Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

A Unified Approach to Pyrrole-Embedded Aza-Heterocyclic Scaffolds Based on RCM/Isomerization/Cyclization Cascade Catalyzed by Ru/BH Binary Catalyst System

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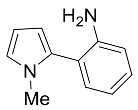
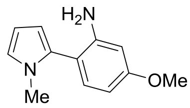
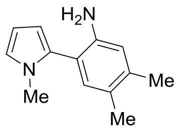
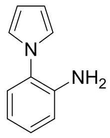
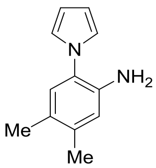
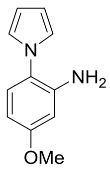
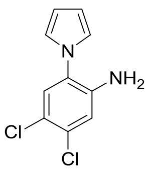
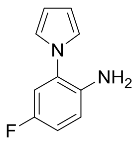
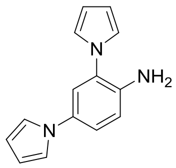
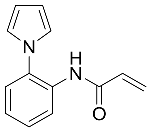
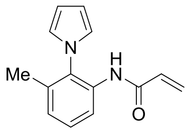
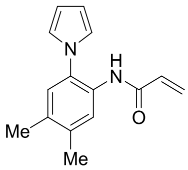
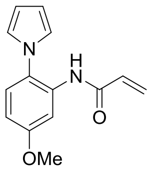
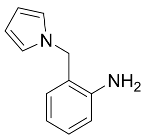
The scaffold building agents (SBA) **12**, **18, 19** and **24** were commercially available while others prepared by literature known procedures. The details are given below in tabular form.

SBA No.	SBA	Reference
12a		*J.Org. Chem.*, 2009, **74**, 9517–9520 *Bioorg. Med. Chem. Lett*., 2003, **13**, 1183–1188
12e		*Chem. Eur. J.*, 2015, **21**, 975–976
12f		*Chem. Eur. J.*, 2015, **21**, 975–976 *Chem. Eur. J.*, 2015, **21**, 3580–3584
18a		*Chem. Eur. J.*, 2015, **21**, 975–976
18c		*Chem. Eur. J.*, 2015, **21**, 975–976
18d		*Chem. Eur. J.*, 2015, **21**, 975–976 *Chem. Eur. J.*, 2015, **21**, 3580–3584
18f		*J.Org. Chem.*, 2010, **75**, 3371–3380
18g		*Eur. J. Org. Chem*., 2011, 6998–7010 *Bioorg. Med. Chem. Lett*., 2014, **24**, 4110–4113.

18i		*Eur. J. Org. Chem.*, 2011, 6998–7010
19a		*Tetrahedron Lett*. 2009, **50**, 5884–5887
19b		*Tetrahedron Lett*. 2009, **50**, 5884–5887
19c		*Tetrahedron Lett*. 2009, **50,** 5884–5887
19d		*Tetrahedron Lett*. 2009, **50**, 5884–5887
24		*Bioorg. Med. Chem. Lett*. 2007, **17**, 5796–5800

1 Experimental Section

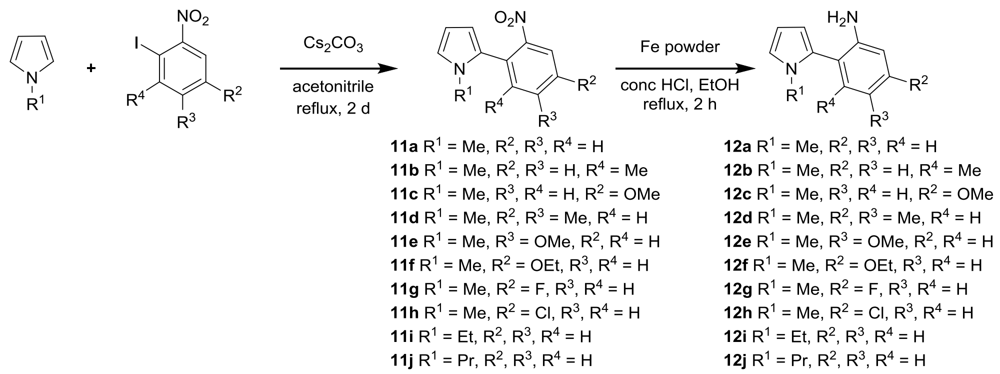
1.1 General Information:

Unless otherwise specified, all reactions were carried out in oven dried vials or reaction vessels with magnetic stirring under argon atmosphere. Dried solvents and liquid reagents were transferred by oven-dried syringes or hypodermic syringe cooled to ambient temperature in a desiccators. All experiments were monitored by analytical thin layer chromatography (TLC). TLC was performed on pre-coated silica gel plates. After elution, plate was visualized under UV illumination at 254 nm for UV active materials. Further visualization was achieved by staining $KMnO_4$ or anisaldehyde and charring on a hot plate. Solvents were removed in vacuo and heated with a water bath at 35 °C. Silica gel finer than 200 mesh was used for flash column chromatography. Columns were packed as slurry of silica gel in hexane and equilibrated with the appropriate solvent mixture prior to use. The compounds were loaded neat or as a concentrated solution using the appropriate solvent system. The elution was assisted by applying pressure with an air pump. Melting points are uncorrected and recorded using digital Buchi Melting Point Apparatus B-540. The ^{1}H NMR spectra and ^{13}C NMR spectra were recorded on Bruker AV, 200/400/500, JEOL 400 MHz spectrometers in appropriate solvents using TMS as an internal standard or the solvent signals as secondary standards and the chemical shifts are shown in δ scales. Multiplicities of ^{1}H NMR signals are designated as s (singlet), brs (broad singlet), d (doublet), dd (doublet of doublet), t (triplet), m (multiplet)… etc. HRMS (ESI) data were recorded on a Thermo Scientific Q-Exactive, Accela 1250 pump. The Ru-catalysts were procured from Sigma-Aldrich. The Brønsted acid catalysts were prepared following literature known procedures.[1] In this section, the characterization data for only new compounds is given.

1.2 General Procedure for the Synthesis of 2-(1-methyl-1H-pyrrol-2-yl)aniline 12:

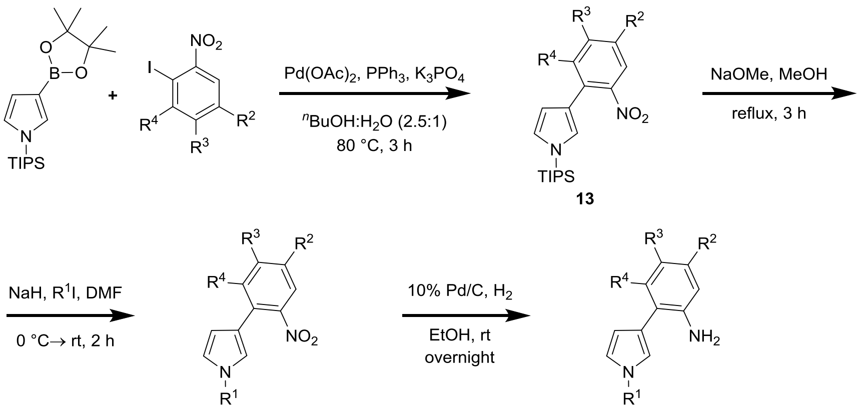
Compounds **12a**, **12c-d** and **12g** are literature known,[2] while substrates **12b**, **12e-f** and **12h-j** were prepared as described below.

A solution of 1-methyl-2-(2-nitrophenyl)-1*H*-pyrroles [**11a-j**, 1.0 equiv.] and Fe powder (5.0 equiv.) in acidic ethanol (1:4 aq. HCl/EtOH,) was heated at reflux under nitrogen atmosphere for 2 h. The solution was cooled down to room temperature and then poured into ice. The pH was made basic (pH 8) by the addition of 10% aqueous $NaHCO_3$. The EtOAc (25 mL) was added to the mixture and filtered through a bed of Celite. The organic layer was finally washed with water (25 mL) and then brine (25 mL) and dried over anhydrous Na_2SO_4. The organic layer was evaporated under reduced pressure. The residue obtained was purified on a silica gel column using pet. ether/EtOAc (9:1, v/v) as eluent to afford corresponding amino aromatics **12a-j** respectively.



1.3 Preparation of 2-(1H-pyrrol-3-yl)aniline 16:

The substrate **16a** is literature known[3] while the substrates **16b-f** was synthesized by the similar procedures.

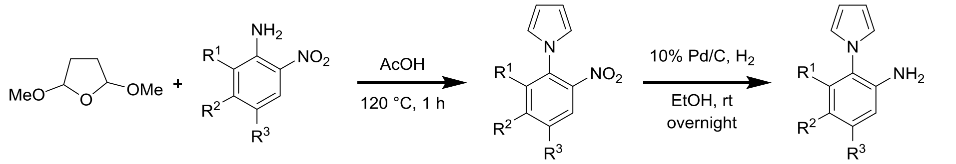


15a R^1 = Me, R^2, R^3, R^4 = H
15b R^1 = Me, R^2, R^3 = H, R^4 = OMe
15c R^1 = Me, R^2 = H, R^3, R^4 = Me
15d R^1 = Me, R^2 = Me, R^3, R^4 = H
15e R^1 = TIPS, R^2, R^3, R^4 = H
15f R^1 = Bn, R^2, R^3, R^4 = H

16a R^1 = Me, R^2, R^3, R^4 = H
16b R^1 = Me, R^2, R^3 = H, R^4 = OMe
16c R^1 = Me, R^2 = H, R^3, R^4 = Me
16d R^1 = Me, R^2 = Me, R^3, R^4 = H
16e R^1 = TIPS, R^2, R^3, R^4 = H
16f R^1 = Bn, R^2, R^3, R^4 = H

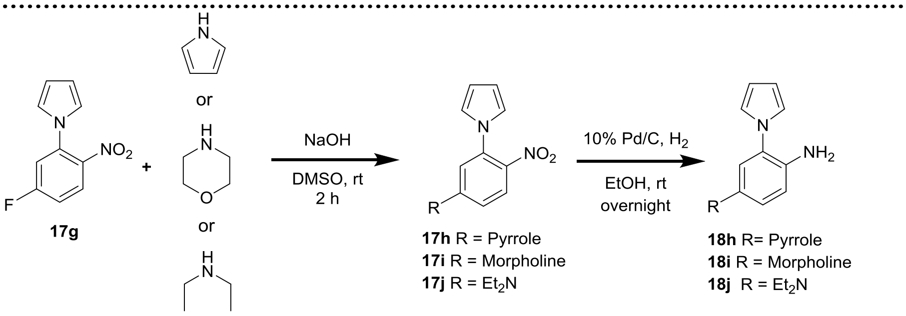
1.4 Preparation of 2-(1H-pyrrol-1-yl)aniline 18:

The amino aromatics **18a-g** were reported in literature,[4] while the substrates **18h-j** were synthesized by the similar procedures.



17a R^1, R^2, R^3 = H
17b R^1 = Me R^2, R^3 = H
17c R^1 = H, R^2, R^3 = Me
17d R^1, R^2 = H, R^3 = OMe
17e R^1, R^2 = H, R^3 = OEt
17f R^1, R^3 = Cl, R^2 = H
17g R^1, R^3 = H, R^2 = F

18a R^1, R^2, R^3 = H
18b R^1 = Me R^2, R^3 = H
18c R^1 = H, R^2, R^3 = Me
18d R^1, R^2 = H, R^3 = OMe
18e R^1, R^2 = H, R^3 = OEt
18f R^1, R^3 = Cl, R^2 = H
18g R^1, R^3 = H, R^2 = F



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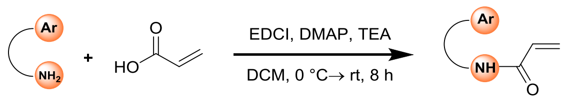
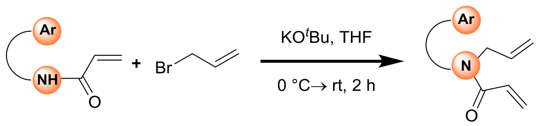


12/16/18 **19/20/21**

To a solution of amino aromatics **12/16/18** (10 mmol) and acrylic acids (12 mmol) in 20 mL of DCM was added EDCI (12 mmol) and DMAP (1 mmol). The reaction mixture was cooled to 0 °C and triethyl amine (12 mmol) was added. The reaction mixture was stirred at room temperature for 16 h. The mixture was diluted with 1:1 mixture of DCM and water. The DCM layer was washed with water (2×10 mL) and brine (1×10 mL). The combined organic layer was dried over anhydrous Na_2SO_4, evaporated under reduced pressure and to obtain the crude products **19/20/21** which was subjected to purify by column chromatography.

1.6 General method for the preparation of 1/3/5.



19/20/21 **1/3/5**

To a solution of acrylamides **19/20/21** (5 mmol) in 10 mL of dry THF was cooled to 0 °C followed by addition of KO^{t}Bu (6 mmol) and allyl bromide (6 mmol) in a dropwise manner. The reaction mixture was stirred at room temperature for 2-4 h and the progress of was monitored by TLC. The mixture was diluted with 1:1 mixture of DCM and water. The DCM layer was washed with water (2×10 mL) and brine (1×10 mL). The combined organic layer was dried over anhydrous Na_2SO_4, evaporated under reduced pressure to obtain the crude compounds **1/3/5** which were subjected to column chromatography for further purification.

1.7 General procedure for the RCM/Isomerisation/Pictet-Spengler cascade reaction

To a flame-dried screw-capped vial equipped with magnetic stir bar, were added substrate **1/3/5** (0.15 mmol), Hoveyda-Grubbs II (4.52 mg, 0.0075 mmol) and phosphoric acid **B-H** (5.22 mg, 0.015 mmol) in toluene (2 mL) under nitrogen atmosphere. The solution was heated to 80 °C (for specified time) and after the reaction was complete (monitored by TLC), the solvent was removed to obtain the residue which was purified by silica gel column chromatography using pet. ether/EtOAc as an eluent to afford product **2/4/6** respectively.

2 Characterization data

3-Methyl-2-(1-methyl-1H-pyrrol-2-yl)aniline (**12b**): Yellowish oil, 73% yield; $\boldsymbol{R_f}$ = 0.4 (pet. ether/EtOAc = 95/05); **^{1}H NMR (500 MHz, CDCl$_3$)** δ = 7.10 (dt, *J* = 2.3, 7.6 Hz, 1 H), 6.85 - 6.76 (m, 1 H), 6.70 (d, *J* = 7.8 Hz, 1 H), 6.68 - 6.63 (m, 1 H), 6.29 - 6.21 (m, 1 H), 6.08 (dd, *J* = 1.8, 3.7 Hz, 1 H), 3.62 (br. s, , 2 H), 3.38 (s, 3 H), 2.05 (s, 3 H); **^{13}C NMR (125 MHz, CDCl$_3$)** δ = 146.73, 140.01, 128.99, 128.77, 122.01, 119.39, 118.63, 112.16, 108.30, 107.56, 33.55, 20.17; **HRMS (ESI)** calcd for $C_{12}H_{15}N_2$ (M^++ H) 187.1230, found 187.1229.

4-Methoxy-2-(1-methyl-1H-pyrrol-2-yl)aniline (**12e**): Brownish viscous liquid, 78% yield; $\boldsymbol{R_f}$ = 0.42 (pet. ether/EtOAc = 95/05); **^{1}H NMR (500 MHz, CDCl$_3$)** δ = 7.04 (d, *J* = 8.2 Hz, 1 H), 6.75 - 6.70 (m, 1 H), 6.39 - 6.37(m, 1 H), 6.33 (d, *J* = 2.7 Hz, 1 H), 6.25 - 6.21 (m, 1 H), 6.15 (dd, *J* = 1.8, 3.2 Hz, 1 H), 3.81 (s, 3 H), 3.48 (s, 3 H); **^{13}C NMR (125 MHz, CDCl$_3$)** δ = 160.53, 147.00, 132.56, 130.23, 122.30, 111.63, 108.65, 107.43, 103.57, 100.37, 55.11, 34.07; **HRMS (ESI)** calcd for $C_{12}H_{15}ON_2$ (M^++ H) 203.1179, found 203.1178.

5-Ethoxy-2-(1-methyl-1H-pyrrol-2-yl)aniline (**12f**): Brownish viscous liquid, 83% yield; $\boldsymbol{R_f}$ = 0.38 (pet. ether/EtOAc = 95/05); **^{1}H NMR (500 MHz, CDCl$_3$)** δ = 7.03 - 6.99 (m, 1 H), 6.77 - 6.71 (m, 1 H), 6.39 - 6.27 (m, 2 H), 6.20 - 6.15 (m, 1 H), 6.14 (dd, *J* = 1.8, 3.5 Hz, 1 H), 4.03 (q, *J* = 7.0 Hz, 2 H), 3.77 (br. s, 2 H), 3.47 (s, 3 H), 1.42 (t, *J* = 7.0 Hz, 3 H); **^{13}C NMR (125 MHz, CDCl$_3$)** δ = 159.91, 146.96, 132.54, 130.32, 122.28, 111.52, 108.63, 107.42, 104.18, 100.94, 63.24, 34.08, 14.87; **HRMS (ESI)** calcd for $C_{13}H_{17}ON_2$ (M^++ H) 217.1335, found 217.1335.

5-Chloro-2-(1-methyl-1H-pyrrol-2-yl)aniline (**12h**): Brown solid, 75% yield; mp = 85-87 °C; $\boldsymbol{R_f}$ = 0.41 (pet. ether/EtOAc = 95/05); **^{1}H NMR (500 MHz, $CDCl_3$)** δ = 7.14 - 7.10 (m, 2 H), 6.75 - 6.70 (m, 1 H), 6.69 (d, *J* = 8.7 Hz, 1 H), 6.23 - 6.18 (m, 1 H), 6.18 (dd, *J* = 1.6, 3.4 Hz, 1 H), 3.79 (br. s., 2 H), 3.50 (s, 3 H); **^{13}C NMR (125 MHz, $CDCl_3$)** δ = 144.38, 131.06, 129.14, 128.81, 123.0, 122.27, 120.04, 116.04, 109.06, 107.81, 34.22; **HRMS (ESI)** calcd for $C_{11}H_{12}N_2Cl$ (M^++ H) 207.0684, found 207.0684.

2-(1-Ethyl-1H-pyrrol-2-yl)aniline (**12i**): Yellowish oil, 73% yield; $\boldsymbol{R_f}$ = 0.43 (pet. ether/EtOAc = 95/05); **^{1}H NMR (500 MHz, $CDCl_3$)** δ = 7.27 - 7.12 (m, 2 H), 6.84 - 6.75 (m, 3 H), 6.26 (t, *J* = 3.1 Hz, 1 H), 6.17 - 6.16 (m, 1 H), 3.79 (q, *J* = 7.2 Hz, 4 H), 1.26 (t, *J* = 7.3 Hz, 3 H); **^{13}C NMR (125 MHz, $CDCl_3$)** δ = 146.19, 132.06, 130.02, 129.42, 120.71, 119.18, 118.17, 115.28, 108.90, 108.11, 41.97, 16.99; **HRMS (ESI)** calcd for $C_{12}H_{15}N_2$ (M^++ H) 187.1330, found 187.1330.

2-(1-Propyl-1H-pyrrol-2-yl)aniline (**12j**): Brownish liquid, 83% yield; $\boldsymbol{R_f}$ = 0.38 (pet. ether/EtOAc = 95/05); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.14 - 7.10 (m, 2 H), 6.82 - 6.74 (m, 3 H), 6.19 (d, *J* = 2.7 Hz, 2 H), 3.78 - 3.69 (m, 4 H), 1.61 (q, *J* = 7.3 Hz, 2 H), 0.79 (t, *J* = 7.3 Hz, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 145.8, 131.8, 130.0, 129.0, 121.2, 118.9, 117.8, 115.0, 108.5, 107.5, 48.6, 24.6, 11.2; **HRMS (ESI)** calcd for $C_{13}H_{17}N_2$ (M^++ H) 201.1386, found 201.1386.

2-(1-Methyl-1H-pyrrol-3-yl)aniline (**16a**): Brownish viscous liquid, 67% yield; $\boldsymbol{R_f}$ = 0.38 (pet. ether/EtOAc = 95/05); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.25 - 7.20 (m, 1 H), 7.10 - 7.06 (m, 1 H), 6.83 - 6.75 (m, 4 H), 6.75 - 6.67 (m, 1 H), 6.37 - 6.35 (m, 1 H), 3.71 (br. s, 2 H), 3.68 (s, 3 H); **NMR (100 MHz, $CDCl_3$)** δ = 143.55, 129.57, 126.87, 122.17, 120.02, 118.49, 115.42, 108.38, 36.18; **HRMS (ESI)** calcd for $C_{11}H_{13}N_2$ (M^++ H) 173.1073, found 173.1073.

5-Methoxy-2-(1-methyl-1H-pyrrol-3-yl)aniline (**16b**): Yellowish oil, 84% yield; $\boldsymbol{R_f}$ = 0.33 (pet. ether/EtOAc = 95/05); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.16 (d, *J* = 8.2 Hz, 1 H), 6.75 (t, *J* = 2.02 Hz, 1 H), 6.67 (t, *J* = 2.4 Hz, 1 H), 6.39 - 6.29 (m, 3 H), 3.79 (s, 3 H), 3.71 (s, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 159.04, 144.76, 130.52, 122.11, 121.70, 119.77, 115.55, 108.46, 103.96, 101.02, 55.14, 36.21; **HRMS (ESI)** calcd for $C_{12}H_{13}ON_2$ (M^++ H) 203.1179, found 203.1179.

4,5-Dimethyl-2-(1-methyl-1H-pyrrol-3-yl)aniline (**16c**): Yellowish oil, 69% yield; $\boldsymbol{R_f}$ = 0.37 (pet. ether/EtOAc = 95/05); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.04 (s, 1 H), 6.81 (t, *J* = 2.0 Hz, 1 H), 6.70 - 6.65 (m, 1 H), 6.61 (s, 1 H), 6.36 - 6.34 (m, 1 H), 3.82 (br. s., 2 H), 3.72 (s, 3 H), 2.23 (d, *J* = 3.36 Hz, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 141.26, 135.06, 130.75, 126.34, 122.05, 119.95, 119.89, 117.17, 108.44, 36.17, 19.39, 18.65; **HRMS (ESI)** calcd for $C_{13}H_{17}N_2$ (M^++ H) 201.1388, found 201.1386.

6-Methyl-2-(1-methyl-1H-pyrrol-3-yl)aniline (**16d**): Brown oil, 78% yield; $\boldsymbol{R_f}$ = 0.41 (pet. ether/EtOAc = 95/05); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.10 (t, *J* = 7.8 Hz, 1 H), 6.80 - 6.79 (m, 1 H), 6.69 (d, *J* = 7.3 Hz, 1 H), 6.62 (d, *J* = 7.8 Hz, 1 H), 6.25 (t, *J* = 3.0 Hz, 1 H), 6.08 (dd, *J* = 1.8, 3.2 Hz, 1 H), 3.62 (br. s., 2 H), 3.38 (s, 3 H), 2.05 (s, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 146.73, 140.01, 128.99, 122.01, 119.40, 112.16, 108.30, 107.56, 33.55, 20.17; **HRMS (ESI)** calcd for $C_{12}H_{15}N_2$ (M^++ H) 187.1230, found 187.31.

2-(1-(Triisopropylsilyl)-1H-pyrrol-3-yl)aniline (**16e**): Brownish viscous liquid, 82% yield; $\boldsymbol{R_f}$ = 0.36 (pet. ether/EtOAc = 95/05); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.28 - 7.26 (m, 2 H), 7.12 (dt, *J* = 1.7, 7.6 Hz, 1 H), 6.97 – 6.96 (m, 1 H), 6.86 (t, *J* = 2.4 Hz, 1 H), 6.80 – 6.76 (m, 2 H), 6.53 (dd, *J* = 1.5, 2.7 Hz, 1 H), 3.95 (br. s., 2 H),1.51 – 1.45 (m, 3 H), 1.15 (d, *J* = 7.3 Hz, 18 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 143.61, 129.70, 126.90, 124.72, 123.84, 122.61, 122.33, 118.56, 115.47, 110.69, 17.84, 11.67; **HRMS (ESI)** calcd for $C_{19}H_{31}N_2Si$ (M^++ H) 207.0684, found 207.0684. 315.2251, found 315.2251.

2-(1-(Benzyl)-1H-pyrrol-3-yl)aniline (**16f**): Brownish viscous liquid, 74% yield; ***R*$_f$** = 0.43 (pet. ether/EtOAc = 95/05); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 7.37 - 7.32 (m, 3 H), 7.22 - 7.20 (m, 3 H), 7.07 (dt, *J* = 1.6, 7.6 Hz, 1 H), 6.92 (t, *J* = 2.0 Hz, 1 H), 6.79 - 6.77 (m, 3 H), 6.42 (dd, *J* = 1.8, 2.7 Hz, 1 H), 5.11 (s, 2 H), 3.99 (br. s., 1 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 143.55, 137.79, 129.62, 128.76, 127.76, 127.13, 126.96, 122.29, 121.70, 119.50, 118.60, 115.52, 108.75, 53.54; **HRMS (ESI)** calcd for $C_{17}H_{17}N_2$ (M^++ H) 249.1386, found 249.1387.

4-Morpholino-2-(1H-pyrrol-1-yl)aniline (**18h**): Brownish liquid, 79% yield; ***R*$_f$** = 0.32 (pet. ether/EtOAc = 95/05); **^{1}H NMR (400 MHz, CDCl$_3$)** δ = 6.87 – 6.78 (m, 5 H), 6.35 (t, *J* = 2.1 Hz, 2 H), 3.88 – 3.83 (m, 4 H), 3.50 (br. s., 2 H), 3.07 – 3.02 (m, 4 H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ = 144.26, 135.60, 128.18, 121.65, 117.36, 115.71, 109.34, 69.92, 50.72; **HRMS (ESI)** calcd for $C_{14}H_{18}ON_3$ (M^++ H) 244.1444, found 244.1431.

2,4-Di(1H-pyrrol-1-yl)aniline (**18i**): White solid, 84% yield; mp = 97-98 °C; ***R*$_f$** = 0.3 (pet. ether/EtOAc = 95/05); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 7.23 (dd, *J* = 2.2, 4.5 Hz, 2 H), 7.00 (t, *J* = 2.2 Hz, 2 H), 6.98 - 6.88 (m, 3 H), 6.39 (t, *J* = 2.1 Hz, 2 H), 6.33 (t, *J* = 2.1 Hz, 2 H), 3.76 (br. s., 2 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 139.92, 132.62, 127.70, 121.54, 121.19, 119.98, 119.52, 116.64, 109.79.; **HRMS (ESI)** calcd for $C_{14}H_{14}N_3$ (M^++ H) 224.1182, found 224.1181.

N,N-Diethyl-3-(1H-pyrrol-1-yl)benzene-1,4-diamine (**18j**): Brownish liquid, 76% yield; ***R*$_f$** = 0.4 (pet. ether/EtOAc = 95/05); **^{1}H NMR (400 MHz, CDCl$_3$)** δ = 6.89 - 6.86 (m, 2 H), 6.77 (d, *J* = 8.7 Hz, 1 H), 6.67 (dd, *J* = 2.7, 8.7 Hz, 1 H), 6.62 (d, *J* = 3.2 Hz, 1 H), 6.35 (t, *J* = 2.1 Hz, 2 H), 3.26 (q, *J* = 6.9 Hz, 4 H), 1.12 (t, 6 H); **NMR (100 MHz, CDCl$_3$)** δ = **^{13}C NMR (200 MHz, CDCl$_3$)** δ = 141.84, 132.18, 128.88, 121.76, 117.79, 114.74, 112.88, 109.03, 45.08, 12.45; **HRMS (ESI)** calcd for $C_{14}H_{20}N_3$ (M^++ H) 230.1652, found 230.1651.

N-(5-Ethoxy-2-(1H-pyrrol-1-yl)phenyl)acrylamide (**19e**): White solid, 62% yield; mp = 90-91 °C; ***R*$_f$** = 0.5 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.19 (br.

s., 1 H) 7.27 – 7.22 (d, *J*=8.59 Hz, 1 H) 7.17 (br. s, 1 H) 6.76 - 6.72 (m, 3 H) 6.39 (s, 2 H) 6.21 (m, 1 H) 6.02 (dd, *J*=16.86, 10.17 Hz, 1 H) 5.73 - 5.72 (m, 1 H) 4.10 (q, 2 H) 1.45 (t, *J*=6.95 Hz, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 163.40, 159.04, 134.84, 131.25, 127.77, 127.51, 122.42, 110.76, 110.26, 106.04, 63.90, 14.71; **HRMS (ESI)** calcd for $C_{15}H_{17}O_2N_2$ (M^++ H) 257.1281, found 257.1285.

N-(3,5-Dichloro-2-(1H-pyrrol-1-yl)phenyl)acrylamide (**19f**): Yellowish oil, 66% yield; ***R*** $\boldsymbol{R_f}$ = 0.4 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.53 (d, *J* = 2.3 Hz, 1 H), 7.18 (d, *J* = 2.1 Hz, 1 H), 6.81 (br. s., 1 H), 6.60 (t, *J* = 2.1 Hz, 2 H), 6.40 (t, *J* = 2.1 Hz, 2 H), 6.18 - 6.08 (m, 1 H), 5.88 (dd, *J* = 10.2, 16.8 Hz, 1 H), 5.79 - 5.67 (m, 1 H); **NMR (50 MHz, $CDCl_3$)** δ = 163.33, 137.56, 135.44, 133.34, 130.76, 128.55, 126.37, 124.35, 121.78, 118.91, 111.23; **HRMS (ESI)** calcd for $C_{13}H_{11}ON_2Cl_2$ (M^++ H) 280.0221, found 280.0219.

N-(4-Fluoro-2-(1H-pyrrol-1-yl)phenyl)acrylamide (**19g**): Yellowish oil, 68% yield; $\boldsymbol{R_f}$ = 0.48 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz ,$CDCl_3$)** δ **=** 8.43 (dd, *J* = 5.7, 9.0 Hz, 1 H), 7.12 – 7.04 (m, 3 H), 6.81 (t, *J* = 2.1 Hz, 2 H), 6.42 (t, *J* = 2.1 Hz, 2 H), 6.26 (dd, *J* = 1.4, 16.9 Hz, 1 H), 6.06 (dd, *J* = 10.1, 16.9 Hz, 1 H), 5.76 (dd, *J* = 1.4, 10.1 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 163.44, 130.92, 128.01, 123.26, 123.09, 121.80, 115.50, 115.07, 114.19, 113.71, 110.96; **HRMS (ESI)** calcd for $C_{13}H_{12}ON_2F$ (M^++ H) 231.0928, found 231.0927.

N-(4-Morpholino-2-(1H-pyrrol-1-yl)phenyl)acrylamide (**19h**): Yellowish solid, 73% yield; mp = 133-136 °C; $\boldsymbol{R_f}$ = 0.4 (pet. ether/EtOAc = 95/05); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 8.31 (d, *J* = 8.8 Hz, 1 H), 7.01 - 6.97 (m, 2 H), 6.83 - 6.80 (m, 3 H), 6.40 - 6.38 (m, 3 H), 6.05 - 5.97 (m, 1 H), 5.71 (dd, *J* = 1.3, 10.1 Hz, 1 H), 3.89 - 3.84 (m, 4 H), 3.18 - 3.13 (m, 4 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 163.29, 148.22, 131.99, 131.15, 127.33, 125.53, 122.96, 121.91, 115.33, 113.67, 110.30, 66.67, 49.10, **HRMS (ESI)** calcd for $C_{17}H_{20}O_2N_3$ (M^++ H) 298.1550, found 298.1548.

N-(2,4-Di(1H-pyrrol-1-yl)phenyl)acrylamide (**19i**): White solid, 78% yield; mp = 159-162 °C; ***R*$_f$** = 0.46 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.58 (d, *J* = 9.0 Hz, 1 H), 7.44 (dd, *J* = 2.7, 8.8 Hz, 1 H), 7.34 (d, *J* = 2.5 Hz, 1 H), 7.16 (br. s., 1 H), 7.07 (t, *J* = 2.1 Hz, 2 H), 6.85 (t, *J* = 2.1 Hz, 2 H), 6.44 (t, *J* = 2.1 Hz, 2 H), 6.39 - 6.24 (m, 3 H), 6.14 - 5.96 (m, 1 H), 5.73 (dd, *J* = 1.2, 10.2 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 163.40, 137.00, 131.52, 130.97, 130.91, 128.05, 122.56, 121.91, 120.14, 119.15, 118.61, 110.96, 110.87; **HRMS (ESI)** calcd for $C_{17}H_{16}ON_3$ (M^++ H) 278.1288, found 278.1284.

N-(4-(Diethylamino)-2-(1H-pyrrol-1-yl)phenyl)acrylamide (**19j**): Yellowish oil, 73% yield; ***R*$_f$** = 0.43 (pet. ether/EtOAc = 95/05); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 8.12 (d, *J* = 9.2 Hz, 1 H), 6.92 (br. s., 1 H), 6.83 (t, *J* = 2.1 Hz, 2 H), 6.69 (dd, *J* = 3.1, 9.2 Hz, 1 H), 6.57 (d, *J* = 2.7 Hz, 1 H), 6.38 (t, *J* = 2.3 Hz, 2 H), 6.37 - 6.24 (m, 1 H), 6.04 (dd, *J* = 10.2, 16.9 Hz, 1 H), 5.65 (dd, *J* = 1.4, 10.2 Hz, 1 H), 3.35 (q, *J* = 7.1 Hz, 4 H), 1.17 (t, *J* = 7.2 Hz, 6 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 163.30, 145.31, 132.98, 131.27, 126.78, 123.96, 121.98, 121.20, 111.32, 109.84, 109.43, 44.41, 12.45; **HRMS (ESI)** calcd for $C_{17}H_{22}ON_3$ (M^++ H) 284.1757, found 284.1755.

N-(2-(1-Methyl-1H-pyrrol-2-yl)phenyl)acrylamide (**20a**): Yellowish oil, 73% yield; ***R*$_f$** = 0.39 (pet. ether/EtOAc = 95/05); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 8.55 (d, *J* = 8.2 Hz, 1 H), 7.74 - 7.61 (m, 1 H), 7.44 - 7.32 (m, 1 H), 7.29 - 7.23 (m, 1 H), 7.20 - 7.10 (m, 1 H), 6.85 - 6.72 (m, 1 H), 6.28 - 6.21 (m, 3 H), 6.11 – 6.08 (m, 1 H), 5.71 - 5.68 (m, 1 H), 3.45 (s, 3 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 163.21, 136.86, 131.55, 130.95, 129.08, 128.20, 127.25, 123.77, 123.60, 122.47, 120.33, 109.44, 108.17, 34.28; **HRMS (ESI)** calcd for $C_{14}H_{15}ON_2$ (M^++ H) 227.1179, found 227.1176.

N-(2-(1-Methyl-1H-pyrrol-2-yl)phenyl)acrylamide (**20b**): Yellowish oil, 73% yield; ***R$_f$*** = 0.62 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.55 (d, *J* = 8.2 Hz, 1 H), 7.68 (br. s., 1 H), 7.41 (t, *J* = 7.8 Hz, 1 H), 7.27 - 7.15 (m, 2 H), 6.88 (br. s., 1 H), 6.30 - 5.71 (m, 4 H), 5.66 (d, *J* = 10.0 Hz, 1 H), 3.74 (q, *J* = 7.2 Hz, 2 H), 1.21 (t, *J* = 7.2 Hz, 3 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 163.2, 137.1, 131.6, 131.0, 129.2, 127.4, 127.2, 123.6, 122.7, 121.6, 120.2, 109.5, 108.4, 41.7, 16.6; **HRMS (ESI)** calcd for $C_{15}H_{17}ON_2$ (M^++ H) 241.1335, found 241.1333.

N-(2-(1-Propyl-1H-pyrrol-2-yl)phenyl)acrylamide (**20c**): Yellowish oil, 73% yield; ***R$_f$*** = 0.55 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.57 - 8.52 (m, 1 H), 7.70 (br. s., 1 H), 7.41 - 7.32 (m, 1 H), 7.27 - 7.18 (m, 2 H), 6.85 (dd, *J* = 1.8, 2.8 Hz, 1 H), 6.31 – 6.06 (m, 4 H), 5.69 (dd, *J* = 1.5, 10.0 Hz, 1 H), 3.67 (dd, *J* = 6.7, 7.8 Hz, 2 H), 1.54 (q, *J* = 7.20 Hz, 2 H), 0.73 (t, *J* = 7.4 Hz, 3 H); **^{13}C NMR (200 MHz, CDCl$_3$)** δ = 163.2, 137.1, 131.6, 131.1, 129.2, 127.7, 127.1, 123.6, 122.8, 122.4, 120.2, 109.4, 108.2, 48.6, 24.5, 11.0; **HRMS (ESI)** calcd for $C_{16}H_{18}ON_2$ (M^++ Na) 277.1311, found 277.1311.

N-(3-Methyl-2-(1-methyl-1H-pyrrol-2-yl)phenyl)acrylamide (**20d**): Yellowish viscous liquid, 76% yield; ***R$_f$*** = 0.48 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.38 (d, *J* = 8.2 Hz, 1 H), 7.39 (d, *J* = 8.0 Hz, 1 H), 7.34 (d, *J* = 8.1 Hz, 1 H), 7.05 (td, *J* = 1.0, 7.7 Hz, 1 H), 6.85 - 6.83 (m, 1 H), 6.29 - 6.28 (m, 1 H), 6.16 - 6.13 (m, 2 H), 6.05 - 5.95 (m, 1 H), 5.67 (dd, *J* = 1.5, 10.0 Hz, 1 H), 3.30 (s, 3 H), 2.08 (s, 3 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 163.16, 139.47, 137.82, 131.74, 129.22, 126.85, 126.69, 125.19, 123.16, 122.36, 117.26, 109.20, 108.22, 33.65, 20.11; **HRMS (ESI)** calcd for $C_{15}H_{17}ON_2$ (M^++ H) 241.1335, found 241.1333.

N-(5-Methoxy-2-(1-methyl-1H-pyrrol-2-yl)phenyl)acrylamide (**20e**): Yellowish oil, 70% yield; ***R$_f$*** = 0.46 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.28 (d, *J* = 2.5 Hz, 1 H), 7.74 (br. s., 1 H), 7.17 (d, *J* = 8.5 Hz, 1 H), 6.80 - 6.74 (m, 2 H), 6.26 - 6.07

(m, 4 H), 5.72 (dd, J = 1.3, 10.0 Hz, 1 H), 3.88 (s, 3 H), 3.43 (s, 3 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 163.3, 160.1, 138.1, 131.6, 131.6, 128.0, 127.4, 123.5, 114.5, 110.3, 109.4, 108.1, 105.0, 55.4, 34.2; **HRMS (ESI)** calcd for $C_{15}H_{17}O_2N_2$ (M^++ H) 257.1285, found 257.1280.

N-(4,5-Dimethyl-2-(1-methyl-1H-pyrrol-2-yl)phenyl)acrylamide (**20f**): Yellowish oil, 69% yield; $\boldsymbol{R_f}$ = 0.52 (pet. ether/EtOAc = 85/15); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.32 (s, 1 H), 7.58 (br. s., 1 H), 7.02 (s, 1 H), 6.80 - 6.77 (m, 1 H), 6.25 - 6.24 (m, 2 H), 6.18 - 6.08 (m, 2 H), 5.67 (dd, J = 1.5, 10.0 Hz, 1 H), 3.44 (s, 3 H), 2.33 (s, 3 H), 2.23 (s, 3 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 163.09, 137.65, 134.47, 132.03, 131.85, 131.59, 128.50, 127.01, 123.45, 121.64, 120.12, 109.30, 108.03, 34.24, 19.94, 19.92; **HRMS (ESI)** calcd for $C_{16}H_{19}ON_2$ (M^++ H) 255.1489, found 255.1492.

N-(4-Methoxy-2-(1-methyl-1H-pyrrol-2-yl)phenyl)acrylamide (**20g**): Yellowish oil, 56% yield; $\boldsymbol{R_f}$ = 0.63 (pet. ether/EtOAc = 85/15); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.38 (d, J = 2.5 Hz, 1 H), 7.86 (br. s., 1 H), 7.24 (d, J = 8.5 Hz, 1 H), 6.90 - 6.84 (m, 2 H), 6.30 - 6.18 (m, 4 H), 5.83 (dd, J = 1.3, 10.0 Hz, 1 H), 3.99 (s, 3 H), 3.54 (s, 3 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 163.28, 160.07, 138.06, 131.64, 131.54, 128.05, 127.36, 123.52, 114.51, 110.27, 109.37, 108.04, 104.97, 55.41, 34.19; **HRMS (ESI)** calcd for $C_{15}H_{17}O_2N_2$ (M^++ H) 257.1285, found 257.1281.

N-(5-Ethoxy-2-(1-methyl-1H-pyrrol-2-yl)phenyl)acrylamide (**20h**): Yellowish viscous oil, 66% yield; $\boldsymbol{R_f}$ = 0.58 (pet. ether/EtOAc = 85/15); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.25 (d, J = 2.5 Hz, 1 H), 7.73 (br. s., 1 H), 7.11 (d, J = 8.5 Hz, 1 H), 6.79 - 6.72 (m, 2 H), 6.25 – 6.07 (m, 4 H), 5.72 - 5.71 (m, 1 H), 4.14 (q, J = 7.0 Hz, 2 H), 3.45 (s, 3 H), 1.44 (t, J = 7.0 Hz, 3 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 163.27, 159.46, 138.01, 131.63, 131.59, 128.15, 127.29, 123.48, 114.38, 110.78, 109.36, 108.03, 105.55, 63.64, 34.19, 14.78; **HRMS (ESI)** calcd for $C_{16}H_{19}O_2N_2$ (M^++ H) 271.1441, found 271.1436.

N-(5-Fluoro-2-(1-methyl-1H-pyrrol-2-yl)phenyl)acrylamide (**20i**): Pale yellow thick liquid, 80% yield; ***R_f*** = 0.54 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.43 (dd, J= 1.77 Hz, 1 H), 7.76 (br. s., 1 H), 7.27 - 7.20 (m, 1 H), 6.87 - 6.80 (m, 2 H), 6.28 - 6.26 (m, 3 H), 6.25 – 6.21 (m, 1 H), 5.75 - 5.74 (m, 1 H), 3.44 (s, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 163.2, 160.3, 132.1, 131.9, 131.3, 127.8, 127.2, 124.0, 118.0, 110.6, 110.1, 109.7, 108.3, 107.9, 107.4, 34.2; **HRMS (ESI)** calcd for $C_{14}H_{14}ON_2F$ (M^++ H) 245.1085, found 245.1082.

N-(5-Chloro-2-(1-methyl-1H-pyrrol-2-yl)phenyl)acrylamide (**20j**): Yellowish oil, 73% yield; ***R_f*** = 0.66 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.52 (dd, *J* = 2.7, 8.72 Hz, 1 H), 7.87 (br. s., 1 H), 7.38 – 7.37 (m, 1 H), 6.96 - 6.91 (m, 2 H), 6.38 - 6.32 (m, 3 H), 6.31 – 6.17 (m, 1 H), 5.85 (dd, *J* = 1.86, 8.84 Hz, 1 H), 3.54 (s, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 163.3, 138.5, 132.1, 131.9, 131.3, 127.8, 124.0, 118.1, 110.6, 110.1, 109.7, 108.3, 107.9, 107.4, 34.2; **HRMS (ESI)** calcd for $C_{14}H_{14}ON_2Cl$ (M^++ H) 260.0716, found 260.0719.

N-(2-(1-Methyl-1H-pyrrol-3-yl)phenyl)acrylamide (**21a**): Yellowish oil, 73% yield; ***R_f*** = 0.53 (pet. ether/EtOAc = 90/10); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 8.43 (d, *J* = 8.1 Hz, 1 H), 7.99 (br. s., 1 H), 7.32 - 7.27 (m, 2 H), 7.14 - 7.06 (m, 1 H), 6.73 (d, *J* = 1.8 Hz, 2 H), 6.33 - 6.26 (m, 3 H), 5.70 (dd, *J* = 1.6, 9.9 Hz, 1 H), 3.74 (s, 3 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 163.20, 139.81, 134.82, 131.72, 129.63, 127.13, 127.01, 126.99, 124.06, 123.06, 120.61, 120.53, 120.46, 108.47, 36.37; **HRMS (ESI)** calcd for $C_{14}H_{15}ON_2$ (M^++ H) 227.1179, found 227.1179.

N-(2-(1-(Triisopropylsilyl)-1H-pyrrol-3-yl)phenyl)acrylamide (**21b**): Yellowish oil, 73% yield; ***Rf*** = 0.58 (pet. ether/EtOAc = 90/10); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 8.48 - 8.43 (m, 1 H), 7.96 (br. s., 1 H), 7.37 - 7.32 (m, 2 H), 7.18 - 7.05 (m, 1 H), 6.91 - 6.88 (m, 2 H), 6.43 (dd, *J* = 1.5, 2.7 Hz, 1 H), 6.30 - 6.29 (m, 1 H), 6.17 – 6.04 (m, 1 H), 5.67 (dd, *J* =

1.5, 10.1 Hz, 1 H), 1.57 - 1.39 (m, 3 H), 1.16 – 1.12 (m, 18 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 163.20, 134.82, 131.69, 129.71, 127.11, 126.90, 125.66, 124.02, 122.78, 122.39, 120.40, 110.91, 18.36, 17.81, 11.62; **HRMS (ESI)** calcd for $C_{22}H_{33}ON_2Si$ (M^++ H) 369.2357, found 369.2356.

N-(2-(1-Benzyl-1H-pyrrol-3-yl)phenyl)acrylamide (**21c**): Brown oil, 73% yield; ***R_f*** = 0.52 (pet. ether/EtOAc = 90/10); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 8.43 (d, *J* = 7.8 Hz, 1 H), 7.95 (br. s., 1 H), 7.40 - 7.35 (m, 5 H), 7.21 (d, *J* = 7.1 Hz, 2 H), 7.15 - 7.08 (m, 1 H), 6.84 (br. s., 1 H), 6.79 (br. s., 1 H), 6.31 - 6.27 (m, 2 H), 6.05 (dd, *J* = 10.3, 16.6 Hz, 1 H), 5.67 (d, *J* = 10.5 Hz, 1 H), 5.12 (s, 2 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 163.14, 137.40, 131.72, 129.60, 128.88, 128.01, 127.26, 126.87, 124.10, 122.63, 120.90, 120.53, 119.79, 108.85, 85.50, 53.69; **HRMS (ESI)** calcd for $C_{20}H_{19}ON_2$ (M^++ H) 303.1492, found 303.1491.

N-(5-Methoxy-2-(1-methyl-1H-pyrrol-3-yl)phenyl)acrylamide (**21d**): Yellow solid, 73% yield; mp = 123-126 °C; ***Rf*** = 0.4 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.21 (br. s., 1 H), 8.02 (br. s., 1 H), 7.16 (d, *J* = 8.5 Hz, 1 H), 6.72 - 6.66 (m, 3 H), 6.41 - 6.32 (m, 1 H), 6.25 - 6.02 (m, 2 H), 5.72 (dd, *J* = 1.5, 10.0 Hz, 1 H), 3.86 (s, 3 H), 3.77 - 3.69 (m, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 158.76, 137.71, 130.34, 127.09, 122.99, 120.40, 120.29, 110.66, 108.54, 55.41, 36.35; **HRMS (ESI)** calcd for $C_{15}H_{17}O_2N_2$ (M^++ H) 257.1285, found 257.1285.

N-(4,5-Dimethyl-2-(1-methyl-1H-pyrrol-3-yl)phenyl)acrylamide (**21e**): Brown solid, 78% yield; mp = 134-137 °C; ***R_f*** = 0.4 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.23 (br. s., 1 H), 7.85 (br. s., 1 H), 7.08 (s, 1 H), 6.71 - 6.69 (m, 2 H), 6.33 - 6.23 (m, 3 H), 5.73 - 5.68 (m, 1 H), 3.72 (s, 3 H), 2.30 (s, 3 H), 2.25 (s, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 163.07, 135.42, 132.35, 131.79, 130.66, 126.70, 124.04, 122.87, 121.84, 120.60, 120.42, 108.53, 36.32, 19.68, 19.21; **HRMS (ESI)** calcd for $C_{16}H_{19}ON_2$ (M^++ H) 255.1492, found 255.1490.

N-(3-Methyl-2-(1-methyl-1H-pyrrol-3-yl)phenyl)acrylamide (**21f**): Yellowish oil, 64% yield; ***R$_f$*** = 0.4 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.49 - 8.45 (m, 1 H), 7.84 (br. s., 1 H), 7.26 - 7.14 (m, 1 H), 7.08 - 6.95 (m, 1 H), 6.80 - 6.72 (m, 1 H), 6.63 (t, *J* = 2.0 Hz, 1 H), 6.29 - 6.28 (m, 1 H), 6.16 - 6.13 (m, 2 H), 5.75 - 5.58 (m, 1 H), 3.83 (s, 3 H), 2.27 (s, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 163.01, 137.80, 136.55, 132.01, 127.22, 126.39, 125.19, 122.88, 121.04, 117.40, 116.96, 109.48, 36.33, 21.08; **HRMS (ESI)** calcd for $C_{15}H_{17}ON_2$ (M^++ H) 241.1335, found 241.1334.

N-(2-((1H-Pyrrol-1-yl)methyl)phenyl)acrylamide (**22**): Brown viscous liquid, 87% yield; ***R$_f$*** = 0.42 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.79 (d, *J* = 6.8 Hz, 1 H), 7.35 - 7.30 (m, 1 H), 7.20 - 7.17 (m, 2 H), 7.01 (br. s., 1 H), 6.66 - 6.65 (m, 2 H), 6.26 - 6.23 (m, 3 H), 6.13 - 6.07 (m, 1 H), 5.72 (dd, *J* = 1.0, 10.3 Hz, 1 H), 5.07 (s, 2 H); **^{13}C NMR (400 MHz, $CDCl_3$)** δ = 163.78, 135.79, 130.87, 129.46, 129.25, 128.99, 127.74, 125.82, 124.62, 120.84, 109.44, 51.20; **HRMS (ESI)** calcd for $C_{14}H_{15}ON_2$ (M^++ H) 227.1179, found 227.1178.

N-(2-((1H-Pyrrol-1-yl)phenyl)cinnamamide (**23**): Brown viscous liquid, 76% yield; ***R$_f$*** = 0.4 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.55 (d, *J* = 7.8 Hz, 1 H), 7.64 (d, *J* = 15.6 Hz, 1 H), 7.50 - 7.46 (m, 2 H), 7.45 - 7.39 (m, 1 H), 7.38 - 7.34 (m, 3 H), 7.30 (dd, *J* = 1.8, 7.8 Hz, 1 H), 7.22 - 7.18 (m, 1 H), 7.18 - 7.14 (m, 1 H), 6.84 (t, *J* = 2.1 Hz, 2 H), 6.46 - 6.45 (m, 2 H), 6.29 (d, *J* = 15.6 Hz, 1 H); **^{13}C NMR (400 MHz, $CDCl_3$)** δ = 163.92, 142.70, 134.36, 133.84, 130.57, 130.14, 128.86, 128.03, 126.80, 124.22, 122.13, 121.45, 120.59, 110.57; **HRMS (ESI)** calcd for $C_{19}H_{17}ON_2$ (M^++ H) 289.1335, found 289.1338.

N-(2-(1H-Pyrrol-1-yl)phenyl)allylacrylamide (**1a**): Yellow solid, 83% yield; mp = 85-87 °C; ***R$_f$*** = 0.38 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.44 - 7.43 (m, 3 H), 7.22 - 7.17 (m, 1 H), 6.75 (t, *J* = 2.1 Hz, 2 H), 6.43 - 6.42 (m, 1 H), 6.31 (t, *J* = 2.1

Hz, 2 H), 6.24 - 6.19 (m, 1 H), 5.66 - 5.59 (m, 2 H), 5.03 - 4.99 (m, 2 H), 4.61 (dd, *J* = 5.3, 14.8 Hz, 1 H), 3.06 (dd, *J* = 7.6, 14.7 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.38, 137.98, 134.98, 132.28, 131.61, 129.27, 129.04, 127.92, 127.33, 126.64, 121.15, 118.35, 110.40, 50.15; **HRMS (ESI)** calcd for $C_{16}H_{17}ON_2$ (M^++ H) 253.1335, found 253.1325.

N-(3-Methyl-2-(1H-pyrrol-1-yl)phenyl)allylacrylamide (**1b**): Yellowish oil, 78% yield; ***R_f*** = 0.42 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.33 - 7.31 (m, 2 H), 7.09 - 6.97 (m, 1 H), 6.54 (br. s., 2 H), 6.43 (dd, *J* = 1.8, 16.9 Hz, 1 H), 6.29 - 6.24 (m, 2 H), 6.08 (dd, *J* = 10.3, 16.7 Hz, 1 H), 5.61 - 5.57 (m, 2 H), 5.05 - 5.03 (m, 2 H), 4.60 - 4.59 (m, 1 H), 3.08 (dd, *J* = 7.8, 15.1 Hz, 1 H), 2.15 (s, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.01, 138.02, 137.96, 137.72, 132.74, 130.95, 128.73, 128.47, 128.16, 121.57, 118.02, 109.45, 50.50, 17.68; **HRMS (ESI)** calcd for $C_{17}H_{19}ON_2$ (M^++ H) 267.1492, found 267.1491.

N-(5-Methoxy-2-(1H-pyrrol-1-yl)phenyl)allylacrylamide (**1d**): Yellow solid, 80% yield; mp = 82-83 °C; ***R_f*** = 0.4 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.36 (d, *J* = 8.7 Hz, 1 H), 6.97 (dd, *J* = 2.9, 8.8 Hz, 1 H), 6.71 - 6.67 (m, 3 H), 6.55 - 6.37 (m, 1 H), 6.29 - 6.22 (m, 3 H), 5.66 - 5.55 (m, 2 H), 5.05 – 5.00 (m, 2 H), 4.59 (dd, *J* = 5.3, 14.8 Hz, 1 H), 3.84 (s, 3 H), 3.08 (dd, *J* = 7.7, 14.8 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.16, 140.07, 132.64, 131.86, 131.19, 130.37, 128.74, 128.27, 127.49, 122.92, 117.18, 109.63, 107.94, 50.77, 34.28; **HRMS (ESI)** calcd for $C_{17}H_{19}O_2N_2$ (M^++ H) 283.1441, found 283.1432.

N-(5-Ethoxy-2-(1H-pyrrol-1-yl)phenyl)allylacrylamide (**1e**): White solid, 82% yield; mp = 80-82 °C; ***R_f*** = 0.43 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.30 (d, *J* = 5.3 Hz, 1 H), 6.88 (dd, *J* = 2.9, 8.8 Hz, 1 H), 6.70 - 6.67 (m, 3 H), 6.46 - 6.30 (m, 1 H), 6.29 - 6.23 (m, 3 H), 5.66 - 5.60 (m, 2 H), 5.06 – 5.02 (m, 2 H), 4.59 - 4.58 (m, 1 H), 4.06 (q, *J* = 6.9 Hz, 2 H), 3.14 – 3.02 (m, 1 H), 1.45 (t, *J* = 7.0 Hz, 3 H); **^{13}C NMR (50 MHz,**

$CDCl_3$) δ = 165.28, 157.82, 136.28, 132.44, 131.24, 128.93, 128.02, 127.70, 121.46, 118.30, 117.05, 114.93, 109.89, 64.07, 50.25, 14.63; **HRMS (ESI)** calcd for $C_{18}H_{21}O_2N_2$ (M^++ H) 297.1598, found 297.1587.

N-(3,5-Dichloro-2-(1H-pyrrol-1-yl)phenyl)allylacrylamide (**1f**): Yellow solid, 80% yield; mp = 90-91 °C; $\boldsymbol{R_f}$ = 0.42 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.58 (d, *J* = 2.4 Hz, 1 H), 7.15 (d, *J* = 2.4 Hz, 1 H), 6.58 - 6.42 (m, 2 H), 6.45 (d, *J* = 2.1 Hz, 1 H), 6.33 (t, *J* = 2.2 Hz, 2 H), 6.16 – 6.03 (m, 1 H), 5.74 - 5.76 (m, 2 H), 5.71 - 4.97 (m, 2 H), 4.61 (dd, *J* = 5.3, 15.0 Hz, 1 H), 2.98 – 2.87 (m, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 164.57, 140.10, 135.54, 133.80, 132.02, 130.07, 127.41, 121.70, 119.02, 110.31, 50.05; **HRMS (ESI)** calcd for $C_{16}H_{15}ON_2Cl_2$ (M^++ H) 321.0556, found 321.0551.

N-(4-Fluoro-2-(1H-pyrrol-1-yl)phenyl)allylacrylamide (**1g**): Yellowish oil, 80% yield; mp = 79-82 °C; $\boldsymbol{R_f}$ = 0.42 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.16 – 7.13 (m, 3 H), 6.75 (t, *J* = 2.1 Hz, 2 H), 6.44 – 6.43 (m, 1 H), 6.32 (t, *J* = 2.1 Hz, 2 H), 6.18 – 6.17 (m, 1 H), 5.68 - 5.62 (m, 2 H), 5.05 – 4.86 (m, 2 H), 4.61 (dd, *J* = 5.3, 14.8 Hz, 1 H), 3.03 (dd, *J* = 7.8, 14.7 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.46, 133.10, 132.92, 132.07, 130.78, 129.48, 127.65, 120.97, 118.71, 114.38, 113.94, 113.42, 110.99, 50.28; **HRMS (ESI)** calcd for $C_{16}H_{16}ON_2$ (M^++ H) 271.1241, found 271.1237.

N-(4-Morpholino-2-(1H-pyrrol-1-yl)phenyl)allylacrylamide (**1h**): Brown solid, 70% yield; mp = 117-120 °C; $\boldsymbol{R_f}$ = 0.43 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.06 - 7.04 (m, 1 H), 6.87 - 6.86 (m, 2 H), 6.73 (t, *J* = 2.1 Hz, 2 H), 6.42 (dd, *J* = 2.1, 16.8 Hz, 1 H), 6.29 - 6.20 (m, 3 H), 5.62 (dd, *J* = 1.8, 10.4 Hz, 2 H), 5.01 - 4.94 (m, 2 H), 4.58 (dd, *J* = 5.3, 14.8 Hz, 1 H), 3.88 - 3.86 (m, 4 H), 3.24 - 3.21 (m, 4 H), 3.05 (dd, *J* = 7.6, 14.6 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.76, 151.36, 138.60, 132.50, 132.00, 128.65, 128.11, 126.28, 121.45, 121.18, 118.16, 113.35, 112.60, 110.15, 109.97, 66.61, 50.46, 48.46, 48.32; **HRMS (ESI)** calcd for $C_{20}H_{24}O_2N_3$ (M^++ H) 338.1863, found 338.1859.

N-Allyl-N-(2,4- di-(1H-pyrrol-1-yl)phenyl)acrylamide (**1i**): White solid, 88% yield; mp = 123-126 °C; $\boldsymbol{R_f}$ = 0.39 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.49 - 7.46 (m, 1 H), 7.40 - 7.37 (m, 1 H), 7.29 - 7.17 (m, 1 H), 7.15 (t, *J* = 2.3 Hz, 2 H), 6.83 (t, *J* = 2.3 Hz, 2 H), 6.45 (td, *J* = 1.0, 16.6 Hz, 1 H), 6.44 - 6.40 (m, 4 H), 6.26 (dd, *J* = 10.1, 16.8 Hz, 1 H), 5.73 - 5.70 (m, 2 H), 5.10 – 5.04 (m, 2 H), 4.72 - 4.67 (m, 1 H), 3.10 (dd, *J* = 7.8, 14.7 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.45, 141.05, 138.91, 132.70, 132.17, 131.80, 129.41, 127.78, 121.08, 119.04, 118.66, 118.27, 117.83, 111.54, 110.86, 50.25; **HRMS (ESI)** calcd for $C_{20}H_{19}ON_3$ (M^++ Na) 340.1420, found 340.1412.

N-(4-(Diethylamino)-2-(1H-pyrrol-1-yl)phenyl)allylacrylamide (**1j**): Brown viscous liquid, 75% yield; $\boldsymbol{R_f}$ = 0.35 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 6.94 (d, *J* = 8.6 Hz, 1 H), 6.74 (t, *J* = 2.1 Hz, 2 H), 6.60 - 6.59 (m, 2 H), 6.54 - 6.47 (m, 1 H), 6.40 - 6.35 (m, 1 H), 6.31 - 6.27 (m, 2 H), 5.63 - 5.56 (m, 2 H), 5.03 - 5.02 (m, 2 H), 4.52 (dd, *J* = 5.5, 16.1 Hz, 1 H), 3.39 (q, *J* = 7.1 Hz, 4 H), 3.06 (dd, *J* = 7.4, 14.7 Hz, 1 H), 1.21 (t, *J* = 7.1 Hz, 6 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 166.08, 148.06, 138.76, 132.76, 131.93, 128.41, 128.15, 122.50, 121.31, 117.77, 109.69, 108.61, 50.79, 44.42, 12.48; **HRMS (ESI)** calcd for $C_{20}H_{26}ON_3$ (M^++ H) 324.2070, found 324.2069.

N-(2-(1-Methyl-1H-pyrrol-2-yl)phenyl)allylacrylamide (**3a**): Yellowish oil, 83% yield; $\boldsymbol{R_f}$ = 0.43 (pet. ether/EtOAc = 90/10); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.39 - 7.36 (m, 3 H), 7.18 (d, *J* = 8.2 Hz, 1 H), 6.70 (dd, *J* = 1.6, 2.5 Hz, 1 H), 6.37 (dd, *J* = 2.1, 16.7 Hz, 1 H), 6.18 - 6.15 (m, 2 H), 6.04 (dd, *J* = 1.8, 3.7 Hz, 1 H), 5.57 - 5.54 (m, 1 H), 5.56 (dd, *J* = 2.1, 10.3 Hz, 1 H), 5.00 (dd, *J* = 1.4, 10.1 Hz, 1 H), 4.99 - 4.97 (m, 1 H), 4.59 - 4.58 (m, 1 H), 3.47 (s, 3 H), 3.42 - 3.39 (m, 1 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 165.47, 140.39, 132.96, 132.18, 131.51, 130.69, 128.58, 128.24, 127.79, 123.23, 117.49, 109.94, 108.25, 51.09, 34.59; **HRMS (ESI)** calcd for $C_{17}H_{19}ON_2$ (M^++ H) 267.1492, found 267.1480.

N-(2-(1-Ethyl-1H-pyrrol-2-yl)phenyl)allylacrylamide (**3b**): Yellowish oil, 80% yield; $\boldsymbol{R_f}$ = 0.45 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.38 - 7.32 (m, 3 H), 7.17 - 7.14 (m, 1 H), 6.80 - 6.78 (m, 1 H), 6.38 - 6.37 (m, 1 H), 6.22 – 6.00 (m, 3 H), 5.59 - 5.53 (m, 2 H), 5.03 - 4.90 (m, 2 H), 4.60 (dd, *J* = 5.4, 14.9 Hz, 1 H), 3.79 - 3.71 (m, 2 H), 3.32 (dd, J= 7.20 Hz, 1 H), 1.32 (t, *J* = 7.3 Hz, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.5, 140.3, 133.0, 132.2, 131.6, 131.0, 128.5, 128.2, 128.0, 127.9, 120.8, 117.6, 109.8, 108.5, 50.8, 41.5, 16.5; **HRMS (ESI)** calcd for $C_{18}H_{21}ON_2$ (M^++ H) 281.1648, found 281.1645.

N-(2-(1-Propyl-1H-pyrrol-2-yl)phenyl)allylacrylamide (**3c**): Yellowish oil, 77% yield; $\boldsymbol{R_f}$ = 0.41 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.39 - 7.35 (m, 3 H), 7.16 - 7.13 (m, 1 H), 6.79 – 6.76 (m, 1 H), 6.40 - 6.36 (m, 1 H), 6.21 – 6.02 (m, 3 H), 5.60 - 5.54 (m, 2 H), 5.04 - 4.90 (m, 2 H), 4.90 - 4.58 (m, 1 H), 3.72 - 3.62 (m, 2 H), 3.28 (dd, *J* = 7.5, 14.8 Hz, 1 H), 1.67 (d, *J* = 7.45 Hz, 2 H), 0.83 (t, *J* = 7.4 Hz, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.5, 140.1, 133.0, 132.2, 131.6, 131.0, 128.7, 128.6, 128.1, 128.0, 127.8, 121.6, 117.6, 109.9, 108.3, 50.6, 48.8, 24.6, 11.2; **HRMS (ESI)** calcd for $C_{19}H_{23}ON_2$ (M^++ H) 295.1805, found 295.1801.

N-(3-Methyl-2-(1-methyl-1H-pyrrol-2-yl)phenyl)allylacrylamide (**3d**): Yellowish oil, 73% yield; $\boldsymbol{R_f}$ = 0.43 (pet. ether/EtOAc = 90/10); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.32 - 7.24 (m, 2 H), 6.98 - 6.96 (m, 1 H), 6.71 - 6.58 (m, 1 H), 6.44 - 6.25 (m, 1 H), 6.15 - 6.03 (m, 3 H), 5.56 - 5.50 (m, 2 H), 4.95 - 4.81 (m, 2 H), 4.46 - 4.36 (m, 1 H), 3.30 - 3.18 (m, 4 H), 2.08 (s, 3 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 141.91, 133.27, 129.82, 129.61, 128.80, 128.75, 128.60, 127.92, 127.58, 127.48, 121.82, 117.07, 108.79, 108.47, 107.77, 51.99, 51.16, 34.09, 20.31; **HRMS (ESI)** calcd for $C_{18}H_{21}ON_2$ (M^++ H) 281.1648, found 281.1645.

N-(5-Methoxy-2-(1-methyl-1H-pyrrol-2-yl)phenyl)allylacrylamide (**3e**): Light yellowish thick liquid, 73% yield; $\boldsymbol{R_f}$ = 0.38 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.30 - 7.24 (m, 1 H), 7.01 - 6.88 (m, 1 H), 6.72 - 6.66 (m, 2 H), 6.35 - 6.34

(m, 1 H), 6.18 - 6.12 (m, 2 H), 5.97 (dd, *J* = 1.7, 3.6 Hz, 1 H), 5.59 - 5.57 (m, 2 H), 5.03 - 4.98 (m, 2 H), 4.52 - 4.51 (m, 1 H), 3.83 (s, 3 H), 3.47 - 3.36 (m, 4 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 159.3, 141.6, 133.1, 128.6, 127.8, 123.9, 122.7, 117.5, 116.0, 113.4, 109.6, 108.1, 55.5, 51.2, 34.5; **HRMS (ESI)** calcd for $C_{18}H_{20}N_2O_2$ (M^++ H) 297.1598, found 297.1594.

N-(4,5-Dimethyl-2-(1-methyl-1H-pyrrol-2-yl)phenyl)allylacrylamide (**3f**): Yellowish oil, 76% yield; R_f = 0.43 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 7.13 (s, 1 H), 6.93 (s, 1 H), 6.68 - 6.67 (m, 1 H), 6.35 - 6.34 (m, 1 H), 6.19 - 6.14 (m, 2 H), 5.99 (dd, *J* = 1.7, 3.6 Hz, 1 H), 5.57 - 5.52 (m, 2 H), 5.02 - 4.97 (m, 2 H), 4.49 - 4.46 (m, 1 H), 3.47 - 3.36 (m, 4 H), 2.30 (d, *J* = 2.8 Hz, 6 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 165.58, 138.04, 137.04, 136.36, 133.19, 133.16, 131.35, 129.28, 128.77, 128.66, 127.46, 122.80, 117.25, 109.61, 108.07, 51.25, 34.54, 19.43; **HRMS (ESI)** calcd for $C_{19}H_{23}ON_2$ (M^++ H) 395.1805, found 295.1797.

N-(4-Methoxy-2-(1-methyl-1H-pyrrol-2-yl)phenyl)allylacrylamide (**3g**): Brown viscous liquid, 69% yield; R_f = 0.43 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 7.25 - 7.23 (m, 1 H), 6.94 (dd, *J* = 2.7, 8.5 Hz, 1 H), 6.69 - 6.67 (m, 2 H), 6.62 - 6.30 (m, 1 H), 6.14 - 6.09 (m, 2 H), 5.94 (dd, *J* = 1.7, 3.6 Hz, 1 H), 5.55 - 5.54 (m, 2 H), 5.00 - 4.95 (m, 2 H), 4.46 (dd, *J* = 5.6, 14.8 Hz, 1 H), 3.80 (s, 3 H), 3.44 - 3.33 (m, 4 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 164.75, 158.66, 141.00, 132.42, 128.24, 127.97, 127.13, 123.24, 122.09, 116.88, 115.39, 112.74, 108.96, 107.42, 54.87, 50.55, 33.81; **HRMS (ESI)** calcd for $C_{18}H_{21}O_2N_2$ (M^++ H) 297.1598, found 297.1593.

N-(4-Ethoxy-2-(1-methyl-1H-pyrrol-2-yl)phenyl)allylacrylamide (**3h**): Yellowish oil, 82% yield; R_f = 0.44 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 7.31 (d, *J* = 4.4 Hz, 1 H), 6.93 (dd, *J* = 2.6, 8.5 Hz, 1 H), 6.72 - 6.69 (m, 2 H), 6.38 - 6.37 (m, 1 H), 6.21 - 6.16 (m, 2 H), 5.98 (dd, *J* = 1.6, 3.5 Hz, 1 H), 5.61 - 5.60 (m, 2 H), 5.06 - 5.03 (m, 2 H), 4.53 (dd, *J* = 5.5, 14.8 Hz, 1 H), 4.05 (q, *J* = 7.0 Hz, 2 H), 3.49 - 3.42 (m, 4 H), 1.46 (t, *J* = 6.9 Hz, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.41, 158.69, 141.58, 133.05, 128.96, 128.65, 127.73, 123.68, 122.69, 117.51, 116.44, 113.97, 109.57, 108.05, 63.92, 63.79, 51.17, 34.45, 14.67; **HRMS (ESI)** calcd for $C_{19}H_{23}O_2N_2$ (M^++ H) 311.1754, found 311.1747.

N-(5-Fluoro-2-(1-methyl-1H-pyrrol-2-yl)phenyl)allylacrylamide (**3i**): Yellowish oil, 72% yield; $\boldsymbol{R_f}$ = 0.40 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.35 (dd, *J* = 6.2, 8.7 Hz, 1 H), 7.33 - 7.27 (m, 1 H), 6.96 - 6.94 (m, 1 H), 6.72 - 6.71 (m, 1 H), 6.38 (m, 1 H), 6.17 - 6.16 (m, 2 H), 6.02 – 6.01 (m, 1 H), 5.61 - 5.58 (m, 2 H), 4.99 (m, 2 H), 4.56 (dd, *J* = 5.4, 14.9 Hz, 1 H), 3.44 (s, 3 H), 3.39 (dd, *J* = 7.3, 14.9 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.2, 142.0, 133.5, 133.3, 132.7, 128.4, 128.2, 128.1, 123.3, 118.0, 117.9, 117.5, 115.3, 114.9, 110.1, 108.3, 51.0, 34.5; **HRMS (ESI)** calcd for $C_{17}H_{18}ON_2F$ (M^++ H) 285.1398, found 285.1393.

N-(5-Chloro-2-(1-methyl-1H-pyrrol-2-yl)phenyl)allylacrylamide (**3j**): Yellowish viscous liquid, 75% yield; $\boldsymbol{R_f}$ = 0.4 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.35 (dd, *J* = 6.3, 8.6 Hz, 1 H), 7.22 - 7.06 (m, 1 H), 6.93 (dd, *J* = 2.7, 9.0 Hz, 1 H), 6.70 - 6.69 (m, 1 H), 6.37 - 6.36 (m, 1 H), 6.18 - 6.01 (m, 3 H), 5.62 - 5.57 (m, 2 H), 5.02 - 5.00 (m, 2 H), 4.55 (dd, *J* = 5.4, 14.9 Hz, 1 H), 3.44 - 3.33 (m, 5 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.89, 134.15, 133.97, 133.34, 129.05, 128.86, 123.97, 118.56, 115.95, 115.53, 110.72, 108.397, 51.65, 35.15; **HRMS (ESI)** calcd for $C_{17}H_{18}ON_2Cl$ (M^++ H) 300.1027, found 300.1031.

N-(2-(1-Methyl-1H-pyrrol-3-yl)phenyl)allylacrylamide (**5a**): Yellowish oil, 80% yield; $\boldsymbol{R_f}$ = 0.62 (pet. ether/EtOAc = 85/15); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.62 (dd, *J* = 1.5, 7.8 Hz, 1 H), 7.34 (dt, *J* = 1.5, 7.5 Hz, 1 H), 7.17 (dt, *J* = 1.5, 7.5 Hz, 1 H), 7.09 - 6.97 (m, 1 H), 6.71 - 6.68 (m, 1 H), 6.62 (t, *J* = 2.5 Hz, 1 H), 6.36 - 6.32 (m, 2 H), 6.15 - 6.09 (m, 1 H), 5.88 – 5.76 (m, 1 H), 5.47 (dd, *J* = 2.2, 10.2 Hz, 1 H), 5.08 – 4.99 (m, 2 H), 4.82 (dd, *J*

= 5.4, 14.4 Hz, 1 H), 3.66 (s, 3 H), 3.43 (dd, *J* = 7.6, 14.4 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 166.01, 137.03, 133.98, 132.75, 130.98, 128.98, 128.68, 128.62, 128.50, 127.75, 125.88, 122.47, 120.51, 118.16, 107.99, 50.80, 36.40; **HRMS (ESI)** calcd for $C_{17}H_{18}ON_2$ (M^++ H) 267.1492, found 267.1492.

N-(2-(1-(Triisopropylsilyl)-1H-pyrrol-3-yl)phenyl)allylacrylamide (**5b**): Brown viscous oil, 69% yield; R_f = 0.66 (pet. ether/EtOAc = 85/15); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.62 - 7.61 (m, 1 H), 7.38 - 7.30 (m, 1 H), 7.21 - 7.13 (m, 1 H), 7.08 - 7.04 (m, 1 H), 6.88 - 6.80 (m, 1 H), 6.80 - 6.79 (m, 1 H), 6.49 (dd, *J* = 1.5, 2.8 Hz, 1 H), 6.32 (dd, *J* = 2.3, 16.7 Hz, 1 H), 6.11 (dd, *J* = 10.1, 16.8 Hz, 1 H), 5.96 - 5.76 (m, 1 H), 5.46 (dd, *J* = 2.3, 10.2 Hz, 1 H), 5.09 - 4.99 (m, 2 H), 4.81 (dd, *J* = 5.4, 14.4 Hz, 1 H), 3.49 (dd, *J* = 7.7, 14.4 Hz, 1 H), 1.49 - 1.38 (m, 3 H), 1.10 (dd, *J* = 2.8, 7.4 Hz, 18 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.78, 137.33, 132.92, 130.79, 129.17, 128.70, 128.42, 127.50, 125.91, 124.80, 122.98, 122.43, 118.13, 110.02, 50.71, 17.75, 11.54; **HRMS (ESI)** calcd for $C_{25}H_{37}ON_2Si$ (M^++ H) 409.2670, found 409.2669.

N-(2-(1-Benzyl-1H-pyrrol-3-yl)phenyl)allylacrylamide (**5c**): Brown viscous oil, 74% yield; R_f = 0.64 (pet. ether/EtOAc = 85/15); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.57 (dd, *J* = 1.5, 7.8 Hz, 1 H), 7.35 - 7.30 (m, 4 H), 7.14 - 7.08 (m, 4 H), 6.82 - 6.75 (m, 1 H), 6.69 (t, *J* = 2.5 Hz, 1 H), 6.34 - 6.33 (m, 2 H), 6.13 - 5.98 (m, 1 H), 5.96 - 5.76 (m, 1 H), 5.50 (dd, *J* = 2.2, 10.2 Hz, 1 H), 5.10 - 5.00 (m, 4 H), 4.87 - 4.77 (m, 1 H), 3.46 (dd, *J* = 7.6, 14.5 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.91, 137.60, 130.82, 129.05, 128.72, 128.63, 128.45, 127.75, 127.65, 126.93, 126.02, 120.09, 118.12, 108.43, 53.62, 50.87; **HRMS (ESI)** calcd for $C_{23}H_{23}ON_2$ (M^++ H) 343.1805, found 343.1805.

N-(5-Methoxy-2-(1-methyl-1H-pyrrol-3-yl)phenyl)allylacrylamide (**5d**): Light yellowish thick liquid, 90% yield; R_f = 0.65 (pet. ether/EtOAc = 85/15); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.51 - 7.49 (m, 1 H), 6.93 (dd, *J* = 2.8, 8.7 Hz, 1 H), 6.62 - 6.59 (m, 3 H), 6.37

(dd, J = 2.0, 16.9 Hz, 1 H), 6.25 - 6.24 (m, 1 H), 6.13 (dd, J = 10.3, 16.6 Hz, 1 H), 5.94 - 5.84 (m, 1 H), 5.51 (dd, J = 2.2, 10.3 Hz, 1 H), 5.14 - 5.01 (m, 2 H), 4.83 (dd, J = 5.4, 14.4 Hz, 1 H), 3.82 - 3.80 (m, 3 H), 3.66 - 3.65 (m, 3 H), 3.45 (dd, J = 7.6, 14.4 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.89, 157.59, 137.98, 132.82, 129.88, 128.65, 127.76, 126.77, 122.26, 120.31, 119.76, 118.18, 116.11, 114.26, 107.14, 55.43, 50.84, 36.33; **HRMS (ESI)** calcd for $C_{18}H_{21}O_2N_2$ (M^++ H) 297.1598, found 297.1598.

N-(4,5-Dimethyl-2-(1-methyl-1H-pyrrol-3-yl)phenyl)allylacrylamide (**5e**): Yellowish oil, 88% yield; ***R_f*** = 0.58 (pet. ether/EtOAc = 85/15); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.36 (s, 1 H), 6.82 (s, 1 H), 6.66 (t, J = 2.1 Hz, 1 H), 6.59 (t, J = 2.4 Hz, 1 H), 6.36 (dd, J = 2.2, 16.9 Hz, 1 H), 6.29 (dd, J = 2.0, 2.7 Hz, 1 H), 6.12 (dd, J = 10.3, 16.9 Hz, 1 H), 5.87 - 5.86 (m, 1 H), 5.48 (dd, J = 2.2, 10.3 Hz, 1 H), 5.12 - 5.01 (m, 2 H), 4.83 (dd, J = 5.5, 14.5 Hz, 1 H), 3.65 (s, 3 H), 3.44 (dd, J = 7.4, 14.6 Hz, 1 H), 2.30 (s, 3 H), 2.24 (s, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 166.08, 136.82, 134.75, 134.39, 132.94, 131.58, 131.06, 130.06, 128.77, 127.39, 122.23, 120.53, 120.13, 117.82, 107.82, 50.98, 36.31, 19.45, 19.15; **HRMS (ESI)** calcd for $C_{19}H_{23}ON_2$ (M^++ H) 295.1805, found 295.1803.

N-(3-Methyl-2-(1-methyl-1H-pyrrol-3-yl)phenyl)allylacrylamide (**5f**): Yellowish oil, 80% yield; ***R_f*** = 0.62 (pet. ether/EtOAc = 85/15); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.36 - 7.31 (m, 2 H), 6.98 - 6.87 (m, 1 H), 6.71 (t, J = 2.4 Hz, 1 H), 6.45 - 6.26 (m, 2 H), 6.19 - 6.01 (m, 1 H), 6.24 (dd, J = 1.8, 2.6 Hz, 1 H), 6.09 – 6.07 (m, 1 H), 5.65 (dd, J = 2.4, 10.1 Hz, 1 H), 5.18 – 5.12 (m, 2 H), 4.67 (dd, J = 5.3, 14.8 Hz, 1 H), 3.77 (s, 3 H), 3.39 (dd, J = 7.5, 14.8 Hz, 1 H), 2.42 (s, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.57, 140.13, 139.27, 133.15, 129.93, 127.70, 127.11, 126.52, 121.57, 120.44, 118.37, 117.41, 109.68, 51.11, 36.20, 21.37; **HRMS (ESI)** calcd for $C_{18}H_{21}ON_2$ (M^++ H) 281.1648, found 281.1643.

N-(2-((1H-Pyrrol-3-yl)methyl)phenyl)allylacrylamide (**7**): Brown oil, 82% yield; ***R_f*** = 0.38 (pet. ether/EtOAc = 90/10); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.35 - 7.33 (m, 2 H), 7.19

- 7.10 (m, 1 H), 7.01 - 6.93 (m, 1 H), 6.65 - 6.61 (m, 2 H), 6.45 (dd, *J* = 1.8, 16.8 Hz, 1 H), 6.18 (t, *J* = 2.1 Hz, 2 H), 6.01 - 5.87 (m, 2 H), 5.56 (dd, *J* = 1.8, 10.4 Hz, 1 H), 5.23 - 5.08 (m, 2 H), 4.98 (d, *J* = 15.9 Hz, 1 H), 4.92 (d, *J* = 15.9 Hz, 1 H), 4.65 - 4.58 (m, 1 H), 3.79 (dd, *J* = 7.2, 14.5 Hz, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 165.20, 139.14, 136.44, 132.39, 129.62, 129.10, 128.98, 128.86, 127.60, 121.21, 119.09, 108.85, 51.87, 49.32; **HRMS (ESI)** calcd for $C_{17}H_{19}ON_2$ (M^++ H) 267.1492, found 267.1492.

N-(2-((1H-Pyrrol-1-yl)phenyl)cinnamylcinnamamide (**10**): Brown thick liquid, 72% yield; ***R_f*** = 0.56 (pet. ether/EtOAc = 80/20); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.82 (d, *J* = 15.6 Hz, 1 H), 7.48 (d, *J* = 2.7 Hz, 1 H), 7.39 - 7.33 (m, 10 H), 7.28 - 7.23 (m, 3 H), 6.83 (t, *J* = 2.1 Hz, 2 H), 6.49 - 6.45 (m, 1 H), 6.37 - 6.33 (m, 2 H), 6.31 - 6.27 (m, 1 H), 6.18 - 6.08 (m, 2 H), 4.81 (ddd, *J* = 1.2, 5.7, 14.7 Hz, 1 H), 3.41 - 3.37 (m, 1 H); **^{13}C NMR (400 MHz, $CDCl_3$)** δ = 166.01, 143.45, 138.08, 133.53, 129.83, 128.71, 128.39, 127.97, 127.56, 127.47, 126.42, 126.06, 123.73, 121.22, 117.84, 110.49, 50.06; **HRMS (ESI)** calcd for $C_{28}H_{15}ON_2$ (M^++ H) 405.1961, found 405.1960.

1,12b-Dihydrodipyrrolo[1,2-a:2',1'-c]quinoxalin-3(2H)-one (**2a**): Grey solid, 87% yield; mp = 140-142 °C; ***R_f*** = 0.4 (pet. ether/EtOAc = 75/25); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.27 - 8.23 (m, 1 H) 7.45 - 7.42 (m, 1 H) 7.27 - 7.18 (m, 3 H) 6.36 (t, *J*=3.22 Hz, 1 H) 6.09 - 6.07 (m, 1 H) 5.00 – 4.93 (m, 1 H) 2.79 - 2.69 (m, 3 H) 2.36 - 2.32 (m, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 173.22, 129.91, 128.47, 126.54, 125.29, 124.60, 121.66, 115.02, 110.79, 104.19, 53.94, 31.38, 24.35; **HRMS (ESI)** calcd for $C_{14}H_{13}ON_2$ (M^++ H) 225.1022, found 225.1014. **HPLC conditions:** Chiralpak IA, 95:05 *n*-Hexane/IPA, Flow rate 1 mL/min; λ = 254 nm; tR = 18.49 min (minor), tR = 19.81 min (major).

8-Methyl-1,12b-dihydrodipyrrolo[1,2-a:2',1'-c]quinoxalin-3(2H)-one (**2b**): Brown solid, 82% yield; mp = 147-150 °C; ***R_f*** = 0.42 (pet. ether/EtOAc = 75/25); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 8.04 (d, *J* = 7.9 Hz, 1 H), 7.32 - 7.27 (m, 1 H), 7.14 - 7.09 (m, 2 H), 6.35

(t, J = 3.3 Hz, 1 H), 6.09 (m, 1 H), 4.81 (t, J = 7.1 Hz, 1 H), 2.73 - 2.70 (m, 1 H), 2.68 - 2.62 (m, 4 H), 2.37 (m, 1 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 172.79, 129.18, 126.47, 124.63, 119.92, 119.72, 109.44, 102.94, 53.77, 31.31, 23.13, 21.45; **HRMS (ESI)** calcd for $C_{15}H_{15}ON_2$ (M^++ H) 239.1179, found 239.1178.

6,7-Dimethyl-1,12b-dihydrodipyrrolo[1,2-a:2',1'-c]quinoxalin-3(2H)-one (**2c**): Grey solid (decomposition observed in solution), 67% yield; mp = 149-151 °C; ***R_f*** = 0.39 (pet. ether/EtOAc = 75/25); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.00 (s, 1 H), 7.27 - 7.16 (m, 2 H), 6.34 - 6.33 (m, 1 H), 6.06 - 6.05 (m, 1 H), 4.92 (t, J = 7.7 Hz, 1 H), 2.74 - 2.72 (m, 3 H), 2.40 - 2.30 (m, 1 H), 2.29 (s, 6 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 172.73, 133.56, 132.78, 129.61, 126.12, 123.93, 122.12, 115.79, 114.66, 110.04, 103.56, 53.88, 31.15, 23.98, 19.47, 19.26; **HRMS (ESI)** calcd for $C_{16}H_{17}ON_2$ (M^++ H) 253.1335, found 253.1328.

6-Methoxy-1,12b-dihydrodipyrrolo[1,2-a:2',1'-c]quinoxalin-3(2H)-one (**2d**): Grey solid, 83% yield; mp = 153-154 °C; ***R_f*** = 0.38 (pet. ether/EtOAc = 75/25); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.91 (d, J = 2.9 Hz, 1 H), 7.35 (d, J = 8.8 Hz, 1 H), 7.17 - 7.02 (m, 1 H), 6.77 (dd, J = 2.8, 8.9 Hz, 1 H), 6.45 - 6.27 (m, 1 H), 6.09 - 6.01 (m, 1 H), 5.01 - 4.87 (m, 1 H), 3.85 (s, 3 H), 2.76 - 2.64 (m, 3 H), 2.34 - 2.31 (m, 1 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 173.27, 156.55, 129.18, 127.47, 122.29, 115.79, 114.79, 111.50, 110.24, 106.44, 103.63, 55.67, 54.19, 31.52, 24.30; **HRMS (ESI)** calcd for $C_{15}H_{15}O_2N_2$ (M^++ H) 255.1128, found 255.1119.

6-Ethoxy-1,12b-dihydrodipyrrolo[1,2-a:2',1'-c]quinoxalin-3(2H)-one (**2e**): Grey solid, 92% yield; mp = 156-158 °C; ***R_f*** = 0.42 (pet. ether/EtOAc = 70/30); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.88 (d, J = 2.8 Hz, 1 H), 7.30 (d, J = 8.8 Hz, 1 H), 7.13 - 7.12 (m, 1 H), 6.77 (dd, J = 2.78, 6.06 Hz, 1 H), 6.33 - 6.32 (m, 1 H), 6.05 - 6.04 (m, 1 H), 4.98 - 4.93 (m, 1 H), 4.13 - 4.03 (m, 2 H), 2.76 - 2.67 (m, 3 H), 2.34 - 2.30 (m, 1 H), 1.42 (t, J = 7.0 Hz, 3 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 173.21, 155.93, 129.18, 127.44, 122.17, 115.75, 114.17, 112.01, 110.20, 107.07, 103.58, 63.93, 54.19, 31.51, 24.29, 14.75; **HRMS (ESI)** calcd for $C_{16}H_{17}O_2N_2$ (M^++ H) 269.1285, found 269.1274.

6,8-Dichloro-1,12b-dihydrodipyrrolo[1,2-a:2',1'-c]quinoxalin-3(2H)-one (**2f**): Grey solid, 90% yield; mp = 145-146 °C; ***R**$_f$* = 0.35 (pet. ether/EtOAc = 75/25); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.23 (d, *J* = 2.4 Hz, 1 H), 7.91 - 7.88 (m, 1 H), 7.29 (d, *J* = 2.4 Hz, 1 H), 6.36 (t, *J* = 3.4 Hz, 1 H), 6.11 (td, *J* = 1.4, 3.6 Hz, 1 H), 4.85 - 4.78 (m, 1 H), 2.79 - 2.68 (m, 3 H), 2.39 - 2.35 (m, 1 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 172.8, 131.4, 130.3, 130.0, 127.5, 122.8, 120.6, 120.1, 110.1, 104.0, 53.5, 31.2, 23.3; **HRMS (ESI)** calcd for $C_{14}H_{11}ON_2Cl_2$ (M^++ H) 293.0243, found 293.0236.

7-Fluoro-1,12b-dihydrodipyrrolo[1,2-a:2',1'-c]quinoxalin-3(2H)-one (**2g**): Yellowish solid, 92% yield; mp = 143-144 °C; ***R**$_f$* = 0.37 (pet. ether/EtOAc = 75/25); **^{1}H NMR (400 MHz, CDCl$_3$)** δ = 8.21 (dd, *J* = 6.6, 8.1 Hz, 1 H), 7.15 - 7.11 (m, 2 H), 6.90 - 6.86 (m, 1 H), 6.39 (br. s., 1 H), 6.11 (br. s., 1 H), 4.95 (t, *J* = 7.3 Hz, 1 H), 2.83 - 2.68 (m, 2 H), 2.67 - 2.57 (m, 1 H), 2.43 - 2.25 (m, 1 H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ = 173.10, 161.03, 158.60, 129.99, 129.65, 123.17, 123.08, 122.67, 122.64, 115.27, 111.37, 111.16, 110.94, 104.72, 102.88, 102.61, 53.82, 31.21, 24.29; **HRMS (ESI)** calcd for $C_{14}H_{12}ON_2F$ (M^++ H) 243.0928, found 243.0925.

7-Morpholino-1,12b-dihydrodipyrrolo[1,2-a:2',1'-c]quinoxalin-3(2H)-one (**2h**): Grey solid, 92% yield; mp = 162-163 °C; ***R**$_f$* = 0.48 (pet. ether/EtOAc = 75/25); **^{1}H NMR (400 MHz, CDCl$_3$)** δ = 8.11 (d, *J* = 8.8 Hz, 1 H), 7.27 - 7.17 (m, 1 H), 6.95 (d, *J* = 2.4 Hz, 1 H), 6.76 (dd, *J* = 2.6, 8.9 Hz, 1 H), 6.36 - 6.35 (m, 1 H), 6.08 - 6.07 (m, 1 H), 4.91 (t, *J* = 7.3 Hz, 1 H), 3.91 - 3.88 (m, 4 H), 3.20 - 3.18 (m, 4 H), 2.73 - 2.72 (m, 2 H), 2.63 - 2.60 (m, 1 H), 2.33 - 2.31 (m, 1 H), **^{13}C NMR (100 MHz, CDCl$_3$)** δ = 172.77, 149.09, 130.36, 129.30, 122.43, 114.92, 122.03, 110.66, 104.21, 102.57, 66.77, 53.97, 49.53, 31.29, 24.26; **HRMS (ESI)** calcd for $C_{18}H_{20}O_2N_3$ (M^++ H) 310.1550, found 310.1545.

7-Pyrrolo-1,12b-dihydrodipyrrolo[1,2-a:2',1'-c]quinoxalin-3(2H)-one (**2i**): White solid, 97% yield; mp = 159-162 °C; $\boldsymbol{R_f}$ = 0.53 (pet. ether/EtOAc = 70/30); **^{1}H NMR (400 MHz, CDCl$_3$)** δ = 8.32 (d, *J* = 8.6 Hz, 1 H), 7.44 (d, *J* = 2.4 Hz, 1 H), 7.27 - 7.17 (m, 2 H), 7.12 (t, *J* = 2.2 Hz, 2 H), 6.44 - 6.37 (m, 3 H), 6.16 - 6.08 (m, 1 H), 4.99 (t, *J* = 7.5 Hz, 1 H), 2.86 - 2.73 (m, 2 H), 2.69 - 2.58 (m, 1 H), 2.44 - 2.26 (m, 1 H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ = 173.19, 137.99, 130.03, 129.28, 124.13, 122.65, 119.43, 116.56, 115.16, 111.35, 110.73, 107.53, 104.73, 53.88, 31.32, 24; **HRMS (ESI)** calcd for $C_{18}H_{16}ON_3$ (M^++ H) 290.1288, found 290.1285.

7-Diethylamino-1,12b-dihydrodipyrrolo[1,2-a:2',1'-c]quinoxalin-3(2H)-one (**2j**): Grey solid, 89% yield; mp = 160-162 °C; $\boldsymbol{R_f}$ = 0.43 (pet. ether/EtOAc = 75/25); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.00 (d, *J* = 9.0 Hz, 1 H), 7.17 (dd, *J* = 1.3, 2.6 Hz, 1 H), 6.69 (d, *J* = 2.5 Hz, 1 H), 6.53 (dd, *J* = 2.7, 9.0 Hz, 1 H), 6.33 (t, *J* = 3.2 Hz, 1 H), 6.07 - 6.05 (m, 1 H), 4.93 - 4.86 (m, 1 H), 3.39 (q, *J* = 7.1 Hz, 4 H), 2.75 - 2.62 (m, 3 H), 2.34 - 2.30 (m, 1 H), 1.23 - 1.16 (m, 6 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 172.44, 145.77, 130.60, 129.70, 122.69, 114.88, 110.22, 108.39, 103.89, 96.35, 54.10, 44.65, 31.26, 24.10, 12.51; **HRMS (ESI)** calcd for $C_{18}H_{22}ON_3$ (M^++ H) 296.1757, found 296.1747.

1-Methyl-1,3b-4,5-tetrahydro-6H-dihydrodipyrrolo[1,2-a:3',2'-c]quinolin-3-one (**4a**): Grey solid, 80% yield; mp = 139-141 °C; $\boldsymbol{R_f}$ = 0.4 (pet. ether/EtOAc = 75/25); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.22 - 8.17 (m, 1 H), 7.53 - 7.52 (m, 1 H), 7.22 - 7.16 (m, 2 H), 6.65 (d, *J* = 2.8 Hz, 1 H), 6.02 – 6.00 (m, 1 H), 5.09 – 5.01 (m, 1 H), 3.92 - 3.89 (m, 3 H), 2.66 - 2.59 (m, 3 H), 2.23 - 2.22 (m, 1 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 174.1, 133.36, 125.9, 124.7, 123.5, 122.2, 120.7, 102.5, 56.3, 36.9, 31.7, 25.85; **HRMS (ESI)** calcd for $C_{15}H_{15}ON_2$ (M^++ H) 239.1179, found 239.1169. **HPLC conditions:** Chiralpak IF, 97:03 *n*-Hexane/IPA, Flow rate 1 mL/min; λ = 254 nm; tR = 97.82 min (minor), tR = 110.32 min (major).

1-Ethyl-1,3b-4,5-tetrahydro-6H-dihydrodipyrrolo[1,2-a:3',2'-c]quinolin-3-one (**4b**): Grey solid, 85% yield; mp = 152 °C decomposed; $\boldsymbol{R_f}$ = 0.42 (pet. ether/EtOAc = 75/25); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.21 - 8.16 (m, 1 H), 7.49 - 7.44 (m, 1 H), 7.23 - 7.16 (m, 2 H), 6.73 - 6.72 (m, 1 H), 6.04 - 6.03 (m, 1 H), 5.04 – 5.00 (m, 1 H), 4.27 - 4.21 (m, 2 H), 2.69 - 2.57 (m, 3 H), 2.58 - 2.57 (m, 1 H), 1.53 - 1.27 (t, *J* = 7.20 Hz, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 174.0, 133.4, 125.6, 124.8, 124.1, 123.9, 123.7, 122.7, 122.3, 120.6, 102.7, 56.2, 43.8, 31.7, 25.7, 16.5; **HRMS (ESI)** calcd for $C_{16}H_{17}ON_2$ (M^++ H) 253.1335, found 253.1331.

1-Propyl-1,3b-4,5-tetrahydro-6H-dihydrodipyrrolo[1,2-a:3',2'-c]quinolin-3-one (**4c**): Brown solid, 93% yield; mp = 160 °C decomposed; $\boldsymbol{R_f}$ = 0.41 (pet. ether/EtOAc = 75/25); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.21 - 8.16 (m, 1 H), 7.42 - 7.41 (m, 1 H), 7.25 - 7.16 (m, 2 H), 6.69 (d, *J* = 2.7 Hz, 1 H), 6.01 (d, *J* = 2.8 Hz, 1 H), 5.07 - 4.99 (m, 1 H), 4.21 – 4.02 (m, 2 H), 2.68 - 2.60 (m, 3 H), 2.38 - 2.09 (m, 1 H), 1.92 - 1.81 (m, 2 H), 0.95 (t, *J* = 7.45 Hz, 3 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 174.1, 133.3, 125.6, 125.3, 124.8, 124.0, 122.8, 122.2, 120.6, 102.4, 56.2, 50.8, 31.7, 25.8, 24.3, 11.1; **HRMS (ESI)** calcd for $C_{17}H_{19}ON_2$ (M^++ H) 267.1492, found 267.1479.

1,11-Dimethyl-1,3b-4,5-tetrahydro-6H-dihydrodipyrrolo[1,2-a:3',2'-c]quinolin-3-one (**4d**): Grey solid, 90% yield; mp = 142-143 °C; $\boldsymbol{R_f}$ = 0.39 (pet. ether/EtOAc = 75/25); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.99 (d, *J* = 7.8 Hz, 1 H), 7.20 (t, *J* = 7.8 Hz, 1 H), 7.09 (d, *J* = 7.6 Hz, 1 H), 6.77 (d, *J* = 2.9 Hz, 1 H), 6.14 - 6.13 (m, 1 H), 4.84 (t, *J* = 7.3 Hz, 1 H), 3.61 (s, 3 H), 2.72 - 2.60 (m, 1 H), 2.60 - 2.54 (m, 2 H), 2.52 (s, 3 H), 2.34 - 2.28 (m, 1 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 173.21, 135.17, 131.12, 127.90, 126.21, 126.00, 124.73, 122.55, 119.34, 103.72, 56.22, 36.99, 31.77, 23.74, 21.96; **HRMS (ESI)** calcd for $C_{16}H_{17}ON_2$ (M^++ H) 253.1335, found 253.1331.

9-Methoxy-1-methyl-1,3b-4,5-tetrahydro-6H-dihydrodipyrrolo[1,2-a:3′,2′-c]quinolin-3-one (**4e**): Grey solid, 81% yield; mp = 149-150 °C; $\boldsymbol{R_f}$ = 0.49 (pet. ether/EtOAc = 70/30); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 7.92 (d, *J* = 2.8 Hz, 1 H), 7.46 (d, *J* = 8.7 Hz, 1 H), 6.76 - 6.59 (m, 2 H), 5.99 (d, *J* = 2.8 Hz, 1 H), 5.31 – 5.01 (m, 1 H), 3.86 (s, 6 H), 2.68 - 2.60 (m, 3 H), 2.26 - 2.20 (m, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 174.1, 157.6, 134.8, 124.8, 121.5, 121.3, 115.8, 110.7, 107.8, 102.2, 56.7, 55.4, 36.8, 31.8, 25.8; **HRMS (ESI)** calcd for $C_{16}H_{15}O_2N_2$ (M^++ H) 267.1125, found 267.1128.

1,9,10-Trimethyl-1,3b-4,5-tetrahydro-6H-dihydrodipyrrolo[1,2-a:3′,2′-c]quinolin-3-one (**4f**): Grey solid, 89% yield; mp = 148-149 °C; $\boldsymbol{R_f}$ = 0.41 (pet. ether/EtOAc = 75/25); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.98 (s, 1 H), 7.30 (s, 1 H), 6.61 (d, *J* = 2.7 Hz, 1 H), 6.00 - 5.99 (m, 1 H), 4.99 (dd, *J* = 6.9, 8.2 Hz, 1 H), 3.91 - 3.89 (m, 3 H), 2.67 - 2.63 (m, 3 H), 2.28 (d, *J* = 3.7 Hz, 6 H), 2.23 - 2.21 (m, 1 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 173.80, 134.12, 132.74, 131.28, 125.16, 124.82, 123.21, 122.82, 121.91, 120.38, 102.33, 56.44, 36.92, 31.71, 25.67, 19.86, 19.81; **HRMS (ESI)** calcd for $C_{17}H_{19}ON_2$ (M^++ H) 267.1492, found 267.1481.

10-Methoxy-1-methyl-1,3b-4,5-tetrahydro-6H-dihydrodipyrrolo[1,2-a:3′,2′-c]quinolin-3-one (**4g**): Brown thick liquid, 78% yield; mp = 150-152 °C; $\boldsymbol{R_f}$ = 0.52 (pet. ether/EtOAc = 70/30); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.92 (d, *J* = 2.7 Hz, 1 H), 7.46 (d, *J* = 8.7 Hz, 1 H), 6.73 (dd, *J* = 2.3, 8.7 Hz, 1 H), 6.60 (d, *J* = 2.7 Hz, 1 H), 5.99 (d, *J* = 2.3 Hz, 1 H), 5.04 (dd, *J* = 6.9, 9.2 Hz, 1 H), 3.88 (s, 3 H), 3.86 - 3.83 (m, 3 H), 2.66 - 2.57 (m, 3 H), 2.20 - 2.18 (m, 1 H); **^{13}C NMR (100 MHz, $CDCl_3$)** δ = 174.15, 157.60, 134.82, 124.81, 121.50, 121.27, 115.79, 110.70, 107.76, 102.24, 56.67, 55.41, 36.84, 31.83, 25.81**; HRMS (ESI)** calcd for $C_{16}H_{15}O_2N_2$ (M^++ H) 267.1128, found 267.1123.

9-Ethoxy-1-methyl-1,3b-4,5-tetrahydro-6H-dihydrodipyrrolo[1,2-a:3′,2′-c]quinolin-3-one (**4h**): Grey solid, 94% yield; mp = 142-144 °C; $\boldsymbol{R_f}$ = 0.44 (pet. ether/EtOAc = 75/25); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.90 (d, *J* = 2.7 Hz, 1 H), 7.44 (d, *J* = 8.7 Hz, 1 H), 6.72 (dd, *J*

= 2.7, 8.7 Hz, 1 H), 6.59 (d, *J* = 2.7 Hz, 1 H), 5.99 (d, *J* = 2.7 Hz, 1 H), 5.06 - 5.02 (m, 1 H), 4.12 - 4.03 (m, 2 H), 3.88 (s, 3 H), 2.66 - 2.53 (m, 4 H), 2.20 - 2.18 (m, 1 H), 1.43 (t, *J* = 6.9 Hz, 3 H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ = 174.08, 156.98, 134.78, 124.82, 124.74, 121.48, 121.21, 115.63, 111.23, 108.30, 102.22, 63.58, 56.66, 36.84, 31.83, 25.81, 14.78; **HRMS (ESI)** calcd for $C_{17}H_{17}O_2N_2$ (M^++ H) 281.1285, found 281.1281.

9-Fluoro-1-methyl-1,3b-4,5-tetrahydro-6H-dihydrodipyrrolo[1,2-a:3′,2′-c]quinolin-3-one (**4i**): Yellow solid, 92% yield; mp = 159-160 °C; ***R_f*** = 0.46 (pet. ether/EtOAc = 70/30); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.06 (dd, *J* = 2.7, 11.0 Hz, 1 H), 7.48 (dd, *J* = 6.0, 8.7 Hz, 1 H), 6.89 - 6.86 (m, 1 H), 6.44 - 6.63 (m, 1 H), 6.00 (d, *J* = 2.7 Hz, 1 H), 5.07 – 5.03 (m, 1 H), 3.90 (s, 3 H), 2.68 - 2.60 (m, 3 H), 2.22 - 2.20 (m, 1 H); **^{13}C NMR (50 MHz, CDCl$_3$)** δ = 174.2, 125.7, 121.5, 121.3, 118.8, 111.4, 110.9, 110.0, 109.5, 102.4, 56.5, 36.9, 31.7, 26.0; **HRMS (ESI)** calcd for $C_{15}H_{14}ON_2F$ (M^++ H) 257.1085, found 257.1080.

9-Chloro-1-methyl-1,3b-4,5-tetrahydro-6H-dihydrodipyrrolo[1,2-a:3′,2′-c]quinolin-3-one (**4j**): Brown thick liquid, 91% yield; mp = 160-162 °C; ***R_f*** = 0.25 (pet. ether/EtOAc = 80/20); **^{1}H NMR (400 MHz, CDCl$_3$)** δ = 8.06 (td, *J* = 2.3, 10.9 Hz, 1 H), 7.47 (ddd, *J* = 2.3, 6.1, 8.6 Hz, 1 H), 6.86 (tt, *J* = 2.3, 8.4 Hz, 1 H), 6.64 (t, *J* = 2.3 Hz, 1 H), 6.00 (t, *J* = 2.3 Hz, 1 H), 5.10 - 4.98 (m, 1 H), 3.89 (s, 3 H), 2.68 - 2.59 (m, 3 H), 2.22 - 2.20 (m, 1 H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ = 174.21, 161.86, 159.25, 134.86, 134.75, 125.72, 124.04, 122.24, 121.47, 121.38, 118.85, 111.29, 111.07, 109.94, 109.68, 102.43, 56.53, 36.95, 31.74, 26.05; **HRMS (ESI)** calcd for $C_{15}H_{14}ON_2Cl$ (M^++ H) 272.0715, found 272.0714.

1-Methyl-1,10,11,11a-tetrahydro-9H-dihydrodipyrrolo[1,2-a:2′,3′-c]quinolin-9-one (**6a**): Grey solid (decomposition observed in solution), 62% yield; mp = 144-146 °C; ***R_f*** = 0.22 (pet. ether/EtOAc = 60/40); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 8.22 (dd, *J* = 2, 8.1 Hz, 1 H), 7.42 (d, *J* = 7.8 Hz, 1 H), 7.19 - 7.11 (m, 2 H), 6.87 - 6.86 (m, 1 H), 6.45 – 6.44 (m, 1 H), 5.01 (t, *J* = 7.8 Hz, 1 H), 3.69 (s, 3 H), 2.70 - 2.57 (m, 3 H), 2.20 - 2.14 (m, 1 H); **^{13}C NMR**

(50 MHz, $CDCl_3$) δ = 173.85, 133.01, 132.81, 125.62, 124.72, 122.37, 121.63, 117.41, 115.93, 115.62, 55.29, 36.45, 31.89, 25.98; **HRMS (ESI)** calcd for $C_{15}H_{15}ON_2$ (M^++ H) 239.1179, found 239.1169. **HPLC conditions:** Chiralpak IF, 90:10 *n*-Hexane/IPA, Flow rate 1 mL/min; λ = 254 nm; tR = 42.25 min (minor), tR = 58.40 min (major).

1-(Triisopropylsilyl)-1,10,11,11a-tetrahydro-9H-dihydrodipyrrolo[1,2-a:2',3'-c]quinolin-9-one (**6b**): Grey solid, 73% yield; mp = 152 °C decomposed; $\boldsymbol{R_f}$ = 0.26 (pet. ether/EtOAc = 60/40); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.22 (d, *J* = 8.1 Hz, 1 H), 7.55 - 7.51 (m, 1 H), 7.21 - 7.12 (m, 2 H), 7.01 (d, *J* = 2 Hz, 1 H), 6.57 (d, *J* = 2 Hz,1 H), 5.05 (m, 1 H), 2.81 - 2.58 (m, 3 H), 2.19 (t, *J* = 10.1 Hz, 1 H), 1.53 - 1.42 (m, 3 H), 1.14 (dd, *J* = 4.5, 7.5 Hz, 19 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 173.83, 133.10, 125.76, 124.66, 124.02, 122.66, 121.68, 119.49, 118.07, 117.51, 55.62, 32.00, 25.95, 17.77, 11.63; **HRMS (ESI)** calcd for $C_{23}H_{33}ON_2Si$ (M^++ H) 381.2357, found 381.2356.

1-Benzyl-1,10,11,11a-tetrahydro-9H-dihydrodipyrrolo[1,2-a:2',3'-c]quinolin-9-one (**6c**): Brown solid (decomposition observed in solution), 67% yield; mp = 156 °C decomposed; $\boldsymbol{R_f}$ = 0.28 (pet. ether/EtOAc = 60/40); **^{1}H NMR (200 MHz, $CDCl_3$)** δ = 8.23 - 8.18 (m, 1 H), 7.34 - 7.31 (m, 4 H), 7.23 - 7.14 (m, 4 H), 6.95 (d, *J* = 2.0 Hz, 1 H), 6.57 - 6.50 (m, 1 H), 5.15 - 5.03 (m, 2 H), 5.00 - 4.91 (m, 1 H), 2.70 - 2.49 (m, 3 H), 2.28 - 2.21 (m, 1 H); **^{13}C NMR (50 MHz, $CDCl_3$)** δ = 173.87, 137.40, 133.07, 128.98, 128.84, 127.94, 127.86, 127.09, 125.85, 125.75, 124.73, 122.48, 115.49, 115.06, 102.58, 55.30, 53.71, 26.55, 25.89; **HRMS (ESI)** calcd for $C_{21}H_{19}ON_2$ (M^++ H) 315.1492, found 315.1488.

6-Methoxy-1-methyl-1,10,11,11a-tetrahydro-9H-dihydrodipyrrolo[1,2-a:2',3'-c]quinolin-9-one (**6d**): Grey solid (decomposition observed in solution), 70% yield; mp = 149-150 °C; $\boldsymbol{R_f}$ = 0.2 (pet. ether/EtOAc = 60/40); **^{1}H NMR (400 MHz, $CDCl_3$)** δ = 7.91 (d, *J* = 2.7 Hz, 1 H), 7.32 (d, *J* = 8.6 Hz, 1 H), 6.77 - 6.69 (m, 2 H), 6.69 - 6.42 (m, 1 H), 5.02 - 4.92 (m, 1 H), 3.83 (s, 3 H), 3.69 - 3.68 (m, 3 H), 2.70 - 2.60 (m, 1 H), 2.58 - 2.54 (m, 2 H), 2.16 - 2.11 (m, 1 H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ = 173.95, 157.64, 134.09, 131.24, 124.28, 123.13, 121.07, 115.4, 114.91, 111.44, 106.66, 55.42, 36.40, 32.02, 25.94; **HRMS (ESI)** calcd for $C_{16}H_{16}O_2N_2$ (M^++ Na) 291.1104, found 291.1107.

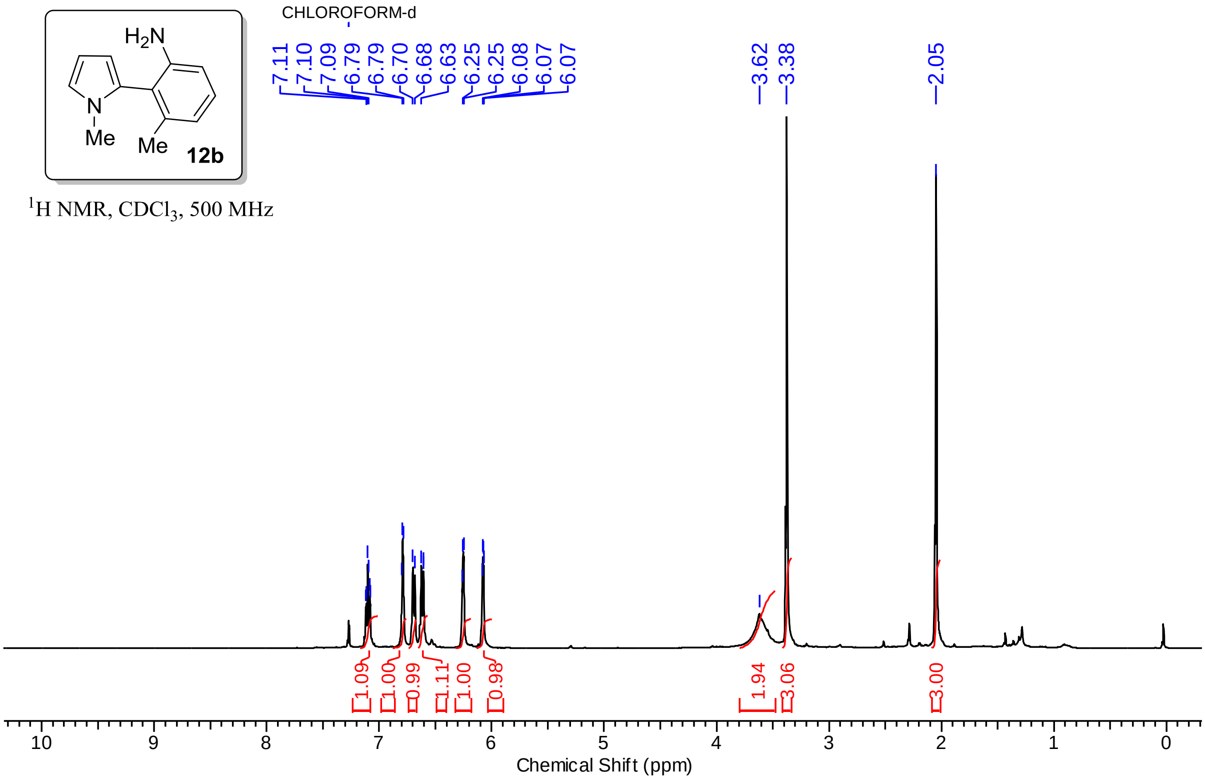
1,6,7-Trimethyl-1,10,11,11a-tetrahydro-9H-dihydrodipyrrolo[1,2-a:2',3'-c]quinolin-9-one (**6e**): Grey solid, 65% yield; mp = 155-156 °C; ***R$_f$*** = 0.22 (pet. ether/EtOAc = 60/40); **^{1}H NMR (400 MHz, CDCl$_3$)** δ = 7.99 (s, 1 H), 7.20 (s, 1 H), 6.82 - 6.81 (m, 1 H), 6.43 - 6.42 (m, 1 H), 4.98 - 4.94 (m, 1 H), 3.68 (s, 3 H), 2.70 - 2.58 (m, 3 H), 2.28 (s, 3 H), 2.25 (s, 3 H), 2.17 - 2.13 (m, 1 H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ = 173.52, 133.95, 132.92, 130.91, 123.43, 122.48, 121.96, 117.55, 115.48, 115.37, 55.40, 36.38, 31.89, 25.82, 19.87, 19.43; **HRMS (ESI)** calcd for $C_{11}H_{18}ON_2$ (M^++ H) 267.1792, found 267.1490.

1,8-Dimethyl-1,10,11,11a-tetrahydro-9H-dihydrodipyrrolo[1,2-a:2',3'-c]quinolin-9-one (**6f**): Grey solid, 64% yield; mp = 159-160 °C; ***R$_f$*** = 0.28 (pet. ether/EtOAc = 60/40); **^{1}H NMR (400 MHz, CDCl$_3$)** δ = 8.02 (dd, *J* = 1.1, 7.9 Hz, 1 H), 7.13 - 7.08 (m, 1 H), 7.07 - 7.00 (m, 1 H), 6.89 (d, *J* = 1.9 Hz, 1 H), 6.50 - 6.48 (m, 1 H), 4.97 - 4.89 (m, 1 H), 3.73 (s, 3 H), 2.70 - 2.6 (m, 3 H), 2.57 (m, 3 H), 2.26 - 2.17 (m, 1 H); **^{13}C NMR (100 MHz, CDCl$_3$)** δ = 173.65, 133.56, 133.31, 127.27, 124.93, 123.32, 119.88, 119.83, 114.81, 54.52, 36.45, 31.72, 25.27, 22.68; **HRMS (ESI)** calcd for $C_{16}H_{16}ON_2$ (M^++ Na) 275.1155, found 275.1150.

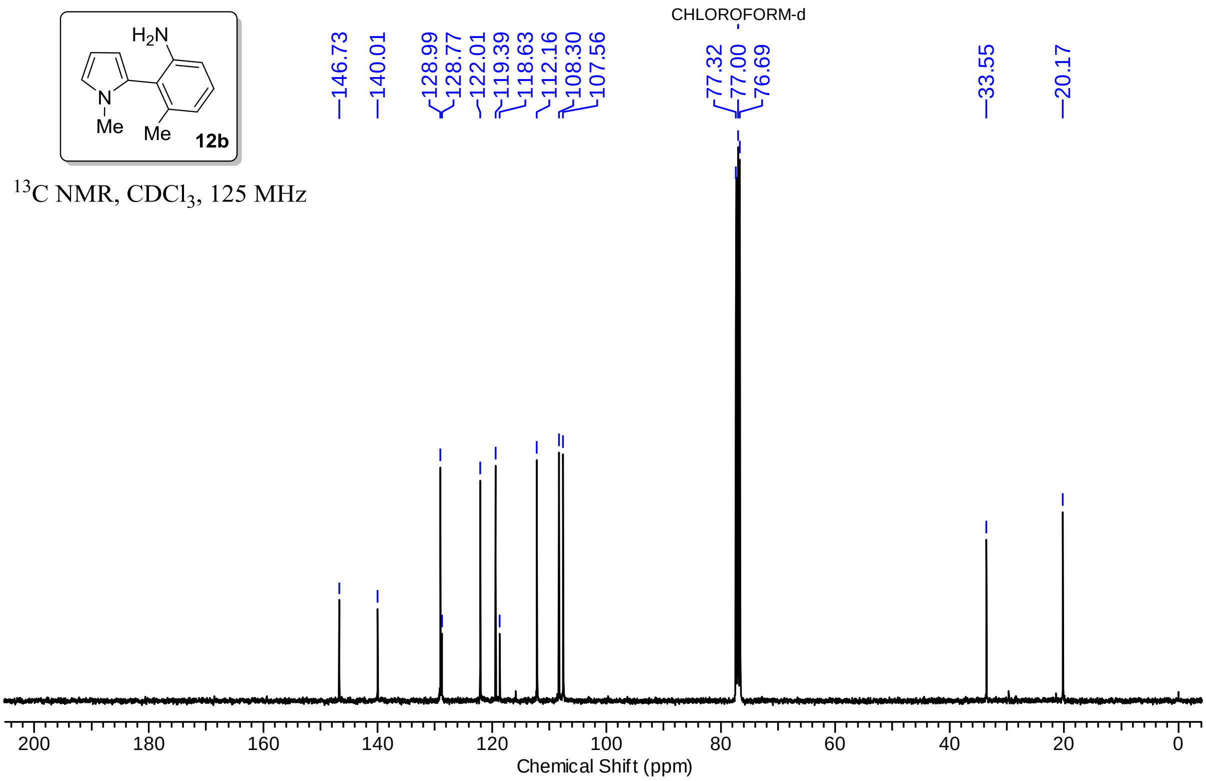
1,13b-Dihydro-9H-benzo[e]dipyrrolo[1,2a:2',1'-c][1,4]diazepin-3(2H)-one (**8**): Grey solid, 87% yield; mp = 170-172 °C; ***R$_f$*** = 0.28 (pet. ether/EtOAc = 80/20); **^{1}H NMR (200 MHz, CDCl$_3$)** δ = 7.59 (d, *J* = 8.1 Hz, 1 H), 7.39 - 7.38 (m, 1 H), 7.31 (d, *J* = 7.3 Hz, 1 H), 7.26 - 7.22 (m, 1 H), 6.66 (t, *J* = 2.1 Hz, 1 H), 6.07 - 6.05 (m, 2 H), 5.24 - 5.17 (m, 2 H), 4.89 (d, *J* = 14.7 Hz, 1 H), 2.70 - 2.66 (m, 2 H), 2.59 - 2.54 (m, 1 H), 2.32 - 2.28 (m, 1 H); **^{13}C NMR (400 MHz, CDCl$_3$)** δ = 174.63, 137.28, 132.46, 129.84, 129.14, 128.55, 127.03, 121.73, 107.13, 106.99, 58.79, 50.99, 31.20, 28.38; **HRMS (ESI)** calcd for $C_{15}H_{15}ON_2$ (M^++ H) 239.1179, found 239.1179.

1-(2-(1H-Pyrrol-1-yl)phenyl)-1,5-dihydro-2H-pyrrol-2-one (**C**): Dark grey oil, 80% yield; **^{1}H NMR (200 MHz, CDCl$_3$)** δ: 7.53 (d, *J* = 2 Hz, 1 H), 7.41-7.43 (m, 3H), 7.07 (d, *J* = 2 Hz,1 H), 6.78 (d, *J* = 4.2 Hz, 2H), 6.28 (d, *J* = 4.1 Hz, 2H), 6.25(m, 1H), 3.49 (d, *J* = 2.7 Hz, 2H); **^{13}C NMR (400 MHz, CDCl$_3$)** δ: 171.44, 144.55, 137.05, 132.49, 129.02, 128.11, 127.99, 127.28, 126.72, 121.31, 110.1, 53.56; **HRMS (ESI)** calcd for $C_{14}H_{12}N_2O$ (M^{+}+ H) 224.0979, found 224.0976.

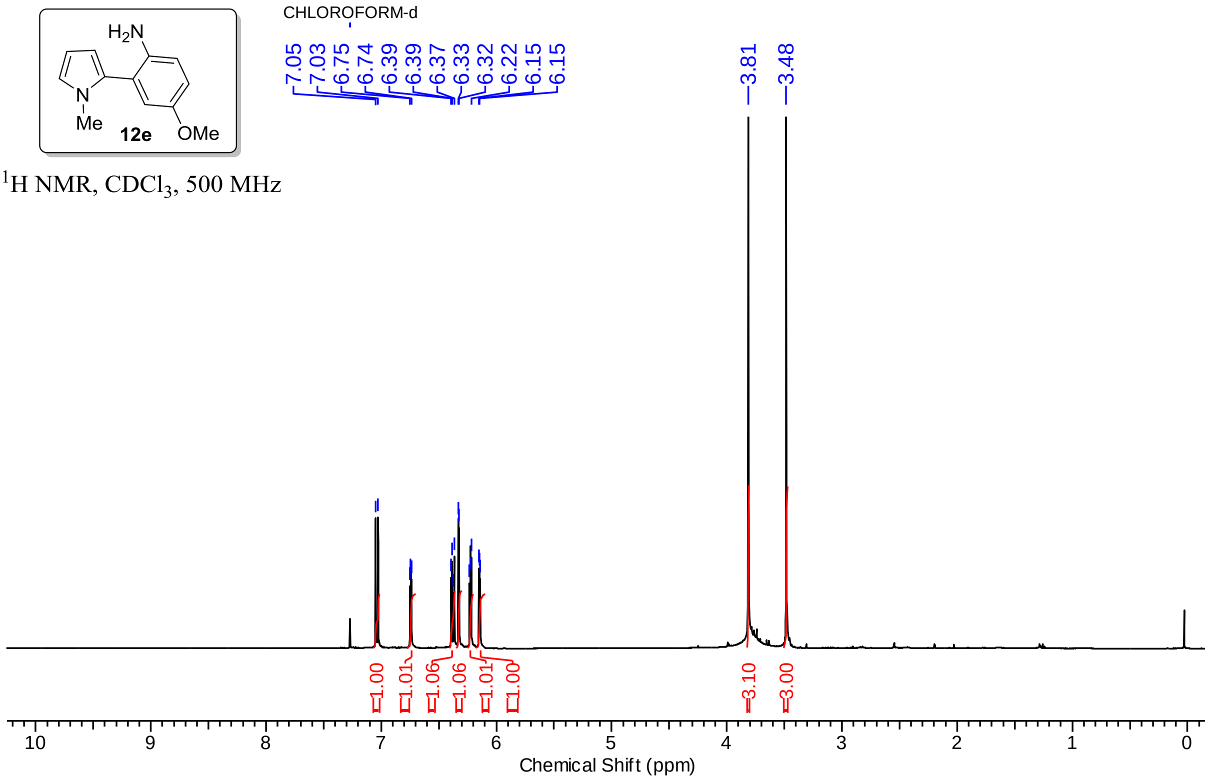
3 Spectral data



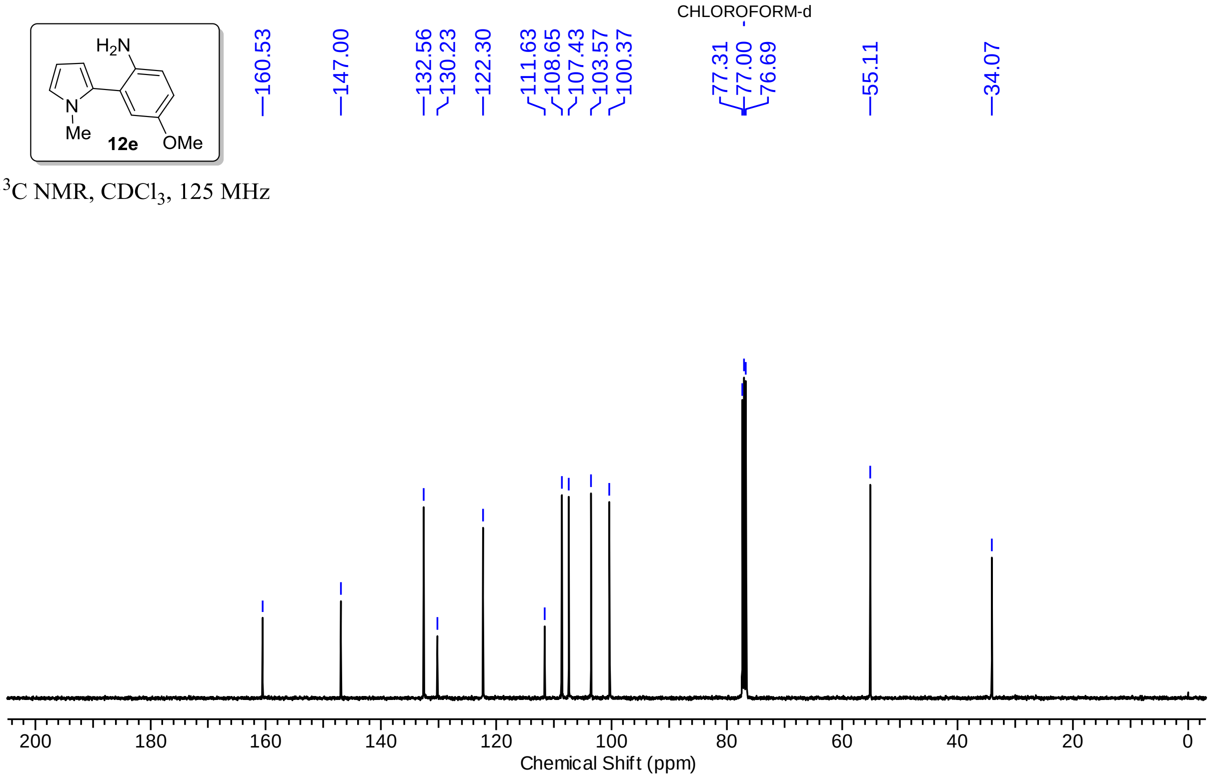
^{1}H NMR, $CDCl_3$, 500 MHz



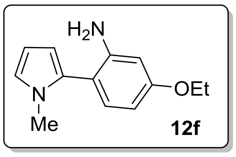
^{13}C NMR, $CDCl_3$, 125 MHz

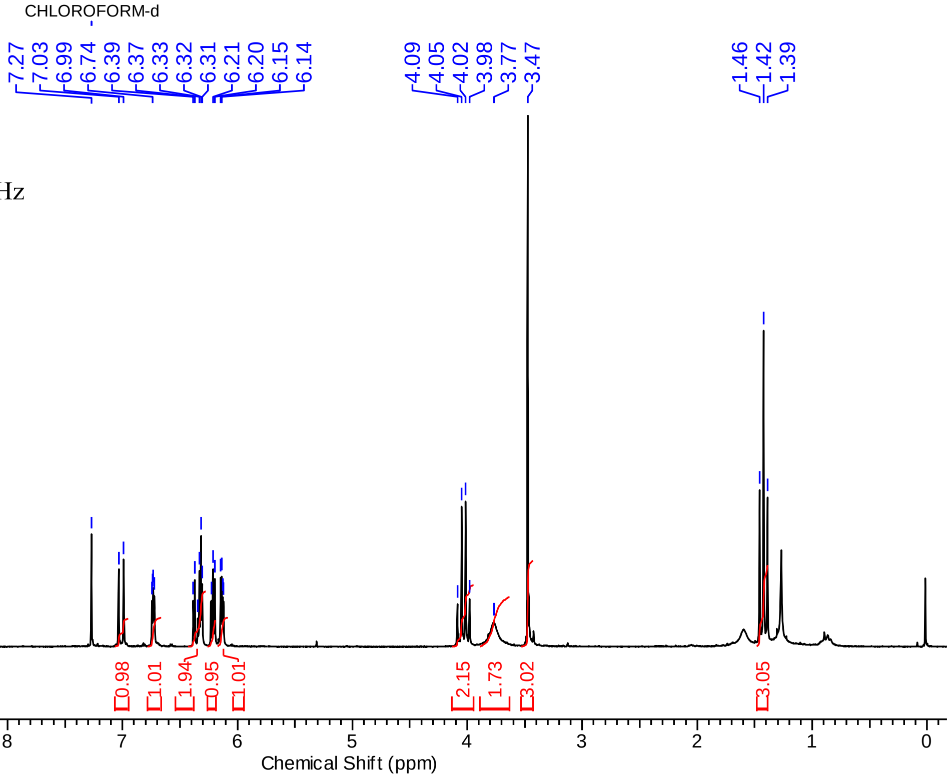


^{1}H NMR, $CDCl_3$, 500 MHz

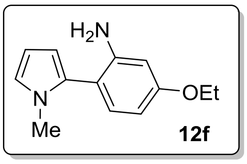


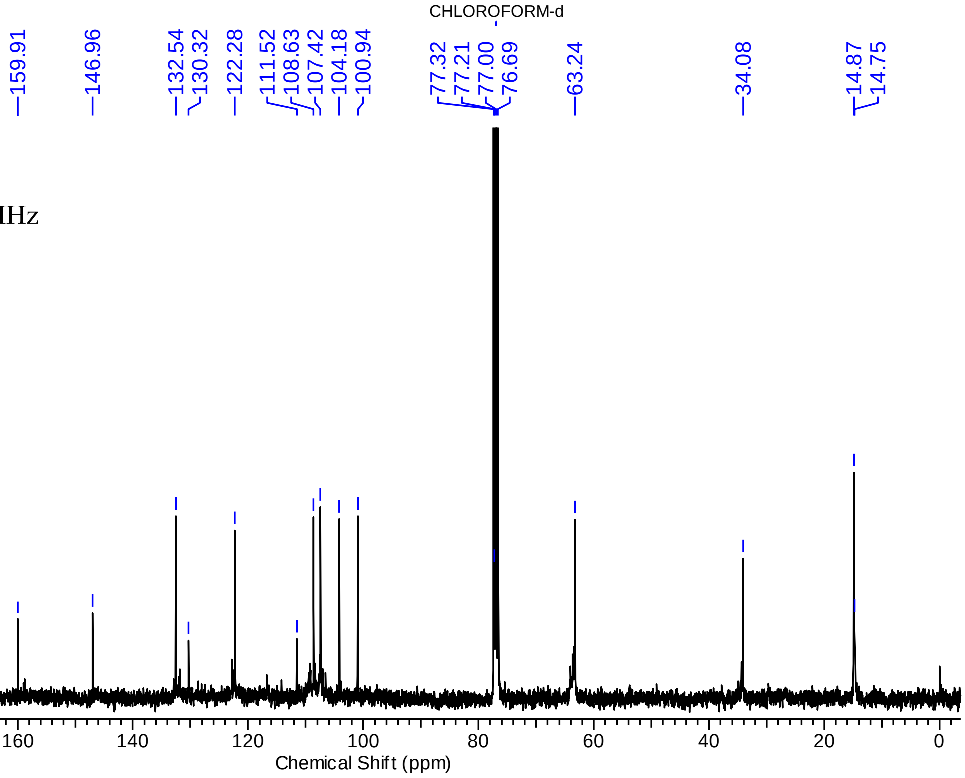
^{13}C NMR, $CDCl_3$, 125 MHz



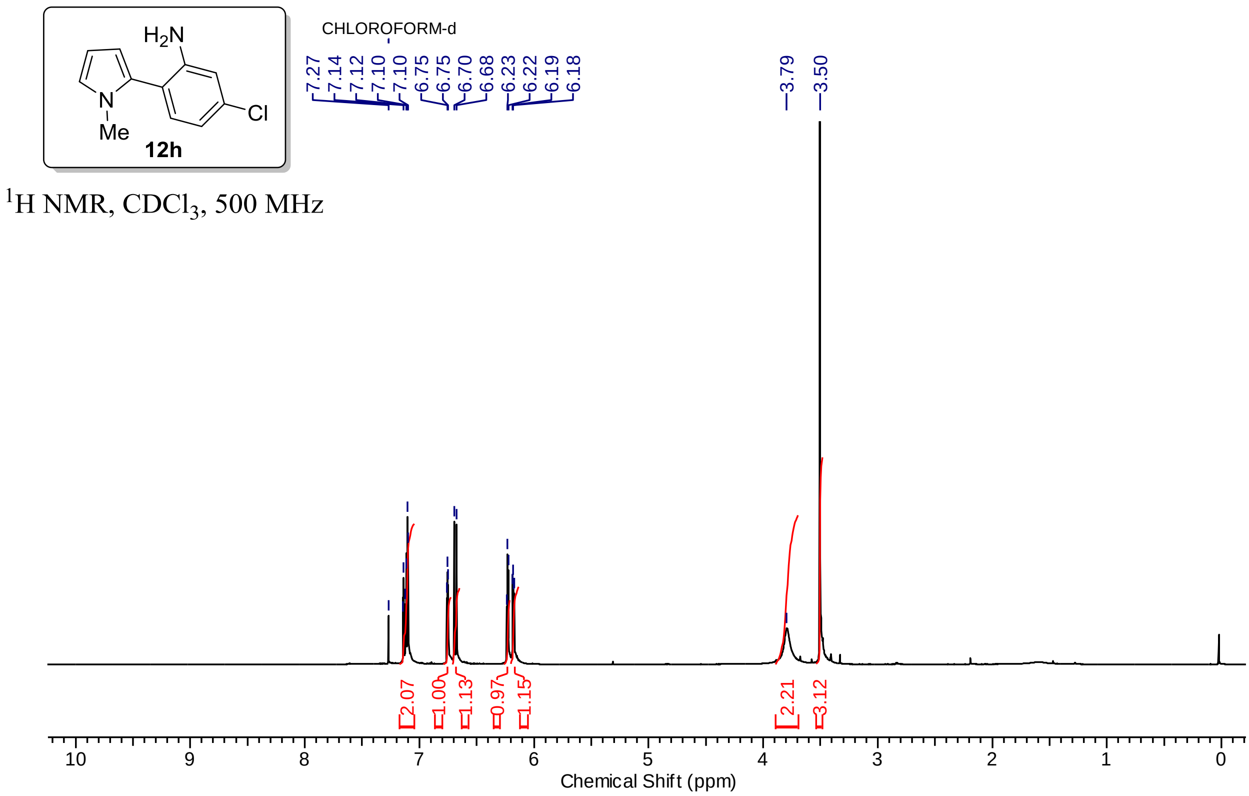


^{1}H NMR, $CDCl_3$, 500 MHz

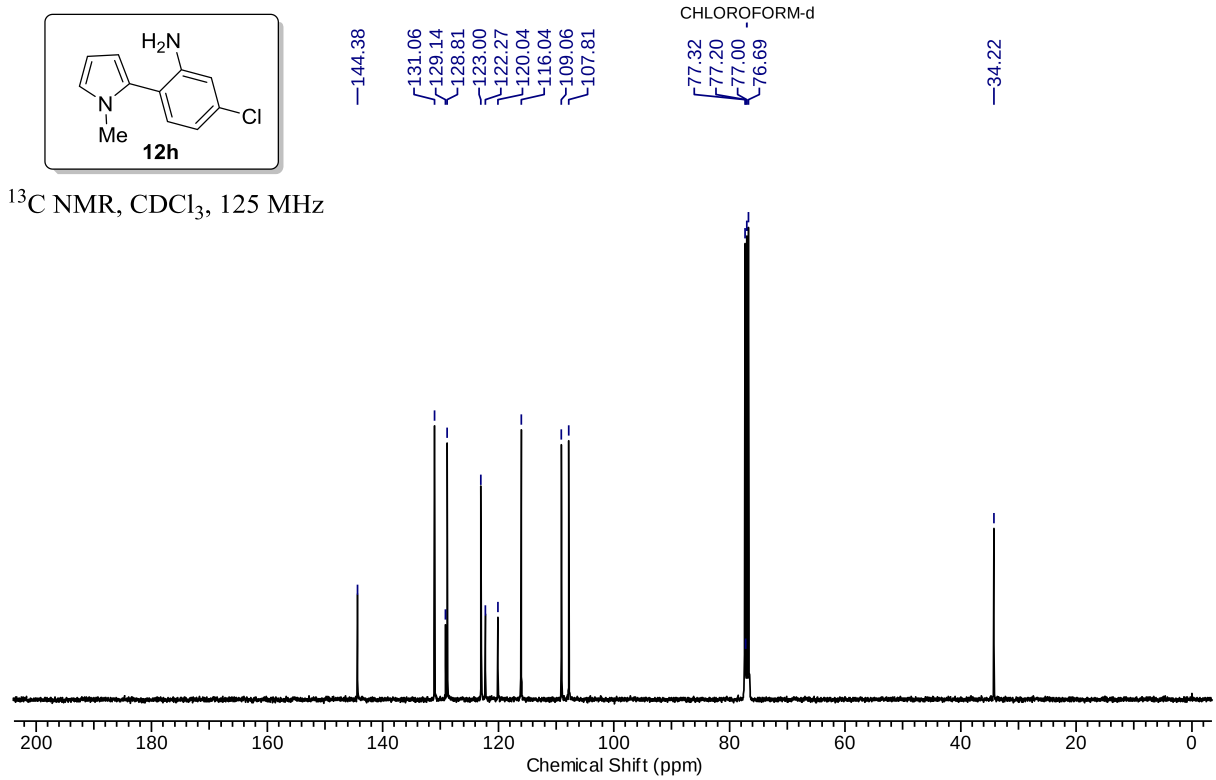




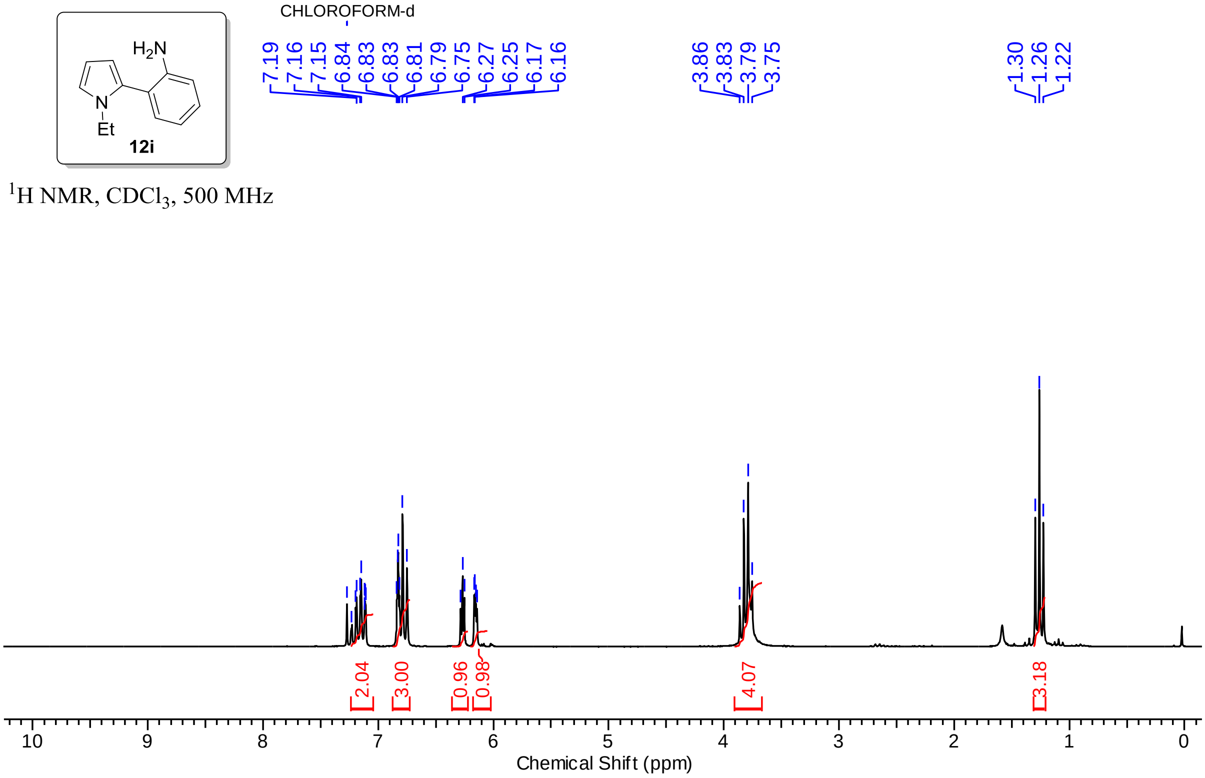
^{13}C NMR, $CDCl_3$, 125 MHz



^{1}H NMR, $CDCl_3$, 500 MHz

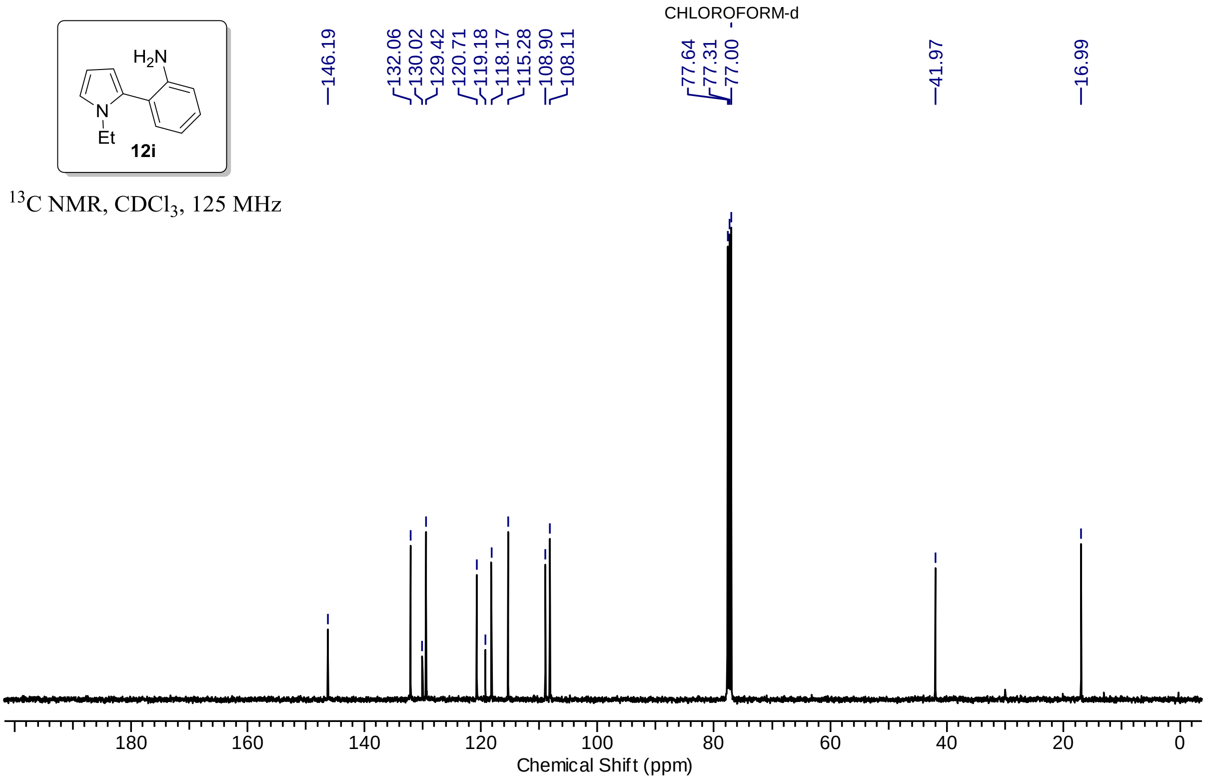


^{13}C NMR, $CDCl_3$, 125 MHz



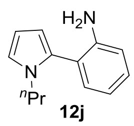
12i

^{1}H NMR, $CDCl_3$, 500 MHz



12i

^{13}C NMR, $CDCl_3$, 125 MHz



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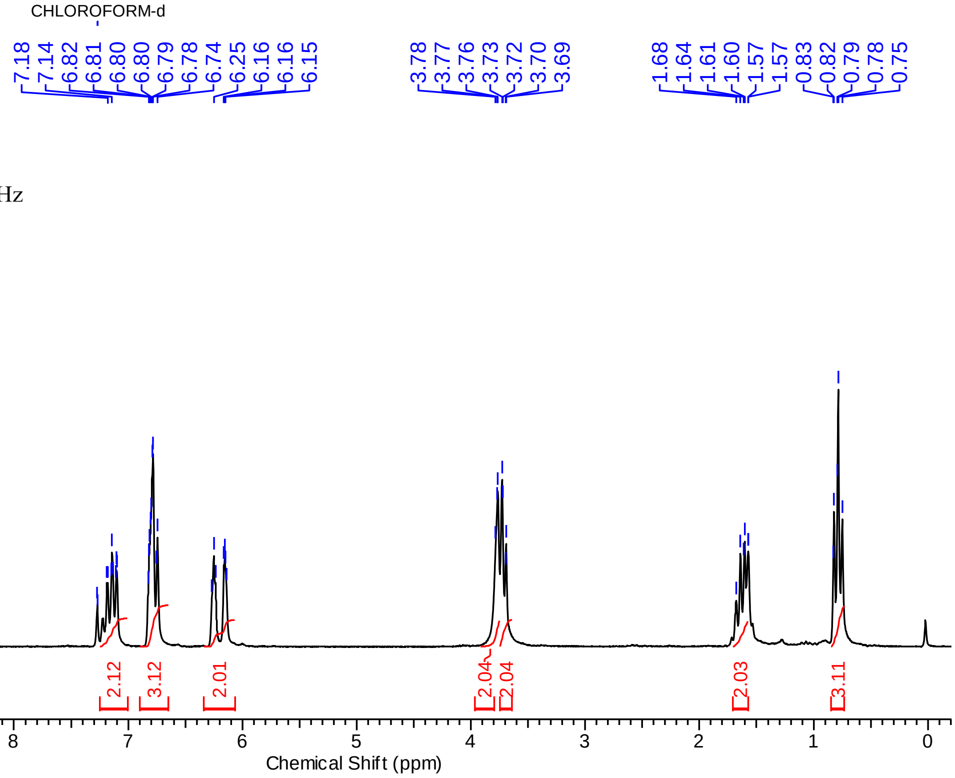
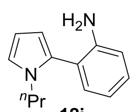


^{1}H NMR, $CDCl_3$, 200 MHz



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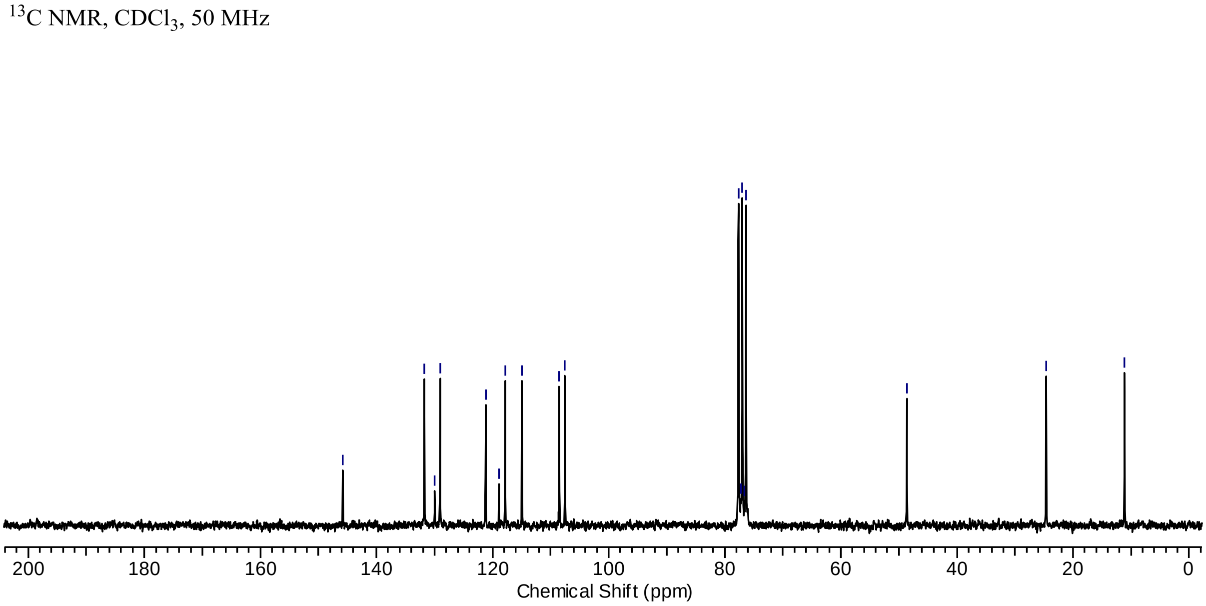
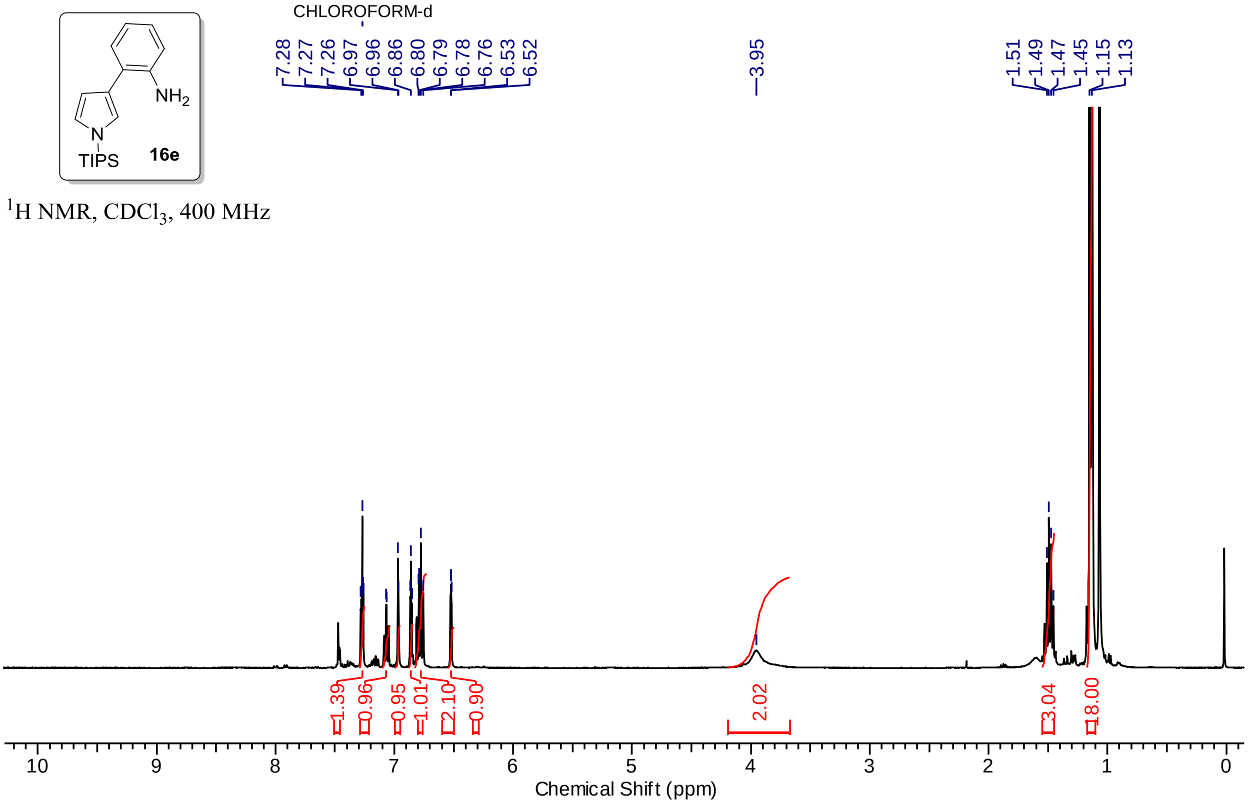
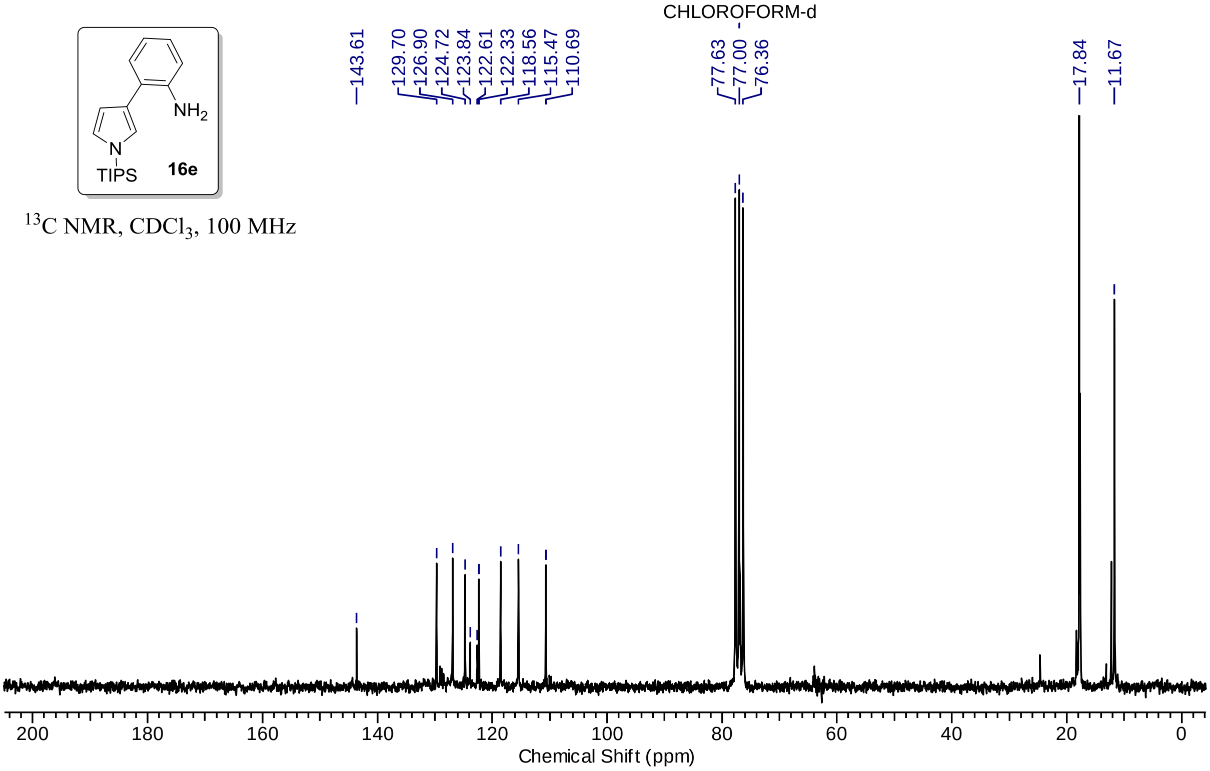


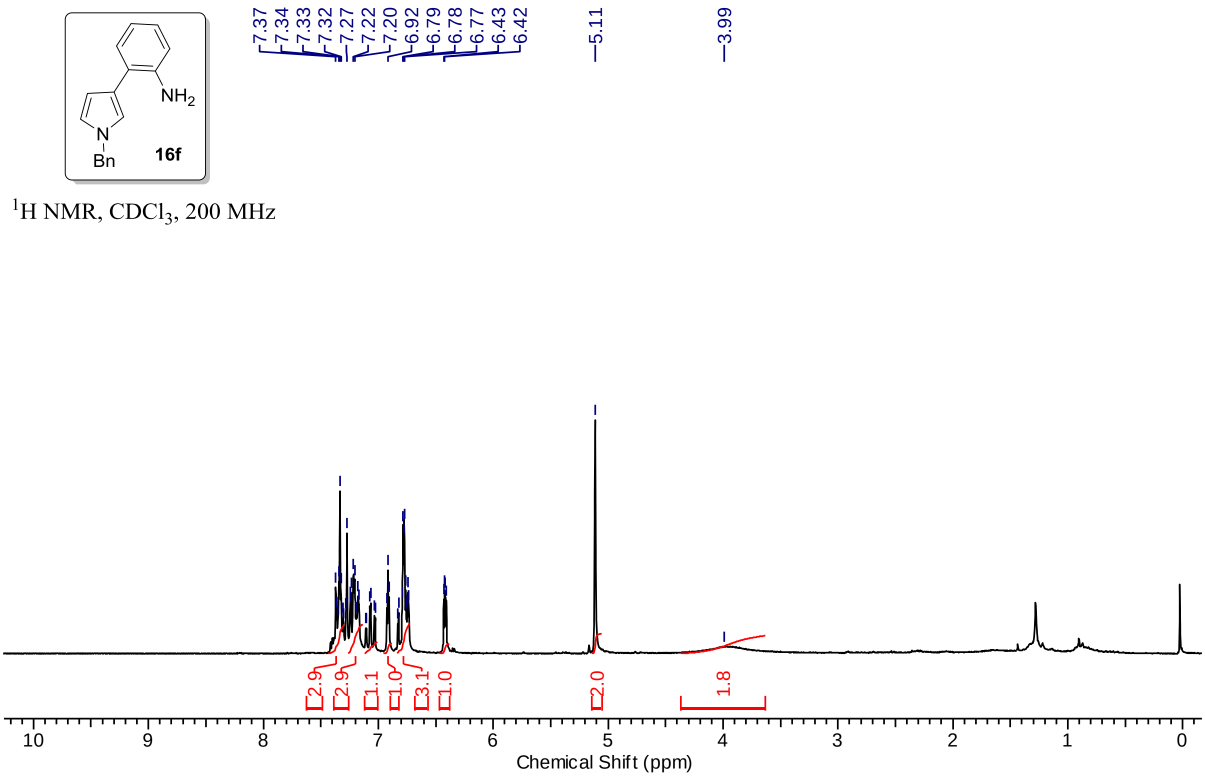
^{13}C NMR, $CDCl_3$, 50 MHz



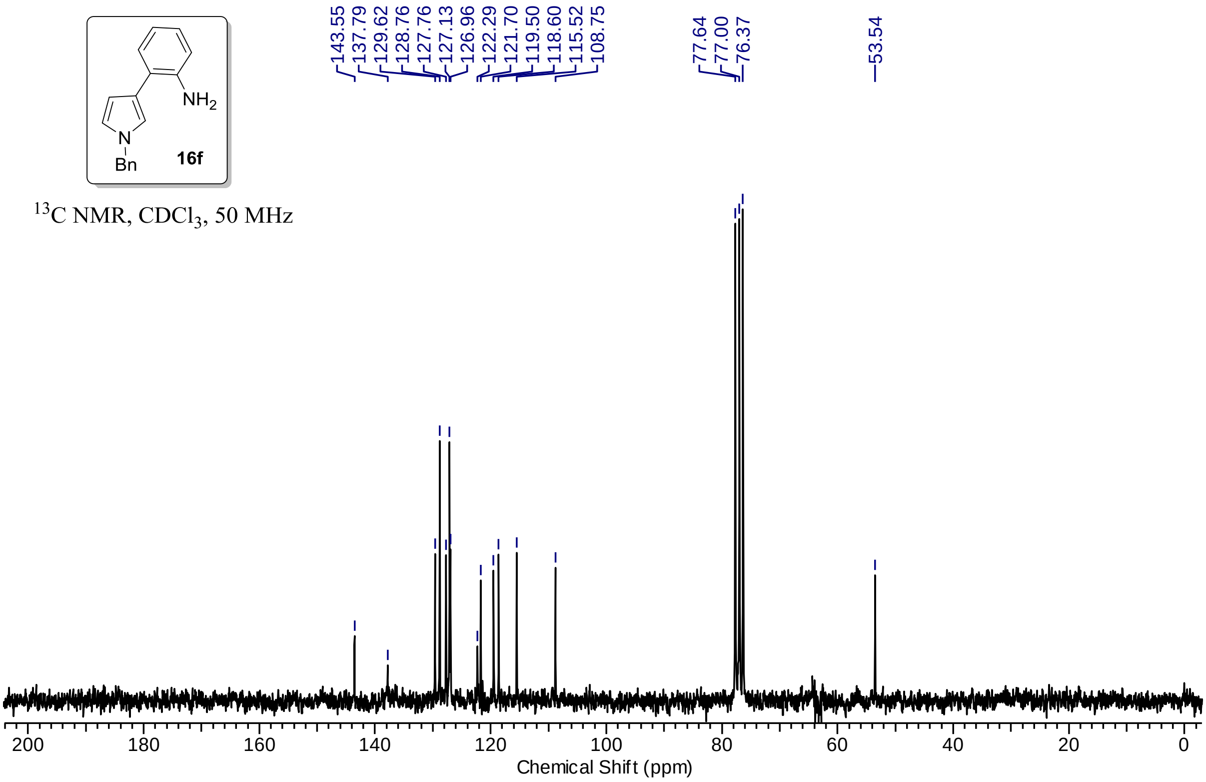
^{1}H NMR, $CDCl_3$, 400 MHz



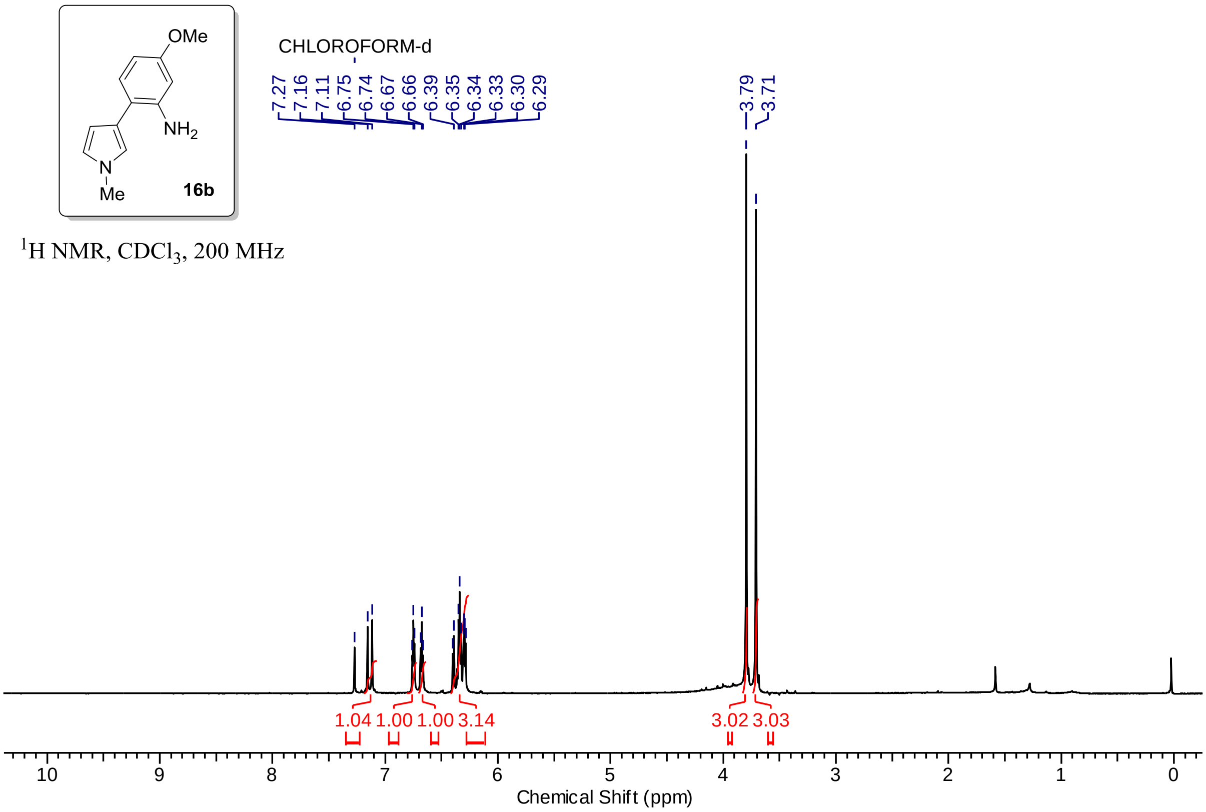
^{13}C NMR, $CDCl_3$, 100 MHz



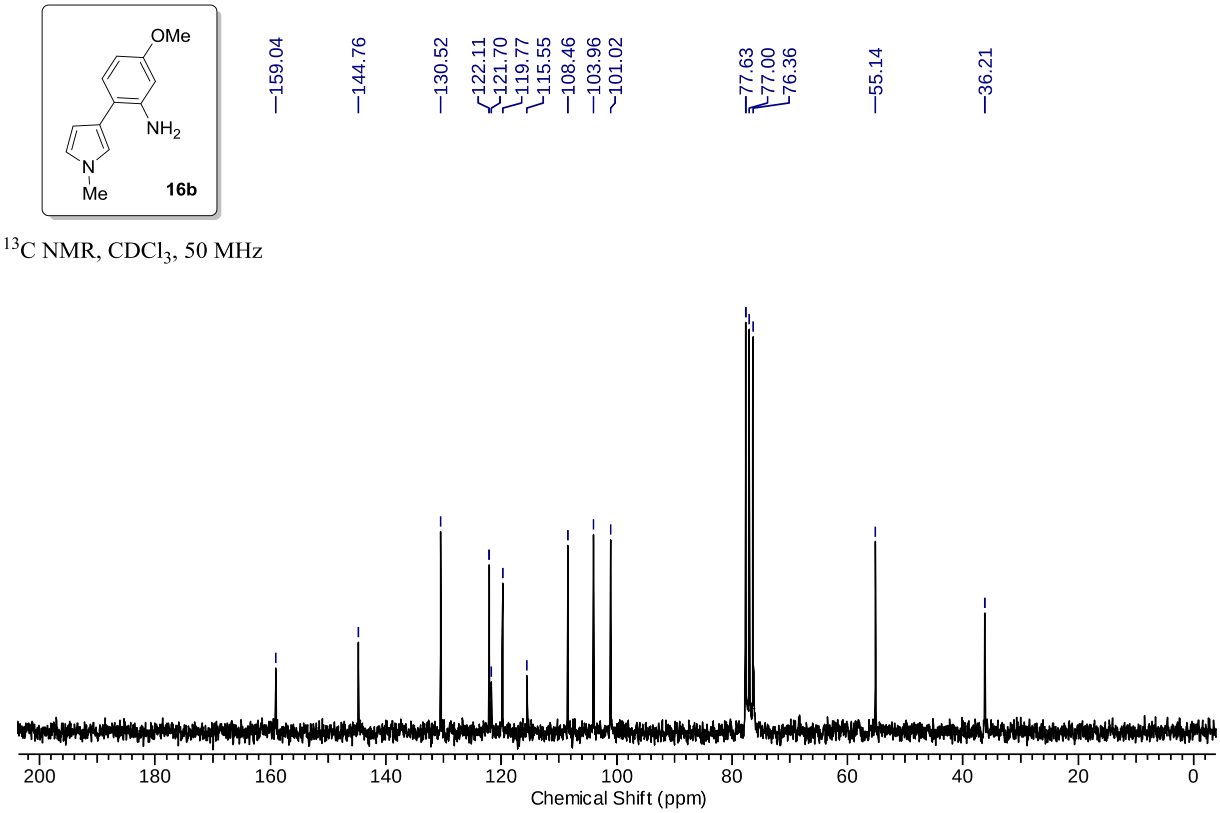
^{1}H NMR, $CDCl_3$, 200 MHz



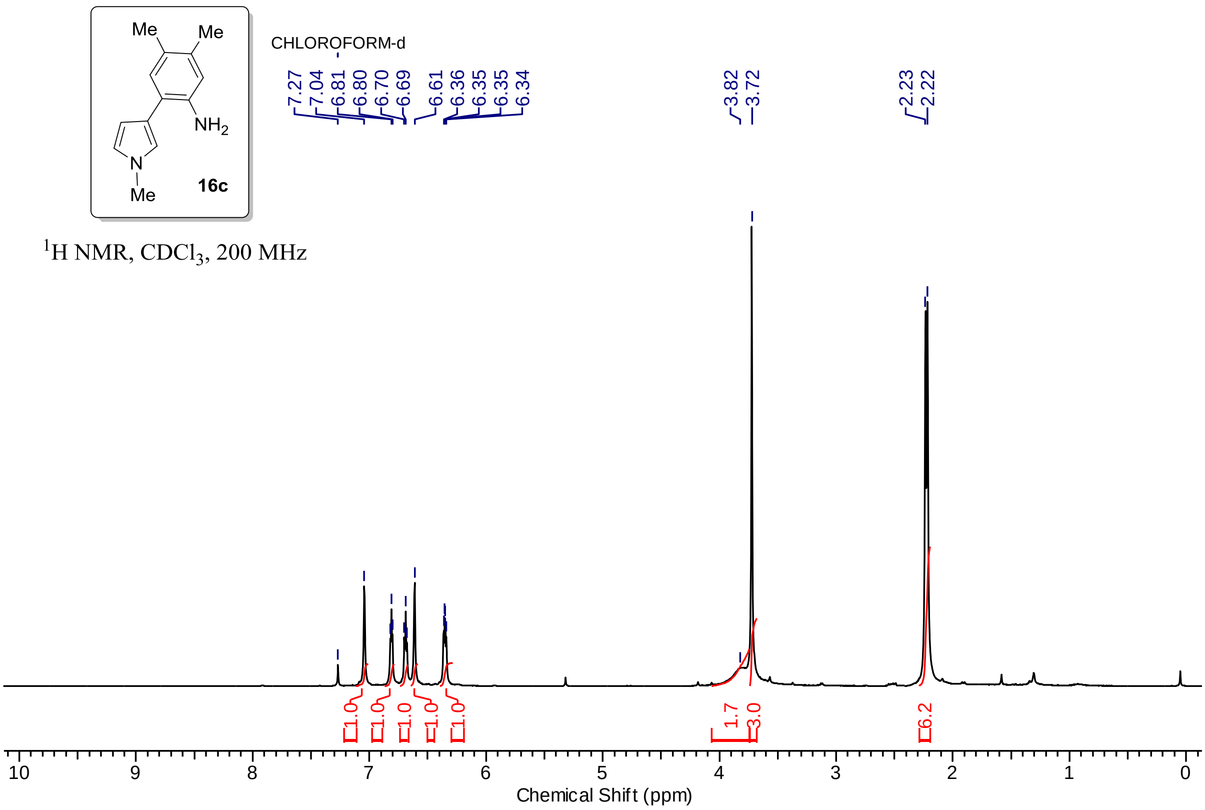
^{13}C NMR, $CDCl_3$, 50 MHz



[1]H NMR, $CDCl_3$, 200 MHz



[13]C NMR, $CDCl_3$, 50 MHz



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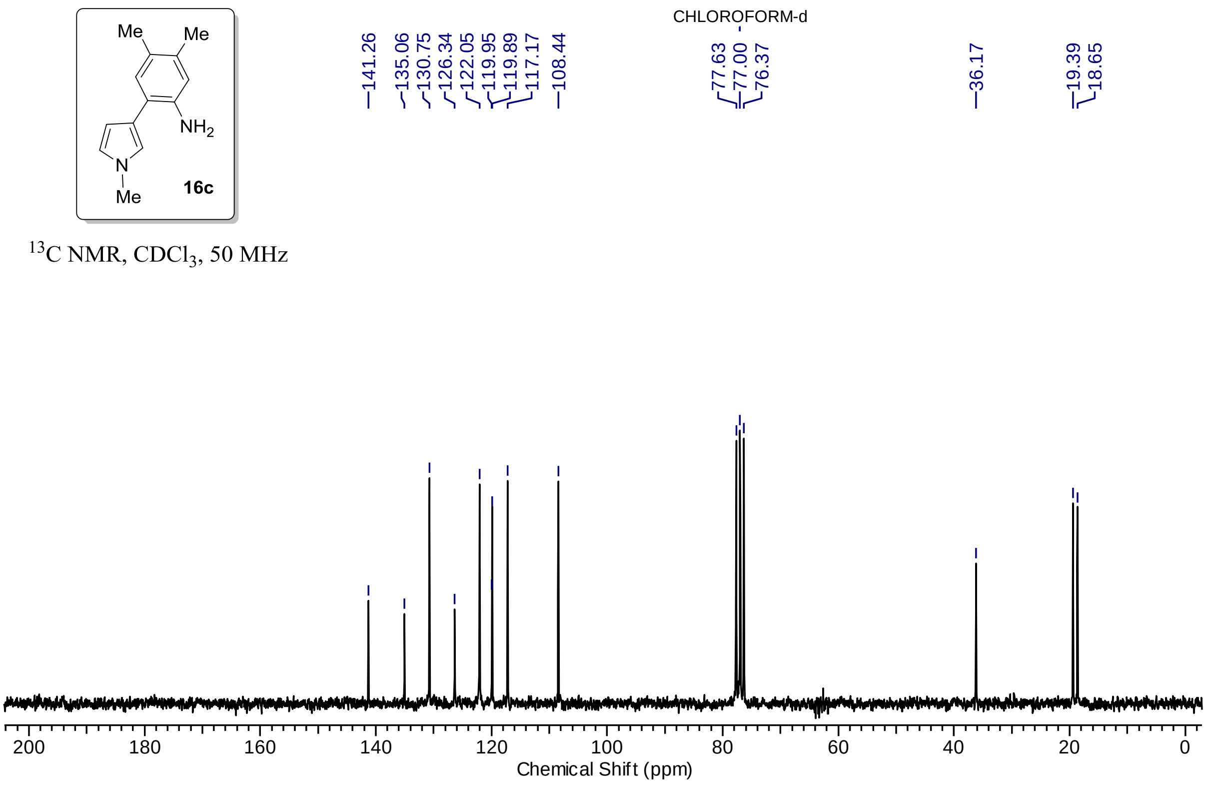
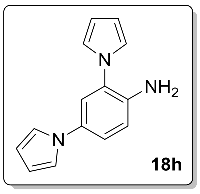


^{13}C NMR, $CDCl_3$, 50 MHz



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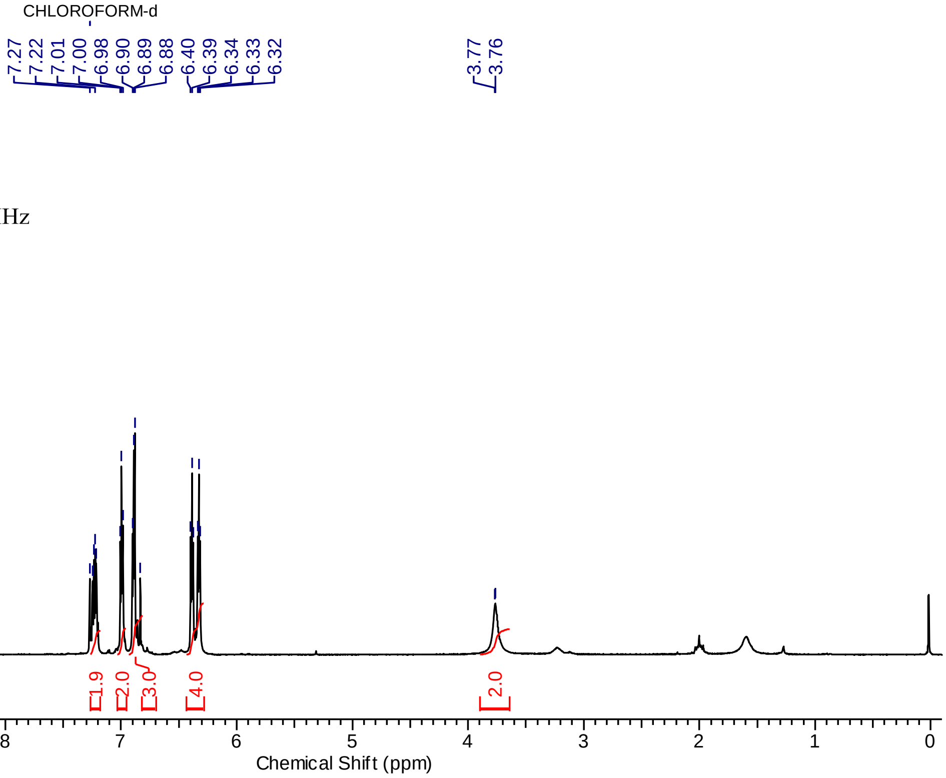
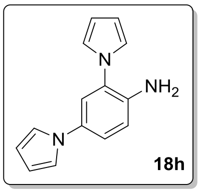
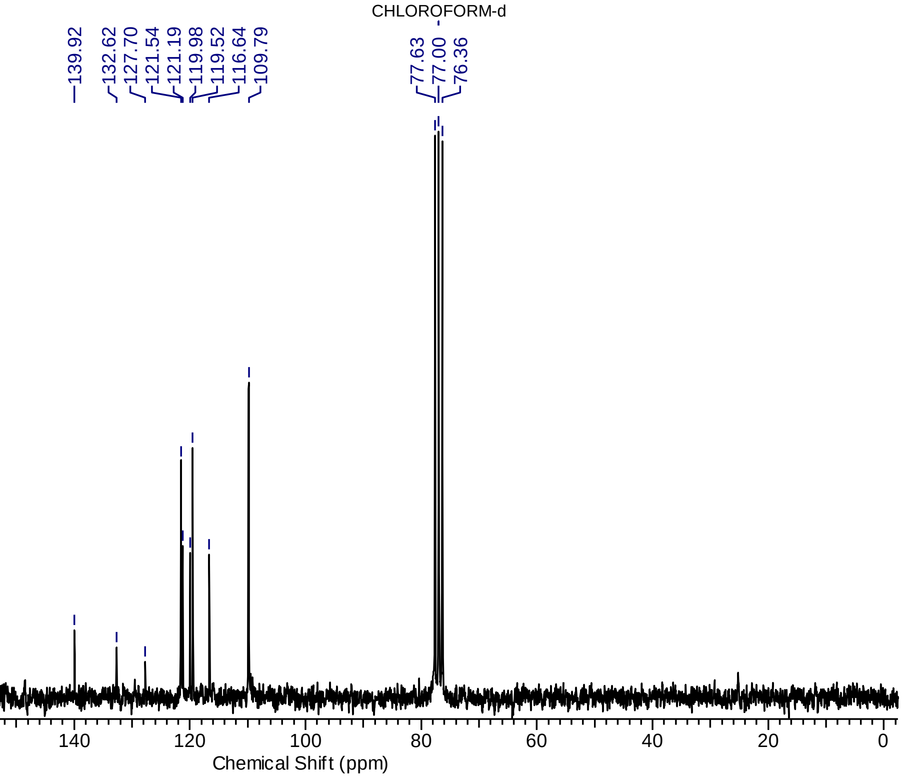
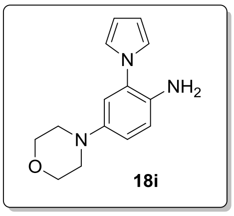


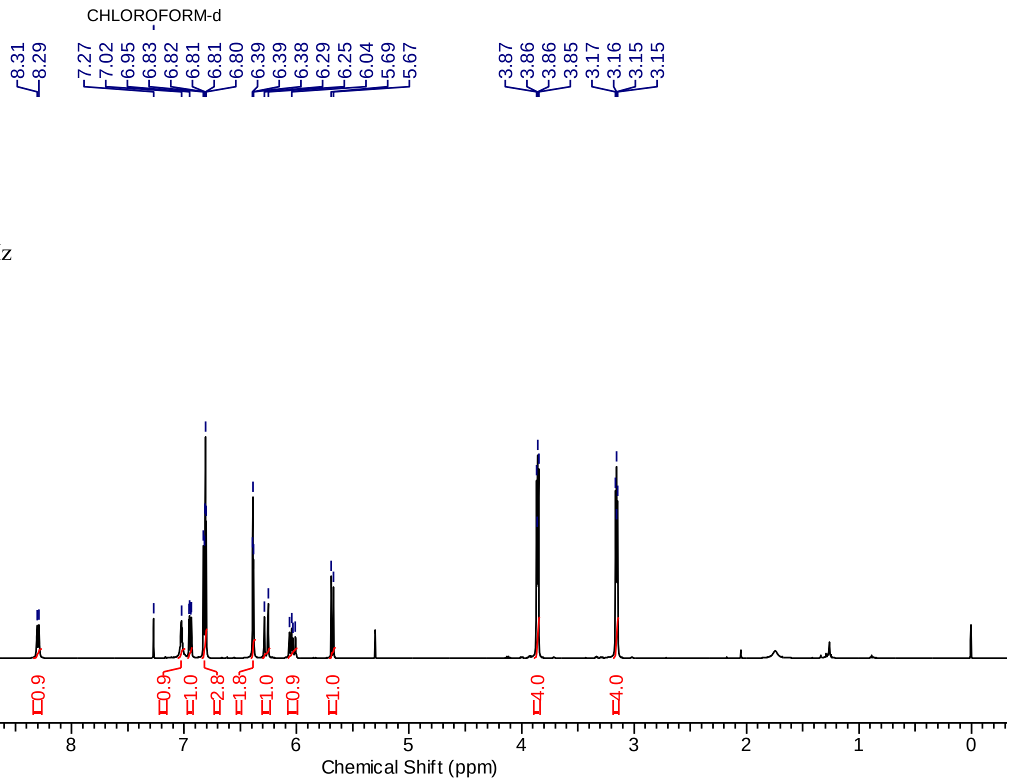


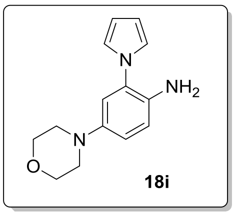
^{13}C NMR, $CDCl_3$, 50 MHz



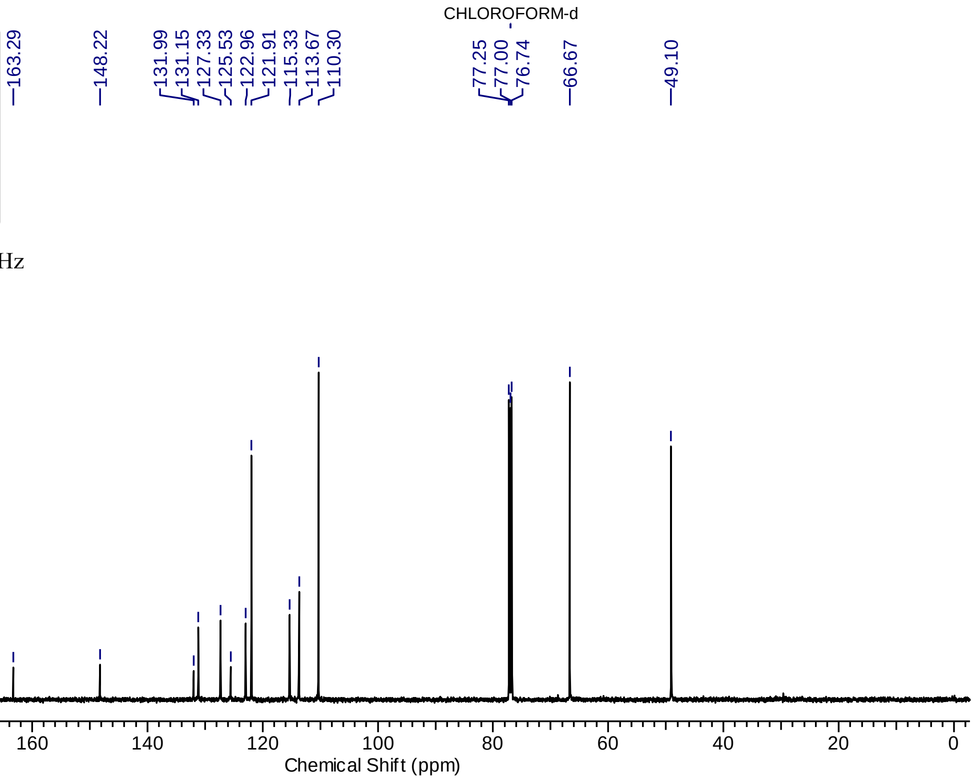


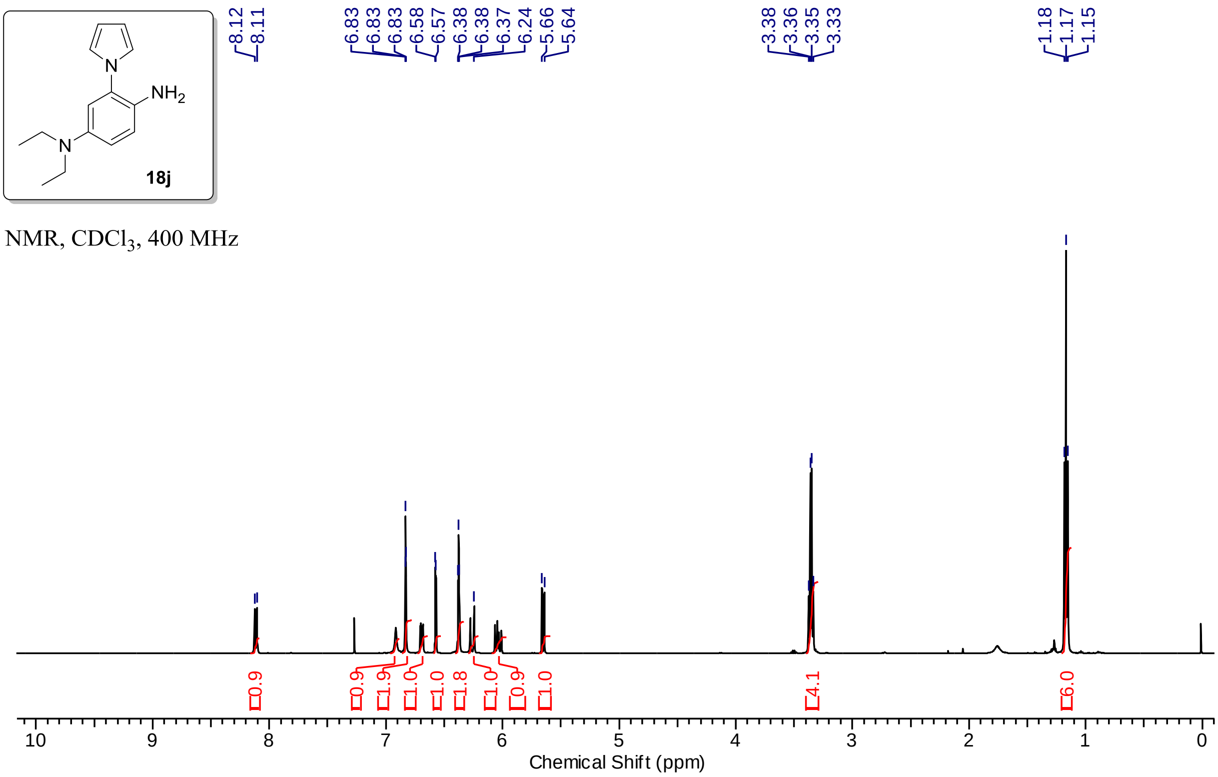
¹H NMR, $CDCl_3$, 400 MHz



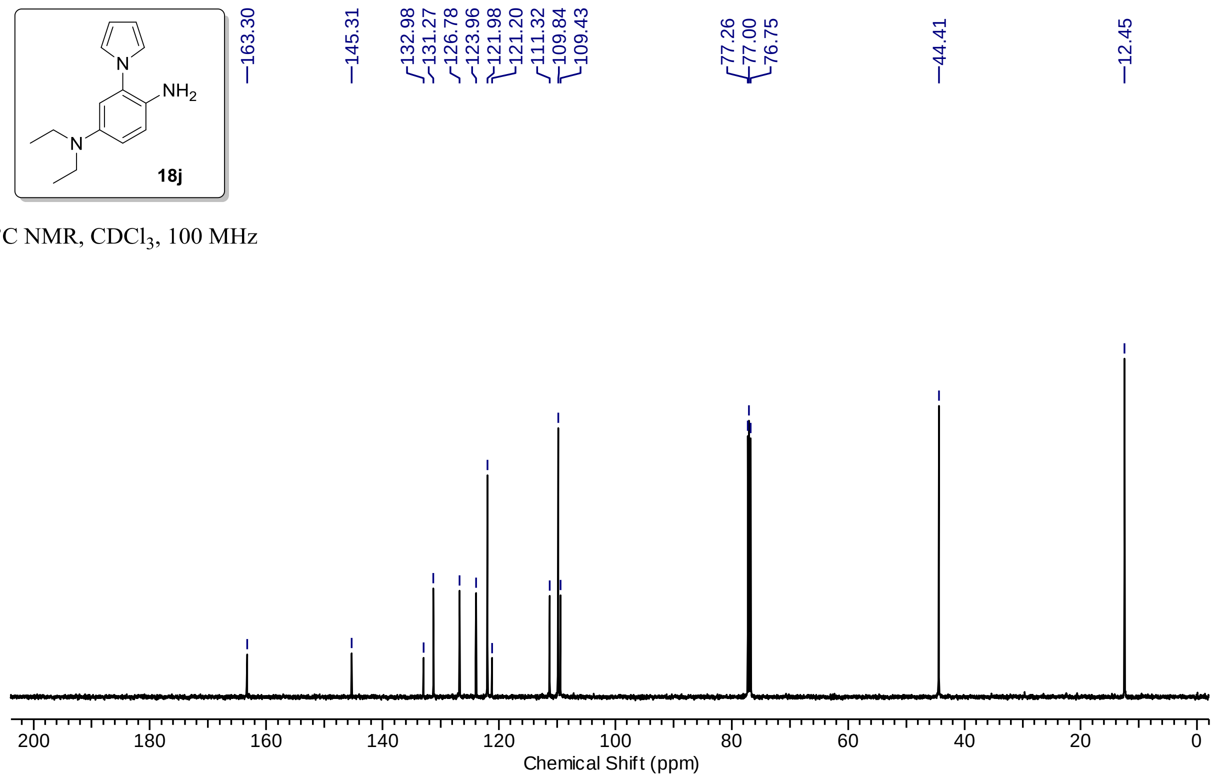


¹³C NMR, $CDCl_3$, 100 MHz

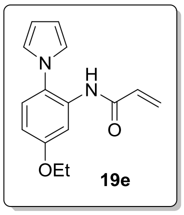




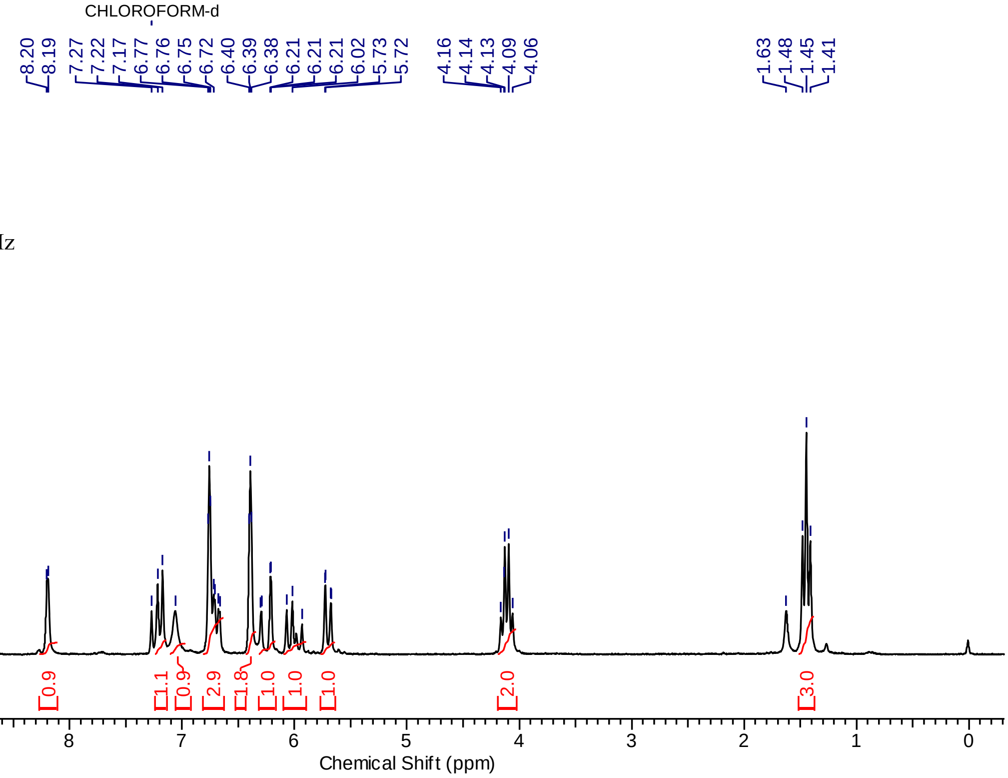
^{1}H NMR, $CDCl_3$, 400 MHz

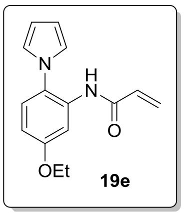


^{13}C NMR, $CDCl_3$, 100 MHz

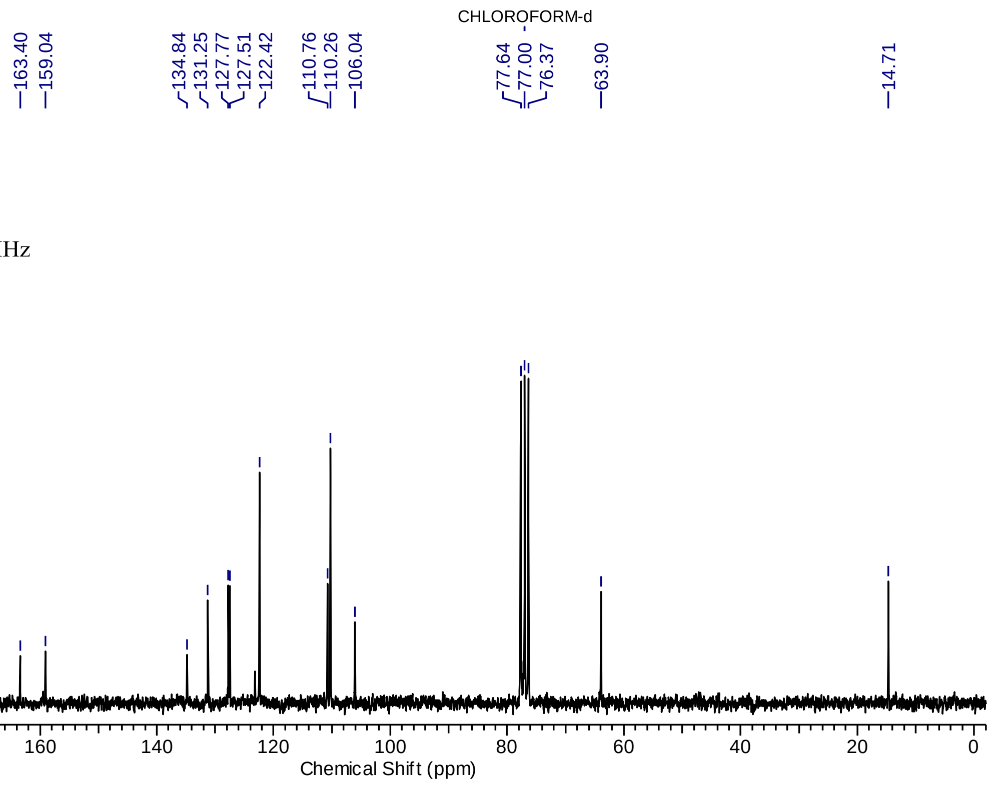


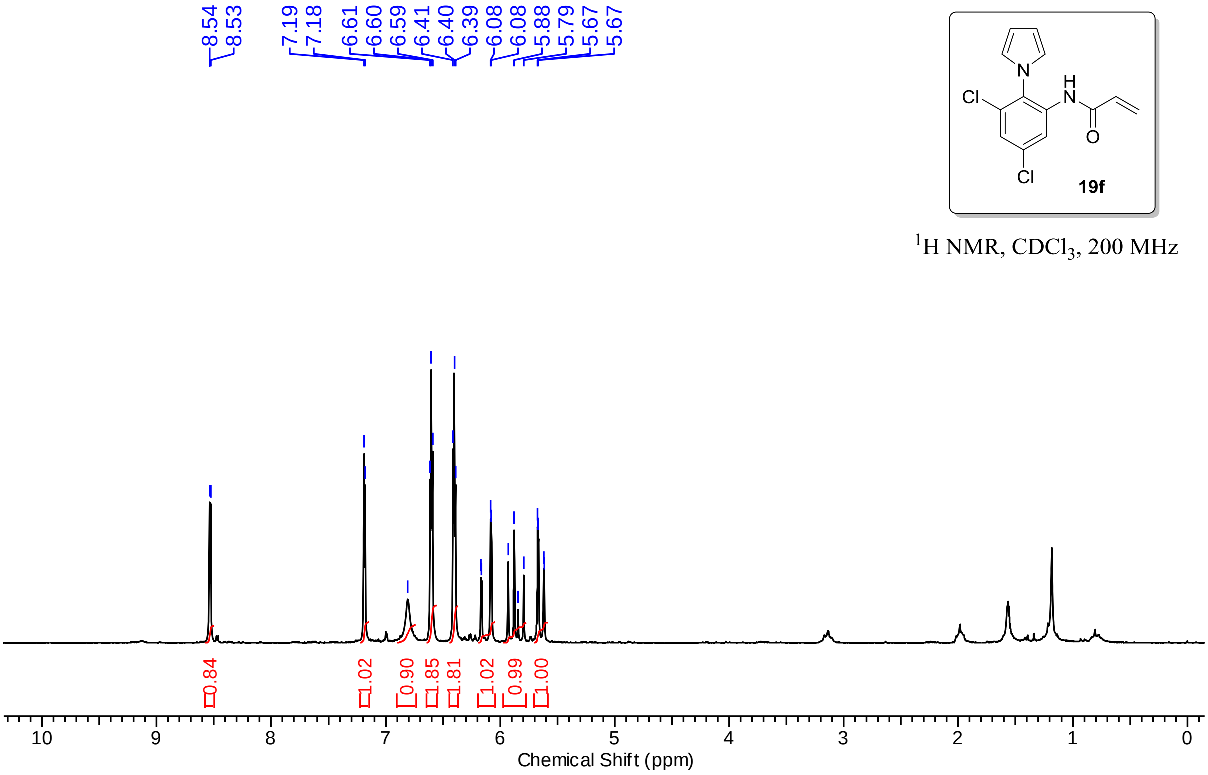
^{1}H NMR, $CDCl_3$, 200 MHz



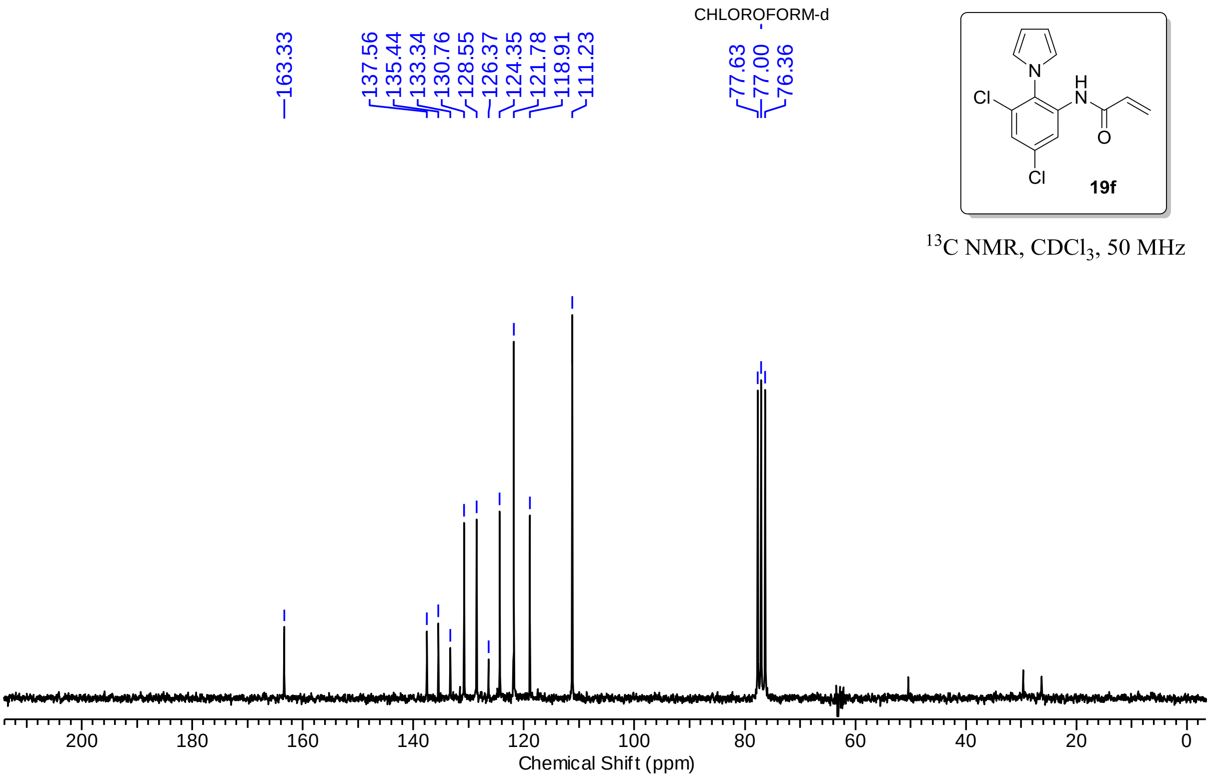


^{13}C NMR, $CDCl_3$, 50 MHz

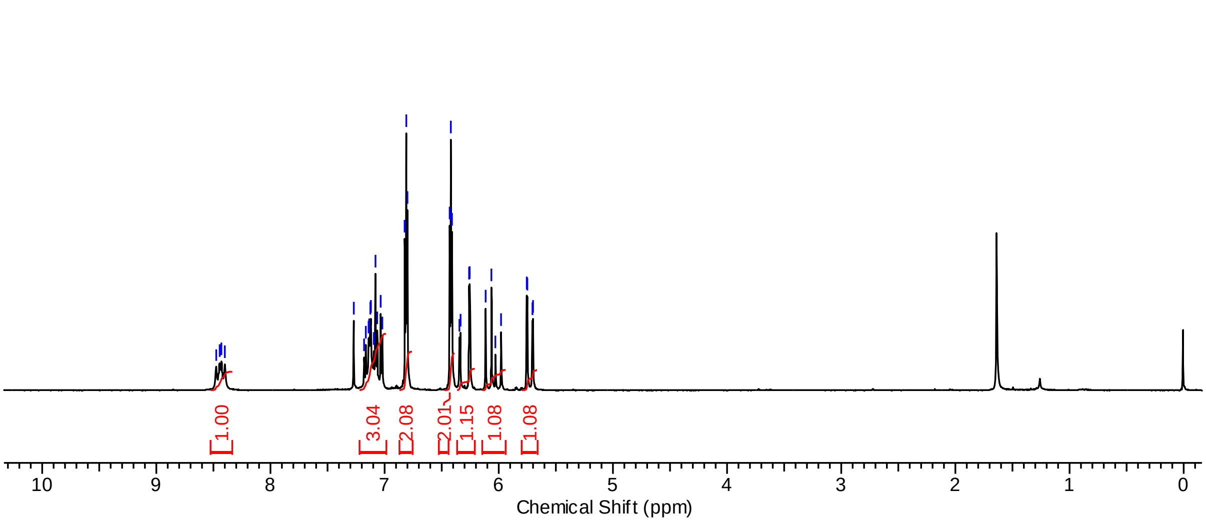


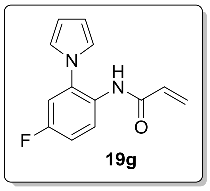


^{1}H NMR, $CDCl_3$, 200 MHz

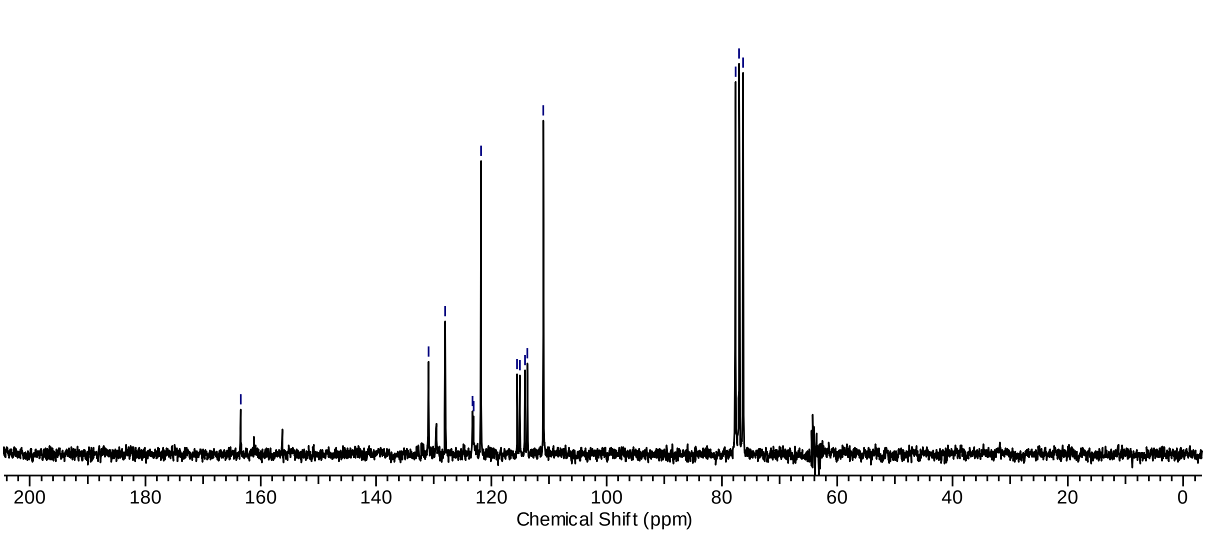


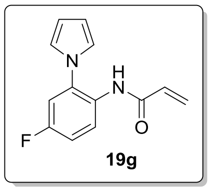
^{13}C NMR, $CDCl_3$, 50 MHz



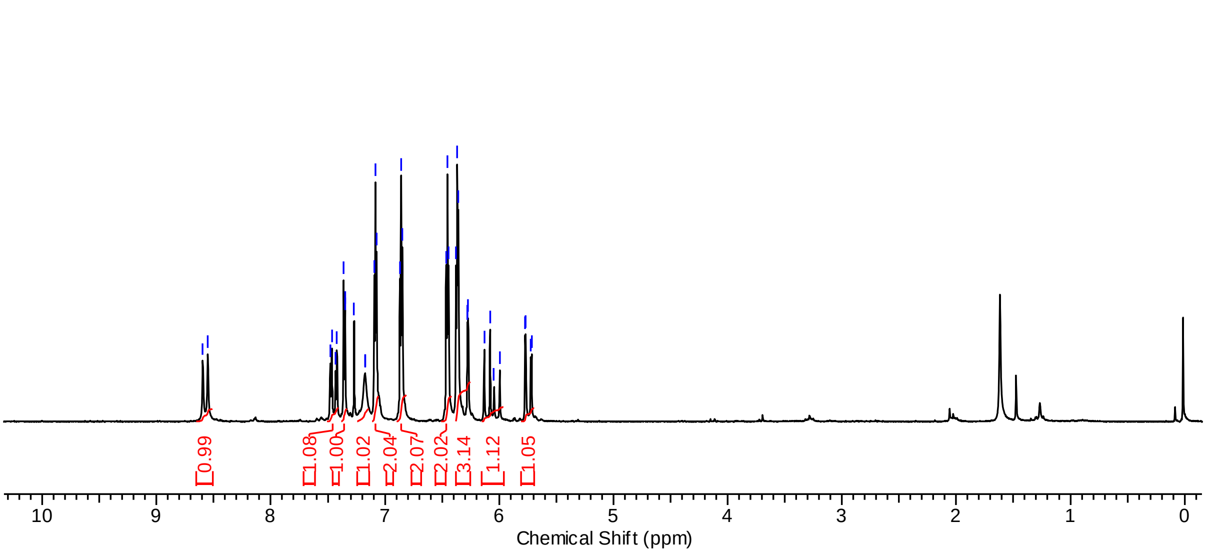


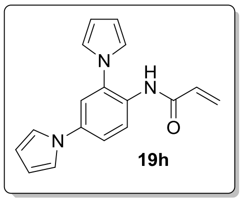
^{1}H NMR, $CDCl_3$, 200 MHz



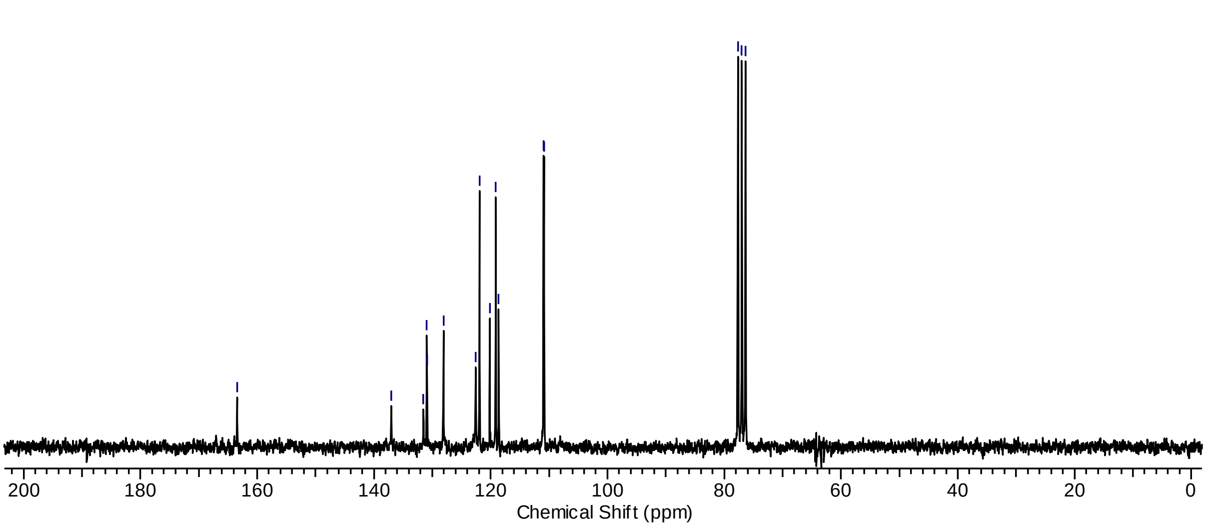


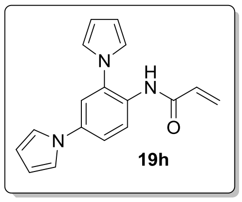
^{13}C NMR, $CDCl_3$, 50 MHz



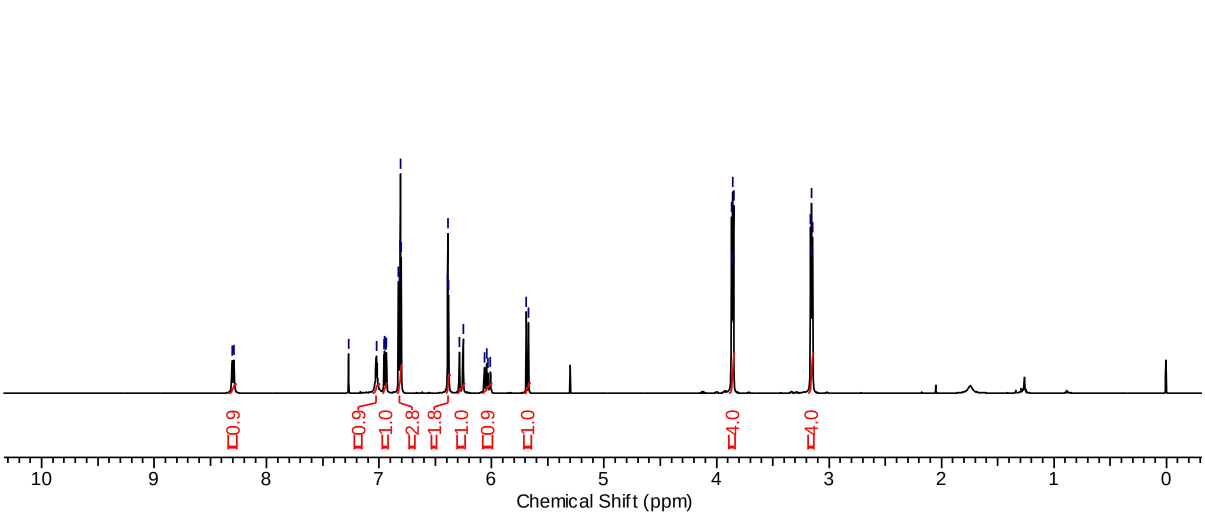


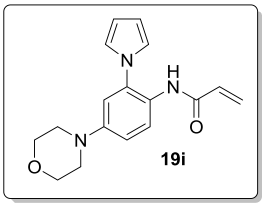
^{1}H NMR, $CDCl_3$, 200 MHz



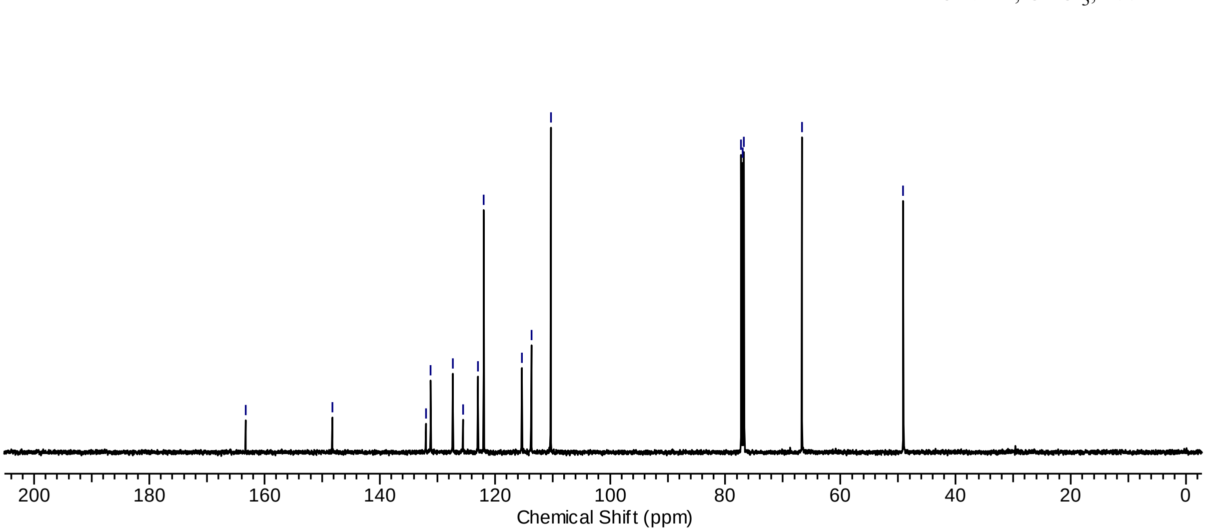


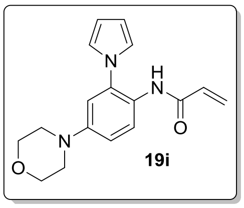
^{13}C NMR, $CDCl_3$, 50 MHz



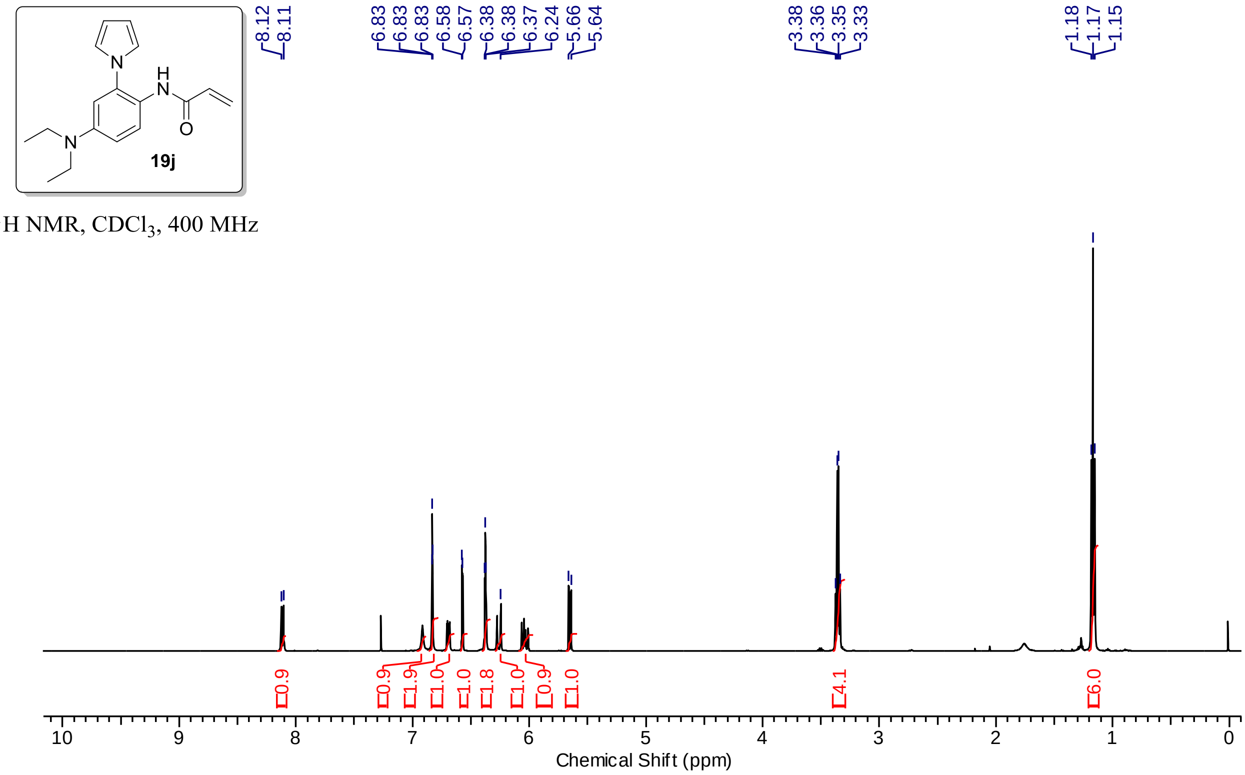


^{1}H NMR, $CDCl_3$, 400 MHz

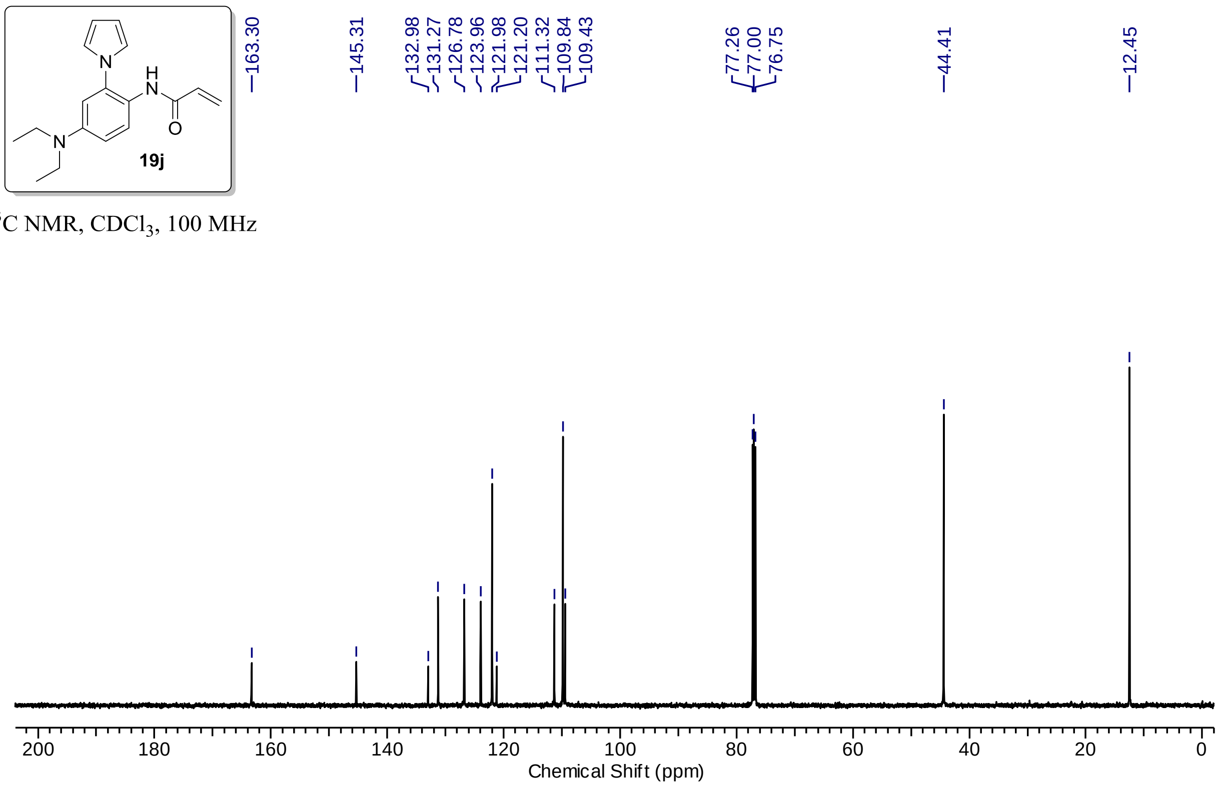




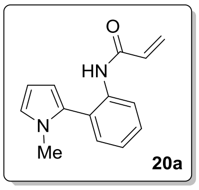
^{13}C NMR, $CDCl_3$, 100 MHz



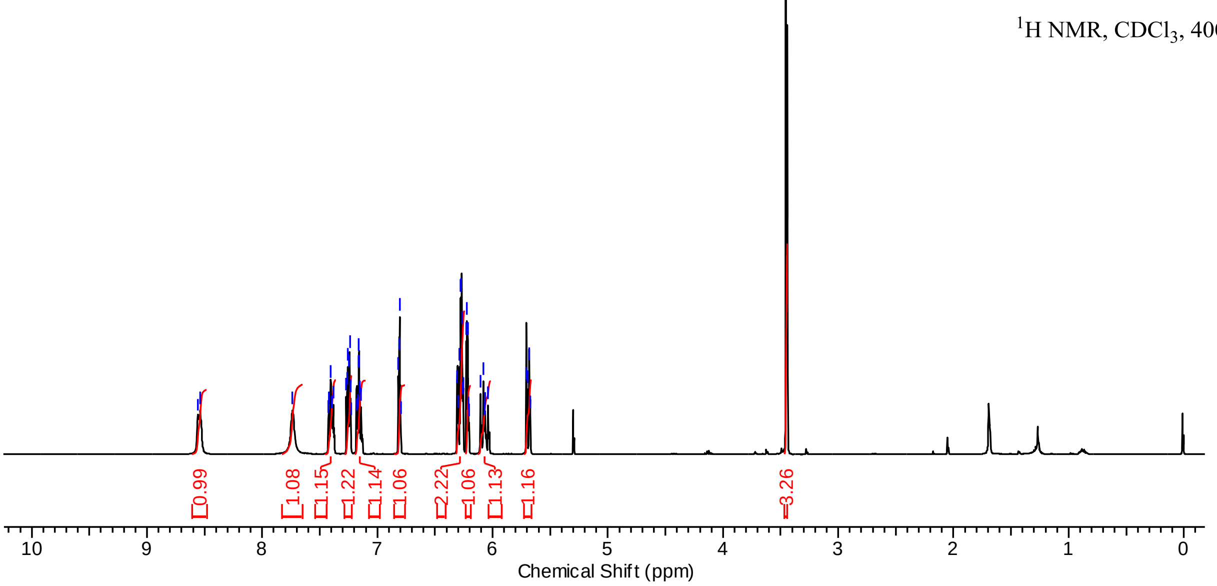
^{1}H NMR, $CDCl_3$, 400 MHz

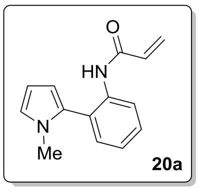


^{13}C NMR, $CDCl_3$, 100 MHz



^{1}H NMR, $CDCl_3$, 400 MHz





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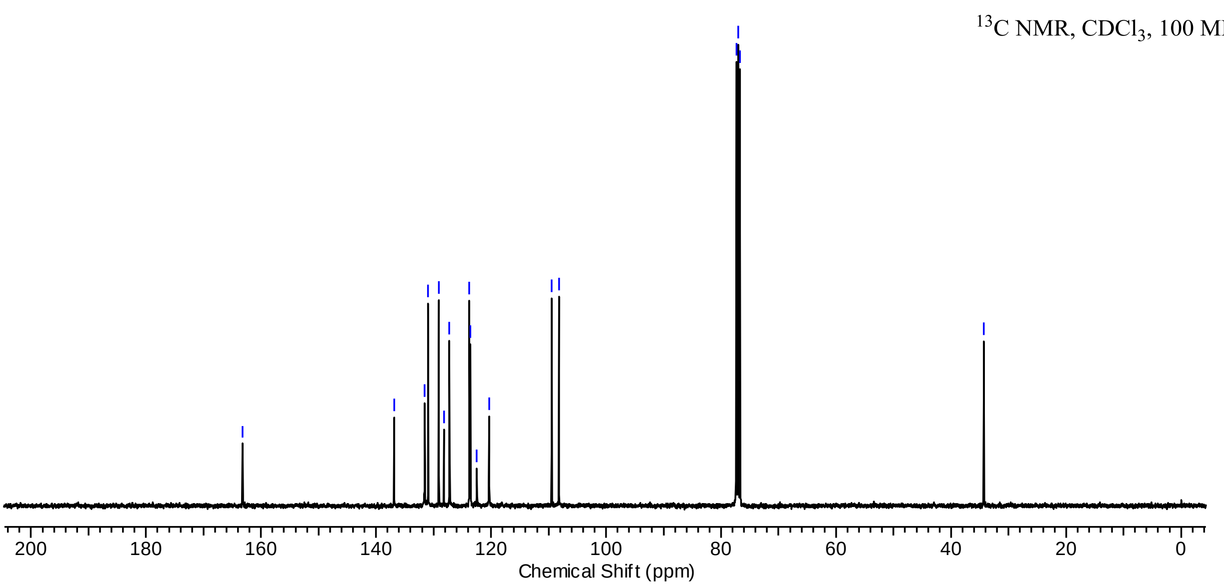
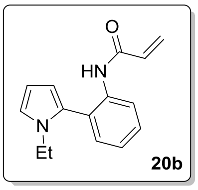
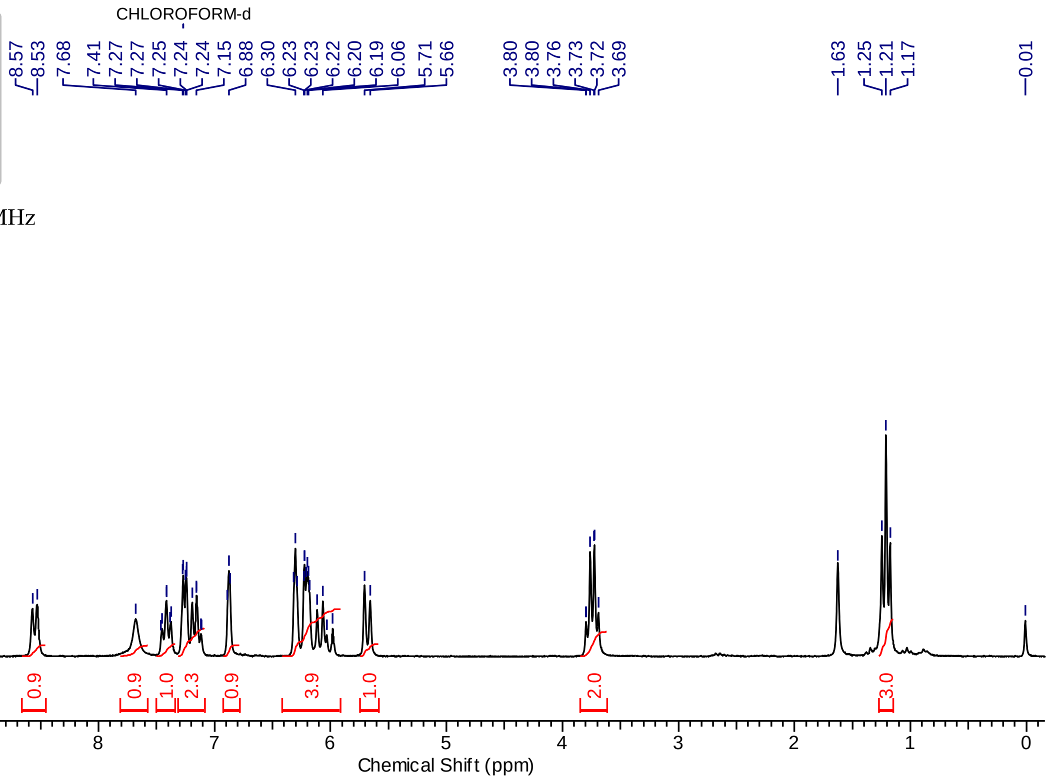
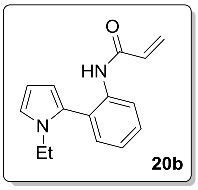
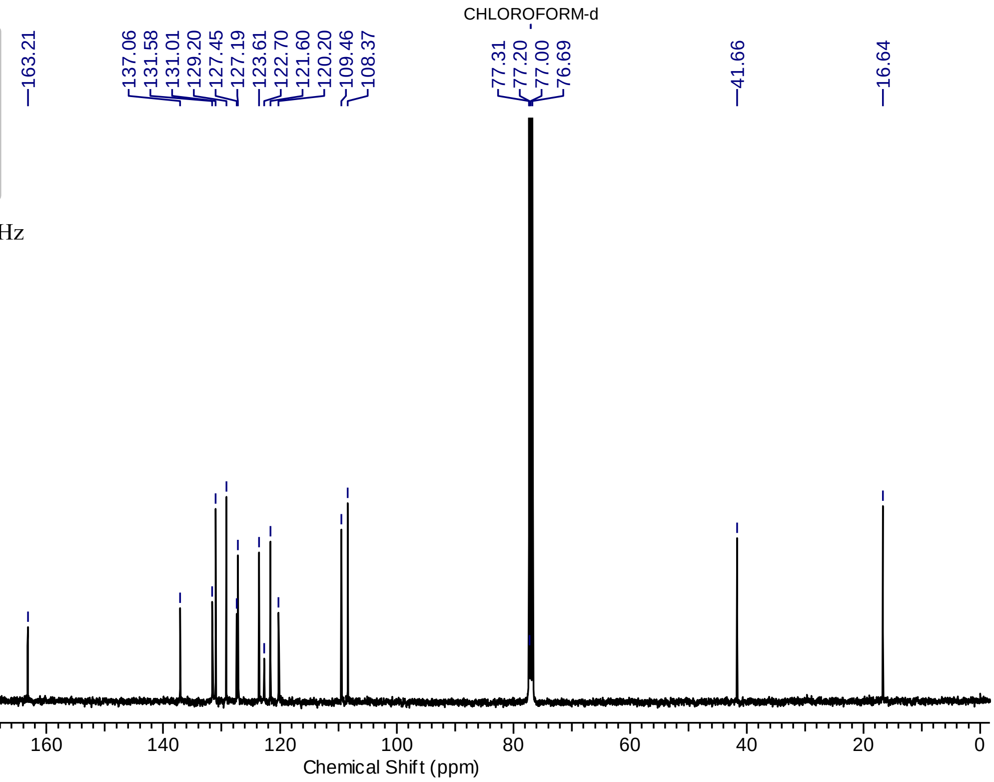




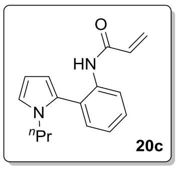


^{1}H NMR, $CDCl_3$, 200 MHz

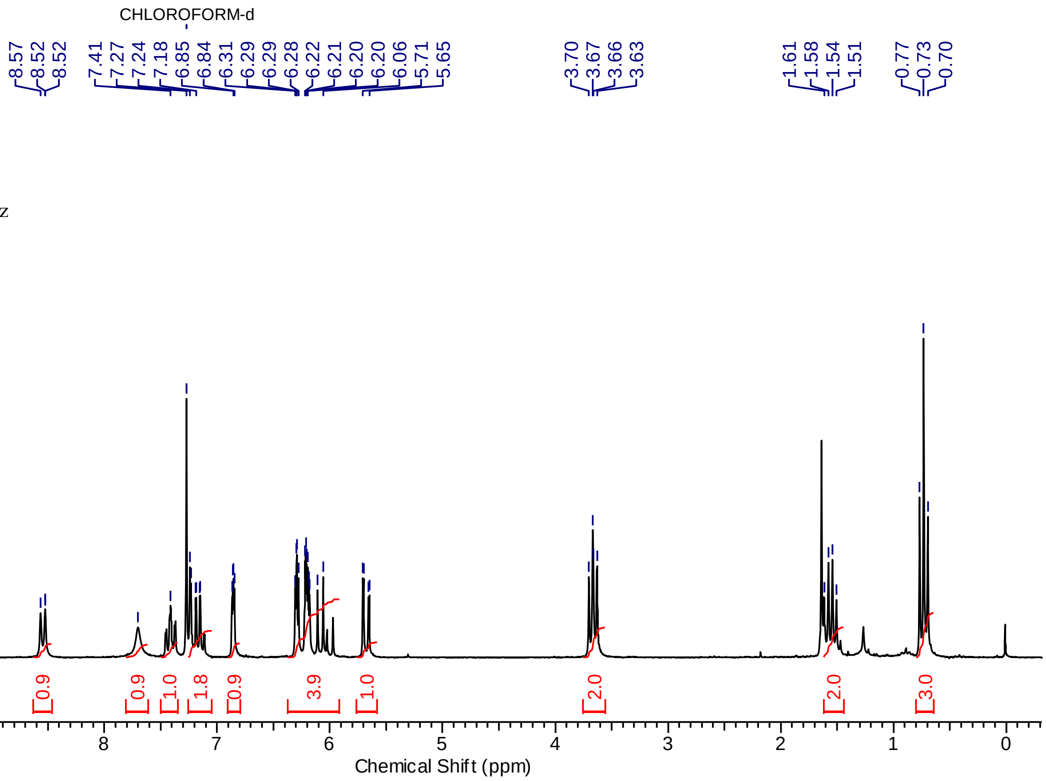


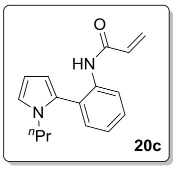


^{13}C NMR, $CDCl_3$, 50 MHz

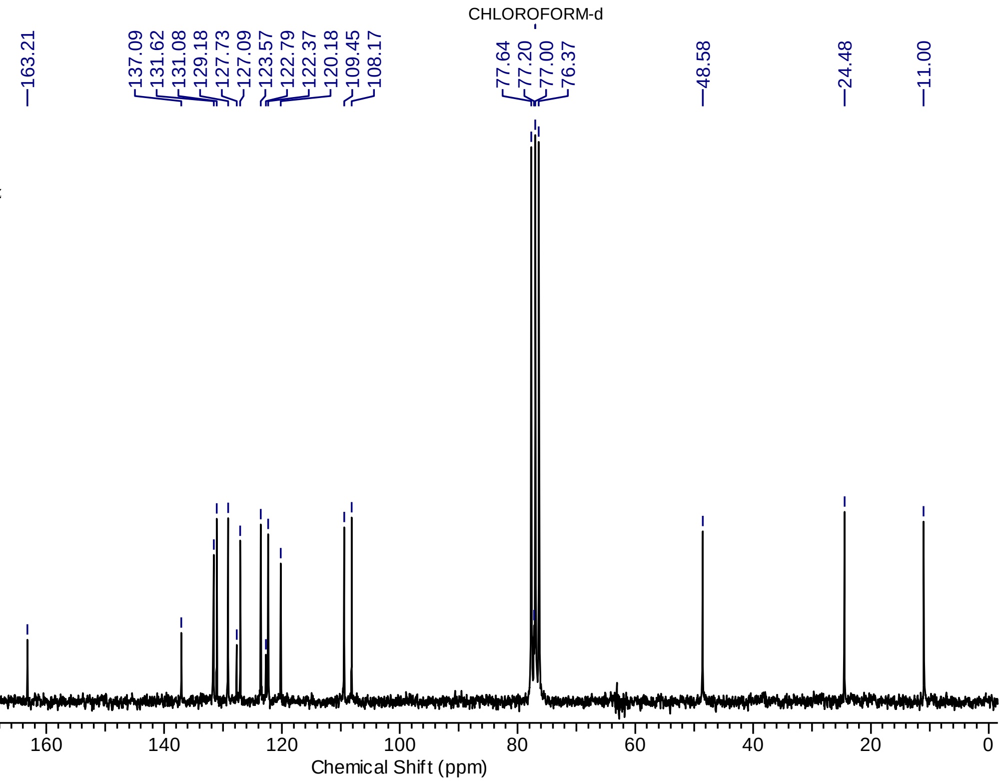


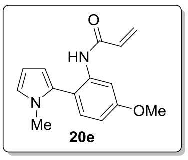
^{1}H NMR, $CDCl_3$, 200 MHz



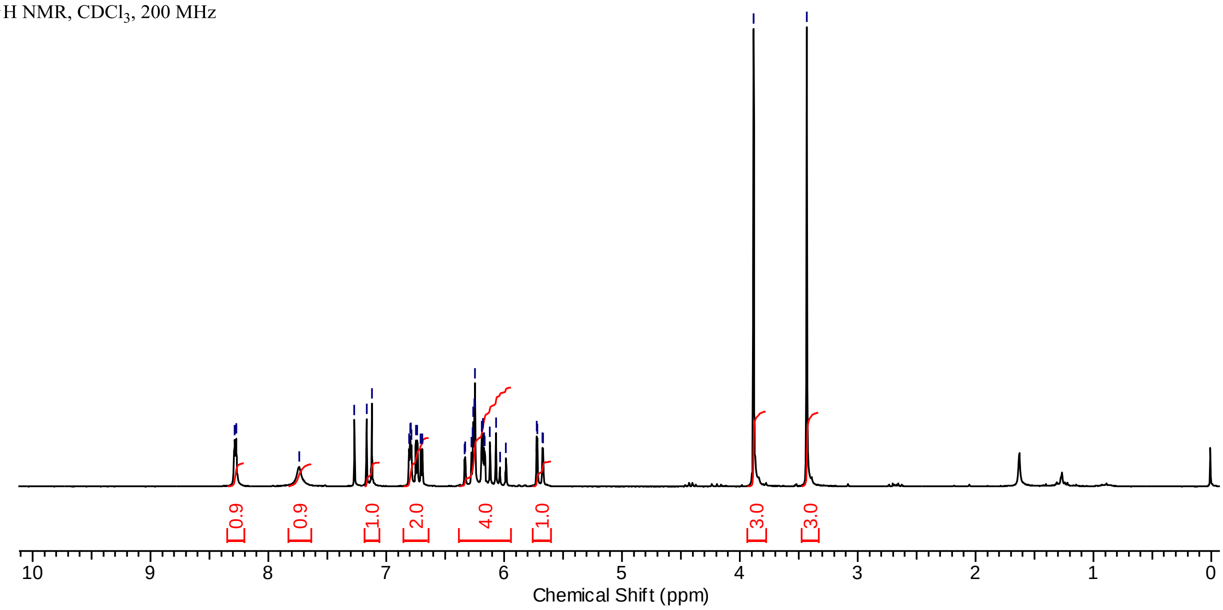


^{13}C NMR, $CDCl_3$, 50 MHz

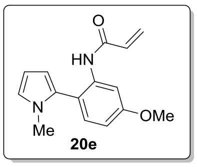


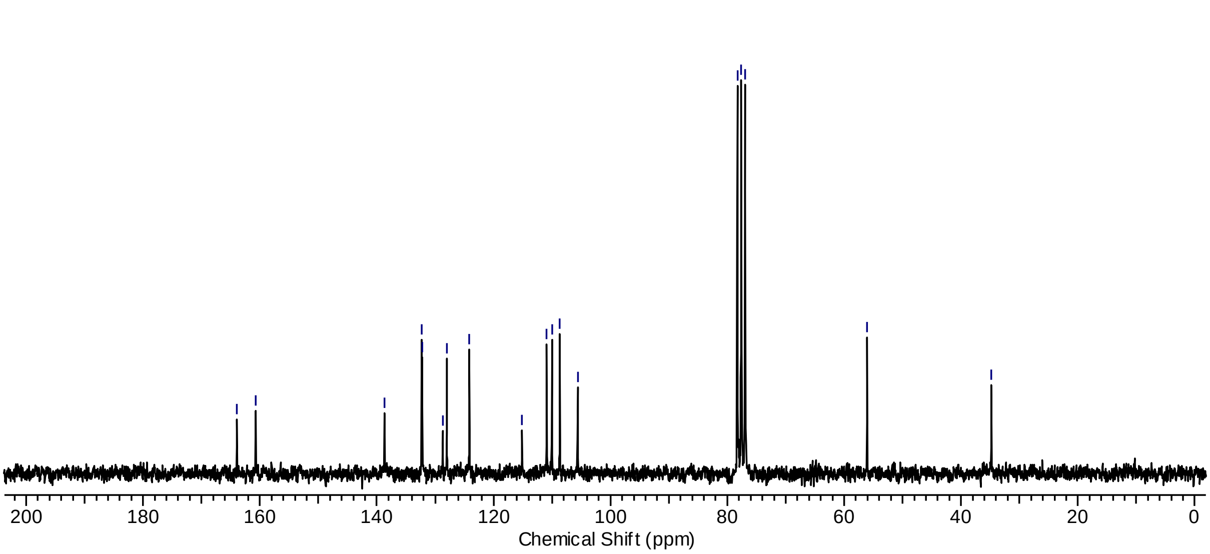


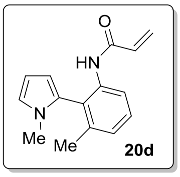
^{1}H NMR, $CDCl_3$, 200 MHz



^{13}C NMR, $CDCl_3$, 50 MHz







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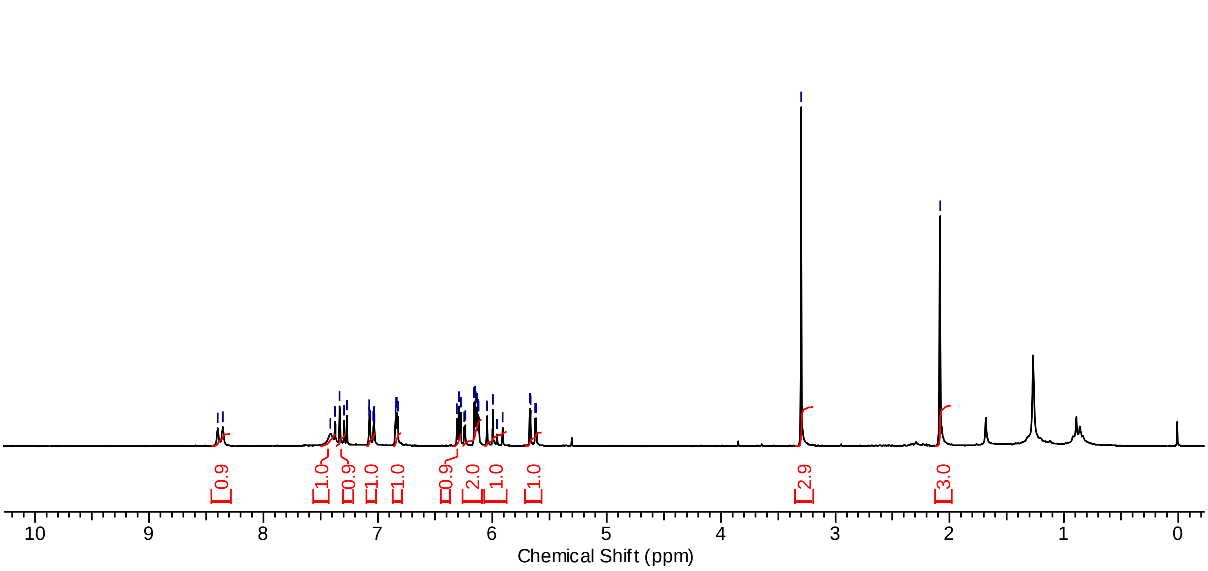
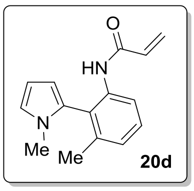
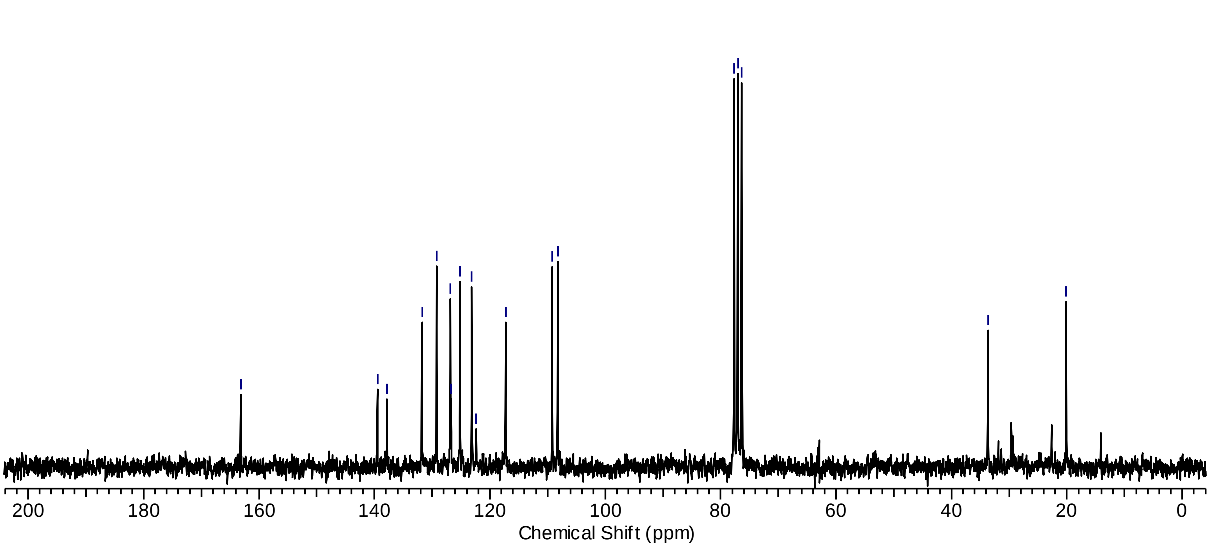
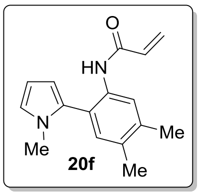


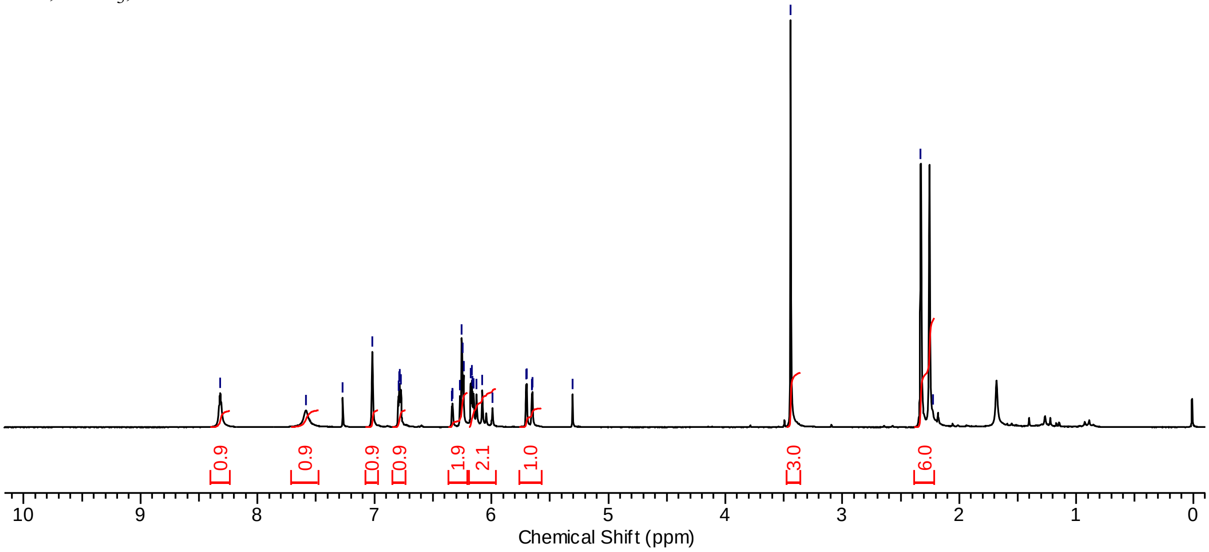


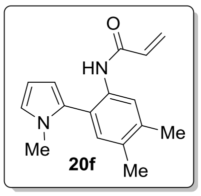
^{13}C NMR, $CDCl_3$, 50 MHz



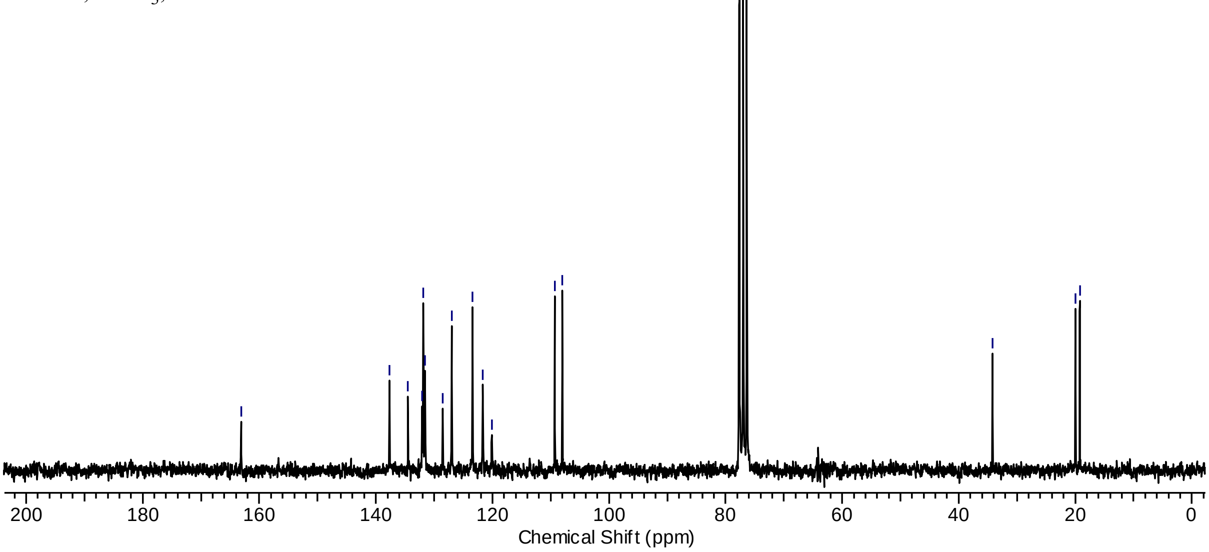


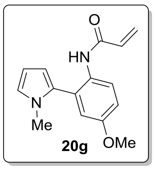
^{1}H NMR, $CDCl_3$, 200 MHz



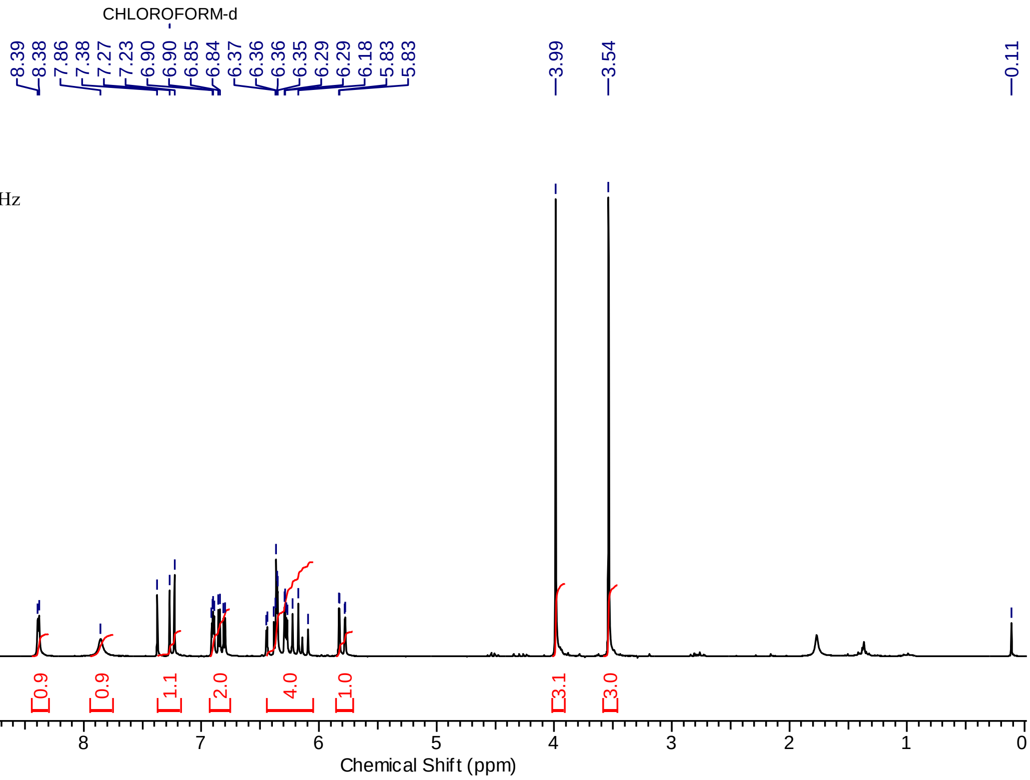


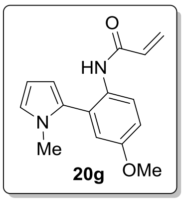
^{13}C NMR, $CDCl_3$, 50 MHz



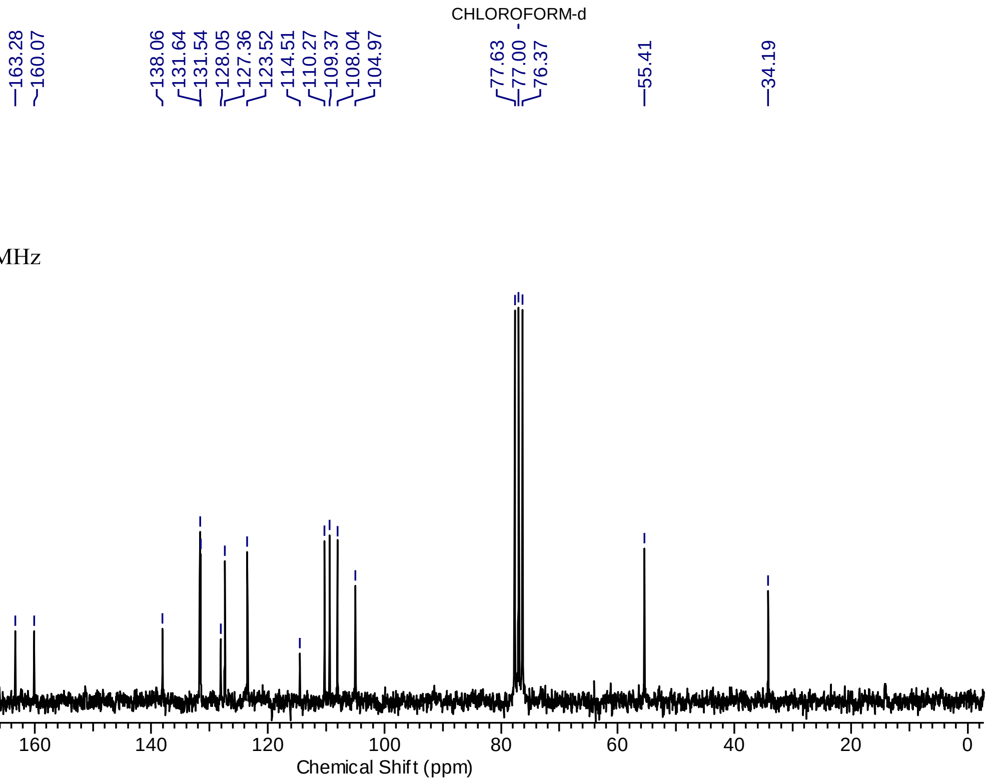


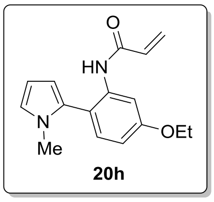
^{1}H NMR, $CDCl_3$, 200 MHz



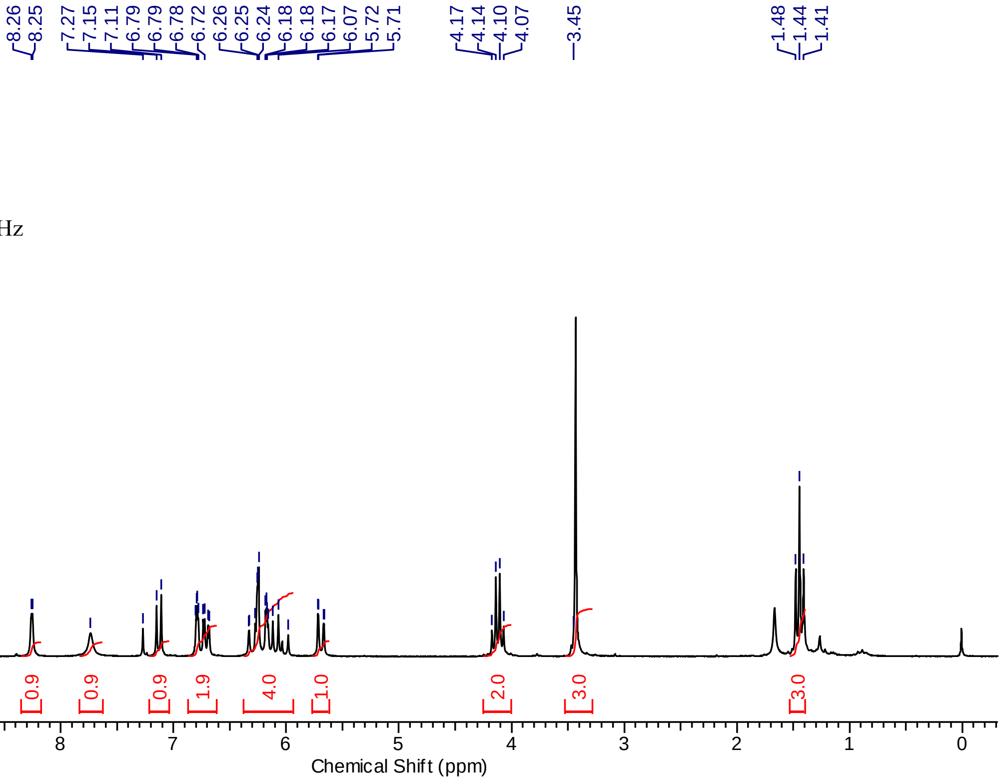


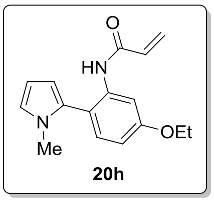
^{13}C NMR, $CDCl_3$, 50 MHz



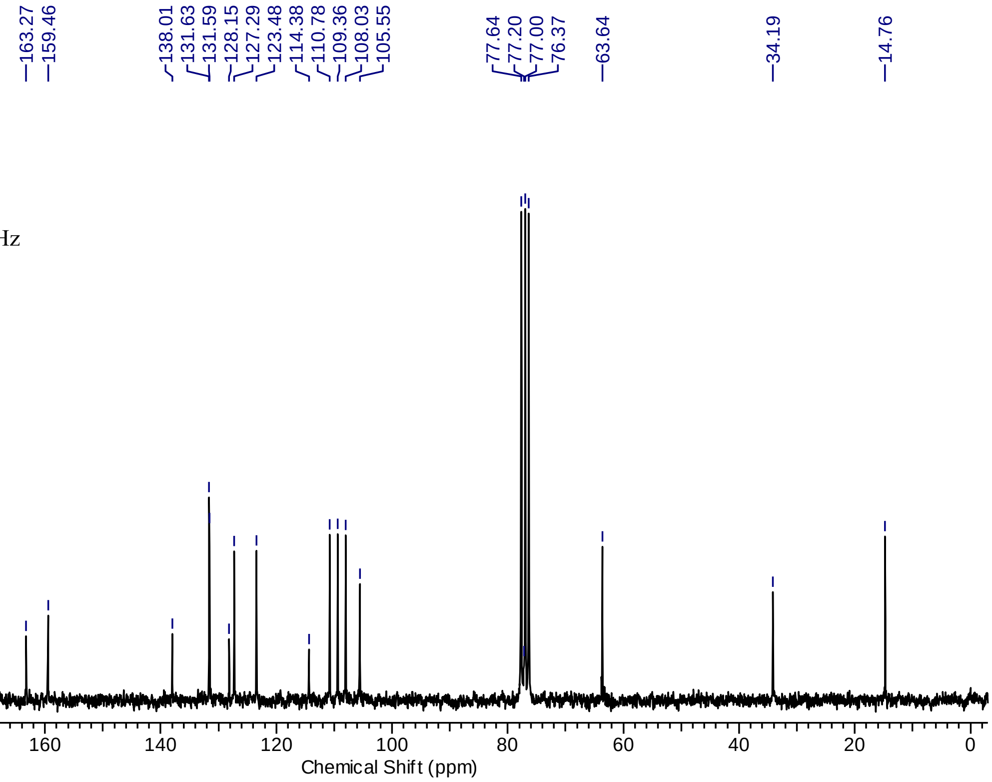


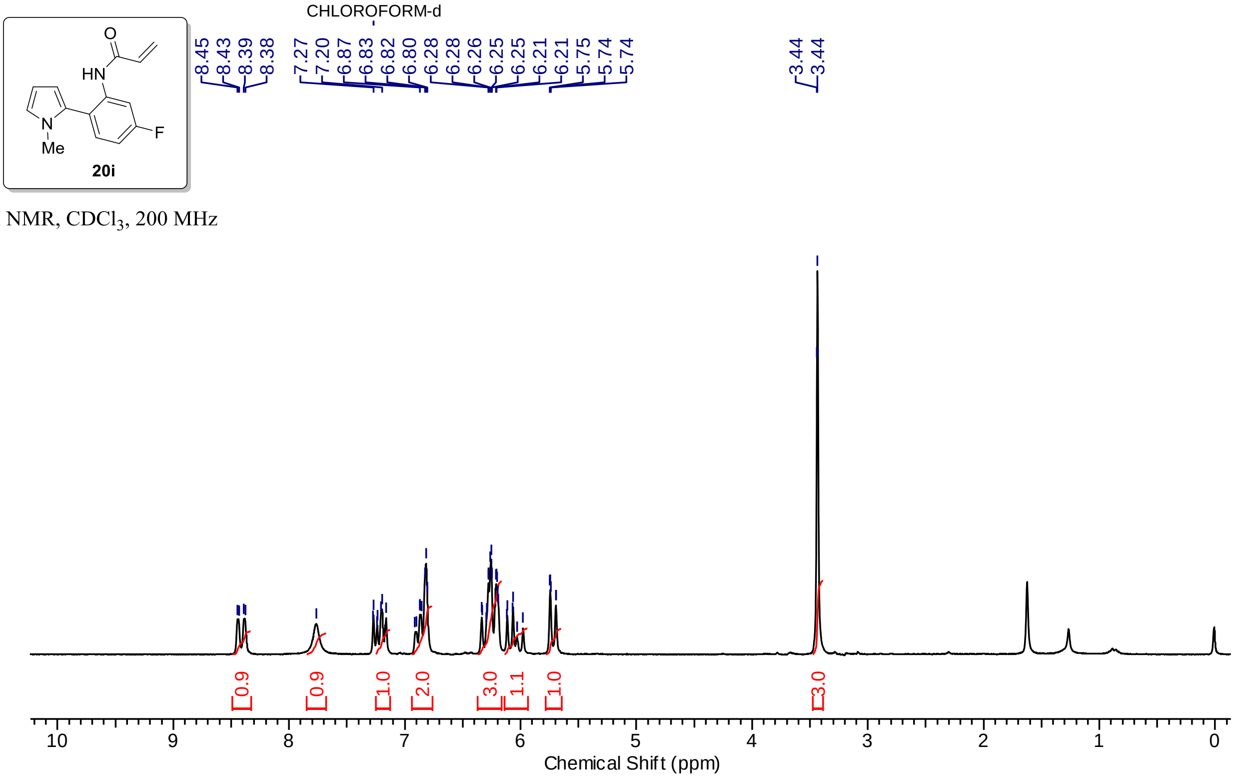
^{1}H NMR, $CDCl_3$, 200 MHz



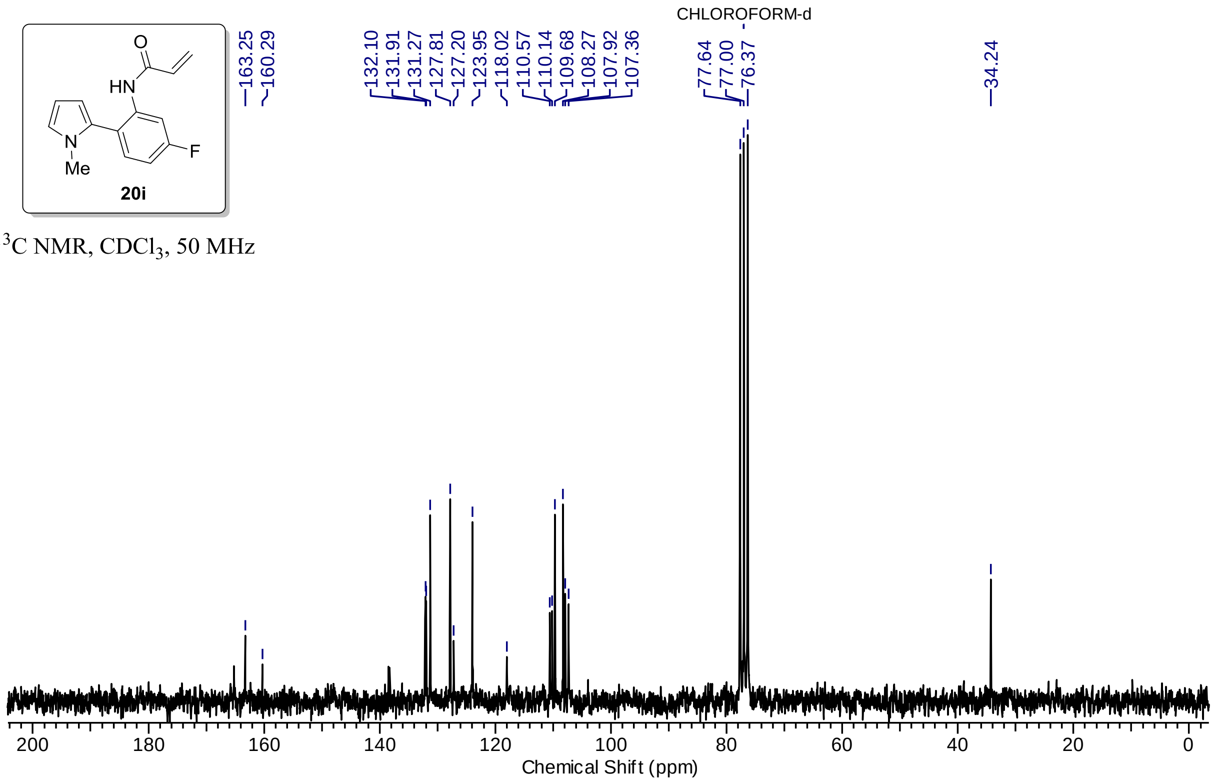


^{13}C NMR, $CDCl_3$, 50 MHz

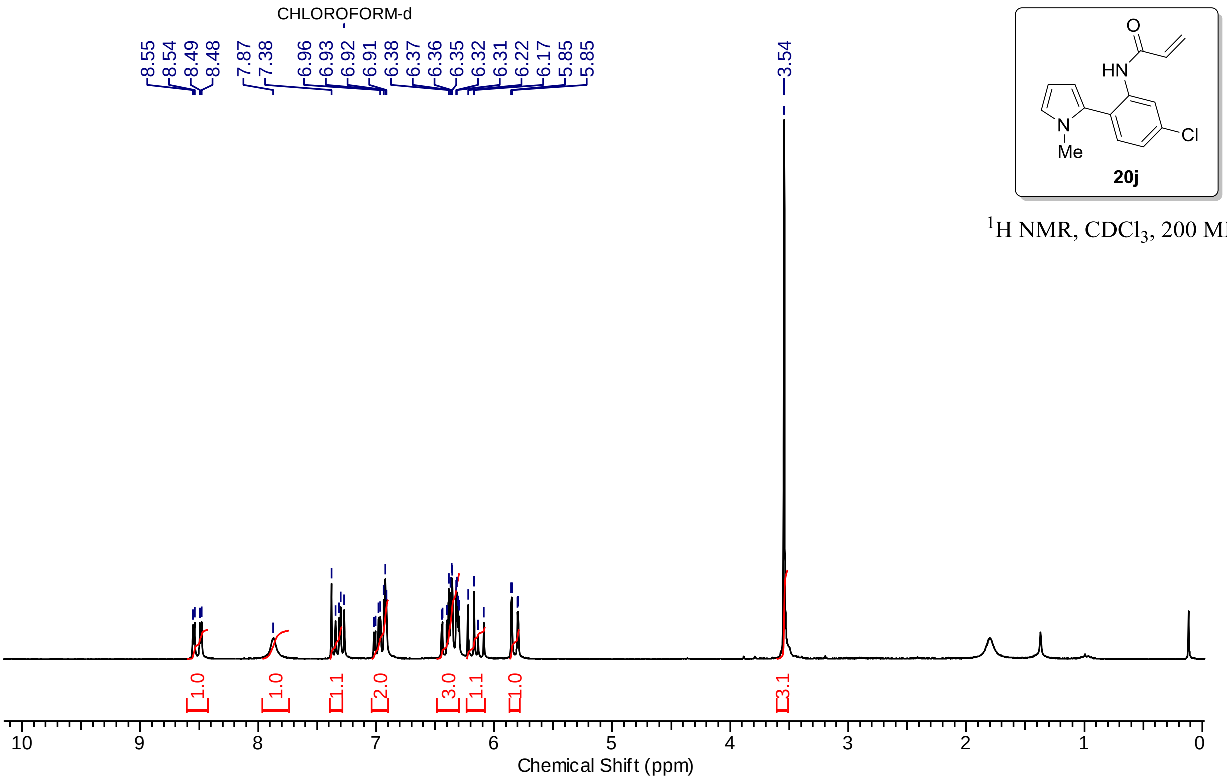




^{1}H NMR, $CDCl_3$, 200 MHz



^{13}C NMR, $CDCl_3$, 50 MHz



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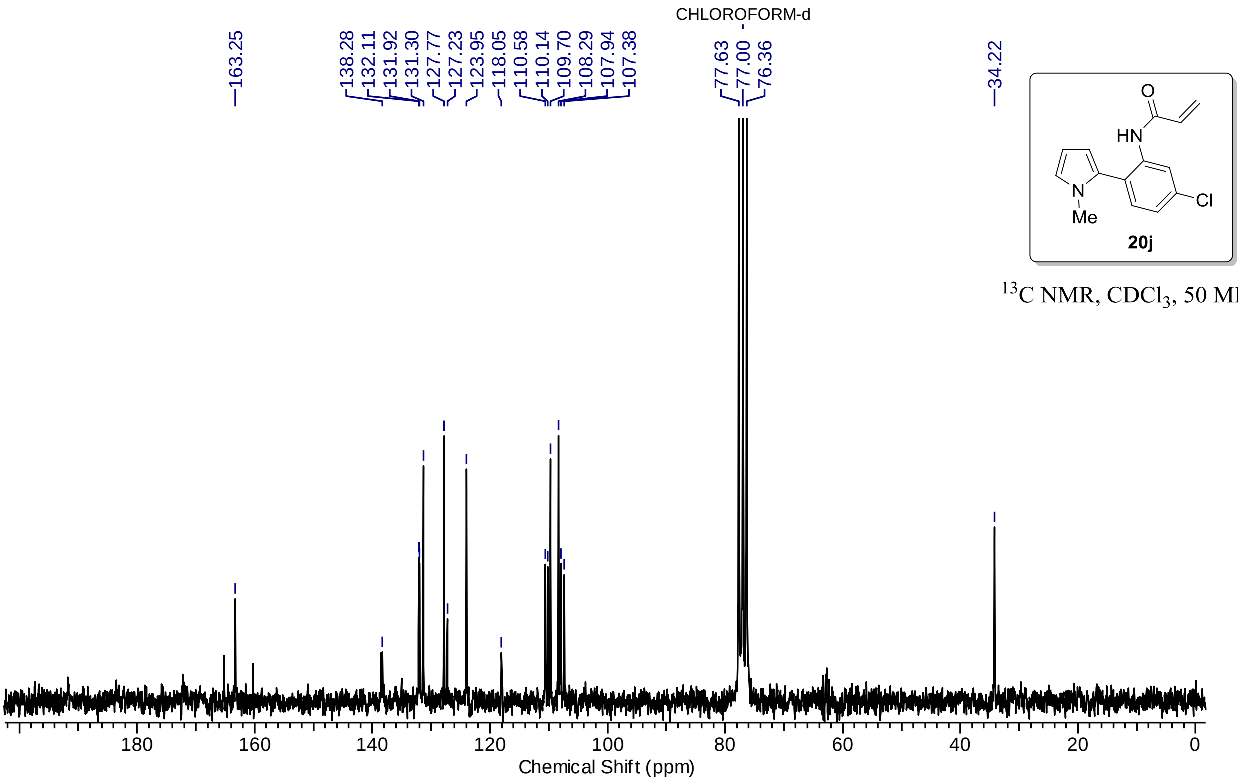
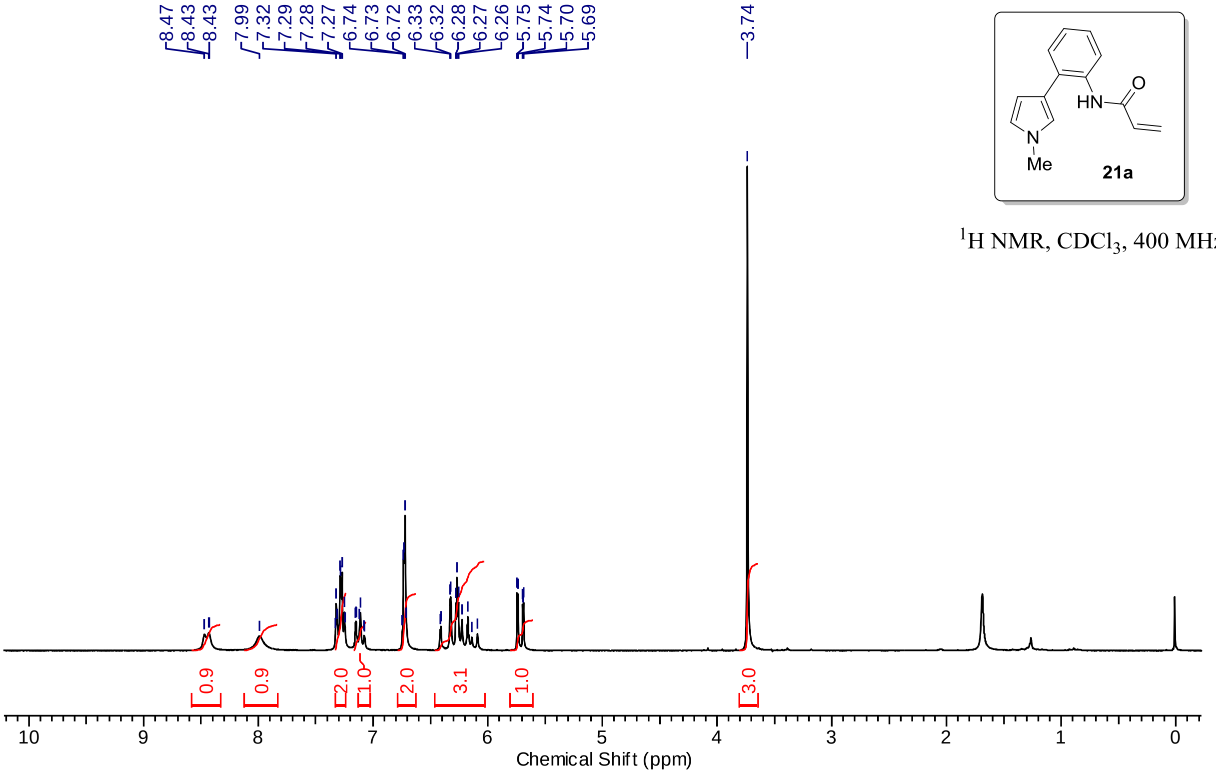
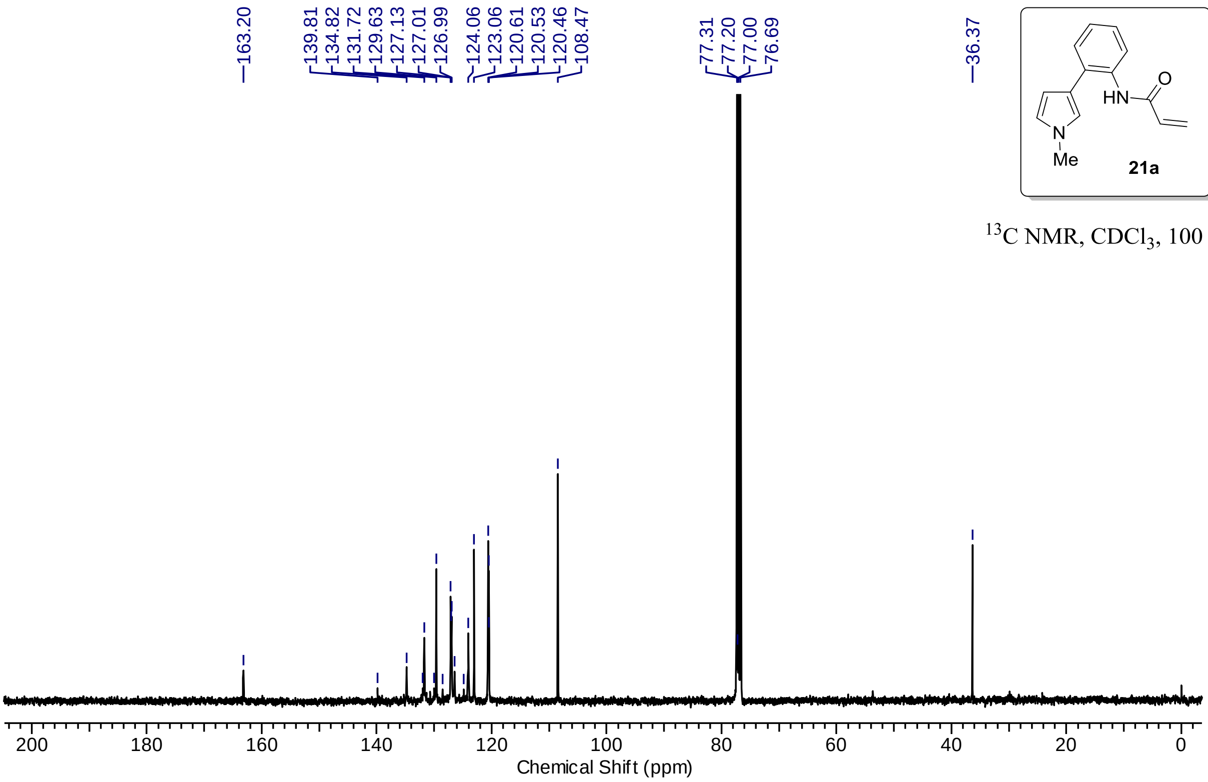


^{13}C NMR, $CDCl_3$, 50 MHz



^{1}H NMR, $CDCl_3$, 400 MHz



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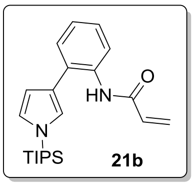
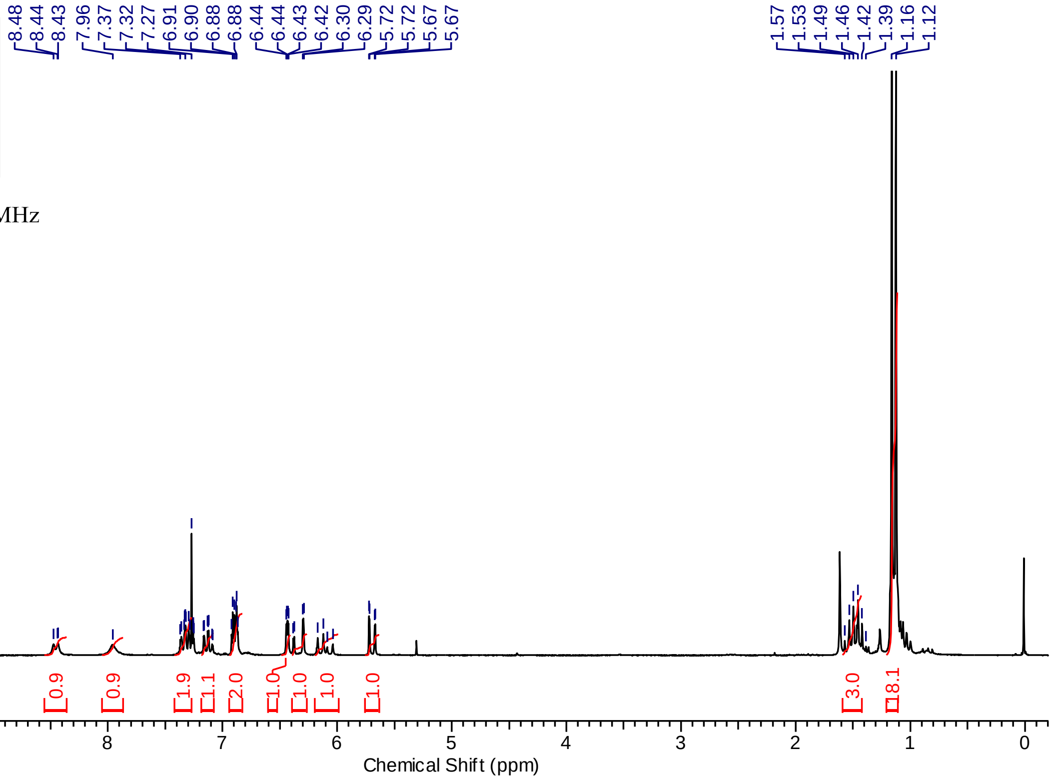
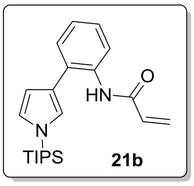
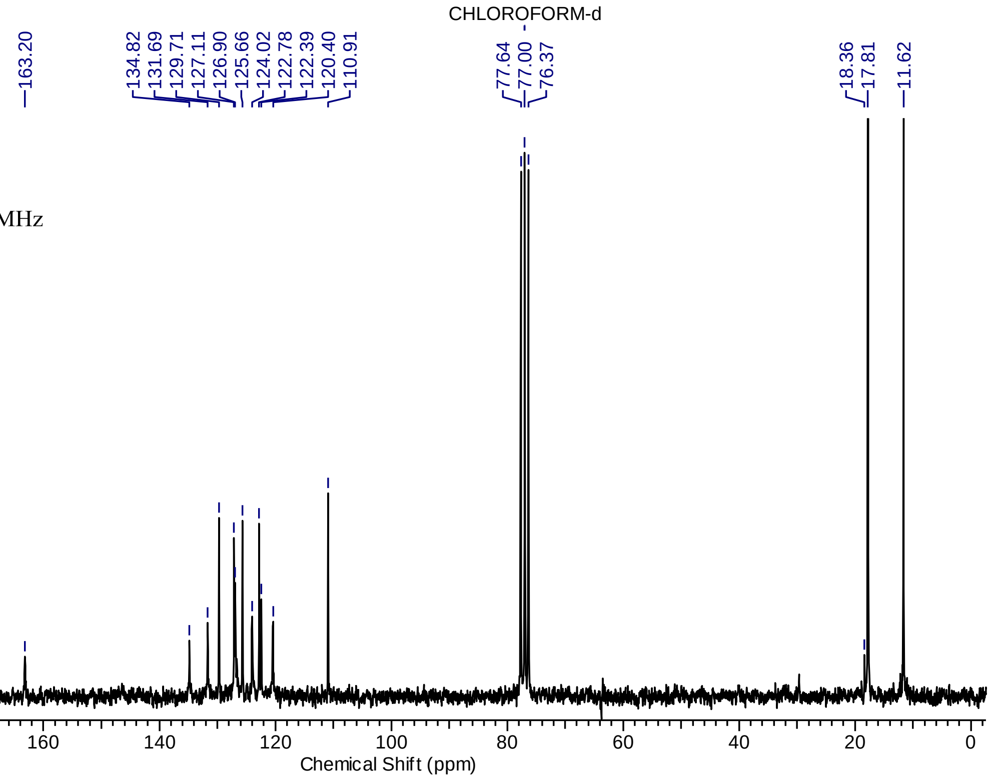


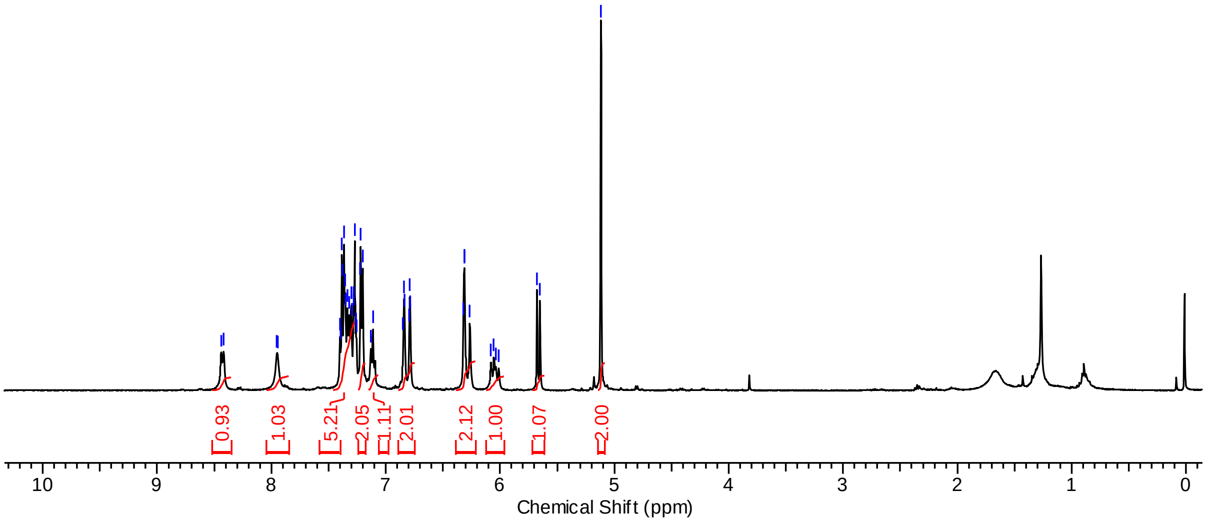
^{1}H NMR, $CDCl_3$, 400 MHz

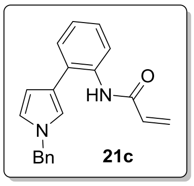




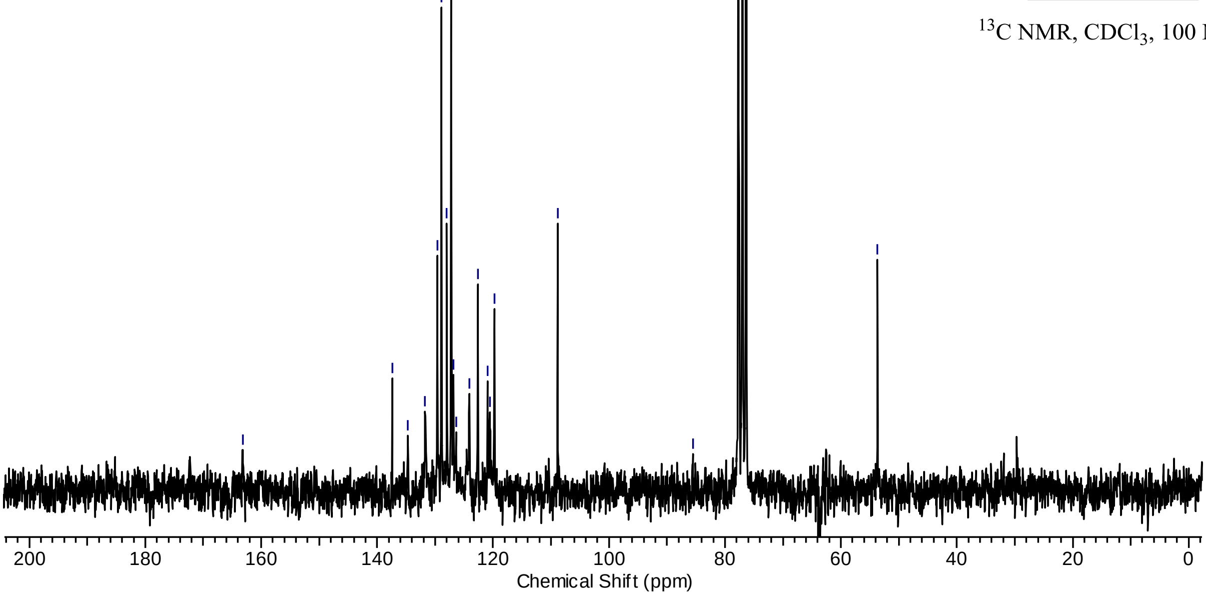
^{13}C NMR, $CDCl_3$, 100 MHz

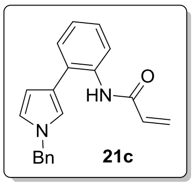




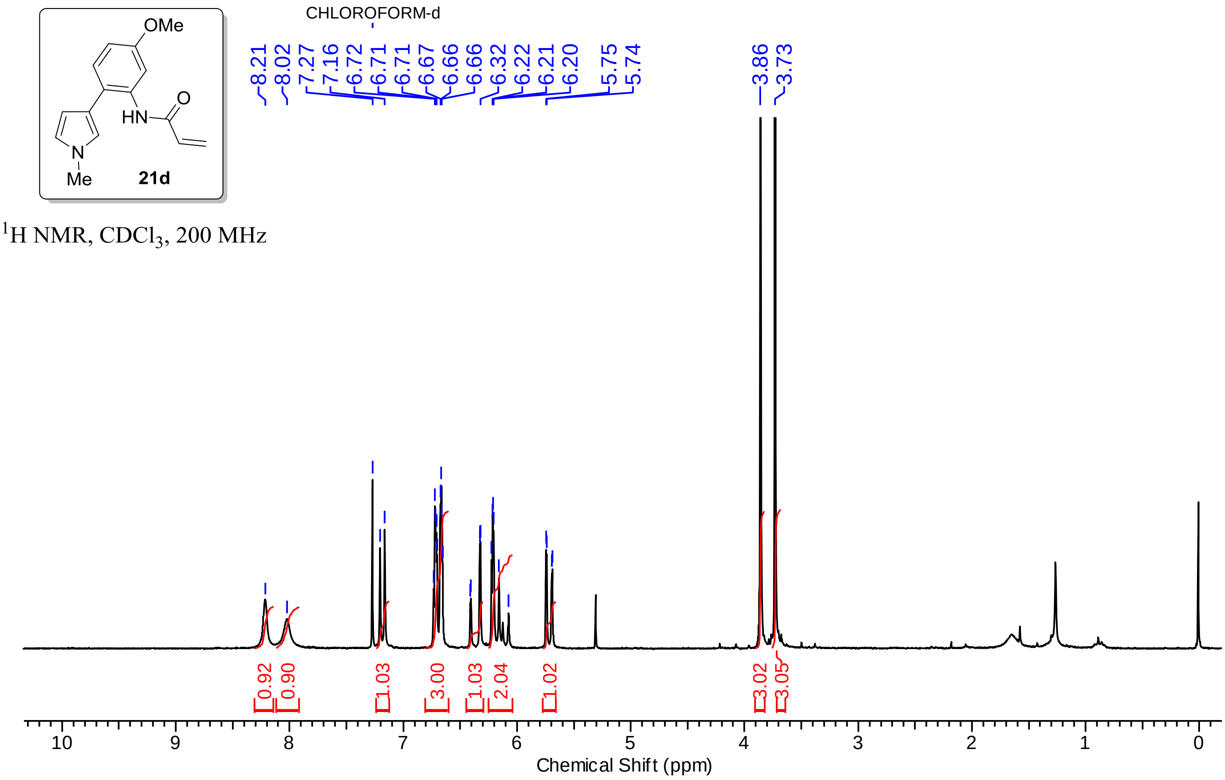


^{1}H NMR, $CDCl_3$, 400 MHz

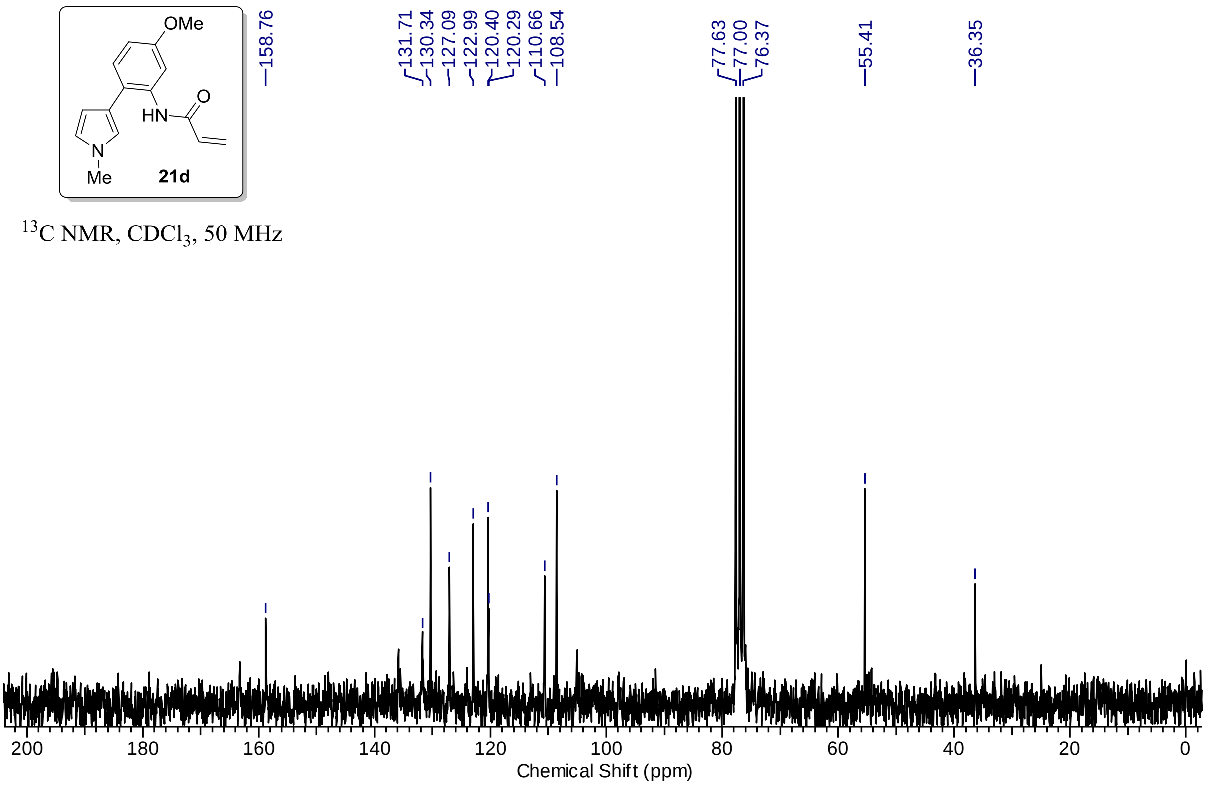




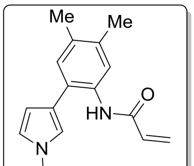
^{13}C NMR, $CDCl_3$, 100 MHz



[1]H NMR, $CDCl_3$, 200 MHz



[13]C NMR, $CDCl_3$, 50 MHz



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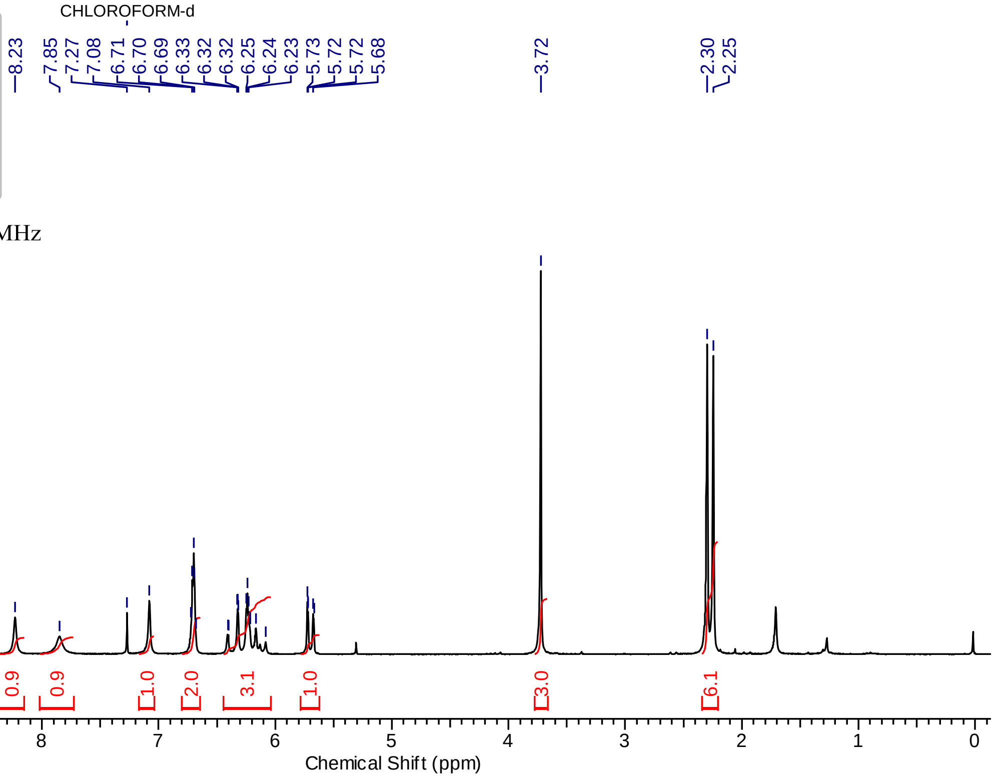
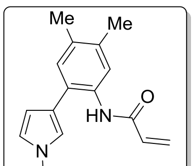


^{1}H NMR, $CDCl_3$, 200 MHz



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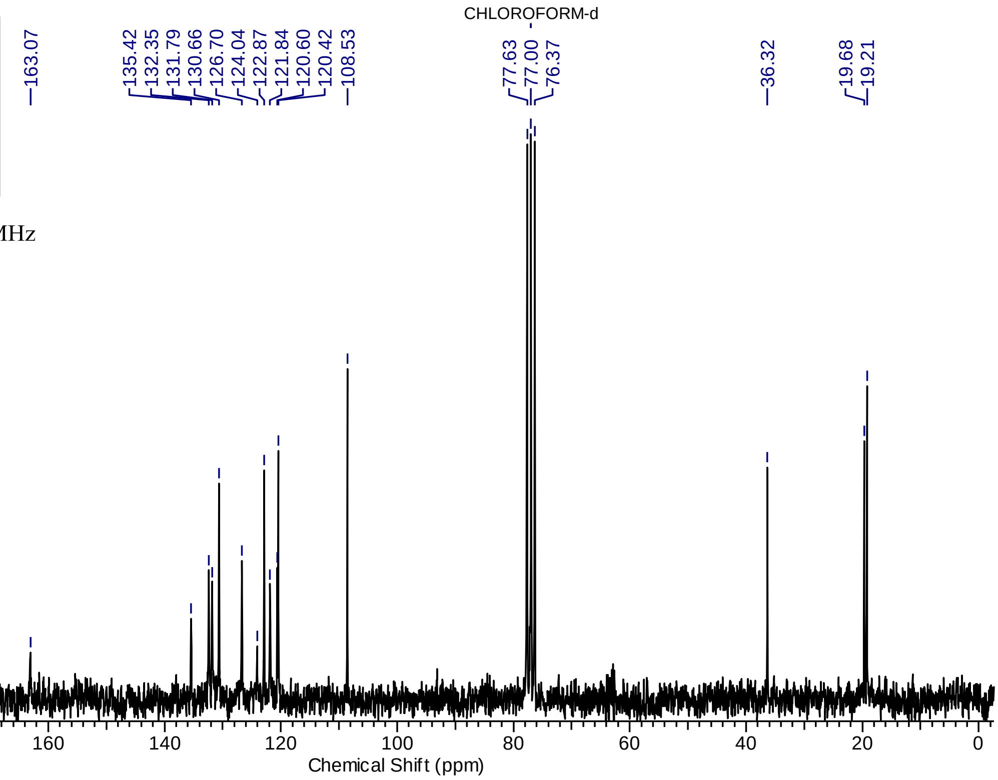
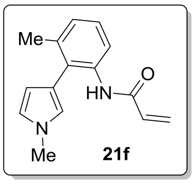
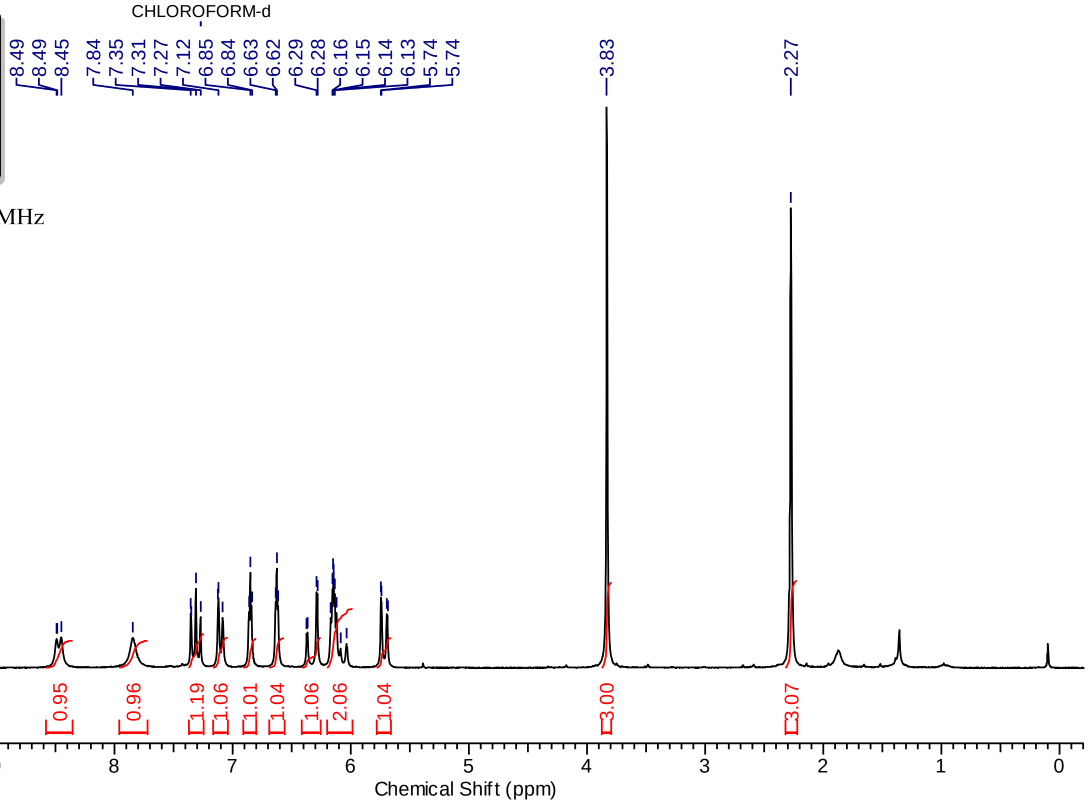
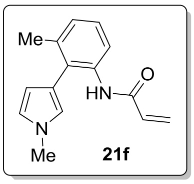


^{13}C NMR, $CDCl_3$, 50 MHz

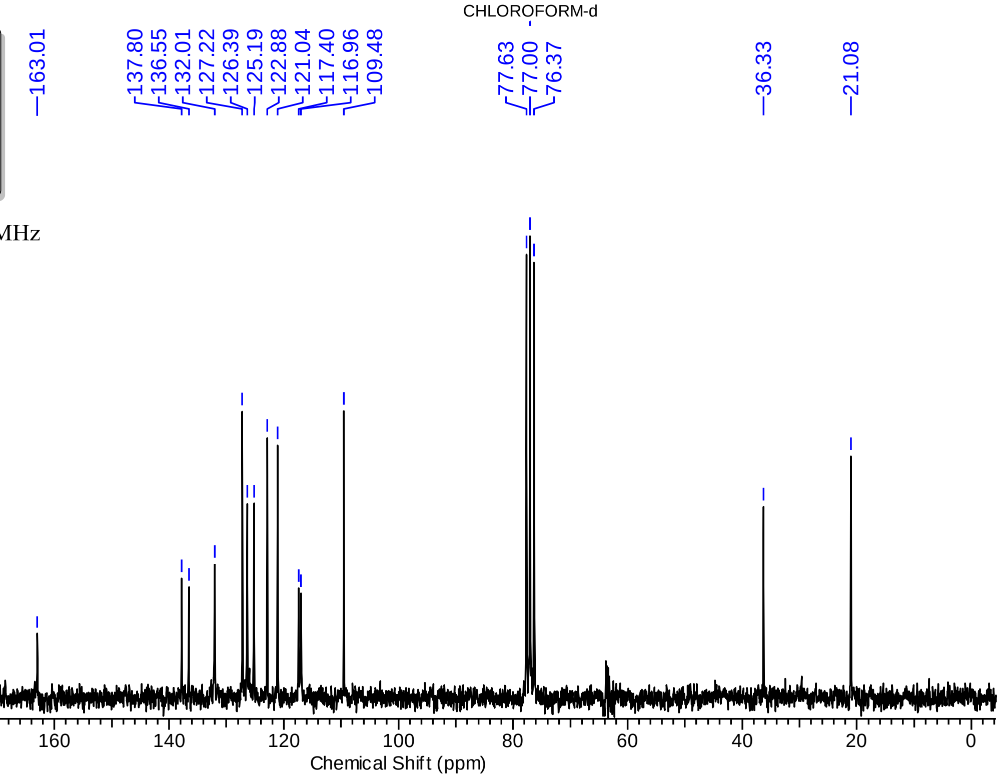


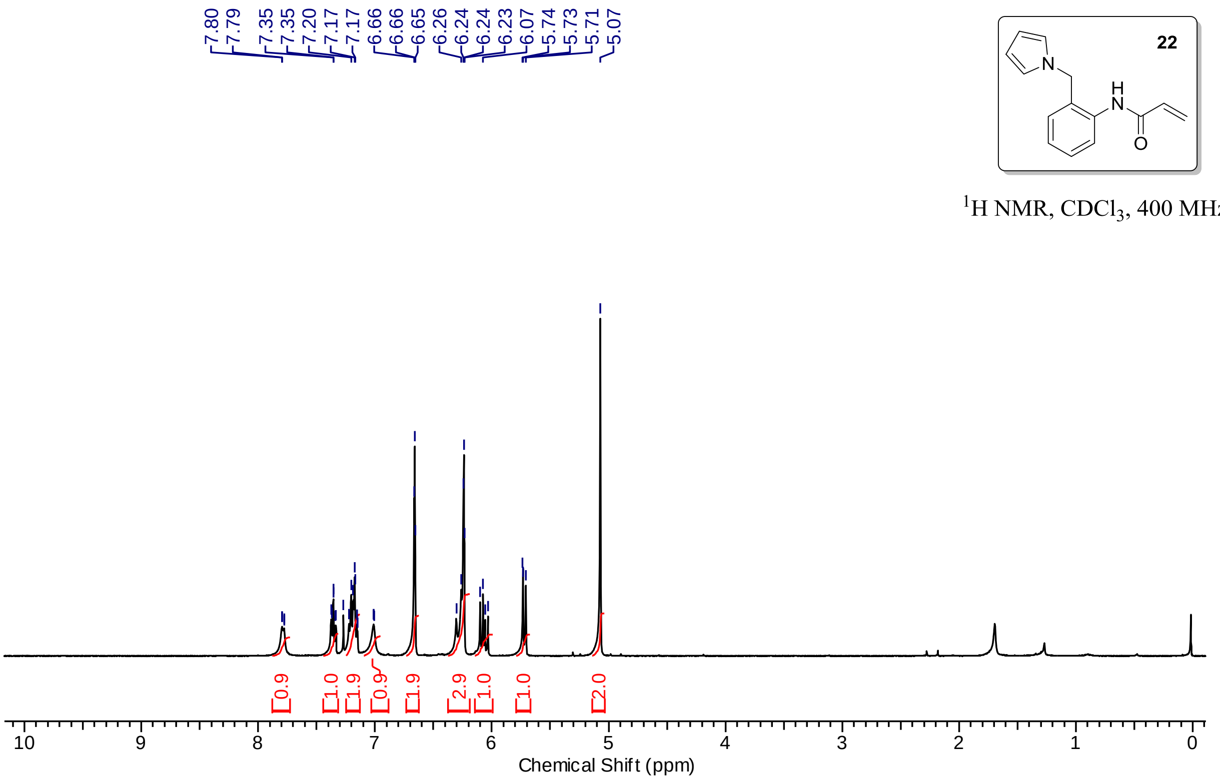
^{1}H NMR, $CDCl_3$, 200 MHz



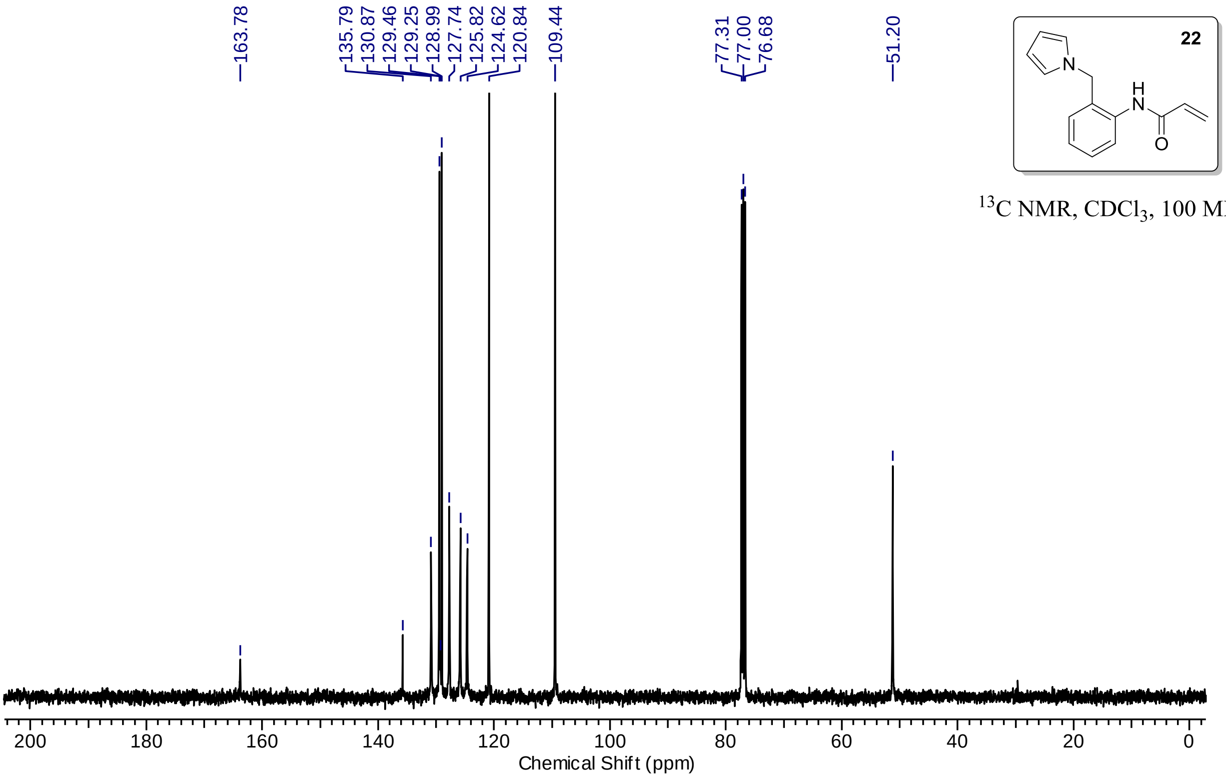


^{13}C NMR, $CDCl_3$, 50 MHz

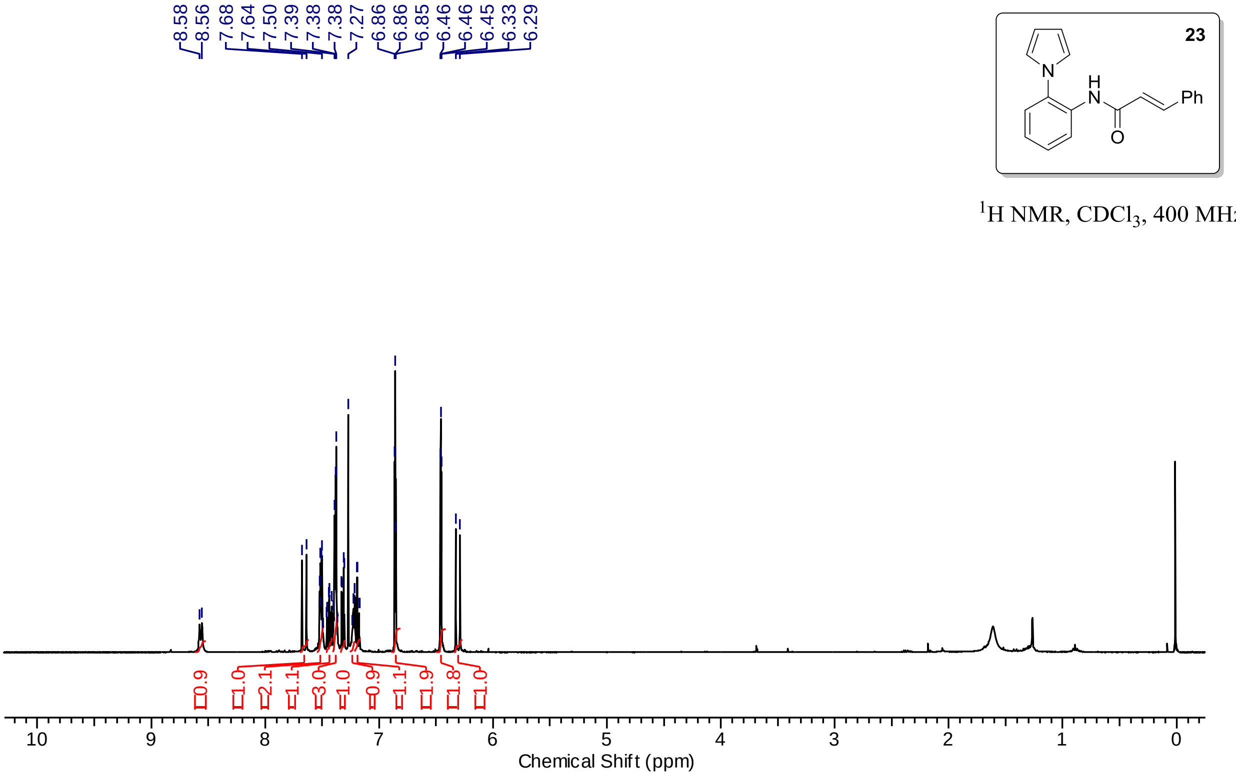




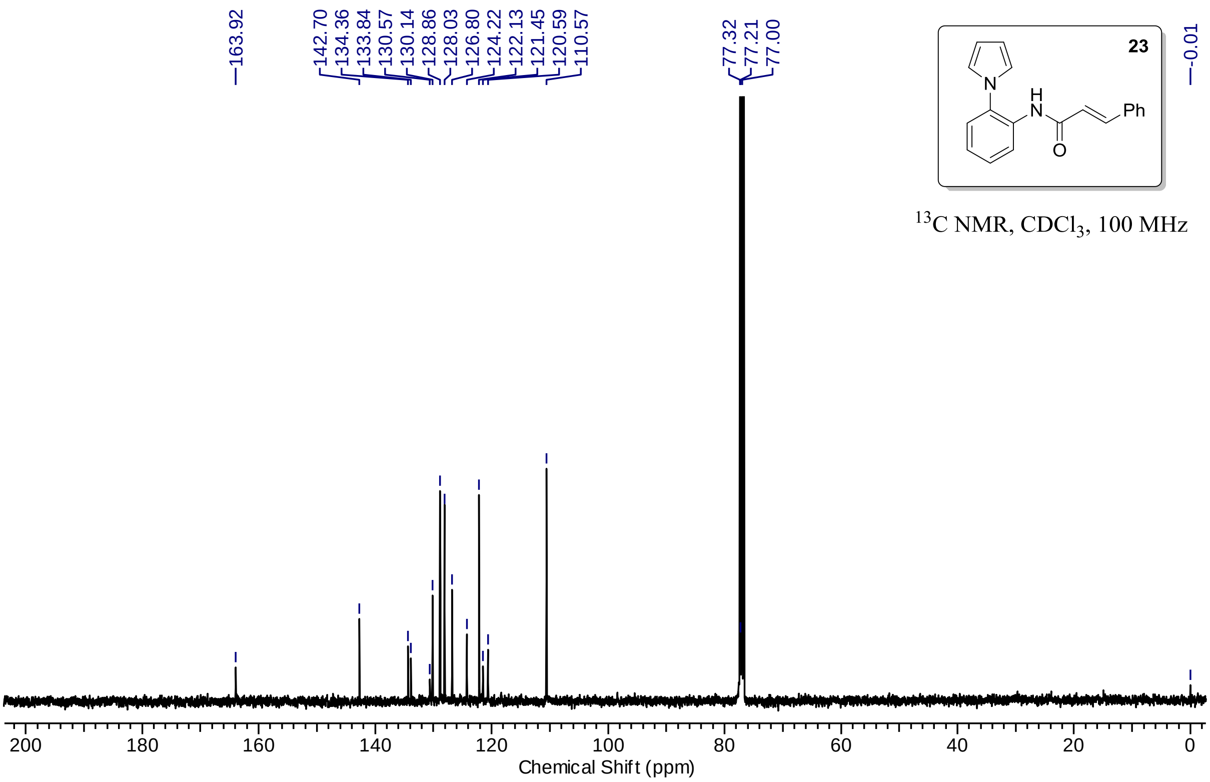
^{1}H NMR, $CDCl_3$, 400 MHz



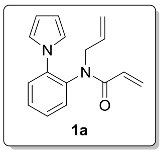
^{13}C NMR, $CDCl_3$, 100 MHz



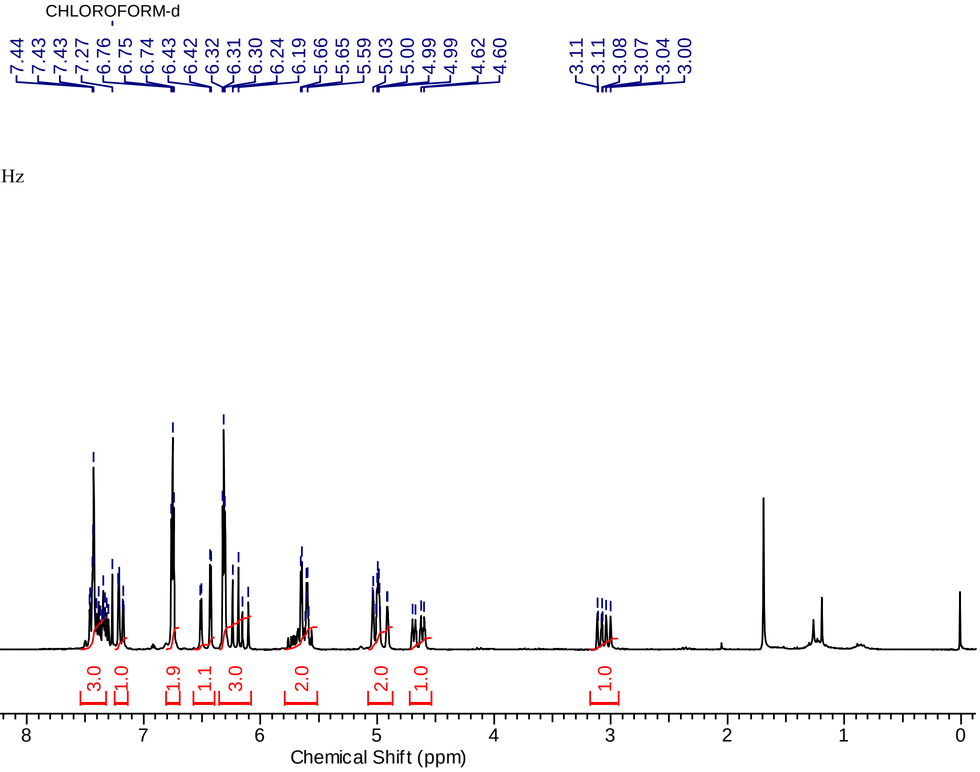
^{1}H NMR, $CDCl_3$, 400 MHz

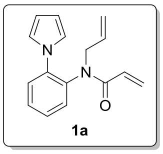


^{13}C NMR, $CDCl_3$, 100 MHz

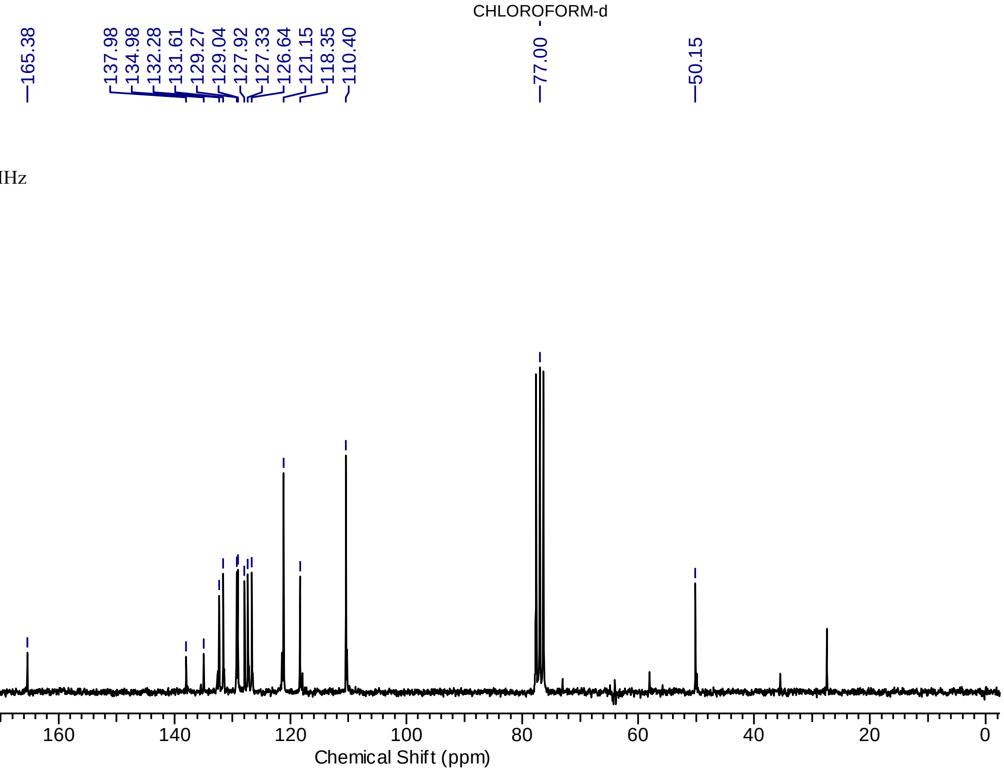


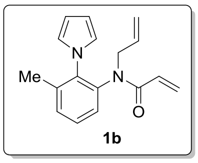
^{1}H NMR, $CDCl_3$, 200 MHz



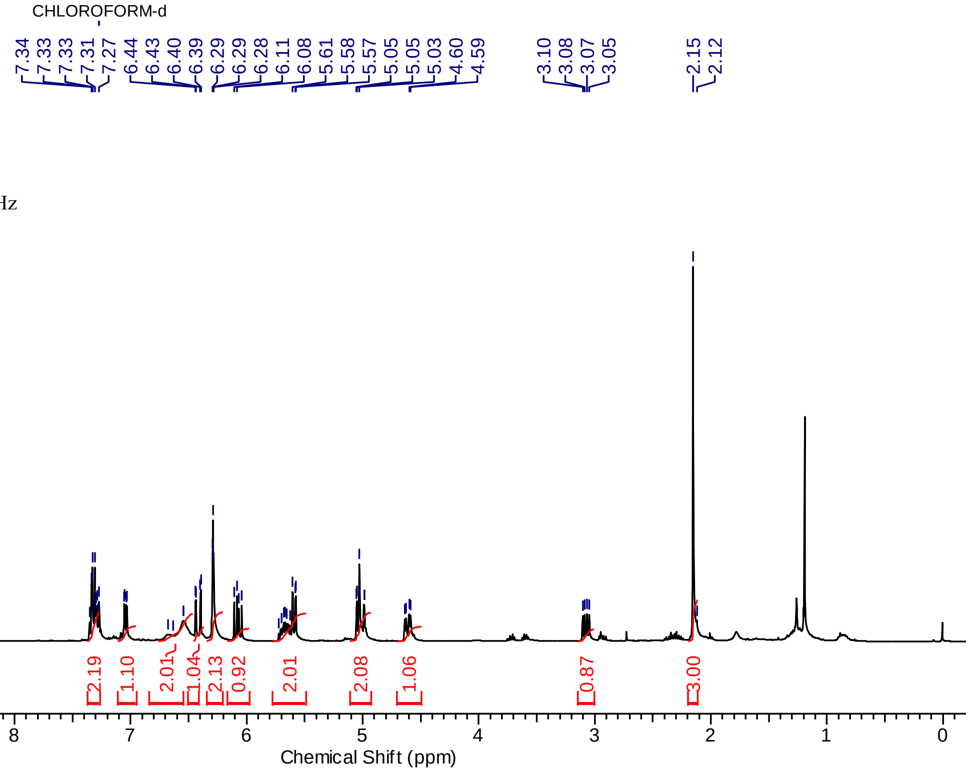


^{13}C NMR, $CDCl_3$, 50 MHz

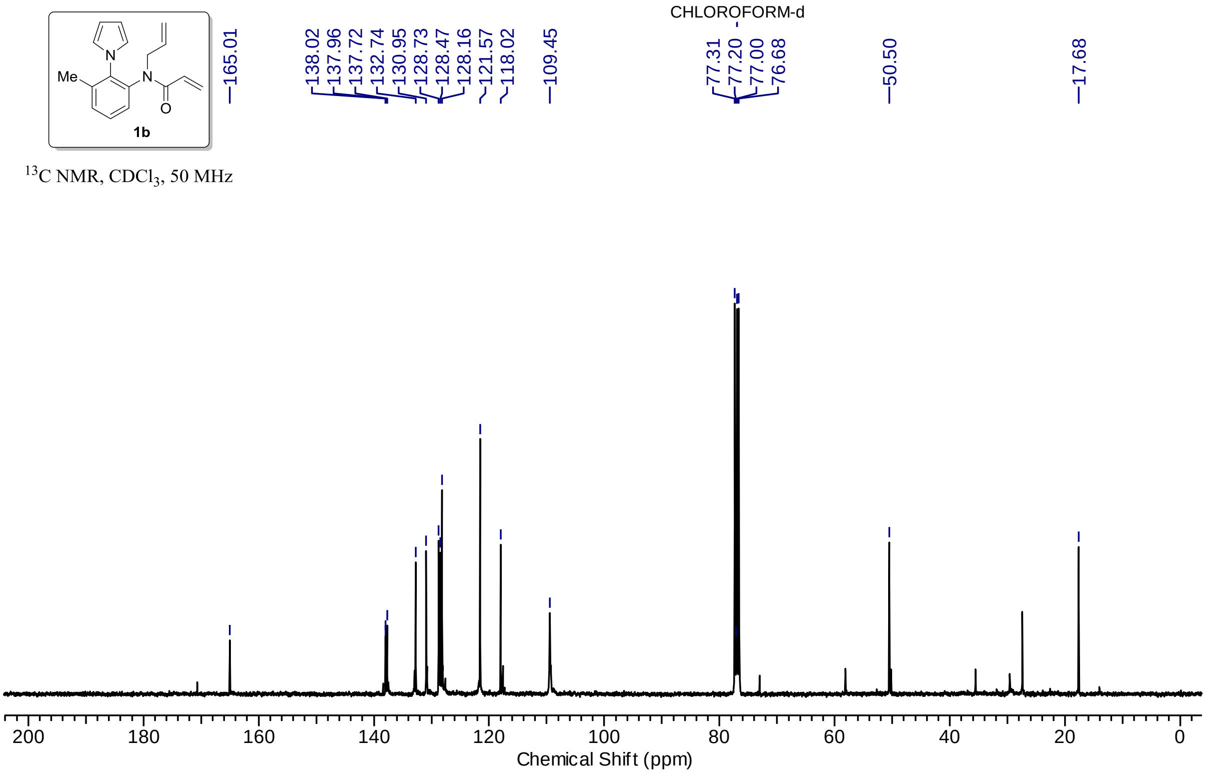


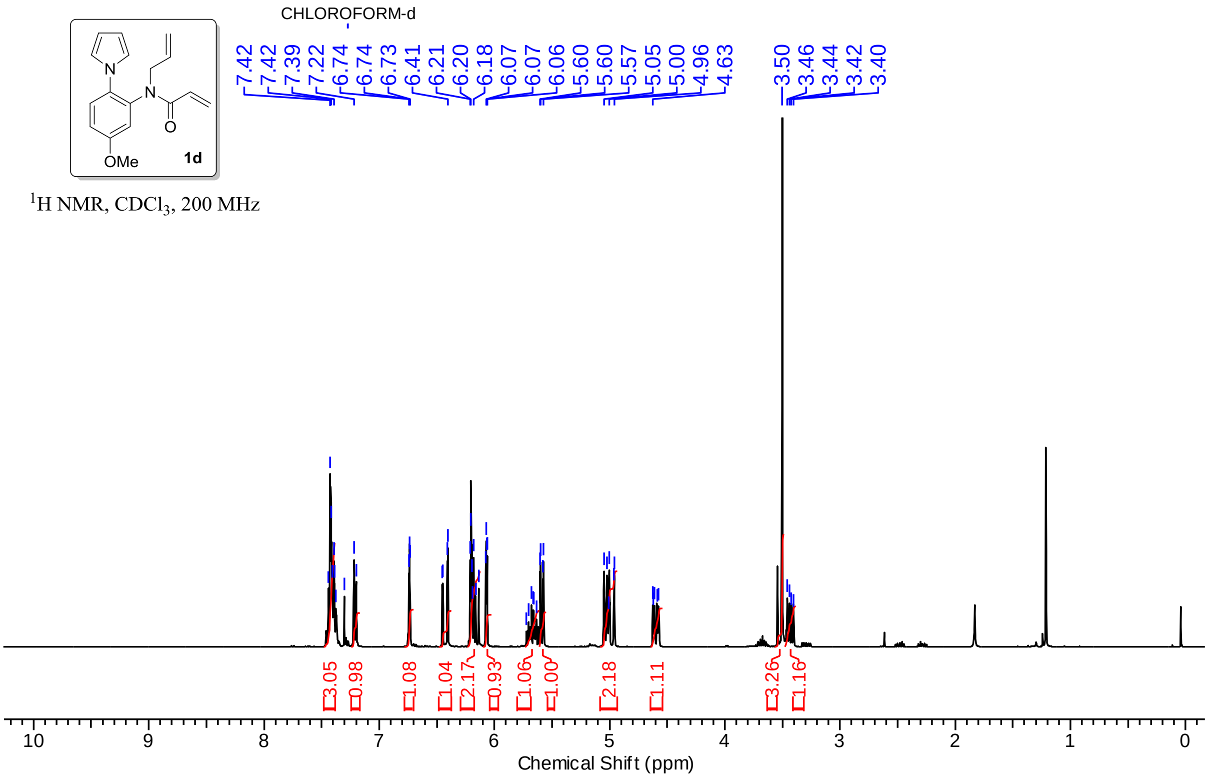


[1]H NMR, $CDCl_3$, 200 MHz

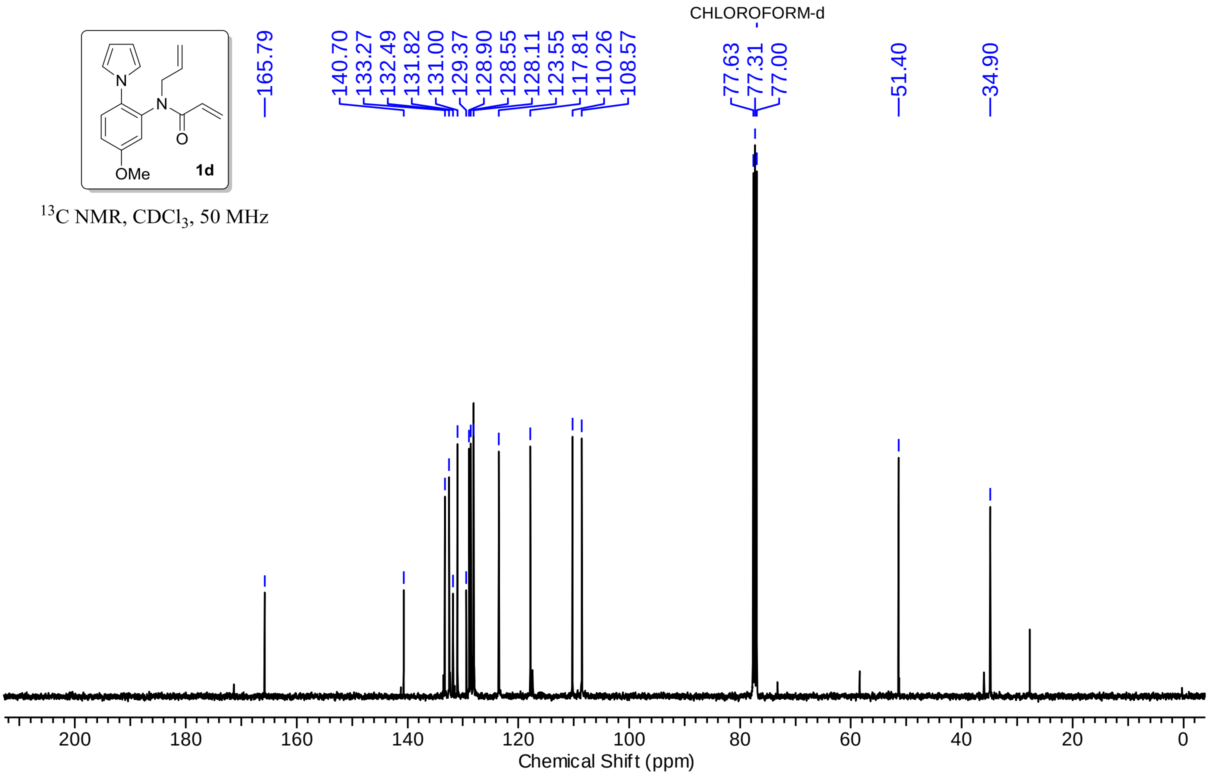


[13]C NMR, $CDCl_3$, 50 MHz

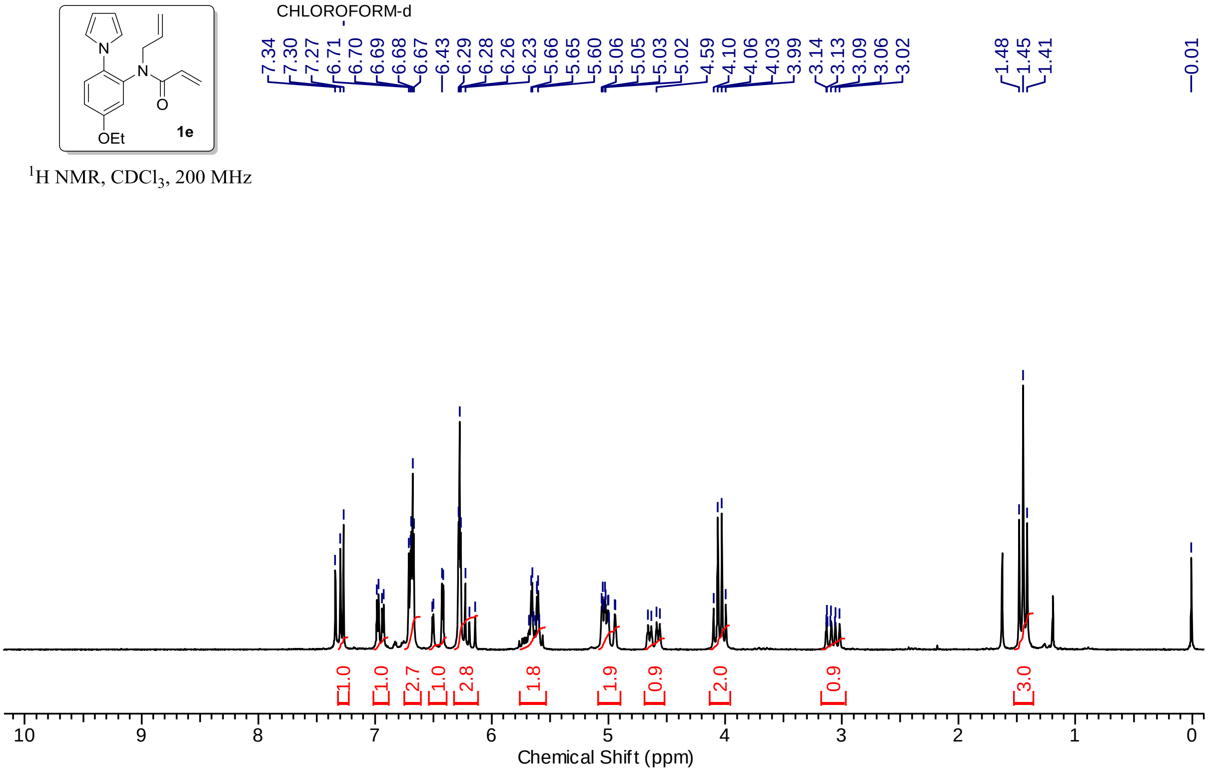




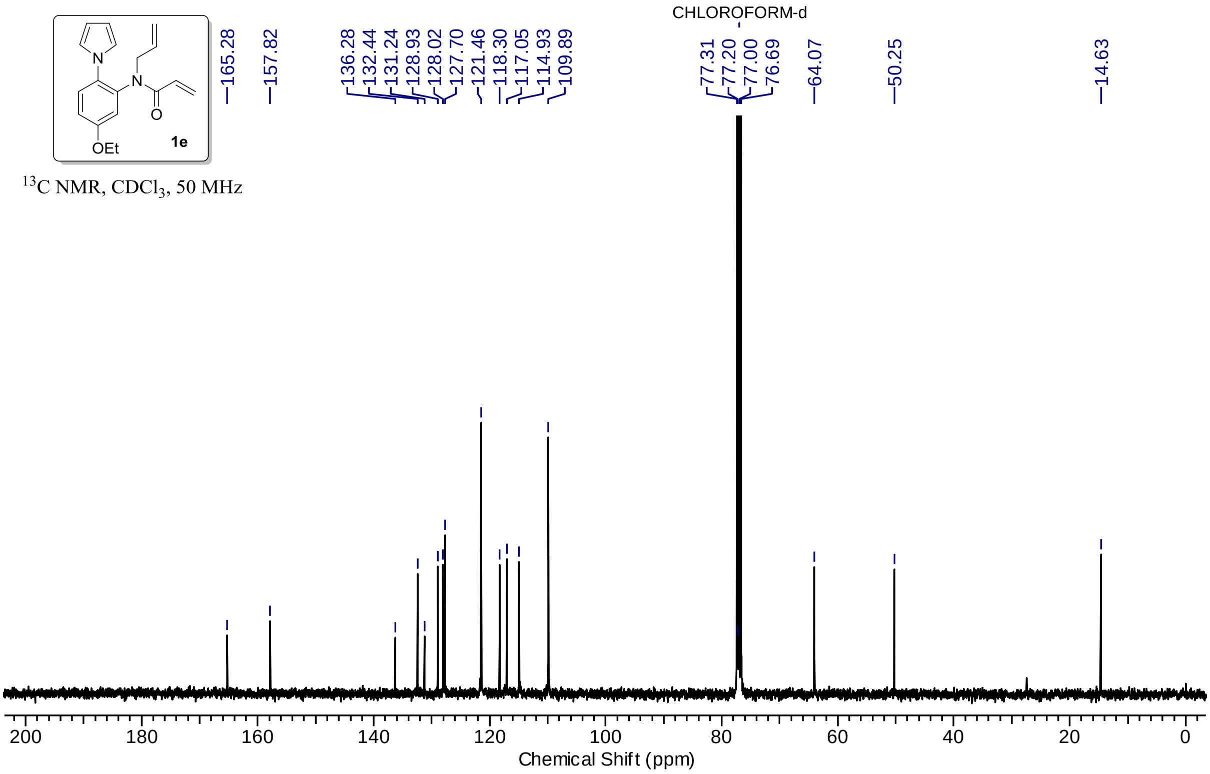
[1]H NMR, $CDCl_3$, 200 MHz



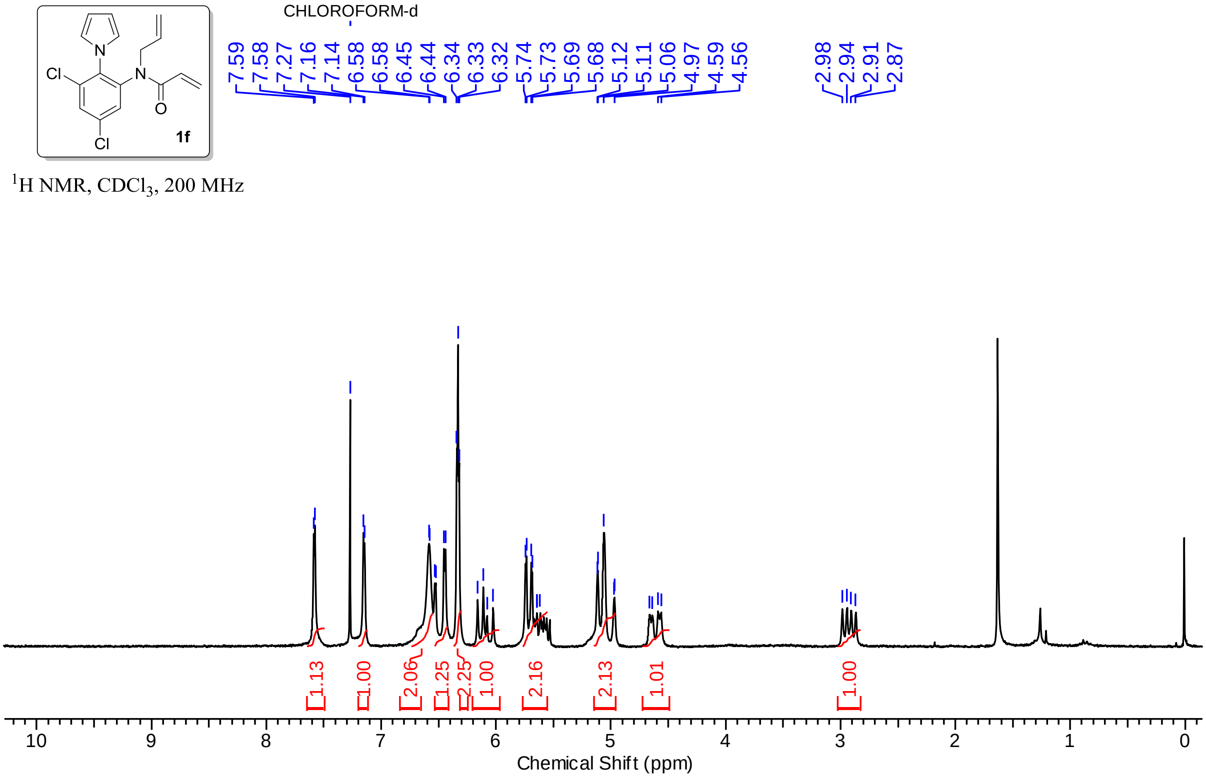
[13]C NMR, $CDCl_3$, 50 MHz



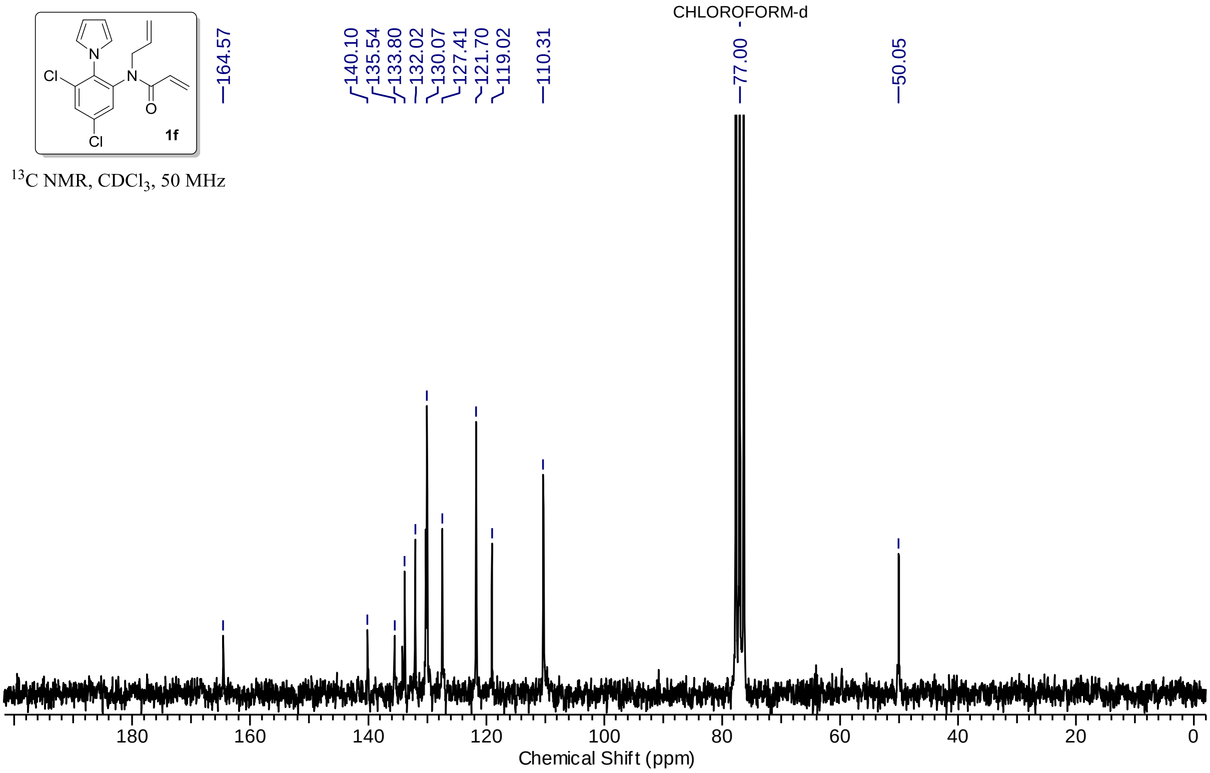
^{1}H NMR, $CDCl_3$, 200 MHz



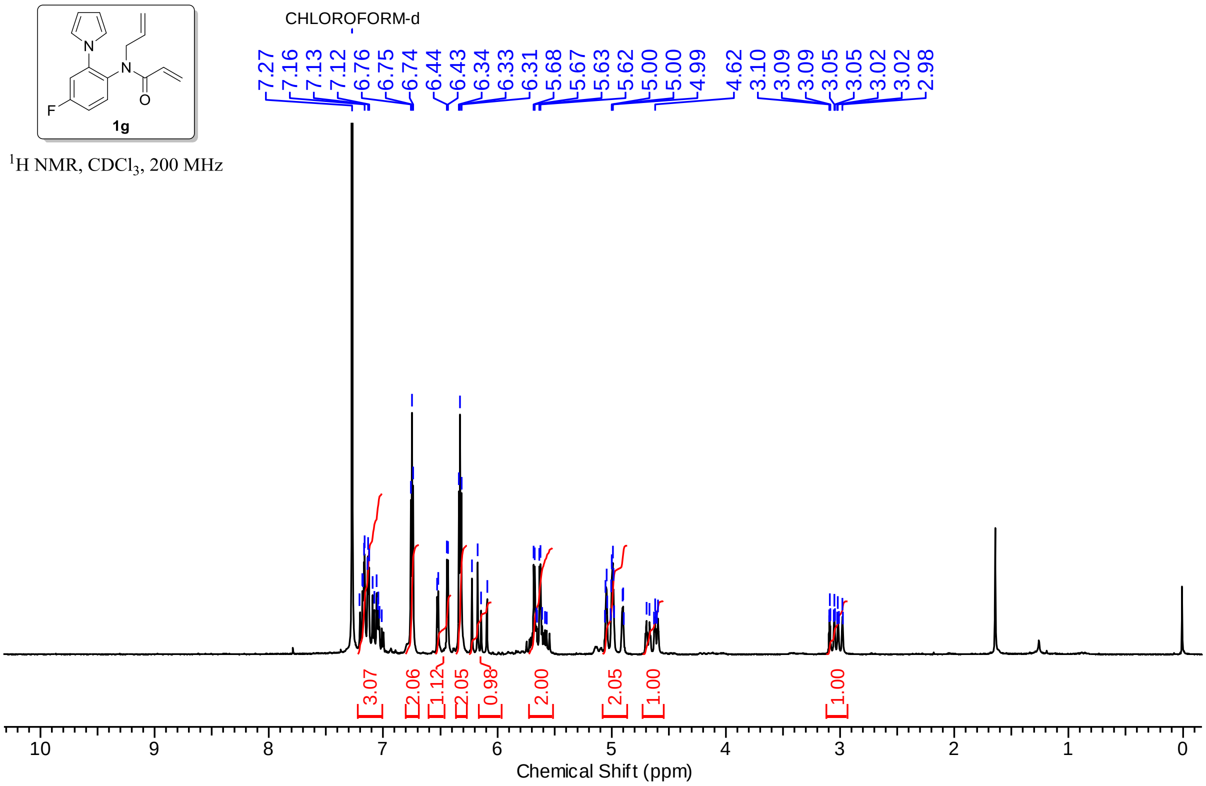
^{13}C NMR, $CDCl_3$, 50 MHz



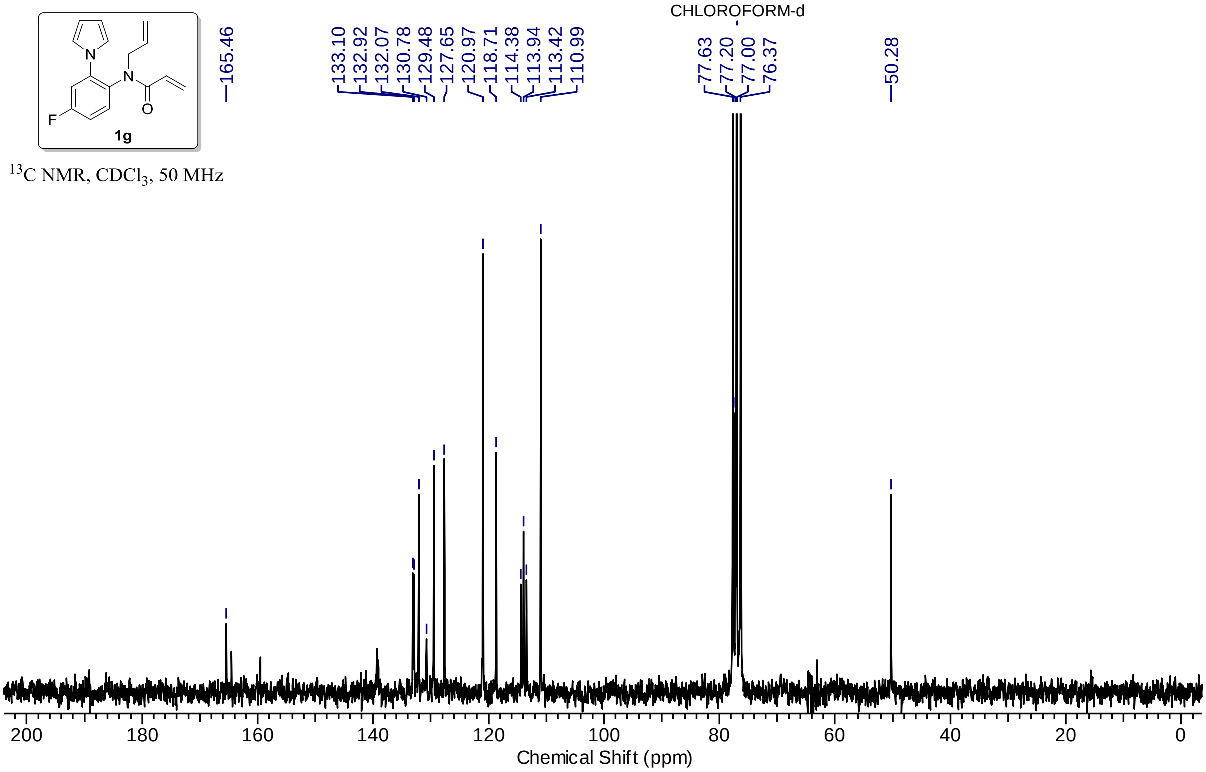
^{1}H NMR, $CDCl_3$, 200 MHz



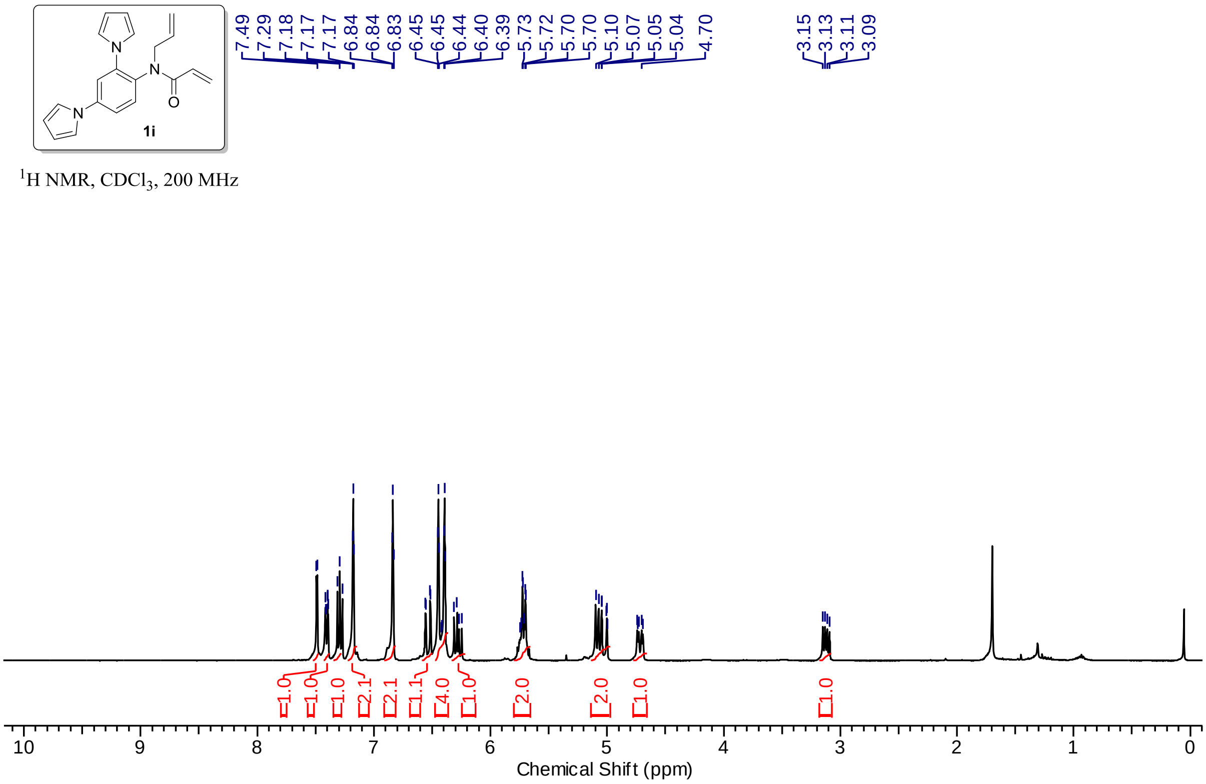
^{13}C NMR, $CDCl_3$, 50 MHz



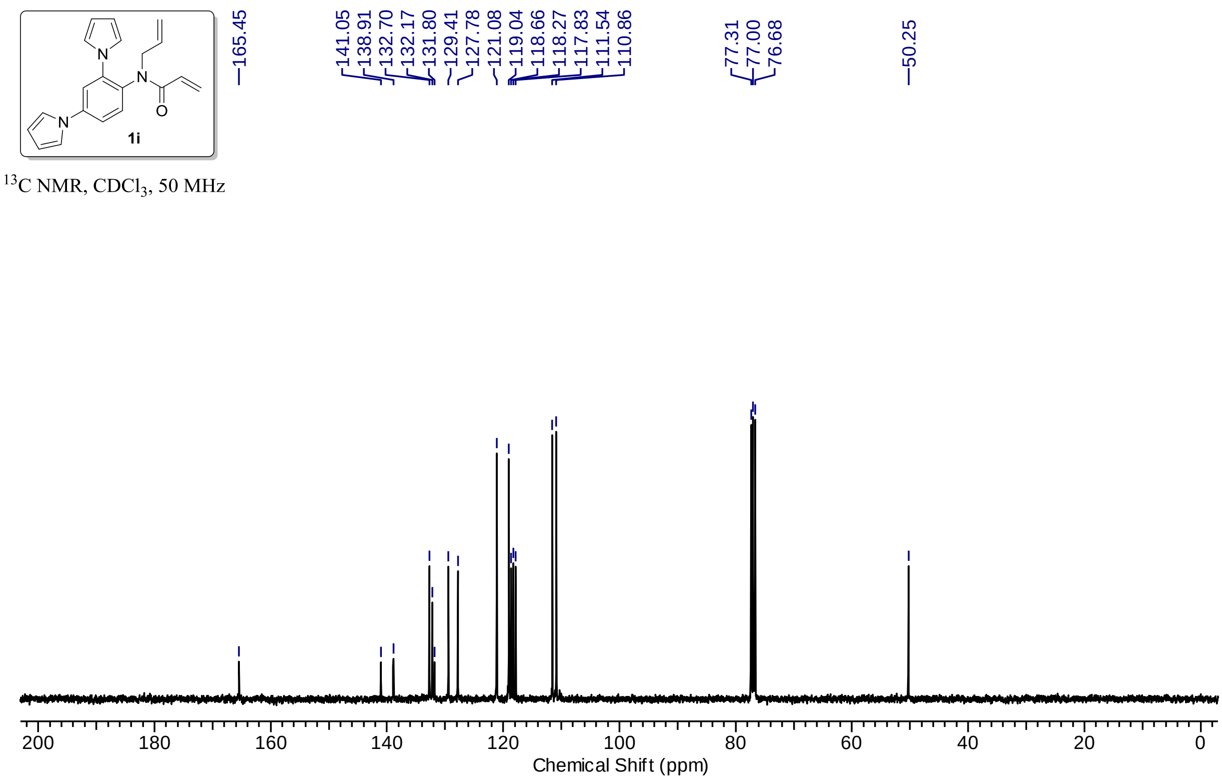
^{1}H NMR, $CDCl_3$, 200 MHz



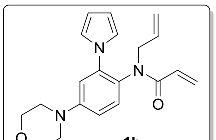
^{13}C NMR, $CDCl_3$, 50 MHz



^{1}H NMR, $CDCl_3$, 200 MHz



^{13}C NMR, $CDCl_3$, 50 MHz



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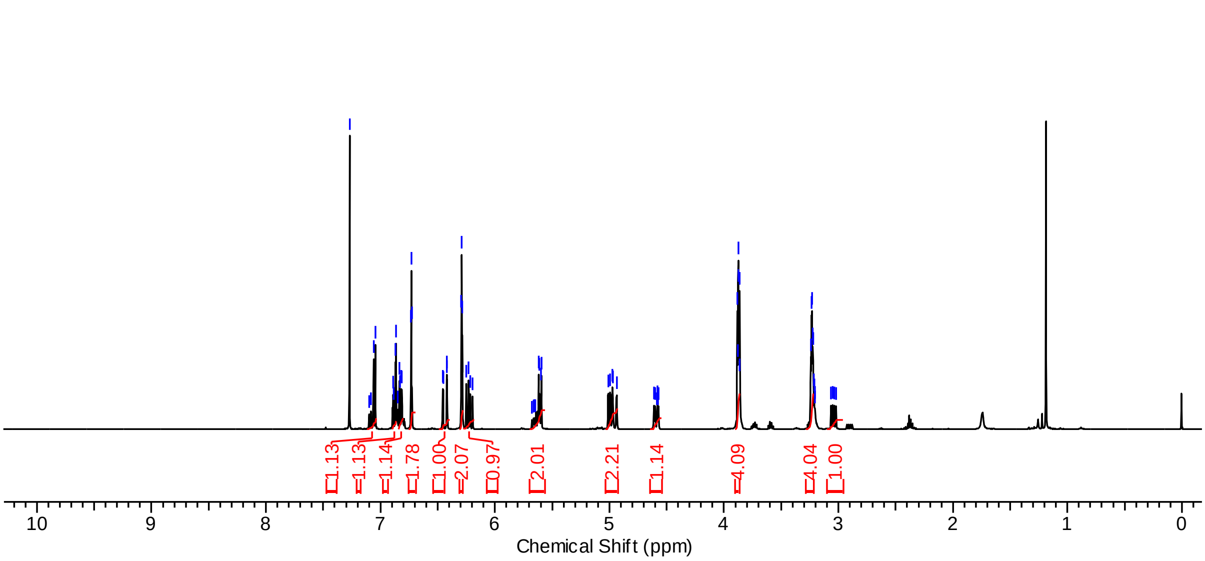
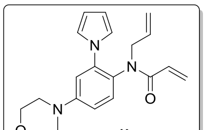
[1]H NMR, $CDCl_3$, 200 MHz





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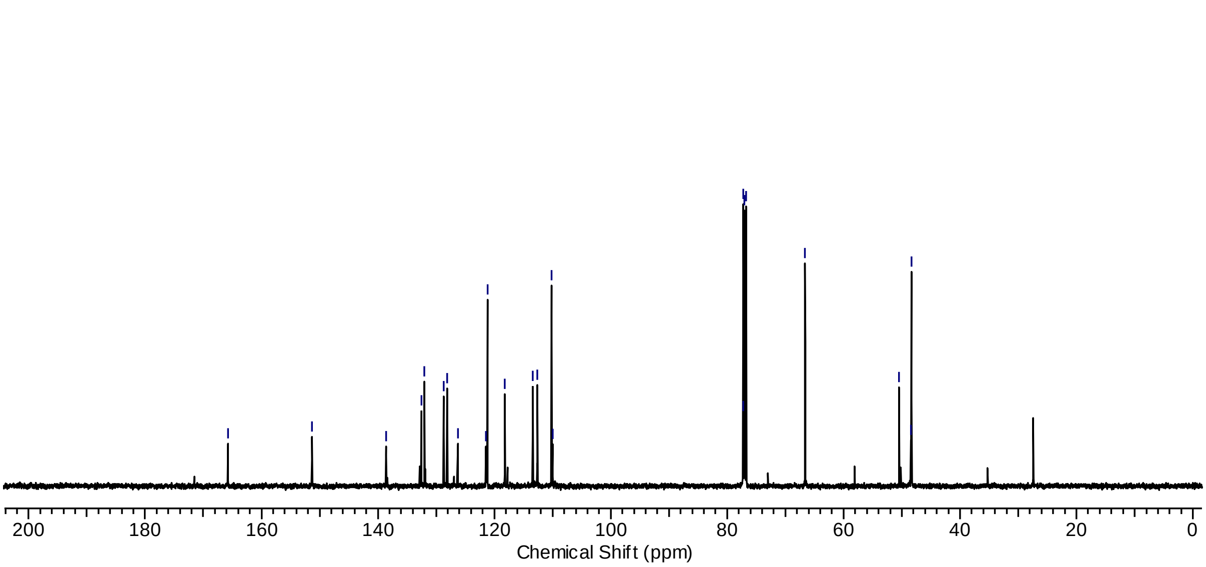
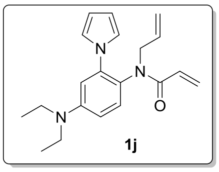
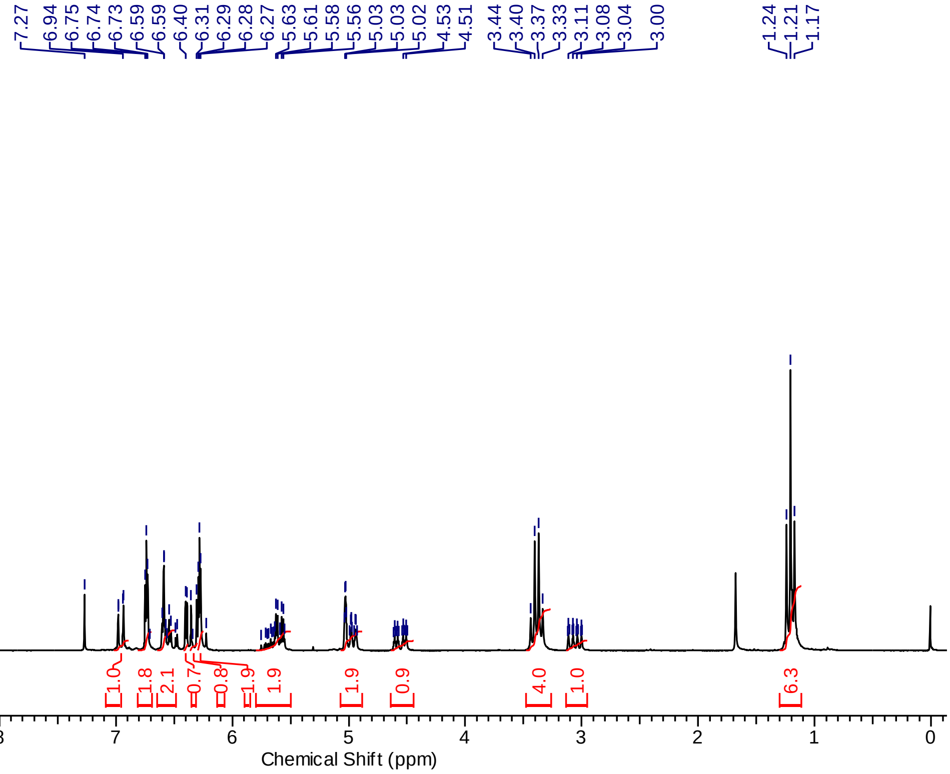
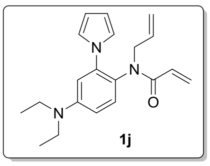
[13]C NMR, $CDCl_3$, 50 MHz



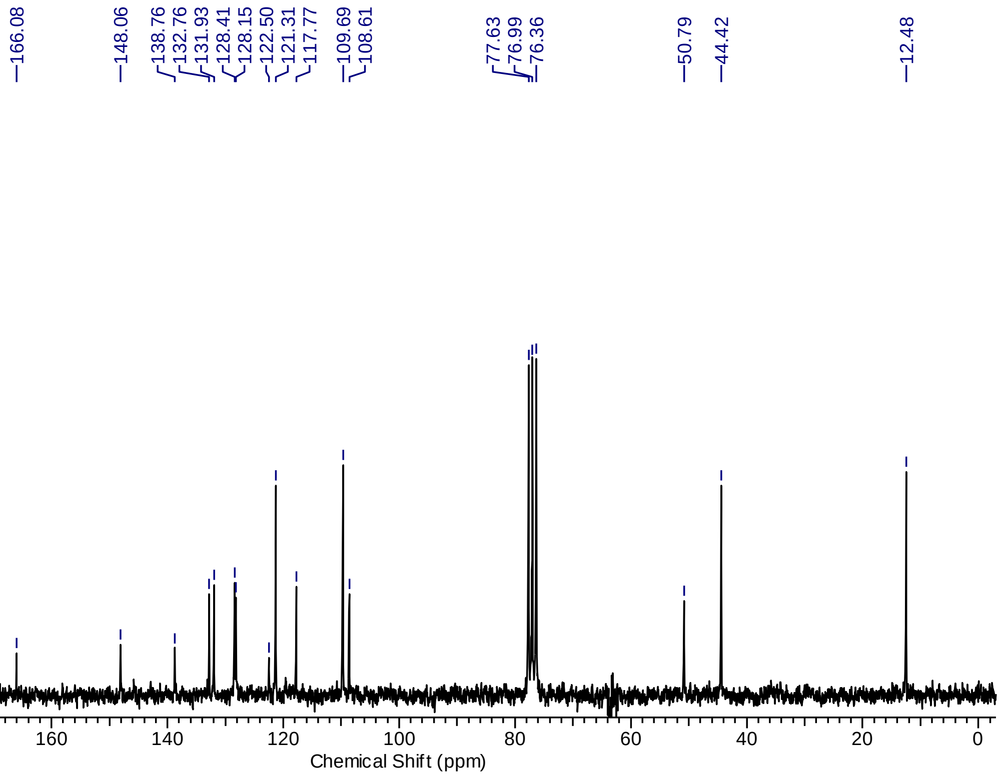


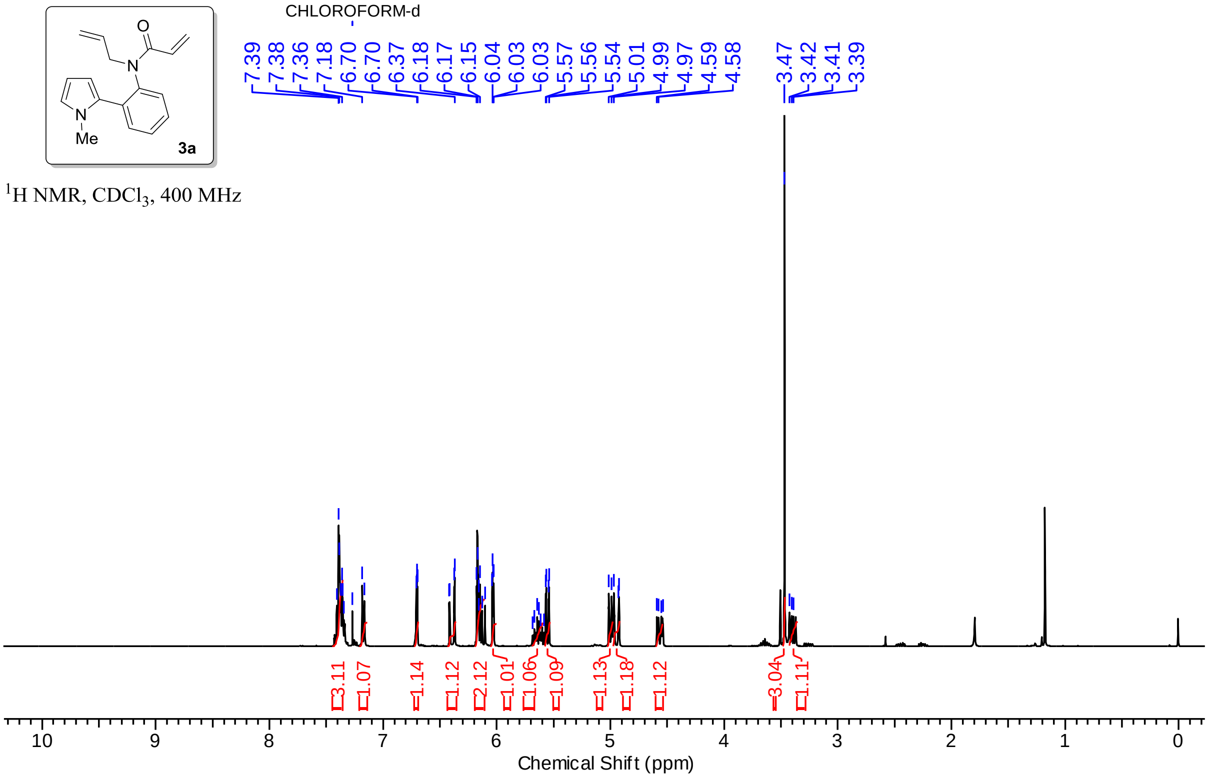
^{1}H NMR, $CDCl_3$, 200 MHz



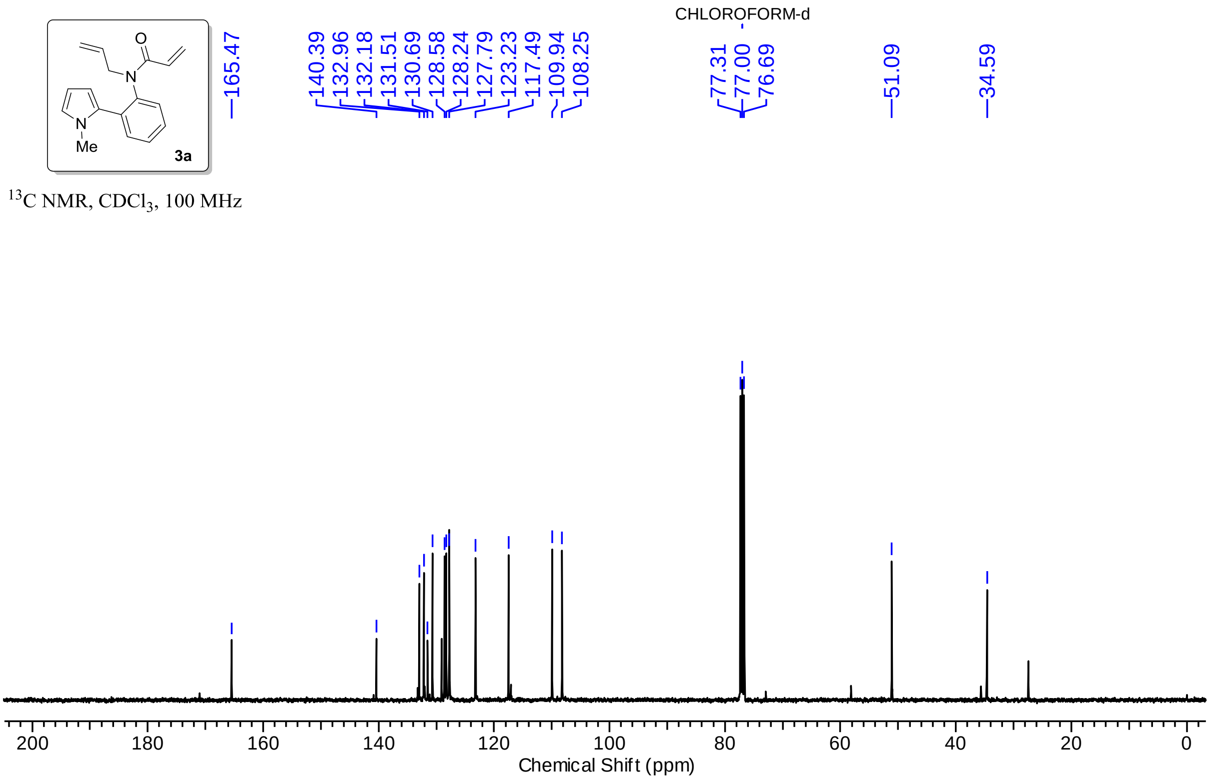


^{13}C NMR, $CDCl_3$, 50 MHz

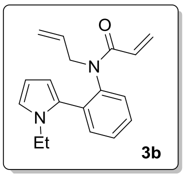




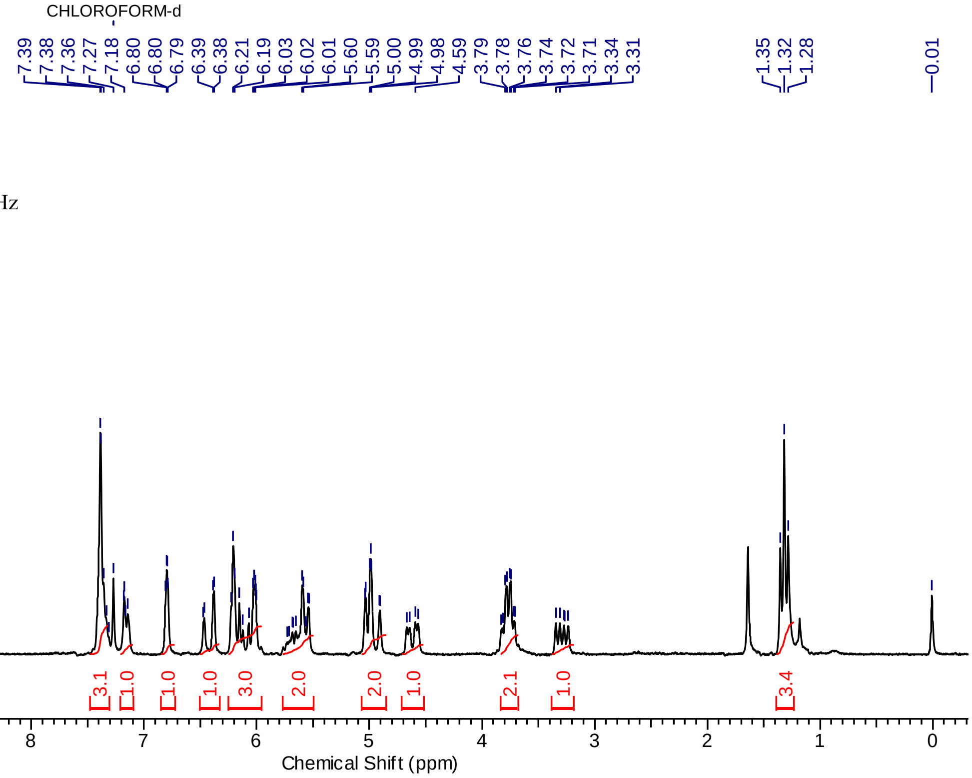
^{1}H NMR, $CDCl_3$, 400 MHz

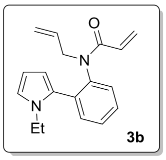


^{13}C NMR, $CDCl_3$, 100 MHz

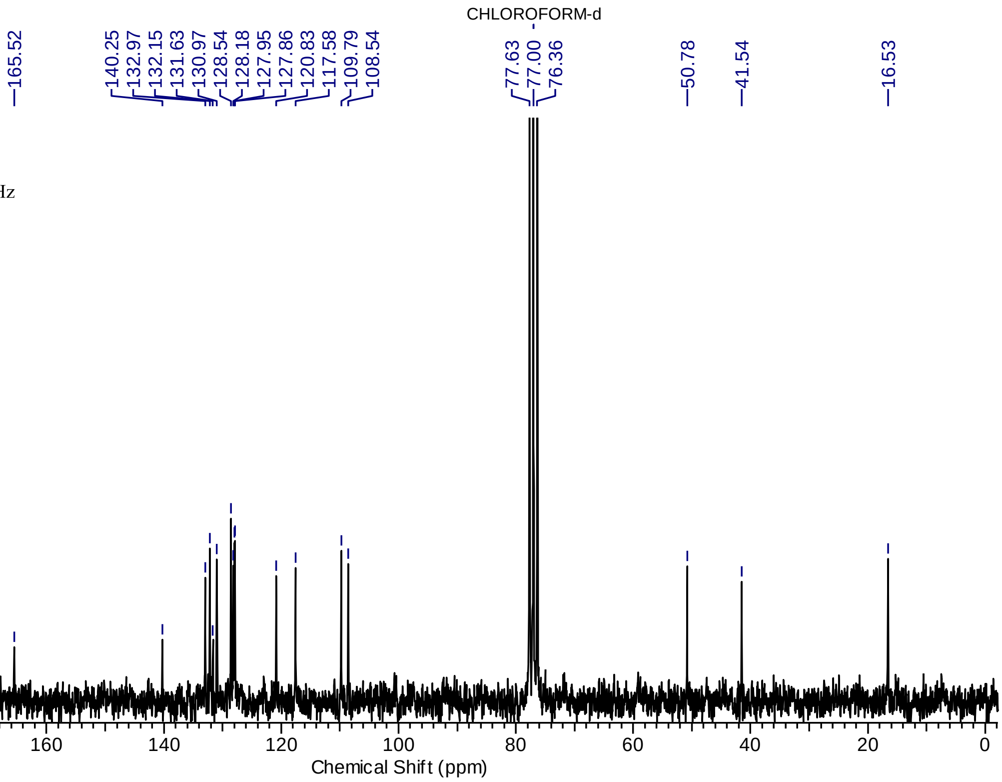


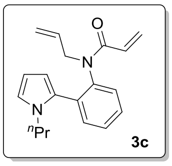
^{1}H NMR, $CDCl_3$, 200 MHz

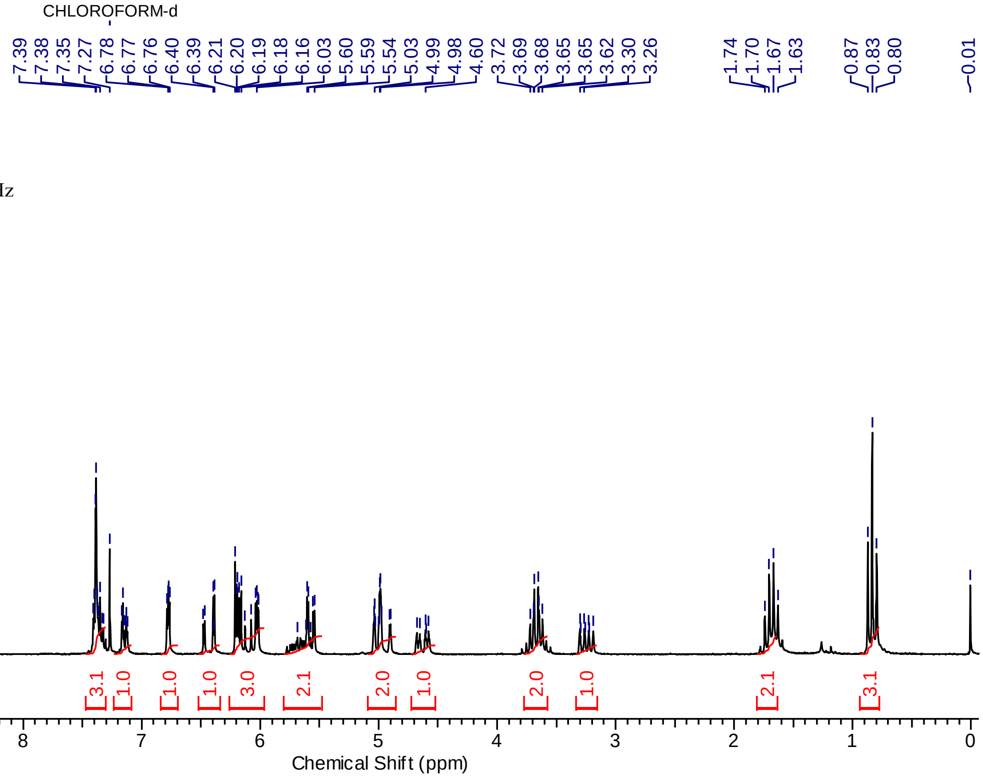




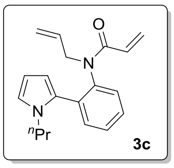
^{13}C NMR, $CDCl_3$, 50 MHz

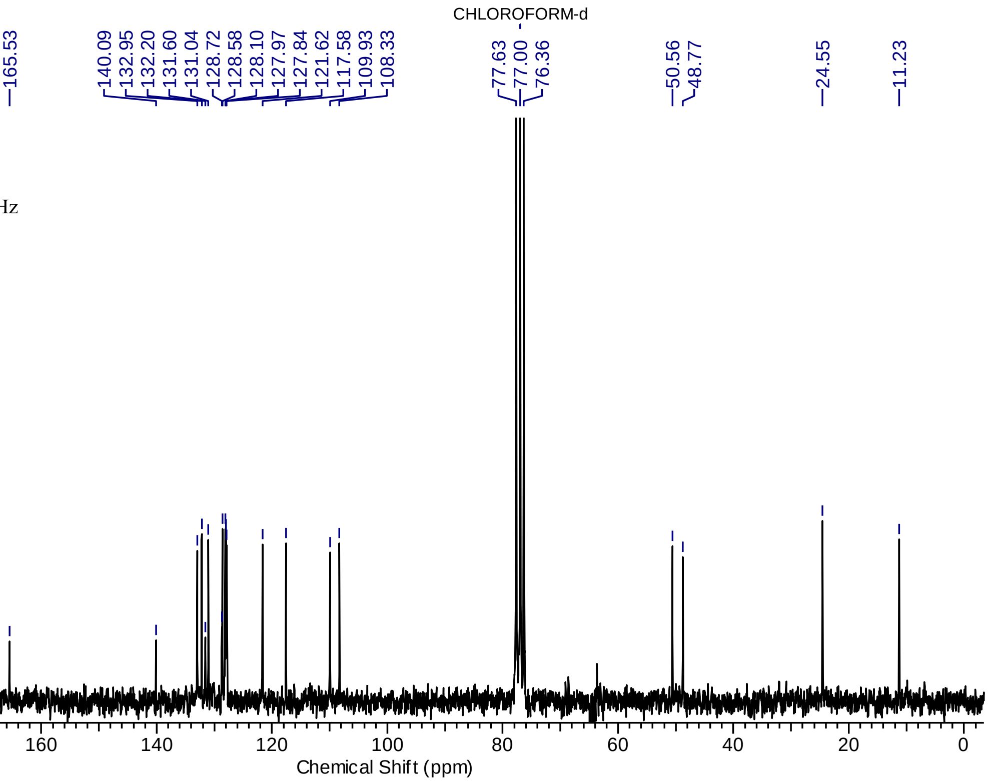




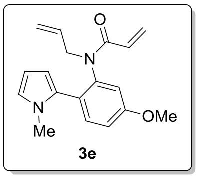


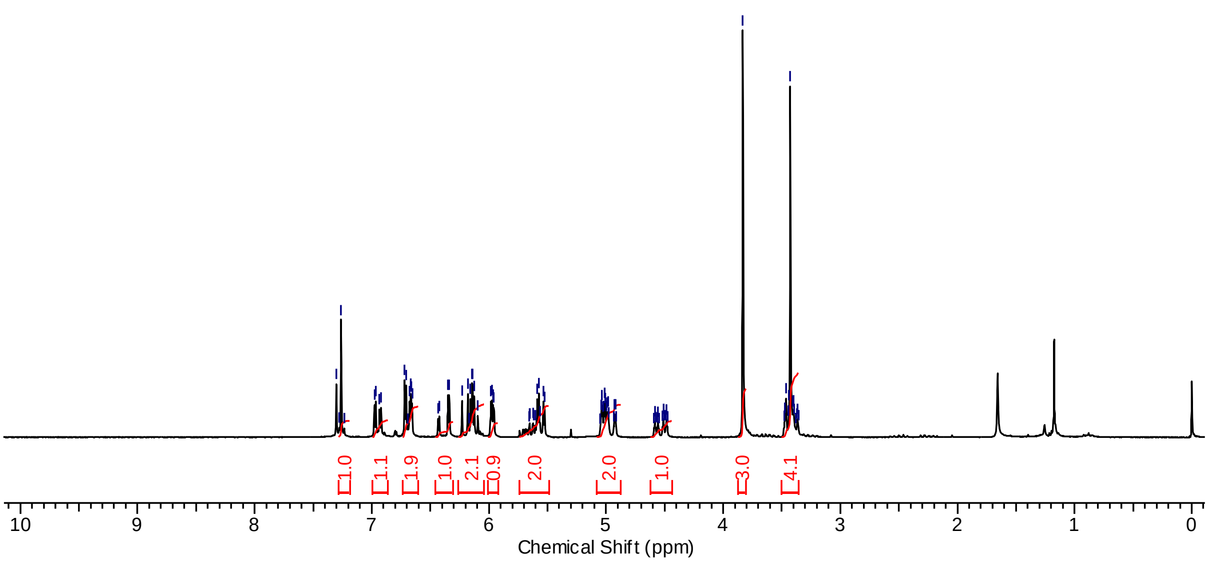
^{1}H NMR, $CDCl_3$, 200 MHz



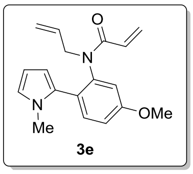


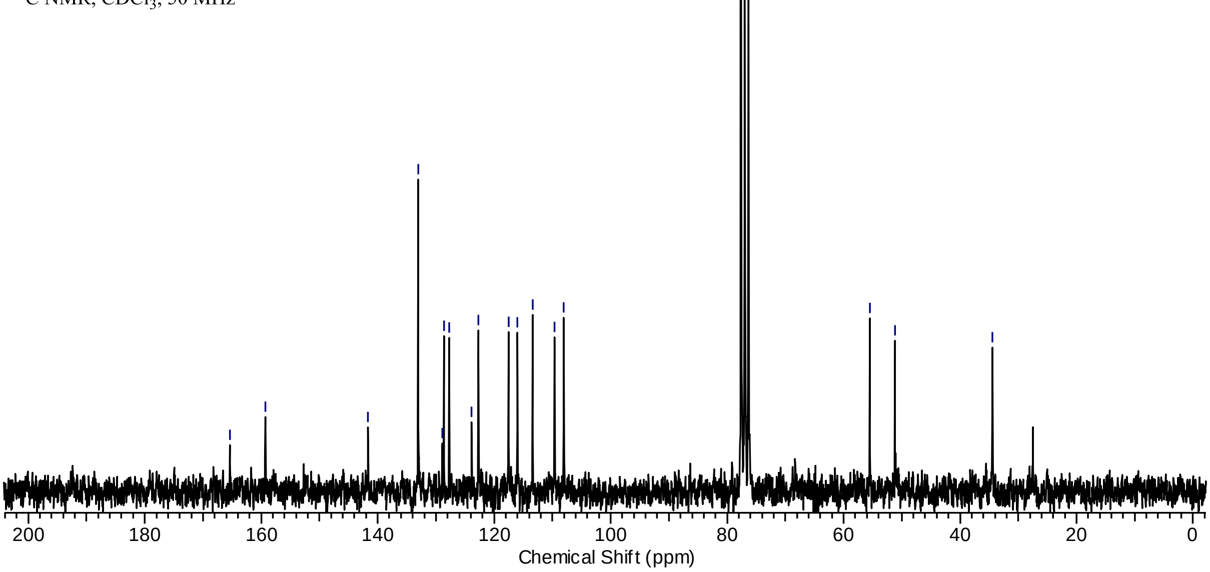
^{13}C NMR, $CDCl_3$, 50 MHz



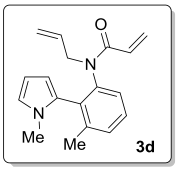


^{1}H NMR, $CDCl_3$, 200 MHz

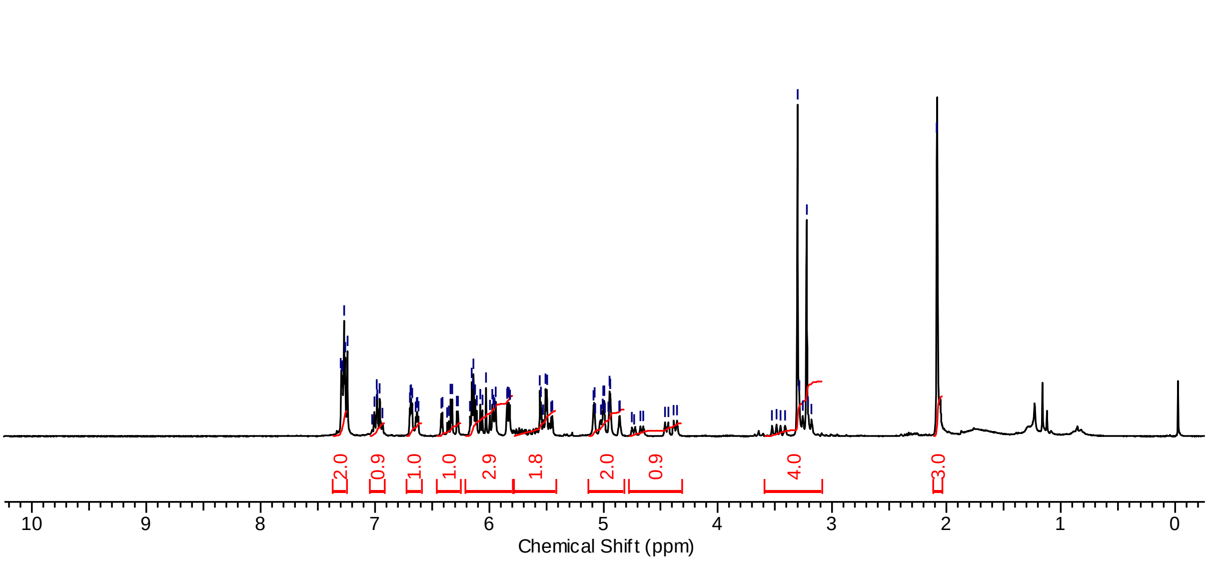


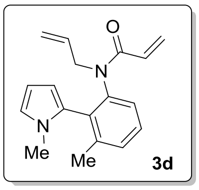


^{13}C NMR, $CDCl_3$, 50 MHz

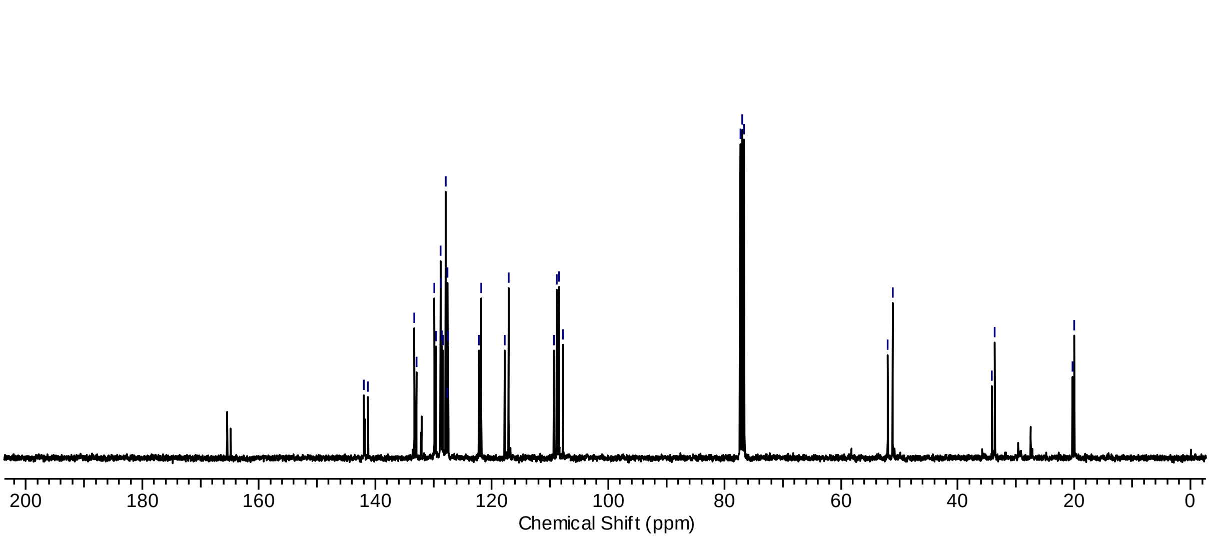


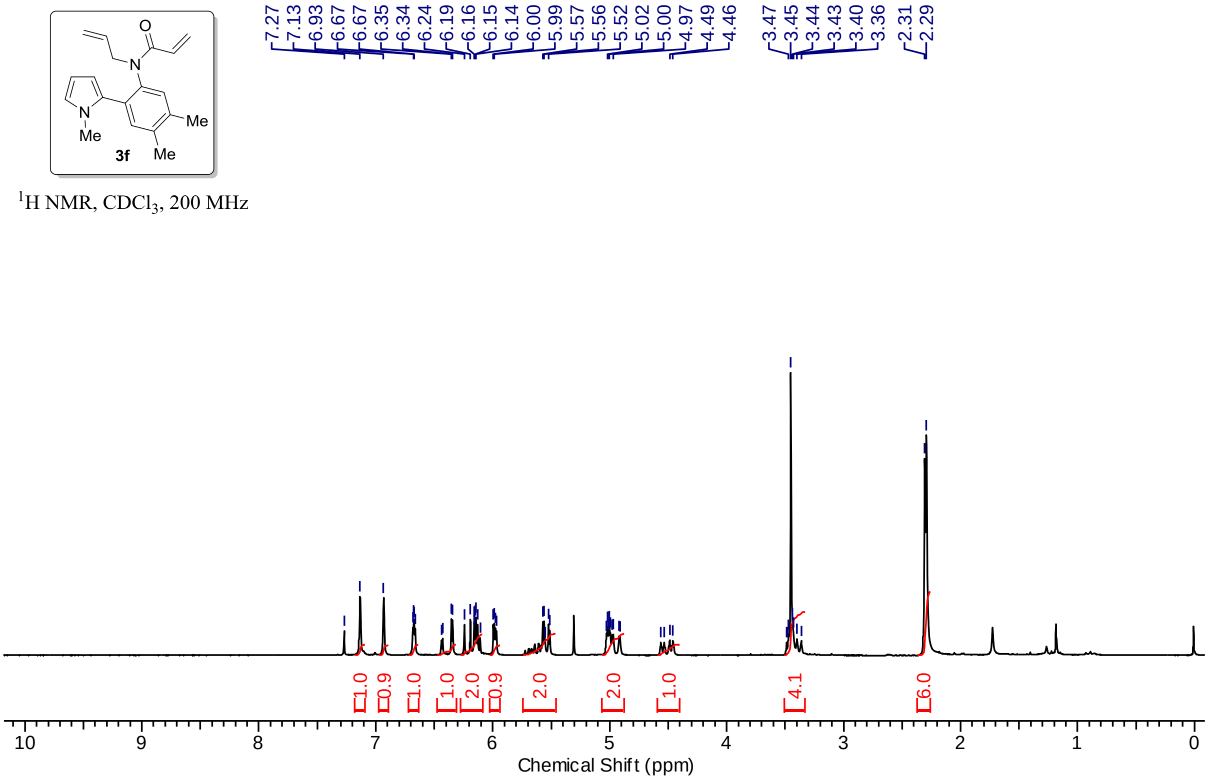
^{1}H NMR, $CDCl_3$, 400 MHz



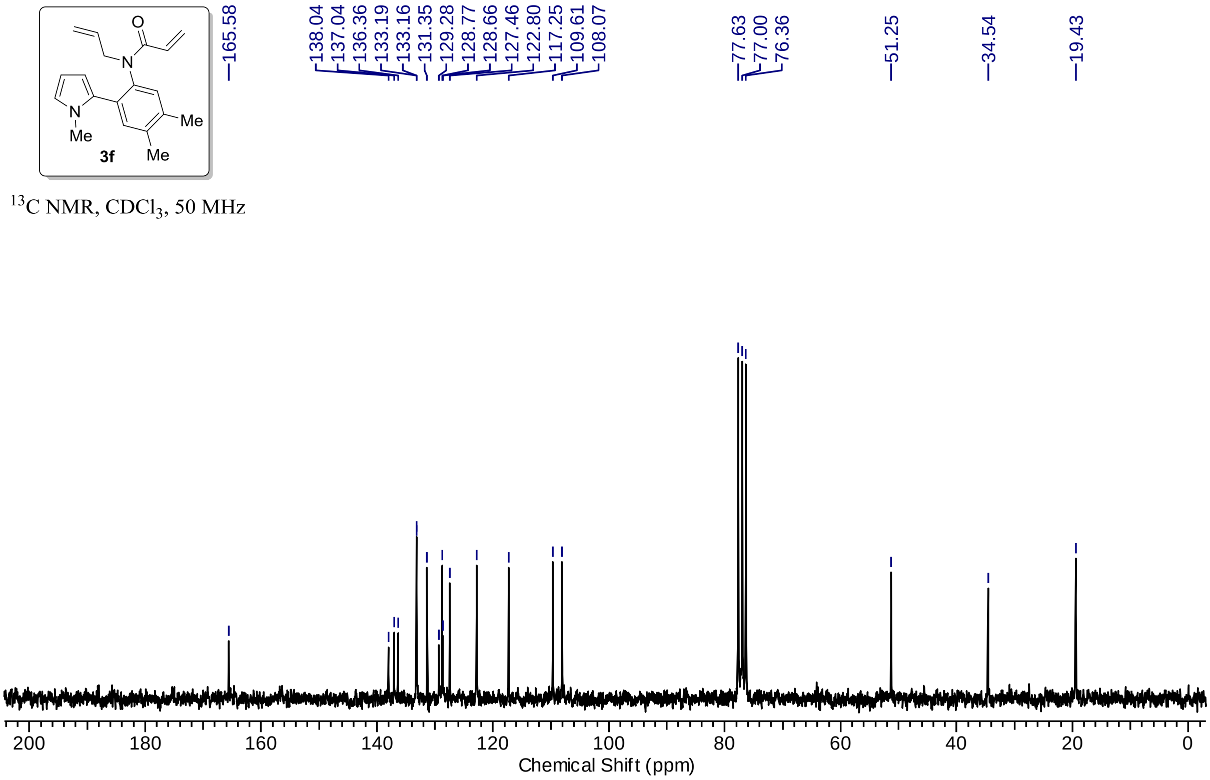


^{13}C NMR, $CDCl_3$, 100 MHz

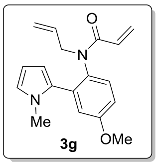


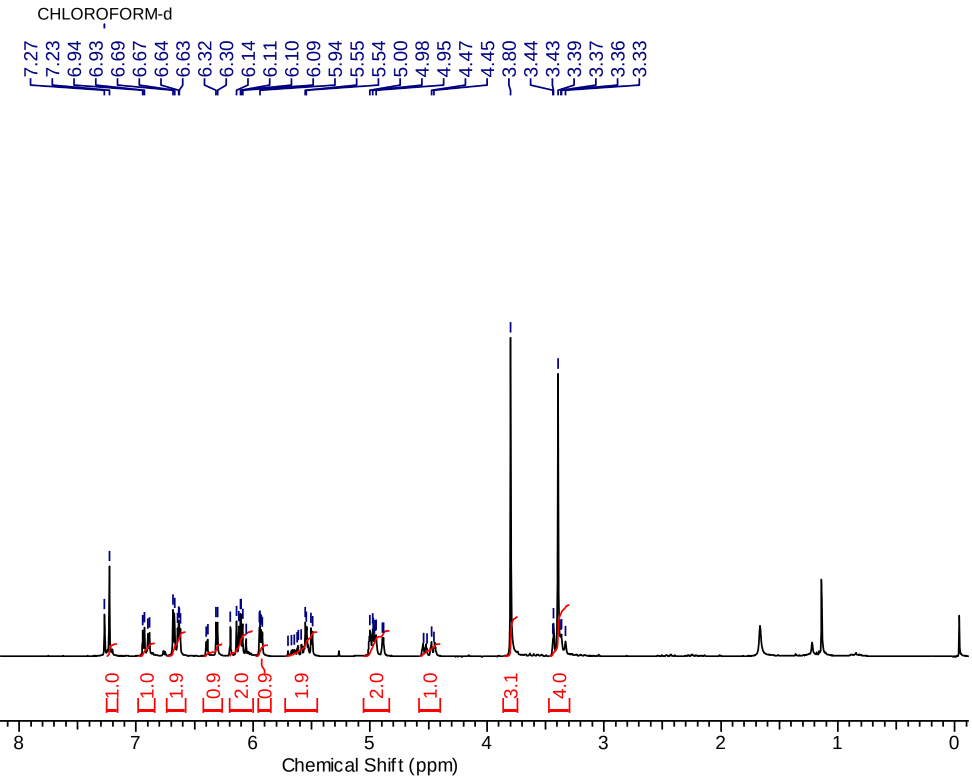


^{1}H NMR, $CDCl_3$, 200 MHz

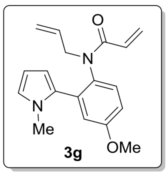


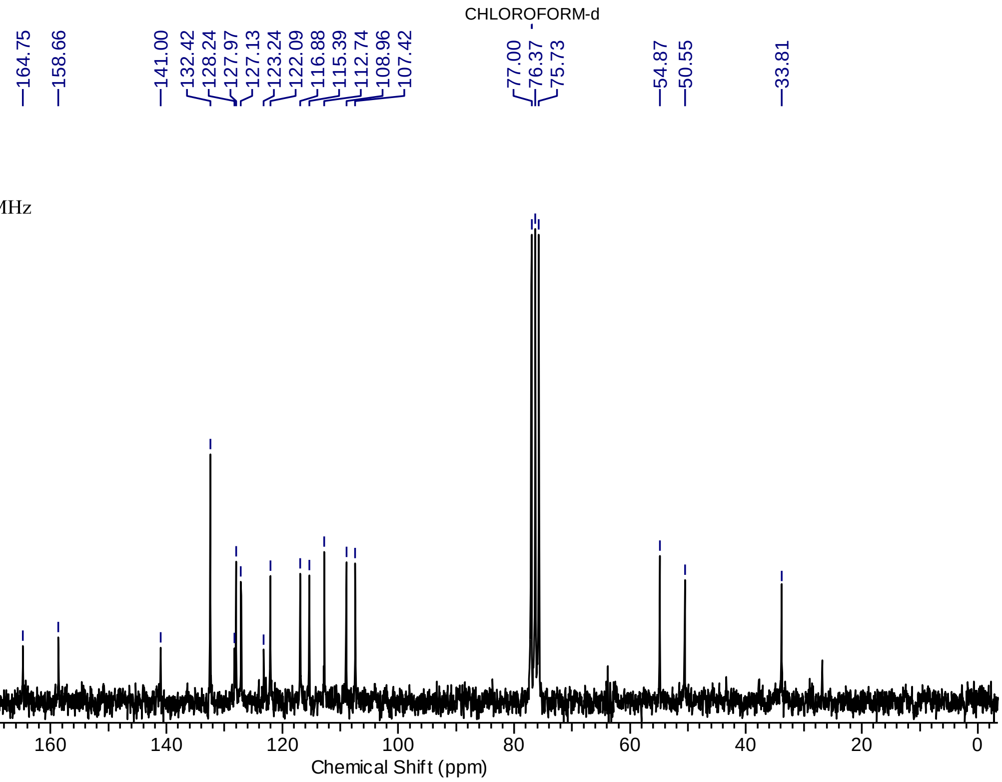
^{13}C NMR, $CDCl_3$, 50 MHz





^{1}H NMR, $CDCl_3$, 200 MHz





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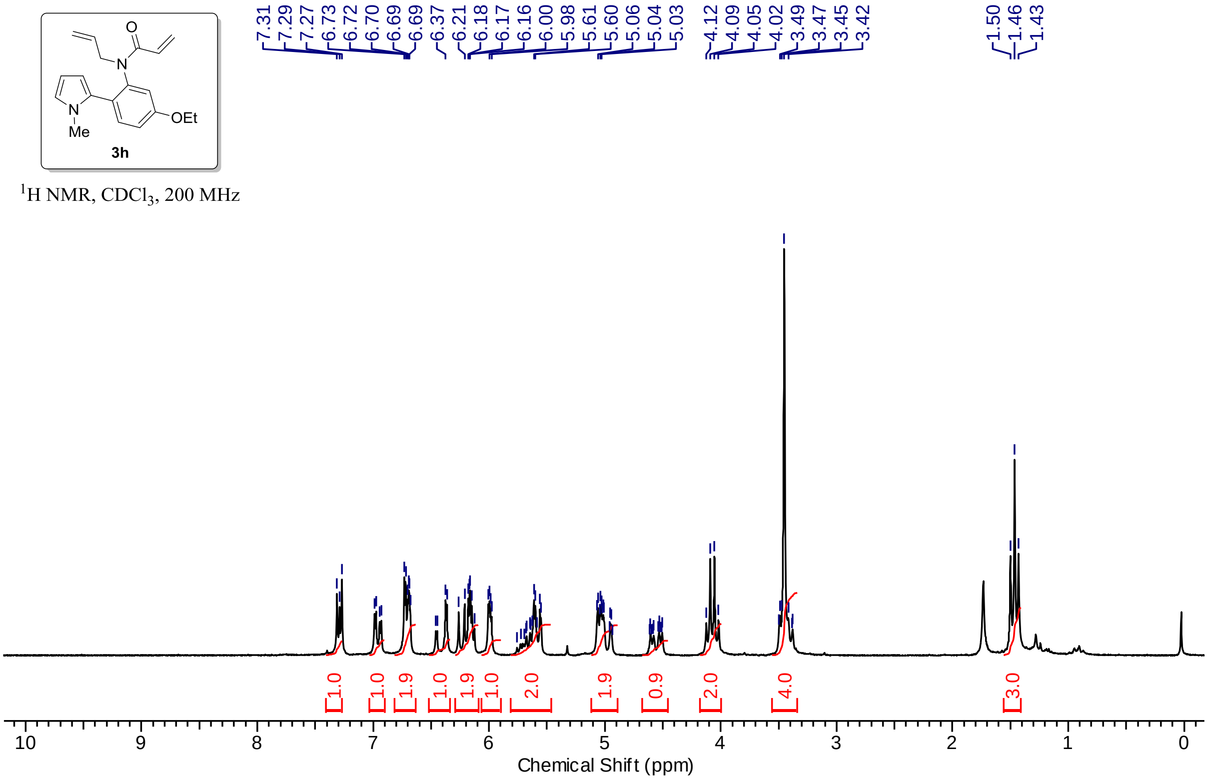

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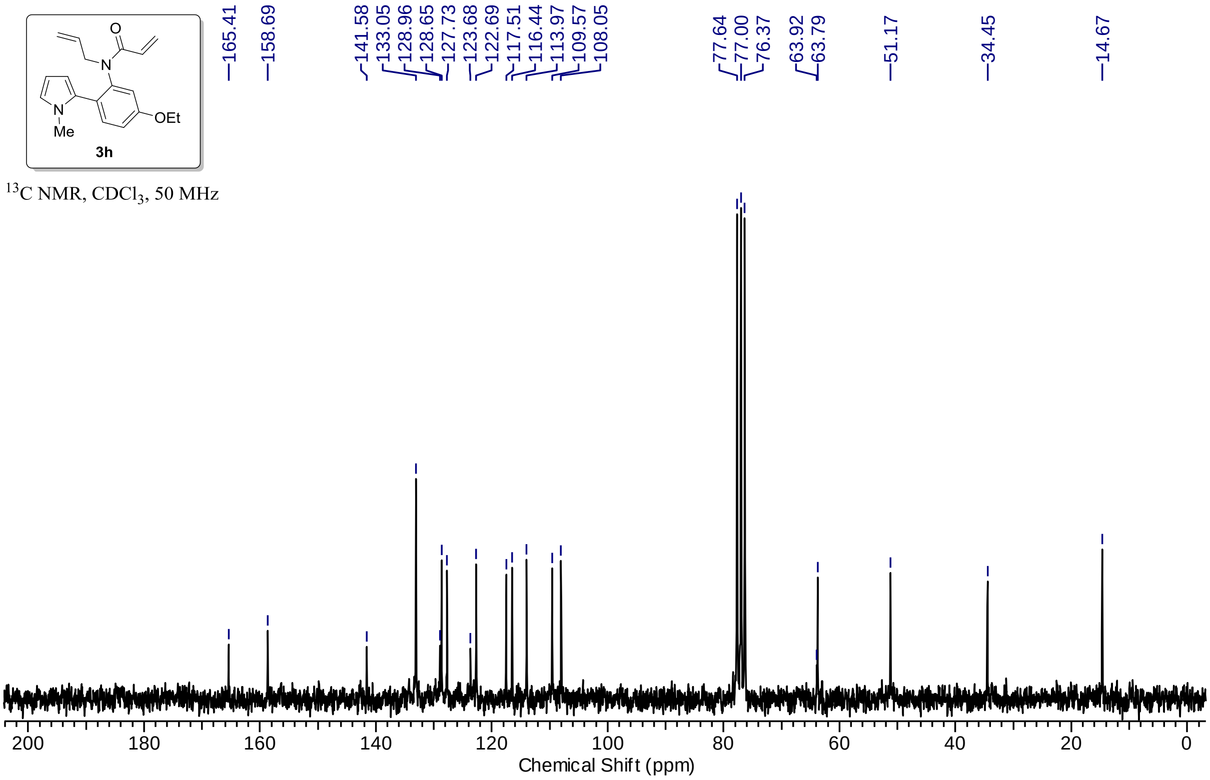

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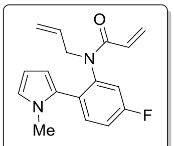
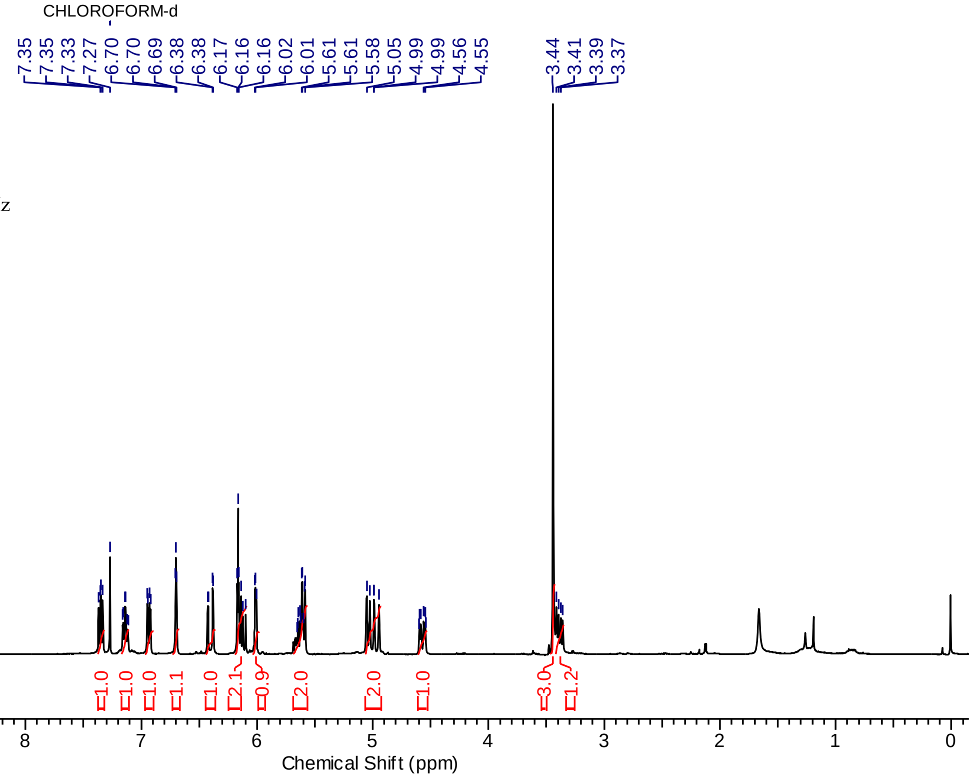
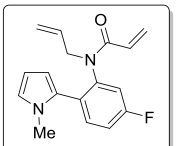


3i

^{1}H NMR, $CDCl_3$, 200 MHz





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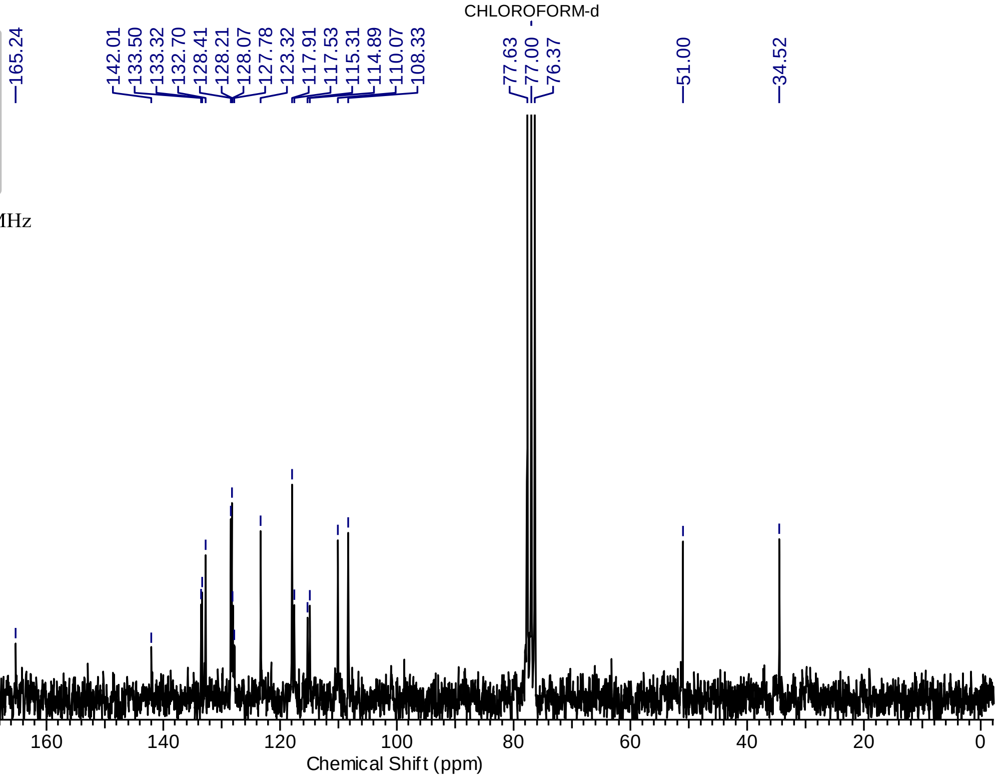
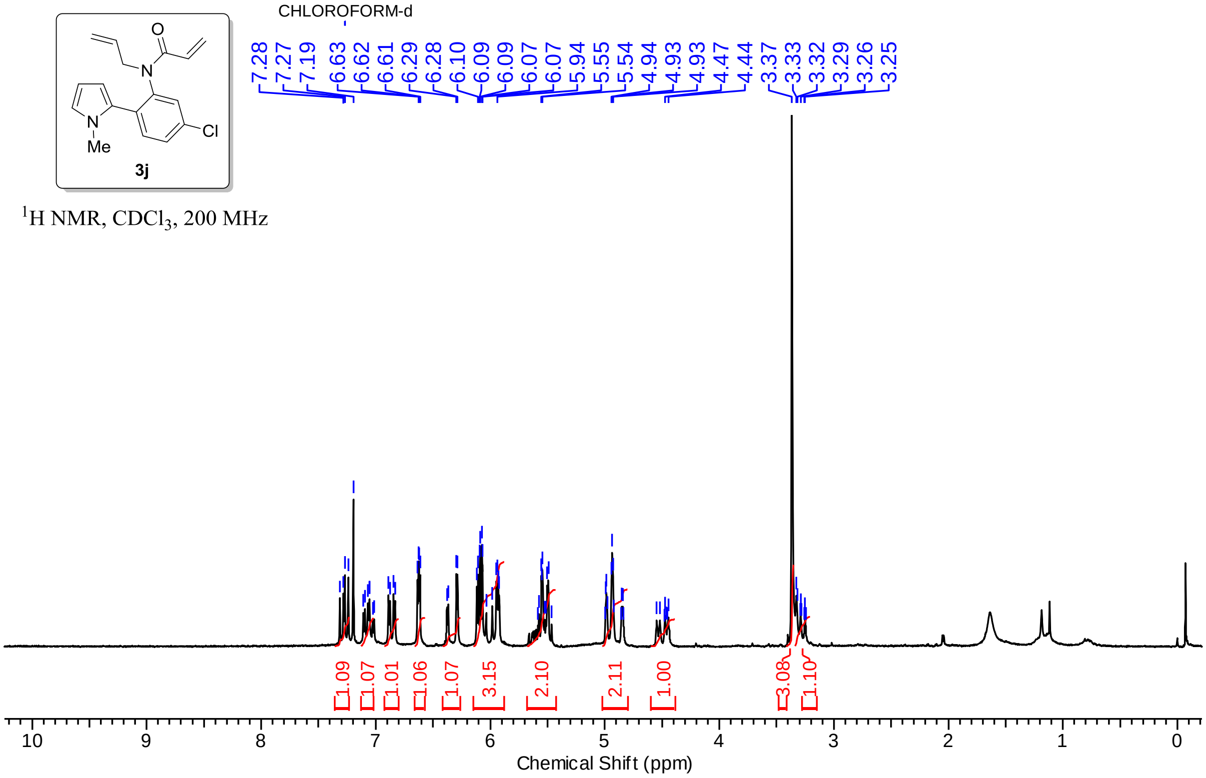
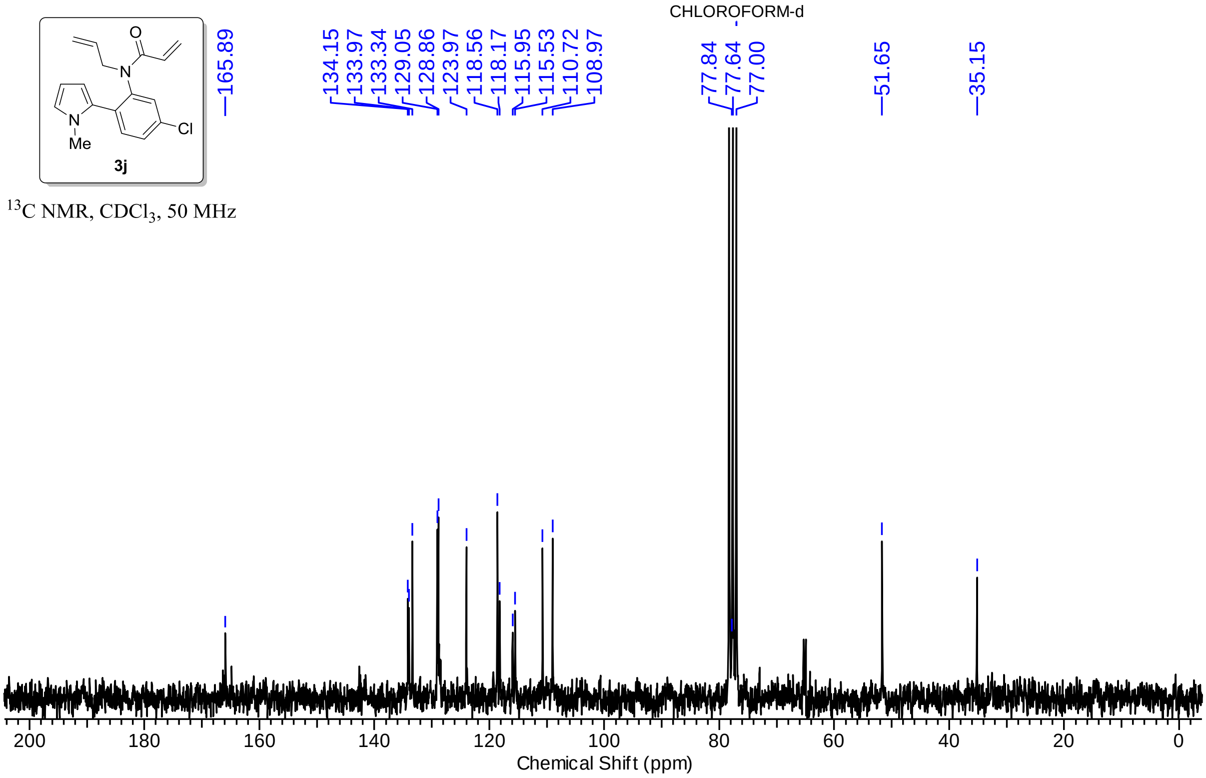
^{13}C NMR, $CDCl_3$, 50 MHz

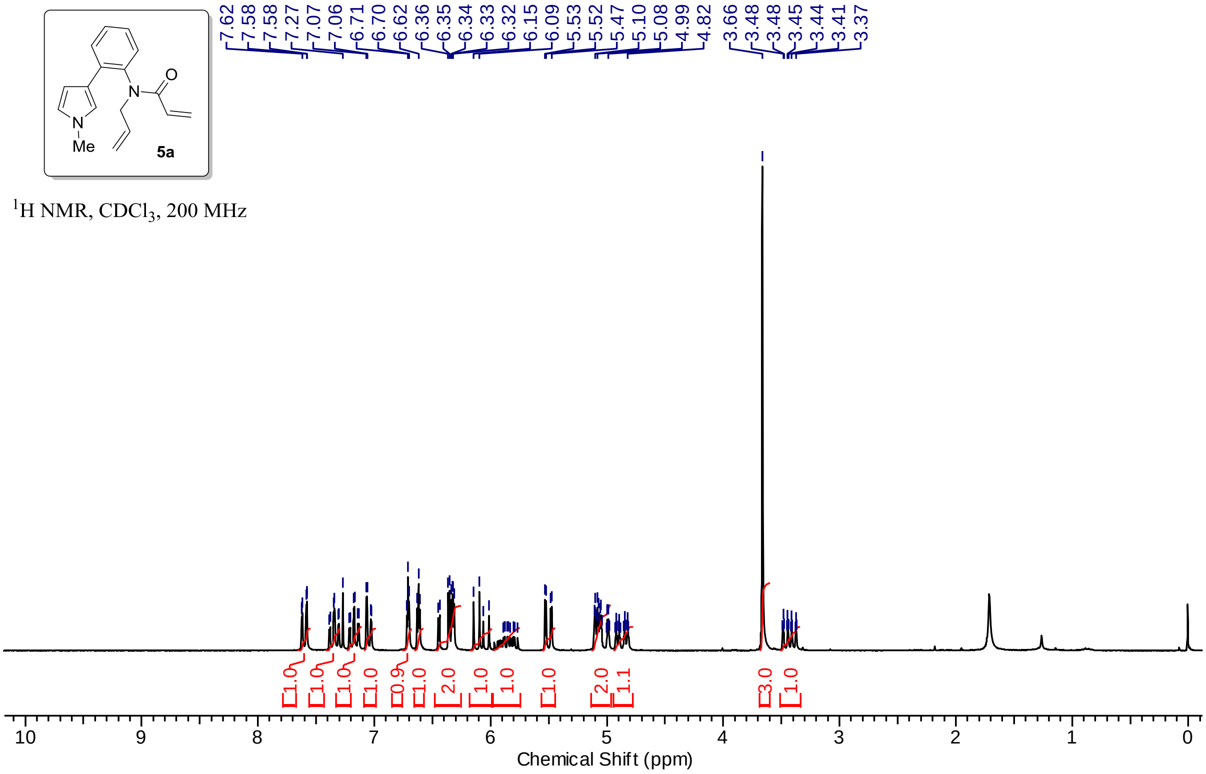




^{1}H NMR, $CDCl_3$, 200 MHz



^{13}C NMR, $CDCl_3$, 50 MHz



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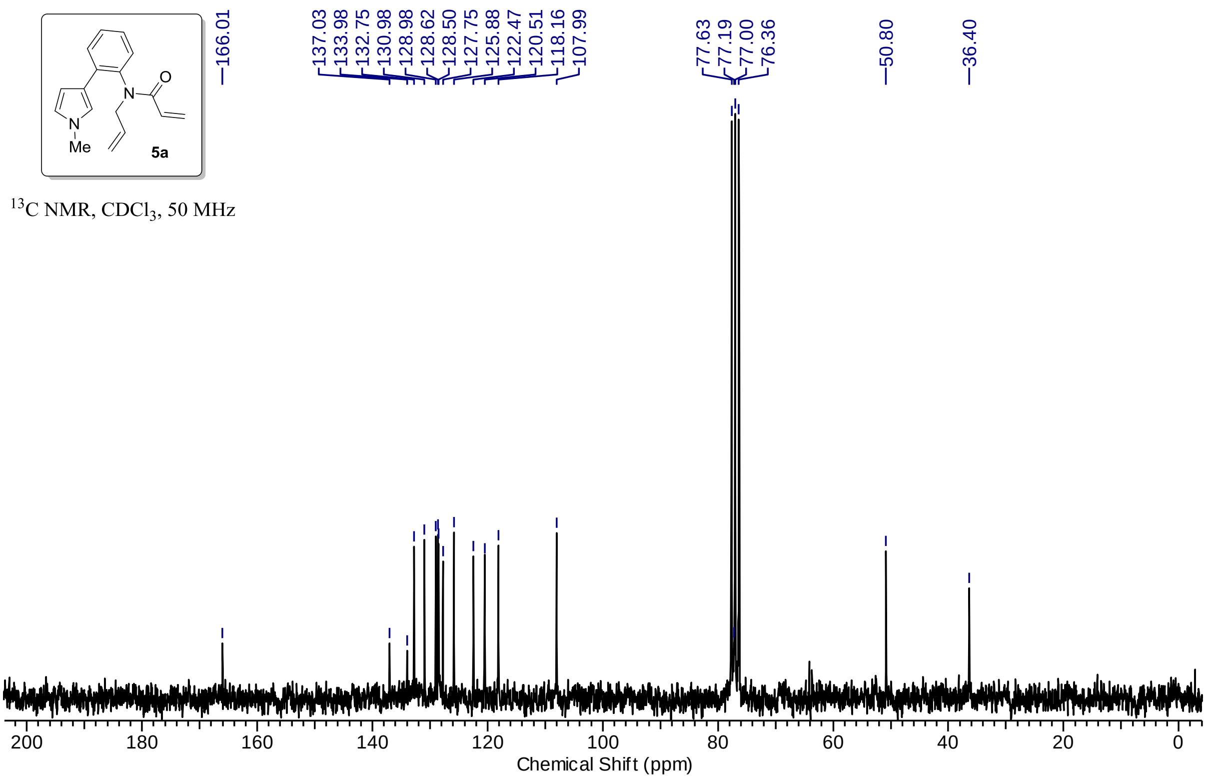

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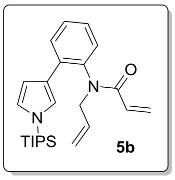
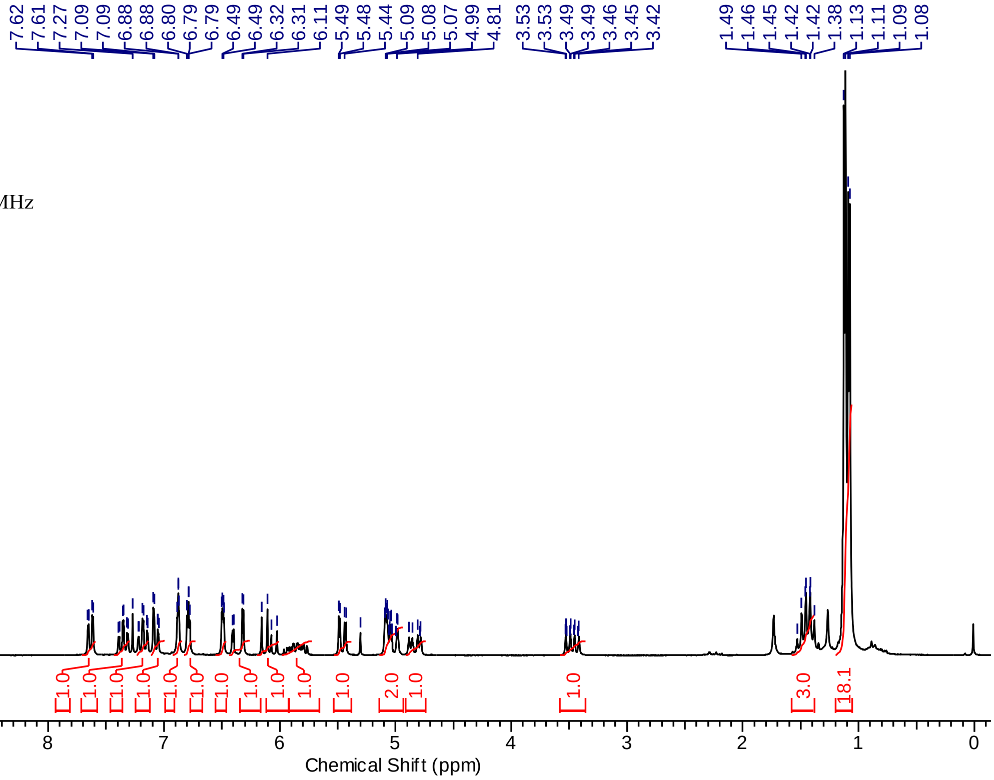
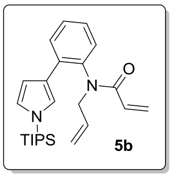
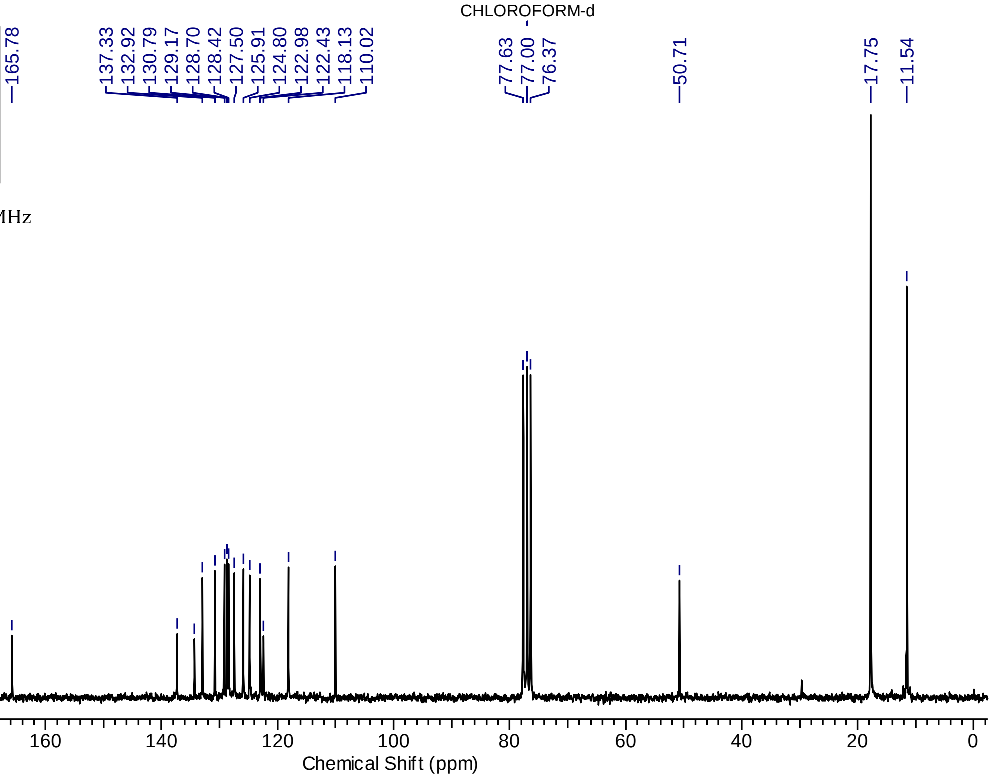


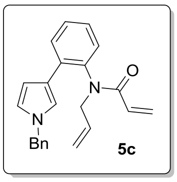
^{1}H NMR, $CDCl_3$, 200 MHz



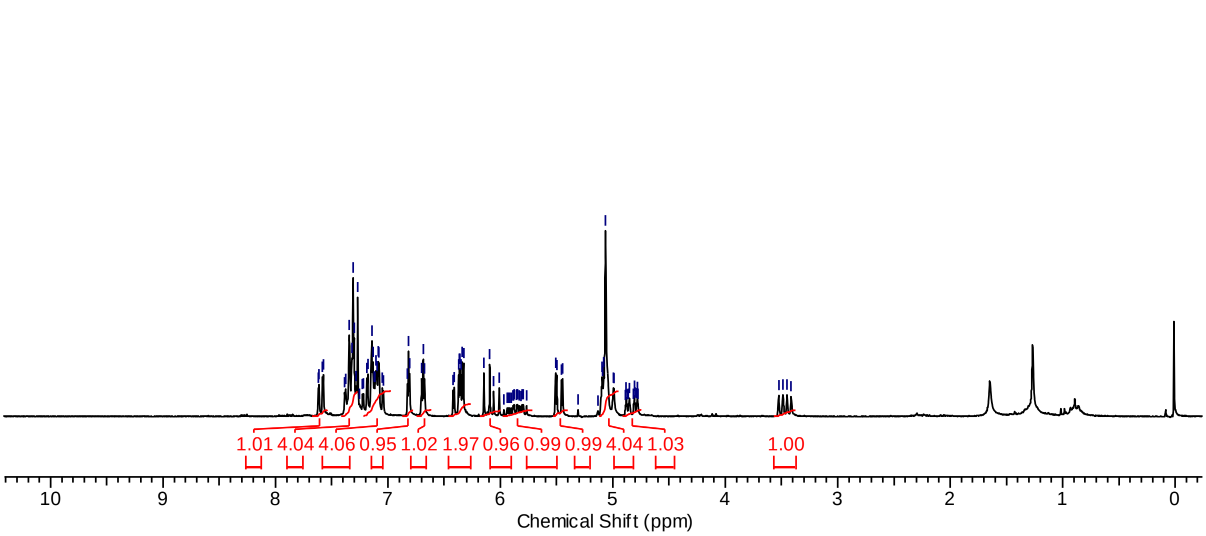


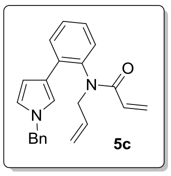
^{13}C NMR, $CDCl_3$, 50 MHz



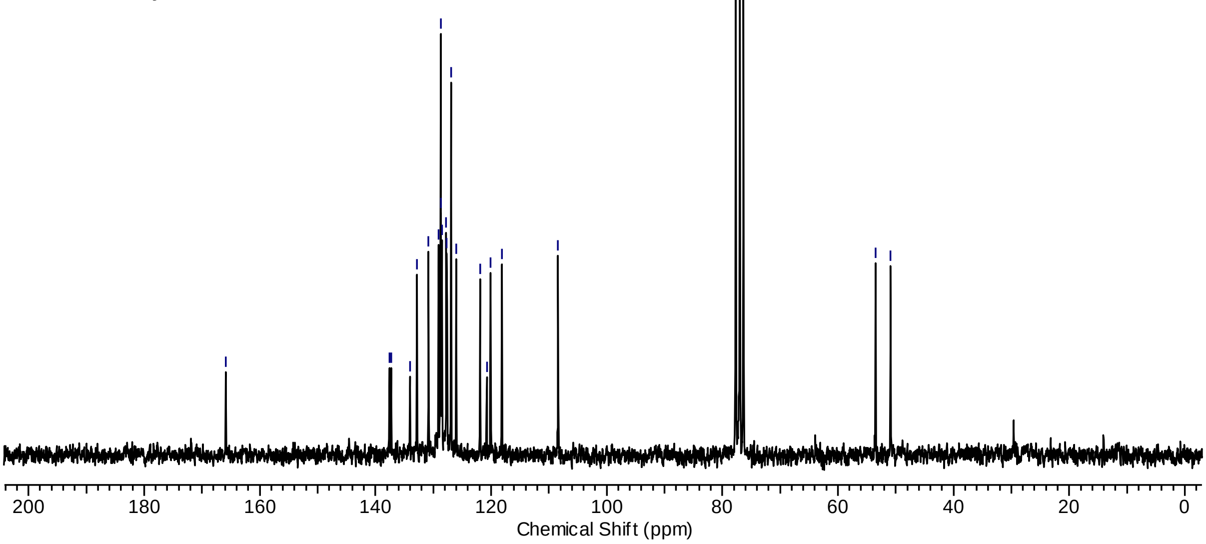


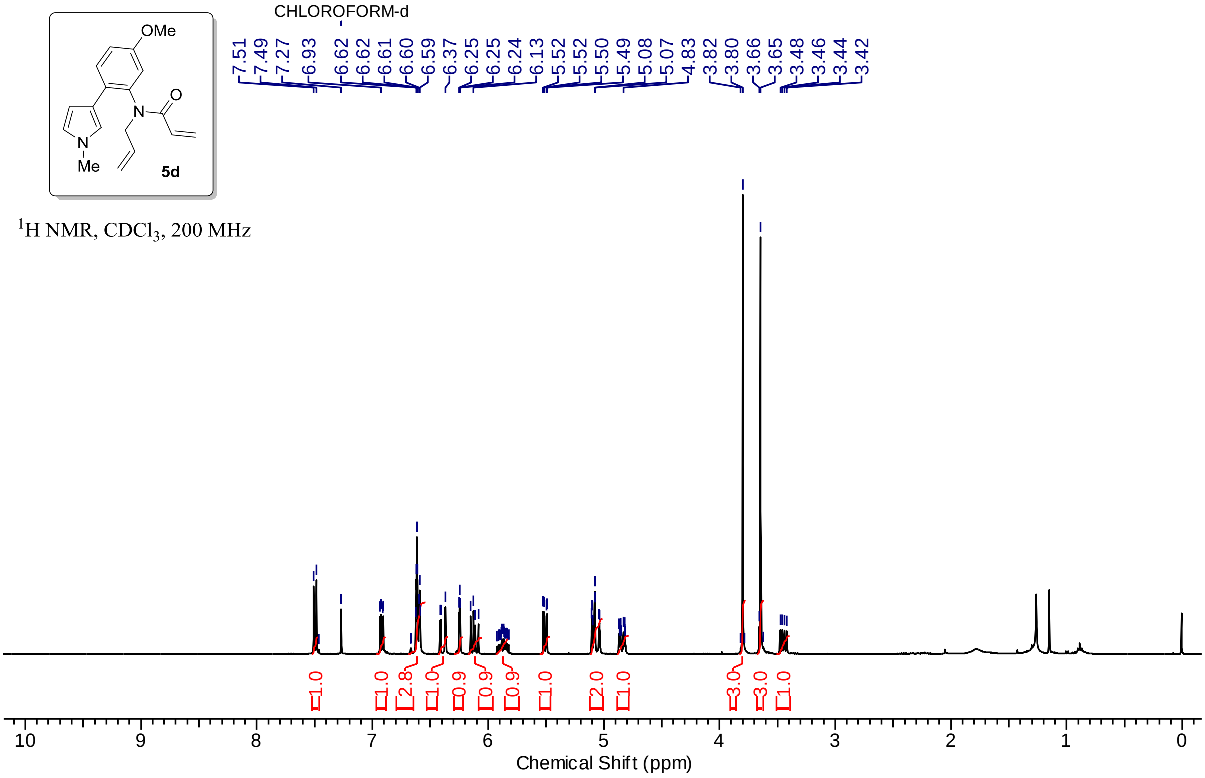
^{1}H NMR, $CDCl_3$, 200 MHz





^{13}C NMR, $CDCl_3$, 50 MHz





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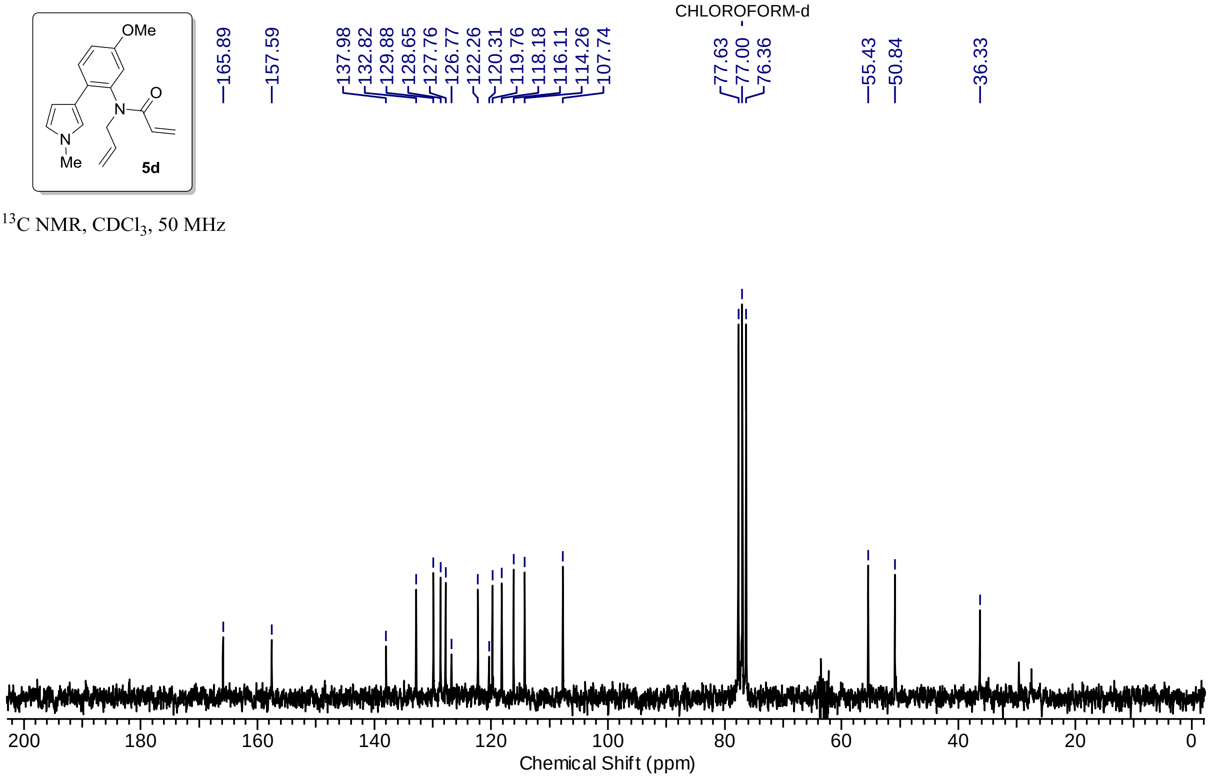
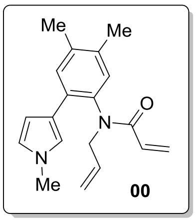
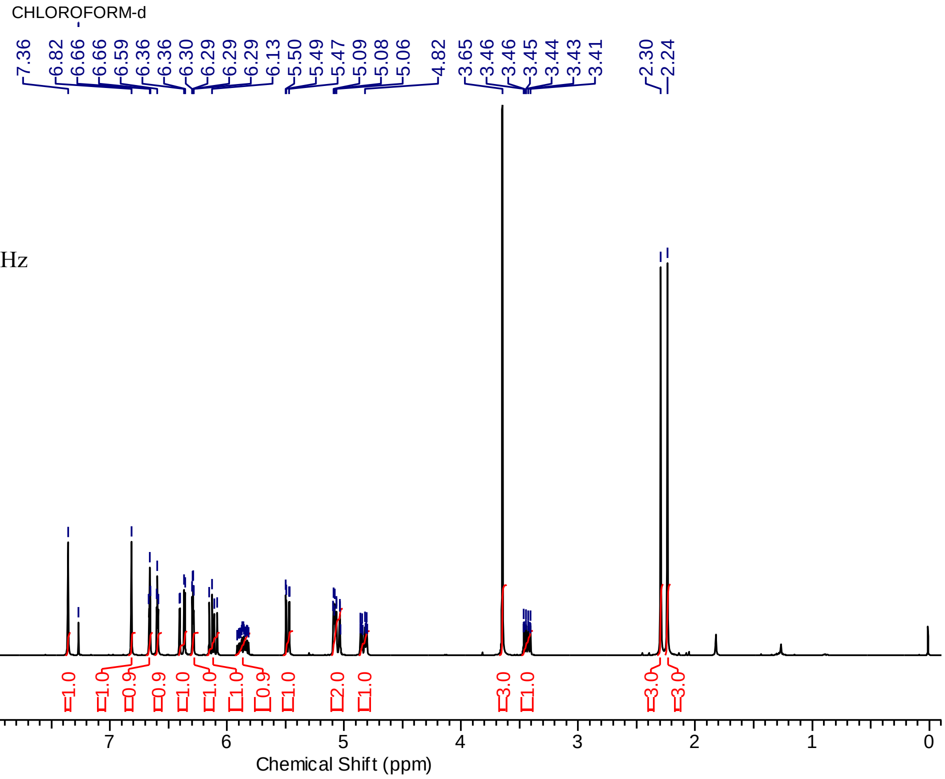
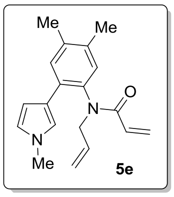


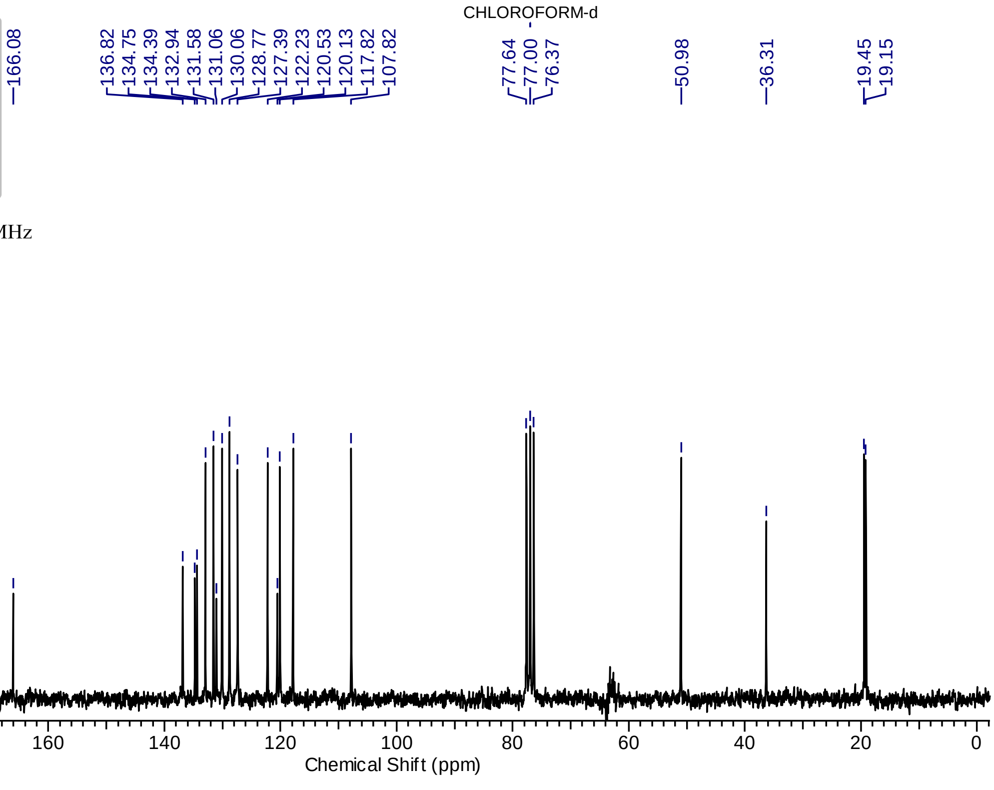
^{13}C NMR, $CDCl_3$, 50 MHz



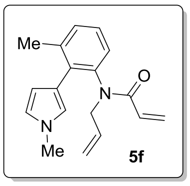


^{1}H NMR, $CDCl_3$, 200 MHz

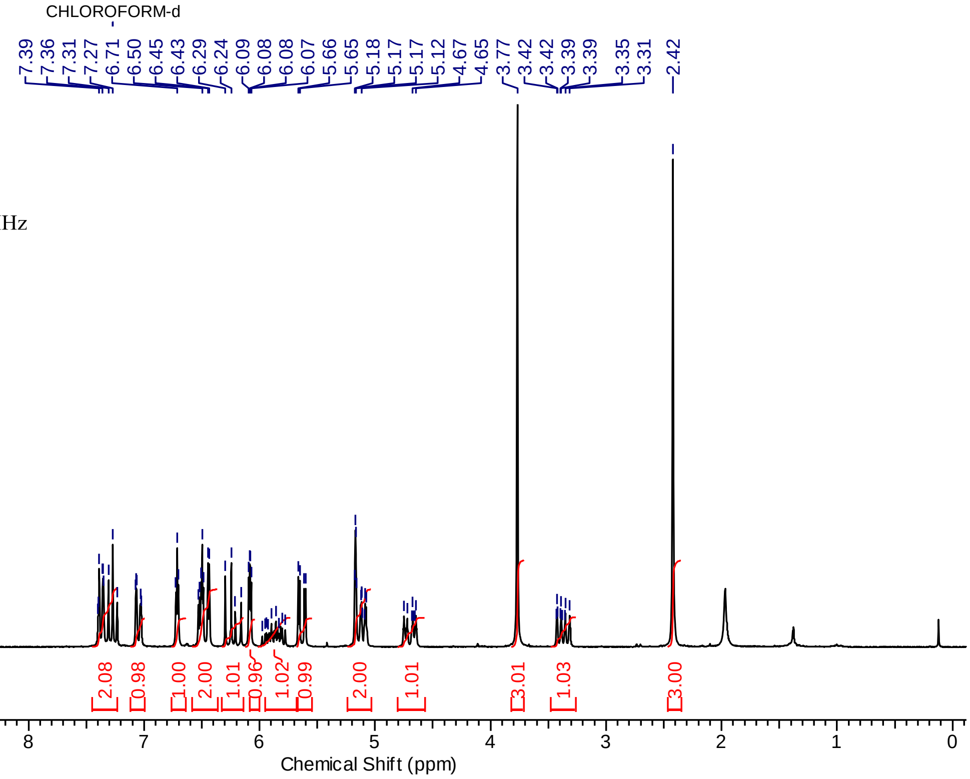


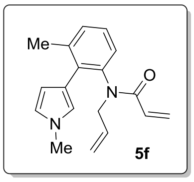


^{13}C NMR, $CDCl_3$, 50 MHz

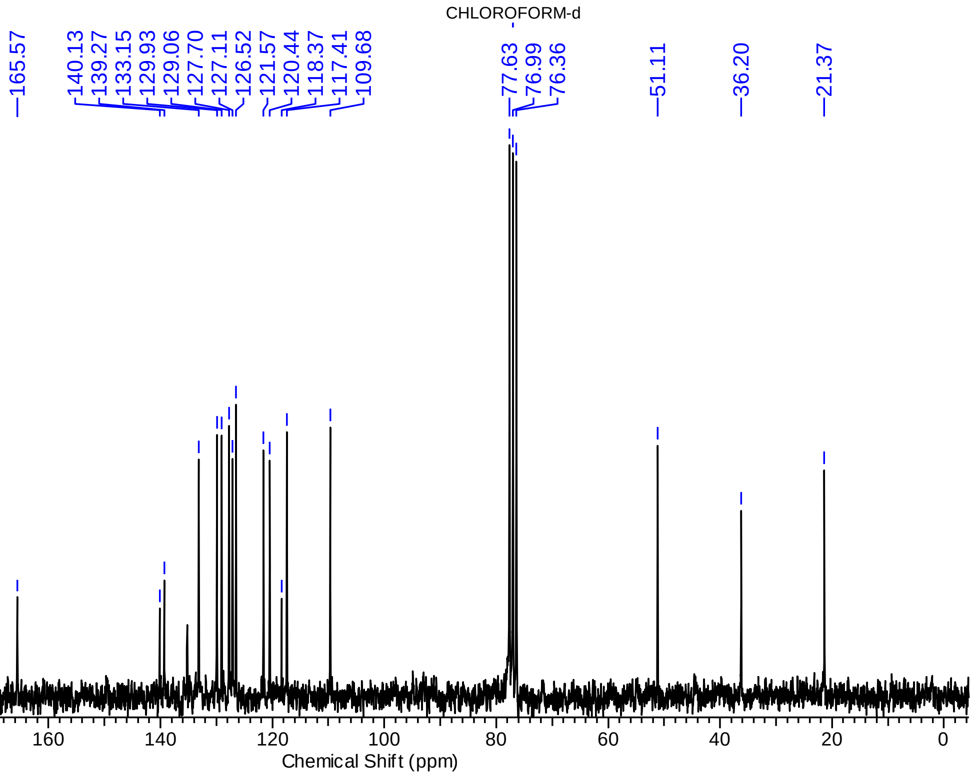


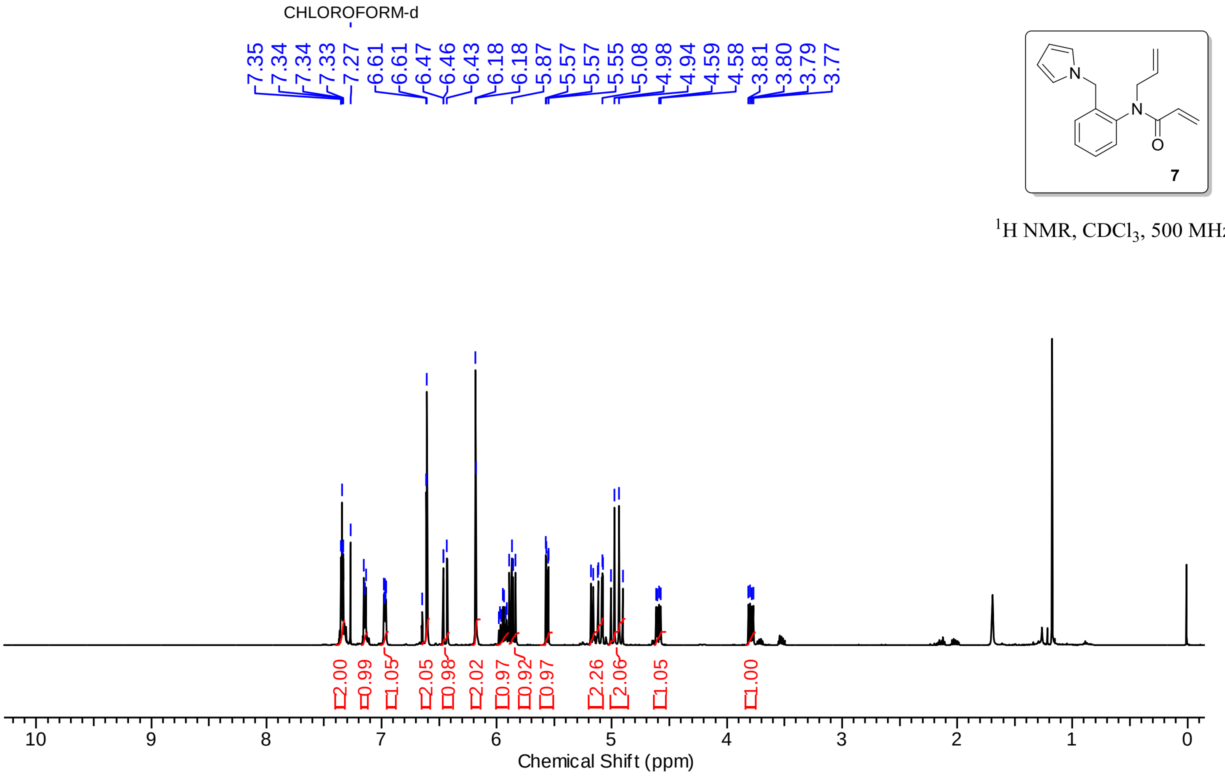
[1]H NMR, $CDCl_3$, 200 MHz



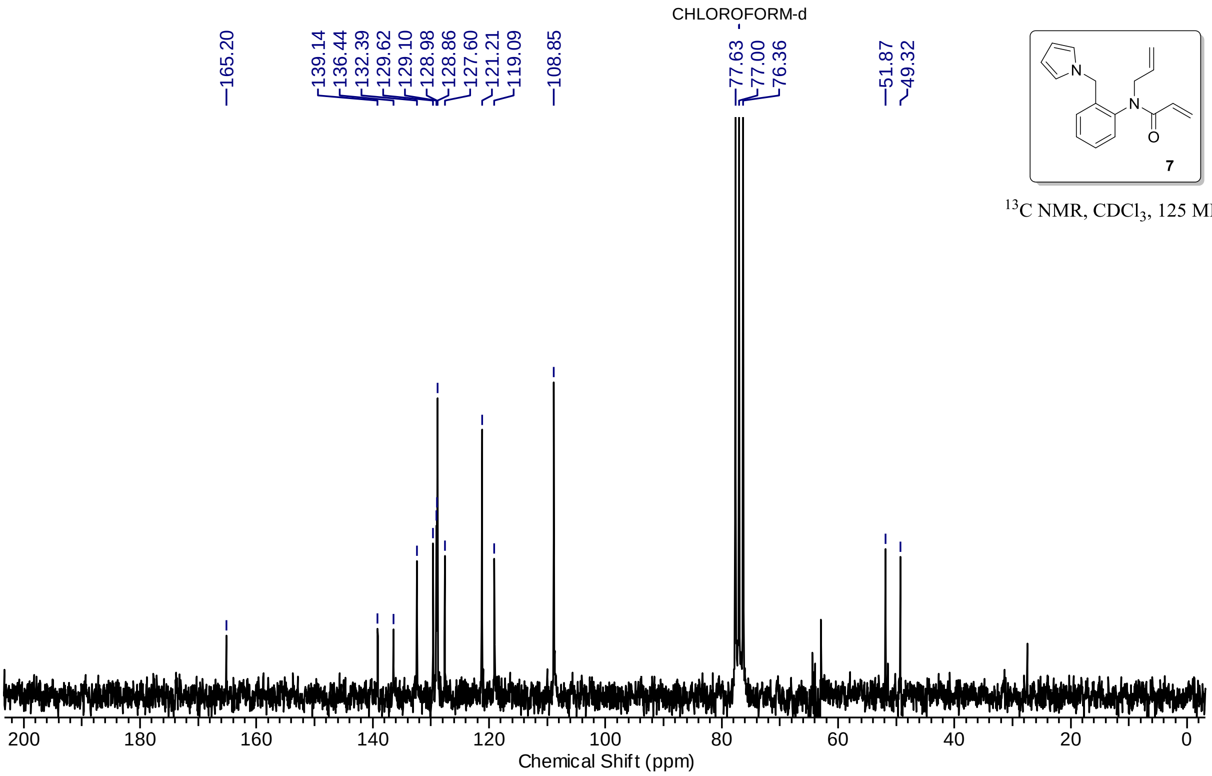


[13]C NMR, $CDCl_3$, 50 MHz

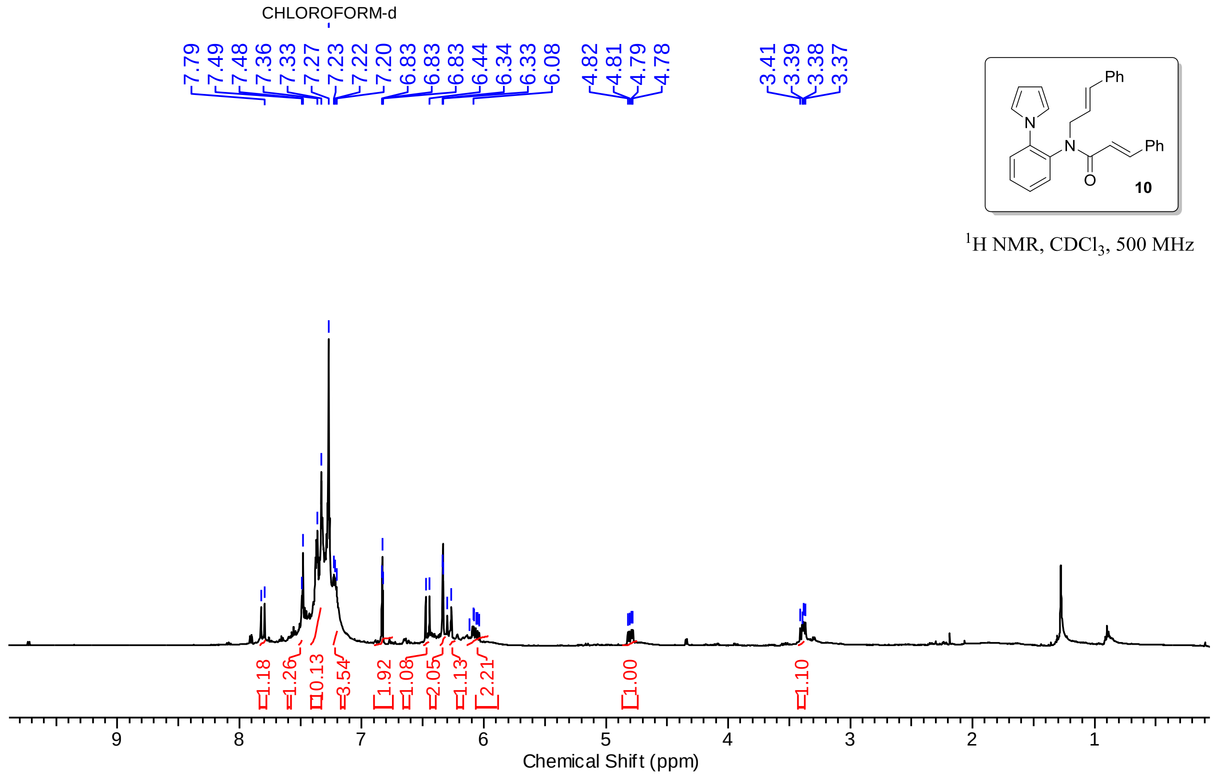




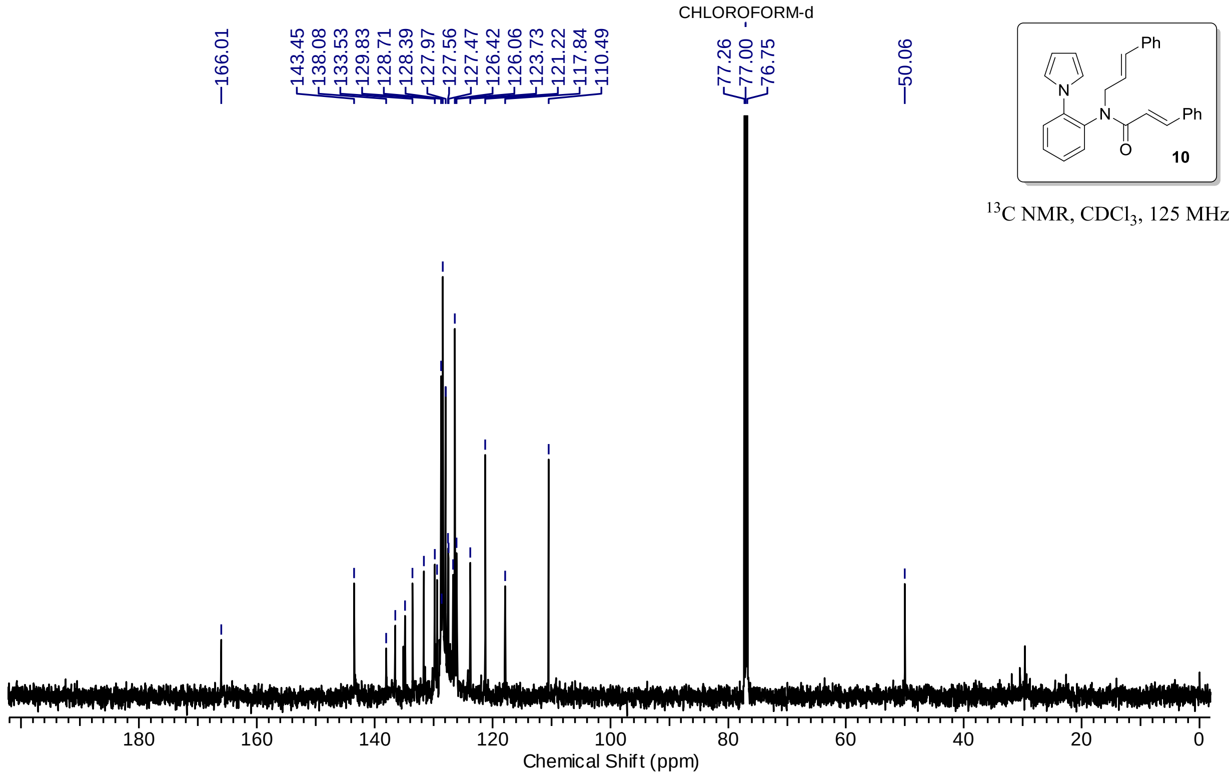
^{1}H NMR, $CDCl_3$, 500 MHz



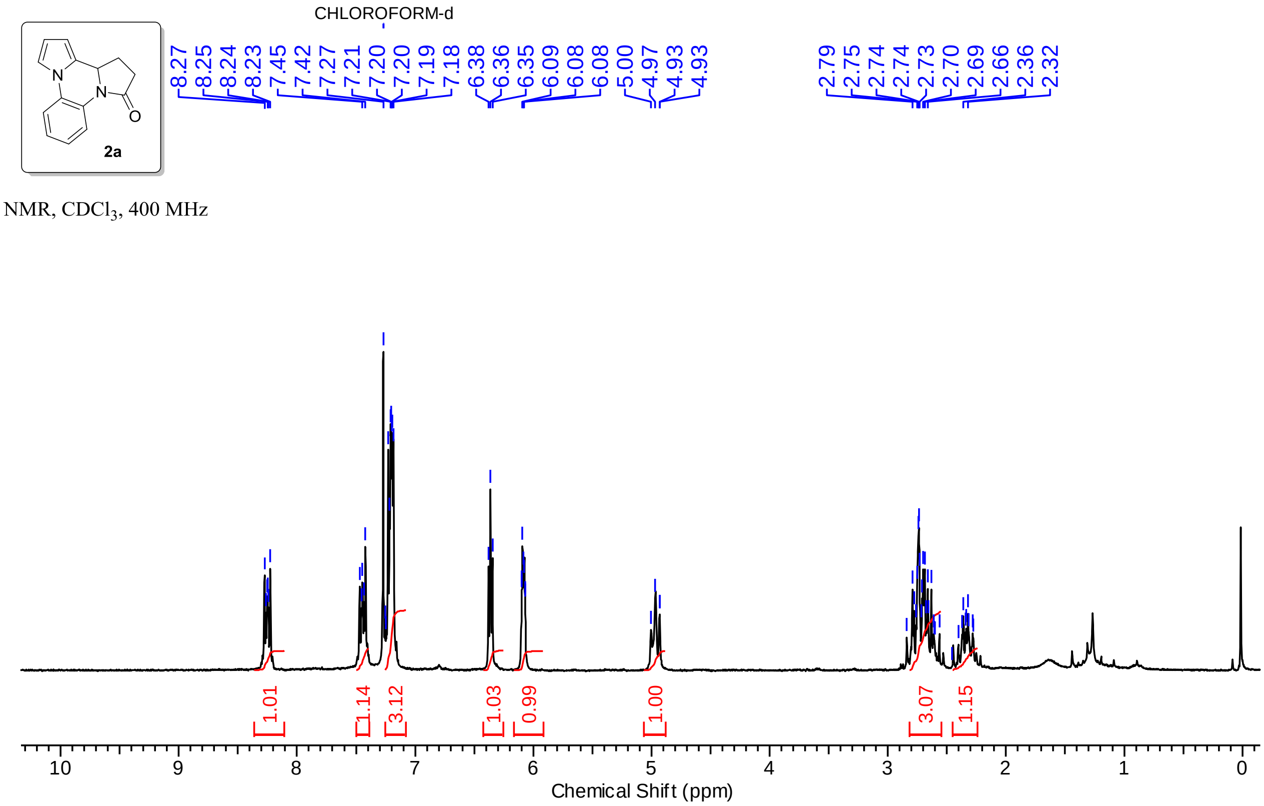
^{13}C NMR, $CDCl_3$, 125 MHz



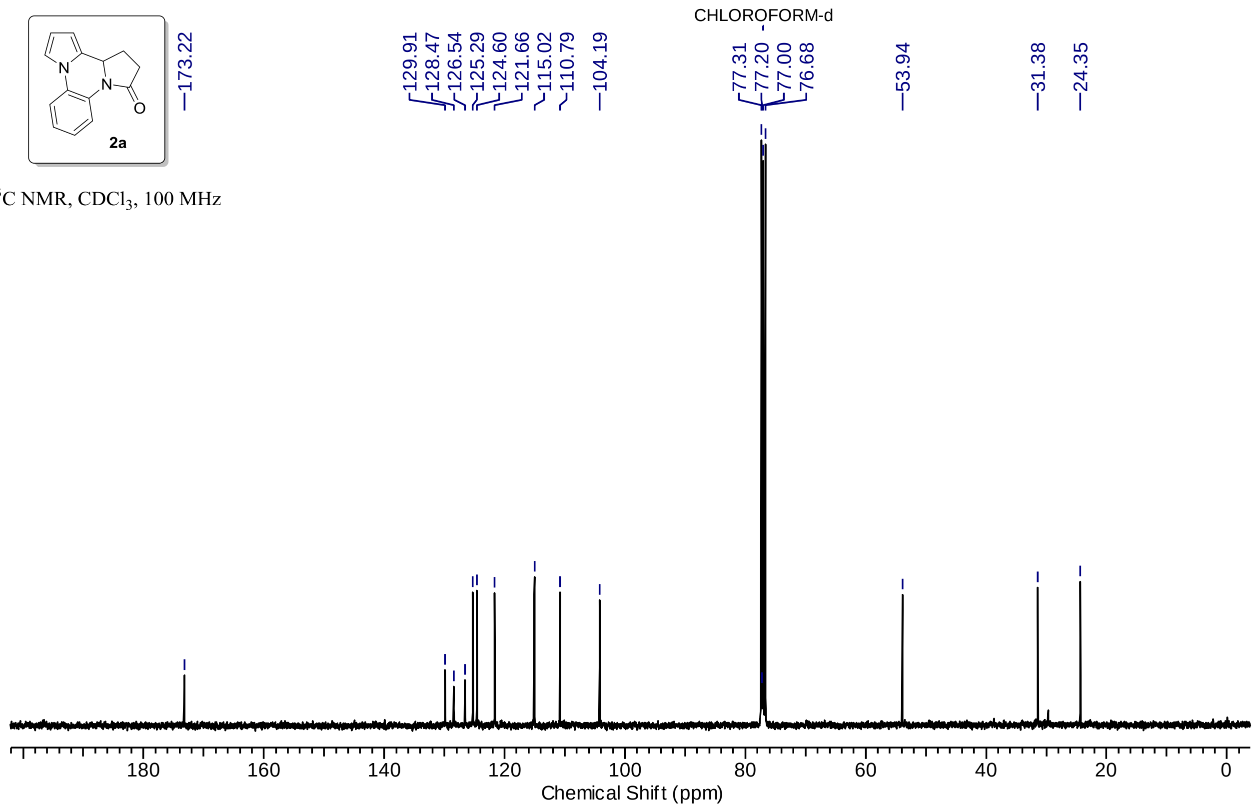
^{1}H NMR, $CDCl_3$, 500 MHz



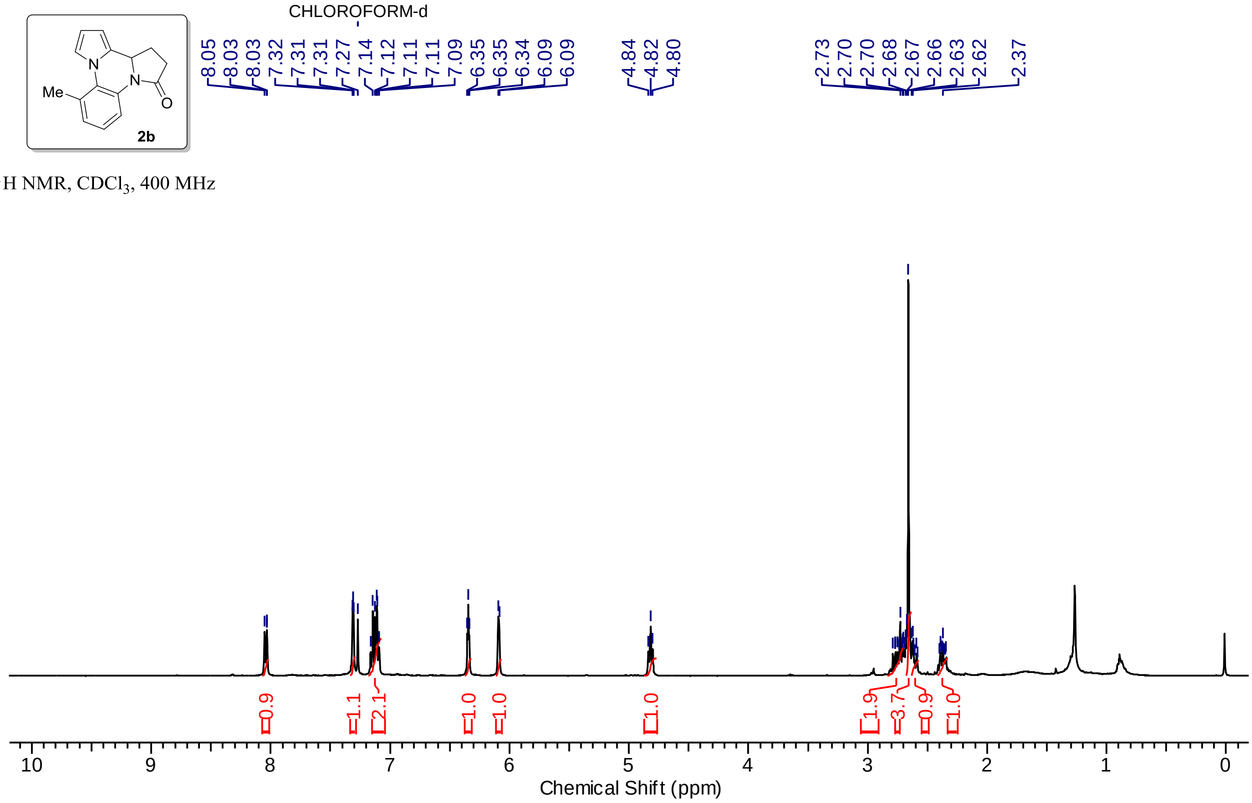
^{13}C NMR, $CDCl_3$, 125 MHz



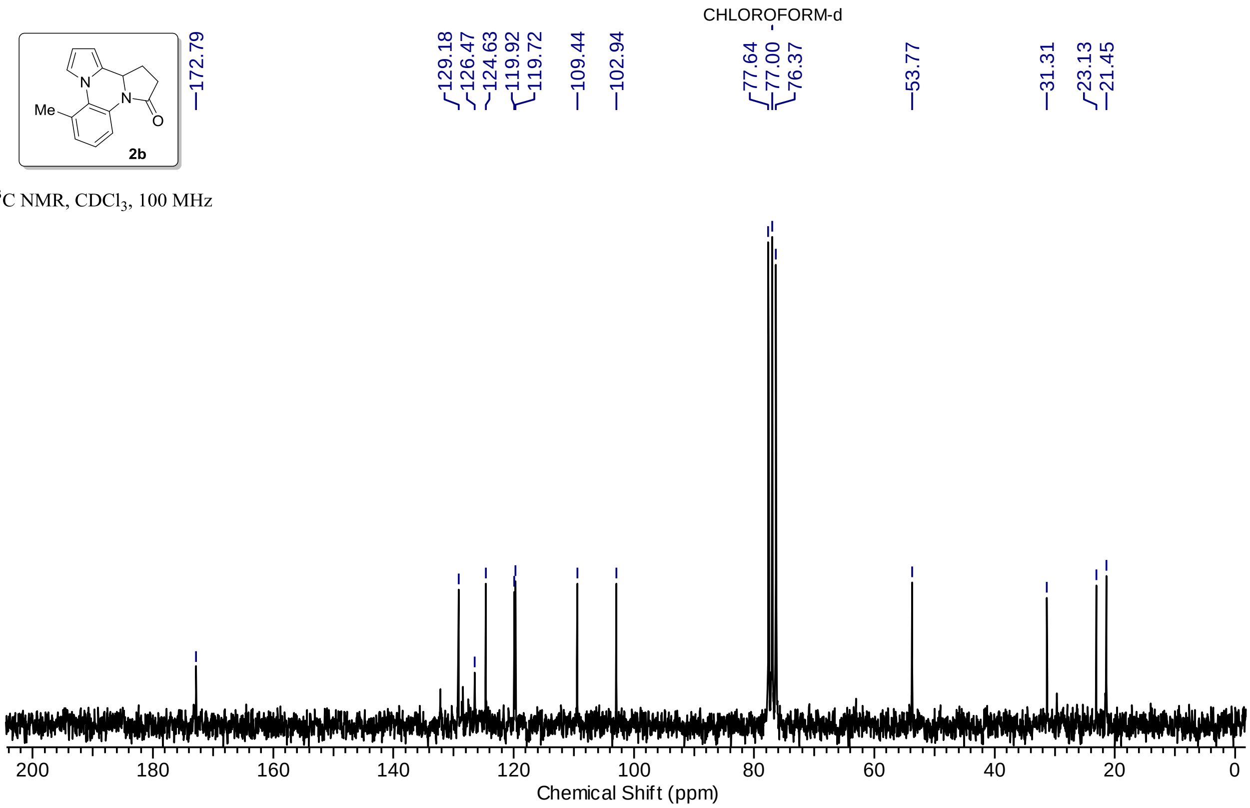
[1]H NMR, $CDCl_3$, 400 MHz



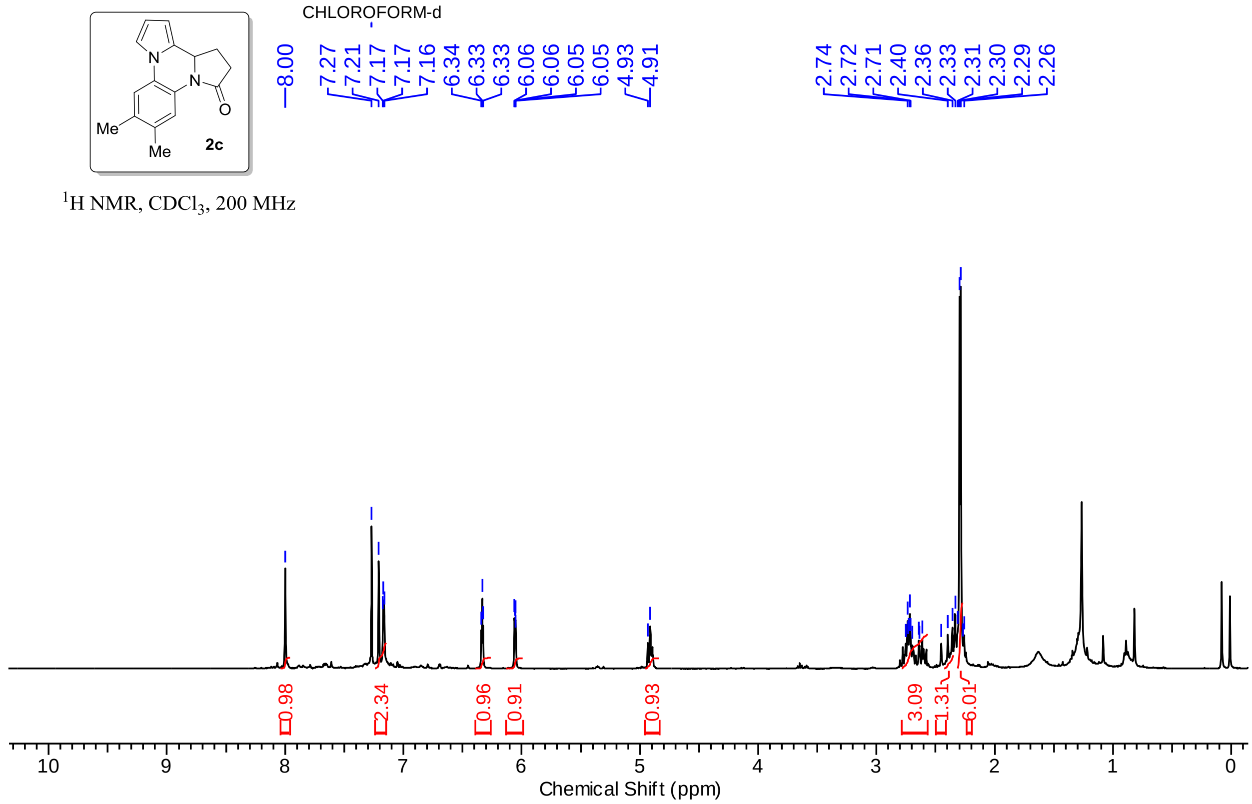
[13]C NMR, $CDCl_3$, 100 MHz



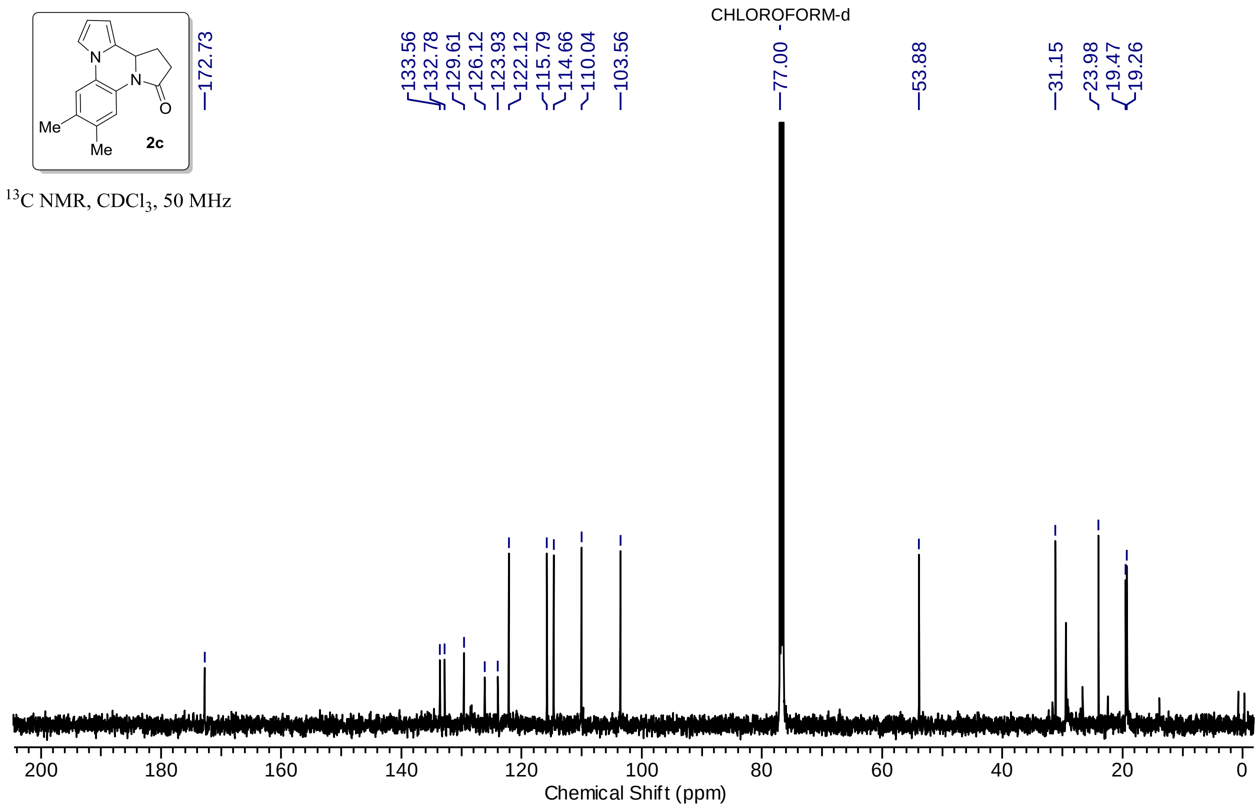
[1]H NMR, $CDCl_3$, 400 MHz



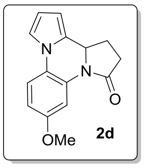
[13]C NMR, $CDCl_3$, 100 MHz



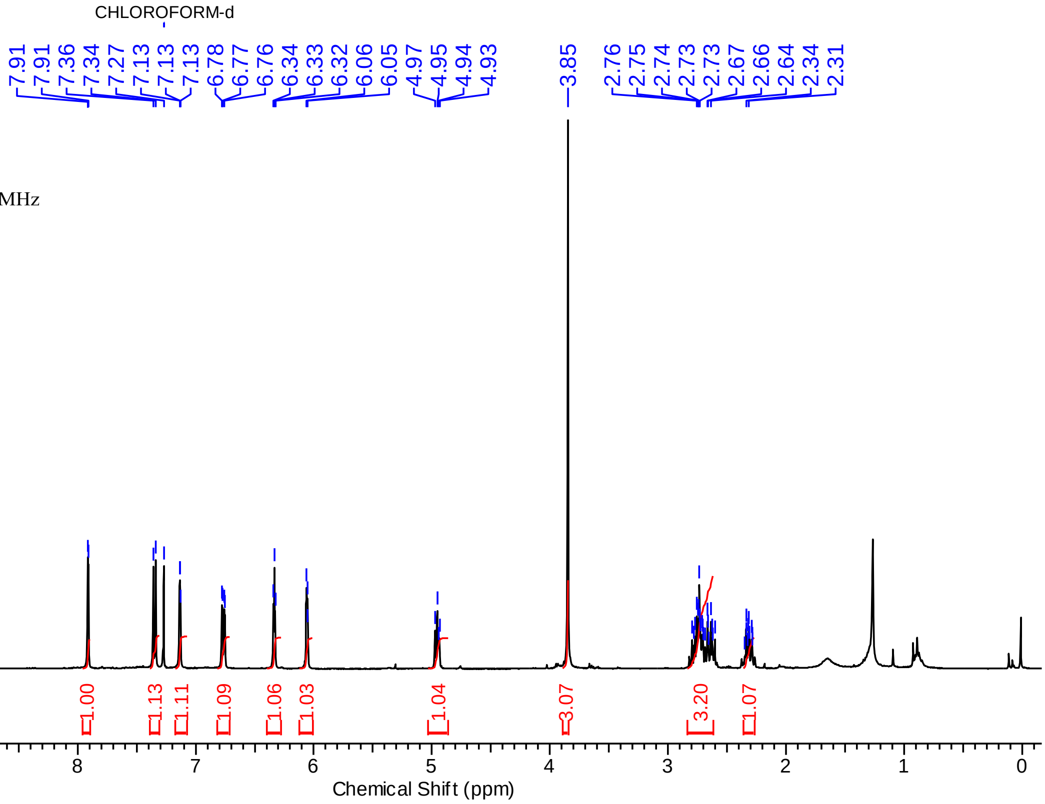
^{1}H NMR, $CDCl_3$, 200 MHz

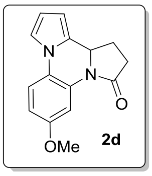


^{13}C NMR, $CDCl_3$, 50 MHz

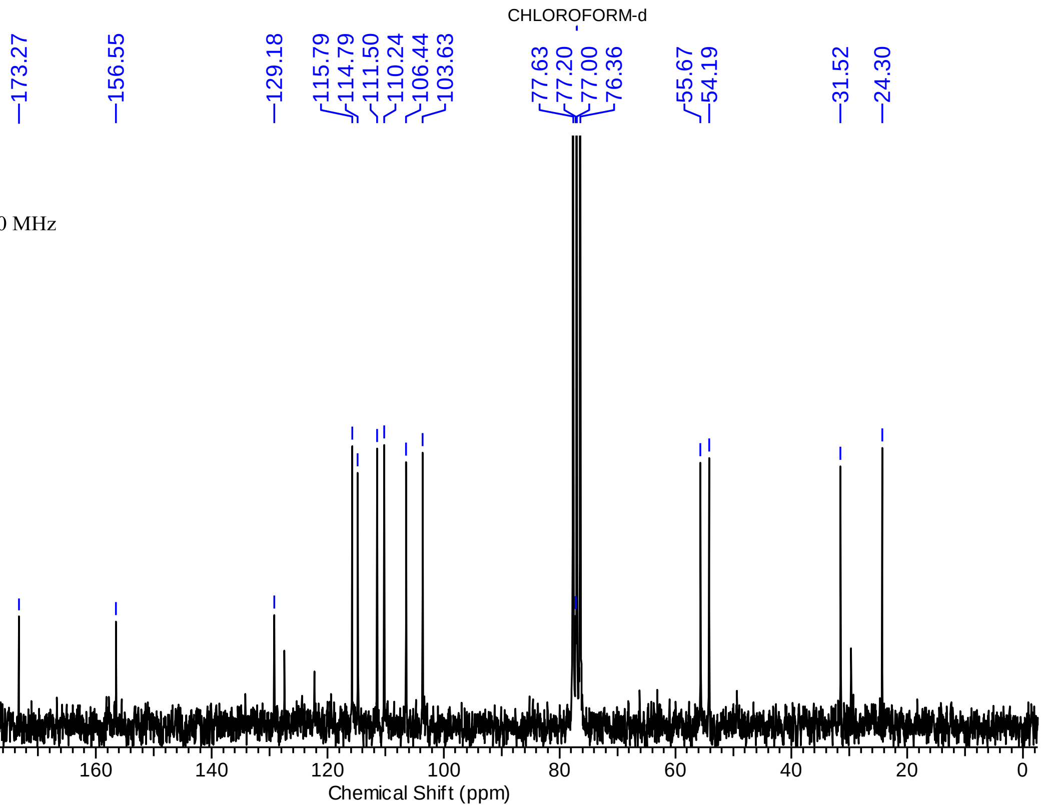


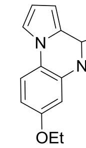
^{1}H NMR, $CDCl_3$, 400 MHz





^{13}C NMR, $CDCl_3$, 100 MHz





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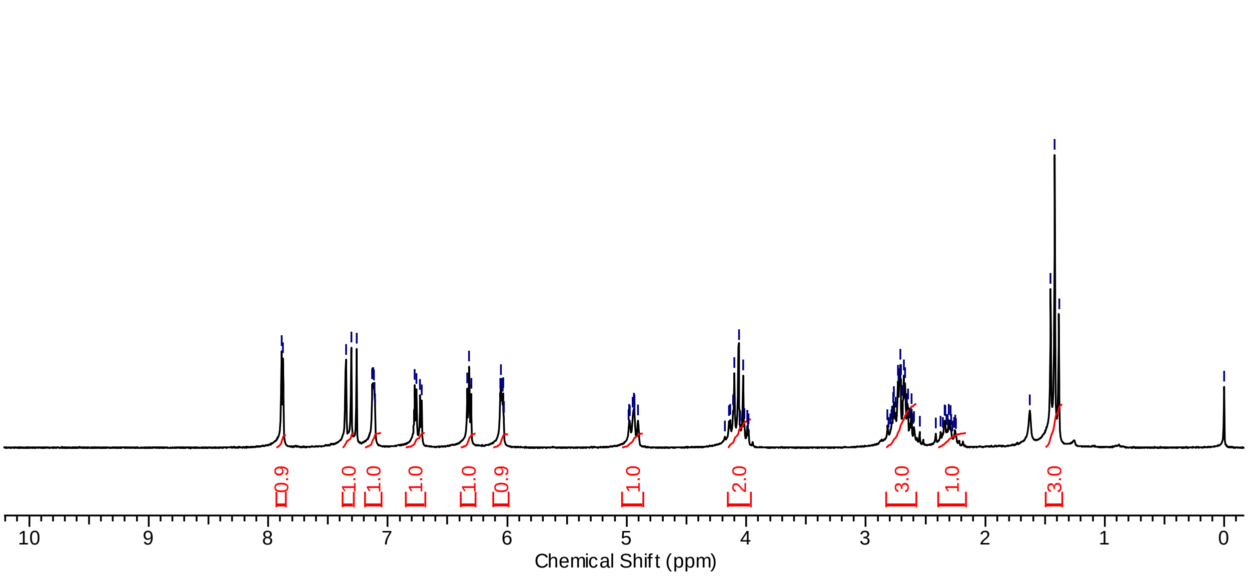
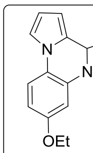
[1]H NMR, $CDCl_3$, 400 MHz





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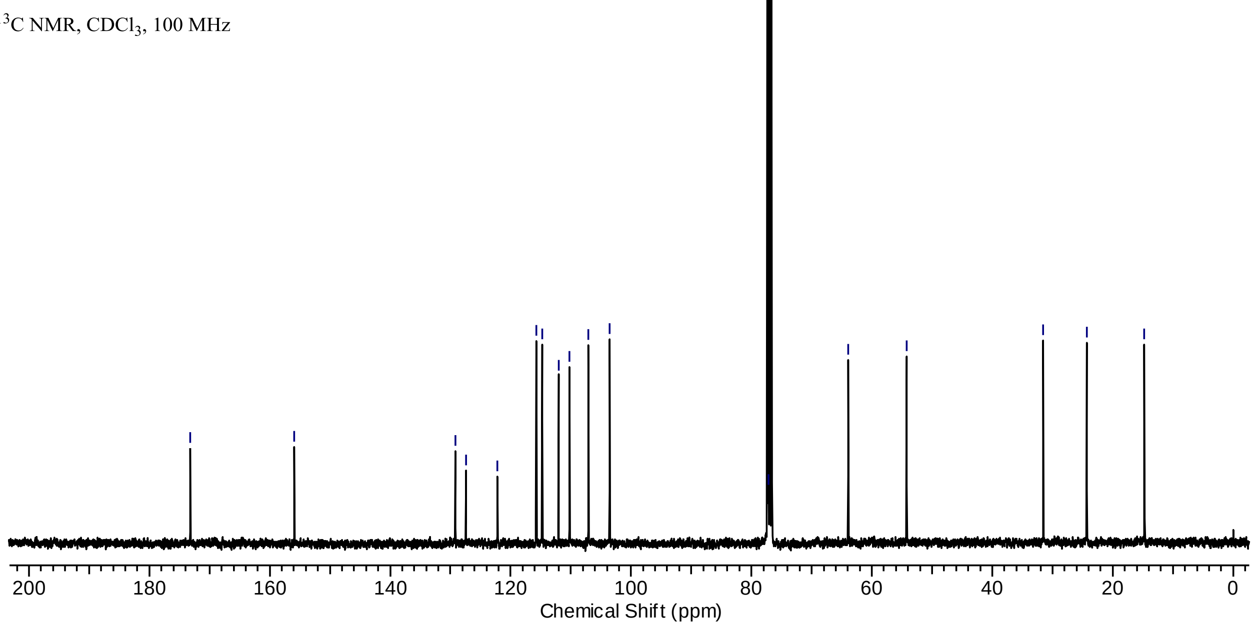
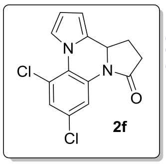
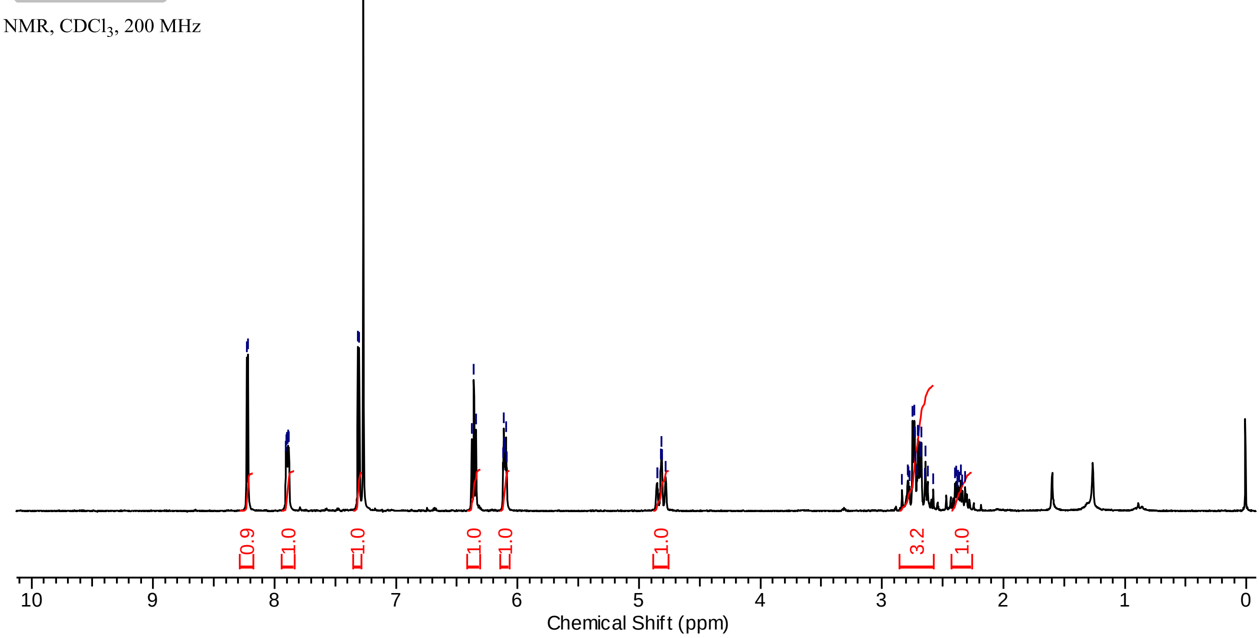
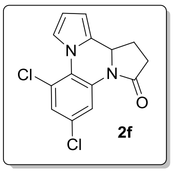
[13]C NMR, $CDCl_3$, 100 MHz

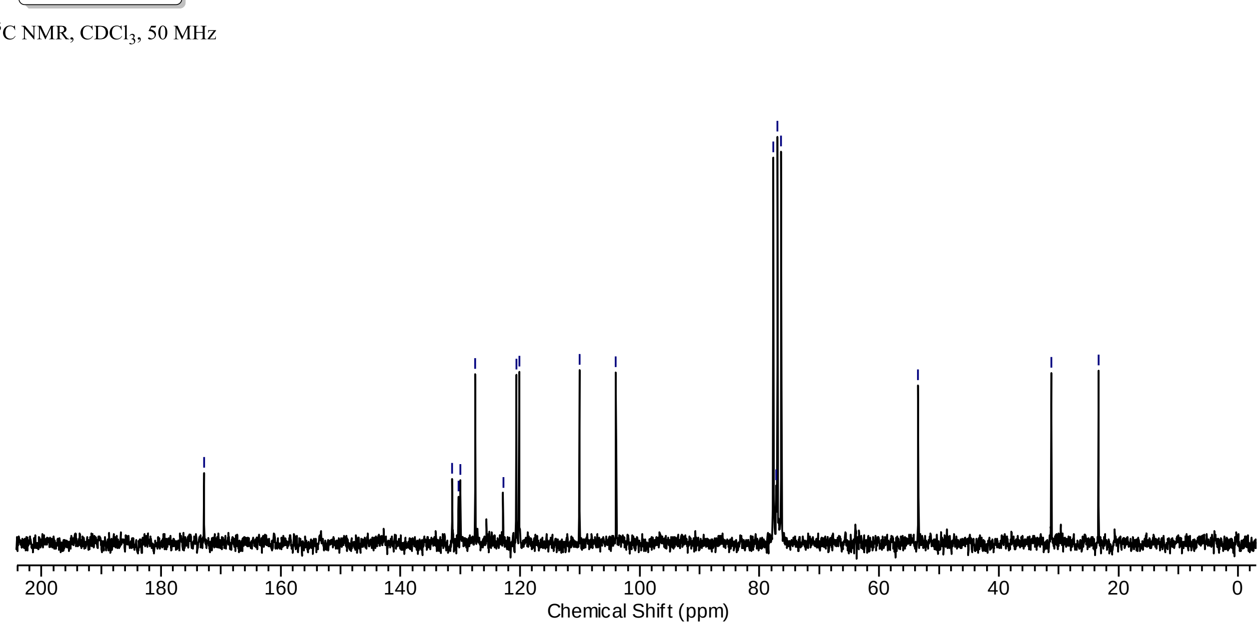




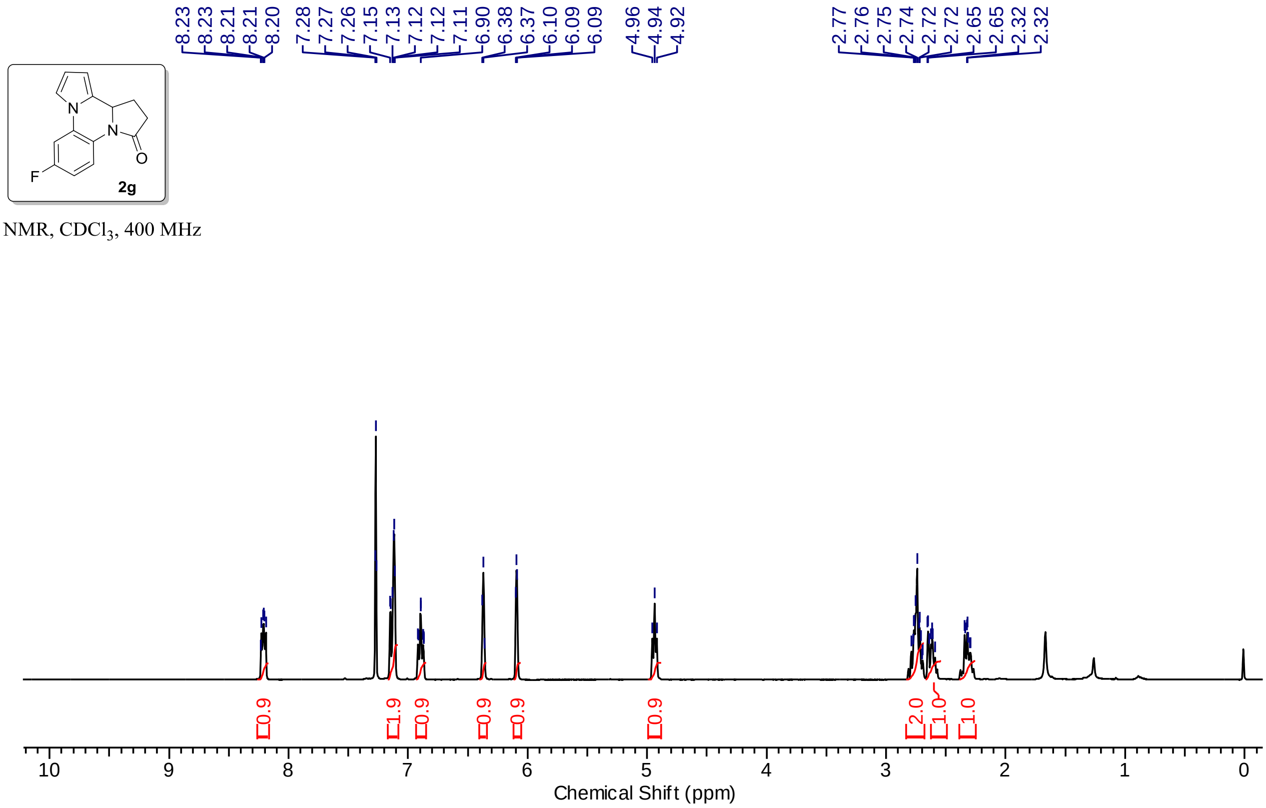


[1]H NMR, $CDCl_3$, 200 MHz

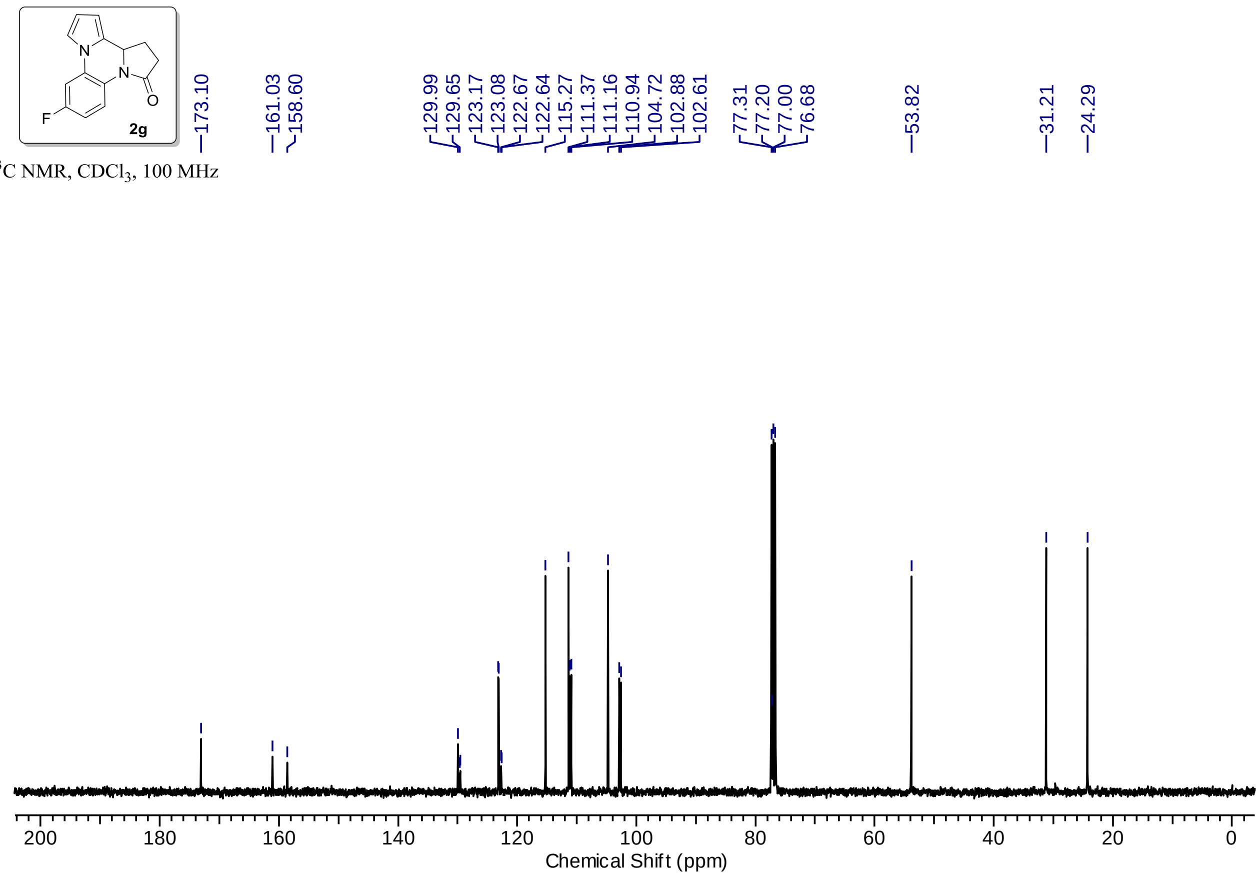




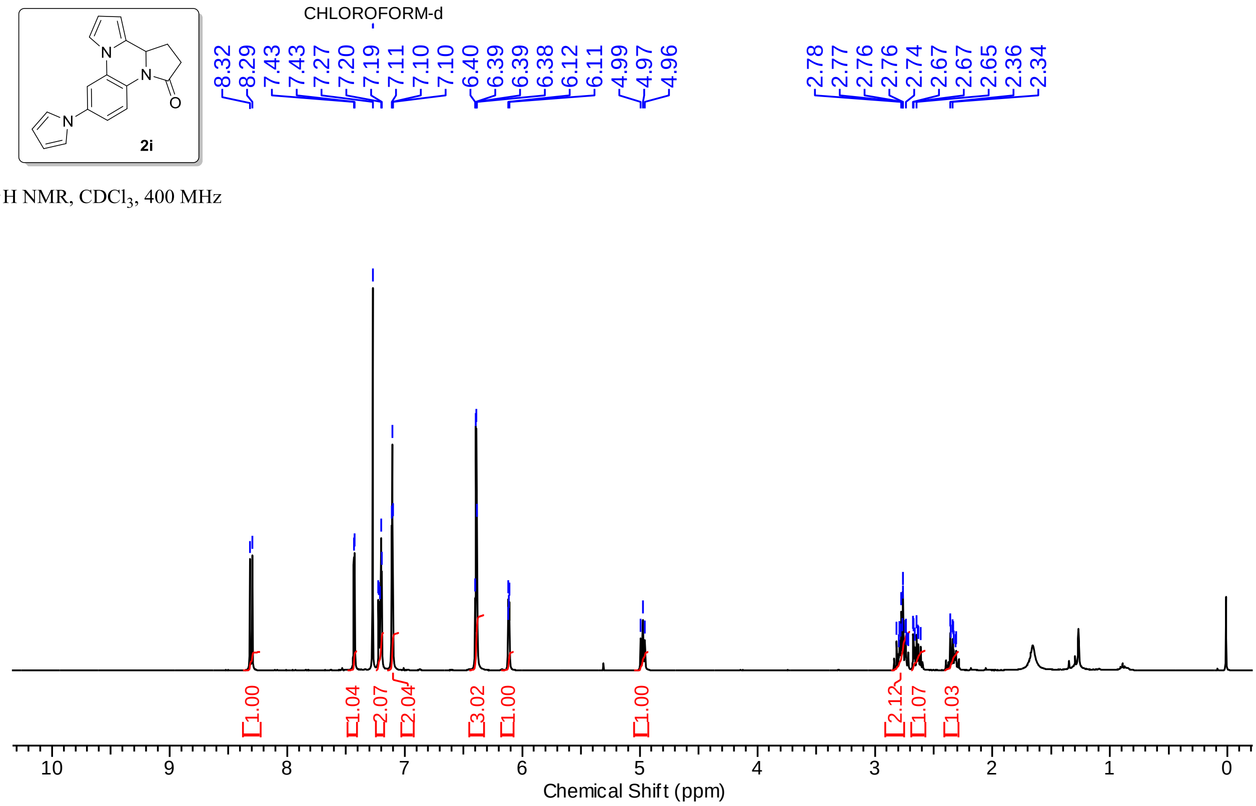
[13]C NMR, $CDCl_3$, 50 MHz



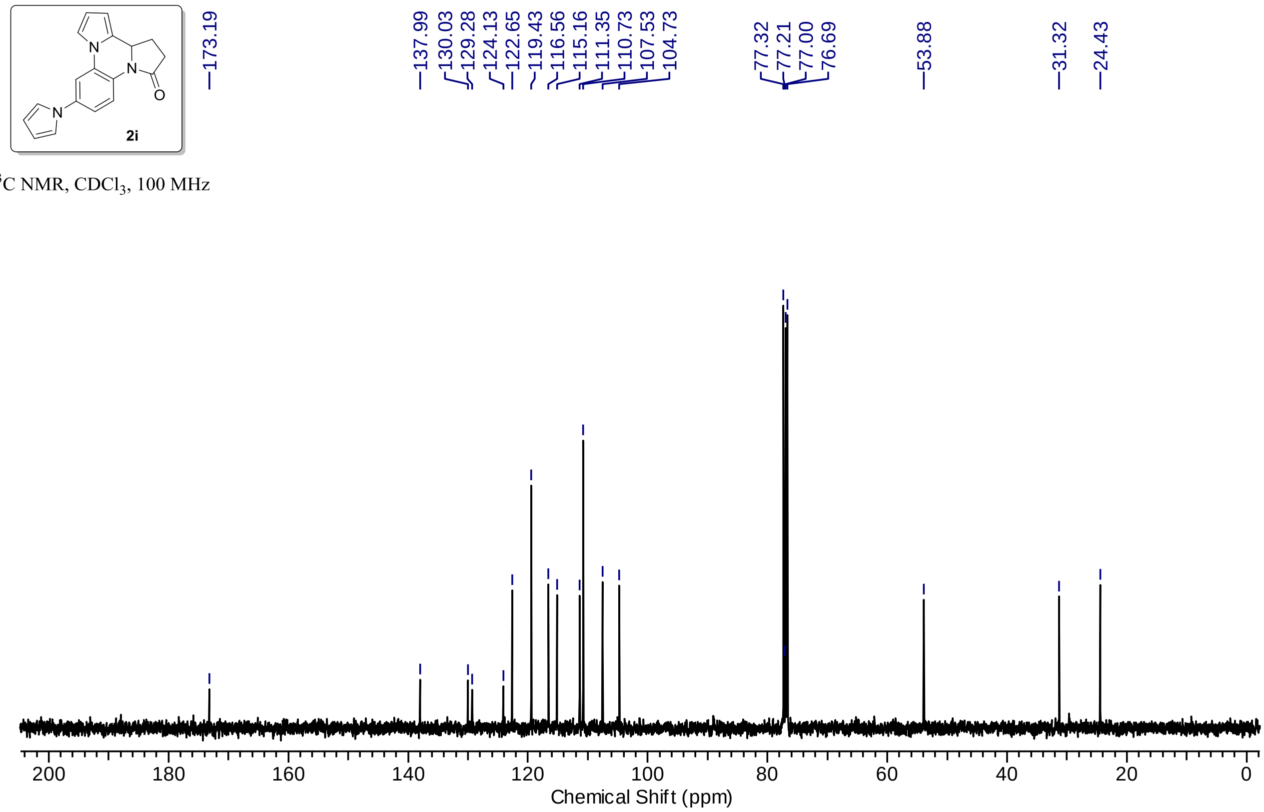
[1]H NMR, $CDCl_3$, 400 MHz



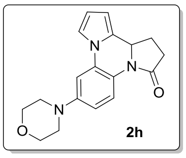
[13]C NMR, $CDCl_3$, 100 MHz



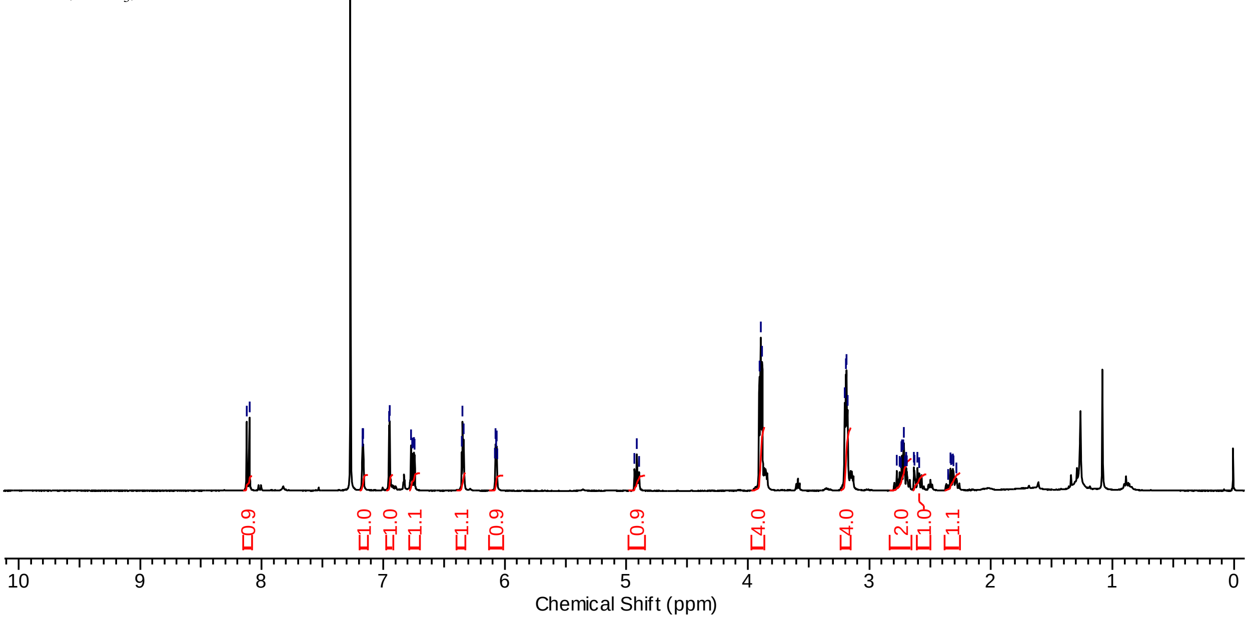
[1]H NMR, $CDCl_3$, 400 MHz



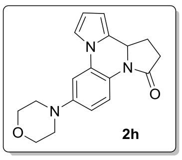
[13]C NMR, $CDCl_3$, 100 MHz

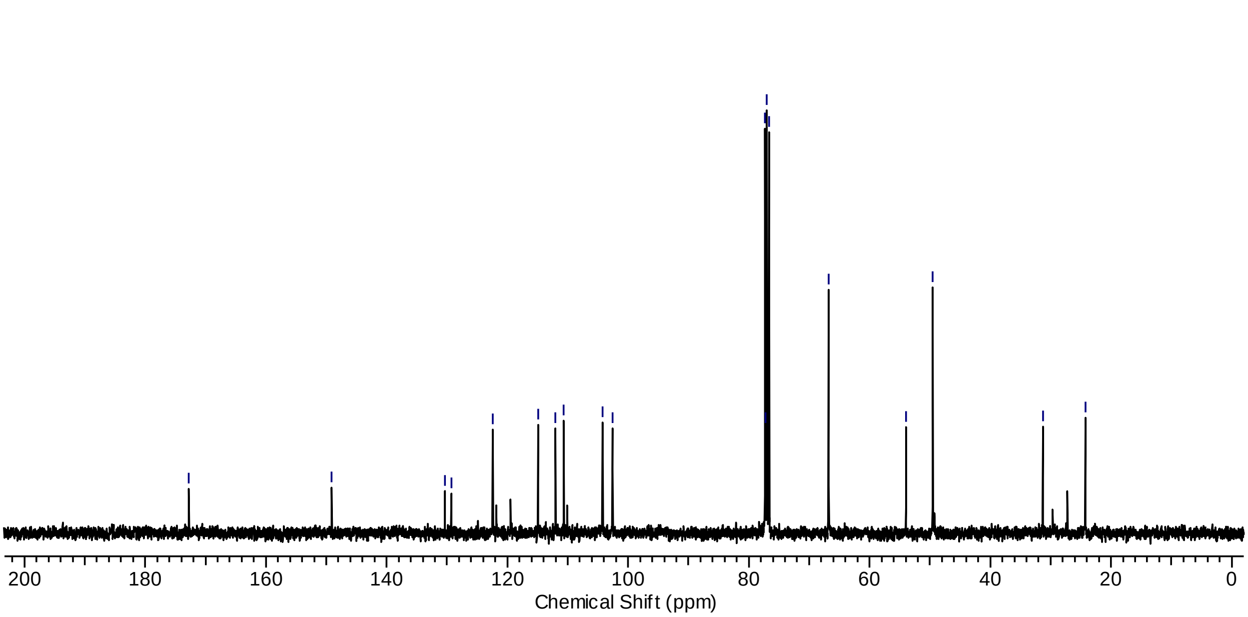


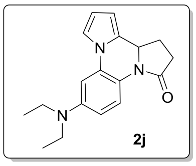
[1]H NMR, $CDCl_3$, 400 MHz



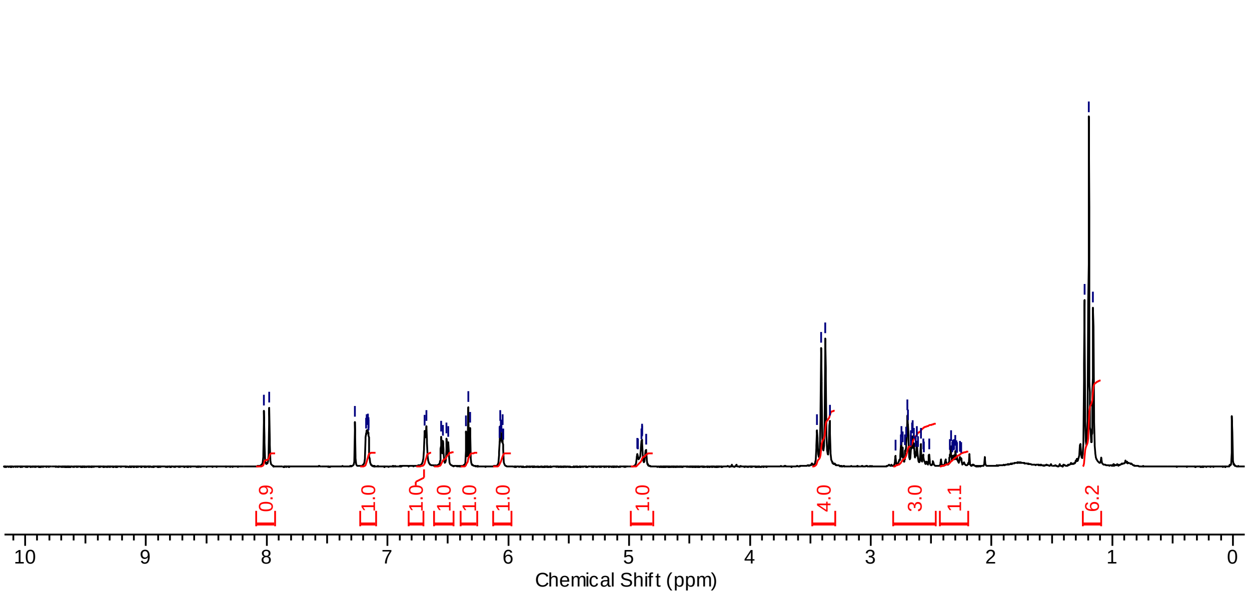
[13]C NMR, $CDCl_3$, 100 MHz

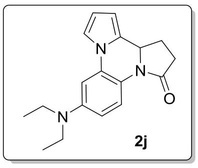




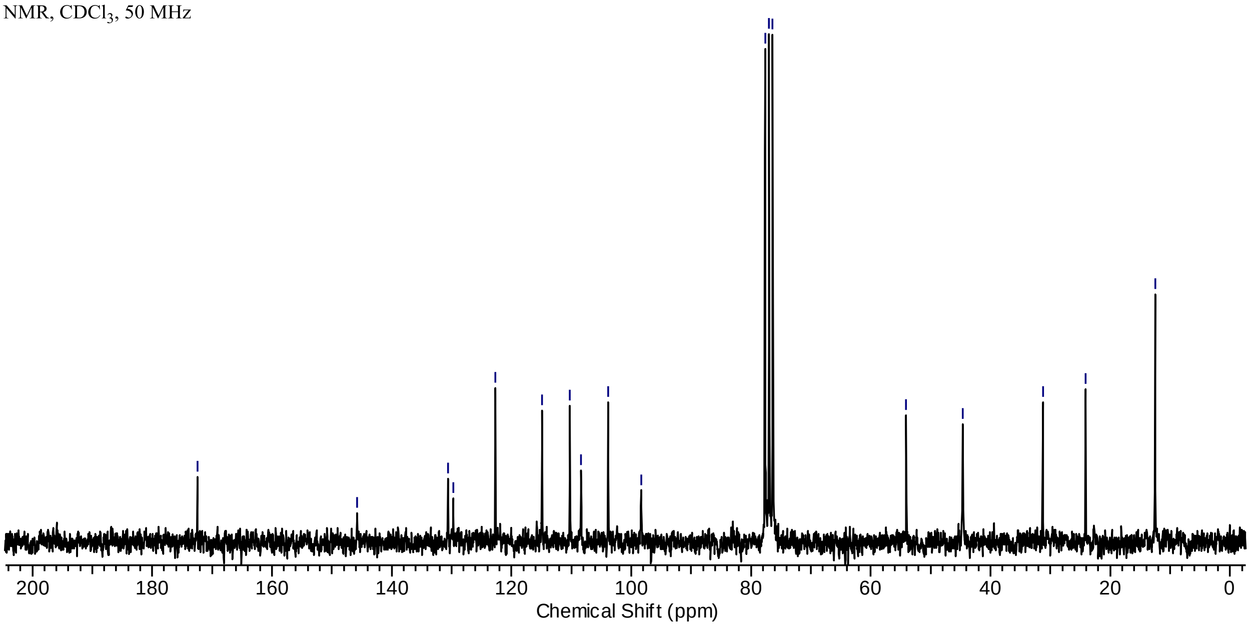


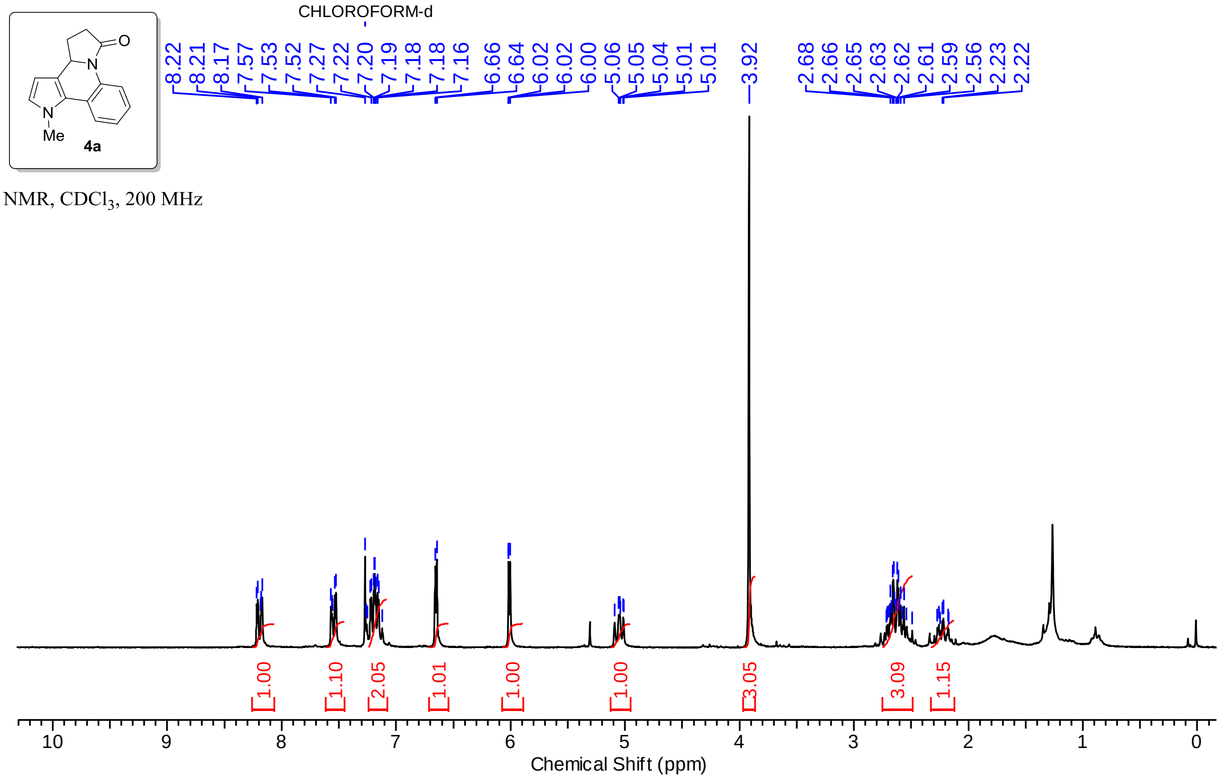
^{1}H NMR, $CDCl_3$, 200 MHz



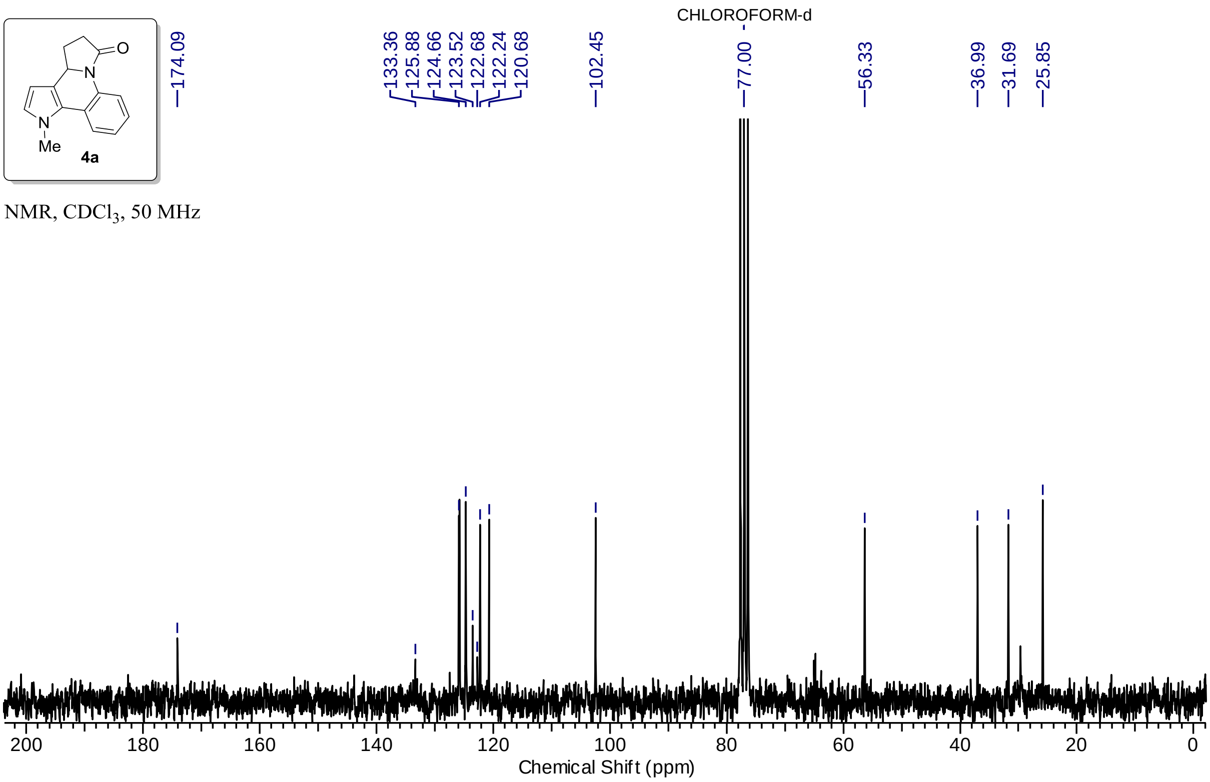


^{13}C NMR, $CDCl_3$, 50 MHz

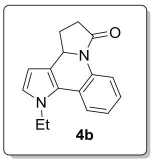




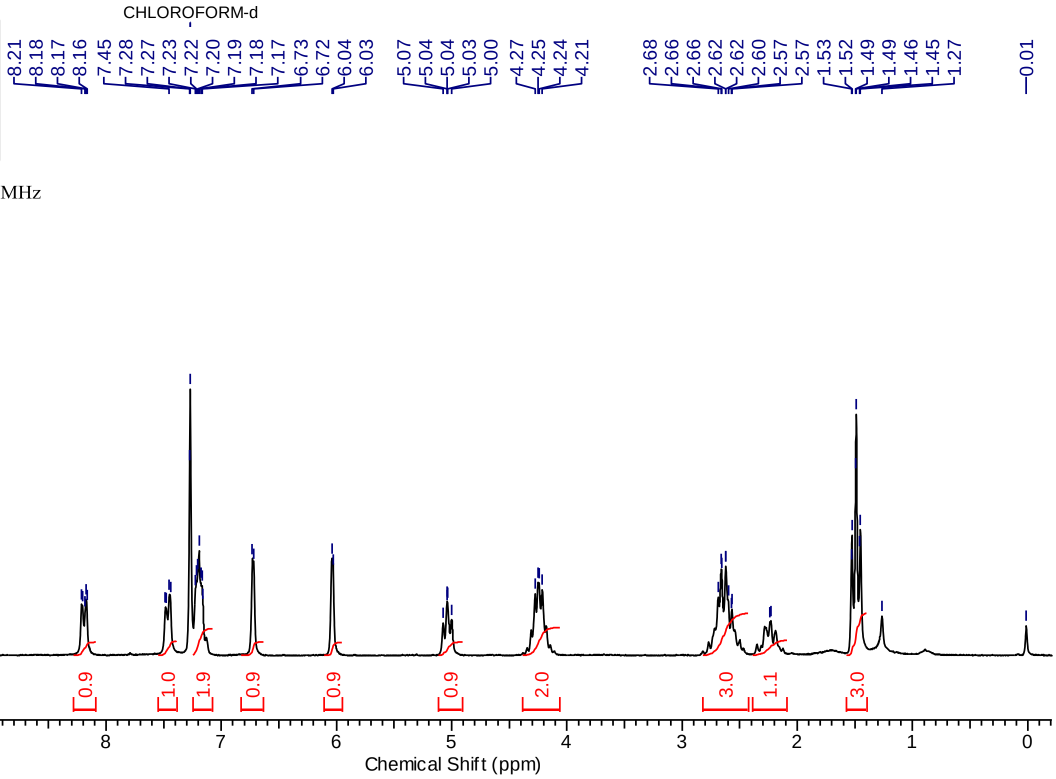
^{1}H NMR, $CDCl_3$, 200 MHz

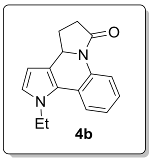


^{13}C NMR, $CDCl_3$, 50 MHz

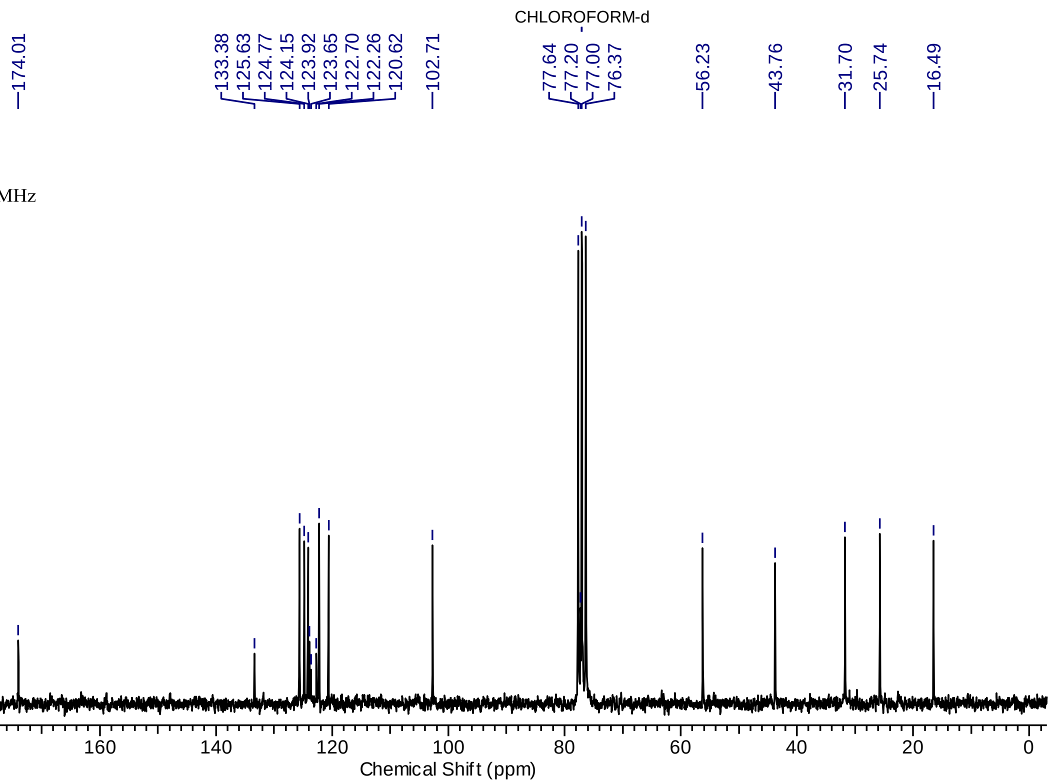


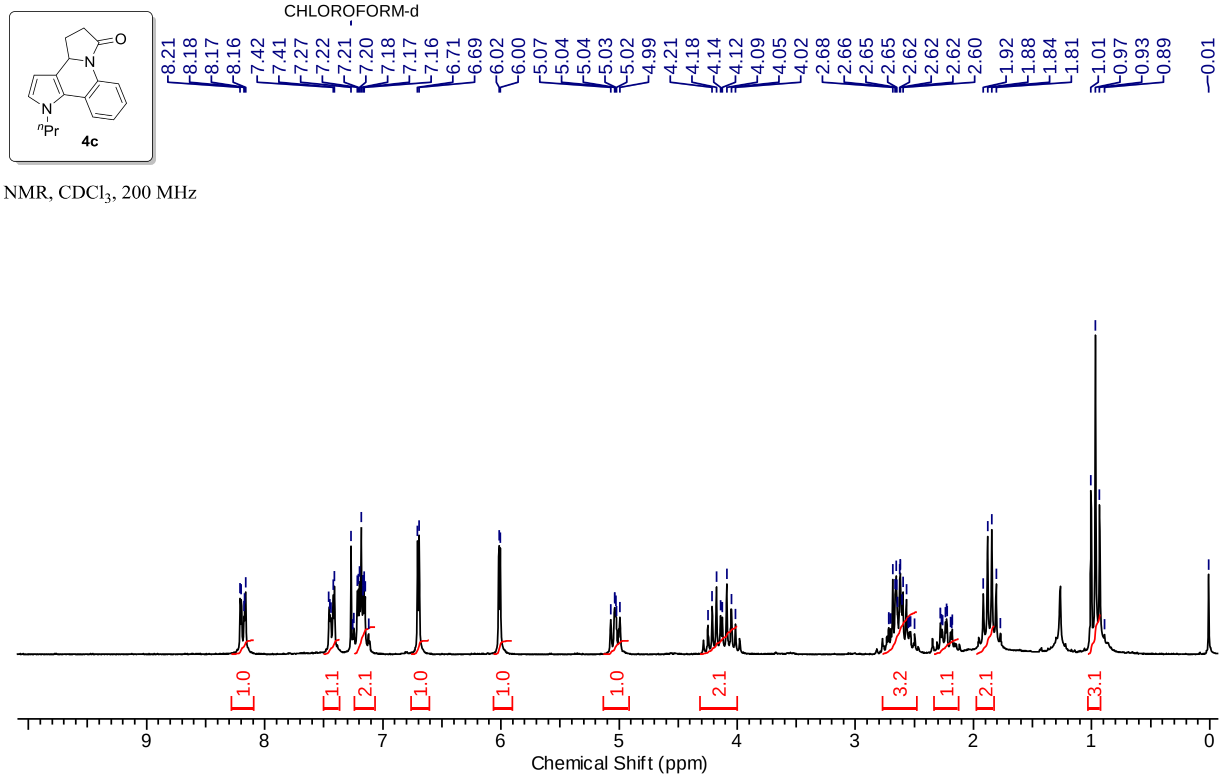
^{1}H NMR, $CDCl_3$, 200 MHz



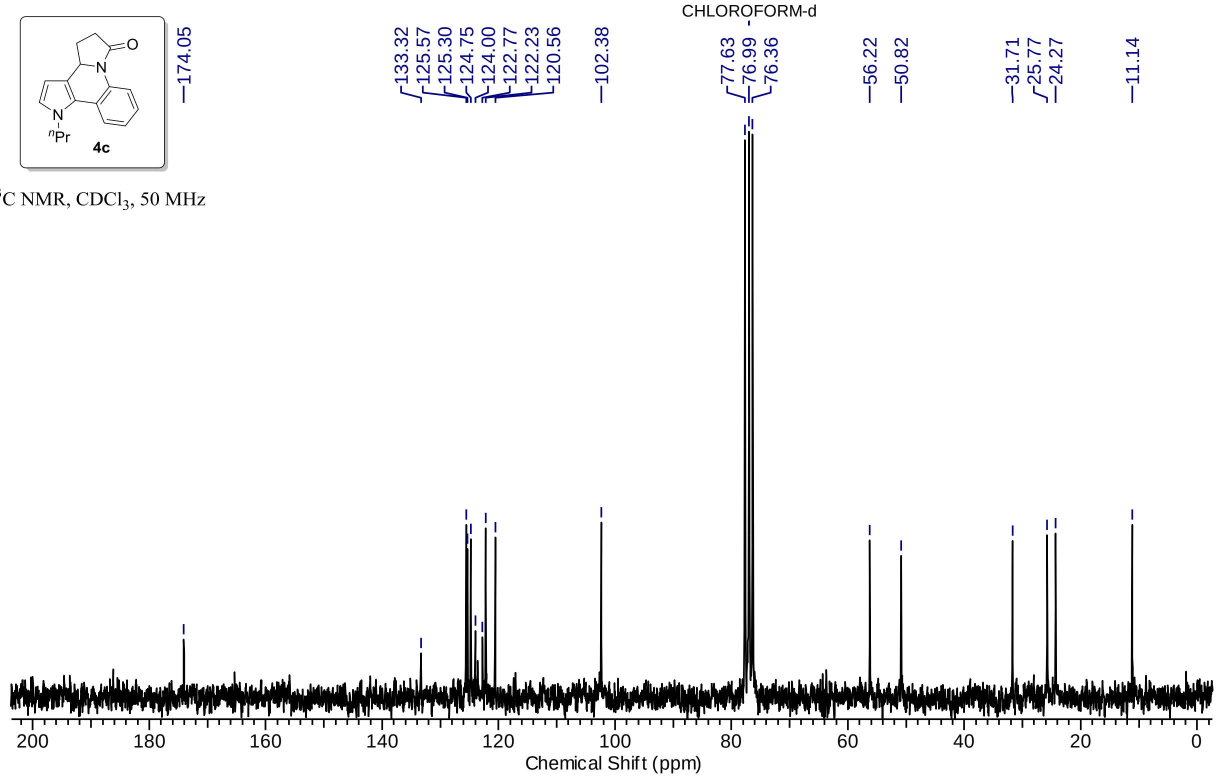


^{13}C NMR, $CDCl_3$, 50 MHz

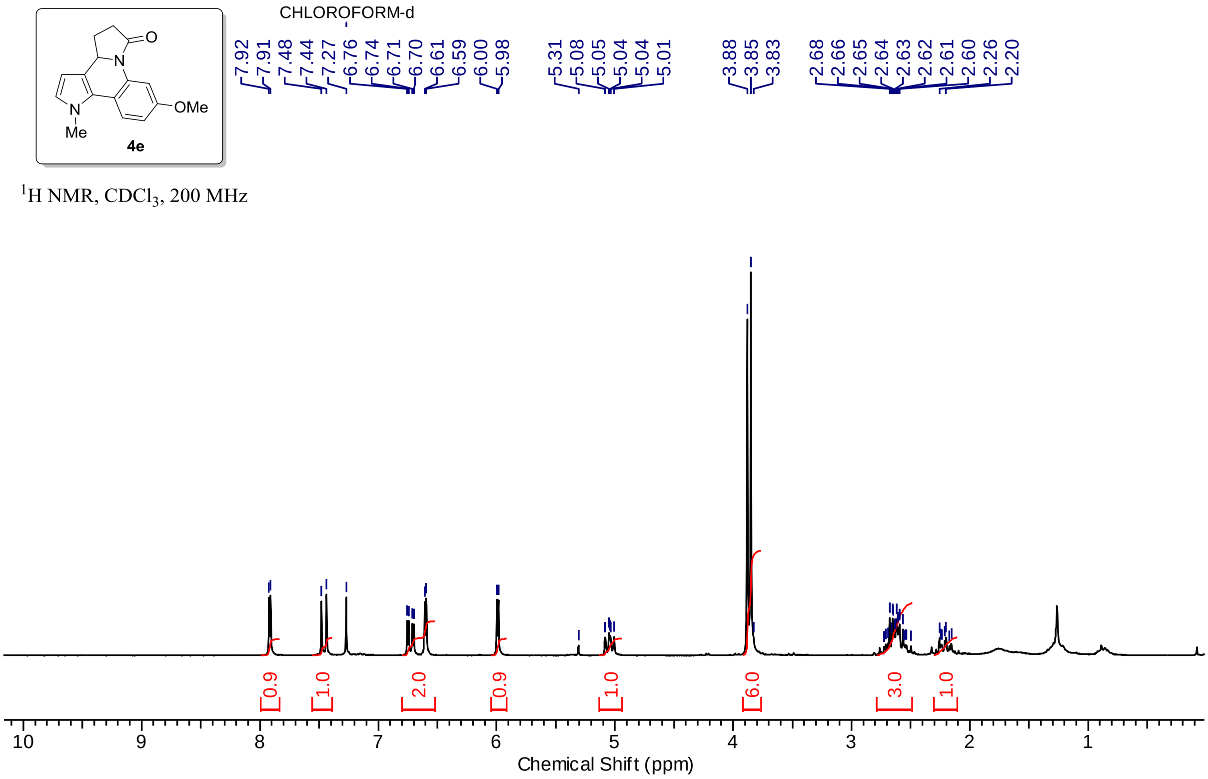




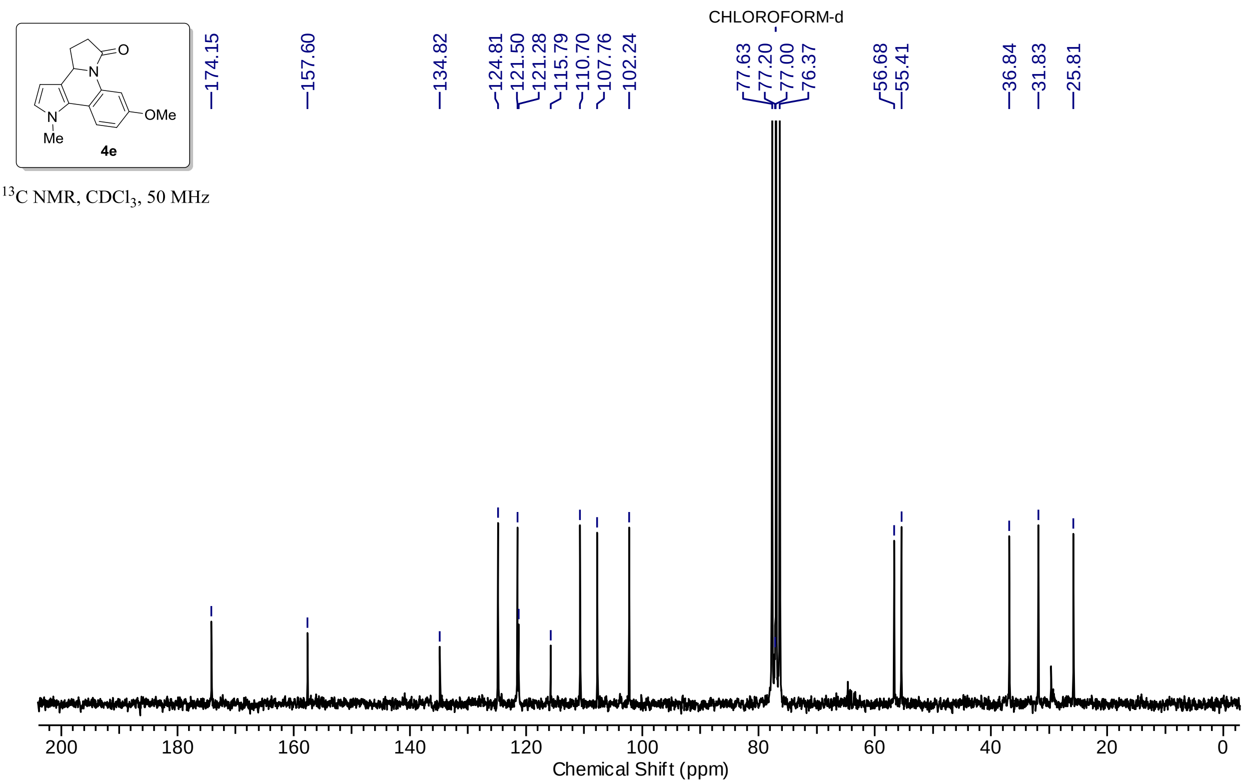
[1]H NMR, $CDCl_3$, 200 MHz



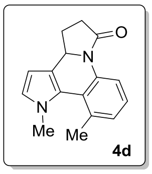
[13]C NMR, $CDCl_3$, 50 MHz



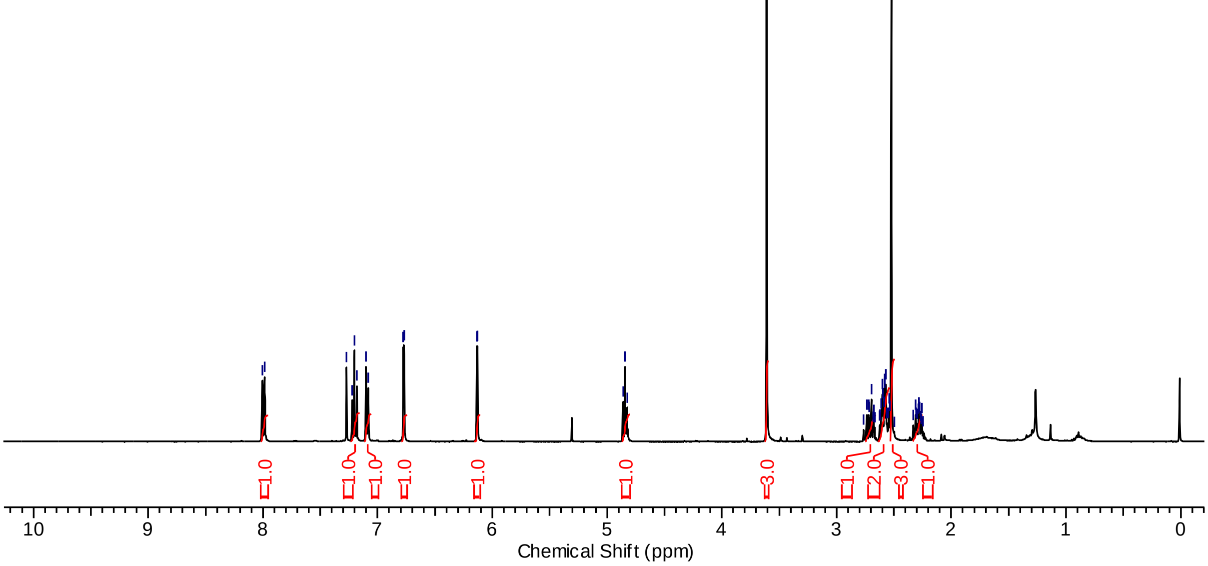
^{1}H NMR, $CDCl_3$, 200 MHz

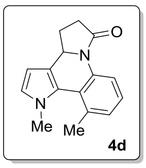


^{13}C NMR, $CDCl_3$, 50 MHz

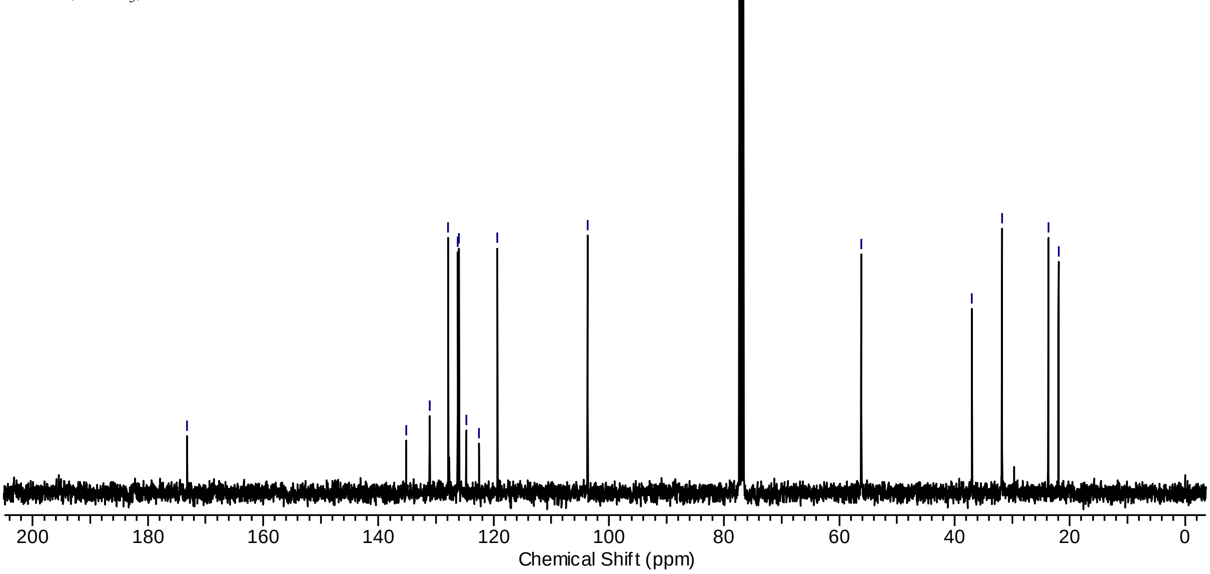


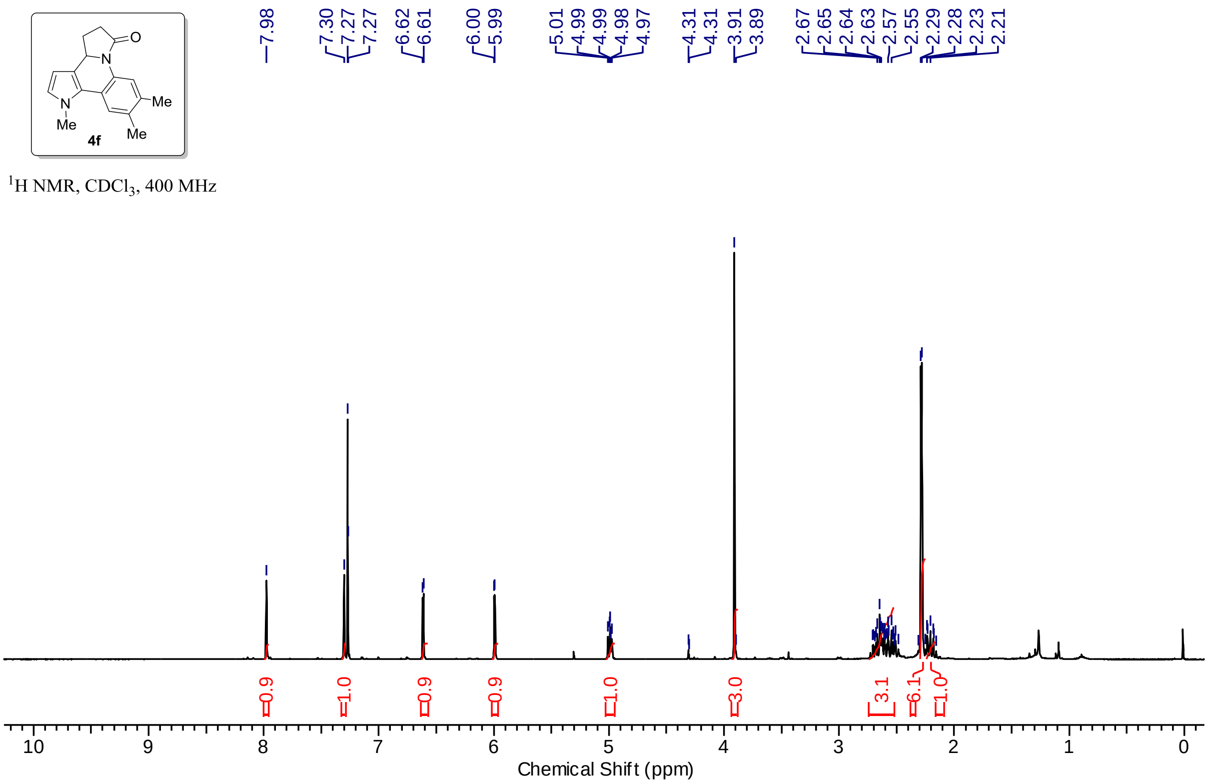
[1]H NMR, $CDCl_3$, 400 MHz



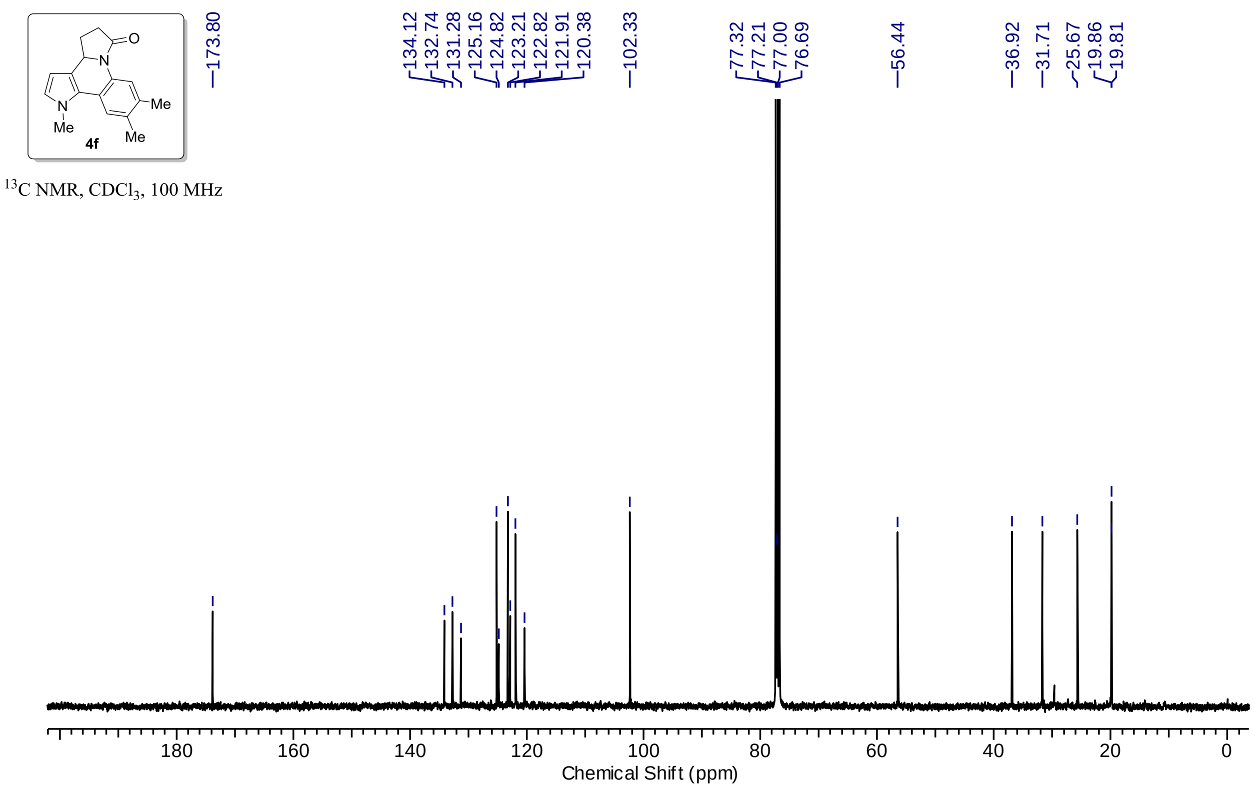


[13]C NMR, $CDCl_3$, 100 MHz

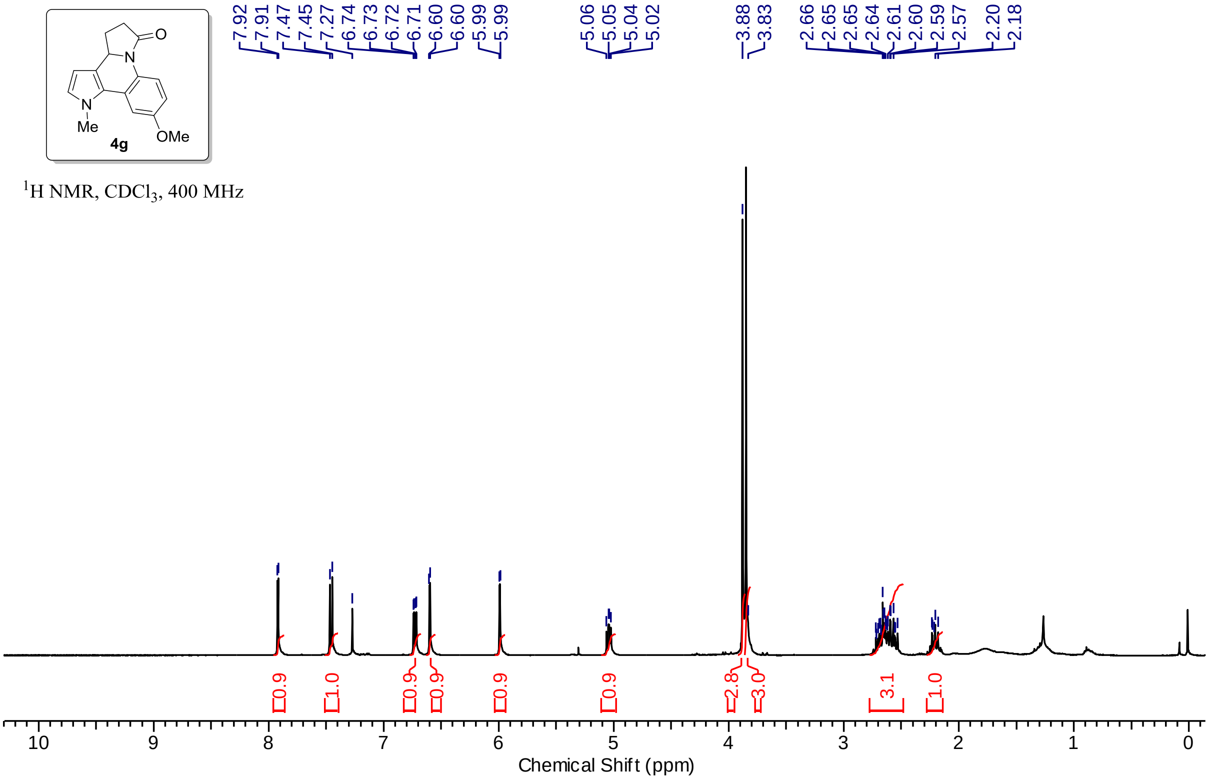




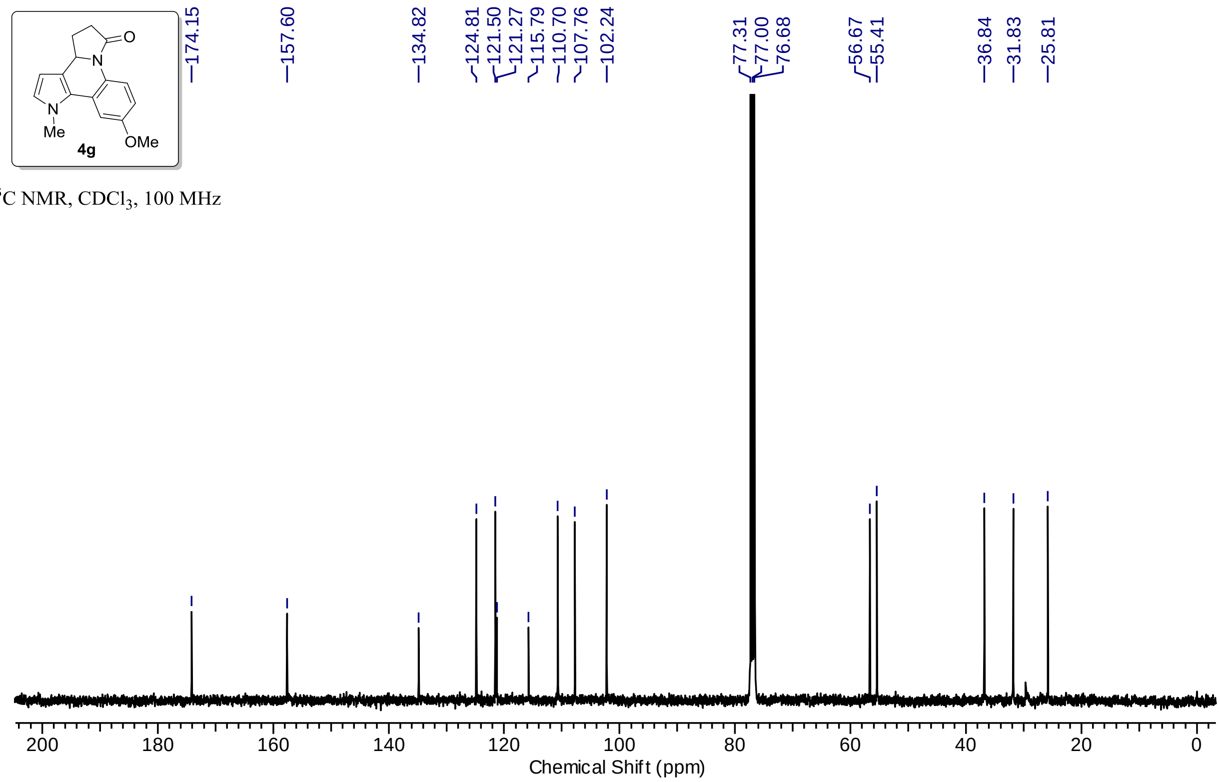
^{1}H NMR, $CDCl_3$, 400 MHz



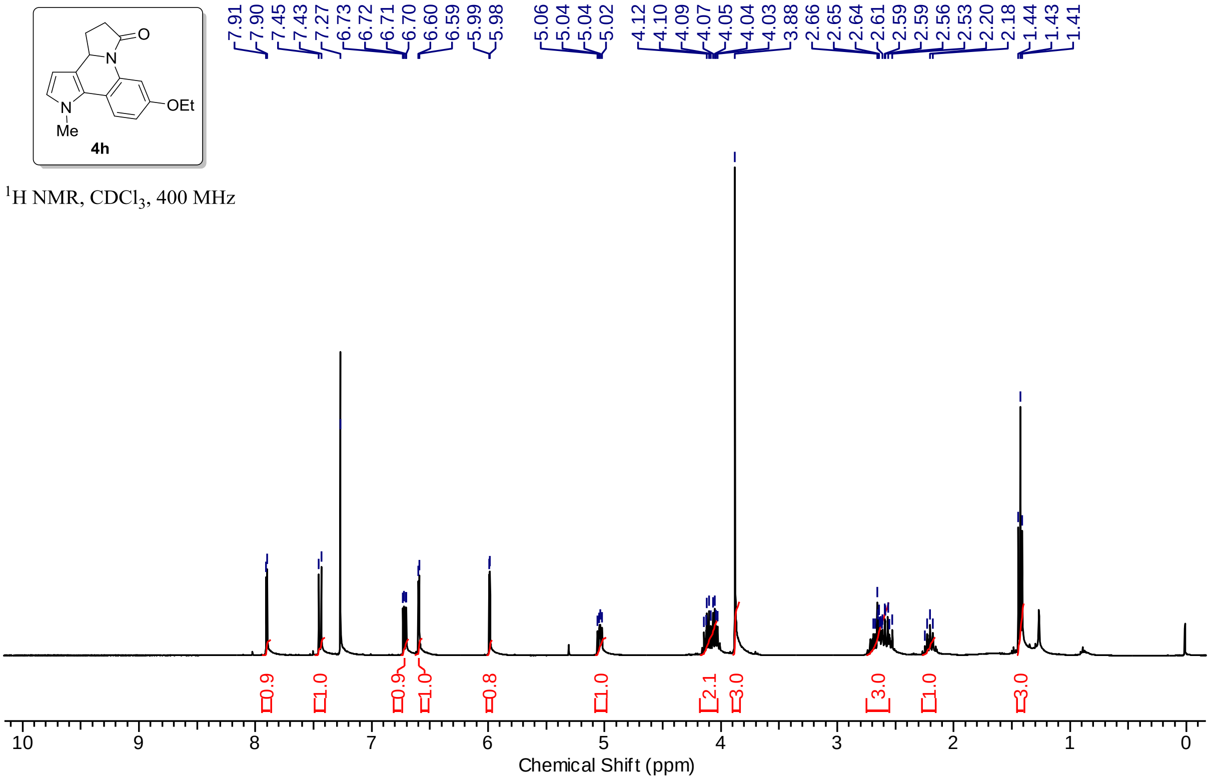
^{13}C NMR, $CDCl_3$, 100 MHz



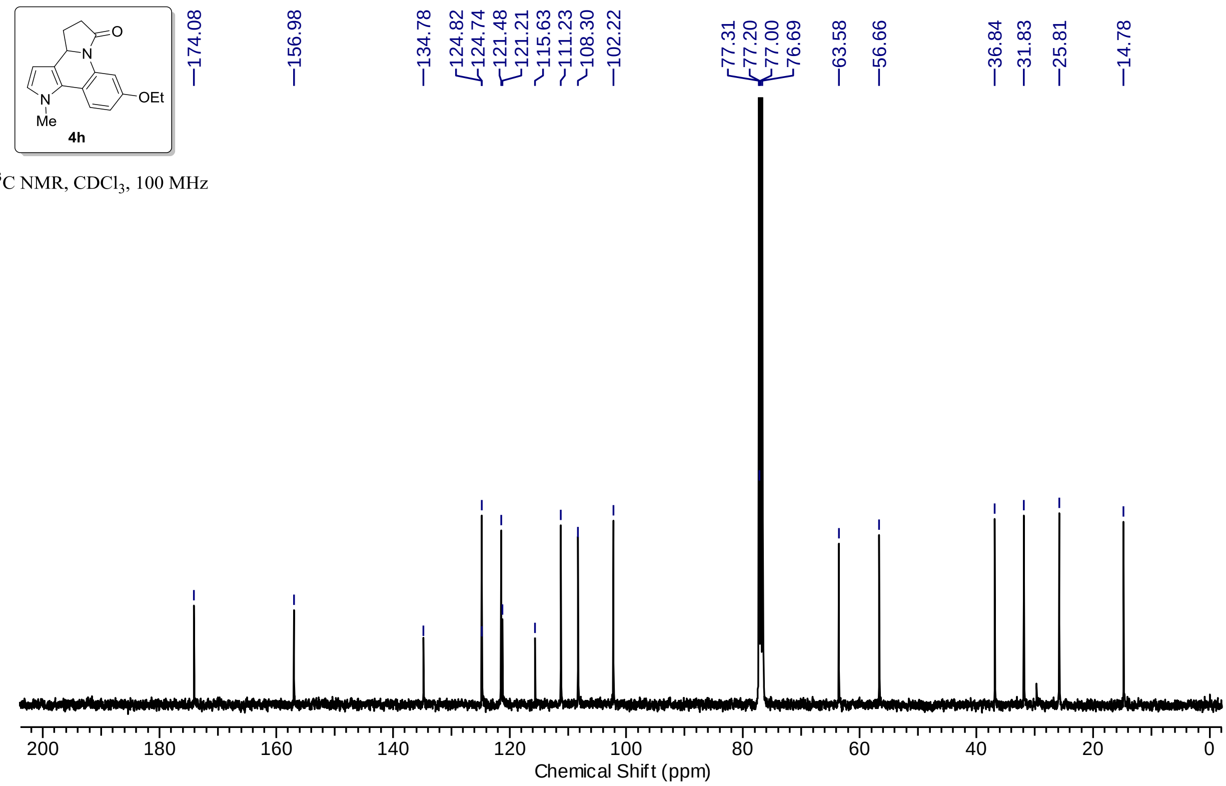
[1]H NMR, $CDCl_3$, 400 MHz



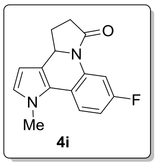
[13]C NMR, $CDCl_3$, 100 MHz



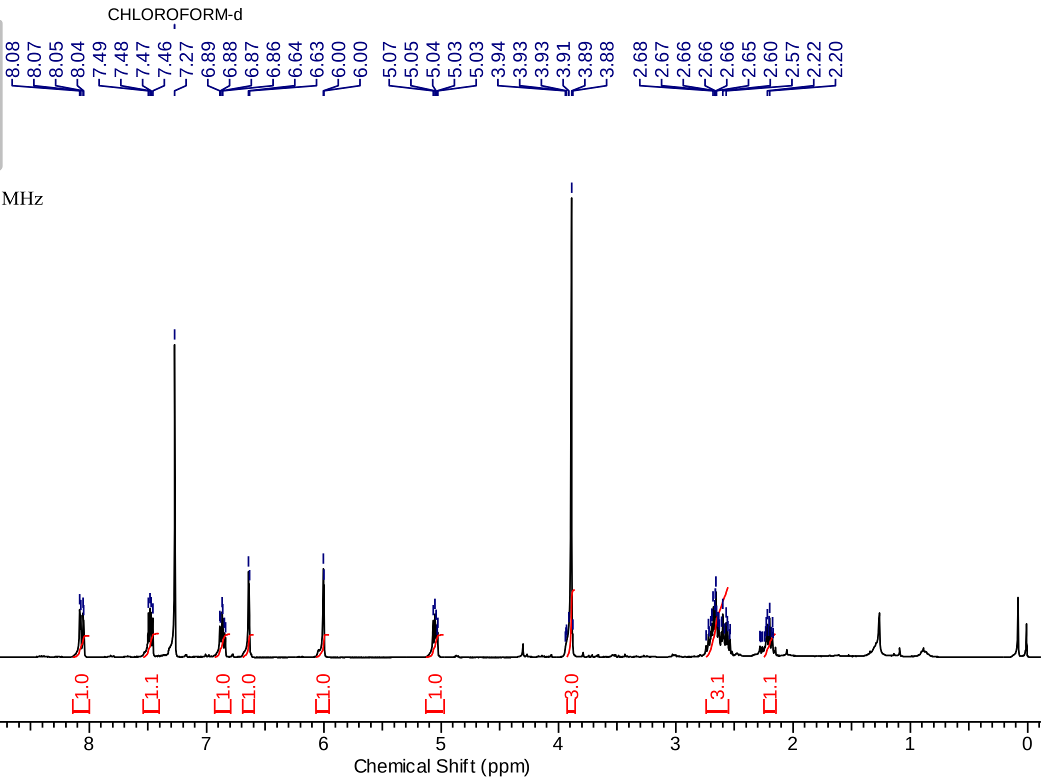
[1]H NMR, $CDCl_3$, 400 MHz

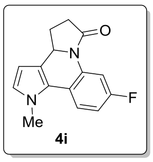


[13]C NMR, $CDCl_3$, 100 MHz

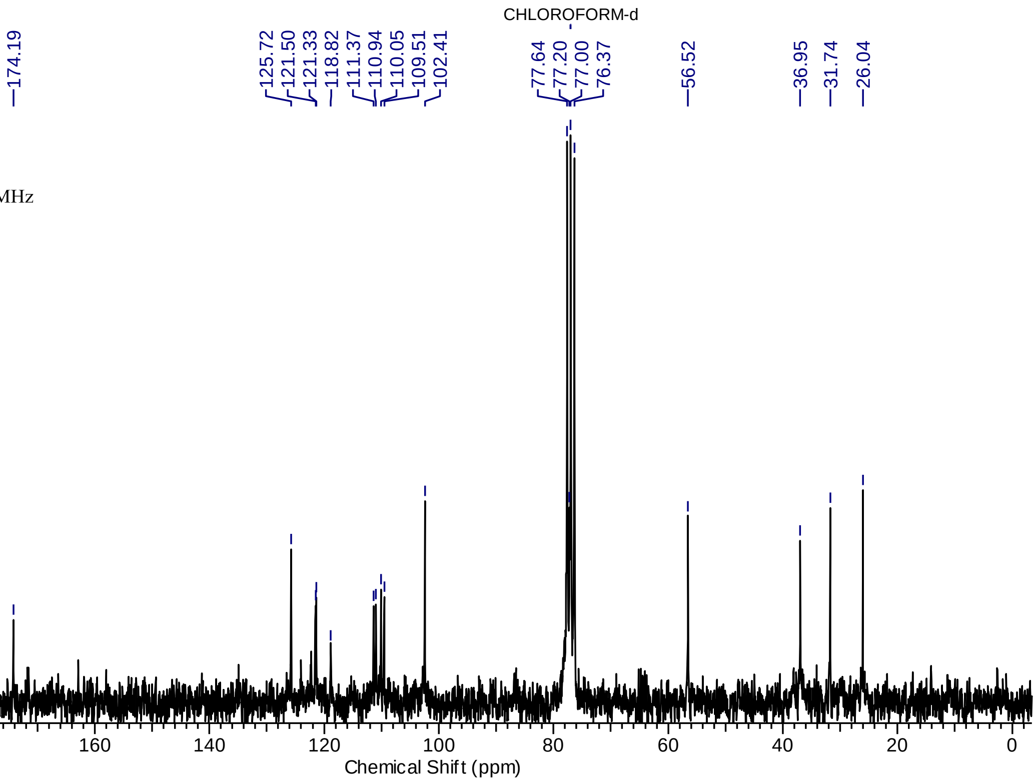


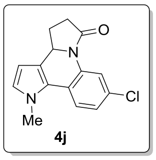
[1]H NMR, $CDCl_3$, 200 MHz





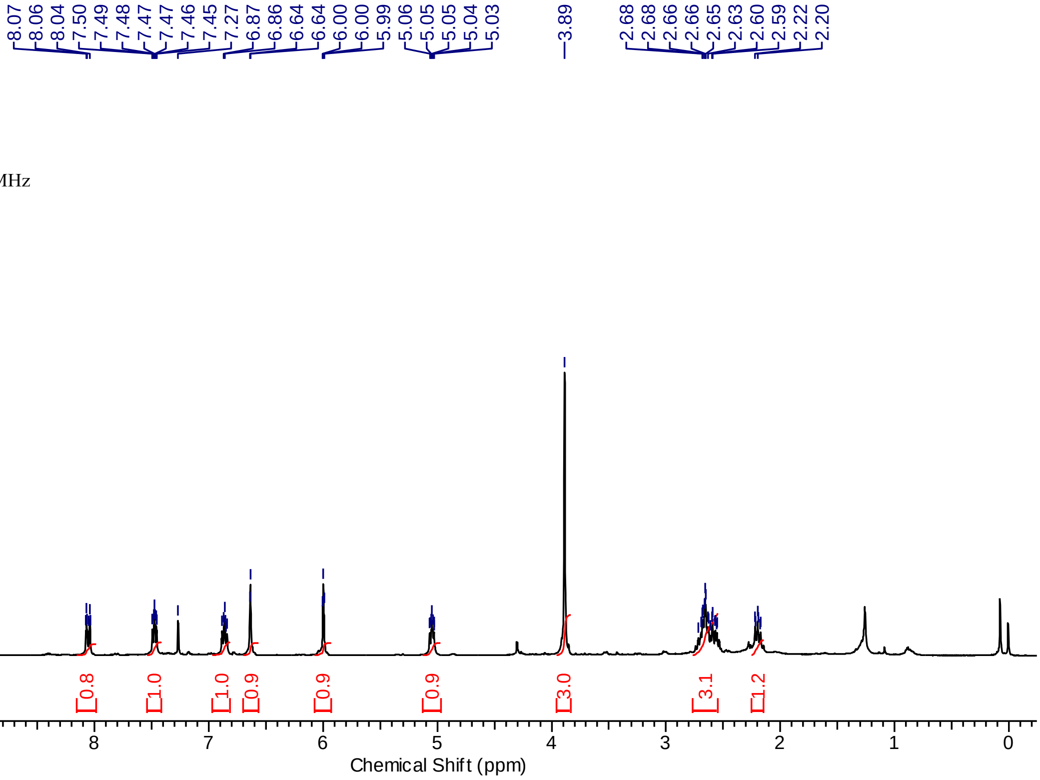
[13]C NMR, $CDCl_3$, 50 MHz

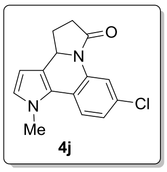




4j

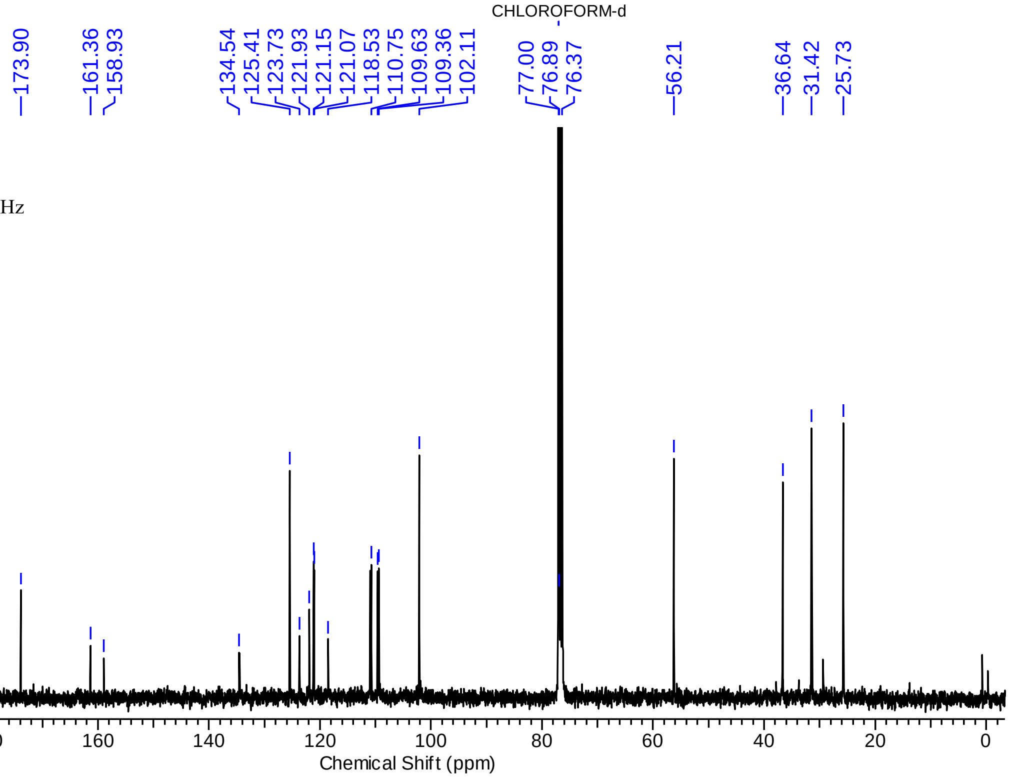
[1]H NMR, $CDCl_3$, 400 MHz

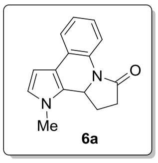




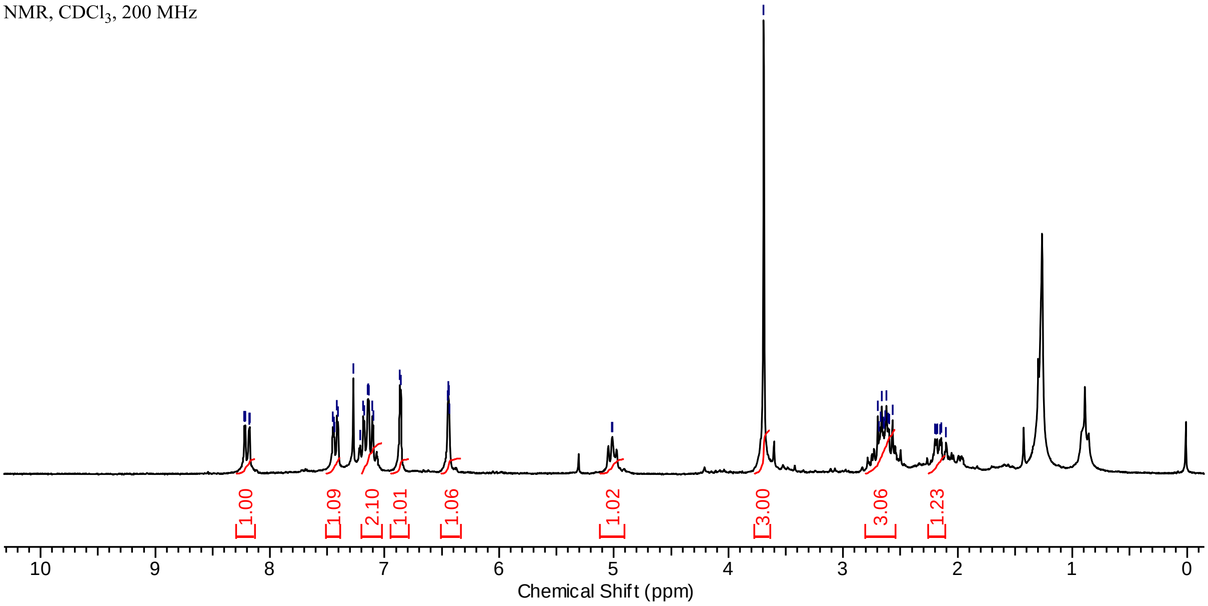
4j

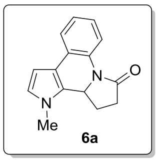
[13]C NMR, $CDCl_3$, 100 MHz



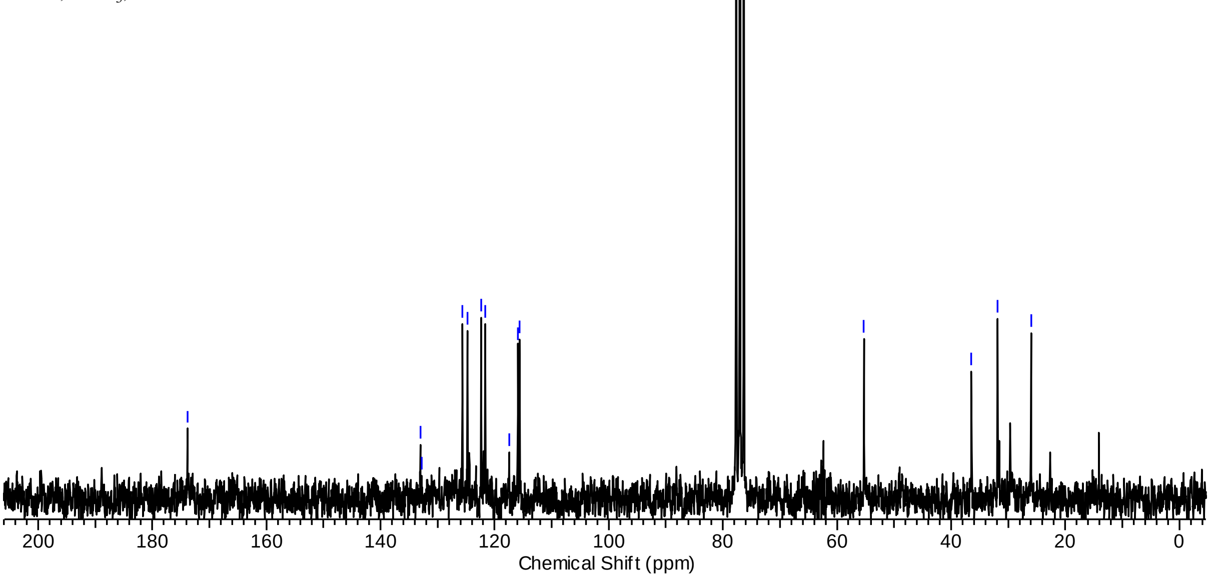


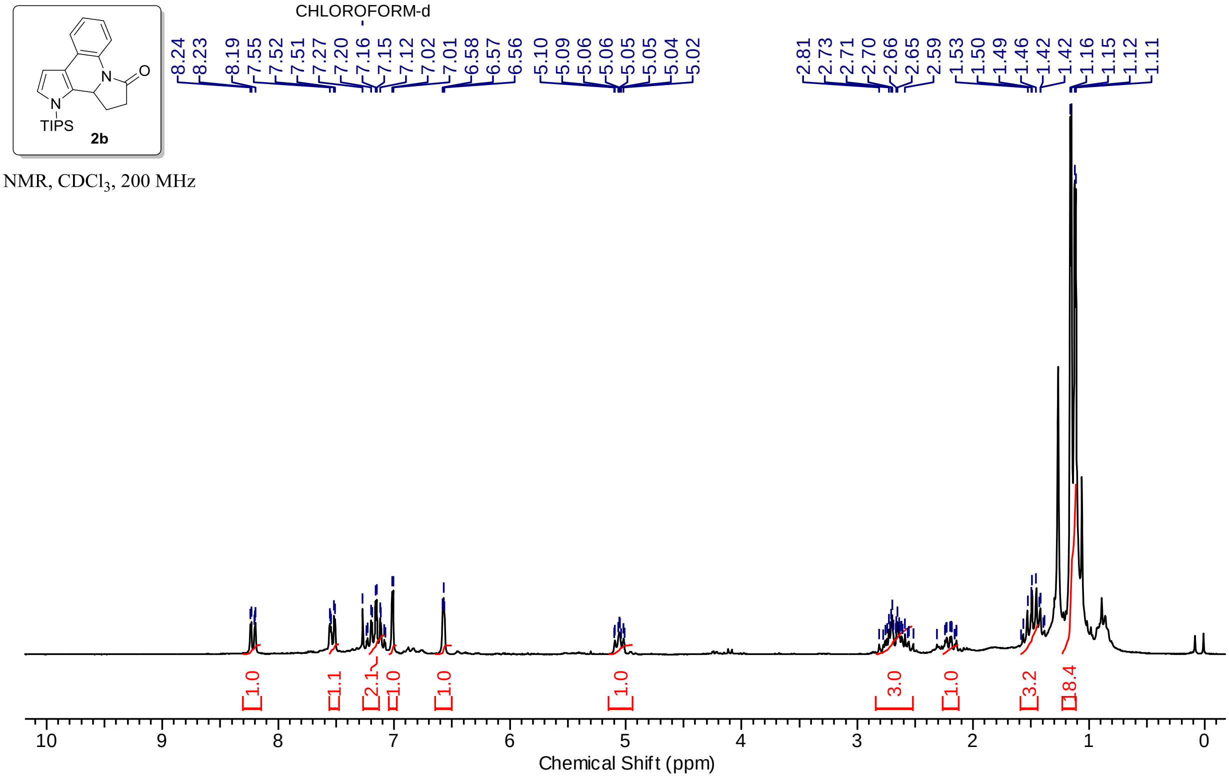
^{1}H NMR, $CDCl_3$, 200 MHz



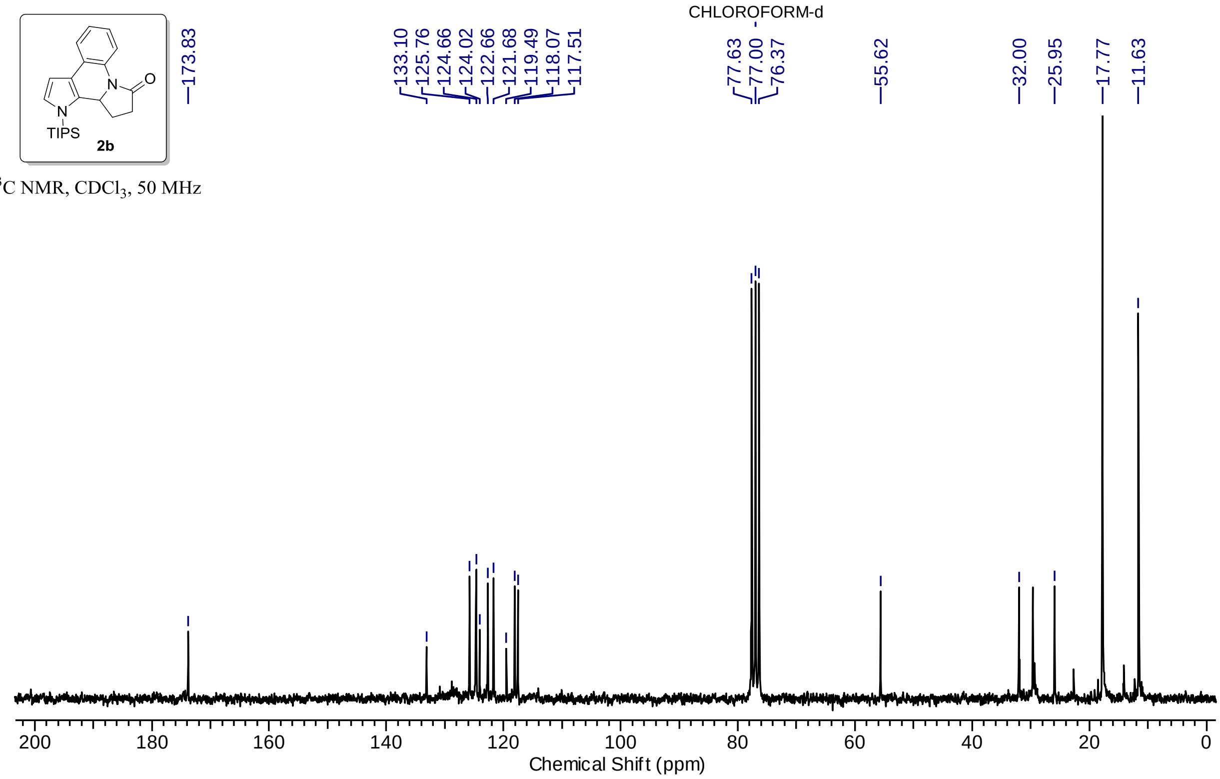


^{13}C NMR, $CDCl_3$, 50 MHz

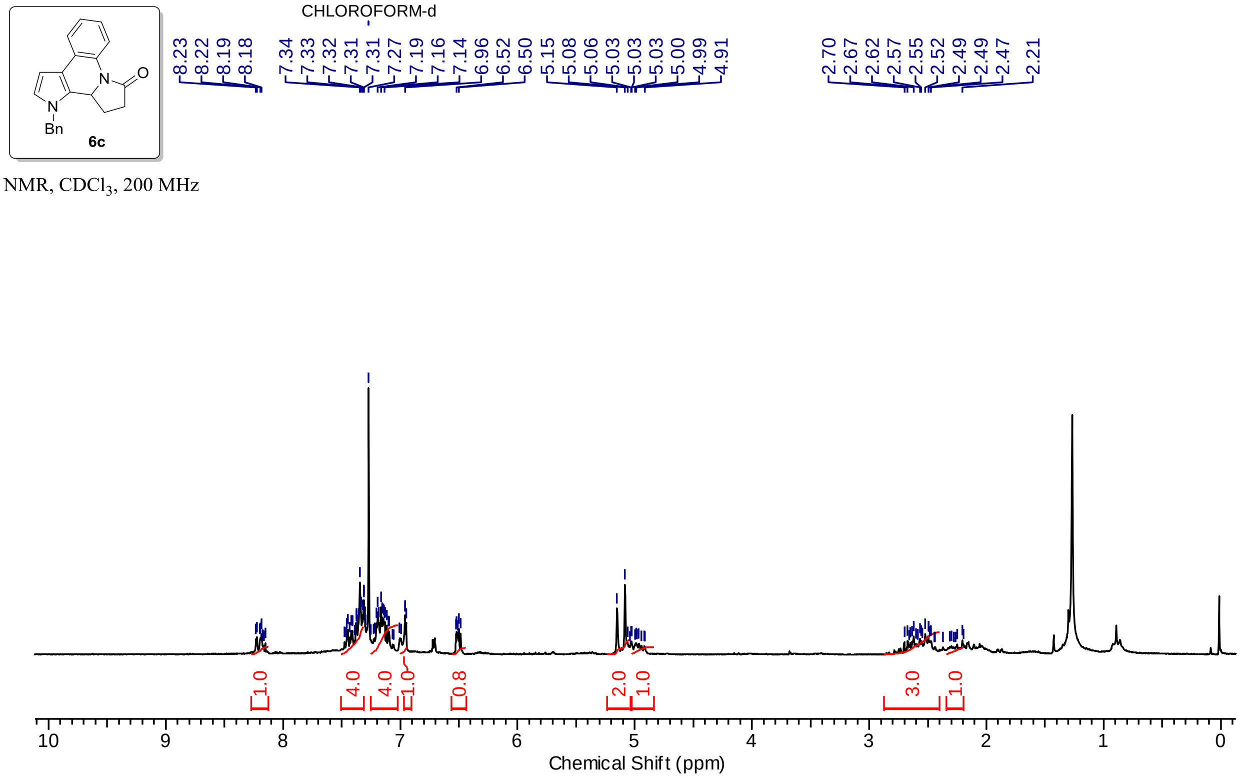




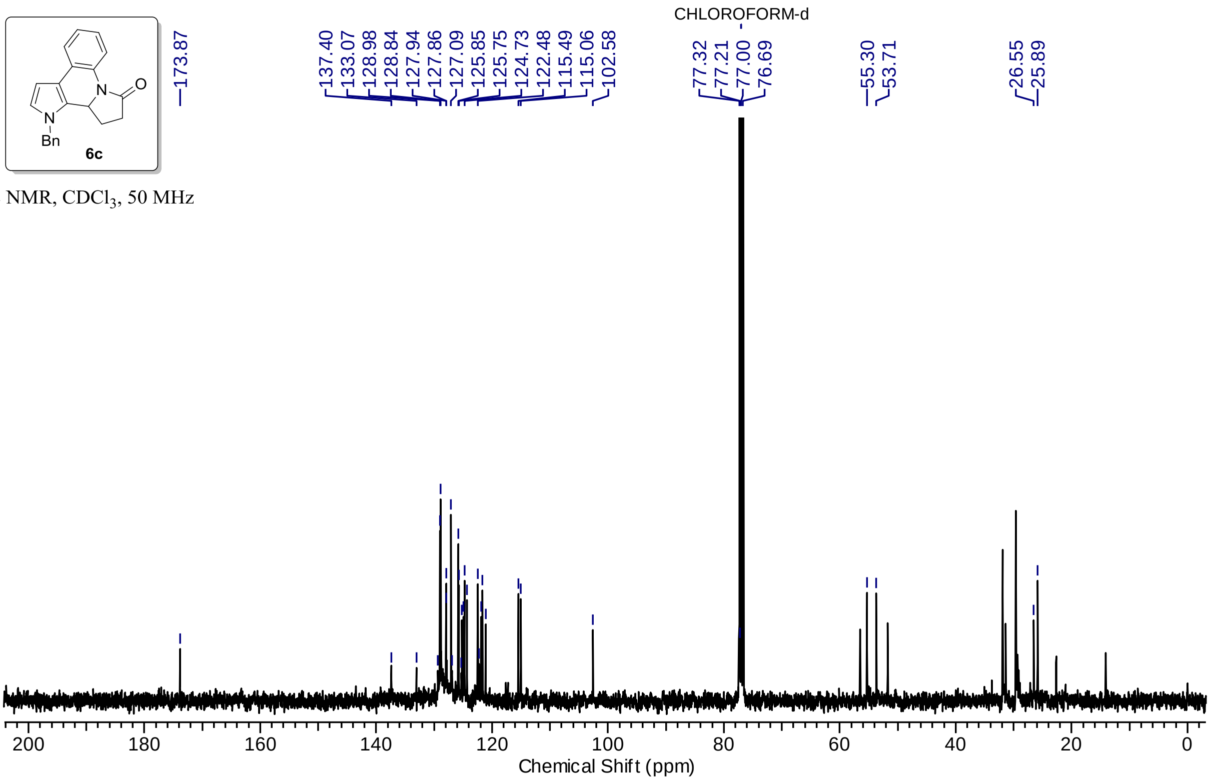
^{1}H NMR, $CDCl_3$, 200 MHz



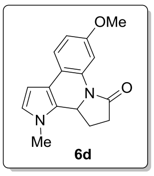
^{13}C NMR, $CDCl_3$, 50 MHz

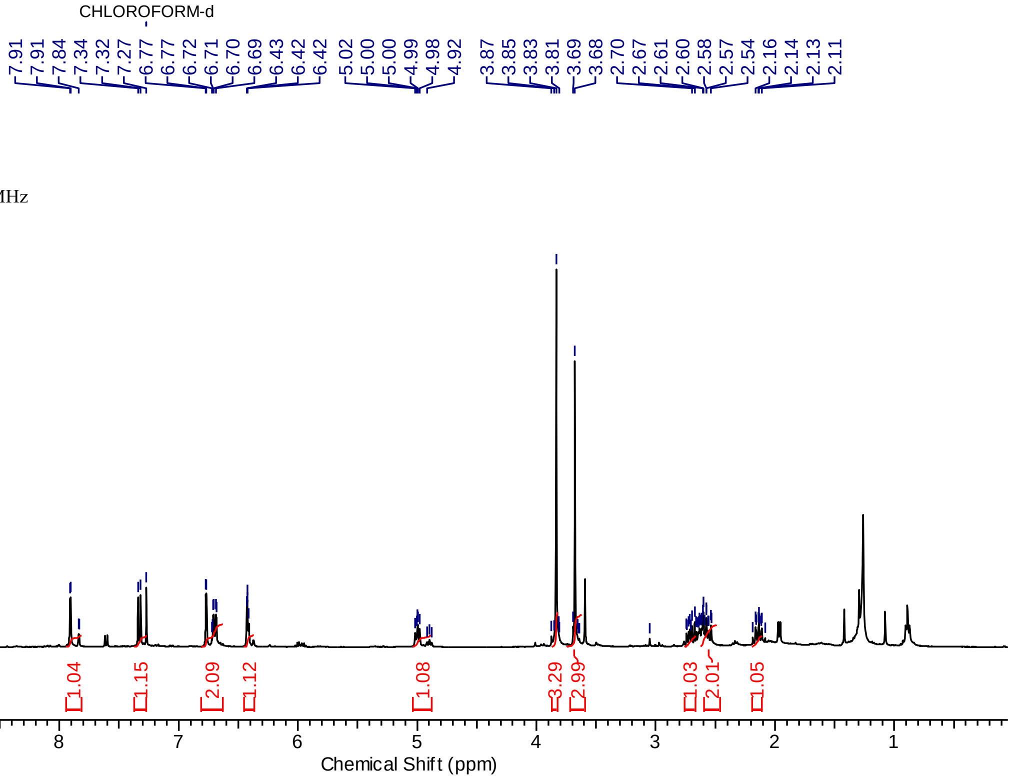


^{1}H NMR, $CDCl_3$, 200 MHz

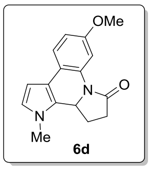


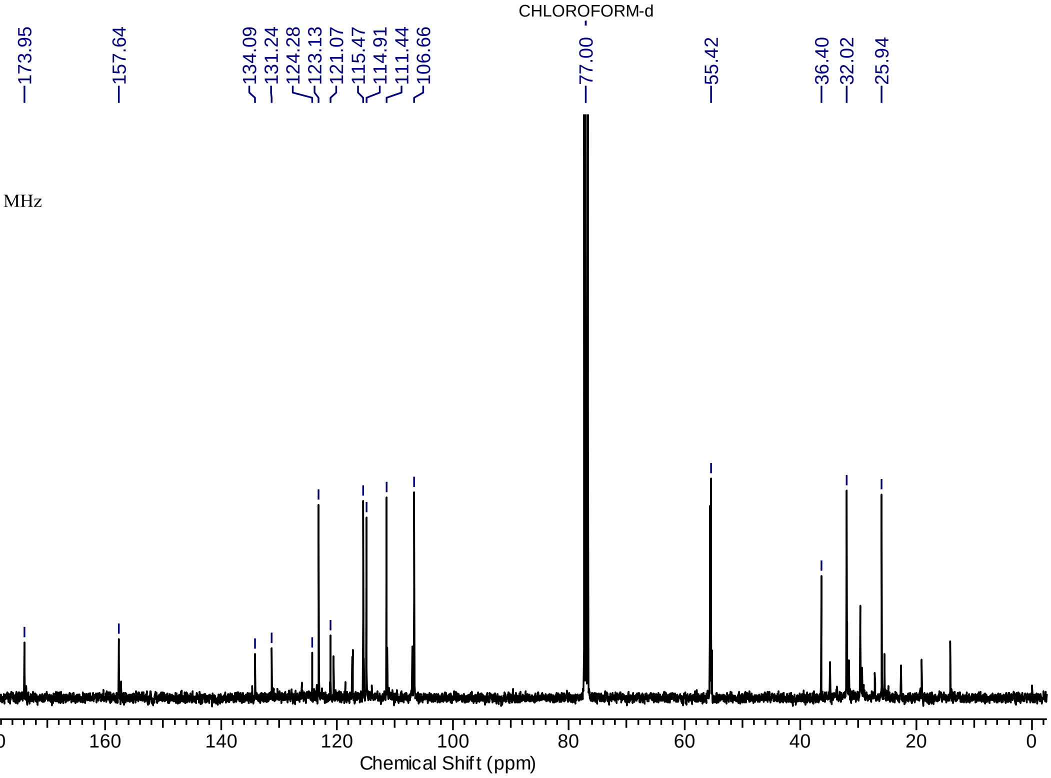
^{13}C NMR, $CDCl_3$, 50 MHz



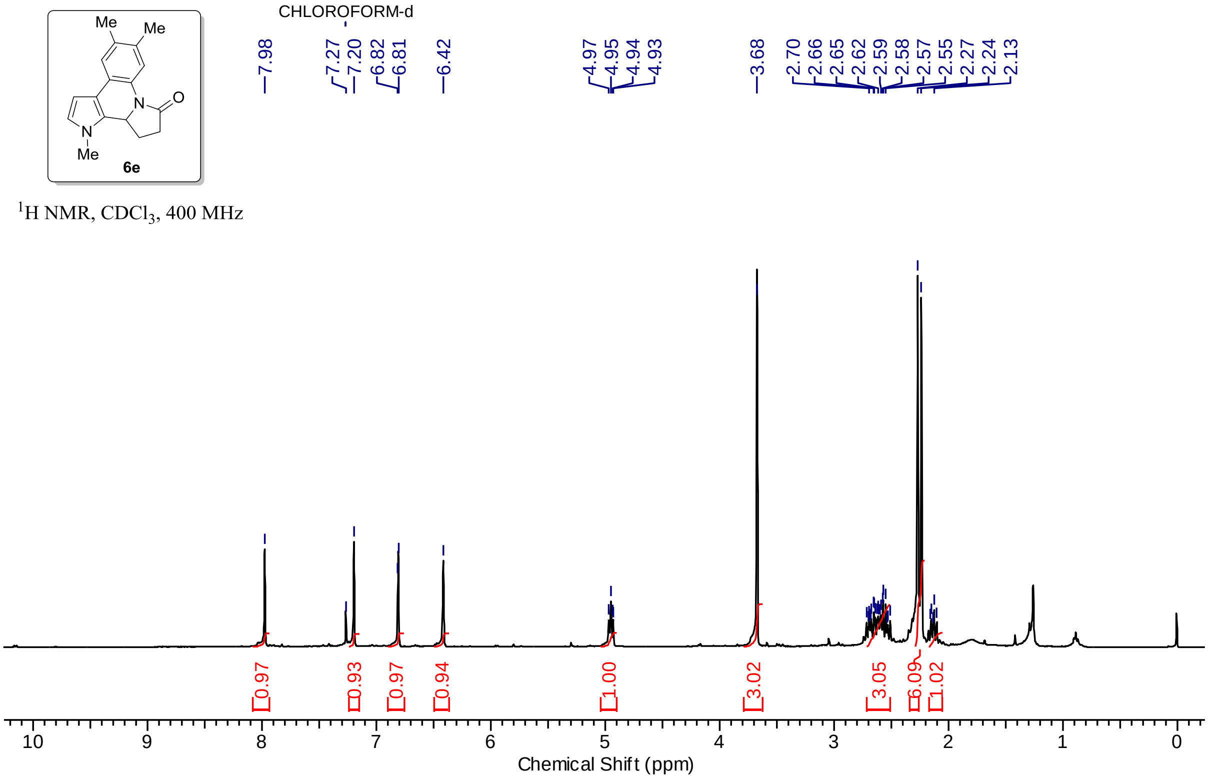


[1]H NMR, $CDCl_3$, 400 MHz

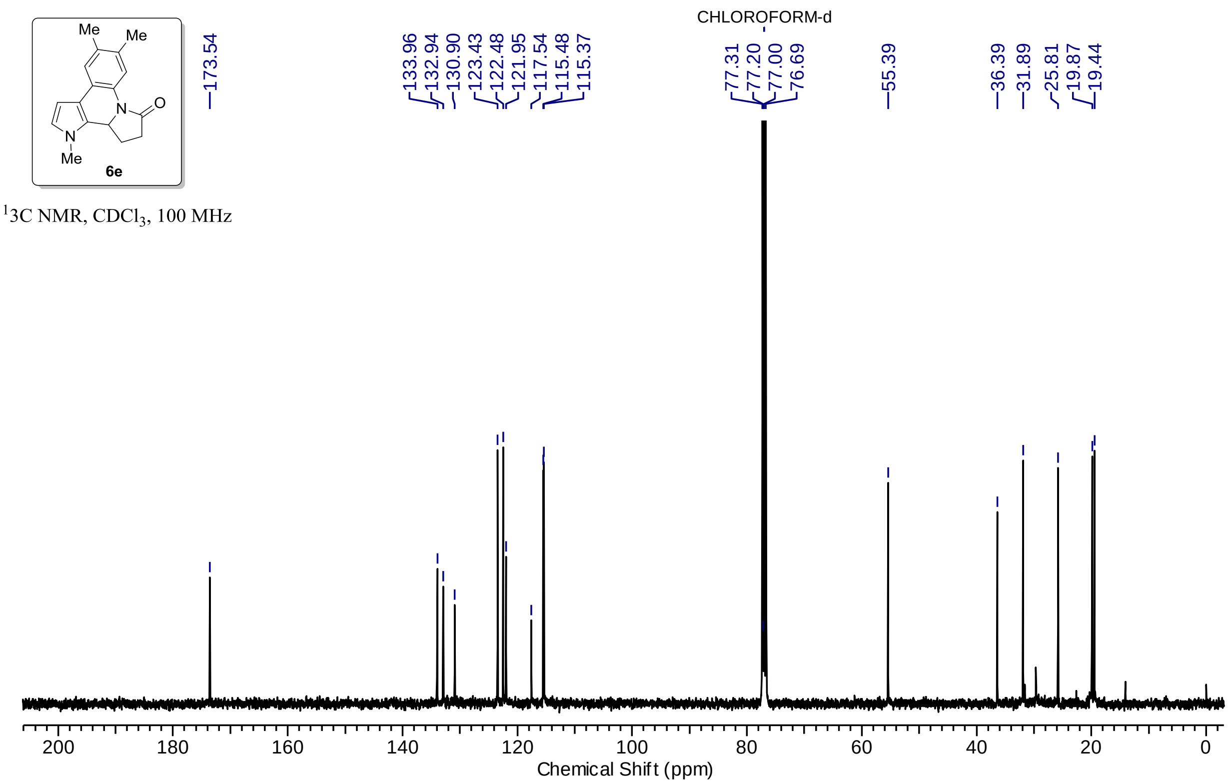




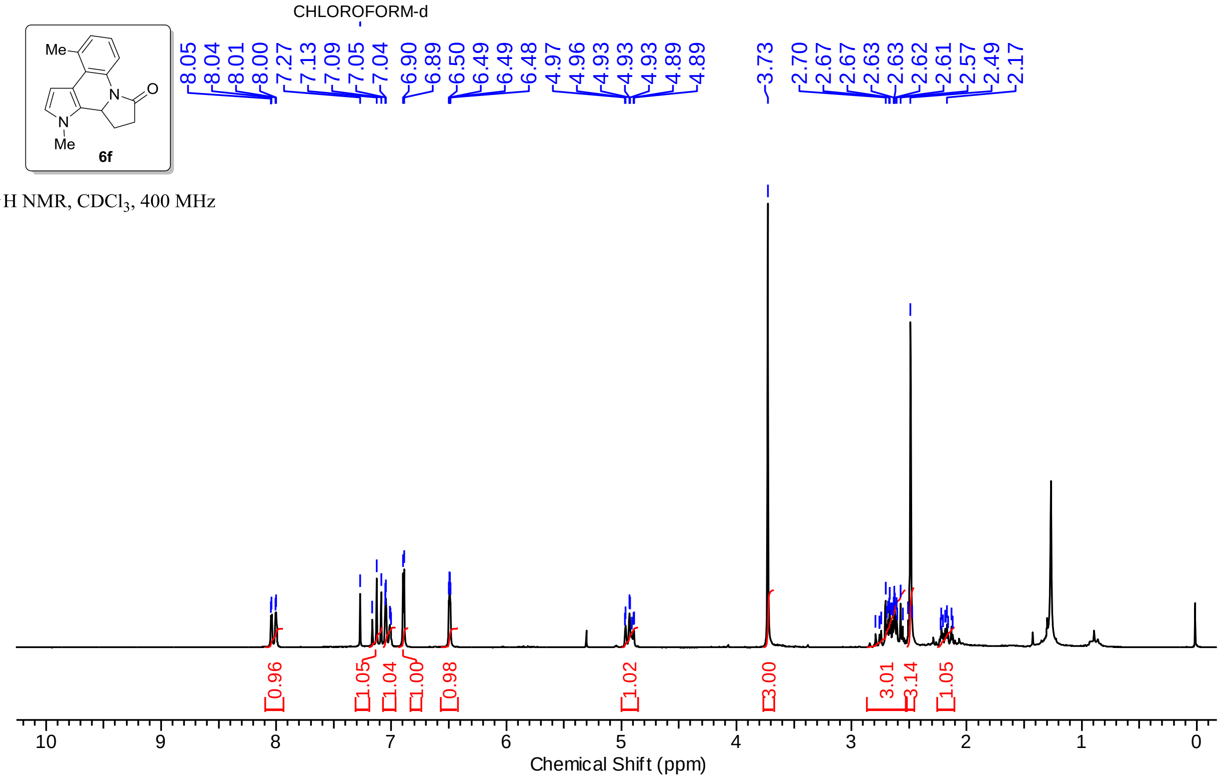
[13]C NMR, $CDCl_3$, 100 MHz



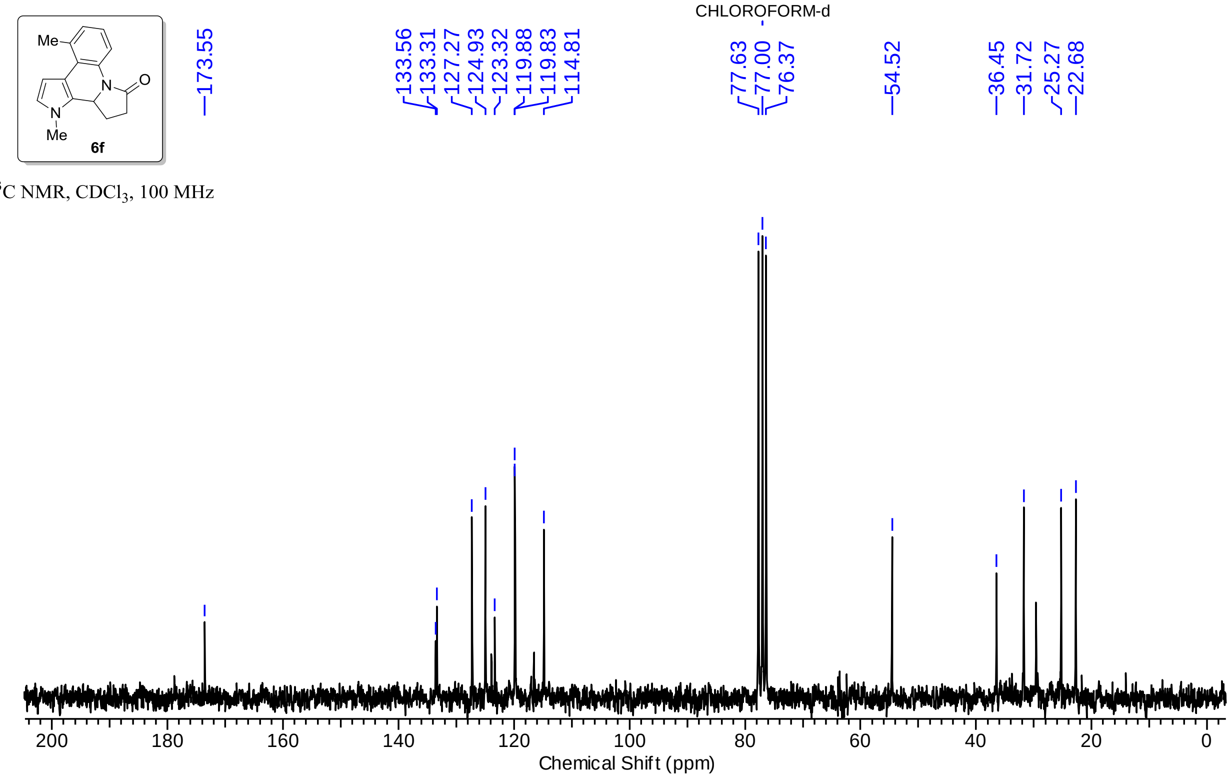
^{1}H NMR, $CDCl_3$, 400 MHz



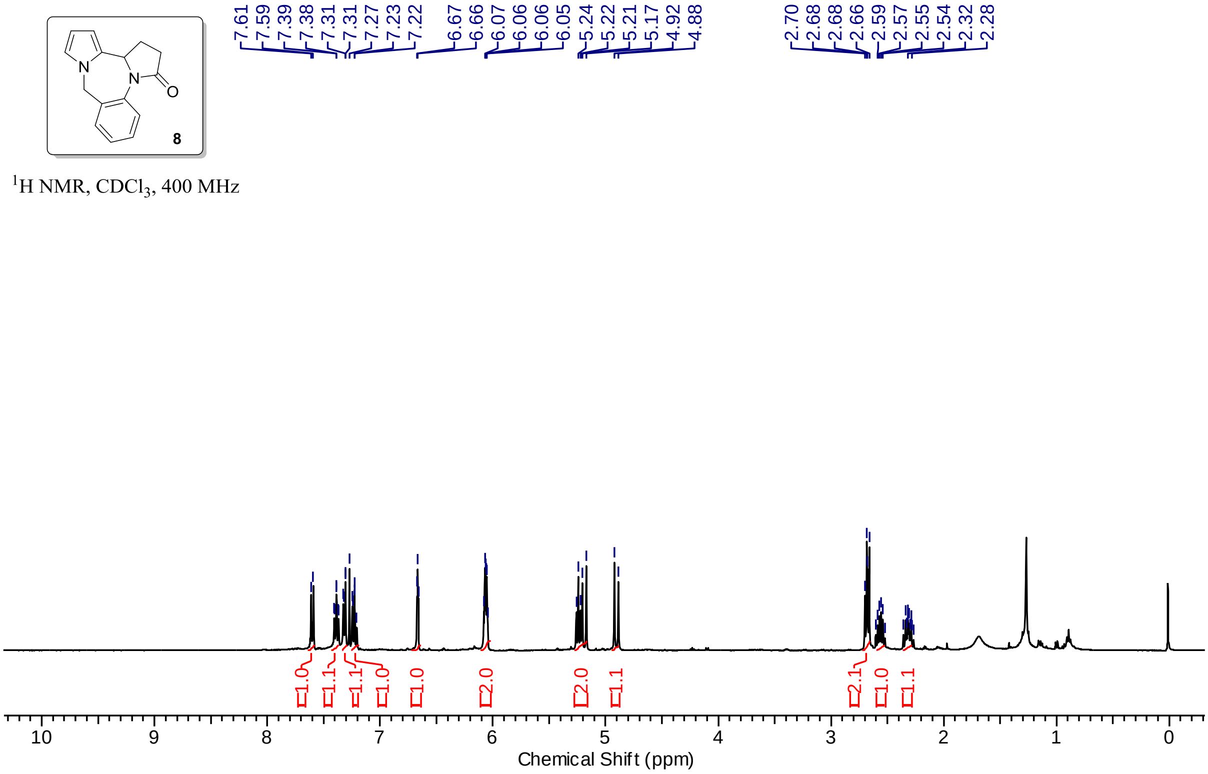
^{13}C NMR, $CDCl_3$, 100 MHz



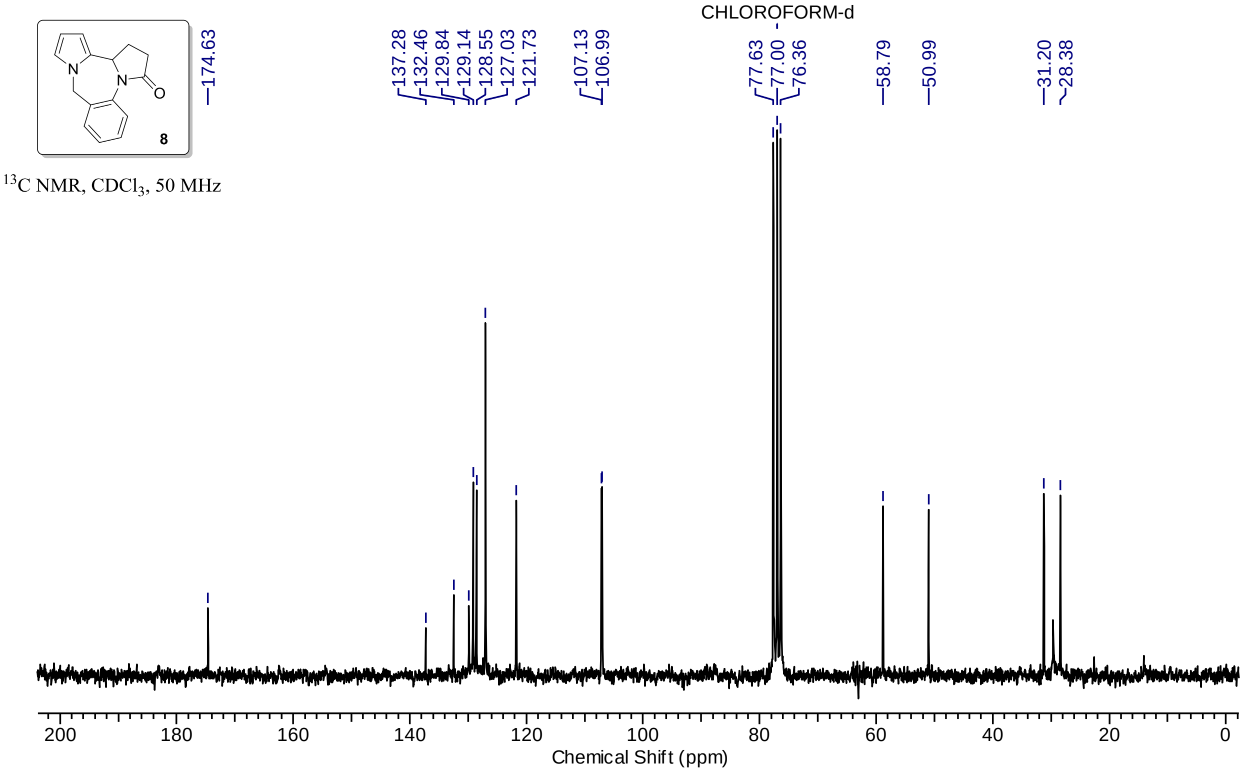
^{1}H NMR, $CDCl_3$, 400 MHz



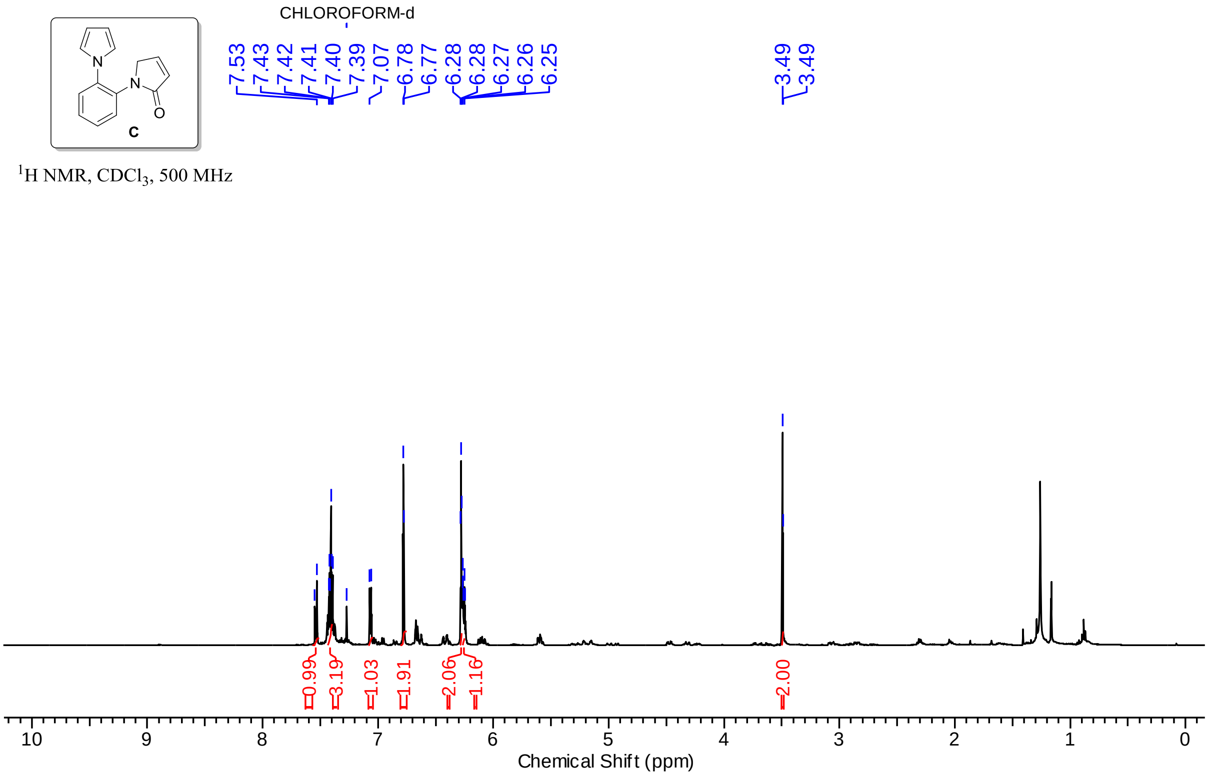
^{13}C NMR, $CDCl_3$, 100 MHz



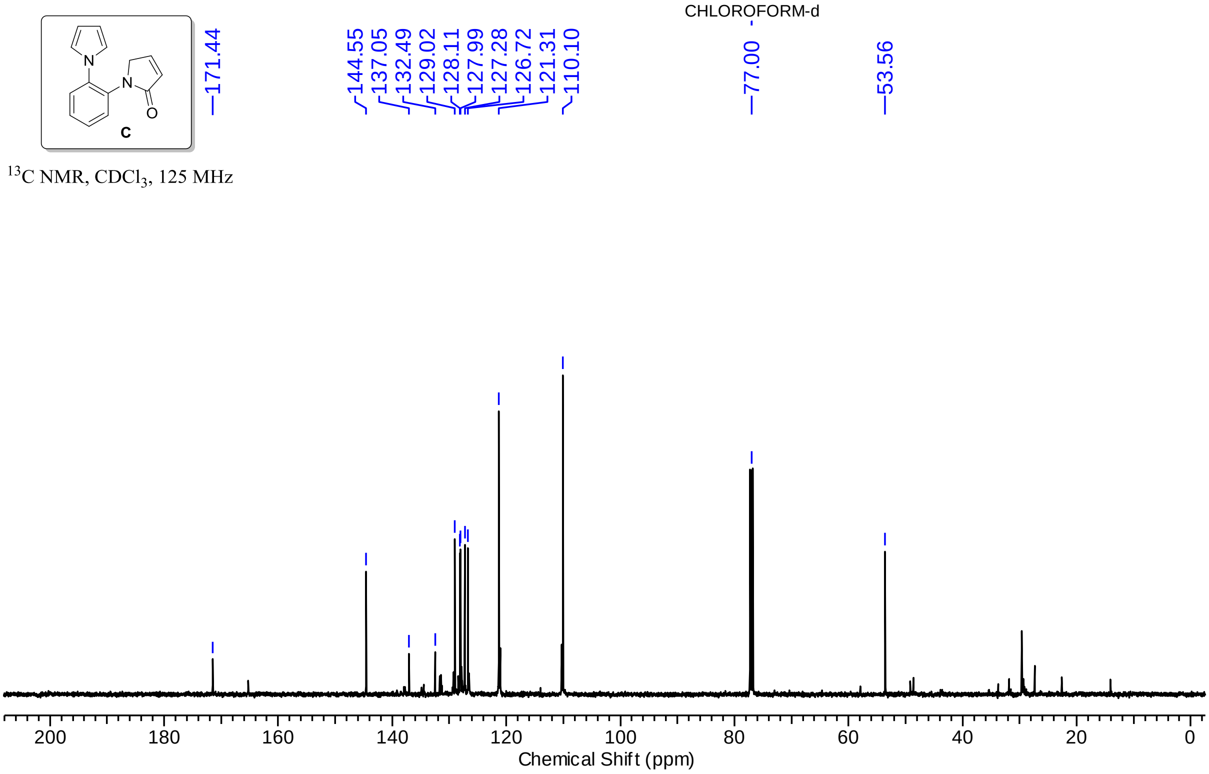
[1]H NMR, $CDCl_3$, 400 MHz



[13]C NMR, $CDCl_3$, 50 MHz



^{1}H NMR, $CDCl_3$, 500 MHz



^{13}C NMR, $CDCl_3$, 125 MHz

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