300161
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00
CO2Et
SO2Ph
N
SO2Ph
N
Ac
4m
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm
1.00
3.88
1.02
2.00
4.05
1.05
1.03
1.93
2.91
2.96

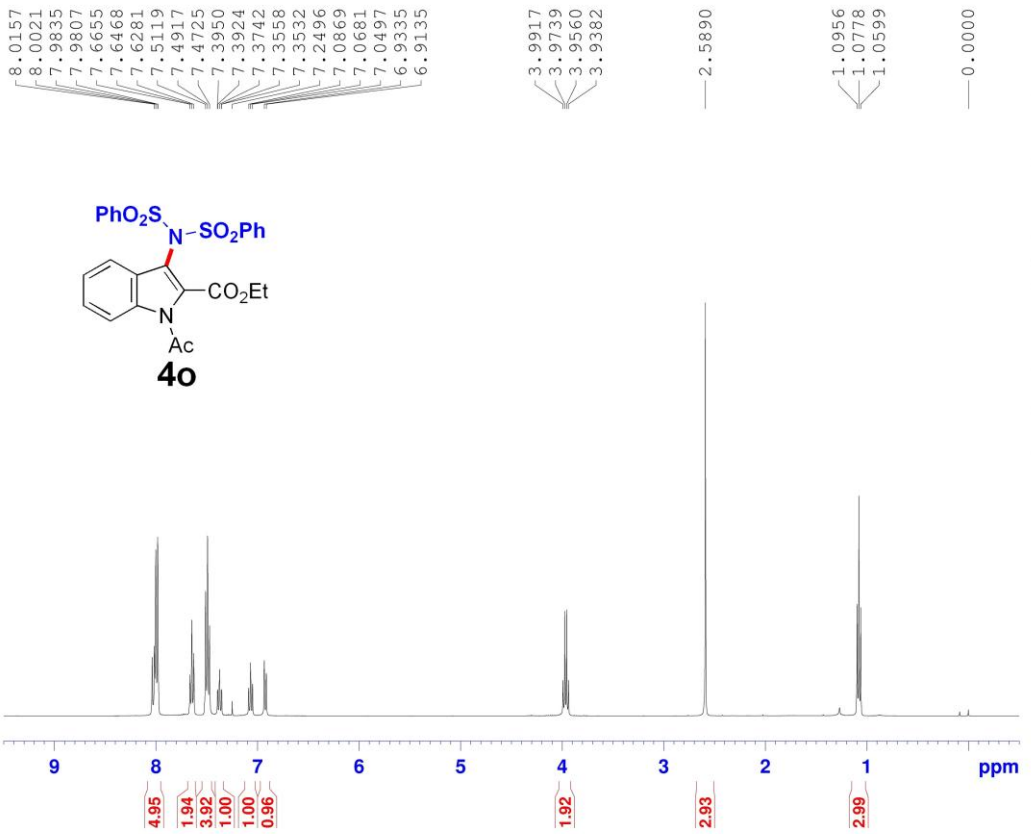

169.464
162.019
139.030
134.211
134.032
129.899
128.748
128.596
126.626
125.525
124.100
122.996
114.261
113.720
77.318
77.000
76.681
60.479
26.707
13.879
BRUKER
NAME CLJ-WL-M267
EXPNO 4
PROCNO 1
Date_ 20190323
Time 13.01
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127839 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
CO2Et
SO2Ph
N
SO2Ph
N
Ac
4m
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm


8.0459
8.0245
8.0040
7.9853
7.6794
7.6607
7.6421
7.5280
7.5079
7.4886
7.4140
7.3956
7.3771
7.2534
7.1182
7.0995
7.0805
6.9955
6.9755
3.4404
2.5897
0.0000
PhO2S
N
SO2Ph
CO2Me
N
Ac
4n
9
8
7
6
5
4
3
2
1
ppm
0.98
3.94
1.96
3.98
1.04
1.00
0.96
2.91
3.01

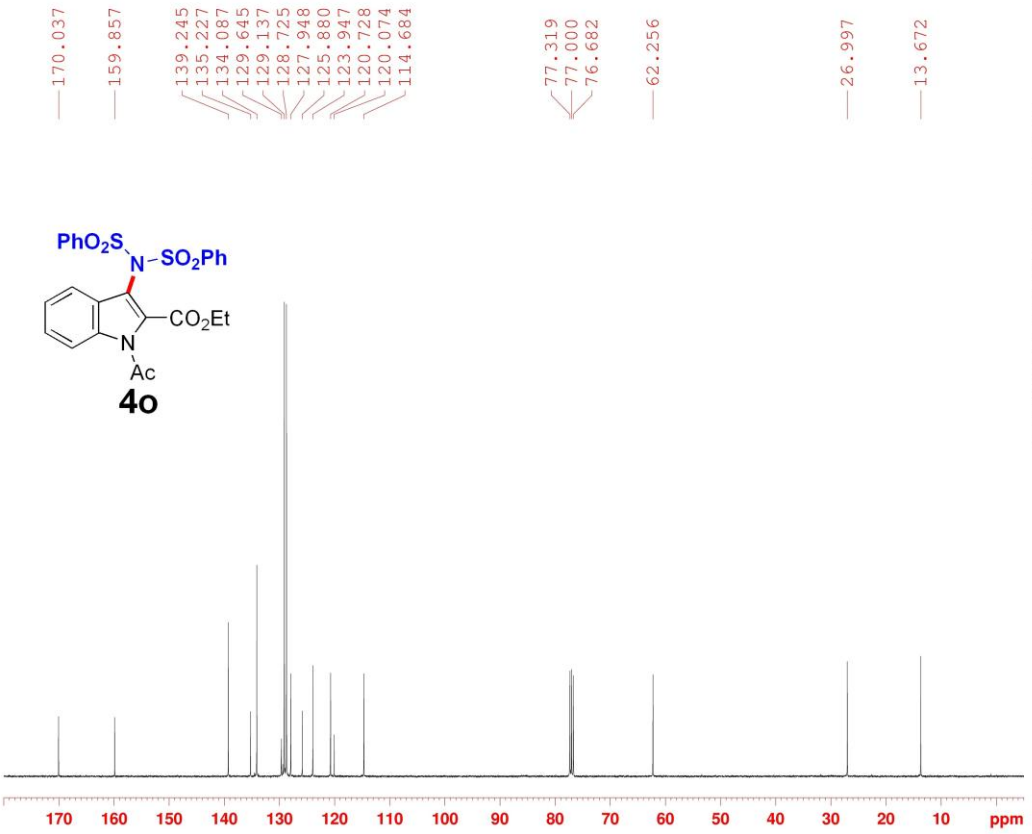

BRUKER
NAME CLJ-WL-M264
EXPNO 1
PROCNO 1
Date_ 20190314
Time 3.30
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 23.9
DW 62.400
DE 6.50
TE 300.6
D1 1.00000000
TD0 1
======== CHANNEL f1 ======
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300122
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00


170.041
160.081
139.213
135.411
134.115
129.157
129.114
128.764
128.159
125.893
124.092
120.754
120.566
114.758
77.318
77.000
76.683
52.391
27.006
PhO2S
N
SO2Ph
CO2Me
N
Ac
4n
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

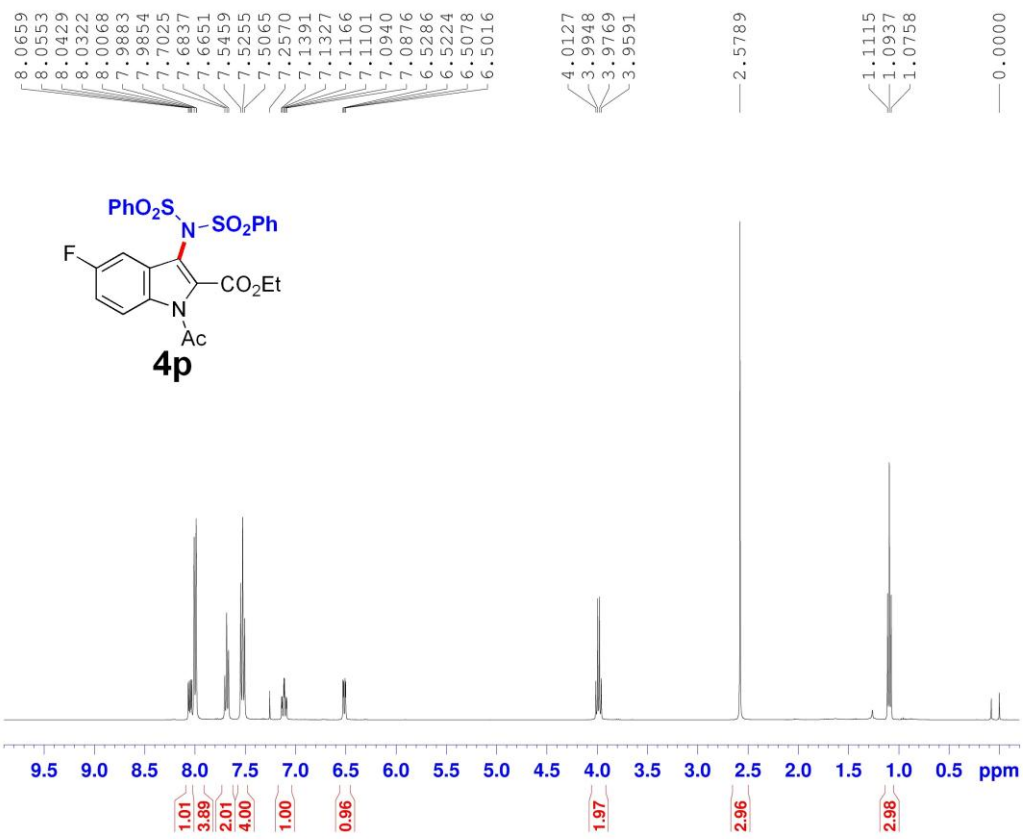

BRUKER
NAME CLJ-WL-M264
EXPNO 2
PROCNO 1
Date_ 20190314
Time 4.00
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.7 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127771 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40



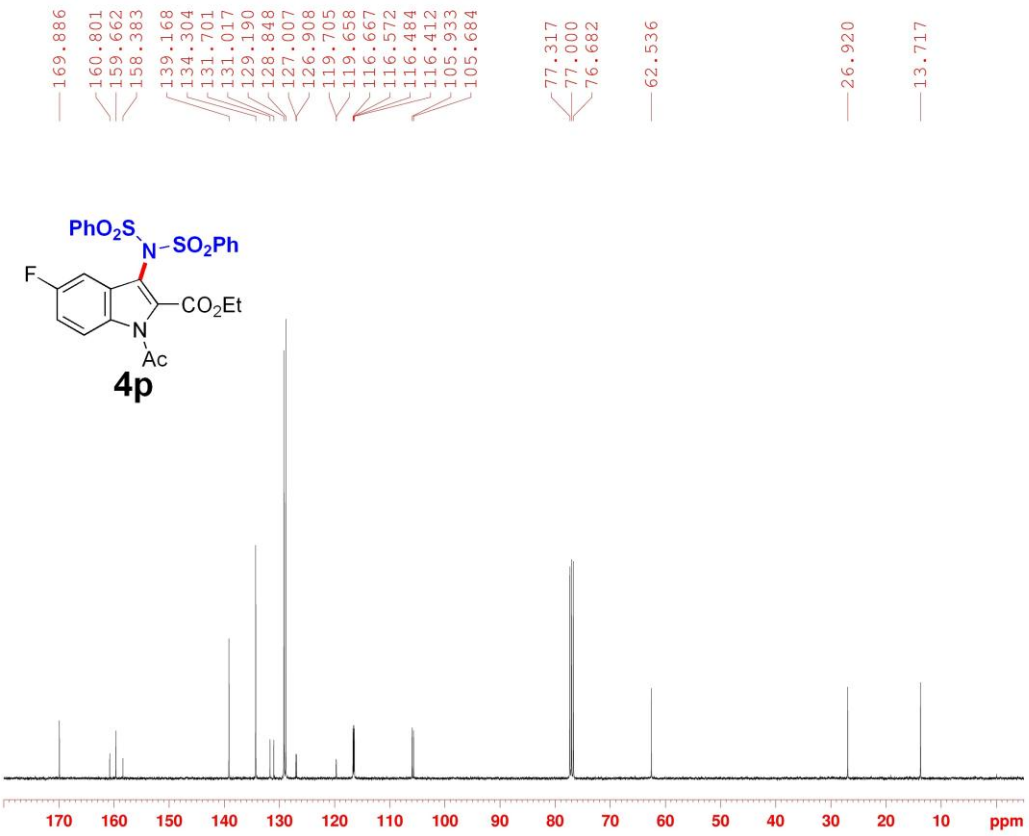

```
NAME          CLJ-WL-M252
EXPNO                   1
PROCNO                  1
Date_          20190307
Time               0.40
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG           zg30
TD               65536
SOLVENT          CDCl3
NS                   8
DS                   0
SWH           8012.820 H
FIDRES        0.122266 H
AQ            4.0894966 s
RG                18.6
DW               62.400 u
DE                6.50 u
TE               300.6 K
D1            1.00000000 s
TD0                  1

======== CHANNEL f1 =====
SFO1       400.1324710 M
NUC1                1H
P1                8.04 u
SI               65536
SF         400.1300136 M
WDW                 EM
SSB                  0
LB                0.30 H
GB                   0
PC                1.00
```



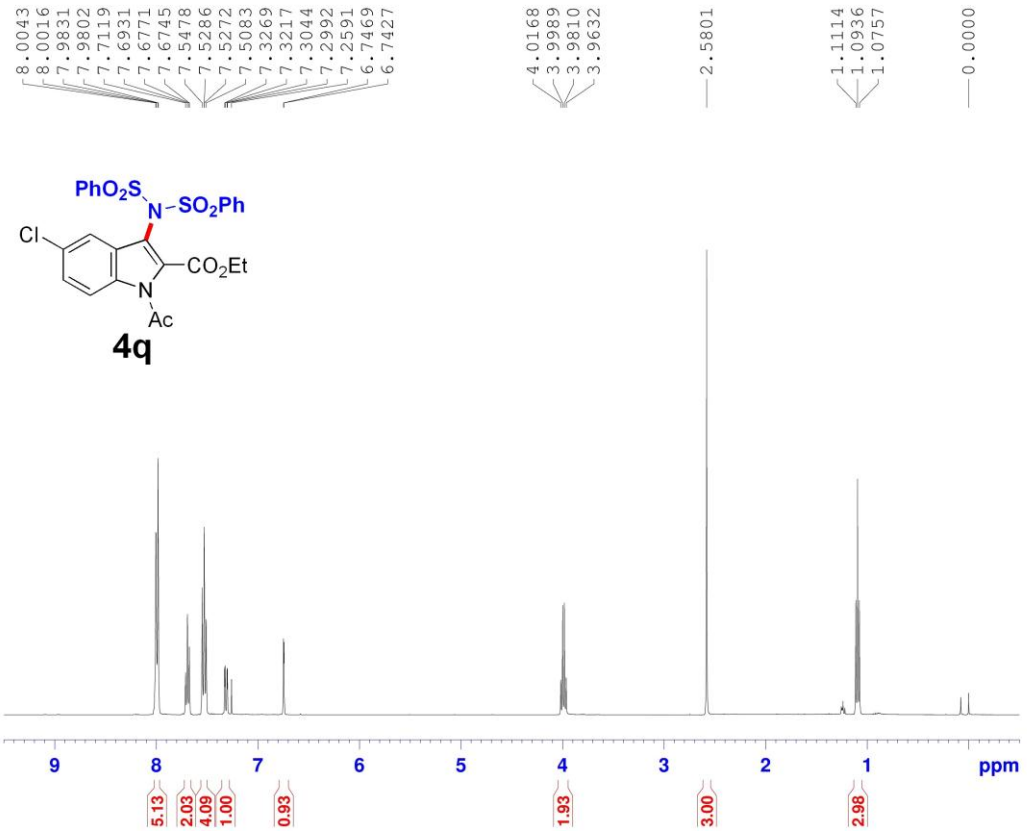

```
NAME          CLJ-WL-M252
EXPNO                   2
PROCNO                  1
Date_          20190307
Time               1.10
INSTRUM           spect
PROBHD   5 mm PABBO BB/
PULPROG         zgpg30
TD               65536
SOLVENT          CDCl3
NS                 512
DS                   0
SWH          24038.461 Hz
FIDRES        0.366798 Hz
AQ            1.3631988 sec
RG                194.26
DW               20.800 usec
DE                6.50 usec
TE               300.6 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                  1

======== CHANNEL f1 ========
SFO1      100.6228293 MHz
NUC1                13C
P1                8.54 usec
SI               32768
SF        100.6127806 MHz
WDW                 EM
SSB                  0
LB                1.00 Hz
GB                   0
PC                1.40
```




```
NAME          CLJ-WL-M270
EXPNO                   2
PROCNO                  1
Date_            20190316
Time                 6.30
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG             zg30
TD                 65536
SOLVENT            CDCl3
NS                     8
DS                     0
SWH           8012.820 Hz
FIDRES        0.122266 Hz
AQ            4.0894966 sec
RG                 47.53
DW                62.400 usec
DE                 6.50 usec
TE                300.6 K
D1            1.00000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         400.1324710 MHz
NUC1                   1H
P1                  8.04 usec
SI                 65536
SF           400.1300107 MHz
WDW                   EM
SSB                    0
LB                  0.30 Hz
GB                     0
PC                  1.00
```

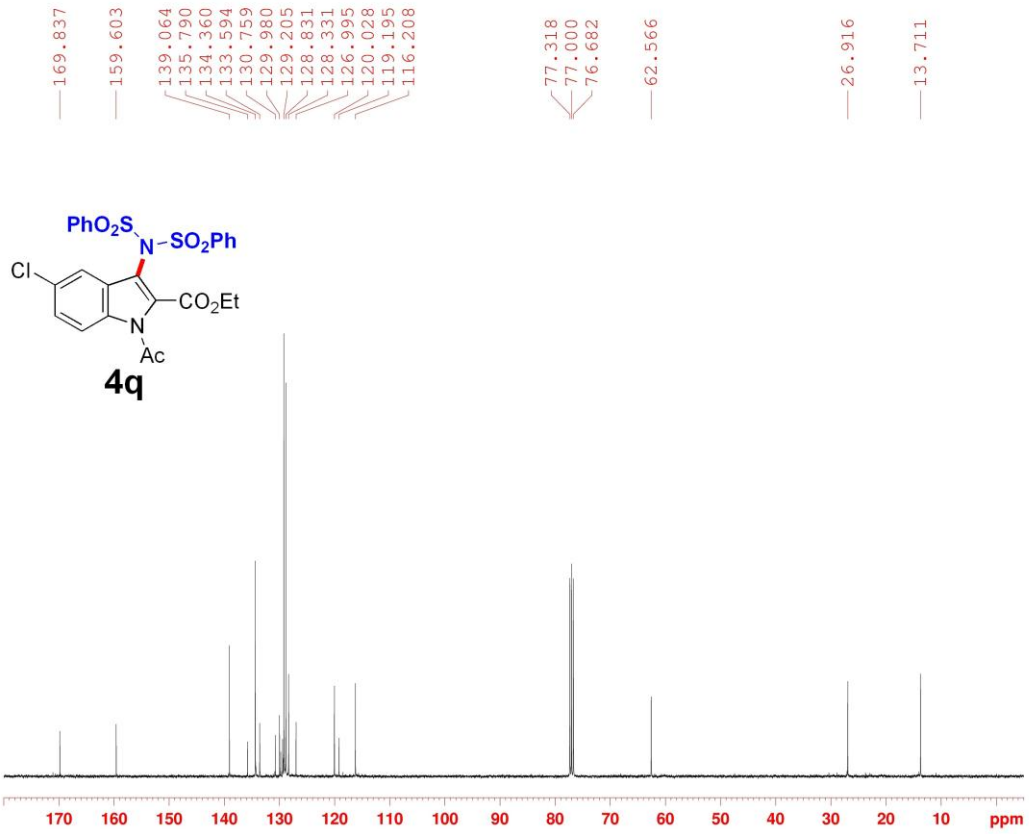



```
NAME          CLJ-WL-M270
EXPNO                   1
PROCNO                  1
Date_            20190316
Time                 6.29
INSTRUM             spect
PROBHD   5 mm PABBO BB/
PULPROG          zgpg30
TD                 65536
SOLVENT            CDCl3
NS                   512
DS                     0
SWH          24038.461 Hz
FIDRES        0.366798 Hz
AQ            1.3631988 sec
RG                194.26
DW               20.800 usec
DE                 6.50 usec
TE                300.7 K
D1            2.00000000 sec
D11           0.03000000 sec
TD0                    1

======== CHANNEL f1 ========
SFO1         100.6228293 MHz
NUC1                   13C
P1                  8.54 usec
SI                 32768
SF           100.6127737 MHz
WDW                   EM
SSB                    0
LB                  1.00 Hz
GB                     0
PC                  1.40
```



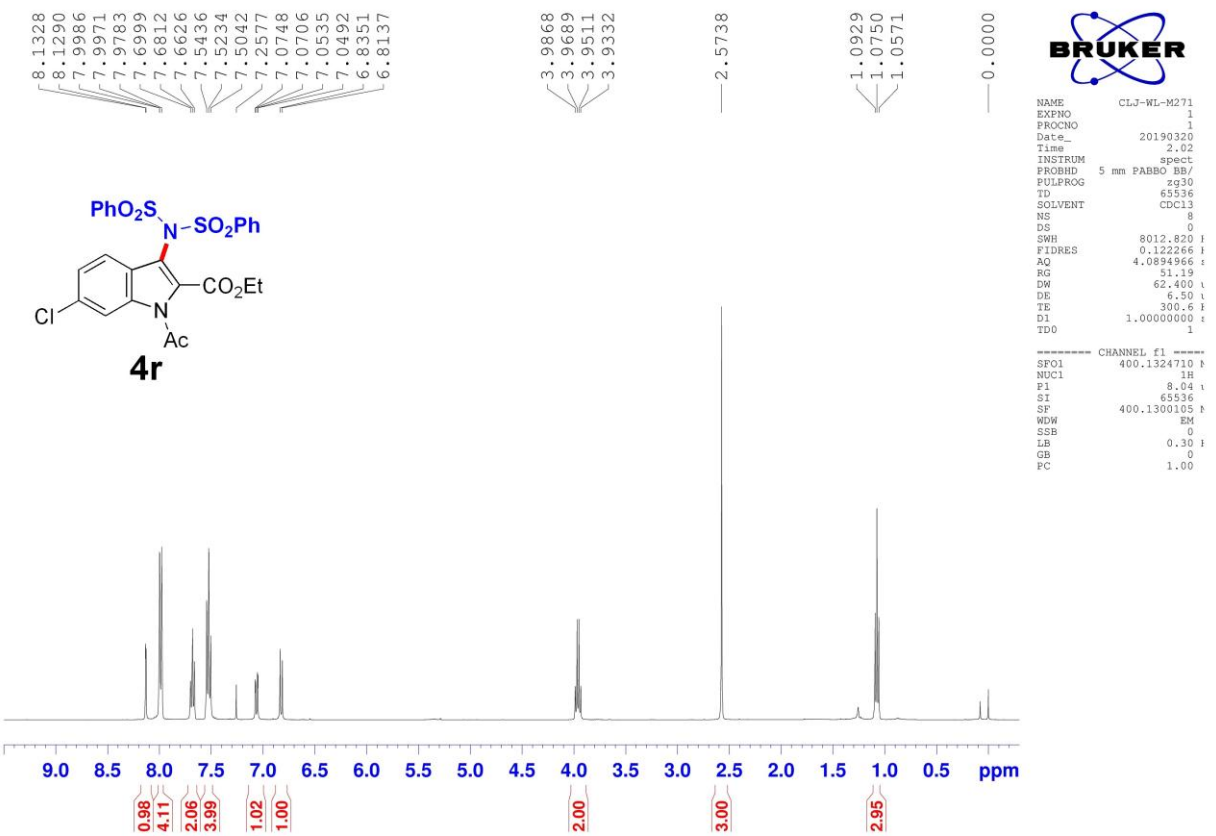
BRUKER

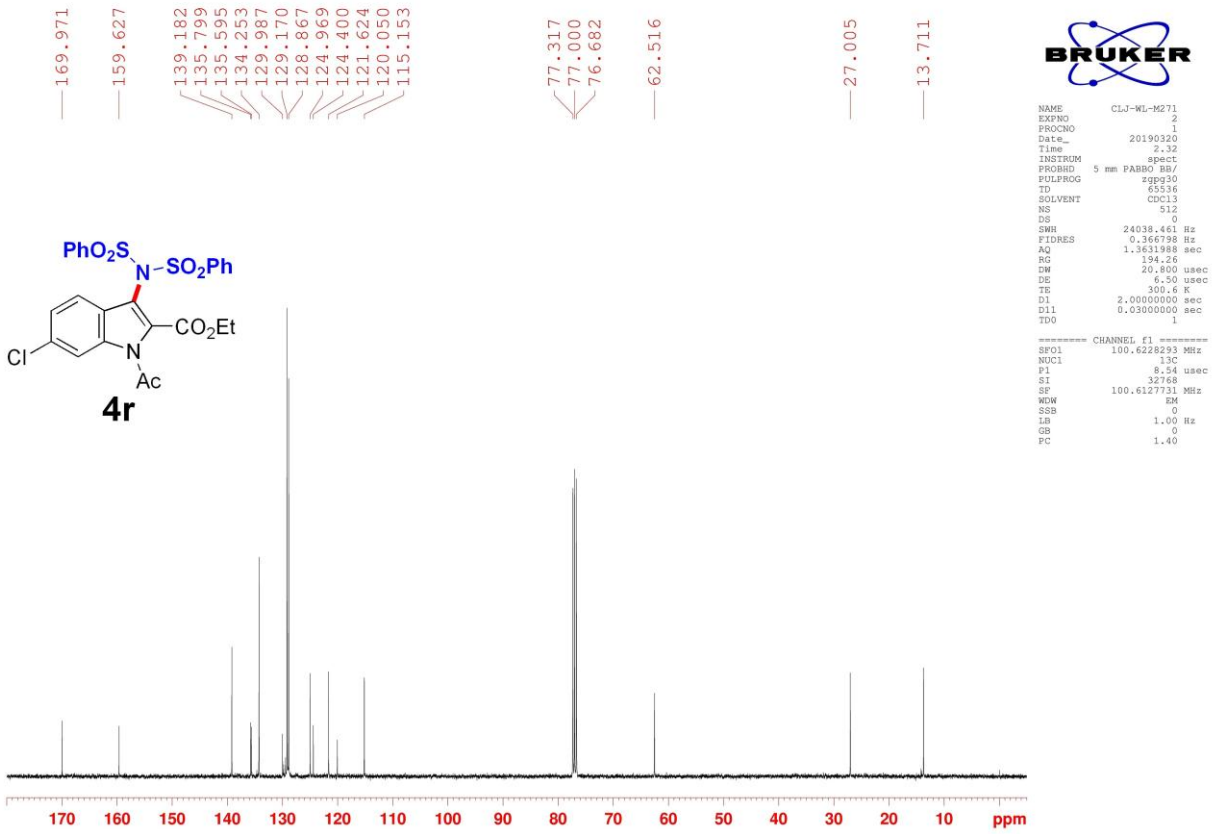
```
NAME            CLJ-WL-M266
EXPNO                     2
PROCNO                    1
Date_            20190316
Time                 14.56
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG               zg30
TD                   65536
SOLVENT              CDCl3
NS                       8
DS                       0
SWH              8012.820 H
FIDRES           0.122266 H
AQ               4.0894966 s
RG                    41.07
DW                   62.400 u
DE                    6.50 u
TE                   300.6 K
D1               1.00000000 s
TD0                      1

======== CHANNEL f1 =======
SFO1          400.1324710 M
NUC1                   1H
P1                   8.04 u
SI                  65536
SF            400.1300099 M
WDW                    EM
SSB                     0
LB                   0.30 H
GB                      0
PC                   1.00
```

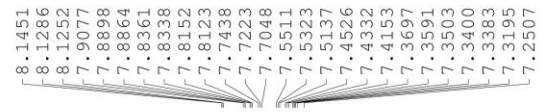


BRUKER

```
NAME            CLJ-WL-M266
EXPNO                     1
PROCNO                    1
Date_            20190316
Time                 14.55
INSTRUM              spect
PROBHD    5 mm PABBO BB/
PULPROG            zgpg30
TD                   65536
SOLVENT              CDCl3
NS                     512
DS                       0
SWH             24038.461 Hz
FIDRES           0.366798 Hz
AQ               1.3631988 sec
RG                   194.26
DW                20.800 usec
DE                 6.50 usec
TE                   300.6 K
D1               2.00000000 sec
D11              0.03000000 sec
TD0                      1

======== CHANNEL f1 ========
SFO1          100.6228293 MHz
NUC1                   13C
P1                  8.54 usec
SI                   32768
SF            100.6127746 MHz
WDW                    EM
SSB                     0
LB                   1.00 Hz
GB                      0
PC                   1.40
```


8.1328
8.1290
7.9986
7.9971
7.9783
7.6999
7.6812
7.6626
7.5436
7.5234
7.5042
7.2577
7.0748
7.0706
7.0535
7.0492
6.8351
6.8137
3.9868
3.9689
3.9511
3.9332
2.5738
1.0929
1.0750
1.0571
0.0000
BRUKER
NAME CLJ-WL-M271
EXPNO 1
PROCNO 1
Date_ 20190320
Time 2.02
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDC13
NS 8
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 51.19
DW 62.400
DE 6.50
TE 300.6
D1 1.00000000
TD0 1
CHANNEL f1
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300105
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00
PhO2S
N
SO2Ph
CO2Et
Cl
N
Ac
4r
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 ppm
0.98
4.11
2.06
3.99
1.02
1.00
2.00
3.00
2.95

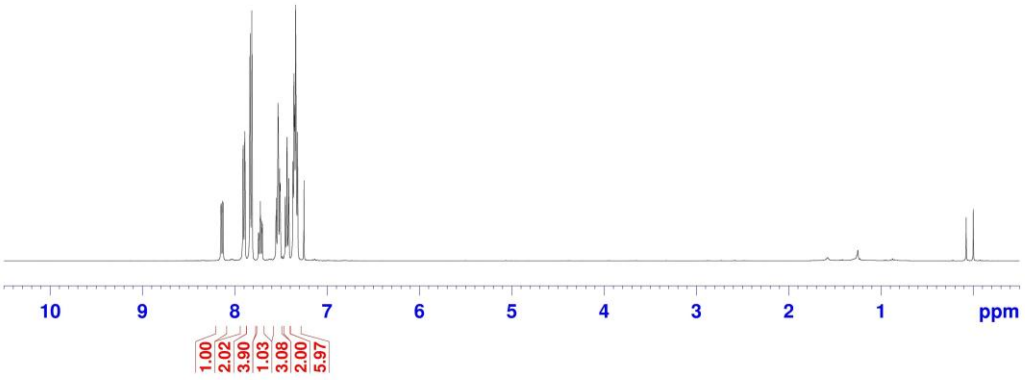

169.971
159.627
139.182
135.799
135.595
134.253
129.987
129.170
128.867
124.969
124.400
121.624
120.050
115.153
77.317
77.000
76.682
62.516
27.005
13.711
BRUKER
NAME CLJ-WL-M271
EXPNO 2
PROCNO 1
Date_ 20190320
Time 2.32
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDC13
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
CHANNEL f1
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127731 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40
PhO2S
N
SO2Ph
CO2Et
Cl
N
Ac
4r
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 ppm

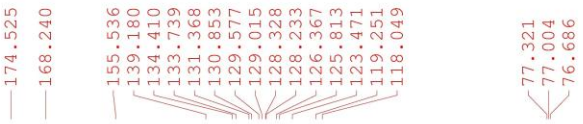

8.1451
8.1286
8.1252
7.9077
7.8898
7.8864
7.8361
7.8338
7.8152
7.8123
7.7438
7.7223
7.7048
7.5511
7.5323
7.5137
7.4526
7.4332
7.4153
7.3697
7.3591
7.3503
7.3400
7.3383
7.3195
7.2507
0.0000

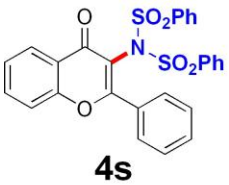

O
SO2Ph
N
SO2Ph
O

4s

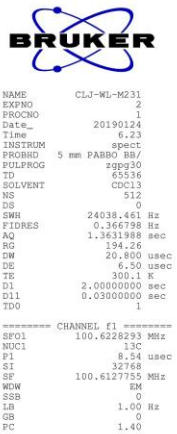

BRUKER
NAME CLJ-WL-M231
EXPNO 1
PROCNO 1
Date_ 20190124
Time 5.53
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 8
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 70.36
DW 62.400
DE 6.50
TE 300.1
D1 1.00000000
TD0 1
======== CHANNEL f1 ======
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1300132
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00

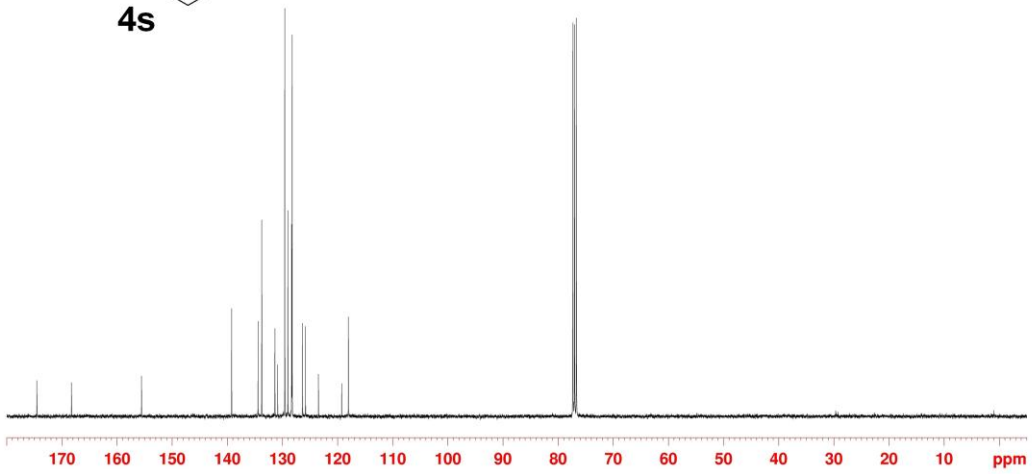

10
9
8
7
6
5
4
3
2
1
ppm
1.00
2.02
3.90
1.03
3.08
2.00
5.97

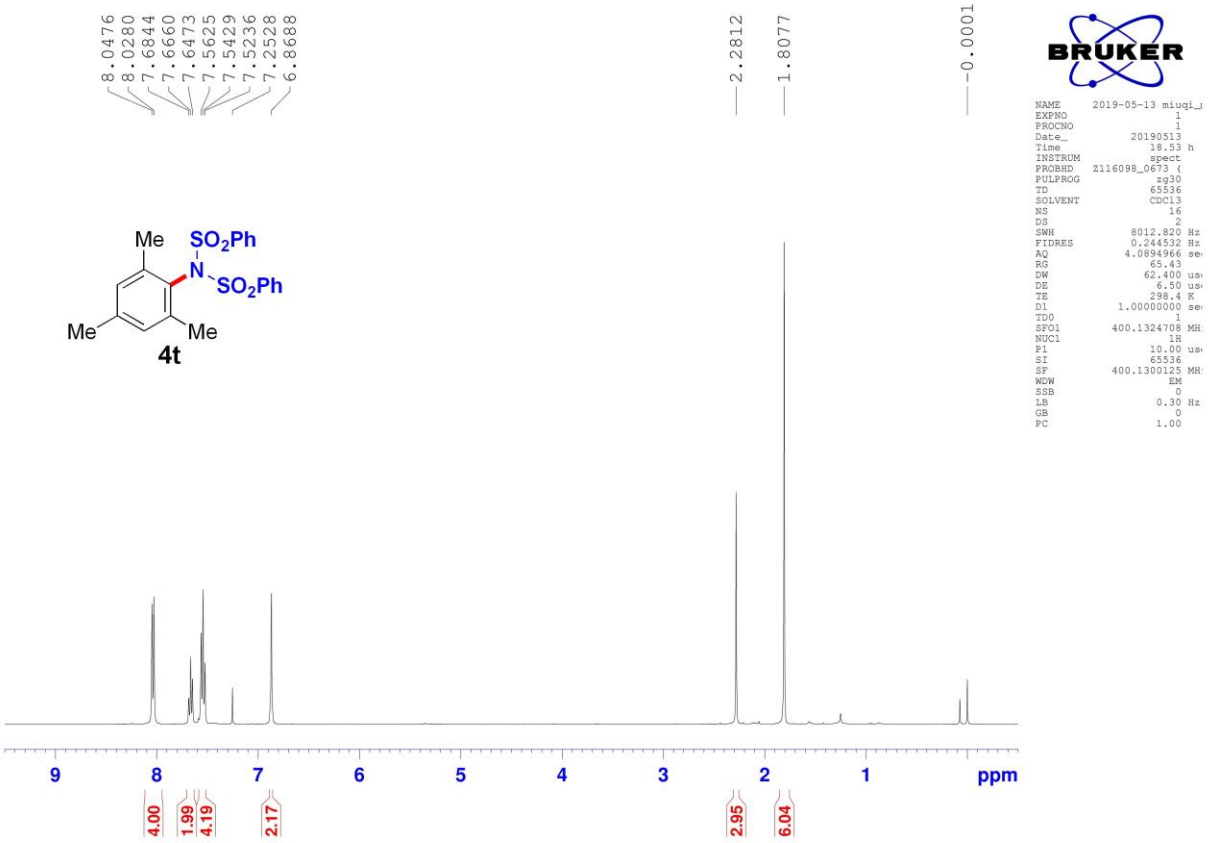

174.525
168.240
155.536
139.180
134.410
133.739
131.368
130.853
129.577
129.015
128.328
128.233
126.367
125.813
123.471
119.251
118.049
77.321
77.004
76.686


O
SO2Ph
N
SO2Ph
O

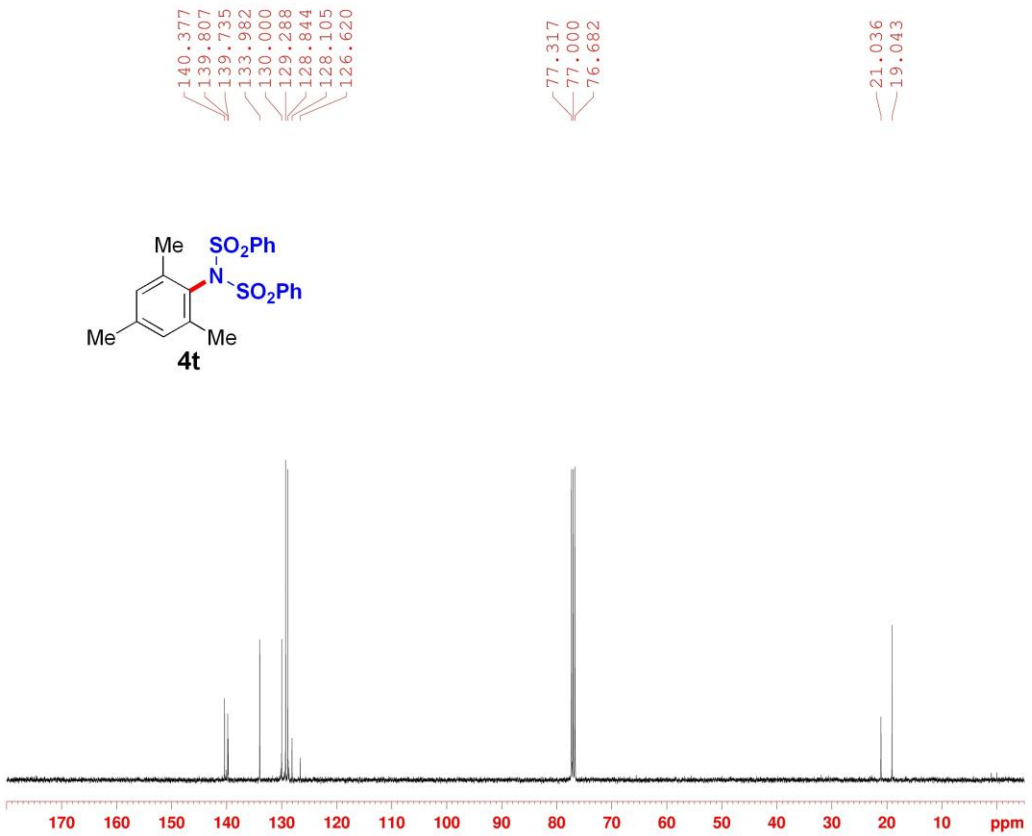
4s

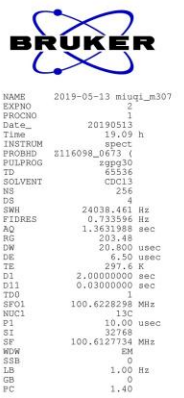

BRUKER
NAME CLJ-WL-M231
EXPNO 2
PROCNO 1
Date_ 20190124
Time 6.23
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.1 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127755 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

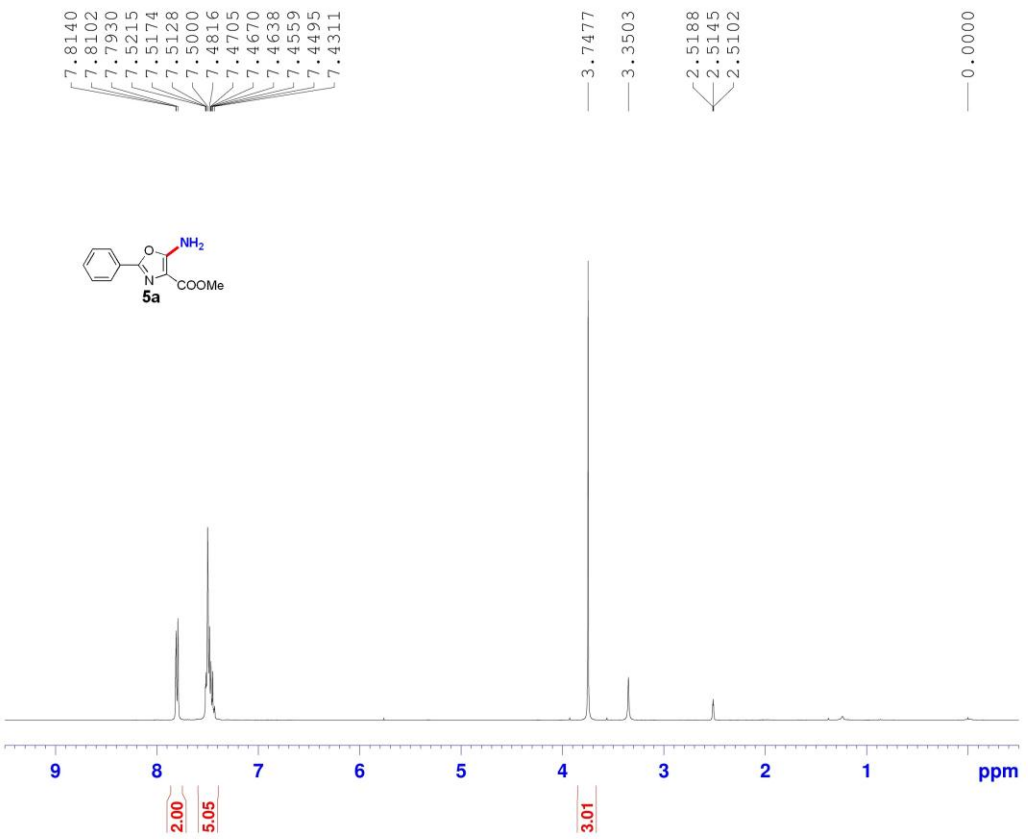

170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm


8.0476
8.0280
7.6844
7.6660
7.6473
7.5625
7.5429
7.5236
7.2528
6.8688
2.2812
1.8077
0.0001
Me
SO2Ph
N
SO2Ph
Me
Me
4t
9
8
7
6
5
4
3
2
1
ppm
4.00
1.99
4.19
2.17
2.95
6.04

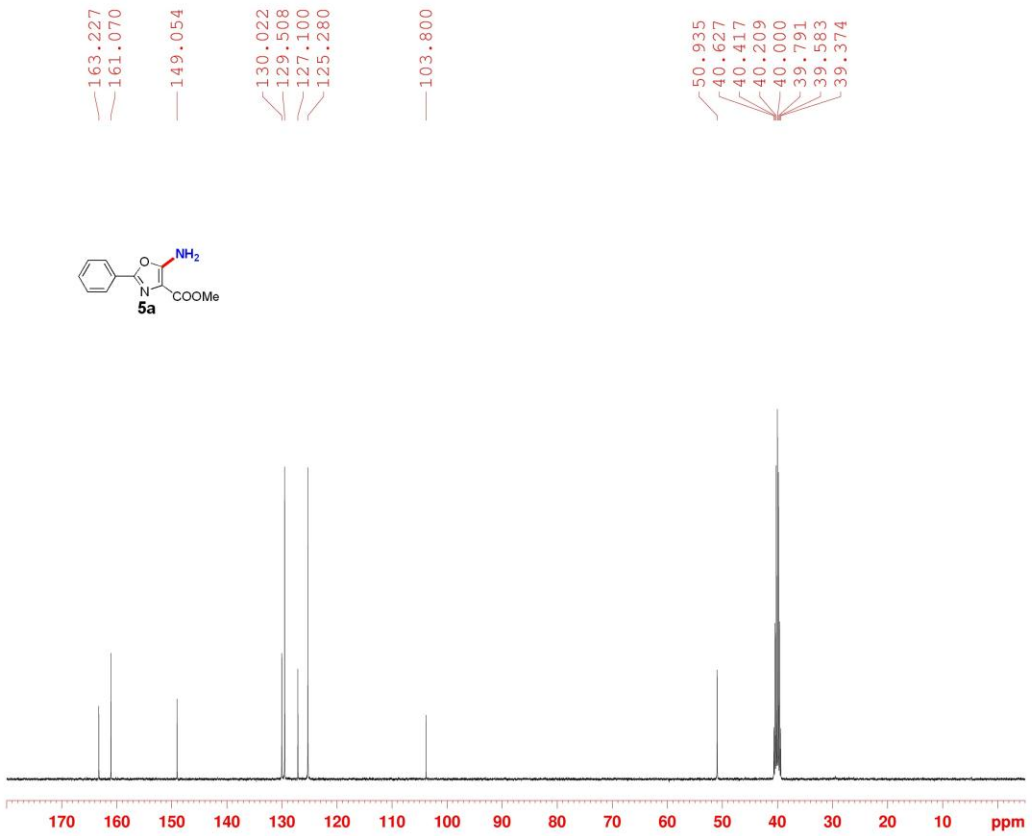
BRUKER
NAME 2019-05-13 miuqi_
EXPNO 1
PROCNO 1
Date_ 20190513
Time 18.53 h
INSTRUM spect
PROBHD Z116098_0673 (
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8012.820 Hz
FIDRES 0.244532 Hz
AQ 4.0894966 se
RG 65.43
DW 62.400 us
DE 6.50 us
TE 298.4 K
D1 1.00000000 se
TD0 1
SFO1 400.1324708 MH
NUC1 1H
P1 10.00 us
SI 65536
SF 400.1300125 MH
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00


140.377
139.807
139.735
133.982
130.000
129.288
128.844
128.105
126.620
77.317
77.000
76.682
21.036
19.043
Me
SO2Ph
N
SO2Ph
Me
Me
4t
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm


BRUKER
NAME 2019-05-13 miuqi_m307
EXPNO 2
PROCNO 1
Date_ 20190513
Time 19.09 h
INSTRUM spect
PROBHD Z116098_0673 (
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 256
DS 4
SWH 24038.461 Hz
FIDRES 0.733596 Hz
AQ 1.3631988 sec
RG 203.48
DW 20.800 usec
DE 6.50 usec
TE 297.6 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
SFO1 100.6228298 MHz
NUC1 13C
P1 10.00 usec
SI 32768
SF 100.6127734 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40


7.8140
7.8102
7.7930
7.5215
7.5174
7.5128
7.5000
7.4816
7.4705
7.4670
7.4638
7.4559
7.4495
7.4311
3.7477
3.3503
2.5188
2.5145
2.5102
0.0000
NH2
O
N
COOMe
5a
9
8
7
6
5
4
3
2
1
ppm
2.00
5.05
3.01


BRUKER
NAME CLJ-WL-M288
EXPNO 1
PROCNO 1
Date_ 20190413
Time 7.42
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zg30
TD 65536
SOLVENT DMSO
NS 8
DS 0
SWH 8012.820
FIDRES 0.122266
AQ 4.0894966
RG 70.36
DW 62.400
DE 6.50
TE 300.6
D1 1.00000000
TD0 1
======== CHANNEL f1 ======
SFO1 400.1324710
NUC1 1H
P1 8.04
SI 65536
SF 400.1299972
WDW EM
SSB 0
LB 0.30
GB 0
PC 1.00


163.227
161.070
149.054
130.022
129.508
127.100
125.280
103.800
50.935
40.627
40.417
40.209
40.000
39.791
39.583
39.374
NH2
O
N
COOMe
5a
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm


BRUKER
NAME CLJ-WL-M289
EXPNO 2
PROCNO 1
Date_ 20190413
Time 8.46
INSTRUM spect
PROBHD 5 mm PABBO BB/
PULPROG zgpg30
TD 65536
SOLVENT DMSO
NS 512
DS 0
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 194.26
DW 20.800 usec
DE 6.50 usec
TE 300.7 K
D1 2.00000000 sec
D11 0.03000000 sec
TD0 1
======== CHANNEL f1 ========
SFO1 100.6228293 MHz
NUC1 13C
P1 8.54 usec
SI 32768
SF 100.6127685 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40