(Supporting Information)

Practical Access to 1,3,5-Triarylbenzenes from Chalcones and DMSO †

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Content

General information:

Unless otherwise stated, all solvents were purchased from commercial suppliers and used without further purification. All melting points were determined on a Beijing Science Instrument Dianguang Instrument Factory XT4B melting point apparatus and are uncorrected. Silica gel was purchased from Qing Dao Hai Yang Chemical Industry Co. The isotope reagents were purchased from Sigma-Aldrich. ^{1}H and ^{13}C NMR spectra were measured on a 400 MHz Bruker spectrometer (^{1}H 400 MHz, ^{13}C 100 MHz), using $CDCl_3$ as the solvent with tetramethylsilane (TMS) as the internal standard at room temperature. HRMS-ESI spectra were obtained on Agilent 6450 spectrometer. GCMS-EI spectra were obtained on East & West GC-MS 3100. 1,3-Diaryl-2-propen-1-ones[1-3] and β-methyl chalcone[4] were synthesized according to the literature.

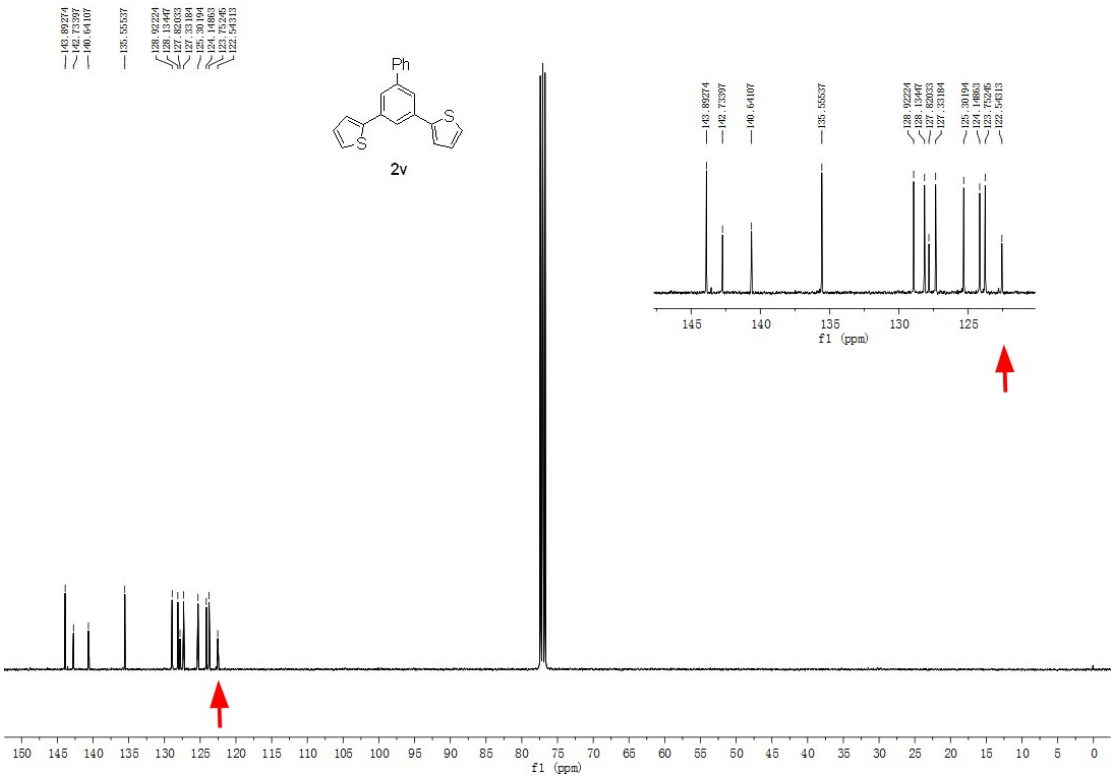
General procedure to synthesize 1,3,5-triarylbenzenes

Chalcones **1** (0.25 mmol), NaO*t*Bu (6 eq) and DMSO (2 mL) were added to a reaction tube (5 mL) equipped with magnetic stirring. The mixture was stirred at 60 °C under air for 5 h (monitored by TLC). After completing reaction, the mixture was diluted with ethyl acetate (10 mL) and washed with brine (3 ×10 mL). The organic phase was dried over anhydrous Na_2SO_4 and filtered. The solvents were removed via rotary evaporator and the residue was purified with flash chromatography (silica gel, petroleum ether/ethyl acetate = 100:1) to give products 1,3,5-triarylbenzenes **2**.

^{13}C DMSO labeled experiments

^{13}C-labeled DMSO was purchased from Sigma-Aldrich and used without further purification.

Comparing **2v** and **2v'**, their differences between C NMR spectras and DEPT-135 spectras were highlighted as follow.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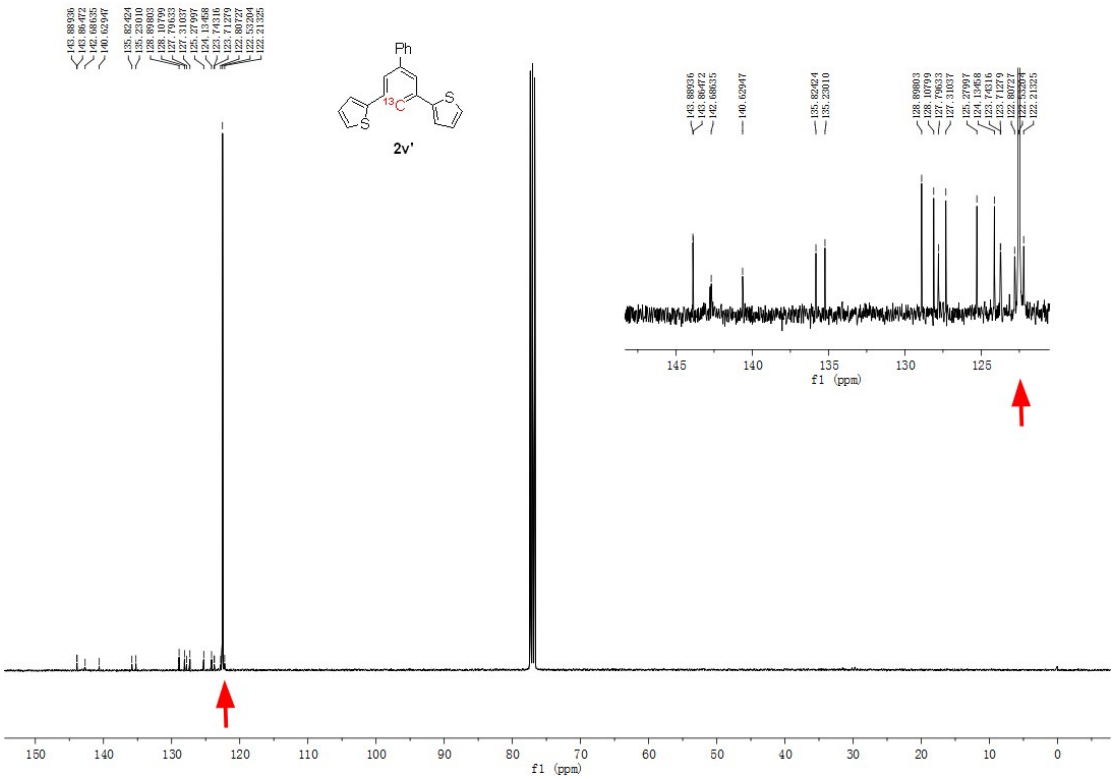
140.64107
135.55537
128.92224
128.13447
127.82033
127.33184
125.30194
124.14863
123.75245
122.54313
Ph
S
S
2v
f1 (ppm)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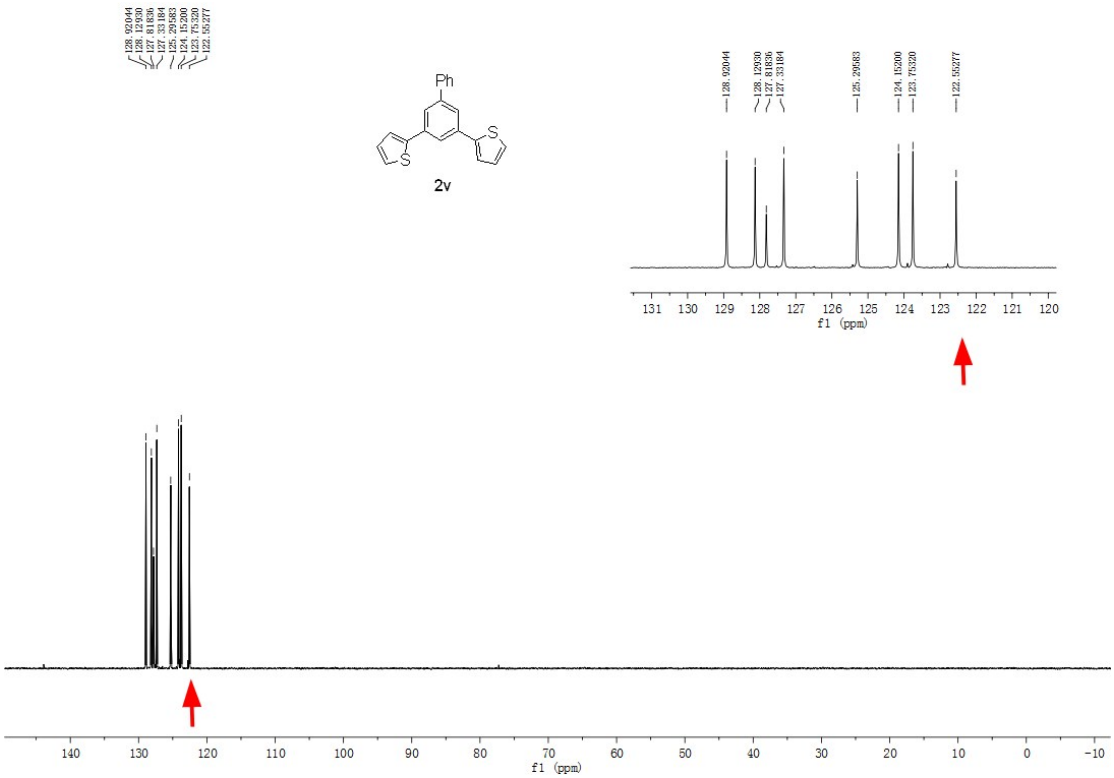
127.31037
125.27997
124.13458
123.71279
123.74316
122.55204
122.21325
Ph
13C
S
S
2v'
f1 (ppm)


128.92044
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127.81836
127.33184
125.29583
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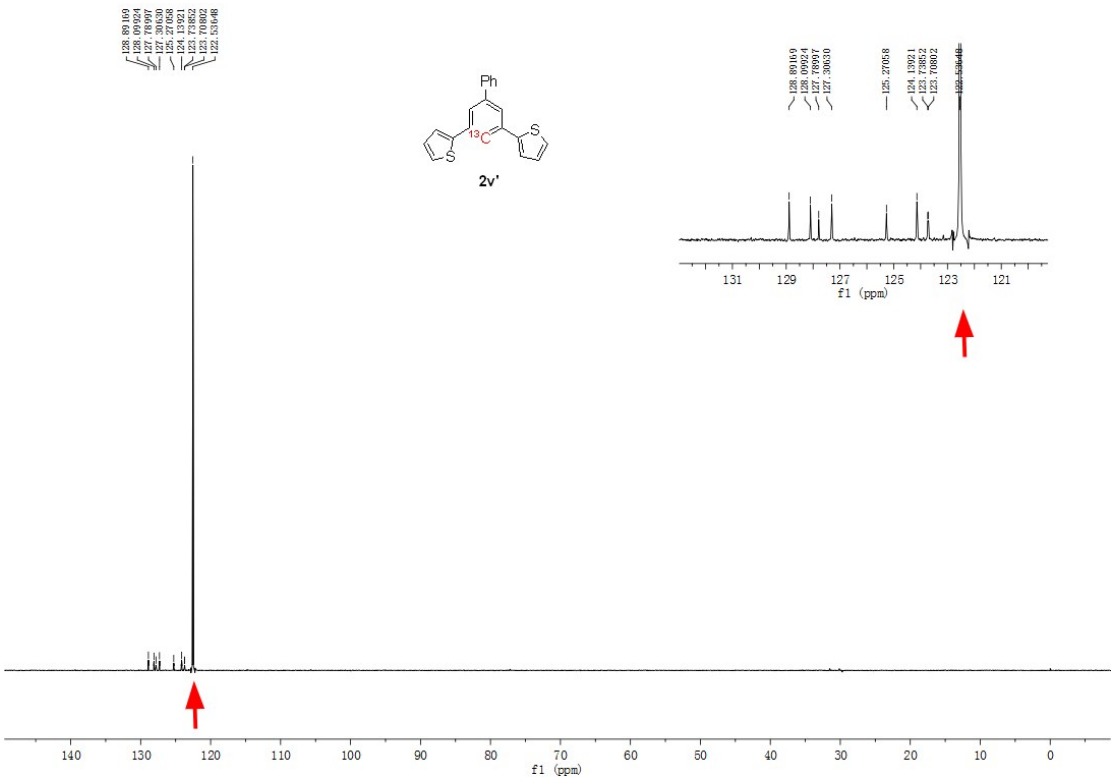
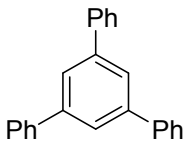
123.75320
122.55277
Ph
S
S
2v
f1 (ppm)


128.89169
128.09924
127.78997
127.30630
125.27058
124.13921
123.73852
123.70802
122.53548
Ph
13C
S
S
2v'
f1 (ppm)

Product characterizations

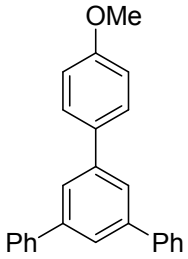
1,3,5-Triphenylbenzene (2a, CAS: 612-71-5)[5]



Colorless crystalline solid: m.p. 174-177 °C (lit. 164-165 °C).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (s, 3H), 7.73 – 7.67 (m, 6H), 7.51 – 7.44 (m, 6H), 7.42 – 7.35 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.3, 141.1, 128.8, 127.5, 127.3, 125.1.

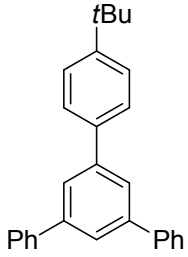
1-(4-Methoxyphenyl)-3,5-diphenylbenzene (2b, CAS: 25960-47-8)[6]



White crystalline solid: m.p. 134-137 °C (lit. 135-136 °C).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (s, 1H), 7.76 – 7.71 (m, 1H), 7.68 (d, J = 8.7 Hz, 1H), 7.51 (t, J = 7.6 Hz, 1H), 7.42 (t, J = 7.3 Hz, 1H), 7.05 (d, J = 8.7 Hz, 1H), 3.91 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.4, 142.3, 141.9, 141.2, 133.6, 128.8, 128.3, 127.5, 127.3, 124.7, 124.6, 114.3, 55.4.

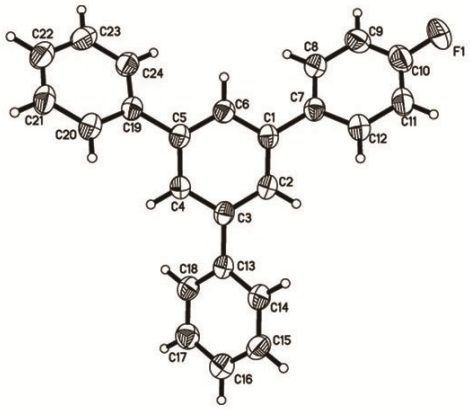
1-(4-*tert*-Butyl-phenyl)-3,5-diphenylbenzene (2c, CAS: 1444122-35-3)[5]

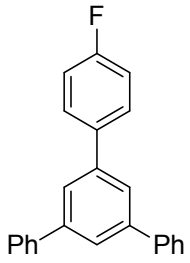


Colorless solid: m.p. 100-102 °C (lit. 102-103 °C).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (dd, J = 6.4, 1.3 Hz, 3H), 7.78 – 7.71 (m, 4H), 7.68 (d, J = 8.3 Hz, 2H), 7.53 (dd, J = 15.5, 8.1 Hz, 6H), 7.42 (t, J = 7.3 Hz, 2H), 1.42 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.6, 142.2, 142.2, 141.2, 138.2, 128.8, 127.5, 127.3, 127.0, 125.8, 125.1, 124.9, 34.6, 31.4.

1-(4-Fluorophenyl)-3,5-diphenylbenzene (2d, CAS: 1443469-16-6)[7]





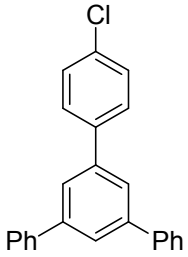
2d

CCDC 1401541

White solid: m.p. 154-161 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (t, *J* = 1.6 Hz, 1H), 7.78 – 7.65 (m, 8H), 7.52 (dd, *J* = 10.3, 4.8 Hz, 4H), 7.47 – 7.38 (m, 2H), 7.24 – 7.16 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.8, 161.3, 142.4, 141.3, 141.0, 137.2, 137.2, 128.9, 128.8, 127.6, 127.3, 125.1, 125.0, 115.8, 115.6.

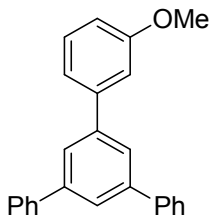
1-(4-Chlorophenyl)-3,5-diphenylbenzene (2e, CAS: 116941-51-6)[8]



White solid: m.p. 134-138 °C (lit. 117-119 °C).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (s, 1H), 7.77 (d, *J* = 1.2 Hz, 2H), 7.72 (d, *J* = 7.3 Hz, 4H), 7.66 (d, *J* = 8.4 Hz, 2H), 7.47 (ddd, *J* = 23.3, 14.9, 7.3 Hz, 8H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.5, 141.1, 140.9, 139.6, 133.7, 129.0, 128.9, 128.6, 127.6, 127.3, 125.5, 124.9.

1-(3- Methoxyphenyl)-3,5-diphenylbenzene (2f)

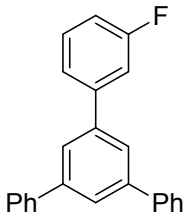


Yellow solid: m.p. 115-117 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (d, *J* = 1.6 Hz, 3H), 7.75 (d, *J* = 8.1 Hz, 4H), 7.53 (t, *J* = 7.6

Hz, 4H), 7.44 (dd, *J* = 10.3, 4.1 Hz, 3H), 7.36 – 7.31 (m, 1H), 7.28 (s, 1H), 7.02 – 6.96 (m, 1H), 3.93 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.0, 142.7, 142.3, 142.2, 141.1, 129.9, 128.8, 127.6, 127.4, 125.3, 125.2, 119.8, 113.1, 113.0, 55.4; HRMS (ESI) m/z calcd for $C_{25}H_{21}O$ $[M + H]^+$ 337.1587, found 337.1588.

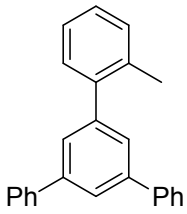
1-(3-Fluorophenyl)-3,5-diphenylbenzene (2g)



White crystalline solid: m.p. 134-137 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (t, *J* = 1.6 Hz, 1H), 7.79 (d, *J* = 1.6 Hz, 2H), 7.73 (dd, *J* = 5.2, 3.3 Hz, 4H), 7.56 – 7.38 (m, 9H), 7.16 – 7.07 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.5, 140.9, 130.3, 130.2, 128.9, 127.6, 127.3, 125.7, 125.0, 123.0, 114.3, 114.1; HRMS (ESI) m/z calcd for $C_{24}H_{18}F$ $[M + H]^+$ 325.1387, found 325.1384.

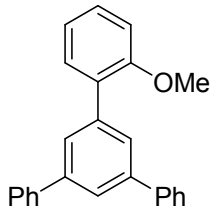
1-*o*-Tolyl-3,5-diphenylbenzene (2h)



Yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.81 (t, *J* = 1.7 Hz, 1H), 7.70 (dd, *J* = 5.1, 3.4 Hz, 4H), 7.56 (d, *J* = 1.7 Hz, 2H), 7.48 (dd, *J* = 10.3, 4.7 Hz, 4H), 7.42 – 7.35 (m, 3H), 7.33 – 7.28 (m, 3H), 2.39 (s, 3H); ^{3}C NMR (100 MHz, $CDCl_3$) δ 142.9, 141.7, 141.6, 141.1, 135.4, 130.4, 129.8, 128.8, 127.4, 127.3, 127.0, 125.8, 124.5, 29.7; HRMS (ESI) m/z calcd for $C_{25}H_{21}$ $[M + H]^+$ 321.1638, found 321.1637.

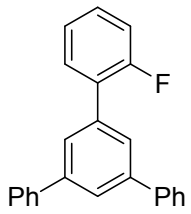
1-(2-Methoxyphenyl)-3,5-diphenylbenzene (2i)



Yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 – 7.76 (m, 3H), 7.76 – 7.70 (m, 4H), 7.53 – 7.45 (m, 5H), 7.44 – 7.36 (m, 3H), 7.09 (ddd, *J* = 11.8, 9.2, 4.6 Hz, 2H), 3.88 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 156.5, 141.5, 141.3, 139.4, 130.9, 130.5, 128.9, 128.7, 127.5, 127.4, 127.3, 124.9, 120.9, 111.2, 55.6; HRMS (ESI) m/z calcd for $C_{25}H_{21}O$ $[M + H]^+$ 337.1587, found 337.1588.

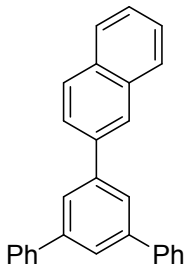
1-(2-Fluorophenyl)-3,5-diphenylbenzene (2j)



White crystalline solid: m.p. 123-126 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 (t, *J* = 1.7 Hz, 1H), 7.78 (t, *J* = 1.6 Hz, 2H), 7.72 (dd, *J* = 5.2, 3.3 Hz, 4H), 7.58 (td, *J* = 7.7, 1.8 Hz, 1H), 7.51 (dd, *J* = 10.3, 4.8 Hz, 4H), 7.46 – 7.35 (m, 3H), 7.30 (d, *J* = 1.2 Hz, 0.5H), 7.28 (d, *J* = 1.2 Hz, 0.5H), 7.26 – 7.19 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.1, 158.6, 142.0, 141.0, 136.8, 130.9, 130.8, 129.2, 129.2, 128.8, 127.5, 127.3, 126.9, 126.9, 125.5, 124.4, 124.4, 116.3, 116.0; HRMS (ESI) m/z calcd for $C_{24}H_{18}$ $[M + H]^+$ 325.1387, found 325.1386.

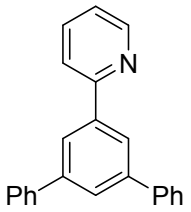
1-(Naphthalene-2-yl)-3,5-diphenylbenzene (2k)



Yellow solid: m.p. 131-138 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.19 (s, 1H), 8.05 – 7.82 (m, 7H), 7.82 – 7.72 (m, 4H), 7.54 (ddd, *J* = 13.4, 6.1, 1.6 Hz, 6H), 7.44 (ddd, *J* = 7.4, 3.8, 1.1 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.5, 142.2, 141.1, 138.4, 133.7, 132.7, 128.9, 128.5, 128.2, 127.7, 127.6, 127.4, 126.4, 126.0, 125.6, 125.4, 125.3; GCMS (EI) m/z calcd for $C_{28}H_{20}$ $[M + H]^+$ 357.16, found 357.16.

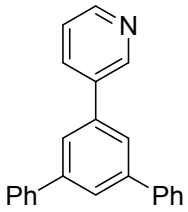
1-(Pyridine-2-yl)-3,5-diphenylbenzene (2l, CAS: 951305-12-7)[9]



Yellow solid: m.p. 142-145 °C (lit. 137-139 °C).

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.77 (d, *J* = 4.3 Hz, 1H), 8.23 (d, *J* = 1.6 Hz, 2H), 7.89 (dd, *J* = 6.6, 5.0 Hz, 2H), 7.82 (td, *J* = 7.7, 1.7 Hz, 1H), 7.79 – 7.73 (m, 4H), 7.51 (t, *J* = 7.5 Hz, 4H), 7.42 (t, *J* = 7.4 Hz, 2H), 7.33 – 7.30 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.3, 149.7, 142.3, 141.0, 140.4, 136.8, 128.8, 127.5, 127.3, 126.7, 124.8, 122.3, 120.8.

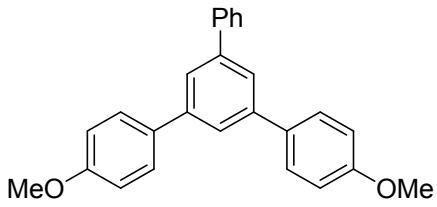
1-(Pyridine-3-yl)-3,5-diphenylbenzene (2m)



White solid: m.p. 126-130 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 8.99 (d, *J* = 2.0 Hz, 1H), 8.67 (dd, *J* = 4.8, 1.5 Hz, 1H), 8.04 – 7.99 (m, 1H), 7.87 (t, *J* = 1.6 Hz, 1H), 7.79 (d, *J* = 1.6 Hz, 2H), 7.73 (dd, *J* = 5.2, 3.3 Hz, 4H), 7.53 (dd, *J* = 10.3, 4.8 Hz, 4H), 7.44 (dd, *J* = 7.8, 5.7 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 148.7, 148.5, 142.7, 140.7, 139.0, 136.6, 134.5, 128.9, 127.7, 127.3, 125.9, 125.0, 123.6; HRMS (ESI) m/z calcd for $C_{23}H_{17}N$ $[M + H]^+$ 308.1434, found 308.1438.

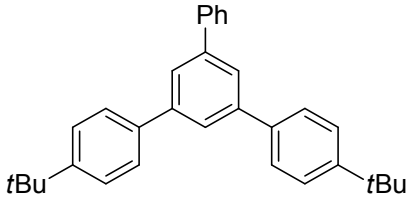
1,3-Di(4-methoxyphenyl)-5-phenylbenzene (2n, CAS: 116941-53-8)[10]



White solid: m.p. 132-133 °C (lit. 130-132 °C).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 7.2 Hz, 1H), 7.66 (d, *J* = 8.6 Hz, 1H), 7.51 (t, *J* = 7.5 Hz, 1H), 7.41 (t, *J* = 7.3 Hz, 1H), 7.05 (d, *J* = 8.6 Hz, 1H), 3.90 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 159.3, 142.2, 141.8, 141.3, 133.7, 128.8, 128.3, 127.4, 127.3, 124.3, 124.2, 114.2, 55.3.

1,3-Di(4-*tert*-butylphenyl)-5-phenylbenzene (2o)

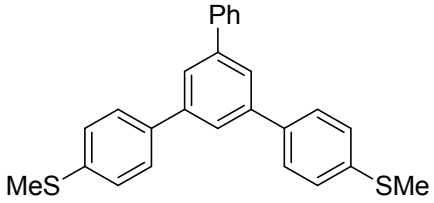


Colorless oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (d, *J* = 7.8 Hz, 3H), 7.71 (dd, *J* = 21.3, 7.8 Hz, 6H), 7.53 (dd, *J* = 16.1, 8.0 Hz, 6H), 7.43 (t, *J* = 7.5 Hz, 1H), 1.43 (s, 18H); ^{13}C NMR (101 MHz, $CDCl_3$) δ

150.5, 142.2, 142.1, 141.3, 138.3, 128.8, 127.4, 127.3, 127.0, 125.8, 124.9, 124.8, 34.6, 31.4; HRMS (ESI) m/z calcd for $C_{32}H_{35}$ $[M + H]^+$ 419.2733, found 419.2739.

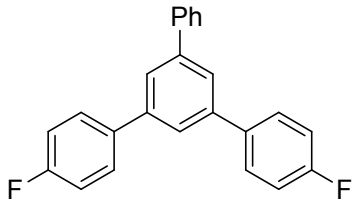
1,3-Di(4-methylthiophenyl)-5-phenylbenzene (2p)



Yellow solid: m.p. 100-104 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (dd, *J* = 4.5, 1.4 Hz, 1H), 7.74 – 7.69 (m, 1H), 7.65 (d, *J* = 8.4 Hz, 1H), 7.51 (t, *J* = 7.5 Hz, 1H), 7.41 (dd, *J* = 14.2, 7.9 Hz, 2H), 2.57 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.5, 141.7, 141.1, 138.0, 137.8, 128.8, 127.6, 127.6, 127.3, 127.0, 124.8, 124.4, 15.9; GCMS (EI) m/z calcd for $C_{26}H_{23}S_2$ $[M + H]^+$ 399.12, found 399.12.

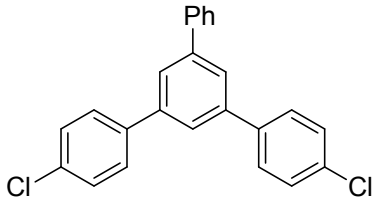
1,3-Di(4-flurohenyl)-5-phenylbenzene (2q)



White solid: m.p. 179-183 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.75 (d, *J* = 1.7 Hz, 1H), 7.74 – 7.64 (m, 4H), 7.52 (dd, *J* = 10.2, 4.7 Hz, 1H), 7.46 – 7.39 (m, 1H), 7.24 – 7.15 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.9, 161.4, 142.5, 141.4, 140.9, 137.1, 137.1, 128.9, 128.9, 128.8, 127.7, 127.3, 125.0, 124.8, 115.8, 115.6; GCMS (EI) m/z calcd for $C_{24}H_{17}F_2$ $[M + H]^+$ 343.12, found 343.12.

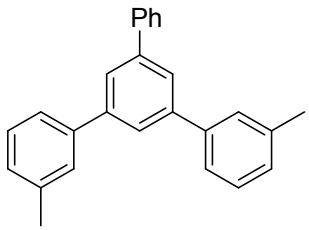
1,3-Di(4-chlorophenyl)-5-phenylbenzene (2r, CAS: 116941-54-9)[10]



White solid: m.p. 153-156 °C (lit. 163-164 °C).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (s, 1H), 7.70 (d, *J* = 7.5 Hz, 2H), 7.64 (d, *J* = 8.4 Hz, 2H), 7.48 (dq, *J* = 14.5, 7.4 Hz, 4H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.7, 141.2, 140.7, 139.4, 133.8, 129.0, 128.9, 128.5, 127.7, 127.3, 125.2, 124.7.

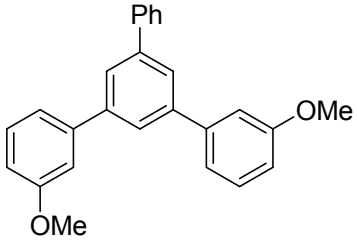
1,3-Di(*m*-tolyl)-5-phenylbenzene (2s)



Yellow solid: m.p. 101-103 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (d, *J* = 4.6 Hz, 1H), 7.74 – 7.68 (m, 1H), 7.55 – 7.45 (m, 2H), 7.39 (ddd, *J* = 12.5, 5.4, 2.8 Hz, 1H), 7.22 (d, *J* = 7.8 Hz, 1H), 2.46 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.4, 142.2, 141.2, 141.2, 138.4, 128.8, 128.7, 128.2, 128.1, 127.4, 127.3, 125.2, 125.1, 124.4; HRMS (ESI) m/z calcd for $C_{26}H_{22}$ $[M + H]^+$ 335.1794, found 335.1791.

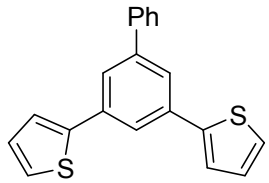
1,3-Di(3-methoxyphenyl)-5-phenylbenzene (2t)



White crystalline solid: m.p. 123-125 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.84 – 7.78 (m, 3H), 7.77 – 7.69 (m, 2H), 7.52 (t, *J* = 7.5 Hz, 2H), 7.48 – 7.39 (m, 3H), 7.32 (d, *J* = 7.7 Hz, 2H), 7.28 – 7.24 (m, 2H), 6.98 (dd, *J* = 8.1, 2.5 Hz, 2H), 3.92 (s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 160.0, 142.6, 142.3, 142.2, 141.1, 129.8, 128.8, 127.5, 127.3, 125.3, 125.2, 119.8, 113.1, 113.0, 55.3; HRMS (ESI) m/z calcd for $C_{26}H_{23}O_2$ $[M + H]^+$ 367.1693, found 367.1695.

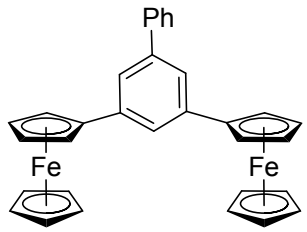
1,3-Di(2-thienyl)-5-phenylbenzene (2v)



Yellow solid: m.p. 126-132 °C.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (t, *J* = 1.6 Hz, 1H), 7.73 (d, *J* = 1.7 Hz, 2H), 7.71 – 7.65 (m, 2H), 7.52 (t, *J* = 1.2 Hz, 1H), 7.50 (d, *J* = 1.4 Hz, 1H), 7.48 (d, *J* = 1.5 Hz, 1H), 7.43 (dt, *J* = 7.6, 2.9 Hz, 3H), 7.35 (dd, *J* = 5.1, 1.1 Hz, 2H), 7.14 (dd, *J* = 5.1, 3.6 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.8, 142.7, 140.6, 135.5, 128.9, 128.1, 127.8, 127.3, 125.2, 124.1, 123.7, 122.5; HRMS (ESI) m/z calcd for $C_{20}H_{14}S_2$ $[M + H]^+$ 319.0610, found 319.0534.

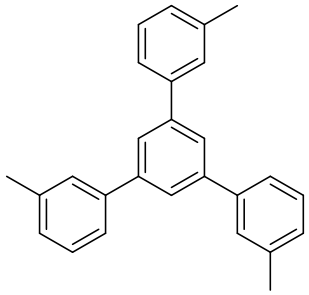
1,3-Diferrocene-5-phenylbenzene (2w)



Yellow oil.

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, J = 7.3 Hz, 1H), 7.62 (s, 1H), 7.54 (dd, J = 11.7, 4.4 Hz, 2H), 7.44 (d, J = 7.4 Hz, 1H), 4.76 (s, 2H), 4.39 (s, 2H), 4.13 (s, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 141.5, 141.3, 139.6, 128.8, 127.3, 127.2, 123.1, 122.9, 85.5, 69.6, 68.9, 66.7; HRMS (ESI) m/z calcd for $C_{32}H_{26}Fe_2$ $[M + H]^+$ 523.0806, found 522.0728.

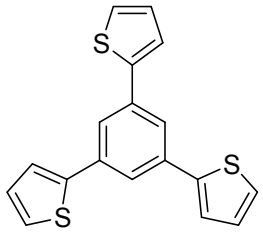
1,3,5-Tri(*m*-tolyl)-benzene (2x, CAS: 96868-61-0)[11]



White solid: m.p. 115-118 °C (lit. 117-118 °C).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (s, 1H), 7.53 (d, J = 7.0 Hz, 2H), 7.40 (t, J = 7.9 Hz, 1H), 7.23 (d, J = 7.5 Hz, 1H), 2.48 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 142.3, 141.2, 138.4, 128.7, 128.2, 128.1, 125.1, 124.4, 21.5.

1,3,5-Tri(2-thienyl)-benzene (2y, CAS: 15509-95-2)[11]



Yellow crystalline solid: m.p. 143-151 °C (lit. 157-158 °C).

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.78 (s, 1H), 7.44 (d, J = 3.1 Hz, 1H), 7.37 (d, J = 4.9 Hz, 1H), 7.16 (dd, J = 4.8, 3.8 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 143.5, 135.7, 128.1, 125.4, 123.8, 122.7.

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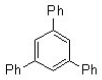
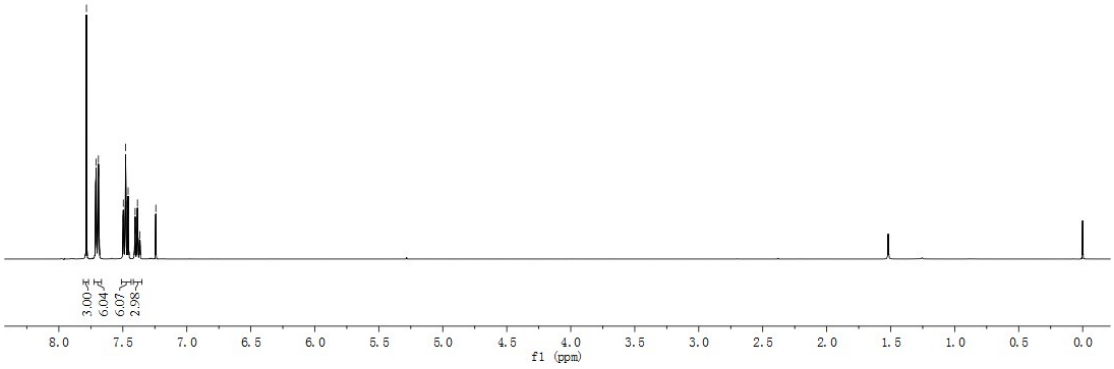
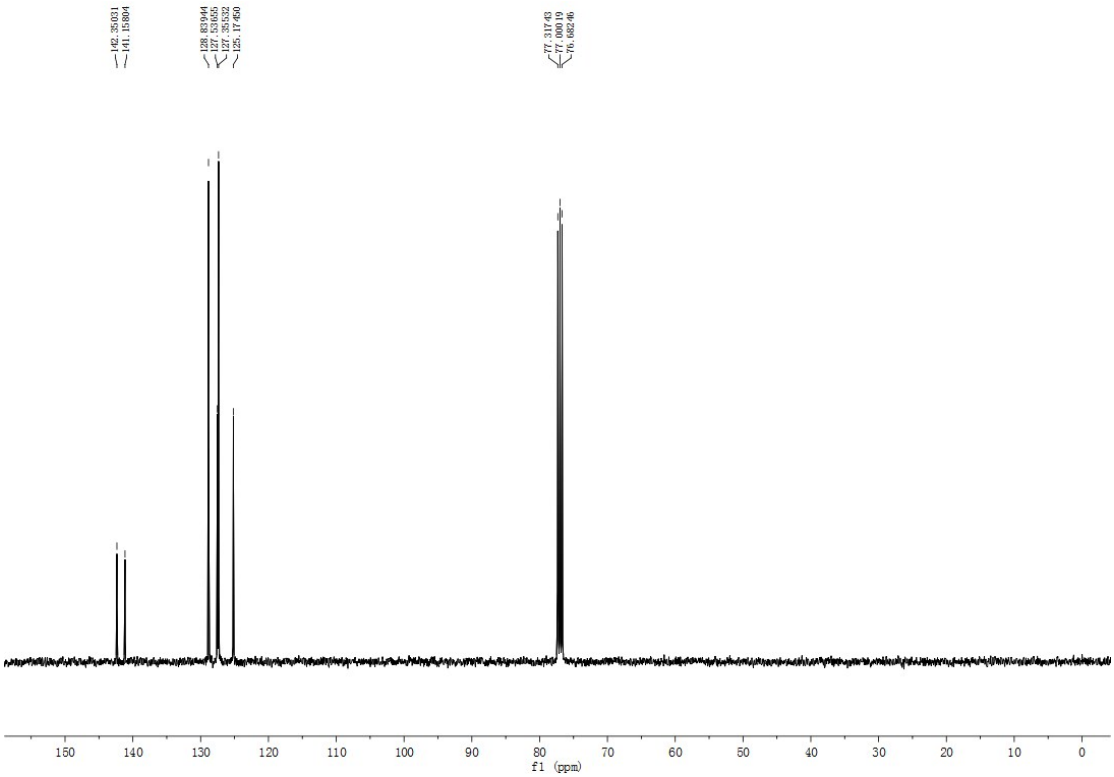
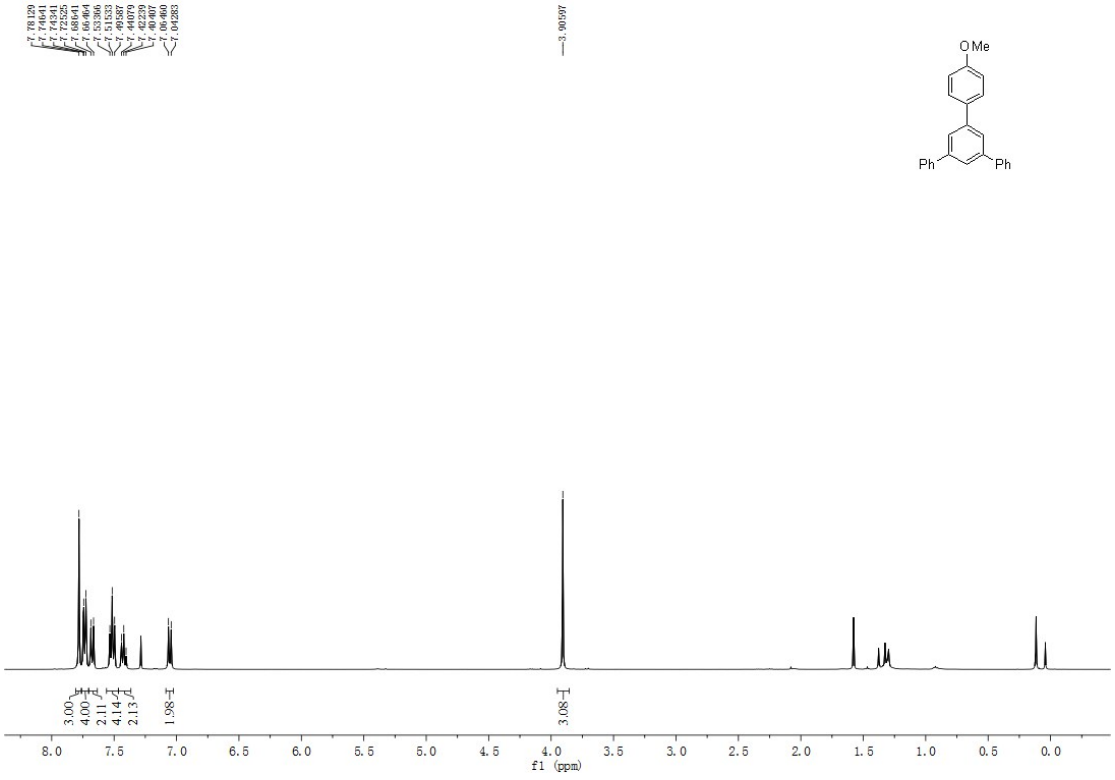
^{1}H NMR and ^{13}C NMR spectra of **2a**

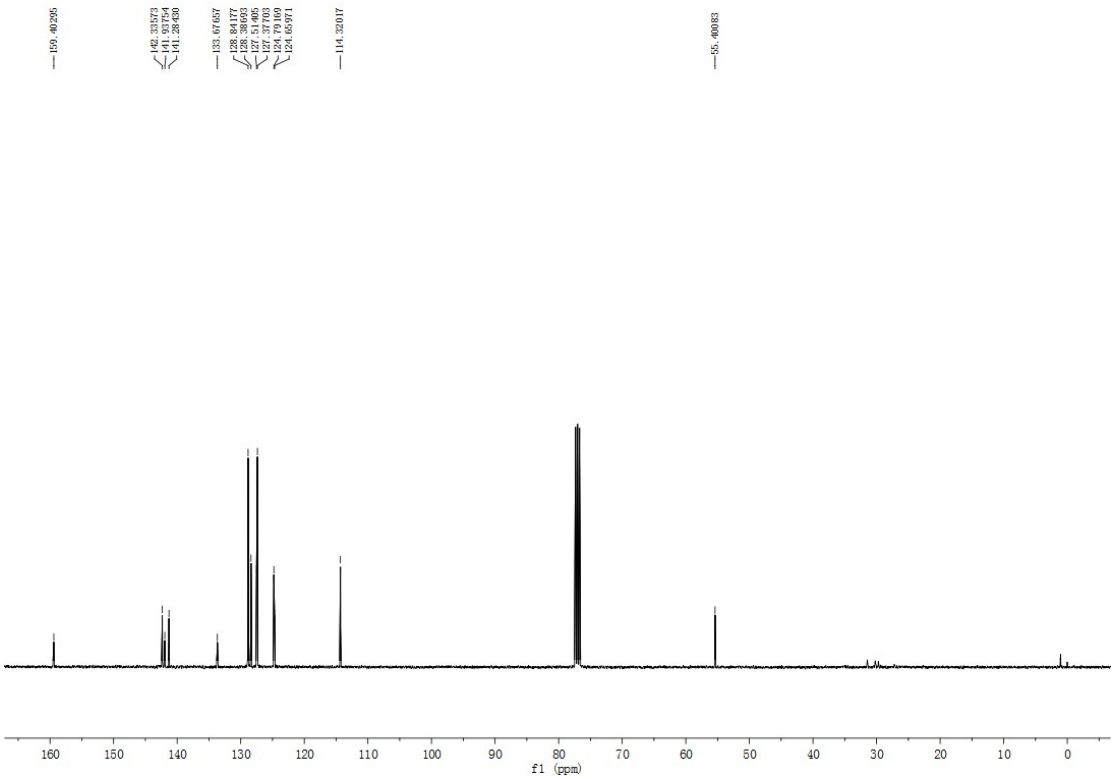




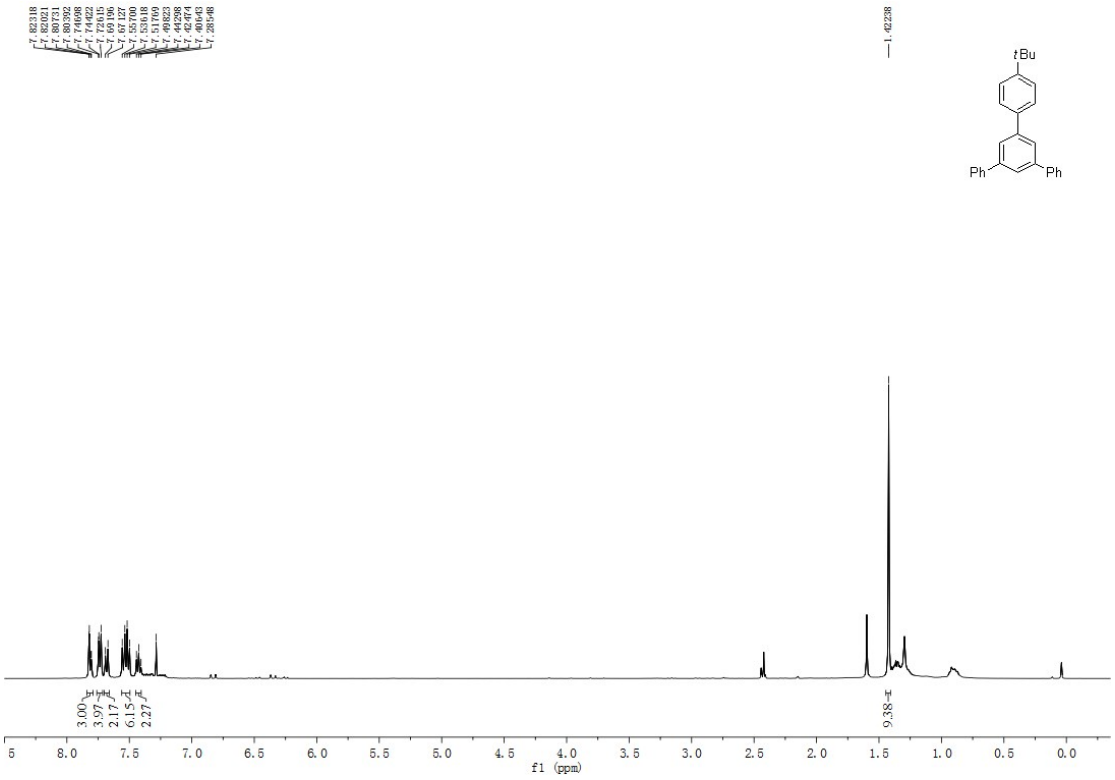


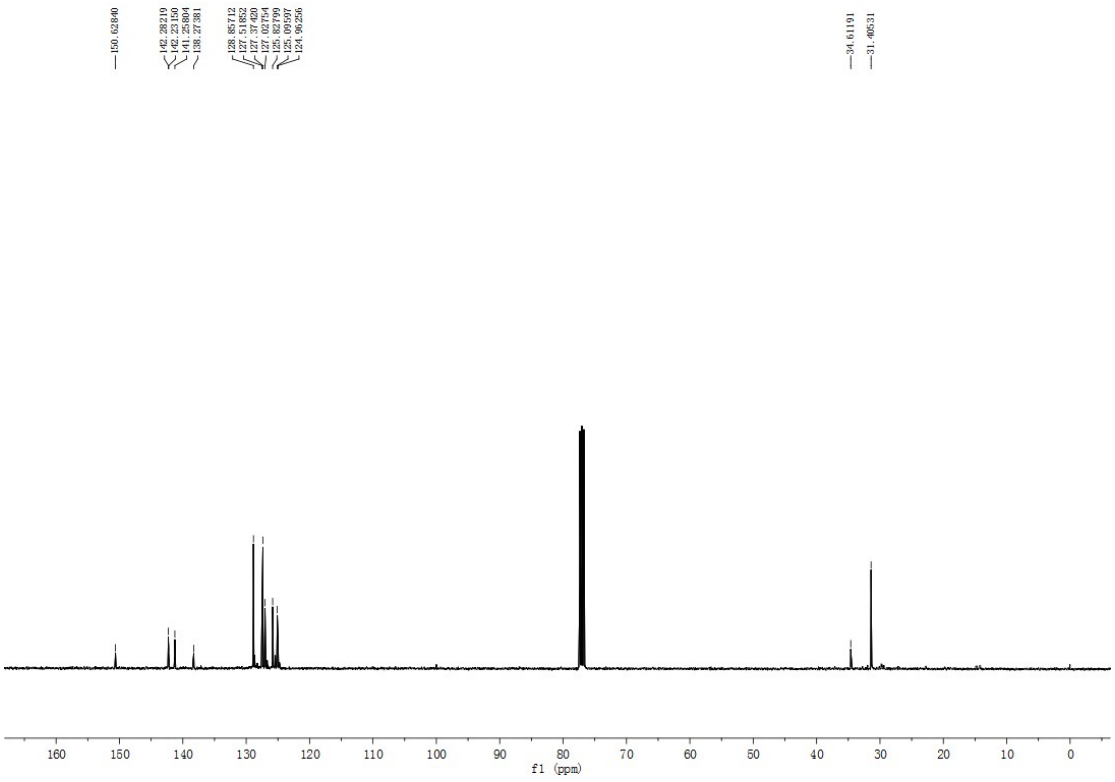
^{1}H NMR and ^{13}C NMR spectra of **2b**



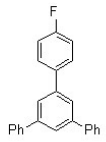


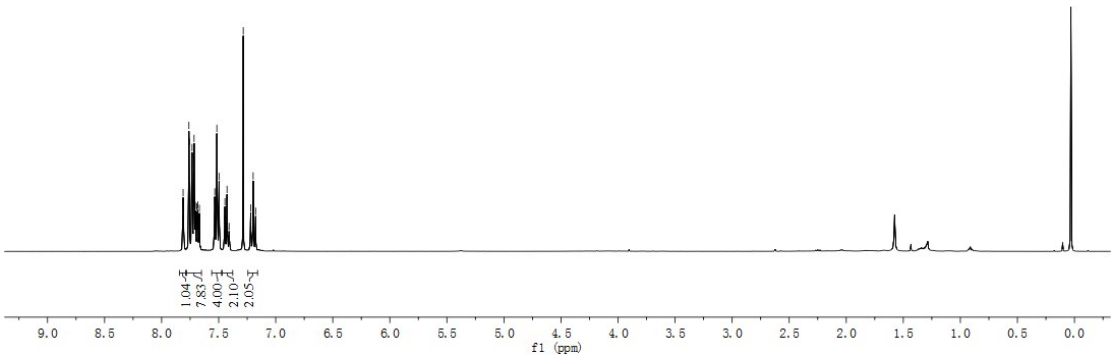
^{1}H NMR and ^{13}C NMR spectra of **2c**

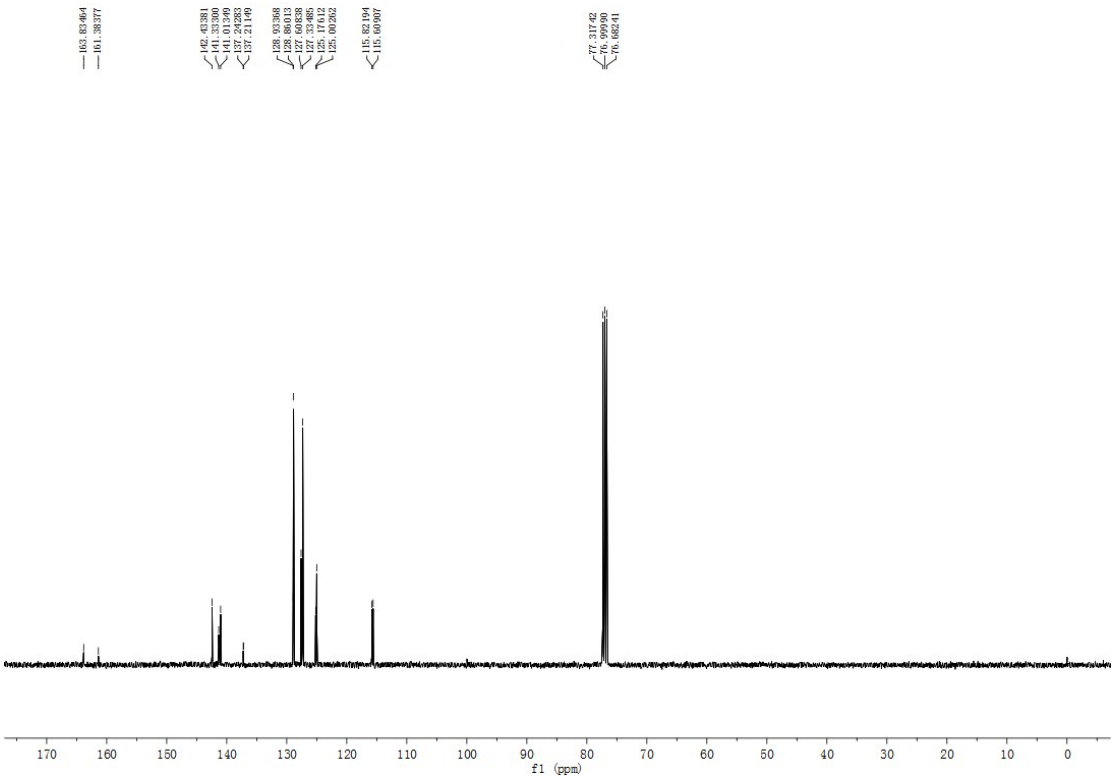




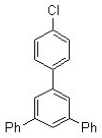
^{1}H NMR and ^{13}C NMR spectra of **2d**

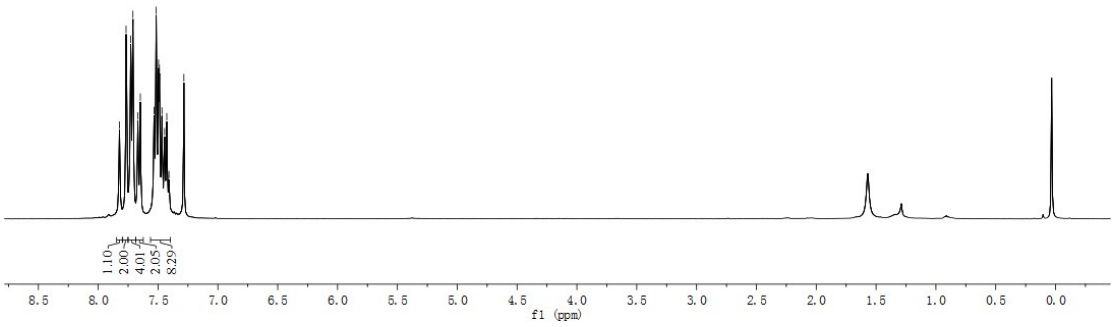


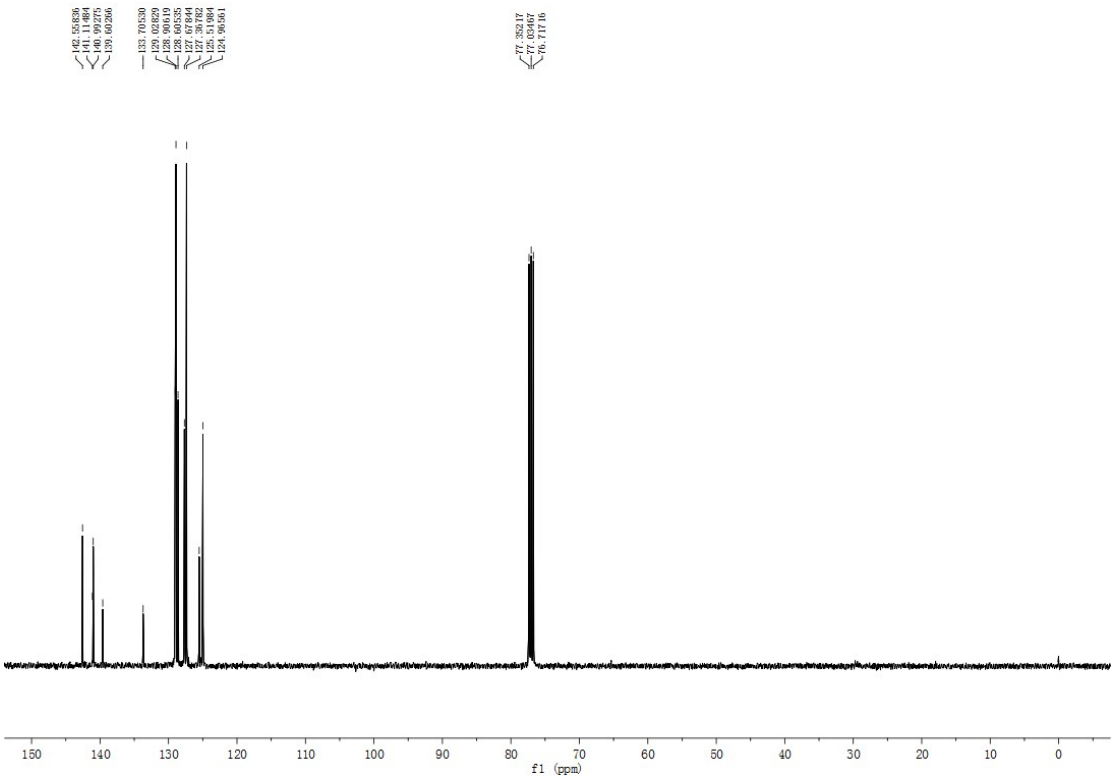




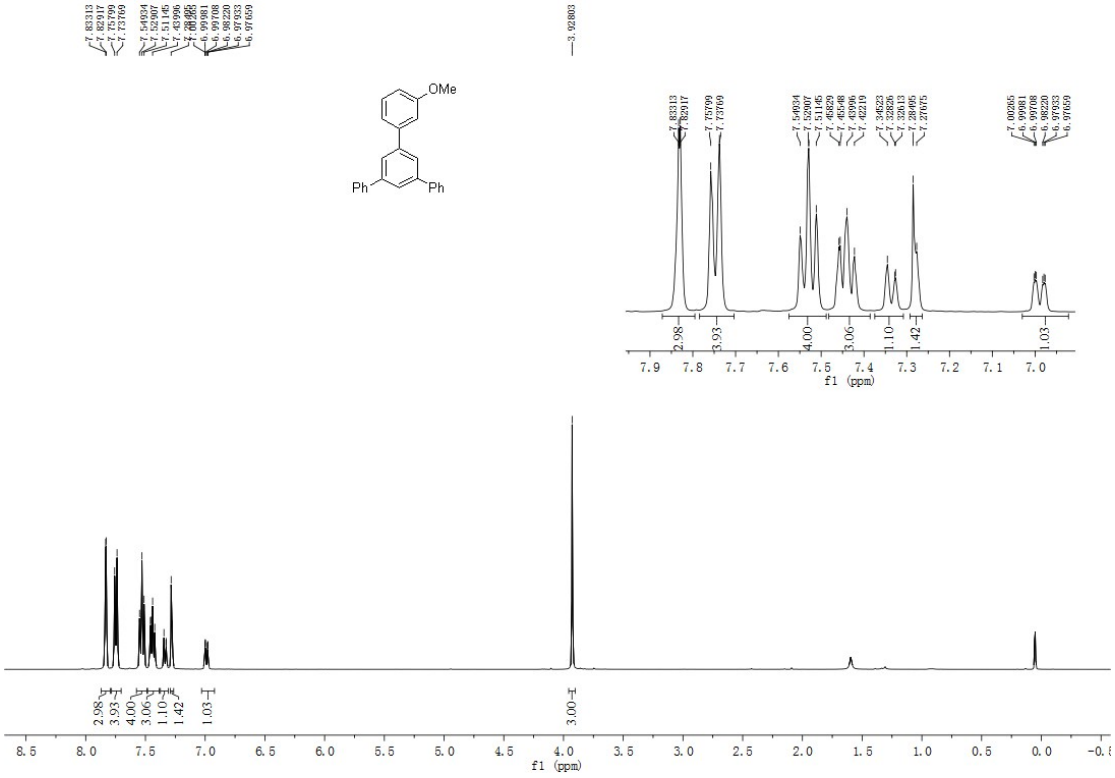
^{1}H NMR and ^{13}C NMR spectra of **2e**

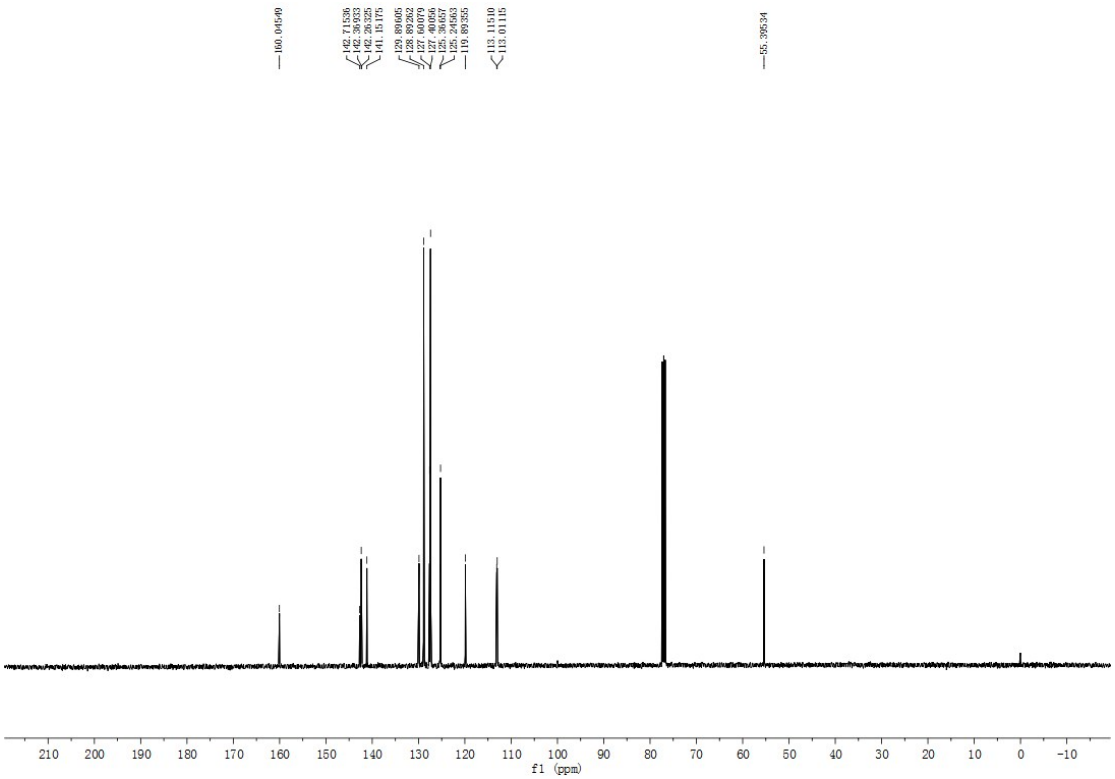




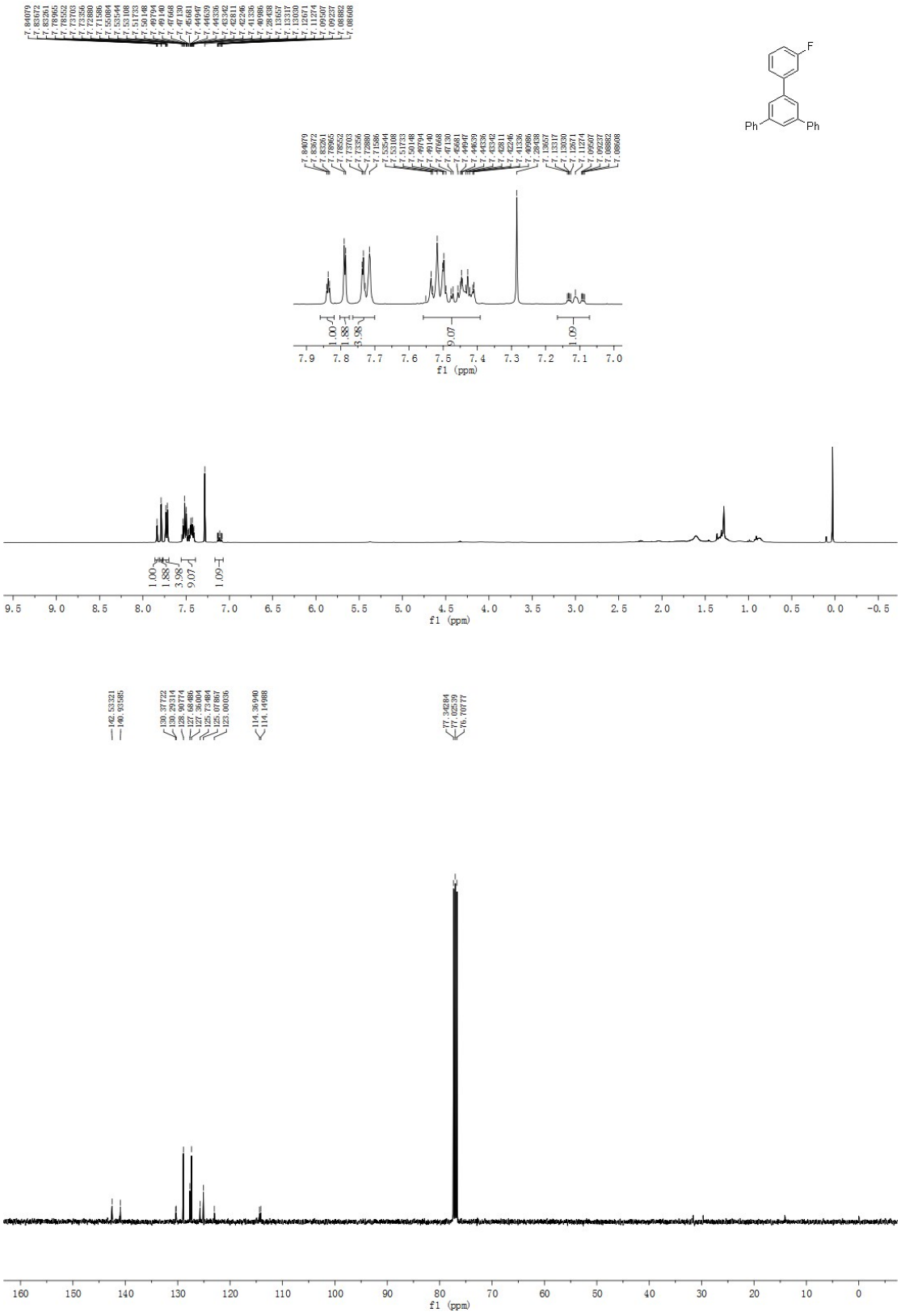


^{1}H NMR and ^{13}C NMR spectra of **2f**

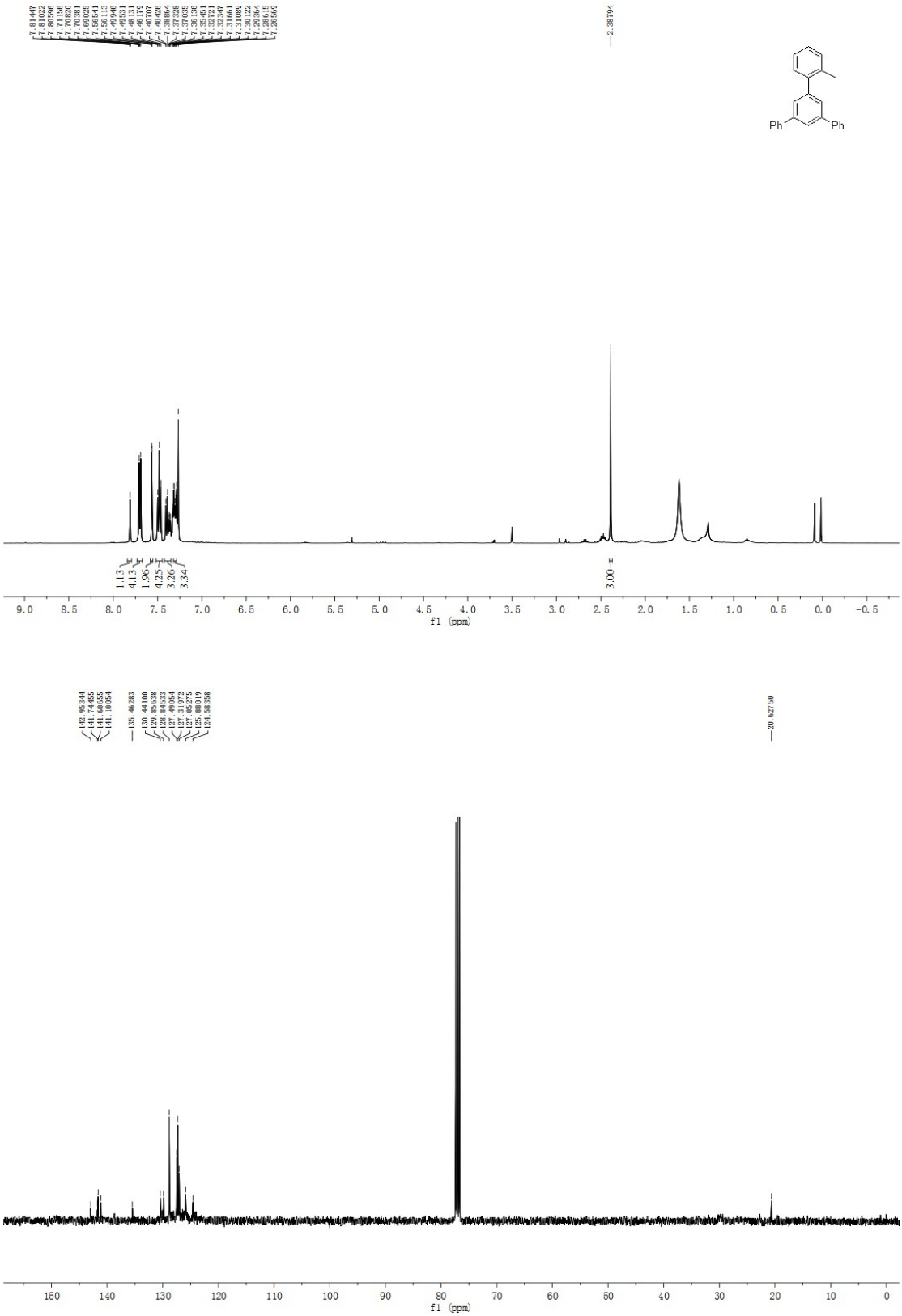




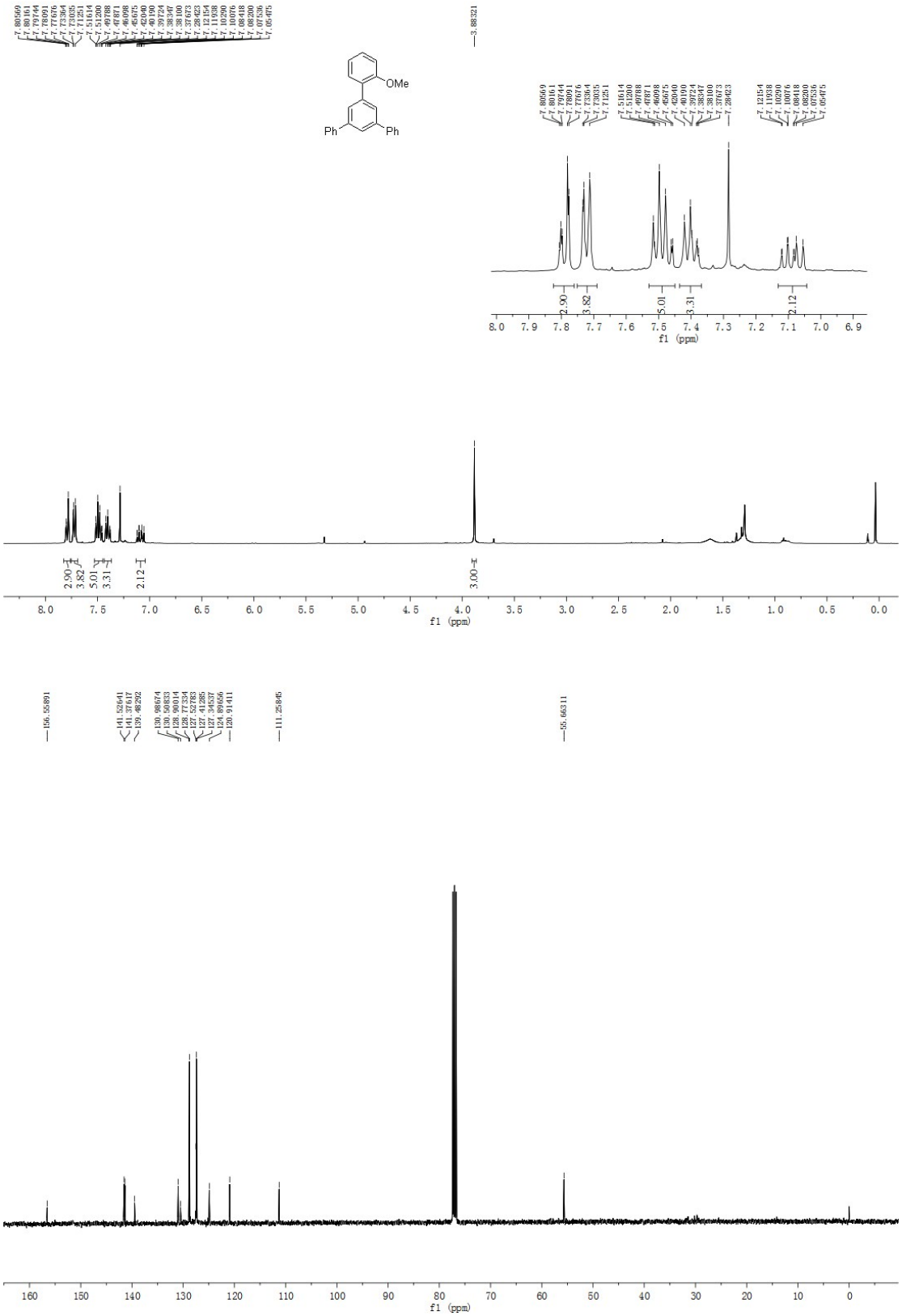
^{1}H NMR and ^{13}C NMR spectra of **2g**



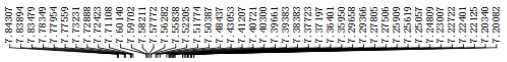
^{1}H NMR and ^{13}C NMR spectra of **2h**

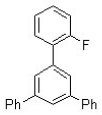


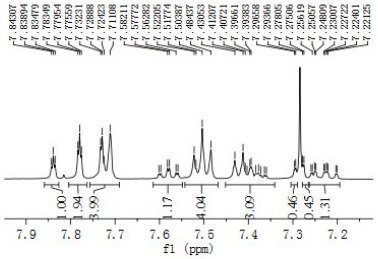
^{1}H NMR and ^{13}C NMR spectra of **2i**

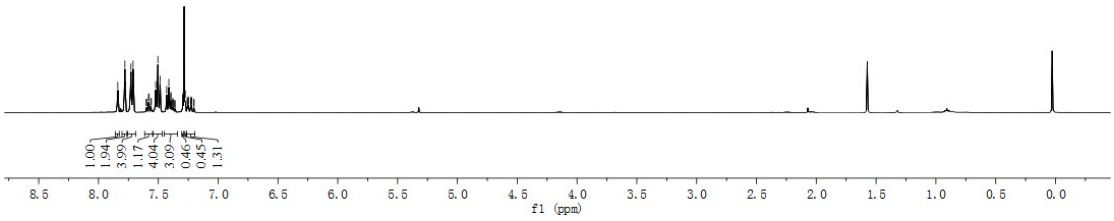


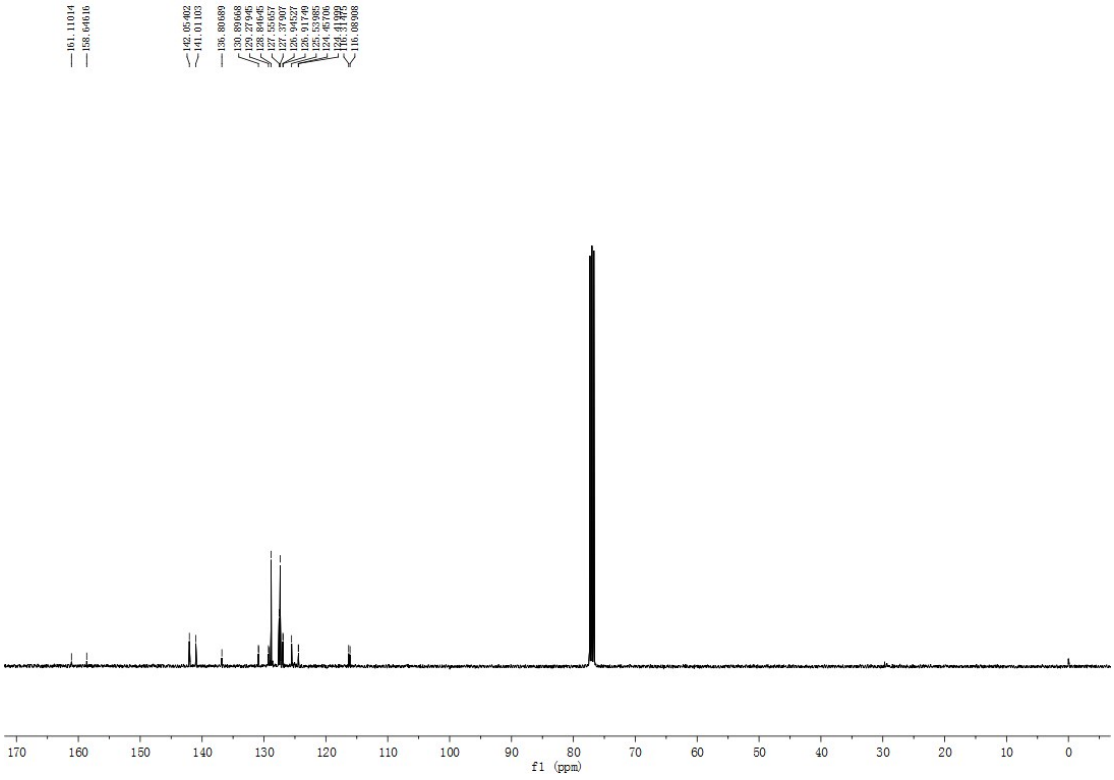
^{1}H NMR and ^{13}C NMR spectra of **2j**



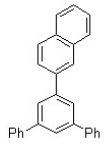


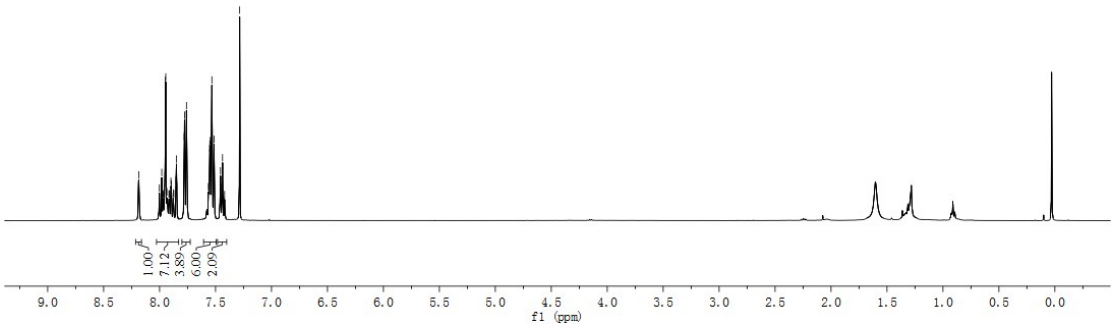


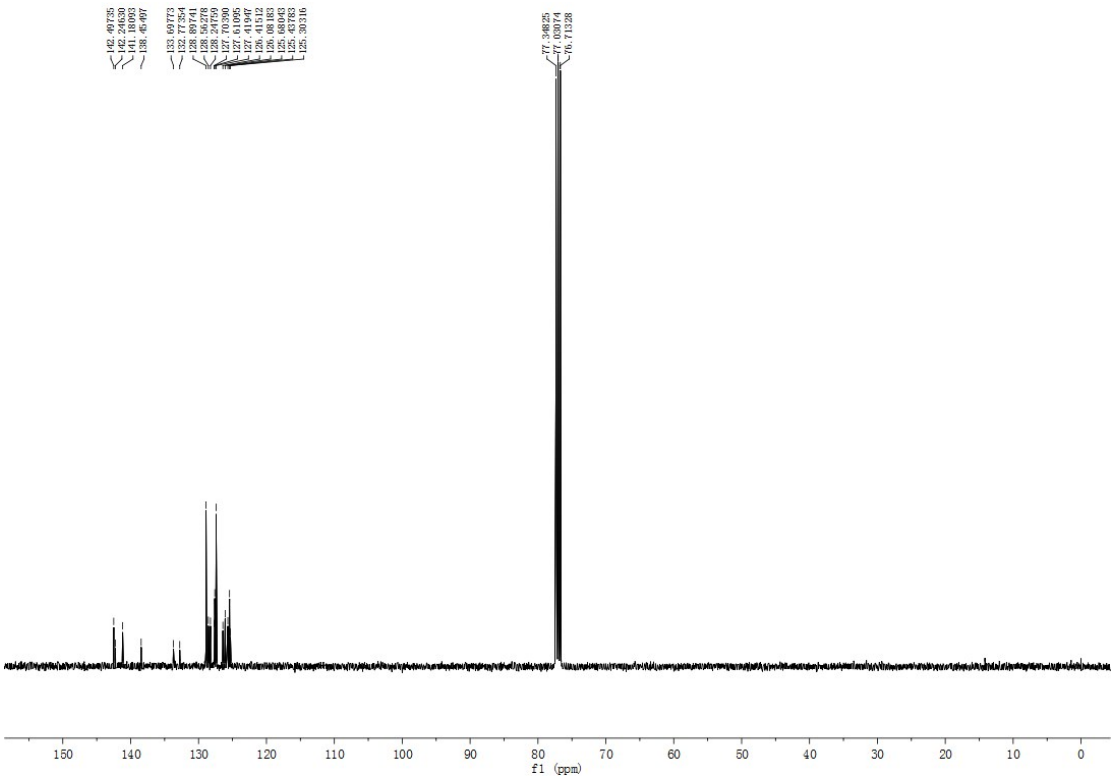




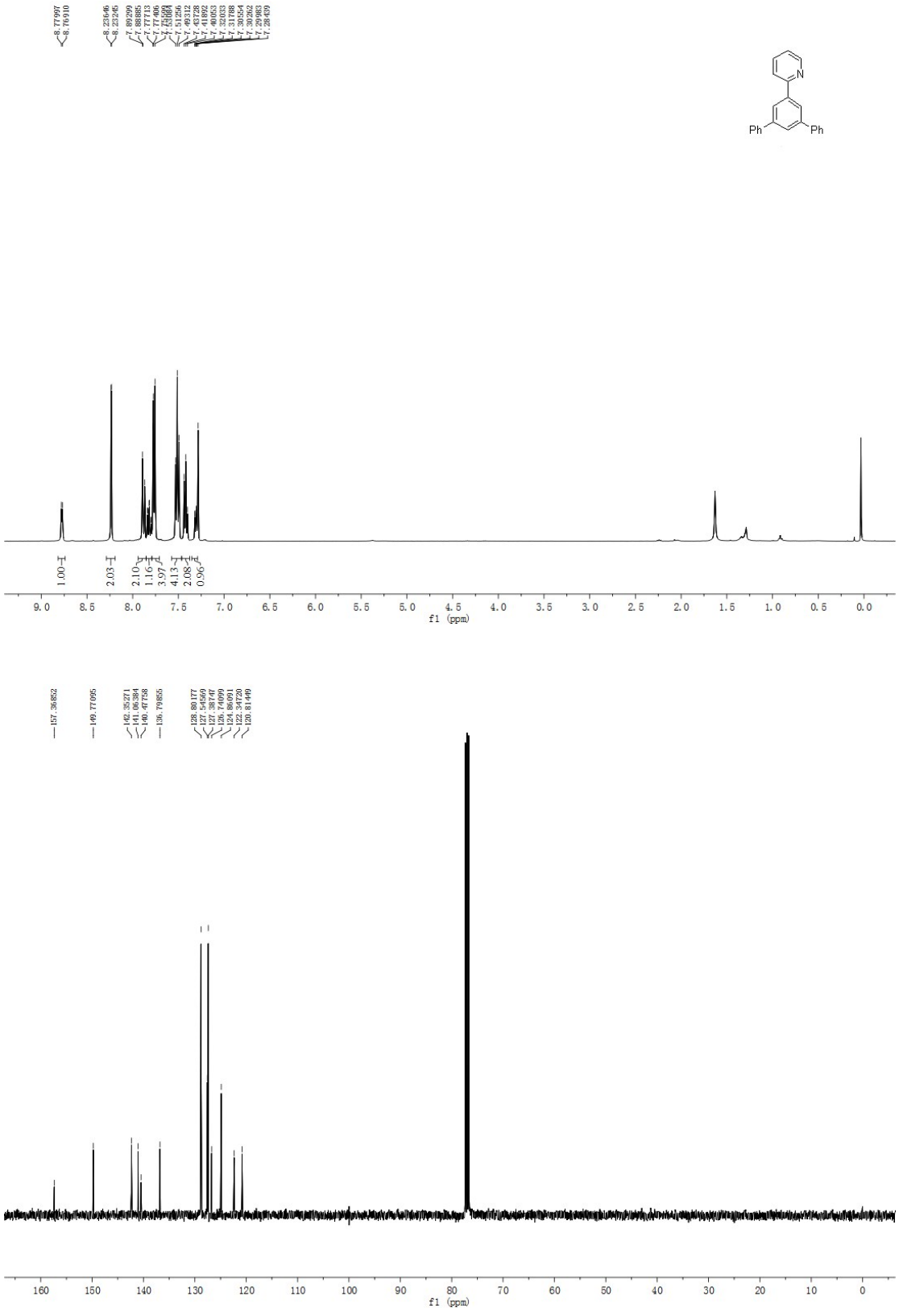
^{1}H NMR and ^{13}C NMR spectra of **2k**



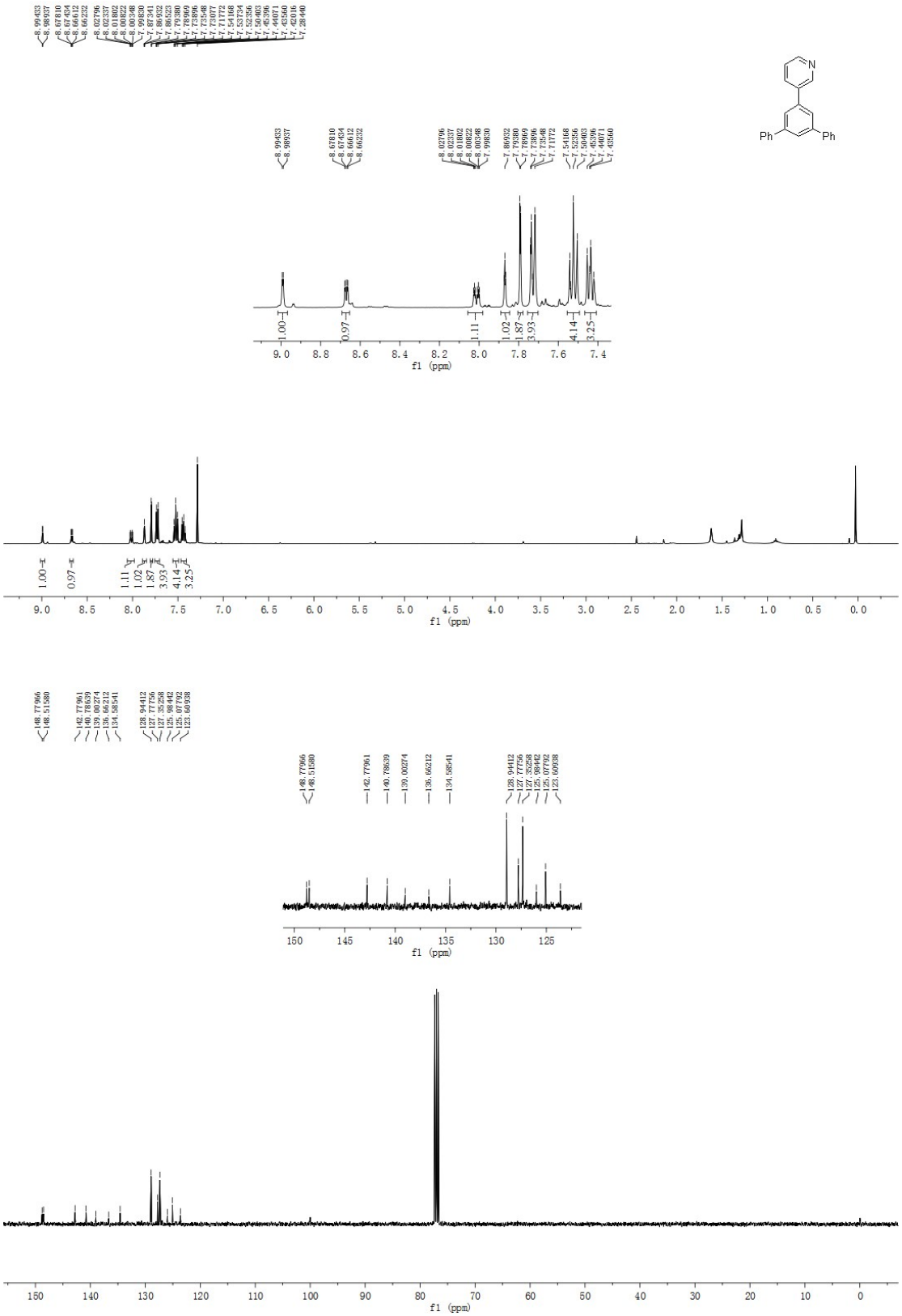




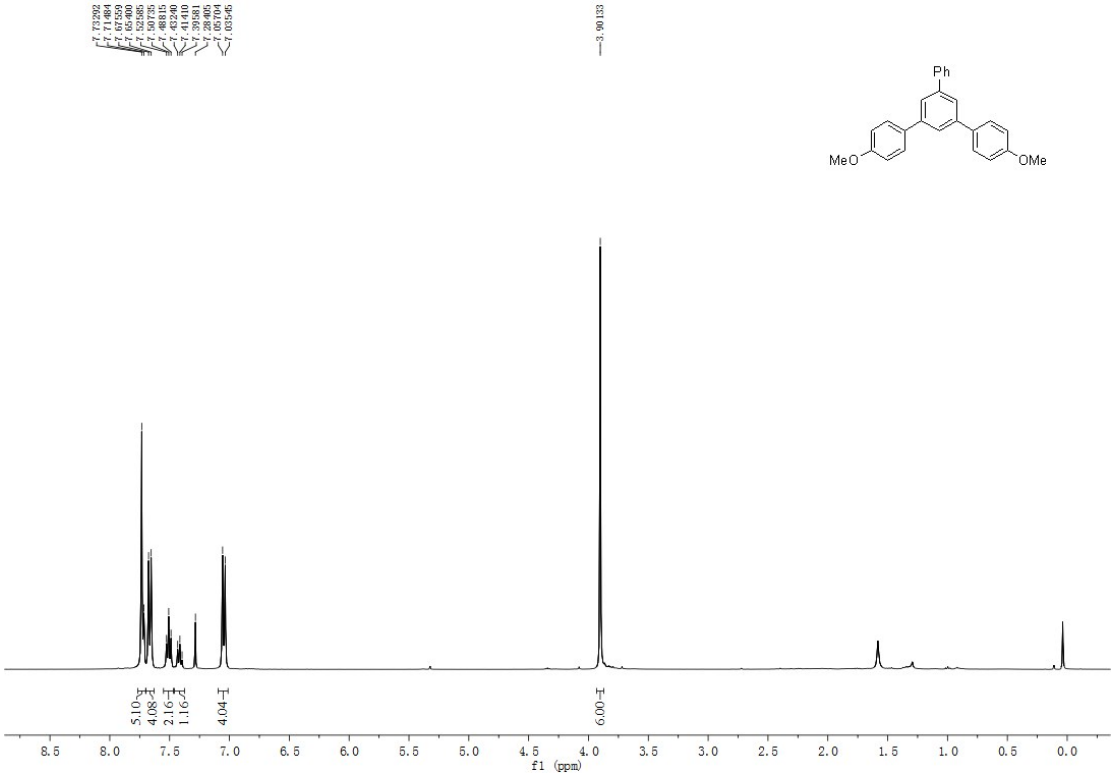
^{1}H NMR and ^{13}C NMR spectra of **2l**

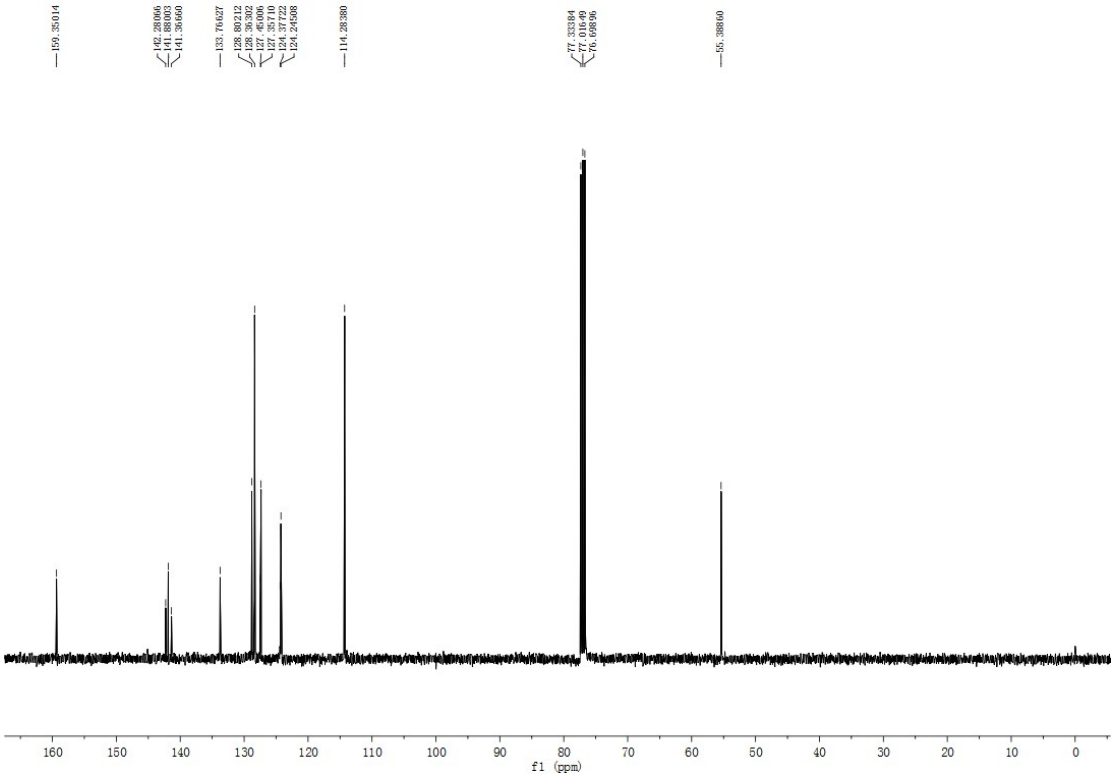


^{1}H NMR and ^{13}C NMR spectra of **2m**

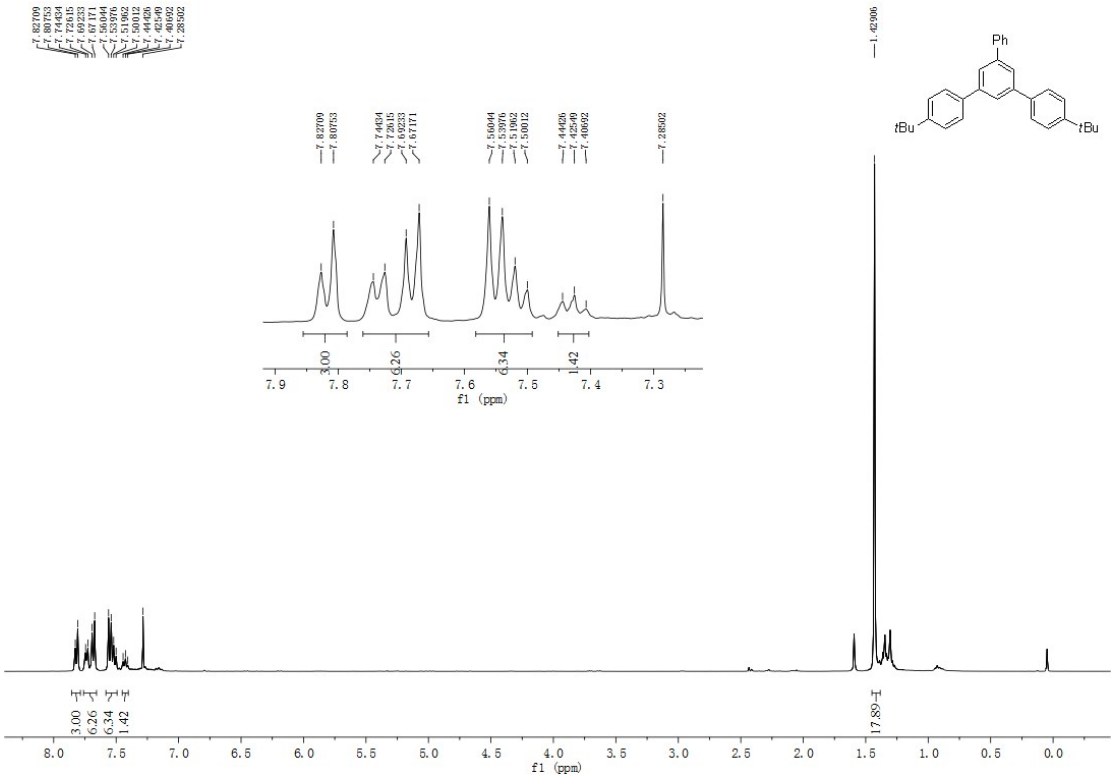


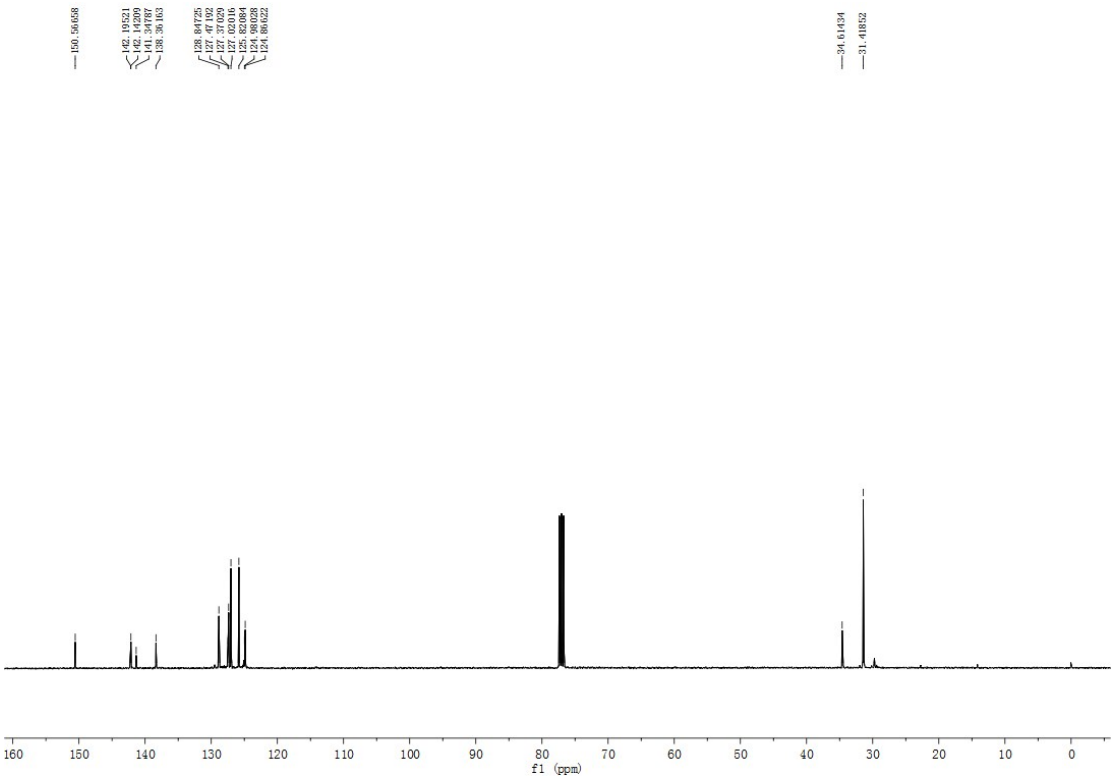
^{1}H NMR and ^{13}C NMR spectra of **2n**



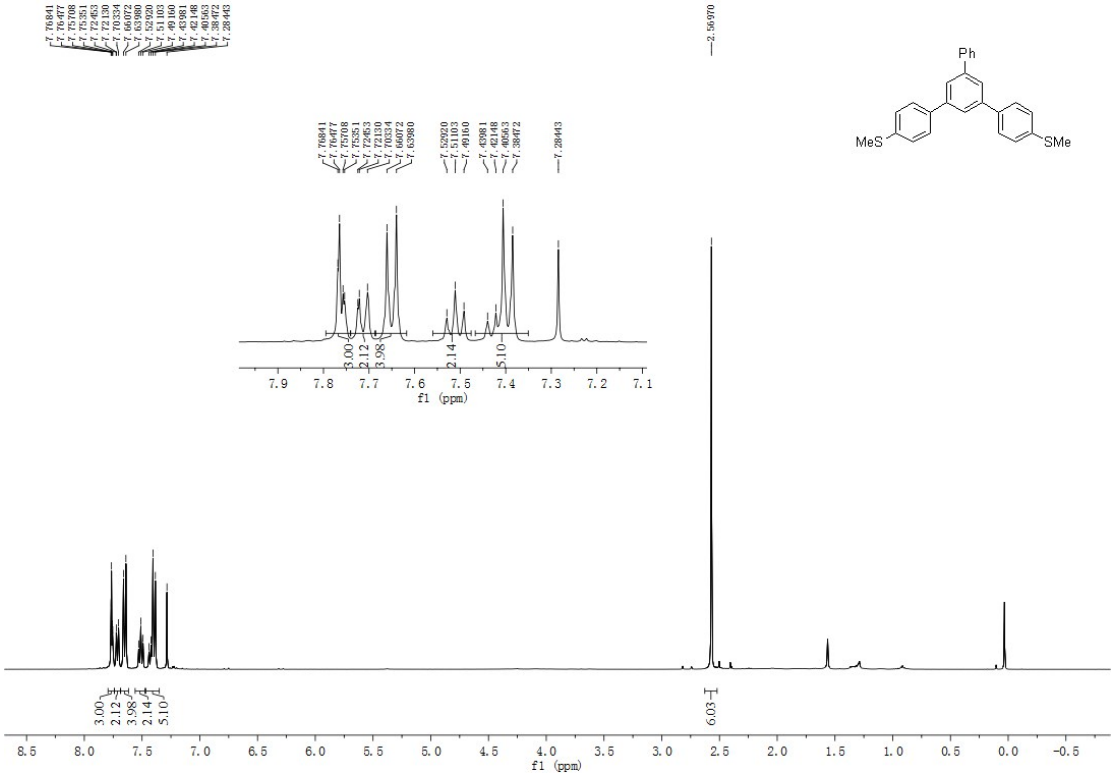


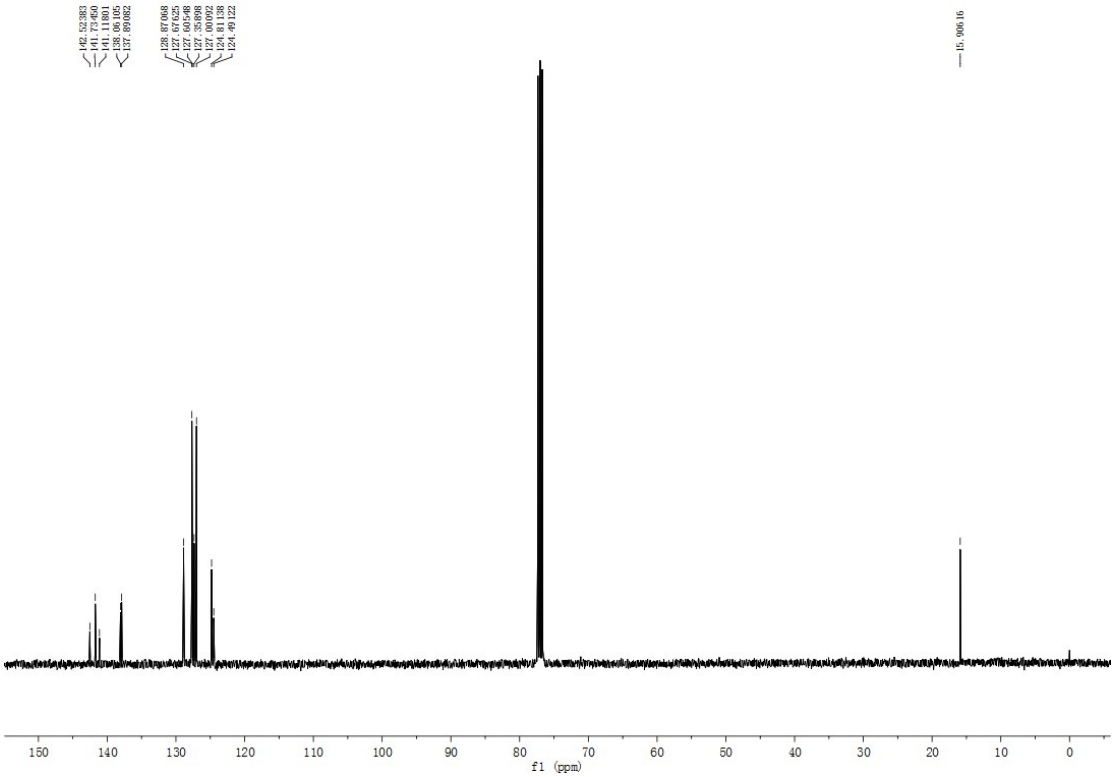
^{1}H NMR and ^{13}C NMR spectra of **2o**



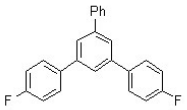


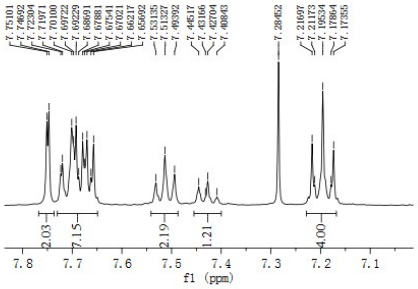
^{1}H NMR and ^{13}C NMR spectra of **2p**

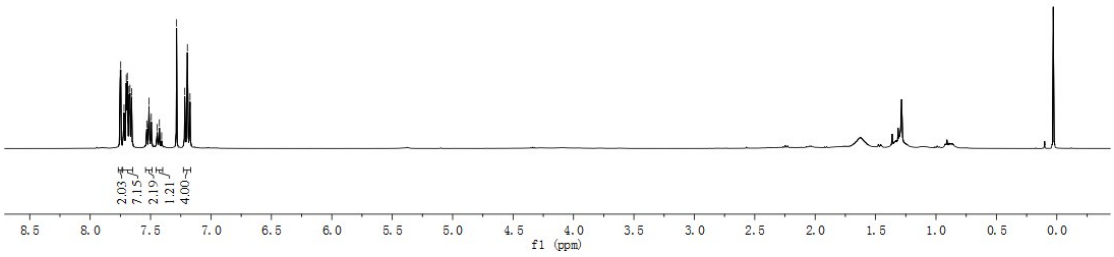


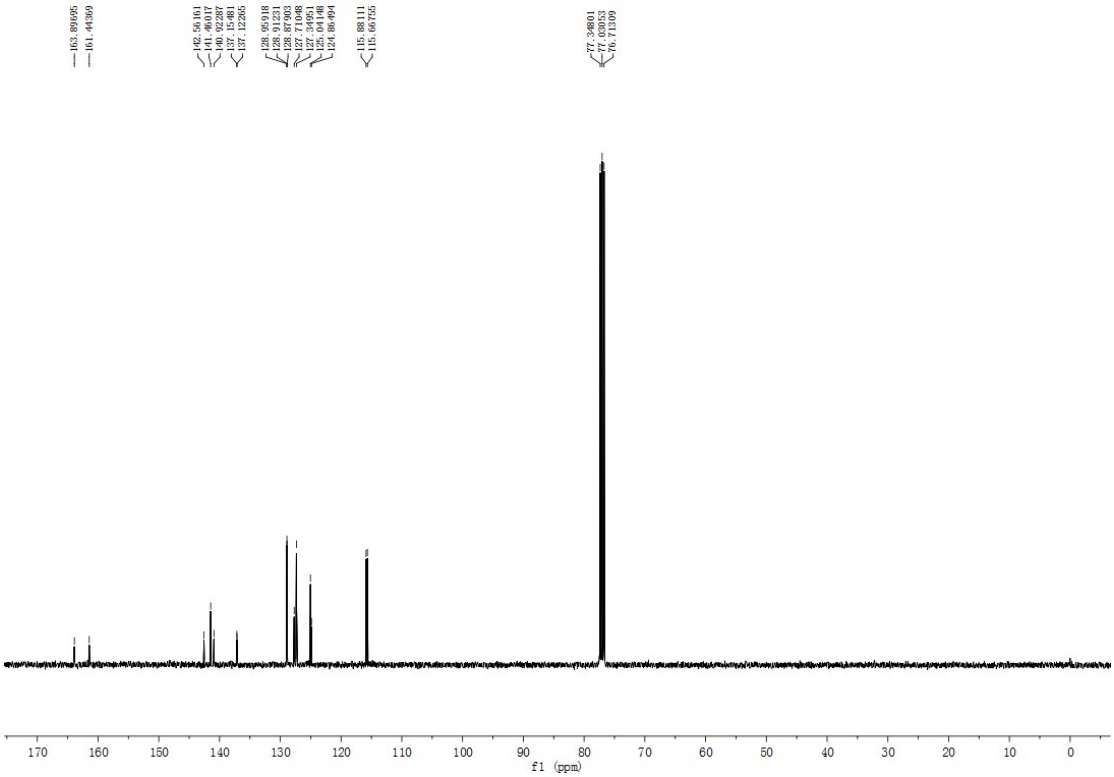


^{1}H NMR and ^{13}C NMR spectra of **2q**

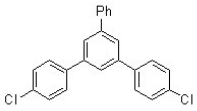


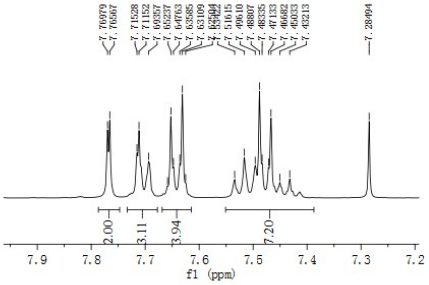


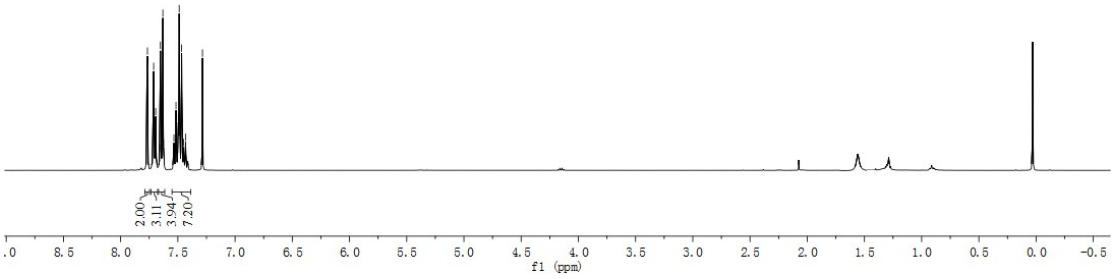


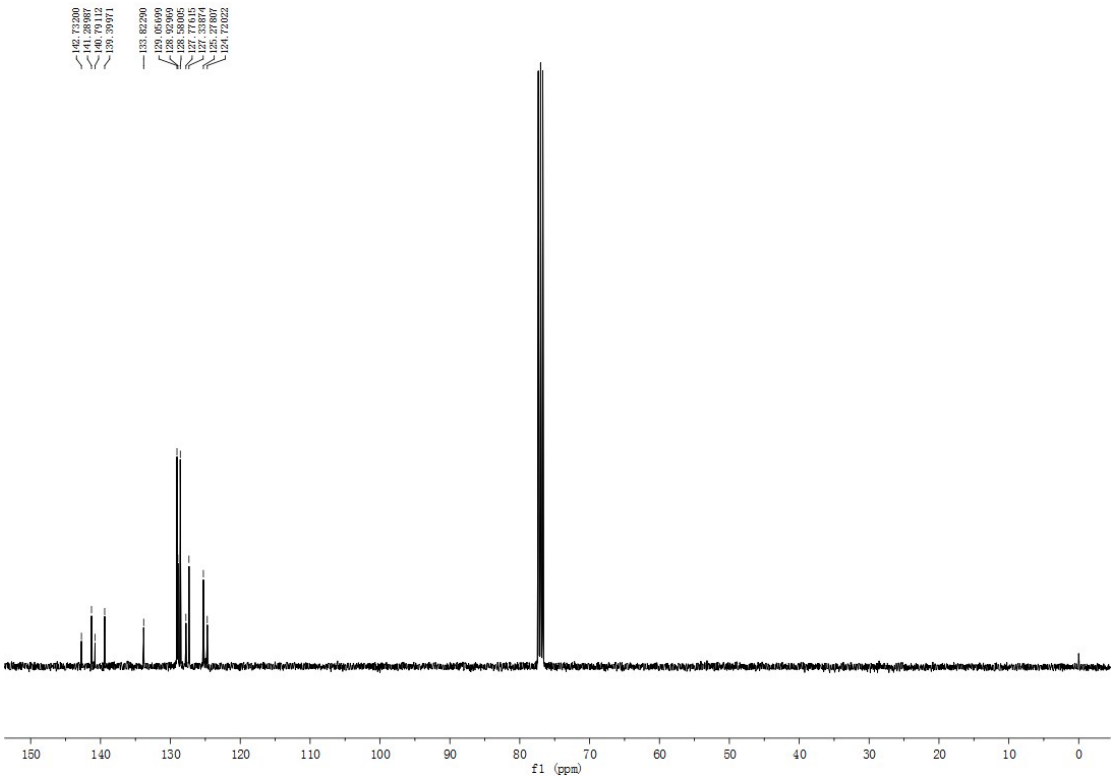


^{1}H NMR and ^{13}C NMR spectra of **2r**

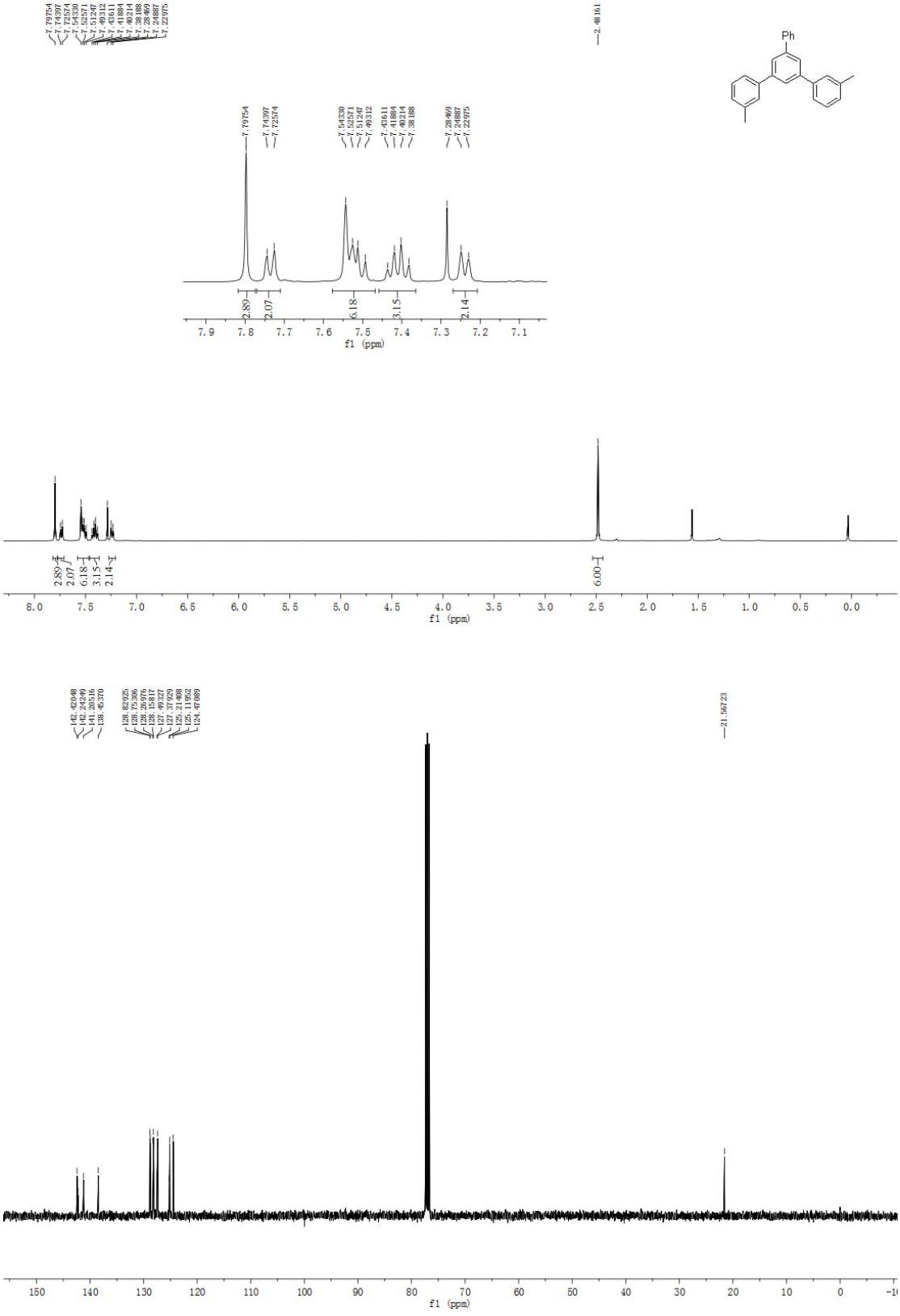




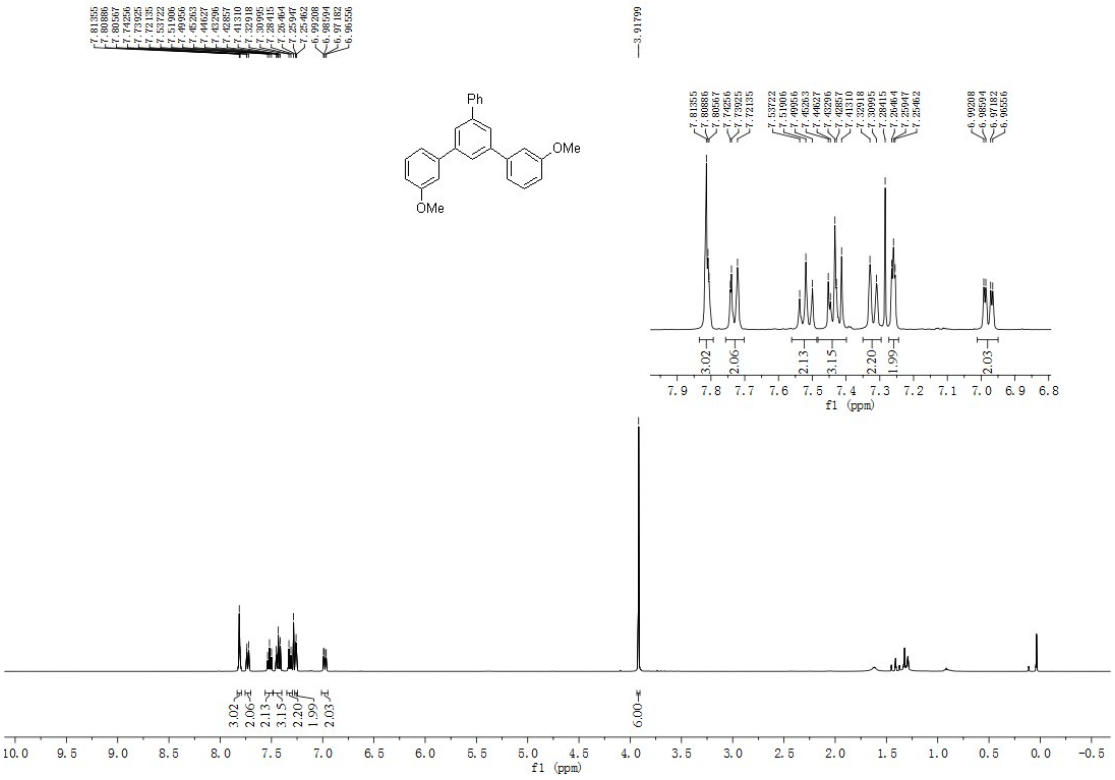


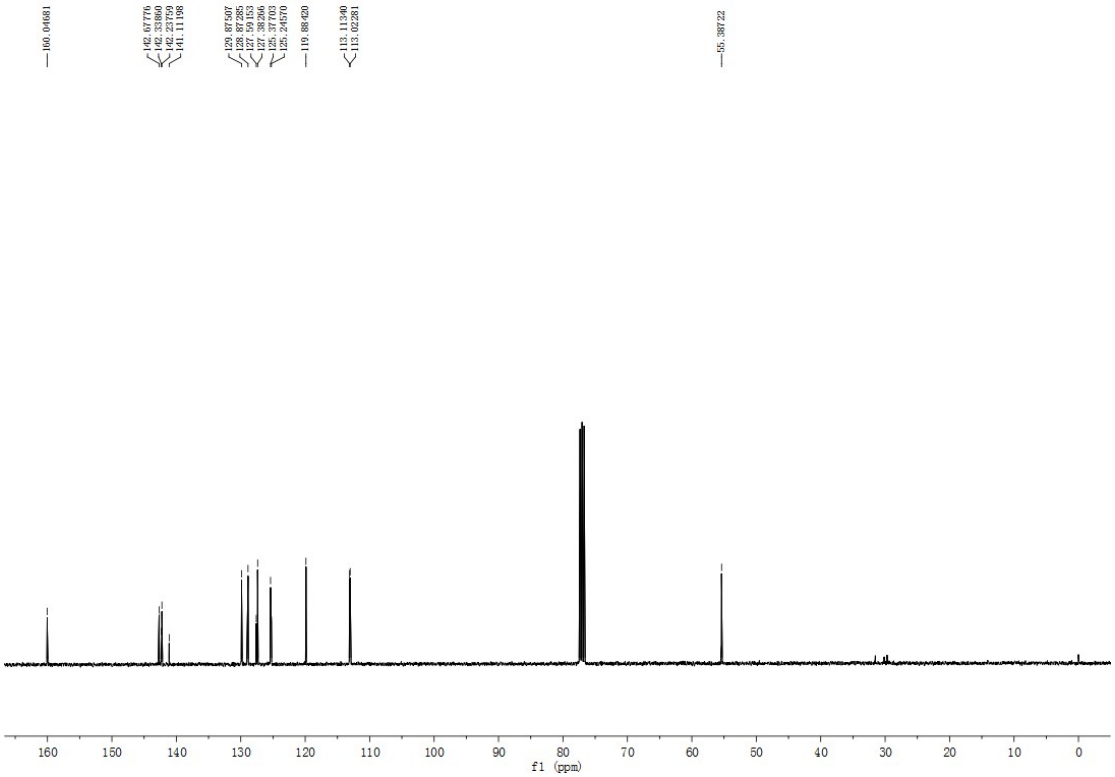


^{1}H NMR and ^{13}C NMR spectra of **2s**

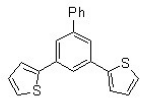


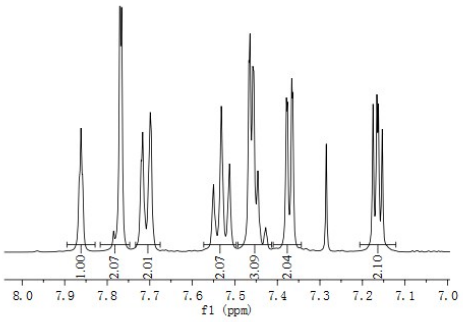
^{1}H NMR and ^{13}C NMR spectra of **2t**

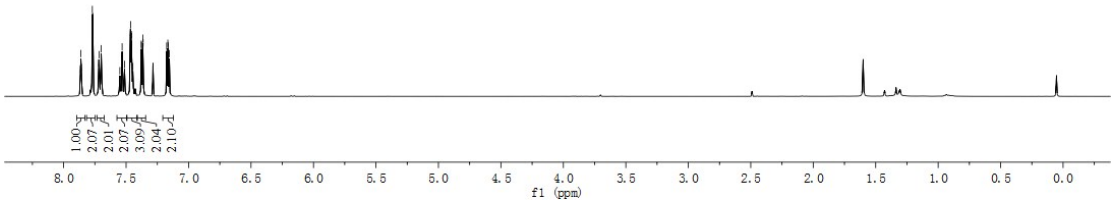


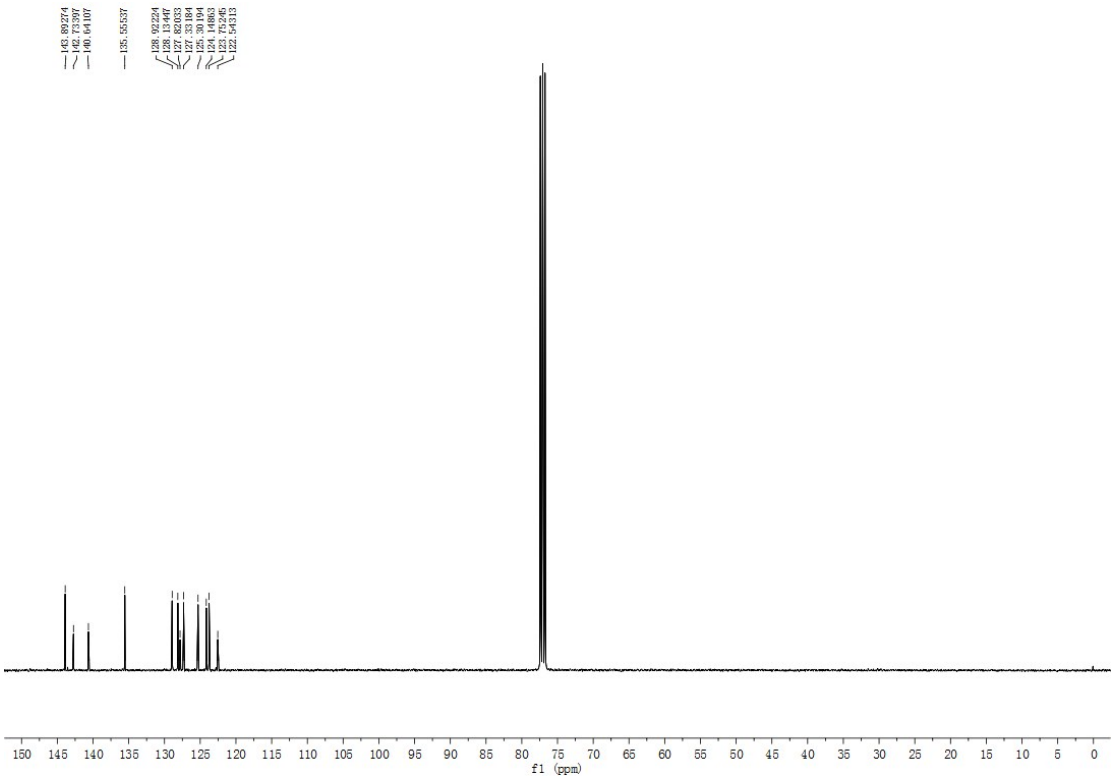


^{1}H NMR and ^{13}C NMR spectra of **2v**

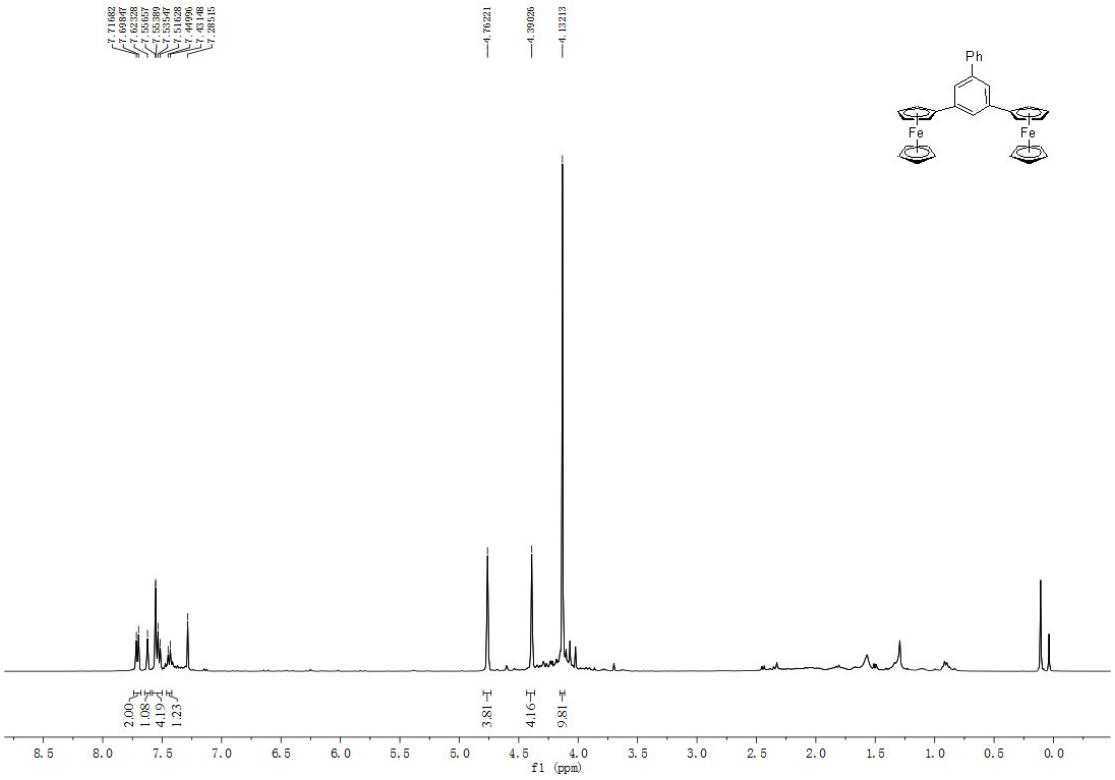


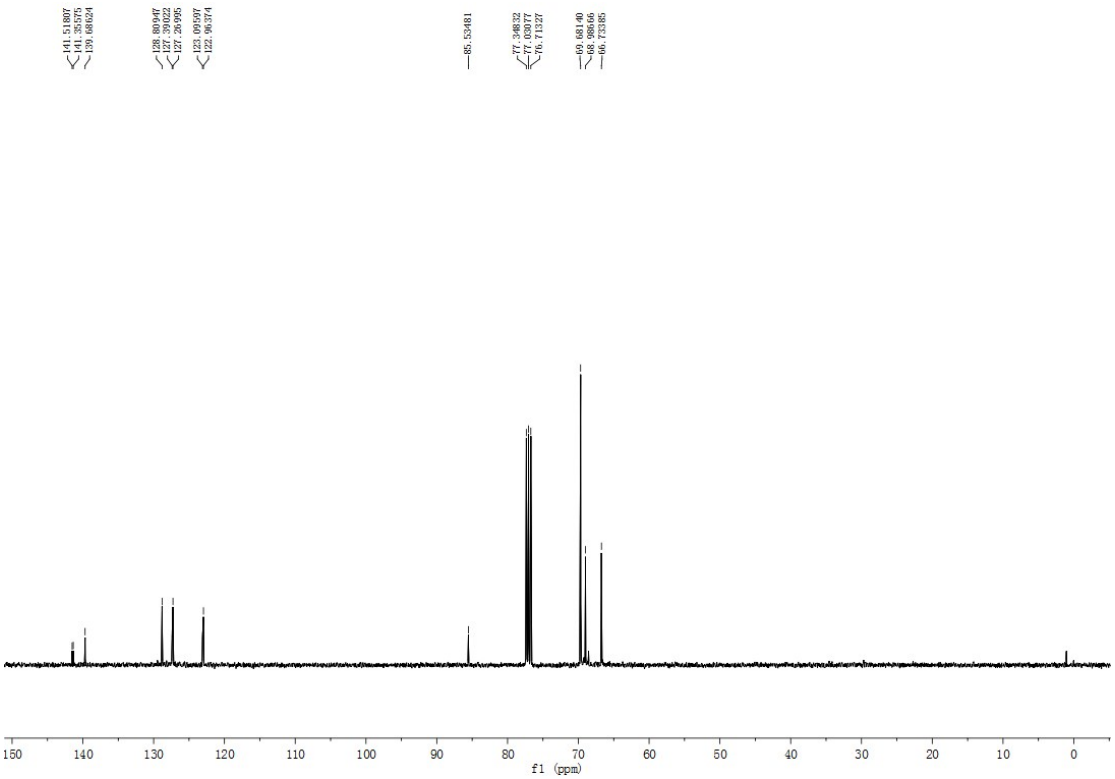




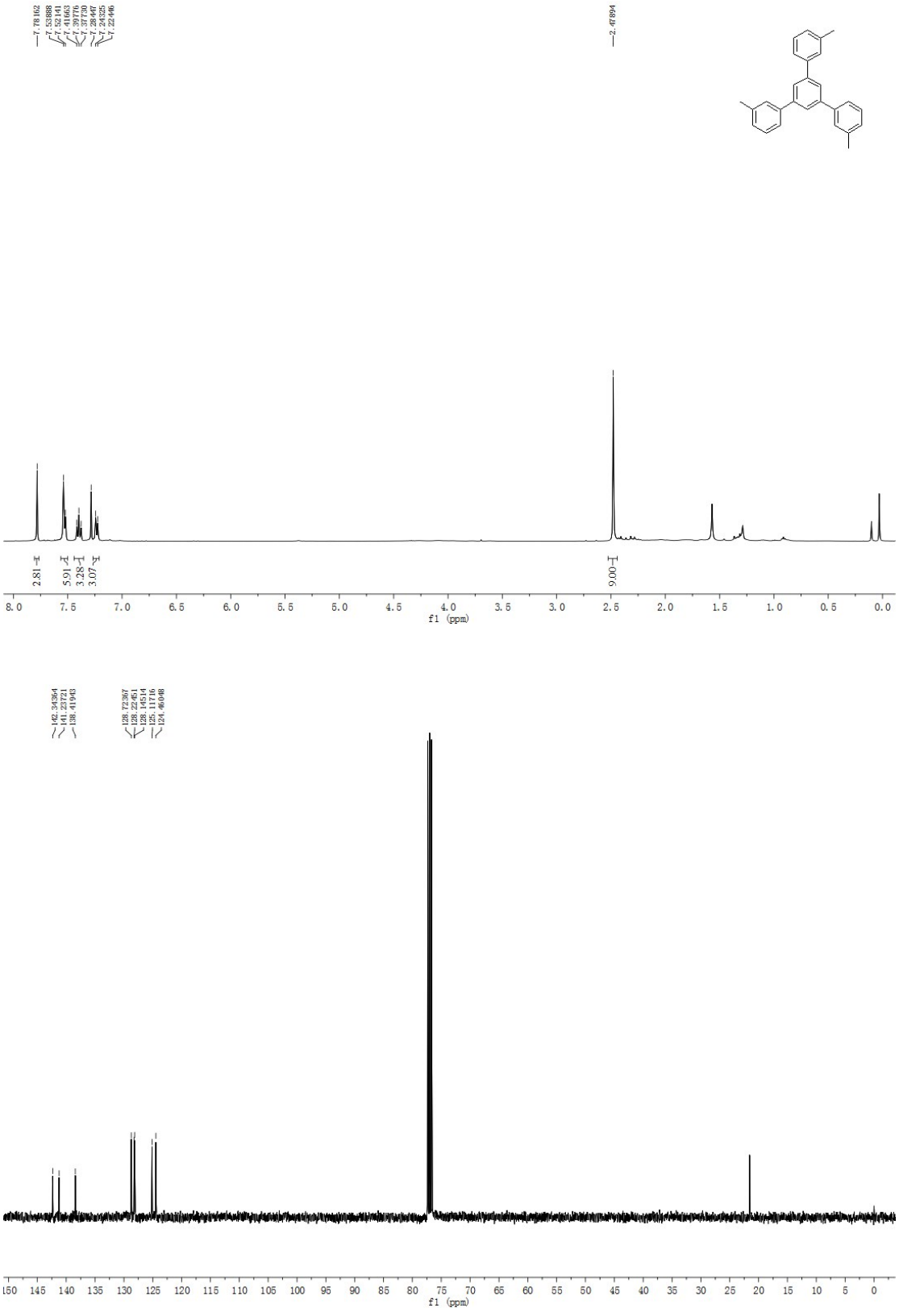


^{1}H NMR and ^{13}C NMR spectra of **2w**





^{1}H NMR and ^{13}C NMR spectra of **2x**



^{1}H NMR and ^{13}C NMR spectra of **2y**