Supporting Information

One Pot Synthesis of Substituted Imidazopyridine and Thiazoles from Styrene in Water Assisted by NBS

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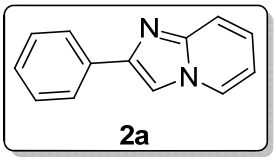
General

All chemicals were of reagent grade quality, purchased commercially from TCI-Chemicals, Sigma-Aldrich, or Spectrochem, and used without further purification except NBS. NBS was recrystallized from water using literature procedure. Purification by column chromatography was performed on Merck chromatographic silica gel (100-200 mesh). TLC analyses were performed using Merck silica gel 60 F_{254} precoated aluminium plates. NMR spectra were recorded on Bruker Avance III (500MHz), or Varian Mercury (300 MHz) instruments; chemical shifts, given in ppm, are relative to Me_4Si as the internal standard or to the residual solvent peak. HR-MS data were obtained using a Thermo-Scientific Bruker Daltonik GmbH, Germany Impact II UHR-ToF Mass Spectrometer ESI (Electron Spray Ionization).

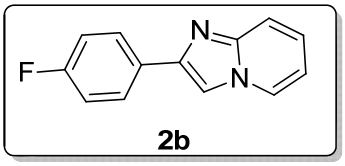
General procedure for 2-substituted imidazo[1,2-a]pyridine (2): *N*-Bromosuccinimide (2.0 mmole) was added to the flask containing styrene (1.0 mmole) and H_2O (1.0 mL) at room temperature under nitrogen atmosphere. Reaction flask was immersed in oil bath and temperature was raised to 80 ^oC. Reaction mixture was stirred at 80 °C for 2 hr. The reaction mixture was then cooled to room temperature and 2-aminopyridine (2.0 mmole) was added. Reaction mixture was further heated to 80 ^0C for 2 hrs. After completion of reaction (checked by TLC), crude product was extracted with ethyl acetate (3 x 20 mL). The combined organic layer was dried over anhydrous Na_2SO_4 and concentrated in vaccuo. The crude product was purified by silica gel column chromatography with hexane–ethyl acetate to give 2-substituted imidazo[1,2-a]pyridine.

General procedure for the synthesis of 2, 4-disubstituted thiazoles (3): *N*-Bromosuccinimide (2.0 mmole) was added to the flask containing styrene (1.0 mmole) and H_2O (1.0 mL) at room temperature under nitrogen atmosphere. Reaction flask was immersed in oil bath and temperature was raised to 80 ^oC. Reaction mixture was stirred at 80 °C for 2 hr. The reaction mixture was then cooled to room temperature and thioamide (2.0 mmole) was added. Reaction mixture was further heated at 80 ^0C for 2hrs. After completion of reaction (checked by TLC), crude product was extracted with ethyl acetate (3 x 20 mL). The combined organic layer was dried over anhydrous Na_2SO_4 and concentrated in vaccuo. The crude product was purified by silica gel column chromatography with hexane to give 2, 4-disubstituted thiazoles.

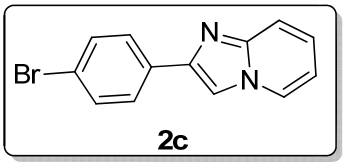
Spectral and Analytical data:



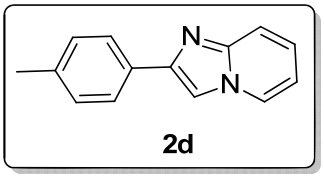
2-phenylimidazo[1,2-a]pyridine (**2a**)**:** white solid, R_f = 0.2 (ethyl acetate:hexane, 2:8); ^{1}H NMR (500 MHz, $CDCl_3$): 6.80 (td, *J* = 0.92, 6.71 Hz, 1H), 7.17-7.22 (m, 1H), 7.33-7.38 (m, 1H), 7.44-7.49 (m, 2H), 7.67 (d, *J* = 9.16 Hz, 1H), 7.88 (s,1H), 7.96-8.01 (m, 2H), 8.14 (dt, *J* = 6.71, 1.22 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 108.1, 112.5, 117.5, 124.7, 125.6, 126.1, 128.0, 128.7, 133.6, 145.6, 145.7; HRMS (ESI, m/z) calcd for $C_{13}H_{11}N_2$ = 195.0922 $[M+H]^+$, found 195.0920.



2-(4-fluorophenyl)imidazo[1,2-a]pyridine (**2b**)**:** white solid, R_f = 0.2 (ethyl acetate:hexane, 2:8); ^{1}H NMR (500 MHz, $CDCl_3$): 6.79 (td, *J* = 0.92, 6.71 Hz, 1H), 7.11-7.16 (m, 2H), 7.17-7.21 (m, 1H), 7.64 (dd, *J* = 0.92, 8.8 Hz, 1H), 7.81 (s,1H), 7.91-7.96 (m, 2H), 8.12 (dt, *J* = 1.22, 6.71 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 107.7, 112.5, 115.6 (d, $J_{C\text{-}F}$ = 21.8 Hz); 117.5, 124.7, 125.5, 127.7 (d, $J_{C\text{-}F}$ = 8.1 Hz), 130.0 (d, $J_{C\text{-}F}$ = 3.63 Hz), 145.4 (d, $J_{C\text{-}F}$ = 90.83 Hz), 161.7, 163.7; HRMS (ESI, m/z) calcd for $C_{13}H_{10}FN_2$ = 213.0828$[M + H]^+$, found 213.0822.

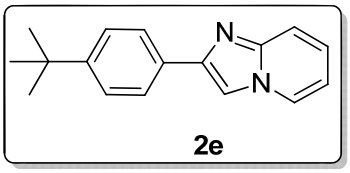


2-(4-chlorophenyl)imidazo[1,2-a]pyridine (**2c**)**:** white solid, R_f = 0.2 (ethyl acetate:hexane, 2:8); ^{1}H NMR (500 MHz, $CDCl_3$): 6.79-6.84 (m, 1H), 7.18-7.24 (m, 1H), 7.56-7.60 (m, 2H), 7.65 (d, *J* = 9.16 Hz, 1H), 7.81 (s,1H), 7.91-7.96 (m, 2H), 8.10-8.14 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 108.2, 112.6, 117.6, 121.9, 124.9, 125.6, 127.6, 131.9, 132.8, 144.8, 145.8 HRMS (ESI, m/z) calcd for $C_{13}H_{10}BrN_2$ = 273.0027$[M + H]^+$, found 273.0022.



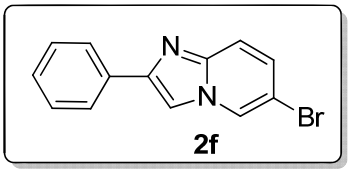
2-(p-tolyl)imidazo[1,2-a]pyridine (**2d**)**:** white solid, R_f = 0.2 (ethyl acetate:hexane, 2:8); ^{1}H NMR (500 MHz, $CDCl_3$): 2.41 (s, 3H), 6.75 (t, *J* = 6.71 Hz, 1H), 7.13-7.18 (m, 1H), 7.26 (d, *J* = 7.93 Hz, 2H), 7.64 (d, *J* = 9.16 Hz, 1H), 7.81 (s,1H), 7.87 (d, *J* = 7.93 Hz, 2H), 8.09 (d, *J*

= 7.02 Hz,1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 21.2, 107.7, 112.2, 117.4, 124.4, 125.5, 125.9, 129.4, 130.9, 137.7, 145.6, 145.9; HRMS (ESI, m/z) calcd for $C_{14}H_{13}N_2$ = 209.1079 $[M + H]^+$, found 209.1079.



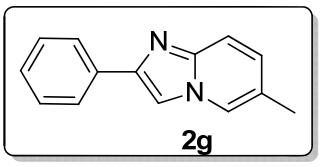
2e

2-(4-(tert-butyl)phenyl)imidazo[1,2-a]pyridine (**2e**)**:** white solid, R_f = 0.3 (ethyl acetate:hexane, 2:8); ^{1}H NMR (500 MHz, $CDCl_3$): 1.38 (s, 9H), 6.79 (dt, *J* = 1.22, 6.71 Hz, 1H), 7.15-7.21 (m, 1H), 7.46-7.51 (m, 2H), 7.67 (dd, *J* = 0.92, 9.16 Hz, 1H), 7.86 (s, 1H), 7.89-7.93 (m, 2H), 8.13 (dt, *J* = 1.22, 6.71 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 31.3, 34.9, 107.8, 112.3, 117.5, 124.5, 125.5, 125.6, 125.8, 130.8, 140.2, 145.6, 151.1; HRMS (ESI, m/z) calcd for $C_{17}H_{19}N_2$ = 251.1548 $[M + H]^+$, found 251.1545.



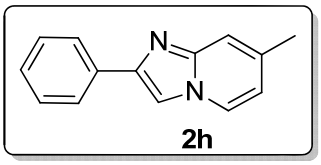
2f

6-bromo-2-phenylimidazo[1,2-a]pyridine (**2f**)**:** white solid, R_f = 0.2 (ethyl acetate:hexane, 2:8); ^{1}H NMR (500 MHz, $CDCl_3$): 7.23 (dd, *J* = 1.83, 9.77 Hz, 1H), 7.35-7.39 (m, 1H), 7.43-7.48 (m, 2H), 7.54 (d, *J* = 9.77 Hz, 1H), 7.81 (s,1H), 7.92-7.96 (m, 2H), 8.23-8.26 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 107.1, 108.3, 118.0, 125.5, 126.1, 128.2, 128.3, 128.8, 133.0, 144.0, 146.4; HRMS (ESI, m/z) calcd for $C_{13}H_{10}BrN_2$ = 273.0027 $[M + H]^+$, found 273.0023.



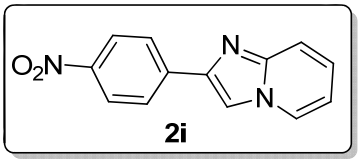
2g

6-methyl-2-phenylimidazo[1,2-a]pyridine (**2g**)**:** white solid, R_f = 0.2 (ethyl acetate:hexane, 2:8); ^{1}H NMR (200 MHz, $CDCl_3$): 2.31 (s, 3H), 7.00-7.05 (m, 1H), 7.26-7.36(m, 1H), 7.39-7.48 (m, 2H), 7.54 (d, *J* = 8.97 Hz, 1h), 7.77 (s, 1H), 7.88-7.97 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 18.1, 107.9, 116.5, 122.5, 123.4, 126.0, 128.0, 128.4, 128.7, 133.4, 144.3, 144.8; HRMS (ESI, m/z) calcd for $C_{14}H_{13}N_2$ = 209.1079 $[M + H]^+$, found 209.1075.



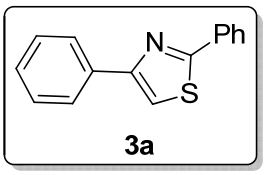
2h

7-methyl-2-phenylimidazo[1,2-a]pyridine (**2h**)**:** white solid, R_f = 0.2 (ethyl acetate:hexane, 2:8); ^{1}H NMR (500 MHz, $CDCl_3$): 2.4 (s, 3H), 6.61 (dd, *J* = 1.83, 6.71 Hz, 1H), 7.31-7.36(m, 1H), 7.38-7.41 (m, 1H), 7.42-7.47 (m, 2h), 7.77 (s, 1H), 7.98-8.00 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 21.4, 107.5, 115.1, 115.8, 124.7, 125.9, 127.8, 128.7, 133.8, 135.7, 145.3, 14.1; HRMS (ESI, m/z) calcd for $C_{14}H_{13}N_2$ = 209.1079 $[M + H]^+$, found 209.1077.



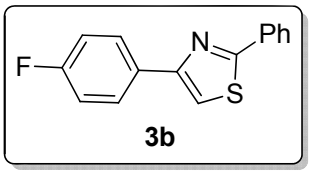
2i

2-(4-nitrophenyl)imidazo[1,2-a]pyridine (**2i**)**:** yellow solid, R_f = 0.2 (ethyl acetate:hexane, 4:6); ^{1}H NMR (500 MHz, $CDCl_3$ + CD_3OD [7:3]): 6.90 (td, *J* = 0.92, 6.87 Hz, 1H), 7.28-7.31 (m, 1H), 7.60 (d, *J* = 9.61 Hz, 1H), 8.07 (dt, *J* = 1.98, 9.00 Hz, 2H), 8.12 (s, 1H), 8.25-8.30 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$ + CD_3OD [7:3]): δ 114.5, 117.4, 120.9, 128.1, 130.2 (2C), 130.4, 143.8, 146.9, 150.0, 151.1; HRMS (ESI, m/z) calcd for $C_{13}H_{10}N_3O_2$= 240.0773 $[M + H]^+$, found 240.0772.



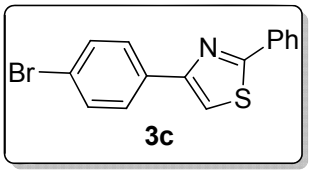
3a

2,4-diphenylthiazole (**3a**)**:** white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (400 MHz, $CDCl_3$): 7.23-7.39 (m, 1H), 7.43-7.49 (m, 6H), 8.00 (m, 1H), 8.02-8.03 (m, 1H), 8.05-8.08 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 112.6, 126.4, 126.6, 128.1, 128.7, 128.9, 130.0, 133.7, 134.5, 156.2, 167.8; HRMS (ESI, m/z) calcd for $C_{15}H_{12}NS$ = 238.0690 $[M + H]^+$, found 238.0688.



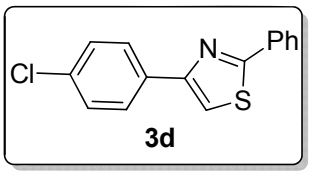
3b

4-(4-fluorophenyl)-2-phenylthiazole (**3b**)**:** white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (400 MHz, $CDCl_3$): 7.12 (t, *J* = 8.79 Hz, 2H), 7.38 (s, 1H), 7.42-7.50 (m, 3H), 7.96 (dd, *J* = 5.57, 8.79 Hz, 2H) 8.00-8.04 (m, 2H); HRMS (ESI, m/z) calcd for $C_{15}H_{11}FNS$ = 256.0596 $[M + H]^+$, found 256.0590.



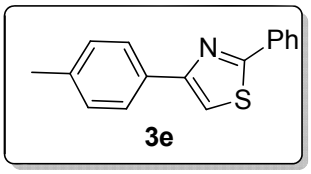
3c

4-(4-bromophenyl)-2-phenylthiazole (3c): white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (400 MHz, $CDCl_3$): 7.43-7.46 (m, 3H), 7.51-7.57 (m, 3H), 7.84-7.87 (m, 2H), 8.01-8.06 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 113.0, 126.6, 128.0, 128.7, 128.9, 130.2, 131.8, 133.4, 133.5, 155.0, 168.1; HRMS (ESI, m/z) calcd for $C_{15}H_{11}BrNS$ = 315.9796 [M + 2+H]$^+$, found 317.9768.



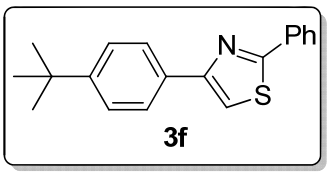
3d

4-(4-chlorophenyl)-2-phenylthiazole (3d): white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (300 MHz, $CDCl_3$): 7.40-7.50 (m, 5H), 7.51-7.55 (m, 1H), 7.92 (s, 1H), 7.95 (s, 1H), 8.01-8.07 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 112.9, 126.5, 128.3, 128.8, 128.9, 130.1, 131.8, 133.5, 133.9, 155.0, 168.1; HRMS (ESI, m/z) calcd for $C_{15}H_{11}ClNS$ = 272.0301[M + H]$^+$, found 272.0301.



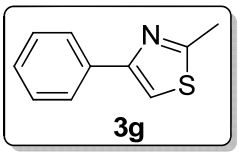
3e

2-phenyl-4-(p-tolyl)thiazole (3e): white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (300 MHz, $CDCl_3$): 2.42 (s, 3H), 7.26-7.30 (m, 2H), 7.42 (s, 1H), 7.45-7.49 (m, 3H), 7.89-7.94 (m, 2H), 8.04-8.08 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 21.3, 111.8, 126.3, 126.6, 128.7, 128.9, 129.4, 129.9, 131.8, 133.8, 156.3, 167.7; HRMS (ESI, m/z) calcd for $C_{16}H_{14}NS$ = 252.0847 [M + H]$^+$, found 252.0845.



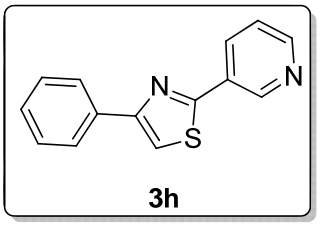
3f

4-(4-(tert-butyl)phenyl)-2-phenylthiazole (3f): white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (300 MHz, $CDCl_3$): 1.29 (s, 9H), 7.34-7.42 (m, 6H), 7.82-7.87 (m, 2H), 7.95-8.00 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 31.3, 34.6, 112.0, 125.6, 126.2, 126.6, 128.9, 130.0, 131.8, 133.8, 151.3, 156.4, 167.7; HRMS (ESI, m/z) calcd for $C_{19}H_{20}NS$ = 294.1316 [M + H]$^+$, found 294.1308.



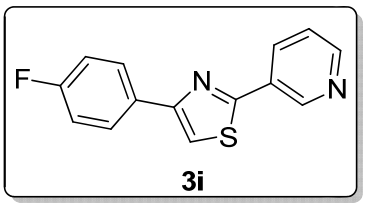
3g

2-methyl-4-phenylthiazole (**3g**)**:** white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (300 MHz, $CDCl_3$): 2.78 (s, 3H), 7.29-7.35 (m, 2H), 7.38-7.45 (m, 2H), 7.88 (d, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 19.3, 112.2, 126.3, 128.0, 128.7, 134.5, 155.1, 165.9; HRMS (ESI, m/z) calcd for $C_{10}H_{10}NS$ = 176.0534 $[M + H]^+$, found 176.0530.



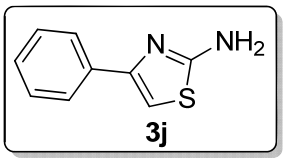
3h

4-phenyl-2-(pyridin-3-yl)thiazole (**3h**)**:** white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (300 MHz, $CDCl_3$): 7.35-7.51 (m, 4H), 7.55 (s, 1H), 7.98-8.03 (m, 2H), 8.31-8.37 (m, 1H), 8.68 (dd, J = 0.95, 4.76 Hz, 1H), 9.26 (d, J = 1.43 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 113.3, 123.7, 126.4, 128.4, 128.8, 129.7, 133.7, 134.0, 147.7, 151.7, 156.7, 164.3; HRMS (ESI, m/z) calcd for $C_{14}H_{11}N_2S$ = 239.0643 $[M + H]^+$, found 239.0640.



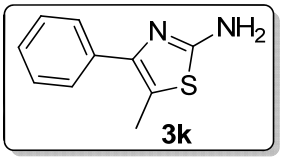
3i

4-(4-fluorophenyl)-2-(pyridin-3-yl)thiazole (**3i**)**:** white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): 7.13-7.20 (m, 2H), 7.40-7.45 (m, 1H), 7.49 (s, 1H), 7.96-8.00 (m, 2H), 8.31-8.35 (m, 1H), 8.69 (dd, J = 1.83 Hz, 1H), 9.24-9.27 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 128.8, 115.7 (d, $J_{C\text{-}F}$ = 21.8 Hz), 123.7, 128.2 (d, $J_{C\text{-}F}$ = 8.17 Hz), 129.7, 130.4 (d, $J_{C\text{-}F}$ = 3.63 Hz), 133.7, 147.8, 150.9, 155.8, 161.9, 164.3 (d, $J_{C\text{-}F}$ = 79.2 Hz); HRMS (ESI, m/z) calcd for $C_{14}H_{10}FN_2S$ = 257.0549 $[M + H]^+$, found 257.0543.

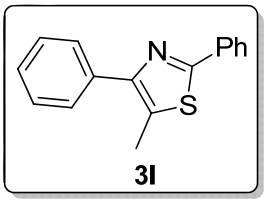


3j

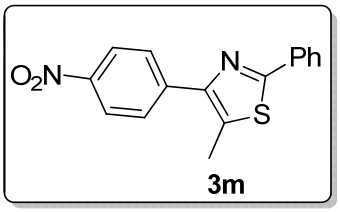
4-phenylthiazol-2-amine (**3j**)**:** white solid, R_f = 0.2 (ethyl acetate:hexane, 2:8); ^{1}H NMR (500 MHz, $CDCl_3$): 5.10 (brs. s, 2H), 6.72 (s, 1H), 7.27-7.32 (m, 1H), 7.35-7.40 (m, 2H), 7.75-7.80 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 102.8, 126.0, 127.7, 128.6, 134.7, 151.3, 167.4; HRMS (ESI, m/z) calcd for $C_9H_9N_2S$ = 177.0486 $[M + H]^+$, found 177.0481



5-methyl-4-phenylthiazol-2-amine (**3k**)**:** white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (400 MHz, $CDCl_3$): δ 2.37 (s, 3H), 7.29 (dt, J = 2.29, 7.78 Hz, 1H), 7.35-7.41 (m, 2H), 7.51-7.55 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 12.3, 117.6, 127.2, 128.2, 128.3, 135.0, 146.0, 163.9; HRMS (ESI, m/z) calcd for $C_{10}H_{11}N_2S$ = 191.0643 $[M + H]^+$, found 191.0635.



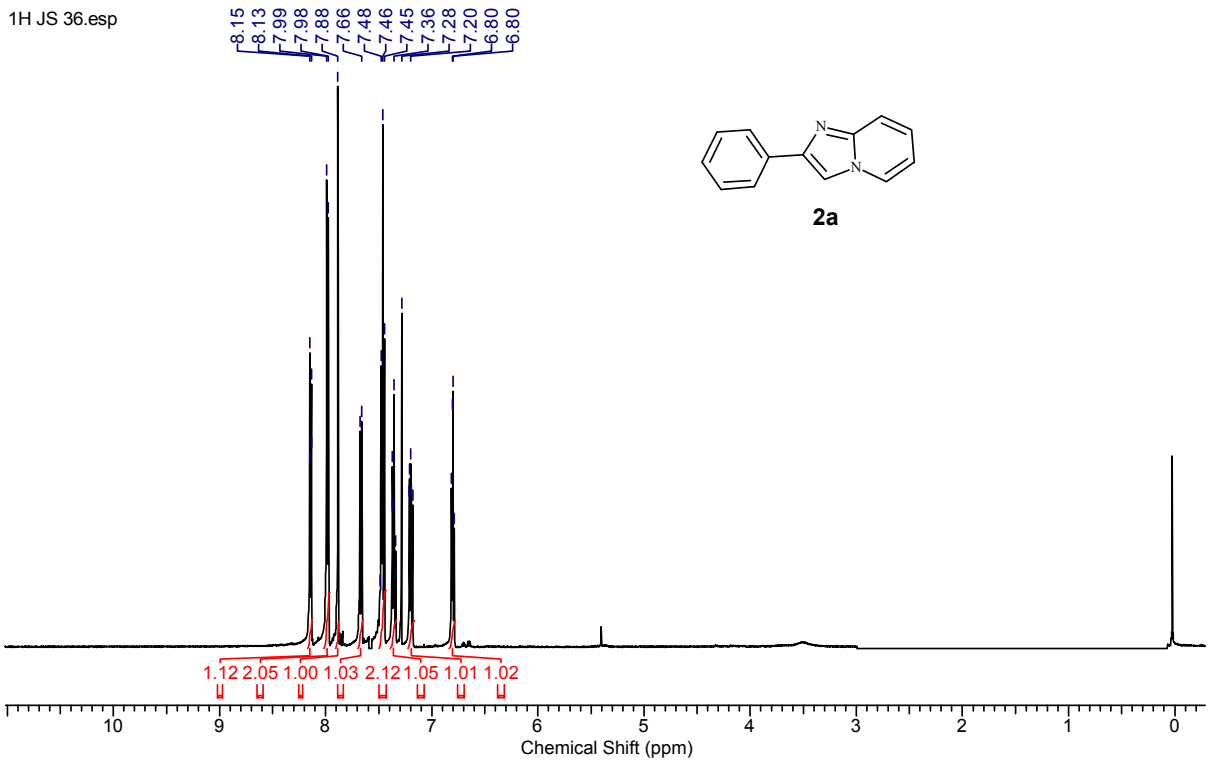
5-methyl-2,4-diphenylthiazole (**3l**)**:** white solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (400 MHz, $CDCl_3$): δ 2.60 (s, 3H), 7.36-7.48 (m, 6H), 7.73 (dd, J = 1.37, 8.24 Hz, 2H), 7.96 (dd, J = 1.83, 8.24 Hz, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 12.8, 126.3, 127.6. 128.4, 128.6, 128.8, 129.6, 133.8, 135.1, 151.9, 163.6; HRMS (ESI, m/z) calcd for $C_{16}H_{14}NS$ = 252.0847 $[M + H]^+$, found 252.0841.



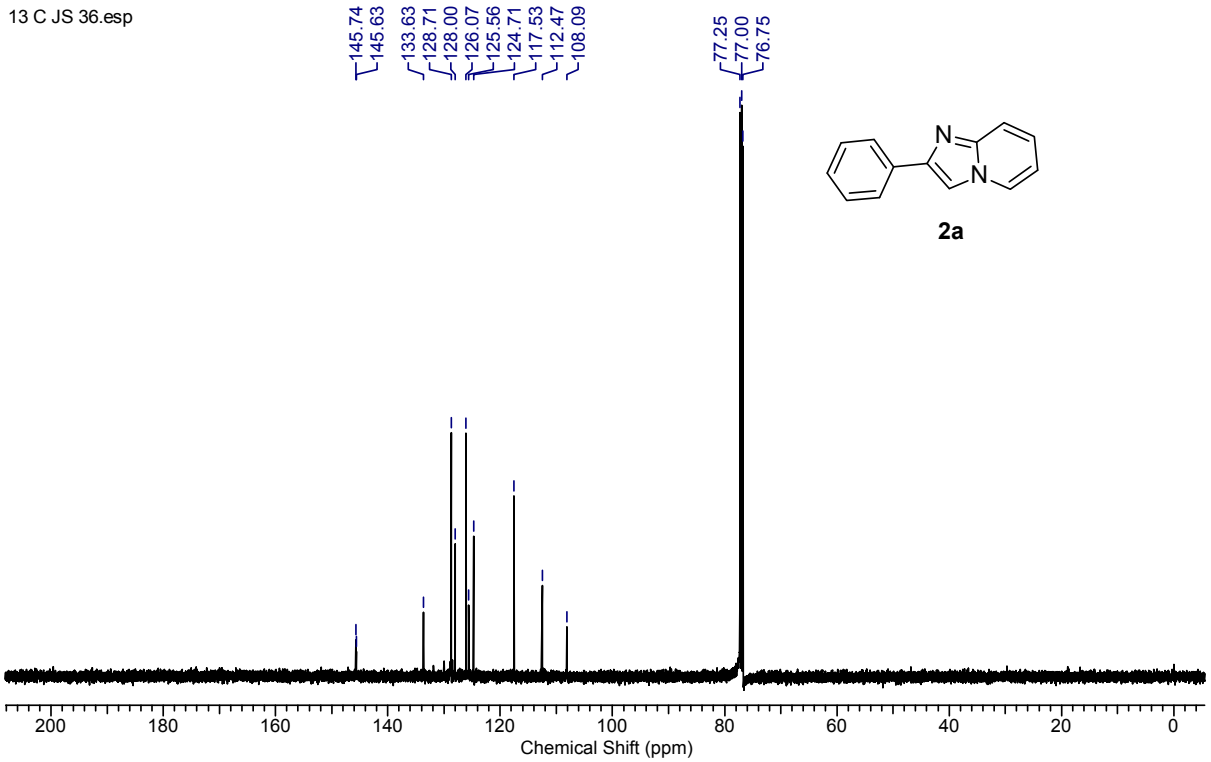
5-methyl-4-(4-nitrophenyl)-2-phenylthiazole (**3m**)**:** Yellow solid, R_f = 0.6 (ethyl acetate:hexane, 1:9); ^{1}H NMR (500 MHz, $CDCl_3$): δ 2.69 (s, 3H), 7.46-7.48 (m, 3H), 7.95-8.00 (m, 4H), 8.34 (dt, J = 1.98, 8.85 Hz, 2H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 13.1, 123.7, 126.3, 129.0, 129.1, 130.1, 131.4, 132.3, 141.4, 146.8, 149.4, 164.4; HRMS (ESI, m/z) calcd for $C_{16}H_{13}N_2O_2S$ = 297.0698 $[M + H]^+$, found 297.0692.

Copies of ^{1}H and ^{13}C NMR spectra:

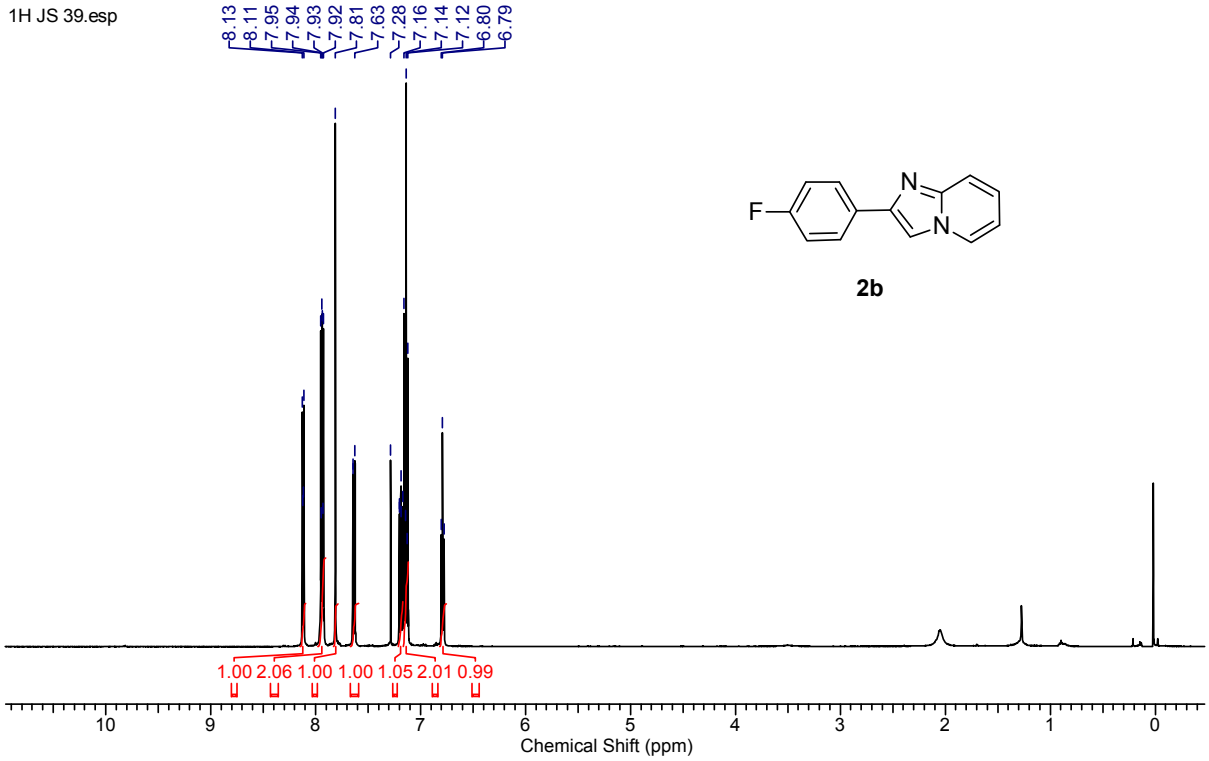
^{1}H NMR spectrum for compound **2a** ($CDCl_3$, 500 MHz)



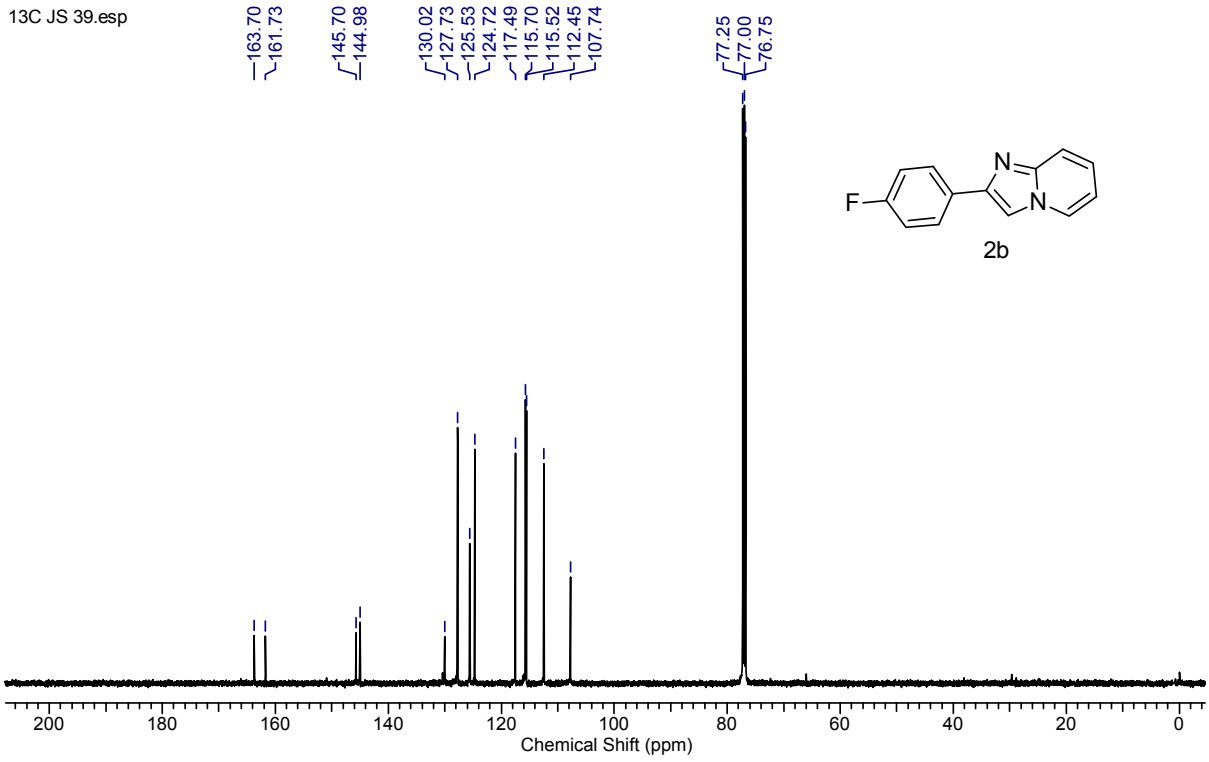
^{13}C NMR spectrum for compound **2a** ($CDCl_3$, 125 MHz)



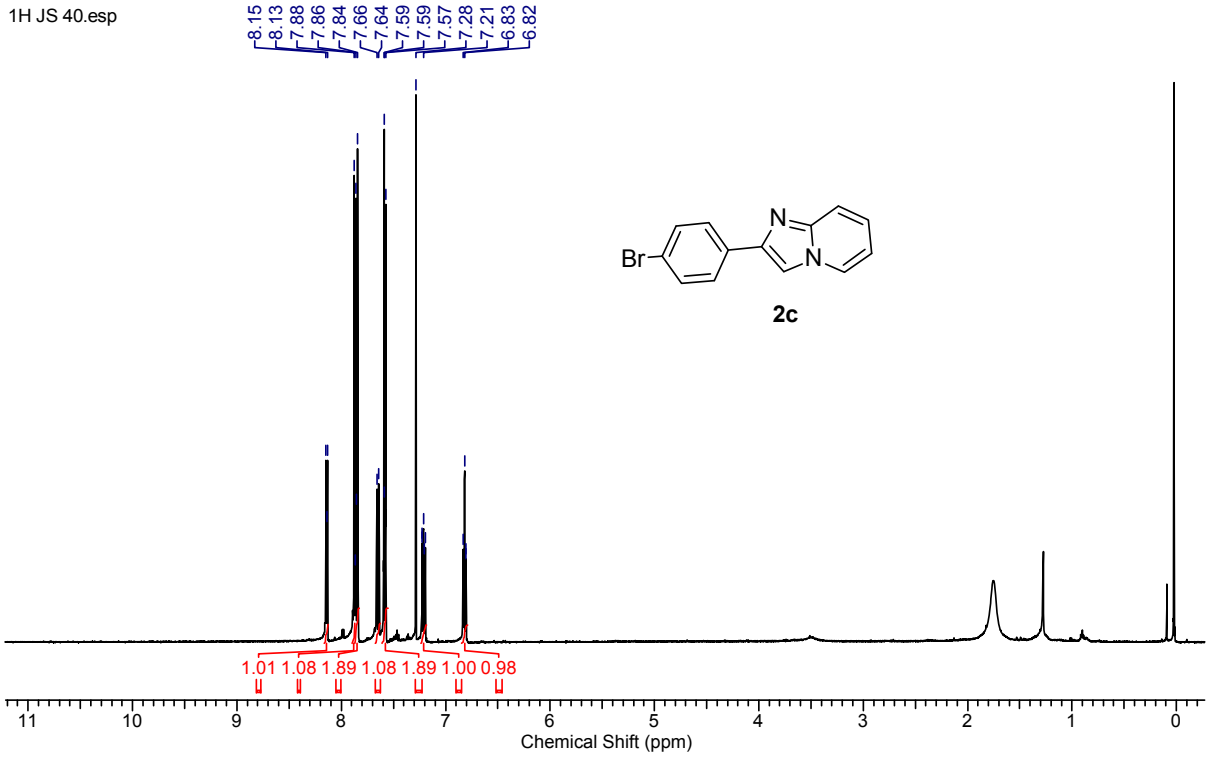
^{1}H NMR spectrum for compound **2b** ($CDCl_3$, 500 MHz)



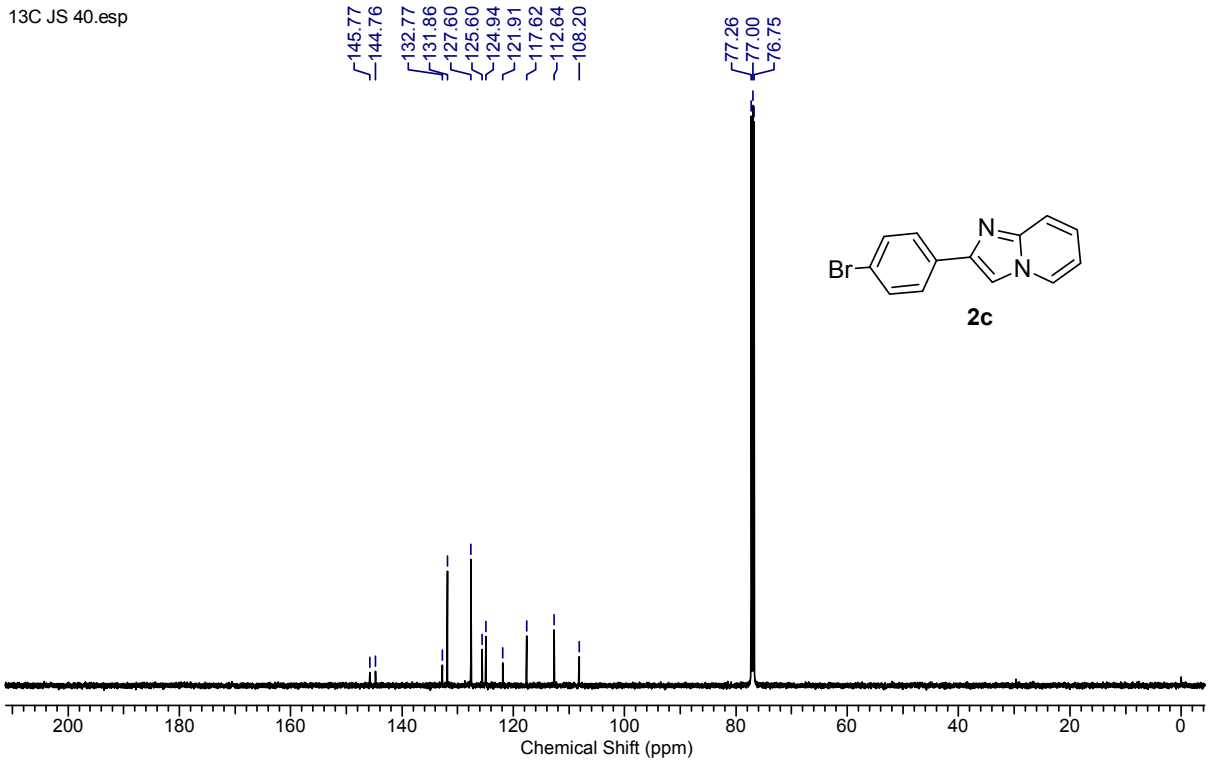
^{13}C NMR spectrum for compound **2b** ($CDCl_3$, 125 MHz)



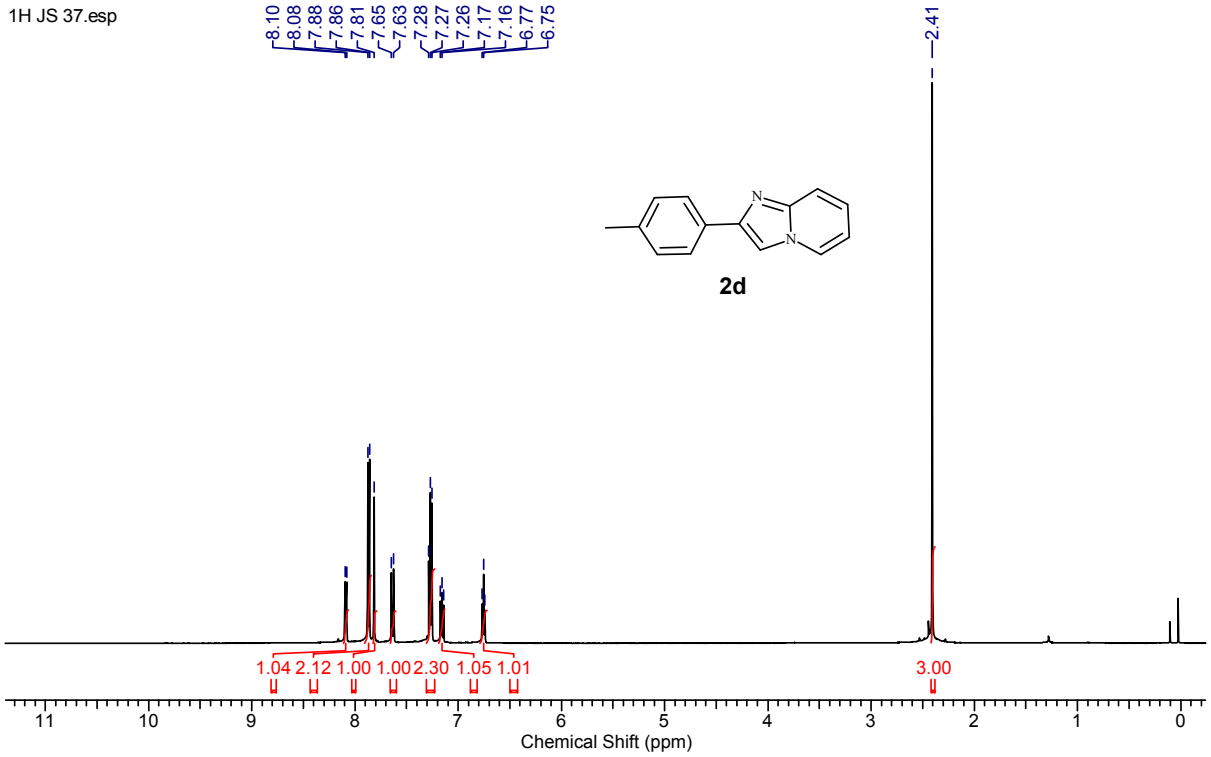
^{1}H NMR spectrum for compound **2c** ($CDCl_3$, 500 MHz)



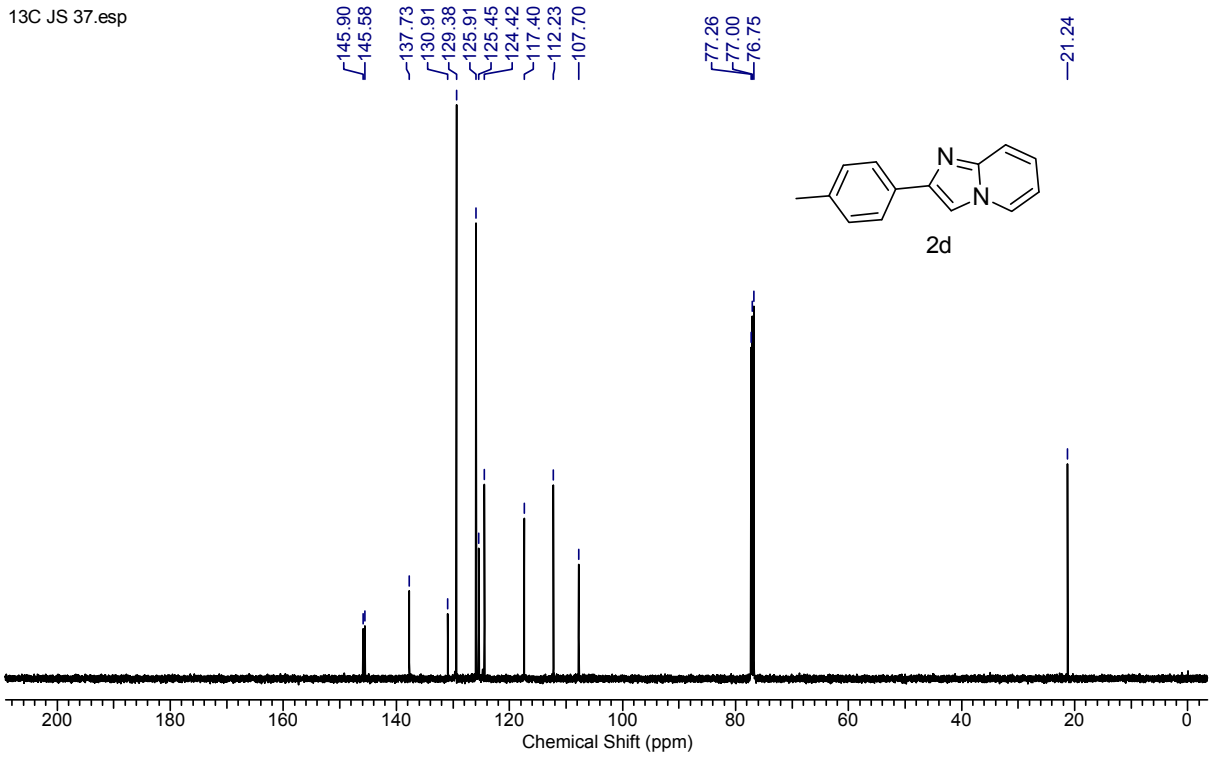
^{13}C NMR spectrum for compound **2c** ($CDCl_3$, 125 MHz)



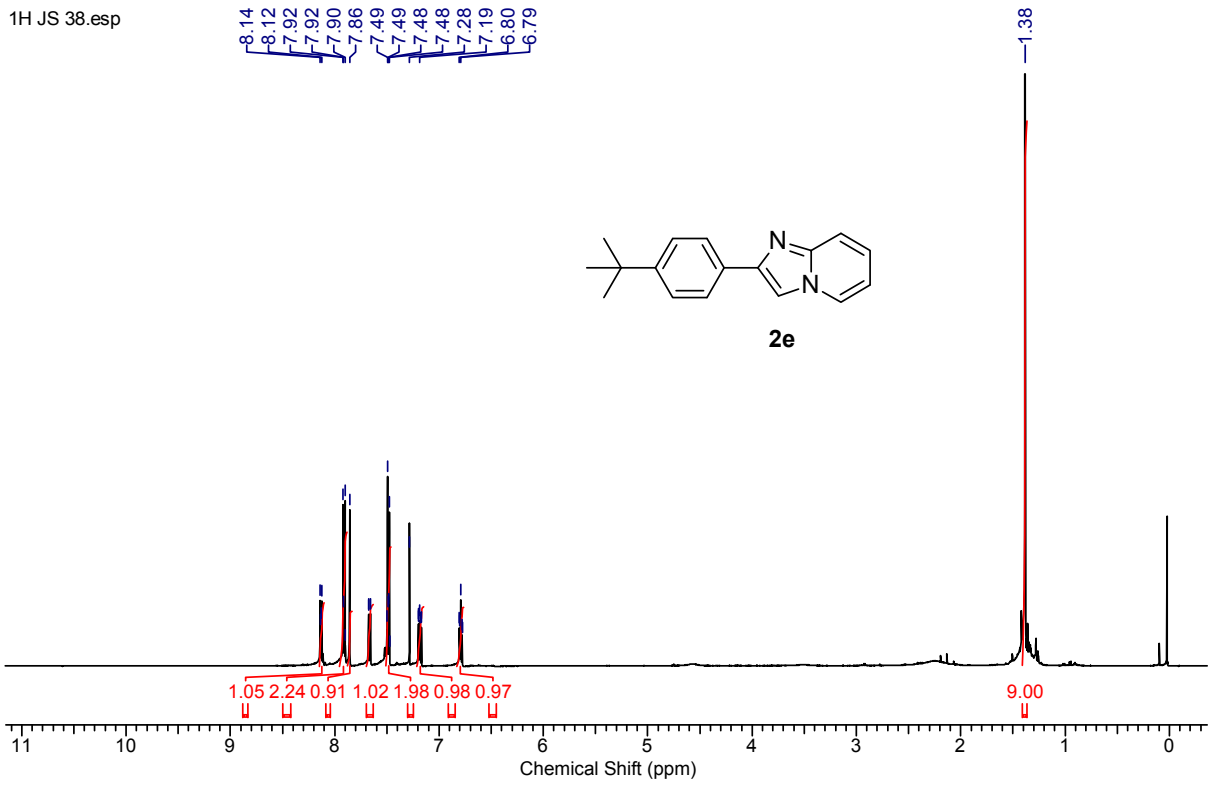
^{1}H NMR spectrum for compound **2d** ($CDCl_3$, 500 MHz)



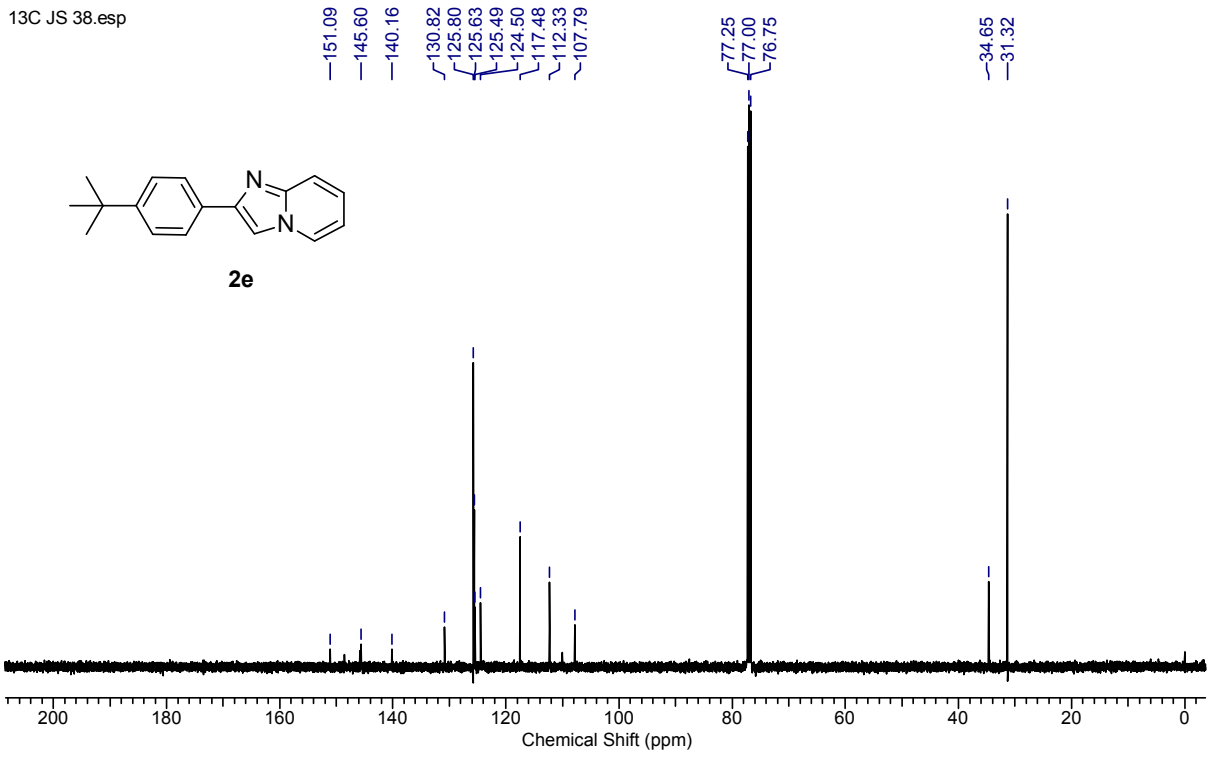
^{13}C NMR spectrum for compound **2d** ($CDCl_3$, 125 MHz)



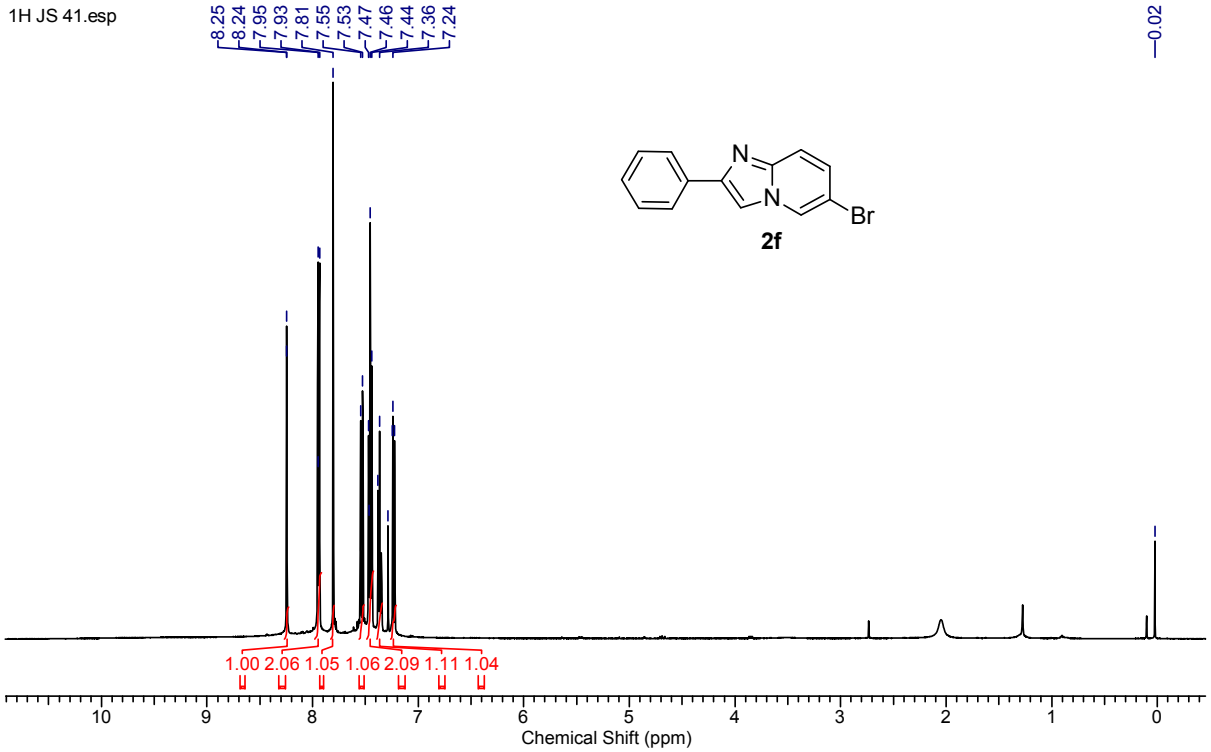
^{1}H NMR spectrum for compound **2e** ($CDCl_3$, 500 MHz)



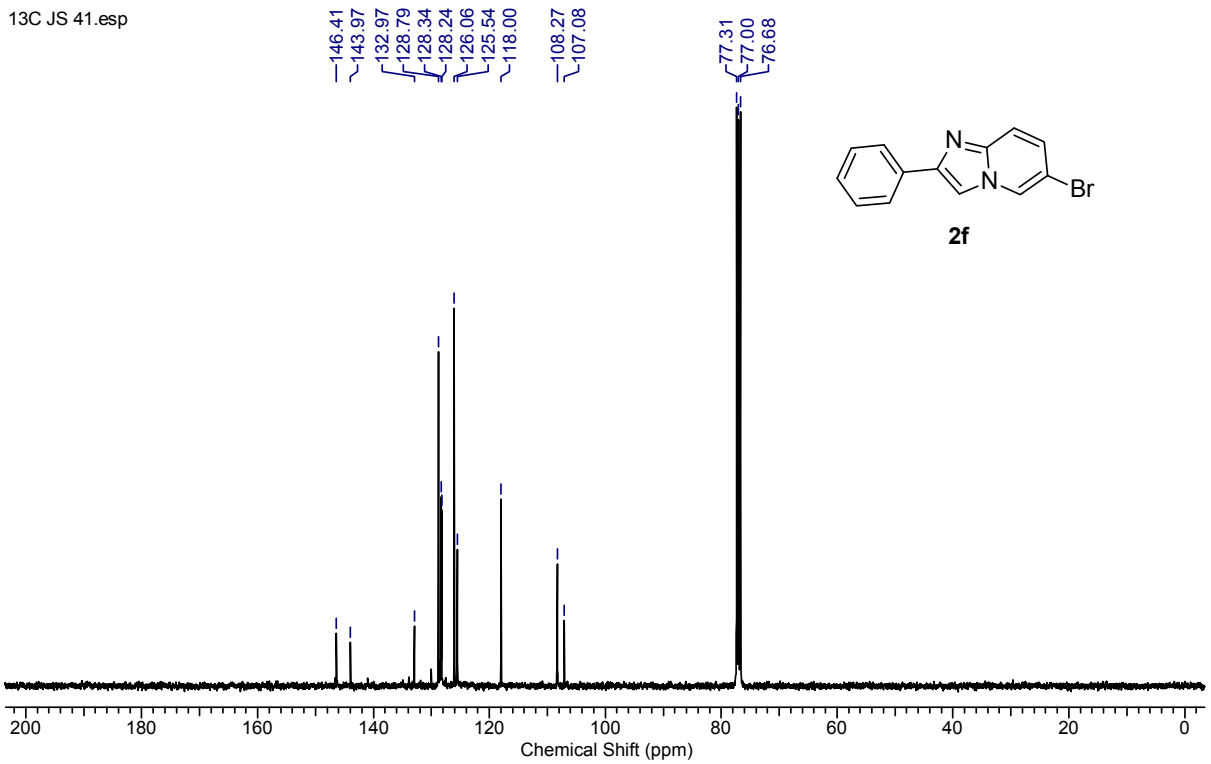
^{13}C NMR spectrum for compound **2e** ($CDCl_3$, 125 MHz)



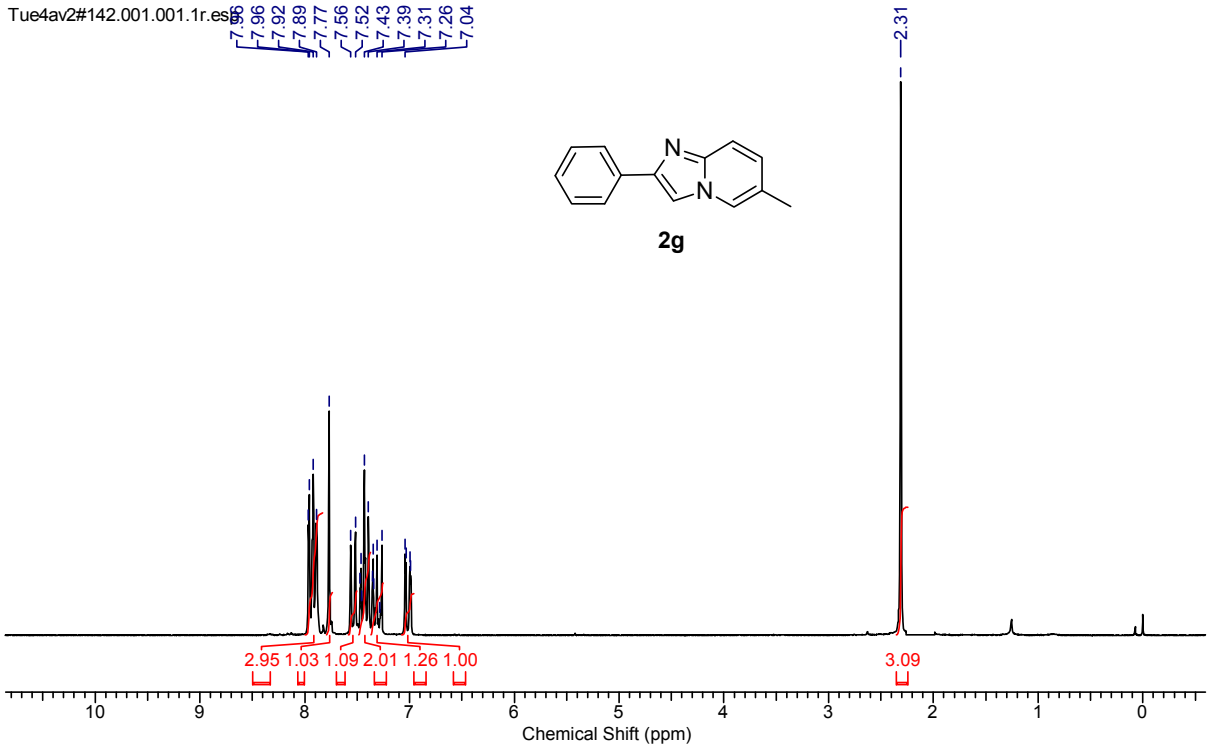
^{1}H NMR spectrum for compound **2f** ($CDCl_3$, 500 MHz)



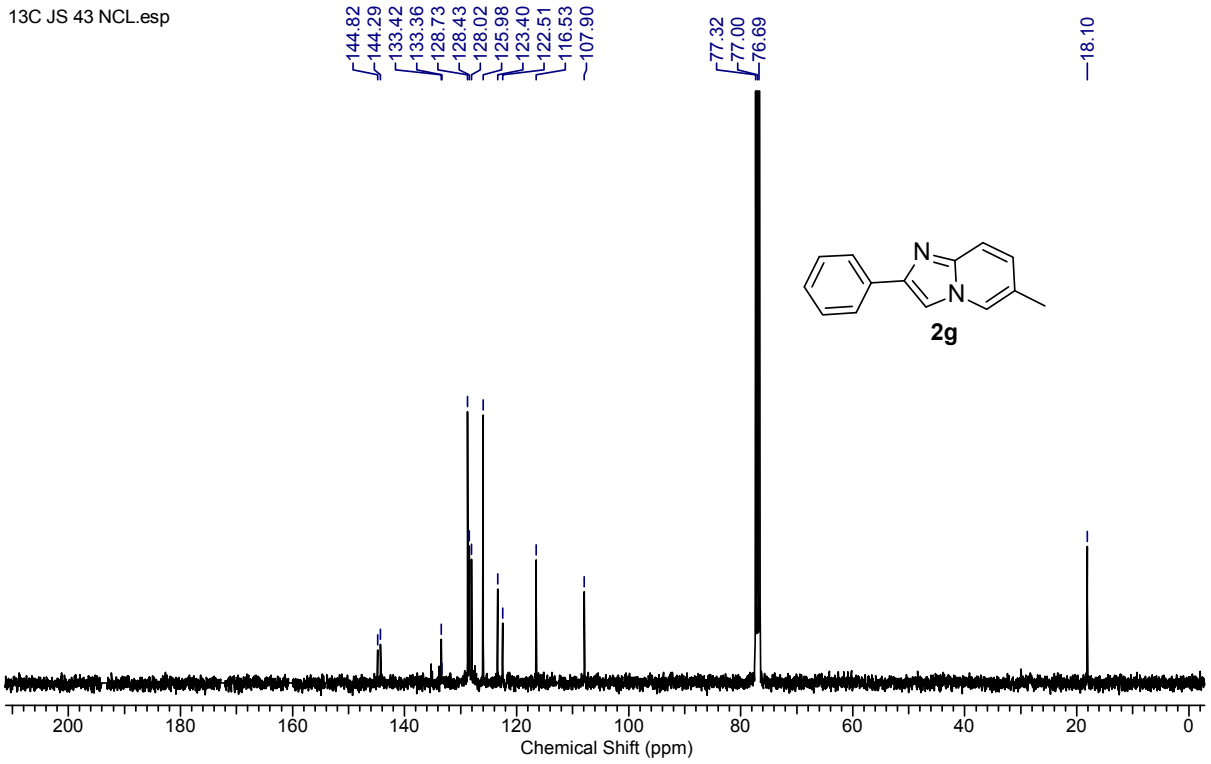
^{13}C NMR spectrum for compound **2f** ($CDCl_3$, 100 MHz)



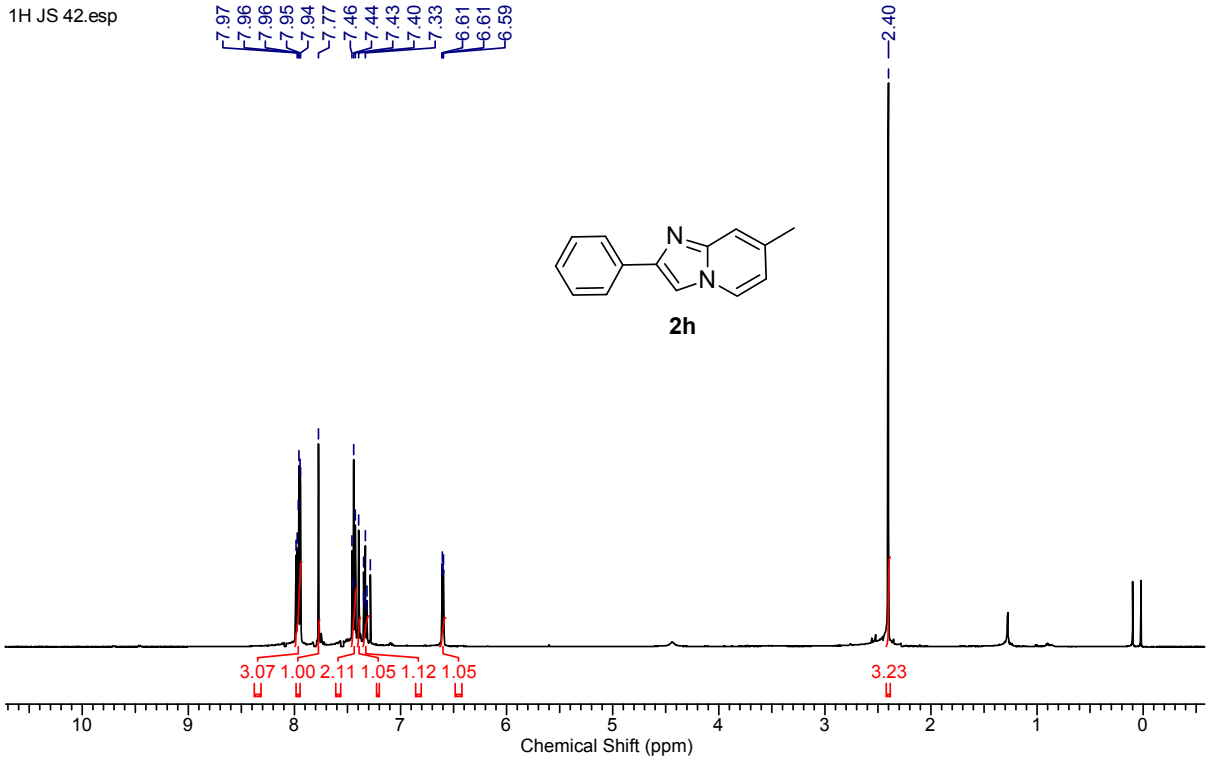
^{1}H NMR spectrum for compound **2g** ($CDCl_3$, 200 MHz)



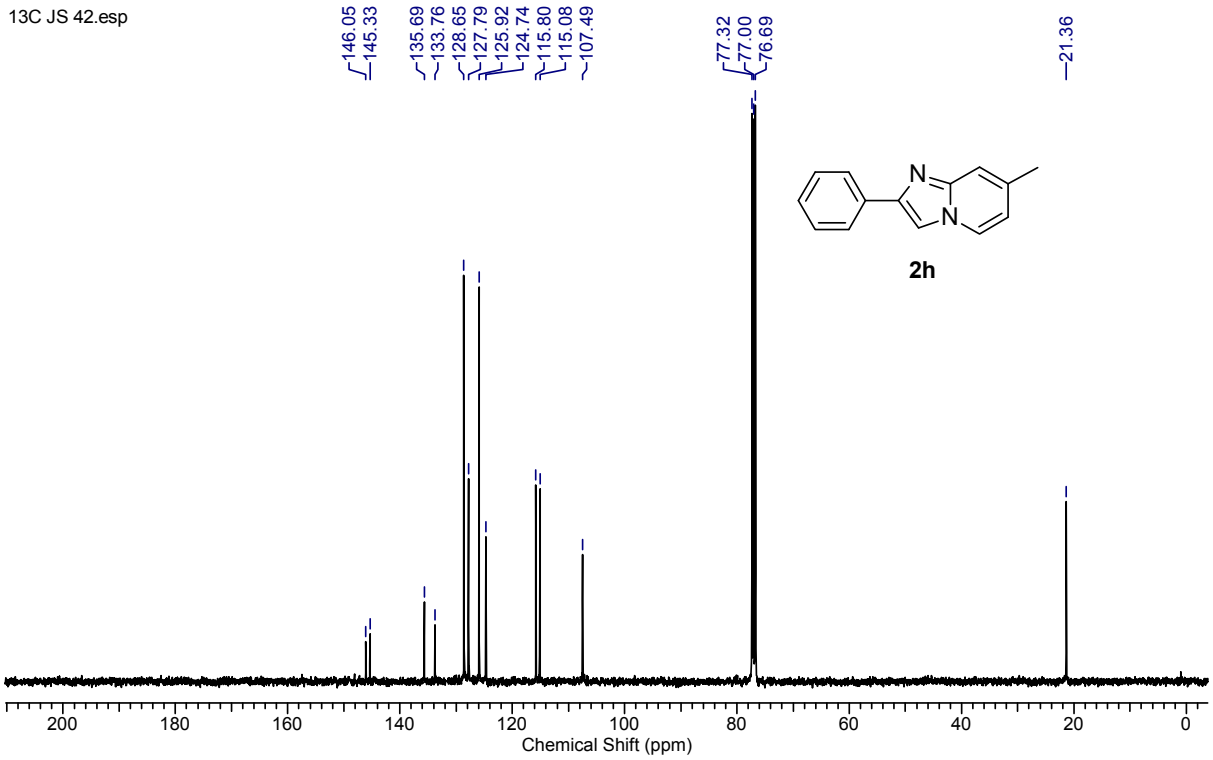
^{13}C NMR spectrum for compound **2g** ($CDCl_3$, 100 MHz)



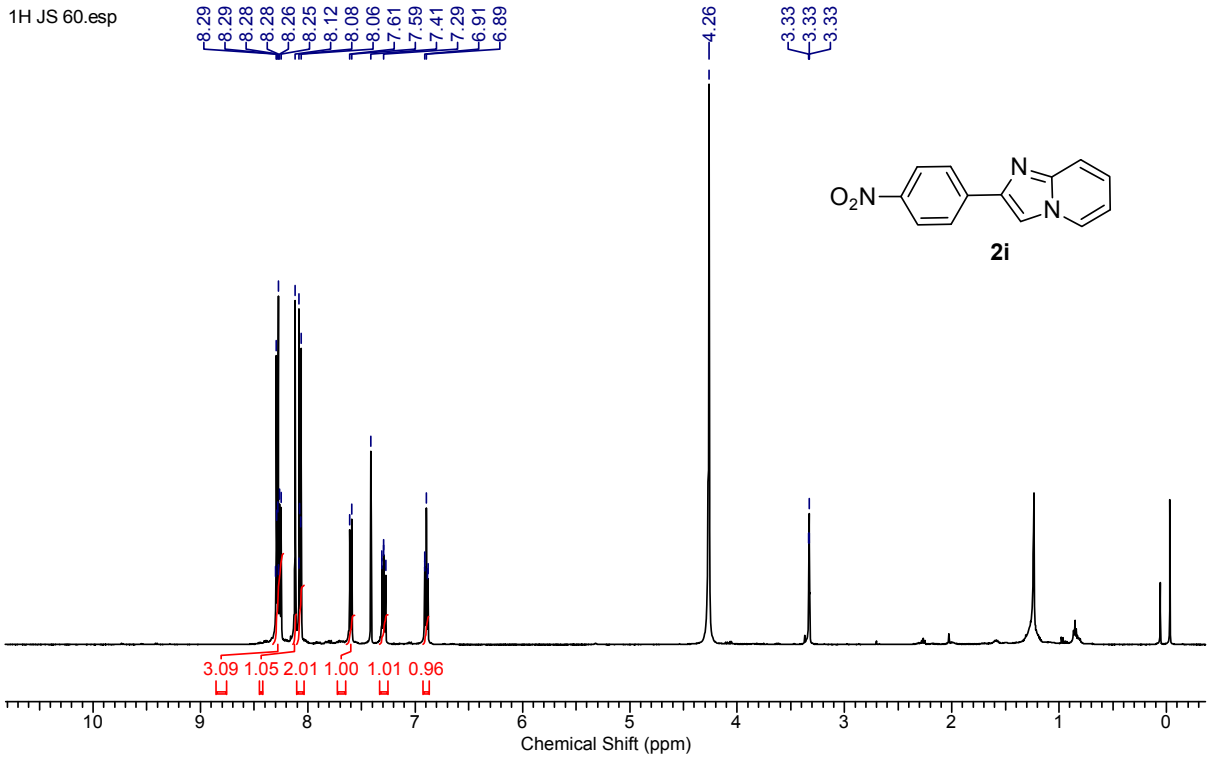
^{1}H NMR spectrum for compound **2h** ($CDCl_3$, 500 MHz)



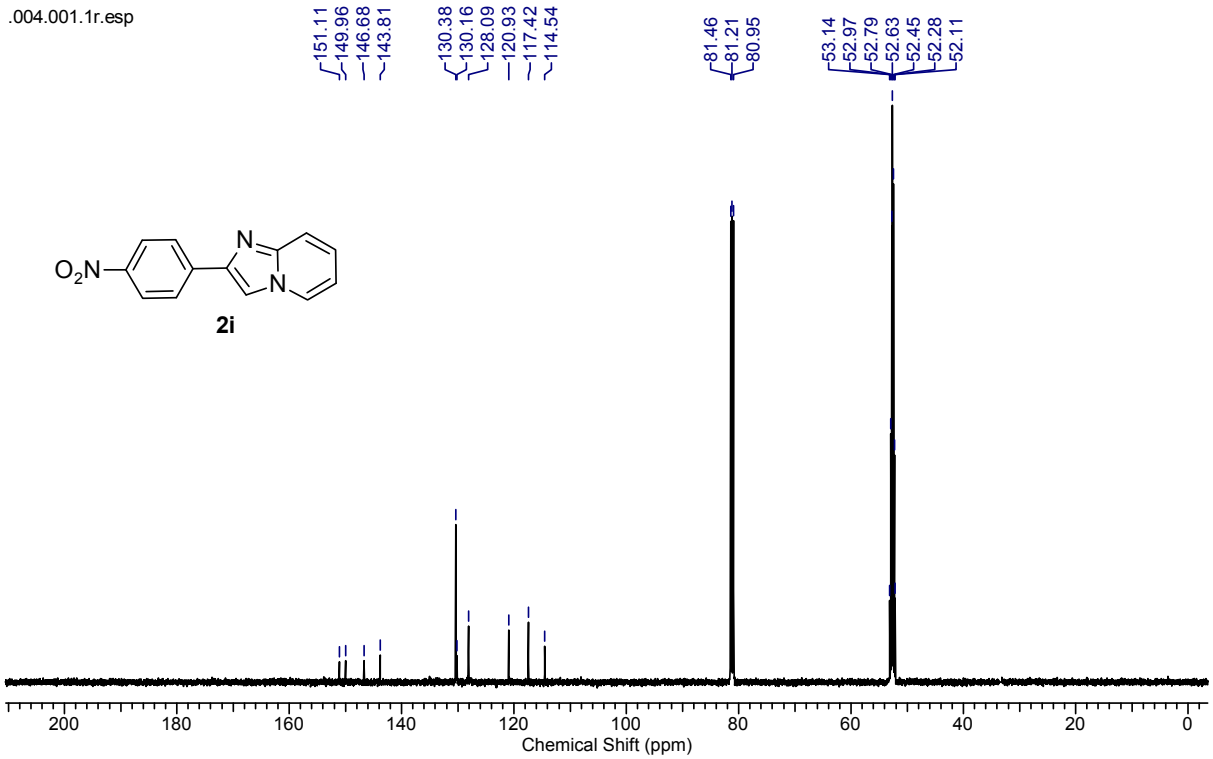
^{13}C NMR spectrum for compound **2h** ($CDCl_3$, 100 MHz)



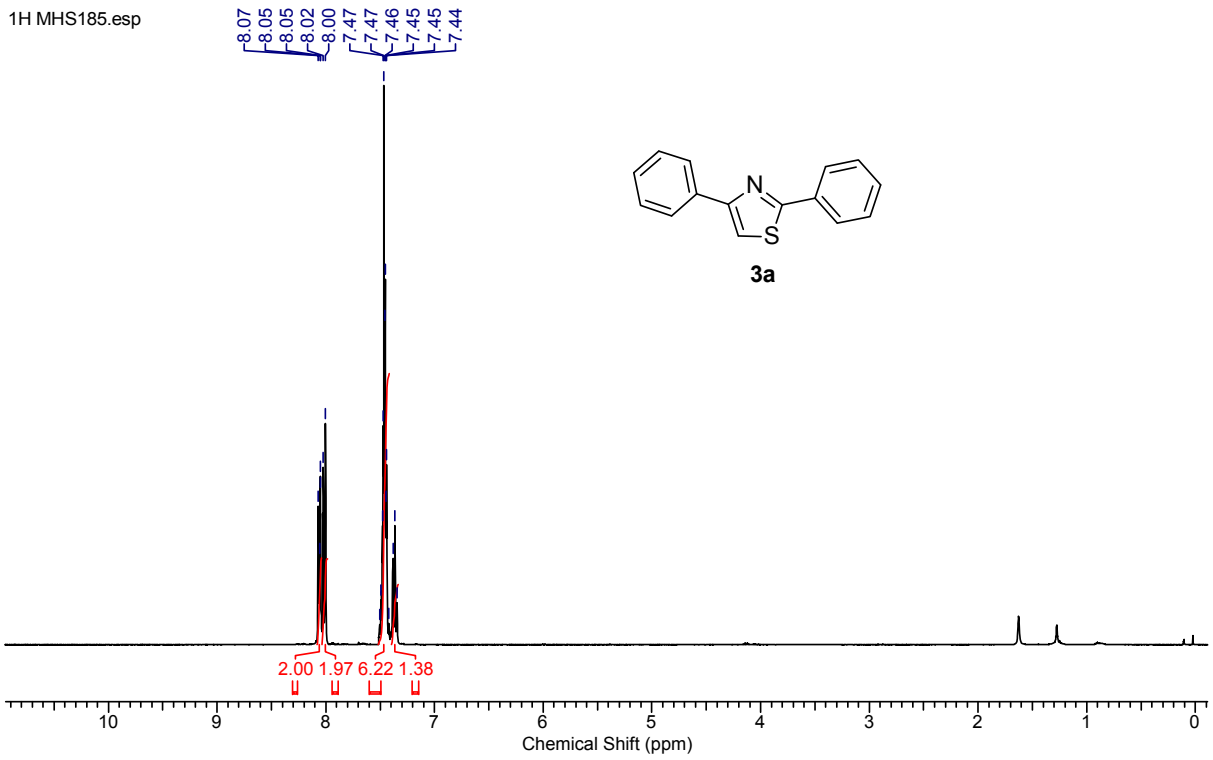
^{1}H NMR spectrum for compound **2i** (CD_3OD + $CDCl_3$, 500 MHz)



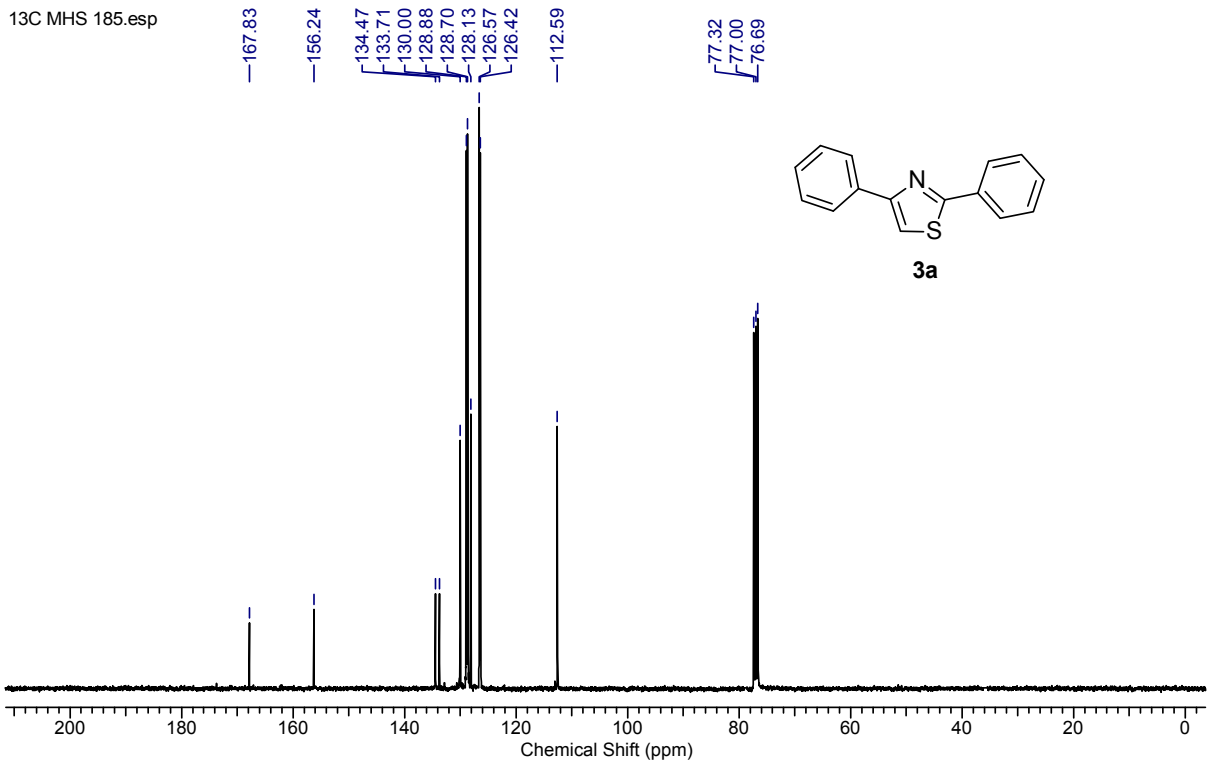
^{13}C NMR spectrum for compound **2i** (CD_3OD + $CDCl_3$, 100 MHz)



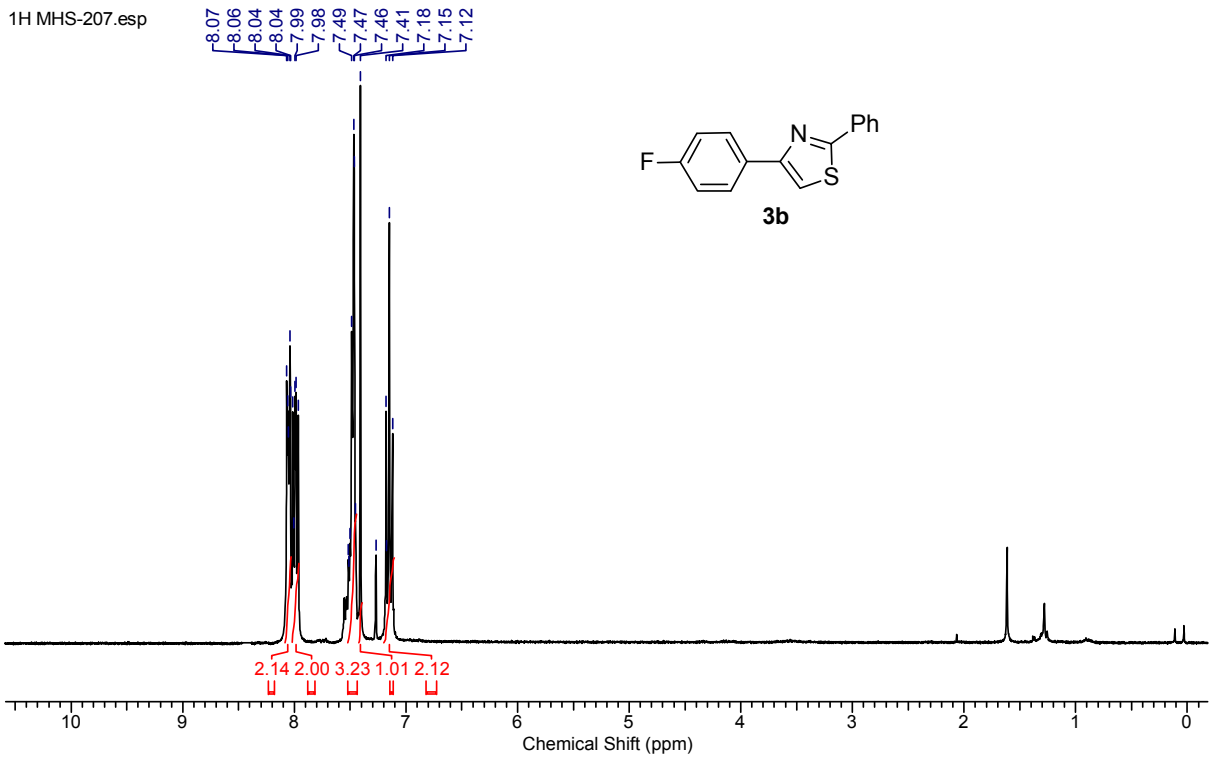
^{1}H NMR spectrum for compound **3a** ($CDCl_3$, 400 MHz)



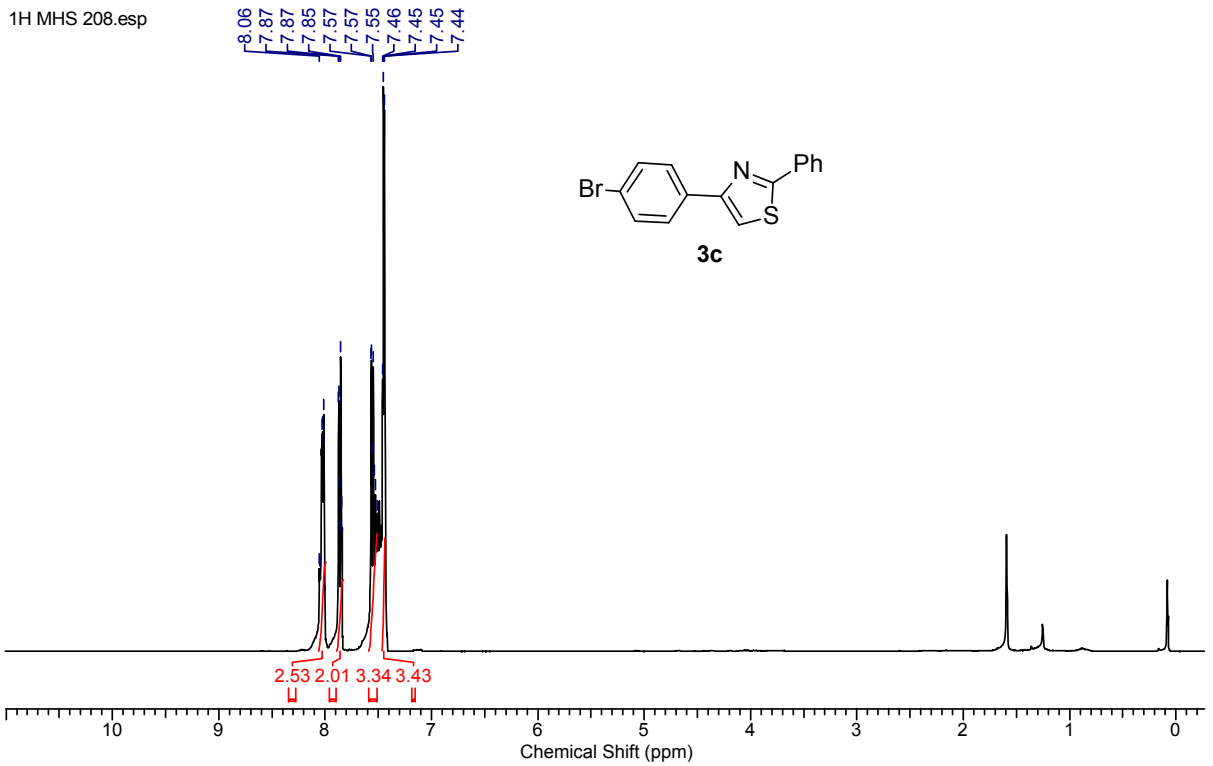
^{13}C NMR spectrum for compound **3a** ($CDCl_3$, 100 MHz)



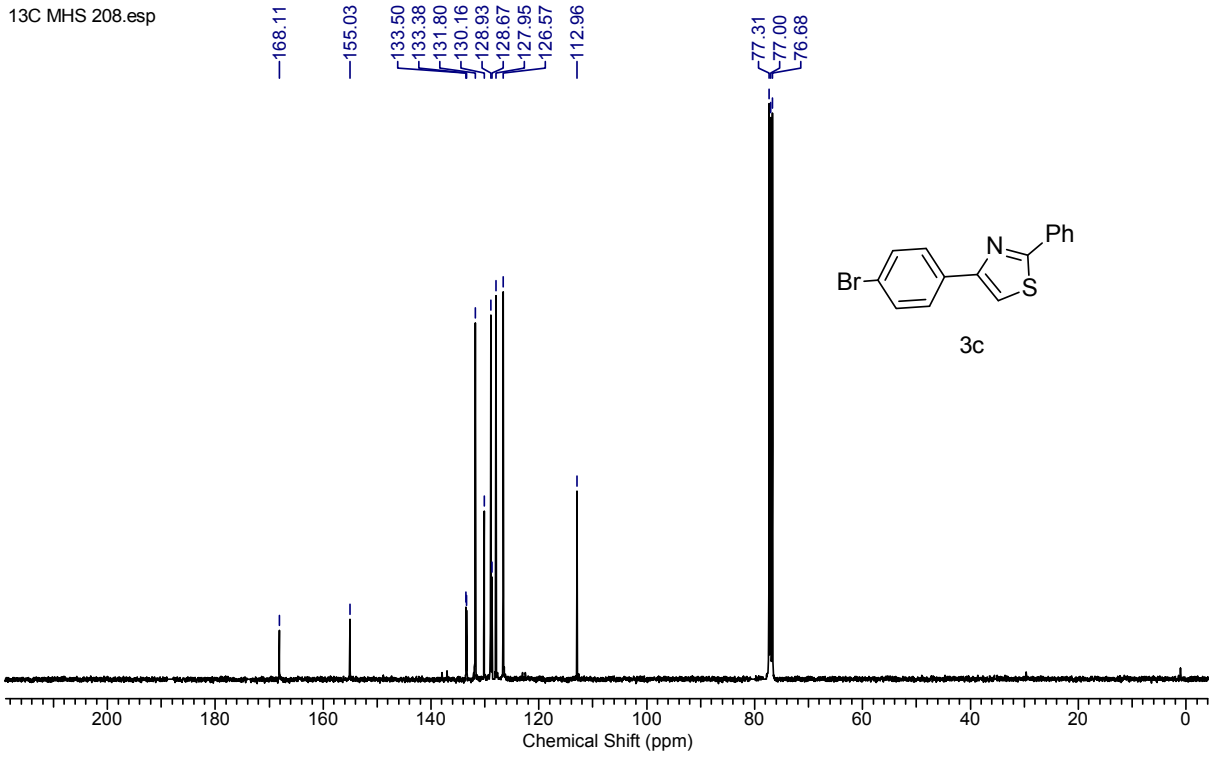
^{1}H NMR spectrum for compound **3b** ($CDCl_3$, 300 MHz)



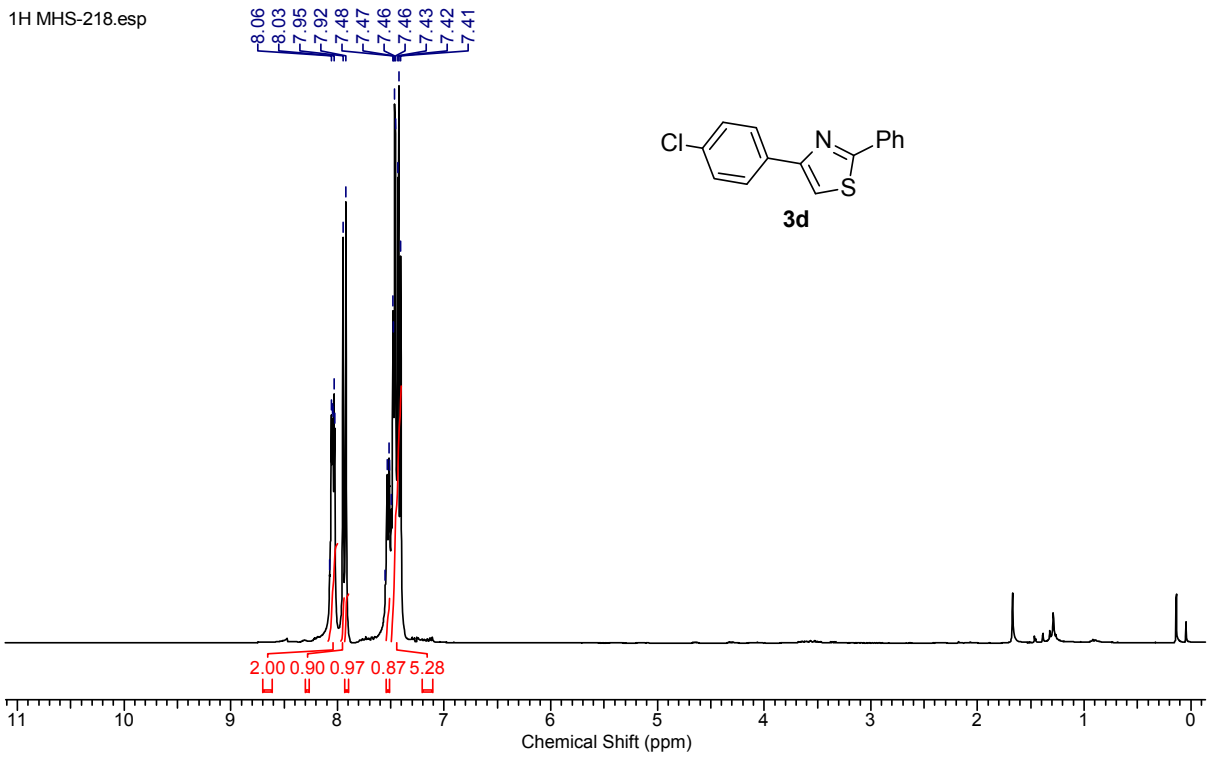
^{1}H NMR spectrum for compound **3c** ($CDCl_3$, 400 MHz)



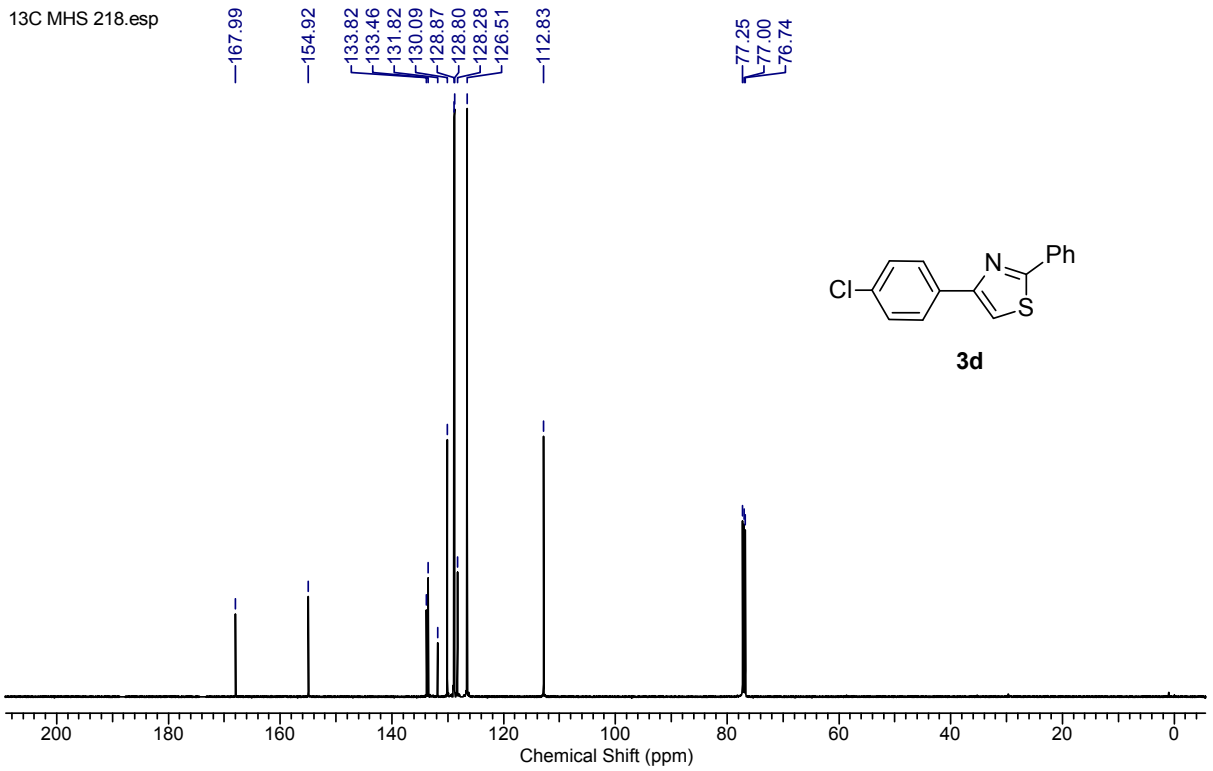
^{13}C NMR spectrum for compound **3c** ($CDCl_3$, 100 MHz)



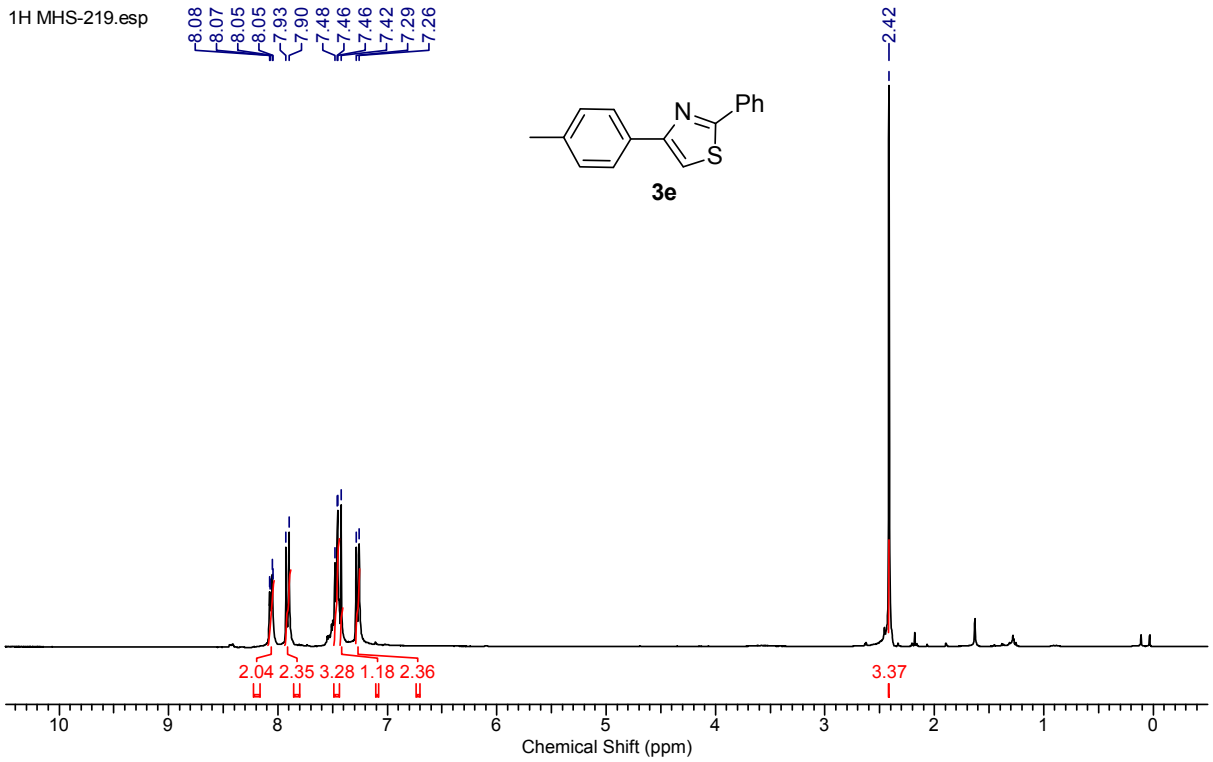
^{1}H NMR spectrum for compound **3d** ($CDCl_3$, 300 MHz)



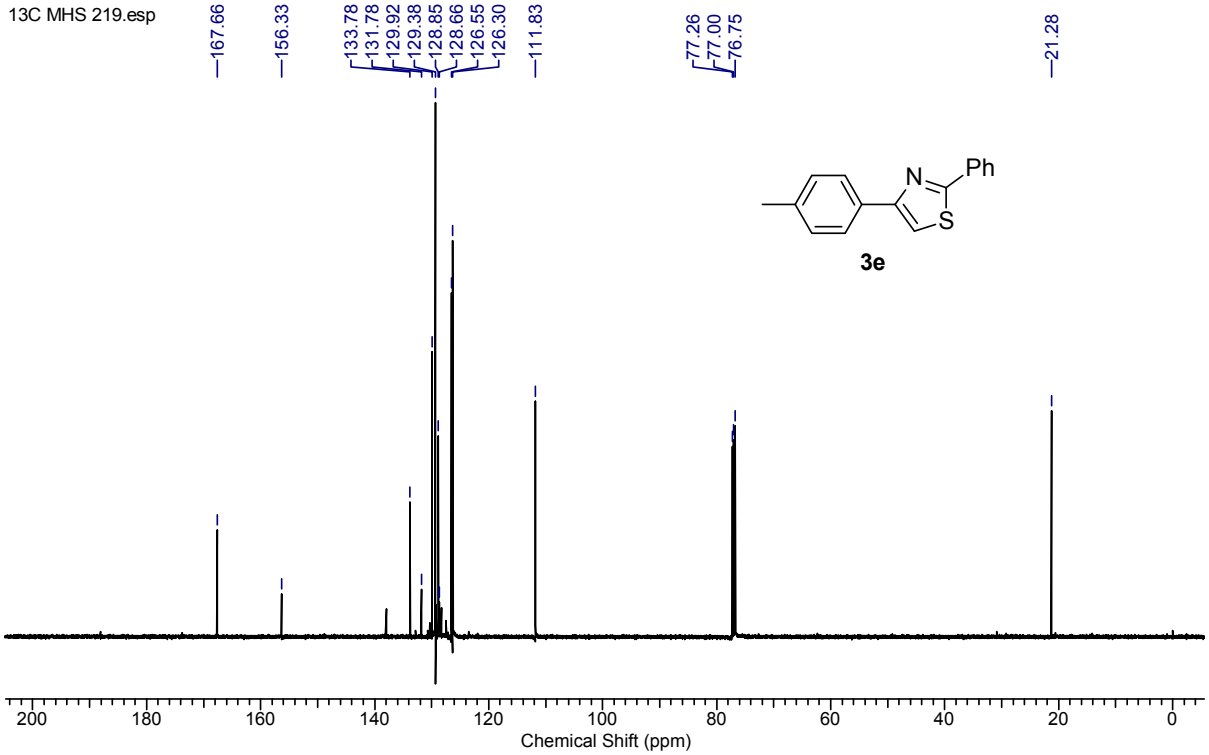
^{13}C NMR spectrum for compound **3d** ($CDCl_3$, 100 MHz)



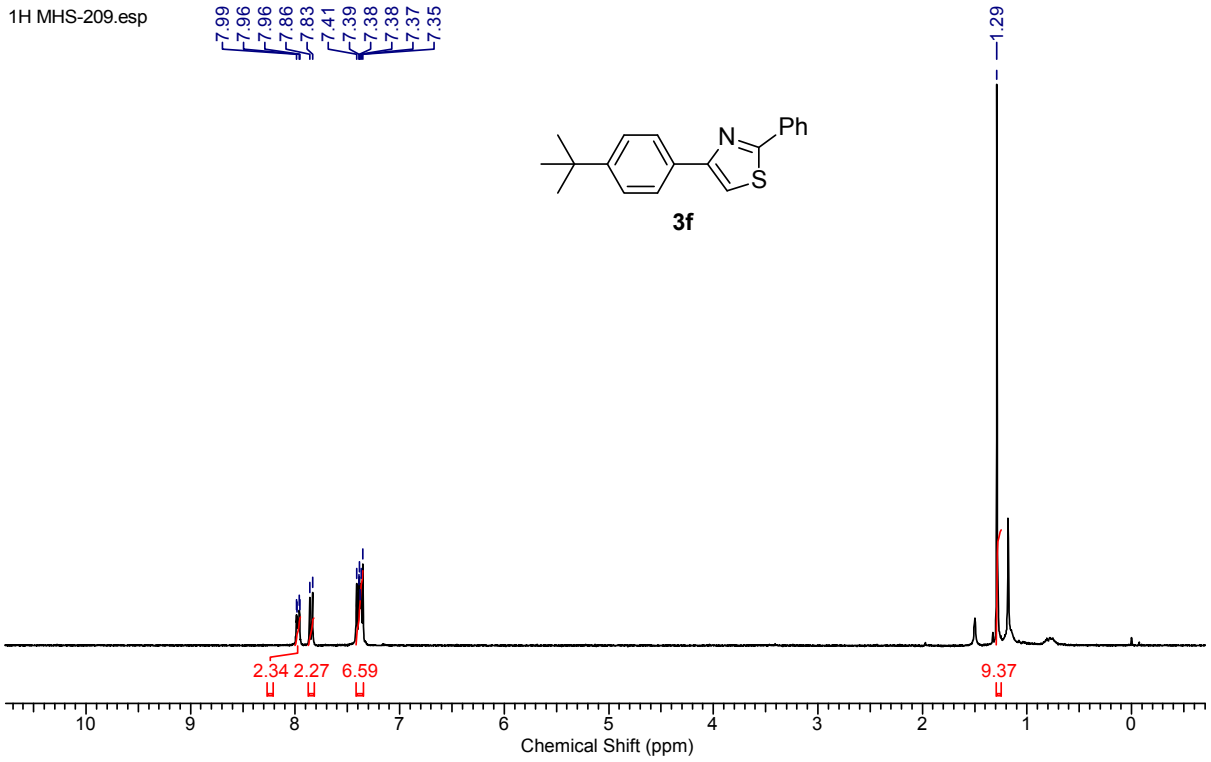
^{1}H NMR spectrum for compound **3e** ($CDCl_3$, 300 MHz)



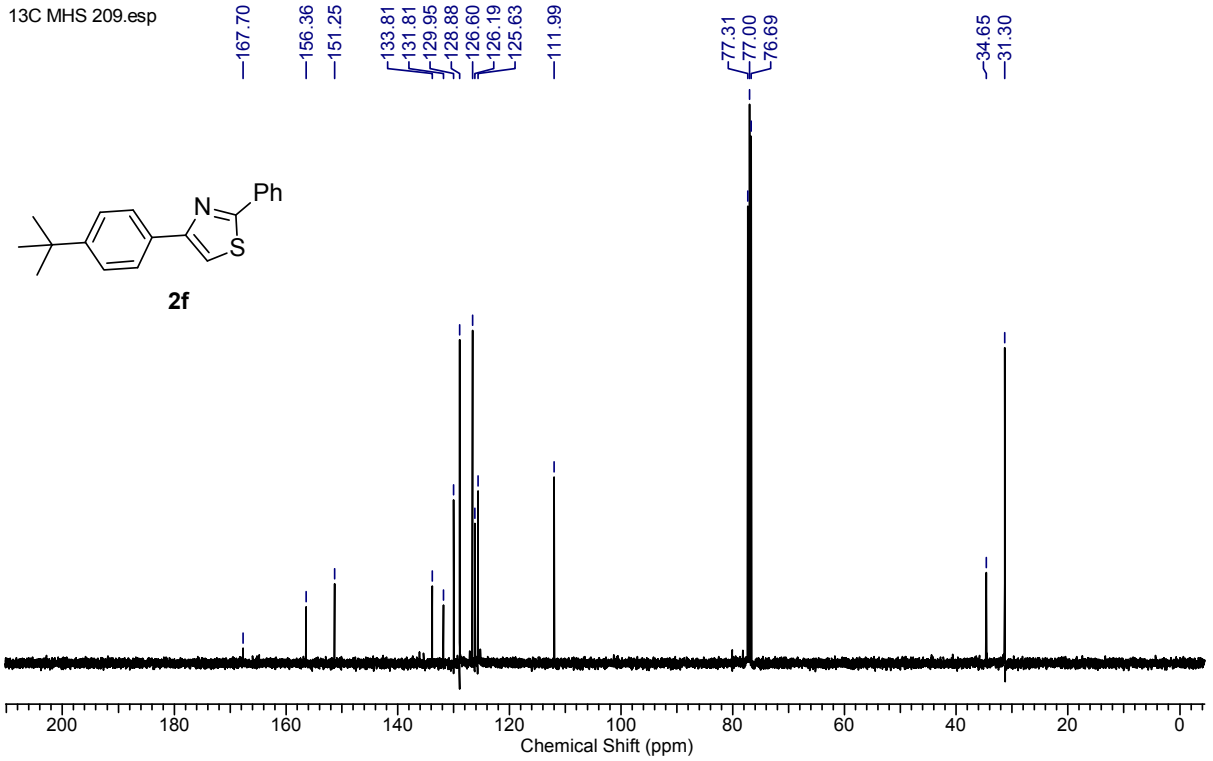
^{13}C NMR spectrum for compound **3e** ($CDCl_3$, 125 MHz)



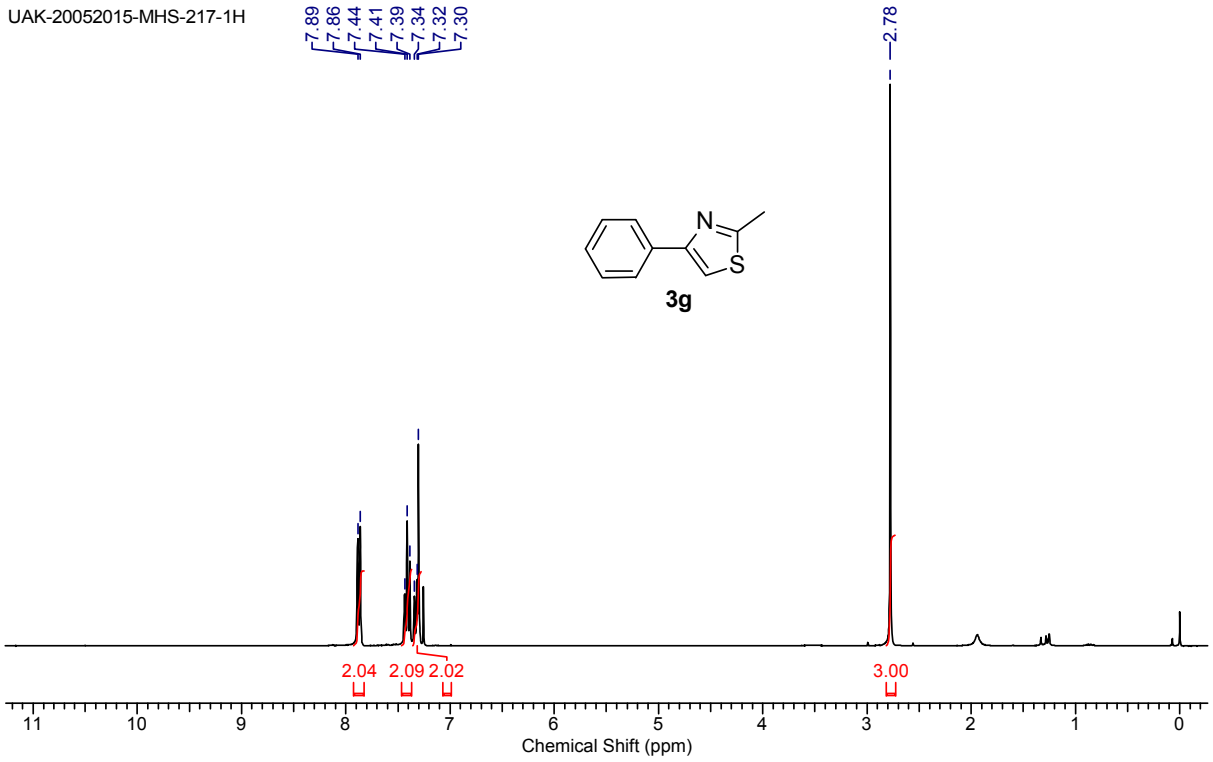
^{1}H NMR spectrum for compound **3f** ($CDCl_3$, 300 MHz)



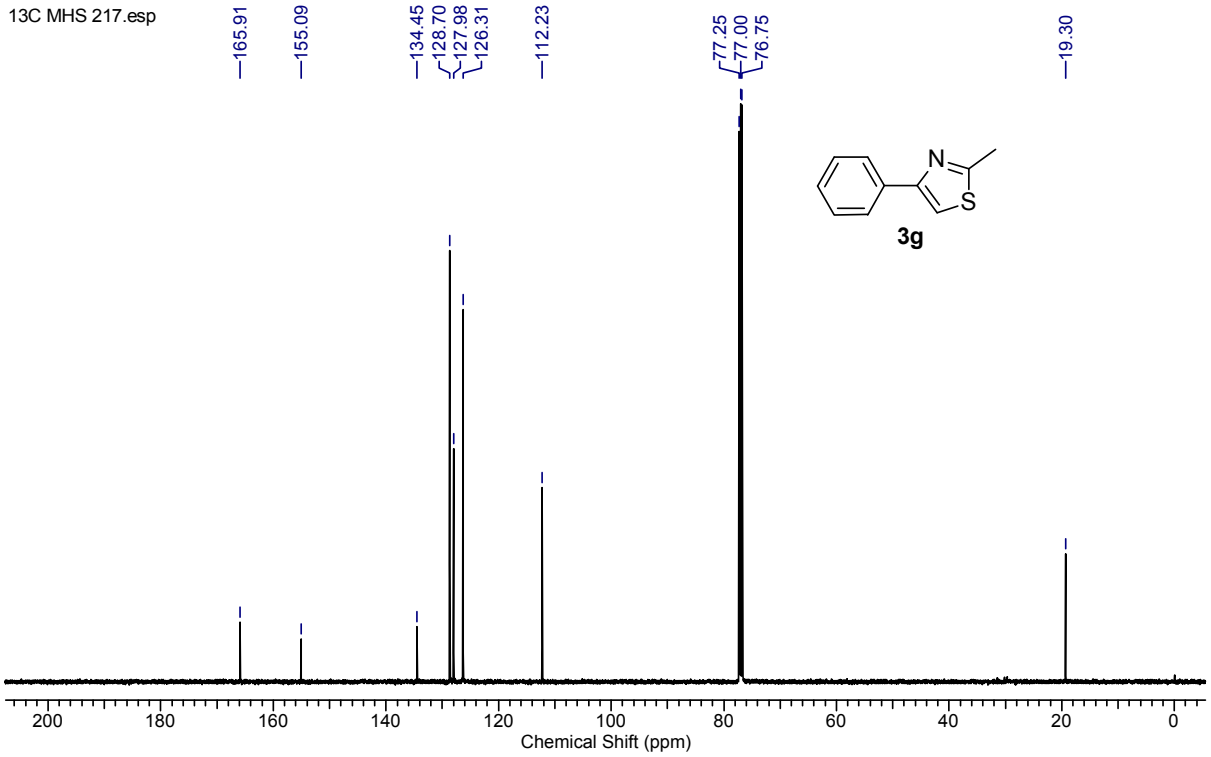
^{13}C NMR spectrum for compound **3f** ($CDCl_3$, 125 MHz)



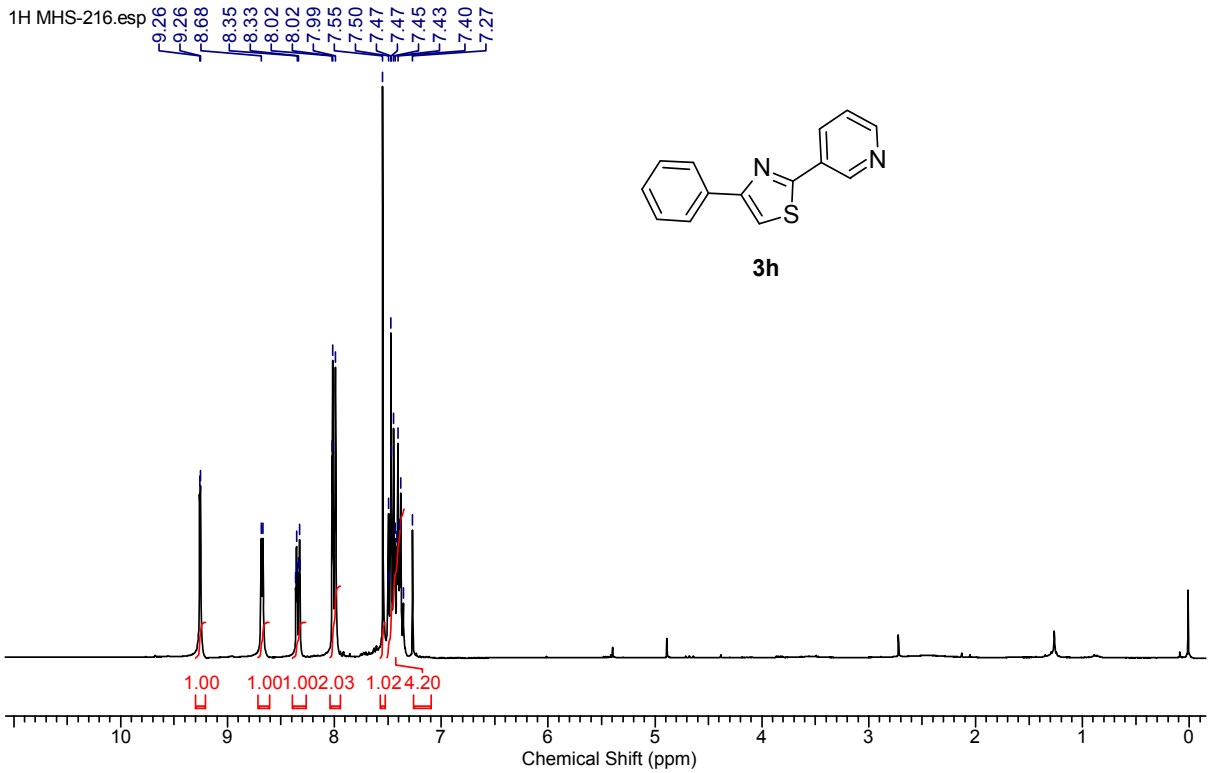
^{1}H NMR spectrum for compound **3g** ($CDCl_3$, 300 MHz)



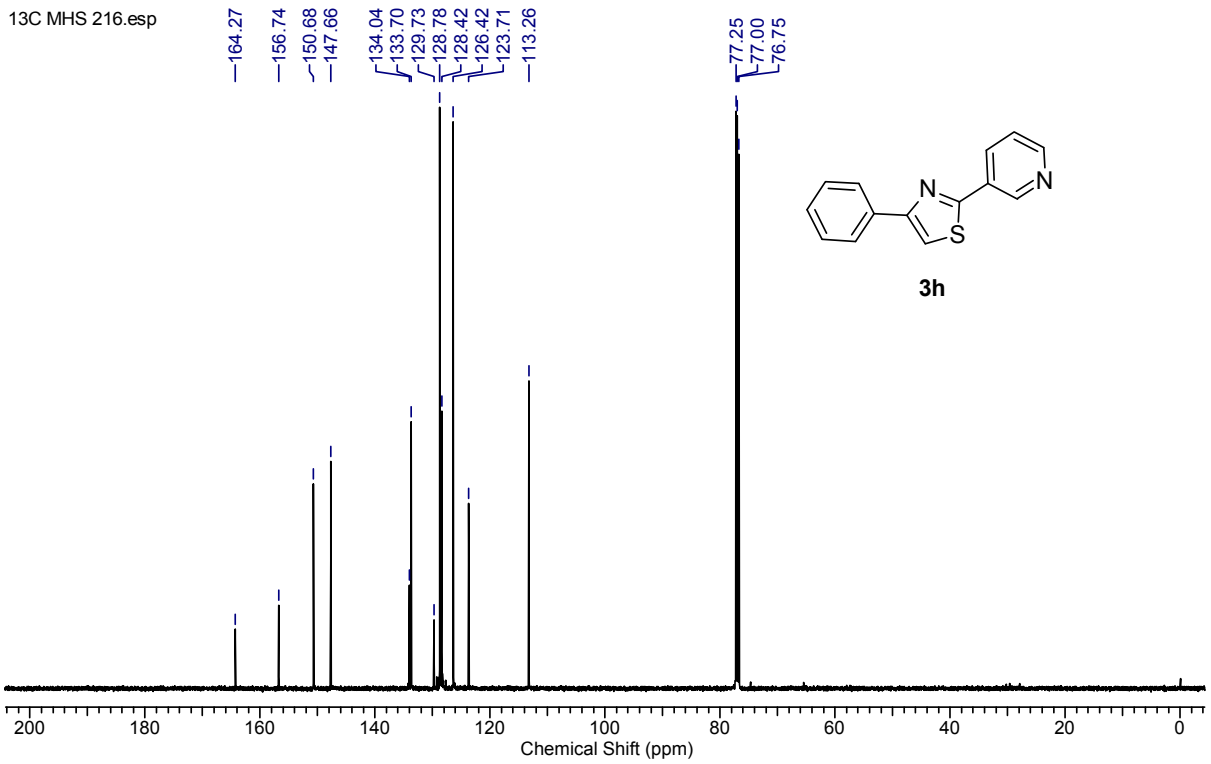
^{13}C NMR spectrum for compound **3g** ($CDCl_3$, 125 MHz)



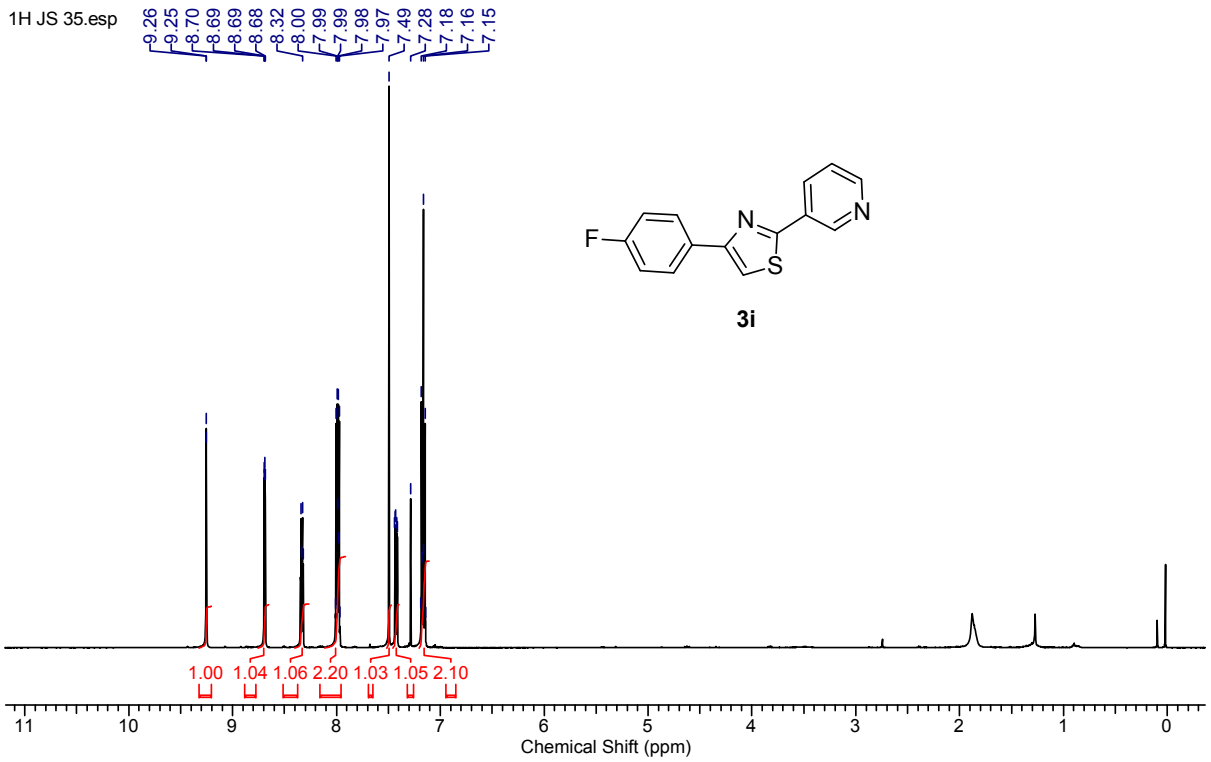
^{1}H NMR spectrum for compound **3h** ($CDCl_3$, 300 MHz)



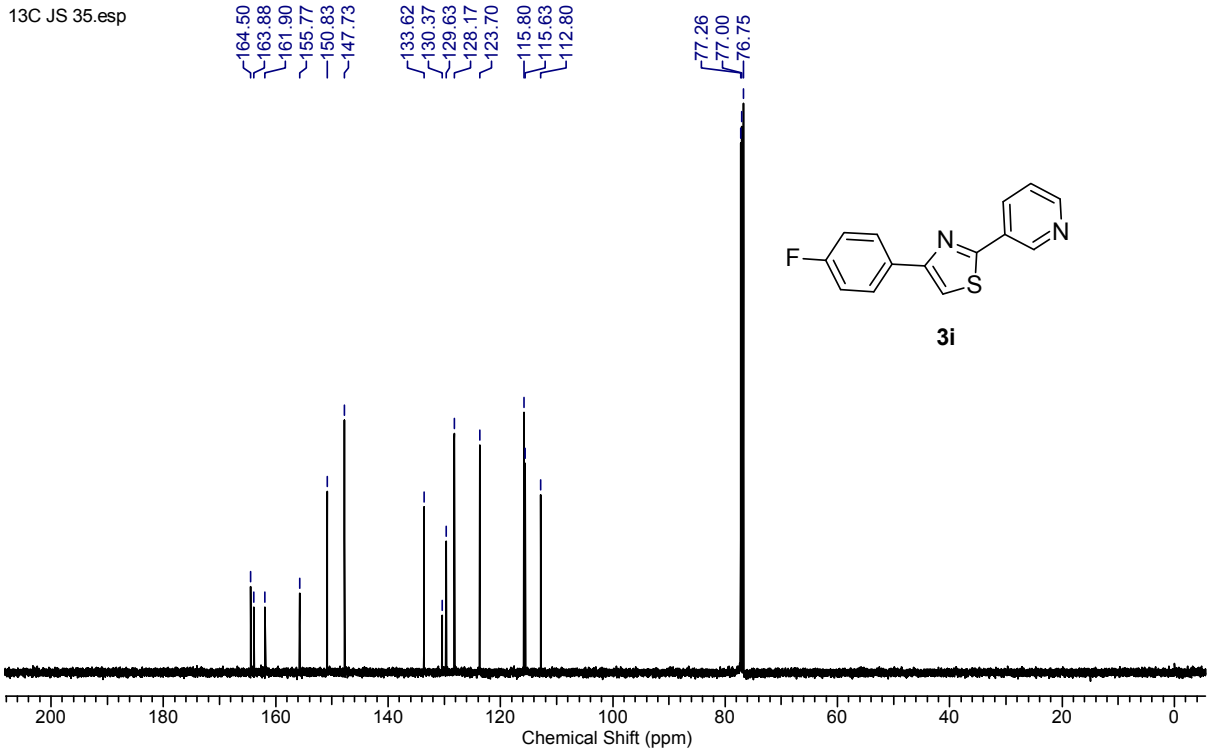
^{13}C NMR spectrum for compound **3h** ($CDCl_3$, 125 MHz)



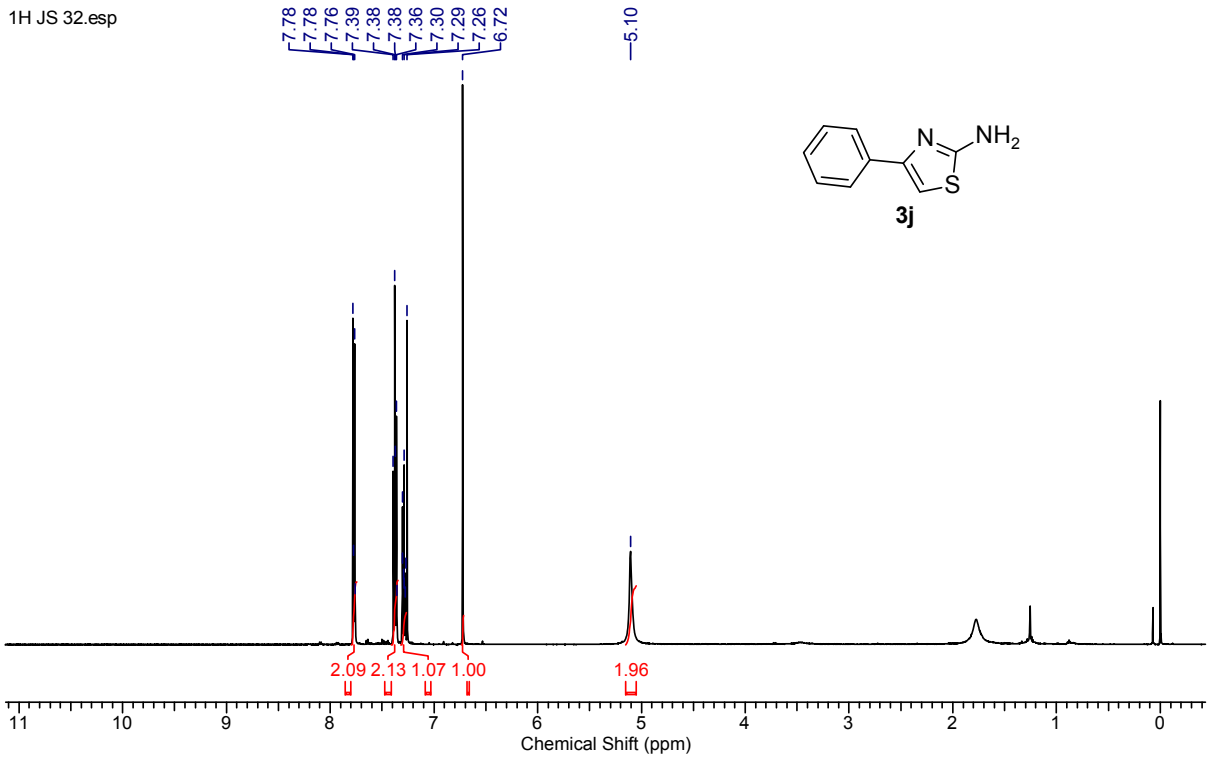
^{1}H NMR spectrum for compound **3i** ($CDCl_3$, 500 MHz)



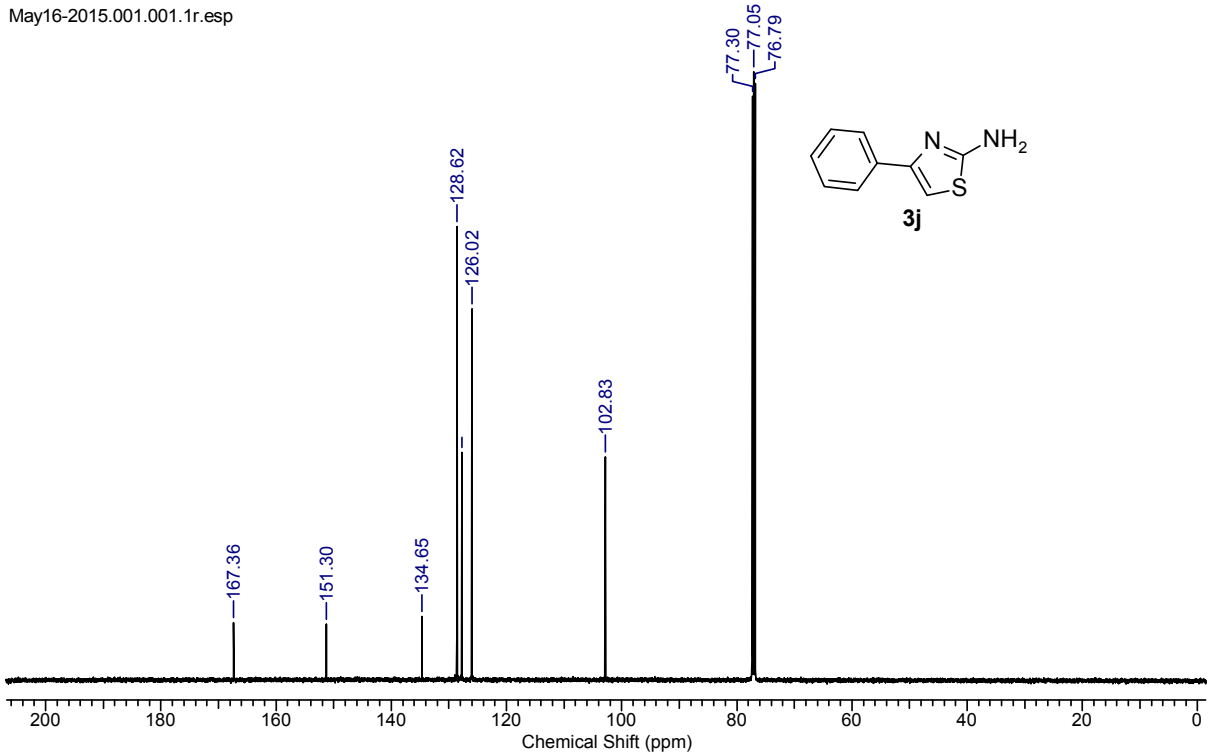
^{13}C NMR spectrum for compound **3i** ($CDCl_3$, 125 MHz)



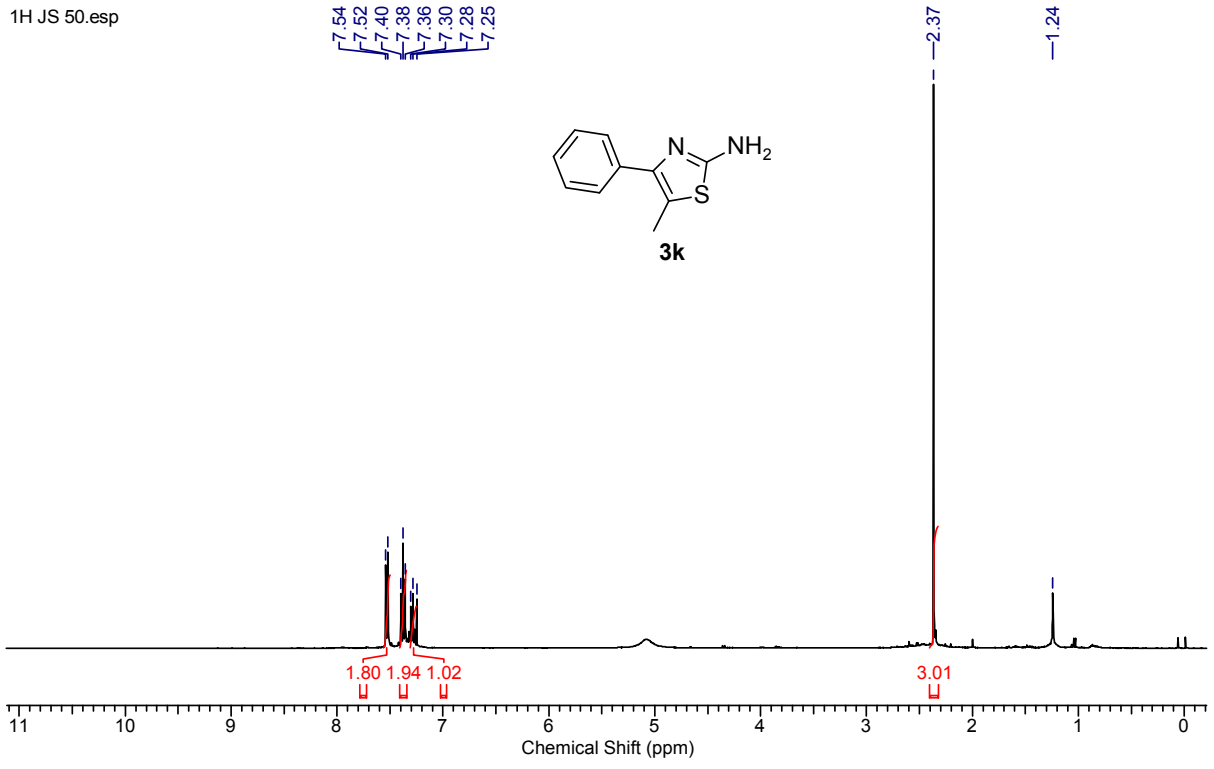
^{1}H NMR spectrum for compound **3j** ($CDCl_3$, 500 MHz)



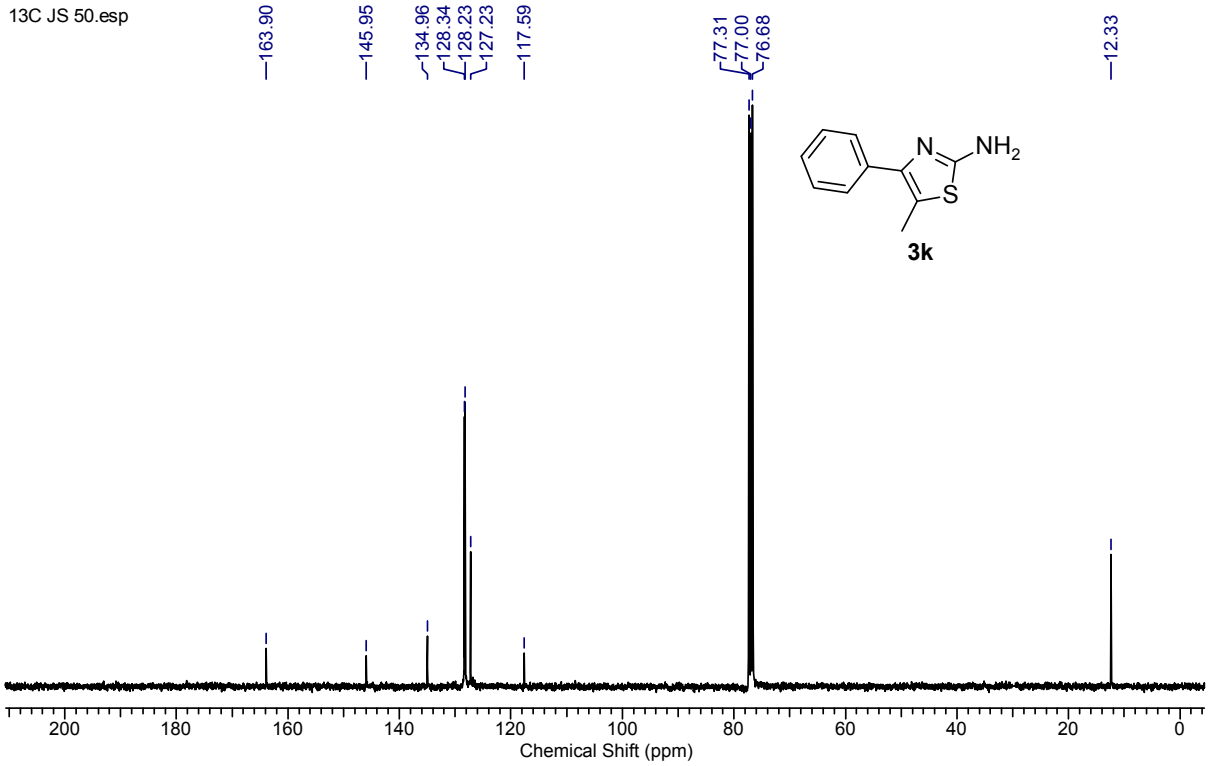
^{13}C NMR spectrum for compound **3j** ($CDCl_3$, 125 MHz)



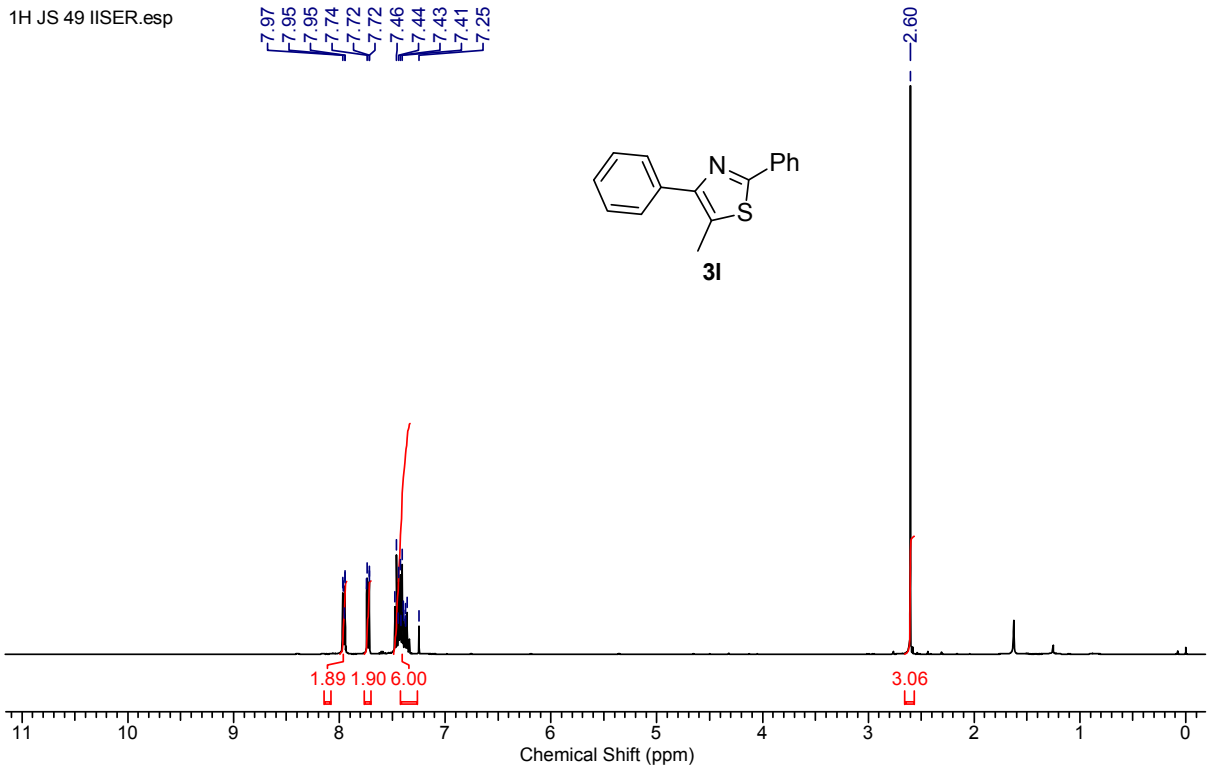
^{1}H NMR spectrum for compound **3k** ($CDCl_3$, 400 MHz)



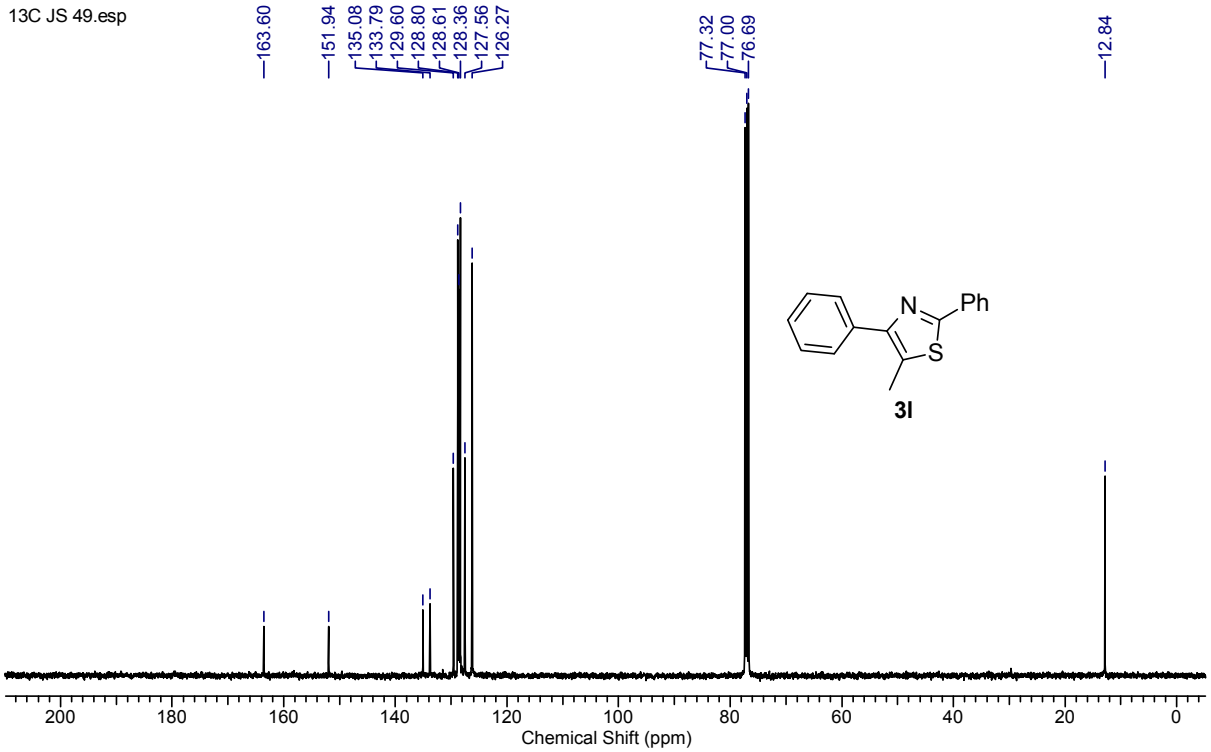
^{13}C NMR spectrum for compound **3k** ($CDCl_3$, 100 MHz)



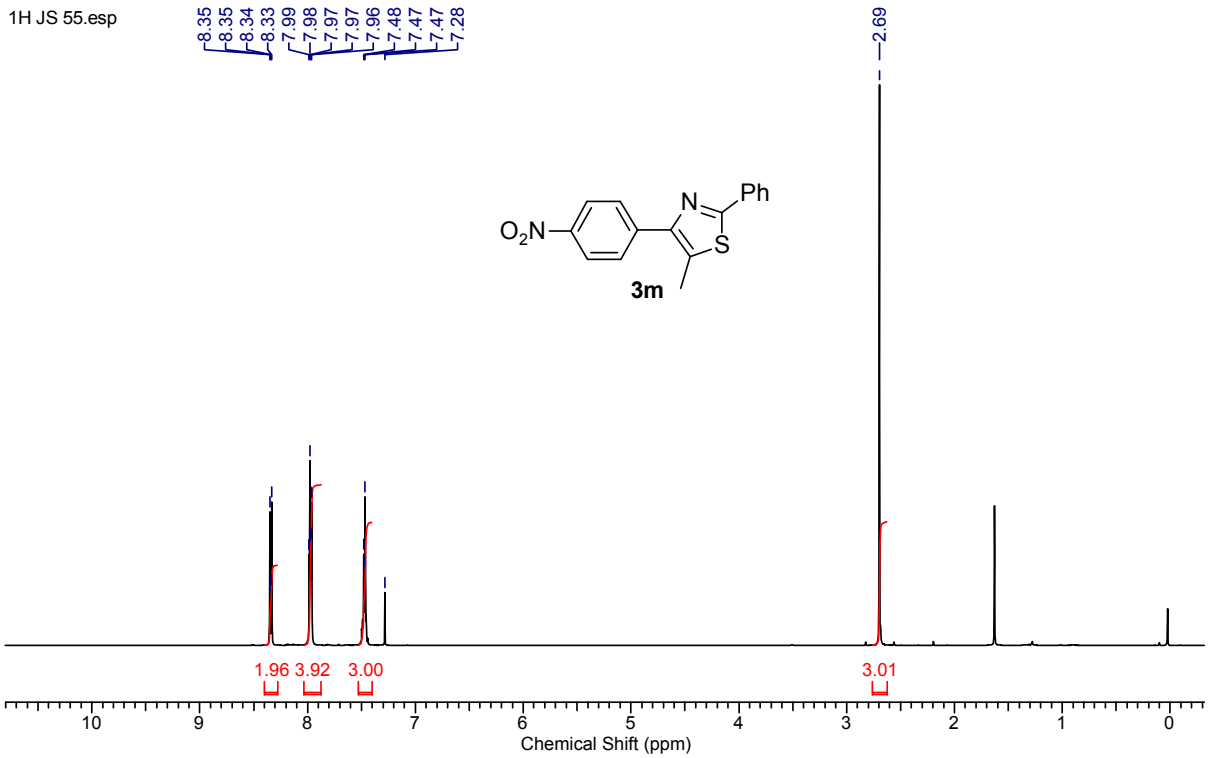
^{1}H NMR spectrum for compound **3l** ($CDCl_3$, 400 MHz)



^{13}C NMR spectrum for compound **3l** ($CDCl_3$, 100 MHz)



^{1}H NMR spectrum for compound **3m** ($CDCl_3$, 500 MHz)



^{13}C NMR spectrum for compound **3m** ($CDCl_3$, 125 MHz)