*Supporting Information For:*

# Synthesis of symmetrical pyridines by iron-catalyzed cyclization of ketoxime acetates and aldehydes

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## 1. General information

$^{1}H$ NMR spectra were recorded on 400 MHz in $CDCl_3$, and $^{13}C$ NMR spectra were recorded on 100 MHz in $CDCl_3$. The following abbreviations were used to explain multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet. All products were further characterized by HRMS (ESI-TOF-Q); copies of their $^{1}H$ NMR and $^{13}C$ NMR spectra are provided in Supporting Information. All reactions were monitored by TLC with GF254 silica gel coated plates. Column chromatography was carried out on silica gel. Aldehydes, $FeCl_3$ (CR, anhydrous) and other reagents were purchased from commercial suppliers and used without further purification. Ketoxime acetates were synthesized by the following procedure.

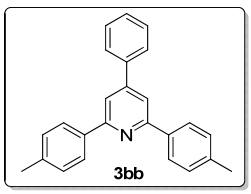
## 2. Typical procedure for preparation of ketoxime acetates

The mixture of ketoxime (3.0 mmol), acetic anhydride (6.0 mmol, 2.0 eq), was stirred at 100 $^{o}C$ for 3h. The reaction mixture was cooled to room temperature, diluted with EtOAc (20 mL) and washed with $H_2O$ (20 mL) and brine (10 mL). The organic layers were dried over anhydrous $Na_2SO_4$ and evaporated in vacuo. The residue was purified by column chromatography on silica gel to afford the oxime acetates with hexane/ethyl acetate as the eluent.

## 3. Procedure for the synthesis of pyridines

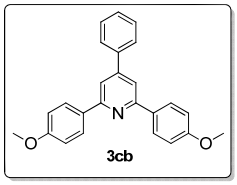
In a 10 mL round bottom flask, the ketoxime acetates **1** (0.6 mmol), aldehydes **2** (0.2 mmol) and $FeCl_3$ (20 mol%, 6.5 mg) was stirred in toluene (2.0 mL) under Ar at 140 $^{o}C$. When the reaction was completed (detected by TLC), the mixture was cooled to room temperature, extracted with EtOAc (2 × 10 mL) and washed with brine (10 mL). The combined organic layers were dried over anhydrous $Na_2SO_4$ and then evaporated in vacuo. The residue was purified by column chromatography on silica gel to afford the corresponding pyridines **3** with hexane/ethyl acetate as the eluent.

## 4. Spectroscopic data for pyridines:

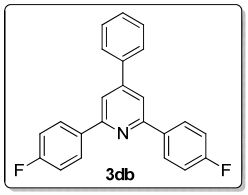



**4-Phenyl-2,6-di-p-tolylpyridine (3bb)**. Yield 70% (47.0 mg); Yellow solid; mp 148-150 $^{o}C$;

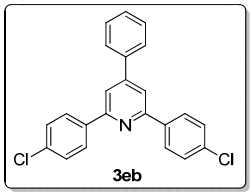
$^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.09 (d, *J* = 8.0 Hz, 4H), 7.82 (s, 2H), 7.72 (d, *J* = 7.2 Hz, 2H), 7.52-7.45 (m, 3H), 7.31 (d, *J* = 8.0 Hz, 4H), 2.42 (s, 6H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 157.3, 149.9, 139.2, 138.9, 136.8, 129.4, 129.0, 128.8, 127.1, 126.9, 116.5, 21.3. HRMS Calcd (ESI) m/z for $C_{25}H_{22}N$: $[M+H]^+$ 336.1747. Found: 336.1731.



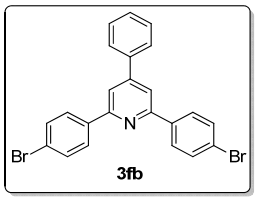

**2,6-Bis(4-methoxyphenyl)-4-phenylpyridine (3cb)**. Yield 85% (62.0 mg); Yellow solid; mp 125-127 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.15 (d, *J* = 8.8 Hz, 4H), 7.76 (s, 2H), 7.72 (d, *J* = 7.2 Hz, 2H), 7.52-7.45 (m, 3H), 7.02 (d, *J* = 8.8 Hz, 4H), 3.86 (s, 6H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 160.4, 156.9, 149.9, 139.3, 132.3, 129.0, 128.8, 128.3, 127.1, 115.6, 114.0, 55.3. HRMS Calcd (ESI) m/z for $C_{25}H_{22}NO_2$: $[M+H]^+$ 368.1645. Found: 368.1636.



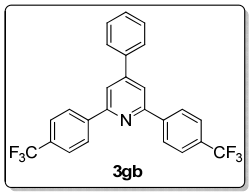

**2,6-Bis(4-fluorophenyl)-4-phenylpyridine (3db)**. Yield 80% (55.0 mg); Yellow solid; mp 168-170 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.17-8.14 (m, 4H), 7.80 (s, 2H), 7.72-7.70 (m, 2H), 7.54-7.47 (m, 3H), 7.20-7.16 (m, 4H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 163.6 (d, $J_{CF}$ = 247.1 Hz), 156.4, 150.4, 138.7, 135.5, 129.1, 129.1, 128.8 (d, $J_{CF}$ = 8.0 Hz), 127.1, 116.6, 115.6 (d, $J_{CF}$ = 21.4 Hz). HRMS Calcd (ESI) m/z for $C_{23}H_{16}F_2N$: $[M+H]^+$ 344.1245. Found: 344.1233.



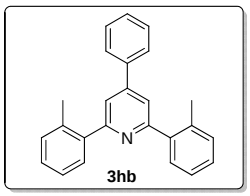

**2,6-Bis(4-chlorophenyl)-4-phenylpyridine (3eb)**. Yield 93% (70.0 mg); Yellow solid; mp 178-180 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.11 (d, *J* = 8.4 Hz, 4H), 7.83 (s, 2H), 7.71 (d, *J* = 7.6 Hz, 2H), 7.547-7.507 (m, 2H), 7.47 (d, *J* = 8.4 Hz, 5H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 156.3, 150.5, 138.6, 137.7, 135.2, 129.2, 128.9, 128.3, 127.1, 117.0. HRMS Calcd (ESI) m/z for $C_{23}H_{16}Cl_2N$: $[M+H]^+$ 376.0654. Found: 376.0647.



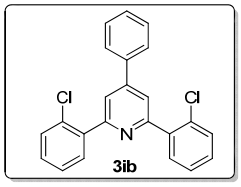

**2,6-Bis(4-bromophenyl)-4-phenylpyridine (3fb)**. Yield 85% (78.3 mg); Yellow solid; mp 194-196 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.06 (d, *J* = 8.4 Hz, 4H), 7.86 (s, 2H), 7.72 (d, *J* = 7.2 Hz, 2H), 7.64 (d, *J* = 8.4 Hz, 4H), 7.56-7.49 (m, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 156.4, 150.6, 138.6, 138.2, 131.9, 129.2, 128.6, 127.1, 123.6, 117.1. HRMS Calcd (ESI) m/z for $C_{23}H_{16}Br_2N$: $[M+H]^+$ 463.9644. Found: 463.9642.




**4-Phenyl-2,6-bis(4-(trifluoromethyl)phenyl)pyridine (3gb)**. Yield 92% (81.0 mg); Yellow solid; mp 152-154 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.28 (d, *J* = 8.4Hz, 4H), 7.94 (s, 2H), 7.77 (d, *J* = 8.4 Hz, 4H), 7.74-7.72 (m, 2H), 7.57-7.51 (m, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 156.2, 150.8, 142.4, 138.3, 131.0 (q, $J_{CF}$ = 32.2), 129.4, 129.3, 127.4, 127.1, 125.7 (q, $J_{CF}$ = 3.7), 122.8, 118.2. HRMS Calcd (ESI) m/z for $C_{25}H_{16}F_6N$: $[M+H]^+$ 444.1181. Found: 444.1168.

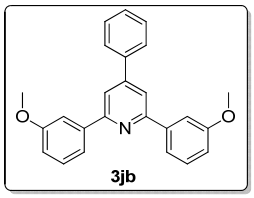



**4-Phenyl-2,6-di-o-tolylpyridine (3hb)**. Yield 78% (52.0 mg); Yellow solid; mp 133-135 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.72 (d, *J* = 7.2 Hz, 2H), 7.59 (s, 2H), 7.52-7.45 (m, 6H), 7.3 (s, 5H), 2.48 (s, 6H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 160.0, 148.7, 140.7, 138.4, 135.9, 130.7, 129.8, 129.1, 129.0, 128.2, 127.1, 125.8, 120.1, 20.6. HRMS Calcd (ESI) m/z for $C_{25}H_{22}N$: $[M+H]^+$ 336.1747. Found: 336.1736.

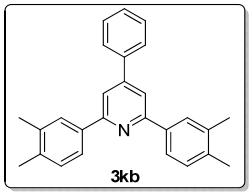



**2,6-Bis(2-chlorophenyl)-4-phenylpyridine (3ib)**. Yield 70% (53.0 mg); Yellow solid; mp

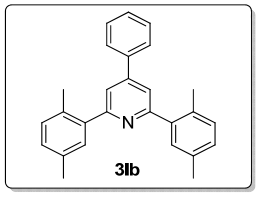
147-149 °C; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.88 (s, 2H), 7.76-7.73 (m, 4H), 7.53-7.45 (m, 5H), 7.40-7.32 (m, 4H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 157.1, 148.4, 139.2, 138.2, 132.3, 131.8, 130.1, 129.6, 129.1, 127.2, 127.1, 121.6. HRMS Calcd (ESI) m/z for $C_{23}H_{16}Cl_2N$: $[M+H]^+$ 376.0654. Found: 376.0647.



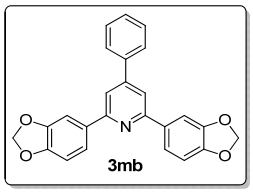

**2,6-Bis(3-methoxyphenyl)-4-phenylpyridine (3jb)**. Yield 83% (61.0 mg); Yellow solid; mp 76-78 °C; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.87 (s, 2H), 7.80-7.79 (m, 2H), 7.76-7.72 (m, 4H), 7.54-7.46 (m, 3H), 7.44-7.40 (m, 2H), 7.00-6.98 (m, 2H), 3.91 (s, 6H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 160.0, 157.1, 150.1, 141.0, 138.9, 129.7, 129.1, 129.0, 127.1, 119.5, 117.4, 114.7, 112.6, 55.3. HRMS Calcd (ESI) m/z for $C_{25}H_{22}NO_2$: $[M+H]^+$ 368.1645. Found: 368.1636.



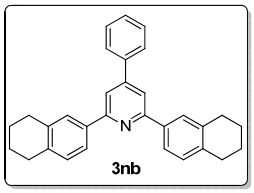

**2,6-Bis(3,4-dimethylphenyl)-4-phenylpyridine (3kb)**. Yield 80% (58.0 mg); Yellow solid; mp 207-209 °C; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.97 (s, 2H), 7.91 (d, *J* = 7.6 Hz, 2H), 7.81 (s, 2H), 7.75-7.73 (m, 2H), 7.53-7.45 (m, 3H), 7.26 (d, *J* = 7.6 Hz, 2H), 2.38 (s, 6H), 2.33 (s, 6H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 157.6, 149.8, 139.3, 137.6, 137.4, 136.8, 129.9, 129.0, 128.8, 128.3, 127.2, 124.5, 116.5, 20.0, 19.6. HRMS Calcd (ESI) m/z for $C_{27}H_{26}N$: $[M+H]^+$ 364.2060. Found: 364.2048.



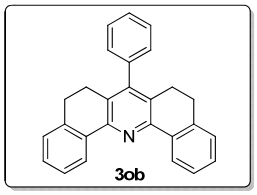

**2,6-Bis(2,5-dimethylphenyl)-4-phenylpyridine (3lb)**. Yield 65% (47.0 mg); Yellow oil; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.72 (d, *J* = 7.2 Hz, 2H), 7.57 (s, 2H), 7.52-7.45 (m, 3H), 7.32 (s, 2H), 7.18 (d, *J* = 7.2 Hz, 2H), 7.12 (d, *J* = 7.2 Hz, 2H), 2.42 (s, 6H), 2.37 (s, 6H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 160.2, 148.6, 140.6, 138.6, 135.2, 132.7, 130.6, 130.5, 129.1, 129.0, 128.9, 127.1, 120.0, 20.9, 20.1. HRMS Calcd (ESI) m/z for $C_{27}H_{26}N$: $[M+H]^+$ 364.2060. Found: 364.2048.



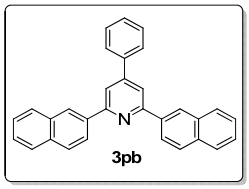

**2,6-Bis(benzo[d][1,3]dioxol-5-yl)-4-phenylpyridine (3mb)**. Yield 75% (60.0 mg); Yellow solid; mp 137-139 $^{o}$C; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.73 (d, *J* = 1.6 Hz, 2H), 7.72 (s, 2H), 7.69-7.67 (m, 2H), 7.65 (d, *J* = 1.6 Hz, 1H), 7.52-7.45 (m, 4H), 6.92 (d, *J* = 8.0 Hz, 2H), 6.02 (s, 4H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 156.6, 150.0, 148.4, 148.2, 139.0, 134.0, 129.0, 128.9, 127.1, 121.0, 116.0, 108.3, 107.5, 101.3. HRMS Calcd (ESI) m/z for $C_{25}H_{18}NO_4$: $[M+H]^+$ 396.1230. Found: 396.1221.



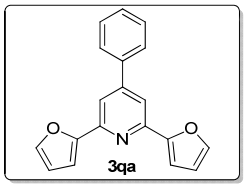

**4-Phenyl-2,6-bis(5,6,7,8-tetrahydronaphthalen-2-yl)pyridine (3nb)**. Yield 66% (55.0 mg); Yellow oil; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.88 (d, *J* = 6.4 Hz, 4H), 7.80 (s, 2H), 7.73-7.71 (m, 2H), 7.52-7.48 (m, 2H), 7.45 (d, *J* = 7.2 Hz, 1H), 7.18 (d, *J* = 8.4 Hz, 2H), 2.89 (s, 4H), 2.82 (s, 4H), 1.84-1.83 (m, 8H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 157.6, 149.7, 139.2, 138.2, 137.3, 137.0, 129.4, 129.0, 128.7, 127.7, 127.1, 124.2, 116.5, 29.6, 29.3, 23.2, 23.2. HRMS Calcd (ESI) m/z for $C_{31}H_{30}N$: $[M+H]^+$ 416.2373. Found: 416.2359.



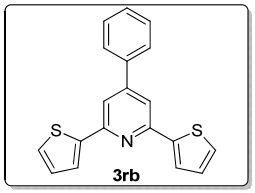

**7-Phenyl-5,6,8,9-tetrahydrodibenzo[c,h]acridine (3ob)**. Yield 75% (54.0 mg); Yellow solid; mp 160-162$^{o}$C; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.58 (d, *J* = 7.6 Hz, 2H), 7.51-7.47 (m, 2H), 7.44-7.39 (m, 3H), 7.34-7.29 (m, 3H), 7.20 (d, *J* = 6.8 Hz, 3H), 2.84-2.81 (m, 4H), 2.67-2.63 (m, 4H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 150.0, 147.4, 137.9, 137.8, 135.3, 128.8, 128.7, 128.6, 128.6, 127.6, 127.4, 127.0, 125.2, 28.1, 25.7. HRMS Calcd (ESI) m/z for $C_{27}H_{22}N$: $[M+H]^+$ 360.1747. Found: 360.1735.



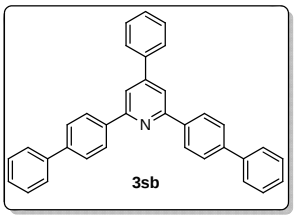

**2,6-Di(naphthalen-2-yl)-4-phenylpyridine (3pb)**. Yield 65% (53.0 mg); Yellow solid; mp 145-147 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.66 (s, 2H), 8.40-8.38 (m, 2H), 8.01-7.97 (m, 6H), 7.89-7.87 (m, 2H), 7.78 (d, *J* = 7.2 Hz, 2H), 7.55-7.50 (m, 7H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 157.4, 150.2, 139.0, 136.9, 133.7, 133.5, 129.1, 129.0, 128.7, 128.4, 127.7, 127.2, 126.5, 126.4, 126.2, 124.9, 117.4. HRMS Calcd (ESI) m/z for $C_{31}H_{22}N$: $[M+H]^+$ 408.1747. Found: 408.1730.




**2,6-Di(furan-2-yl)-4-phenylpyridine (3qb)**. Yield 64% (37.0 mg); Yellow solid; mp 102-104 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.79 (s, 2H), 7.76-7.73 (m, 2H), 7.55 (d, *J* = 0.8 Hz, 2H), 7.52-7.45 (m, 3H), 7.19 (d, *J* = 3.2 Hz, 2H), 6.56-6.55 (m, 2H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 153.7, 149.6, 143.3, 129.1, 129.0, 127.0, 114.8, 112.0, 109.1. HRMS Calcd (ESI) m/z for $C_{19}H_{14}NO_2$: $[M+H]^+$ 288.1019. Found: 288.1010.

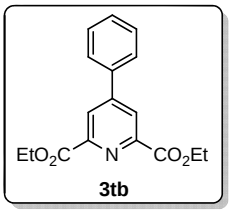


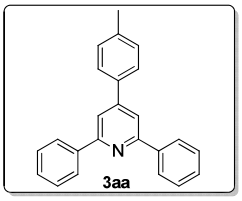

**4-Phenyl-2,6-di(thiophen-2-yl)pyridine (3rb)**. Yield 71% (46.0 mg); Yellow solid; mp 108-110 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 7.69-7.66 (m, 6H), 7.52-7.45 (m, 3H), 7.40 (d, *J* = 4.8 Hz, 2H), 7.12-7.10 (m, 2H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 152.5, 150.1, 144.8, 138.5, 129.1, 129.1, 127.9, 127.8, 127.0, 124.8, 115.0. HRMS Calcd (ESI) m/z for $C_{19}H_{14}NS_2$: $[M+H]^+$ 320.0562. Found: 320.0556.



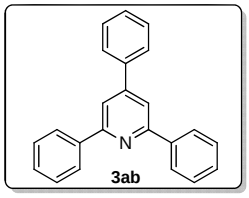

**2,6-di([1,1'-biphenyl]-4-yl)-4-phenylpyridine (3sb)**. Yield 72% (66.0 mg); Yellow solid; $^{1}$H

NMR (400 MHz, $CDCl_3$): δ 8.30 (d, *J* = 8.4 Hz, 4H), 7.93 (s, 2H), 7.77-7.74 (m, 6H), 7.70-7.67(m, 4H), 7.49-7.45 (m, 6H), 7.39-7.36 (m, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$): δ 157.1, 150.2, 141.8, 140.6, 139.0, 138.4, 129.1, 129.0, 128.8, 127.5, 127.4, 127.2, 127.1, 117.0. HRMS Calcd (ESI) m/z for $C_{35}H_{26}N$: $[M+H]^+$ 460.2060. Found: 460.2059.

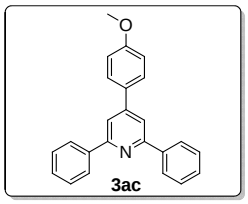



**diethyl 4-phenylpyridine-2,6-dicarboxylate (3tb)**. Yield 65% (39.0 mg); Yellow solid; $^1H$ NMR (400 MHz, $CDCl_3$): δ 8.52 (s, 2H), 7.78-7.76 (m, 2H), 7.57-7.53 (m, 3H), 4.55-4.50 (m, 4H), 1.51-1.47 (m, 6H). $^{13}C$ NMR (100 MHz, $CDCl_3$): δ 164.8, 149.2, 130.1, 129.4, 127.2, 125.5, 62.5, 14.3. HRMS Calcd (ESI) m/z for $C_{17}H_{17}NNaO_4$: $[M+H]^+$ 322.1050. Found: 322.1052. 

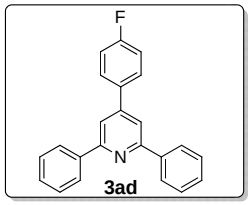

**2,6-Diphenyl-4-(p-tolyl)pyridine (3aa)**. Yield 87% (56.0 mg); Yellow solid; mp 109-111 °C; $^1H$ NMR (400 MHz, $CDCl_3$): δ 8.19 (d, *J* = 7.2 Hz, 4H), 7.86 (s, 2H), 7.63 (d, *J* = 8.0 Hz, 2H), 7.52-7.48 (m, 4H), 7.43 (d, *J* = 7.2 Hz, 2H), 7.31 (d, *J* = 8.0 Hz, 2H), 2.42 (s, 3H). $^{13}C$ NMR (100 MHz, $CDCl_3$): δ 157.4, 150.0, 139.6, 139.0, 136.0, 129.8, 128.9, 128.6, 127.1, 126.9, 116.8, 21.2. HRMS Calcd (ESI) m/z for $C_{24}H_{20}N$: $[M+H]^+$ 322.1590. Found: 322.1585.



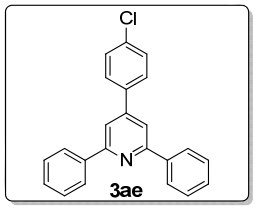

**2,4,6-Triphenylpyridine (3ab)**. Yield 92% (56.6 mg); Yellow solid; mp 130-132 °C; $^1H$ NMR (400 MHz, $CDCl_3$): δ 8.21-8.19 (m, 4H), 7.88 (s, 2H), 7.74-7.72 (m, 2H), 7.53-7.49 (m, 7H), 7.46-7.44 (m, 2H). $^{13}C$ NMR (100 MHz, $CDCl_3$): δ 157.4, 150.1, 139.5, 139.0, 129.1, 129.0, 128.9, 128.7, 127.1, 127.1, 117.1. HRMS Calcd (ESI) m/z for $C_{23}H_{18}N$: $[M+H]^+$ 308.1434. Found: 308.1427.



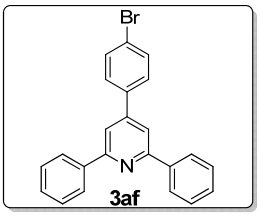

**4-(4-Methoxyphenyl)-2,6-diphenylpyridine (3ac)**. Yield 60% (40.0 mg); Yellow solid; mp 103-105 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.19 (d, *J* = 7.6 Hz, 4H), 7.84 (s, 2H), 7.68 (d, *J* = 8.4 Hz, 2H), 7.52-7.48 (m, 4H), 7.44 (d, *J* = 7.2 Hz, 2H), 7.03 (d, *J* = 8.4 Hz, 2H), 3.85 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 160.4, 157.4, 149.6, 139.7, 131.2, 128.9, 128.6, 128.3, 127.1, 116.5, 114.5, 55.4. HRMS Calcd (ESI) m/z for $C_{24}H_{20}NO$: $[M+H]^+$ 338.1539. Found: 338.1533.



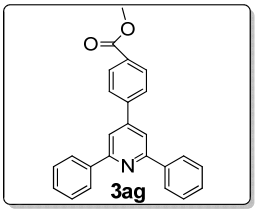

**4-(4-Fluorophenyl)-2,6-diphenylpyridine (3ad)**. Yield 73% (47.5 mg); Yellow solid; mp 138-140 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.20-8.17 (m, 4H), 7.81 (s, 2H), 7.71-7.68 (m, 2H), 7.53-7.49 (m, 4H), 7.46-7.44 (m, 2H), 7.22-7.18 (m, 2H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 163.3 (d, $J_{CF}$ = 247.4 Hz), 157.5, 149.1, 139.4, 135.0, 129.1, 128.9 (d, $J_{CF}$ = 8.2 Hz), 128.7, 127.1, 116.8, 116.1 (d, $J_{CF}$ = 21.5 Hz). HRMS Calcd (ESI) m/z for $C_{23}H_{17}FN$: $[M+H]^+$ 326.1340. Found: 326.1331.



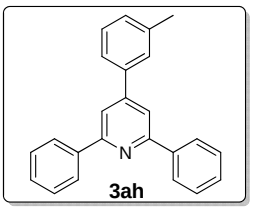

**4-(4-Chlorophenyl)-2,6-diphenylpyridine (3ae)**. Yield 75% (51.0 mg); Yellow solid; mp 112-114 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.19-8.16 (m, 4H), 7.80 (s, 2H), 7.64 (d, *J* = 8.4 Hz, 2H), 7.52-7.48 (m, 6H), 7.46-7.43 (m, 2H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 157.6, 148.8, 139.3, 137.4, 135.1, 129.3, 129.1, 128.7, 128.4, 127.1, 116.7. HRMS Calcd (ESI) m/z for $C_{23}H_{17}ClN$: $[M+H]^+$ 342.1044. Found: 342.1037.



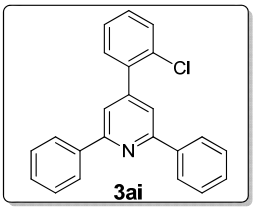

**4-(4-Bromophenyl)-2,6-diphenylpyridine (3af)**. Yield 65% (50.0 mg); Yellow solid; mp 115-117 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.19-8.17 (m, 4H), 7.80 (s, 2H), 7.63 (d, *J* = 8.8 Hz, 2H), 7.57 (d, *J* = 8.4 Hz, 2H), 7.52-7.49 (m, 4H), 7.45 (d, *J* = 7.2 Hz, 2H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 157.6, 148.9, 139.3, 137.9, 132.2, 129.1, 128.7, 127.1, 123.4, 116.7. HRMS Calcd (ESI) m/z for $C_{23}H_{17}BrN$: $[M+H]^+$ 386.0539. Found: 386.0523.



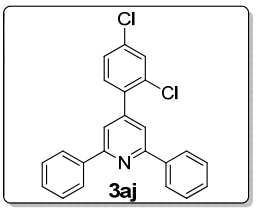

**Methyl 4-(2,6-diphenylpyridin-4-yl)benzoate (3ag)**. Yield 60% (44.0 mg); Yellow solid; mp 156-158 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.21-8.17 (m, 6H), 7.88 (s, 2H), 7.79 (d, *J* = 8.8 Hz, 2H), 7.53-7.50 (m, 4H), 7.46 (d, *J* = 7.2 Hz, 2H), 3.96 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 166.6, 157.6, 149.0, 143.3, 139.3, 130.3, 129.2, 128.7, 127.2, 127.1, 117.0, 52.3. HRMS Calcd (ESI) m/z for $C_{25}H_{20}NO_2$: $[M+H]^+$ 366.1489. Found: 366.1479.



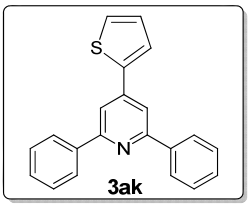

**2,6-Diphenyl-4-(m-tolyl)pyridine (3ah)**. Yield 70% (43.0 mg); Yellow solid; mp 90-92 ºC; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.21-8.19 (m, 4H), 7.87 (s, 2H), 7.54-7.49 (m, 6H), 7.45-7.38 (m, 3H), 7.27 (d, *J* = 7.6 Hz, 1H), 2.46 (s, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 157.4, 150.3, 139.6, 139.0, 138.8, 129.7, 129.0, 128.7, 127.8, 127.1, 124.3, 117.1, 21.5. HRMS Calcd (ESI) m/z for $C_{24}H_{20}N$: $[M+H]^+$ 322.1590. Found: 322.1580.



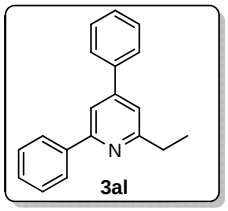

**4-(2-Chlorophenyl)-2,6-diphenylpyridine (3ai)**. Yield 73% (50.0 mg); Yellow oil; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.19 (d, *J* = 7.6 Hz, 4H), 7.77 (s, 2H), 7.52-7.48 (m, 5H), 7.45-7.42 (m, 3H), 7.38-7.36 (m, 2H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 156.8, 148.5, 139.3, 138.5, 132.2, 130.9, 130.2, 129.7, 129.1, 128.7, 127.1, 127.1, 119.4. HRMS Calcd (ESI) m/z for $C_{23}H_{17}ClN$: $[M+H]^+$ 342.1044. Found: 342.1033.



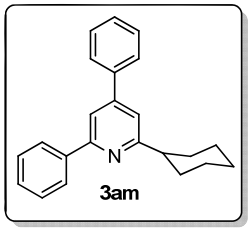

**4-(2,4-Dichlorophenyl)-2,6-diphenylpyridine (3aj)**. Yield 76% (57.0 mg); Yellow oil; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.19-8.16 (m, 4H), 7.72 (s, 2H), 7.56 (s, 1H), 7.52-7.49 (m, 4H), 7.45 (d, *J* = 7.2 Hz, 2H), 7.37 (d, *J* = 0.8 Hz, 2H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 157.0, 147.5, 139.2, 137.0, 135.0, 133.1, 131.6, 130.1, 128.7, 127.5, 127.1, 119.2. HRMS Calcd (ESI) m/z for $C_{23}H_{16}Cl_2N$: $[M+H]^+$ 376.0654. Found: 376.0645.




**2,6-Diphenyl-4-(thiophen-2-yl)pyridine (3ak)**. Yield 80% (50.0 mg); Yellow solid; mp 162-164 °C; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.19-8.17 (m, 4H), 7.86 (s, 2H), 7.61 (d, *J* = 2.8 Hz, 1H), 7.53-7.50 (m, 4H), 7.46-7.43 (m, 3H), 7.18-7.16 (m, 1H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 157.7, 142.9, 141.9, 139.3, 129.1, 128.7, 128.4, 127.1, 126.9, 125.2, 115.3. HRMS Calcd (ESI) m/z for $C_{21}H_{16}NS$: $[M+H]^+$ 314.0998. Found: 314.0990.

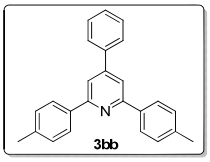


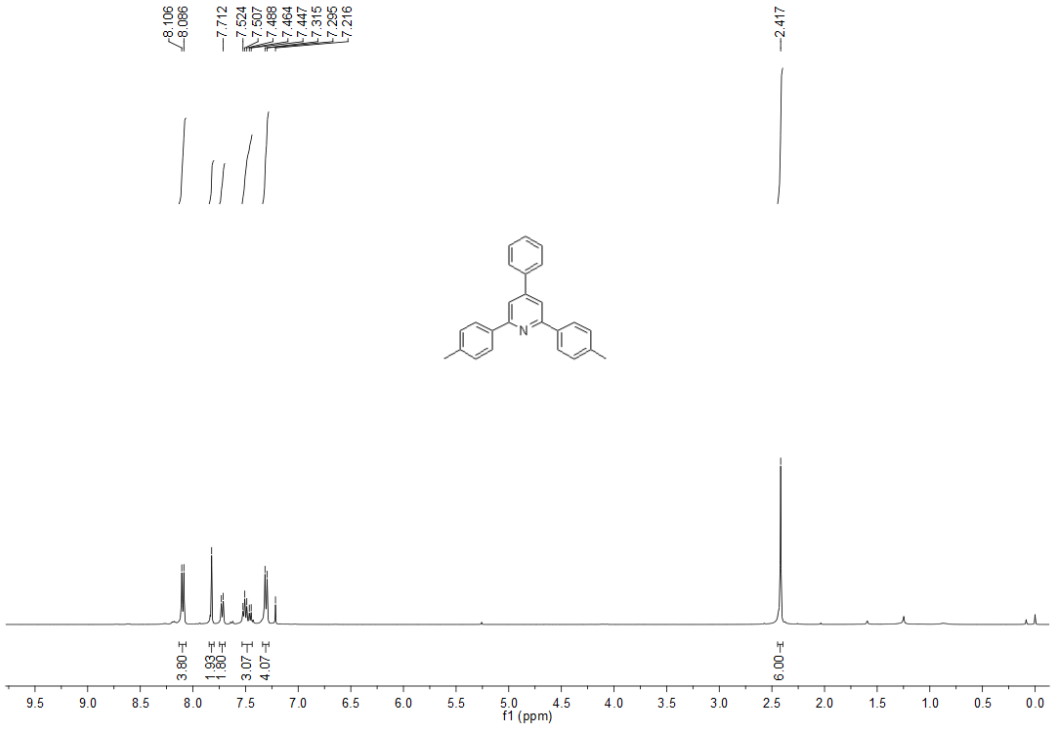

**2-ethyl-4,6-diphenylpyridine (3al)**. Yield 48% (25.0 mg); Yellow oil; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.06 (d, *J* = 3.6 Hz, 2H), 7.69 (d, *J* = 7.2 Hz, 1H), 7.51-7.46 (m, 4H), 7.45-7.41 (m, 2H), 7.32 (s, 1H), 3.00-2.98 (m, 2H), 1.44-1.40 (m, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 163.9, 157.4, 149.6, 139.8, 139.0, 129.0, 128.8, 128.7, 127.1, 127.1, 118.6, 116.3, 31.6, 14.0. HRMS Calcd (ESI) m/z for $C_{19}H_{17}NNa$: $[M+Na]^+$ 282.1253. Found: 282.1267.

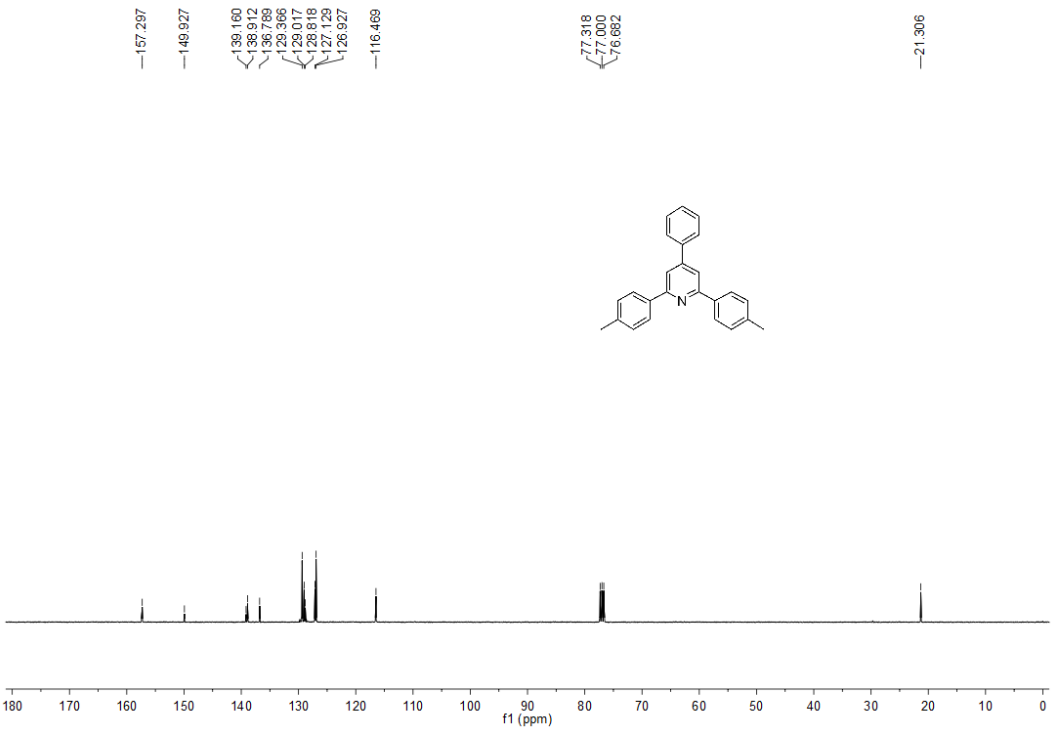


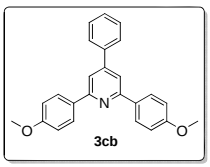

**2-cyclohexyl-4,6-diphenylpyridine (3am)**. Yield 56% (35.0 mg); Yellow oil; $^{1}$H NMR (400 MHz, $CDCl_3$): δ 8.08 (d, *J* = 7.2 Hz, 2H), 7.73 (d, *J* = 1.2 Hz, 1H), 7.70-7.68 (m, 2H), 7.50-7.48 (m, 4H), 7.44-7.41 (m, 2H), 7.31 (s, 1H), 2.08 (d, *J* = 12.0 Hz, 2H), 1.92-1.88 (m, 3H), 1.71-1.61 (m, 3H), 1.52-1.42 (m, 3H). $^{13}$C NMR (100 MHz, $CDCl_3$): δ 166.9, 158.0, 149.4, 139.2, 137.5,129.0, 128.6, 128.6, 127.1, 127.1, 127.0, 118.6, 116.2, 46.7, 33.7, 33.0, 26.6. HRMS Calcd (ESI) m/z for $C_{23}H_{23}NNa$: $[M+Na]^+$ 336.1723. Found: 336.1730.

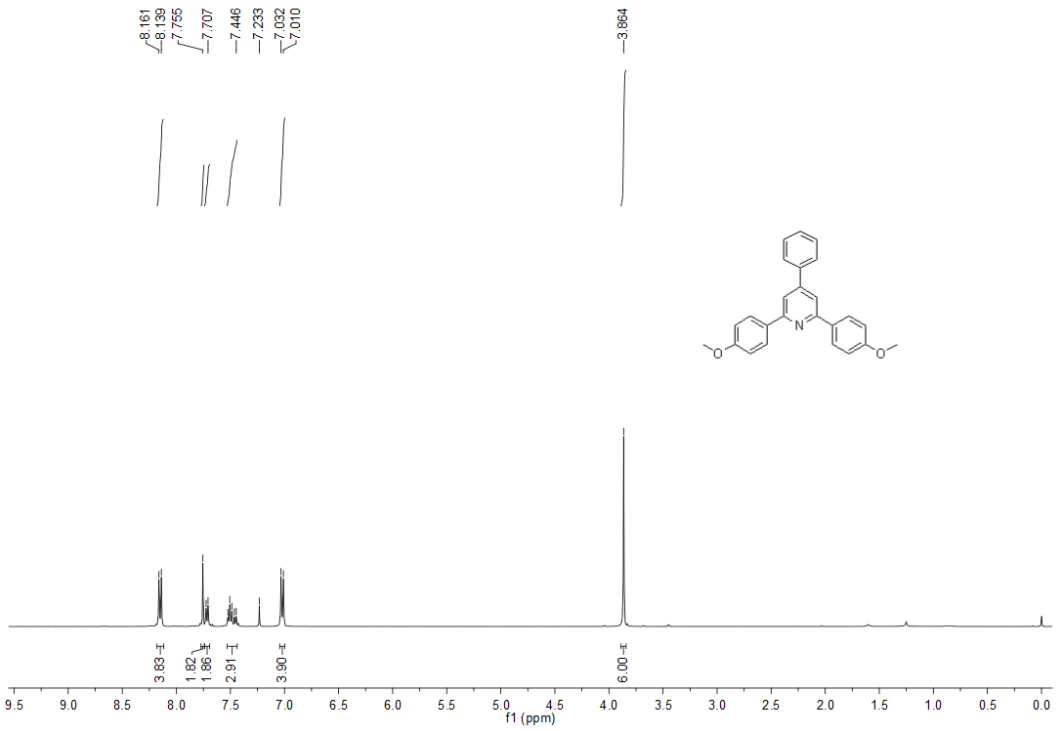
## 5. Appendix (copies of $^{1}H$ and $^{13}C$ NMR spectra)




3cb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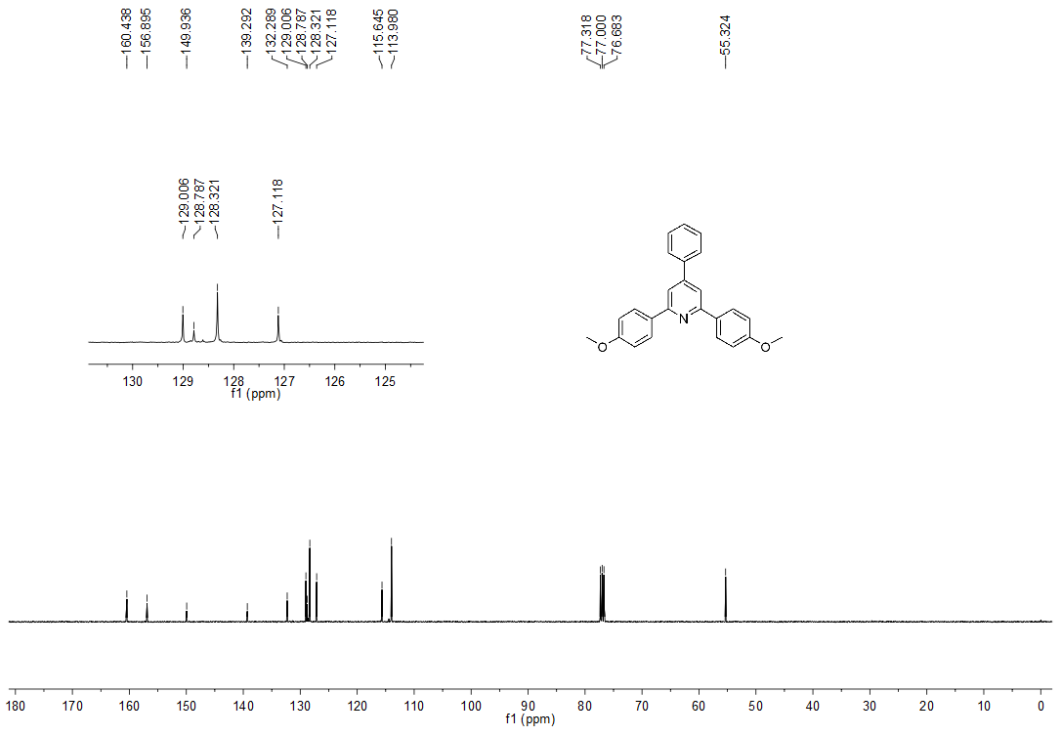
7.233
7.032
7.010
3.864
3.83
1.82
1.86
2.91
3.90
6.00
f1 (ppm)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149.936
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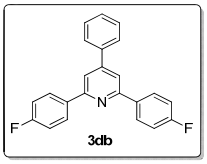
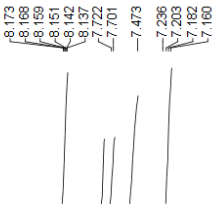
113.990
77.318
77.000
76.683
55.324
f1 (ppm)


F
N
F
3db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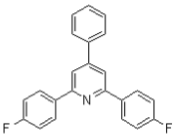
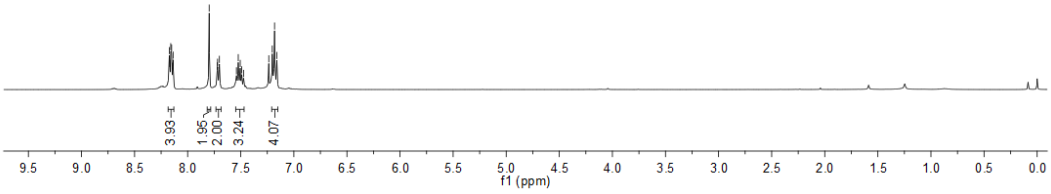
8.151
8.142
8.137
7.722
7.701
7.473
7.236
7.203
7.182
7.160


F
N
F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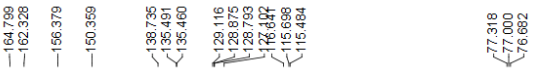
2.00
3.24
4.07
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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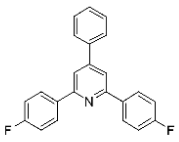
115.484
77.318
77.000
76.682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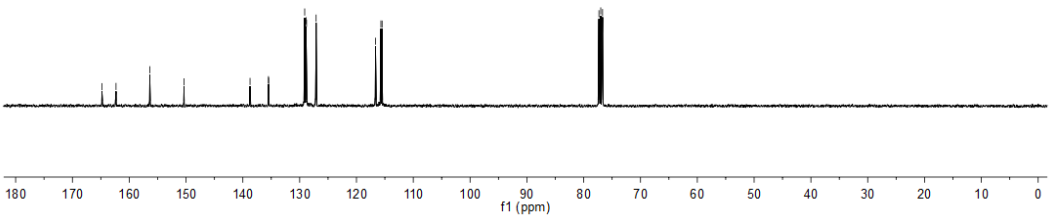
F


180
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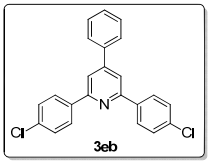
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


Cl
N
Cl
3eb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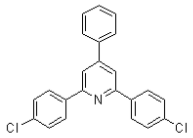
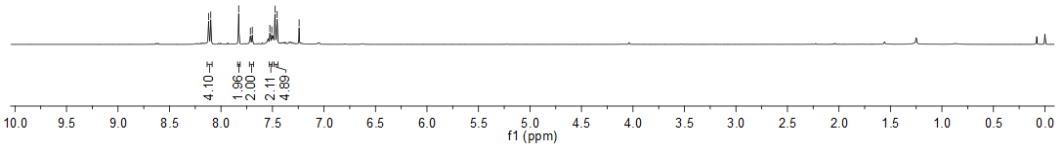
7.241


Cl
N
Cl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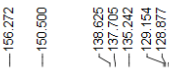
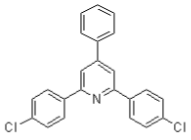
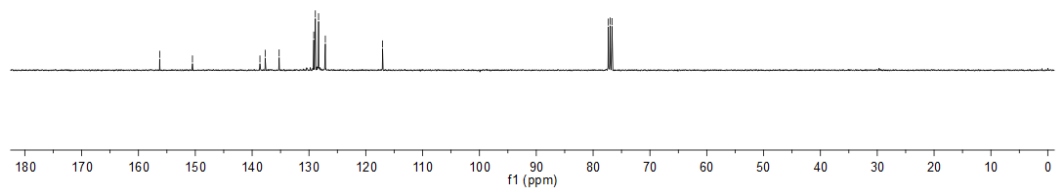
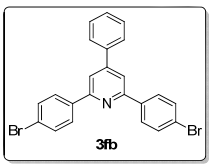
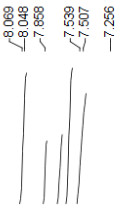
1.96
2.00
2.11
4.89
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

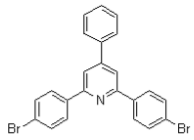

156.272
150.500
138.625
137.705
135.242
129.154
128.877
128.309
127.118
117.042
77.317
77.000
76.682

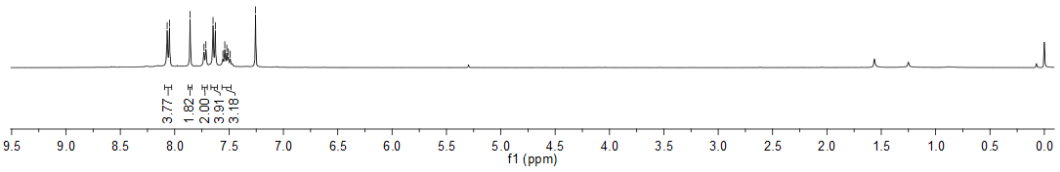

Cl
N
Cl

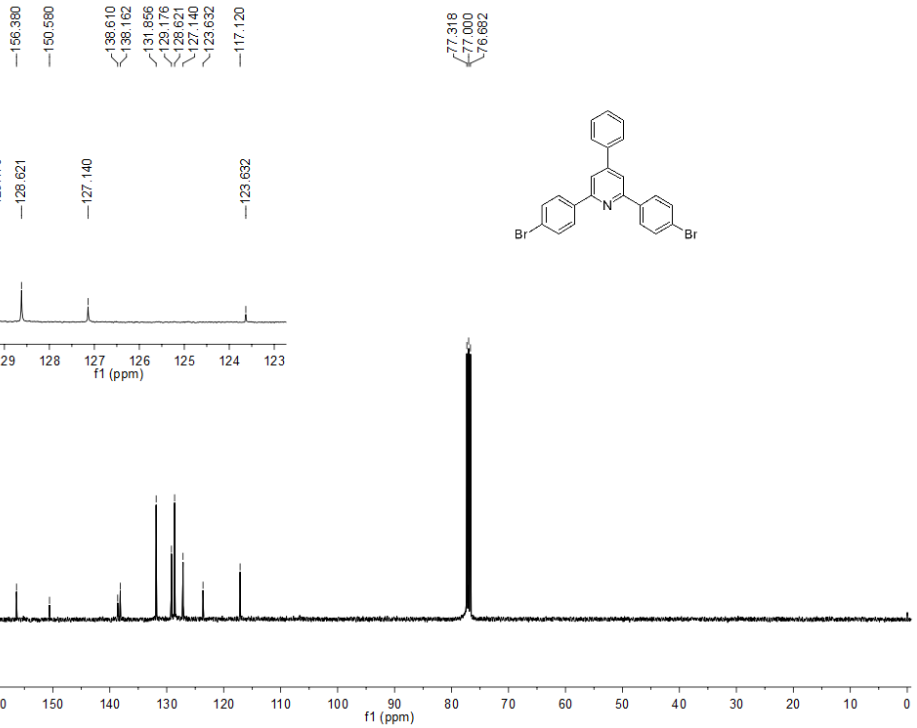

180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

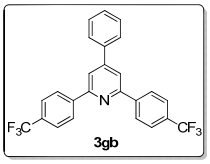

Br
N
Br
3fb

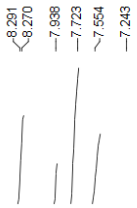

8.069
8.048
7.868
7.539
7.507
7.256

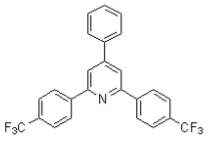

Br
N
Br

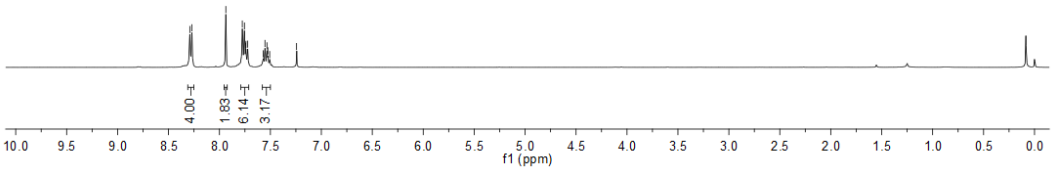

3.77
1.82
2.00
3.91
3.18
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

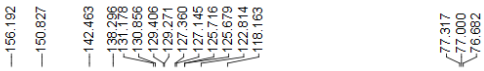

156.380
150.580
138.610
138.162
131.856
129.176
128.621
127.140
123.632
117.120
77.318
77.000
76.682
129.176
128.621
127.140
123.632
130
129
128
127
126
125
124
123
f1 (ppm)
Br
N
Br
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

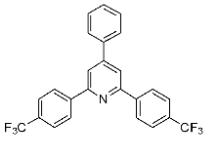

F3C
CF3
N
3gb

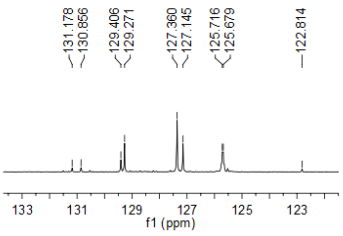

8.291
8.270
7.938
7.723
7.554
7.243

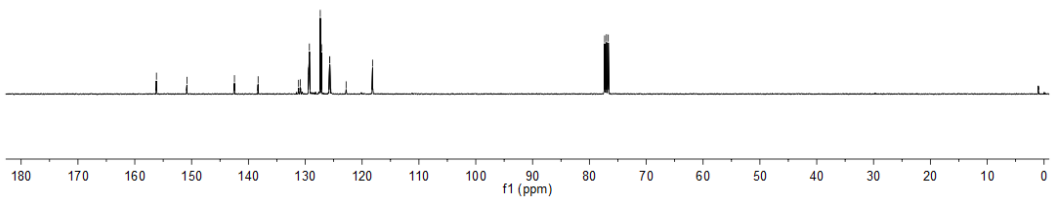

F3C
CF3
N

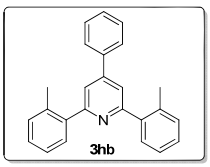

4.00
1.83
6.14
3.17
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

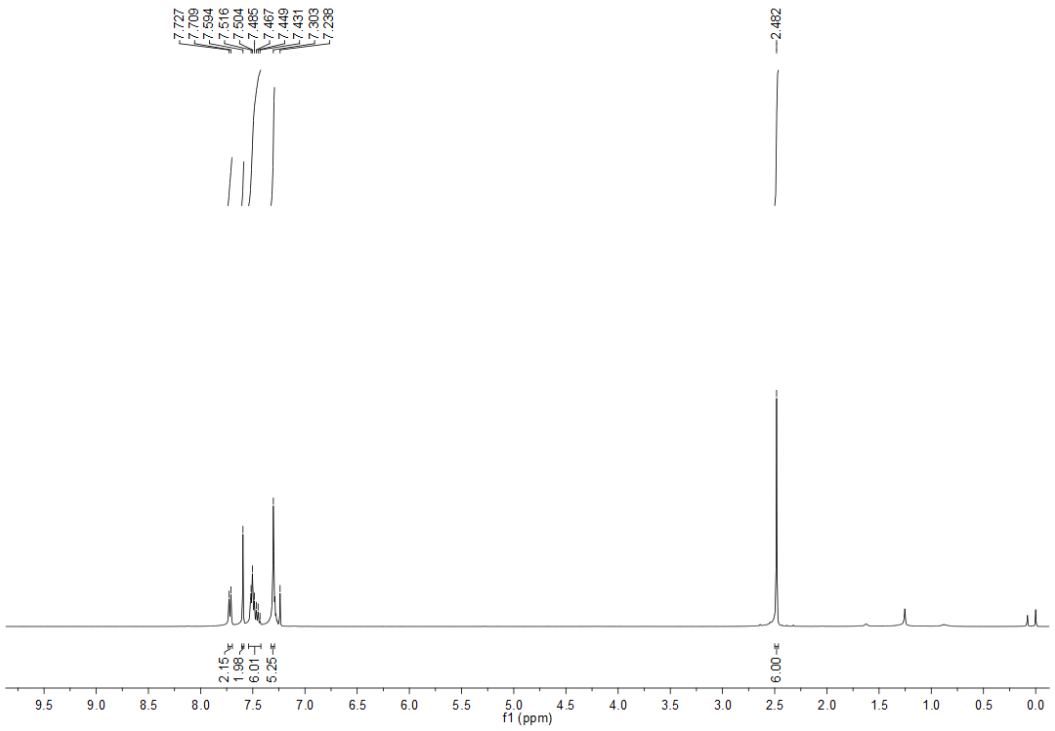

156.192
150.827
142.463
138.296
131.178
130.856
129.406
129.271
127.360
127.145
125.716
125.679
122.814
118.163
77.317
77.000
76.682

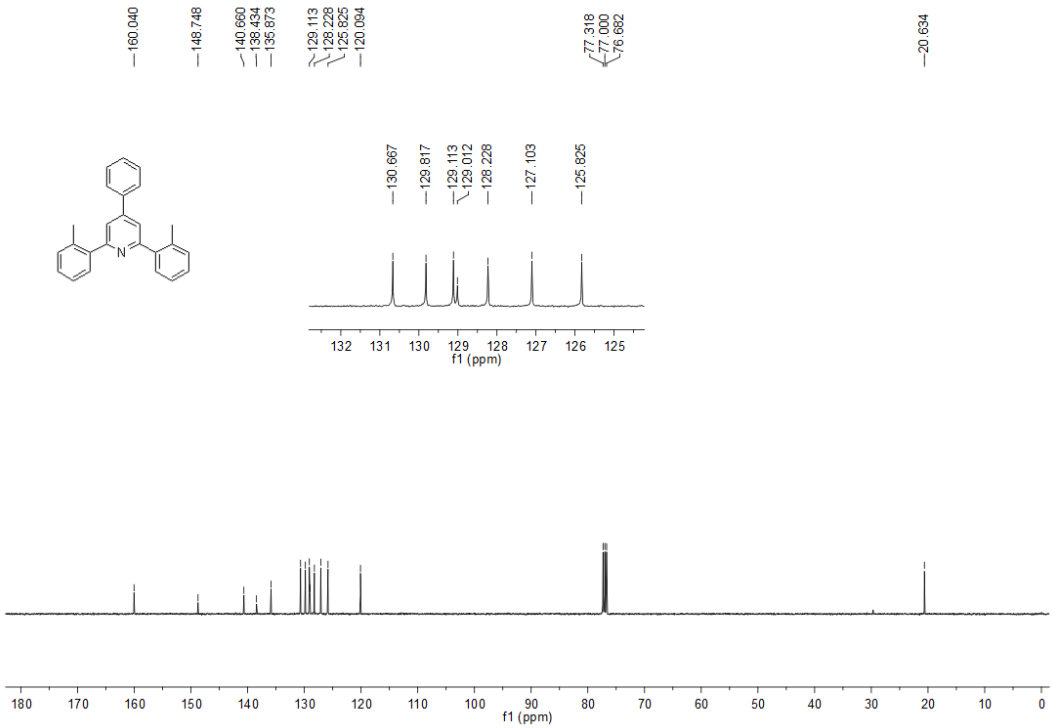

F3C
CF3
N

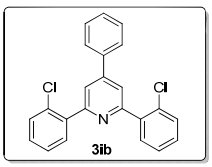

131.178
130.856
129.406
129.271
127.360
127.145
125.716
125.679
122.814
133 131 129 127 125 123
f1 (ppm)

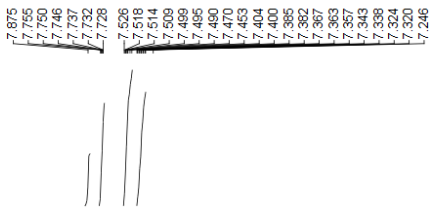

180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

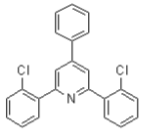

3hb

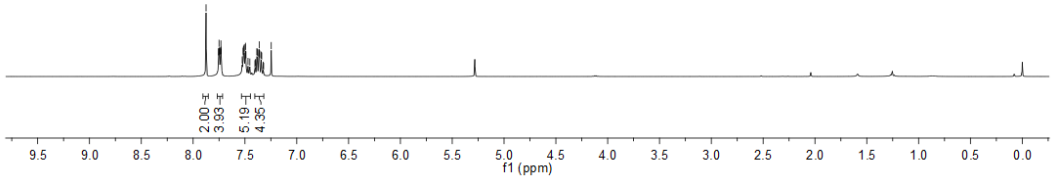

7.727
7.709
7.594
7.516
7.504
7.485
7.467
7.449
7.431
7.303
7.238
2.482
2.15
1.98
6.01
5.25
6.00
f1 (ppm)


160.040
148.748
140.660
138.434
135.873
129.113
128.228
125.825
120.094
77.318
77.000
76.682
20.634
130.667
129.817
129.113
129.012
128.228
127.103
125.825
f1 (ppm)

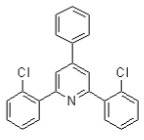

Cl
Cl
N
3ib

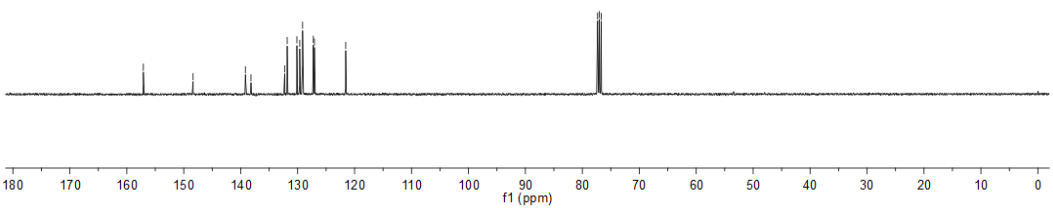

7.875
7.755
7.750
7.746
7.737
7.732
7.728
7.526
7.518
7.514
7.509
7.499
7.485
7.480
7.470
7.453
7.404
7.400
7.385
7.382
7.367
7.363
7.357
7.343
7.338
7.324
7.320
7.246

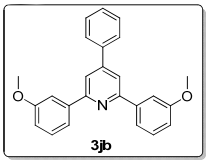

Cl
Cl
N

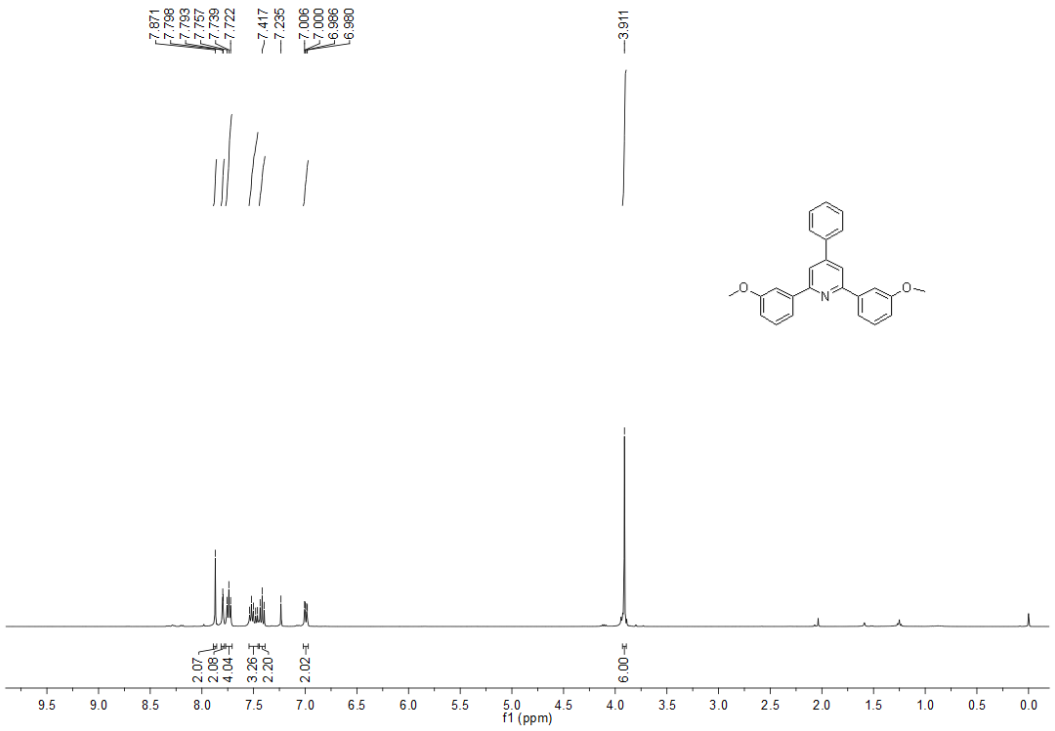

2.00
3.93
5.19
4.35
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

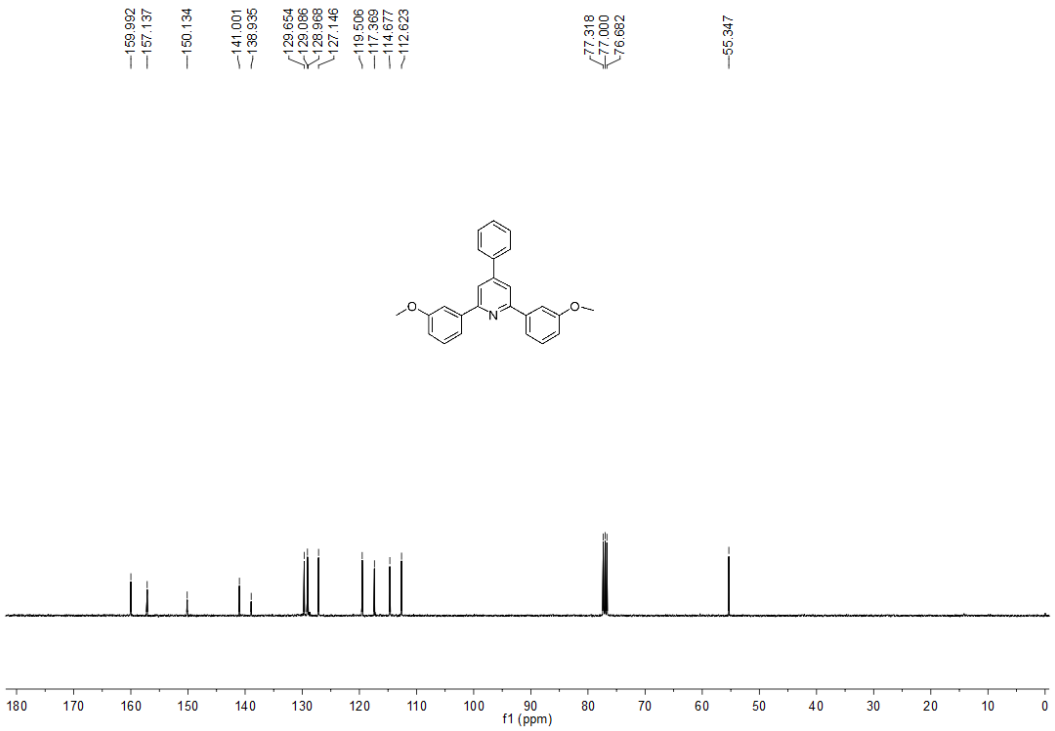

157.099
148.363
139.177
138.196
130.127
129.628
129.127
127.244
127.053
121.555
77.318
77.000
76.683
132.279
131.836
130.127
129.628
129.127
127.244
127.053
133
132
131
130
129
128
127
126
f1 (ppm)

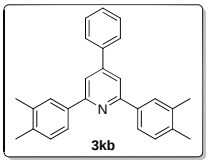

Cl
Cl
N

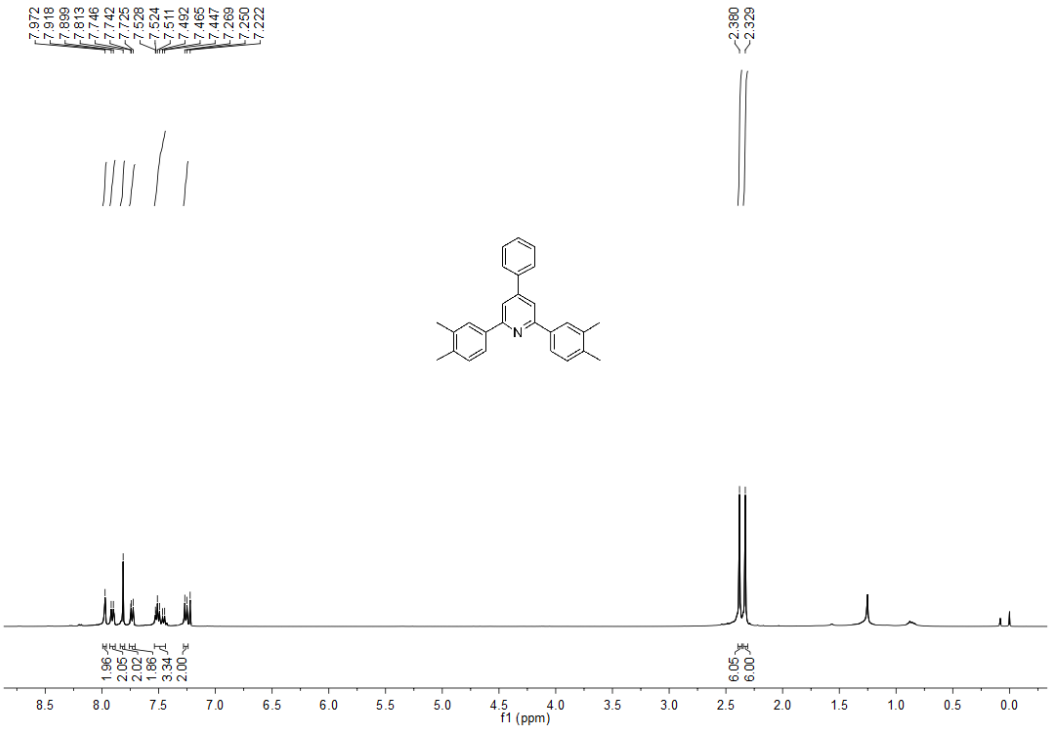

180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

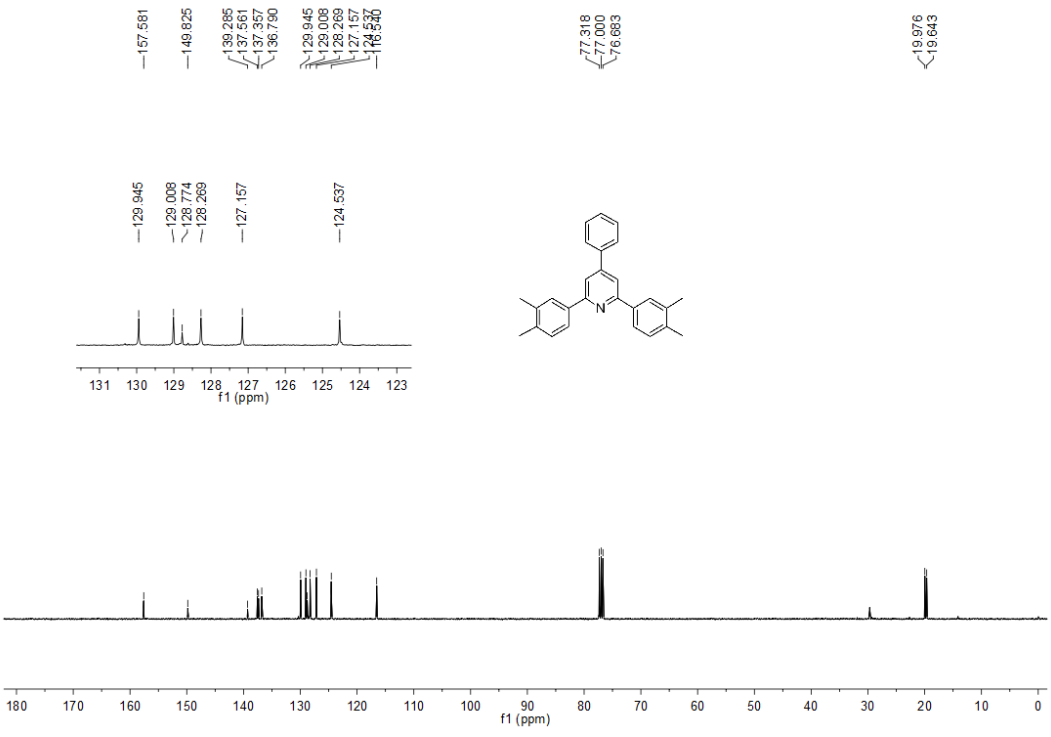

O
N
O
3jb

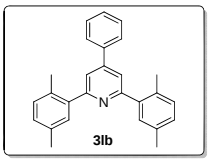

7.871
7.798
7.793
7.757
7.739
7.722
7.417
7.235
7.006
7.000
6.986
6.980
3.911
O
N
O
2.07
2.08
4.04
3.26
2.20
2.02
6.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

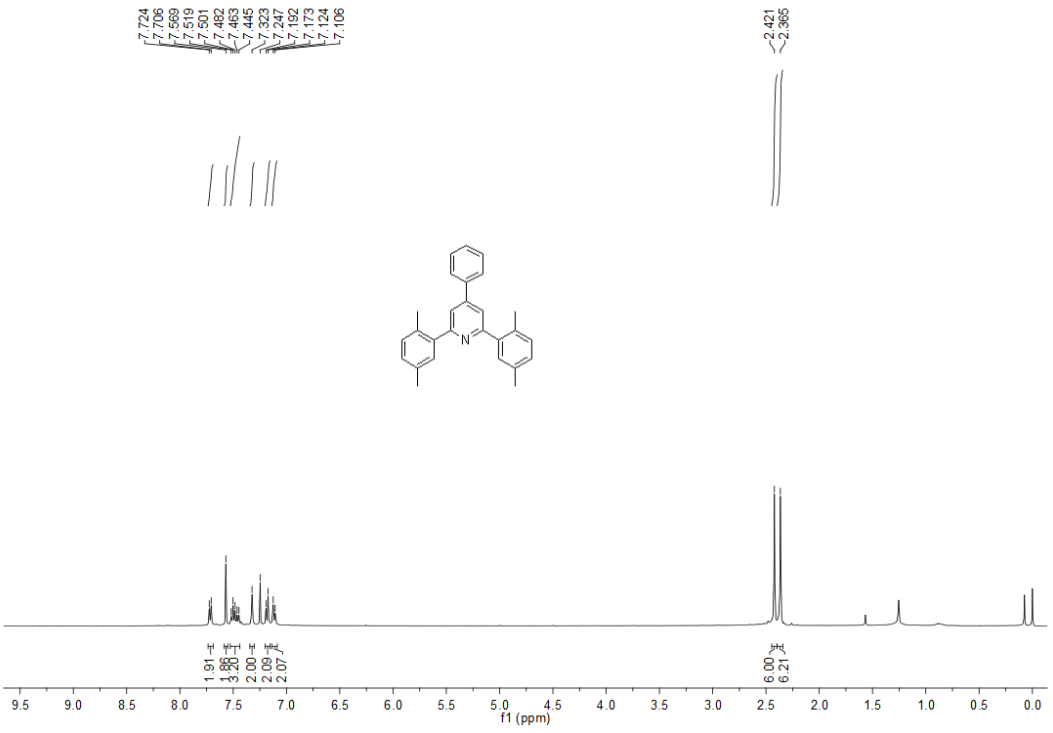

159.992
157.137
150.134
141.001
138.935
129.654
129.086
128.988
127.146
119.506
117.369
114.677
112.623
77.318
77.000
76.682
55.347
O
N
O
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


3kb


7.972
7.918
7.899
7.813
7.746
7.742
7.725
7.528
7.524
7.511
7.492
7.465
7.447
7.269
7.250
7.222
2.380
2.329
1.96
2.05
2.02
1.86
3.34
2.00
6.05
6.00
f1 (ppm)


157.581
149.825
139.285
137.561
137.357
136.790
129.945
129.008
128.269
127.157
124.537
118.540
77.318
77.000
76.683
19.976
19.643
129.945
129.008
128.774
128.269
127.157
124.537
131 130 129 128 127 126 125 124 123
f1 (ppm)
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


3lb


7.724
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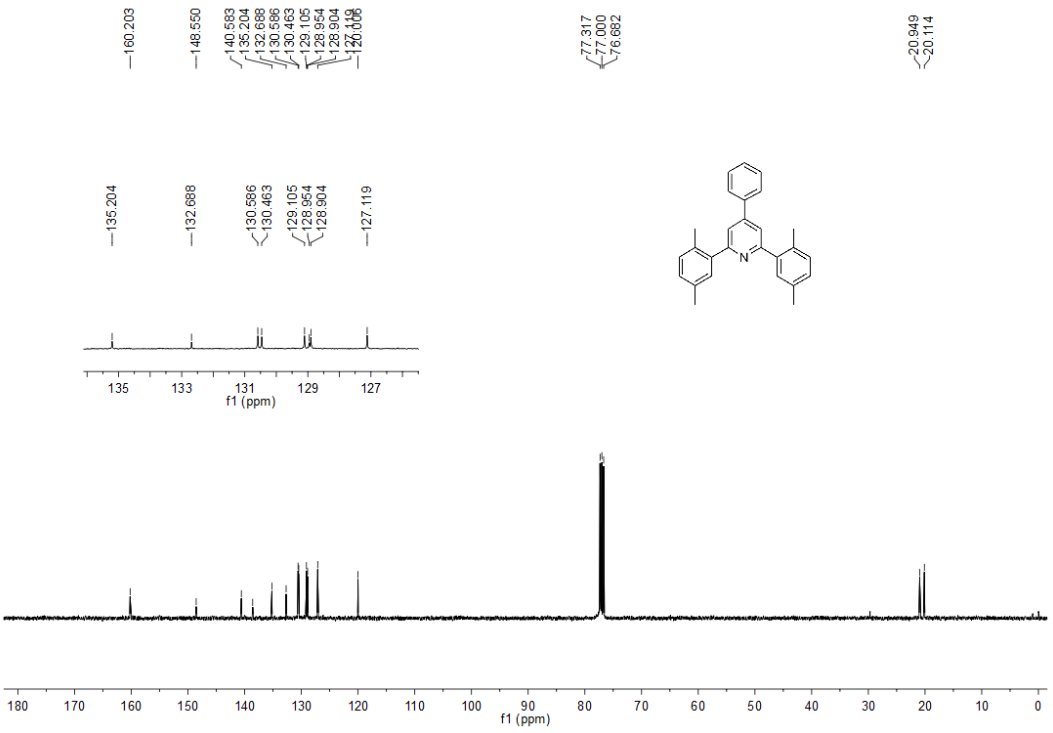
7.569
7.519
7.501
7.482
7.463
7.445
7.323
7.247
7.192
7.173
7.124
7.106
2.421
2.365
1.91
1.86
3.20
2.00
2.09
2.07
6.00
6.21
f1 (ppm)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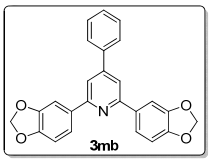
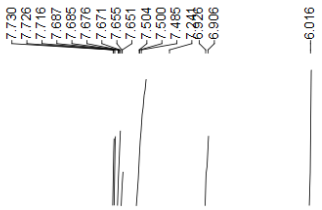
148.550
140.583
135.204
132.688
130.586
130.463
129.105
128.954
128.904
127.119
120.008
77.317
77.000
76.682
20.949
20.114
135
133
131
129
127
f1 (ppm)
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


3mb


7.730
7.726
7.716
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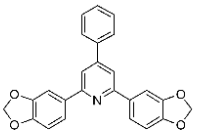
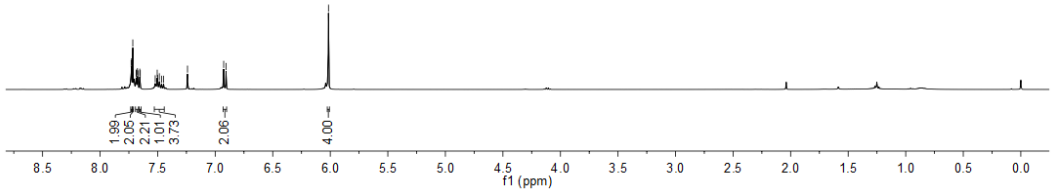
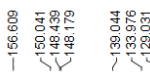
7.685
7.676
7.671
7.655
7.651
7.504
7.500
7.485
6.906
6.016




1.99
2.05
2.21
1.01
3.73
2.06
4.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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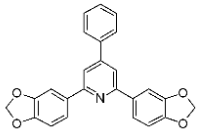
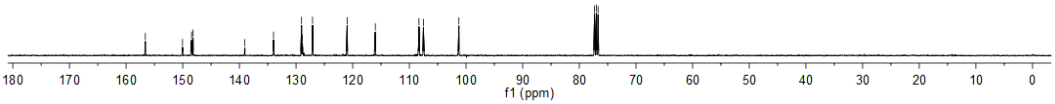
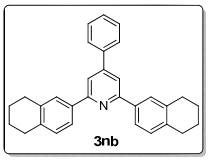
150.041
148.439
148.179
139.044
133.976
129.031
128.881
127.088
120.979
116.015
108.309
107.522
101.262
77.317
77.000
76.682




180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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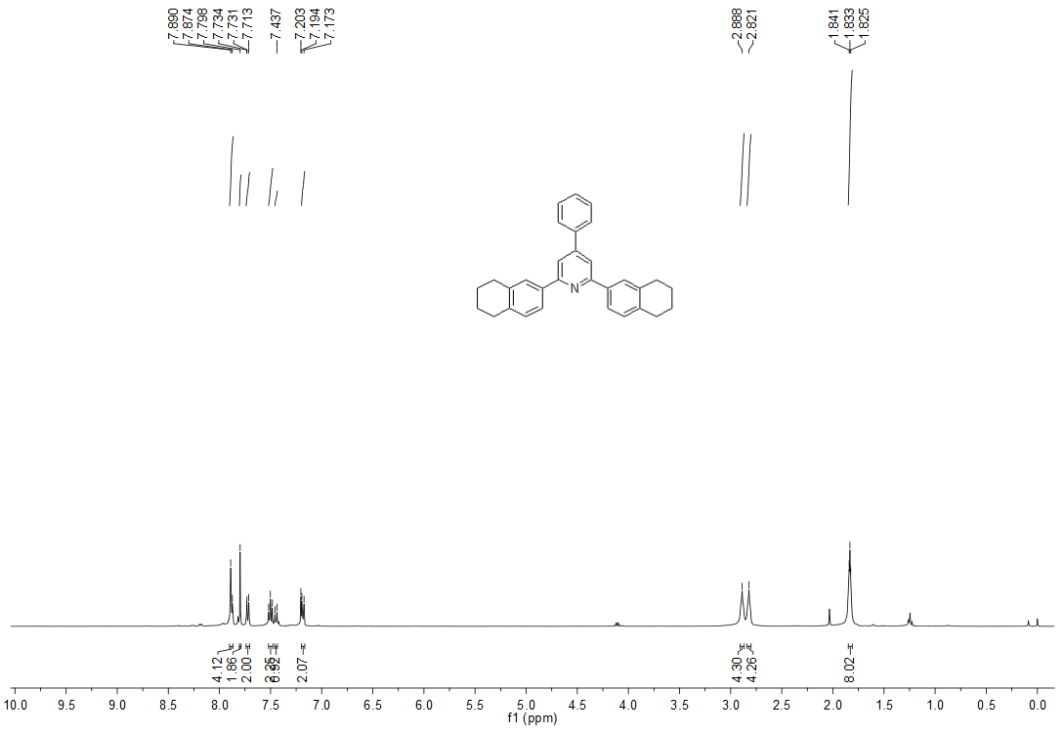
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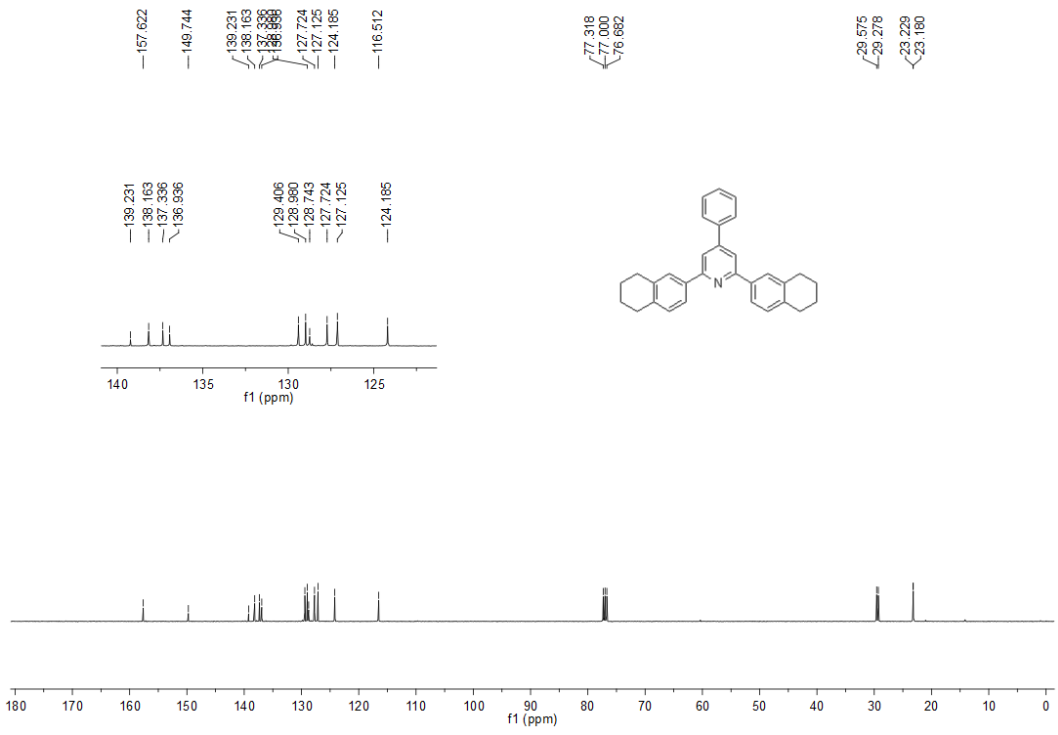
7.874
7.796
7.734
7.731
7.713
7.437
7.203
7.194
7.173
2.888
2.821
1.841
1.833
1.825
4.12
1.86
2.00
2.07
4.30
4.26
8.02
f1 (ppm)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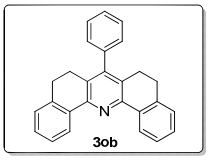
149.744
139.231
138.163
137.336
136.936
129.406
128.960
128.743
127.724
127.125
124.185
116.512
77.318
77.000
76.682
29.575
29.278
23.229
23.180
f1 (ppm)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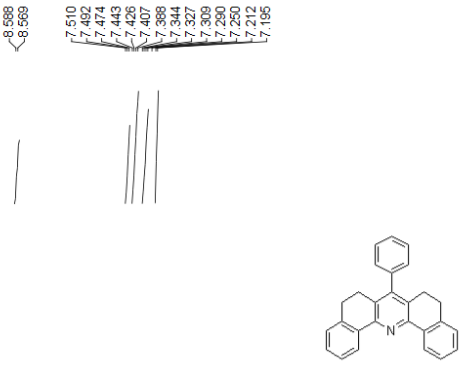
8.588
8.569
7.510
7.492
7.474
7.443
7.426
7.407
7.388
7.344
7.327
7.309
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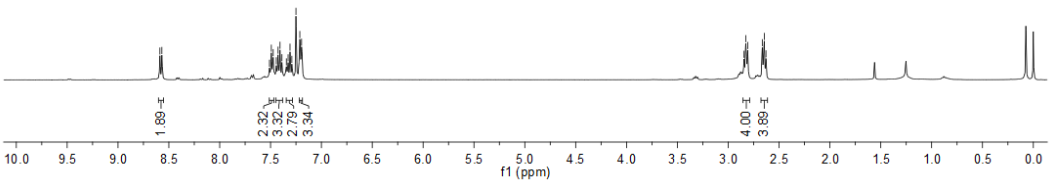
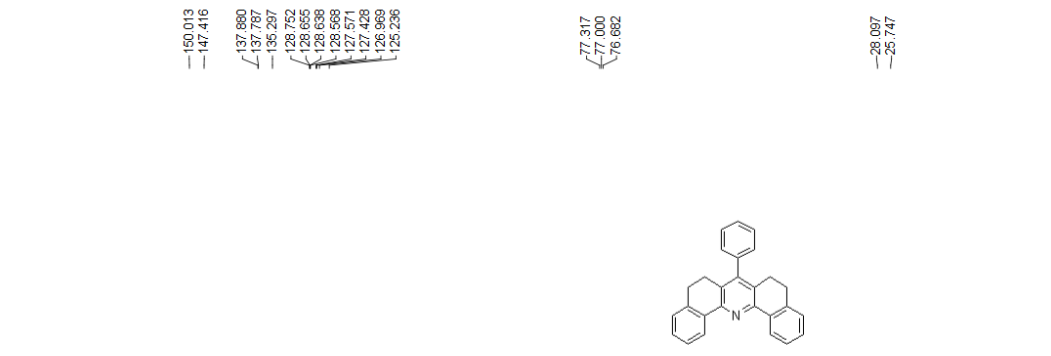
7.250
7.212
7.195
2.844
2.828
2.808
2.665
2.645
2.629


1.89
2.32
3.32
2.79
3.34
4.00
3.89
f1 (ppm)


150.013
147.416
137.880
137.787
135.297
128.752
128.655
128.638
128.568
127.571
127.428
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125.236
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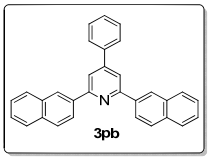
77.000
76.682
29.097
25.747
f1 (ppm)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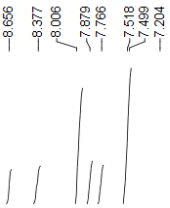
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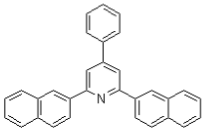
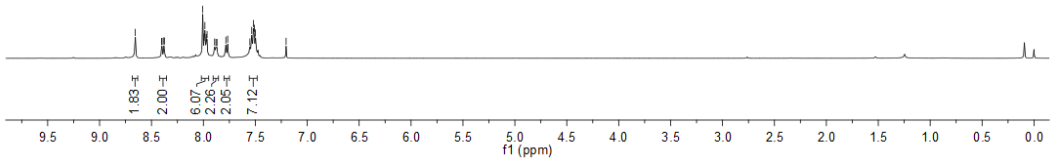
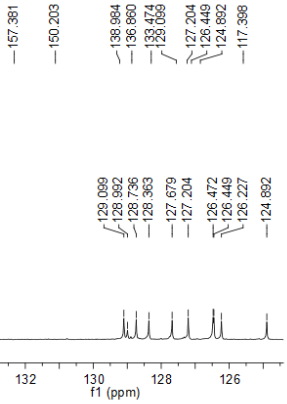
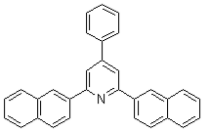
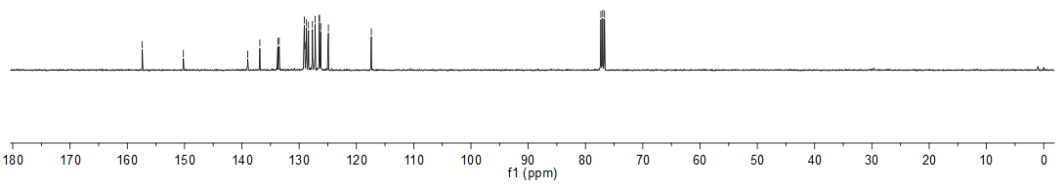
8.377
8.006
7.879
7.766
7.518
7.499
7.204

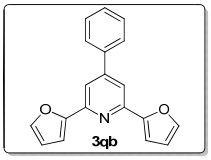



1.83
2.00
6.07
2.26
2.05
7.12
f1 (ppm)


157.381
150.203
138.994
136.860
133.474
129.059
127.204
126.449
124.892
117.398
77.318
77.000
76.682
133.724
133.474
129.099
128.992
128.736
128.363
127.679
127.204
126.472
126.449
126.227
124.892
f1 (ppm)




f1 (ppm)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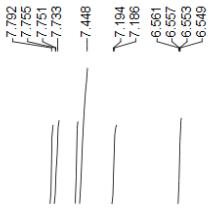
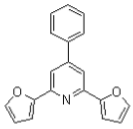
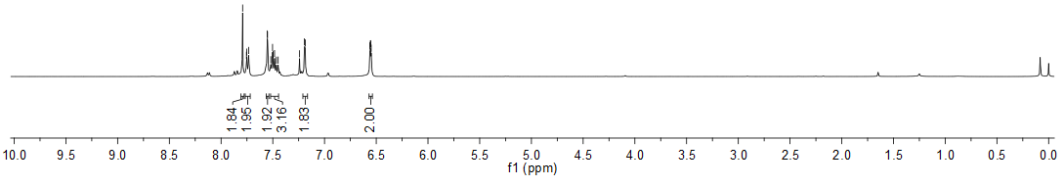
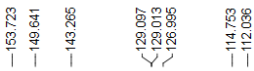
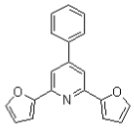
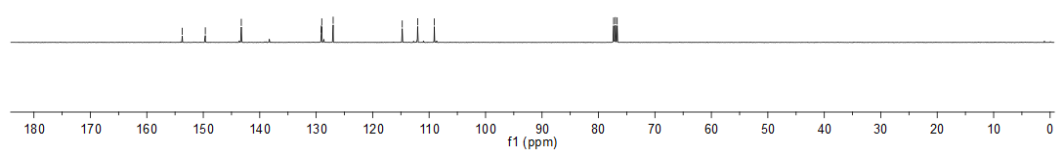

7.792
7.755
7.751
7.733
7.448
7.194
7.186
6.561
6.557
6.553
6.549

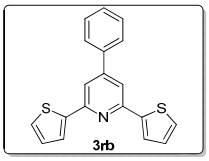


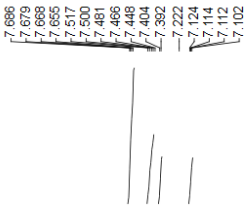

1.84
1.95
1.92
3.16
1.83
2.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

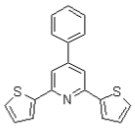

153.723
149.641
143.265
129.097
129.013
126.995
114.753
112.036
109.074
77.318
77.000
76.683

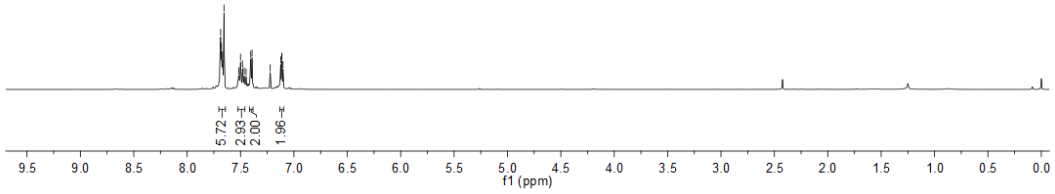


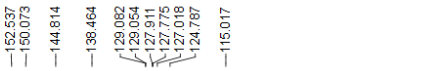

180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


S
N
S
3rb


7.686
7.679
7.668
7.655
7.517
7.500
7.461
7.466
7.448
7.404
7.392
7.222
7.124
7.114
7.112
7.102


S
N
S


5.72
2.93
2.00
1.96
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


152.537
150.073
144.814
138.464
129.082
129.054
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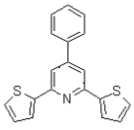
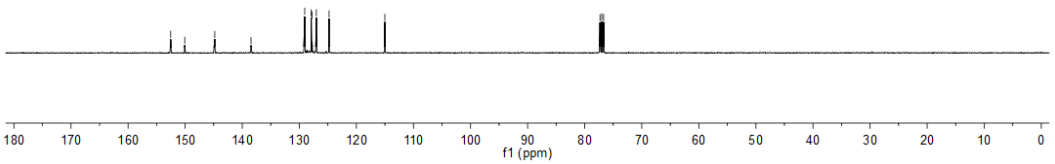
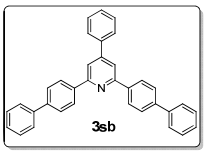
127.775
127.018
124.787
115.017
77.318
77.000
76.683


S
N
S


180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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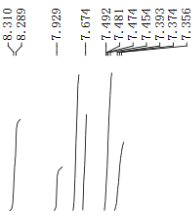
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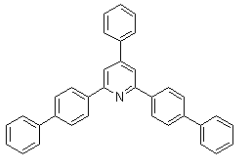
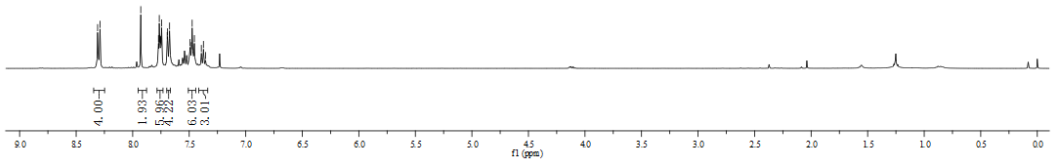
7.674
7.492
7.481
7.471
7.454
7.393
7.374
7.356

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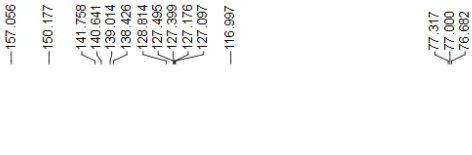
1.93
5.96
2.22
6.03
3.01
f1 (ppm)


157.056
150.177
141.758
140.641
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138.426
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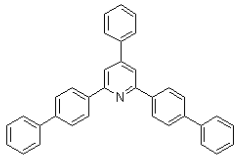
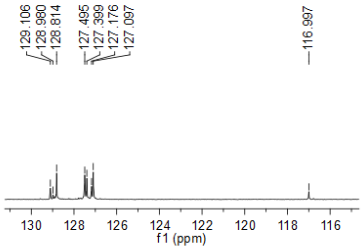
127.495
127.399
127.176
127.097
116.997
77.317
77.000
76.682

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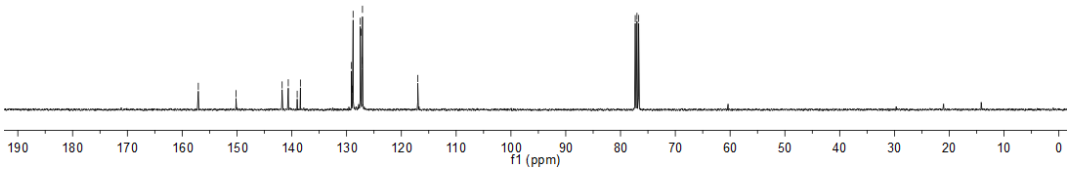
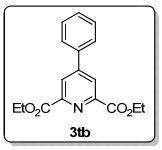
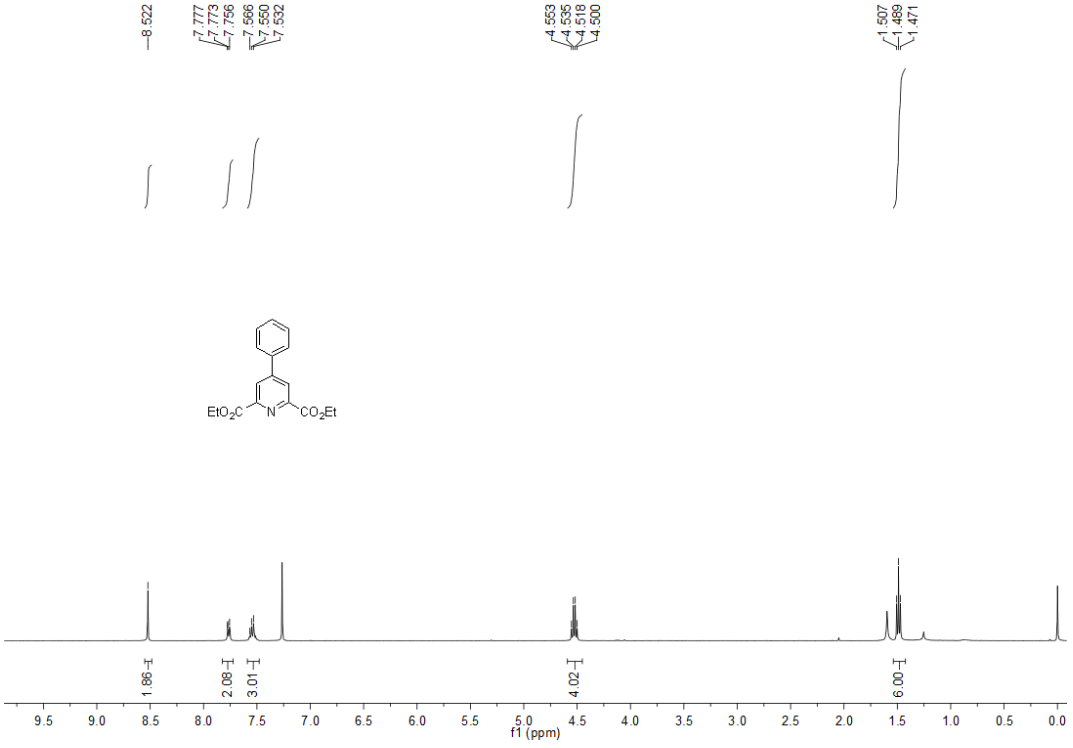
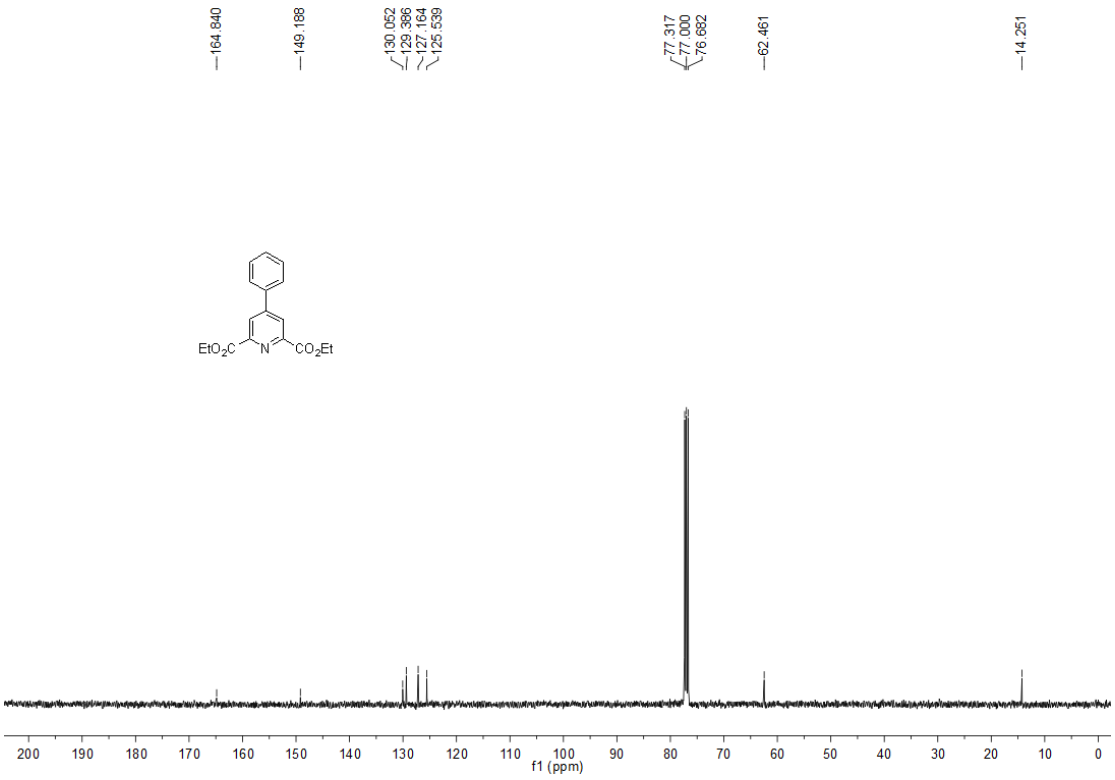
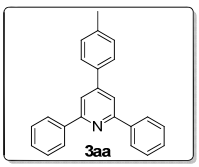
127.495
127.399
127.176
127.097
116.997
f1 (ppm)


f1 (ppm)


EtO2C
N
CO2Et
3tb


8.522
7.777
7.773
7.756
7.566
7.550
7.532
4.553
4.535
4.518
4.500
1.507
1.489
1.471
EtO2C
N
CO2Et
1.86
2.08
3.01
4.02
6.00
f1 (ppm)


164.840
149.188
130.052
129.386
127.164
125.539
77.317
77.000
76.682
62.461
14.251
EtO2C
N
CO2Et
f1 (ppm)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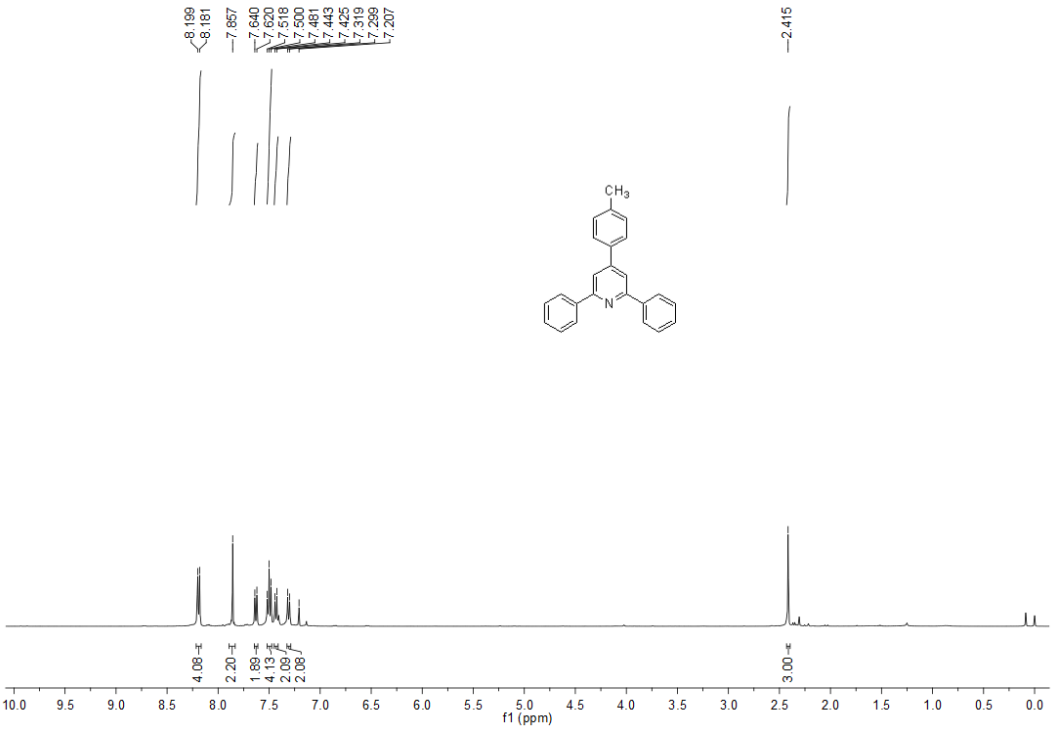
8.199
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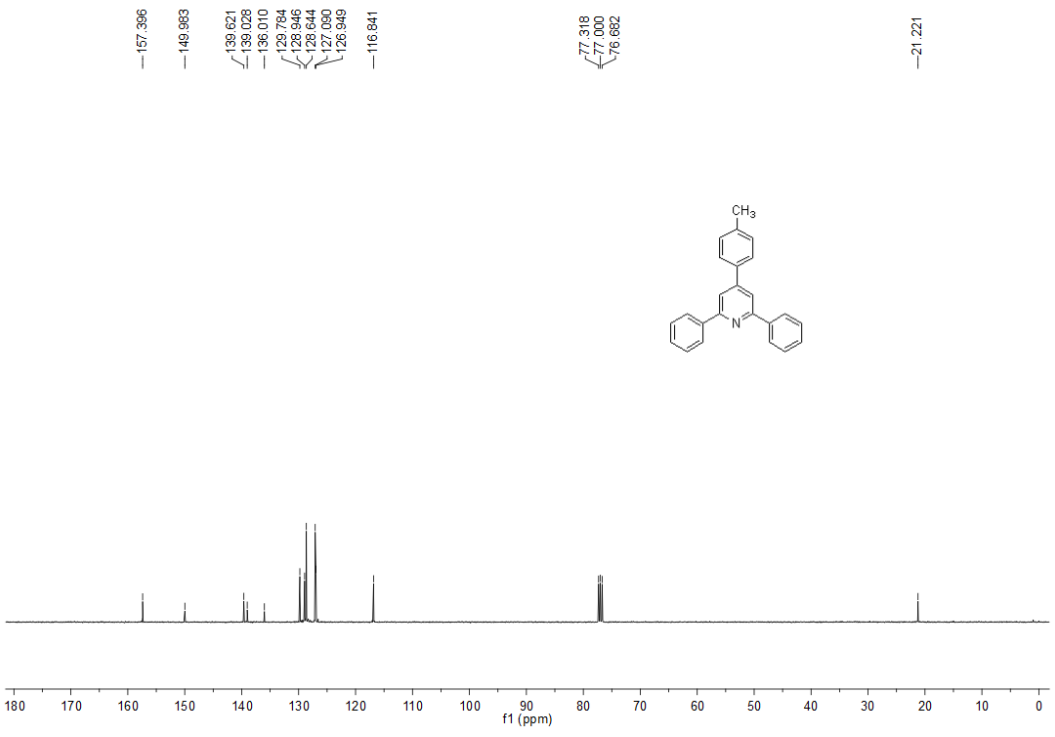
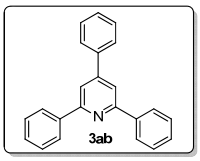
7.640
7.620
7.518
7.500
7.481
7.443
7.425
7.319
7.239
7.207
2.415
CH3
N
4.08
2.20
1.89
4.13
2.09
2.08
3.00
f1 (ppm)


157.396
149.983
139.621
139.028
136.010
129.784
128.946
128.644
127.090
126.949
116.841
77.318
77.000
76.682
21.221
CH3
N
f1 (ppm)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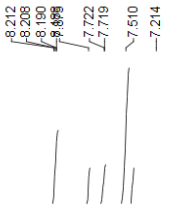
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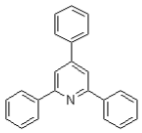
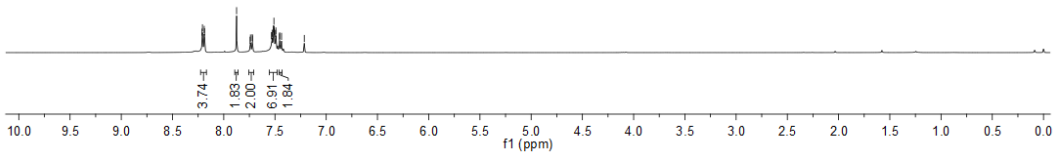
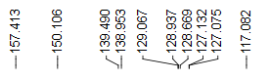
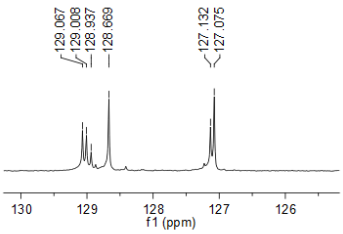
8.208
8.190
7.722
7.719
7.510
7.214

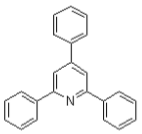


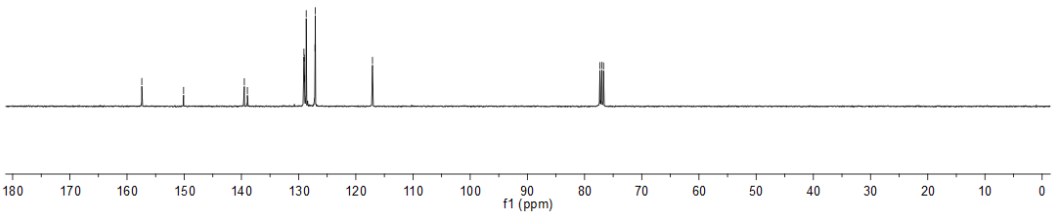

3.74
1.83
2.00
6.91
1.84
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

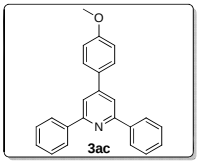

157.413
150.106
139.490
138.953
129.067
128.937
128.669
127.132
127.075
117.062

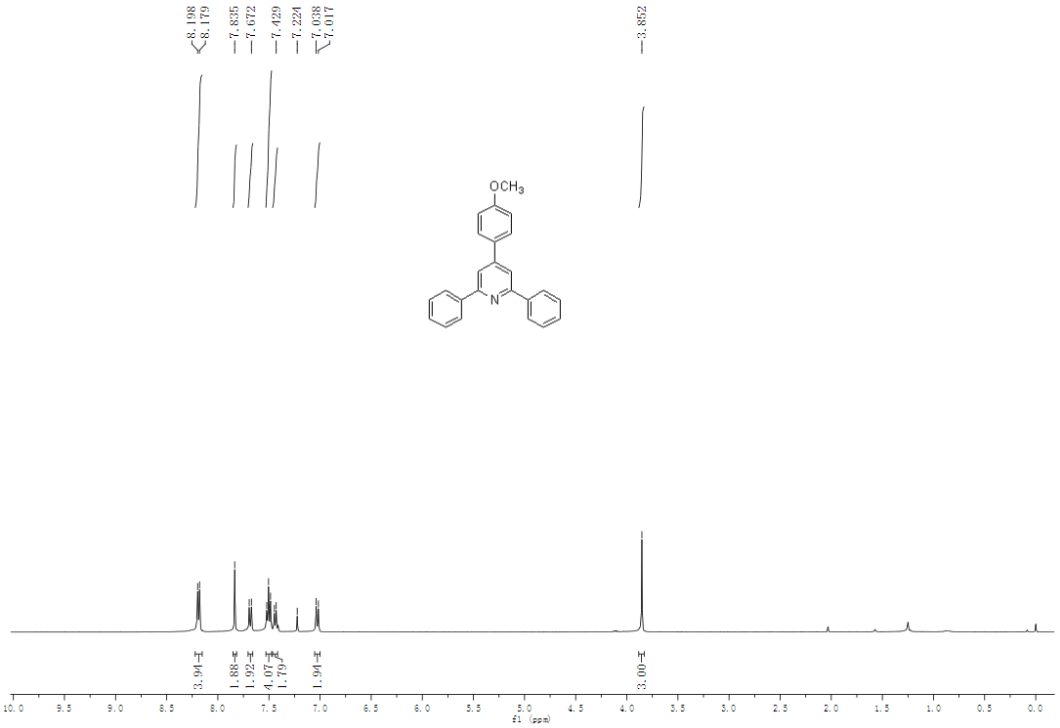

77.317
77.000
76.682

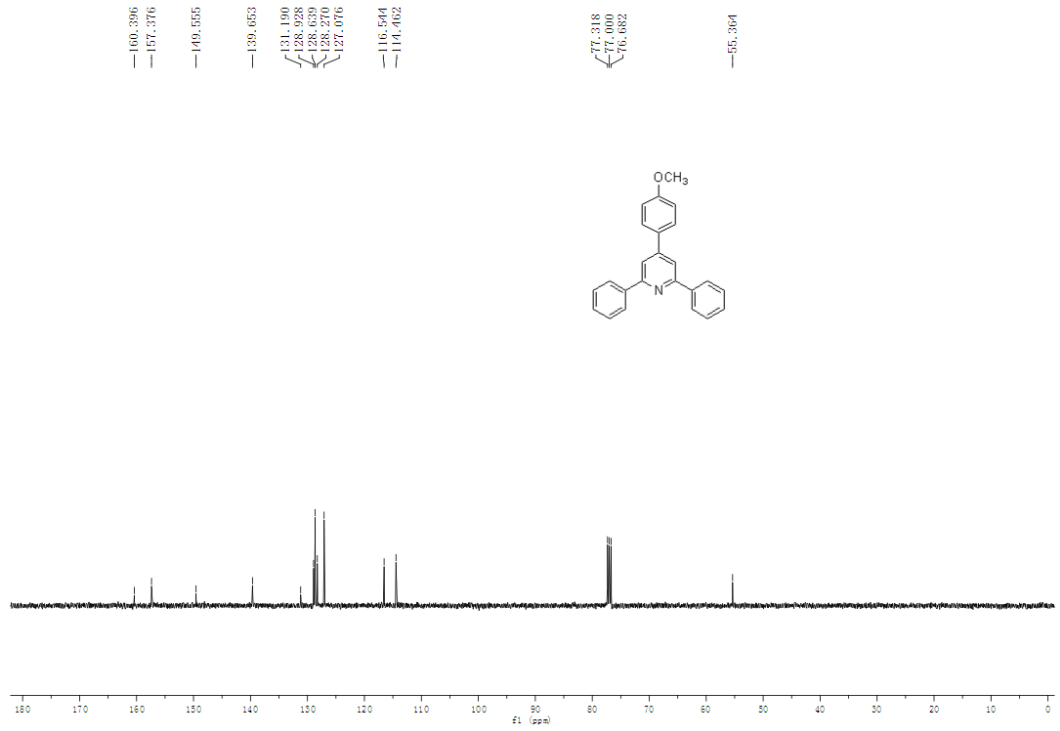

129.067
129.008
128.937
128.669
127.132
127.075
130 129 128 127 126
f1 (ppm)

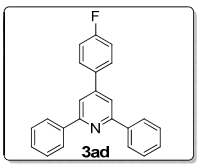


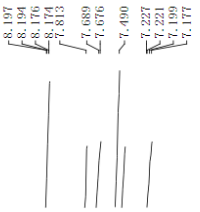

180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

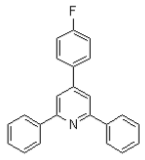

O
N
3ac

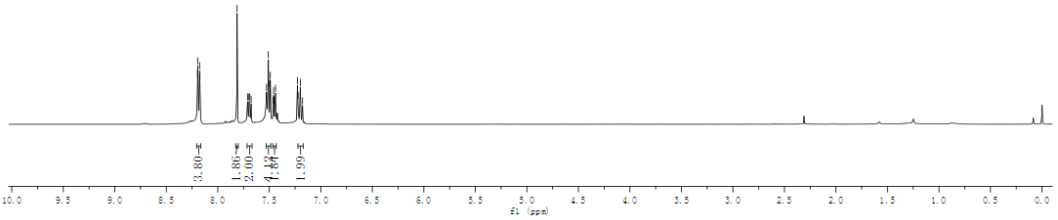

8.198
8.179
7.835
7.672
7.429
7.224
7.038
7.017
3.852
OCH3
N
3.94
1.88
1.92
4.07
1.79
1.94
3.00
f1 (ppm)

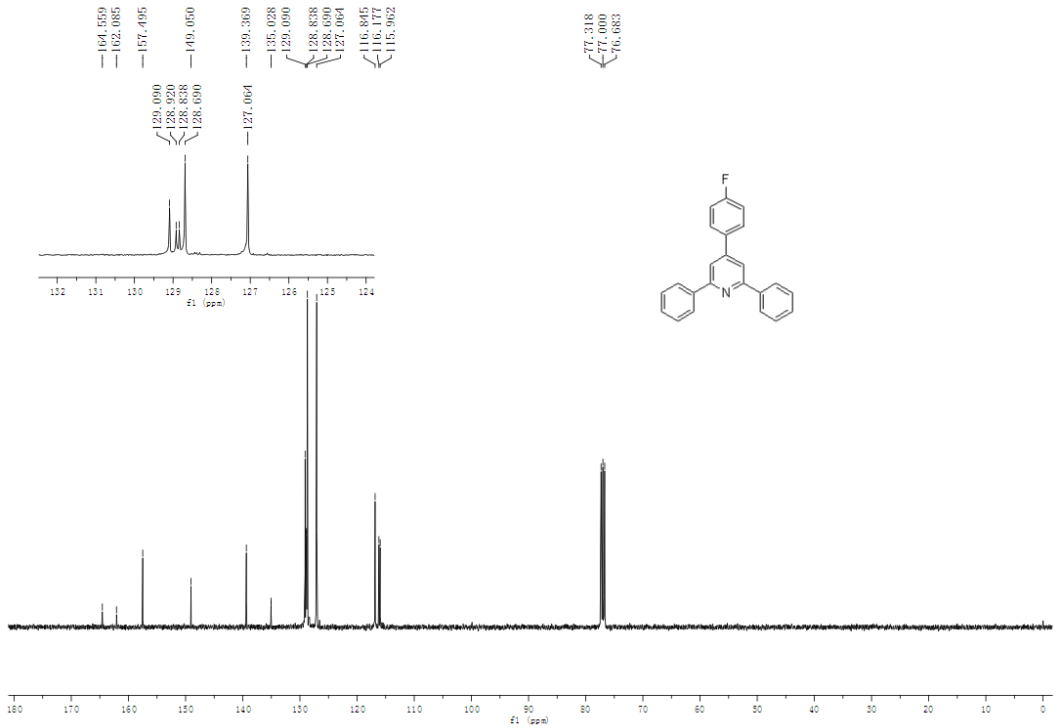

160.396
157.376
149.555
139.653
131.190
128.928
128.639
128.270
127.076
116.544
114.462
77.318
77.000
76.682
55.364
OCH3
N
f1 (ppm)

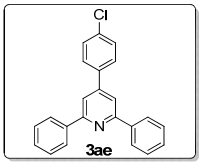

F
N
3ad

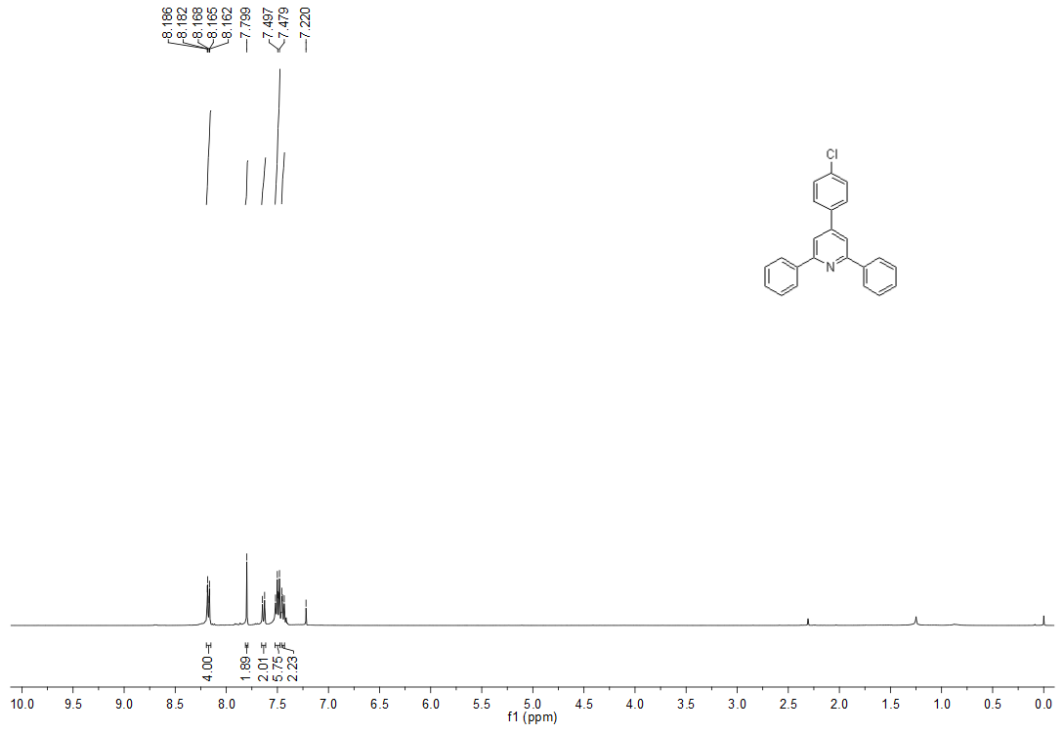

8.197
8.194
8.176
8.174
7.813
7.689
7.676
7.490
7.227
7.221
7.199
7.177

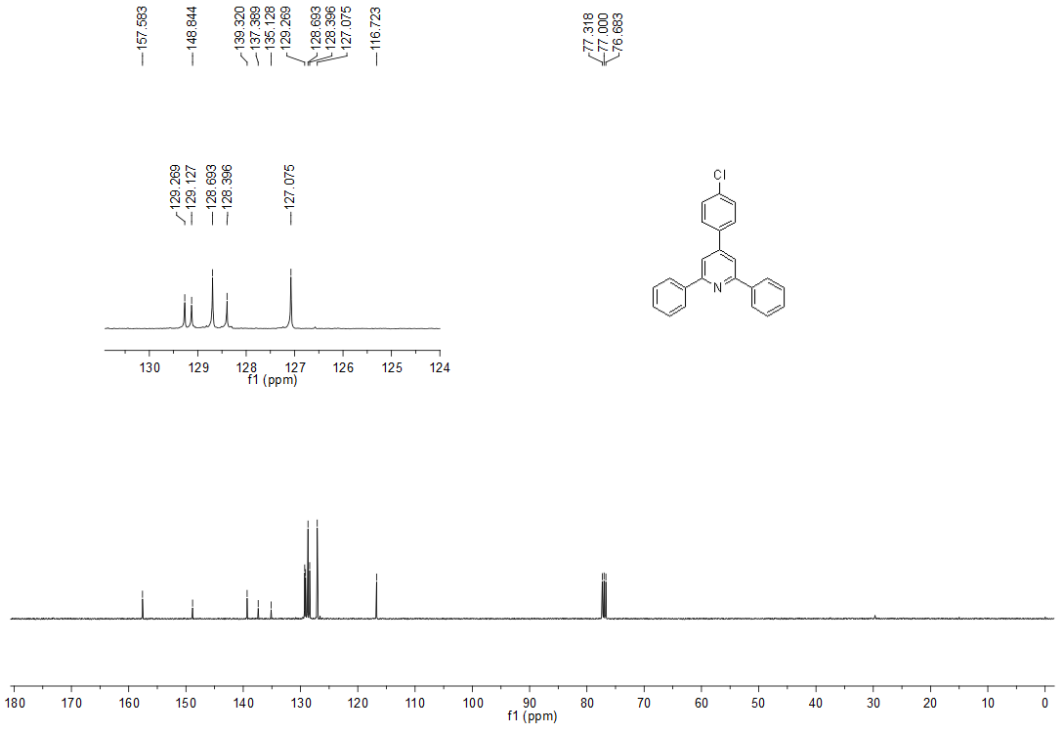

F
N

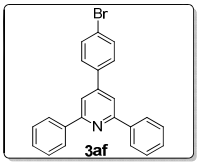

3.80
1.86
2.00
1.99
f1 (ppm)

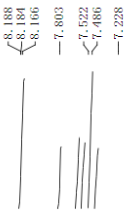

164.559
162.085
157.495
149.050
139.369
135.028
129.090
128.838
128.690
127.064
116.845
116.177
115.962
77.318
77.000
76.683
129.090
128.920
128.838
128.690
127.064
f1 (ppm)
F
N
f1 (ppm)

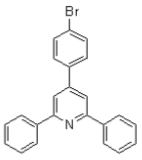

Cl
N
3ae

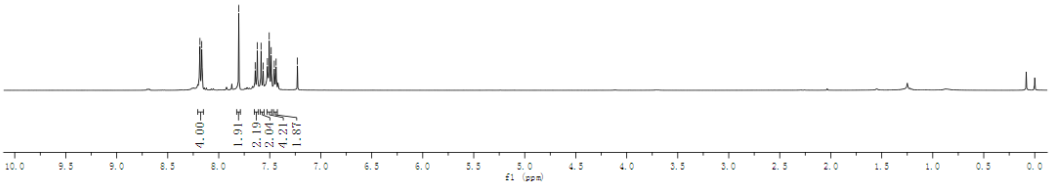

8.186
8.182
8.168
8.165
8.162
7.799
7.497
7.479
7.220
Cl
N
4.00
1.89
2.01
5.75
2.23
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

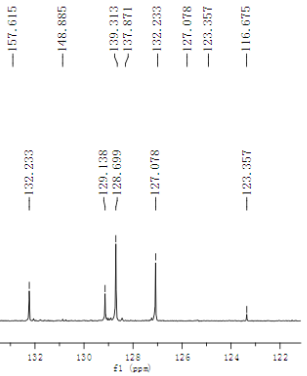

157.583
148.844
139.320
137.389
135.128
129.269
128.693
128.396
127.075
116.723
77.318
77.000
76.683
129.269
129.127
128.693
128.396
127.075
Cl
N
130 129 128 127 126 125 124
f1 (ppm)
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

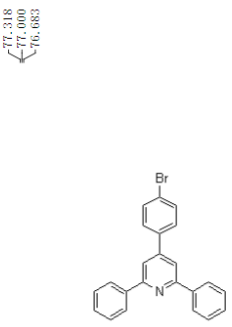

Br
N
3af

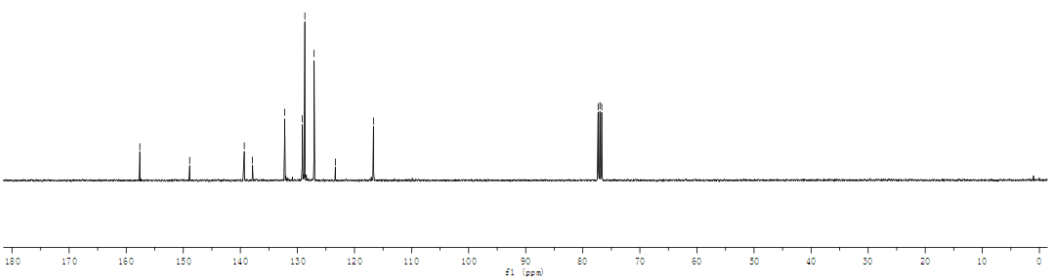

8.188
8.184
8.166
7.803
7.522
7.486
7.228

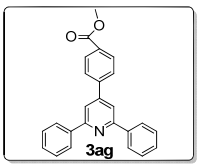

Br
N

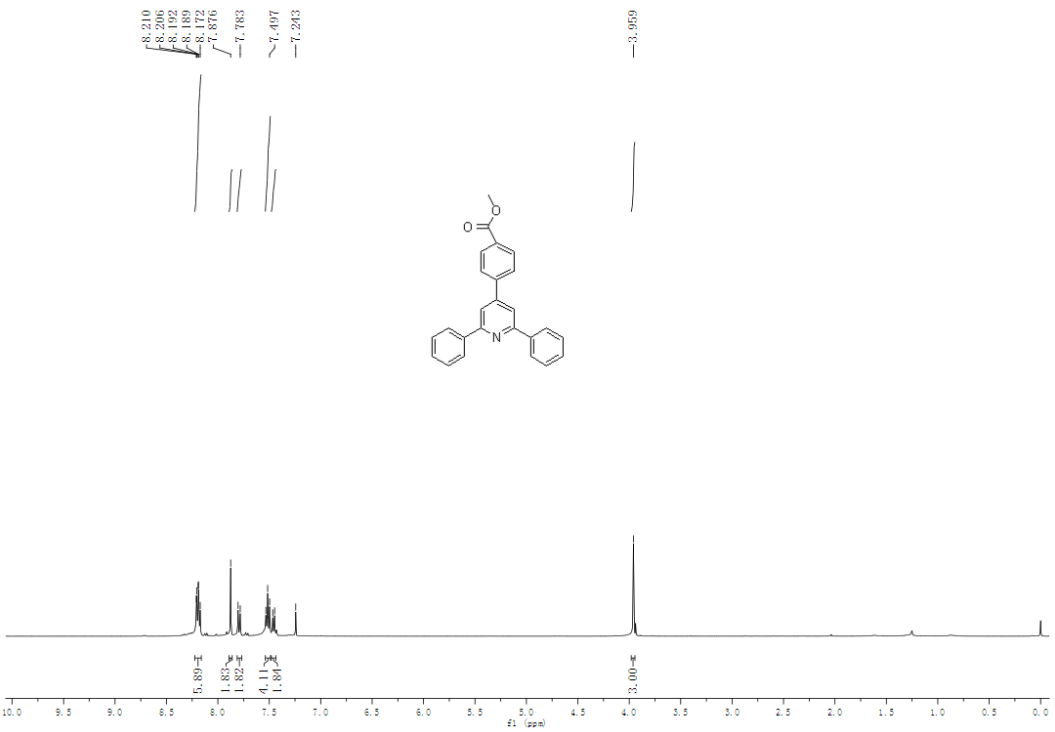

4.00
1.91
2.19
2.04
4.21
1.87
f1 (ppm)

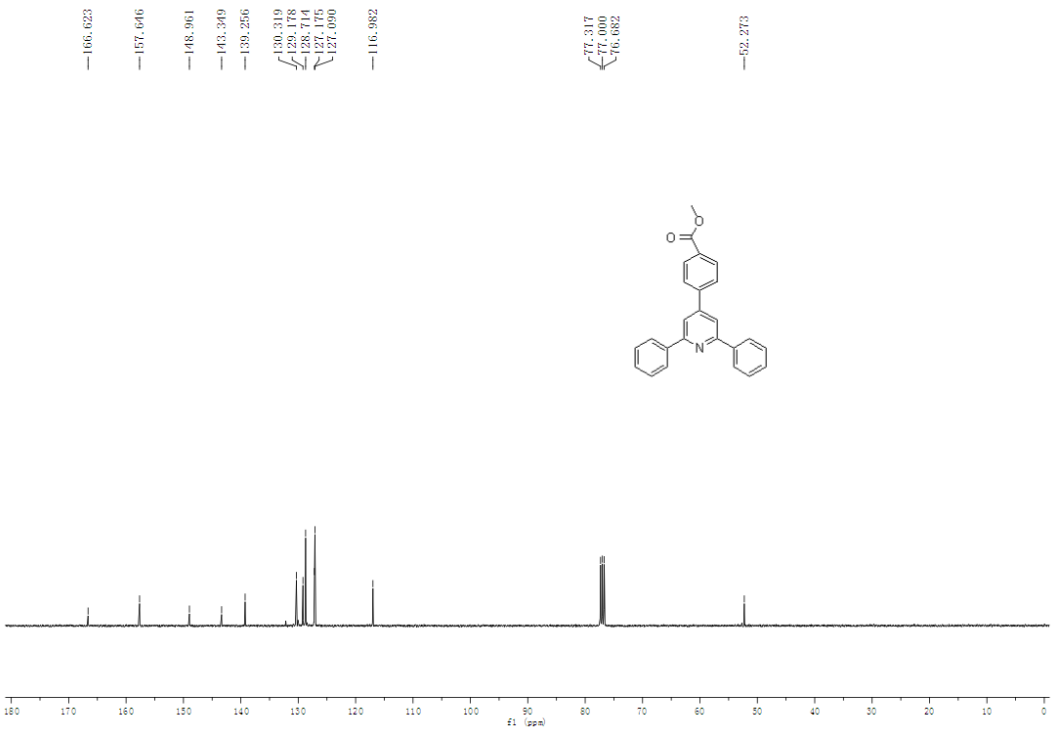

157.615
148.885
139.313
137.871
132.233
127.078
123.357
116.675
132.233
129.138
128.699
127.078
123.357
f1 (ppm)

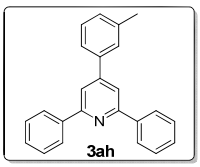

77.318
77.000
76.683
Br
N

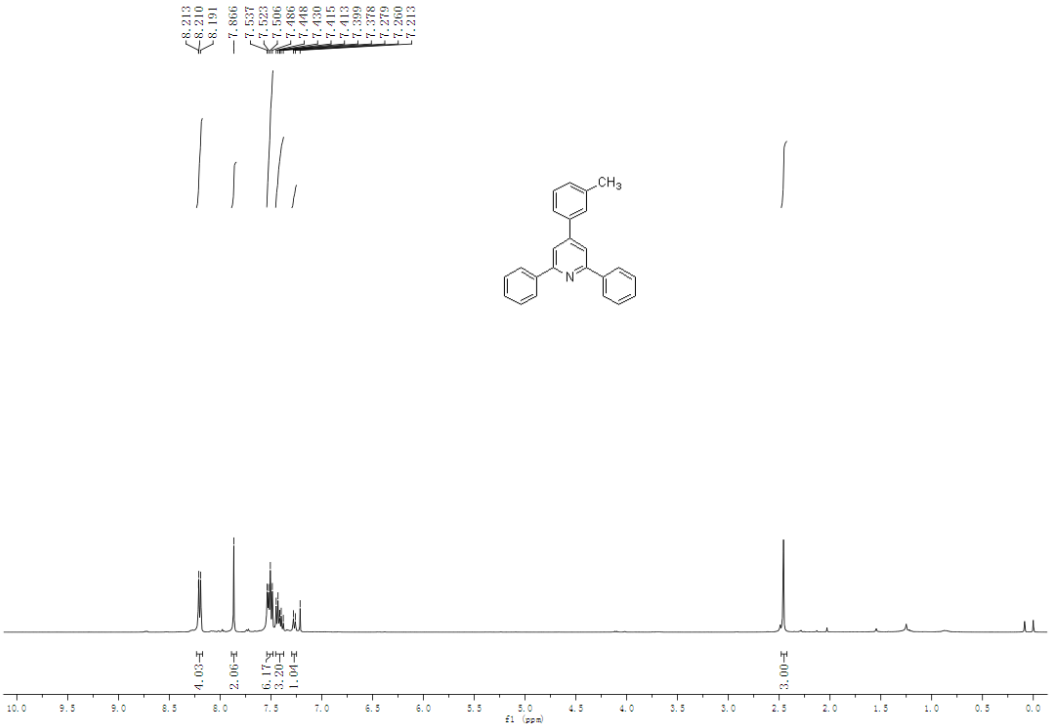

f1 (ppm)

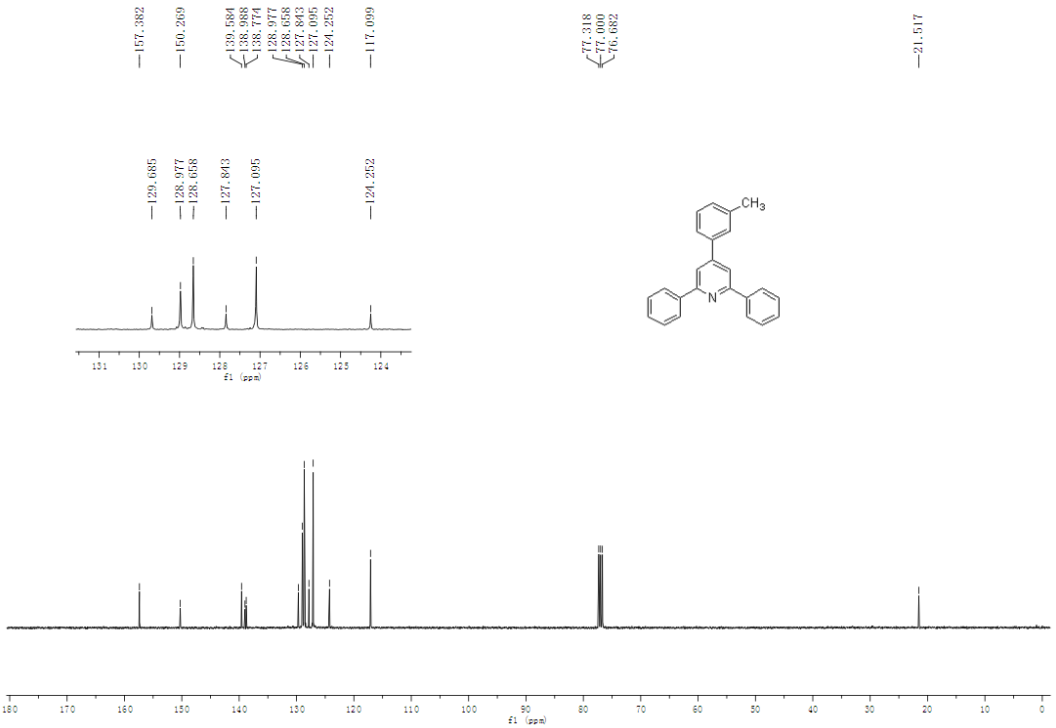

3ag

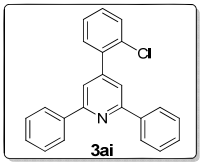

8.210
8.206
8.192
8.189
8.172
7.876
7.783
7.497
7.243
3.959
5.89
1.83
1.82
4.11
1.84
3.00
f1 (ppm)

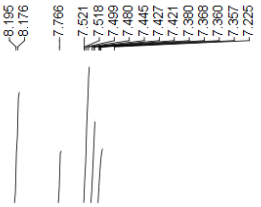

166.623
157.646
148.961
143.349
139.256
130.319
129.178
128.714
127.175
127.090
116.982
77.317
77.000
76.682
52.273
f1 (ppm)

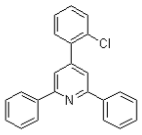

3ah

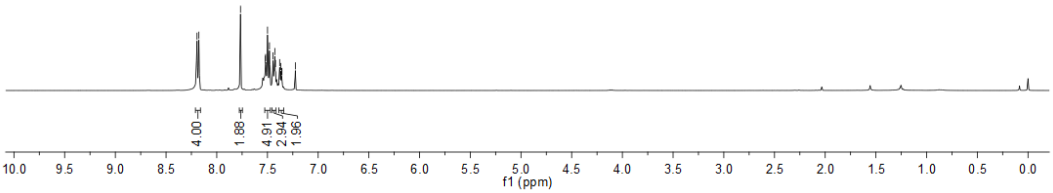

8.213
8.210
8.191
7.866
7.537
7.523
7.506
7.486
7.448
7.430
7.415
7.413
7.399
7.378
7.279
7.260
7.213
CH3
N
4.03
2.06
6.17
3.20
1.04
3.00
f1 (ppm)

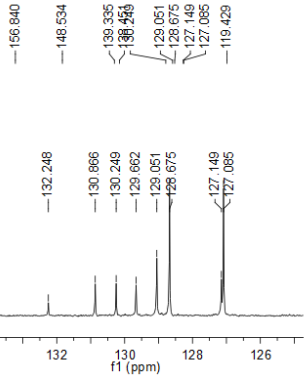

157.382
150.269
139.584
138.988
138.774
128.977
128.658
127.843
127.095
124.252
117.099
77.318
77.000
76.682
21.517
129.685
128.977
128.658
127.843
127.095
124.252
CH3
N
f1 (ppm)

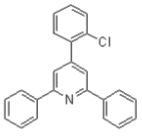

Cl
N
3ai

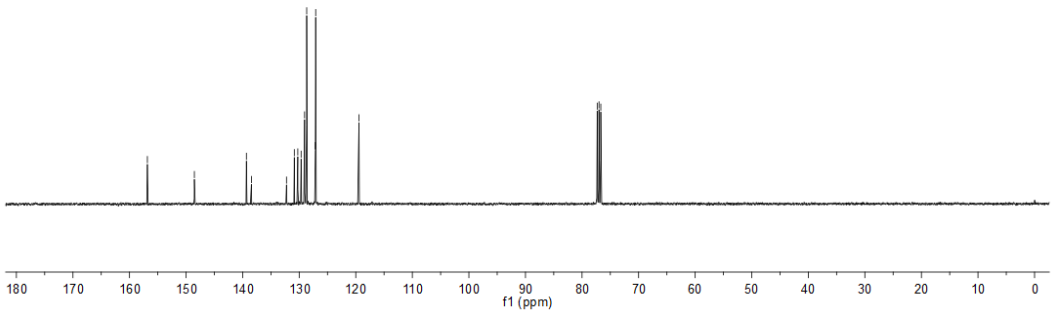

8.195
8.176
7.766
7.521
7.518
7.499
7.480
7.445
7.427
7.421
7.390
7.368
7.360
7.357
7.225

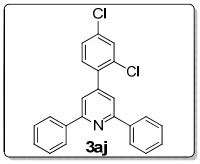

Cl
N

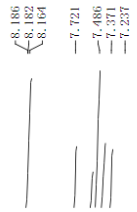

4.00
1.88
4.91
2.94
1.96
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

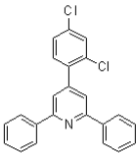

156.840
148.534
139.335
138.451
130.249
129.051
128.675
127.149
127.085
119.429
77.318
77.000
76.682
132.248
130.866
130.249
129.662
129.051
128.675
127.149
127.085
134 132 130 128 126
f1 (ppm)

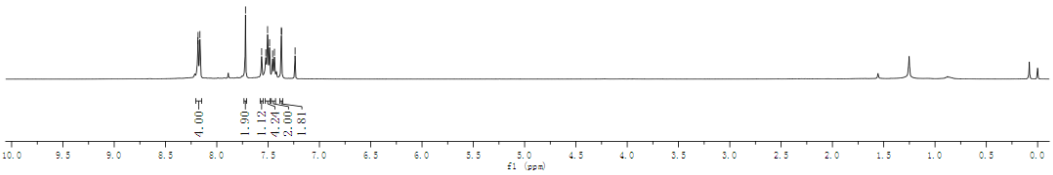

Cl
N


180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


Cl
Cl
N
3aj


8.186
8.182
8.164
7.721
7.486
7.371
7.237


Cl
Cl
N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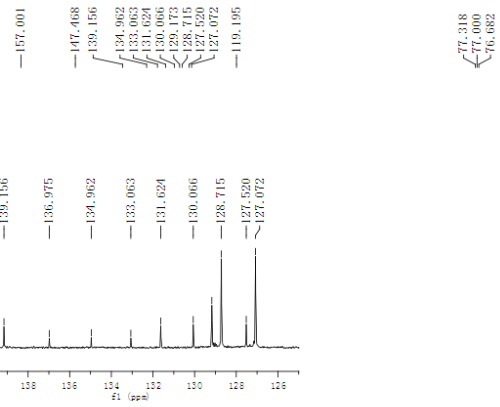
1.90
1.12
4.24
2.00
1.81
f1 (ppm)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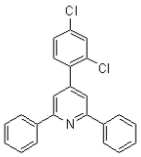
147.468
139.156
134.962
133.063
131.624
130.066
129.173
128.715
127.520
127.072
119.195
77.318
77.000
76.682
f1 (ppm)


139.156
136.975
134.962
133.063
131.624
130.066
128.715
127.520
127.072
f1 (ppm)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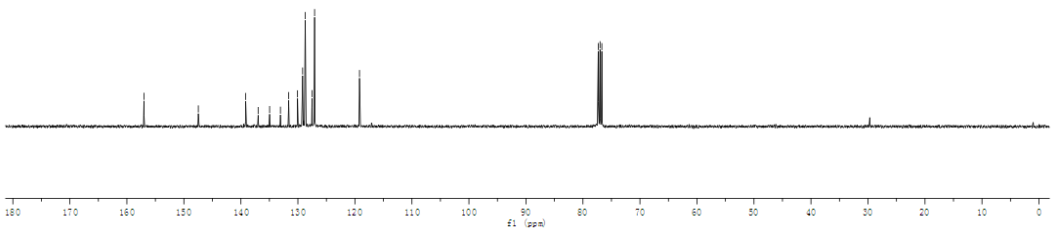
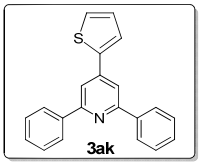
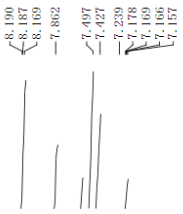
Cl
N


f1 (ppm)


S
N
3ak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8.187
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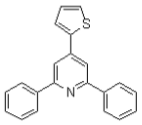
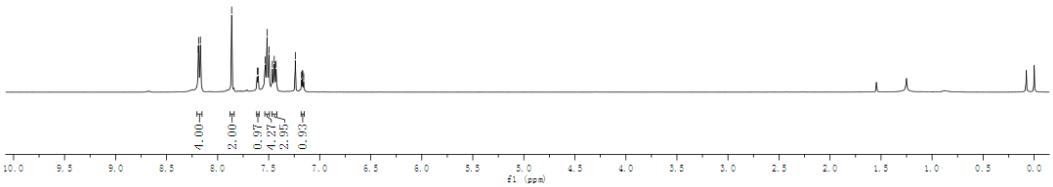
7.497
7.427
7.239
7.178
7.169
7.166
7.157


S
N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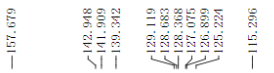
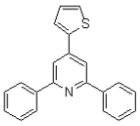
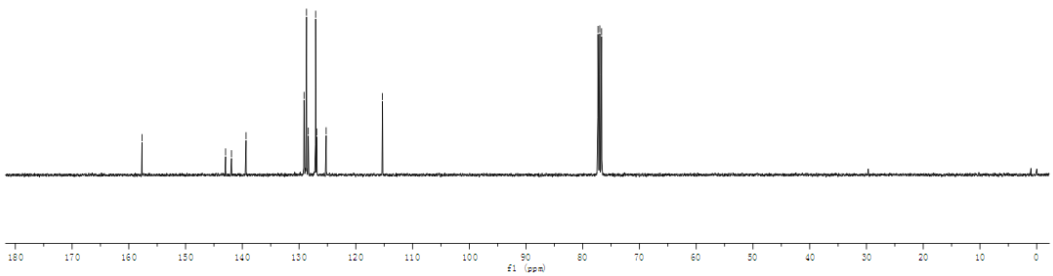
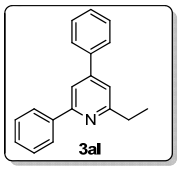
4.27
2.95
0.93
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


157.679
142.948
141.909
139.342
129.119
128.683
128.368
127.075
126.899
125.224
115.296
77.317
77.000
76.682


S
N


180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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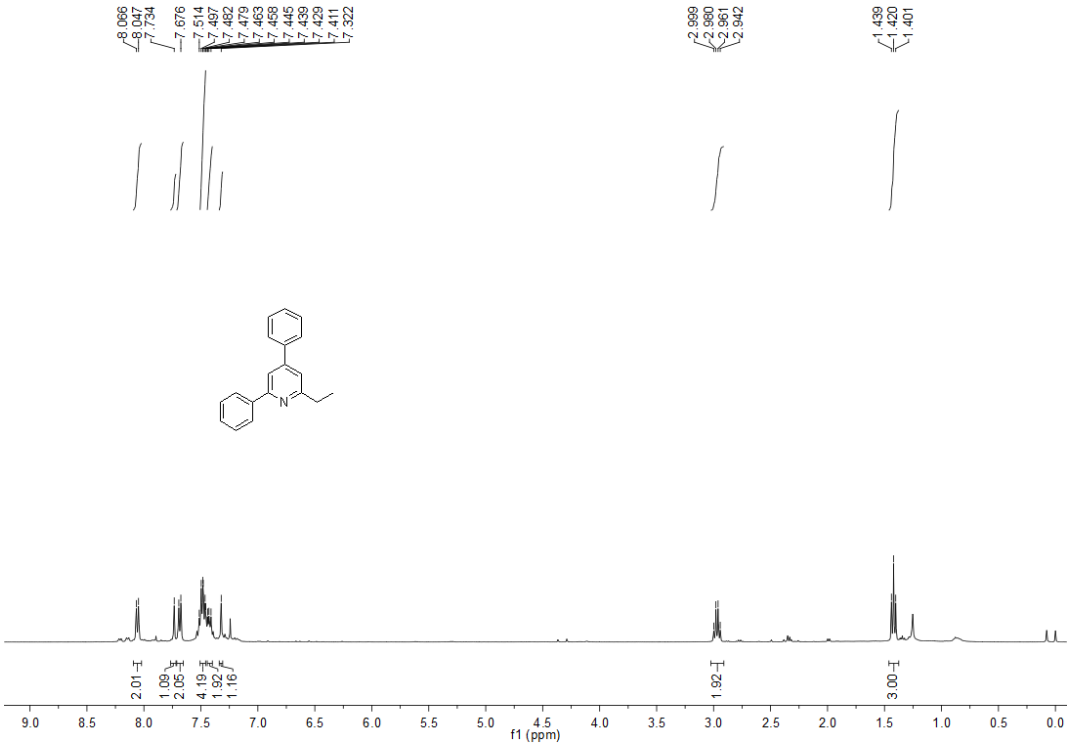
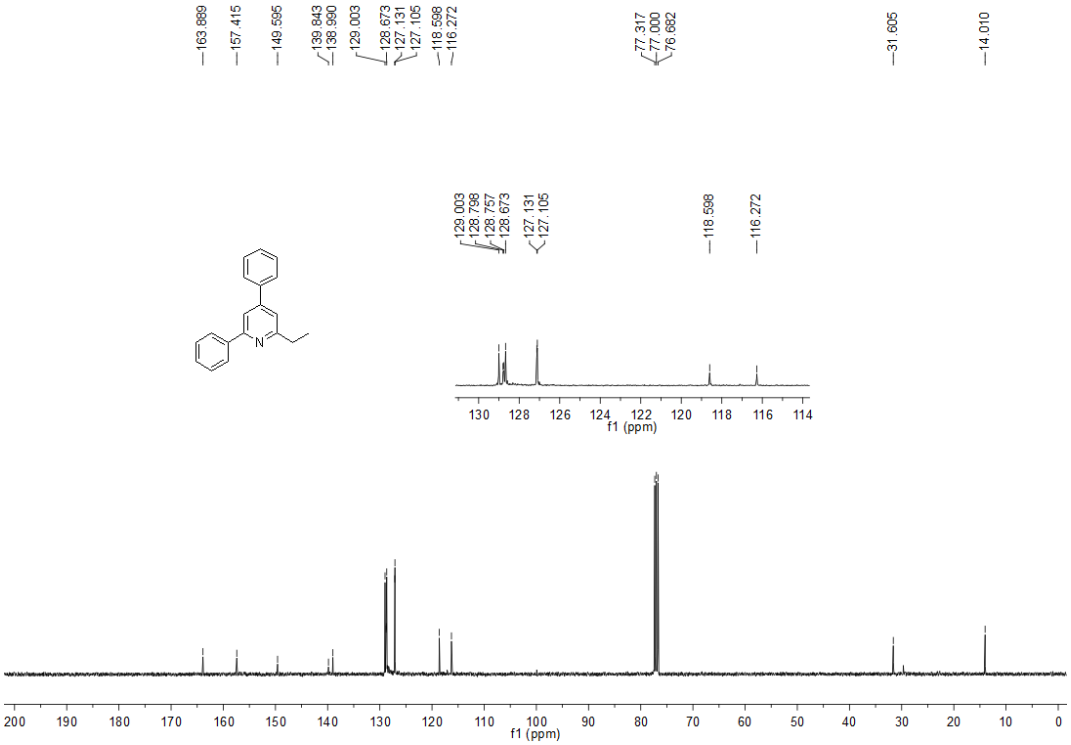
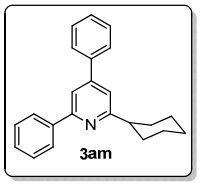
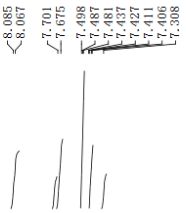
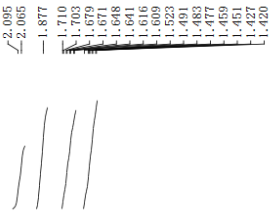

8.066
8.047
7.734
7.676
7.514
7.497
7.482
7.479
7.463
7.458
7.445
7.439
7.429
7.411
7.322
2.999
2.980
2.961
2.942
1.439
1.420
1.401
2.01
1.09
2.05
4.19
1.92
1.16
1.92
3.00
f1 (ppm)


163.869
157.415
149.595
139.843
138.990
129.003
128.673
127.131
127.105
118.598
116.272
77.317
77.000
76.682
31.605
14.010
129.003
128.798
128.757
128.673
127.131
127.105
118.598
116.272
f1 (ppm)
f1 (ppm)


N
3am


8.085
8.067
7.701
7.675
7.498
7.487
7.481
7.437
7.427
7.411
7.406
7.308


2.095
2.065
1.877
1.710
1.703
1.679
1.671
1.648
1.641
1.616
1.609
1.523
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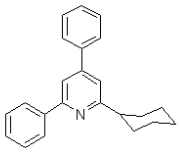
1.483
1.477
1.459
1.451
1.427
1.420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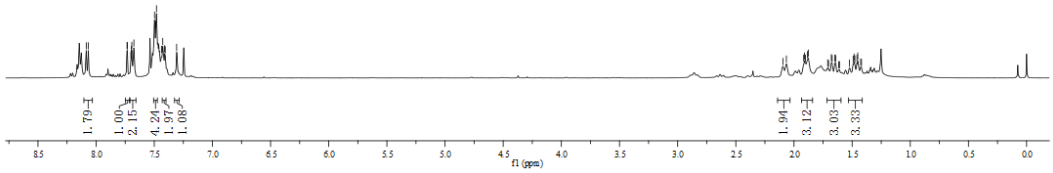
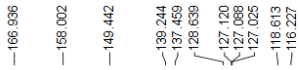
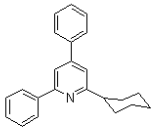
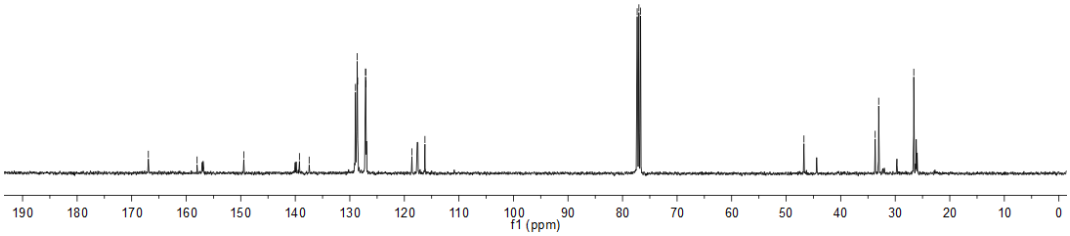

1.79
1.00
2.15
4.24
1.97
1.08
1.94
3.12
3.03
3.33
f1 (ppm)


166.936
158.002
149.442
139.244
137.459
128.639
127.120
127.088
127.025
118.613
116.227
77.318
77.000
76.683
46.738
33.678
33.037
26.602


N


f1 (ppm)