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# Electronic Supplementary Information (ESI)

## Cobalt-Catalyzed Synthesis of Quinolines from the Redox-Neutral Annulation of Anilides and Alkynes

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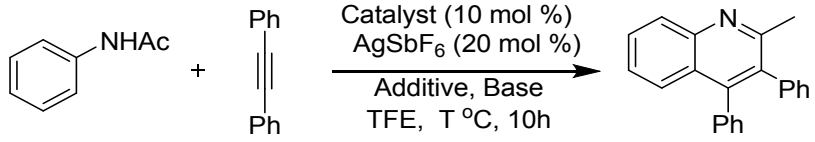
## General Information

All reactions were performed under air atmosphere in a 25 mL sealed tube. The other materials and solvents were purchased from common commercial sources and used without additional purification, if there is no special version. Starting materials, including diphenylacetylenes[1], [Cp*Co(CO)$I_2$][2] were synthesized according to literature procedures. $^1$H NMR spectra were recorded at 400 MHz using TMS as internal standard, $^{13}$C NMR spectra were recorded at 100 MHz using TMS as internal standard. The multiplicities are reported as follows: singlet (s), doublet (d), doublet of doublets (dd), multiplet (m), triplet (t) and broad resonances (br). Mass spectroscopy data of the products were collected on an HRMS-TOF instrument.

## Optimization of the Reaction Conditions [a]

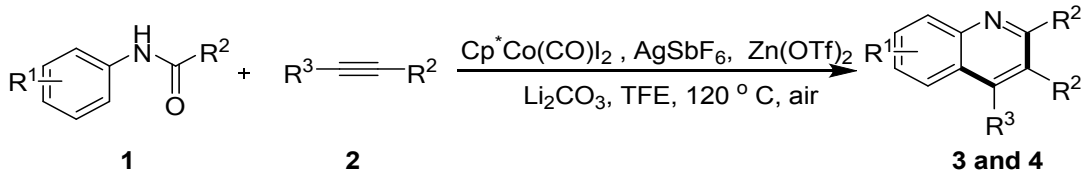



**1a** **2a** **3a**

| Entry | Catalyst (mol %) | Additive (mol %) | Base (mol %) | T [°C] | Yield [%][b] |
|---|---|---|---|---|---|
| **1** | [{Cp*$RhCl_2$}$_2$] | $Cu(OAc)_2$(100) | — | 90 | n.r. |
| **2** | [(*p*-cymene)$RuCl_2$}$_2$] | KOAc(100) | $Na_2CO_3$(100) | 90 | n.r.[c] |
| **3** | [Cp*Co(CO)$I_2$] | — | KOAc(20) | 90 | trace |
| **4** | [Cp*Co(CO)$I_2$] | — | $Li_2CO_3$ (20) | 90 | 15 |
| **5** | [Cp*Co(CO)$I_2$] | $AgNTf_2$(20) | $Li_2CO_3$(20) | 90 | 56 |
| **6** | [Cp*Co(CO)$I_2$] | AgOPiv(20) | $Li_2CO_3$(20) | 90 | 30 |
| **7** | [Cp*Co(CO)$I_2$] | AgOAc(20) | $Li_2CO_3$(20) | 90 | 25 |
| **8** | [Cp*Co(CO)$I_2$] | AgOTf(20) | $Li_2CO_3$(20) | 90 | 52 |
| **9** | [Cp*Co(CO)$I_2$] | $Cu(OTf)_2$(20) | $Li_2CO_3$(20) | 90 | 45 |
| **10** | [Cp*Co(CO)$I_2$] | $Sc(OTf)_3$(20) | $Li_2CO_3$(20) | 90 | 30 |
| **11** | [Cp*Co(CO)$I_2$] | $FeCl_3$(20) | $Li_2CO_3$(20) | 90 | trace |
| **12** | [Cp*Co(CO)$I_2$] | $Mn(OAc)_2$(20) | $Li_2CO_3$(20) | 90 | trace |
| **13** | [Cp*Co(CO)$I_2$] | $ZnCl_2$(20) | $Li_2CO_3$(20) | 90 | trace |
| **14** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 90 | 71 |
| **15** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | KOAc(20) | 90 | 53 |
| **16** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | CaO(20) | 90 | 62 |
| **17** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Na_2CO_3$(20) | 90 | 47 |
| **18** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Cs_2CO_3$(20) | 90 | 25 |
| **19** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Et_3N$(20) | 90 | trace |
| **20** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 120 | 76 |
| **21** | **[Cp*Co(CO)$I_2$]** | **$Zn(OTf)_2$(20)** | **$Li_2CO_3$(20)** | **120** | **77[d]** |
| **22** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 130 | 76[d] |
| **23** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 120 | 64[e] |
| **24** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 120 | n.r. [f] |
| **25** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 120 | 52[g] |
| **26** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 120 | n.r. [h] |
| **27** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 120 | n.r. [i] |
| **28** | $Co(OAc)_2$ | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 120 | n.r. |
| **29** | $CoBr_2$ | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 120 | n.r. |
| **30** | — | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 120 | n.r. |
| **31** | [Cp*Co(CO)$I_2$] | $Zn(OTf)_2$(20) | $Li_2CO_3$(20) | 120 | n.r.[c ] |

[a]Reaction conditions: **1a** (0.1mmol), 2a (0.15mmol), solvent (1.5 ml), 120 °C, 10 h, seal tube under air. [b]Isolated yield. [c]Without $AgSbF_6$. [d]Under $N_2$ atmosphere. [e]Under $O_2$ atmosphere.[f] 1,4-dioxane as solvent.[g]DCE as solvent. [h]DMF as solvent. [i]Toluene as solvent.

## Typical Procedure for the Product

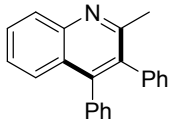



**1** **2** **3 and 4**

To an oven-dried 25 mL sealed tube, amides **1** (0.1 mmol), alkynes **2** (0.15 mmol), [Cp*Co(CO)$I_2$] (4.5 mg, 0.01 mmol), $AgSbF_6$ (6.8 mg, 0.02 mmol), $Zn(OTf)_2$ (7.2 mg, 0.02 mmol), $Li_2CO_3$ (1.5 mg, 0.02 mmol) and TFE (1.5 mL) were added under air atmosphere. The mixture was stirred for 10 h at 120 °C. The mixture was then cooled to room temperature, diluted with EtOAc, filtered through a celite pad, and concentrated in vacuo. The residue was purified by flash column chromatography on silica gel (eluent: hexane/EtOAc = 5/1 with triethylamine), to afford the desired product **3** and **4**.

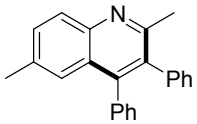
## Analytical Data for Products

**2-methyl-3,4-diphenylquinoline (3a)**



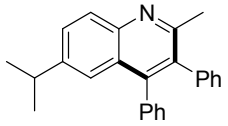

$R_f$ = 0.52 (hexane/EtOAc = 5/1); light yellow solid; yield: 76%(22.4mg); m.p = 166-168 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.15 (d, $J$ = 8.4 Hz, 1H), 7.70 (t, $J$ = 7.6 Hz, 1H), 7.50 (d, $J$ = 8.4 Hz, 1H), 7.40 (t, $J$ = 7.6 Hz, 1H), 7.28-7.18 (m, 6H), 7.10-7.05 (m, 4H), 2.56 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 157.8, 146.9, 146.8, 138.5, 136.7, 134.1, 130.1, 130.1, 129.3, 128.4, 127.9, 127.7, 127.3, 126.9, 126.7, 126.3, 125.9, 25.3.HRMS (EI-TOF): Calculated for $C_{22}H_{17}N$ $[M]^+$ 295.1361, found :295.1358.

**2,6-dimethyl-3,4-diphenylquinoline(3b)**




$R_f$ = 0.48 (hexane/EtOAc = 5/1); light yellow solid; yield: 73%(22.5mg); m.p = 164-166 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 8.01 (d, $J$ = 8.5 Hz, 1H), 7.53 (dd, $J$ = 8.4, 1.6 Hz, 1H), 7.25-7.13 (m, 7H), 7.09-7.03 (m, 4H), 2.52 (s, 3H), 2.40 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 156.8, 146.2, 145.5, 138.8, 136.9, 135.6, 134.1, 131.4, 130.1, 130.1, 128.2, 127.9, 127.7, 127.2, 126.8, 126.2, 125.4, 25.3, 21.8. HRMS (EI-TOF) calcd for $C_{23}H_{19}N$ ($M^+$): 309.1517, found: 309.1521.

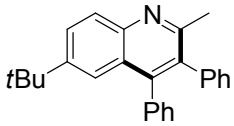
**6-isopropyl-2-methyl-3,4-diphenylquinoline(3c)**




$R_f$ = 0.53 (hexane/EtOAc = 5/1); light yellow solid; yield: 71%(23.9mg); m.p = 129-131 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 8.07 (d, $J$ = 8.4 Hz, 1H), 7.62 (dd, $J$ = 8.4, 2.0 Hz, 1H), 7.28-7.16 (m, 7H), 7.11-7.03 (m, 4H), 2.98-2.92 (m, 1H) 2.55 (s, 3H), 1.22 (d, $J$ = 6.8 Hz, 6H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 156.8, 146.2,

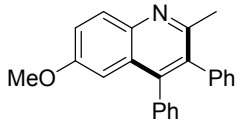
145.5, 138.8, 136.9, 135.8, 134.1, 131.4, 130.1, 130.1, 128.2, 127.9, 127.7, 127.2, 126.8, 126.2, 125.4, 25.2, 21.8. HRMS (EI-TOF) calcd for $C_{25}H_{23}N$ ($M^+$): 337.1830, found: 337.1833

**6-tert-butyl-2-methyl-3,4-diphenylquinoline(3d)**



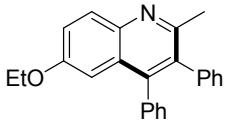

$R_f$ = 0.5 (hexane/EtOAc = 5/1); light yellow solid; yield: 74%(25.9mg); m.p = 147-149 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 8.08 (d, J = 8.8 Hz, 1H), 7.79 (dd, *J* = 8.8, 1.6 Hz, 1H), 7.43 (d, *J* = 1.7 Hz, 1H), 7.29-7.15 (m, 6H), 7.10 (d, *J* = 7.6 Hz, 2H), 7.05 (d, *J* = 8.0 Hz, 2H), 2.53 (s, 3H), 1.27 (s, 9H).$^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 157.0, 148.7, 146.8, 145.4, 139.8, 136.9, 134.0, 130.1, 128.1, 128.0, 127.9, 127.6, 127.2, 126.8, 125.8, 121.6, 35.0, 31.1, 25.2. HRMS (EI-TOF) calcd for $C_{26}H_{25}N$ ($M^+$): 351.1987, found: 351.1991

**6-methoxy-2-methyl-3,4-diphenylquinoline(3e)**




$R_f$ = 0.39 (hexane/EtOAc = 5/1); light yellow solid; yield: 82%(26.6mg); m.p = 157-160 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 8.05 (d, *J* = 9.2 Hz, 1H), 7.36 (dd, *J* = 9.2, 2.8 Hz, 1H), 7.27-7.14 (m, 6H), 7.10-7.04 (m, 4H), 6.76 (d, *J* = 2.8 Hz, 1H), 3.70 (s, 3H), 2.51 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 157.3, 155.2, 145.7, 143.0, 138.8, 137.0, 134.4, 130.0, 130.0, 130.0, 127.9, 127.8, 127.2, 127.2, 126.8, 121.3, 104.8, 55.4, 25.0. HRMS (EI-TOF) calcd for $C_{23}H_{19}NO$ ($M^+$): 325.1467, found: 325.1470.

**6-ethoxy-2-methyl-3,4-diphenylquinoline(3f)**

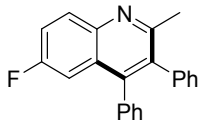



$R_f$ = 0.57 (hexane/EtOAc = 5/1); light yellow solid; yield: 63%(21.3mg); m.p = 149-

151 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 8.02 (d, *J* = 9.2 Hz, 1H), 7.35 (dd, *J* = 9.2, 2.8 Hz, 1H), 7.24-7.16 (m, 6H), 7.10-7.04 (m, 4H), 6.76 (d, *J* = 2.8 Hz, 1H), 3.90 (q, *J* = 14.0, 6.8 Hz, 2H), 2.50 (s, 3H), 1.36 (t, *J* = 6.8 Hz, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 156.6, 155.1, 145.6, 143.0, 138.9, 137.0, 134.3, 130.0, 130.0, 127.9, 127.8, 127.2, 126.8, 121.5, 105.7, 63.6, 25.1, 14.6.

HRMS (EI-TOF) calcd for $C_{24}H_{21}NO$ ($M^+$): 339.1623, found: 339.1626

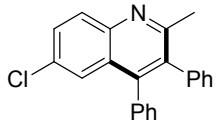
**6-fluoro-2-methyl-3,4-diphenylquinoline(3g)**




$R_f$ = 0.46 (hexane/EtOAc = 5/1); light yellow solid; yield: 68%(21.2mg); m.p = 166-168 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) *δ* 8.11 (t, *J* = 7.4 Hz, 1H), 7.75 (t, *J* = 7.6 Hz, 1H), 7.26-7.17 (m, 6H), 7.11 (t, *J* = 8.2 Hz, 1H), 7.08-7.04 (m, 4H), 2.52 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) *δ* 159.1 (d, $J_{C\text{-}F}$ = 244.7 Hz), 156.2, 145.0, 145.0, 143.1, 137.3, 135.3, 129.9 (d, $J_{C\text{-}F}$ = 9.0 Hz), 128.8 (d, $J_{C\text{-}F}$ = 2.6 Hz), 128.8, 128.7, 126.9, 126.8, 126.4, 118.1 (d, $J_{C\text{-}F}$= 25.8 Hz), 108.9 (d, $J_{C\text{-}F}$= 23.1 Hz), 24.3.

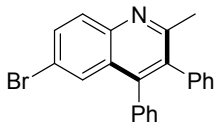
HRMS (EI-TOF): Calculated for $C_{22}H_{15}F_2N$ $[M]^+$ 313.1267, Found 313.1270.

**6-chloro-2-methyl-3,4-diphenylquinoline(3h)**




$R_f$ = 0.5 (hexane/EtOAc = 5/1); light yellow solid; yield: 72%(23.7mg); m.p = 200-201 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 8.05 (d, *J* = 8.8 Hz, 1H), 7.62 (dd, *J* = 8.8, 2.0 Hz, 1H), 7.46 (d, *J* = 2.0 Hz, 1H), 7.29-7.16 (m, 6H), 7.08-7.03 (m, 4H), 2.53 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 158.3, 145.9, 145.4, 138.2, 136.1, 134.9, 131.7, 130.3, 130.0, 129.9, 128.0, 127.9, 127.6, 127.1, 127.0, 125.4, 25.4. HRMS (EI-TOF) calcd for $C_{22}H_{16}ClN$ ($M^+$): 329.0971, found: 329.0973.

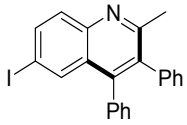
**6-bromo-2-methyl-3,4-diphenylquinoline(3i)**




$R_f$ = 0.5 (hexane/EtOAc = 5/1); light yellow solid; yield: 76%(28.3); m.p = 197-200 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 7.98 (d, *J* = 8.8 Hz, 1H), 7.75 (dd, *J* = 8.8, 2.4 Hz, 1H), 7.63 (d, *J* = 2.4 Hz, 1H), 7.30-7.15 (m, 6H), 7.09-7.03 (m, 4H), 2.52 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 158.5, 145.8, 145.6, 138.2, 136.0, 134.9, 132.6, 130.4, 130.0,130.0, 129.9, 128.7, 128.0, 127.6, 127.5, 127.1, 119.9, 25.5..

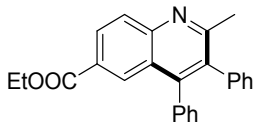
HRMS (EI-TOF) calcd for $C_{22}H_{16}BrN$ ($M^+$): 373.0466, found: 373.0470

**6-iodo-2-methyl-3,4-diphenylquinoline(3j)**



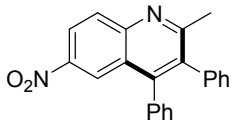

$R_f$ = 0.53 (hexane/EtOAc = 5/1); light yellow solid; yield: 63%(26.5mg); m.p = 205-206 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 7.92 (dd, *J* = 8.8, 2.0 Hz, 1H), 7.84-7.82 (m, 2H), 7.28-7.18 (m, 6H), 7.07-7.02 (m, 4H), 2.51 (s, 3H) $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 158.7, 146.0, 145.6, 138.2, 137.9, 136.0, 135.3, 134.8, 130.4, 130.0, 129.9, 128.2, 128.0, 127.9, 127.6, 127.0, 91.6, 25.5. HRMS (EI-TOF) calcd for $C_{22}H_{16}IN$ ($M^+$): 421.0327, found: 421.0332.

**ethyl 2-methyl-3,4-diphenylquinoline-6-carboxylate(3k)**



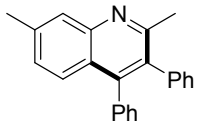

$R_f$ = 0.46 (hexane/EtOAc = 5/1); ight yellow solid; yield: 61%(22.4mg); m.p = 163-164 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 8.29-8.27 (m, 2H), 8.14 (d, *J* = 9.6 Hz, 1H), 7.27-7.20 (m, 6H), 7.10-7.04 (m, 4H), 3.87 (s, 3H), 2.56 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 166.9, 160.5, 149.0, 147.8, 138.2, 136.0, 134.9, 130.1, 130.0, 129.8, 129.0, 128.8, 128.0, 127.9, 127.6, 127.4, 127.1, 125.6, 52.3, 25.8. HRMS (EI-TOF) calcd for $C_{25}H_{21}NO_2$ ($M^+$): 367.1572 , found: 367.1571.

**2-methyl-6-nitro-3,4-diphenylquinoline(3l)**



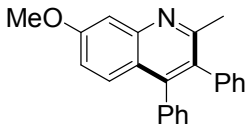

$R_f$ = 0.57 (hexane/EtOAc = 5/1); light yellow solid; yield: 48%(16.3mg); m.p = 188-189 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 8.47-8.44 (m, 2H), 8.22 (d, *J* = 8.8 Hz, 1H), 7.31-7.22 (m, 6H), 7.10-7.05 (m, 4H), 2.60 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 162.4, 149.1, 148.4, 145.2, 137.5, 136.0, 135.2, 130.4, 130.0, 129.8, 128.2, 128.2, 127.4, 125.6, 123.8, 122.7, 25.9. HRMS (EI-TOF) calcd for $C_{22}H_{16}N_2O_2$ ($M^+$): 340.1212, found: 340.1215

**2,7-dimethyl-3,4-diphenylquinoline(3m)**



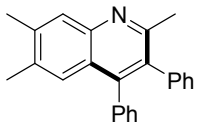

$R_f$ = 0.52 (hexane/EtOAc = 5/1); light yellow solid; yield: 58%(17.9mg); m.p = 173-175 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 7.90 (s, 1H), 7.38 (d, *J* = 8.4 Hz, 1H), 7.27-7.14 (m, 7H), 7.09-7.04 (m, 4H), 2.56 (s, 3H), 2.52 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 157.7, 147.1, 146.5, 139.5, 138.7, 136.9, 133.3, 130.1, 130.1, 128.1, 127.8, 127.7, 127.6, 127.2, 126.8, 126.3, 124.3, 25.3, 21.8. HRMS (EI-TOF) calcd for $C_{23}H_{19}N$ ($M^+$): 309.1517, found: 309.1515.

**7-methoxy-2-methyl-3,4-diphenylquinoline (3n)**




$R_f$ = 0.46 (hexane/EtOAc = 5/1); light yellow solid; yield: 53%(17.2mg); m.p = 161-162 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 7.46 (d, *J* = 2.4 Hz, 1H), 7.38 (d, *J* = 9.2 Hz, 1H), 7.25-7.14 (m, 6H), 7.08-7.03 (m, 5H), 3.97 (s, 3H), 2.52 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 160.5, 158.0, 148.7, 146.6, 138.8, 136.9, 132.1, 130.3, 130.1, 127.9, 127.8, 127.7, 127.2, 126.7, 121.3, 118.8, 106.7, 55.6, 25.3.
HRMS (EI-TOF) calcd for $C_{23}H_{19}NO$ ($M^+$): 325.1467, found: 325.1469.

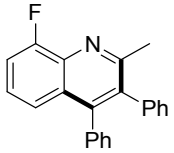
**2,6,7-trimethyl-3,4-diphenylquinoline(3o)**



$R_f$ = 0.46 (hexane/EtOAc = 5/1); light yellow solid; yield: 47%(15.1mg); m.p = 163-166 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 7.88 (s, 1H), 7.24-7.15 (m, 7H), 7.09-7.03 (m, 4H), 2.50 (s, 3H), 2.47 (s, 3H), 2.30 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 156.7, 146.2, 145.8, 139.3, 139.0, 137.1, 135.7, 133.3, 130.2, 130.1, 128.1, 127.8, 127.6, 127.1, 126.7, 125.7, 124.7, 25.3, 20.4, 20.2.

HRMS (EI-TOF) calcd for $C_{24}H_{21}N$ ($M^+$): 323.1674, found: 323.1678

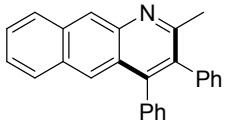
**8-fluoro-2-methyl-3,4-diphenylquinoline(3p)**



$R_f$ = 0.6 (hexane/EtOAc = 5/1); light yellow solid; yield: 57%(17.8mg); m.p = 157-159 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.11 (t, $J$ = 7.4 Hz, 1H), 7.75 (t, $J$ = 7.6 Hz, 1H), 7.26-7.17 (m, 6H), 7.11 (t, $J$ = 8.2 Hz, 1H), 7.08-7.04 (m, 4H), 2.52 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 159.1 (d, $J_{C\text{-}F}$ = 244.7 Hz), 156.2, 145.0, 145.0, 143.1, 137.3, 135.3, 129.9 (d, $J_{C\text{-}F}$ = 9.0 Hz), 128.8 (d, $J_{C\text{-}F}$ = 2.6 Hz), 128.8, 128.7, 126.9, 126.8, 126.4, 118.1 (d, $J_{C\text{-}F}$= 25.8 Hz), 108.9 (d, $J_{C\text{-}F}$= 23.1 Hz), 24.3.

HRMS (EI-TOF): Calculated for $C_{22}H_{15}F_2N$ $[M]^+$ 313.1267, Found 313.1270.

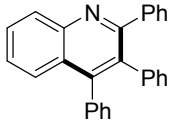
**2-methyl-3,4-diphenylbenzo[g]quinolone(3q)**



$R_f$ = 0.48 (hexane/EtOAc = 5/1); light yellow solid; yield: 63%(21.7mg); m.p = 157-159 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) δ 8.69 (s, 1H) 8.08 (d, $J$ = 8.4 Hz, 1H), 8.04 (s, 1H), 7.82 (d, $J$ = 8.4 Hz, 1H), 7.50 (t, $J$ = 7.6 Hz, 1H), 7.42 (t, $J$ = 7.2Hz, 1H) 7.33-7.29 (m, 3H), 7.25-7.16 (m, 5H), 7.10 (d, $J$ = 6.8 Hz, 2H) 2.58 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) δ 159.4, 146.2, 143.7, 138.7, 136.9, 133.7, 133.6, 131.5, 130.2, 130.1, 128.5, 128.4, 128.3, 128.2, 128.0, 127.8, 127.4, 126.9, 126.3, 126.2, 126.1, 125.6, 26.1.

HRMS (EI-TOF) calcd for $C_{26}H_{19}N$ ($M^+$): 345.1517, found: 345.1520.

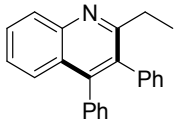
**2,3,4-triphenylquinoline(3r)**




$R_f$ = 0.61 (hexane/EtOAc = 5/1); light yellow solid; yield: 56%(20.1mg); m.p = 175-177 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.26 (d, $J$ = 8.4 Hz, 1H), 7.75-7.71 (m, 1H), 7.59 (d, $J$ = 8.2 Hz, 1H), 7.46 (t, $J$ = 7.6 Hz, 1H), 7.39-7.37 (m, 2H), 7.30-7.27 (m, 3H), 7.23-7.20 (m, 3H), 7.15-7.12 (m, 2H), 7.01-6.98 (m, 2H), 6.90-6.88 (m, 2H).$^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 158.9, 147.7, 147.3, 141.1, 138.3, 136.9, 132.9, 131.3, 130.3, 129.9, 129.7, 129.4, 127.8, 127.7, 127.6, 127.3, 127.3, 126.6, 126.6, 126.6, 126.3.

HRMS (EI-TOF): Calculated for $C_{27}H_{19}N$ $[M]^+$ 357.1517, Found : 357.1520.

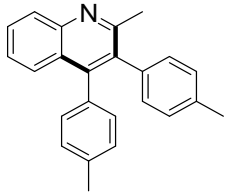
**2-ethyl-3,4-diphenylquinoline(3s)**




$R_f$ = 0.53 (hexane/EtOAc = 5/1); light yellow solid; yield: 67%(20.7mg); m.p = 130-131 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.16 (d, $J$ = 8.4 Hz, 1H), 7.71-7.67 (m, 1H), 7.48 (dd, $J$ = 8.0, 0.8 Hz, 1H), 7.41-7.37 (m, 1H), 7.24-7.17 (m, 6H), 7.09-7.07 (m, 4H), 2.84 (q, $J$ = 7.6 Hz, 2H), 1.23 (t, $J$= 8.0 Hz, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 162.3, 147.1, 146.9, 138.3, 136.9, 133.7, 130.3, 130.0, 129.1, 128.7, 127.7, 127.6, 127.1, 126.8, 126.6, 126.2, 125.8, 30.5, 13.8. HRMS (EI-TOF): Calculated for $C_{23}H_{19}N$ $[M]^+$ 309.1517, Found : 309.1519.

**s**

**2-methyl-3,4-dip-tolylquinoline(4a)**

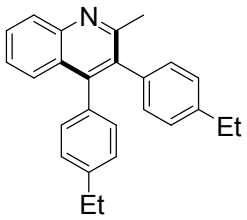



$R_f$ = 0.47 (hexane/EtOAc = 5/1); light yellow solid; yield: 71%(22.9mg); m.p = 115-

116 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.11 (d, $J$ = 8.2 Hz, 1H), 7.67 (t, $J$ = 7.4 Hz, 1H), 7.50 (d, $J$ = 8.0 Hz, 1H), 7.07-7.02 (m, 4H), 6.98-6.93 (m, 4H), 2.53 (s, 3H), 2.31 (s, 3H), 2.29 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 157.1, 145.9, 145.8, 135.7, 135.2, 134.6, 133.1, 132.8, 128.9, 128.8, 127.9, 127.8, 127.6, 127.4, 125.7, 125.6, 124.7, 24.4, 20.2, 20.2.

HRMS (EI-TOF): Calculated for $C_{24}H_{21}N$ $[M]^+$ 323.1674, Found :323.1674.

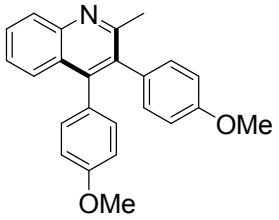
**3,4-bis(4-ethylphenyl)-2-methylquinoline(4b)**




$R_f$ = 0.62 (hexane/EtOAc = 5/1); light yellow solid; yield: 67%(23.5mg); m.p = 111-112 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.14 (d, $J$ = 8.2 Hz, 1H), 7.68 (t, $J$ = 7.0 Hz, 1H), 7.54 (d, $J$ = 8.0 Hz, 1H), 7.39 (t, $J$ = 7.2 Hz, 1H), 7.08-7.03 (m, 4H), 7.00-6.94 (m, 4H), 2.60 (t, $J$ = 7.6 Hz, 4H), 2.56 (s, 3H), 1.23-1.17 (m, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 158.1, 147.2, 146.6, 143.1, 142.6, 135.8, 134.3, 133.9, 130.1, 129.9, 129.1, 128.2, 127.3, 127.1, 126.8, 126.6, 125.8, 28.5, 28.5, 25.3, 15.4, 15.4.

HRMS (EI-TOF): Calculated for $C_{26}H_{25}N$ $[M]^+$ 351.1987, Found: 351.1990.

**3,4-bis(4-methoxyphenyl)-2-methylquinoline(4c)**

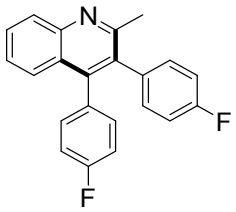



$R_f$ = 0.25 (hexane/EtOAc = 5/1); light yellow solid; yield: 73%(25.9mg); m.p = 176-178 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.10 (d, $J$ = 8.2 Hz, 1H), 7.67 (t, $J$ = 7.6 Hz, 1H), 7.54 (d, $J$ = 8.0 Hz, 1H), 7.38 (t, $J$ = 8.0 Hz, 1H), 7.02-6.94 (m, 4H), 6.84-6.76 (m, 4H), 3.79 (s, 3H), 3.78 (s, 3H), 2.54 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 158.5, 158.4, 158.2, 146.9, 146.7, 134.0, 131.3, 131.2, 131.1, 129.1, 129.0,

128.5, 126.7, 126.7, 125.7, 113.4, 113.2, 55.2, 55.1, 25.5.

HRMS (EI-TOF): Calculated for $C_{24}H_{21}NO_2$ $[M]^+$ 355.1572, Found :355.1575.

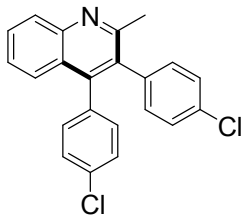
**3,4-bis(4-fluorophenyl)-2-methylquinoline(4d)**




$R_f$ = 0.42 (hexane/EtOAc = 5/1); light yellow solid; yield: 61%(20.2mg); m.p = 121-123 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.17 (d, $J$ = 8.2 Hz, 1H), 7.74-7.70 (m, 1H), 7.49-7.42 (m, 2H), 7.07-6.93 (m, 8H), 2.55 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 161.9 (d, $J_{C\text{-}F}$ = 246.1 Hz), 161.7(d, $J_{C\text{-}F}$ = 245.5 Hz), 157.7, 146.6, 146.4, 134.1 (d, $J_{C\text{-}F}$ = 3.6 Hz), 133.4, 132.4 (d, $J_{C\text{-}F}$ = 3.8 Hz), 131.7 (d, $J_{C\text{-}F}$ = 8.1 Hz), 131.5 (d, $J_{C\text{-}F}$ = 8.1 Hz), 129.6, 128.3, 126.4, 126.3, 126.3, 115.2 (d, $J_{C\text{-}F}$= 21.3 Hz), 115.0 (d, $J_{C\text{-}F}$ = 21.2 Hz), 25.0.

HRMS (EI-TOF): Calculated for $C_{22}H_{15}F_2N$ $[M]^+$ 331.1173, Found :331.1172.

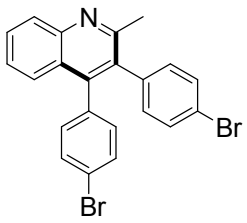
**3,4-bis(4-chlorophenyl)-2-methylquinoline(4e)**




$R_f$ = 0.47 (hexane/EtOAc = 5/1); light yellow solid; yield: 57%(20.7mg); m.p = 183-184 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.11 (d, $J$ = 8.2 Hz, 1H), 7.71 (t, $J$ = 7.4 Hz, 1H), 7.45-7.40 (m, 2H), 7.28-7.23 (m, 4H), 7.03-6.98 (m, 4H), 2.52 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 157.5, 147.1, 145.5, 136.9, 134.9, 133.6, 133.2, 132.9, 131.3, 131.3, 129.5, 128.8, 128.5, 128.3, 126.3, 126.2, 125.9, 25.4.

HRMS (EI-TOF): Calculated for $C_{22}H_{15}Cl_2N$ $[M]^+$ 363.0582, Found :363.0583.

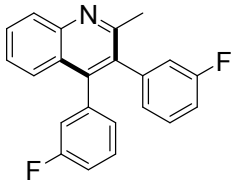
**3,4-bis(4-bromophenyl)-2-methylquinoline(4f)**




$R_f$ = 0.42 (hexane/EtOAc = 5/1); light yellow solid; yield: 68%(30.7mg); m.p = 182-183 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.14 (d, $J$ = 8.2 Hz, 1H), 7.74-7.70 (m, 1H), 7.45-7.39 (m, 6H), 6.97-6.95 (m, 4H), 2.53 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 157.4, 146.7, 145.8, 138.1, 135.3, 132.8, 131.7, 131.6, 131.5, 131.2, 129.7, 128.5, 126.4, 126.2, 125.8, 121.9, 121.5, 25.2.

HRMS (EI-TOF): Calculated for $C_{22}H_{15}Br_2N$ $[M]^+$ 450.9571, Found :450.9572.

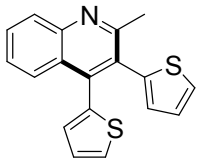
**3,4-bis(3-fluorophenyl)-2-methylquinoline(4g)**




$R_f$ = 0.46 (hexane/EtOAc = 5/1); light yellow solid; yield: 52%(17.2mg); m.p = 102-104 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.20 (d, $J$ = 8.2 Hz, 1H), 7.78 (t, $J$ = 6.8 Hz, 1H), 7.55-7.48 (m, 2H), 7.39-7.26 (m, 2H), 7.05-6.85 (m, 6H), 2.62 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) $\delta$ 162.7 (d, $J_{C\text{-}F}$ = 245.3 Hz), 161.6 (d, $J_{C\text{-}F}$ = 245.0 Hz), 161.55 (d, $J_{C\text{-}F}$ =245.7 Hz), 161.54 (d, $J$ = 245.8 Hz), 156.7, 146.4, 139.7 (d, $J_{C\text{-}F}$ = 6.5 Hz), 137.9 (d, $J_{C\text{-}F}$ = 8.5 Hz), 132.1, 129.4, 129.4, 129.2, 129.2, 129.1, 129.0 (d, $J_{C\text{-}F}$ = 2.3 Hz), 128.9, 128.8, 128.0, 125.6, 125.59, 125.1, 125.08, 116.5 (d, $J_{C\text{-}F}$ = 21.3 Hz), 116.4 (d, $J_{C\text{-}F}$ = 22.3 Hz), 113.8 (d, $J_{C\text{-}F}$ =20.6 Hz), 113.5 (d, $J_{C\text{-}F}$ =20.0 Hz), 24.5.

HRMS (EI-TOF): Calculated for $C_{22}H_{15}F_2N$ $[M]^+$ 331.1173, Found 331.1171.

**2-methyl-3,4-di(thiophen-2-yl)quinolone(4h)**

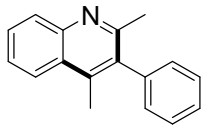



$R_f$ = 0.55 (hexane/EtOAc = 5/1); light yellow solid; yield: 72%(22.1mg); m.p = 121-

123 °C; $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.10 (d, $J$ = 8.2 Hz, 1H), 7.778 (d, $J$ = 8.2 Hz, 1H), 7.72 (t, $J$ = 7.2 Hz, 1H), 7.46 (t, $J$ = 7.2 Hz, 1H), 7.37 (d, $J$ = 5.0 Hz, 1H), 7.31 (d, $J$ = 5.2 Hz, 1H), 7.04-7.01 (m, 1H), 6.99-6.97 (m, 2H), 6.87 (dd, $J$ = 3.4, 1.0 Hz, 1H), 2.66 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) 158.6, 147.2, 142.0, 138.8, 136.5, 129.9, 129.6, 128.8, 128.6, 128.3, 127.2, 126.7, 126.6, 126.6, 126.5, 126.4, 25.4.

HRMS (EI-TOF): Calculated for $C_{18}H_{13}NS_2$ $[M]^+$ 307.0489, Found :307.0488.

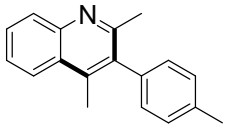
**2,4-dimethyl-3-phenylquinoline(4i)**



$R_f$ = 0.48 (hexane/EtOAc = 5/1); Light yellow oil; yield: 61%(14.2mg); $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.07 (d, $J$ = 8.2 Hz, 1H), 7.99 (d, $J$ = 8.2 Hz, 1H), 7.69 (t, $J$ = 7.6 Hz, 1H), 7.56-7.40 (m, 4H), 7.22-7.20 (m, 2H), 2.43 (s, 3H), 2.39 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) 157.6, 146.6, 141.3, 139.5, 134.9, 129.3, 129.1, 128.9, 128.7, 127.4, 126.7, 125.8, 124.1, 25.4, 15.9.

HRMS (EI-TOF): Calculated for $C_{17}H_{15}N$ $[M]^+$ 233.1204, Found: 233.1207.

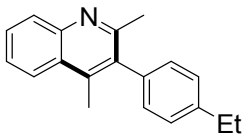
**2,4-dimethyl-3-p-tolylquinoline(4j)**



$R_f$ = 0.48 (hexane/EtOAc = 5/1); Light yellow oil; yield: 64%(15.8mg); $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.06 (d, $J$ = 8.0 Hz, 1H), 7.99 (d, $J$ = 8.2 Hz, 1H), 7.68 (t, $J$ = 7.6 Hz, 1H), 7.52 (t, $J$ = 7.6 Hz, 1H), 7.23 (t, $J$ = 8.0 Hz, 2H), 7.09 (d, $J$ = 8.0 Hz, 2H), 2.45 (s, 3H), 2.43 (s, 3H), 2.39(s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) 157.9, 146.5, 141.4, 137.0, 136.5, 134.9, 129.4, 129.2, 129.1, 128.8, 126.8, 125.7, 124.1, 25.4, 21.3, 15.9.

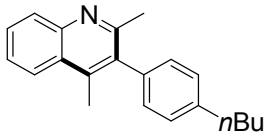
HRMS (EI-TOF): Calculated for $C_{18}H_{17}N$ $[M]^+$ 247.1361, Found :247.1358.

**3-(4-ethylphenyl)-2,4-dimethylquinoline(4k)**




$R_f$ = 0.48 (hexane/EtOAc = 5/1); Light yellow oil; yield: 63%(16.4mg); $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.06 (d, $J$ = 8.2 Hz, 1H), 7.99 (d, $J$ = 8.2 Hz, 1H), 7.69 (t, $J$ = 7.4 Hz, 1H), 7.53 (t, $J$ = 7.4 Hz, 1H), 7.31 (d, $J$ = 8.0 Hz, 2H), 7.11 (d, $J$ = 8.0 Hz, 2H), 2.78-2.72 (m, 2H), 2.44 (s, 3H), 2.40 (s, 3H), 1.32 (t, $J$ = 7.6 Hz, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) 157.9, 146.4, 143.3, 141.5, 136.6, 135.0, 129.2, 129.0, 128.9, 128.1, 126.8, 125.7, 124.1, 28.6, 25.4, 16.0, 15.5. HRMS (EI-TOF): Calculated for $C_{19}H_{19}N$ $[M]^+$ 261.1517, Found :261.1519.

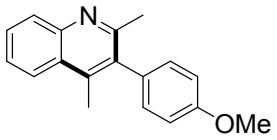
**3-(4-butylphenyl)-2,4-dimethylquinoline(4l)**




$R_f$ = 0.5 (hexane/EtOAc = 5/1); Light yellow oil; yield: 61%(17.6mg); $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 8.06 (d, $J$ = 8.2 Hz, 1H), 7.99 (d, $J$ = 8.2 Hz, 1H), 7.69 (t, $J$ = 7.6 Hz, 1H), 7.53 (t, $J$ = 7.6 Hz, 1H), 7.28 (d, $J$ = 7.6 Hz, 2H), 7.10 (d, $J$ = 8.0 Hz, 2H), 2.70 (t, $J$ = 7.8 Hz, 2H), 2.44 (s, 3H), 2.40 (s, 3H), 1.70-1.65 (m, 2H), 1.45-1.39 (m, 2H), 0.98(t, $J$ = 7.4 Hz, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) 157.9, 146.4, 142.0, 141.5, 136.6, 135.0, 129.2, 129.1, 128.8, 128.7, 126.8, 125.7, 124.1, 35.5, 33.6, 25.4, 22.5, 16.0, 14.0.

HRMS (EI-TOF): Calculated for $C_{21}H_{23}N$ $[M]^+$ 289.1830, Found :289.1833

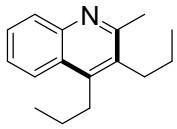
**3-(4-methoxyphenyl)-2,4-dimethylquinoline(4m)**




$R_f$ = 0.47 (hexane/EtOAc = 5/1); Light yellow oil; yield: 66%(17.4mg); $^1$H NMR

(400 MHz, $CDCl_3$, ppm) $\delta$ 8.07 (d, $J$ = 8.2 Hz, 1H), 7.99 (d, $J$ = 8.2 Hz, 1H), 7.69 (t, $J$ = 7.6 Hz, 1H), 7.54 (t, $J$ = 7.6 Hz, 1H), 7.13 (d, $J$ = 8.2 Hz, 2H), 7.03 (d, $J$ = 8.2 Hz, 2H), 3.89 (s, 3H), 2.45 (s, 3H), 2.42 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$, ppm) 158.9, 158.1, 146.3, 142.0, 134.7, 131.5, 130.4, 128.9, 128.9, 126.8, 125.8, 124.2, 114.1, 55.3, 25.3, 16.0. HRMS (EI-TOF): Calculated for $C_{18}H_{17}NO$ $[M]^+$ 263.1310, Found :263.1312.

**2-methyl-3,4-dipropylquinoline(4n)**



$R_f$ = 0.48 (hexane/EtOAc = 5/1); Light yellow oil; yield: 43%(9.8mg); $^1$H NMR (400 MHz, $CDCl_3$, ppm) $\delta$ 7.98-7.92 (m, 2H), 7.59 (t, $J$ = 8.0 Hz, 1H), 7.46 (t, $J$ = 7.6 Hz, 1H), 3.04-2.99 (m, 2H), 2.79-2.75 (m, 2H), 2.74 (s, 3H), 1.71-1.56 (m, 4H), 1.13-1.04 (m, 6H).$^{13}$C NMR (100 MHz, $CDCl_3$, ppm) 158.4, 146.2, 144.9, 131.9, 129.2, 127.9, 126.5, 125.4, 123.7, 31.7, 30.3, 24.2, 24.1, 23.7, 14.8, 14.7. HRMS (EI-TOF): Calculated for $C_{16}H_{21}N$ $[M]^+$ 227.1674, Found: 227.1671.

**MALDI-TOF**

**Materials and methods**

**Chemicals**

The used matrixes 2,5-dihydroxybenzoic acid (DHB) was obtained from Sigma and used without further purification.

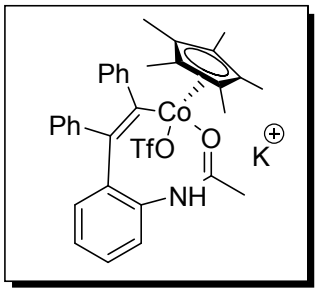
**Matrix Preparation**

20 mg/ml solutions of the DHB were prepared in pure tetrahydrofuran(THF) under vortexing. Matrix solutions were prepared freshly each day.

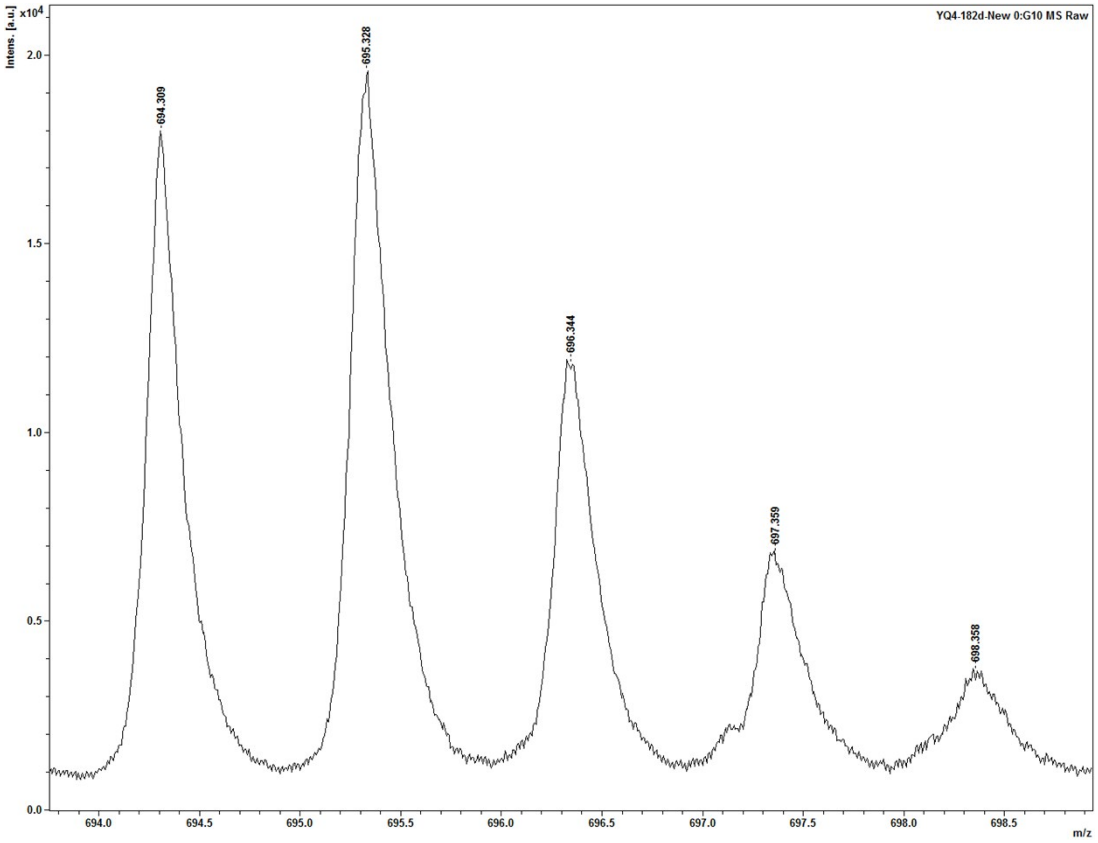
**MALDI-TOF MS spectrometry**

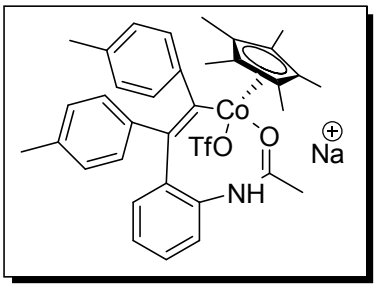
To an oven-dried 25 mL sealed tube was added substrate acetanilide **1a** (0.2 mmol, 27.0 mg), acetanilide **2a** (0.3 mmol, 56.1 mg), [Cp*Co(CO)$I_2$] (9.0 mg, 0.02 mmol), $AgSbF_6$ (13.6 mg, 0.04 mmol), $Zn(OTf)_2$ (14.4 mg, 0.04 mmol), $Li_2CO_3$ (3.0 mg, 0.04 mmol) and TFE (1.5 mL). The mixture was stirred for 20min at 120 °C. The mixture was then cooled to room temperature. 20μl aliquot of the corresponding mixtures was mixed with 20μl of the corresponding matrix solution. Then 2.5μl of the mixed solution was taken out and subsequently directly deposited onto the MALDI target, to dry in nature.

All MALDI-TOF mass spectra were acquired on a BRUKER ultraflex™ workstation (Bruker Daltonics, Germany). The system utilizes a pulsed modified Nd:YAG Laser(Smartbeam II), emitting at 355 nm. The extraction voltage was 25 kV in all cases.

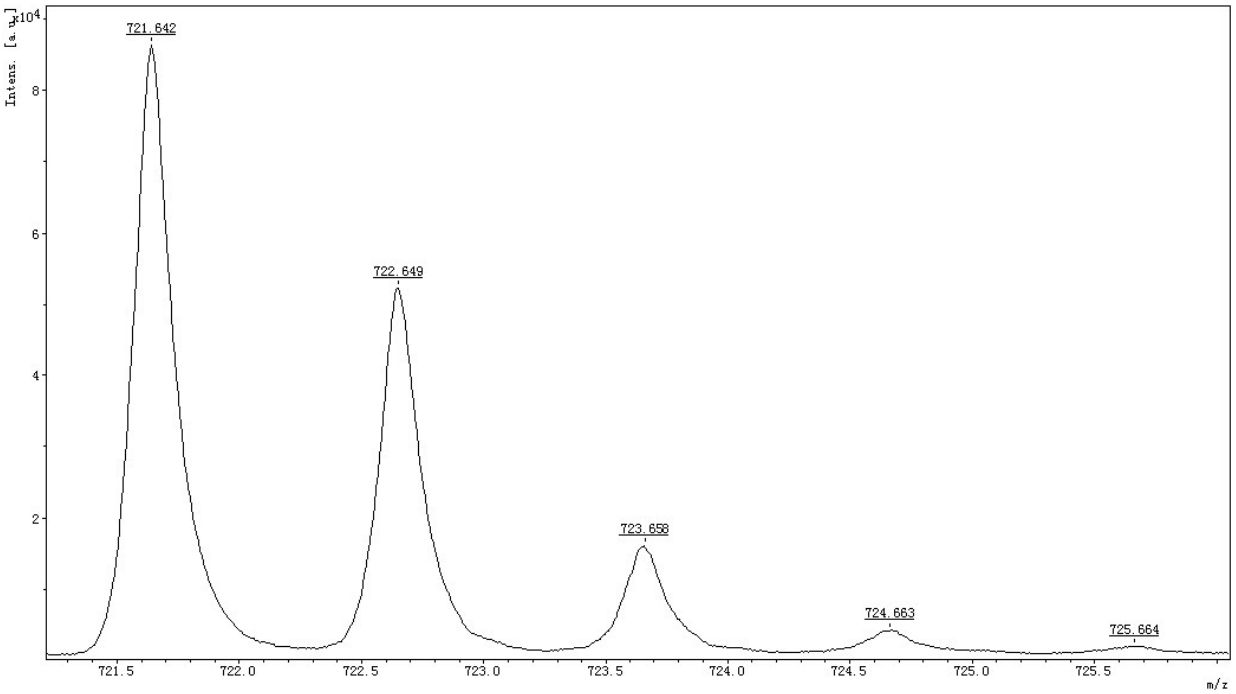



**Detected by MALDI-TOF:694.328**
**Exact Mass: 694.1046**



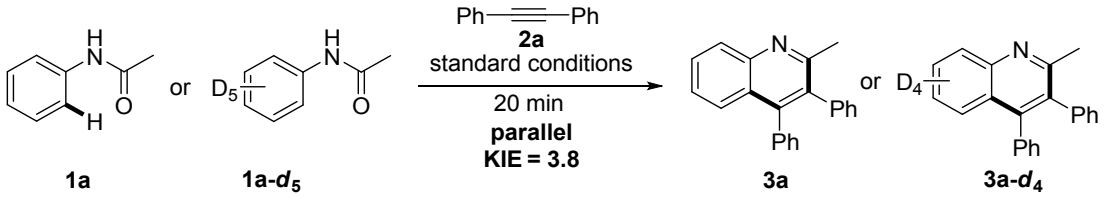



**Detected by MALDI-TOF:721.642**
**Exact Mass: 721.1854**



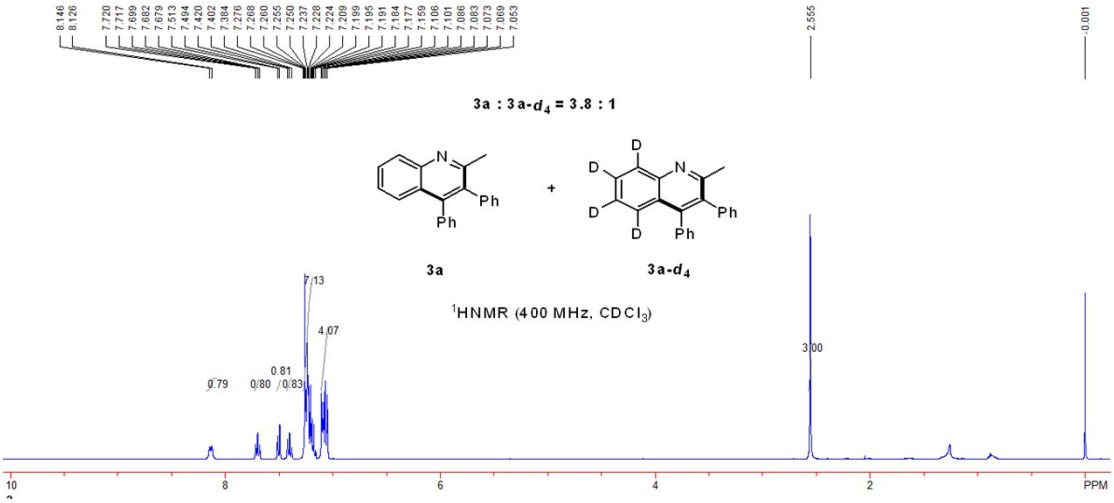
## Deuterium Labeling Experiment

### Parrellel experiment

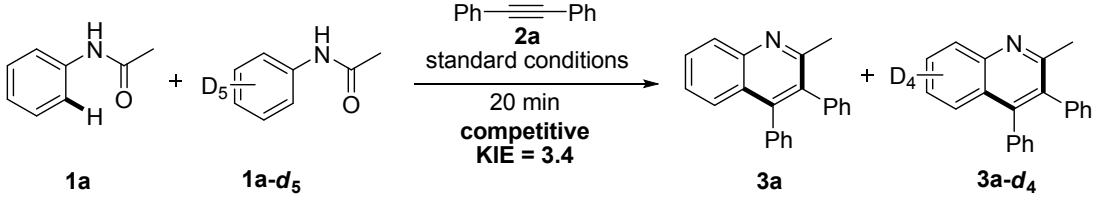



**1a** **1a-$d_5$** **3a** **3a-$d_4$**

To an oven-dried 25 mL sealed tube was added substrate **1a** (0.2 mmol, 27.0 mg) or **1a-$d_5$** (0.2 mmol, 28.0 mg), **2a** (0.3 mmol, 56.1 mg), [Cp*Co(CO)$I_2$] (9.0 mg, 0.02 mmol), $AgSbF_6$ (13.6 mg, 0.04 mmol), $Zn(OTf)_2$ (14.4 mg, 0.04 mmol), $Li_2CO_3$ (3.0 mg, 0.04 mmol) and TFE (1.5 mL). The mixture was stirred for 20min at 120 °C. These two mixtures were then cooled to room temperature and combined, diluted with EtOAc, filtered through a celite pad, and concentrated in vacuo. The residue was purified by flash column chromatography on silica gel (eluent: hexane/EtOAc = 5/1 with triethylamine) to afford the desired product. The ratio of product **3a/3a-$d_4$** was analyzed by $^1$H NMR.



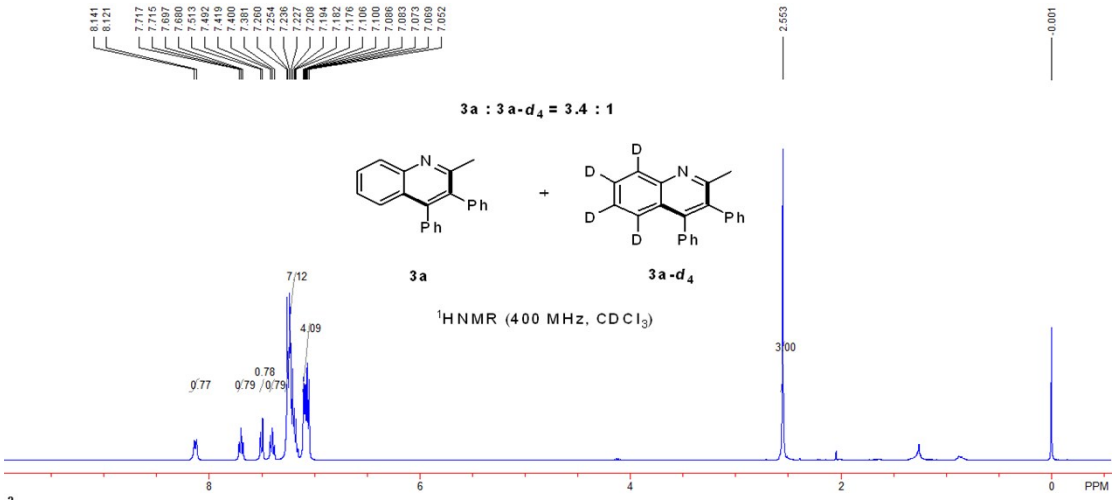

### Competitive experiment




**1a** **1a-$d_5$** **3a** **3a-$d_4$**

To an oven-dried 25 mL sealed tube was added substrate **1a** (0.1 mmol, 13.5 mg) and **1a-$d_5$** (0.1 mmol, 14.0 mg), **2a** (0.3 mmol, 56.1 mg), [Cp*Co(CO)$I_2$] (9.0 mg,

0.02 mmol), $AgSbF_6$ (13.6 mg, 0.04 mmol), $Zn(OTf)_2$ (14.4 mg, 0.04 mmol), $Li_2CO_3$ (3.0 mg, 0.04 mmol) and TFE (1.5 mL). The mixture was stirred for 20min at 120 °C. The mixture was then cooled to room temperature, diluted with EtOAc, filtered through a celite pad, and concentrated in vacuo. The residue was purified by flash column chromatography on silica gel (eluent: hexane/EtOAc = 5/1 with triethylamine) to afford the desired product. The ratio of product **3a**/**3a-*d*$_4$** was analyzed by $^1$H NMR.

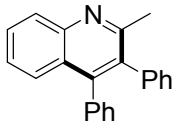


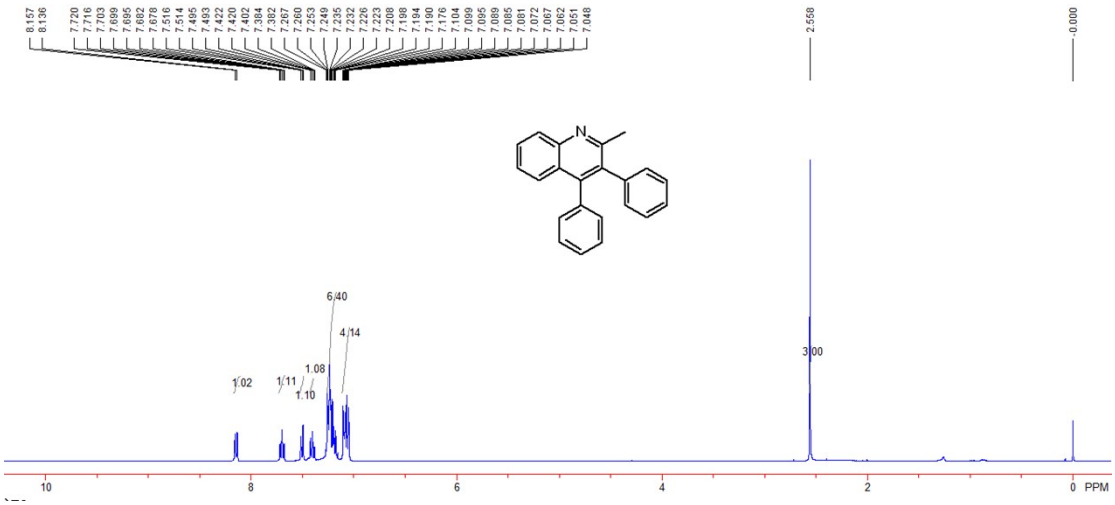

## References

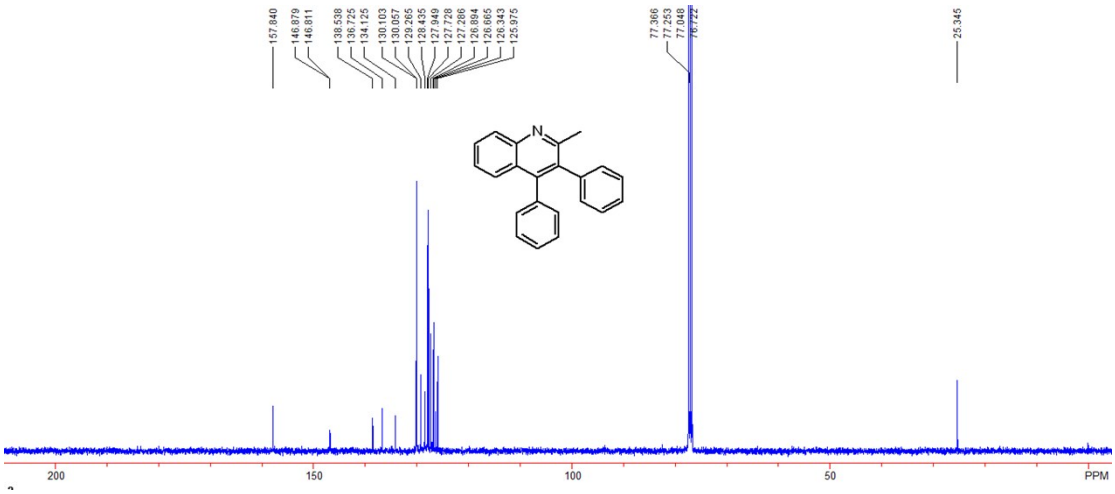
1. M. J. Mio, L. C. Kopel, J. B. Braun, T. L. Gadzikwa, K. L. Hull, R. G. Brisbois, C. J. Markworth and P. A. Grieco, *Org. Lett*., 2002, **4**, 3199.
2. B. Sun, T. Yoshino, S. Matsunaga and M. Kanaia, *Adv. Synth. Catal.,* 2014, **356**, 1491.

# Copies of $^{1}H$ and $^{13}C$ NMR Spectra

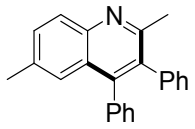
## 2-Methyl-3,4-diphenylquinoline(3a)

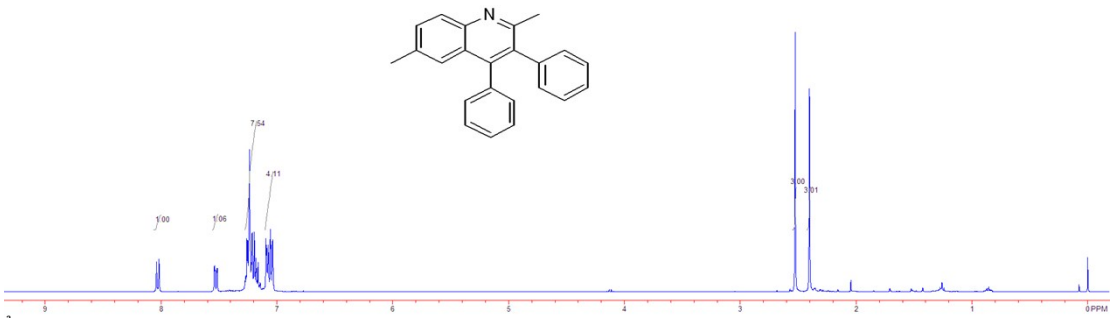


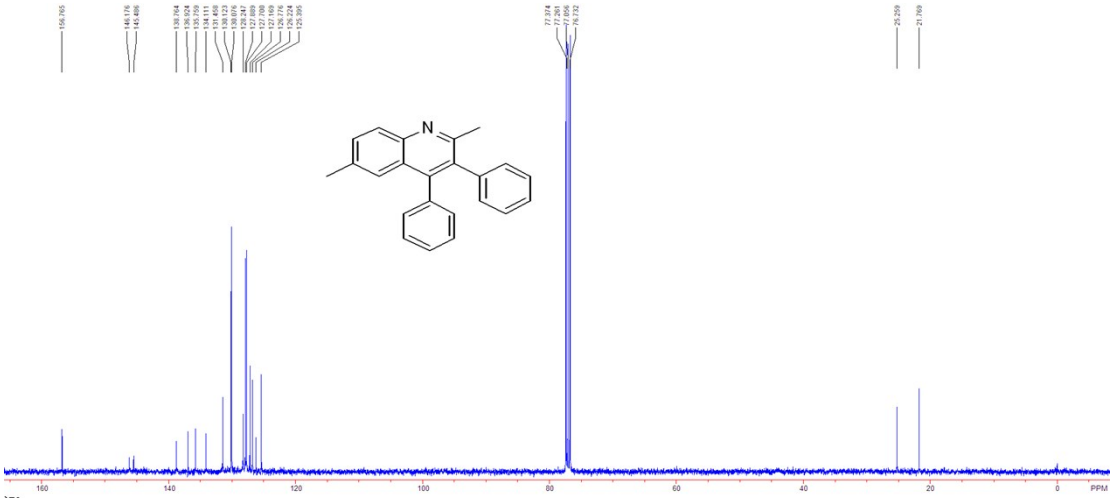



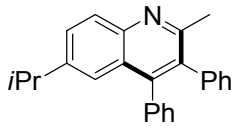
## 2-Methyl-3,4-diphenylquinoline(3b)

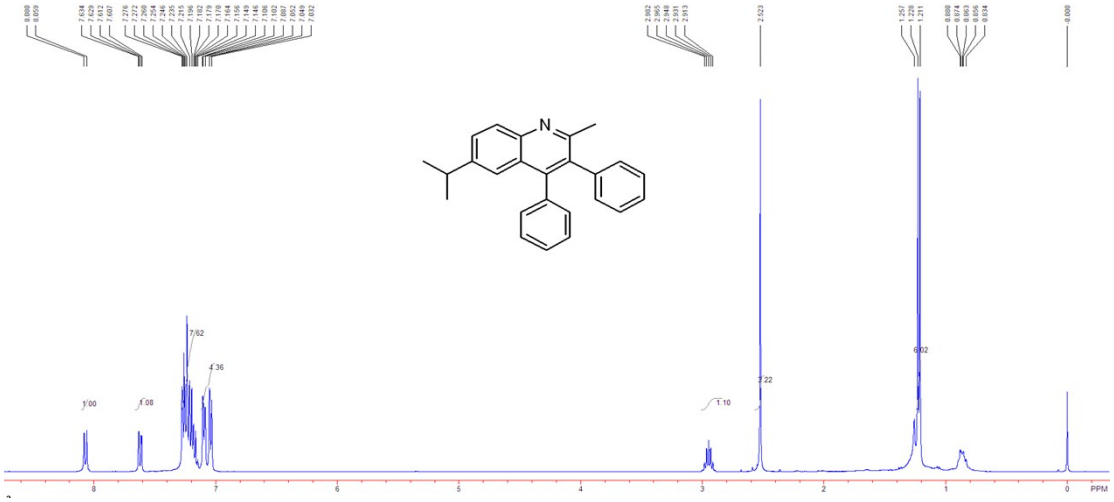


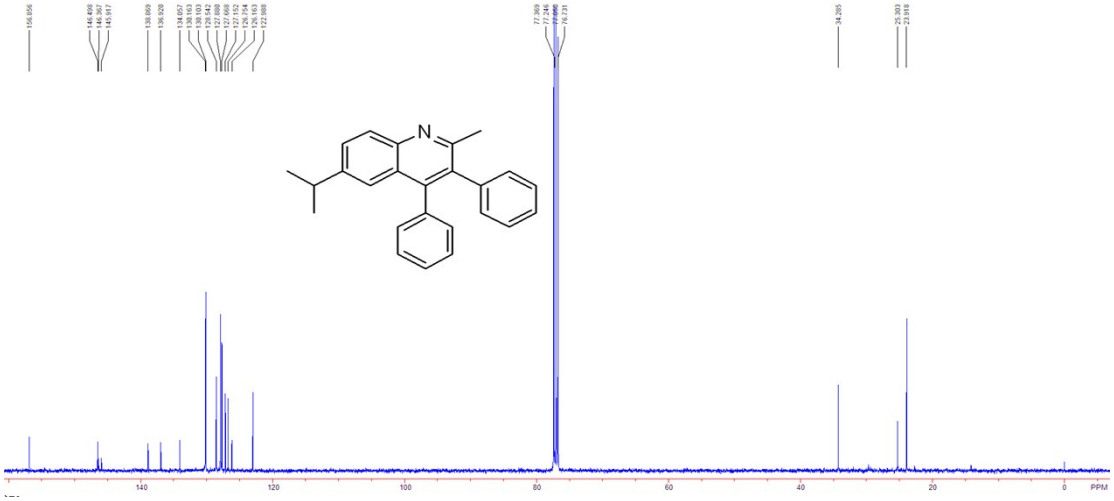



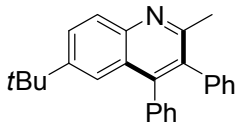
## 6-isopropyl-2-methyl-3,4-diphenylquinoline(3c)

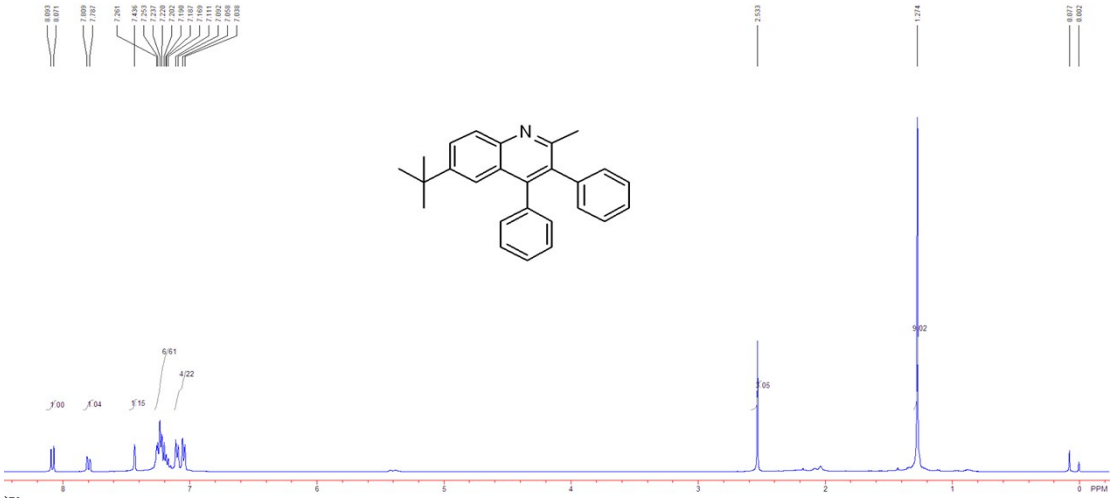


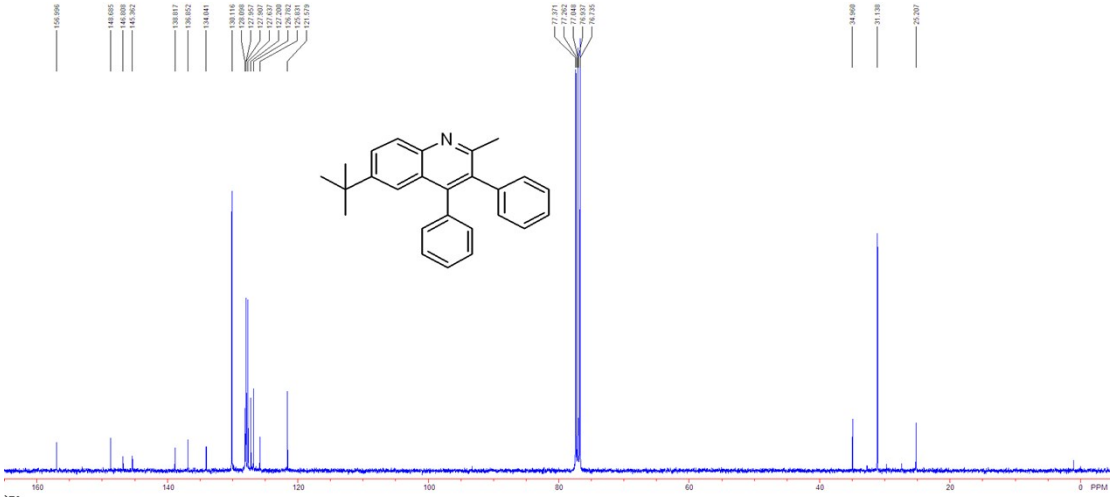



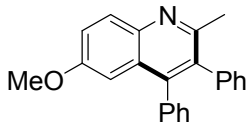
## 6-tert-butyl-2-methyl-3,4-diphenylquinoline(3d)

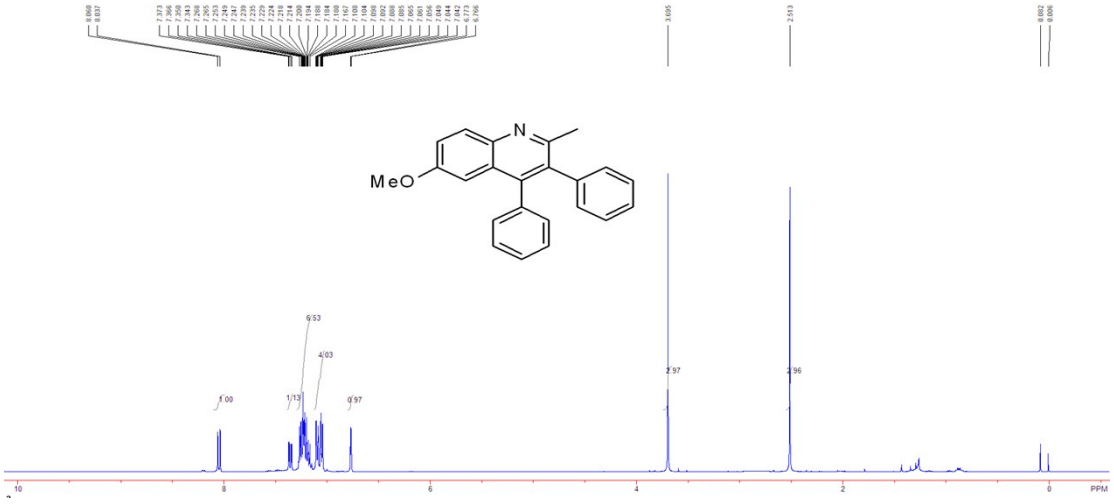


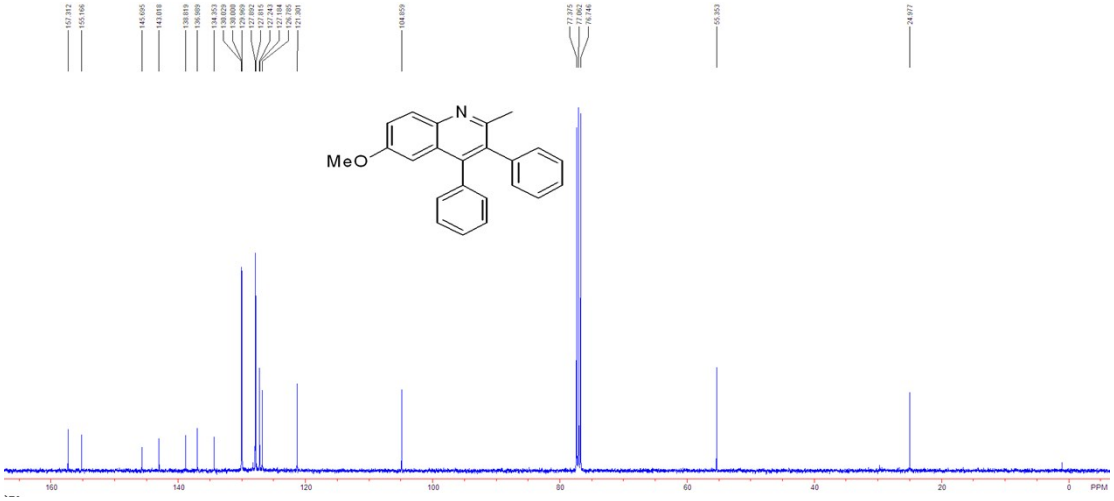



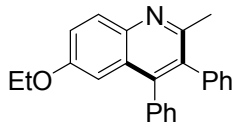
## 6-methoxy-2-methyl-3,4-diphenylquinoline(3e)

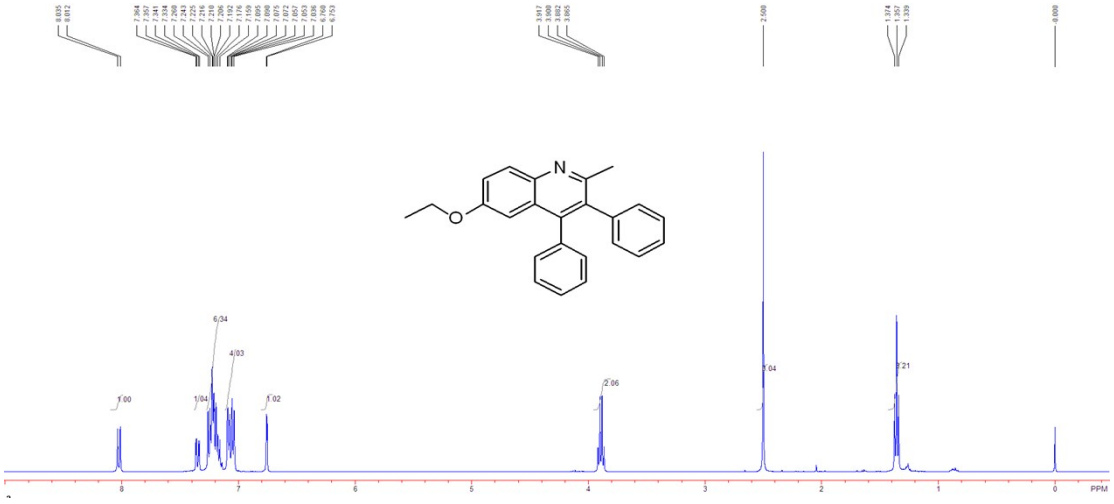


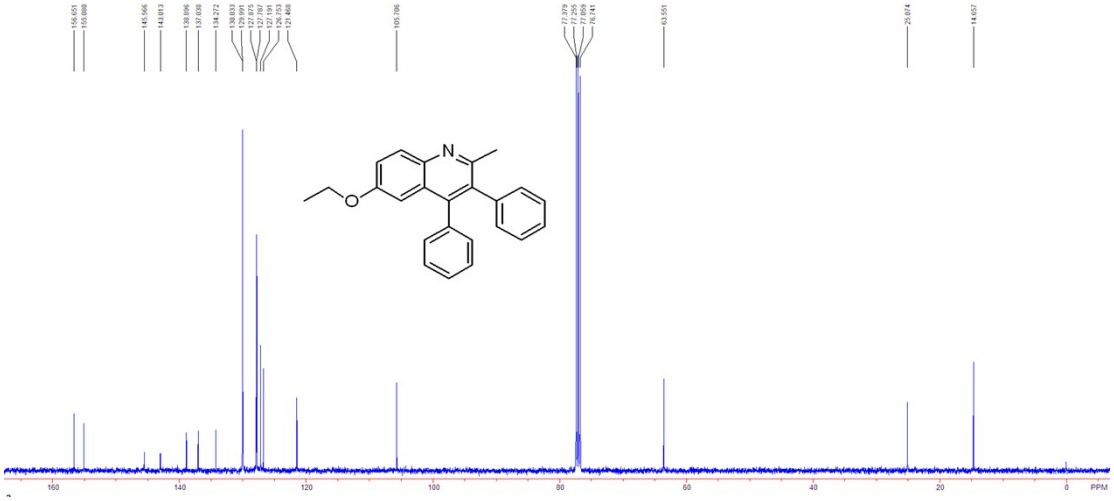



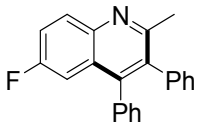
## 6-ethoxy-2-methyl-3,4-diphenylquinoline(3f)

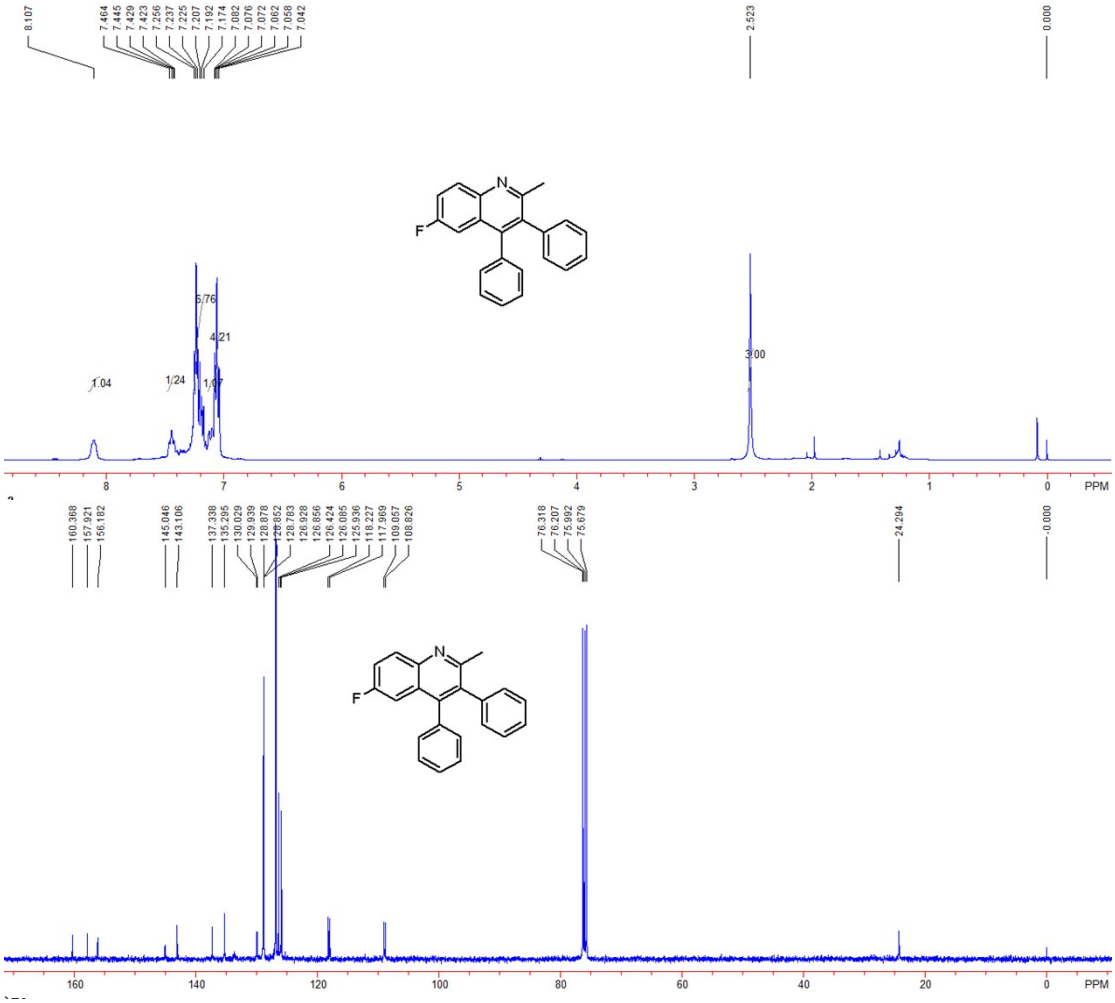


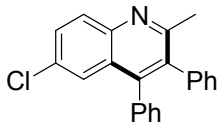



## 6-fluoro-2-methyl-3,4-diphenylquinoline(3g)



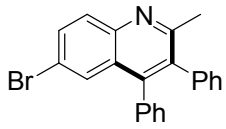



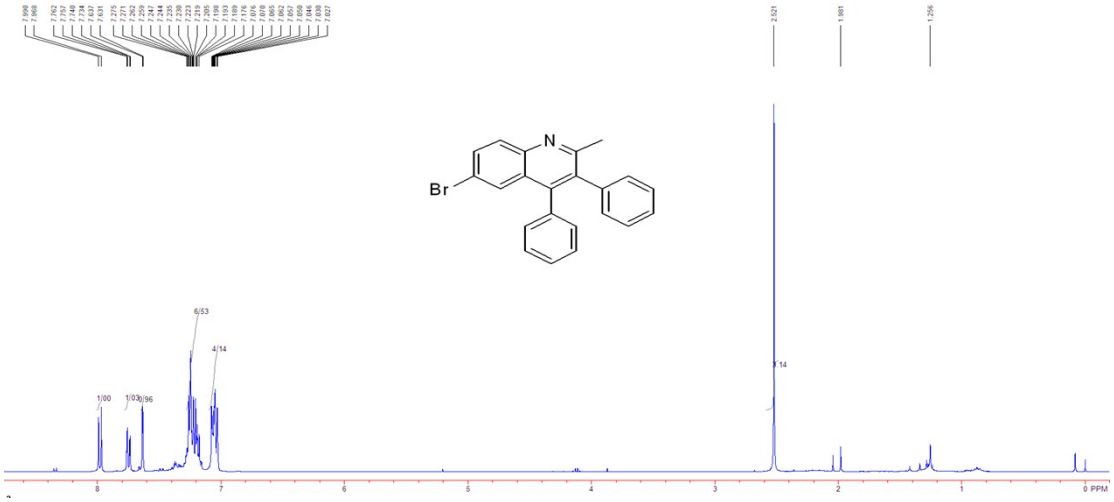
## 6-chloro-2-methyl-3,4-diphenylquinoline(3h)

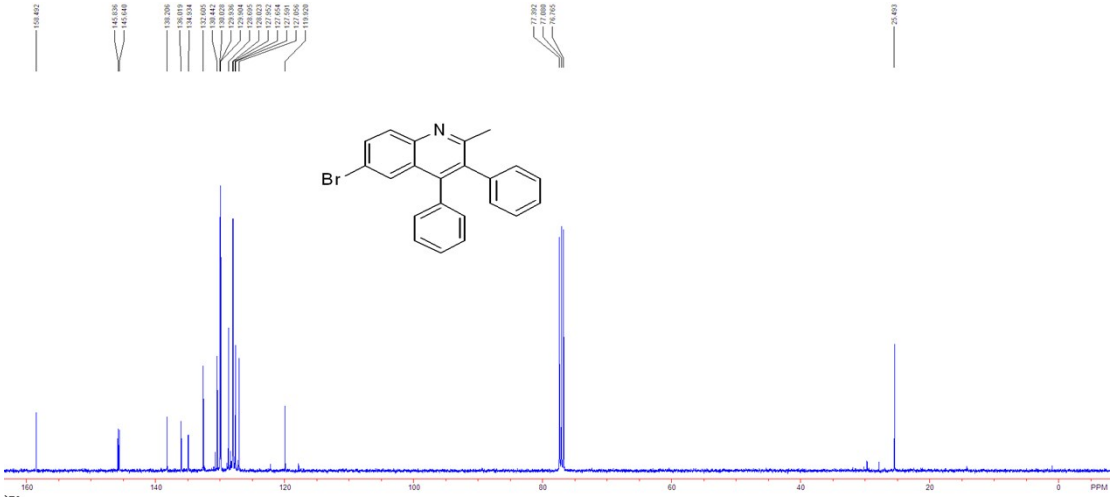




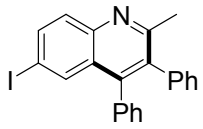
## 6-bromo-2-methyl-3,4-diphenylquinoline(3i)

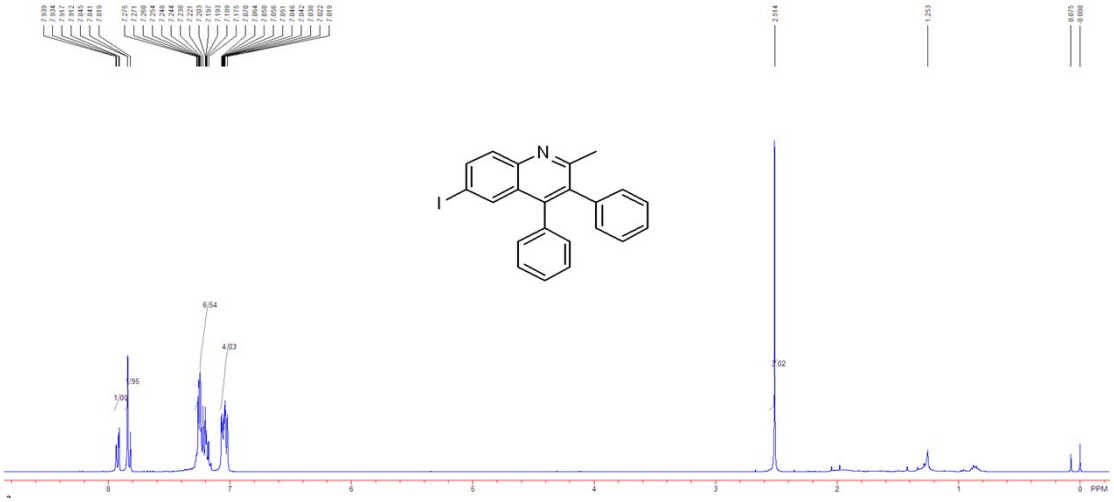


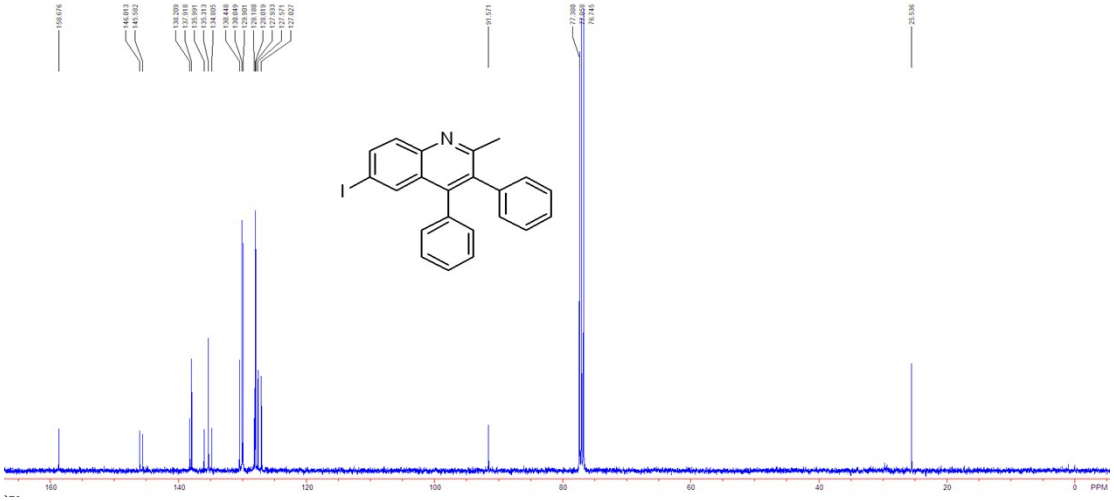



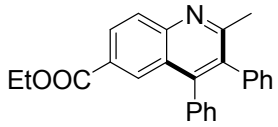
## 6-iodo-2-methyl-3,4-diphenylquinoline(3j)

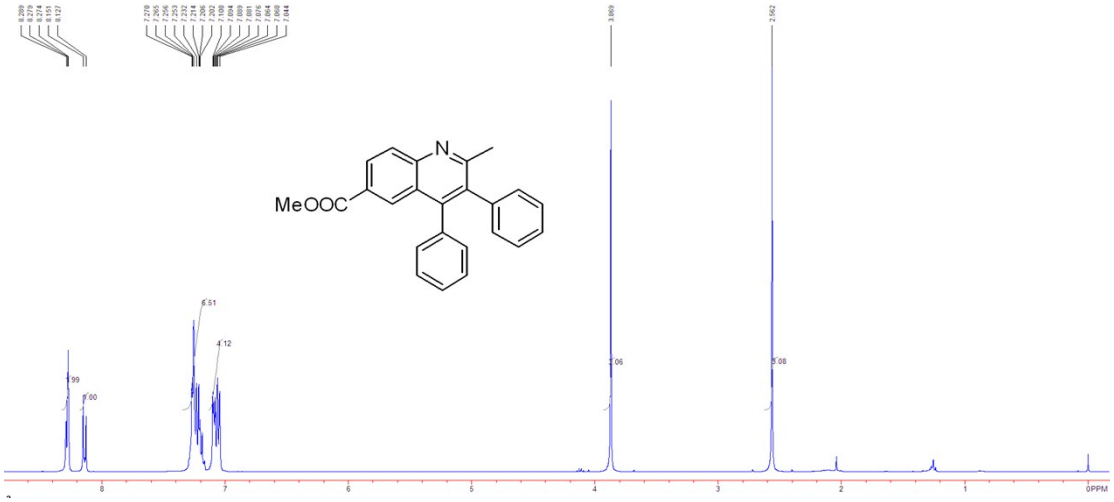


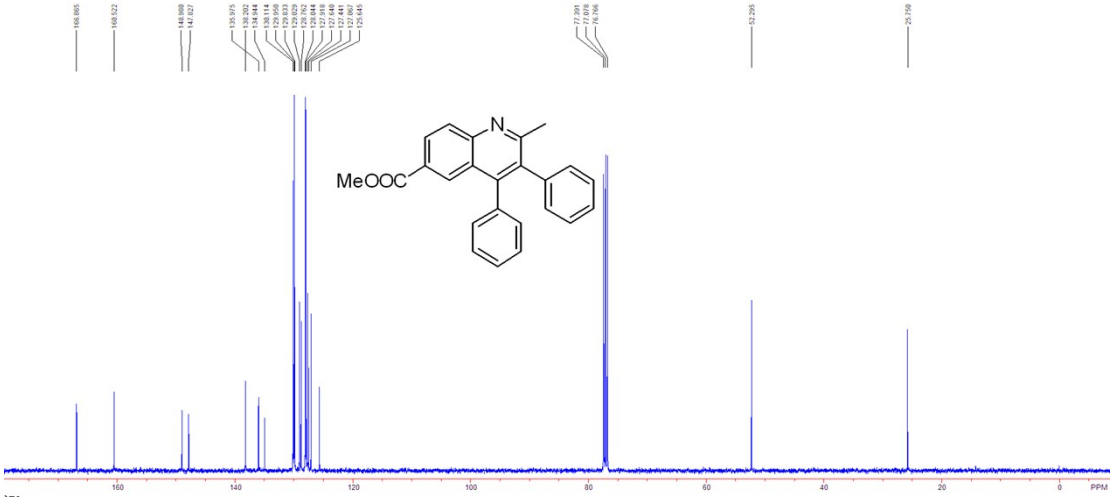



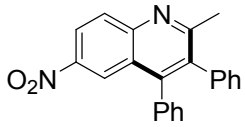
**ethyl 2-methyl-3,4-diphenylquinoline-6-carboxylate (3k)**

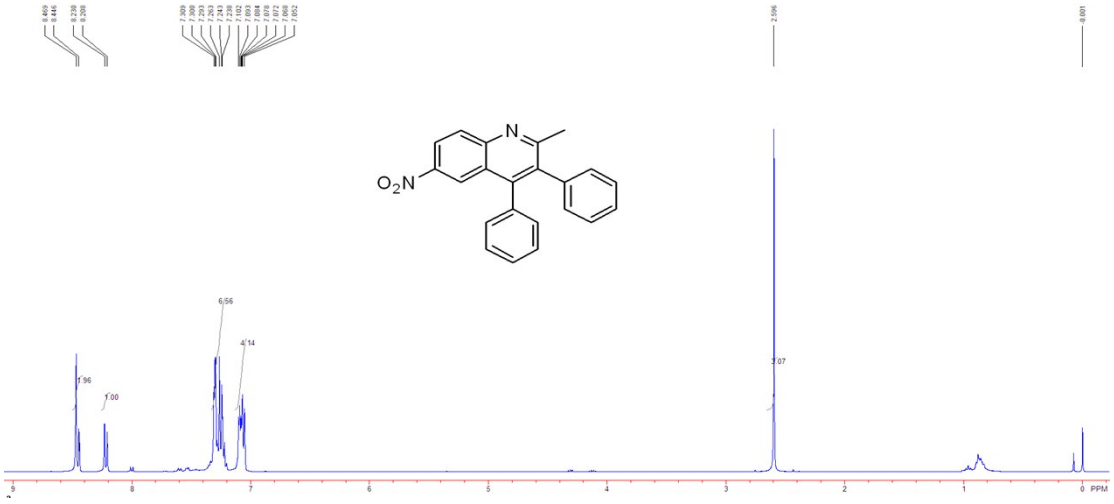


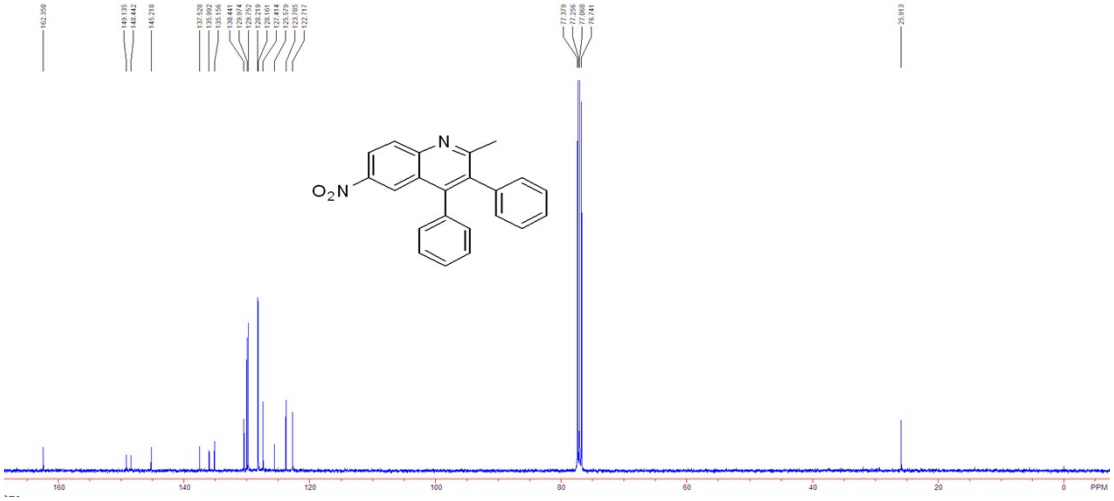



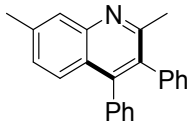
**2-methyl-6-nitro-3,4-diphenylquinoline（3l）**

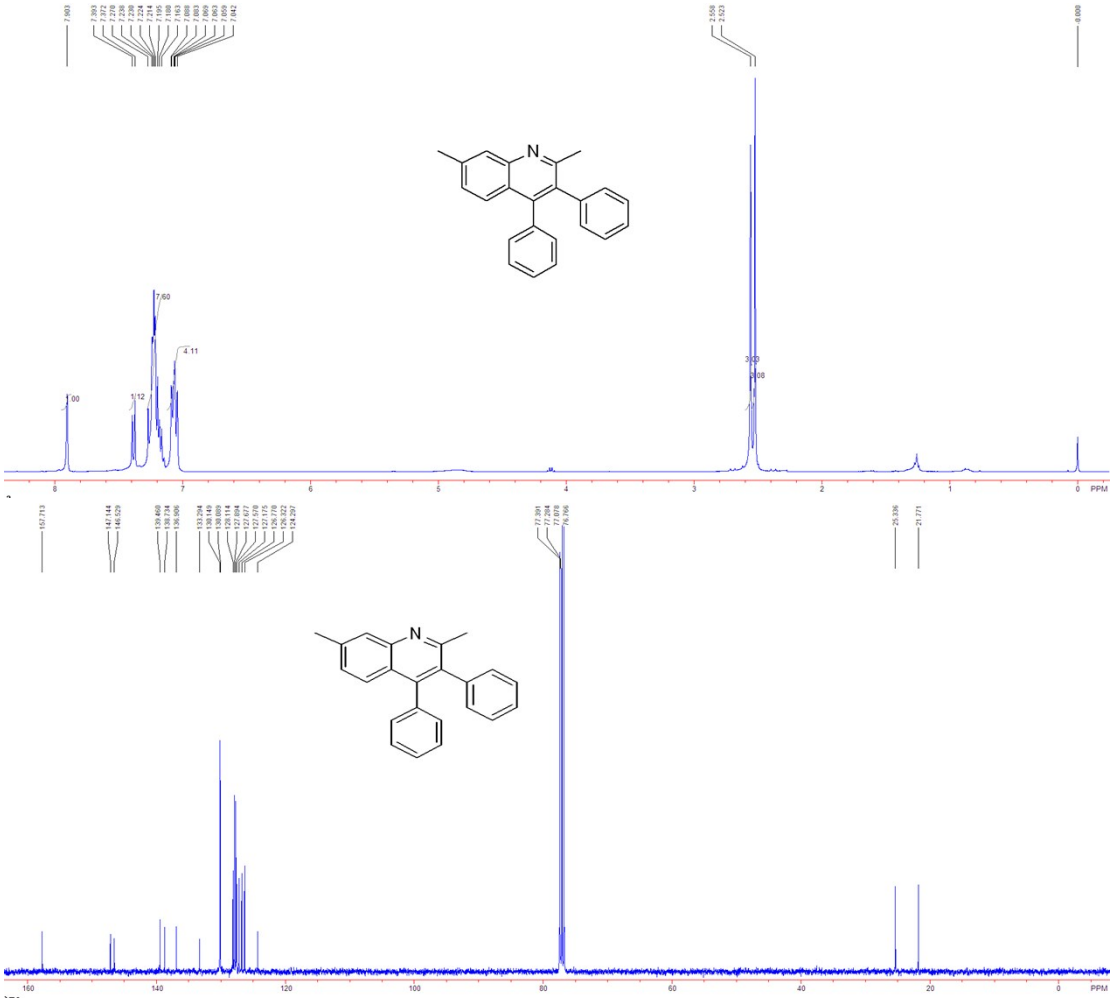


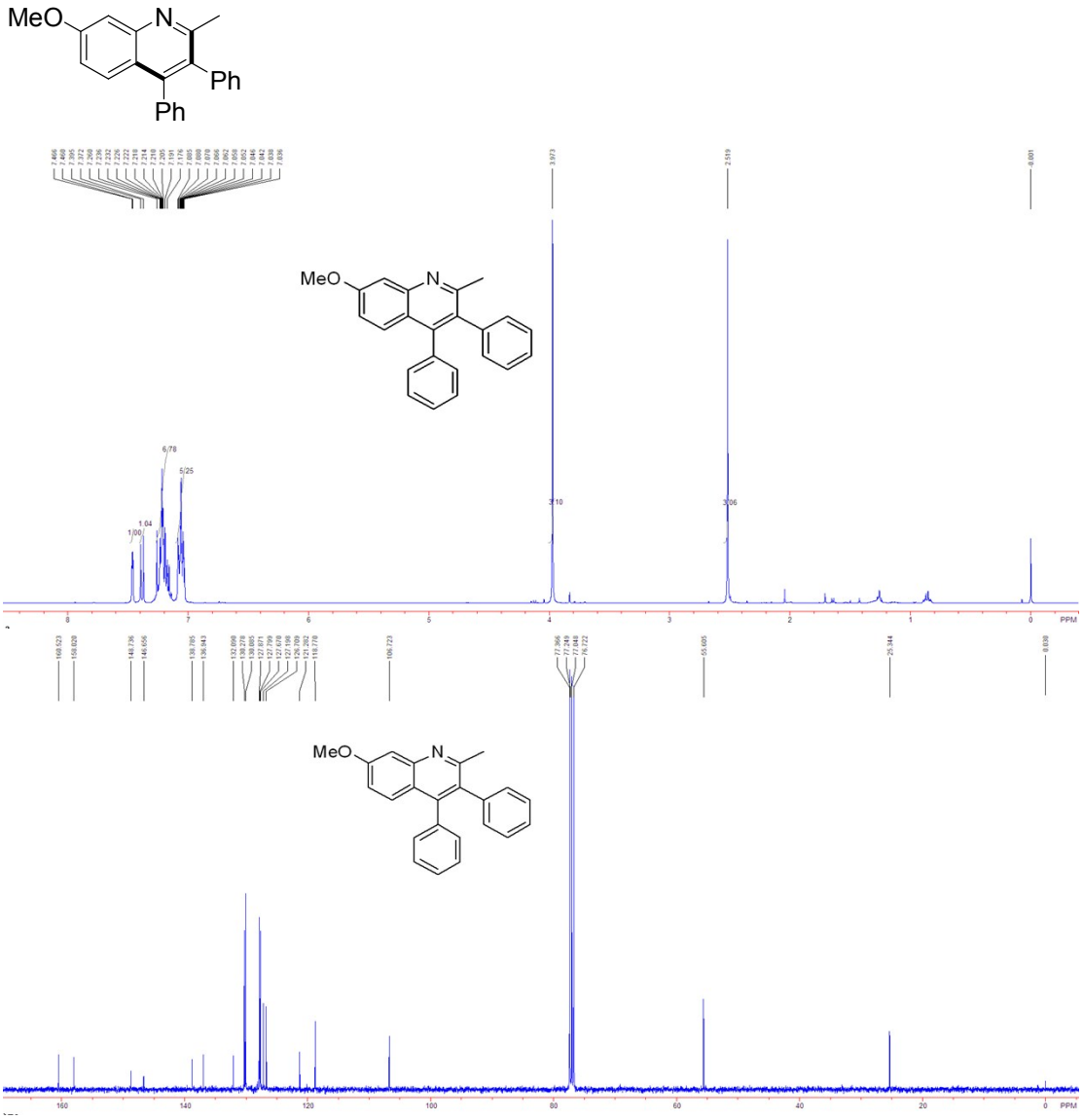



## 2-Methyl-3,4-diphenylquinoline(3m)

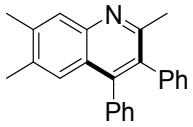


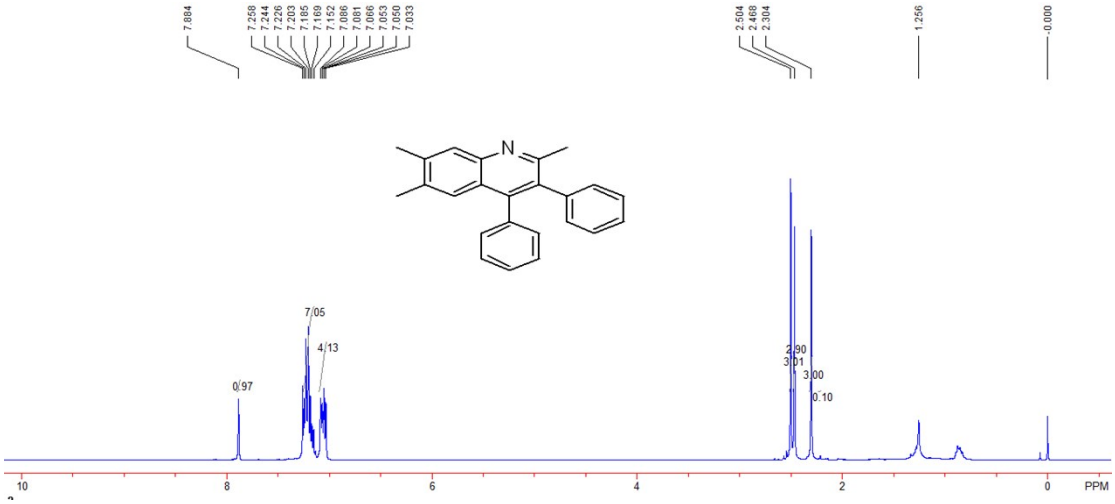



**7-methoxy-2-methyl-3,4-diphenylquinoline(3n)**

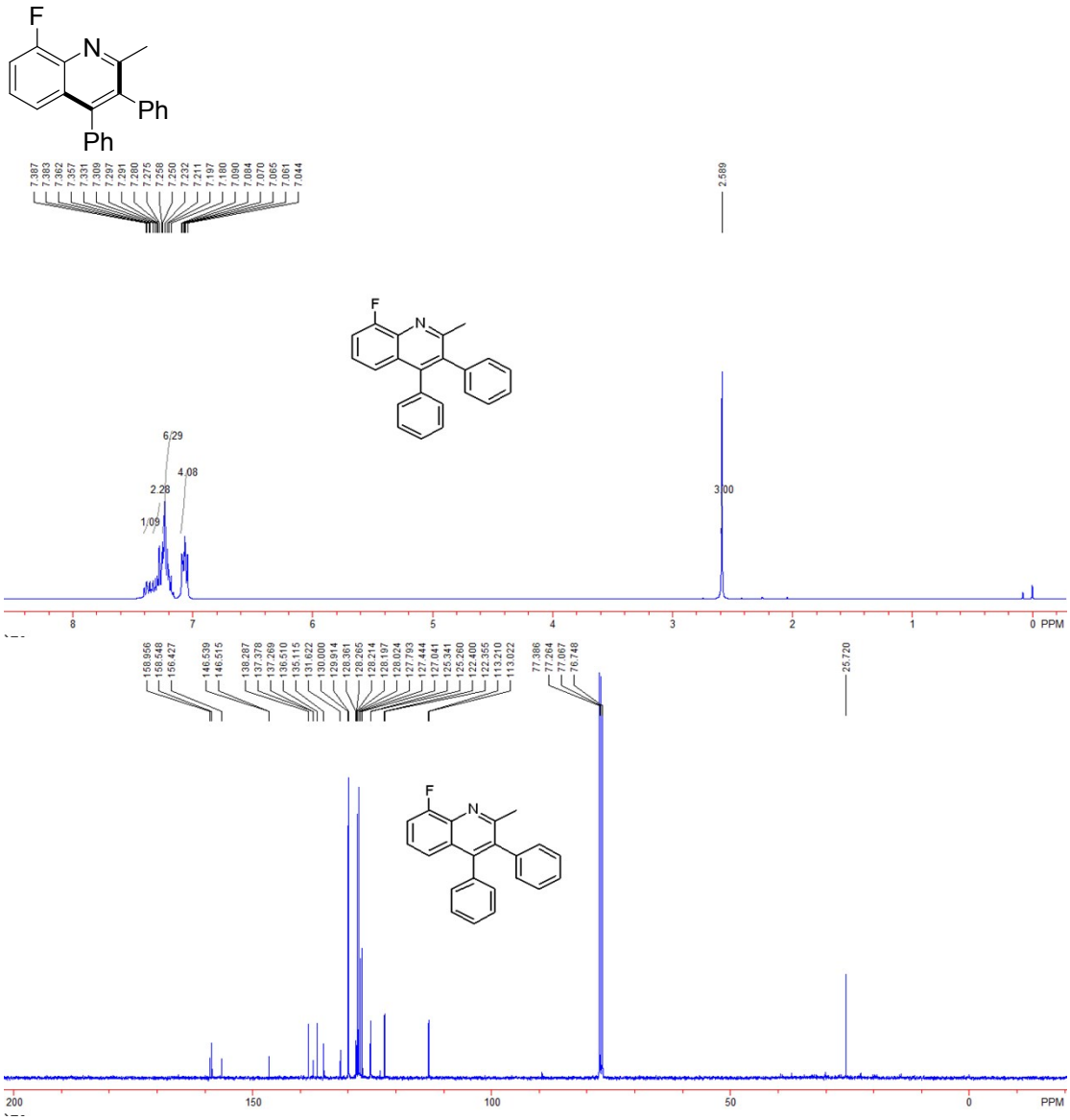


## 2,6,7-trimethyl-3,4-diphenylquinoline(3o)

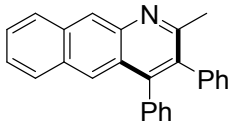


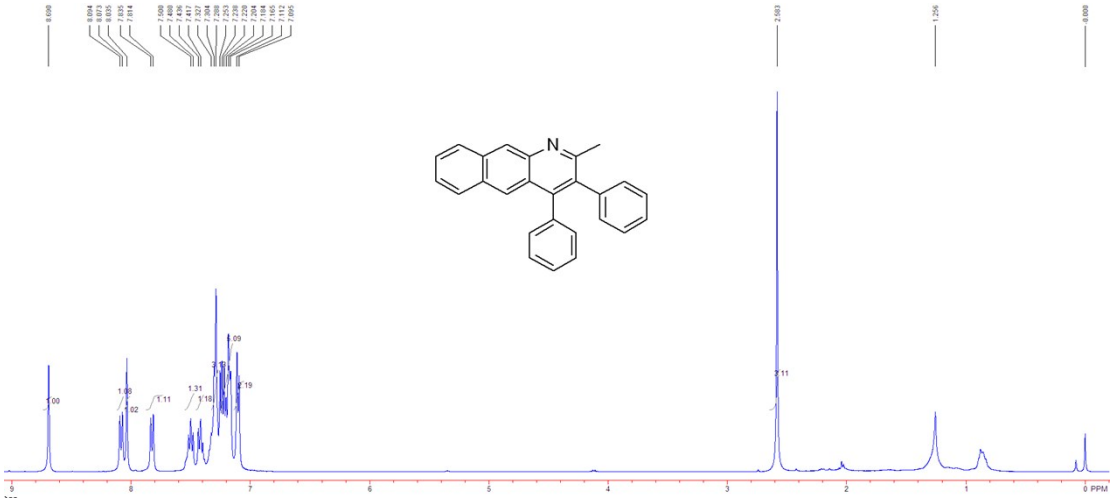




**8-fluoro-2-methyl-3,4-diphenylquinoline(3p)**

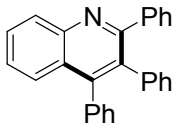


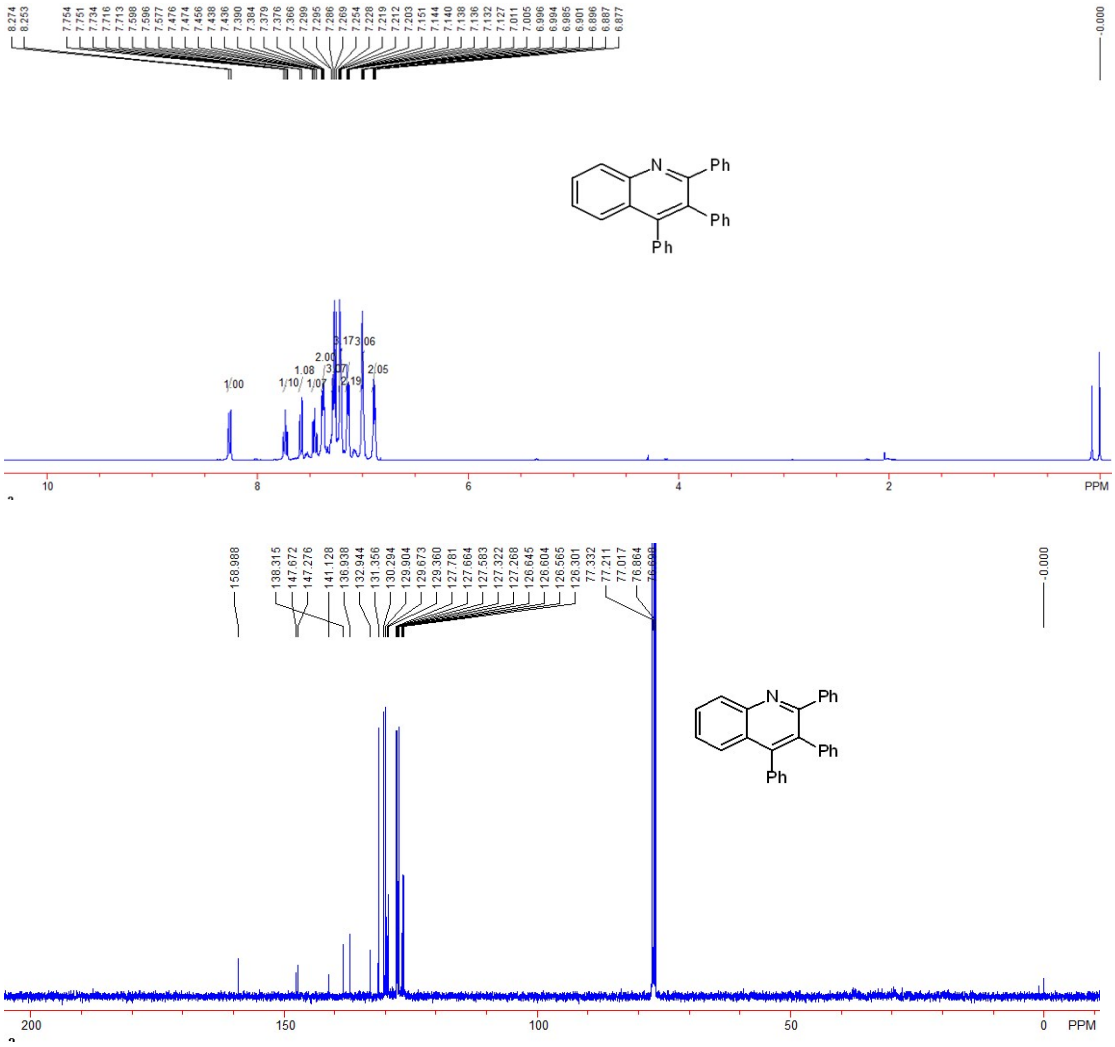
## 2-methyl-3,4-diphenylbenzo[g]quinolone(3q)



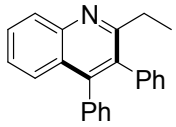



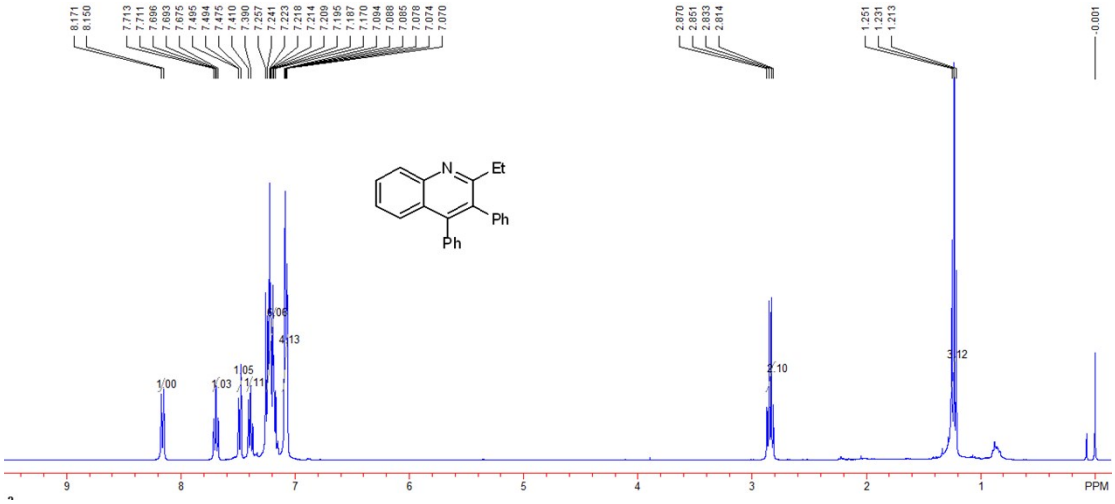

## 2,3,4-triphenylquinoline(3r)

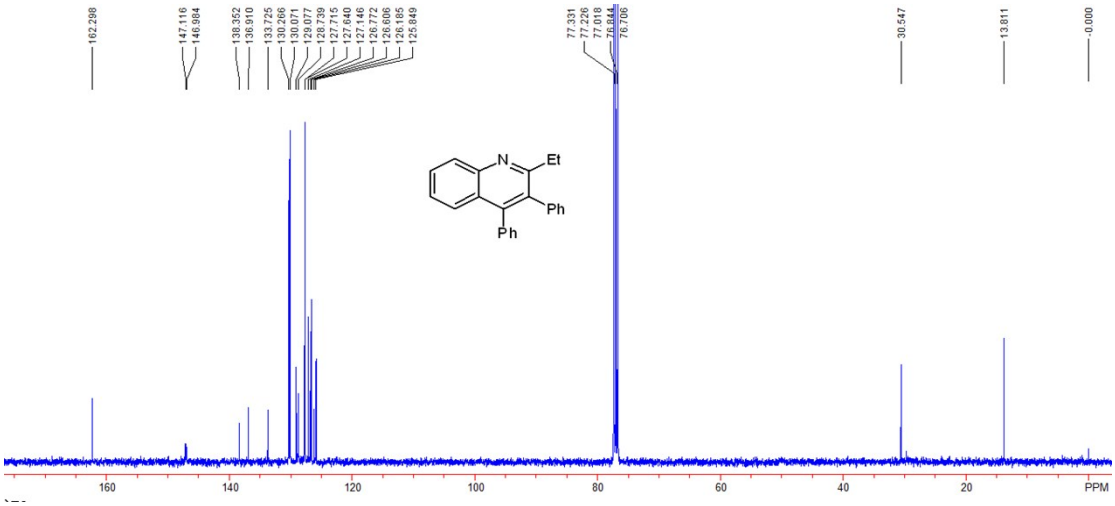


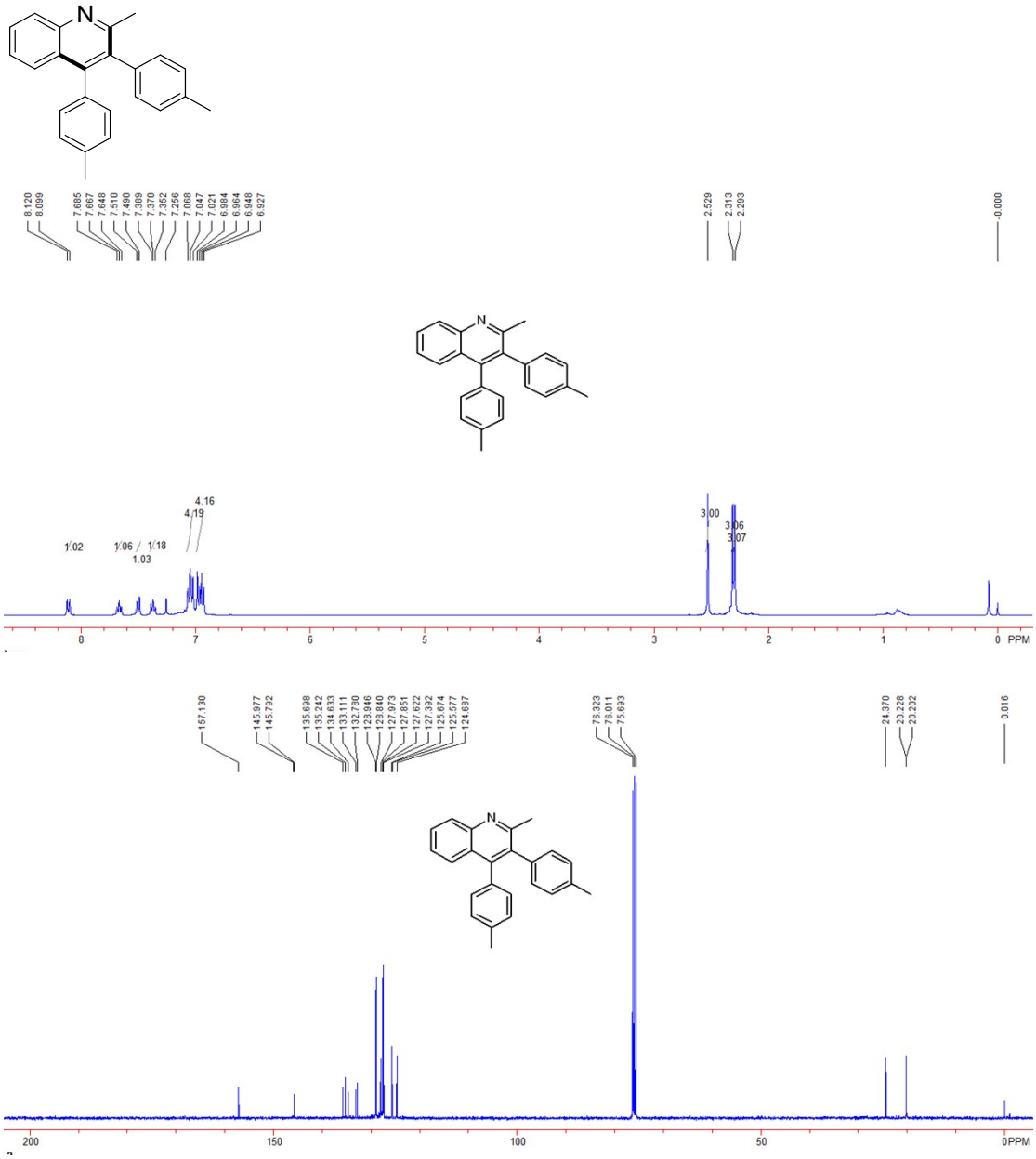
## 2-ethyl-3,4-diphenylquinoline(3s)



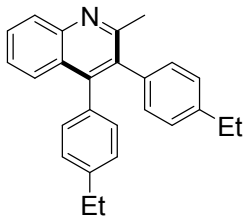



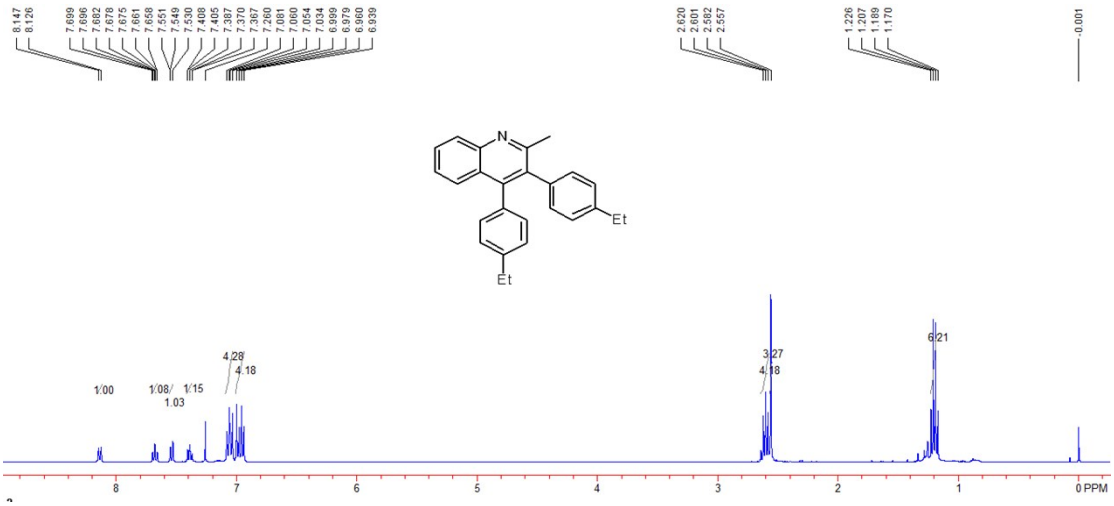



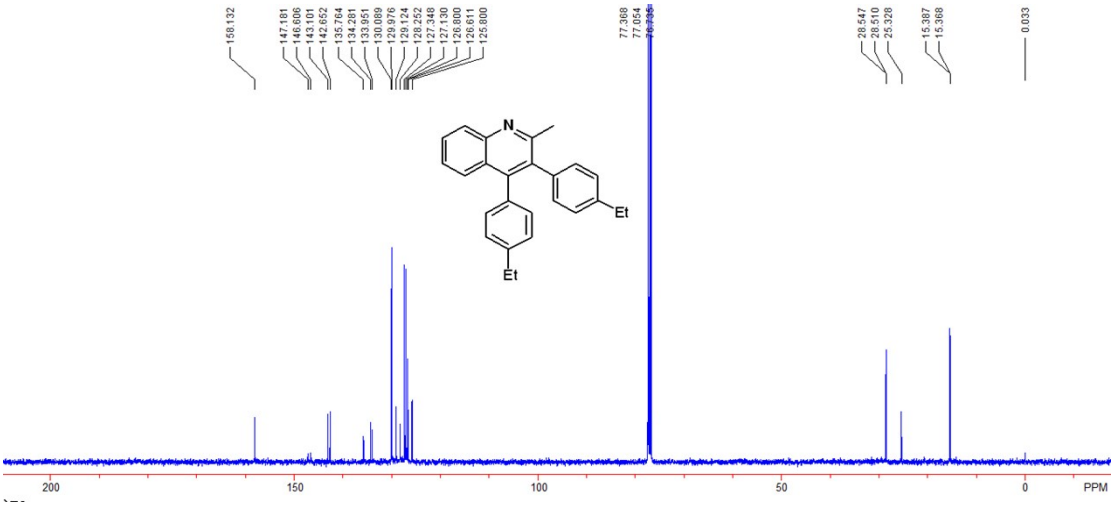
## 2-methyl-3,4-dip-tolylquinoline(4a)



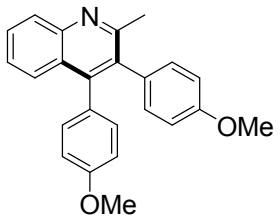
## 3,4-bis(4-ethylphenyl)-2-methylquinoline(4b)

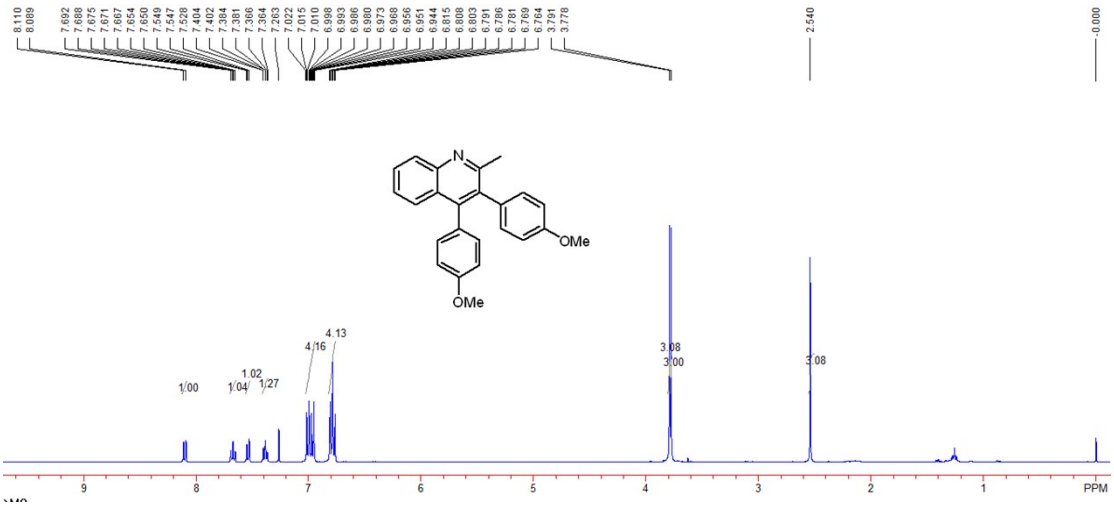


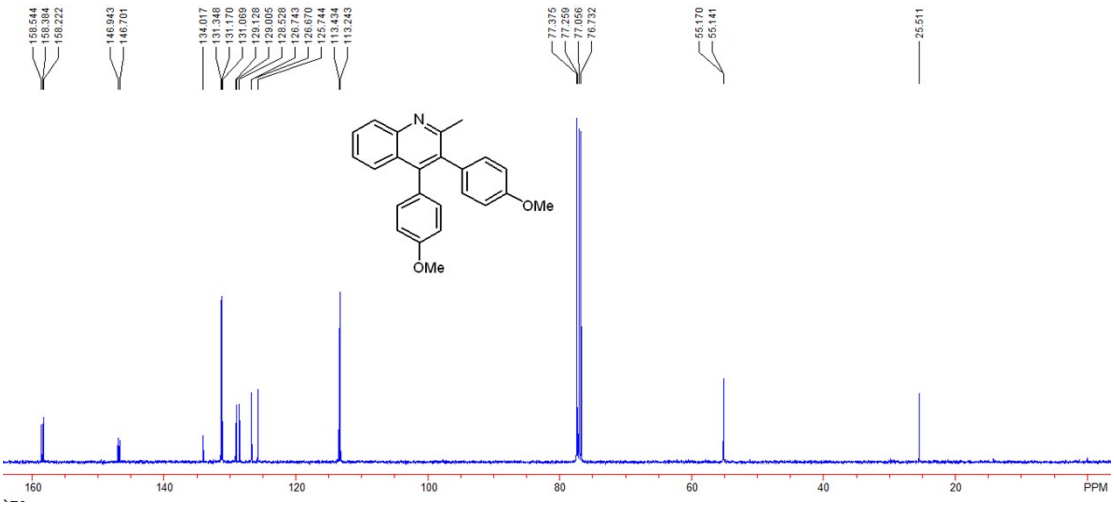



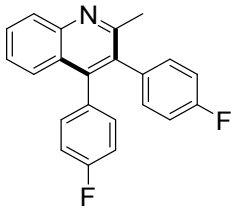
## 3,4-bis(4-methoxyphenyl)-2-methylquinoline(4c)

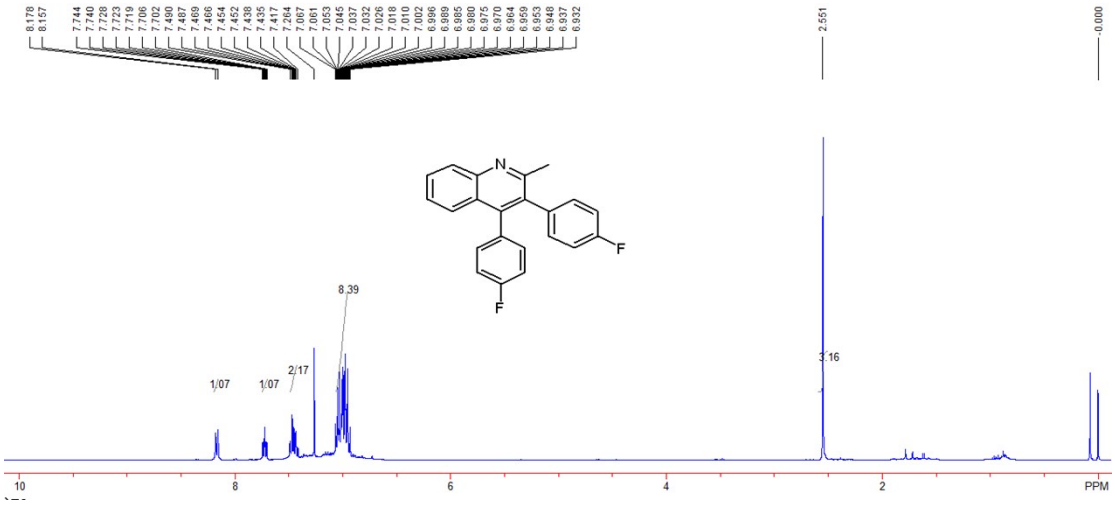


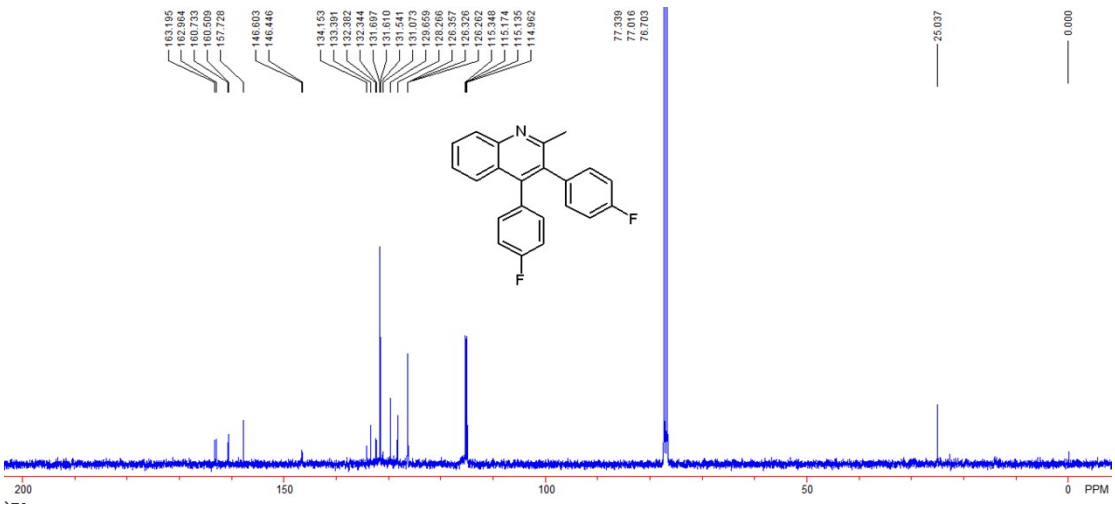



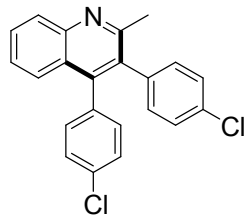
## 3,4-bis(4-fluorophenyl)-2-methylquinoline(4d)

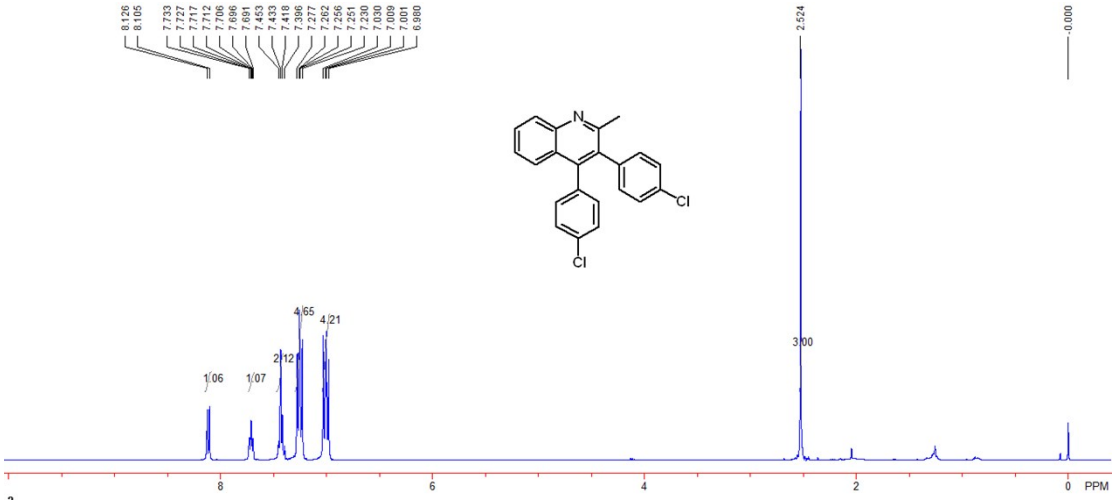


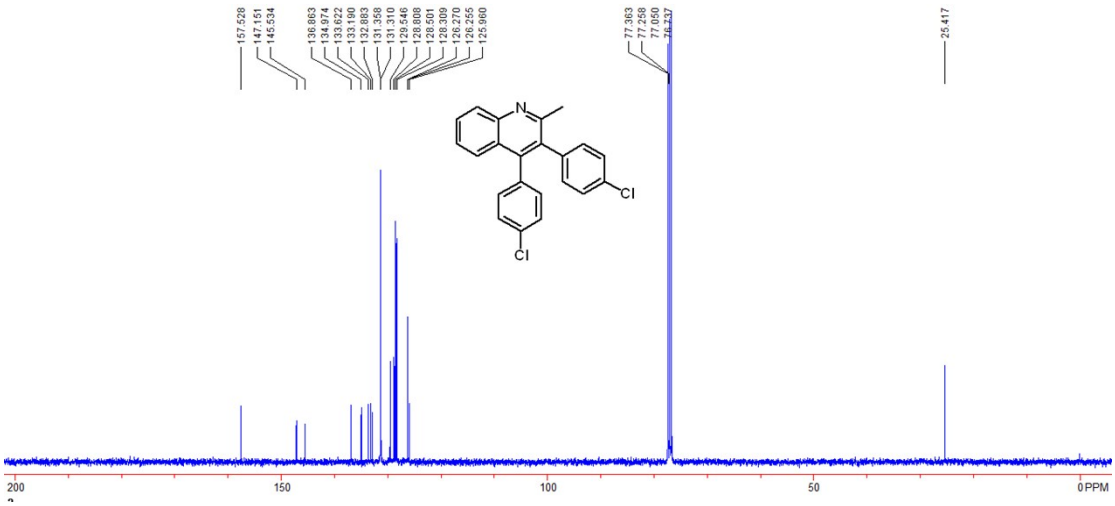



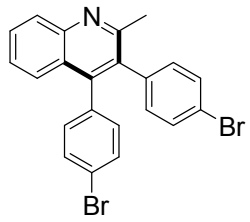
## 3,4-bis(4-chlorophenyl)-2-methylquinoline(4e)

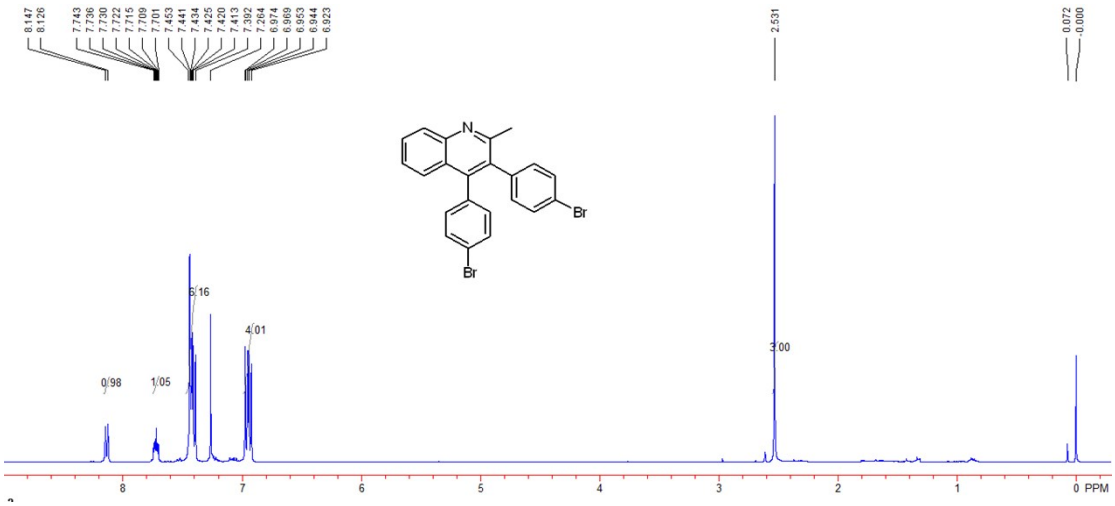


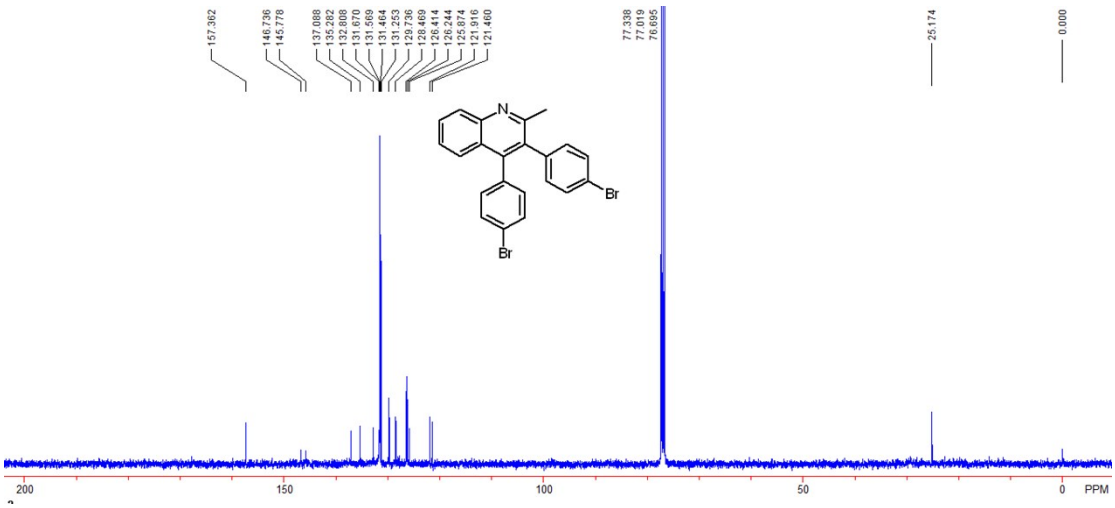



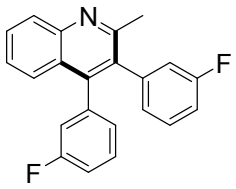
## 3,4-bis(4-bromophenyl)-2-methylquinoline(4f)

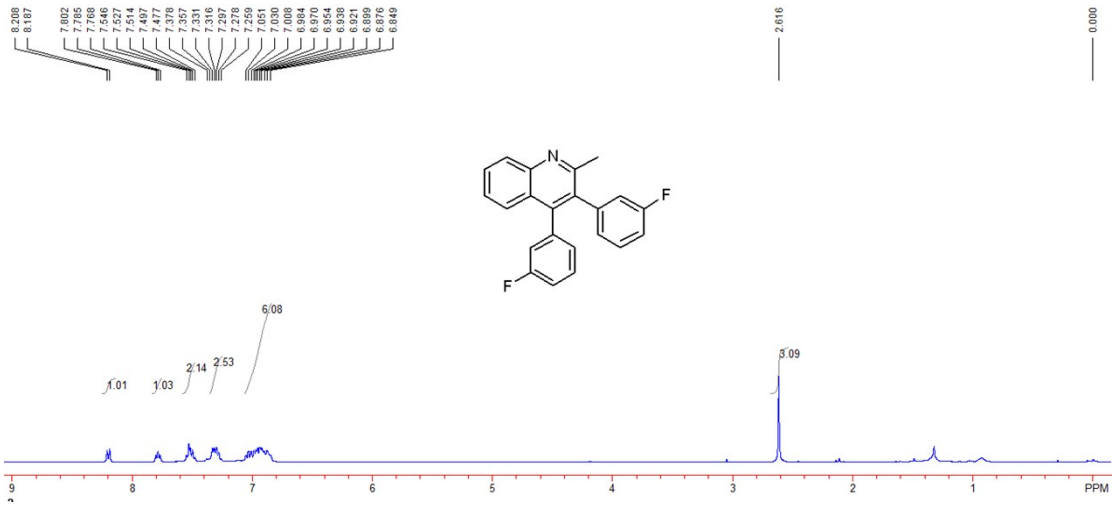


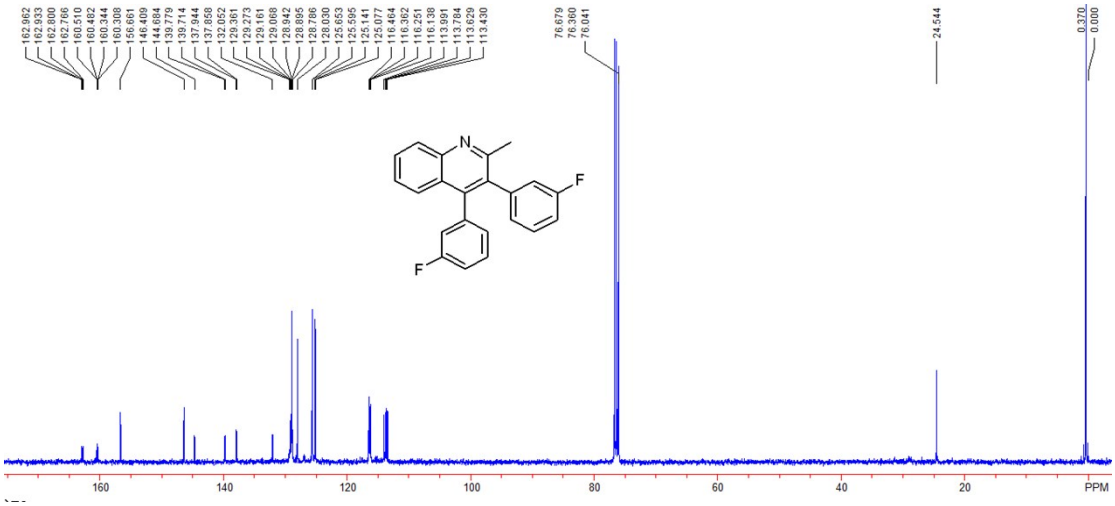



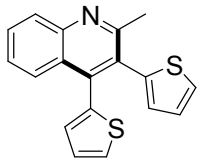
## 3,4-bis(3-fluorophenyl)-2-methylquinolisne(4g)

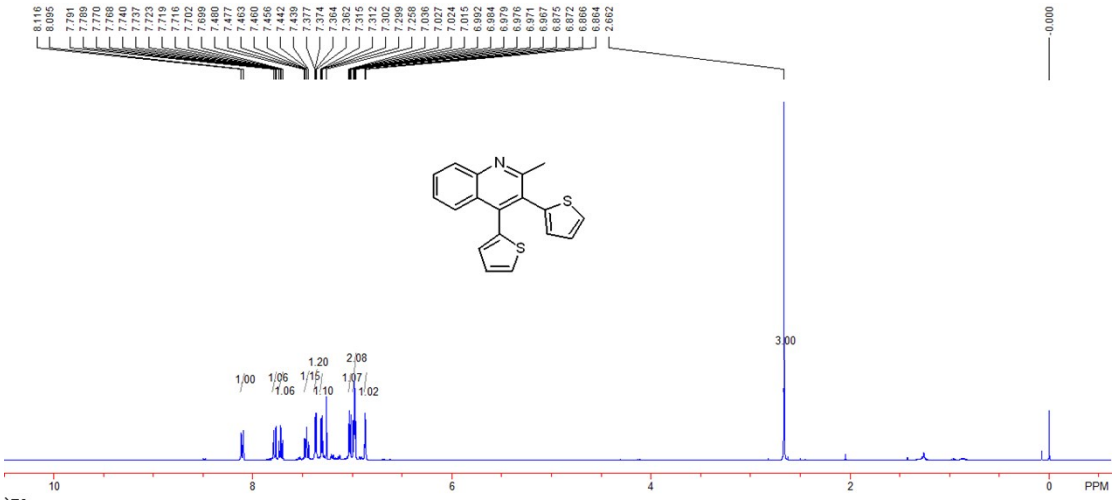


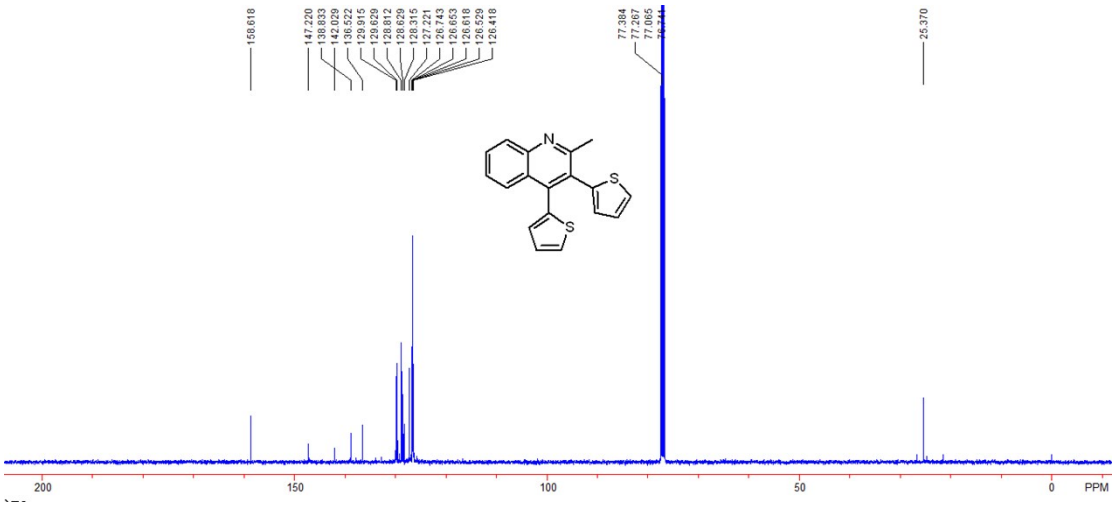



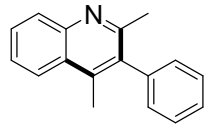
**2-methyl-3,4-di(thiophen-2-yl)quinolone(4h)**

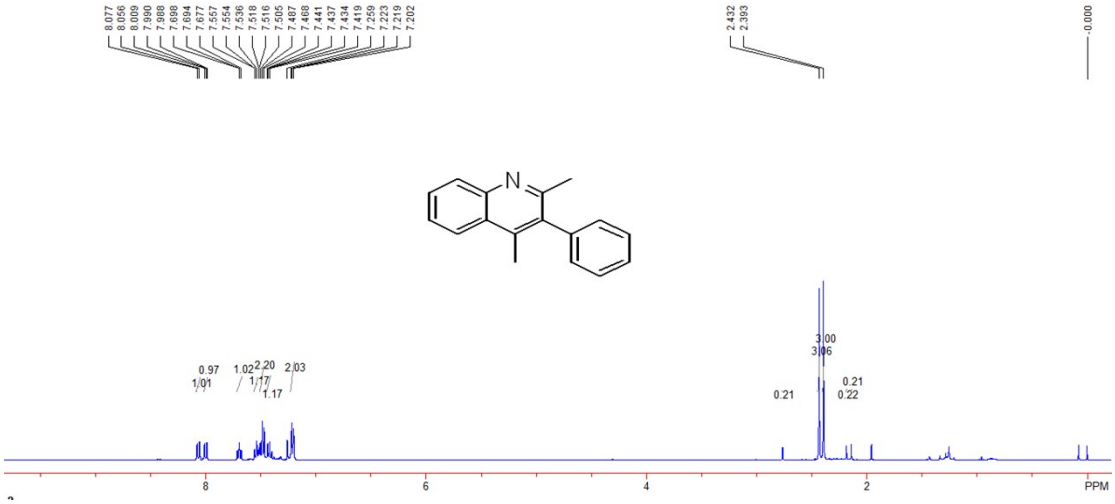


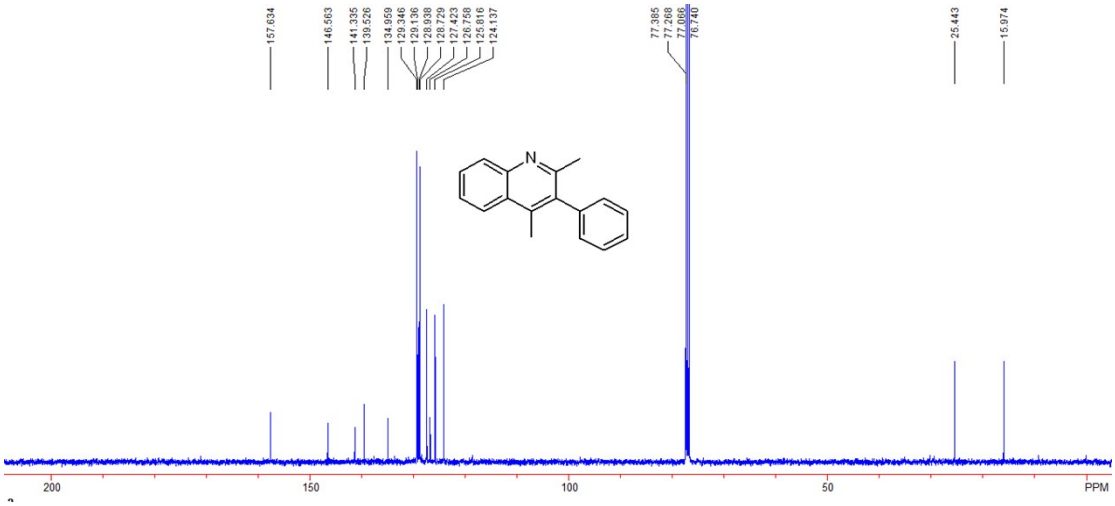


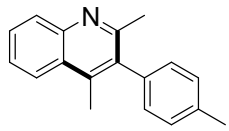
## 2,4-dimethyl-3-phenylquinoline(4i)

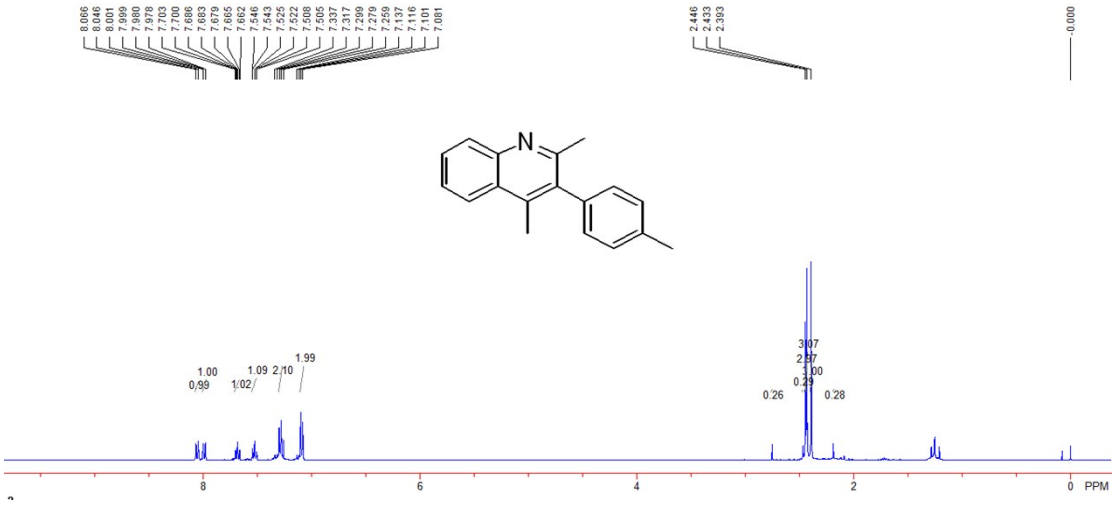


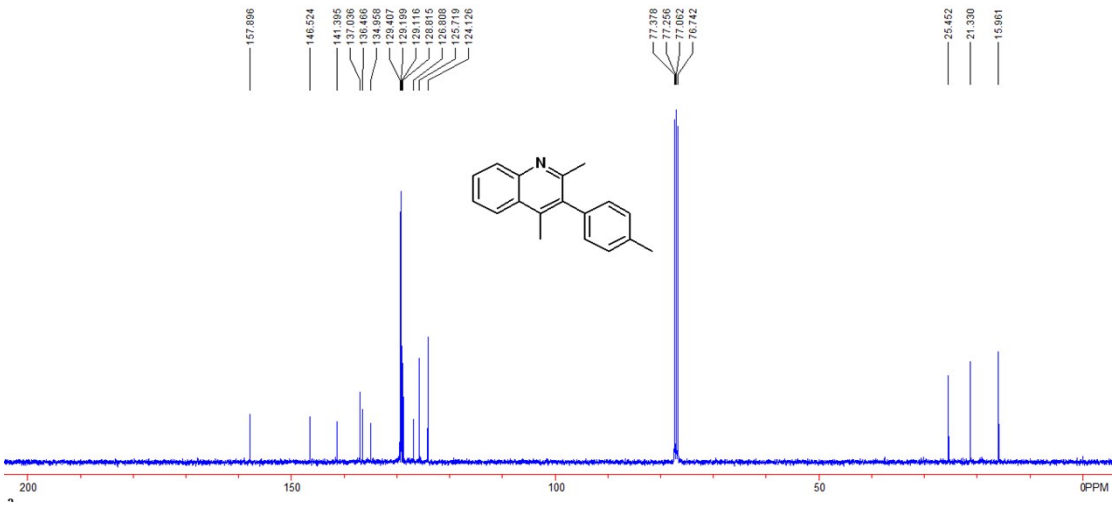


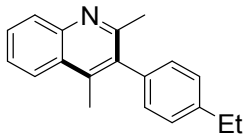
## 2,4-dimethyl-3-p-tolylquinoline(4j)

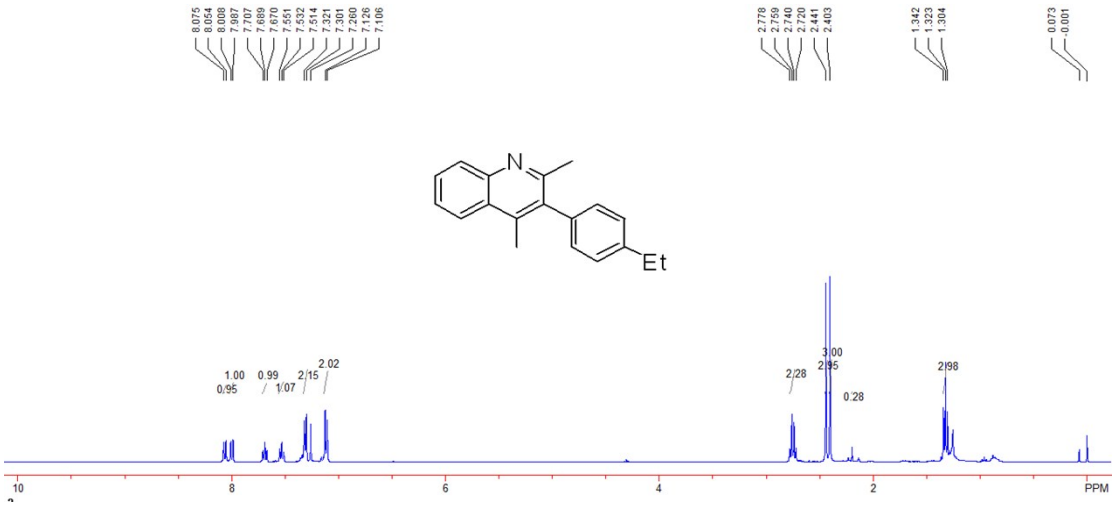


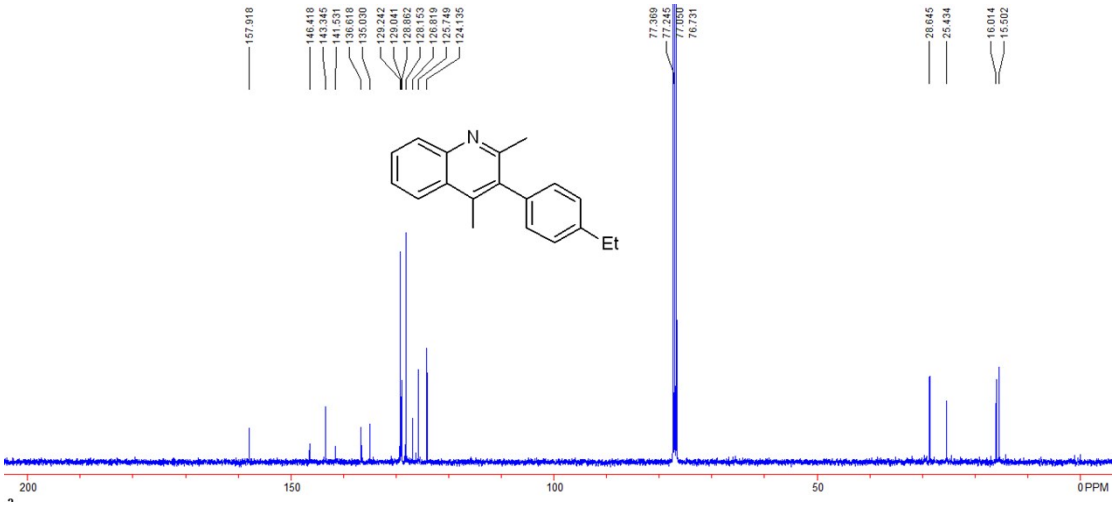


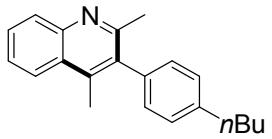
## 3-(4-ethylphenyl)-2,4-dimethylquinoline(4k)

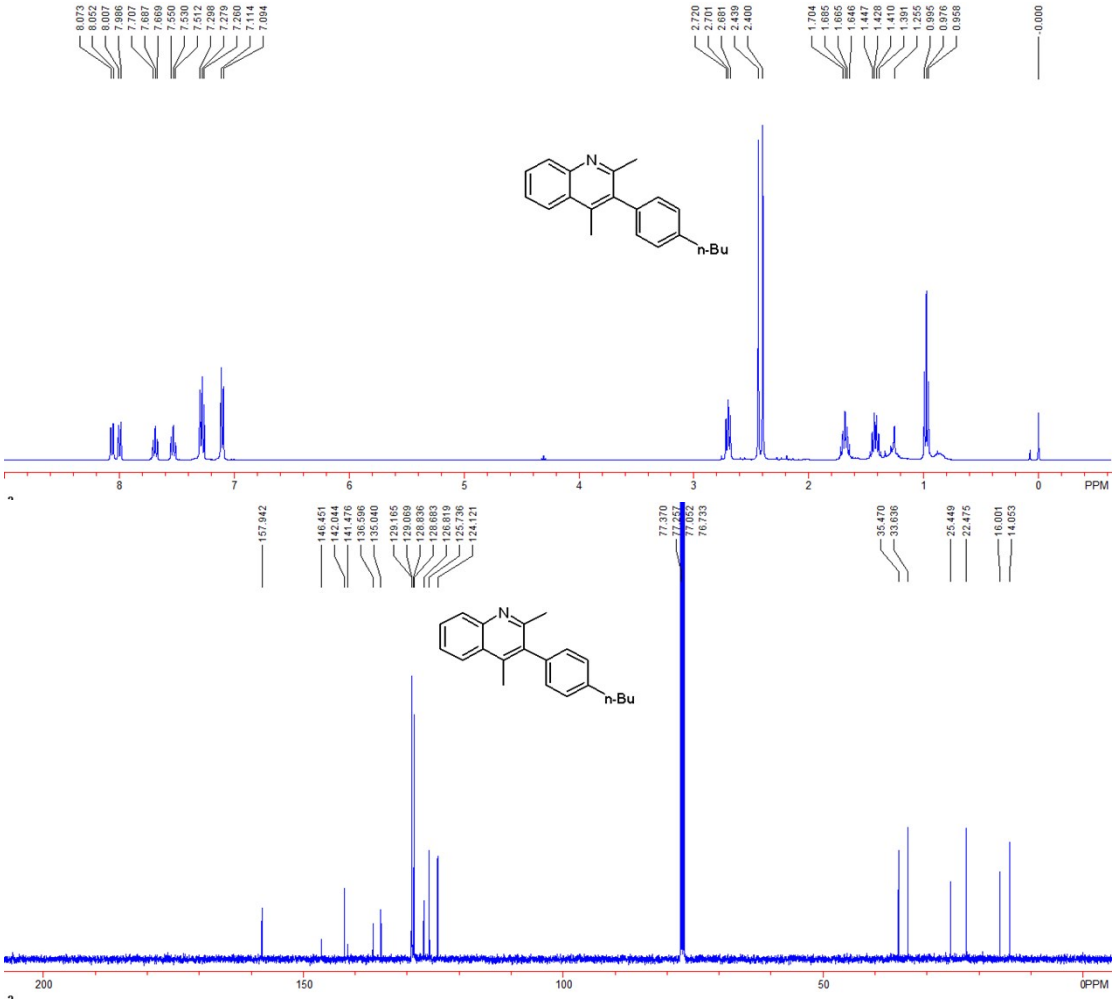


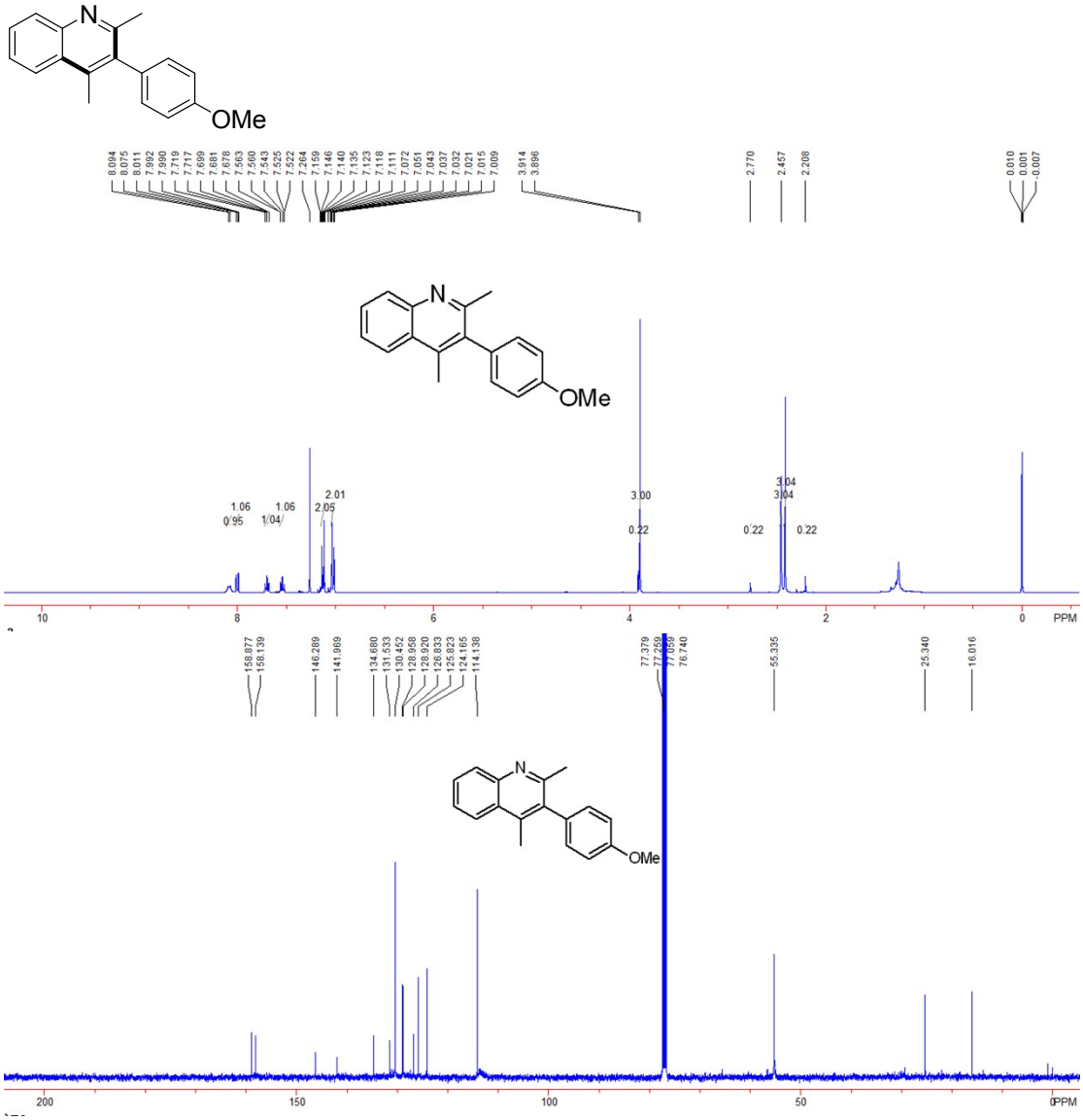



## 3-(4-butylphenyl)-2,4-dimethylquinoline(4l)



**3-(4-methoxyphenyl)-2,4-dimethylquinoline(4m)**



## 2-methyl-3,4-dipropylquinoline(4n)