Electronic Supplementary Material (ESI) for ChemComm.

Supporting Information

Synergy of anodic oxidation and cathodic reduction leads to electrochemical deoxygenative C2 arylation of quinoline *N*-oxides

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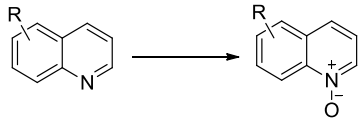
General information

Unless otherwise noted, materials were obtained from commercial suppliers and used without further purification. The instrument for electrolysis is dual display potentiostat (DJS-292B) (made in China). The anodic electrode was graphite rod (ϕ 6 mm) and cathodic electrode was platinum plate (15 mm×15 mm×0.3 mm). Thin layer chromatography (TLC) employed glass 0.25 mm silica gel plates. Flash chromatography columns were packed with 300-400 mesh silica gel in petroleum (boiling point is between 60-90 ^{o}C). Gradient flash chromatography was conducted eluting with a continuous gradient from petroleum to the indicated solvent, and they are listed as volume/volume ratios. NMR spectra were recorded on a Bruker spectrometer at 400 MHz (^{1}H NMR), 100 MHz (^{13}C NMR), 376 MHz (^{19}F NMR).

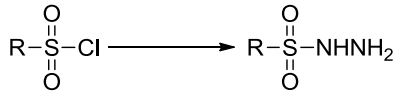
Experimental procedure

General procedure for the preparation of quinoline-*N*-oxides [1]



To a mixture of quinoline (10.0 mmol) in AcOH (20 mL) was added H_2O_2 (30 wt%, 1.40 mL) at room temperature. The reaction mixture was stirred at 70 ℃ for 36 h, and then was cooled to room temperature. The product was extracted with DCM (3 × 10 mL), and the combined organic layers were dried over Na_2SO_4. The solvent was removed under reduced pressure, and the residue obtained was purified via silica gel chromatography (eluent: ethyl acetate/methanol = 8/1) to afford quinoline *N*-oxide.

General procedure for the preparation of sulfonyl hydrazides [2]



The hydrazine monohydrate (30 mmol) was added dropwise into the solution of sulfonyl chloride (10 mmol) in THF (50 mL) under nitrogen at 0 ℃. Subsequently, the mixture was further stirred at 0 ℃ for 30 minutes. After the completion of the reaction, the solvent was removed by evaporation, and the residue was extracted with dichloromethane (3 x 20 mL), and the combined organic layer was washed with water, and brine, and dried over Na_2SO_4. Concentration in vacuum followed by silica gel column purification with petroleum ether/ethyl acetate eluent gave the desired product in yields range from 70-95%.

General procedure for electrochemical deoxygenative C2 arylation:

In an oven-dried undivided three-necked bottle (25 mL) equipped with a stir bar, quinoline-*N*-oxides **1** (0.5 mmol), sulfonyl hydrazides **2** (2 equiv.), and $^{n}Bu_4NBF_4$ (0.1 mmol, 32.9 mg) were combined and added. The bottle was equipped with graphite rod (ϕ 6 mm, about 16 mm immersion depth in solution) as the anode and platinum plate (15 mm × 15 mm × 0.3 mm) as the cathode and was then charged with nitrogen. Under the protection of N_2, HFIP (1.0 mL), and MeCN (9.0 mL) were injected respectively into the tubes via syringes. The reaction mixture was

stirred and electrolyzed at a constant current of 24 mA at 70 ^{o}C for 2.5 h. When the reaction was finished, the pure product was obtained by flash column chromatography on silica gel (petroleum ether/ethyl acetate = 10/1).

Procedure for gram scale synthesis of 3aa:

In an oven-dried undivided three-necked bottle equipped with a stir bar, quinoline-*N*-oxide **1a** (5 mmol, 725 mg), *p*-tosylsulfonyl hydrazide **2a** (2 equiv., 1.9 g), and $^{n}Bu_4NBF_4$ (1 mmol, 329 mg) were combined and added. The bottle was equipped with graphite rod (ϕ 6 mm, about 16 mm immersion depth in solution) as the anode and platinum plate (15 mm × 15 mm × 0.3 mm) as the cathode and was then charged with nitrogen. Under the protection of N_2, HFIP (10 mL), and MeCN (90 mL) were injected respectively into the tubes via syringes. The reaction mixture was stirred and electrolyzed at a constant current of 24 mA at 70 ^{o}C for 25 h. When the reaction was finished, the pure product was obtained by flash column chromatography on silica gel (petroleum ether/ethyl acetate = 10/1).

Procedure for cyclic voltammetry (CV):

Cyclic voltammetry was performed in a three-electrode cell connected to a Schlenk line under nitrogen at room temperature. The working electrode was a steady glassy carbon disk electrode while the counter electrode was a platinum wire. The reference was an Ag/AgCl electrode submerged in saturated aqueous KCl solution. A mixed solvent (MeCN/HFIP = 9/1, 10 mL) containing $^{n}Bu_4NBF_4$ (0.1 mmol) was poured into the electrochemical cell in cyclic voltammetry experiments. The scan rate was 0.10 V/s, ranging from 0 V to 2.5 V.

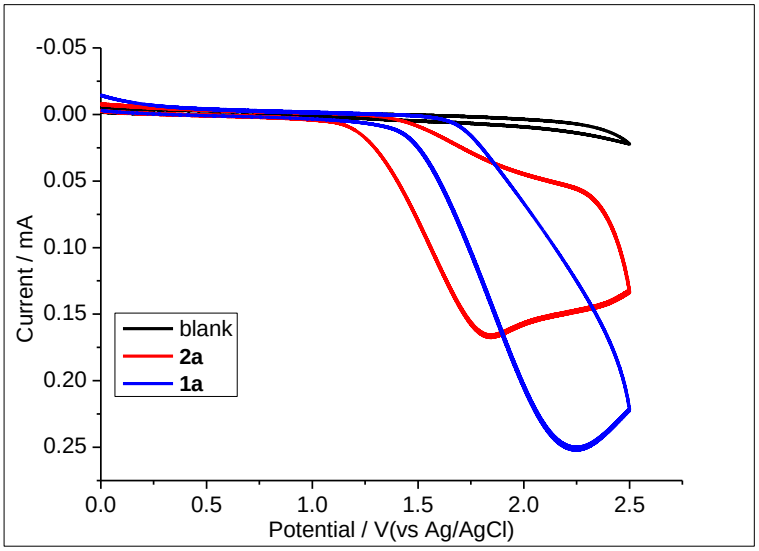
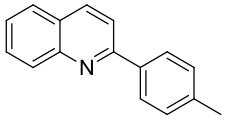
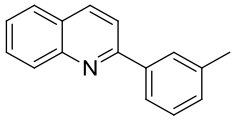


Figure S1. Cyclic voltammogram: **1a**, 0.1 mmol, **2a**, 0.1 mmol.

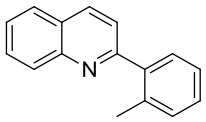
Detailed descriptions for products



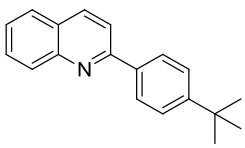
2-(*p*-Tolyl)quinoline (3aa).[3] Yellowish solid (79.2 mg, 72%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.36 (d, *J* = 8.5 Hz, 1H), 8.21 – 8.14 (m, 2H), 8.02 (d, *J* = 8.3 Hz, 2H), 7.86 (d, *J* = 8.2 Hz, 1H), 7.80 – 7.75 (m, 1H), 7.68 – 7.61 (m, 1H), 7.32 (d, *J* = 8.1 Hz, 2H), 2.40 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 158.4, 147.4, 144.7, 138.6, 136.1, 130.9, 130.4, 129.7, 129.1, 129.0, 128.8, 127.6, 117.6, 21.6.



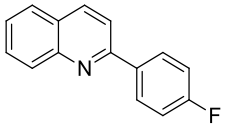
2-(*m*-Tolyl)quinoline (3ab).[3] Yellowish solid (56 mg, 52%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.38 (d, *J* = 8.5 Hz, 1H), 8.20 (t, *J* = 8.1 Hz, 2H), 7.97 – 7.85 (m, 3H), 7.79 (ddd, *J* = 8.4, 6.9, 1.4 Hz, 1H), 7.69 – 7.62 (m, 1H), 7.40 (t, *J* = 6.4 Hz, 2H), 2.42 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 158.2, 147.5, 139.3, 139.0, 138.7, 134.5, 130.9, 130.4, 129.2, 129.1, 128.9, 128.8, 127.7, 126.2, 117.8, 21.3.



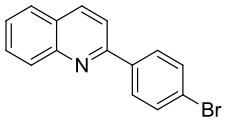
2-(*o*-Tolyl)quinoline (3ac).[3] Canary yellow solid (57.2 mg, 52%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.39 (d, *J* = 8.5 Hz, 1H), 8.31 (dd, *J* = 7.9, 1.1 Hz, 1H), 8.18 (d, *J* = 8.6 Hz, 1H), 8.11 (d, *J* = 8.5 Hz, 1H), 7.89 (d, *J* = 7.9 Hz, 1H), 7.80 – 7.74 (m, 1H), 7.70 – 7.62 (m, 1H), 7.50 (td, *J* = 7.5, 1.3 Hz, 1H), 7.42 (t, *J* = 7.7 Hz, 1H), 7.25 (d, *J* = 8.5 Hz, 1H), 2.56 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 158.2, 147.2, 139.1, 138.6, 137.2, 133.8, 132.4, 130.9, 130.6, 130.4, 129.1, 128.9, 127.7, 126.4, 117.7, 20.7.



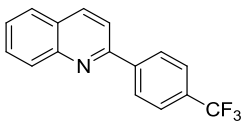
2-(4-(Tert-butyl)phenyl)quinoline (3ad).[4] Yellowish solid (80 mg, 62%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.36 (d, *J* = 8.5 Hz, 1H), 8.27 – 8.14 (m, 2H), 8.06 (d, *J* = 8.5 Hz, 2H), 7.87 (d, *J* = 8.1 Hz, 1H), 7.78 (t, *J* = 7.7 Hz, 1H), 7.65 (t, *J* = 7.5 Hz, 1H), 7.54 (d, *J* = 8.5 Hz, 2H), 1.30 (s, 9H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 158.4, 157.6, 147.4, 138.6, 136.2, 130.9, 130.4, 129.1, 128.8, 128.7, 127.7, 126.1, 117.8, 35.2, 31.0.



2-(4-Fluorophenyl)quinoline (3ae).[4] Yellowish solid (90.6 mg, 81%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.40 (d, *J* = 8.5 Hz, 1H), 8.23 – 8.12 (m, 4H), 7.89 (d, *J* = 8.2 Hz, 1H), 7.83 – 7.76 (m, 1H), 7.71 – 7.63 (m, 1H), 7.25 – 7.16 (m, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 165.9 (d, *J* = 256.5 Hz), 158.0, 147.4, 138.8, 135.0, 132.0 (d, *J* = 9.7 Hz), 131.1, 130.3, 129.3, 128.9, 127.7, 117.4, 116.4 (d, *J* = 22.7 Hz). **^{19}F NMR** (376 MHz, $CDCl_3$) δ -103.39.

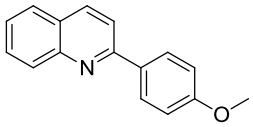


2-(4-Bromophenyl)quinoline (3af).[4] Yellowish solid (64.0 mg, 51%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.40 (d, *J* = 8.5 Hz, 1H), 8.20 (d, *J* = 8.5 Hz, 1H), 8.15 (d, *J* = 8.5 Hz, 1H), 8.01 (d, *J* = 8.5 Hz, 2H), 7.89 (d, *J* = 8.1 Hz, 1H), 7.80 (t, *J* = 7.6 Hz, 1H), 7.74 – 7.58 (m, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 157.7, 147.4, 138.8, 138.0, 132.3, 131.1, 130.6, 130.3, 129.3, 129.2, 128.8, 127.7, 117.4.

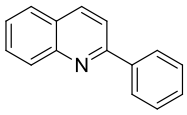


2-(4-(Trifluoromethyl)phenyl)quinoline (3ag).[5] Yellowish solid (56.0 mg, 41%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.43 (d, *J* = 8.5 Hz, 1H), 8.30 (d, *J* = 8.2 Hz, 2H), 8.25 (d, *J* = 8.5 Hz, 1H), 8.15 (d, *J* = 8.6 Hz, 1H), 7.90 (d, *J* = 8.2 Hz, 1H), 7.85 – 7.77 (m, 3H), 7.69 (dd, *J* = 11.1, 3.9 Hz, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 157.3, 147.4, 142.6, 139.0, 135.2 (q, *J* = 33.1 Hz), 131.2, 130.2, 129.7,

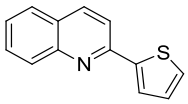
129.5, 128.9, 127.7, 126.1 (q, *J* = 3.6 Hz), 123.1 (q, *J* = 272.0 Hz), 117.5. **^{19}F NMR** (376 MHz, $CDCl_3$) δ -63.21.



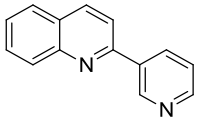
2-(3-Methoxyphenyl)quinoline (3ah).[4] Yellowish solid (32.9 mg, 28%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.36 (d, *J* = 8.5 Hz, 1H), 8.18 (dd, *J* = 8.3, 5.7 Hz, 2H), 8.07 (d, *J* = 8.7 Hz, 2H), 7.87 (d, *J* = 8.2 Hz, 1H), 7.78 (t, *J* = 7.7 Hz, 1H), 7.65 (t, *J* = 7.5 Hz, 1H), 7.00 (d, *J* = 8.7 Hz, 2H), 3.84 (s, 3H). **^{13}C NMR** (100 MHz, CDCl3) δ 163.9, 158.7, 147.4, 138.6, 131.3, 130.9, 130.5, 130.4, 129.0, 128.7, 127.7, 117.5, 114.4, 55.6.



2-Phenylquinoline (3ai).[4] Yellowish solid (64 mg, 62%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.38 (d, *J* = 8.5 Hz, 1H), 8.24 – 8.13 (m, 4H), 7.87 (d, *J* = 8.2 Hz, 1H), 7.81 – 7.75 (m, 1H), 7.69 – 7.50 (m, 4H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 158.1, 147.4, 139.1, 138.7, 133.7, 131.0, 130.4, 129.2, 129.1, 129.0, 128.8, 127. 7, 117.7.

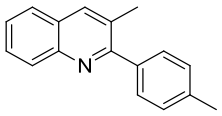


2-(Thiophen-2-yl)quinoline (3aj).[3] White solid (35 mg, 33%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.40 (d, *J* = 8.6 Hz, 1H), 8.21 (d, *J* = 8.5 Hz, 2H), 7.95 – 7.87 (m, 2H), 7.82 (dd, *J* = 11.3, 4.1 Hz, 1H), 7.76 – 7.65 (m, 2H), 7.17 – 7.11 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 158.0, 147.4, 139.7, 138.8, 135.3, 135.2, 131.1, 130.3, 129.3, 128.9, 127.8, 127.7, 117.3.

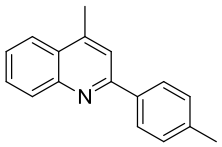


2-(Pyridin-3-yl)quinoline (3ak).[3] Yellowish solid (65.9 mg, 64%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.34 (d, *J* = 1.7 Hz, 1H), 8.83 (dd, *J* = 4.9, 1.5 Hz, 1H), 8.48 – 8.41 (m, 2H), 8.25 (d, *J* = 8.5 Hz,

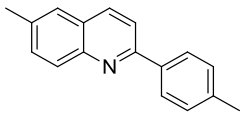
1H), 8.13 (d, *J* = 8.6 Hz, 1H), 7.91 (d, *J* = 8.2 Hz, 1H), 7.84 – 7.77 (m, 1H), 7.72 – 7.66 (m, 1H), 7.55 – 7.47 (m, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 157.5, 154.1, 150.1, 147.4, 139.0, 136.9, 135.6, 131.3, 130.3, 129.5, 129.0, 127.8, 123.6, 117.3.



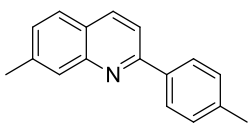
3-Methyl-2-(*p*-tolyl)quinoline (3ba).[6] Yellowish solid (76.9 mg, 67%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.04 (d, *J* = 2.8 Hz, 1H), 7.98 – 7.89 (m, 3H), 7.79 – 7.72 (m, 1H), 7.68 – 7.54 (m, 2H), 7.39 – 7.32 (m, 2H), 2.86 (d, *J* = 3.8 Hz, 3H), 2.46 (d, *J* = 3.8 Hz, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 157.0, 144.6, 144.4, 139.8, 135.8, 129.9, 129.7, 129.4, 129.3, 129.1, 128.9, 128.5, 126.6, 21.6, 18.8.



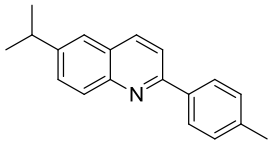
4-Methyl-2-(*p*-tolyl)quinoline (3ca).[6] Yellowish solid (83.3 mg, 72%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.16 (d, *J* = 8.5 Hz, 1H), 8.05 – 7.98 (m, 4H), 7.78 – 7.72 (m, 1H), 7.69 – 7.63 (m, 1H), 7.32 (d, *J* = 8.1 Hz, 2H), 2.78 (s, 3H), 2.40 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 158.0, 147.8, 147.2, 144.6, 136.3, 131.1, 130.5, 129.7, 129.0, 128.8, 128.7, 123.8, 118.0, 21.6, 19.1.



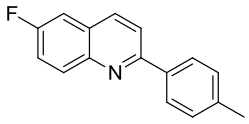
6-Methyl-2-(*p*-tolyl)quinoline (3da).[3] Yellowish solid (83.3 mg, 72%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.25 (d, *J* = 8.5 Hz, 1H), 8.14 (d, *J* = 8.5 Hz, 1H), 8.03 (dd, *J* = 17.9, 8.4 Hz, 3H), 7.64 – 7.58 (m, 2H), 7.32 (d, *J* = 8.1 Hz, 2H), 2.54 (s, 3H), 2.39 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 157.5, 146.1, 144.6, 139.5, 137.7, 136.4, 133.3, 130.0, 129.7, 129.0, 128.9, 126.4, 117.7, 21.7, 21.6. **HRMS (EI)** Calcd for $C_{17}H_{15}N$ **[M^+]**: 233.1204 Found: m/z 233.1199.



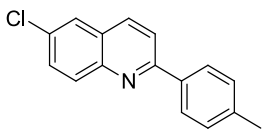
7-Methyl-2-(*p*-tolyl)quinoline (3ea). Yellowish solid (74.1 mg, 62%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.30 (d, *J* = 8.5 Hz, 1H), 8.12 (d, *J* = 8.5 Hz, 1H), 8.01 (d, *J* = 8.3 Hz, 2H), 7.94 (s, 1H), 7.75 (d, *J* = 8.4 Hz, 1H), 7.47 (dd, *J* = 8.4, 1.3 Hz, 1H), 7.32 (d, *J* = 8.1 Hz, 2H), 2.54 (s, 3H), 2.39 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 158.3, 147.7, 144.6, 141.6, 138.2, 136.3, 131.4, 129.7, 129.2, 129.0, 127.2, 126.9, 116.8, 21.8, 21.6. **HRMS (ESI)** Calcd for $C_{17}H_{16}N$ **[M+H$^+$]**: 234.1277 Found: m/z 234.1284.



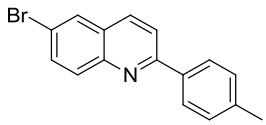
6-Isopropyl-2-(*p*-tolyl)quinoline (3fa). Yellowish solid (84.0 mg, 66%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.29 (d, *J* = 8.5 Hz, 1H), 8.13 (dd, *J* = 20.3, 8.7 Hz, 2H), 8.00 (d, *J* = 8.3 Hz, 2H), 7.71 – 7.62 (m, 2H), 7.31 (d, *J* = 8.1 Hz, 2H), 3.13 – 3.06 (m, 1H), 2.39 (s, 3H), 1.33 (d, *J* = 6.9 Hz, 6H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 157.5, 150.2, 146.4, 144.6, 138.1, 136.5, 131.0, 130.2, 129.7, 129.0, 128.9, 123.6, 117.7, 34.2, 23.6, 21.6. **HRMS (ESI)** Calcd for $C_{19}H_{20}N$ **[M+H]$^+$**: 262.1590 Found: m/z 262.1589.



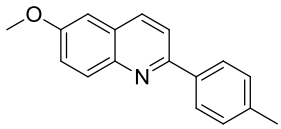
6-Fluoro-2-(*p*-tolyl)quinoline (3ga). Yellowish solid (72 mg, 61%)**. ^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.32 (d, *J* = 8.6 Hz, 1H), 8.25 – 8.14 (m, 2H), 8.01 (d, *J* = 8.2 Hz, 2H), 7.61 – 7.52 (m, 1H), 7.48 (dd, *J* = 8.5, 2.6 Hz, 1H), 7.34 (d, *J* = 8.1 Hz, 2H), 2.41 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 144.7 (d, *J* = 148.0 Hz), 138.0, 137.9, 136.0, 133.2, 133.1, 129.8, 129.1, 121.7, 121.4, 118.5, 110.9, 110.6, 21.6. **^{19}F NMR** (376 MHz, $CDCl_3$) δ -108.40. **HRMS (ESI)** Calcd for $C_{16}H_{13}FN$ **[M+H]$^+$**: 238.1207 Found: m/z 238.1209.



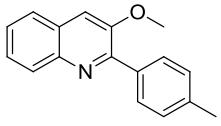
6-Chloro-2-(*p*-tolyl)quinoline (3ha).[7] Yellowish solid (38.0 mg, 30%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.28 (d, *J* = 8.6 Hz, 1H), 8.21 (d, *J* = 8.6 Hz, 1H), 8.10 (d, *J* = 9.1 Hz, 1H), 8.01 (d, *J* = 8.3 Hz, 2H), 7.86 (d, *J* = 2.2 Hz, 1H), 7.71 (dd, *J* = 9.1, 2.3 Hz, 1H), 7.34 (d, *J* = 8.1 Hz, 2H), 2.41 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 158.7, 145.8, 145.0, 137.7, 135.9, 135.2, 132.0, 131.9, 129.8, 129.3, 129.1, 126.3, 118.6, 21.6.



6-Bromo-2-(*p*-tolyl)quinoline (3ia). Yellowish solid (92 mg, 62%)**. ^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.24 (dd, *J* = 26.6, 8.6 Hz, 2H), 8.08 – 7.97 (m, 4H), 7.84 (dd, *J* = 9.0, 1.9 Hz, 1H), 7.34 (d, *J* = 8.1 Hz, 2H), 2.41 (s, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 158.8, 146.0, 145.0, 137.6, 135.8, 134.5, 131.9, 129.8, 129.7, 129.1, 123.5, 118.6, 21.6. **HRMS (EI)** Calcd for $C_{16}H_{12}BrN$ **[M]$^+$**: 297.0153 Found: m/z 297.0158.

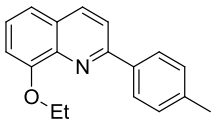


6-Methoxy-2-(*p*-tolyl)quinoline (3ja). Yellowish solid (71 mg, 57%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.20 (d, *J* = 8.6 Hz, 1H), 8.12 (d, *J* = 8.5 Hz, 1H), 8.02 (dd, *J* = 15.9, 8.7 Hz, 3H), 7.47 – 7.37 (m, 1H), 7.29 (t, *J* = 8.8 Hz, 2H), 7.08 (d, *J* = 2.5 Hz, 1H), 3.93 (s, 3H), 2.38 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 159.8, 155.8, 144.6, 143.6, 136.8, 136.6, 131.8, 130.4, 129.7, 128.9, 124.2, 118.2, 104.7, 55.7, 21.6. **HRMS (EI)** Calcd for $C_{17}H_{15}NO$ **[M$^+$]**: 249.1154 Found: m/z 249.1160.

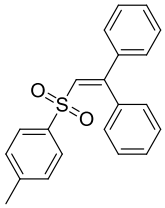


3-Methoxy-2-(*p*-tolyl)quinoline (3ka). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.11 (d, *J* = 9.0 Hz, 1H), 7.96 (d, *J* = 8.1 Hz, 2H), 7.74 (dd, *J* = 5.9, 3.1 Hz, 1H), 7.58 (dd, *J* = 12.2, 8.4 Hz, 3H), 7.32 (d, *J* = 8.1 Hz, 2H), 3.96 (s, 3H), 2.44 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 150.4, 148.8, 144.5,

141.3, 136.4, 130.9, 130.4, 129.5, 129.4, 129.2 128.0, 126.2, 116.1, 56.1, 21.6. **HRMS (EI)** Calcd for $C_{17}H_{15}NO$ **[M^+]**: 249.1154 Found: m/z 249.1162.



8-Ethoxy-2-(*p*-tolyl)quinoline (3la). Yellowish solid (89 mg, 68%). **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.30 (d, *J* = 8.5 Hz, 1H), 8.18 (d, *J* = 8.5 Hz, 1H), 8.09 (d, *J* = 8.1 Hz, 2H), 7.52 (t, *J* = 8.0 Hz, 1H), 7.40 (d, *J* = 8.2 Hz, 1H), 7.33 (d, *J* = 8.0 Hz, 2H), 7.07 (d, *J* = 7.7 Hz, 1H), 4.21 (q, *J* = 6.9 Hz, 2H), 2.41 (s, 3H), 1.53 (t, *J* = 6.9 Hz, 3H).**^{13}C NMR** (100 MHz, $CDCl_3$) δ 157.2, 155.5, 144.6, 139.6, 138.2, 136.0, 130.1, 129.6, 129.5, 129.3, 119.2, 117.5, 111.1, 65.0, 21.6, 14.7. **HRMS (EI)** Calcd for $C_{18}H_{17}NO$ **[M^+]**: 263.1310 Found: m/z 263.1318



(2-Tosylethene-1,1-diyl)dibenzene (5a).[8] **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 8.0 Hz, 2H), 7.36 (dd, *J* = 13.4, 6.9 Hz, 2H), 7.29 (t, *J* = 7.3 Hz, 4H), 7.20 (d, *J* = 7.8 Hz, 2H), 7.12 (dd, *J* = 18.3, 7.8 Hz, 4H), 6.99 (s, 1H), 2.36 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 154.6, 143.7, 139.1, 138.5, 135.5, 130.1, 129.7, 129.2, 128.9, 128.7, 128.5, 128.1, 127.7, 127.6, 21.5.

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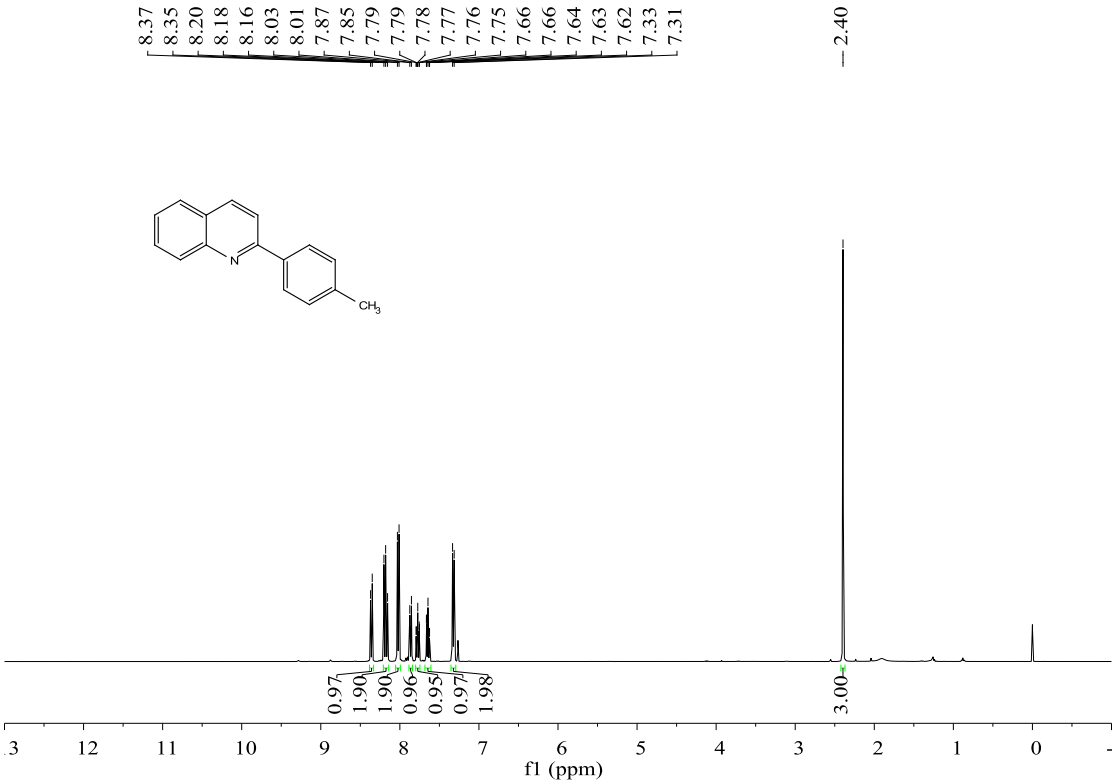
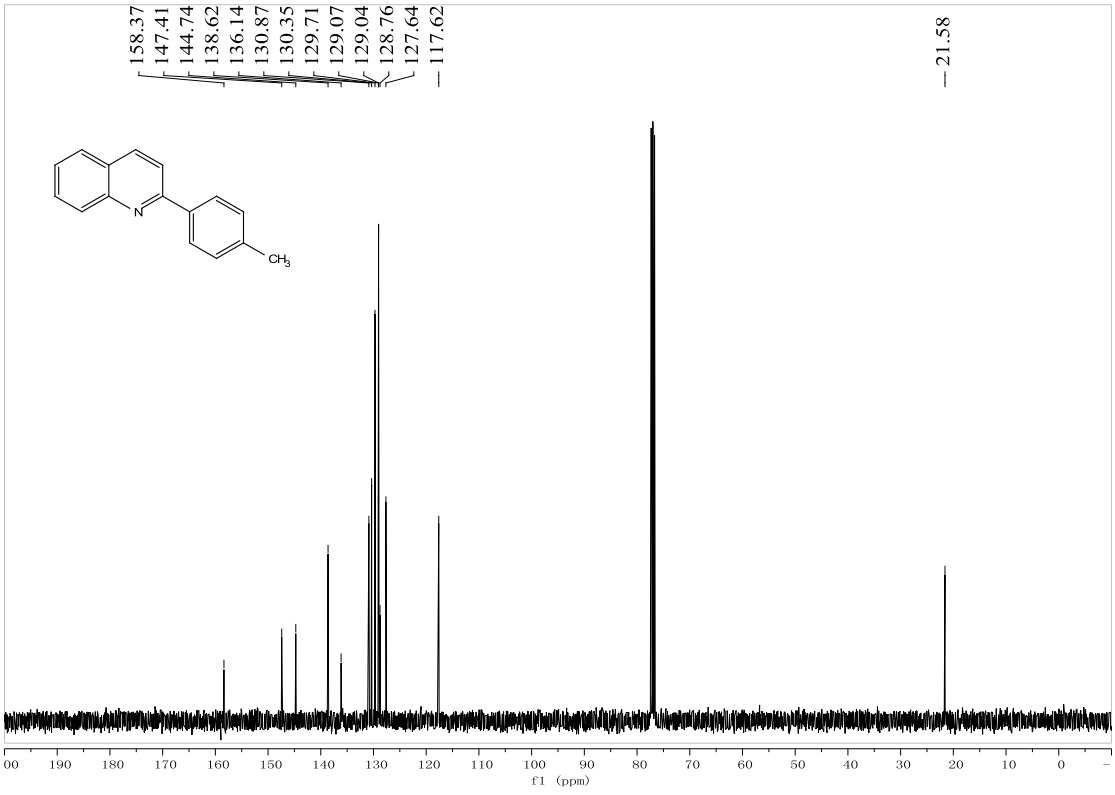
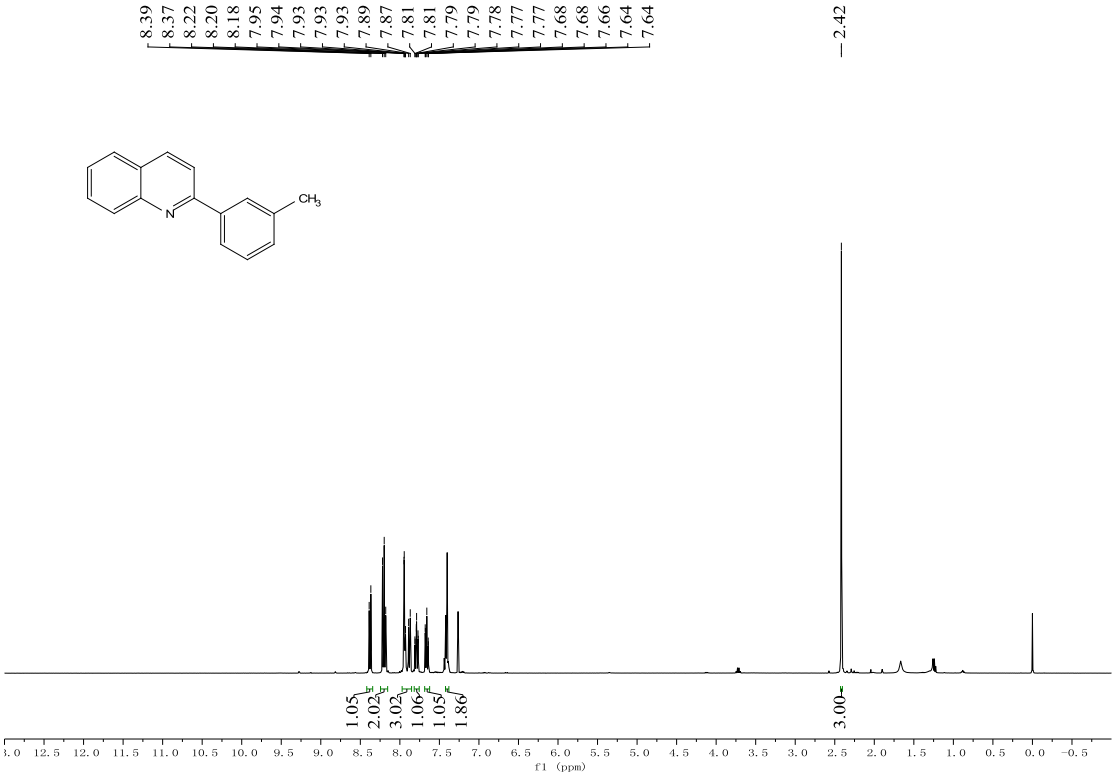
Copies of ^{1}H NMR, ^{13}C NMR and ^{19}F NMR spectra

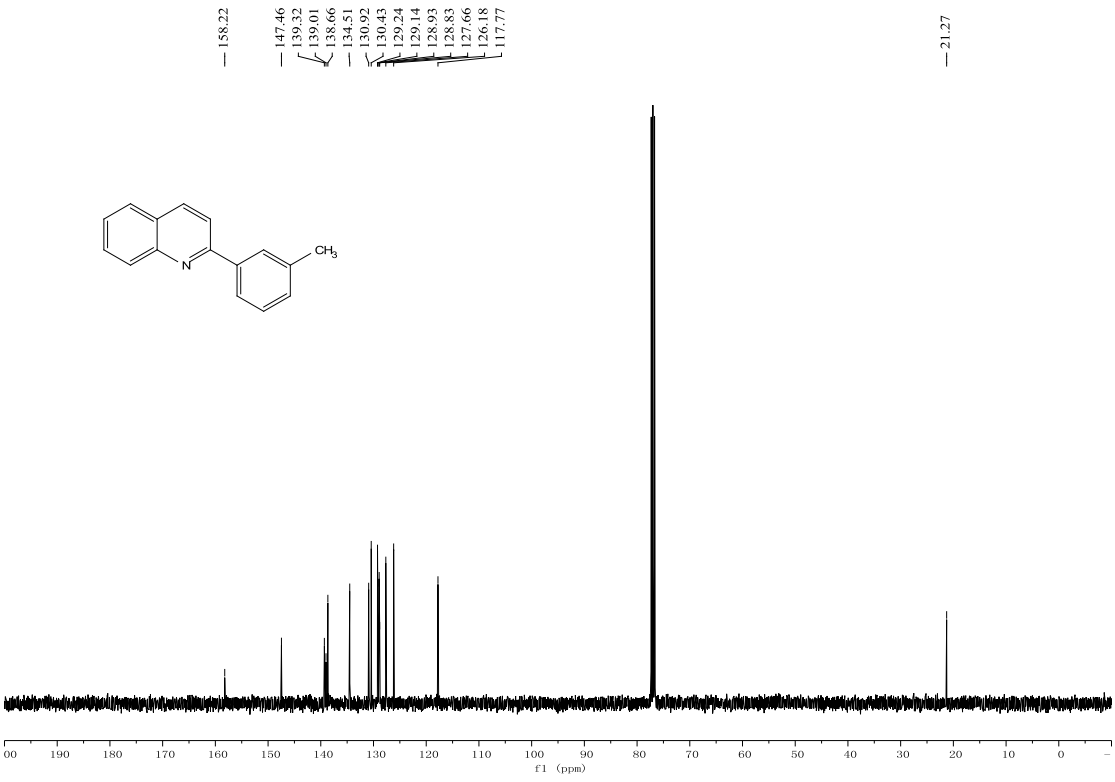
2-(*p*-Tolyl)quinolone (3aa)



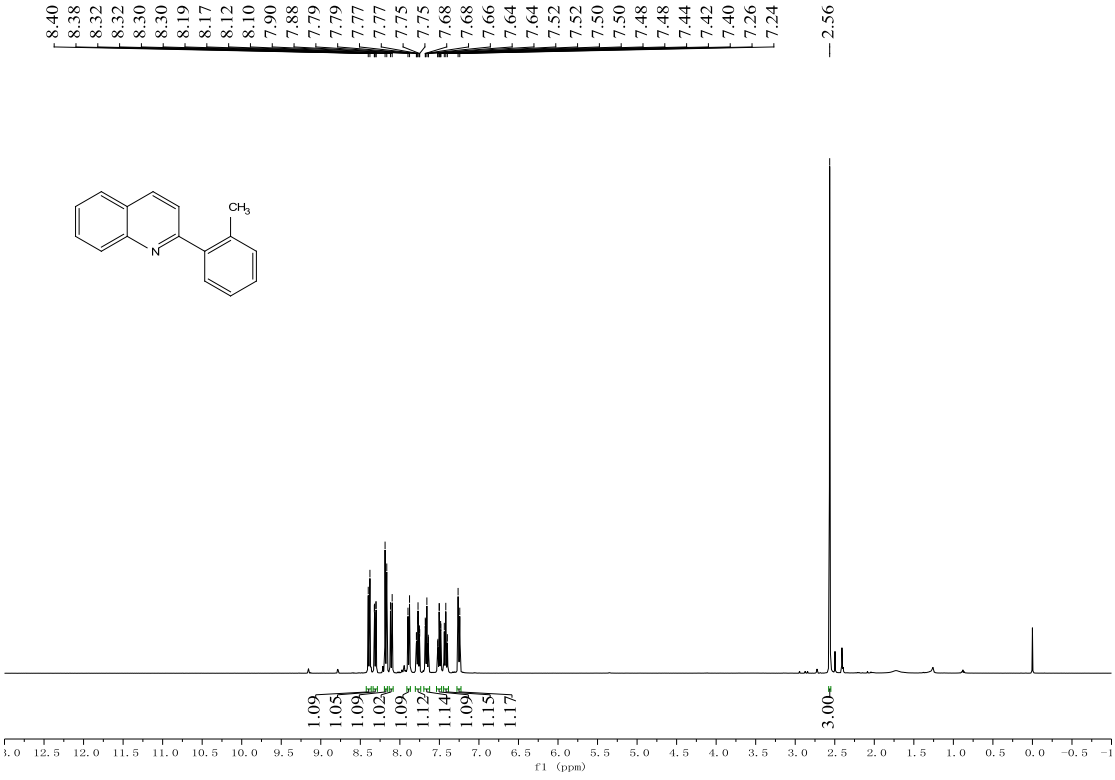


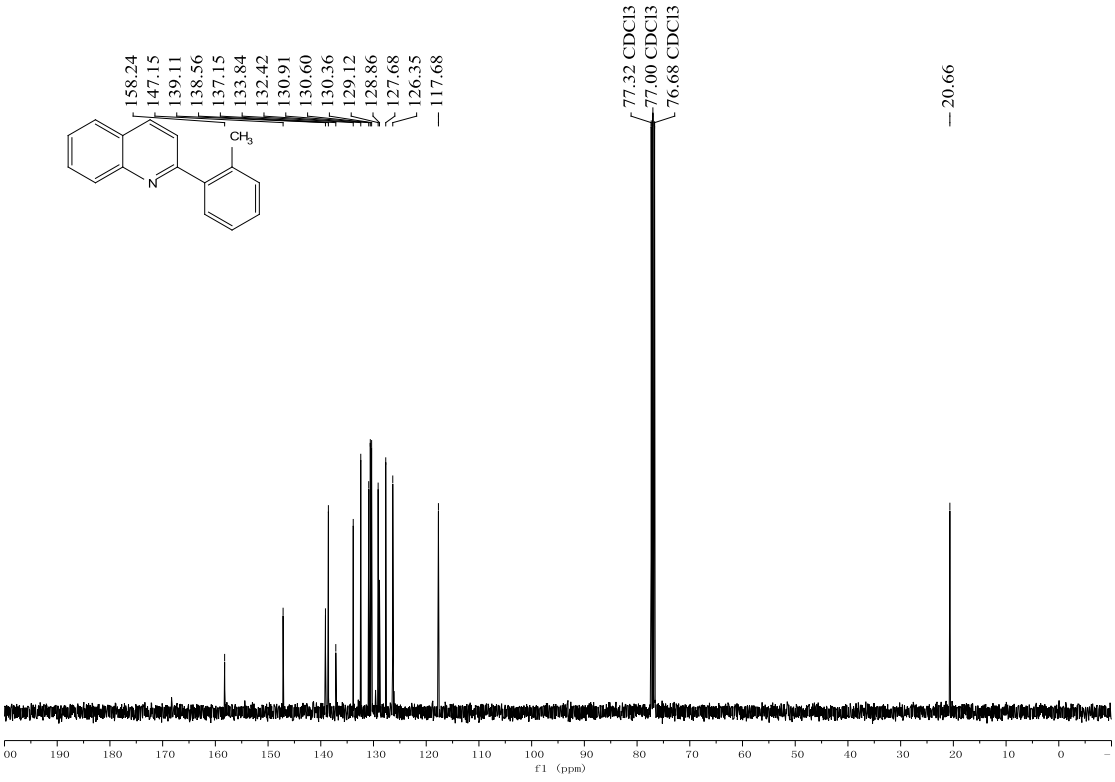
2-(*m*-Olyl)quinolone (3ab)



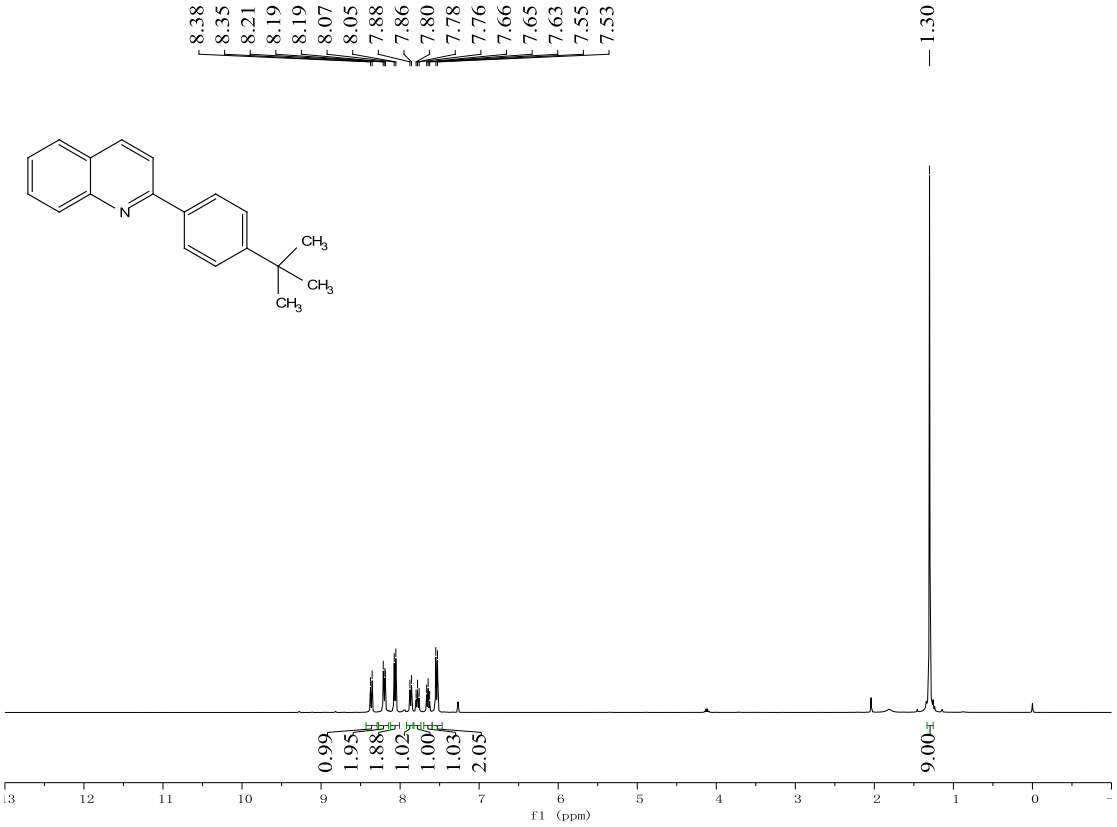


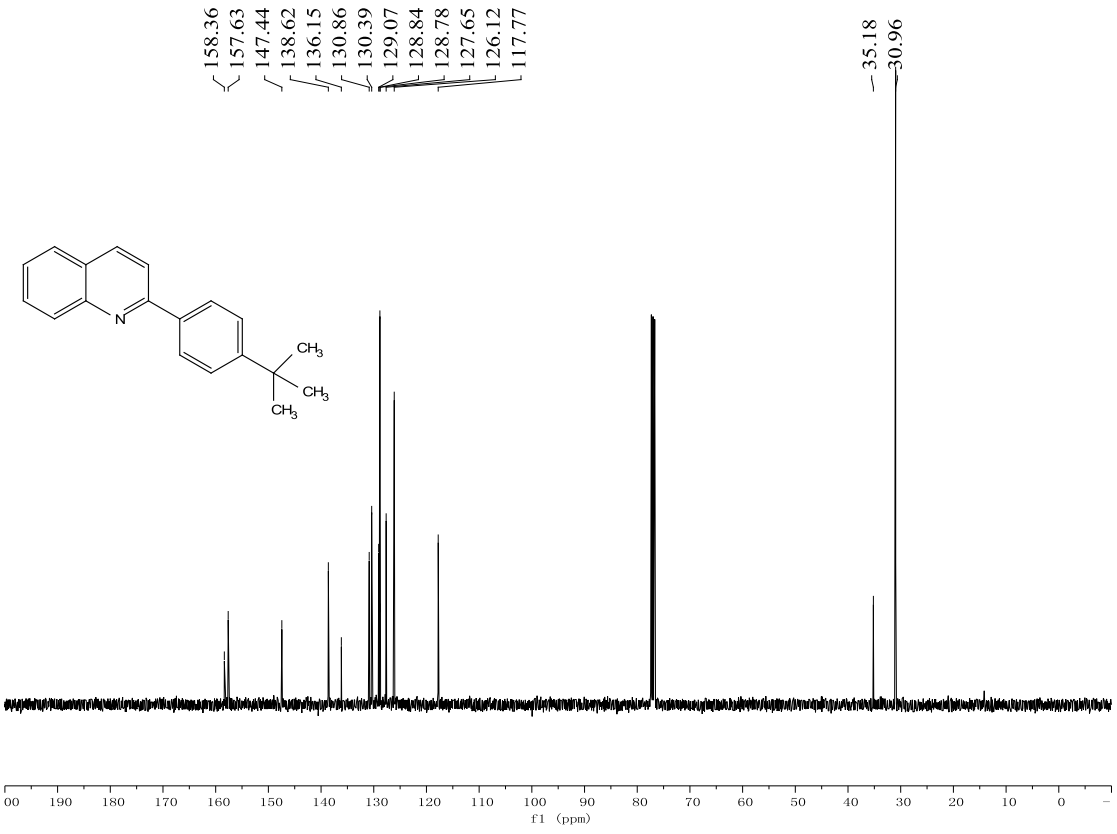
2-(*o*-Tolyl)quinolone (3ac)



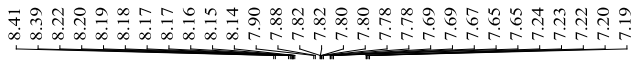


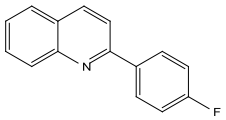
2-(4-(Tert-butyl)phenyl)quinoline (3ad)

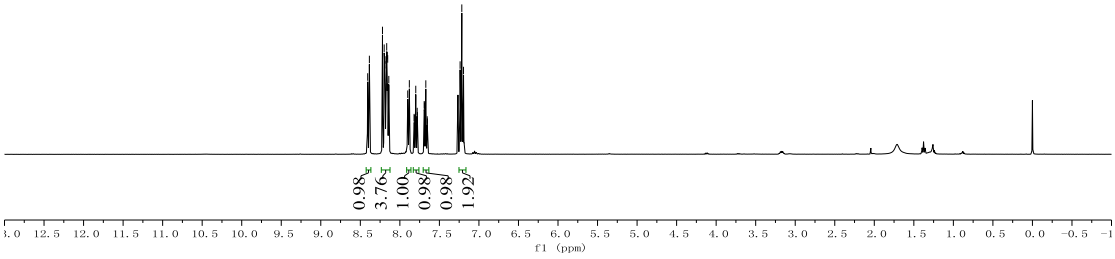


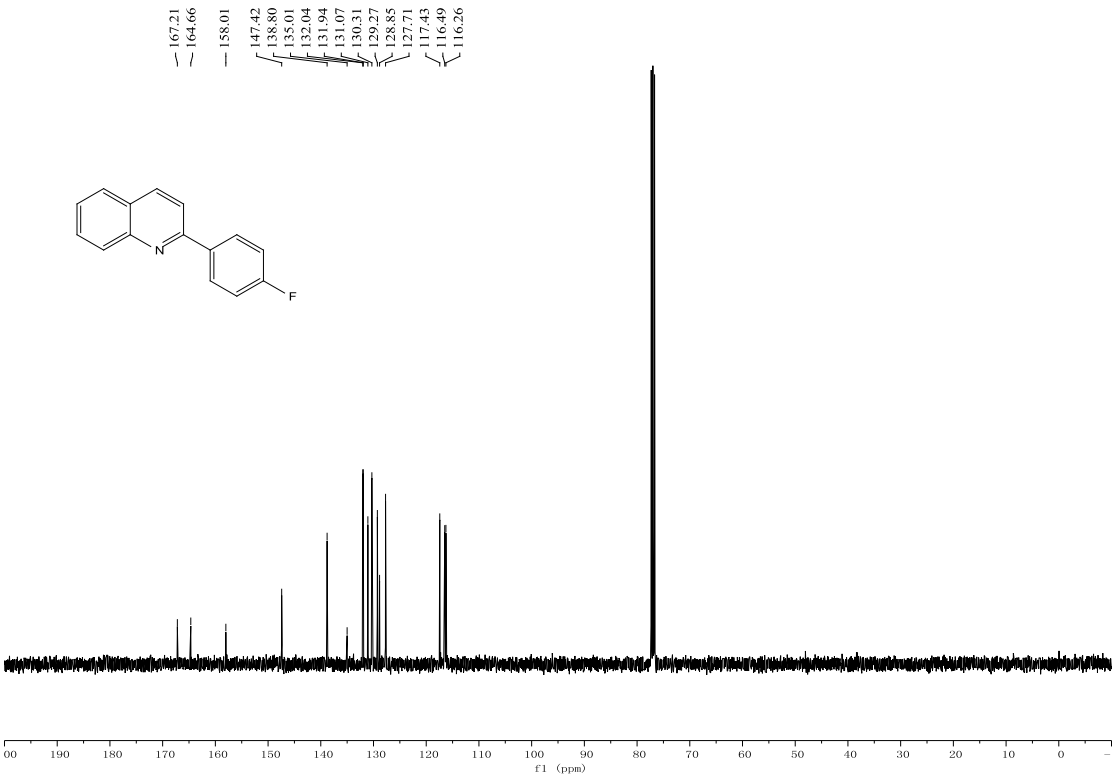


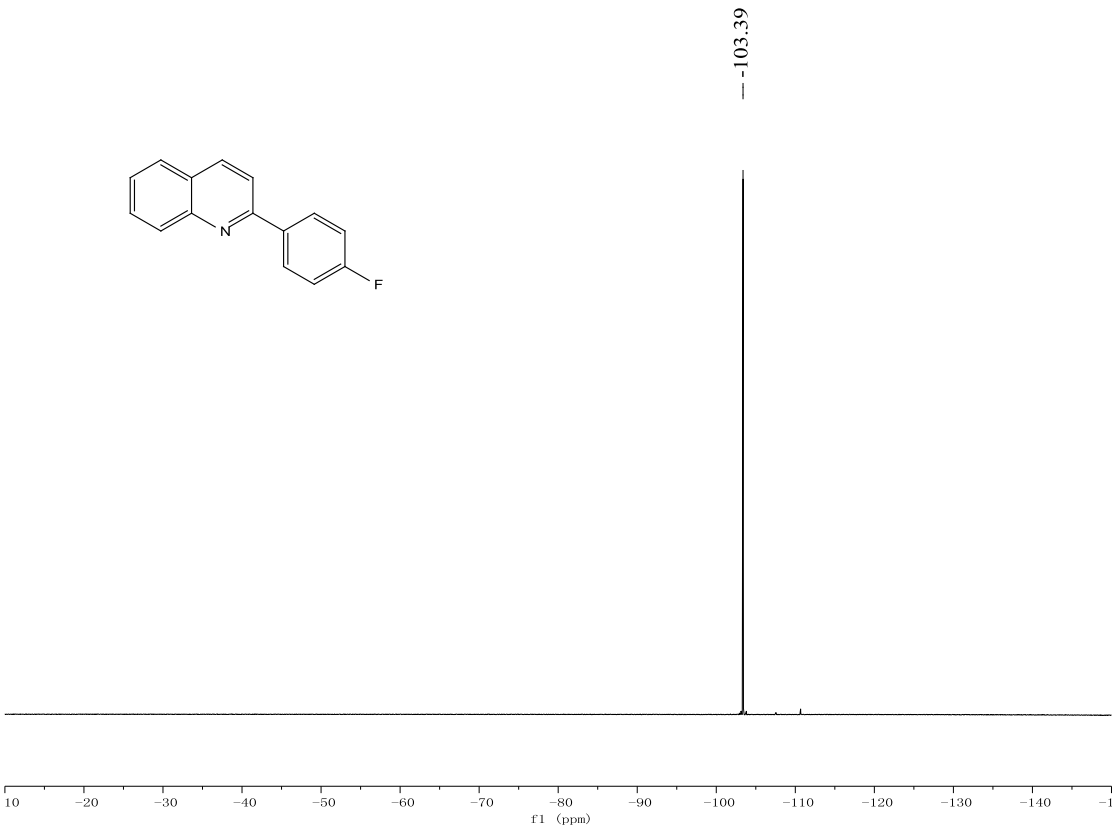
2-(4-Fluorophenyl)quinolone (3ae)







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−40
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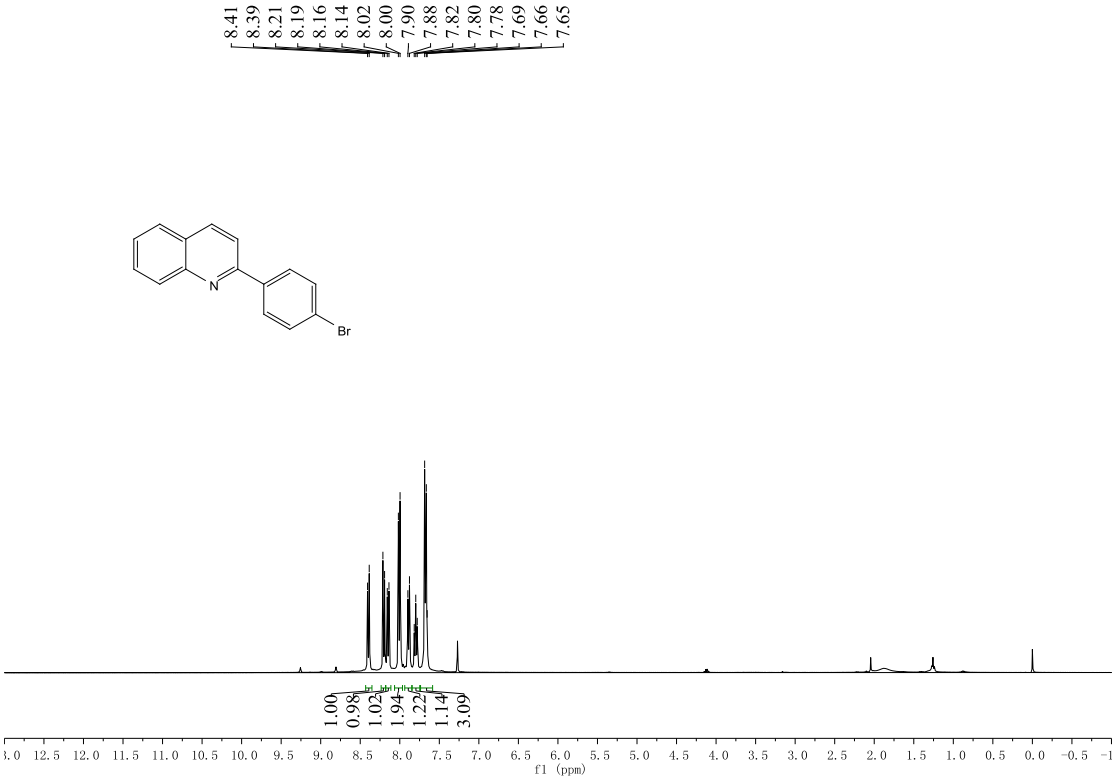
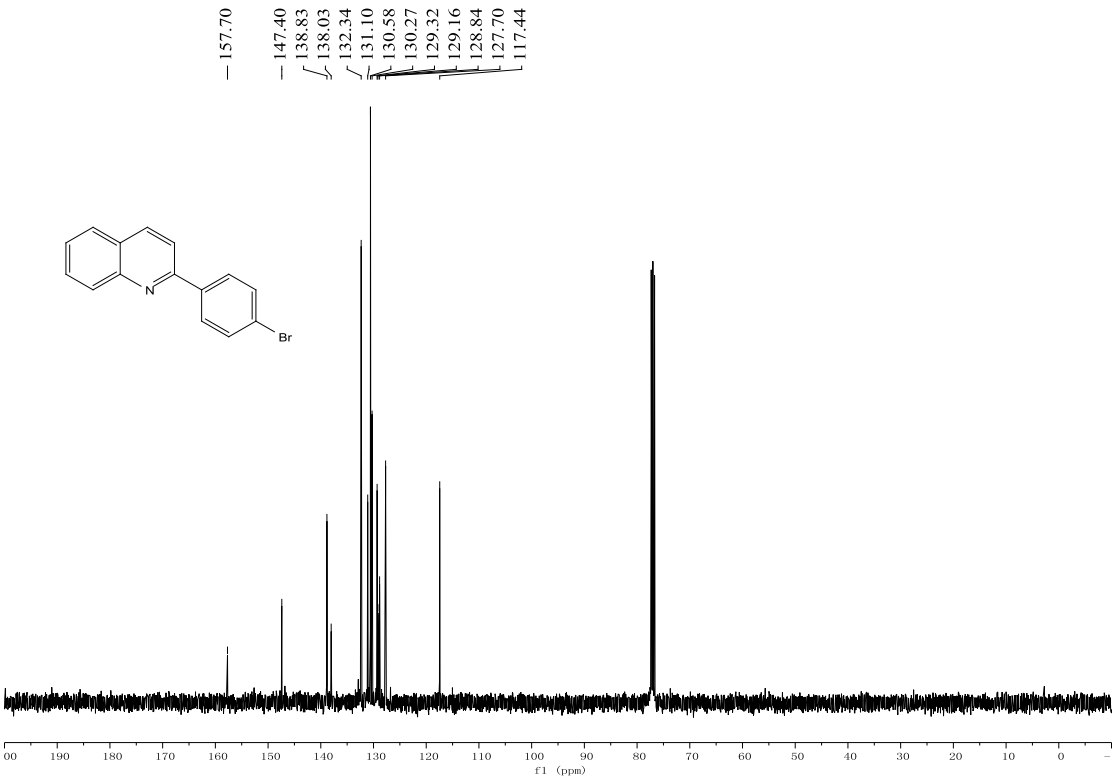
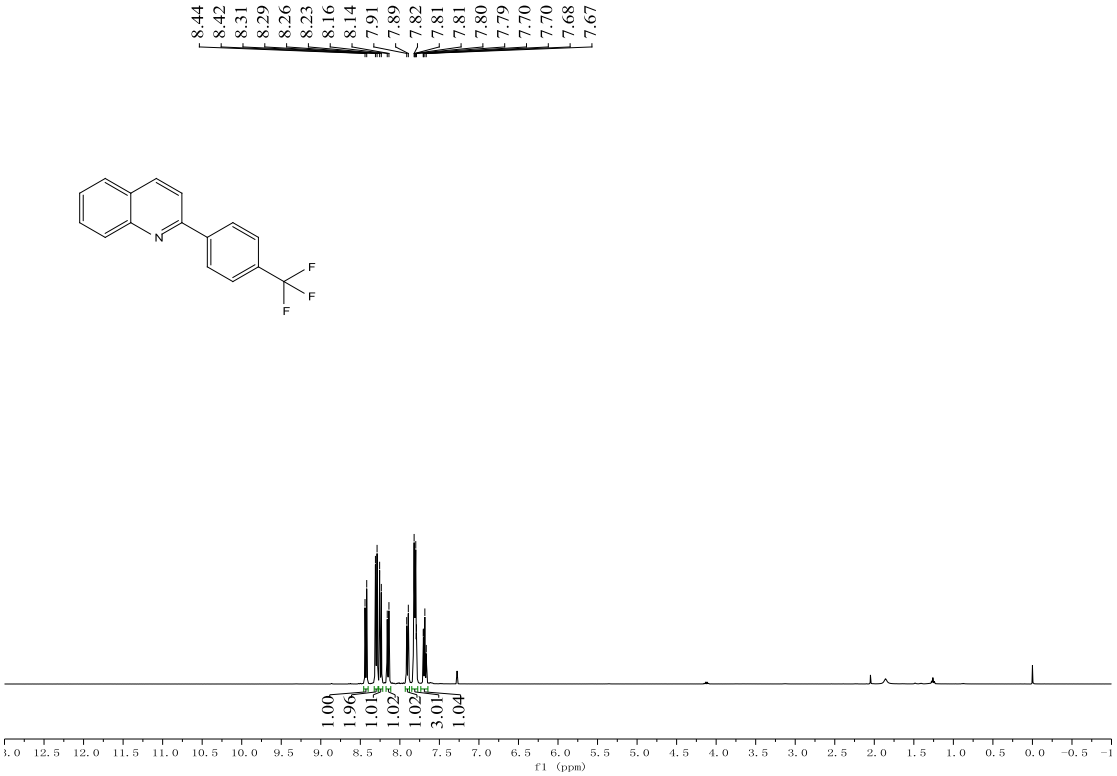
f1 (ppm)

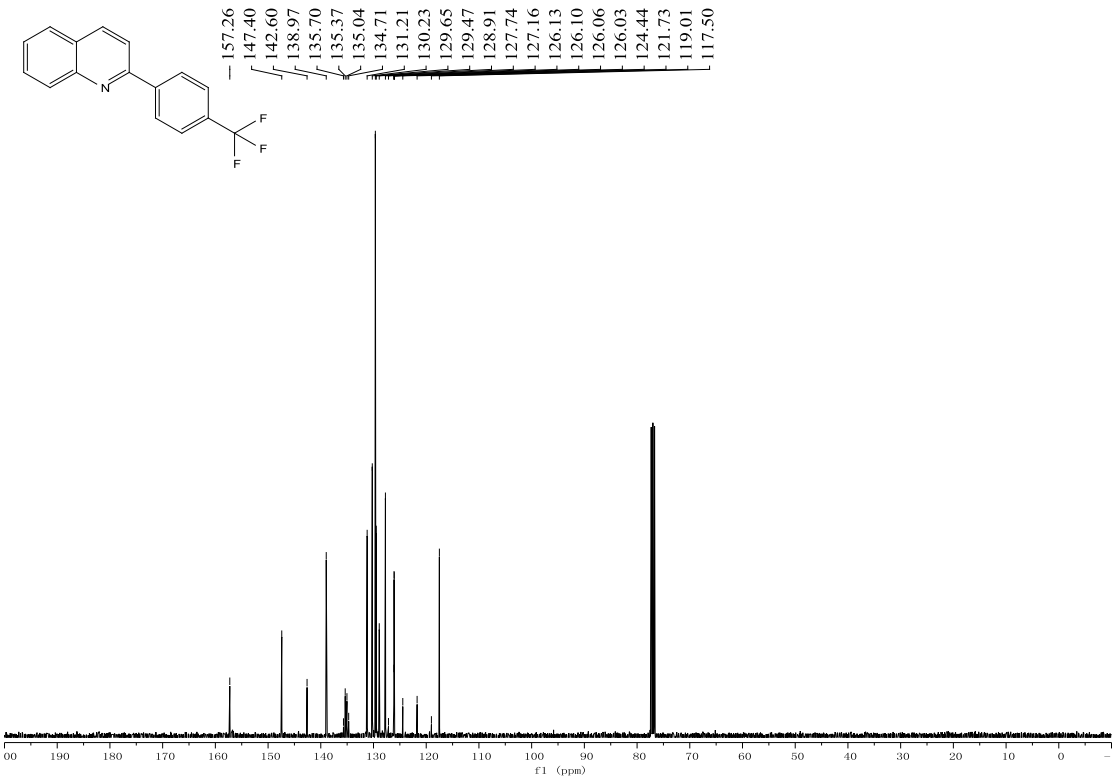
2-((4-Bromophenyl)sulfonyl)quinoline (3af)

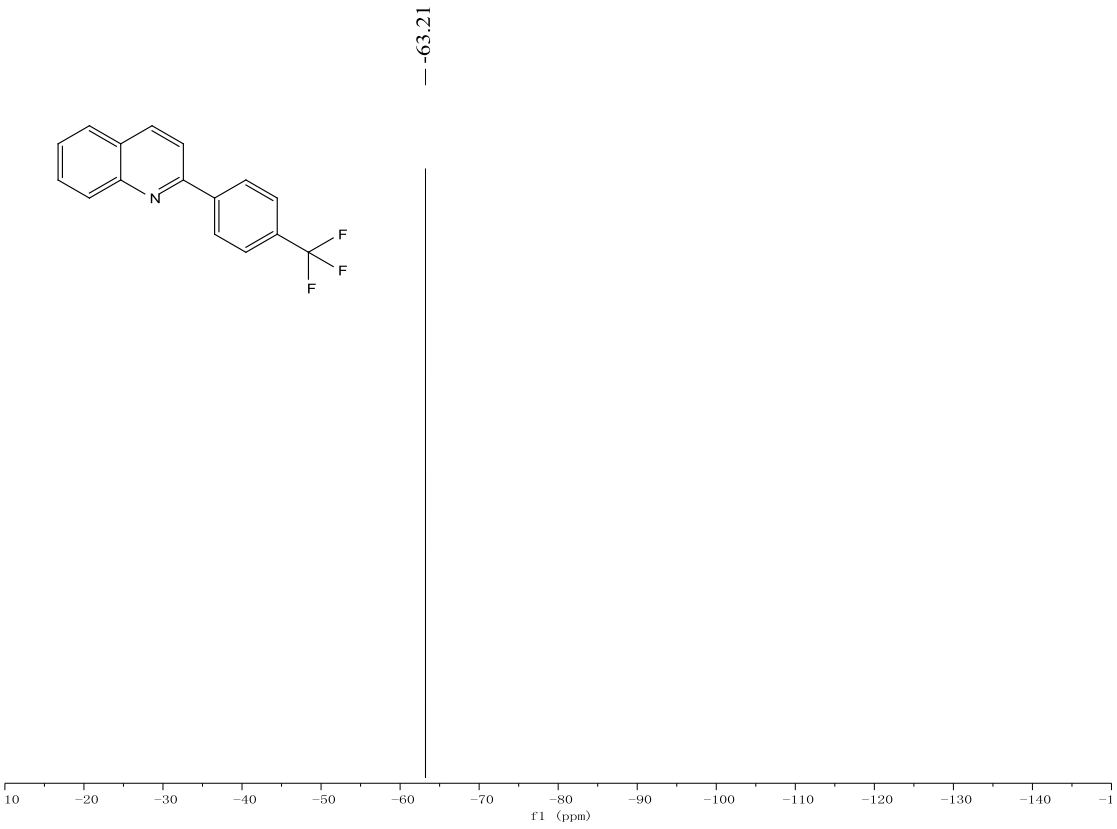




2-(4-(Trifluoromethyl)phenyl)quinolone (3ag)



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-60
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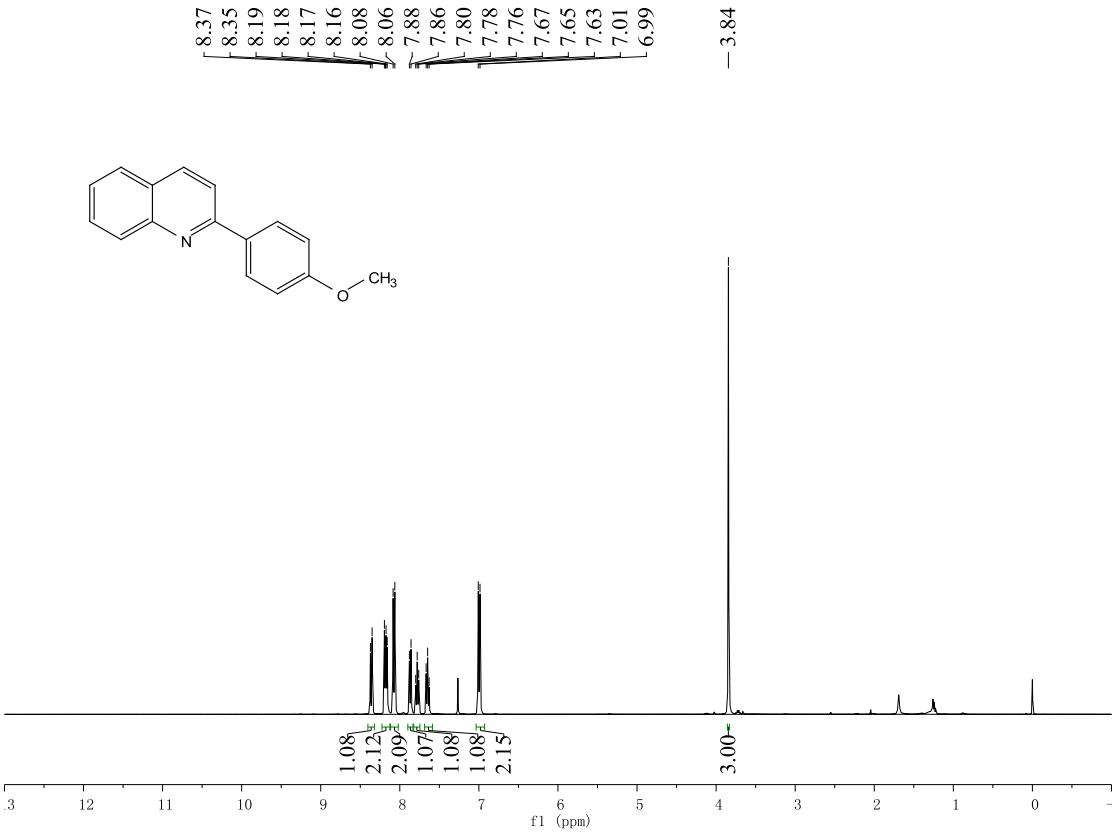
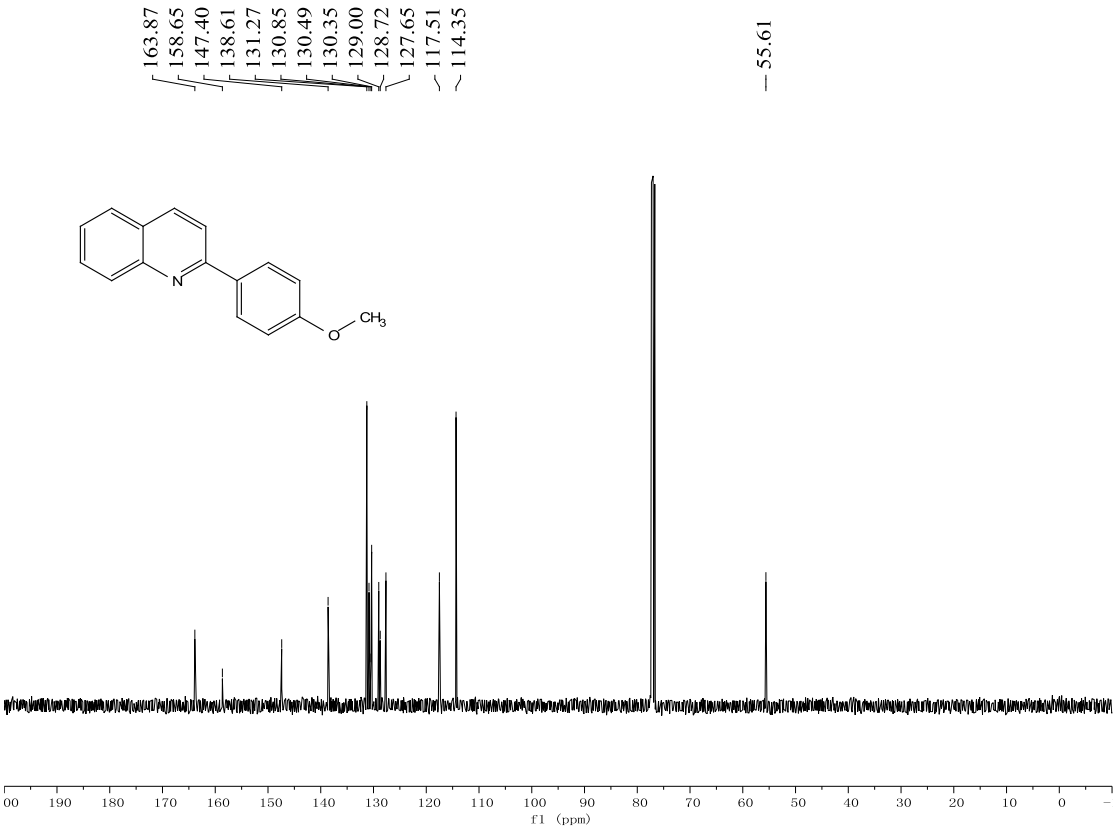
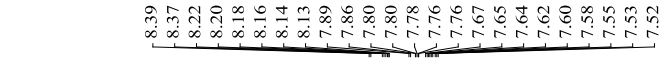
f1 (ppm)

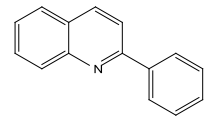
2-(4-Methoxyphenyl)quinoline (3ah）

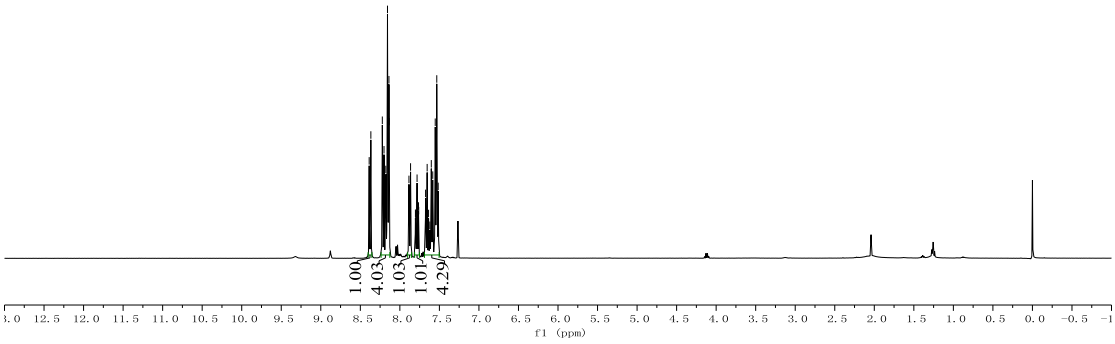


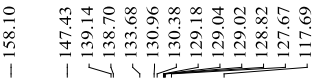


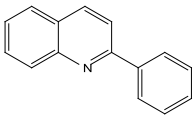
2-Phenylquinoline (3ai)



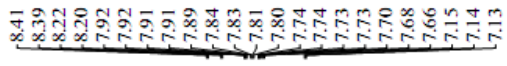


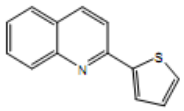


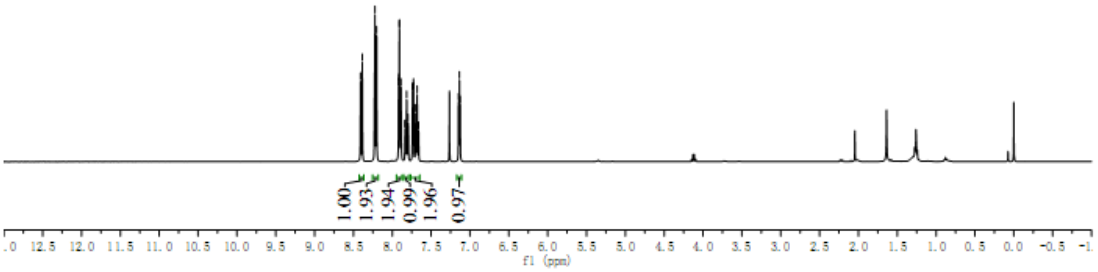


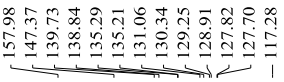


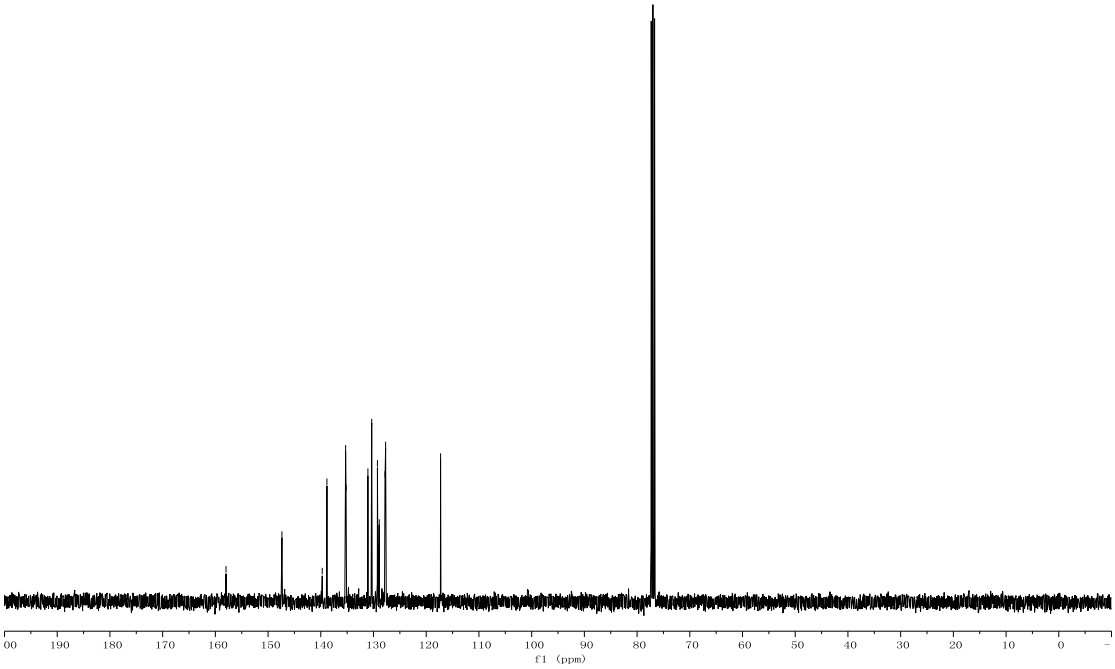
2-(Thiophen-2-yl)quinoline（3aj）



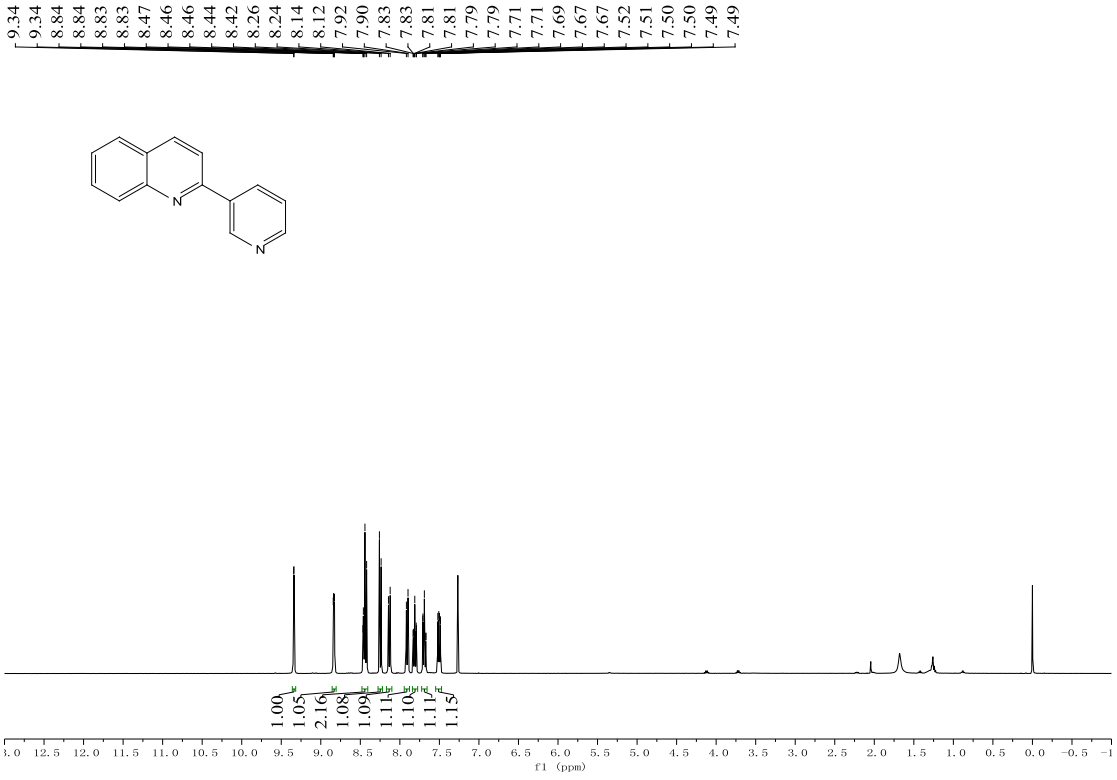


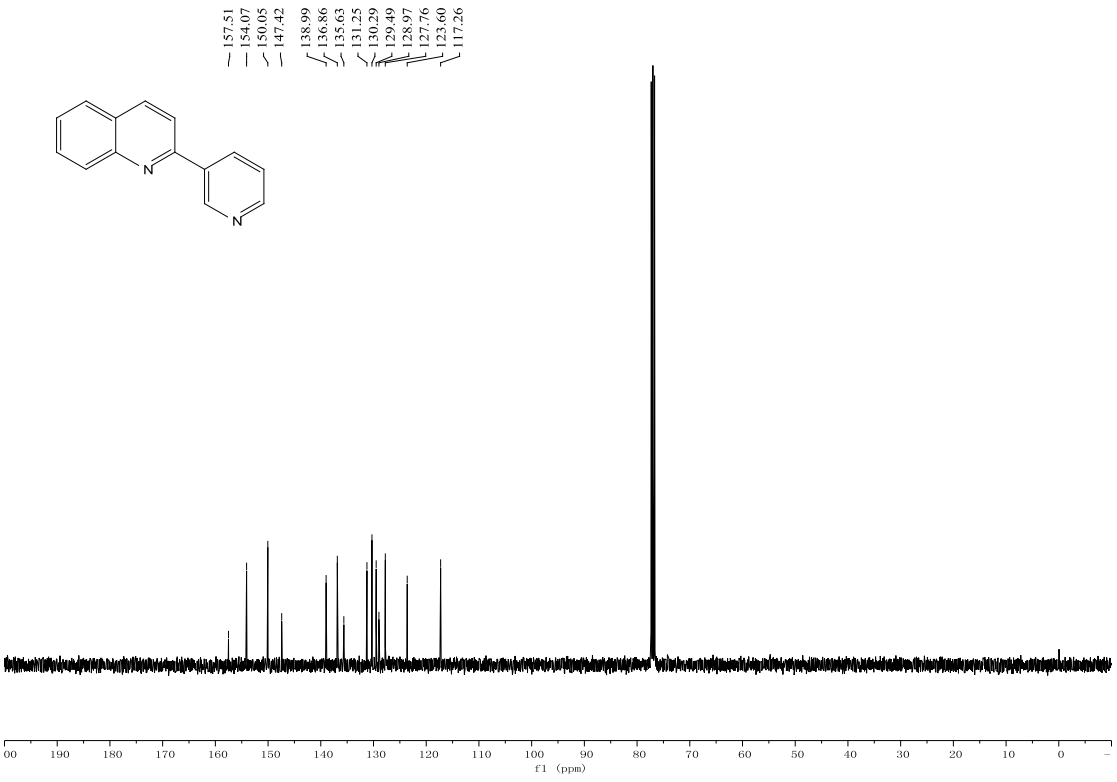




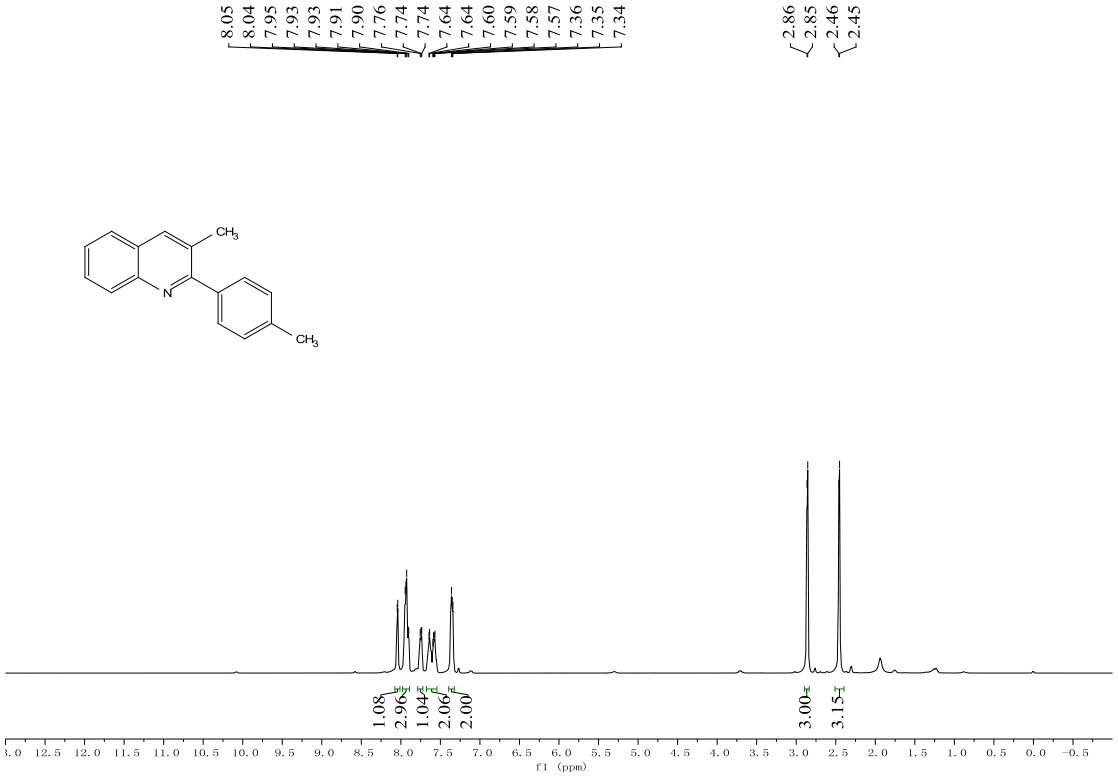


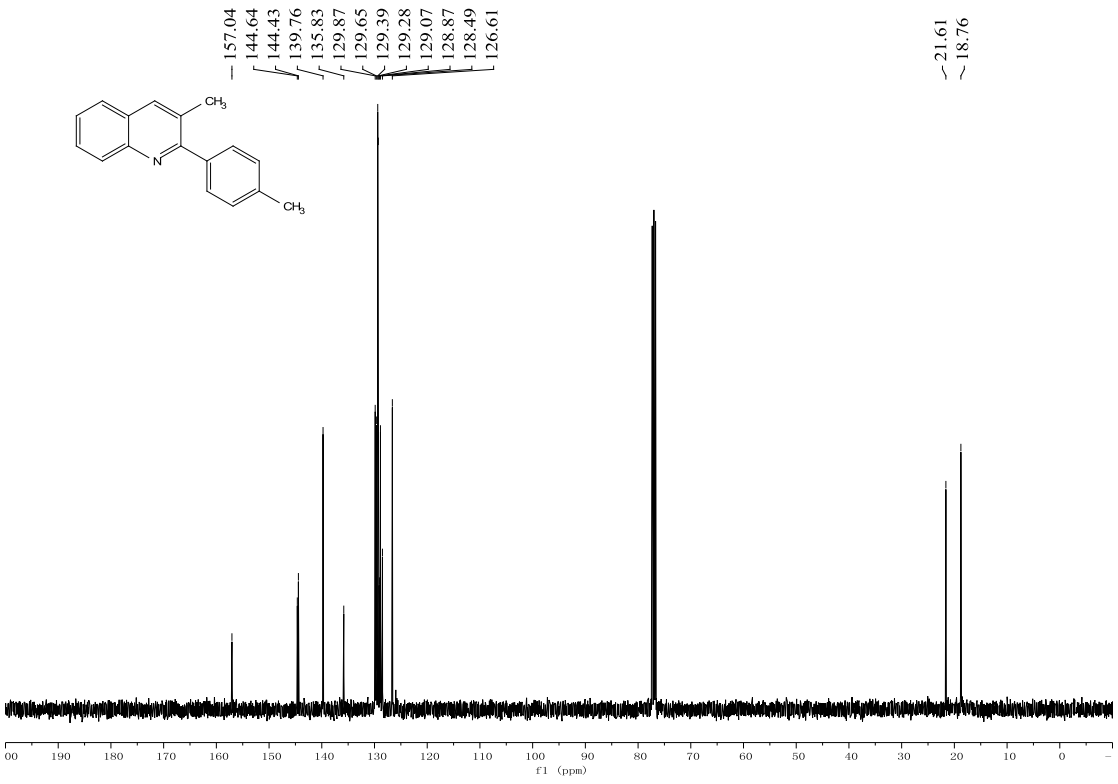
3-Methyl-2-(phenylsulfonyl)quinolone (3ak)



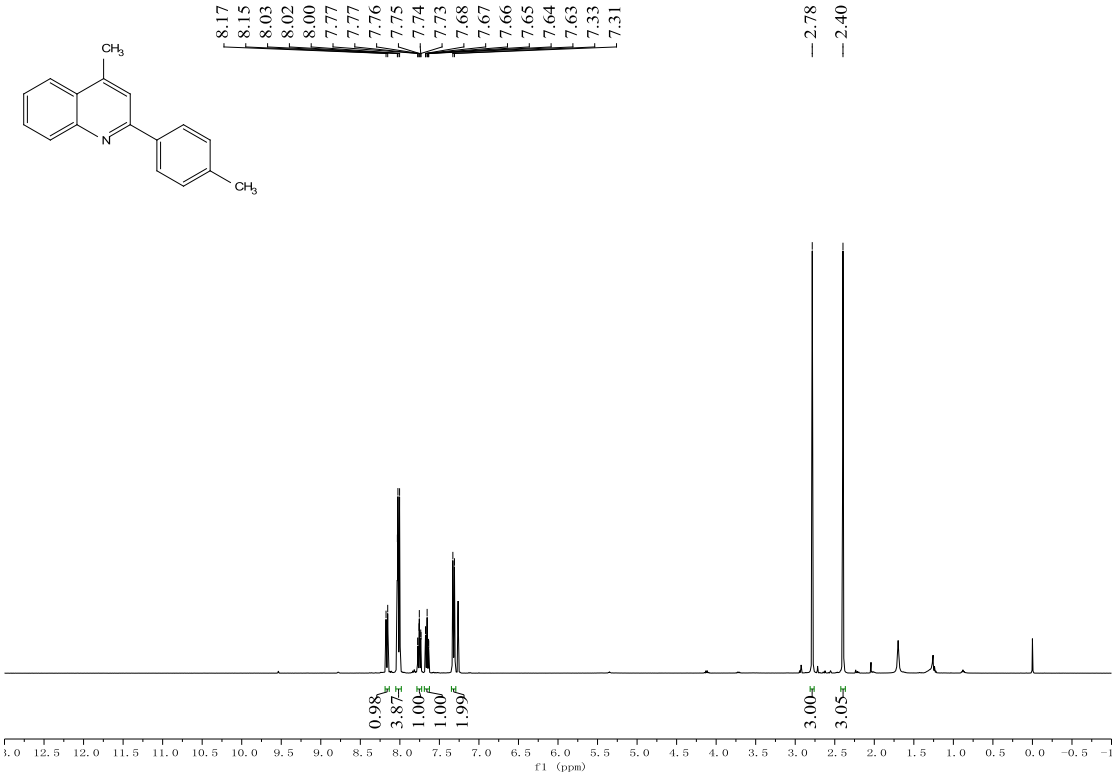


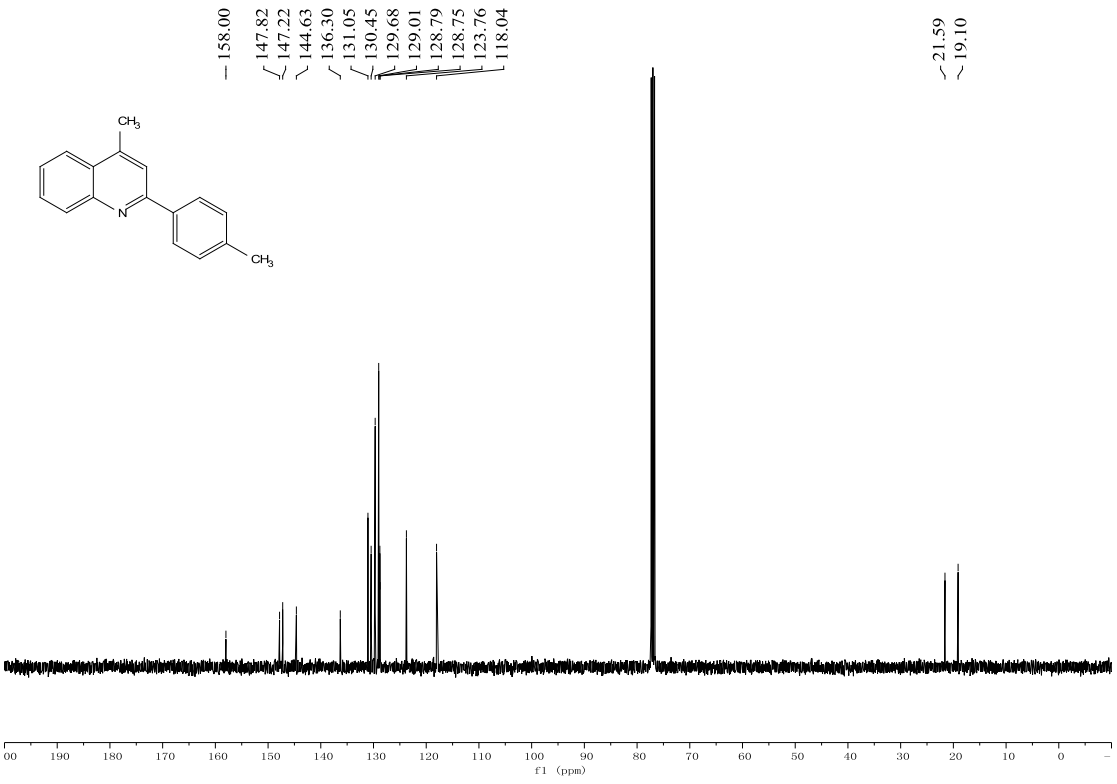
3-Methyl-2-(*p*-tolyl)quinoline（3ba）



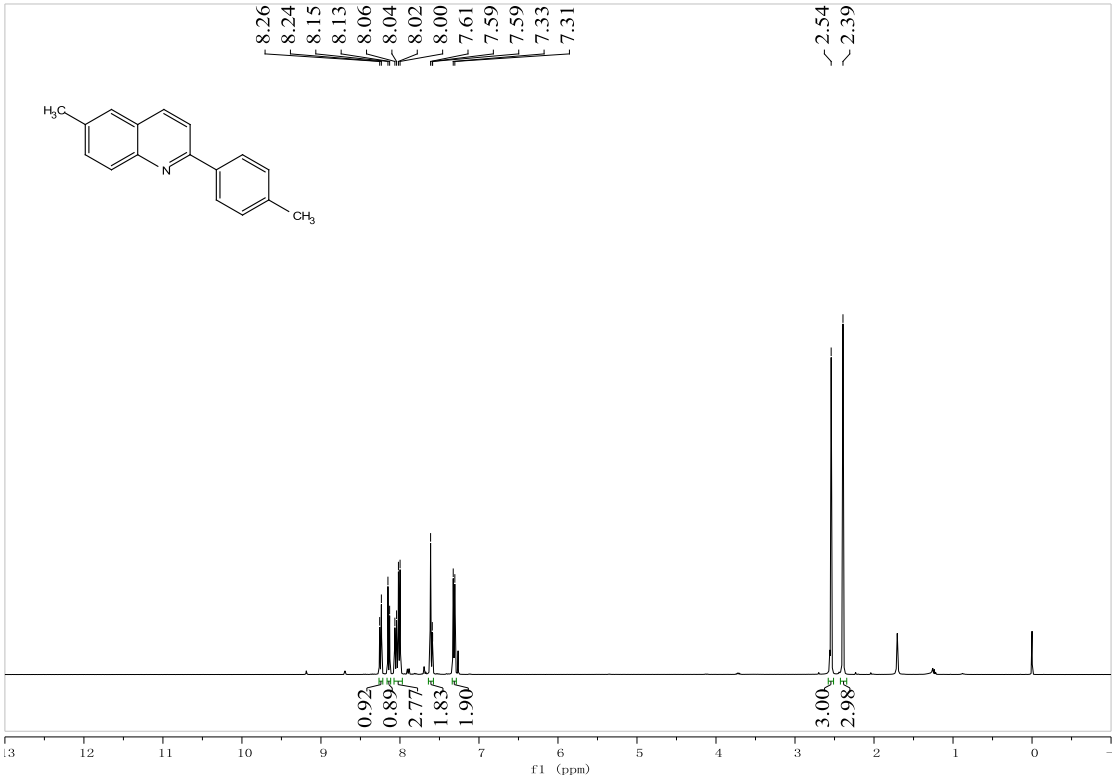


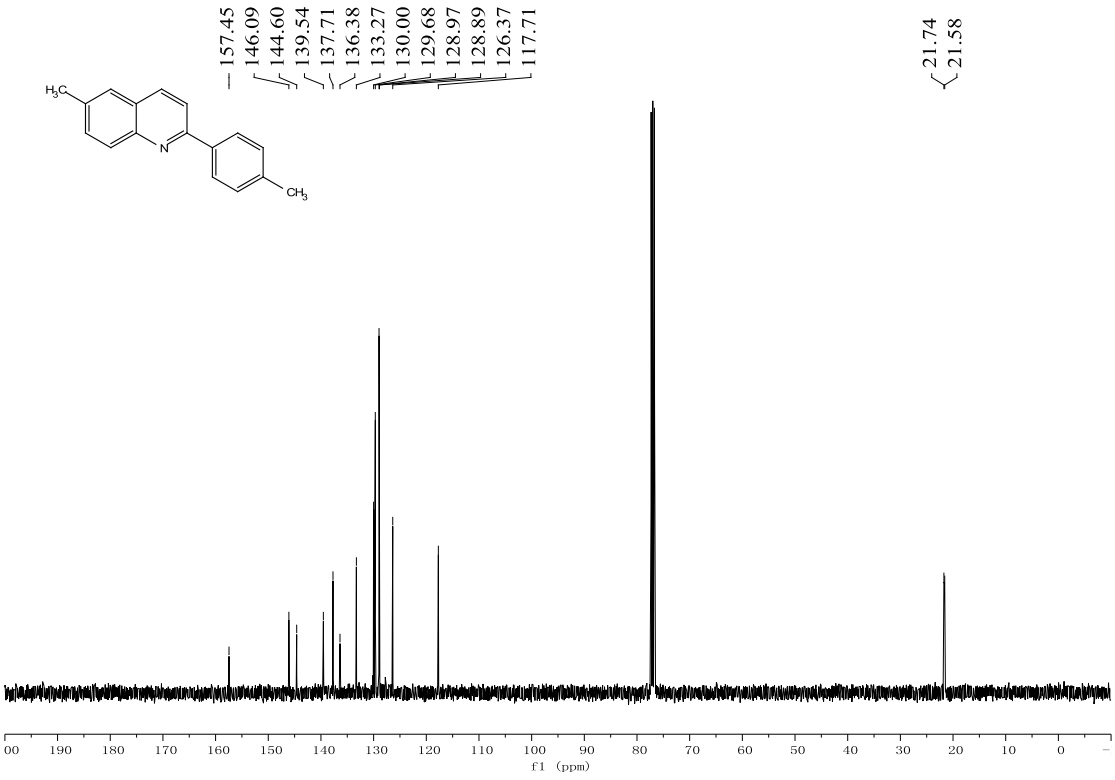
4-Methyl-2-(*p*-tolyl)quinolone（3ca）



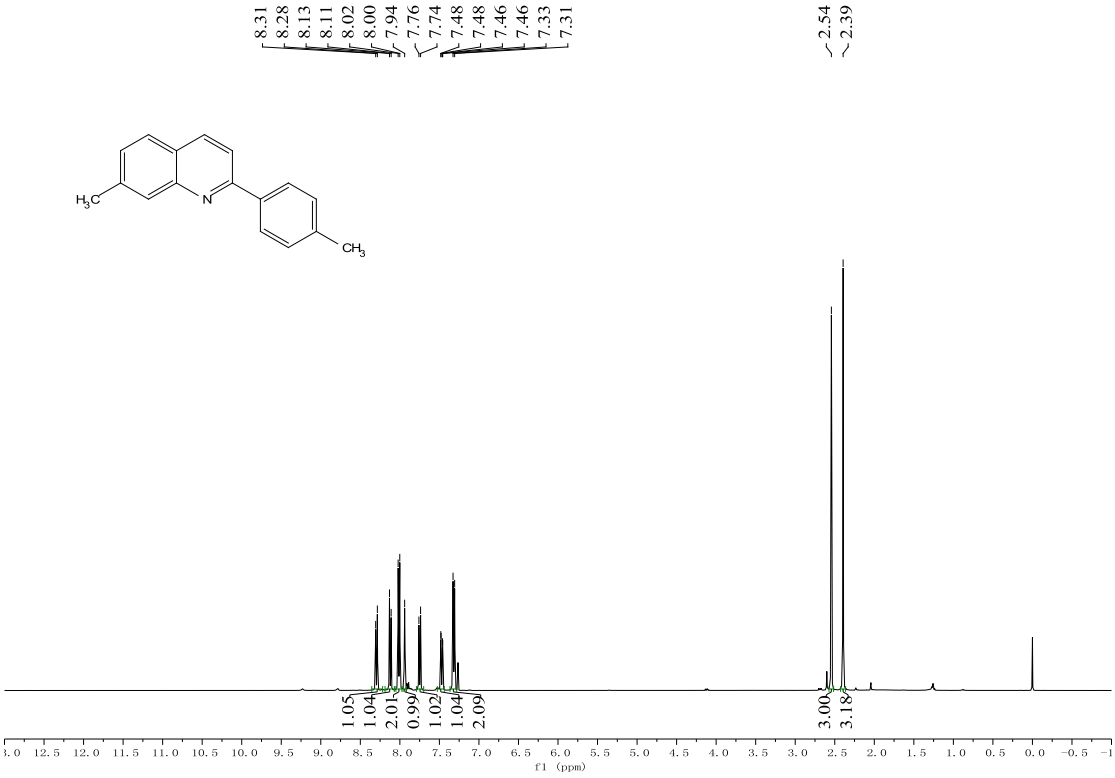


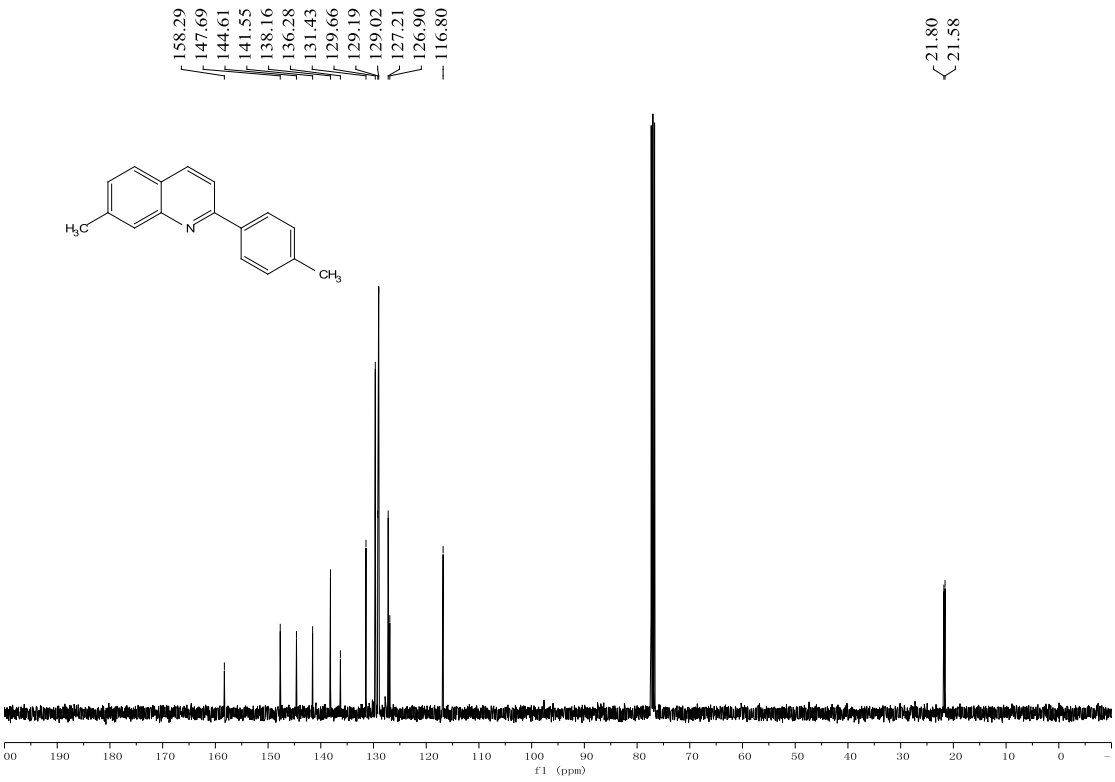
6-Methyl-2-(*p*-tolyl)quinolone (3da）



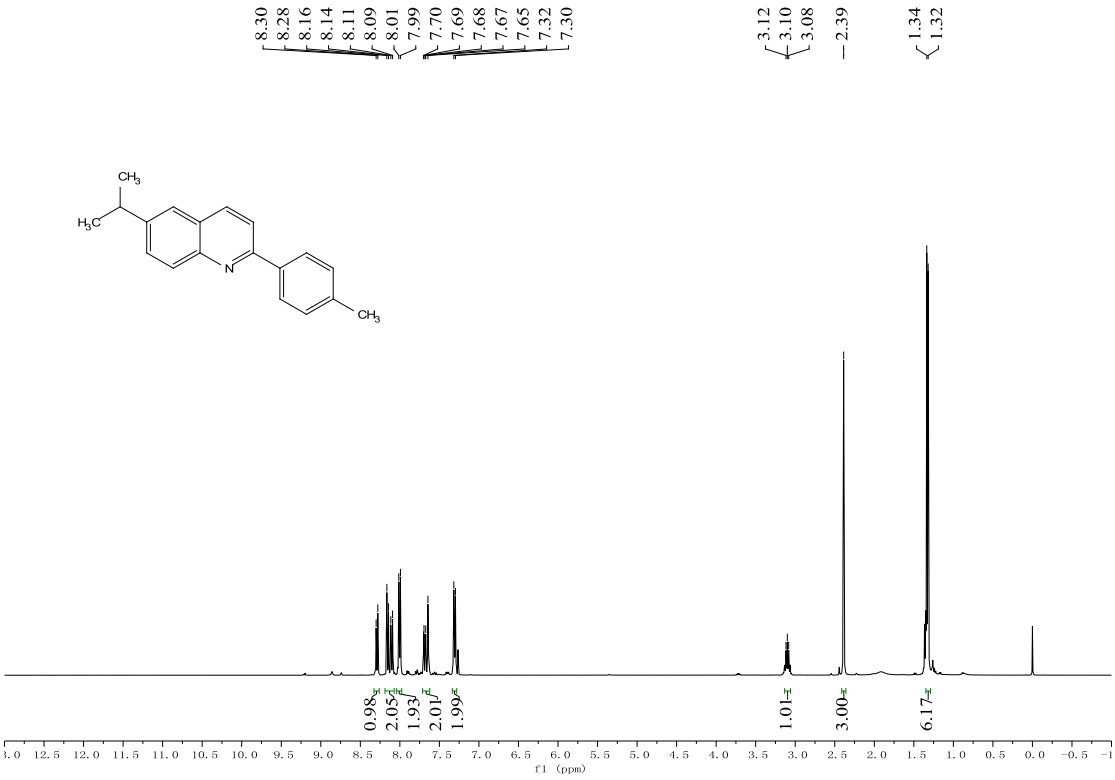


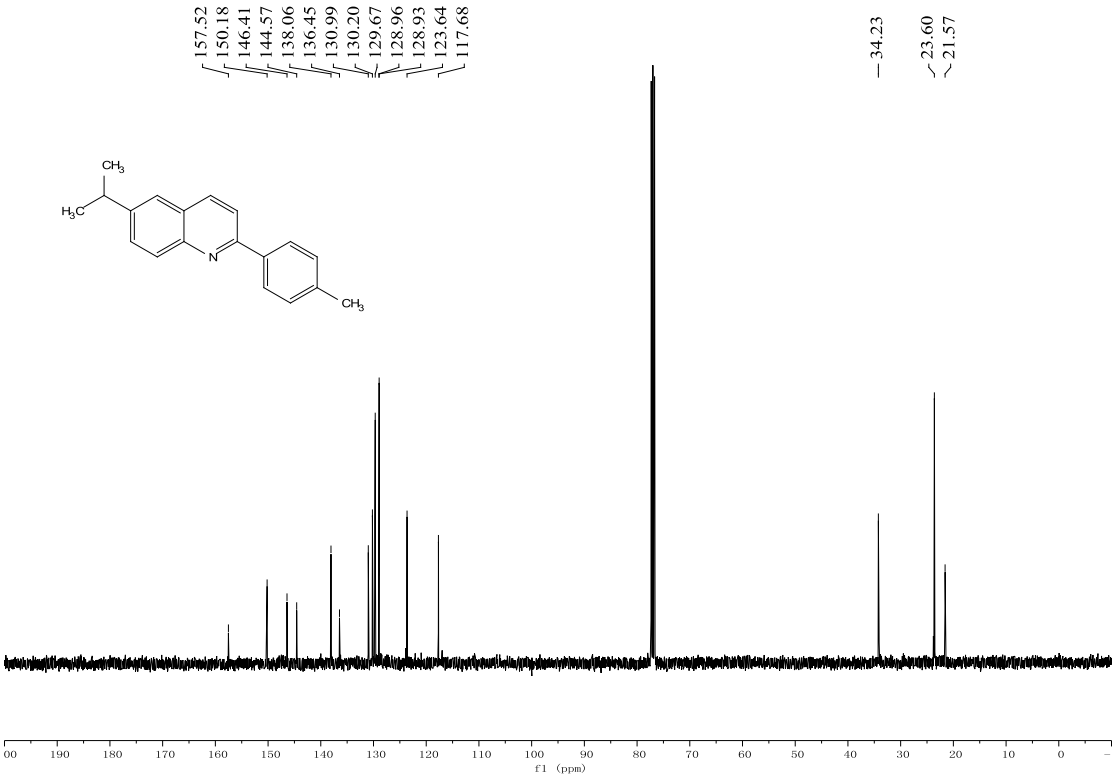
7-Methyl-2-(*p*-tolyl)quinolone (3ea)



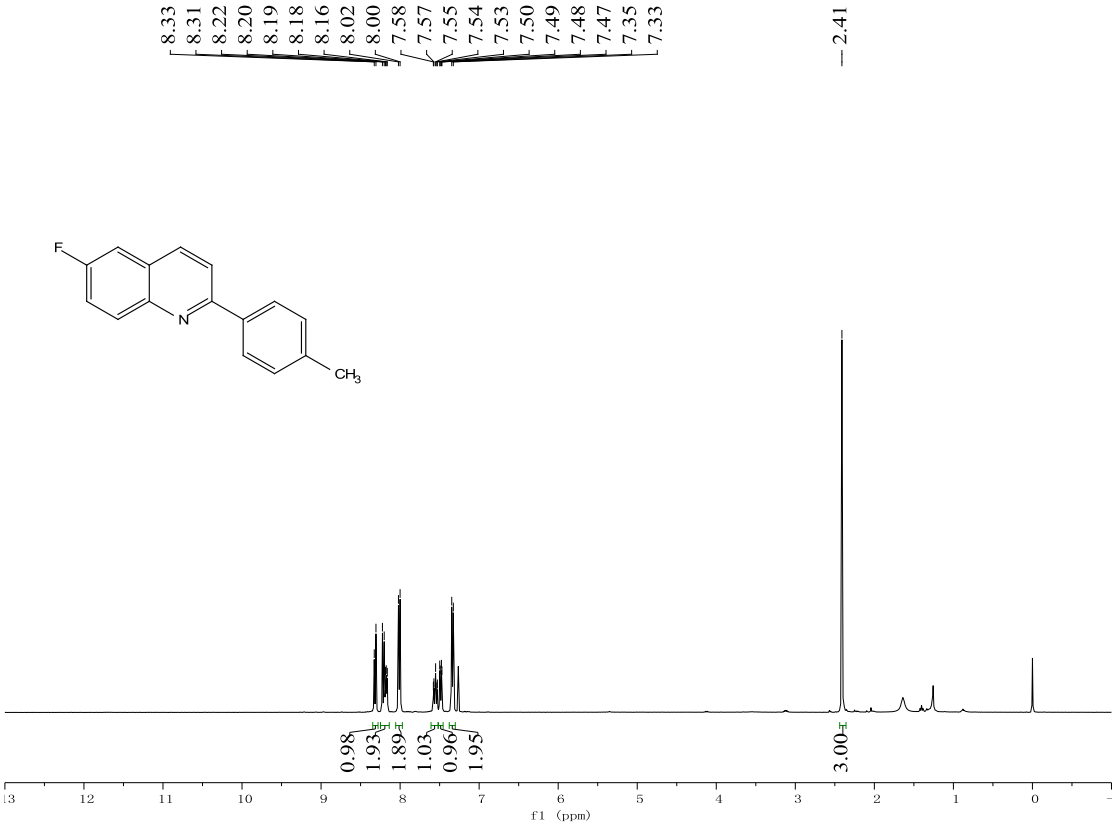


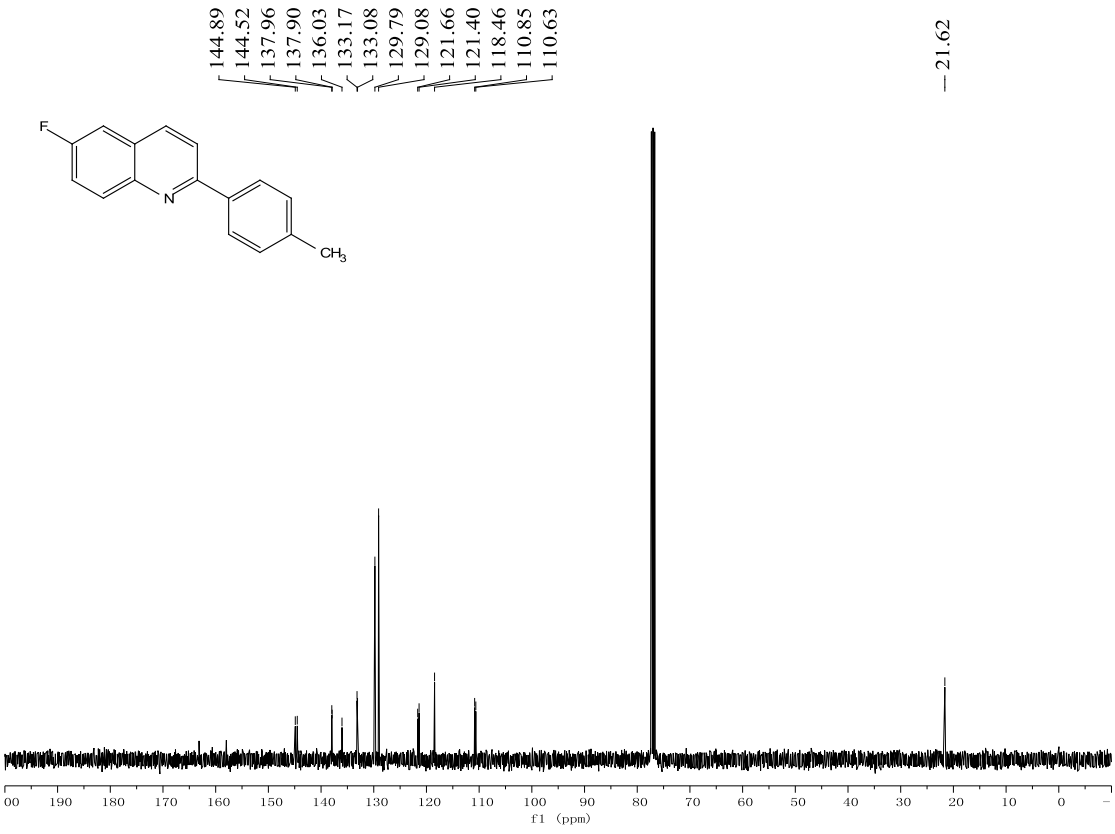
6-Isopropyl-2-(*p*-tolyl)quinolone (3fa)

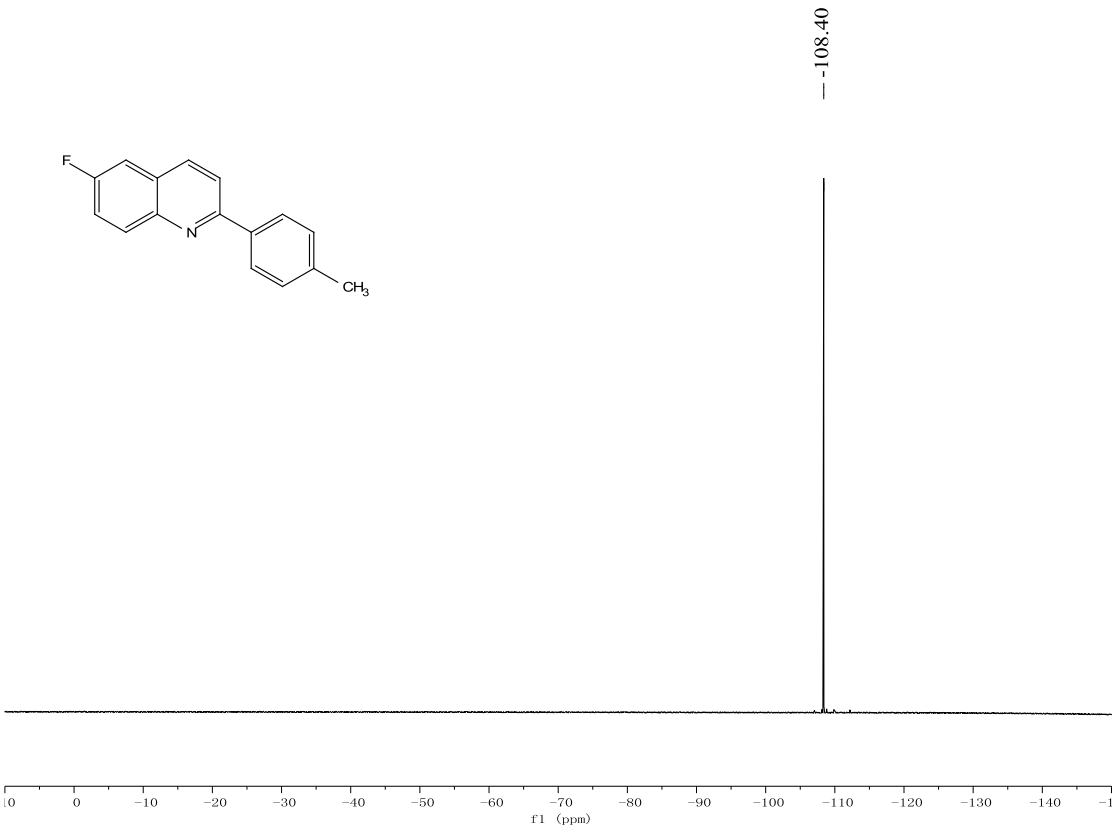




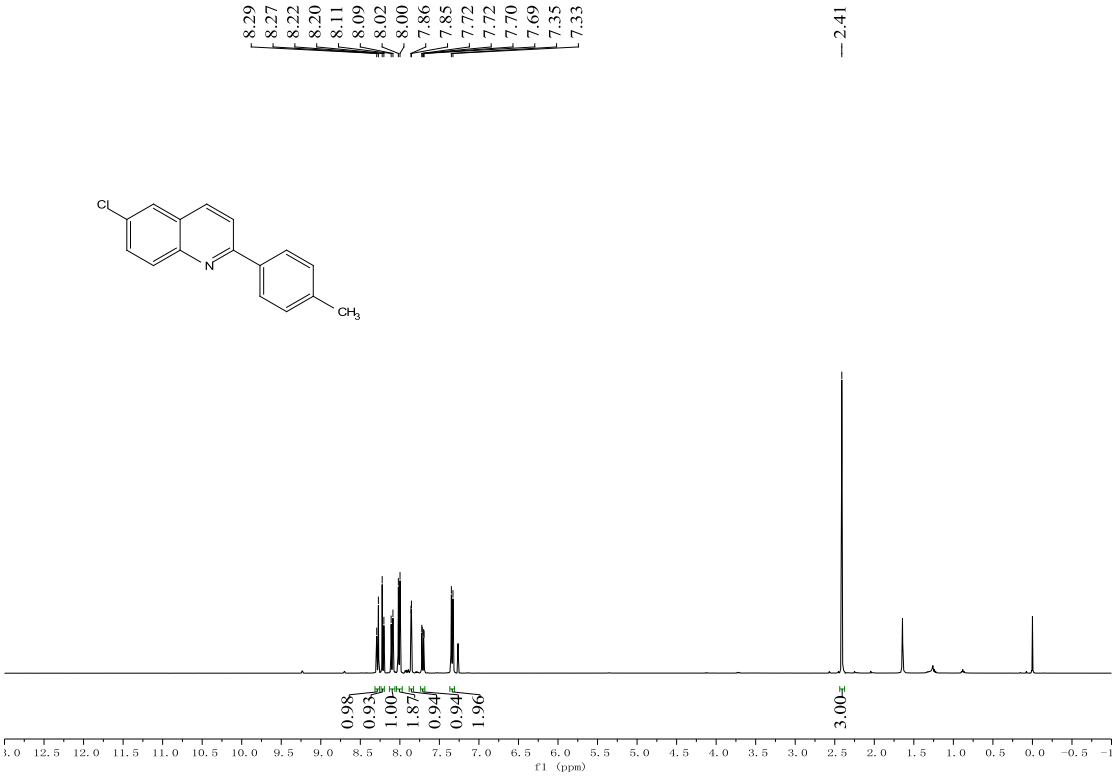
6-Fluoro-2-(*p*-tolyl)quinoline (3ga)

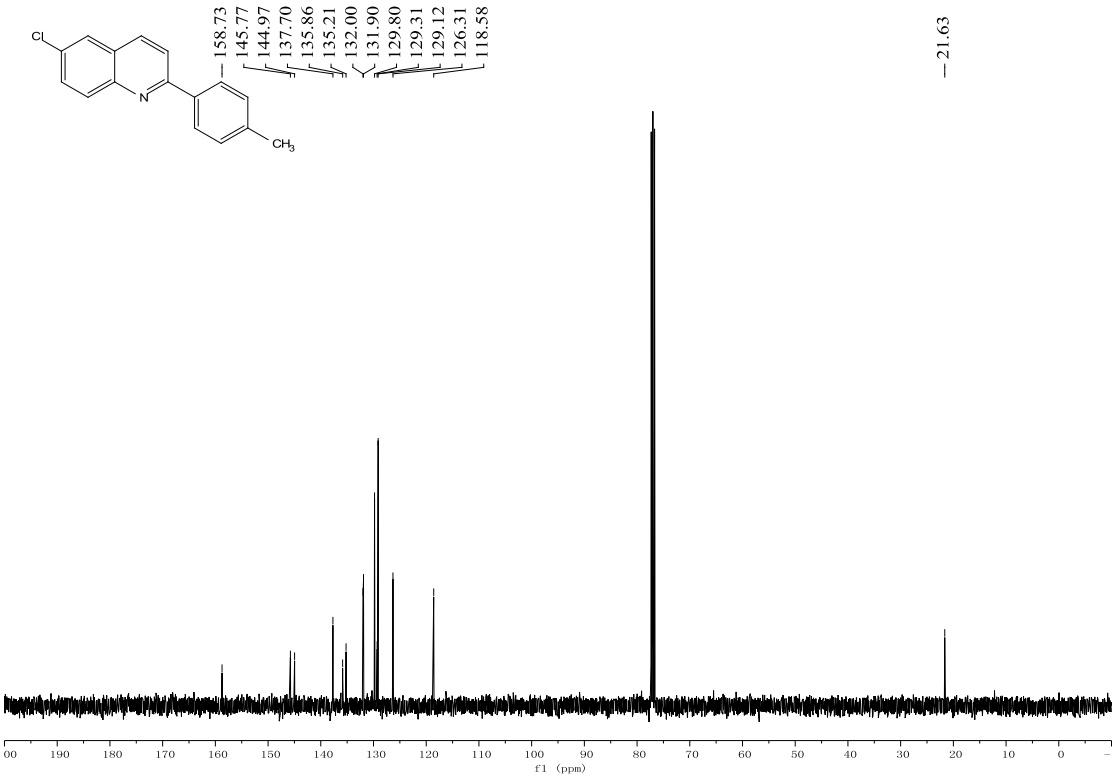




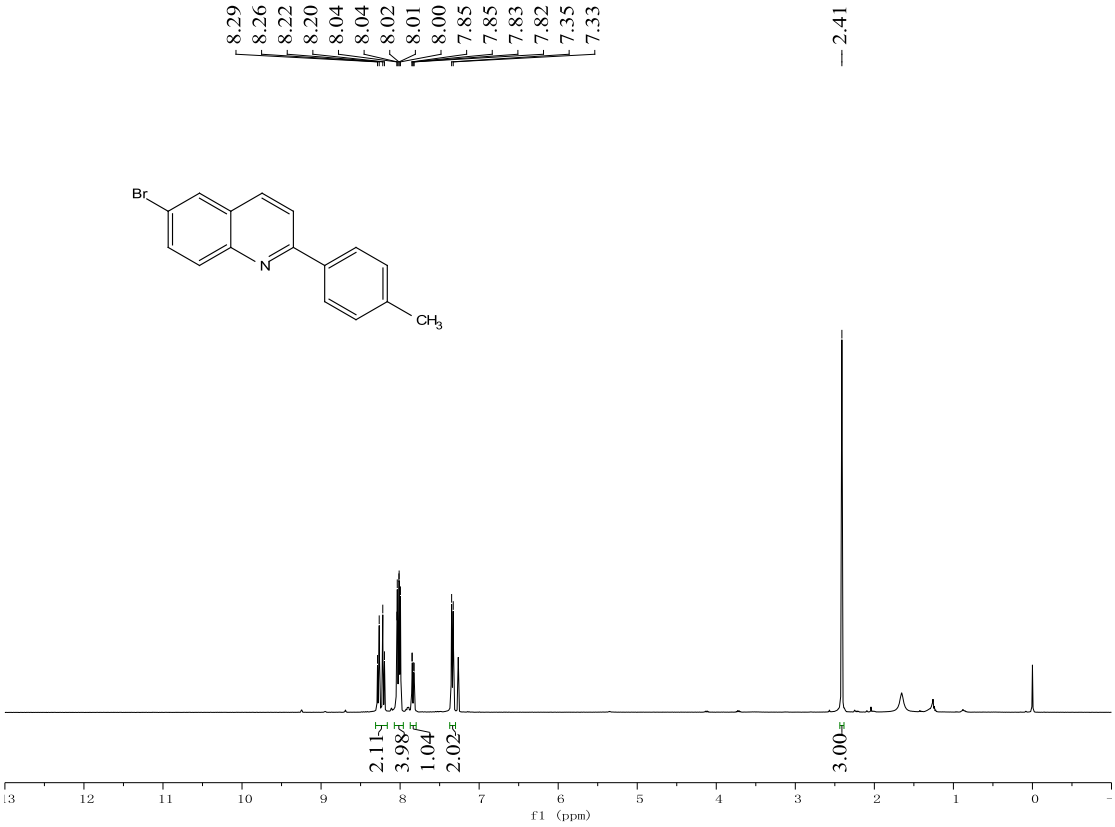

F
N
CH3
-108.40
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-1
f1 (ppm)

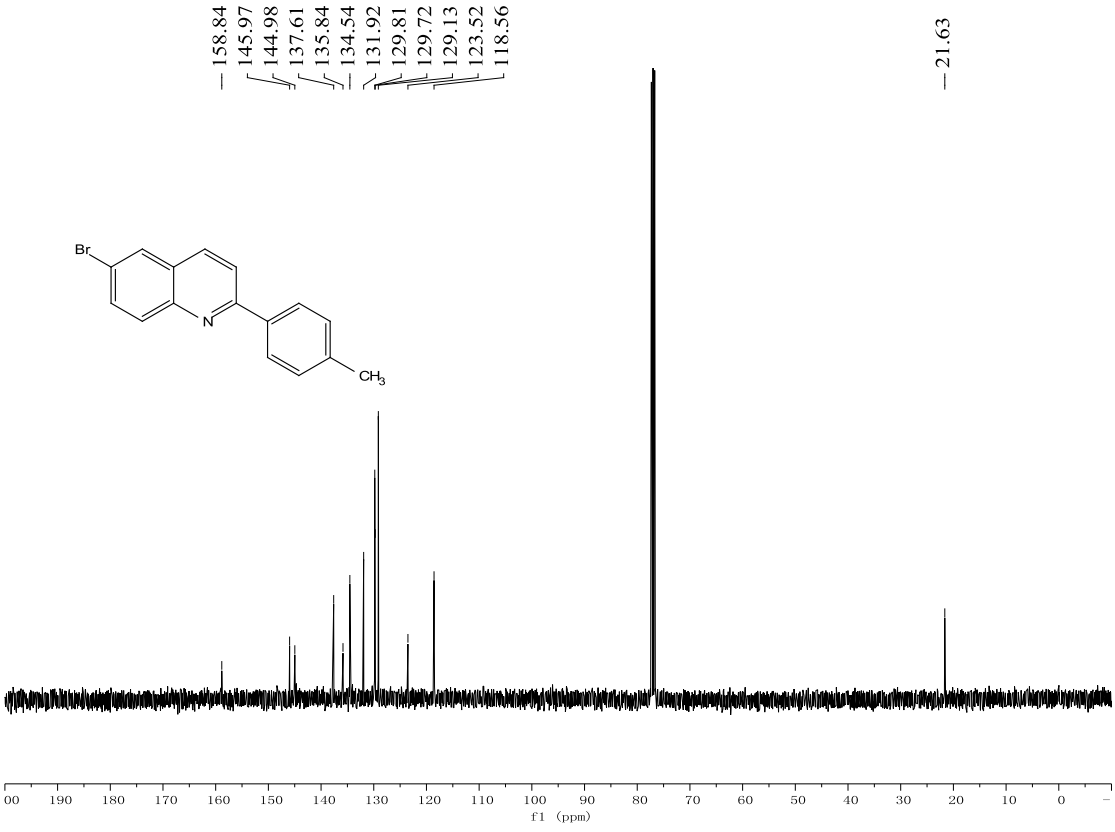
6-Chloro-2-(*p*-tolyl)quinoline (3ha）



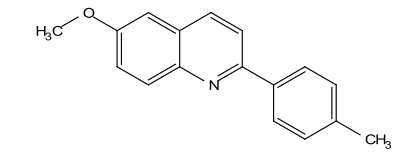


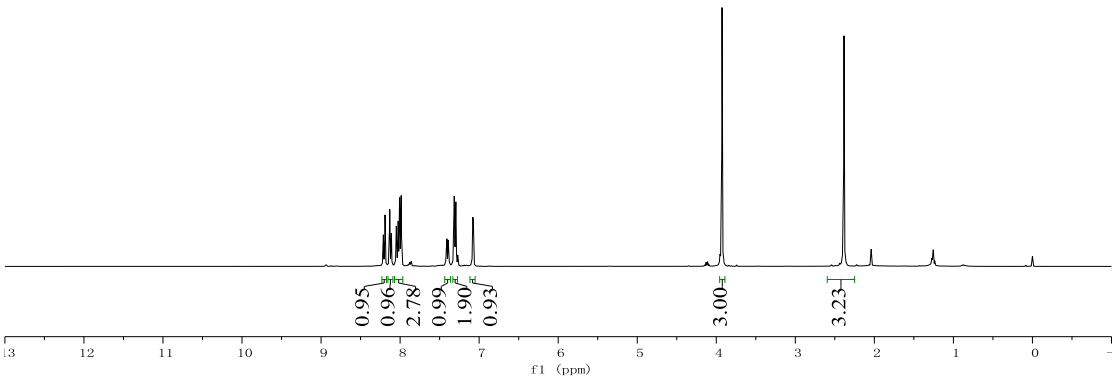
6-Bromo-2-(*p*-tolyl)quinoline (3ia)

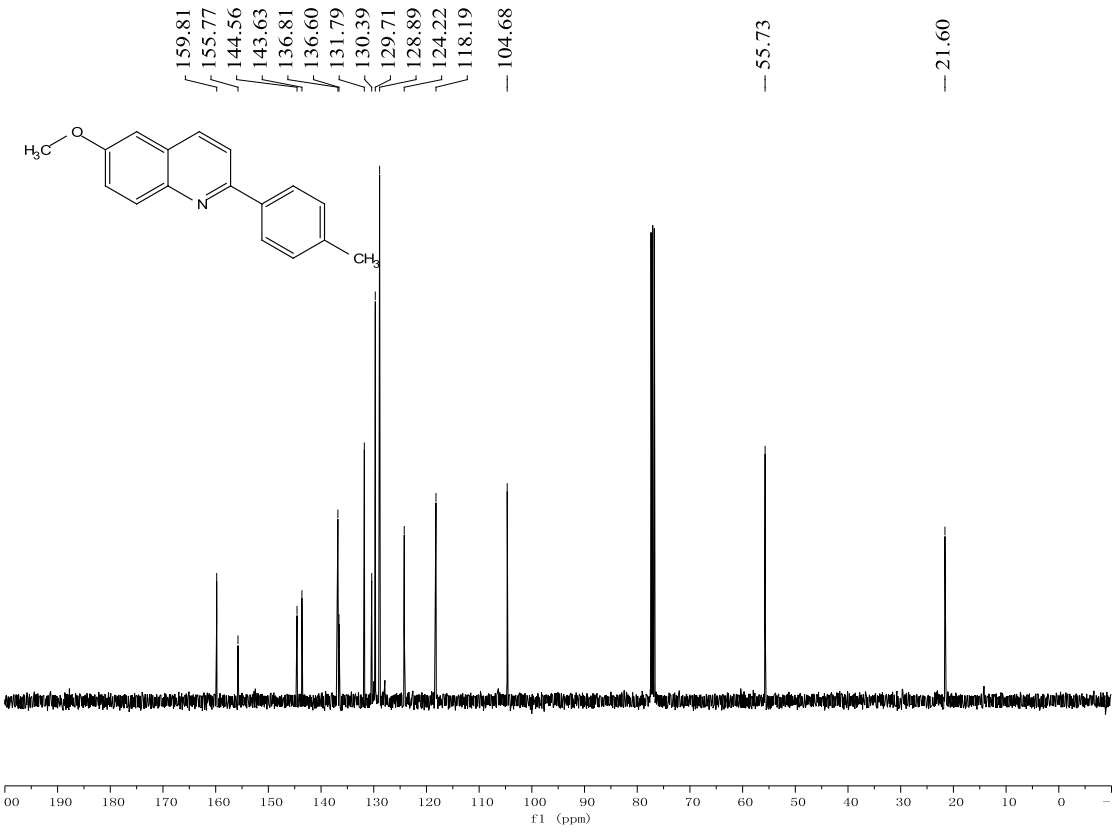




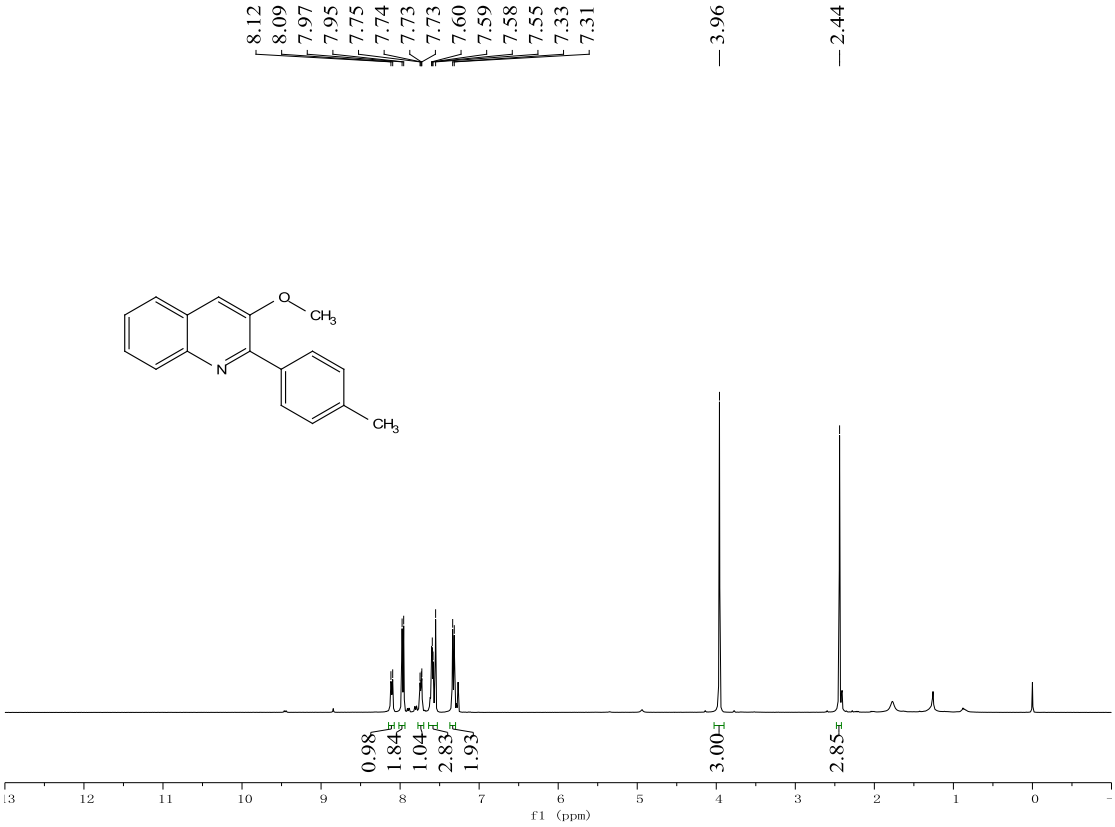
6-Methoxy-2-(*p*-tolyl)quinoline (3ja)

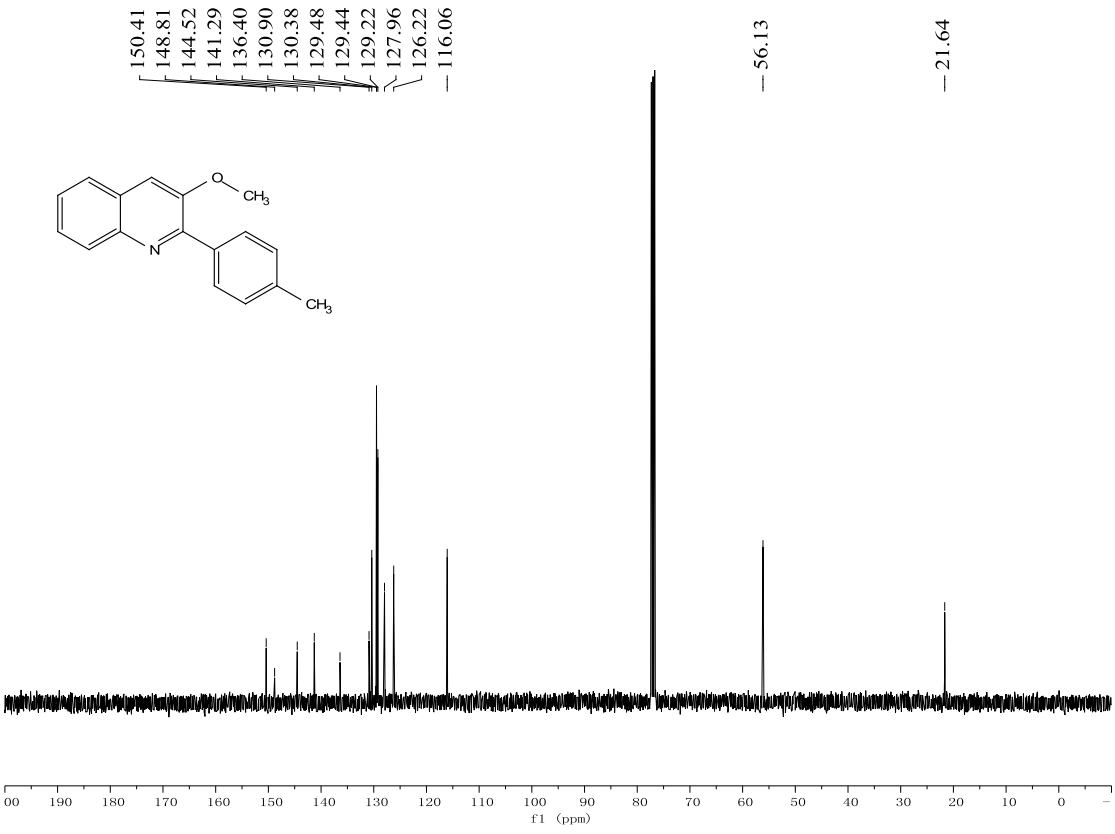




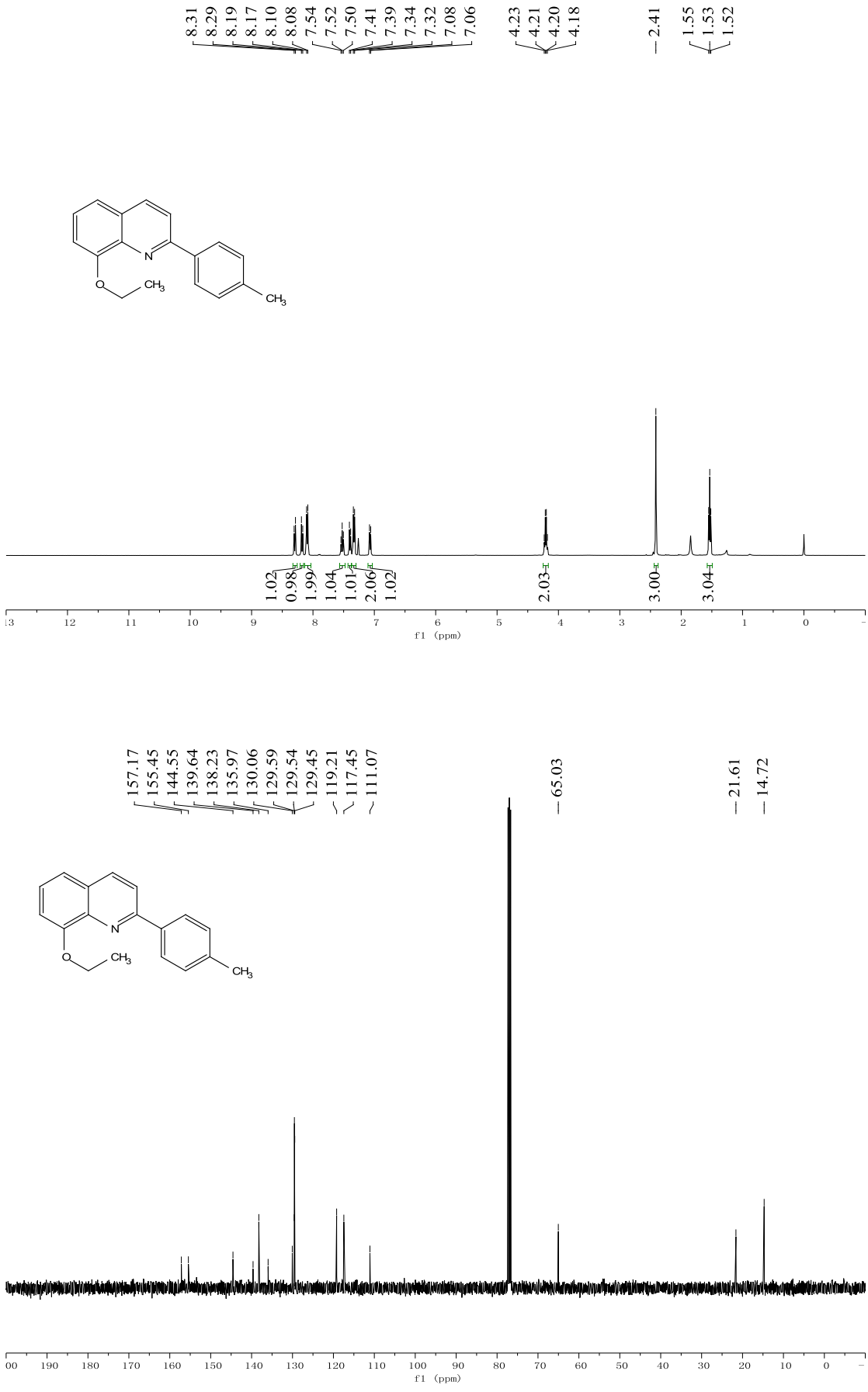


3-Methoxy-2-(*p*-tolyl)quinoline (3ka)





8-Ethoxy-2-(*p*-tolyl)quinoline (3la)



(2-Tosylethene-1,1-diyl)dibenzene (5a)