Supporting Information

Copper(I)-Catalyzed Radical Decarboxylative Amidation of Carboxylic Acids with *N*-fluoroarylsulfonimides

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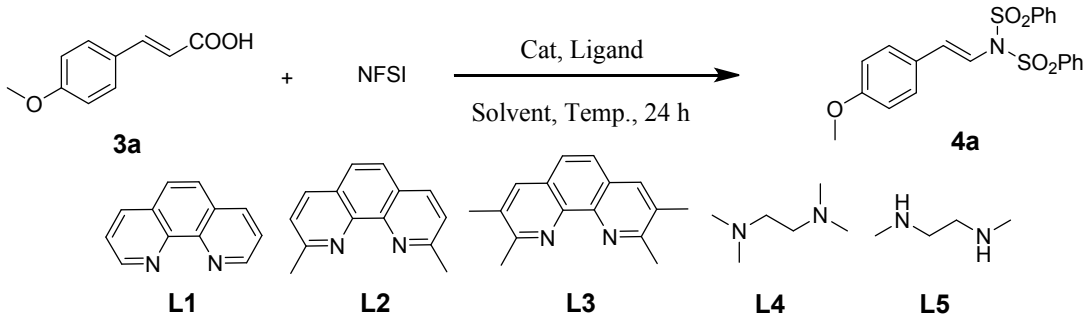
1. General information

Unless otherwise noted, all chemicals were purchased from commercial suppliers (Adamas, Aladdin, J&K etc) and used without further purification. ^{1}H NMR and ^{13}C NMR were recorded at ambient temperature on a 300, 400 or 500 MHz spectrometer (75, 100 or 125 MHz for ^{13}C NMR). NMR experiments are reported in δ units, parts per million (ppm), and were referenced to $CDCl_3$ (δ 7.26 or 77.0 ppm) as the internal standard. The coupling constants J are given in Hertz. Mass spectra were recorded on BRUKER AutoflexIII Smartbeam MS-spectrometer. High resolution mass spectra (HRMS) were recorded on Bruck microTof by using ESI method. Column chromatography was performed using EM silica gel 60 (300−400 mesh).

2. Table

Table S1 Decarboxylative Coupling of 4-Methoxycinnamic Acid with NFSI over Different conditions[a]



Entry	Catalyst	Ligand	Solvent	Temp.(°C)	Conversion (%)	Selectivity (%)	Yield (%)[b]
1	CuI	**L2**	CH_3CN	70	93	89	83
2	Cu_2O	**L2**	CH_3CN	70	77	88	68
3	CuCl	**L2**	CH_3CN	70	89	92	82
4	$CuCl_2$	**L2**	CH_3CN	70	97	77	75
5	$Cu(OAc)_2$	**L2**	CH_3CN	70	75	91	68
6	$Cu(OTf)_2$	**L2**	CH_3CN	70	72	92	66
7	CuI	**L2**	CH_3CN	80	85	86	73
8	CuI	**L2**	CH_3CN	90	61	67	41
9	CuI	**L1**	CH_3CN	70	89	90	80
10	CuI	**L3**	CH_3CN	70	84	94	79

11	CuI	**L5**	CH_3CN	70	100	87	87
12	**CuI**	**L4**	**CH_3CN**	**70**	**97**	**92**	**89**
13	CuI	**L2**	DCE	70	89	86	77
14	CuI	**L2**	DMF	70	23	87	20
15	CuI	**L2**	DMSO	70	0	0	0
16	CuI	**L2**	TCP	70	90	88	79

[a] Reaction condition: 4-methoxycinnamic acid **3a** (0.3 mmol), NFSI (0.42 mmol), catalyst (30 mol %), ligand (30 mol %) and DCE (2.0 mL); [b] Yield by LC.

3. Mechanism study

Scheme S1 Mechanistic Investigations

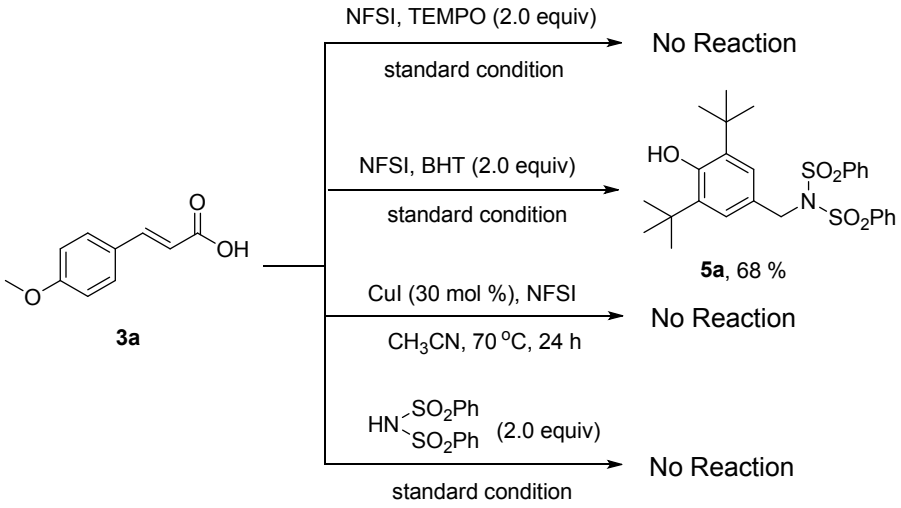
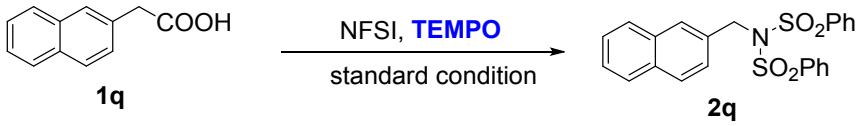


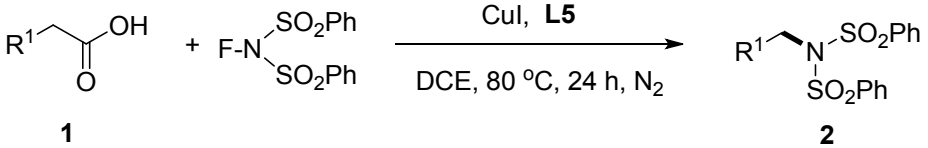
Table S2[a]



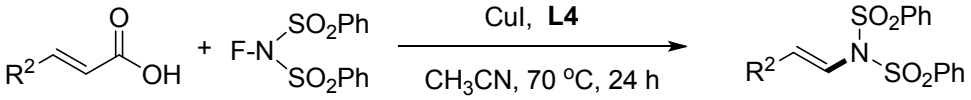
Entry	Radical trap	Conversion (%)	Yield (%)
1	TEMPO (30 ml%)	38	28
2	TEMPO (10 mol%)	57	50

[a] Yield by LC.

4. Synthesis and analytical d ata of 2, 4 and 5a

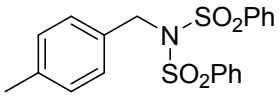


The typical experimental procedure for the decarboxylative coupling reaction was as followed: 2-naphthylacetic acid **1a** (0.3 mmol, 56 mg), NFSI (0.42 mmol, 132 mg), CuI (0.09 mmol, 17 mg), **L5** (0.09 mmol, 0.009 μL) and DCE (2.0 mL) were placed into a sealed tube (10 mL) with a magnetic stirrer bar under nitrogen atmosphere. The reaction was heated at 80 °C for 24 h. After the reaction finished, the catalyst was separated by centrifugation and filtration to obtain the liquid phase. The liquid products were analyzed by an Agilent 1260 Infinity Liquid Chromatogram. The pure product was obtained by flash column chromatography on silica gel by using petroleum ether (60-90 °C) and ethyl acetate as eluents.

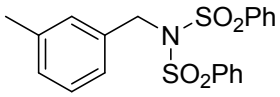


3 **4**

The typical experimental procedure for synthesis of *N*-vinyl sulfamide **4a**: 4-methoxcinnamic acid **3a** (0.3 mmol, 52 mg), NFSI (0.42 mmol, 132 mg), CuI (0.09 mmol, 17 mg), **L4** (0.09 mmol, 0.013 μL) and CH_3CN (2.0 mL) were placed into a sealed tube (10 mL) with a magnetic stirrer bar. The reaction was heated at 70 °C for 24 h. After the reaction finished, the catalyst was separated by centrifugation and filtration to obtain the liquid phase. The liquid products were analyzed by an Agilent 1260 Infinity Liquid Chromatogram. The pure product was obtained by flash column chromatography on silica gel by using petroleum ether (60-90 °C) and ethyl acetate as eluents.

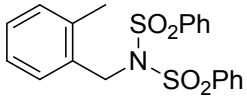


(2a) ***N*-(4-methylbenzyl)-*N*-(phenylsulfonyl)benzenesulfonamide**: White solid, m. p. 149-150 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.78 (d, *J*= 7.5 Hz, 4H), 7.56 (t, *J* = 7.5 Hz, 2H), 7.42 (t, *J* = 8.0 Hz, 4H), 7.26-7.23 (m, 2H), 7.03 (d, *J* = 7.5 Hz, 2H), 4.89 (s, 2H), 2.32 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 140.0, 137.8, 133.4, 131.4, 129.1, 128.9, 128.7, 128.0, 52.2, 21.0; **HRMS** (ESI) m/z calculated for $C_{20}H_{19}NNaO_4S_2$ $[M+Na]^+$: 424.0653, found 424.0658.

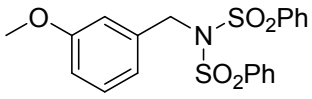


(2b) ***N*-(3-methylbenzyl)-*N*-(phenylsulfonyl)benzenesulfonamide**: White solid, m. p. 126-127 °C; **^{1}H NMR**

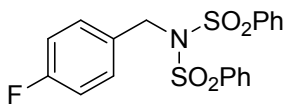
(500 MHz, $CDCl_3$) δ 7.80 (dd, *J* = 1.0, 8.5 Hz, 4H), 7.58 (t, *J* = 7.5 Hz, 2H), 7.44 (t, *J* = 8.0 Hz, 4H), 7.16-7.03 (m, 4H), 4.91 (s, 2H), 2.21 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 140.0, 138.0, 134.1, 133.5, 129.5, 128.7, 128.7, 128.2, 128.0, 126.1, 52.5, 21.1; **HRMS** (ESI) m/z calculated for $C_{20}H_{19}NNaO_4S_2$ $[M+Na]^+$: 424.0653, found 424.0654.



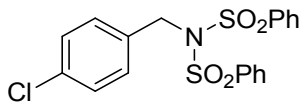
(2c) ***N*-(2-methylbenzyl)-*N*-(phenylsulfonyl)benzenesulfonamide**: White solid, m. p. 140-141 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.82-7.77 (m, 4H), 7.60-7.55 (m, 2H), 7.46-7.40 (m, 4H), 7.21 (d, *J* = 7.5 Hz, 1H), 7.12 (td, *J* = 1.0, 7.5 Hz, 1H), 7.04 (d, *J* = 7.5 Hz, 1H), 6.96 (t, *J* = 7.5 Hz, 1H), 5.02 (s, 2H), 2.30 (s, 3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 139.9, 136.3, 133.5, 132.0, 130.2, 129.2, 128.7, 128.0, 127.8, 125.9, 50.0, 19.1; **HRMS** (ESI) m/z calculated for $C_{20}H_{19}NNaO_4S_2$ $[M+Na]^+$: 424.0653, found 424.0663.



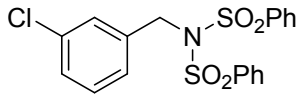
(2d) ***N*-(3-methoxybenzyl)-*N*-(phenylsulfonyl)benzenesulfonamide**: White solid, m. p. 108-109 °C; **^{1}H NMR** (300 MHz, $CDCl_3$) δ 7.84-7.78 (m, 4H), 7.61-7.53 (m, 2H), 7.47-7.39 (m, 4H), 7.17 (t, *J* = 8.1 Hz, 1H), 6.94 (d, *J* = 7.5 Hz, 1H), 6.86-6.84 (m, 1H), 6.82-6.76 (m, 1H), 4.92 (s, 2H), 3.65 (s, 3H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 159.5, 139.8, 135.7, 133.5, 129.3, 128.7, 128.0, 121.3, 114.2, 113.6, 55.0, 52.4; **HRMS** (ESI) m/z calculated for $C_{20}H_{19}NNaO_5S_2$ $[M+Na]^+$: 440.0602, found 440.0608.



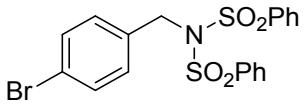
(2e) ***N*-(4-fluorobenzyl)-*N*-(phenylsulfonyl)benzenesulfonamide**: White solid, m. p. 129-130 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.80 (d, *J* = 7.5 Hz, 4H), 7.60 (t, *J* = 7.5 Hz, 2H), 7.46 (t, *J* = 8.0 Hz, 4H), 7.37 (dd, *J* = 5.5, 8.5 Hz, 2H), 6.93 (t, *J* = 9.0 Hz, 2H), 4.89 (s, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 163.5 (d, *J* = 245.7 Hz), 139.8, 133.6, 131.1 (d, *J* = 8.1 Hz), 130.3 (d, *J* = 2.5 Hz), 128.8, 128.0, 115.3 (d, *J* = 21.3 Hz), 51.6; **HRMS** (ESI) m/z calculated for $C_{19}H_{16}FNNaO_4S_2$ $[M+Na]^+$: 428.0402, found 428.0407.



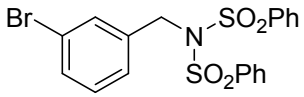
(2f) ***N*****-(4-chlorobenzyl)-*****N*****-(phenylsulfonyl)benzenesulfonamide**: White solid, m. p. 126-127 °C; **^{1}H NMR** (300 MHz, $CDCl_3$) δ 7.82-7.77 (m, 4H), 7.63-7.57 (m, 2H), 7.49-7.41 (m, 4H), 7.32-7.26 (m, 2H), 7.22-7.16 (m, 2H), 4.88 (s, 2H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 139.7, 134.0, 133.7, 133.0, 130.5, 128.8, 128.5, 128.0, 51.6; **HRMS** (ESI) m/z calculated for $C_{19}H_{16}ClNNaO_4S_2$ $[M+Na]^+$: 444.0107, found 444.0111.



(2g) ***N*****-(3-chlorobenzyl)-*****N*****-(phenylsulfonyl)benzenesulfonamide**: White solid, m. p. 112-113 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.83 (d, *J* = 8.0 Hz, 4H), 7.61 (t, *J* = 7.5 Hz, 2H), 7.47 (t, *J* = 8.0 Hz, 4H), 7.28 (s, 1H), 7.23 (d, *J* = 8.0 Hz, 2H), 7.17 (t, *J* = 7.5 Hz, 1H), 4.90 (s, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 139.7, 136.4, 134.3, 133.8, 129.6, 129.0, 128.8, 128.2, 128.0, 127.0, 51.7; **HRMS** (ESI) m/z calculated for $C_{19}H_{16}ClNNaO_4S_2$ $[M+Na]^+$: 444.0107, found 444.0109.

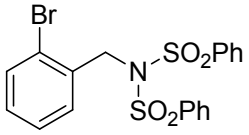


(2h) ***N*****-(3-bromobenzyl)-*****N*****-(phenylsulfonyl)benzenesulfonamide**: White solid, m. p. 135-136 °C; **^{1}H NMR** (300 MHz, $CDCl_3$) δ 7.82-7.76 (m, 4H), 7.64-7.56 (m, 2H), 7.48 (t, *J* = 8.1 Hz, 4H), 7.37-7.32 (m, 2H), 7.24 (d, *J* = 8.4 Hz, 2H), 4.87 (s, 2H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 139.7, 133.7, 133.5, 131.4, 130.8, 128.8, 128.0, 122.2, 51.7; **HRMS** (ESI) m/z calculated for $C_{19}H_{16}BrNNaO_4S_2$ $[M+Na]^+$: 487.9602, found 487.9615.



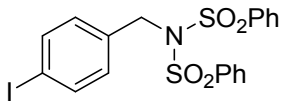
(2i) ***N*****-(3-bromobenzyl)-*****N*****-(phenylsulfonyl)benzenesulfonamide**: White solid, m. p. 113-114 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.83 (dd, *J* = 1.0, 8.5 Hz, 4H), 7.63-7.57 (m, 2H), 7.48 (dd, *J* = 8.0, 8.0 Hz, 4H),7.42 (s, 1H), 7.38

(d, J = 8.0 Hz, 1H), 7.28 (d, J = 10.5 Hz, 1H), 7.11 (t, J = 7.5 Hz, 1H), 4.89 (s, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 139.7, 136.6, 133.8, 131.8, 131.1, 129.9, 128.9, 128.0, 127.5, 122.4, 51.7; **HRMS** (ESI) m/z calculated for $C_{19}H_{16}BrNNaO_4S_2$ $[M+Na]^+$: 487.9602, found 487.9606.

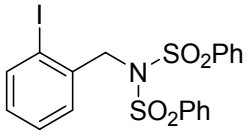


(2j) *N*-(2-bromobenzyl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 143-144 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.91 (dd, J = 1.0, 8.5 Hz, 4H), 7.64-7.59 (m, 2H), 7.50-7.45 (m, 5H), 7.16 (dd, J = 1.5, 7.5 Hz, 1H), 7.07-6.98 (m, 2H), 5.12 (s, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 139.5, 133.9, 133.7, 132.6, 129.3, 129.0, 128.9, 128.3, 127.2, 122.4, 52.3;

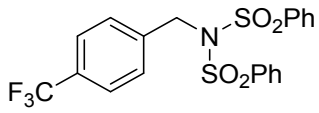
HRMS (ESI) m/z calculated for $C_{19}H_{16}BrNNaO_4S_2$ $[M+Na]^+$: 487.9602, found 487.9618.



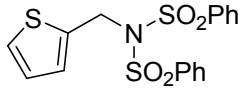
(2k) *N*-(4-iodobenzyl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 138-139 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.79 (d, J = 7.5 Hz, 4H), 7.60 (t, J = 7.5 Hz, 2H), 7.54 (d, J = 8.0 Hz, 2H), 7.45 (t, J = 7.5 Hz, 4H), 7.09 (d, J = 8.0 Hz, 2H), 4.85 (s, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 139.7, 137.4, 134.2, 133.6, 130.9, 128.8, 127.9, 93.8, 51.8; **HRMS** (ESI) m/z calculated for $C_{19}H_{16}INNaO_4S_2$ $[M+Na]^+$: 535.9463, found 535.9471.



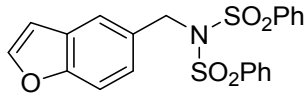
(2l) *N*-(2-iodobenzyl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 146-147 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.90 (d, J = 7.5 Hz, 4H), 7.78 (d, J = 7.5 Hz, 1H), 7.62 (t, J = 7.5 Hz, 2H), 7.48 (t, J = 8.0 Hz, 4H), 7.12 (d, J = 7.5 Hz, 1H), 7.03 (t, J = 7.5 Hz, 1H), 6.88 (t, J = 7.0 Hz, 1H), 5.04 (s, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 139.5, 139.2, 136.5, 133.9, 129.1, 128.9, 128.7, 128.3, 128.0, 97.3, 57.3; **HRMS** (ESI) m/z calculated for $C_{19}H_{16}INNaO_4S_2$ $[M+Na]^+$: 535.9463, found 535.9482.



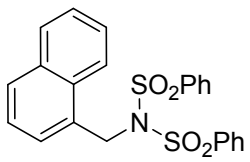
(2m) ***N*-(phenylsulfonyl)-*N*-(4-(trifluoromethyl)benzyl)benzenesulfonamide**: White solid, m. p. 134-135 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.80 (d, *J* = 8.0 Hz, 4H), 7.61 (t, *J* = 7.0 Hz, 2H), 7.49-7.41 (m, 8H), 4.98 (s, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 138.7, 137.5, 132.8, 129.4, 129.1, 128.3, 128.2, 127.9, 127.2, 127.0, 124.2 (q, *J* = 7.5 Hz), 121.8, 50.8; **HRMS** (ESI) m/z calculated for $C_{20}H_{17}F_3NO_4S_2$ $[M+H]^+$: 456.0551, found 456.0552.



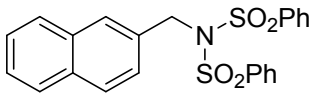
(2n) ***N*-(phenylsulfonyl)-*N*-(thiophen-2-ylmethyl)benzenesulfonamide**: White solid, m. p. 125-126 °C; **^{1}H NMR** (300 MHz, $CDCl_3$) δ 7.88-7.81 (m, 4H), 7.63-7.56 (m, 2H), 7.50-7.42 (m, 4H), 7.25 (dd, *J* = 1.2, 5.1 Hz, 1H), 7.12 (d, *J* = 2.7 Hz, 1H), 6.92 (dd, *J* = 3.6, 5.1 Hz, 1H), 5.09 (s, 2H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 139.8, 137.2, 133.7, 129.4, 128.8, 127.9, 127.2, 126.4, 47.1; **HRMS** (ESI) m/z calculated for $C_{17}H_{15}NNaO_4S_3$ $[M+Na]^+$: 416.0061, found 416.0061.



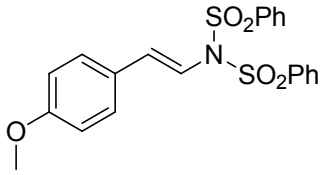
(2o) ***N*-(benzofuran-5-ylmethyl)-*N*-(phenylsulfonyl)benzenesulfonamide**: White solid, m. p. 130-131 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.77 (dd, *J* = 1.0, 8.0 Hz, 4H), 7.63-7.59 (m, 2H), 7.55-7.50 (m, 2H), 7.39-7.30 (m, 6H), 6.68-6.67 (m, 1H), 5.04 (s, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 154.6, 145.5, 140.0, 133.5, 128.9, 128.7, 128.0, 127.4, 125.5, 122.4, 111.1, 106.5, 52.6; **HRMS** (ESI) m/z calculated for $C_{21}H_{17}NNaO_5S_2$ $[M+Na]^+$: 450.0446, found 450.0450.



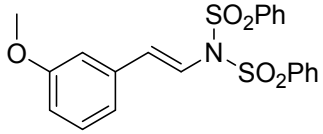
(2p) *N*-(naphthalen-1-ylmethyl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 147-148 °C; **^{1}H NMR** (300 MHz, $CDCl_3$) δ 8.09 (d, *J* = 8.4 Hz, 1H), 7.81-7.72 (m, 5H), 7.69 (d, *J* = 8.4 Hz, 1H), 7.53-7.39 (m, 4H), 7.38-7.30 (m, 5H), 7.25-7.17 (m, 1H), 5.52 (s, 2H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 139.6, 133.4, 133.3, 130.9, 129.1, 128.66, 128.62, 128.5, 127.8, 127.7, 126.4, 125.6, 124.8, 122.5, 50.6; **HRMS** (ESI) m/z calculated for $C_{23}H_{19}NNaO_4S_2$ $[M+Na]^+$: 460.0653, found 460.0654.



(2q) *N*-(naphthalen-2-ylmethyl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 143-144 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.78 (t, *J* = 8.0 Hz, 6H), 7.72-7.69 (m, 1H), 7.65 (d, *J* = 8.5 Hz, 1H), 7.50-7.43 (m, 5H), 7.31 (d, *J* = 7.5 Hz, 4H), 5.09 (s, 2H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 139.8, 133.5, 132.86, 132.83, 131.6, 128.6, 128.4, 128.1, 127.99, 127.92, 127.4, 126.2, 126.18, 126.16, 52.6; **HRMS** (ESI) m/z calculated for $C_{23}H_{19}NNaO_4S_2$ $[M+Na]^+$: 460.0653, found 460.0659.

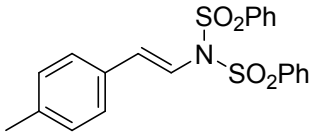


(4a) (*E*)-*N*-(4-methoxystyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 145-146 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.0 Hz, 4H), 7.67 (t, *J* = 7.2 Hz, 2H), 7.56 (t, *J* = 8.0 Hz, 4H), 7.30 (d, *J* = 8.4 Hz, 2H), 6.87 (d, *J* = 8.4 Hz, 2H), 6.61 (d, *J* = 13.6 Hz, 1H), 6.38 (d, *J* = 13.6 Hz, 1H), 3.81 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 160.5, 139.5, 139.2, 133.8, 129.0, 128.6, 128.1, 126.2, 117.0, 114.1, 55.3; **HRMS** (ESI) m/z calculated for $C_{21}H_{20}NO_5S_2$ $[M+Na]^+$: 430.0783, found 430.0785.

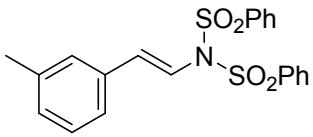


(4b) (*E*)-*N*-(3-methoxystyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 129-130 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.02-7.97 (m, 4H), 7.69-7.64 (m, 2H), 7.58-7.53 (m, 4H), 7.28 (t, *J* = 8.0 Hz, 1H), 6.95 (d, *J* = 7.5 Hz, 1H), 6.90 (dd, *J* = 2.0, 11.0, 2H), 6.67 (d, *J* = 13.5 Hz, 1H), 6.53 (d, *J* = 13.5 Hz, 1H), 3.81 (s,

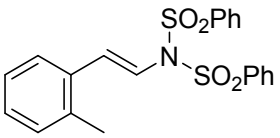
3H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 159.8, 139.4, 138.8, 135.0, 133.9, 129.8, 129.1, 128.1, 119.8, 119.6, 115.0, 112.4, 55.3; **HRMS** (ESI) m/z calculated for $C_{21}H_{20}NO_5S_2$ $[M+Na]^+$: 430.0783, found 430.0789.



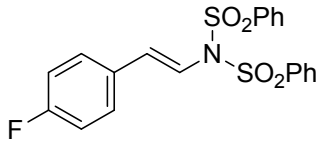
(4c) (*E*)-*N*-(4-methylstyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 141-142 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.0 (d, *J* = 8.0 Hz, 4H), 7.69 (t, *J* = 7.2 Hz, 2H), 7.57 (t, *J* = 8.0 Hz, 4H), 7.26 (d, *J* = 6.8 Hz, 2H), 7.16 (d, *J* = 8.0 Hz, 2H), 6.65 (d, *J* = 13.6 Hz, 1H), 6.48 (d, *J* = 13.6 Hz, 1H), 2.36 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 139.5, 139.4, 139.3, 133.9, 130.8, 129.4, 129.0, 128.1, 127.1,118.3, 21.3; **HRMS** (ESI) m/z calculated for $C_{21}H_{19}NNaO_4S_2$ $[M+Na]^+$: 436.0653, found 436.0658.



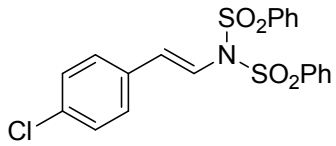
(4d) (*E*)-*N*-(3-methylstyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 125-126 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.01 (d, *J* = 7.6 Hz, 4H), 7.69 (t, *J* = 7.2 Hz, 2H), 7.58 (t, *J* = 7.6 Hz, 4H), 7.24 (d, *J* = 7.2 Hz, 1H), 7.18 (t, *J* = 8.0 Hz, 3H), 6.67 (d, *J* = 14.0 Hz, 1H), 6.53 (d, *J* = 14.0 Hz, 1H), 2.35 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 139.5, 139.2, 138.4, 133.9, 133.6, 130.1, 129.0, 128.6, 128.1, 127.8, 124.4, 119.1, 21.2; **HRMS** (ESI) m/z calculated for $C_{21}H_{19}NNaO_4S_2$ $[M+Na]^+$: 436.0653, found 436.0663.



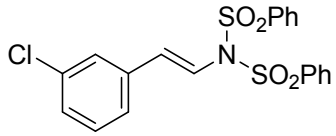
(4e) (*E*)-*N*-(2-methylstyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 132-133 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 7.6 Hz, 4H), 7.69 (t, *J* = 7.2 Hz, 2H), 7.58 (t, *J* = 8.0 Hz, 4H), 7.39 (d, *J* = 7.2 Hz, 1H), 7.28-7.14 (m, 4H), 6.90 (d, *J* = 13.6 Hz, 1H), 6.38 (d, *J* = 13.6 Hz, 1H), 2.22 (s, 3H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 139.5, 137.8, 136.5, 133.9, 132.8, 130.4, 129.2, 129.1, 128.1, 126.3, 126.2, 120.3, 19.6; **HRMS** (ESI) m/z calculated for $C_{21}H_{19}NNaO_4S_2$ $[M+Na]^+$: 436.0653, found 436.0654.



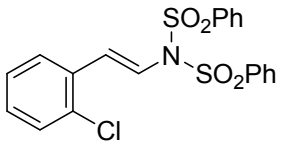
(4f) (*E*)-*N*-(4-fluorostyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 112-123 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.01-7.97 (m, 4H), 7.69 (t, *J* = 7.5 Hz, 2H), 7.57 (t, *J* = 8.0 Hz, 4H), 7.36-7.31 (m, 2H), 7.07-7.01 (m, 2H), 6.66 (d, *J* = 13.5 Hz, 1H), 6.46 (d, *J* = 13.5 Hz, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 164.3 (d, *J* = 248.7 Hz), 139.4, 137.8, 134.0, 129.9 (d, *J* = 3.3 Hz), 129.1, 129.0 (d, *J* = 12.5 Hz), 128.1, 119.1 (d, *J* = 1.6 Hz), 115.9 (d, *J* = 21.7 Hz); **HRMS** (ESI) m/z calculated for $C_{20}H_{16}FNNaO_4S_2$ $[M+Na]^+$: 440.0402, found 440.0404.



(4g) (*E*)-*N*-(4-chlorostyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 131-132 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.0 Hz, 4H), 7.70 (t, *J* = 7.2 Hz, 2H), 7.58 (t, *J* = 7.6 Hz, 4H), 7.33 (dd, *J* = 8.4, 16.8 Hz, 4H), 6.67 (d, *J* = 13.6 Hz, 1H), 6.53 (d, *J* = 13.6 Hz, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 139.4, 137.4, 135.2, 134.0, 132.2, 129.1, 129.0. 128.3, 128.1. 119.9; **HRMS** (ESI) m/z calculated for $C_{20}H_{16}ClNNaO_4S_2$ $[M+Na]^+$: 456.0107, found 456.0114.

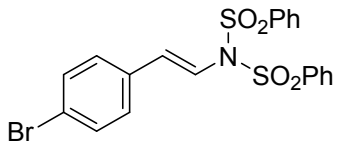


(4h) (*E*)-*N*-(3-chlorostyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 125-126 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.00 (dd, *J* = 0.5, 8.0 Hz, 4H), 7.69 (t, *J* = 7.5 Hz, 2H), 7.59-7.54 (m, 4H), 7.36-7.26 (m, 3H), 7.24-7.21 (m, 1H), 6.67 (d, *J* = 14.0 Hz, 1H), 6.57 (d, *J* = 14.0 Hz, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 139.3, 136.8, 135.5, 134.8, 134.1, 130.0, 129.2, 129.1, 128.1, 126.9, 125.4, 120.8; **HRMS** (ESI) m/z calculated for $C_{20}H_{16}ClNNaO_4S_2$ $[M+Na]^+$: 456.0107, found 456.0111.

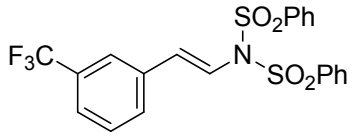


(4i) (*E*)-*N*-(2-chlorostyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 127-128 °C; **^{1}H NMR**

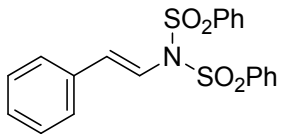
(400 MHz, $CDCl_3$) δ 8.03 (d, *J* = 8.0 Hz, 4H), 7.70 (dd, *J* = 7.6, 14.8 Hz, 2H), 7.60 (t, *J* = 7.6 Hz, 4H), 7.49-7.26 (m, 4H), 7.07 (d, *J* = 13.6 Hz, 1H), 6.55 (d, *J* = 13.6 Hz, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 139.4, 134.8, 134.5, 134.0, 132.2, 130.2, 129.9, 129.1, 128.2, 127.4, 127.0, 121.9; **HRMS** (ESI) m/z calculated for $C_{20}H_{16}ClNNaO_4S_2$ $[M+Na]^+$: 456.0107, found 456.0108.



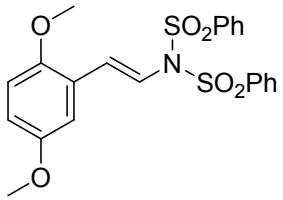
(4j) (*E*)-*N*-(4-bromostyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 128-129 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.99 (d, *J* = 7.6 Hz, 4H), 7.70 (t, *J* = 7.6 Hz, 2H), 7.56 (t, *J* = 7.8 Hz, 4H), 7.49 (d, *J* = 8.4 Hz, 2H), 7.23 (d, *J* = 8.4 Hz, 2H), 6.66 (d, *J* = 13.6 Hz, 1H), 6.55 (d, *J* = 13.6 Hz, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 139.3, 137.4, 134.0, 132.6, 132.0, 129.1, 128.6, 128.1, 123.4, 120.0; **HRMS** (ESI) m/z calculated for $C_{20}H_{16}BrNNaO_4S_2$ $[M+Na]^+$: 499.9602, found 499.9623.



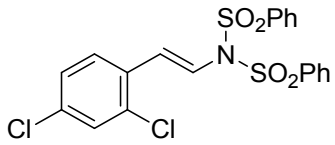
(4k) (*E*)-*N*-(phenylsulfonyl)-*N*-(3-(trifluoromethyl)styryl)benzenesulfonamide: White solid, m. p. 137-138 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.90 (d, *J* = 7.0 Hz, 4H), 7.75-7.70 (m, 2H), 7.65-7.53 (m, 4H), 7.45 (t, *J* = 7.5 Hz, 4H), 6.18 (dd, *J* = 1.5, 4.5, 1H), 5.50 (d, *J* = 5.0 Hz, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 165.8, 138.6, 134.4, 133.8, 132.9, 129.7, 129.1, 128.5, 126.2, 126.0 (q, *J* = 10.6 Hz),124.1, 74.8 (d, *J* = 393.1 Hz), 29.6; **HRMS** (ESI) m/z calculated for $C_{21}H_{16}F_3NNaO_4S_2$ $[M+Na]^+$: 490.0371, found 490.0377.



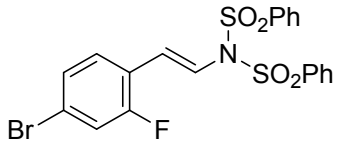
(4l) (*E*)-*N*-(phenylsulfonyl)-*N*-styrylbenzenesulfonamide: White solid, m. p. 147-148 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.01 (d, *J* = 7.6 Hz, 4H), 7.67 (t, *J* = 7.6 Hz, 2H), 7.56 (t, *J* = 8.0 Hz, 4H), 7.38-7.32 (m, 5H), 6.71 (d, *J* = 14.0 Hz, 1H), 6.54 (d, *J* = 13.6 Hz, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 139.5, 139.0, 133.9, 133.7, 129.3, 129.0, 128.8, 128.1, 127.2, 119.4; **HRMS** (ESI) m/z calculated for $C_{20}H_{17}NNaO_4S_2$ $[M+Na]^+$: 422.0497, found 422.0499.



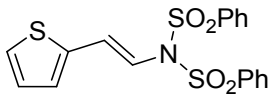
(4m) (*E*)-*N*-(2,5-dimethoxystyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 136-137 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.0 Hz, 4H), 7.68 (t, *J* = 7.6 Hz, 2H), 7.57 (t, *J* = 7.6 Hz, 4H), 6.89-6.79 (m, 4H), 6.63 (d, *J* = 13.6 Hz, 1H), 3.77 (s, 6H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 153.4, 152.0, 139.6, 135.2, 133.8, 129.0, 128.2, 123.3, 120.4, 115.5, 113.7, 112.3, 56.0, 55.8; **HRMS** (ESI) m/z calculated for $C_{22}H_{21}NNaO_6S_2$ $[M+Na]^+$: 482.0708, found 482.0709.



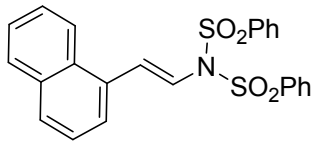
(4n) (*E*)-*N*-(2,4-dichlorostyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 135-136 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.02 (d, *J* = 7.6 Hz, 4H), 7.71 (t, *J* = 7.6 Hz, 2H), 7.60 (t, *J* = 8.0 Hz, 4H), 7.42-7.38 (m, 2H), 7.24 (dd, *J* = 1.2, 8.4 Hz, 1H), 7.00 (d, *J* = 13.6 Hz, 1H), 6.55 (d, *J* = 13.6 Hz, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 139.3, 135.4, 134.4, 134.1, 133.2, 130.8, 129.7, 129.1, 128.2, 128.1, 127.4, 122.4; **HRMS** (ESI) m/z calculated for $C_{20}H_{15}Cl_2NNaO_4S_2$ $[M+Na]^+$: 489.9717, found 489.9718.



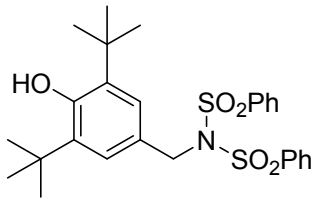
(4o) (*E*)-*N*-(4-bromo-2-fluorostyryl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 134-135 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.06-8.00 (m, 4H), 7.70 (t, *J* = 7.5 Hz, 2H), 7.59 (t, *J* = 8.0 Hz, 4H), 7.46 (dd, *J* = 6.0, 9.0 Hz, 1H), 7.34 (dd, *J* = 2.5, 8.0 Hz, 1H), 7.05 (td, *J* = 2.5, 8.0 Hz, 1H), 6.97 (d, *J* = 13.5 Hz, 1H), 6.45 (d, *J* = 13.5 Hz, 1H); **^{13}C NMR** (125 MHz, $CDCl_3$) δ 163.6 (d, *J* = 252.5 Hz), 139.4, 136.1, 134.1, 130.4 (d, *J* = 3.6 Hz), 129.1, 128.7 (d, *J* = 8.5 Hz), 128.2, 124.3 (d, *J* =9.5 Hz), 121.9, 120.5 (d, *J* = 24.3 Hz), 115.2 (d, *J* = 21.1 Hz); **HRMS** (ESI) m/z calculated for $C_{20}H_{15}BrFNNaO_4S_2$ $[M+Na]^+$: 517.9508, found 517.9512.



(4p) (*E*)-*N*-(phenylsulfonyl)-*N*-(2-(thiophen-2-yl)vinyl)benzenesulfonamide: White solid, m. p. 155-156 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.93 (d, *J* = 7.6 Hz, 4H), 7.62 (t, *J* = 7.6 Hz, 2H), 7.51 (t, *J* = 7.6 Hz, 4H), 7.23 (d, *J* = 4.8 Hz, 1H), 7.00 (d, *J* = 3.2 Hz, 1H), 6.96-6.93 (m, 1H), 6.78-6.72 (m, 1H), 6.32 (d, *J* = 13.6 Hz, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 139.4, 137.3, 134.0, 132.3, 129.1, 128.8, 128.2, 127.7, 126.8, 117.9; **HRMS** (ESI) m/z calculated for $C_{18}H_{15}NNaO_4S_3$ $[M+Na]^+$: 428.0061, found 428.0064.



(4q) (*E*)-*N*-(2-(naphthalen-1-yl)vinyl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 132-133 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.06 (d, *J* = 8.0 Hz, 4H), 7.89-7.82 (m, 3H), 7.70 (t, *J* = 7.6 Hz, 2H), 7.59 (t, *J* = 7.6 Hz, 5H), 7.54-7.50 (m, 2H), 7.48-7.42 (m, 2H), 6.53 (d, *J* = 13.2 Hz, 1H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 139.5, 137.3, 134.0, 133.4, 131.2, 131.1, 129.6, 129.1, 128.5, 128.2, 126.7, 126.2, 125.4, 124.8, 123.7, 121.6; **HRMS** (ESI) m/z calculated for $C_{24}H_{19}NNaO_4S_2$ $[M+Na]^+$: 472.0653, found 472.0656.



(5a) (*E*)-*N*-(2-(naphthalen-1-yl)vinyl)-*N*-(phenylsulfonyl)benzenesulfonamide: White solid, m. p. 152-153 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.79 (d, *J* = 7.6 Hz, 4H), 7.55 (t, *J* = 7.6 Hz, 2H), 7.42 (t, *J* = 8.0 Hz, 4H), 7.18 (s, 2H), 5.20 (s, 1H), 4.89 (s, 2H), 1.35 (s, 18H); **^{13}C NMR** (100 MHz, $CDCl_3$) δ 153.5, 140.3, 135.7, 133.3, 128.6, 127.8, 126.2, 124.7, 53.1, 34.1, 30.1; **HRMS** (ESI) m/z calculated for $C_{27}H_{33}NNaO_5S_2$ $[M+Na]^+$: 538.1698, found 538.1699.

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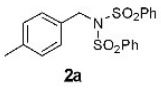
5. NMR spectra copies



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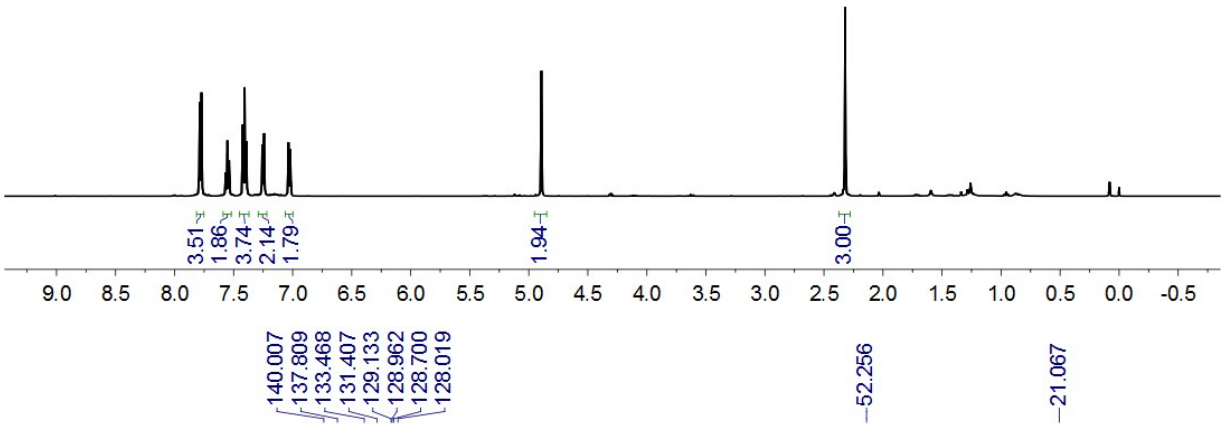

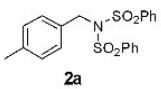

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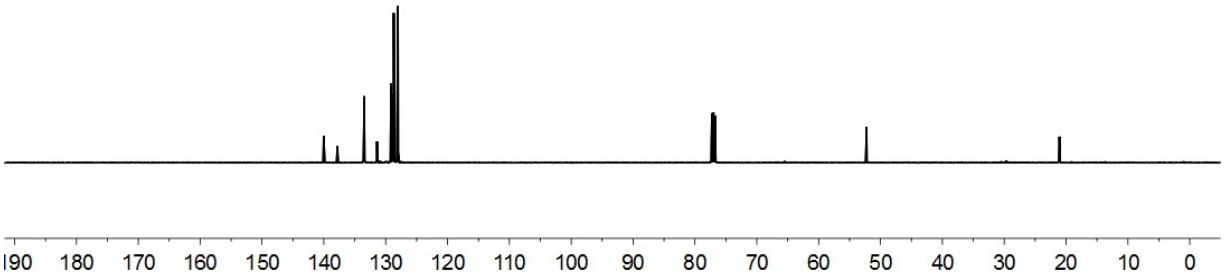

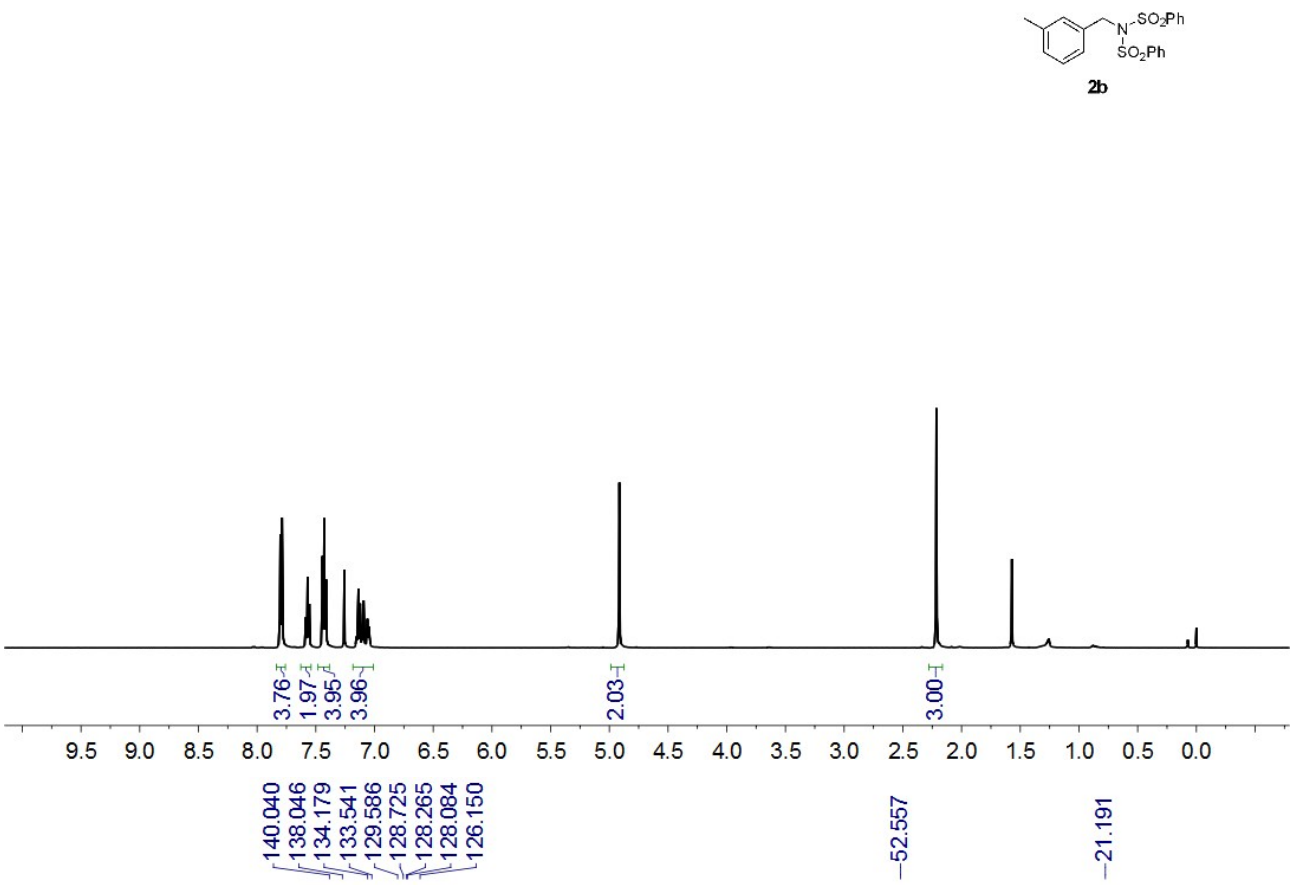
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N
SO2Ph
2b
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3.95
3.96
2.03
3.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
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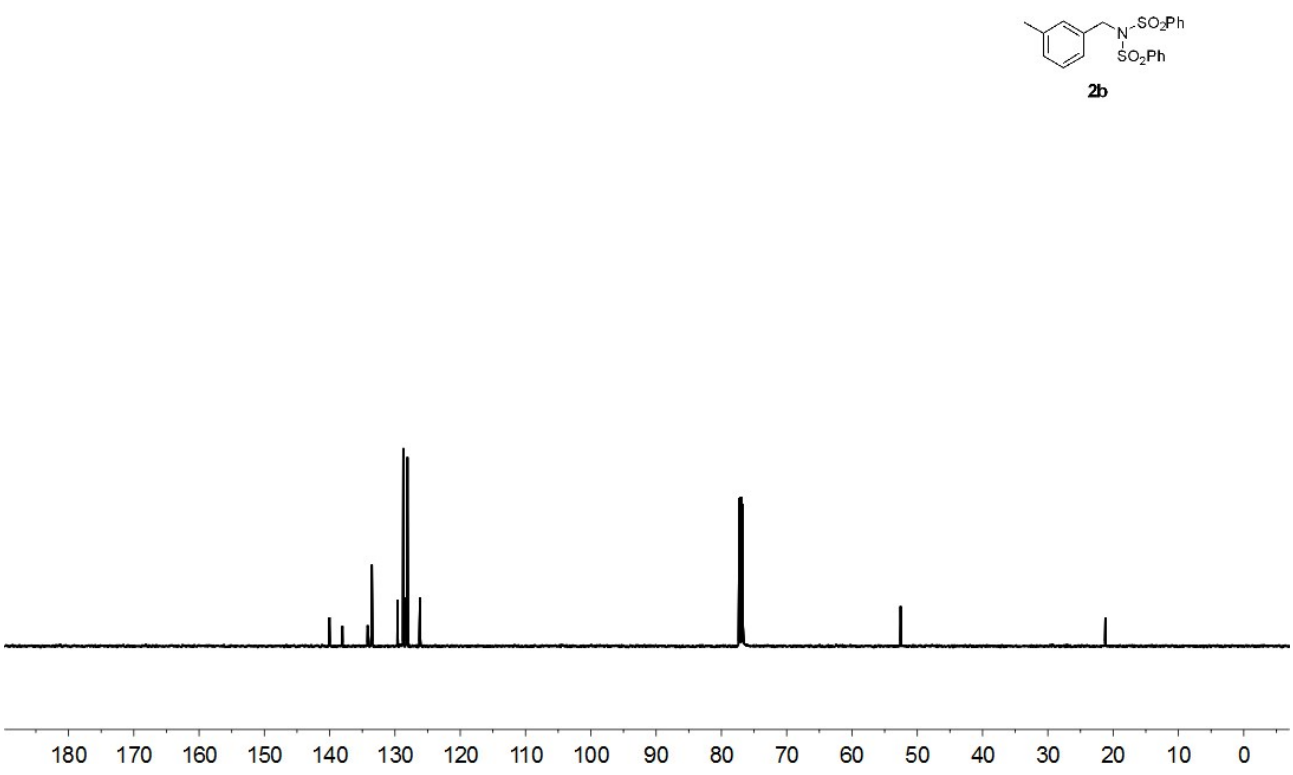
128.265
128.084
126.150
52.557
21.191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N
SO2Ph
2b
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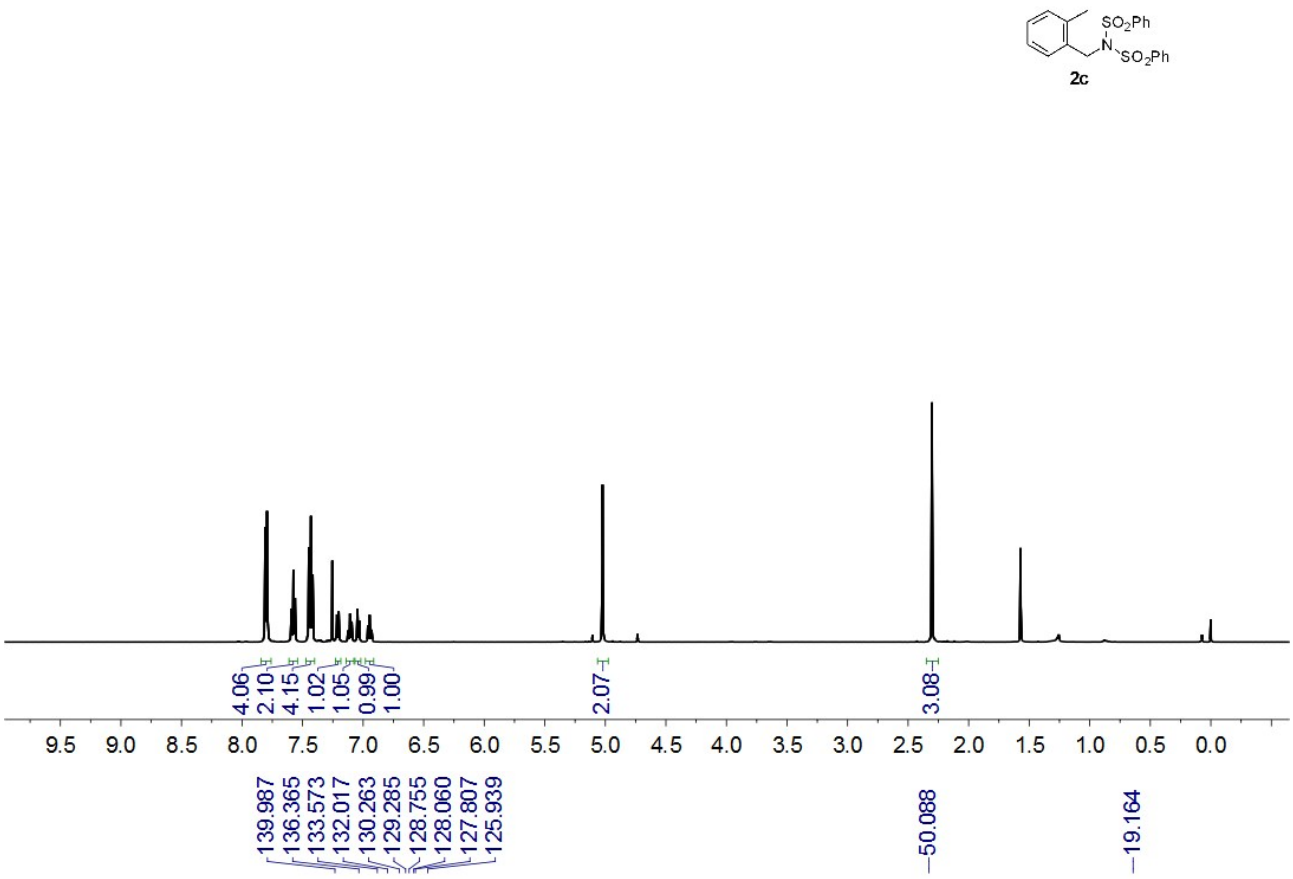
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SO2Ph
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1.02
1.05
0.99
1.00
2.07
3.08
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
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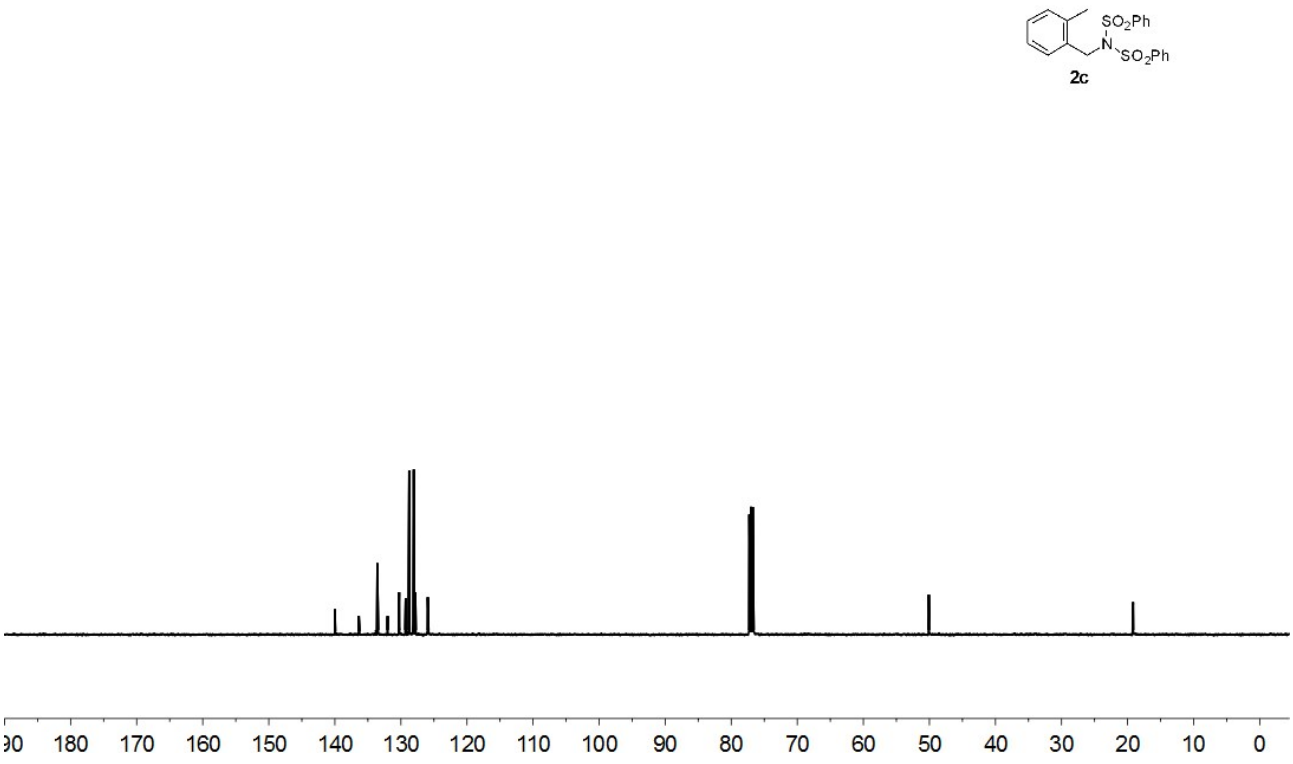
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N
SO2Ph
2c
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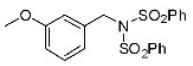
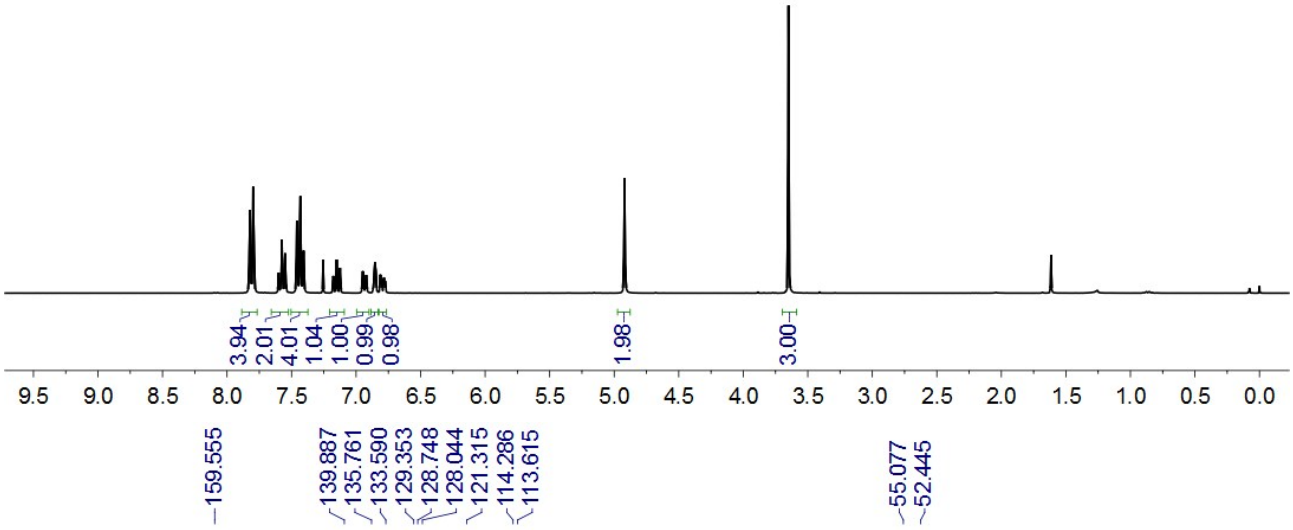

O
N
SO2Ph
SO2Ph

2d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4.01
1.04
1.00
0.99
0.98
1.98
3.00
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133.590
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121.315
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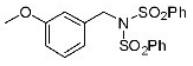
113.615
55.077
52.445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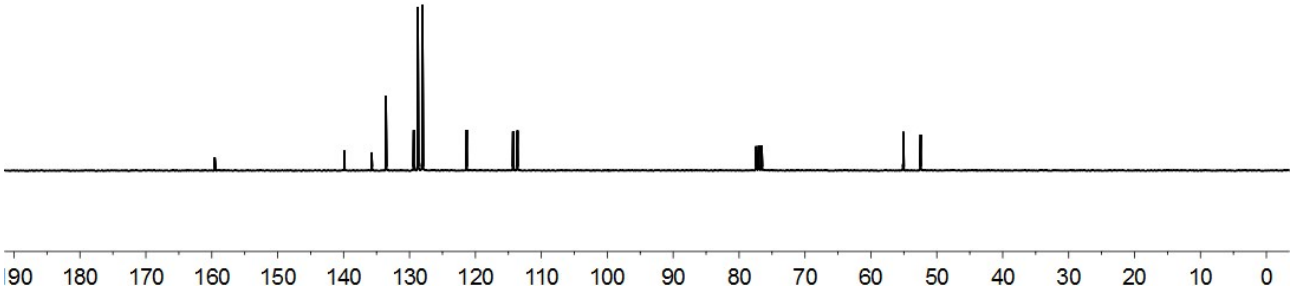
N
SO2Ph
SO2Ph

2d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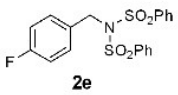
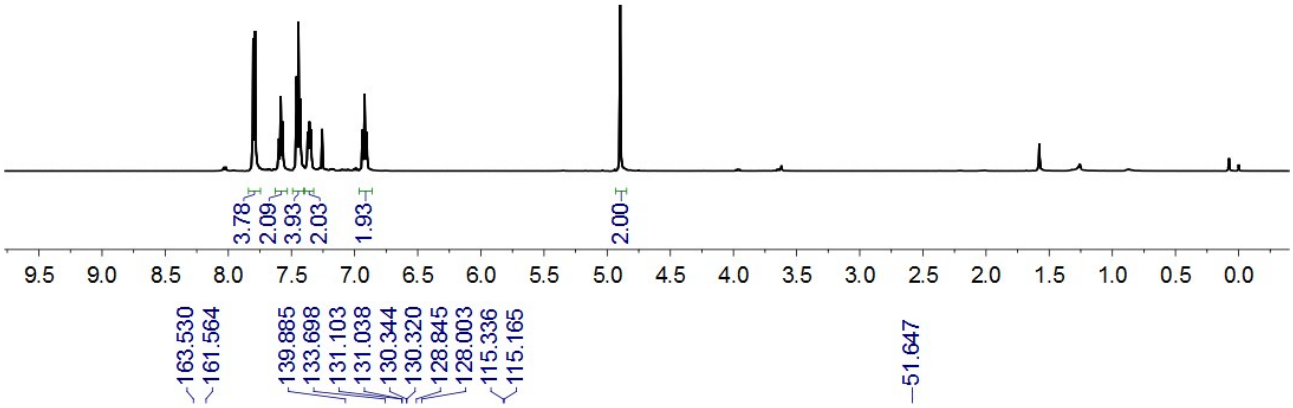

F
N
SO2Ph
SO2Ph

2e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2.00
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130.344
130.320
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128.003
115.336
115.165
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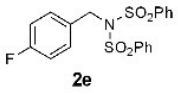
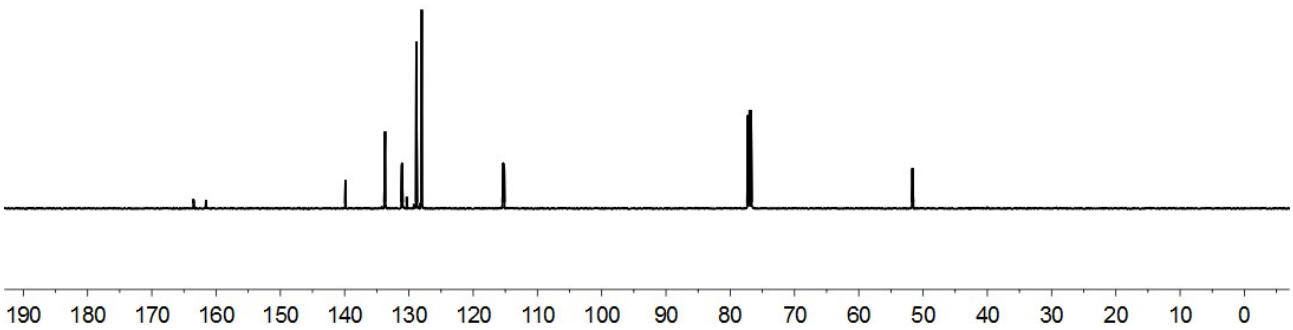

F
N
SO2Ph
SO2Ph

2e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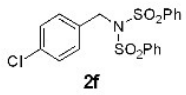
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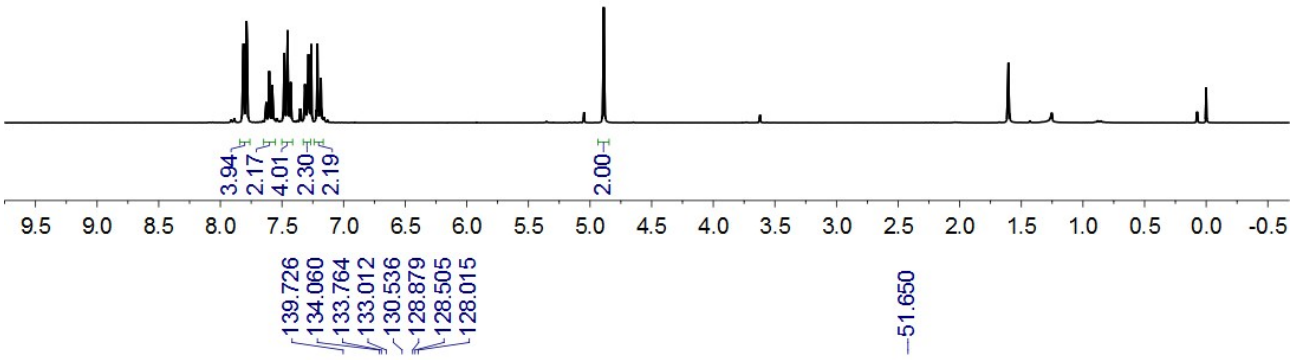
N
SO2Ph
SO2Ph

2f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4.01
2.30
2.19
2.00
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 0.0 -0.5

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133.764
133.012
130.536
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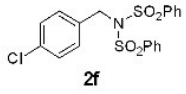
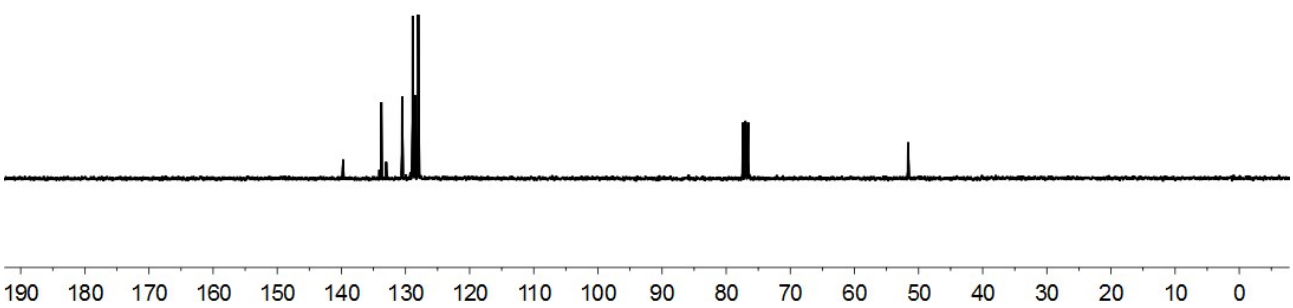
128.505
128.015
51.650


Cl
N
SO2Ph
SO2Ph

2f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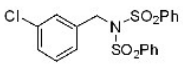
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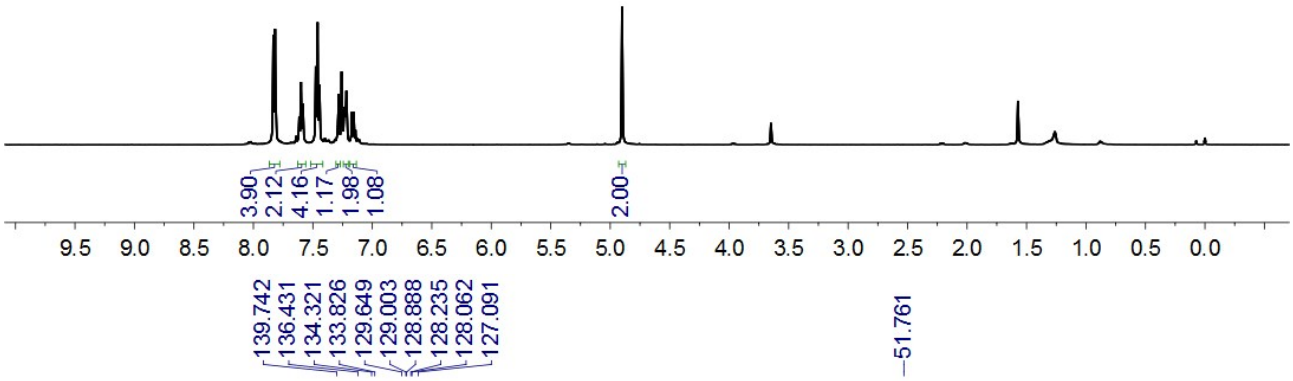
N
SO2Ph
SO2Ph

2g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1.98
1.08
2.00
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 0.0

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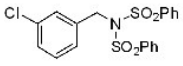
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N
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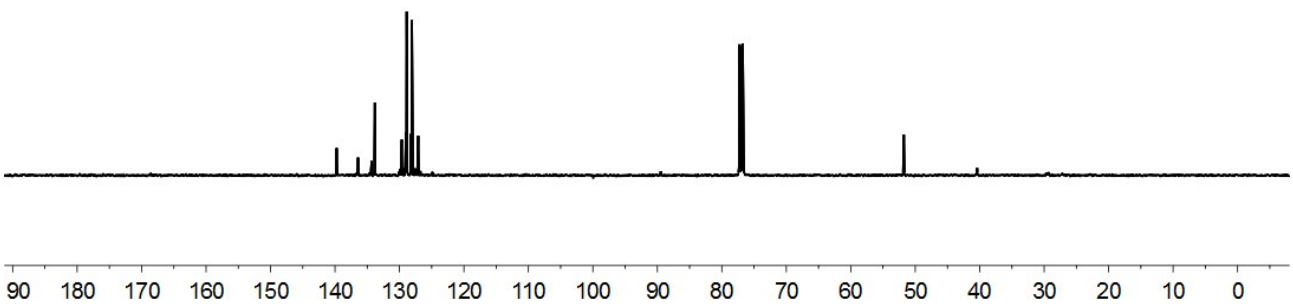
SO2Ph

2g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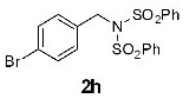
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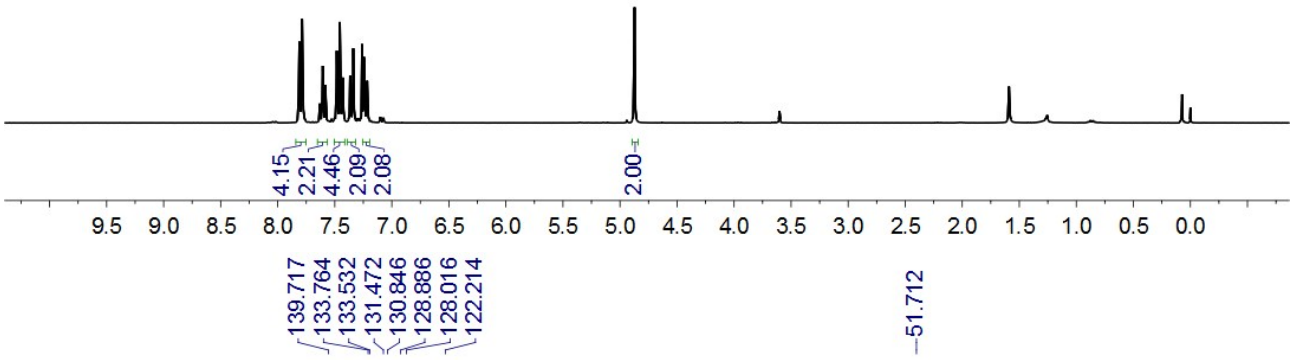
N
SO2Ph
SO2Ph

2h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2.00
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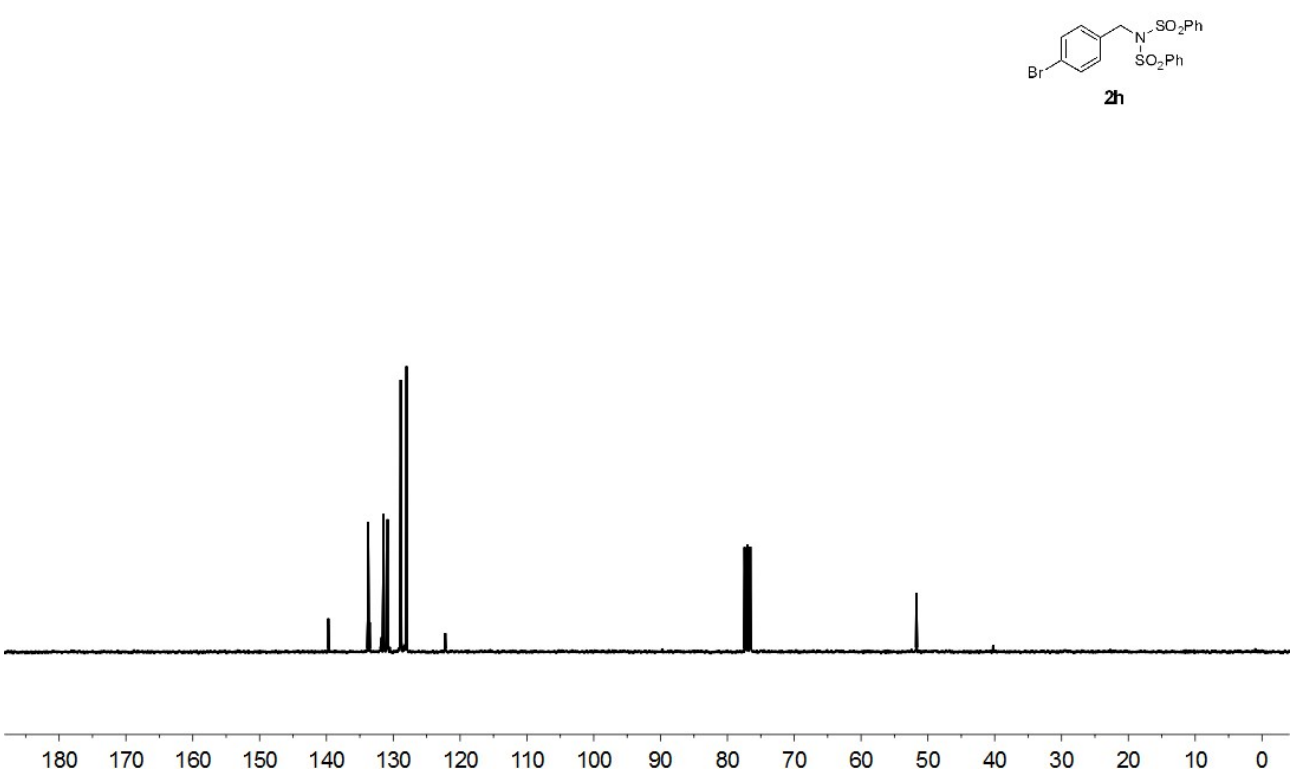
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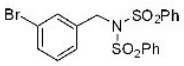
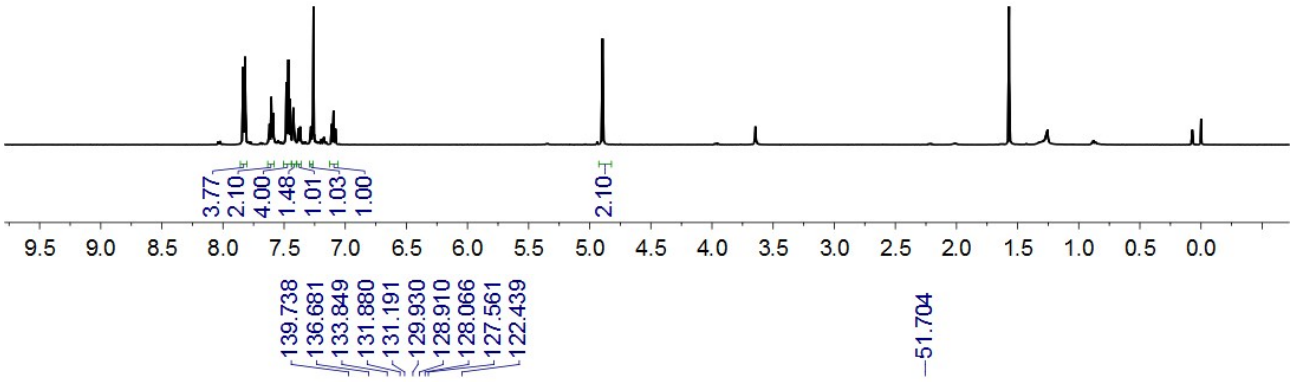
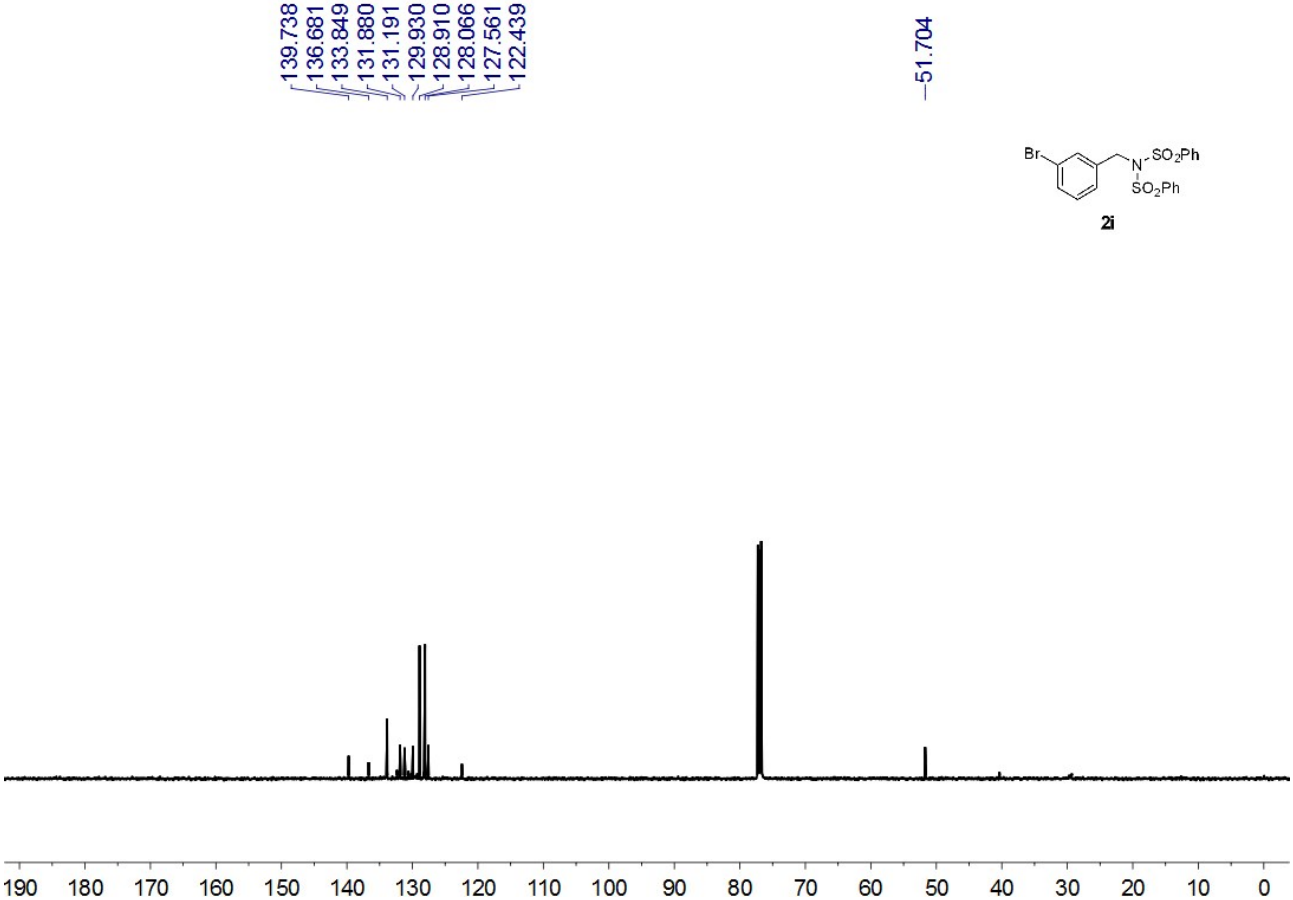
Br
N
SO2Ph
SO2Ph

2h



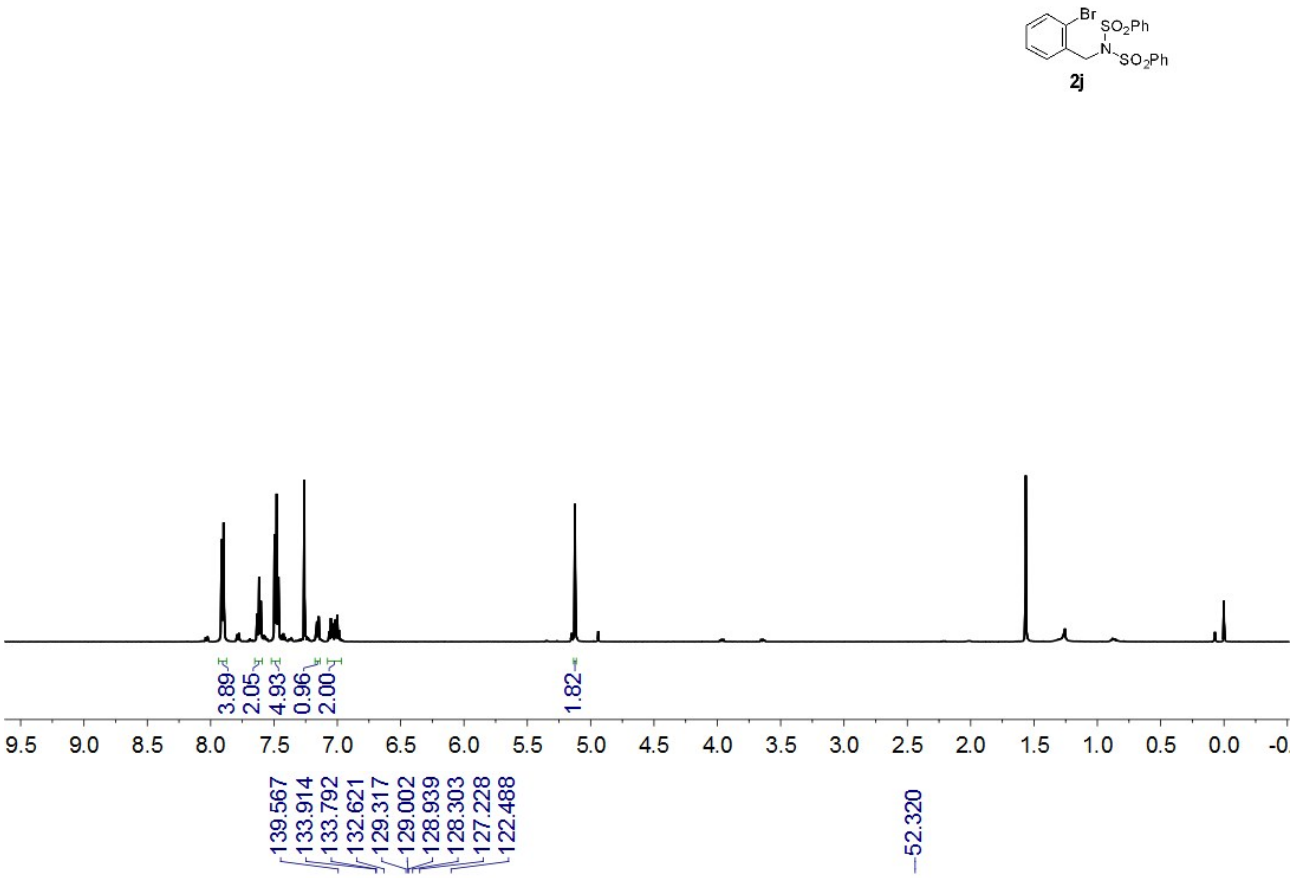
2i





Br
N
SO2Ph
SO2Ph

2i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N
SO2Ph
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4.93
0.96
2.00
1.82
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 0.0
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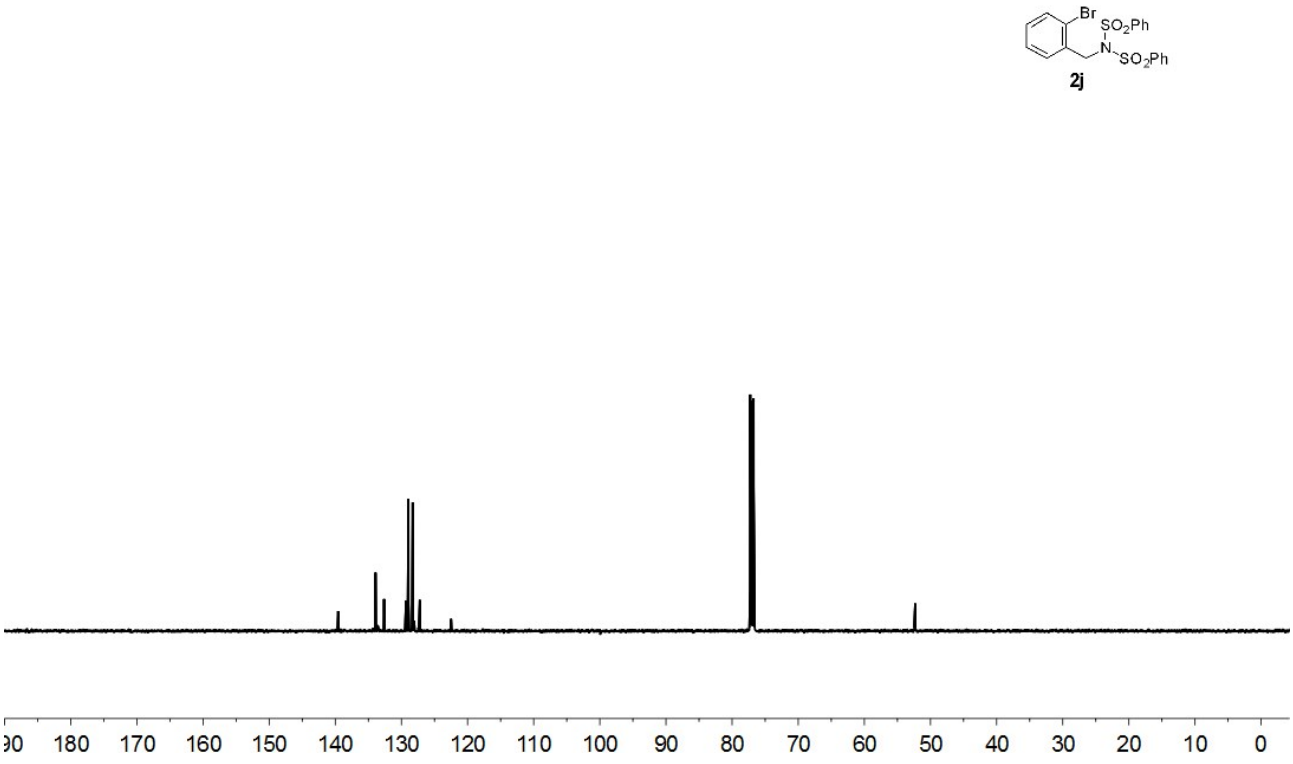
133.792
132.621
129.317
129.002
128.939
128.303
127.228
122.488
52.320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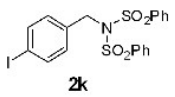
N
SO2Ph
2j
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0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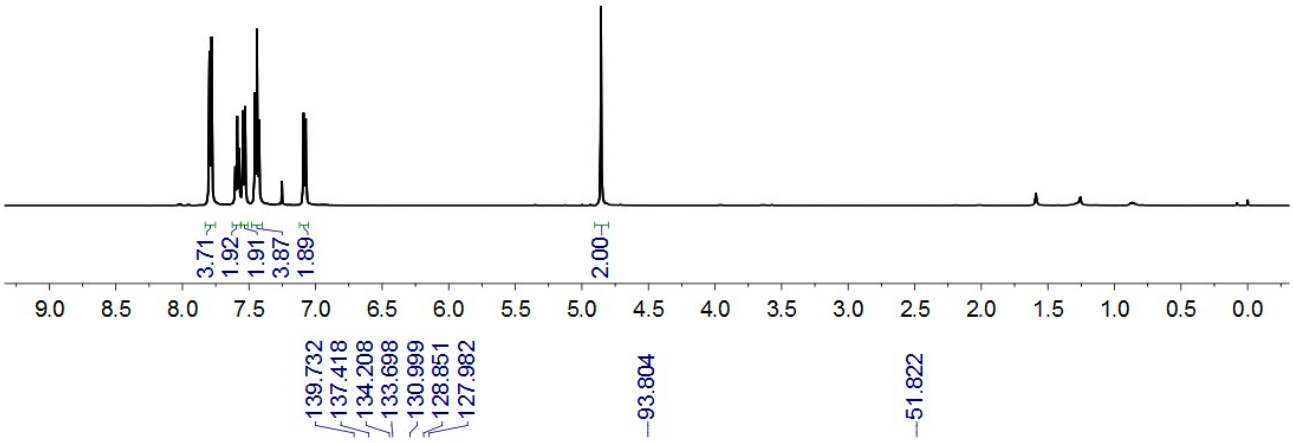
N
SO2Ph
I

2k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7.0
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6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
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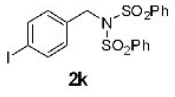
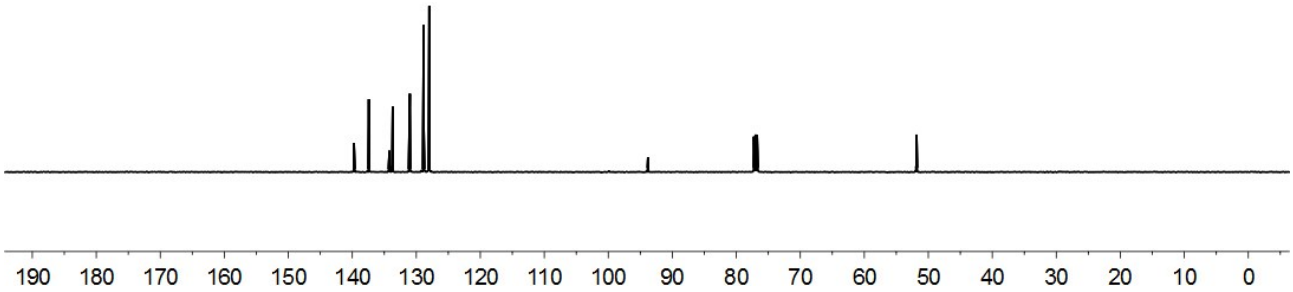
127.982

93.804

51.822


SO2Ph
N
SO2Ph
I

2k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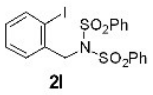
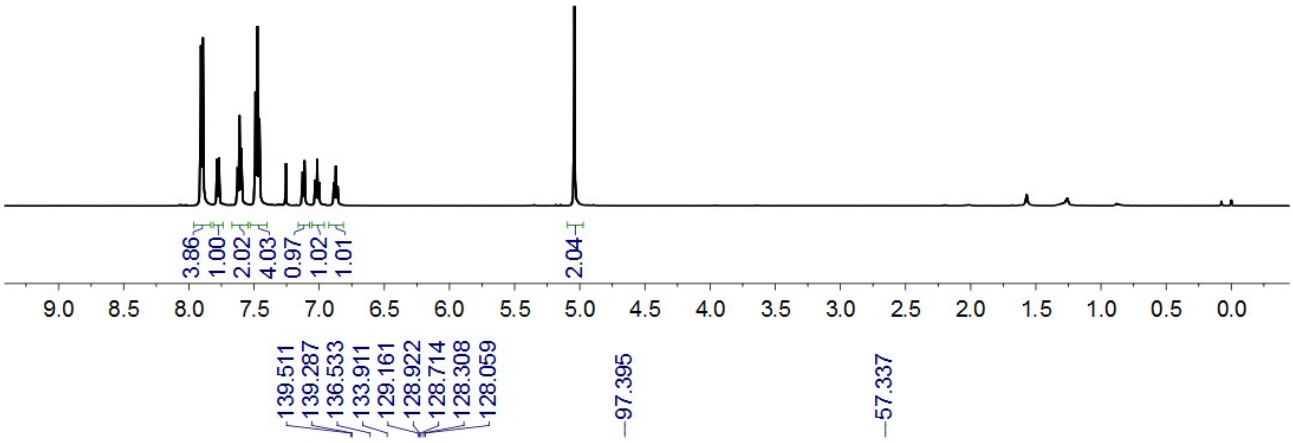

I
SO2Ph
N
SO2Ph

2l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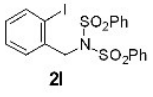
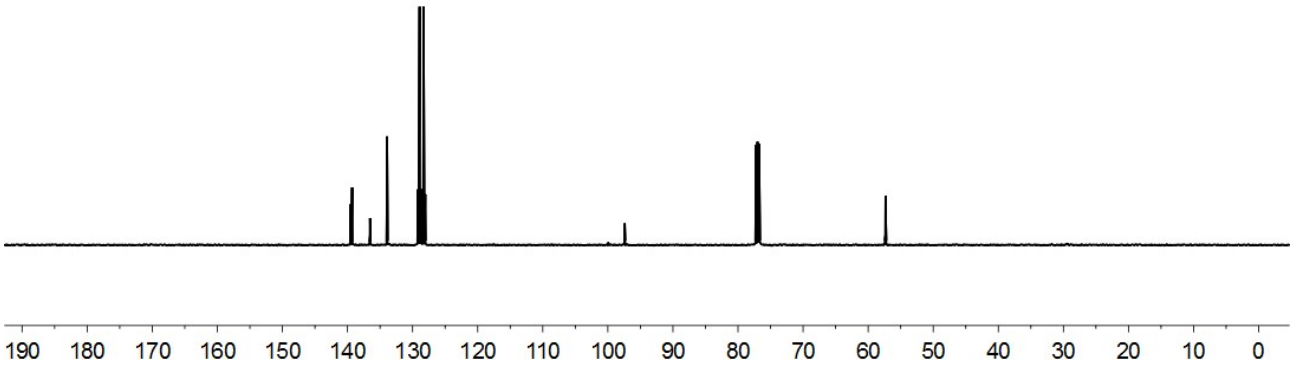
2.02
4.03
0.97
1.02
1.01
2.04
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
139.511
139.287
136.533
133.911
129.161
128.922
128.714
128.308
128.059
97.395
57.337


I
SO2Ph
N
SO2Ph

2l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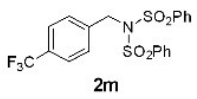
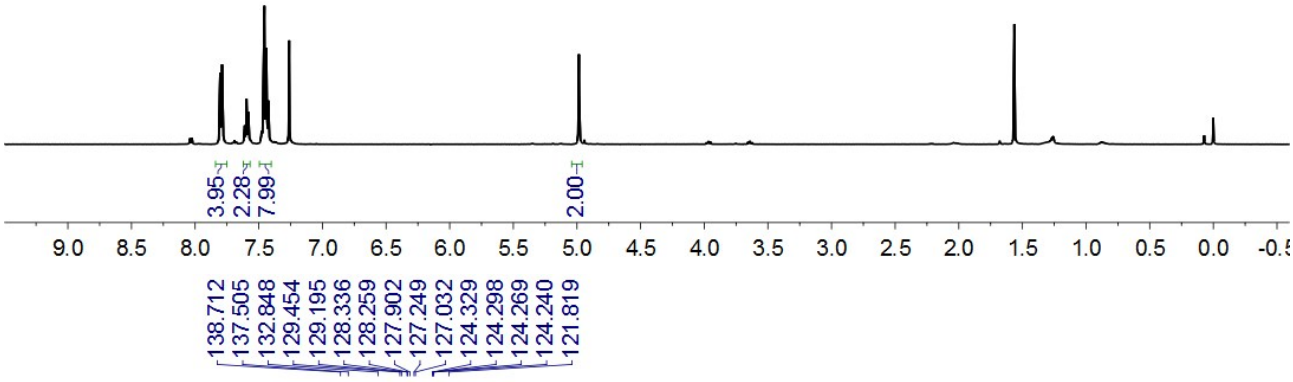

SO_2Ph
N
SO_2Ph
F_3C

2m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7.99
2.00
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138.712
137.505
132.848
129.454
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127.249
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124.329
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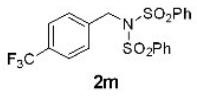
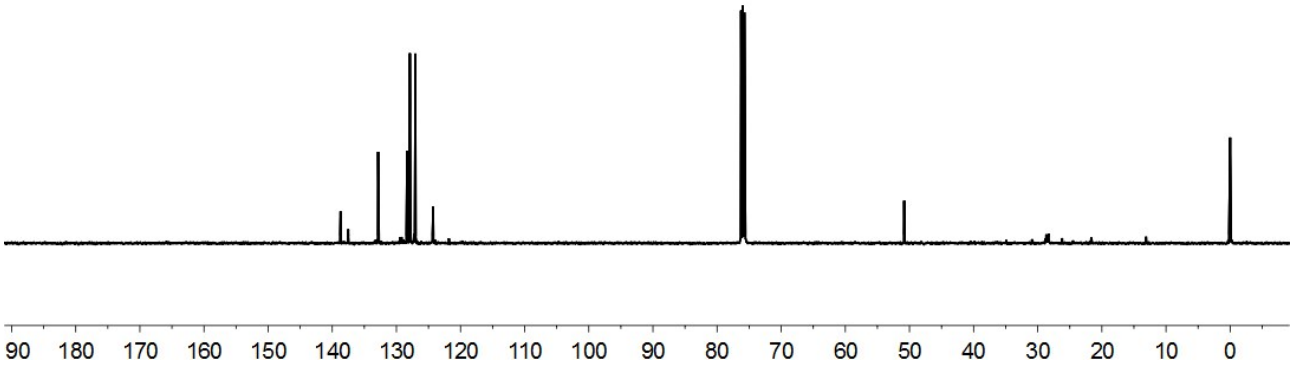
124.240
121.819


SO_2Ph
N
SO_2Ph
F_3C

2m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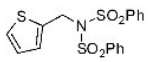

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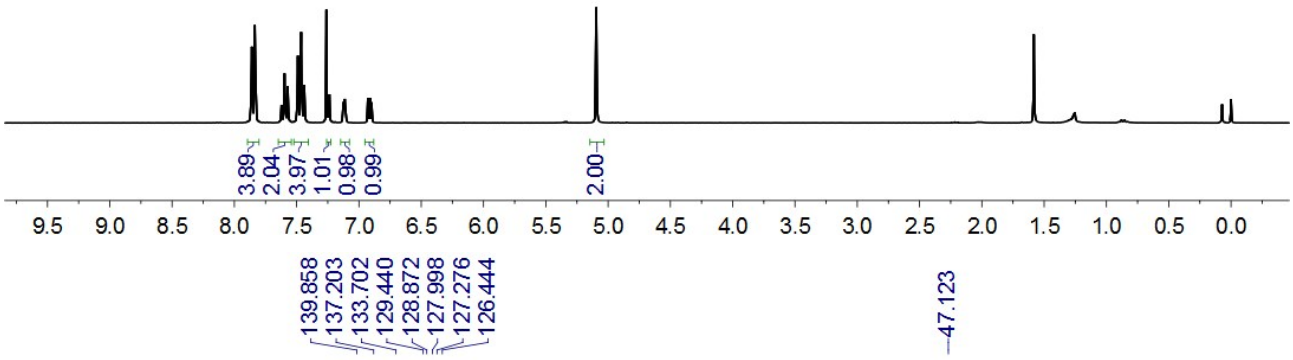
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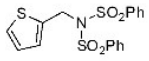
3.97
1.01
0.98
0.99
2.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0

139.858
137.203
133.702
129.440
128.872
127.998
127.276
126.444

47.123



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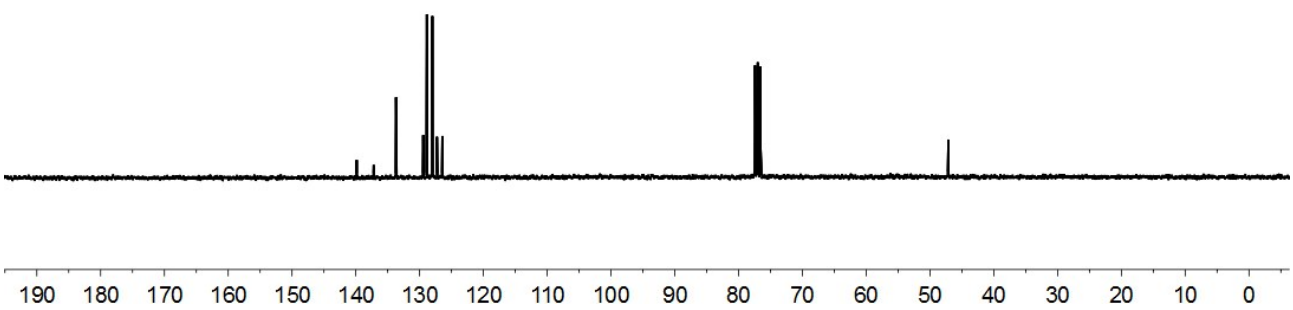
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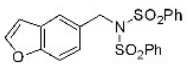
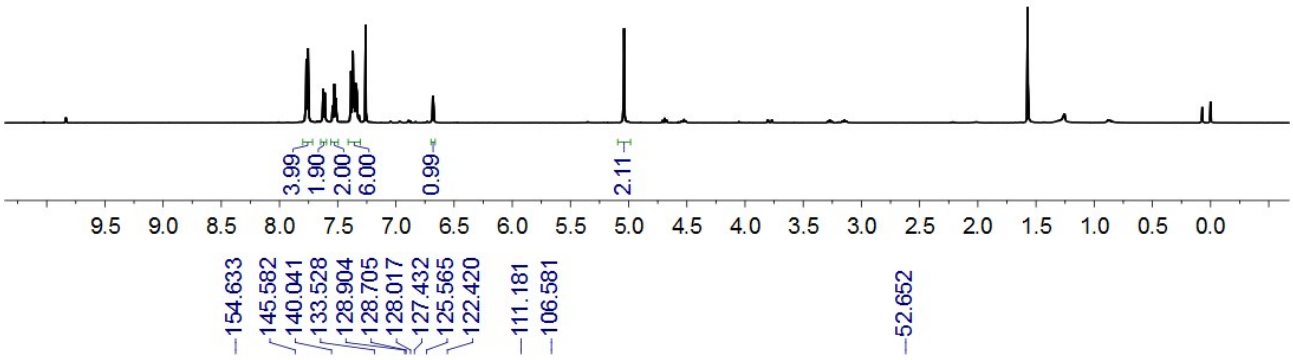


2o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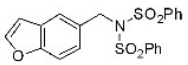
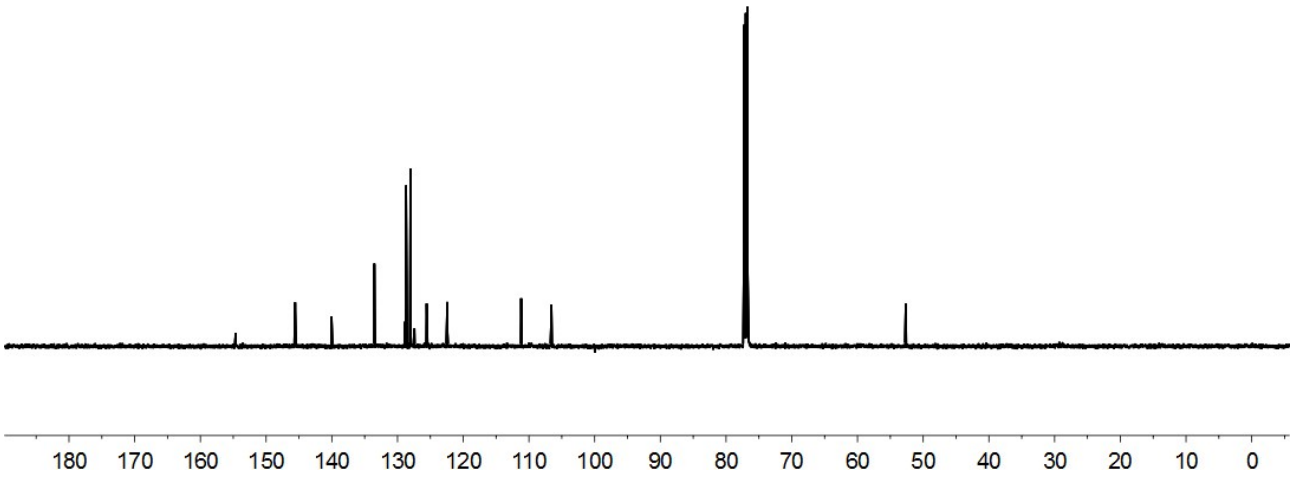
2.00
6.00
0.99
2.11
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
154.633
145.582
140.041
133.528
128.904
128.705
128.017
127.432
125.565
122.420
111.181
106.581
52.652



2o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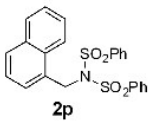
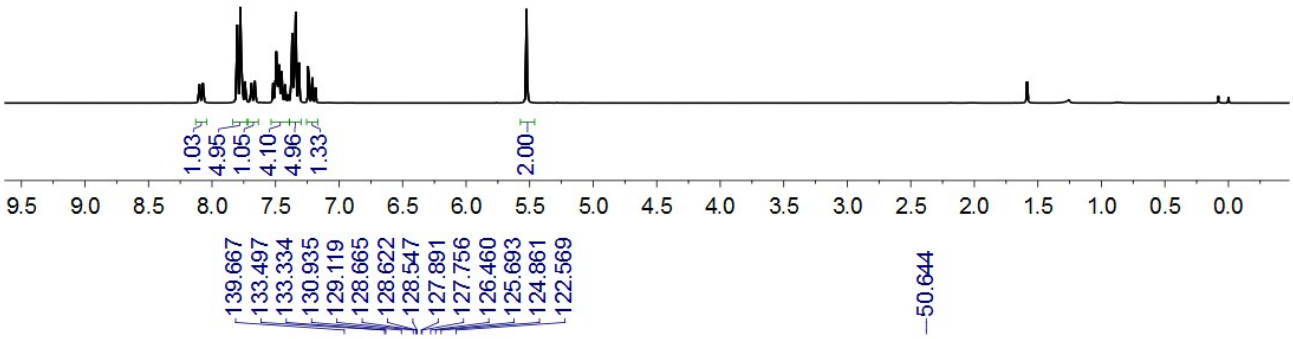

SO2Ph
N
SO2Ph

2p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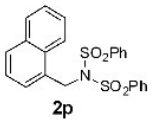
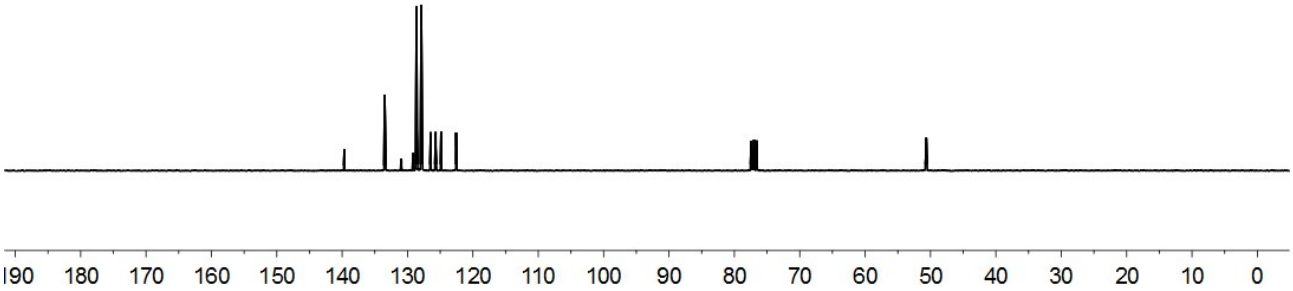
4.95
1.05
4.10
4.96
1.33
2.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0

139.667
133.497
133.334
130.935
129.119
128.665
128.622
128.547
127.891
127.756
126.460
125.693
124.861
122.569

50.644


SO2Ph
N
SO2Ph

2p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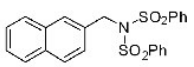
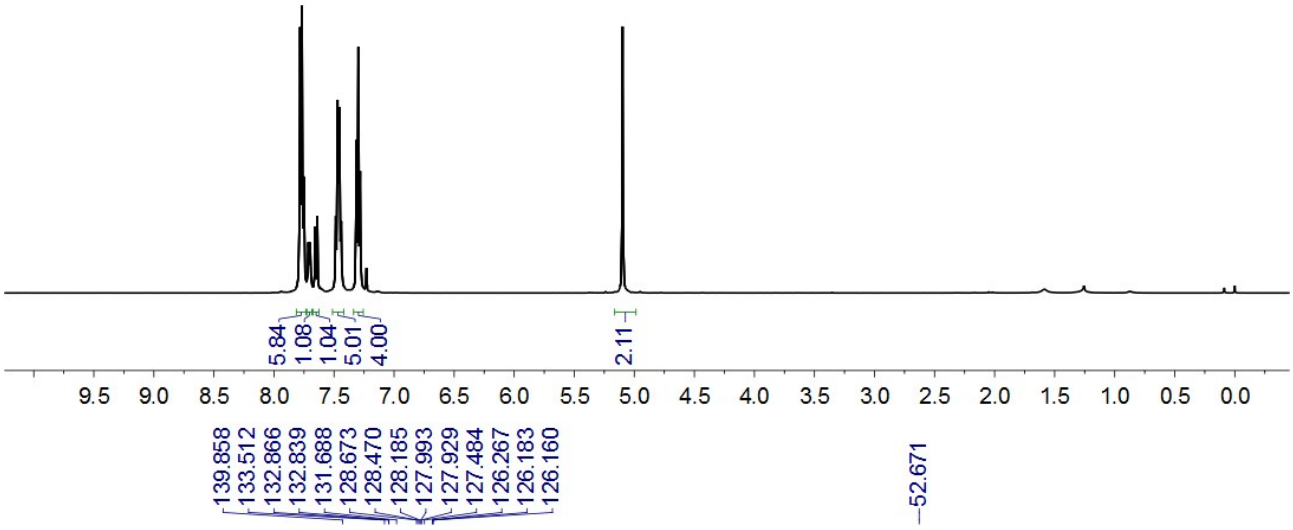

SO2Ph
N
SO2Ph

2q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1.08
1.04
5.01
4.00
2.11
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 0.0
139.858
133.512
132.866
132.839
131.688
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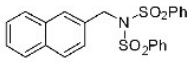
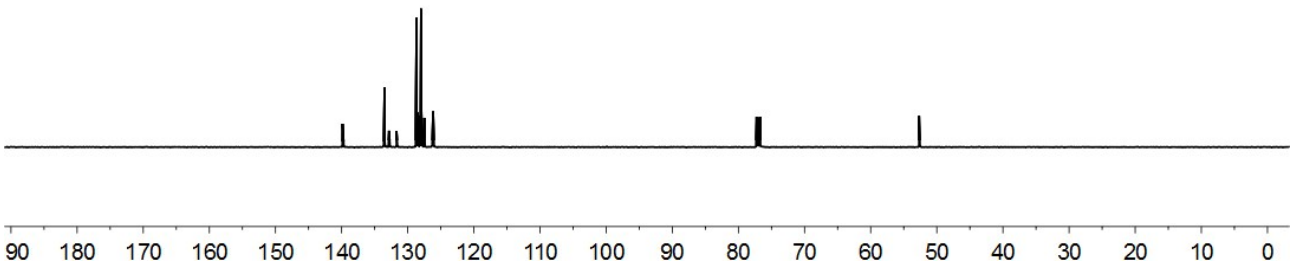
128.470
128.185
127.993
127.929
127.484
126.267
126.183
126.160
52.671


SO2Ph
N
SO2Ph

2q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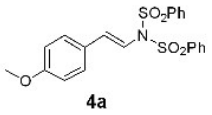
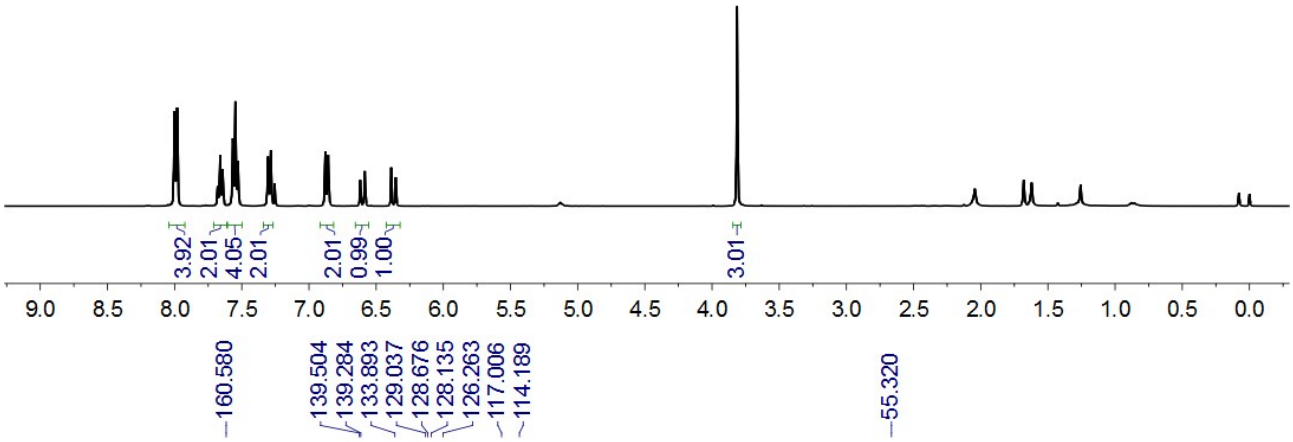

SO2Ph
N
SO2Ph
O

4a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4.05
2.01
2.01
0.99
1.00
3.01
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 0.0
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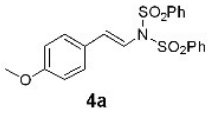
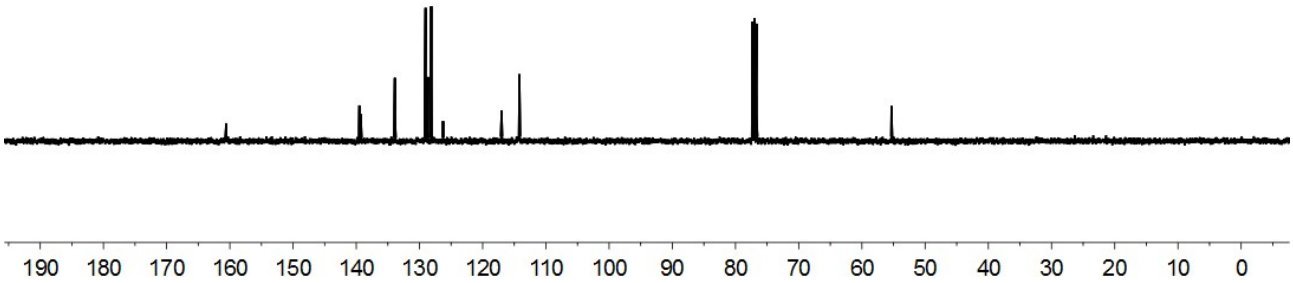
139.504
139.284
133.893
129.037
128.676
128.135
126.263
117.006
114.189
55.320


SO2Ph
N
SO2Ph
O

4a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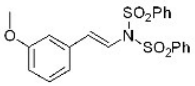
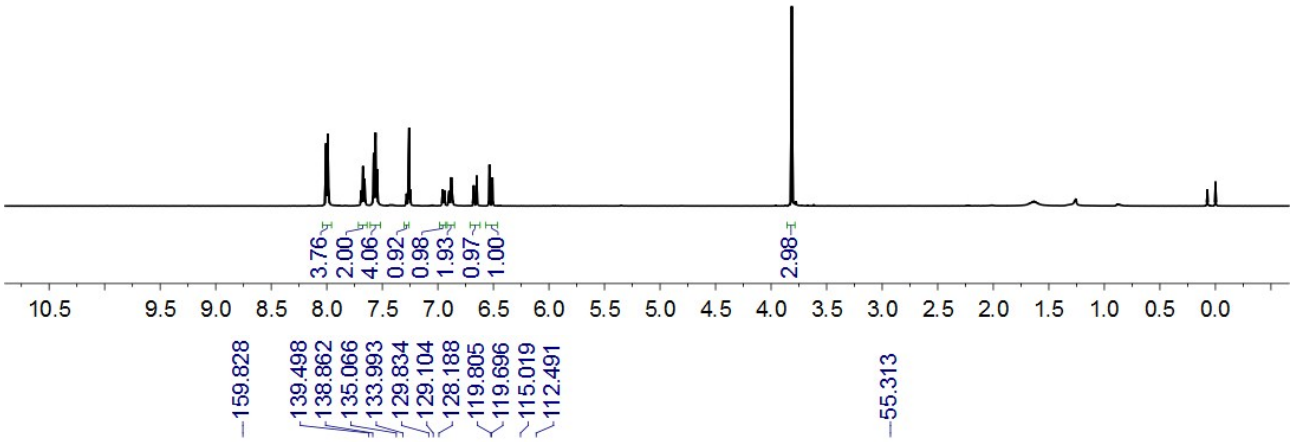

SO2Ph
N
SO2Ph
O

4b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1.00
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10.5
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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
0.0

159.828
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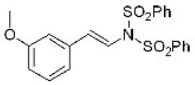
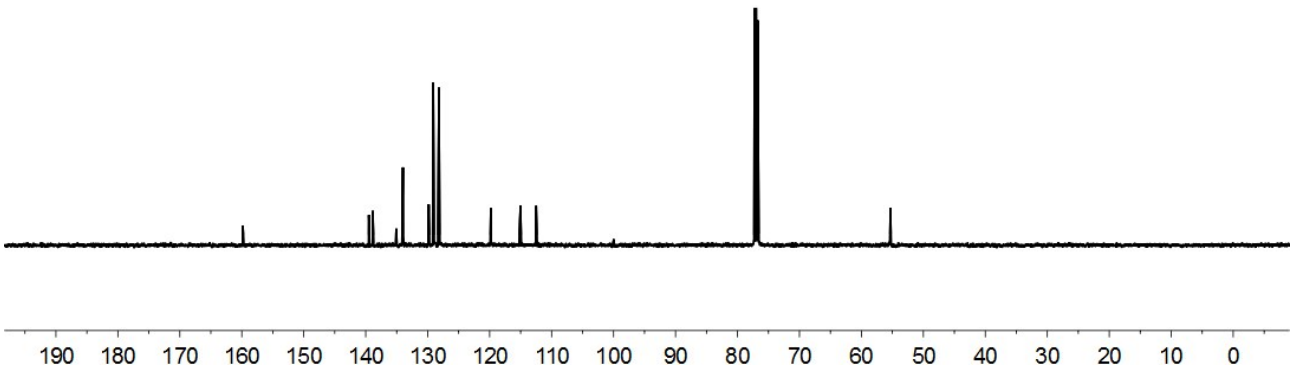
138.862
135.066
133.993
129.834
129.104
128.188
119.805
119.696
115.019
112.491
55.313


SO2Ph
N
SO2Ph
O

4b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80
70
60
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30
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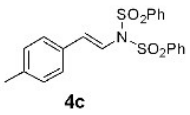
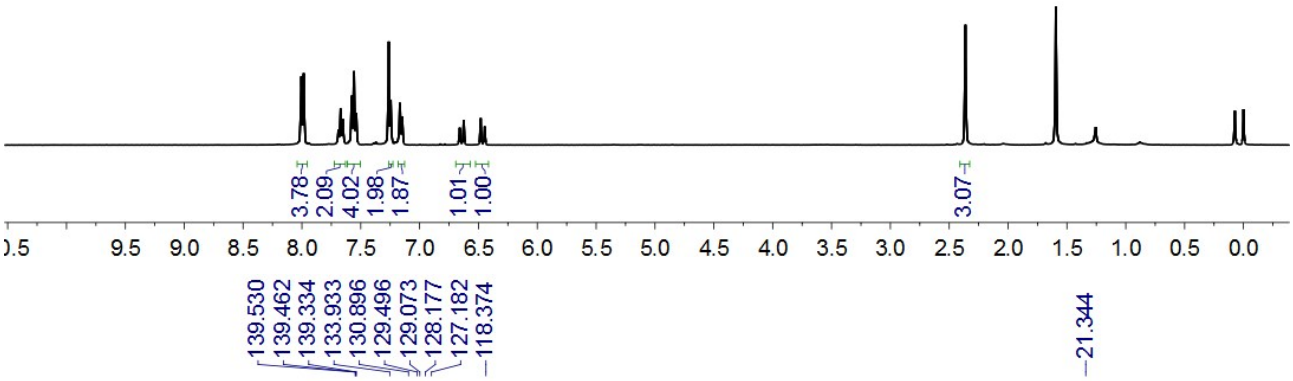
10
0


SO2Ph
N
SO2Ph

4c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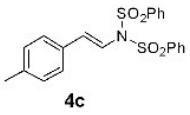
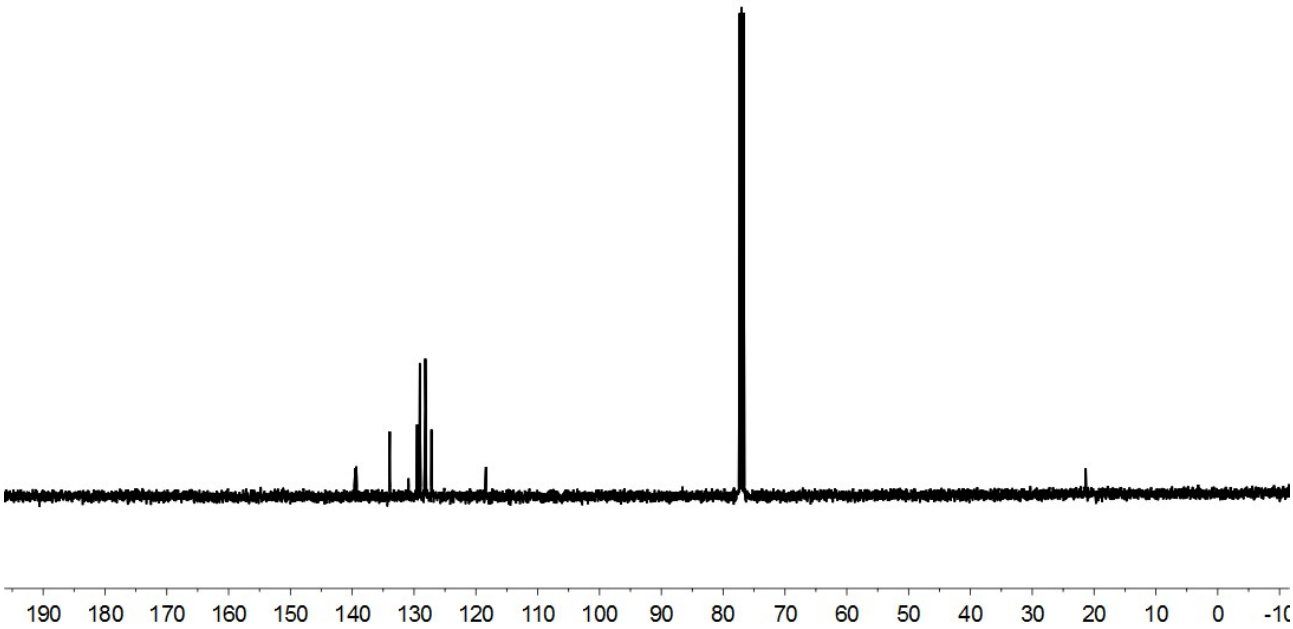
4.02
1.98
1.87
1.01
1.00
3.07
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0

139.530
139.462
139.334
133.933
130.896
129.496
129.073
128.177
127.182
118.374

21.344


SO2Ph
N
SO2Ph

4c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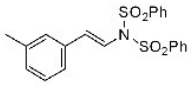
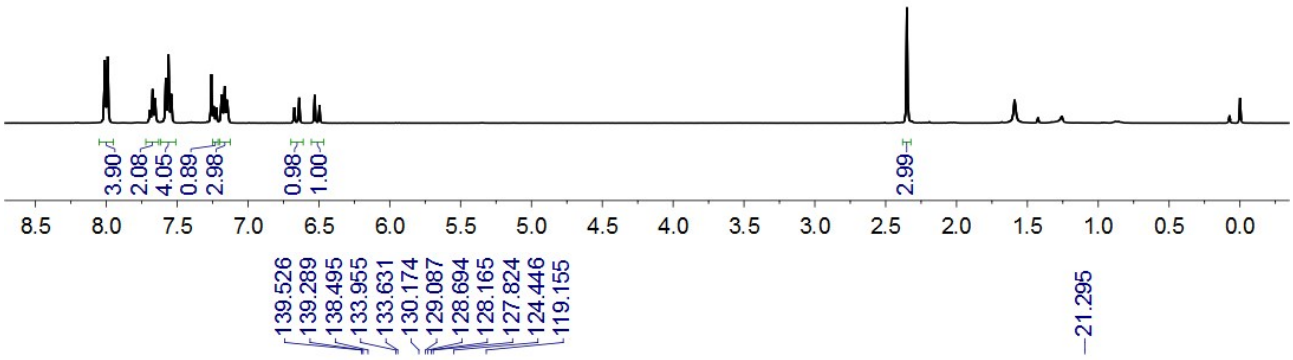


4d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4.05
0.89
2.98
0.98
1.00
2.99
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

139.526
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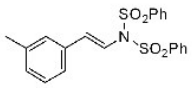
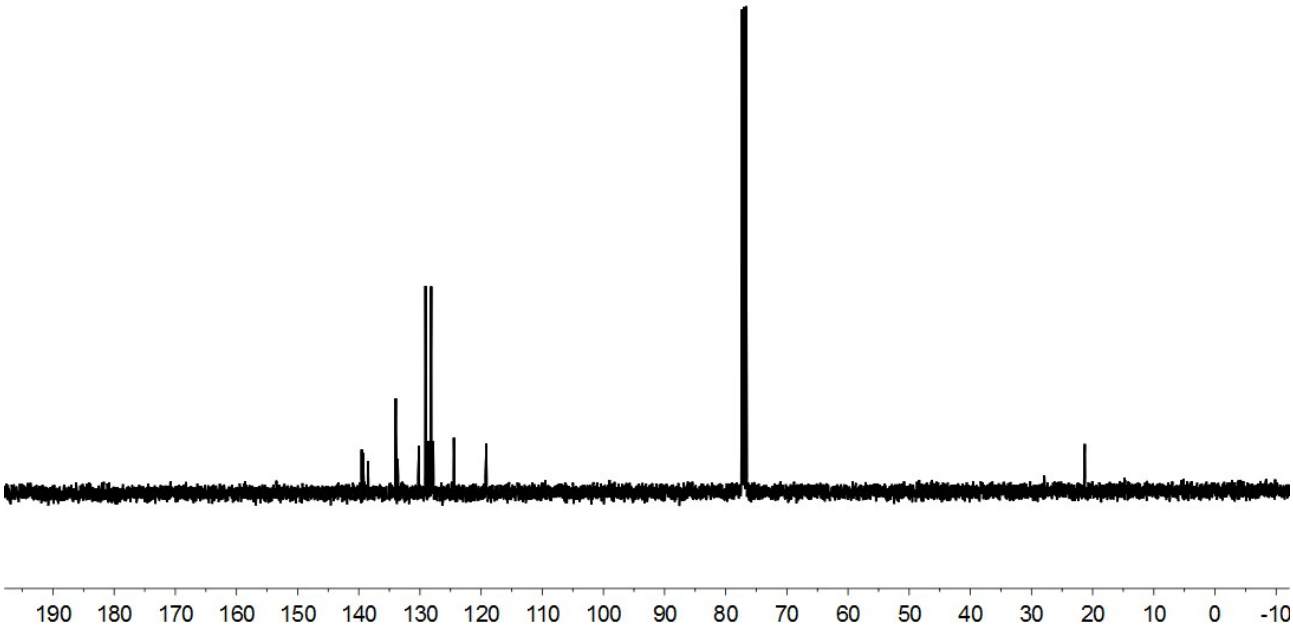
138.495
133.955
133.631
130.174
129.087
128.694
128.165
127.824
124.446
119.155

21.295



4d


190
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120
110
100
90
80
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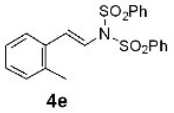
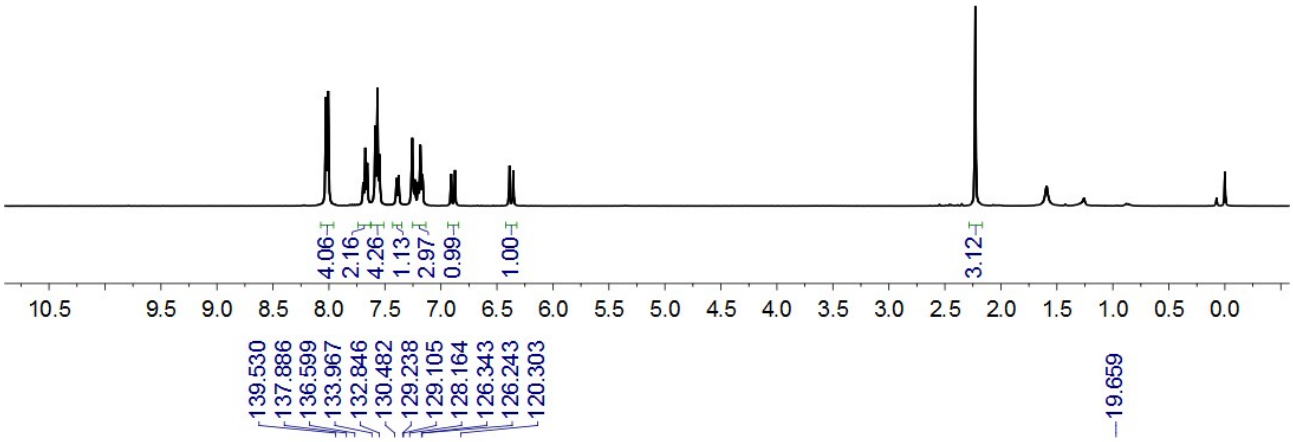
60
50
40
30
20
10
0
-10

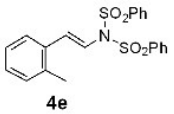

SO2Ph
N
SO2Ph

4e

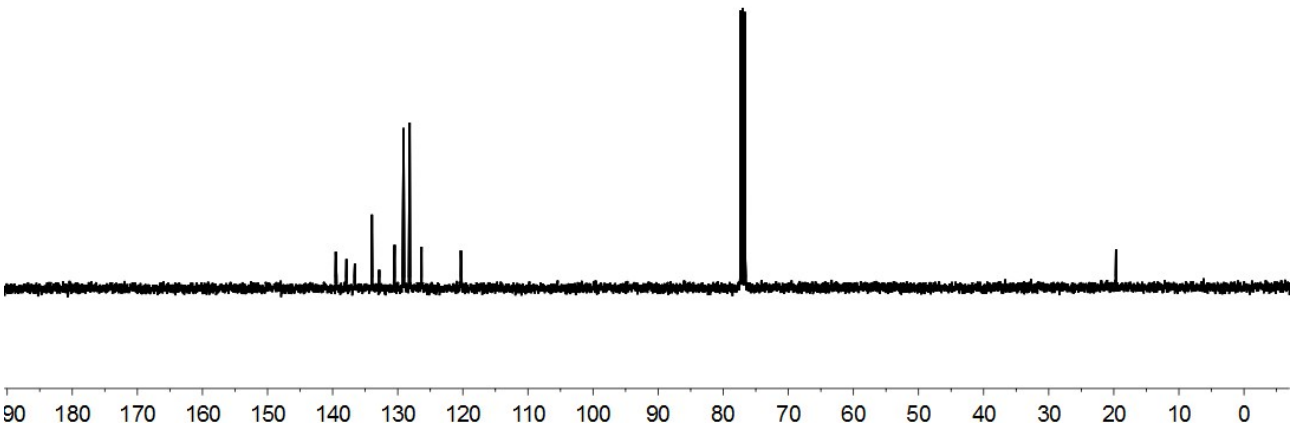

4.06
2.16
4.26
1.13
2.97
0.99
1.00
3.12
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

139.530
137.886
136.599
133.967
132.846
130.482
129.238
129.105
128.164
126.343
126.243
120.303

19.659


SO2Ph
N
SO2Ph

4e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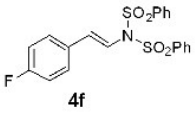
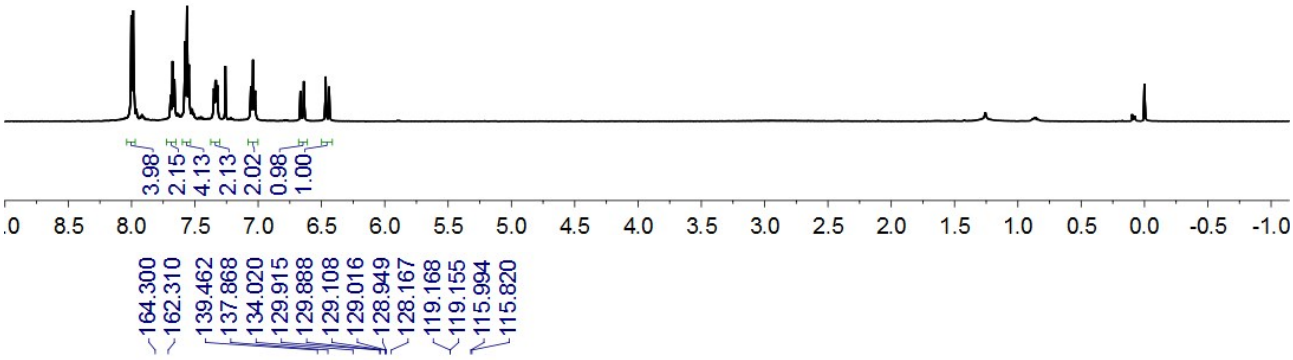

SO2Ph
N
SO2Ph
F

4f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2.02
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1.00
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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
0.0
-0.5
-1.0

164.300
162.310
139.462
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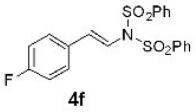
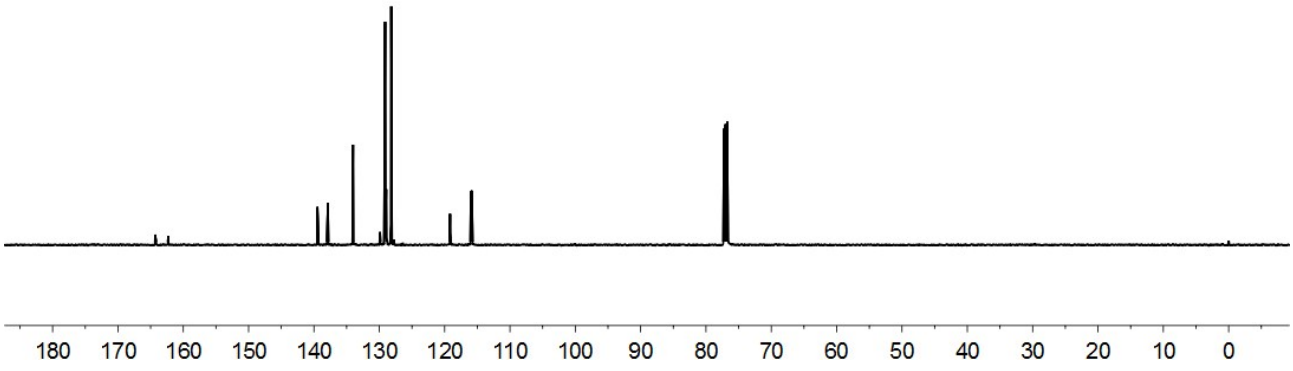
129.016
128.949
128.167
119.168
119.155
115.994
115.820


SO2Ph
N
SO2Ph
F

4f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10
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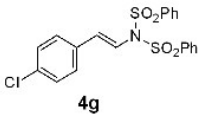
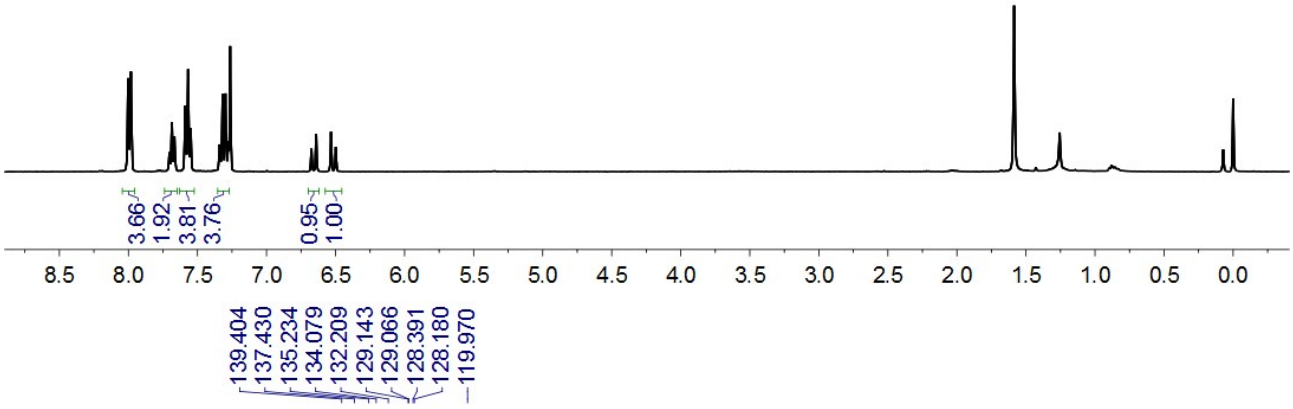

SO2Ph
N
SO2Ph
Cl

4g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8.0
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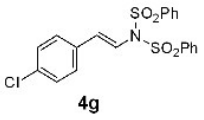
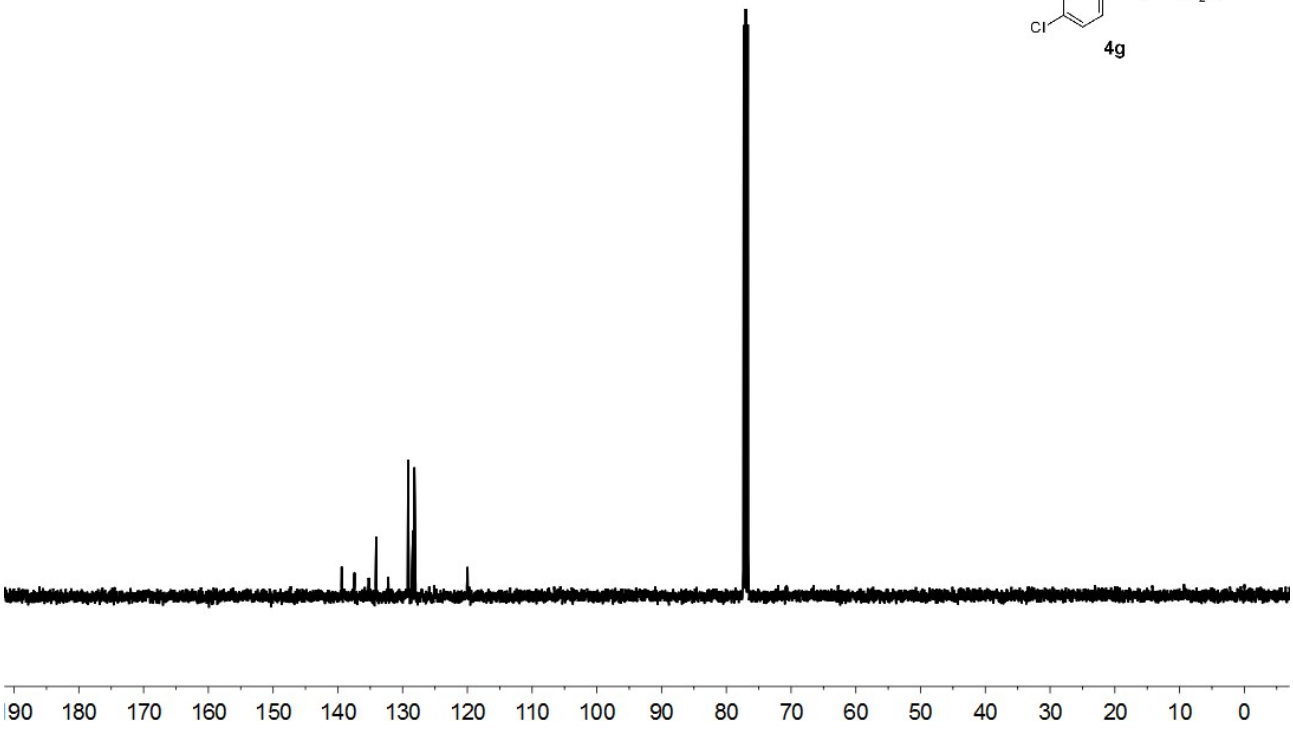
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0

139.404
137.430
135.234
134.079
132.209
129.143
129.066
128.391
128.180
119.970


SO2Ph
N
SO2Ph
Cl

4g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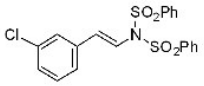
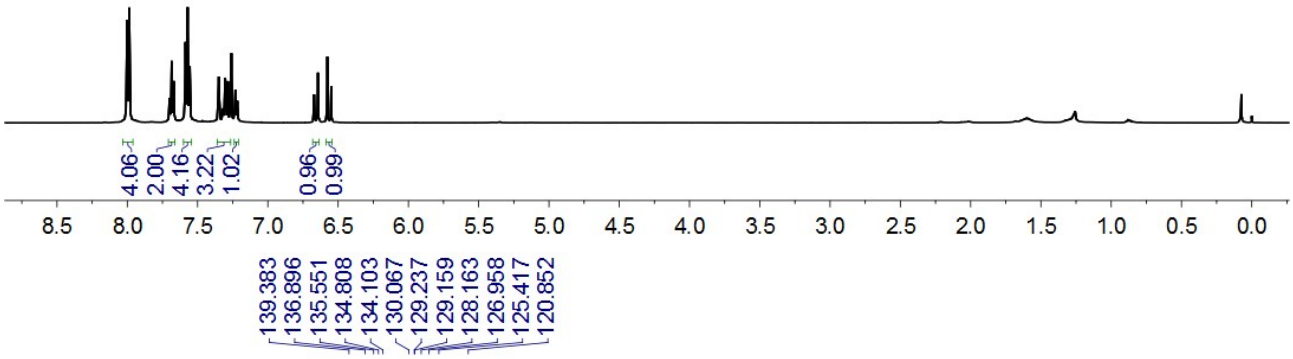
10
0


Cl
SO2Ph
N
SO2Ph

4h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1.02
0.96
0.99
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
0.0

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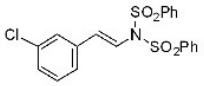
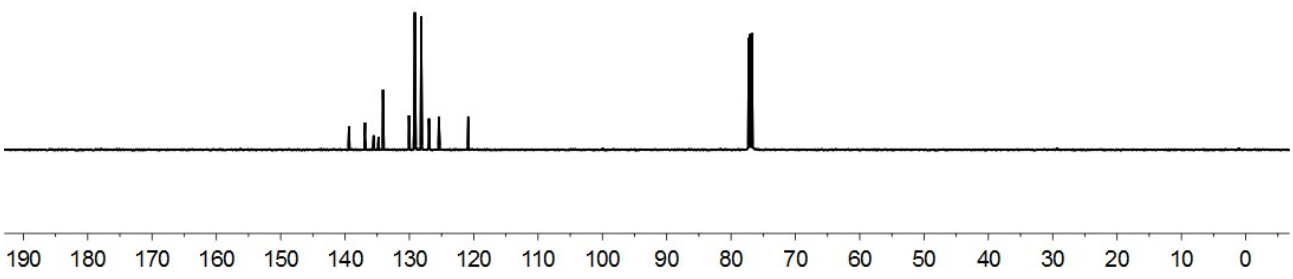
135.551
134.808
134.103
130.067
129.237
129.159
128.163
126.958
125.417
120.852


Cl
SO2Ph
N
SO2Ph

4h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30
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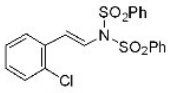
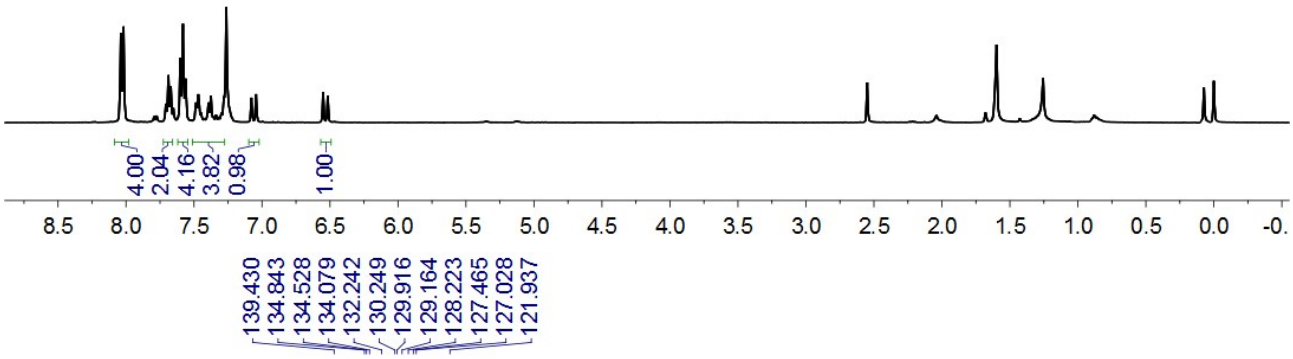

SO2Ph
N
SO2Ph
Cl

4i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0.98
1.00
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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
0.0
-0.

139.430
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134.079
132.242
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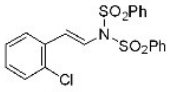
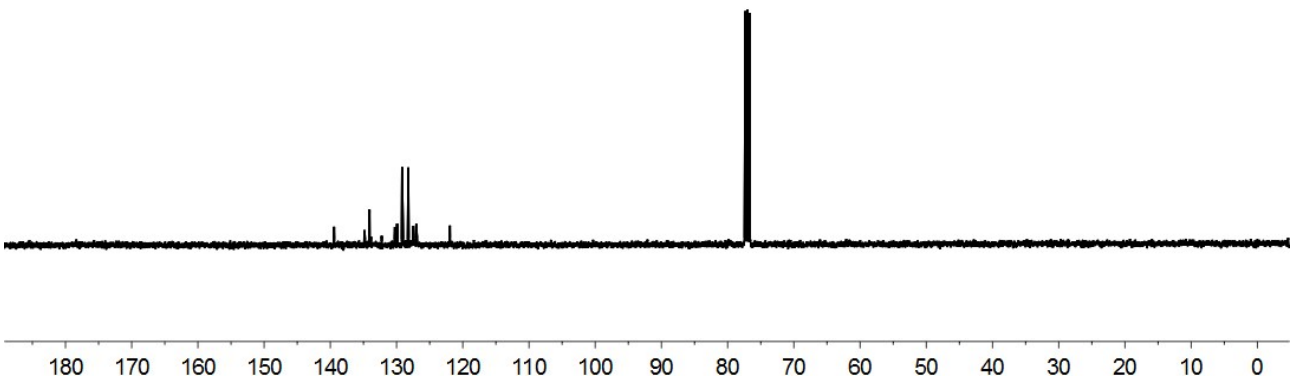
129.916
129.164
128.223
127.465
127.028
121.937


SO2Ph
N
SO2Ph
Cl

4i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50
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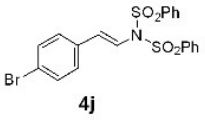
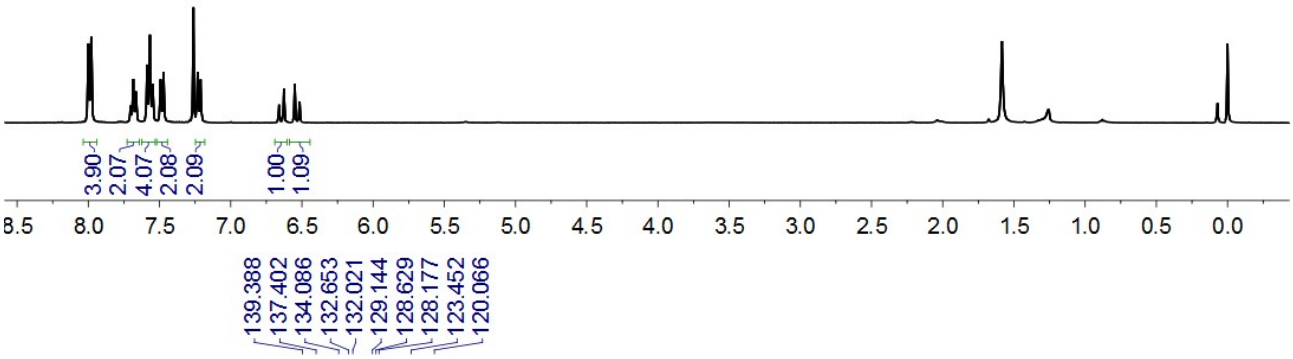
30
20
10
0


SO2Ph
N
SO2Ph
Br

4j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1.00
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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
0.0

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134.086
132.653
132.021
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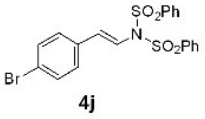
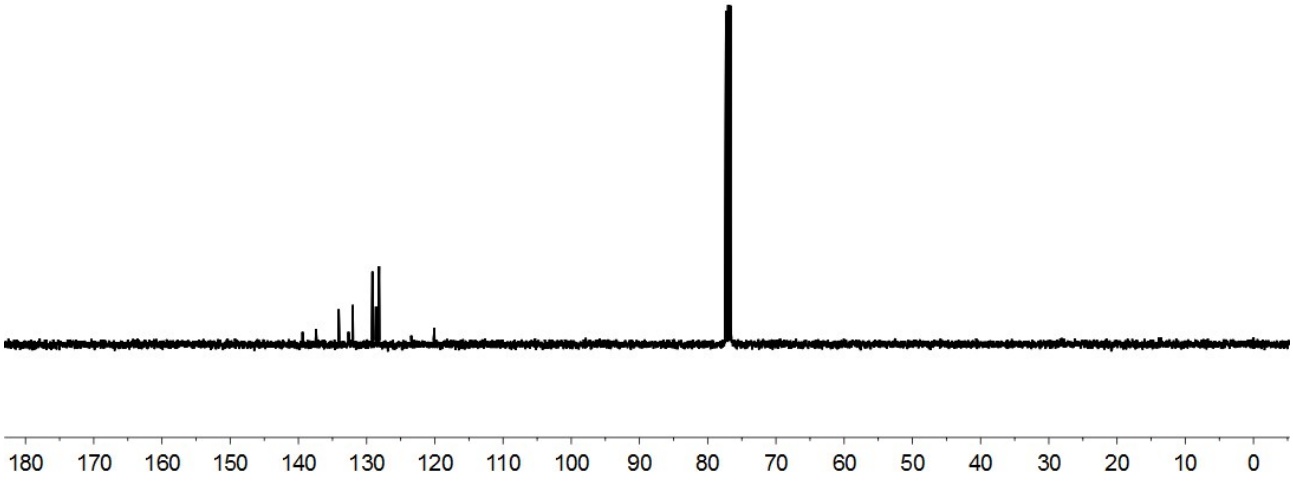
128.177
123.452
120.066


SO2Ph
N
SO2Ph
Br

4j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100
90
80
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60
50
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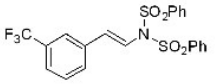
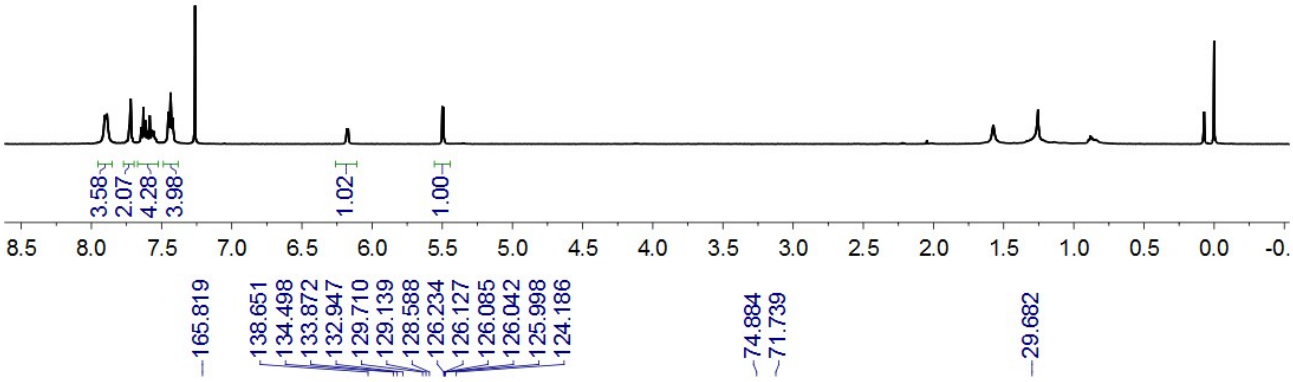
30
20
10
0


SO2Ph
F3C
N
SO2Ph

4k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8.0
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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
0.0
165.819
138.651
134.498
133.872
132.947
129.710
129.139
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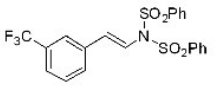
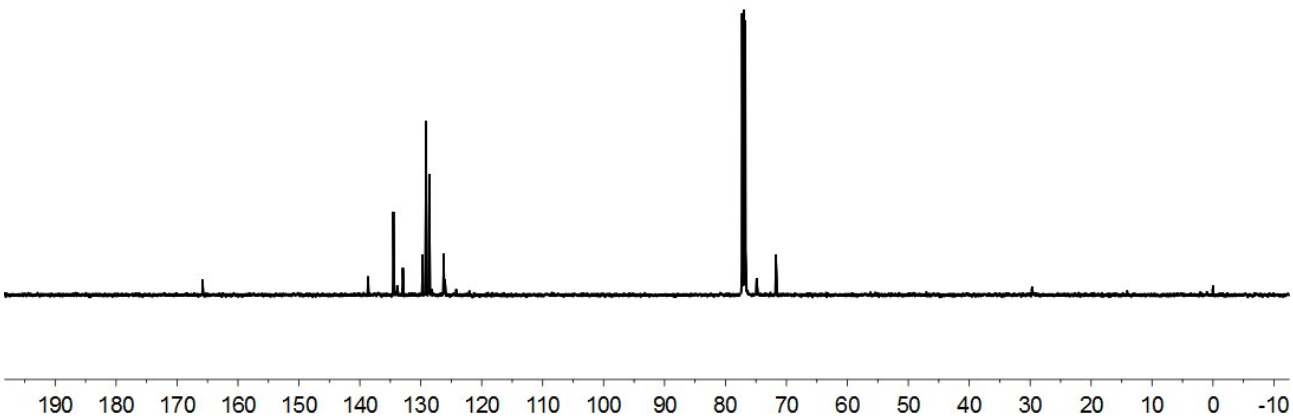
126.234
126.127
126.085
126.042
125.998
124.186
74.884
71.739
29.682


SO2Ph
F3C
N
SO2Ph

4k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100
90
80
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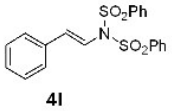
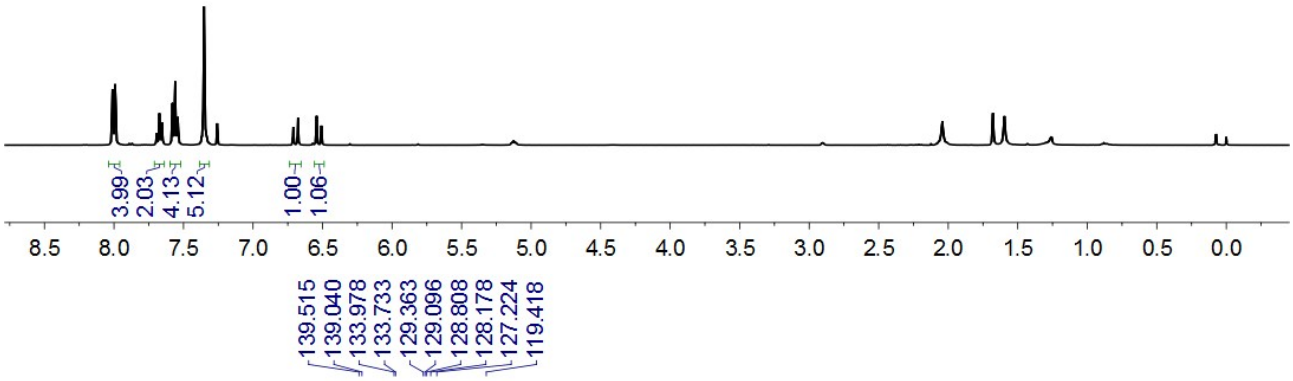
10
0
-10


SO2Ph
N
SO2Ph

4l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1.06
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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
0.0

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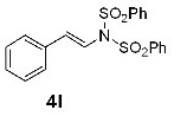
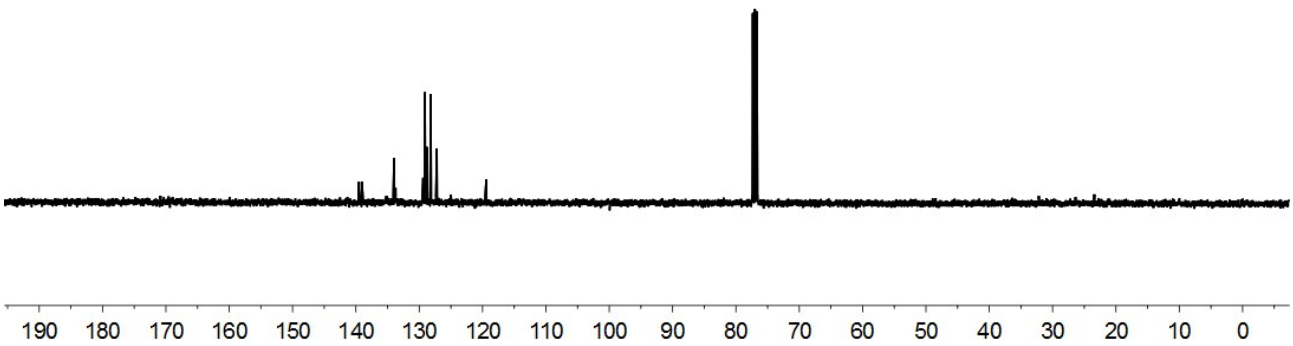
133.733
129.363
129.096
128.808
128.178
127.224
119.418


SO2Ph
N
SO2Ph

4l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70
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30
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10
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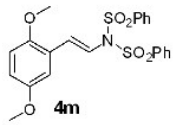
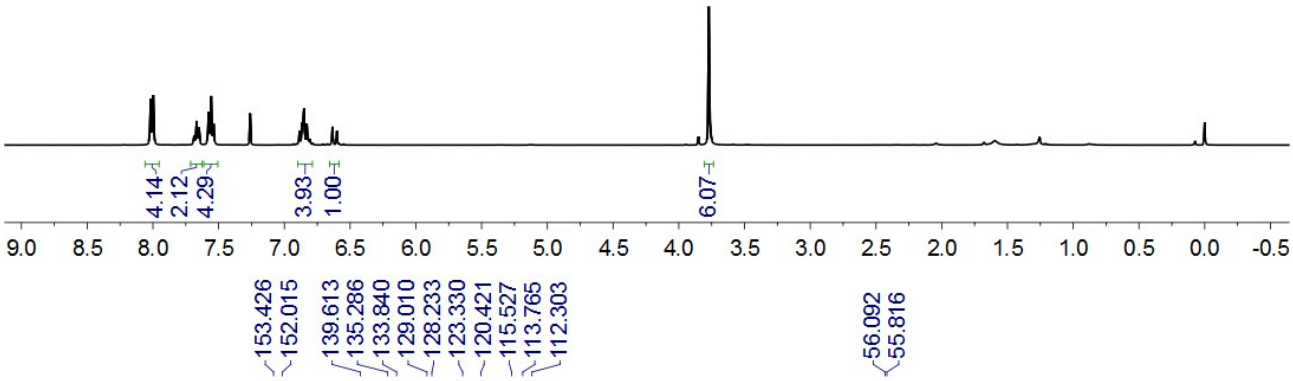

SO2Ph
N
SO2Ph
O
O
4m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2.12
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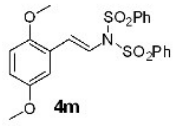
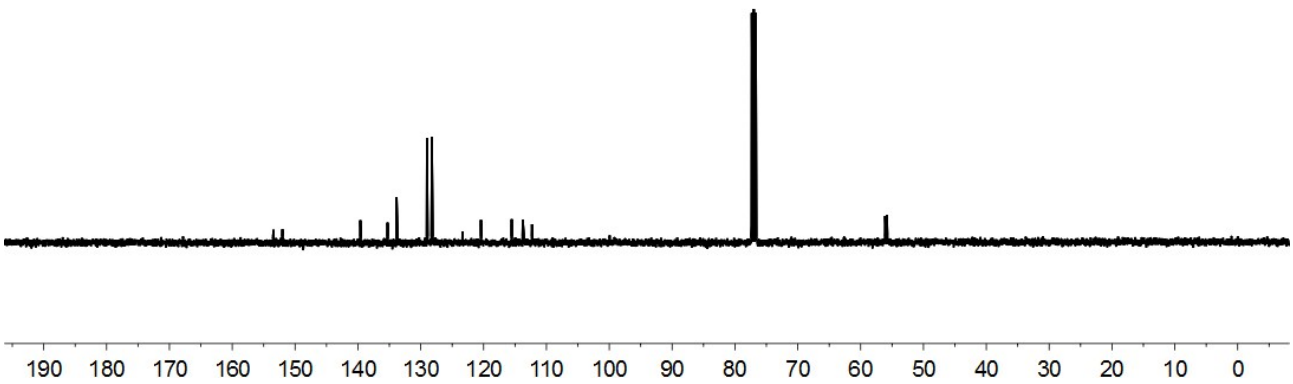
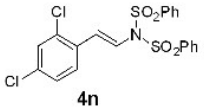
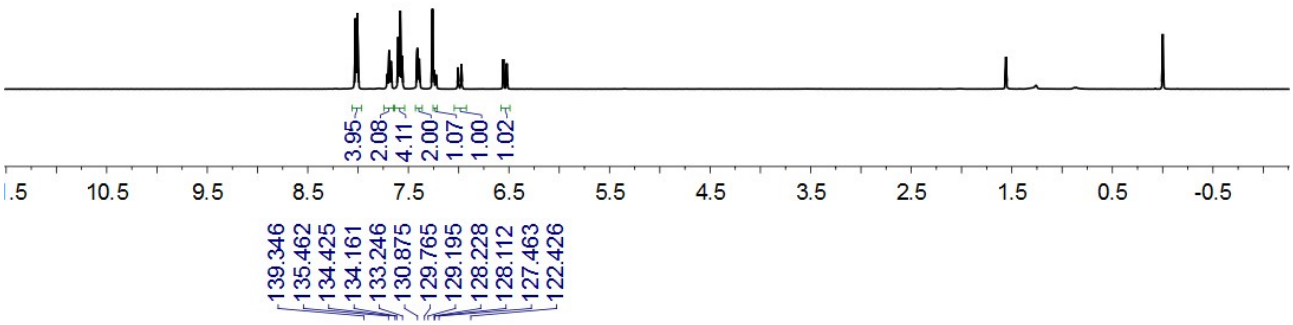
3.93
1.00
6.07
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
153.426
152.015
139.613
135.286
133.840
129.010
128.233
123.330
120.421
115.527
113.765
112.303
56.092
55.816


SO2Ph
N
SO2Ph
O
O
4m


190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0


Cl
SO2Ph
N
SO2Ph
Cl

4n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1.07
1.00
1.02
10.5
9.5
8.5
7.5
6.5
5.5
4.5
3.5
2.5
1.5
0.5
-0.5

139.346
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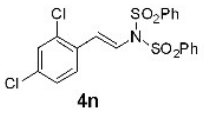
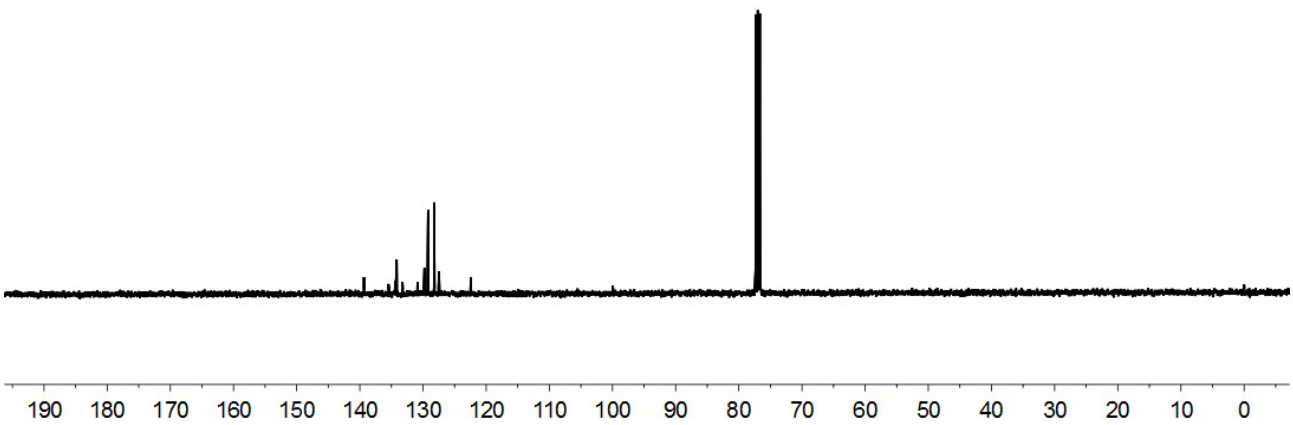
134.425
134.161
133.246
130.875
129.765
129.195
128.228
128.112
127.463
122.426


Cl
SO2Ph
N
SO2Ph
Cl

4n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140
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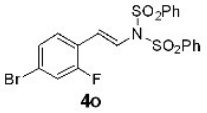
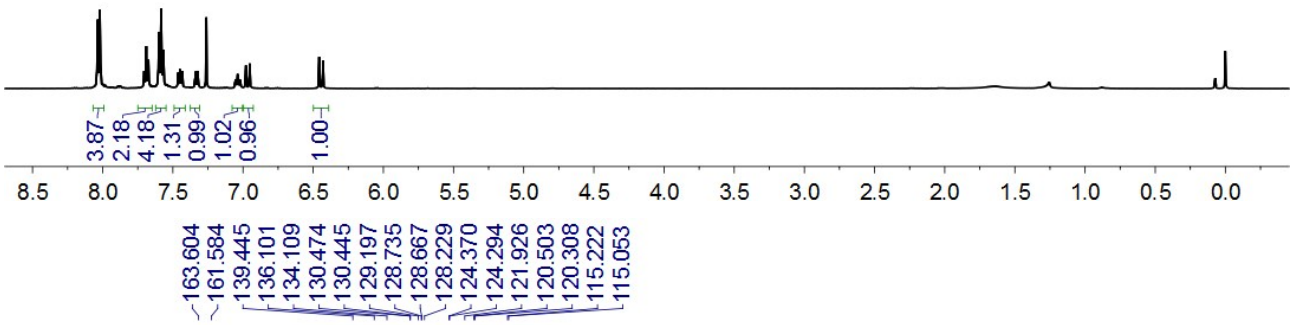
120
110
100
90
80
70
60
50
40
30
20
10
0


SO2Ph
N
SO2Ph
Br
F

4o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1.02
0.96
1.00
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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
0.0

163.604
161.584
139.445
136.101
134.109
130.474
130.445
129.197
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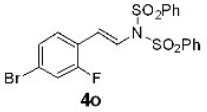
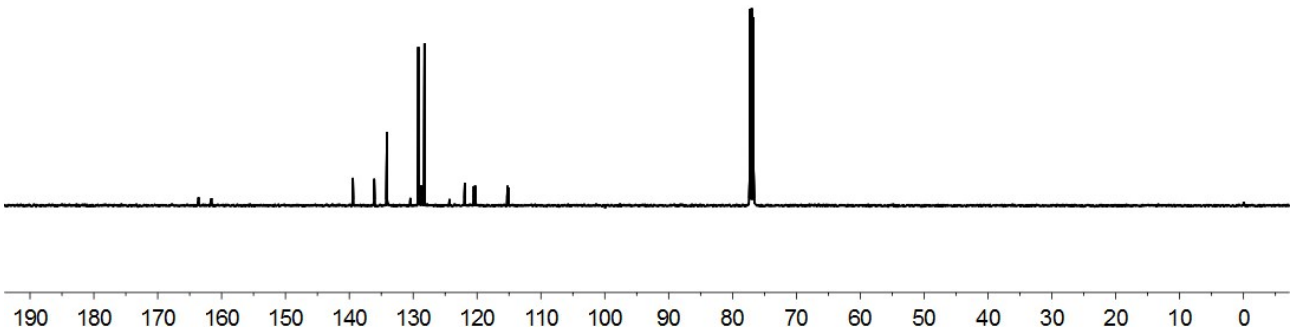
128.667
128.229
124.370
124.294
121.926
120.503
120.308
115.222
115.053


SO2Ph
N
SO2Ph
Br
F

4o


190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
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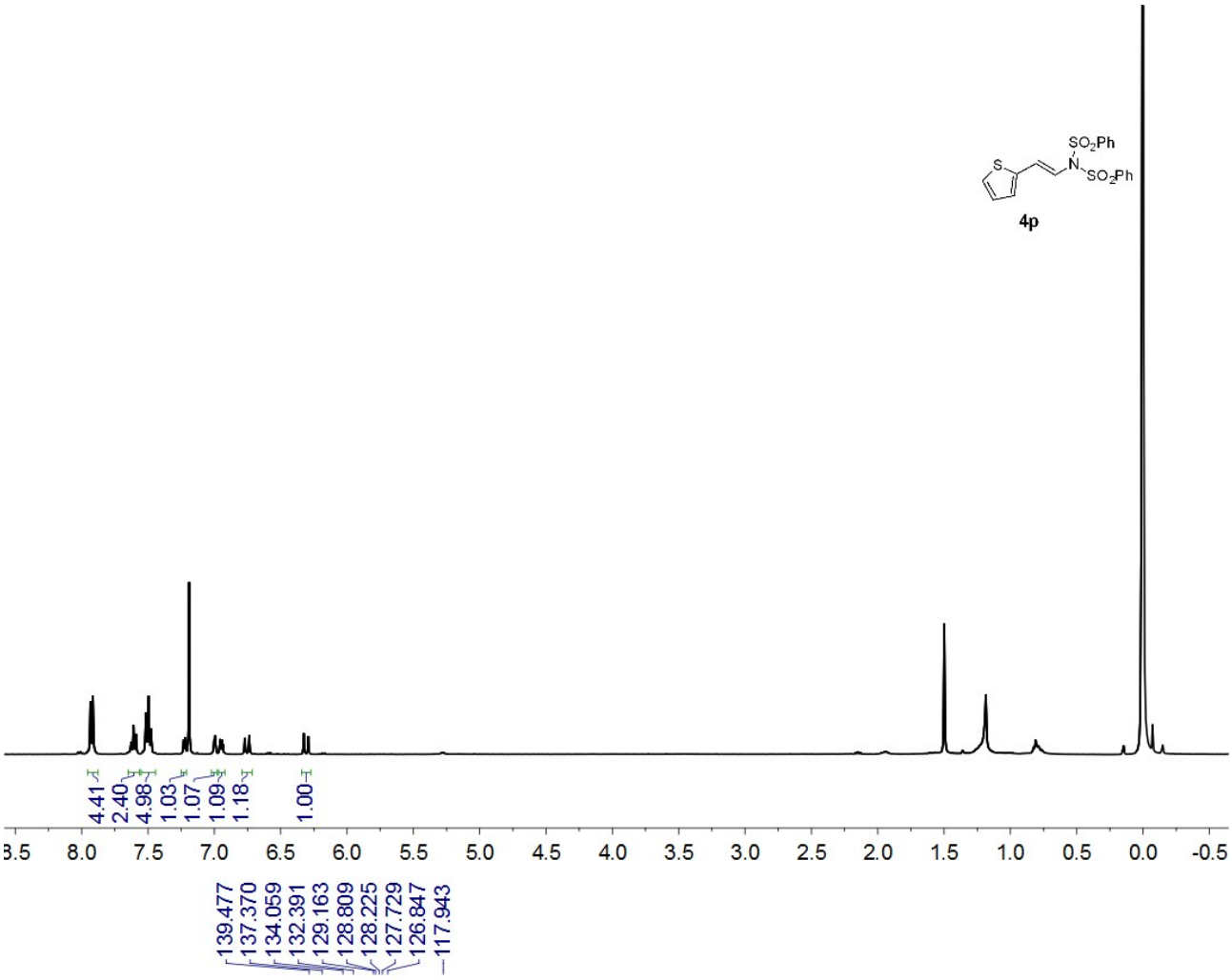
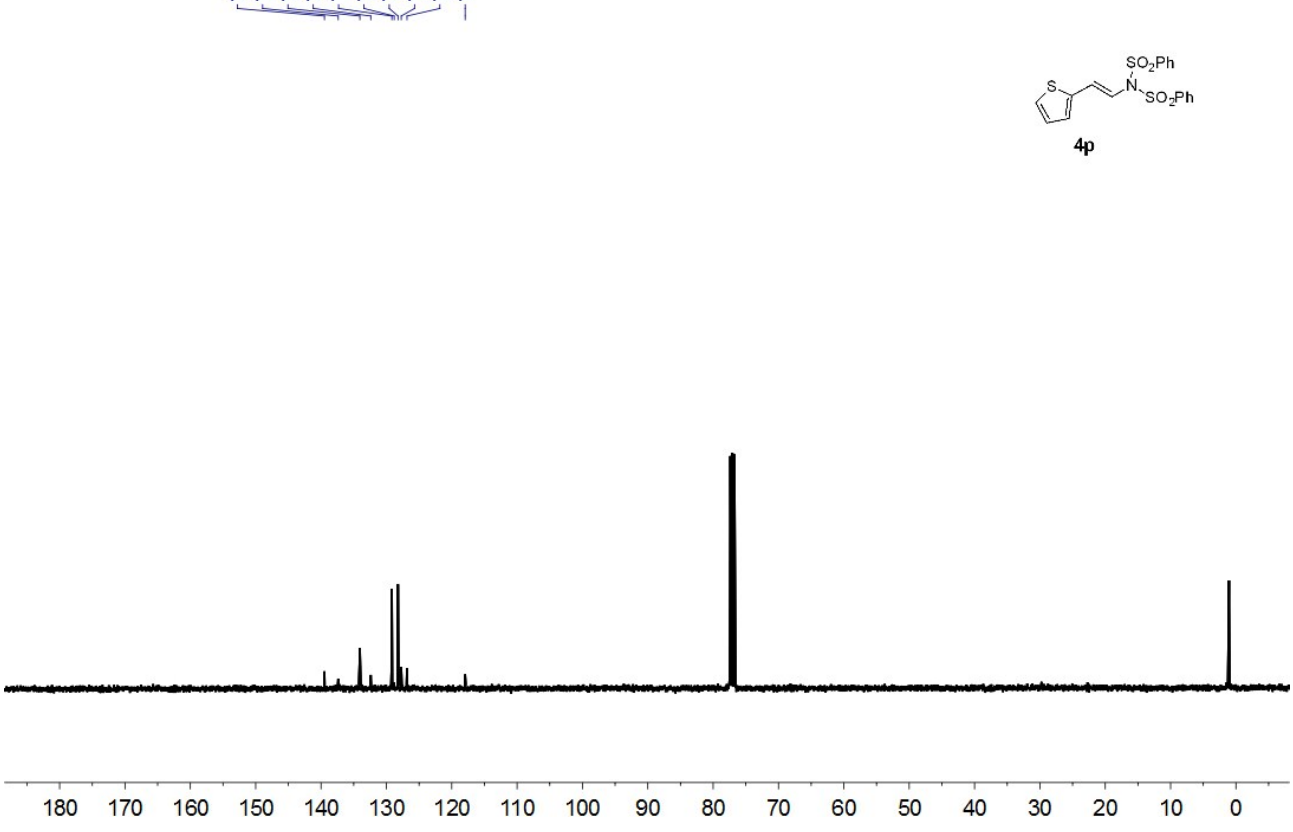
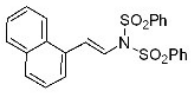
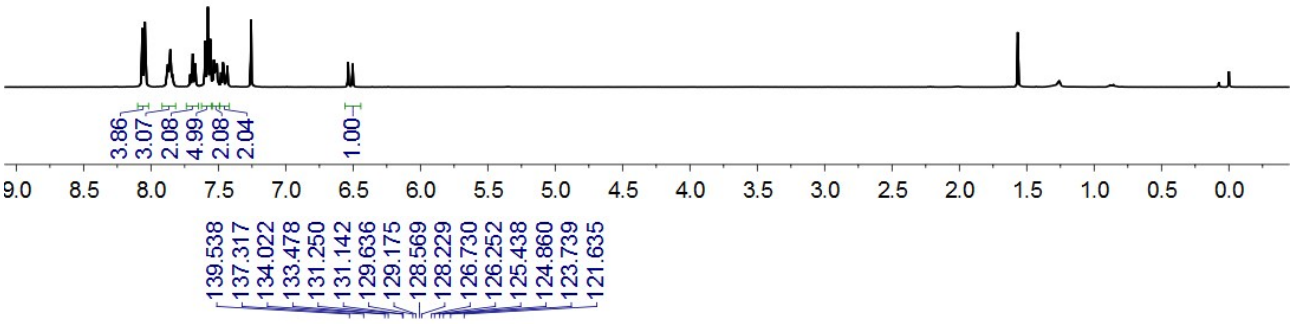

SO2Ph
S
N
SO2Ph
4p
4.41
2.40
4.98
1.03
1.07
1.09
1.18
1.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5

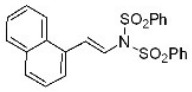

139.477
137.370
134.059
132.391
129.163
128.809
128.225
127.729
126.847
117.943
SO2Ph
S
N
SO2Ph
4p
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0


SO2Ph
N
SO2Ph

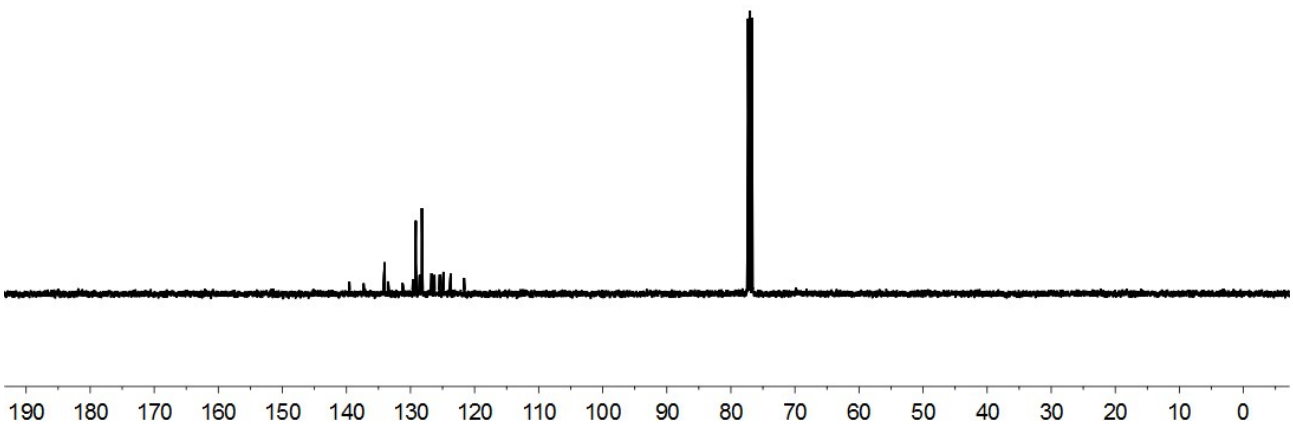
4q


3.86
3.07
2.08
4.99
2.08
2.04
1.00
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
0.0

139.538
137.317
134.022
133.478
131.250
131.142
129.636
129.175
128.569
128.229
126.730
126.252
125.438
124.860
123.739
121.635


SO2Ph
N
SO2Ph

4q


190
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100
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70
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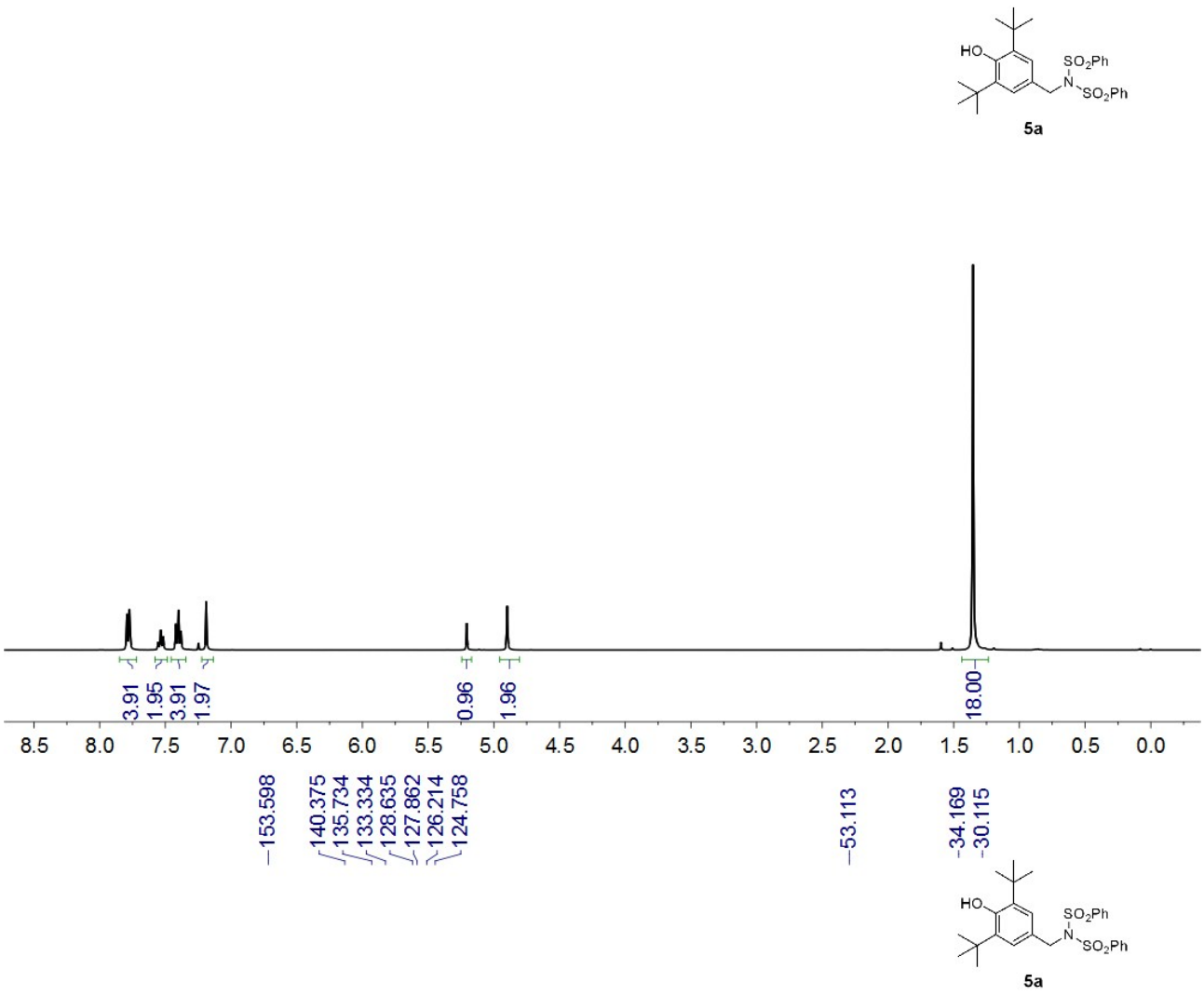
40
30
20
10
0


HO
SO2Ph
N
SO2Ph
5a
3.91
1.95
3.91
1.97
0.96
1.96
18.00
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 0.0
153.598
140.375
135.734
133.334
128.635
127.862
126.214
124.758
53.113
34.169
30.115
HO
SO2Ph
N
SO2Ph
5a
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0