Supplementary Information

Access to Pyridines via DMAP-Catalyzed Activation of α-Chloro Acetic Ester to React with Unsaturated Imines

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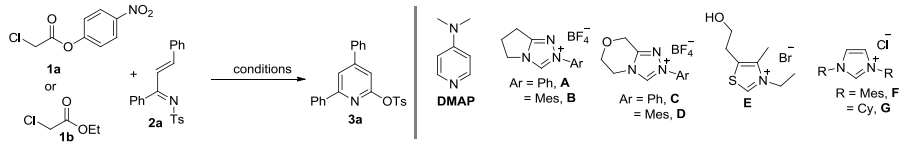
I. General Information:

Commercially available materials purchased from Alfa Aesar or Aldrich were used as received. *a*, *β*-Unsaturated imines **2** were synthesized following the literature reported method.[1] *p*-Nitrophenyl chloroacetate **1** was synthesized following the literature reported method.[2] Proton nuclear magnetic resonance (^{1}H NMR) spectra were recorded on Bruker Avance 400 (400 MHz), 500 (500 MHz) spectrometer or JEOL ECA400 (400 MHz) spectrometer in $CDCl_3$. Chemical shifts were recorded in parts per million (ppm, δ) relative to tetramethylsilane (δ 0.00). ^{1}H NMR splitting patterns are designated as singlet (s), doublet (d), triplet (t), quartet (q), dd (doublet of doublets); m (multiplets), and etc. All first-order splitting patterns were assigned on the basis of the appearance of the multiplet. Splitting patterns that could not be easily interpreted are designated as multiplet (m) or broad (br). Carbon nuclear magnetic resonance (^{13}C NMR) spectra were recorded either on Bruker AV400 (100 MHz) or JEOL ECA400 (100 MHz) spectrometer. High resolution mass spectral analysis (HRMS) was performed on Waters Q-TOF Premier mass spectrometer. Analytical thin-layer chromatography (TLC) was carried out on Merck 60 F254 pre-coated silica gel plate (0.2 mm thickness). Visualization was performed using a UV lamp.

II. General Procedures:

Condition Optimization:

Table S1. Screening of catalysts and bases (selected results)[a]



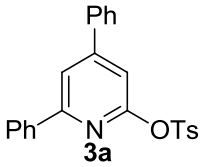
Entry	Substrate	Cat. (mol %)	Base	Solvent	Yield (%)[b]
1	**1a**	-	DIPEA (5 equiv)	CH_2Cl_2	<5
2	**1a**	-	Et_3N (5 equiv)	CH_2Cl_2	<5
3	**1a**	-	DBU (2 equiv)	CH_2Cl_2	<5
4	**1a**	-	Cs_2CO_3 (2 equiv)	CH_2Cl_2	<5
5	**1a**	-	K_2CO_3 (2 equiv)	CH_2Cl_2	<5
6	**1a**	-	DABCO (2 equiv)	CH_2Cl_2	<5
7	**1a**	-	TMEDA (2 equiv)	CH_2Cl_2	<5
8	**1a**	-	DMAP (2 equiv)	CH_2Cl_2	84[c]
9	**1a**	DMAP (50)	Et_3N (5 equiv)	CH_2Cl_2	81[c]
10	**1a**	**A** (20)	Et_3N (5 equiv)	CH_2Cl_2	10
11	**1a**	**B** (20)	Et_3N (5 equiv)	CH_2Cl_2	6
12	**1a**	**C** (20)	Et_3N (5 equiv)	CH_2Cl_2	45[c]
13	**1a**	**D** (20)	Et_3N (5 equiv)	CH_2Cl_2	57[c]
14	**1a**	**E** (20)	Et_3N (5 equiv)	CH_2Cl_2	<5
15	**1a**	**F** (20)	Et_3N (5 equiv)	CH_2Cl_2	<5
16	**1a**	**G** (20)	Et_3N (5 equiv)	CH_2Cl_2	<5
17	**1a**	DMAP (20)	Et_3N (5 equiv)	CH_2Cl_2	54[c]
18[d]	**1a**	DMAP (20)	Et_3N (5 equiv)	CH_2Cl_2	66[c]
19[d]	**1a**	DMAP (20)	Et_3N (5 equiv)	$(CH_2Cl)_2$	75[c]
20[d]	**1a**	DMAP (20)	Et_3N (5 equiv)	toluene	25
21[d]	**1a**	DMAP (20)	Et_3N (5 equiv)	THF	29
22[d]	**1a**	DMAP (20)	Et_3N (5 equiv)	EtOAc	31
23[d]	**1a**	DMAP (20)	Et_3N (5 equiv)	CH_3CN	11
24[d]	**1a**	DMAP (20)	Et_3N (5 equiv)	Et_2O	<5
25[d]	**1a**	DMAP (20)	Et_3N (5 equiv)	Hexane	<5
26[d]	**1b**	-	DBU (2 equiv)	$(CH_2Cl)_2$	<5
27[d]	**1b**	-	Cs_2CO_3 (2 equiv)	$(CH_2Cl)_2$	<5
28[d]	**1b**	-	NaOMe (2 equiv)	$(CH_2Cl)_2$	<5

[a] Reaction condition: **1** (0.20 mmol), **2a** (0.10 mmol), solvent (0.40 mL), reacted at room temperature for 24 h and then at 60 ^oC for 6 h. In all above cases, all the ester **1a** was consumed. [b] Estimated *via* ^1H NMR analysis of crude reaction mixture. [c] Isolated yield based on **2a**. [d] Reacted at room temperature for 48h and then at 60 ^oC for 6 h.

General procedure for the DMAP-catalyzed reactions of esters and unsaturated imines (Scheme 2): To a 4 mL dry screw cap glass vial, equipped with a magnetic stir bar, was added ester **1a** (0.2 mmol), α,β-unsaturated imine **2** (0.1 mmol) and DMAP (0.02 mmol). $(CH_2Cl)_2$ (0.4 mL) was added, followed by an injection of Et_3N (0.5 mmol) and the reaction mixture was stirred at room temperature for 48 h. After all the ester **1a** was consumed (monitored by TLC and ^1H NMR), the reaction mixture was heated to 60 ^oC for further 6 h. Then the solvent was removed under reduced pressure, and the residue was purified *via* column chromatography on silica gel with hexane/EtOAc as eluent to afford the desired pyridine products **3**.

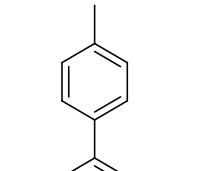
III. Characterization of products:

4,6-Diphenylpyridin-2-yl 4-methylbenzenesulfonate (3a): 75% yield; colorless solid; mp 114-117 ^oC; **^1H NMR** (400 MHz, CHLOROFORM-d) δ = 7.97 (d, J = 7.7 Hz, 2 H), 7.83 (s, 1 H), 7.75 (dd, J = 2.7, 5.9 Hz, 2 H), 7.69-7.60 (m, 2 H), 7.55-7.44 (m, 3 H), 7.44-7.39 (m, 3 H), 7.36 (d, J = 8.1 Hz, 2 H), 2.47 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 157.8, 156.7, 153.9, 145.1, 137.7, 137.5, 134.6, 129.7, 129.7, 129.3, 128.9, 128.7, 127.2, 127.1, 117.1, 111.8, 21.8; **HRMS** (ESI): calculated for $[C_{24}H_{20}NO_3S]^+$: m/z = 402.1164, found: m/z = 402.1164.



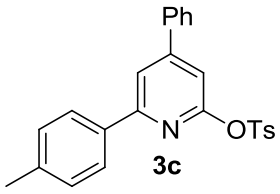
3a

6-Phenyl-4-(*p*-tolyl)pyridin-2-yl 4-methylbenzenesulfonate (3b): 74% yield; light yellow oil; **^1H NMR** (400 MHz, CHLOROFORM-d) δ = 7.97 (d, J = 8.4 Hz, 2 H), 7.82 (d, J = 1.2 Hz, 1 H), 7.79-7.71 (m, 2 H), 7.56 (d, J = 8.2 Hz, 2 H), 7.43-7.38 (m, 3 H), 7.36 (d, J = 8.1 Hz, 2 H), 7.31 (d, J = 7.9 Hz, 2 H), 7.24 (d, J = 1.2 Hz, 1 H), 2.48 (s, 3 H), 2.43 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d): δ = 157.8, 156.6, 153.8, 145.1, 140.0, 137.8, 134.6, 134.5, 130.0, 129.7, 129.6, 128.9, 128.7, 127.1, 116.8, 111.4, 21.8, 21.4; **HRMS** (ESI): calculated for $[C_{25}H_{22}NO_3S]^+$: m/z = 416.1320, found: m/z = 416.1329.

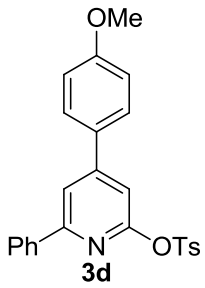


3b

4-Phenyl-6-(*p*-tolyl)pyridin-2-yl 4-methylbenzenesulfonate (3c): 40% yield; colourless oil; **^1H NMR** (400 MHz, CHLOROFORM-d) δ = 7.98 (d, J = 8.2 Hz, 2 H), 7.80 (d, J = 1.1 Hz, 1 H), 7.70-7.60 (m, 4 H), 7.56-7.43 (m, 3 H), 7.37 (d, J = 8.1 Hz, 2 H), 7.24 - 7.17 (m, 3 H), 2.48 (s, 3 H), 2.40 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 157.7, 156.6, 153.7, 145.0, 139.7, 137.5, 134.8, 134.6, 129.6, 129.3, 129.2, 128.9, 127.1, 126.9, 116.7, 111.3, 21.7, 21.3; **HRMS** (ESI): calculated for $[C_{25}H_{22}NO_3S]^+$: m/z = 416.1320, found: m/z = 416.1326.

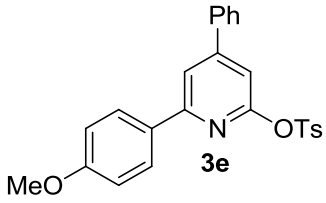


3c

4-(4-Methoxyphenyl)-6-phenylpyridin-2-yl 4-methylbenzenesulfonate (3d): 35% yield; colourless oil; 

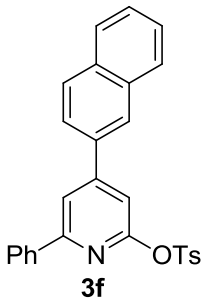
3d

^{1}H NMR (400 MHz, CHLOROFORM-d) δ = 7.97 (d, J = 8.2 Hz, 2 H), 7.79 (d, J = 1.1 Hz, 1 H), 7.75 (dd, J = 2.9, 6.7 Hz, 2 H), 7.62 (d, J = 8.9 Hz, 2 H), 7.43-7.38 (m, 3 H), 7.37 (d, J = 8.2 Hz, 2 H), 7.22 (d, J = 1.1 Hz, 1 H), 7.02 (d, J = 8.9 Hz, 2 H), 3.88 (s, 3 H), 2.48 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 161.0, 157.8, 156.5, 153.3, 145.0, 137.7, 134.5, 129.6, 129.5, 128.9, 128.6, 128.4, 127.0, 116.4, 114.6, 111.0, 55.5, 21.7; **HRMS** (ESI): calculated for $[C_{25}H_{22}NO_4S]^+$: m/z = 432.1270, found: m/z = 432.1267.

6-(4-Methoxyphenyl)-4-phenylpyridin-2-yl 4-methylbenzenesulfonate (3e): 32% yield; colourless oil; 

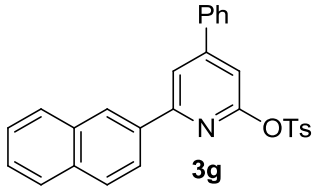
3e

^{1}H NMR (400 MHz, CHLOROFORM-d) δ = 7.97 (d, J = 8.2 Hz, 2 H), 7.76 (s, 1 H), 7.72 (d, J = 8.7 Hz, 2 H), 7.67-7.61 (m, 2 H), 7.55-7.45 (m, 3 H), 7.37 (d, J = 8.2 Hz, 2 H), 7.18 (s, 1 H), 6.92 (d, J = 8.8 Hz, 2 H), 3.87 (s, 3 H), 2.48 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 160.9, 157.6, 156.3, 153.7, 144.9, 137.6, 134.5, 130.2, 129.6, 129.2, 128.8, 128.4, 127.1, 116.2, 113.9, 110.8, 55.4, 21.7; **HRMS** (ESI): calculated for $[C_{25}H_{22}NO_4S]^+$: m/z = 432.1270, found: m/z = 432.1269.

4-(Naphthalen-2-yl)-6-phenylpyridin-2-yl 4-methylbenzenesulfonate (3f): 61% yield; white solid; 

3f

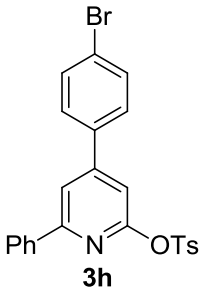
^{1}H NMR (400 MHz, CHLOROFORM-d) δ = 8.15 (s, 1 H), 8.03 - 7.93 (m, 5 H), 7.93-7.87 (m, 1 H), 7.83-7.78 (m, 2 H), 7.76 (dd, J = 1.7, 8.5 Hz, 1 H), 7.60-7.53 (m, 2 H), 7.46-7.41 (m, 3 H), 7.41 - 7.35 (m, 3 H), 2.49 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 157.8, 156.7, 153.8, 145.0, 137.6, 134.7, 134.5, 133.7, 133.4, 129.6, 129.1, 128.9, 128.6, 128.6, 127.8, 127.2, 127.0, 126.9, 126.8, 124.4, 117.2, 111.9, 21.7; **HRMS** (ESI): calculated for $[C_{28}H_{22}NO_3S]^+$: m/z = 452.1320, found: m/z = 452.1319.

6-(Naphthalen-2-yl)-4-phenylpyridin-2-yl 4-methylbenzenesulfonate (3g): 67% yield; light yellow solid; 

3g

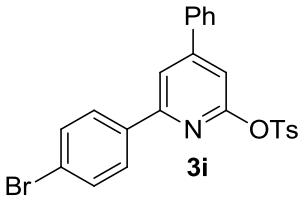
^{1}H NMR (500 MHz, CHLOROFORM-d) δ = 8.25 (s, 1 H), 8.02 (d, J = 7.9 Hz, 2 H), 7.98 (s, 1 H), 7.90-7.83 (m, 4 H), 7.70 (d, J = 7.6 Hz, 2 H), 7.57-7.49 (m, 5 H), 7.40 (d, J = 7.9 Hz, 2 H), 7.29 (s, 1 H), 2.50 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 157.9, 156.5, 154.0, 145.0, 137.5, 134.9, 134.6, 133.9, 133.3, 129.7, 129.7, 129.3, 128.9, 128.7, 128.3, 127.7, 127.2, 126.9, 126.7, 126.5, 124.3, 117.3, 111.8, 21.8; **HRMS** (ESI): calculated for $[C_{28}H_{22}NO_3S]^+$: m/z = 452.1320, found: m/z = 452.1318.

4-(4-Bromophenyl)-6-phenylpyridin-2-yl 4-methylbenzenesulfonate (3h): 82% yield; white solid; **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ = 7.97 (d, *J* = 8.4 Hz, 2 H), 7.78 (d, *J* = 0.9 Hz, 1 H), 7.75 (dd, *J* = 2.9, 6.7 Hz, 2 H), 7.65 (d, *J* = 8.4 Hz, 2 H), 7.52 (d, 2 H), 7.45-7.39 (m, 3 H), 7.37 (d, *J* = 8.4 Hz, 2 H), 7.21 (d, *J* = 0.9 Hz, 1 H), 2.48 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 157.8, 156.8, 152.6, 145.1, 137.4, 136.3, 134.4, 132.4, 129.7, 129.6, 128.9, 128.7, 128.6, 127.0, 124.2, 116.7, 111.4, 21.7; **HRMS** (ESI): calculated for $[C_{24}H_{19}NO_3SBr]^+$: m/z = 480.0269, found: m/z = 480.0269.



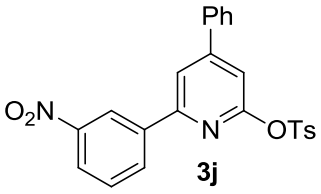
3h

6-(4-Bromophenyl)-4-phenylpyridin-2-yl 4-methylbenzenesulfonate (3i): 72% yield; white solid; **^{1}H NMR** (500 MHz, CHLOROFORM-d) *δ* = 7.96 (d, *J* = 7.9 Hz, 2 H), 7.80 (s, 1 H), 7.65-7.64 (m, 4 H), 7.56-7.43 (m, 5 H), 7.37 (d, *J* = 7.9 Hz, 2 H), 2.49 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) *δ* = 157.8, 155.4, 154.1, 145.1, 137.2, 136.5, 134.5, 131.8, 129.8, 129.6, 129.3, 128.8, 128.5, 127.1, 124.1, 116.8, 112.0, 21.7; **HRMS** (ESI): calculated for $[C_{24}H_{19}NO_3SBr]^+$: m/z = 480.0269, found: m/z = 480.0280.



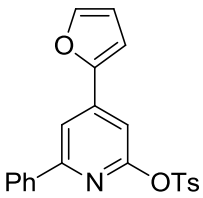
3i

6-(3-Nitrophenyl)-4-phenylpyridin-2-yl 4-methylbenzenesulfonate (3j): 99% yield; yellow oil; **^{1}H NMR** (400 MHz, CHLOROFORM-d) *δ* = 8.61-8.60 (m, 1 H), 8.27 (dd, *J* = 2.1, 8.1 Hz, 1 H), 8.14 (d, *J* = 7.8 Hz, 1 H), 8.00 (d, *J* = 8.2 Hz, 2 H), 7.90 (s, 1 H), 7.69-7.67 (m, 2 H), 7.61 (t, *J* = 7.9 Hz, 1 H), 7.58-7.48 (m, 3 H), 7.42 (d, *J* = 8.4 Hz, 2 H), 7.36 (s, 1 H), 2.49 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) *δ* = 158.0, 154.5, 153.8, 148.8, 145.6, 139.4, 136.9, 134.3, 132.6, 130.0, 129.8, 129.7, 129.4, 128.7, 127.2, 124.1, 121.9, 117.3, 113.1, 21.8; **HRMS** (ESI): calculated for $[C_{24}H_{19}N_2O_5S]^+$: m/z = 447.1015, found: m/z = 447.1014.



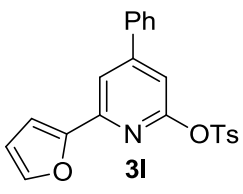
3j

4-(Furan-2-yl)-6-phenylpyridin-2-yl 4-methylbenzenesulfonate (3k): 51% yield; yellow oil; **^{1}H NMR** (400 MHz, CHLOROFORM-d) *δ* = 7.95 (d, *J* = 8.2 Hz, 2 H), 7.86 (s, 1 H), 7.76-7.69 (m, 2 H), 7.57 (d, *J* = 1.8 Hz, 1 H), 7.44-7.37 (m, 3 H), 7.35 (d, *J* = 8.2 Hz, 2 H), 7.26 (d, *J* = 0.9 Hz, 1 H), 6.94 (d, *J* = 3.2 Hz, 1 H), 6.55 (dd, *J* = 1.8, 3.6 Hz, 1 H), 2.46 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) *δ* = 157.9, 156.8, 150.7, 145.1, 144.4, 142.4, 137.5, 134.5, 129.7, 128.9, 128.6, 127.0, 113.0, 112.4, 109.9, 107.8, 21.8; **HRMS** (ESI): calculated for $[C_{22}H_{18}NO_4S]^+$: m/z = 392.0957, found: m/z = 392.0959.



3k

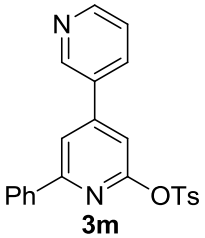
6-(Furan-2-yl)-4-phenylpyridin-2-yl 4-methylbenzenesulfonate (3l): 91% yield; yellow oil; **^{1}H NMR** (400 MHz, CHLOROFORM-d) *δ* = 7.99 (d, *J* = 8.2 Hz, 2 H), 7.79 (d, *J* = 1.4 Hz, 1 H), 7.66 (dd, *J* = 1.8, 7.9 Hz, 2 H), 7.58-7.45 (m, 4 H), 7.38 (d, *J* = 8.1 Hz, 2 H), 7.17 (d, *J* = 1.2 Hz, 1 H), 6.78 (d, *J* = 3.4 Hz, 1 H), 6.50 (dd, *J* = 1.8, 3.4 Hz, 1 H), 2.48 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) *δ* = 157.7, 153.7, 152.6, 148.4, 145.1, 143.7, 137.1, 134.3, 129.7, 129.5, 129.2, 128.9, 127.1, 114.9, 112.2,



3l

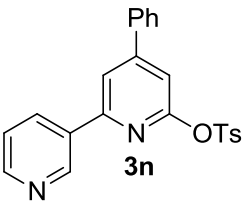
111.1, 110.0, 21.7; **HRMS** (ESI): calculated for $[C_{22}H_{18}NO_4S]^+$: m/z = 392.0957, found: m/z = 392.0958;

6'-Phenyl-[3,4'-bipyridin]-2'-yl 4-methylbenzenesulfonate (3m): 71% yield; yellow solid; **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ = 8.91 (d, J = 1.8 Hz, 1 H), 8.73 (dd, J = 1.5, 4.9 Hz, 1 H), 8.25-8.10 (m, 1 H), 8.05-7.92 (m, 2 H), 7.83 (d, J = 1.2 Hz, 1 H), 7.81-7.73 (m, 2 H), 7.51-7.48 (m, 1 H), 7.47-7.40 (m, 2 H), 7.38 (d, J = 8.1 Hz, 2 H), 7.25 (d, J = 1.2 Hz, 1 H), 7.02-6.84 (m, 1 H), 2.49 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 162.2, 157.8, 157.2, 150.4, 147.9, 145.2, 137.1, 134.8, 129.9, 129.6, 128.8, 128.7, 127.0, 126.2, 124.1, 116.8, 115.7, 111.6, 21.7; **HRMS** (ESI): calculated for $[C_{23}H_{19}N_2O_3S]^+$: m/z = 403.1116, found: m/z = 403.1111;



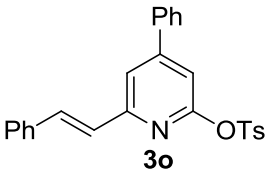
3m

4-Phenyl-[2,3'-bipyridin]-6-yl 4-methylbenzenesulfonate (3n): 68% yield; yellow solid; **^{1}H NMR** (400 MHz, CHLOROFORM-d) δ = 9.02 (s, 1 H), 8.65 (d, J = 3.5 Hz, 1 H), 8.20-8.13 (m, 1 H), 8.09 (td, J = 1.9, 8.0 Hz, 1 H), 7.97 (d, J = 8.3 Hz, 2 H), 7.85 (d, J = 1.0 Hz, 1 H), 7.66 (dd, J = 1.8, 7.8 Hz, 2 H), 7.56-7.49 (m, 2 H), 7.42-7.35 (m, 2 H), 7.32 (d, J = 1.0 Hz, 1 H), 6.93-6.89 (m, 1 H), 2.47 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 158.0, 154.3, 153.9, 150.2, 148.1, 145.4, 137.0, 134.6, 129.9, 129.7, 129.4, 128.8, 127.2, 126.2, 123.6, 117.2, 115.7, 112.6, 21.7; **HRMS** (ESI): calculated for $[C_{23}H_{19}N_2O_3S]^+$: m/z = 403.1116, found: m/z = 403.1121;



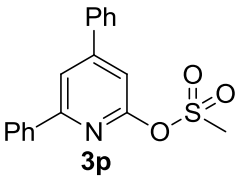
3n

4-Phenyl-6-styrylpyridin-2-yl 4-methylbenzenesulfonate (3o): 75% yield; white solid; **^{1}H NMR** (400 MHz, CHLOROFORM-*d*) δ = 7.98 (d, J = 8.2 Hz, 2 H), 7.62 (dd, J = 1.8, 7.2 Hz, 2 H), 7.55-7.45 (m, 5 H), 7.43-7.26 (m, 7 H), 7.16 (s, 1 H), 7.01 (d, J = 15.9 Hz, 1 H), 2.47 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-*d*) δ = 157.7, 155.0, 153.7, 145.1, 137.3, 136.3, 134.7, 134.6, 129.7, 129.3, 128.9, 128.9, 128.8, 127.3, 127.1, 126.2, 119.5, 111.6, 21.8; **HRMS** (ESI): calculated for $[C_{26}H_{22}NO_3S]^+$: m/z = 428.1320, found: m/z = 428.1320;



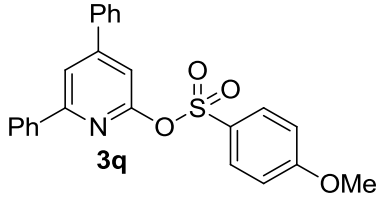
3o

4,6-Diphenylpyridin-2-yl methanesulfonate (3p): 45% yield; white solid; **^{1}H NMR** (400 MHz, CHLOROFORM-*d*) δ = 8.01 (dd, J = 1.5, 8.1 Hz, 2 H), 7.91 (d, J = 1.2 Hz, 1 H), 7.69 (dd, J = 1.6, 7.9 Hz, 2 H), 7.59-7.42 (m, 6 H), 3.63 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 158.1, 157.0, 154.4, 137.9, 137.3, 129.9, 129.4, 129.0, 127.3, 127.1, 117.6, 111.6, 41.1; **HRMS** (ESI): calculated for $[C_{18}H_{16}NO_3S]^+$: m/z = 326.0851, found: m/z = 362.0852;



3p

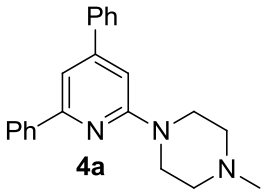
4,6-Diphenylpyridin-2-yl 4-methoxybenzenesulfonate (3q): 78% yield; white solid; **^{1}H NMR** (400 MHz, CHLOROFORM-*d*) δ = 8.01 (d, J = 9.1 Hz, 2 H), 7.83 (s, 1 H), 7.81-7.72 (m, 2 H), 7.68-7.59 (m, 2 H), 7.55-7.43 (m, 3 H), 7.43-7.33 (m,



3q

3 H), 7.01 (d, J = 9.1 Hz, 2 H), 3.88 (s, 3 H); **^{13}C NMR** (100 MHz, CHLOROFORM-d) δ = 164.1, 157.9, 156.7, 153.9, 137.7, 137.5, 131.3, 129.7, 129.7, 129.3, 128.8, 128.7, 127.2, 127.1, 117.1, 114.3, 111.8, 55.8; **HRMS** (ESI): calculated for $[C_{24}H_{20}NO_4S]^+$: m/z = 418.1113, found: m/z = 418.1113;

1-(4,6-Diphenylpyridin-2-yl)-4-methylpiperazine (4a) (CAS #: 583058-18-8)



4a

A 10 mL microwave reaction tube was charged with a stirring bar, pyridine **3a** (20 mg, 0.05 mmol), toluene (0.5 ml) was added Et_3N (0.10 mmol) and 1-methylpiperazine (5 mg, 0.05 mmol) The reaction tube was sealed with a Teflon-lined snap cap, and heated with stirring in a microwave reactor at 160 °C for 30 minutes (**Note**). A further portion of 1-methylpiperazine (5 mg, 0.05 mmol) was added and the reaction mixture was heated with stirring in the microwave reactor at 160 °C for further 30 min. Repeated this addition for 8 times. After cooling, the mixture was purified through column chromatography (eluent CH_2Cl_2 : EtOH 40:1) to give the known product **4a**[3] as a yellow oil (11.8 mg, 72%); **^{1}H NMR** (500 MHz, CHLOROFORM-*d*) δ = 8.07 (d, J = 7.9 Hz, 2 H), 7.65 (d, J = 7.9 Hz, 2 H), 7.53-7.35 (m, 6 H), 7.32 (s, 1 H), 6.79 (s, 1 H), 3.76-3.74 (m, 4 H), 2.61-2.59 (m, 4 H), 2.39 (s, 3 H). **^{13}C NMR** (100 MHz, CHLOROFORM-*d*) δ = 159.6, 155.8, 151.1, 140.1, 140.0, 128.9, 128.6, 128.6, 128.5, 127.1, 126.9, 109.0, 103.7, 55.0, 46.2, 45.2 **HRMS** (ESI): calculated for $[C_{22}H_{24}N_3]^+$: m/z = 330.1970, found: m/z = 330.1973;

Note: The temperature was detected and controlled intelligently by the reactor *via* external surface sensor; the actual temperature was 160 ± 1 °C; inner pressure was 15-30 psi, which was detected by external surface sensor of the reactor; it needed about 5 minutes for microwave to heat the reaction mixture from room temperature to 160 °C. Afterwards the reaction mixture maintained at 160 °C for 30 minutes.
For more information of the microwave reactor, please see the CEM website: http://cem.com/discover-sp.html.

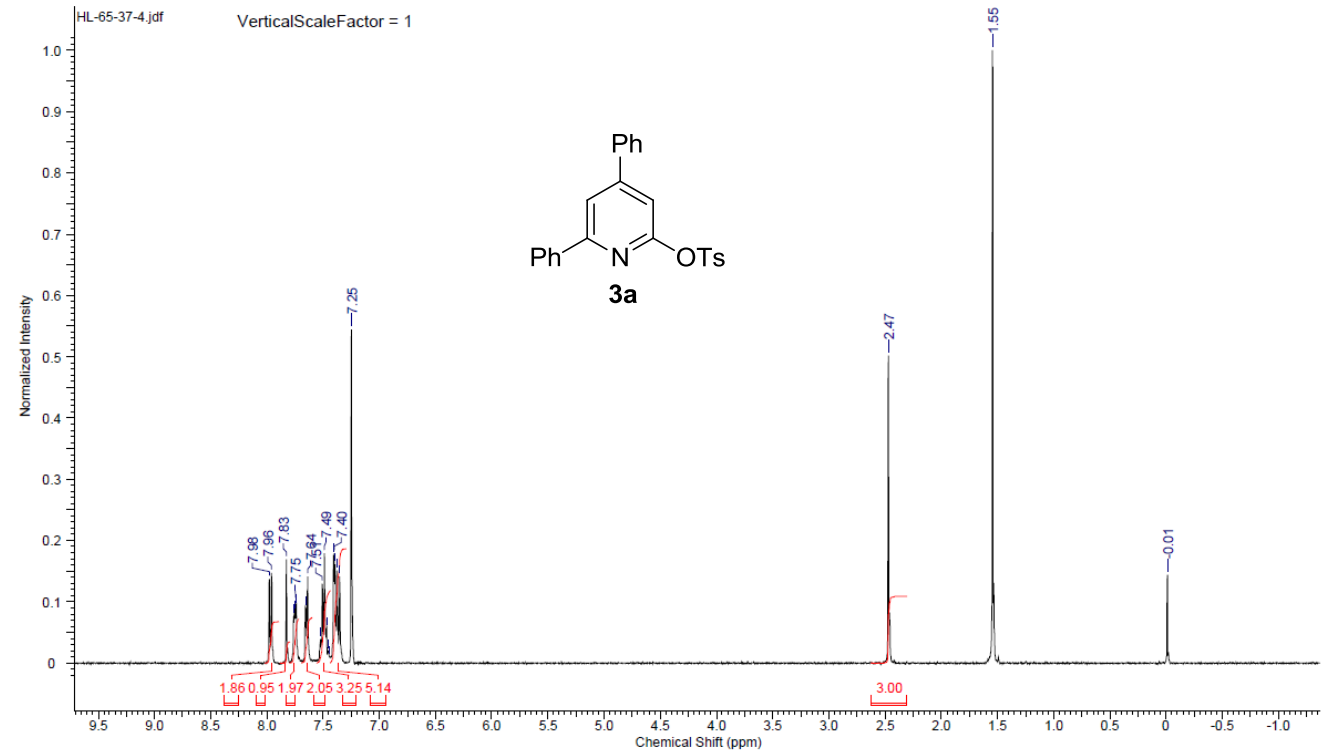
References:

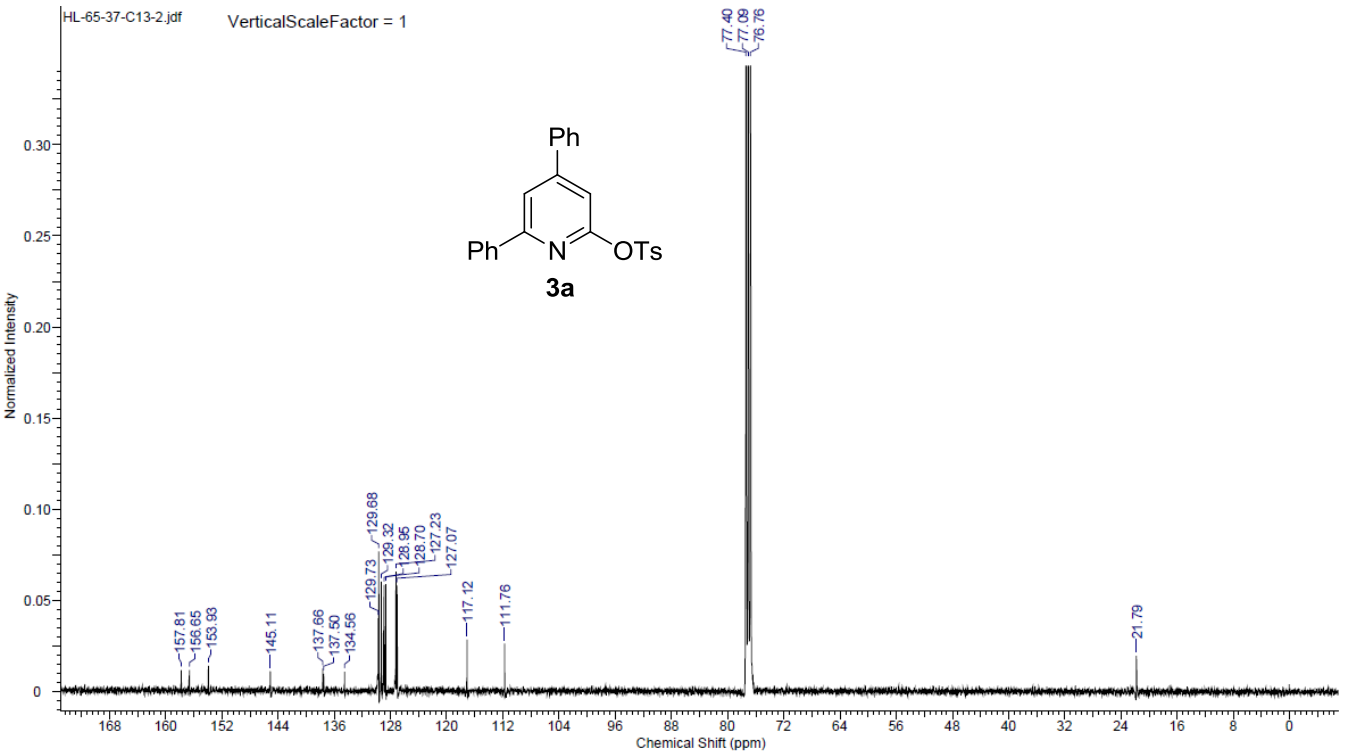
1) R. N. Ram, A. A. Khan, *Synthetic Commun.* **2001**, *31*, 841-846.

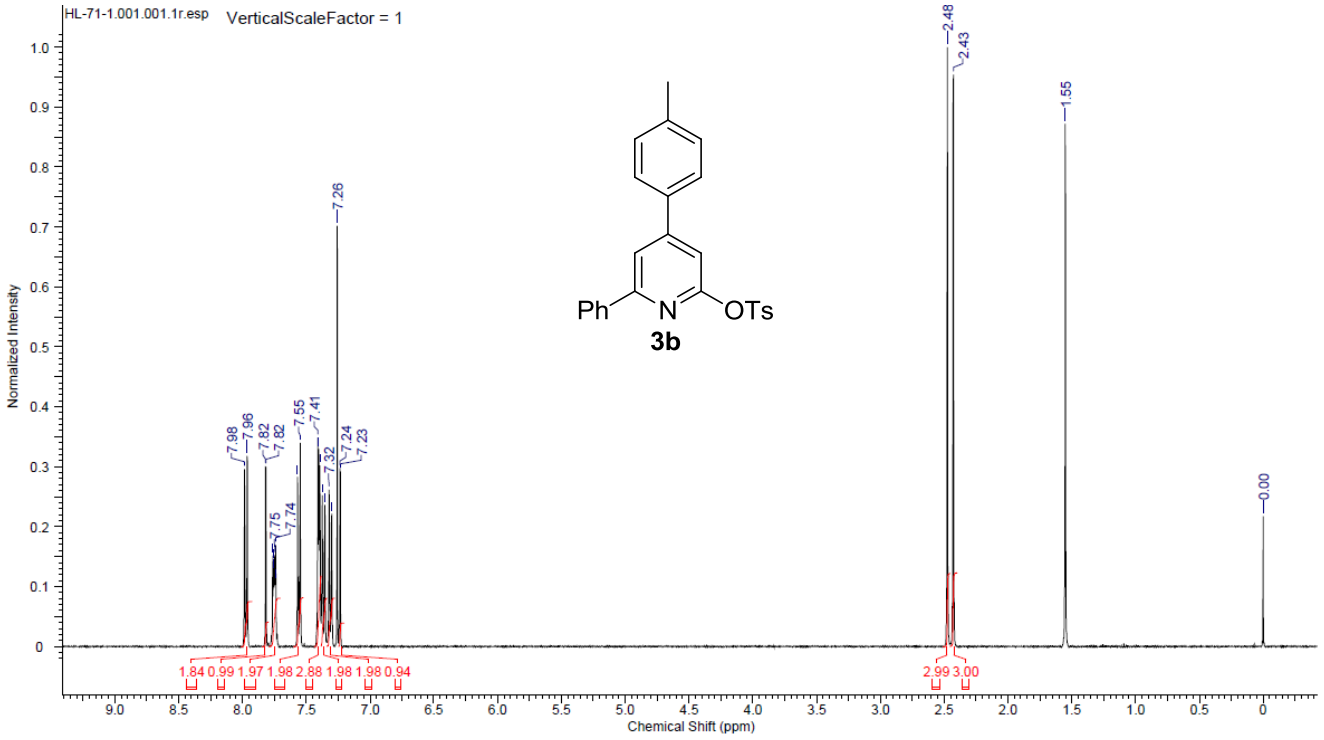
2) J. Correa-Basurto, L. Rodríguez-Páez, L, E. S. Aguiar-Moreno, P. López-Sánchez, L. M. Espinoza-Fonseca, C. Wong, J. Trujillo-Ferrara, *Medicinal Chemistry Research* **2008**, *18*, 20-30.

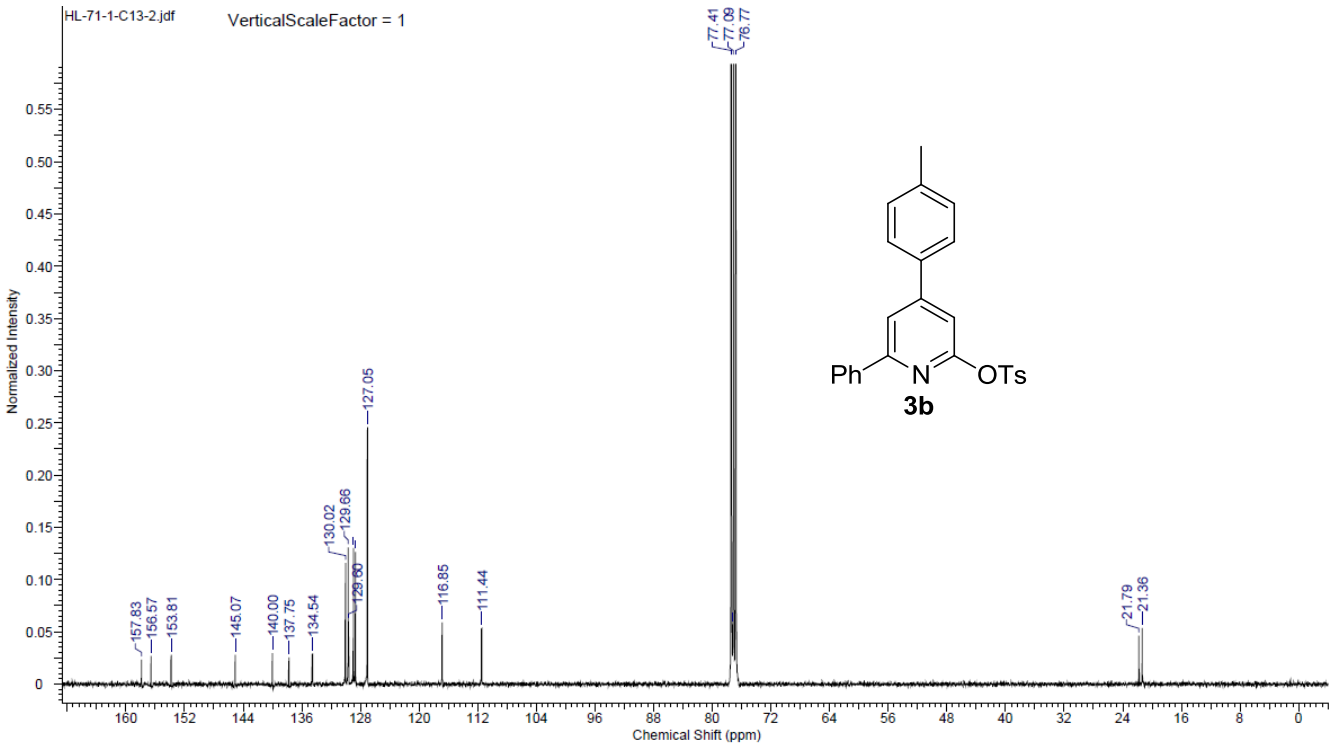
3) M. H. Paluchowska, A. J. Bojarski, R. Bugno, S. Charakchieva-Minol, A. Wesolowska, *Arch. Pharm.* **2003**, *336*, 104-110.

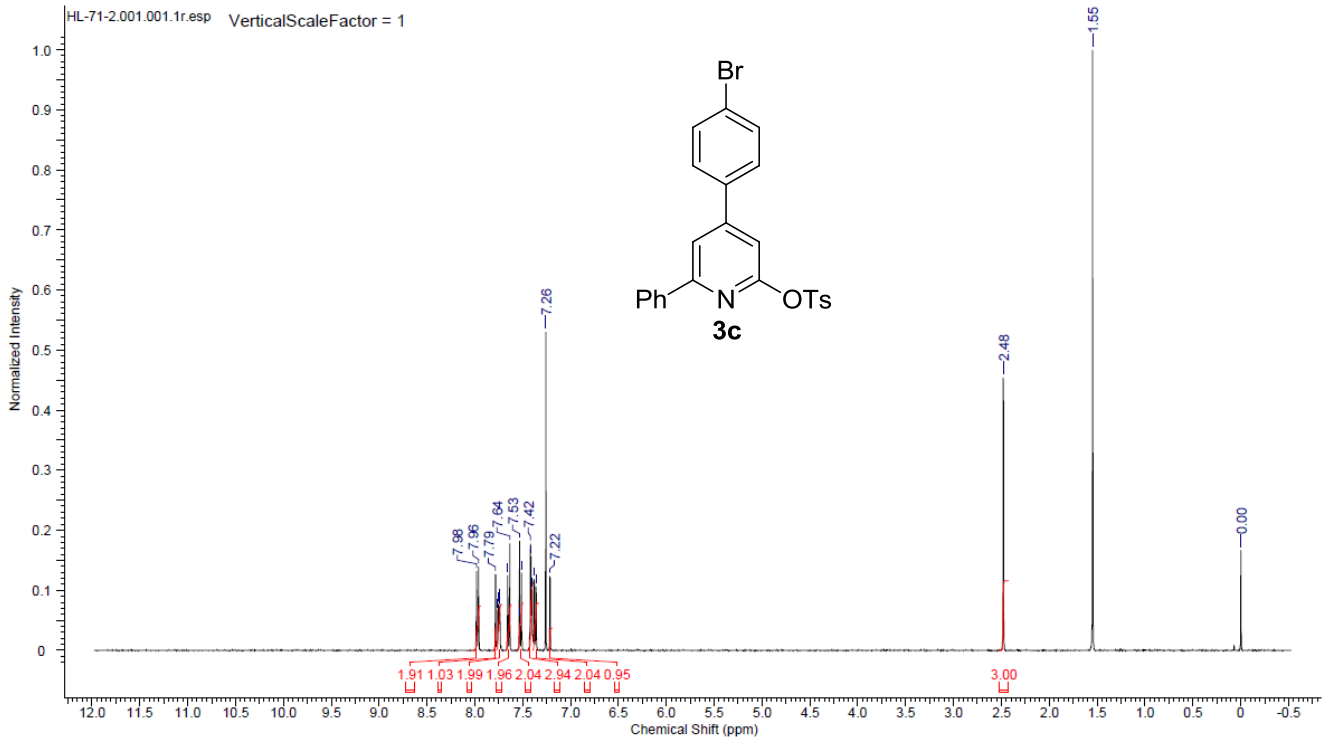
IV NMR Spectra







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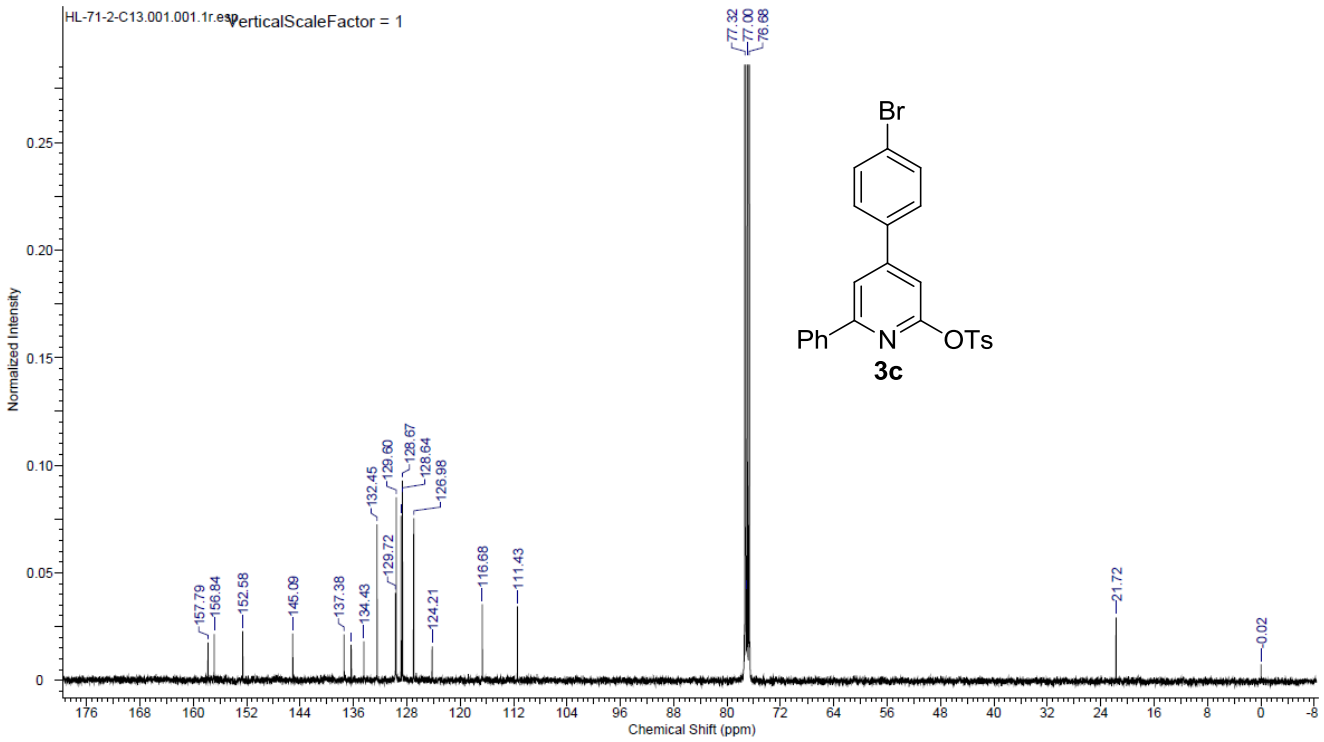
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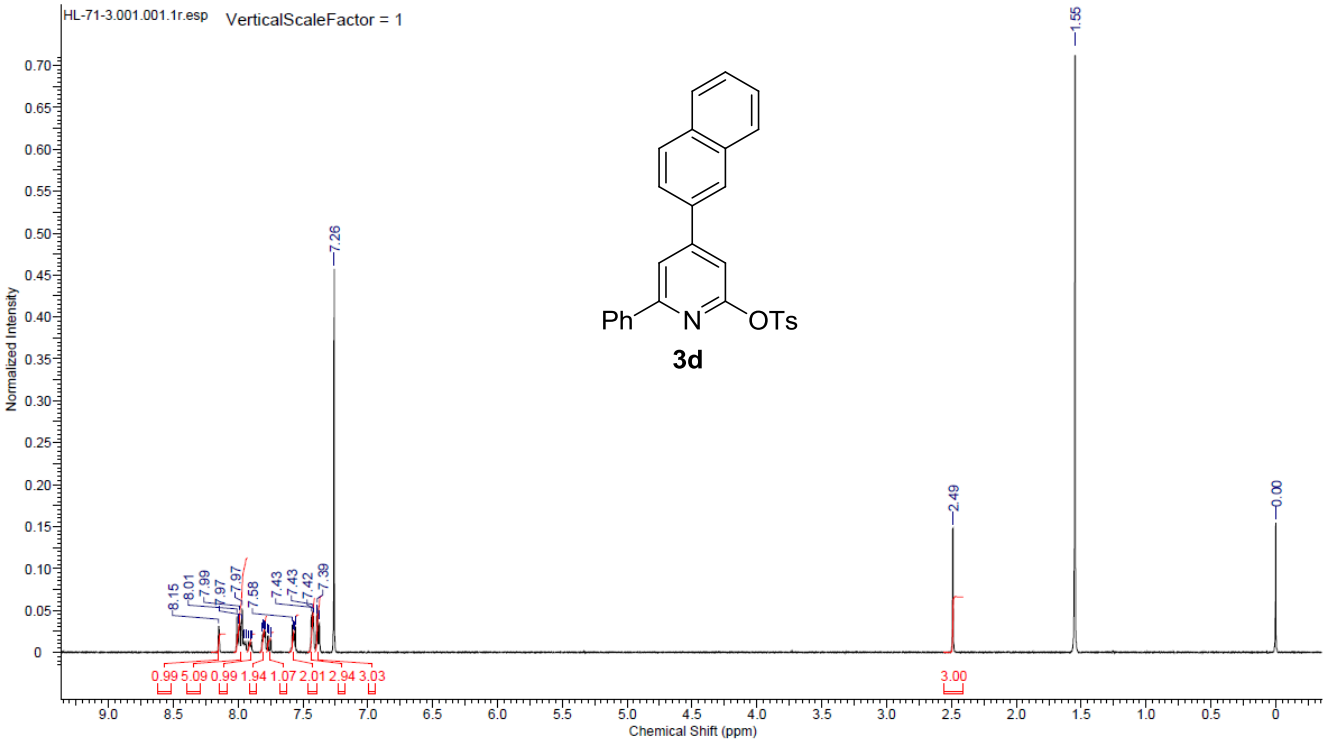

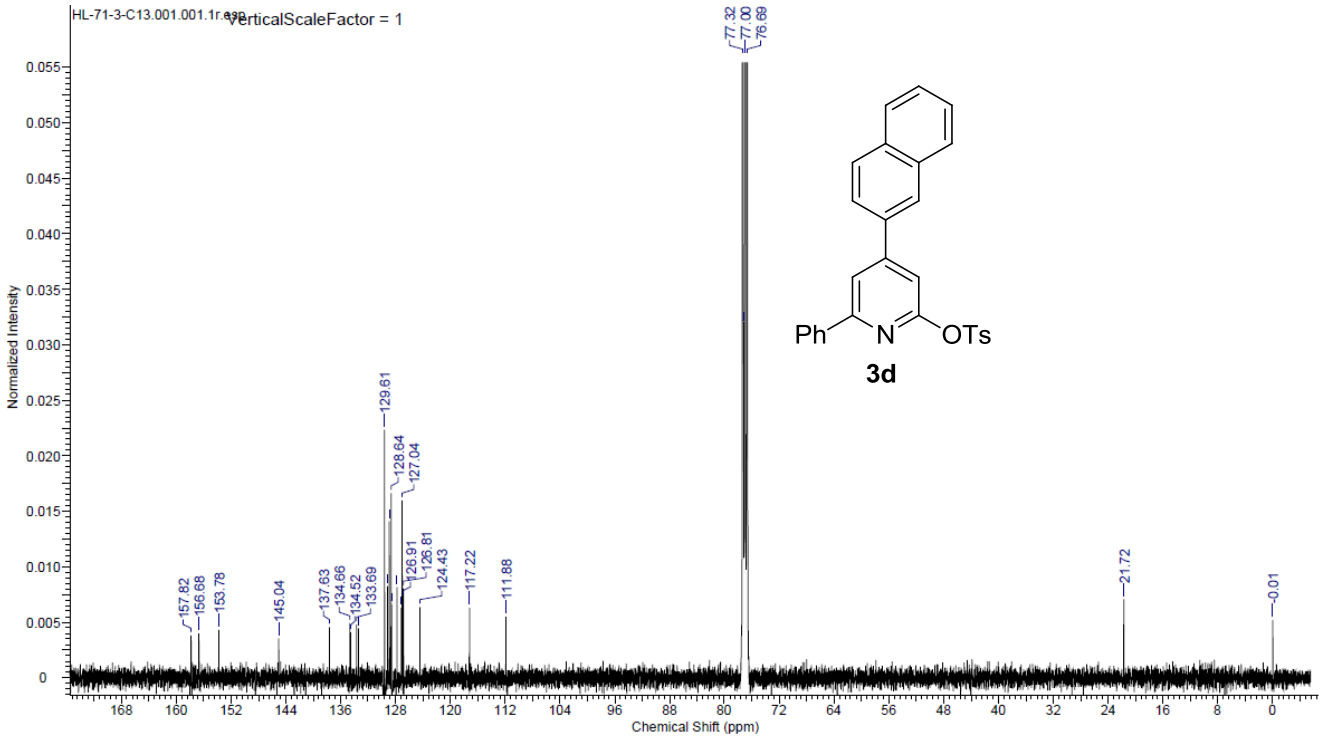

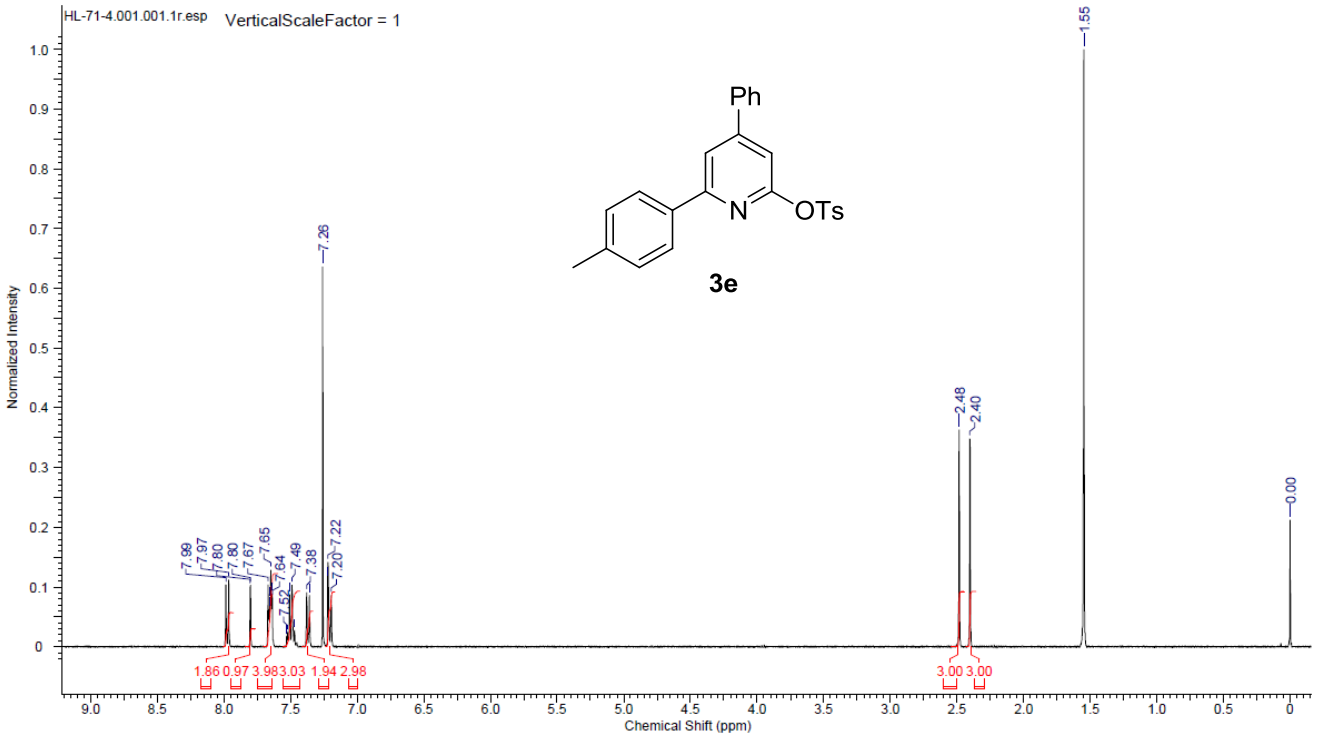

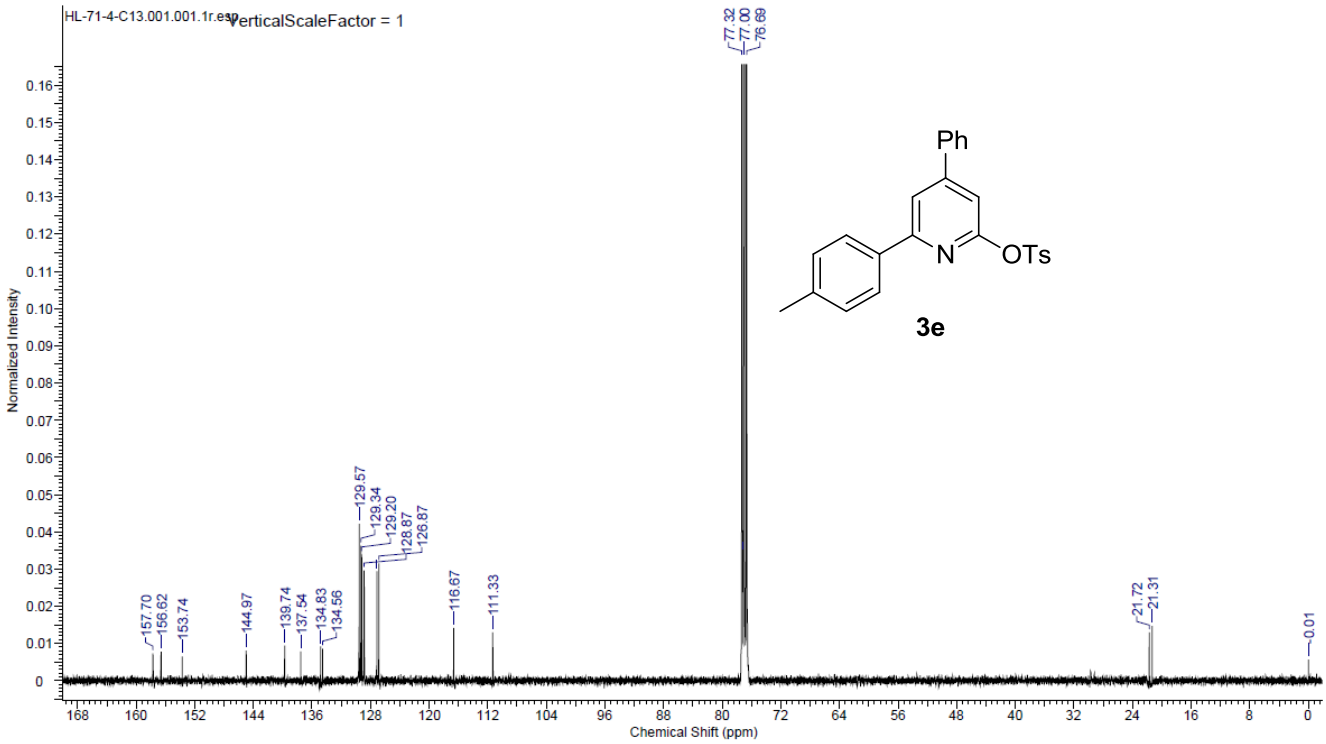

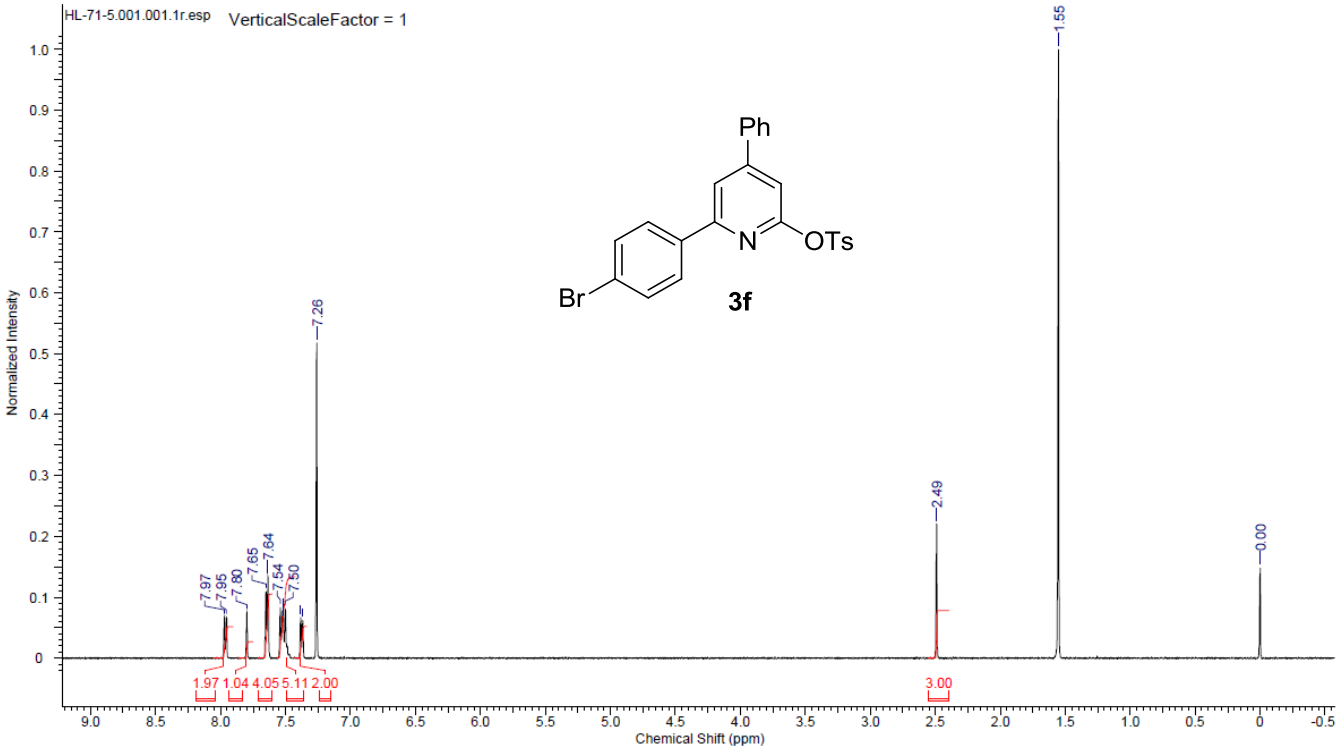

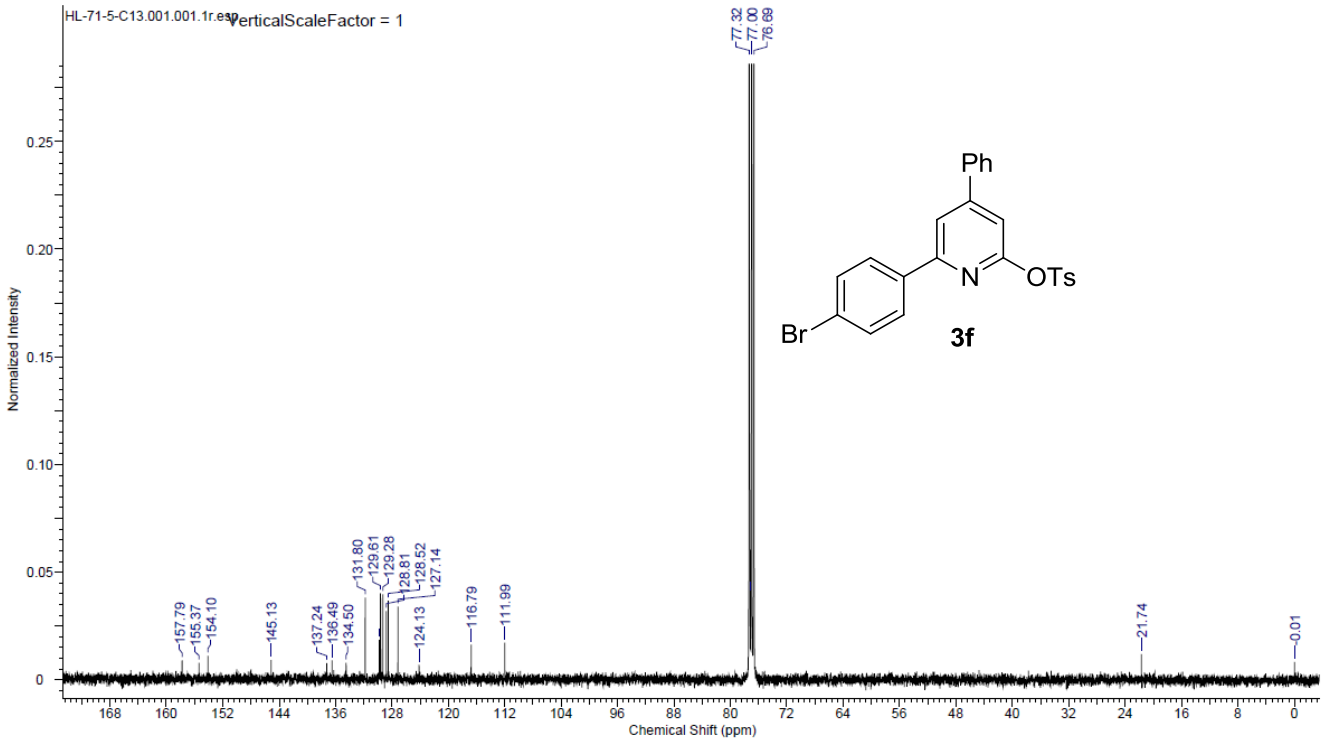

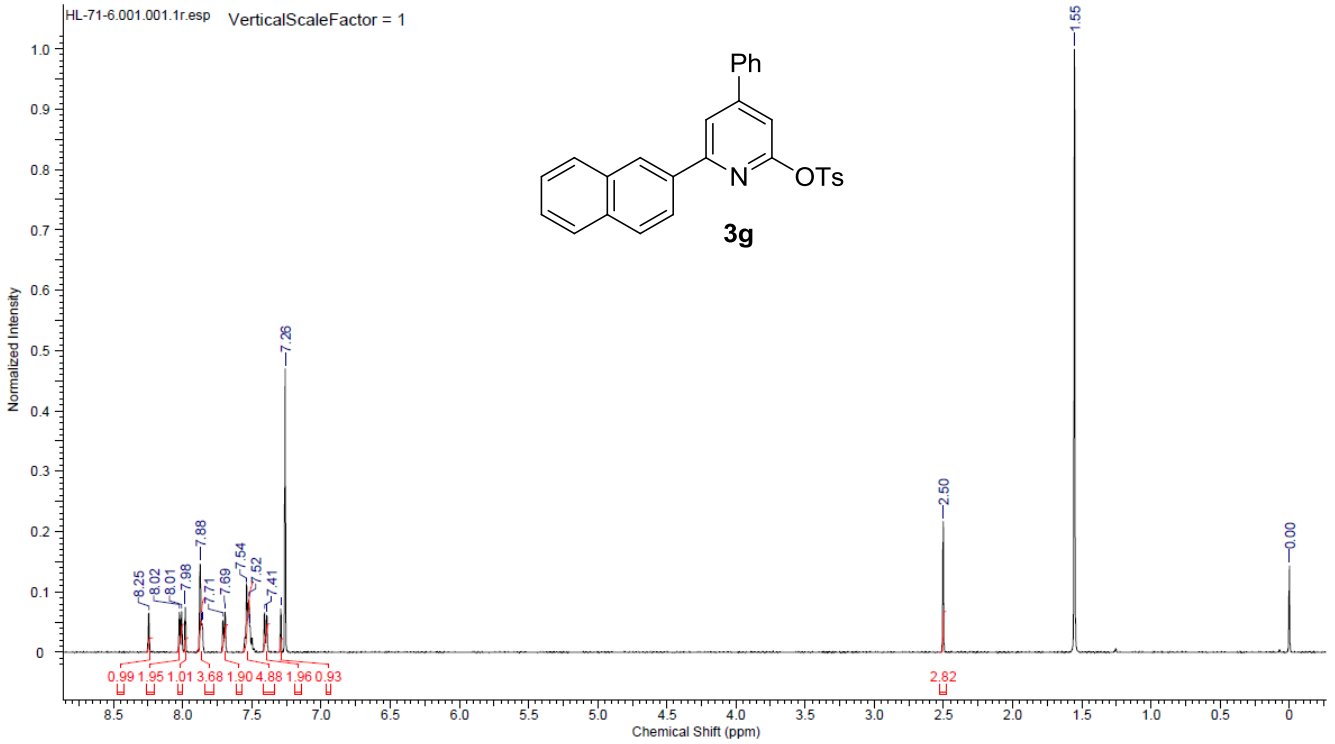

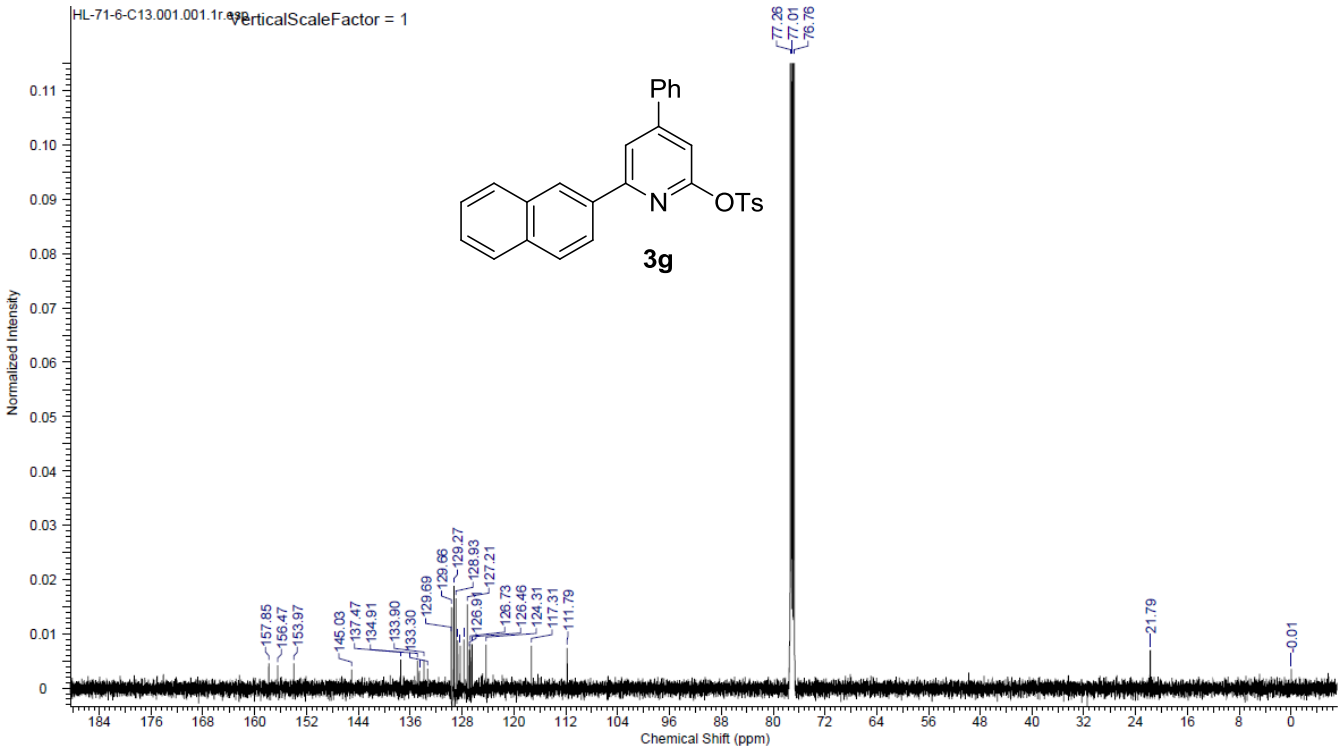

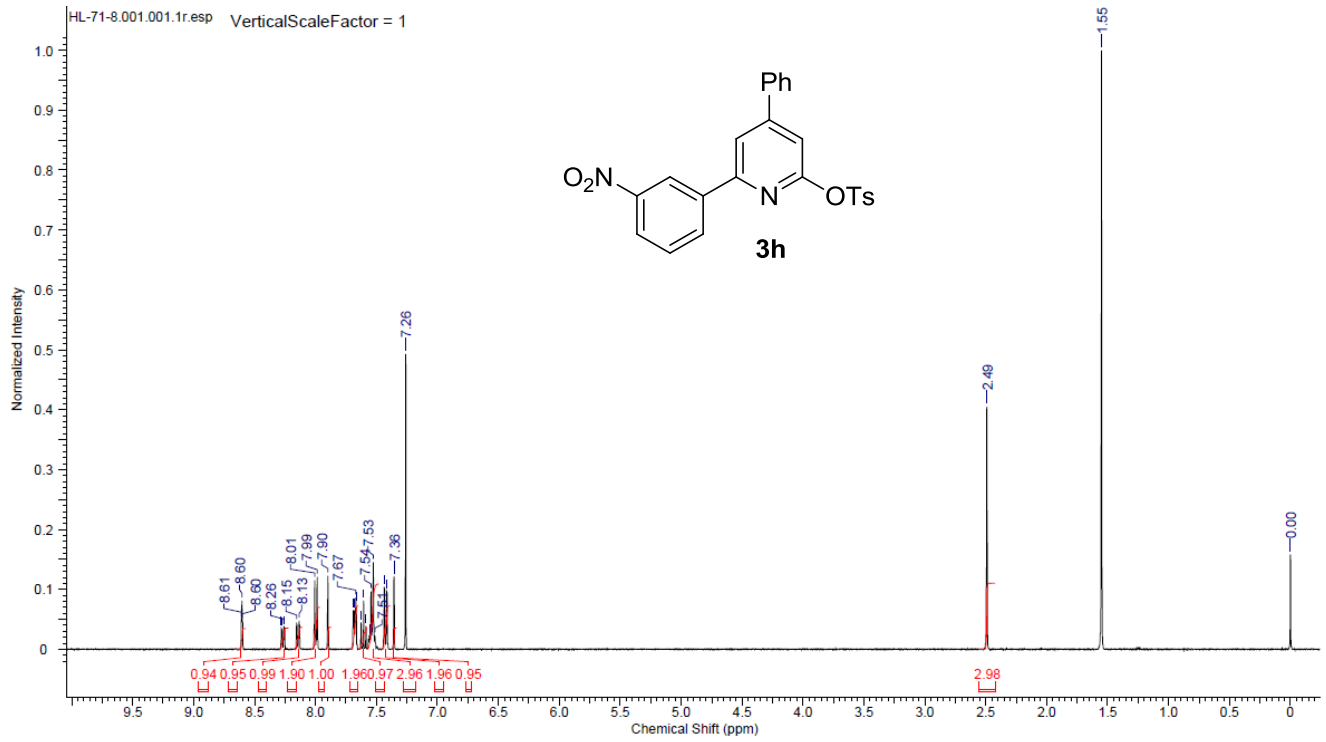
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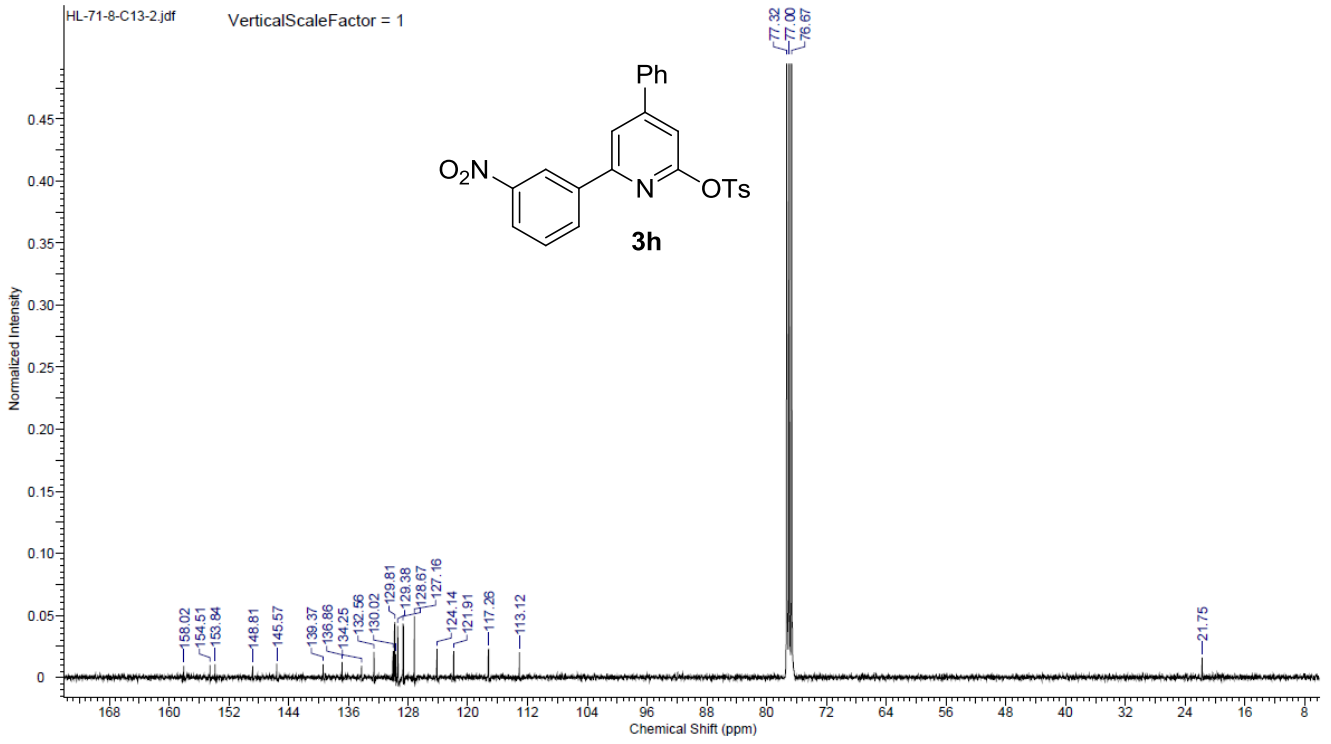
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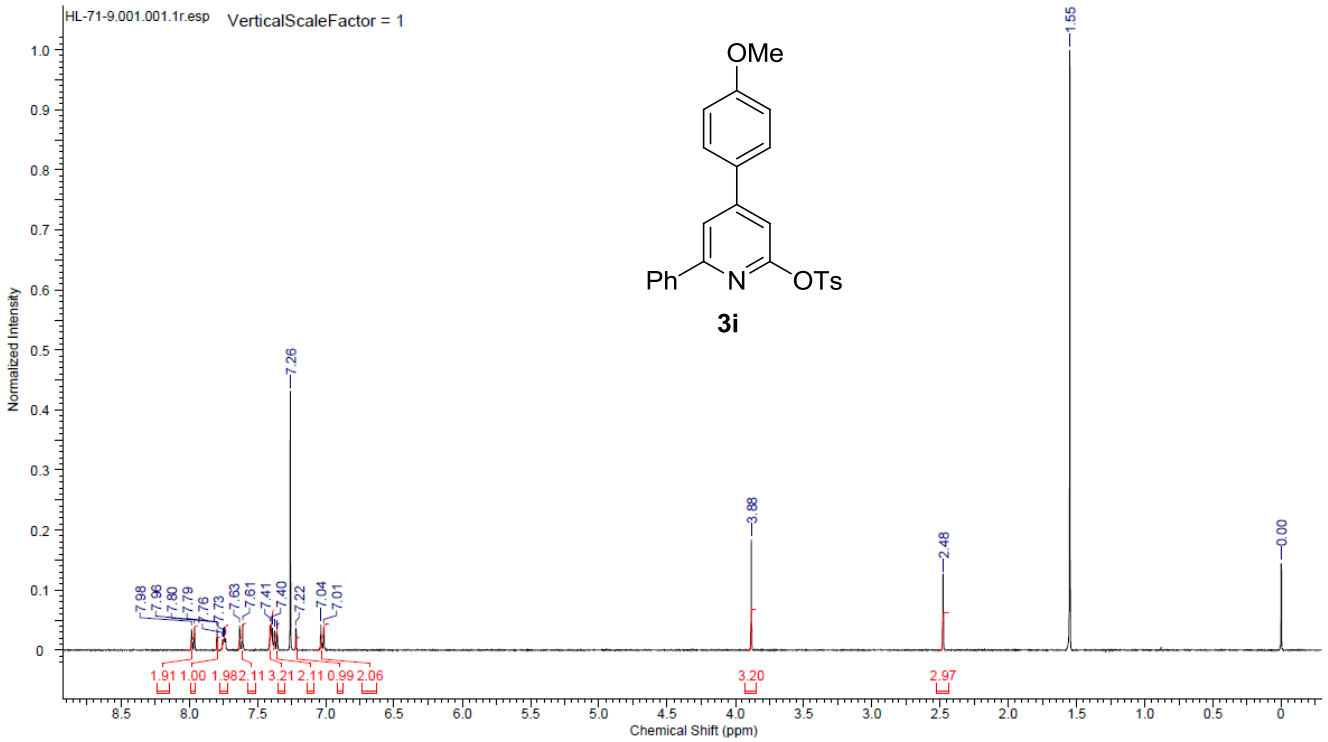
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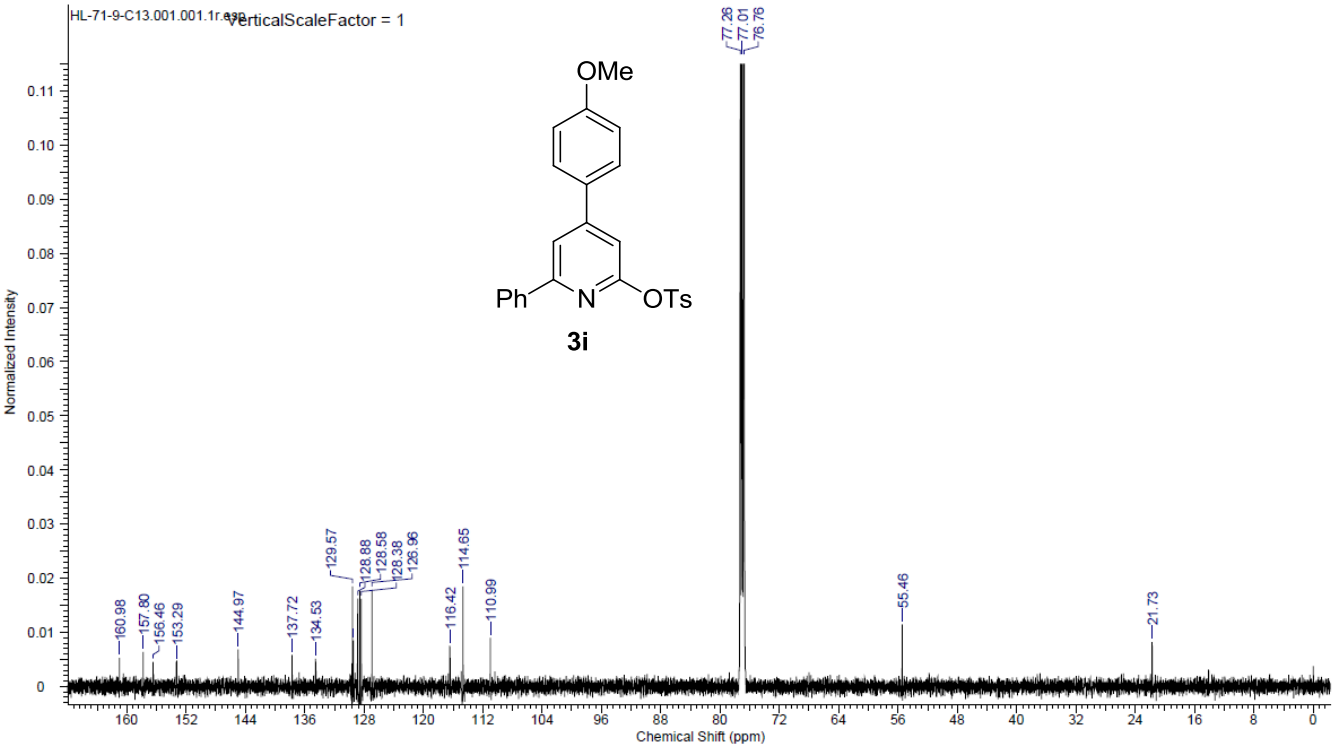
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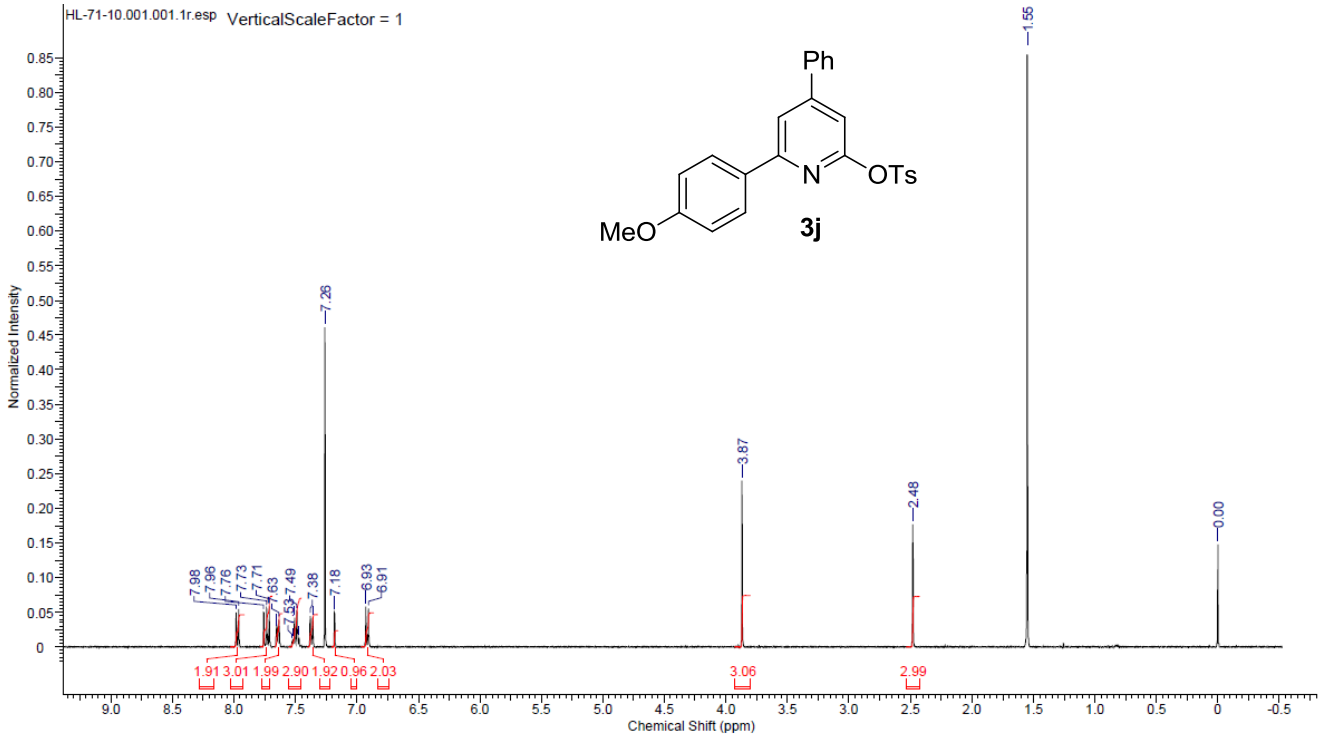

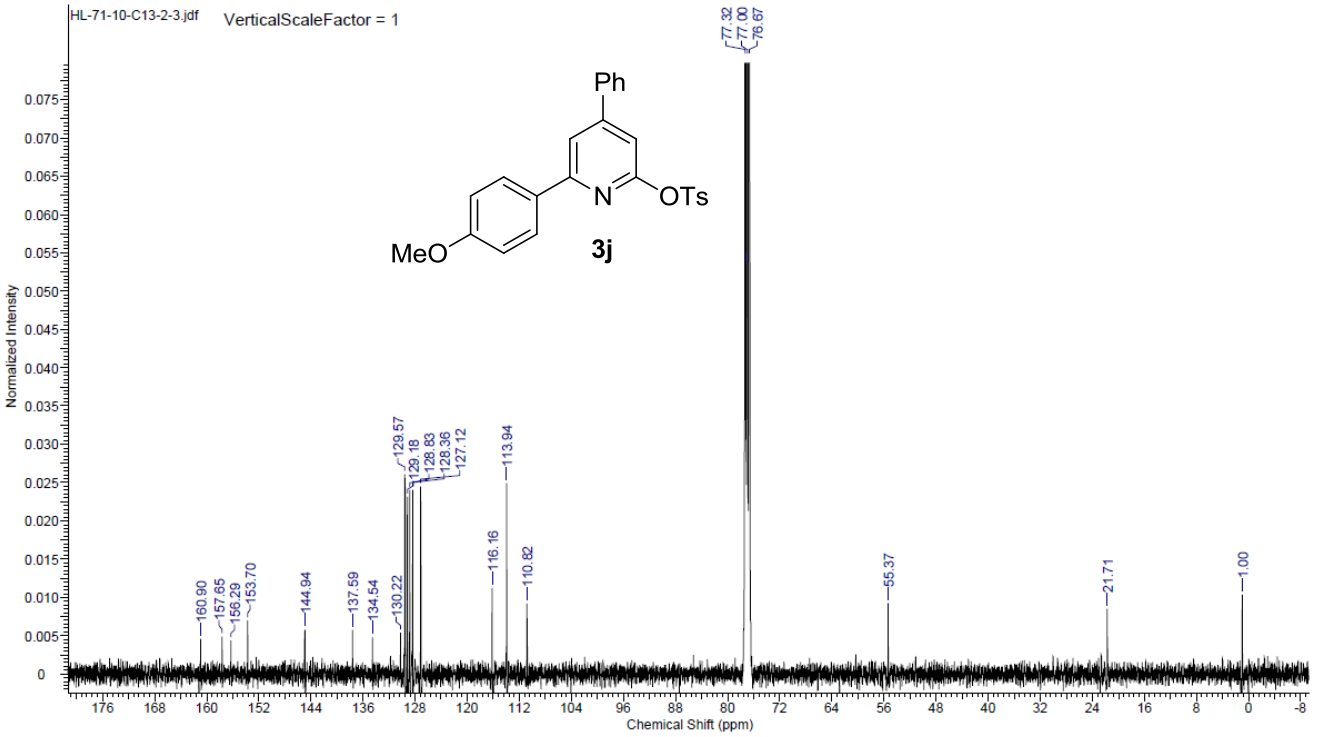

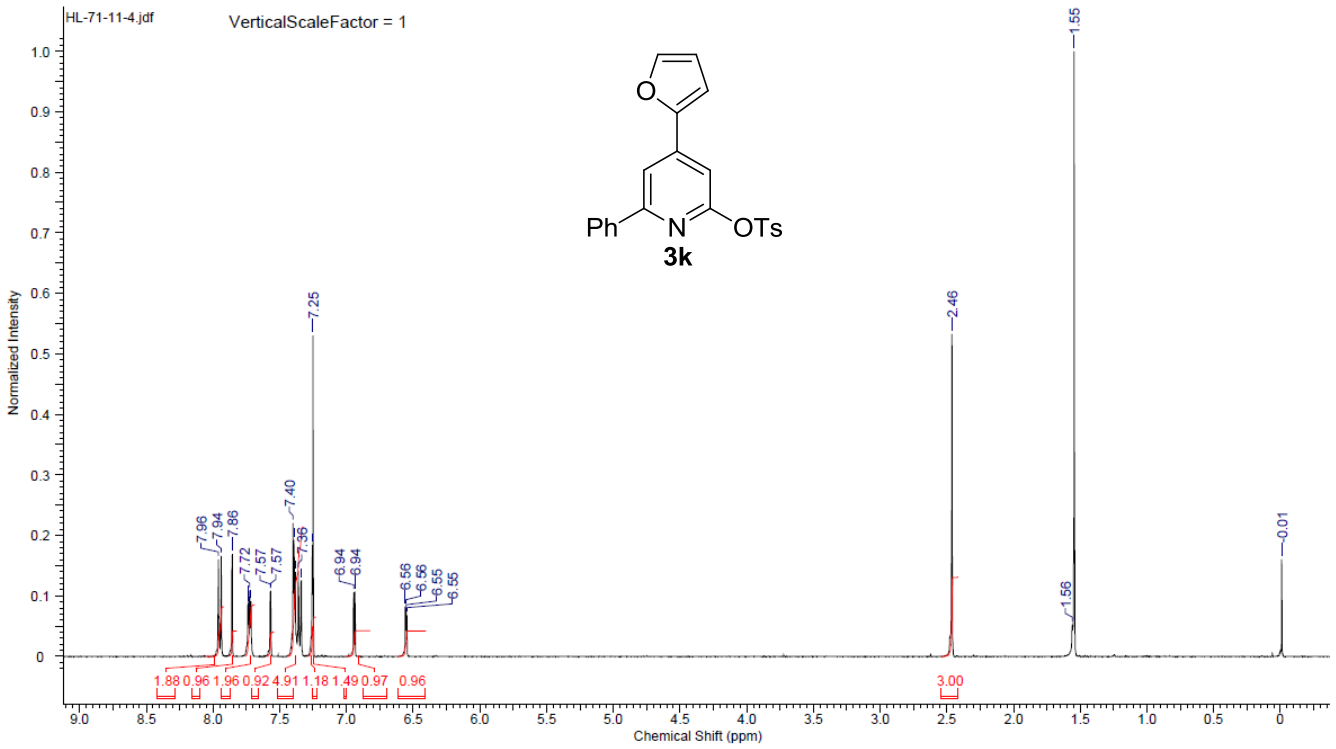
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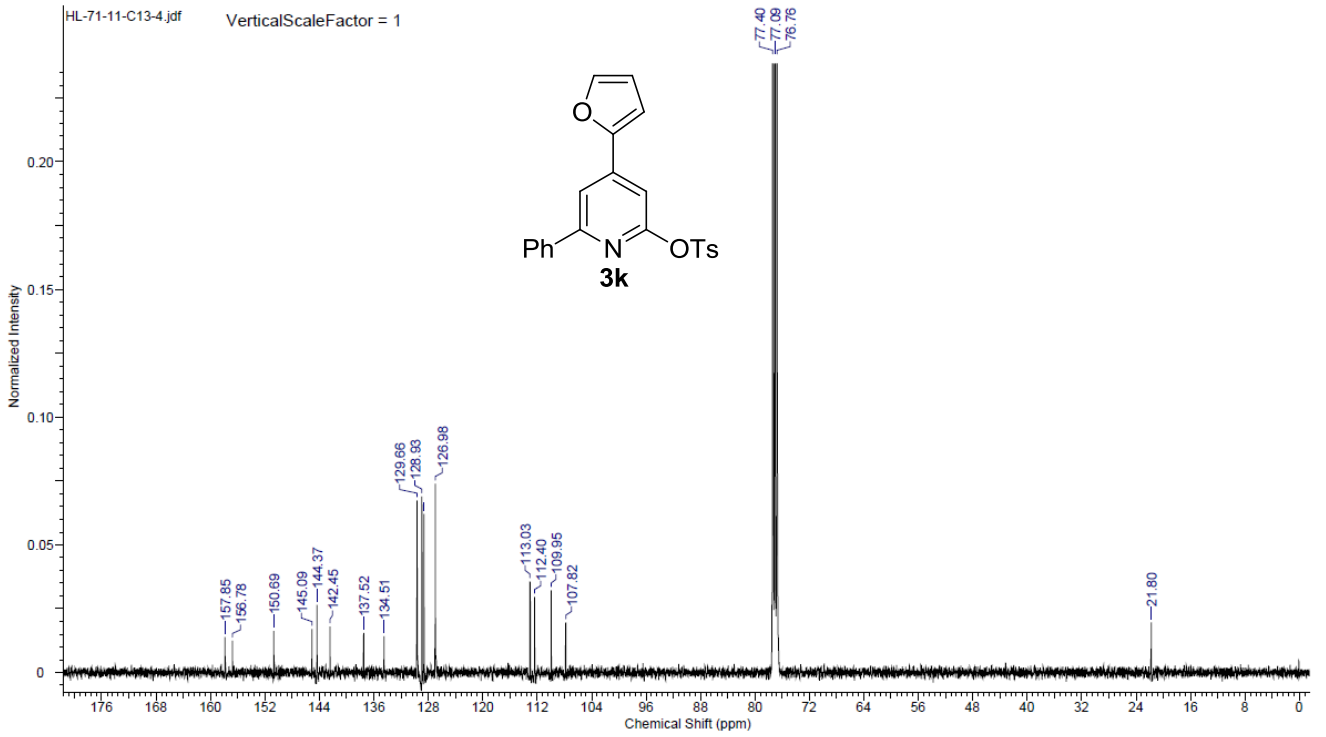
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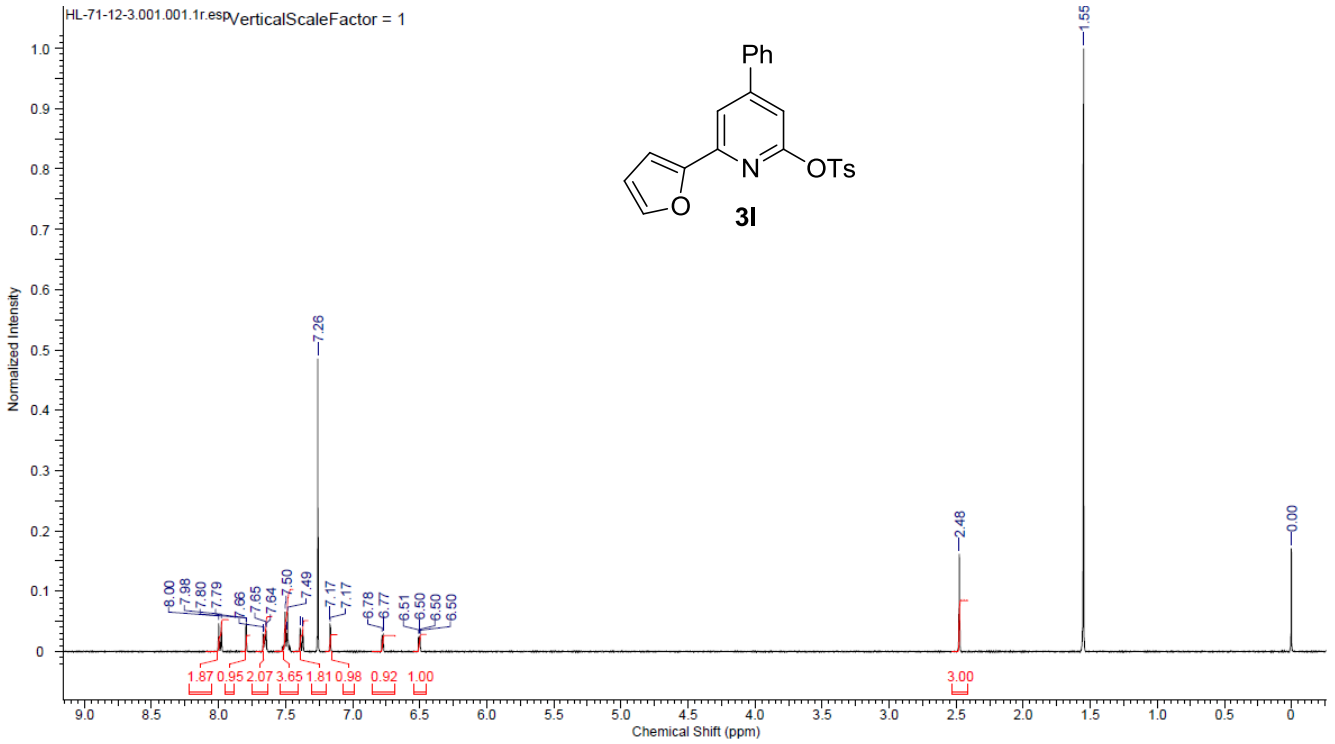
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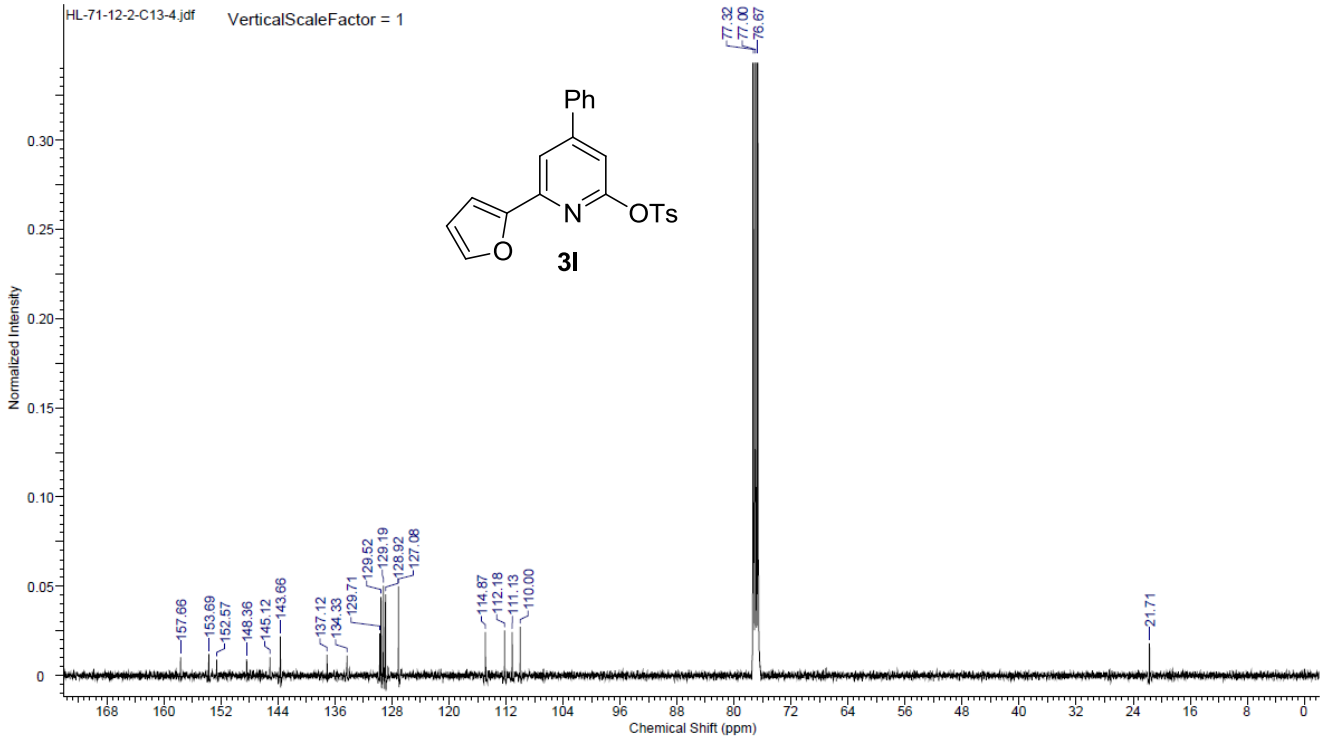
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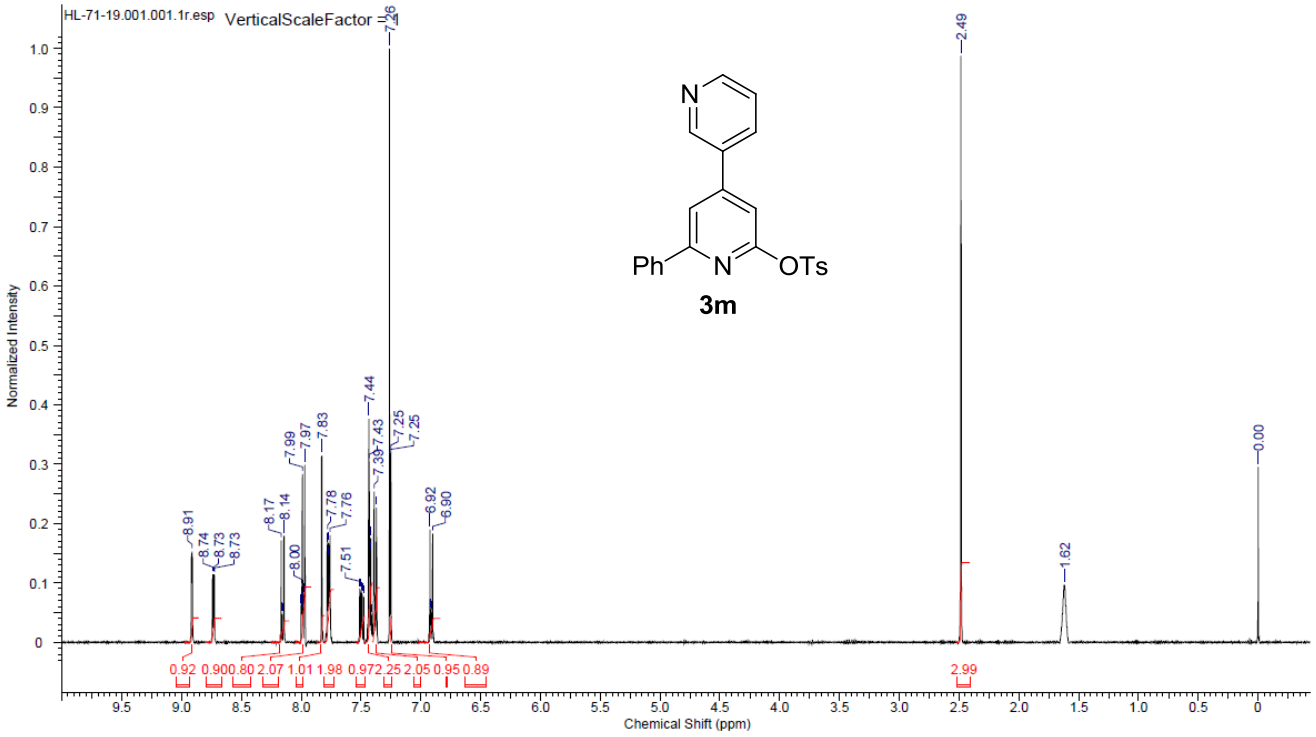

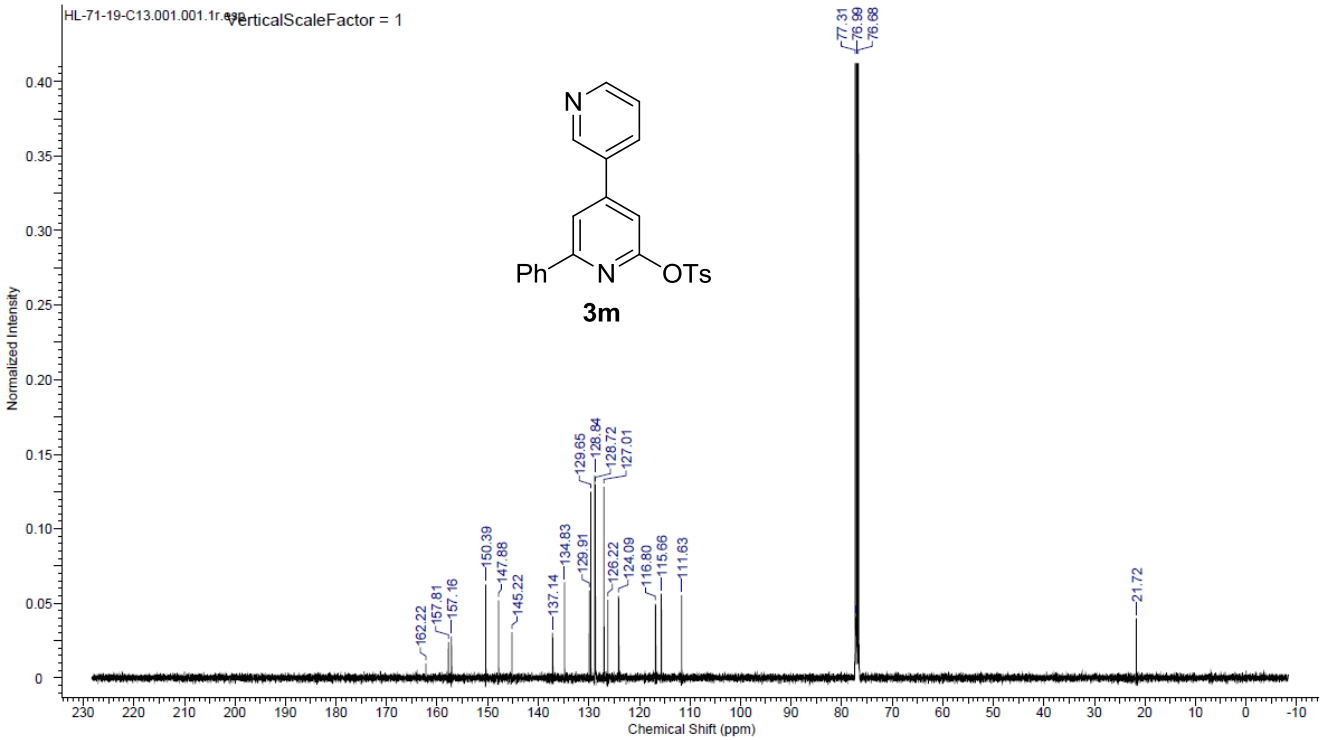

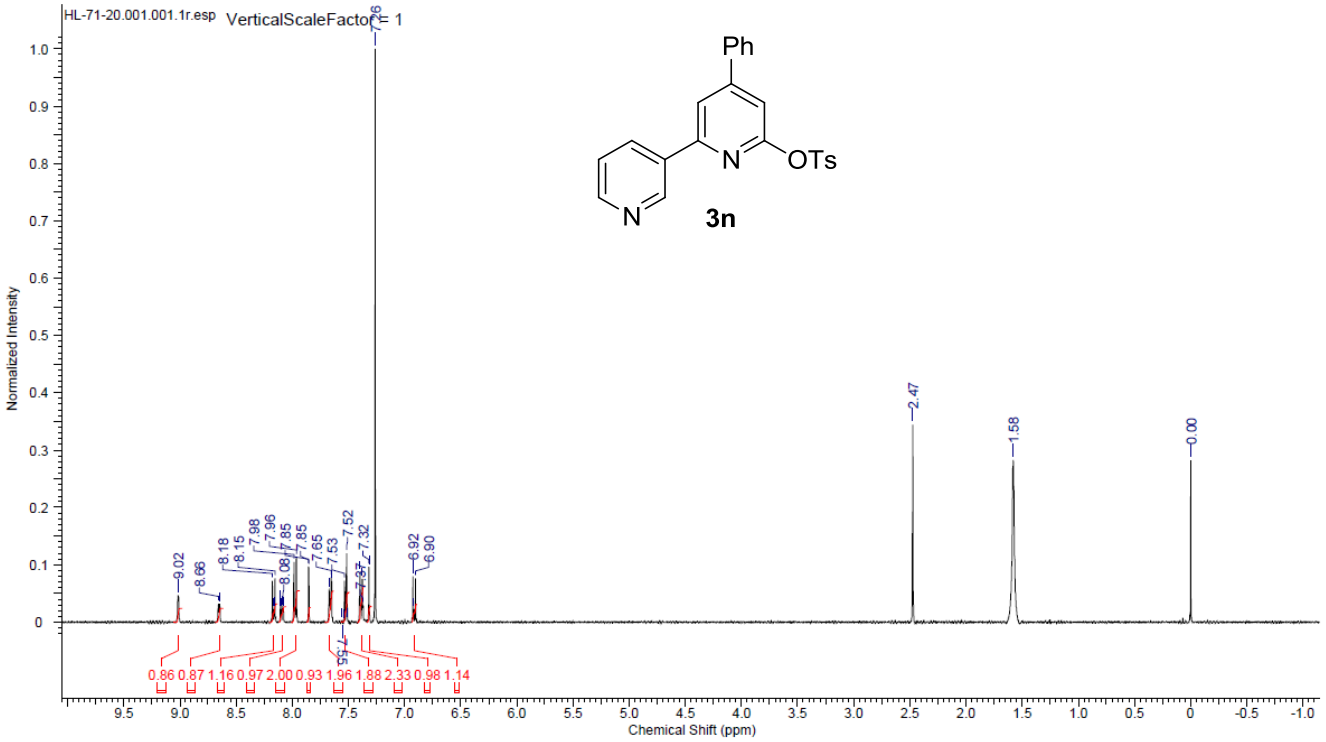
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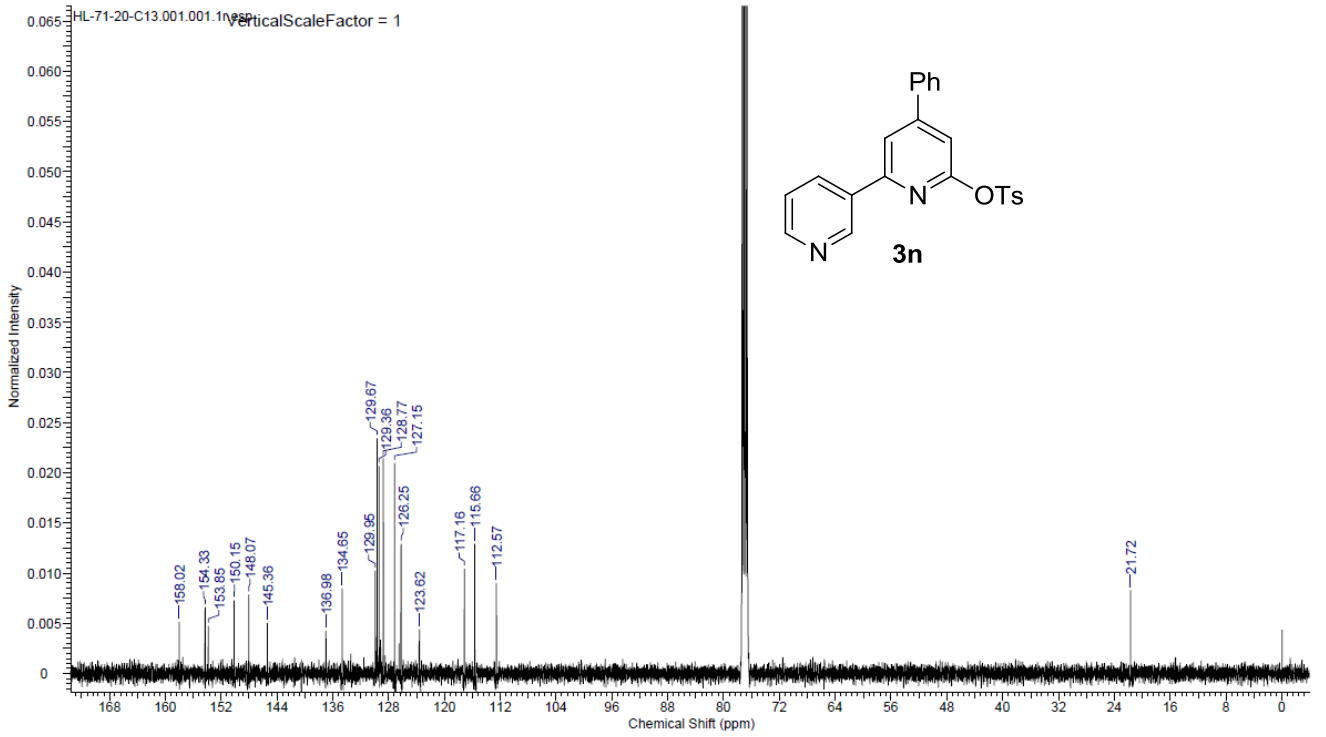
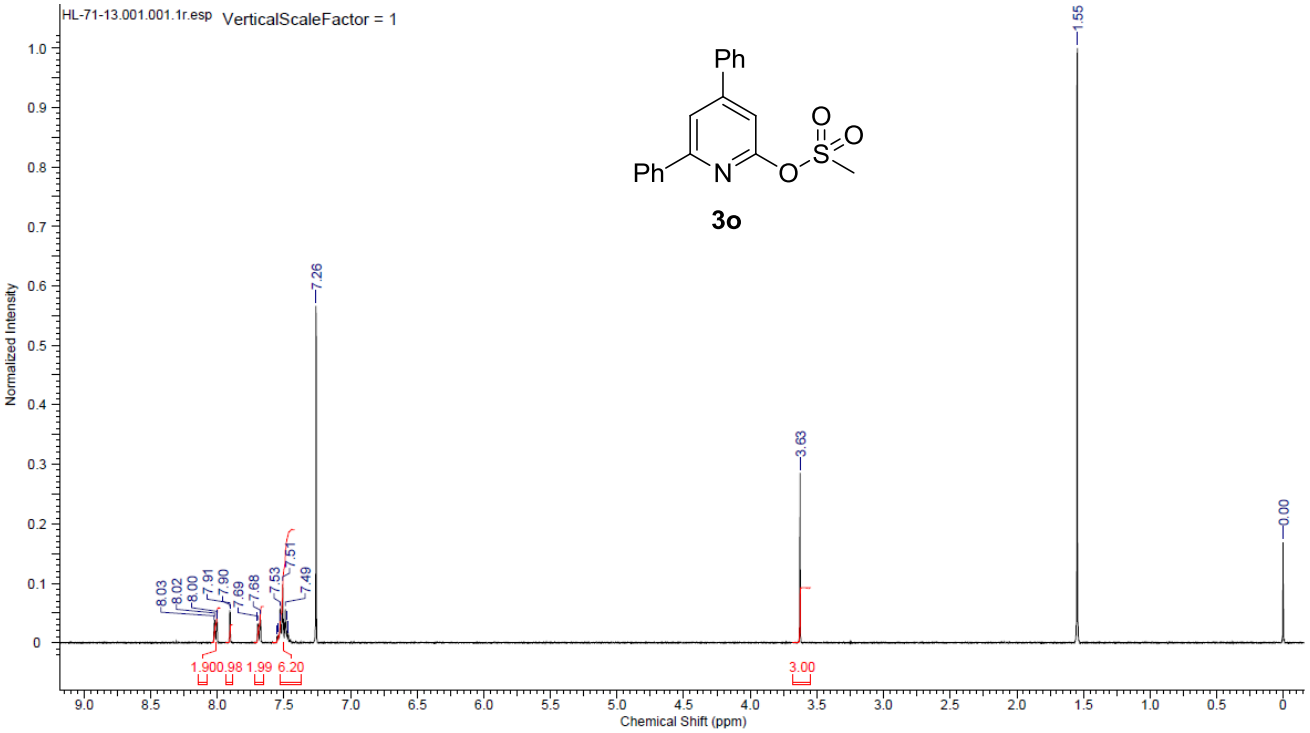
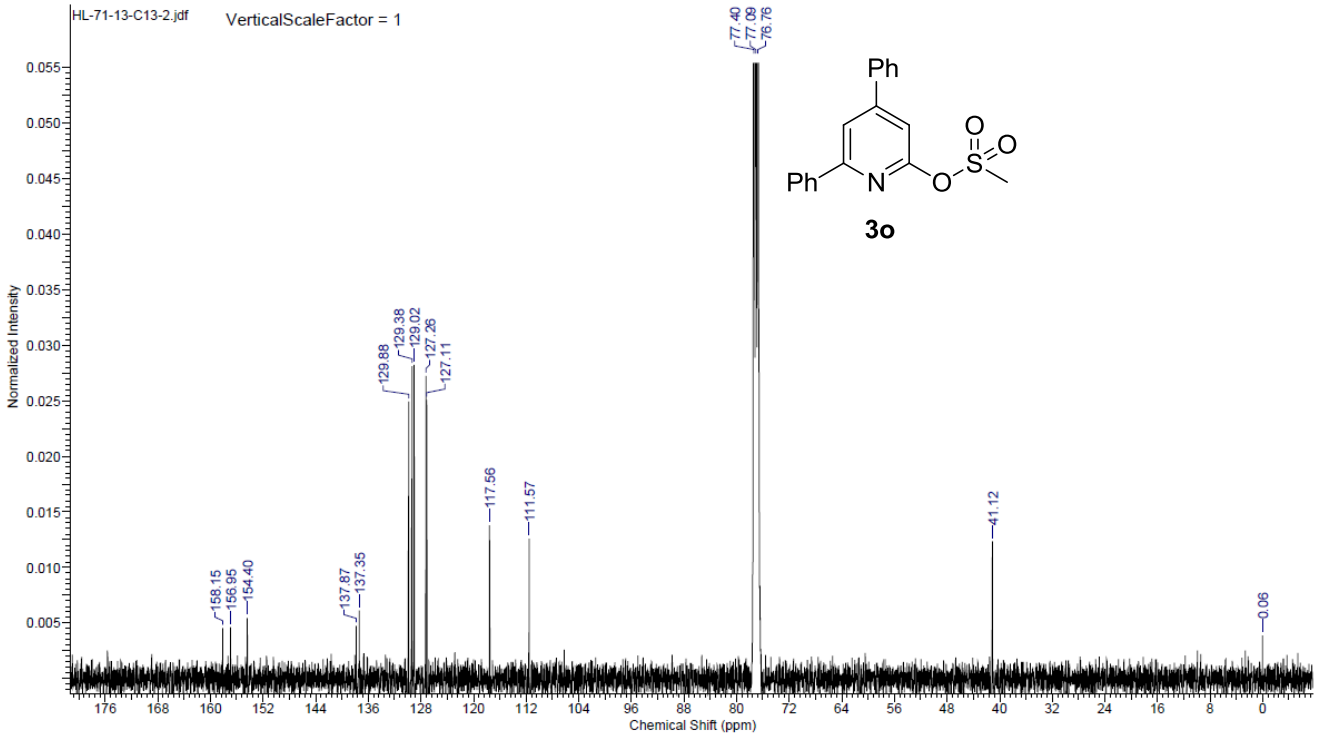
0.00
0.86 0.87 1.16 0.97 2.00 0.93 1.96 1.88 2.33 0.98 1.14
Ph
N
OTs
N
3n

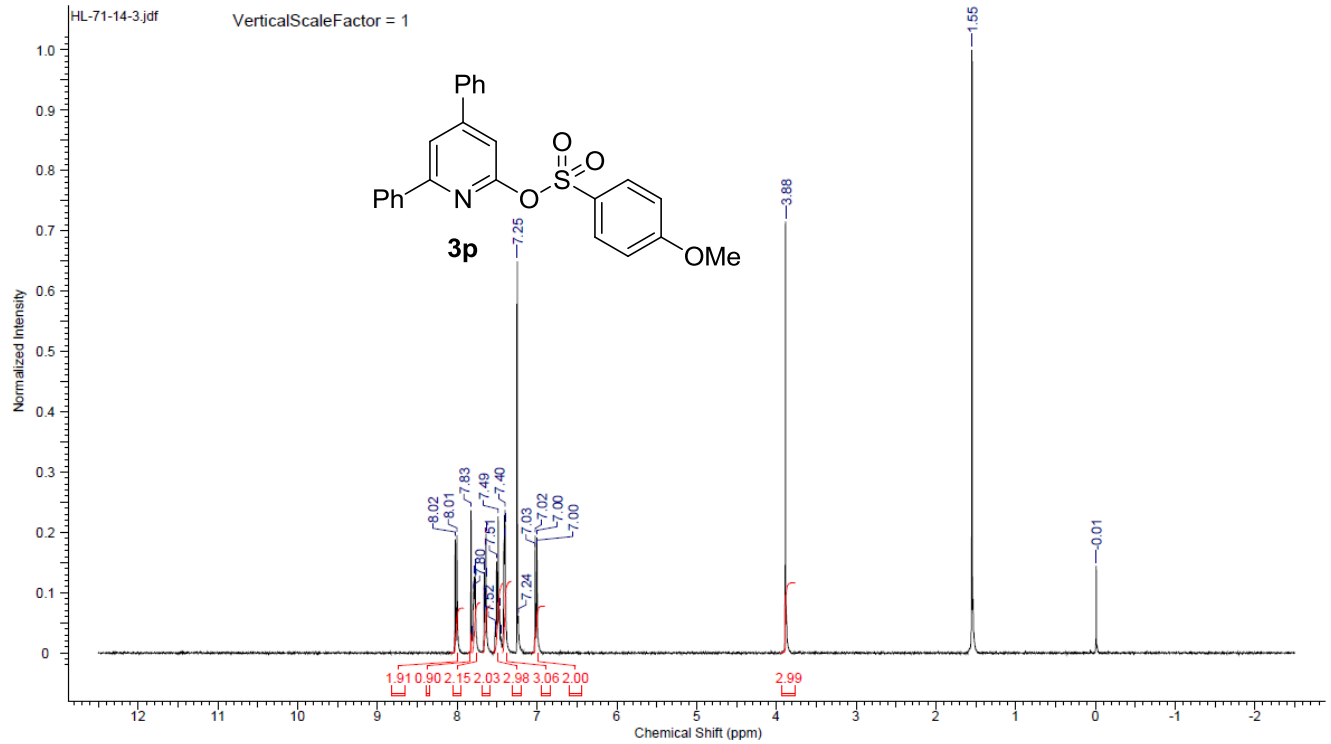

HL-71-20-C13.001.001.1r.esp
VerticalScaleFactor = 1
Normalized Intensity
Chemical Shift (ppm)
158.02
154.33
153.85
150.15
148.07
145.36
136.98
134.85
129.95
129.67
129.36
128.77
127.15
126.25
123.62
117.16
115.66
112.57
21.72
Ph
N
OTs
N
3n

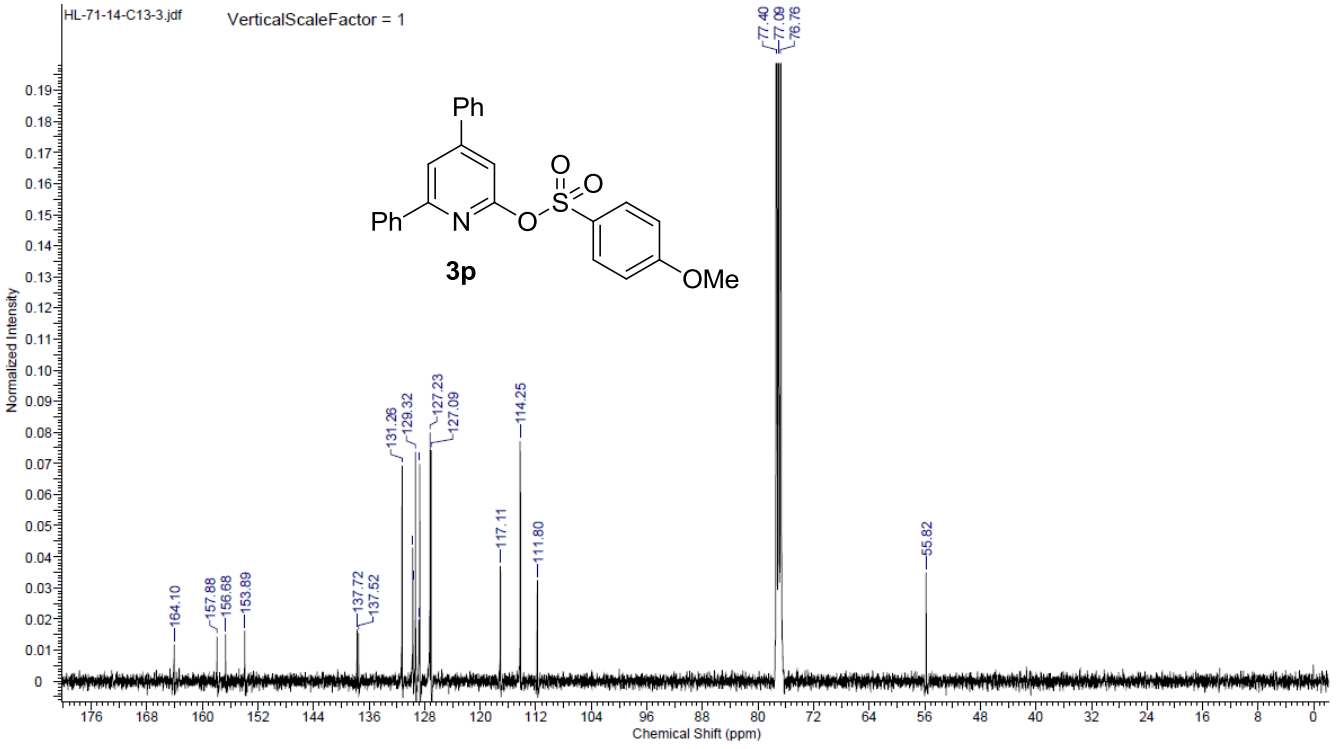


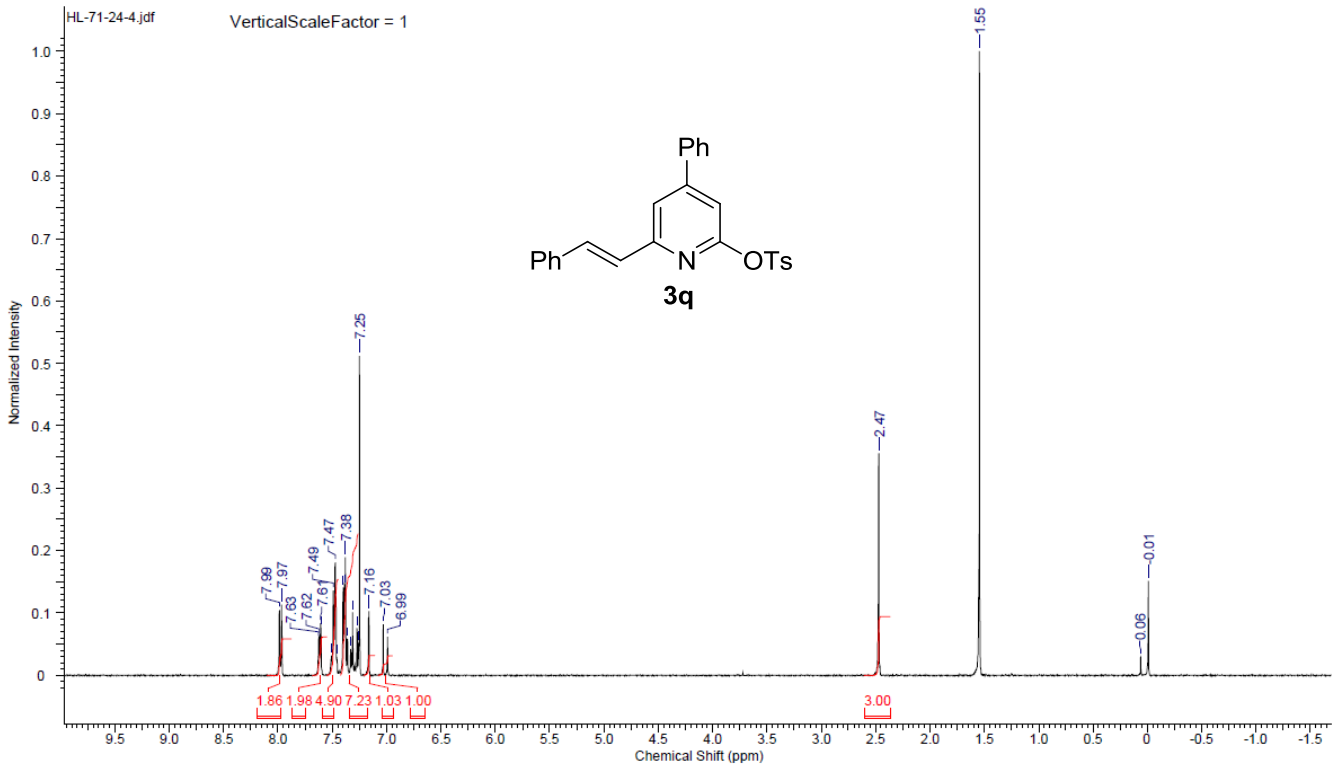
3o

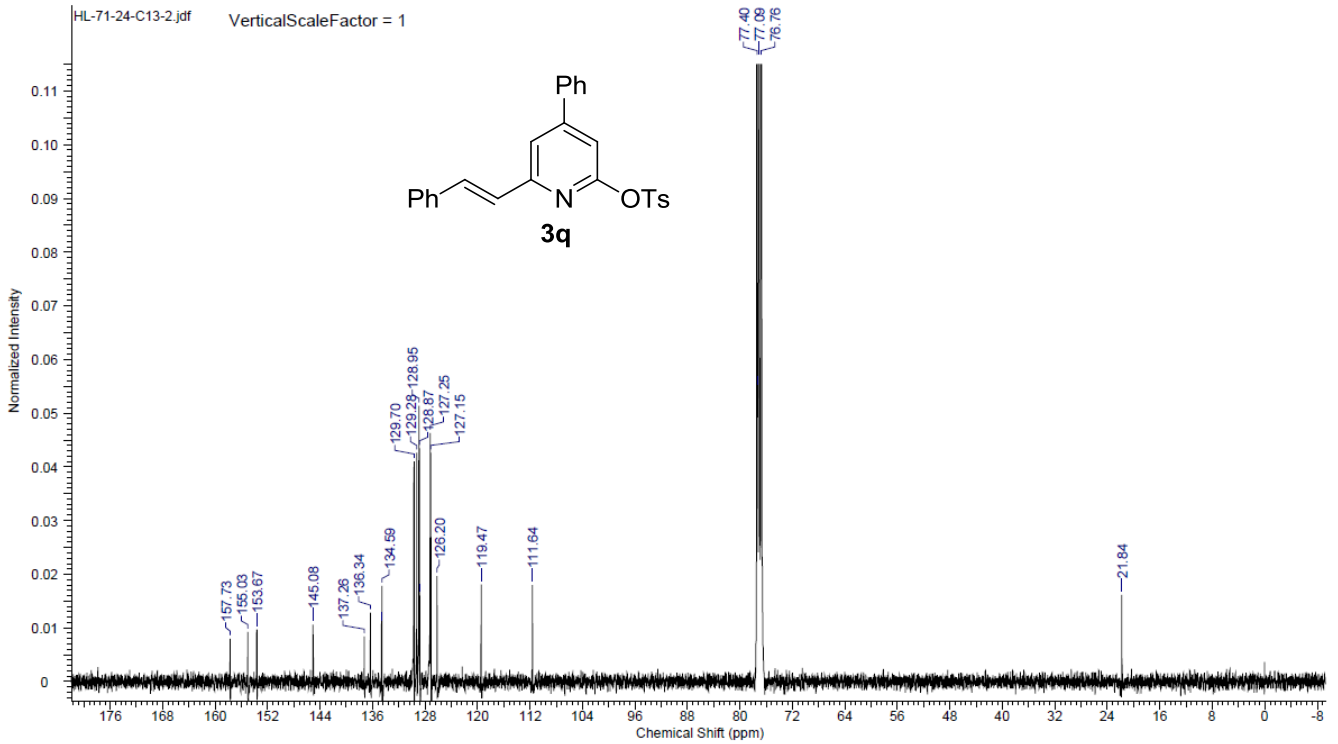


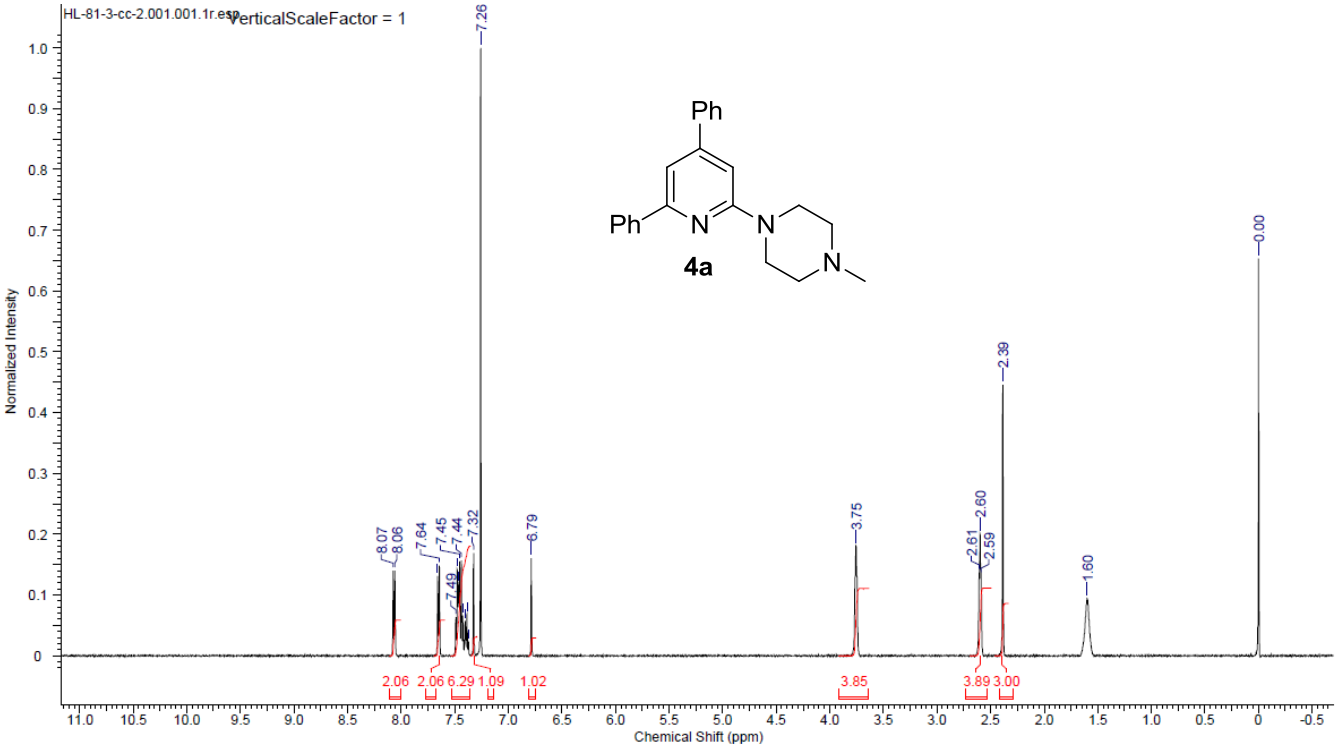
3o

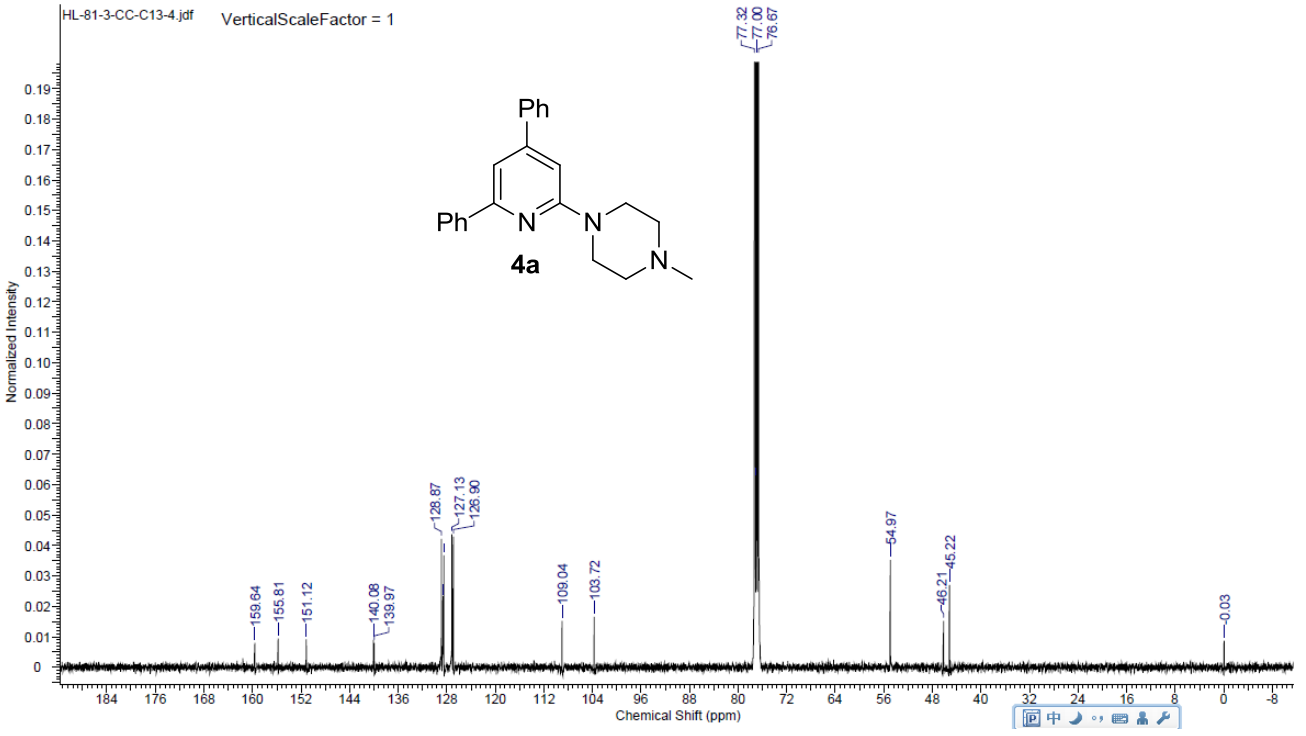





HL-71-24-4.jdf
VerticalScaleFactor = 1
Ph
Ph
N
OTs
3q
Normalized Intensity
Chemical Shift (ppm)
7.99
7.97
7.63
7.62
7.61
7.49
7.47
7.38
7.25
7.16
7.03
6.99
2.47
1.55
0.06
0.01
1.86 1.98 4.90 7.23 1.03 1.00
3.00


HL-71-24-C13-2.jdf
VerticalScaleFactor = 1
Ph
Ph
N
OTs
3q
Normalized Intensity
Chemical Shift (ppm)
77.40
77.08
76.76
129.70
129.28
128.95
128.87
127.25
127.15
126.20
119.47
111.64
157.73
155.03
153.67
145.08
137.26
136.34
134.59
21.84


HL-81-3-cc-2.001.001.1r.esp
VerticalScaleFactor = 1
Ph
Ph
N
N
N
4a
Normalized Intensity
Chemical Shift (ppm)
7.26
8.07
8.06
7.64
7.45
7.44
7.32
6.79
3.75
2.61
2.60
2.59
2.39
1.60
0.00
2.06
2.06
6.29
1.09
1.02
3.85
3.89
3.00


HL-81-3-CC-C13-4.jdf
VerticalScaleFactor = 1
Ph
Ph
N
N
N
4a
Normalized Intensity
Chemical Shift (ppm)
77.32
77.00
76.67
159.64
155.81
151.12
140.08
139.97
128.87
127.13
126.90
109.04
103.72
54.97
46.21
45.22
0.03