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Tin (II) chloride dihydrate/choline chloride deep eutectic solvent: redox properties in the efficient synthesis of N-arylacetamides and indolo(pyrrolo)[1,2-*a*]quinoxalines

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General Information

All the chemicals and solvents were purchased from commercial suppliers (Aldrich, Merck). Melting points, reported without correction, were measured using a Stuart SMP10 apparatus. The FT-IR spectra were obtained with a Shimadzu IR prestige 21 spectrophotometer (Columbia, MD, USA). ^{1}H and ^{13}C NMR spectra were recorded with a Bruker AVANCE III system operating at 400 MHz, using residual and deuterated solvent peaks of $CDCl_3$ (δH 7.26; δC 77.0) and DMSO (δH 2.50; δC 39.5) as reference standards. Elemental analyses were performed on a Thermo Scientific Flash 2000 CHNS/O analyser and their results agreed with the calculated values. Raman spectra was acquired with Thermo Scientific DXR Raman Microscope, excitation was accomplished by using a single line of 780 nm wavelength from a frequency-stabilized single mode diode laser. The incident power was about 20 mW at the sample point. The density of the DES was measured using a liquid densitometer (Anton Paar DMA4500M). An Abbe type refractometer (model 2WAJ equipped with a sodium D1 line) was used to measure the DES refractive. The conductivity and its temperature dependence were determined using a Jenway 470 portable conductivity/TDS meter calibrated by measuring the conductivities of aqueous solutions of KCl at different concentrations. The variation of the temperature for the determination of the physical properties was done by using a Lauda Alpha water circulator. Cyclic voltammetry was carried out using a Gamry Interface 1000E potentiostat from Gamry Instruments. The electrochemical measurements were performed in a conventional three-electrode cell, with the 0,071 cm^2 Glassy Carbon, the 0.0314 cm^2 Au, the 0.0314 cm^2 Pt, and 0.0314 cm^2 Sn disks as the working electrodes, Ag/AgCl as the reference electrode, and Pt wire as the counter electrode. The working electrodes were polished with 1 and 0.3 μm γ-alumina paste, rinsed and sonicated for two minutes with deionized water, and dried prior to all measurements. The experiments were performed at 60 °C using a scan rate of 100 mV s^{-1}.

*General procedure for preparation of 1-(2-nitrophenyl)pyrrole (**17**)*: A mixture of *o*-nitroaniline (5.00 mmol) and 2,5-dimethoxytetrahydrofuran (5.00 mmol) in acetic acid (10 ml) was refluxed for 3 h with vigorous stirring. The solvent was distilled under reduced pressure and the reaction mixture was neutralized with Na_2CO_3, extracted with ethyl acetate, dried over Na_2SO_4 and evaporated to dryness under reduced pressure. The residue was purified by flash column chromatography (petroleum ether/ethyl acetate) to give the product.

*General procedure for preparation of 1-(2-Nitrophenyl)-1H-indole (**18**)*: To a well-stirred solution of indole (5.0 mmol) in DMSO (15 ml), NaOH (1.0 equiv.) and 1-fluoro-2-nitrobenzene (5.0 mmol) were added slowly. The reaction mixture was stirred vigorously for

3 h at room temperature until no more starting material was detectable (TLC analysis). Then water was added, and reaction mixture was extracted with ethyl acetate and dried with Na_2SO_4. The solvent was evaporated in vacuo and the resulting solid was purified by column chromatography (petroleum ether/ethyl acetate) on silica gel to afford the target compound.

*General procedure for preparation of 2-(1H-pyrrol-1-yl)aniline (**19**)*: to a solution of 1-(2-nitrophenyl)-1H-pyrrole 17 (3.76 g, 20 mmol) in EtOH (80 mL) was added $CuSO_4 \cdot 5H_2O$ (6.24 g, 25 mmol). $NaBH_4$ (1.51 g, 40 mmol) was then added portionwise at 0 °C and the reaction mixture was stirred at room temperature for 1 h. The mixture was filtered through a short pad of silica gel using EtOAc (3 × 40 mL) as eluent. The solvent was evaporated in vacuo and the residue was subjected to flash chromatography (petroleum ether/EtOAc, 20:1) to afford 2-(1*H*-pyrrol-1-yl)aniline (**19**).

*Synthetic procedure for the synthesis of 4-phenyl-4,5-dihydropyrrolo[1,2-a]quinoxaline (**20**)*: A solution of 2-(1*H*-pyrrol-1-yl)aniline **19** (158.2 mg, 1.0 mmol) and benzaldehyde (106 mg, 102 µL, 1.0 mmol), in ethanol (2 ml) and hydrochloric acid (5 drops) was heated to reflux during 20 minutes. After complete reaction (TLC), the solvent was evaporated and the resulting solid was recrystallized from ethanol affording the target compound.

Spectral Data for compounds

Aniline (1a)[1]: light yellow liquid. Yield: 96 %. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm) 7.20 (t, J = 7.5 Hz, 2H), 6.81 (t, J = 7.5 Hz, 1H), 6.71 (d, 2H, J = 7.5 Hz), 3.65 (brs, 2H, -NH_2). ^{13}C NMR: (100 MHz, $CDCl_3$, 25 °C): δ (ppm) 146.4, 129.3, 118.6, 115.1.

***o*-Aminophenol (2a)[2]:** brown solid, mp. 172-175 °C. Yield: 94 %. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 8.93 (s, 1H), 6.63 (dd, J = 7.7, 1.3 Hz, 1H), 6.55 (dtd, J = 9.1, 7.7, 1.6 Hz, 2H), 6.45–6.32 (m, 1H), 4.46 (s, 2H, -NH_2) ppm. ^{13}C NMR (100 MHz, DMSO-d_6) δ (ppm) : 143.9, 136.4, 119.4, 116.3, 114.3, 114.3.

***p*-Aminophenol (3a)[3]:** beige solid, mp. 187-189 °C. Yield: 93 %. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 8.49 (brs,1H), 6.50 (d, J = 8.8, 2H), 6.43 (d, J = 8.8, 2H), 4.38 (br s, 2H-NH_2). ^{13}C NMR (100 MHz, DMSO-d_6) δ (ppm): 148.7, 141.1, 116.2, 115.7.

***o*-Phenylenediamine (4a)[4]:** light brown solid, mp. 100-102 °C. Yield: 96 % from compound **4** and 94 % from compound **7**. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 6.6-6.56 (m, 2H), 6.48-6.45 (m, 2H), 4.40 (brs, 4H, -NH_2); ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 134.3, 117, 114.2.

***m*-Phenylenediamine (5a)[1]:** grey solid, mp. 65-67 °C. Yield: 95 % from compound **5** and 93 % from compound **8**. ^{1}H NMR (400 MHz, $CDCl_3$, 25 °C) δ (ppm): 7.58 (d, J = 8 Hz, 1H), 7.48 (s, 1H), 7.28 (t, J = 7.6 Hz, 1H), 3.99 (brs, 2H, -NH_2). ^{13}C NMR (100 MHz, $CDCl_3$, 25 °C) δ (ppm): 147.6, 130.2, 106.07, 102.0.

***p*-Phenylenediamine (6a)[1]:** brown solid, mp. 140-144 °C. Yield: 96 % from compound **6** and 94 % from compound **9**. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 6.57 (s, 4H), 3.33 (brs, 4H, -NH_2). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 138.7, 116.8.

***o*-Toluidine (10a)[3]:** light yellow liquid. Yield 97 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.17 (t, J = 7.3 Hz, 2H), 6.84 (t, J = 7.3 Hz, 1H), 6.77 (t, J = 7.40 Hz, 1H), 3.62 (brs, 2H, -NH_2),

2.27 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 144.7, 130.5, 127.1, 122.4, 118.8, 115.1, 17.4.

***m*-Toluidine (11a)[3]:** light yellow liquid. Yield 96 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.07 (t, J = 7.6 Hz, 1H), 6.61 (d, J = 7.4 Hz, 1H), 6.55 (s, 2H), 3.64 (brs, 2H, -NH_2), 2.29 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 146.3, 139.1, 129.2, 119.6, 116.1, 112.5, 21.6.

***p*-Toluidine (12a)[1]:** white solid, mp. 41-43 ^{o}C. Yield 94 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.04 (d, J = 7.5 Hz, 2H), 6.67 (d, J= 6.7 Hz, 2H), 3.56 (s, 2H, -NH_2), 2.32 (s, 3H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 143.9, 129.8, 127.8, 115.3, 20.5.

***p*-Chloroaniline (13a)[1]:** white solid, mp. 73-75 ^{o}C. Yield 95 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.11 (d, J = 7.5 Hz, 2H), 6.61 (d, J = 7.5 Hz, 2H), 3.62 (brs, 2H, -NH_2). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 145.0, 129.2, 123.2, 116.3.

***p*-Bromoaniline (14a)[1]:** beige solid, mp. 62-64 ^{o}C. Yield: 98 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.26 (d, J = 7.0 Hz, 2H), 6.58 (d, J = 7.1 Hz, 2H), 3.54 (brs, 2H, -NH_2). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 145.6, 132.1, 116.8, 110.2.

***p*-Aminoacetophenone (15a)[4]:** light yellow solid, mp. 104-106 ^{o}C. Yield: 93 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.84-7.78 (m, 2H), 6.68-6.62 (m, 2H), 4.11 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 196.6. 151.0, 131.0, 127.9, 113.7, 26.1.

Methyl 4-aminobenzoate (16a)[5]: light yellow solid, mp. 109-111 ^{o}C. Yield: 90 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.85 (d, J = 7.5 Hz, 2H), 6.64 (d, J = 7.5 Hz, 2H), 4.09 (s, 2H), 3.85 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 167.3, 150.9, 131.7, 119.9, 113.9, 51.8.

N-phenylacetamide (1b)[6]: light yellow solid, mp. 112-114 ^{o}C. Yield: 92 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.24 (brs, 1H), 7.54 (d, J = 7.2 Hz, 2H), 7.32–7.28 (m, 2H), 7.12–7.08

(m, 1H), 2.16 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 169.1, 138.1, 128.9, 124.2, 120.2, 24.4.

2-Acetamidophenyl acetate (2b)[7]: white solid, mp. 123-125 °C. Yield 70 %. ^{1}H NMR ($CDCl_3$, 400 MHz) δ (ppm): 8.11 (d, J = 7.6 Hz, 1H), 7.39 (brs, 1H), 7.22–7.25 (m, 1H), 7.14–7.17 (m, 2H), 2.36 (s, 3H), 2.16 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz) δ (ppm): 167.9, 167.0, 140.5, 130.7, 125.9, 123.9, 120.7, 117.8, 22.7, 20.6.

4-Acetamidophenyl acetate (3b)[8]: white solid, mp. 150-152 °C. Yield 89 %. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 10.00 (s, NH), 7.59 (d, J = 7.1 Hz, 2H), 7.04 (d, J = 7.1 Hz, 2H), 2.26 (s, 3H, CH_3), 1.98 (s, 3H). ^{13}C NMR (100 MHz, DMSO-d_6) δ (ppm): 169.3, 168.5, 145.6, 136.9, 121.9, 119.8, 23.7, 20.8.

N,N'-(1,3-Phenylene)diacetamide (8b)[9]: white solid, m.p. 197-199 °C. Yield 88 %. ^{1}H NMR (400 MHz, DMSO-d_6) δ: 9.88 (brs, 2H, NH), 7.86 (s, 1H), 7.26-7.24 (d, J 8.3 Hz, 2H), 7.18-7.12 (m, 1H), 2.02 (s, 6H). ^{13}C NMR (100 MHz, DMSO-d_6) δ: 168.7,140.7, 129.2, 114.2, 110.2, 24.4.

N,N'-(1,4-Phenylene)diacetamide (9b)[6]: gray solid, mp. > 300 °C. Yield 91 %. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 9.82 (s, 2H, NH), 7.46 (s, 4H), 1.98 (s, 6H). ^{13}C NMR (100 MHz, DMSO-d_6) δ (ppm): 169.4, 134.7, 121.9, 23.8.

N-(*o*-Tolyl)acetamide (10b)[10]: Colorless solid, mp. 108-110 °C. Yield 87 % ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.64–7.62 (m, 1H), 7.38 (br s, 1H), 7.17–7.15 (m, 2H), 7.09–7.05 (m, 1H), 2.22 (s, 3H), 2.15 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 168.7, 135.6, 130.4, 130.0, 126.5, 125.4, 123.9, 23.9, 17.7.

N-(*m*-Tolyl)acetamide (11b)[11]: white solid, mp. 67-69 °C. Yield: 89 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.96 (br s, 1H), 7.36 (s, 1H), 7.31–7.29 (m, 1H), 7.19–7.16 (m, 1H), 6.92–

6.91 (m, 1H), 2.30 (s, 3H), 2.15 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 168.8, 138.7, 137.8, 128.6, 125.0, 120.7, 117.1, 24.4, 21.4.

N-(*p*-Tolyl)acetamide (12b)[11]: Colorless solid, mp. 151-153 °C. Yield: 93 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.67 (br s, 1H), 7.38 (d, J = 8.4 Hz, 2H), 7.23 (d, J = 8.4 Hz, 2H), 2.31 (s, 3H), 2.15 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 168.5, 135.4, 133.4, 129.4, 120.1, 24.3, 20.8.

N-(4-Chlorophenyl)acetamide (13b)[11]: white solid. mp. 177-179 °C. Yield: 94 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.47–7.45 (m, 2H), 7.33 (br s, 1H), 7.31–7.27 (m, 2H), 2.18 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 168.3, 136.4, 129.3, 129.0, 121.1, 24.5.

N-(4-Bromophenyl)acetamide (14b)[11]: light beige solid. mp. 166-169 °C. Yield: 92 %. ^{1}H NMR (400 MHz, $CDCl_3$ + DMSO-d_6) δ (ppm): 9.37 (br s, 1H), 7.40 (d, J = 6.3 Hz, 2H), 7.29 (d, J = 6.0 Hz, 2H), 2.05 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$ +DMSO-d_6) δ (ppm): 169.0, 138.1, 131.5, 121.3, 115.6, 24.2.

1-(2-Nitrophenyl)-1*H*-pyrrole (17)[12]: yellow solid, mp. 68-70 °C. Yield 96 %. ^{1}H NMR (400 MHz, $CDCl_3$): δ (ppm): 7.83 (dd, J = 8.4, 1.5 Hz, 1H), 7.69–7.60 (m, 1H), 7.51–7.40 (m, 2H), 6.79 (t, J = 2.2 Hz, 2H), 6.35 (t, J=2.2 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ (ppm): 145.3, 134.2, 133.3, 127.9, 127.7, 124.9, 121.3, 111.1.

4-Phenylpyrrolo[1,2-*a*]quinoxaline (17a)[13]: yellow solid, mp. 116-119 °C. Yield 92 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.11–8.04 (m, 3H), 7.86 (s, 1H), 7.71 (d, J = 2.8 Hz, 1H), 7.59–7.56 (m, 3H), 7.41 (s, 2H), 6.99 (d, J = 4.0 Hz, 1H), 6.82 (d, J = 2.6 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 154.2, 138.4, 136.1, 130.0, 129.8, 128.7, 128.6, 127.4, 127.0, 125.2, 125.2, 114.7, 114.0, 113.6, 108.7. Anal. Calcd for $C_{17}H_{12}N_2$: C, 83.58; H, 4.95; N, 11.47. Found: C, 83.60; H, 4.91; N, 11.49.

4-(4-Methoxyphenyl)pyrrolo[1,2-*a*]quinoxaline (17b)[13]: yellow solid, mp. 106-107 °C. Yield 85 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.06–8.00 (m, 4H), 7.86 (d, J = 8.0 Hz, 1H),

7.52–7.43 (m, 2H), 7.08 (d, J = 8.3 Hz, 2H), 7.03 (d, J = 3.7 Hz, 1H), 6.90 (s, 1H), 3.91 (s, 3H). ^{13}C NMR (100 MHz, CDCl3) δ (ppm): 161.0, 153.9, 136.2, 130.9, 130.1, 129.9, 128.8, 127.2, 127.0, 125.3, 125.2, 114.6, 113.9, 113.6, 108.7, 55.4. Anal. Calcd for $C_{17}H_{12}N_2$: C, 78.81; H, 5.14; N, 10.21; O, 5.83. Found: C, 78.77; H, 5.10; N, 10.19.

4-(4-Isopropylphenyl)pyrrolo[1,2-*a*]quinoxaline (17c): yellow solid, mp. 98-107 °C. Yield 86 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.12 (d, J = 7.5 Hz, 1H), 8.04-8.02 (m, 3H), 7.89 (d, J = 7.3 Hz, 1H), 7.80 (d, J = 3.4 Hz, 1H), 7.57-7.47 (m, 3H), 7.09 (d, J = 3.7 Hz, 1H), 6.94 (d, J = 2.3 Hz, 1H), 3.10–3.07 (m, 1H), 1.40 (s, 3H), 1.39 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 167.7, 150.8, 130.8, 130.2, 128.7, 127.2, 126.7, 121.6, 114.4, 113.8, 108.7, 34.2, 23.9. Anal. Calcd for $C_{20}H_{18}N_2$: C, 83.88; H, 6.34; N, 9.78. Found: C, 83.85; H, 6.36; N, 9.79.

4-(*p*-Tolyl)pyrrolo[1,2-*a*]quinoxaline (17d)[13]: yellow solid, mp. 76-78 °C. Yield 89 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.08 (d, J = 7.5 Hz, 1H), 7.97–7.95 (m, 3H), 7.85 (d, J = 8.5 Hz, 1H), 7.52–7.45 (m, 2H), 7.39 (d, J = 7.9 Hz, 2H), 7.04 (d, J = 3.9 Hz, 1H), 6.91–6.89 (m, 1H), 2.50 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 154.3, 139.9, 136.3, 135.6, 130.0, 129.2, 128.6, 127.3, 127.1, 125.4, 125.2, 114.5, 113.9, 113.6, 109.4, 108.7, 21.5. Anal. Calcd for $C_{18}H_{14}N_2$: C, 83.69; H, 5.46; N, 10.84. Found: C, 83.65; H, 5.49; N, 10.85.

4-(Benzo[d][1,3]dioxol-5-yl)pyrrolo[1,2-*a*]quinoxaline (17e)[13]: yellow solid, mp. 142-144 °C. Yield 84 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm). 8.07 (dd, J = 7.8, 1.2 Hz, 1H), 7.98 (d, J = 1.5 Hz, 1H), 7.86 (d, J = 7.8 Hz, 1H), 7.63 (dd, J = 8.1, 1.4 Hz, 1H), 7.58 (d, J = 1.1 Hz, 1H), 7.48 (dt, J = 15.5, 6.8 Hz, 2H), 7.05 (d, J = 3.3 Hz, 1H), 6.98 (d, J = 8.0 Hz, 1H), 6.92–6.89 (m, 1H), 6.07 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 153.5, 149.1, 147.9, 136.3, 132.7, 130.2, 127.1, 125.2, 125.1, 122.9, 114.3, 113.8, 113.4, 109.2, 108.5, 108.2, 101.3. Anal. Calcd for $C_{18}H_{12}N_2O_2$: C, 74.99; H, 4.20; N, 9.72; O, 11.10. Found: C, 74.96; H, 4.21; N, 9.69.

4-(2-Chlorophenyl)pyrrolo[1,2-*a*]quinoxaline (17f)[14]: brown solid; mp. 110-112 °C. Yield 98 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.07–8.01 (m, 2H), 7.99–7.94 (m, 2H), 7.92–7.87 (m, 1H), 7.54 (d, J = 8.2 Hz, 3H), 7.51–7.46 (m, 1H), 6.98 (d, J = 3.8 Hz, 1H), 6.93 (d, J =

2.3 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 153.1, 136.8, 136.0, 135.9, 130.1, 130.0, 128.8, 127.7, 127.1, 125.4, 125.0, 114.8, 114.1, 113.6, 108.5. Anal. Calcd for $C_{17}H_{11}ClN_2$: C, 73.25; H, 3.98; Cl, 12.72; N, 10.05. Found: C, 73.22; H, 3.94; N, 10.01.

4-(4-Chlorophenyl)pyrrolo[1,2-*a*]quinoxaline (17g)[13]: yellow solid, mp. 110-113 °C. Yield 75 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.10–7.97 (m, 4H), 7.88 (d, J = 8.0 Hz, 1H), 7.58–7.53 (m, 3H), 7.51–7.47 (m, 1H), 7.03 (d, J = 1.3 Hz, 1H), 6.91 (d, J = 1.7 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 153.0, 136.7, 135.9, 135.8, 130.0, 129.9, 128.7, 127.6, 127.0, 125.3, 124.9, 114.7, 114.0, 113.5, 108.4. Anal. Calcd for $C_{17}H_{11}ClN_2$: C, 73.25; H, 3.98; Cl, 12.72; N, 10.05. Found: C, 73.23; H, 3.95; N, 10.03.

4-(4-Bromophenyl)pyrrolo[1,2-*a*]quinoxaline (17h)[13]: yellow solid, mp. 105-108 °C. Yield 87 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.04 (d, J = 7.9 Hz, 1H), 8.00 (s, 1H), 7.91 (d, J = 8.3 Hz, 2H), 7.86 (d, J = 8.1 Hz, 1H), 7.69 (d, J = 8.2 Hz, 2H), 7.53 (t, J = 7.6 Hz, 1H), 7.46 (t, J = 7.3 Hz, 1H), 6.97 (d, J = 3.0 Hz, 1H), 6.91 (d, J = 1.7 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 153.1, 137.3, 136.0, 131.7, 130.2, 130.1, 127.7, 127.1, 125.4, 125.0, 124.2, 114.8, 114.1, 113.7, 108.5. Anal. Calcd for $C_{17}H_{11}BrN_2$: C, 63.18; H, 3.43; Br, 24.72; N, 8.67. Found: C, 63.16; H, 3.40; N, 8.63.

2-(Pyrrolo[1,2-*a*]quinoxalin-4-yl)phenol (17i)[14]: brown solid, mp. 154-156 °C. Yield 89 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.21 (d, J = 7.9 Hz, 1H), 7.99 (s, 1H), 7.86 (d, J = 7.9 Hz, 1H), 7.83 (d, J = 8.2 Hz, 1H), 7.50 (t, J = 7.5 Hz, 1H), 7.43 (t, J = 7.2 Hz, 2H), 7.35 (d, J = 3.9 Hz, 1H), 7.16 (d, J = 8.1 Hz, 1H), 7.02 (t, J = 7.6 Hz, 1H), 6.96 – 6.93 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 160.1, 153.5, 133.0, 132.0, 129.1, 128.3, 127.8, 126.9, 125.5, 123.6 119.2, 118.6, 118.2, 115.5, 114.5, 113.7, 110.5. Anal. Calcd for $C_{17}H_{12}N_2O$: C, 78.44; H, 4.65; N, 10.76; O, 6.15. Found: C, 78.42; H, 4.62; N, 10.72.

4-(Pyridin-2-yl)pyrrolo[1,2-a]quinoxaline (17j)[13]: yellow solid, mp. 105-106 °C. Yield 88 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.83 (d, J = 4.3 Hz, 1H), 8.44 (d, J = 7.9 Hz, 1H), 8.08 (d, J = 7.9 Hz, 1H), 8.01 (s, 1H), 7.92–7.83 (m, 2H), 7.77 (d, J = 3.1 Hz, 1H), 7.53 (t, J = 7.6 Hz, 1H), 7.48 (d, J = 7.5 Hz, 1H), 7.42 (dd, J = 6.8, 5.3 Hz, 1H), 6.99 – 6.95 (m, 1H).

^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm) 156.4, 151.2, 148.9, 136.6, 135.7, 130.4, 128.0, 127.6, 125.1, 124.7, 124.2, 123.4, 114.4, 114.3, 113.7, 110.6, 109.3. Anal. Calcd for $C_{16}H_{11}N_3$: C, 78.35; H, 4.52; N, 17.13. Found: C, 78.33; H, 4.51; N, 17.16.

4-Nonylpyrrolo[1,2-*a*]quinoxaline (17k)[15]: ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.98 (d, J = 7.3 Hz, 1H), 7.90 (s, 1H), 7.82 (d, J = 7.7 Hz, 1H), 7.49–7.42 (m, 2H), 6.82 (m, 2H), 3.11–2.99 (m, 2H), 2.03–1.84 (m, 2H), 1.52 (m, 5H), 0.94 (s, 10H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 157.6, 136.0, 129.3, 128.5, 127.1, 126.8, 125.0, 114.1, 113.6, 113.4, 109.4, 106.3, 35.9, 31.9, 29.8, 29.5, 29.3, 28.6, 22.7, 14.1. Anal. Calcd for $C_{20}H_{26}N_2$: C, 81.58; H, 8.90; N, 9.51. Found: C, 81.55; H, 8.91; N, 9.53.

1-(2-Nitrophenyl)-1*H*-indole (18)[16]: Yellow solid, mp. 94-95 ^{o}C. Yield 98 %. ^{1}H NMR (400 MHz $CDCl_3$) δ (ppm): 8.04 (dd, J = 8.1, 1.5 Hz, 1H), 7.71–7.69 (m, 2H), 7.56–7.53 (m, 2H), 7.22–7.19 (m, 4H), 6.76 (dd, J = 3.3, 0.8 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 146.2, 136.7, 133.9, 132.8, 129.8, 129.0, 128.5, 128.1, 125.5, 123.0, 121.3, 121.3, 121.0, 109.6, 105.0.

6-Phenylindolo[1,2-a]quinoxaline (18a)[13]: orange solid, mp. 170-172 ^{o}C. Yield 94 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.56 (d, J = 7.8 Hz, 1H), 8.15–7.96 (m, 2H), 7.60 (d, J = 7.2 Hz, 3H), 7.48 (d, J = 2.4 Hz, 2H), 7.34 (m, 4H), 6.39 (d, J = 1.5 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 172.2, 138.6, 136.5, 135.0, 134.3, 132.8, 131.5, 130.1, 128.6, 128.4, 124.5, 124.2, 122.7, 115.2, 114.6, 107.5. Anal. Calcd for $C_{21}H_{14}N_2$: C, 85.69; H, 4.79; N, 9.52. Found: C, 85.67; H, 4.78; N, 9.55.

6-(4-Methoxyphenyl)indolo[1,2-*a*]quinoxaline (18b)[17]: red solid, mp. 165-167 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.49 (dd, J = 15.8, 10.0 Hz, 1H), 8.14 (d, J = 8.5 Hz, 1H), 7.86 (d, J = 8.5 Hz, 1H), 7.71 (d, J = 6.4 Hz, 1H), 7.64 (d, J = 8.7 Hz, 1H), 7.58 (m, 1H), 7.15 (d, J = 8.7 Hz, 2H), 7.03 (d, J = 8.4 Hz, 3H), 6.70 (d, J = 1.4 Hz, 1H), 3.91 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 172.9, 163.0, 134.3, 133.6, 131.9, 131.4, 129.9, 129.4, 128.8, 127.5, 127.1, 125.2, 123.6, 123.5, 120.8, 115.0, 114.7, 114.4, 114.0, 55.5. Anal. Calcd for $C_{22}H_{16}N_2O$: C, 81.46; H, 4.97; N, 8.64; O, 4.93. Found: C, 81.45; H, 4.95; N, 8.65.

6-(4-Isopropylphenyl)indolo[1,2-*a*]quinoxaline (18c): yellow solid, mp. 163-165 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.53 (t, J = 8.8 Hz, 2H), 8.09 (d, J = 1.5 Hz, 1H), 7.95 (t, J = 8.2 Hz, 3H), 7.58 (d, J = 8.4 Hz, 1H), 7.47–7.42 (m, 4H), 7.29 (s, 1H), 6.46 (d, J = 1.4 Hz, 1H), 3.04 (dt, J = 13.7, 7.0 Hz, 1H), 1.34 (d, J = 6.9 Hz, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 176.5, 151.5, 139.3, 136.4, 135.9, 135.5, 134.3, 133.7, 133.1, 130.5, 128.6, 128.1, 126.7, 124.2, 122.7, 122.6, 120.4, 114.6, 102.5, 34.1, 23.9. Anal. Calcd for $C_{24}H_{20}N_2$: C, 85.68; H, 5.99; N, 8.33. Found: C, 85.67; H, 5.98; N, 8.35.

6-(*p*-Tolyl)indolo[1,2-*a*]quinoxaline (18d)[17]: yellow solid, mp. 158-159 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.48 (t, J = 8.6 Hz, 2H), 8.12 (d, J = 7.9 Hz, 1H), 7.99 (d, J = 8.0 Hz, 2H), 7.94 (d, J = 7.9 Hz, 1H), 7.63–7.54 (m, 3H), 7.44 (d, J = 7.6 Hz, 3H), 6.45 (d, J = 1.5 Hz, 1H), 2.54 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 172.6, 141.7, 137.1, 135.9, 135.6, 134.5, 134.3, 132.3, 131.2, 129.8, 129.4, 129.2, 126.1, 124.8, 124.6, 123.7, 119.7, 114.6, 105.3, 21.1. Anal. Calcd for $C_{22}H_{16}N_2$: C, 85.69; H, 5.23; N, 9.08. Found: C, 85.67; H, 5.21; N, 9.12.

6-(Benzo[d][1,3]dioxol-5-yl)indolo[1,2-*a*]quinoxaline (18e): brown solid, mp. 159-161 °C. ^{1}H NMR (400 MHz, $CDCl^3$) δ (ppm): 8.52 (s, 1H), 8.08 (dd, J = 7.9, 1.4 Hz, 1H), 7.98–7.94 (m, 1H), 7.60 (t, J = 6.6 Hz, 3H), 7.50–7.42 (m, 3H), 7.36 (t, J = 6.1 Hz, 2H), 7.30 (s, 1H), 7.01 (s, 1H), 6.10 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 174.4, 151.1, 149.7, 137.1, 135.9, 134.5, 134.3, 131.2, 130.3, 129.8, 129.4, 127.2, 126.1, 124.8, 124.6, 123.7, 119.7, 114.7, 107.4, 105.3, 102.1. Anal. Calcd for $C_{22}H_{14}N_2O_2$: C, 78.09; H, 4.17; N, 8.28; O, 9.46. Found: C, 78.06; H, 4.15; N, 8.27.

6-(2-Chlorophenyl)indolo[1,2-*a*]quinoxaline (18f): brown solid, mp. 235-237 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.54 (dd, J = 11.5, 8.5 Hz, 2H), 8.10 (d, J = 7.8 Hz, 2H), 7.90 (d, J = 8.1 Hz, 2H), 7.72–7.66 (m, 2H), 7.60 (dd, J = 9.7, 5.1 Hz, 2H), 7.50–7.44 (m, 2H), 6.43 (s, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.1, 147.6, 145.5, 142.5, 139.4, 136.4, 134.1, 130.9, 131.0, 130.5, 130.2, 128.8, 127.0, 124.5, 124.2, 122.8, 114.7, 102.2. Anal. Calcd for $C_{21}H_{13}ClN_2$: C, 76.71; H, 3.99; Cl, 10.78; N, 8.52. Found: C, 76.69; H, 3.97; N, 8.50.

6-(4-Chlorophenyl)indolo[1,2-*a*]quinoxaline (18g)[17]: Yellow solid, mp. 240-242 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.55 (m, 1H), 8.10 (d, J = 8.1 Hz, 1H), 7.99 (dd, J = 10.0, 8.2 Hz, 2H), 7.76–7.60 (m, 1H), 7.58 (dd, J = 10.7, 2.2 Hz, 2H), 7.48 (d, J = 7.6 Hz, 1H), 7.38 (d, J = 7.7 Hz, 1H), 7.24–7.19 (m, 3H), 6.45 (d, J = 1.4 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 167.8, 136.6, 136.1, 133.6, 132.4, 130.9, 130.5, 130.0, 128.9, 128.8, 128.6, 128.3, 125.1, 124.4, 122.8, 121.1, 114.7, 109.4, 105.0, 102.3. Anal. Calcd for $C_{21}H_{13}ClN_2$: C, 76.71; H, 3.99; Cl, 10.78; N, 8.52. Found: C, 76.69; H, 3.96; N, 8.49.

6-(4-Bromophenyl)indolo[1,2-*a*]quinoxaline (18h)[17]: brown solid, mp. 220-222°C. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.58 (m, 2H), 7.95 (d, J = 8.3 Hz, 2H), 7.77–7.70 (m, 2H), 7.51–7.47 (m, 2H), 7.21 (dd, J = 8.2, 5.7 Hz, 4H), 6.32 (s, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 155.0, 137.1, 133.6, 133.1, 132.4, 131.9, 130.9, 130.5, 130.2, 129.1, 128.6, 128.3, 127.9, 125.5, 124.6, 124.3, 122.9, 121.3, 120.9, 114.6, 109.4, 105.0, 102.3. Anal. Calcd for $C_{21}H_{13}BrN_2$: C, 67.58; H, 3.51; Br, 21.41; N, 7.51. Found: C, 67.55; H, 3.50; N, 7.49.

6-(Pyridin-2-yl)indolo[1,2-*a*]quinoxaline (18i)[18]: green solid, mp. 177-179 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.62–8.52 (m, 2H), 8.43 (dd, J = 13.4, 4.8 Hz, 1H), 8.10–8.05 (m, 1H), 7.62 (dd, J = 11.0, 7.1 Hz, 1H), 7.36–7.32 (m, 1H), 7.25–7.14 (m, 3H), 7.09–6.98 (m, 3H), 6.35 (s, 1H). ^{13}C NMR (100 MHz, $CDCl^3$) δ (ppm): 156.9, 155.5, 149.4, 149.0, 148.5, 148.1, 136.4, 132.5, 130.4, 128.6, 124.0, 122.9, 122.4, 121.3, 119.8, 116.8, 111.9, 103.2. Anal. Calcd for $C_{20}H_{13}N_3$: C, 81.34; H, 4.44; N, 14.23. Found: C, 81.33; H, 4.42; N, 14.26.

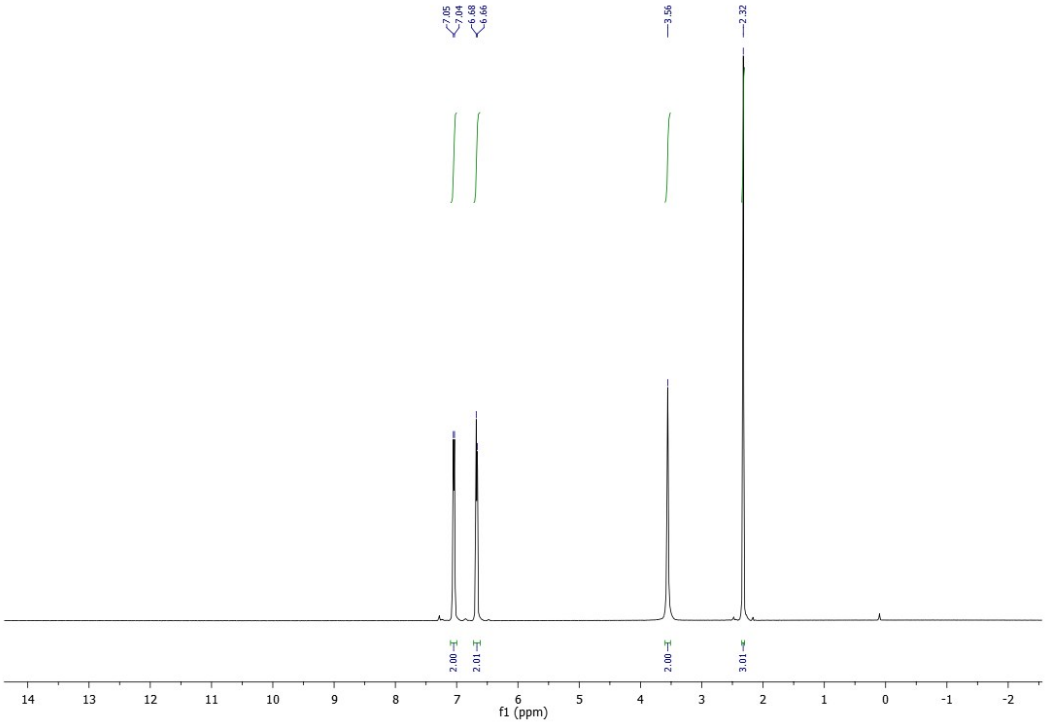
6-Nonylindolo[1,2-*a*]quinoxaline (18j): brown oil. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 8.50 (t, J = 7.9 Hz, 1H), 8.00 (d, J = 8.2 Hz, 2H), 7.62–7.54 (m, 2H), 7.47 (d, J = 7.7 Hz, 1H), 7.25 (d, J = 7.2 Hz, 2H), 6.46 (d, J = 1.4 Hz, 1H), 3.14–3.11 (m, 2H), 2.02–1.94 (m, 2H), 1.31 (s, 12H), 0.95–0.89 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 159.1, 136.0, 134.9, 134.2, 132.9, 129.7, 129.5, 129.0, 127.7, 124.0, 123.9, 122.6, 122.5, 114.6, 99.7, 36.1, 31.8, 30.2, 29.5, 29.2, 28.2, 22.6, 14.0. Anal. Calcd for $C_{24}H_{28}N_2$: C, 83.68; H, 8.19; N, 8.13. Found: C, 83.67; H, 8.18; N, 8.15.

2-(1*H*-Pyrrol-1-yl)aniline (19)[19]: white crystalline solid; mp. 94–95 °C. yield 95 %. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 7.17–7.13 (m, 2H), 6.83–6.78 (m, 4H), 6.34 (d, J = 2.0 Hz, 2H), 3.53 (brs, 2H). ^{13}C NMR (100 MHz, DMSO-d_6) δ (ppm): 137.3, 123.8, 122.8, 122.4, 117.0, 113.7, 111.4, 104.7.

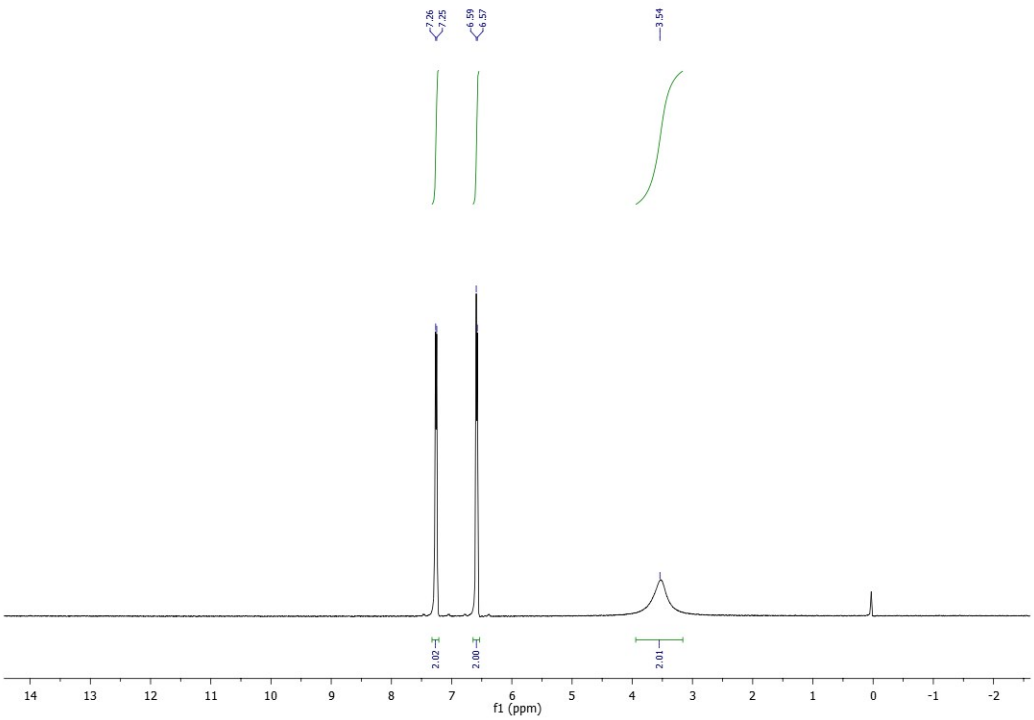
4-Phenyl-4,5-dihydropyrrolo[1,2-*a*]quinoxaline (20)[20]: colorless crystals, mp. 90-91 ^{o}C. Yield 82 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.46-7.32 ppm (m, 6H), 7.20 (dd, J = 3.0, J = 1.5 Hz, Hz, 1H), 6.98 (td, 1 H), 6.86 (td, 1H), 6.73 (dd, 1H), 6.26 (t, J = 3.0 Hz, 1H), 5.60 (dd, J = 2.9, J = 1.5 Hz, 1H), 5.53 (s, 1H), 4.13 (brs, 1H, N-H). ^{13}C NMR (100 MHz, $CDCl_3$) δ (ppm): 141.3, 136.0, 129.8, 128.7, 128.3, 127.8, 125.6, 124.7, 119.5, 115.5, 114.8, 114.4, 110.2, 106.0, 56.2.

Selected NMR Spectra

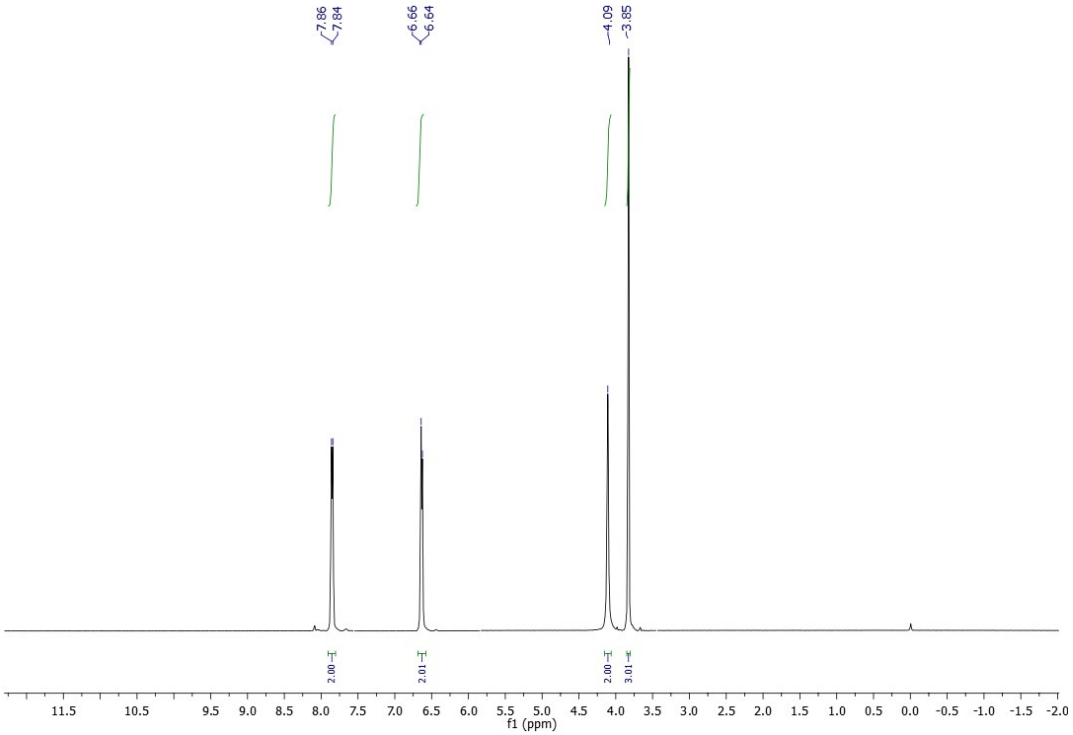
^{1}H NMR spectrum of 4-Methylaniline (**12a**)



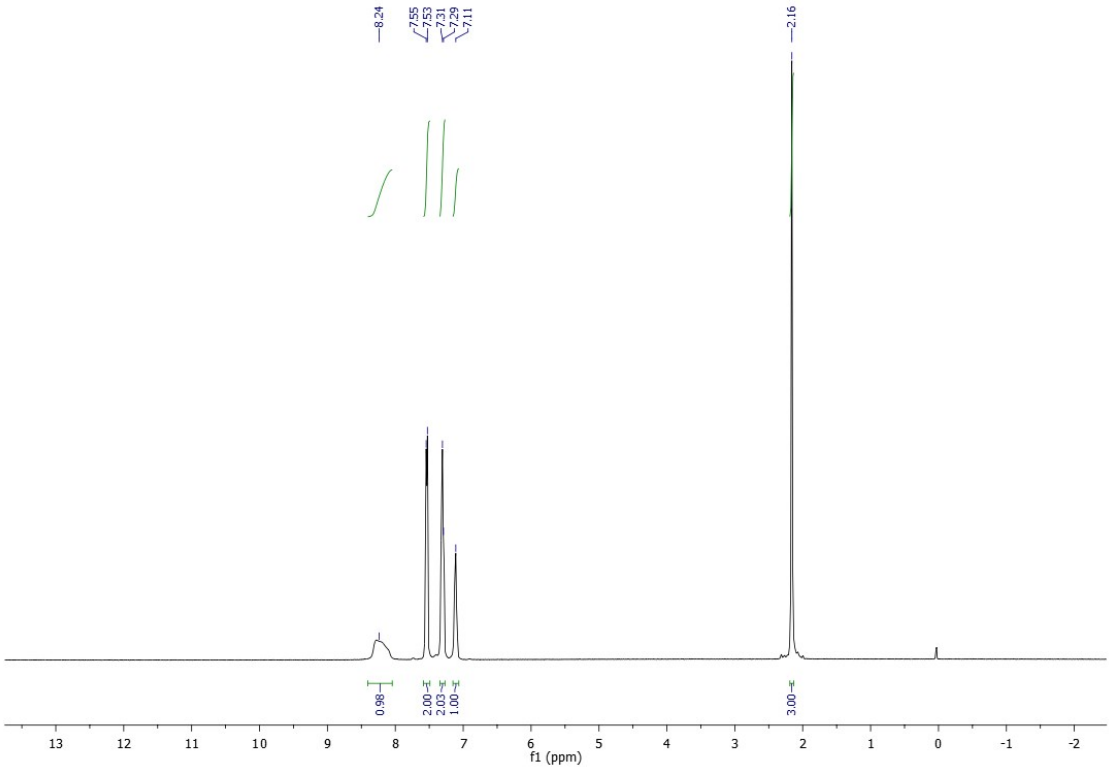
^{1}H NMR spectrum of 4-Bromoaniline (**14a**)



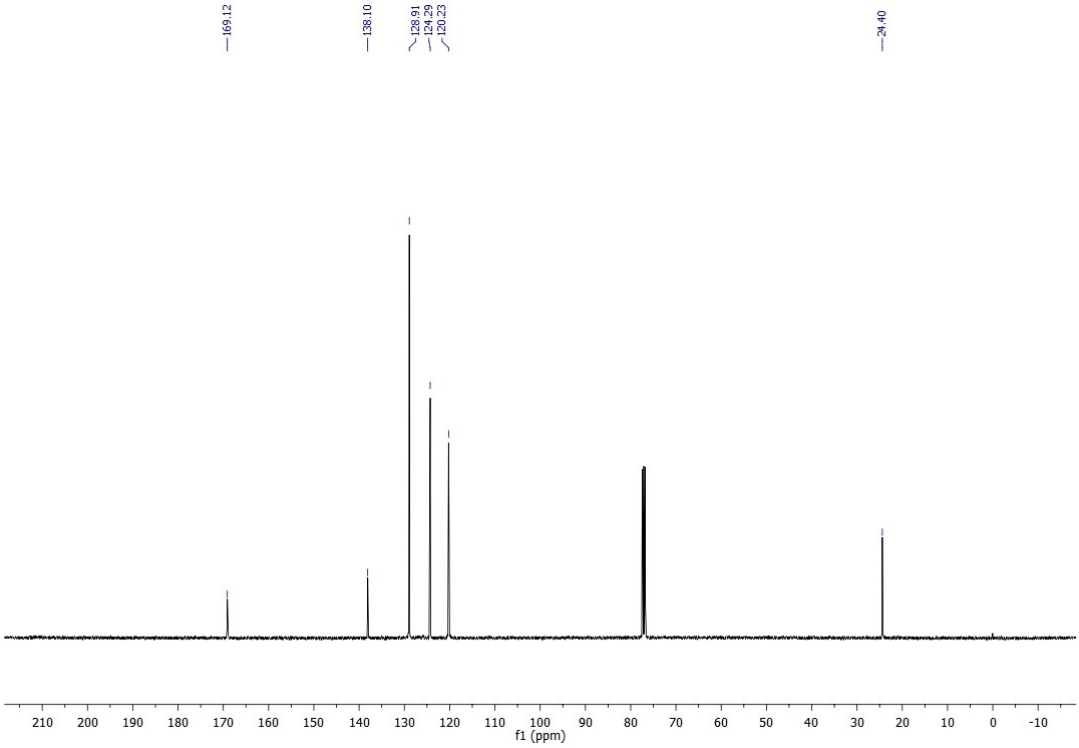
^{1}H NMR spectrum of Methyl 4-aminobenzoate (**16a**)



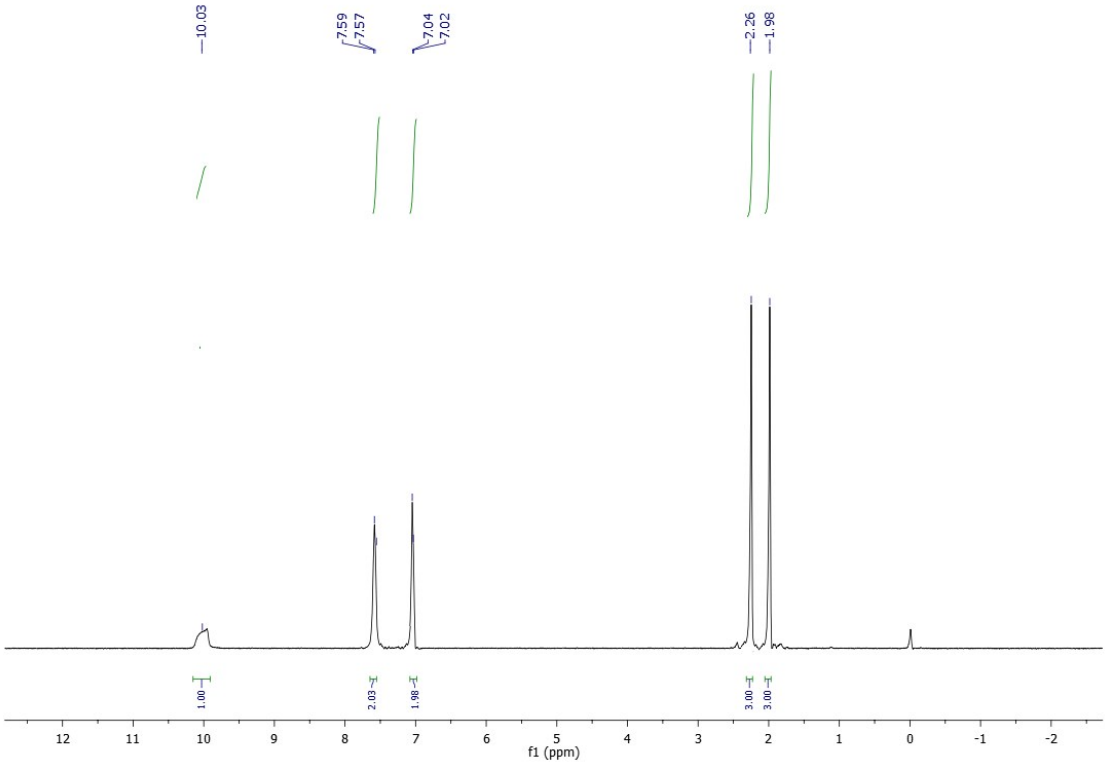
^{1}H NMR spectrum of N-phenylacetamide (**1b**)



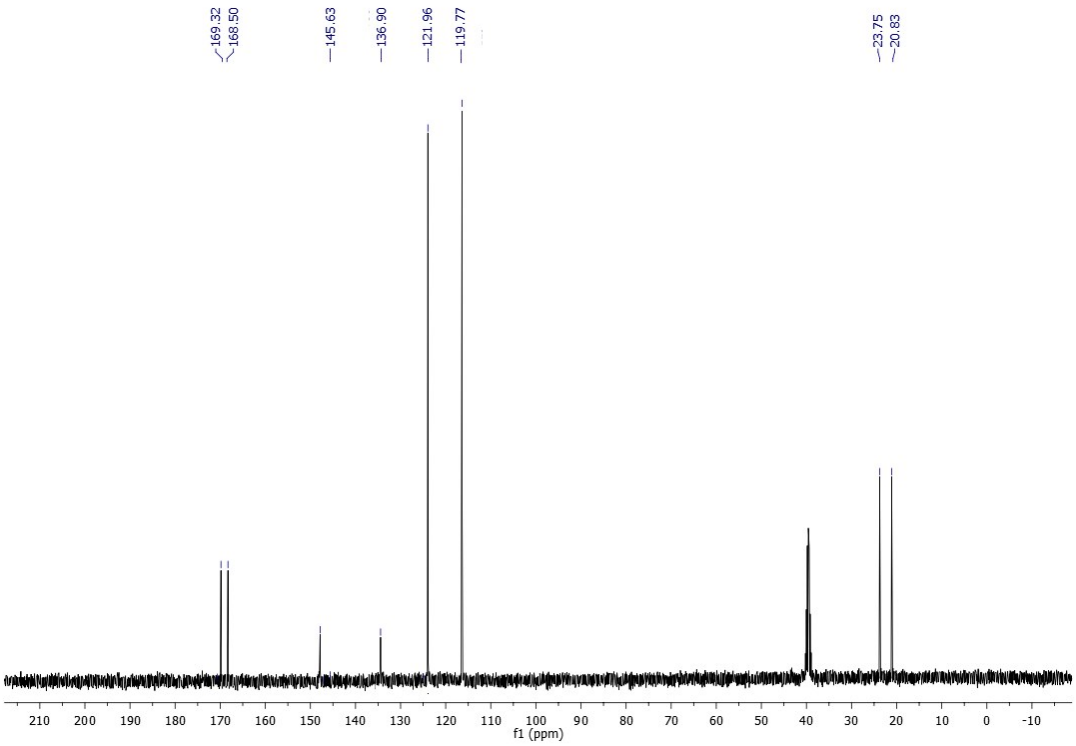
^{13}C NMR spectrum of N-phenylacetamide (**1b**)



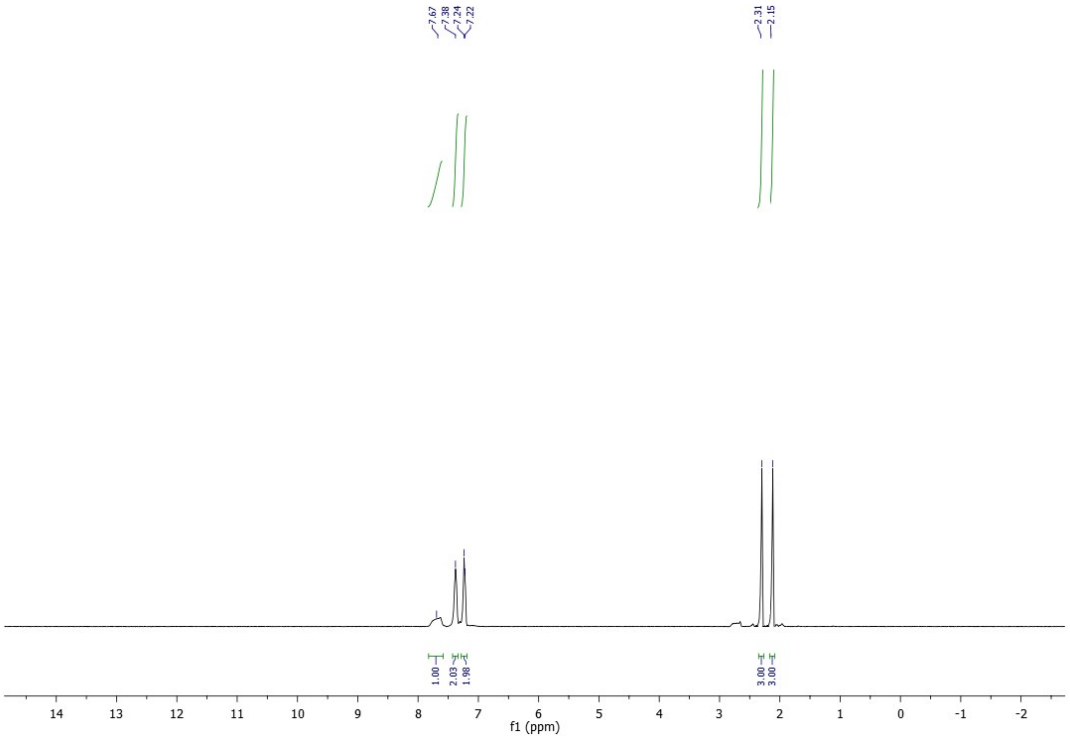
^{1}H NMR spectrum of 4-Acetamidophenyl acetate (**3b**)



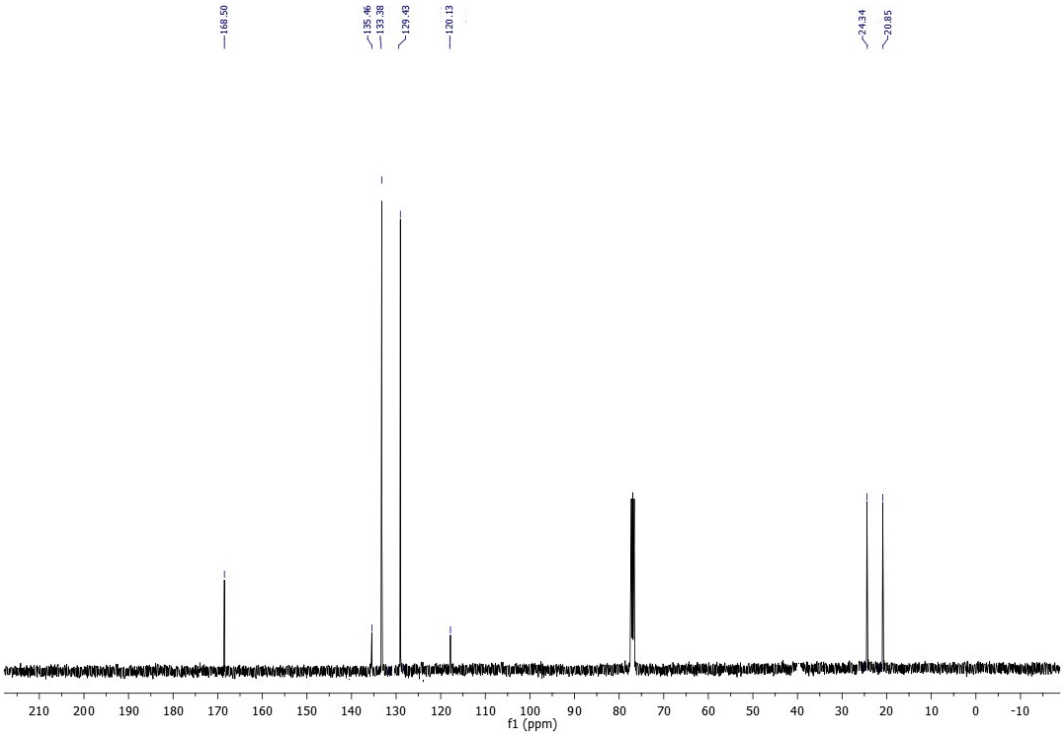
^{13}C NMR spectrum of 4-Acetamidophenyl acetate (**3b**)



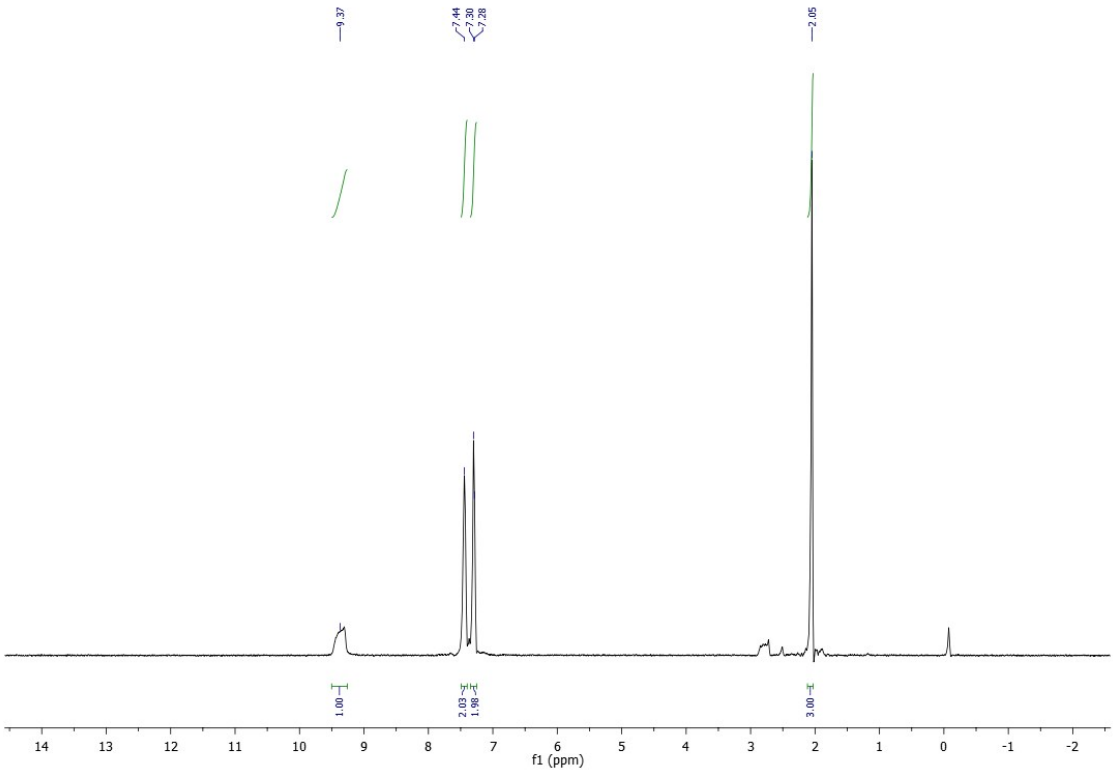
^{1}H NMR spectrum of N-(*p*-Tolyl)acetamide (**12b**)



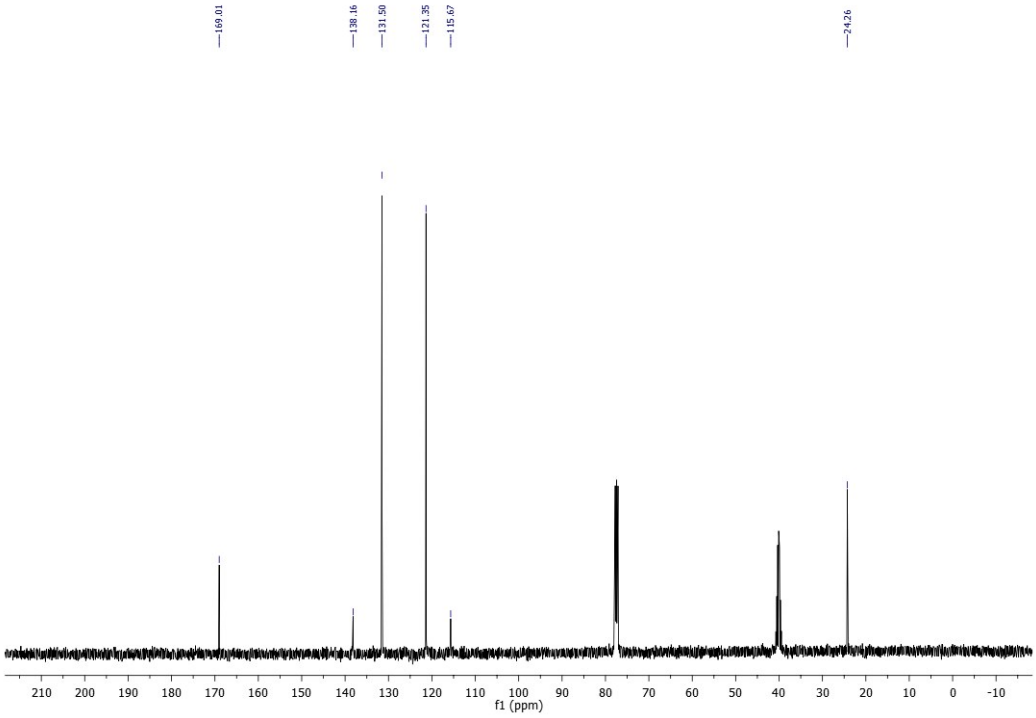
^{13}C NMR spectrum of N-(*p*-Tolyl)acetamide (**12b**)



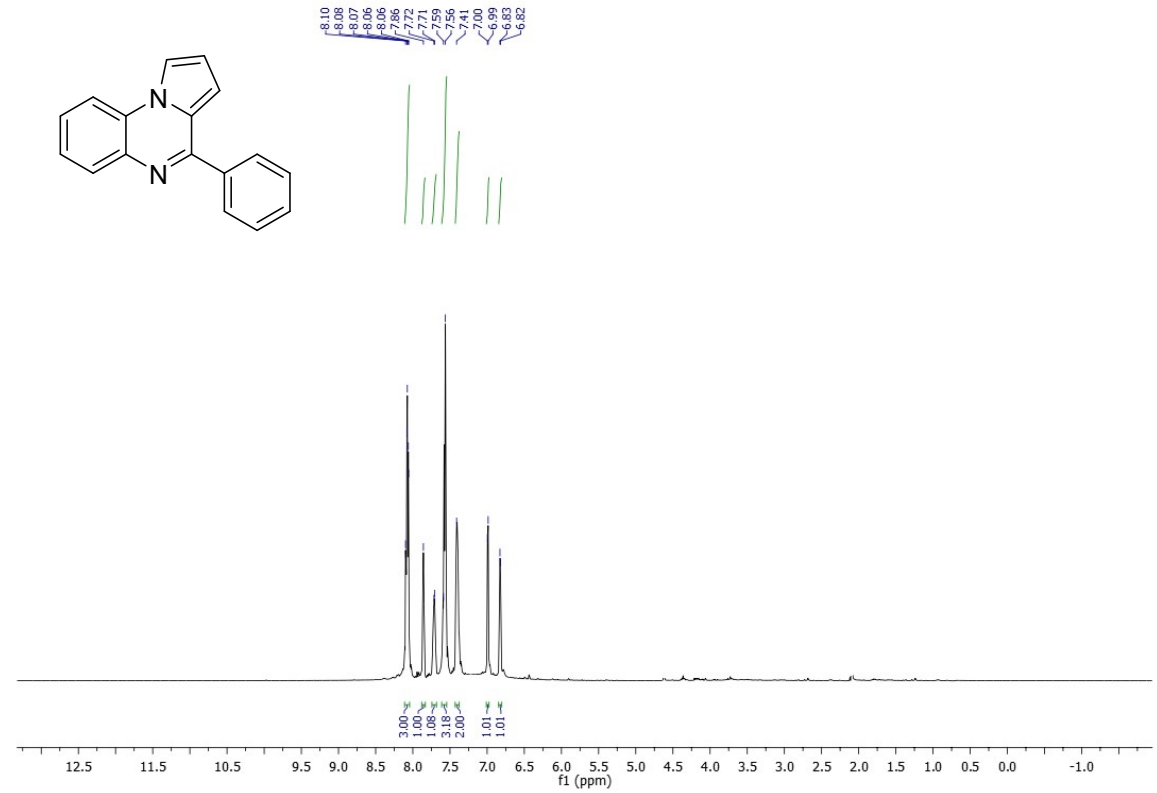
^{1}H NMR spectrum of N-(4-Bromophenyl)acetamide (**14b**)



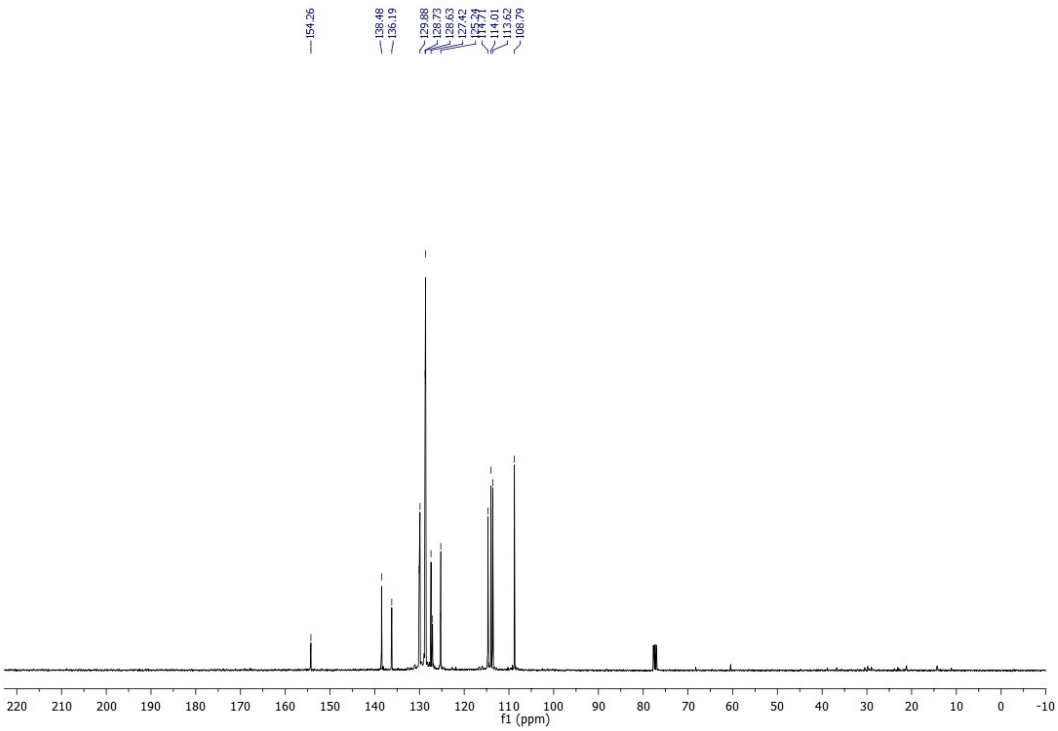
^{13}C NMR spectrum of N-(4-Bromophenyl)acetamide (**14b**)



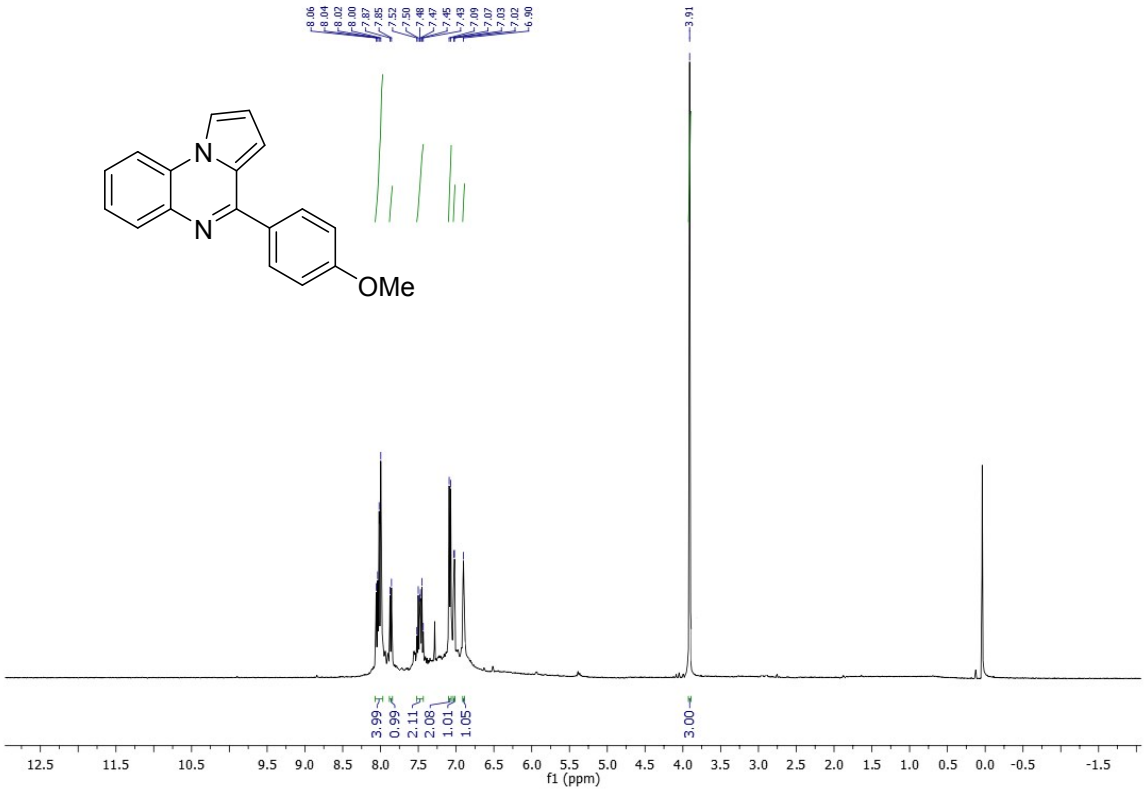
^{1}H NMR spectrum of 4-phenylpyrrolo[1,2-*a*]quinoxaline (**17a**)



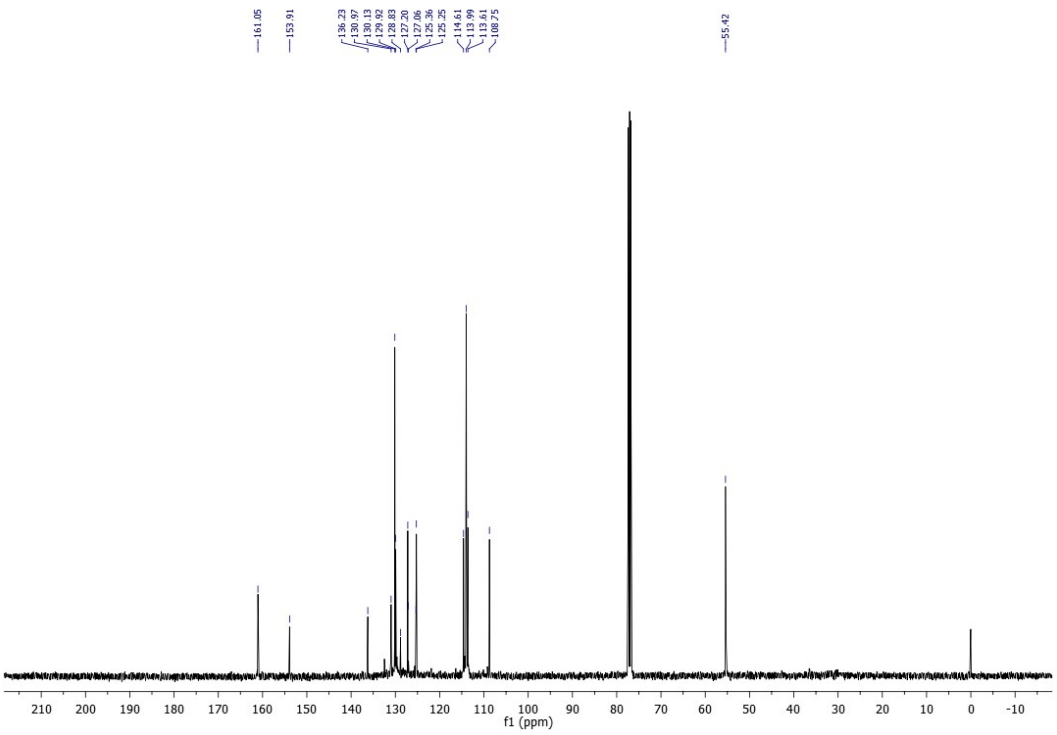
^{13}C NMR spectrum of 4-phenylpyrrolo[1,2-*a*]quinoxaline (**17a**)



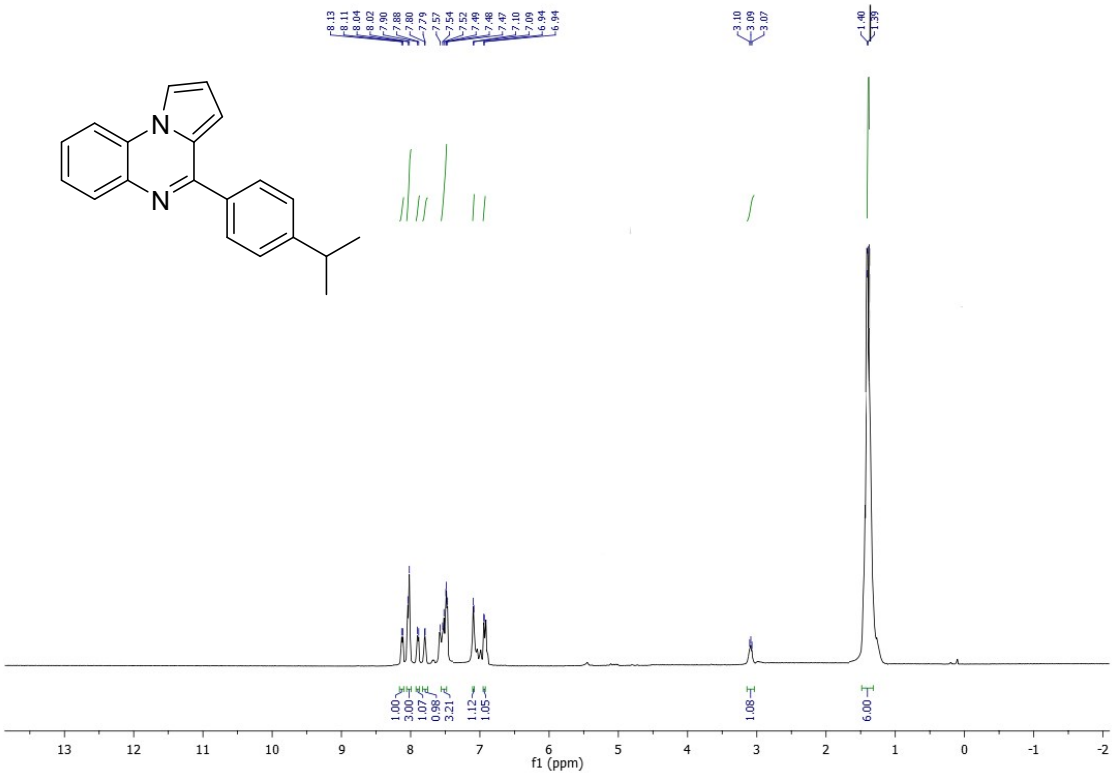
^{1}H NMR spectrum of 4-(4-methoxyphenyl)pyrrolo[1,2-*a*]quinoxaline (**17b**)



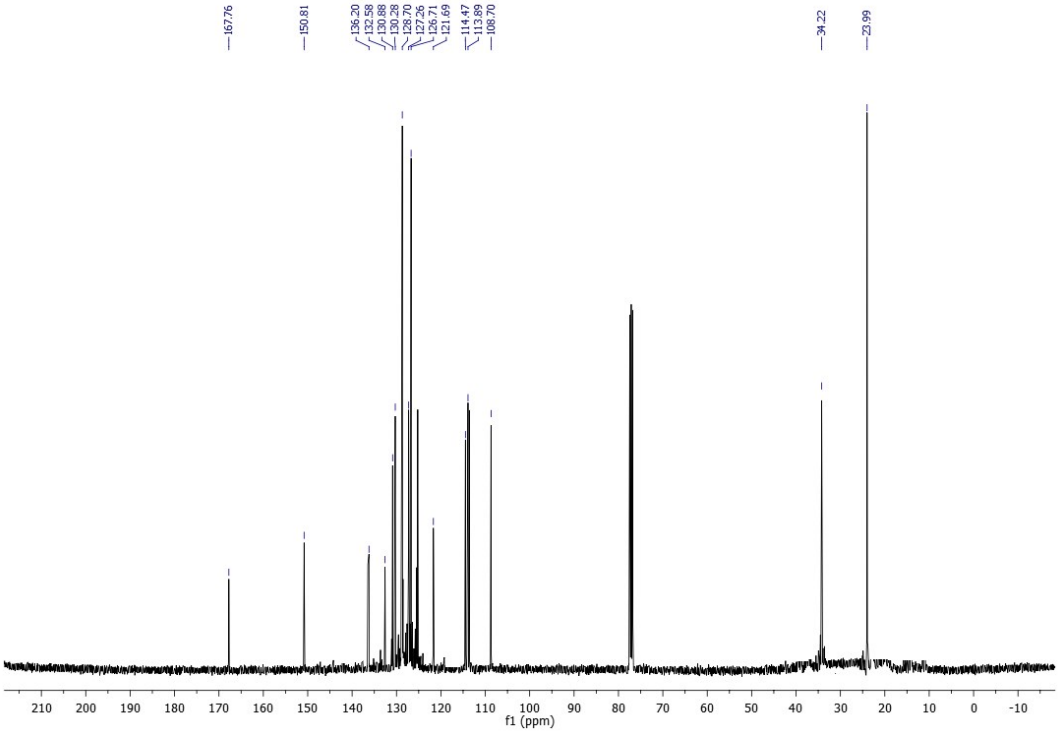
^{13}C NMR spectrum of 4-(4-methoxyphenyl)pyrrolo[1,2-*a*]quinoxaline (**17b**)



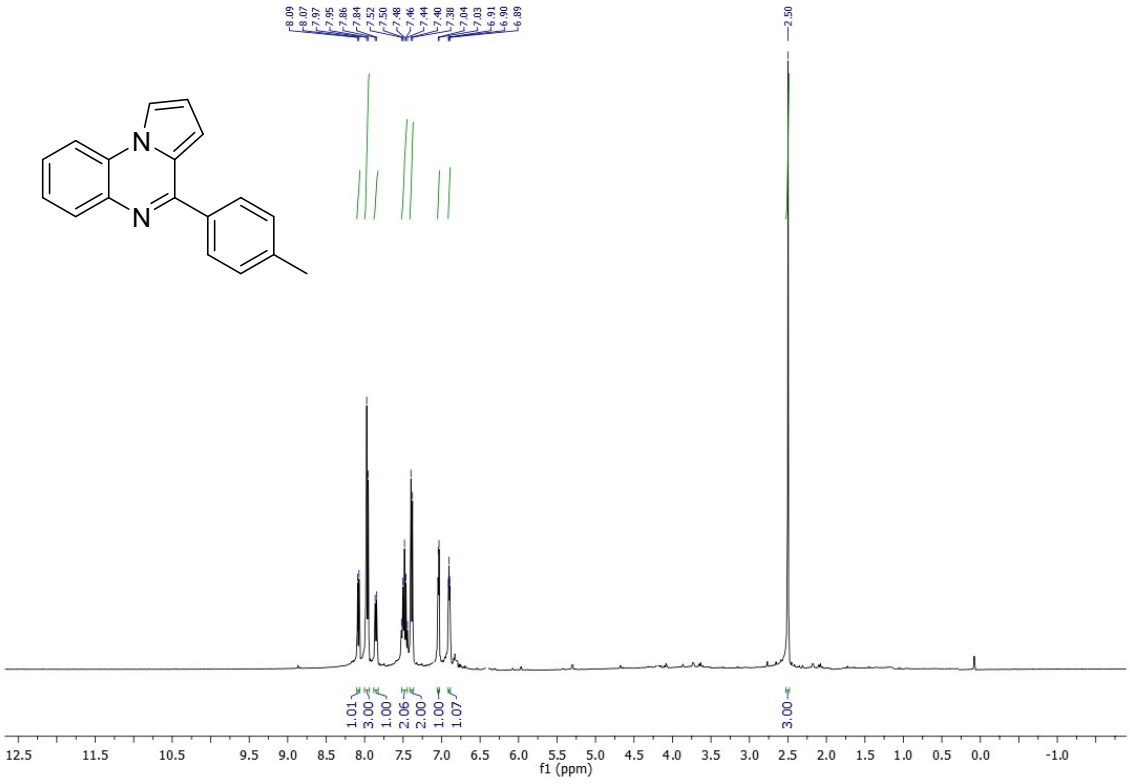
^{1}H NMR spectrum of 4-(4-isopropylphenyl)pyrrolo[1,2-*a*]quinoxaline (**17c**):



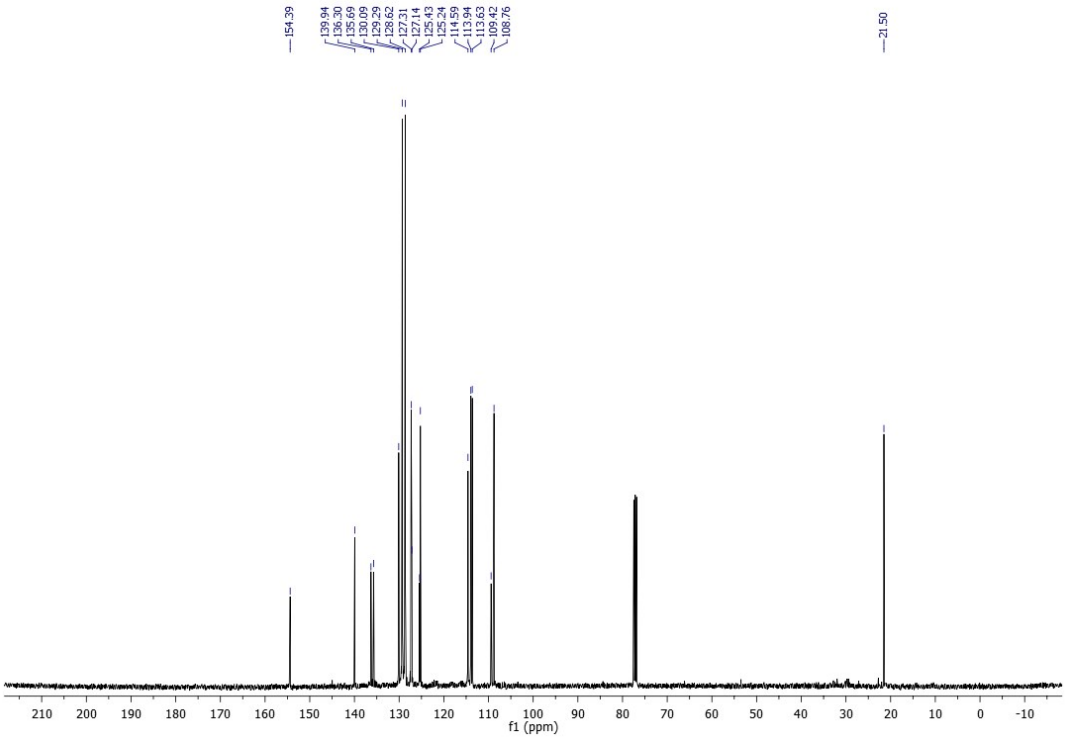
^{13}C NMR spectrum of 4-(4-isopropylphenyl)pyrrolo[1,2-*a*]quinoxaline (**17c**)



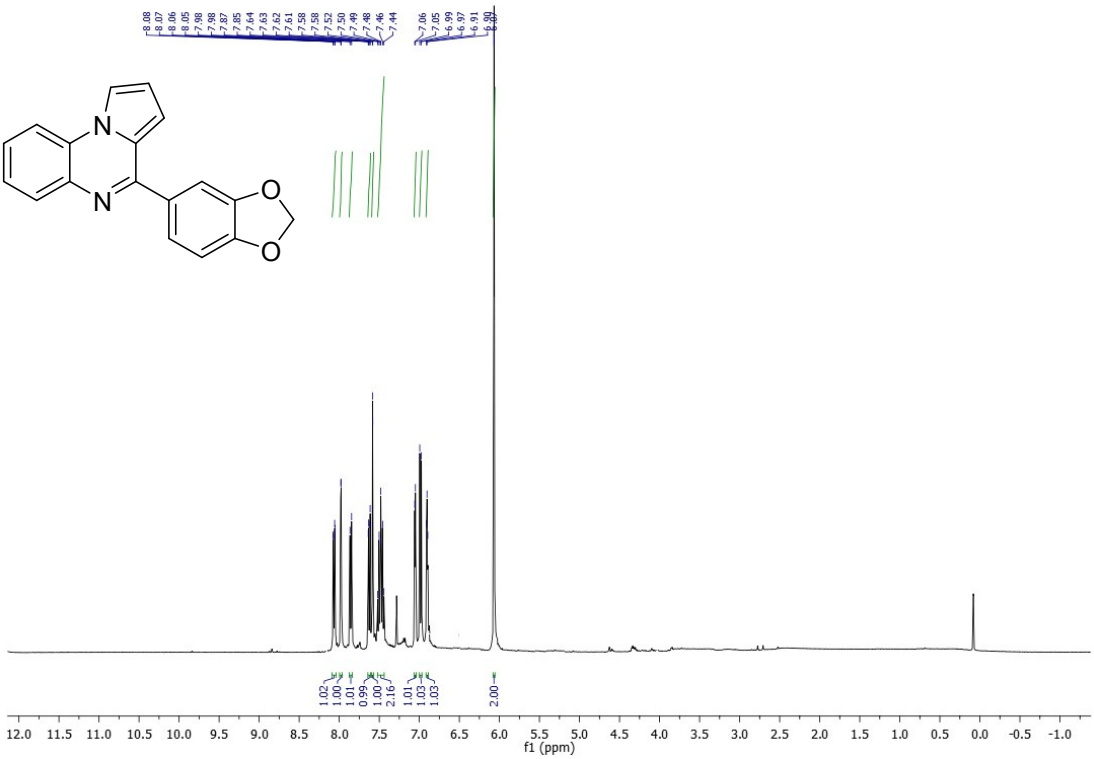
^{1}H NMR spectrum of 4-(p-tolyl)pyrrolo[1,2-*a*]quinoxaline (**17d**)



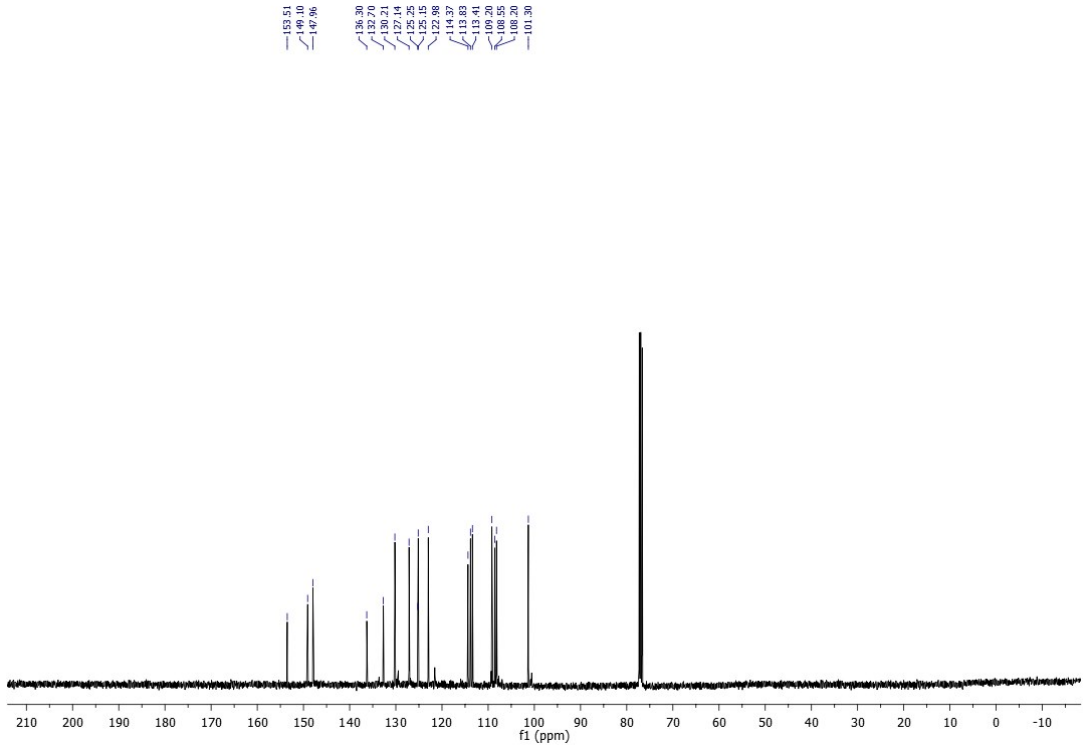
^{13}C NMR spectrum of 4-(p-tolyl)pyrrolo[1,2-*a*]quinoxaline (**17d**)



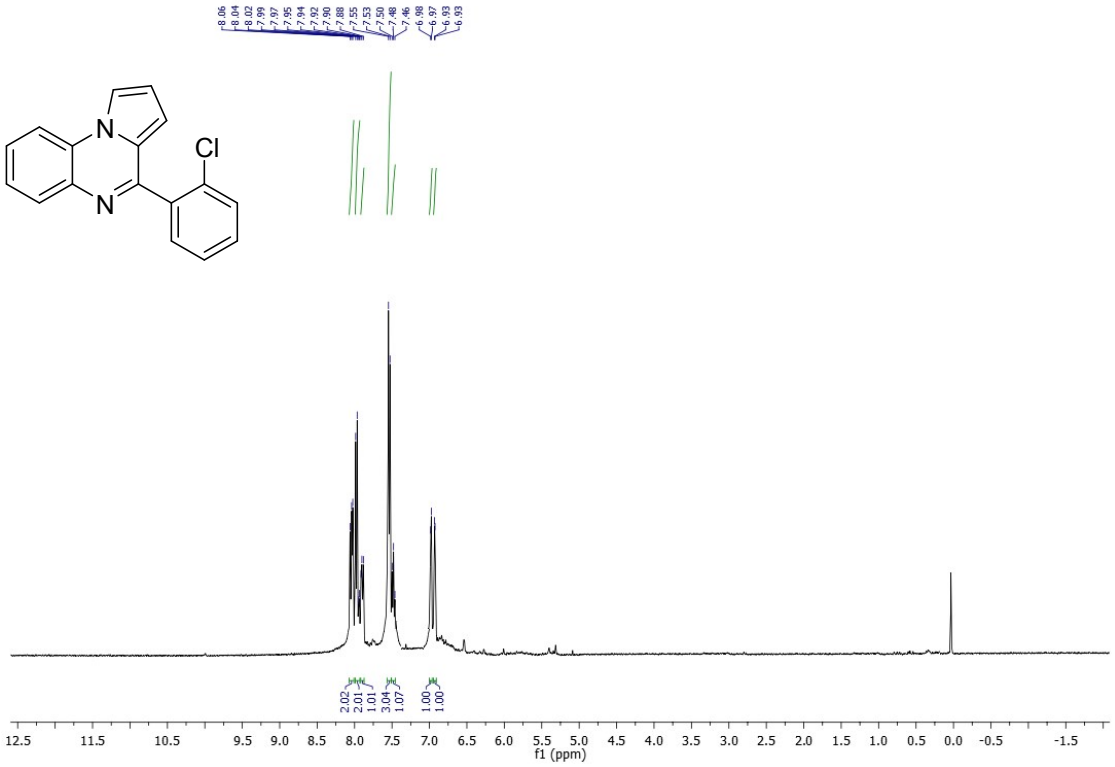
^{1}H NMR spectrum of 4-(benzo[*d*][1,3]dioxol-5-yl)pyrrolo[1,2-*a*]quinoxaline (**17e**)



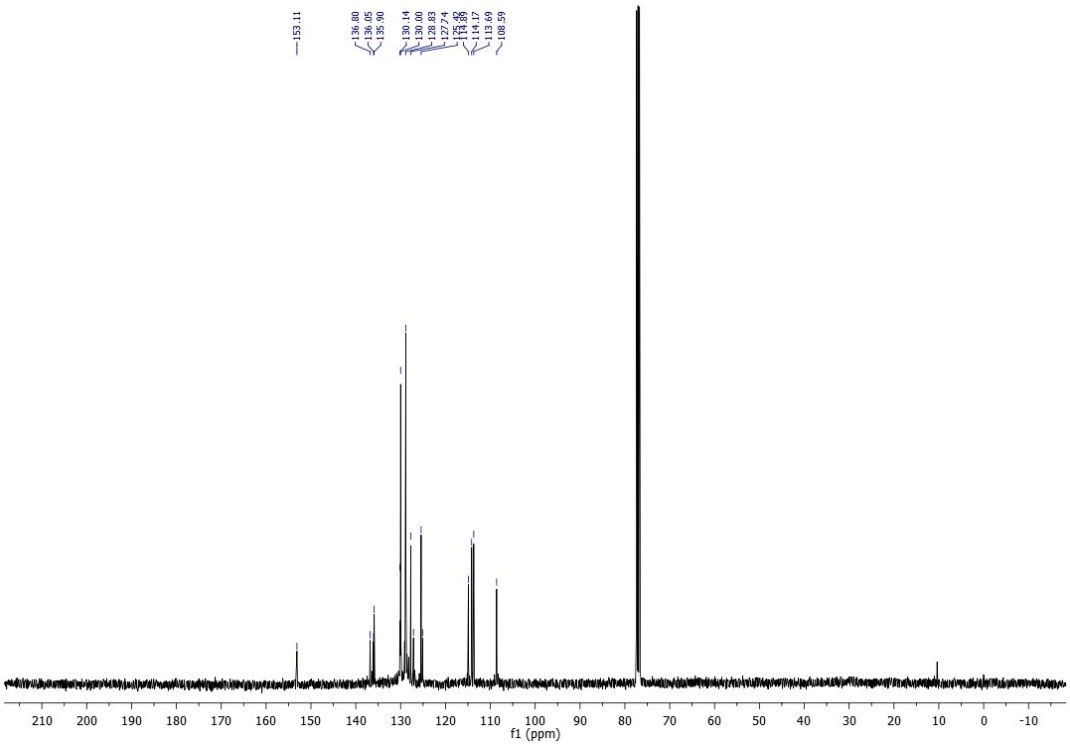
^{13}C NMR spectrum of 4-(benzo[*d*][1,3]dioxol-5-yl)pyrrolo[1,2-*a*]quinoxaline (**17e**)



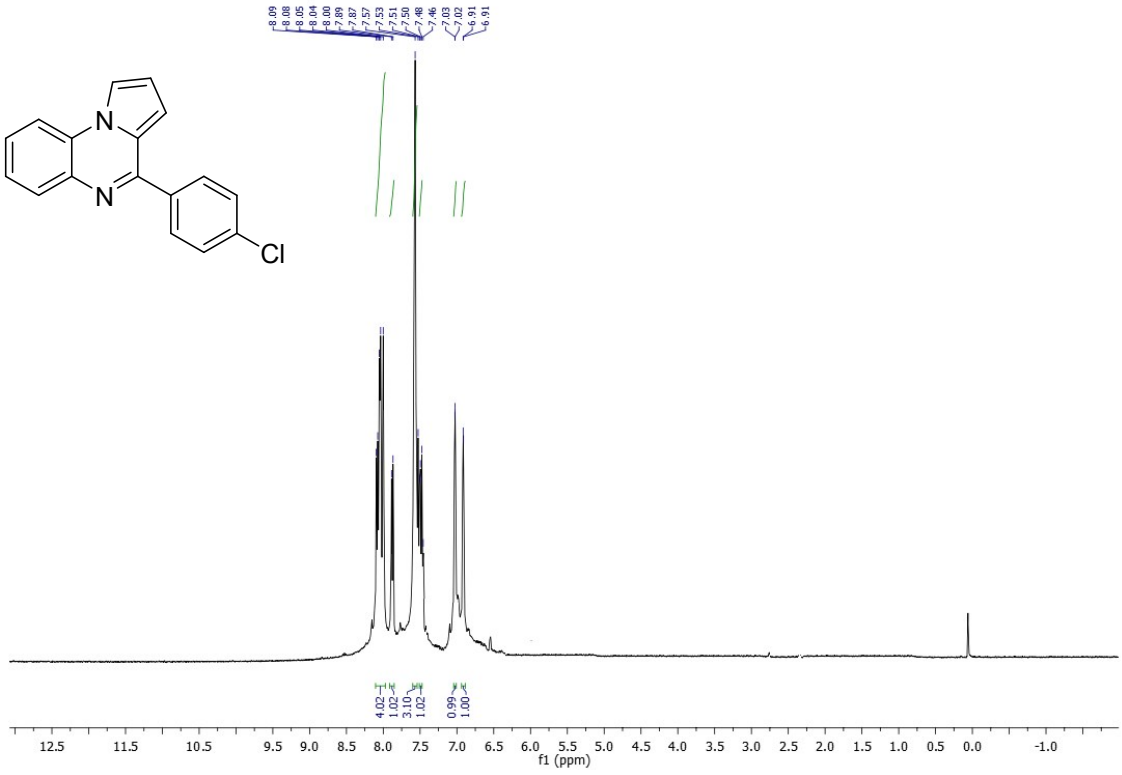
^{1}H NMR spectrum of 4-(2-chlorophenyl)pyrrolo[1,2-*a*]quinoxaline (**17f**)



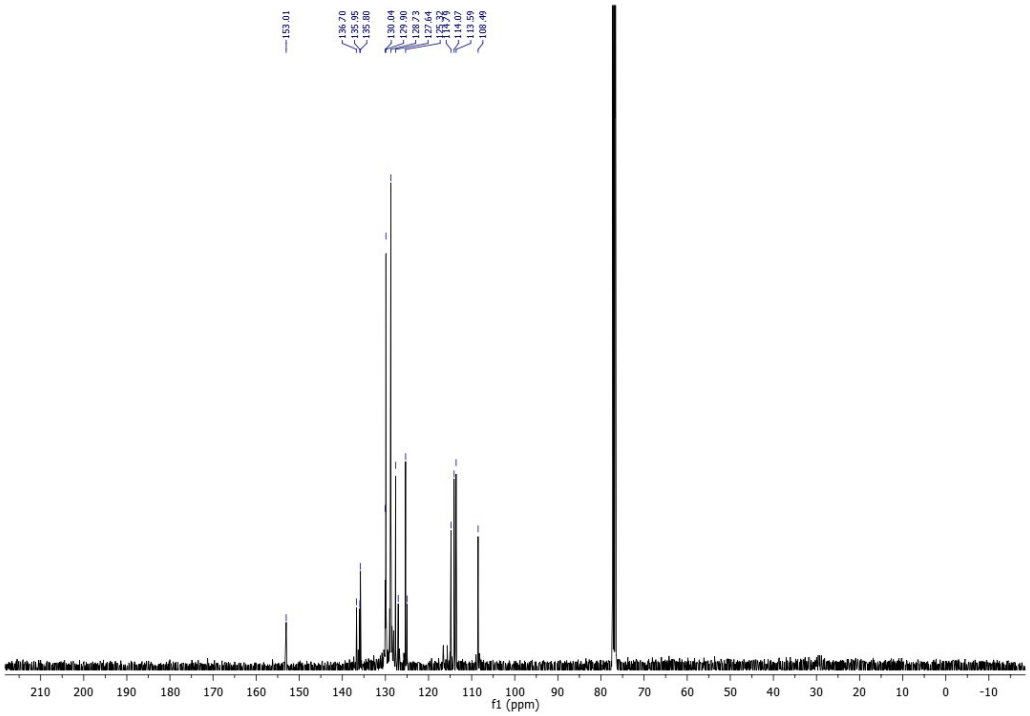
^{13}C NMR spectrum of 4-(2-chlorophenyl)pyrrolo[1,2-*a*]quinoxaline (**17f**)



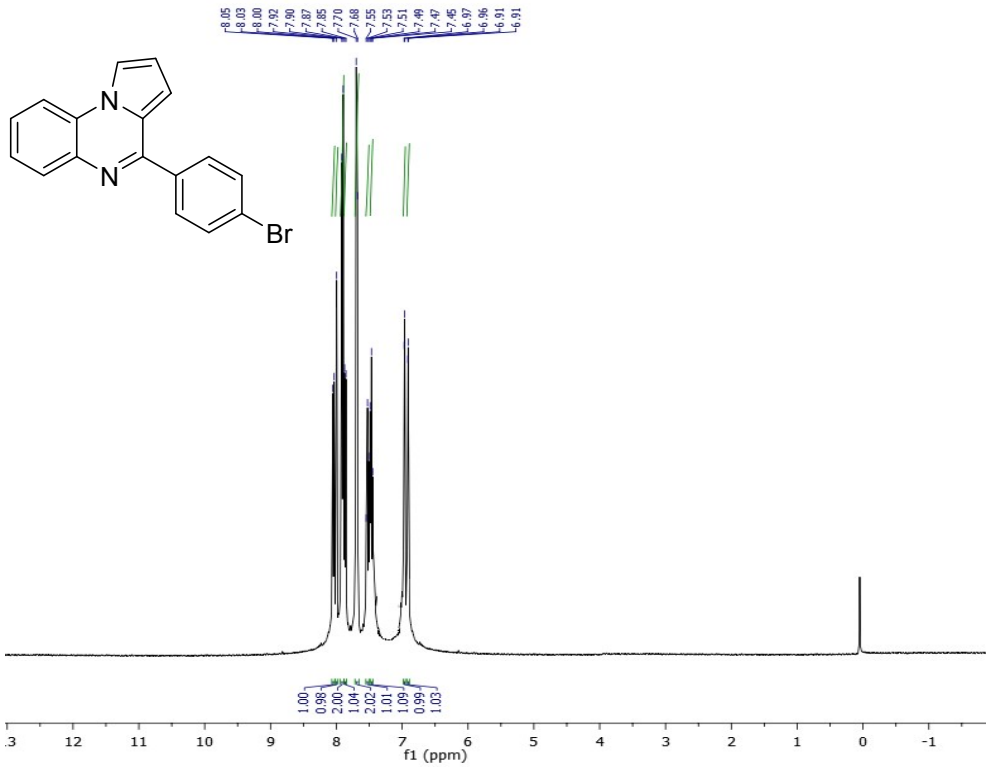
^{1}H NMR spectrum of 4-(4-chlorophenyl)pyrrolo[1,2-*a*]quinoxaline (**18g**)



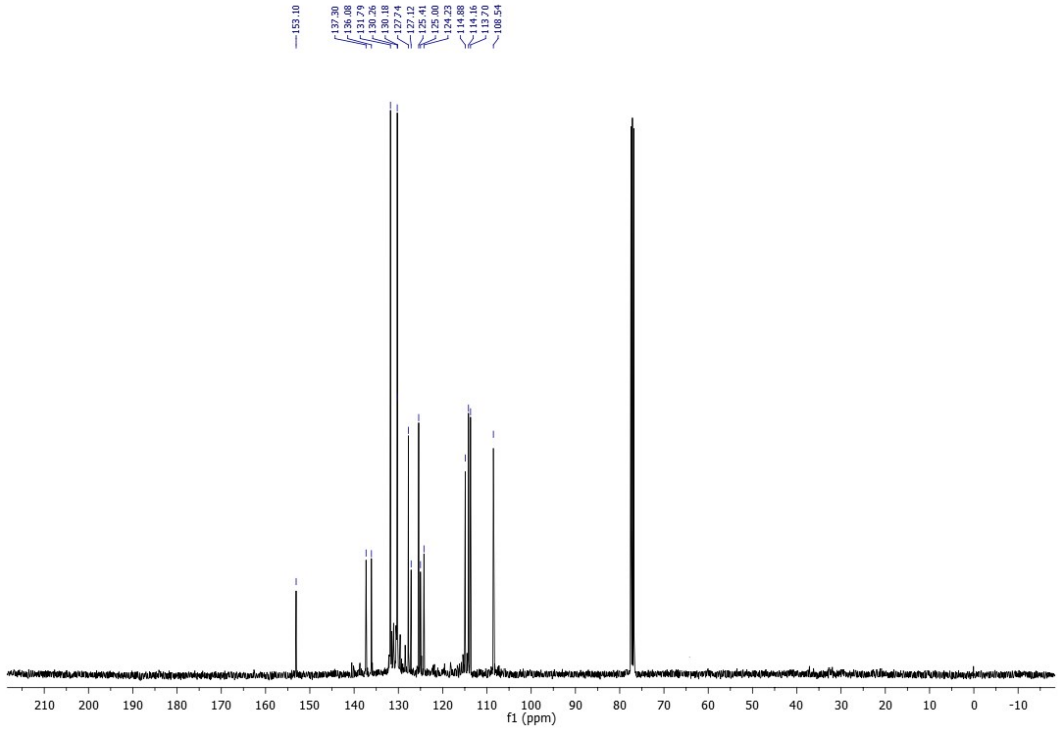
^{13}C NMR spectrum of 4-(4-chlorophenyl)pyrrolo[1,2-*a*]quinoxaline (**18g**)



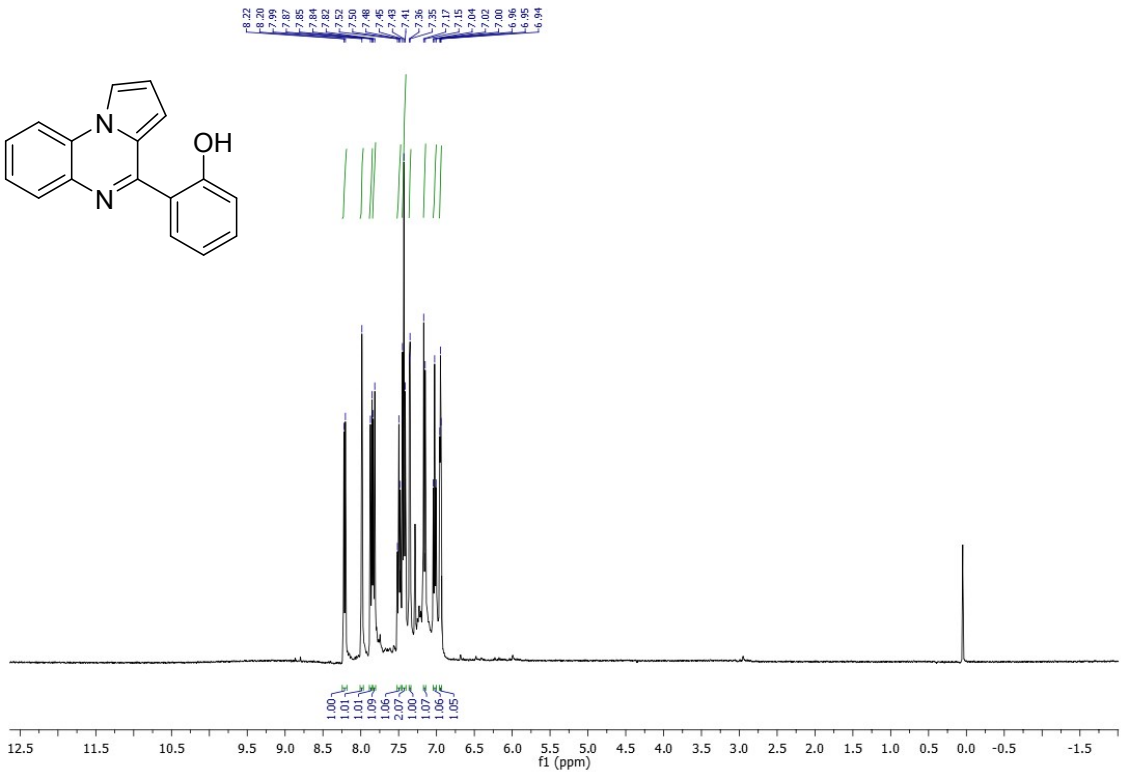
^{1}H NMR spectrum of 4-(4-Bromophenyl)pyrrolo[1,2-*a*]quinoxaline (**17h**)



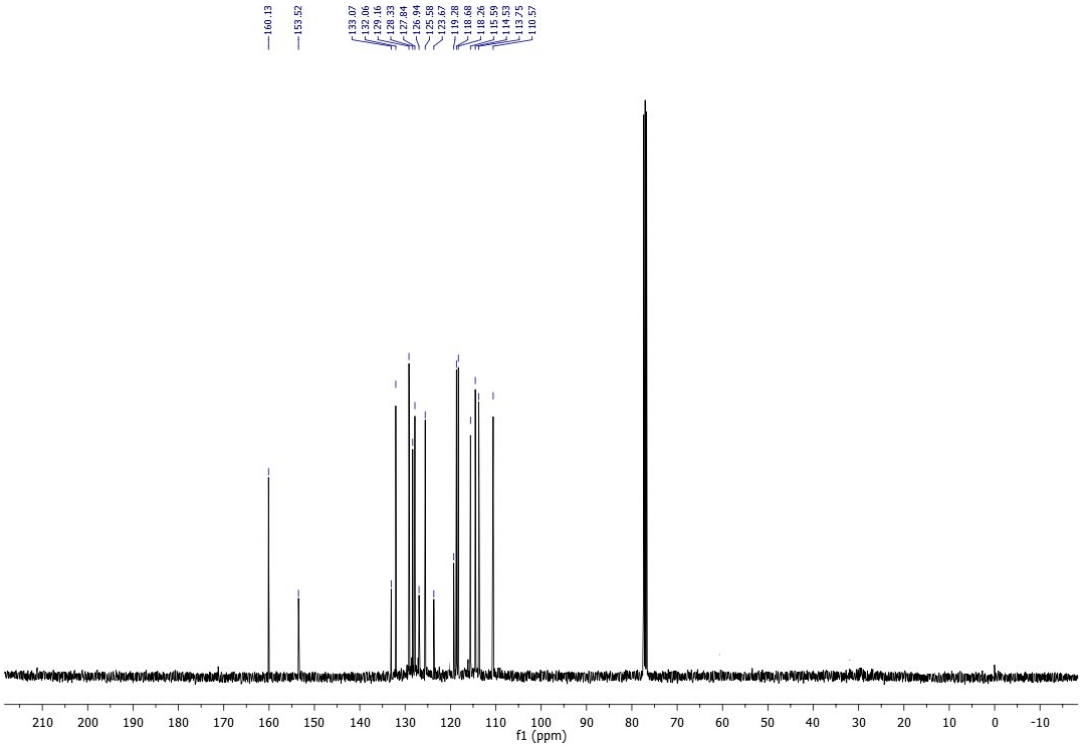
^{13}C NMR spectrum of 4-(4-Bromophenyl)pyrrolo[1,2-*a*]quinoxaline (**17h**)



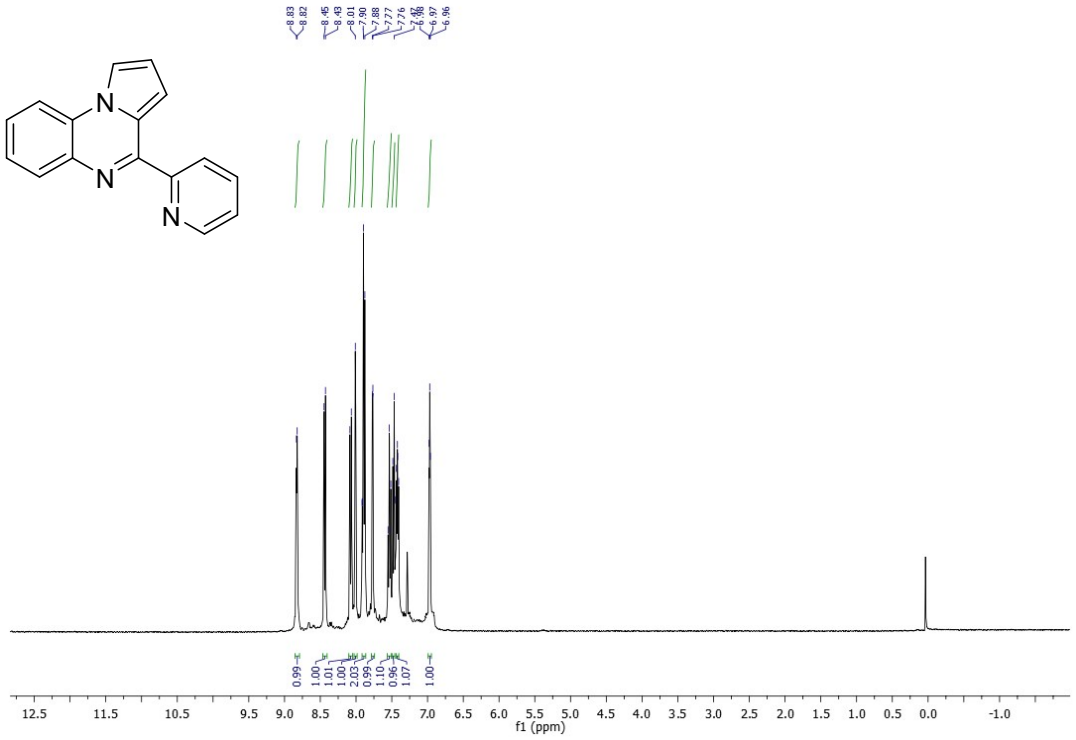
^{1}H NMR spectrum of 2-(pyrrolo[1,2-*a*]quinoxalin-4-yl)phenol (**17i**)



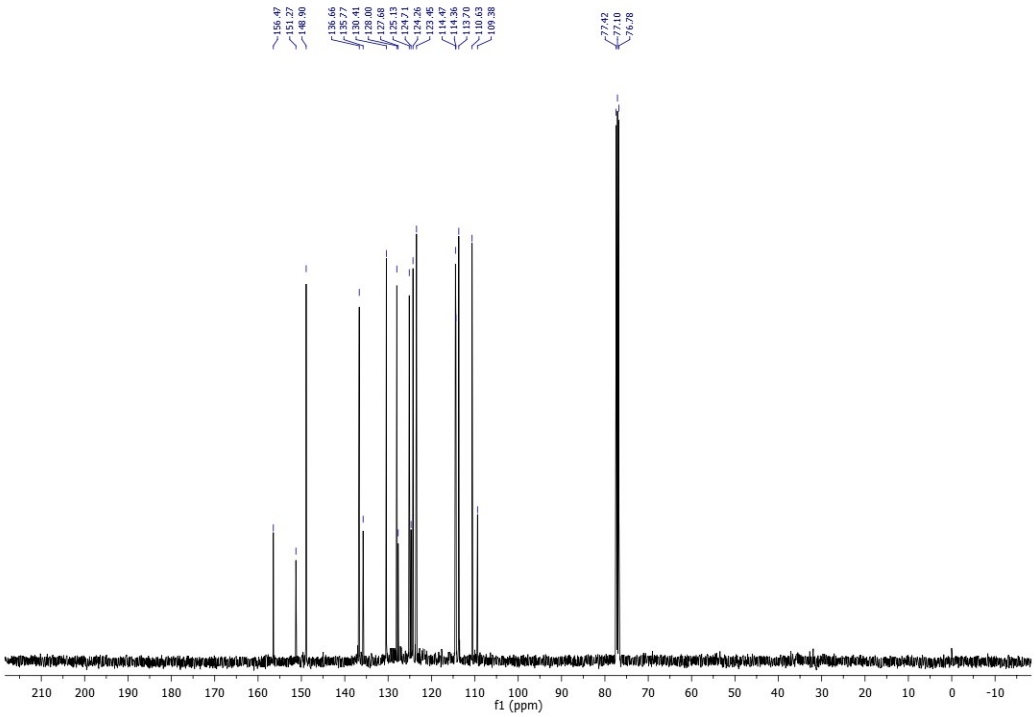
^{13}C NMR spectrum of 2-(pyrrolo[1,2-*a*]quinoxalin-4-yl)phenol (**17i**)



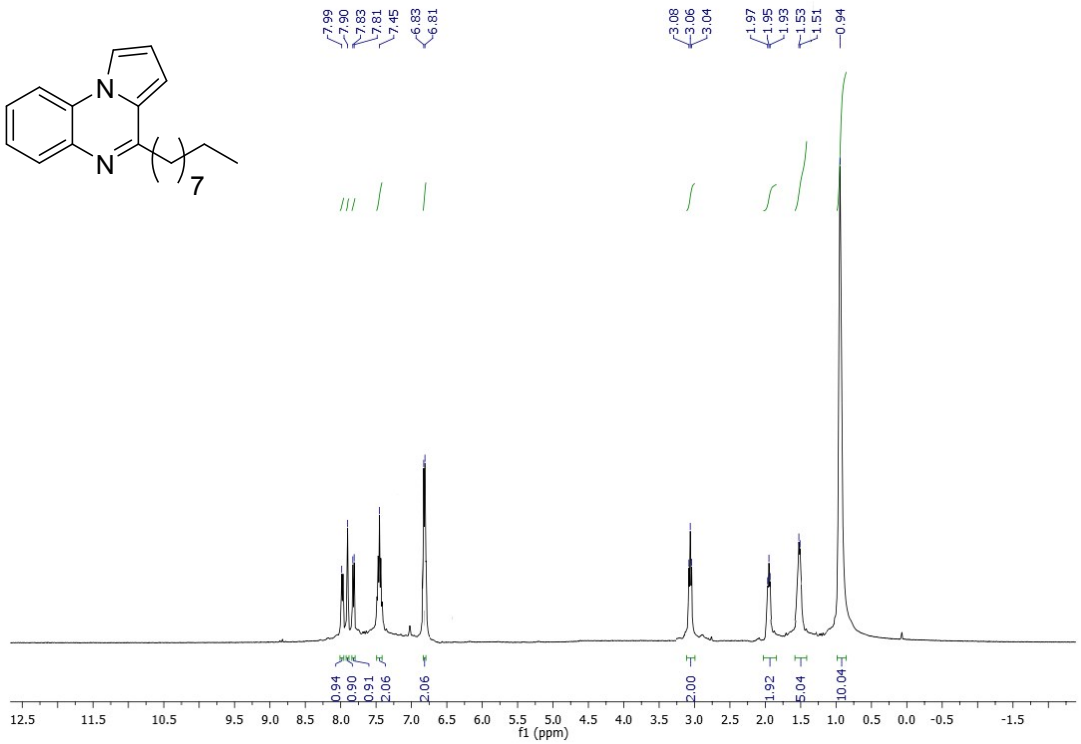
^{1}H NMR spectrum of 4-(pyridin-2-yl)pyrrolo[1,2-*a*]quinoxaline (**17j**)



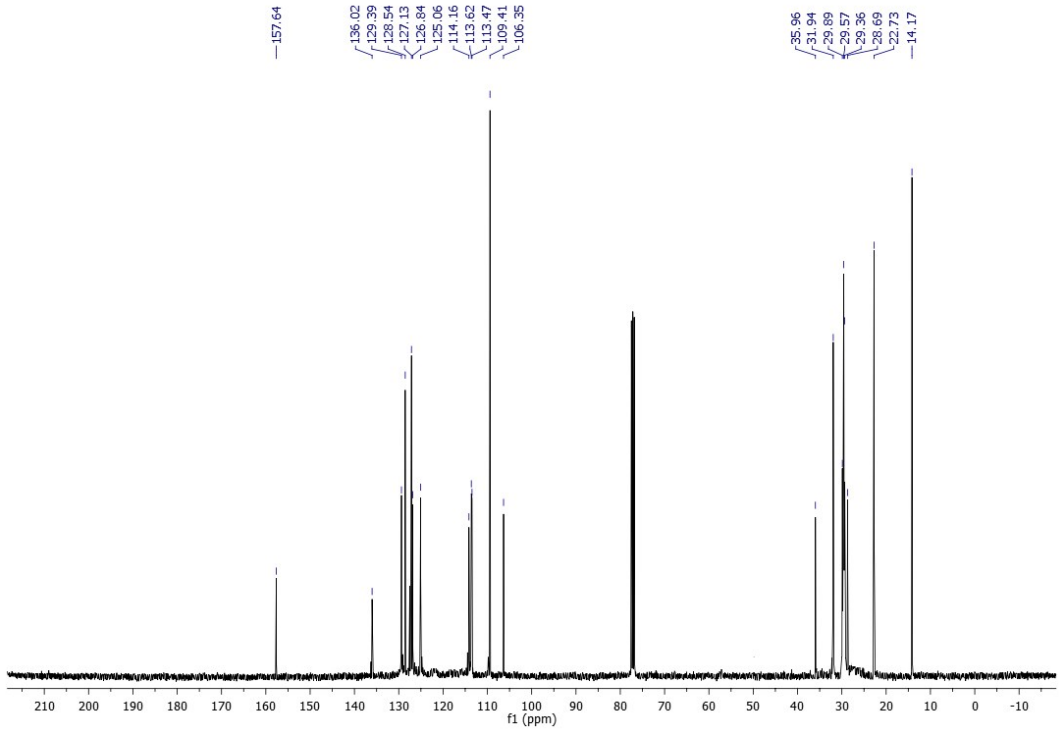
^{13}C NMR spectrum of 4-(pyridin-2-yl)pyrrolo[1,2-a]quinoxaline (**17j**)



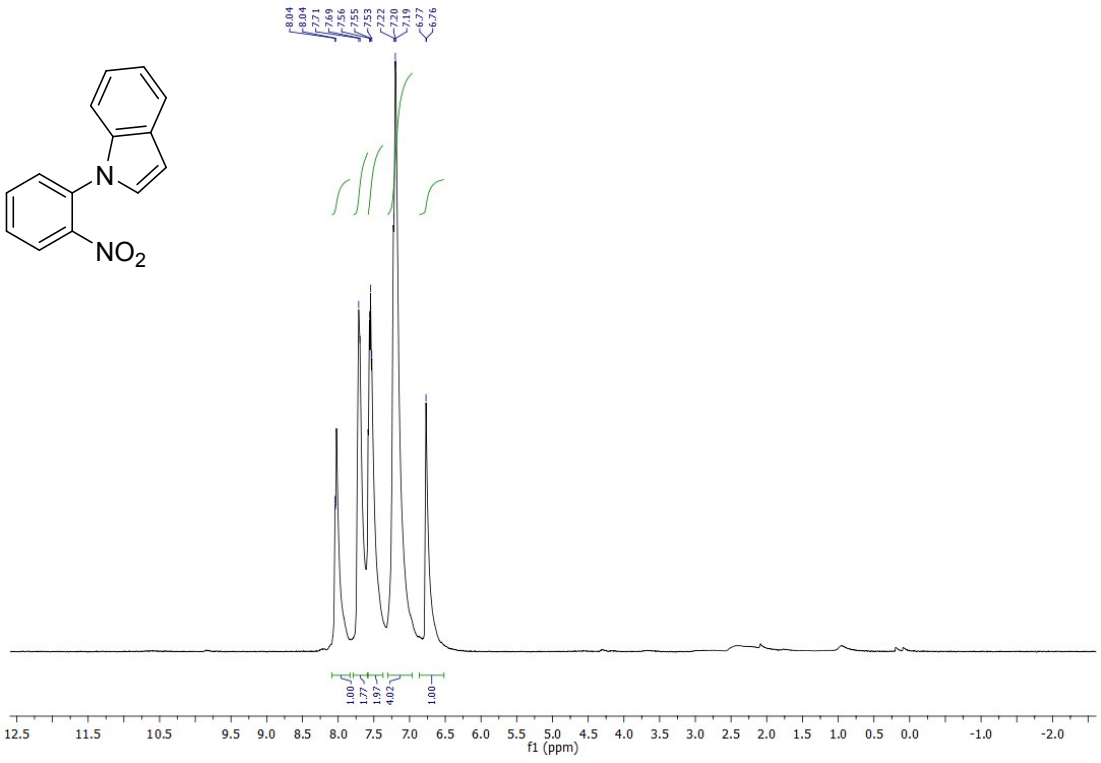
^{1}H NMR spectrum of 4-nonylpyrrolo[1,2-*a*]quinoxaline (**17k**)



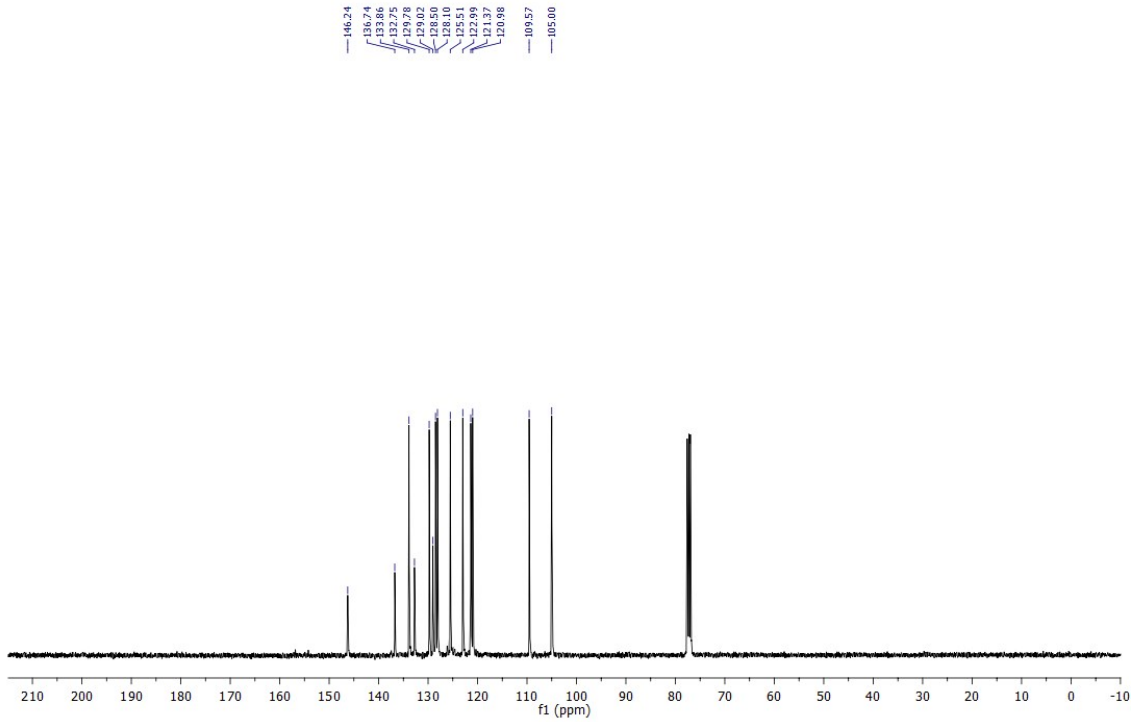
^{13}C NMR spectrum of 4-nonylpyrrolo[1,2-*a*]quinoxaline (**17k**)



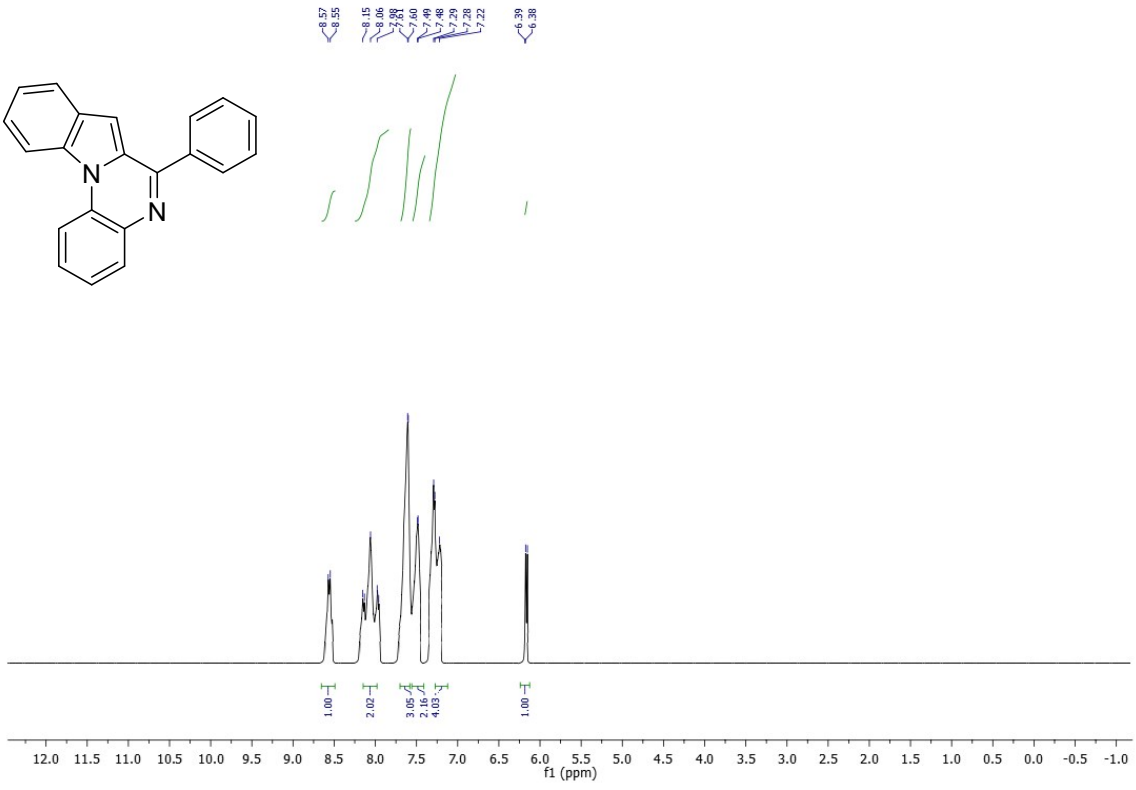
^{1}H NMR spectrum of 1-(2-Nitrophenyl)-1*H*-indole (**18**)



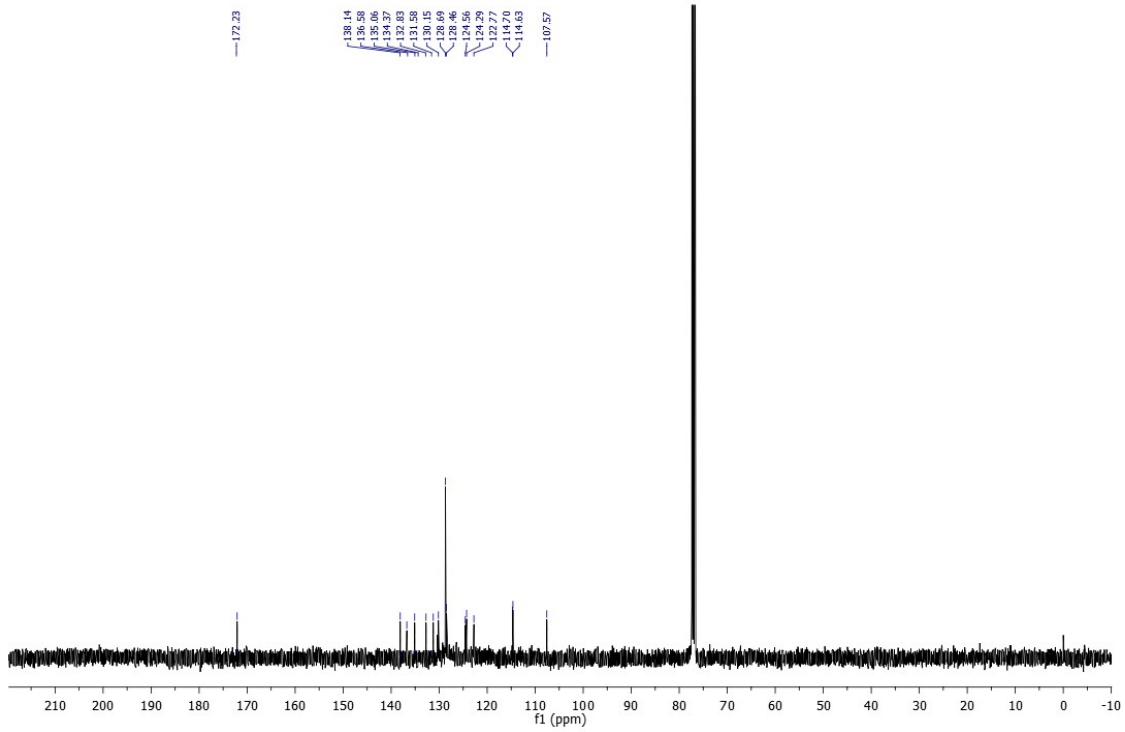
^{13}C NMR spectrum of 1-(2-Nitrophenyl)-1*H*-indole (**18**)



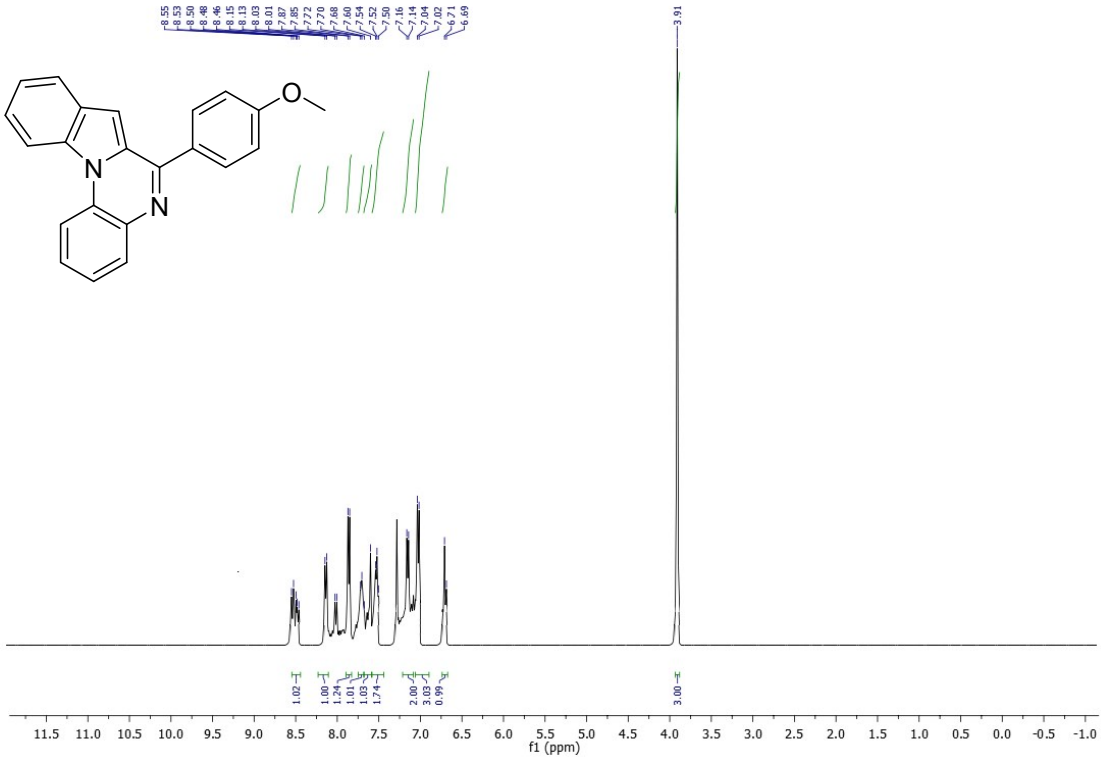
^{1}H NMR spectrum of 6-phenylindolo[1,2-*a*]quinoxaline (**18a**)



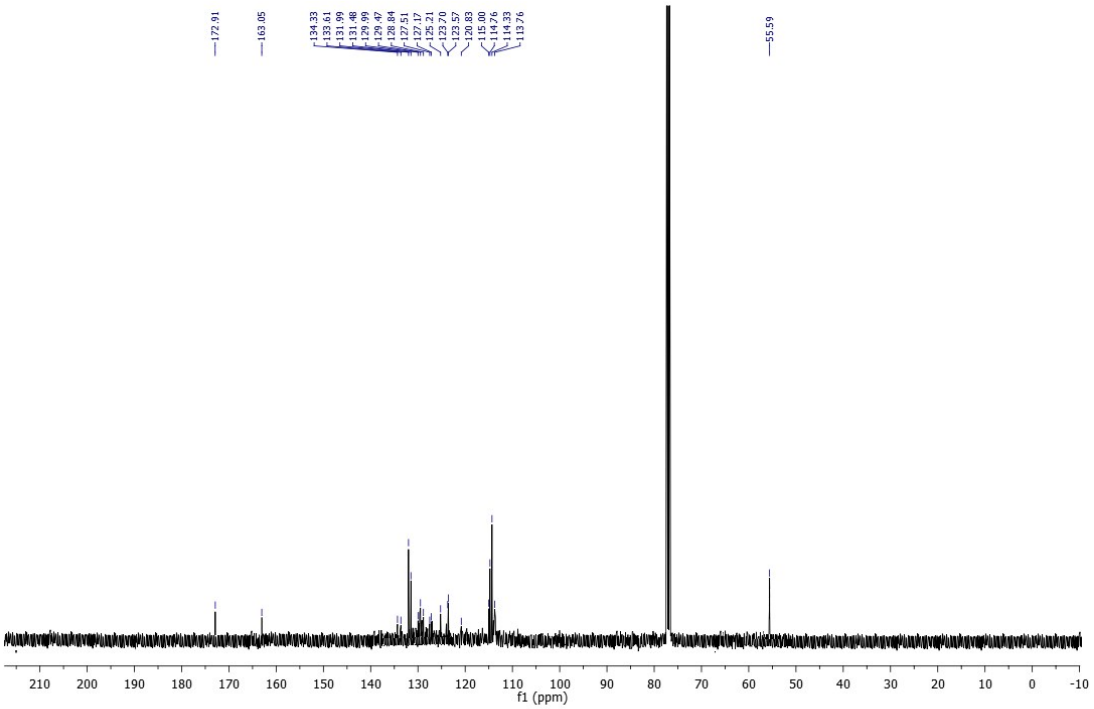
^{13}C NMR spectrum of 6-phenylindolo[1,2-*a*]quinoxaline (**18a**)



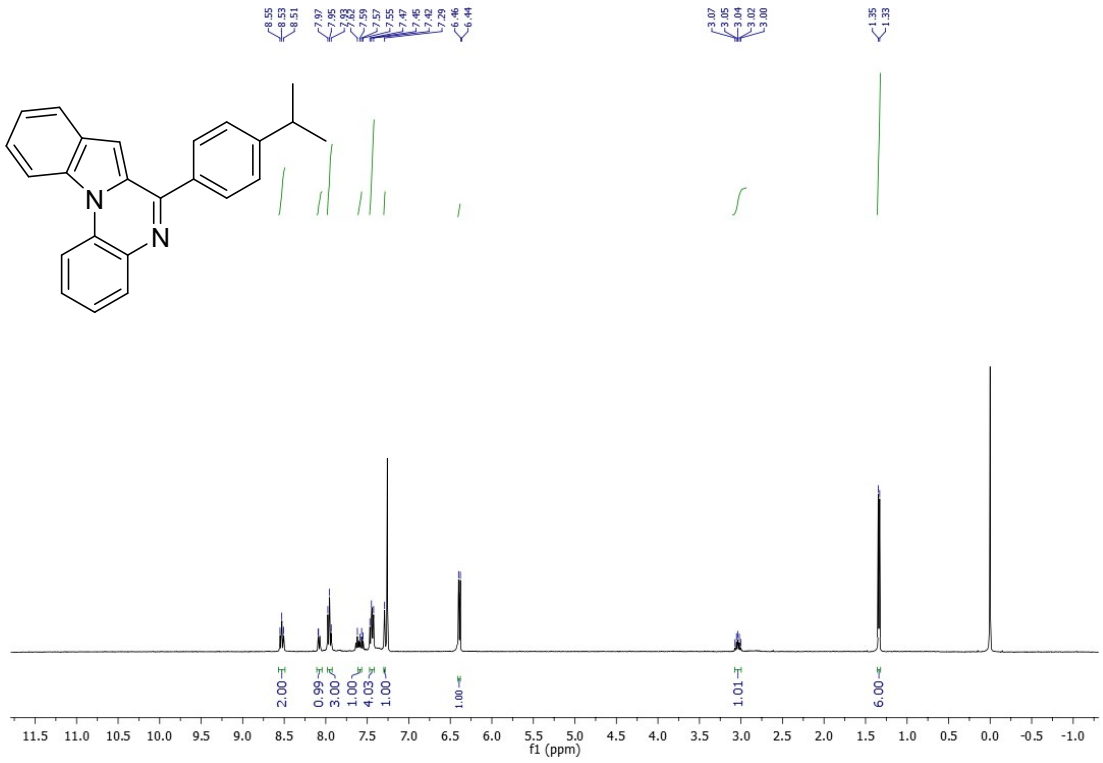
^{1}H NMR spectrum of 6-(4-methoxyphenyl)indolo[1,2-*a*]quinoxaline (**18b**)



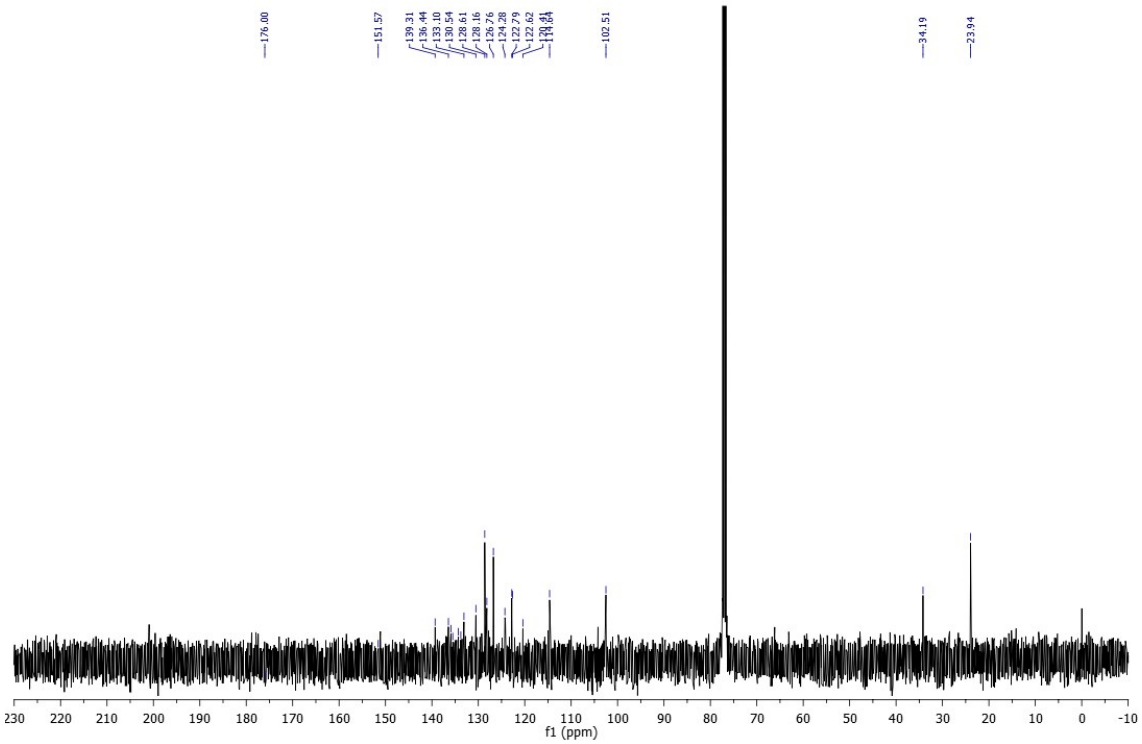
^{13}C NMR spectrum of 6-(4-methoxyphenyl)indolo[1,2-*a*]quinoxaline (**18b**)



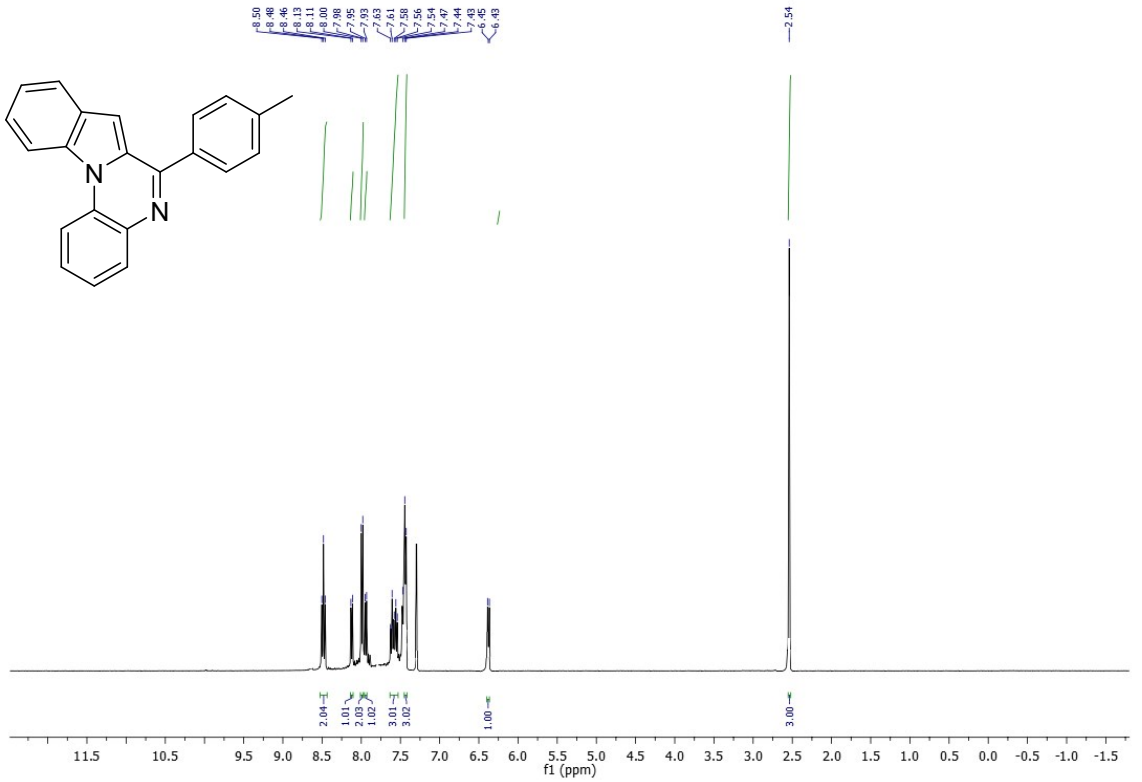
^{1}H NMR spectrum of 6-(4-isopropylphenyl)indolo[1,2-*a*]quinoxaline (**18c**)



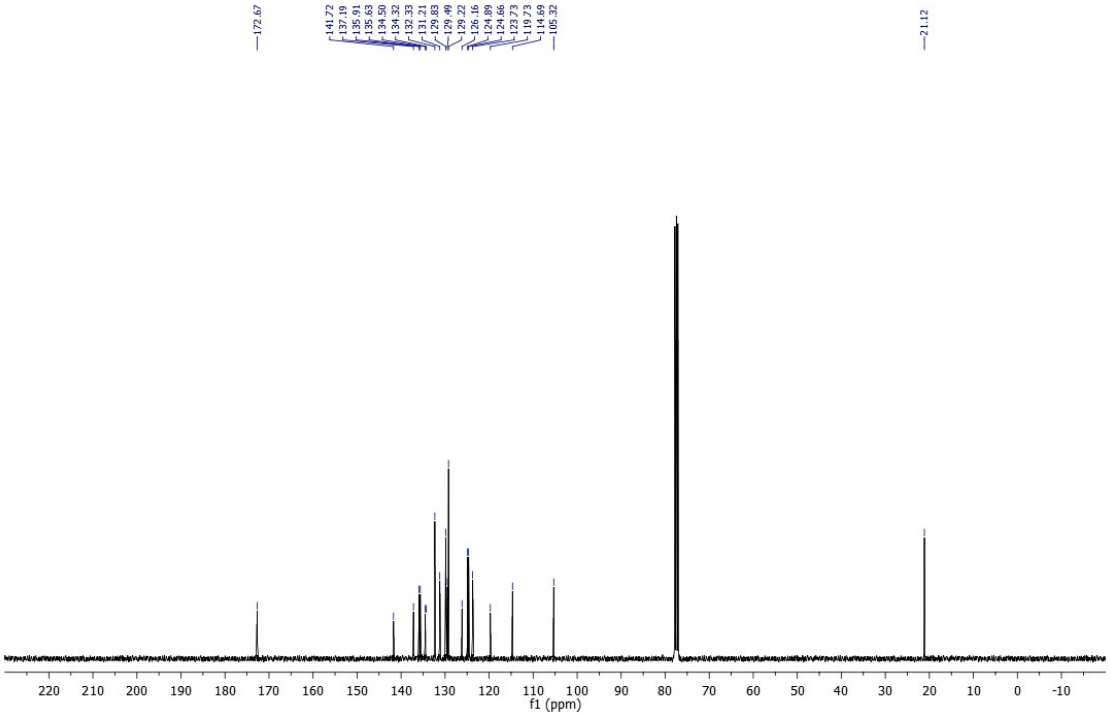
^{13}C NMR spectrum of 6-(4-isopropylphenyl)indolo[1,2-*a*]quinoxaline (**18c**)



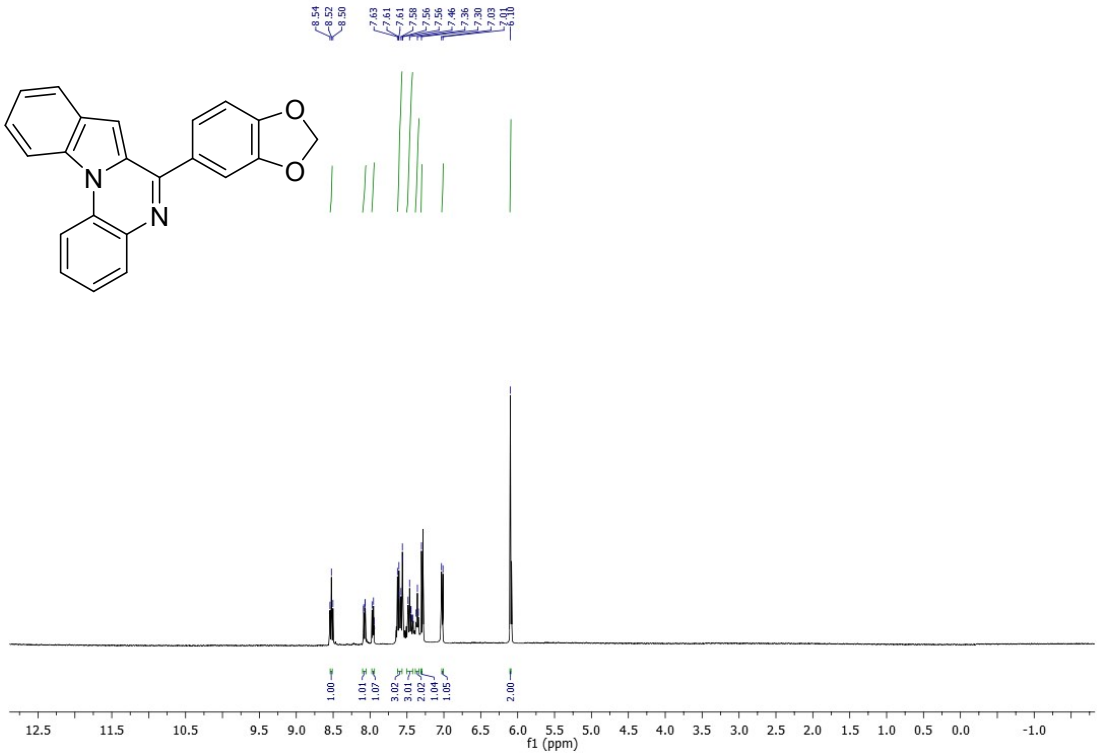
^{1}H NMR spectrum of 6-(*p*-tolyl)indolo[1,2-*a*]quinoxaline (**18d**)



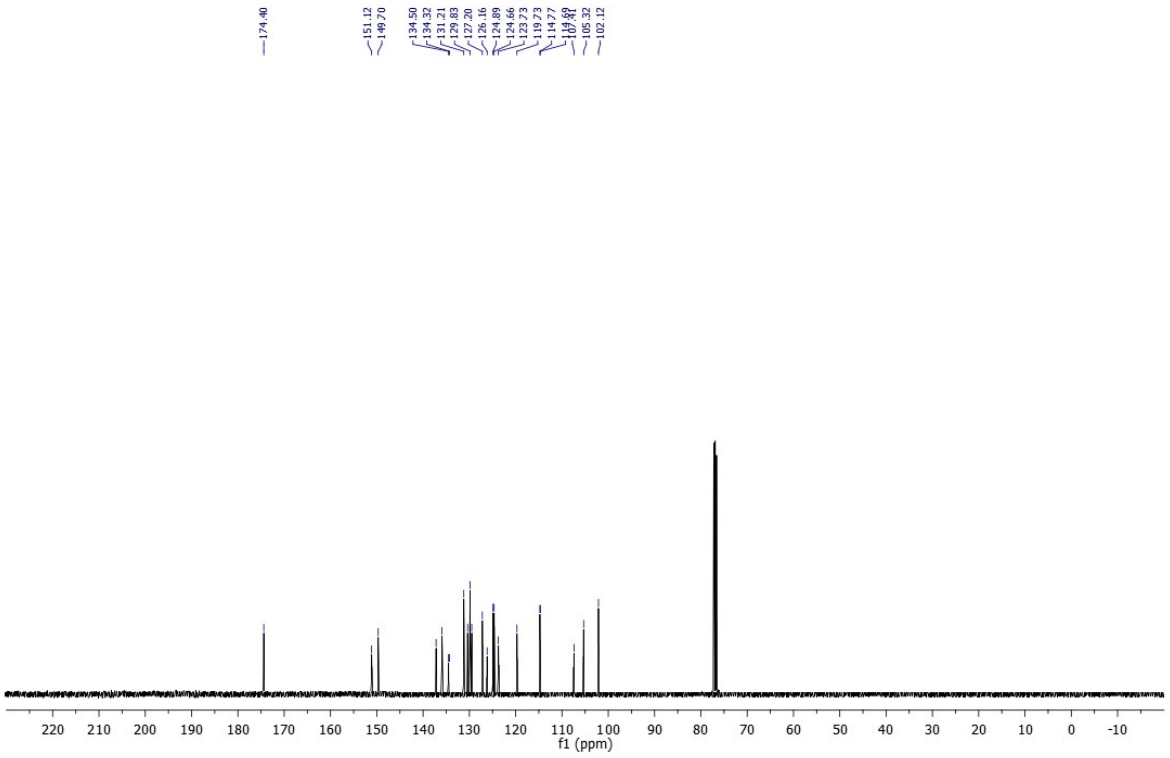
^{13}C NMR spectrum of 6-(*p*-tolyl)indolo[1,2-*a*]quinoxaline (**18d**)



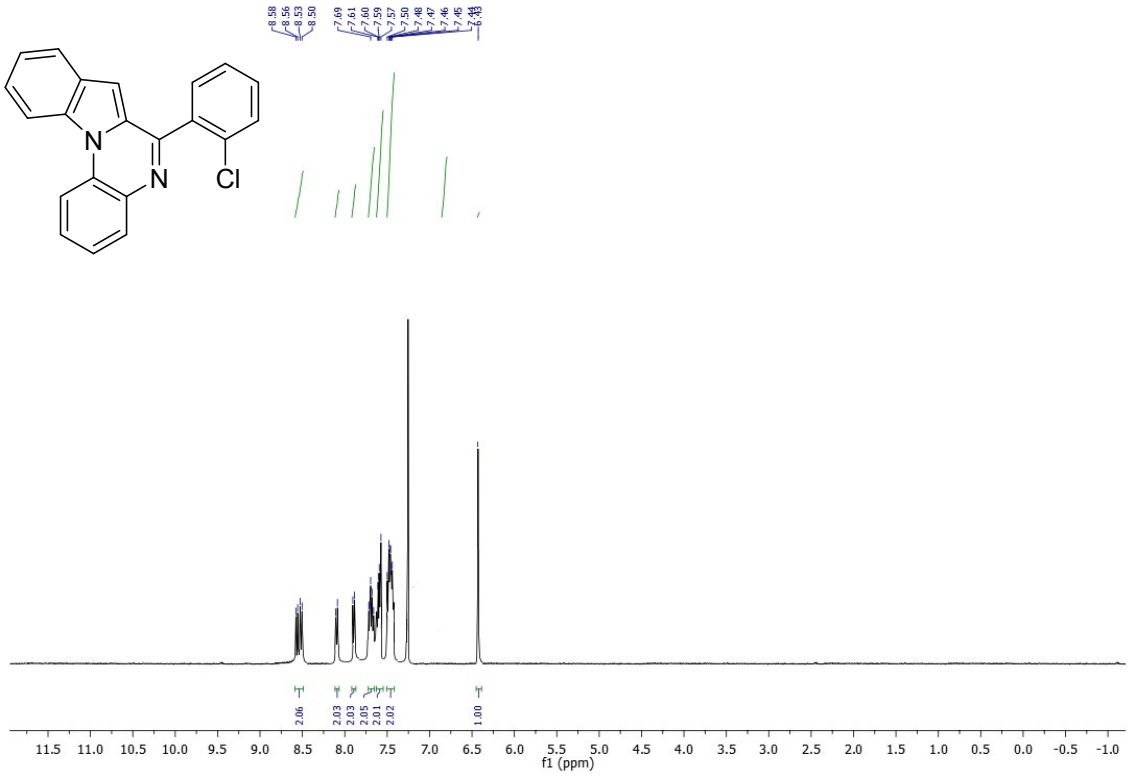
^{1}H NMR spectrum of 6-(benzo[*d*][1,3]dioxol-5-yl)indolo[1,2-*a*]quinoxaline (**18e**)



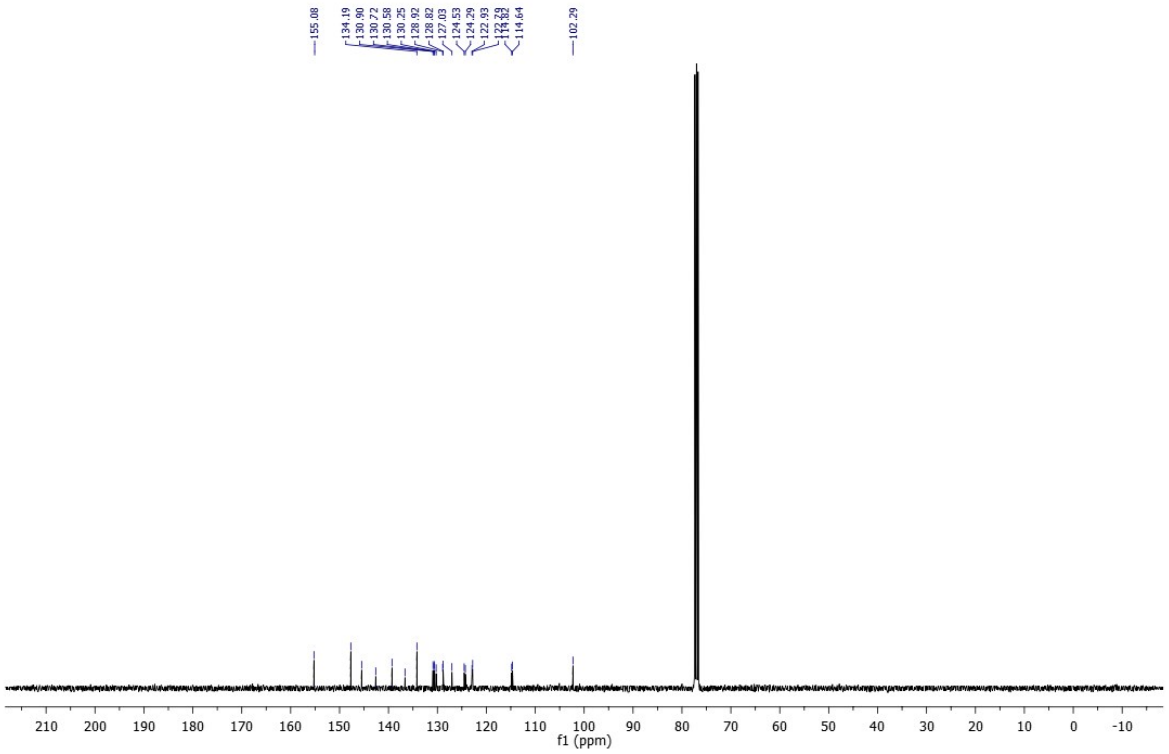
^{13}C NMR spectrum of 6-(benzo[*d*][1,3]dioxol-5-yl)indolo[1,2-*a*]quinoxaline (**18e**)



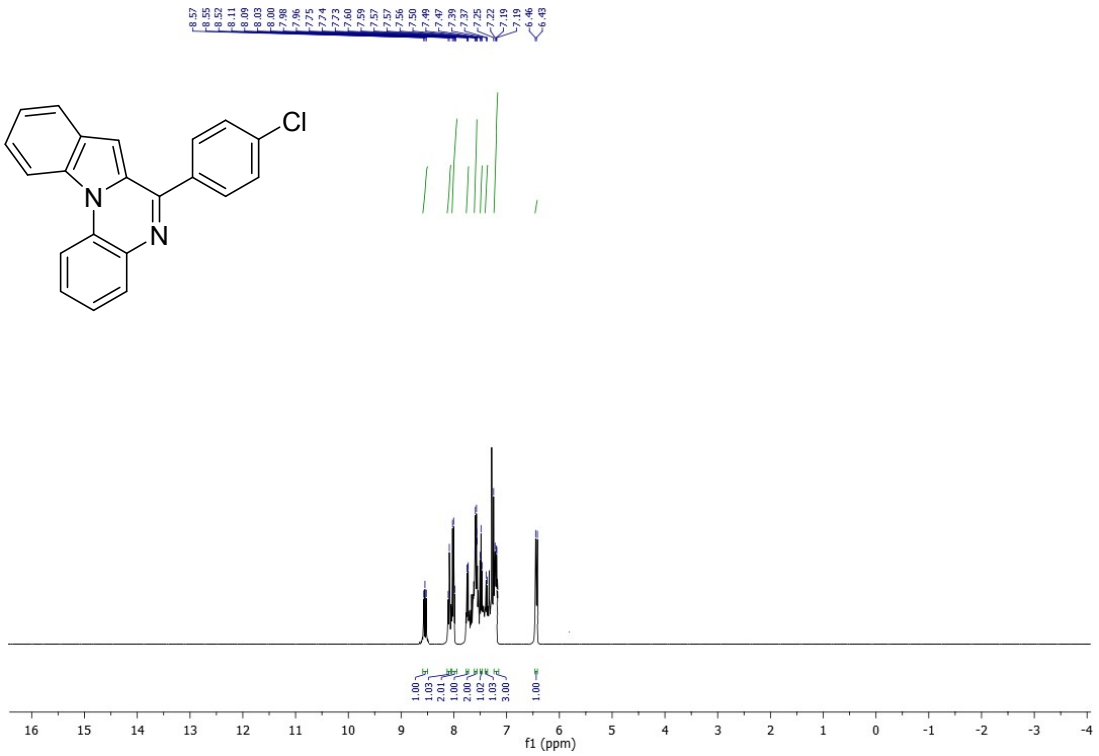
^{1}H NMR spectrum of 6-(2-chlorophenyl)indolo[1,2-*a*]quinoxaline (**18f**)



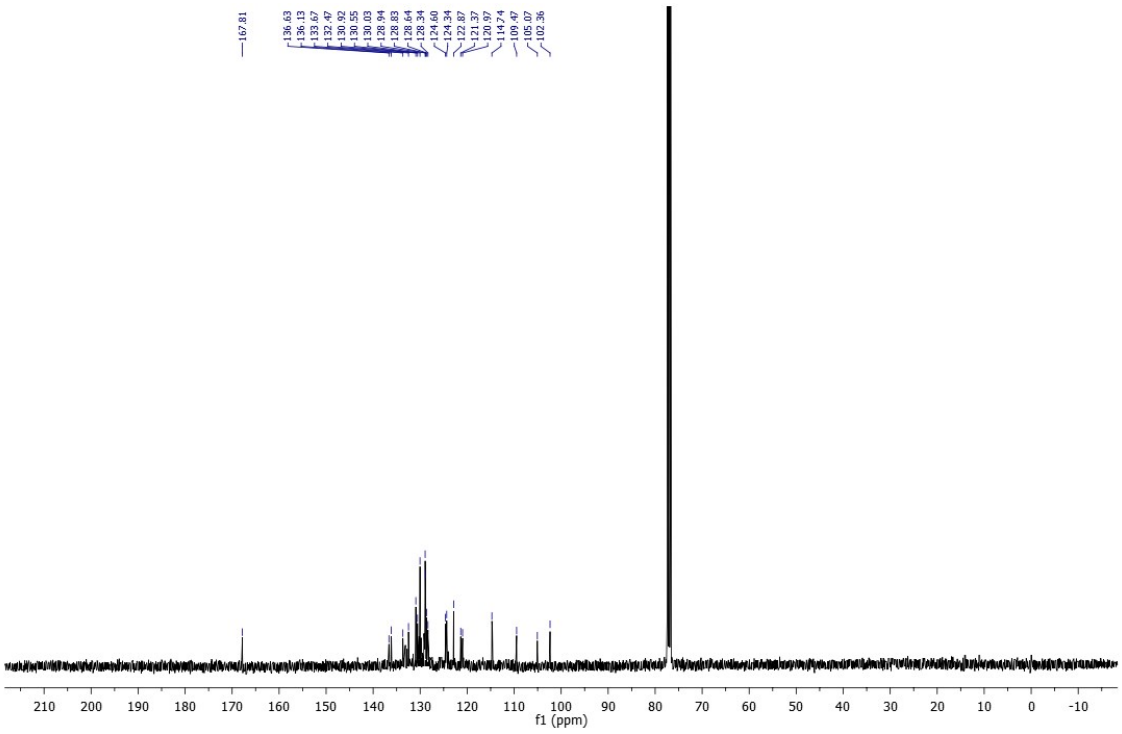
^{13}C NMR spectrum of 6-(2-chlorophenyl)indolo[1,2-*a*]quinoxaline (**18f**)



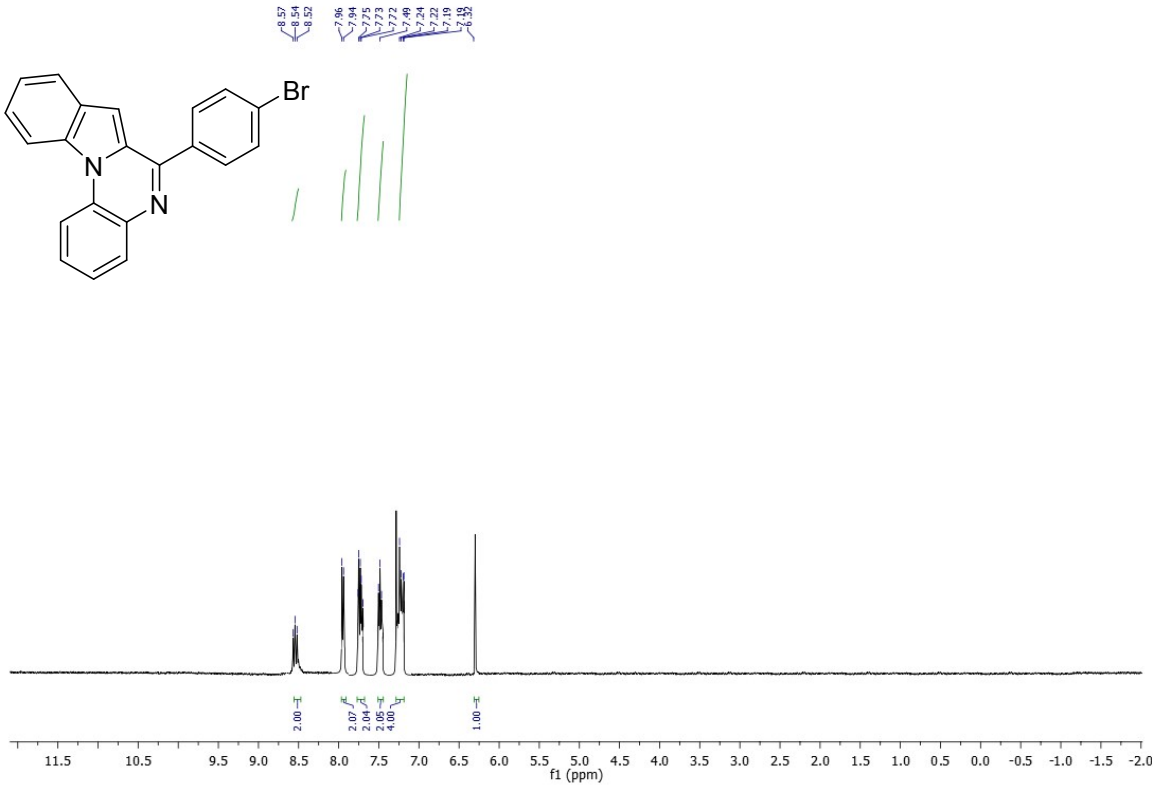
^{1}H NMR spectrum of 6-(4-chlorophenyl)indolo[1,2-*a*]quinoxaline (**18g**)



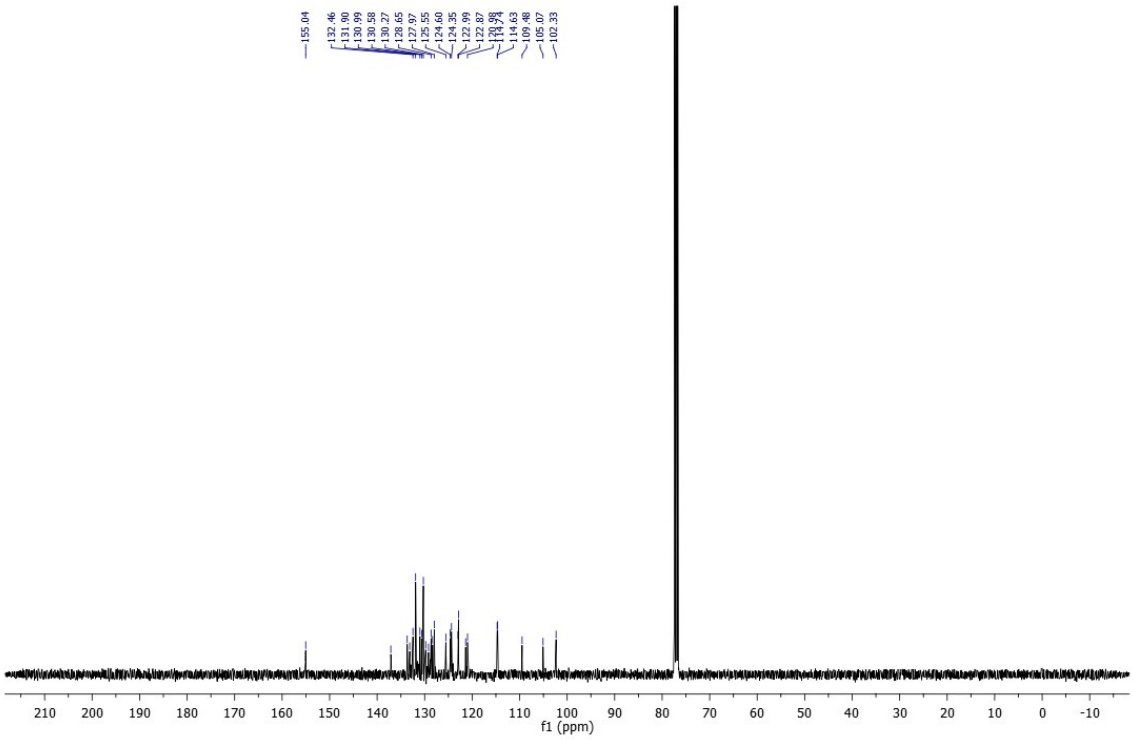
^{13}C NMR spectrum of 6-(4-chlorophenyl)indolo[1,2-*a*]quinoxaline (**18g**)



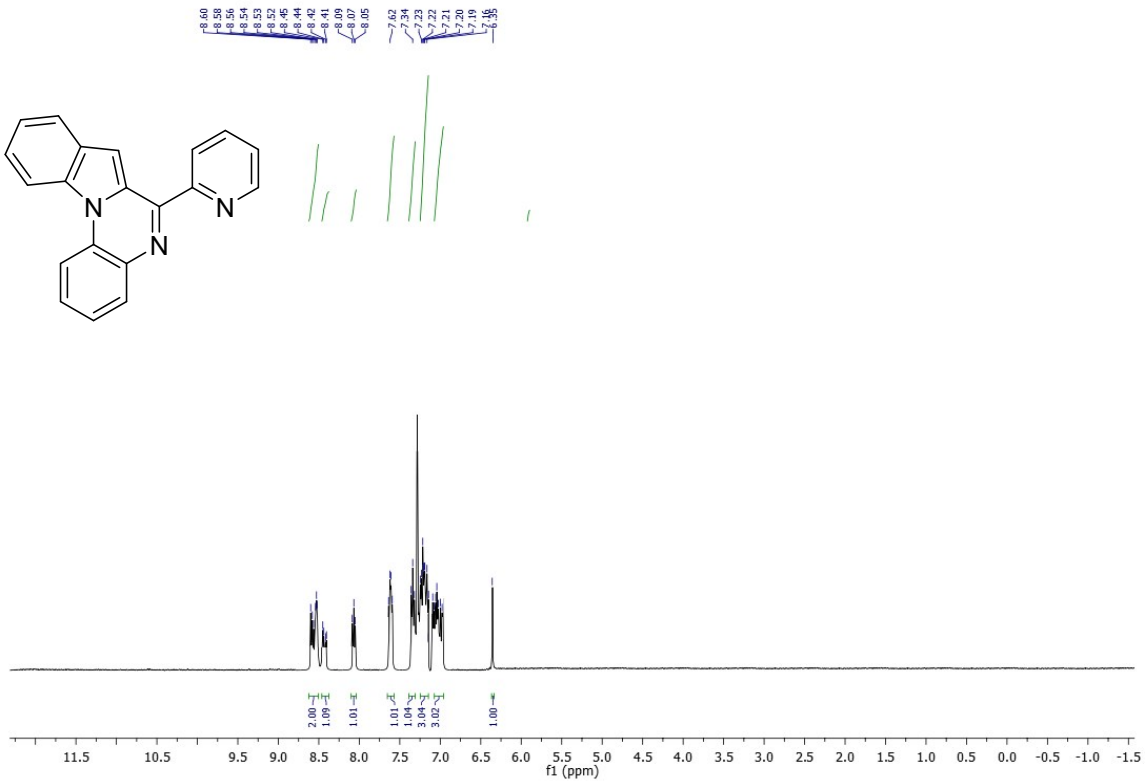
^{1}H NMR spectrum of 6-(4-bromophenyl)indolo[1,2-*a*]quinoxaline (**18h**)



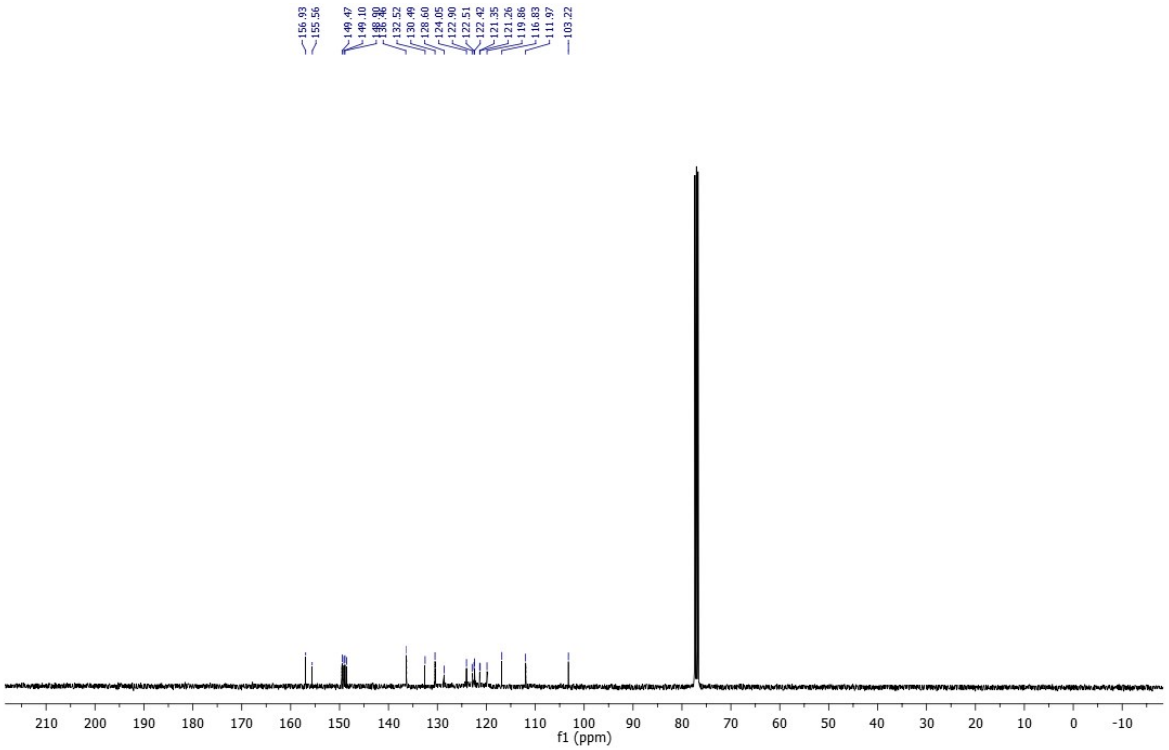
^{13}C NMR spectrum of 6-(4-bromophenyl)indolo[1,2-*a*]quinoxaline (**18h**)



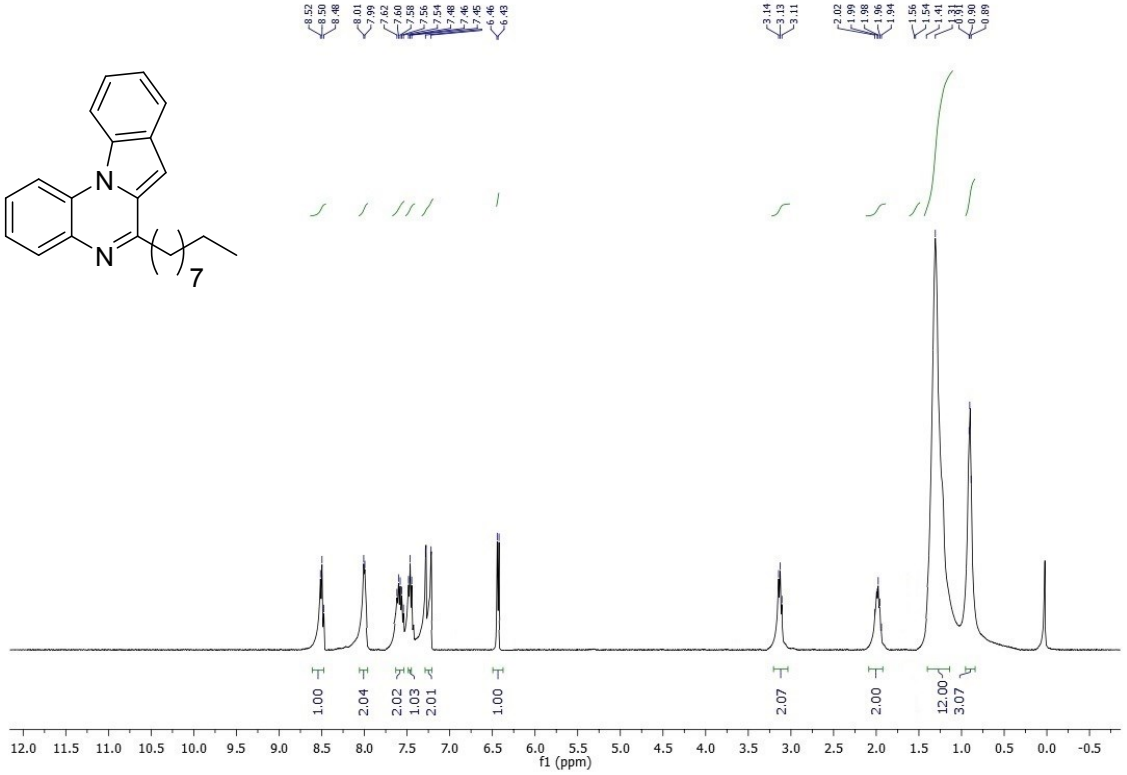
^{1}H NMR spectrum of 6-(pyridin-2-yl)indolo[1,2-*a*]quinoxaline (**18i**)



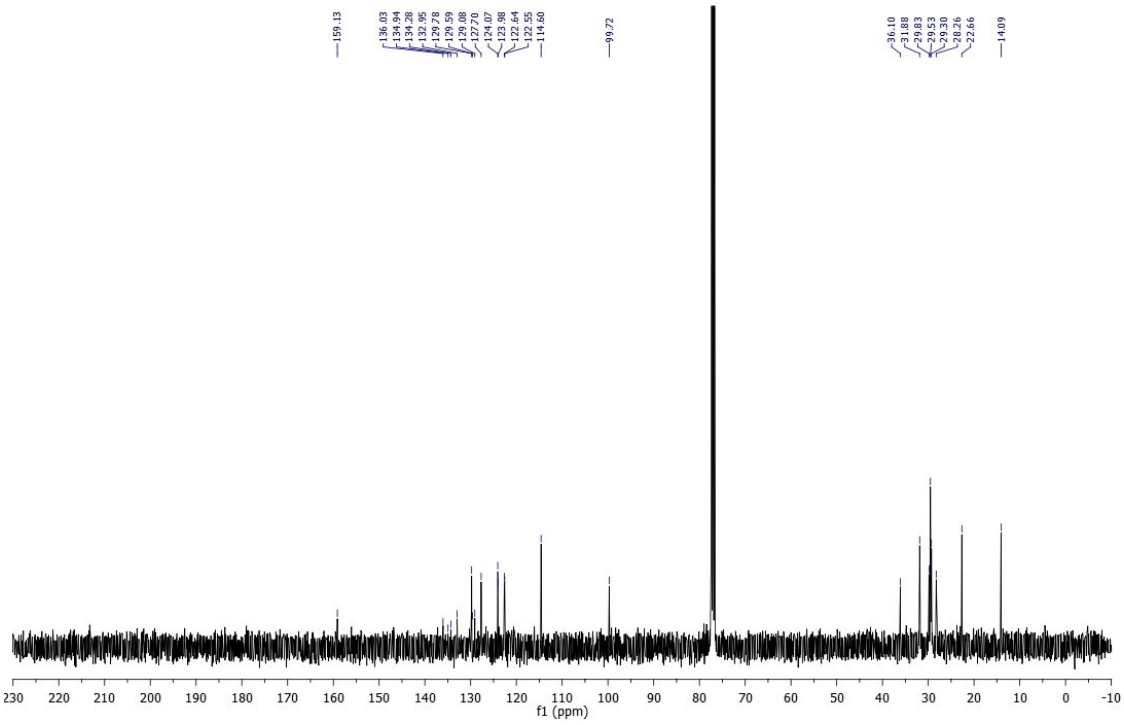
^{13}C NMR spectrum of 6-(pyridin-2-yl)indolo[1,2-*a*]quinoxaline (**18i**)



^{1}H NMR spectrum of 6-nonylindolo[1,2-a]quinoxaline (**18j**)



^{13}C NMR spectrum of 6-nonylindolo[1,2-a]quinoxaline (**18j**)



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