Supplementary Information

TMEDA-enabled regioselective sulfenylation of unprotected *N*-heterocycles via electrochemical sulfinyl radical generation

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1. General Information

NMR spectra were recorded on Bruker-600 (600 MHz for ^{1}H; 151 MHz for ^{13}C). ^{1}H NMR spectra were referenced relative to internal $Si(Me)_4$ (TMS) at δ 0.00 ppm or $CDCl_3$ at δ 7.26 ppm, DMSO-d_6 at δ 2.50 ppm. ^{13}C NMR spectra were recorded at ambient temperature on Bruker-600 (151 MHz) spectrometers and are referenced relative to $CDCl_3$ at δ 77.16 ppm, DMSO-d_6 at δ 39.50 ppm. Data for. Data for ^{1}H, ^{13}C NMR are recorded as follows: chemical shift (δ, ppm), multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet, q = quartet, quint = quintet, br = broad), integration, and coupling constant (Hz). High resolution mass spectra were conducted at Accurate-Mass Q-Tof instrument (ESI). Melting points were determined in open capillary tube using WRS-1B digital melting point apparatus. Et_4NClO_4, HFIP, TMEDA were purchased from Energy Chemical Company in China. Sildenafil Chlorosulfonyl **1y** were prepared according to the reported method.[1] Cyclic voltammetry data were measured with a CHI660E electrochemical workstation.

2. Experimental Setup for the Sulfenylation of *N*-heterocycles with Sulfonyl chlorides

2.1 Graphical Guide for the Setup

As experimental setup, we used a carbon rod (Φ 6 mm) anode and platinum plate (10 mm×10 mm×0.3 mm) cathode, rubber stoppers, an undivided 15 mL single-necked flask, a DC adjustable power supply regulator (HY3005MT) (Made in China) and a magnetic stirrer.

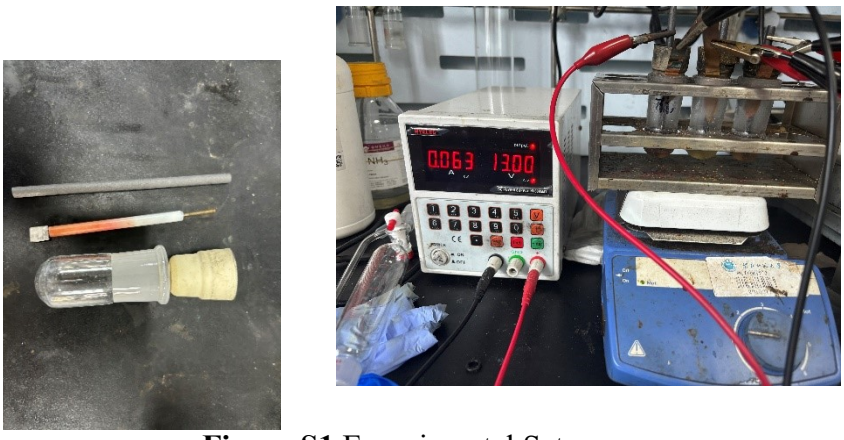
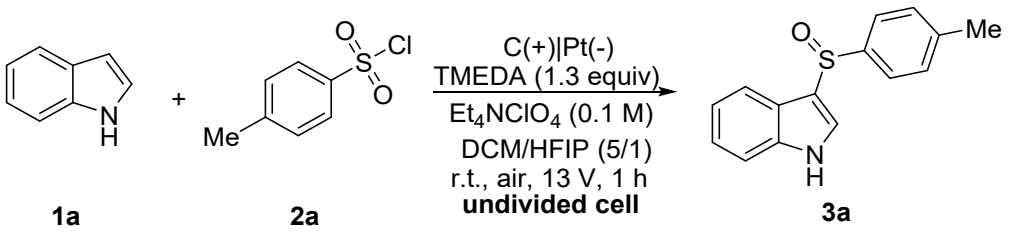


Figure S1 Experimental Setup

2.2 Typical Procedure for the Synthesis of 3a



To a 15 mL single-necked flask, indole (**1a**, 0.3 mmol, 35.1 mg, 1.0 equiv), TsCl (**2a**, 0.6 mmol, 114.4 mg, 2.0 equiv), TMEDA (1.3 equiv, 0.39 mmol, 45.2 mg), Et_4NClO_4 (0.1 M, 137.8 mg), DCM (5 mL) and HFIP (1 mL) were added. Then, the flask was blocked up with a rubber stopper which was equipped with a carbon rod (Φ 6 mm) anode and a platinum electrode (10 mm×10 mm×0.3 mm). About 1.0 cm of the electrodes was under the solution. Set the power supply to a constant voltage of 13 V and the mixture was electrolyzed under vigorous stirring at room temperature. One hour later, the solution was transferred to a separatory funnel and water (10 mL) was added. Then DCM (2 × 10 mL) was added to extract the aqueous phase, and the combined organic phase was concentrated in vacuum. The resulting crude mixture was purified by flash column chromatography to give the desired product **3a** (58.1 mg, 76% yield).

2.3 Gram-Scale Synthesis of 3a

To a 15 mL single-necked flask, indole (**1a**, 10 mmol, 1.17 g, 1.0 equiv), TsCl (**2a**, 20 mmol, 3.81 mg, 2.0 equiv), TMEDA (1.3 equiv, 13 mmol, 1.51 mg), Et_4NClO_4 (0.1 M, 1.15 mg), DCM (42 mL) and HFIP (8 mL) sequentially added. Then, the flask was blocked up with a rubber stopper which was equipped with two carbon rod (Φ 6 mm) anodes and a platinum electrode (20 mm×20 mm×0.1 mm). About 1.0 cm of the electrodes was under the solution. Set the power supply to a constant voltage of 13 V and the mixture was electrolyzed under vigorous stirring at room temperature. Two hours later, the solution was transferred to a separatory funnel and water (50 mL) was added. Then DCM (3 × 50 mL) was added to extract the aqueous phase, and the combined organic phase was concentrated in vacuum. The

resulting crude mixture was purified by flash column chromatography to give the desired product **3a** (1.45 g, 57% yield).

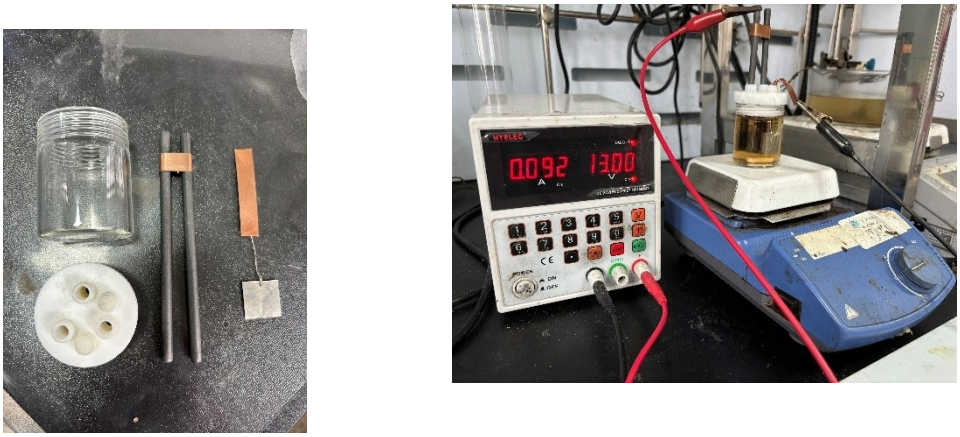


Figure S2 Experiment Setup for the Gram-scale Synthesis of **3a**.

3. Mechanistic Studies

3.1 Time-Yield Curve

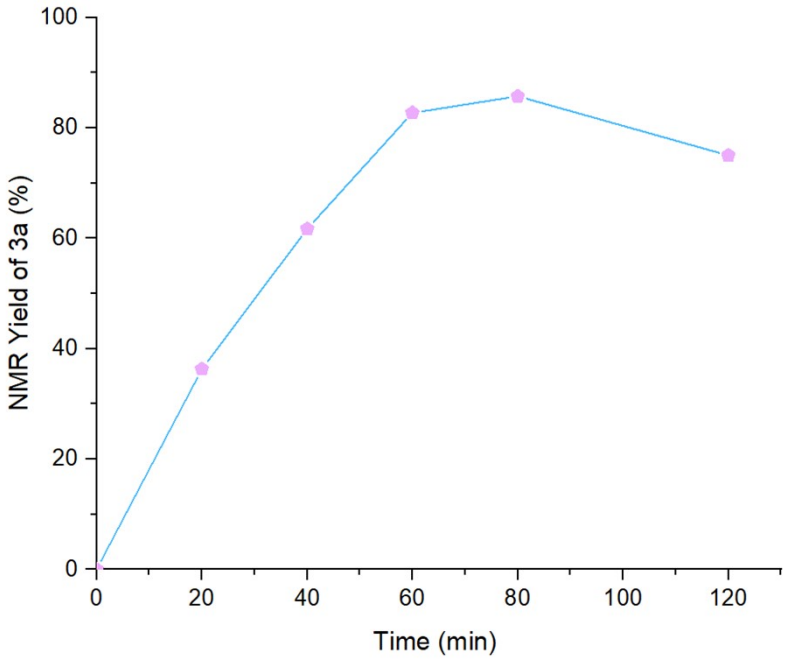


Figure S3 Time-Yield Curve, showing % formation of **3a** over time.

To a 15 mL undivided three-necked bottle, indole (**1a**, 0.3 mmol, 35.1 mg, 1.0 equiv), TsCl (**2a**, 0.6 mmol, 114.4 mg, 2.0 equiv), TMEDA (1.3 equiv, 0.39 mmol, 45.2 mg), Et_4NClO_4 (0.1 M, 137.8 mg), DCM (5 mL) and HFIP (1 mL) were added. The bottle was equipped with a carbon rod (Φ 6 mm) anode and platinum plate (10

mm×10 mm×0.3 mm). Set the power supply to a constant voltage of 13 V and the mixture was electrolyzed under vigorous stirring for (20 mins, 40 mins, 60 mins, 80 mins, 120 mins) at room temperature. After completion, 0.25 mL of the mixture was transferred to a flask, evaporated to dryness, added triphenylmethane (6.11 mg, 0.025 mmol) as the internal standard and $CDCl_3$ as the deuterium reagent. The yields were determined by ^1H NMR.

3.2 Cyclic Voltammetry Studies

Cyclic voltammetry data were measured with a CHI660E electrochemical workstation.

Working electrode: Φ 3 mm diameter glassy carbon electrode. Polished with 0.3 μm aluminum oxide and then sonicated in distilled water before drying.

Reference electrode: The inside of the calomel electrode is filled with saturated KCl solution (SCE).

Counter electrode: Φ 5 mm platinum wire electrode

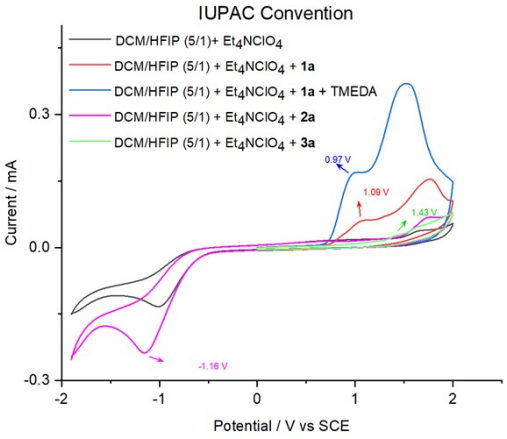
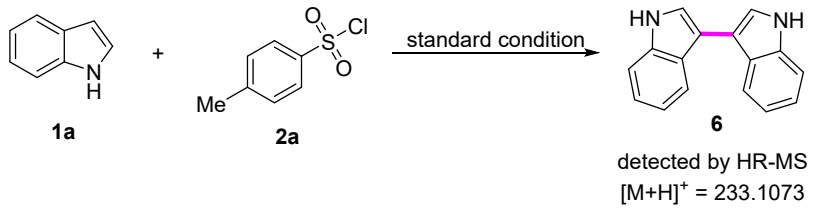


Figure S4 Cyclic voltammograms of Et_4NClO_4, **1a**, **1a**+TMEDA, **2a**, **3a** in DCM/HFIP (5/1).

Cyclic voltammetry experiments were conducted in a three-electrode cell connected to a Schlenk line with DCM/HFIP (5/1) as solvent, Et_4NClO_4 (0.1 M) as electrolyte. They were recorded under air at room temperature. The scan rate was 0.10 V/s, ranging from -2.0 V to 2.0 V. The concentration of each compound used is: Et_4NClO_4 (1 mM), **1a** (1 mM), **2a** (1 mM), **3a** (1 mM), TMEDA (5 mM).

3.3 Radical–Trapping Experiments



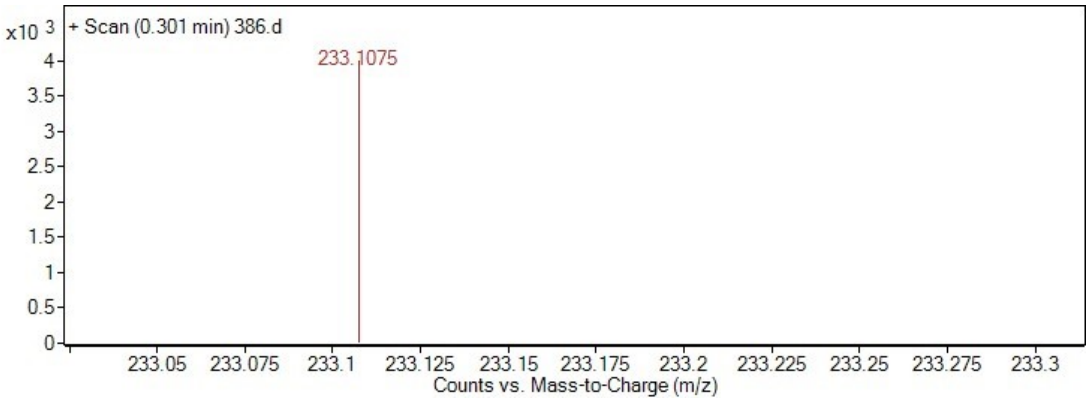
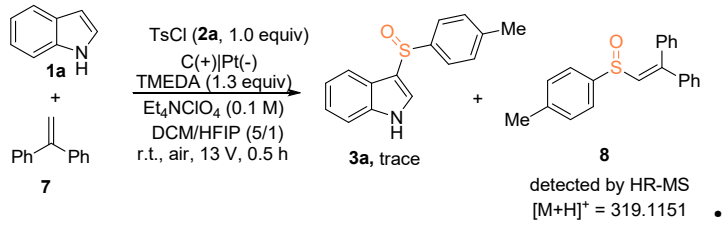


Figure S5 HRMS of compound **6**



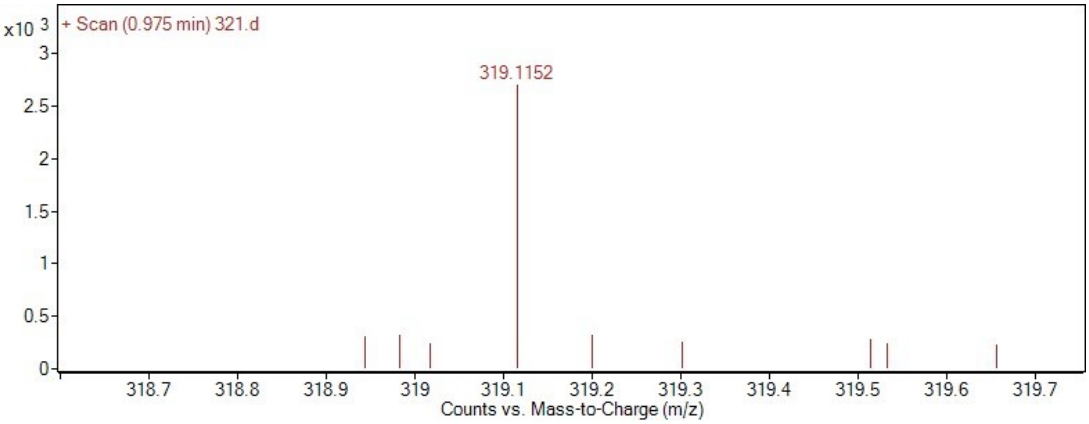
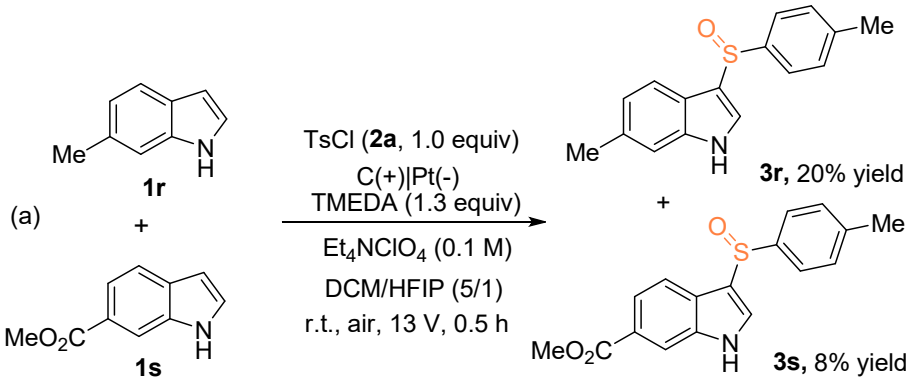


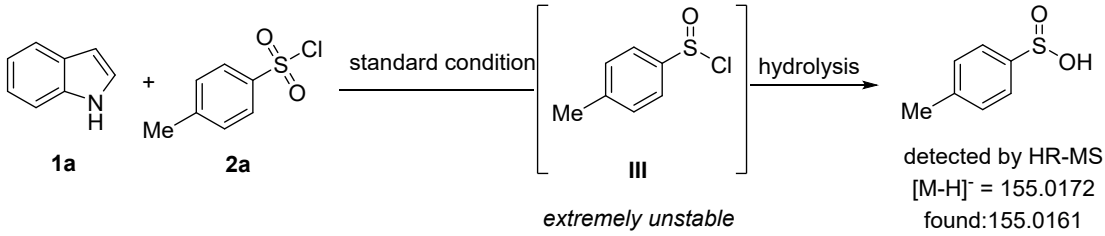
Figure S6 HRMS of compound **8**

3.4 Intermolecular Competition Experiment



To a 15 mL undivided three-necked bottle, **1r** (19.7 mg, 0.15 mmol, 1.0 equiv), **1s** (26.3 mg, 0.15 mmol, 1.0 equiv),) TMEDA (1.3 equiv, 0.39 mmol, 45.2 mg), Et_4NClO_4 (0.1 M, 137.8 mg), DCE (5 mL) and HFIP (1 mL) were added. The bottle was equipped with a carbon rod (Φ 6 mm) anode and platinum plate (10 mm×10 mm×0.3 mm). Set the power supply to a constant voltage of 13 V and the mixture was electrolyzed under vigorous stirring for 0.5 hour at room temperature. After completion, the solvent was concentrated under reduced pressure and separated by flash column chromatography to give **3r** (8.0 mg, 20% yield) and **3s** (3.7 mg, 8% yield)

3.5 *p*-Toluenesulfinic acid–Trapping Experiments



To a 15 mL single-necked flask, indole (**1a**, 0.3 mmol, 35.1 mg, 1.0 equiv), TsCl (**2a**, 0.6 mmol, 114.4 mg, 2.0 equiv), TMEDA (1.3 equiv, 0.39 mmol, 45.2 mg), Et_4NClO_4 (0.1 M, 137.8 mg), DCM (5 mL) and HFIP (1 mL) were added. Then, the flask was blocked up with a rubber stopper which was equipped with a carbon rod (Φ 6 mm) anode and a platinum electrode (10 mm×10 mm×0.3 mm). About 1.0 cm of the electrodes was under the solution. Set the power supply to a constant voltage of 13 V and the mixture was electrolyzed under vigorous stirring at room temperature. One hour later, the solution was transferred to a separatory funnel and water (10 mL) was

added. Then DCM (2 × 10 mL) was added to extract the aqueous phase, and the combined organic phase was concentrated in vacuum.

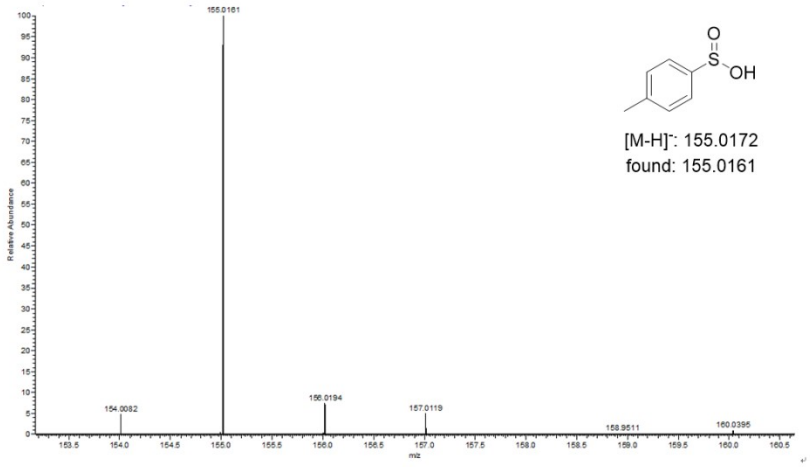
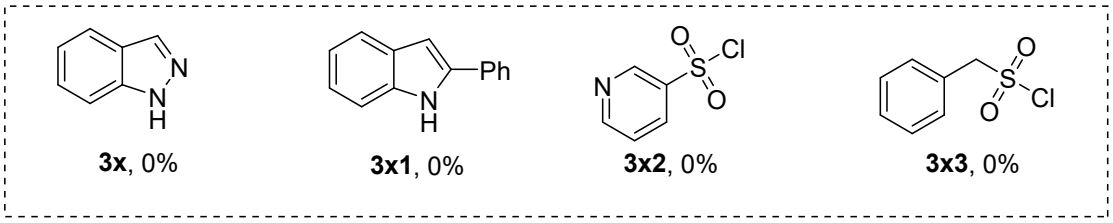
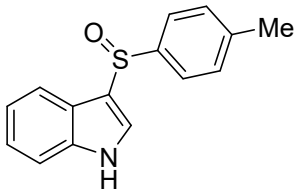


Figure S7 HRMS of compound **9**

3.6 Unsuccessful Examples of Substrates



4. Characterization Data for the Products

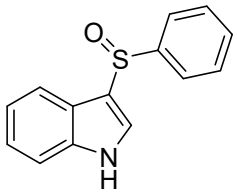


3-(*p*-Tolylsulfinyl)-1*H*-indole (3a)[2]**:** Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3a** (58.1 mg, 76% yield).

Brown solid; m.p.: 127.1~128.7 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.31 (s, 1H), 7.54 (d, *J* = 7.8 Hz, 2H), 7.34 (d, *J* = 8.4 Hz, 1H), 7.25 (d, *J* = 6.0 Hz, 2H), 7.21 (d, *J* = 7.8 Hz, 1H), 7.17 (s, 1H), 7.09 (t, *J* = 7.2 Hz, 1H), 6.97 (t, *J* = 7.2 Hz, 1H), 2.38 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 140.7, 140.2, 137.3, 130.1, 129.9, 125.1, 123.6, 123.5, 121.5, 119.4, 116.4, 112.7, 21.5.

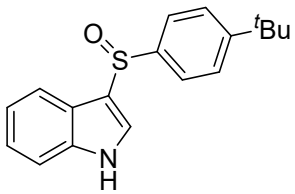


3-(Phenylsulfinyl)-1*H*-indole (3b)[3]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3b** (50.7 mg, 70% yield).

Brown solid; m.p.: 124.3~125.9 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.37–10.31 (m, 1H), 7.67 (d, *J* = 7.2 Hz, 2H), 7.47–7.43 (m, 3H), 7.31 (d, *J* = 7.8 Hz, 1H), 7.21 (d, *J* = 8.4 Hz, 1H), 7.18 (s, 1H), 7.10 (t, *J* = 7.8 Hz, 1H), 6.97 (t, *J* = 7.2 Hz, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 143.3, 137.3, 130.4, 130.3, 129.1, 125.1, 123.6, 123.5, 121.6, 119.3, 116.0, 112.7.



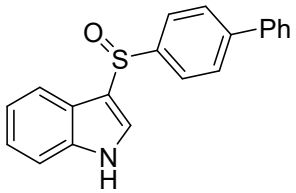
3-((4-(*tert*-Butyl)phenyl)sulfinyl)-1*H*-indole (3c): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3c** (59.6 mg, 67% yield).

Brown solid; m.p.: 130.6~131.7 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.50 (s, 1H), 7.59 (d, *J* = 8.4 Hz, 2H), 7.48 (d, *J* = 8.4 Hz, 2H), 7.38 (d, *J* = 7.8 Hz, 1H), 7.19 (d, *J* = 8.4 Hz, 1H), 7.13 (s, 1H), 7.09 (t, *J* = 7.8 Hz, 1H), 6.99 (t, *J* = 7.8 Hz, 1H), 1.33 (s, 9H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 154.0, 140.1, 137.2, 129.9, 126.2, 125.0, 123.7, 123.5, 121.5, 119.4, 116.4, 112.6, 35.0, 31.4.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{18}H_{20}NOS$ 298.1260; Found: 298.1259.



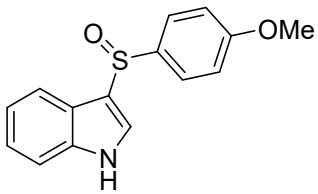
3-([1,1'-Biphenyl]-4-ylsulfinyl)-1*H*-indole (3d): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3d** (61.6 mg, 65% yield).

White solid; m.p.: 136.8~138.3 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.34–10.30 (m, 1H), 7.72 (d, *J* = 7.8 Hz, 2H), 7.67 (d, J = 8.4 Hz, 2H), 7.57 (d, *J* = 7.8 Hz, 2H), 7.44 (t, *J* = 7.8 Hz, 2H), 7.41 (d, *J* = 8.4 Hz, 1H), 7.37 (t, *J* = 7.2 Hz, 1H), 7.23–7.22 (m, 2H), 7.10 (t, *J* = 7.2 Hz, 1H), 6.99 (t, *J* = 7.8 Hz, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 143.4, 142.1, 139.9, 137.3, 130.3, 129.1, 128.1, 127.8, 127.3, 125.6, 123.6, 123.6, 121.7, 119.4, 116.0, 112.7.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{20}H_{16}NOS$ 318.0947; Found: 318.0950.

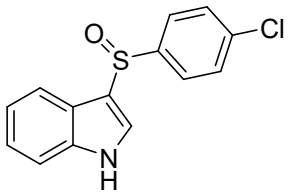


3-((4-Methoxyphenyl)sulfinyl)-1*H*-indole (3e)[4]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3e** (49.6 mg, 61% yield).

Brown solid; m.p.: 129.6~131.4 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 9.92–9.82 (m, 1H), 7.57 (d, *J* = 8.4 Hz, 2H), 7.35 (d, *J* = 8.4 Hz, 1H), 7.26–7.21 (m, 2H), 7.15–7.12 (m, 1H), 7.01–7.00 (m, 1H), 6.94 (d, *J* = 8.4 Hz, 2H), 3.81 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 161.5, 137.2, 134.4, 131.7, 129.6, 126.9, 123.6, 121.6 119.5, 114.7, 112.6, 112.6, 55.6.

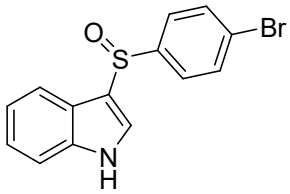


3-((4-Chlorophenyl)sulfinyl)-1*H*-indole (3f)[5]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3f** (62.3 mg, 75% yield).

Brown solid; m.p.: 126.9~128.4 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.34 (s, 1H), 7.58 (d, *J* = 9.0 Hz, 2H), 7.43 (d, *J* = 9.0 Hz, 2H), 7.30 (d, *J* = 7.8 Hz, 1H), 7.20 (d, *J* = 8.4 Hz, 1H), 7.18 (d, *J* = 3.0 Hz, 1H), 7.12 (t, *J* = 7.8 Hz, 1H), 7.00 (t, *J* = 7.8 Hz, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 142.0, 137.3, 136.6, 130.5, 129.4, 126.5, 123.8, 123.3, 121.8, 119.2, 115.5, 112.8.

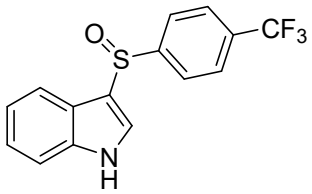


3-((4-Bromophenyl)sulfinyl)-1*H*-indole (3g)[4]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3g** (73.6 mg, 77% yield).

Brown solid; m.p.: 131.3~133.1 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 9.67 (s, 1H), 7.59 (d, *J* = 8.4 Hz, 2H), 7.53 (d, *J* = 8.4 Hz, 2H), 7.33 (d, *J* = 7.8 Hz, 1H), 7.31 (s, 1H), 7.25 (t, *J* = 9.0 Hz, 1H), 7.15 (t, *J* = 7.2 Hz, 1H), 7.03 (t, *J* = 7.8 Hz, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 142.9, 137.1, 132.3, 130.0, 126.8, 124.9, 124.0, 123.4, 121.95, 119.5, 116.3, 112.6.



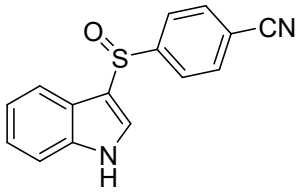
3-((4-(Trifluoromethyl)phenyl)sulfinyl)-1*H*-indole (3h)[5]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3h** (75.0 mg, 81% yield).

Brown solid; m.p.: 125.3~126.7 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.45 (s, 1H), 7.78 (d, *J* = 8.4 Hz, 2H), 7.72 (d, *J* = 8.4 Hz, 2H), 7.28 (d, *J* = 8.4 Hz, 1H), 7.24 (d, *J* = 3.0 Hz, 1H), 7.21 (d, *J* = 8.4 Hz, 1H), 7.12 (t, *J* = 7.8 Hz, 1H), 7.00 (t, *J* = 7.2 Hz, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 147.9, 137.3, 132.4 (q, *J* = 33.2 Hz), 130.9, 126.1 (q, *J* = 3.0 Hz), 125.6, 124.6, 123.9 (q, *J* = 273.3 Hz), 123.2, 122.0, 119.1, 115.0, 112.9.

^{19}F NMR (565 MHz, $CDCl_3$) δ -62.65.



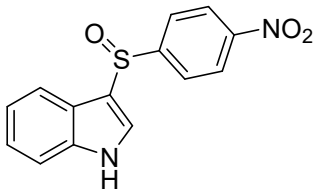
4-((1*H*-indol-3-yl)sulfinyl)benzonitrile (3i): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3i** (67.9 mg, 85% yield).

White solid; m.p.: 126.7~128.1 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.23–10.15 (m, 1H), 7.76 (d, *J* = 8.4 Hz, 2H), 7.72 (d, *J* = 7.8 Hz, 2H), 7.35 (s, 1H), 7.24 (d, *J* = 8.4 Hz, 1H), 7.22 (d, *J* = 8.4 Hz, 1H), 7.14 (t, *J* = 7.8 Hz, 1H), 7.00 (t, *J* = 7.2 Hz, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 149.4, 137.3, 132.7, 131.0, 125.9, 124.1, 123.0, 122.1, 119.1, 118.0, 114.8, 114.0, 112.9.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{15}H_{11}N_2OS$ 267.0587; Found: 267.0586.

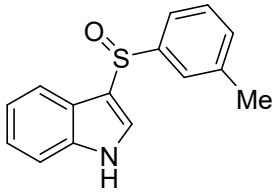


3-((4-Nitrophenyl)sulfinyl)-1*H*-indole (3j)[5]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3j** (70.5 mg, 82% yield).

Brown solid; m.p.: 128.1~129.8 ℃.

^{1}H NMR (600 MHz, DMSO-d_6) δ 12.09 (s, 1H), 8.34 (d, *J* = 8.4 Hz, 2H), 8.25 (d, *J* = 3.0 Hz, 1H), 7.90 (d, *J* = 8.4 Hz, 2H), 7.49 (d, *J* = 8.4 Hz, 1H), 7.21 (d, *J* = 7.8 Hz, 1H), 7.16 (t, *J* = 7.2 Hz, 1H), 6.97 (t, *J* = 7.2 Hz, 1H).

^{13}C NMR (151 MHz, DMSO-d_6) δ 152.6, 148.3, 137.1, 131.7, 126.0, 124.1, 123.1, 123.0, 121.0, 118.7, 114.8, 112.9.



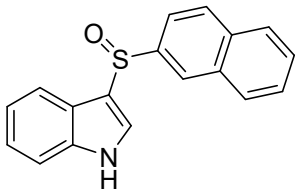
3-(*m*-Tolylsulfinyl)-1*H*-indole (3k): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3k** (53.9 mg, 70% yield).

Brown solid; m.p.: 123.1~124.9 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.45–10.39 (m, 1H), 7.52 (s, 1H), 7.43 (d, *J* = 7.8 Hz, 1H), 7.36 (d, *J* = 7.8 Hz, 1H), 7.33 (t, *J* = 7.8 Hz, 1H), 7.23 (d, *J* = 7.8 Hz, 1H), 7.20 (d, *J* = 8.4 Hz, 1H), 7.14 (s, 1H), 7.09 (t, *J* = 7.8 Hz, 1H), 6.98 (t, *J* = 7.8 Hz, 1H), 2.37 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 143.1, 139.2, 137.3, 131.3, 130.3, 129.0, 125.4, 123.6, 123.5, 122.2, 121.5, 119.3, 116.0, 112.7, 21.6.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{15}H_{14}NOS$ 256.0781; Found: 256.0791.

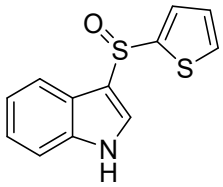


3-(Naphthalen-2-ylsulfinyl)-1*H*-indole (3l)[4]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3l** (57.5 mg, 66% yield).

Brown solid; m.p.: 139.3~141.7 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.07 (s, 1H), 8.46 (s, 1H), 7.95 (d, *J* = 5.4 Hz, 1H), 7.85 (d, *J* = 5.4 Hz, 1H), 7.80 (d, *J* = 8.4 Hz, 1H), 7.60–7.54 (m, 2H), 7.39 (d, *J* = 8.4 Hz, 1H), 7.35 (d, *J* = 7.8 Hz, 1H), 7.25 (s, 1H), 7.22 (d, *J* = 8.4 Hz, 1H), 7.05 (t, *J* = 7.8 Hz, 1H), 6.91 (t, *J* = 7.2 Hz, 1H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 140.6, 137.2, 134.1, 133.0, 130.2, 129.2, 128.7, 128.1, 127.7, 127.3, 125.3, 123.8, 123.7, 121.7, 121.4, 119.4, 116.1, 112.6.

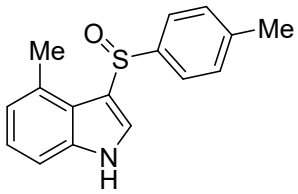


3-(Thiophen-2-ylsulfinyl)-1*H*-indole (3m)[5]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3m** (39.2 mg, 53% yield).

Brown solid; m.p.: 120.2~121.9 ℃.

^{1}H NMR (600 MHz, DMSO-d_6) δ 11.99 (s, 1H), 8.07 (d, *J* = 3.0 Hz, 1H), 7.84 (d, *J* = 4.8 Hz, 1H), 7.51 (d, *J* = 8.4 Hz, 1H), 7.49 (d, *J* = 7.8Hz, 1H), 7.45 (d, *J* = 3.6 Hz, 1H), 7.20 (t, *J* = 7.8 Hz, 1H), 7.15 (d, *J* = 4.2 Hz, 1H), 7.06 (t, *J* = 7.2 Hz, 1H).

^{13}C NMR (151 MHz, DMSO-d_6) δ 148.4, 137.1, 131.2, 129.6, 128.9, 127.8, 123.1, 122.9, 120.8, 119.2, 116.8, 112.8.



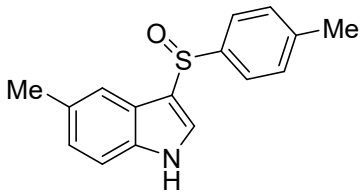
4-Methyl-3-(*p*-tolylsulfinyl)-1*H*-indole (3n): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3n** (42.1 mg, 52% yield).

Brown solid; m.p.: 127.8~129.3 ℃.

^{1}H NMR (600 MHz, DMSO-d_6) δ 11.94 (s, 1H), 7.76 (s, 1H), 7.38 (d, *J* = 7.8 Hz, 2H), 7.31 (d, *J* = 8.4 Hz, 3H), 7.09 (t, *J* = 7.2 Hz, 1H), 6.85 (d, *J* = 7.2 Hz, 1H), 2.34 (s, 6H).

^{13}C NMR (151 MHz, DMSO-d_6) δ 143.0, 139.8, 137.5, 131.1, 129.7, 129.6, 125.0, 123.8, 123.1, 122.1, 117.9, 110.0, 21.4, 20.8.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{16}H_{16}NOS$ 270.0947; Found: 270.0944.



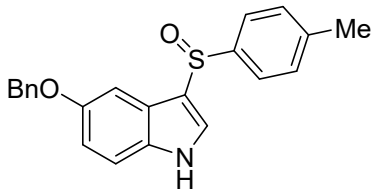
5-Methyl-3-(*p*-tolylsulfinyl)-1*H*-indole (3o): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3o** (58.8 mg, 73% yield).

Brown solid; m.p.: 129.6~131.2 ℃.

^{1}H NMR (600 MHz, DMSO-d_6) δ 11.75 (s, 1H), 7.98 (s, 1H), 7.49 (d, *J* = 7.2 Hz, 2H), 7.31 (d, *J* = 7.8 Hz, 2H), 7.24 (s, 1H), 7.10 (d, *J* = 8.4 Hz, 1H), 6.78 (d, *J* = 7.8 Hz, 1H), 2.33 (s, 3H), 2.32 (s, 3H).

^{13}C NMR (151 MHz, DMSO-d_6) δ 141.9, 139.6, 137.5, 132.1, 129.9, 129.5, 124.4, 122.3, 121.0, 118.7, 116.4, 112.3, 21.2, 20.8.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{16}H_{16}NOS$ 270.0947; Found: 270.0945.



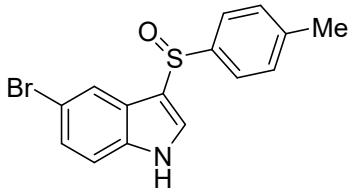
5-(Benzyloxy)-3-(*p*-tolylsulfinyl)-1*H*-indole (3p): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3p** (86.3 mg, 80% yield).

White solid; m.p.: 135.7~137.4 ℃.

^{1}H NMR (600 MHz, DMSO-d_6) δ 11.78 (s, 1H), 7.98 (d, *J* = 3.0 Hz, 1H), 7.51 (d, *J* = 8.4 Hz, 2H), 7.36 (d, *J* = 4.2 Hz, 5H), 7.32 (d, *J* = 7.8 Hz, 3H), 6.87 (d, *J* = 9.0 Hz, 1H), 6.78 (s, 1H), 4.93 (d, *J* = 12.0 Hz, 1H), 4.86 (d, *J* = 12.0 Hz, 1H), 2.33 (s, 3H).

^{13}C NMR (151 MHz, DMSO-d_6) δ 153.0, 141.7, 139.6, 137.2, 132.0, 130.8, 129.5, 128.4, 127.7, 127.5, 124.3, 123.8, 116.2, 113.4, 113.3, 102.4, 69.6, 20.8.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{22}H_{20}NO_2S$ 362.1209; Found: 362.1208.

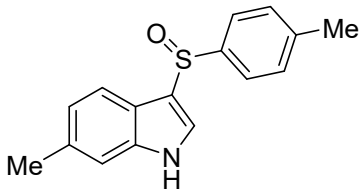


5-Bromo-3-(*p*-tolylsulfinyl)-1*H*-indole (3q)[5]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3q** (69.0 mg, 69% yield).

Brown solid; m.p.: 128.5~130.2 ℃.

^{1}H NMR (600 MHz, DMSO-d_6) δ 12.10 (s, 1H), 8.14 (s, 1H), 7.52 (d, *J* = 7.8 Hz, 2H), 7.45 (d, *J* = 8.6 Hz, 1H), 7.40 (s, 1H), 7.35 (d, *J* = 7.8 Hz, 2H), 7.28 (d, *J* = 9.0 Hz, 1H), 2.34 (s, 3H).

^{13}C NMR (151 MHz, DMSO-d_6) δ 141.6, 139.9, 135.8, 131.6, 129.6, 125.4, 124.9, 124.3, 121.1, 116.3, 114.8, 113.1, 20.8.



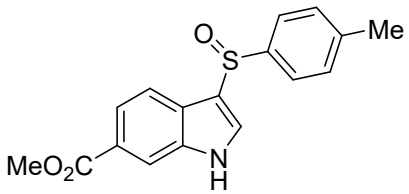
6-Methyl-3-(*p*-tolylsulfinyl)-1*H*-indole (3r): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3r** (63.0 mg, 78% yield).

Brown solid; m.p.: 126.9~128.3 ℃.

^{1}H NMR (600 MHz, DMSO-d_6) δ 11.77 (s, 1H), 7.96 (d, *J* = 3.0 Hz, 1H), 7.51 (d, *J* = 7.8 Hz, 2H), 7.33 (t, *J* = 9.6 Hz, 3H), 7.10 (s, 1H), 6.97 (d, *J* = 8.4 Hz, 1H), 2.33 (s, 3H), 2.24 (s, 3H).

^{13}C NMR (151 MHz, DMSO-d_6) δ 142.0, 139.6, 135.3, 130.1, 129.5, 129.3, 124.4, 124.3, 123.5, 118.6, 115.9, 112.3, 21.1, 20.8.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{16}H_{16}NOS$ 270.0947; Found: 270.0944.



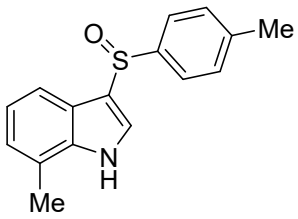
Methyl 3-(*p*-tolylsulfinyl)-1*H*-indole-6-carboxylate (3s): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3s** (61.2 mg, 65% yield).

White solid; m.p.: 131.2~132.7 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.65–10.58 (m, 1H), 8.01 (s, 1H), 7.67 (d, *J* = 9.0 Hz, 1H), 7.54 (d, *J* = 7.8 Hz, 2H), 7.50 (s, 1H), 7.37 (d, *J* = 8.4 Hz, 1H), 7.27 (d, *J* = 7.8 Hz, 2H), 3.85 (s, 3H), 2.38 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 167.6, 141.2, 139.9, 136.6, 132.3, 130.0, 127.3, 125.4, 125.1, 122.5, 119.1, 117.5, 114.9, 52.2, 21.5.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{17}H_{16}NO_3S$ 314.0845; Found: 314.0845.

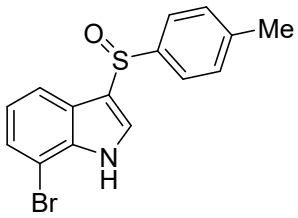


7-Methyl-3-(*p*-tolylsulfinyl)-1*H*-indole (3t)[2]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3t** (62.2 mg, 77% yield).

Brown solid; m.p.: 123.1~124.7 ℃.

^{1}H NMR (600 MHz, DMSO-d_6) δ 11.92 (s, 1H), 8.07 (d, *J* = 3.0 Hz, 1H), 7.50 (d, *J* = 7.8 Hz, 2H), 7.30 (d, *J* = 7.8 Hz, 2H), 7.09 (d, *J* = 8.4 Hz, 1H), 6.94 (d, *J* = 7.2 Hz, 1H), 6.86 (t, *J* = 7.8 Hz, 1H), 2.45 (s, 3H), 2.31 (s, 3H).

^{13}C NMR (151 MHz, DMSO-d_6) δ 141.9, 139.6, 136.5, 130.1, 129.5, 124.4, 123.2, 122.9, 122.0, 120.8, 116.9, 116.6, 20.8, 16.7



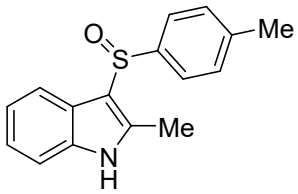
7-Bromo-3-(*p*-tolylsulfinyl)-1*H*-indole (3u): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3u** (64.0 mg, 64% yield).

Brown solid; m.p.: 129.8~131.5 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 9.37 (s, 1H), 7.59 (s, 1H), 7.54 (d, *J* = 7.8 Hz, 2H), 7.28 (d, *J* = 8.4 Hz, 1H), 7.25 (d, *J* = 4.8 Hz, 1H), 7.23 (d, *J* = 8.4 Hz, 2H), 6.82 (t, *J* = 7.8 Hz, 1H), 2.35 (s, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 141.1, 140.1, 135.7, 129.9, 129.6, 126.2, 125.1, 124.8, 122.8, 119.0, 113.9, 105.4, 21.5

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{15}H_{13}BrNOS$ 333.9896; Found: 333.9895.

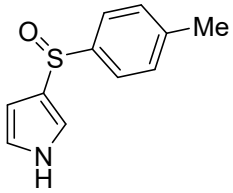


2-Methyl-3-(*p*-tolylsulfinyl)-1*H*-indole (3v)[5]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3v** (54.6 mg, 68% yield).

White solid; m.p.: 132.3~134.8 ℃.

^{1}H NMR (600 MHz, DMSO-d_6) δ 11.83 (s, 1H), 7.49 (d, *J* = 7.8 Hz, 2H), 7.35 (d, *J* = 8.4 Hz, 1H), 7.30 (d, *J* = 7.8 Hz, 2H), 7.14 (d, *J* = 7.8 Hz, 1H), 7.05 (t, *J* = 7.2 Hz, 1H), 6.88 (t, *J* = 7.2 Hz, 1H), 2.66 (s, 3H), 2.31 (s, 3H).

^{13}C NMR (151 MHz, DMSO-d_6) δ 141.8, 141.7, 139.5, 135.7, 129.6, 124.5, 124.2, 122.1, 120.4, 118.5, 112.2, 111.7, 20.8, 11.8.

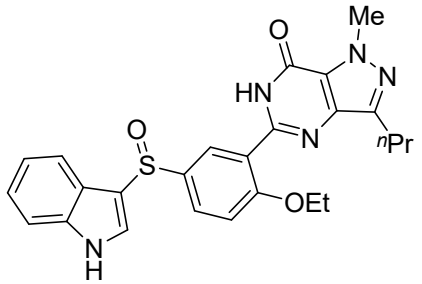


3-(*p*-Tolylsulfinyl)-1*H*-pyrrole (3w)[5]: Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate (EA) to afford the product **3w** (39.9 mg, 65% yield).

Brown solid; m.p.: 116.6~118.4 ℃.

^{1}H NMR (600 MHz, DMSO-d_6) δ 11.44 (s, 1H), 7.46 (d, *J* = 7.8 Hz, 2H), 7.32 (d, *J* = 7.2 Hz, 3H), 6.85 (s, 1H), 6.02 (s, 1H), 2.34 (s, 3H).

^{13}C NMR (151 MHz, DMSO-d_6) δ 143.2, 139.8, 129.5, 126.3, 124.1, 121.5, 120.7, 105.7, 20.8.



5-(5-((1*H*-indol-3-yl)sulfinyl)-2-ethoxyphenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (3y): Prepared following general procedure and the reaction mixture was purified by flash column chromatography with ethyl acetate: methanol (EA:MeOH=9/1) to afford the product **3y** (69.7 mg, 49% yield).

White solid; m.p.: 196.4~198.2 ℃.

^{1}H NMR (600 MHz, $CDCl_3$) δ 10.99 (s, 1H), 10.64 (s, 1H), 8.67 (s, 1H), 7.73 (d, *J* = 8.4 Hz, 1H), 7.44 (d, *J* = 7.8 Hz, 1H), 7.29 (s, 1H), 7.27 (d, *J* = 4.8 Hz, 1H), 7.10–7.05 (m, 2H), 6.98 (t, *J* = 7.8 Hz, 1H), 4.25–4.23 (m, 5H), 2.83 (t, *J* = 7.2 Hz, 2H), 1.78–1.72 (m, 2H), 1.55 (t, *J* = 7.2 Hz, 3H), 0.91 (t, *J* = 7.8 Hz, 3H).

^{13}C NMR (151 MHz, $CDCl_3$) δ 158.0, 153.8, 147.4, 146.8, 138.5, 137.3, 136.3, 129.8, 128.9, 128.3, 124.5, 123.6, 123.5, 121.6, 121.2, 119.3, 116.0, 113.6, 112.7, 65.9, 38.3, 27.7, 22.3, 14.6, 14.1.

HRMS (ESI) m/z: $[M+H]^+$ Calcd for $C_{25}H_{26}N_5O_3S$ 476.1751; Found: 476.1751

5. References

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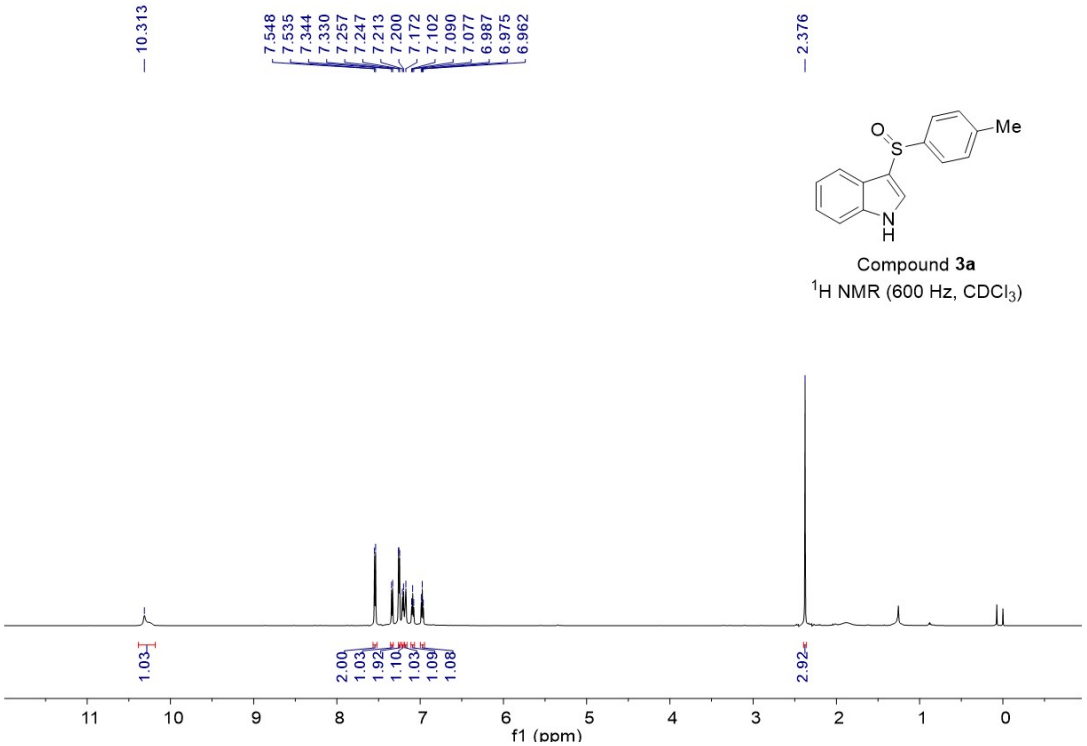
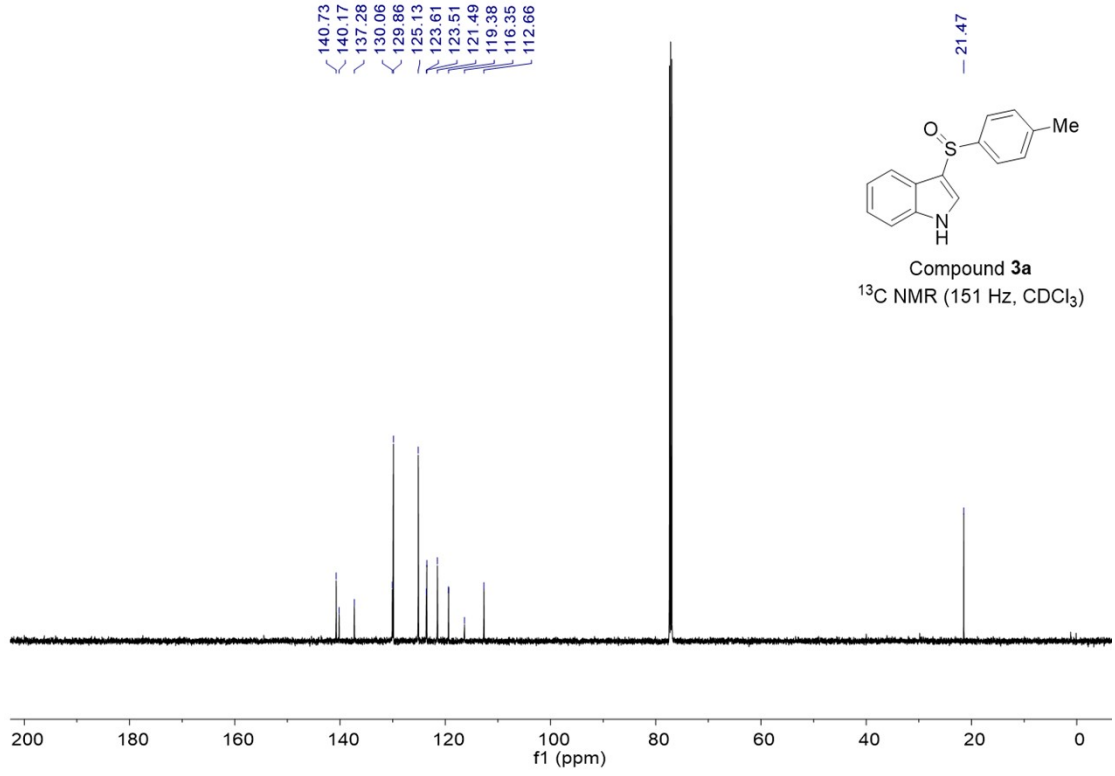
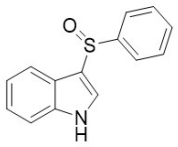
6. NMR Spectra

NMR spectra of 3-(*P*-tolylsulfinyl)-1*H*-indole (**3a**)

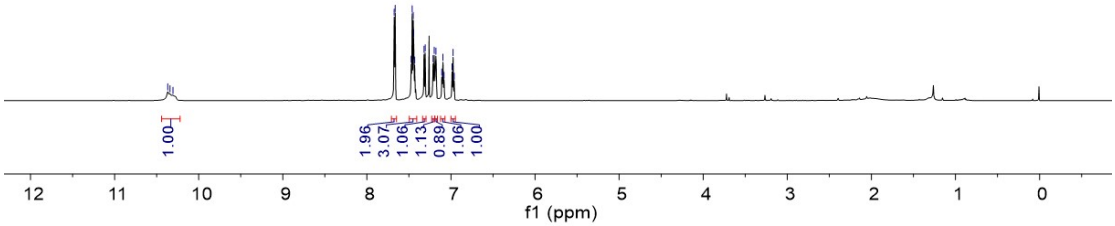


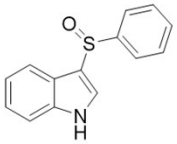


NMR spectra of 3-(Phenylsulfinyl)-1*H*-indole (**3b**)

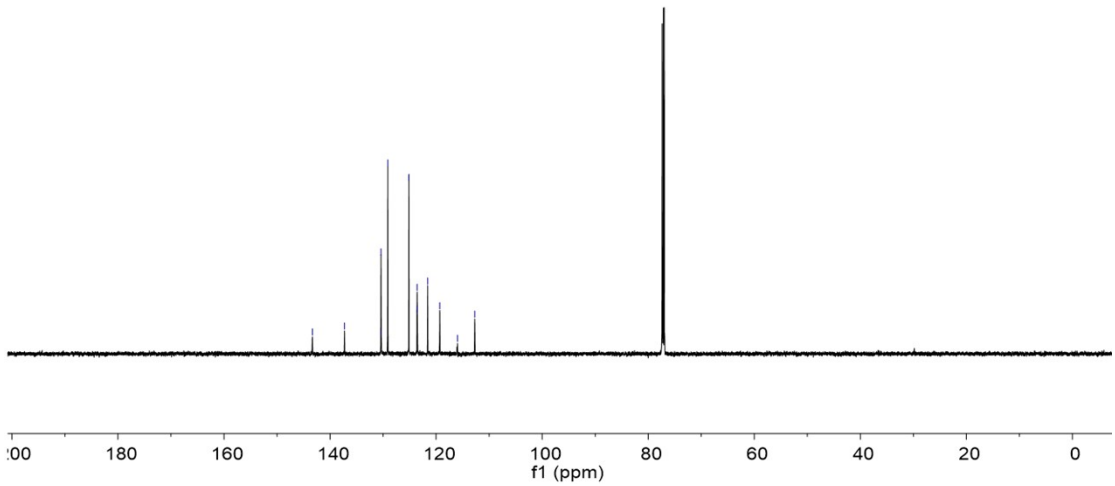


Compound **3b**
^{1}H NMR (600 Hz, $CDCl_3$)

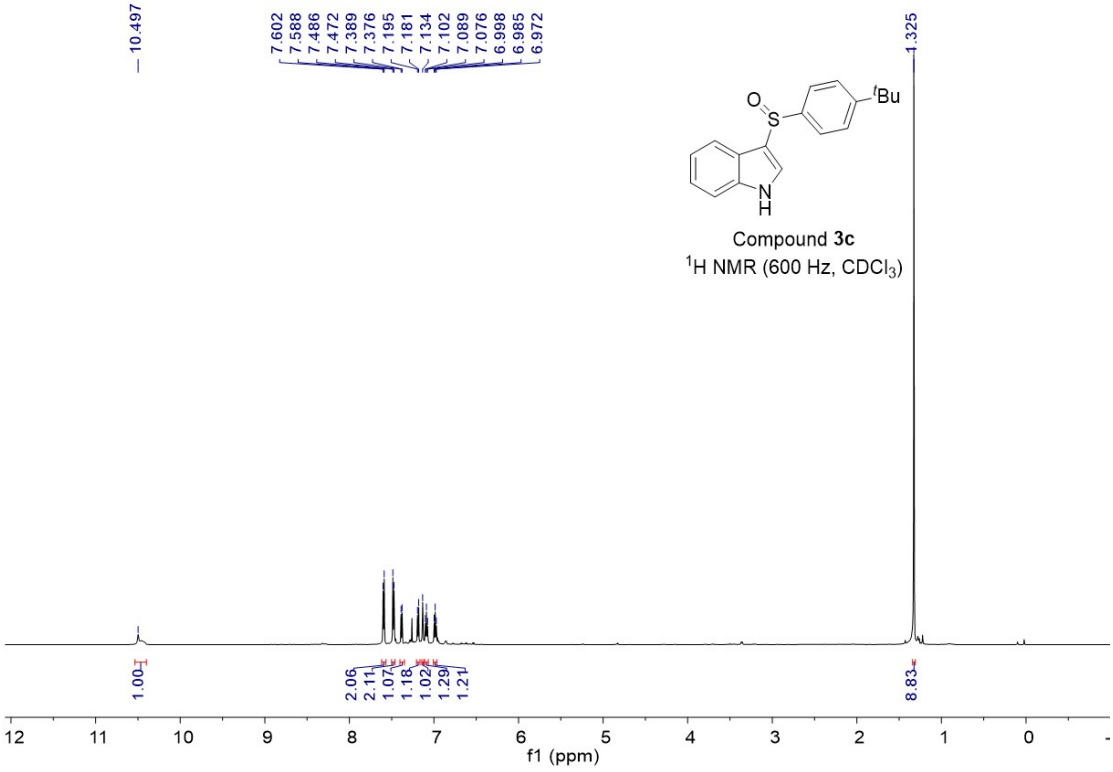


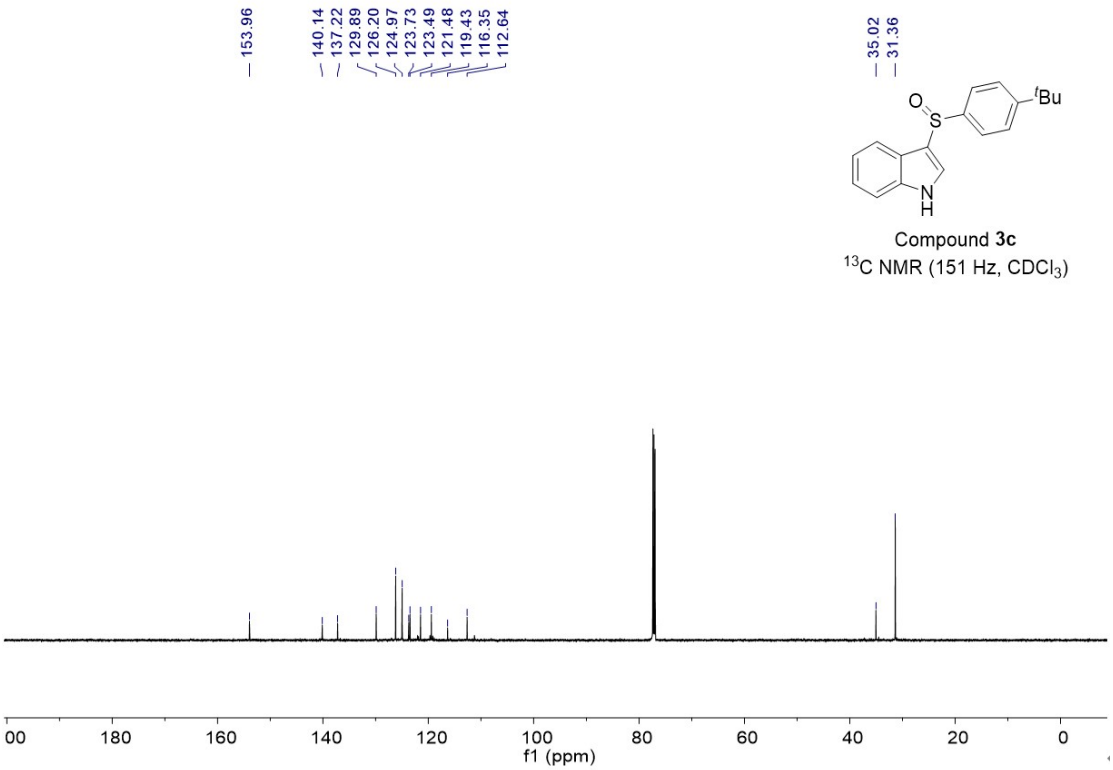


Compound **3b**
^{13}C NMR (151 Hz, $CDCl_3$)

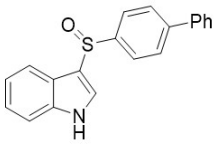


NMR spectra of 3-((4-(Tert-butyl)phenyl)sulfinyl)-1*H*-indole (**3c**)

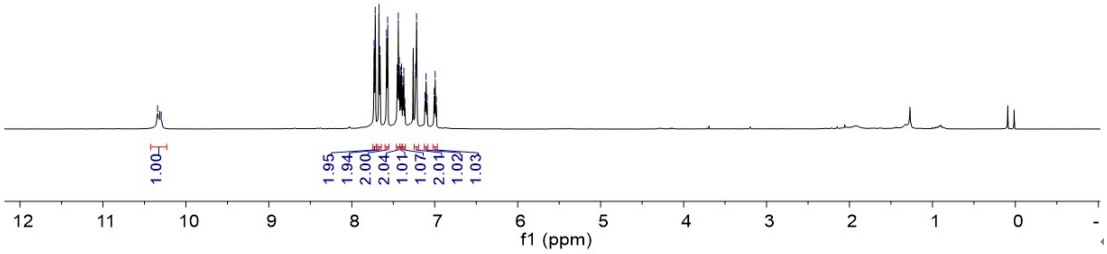


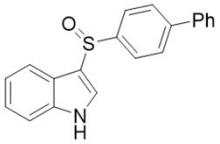


NMR spectra of 3-([1,1'-Biphenyl]-4-ylsulfinyl)-1*H*-indole (**3d**)



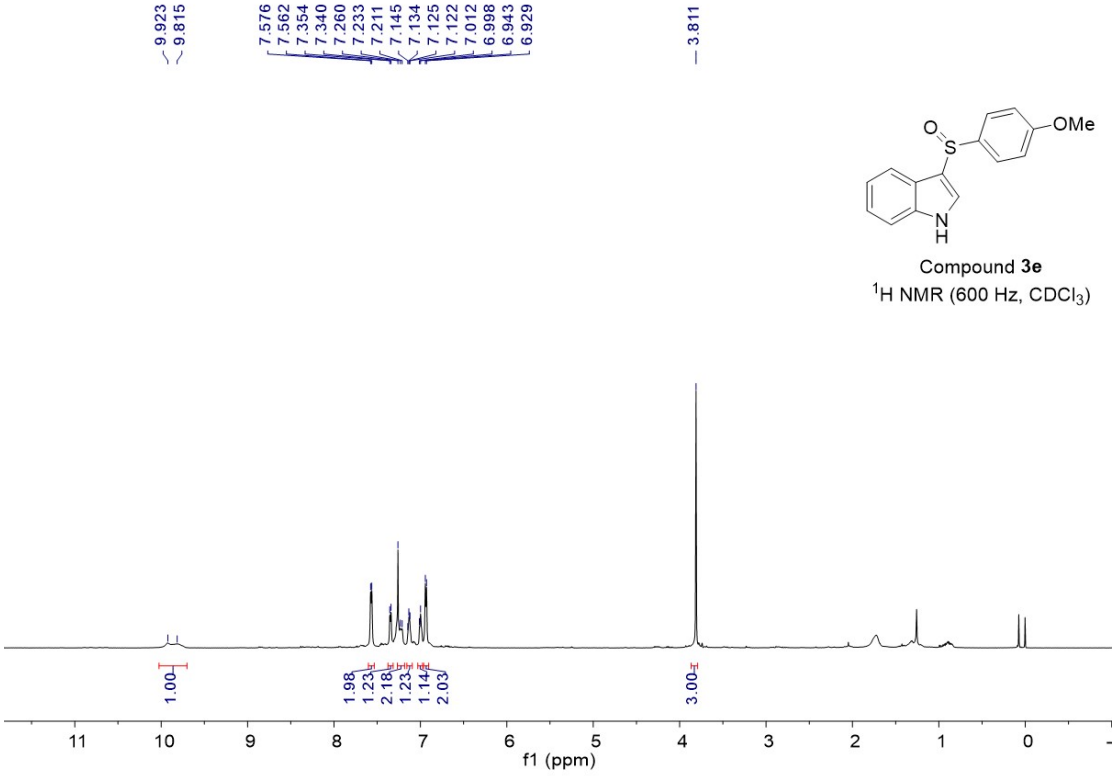
Compound **3d**
^{1}H NMR (600 Hz, $CDCl_3$)

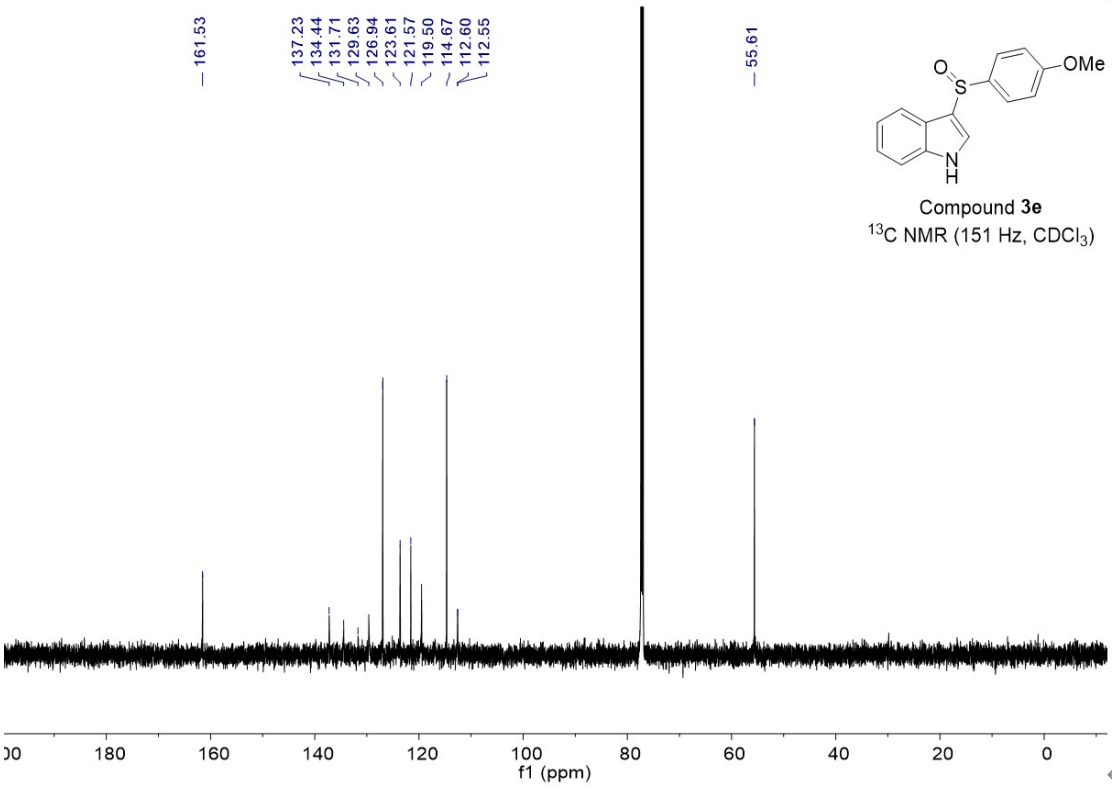




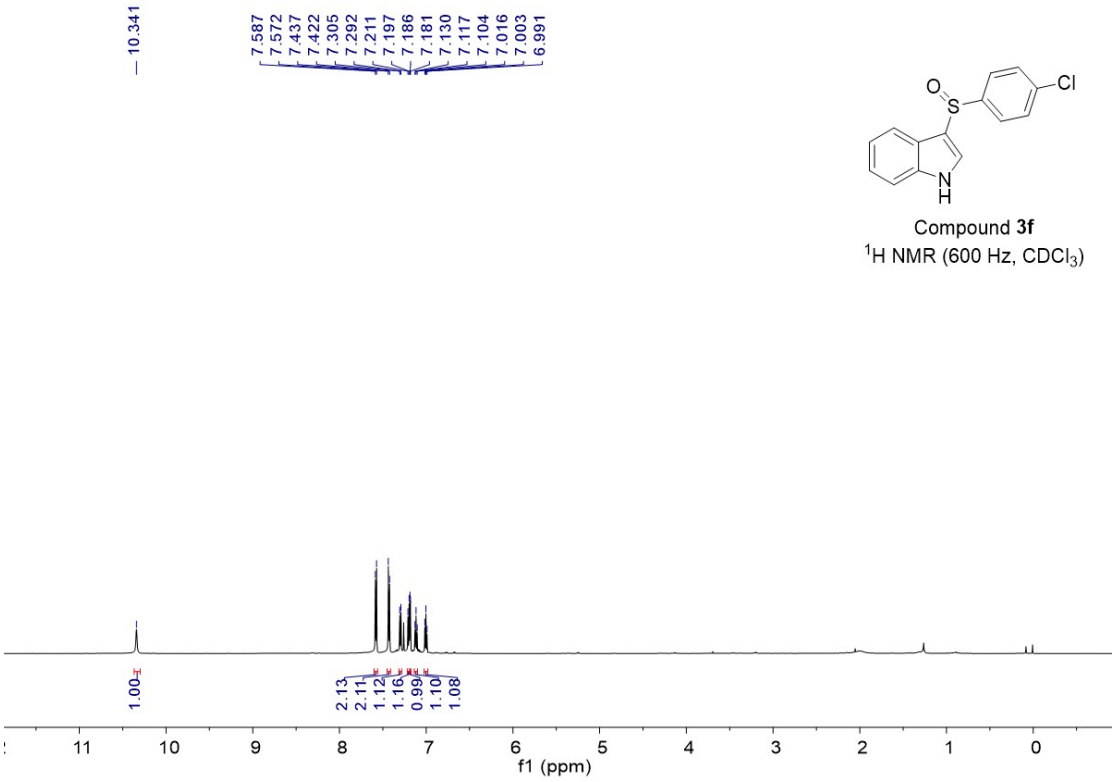
Compound **3d**
^{13}C NMR (151 Hz, $CDCl_3$)

NMR spectra of 3-((4-Methoxyphenyl)sulfinyl)-1*H*-indole (**3e**)

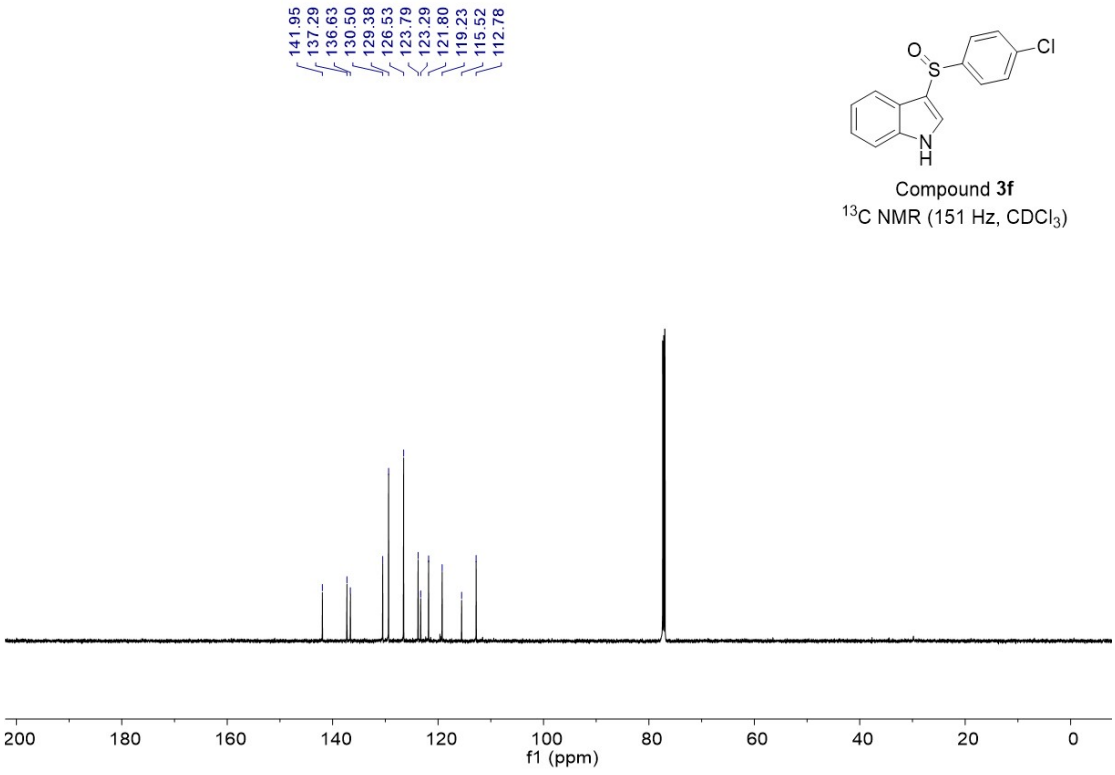




NMR spectra of 3-((4-Chlorophenyl)sulfinyl)-1*H*-indole (**3f**)

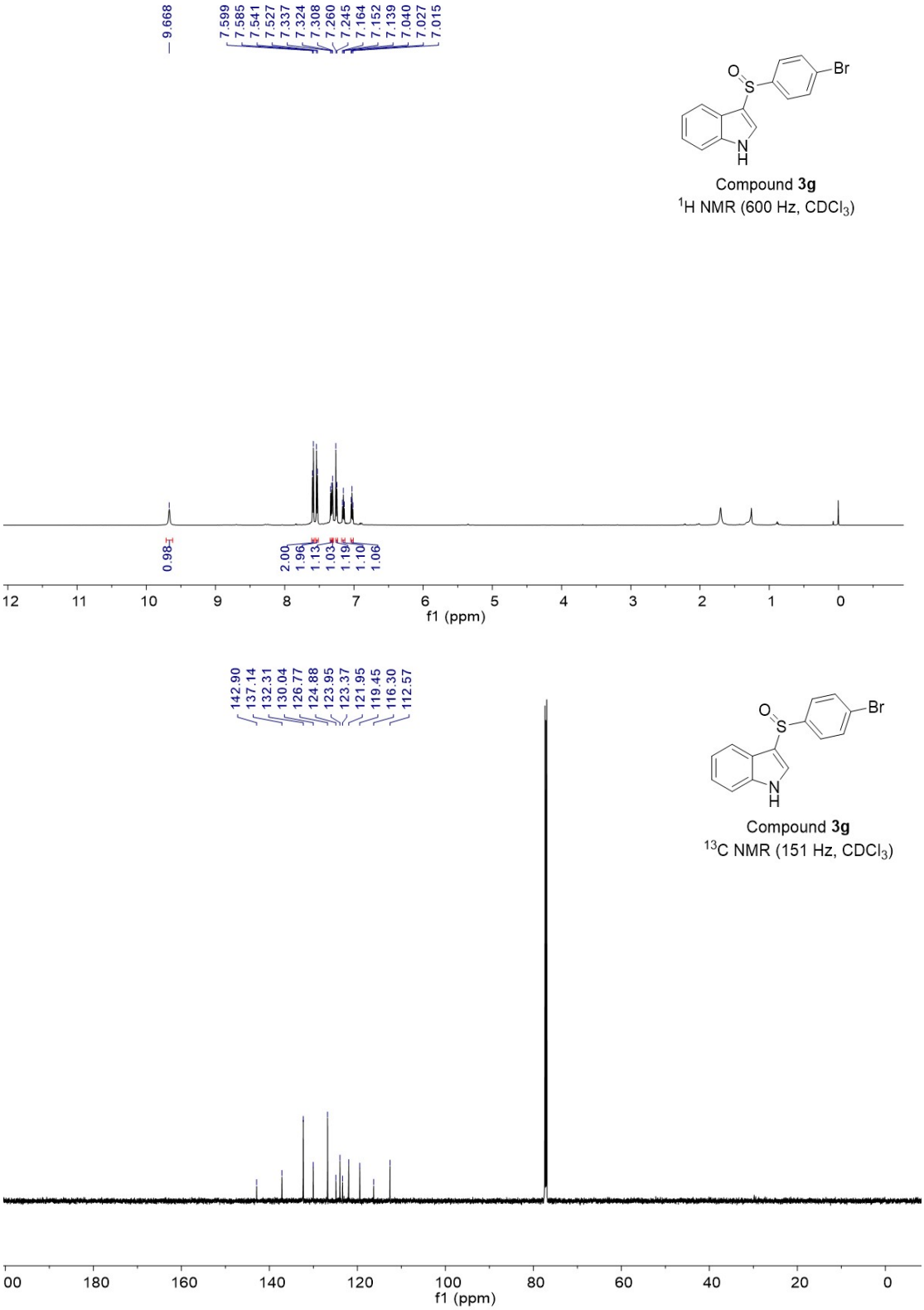


Compound **3f**
^{1}H NMR (600 Hz, $CDCl_3$)

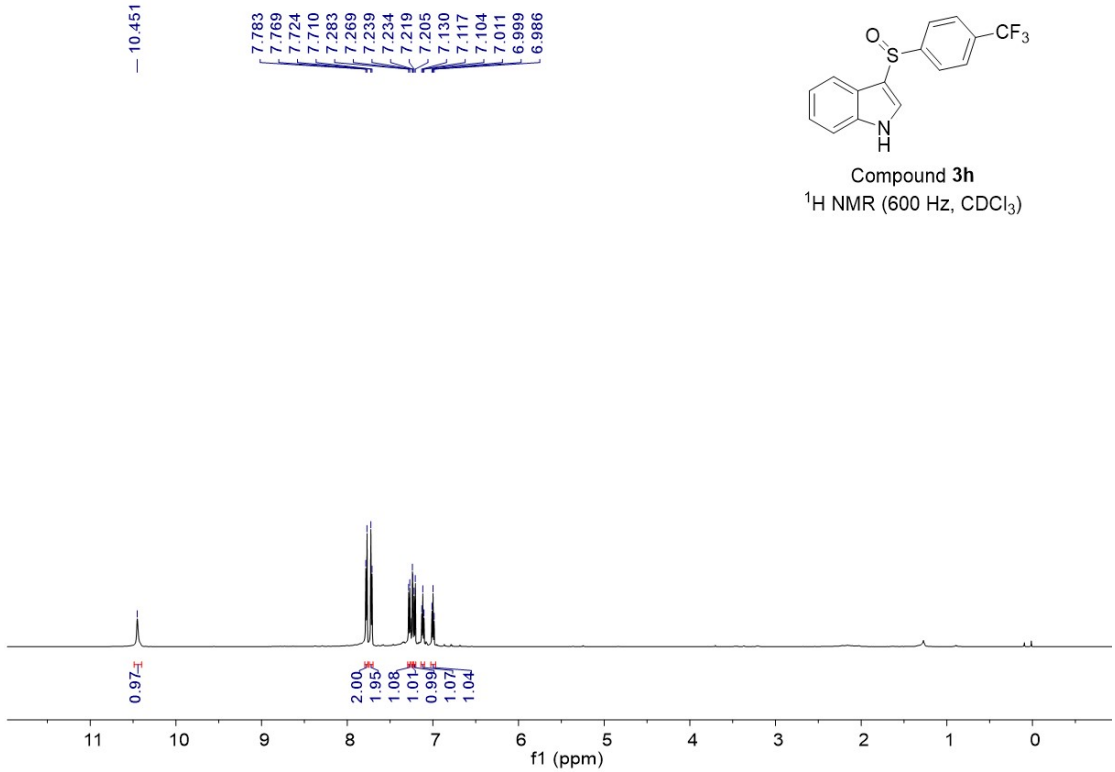


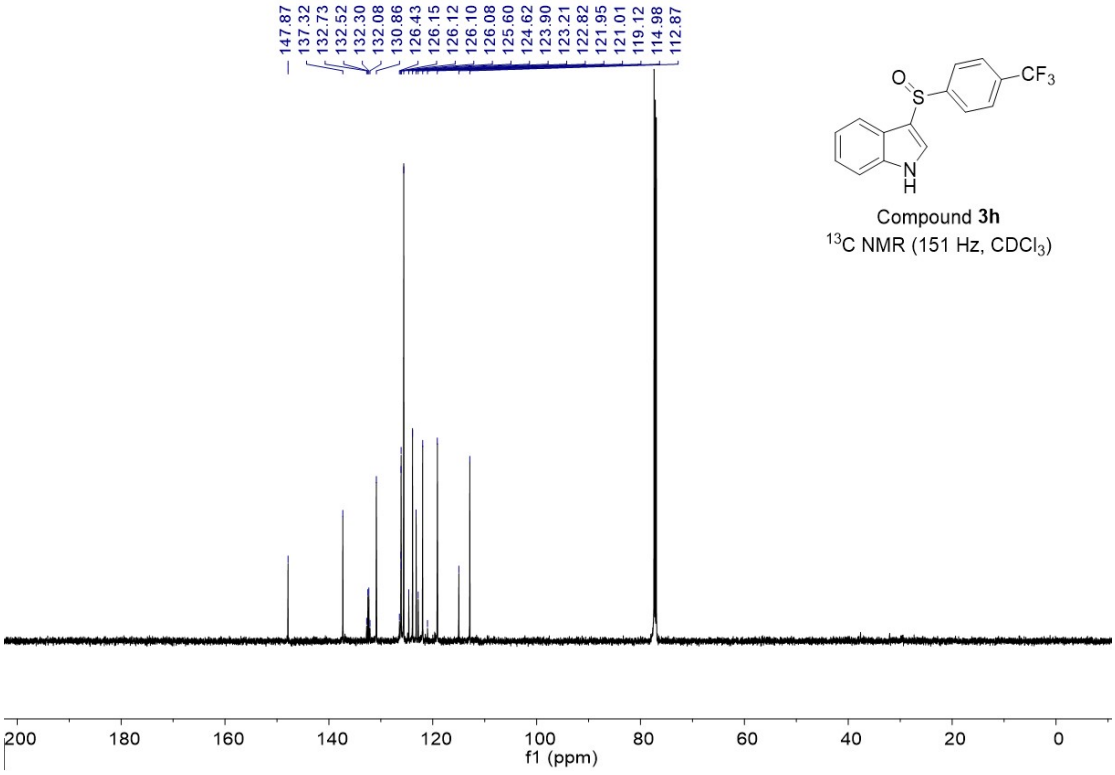
Compound **3f**
^{13}C NMR (151 Hz, $CDCl_3$)

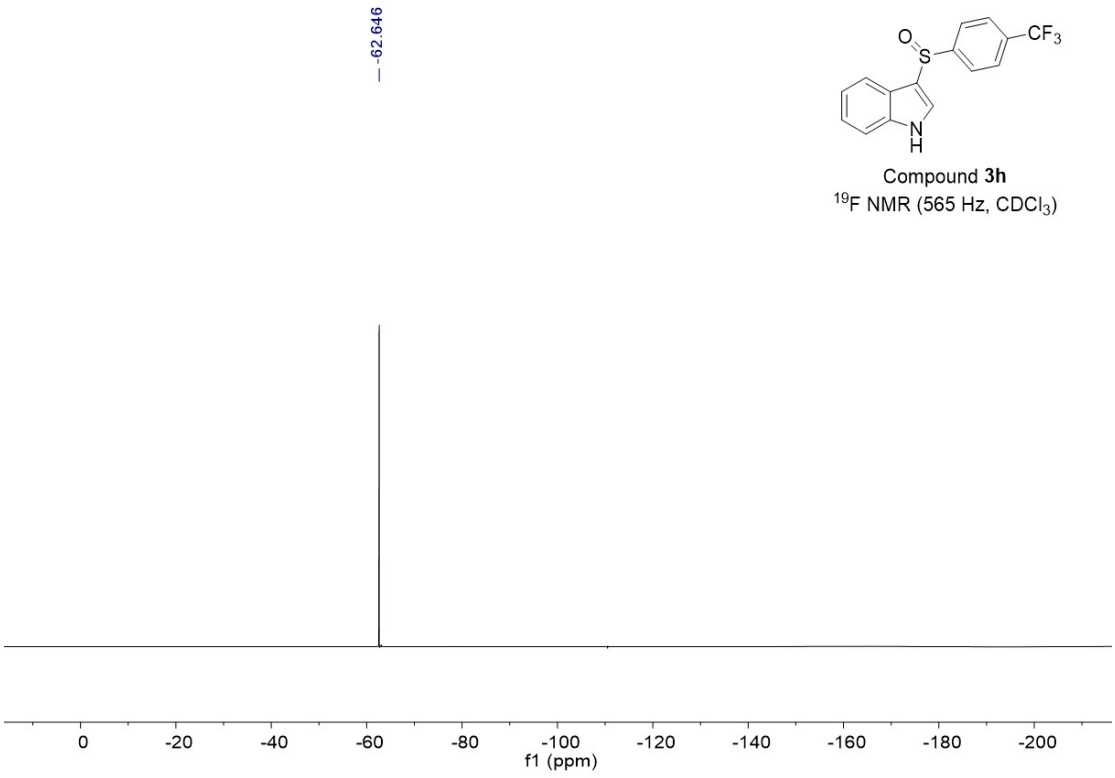
NMR spectra of 3-((4-Bromophenyl)sulfinyl)-1*H*-indole (**3g**)



NMR spectra of 3-((4-(Trifluoromethyl)phenyl)sulfinyl)-1*H*-indole (**3h**)



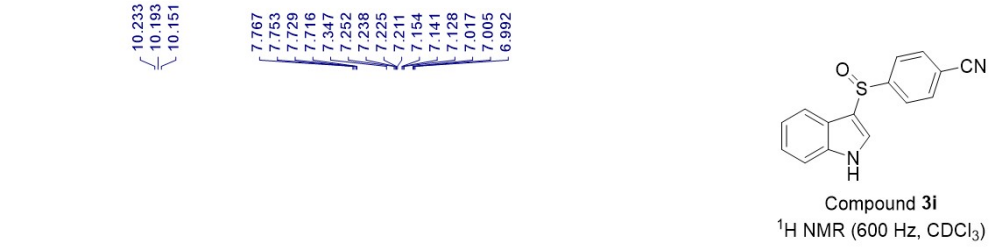




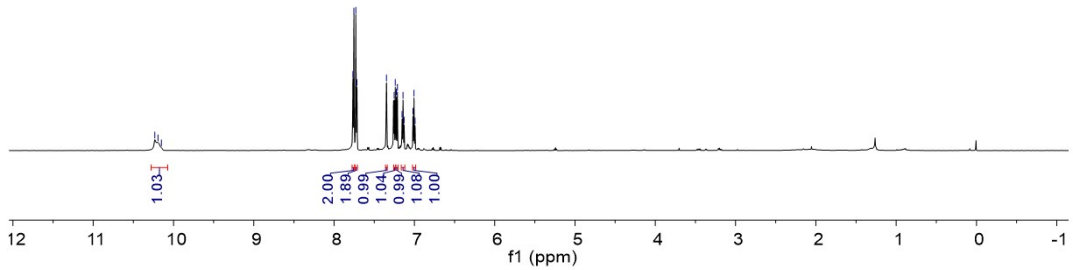
Compound **3h**

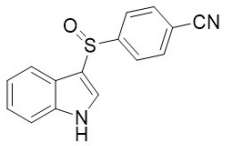
^{19}F NMR (565 Hz, $CDCl_3$)

NMR spectra of 4-((1*H*-indol-3-yl)sulfinyl)benzonitrile (**3i**)

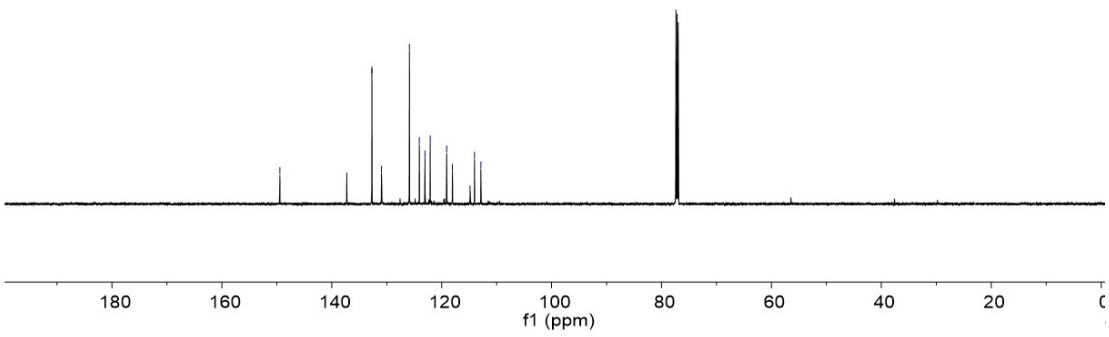


Compound **3i**
^{1}H NMR (600 Hz, $CDCl_3$)

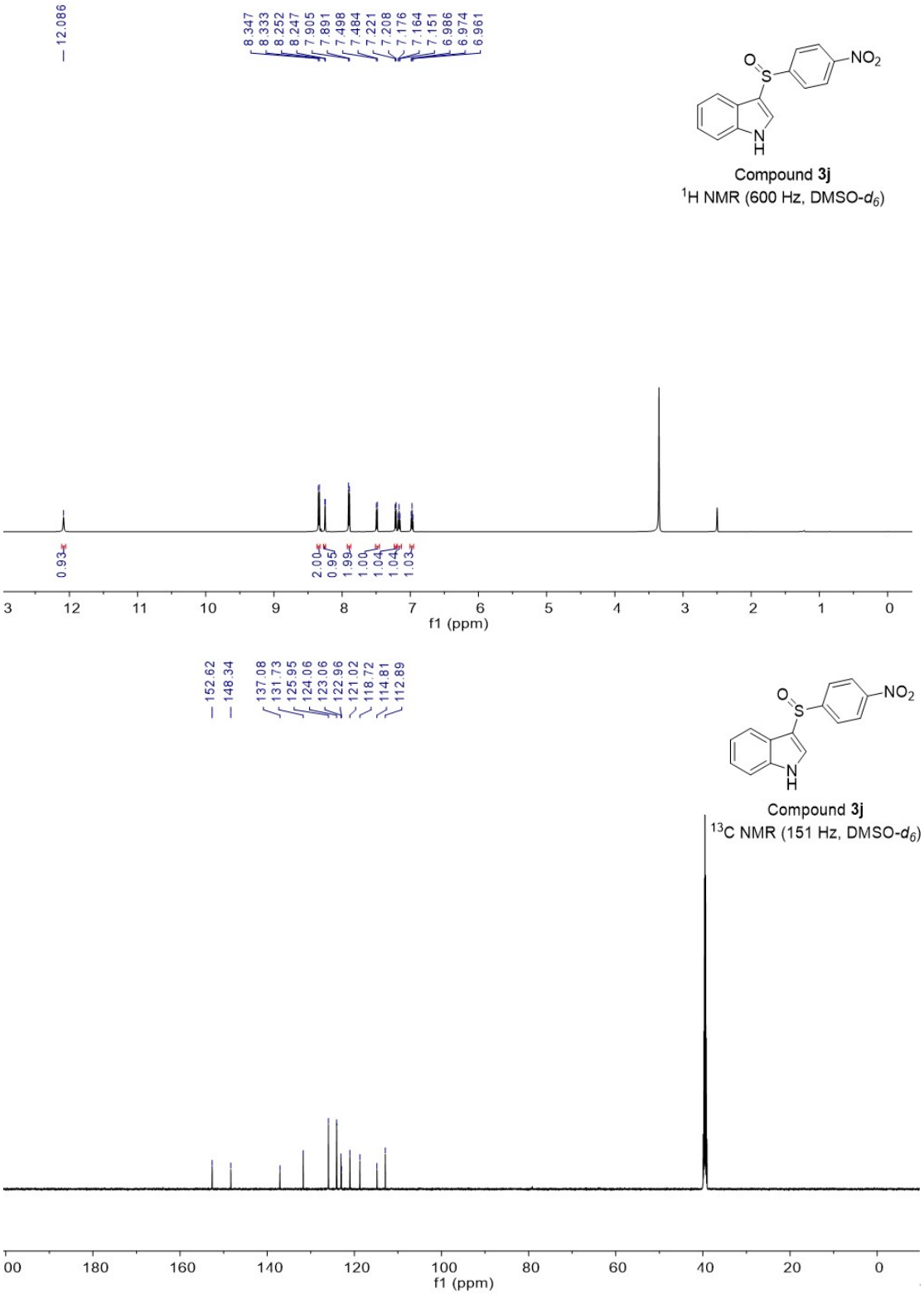




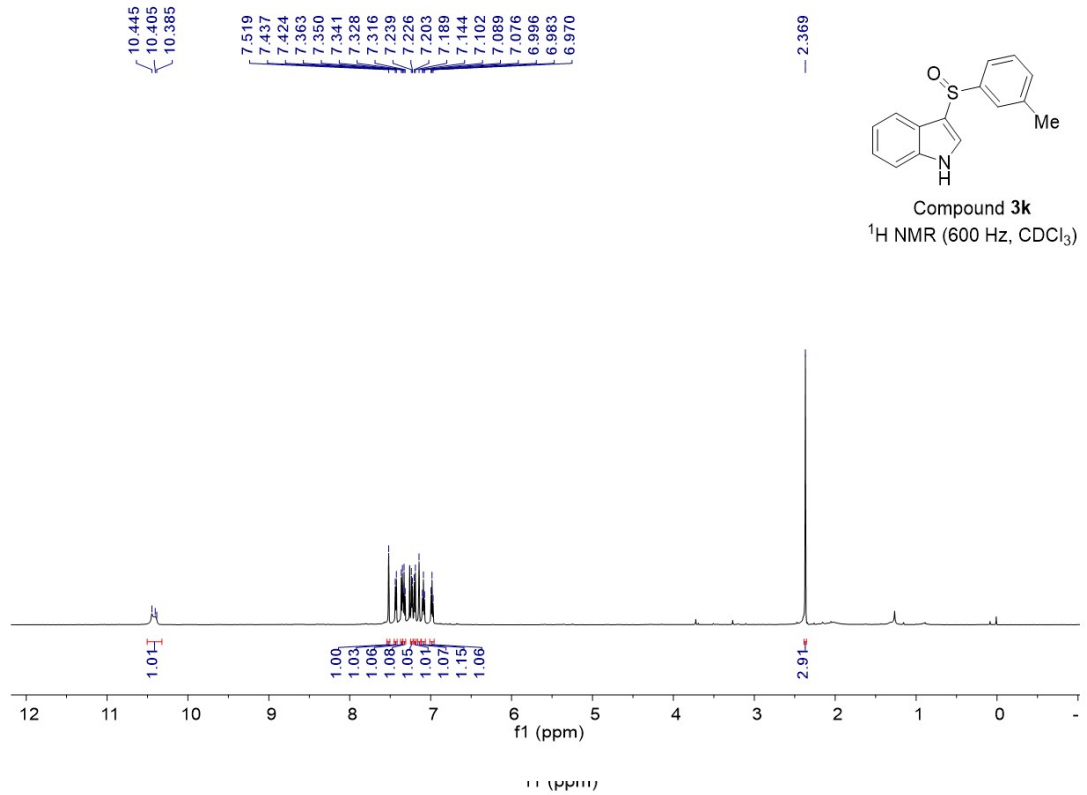
Compound **3i**
^{13}C NMR (151 Hz, $CDCl_3$)



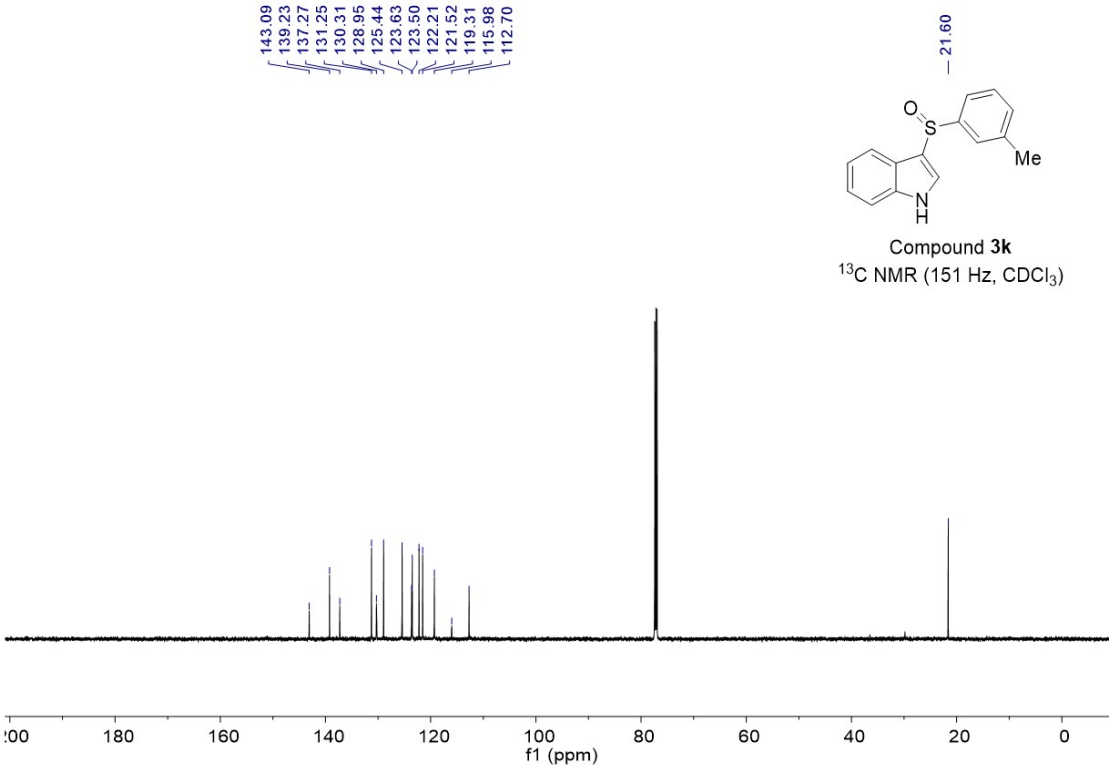
NMR spectra of 3-((4-Nitrophenyl)sulfinyl)-1*H*-indole (**3j**)



NMR spectra of 3-(M-tolylsulfinyl)-1*H*-indole (**3k**)

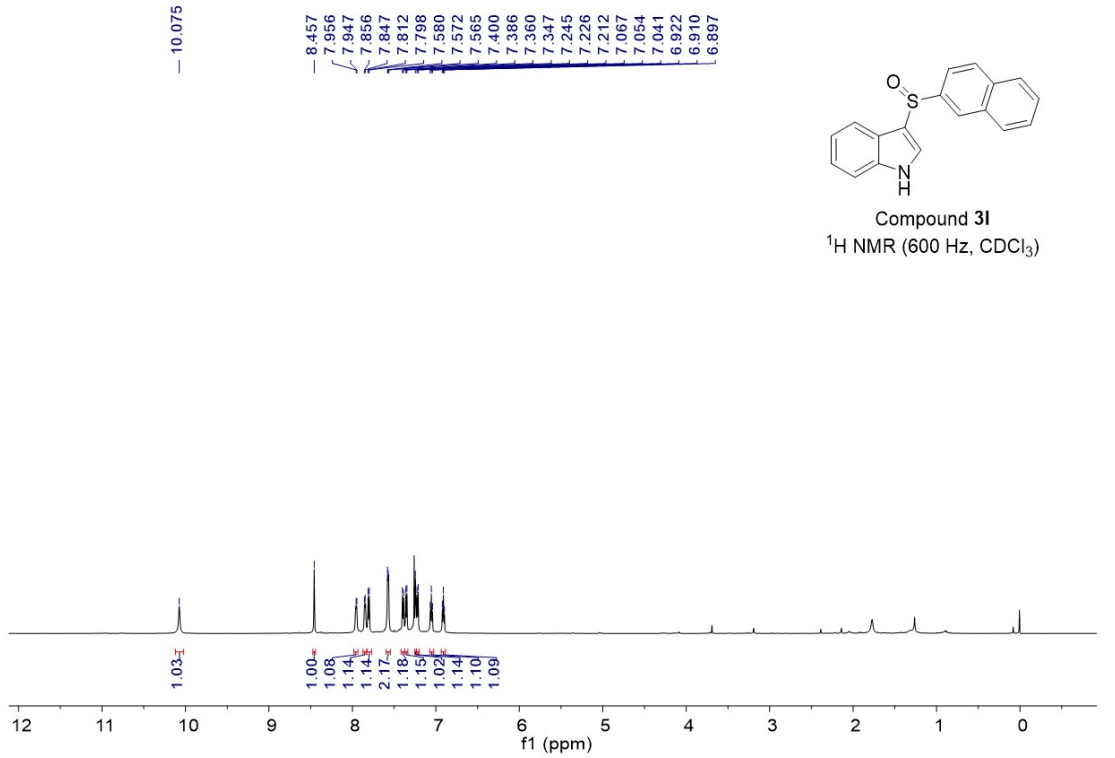


Compound **3k**
^{1}H NMR (600 Hz, $CDCl_3$)

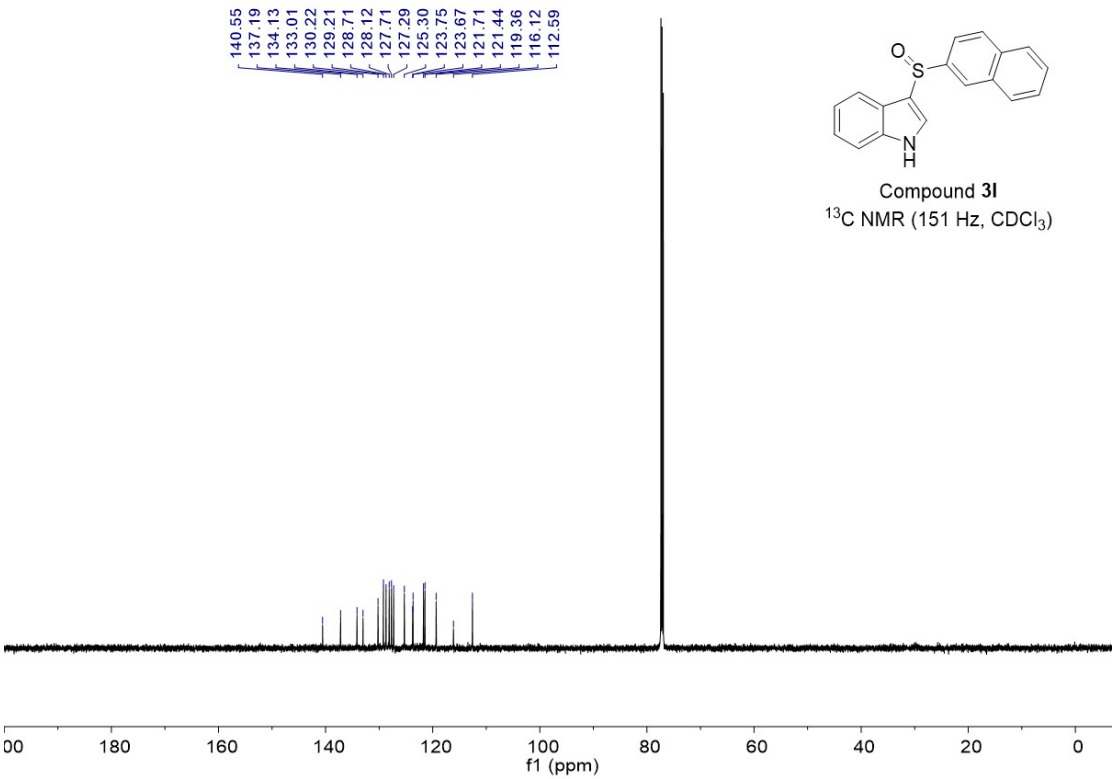


Compound **3k**
^{13}C NMR (151 Hz, $CDCl_3$)

NMR spectra of 3-(Naphthalen-2-ylsulfinyl)-1*H*-indole (**3l**)

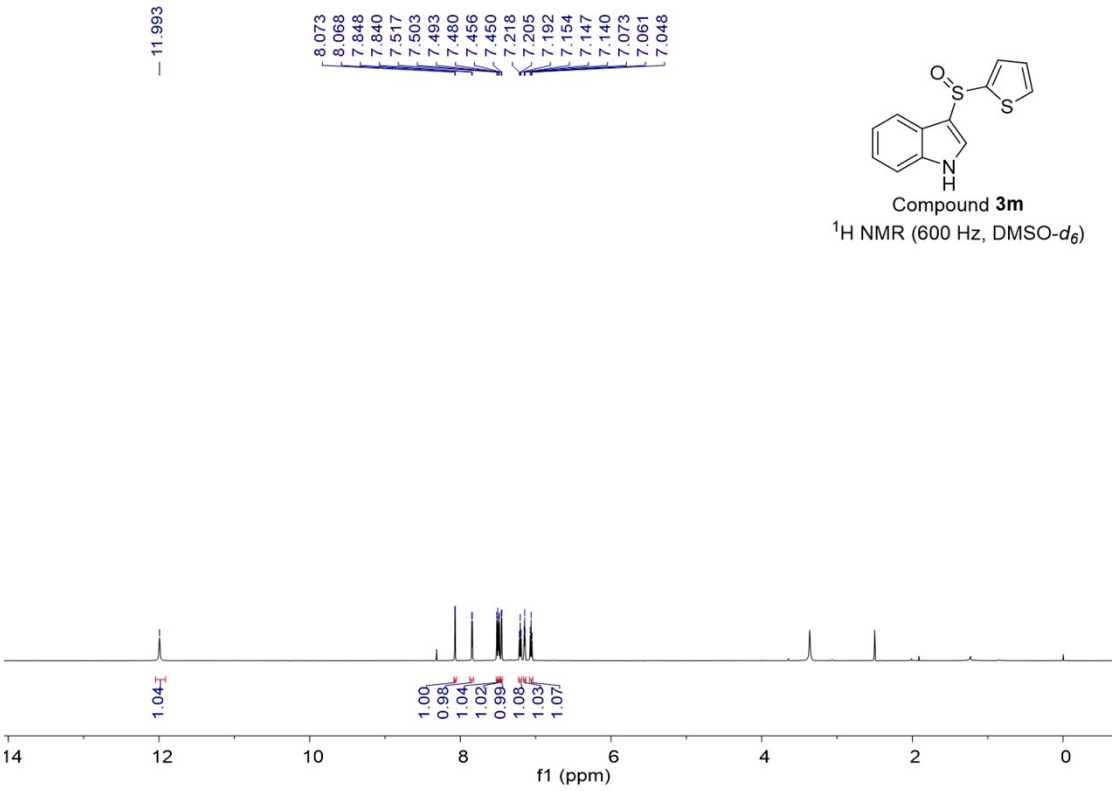


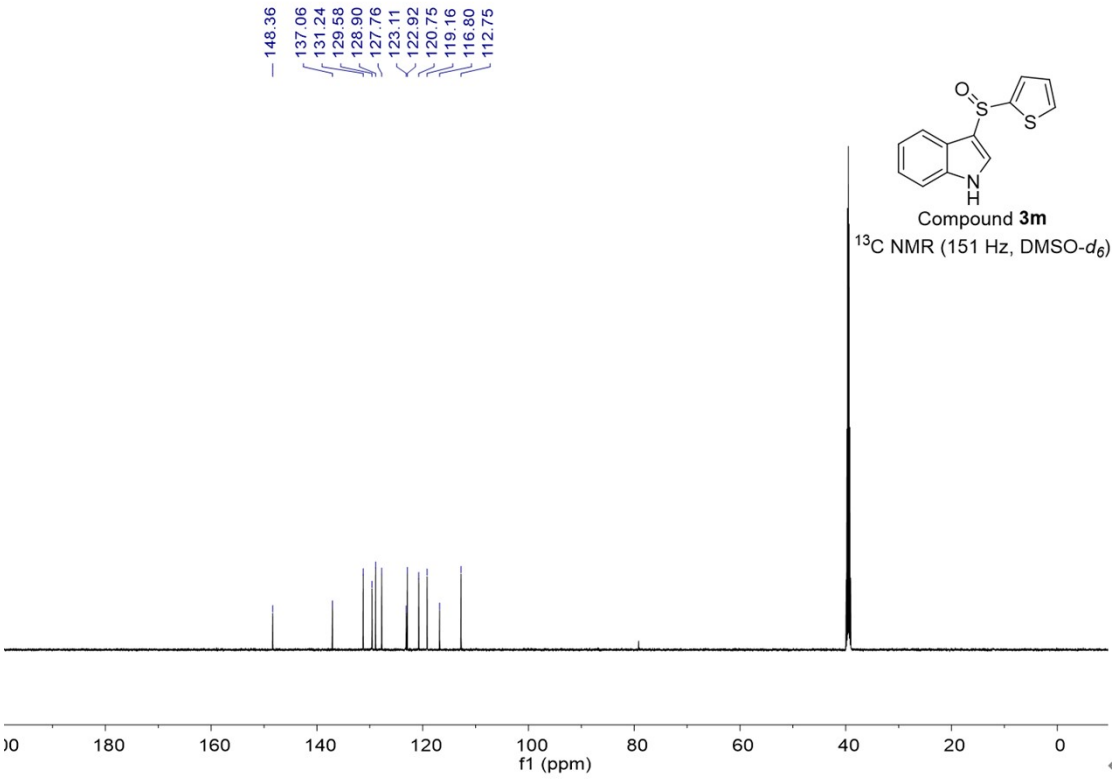
Compound **3l**
^{1}H NMR (600 Hz, $CDCl_3$)



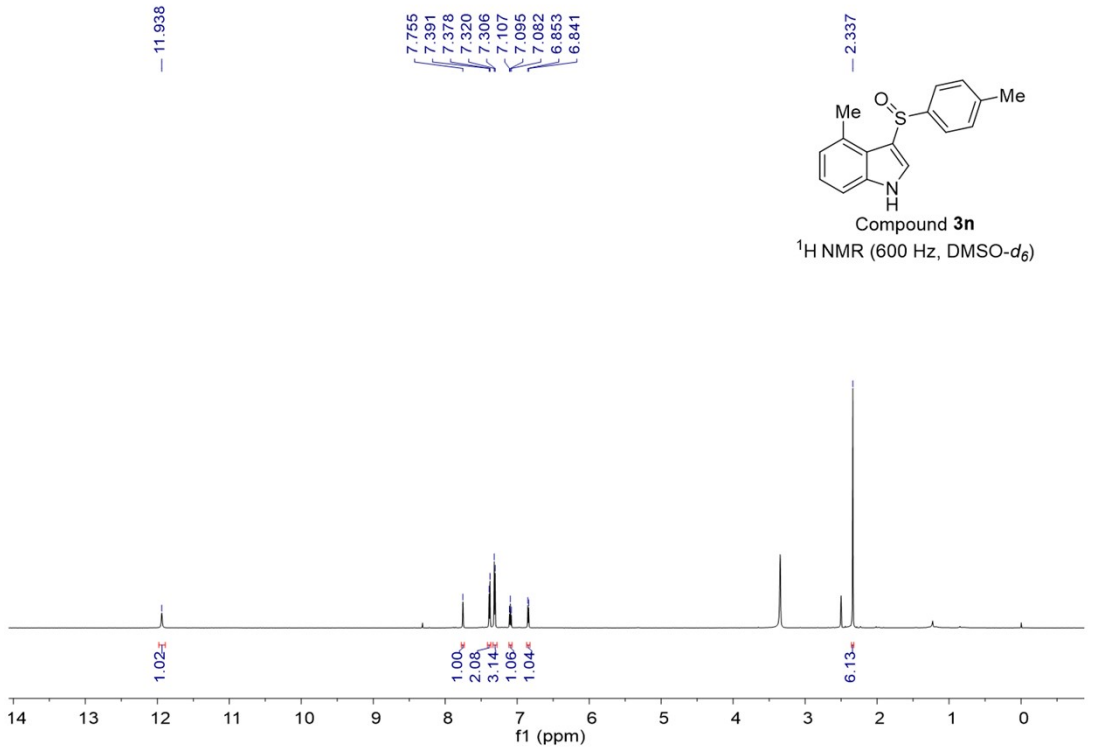
Compound **3l**
^{13}C NMR (151 Hz, $CDCl_3$)

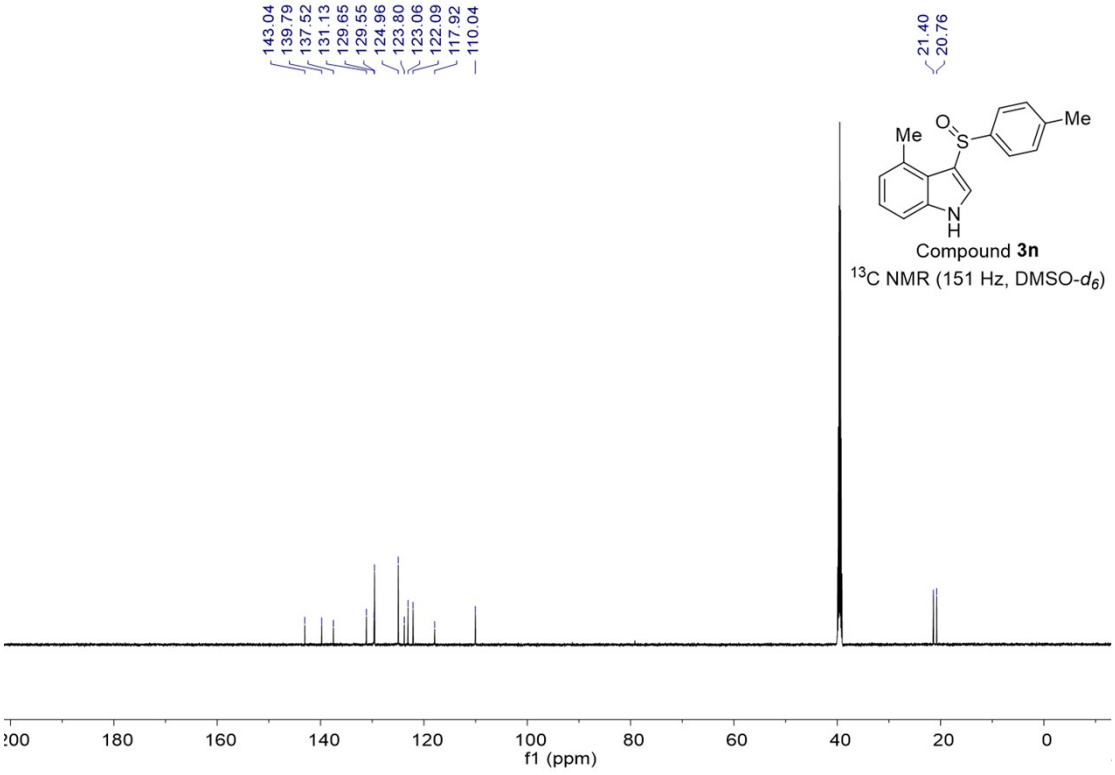
NMR spectra of 3-(Thiophen-2-ylsulfinyl)-1*H*-indole (**3m**)



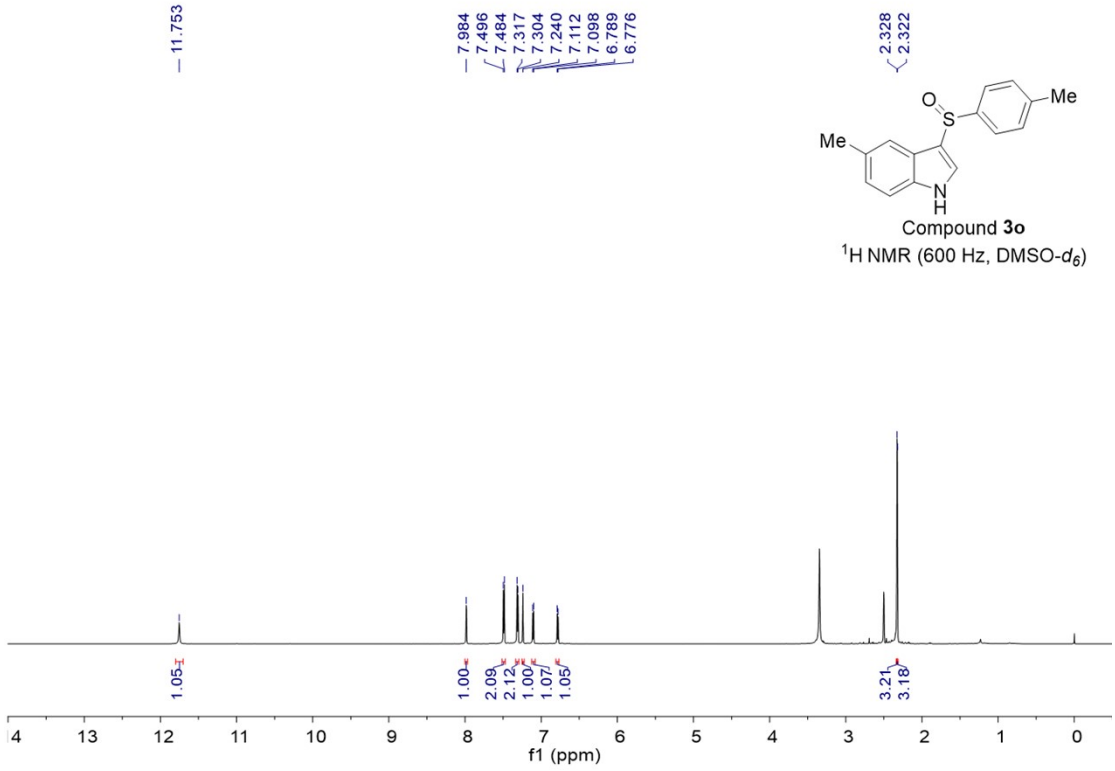


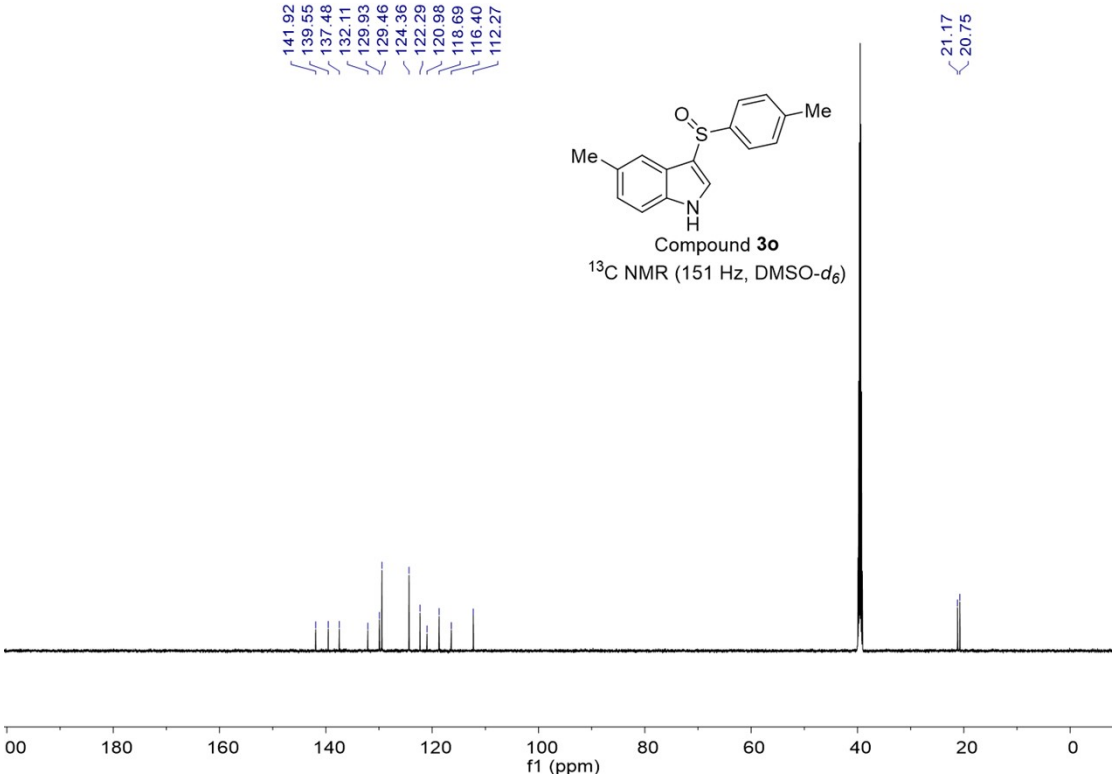
NMR spectra of 4-Methyl-3-(*p*-tolylsulfinyl)-1*H*-indole (**3n**)



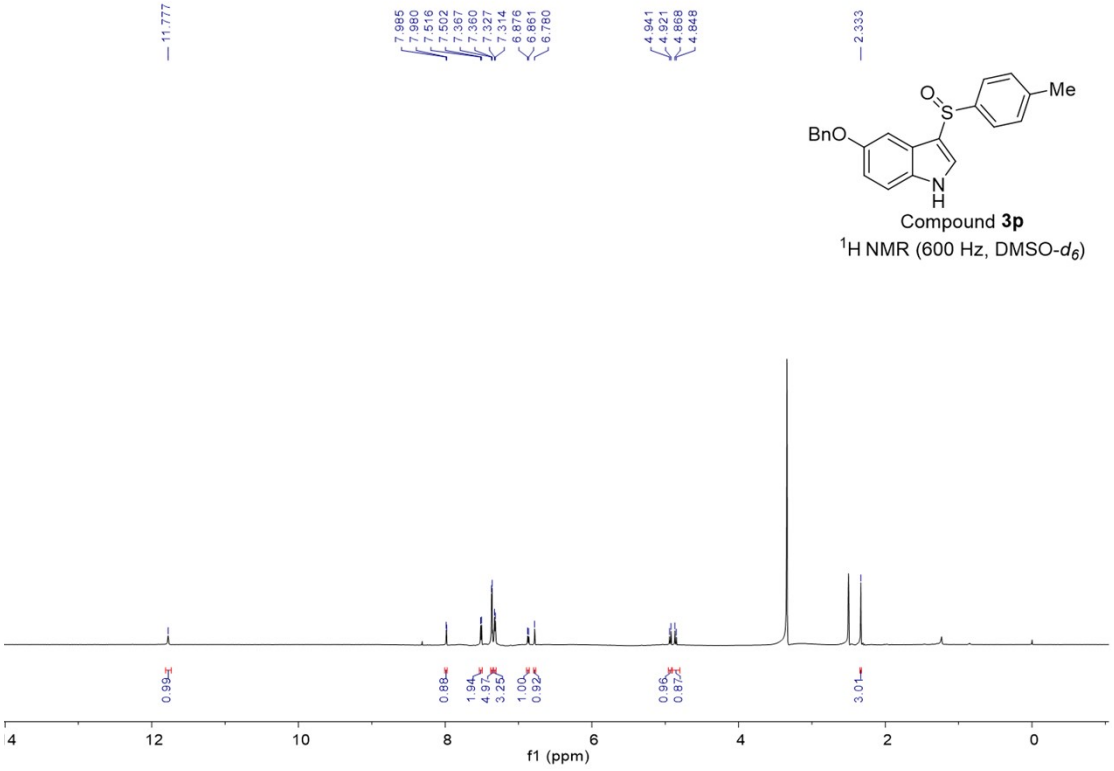


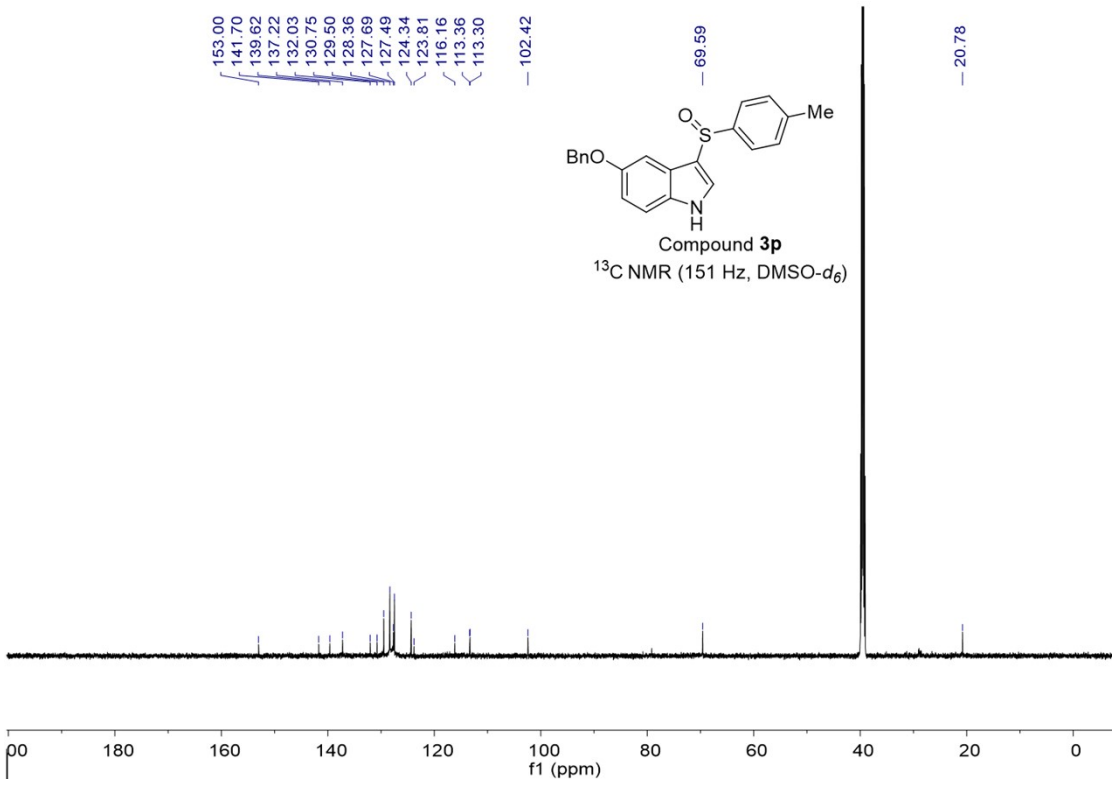
NMR spectra of 5-Methyl-3-(*p*-tolylsulfinyl)-1*H*-indole (**3o**)



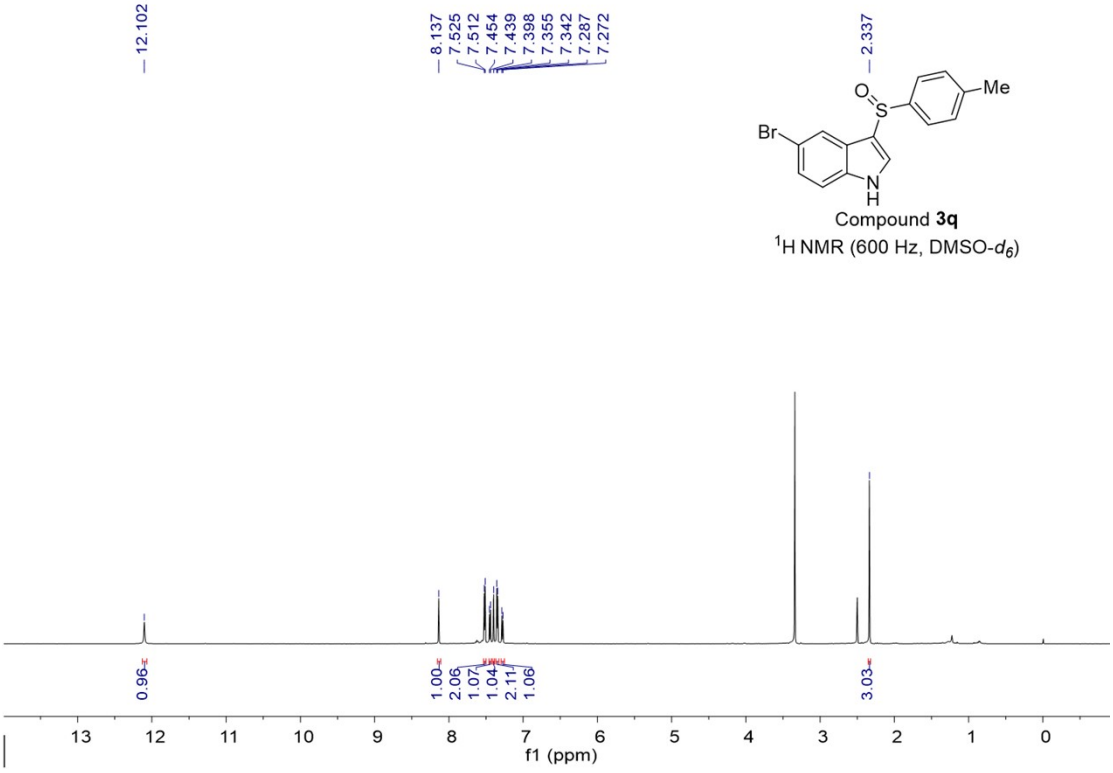


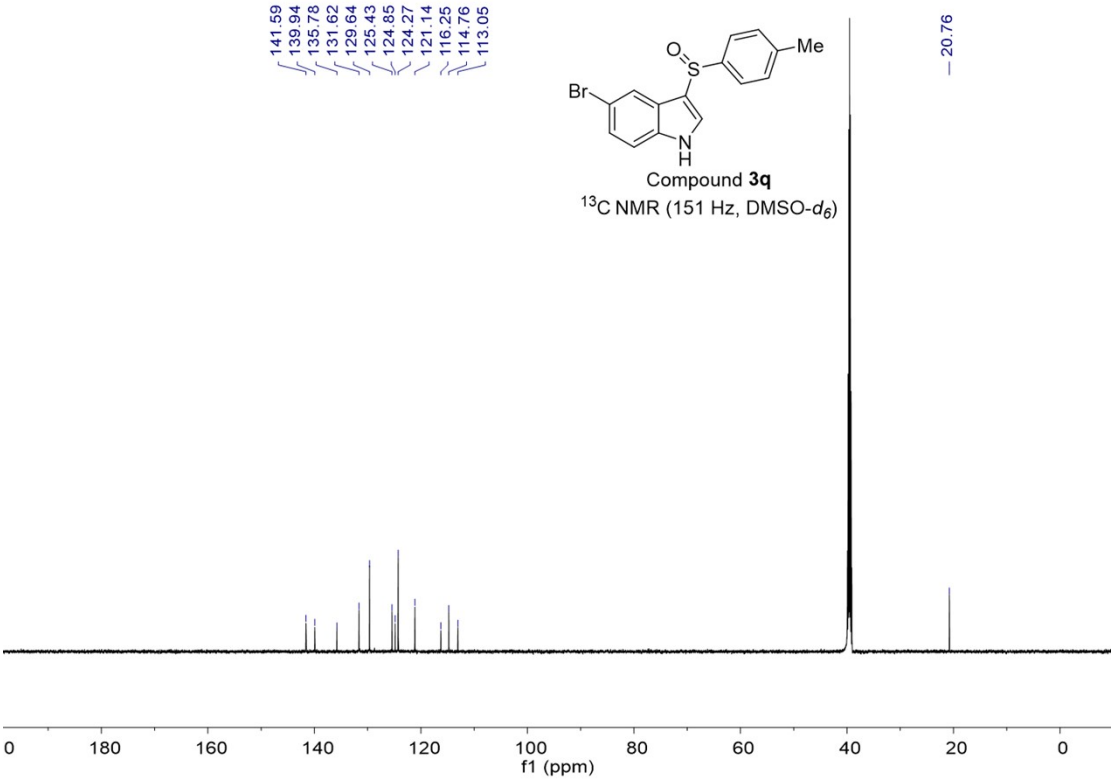
NMR spectra of 5-(Benzyloxy)-3-(*p*-tolylsulfinyl)-1*H*-indole (**3p**)



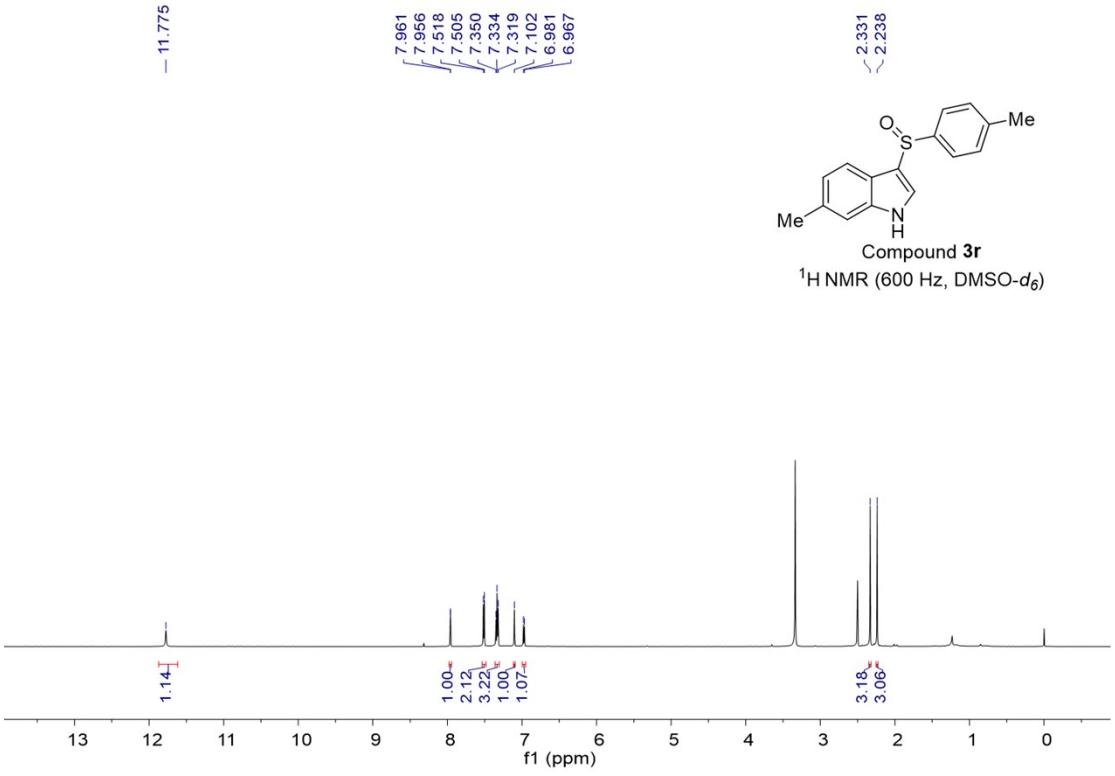


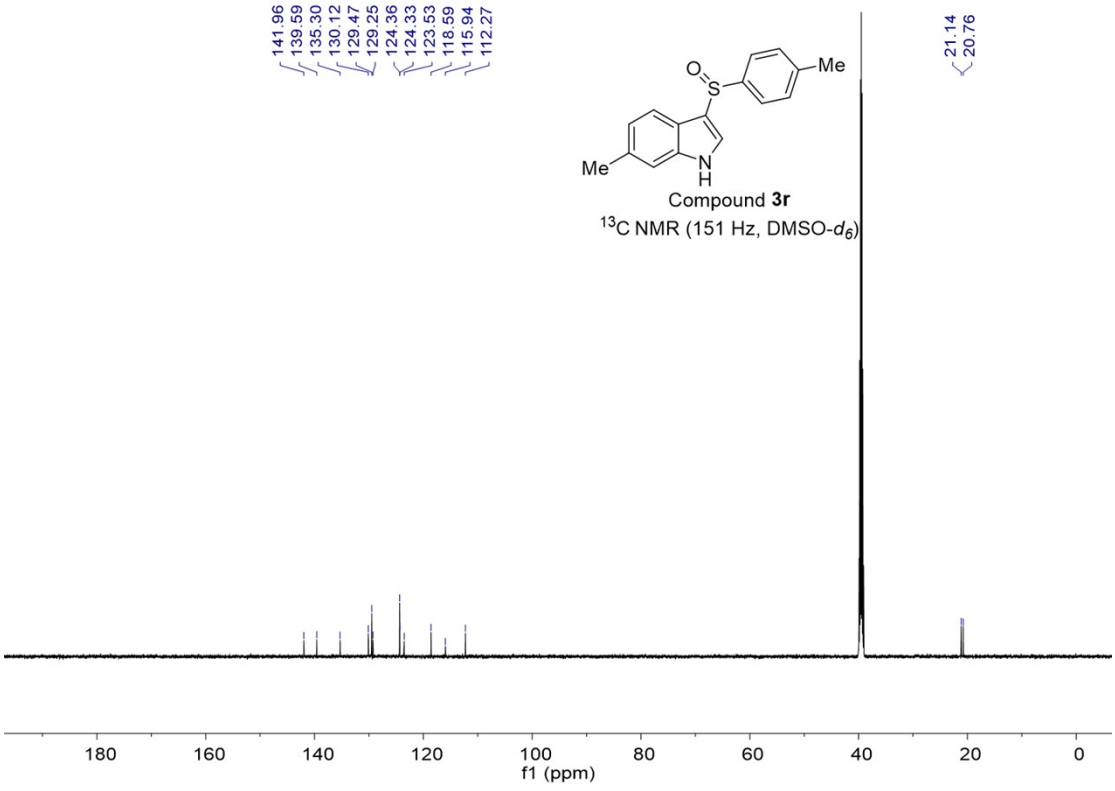
NMR spectra of 5-Bromo-3-(*p*-tolylsulfinyl)-1*H*-indole (**3q**)



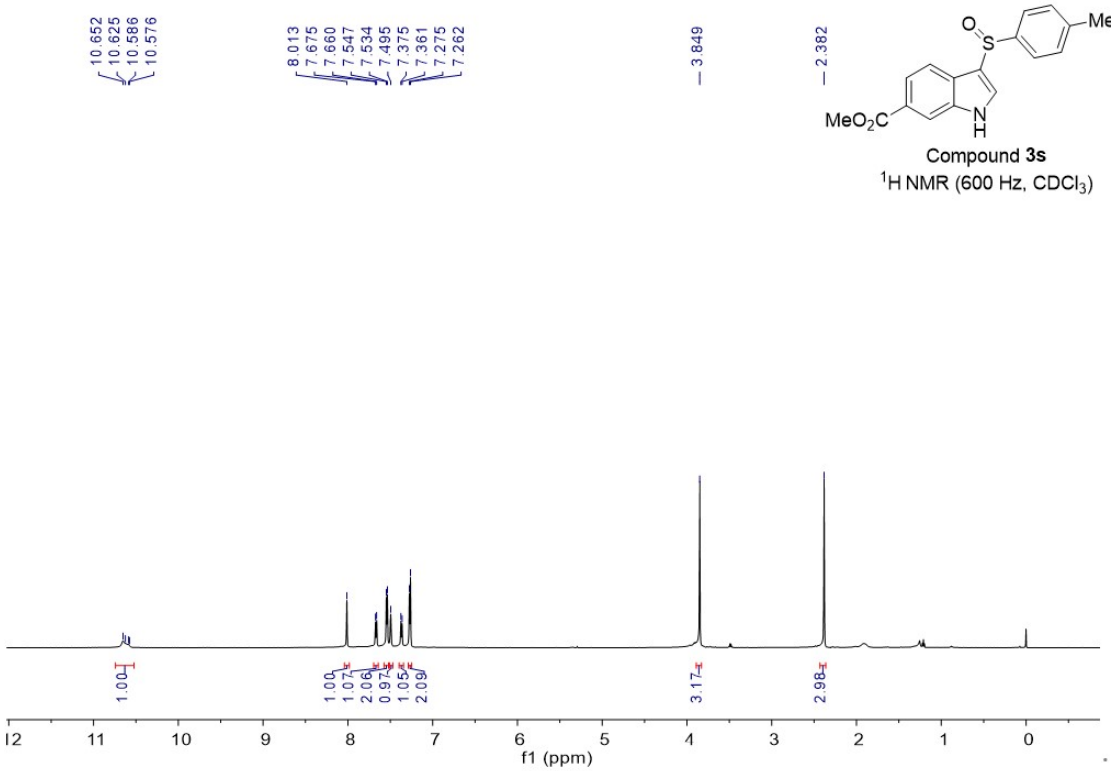


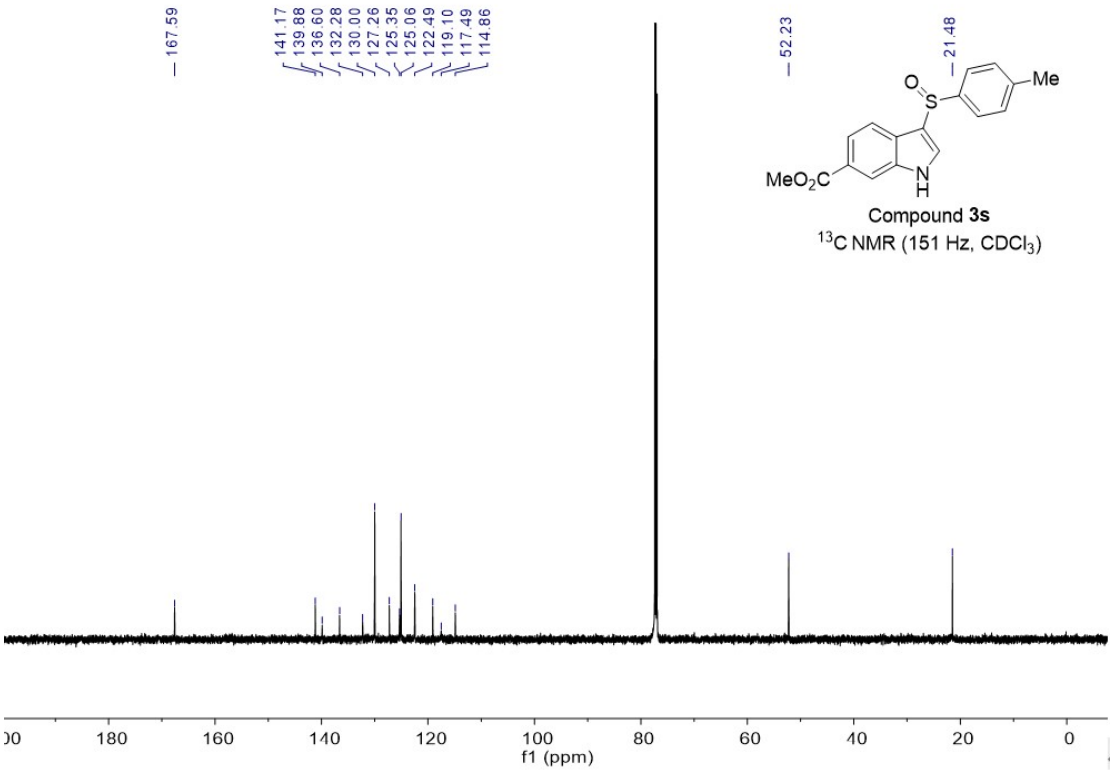
NMR spectra of 6-Methyl-3-(*p*-tolylsulfinyl)-1*H*-indole (**3r**)



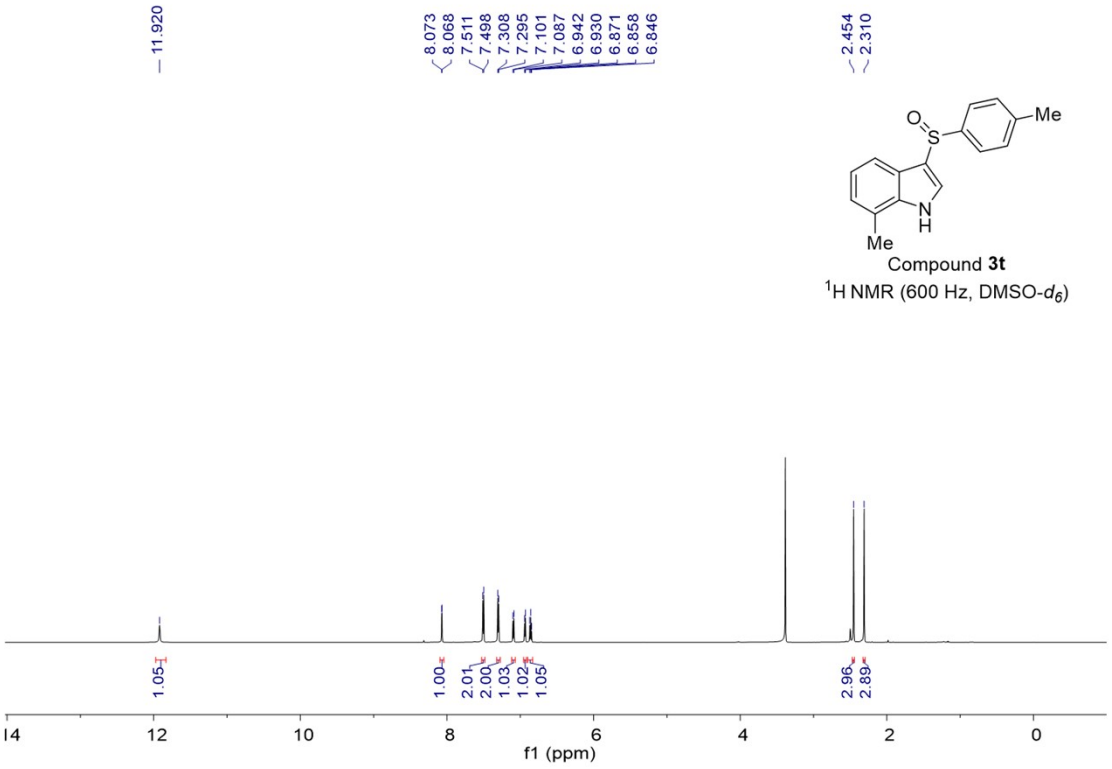


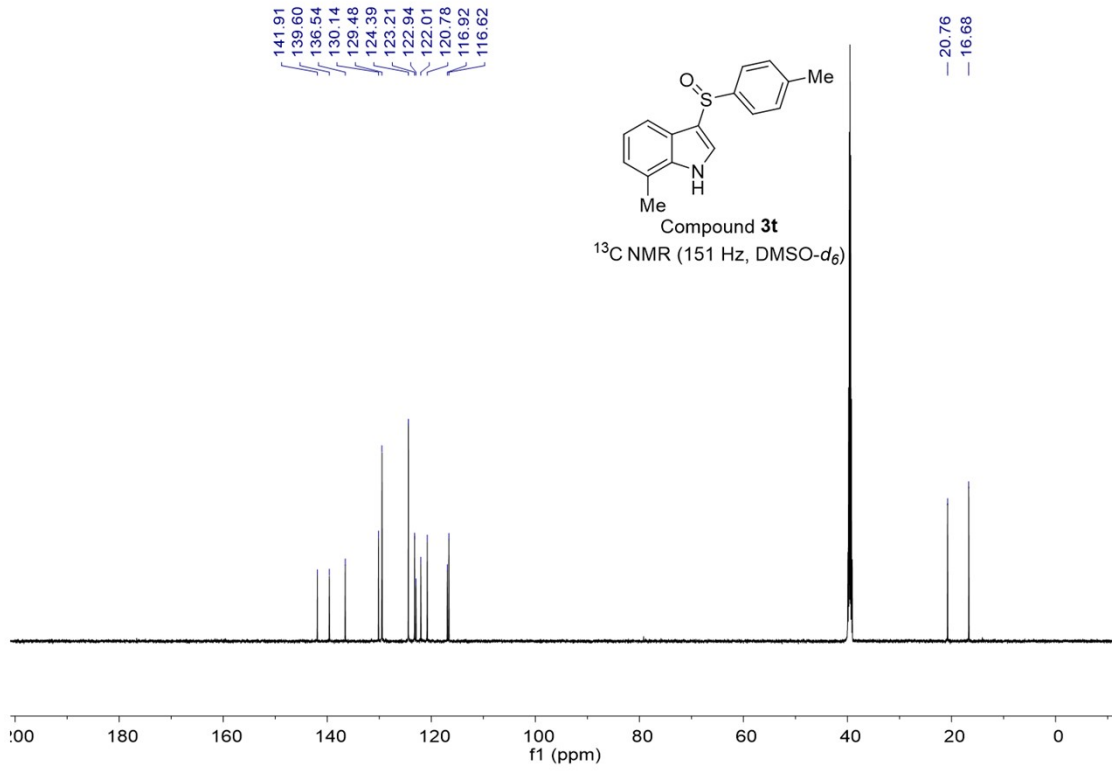
NMR spectra of Methyl 3-(*p*-tolylsulfinyl)-1*H*-indole-6-carboxylate (**3s**)



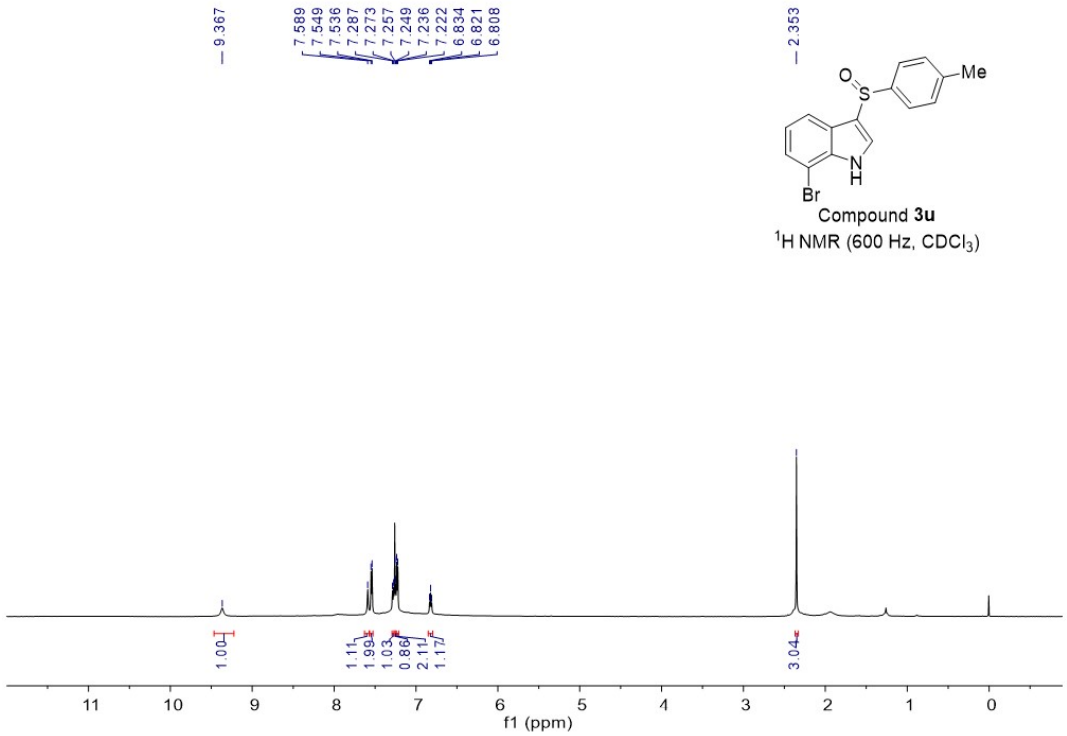


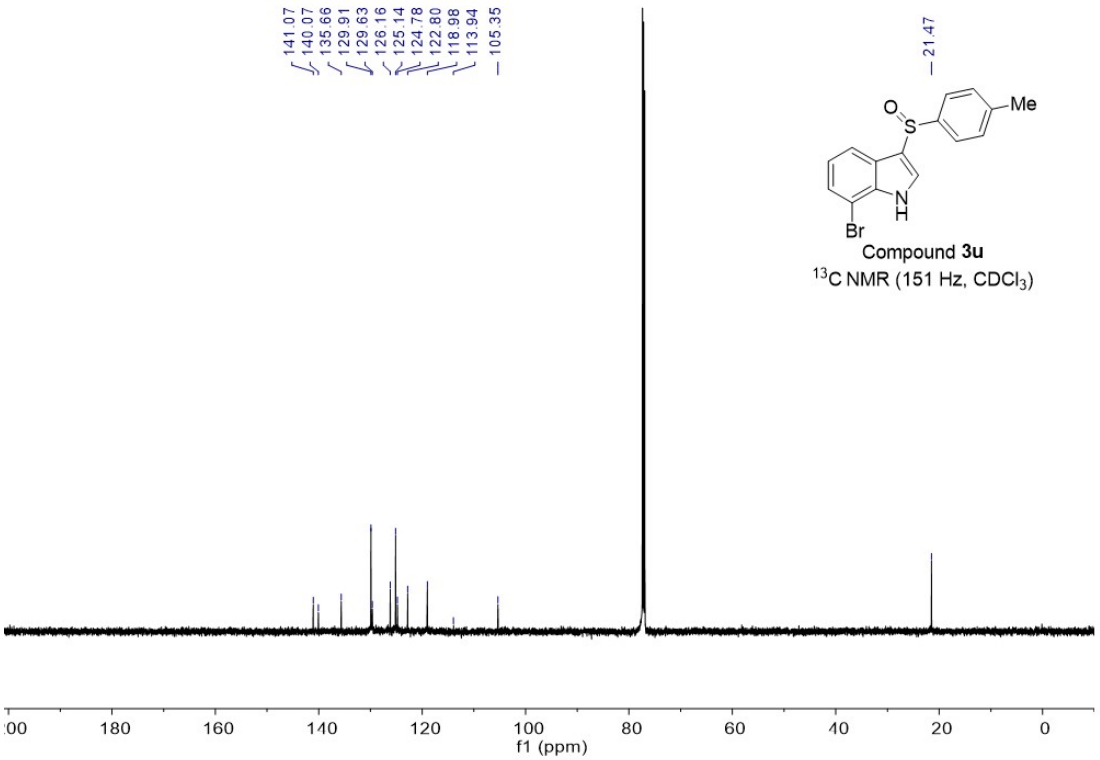
NMR spectra of 7-Methyl-3-(*p*-tolylsulfinyl)-1*H*-indole (**3t**)



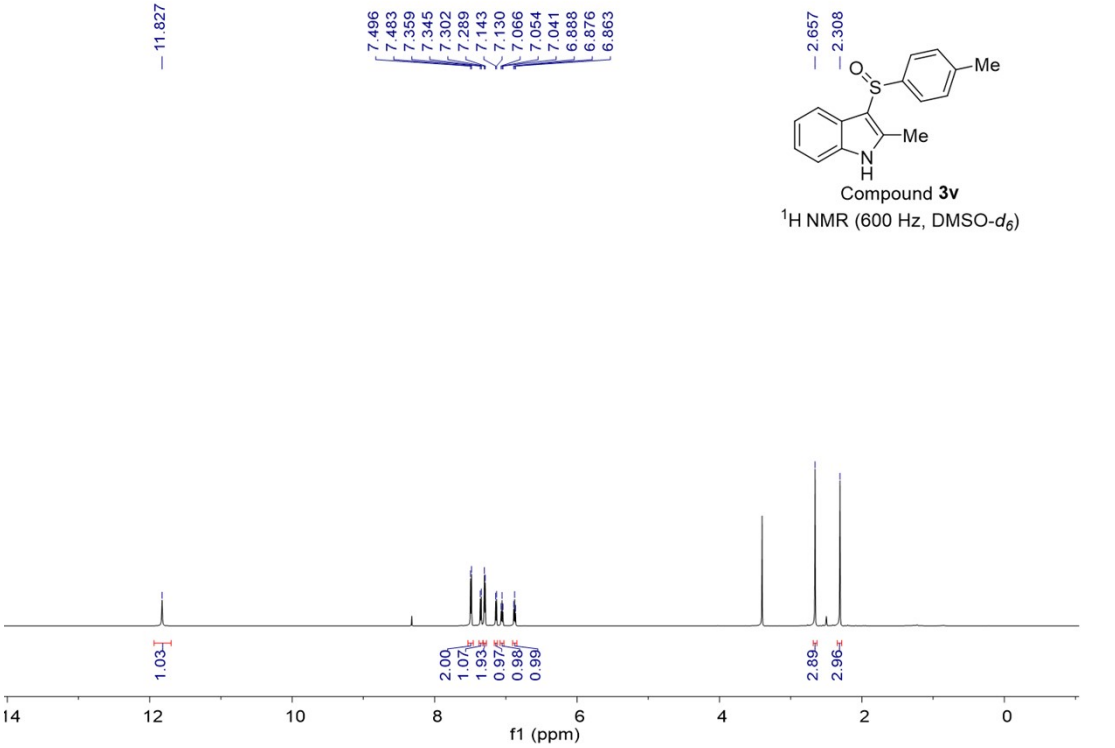


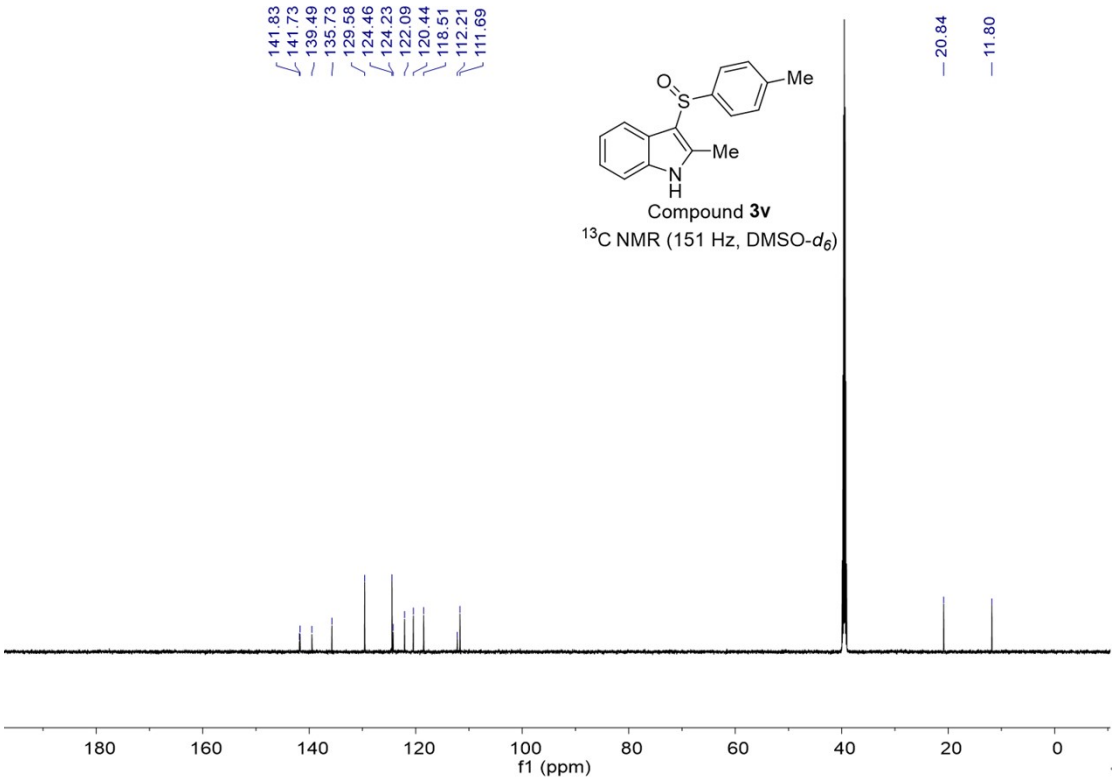
NMR spectra of 7-bBromo-3-(*p*-tolylsulfinyl)-1*H*-indole (**3u**)



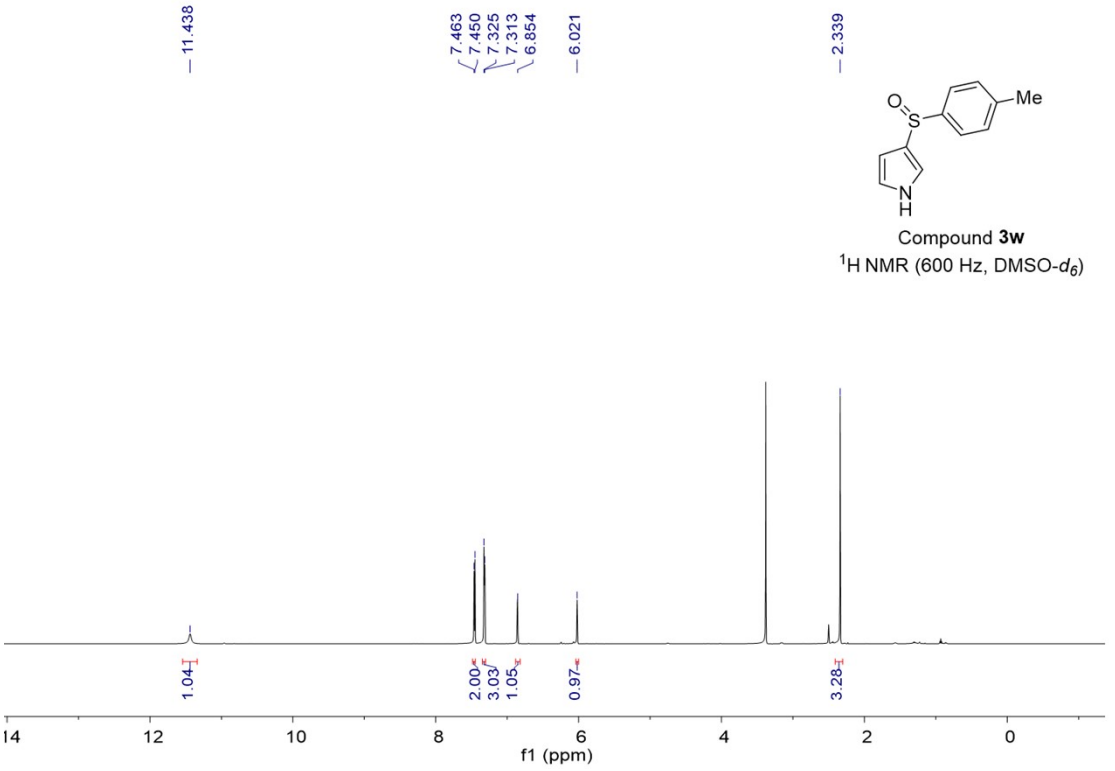


NMR spectra of 2-Methyl-3-(*p*-tolylsulfinyl)-1*H*-indole (**3v**)

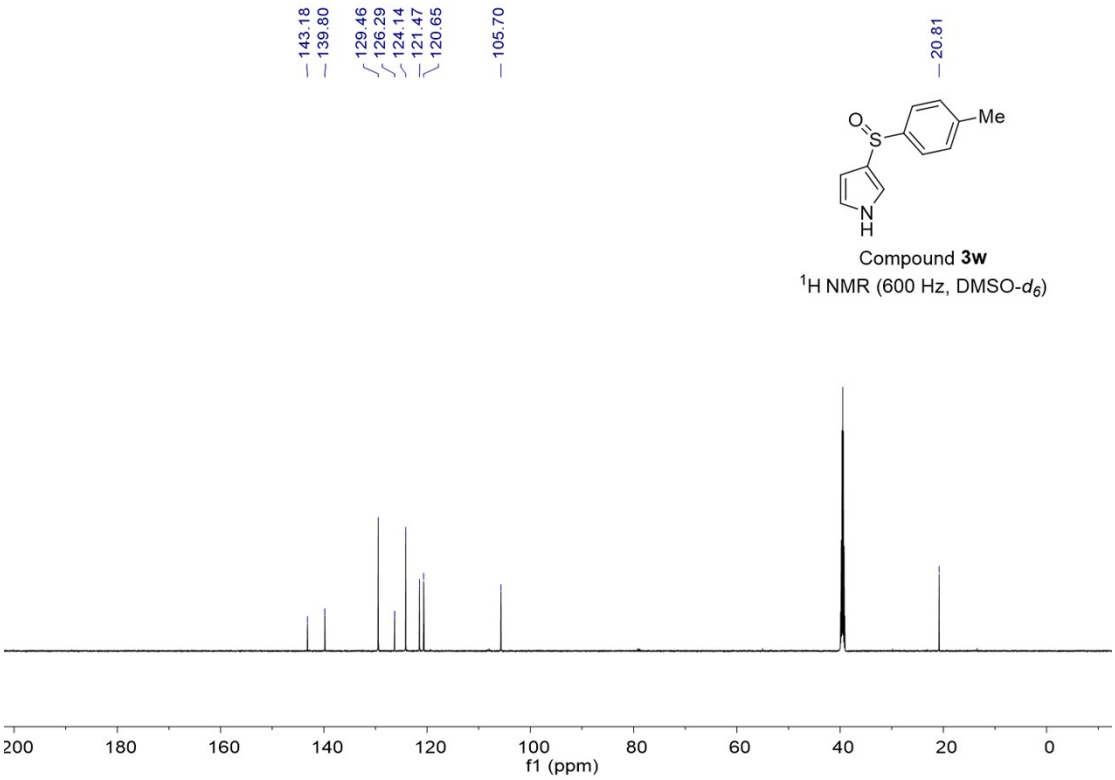




NMR spectra of 3-(*P*-tolylsulfinyl)-1*H*-pyrrole (**3w**)

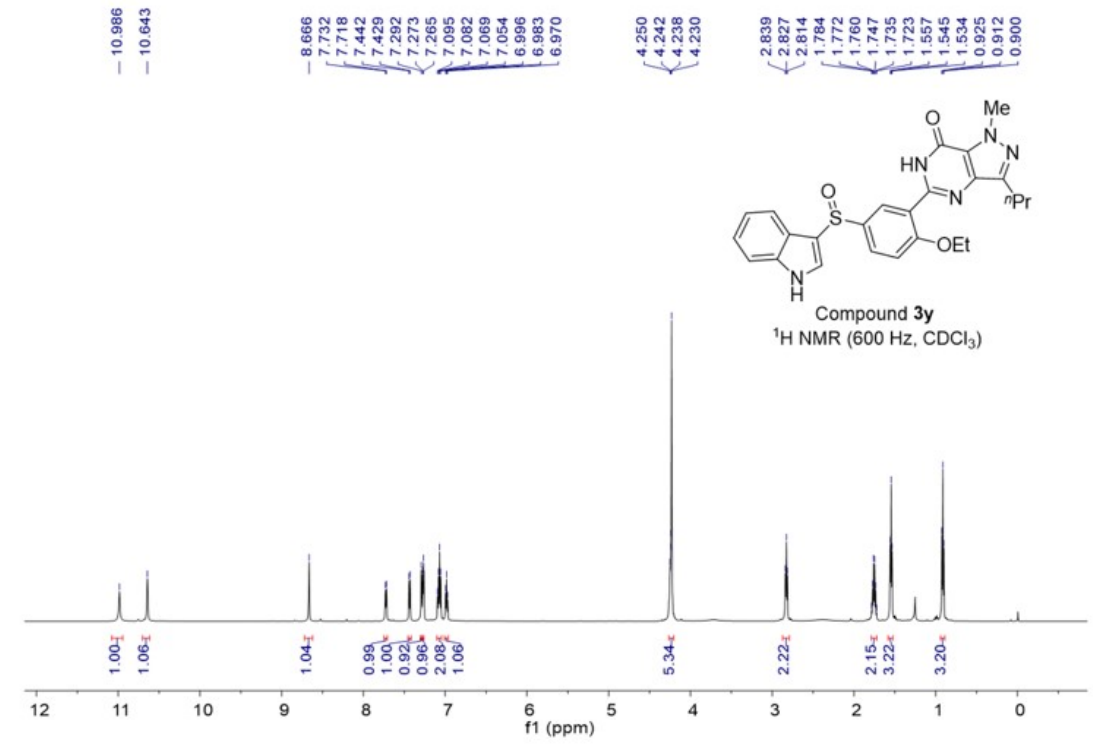


Compound **3w**
^{1}H NMR (600 Hz, DMSO-d_6)

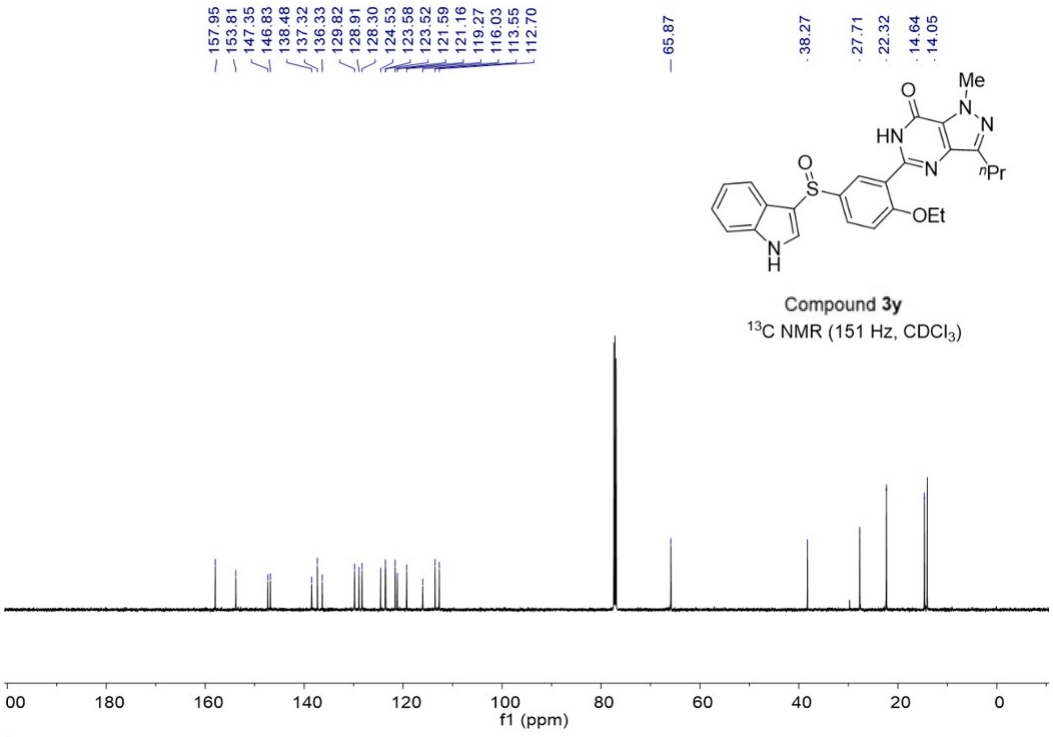


Compound **3w**
^{1}H NMR (600 Hz, DMSO-d_6)

NMR spectra of 5-(5-((1*H*-indol-3-yl)sulfinyl)-2-ethoxyphenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**3y**)



Compound **3y**
^{1}H NMR (600 Hz, $CDCl_3$)



Compound **3y**
^{13}C NMR (151 Hz, $CDCl_3$)