Supporting Information

Site-selective Synthesis of Functionalized Dibenzo[*f*,*h*]quinolines and their derivatives involving cyclic diaryliodonium salts via Decarboxylative Annulation Strategy

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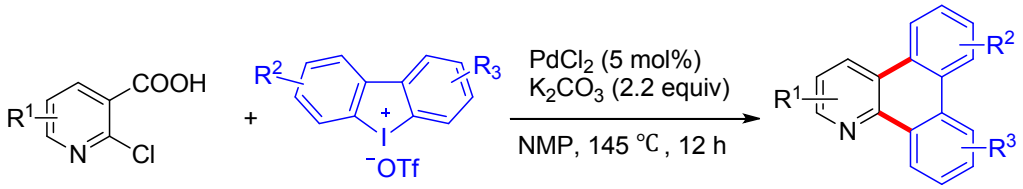
Ⅰ. General Information

All reagents were obtained from commercial suppliers and used without further purification. Yields for all compounds were determined by the column chromatography which was generally performed on silica gel (200-300 mesh) using petroleum ether 40-60 (PE)/EtOAc as eluent, and reactions were monitored by thin layer chromatography (TLC) on a glass pate coated with silica gel with fluorescent indicator (GF254)

using UV light. The ^{1}H and ^{13}C nuclear magnetic resonance (NMR) spectra were recorded on a Bruker ADNANCE III 500 MHz using $CDCl_3$ as solvent with TMS as internal standard. Chemical shifts are given in ppm (δ) referenced to $CDCl_3$ with 7.26 for ^{1}H and 77.16 for ^{13}C, and to DMSO-d_6 with 2.50 for ^{1}H and 39.52 for ^{13}C. Signals are abbreviated as follows: s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet, and coupling constants are expressed in hertz. Melting points were measured on a SGW® X-4B apparatus and uncorrected. HRMS were recorded on Agilent 6210TOF LC/MS mass spectrometer.

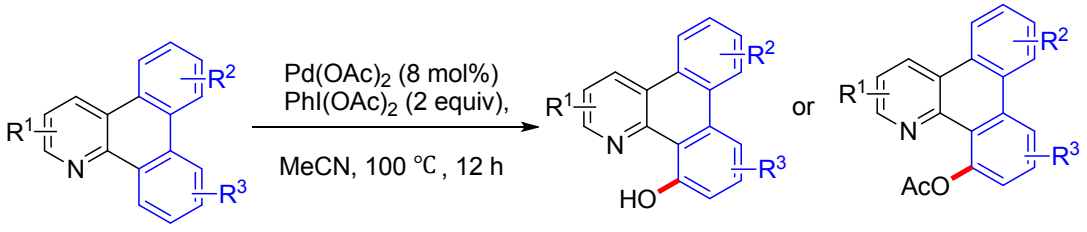
Ⅱ. General Procedure for the Synthesis of Dibenzo[f,h]quinolines



1 **2** **3**

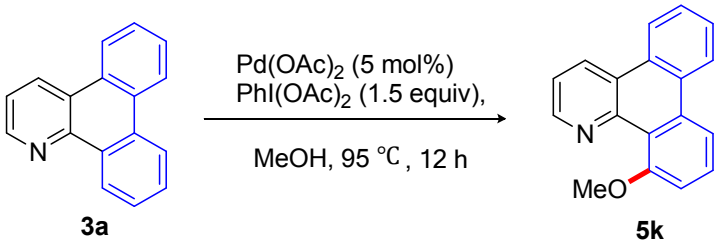
The reaction of cyclic diaryliodonium salt **2a,** 2-chloronicotinic acid **1a** was exemplified here. 2-chloronicotinic acid **1a** (78.5 mg, 0.50 mmol), cyclic diaryliodonium salt **2a** (258 mg, 0.60 mmol), K_2CO_3 (152 mg, 1.1 mmol) and $PdCl_2$ (4.5 mg, 0.025 mmol) were dissolved in NMP (3.0 mL) in a pressure vessel. The reaction mixture was stirred at 145 °C for 12 h before it was cooled to r.t. and filtered. The mixture was then extracted with EtOAc (50 mL) and washed with water (2×30 mL) and brine (30 mL) before the organic phase was dried over anhydrous Na_2SO_4 and concentrated *in vacuo*. The residue was purified by column chromatography (PE/EtOAc = 30:1) on silica gel to provide the desired product **3a** (81 mg, 70% yield).

Ⅲ. Procedure for directed site-selective oxygenation of dibenzo[*f*,*h*]quinolines



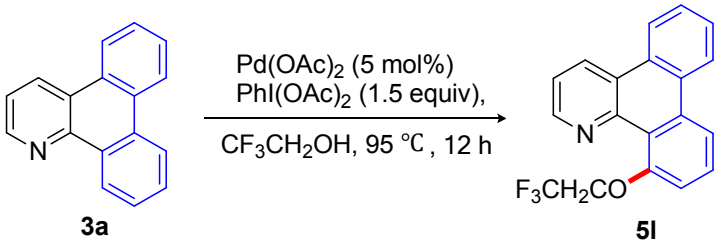
3 **5**

The reaction of dibenzo[f,h]quinoline **3a** was exemplified here. Dibenzo[f,h]quinoline **3a** (69.0 mg, 0.30 mmol), $Pd(OAc)_2$ (5.4 mg, 0.024 mmol) and $PhI(OAc)_2$ (193.6 mg, 0.60 mmol) were dissolved in MeCN (2.0 mL) in a pressure vessel. The reaction mixture was stirred at 100 °C for 12 h before it was cooled to r.t. The reaction mixture was concentrated *in vacuo*. The residue was purified by column chromatography (PE/EtOAc = 10:1) on silica gel to provide the desired product dibenzo[f,h]quinolin-12-ol **5a** (53.8 mg, 73% yield).



3a **5k**

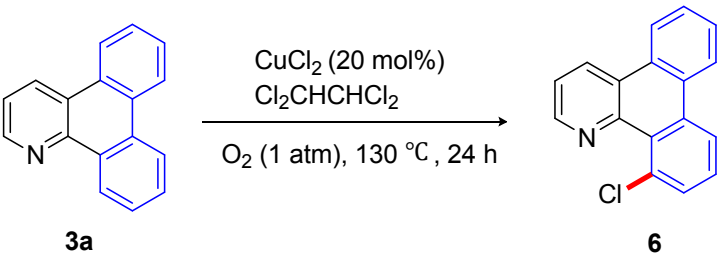
Dibenzo[f,h]quinoline **3a** (69.0 mg, 0.30 mmol), $Pd(OAc)_2$ (3.4 mg, 0.015 mmol) and $PhI(OAc)_2$ (145.2 mg, 0.45 mmol) were dissolved in MeOH (2.0 mL) in a pressure vessel. The reaction mixture was stirred at 95 °C for 12 h before it was cooled to r.t. The reaction mixture was concentrated *in vacuo*. The residue was purified by column chromatography (EtOAc) on silica gel to provide the desired product 12-methoxydibenzo[f,h]quinoline **5k** (69.2 mg, 89% yield).



3a **5l**

Dibenzo[f,h]quinoline **3a** (69.0 mg, 0.30 mmol), $Pd(OAc)_2$ (3.4 mg, 0.015 mmol) and $PhI(OAc)_2$ (145.2 mg, 0.45 mmol) were dissolved in CF_3CH_2OH (2.0 mL) in a pressure vessel. The reaction mixture was stirred at 95 °C for 12 h before it was cooled to r.t. The reaction mixture was concentrated *in vacuo*. The residue was purified by column chromatography (PE/EtOAc = 6:1) on silica gel to provide the desired product 12-(2,2,2-trifluoroethoxy)dibenzo[f,h]quinoline **5l** (89 mg, 90% yield).

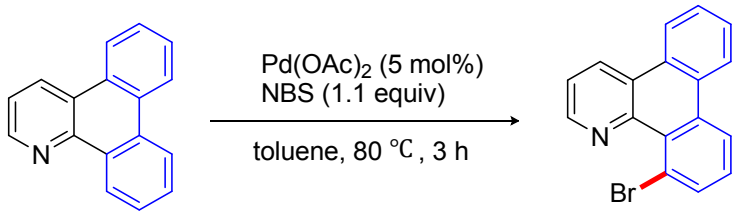
Ⅳ Procedure for Directed site-selective C—H halogenation and arylation of dibenzoquinolines



3a **6**

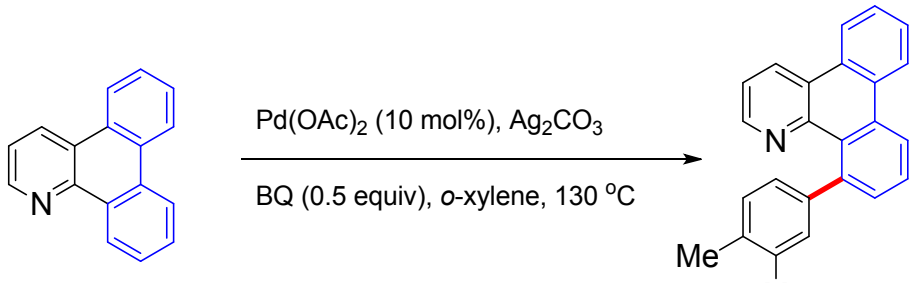
To a dried schlenk tube was added **3a** (69.0 mg, 0.3 mmol) and $CuCl_2$ (8.0 mg, 0.06 mmol). The tube and its contents were then purged under oxygen and $Cl_2CHCHCl_2$ (2 mL) was added via syringe. The reaction mixture was then heated with stirring at 130 °C for 24 h under oxygen (balloon) atmosphere. The mixture was concentrated in *vacuo*. The residue was purified by column chromatography (PE/EtOAc

= 20:1) on silica gel to provide the desired product 12-chlorodibenzo[f,h]quinoline **6** (64.7 mg, 82% yield).



3a **7**

Dibenzo[f,h]quinoline **3a** (69.0 mg, 0.30 mmol), $Pd(OAc)_2$ (3.4 mg, 0.015 mmol) and NBS (58.8 mg, 0.33 mmol) were dissolved in toluene (2.0 mL) in a pressure vessel. The reaction mixture was stirred at 80 °C for 3 h before it was cooled to r.t. The reaction mixture was concentrated *in vacuo*. The residue was purified by column chromatography (PE/EtOAc = 20:1) on silica gel to provide the desired product 12-bromodibenzo[f,h]quinoline **7** (75.6 mg, 82% yield).

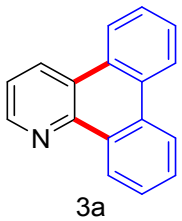


3a **8**

Dibenzo[f,h]quinoline **3a** (69.0 mg, 0.30 mmol), $Pd(OAc)_2$ (6.8 mg, 0.03 mmol), Ag_2CO_3 (165 mg, 0.60 mmol) and benzoquinone (17.0 mg, 0.15 mmol) were dissolved in *o*-xylene (2.0 mL) in a pressure vessel. The reaction mixture was stirred at 130 °C for 16 h before it was cooled to r.t. The reaction mixture was concentrated *in vacuo*. The residue was purified by column chromatography (PE/EtOAc = 20:1) on silica gel to provide the desired product 12-(3,4-dimethylphenyl)dibenzo[f,h]quinoline **8** (46.1 mg, 46% yield).

Ⅴ. Characterization of the Products

Dibenzo[f,h]quinoline (3a)

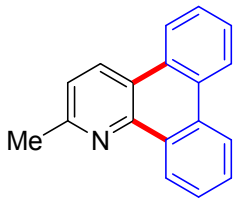


3a

White solid (81 mg, 70% yield). Mp: 170 - 173 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.41 - 9.26 (m, 1H), 8.97 (dd, *J* = 4.3, 1.6 Hz, 1H), 8.81 (dd, *J* = 8.3, 1.4 Hz, 1H), 8.66 - 8.62 (m, 1H), 8.61 - 8.58 (m, 1H),

8.53 - 8.48 (m, 1H), 7.79 - 7.72 (m, 2H), 7.67 - 7.65 (m, 2H), 7.54 (dd, *J* = 8.2, 4.4 Hz, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 148.79, 146.44, 131.26, 130.83, 130.72, 129.74, 128.80, 128.65, 127.80, 127.45, 127.27, 125.35, 124.42, 123.35, 123.18, 122.51, 122.06. The NMR data agree with those in a literature report.[1]

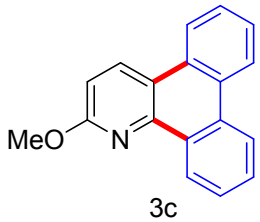
2-methyldibenzo[f,h]quinoline (3b)



3b

White solid (95 mg, 78% yield). Mp: 106 - 109 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.47 - 9.31 (m, 1H), 8.75 (d, *J* = 8.4 Hz, 1H), 8.70 - 8.66 (m, 1H), 8.65 - 8.61 (m, 1H), 8.57 - 8.52 (m, 1H), 7.78 - 7.72 (m, 2H), 7.71 - 7.64 (m, 2H), 7.45 (d, *J* = 8.4 Hz, 1H), 2.85 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 157.77, 145.78, 131.32, 131.07, 130.86, 129.44, 128.92, 128.61, 127.35, 127.34, 127.24, 125.41, 123.38, 123.02, 122.51, 122.34, 122.00, 25.06. HRMS m/z (ESI): calcd for $C_{17}H_{14}N$ $[M+H]^+$: 244.1121, found: 244.1124.

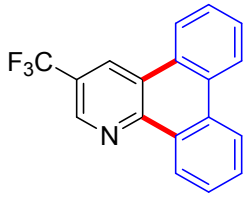
2-methoxydibenzo[f,h]quinoline (3c)



3c

White solid (82 mg, 63% yield). Mp: 90 - 93 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.34 - 9.22 (m, 1H), 8.76 (dd, *J* = 8.9, 3.7 Hz, 1H), 8.71 - 8.68 (m, 1H), 8.67-8.64 (m, 1H), 8.50 - 8.46 (m, 1H), 7.78 - 7.71 (m, 2H), 7.70 - 7.64 (m, 2H), 7.08 (d, *J* = 8.9 Hz, 1H), 4.24(s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 162.48, 144.29, 134.05, 131.49, 130.59, 129.07, 128.56, 128.40, 127.22, 127.03, 126.45, 125.35, 123.34, 122.59, 122.52, 119.14, 111.53, 53.47. HRMS m/z (ESI): calcd for $C_{18}H_{14}NO$ $[M+H]^+$: 260.1070, found: 260.1073.

3-(trifluoromethyl)dibenzo[f,h]quinoline (3d)

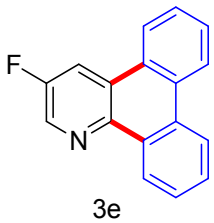


3d

Yellow solid (92 mg, 60% yield). Mp: 110 - 112 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.30 (dd, *J* = 8.0, 1.3 Hz, 1H), 9.16 (d, *J* = 1.5 Hz, 1H), 9.03 (s, 1H), 8.65 - 8.61 (m, 1H), 8.58 (d, *J* = 8.1 Hz, 1H), 8.52 (d, *J* = 7.9 Hz, 1H), 7.85 - 7.67 (m, 4H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 148.76, 144.87, 144.84, 132.00, 130.11, 129.94(d, J_{C-F} = 4.0 Hz), 128.69, 128.17(d, J_{C-F} = 3.8 Hz), 127.79, 127.71, 126.01, 125.14,

124.62, 124.36, 123.52, 123.38, 122.98, 122.62. HRMS m/z (ESI): calcd for $C_{18}H_{11}F_3N$ $[M+H]^+$: 298.0838, found: 298.0842.

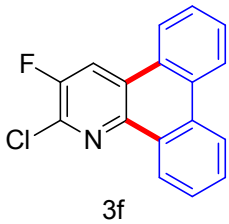
3-fluorodibenzo[f,h]quinoline (3e)



3e

White solid (83.4 mg, 67% yield). Mp: 140 - 142 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.29 - 9.18 (m, 1H), 8.83 (d, J = 2.7 Hz, 1H), 8.66 (d, J = 7.7 Hz, 1H), 8.64 - 8.56 (m, 1H), 8.47 (dd, J = 10.1, 2.7 Hz, 1H), 8.42 (dd, J = 8.0, 0.6 Hz, 1H), 7.78 - 7.71 (m, 3H), 7.70 - 7.64 (m, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.40 (d, $J_{C\text{-}F}$ = 255.0 Hz), 143.03, 138.05, 137.86, 130.68, 130.36 (d, $J_{C\text{-}F}$ = 8.1 Hz), 128.64, 128.46, 127.99 (d, $J_{C\text{-}F}$ = 2.6 Hz), 127.69, 127.39, 125.78 (d, $J_{C\text{-}F}$ = 4.1 Hz), 125.33, 123.55, 123.51, 122.55, 115.87 (d, $J_{C\text{-}F}$ = 18.8 Hz). HRMS m/z (ESI): calcd for $C_{17}H_{11}FN$ $[M+H]^+$: 248.0870, found: 248.0872.

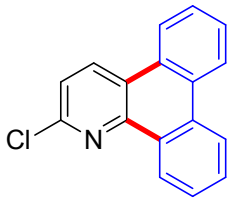
2-chloro-3-fluorodibenzo[f,h]quinoline (3f)



3f

Yellow solid (86.2 mg, 61% yield). Mp: 121 - 123 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.11 (dd, J = 8.0, 1.4 Hz, 1H), 8.63 (d, J = 8.1 Hz, 1H), 8.59 - 8.54 (m, 1H), 8.44 (d, J = 9.5 Hz, 1H), 8.31 (dd, J = 8.0, 0.6 Hz, 1H), 7.77 - 7.70 (m, 3H), 7.69-7.65 (m, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 153.28 (d, $J_{C\text{-}F}$ = 260.1 Hz), 142.57, 138.05(d, $J_{C\text{-}F}$ = 20.4 Hz), 131.00, 130.20, 129.25, 129.16, 128.66, 127.80, 127.62, 127.36 (d, $J_{C\text{-}F}$ = 2.5 Hz), 125.65, 125.36 (d, $J_{C\text{-}F}$ = 2.9 Hz), 123.61, 123.59, 122.54, 117.83 (d, $J_{C\text{-}F}$ = 19.6 Hz). HRMS m/z (ESI): calcd for $C_{17}H_{10}ClFN$ $[M+H]^+$: 282.0480, found: 282.0483.

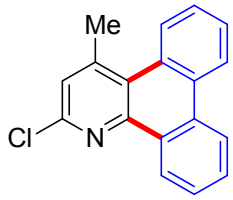
2-chlorodibenzo[f,h]quinoline (3g)



3g

White solid (65.9 mg, 50% yield). Mp: 112 - 114 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.24 (dd, J = 7.9, 1.5 Hz, 1H), 8.75 (d, J = 8.6 Hz, 1H), 8.67 - 8.62 (m, 1H), 8.61 - 8.57 (m, 1H), 8.46 (dd, J = 8.0, 1.1 Hz, 1H), 7.80 - 7.65 (m, 4H), 7.54 (d, J = 8.6 Hz, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 150.13, 146.81, 133.75, 131.60, 129.70, 129.68, 129.39, 128.08, 127.94, 127.59, 127.53, 125.74, 123.48, 123.24, 122.74, 122.50. HRMS m/z (ESI): calcd for $C_{17}H_{11}ClN$ $[M+H]^+$: 264.0575, found: 264.0577.

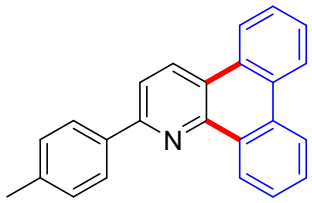
2-chloro-4-methyldibenzo[f,h]quinoline (3h)



3h

White solid (84.7 mg, 61% yield). Mp: 106 - 108 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.25 (dd, *J* = 8.1, 1.3 Hz, 1H), 8.72 - 8.65 (m, 1H), 8.58-8.54 (m, 2H), 7.77 - 7.73 (m, 1H), 7.73 - 7.67 (m, 2H), 7.66 - 7.61 (m, 1H), 7.38 (d, *J* = 0.6 Hz, 1H), 3.03 (s, 4H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 148.85, 147.99, 147.75, 131.48, 130.74, 130.31, 129.30, 129.09, 128.14, 127.57, 127.34, 126.33, 125.67, 123.99, 123.51, 122.16, 26.07. HRMS m/z (ESI): calcd for $C_{18}H_{13}ClN$ $[M+H]^+$: 278.0731, found: 278.0733.

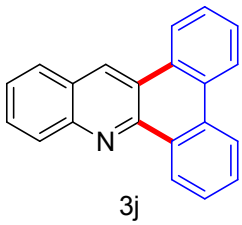
2-(p-tolyl)dibenzo[f,h]quinoline (3i)



3i

White solid (123 mg, 77% yield). Mp: 185 - 187 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.58 - 9.54 (m, 1H), 8.84 (d, *J* = 8.6 Hz, 1H), 8.69 – 8.64 (m, 1H), 8.64 - 8.60 (m, 1H), 8.55 – 8.49 (m, 1H), 8.27 (d, *J* = 8.1 Hz, 2H), 8.00 (d, *J* = 8.5 Hz, 1H), 7.80 – 7.75 (m, 2H), 7.68 (pd, *J* = 7.0, 1.4 Hz, 2H), 7.39 (d, *J* = 7.9 Hz, 2H), 2.49 (s, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 155.49, 146.00, 139.29, 136.64, 131.55, 131.49, 131.24, 129.64, 129.56, 128.82, 128.71, 127.52, 127.34, 127.29, 127.15, 125.71, 123.41, 123.22, 122.88, 122.51, 118.71, 21.43. HRMS m/z (ESI): calcd for $C_{24}H_{18}N$ $[M+H]^+$:320.1434, found: 320.1432.

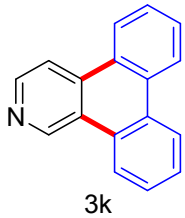
Dibenzo[a,c]acridine (3j)



3j

White solid (108 mg, 77% yield). Mp: 185 - 187 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.55 (s, 1H), 9.25 (s, 1H), 8.72 – 8.62 (m, 1H), 8.60 – 8.51 (m, 2H), 8.35 (s, 1H), 8.05 (d, *J* = 8.1 Hz, 1H), 7.85 – 7.80 (m, 1H), 7.79 – 7.74 (m, 2H), 7.70 – 7.64 (m, 2H), 7.61 (t, *J* = 7.4 Hz, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 132.07, 129.84, 129.67, 128.17, 128.02, 127.74, 127.60, 127.09, 126.35, 126.22, 123.58, 123.53, 123.38, 122.68. HRMS m/z (ESI): calcd for $C_{21}H_{14}N$ $[M+H]^+$: 280.1121, found: 280.1130.

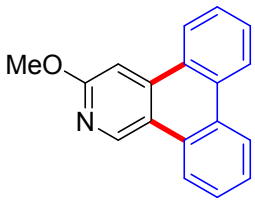
Dibenzo[f,h]isoquinoline (3k)



3k

White solid (98.7 mg, 86% yield). Mp: 162 - 164 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.76 (s, 1H), 8.66(d, *J* = 5.5 Hz, 1H), 8.54-8.50 (m, 1H), 8.45 - 8.39 (m, 2H), 8.37 (d, *J* = 8.1 Hz, 1H), 8.12(d, *J* = 5.4 Hz, 1H), 7.65 - 7.59(m, 1H), 7.59 - 7.52 (m, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.46, 146.02, 134.78, 130.92, 129.57, 129.03, 128.63, 127.74, 127.71, 127.54, 127.23, 127.12, 124.20, 123.43, 123.10, 122.27, 116.00. The NMR data agree with those in a literature report.[2]

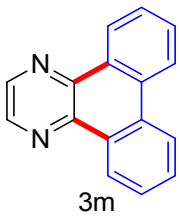
3-methoxydibenzo[f,h]isoquinoline (3l)



3l

White solid (83 mg, 64% yield). Mp: 158 - 160 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.52 (s, 1H), 8.61 – 8.53 (m, 3H), 8.49 (d, *J* = 8.0 Hz, 1H), 7.75 – 7.70 (m, 2H), 7.68 – 7.59 (m, 3H), 4.13 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 163.25, 144.40, 138.92, 131.54, 129.42, 128.74, 128.65, 127.87, 127.59, 127.41, 127.05, 123.92, 123.42, 121.90, 119.87, 101.06, 53.95. HRMS m/z (ESI): calcd for $C_{18}H_{14}NO$ $[M+H]^+$: 260.1075, found: 260.1078.

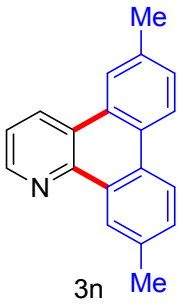
Dibenzo[f,h]quinoxaline (3m)



3m

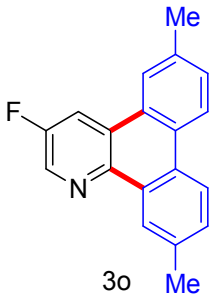
White solid (14.2 mg, 12% yield). Mp: 148 - 151 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.25 (dd, *J* = 8.0, 1.3 Hz, 2H), 8.93 (s, 2H), 8.66 (d, *J* = 8.0 Hz, 2H), 7.85 - 7.80 (m, 2H), 7.80 - 7.75 (m, 2H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 143.53, 141.52, 131.49, 129.93, 129.64, 127.75, 125.44, 122.80. HRMS m/z (ESI): calcd for $C_{16}H_{11}N_2$ $[M+H]^+$: 231.0917, found: 231.0922.

6,11-dimethyldibenzo[f,h]quinoline (3n)



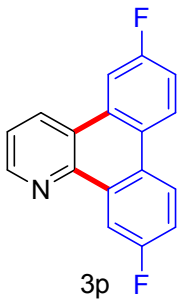
White solid (85.4 mg, 66% yield). Mp: 131 - 132 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.10 (s, 1H), 8.96 (dd, *J* = 4.4, 1.6 Hz, 1H), 8.86 (dd, *J* = 8.2, 1.1 Hz, 1H), 8.51 (d, *J* = 8.4 Hz, 1H), 8.47 (d, *J* = 8.3 Hz, 1H), 8.33 (s, 1H), 7.59 - 7.53 (m, 2H), 7.50 (dd, *J* = 8.3, 1.1 Hz, 1H), 2.65 (s, 3H), 2.61 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 148.54, 146.60, 136.97, 136.61, 130.82, 130.37, 130.30, 129.30, 129.16, 128.28, 127.62, 125.00, 124.57, 123.20, 123.12, 122.37, 121.89, 21.75, 21.64. HRMS m/z (ESI): calcd for $C_{19}H_{16}N$ $[M+H]^+$: 258.1277, found: 258.1280.

3-fluoro-6,11-dimethyldibenzo[f,h]quinoline (3o)



White solid (94 mg, 68% yield). Mp: 157 - 159 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.97 (s, 1H), 8.79 (d, *J* = 2.3 Hz, 1H), 8.54 - 8.34 (m, 3H), 8.14 (s, 1H), 7.52 (dd, *J* = 17.0, 8.2 Hz, 2H), 2.63 (s, 3H), 2.59 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.32 (d, $J_{C\text{-}F}$ = 254.6 Hz), 143.15, 137.62 (d, $J_{C\text{-}F}$ = 24.5 Hz), 137.17, 136.73, 130.07, 129.92 (d, $J_{C\text{-}F}$ = 5.0 Hz), 128.54, 128.12, 127.57, 125.86 (d, $J_{C\text{-}F}$ = 4.3 Hz), 125.00, 123.48, 123.21, 122.37, 115.85 (d, $J_{C\text{-}F}$ = 18.6 Hz), 21.68, 21.67. HRMS m/z (ESI): calcd for $C_{19}H_{15}FN$ $[M+H]^+$: 276.1183, found: 276.1187.

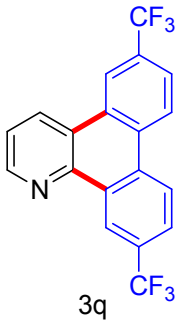
6,11-difluorodibenzo[f,h]quinoline (3p)



White solid (105 mg, 79% yield). Mp: 210 - 212 °C ^{1}H NMR (500 MHz, DMSO) δ 9.20 (d, *J* = 8.3 Hz, 1H), 9.03 (d, *J* = 4.1 Hz, 1H), 8.93 - 8.78 (m, 3H), 8.65 (dd, *J* = 10.9, 2.2 Hz, 1H), 7.79 (dd, *J* = 8.2, 4.3 Hz, 1H), 7.70-7.61 (m, 2H). ^{13}C NMR (126 MHz, DMSO) δ 162.74, 149.98, 144.77, 132.45, 127.24,

126.54 (d, $J_{C\text{-}F}$ = 8.8 Hz), 126.35 (d, $J_{C\text{-}F}$ = 8.4 Hz), 125.39, 124.08, 123.47, 117.60, 117.42, 116.70, 116.51, 109.74, 109.60 (d, $J_{C\text{-}F}$ = 4.5 Hz), 109.42. HRMS m/z (ESI): calcd for $C_{17}H_{10}F_2N$ $[M+H]^+$: 266.0776, found: 266.0779.

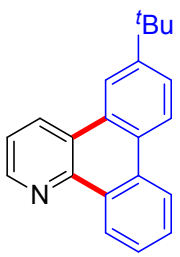
6,11-bis(trifluoromethyl)dibenzo[f,h]quinoline (3q)



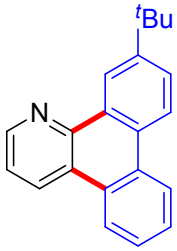
3q

White solid (143.4 mg, 78% yield). Mp: 193 - 195 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.57 (s, 1H), 9.00 (dd, *J* = 4.3, 1.5 Hz, 1H), 8.77 (d, *J* = 8.3 Hz, 1H), 8.70 (s, 1H), 8.64 (d, *J* = 8.5 Hz, 1H), 8.58 (d, *J* = 8.5 Hz, 1H), 7.93 (d, *J* = 8.6 Hz, 1H), 7.88 (d, *J* = 8.6 Hz, 1H), 7.64 (dd, *J* = 8.3, 4.3 Hz, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 149.96, 145.59, 132.23, 131.36, 130.94, 130.84, 130.41, 130.23, 129.97, 129.21, 125.34, 125.04 (d, $J_{C\text{-}F}$ = 3.6 Hz), 124.60, 124.14 (d, $J_{C\text{-}F}$ = 3.4 Hz), 123.89, 123.68, 123.17, 123.14, 120.55 (d, $J_{C\text{-}F}$ = 4.0 Hz). HRMS m/z (ESI): calcd for $C_{19}H_{10}F_6N$ $[M+H]^+$: 366.0712, found:366.0714.

6-(tert-butyl)dibenzo[f,h]quinoline (3r) and **11-(tert-butyl)dibenzo[f,h]quinoline** (3r')



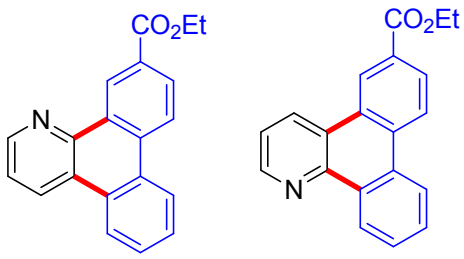
3r



3r'

Colorless liquid (97 mg, 68% yield) ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.43 (d, *J* = 2.2 Hz, 1H), 9.39 - 9.32 (m, 1H), 9.00 (ddd, *J* = 7.7, 4.3, 1.6 Hz, 2H), 8.93 (dd, *J* = 8.4, 1.4 Hz, 1H), 8.84 (dd, *J* = 8.3, 1.5 Hz, 1H), 8.68 - 8.48 (m, 6H), 7.85 (dd, *J* = 8.6, 2.2 Hz, 1H), 7.81 - 7.72 (m, 3H), 7.72 - 7.67 (m, 1H), 7.67 - 7.62 (m, 1H), 7.59 (dd, *J* = 8.2, 4.3 Hz, 1H), 7.56 (dd, *J* = 8.2, 4.4 Hz, 1H), 1.58 (s, 9H), 1.54 (s, 9H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 150.52, 150.15, 148.73, 148.61, 146.74, 146.68, 131.29, 130.73, 130.65, 130.59, 130.55, 129.81, 129.02, 128.77, 128.40, 128.29, 127.74, 127.48, 127.08, 126.88, 126.79, 125.90, 125.31, 124.74, 124.54, 123.23, 123.21, 123.15, 122.45, 122.39, 121.94, 121.85, 121.26, 119.11, 35.17, 35.07, 31.52, 31.43. HRMS m/z (ESI): calcd for $C_{21}H_{20}N$ $[M+H]^+$: 286.1590, found: 286.1590.

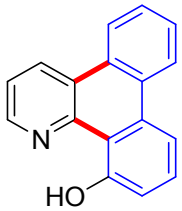
ethyl dibenzo[f,h]quinoline-11-carboxylate (3s) and **ethyl dibenzo[f,h]quinoline-6-carboxylate** (3s')



3s 3s'

White solid (86.7 mg, 57% yield). ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.83 (s, 1H), 9.21 (d, *J* = 7.9 Hz, 2H), 8.98 (s, 2H), 8.95 – 8.86 (m, 3H), 8.71 (d, *J* = 8.0 Hz, 2H), 8.64 (d, *J* = 8.1 Hz, 1H), 8.48-8.40 (m, 6H), 8.36-8.32 (m, 1H), 8.26 (d, *J* = 8.5 Hz, 1H), 8.11 (d, *J* = 8.5 Hz, 2H), 7.69 (dt, *J* = 14.9, 7.0 Hz, 4H), 7.61 – 7.54 (m, 2H), 7.49-7.45 (m, 3H), 4.59 – 4.43 (m, 6H), 1.51 (q, *J* = 7.2 Hz, 9H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 166.63, 166.28, 149.05, 148.92, 146.20, 145.83, 134.18, 132.78, 131.38, 130.79, 130.50, 130.35, 130.24, 129.29, 128.99, 128.82, 128.76, 128.72, 128.60, 128.30, 128.09, 127.80, 127.65, 127.17, 125.33, 124.92, 124.35, 123.96, 123.82, 123.21, 123.08, 122.99, 122.54, 122.31, 122.15, 61.20, 61.08, 14.49, 14.41. HRMS m/z (ESI): calcd for $C_{20}H_{16}NO_2$ $[M+H]^+$: 302.1176, found:302.1182.

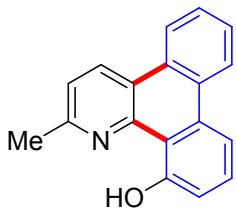
Dibenzo[f,h]quinolin-12-ol (5a)



5a

Yellow solid (53.8 mg, 73% yield). Mp: 193 - 194 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 15.64 (s, 1H), 8.86 (dd, *J* = 8.3, 1.3 Hz, 1H), 8.74 (dd, *J* = 4.6, 1.5 Hz, 1H), 8.58 (d, *J* = 7.9 Hz, 1H), 8.46 - 8.41 (m, 1H), 8.07 (d, *J* = 8.1 Hz, 1H), 7.72 - 7.59 (m, 3H), 7.56 (dd, *J* = 8.3, 4.6 Hz, 1H), 7.28-7.24 (m, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 160.47, 148.68, 144.47, 132.87, 131.34, 130.40, 130.23, 128.37, 127.75, 127.52, 124.59, 124.12, 122.95, 121.02, 115.32, 114.39, 112.74. HRMS m/z (ESI): calcd for $C_{17}H_{12}NO$ $[M+H]^+$: 246.0913, found: 246.0918.

2-methyldibenzo[f,h]quinolin-12-ol (5b)

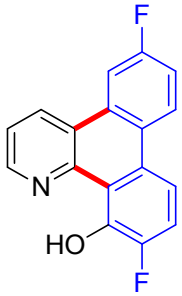


5b

Yellow solid (63.9 mg, 82% yield). Mp: 187 - 188 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 15.96 (s, 1H), 8.68 (d, *J* = 8.4 Hz, 1H), 8.57 (d, *J* = 7.7 Hz, 1H), 8.36 (d, *J* = 7.6 Hz, 1H), 8.05 (d, *J* = 8.0 Hz, 1H), 7.68 - 7.57 (m, 3H), 7.34 (d, *J* = 8.4 Hz, 1H), 7.22 (d, *J* = 7.8 Hz, 1H), 2.75 (s, 3H). ^{13}C NMR (126 MHz,

$CDCl_3$) δ 160.68, 154.04, 148.00, 132.97, 131.68, 130.95, 130.18, 129.86, 128.89, 127.89, 127.46, 124.08, 122.75, 122.08, 121.34, 115.13, 112.69, 24.00. HRMS m/z (ESI): calcd for $C_{18}H_{14}NO$ $[M+H]^+$: 260.1070, found: 260.1074.

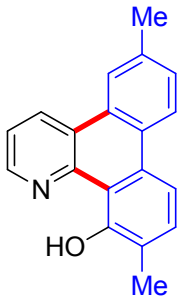
6,11-difluorodibenzo[f,h]quinolin-12-ol (5c)



5c

Yellow solid (29.8 mg, 35% yield). Mp: 238 - 240 °C ^{1}H NMR (500 MHz, DMSO) δ 15.84 (s, 1H), 9.28 (dd, *J* = 8.4, 1.4 Hz, 1H), 8.96 (dd, *J* = 4.7, 1.4 Hz, 1H), 8.73 (dd, *J* = 9.2, 5.7 Hz, 1H), 8.55 (dd, *J* = 11.0, 2.6 Hz, 1H), 8.12 (dd, *J* = 9.1, 4.5 Hz, 1H), 7.85 (dd, *J* = 8.3, 4.7 Hz, 1H), 7.66 - 7.61 (m, 1H), 7.61 - 7.55 (m, 1H). ^{13}C NMR (126 MHz, DMSO) δ 160.78, 147.69, 146.91 (d, J_{C-F} = 13.0 Hz), 146.85, 146.02, 133.62, 127.75, 126.82 (d, J_{C-F} = 8.8 Hz), 125.78, 123.95, 122.57, 118.02 (d, J_{C-F} = 19.0 Hz), 117.01 (d, J_{C-F} = 23.1 Hz), 114.79, 112.76 (d, J_{C-F} = 7.0 Hz), 109.56, 109.38. HRMS m/z (ESI): calcd for $C_{17}H_{10}F_2NO$ $[M+H]^+$: 282.0725, found: 282.0729.

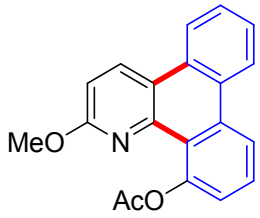
6,11-dimethyldibenzo[f,h]quinolin-12-ol (5d)



5d

Yellow solid (42.5 mg, 50% yield). Mp: 173 - 174 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 15.92 (s, 1H), 8.80 (d, *J* = 8.1 Hz, 1H), 8.69 (d, *J* = 4.0 Hz, 1H), 8.39 (d, *J* = 8.4 Hz, 1H), 8.14 (s, 1H), 7.91 (d, *J* = 8.2 Hz, 1H), 7.55 - 7.48 (m, 2H), 7.43 (d, *J* = 8.3 Hz, 1H), 2.56 (s, 3H), 2.52 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 158.09, 148.92, 143.99, 136.75, 131.95, 131.17, 130.94, 129.72, 128.11, 127.32, 124.58, 123.64, 123.59, 122.81, 120.64, 113.33, 111.73, 21.63, 16.18. HRMS m/z (ESI): calcd for $C_{19}H_{16}NO$ $[M+H]^+$: 274.1226, found: 274.1232.

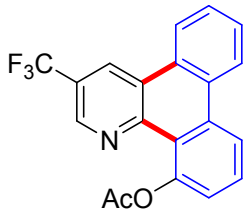
2-methoxydibenzo[f,h]quinolin-12-yl acetate (5e)



5e

White solid (43.1 mg, 45% yield). Mp: 97 - 99 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.75 (d, *J* = 9.0 Hz, 1H), 8.67 - 8.53 (m, 2H), 8.39-8.36 (m, 1H), 7.75 - 7.68 (m, 1H), 7.66 - 7.58 (m, 2H), 7.34 (dd, *J* = 7.7, 1.1 Hz, 1H), 7.04 (d, *J* = 8.9 Hz, 1H), 4.12 (s, 3H), 2.55 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.57, 162.02, 149.43, 143.92, 134.25, 134.14, 129.08, 128.28, 128.25, 127.71, 126.80, 123.81, 123.24, 122.75, 122.41, 121.21, 120.56, 109.80, 54.15, 22.08. HRMS m/z (ESI): calcd for $C_{20}H_{16}NO_3$ $[M+H]^+$: 318.1125, found: 318.1130.

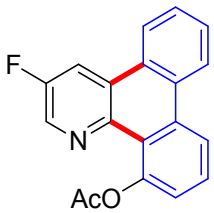
3-(trifluoromethyl)dibenzo[f,h]quinolin-12-yl acetate (5f)



5f

White solid (69.3 mg, 65% yield).Mp: 186 - 188 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.12 (d, *J* = 1.8 Hz, 1H), 9.02 (s, 1H), 8.56 (dd, *J* = 14.9, 8.0 Hz, 2H), 8.51 - 8.43 (m, 1H), 7.78 (t, *J* = 8.0 Hz, 1H), 7.73 - 7.62 (m, 2H), 7.41 (dd, *J* = 7.6, 0.7 Hz, 1H), 2.59 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.83, 149.69, 147.72, 143.69 (d, $J_{C\text{-}F}$ = 3.6 Hz), 134.55, 129.91, 129.79, 128.94, 128.19, 127.91 (d, $J_{C\text{-}F}$ = 4.0 Hz), 127.83, 124.91, 124.51, 124.31, 124.08, 123.37 (d, $J_{C\text{-}F}$ = 32.4 Hz), 122.75, 121.95, 121.24, 21.60. HRMS m/z (ESI): calcd for $C_{20}H_{13}F_3NO_2$ $[M+H]^+$: 356.0893, found: 356.0897.

3-fluorodibenzo[f,h]quinolin-12-yl acetate (5g)

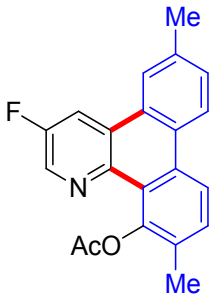


5g

White solid (68.6 mg, 75% yield). Mp: 200 - 203 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.80 - 8.75 (m, 1H), 8.60 (d, *J* = 8.1 Hz, 1H), 8.56 (d, *J* = 8.0 Hz, 1H), 8.44 (dd, *J* = 10.2, 2.8 Hz, 1H), 8.35 (d, *J* = 7.6 Hz, 1H), 7.73 (t, *J* = 8.0 Hz, 1H), 7.71 - 7.66 (m, 1H), 7.66 - 7.62 (m, 1H), 7.40 (dd, *J* = 7.7, 1.0 Hz, 1H), 2.57 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.95, 157.84 (d, $J_{C\text{-}F}$ = 257.6 Hz), 149.04, 142.06, 136.83(d, $J_{C\text{-}F}$ = 23.8 Hz), 133.40, 130.04, 128.78, 128.68, 128.20(d, $J_{C\text{-}F}$ = 2.5 Hz), 127.95, 127.22(d,

$J_{C\text{-}F}$ = 4.2 Hz), 124.13, 123.48, 123.36, 122.45, 121.25, 115.81(d, $J_{C\text{-}F}$ = 18.7 Hz), 21.66. HRMS m/z (ESI): calcd for $C_{19}H_{13}FNO_2$ $[M+H]^+$: 306.0925, found: 360.0929.

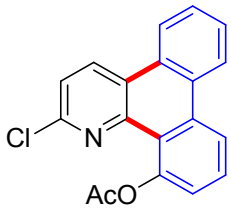
3-fluoro-6,11-dimethyldibenzo[f,h]quinolin-12-yl acetate (5h)



5h

White solid (82.2 mg, 82% yield).Mp: 165 - 167 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.71 (d, J = 2.3 Hz, 1H), 8.40 - 8.25 (m, 3H), 8.00 (s, 1H), 7.55 (d, J = 8.3 Hz, 1H), 7.40 (dd, J = 8.4, 1.2 Hz, 1H), 2.59 (s, 3H), 2.51 (s, 3H), 2.45 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.36, 157.58 (d, $J_{C\text{-}F}$ = 257.4 Hz), 146.89, 142.14, 142.11, 137.16, 136.24 (d, $J_{C\text{-}F}$ = 23.8 Hz), 131.40, 130.78, 130.73, 129.99, 127.66 (d, $J_{C\text{-}F}$ = 4.1 Hz), 127.09 (d, $J_{C\text{-}F}$ = 3.9 Hz), 123.48, 123.17, 121.63, 120.25, 115.54 (d, $J_{C\text{-}F}$ = 18.6 Hz), 21.52, 21.40, 16.72. HRMS m/z (ESI): calcd for $C_{21}H_{17}FNO_2$ $[M+H]^+$: 334.1238, found: 334.1242.

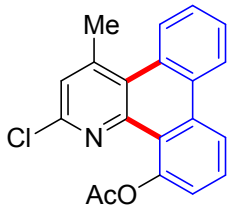
2-chlorodibenzo[f,h]quinolin-12-yl acetate (5i)



5i

White solid (63.8 mg, 66% yield). Mp: 171 - 173 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.58 (d, J = 8.7 Hz, 1H), 8.46 (d, J = 8.3 Hz, 2H), 8.22 (d, J = 8.1 Hz, 1H), 7.70 (t, J = 8.0 Hz, 1H), 7.61 - 7.55 (m, 1H), 7.54 - 7.49 (m, 1H), 7.41 (d, J = 8.6 Hz, 1H), 7.36 (dd, J = 7.7, 0.9 Hz, 1H), 2.69 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.88, 149.20, 148.63, 145.13, 134.07, 133.35, 129.12, 128.15, 127.83, 124.15, 123.80, 123.19, 122.93, 122.66, 121.93, 121.08, 21.90. HRMS m/z (ESI): calcd for $C_{19}H_{13}ClNO_2$ $[M+H]^+$: 322.0629, found: 322.0632.

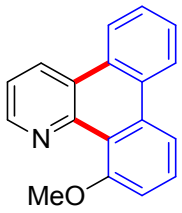
2-chloro-4-methyldibenzo[f,h]quinolin-12-yl acetate (5j)



5j

White solid (43.6 mg, 43% yield). Mp: 132 - 134 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.60 (d, *J* = 8.2 Hz, 1H), 8.51 (d, *J* = 8.3 Hz, 1H), 8.39 (d, *J* = 8.3 Hz, 1H), 7.72 (t, *J* = 8.0 Hz, 1H), 7.66 (t, *J* = 7.5 Hz, 1H), 7.58 (t, *J* = 7.6 Hz, 1H), 7.36 (d, *J* = 8.5 Hz, 2H), 2.96 (s, 3H), 2.66 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.85, 149.15, 147.47, 147.03, 146.63, 134.16, 130.50, 129.28, 128.85, 128.12, 127.69, 126.56, 125.54, 125.13, 124.17, 123.42, 122.69, 120.90, 25.85, 21.92. HRMS m/z (ESI): calcd for $C_{20}H_{15}ClNO_2$ $[M+H]^+$: 336.0786, found: 336.0787.

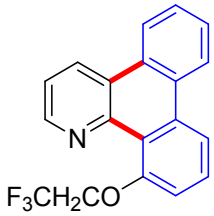
12-methoxydibenzo[f,h]quinolone (5k)



6k

White solid (69.2 mg, 89% yield). Mp: 180 - 182 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.09 (dd, *J* = 4.3, 1.7 Hz, 1H), 8.89 (dd, *J* = 8.3, 1.6 Hz, 1H), 8.67 - 8.62 (m, 1H), 8.58 - 8.52 (m, 1H), 8.33 (d, *J* = 8.2 Hz, 1H), 7.72 - 7.64 (m, 3H), 7.56 (dd, *J* = 8.3, 4.3 Hz, 1H), 7.31 (d, *J* = 8.0 Hz, 1H), 4.17 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 159.82, 148.28, 147.37, 134.22, 130.44, 129.90, 129.18, 129.05, 127.93, 127.64, 125.05, 124.20, 123.02, 121.15, 120.82, 115.69, 111.61, 57.21. HRMS m/z (ESI): calcd for $C_{18}H_{14}NO$ $[M+H]^+$: 260.1070, found: 260.1075.

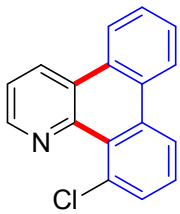
12-(2,2,2-trifluoroethoxy)dibenzo[f,h]quinoline (5l)



5l

White solid (89 mg, 90% yield). Mp: 113 - 115 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.07 (d, *J* = 3.0 Hz, 1H), 8.90 (dd, *J* = 8.3, 1.2 Hz, 1H), 8.65-8.62 (m, 1H), 8.57 – 8.53 (m, 1H), 8.51 (d, *J* = 8.1 Hz, 1H), 7.74 – 7.67 (m, 3H), 7.60 (dd, *J* = 8.3, 4.3 Hz, 1H), 7.52 (d, *J* = 7.7 Hz, 1H), 4.65 (q, *J* = 8.7 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 157.52, 148.35, 145.83, 134.27, 130.52, 129.56, 129.01, 128.83, 128.08, 127.80, 125.36, 125.16, 123.98, 123.14, 123.01, 121.76, 121.56, 119.63, 70.63 (q, $J_{C\text{-}F}$ = 34.1 Hz). HRMS m/z (ESI): calcd for $C_{19}H_{13}F_3NO$ $[M+H]^+$: 328.0944, found: 328.0954.

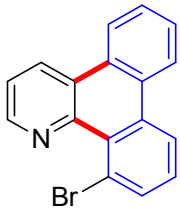
12-chlorodibenzo[f,h]quinoline (6)



6

White solid (64.7 mg, 82% yield). Mp: 139 - 141 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.05 (dd, *J* = 4.3, 1.7 Hz, 1H), 8.84 (dd, *J* = 8.3, 1.6 Hz, 1H), 8.58 - 8.54 (m, 2H), 8.50 - 8.47 (m, 1H), 7.82 (dd, *J* = 7.7, 1.1 Hz, 1H), 7.68 - 7.64 (m, 2H), 7.61 - 7.56 (m, 2H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 147.06, 146.06, 134.27, 133.18, 132.13, 130.38, 129.36, 128.95, 128.10, 128.07, 127.94, 127.33, 125.41, 123.89, 122.98, 122.12, 121.76. HRMS m/z (ESI): calcd for $C_{17}H_{11}ClN$ $[M+H]^+$: 264.0575, found: 264.0577.

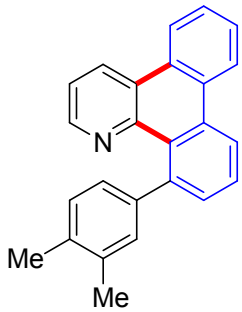
12-bromodibenzo[f,h]quinoline (7)



7

White solid (75.6 mg, 82% yield). Mp: 133 - 135 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.03 (dd, *J* = 4.3, 1.7 Hz, 1H), 8.83 - 8.79 (m, 1H), 8.61 - 8.58 (m, 1H), 8.56 - 8.53 (m, 1H), 8.49 - 8.46 (m, 1H), 8.09 (dd, *J* = 7.7, 1.2 Hz, 1H), 7.67 - 7.62 (m, 2H), 7.59 (dd, *J* = 8.2, 4.3 Hz, 1H), 7.52 - 7.45 (m, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.50, 145.56, 135.98, 134.22, 130.35, 129.31, 128.91, 128.34, 128.17, 128.05, 127.92, 125.18, 123.80, 122.97, 122.42, 122.29, 120.41. HRMS m/z (ESI): calcd for $C_{17}H_{11}BrN$ $[M+H]^+$: 308.0069, found: 308.0074.

12-(3,4-dimethylphenyl)dibenzo[f,h]quinoline (8)



8

White solid (46.1 mg, 46% yield). Mp: 95 - 97 °C ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.79 (dd, *J* = 8.3, 1.5 Hz, 1H), 8.74 – 8.70 (m, 1H), 8.67 (d, *J* = 7.6 Hz, 1H), 8.58 – 8.55 (m, 1H), 8.42 (dd, *J* = 4.2, 1.6 Hz, 1H), 7.78 – 7.67 (m, 3H), 7.63 (dd, *J* = 7.3, 1.1 Hz, 1H), 7.38 (dd, *J* = 8.2, 4.2 Hz, 1H), 7.22 (s, 1H), 7.18 (d, *J* = 7.7 Hz, 1H), 7.09 (dd, *J* = 7.6, 1.6 Hz, 1H), 2.41 (s, 3H), 2.35 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 146.88, 146.67, 144.37, 142.44, 135.56, 133.49, 132.83, 132.15, 130.11, 129.53, 129.13,

128.81, 128.73, 127.85, 127.64, 127.37, 126.04, 125.78, 125.04, 123.87, 122.97, 121.78, 121.39, 19.93, 19.55.

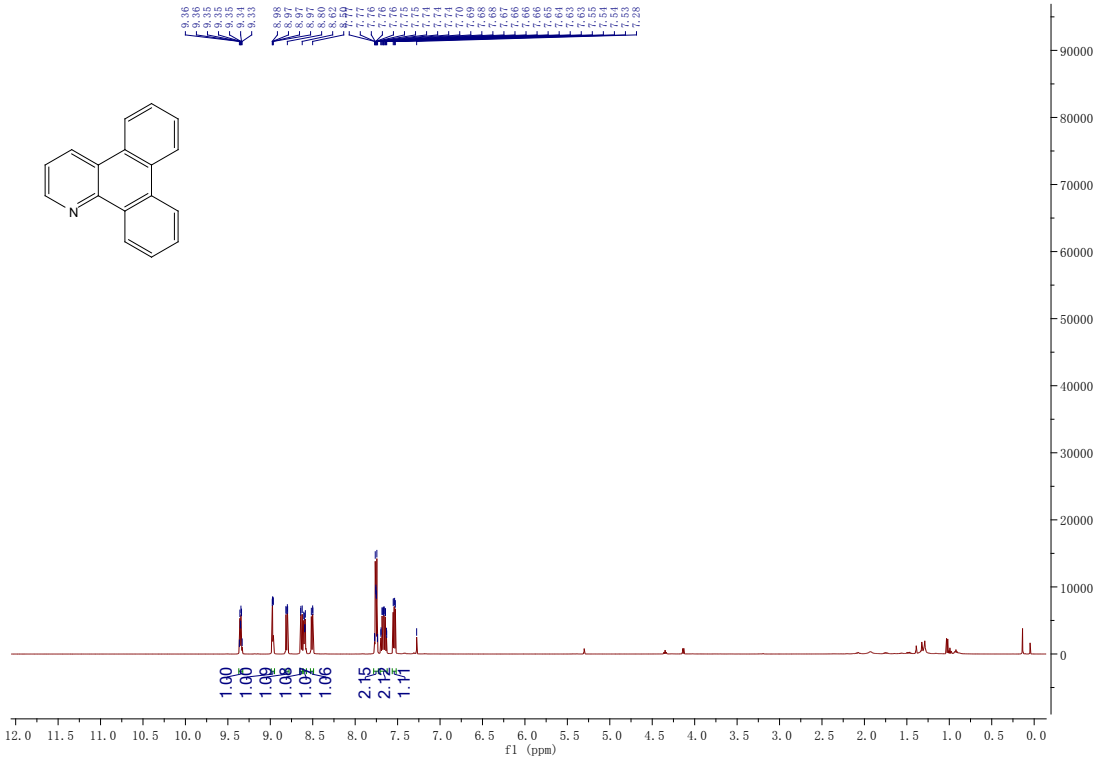
HRMS m/z (ESI): calcd for $C_{25}H_{20}N$ $[M+H]^+$: 334.1596, found:334.1583.

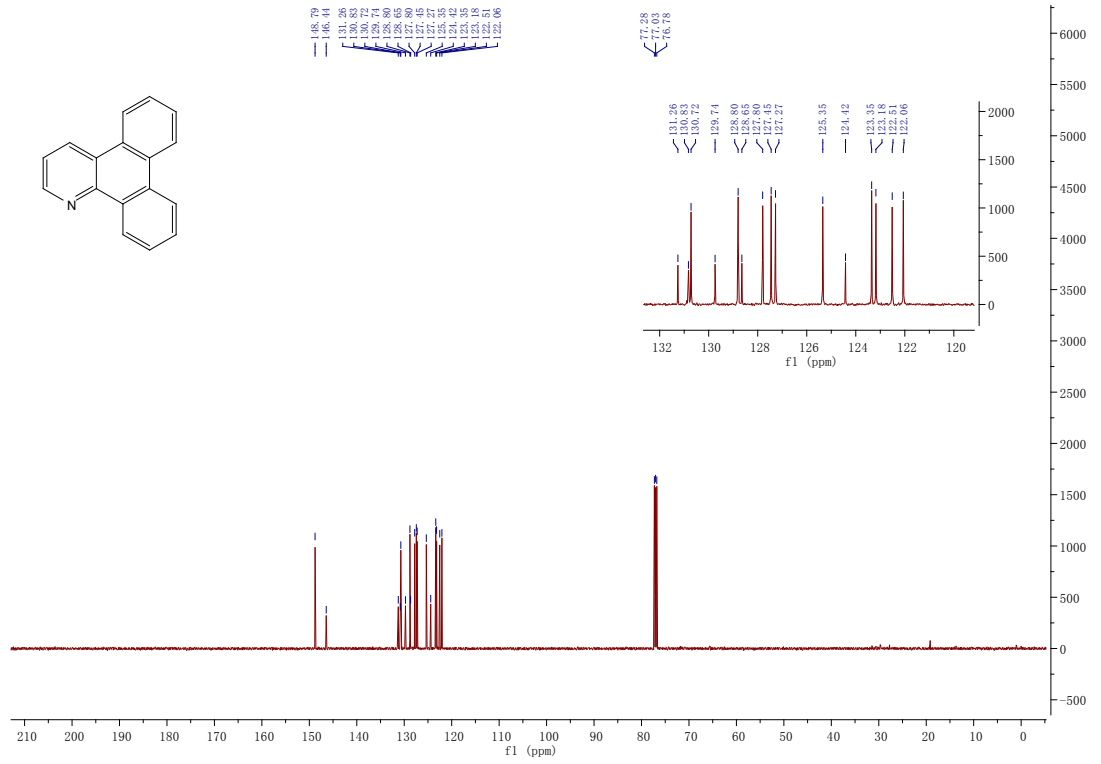
Ⅵ. References

1. N. Suzuki, T. FuJita, K. Y. Amsharov. J. Ichikawa, *Chem., Commun*. 2016, **52**, 12948-12951.
2. J. E. H. Michael, *Synthesis*, 2007, **14**, 2157-2163.

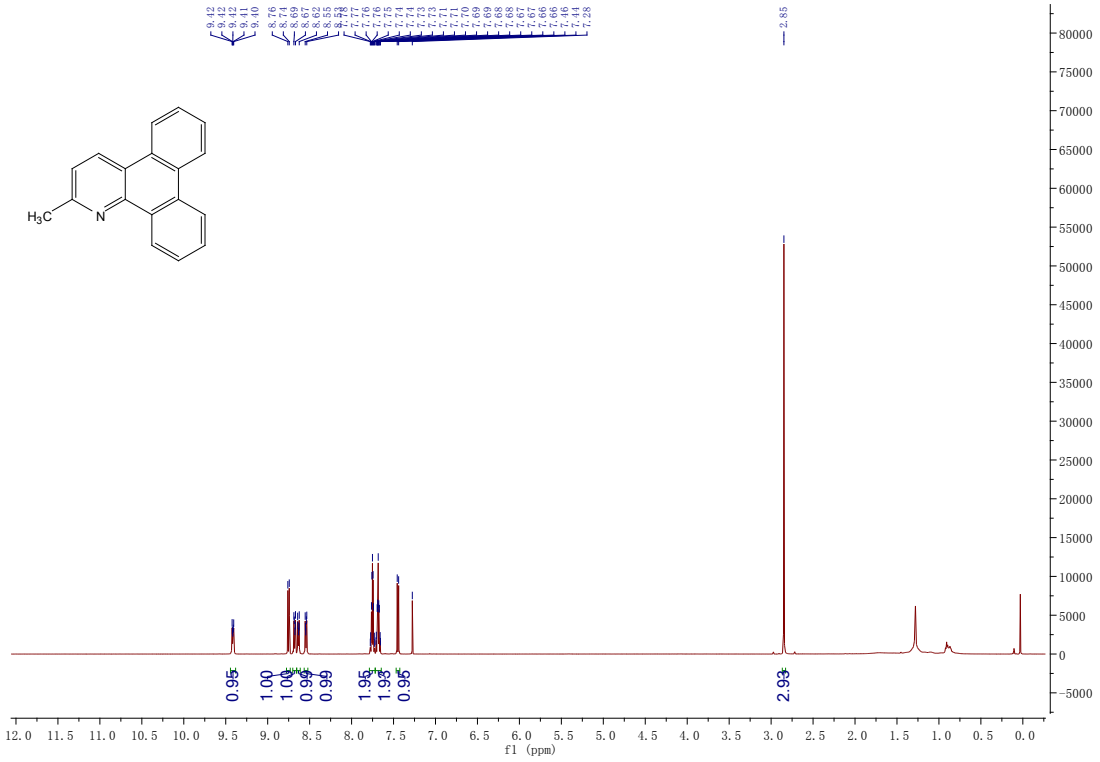
Ⅶ. NMR Spectra

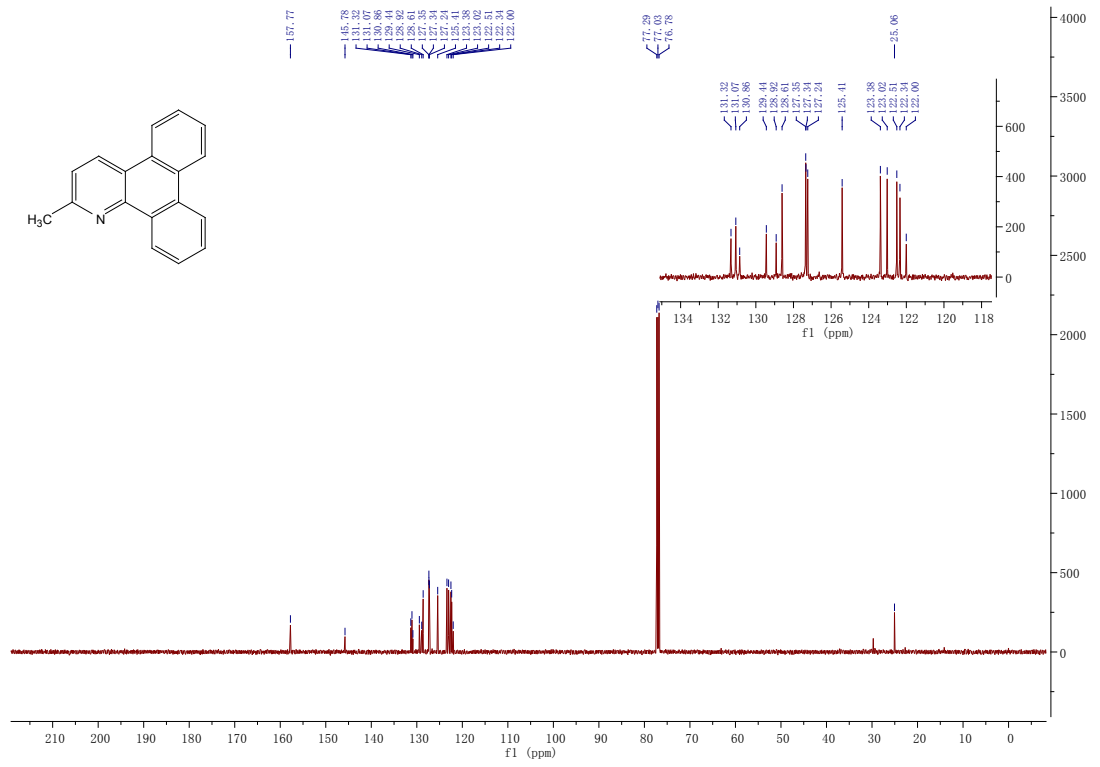
dibenzo[f,h]quinoline (3a)



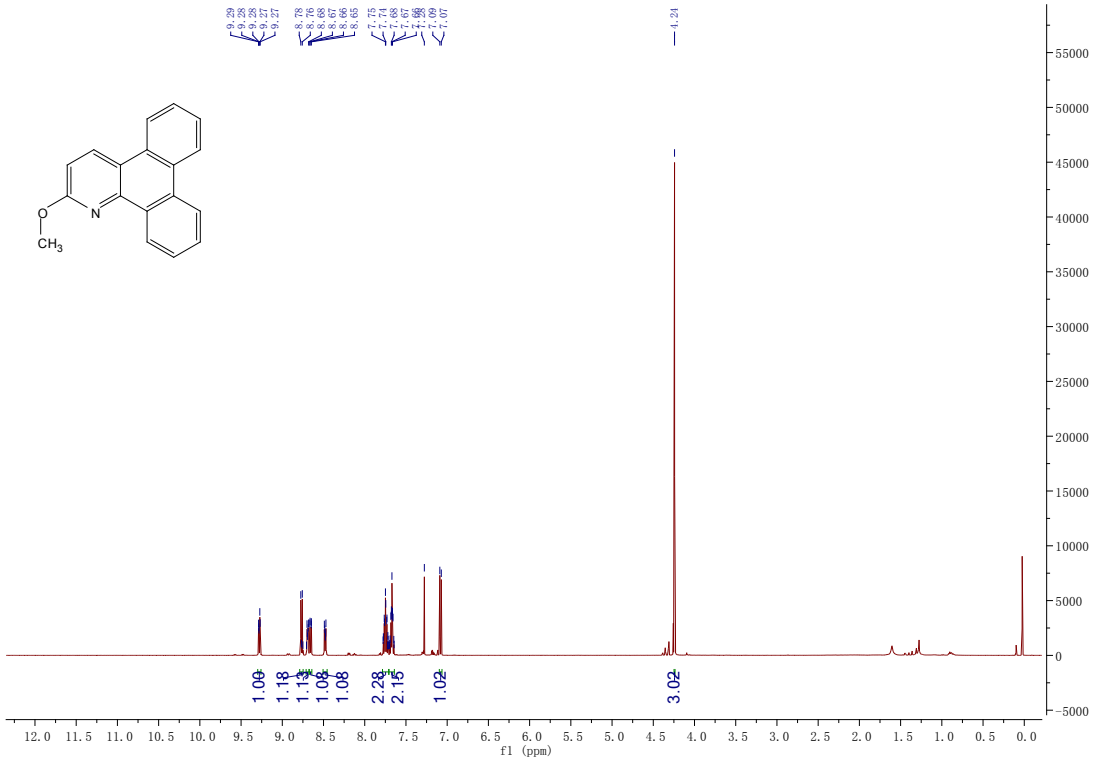


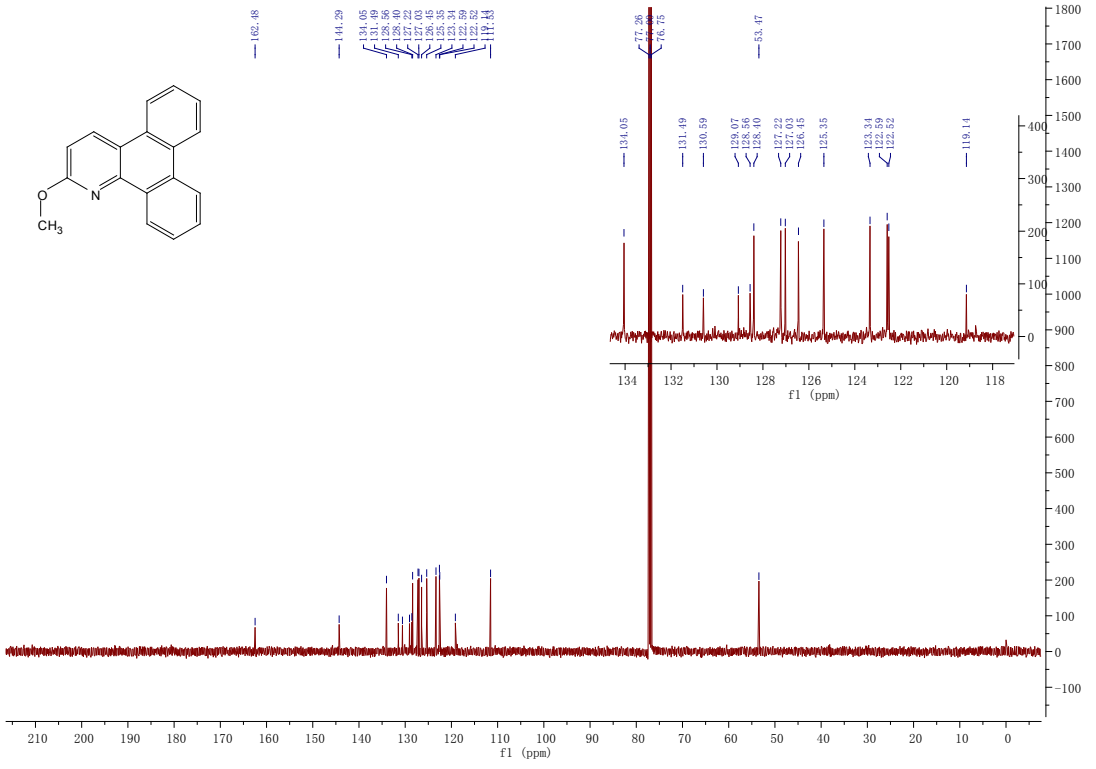
2-methyldibenzo[f,h]quinoline (3b)



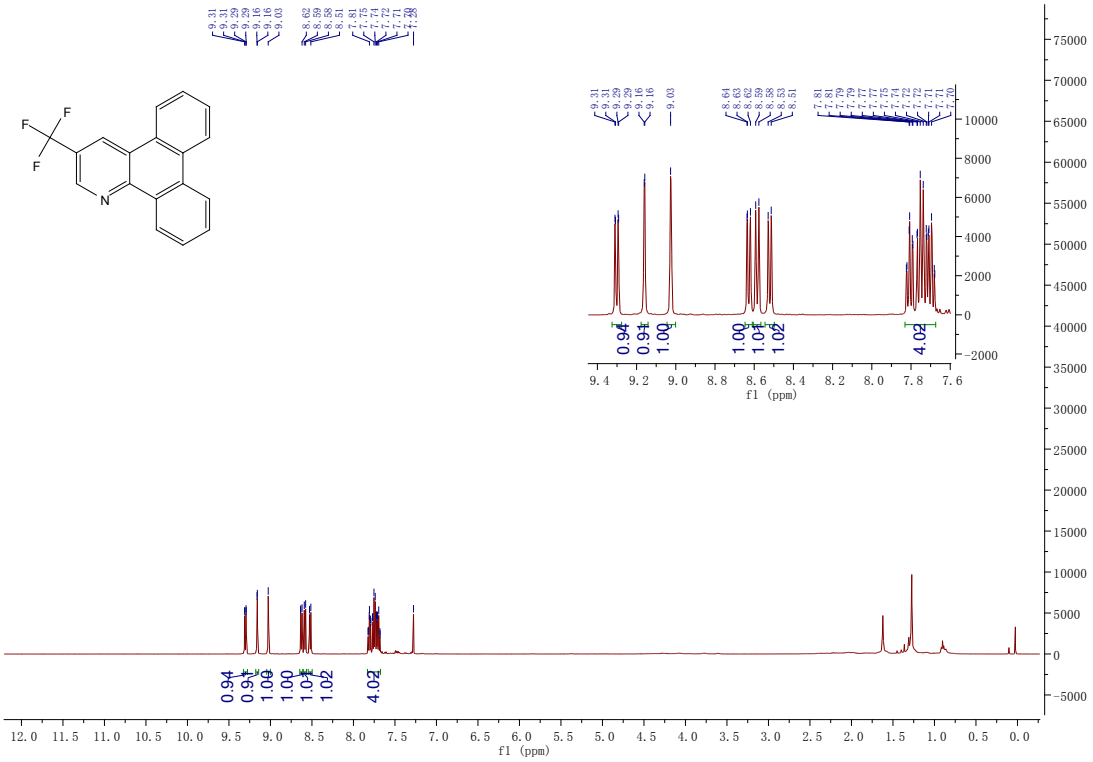


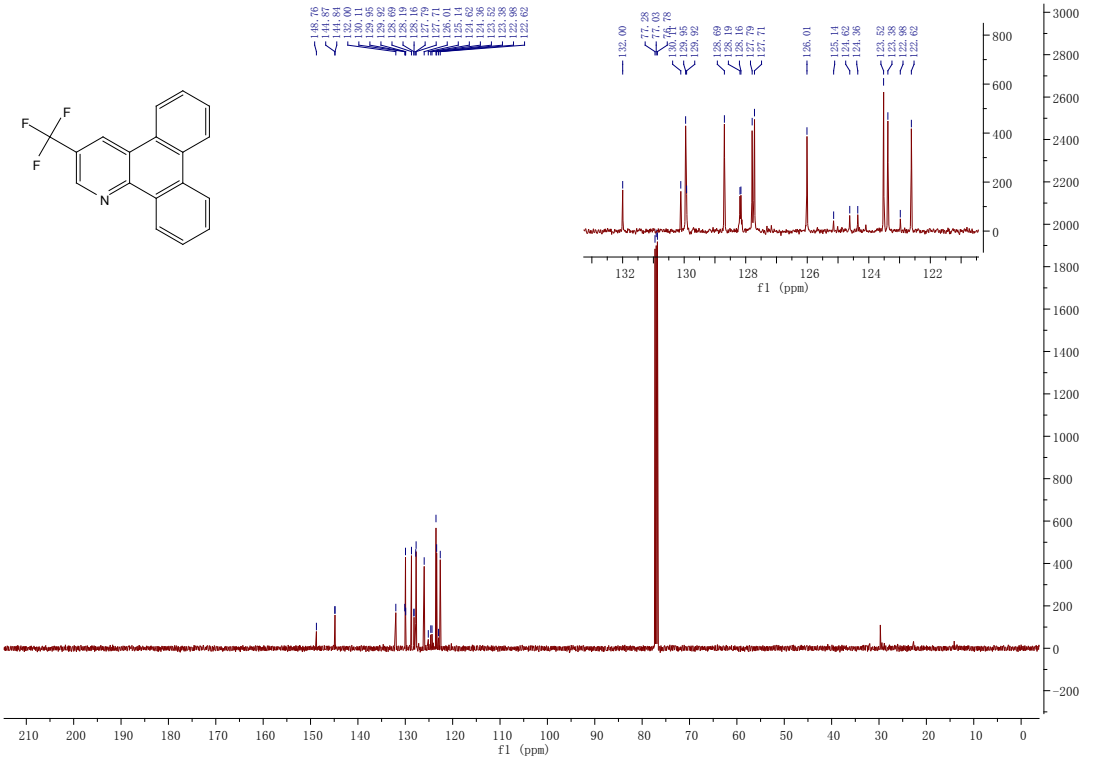
2-methoxydibenzo[f,h]quinoline (3c)



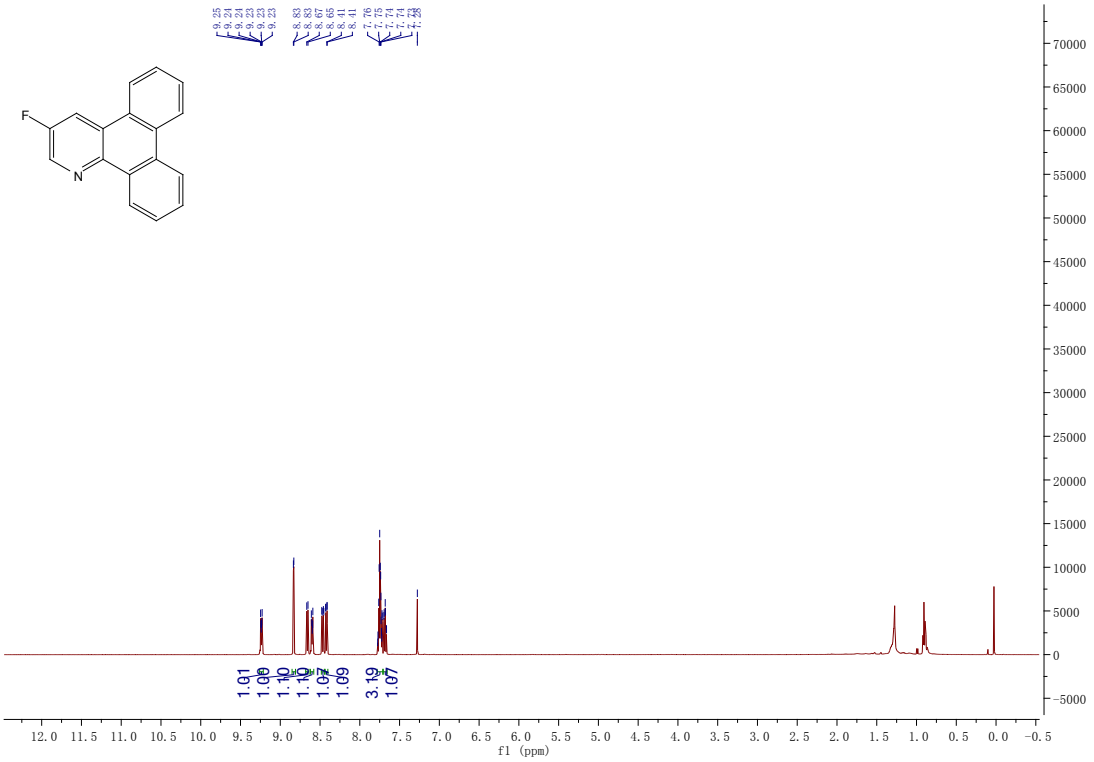


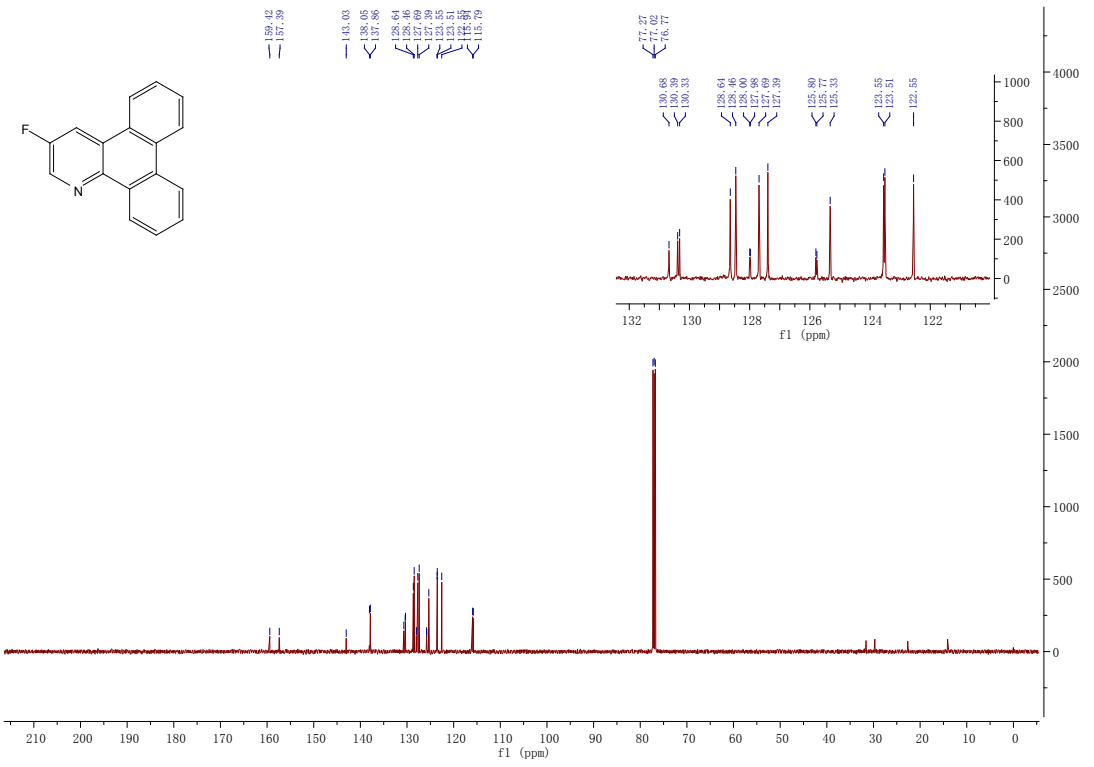
3-(trifluoromethyl)dibenzo[f,h]quinoline (3d)



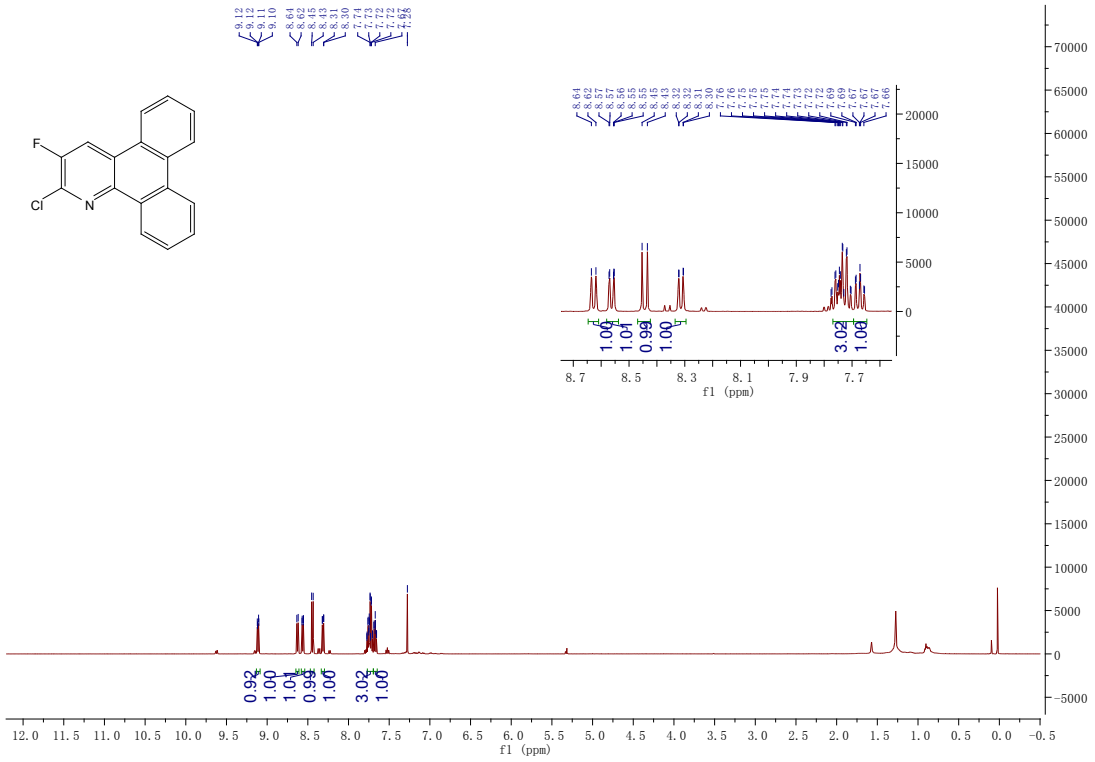


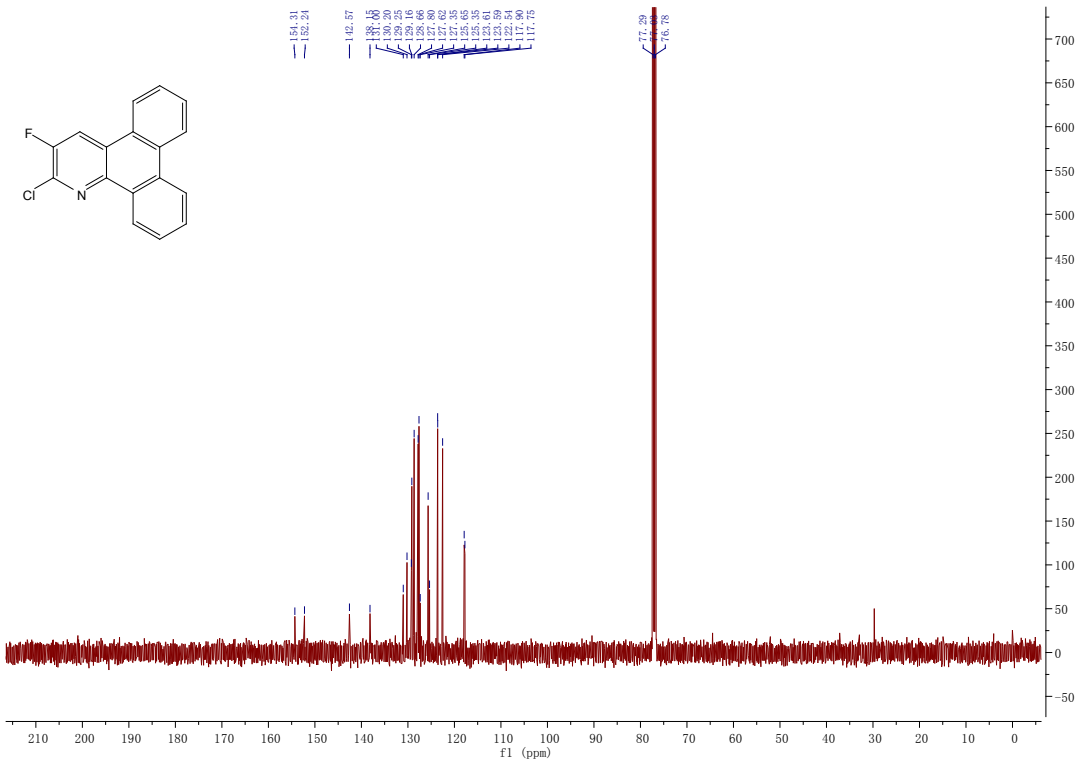
3-fluorodibenzo[f,h]quinoline (3e)



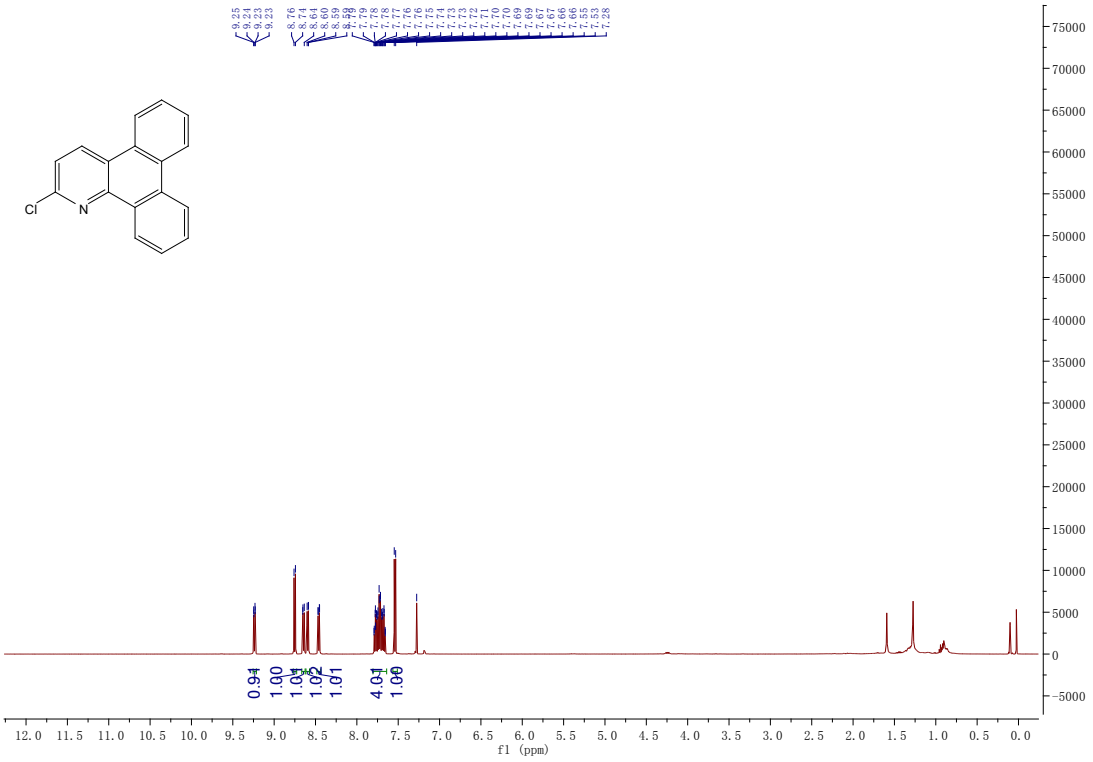


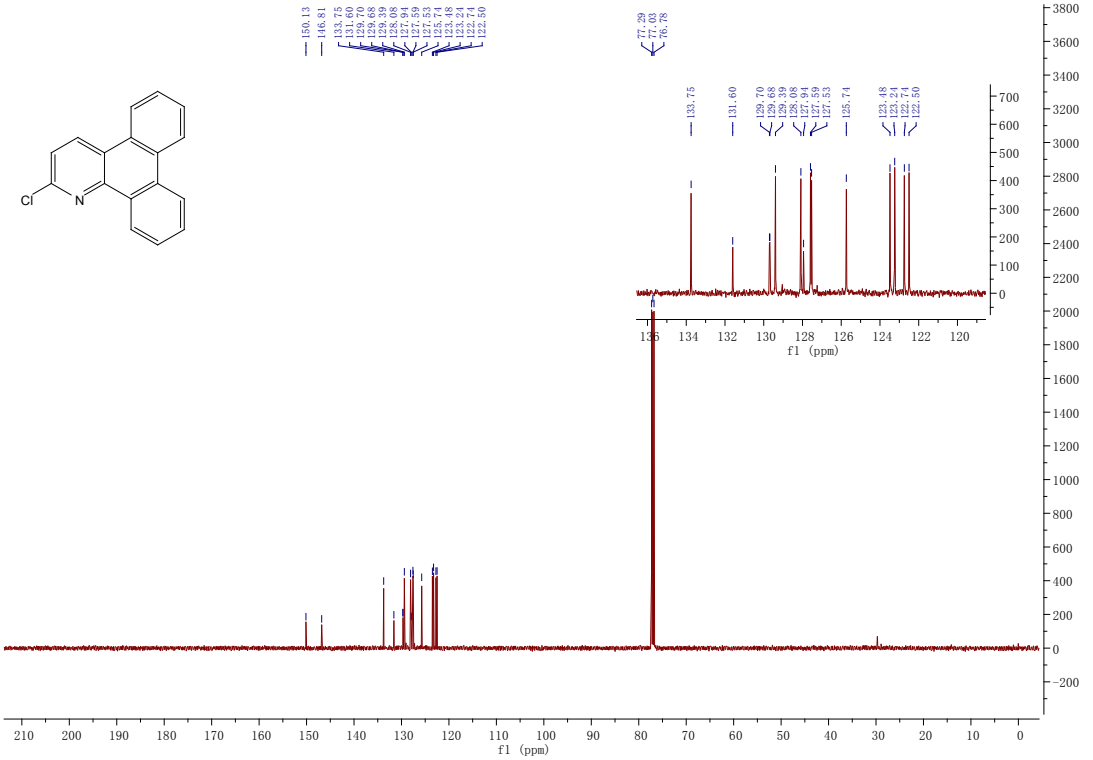
2-chloro-3-fluorodibenzo[f,h]quinoline (3f)



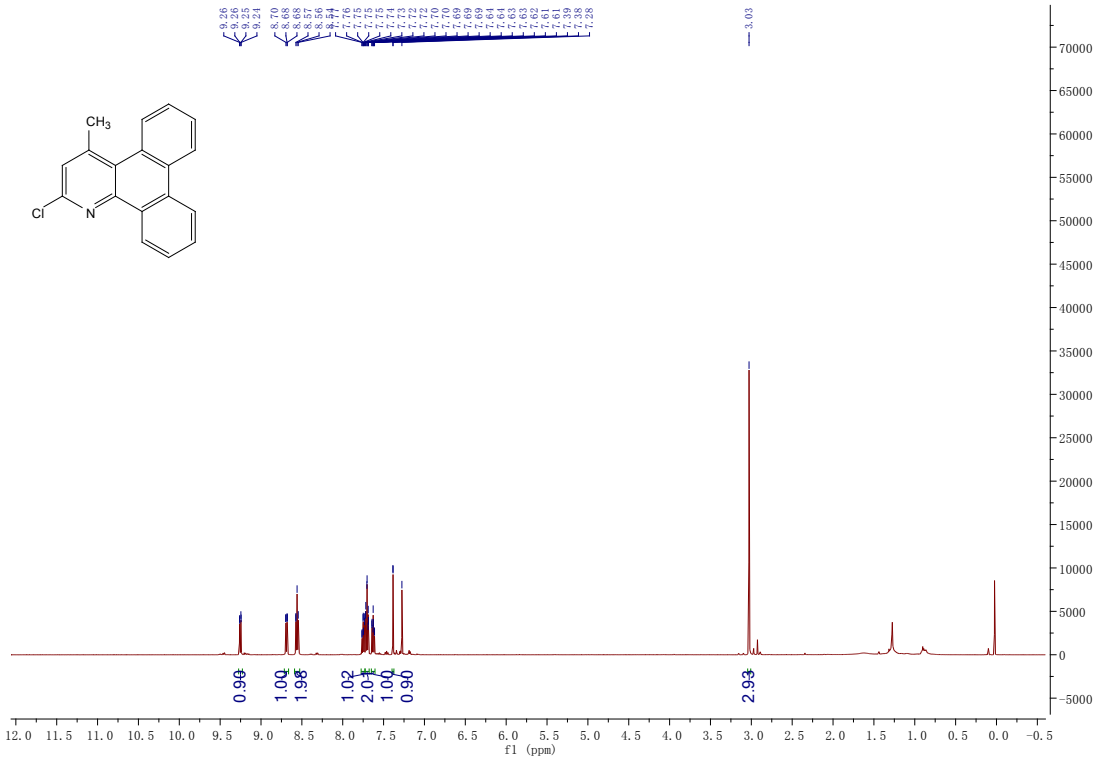


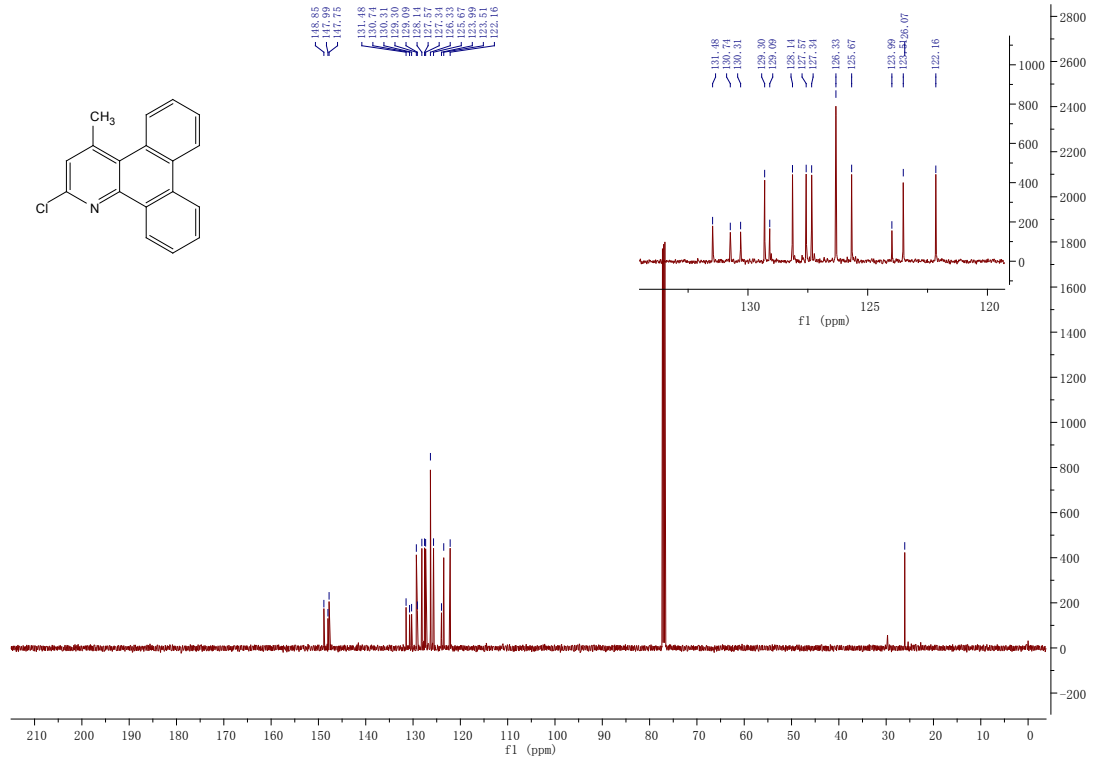
2-chlorodibenzo[f,h]quinoline (3g)



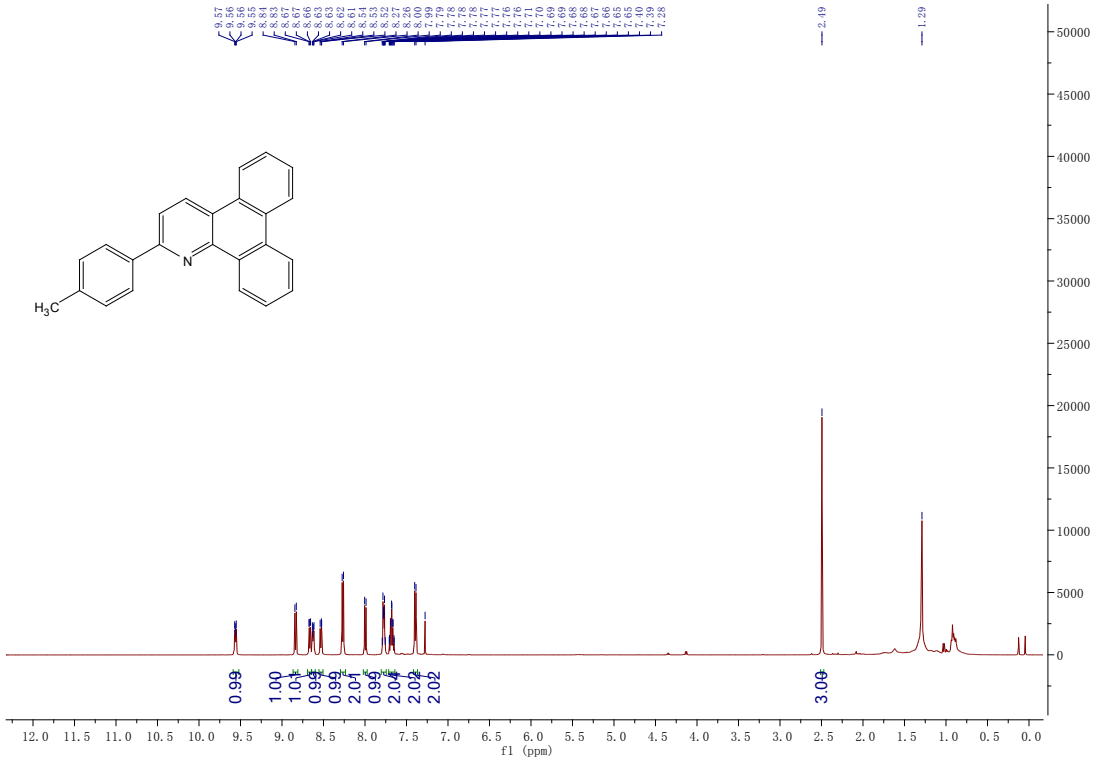


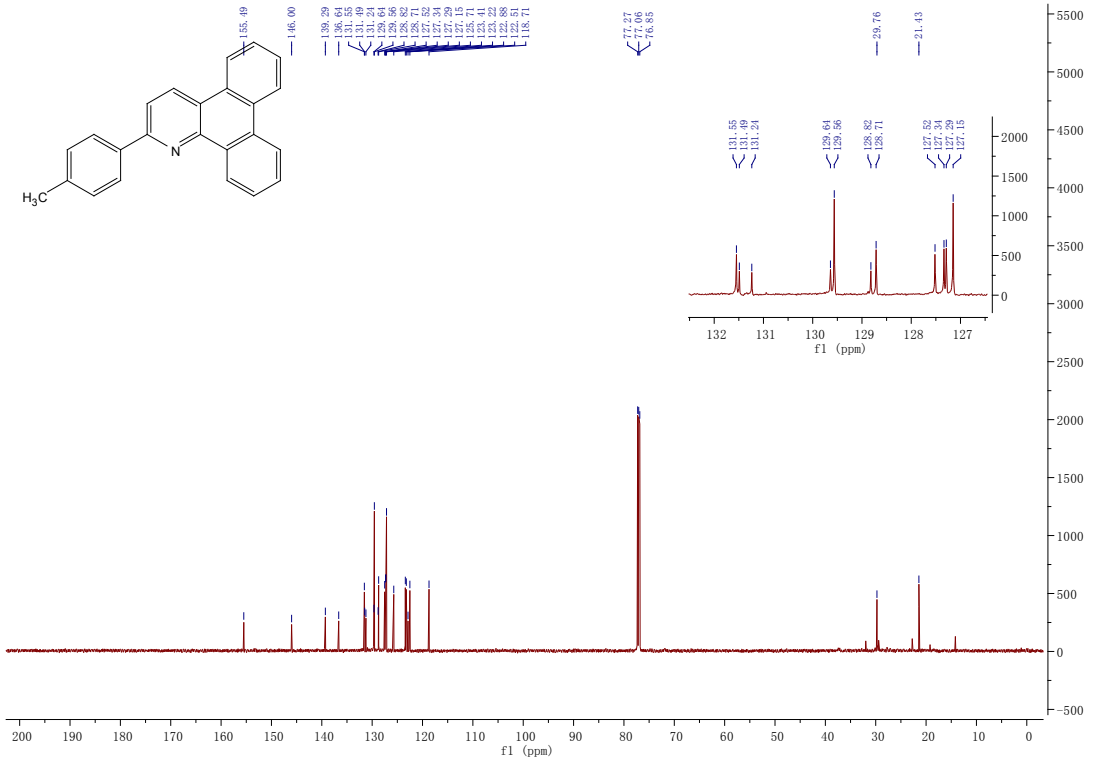
2-chloro-4-methyldibenzo[f,h]quinoline (3h)



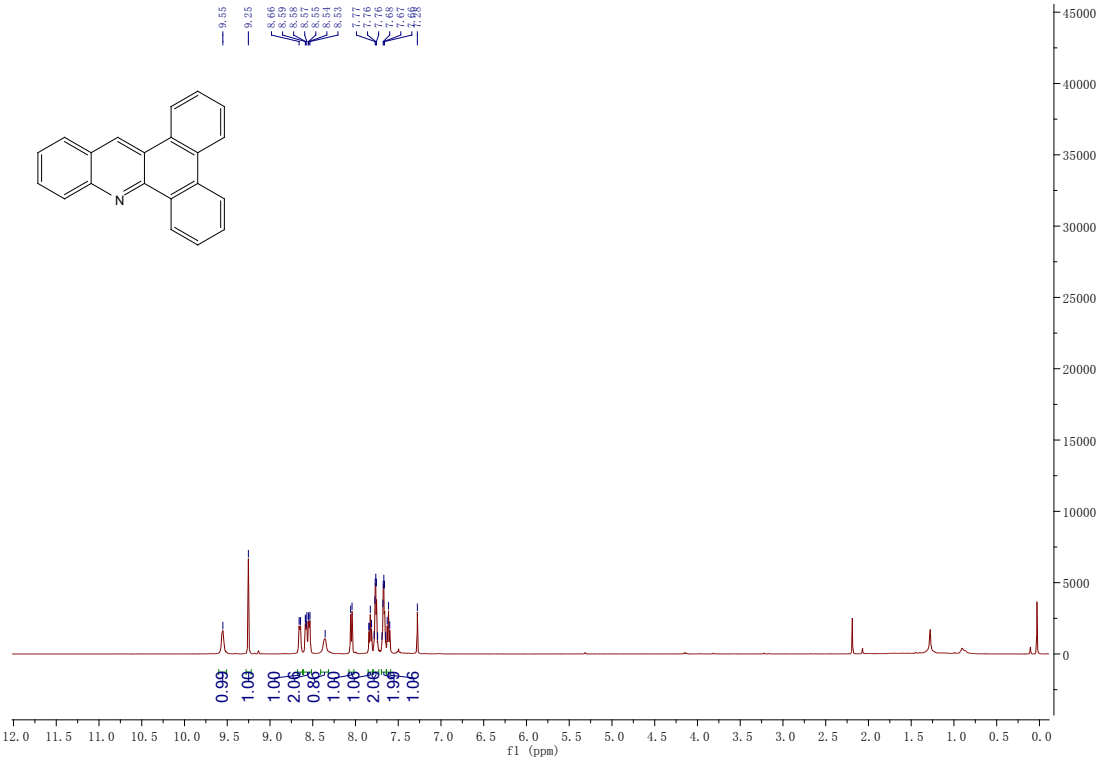


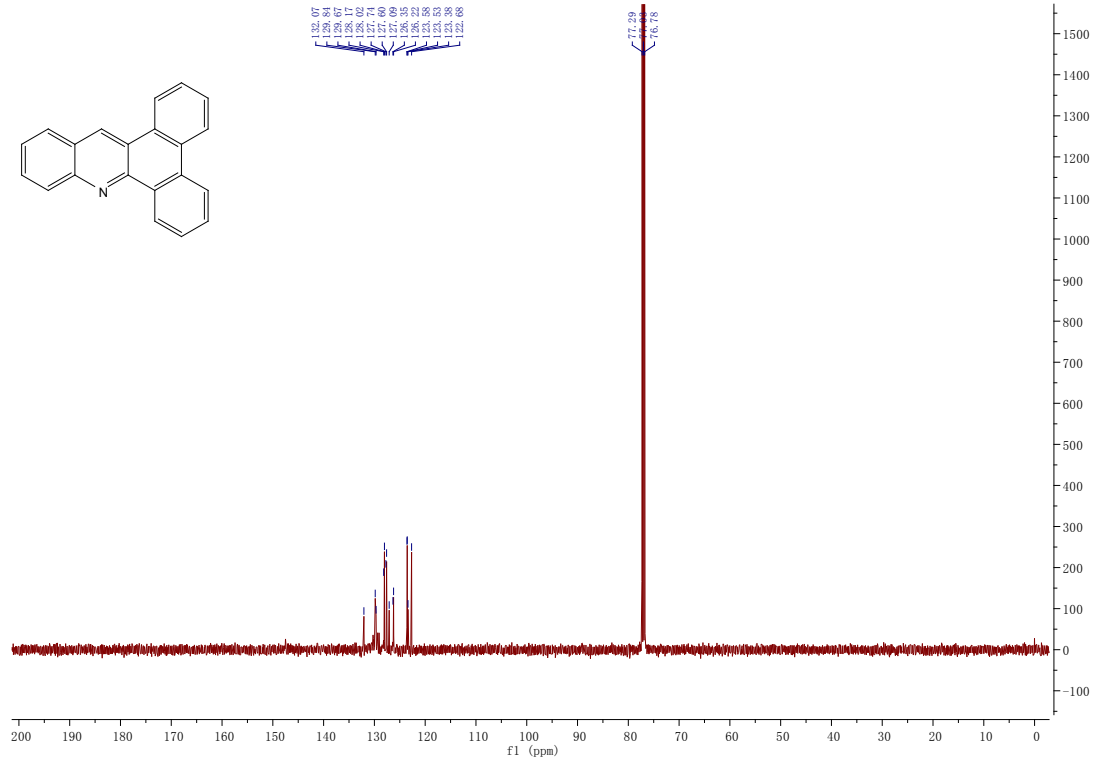
2-(p-tolyl)dibenzo[f,h]quinoline (3i)



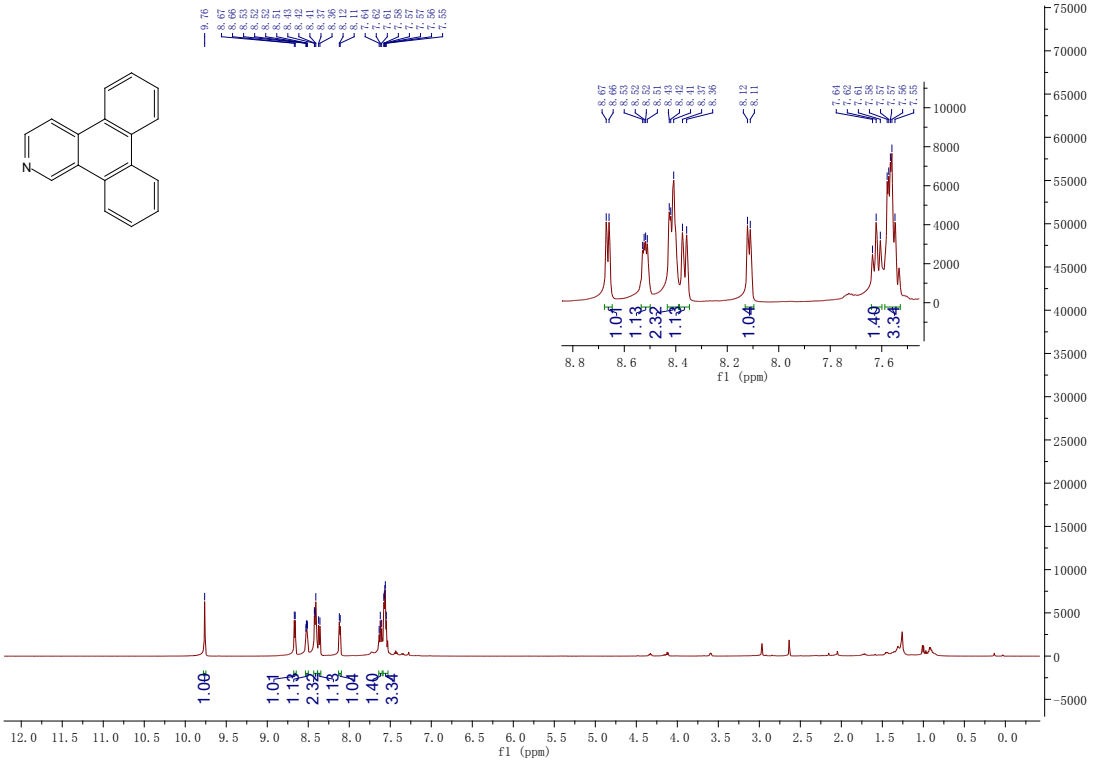


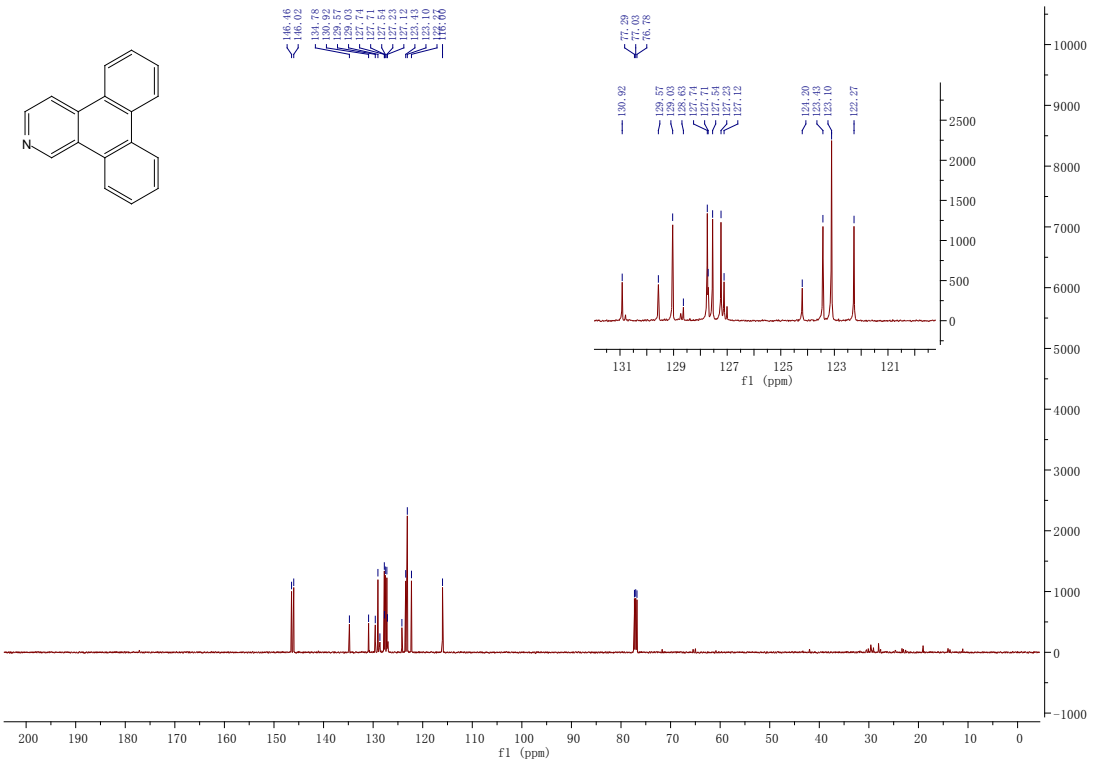
dibenzo[a,c]acridine (3j)



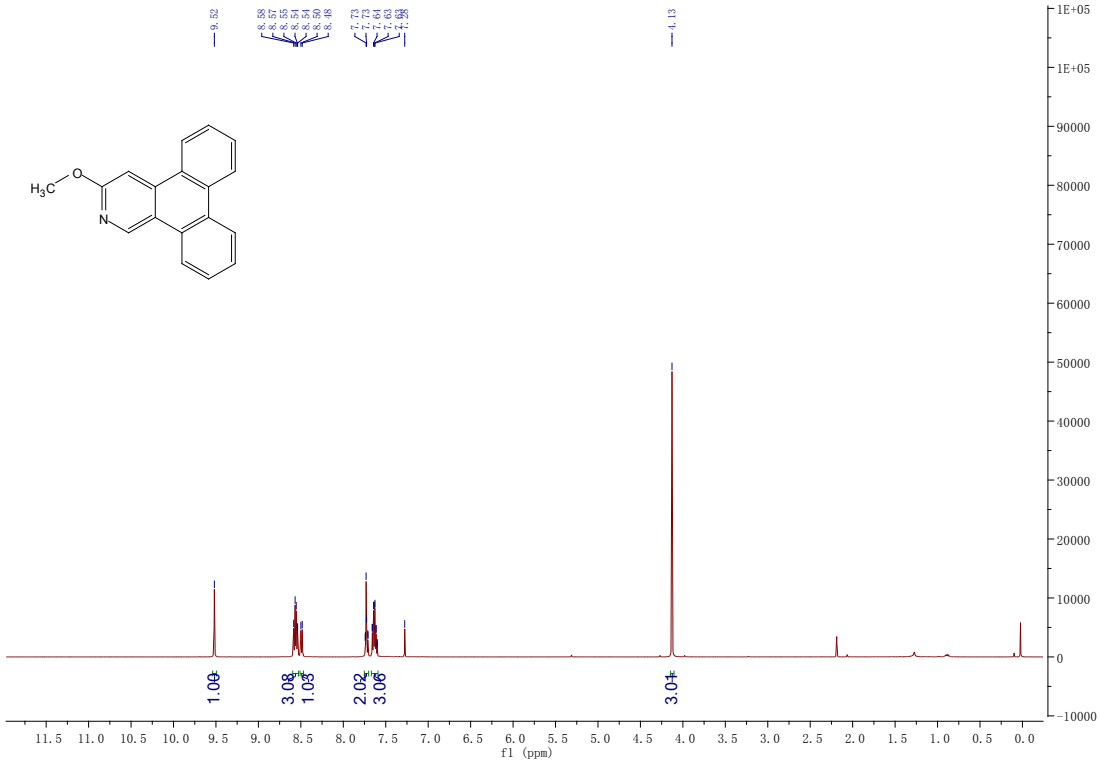


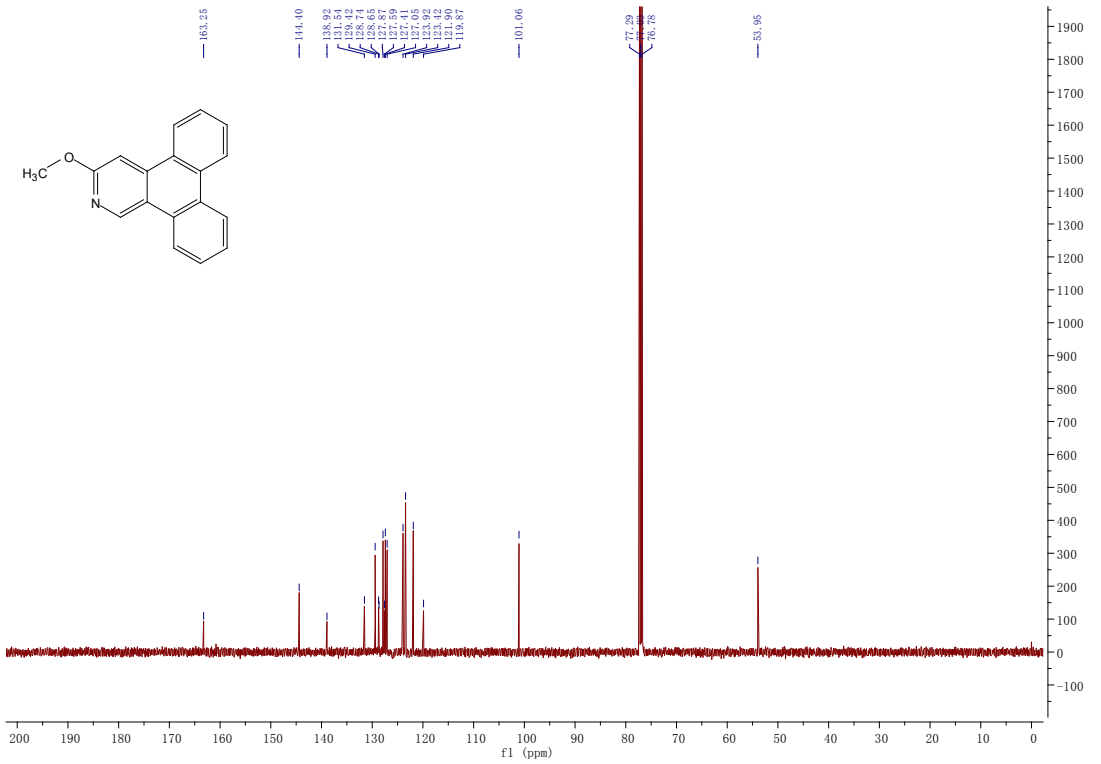
dibenzo[f,h]isoquinoline (3k)



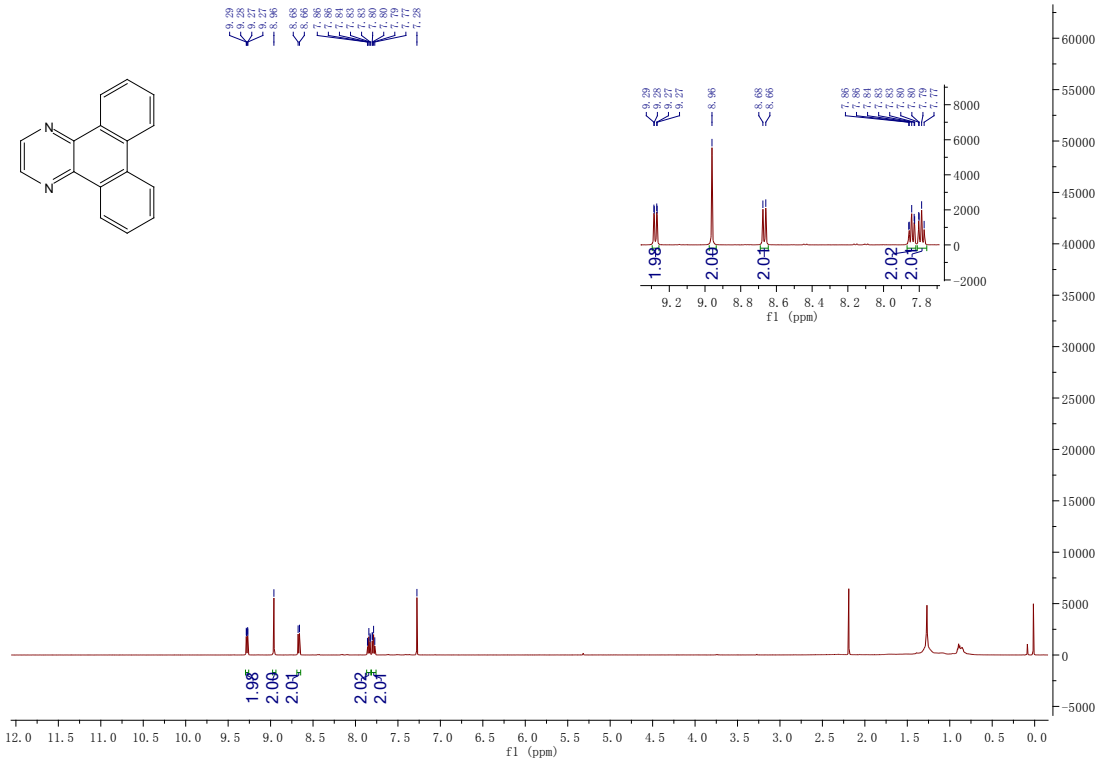


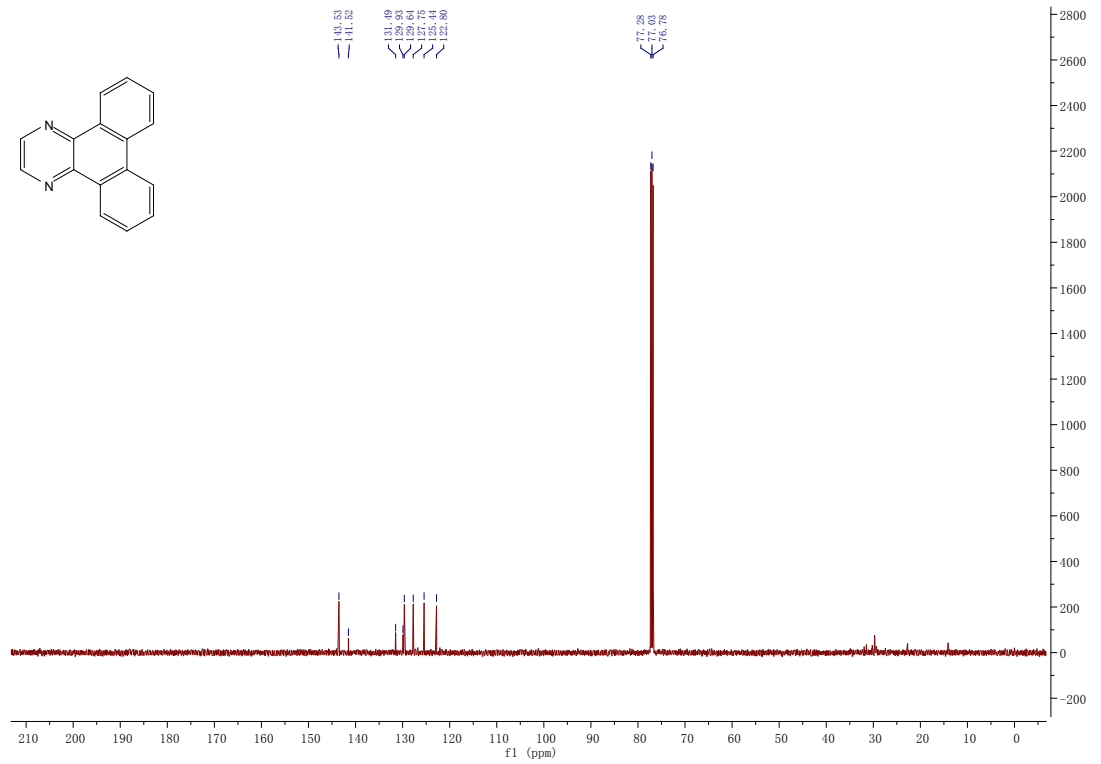
3-methoxydibenzo[f,h]isoquinoline (3l)



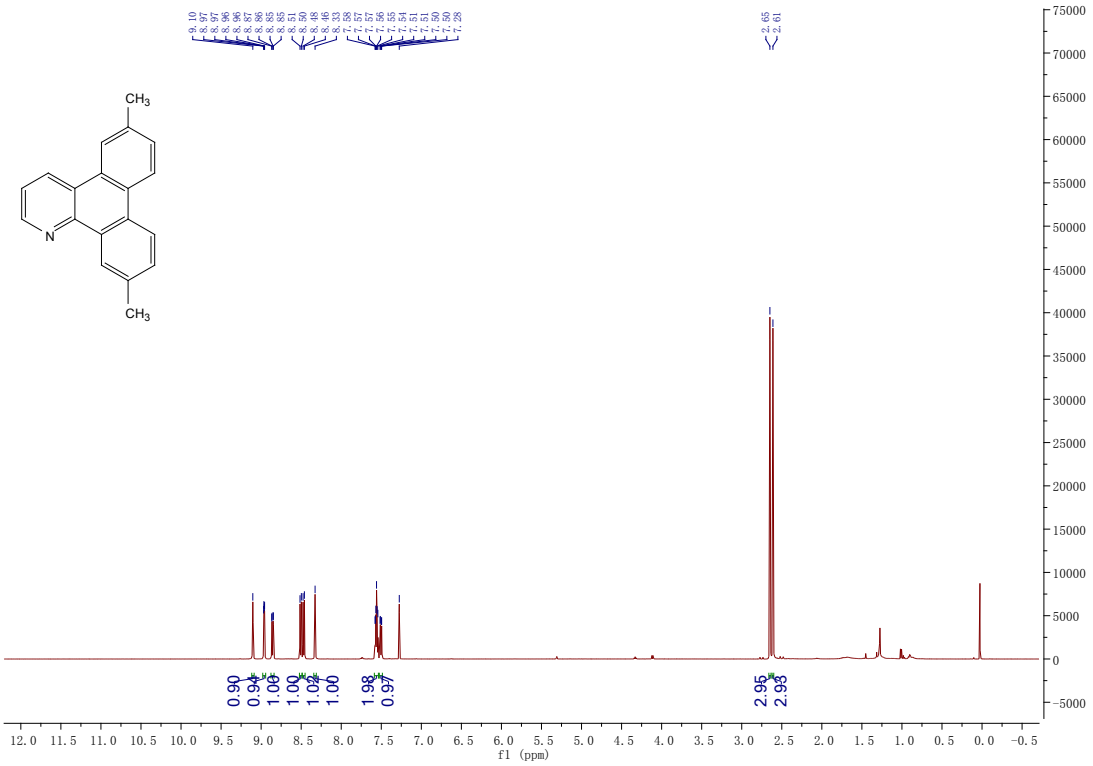


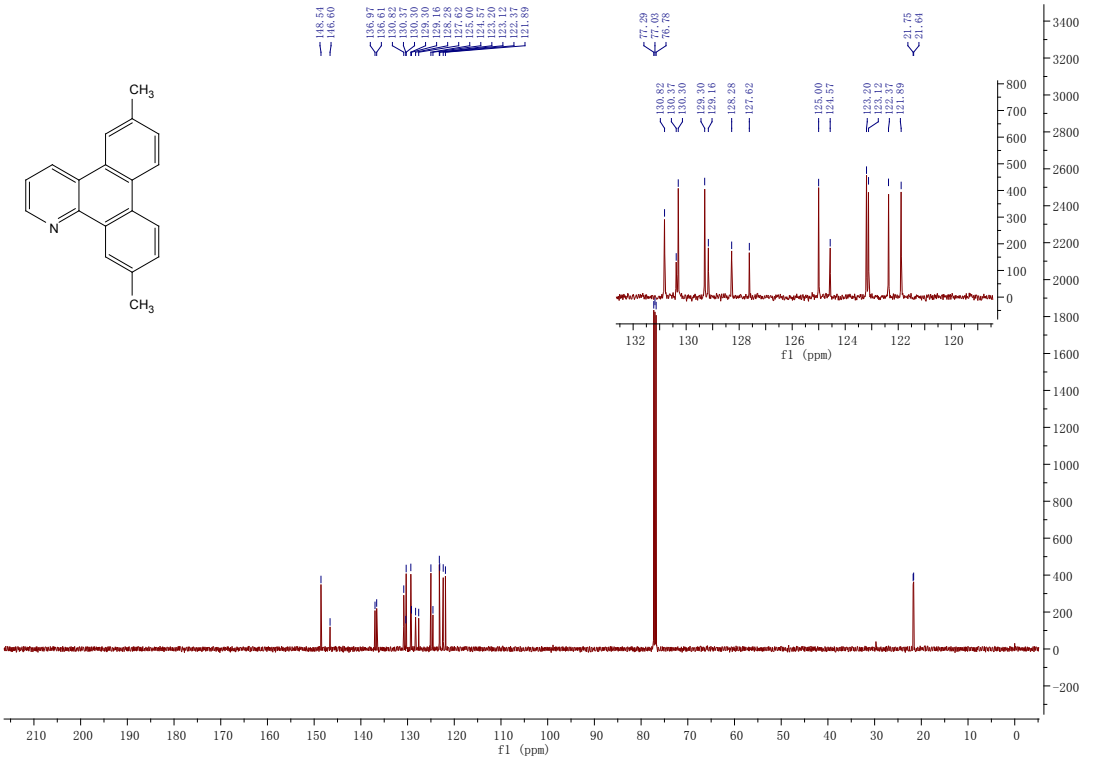
dibenzo[f,h]quinoxaline (3m)



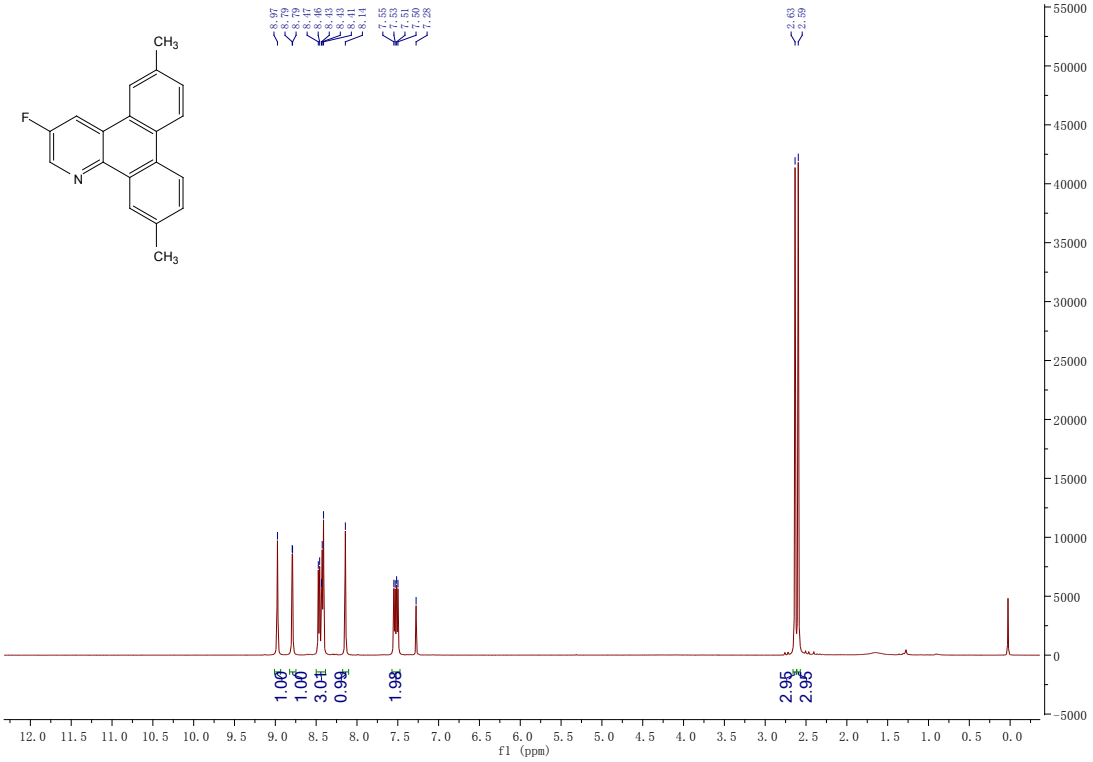


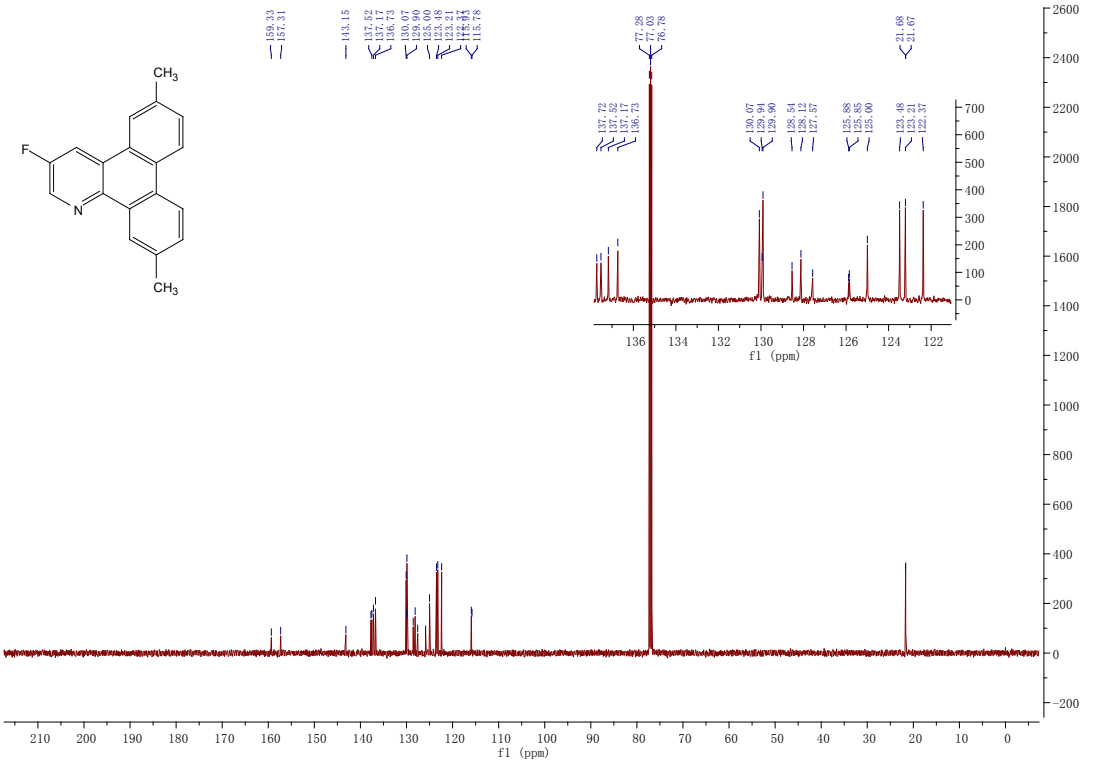
6,11-dimethyldibenzo[f,h]quinoline (3n)



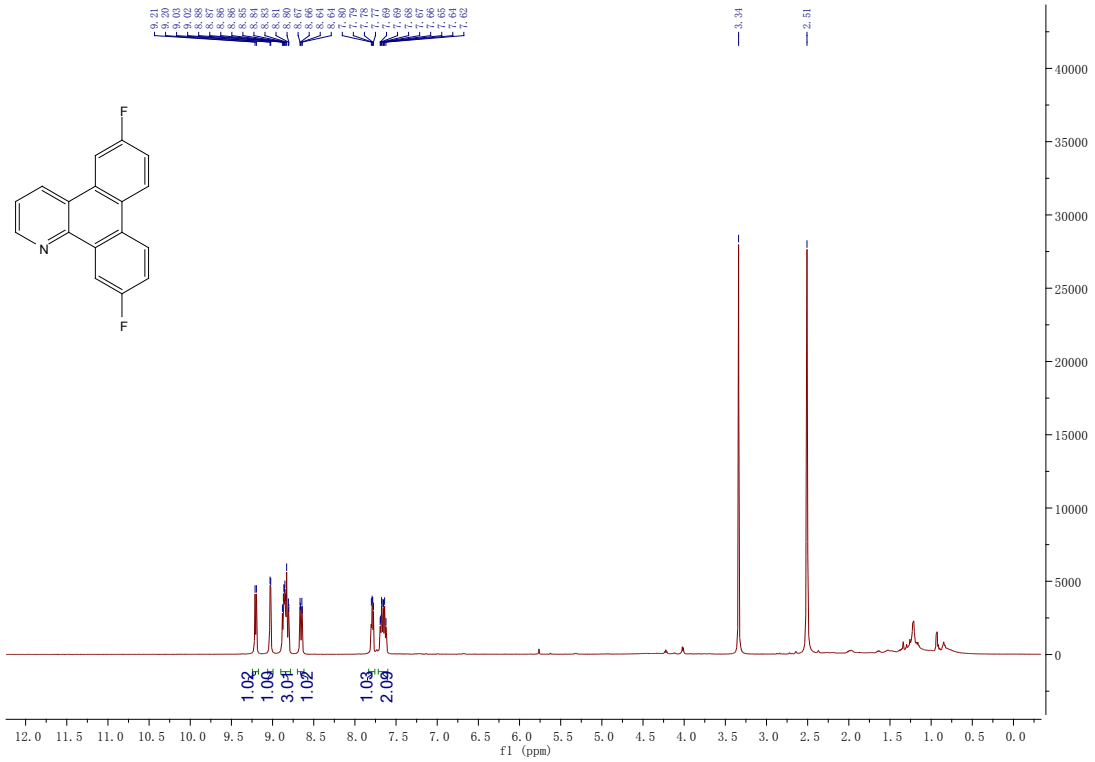


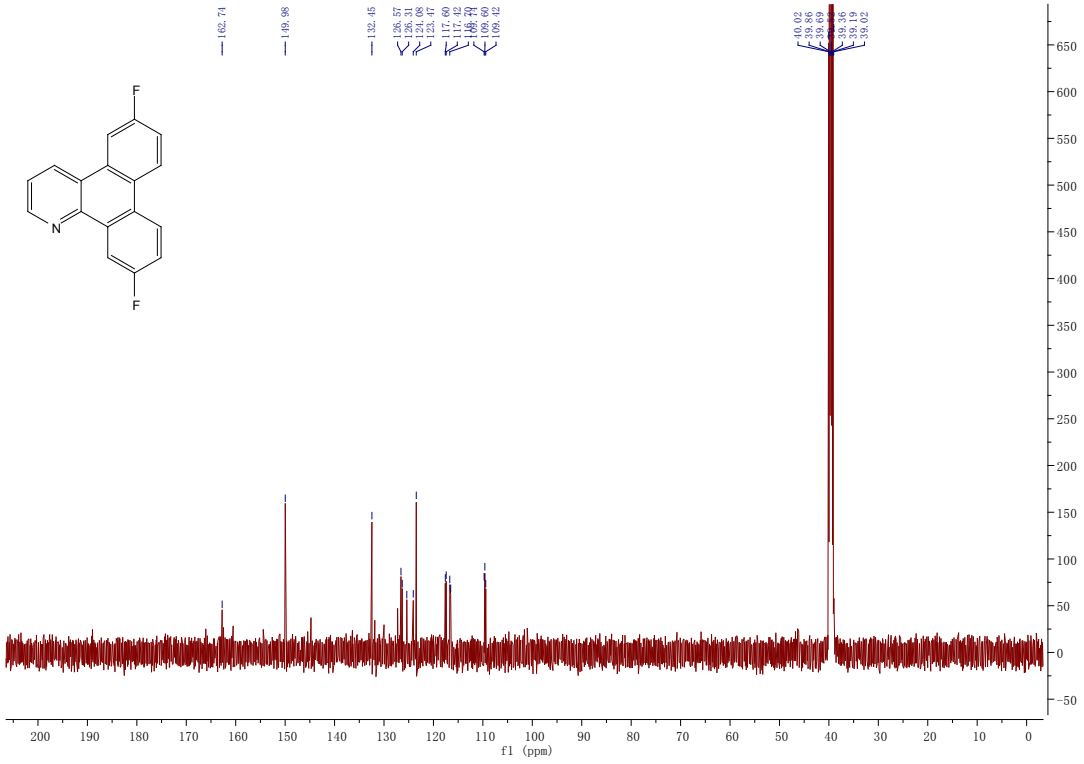
3-fluoro-6,11-dimethyldibenzo[f,h]quinoline (3o)



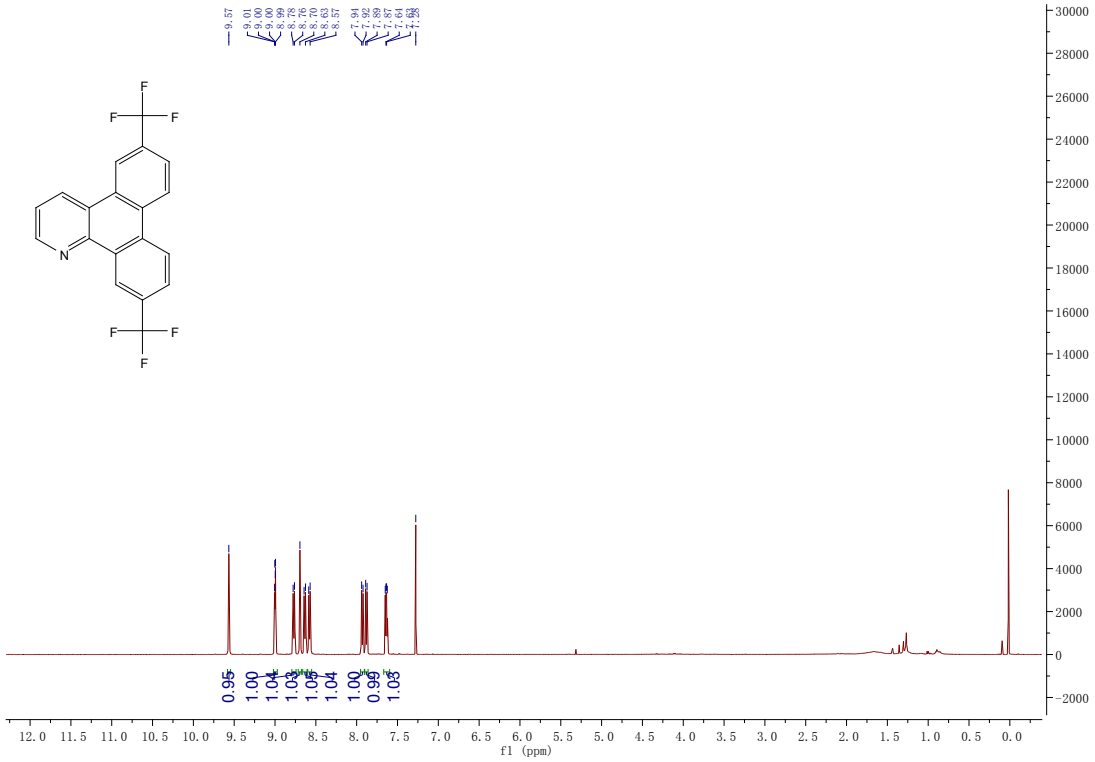


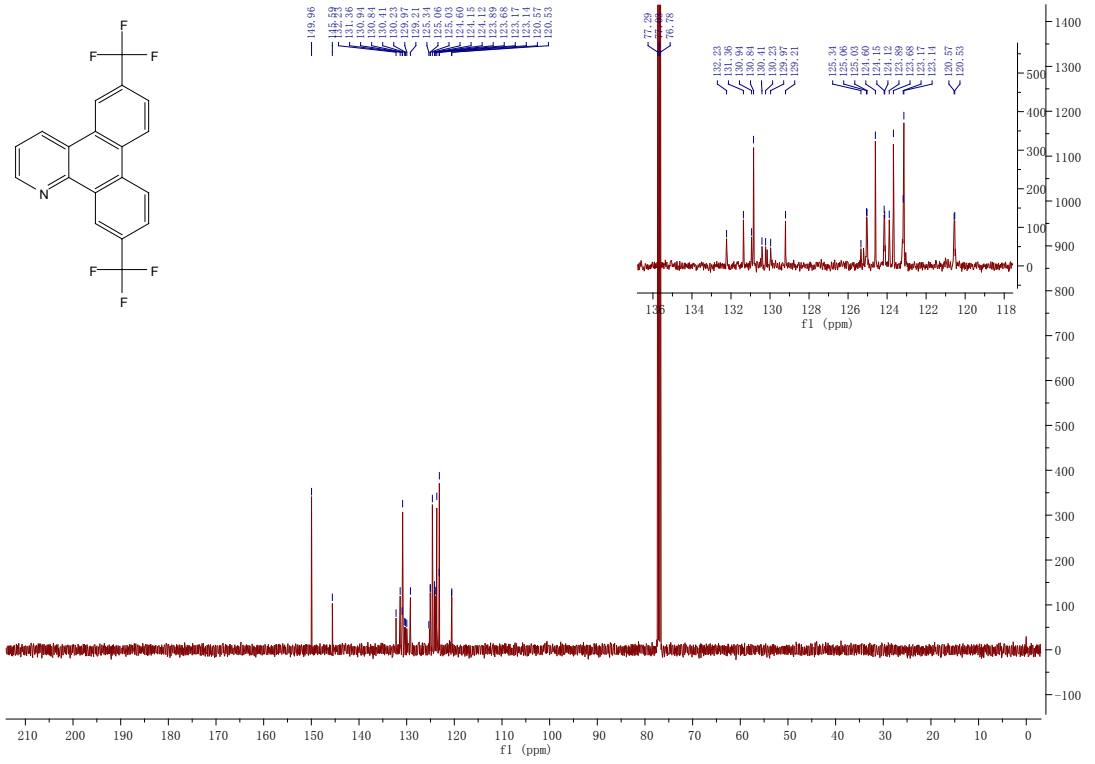
6,11-difluorodibenzo[f,h]quinoline (3p)



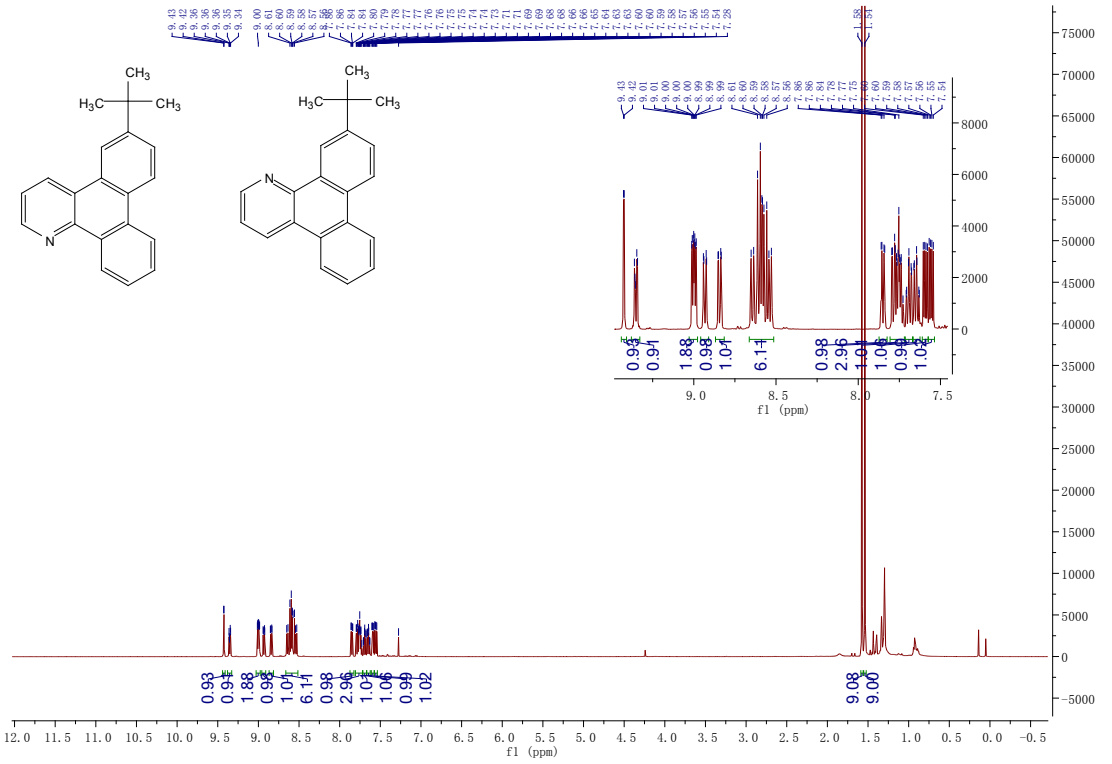


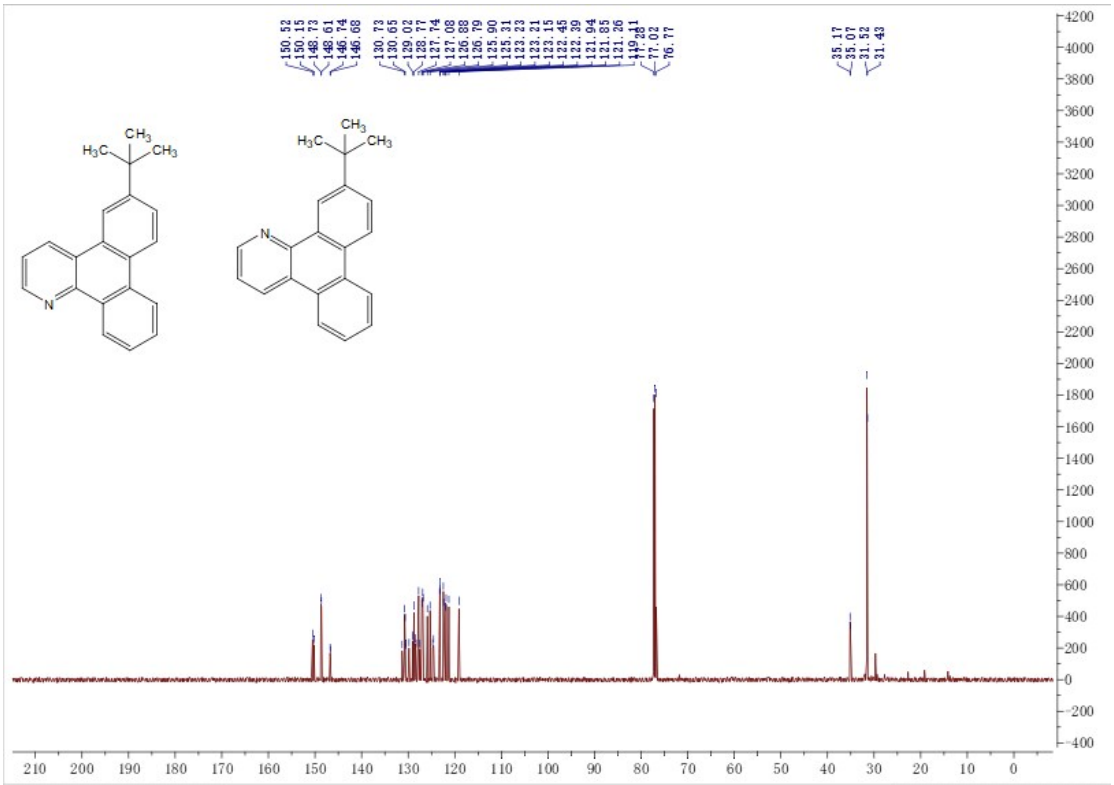
6,11-bis(trifluoromethyl)dibenzo[f,h]quinoline (3q)



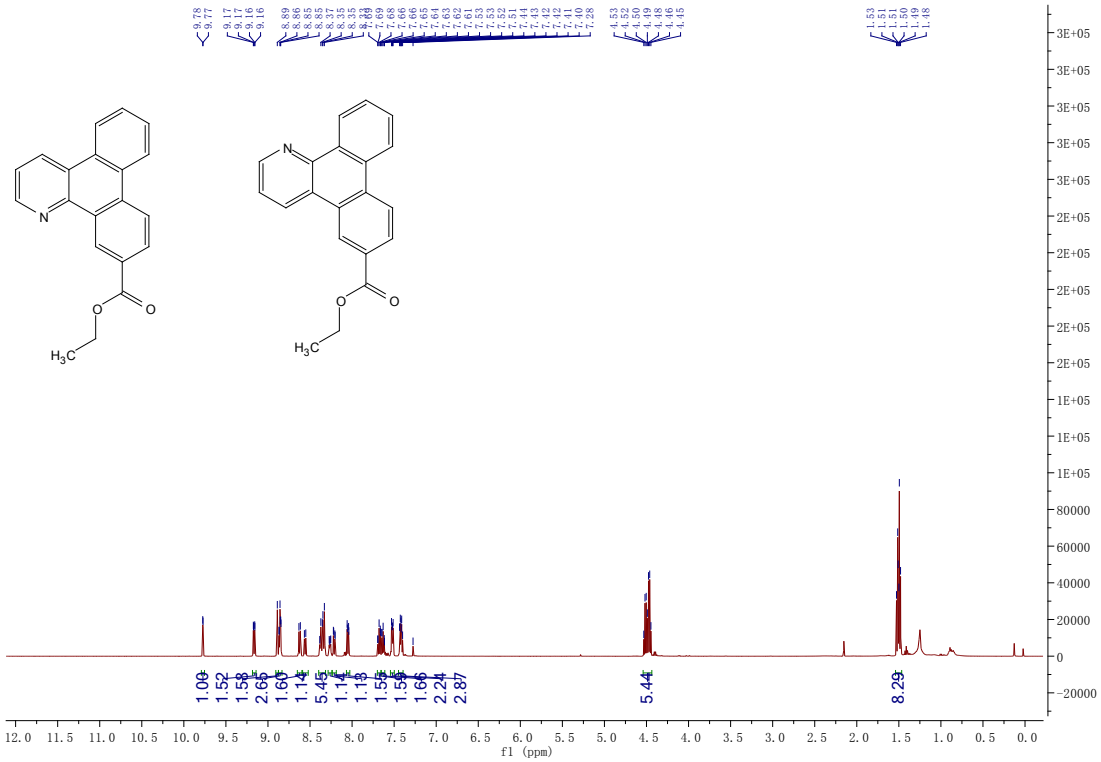


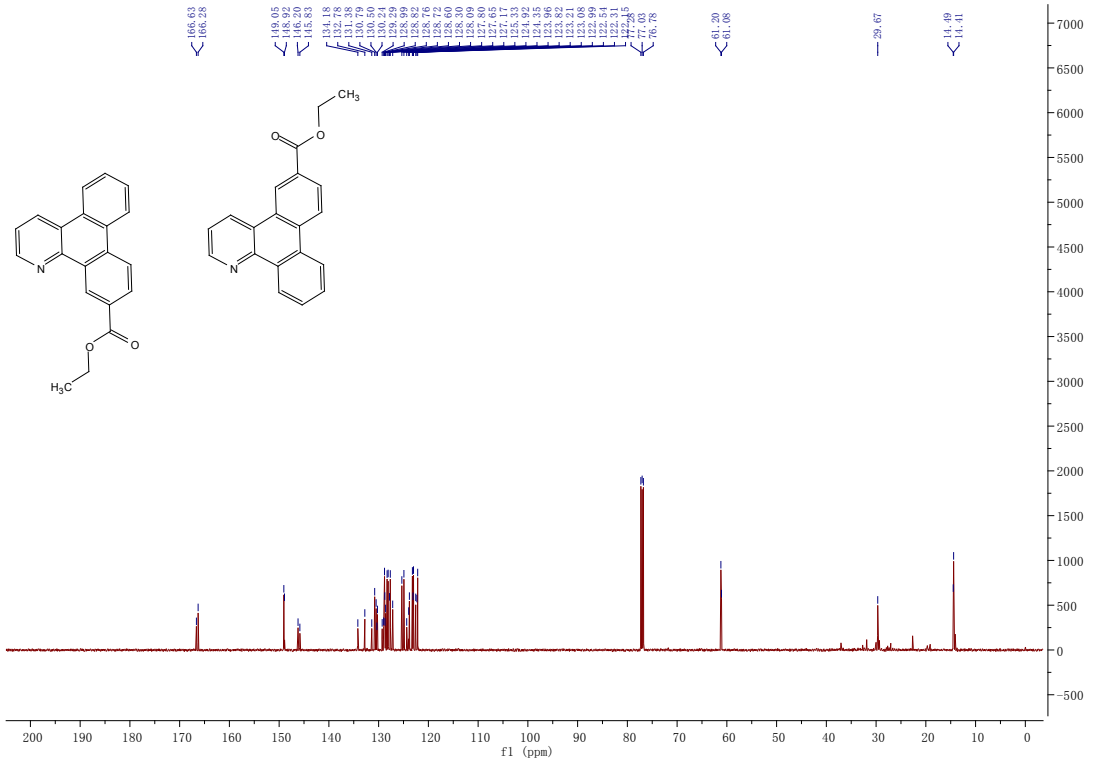
6-(tert-butyl)dibenzo[f,h]quinoline (3r) and 11-(tert-butyl)dibenzo[f,h]quinoline (3r')



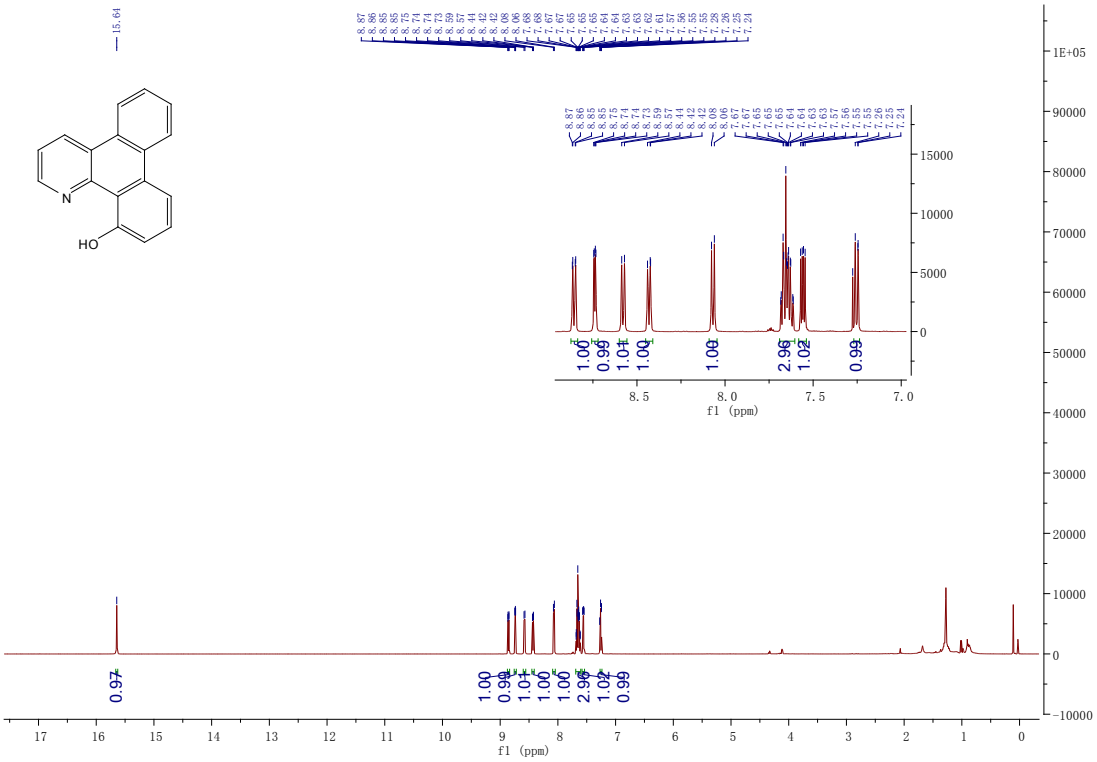


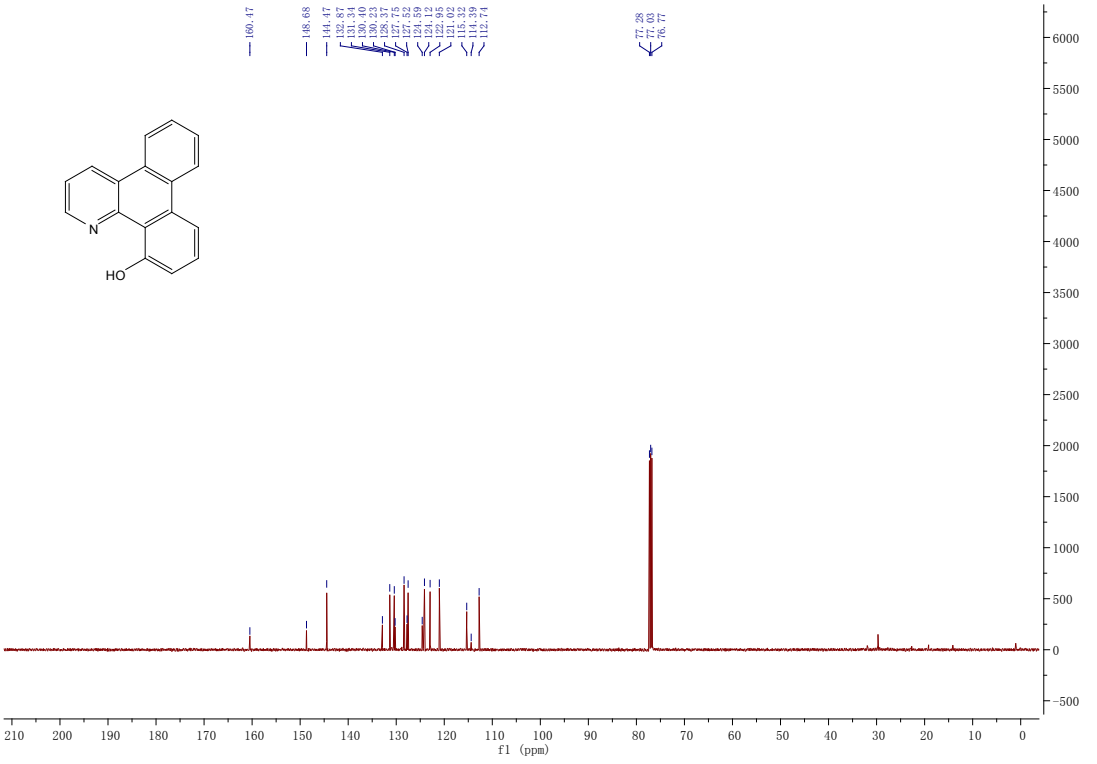
ethyl dibenzo[f,h]quinoline-11-carboxylate (3s) and ethyl dibenzo[f,h]quinoline-6-carboxylate (3s')



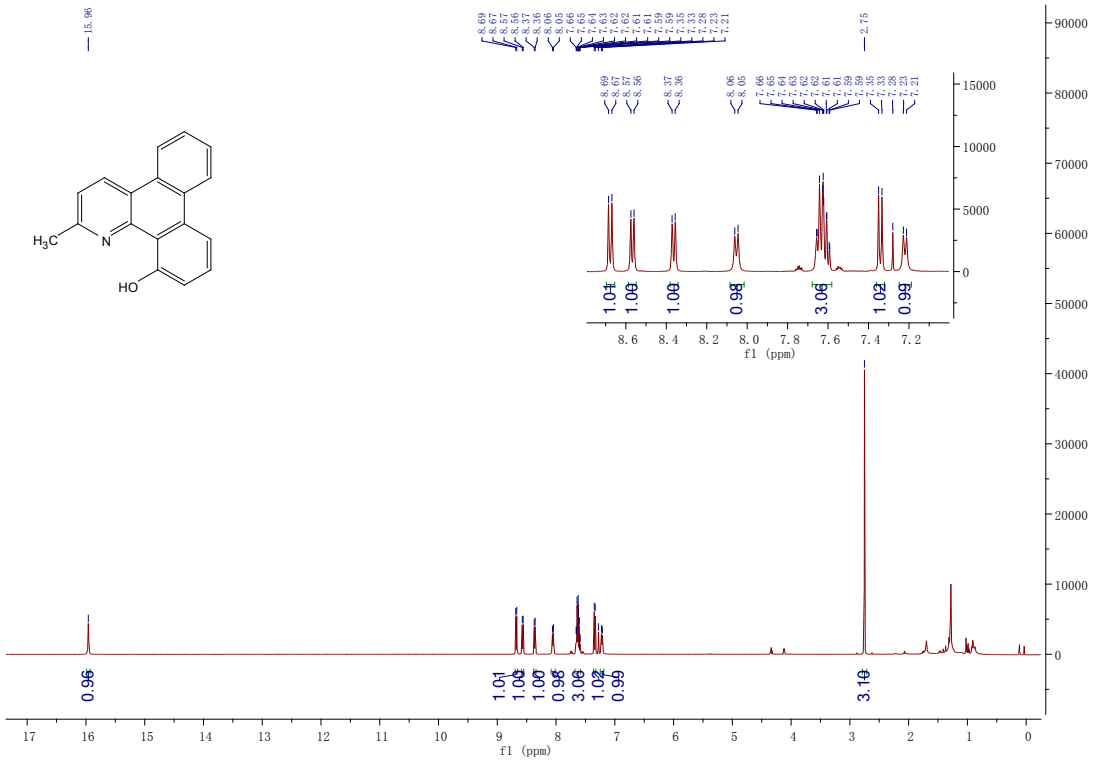


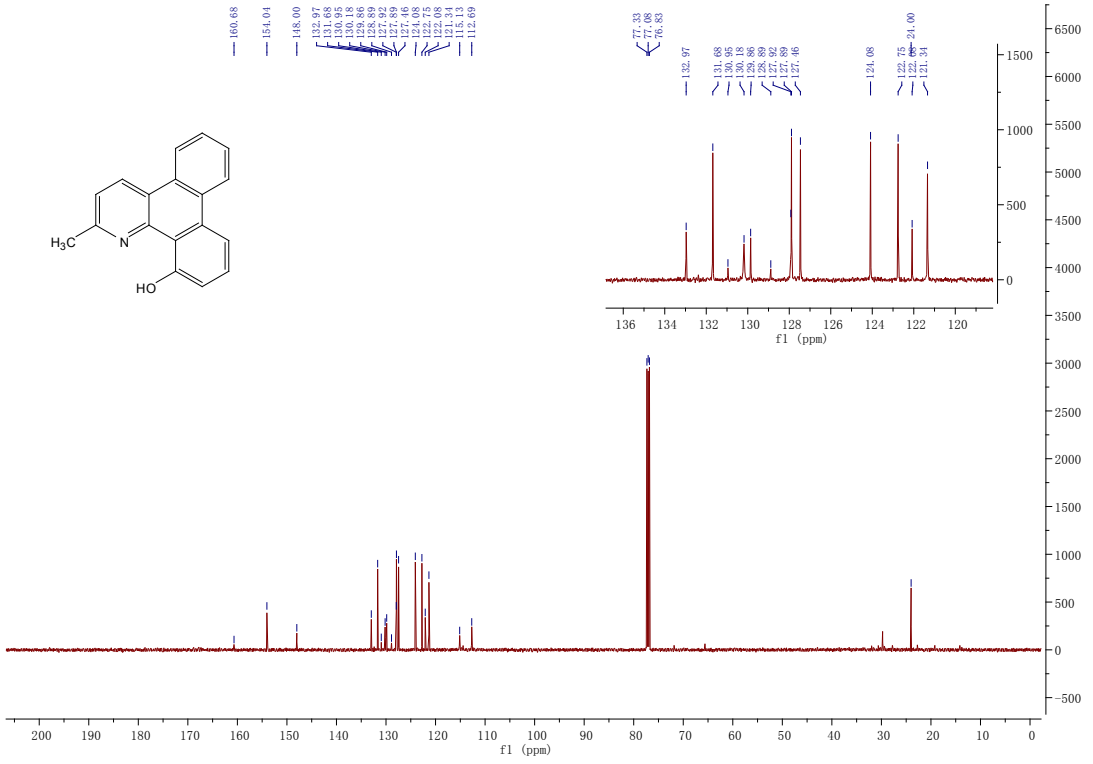
dibenzo[f,h]quinolin-12-ol (5a)



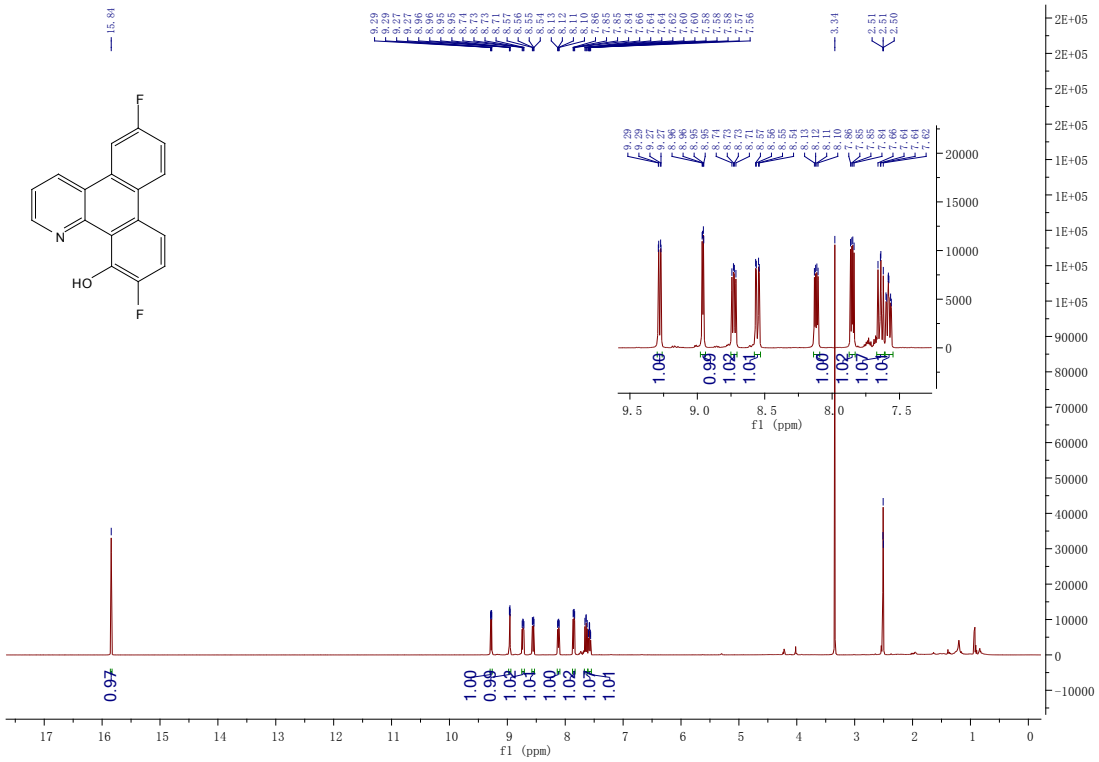


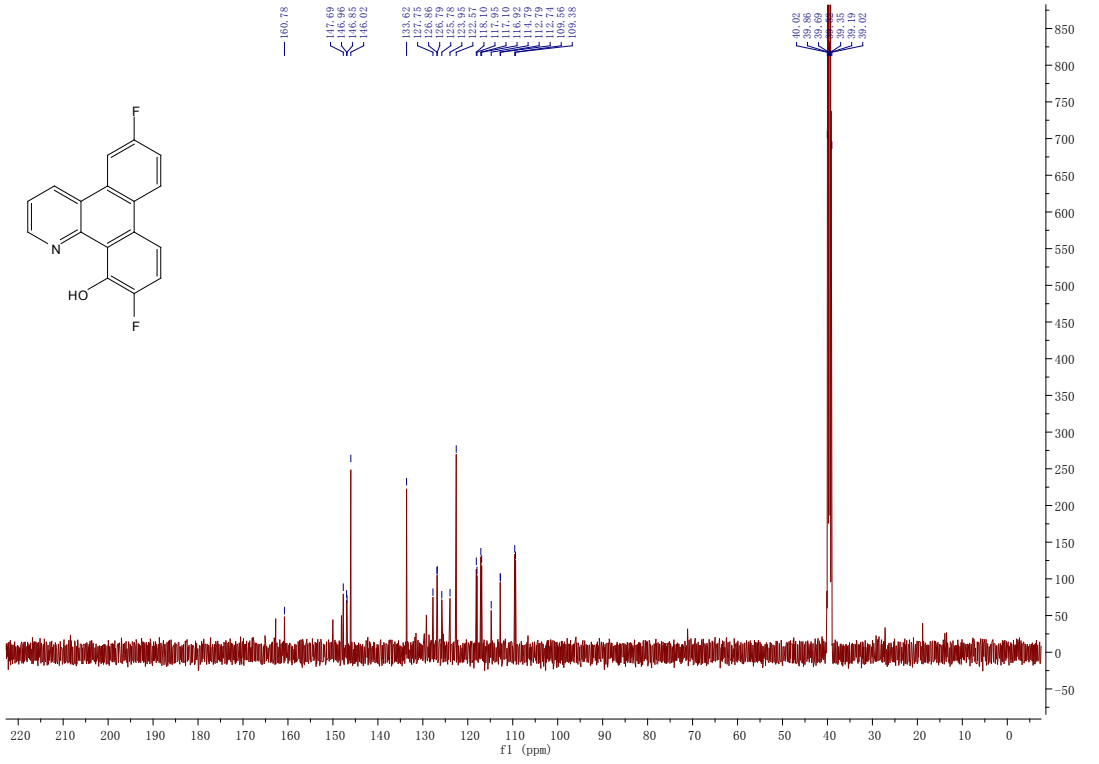
2-methyldibenzo[f,h]quinolin-12-ol (5b)



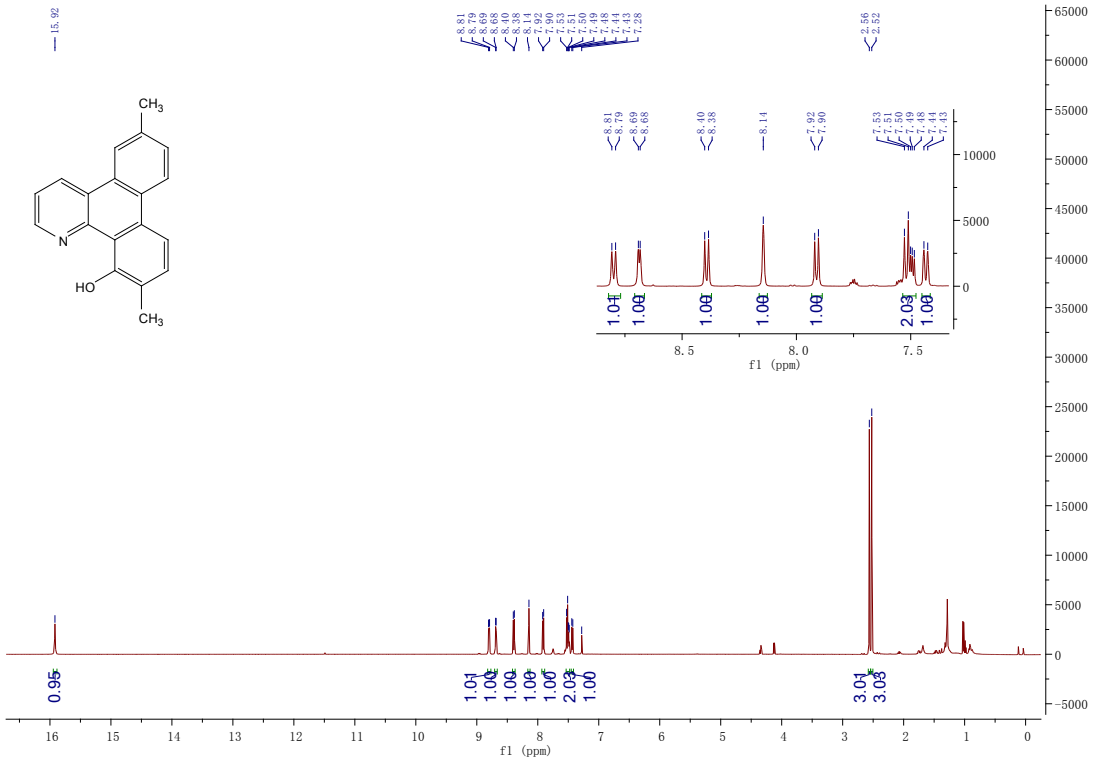


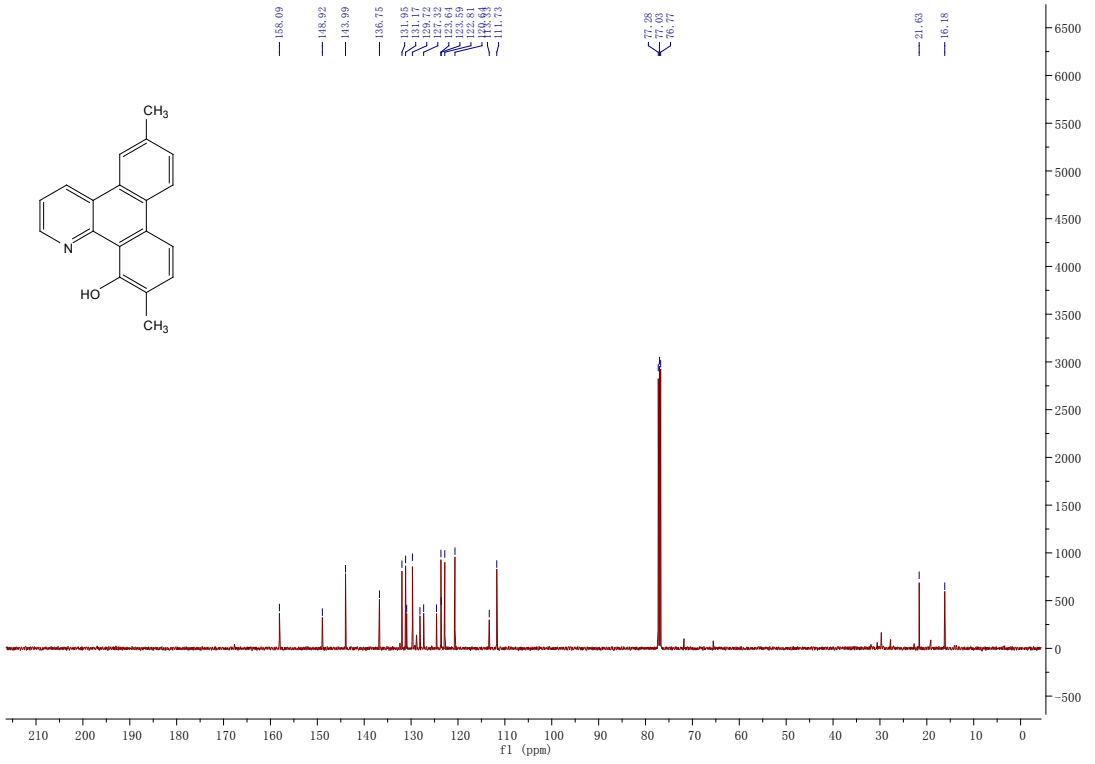
6,11-difluorodibenzo[f,h]quinolin-12-ol (5c)



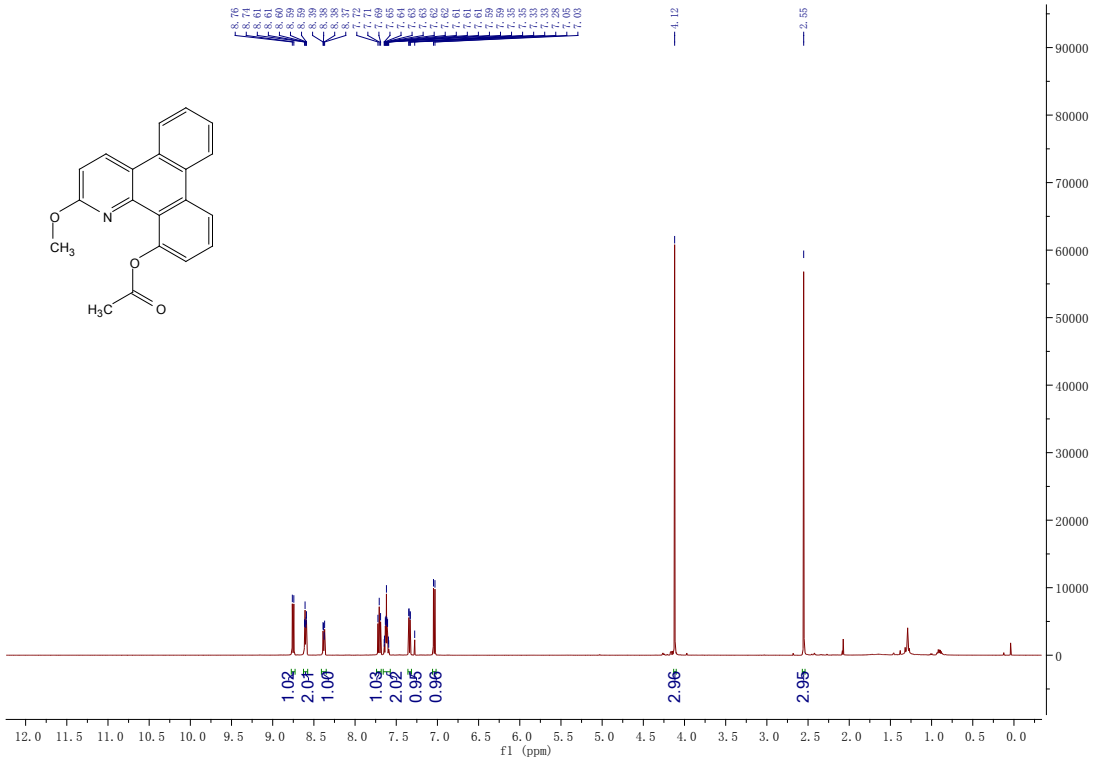


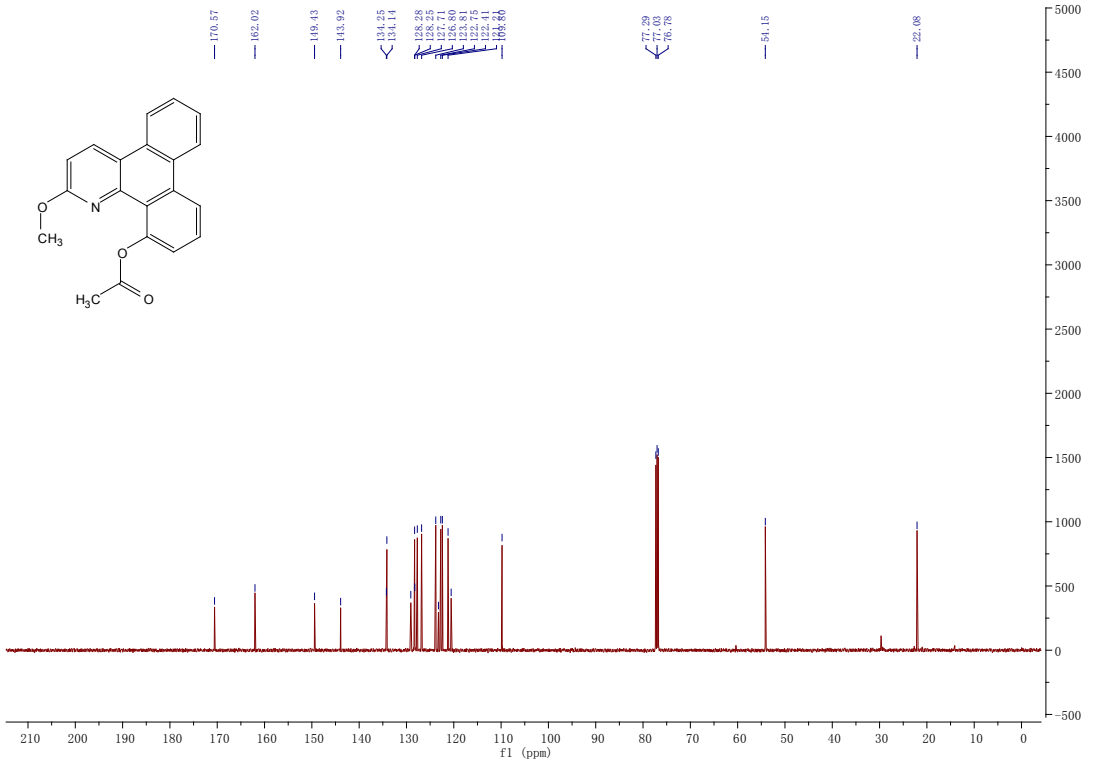
6,11-dimethyldibenzo[f,h]quinolin-12-ol (5d)



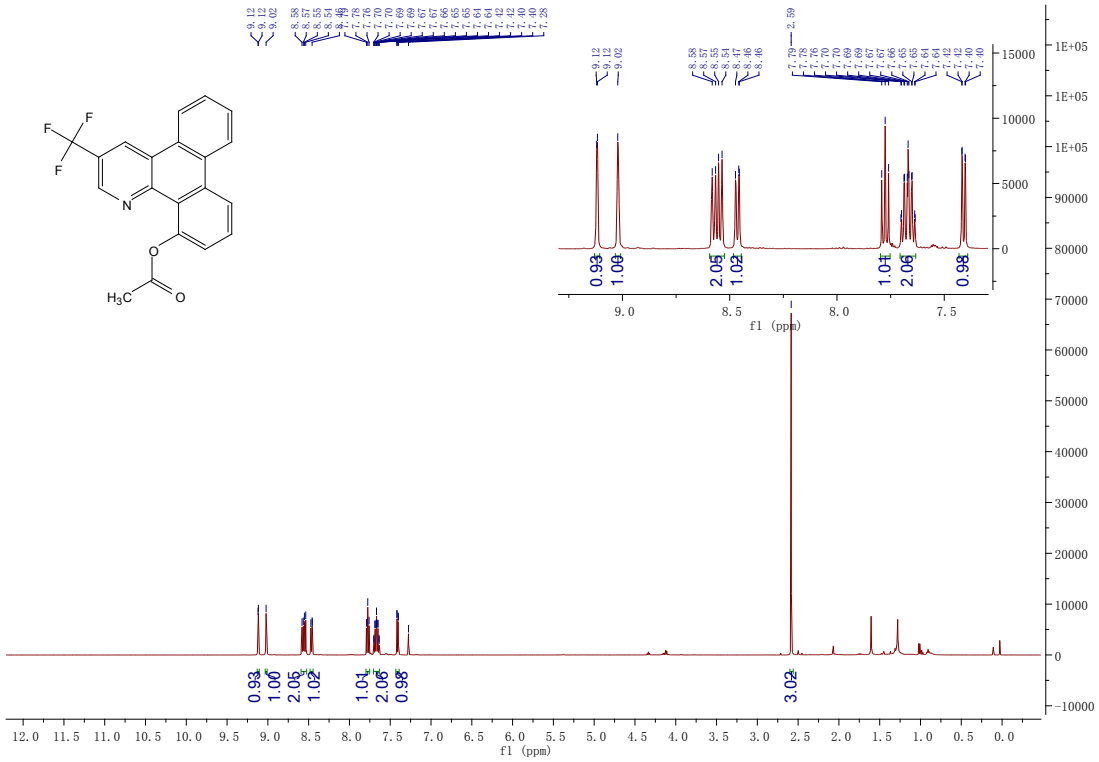


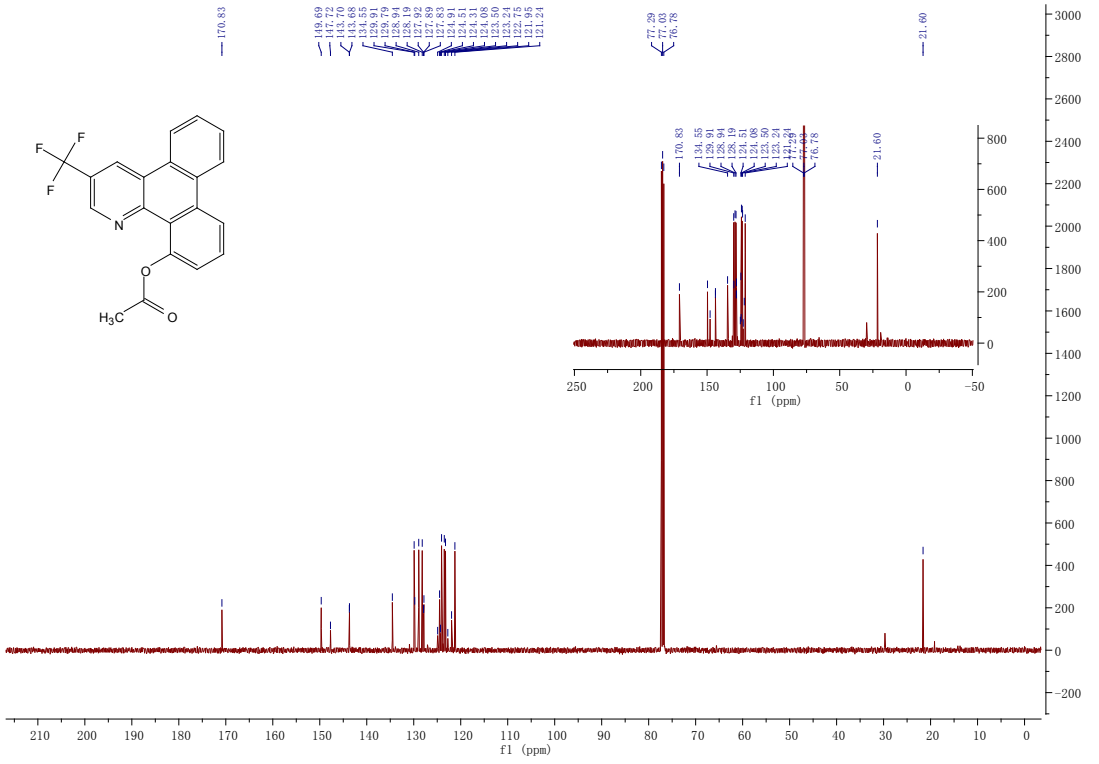
2-methoxydibenzo[f,h]quinolin-12-yl acetate (5e)



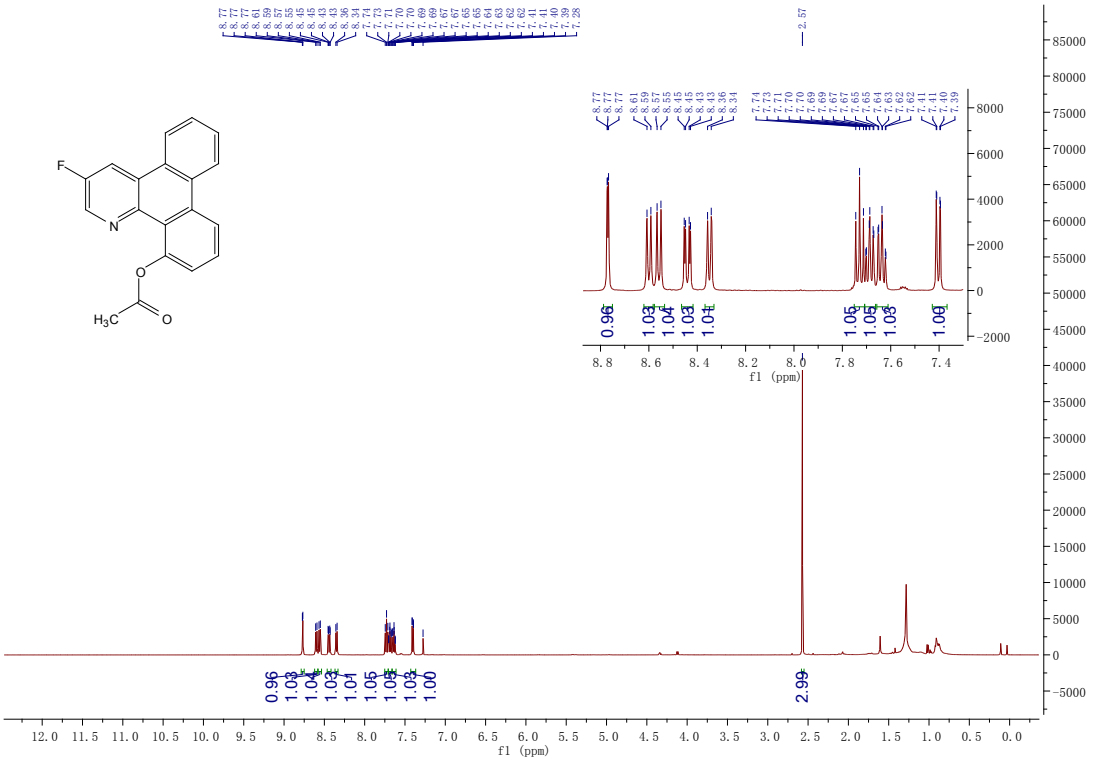


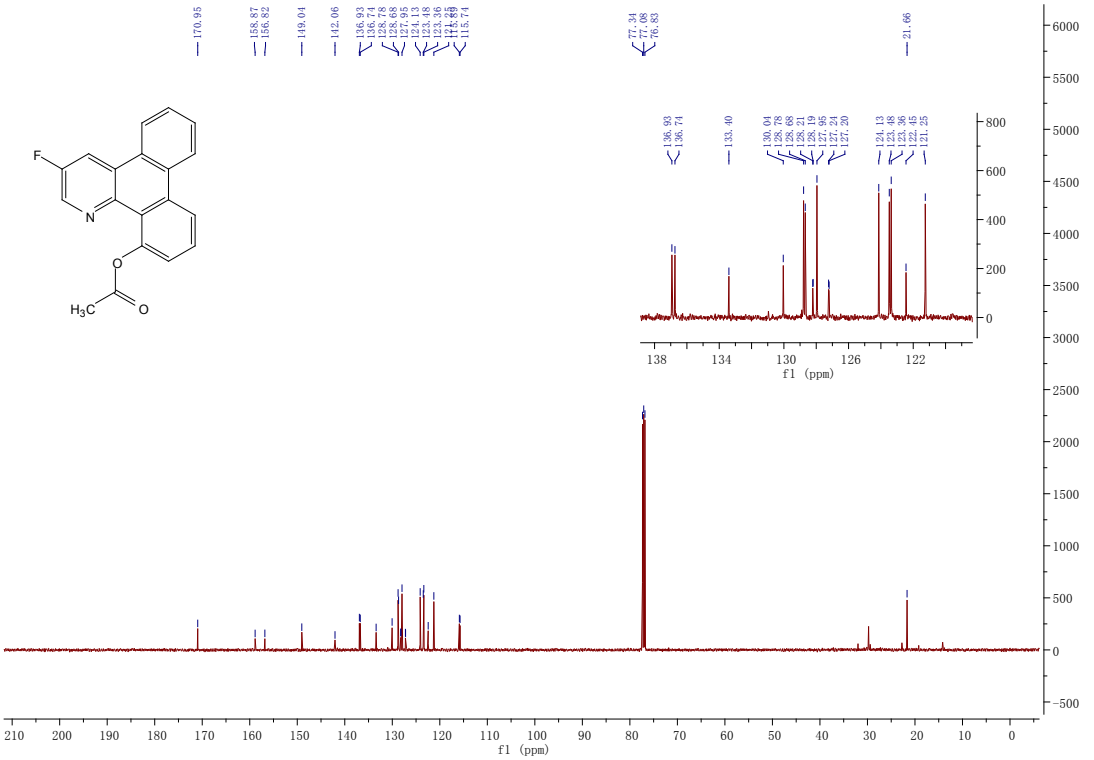
3-(trifluoromethyl)dibenzo[f,h]quinolin-12-yl acetate (5f)



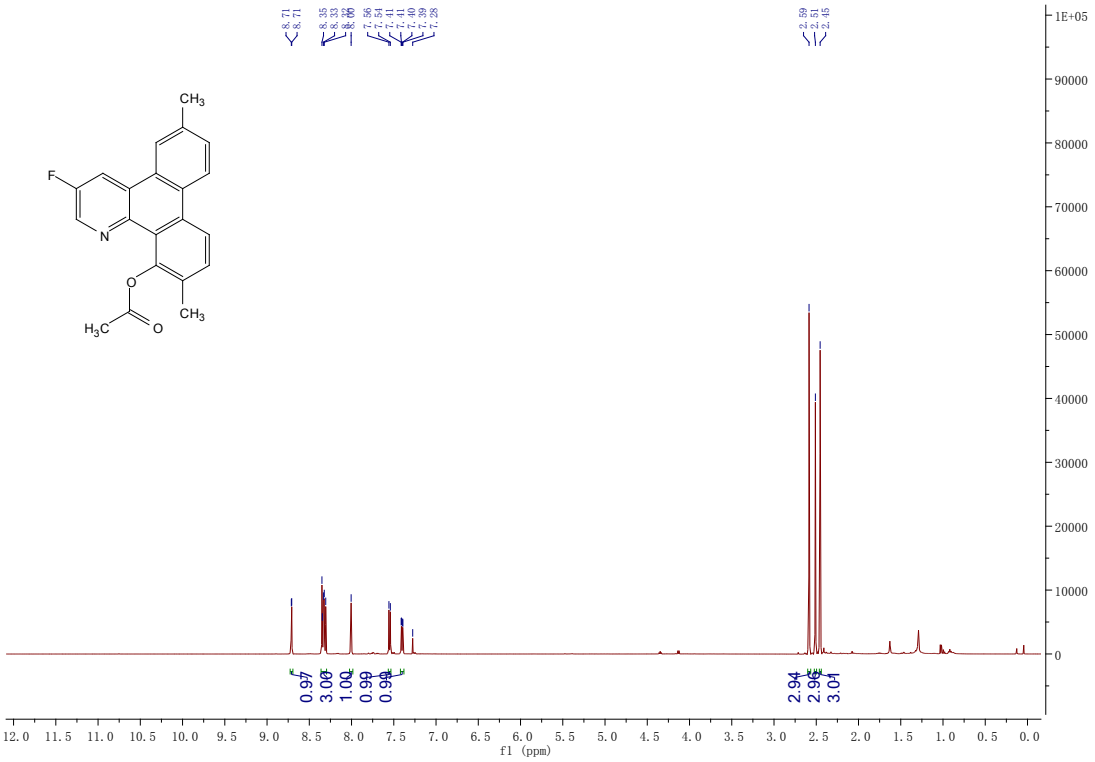


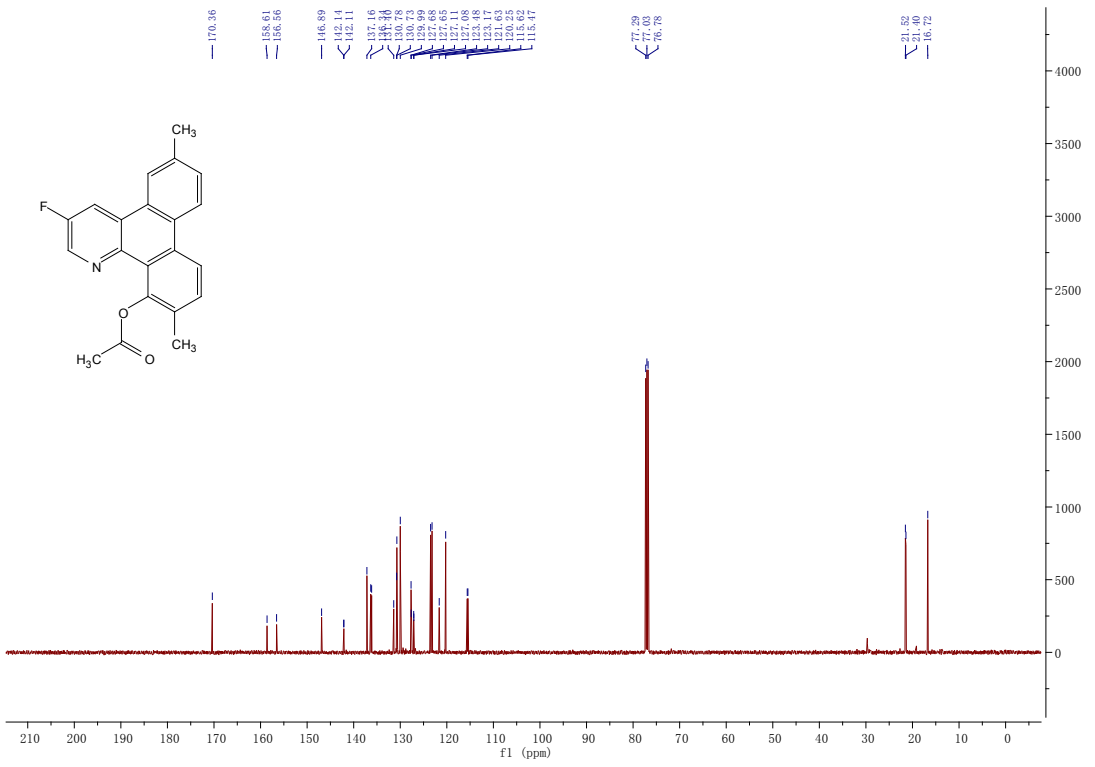
3-fluorodibenzo[f,h]quinolin-12-yl acetate (5g)



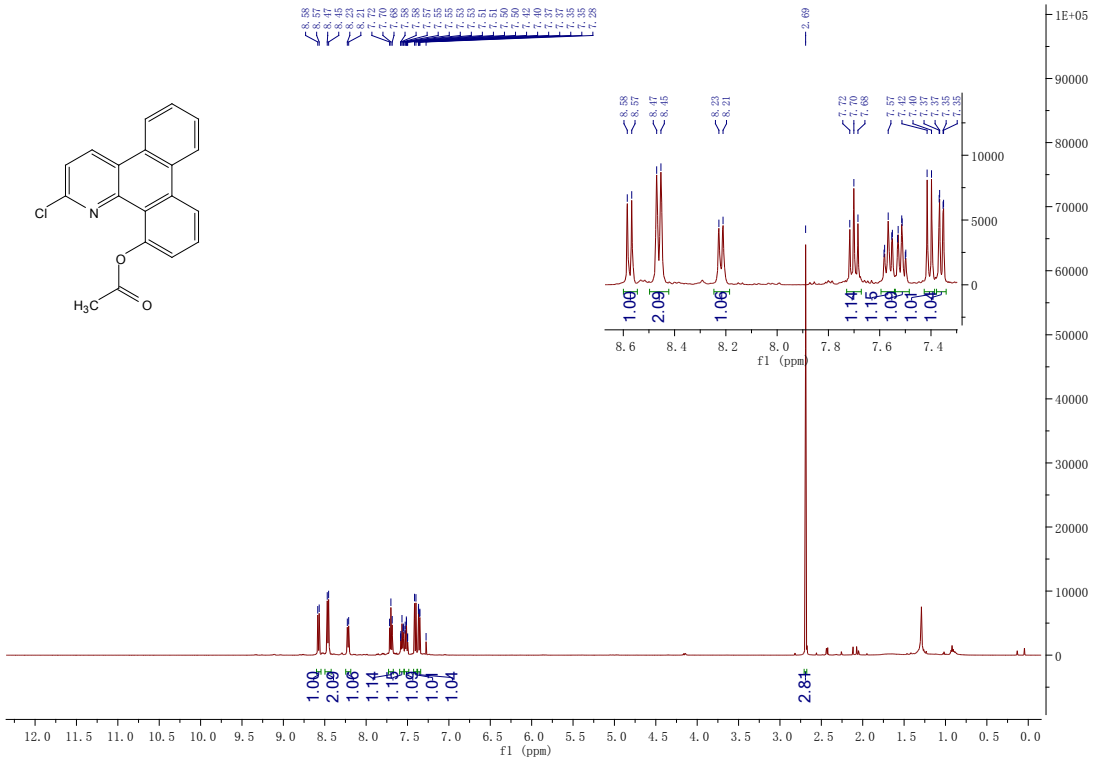


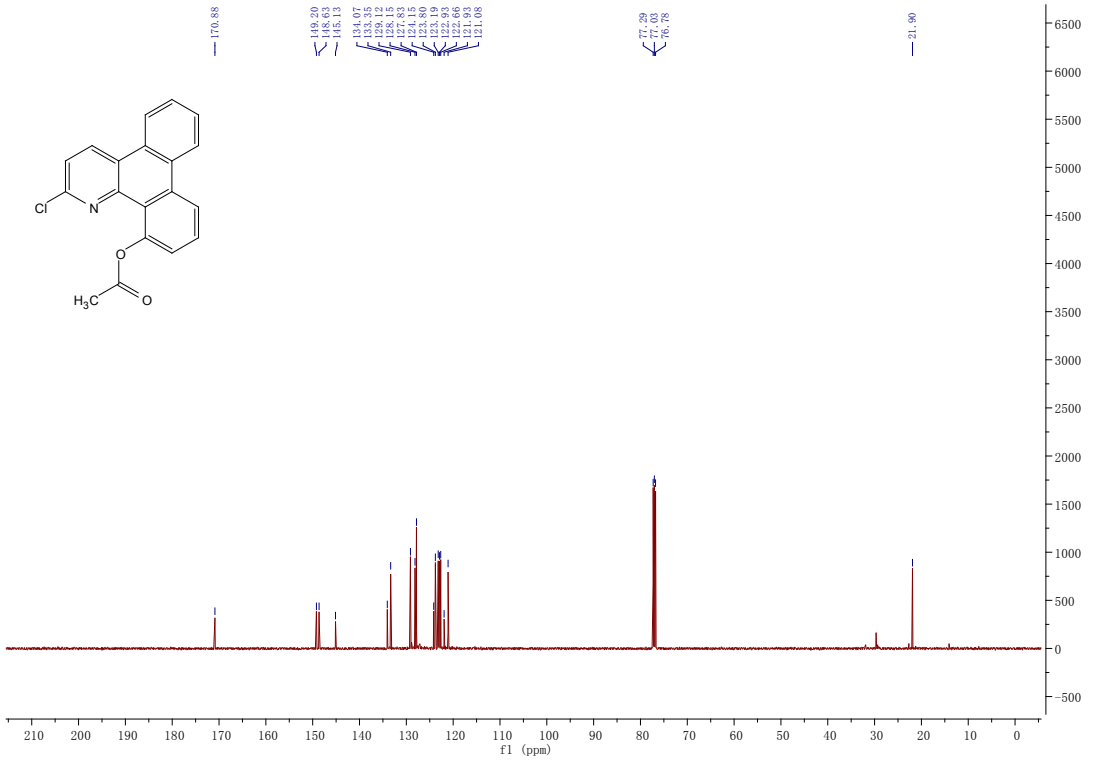
3-fluoro-6,11-dimethyldibenzo[f,h]quinolin-12-yl acetate (5h)



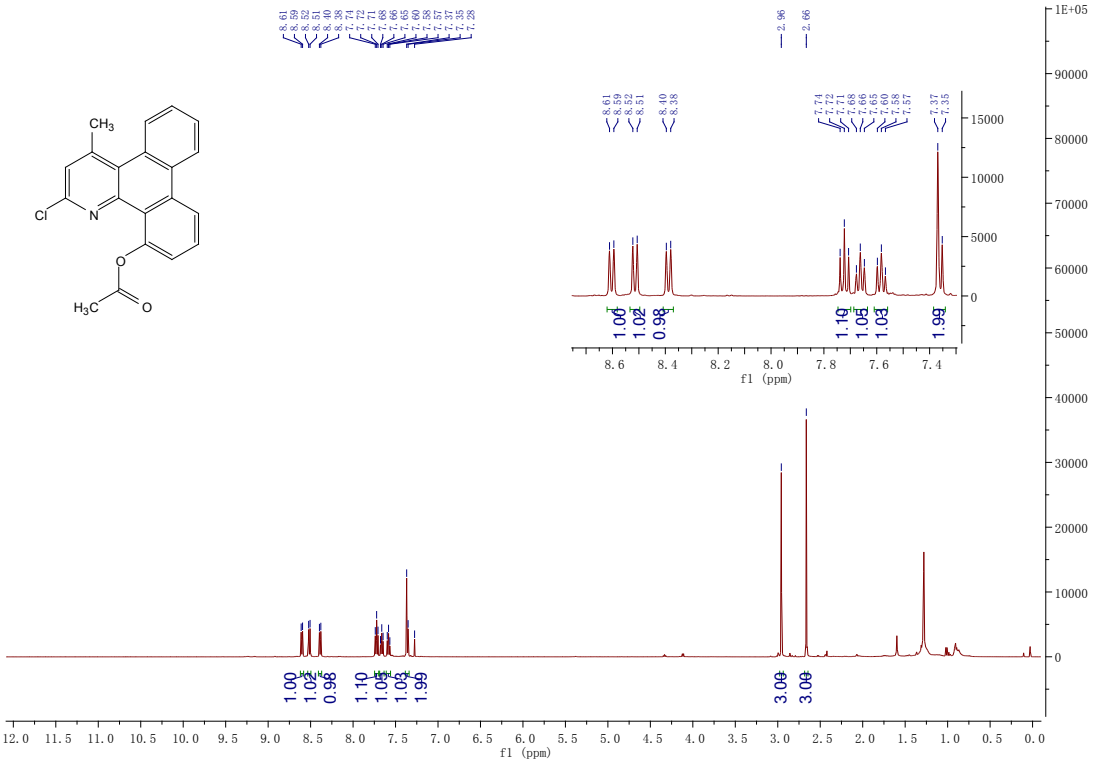


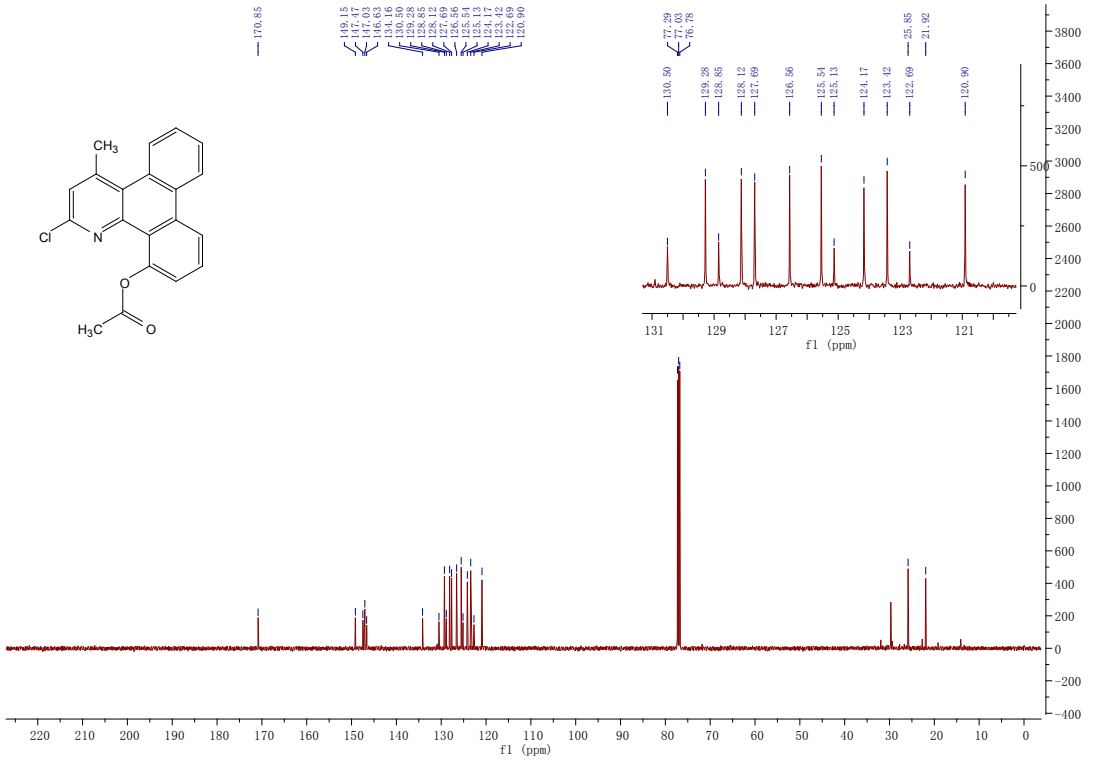
2-chlorodibenzo[f,h]quinolin-12-yl acetate (5i)



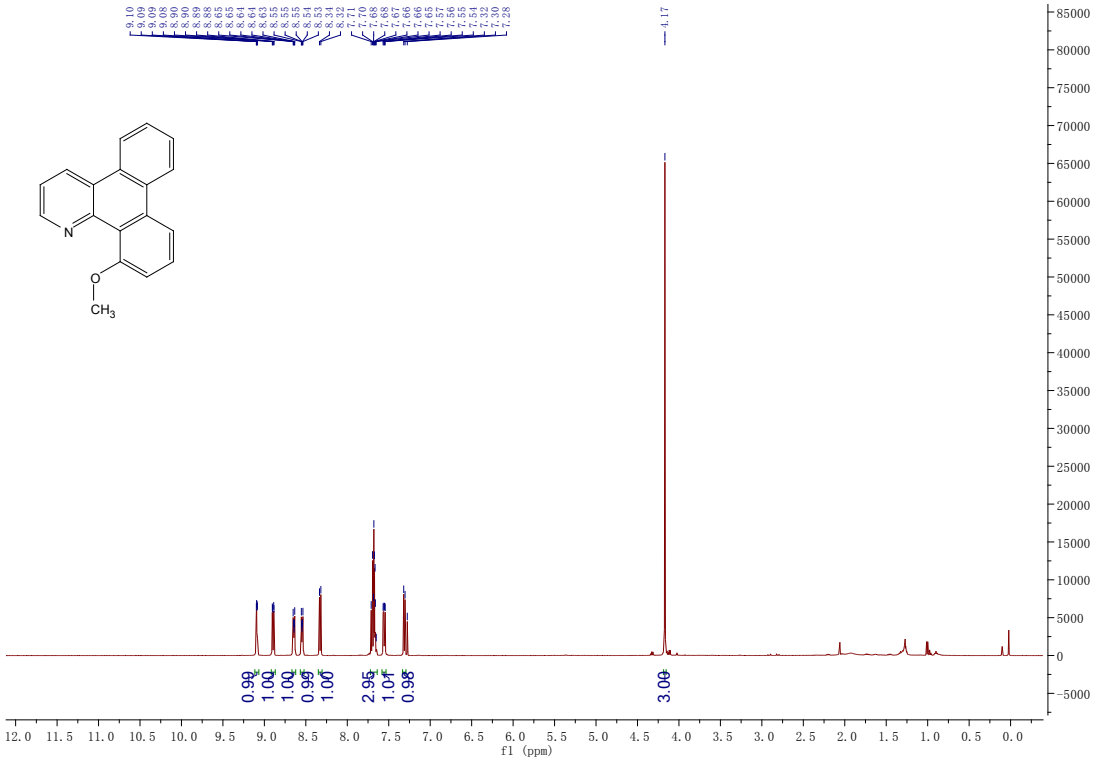


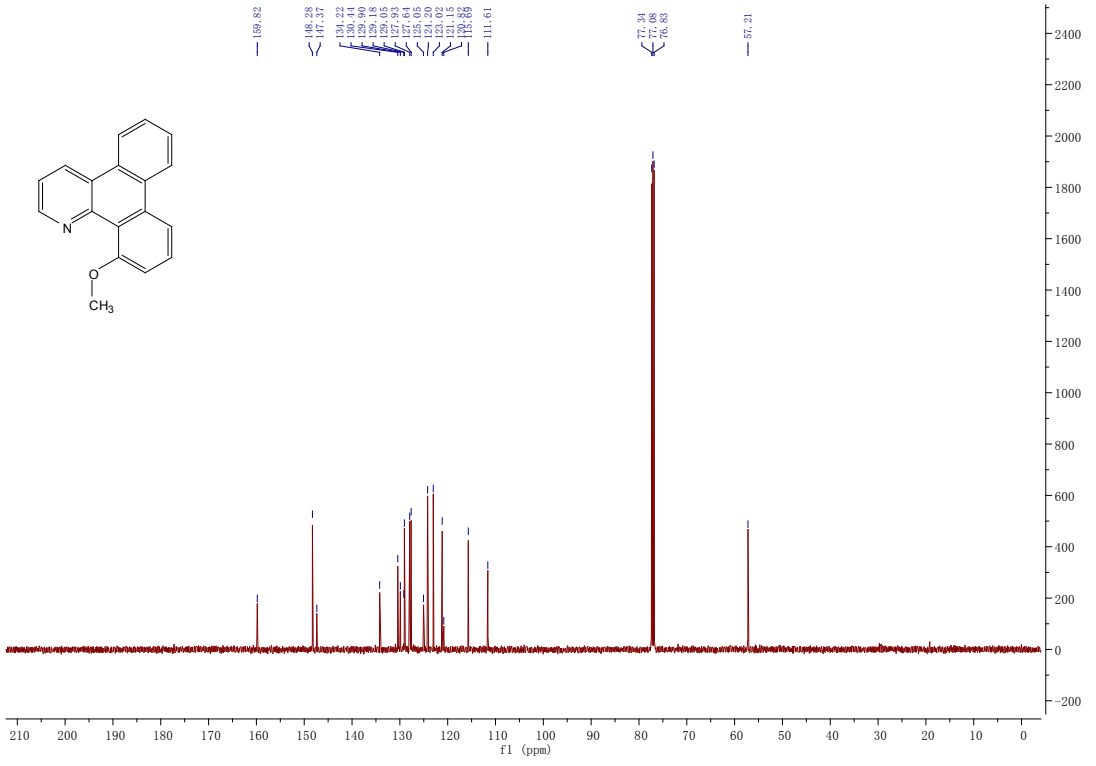
2-chloro-4-methyldibenzo[f,h]quinolin-12-yl acetate (5j)



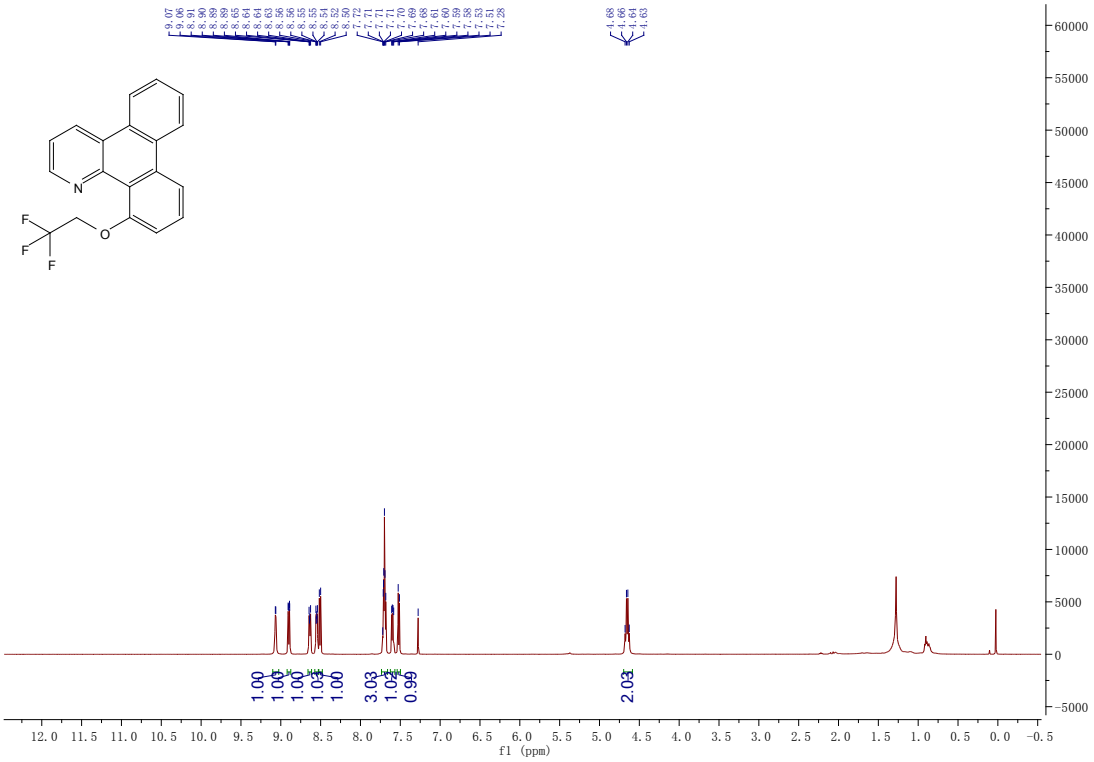


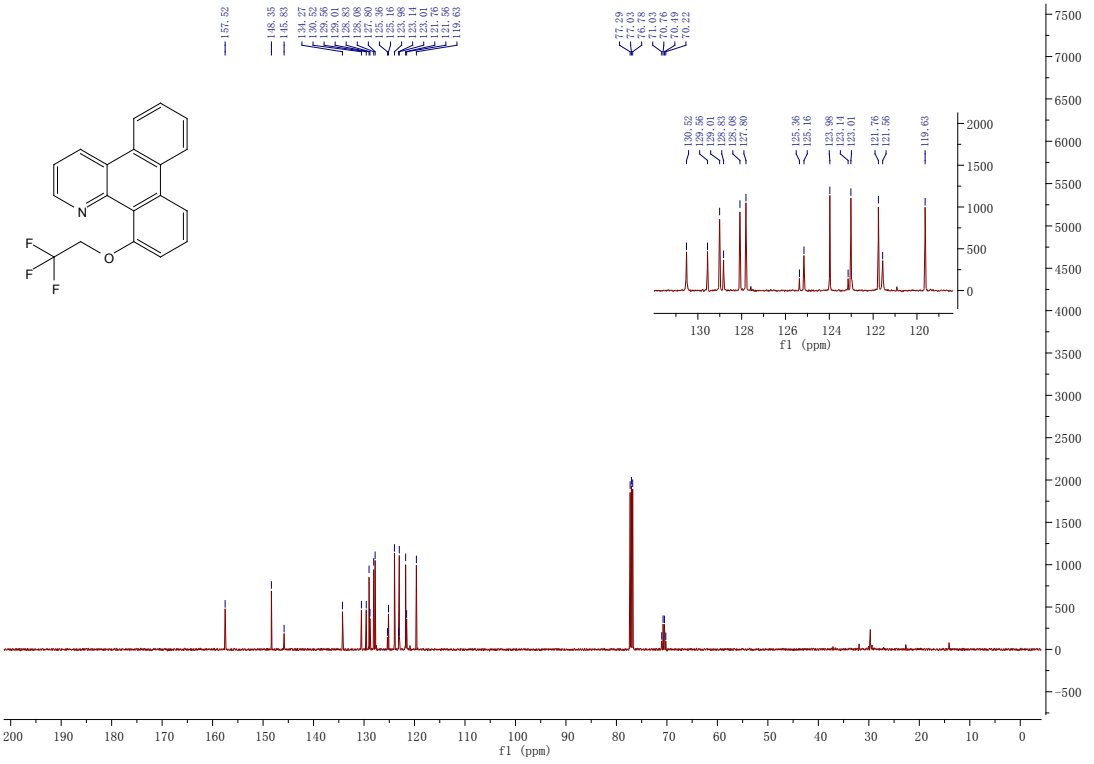
12-methoxydibenzo[f,h]quinoline (5k)



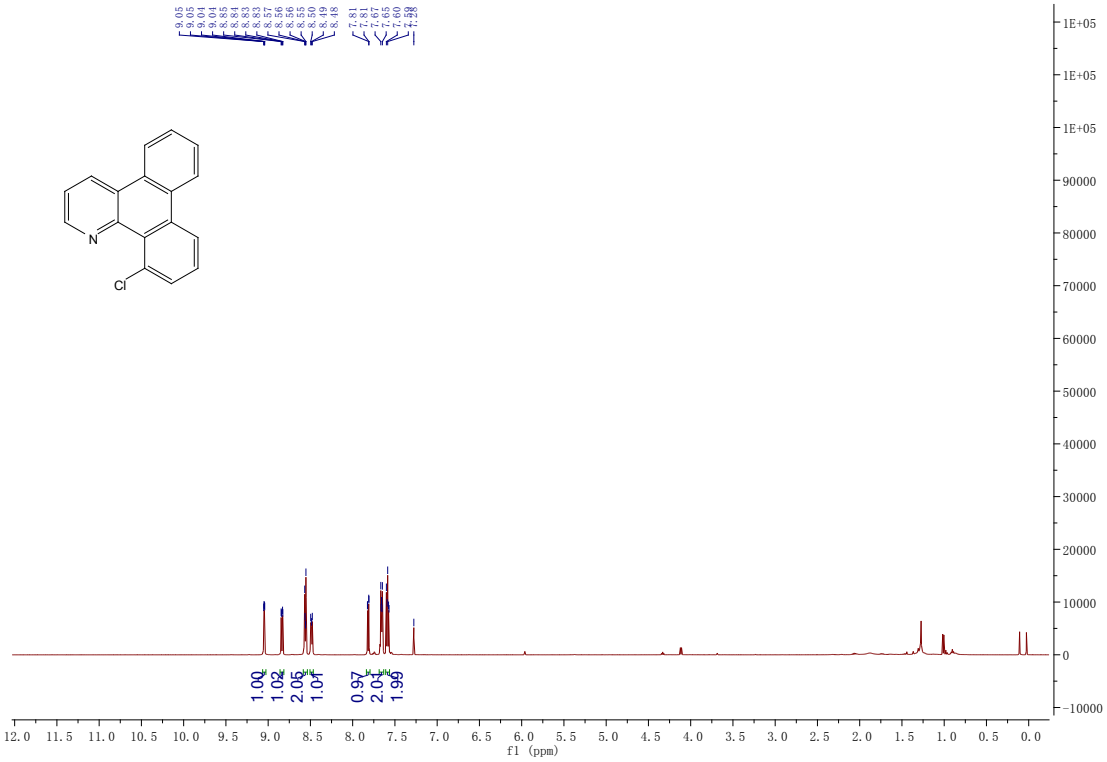


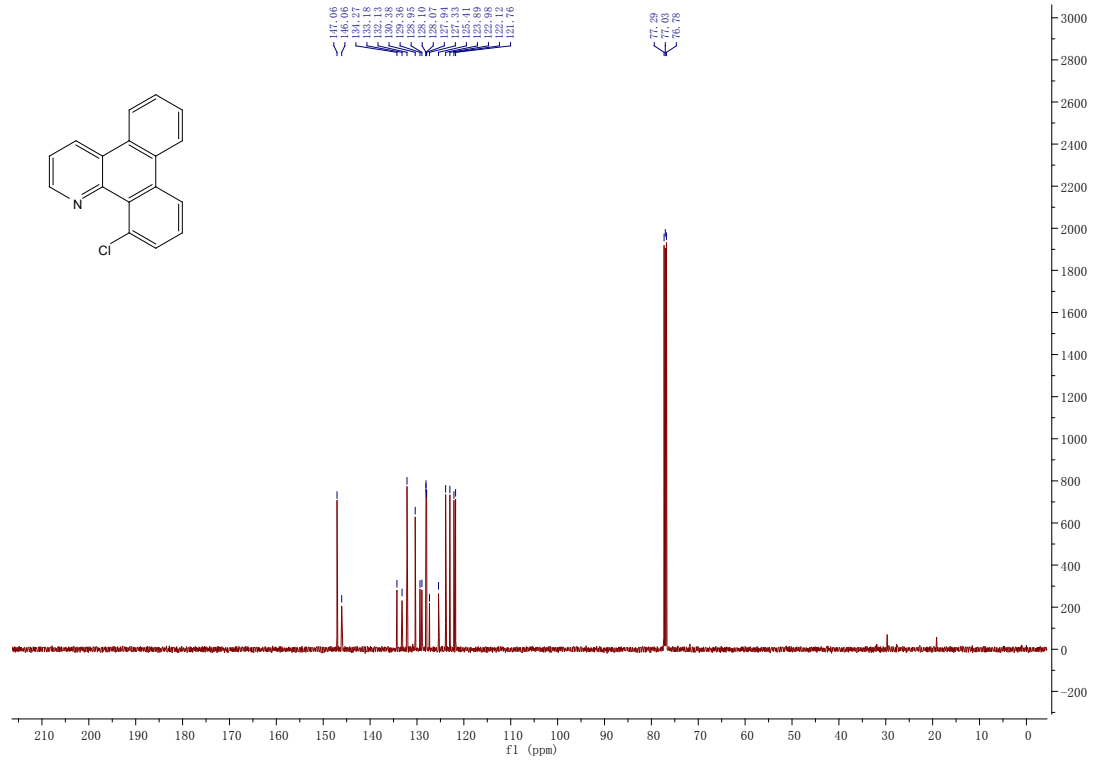
12-(2,2,2-trifluoroethoxy)dibenzo[f,h]quinoline (5l)



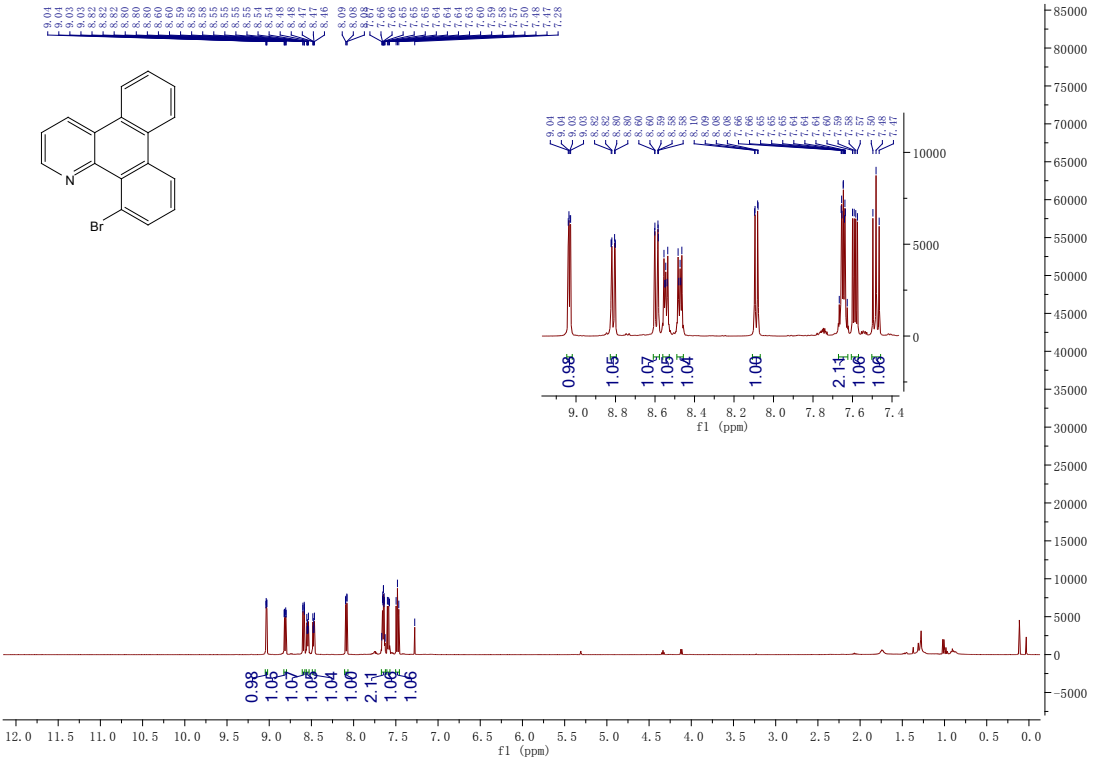


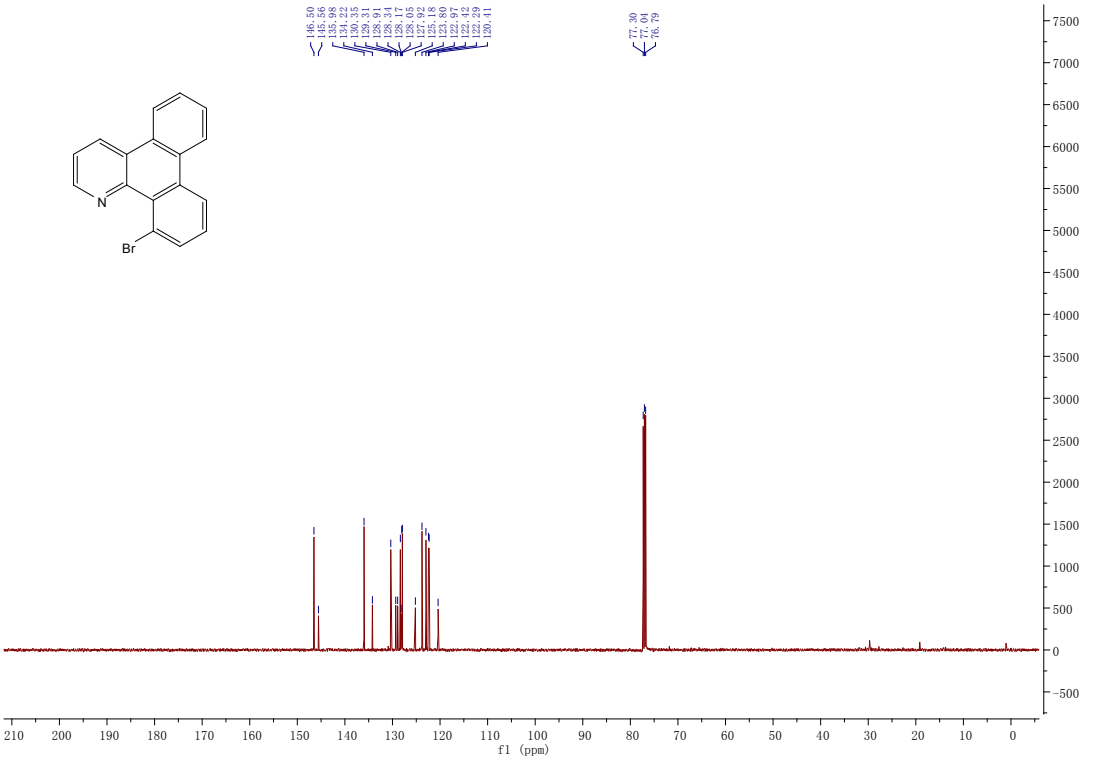
12-chlorodibenzo[f,h]quinoline (6)





12-bromodibenzo[f,h]quinoline (7)





12-(3,4-dimethylphenyl)dibenzo[f,h]quinoline (8)