Supporting Information

for

Photoredox-catalyzed cascade annulation of *N*-propargylindoles with sulfonyl chlorides: access to 2-sulfonated 9*H*-pyrrolo[1,2-*a*]indoles

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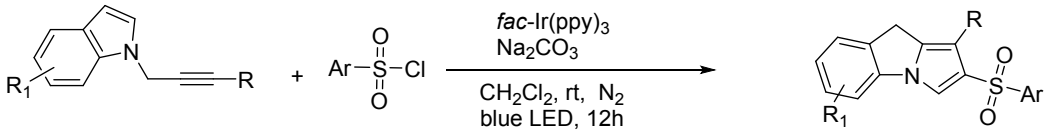
General:

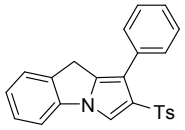
Unless otherwise stated, all reactions were carried out under Ar. CH_2Cl_2 was freshly purified. ^1H NMR (600MHz) and ^{13}C NMR (151 MHz) spectra were measured on Bruker AVⅢ 600M spectrometers with $CDCl_3$ as solvent and tetramethylsilane (TMS) as internal standard. Chemical shifts were reported in units (ppm) by assigning TMS resonance in the ^1H spectrum as 0.00 ppm and $CDCl_3$ resonance in the ^{13}C spectrum as 77.23 ppm. All coupling constants (*J* values) were reported in Hertz (Hz). Chemical shifts of common trace ^1H NMR impurities (ppm): H_2O: 1.56, $CHCl_3$: 7.26. Column chromatography was performed on silica gel 300-400 mesh. Mass spectra were obtained on an ion trap mass spectrometry equipped with an ESI source. The unknown products were further characterized by HRMS-ESI. The CAS number of the known compound was listed.

Experimental procedures



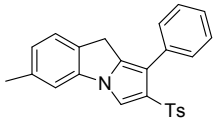
To a flame dried transparent Schlenk tube equipped with a stirring bar was added *N*-propargylindoles (0.2 mmol), *fac*-Ir(bpy)$_3$ (3 mol %), benzenesulfonyl chloride (0.4 mmol) and Na_2CO_3 (0.4 mmol). Then dry CH_2Cl_2 (2 mL) was added under Ar. The reaction mixture was stirred under the irradiation of a 24 W blue LEDs at room temperature for 12 h. Upon completion, the reaction mixture was concentrated under vacuum. The residue was purified by silica gel column chromatography using a petroleum ether/AcOEt as the eluent to give the corresponding products.

1-Phenyl-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3a) (CAS: 2095737-49-6)



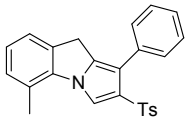
Yield: 54 mg, 71%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.95 (s, 1H), 7.48 (d, *J* = 8.3 Hz, 2H), 7.46 – 7.39 (m, 5H), 7.39 – 7.30 (m, 3H), 7.26-7.22 (m, 1H), 7.09 (d, *J* = 8.1 Hz, 2H), 3.88 (s, 2H), 2.34 (s, 3H). ^{13}C NMR ($CDCl_3$, 151 MHz): δ 143.3, 139.9, 139.8, 135.5, 134.2, 132.7, 129.9, 129.3, 128.3, 128.2, 127.5, 127.4, 127.3, 126.4, 125.4, 117.7, 115.7, 111.4, 29.4, 21.7. MS-ESI: *m/z* 407.94, $[M + Na]^+$.

6-Methyl-1-phenyl-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3b) (CAS: 2095737-63-4)



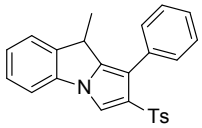
Yield: 64 mg, 80%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.89 (s, 1H), 7.46 (d, *J* = 8.2 Hz, 2H), 7.41 (d, *J* = 6.6 Hz, 2H), 7.35 – 7.18 (m, 5H), 7.05 (d, *J* = 8.1 Hz, 2H), 6.99 (d, *J* = 7.6 Hz, 1H), 3.79 (s, 2H), 2.44 (s, 3H), 2.33 (s, 3H); ^{13}C NMR ($CDCl_3$, 151 MHz): δ 143.2, 140.1, 139.8, 138.4, 135.9, 132.74, 131.2, 129.9, 129.3, 128.2, 127.4, 127.3, 127.1, 126.1, 125.9, 117.6, 115.5, 111.7, 28.9, 21.7, 21.6. MS-ESI: *m/z* 421.95, $[M + Na]^+$.

5-Methyl-1-phenyl-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3c) (CAS: 2095737-64-5)



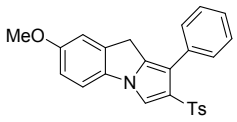
Yield: 52 mg, 65%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.05 (s, 1H), 7.45 (d, *J* = 8.3 Hz, 2H), 7.42-7.36 (m, 2H), 7.36-7.28 (m, 3H), 7.26-7.23 (m, 1H), 7.18-7.09 (m, 2H), 7.05 (d, *J* = 8.0 Hz, 2H), 3.84 (s, 3H), 2.67 (s, 3H), 2.31 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 143.2, 140.1, 138.7, 136.0, 134.4, 132.7, 130.4, 130.0, 129.3, 128.3, 127.4, 127.4, 127.0, 125.3, 123.9, 123.1, 118.4, 117.3, 29.2, 21.7, 18.7. MS-ESI: *m/z* 421.98, $[M + Na]^+$.

9-Methyl-1-phenyl-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3d) (CAS: 2095737-70-3)



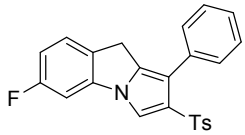
Yield: 64 mg, 81%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.89 (s, 1H), 7.47 – 7.27 (m, 10H), 7.24 – 7.17 (m, 1H), 7.05 (d, *J* = 8.1 Hz, 2H), 4.12 (q, *J* = 7.2 Hz, 1H), 2.34 (s, 3H), 1.24 (d, *J* = 7.3 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 143.2, 140.5, 140.4, 139.9, 138.8, 132.2, 130.5, 129.3, 128.2, 128.1, 127.6, 127.5, 125.5, 125.2, 117.9, 114.8, 110.9, 36.3, 21.7, 17.6. MS-ESI: *m/z* 421.96, $[M + Na]^+$.

7-Methoxy-1-phenyl-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3e) (CAS: 2095737-65-6)



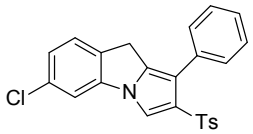
Yield: 57 mg, 69%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.84 (s, 1H), 7.46 (d, *J* = 8.3 Hz, 2H), 7.44 – 7.38 (m, 2H), 7.36 – 7.27 (m, 4H), 7.05 (d, *J* = 8.1 Hz, 2H), 6.96 (d, *J* = 2.1 Hz, 1H), 6.88 (dd, *J* = 8.6, 2.4 Hz, 1H), 3.82 (s, 3H), 3.81 (s, 2H), 2.30 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 157.9, 143.1, 140.2, 135.8, 135.3, 133.6, 132.7, 129.9, 129.3, 128.3, 127.4, 126.5, 117.7, 115.4, 112.9, 112.8, 111.4, 56.0, 29.6, 21.7. MS-ESI: *m/z* 438.00, $[M + Na]^+$.

6-Fluoro-1-phenyl-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3f) (CAS: 2095737-66-7)



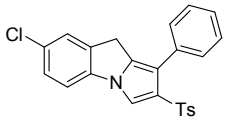
Yield: 57 mg, 71%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.88 (s, 1H), 7.44 (d, *J* = 8.2 Hz, 2H), 7.40 (d, *J* = 6.7 Hz, 2H), 7.37 – 7.28 (m, 4H), 7.12 (dd, *J* = 8.1, 2.2 Hz, 1H), 7.06 (d, *J* = 8.1 Hz, 2H), 6.94 – 6.88 (m, 1H), 3.82 (s, 2H), 2.31 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 162.9 (d, $J_{C\text{-}F}$= 246.3Hz), 143.4, 140.8 (d, $J_{C\text{-}F}$= 11.3Hz), 139.8, 136.4, 132.4, 129.9, 129.6 (d, $J_{C\text{-}F}$= 2.7Hz), 129.3, 128.3, 128.2, 127.6, 127.5, 127.2 (d, $J_{C\text{-}F}$= 9.7Hz), 118.0, 115.6, 112.1 (d, $J_{C\text{-}F}$= 22.7Hz), 99.6 (d, $J_{C\text{-}F}$= 27.3Hz), 28.8, 21.7. MS-ESI: *m/z* 425.98, $[M + Na]^+$.

6-Chloro-1-phenyl-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3g) (CAS: 2095737-67-8)



Yield: 66 mg, 79%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.87 (s, 1H), 7.49 – 7.38 (m, 5H), 7.37 – 7.29 (m, 4H), 7.19 (dd, *J* = 8.0, 1.8 Hz, 1H), 7.06 (d, *J* = 8.0 Hz, 2H), 3.83 (s, 2H), 2.32 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 143.4, 140.8, 139.7, 135.8, 134.1, 132.7, 132.3, 129.9, 129.4, 128.3, 128.3, 127.6, 127.5, 127.2, 125.4, 118.0, 115.6, 111.8, 29.0, 21.7. MS-ESI: *m/z* 419.97, $[M + H]^+$.

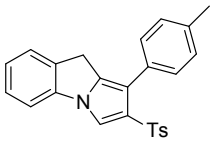
7-Chloro-1-phenyl-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3h) (CAS: 2095737-68-9)



Yield: 60 mg, 72%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.92 (s, 1H), 7.50-7.45 (m, 2H), 7.44 – 7.27 (m, 8H), 7.09 (d, *J* = 8.1 Hz, 2H), 3.86 (s, 2H), 2.34 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 143.4, 139.8, 138.4, 136.0, 135.2, 132.3, 130.9,

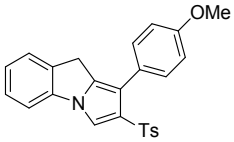
129.9, 129.3, 128.3, 127.9, 127.6, 127.5, 126.7, 118.0, 115.7, 111.9, 29.3, 21.7. MS-ESI: *m/z* 419.92, $[M+H]^+$.

1-(*p*-Tolyl)-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3i) (CAS: 2095737-50-9)



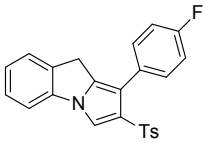
Yield: 53 mg, 66%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.93 (s, 1H), 7.52 (d, *J* = 8.2 Hz, 3H), 7.41 (dd, *J* = 12.8, 6.9 Hz, 4H), 7.34 (d, *J* = 7.9 Hz, 3H), 7.27 – 7.15 (m, 4H), 7.11 (d, *J* = 8.0 Hz, 2H), 3.86 (s, 3H), 2.42 (s, 4H), 2.34 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 143.2, 140.2, 139.8, 137.1, 135.3, 134.3, 129.7, 129.7, 129.3, 129.0, 128.2, 127.4, 127.2, 126.4, 125.3, 117.7, 115.6, 111.0, 29.3, 21.7, 21.5. MS-ESI: *m/z* 422.01, $[M + Na]^+$.

1-(4-Methoxyphenyl)-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3j) (CAS: 2095737-51-0)



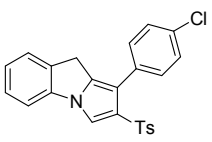
Yield: 38 mg, 46%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.90 (s, 1H), 7.47 (d, *J* = 8.3 Hz, 2H), 7.43 – 7.31 (m, 5H), 7.22-7.18 (m, 1H), 7.08 (d, *J* = 8.4 Hz, 2H), 6.91-6.87 (m, 2H), 3.86 (s, 2H), 3.84 (s, 2H), 2.32 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 158.8, 143.0, 139.9, 139.6, 135.0, 134.1, 130.9, 129.1, 128.0, 127.2, 127.1, 126.2, 125.1, 124.8, 117.2, 115.3, 113.5, 110.8, 55.3, 29.1, 21.5. MS-ESI: *m/z* 438.01, $[M + Na]^+$.

1-(4-Fluorophenyl)-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3k) (CAS: 2095737-54-3)



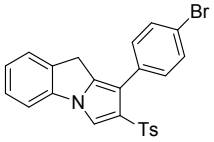
Yield: 62 mg, 77%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.92 (s, 1H), 7.51 – 7.34 (m, 7H), 7.22 (t, *J* = 7.0 Hz, 1H), 7.12 – 6.97 (m, 4H), 3.83 (s, 3H), 2.33 (s, 4H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 162.3 (d, *J* = 246.6 Hz), 143.4, 139.8 (d, *J* = 27.0 Hz), 135.5, 134.1, 131.7 (d, *J* = 8.1 Hz), 129.4, 128.6 (d, *J* = 3.4 Hz), 128.3, 127.4, 127.3, 126.4, 125.5, 116.6, 115.6, 115.3, 115.1, 111.1, 29.2, 21.7. MS-ESI: *m/z* 425.96, $[M + Na]^+$.

1-(4-Chlorophenyl)-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3l) (CAS:2095737-55-4)



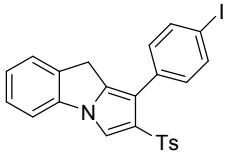
Yield: 58 mg, 70%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.92 (s, 1H), 7.48 (d, *J* = 8.3 Hz, 2H), 7.43-7.35 (m, 5H), 7.32-7.27 (m, 2H), 7.25 – 7.19 (m, 1H), 7.10 (d, *J* = 8.1 Hz, 2H), 3.84 (s, 2H), 2.33 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 143.5, 139.9, 139.6, 135.7, 134.0, 133.3, 131.2 (2C, overlap), 129.4, 128.5, 128.3, 127.4, 127.2, 126.4, 125.6, 116.4, 115.9, 111.1, 29.4, 21.7. MS-ESI: *m/z* 441.92, $[M + Na]^+$.

1-(4-Bromophenyl)-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3m) (CAS: 2095737-56-5)



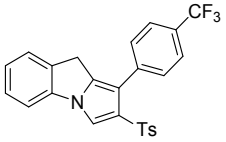
Yield: 69 mg, 75%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.92 (s, 1H), 7.50-7.46 (m, 4H), 7.42-7.38 (m, 3 H), 7.31 (d, *J* = 8.4 Hz, 2H), 7.25-7.19 (m, 1H), 7.11 (d, *J* = 8.1 Hz, 2H), 3.83 (s, 2H), 2.33 (s,3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 143.5, 139.9, 139.6, 135.6, 134.0, 131.7, 131.5, 131.4, 129.4, 128.3, 127.4, 127.1, 126.4, 125.6, 121.5, 116.4, 115.9, 111.1, 29.3, 21.7. MS-ESI: *m/z* 485.92, $[M + Na]^+$.

1-(4-Iodophenyl)-2-tosyl-9*H*-pyrrolo[1,2-*a*]indole (3n) (CAS: 2095737-57-6)



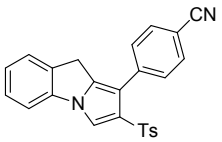
Yield: 76 mg, 74%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.92 (s, 1H), 7.66 (d, *J* = 8.3 Hz, 2H), 7.48 (t, *J* = 10.0 Hz, 2H), 7.43 – 7.33 (m, 3H), 7.24 – 7.12 (m, 3H), 7.11 (d, *J* = 8.1 Hz, 2H), 3.84 (s, 2H), 2.34 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 143.5, 139.9, 139.6, 137.4, 135.6, 134.0, 132.3, 131.7, 129.5, 128.3, 127.4, 127.1, 126.4, 125.6, 116.5, 116.0, 111.1, 93.1, 29.4, 21.7. MS-ESI: *m/z* 533.93, $[M + Na]^+$.

2-Tosyl-1-(4-(trifluoromethyl)phenyl)-9*H*-pyrrolo[1,2-*a*]indole (3o) (CAS: 2095737-59-8)



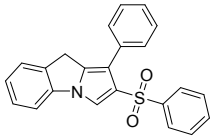
Yield: 64 mg, 71%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.95 (s, 1H), 7.57 (dd, *J* = 24.6, 8.2 Hz, 4H), 7.50 – 7.37 (m, 5H), 7.26 – 7.22 (m, 1H), 7.09 (d, *J* = 8.1 Hz, 2H), 3.87 (s, 2H), 2.32 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 143.6, 139.8, 139.6, 136.6, 136.1, 133.9, 130.1, 129.5, 129.4 (q, J_{C-F}= 32.3 Hz), 128.4, 127.4, 127.4, 126.7 (q, J_{C-F}= 270.2 Hz), 126.5, 125.7, 125.2 (q, J_{C-F}= 3.6 Hz), 116.3, 116.2, 111.2, 29.4, 21.7. MS-ESI: *m/z* 441.92, $[M + Na]^+$. MS-ESI: *m/z* 475.99, $[M + Na]^+$.

4-(2-Tosyl-9*H*-pyrrolo[1,2-*a*]indol-1-yl)benzonitrile (3p) (CAS: 2095737-58-7)



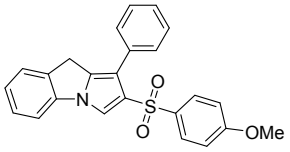
Yield: 62 mg, 76%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.95 (s, 1H), 7.64-7.58 (m, 4H), 7.50 (d, *J* = 8.2 Hz, 2H), 7.45-7.38 (m, 3H), 7.27-7.23 (m, 1H), 7.12 (d, *J* = 8.1 Hz, 2H), 3.89 (s, 2H), 2.34 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 143.8, 139.6, 139.4, 137.8, 136.4, 133.7, 132.1, 130.3, 129.5, 128.4, 127.3, 127.2, 126.4, 125.8, 119.2, 116.7, 115.8, 111.2, 110.8, 29.6, 21.7. MS-ESI: *m/z* 432.97, $[M + Na]^+$.

1-Phenyl-2-(phenylsulfonyl)-9*H*-pyrrolo[1,2-*a*]indole (3q) (CAS: 2095737-73-6)



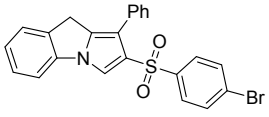
Yield: 56 mg, 75%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.95 (s, 1H), 7.58-7.56 (m, 2H), 7.42-7.38 (m, 6H), 7.34-7.31 (m, 3H), 7.26-7.23 (m, 2H), 7.21 (t, *J* = 7.3 Hz, 1H), 3.85 (s, 2H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 142.8, 139.7, 135.5, 134.2, 132.6, 132.5, 129.9, 128.7, 128.3, 128.2, 127.5, 127.4, 126.9, 126.4, 125.5, 117.8, 115.9, 111.1, 29.3. HRMS: *m/z* 394.0865, $[M + Na]^+$.

2-((4-Methoxyphenyl)sulfonyl)-1-phenyl-9*H*-pyrrolo[1,2-a]indole (3r) (CAS: 2095737-74-7)



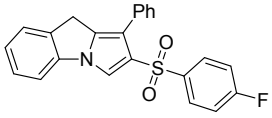
Yield: 43 mg, 53%; Pale yellow solid; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.91 (s, 1H), 7.49 (d, *J* = 8.9 Hz, 2H), 7.45 – 7.28 (m, 8H), 7.20 (td, *J* = 7.3, 1.7 Hz, 1H), 6.72 (d, *J* = 8.9 Hz, 2H), 3.84 (s, 2H), 3.76 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 162.8, 139.7, 135.4, 134.5, 134.2, 132.7, 129.9, 129.6, 128.3, 128.2, 127.7, 127.4, 126.4, 125.3, 117.5, 115.3, 113.8, 111.0, 55.7, 29.3. HRMS: *m/z* 424.0973, $[M + Na]^+$.

2-((4-Bromophenyl)sulfonyl)-1-phenyl-9*H*-pyrrolo[1,2-*a*]indole (3s) (CAS: 2095737-76-9)



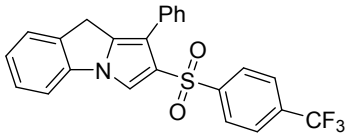
Yield: 58 mg, 65%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.93 (s, 1H), 7.42-7.34 (m, 12 H), 7.22 (t, *J* = 8.6 Hz, 1H), 3.84 (s, 2H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 141.8, 139.6, 135.7, 134.2, 132.4, 131.9, 130.0, 129.0, 128.4, 128.2, 127.7, 127.5, 126.4, 126.4, 125.6, 117.7, 115.8, 111.1, 29.2. MS-ESI: *m/z* 471.91, $[M + Na]^+$.

2-((4-Fluorophenyl)sulfonyl)-1-phenyl-9*H*-pyrrolo[1,2-*a*]indole (3t) (CAS: 2095737-75-8)



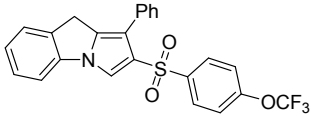
Yield: 50 mg, 64%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.97 (s, 1H), 7.50-7.44 (m, 2H), 7.38 – 7.22 (m, 8H), 7.16-7.12 (m, 1H), 6.83 (t, J = 8.6 Hz, 2H), 3.87 (s, 2H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 165.2 (d, $J_{C\text{-}F}$= 259.2 Hz), 139.7, 138.8 (d, $J_{C\text{-}F}$= 3.1Hz), 135.6, 134.2, 132.4, 130.2 (d, $J_{C\text{-}F}$= 9.3 Hz), 130.2, 128.4, 128.2, 127.6, 126.8, 126.4, 125.5, 117.7, 115.9 (d, $J_{C\text{-}F}$= 32.9 Hz), 115.7, 111.1, 29.2. MS-ESI: *m/z* 411.97, $[M + Na]^+$.

1-Phenyl-2-((4-(trifluoromethyl)phenyl)sulfonyl)-9*H*-pyrrolo[1,2-*a*]indole (3u) (CAS: 2095737-78-1)



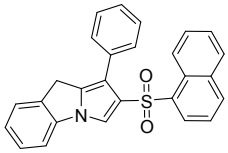
Yield: 51 mg, 58%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 7.98 (s, 1H), 7.64 (d, J = 8.2 Hz, 2H), 7.50 (d, J = 8.4 Hz, 2H), 7.43-7.40 (m, 3H), 7.39 – 7.30 (m, 5H), 7.25-7.20 (m, 1H), 3.86 (s, 2H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 146.3, 139.6, 135.8, 134.2, 134.0 (q, $J_{C\text{-}F}$= 34.0 Hz), 132.3, 130.0, 128.4, 128.3, 127.9, 127.8, 126.5, 125.9, 125.8 (d, $J_{C\text{-}F}$= 3.7 Hz), 125.7, 125.5 (q, $J_{C\text{-}F}$= 272.0 Hz), 117.9, 116.1, 111.2, 29.3. MS-ESI: *m/z* 461.94, $[M + Na]^+$.

1-Phenyl-2-((4-(trifluoromethoxy)phenyl)sulfonyl)-9*H*-pyrrolo[1,2-*a*]indole (3v) (CAS: 2095737-77-0)



Yield: 54 mg, 60%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.96 (s, 1H), 7.60 – 7.53 (m, 2H), 7.45 – 7.29 (m, 8H), 7.23 (t, J = 7.2 Hz, 1H), 7.05 (d, J = 8.2 Hz, 2H), 3.85 (s, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 152.0, 141.0, 139.6, 135.7, 134.2, 132.3, 130.0, 129.6, 128.4, 128.3, 127.7, 126.5, 126.5, 125.6, 120.6, 120.5 (q, $J_{C\text{-}F}$= 259.0 Hz), 117.7, 115.7, 111.1, 29.2. MS-ESI: *m/z* 477.96, $[M + Na]^+$.

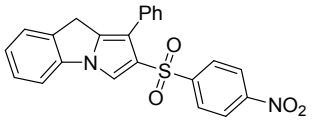
2-(Naphthalen-2-ylsulfonyl)-1-phenyl-9*H*-pyrrolo[1,2-*a*]indole (3w) (CAS: 2095737-80-5)



Yield: 26 mg, 31%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.06 (s, 1H), 8.02 (s, 1H), 7.81 – 7.71 (m, 2H), 7.70 – 7.60 (m, 2H), 7.56 – 7.46 (m, 2H), 7.40-7.34

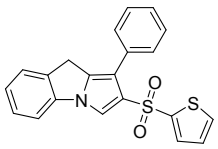
(m, 5H), 7.33 – 7.28 (m, 3H), 7.19 (t, *J* = 7.2 Hz, 1H), 3.83 (s, 2H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 139.7, 139.6, 135.5, 134.8, 134.1, 132.5, 132.1, 130.0, 129.4, 128.9, 128.8, 128.7, 128.2, 128.1, 127.8, 127.5, 127.2, 126.9, 126.3, 125.4, 122.7, 117.7, 115.7, 111.0, 29.2. MS-ESI: *m/z* 443.98, $[M + Na]^+$.

2-((4-Nitrophenyl)sulfonyl)-1-phenyl-9*H*-pyrrolo[1,2-*a*]indole (3x) (CAS: 2095737-79-2)



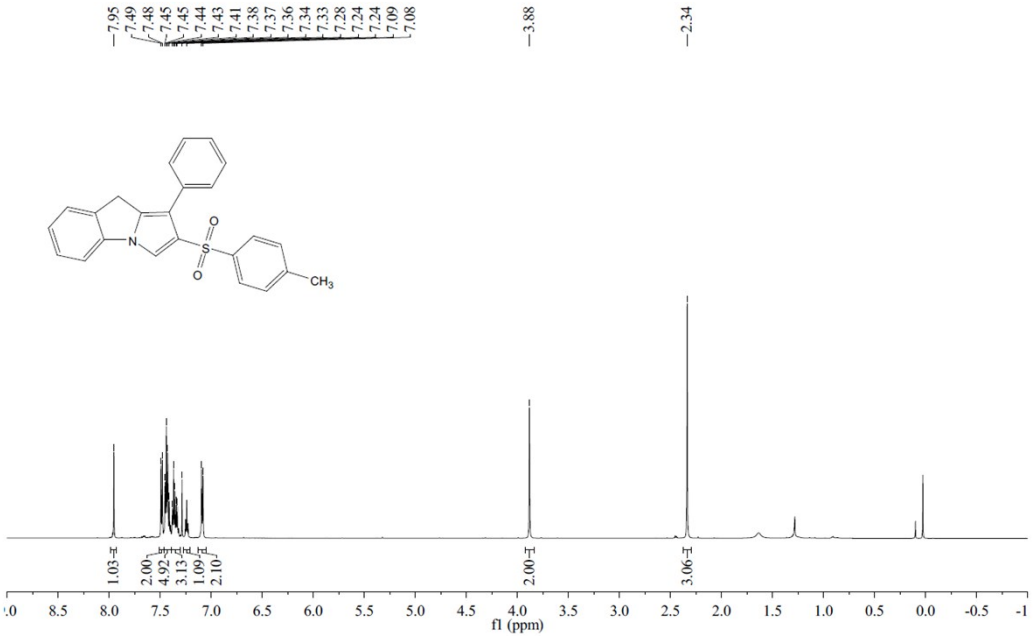
Yield: 37 mg, 45%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$): δ 8.07 (d, *J* = 8.7 Hz, 2H), 8.00 (s, 1H), 7.68 (d, *J* = 8.3 Hz, 2H), 7.46-7.43 (m, 4H), 7.43-7.35 (m, 4H), 7.26 – 7.22 (m, 1H), 3.87 (s, 2H); ^{13}C NMR (151 MHz, $CDCl_3$): δ 149.9, 148.4, 139.5, 136.0, 134.2, 132.1, 130.2, 128.9, 128.7, 128.5, 128.4, 126.5, 125.9, 125.4, 123.9, 117.9, 116.3, 111.3, 29.2. MS-ESI: *m/z* 438.96, $[M + Na]^+$.

1-Phenyl-2-(thiophen-2-ylsulfonyl)-9H-pyrrolo[1,2-*a*]indole (3y) (New compound)



Yield: 46 mg, 61%; Pale yellow solid; ^{1}H NMR (600 MHz, $CDCl_3$) δ 7.94 (s, 1H), 7.49 (d, *J* = 7.6 Hz, 2H), 7.44 – 7.30 (m, 7H), 7.22 (t, *J* = 7.3 Hz, 1H), 7.18 (d, *J* = 3.6 Hz, 1H), 6.82 (t, *J* = 4.3 Hz, 1H), 3.88 (s, 2H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 142.8, 139.7, 135.5, 134.2, 132.6, 132.5, 129.9, 128.7, 128.3, 128.2, 127.5, 127.4, 126.9, 126.4, 125.5, 117.8, 115.8, 111.1, 29.3. HRMS: $[M+Na]^+$ *m/z* calcd for $C_{21}H_{15}NNaO_2S_2^+$: 400.0436, found: 400.0426

3a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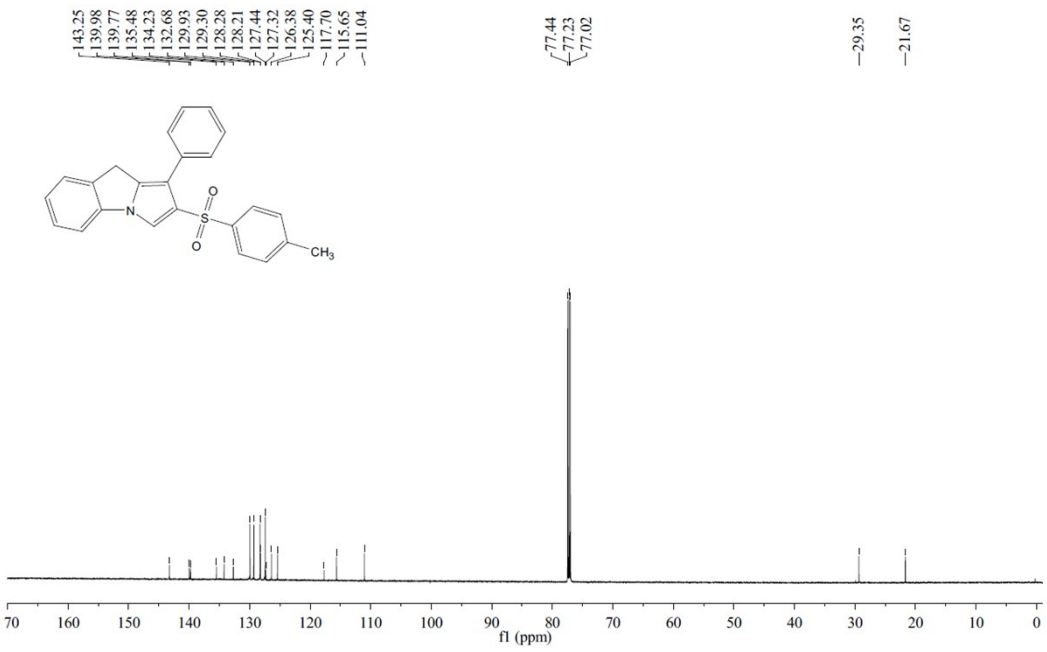
7.48
7.45
7.45
7.44
7.43
7.41
7.38
7.37
7.36
7.34
7.33
7.28
7.24
7.24
7.09
7.08
3.88
2.34
O
S
O
N
CH3
1.03
2.00
4.92
3.13
1.09
2.10
2.00
3.06
f1 (ppm)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139.77
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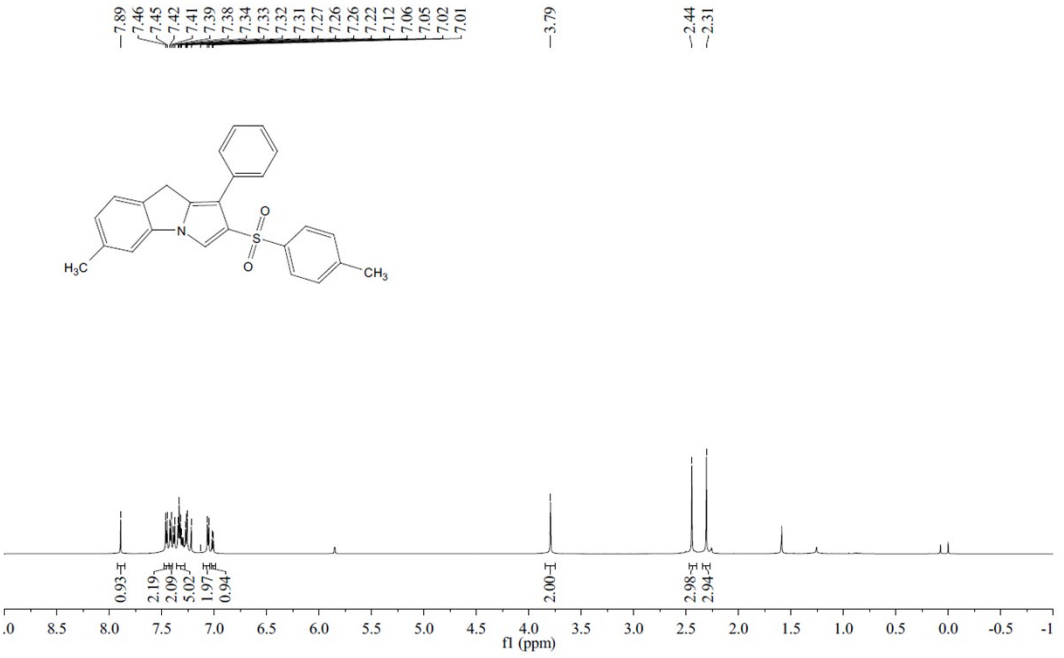
134.23
132.68
129.93
129.30
128.28
128.21
127.44
127.32
126.38
125.40
117.70
115.65
111.04
77.44
77.23
77.02
29.35
21.67
O
S
O
N
CH3
f1 (ppm)

3b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7.45
7.42
7.41
7.39
7.38
7.34
7.33
7.32
7.31
7.27
7.26
7.26
7.22
7.12
7.06
7.05
7.02
7.01
3.79
2.44
2.31
H3C
CH3
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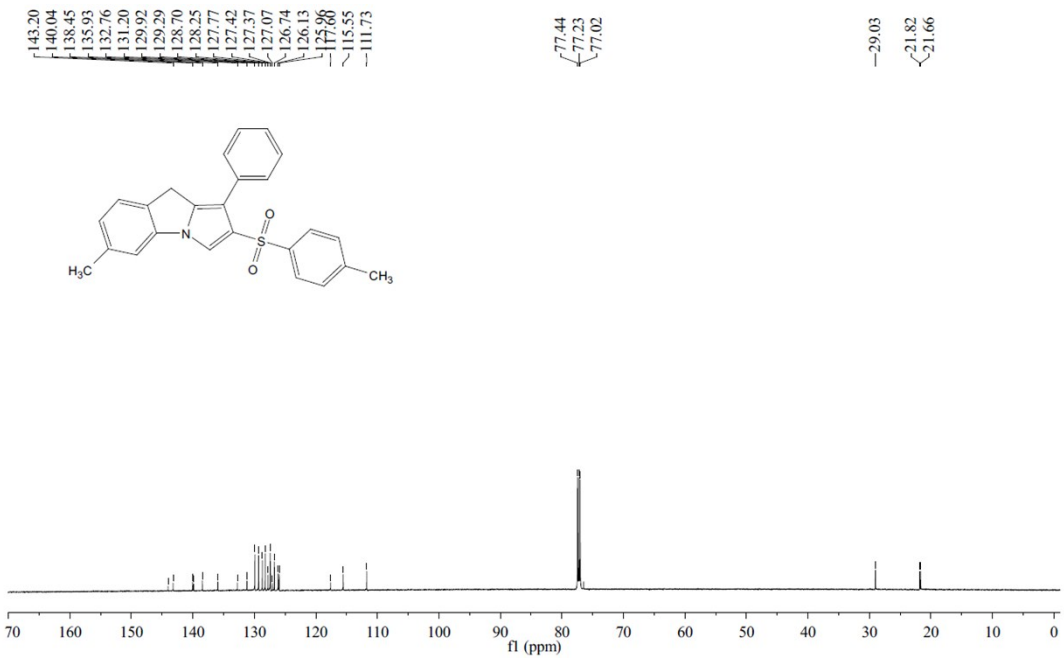
2.19
2.09
5.02
1.97
0.94
2.00
2.98
2.94
f1 (ppm)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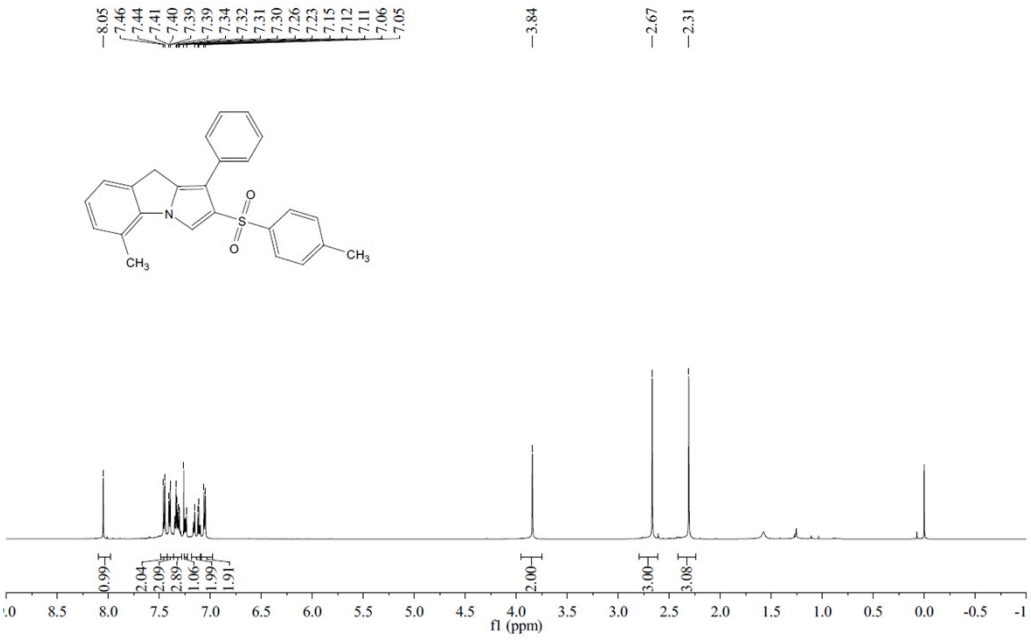
135.93
132.76
131.20
129.92
129.29
128.70
128.25
127.77
127.42
127.37
127.07
126.74
126.13
125.96
117.60
115.55
111.73
77.44
77.23
77.02
29.03
21.82
21.66
H3C
CH3
f1 (ppm)

3c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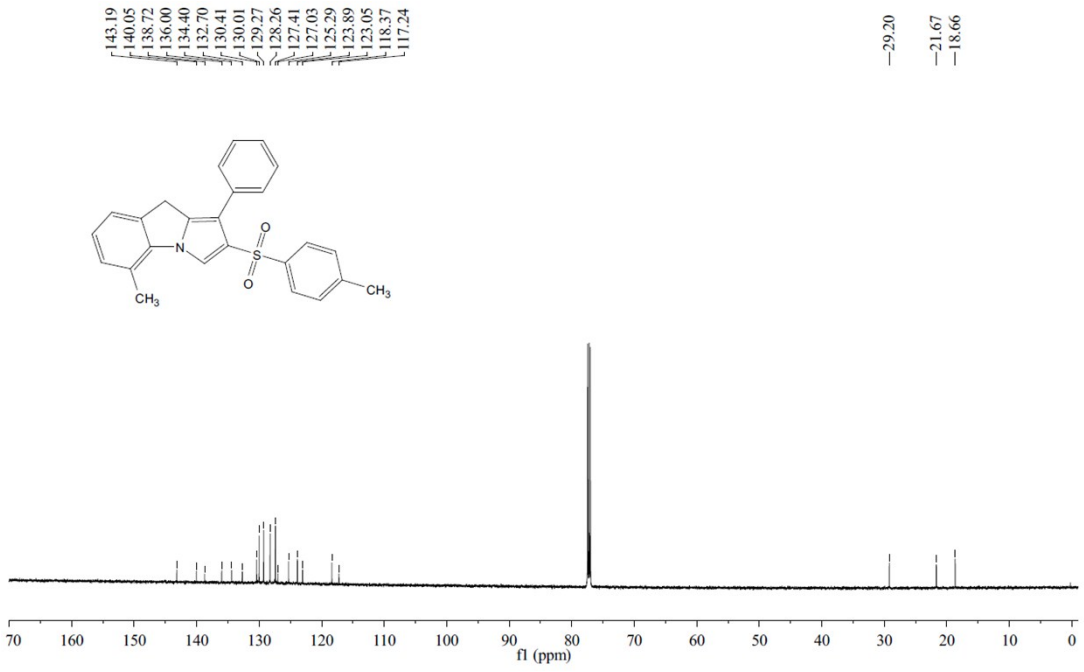
7.39
7.39
7.34
7.32
7.31
7.30
7.26
7.23
7.15
7.12
7.11
7.06
7.05
3.84
2.67
2.31
N
O
S
O
CH3
CH3
0.99
2.04
2.09
2.89
1.06
1.99
1.91
2.00
3.00
3.08
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1
f1 (ppm)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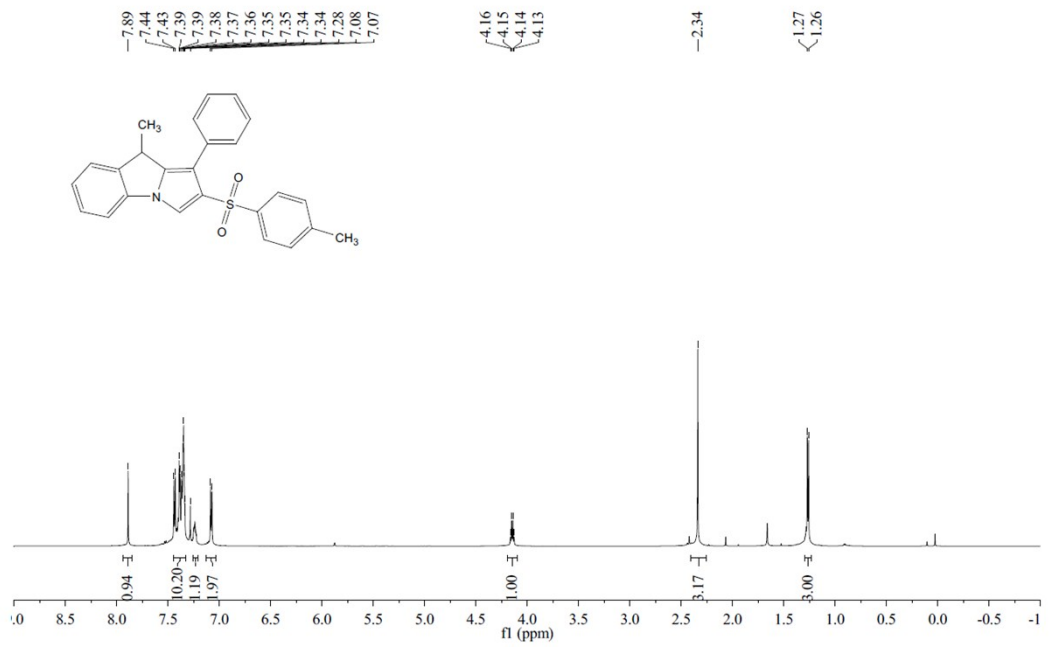
130.01
129.27
128.26
127.41
127.03
125.29
123.89
123.05
118.37
117.24
29.20
21.67
18.66
N
O
S
O
CH3
CH3
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

3d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7.36
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7.34
7.34
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7.08
7.07
4.16
4.15
4.14
4.13
2.34
1.27
1.26
CH3
N
S
O
O
CH3
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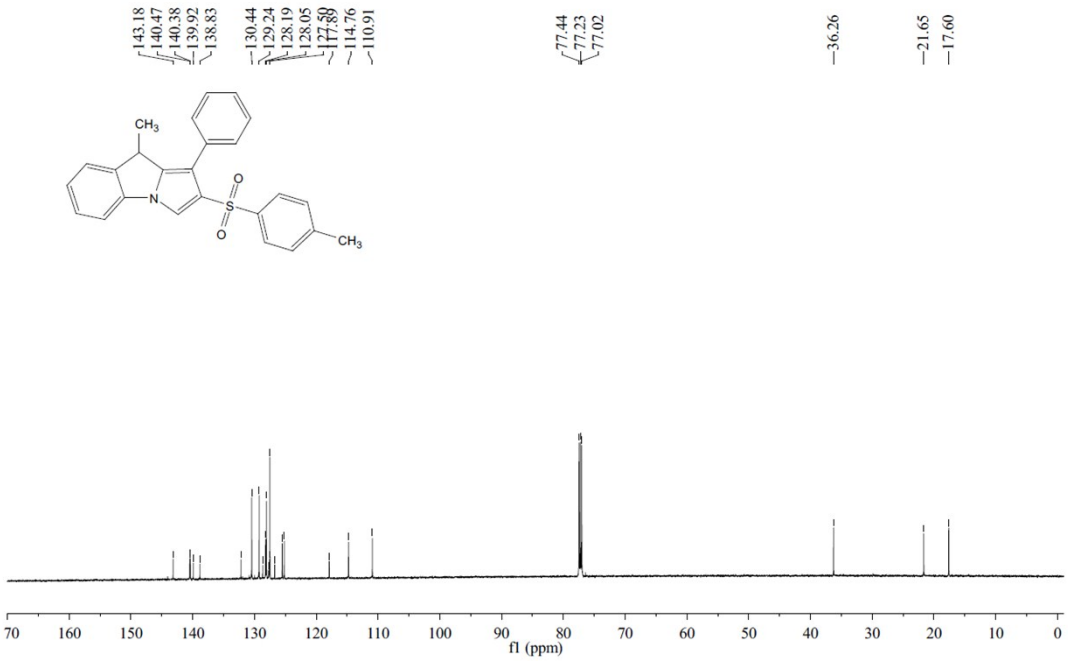
10.20
1.19
1.97
1.00
3.17
3.00
fl (ppm)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128.05
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110.91
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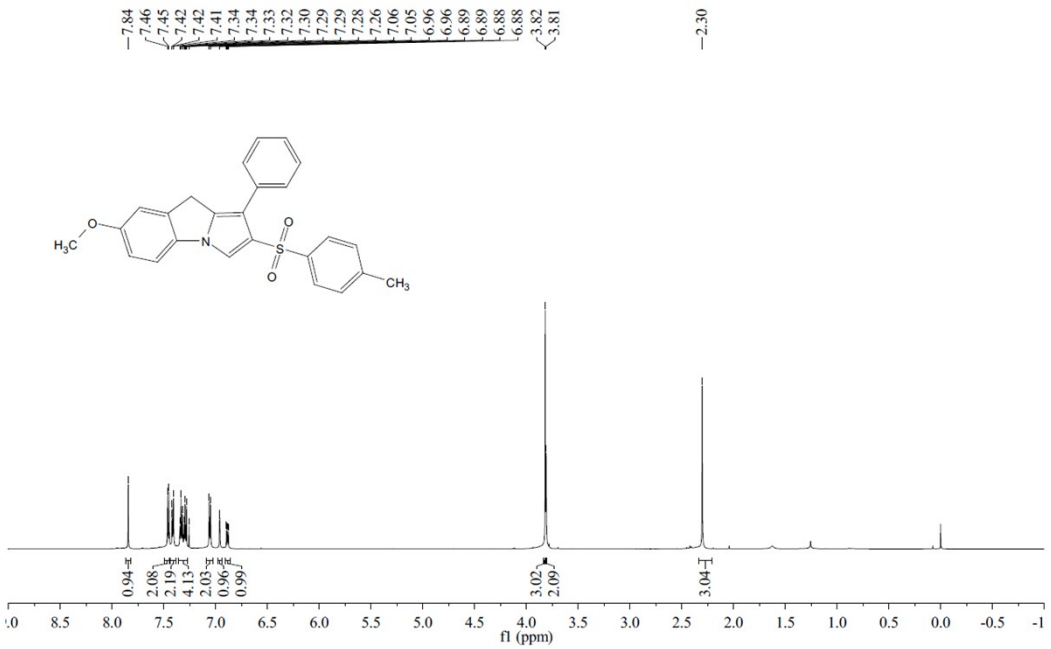
77.02
36.26
21.65
17.60
CH3
N
S
O
O
CH3
fl (ppm)

3e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7.32
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7.29
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7.28
7.26
7.06
7.05
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6.96
6.89
6.89
6.88
6.88
3.82
3.81
2.30
O
H3C
N
O
S
O
CH3
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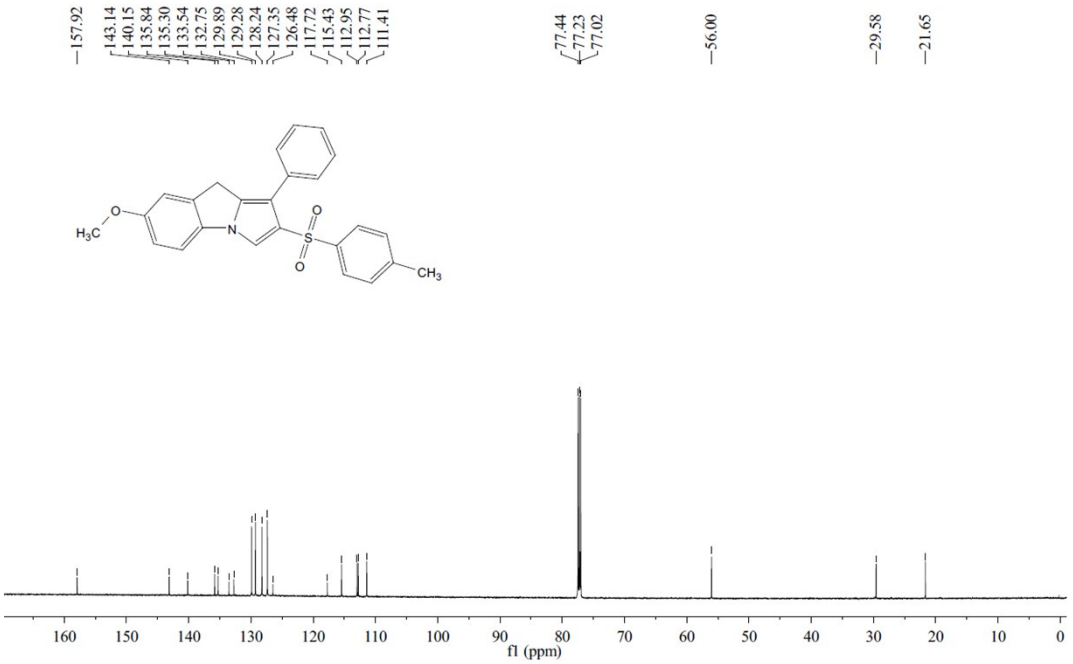
2.19
4.13
2.03
0.96
0.99
3.02
2.09
3.04
f1 (ppm)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128.24
127.35
126.48
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112.95
112.77
111.41
77.44
77.23
77.02
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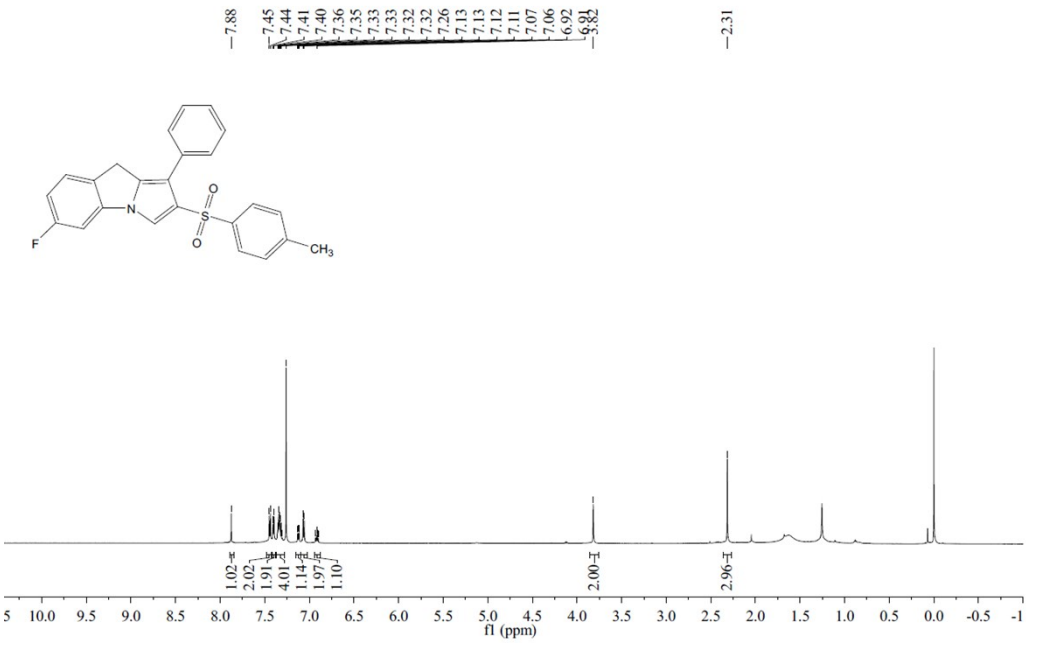
29.58
21.65
O
H3C
N
O
S
O
CH3
f1 (ppm)

3f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7.35
7.33
7.33
7.32
7.32
7.26
7.13
7.13
7.12
7.11
7.07
7.06
6.92
6.91
3.82
2.31
F
O
S
O
N
CH3
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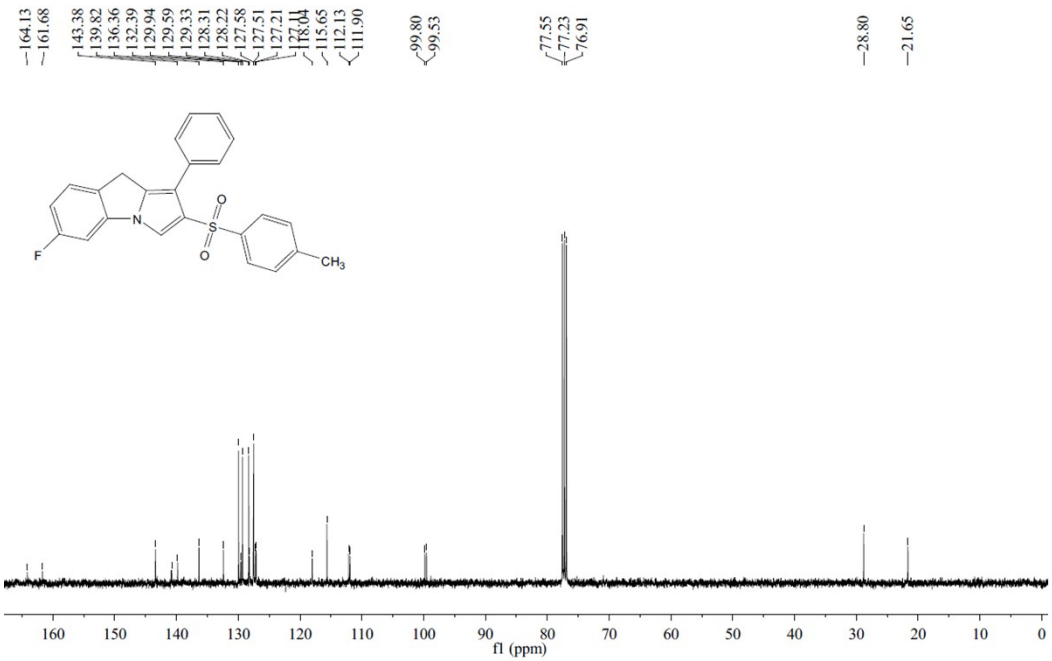
2.02
1.91
4.01
1.14
1.97
1.10
2.00
2.96
fl (ppm)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132.39
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129.59
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128.31
128.22
127.58
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127.21
118.04
115.65
112.13
111.90
99.80
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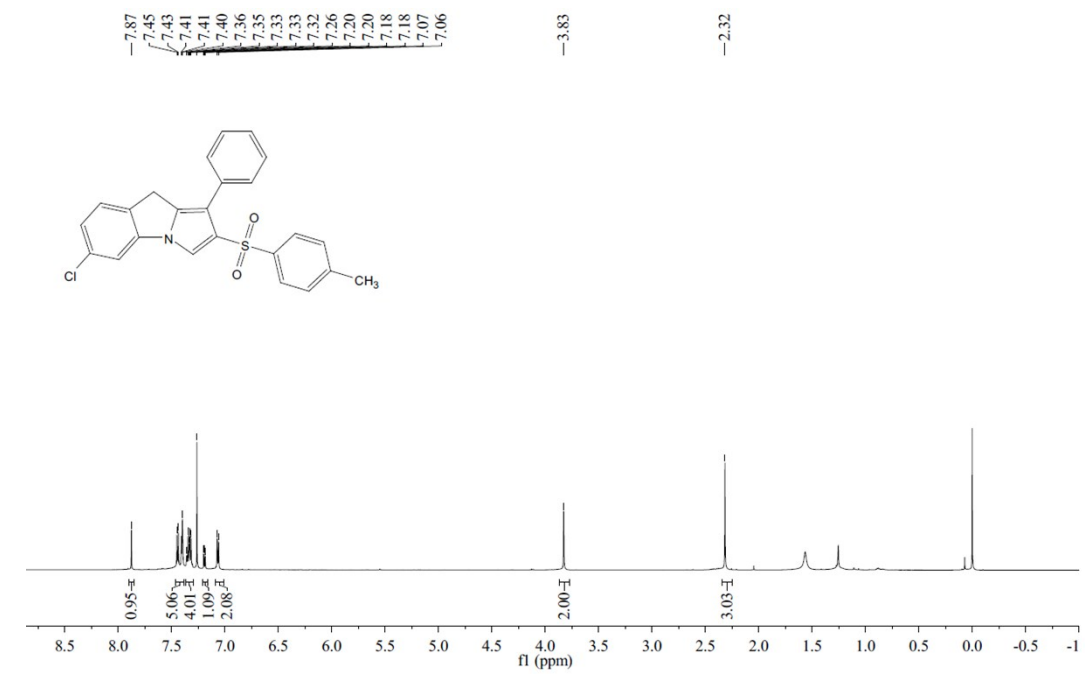
76.91
28.80
21.65
F
O
S
O
N
CH3
fl (ppm)

3g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7.32
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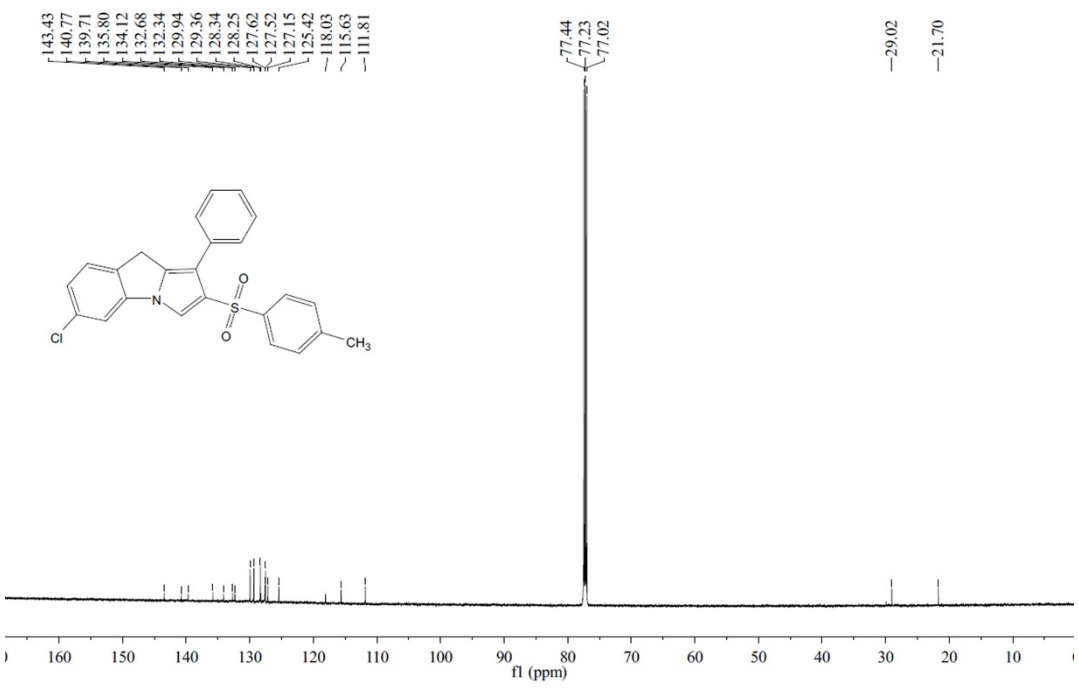
7.20
7.20
7.18
7.18
7.07
7.06
3.83
2.32
Cl
N
S
O
O
CH3
0.95
5.06
4.01
1.09
2.08
2.00
3.03
fl (ppm)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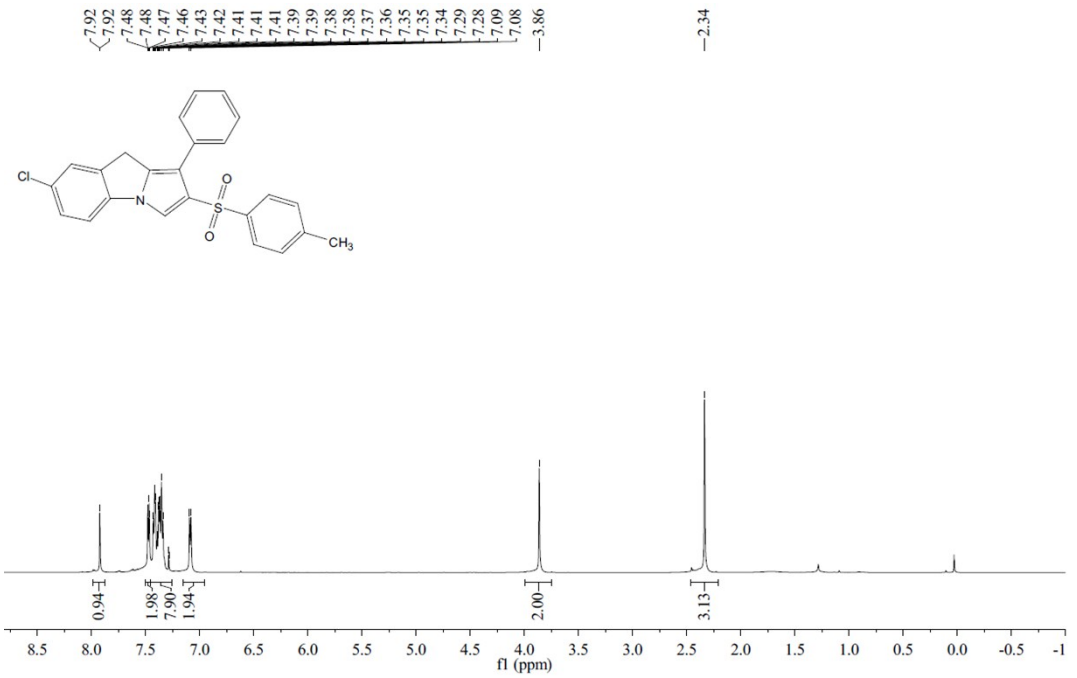
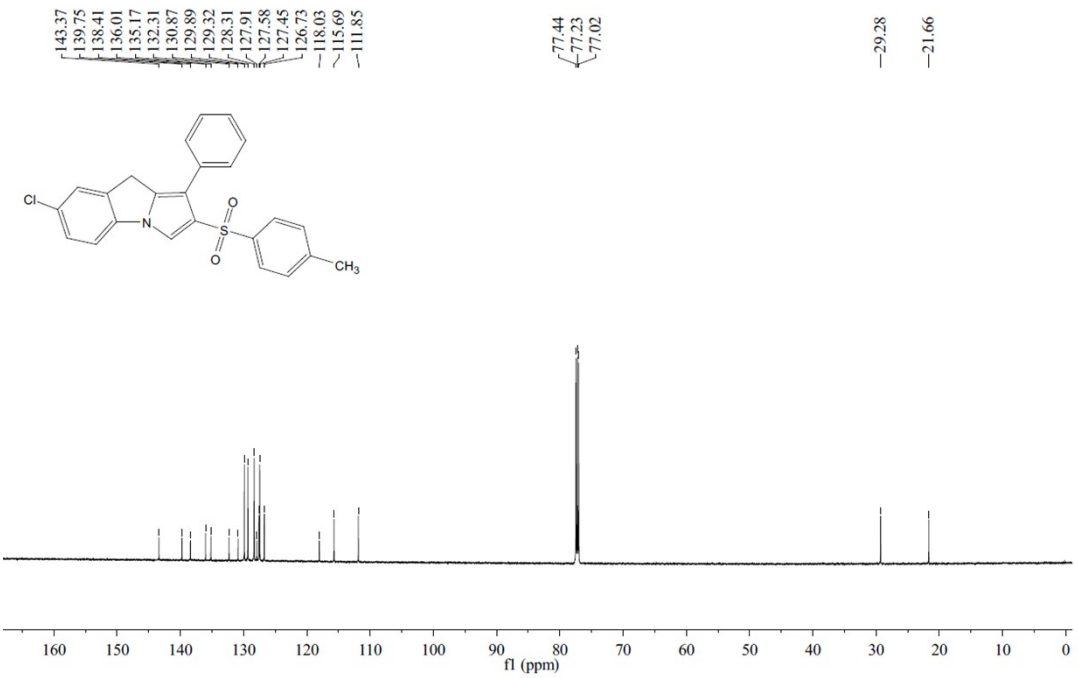
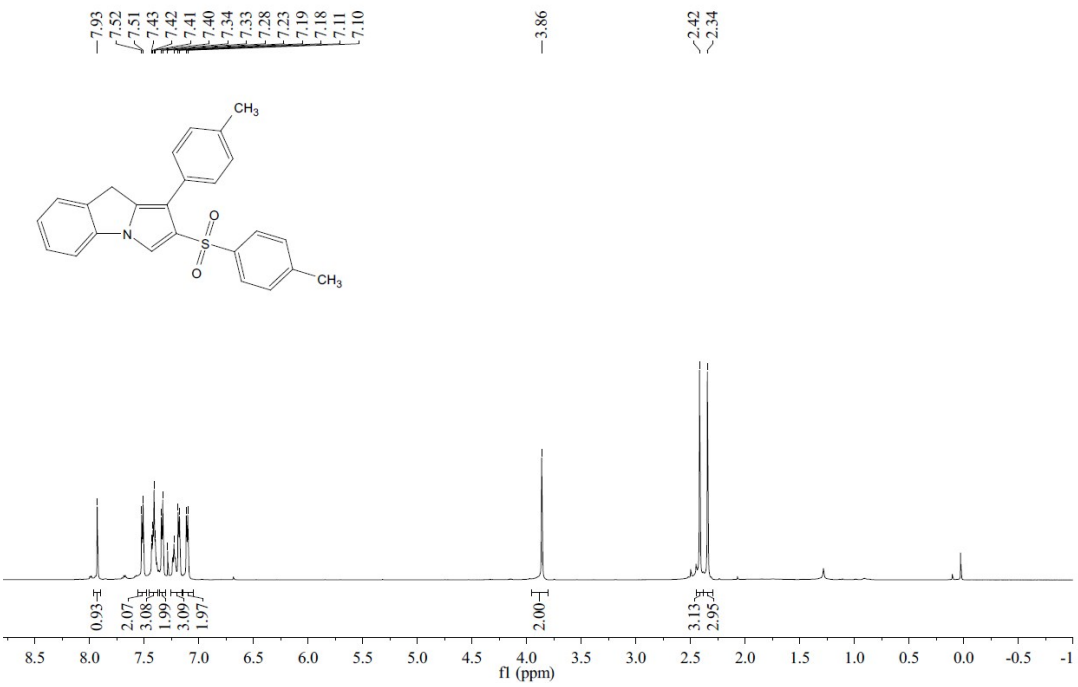
127.15
125.42
118.03
115.63
111.81
77.44
77.23
77.02
29.02
21.70
Cl
N
S
O
O
CH3
fl (ppm)

3h


7.92
7.92
7.48
7.48
7.47
7.46
7.43
7.42
7.41
7.41
7.41
7.39
7.39
7.38
7.38
7.37
7.36
7.35
7.35
7.34
7.29
7.28
7.09
7.08
3.86
2.34
Cl
O
S
O
N
CH3
0.94
1.98
7.90
1.94
2.00
3.13
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
-1
f1 (ppm)


143.37
139.75
138.41
136.01
135.17
132.31
130.87
129.89
129.32
128.31
127.91
127.58
127.45
126.73
118.03
115.69
111.85
77.44
77.23
77.02
29.28
21.66
Cl
O
S
O
N
CH3
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

3i


7.93
7.52
7.51
7.43
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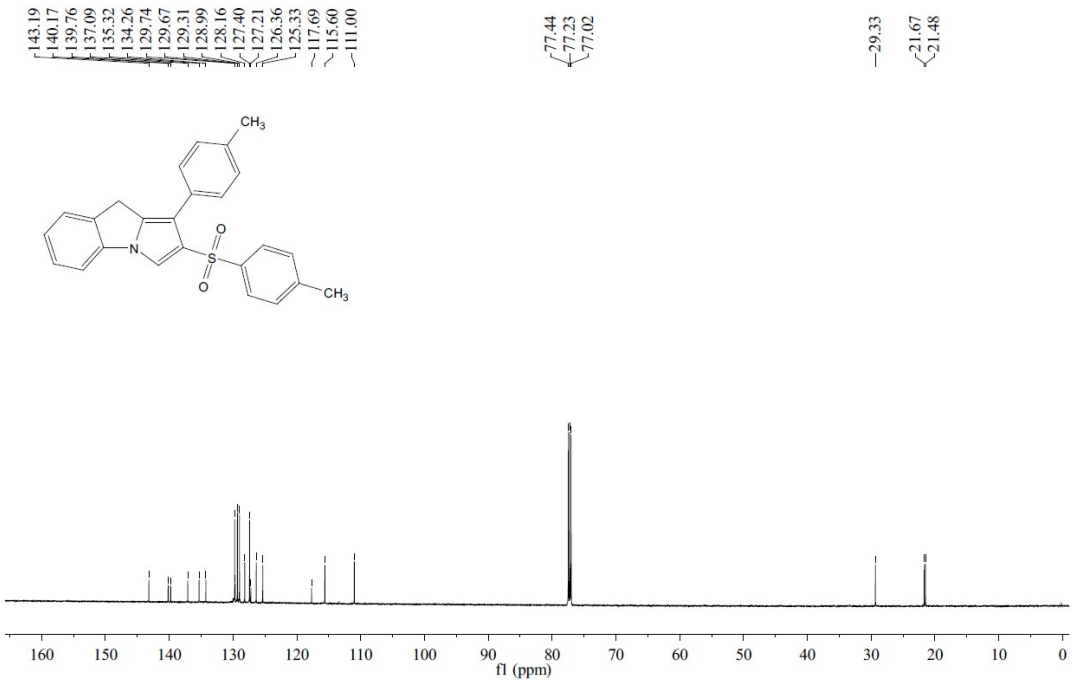
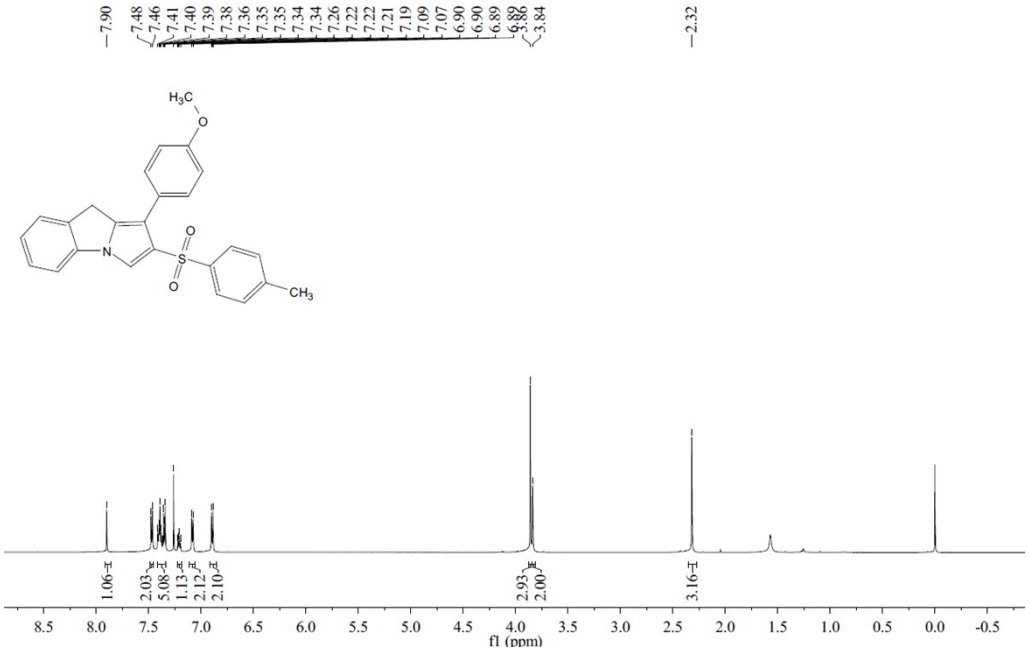
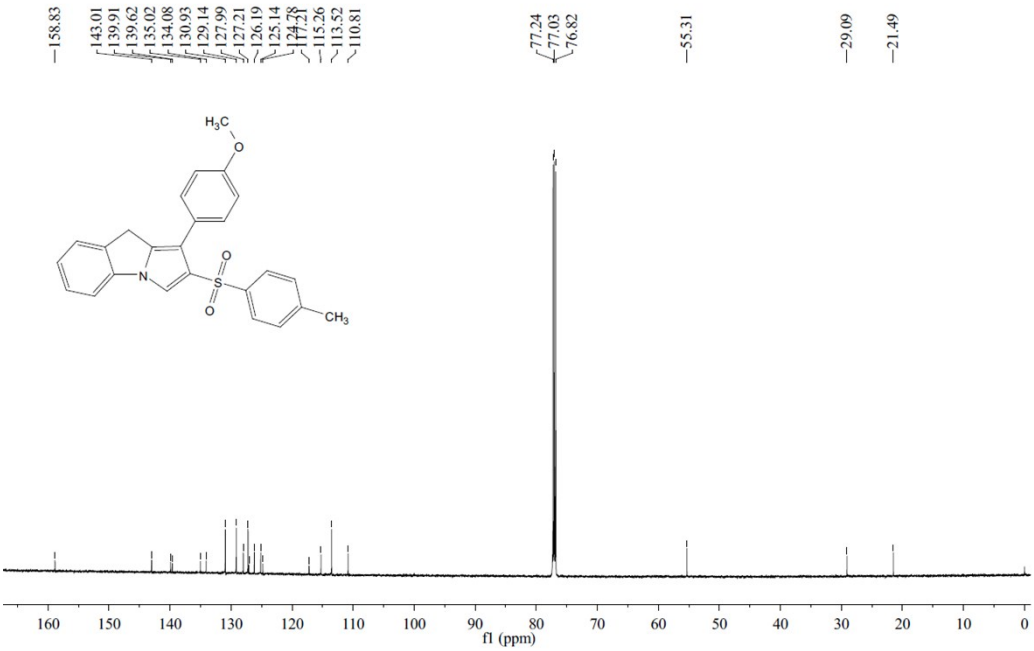
7.41
7.40
7.34
7.33
7.28
7.23
7.19
7.18
7.11
7.10
3.86
2.42
2.34
CH3
O
S
O
N
CH3
0.93
2.07
3.08
1.99
3.09
1.97
2.00
3.13
2.95
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5 -1
f1 (ppm)

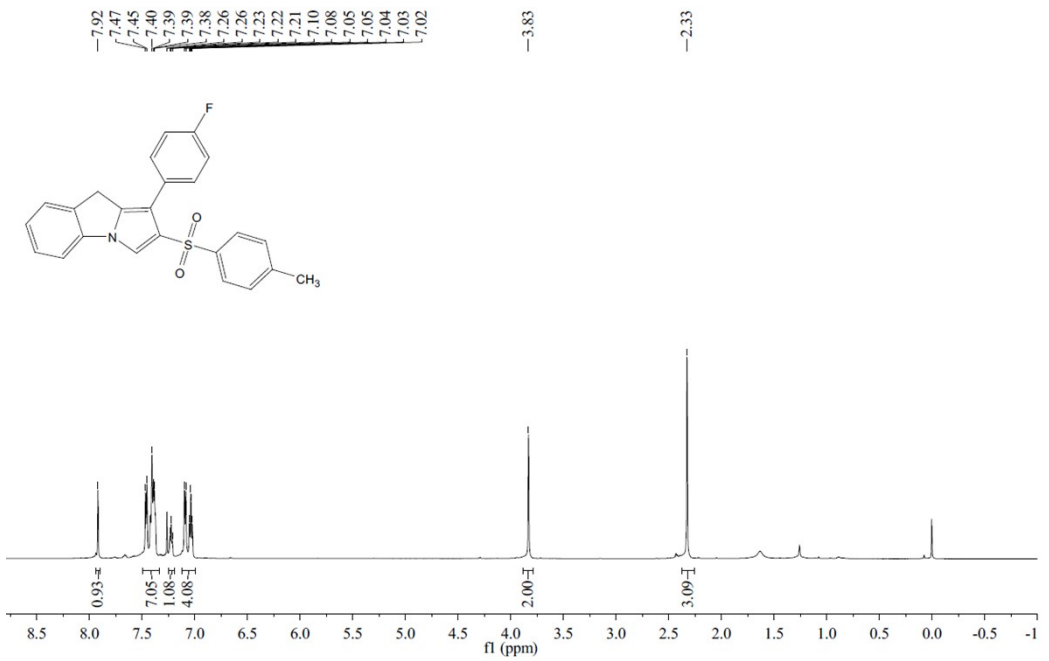

143.19
140.17
139.76
137.09
135.32
134.26
129.74
129.67
129.31
128.99
128.16
127.40
127.21
126.36
125.33
117.69
115.60
111.00
77.44
77.23
77.02
29.33
21.67
21.48
CH3
O
S
O
N
CH3
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

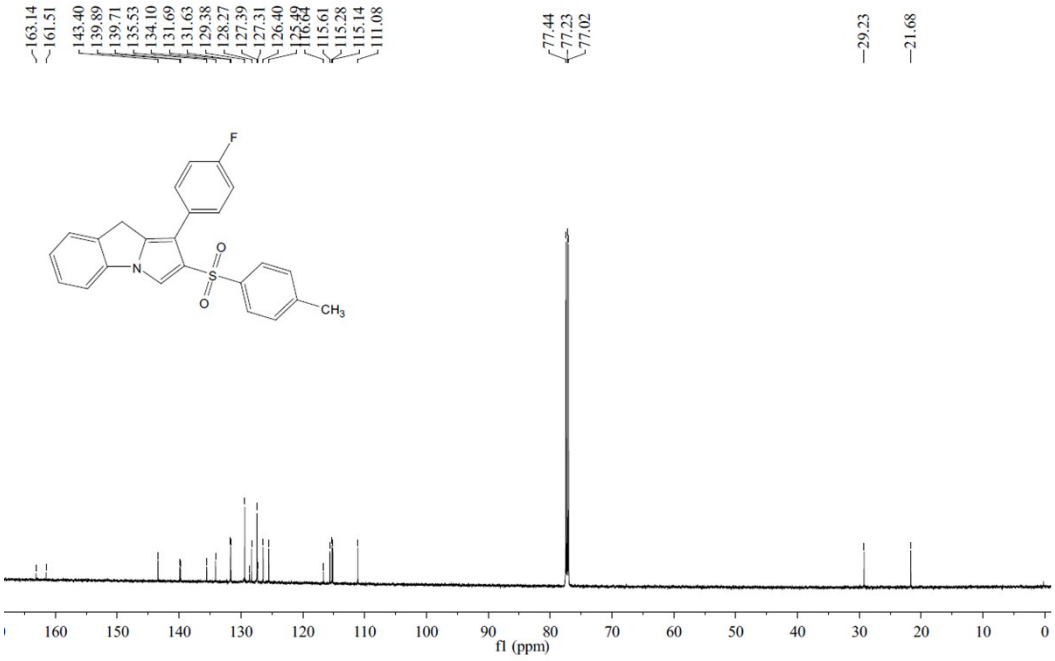
3j


7.90
7.48
7.46
7.41
7.40
7.39
7.38
7.36
7.35
7.35
7.34
7.34
7.26
7.22
7.22
7.21
7.19
7.09
7.07
6.90
6.90
6.89
6.88
3.86
3.84
2.32
H3C
O
N
S
O
O
CH3
1.06
2.03
5.08
1.13
2.12
2.10
2.93
2.00
3.16
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
f1 (ppm)

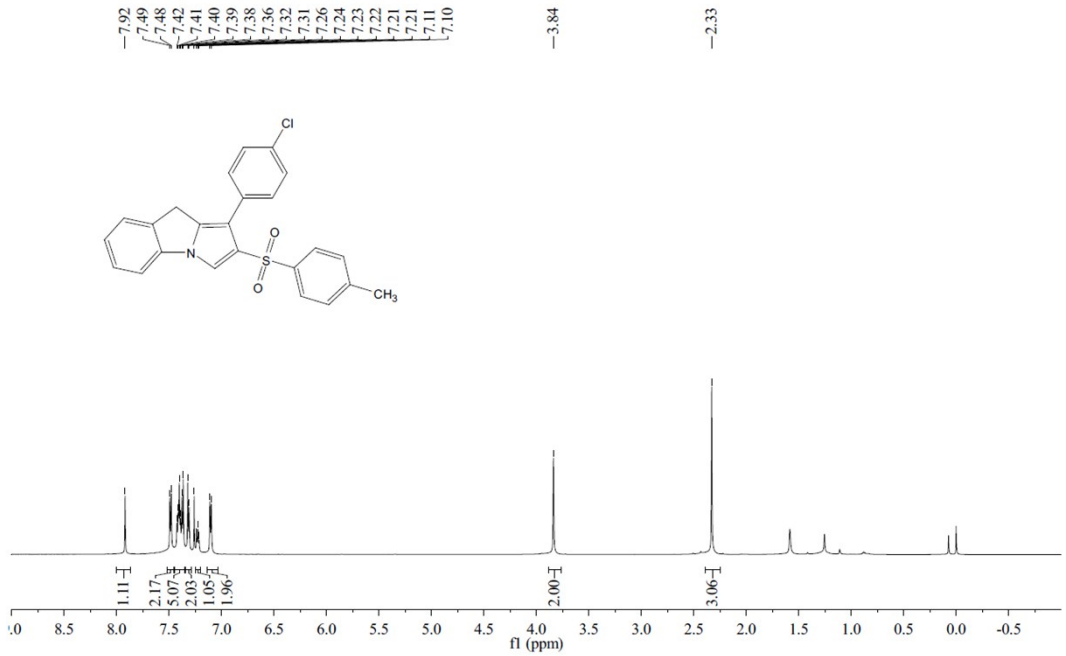

158.83
143.01
139.91
139.62
135.02
134.08
130.93
129.14
127.99
127.21
126.19
125.14
124.78
117.21
115.26
113.52
110.81
77.24
77.03
76.82
55.31
29.09
21.49
H3C
O
N
S
O
O
CH3
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

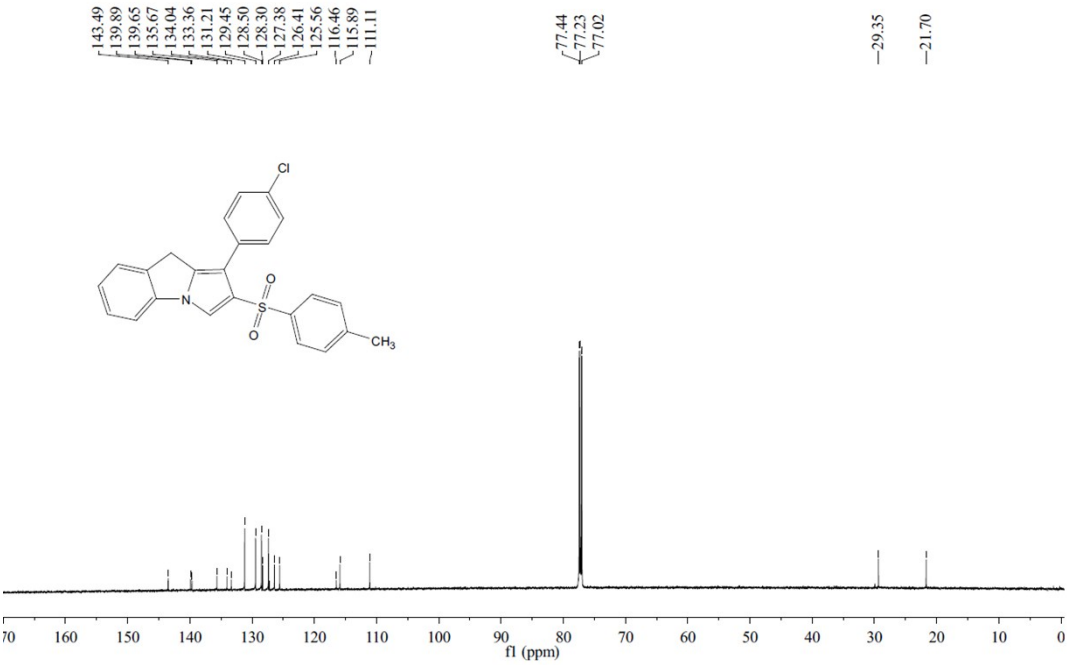
3k


7.92
7.47
7.45
7.40
7.39
7.39
7.38
7.26
7.26
7.23
7.22
7.21
7.10
7.08
7.05
7.05
7.04
7.03
7.02
3.83
2.33
F
O
S
O
N
CH3
0.93
7.05
1.08
4.08
2.00
3.09
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 -1
f1 (ppm)


163.14
161.51
143.40
139.89
139.71
135.53
134.10
131.69
131.63
129.38
128.27
127.39
127.31
126.40
125.49
116.84
115.61
115.28
115.14
111.08
77.44
77.23
77.02
29.23
21.68
F
O
S
O
N
CH3
160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

3l


7.92
7.49
7.48
7.42
7.41
7.40
7.39
7.38
7.36
7.32
7.31
7.26
7.24
7.23
7.22
7.21
7.21
7.11
7.10
3.84
2.33
Cl
O
S
O
N
CH3
1.11
2.17
5.07
2.03
1.05
1.96
2.00
3.06
f1 (ppm)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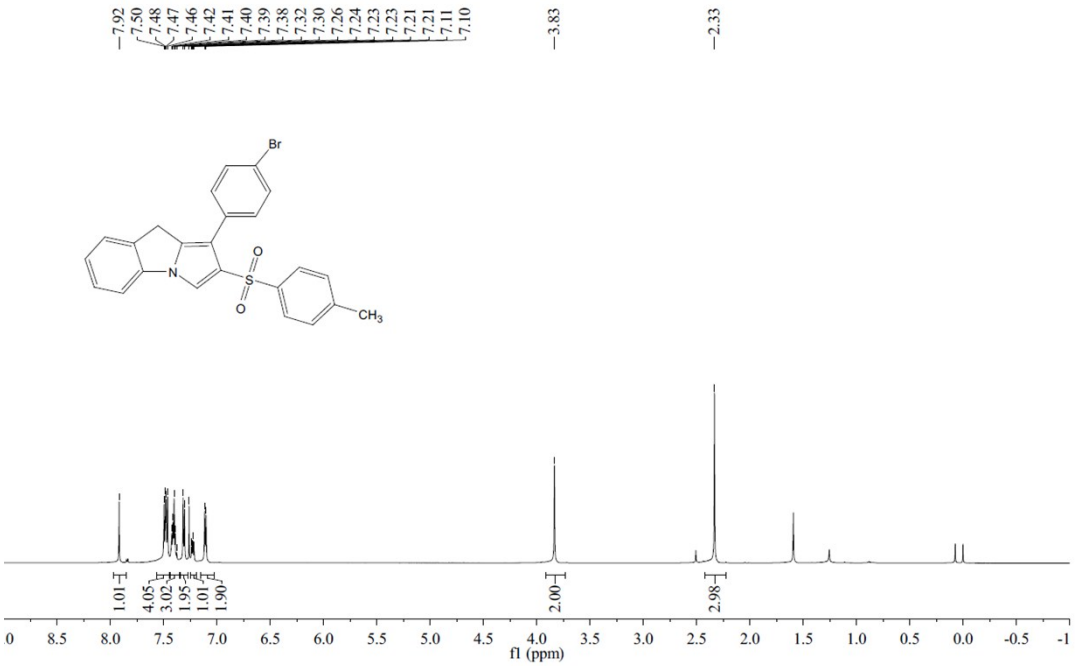
139.89
139.65
135.67
134.04
133.36
131.21
129.45
128.50
128.30
127.38
126.41
125.56
116.46
115.89
111.11
77.44
77.23
77.02
29.35
21.70
Cl
O
S
O
N
CH3
f1 (ppm)

3m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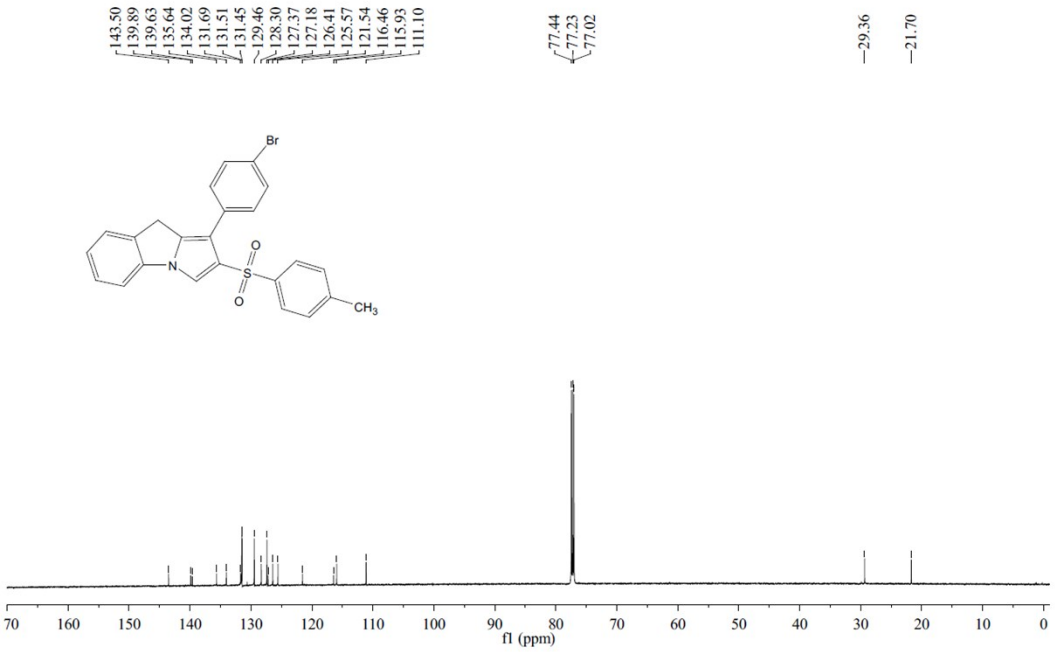
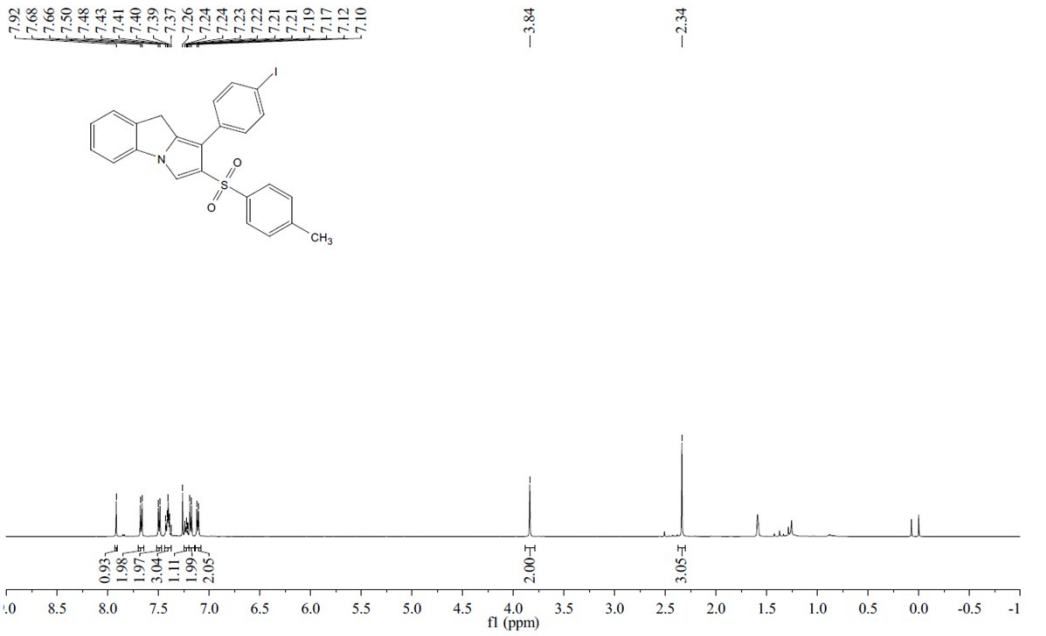
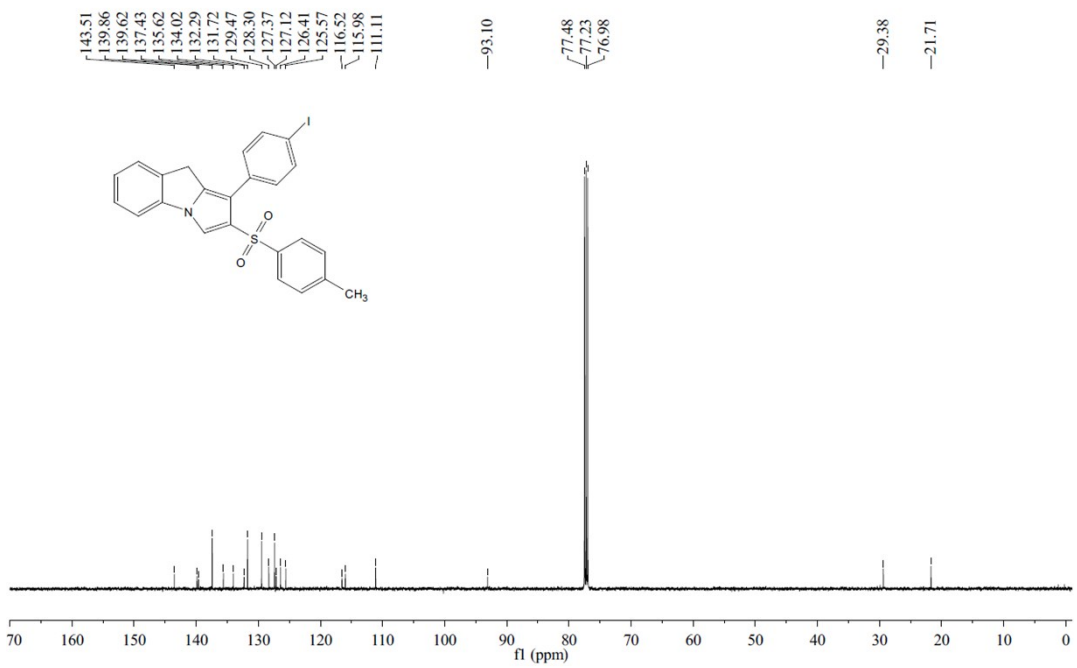
7.50
7.48
7.47
7.46
7.42
7.41
7.40
7.39
7.38
7.32
7.30
7.26
7.24
7.23
7.23
7.21
7.21
7.11
7.10
3.83
2.33
Br
O
S
O
N
CH3
1.01
4.05
3.02
1.95
1.01
1.90
2.00
2.98
0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1
f1 (ppm)


143.50
139.89
139.63
135.64
134.02
131.69
131.51
131.45
129.46
128.30
127.37
127.18
126.41
125.57
121.54
116.46
115.93
111.10
77.44
77.23
77.02
29.36
21.70
Br
O
S
O
N
CH3
70
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

3n


7.92
7.68
7.66
7.50
7.48
7.43
7.41
7.40
7.39
7.37
7.26
7.24
7.24
7.23
7.22
7.21
7.21
7.19
7.17
7.12
7.10
3.84
2.34
I
N
O
S
O
CH3
0.93
1.98
1.97
3.04
1.11
1.99
2.05
2.00
3.05
f1 (ppm)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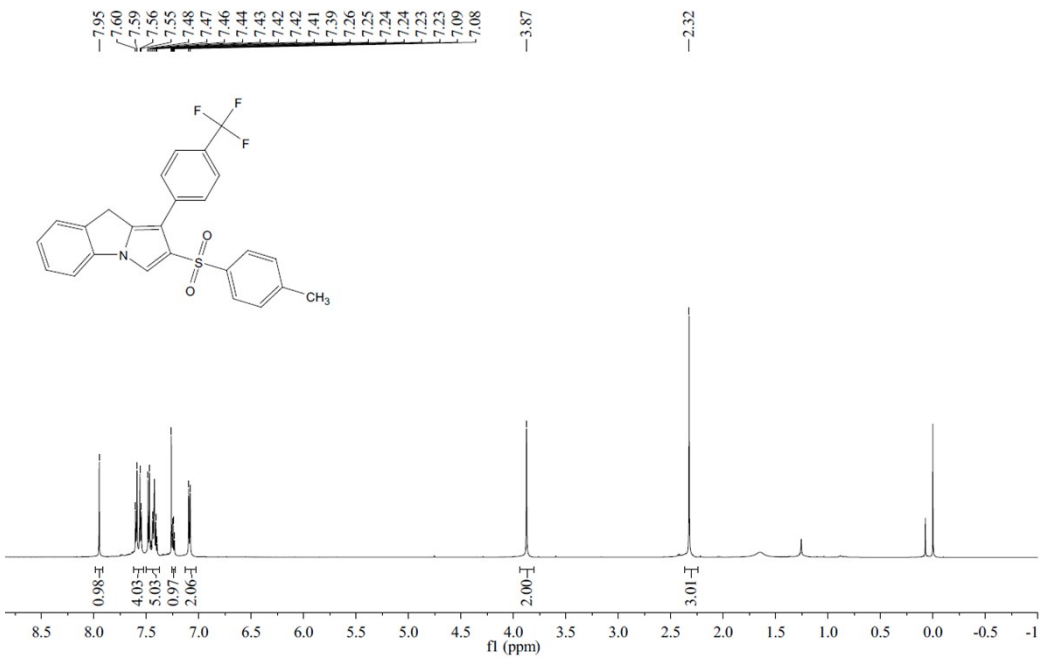
139.86
139.62
137.43
135.62
134.02
132.29
131.72
129.47
128.30
127.37
127.12
126.41
125.57
116.52
115.98
111.11
93.10
77.48
77.23
76.98
29.38
21.71
I
N
O
S
O
CH3
f1 (ppm)

3o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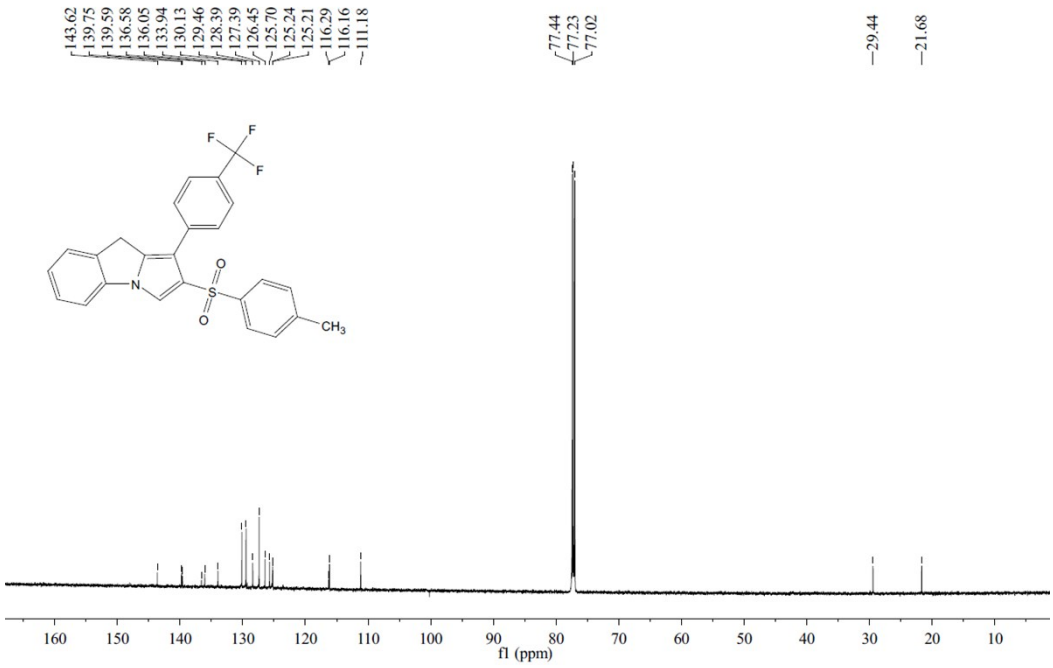
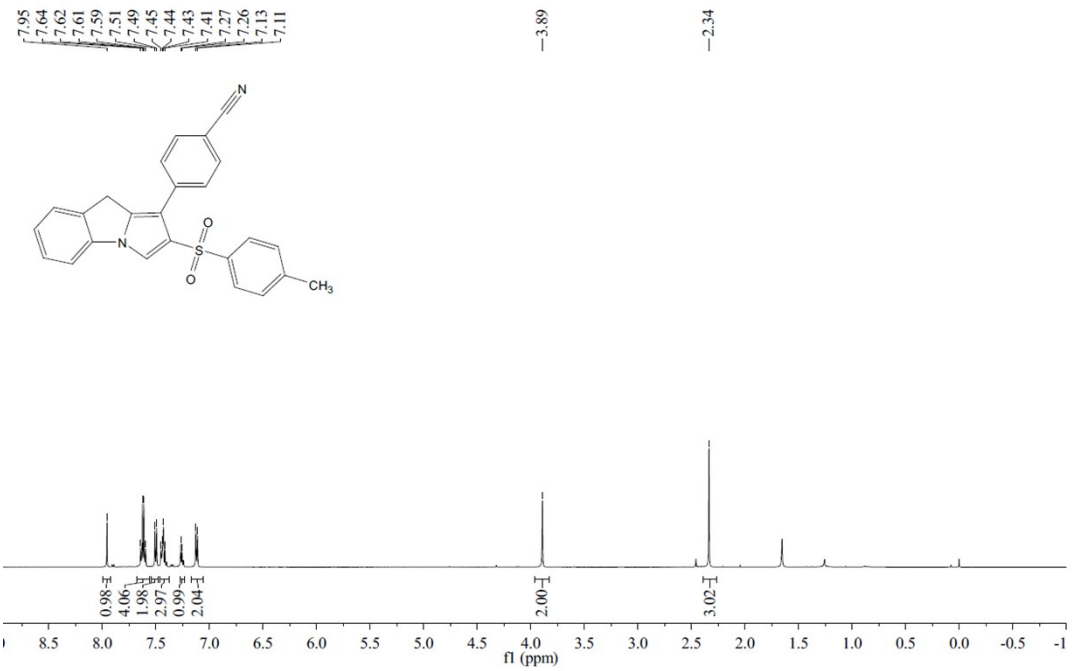
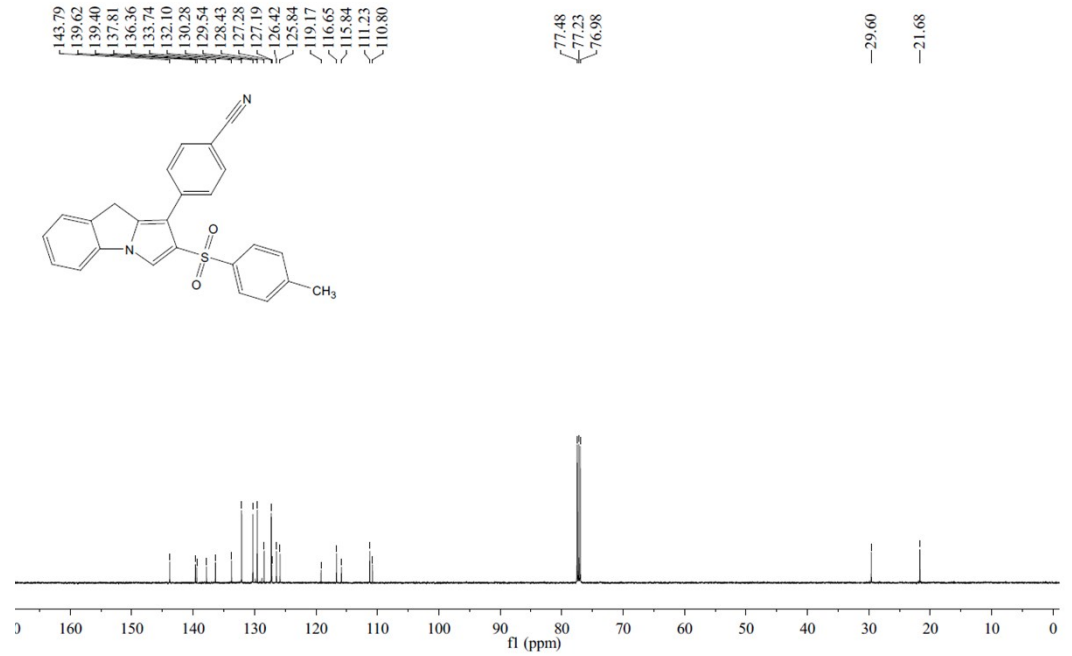
7.60
7.59
7.56
7.55
7.48
7.47
7.46
7.44
7.43
7.42
7.42
7.41
7.39
7.26
7.25
7.24
7.24
7.23
7.23
7.09
7.08
3.87
2.32
F
F
F
O
S
O
N
CH3
0.98
4.03
5.03
0.97
2.06
2.00
3.01
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1
f1 (ppm)


143.62
139.75
139.59
136.58
136.05
133.94
130.13
129.46
128.39
127.39
126.45
125.70
125.24
125.21
116.29
116.16
111.18
77.44
77.23
77.02
29.44
21.68
F
F
F
O
S
O
N
CH3
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

3p


7.95
7.64
7.62
7.61
7.59
7.51
7.49
7.45
7.44
7.43
7.41
7.27
7.26
7.13
7.11
3.89
2.34
N
O
S
O
N
CH3
0.98
4.06
1.98
2.97
0.99
2.04
2.00
3.02
f1 (ppm)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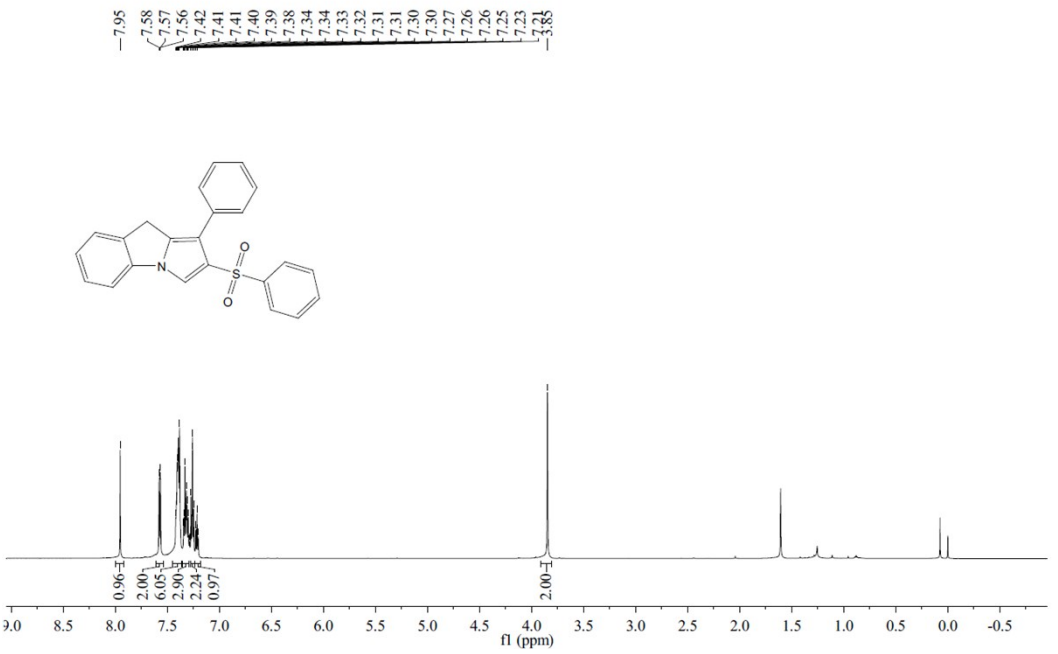
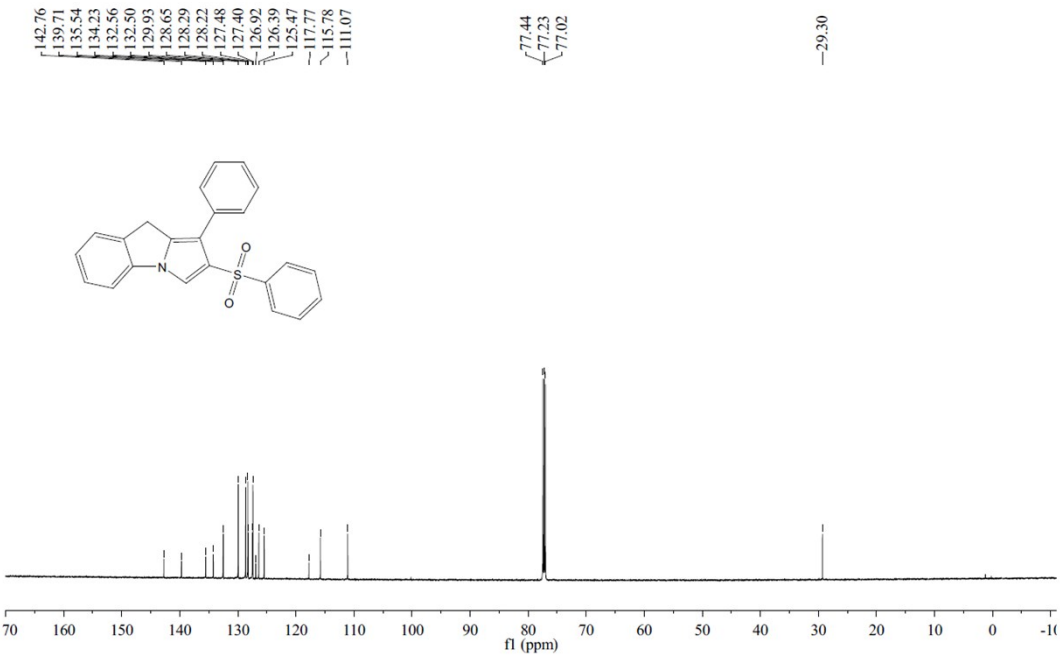
139.62
139.40
137.81
136.36
133.74
132.10
130.28
129.54
128.43
127.28
127.19
126.42
125.84
119.17
116.65
115.84
111.23
110.80
77.48
77.23
76.98
29.60
21.68
N
O
S
O
N
CH3
f1 (ppm)

3q


7.95
7.58
7.57
7.56
7.42
7.41
7.41
7.40
7.39
7.38
7.34
7.34
7.33
7.32
7.31
7.31
7.30
7.30
7.27
7.26
7.26
7.25
7.23
7.21
3.85
O
S
O
N
0.96
2.00
6.05
2.90
2.24
0.97
2.00
f1 (ppm)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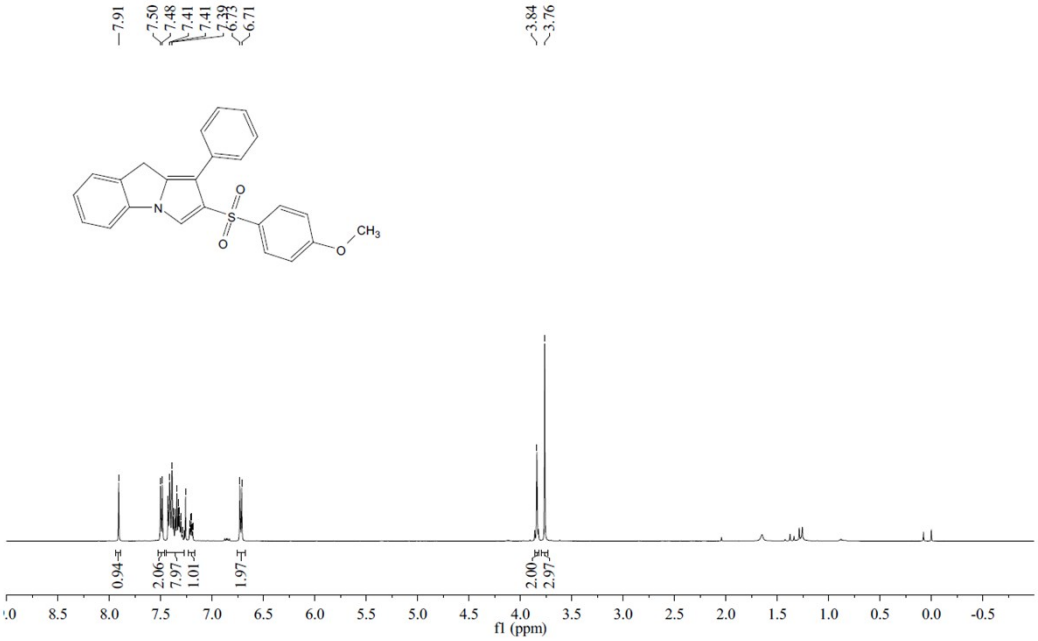
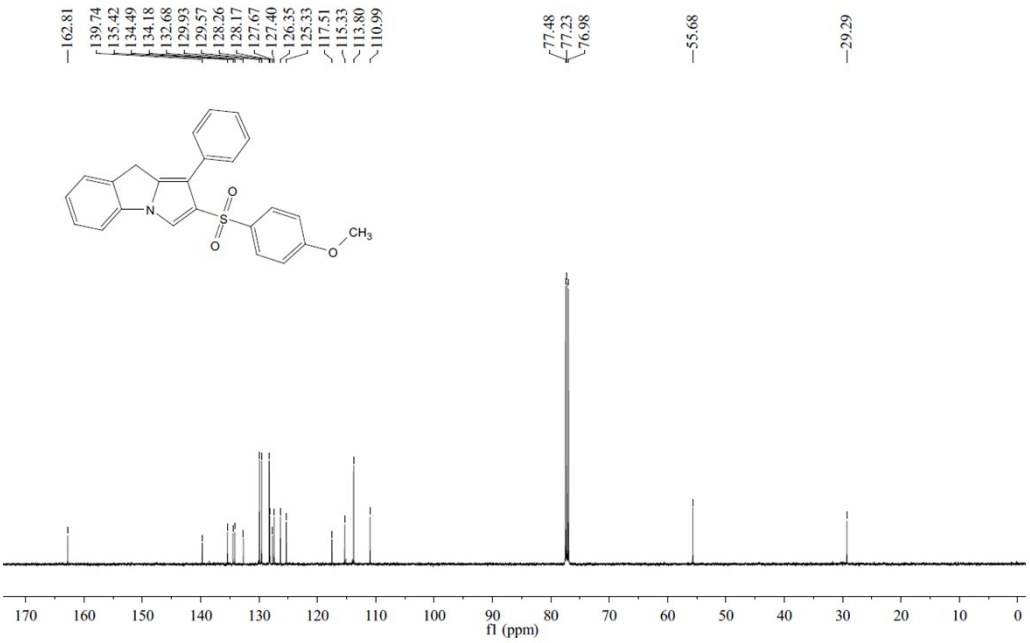
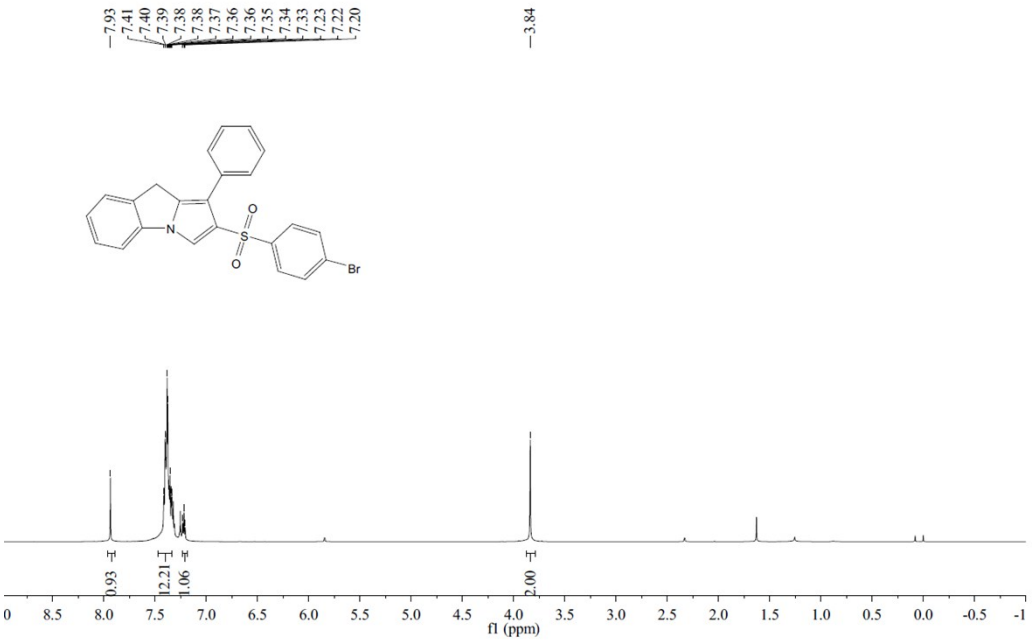
132.56
132.50
129.93
128.65
128.29
128.22
127.48
127.40
126.92
126.39
125.47
117.77
115.78
111.07
77.44
77.23
77.02
29.30
O
S
O
N
f1 (ppm)

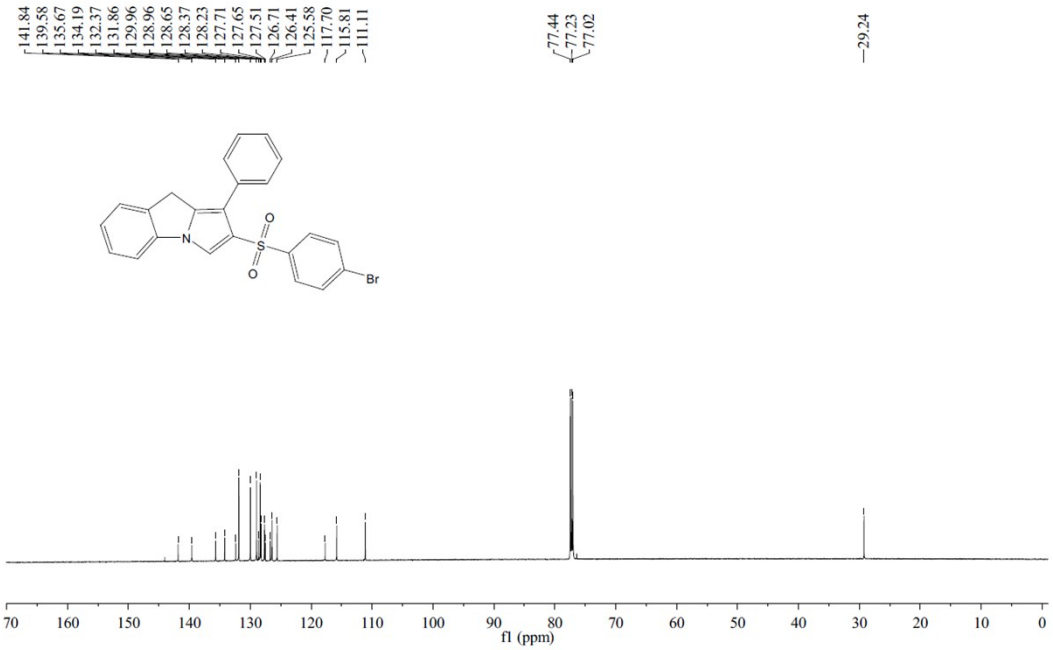
3r


7.91
7.50
7.48
7.41
7.41
7.39
6.73
6.71
3.84
3.76
0.94
2.06
7.97
1.01
1.97
2.00
2.97
f1 (ppm)

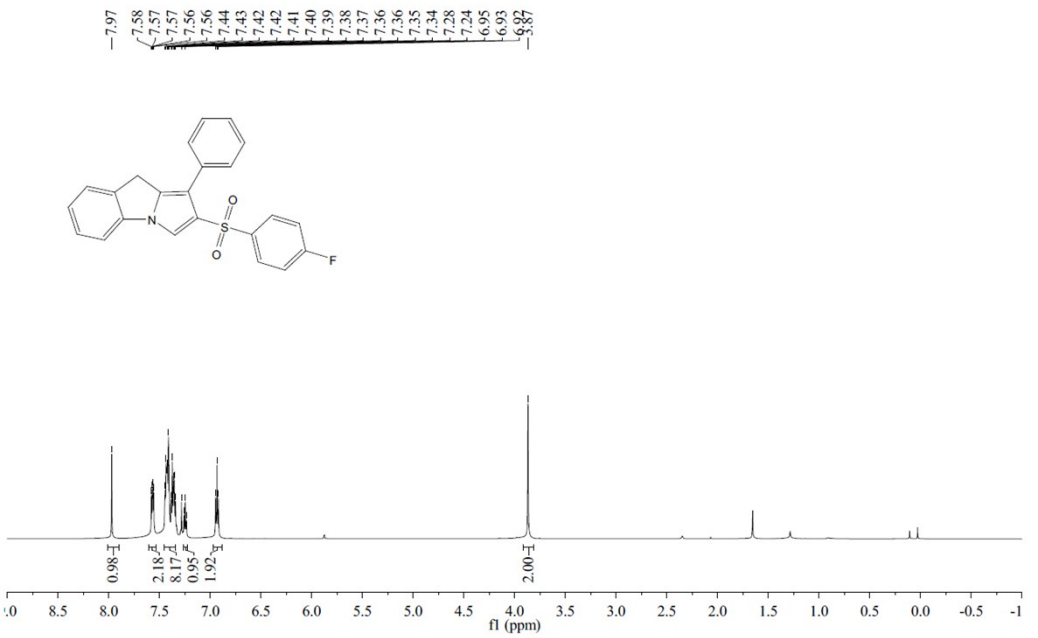

162.81
139.74
135.42
134.49
134.18
132.68
129.93
129.57
128.26
128.17
127.67
127.40
126.35
125.33
117.51
115.33
113.80
110.99
77.48
77.23
76.98
55.68
29.29
f1 (ppm)

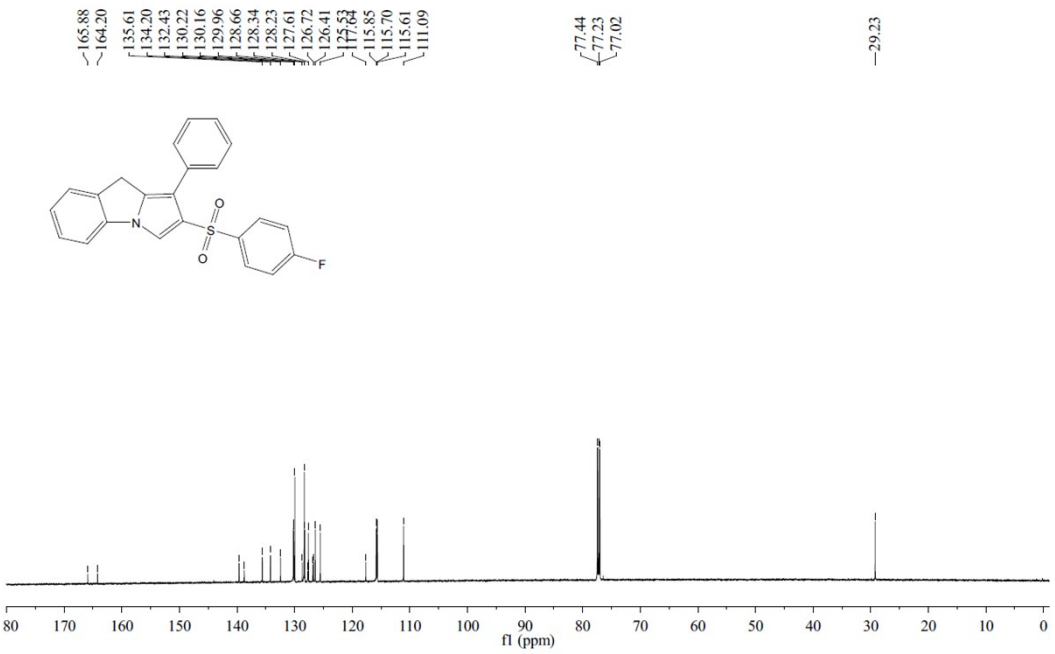
3s


7.93
7.41
7.40
7.39
7.38
7.38
7.37
7.36
7.36
7.35
7.34
7.33
7.23
7.22
7.20
3.84
O
S
O
N
Br
0.93
12.21
1.06
2.00
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 -1
f1 (ppm)


141.84
139.58
135.67
134.19
132.37
131.86
129.96
128.96
128.65
128.37
128.23
127.71
127.65
127.51
126.71
126.41
125.58
117.70
115.81
111.11
77.44
77.23
77.02
29.24
O
S
O
N
Br
70 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

3t


7.97
7.58
7.57
7.57
7.57
7.56
7.56
7.44
7.43
7.42
7.42
7.41
7.40
7.39
7.38
7.37
7.36
7.36
7.35
7.34
7.28
7.24
6.95
6.93
6.92
5.87
O
S
O
N
F
0.98
2.18
8.17
0.95
1.92
2.00
fl (ppm)


165.88
164.20
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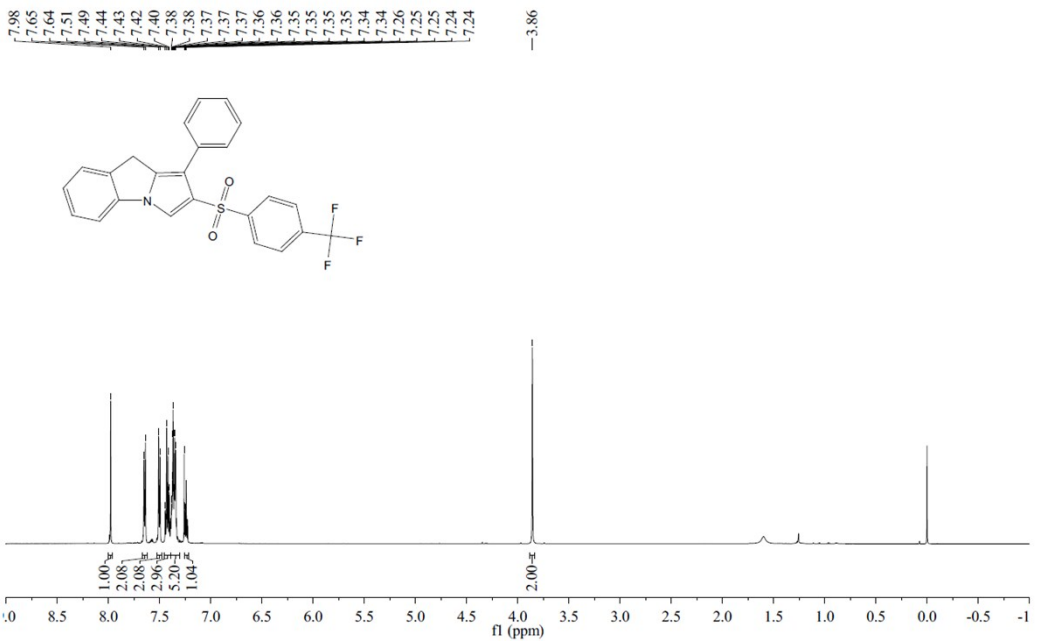
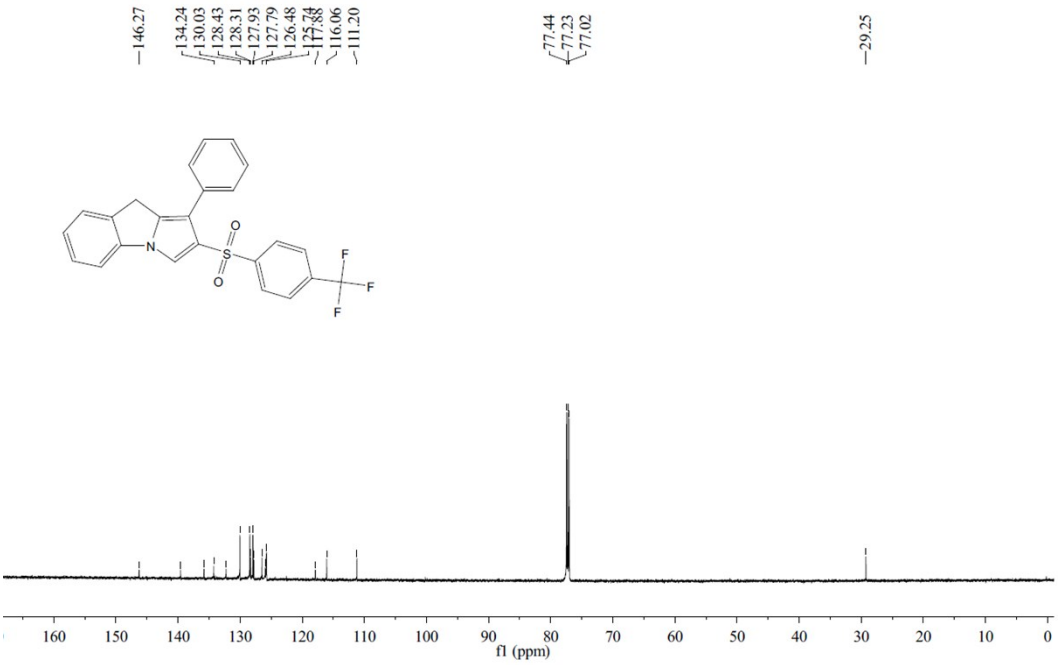
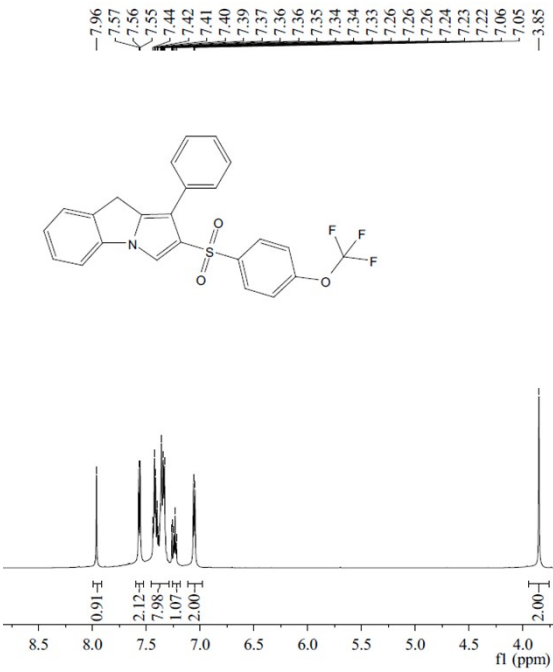
129.96
128.66
128.34
128.23
127.61
126.72
126.41
125.53
125.04
117.64
115.85
115.70
115.61
111.09
77.44
77.23
77.02
29.23
O
S
O
N
F
fl (ppm)

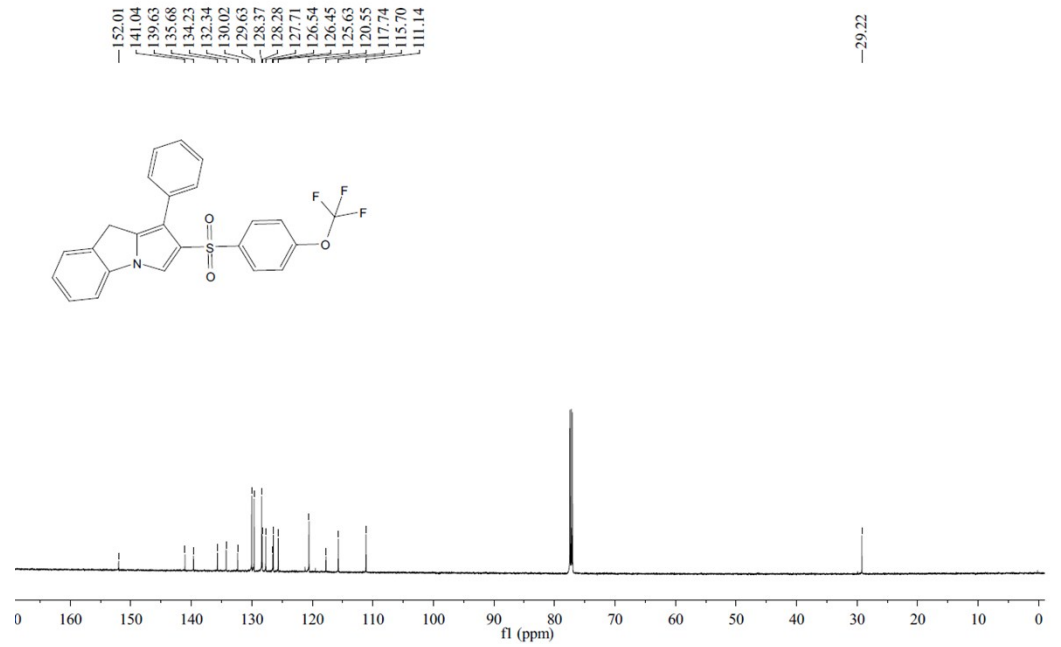
3u


7.98
7.65
7.64
7.51
7.49
7.44
7.43
7.42
7.40
7.38
7.38
7.37
7.37
7.37
7.36
7.36
7.35
7.35
7.35
7.35
7.34
7.34
7.26
7.25
7.25
7.24
7.24
3.86
O
S
O
N
F
F
F
1.00
2.08
2.08
2.96
5.20
1.04
2.00
f1 (ppm)

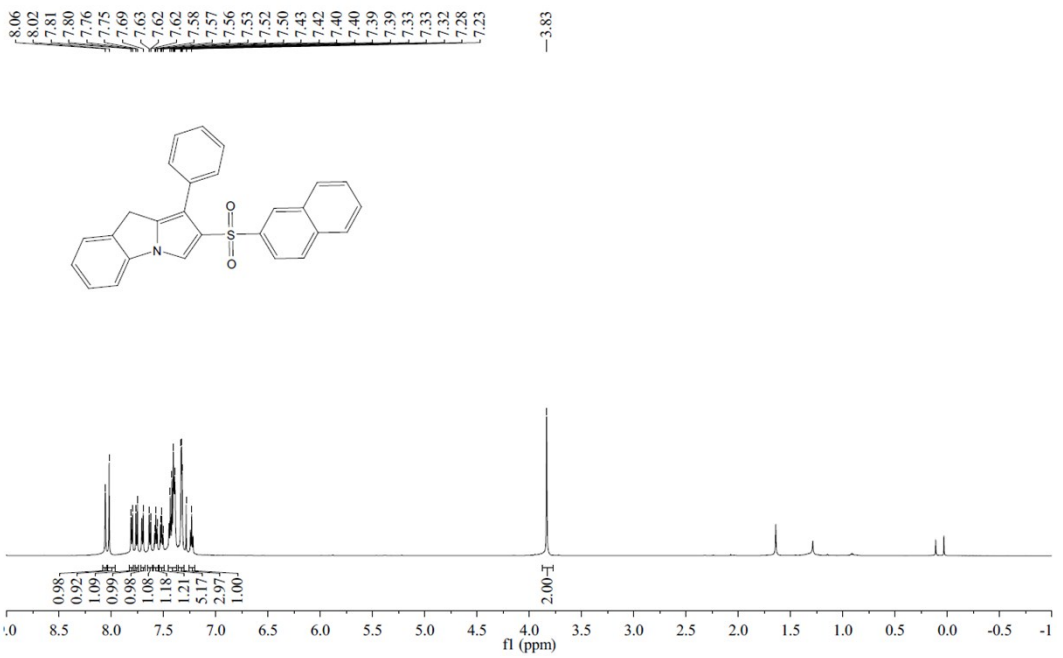

146.27
134.24
130.03
128.43
128.31
127.93
127.79
126.48
125.74
117.88
116.06
111.20
77.44
77.23
77.02
29.25
O
S
O
N
F
F
F
f1 (ppm)

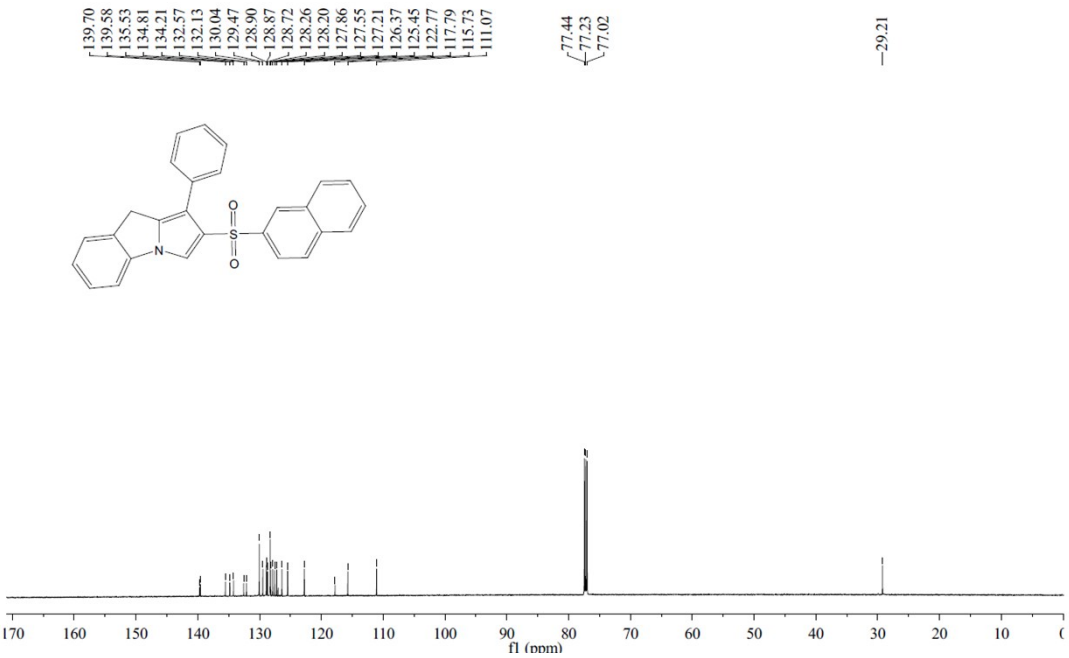
3v


7.96
7.57
7.56
7.55
7.44
7.42
7.41
7.40
7.39
7.37
7.36
7.36
7.35
7.34
7.34
7.33
7.26
7.26
7.26
7.24
7.23
7.22
7.06
7.05
3.85
0.91
2.12
7.98
1.07
2.00
2.00
fl (ppm)

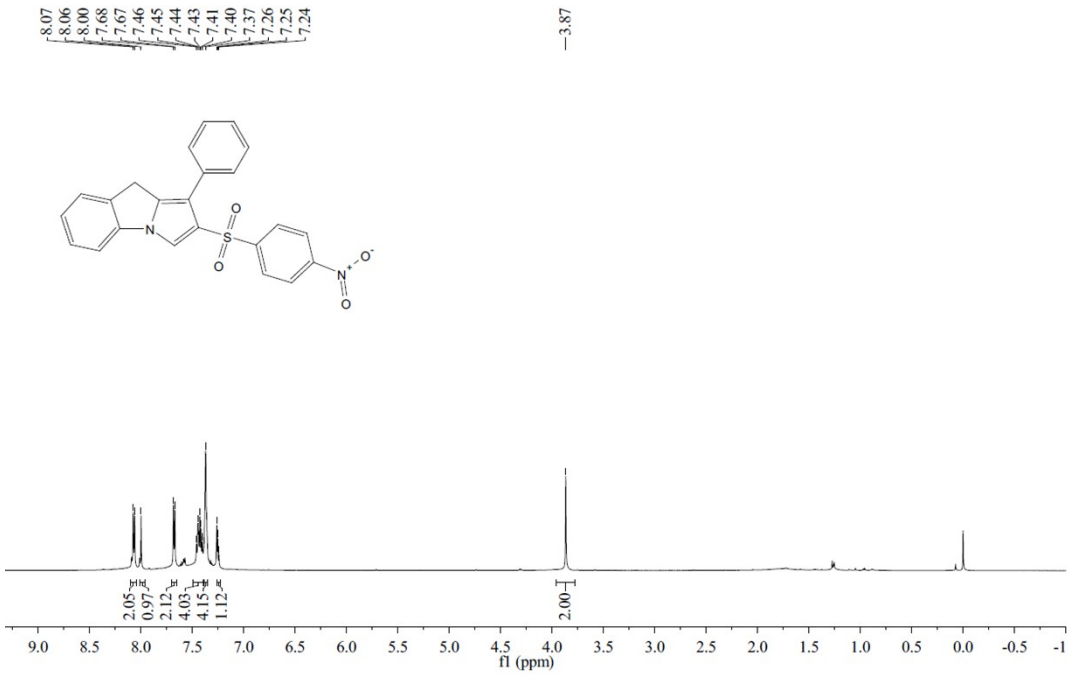

152.01
141.04
139.63
135.68
134.23
132.34
130.02
129.63
128.37
128.28
127.71
126.54
126.45
125.63
120.55
117.74
115.70
111.14
29.22
fl (ppm)

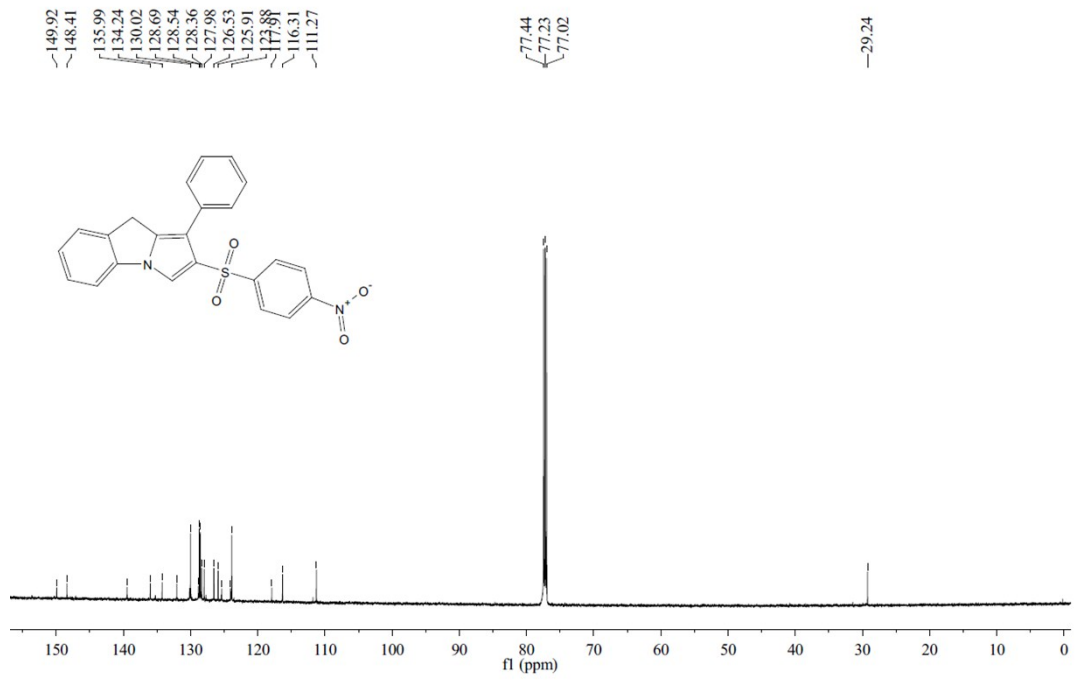
3w


8.06
8.02
7.81
7.80
7.76
7.75
7.69
7.63
7.62
7.62
7.58
7.57
7.56
7.53
7.52
7.50
7.43
7.42
7.40
7.40
7.39
7.39
7.33
7.33
7.32
7.28
7.23
3.83
0.98
0.92
1.09
0.99
0.98
1.08
1.18
1.21
5.17
2.97
1.00
2.00
f1 (ppm)

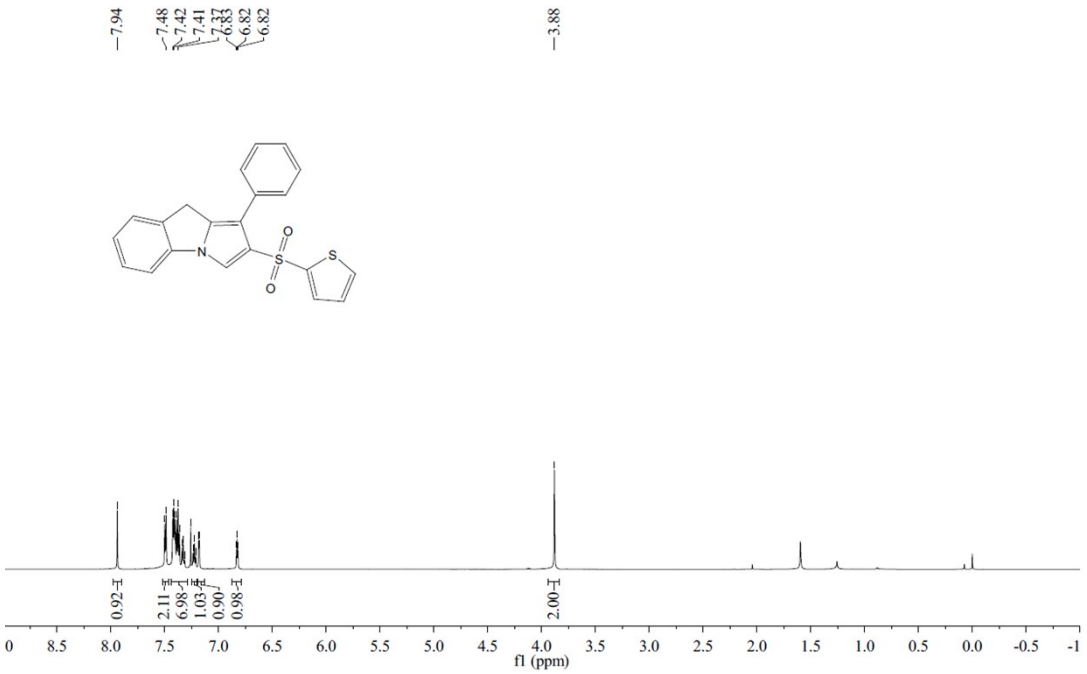

139.70
139.58
135.53
134.81
134.21
132.57
132.13
130.04
129.47
128.90
128.87
128.72
128.26
128.20
127.86
127.55
127.21
126.37
125.45
122.77
117.79
115.73
111.07
77.44
77.23
77.02
29.21
f1 (ppm)

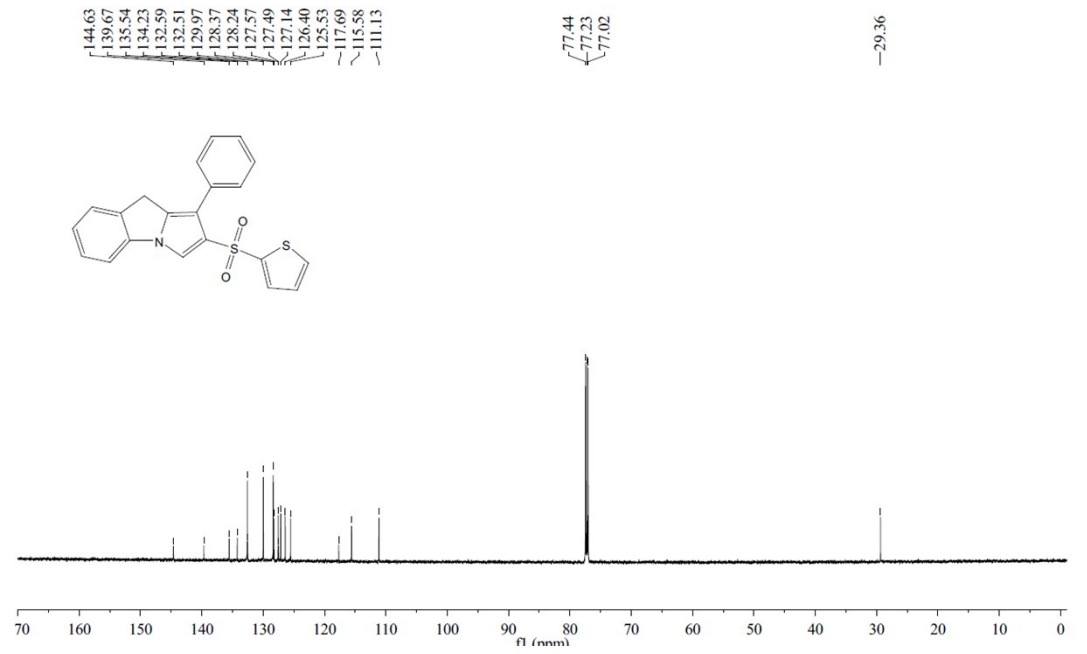
3x


8.07
8.06
8.00
7.68
7.67
7.46
7.45
7.44
7.43
7.41
7.40
7.37
7.26
7.25
7.24
3.87
2.05
0.97
2.12
4.03
4.15
1.12
2.00
f1 (ppm)


149.92
148.41
135.99
134.24
130.02
128.69
128.54
128.36
127.98
126.53
125.91
123.88
117.97
116.31
111.27
77.44
77.23
77.02
29.24
f1 (ppm)

3y


7.94
7.48
7.42
7.41
7.37
6.83
6.82
6.82
3.88
0.92
2.11
6.98
1.03
0.90
0.98
2.00
fl (ppm)


144.63
139.67
135.54
134.23
132.59
132.51
129.97
128.37
128.24
127.57
127.49
127.14
126.40
125.53
117.69
115.58
111.13
77.44
77.23
77.02
29.36
fl (ppm)