Supporting Information

LiBr-promoted photoredox neutral Minisci hydroxyalkylations of quinolines with aldehydes

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1. General information

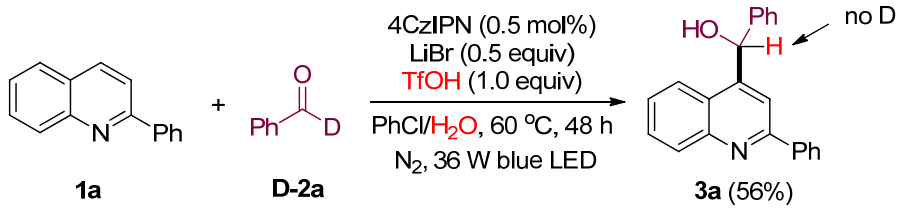
The reactions via general procedure **A** was carried out under an atmosphere of nitrogen unless otherwise noted. Column chromatography was performed using silica gel (200-300 mesh) or thin layer chromatography was performed using silica gel (GF254). ^{1}H NMR, ^{13}C NMR spectra were recorded on Bruker-AV instrument (400 and 100 MHz, respectively), and chloroform is the solvent with TMS as the internal standard, with the chemical shifts referenced to signals at 7.26 and 77.16 ppm, respectively. Mass spectra were measured on Agilent 5975 GC-MS instrument (EI). High-resolution mass spectra (ESI) were obtained with the Thermo Scientific LTQ Orbitrap XL mass spectrometer. The structures of known compounds were further corroborated by comparing their ^{1}H NMR, ^{13}C NMR data and HRMS data with those in literature. Melting points were measured with a YUHUA X-5 melting point instrument and were uncorrected. All reagents obtained from commercial suppliers were used without further purification. Cyclic voltammograms were recorded with a CHI830B potentiostat at room temperature in MeCN. *n*-Bu_4NBF_4 (0.1 M) was used as the supporting electrolyte, and a glass carbon electrode was used as the working electrode. The auxiliary electrode was a platinum wire electrode. All potentials are referenced against the Ag/AgCl redox couple. The scan rate was 100 $mV \cdot s^{-1}$.

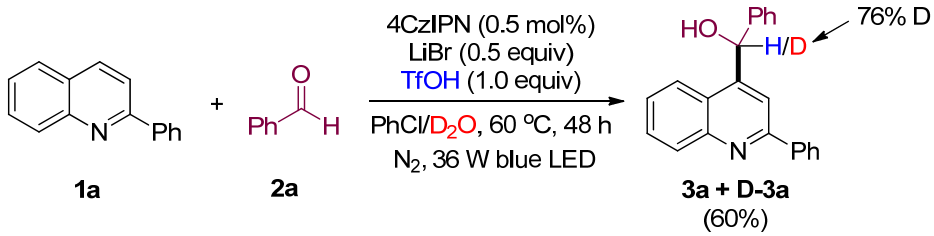
2. General procedure

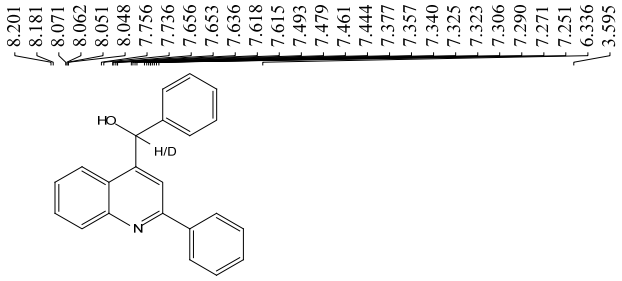
A 10 mL reaction vessel was charged with 2-phenylquinoline (**1a**, 41 mg, 0.2 mmol), benzaldehyde (**2a**, 43 μL, 2.0 equiv), LiBr (8.7 mg, 0.5 equiv), 4CzIPN (0.8 mg, 0.5 mol %), TfOH (5.6 M aq, TfOH/H_2O=1/5, 36 μL, 1.0 equiv), H_2O (162 μL, 45 equiv) and PhCl (1.0 mL) successively. The atmosphere was exchanged by applying vacuum and backfilling with N_2 (this process was conducted for three times). The reaction mixture was stirred at 60 ºC under the irradiation by a 35 W blue LED for 48 h. The reaction was monitored by TLC. The crude reaction mixture was quenched with saturated sodium carbonate and extracted with ethyl acetate (3×10 mL). The solvent was evaporated under vacuum, and the crude product was purified using silica gel (200-300 mesh) or thin layer chromatography was performed using silica gel (GF254) to give product **3a**.

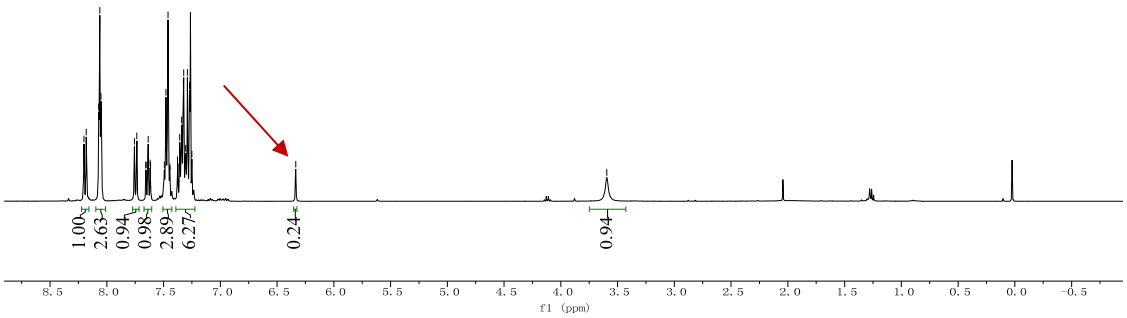
3. Mechanistic studies

3.1. H/D exchange experiments





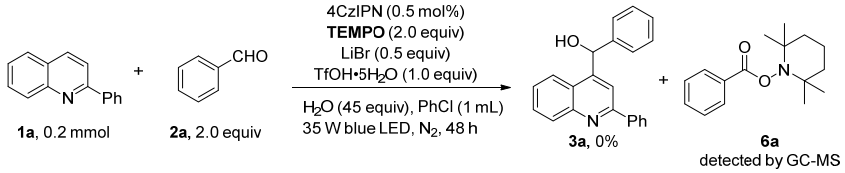




3.2. Radical trapping experiments

The following reaction was carried out under general procedure. A 10 mL reaction vessel was charged with 2-phenylquinoline (41 mg, 0.2 mmol), benzaldehyde (43 μL, 2.0 equiv), LiBr (8.7 mg, 0.5 equiv), 4CzIPN (0.8 mg, 0.5 mol %), TfOH (5.6 M aq, TfOH/H_2O=1/5, 36 μL, 1.0 equiv), H_2O (162 μL, 45 equiv), 2,2,6,6-tetramethyl-1-piperidinyloxy (TEMPO) (62.8 mg, 2.0 equiv), and

PhCl (1.0 mL), The atmosphere was exchanged by applying vacuum and backfilling with N_2 (this process was conducted for three times). The reaction mixture was stirred at 50-60 ºC under the irradiation by a 35 W blue LED for 48 h. After completion, The formation of **3a** was completely suppressed. Meanwhile, TEMPO-trapped product **6a** was detected by GC-MS.

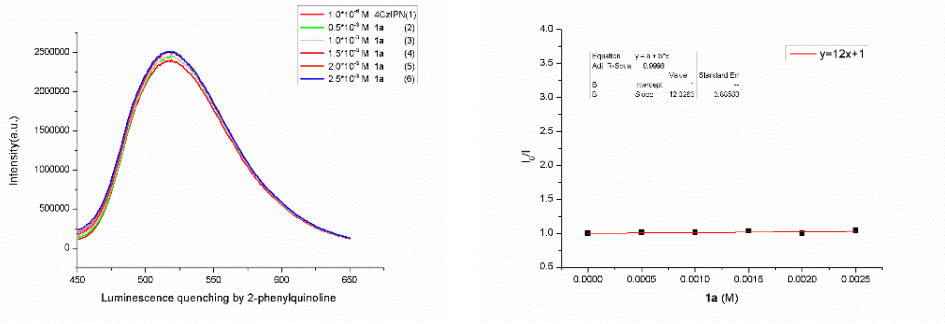


3.3. Stern–Volmer Quenching[1]

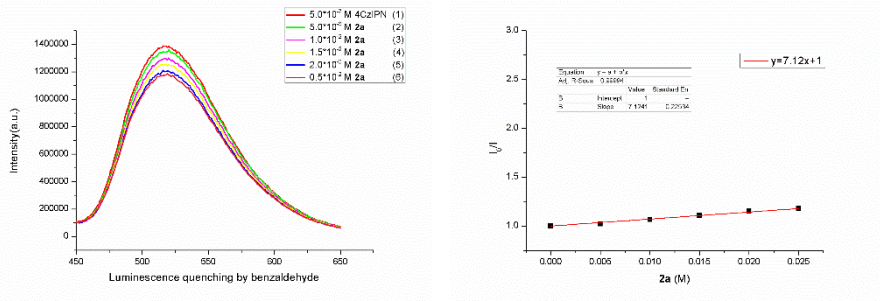
Formulation solution: 2-Phenylquinoline (513.8 mg) was dissolved in PhCl in a 25 mL volumetric flask to set the concentration to be 0.1 M. Benzaldehyde (255 μL) was dissolved in PhCl in a 25 mL volumetric flask to set the concentration to be 0.1 M. LiBr (217.1 mg) was dissolved in acetone in a 25 mL volumetric flask to set the concentration to be 0.1 M. Photocatalyst 4CzIPN (4 mg) was dissolved in PhCl (50 mL) to set the concentration to be 0.1 mM.

Experimental procedure: The resulting 0.1 mM solution (20 μL) was added to cuvette to obtain different concentrations of catalyst solution. This solution was then diluted to a volume of 2.0 mL by adding further solvent (PhCl) to prepare a 1.0 μM solution. The resulting mixture was sparged with nitrogen for 3 minutes and then irradiated at 430 nm. Fluorescence emission spectra were recorded (3 trials per sample). Into this solution, 10.0 μL of a 2-phenylquinoline solution was successively added and uniformly stirred, and the resulting mixture was bubbled with nitrogen for 3 minutes and irradiated at 430 nm. Fluorescence emission spectra of 0 μL, 10.0 μL, 20.0 μL, 30.0 μL, 40.0 μL, 50.0 μL fluorescence intensity. Follow this method and make changes to the amount to obtain the Stern–Volmer relationship in turn.

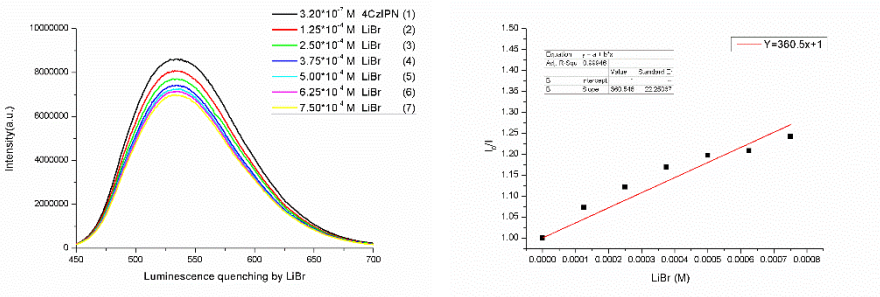
(a) 4CzIPN quenched by 2-phenylquinoline in PhCl.



(b) 4CzIPN quenched by benzaldehyde in PhCl.

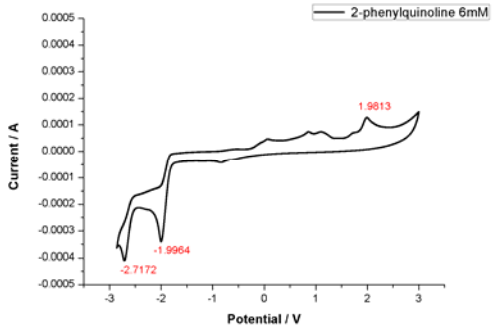


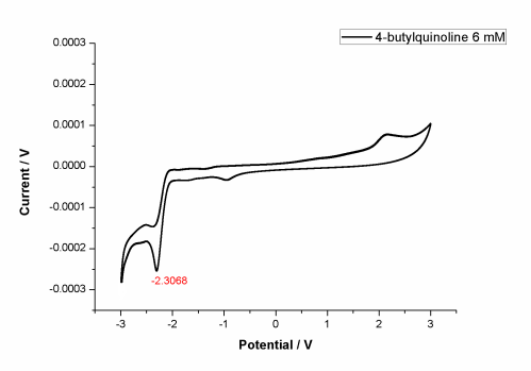
(c) 4CzIPN quenched by LiBr in acetone.

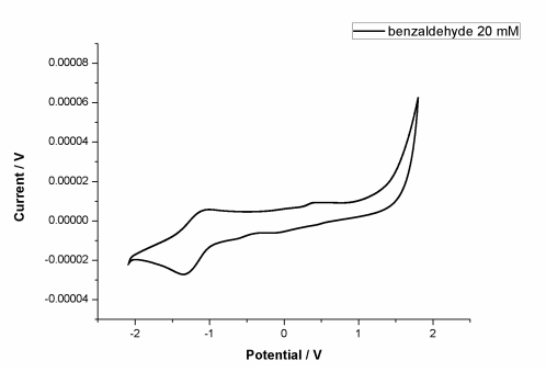


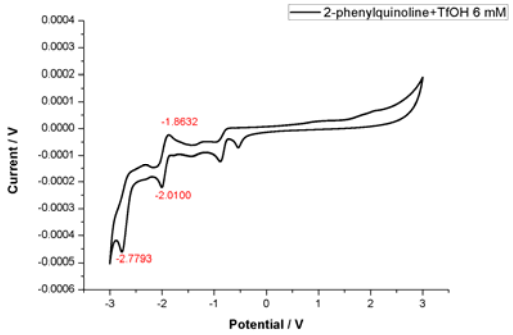
3.4. Cyclic Voltammetry

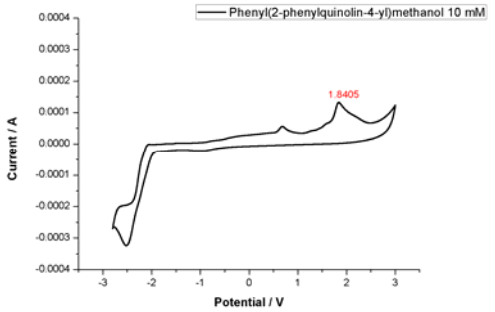
Cyclic voltammograms were recorded with a CHI830B potentiostat at room temperature in MeCN. *n*-Bu_4NBF_4 (0.1 M) was used as the supporting electrolyte, and a glass carbon electrode was used as the working electrode. The auxiliary electrode was a platinum wire electrode. All potentials are referenced against the Ag/AgCl redox couple. The scan rate was 100 $mV \cdot s^{-1}$.

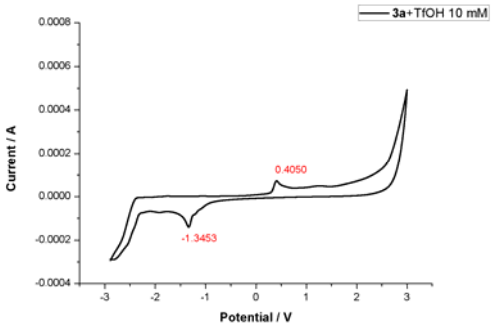




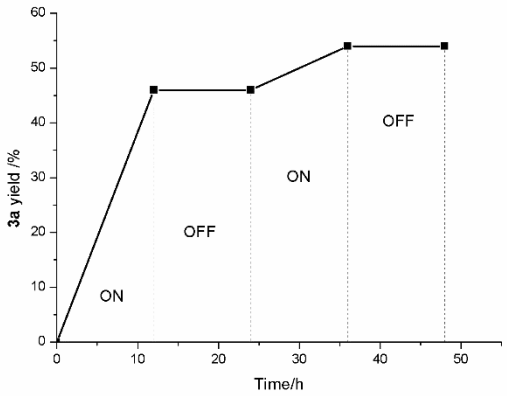








3.5 Light On-Off Experiments



The yield of **3a** was determined by ^{1}H NMR using CH_2Br_2 as an internal standard. The results revealed that a radical chain process was not the major reaction pathway.

4. Late-stage modification of product 3a

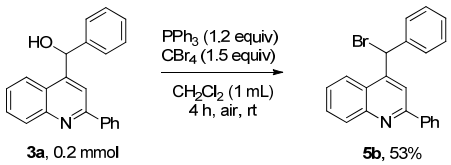
4.1 Oxidation

3a, 0.2 mmol **5a**, 84%

To a 10 mL reaction vessel was charged successively with **3a** (62.2 mg, 0.2 mmol), Dess-Martin Periodinane (DMP, 848.3 mg, 1.5 equiv) and CH_2Cl_2 (1.0 mL) at 0 ºC. The reaction mixture was stirred at room temperature for 4 h. The reaction was monitored by TLC. The crude reaction mixture was quenched with $Na_2S_2O_3$ (aq, 10%, 5 mL) and then NaOH (1.0 N, 2 mL) were added sequentially. Then the mixture was extracted with ethyl acetate for three times (3*10 mL). The organic solution was washed with brine, dried over sodium sulfate, and filtered. The crude material was purified by silica gel to deliver the product **5a** as a white solid (52.2 mg, 84%).

Phenyl(2-phenylquinolin-4-yl)methanone (5a).[2] Mp: 102 – 104 °C. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.28 (d, J = 8.5 Hz, 1H), 8.17 (d, J = 7.0 Hz, 2H), 7.94 – 7.90 (m, 2H), 7.89 (s, 1H), 7.86 (d, J = 8.4 Hz, 1H), 7.81 – 7.75 (m, 1H), 7.65 (t, J = 7.4 Hz, 1H), 7.55 – 7.46 (m, 6H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.4, 156.6, 148.8, 145.4, 139.0, 136.8, 134.3, 130.5, 130.4, 130.3, 129.9, 129.0, 128.9, 127.6, 127.4, 125.3, 124.0, 117.7. HRMS (ESI) m/z calcd for $C_{22}H_{16}NO^+$ $(M+H)^+$ 310.1226, found 310.1222.

4.2 Bromination



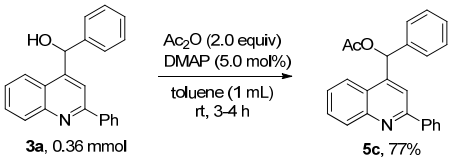
3a, 0.2 mmol **5b**, 53%

To a 10 mL reaction vessel was charged successively with **3a** (62.2 mg, 0.2 mmol), CBr_4 (99.5 mg, 1.5 equiv), CH_2Cl_2 (1.0 mL), and PPh_3 (62.9 mg, 1.2 equiv) in an ice bath. After the reaction mixture was stirred for 4 h at room temperature, the reaction solution was concentrated under reduced pressure. The residue was purified by silica gel flash column chromatography to give the corresponding compound **5b** (39.2 mg, 53% yield).

4-(Bromo(phenyl)methyl)-2-phenylquinoline (5b). Yellow oil. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.24 (d, J = 8.4 Hz, 1H), 8.16 – 8.14 (m, 3H), 8.02 (d, J = 8.4 Hz, 1H), 7.72 (t, J

= 7.5 Hz, 1H), 7.56 – 7.46 (m, 6H), 7.40 – 7.30 (m, 3H), 6.98 (s, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 148.9, 145.8, 139.5, 139.4, 130.7, 129.8, 129.7, 129.0, 129.0, 128.8, 128.6, 127.7, 126.8, 124.3, 123.4, 120.0, 50.9. HRMS (ESI) m/z calcd for $C_{22}H_{17}BrN^+$ $(M+H)^+$ 374.0539, found 374.0540.

4.3 Esterification



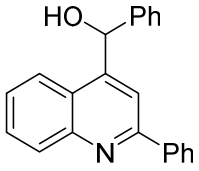
3a, 0.36 mmol **5c**, 77%

To a 10 mL reaction vessel was charged successively with **3a** (112.0 mg, 0.36 mmol), Ac_2O (70 μL, 2.0 equiv), toluene (1.0 mL), and N,N-dimethylpyridin-4-amine (DMAP, 2.2 mg, 5 mol%). The reaction mixture was stirred at room temperature for 4 h. After completion, saturated $NaHCO_3$ (aq, 10 mL) was added and then the mixture was extracted with ethyl acetate for three times (3*10 mL). The organic solution was washed with brine, dried over sodium sulfate, and filtered. The filtrate was concentrated in vacuo. The crude product was purified by the flash column chromatography to give compound **5c** (97.0 mg, 77%).

Phenyl(2-phenylquinolin-4-yl)methyl acetate (5c). Yellow oil. ^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.21 (dd, J = 13.8, 8.3 Hz, 3H), 8.06 (s, 1H), 7.96 (d, J = 8.4 Hz, 1H), 7.74 – 7.67 (m, 1H), 7.64 (s, 1H), 7.57 (t, J = 7.4 Hz, 2H), 7.53 – 7.40 (m, 4H), 7.38 – 7.32 (m, 3H), 2.25 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 169.9, 157.2, 148.8, 145.5, 139.7, 138.4, 130.7, 129.6, 129.6, 129.0, 128.9, 128.8, 127.9, 127.7, 126.8, 124.5, 123.7, 116.9, 73.6, 21.4. HRMS (ESI) m/z calcd for $C_{24}H_{20}NO_2^+$ $(M+H)^+$ 354.1489, found 354.1490.

5. Characterization data of products

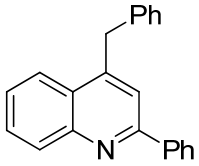
Phenyl(2-phenylquinolin-4-yl)methanol (3a)[3]



White solid. mp: 74 – 76 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.18 (d, J = 8.4 Hz, 1H), 8.12 – 7.96 (m, 3H), 7.74 (d, J = 8.4 Hz, 1H), 7.63 (t, J = 7.6 Hz, 1H), 7.48 – 7.44 (m, 3H), 7.40 – 7.15 (m, 6H), 6.32 (s, 1H), 3.64 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 149.2, 148.4, 141.9, 139.5, 130.2, 129.5, 129.4, 128.9, 128.9, 128.3, 127.7, 127.4, 126.3, 124.7, 123.8, 116.4, 72.8. HRMS (ESI) m/z calcd for $C_{22}H_{18}NO^+$ $(M + H)^+$ 312.1390, found 312.1392.

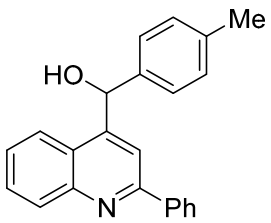
4-Benzyl-2-phenylquinoline (3a')[4]



Yellow oil.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.22 (d, J = 84 Hz, 1H), 8.13 – 8.11 (m, 2H), 8.03 (d, J = 8.4, 1H), 7.71 (ddd, J = 8.3, 6.8, 1.4 Hz, 1H), 7.66 (s, 1H), 7.56 – 7.42 (m, 4H), 7.35 – 7.31 (m, 2H), 7.27 – 7.24 (m, 3H), 4.51 (s, 2H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 148.7, 147.2, 139.9, 138.9, 130.6, 129.5, 129.4, 129.0, 128.9, 128.9, 127.7, 126.8, 126.7, 126.4, 123.9, 120.0, 38.7.

(2-Phenylquinolin-4-yl)(*p*-tolyl)methanol (3b)

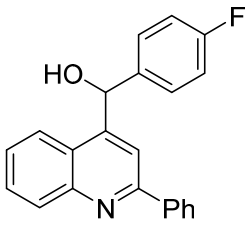


Yellow solid. mp: 116 – 118 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.23 – 8.13 (m, 4H), 7.81 (d, J = 8.4 Hz, 1H), 7.65 (ddd, J = 8.3, 6.9, 1.2 Hz, 1H), 7.57 – 7.43 (m, 3H), 7.39 (ddd, J = 8.2, 6.9, 1.2 Hz, 1H), 7.27 (d, J = 8.4 Hz,

2H), 7.12 (d, *J* = 7.9 Hz, 2H), 6.44 (s, 1H), 2.75 (brs, 1H), 2.31 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 149.0, 148.6, 139.8, 139.2, 138.3, 130.5, 129.7, 129.5, 129.3, 128.9, 127.8, 127.4, 126.3, 124.7, 123.7, 116.2, 72.9, 21.3. HRMS (ESI) m/z calcd for $C_{23}H_{20}NO^+$ $(M+H)^+$ 326.1539, found 326.1539.

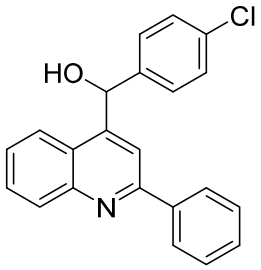
(4-Fluorophenyl)(2-phenylquinolin-4-yl)methanol (3c)



Yellow solid. mp: 148 – 150 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.18 (d, *J* = 8.4 Hz, 1H), 8.05 (dd, *J* = 7.9, 1.7 Hz, 2H), 8.03 (s, 1H), 7.70 (d, *J* = 8.4 Hz, 1H), 7.68 – 7.61 (m, 1H), 7.53 – 7.43 (m, 3H), 7.37 (ddd, *J* = 8.3, 6.9, 1.2 Hz, 1H), 7.29 (dd, *J* = 8.7, 5.3 Hz, 2H), 6.96 (t, *J* = 8.7 Hz, 2H), 6.33 (s, 1H), 3.51 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 162.5 (d, *J* = 245.6 Hz), 157.3, 148.9, 148.5, 139.5, 137.8(d, *J* = 3.2 Hz), 130.4, 129.6 (d, *J* = 13.6 Hz), 129.2 (d, *J* = 8.2 Hz), 128.9, 127.7, 126.4, 124.5, 123.6, 116.3, 115.9, 115.7, 72.2. HRMS (ESI) m/z calcd for $C_{22}H_{17}FNO^+$ $(M+H)^+$ 330.1289, found 330.1286.

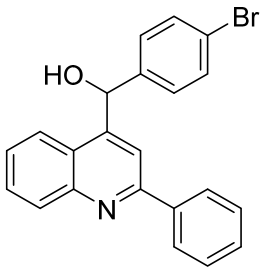
(4-Chlorophenyl)(2-phenylquinolin-4-yl)methanol (3d)



White solid. mp: 155 – 158 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.19 (d, *J* = 8.4 Hz, 1H), 8.15 – 8.10 (m, 2H), 8.08 (s, 1H), 7.77 (d, *J* = 8.3 Hz, 1H), 7.71 – 7.61 (m, 1H), 7.55 – 7.44 (m, 3H), 7.43 – 7.35 (m, 1H), 7.33 – 7.26 (m, 4H), 6.41 (s, 1H), 3.03 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 148.6, 148.5, 140.5, 139.5, 134.2, 130.6, 129.7, 129.6, 129.1, 128.9, 128.8, 127.7, 126.5, 124.5, 123.6, 116.4, 72.4. HRMS (ESI) m/z calcd for $C_{22}H_{17}ClNO^+$ $(M+H)^+$ 346.0993, found 346.0994.

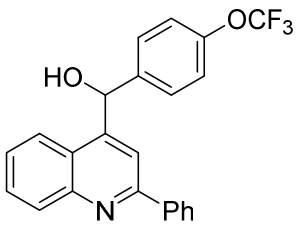
(4-Bromophenyl)(2-phenylquinolin-4-yl)methanol (3e)



White solid. mp: 162 – 164°C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.17 (d, J = 8.4 Hz, 1H), 8.09 – 8.02 (m, 2H), 8.00 (s, 1H), 7.72 (d, J = 8.4 Hz, 1H), 7.65 (t, J = 7.7 Hz, 1H), 7.50 – 7.45 (m, J = 5.9 Hz, 3H), 7.39 (t, J = 7.5 Hz, 3H), 7.19 (d, J = 8.4 Hz, 2H), 6.30 (s, 1H), 3.55 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 148.7, 148.5, 140.9, 139.4, 131.9, 130.4, 129.7, 129.6, 129.0, 128.9, 127.7, 126.5, 124.5, 123.6, 122.3, 116.5, 72.3. HRMS (ESI) m/z calcd for $C_{22}H_{17}BrNO^{+}$ $(M+H)^{+}$ 390.0488, found 390.0489.

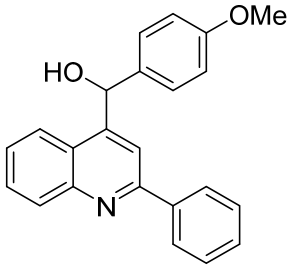
(2-Phenylquinolin-4-yl)(4-(trifluoromethoxy)phenyl)methanol (3f)



Yellow solid. mp: 141 – 144°C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.18 (d, J = 8.4 Hz, 1H), 8.04 – 7.93 (m, 3H), 7.74 – 7.61 (m, 2H), 7.51 – 7.42 (m, 3H), 7.41 – 7.30 (m, 3H), 7.12 (d, J = 8.1 Hz, 2H), 6.30 (s, 1H), 3.83 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 148.9, 148.8, 148.4, 140.6, 139.3, 130.3, 129.7, 129.6, 128.9, 128.8, 127.7, 126.5, 124.5, 123.6, 121.2, 120.5 (q, J = 256.0 Hz), 116.5, 72.0. HRMS (ESI) m/z calcd for $C_{23}H_{17}F_3NO_2^{+}$ $(M+H)^{+}$ 396.1206, found 396.1204.

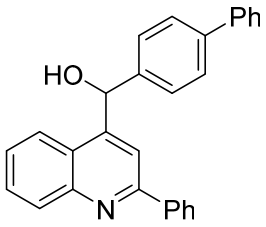
(4-Methoxyphenyl)(2-phenylquinolin-4-yl)methanol (3g)



Yellow oil.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.18 (d, *J* = 8.3 Hz, 1H), 8.13 (s, 1H), 8.12 – 8.08 (m, 2H), 7.73 (d, *J* = 8.3 Hz, 1H), 7.67 – 7.60 (m, 1H), 7.53 – 7.41 (m, 3H), 7.36 (t, *J* = 7.6 Hz, 1H), 7.23 (d, *J* = 8.7 Hz, 2H), 6.80 (d, *J* = 8.7 Hz, 2H), 6.33 (s, 1H), 3.74 (s, 3H), 3.28 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) *δ* 159.5, 157.3, 149.3, 148.4, 139.6, 134.3, 130.3, 129.5, 129.3, 128.9, 128.8, 127.7, 126.3, 124.6, 123.7, 116.1, 114.3, 72.4, 55.4. HRMS (ESI) m/z calcd for $C_{23}H_{20}NO_2^+$ $(M+H)^+$ 342.1489, found 342.1487.

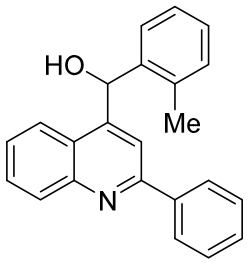
[1,1'-Biphenyl]-4-yl(2-phenylquinolin-4-yl)methanol (3h)



White solid. mp: 206 – 209 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) *δ* 8.21 (d, *J* = 8.4 Hz, 1H), 8.14 (s, 1H), 8.12 (d, *J* = 6.7 Hz, 2H), 7.82 (d, *J* = 8.3 Hz, 1H), 7.66 (t, *J* = 8.2 Hz, 1H), 7.56 – 7.31 (m, 14H), 6.42 (s, 1H), 3.39 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) *δ* 157.3, 149.1, 148.5, 141.2, 140.9, 140.5, 139.6, 130.4, 129.6, 129.4, 128.9, 128.9, 127.8, 127.7, 127.6, 127.6, 127.2, 126.4, 124.7, 123.8, 116.4, 72.6. HRMS (ESI) m/z calcd for $C_{28}H_{22}NO^+$ $(M+H)^+$ 388.1696, found 388.1700.

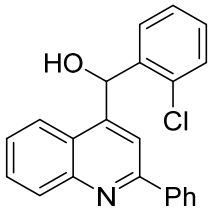
(2-Phenylquinolin-4-yl)(*o*-tolyl)methanol (3i)



Yellow solid. mp: 146 – 147 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) *δ* 8.20 (d, *J* = 8.4 Hz, 1H), 8.14 – 8.07 (m, 2H), 8.01 (s, 1H), 7.71 – 7.60 (m, 2H), 7.53 – 7.42 (m, 3H), 7.42 – 7.34 (m, 1H), 7.26 – 7.18 (m, 2H), 7.06 (dt, *J* = 14.2, 7.6 Hz, 2H), 6.61 (s, 1H), 2.72 (brs, 1H), 2.50 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) *δ* 157.3, 148.9, 148.5, 139.8, 139.7, 136.2, 131.1, 130.5, 130.5, 129.5, 129.4, 128.9, 128.6, 127.7, 127.3, 126.6, 126.5, 124.9, 123.5, 116.7, 69.7, 19.4. HRMS (ESI) m/z calcd for $C_{23}H_{20}NO^+$ $(M+H)^+$ 326.1539, found 326.1541.

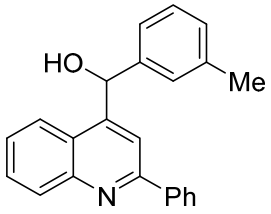
(2-Chlorophenyl)(2-phenylquinolin-4-yl)methanol (3j)



Yellow solid. mp: 160 – 163 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.19 (d, J = 8.7 Hz, 1H), 8.06 – 8.02 (m, 2H), 8.01 (s, 1H), 7.69 – 7.60 (m, 2H), 7.49 – 7.35 (m, 5H), 7.21 (dt, J = 8.3, 4.5 Hz, 1H), 7.09 (d, J = 4.4 Hz, 2H), 6.80 (s, 1H), 3.69 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 148.3, 148.2, 139.5, 139.3, 133.4, 130.3, 129.9, 129.7, 129.5, 129.5, 129.2, 128.9, 127.7, 127.5, 126.6, 124.7, 123.5, 116.6, 68.9. HRMS (ESI) m/z calcd for $C_{22}H_{17}ClNO^+$ $(M+H)^+$ 346.0993, found 346.0994.

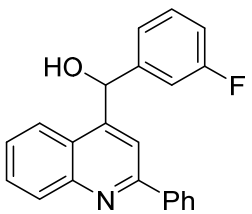
(2-Phenylquinolin-4-yl)(*m*-tolyl)methanol (3k)



Yellow solid. mp: 128 – 130 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.19 (d, J = 8.4 Hz, 1H), 8.13 (s, 2H), 8.12 – 8.11 (m, 1H), 7.78 (d, J = 8.0 Hz, 1H), 7.69 – 7.61 (m, 1H), 7.54 – 7.42 (m, 3H), 7.38 (ddd, J = 8.2, 6.9, 1.2 Hz, 1H), 7.23 – 7.10 (m, 3H), 7.08 (d, J = 7.3 Hz, 1H), 6.36 (s, 1H), 3.19 (brs, 1H), 2.28 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 149.1, 148.5, 142.0, 139.7, 138.7, 130.4, 129.5, 129.3, 129.2, 128.9, 128.8, 128.1, 127.7, 126.3, 124.7, 124.5, 123.8, 116.3, 73.0, 21.6. HRMS (ESI) m/z calcd for $C_{23}H_{20}NO^+$ $(M+H)^+$ 326.1539, found 326.1538.

(3-Fluorophenyl)(2-phenylquinolin-4-yl)methanol (3l)

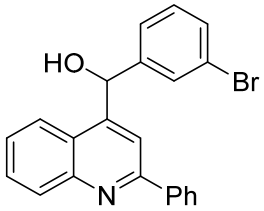


Yellow oil.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.18 (d, J = 8.4 Hz, 1H), 8.02 (dd, J = 7.5, 1.7 Hz, 2H), 7.96

(s, 1H), 7.74 (d, *J* = 8.4 Hz, 1H), 7.65 (t, *J* = 7.5 Hz, 1H), 7.52 – 7.42 (m, 3H), 7.38 (t, *J* = 7.6 Hz, 1H), 7.25 – 7.19 (m, 1H), 7.07 (t, *J* = 8.4 Hz, 2H), 6.94 (td, *J* = 8.5, 2.2 Hz, 1H), 6.30 (s, 1H), 3.72 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 163.1 (d, *J* = 245.3 Hz), 157.3, 148.6, 148.5, 144.5 (d, *J* = 6.6 Hz), 139.4, 130.4 (d, *J* = 10.5 Hz), 129.6 (d, *J* = 9.3 Hz), 128.9, 127.7, 126.5, 124.5, 123.6, 122.9 (d, *J* = 2.9 Hz), 116.6, 115.3, 115.1, 114.4, 114.2, 72.3. HRMS (ESI) m/z calcd for $C_{22}H_{17}FNO^+$ $(M+H)^+$ 330.1289, found 330.1288.

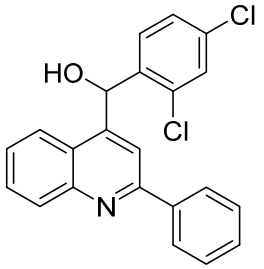
(3-Bromophenyl)(2-phenylquinolin-4-yl)methanol (3m)



Yellow solid. mp: 135 – 137 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.18 (d, *J* = 8.4 Hz, 1H), 8.09 – 8.02 (m, 2H), 8.00 (s, 1H), 7.74 (d, *J* = 8.3 Hz, 1H), 7.71 – 7.63 (m, 1H), 7.56 – 7.43 (m, 4H), 7.43 – 7.35 (m, 2H), 7.22 (d, *J* = 7.8 Hz, 1H), 7.14 (t, *J* = 7.8 Hz, 1H), 6.31 (s, 1H), 3.51 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 148.5, 148.4, 144.2, 139.4, 131.4, 130.4, 130.3, 129.7, 129.6, 128.9, 127.7, 126.6, 125.9, 124.5, 123.6, 123.0, 116.6, 72.3. HRMS (ESI) m/z calcd for $C_{22}H_{17}BrNO^+$ $(M+H)^+$ 390.0488, found 390.0489.

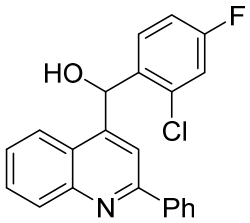
(2,4-Dichlorophenyl)(2-phenylquinolin-4-yl)methanol (3n)



Yellow solid. mp: 153 – 156 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.19 (d, *J* = 8.4 Hz, 1H), 8.03 (dd, *J* = 7.8, 1.6 Hz, 2H), 7.96 (s, 1H), 7.70 – 7.58 (m, 2H), 7.51 – 7.36 (m, 5H), 7.12 – 6.99 (m, 2H), 6.73 (s, 1H), 3.66 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 148.3, 147.7, 139.4, 137.9, 134.9, 134.1, 130.4, 130.1, 129.7, 129.7, 129.6, 128.9, 127.8, 127.7, 126.8, 124.5, 123.2, 116.5, 68.4. HRMS (ESI) m/z calcd for $C_{22}H_{16}Cl_2NO^+$ $(M+H)^+$ 380.0603, found 380.0605.

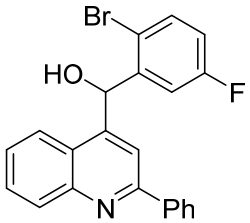
(2-Chloro-4-fluorophenyl)(2-phenylquinolin-4-yl)methanol (3o)



Yellow solid. mp: 148 – 150 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.19 (d, J = 8.4 Hz, 1H), 8.07 – 8.01 (m, 2H), 8.00 (s, 1H), 7.69 – 7.63 (m, 1H), 7.61 (d, J = 8.3 Hz, 1H), 7.48 – 7.44 (m, 3H), 7.40 (t, J = 8.0 Hz, 1H), 7.17 (dd, J = 8.4, 2.5 Hz, 1H), 7.06 (dd, J = 8.7, 6.1 Hz, 1H), 6.81 (td, J = 8.4, 2.6 Hz, 1H), 6.75 (s, 1H), 3.58 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 162.2 (d, J = 249.7 Hz), 157.28, 148.31, 148.02, 139.38, 135.4 (d, J = 3.5 Hz), 134.2 (d, J = 10.4 Hz), 130.5 (d, J = 6.9 Hz), 130.34, 129.6 (d, J = 3.8 Hz), 128.96, 127.70, 126.72, 124.53, 123.29, 117.3 (d, J = 24.7 Hz), 116.47, 114.89, 114.68, 68.37. HRMS (ESI) m/z calcd for $C_{22}H_{16}ClFNO^+$ $(M+H)^+$ 364.0899, found 364.0901.

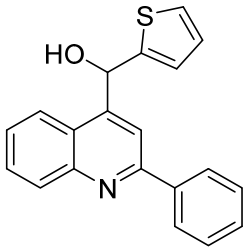
(2-Bromo-5-fluorophenyl)(2-phenylquinolin-4-yl)methanol (3p)



Yellow solid. mp: 175 – 179 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.20 (d, J = 8.6 Hz, 1H), 8.06 – 7.98 (m, 2H), 7.87 (s, 1H), 7.73 – 7.71(m, 2H), 7.54 (dd, J = 8.4, 5.1 Hz, 1H), 7.51 – 7.37 (m, 4H), 6.94 – 6.82 (m, 2H), 6.68 (s, 1H), 3.81 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 162.3 (d, J = 246.6 Hz), 157.3, 147.4, 143.1 (d, J = 6.8 Hz), 139.3, 134.4 (d, J = 7.7 Hz), 130.4, 129.7, 128.9, 127.7, 126.8, 124.7, 123.3, 117.7 (d, J = 3.2 Hz), 117.4, 117.1, 116.8, 116.6 (d, J = 4.5 Hz), 71.2. HRMS (ESI) m/z calcd for $C_{22}H_{16}BrFNO^+$ $(M+H)^+$ 408.0394, found 408.0397.

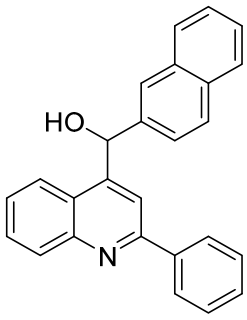
(2-Phenylquinolin-4-yl)(thiophen-2-yl)methanol (3q)



Brown solid. mp: 150 – 151 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.20 (d, J = 8.4 Hz, 1H), 8.16 (s, 1H), 8.15 – 8.10 (m, 2H), 7.85 (d, J = 8.3 Hz, 1H), 7.72 – 7.63 (m, 1H), 7.55 – 7.38 (m, 4H), 7.28 – 7.24 (m, 1H), 6.94 – 6.80 (m, 2H), 6.67 (s, 1H), 3.25 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.4, 148.6, 148.5, 145.9, 139.6, 130.5, 129.6, 129.5, 128.9, 127.7, 127.0, 126.5, 126.2, 126.2, 124.5, 123.5, 115.8, 68.4. HRMS (ESI) m/z calcd for $C_{20}H_{16}NOS^+$ $(M+H)^+$ 318.0947, found 318.0947.

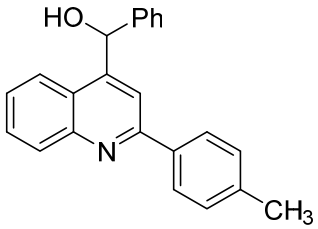
Naphthalen-2-yl(2-phenylquinolin-4-yl)methanol (3r)



Brown solid. mp: 138 – 140 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.26 – 8.10 (m, 4H), 7.88 – 7.74 (m, 5H), 7.66 – 7.61 (m, 1H), 7.53 – 7.43 (m, 6H), 7.38 – 7.32 (m, 1H), 6.58 (s, 1H), 3.20 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.3, 148.8, 148.5, 139.6, 139.4, 133.4, 133.2, 130.4, 129.6, 129.5, 123.0, 128.9, 128.3, 127.8, 127.8, 126.5, 126.5, 126.5, 125.1, 124.7, 123.8, 116.6, 73.2. HRMS (ESI) m/z calcd for $C_{26}H_{20}NO^+$ $(M+H)^+$ 362.1539, found 362.1540.

Phenyl(2-(*p*-tolyl)quinolin-4-yl)methanol (4a)

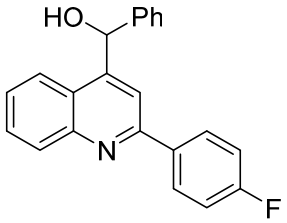


Yellow solid. mp: 177 – 180 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.16 (d, J = 8.4 Hz, 1H), 8.06 (s, 1H), 7.99 (d, J = 8.1 Hz,

2H), 7.76 (d, *J* = 8.3 Hz, 1H), 7.68 – 7.55 (m, 1H), 7.42 – 7.20 (m, 8H), 6.37 (s, 1H), 3.38 (brs, 1H), 2.42 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.2, 148.9, 148.5, 142.0, 139.6, 136.8, 130.2, 129.6, 129.3, 128.9, 128.9, 128.3, 127.6, 127.4, 126.1, 124.6, 123.7, 116.3, 72.9, 21.5. HRMS (ESI) m/z calcd for $C_{23}H_{20}NO^+$ $(M+H)^+$ 326.1539, found 326.1537.

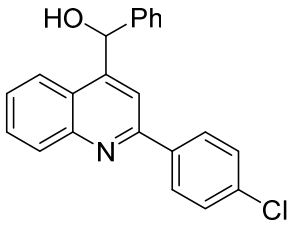
(2-(4-Fluorophenyl)quinolin-4-yl)(phenyl)methanol (4b)



Yellow solid. mp: 171 – 174 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.18 (d, *J* = 8.4 Hz, 1H), 8.05 (dd, *J* = 7.9, 1.7 Hz, 2H), 8.03 (s, 1H), 7.70 (d, *J* = 8.4 Hz, 1H), 7.64 (ddd, *J* = 8.3, 6.9, 1.3 Hz, 1H), 7.53 – 7.42 (m, 3H), 7.40 – 7.33 (m, 1H), 7.33 – 7.27 (m, 2H), 7.01 – 6.90 (m, 2H), 6.33 (s, 1H), 3.51 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 162.5 (d, *J* = 245.6 Hz), 157.3, 148.9, 148.4, 139.4, 137.8 (d, *J* = 3.2 Hz), 130.3, 129.6 (d, *J* = 13.6 Hz), 129.2 (d, *J* = 8.2 Hz), 128.9, 127.7, 126.4, 124.5, 123.6, 116.3, 115.9, 115.7, 72.2. HRMS (ESI) m/z calcd for $C_{22}H_{17}FNO^+$ $(M+H)^+$ 330.1289, found 330.1288.

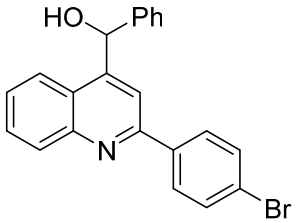
(2-(4-Chlorophenyl)quinolin-4-yl)(phenyl)methanol (4c)



Yellow solid. mp: 169 – 171 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.17 (d, *J* = 8.4 Hz, 1H), 8.09 (s, 1H), 8.06 (d, *J* = 8.5 Hz, 2H), 7.79 (d, *J* = 8.4 Hz, 1H), 7.70 – 7.62 (m, 1H), 7.45 (d, *J* = 8.5 Hz, 2H), 7.43 – 7.27 (m, 6H), 6.42 (s, 1H), 3.08 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 155.9, 149.2, 148.4, 141.9, 138.0, 135.7, 130.4, 129.6, 129.1, 129.0, 128.9, 128.5, 127.4, 126.6, 124.7, 123.7, 115.9, 72.9. HRMS (ESI) m/z calcd for $C_{22}H_{17}ClNO^+$ $(M+H)^+$ 346.0993, found 346.0990.

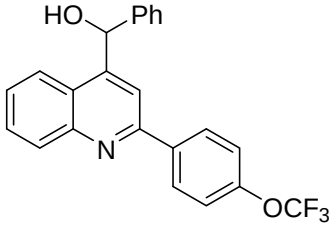
(2-(4-Bromophenyl)quinolin-4-yl)(phenyl)methanol (4d)



Yellow solid. mp: 100 – 101 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.16 (d, J = 8.4 Hz, 1H), 8.03 (s, 1H), 7.91 (d, J = 8.5 Hz, 2H), 7.74 (d, J = 8.3 Hz, 1H), 7.64 (t, J = 7.6 Hz, 1H), 7.57 (d, J = 8.5 Hz, 2H), 7.38 (t, J = 7.6 Hz, 1H), 7.35 – 7.23 (m, 5H), 6.35 (s, 1H), 3.54 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 155.9, 149.4, 148.3, 141.9, 138.3, 132.0, 130.2, 129.6, 129.2, 128.9, 128.4, 127.4, 126.6, 124.7, 124.1, 123.7, 115.9, 72.8. HRMS (ESI) m/z calcd for $C_{22}H_{17}BrNO^{+}$ $(M+H)^{+}$ 390.0488, found 390.0490.

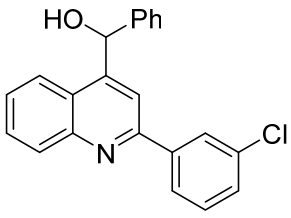
Phenyl(2-(4-(trifluoromethoxy)phenyl)quinolin-4-yl)methanol (4e)



Yellow solid. mp: 158 – 160 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.17 (d, J = 8.4 Hz, 1H), 8.13 (d, J = 8.7 Hz, 2H), 8.09 (s, 1H), 7.78 (d, J = 8.4 Hz, 1H), 7.66 (t, J = 7.6 Hz, 1H), 7.43 – 7.27 (m, 8H), 6.40 (s, 1H), 3.23 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 155.8, 150.3, 149.3, 148.4, 141.9, 138.2, 130.4, 129.6, 129.2, 129.0, 128.5, 127.4, 126.7, 124.7, 123.7, 121.2, 120.6 (q, J = 255.9 Hz), 116.0, 72.9. HRMS (ESI) m/z calcd for $C_{23}H_{17}F_3NO_2^{+}$ $(M+H)^{+}$ 396.1206, found 396.1207.

(2-(3-Chlorophenyl)quinolin-4-yl)(phenyl)methanol (4f)

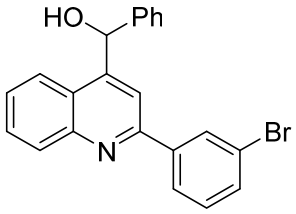


Yellow solid. mp: 101 – 102 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.16 (d, J = 8.4 Hz, 1H), 8.03 (s, 1H), 7.99 (d, J = 8.6 Hz, 2H), 7.75 (d, J = 8.3 Hz, 1H), 7.69 – 7.61 (m, 1H), 7.44 – 7.24 (m, 8H), 6.36 (s, 1H), 3.46 (brs,

1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 155.9, 149.3, 148.4, 141.9, 137.9, 135.7, 130.3, 129.5, 129.0, 128.9, 128.9, 128.4, 127.4, 126.5, 124.7, 123.7, 115.9, 72.8. HRMS (ESI) m/z calcd for $C_{22}H_{17}ClNO^+$ $(M+H)^+$ 346.0993, found 346.0995.

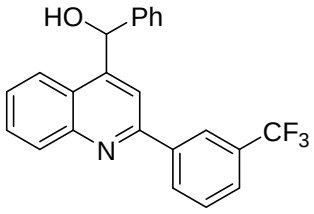
(2-(3-Bromophenyl)quinolin-4-yl)(phenyl)methanol (4g)



Yellow oil.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.34 (t, *J* = 1.8 Hz, 1H), 8.18 (d, *J* = 8.4 Hz, 1H), 8.15 (s, 1H), 8.10 – 8.04 (m, 1H), 7.82 (d, *J* = 8.4 Hz, 1H), 7.71 – 7.63 (m, 1H), 7.61 – 7.56 (m, 1H), 7.45 – 7.28 (m, 7H), 6.47 (s, 1H), 2.87 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 155.6, 149.2, 148.5, 141.9, 141.7, 132.4, 130.7, 130.6, 130.4, 129.6, 129.1, 128.6, 127.4, 126.8, 126.2, 124.8, 123.7, 123.2, 115.9, 73.0. HRMS (ESI) m/z calcd for $C_{22}H_{17}BrNO^+$ $(M+H)^+$ 390.0488, found 390.0487.

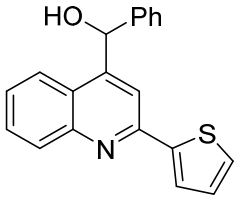
Phenyl(2-(4-(trifluoromethyl)phenyl)quinolin-4-yl)methanol (4h)



Brown oil.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.45 (s, 1H), 8.30 (d, *J* = 7.8 Hz, 1H), 8.22 – 8.16 (m, 2H), 7.79 (d, *J* = 8.4 Hz, 1H), 7.74 – 7.63 (m, 2H), 7.60 (t, *J* = 7.8 Hz, 1H), 7.40 (t, *J* = 8.1 Hz, 1H), 7.37 – 7.27 (m, 5H), 6.43 (s, 1H), 3.20 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 155.5, 149.5, 148.4, 141.9, 140.4, 131.3 (q, *J* = 32.0 Hz), 130.9, 130.5, 129.7, 129.4, 129.0, 128.5, 127.4, 126.8, 126.1 (q, *J* = 10.9 Hz), 124.8, 124.5 (q, *J* = 11.4 Hz), 124.3 (q, *J* = 270.9 Hz), 123.7, 115.8, 72.9. HRMS (ESI) m/z calcd for $C_{23}H_{17}F_3NO^+$ $(M+H)^+$ 380.1257, found 380.1258.

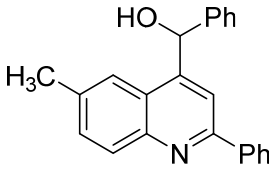
Phenyl(2-(thiophen-2-yl)quinolin-4-yl)methanol (4i)



Yellow solid. mp:160 – 163 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.07 (d, J = 8.4 Hz, 1H), 7.98 (s, 1H), 7.67 (t, J = 5.9 Hz, 2H), 7.63 – 7.56 (m, 1H), 7.47 (dd, J = 5.0, 0.9 Hz, 1H), 7.39 – 7.27 (m, 6H), 7.14 (dd, J = 5.0, 3.7 Hz, 1H), 6.36 (s, 1H), 3.07 (brs, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 152.3, 148.9, 148.2, 145.2, 141.7, 129.8, 129.5, 128.9, 128.8, 128.4, 128.2, 127.4, 126.4, 126.1, 124.7, 123.7, 114.9, 72.8. HRMS (ESI) m/z calcd for $C_{20}H_{16}NOS^+$ $(M+H)^+$ 318.0947, found 318.0948.

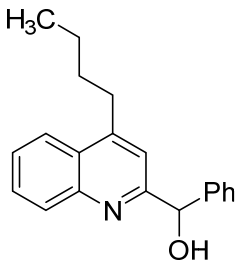
(6-Methyl-2-phenylquinolin-4-yl)(phenyl)methanol (4j)



Orange solid. mp: 138 – 140 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.09 – 8.04 (m, 3H), 7.98 (s, 1H), 7.53 (s, 1H), 7.51 – 7.42 (m, 4H), 7.38 – 7.26 (m, 5H), 6.35 (s, 1H), 3.35 (brs, 1H), 2.42 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 156.3, 148.3, 147.0, 142.0, 139.6, 136.2, 131.6, 130.0, 129.3, 128.9, 128.9, 128.3, 127.6, 127.3, 124.7, 122.7, 116.3, 72.7, 22.1. HRMS (ESI) m/z calcd for $C_{23}H_{20}NO^+$ $(M+H)^+$ 326.1539, found 326.1540.

(4-Butylquinolin-2-yl)(phenyl)methanol (4k)

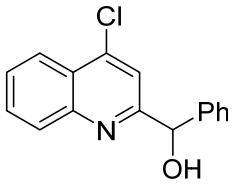


Yellow solid. mp: 130 – 134 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.15 (d, J = 8.4 Hz, 1H), 8.00 (d, J = 8.3 Hz, 1H), 7.73 (ddd, J = 8.3, 7.0, 1.3 Hz, 1H), 7.56 (ddd, J = 8.2, 7.0, 1.2 Hz, 1H), 7.46 – 7.38 (m, 2H), 7.38 – 7.27 (m, 3H), 7.00 (s, 1H), 6.15 (s, 1H), 5.84 (brs, 1H), 3.06 – 2.87 (m, 2H), 1.67 – 1.61 (m, 2H), 1.43 –

1.33 (m, 2H), 0.92 (t, J = 7.3 Hz, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 160.1, 145.0, 146.2, 143.1, 129.6, 129.5, 128.7, 128.0, 127.6, 127.0, 126.4, 123.7, 118.8, 75.1, 32.2, 32.2, 22.8, 13.9. HRMS (ESI) m/z calcd for $C_{20}H_{22}NO^+$ $(M+H)^+$ 292.1696, found 292.1696.

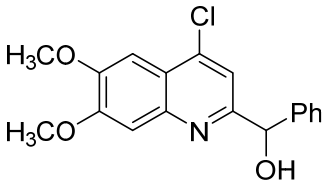
(4-Chloroquinolin-2-yl)(phenyl)methanol (4l)



Yellow solid. mp: 123 – 125 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.21 – 8.18 (m, 1H), 8.16 (d, J = 8.5 Hz, 1H), 7.87 – 7.75 (m, 1H), 7.69 – 7.61 (m, 1H), 7.45 – 7.28 (m, 6H), 5.84 (s, 1H), 5.80 (s, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 160.8, 146.9, 143.6, 142.2, 131.0, 129.3, 128.9, 128.4, 127.7, 127.5, 125.8, 124.3, 119.4, 75.2. HRMS (ESI) m/z calcd for $C_{16}H_{13}ClNO^+$ $(M+H)^+$ 270.0680, found 270.0680.

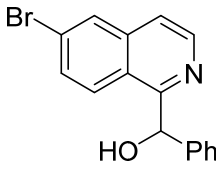
(4-Chloro-6,7-dimethoxyquinolin-2-yl)(phenyl)methanol (4m)



Brown solid. mp: 187 – 190 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.46 (s, 1H), 7.42 – 7.39 (m, 2H), 7.38 – 7.33 (m, 3H), 7.32 – 7.29 (m, 1H), 7.15 (s, 1H), 5.80 (s, 1H), 5.64 (brs, 1H), 4.08 (s, 3H), 4.05 (s, 3H). ^{13}C NMR (100MHz, Chloroform-*d*) δ 158.7, 153.5, 150.7, 144.1, 142.7, 141.4, 128.8, 128.2, 127.4, 121.1, 117.6, 108.1, 102.0, 75.1, 56.5, 56.4. HRMS (ESI) m/z calcd for $C_{18}H_{17}ClNO_3^+$ $(M+H)^+$ 330.0891, found 330.0894.

(6-Bromoisoquinolin-1-yl)(phenyl)methanol (4n)

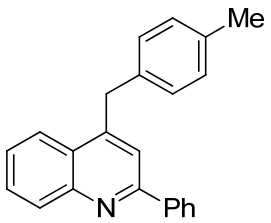


Yellow solid. mp: 118 – 120 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.56 (d, J = 5.7 Hz, 1H), 8.01 (d, J = 1.9 Hz, 1H), 7.82 (d, J = 9.0 Hz, 1H), 7.63 – 7.50 (m, 2H), 7.36 – 7.16 (m, 6H), 6.33 (s, 1H). ^{13}C NMR (100 MHz,

Chloroform-*d*) *δ* 159.6, 143.0, 141.0, 137.9, 131.2, 129.7, 128.9, 128.2, 127.7, 126.7, 125.4, 123.7, 120.2, 72.7. 6. HRMS (ESI) m/z calcd for $C_{16}H_{13}BrNO^+$ $(M+H)^+$ 314.0175, found 314.0178.

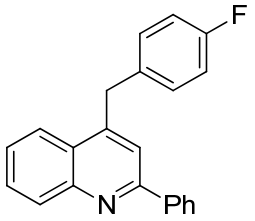
4-(4-methylbenzyl)-2-phenylquinoline (3b')



White solid. mp: 121 – 123 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.23 (d, *J* = 8.4 Hz, 1H), 8.14 (d, *J* = 7.6 Hz, 2H), 8.04 (d, *J* = 8.4 Hz, 1H), 7.72 (t, *J* = 7.6 Hz, 1H), 7.67 (s, 1H), 7.55 – 7.45 (m, 4H), 7.17 – 7.12 (m, 4H), 4.47 (s, 2H), 2.35 (s, 3H); ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.1, 148.5, 147.3, 139.7, 136.1, 135.6, 130.3, 129.4, 129.3, 129.2, 128.7, 128.7, 127.5, 126.5, 126.2, 123.7, 119.8, 38.1, 21.0. HRMS (ESI) m/z calcd for $C_{23}H_{20}N^+$ $(M+H)^+$ 310.1590, found 310.1584.

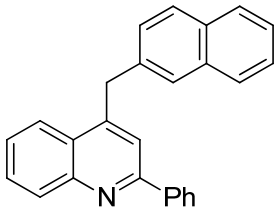
4-(4-fluorobenzyl)-2-phenylquinoline (3c')



White solid. mp: 113 – 115 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.25 (d, *J* = 8.5 Hz, 1H), 8.14 (d, *J* = 7.8 Hz, 2H), 7.98 (d, *J* = 8.3 Hz, 1H), 7.73 (t, *J* = 7.7 Hz, 1H), 7.62 (s, 1H), 7.58 – 7.43 (m, 4H), 7.19 (dd, *J* = 8.4, 5.5 Hz, 2H), 7.02 (t, *J* = 8.6 Hz, 2H), 4.44 (s, 2H); ^{13}C NMR (100 MHz, Chloroform-*d*) δ 161.5 (d, *J* = 245.0 Hz), 157.1, 148.5, 146.7, 139.5, 134.3 (d, *J* = 3.2 Hz), 130.4, 130.3, 130.2, 129.3 (d, *J* = 9.6 Hz), 128.7, 127.4, 126.3, 126.3, 123.5, 119.6, 115.5 (d, *J* = 21.3 Hz), 37.6. HRMS (ESI) m/z calcd for $C_{22}H_{17}FN^+$ $(M+H)^+$ 314.1340, found 314.1342.

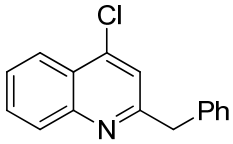
4-(naphthalen-2-ylmethyl)-2-phenylquinoline (3r')



White solid. mp: 158 – 160 °C.

^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.26 (d, *J* = 8.5 Hz, 1H), 8.15 (d, *J* = 8.0 Hz, 2H), 8.06 (d, *J* = 8.4 Hz, 1H), 7.85 – 7.81 (m, 2H), 7.77 – 7.72 (m, 3H), 7.66 (s, 1H), 7.54 – 7.46 (m, 6H), 7.41 – 7.38 (m, 1H), 4.65 (s, 2H); ^{13}C NMR (100 MHz, Chloroform-*d*) δ 157.1, 148.5, 146.8, 139.6, 136.2, 133.5, 132.2, 130.4, 129.4, 129.2, 128.7, 128.3, 127.6, 127.6, 127.5, 127.3, 127.1, 126.6, 126.3, 126.1, 125.6, 123.7, 119.9, 38.7. HRMS (ESI) m/z calcd for $C_{26}H_{20}N^{+}$ $(M+H)^{+}$ 346.1590, found 346.1588.

2-benzyl-4-chloroquinoline (4l')



White solid. mp: 57 – 59 °C.

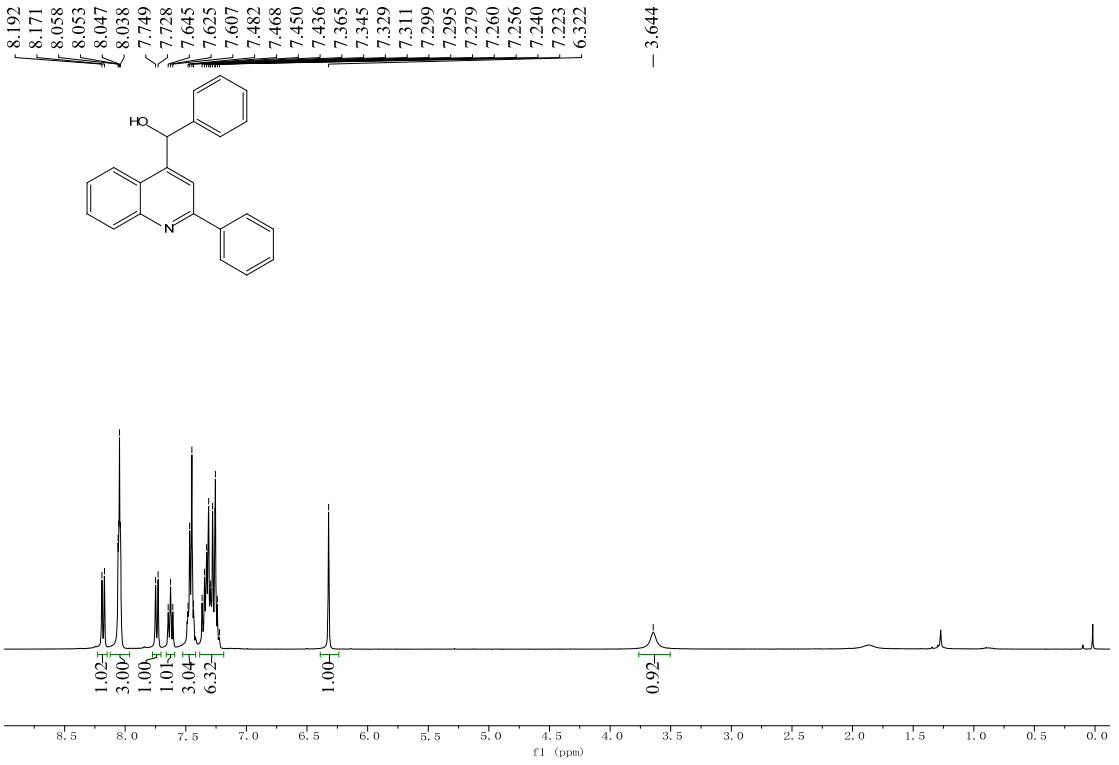
^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.12 (d, *J* = 8.4 Hz, 1H), 8.10 (d, *J* = 8.4 Hz, 1H), 7.74 – 7.70 (m, 1H), 7.57 – 7.53 (m, 1H), 7.31 – 7.29 (m, 5H), 7.25 – 7.21 (m, 1H), 4.29 (s, 2H); ^{13}C NMR (100 MHz, Chloroform-*d*) δ 161.1, 148.5, 142.8, 138.4, 130.3, 129.2, 129.1, 128.7, 126.9, 126.7, 124.9, 123.9, 121.4, 45.2. HRMS (ESI) m/z calcd for $C_{16}H_{13}ClN^{+}$ $(M+H)^{+}$ 254.0731, found 254.0727.

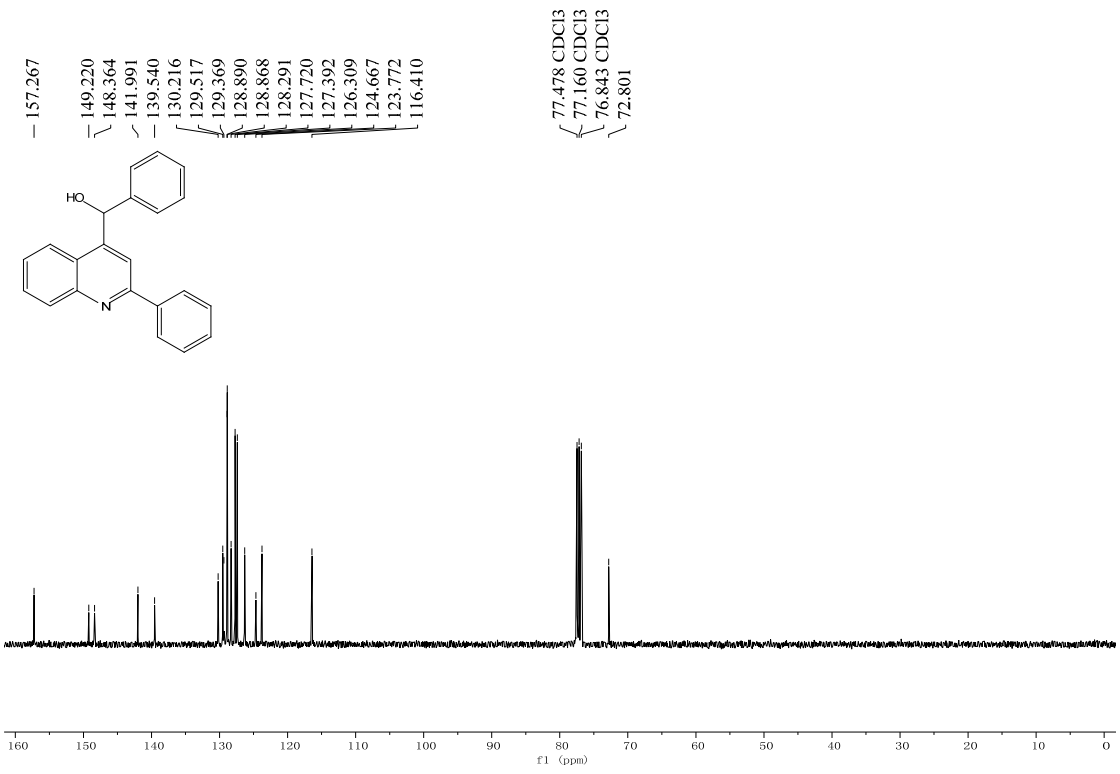
6. References

1. Nacsa, E. D.; MacMillan, D. W. C. *J. Am. Chem. Soc.* **2018**, *140*, 3322 – 3330.
2. Gao, G.-L.; Niu, Y.-N.; Yan, Z.-Y.; Wang, H.-L.; Wang, G.-W. Shaukat, A.; Liang, Y.-M. *J. Org. Chem.* **2010**, *75*, 1305 – 1308.
3. León, B.; Fong, J. C. N.; Peach, K. C.; Wong, W. R.; Yildiz, F. H.; Linington, R. G. *Org. Lett.* **2013**, *15*, 1234 – 1237.
4. Z. Wang, Q. Liu, X. Ji, G.-J. Deng and H. Huang, *ACS Catal.*, 2020, **10**, 154-159.

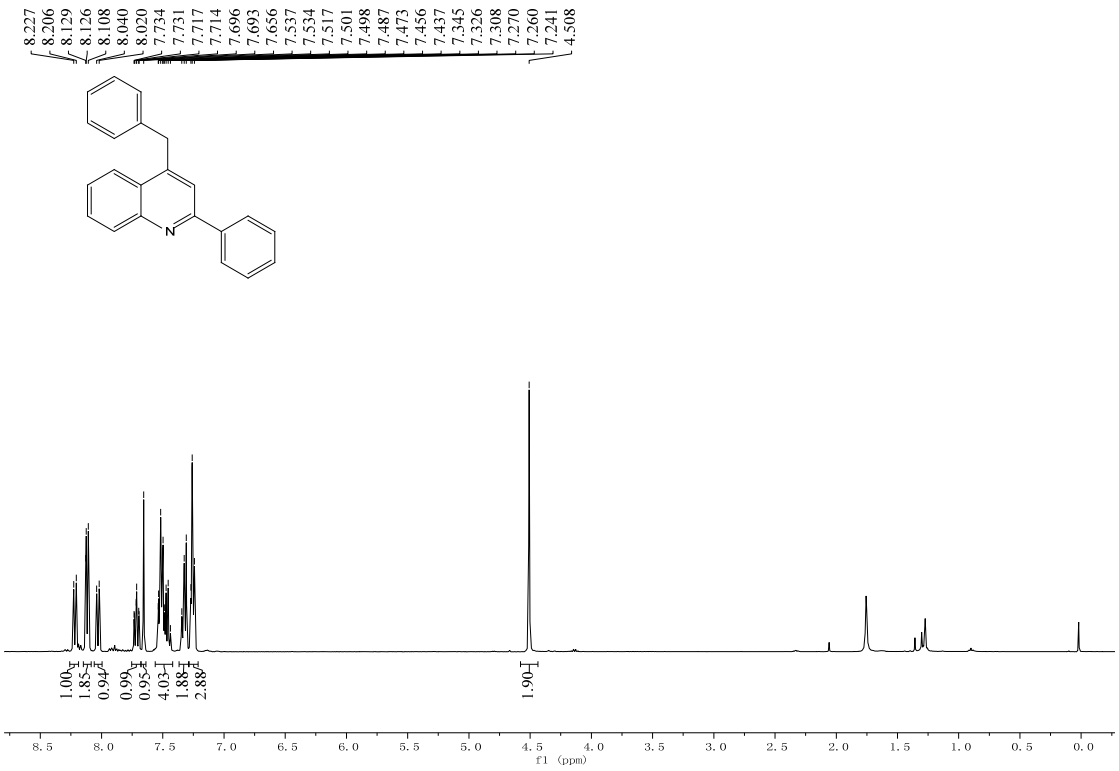
7. Copies of ^{1}H and ^{13}C NMR spectra of products

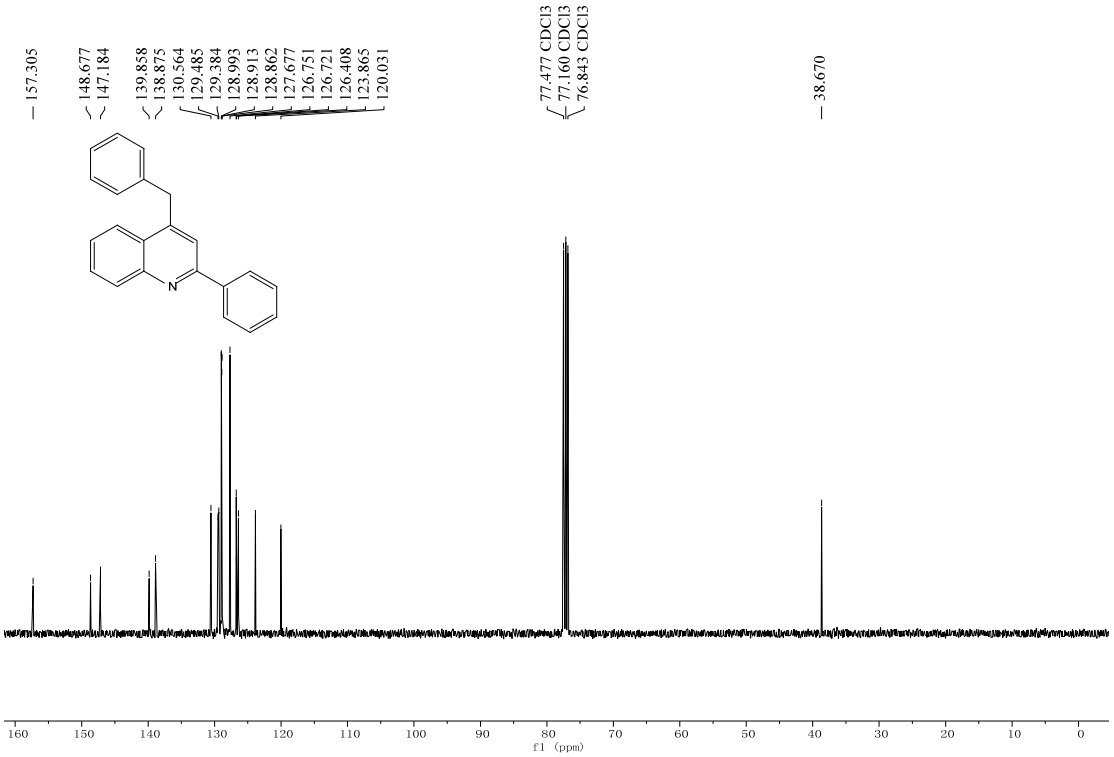
^{1}H and ^{13}C NMR spectra of 3a



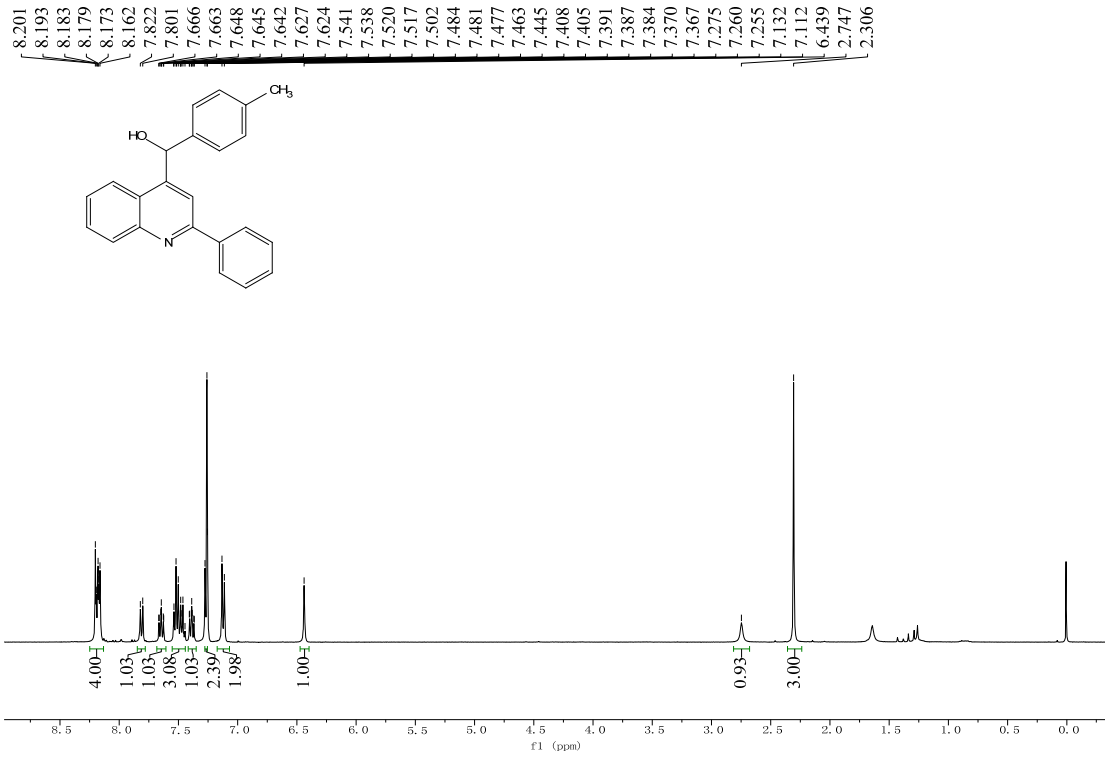


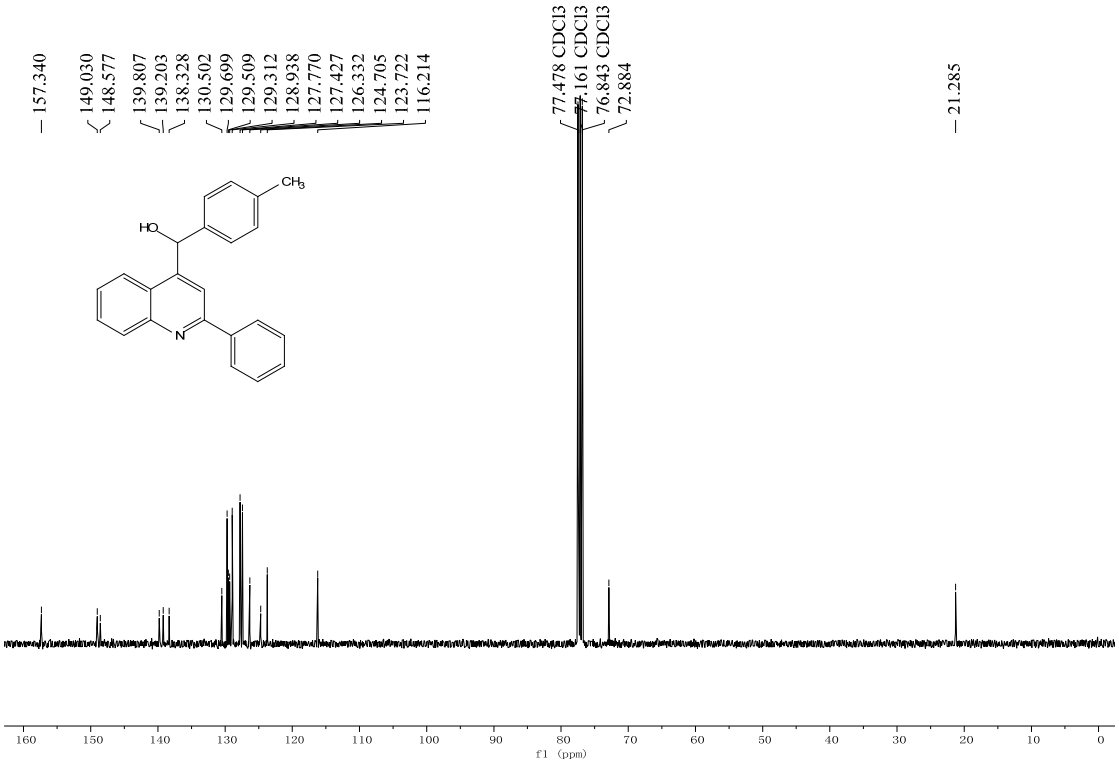
^{1}H and ^{13}C NMR spectra of 3a’



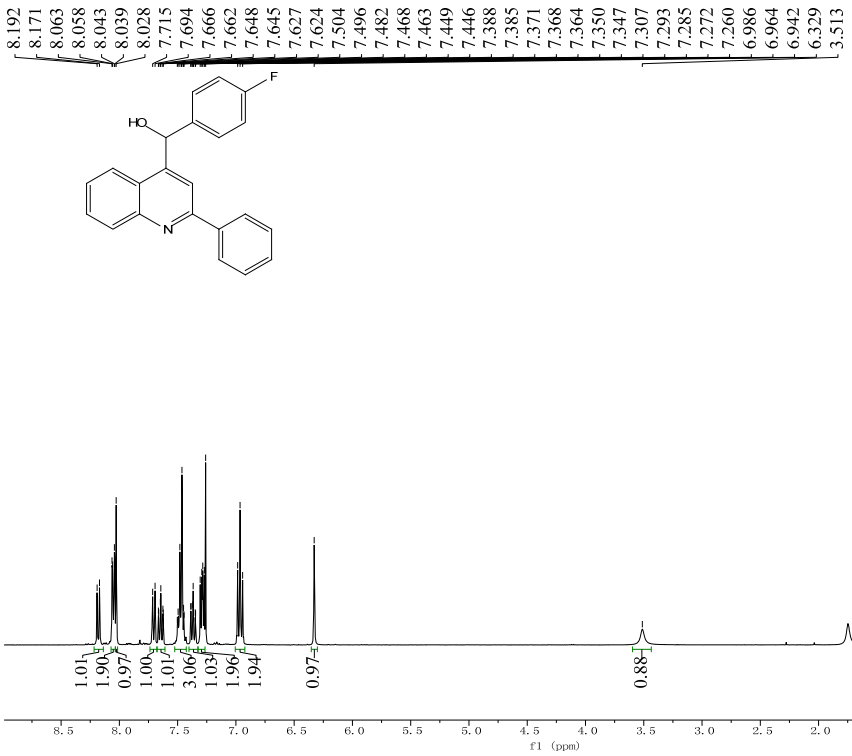


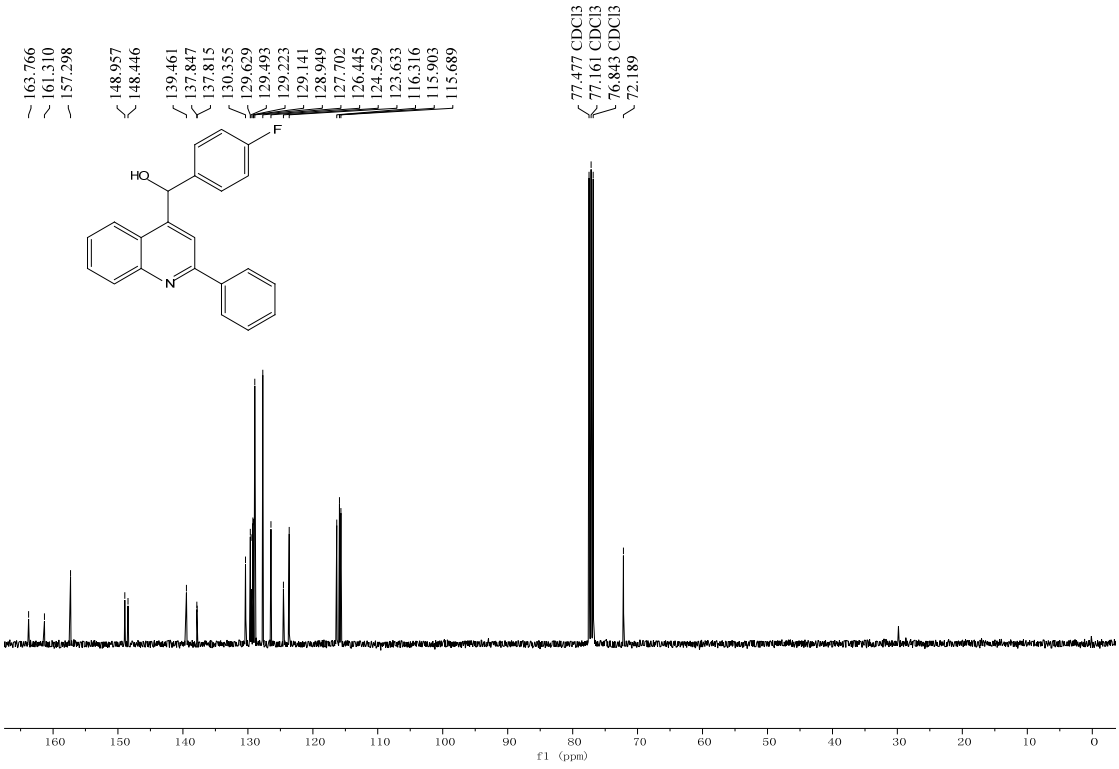
^{1}H and ^{13}C NMR spectra of 3b



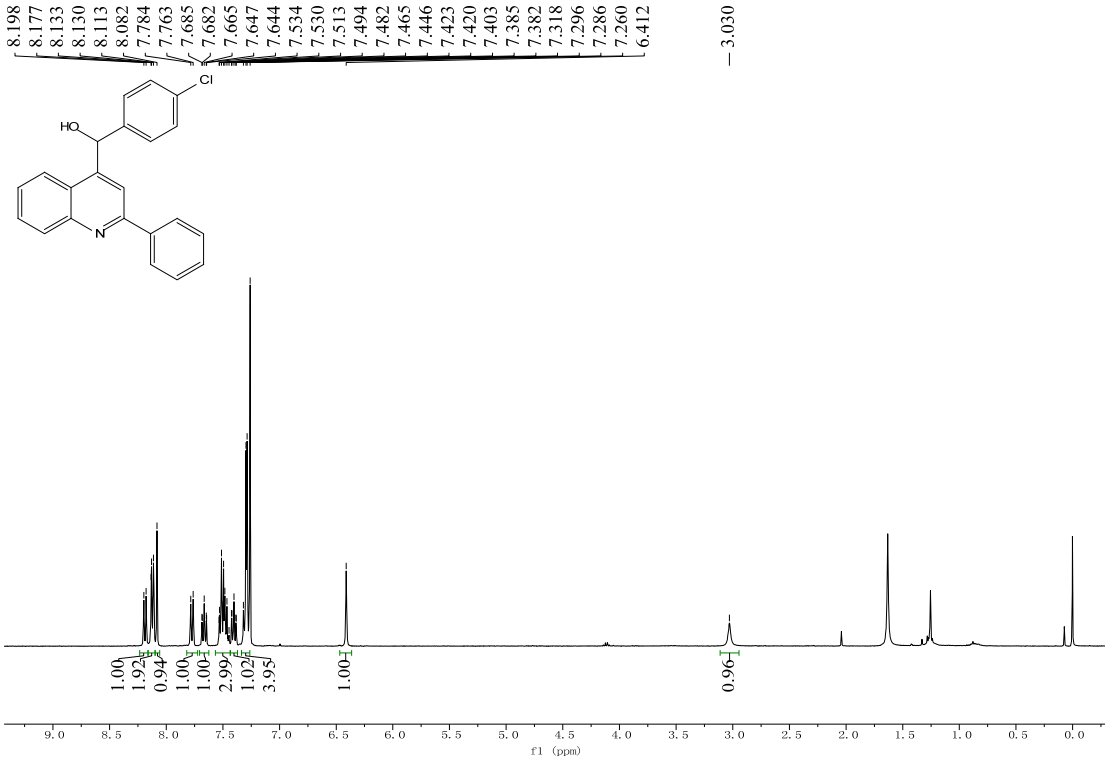


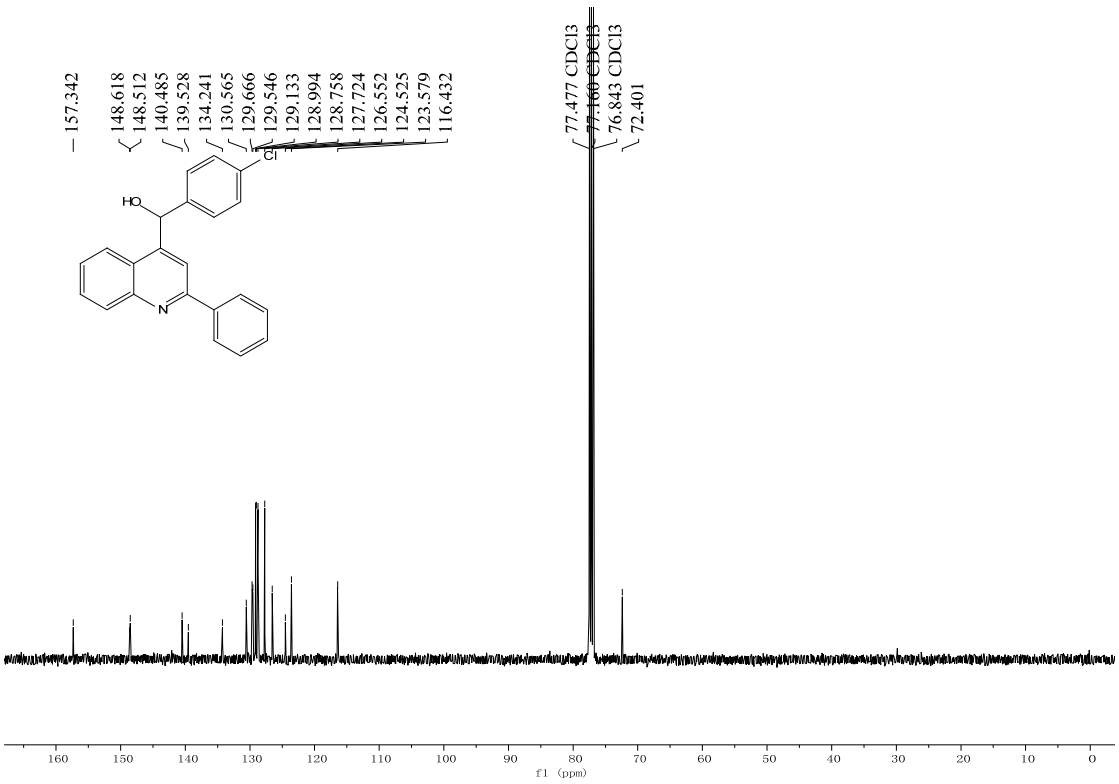
^{1}H and ^{13}C NMR spectra of 3c



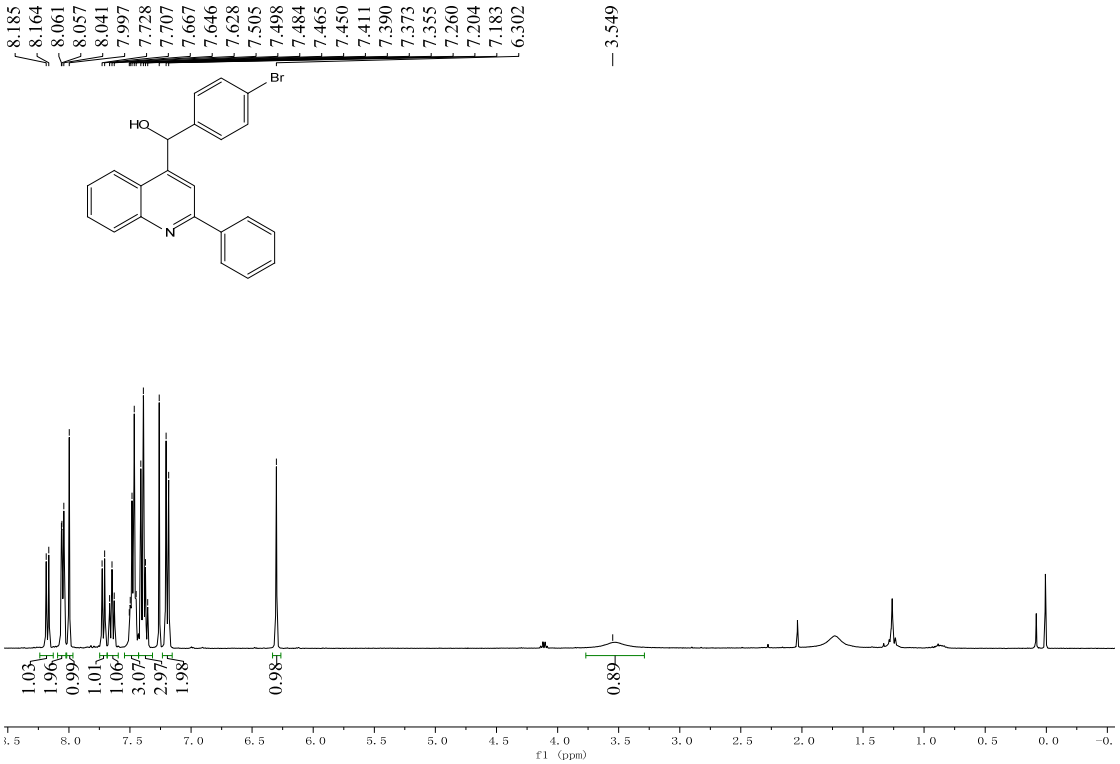


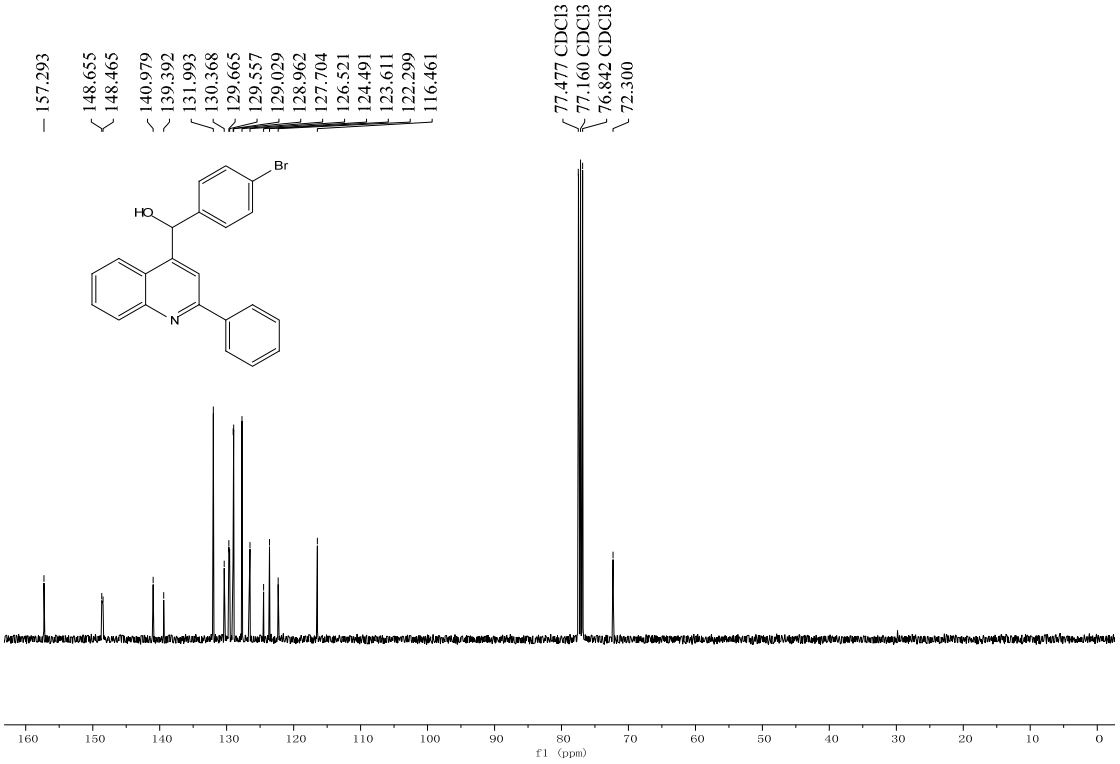
^{1}H and ^{13}C NMR spectra of 3d



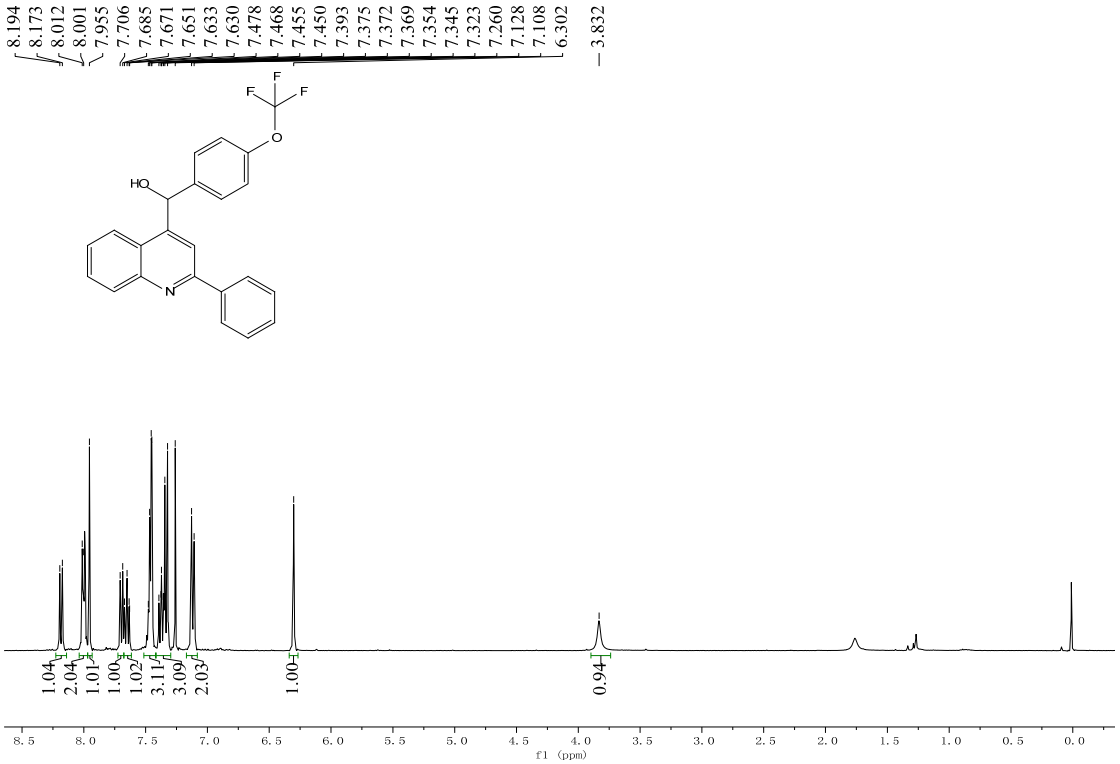


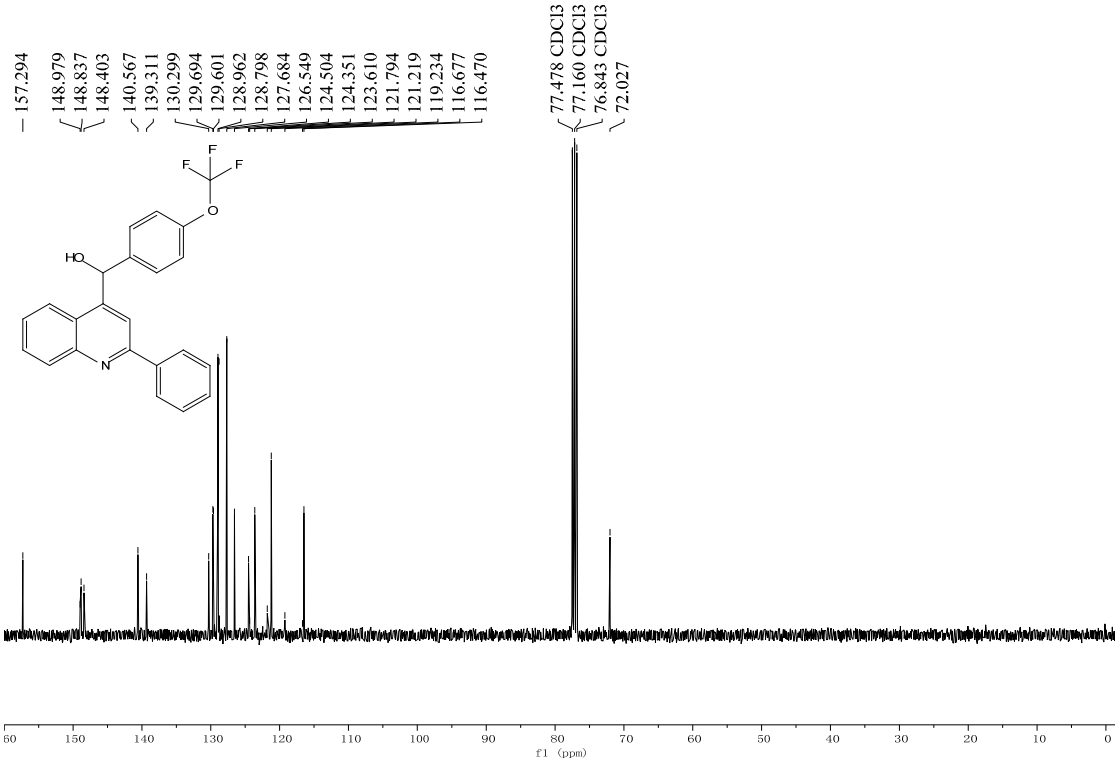
^{1}H and ^{13}C NMR spectra of 3e



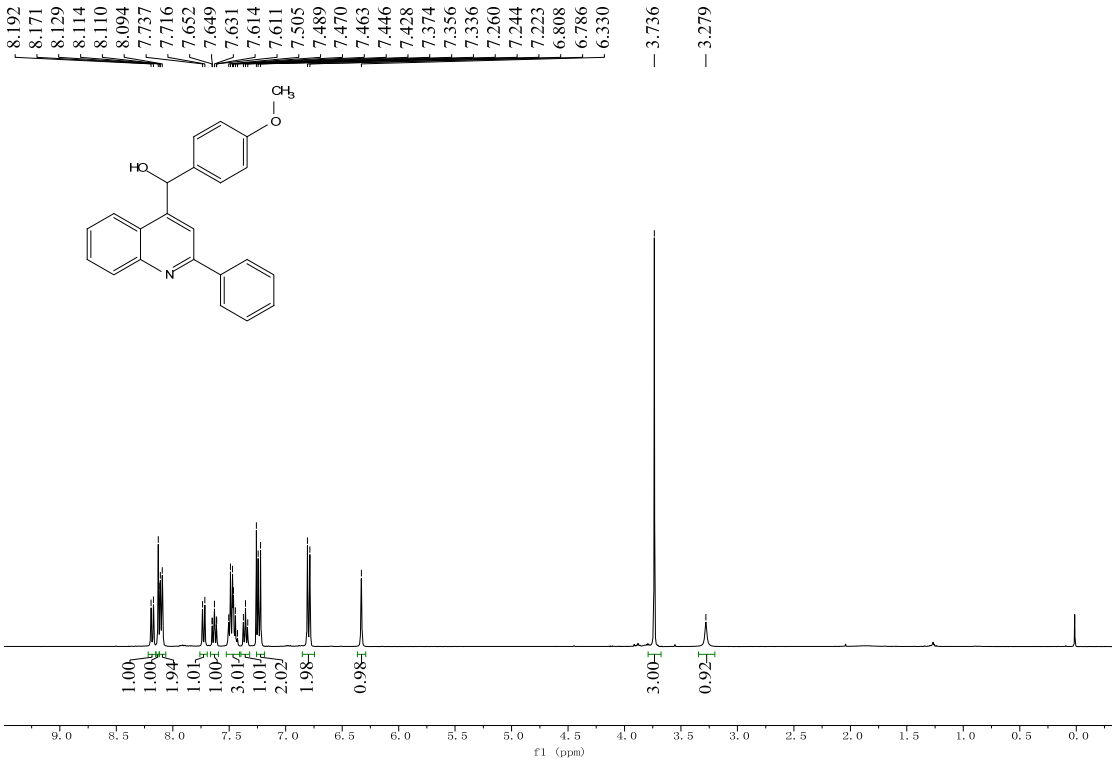


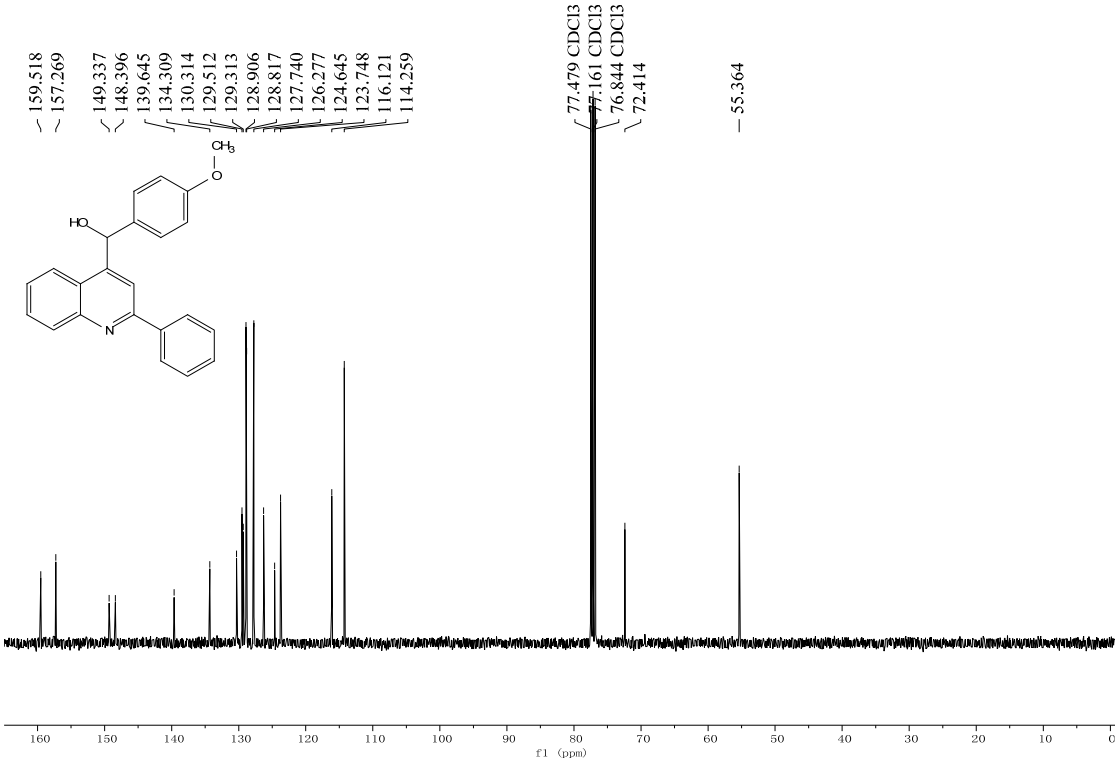
^{1}H and ^{13}C NMR spectra of 3f



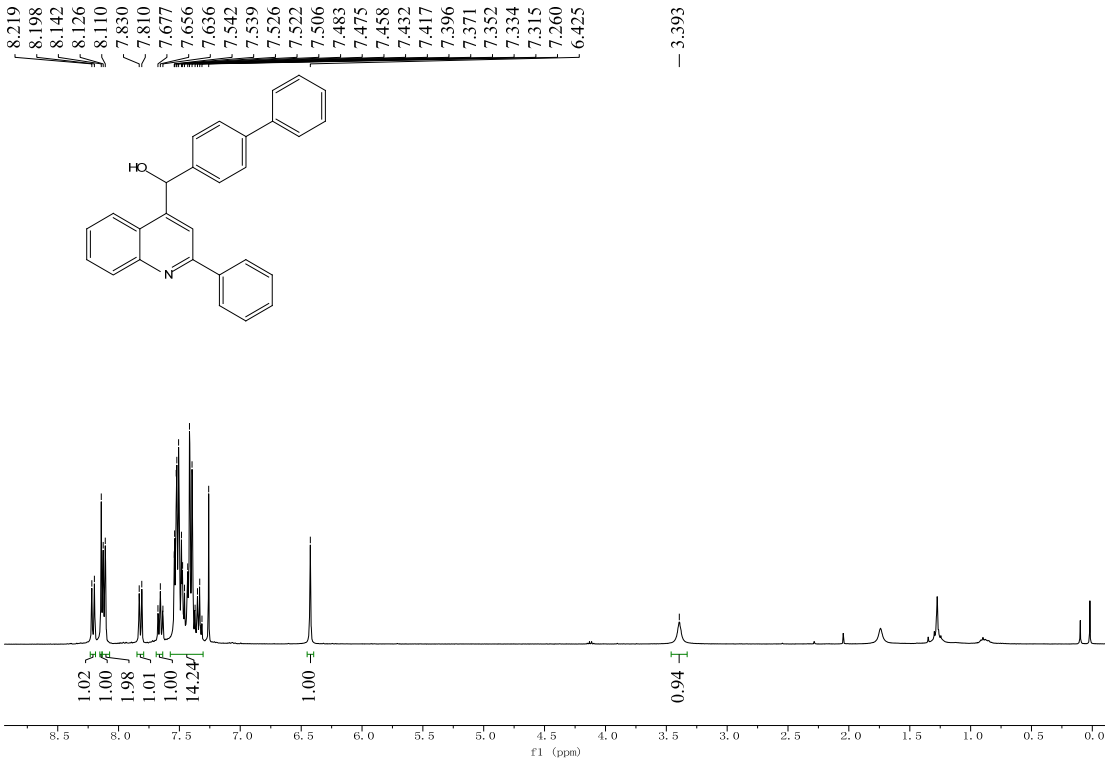


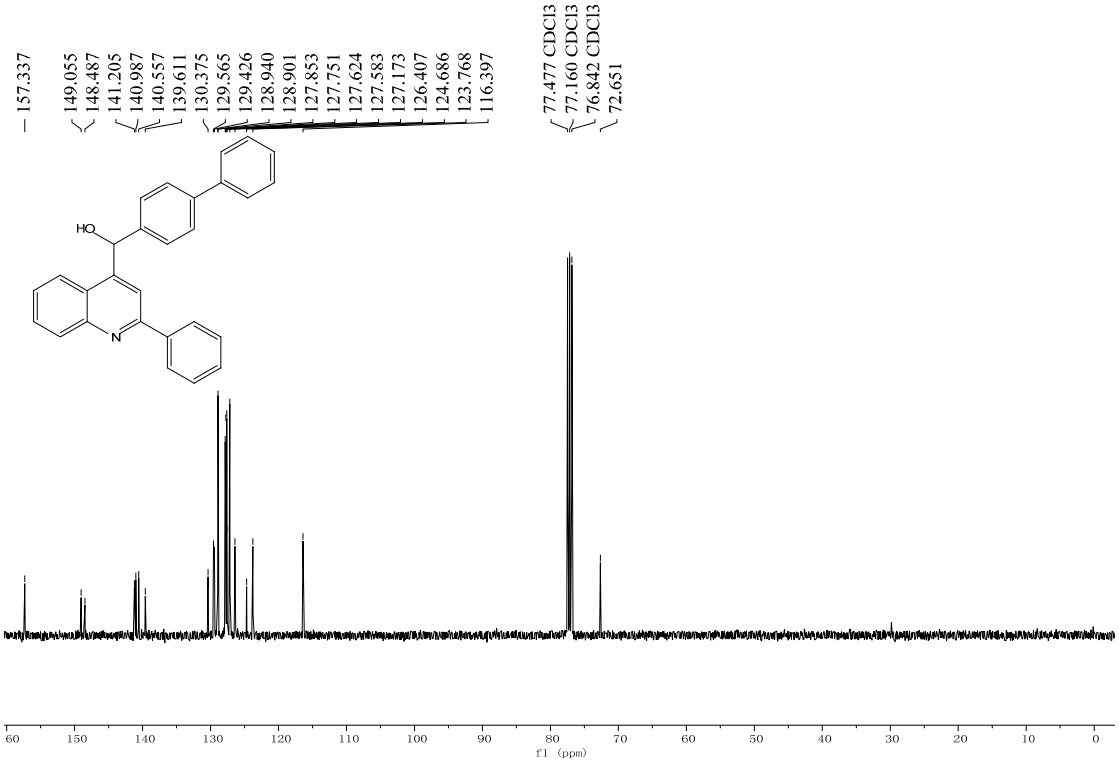
^{1}H and ^{13}C NMR spectra of 3g



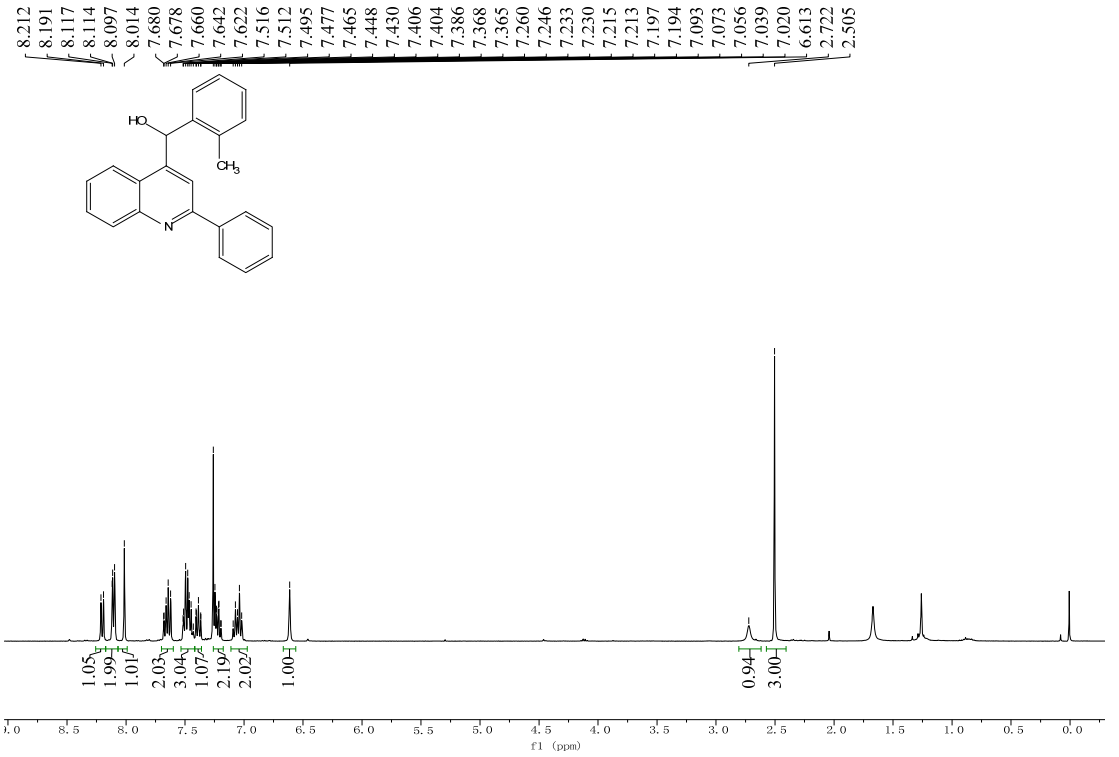


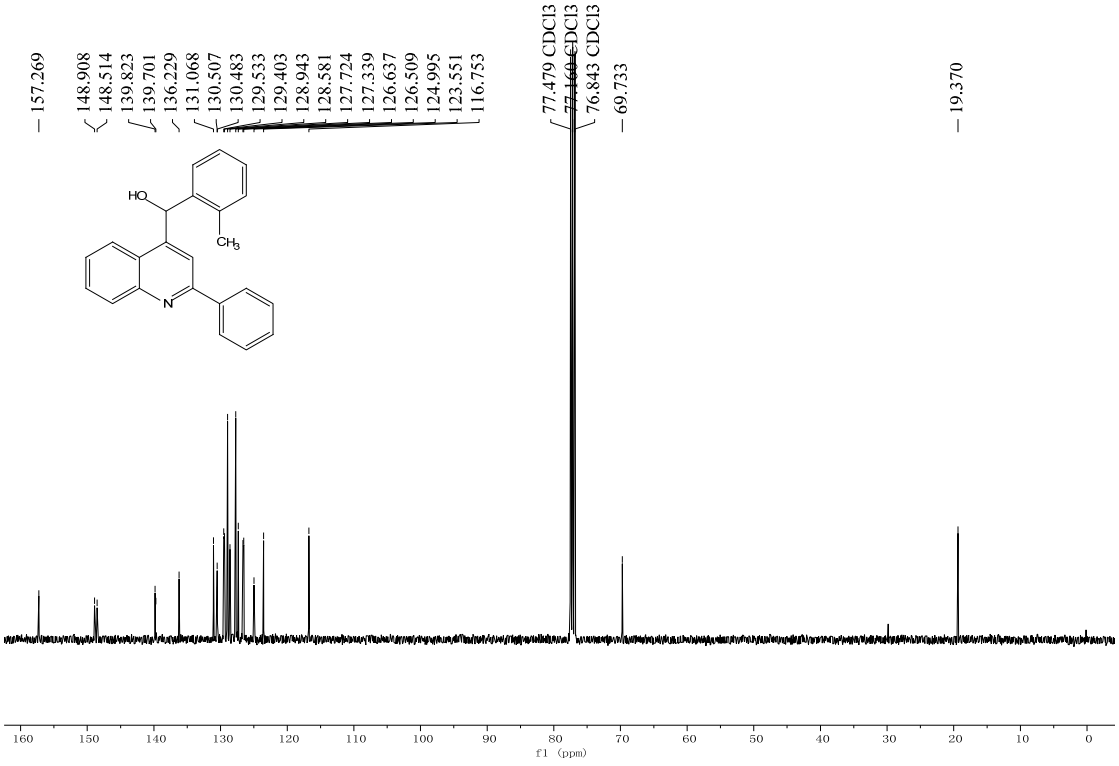
^{1}H and ^{13}C NMR spectra of 3h



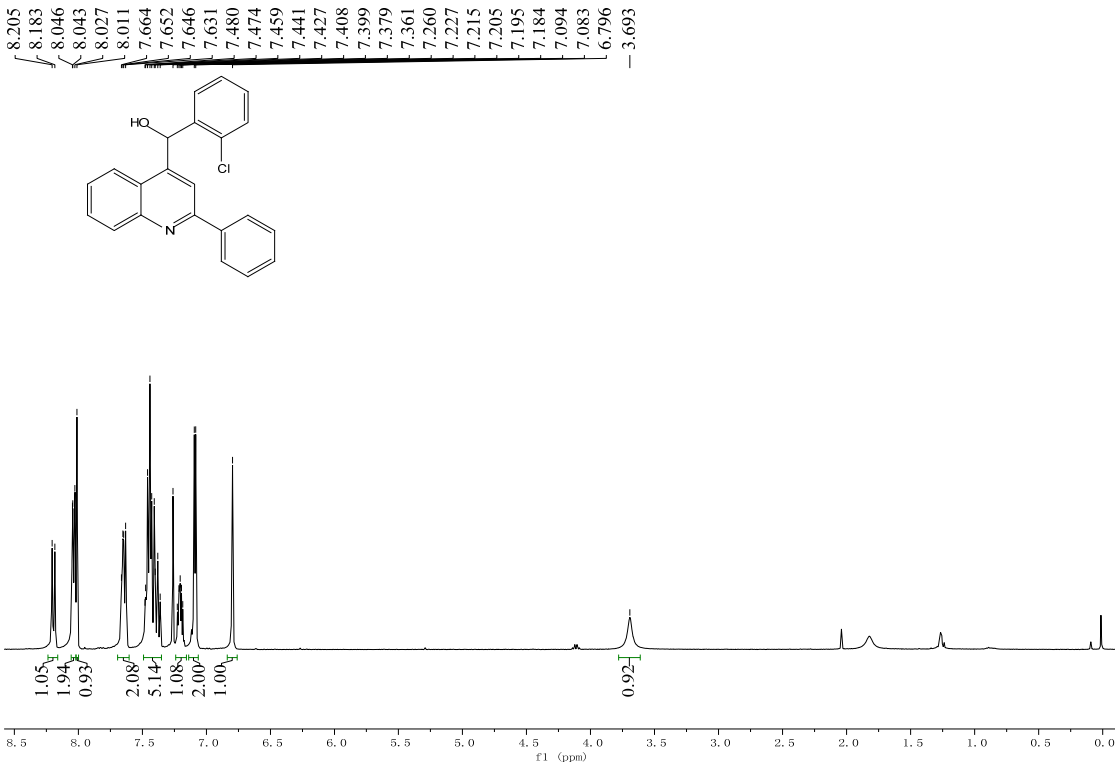


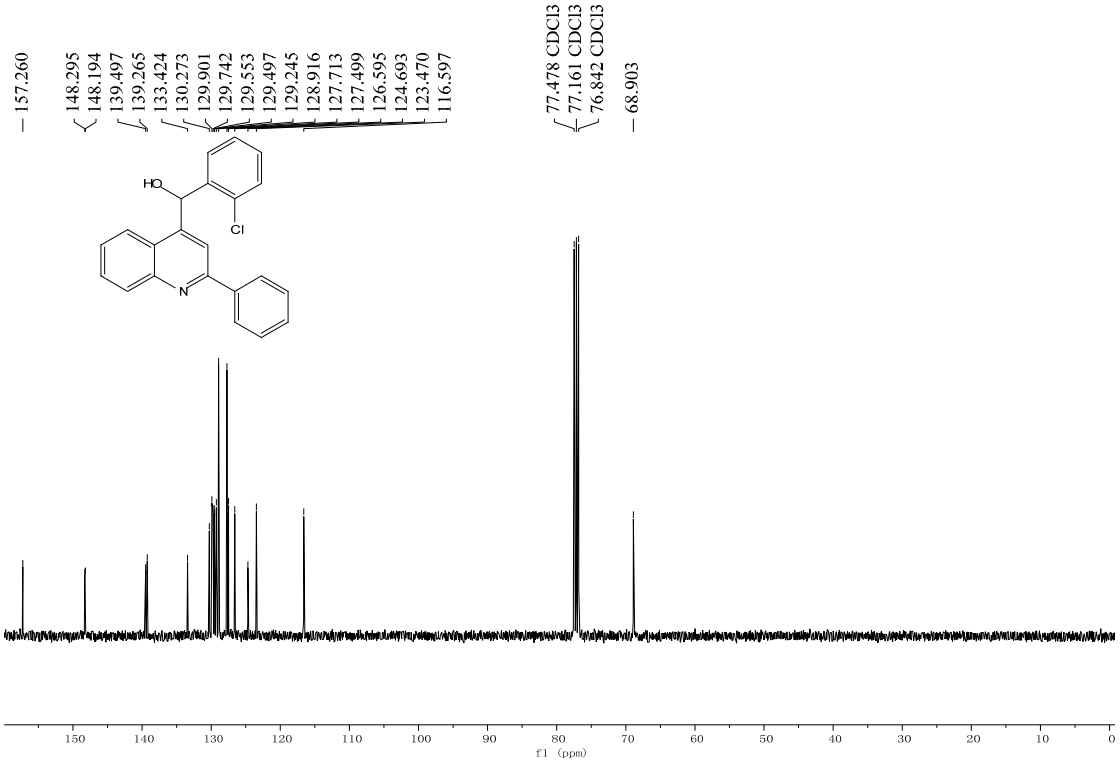
^{1}H and ^{13}C NMR spectra of 3i



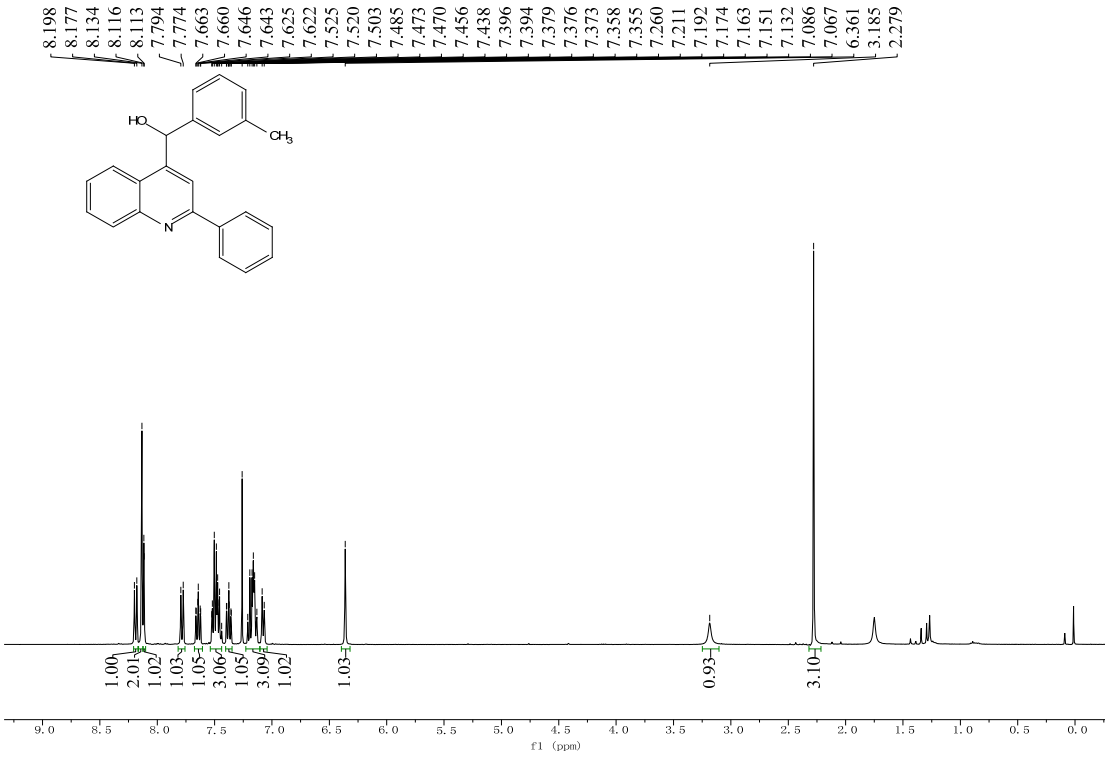


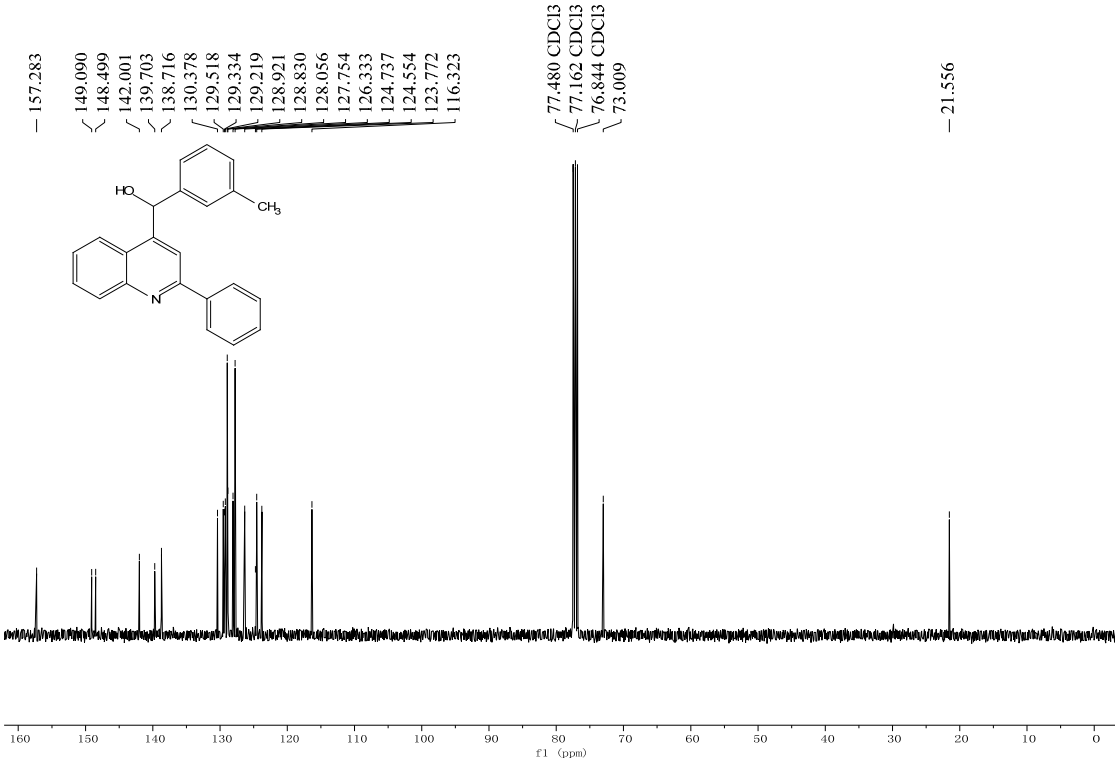
^{1}H and ^{13}C NMR spectra of 3j



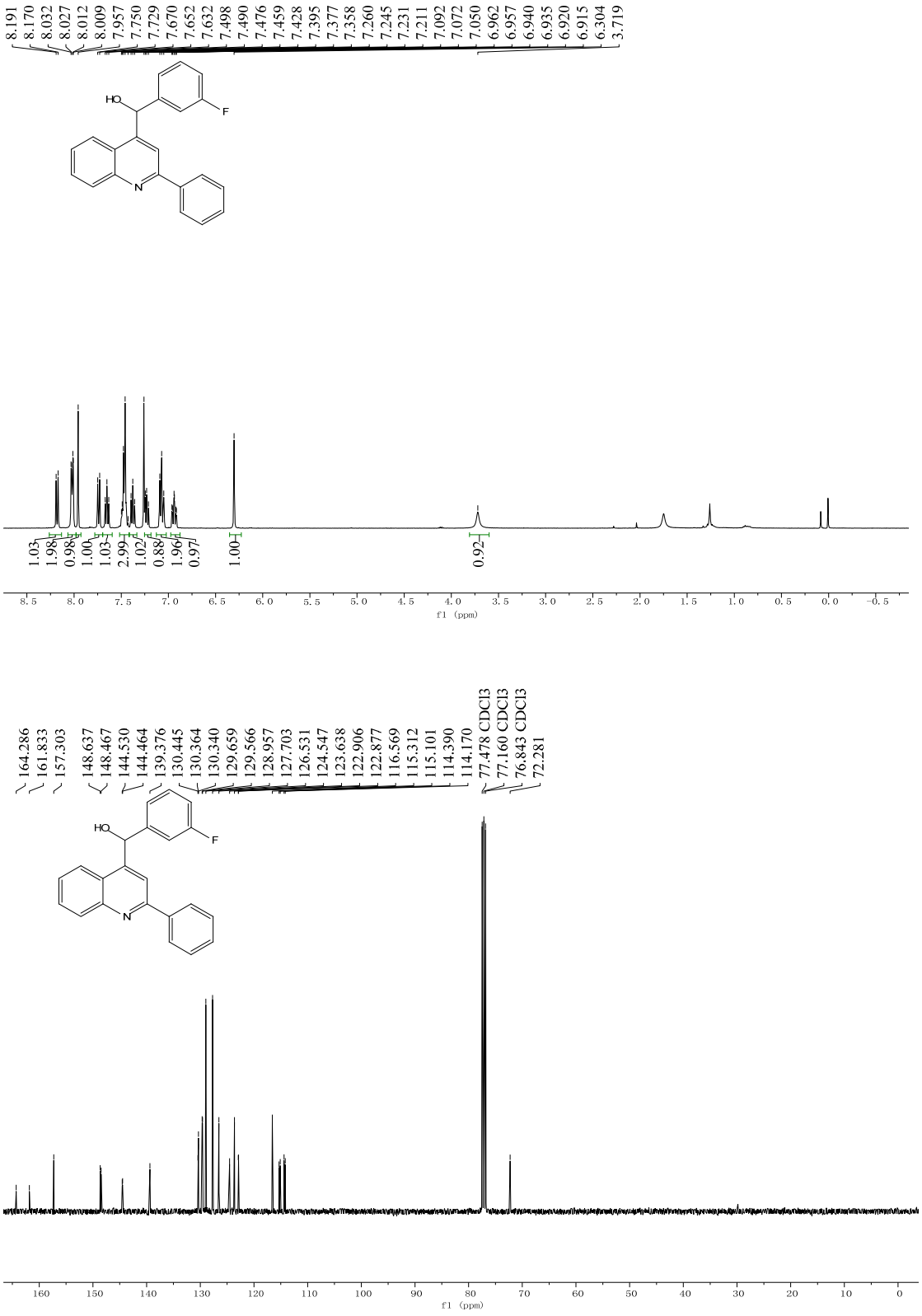


^{1}H and ^{13}C NMR spectra of 3k

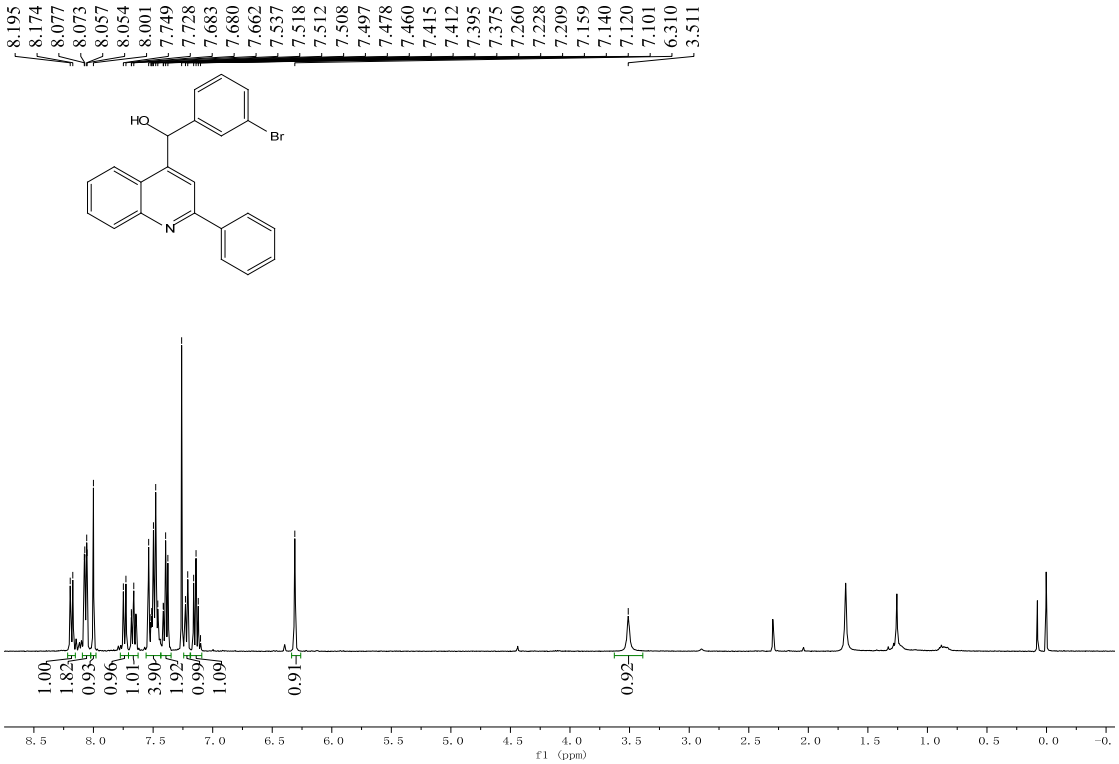


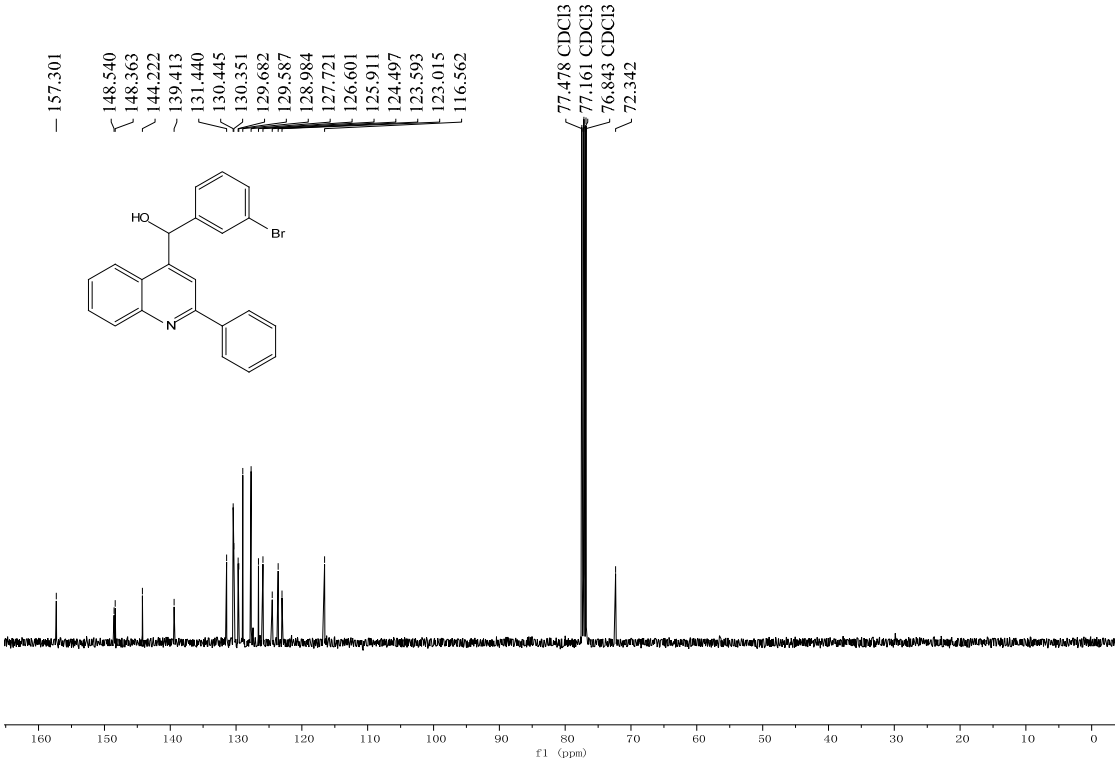


^{1}H and ^{13}C NMR spectra of 3l

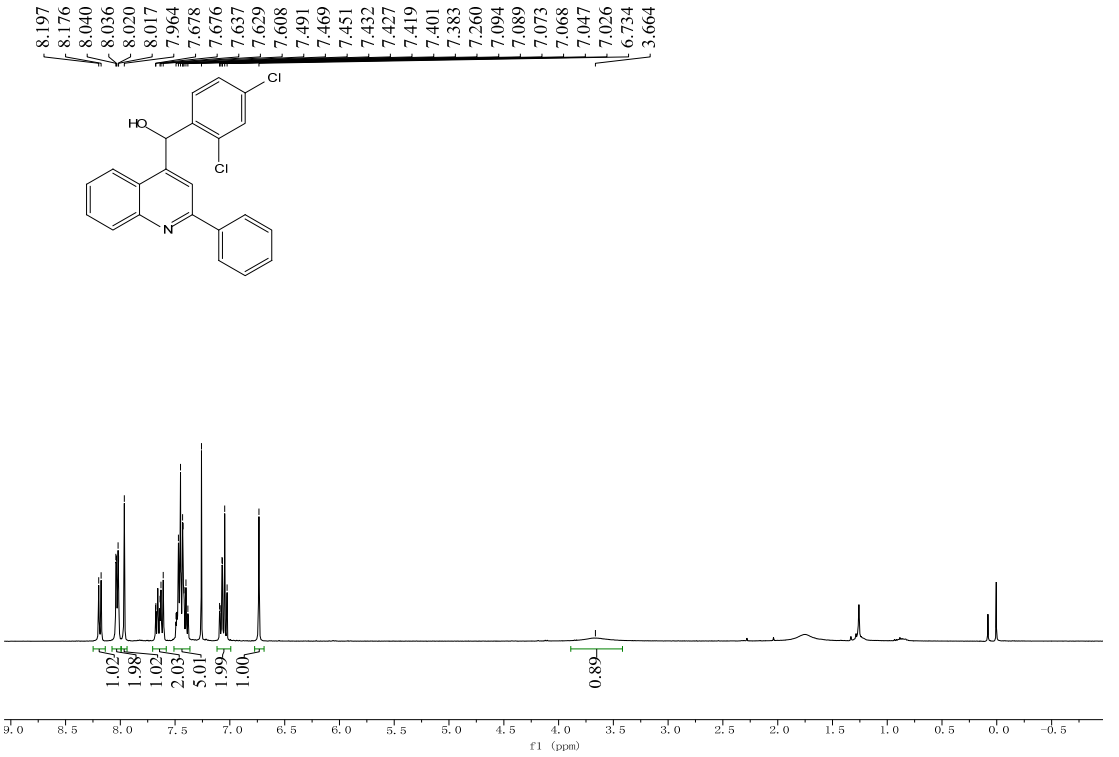


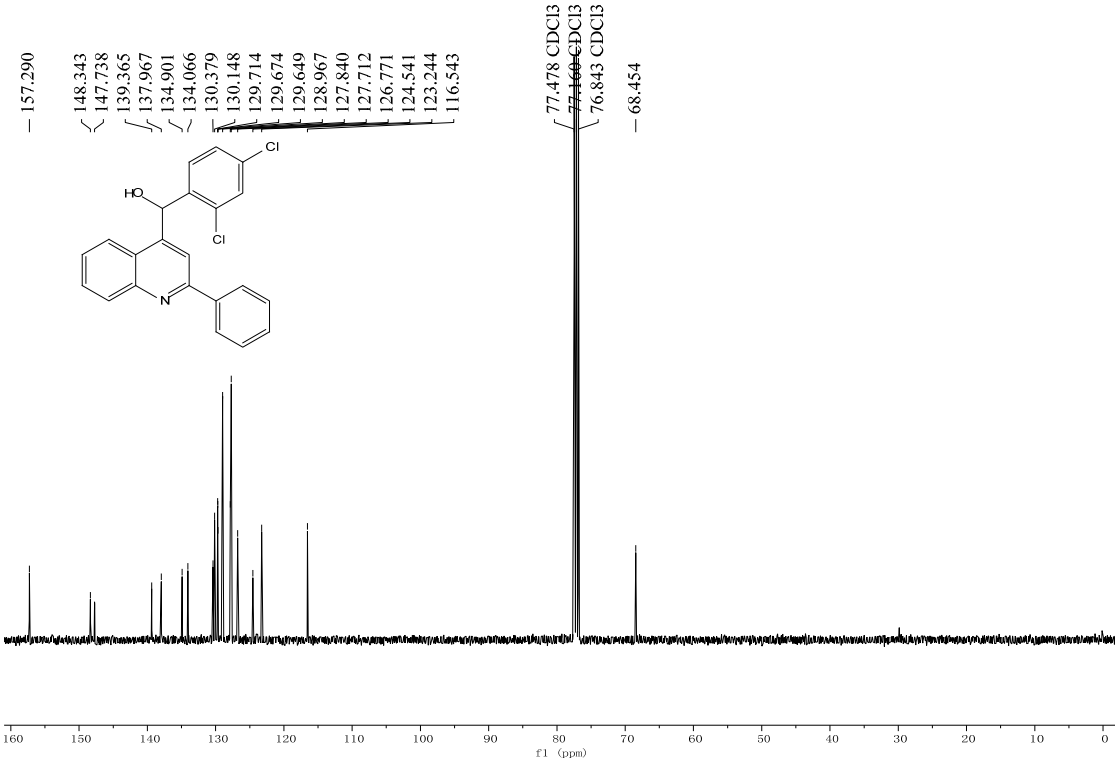
^{1}H and ^{13}C NMR spectra of 3m



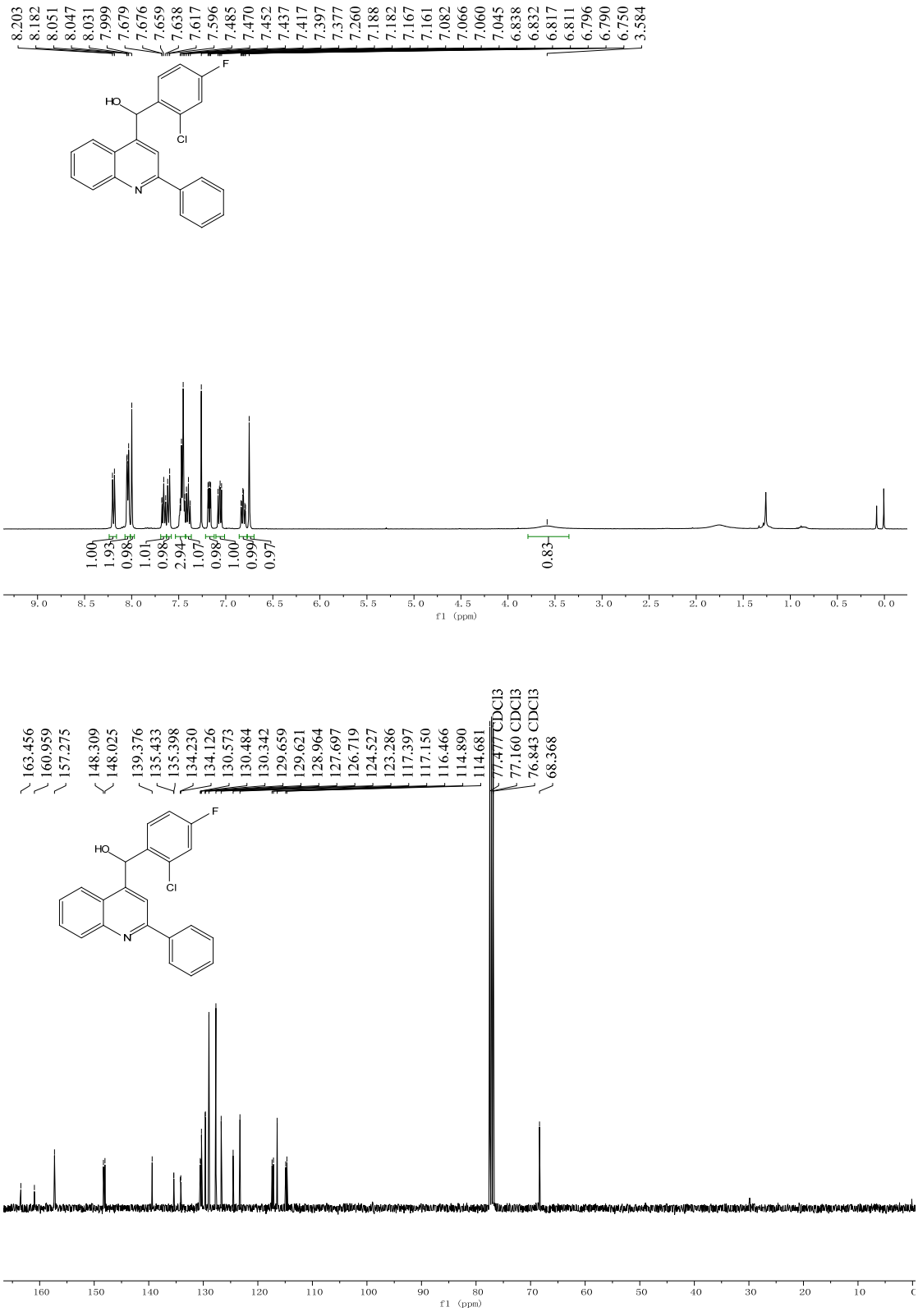


^{1}H and ^{13}C NMR spectra of 3n

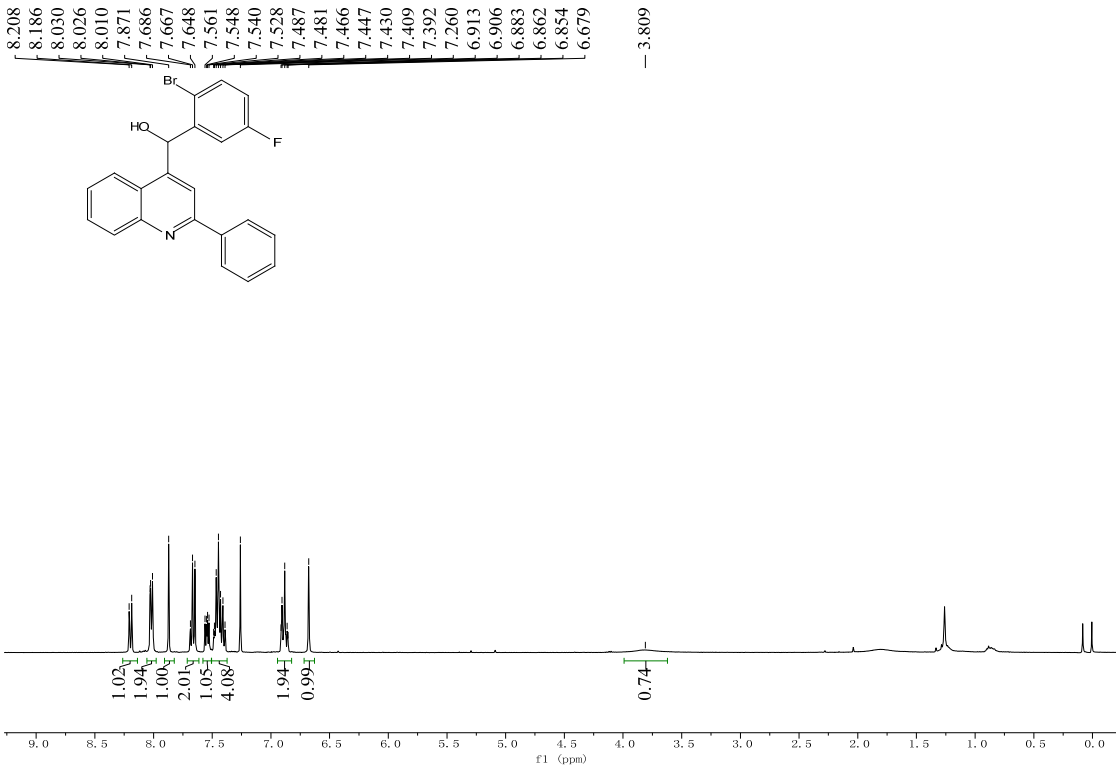


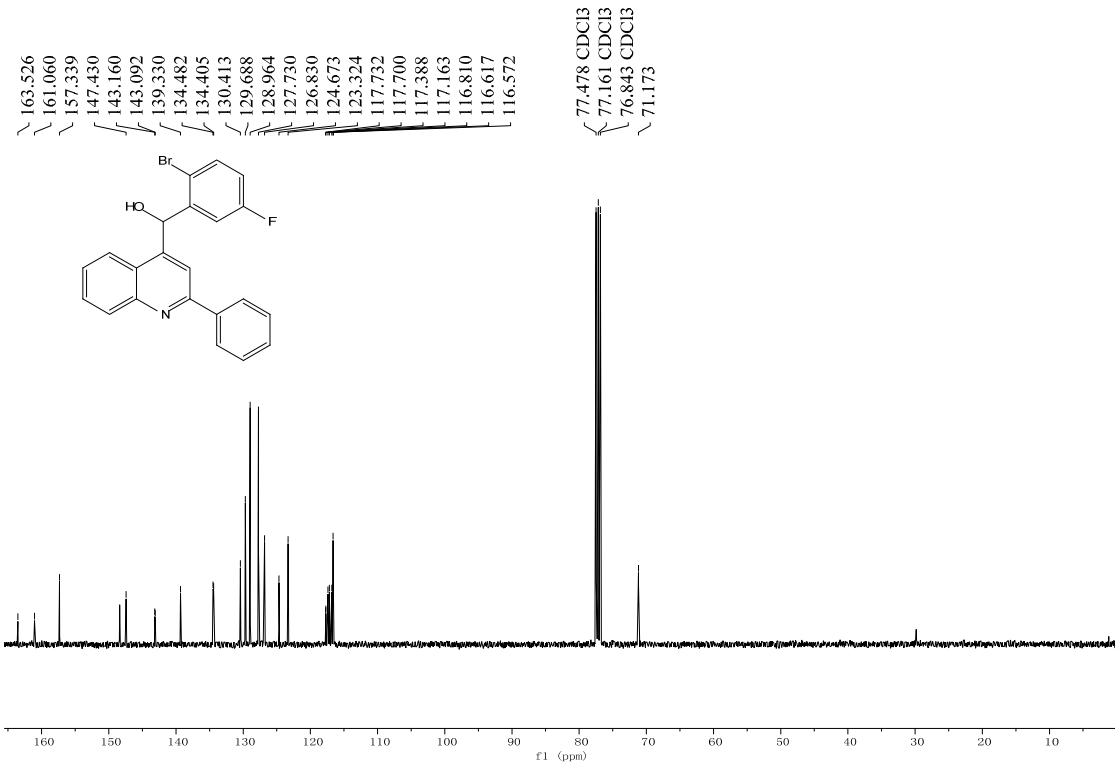


^{1}H and ^{13}C NMR spectra of 3o

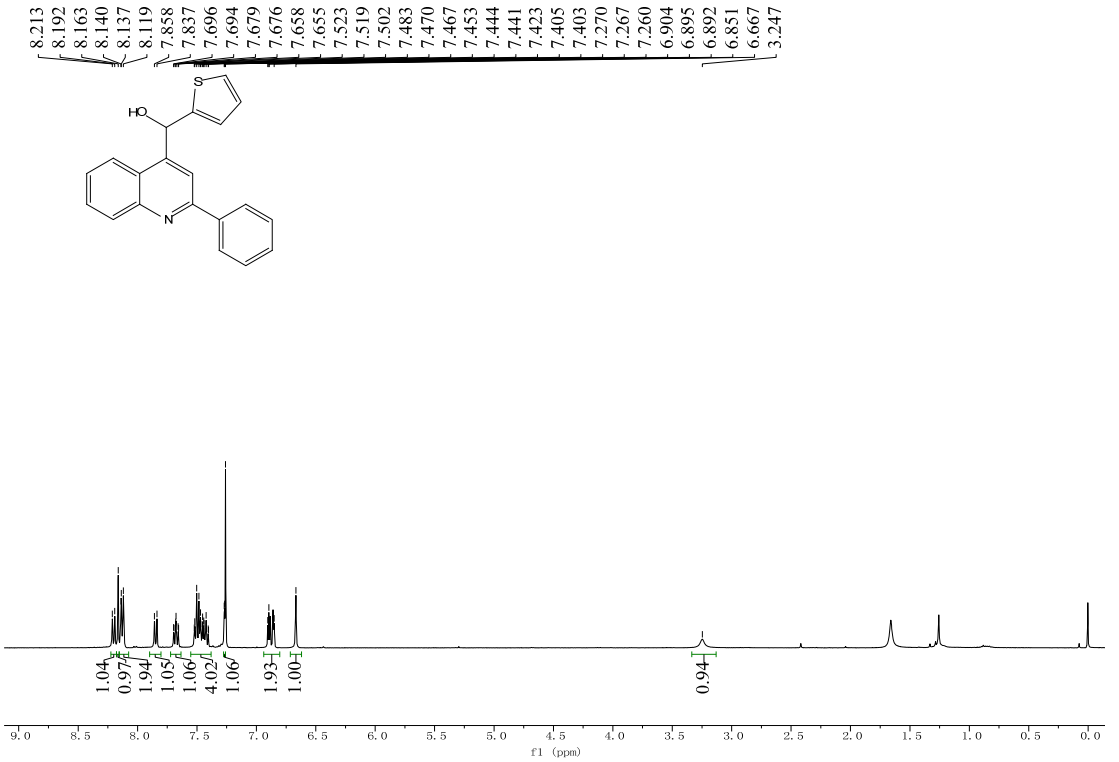


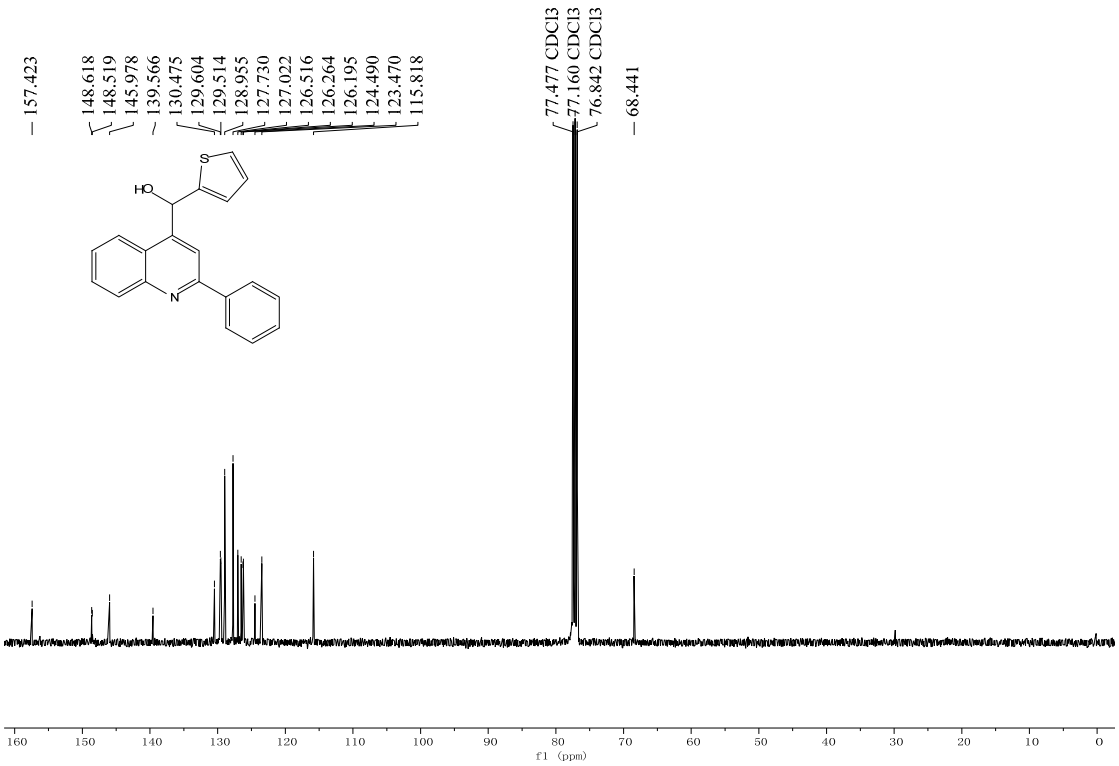
^{1}H and ^{13}C NMR spectra of 3p



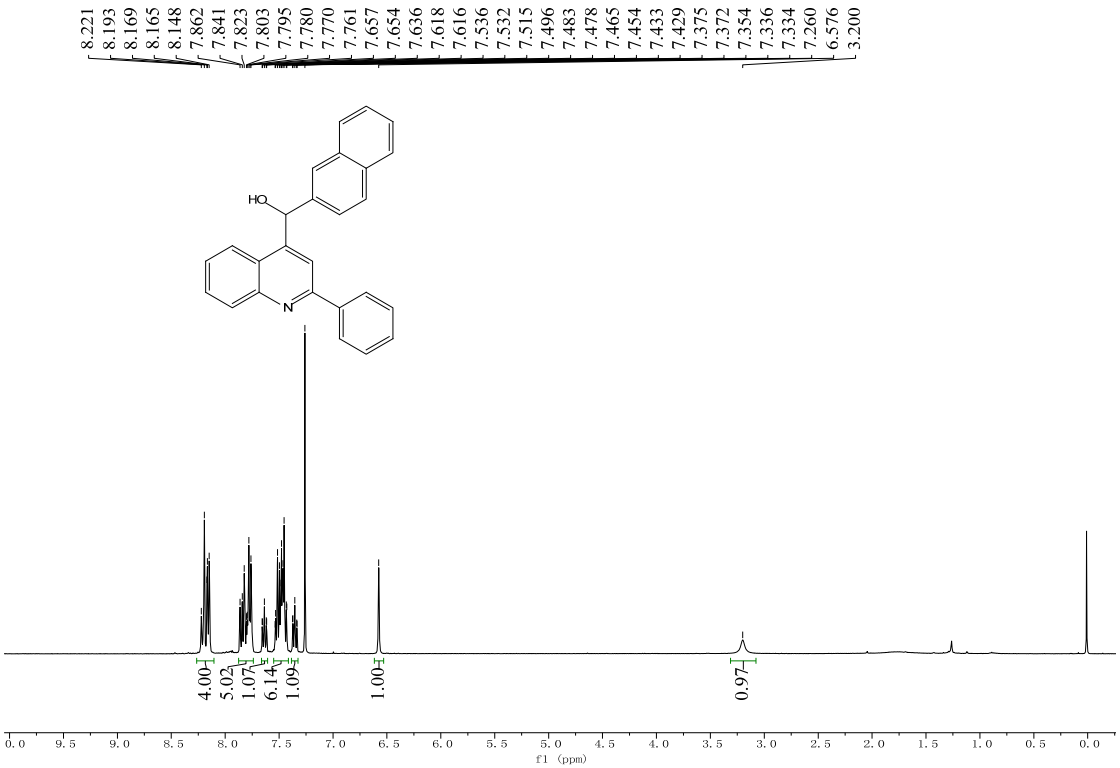


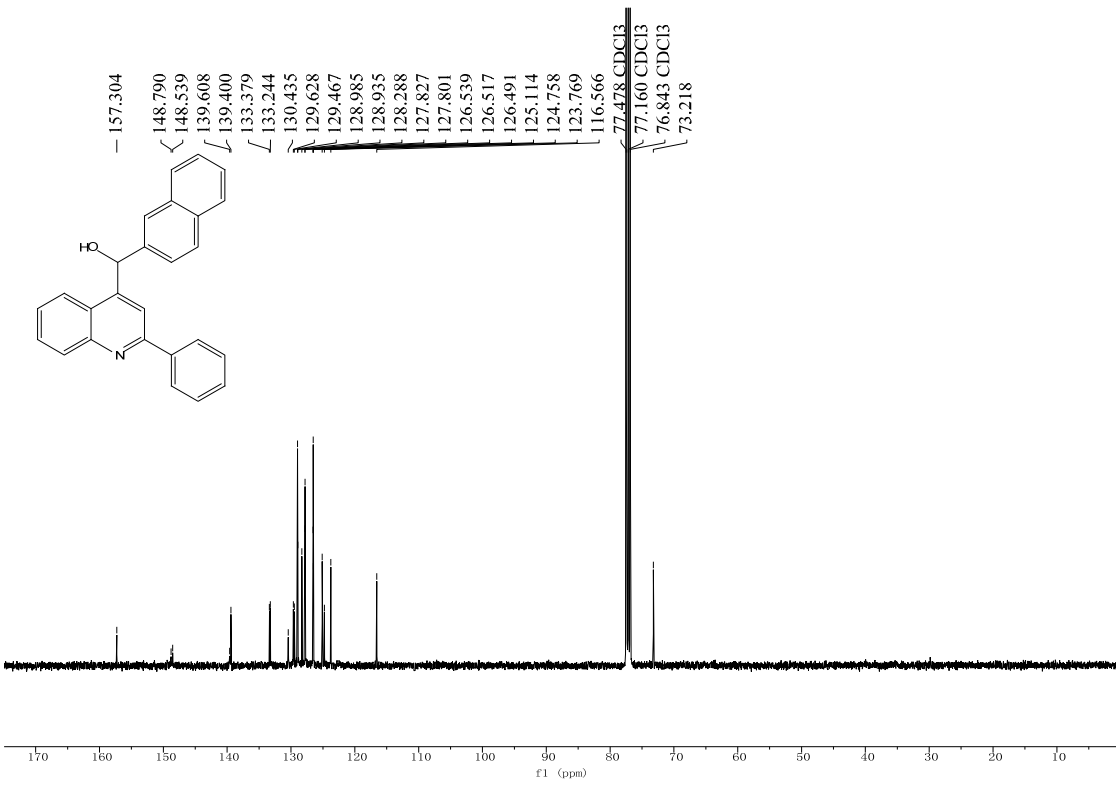
^{1}H and ^{13}C NMR spectra of 3q



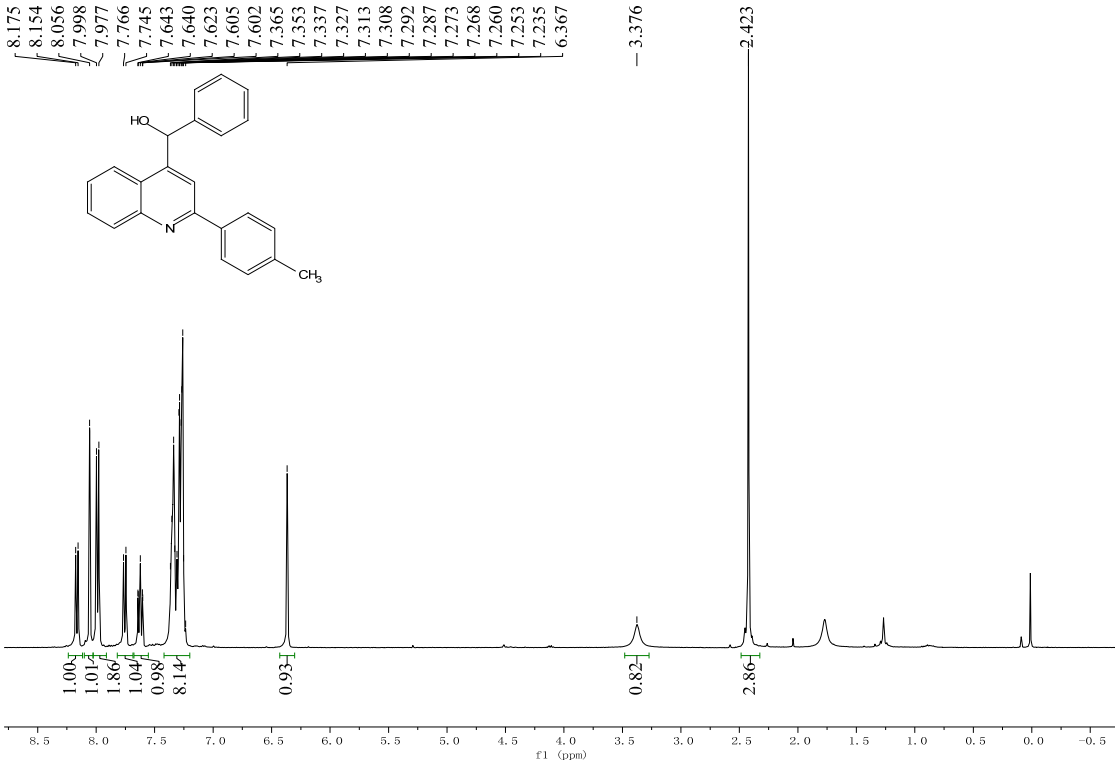


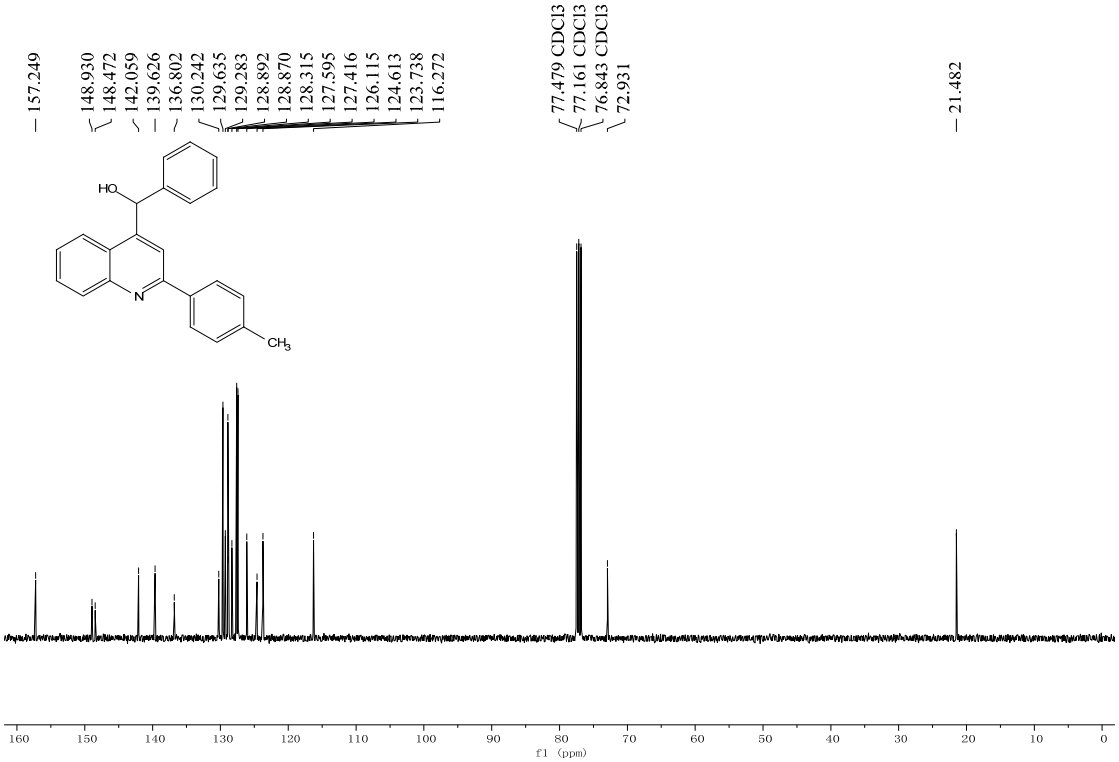
^{1}H and ^{13}C NMR spectra of 3r



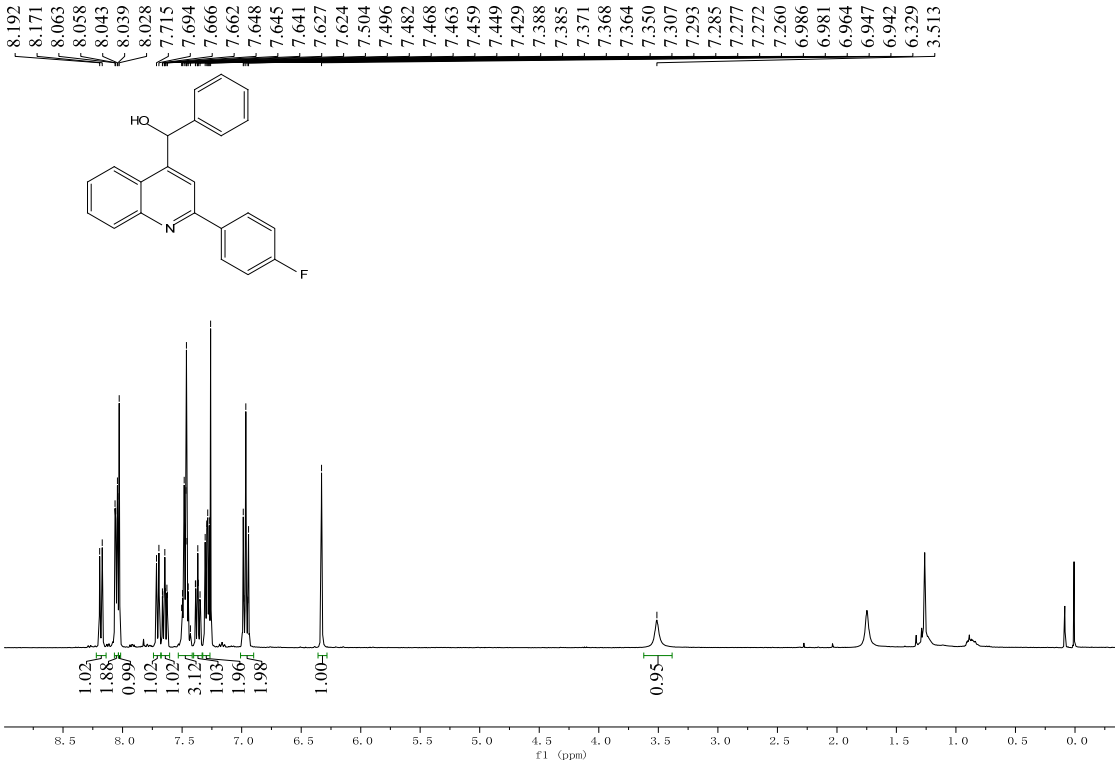


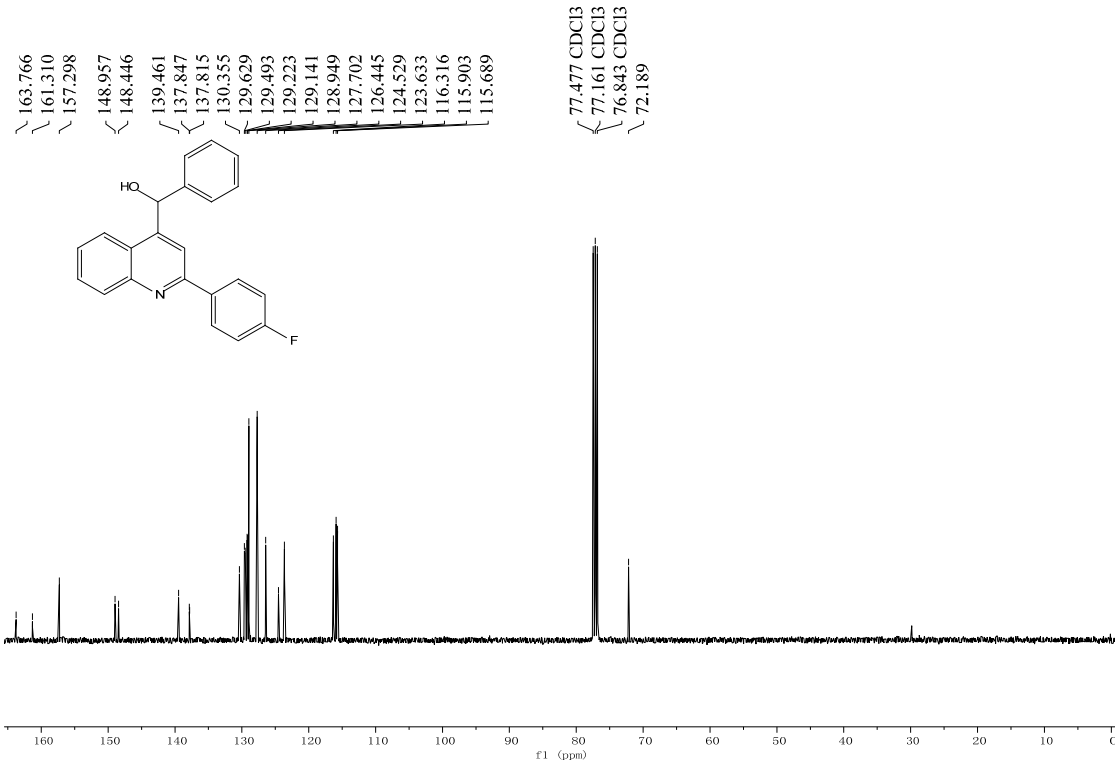
^{1}H and ^{13}C NMR spectra of 4a



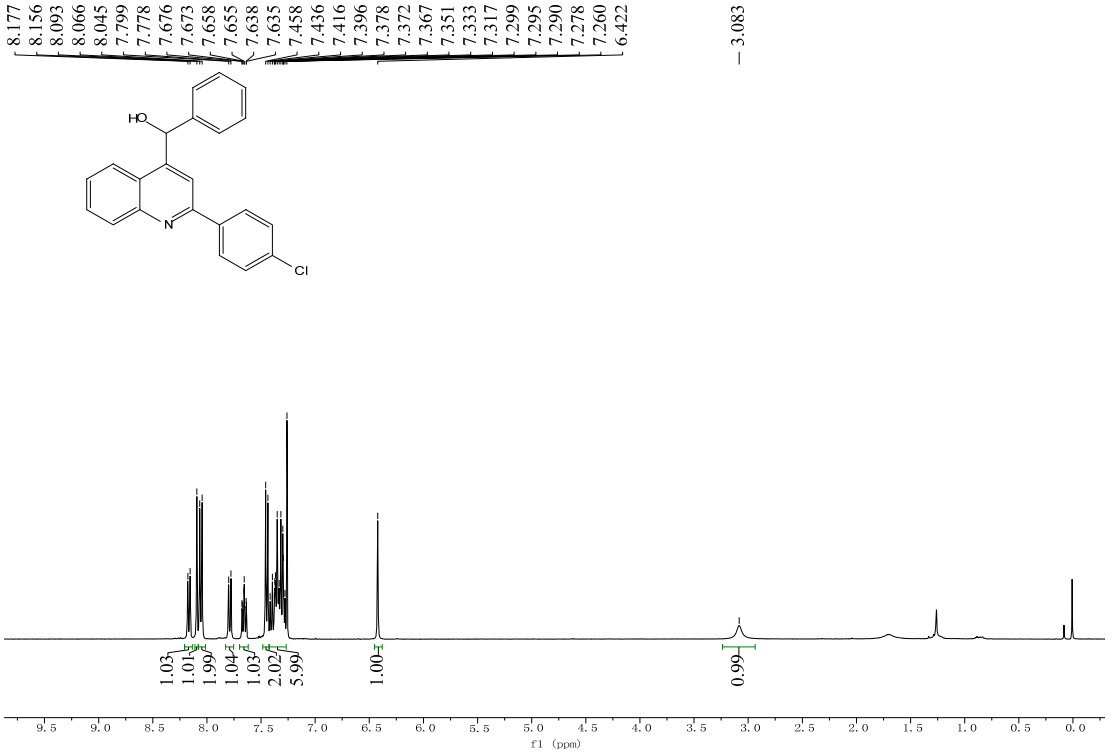


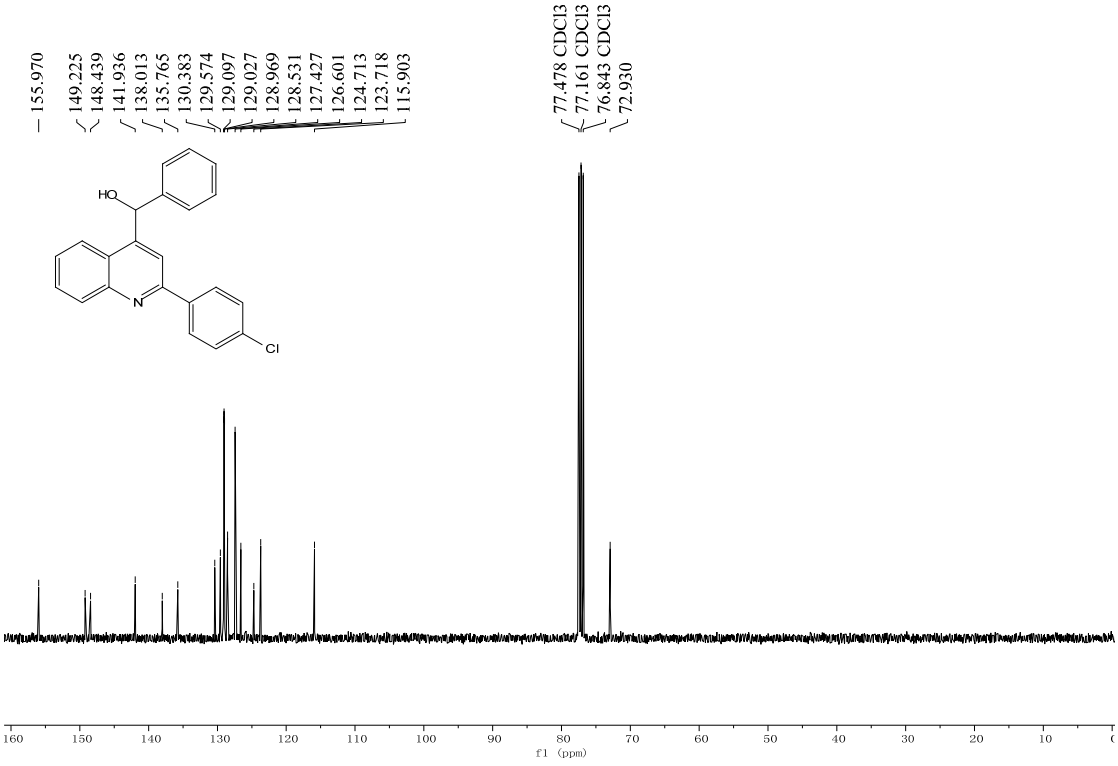
^{1}H and ^{13}C NMR spectra of 4b



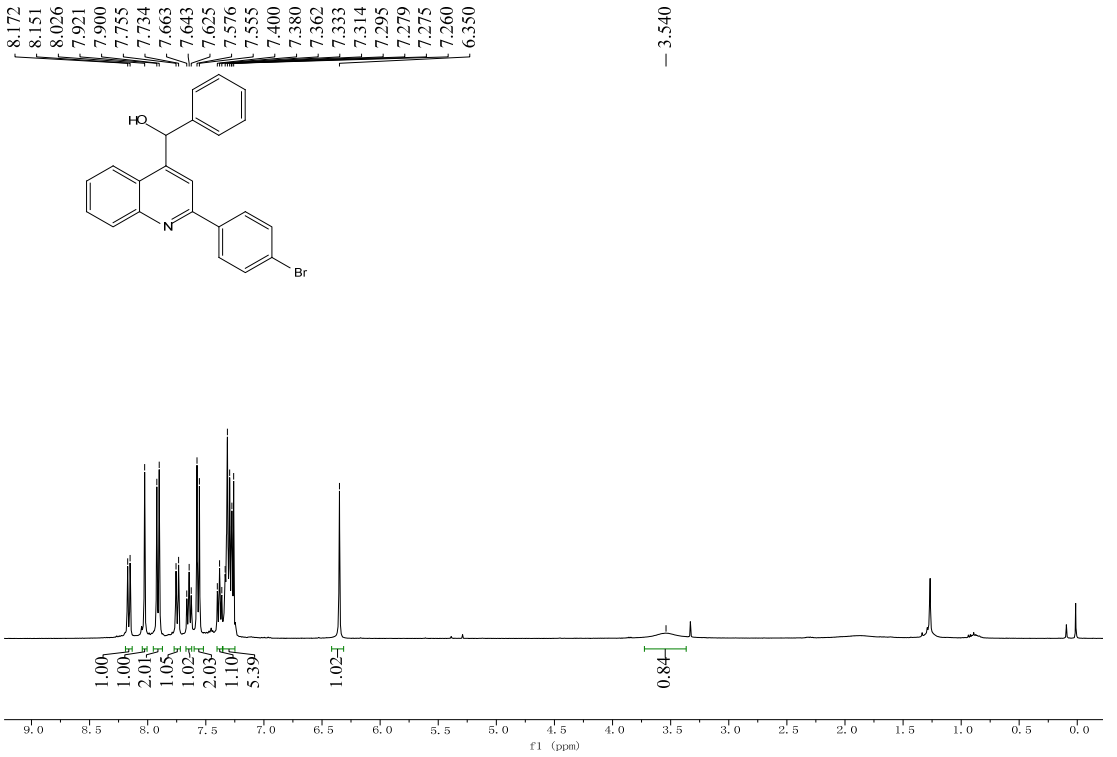


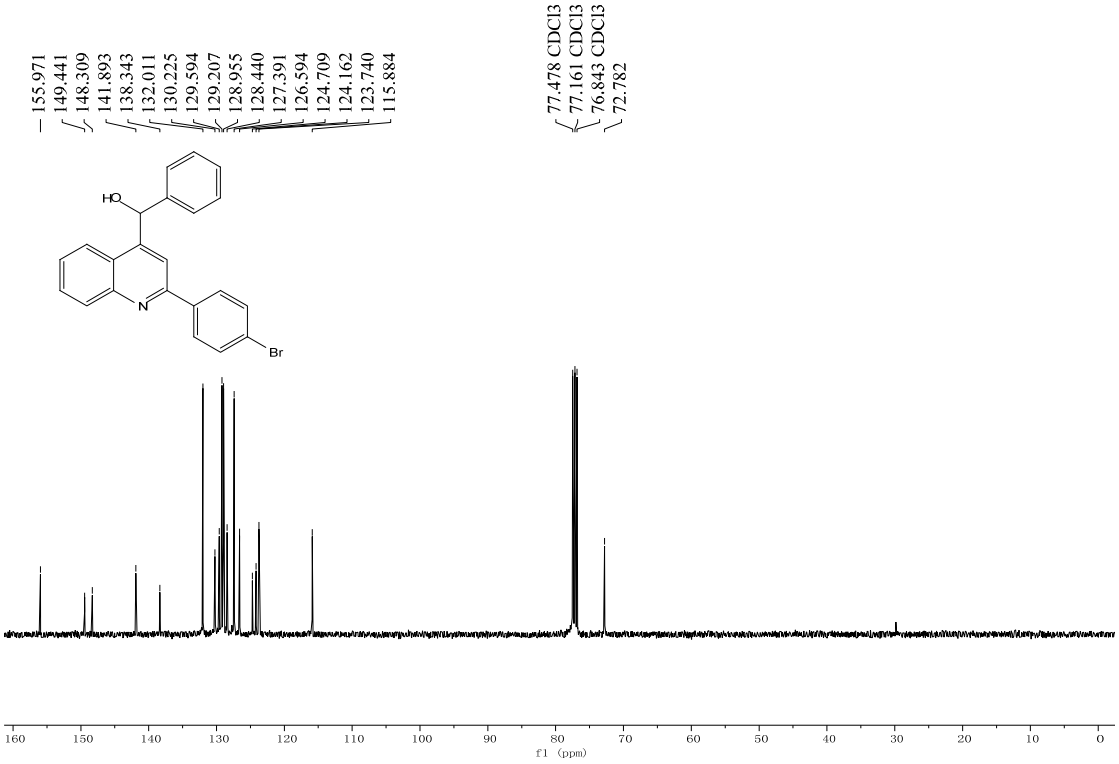
^{1}H and ^{13}C NMR spectra of 4c



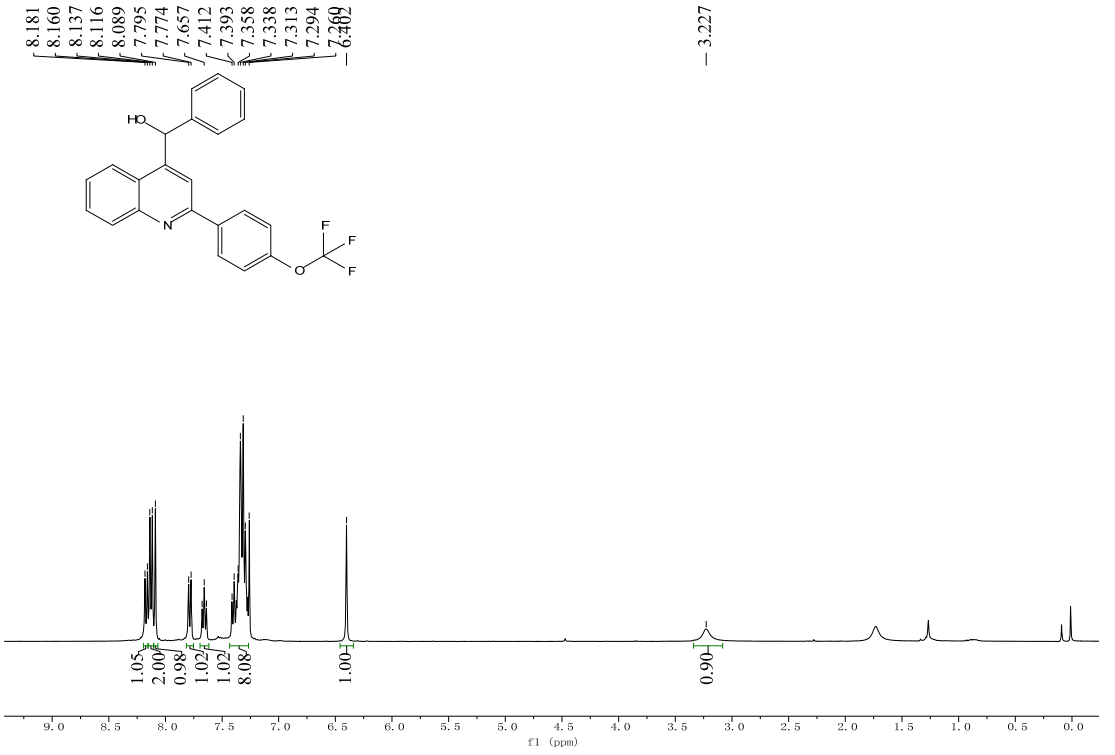


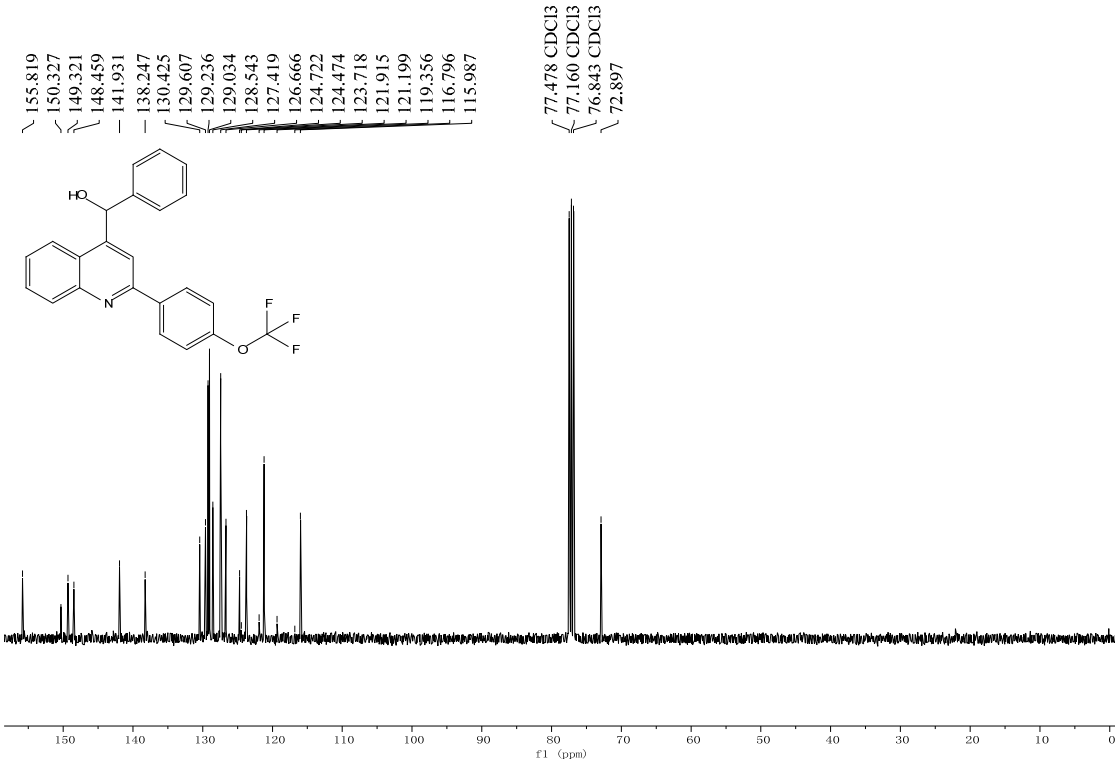
^{1}H and ^{13}C NMR spectra of 4d



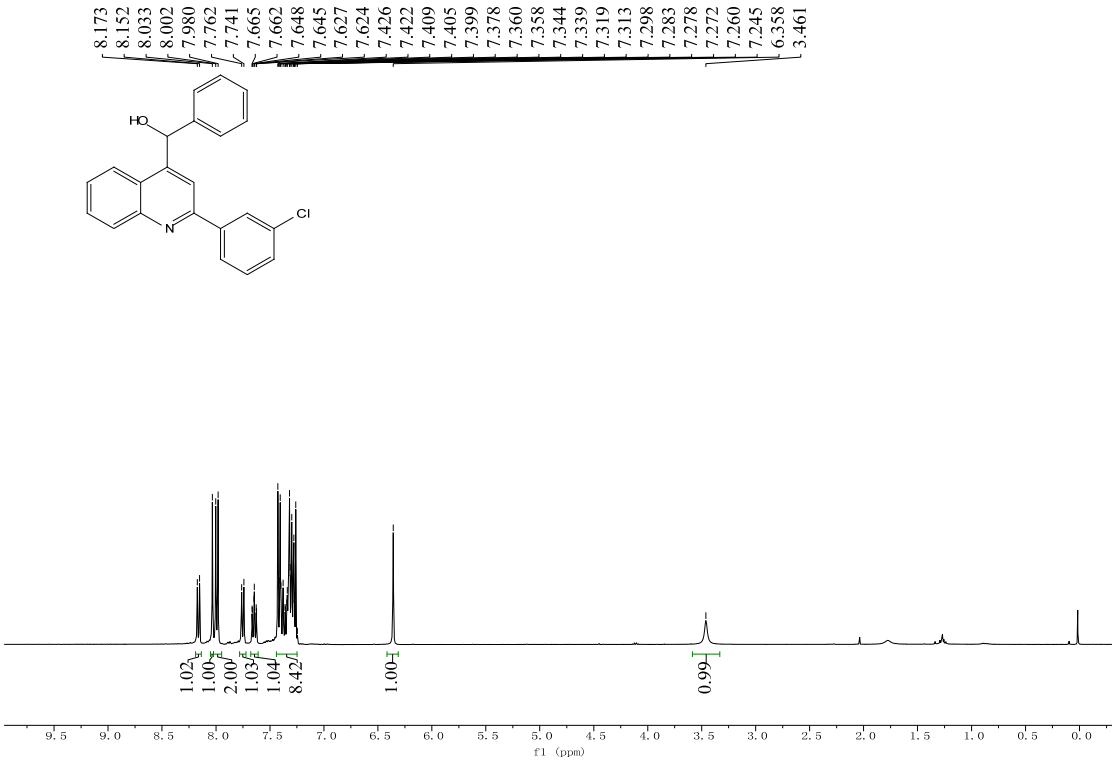


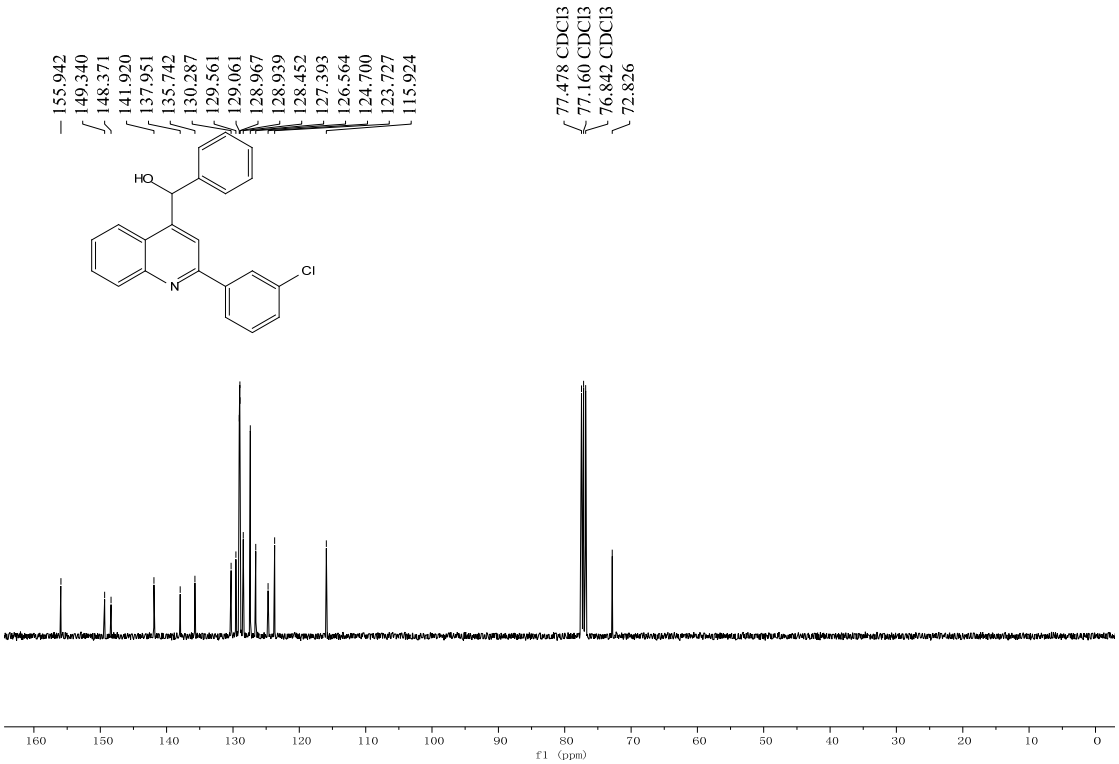
^{1}H and ^{13}C NMR spectra of 4e



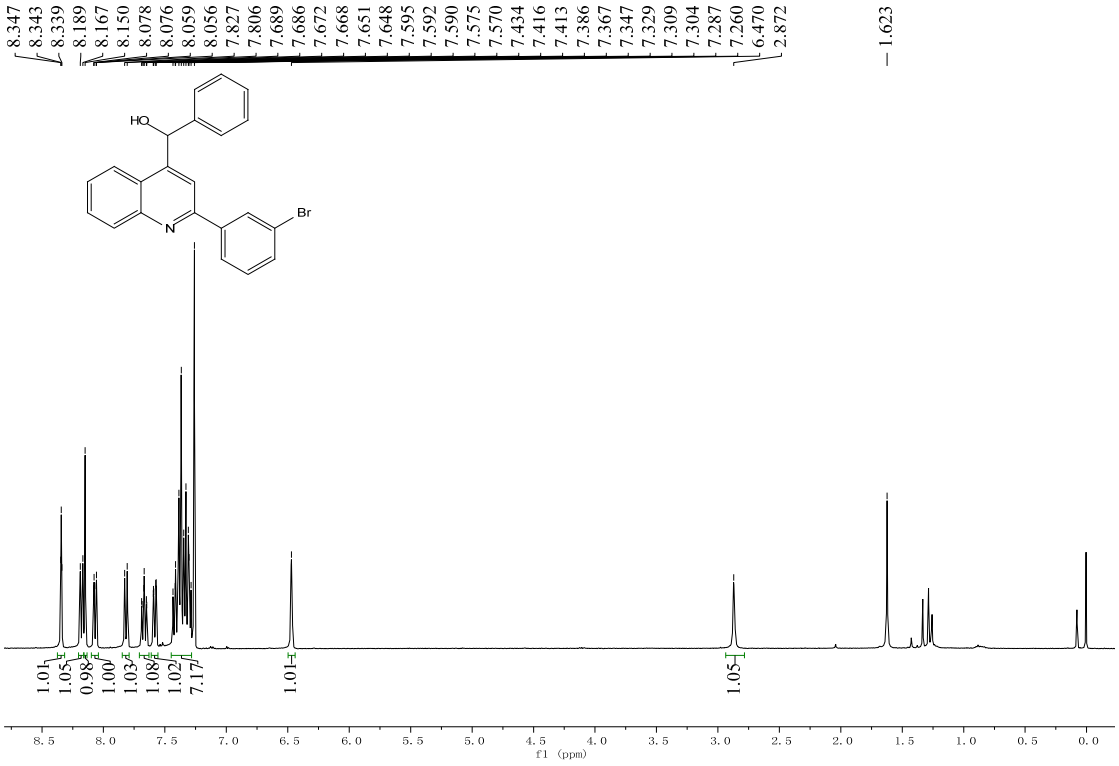


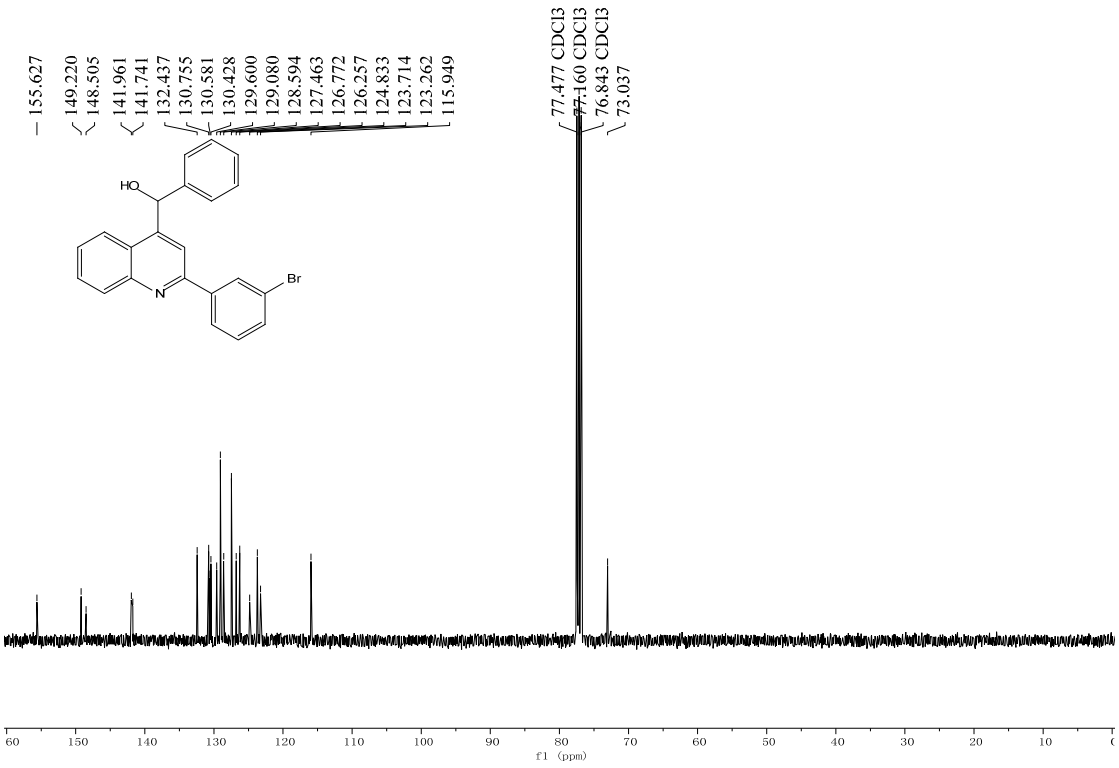
^{1}H and ^{13}C NMR spectra of 4f



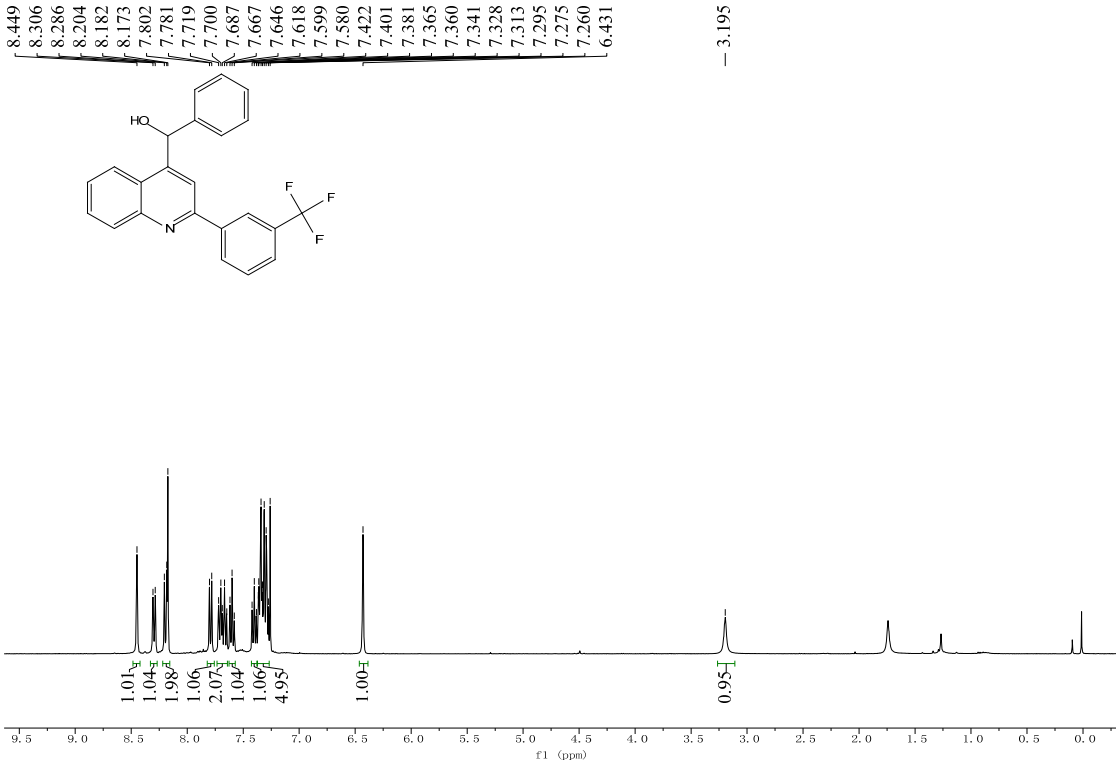


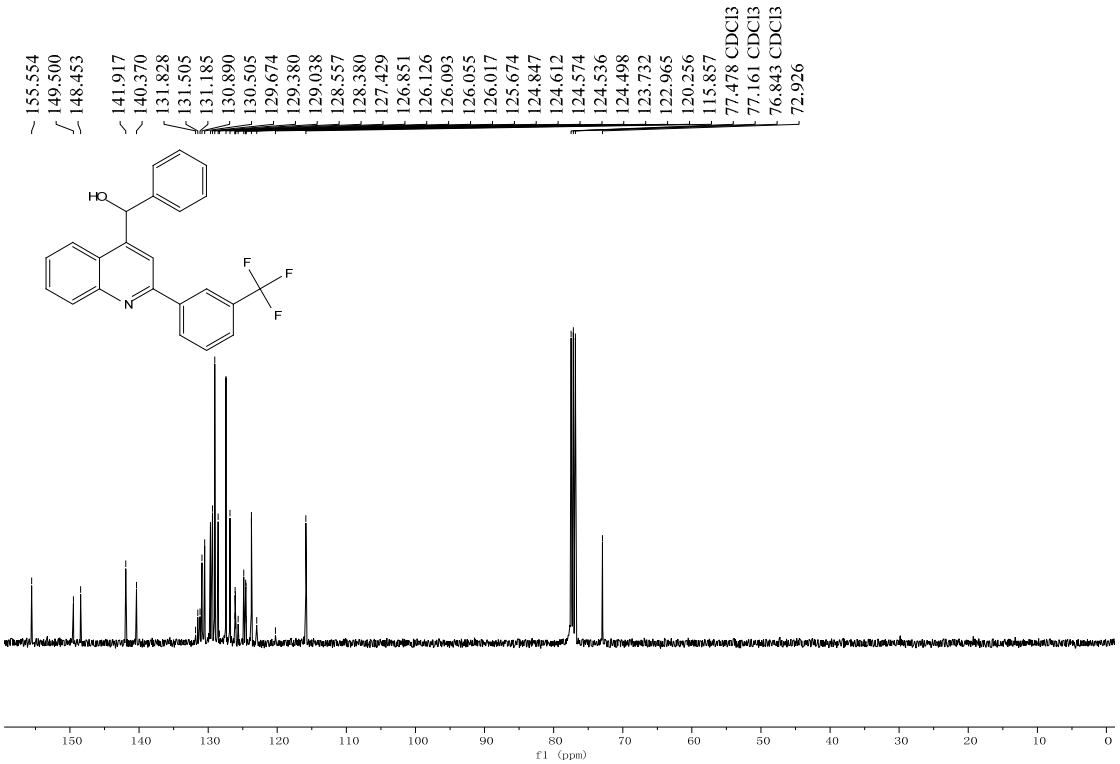
^{1}H and ^{13}C NMR spectra of 4g



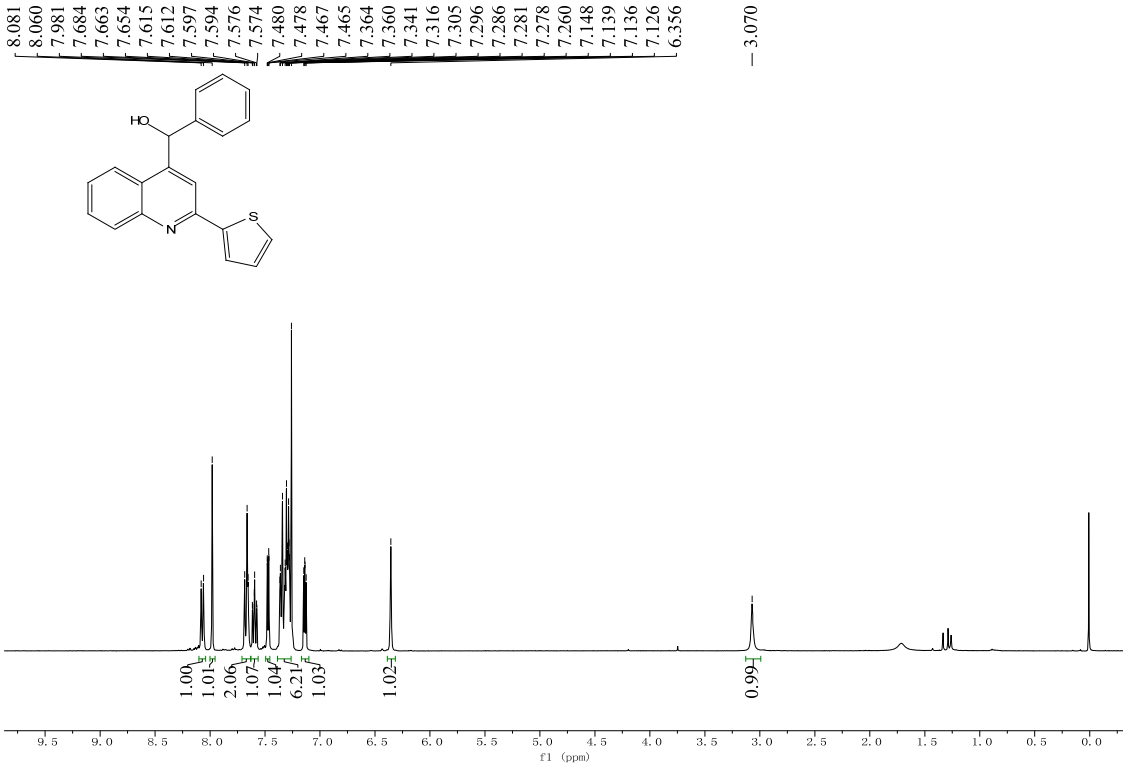


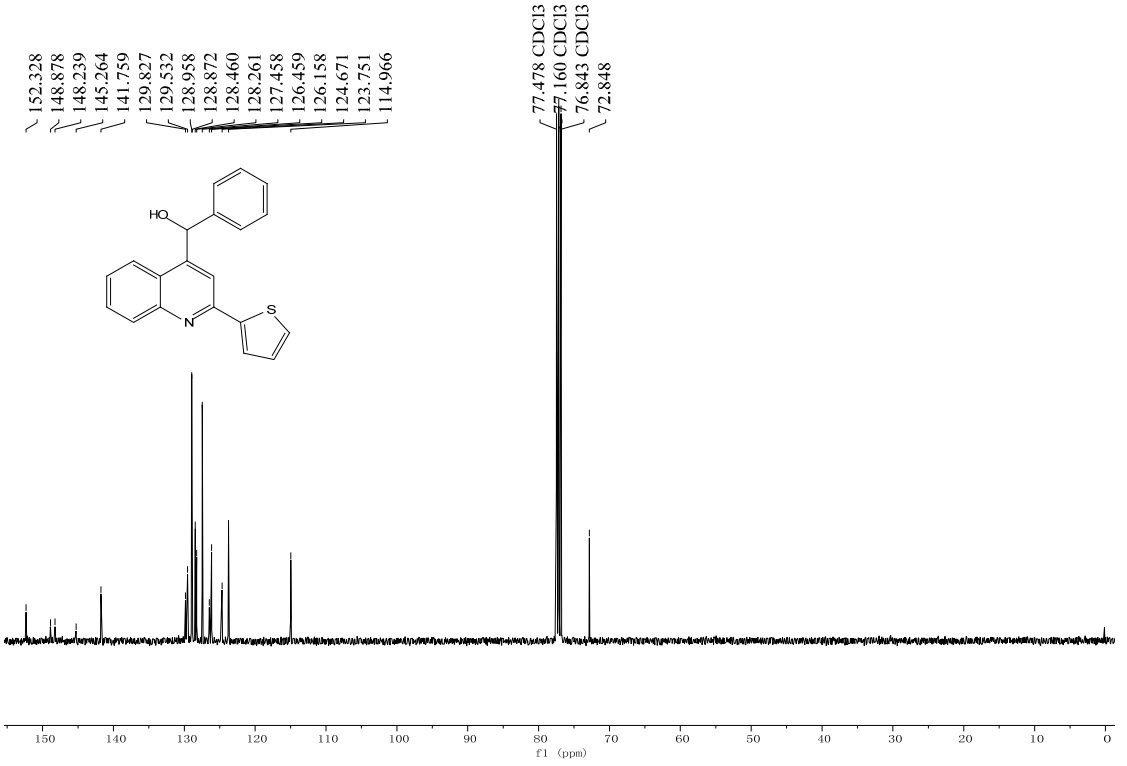
^{1}H and ^{13}C NMR spectra of 4h



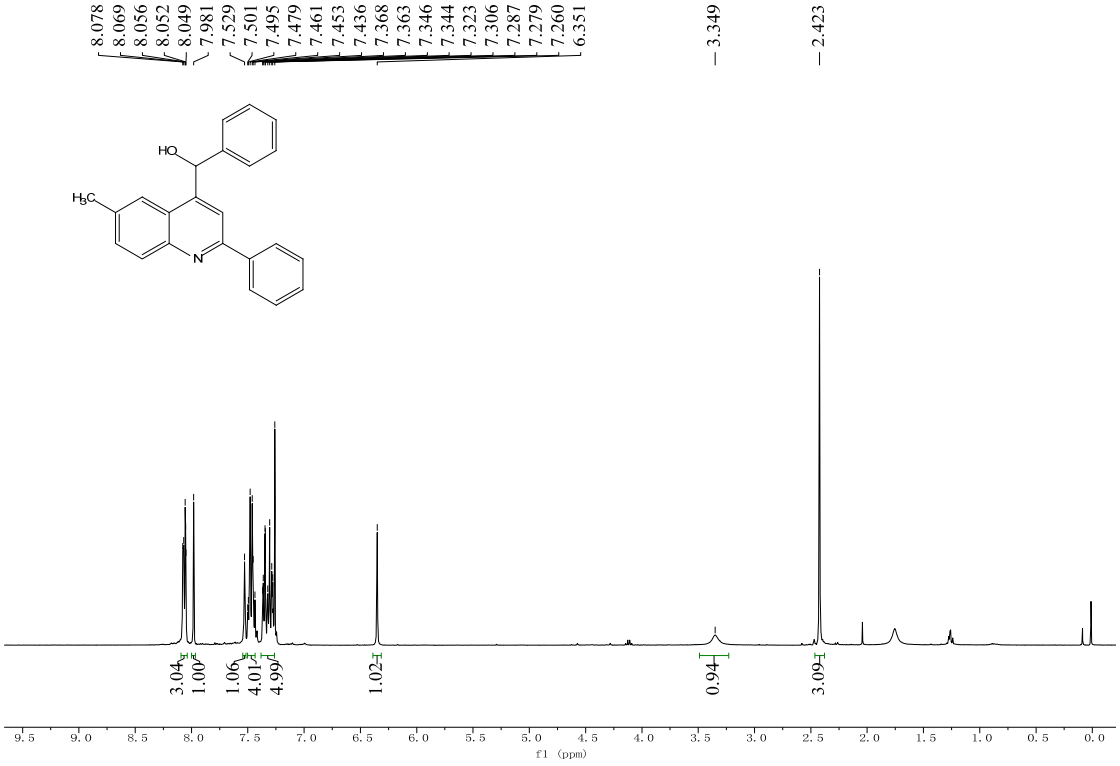


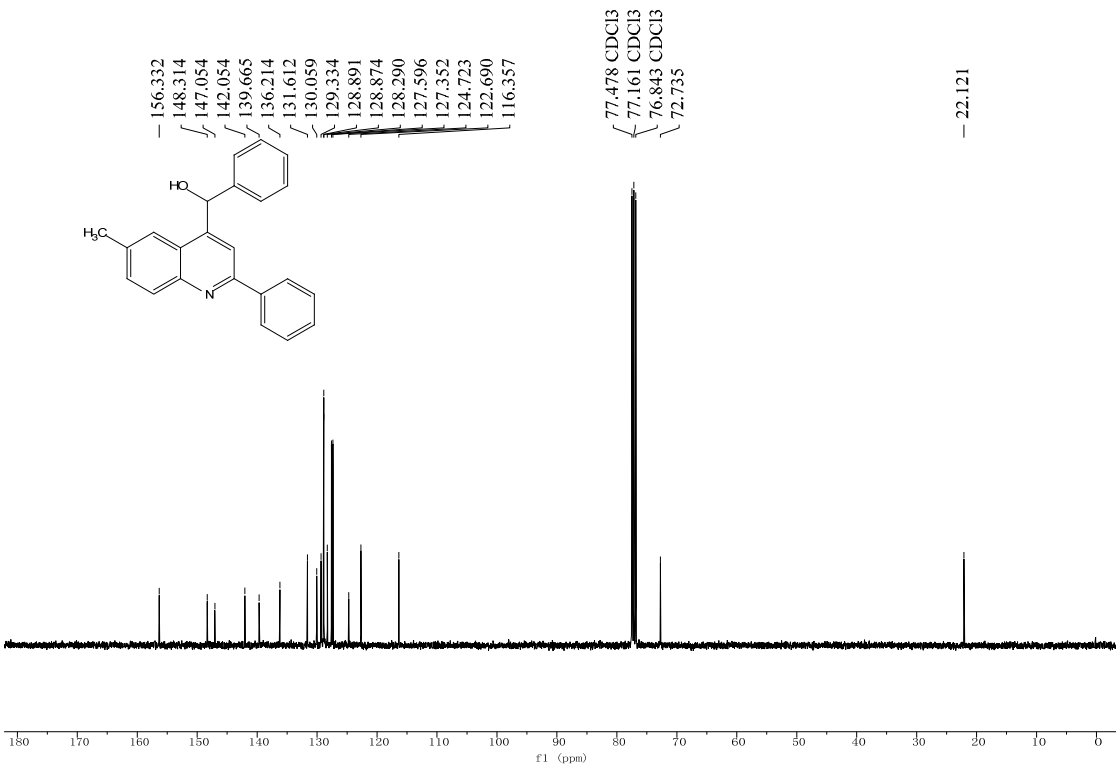
^{1}H and ^{13}C NMR spectra of 4i



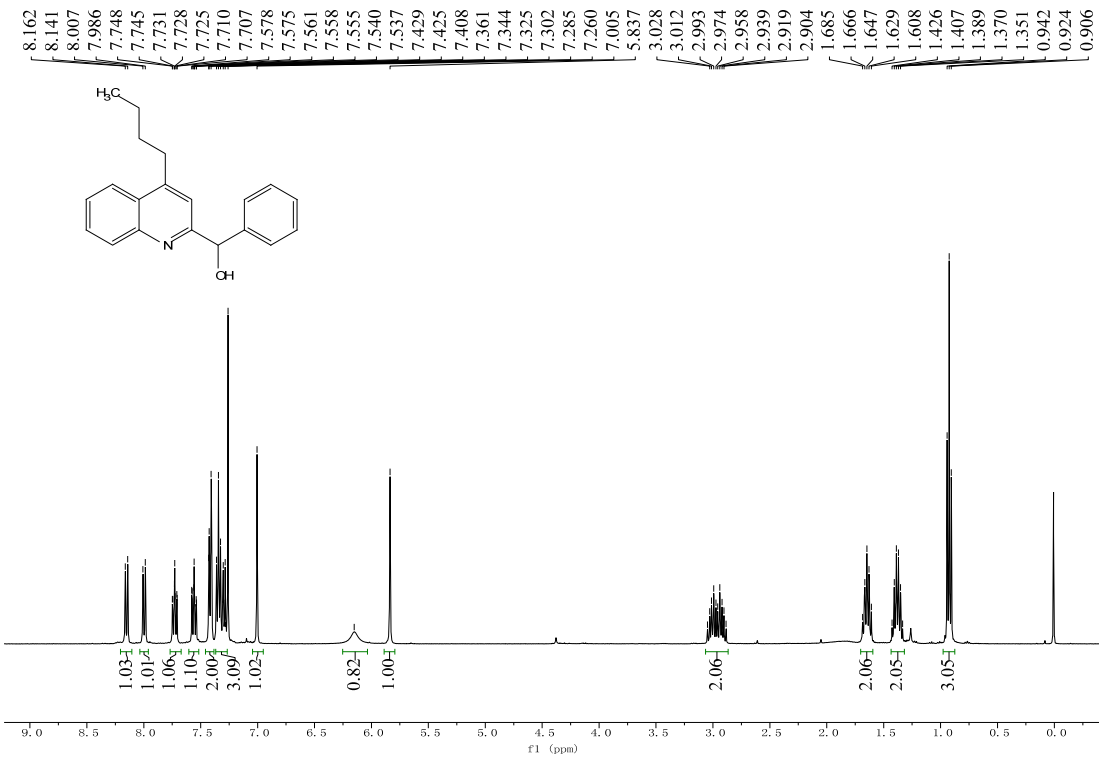


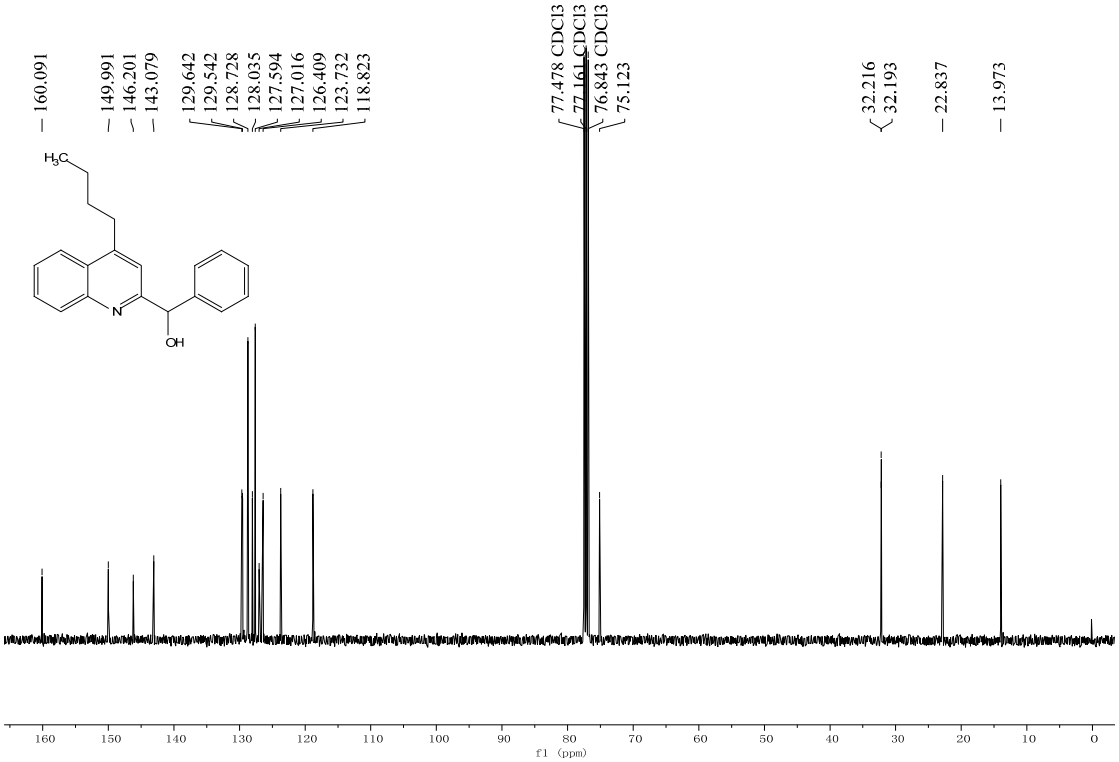
^{1}H and ^{13}C NMR spectra of 4j



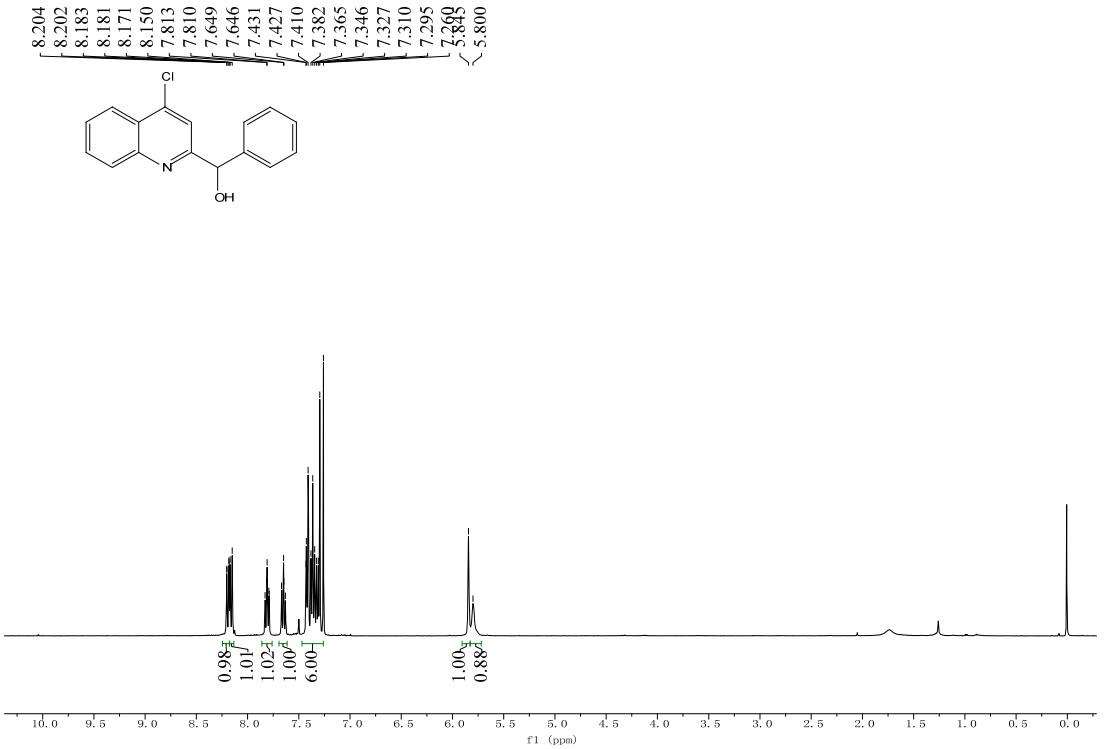


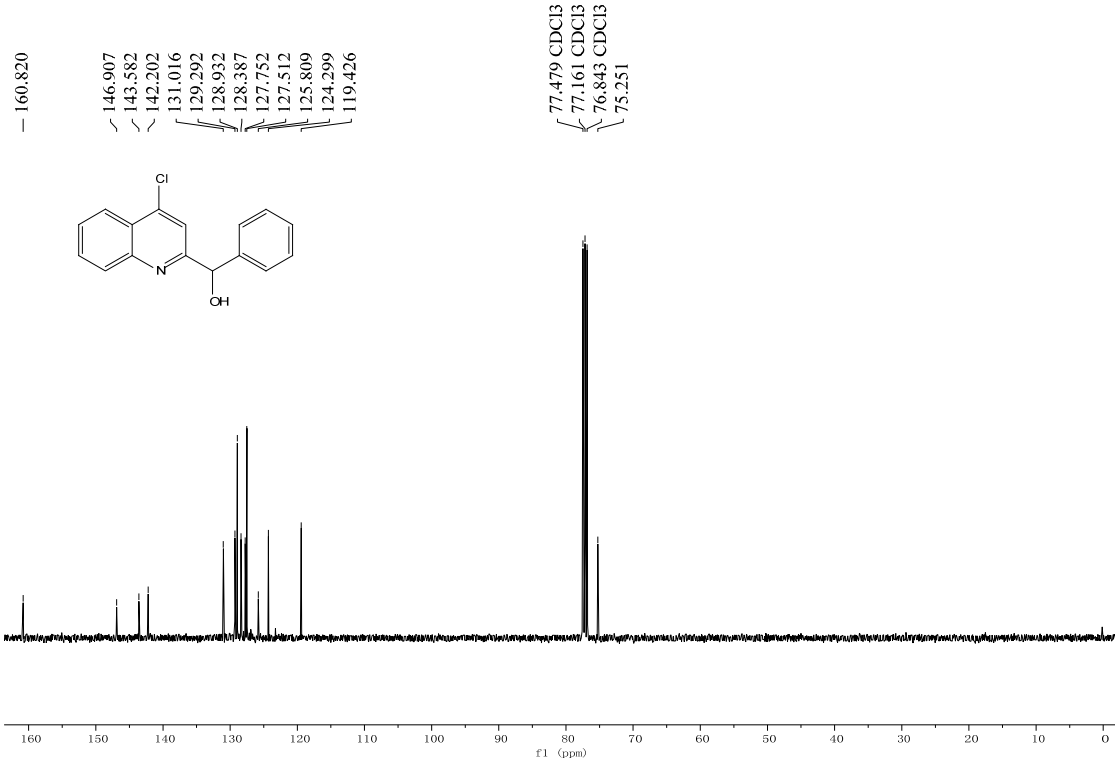
^{1}H and ^{13}C NMR spectra of 4k



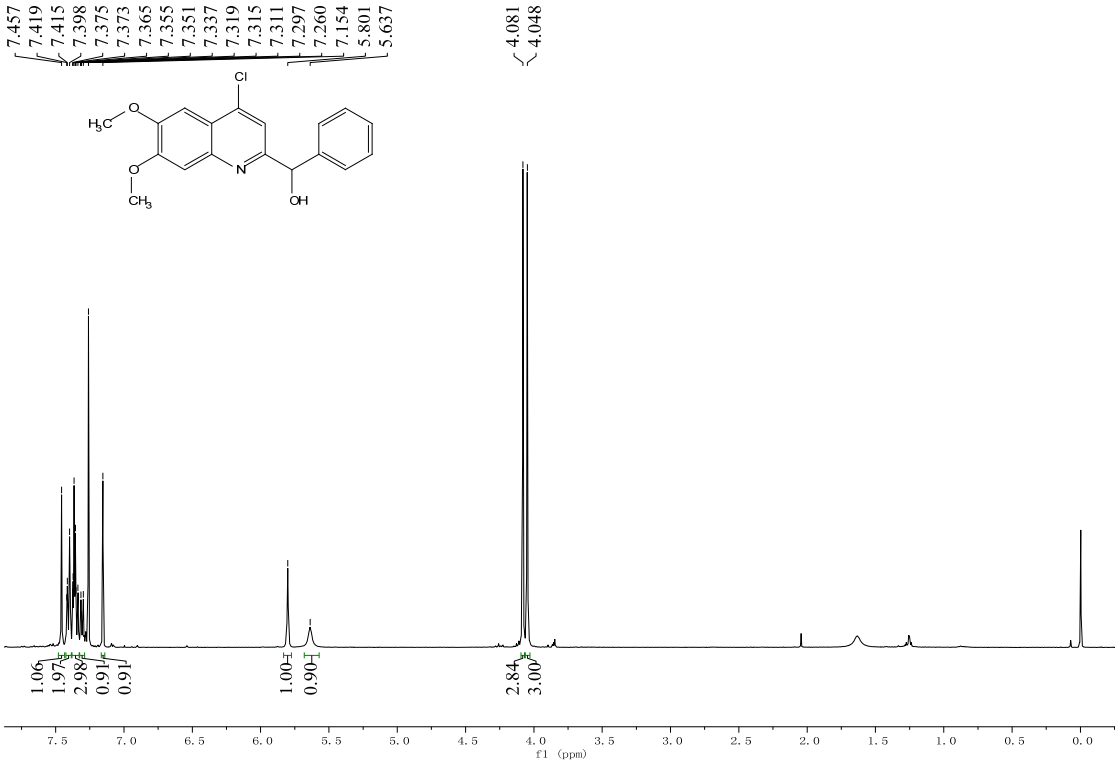


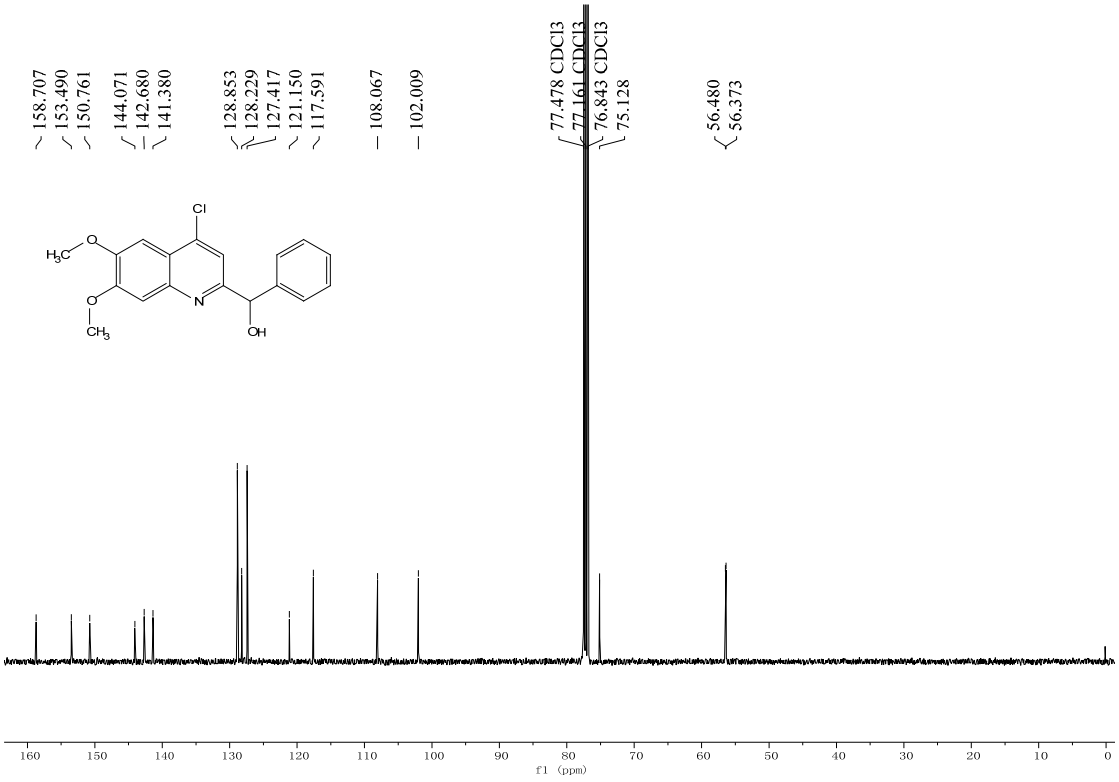
^{1}H and ^{13}C NMR spectra of 4l



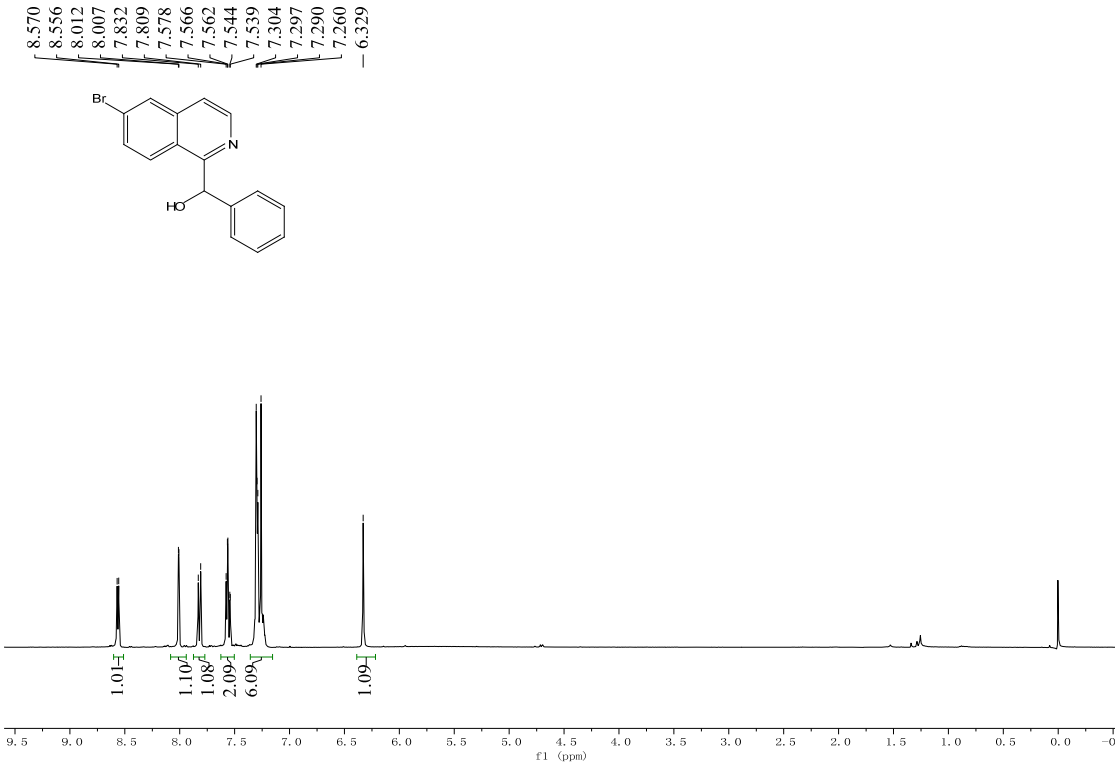


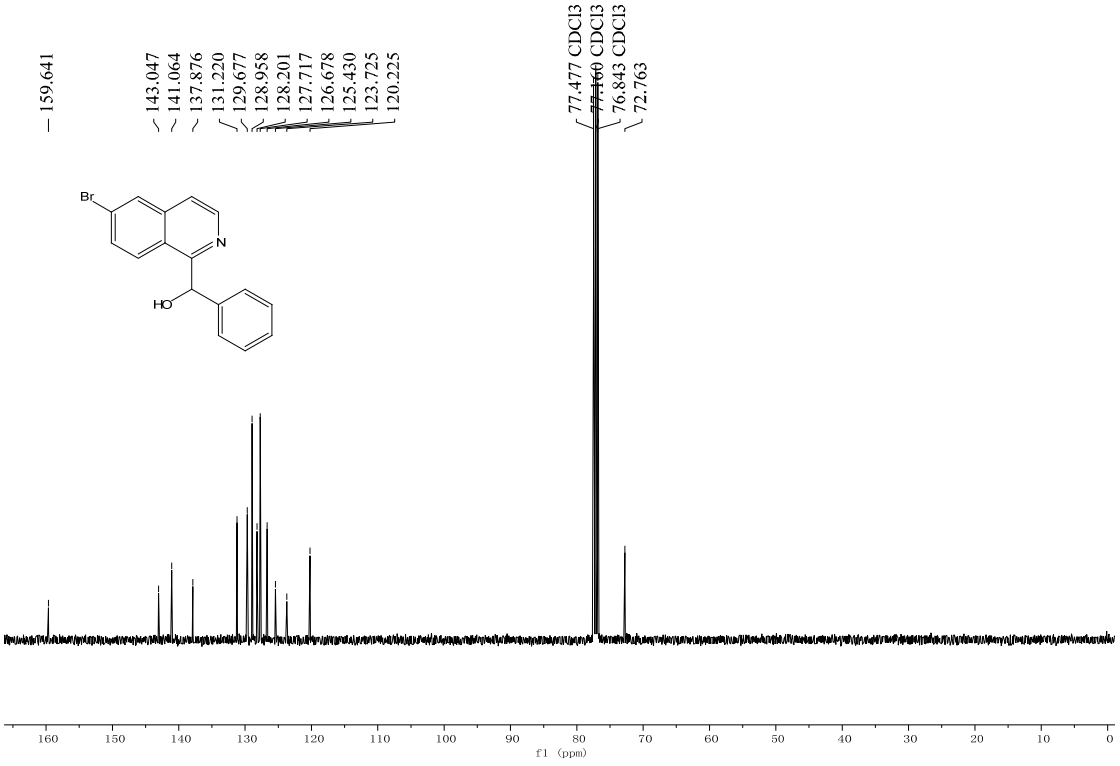
^{1}H and ^{13}C NMR spectra of 4m



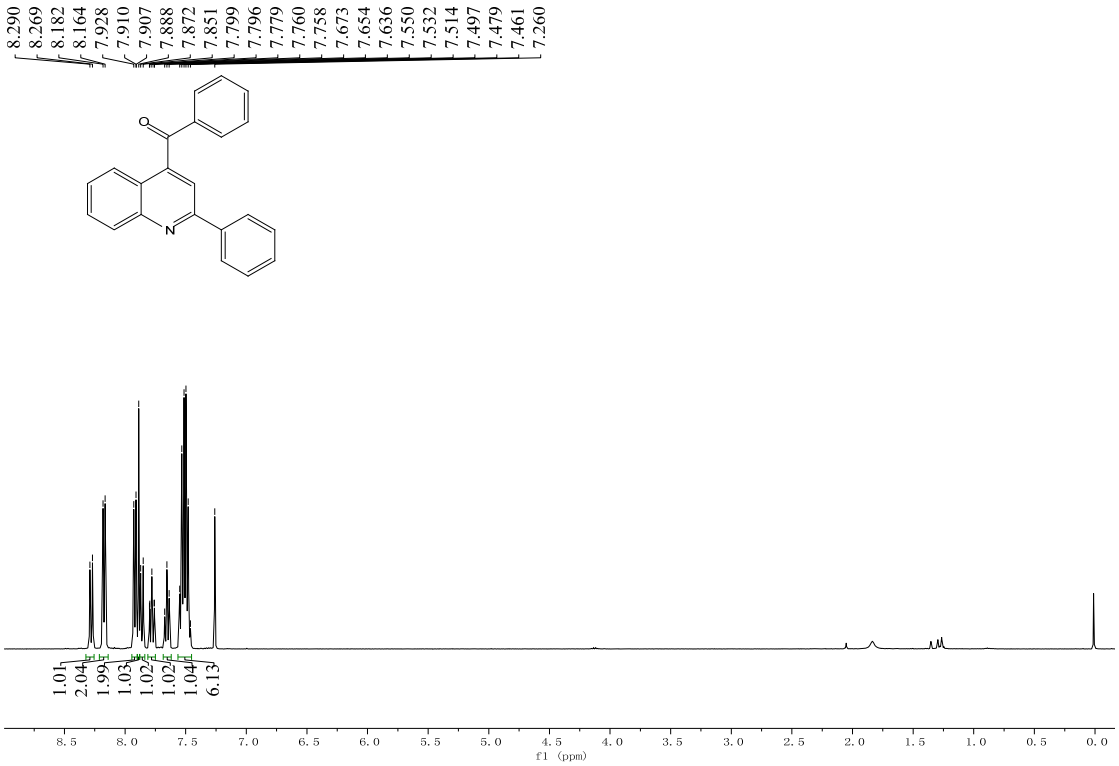


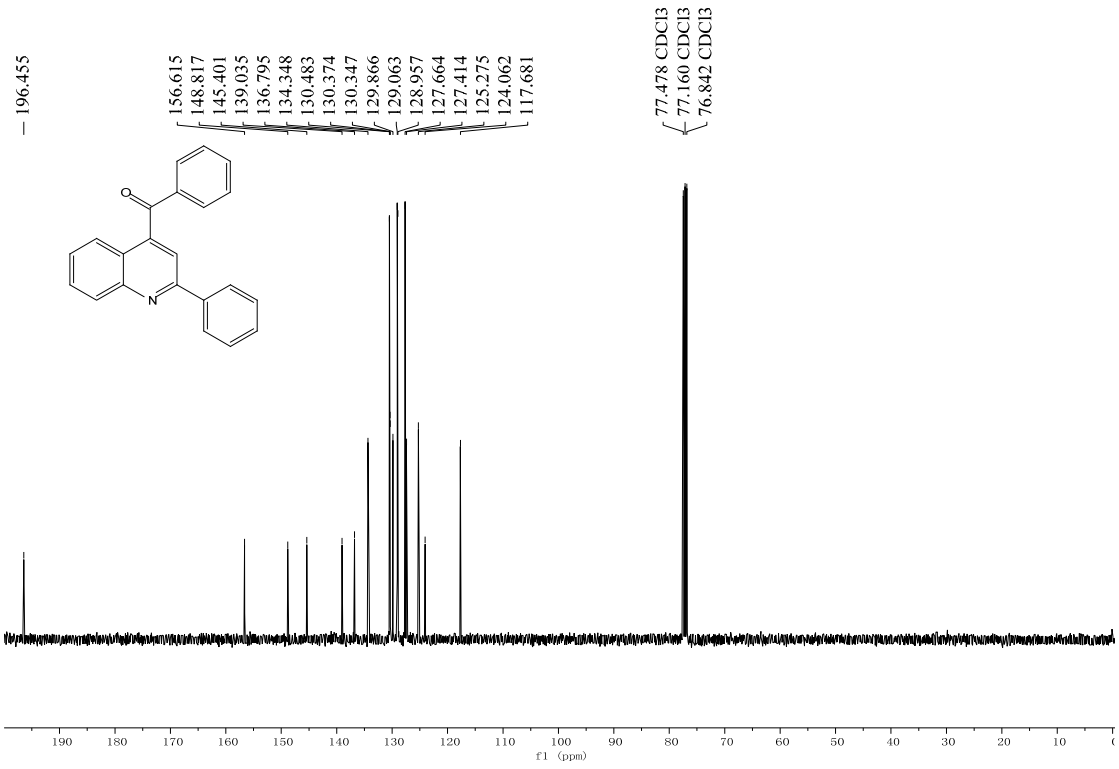
^{1}H and ^{13}C NMR spectra of 4n



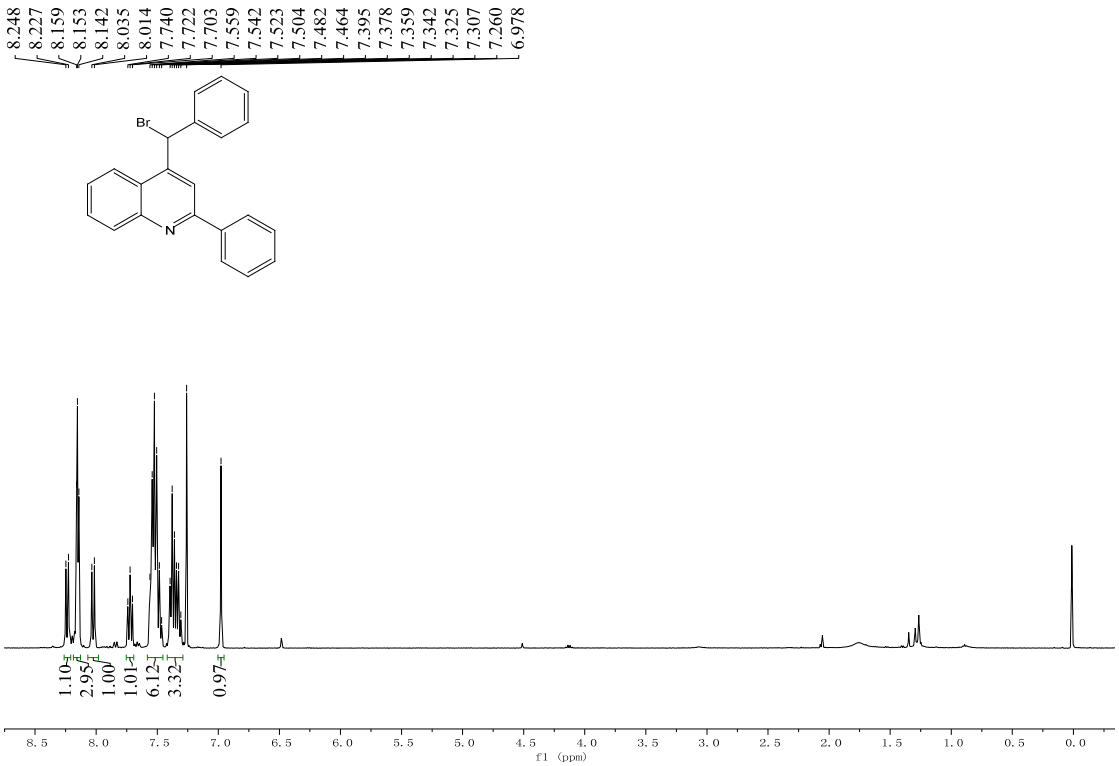


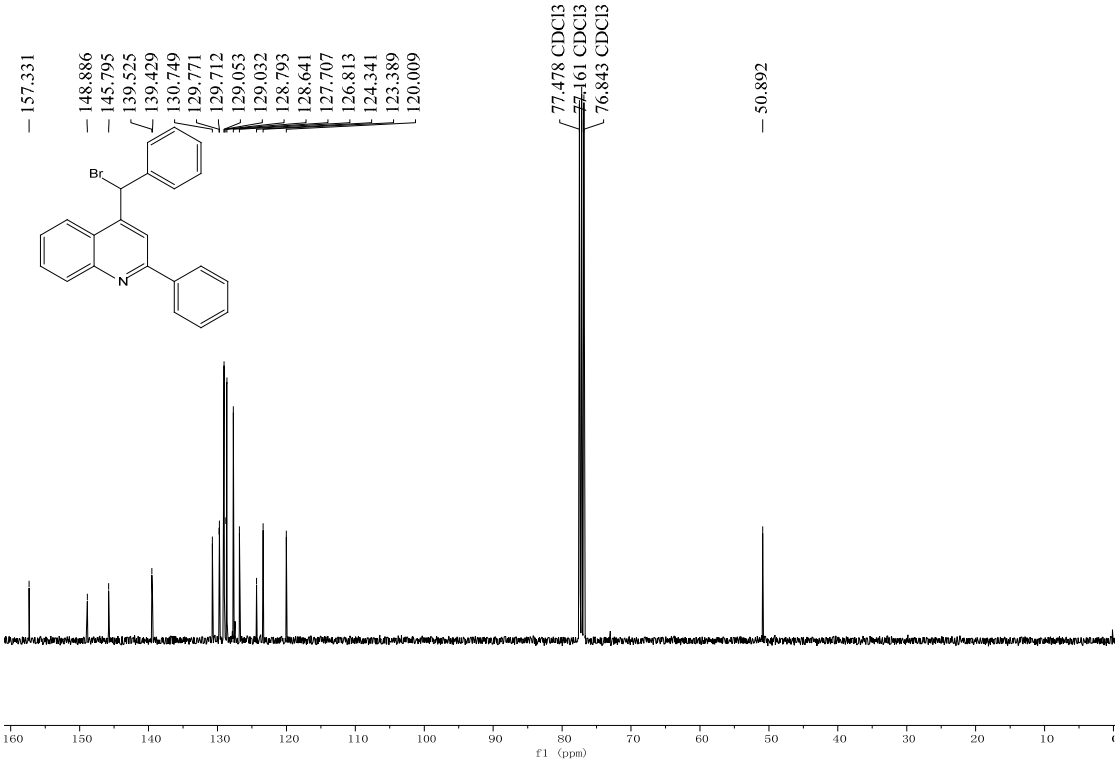
^{1}H and ^{13}C NMR spectra of 7



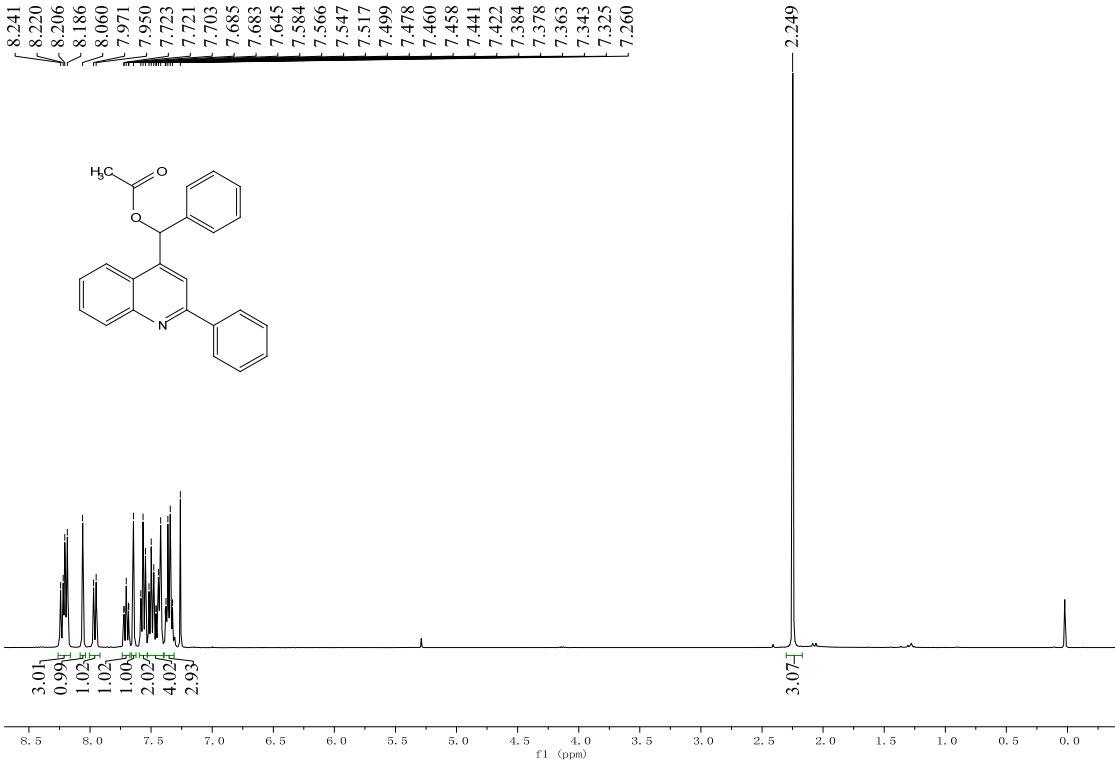


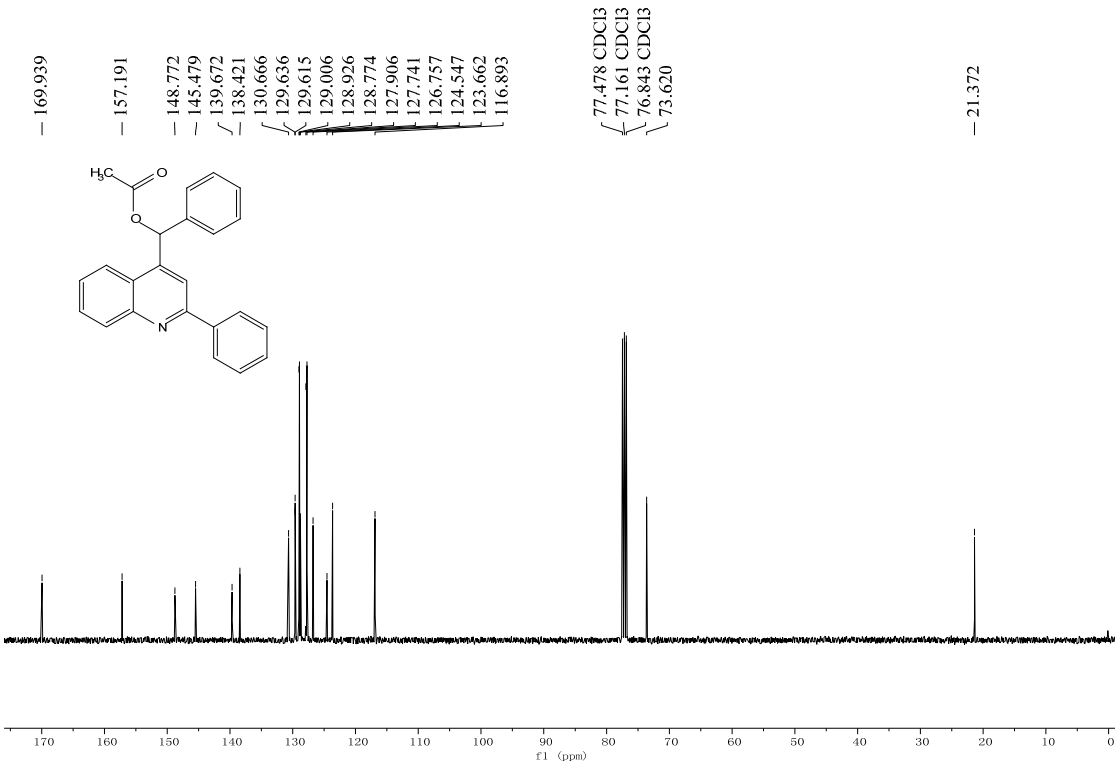
H and ^{13}C NMR spectra of 8



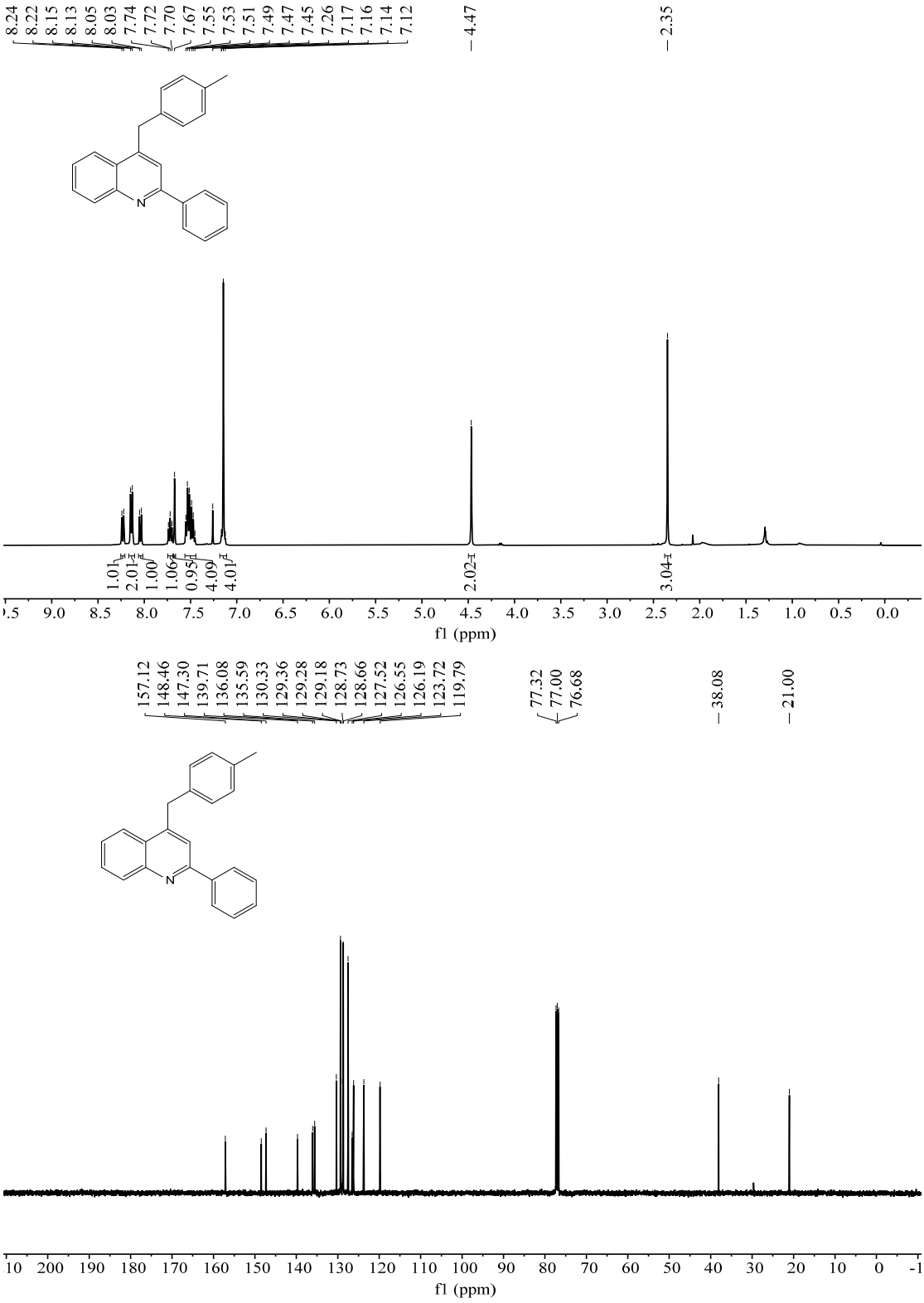


^{1}H and ^{13}C NMR spectra of 9

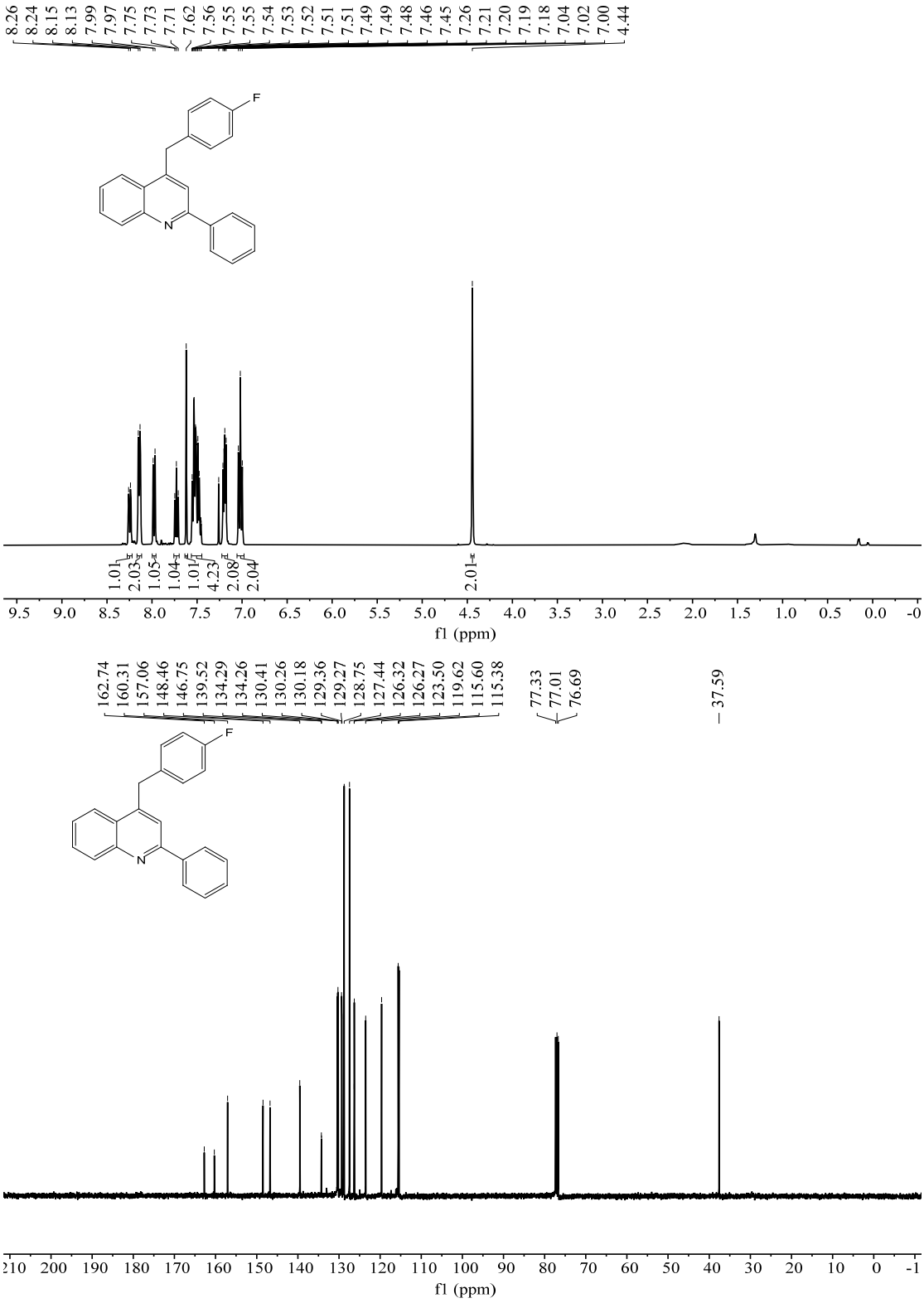




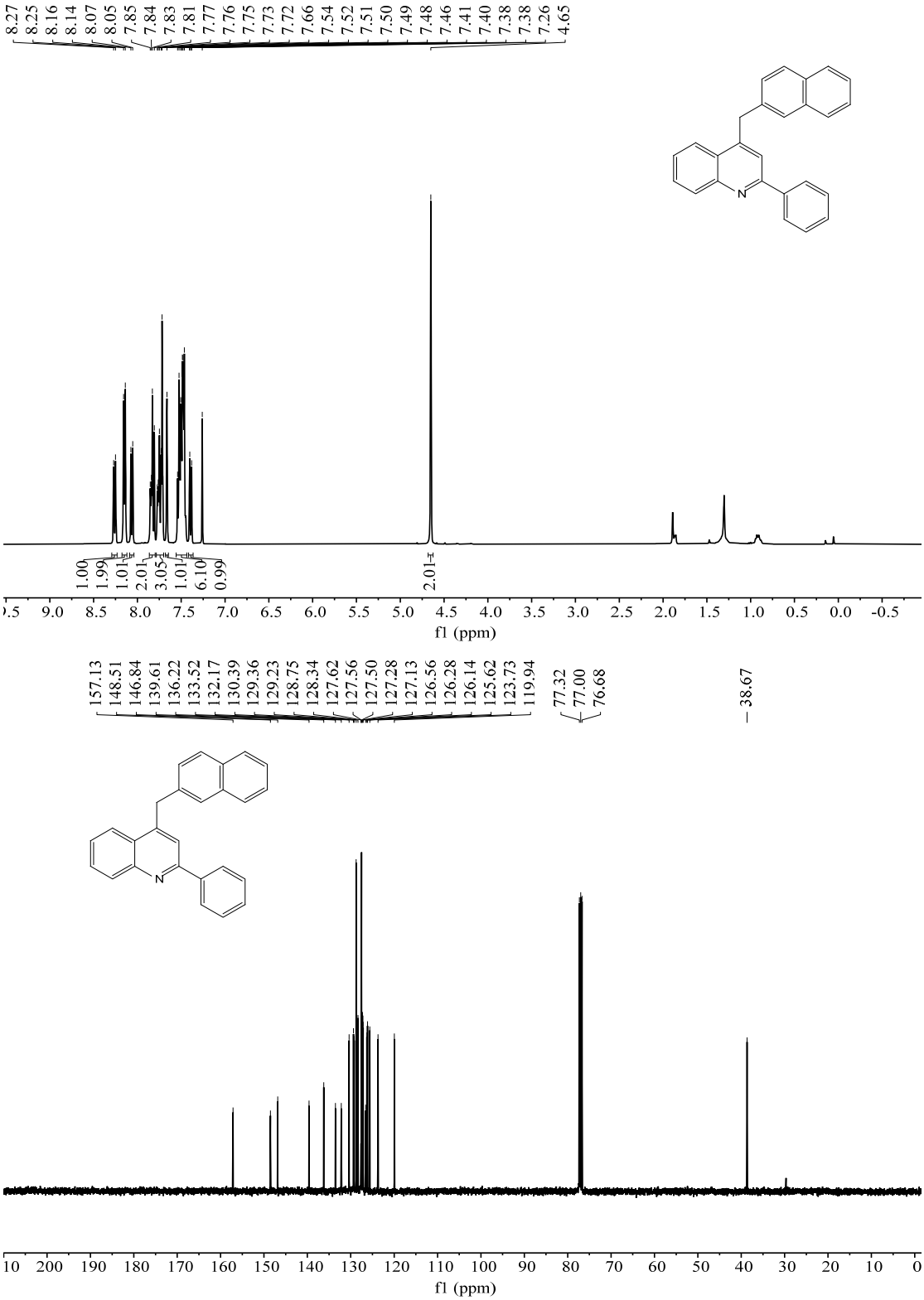
^{1}H and ^{13}C NMR spectra of 3b’



^{1}H and ^{13}C NMR spectra of 3c’



^{1}H and ^{13}C NMR spectra of 3r’



^{1}H and ^{13}C NMR spectra of 4l’