Electronic Supplementary Material (ESI) for Green Chemistry.

An efficient and eco-friendly synthesis of 2-pyridones and functionalized azaxanthone frameworks *via* indium triflate catalyzed domino reaction

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Experimental General:

All chemicals were purchased from Sigma Aldrich. All melting points are uncorrected. ^{1}H and ^{13}C NMR spectra were recorded in $CDCl_3$ and DMSO-d_6 using TMS as an internal standard on a Bruker avance spectrometer at 400 Mhz amd 100 MHz and JEOl spectrometer at 500 and 125 Mhz, respectively. Mass spectra were recorded using a JEOL GCMate-II–HR mass spectrometer. Analytical TLC was performed on precoated aluminium sheets of siliga gel G/UV-254 of 0.2 mm thickness (Merck, Germany).

Starting materials

Starting materials **2** and **4** derivatives (Table 1 in manuscript) has been prepared according to the literature procedure.[13c,d]

General procedure for the preparation of 2-pyridone and chrominopyridine derivatives: A mixture of 3-formylchromone **1** (1 mmol), (Z)-N-methyl-1-(methyl-thio)-2-nitroethenamine/N,N'-dimethyl-2-nitro-ethene-1,1-diamine **2/4** (1 mmol), and indium triflate (2 mol %) in ethanol (3 mL) were charged in a 25 mL round bottomed flask and the mixture was heated at reflux. The resulting solution was stirred for 1-3 hrs. The consumption of the starting material was monitored by TLC. After completition of the reaction, the products (**3a-s**) was filtered and washed with ethanol, dried under vacum and the products **5a-p** was purified by coloumn chromatography to obtain pure products **3a-s** and **5a-p** in good yields (65-95 %). The identities of products **3a-s** and **5a-p** were confirmed by NMR and EI-HRMS, giving good agreement with the assigned structures.

Synthetic transformation of products 3a:

A mixture of *γ*-nitro-2-pyridone **3a** (1 mmol) and stannous chloride dihydrate (7 equiv) in ethanol (3 mL) were charged in a 25 mL round bottomed flask and the mixture was heated at reflux. The resulting solution was stirred for 2 hrs. The consumption of the starting material was monitored by TLC. After completition of the reaction, the products was purified by coloumn chromatography to obtain pure products **14** in good yield (82 %). The identities of products **14** was confirmed by NMR and EI-HRMS, giving good agreement with the assigned structures.

Isolated as yellow solid, 82%, mp: 188-190 ^{o}C,^{1}H NMR (400 MHz, DMSO-d_6) δ_H 10.20 (1H, s), 7.74 (1 H, d, J = 1.3), 7.57 (1H, d, J = 1.8), 7.39 (2H, dd, J = 16.8, 8.0), 7.03 – 6.93 (2H, m), 3.72 (1H, s), 3.59 (3 H, s), 3.57 (1H, s) ppm. ^{13}C NMR (100 MHz, DMSO-d_6) δ_C 192.73, 158.55, 156.44, 137.27, 132.98, 130.50, 130.26, 125.21, 119.55, 117.61, 117.23, 110.72, 38.43 ppm. EI-HRMS: Anal. Calcd for $C_{13}H_{12}N_2O_3$: 244.0848, Found: 244.0847

Catalyst recovery and reuse during the preparation of 2-pyridone 3a

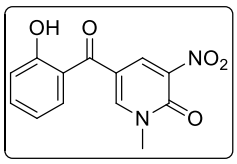
A mixture of 3-formylchromone **1** (1 equiv), (Z)-N-methyl-1-(methyl-thio)-2-nitroethenamine **2** (1 equiv), and indium triflate (2 mol %) in ethanol were charged in a 25 mL round bottomed flask and the mixture was heated at reflux. The resulting solution was stirred for 1 hr. The consumption of the starting material was monitored by TLC. After completion of the reaction, the products **3a** was filtered and washed with ethanol, dried under vacum to obtain pure product **3a** as 88 % yield**.** The filtrate was evaporated to dryness by repeated codistillation with toluene and finally dried under vacuum at 95–100◦C. The recovered catalyst is effective in subsequent experiments. It should be noted that the yields in second and even fifth run are comparable to that of the first run (Table 1).

Table 1 Catalyst recovery and reuse during the preparation of 2-pyridone **3a**

Run	$In(OTf)_3$ Product (%)	Yield[a,b,c] (%)
1st	3a	88
2nd	3a	86
3rd	3a	84
4th	3a	84
5th	3a	80

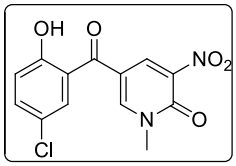
[a]The reaction was performed with 3-formylchromone **1** (1 equiv), NMSM **2** (1 equiv), $In(OTf)_3$ (2 mol %) and ethanol, at reflux, [b]Reaction progress was followed by TLC analysis. [c]Yield of isolated products.

3a:5-(2-hydroxybenzoyl)-1-methyl-3-nitropyridin-2(1*H*)-one



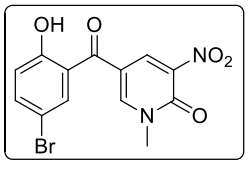
Isolated as yellow solid, 89%, mp: 219-221°C,^{1}H NMR (400 MHz, DMSO-d_6) δ 10.34 (s, 1H), 8.74 (s, 1H), 8.52 (d, J = 2.3 Hz, 1H), 7.51–7.22 (m, 2H), 7.07–6.67 (m, 2H), 3.62 (s, 3H) ppm. ^{13}C NMR (100 MHz, DMSO-d_6) δ 190.19, 155.83, 154.05, 150.44, 137.66, 136.15, 133.39, 130.21, 124.11, 119.45, 116.77, 114.28, 38.62 ppm. EI-HRMS: Anal. Calcd for $C_{13}H_{10}N_2O_5$: 274.0590, Found: 274.0587

3b: 5-(5-chloro-2-hydroxybenzoyl)-1-methyl-3-nitropyridin-2(1*H*)-one



Isolated as yellow solid, 88 %, mp: 202-204 °C, ^{1}H NMR (400 MHz, DMSO-d_6) δ 10.61 (s, 1H), 8.78 (d, J = 2.5 Hz, 1H), 8.56 (d, J = 2.5 Hz, 1H), 7.47 (dd, J = 8.8, 2.7 Hz, 1H), 7.38 (d, J = 2.7 Hz, 1H), 7.01 (d, J = 8.8 Hz, 1H), 3.65 (s, 3H) ppm. ^{13}C NMR (100 MHz, DMSO-d_6) δ 193.94, 159.51, 159.32, 156.00, 142.56, 141.67, 137.80, 134.30, 131.31, 128.28, 123.82, 119.25, 43.85 ppm. EI-HRMS: Anal. Calcd for $C_{13}H_9ClN_2O_5$: 308.0200, Found: 308.0199.

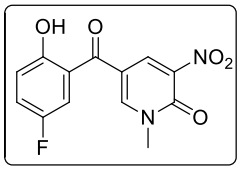
3c:5-(5-bromo-2-hydroxybenzoyl)-1-methyl-3-nitropyridin-2(1*H*)-one



Isolated as yellow solid, 85 %, mp: 210-212 °C,^{1}H NMR (400 MHz, DMSO-d_6) δ 10.65 (s, 1H), 8.78 (d, J = 2.0 Hz, 1H), 8.57 (d, J = 2.1 Hz, 1H), 7.69–7.37 (m,

2H), 6.97 (d, *J* = 8.7 Hz, 1H), 3.66 (s, 3H) ppm.^{13}C NMR (100 MHz, DMSO-d_6) δ 193.85, 159.92, 159.31, 156.06, 142.60, 141.64, 140.63, 137.14, 131.86, 124.26, 119.25, 115.71, 43.86. EI-HRMS: Anal. Calcd for $C_{13}H_9BrN_2O_5$: 351.9695, Found: 351.9690.

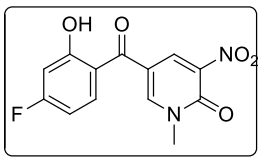
3d:5-(5-fluoro-2-hydroxybenzoyl)-1-methyl-3-nitropyridin-2(1*H*)-one



Isolated as yellow solid, 83 %, mp: 210-212 ^{o}C, ^{1}H NMR (400 MHz DMSO-d_6,) δ 10.32 (s, 1H), 8.77 (d, *J* = 2.0 Hz, 1H), 8.57 (d, *J* = 2.4 Hz, 1H), 7.30 (td, *J* = 8.6, 3.2 Hz, 1H), 7.21 (dd, *J* = 8.6, 3.2 Hz, 1H), 7.00 (dd, *J* = 9.0, 4.4 Hz, 1H), 3.66 (s, 3H).^{13}C NMR (100 MHz, DMSO-d_6) . δ $_C$ 194.09, 161.62, 159.32-159.27 (d, *J* = 4.10 Hz), 157.06, 156.08, 142.66, 141.65, 130.24-130.17 (d, *J* = 6.70 Hz), 125.16-124.93 (d, *J* = 23.75 Hz), 123.40-123.32 (d, *J* = 8.70 Hz), 121.08-120.84 (d, *J* = 24.69 Hz), 119.21, 43.86.

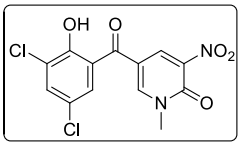
HRMS: Anal. Calcd for $C_{13}H_9FN_2O_5$: 292.0495, Found: 292.0491.

3e:5-(4-fluoro-2-hydroxybenzoyl)-1-methyl-3-nitropyridin-2(1*H*)-one



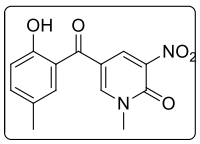
Isolated as yellow solid, 86 %, mp: 260-261^{o}C, ^{1}H NMR (400 MHz, DMSO-d_6) δ 8.77 (d, *J* = 2.3 Hz, 1H), 8.58 (d, *J* = 2.4 Hz, 1H), 7.50 (dd, *J* = 8.2, 7.2 Hz, 1H), 6.80 (ddd, *J* = 12.8, 9.5, 2.1 Hz, 2H), 3.66 (s, 3H).^{13}C NMR (100 MHz, DMSO-d_6). δ $_C$ 194.35, 171.37, 168.89, 163.37-163.25 (d, *J* = 13.62 Hz), 159.31, 155.74, 142.75-142.69 (d, *J* = 5.68 Hz), 141.56, 137.94-137.82 (d, *J* = 11.35 Hz), 126.34-126.32 (d, *J* = 2.25 Hz), 119.58, 112.15-108.71 (dd, *J* = 322.91, 23.01 Hz), 43.81ppm. EI-HRMS: Anal. Calcd for $C_{13}H_9FN_2O_5$: 292.0495, Found: 292.0493.

3f:5-(3,5-dichloro-2-hydroxybenzoyl)-1-methyl-3-nitropyridin-2(1*H*)-one



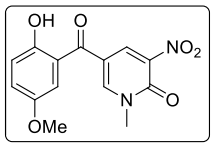
Isolated as yellow solid, 84 %, mp: 209-211^{o}C,^{1}H NMR (400 MHz, DMSO-d_6) δ 8.72 (d, *J* = 1.8 Hz, 1H), 8.56 (d, *J* = 2.0 Hz, 1H), 7.72 (d, *J* = 2.2 Hz, 1H), 7.36 (d, *J* = 2.2 Hz, 1H), 3.60 (s, 3H).^{13}C NMR (100 MHz, DMSO-d_6) δ 188.11, 154.03, 150.92, 150.50, 136.81, 136.60, 131.89, 128.11, 127.84, 123.54, 123.36, 113.82, 38.62 ppm. EI-HRMS: Anal. Calcd for $C_{13}H_8Cl_2N_2O_5$: 341.9810, Found: 341.9810.

3g: 5-(2-hydroxy-5-methylbenzoyl)-1-methyl-3-nitropyridin-2(1*H*)-one



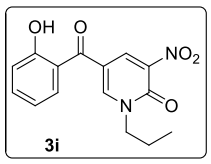
Isolated as yellow solid, 80 %, mp: 216-218 ^{o}C,^{1}H NMR (400 MHz, DMSO-d_6) δ 10.18 (s, 1H), 8.77 (d, *J* = 2.4 Hz, 1H), 8.56 (d, *J* = 2.5 Hz, 1H), 7.27 (dd, *J* = 8.3, 1.9 Hz, 1H), 7.20 (d, *J* = 1.7 Hz, 1H), 6.91 (d, *J* = 8.3 Hz, 1H), 3.68 (s, 3H), 2.26 (s, 3H).^{13}C NMR (100 MHz, DMSO-d_6) δ 195.55, 159.29, 158.83, 155.73, 143.10, 141.37, 139.31, 135.36, 133.50, 129.06, 121.92, 119.63, 43.86, 25.05 ppm. EI-HRMS: Anal. Calcd for $C_{14}H_{12}N_2O_5$: 288.0746, Found: 288.0743.

3h:5-(2-hydroxy-5-methoxybenzoyl)-1-methyl-3-nitropyridin-2(1*H*)-one



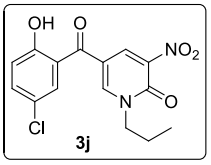
Isolated as yellow solid, 78 %, mp: 215-217 ^{o}C,^{1}H NMR (400 MHz, DMSO-d_6) δ 9.86 (s, 1H), 8.71 (s, 1H), 8.52 (d, *J* = 2.0 Hz, 1H), 7.02 (dd, *J* = 8.9, 2.9 Hz, 1H), 6.91 – 6.77 (m, 2H), 3.68 (s, 3H), 3.62 (s, 3H).^{13}C NMR (100 MHz, DMSO-d_6) δ 195.05, 159.34, 157.40, 155.77, 154.79, 142.97, 141.35, 129.46, 125.20, 123.13, 119.46, 118.86, 60.74, 43.80. EI-HRMS: Anal. Calcd for $C_{14}H_{12}N_2O_6$: 304.0695, Found: 304.0689.

3i: 5-(2-hydroxybenzoyl)-3-nitro-1-propylpyridin-2(1*H*)-one



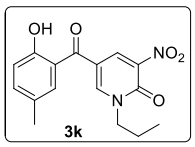
Isolated as yellow solid, 75 %, mp: 170-172^{o}C, ^{1}H NMR (400 MHz, DMSO-d_6) δ_H 10.43 (1H, s), 8.70 (1H, d, *J* = 2.5), 8.55 (1H, d, *J* = 2.5), 7.51–7.36 (2H, m), 7.05 –6.89 (2H, m), 4.08 (2H, t, *J* = 7.2), 1.70 (2H, dd, *J* = 14.6, 7.3), 0.88 (3H, t, *J* = 7.4) ppm. ^{13}C NMR (100 MHz, DMSO-d_6): δ_C 190.68, 156.30, 154.09, 150.36, 137.91, 137.26, 133.99, 130.84, 124.58, 120.00, 117.25, 115.02, 52.49, 22.24, 11.06 ppm. EI-HRMS: Anal. Calcd for $C_{15}H_{14}N_2O_5$: 302.0903, Found: 302.0900.

3j:5-(5-chloro-2-hydroxybenzoyl)-3-nitro-1-propylpyridin-2(1*H*)-one



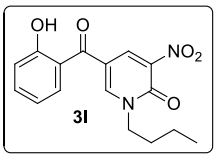
Isolated as yellow solid, 82 %, mp: 192-194^{o}C, ^{1}H NMR (400 MHz, DMSO-d_6): δ_H 10.55 (1H, d, *J* = 63.9), 8.72 (1H, d, *J* = 2.5), 8.56 (1H, d, *J* = 2.5), 7.47 (1H, dd, *J* = 8.8, 2.7), 7.38 (1H, d, *J* = 2.7), 7.01 (1H, d, *J* = 8.8), 4.08 (2H, t, *J* = 7.2), 1.66 (2H, dd, *J* = 14.5, 7.3), 0.88 (3H, t, *J* = 7.3). ^{13}C NMR (100 MHz, DMSO-d_6): δ_C 189.13, 154.83, 154.09, 150.69, 137.50, 137.47, 133.15, 129.73, 126.47, 123.55, 119.10, 114.66, 52.44, 22.22, 11.04. EI-HRMS: Anal. Calcd for $C_{15}H_{13}ClN_2O_5$: 336.0513, Found: 336.0512.

3k: 5-(2-hydroxy-5-methylbenzoyl)-3-nitro-1-propylpyridin-2(1*H*)-one



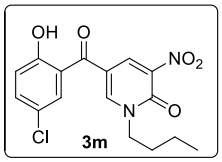
Isolated as yellow solid, 79 %, mp: 177-179^{o}C, ^{1}H NMR (400 MHz, DMSO-d_6): δ_H 10.16 (1H, s), 8.69 (1H, d, *J* = 2.5), 8.56 (1H, t, *J* = 6.3), 7.25 (1H, dt, *J* = 17.6, 8.8), 7.20 (1H, s), 6.90 (1H, d, *J* = 8.3), 4.16–3.98 (2H, m), 2.25 (3H, s), 1.77–1.63 (2H, m), 0.88 (3 H, t, *J* = 7.6) ppm. ^{13}C NMR (100 MHz, DMSO-d_6): δ_C 190.74, 154.13, 154.09, 150.38, 137.95, 137.28, 134.66, 130.76, 128.75, 124.27, 117.20, 115.05, 52.46, 22.23, 20.30, 11.07 ppm. EI-HRMS: Anal. Calcd for $C_{16}H_{16}N_2O_5$: 316.1059, Found: 316.1054.

3l:1-butyl-5-(2-hydroxybenzoyl)-3-nitropyridin-2(1*H*)-one



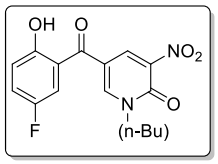
Isolated as yellow solid, 83 %, mp: 155-157^{o}C, ^{1}H NMR (400 MHz, DMSO-d_6): δ_H 10.42 (1H, s), 8.70 (1H, d, *J* = 2.5), 8.55 (1H, d, *J* = 2.5), 7.50 – 7.35 (2H, m), 6.99 (2H, dd, *J* = 16.0, 7.9), 4.12 (1H, t, *J* = 7.3), 3.40 (1H, d, *J* = 6.3), 1.74 – 1.50 (2H, m), 1.37 – 1.22 (2 H, m), 0.88 (3 H, td, *J* = 7.3, 3.4) ppm.^{13}C NMR (100 MHz, DMSO-d_6): δ_C 190.66, 156.37, 154.04, 150.30, 137.88, 133.96, 130.83, 124.54, 119.95, 117.25, 115.05, 112.70, 50.81, 30.96, 19.55, 13.87 ppm. EI-HRMS: Anal. Calcd for $C_{16}H_{16}N_2O_5$: 316.1059, Found: 316.1052.

3m:1-butyl-5-(5-chloro-2-hydroxybenzoyl)-3-nitropyridin-2(1*H*)-one



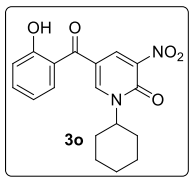
Isolated as yellow solid, 78 %, mp: 160-162°C, ^{1}H NMR (400 MHz, DMSO-d_6): δ_H (400 MHz, DMSO) 10.61 (1H, s), 8.72 (1H, d, *J* = 2.5), 8.56 (1H, d, *J* = 2.5), 7.47 (1H, dd, *J* = 8.8, 2.7), 7.38 (1H, d, *J* = 2.7), 7.02 (1H, d, *J* = 8.8), 4.11 (2H, t, *J* = 7.3), 1.71 – 1.56 (2H, m), 1.29 (2H, m), 0.90 (3 H, t, *J* = 7.3) ppm. ^{13}C NMR (100 MHz, DMSO-d_6): δ_C 189.11, 154.86, 154.07, 150.60, 137.51, 137.43, 133.15, 129.73, 126.48, 123.54, 119.11, 114.70, 50.77, 30.94, 19.52, 13.92. ppm. EI-HRMS: Anal. Calcd for $C_{16}H_{15}ClN_2O_5$: 350.0669, Found: 350.0664.

3n: 1-Butyl-5-(5-fluoro-2-hydroxybenzoyl)-3-nitropyridin-2(1*H*)-one



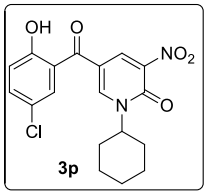
Isolated as yellow solid, 75 %, mp: 144-146 °C, ^{1}H NMR (400 MHz, $CDCl_3$):δ_H 10.86 (1H, s), 8.68 (1H, d, *J*= 2.6), 8.30 (1H, d, *J*= 2.6), 7.33 (1H, dd, *J*= 9.2, 7.7), 7.21 (1H, dd, *J*= 8.4, 3.0), 7.10 (1H, dd, *J*= 9.2, 4.5), 4.22–4.04 (2 H, m), 1.89–1.77 (2H, m), 1.44 (2H, dd, *J*= 15.1, 7.5), 1.00 (3H, t, *J*= 7.4).^{13}C NMR (100 MHz, $CDCl_3$): δ_C 192.21, 158.68-158.66 (d, J = 2.18 Hz), 156.10, 153.71, 153.65, 147.43, 137.42, 124.73-124.49 (d, J = 23.84 Hz), 120.70-120.63 (d, J = 7.59 Hz), 117.80-117.74 (d, J = 7.11 Hz), 116.13-115.89 (d, J = 23.69 Hz), 113.92, 52.04, 31.08, 19.80, 13.50 ppm. EI-HRMS: Anal. Calcd for $C_{16}H_{15}FN_2O_5$: 334.0965, Found: 334.0961.

3o: cyclohexyl-5-(2-hydroxybenzoyl)-3-nitropyridin-2(1H)-one



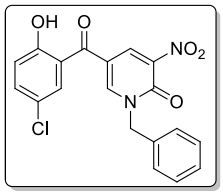
Isolated as yellow solid, 87 %, mp: 206-208°C, ^{1}H NMR (400 MHz, DMSO-d_6): δ_H 10.47 (1H, s), 8.51 (2H, d, *J* = 3.7), 7.56–7.28 (2H, m), 7.12–6.83 (2H, m), 4.72 (1H, dd, *J* = 16.2, 7.5), 1.85 (4H, t, *J* = 13.5), 1.62 (3H, dd, *J* = 20.7, 11.8), 1.41 (2H, q, *J* = 12.7), 1.22 (1H, t, *J* = 12.8) ppm. ^{13}C NMR (100 MHz, DMSO-d_6): δ_C 190.51, 156.29, 153.86, 146.42, 137.36, 137.17, 134.15, 131.02, 124.45, 120.09, 117.25, 115.09, 57.43, 31.61, 25.74, 24.90 ppm. EI-HRMS: Anal. Calcd for $C_{18}H_{18}N_2O_5$: 342.1216, Found: 342.1212.

3p:5-(5-chloro-2-hydroxybenzoyl)-1-cyclohexyl-3-nitropyridin-2(1*H*)-one



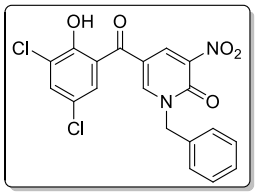
Isolated as yellow solid, 85 %, mp: 210-212°C, ^{1}H NMR (400 MHz, $CDCl_3$): δ_H 11.05 (1H, s), 8.62 (1H, s), 8.29 (1H, s), 7.52 (H, d, *J* = 8.9), 7.47 (1H, s), 7.09 (1H, d, *J* = 8.9), 5.00 (1H, t, *J* = 11.5), 2.16 – 1.93 (4H, m), 1.82 (1H, d, *J* = 13.9), 1.66 – 1.40 (4H, m), 1.32 – 1.06 (1H, m) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ_C 192.38, 161.06, 153.52, 144.21, 137.67, 136.77, 136.41, 130.13, 124.27, 120.85, 118.88, 113.78, 57.05, 32.81, 25.63, 25.02 ppm. EI-HRMS: Anal. Calcd for $C_{18}H_{17}ClN_2O_5$: 376.0826, Found: 376.0820.

3q: 1-Benzyl-5-(5-chloro-2-hydroxybenzoyl)-3-nitropyridin-2(1*H*)-one



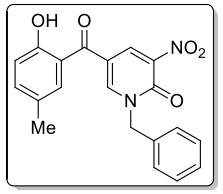
Isolated as yellow solid, 65 %, mp: 186-188 ^{o}C, ^{1}H NMR (400 MHz, $CDCl_3$):δ_H 11.00 (s, 1H), 8.67 (d, *J* = 2.6 Hz, 1H), 8.23 (d, *J* = 2.6 Hz, 1H), 7.46 – 7.40 (m, 5H), 7.32 (d, *J* = 2.6 Hz, 1H), 7.26 (s, 1H), 7.05 (d, *J* = 8.9 Hz, 1H), 5.29 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ_C 191.99, 161.00, 153.81, 146.69, 137.31, 136.80, 133.52, 129.95, 129.74, 129.57, 129.06, 127.42, 124.22, 120.81, 118.81, 114.01. 54.11 ppm. EI-HRMS: Anal. Calcd for $C_{19}H_{13}ClN_2O_5$: 384.0513, Found: 384.0511.

3r:1-Benzyl-5-(3,5-dichloro-2-hydroxybenzoyl)-3-nitropyridin-2(1*H*)-one



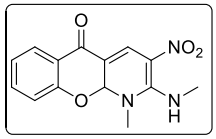
Isolated as yellow solid, 78 %, mp: 180-182 ^{o}C, ^{1}H NMR (400 MHz, $CDCl_3$):δ_H 11.07 (1H, s), 8.66 (1H, d, *J*= 2.6), 8.24 (1H, d, *J*= 2.6), 7.61 (1H, d, *J*= 2.4), 7.48–7.37 (5H, m), 7.26 (1H, d, *J*= 2.2), 5.29 (2H, s).^{13}C NMR (100 MHz, $CDCl_3$): δ_C 191.44, 160.47, 156.13, 153.78, 147.03, 137.17, 136.03, 133.38, 129.75, 129.62, 129.10, 128.56, 124.77, 124.24, 119.88, 113.70, 54.14 ppm. EI-HRMS: Anal. Calcd for $C_{19}H_{12}Cl_2N_2O_5$: 418.0123, Found: 418.0122.

3s:1-Benzyl-5-(2-hydroxy-5-methylbenzoyl)-3-nitropyridin-2(1*H*)-one



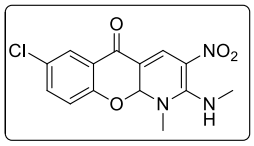
Isolated as yellow solid, 72 %, mp: 184-186^{o}C, ^{1}H NMR (400 MHz, $CDCl_3$):δ_H 10.96 (1H, s), 8.67 (1H, d, *J* 2.5), 8.26 (1H, d, *J* 2.5), 7.46–7.39 (5H, m), 7.34 (1H, dd, *J* 8.5, 2.0), 7.10 (1H, d, *J* 1.3), 6.97 (1H, d, *J* 8.5), 5.30 (2H, s), 2.22 (3 H, s).^{13}C NMR (100 MHz, $CDCl_3$): δ_C 192.91, 160.57, 153.93, 146.80, 138.09, 137.92, 137.80, 133.96, 130.73, 129.55, 129.37, 129.02, 128.69, 118.91, 117.83, 114.71, 53.84, 20.49 ppm. EI-HRMS: Anal. Calcd for $C_{20}H_{16}N_2O_5$: 364.1059, Found: 364.1056.

5a:1-methyl-2-(methylamino)-3-nitro-1H-chromeno[2,3-b]pyridin-5(10a*H*)-one



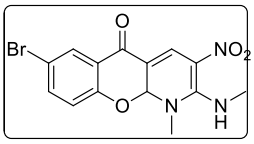
Isolated as yellow solid, 94 %, mp: 200-202^{o}C,^{1}H NMR (400 MHz, DMSO-d_6) δ 10.59 (d, *J* = 3.7 Hz, 1H), 7.90 (s, 1H), 7.81 (dd, *J* = 7.8, 1.5 Hz, 1H), 7.63 – 7.56 (m, 1H), 7.15 (t, *J* = 7.2 Hz, 1H), 7.07 (d, *J* = 8.2 Hz, 1H), 6.40 (d, *J* = 16.6 Hz, 1H), 3.51 (s, 3H), 3.25 (d, *J* = 5.1 Hz, 3H).^{13}C NMR (100 MHz, DMSO-d_6) δ 179.39, 157.41, 156.49, 136.07, 126.85, 126.52, 122.87, 122.47, 118.14, 113.10, 112.97, 90.49, 42.71, 33.89.EI-HRMS: Anal. Calcd for $C_{14}H_{13}N_3O_4$: 287.0906, Found: 287.0902.

5b:7-chloro-1-methyl-2-(methylamino)-3-nitro-1H-chromeno[2,3-b]pyridin-5(10a*H*)-one



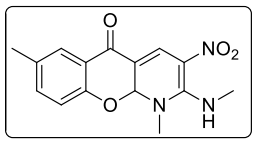
Isolated as yellow solid, 93 %, mp: 219-221^{o}C,^{1}H NMR (400 MHz, DMSO-d_6) δ 10.54 (s, 1H), 7.94 (s, 1H), 7.74 (d, *J* = 2.7 Hz, 1H), 7.65 (dd, *J* = 8.8, 2.7 Hz, 1H), 7.14 (d, *J* = 8.8 Hz, 1H), 6.44 (s, 1H), 3.52 (s, 3H), 3.25 (d, *J* = 5.2 Hz, 3H).^{13}C NMR (100 MHz, DMSO) δ 179.42, 157.41, 154.48, 136.86, 131.61, 126.43, 126.36, 122.51, 117.94, 113.32, 112.92, 90.38, 42.68, 33.88 ppm. EI-HRMS: Anal. Calcd for $C_{14}H_{12}ClN_3O_4$: 321.0516, Found: 321.0513

5c: 7-bromo-1-methyl-2-(methylamino)-3-nitro-1*H*-chromeno[2,3-b]pyridin-5(10a*H*)-one



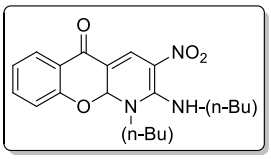
Isolated as yellow solid, 95 %, mp: 220-222^{o}C,^{1}H NMR (400 MHz, DMSO-d_6) δ 10.54 (s, 1H), 7.94-7.81 (m, 2H), 7.74 (dd, J = 8.7, 2.3, 1H) 7.08 (d, *J* = 8.8 Hz, 1H), 6.45 (s, 1H), 3.52 (s, 3H), 3.25 (d, *J* = 5.3 Hz, 3H) ppm. ^{13}C NMR (100 MHz, DMSO-d_6) δ $_{C}$ 178.67, 157.83, 156.03, 138.84, 132.12, 129.31, 124.96, 121.34, 114.69, 113.69, 112.39, 91.36, 43.32, 34.46 ppm. EI-HRMS: Anal. Calcd for C_{14} H_{12}Br N_3 O_4: 365.0011, Found: 365.0010

5d: 7-methyl-1-methyl-2-(methylamino)-3-nitro-1*H*-chromeno[2,3-b]pyridin-5(10a*H*)-one



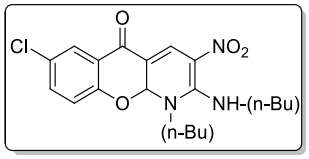
Isolated as yellow solid, 92 %, mp: 192-194^{o}C,^{1}H NMR (400 MHz, DMSO-d_6) δ 10.60 (d, *J* = 4.5 Hz, 1H), 7.90 (s, 1H), 7.60 (d, *J* = 1.5 Hz, 1H), 7.42 (dd, *J* = 8.4, 2.1 Hz, 1H), 6.98 (d, *J* = 8.4 Hz, 1H), 6.33 (s, 1H), 3.51 (s, 3H), 3.26 (d, *J* = 5.2 Hz, 3H), 2.30 (s, 3H). ^{13}C NMR (100 MHz, DMSO-d_6) δ 179.42, 157.42, 154.49, 136.86, 131.62, 126.43, 126.36, 122.52, 117.94, 113.32, 112.93, 90.39, 42.66, 33.87, 20.00. EI-HRMS: Anal. Calcd for C_{15} $H_{15}N_3$ O_4: 301.1063, Found: 301.1060

5e:1-Butyl-2-(butylamino)-3-nitro-1*H*-chromeno[2,3-b]pyridin-5(10a*H*)-one



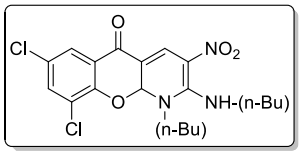
Isolated as yellow semi solid, 87 %, ^{1}H NMR (400 MHz, $CDCl_3$) δ $_{H}$ 11.07 (1 H, d, *J* = 2.5), 8.16 (1 H, s), 7.92 (1 H, dd, *J* = 7.8, 1.6), 7.54 – 7.43 (1 H, m), 7.12 – 7.02 (1 H, m), 6.97 (1 H, d, *J* = 8.2), 6.13 (1 H, s), 3.91 – 3.43 (4 H, m), 1.92 – 1.71 (4 H, m), 1.50 (2 H, dd, *J* = 15.1, 7.5), 1.46 – 1.30 (2 H, m), 0.99 (6 H, td, *J* = 7.3, 5.7). ^{13}C NMR (100 MHz, $CDCl_3$) δ $_{C}$ 180.44, 157.03, 156.66, 135.87, 127.65, 123.39, 122.66, 117.98, 114.18, 114.12, 89.09, 54.18, 47.48, 32.10, 29.97, 19.86, 19.83, 13.73, 13.52 ppm. EI-HRMS: Anal. Calcd for C_{20} H_{25} N_3 O_4: 371.1845, Found: 371.1838

5f:1-Butyl-2-(butylamino)-7-chloro-3-nitro-1*H*-chromeno[2,3-b]pyridin-5(10a*H*)-one



Isolated as yellow semi solid, 85 %, ^{1}H NMR (400 MHz, $CDCl_3$) δ $_{H}$ 11.01 (1H, s), 8.19 (1H, s), 7.88 (1H, d, *J* = 1.1), 7.43 (1H, dd, *J* = 8.7, 2.8), 6.93 (1H, d, *J* = 8.8), 6.12 (1H, s), 3.92 – 3.79 (1H, m), 3.78 – 3.64 (1H, m), 3.65 – 3.53 (1H, m), 3.48 (1H, dd, *J* = 12.5, 6.3), 1.79 (4 H, dd, *J* = 12.9, 5.7), 1.50 (2H, dd, *J* = 15.0, 7.5), 1.45 – 1.33 (2H, m), 0.99 (6H, td, *J* = 7.3, 5.4) ppm. ^{13}C NMR (100 MHz, $CDCl_3$) δ $_{C}$179.26, 157.01, 154.99, 135.60, 128.53, 128.21, 127.07, 124.33, 119.64, 114.36, 112.99, 89.32, 54.31, 47.54, 32.10, 29.95, 19.87, 19.83, 13.72, 13.51 ppm. EI-HRMS: Anal. Calcd for $C_{20}H_{24}$Cl N_3 O_4: 405.1455, Found: 405.1454

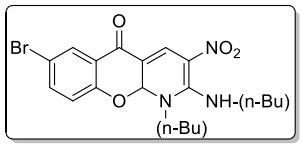
5g: 1-Butyl-2-(butylamino)-7,9-dichloro-3-nitro-1*H*-chromeno[2,3-b]pyridin-5(10a*H*)-one



Isolated as yellow semi solid, 89 %, ^{1}H NMR (400 MHz, $CDCl_3$) δ $_{H}$ 11.04 (1 H, s), 8.25 (1 H, s), 7.81 (1 H, d, *J* = 2.5), 7.55 (1H, d, *J* = 2.5), 6.19 (1H,

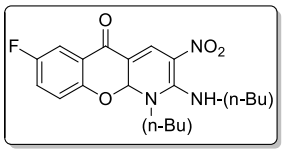
s), 3.78 (2H, t, *J* = 7.9), 3.66–3.40 (2H, m), 2.03 – 1.77 (4H, m), 1.59–1.33 (4 H, m). 1.0 (6H, t, *J* = 7.0).[13]C NMR (100 MHz, $CDCl_3$) δ_C 178.41, 156.95, 155.36, 135.17, 129.41, 127.94, 125.82, 125.24, 124.17, 114.39, 111.77, 90.44, 54.63, 47.61, 32.14, 30.40, 19.95, 19.87, 13.71, 13.51 ppm. EI-HRMS: Anal. Calcd for $C_{20}H_{23}Cl_2N_3O_4$: 439. 1066, Found: 439. 1063

5h:7-Bromo-1-butyl-2-(butylamino)-3-nitro-1*H*-chromeno[2,3-b]pyridin-5(10a*H*)-one



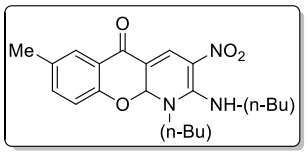
Isolated as yellow semi solid, 80 %, [1]H NMR (400 MHz, $CDCl_3$). δ_H 11.01 (1H, d, *J* = 2.5), 8.18 (1H, s), 8.02 (1H, d, *J* = 2.5), 7.56 (1H, dd, *J* = 8.7, 2.5), 6.87 (1H, d, *J* = 8.7), 6.12 (1H, s), 3.97– 3.34 (4H, m), 1.94–1.69 (4H, m), 1.58–1.33 (4H, m), 0.99 (6H, td, *J* = 7.3, 5.1) ppm. [13]C NMR (100 MHz, $CDCl_3$) δ_C 179.14, 157.00, 155.47, 138.41, 130.16, 128.55, 124.75, 119.99, 115.42, 114.36, 112.90, 89.31, 54.32, 47.54, 32.10, 29.96, 19.87, 19.83, 13.73, 13.52 ppm. EI-HRMS: Anal. Calcd for $C_{20}H_{24}BrN_3O_4$: 449.0950, Found: 449.0950

5i: 1-Butyl-2-(butylamino)-7-fluoro-3-nitro-1*H*-chromeno[2,3-b]pyridin-5(10a*H*)-one



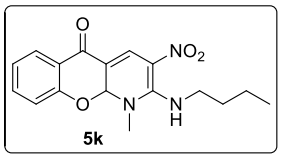
Isolated as yellow semi solid, 84 %, [1]H NMR (400 MHz, $CDCl_3$) δ_H 11.03 (1 H, s), 8.18 (1 H, d, *J* = 2.5), 7.60 – 7.53 (1 H, m), 7.24 – 7.15 (1 H, m), 6.96 (1 H, dd, *J* = 9.0, 4.2), 6.12 (1 H, s), 3.90 – 3.43 (4 H, m), 1.80 (4 H, dd, *J* = 14.3, 7.0), 1.45 (4 H, ddd, *J* = 44.7, 14.8, 7.4), 1.00 (6 H, dt, *J* = 11.8, 6.0) ppm. [13]C NMR (100 MHz, $CDCl_3$) δ_C 179.56, 157.04, 152.69-152.68 (d, J = 1.96 Hz), 128.42, 124.27-124.20 (d, J = 6.47 Hz), 123.28-123.03 (d, J = 24.31 Hz), 119.64-119.56 (d, J = 7.59 Hz), 114.34, 113.20, 113.03, 112.79, 89.25, 54.24, 47.53, 32.09, 29.93, 19.86, 19.83, 13.72, 13.51 ppm. EI-HRMS: Anal. Calcd for $C_{20}H_{24}FN_3O_4$: 389.1751, Found: 389.1748.

5j: 1-Butyl-2-(butylamino)-7-methyl-3-nitro-1*H*-chromeno[2,3-b]-pyridin-5(10a*H*)-one



Isolated as yellow semi solid, 86 %, [1]H NMR (400 MHz, $CDCl_3$) δ_H 11.09 (1H, d, *J* = 10.6), 8.20 (1H, d, *J* = 0.4), 7.76 (1H, d, *J* = 1.6), 7.32 (1H, dd, *J* = 8.3, 2.1), 6.87 (1H, d, *J* = 8.4), 6.08 (1H, s), 3.82 – 3.45 (4H, m), 1.78 (4H, m), 1.53 (2H, m), 1.37 (2H, dd, *J* = 14.7, 7.3), 1.0 (6H, t, *J* = 6.9) ppm. [13]C NMR (100 MHz, $CDCl_3$) δ_C 180.65, 157.12, 154.63, 136.87, 132.35, 127.64, 127.44, 123.07, 117.69, 114.36, 114.23, 89.02, 54.09, 47.50, 32.13, 29.92, 20.50, 19.88, 19.84, 13.73, 13.53 ppm. EI-HRMS: Anal. Calcd for $C_{21}H_{27}N_3O_4$: 385.2002, Found: 385.2000

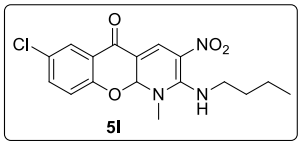
5k:2-(butylamino)-1-methyl-3-nitro-1*H*-chromeno[2,3-*b*]pyridin-5(10*aH*)-one



Isolated as yellow semi solid, 80 %, [1]H NMR (400 MHz, DMSO-d_6) δ_H 11.68 (1H, s), 8.94 (1H, s), 8.85 (1H, d, *J* = 7.6), 8.65 (1H, t, *J* = 7.6), 8.20 (1H, t, *J* = 7.5), 8.12 (1H, d, *J* = 8.3), 7.42 (1H, s) 4.81–4.74 (1 H, m), 4.63 (1H, d, *J* =

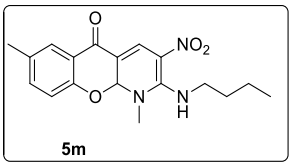
4.6), 4.55 (3H, s), 2.73–2.61 (2H, m), 2.41 (2H, dd, *J* = 14.9, 7.3), 1.95 (3H, t, *J* = 7.3) ppm. ^{13}C NMR (100 MHz, DMSO-d_6) δ_C 181.03, 158.18, 158.02, 137.75, 128.41, 127.85, 124.34, 124.12, 119.70, 115.08, 114.48, 91.85, 48.25, 44.32, 33.15, 20.70, 14.92 ppm. EI-HRMS: Anal. Calcd for $C_{17}H_{19}N_3O_4$: 329.1376, Found: 329.1371.

5l:2-(butylamino)-7-chloro-1-methyl-3-nitro-1*H*-chromeno[2,3-*b*]pyridin-5(10*aH*)-one



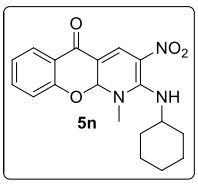
Isolated as yellow semi solid, 84 %, ^{1}H NMR (400 MHz, DMSO-d_6) δ_H 10.60 (1H, s), 7.93 (1H, s), 7.73 (1H, d, *J* = 2.7), 7.64 (1H, dd, *J* = 8.8, 2.7), 7.13 (1H, d, *J* = 8.8), 6.44 (1H, s), 3.84–3.67 (1H, m), 3.67– 3.54 (1 H, m), 3.51 (3H, s), 1.65 (2H, dt, *J* = 14.0, 6.9), 1.45– 1.31 (2H, m), 0.92 (3 H, t, *J* = 7.4) ppm. ^{13}C NMR (100 MHz, DMSO-d_6) δ_C 178.80, 157.09, 155.63, 136.13, 127.13, 126.28, 124.48, 121.03, 118.86, 113.65, 112.89, 91.13, 47.24, 43.40, 32.09, 19.67, 13.89 ppm. EI-HRMS: Anal. Calcd for $C_{17}H_{18}ClN_3O_4$: 363.0986, Found: 363.0980.

5m:2-(butylamino)-1,7-dimethyl-3-nitro-1*H*-chromeno[2,3-*b*]pyridin-5(10*aH*)-one



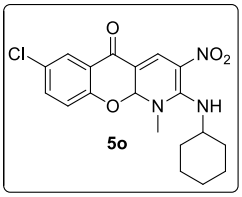
Isolated as yellow semi solid, 83 %, ^{1}H NMR (400 MHz, DMSO-d_6) δ_H10.65 (1H, d, *J*= 2.5), 7.88 (1H, s), 7.59 (1H, d, *J*= 1.6), 7.41 (1H, dd, *J*= 8.4, 2.1), 6.96 (1H, d, *J*= 8.4), 6.31 (1H, s), 3.85–3.64 (1H, m), 3.57 (1H, dd, *J*= 13.6, 7.1), 3.50 (3H, s), 2.29 (3H, s), 1.71–1.57 (2H, m), 1.36 (2H, m), 0.91 (3H, t, *J*= 7.4) ppm.^{13}C NMR (100 MHz, DMSO-d_6) δ_C 179.95, 157.14, 154.98, 137.43, 132.20, 126.93, 126.65, 122.97, 118.44, 114.21, 113.40, 90.72, 47.21, 43.20, 32.14, 20.49, 19.68, 13.87..EI-HRMS: Anal. Calcd for $C_{18}H_{21}N_3O_4$: 343.1532, Found: 343.1529.

5n:1-benzyl-5-(5-chloro-2-hydroxybenzoyl)-3-nitropyridin-2(1*H*)-one



Isolated as yellow semi solid, 85 %, ^{1}H NMR (400 MHz, DMSO-d_6) δ_H 10.69 (1H, d, *J*= 8.2), 7.89 (1H, s), 7.81 (1H, dd, *J*= 7.8, 1.3), 7.6–7.51 (1H, m), 7.16 (2H, d, *J*= 7.4), 6.40 (1H, s), 4.02–3.92 (1H, m), 3.50 (3H, s), 2.08 (1H, d, *J*= 9.6), 1.91–1.81 (1H, m), 1.71 (1H, d, *J*= 8.8), 1.60–1.14 (7H, m) ppm.^{13}C NMR (100 MHz, DMSO-d_6) δ_C 179.94, 156.92, 156.37, 136.66, 127.35, 126.64, 123.32, 123.06, 118.68, 114.12, 113.84, 90.94, 55.21, 43.24, 34.12, 33.15, 25.17, 24.07, 23.88 ppm.EI-HRMS: Anal. Calcd for $C_{19}H_{21}N_3O_4$: 355.1532, Found: 355.1533.

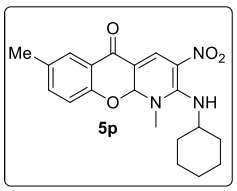
5o:7-chloro-2-(cyclohexylamino)-1-methyl-3-nitro-1*H*-chromeno[2,3-*b*]pyridin-5(10*aH*)-one



Isolated as yellow semi solid, 87 %, ^{1}H NMR (400 MHz, DMSO-d_6) δ_H 10.45 (1H, d, *J*= 7.7), 7.71 (1H, s), 7.51 (1H, d, *J*= 2.1), 7.42 (1H, dd, *J*= 8.7, 2.2), 6.92 (1H, d, *J*= 8.8), 6.23 (1H, s), 3.77 (1H, s), 3.29 (3H, s), 1.87 (1H, s), 1.67 (1H, d,

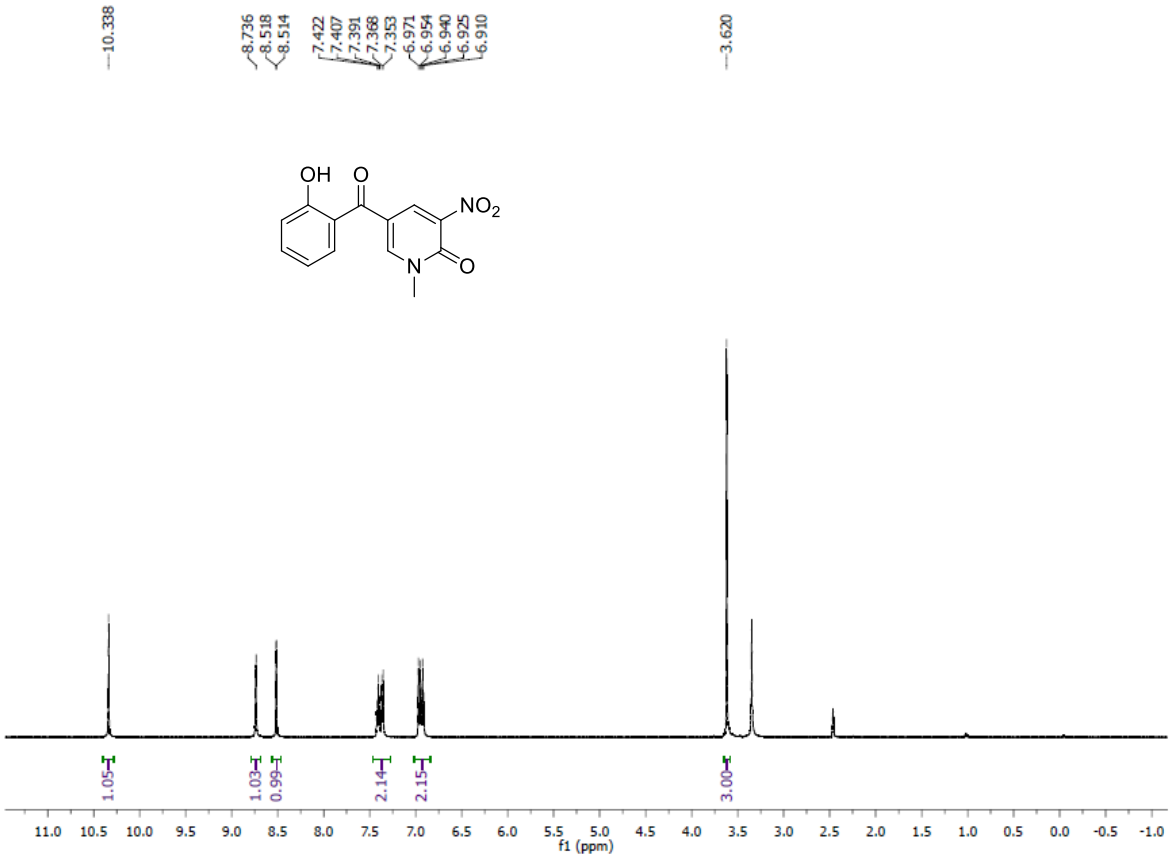
J= 8.5), 1.50 (1H, s), 1.44 –1.02 (7H, m) ppm.^{13}C NMR (100 MHz, DMSO-d_6) δ_C 178.87, 156.32, 155.59, 136.19, 127.50, 127.18, 126.28, 124.47, 121.10, 114.02, 113.08, 91.21, 55.27, 43.40, 34.07, 33.11, 25.14, 24.05, 23.89 ppm.EI-HRMS: Anal. Calcd for $C_{19}H_{20}ClN_3O_4$: 389.1142, Found: 389.1140.

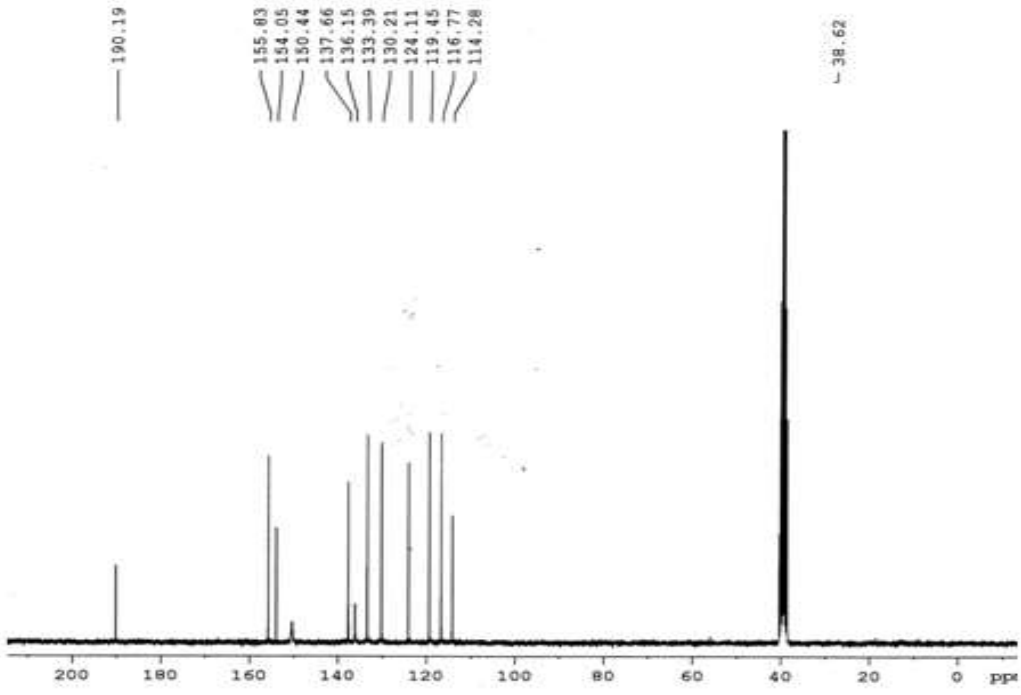
5p:2-(cyclohexylamino)-1,7-dimethyl-3-nitro-1*H*-chromeno[2,3-*b*]pyridin-5(10*aH*)-one



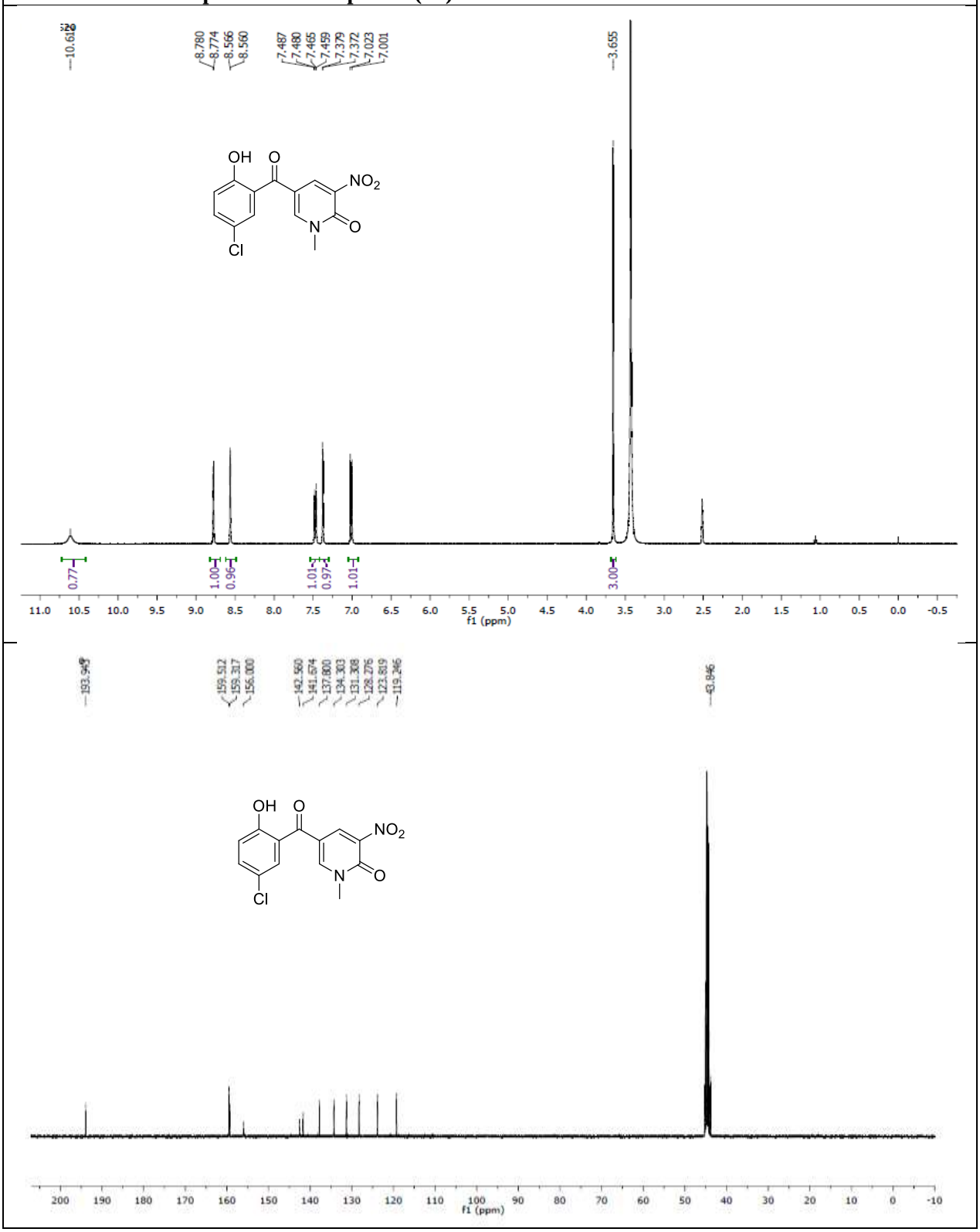
Isolated as yellow semi solid, 86 %, ^{1}H NMR (400 MHz, DMSO-d_6) δ_H 10.70 (1 H, d, *J*= 8.2), 7.88 (1H, s), 7.60 (1H, d, *J*= 1.3), 7.42 (1H, dd, *J*= 8.4, 2.0), 6.99 (1H, d, *J*= 8.4), 6.36 (1H, s), 4.01–3.91 (1H, m), 3.49 (3H, s), 2.29 (3H, s), 2.08 (1H, d, *J*= 9.9), 1.95–1.82 (1H, m), 1.72 (1H, dd, *J*= 9.4, 3.8), 1.45 (7H, m) ppm.^{13}C NMR (100 MHz, DMSO-d_6) δ_C 180.04, 156.41, 154.95, 137.52, 132.27, 126.95, 126.49, 122.98, 118.52, 114.40, 113.79, 90.84, 55.20, 43.24, 34.10, 33.14, 25.16, 24.06, 23.87, 20.50 ppm. EI-HRMS: Anal. Calcd for $C_{20}H_{23}N_3O_4$: 369.1689, Found: 369.1684.

^{1}H and ^{13}C NMR Spectra of Compound (3a)

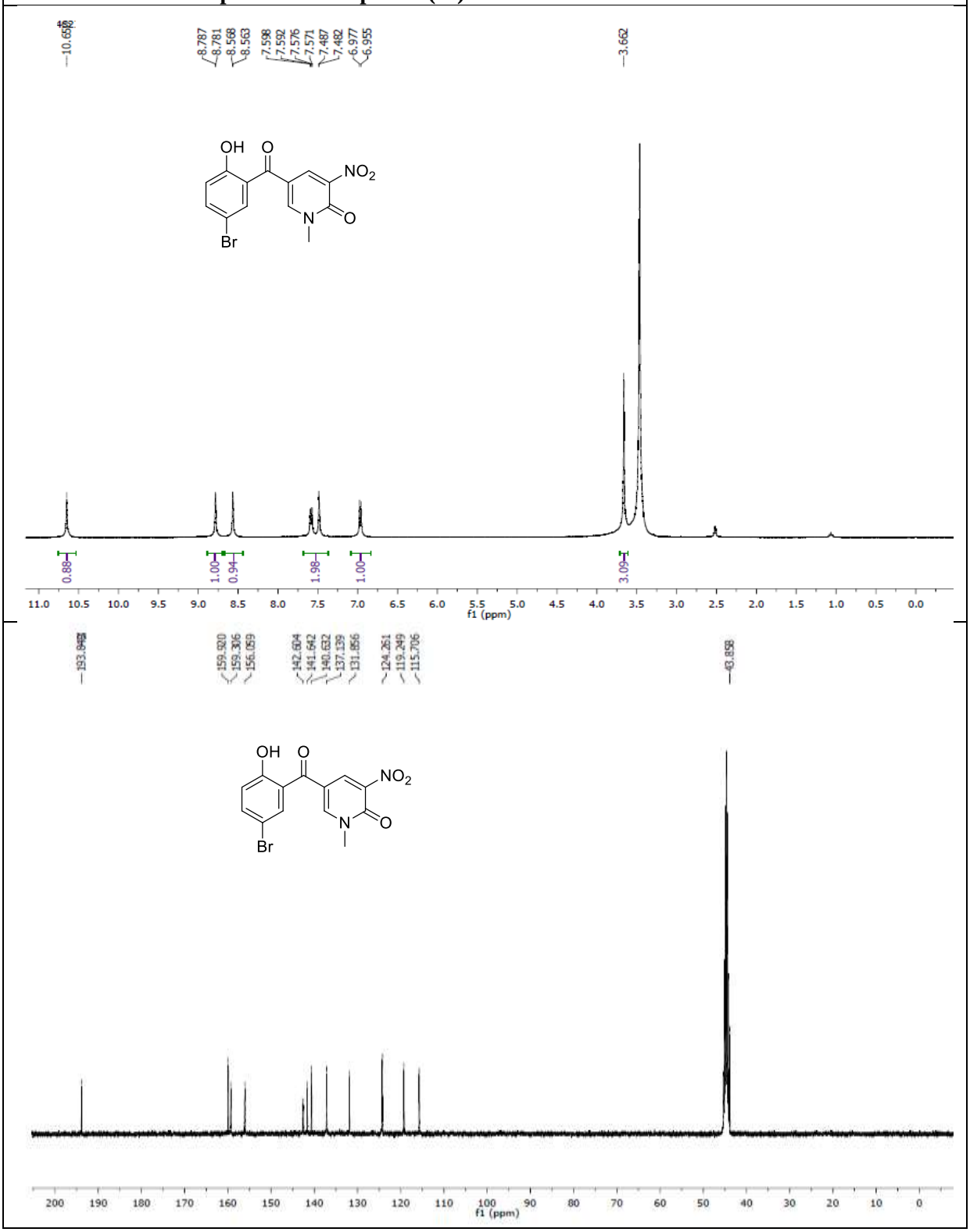




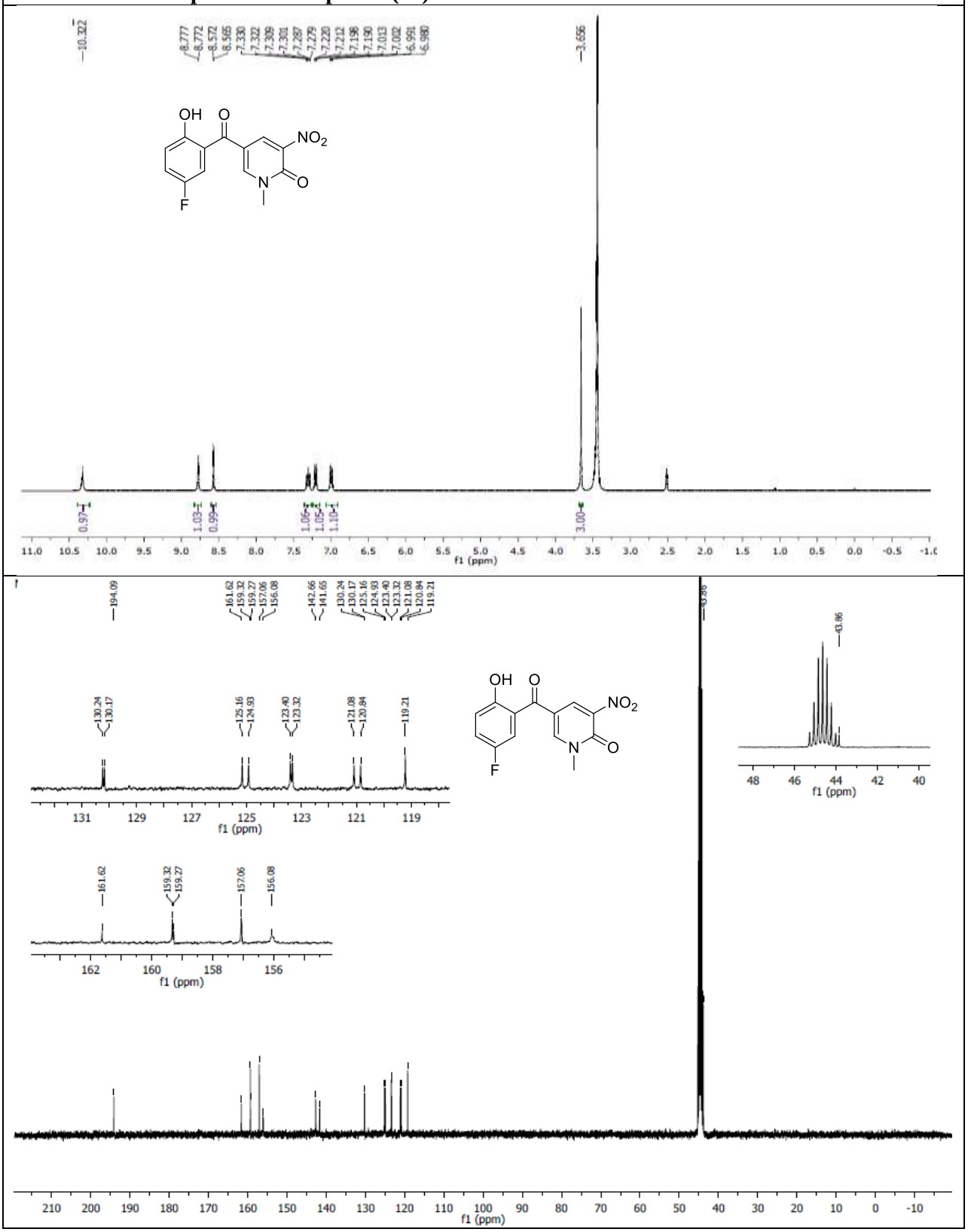
^{1}H and ^{13}C NMR Spectra of Compound (3b)



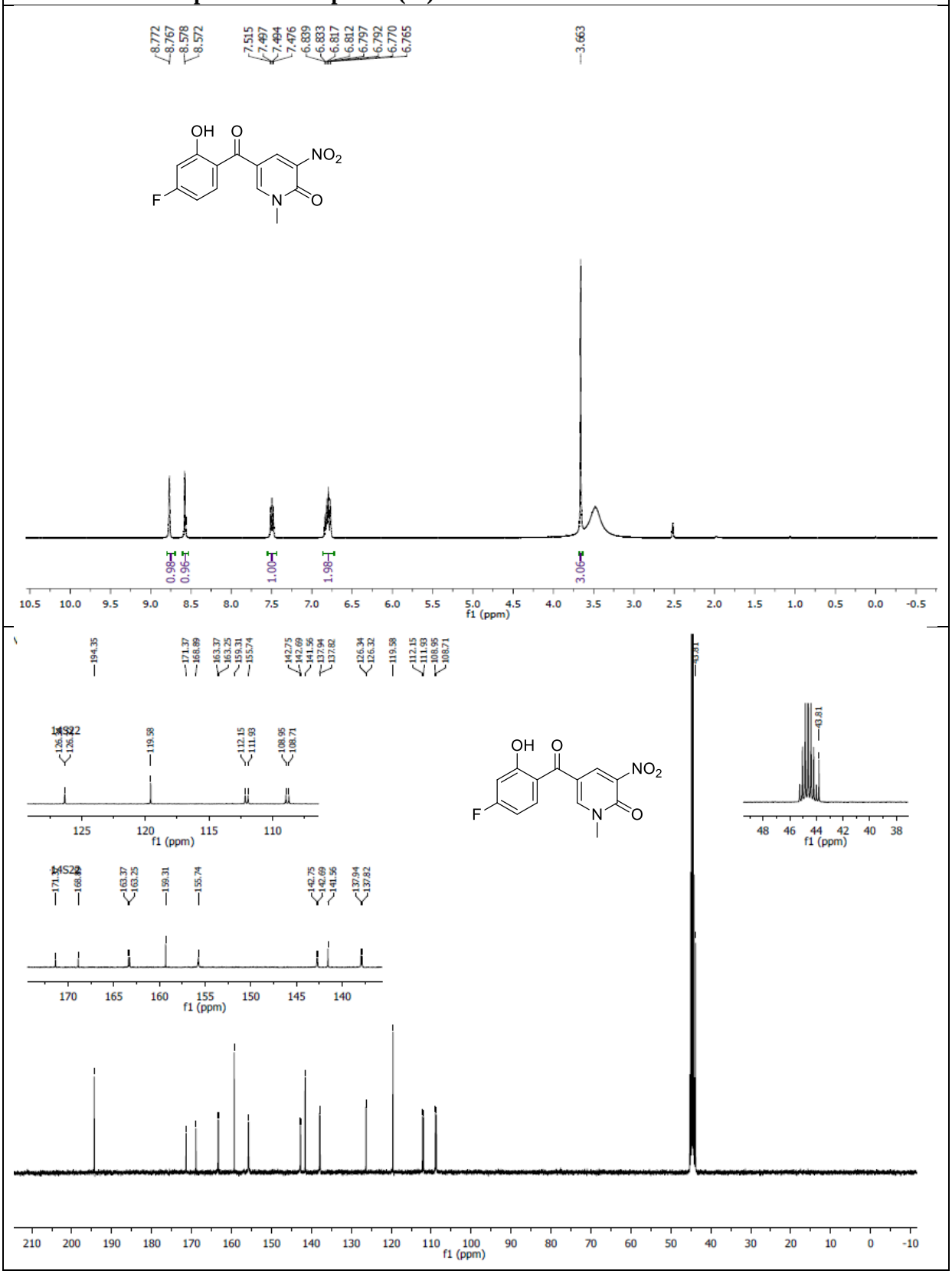
^{1}H and ^{13}C NMR Spectra of Compound (3c)



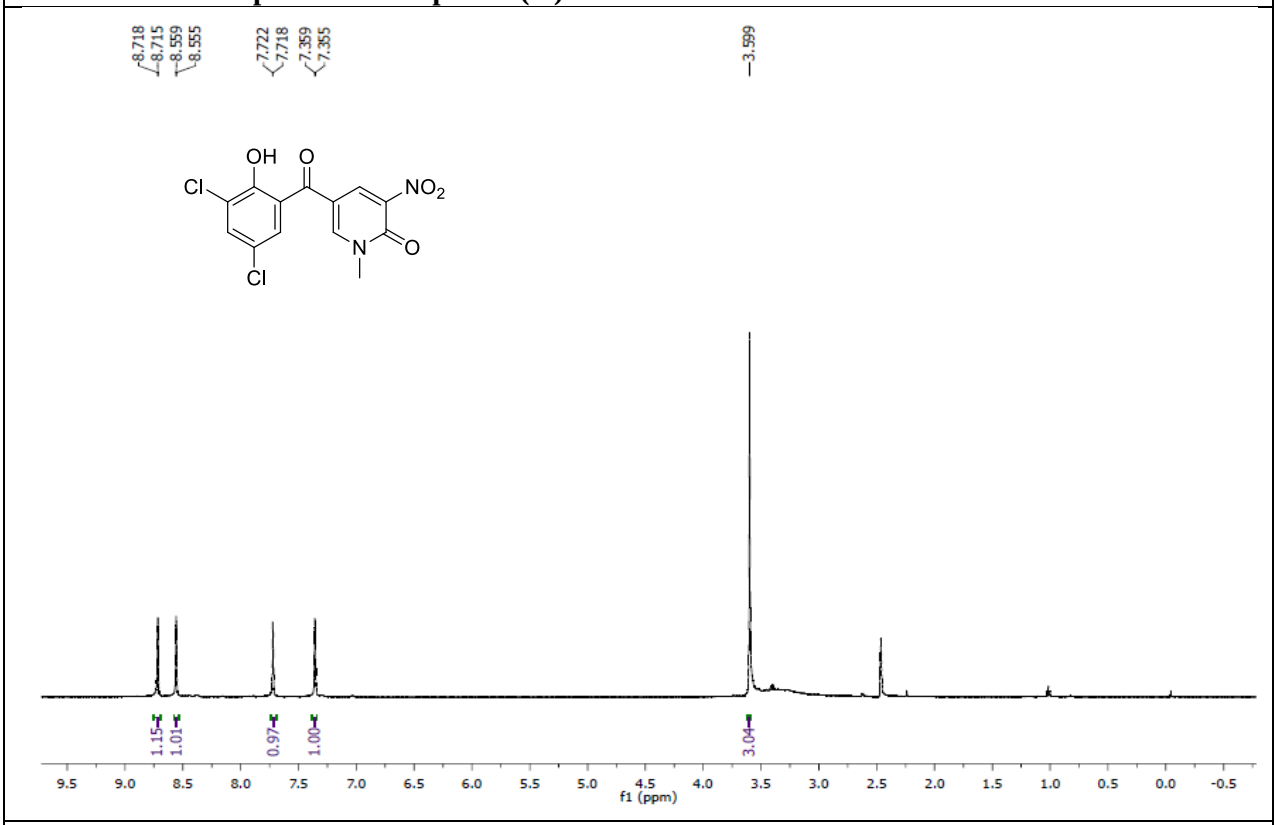
^{1}H and ^{13}C NMR Spectra of Compound (3d)

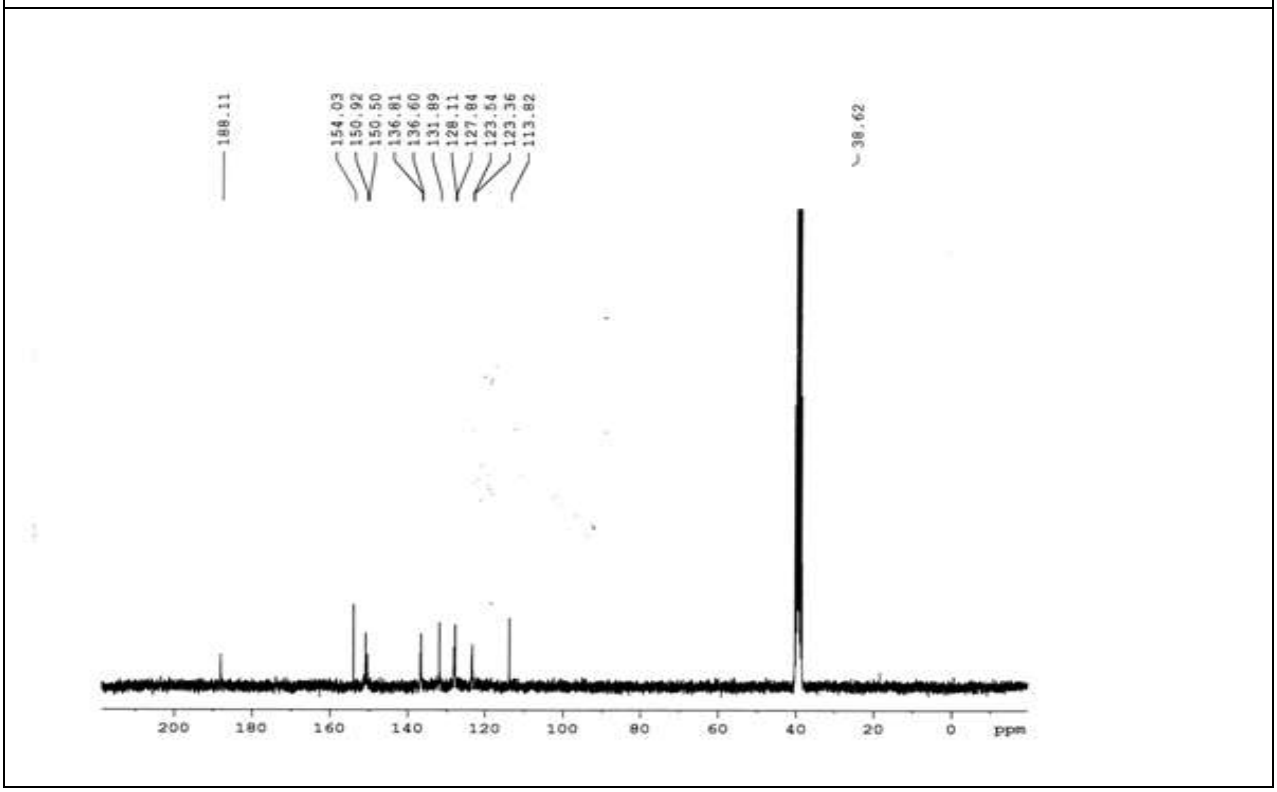


^{1}H and ^{13}C NMR Spectra of Compound (3e)

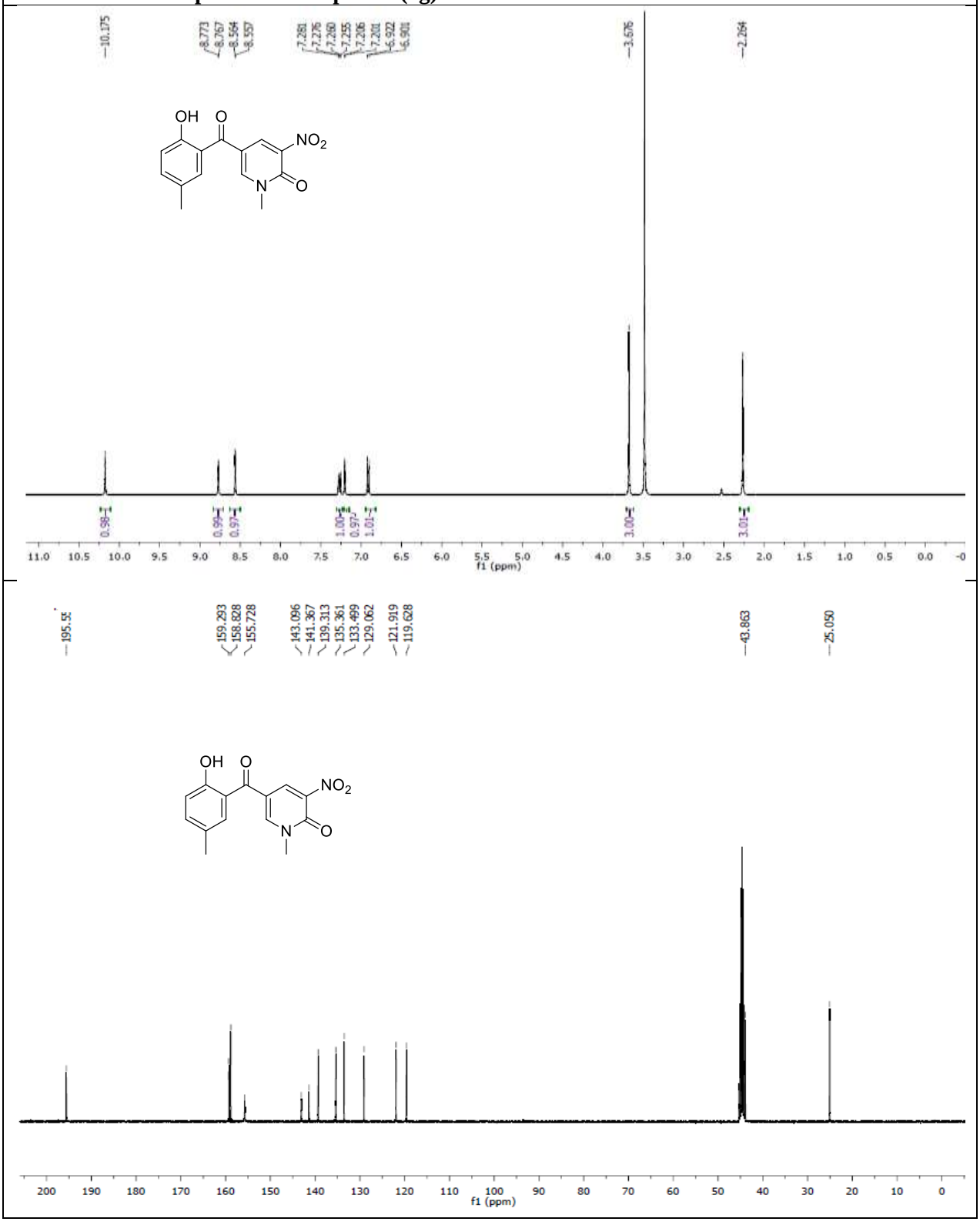


^{1}H and ^{13}C NMR Spectra of Compound (3f)

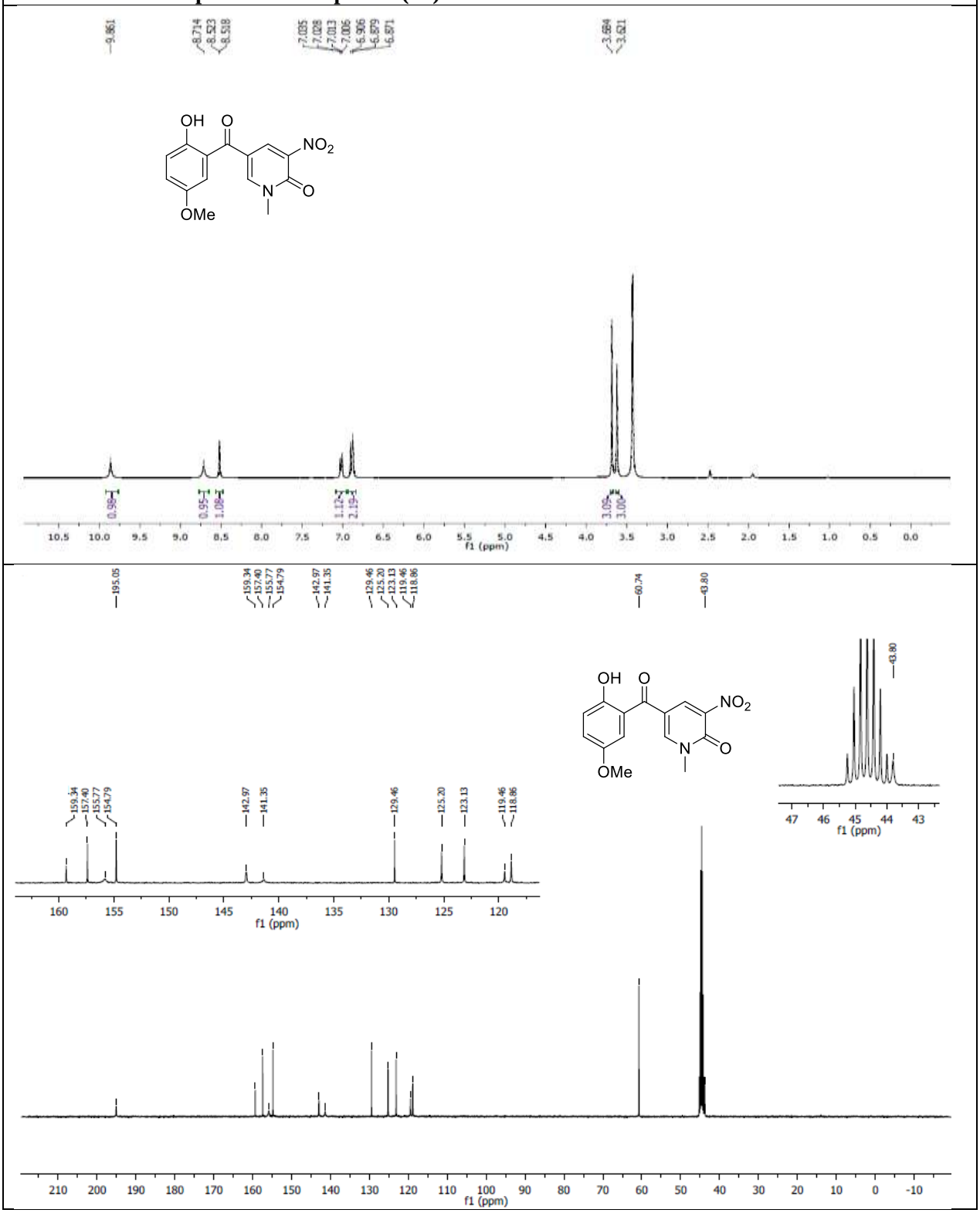




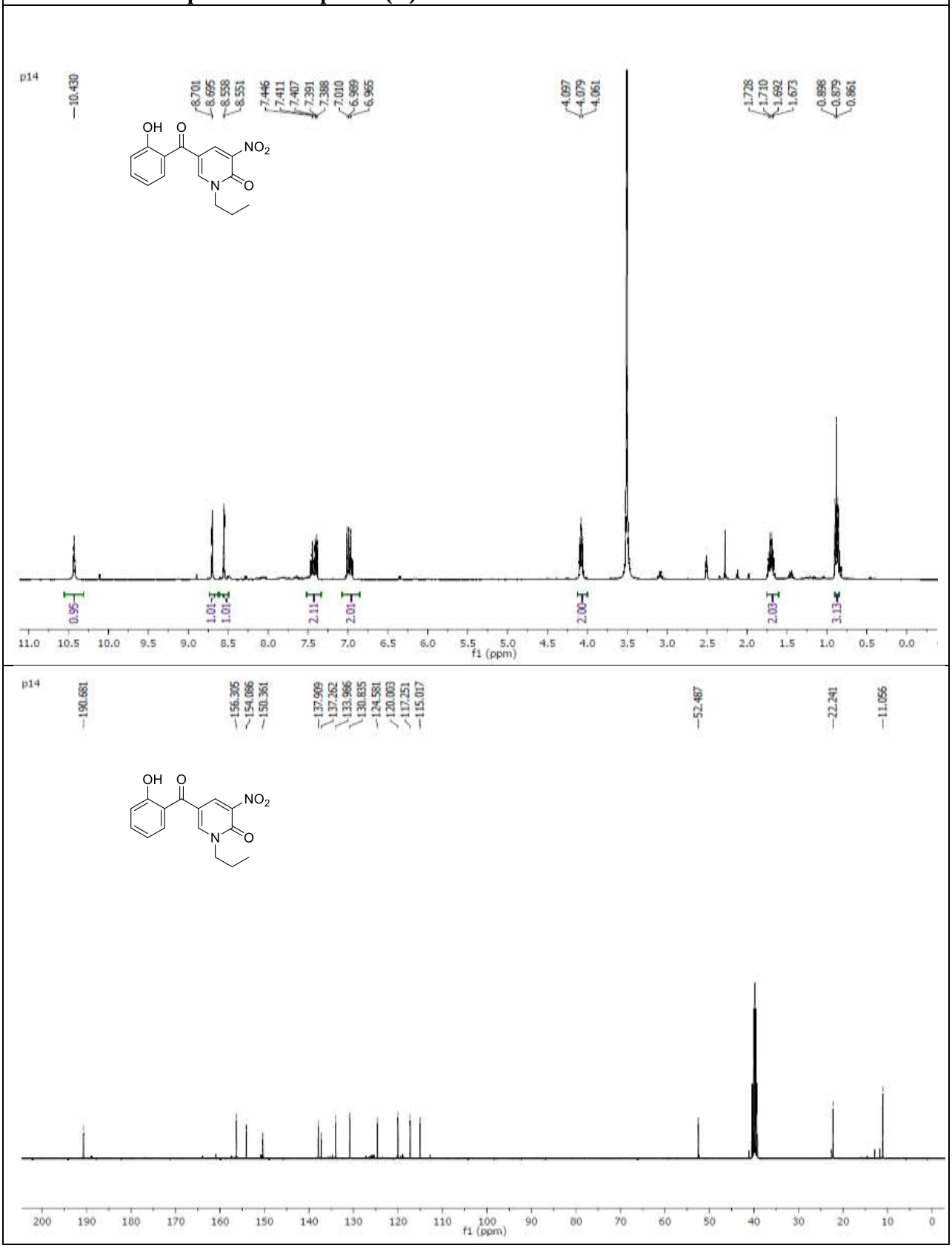
^{1}H and ^{13}C NMR Spectra of Compound (3g)



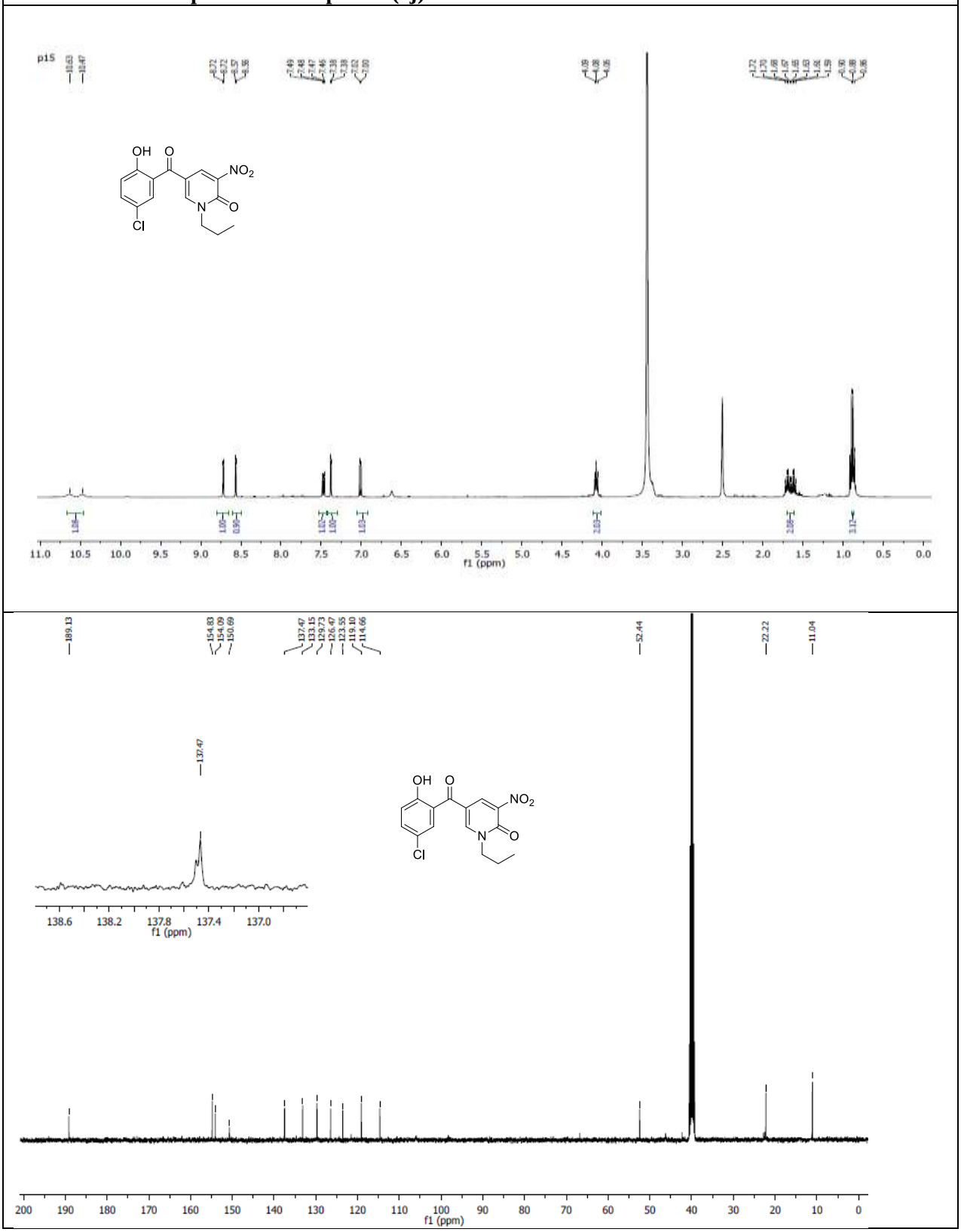
^{1}H and ^{13}C NMR Spectra of Compound (3h)



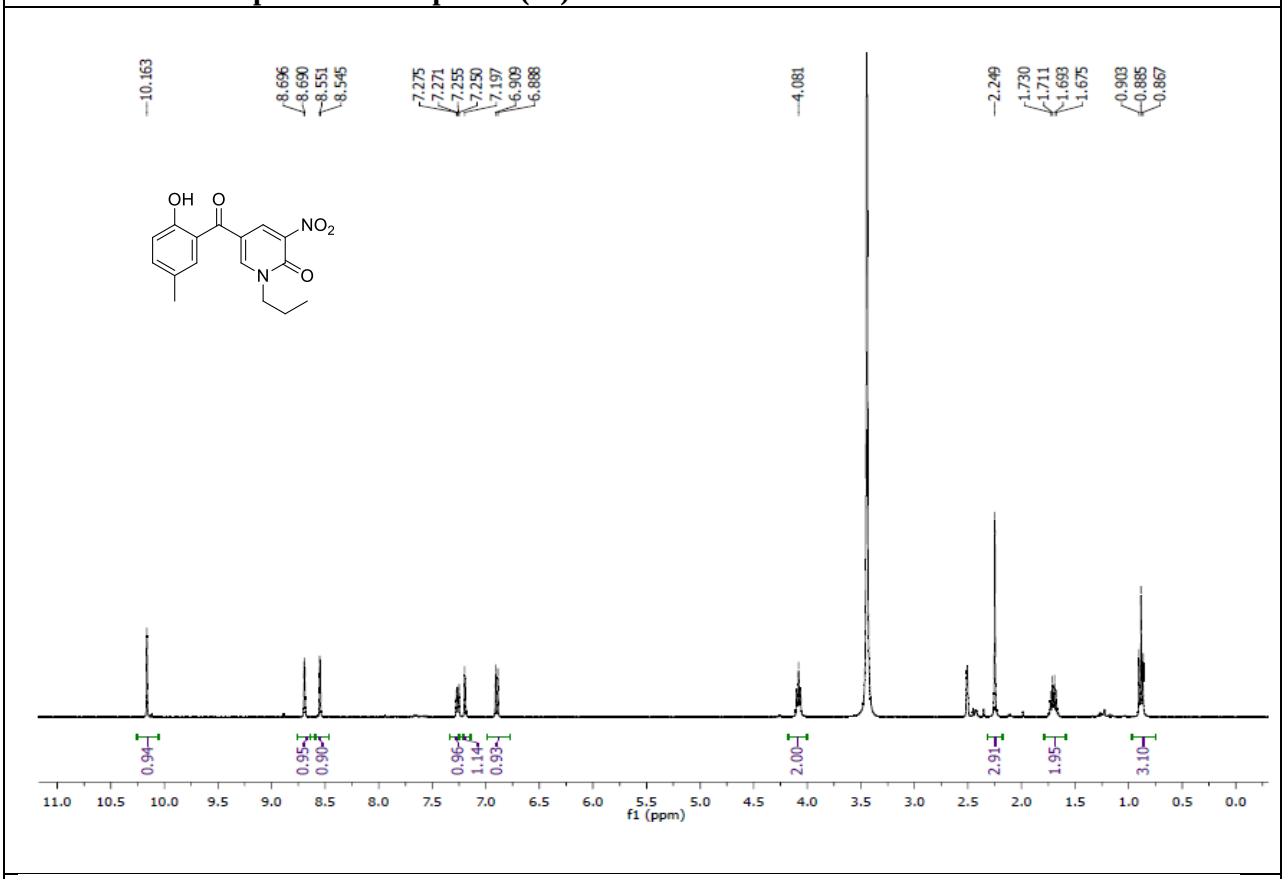
^{1}H and ^{13}C NMR Spectra of Compound (3i)

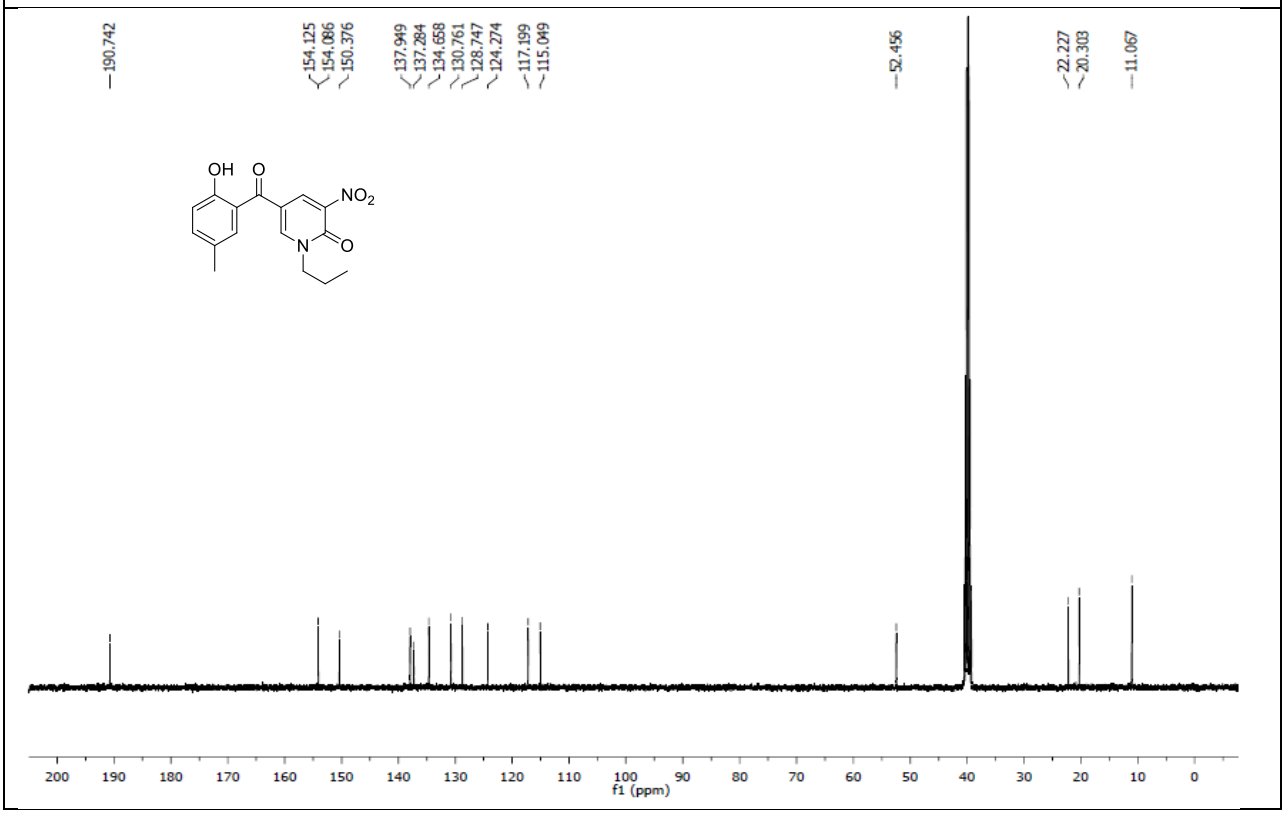


^{1}H and ^{13}C NMR Spectra of Compound (3j)

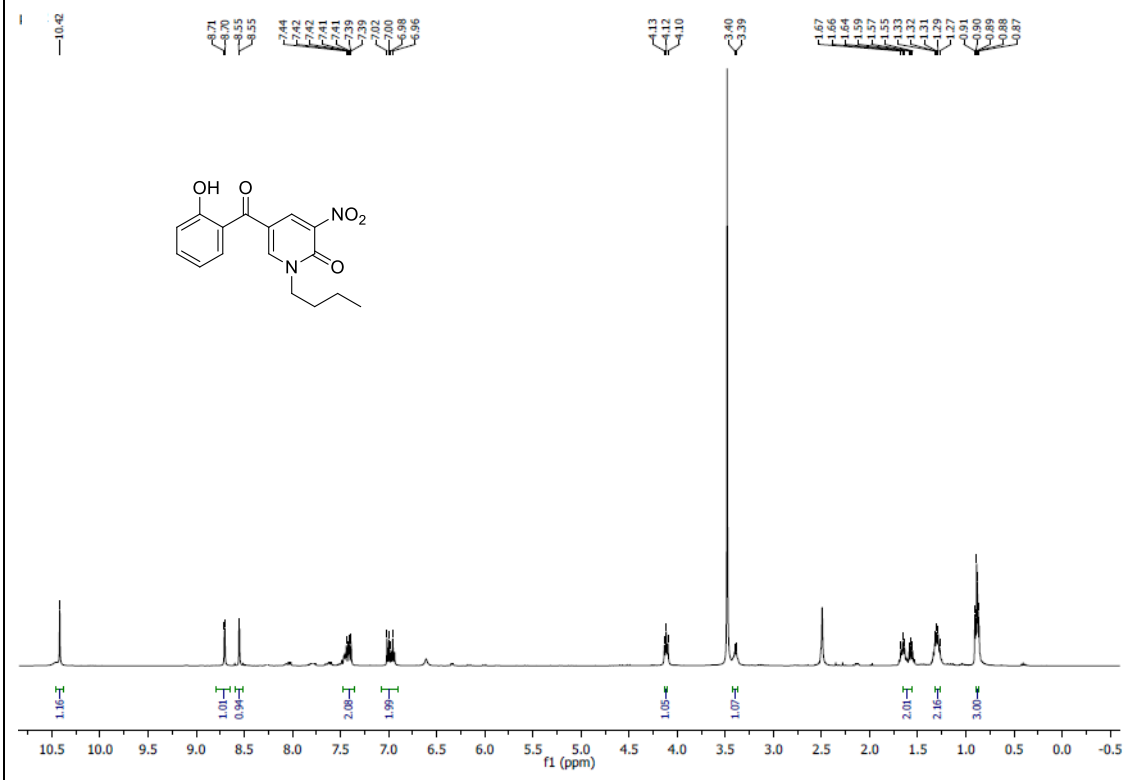


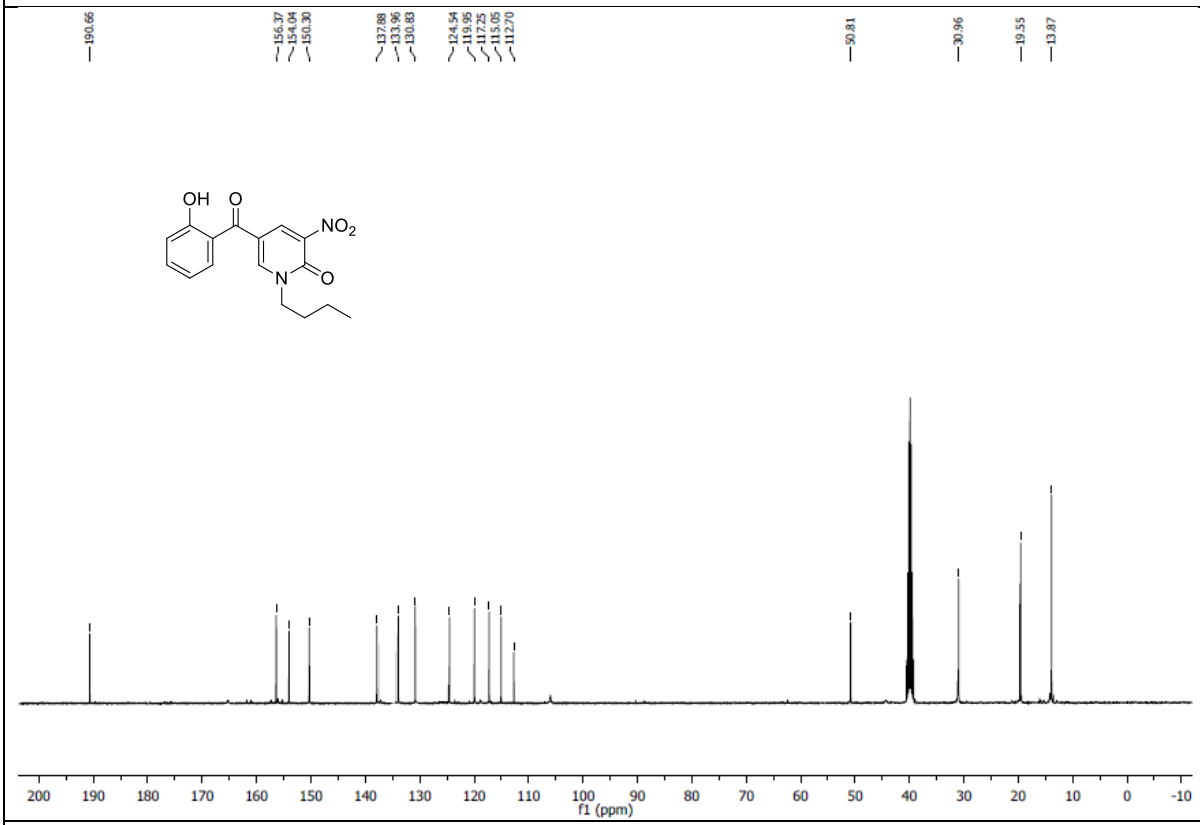
^{1}H and ^{13}C NMR Spectra of Compound (3k)



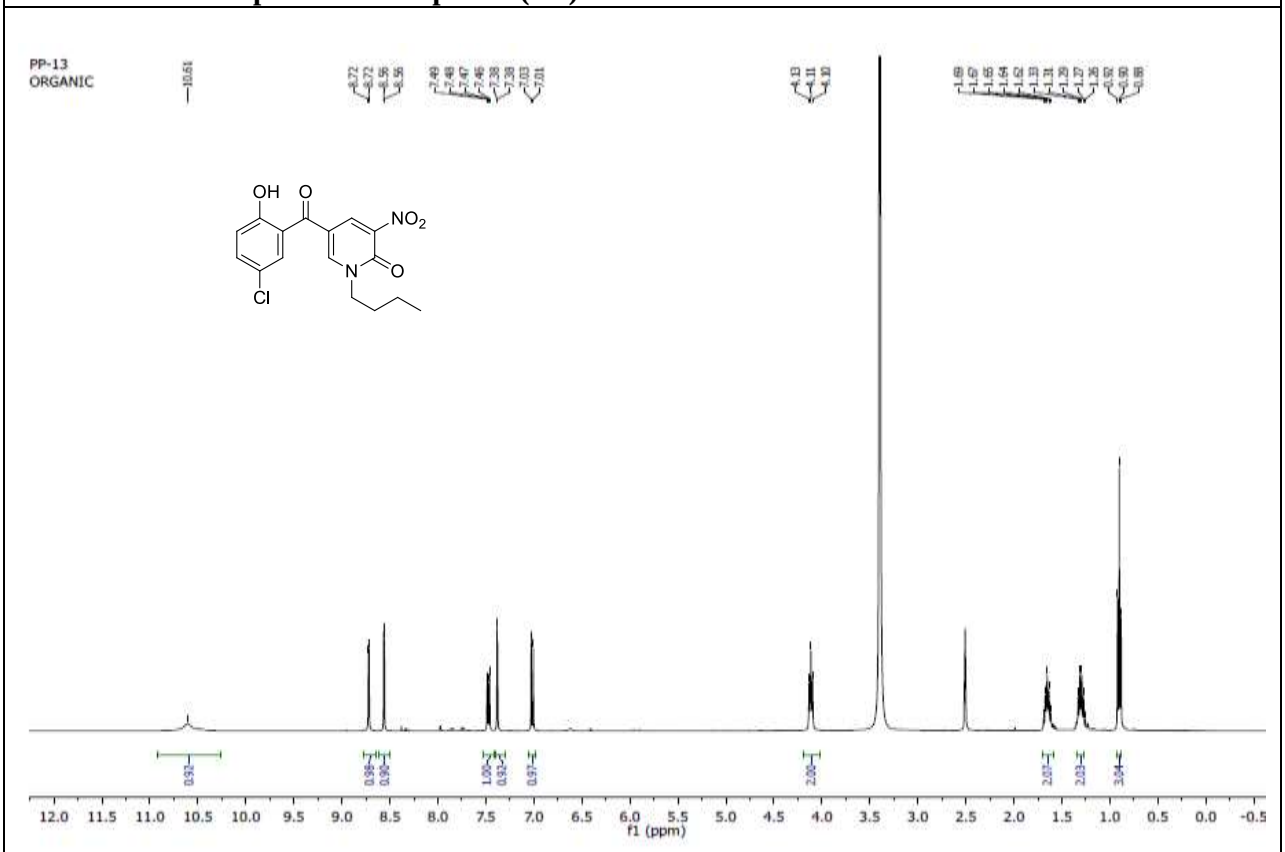


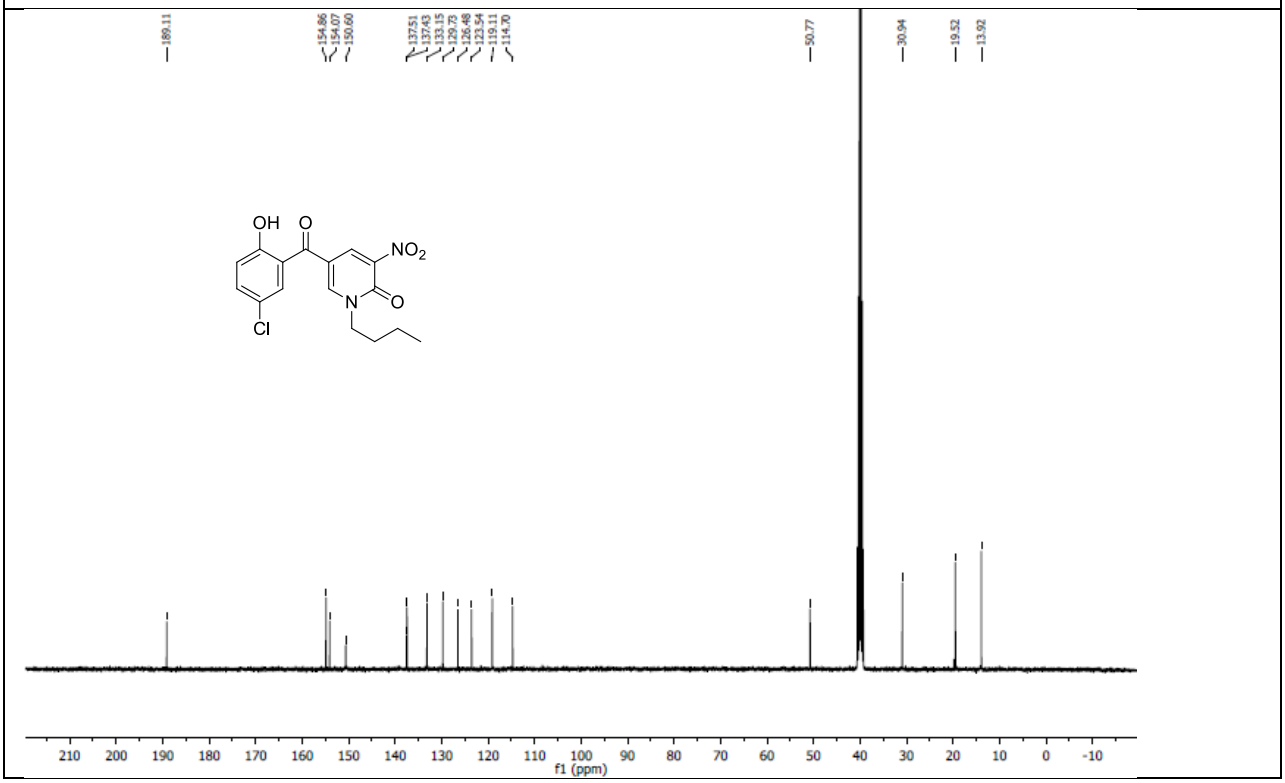
^{1}H and ^{13}C NMR Spectra of Compound (3l)



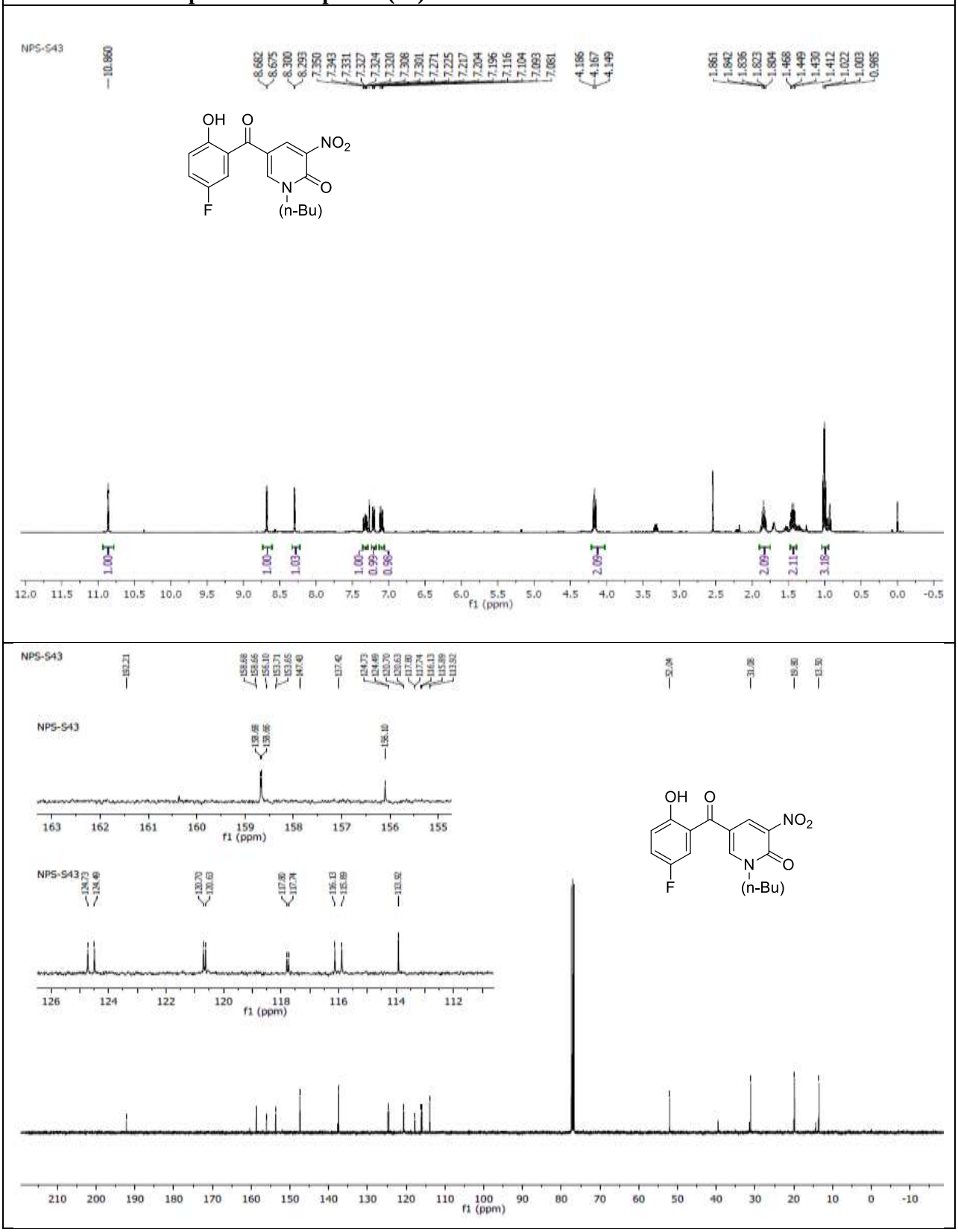


^{1}H and ^{13}C NMR Spectra of Compound (3m)

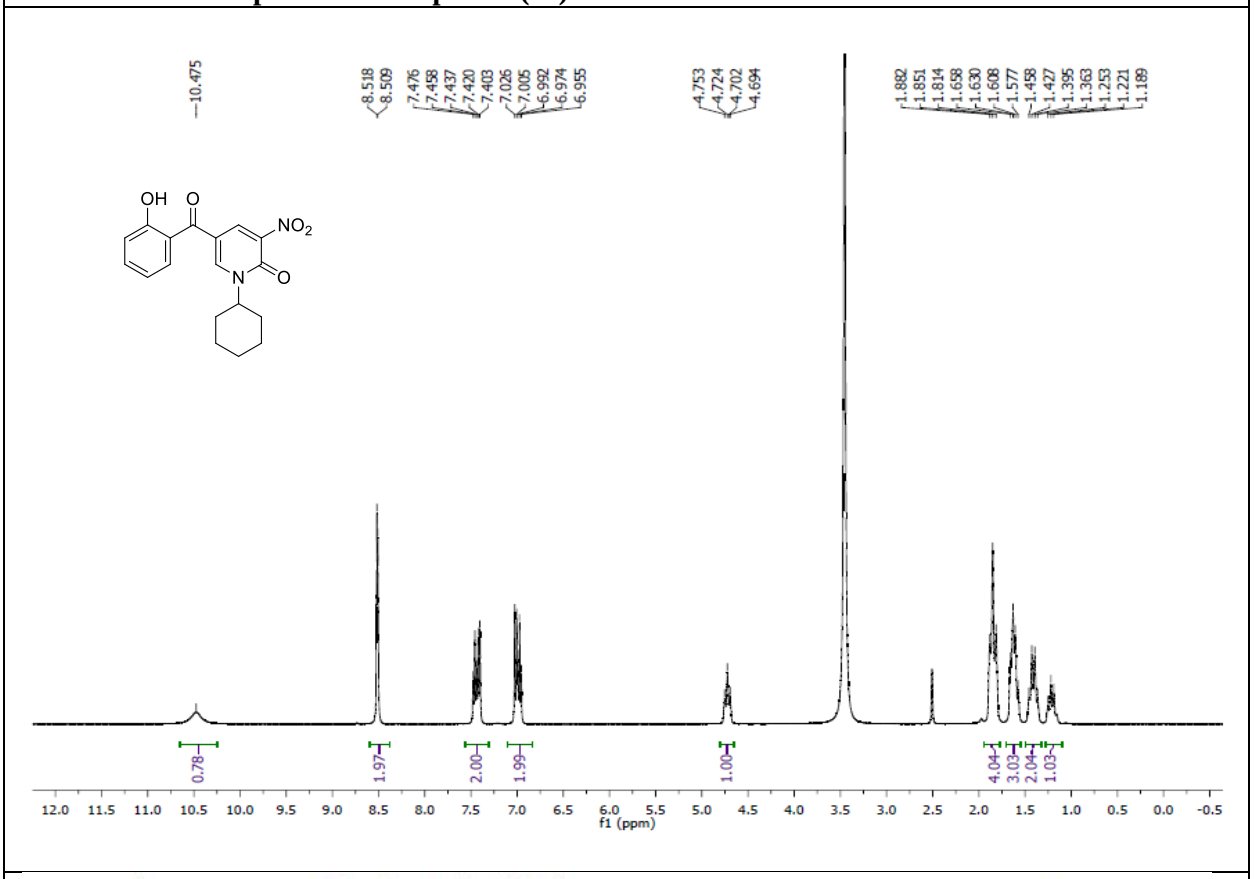


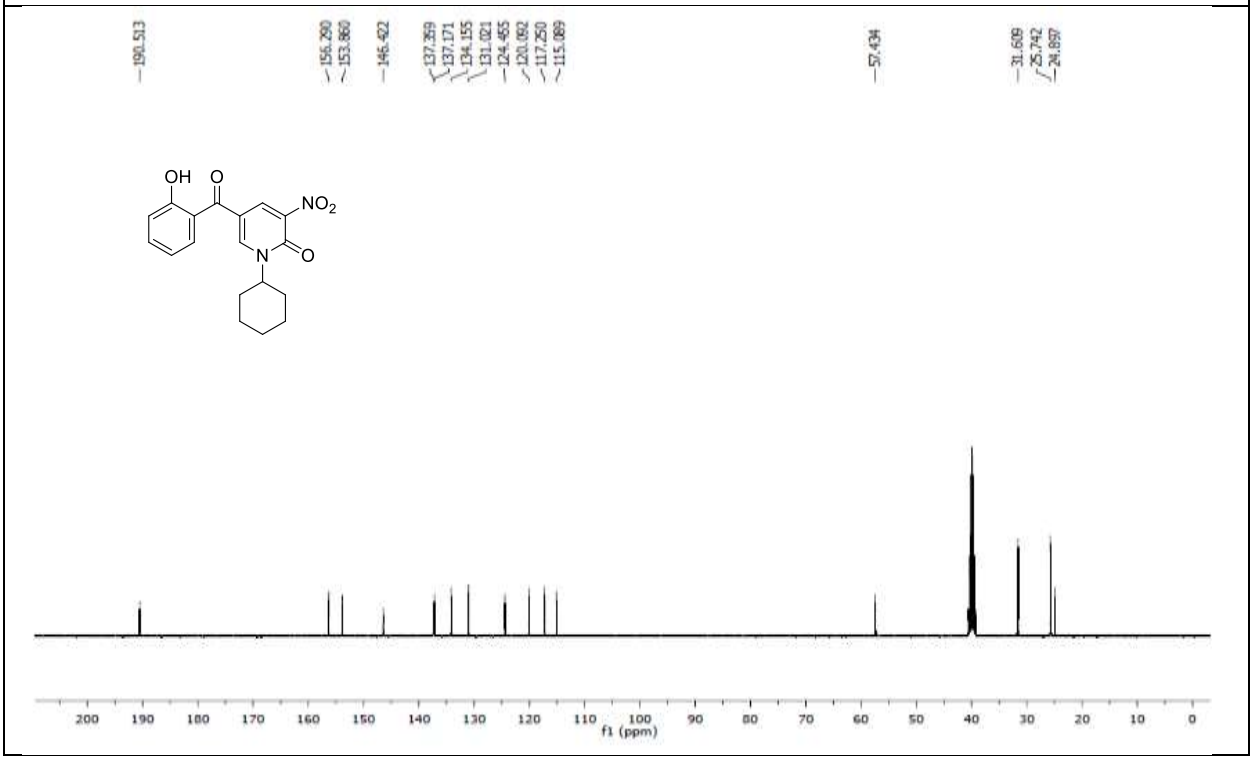


^{1}H and ^{13}C NMR Spectra of Compound (3n)

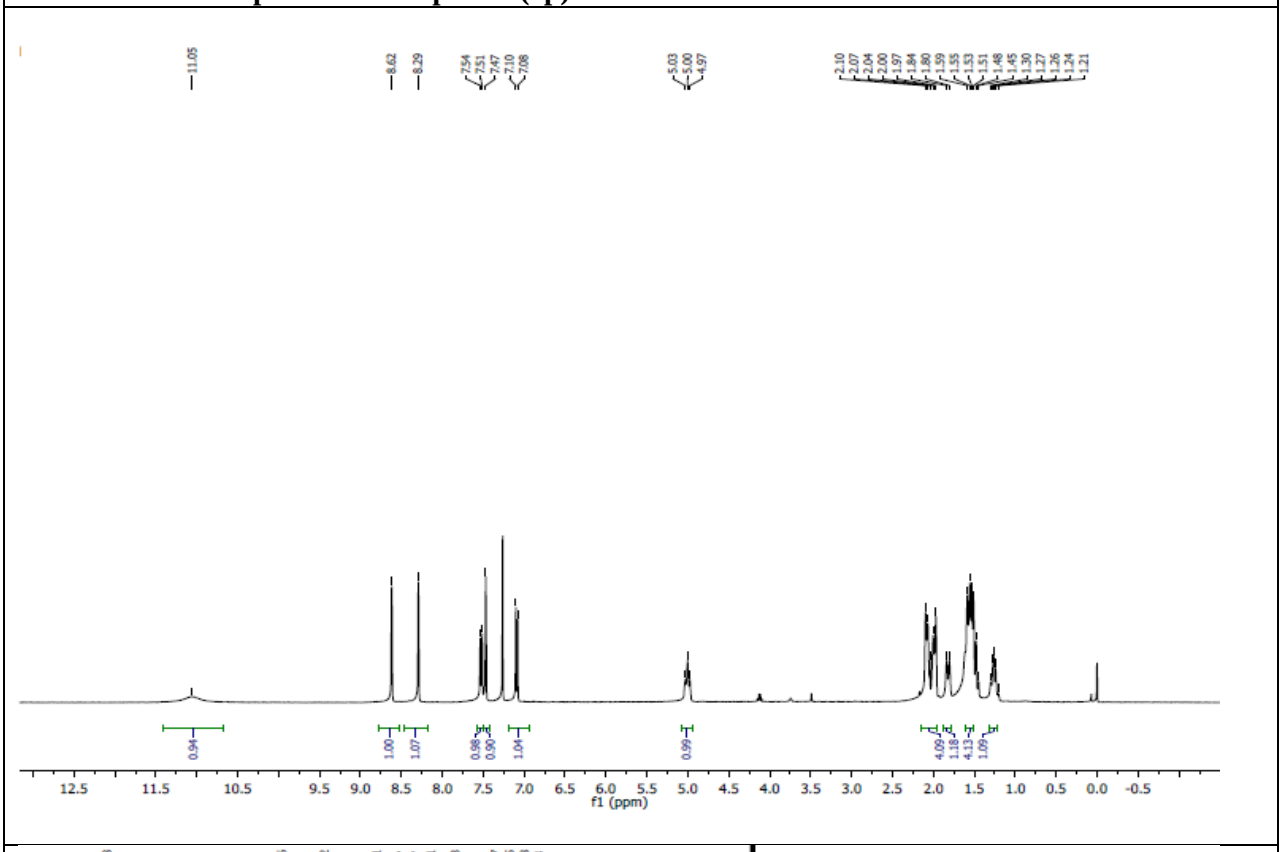


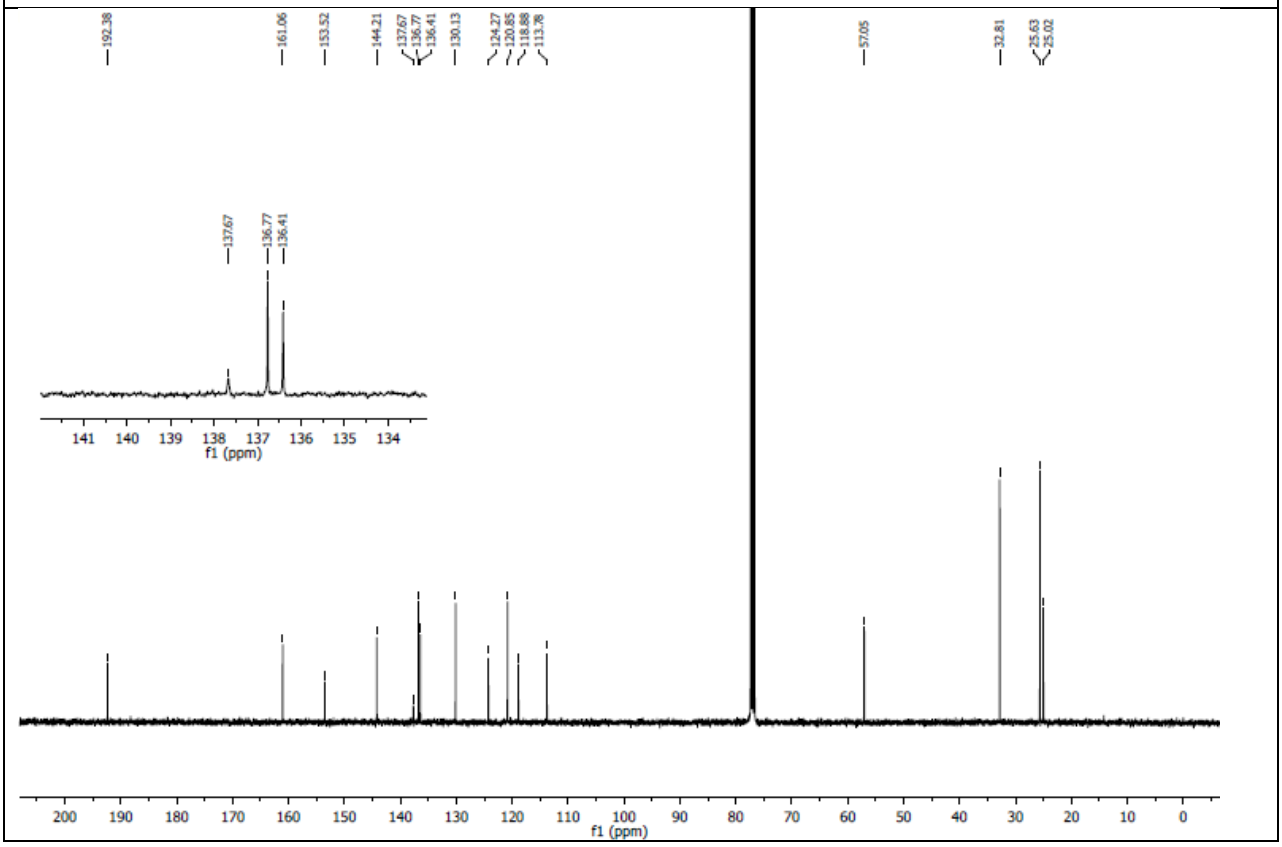
^{1}H and ^{13}C NMR Spectra of Compound (3o)



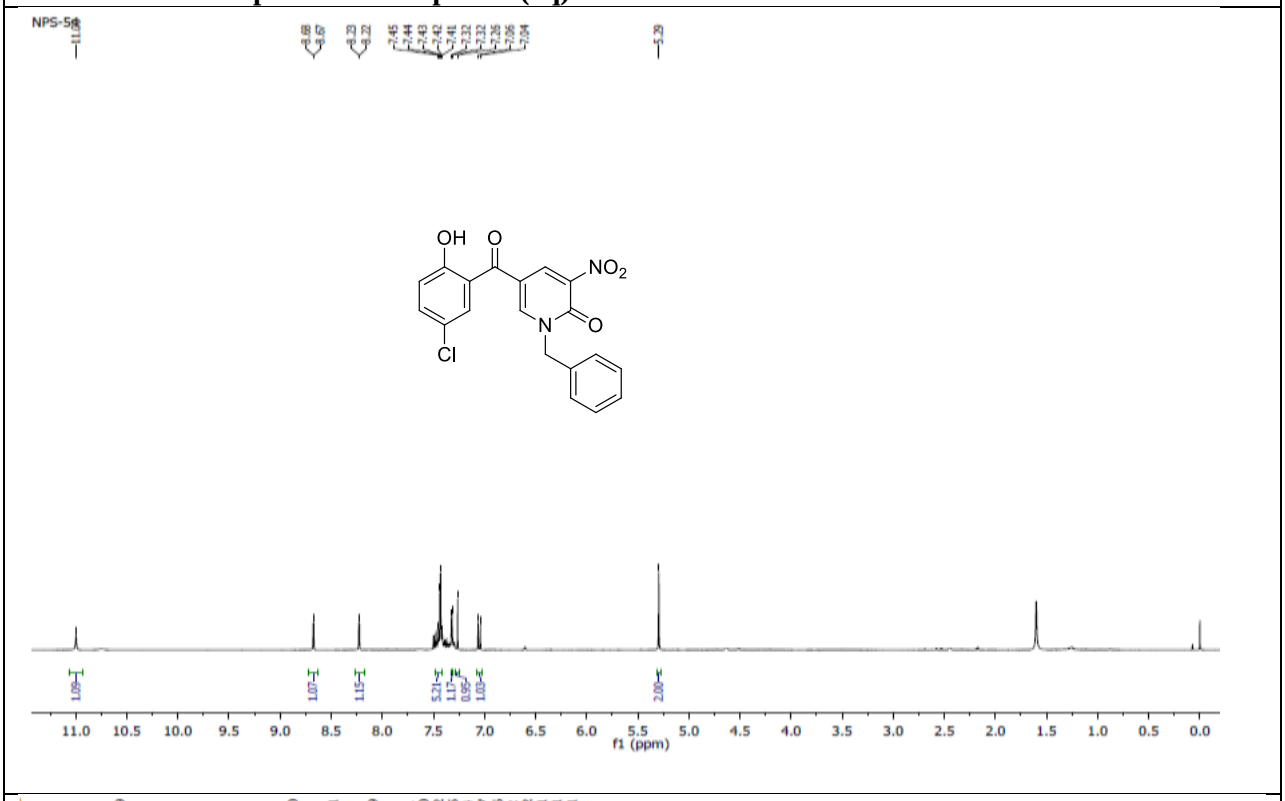


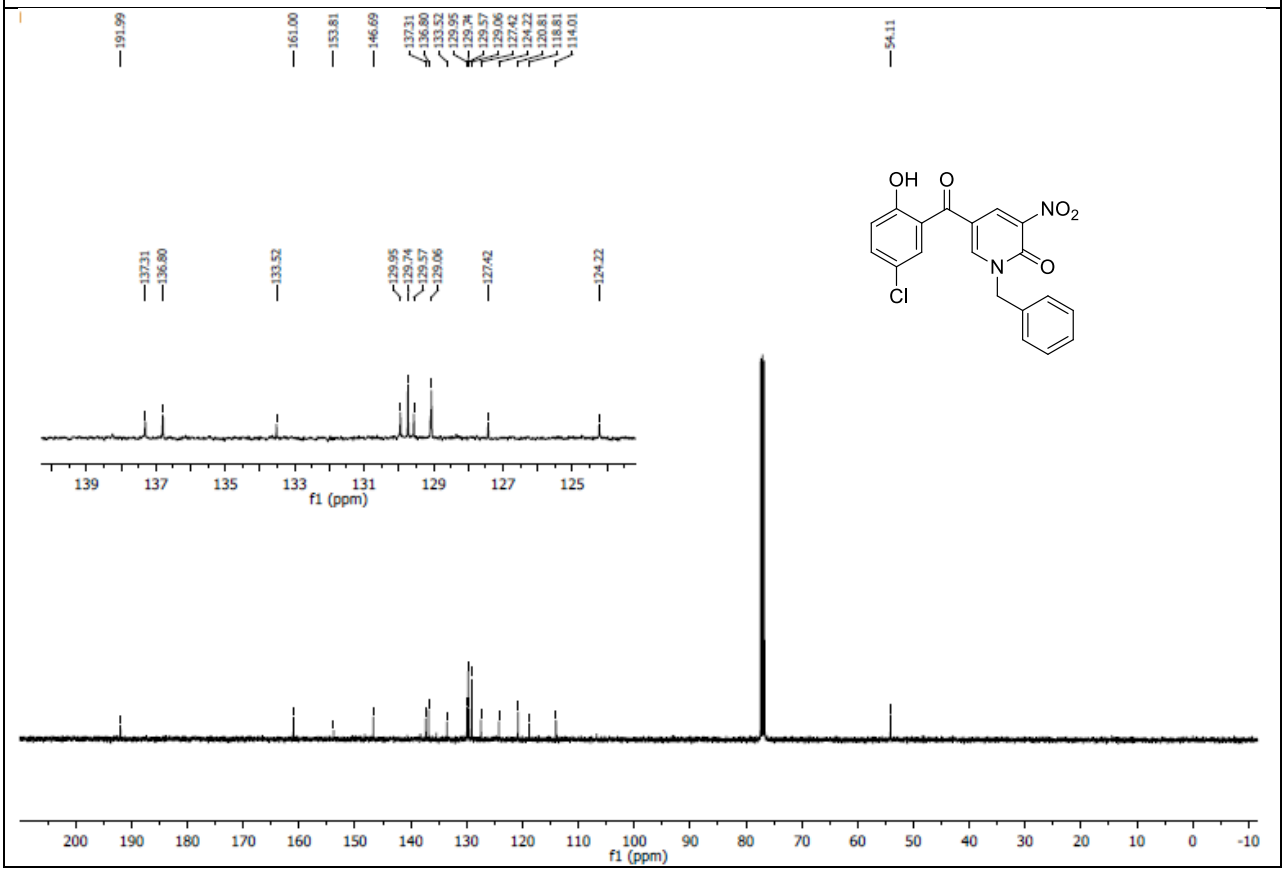
^{1}H and ^{13}C NMR Spectra of Compound (3p)



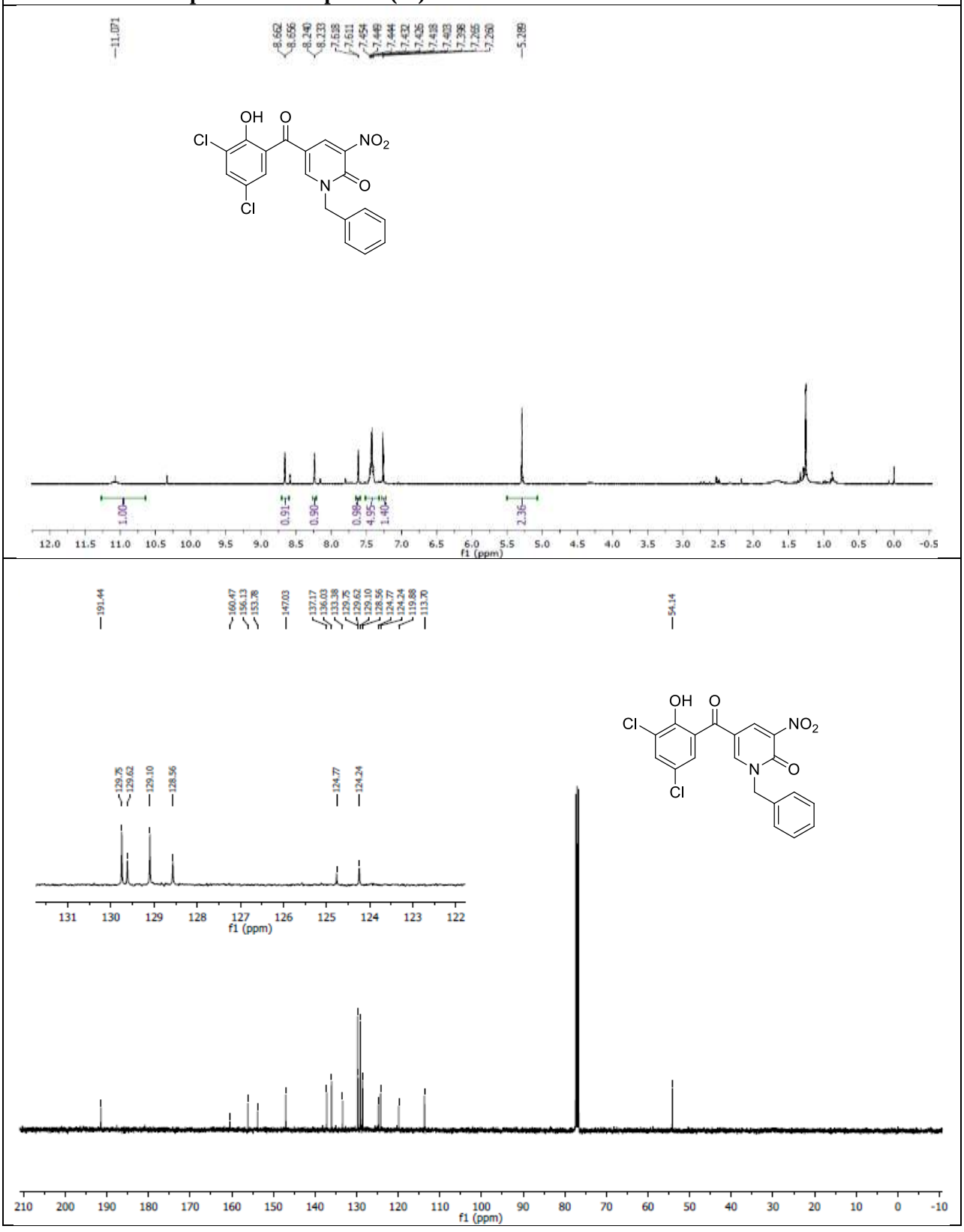


^{1}H and ^{13}C NMR Spectra of Compound (3q)

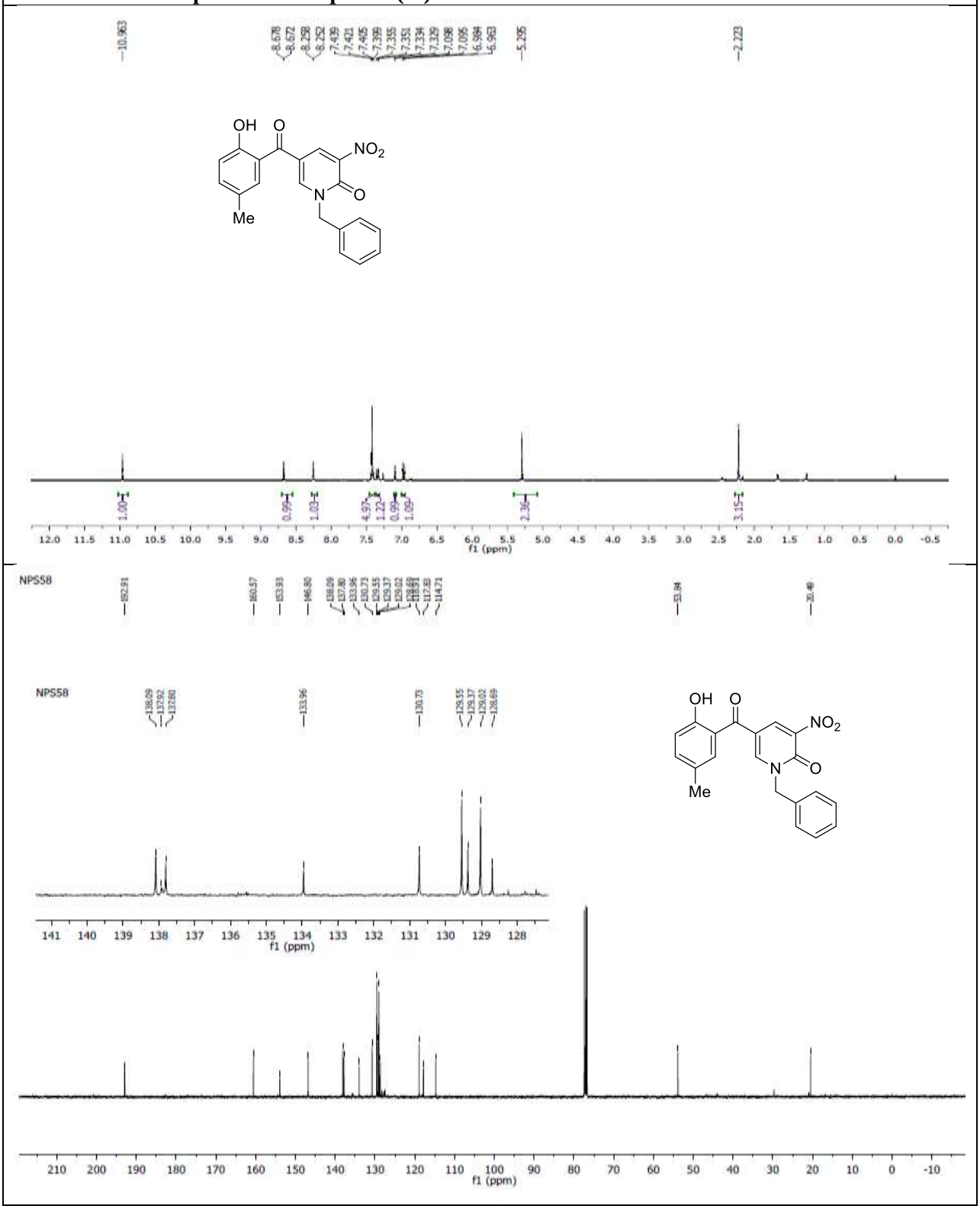




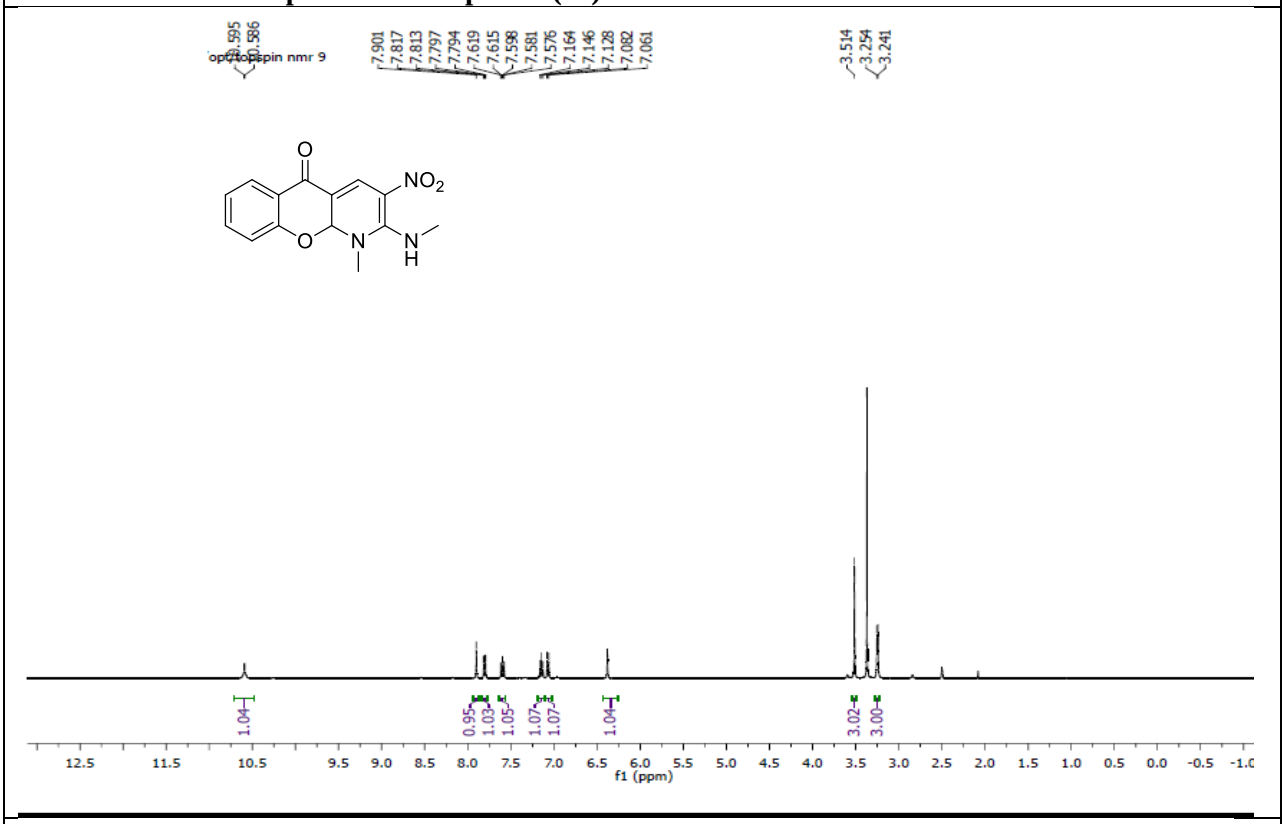
^{1}H and ^{13}C NMR Spectra of Compound (3r)

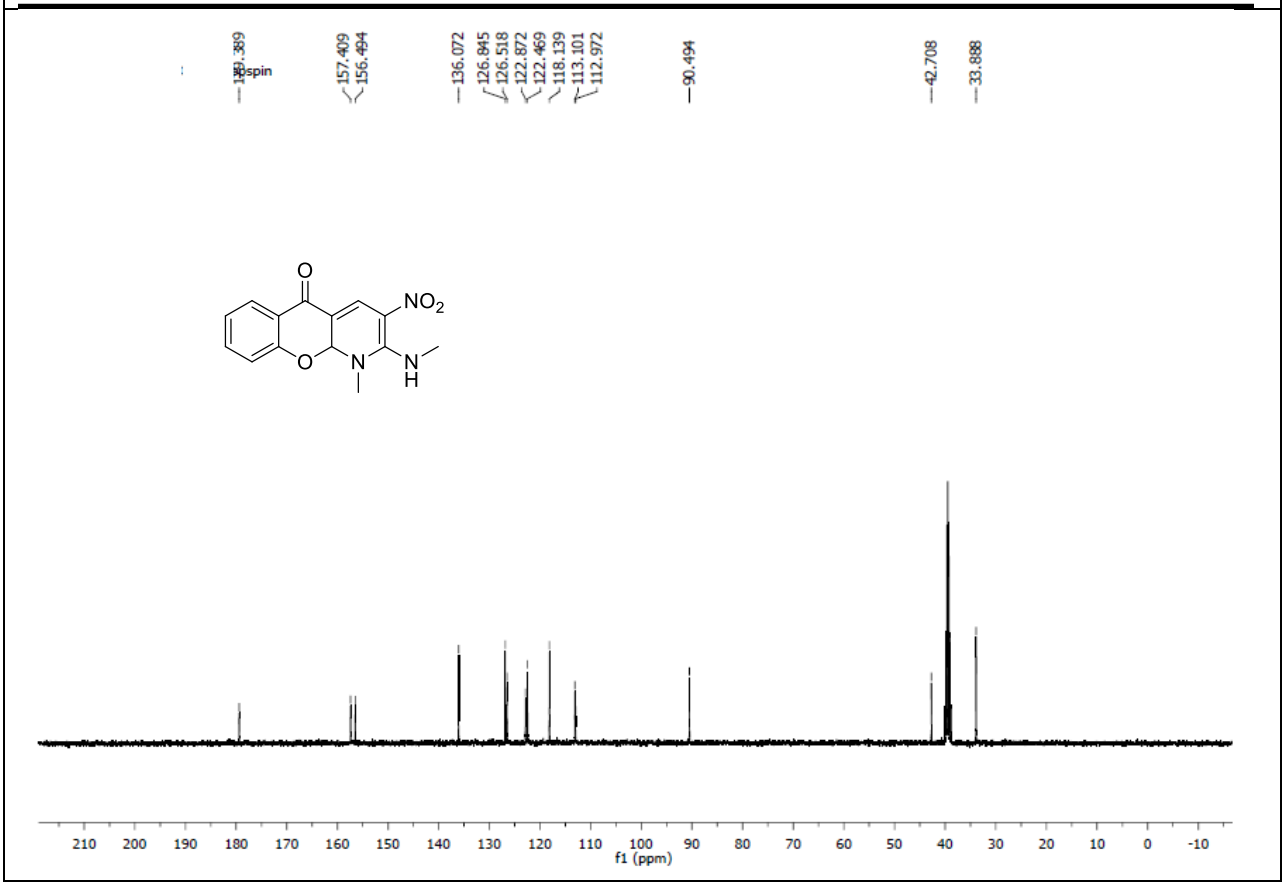


^{1}H and ^{13}C NMR Spectra of Compound (3s)

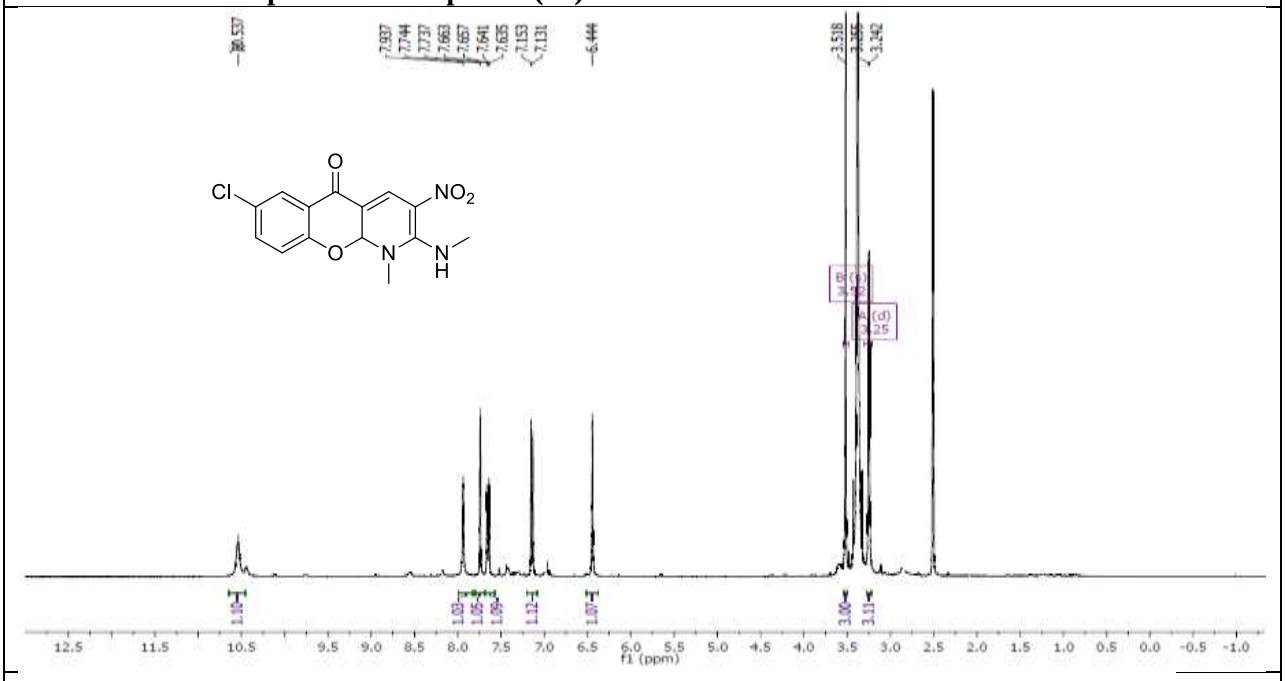


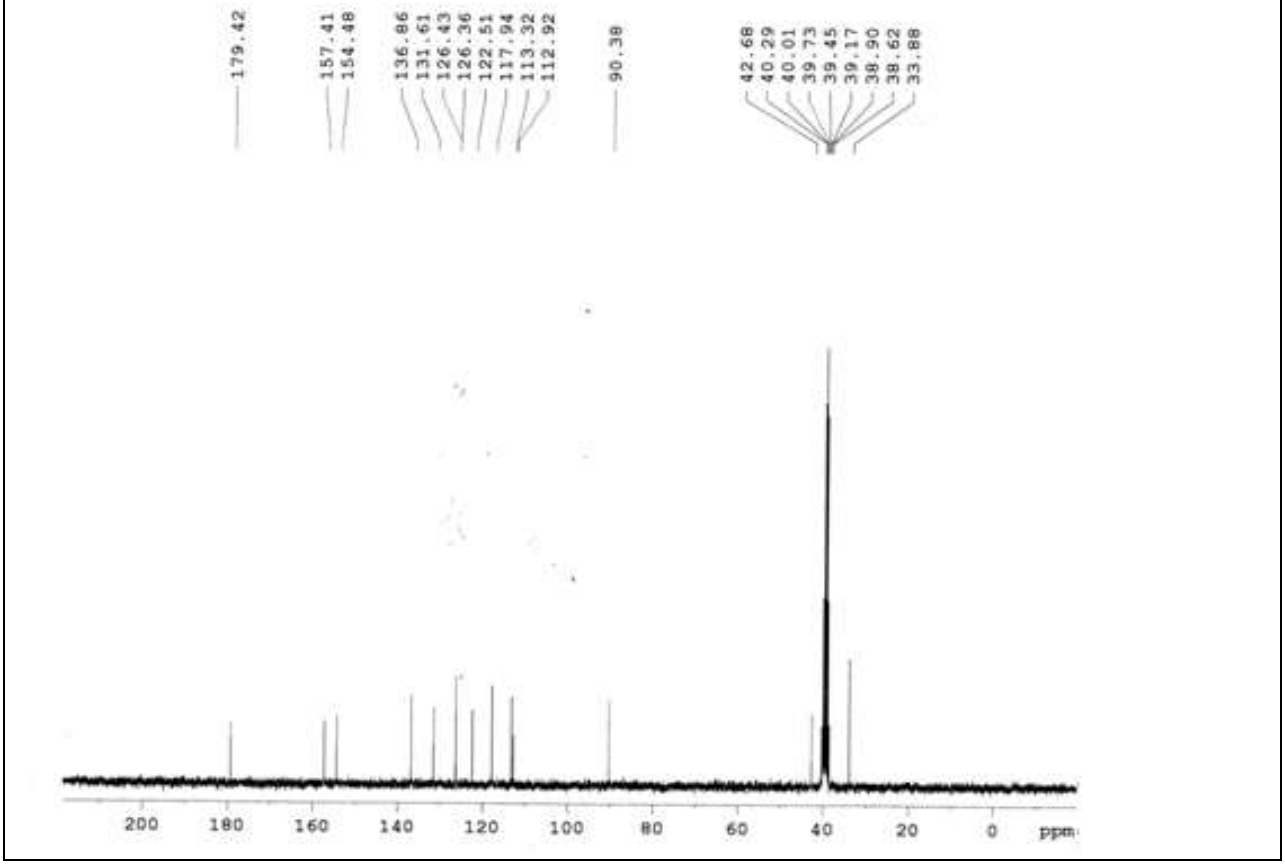
^{1}H and ^{13}C NMR Spectra of Compound (5a)



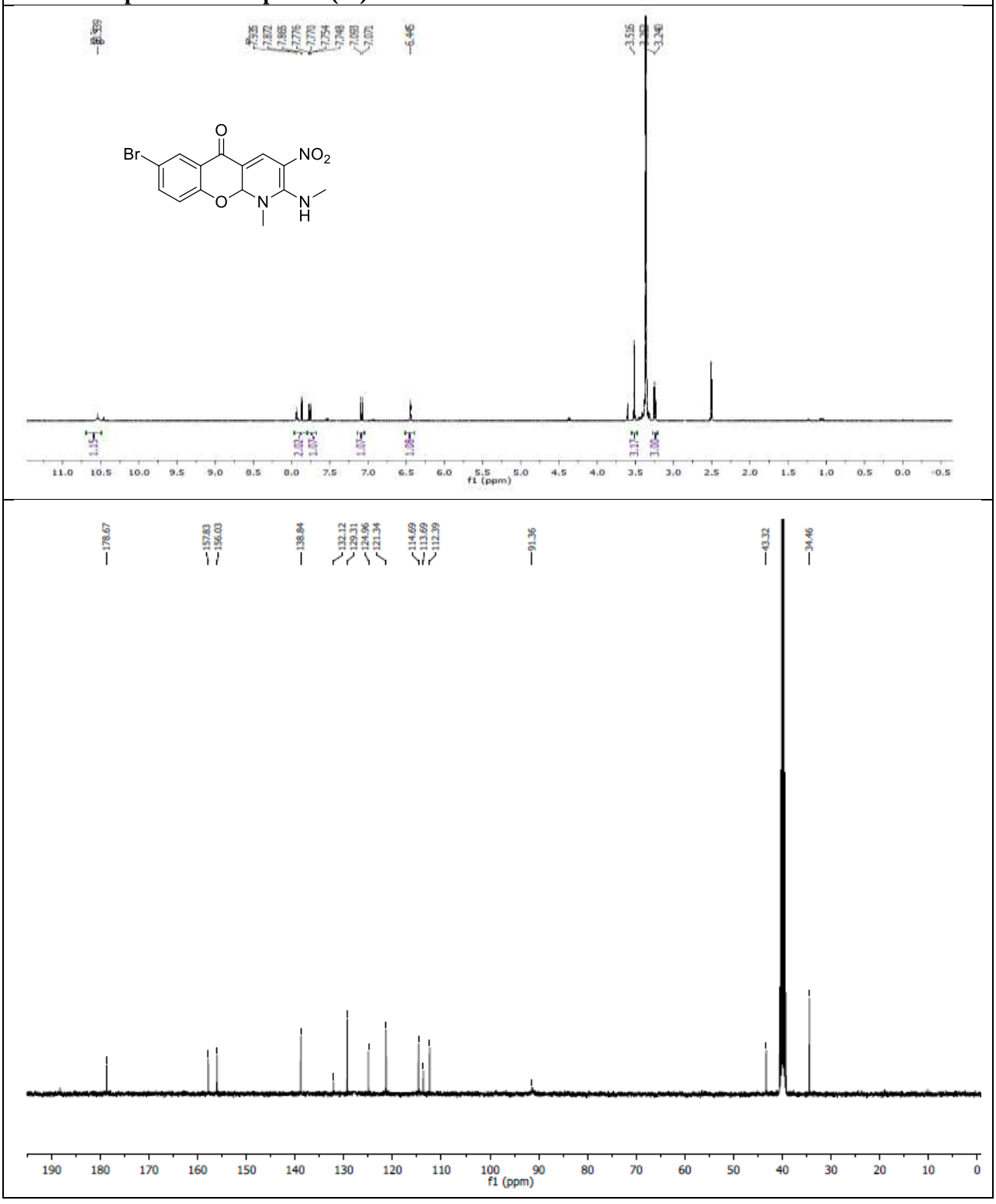


^{1}H and ^{13}C NMR Spectra of Compound (5b)

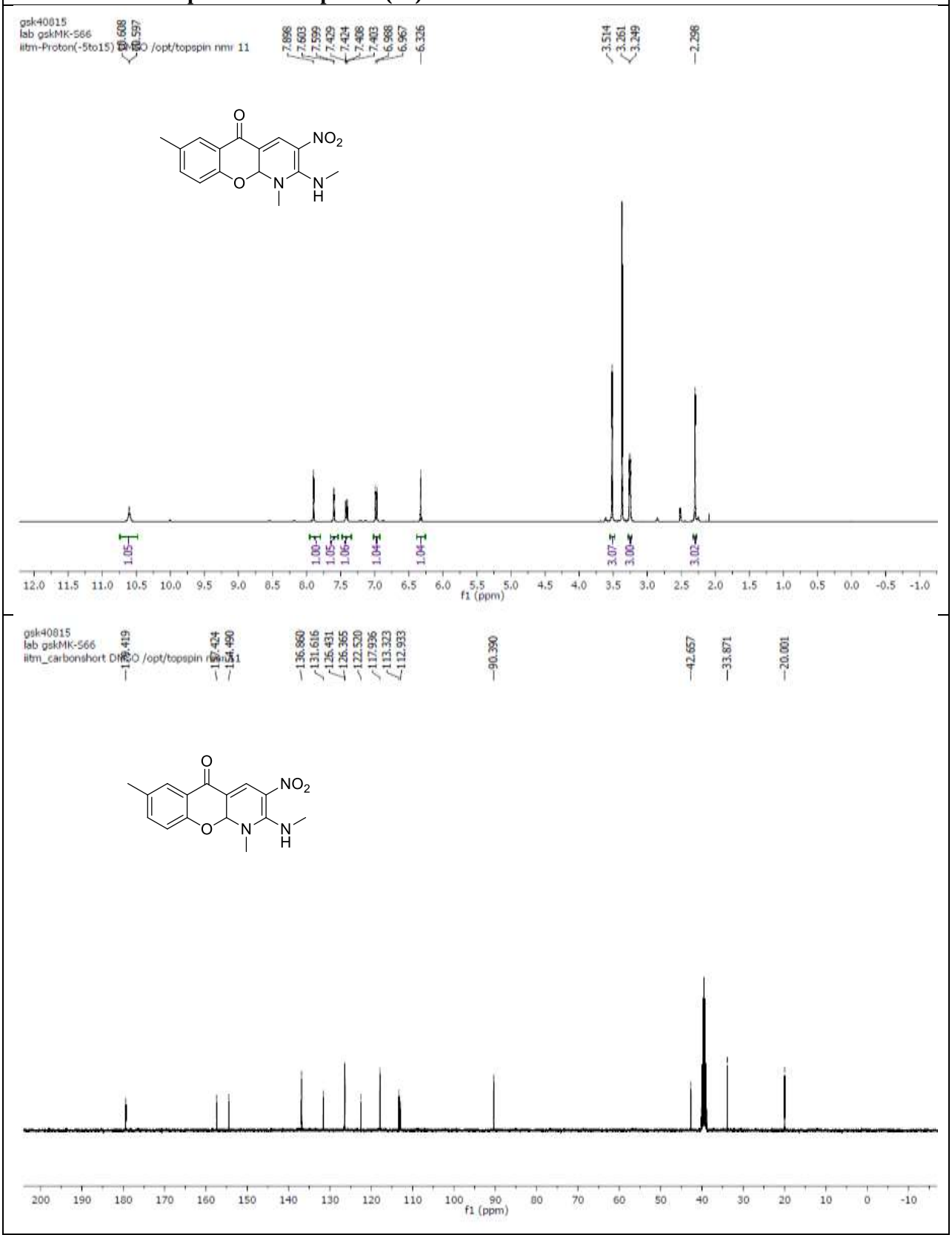




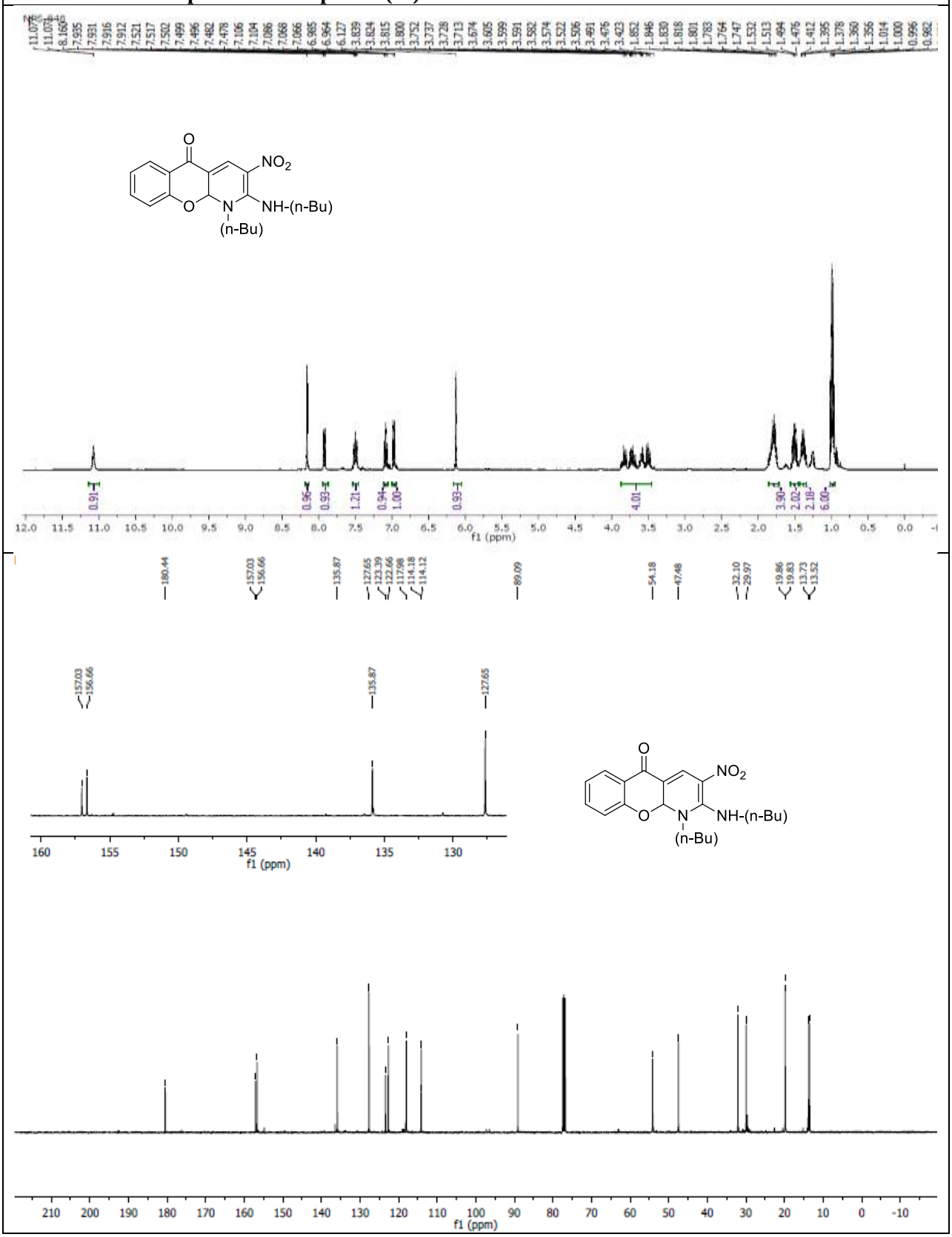
^{1}H NMR Spectra of Compound (5c)



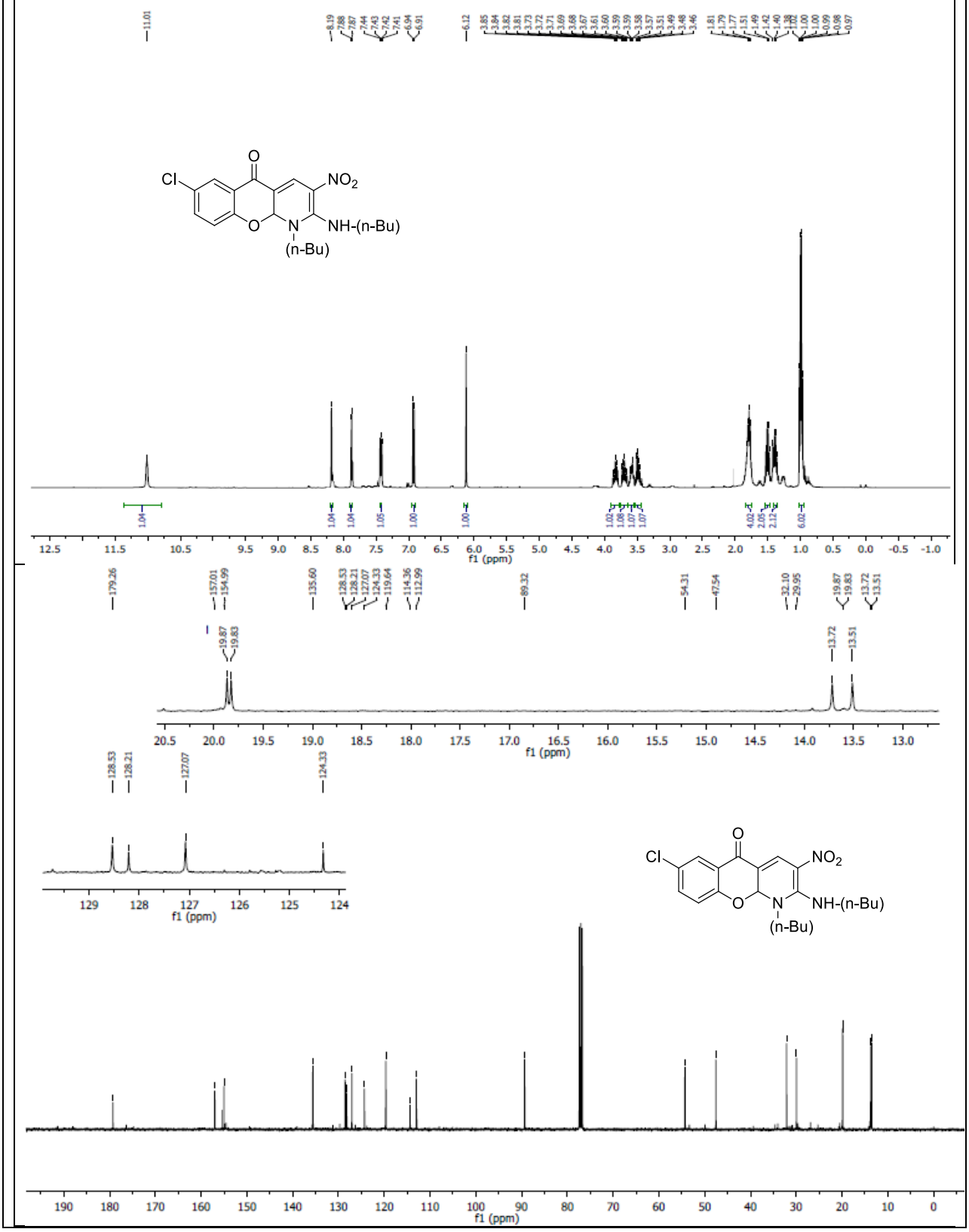
^{1}H and ^{13}C NMR Spectra of Compound (5d)



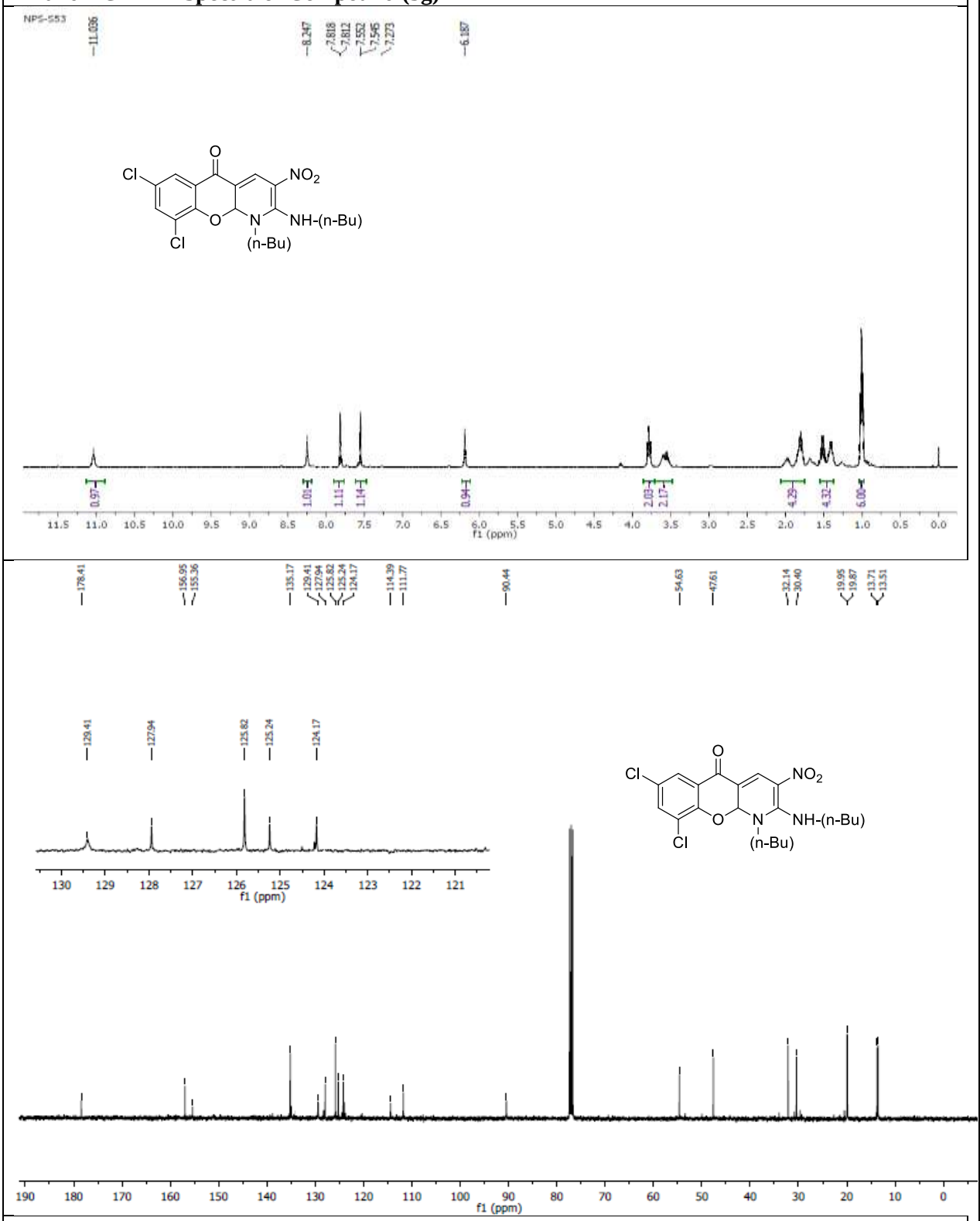
^{1}H and ^{13}C NMR Spectra of Compound (5e)



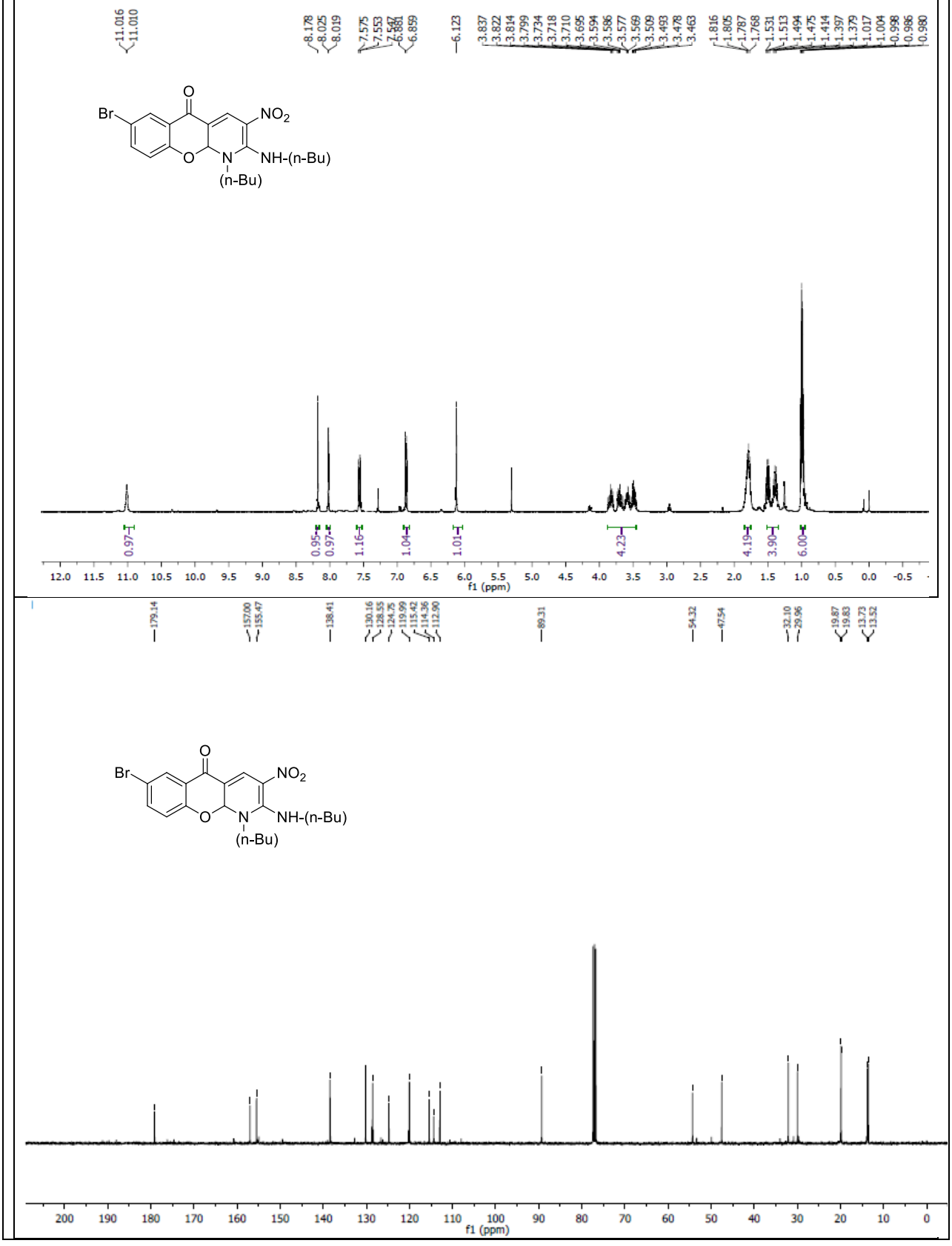
^{1}H and ^{13}C NMR Spectra of Compound (5f)



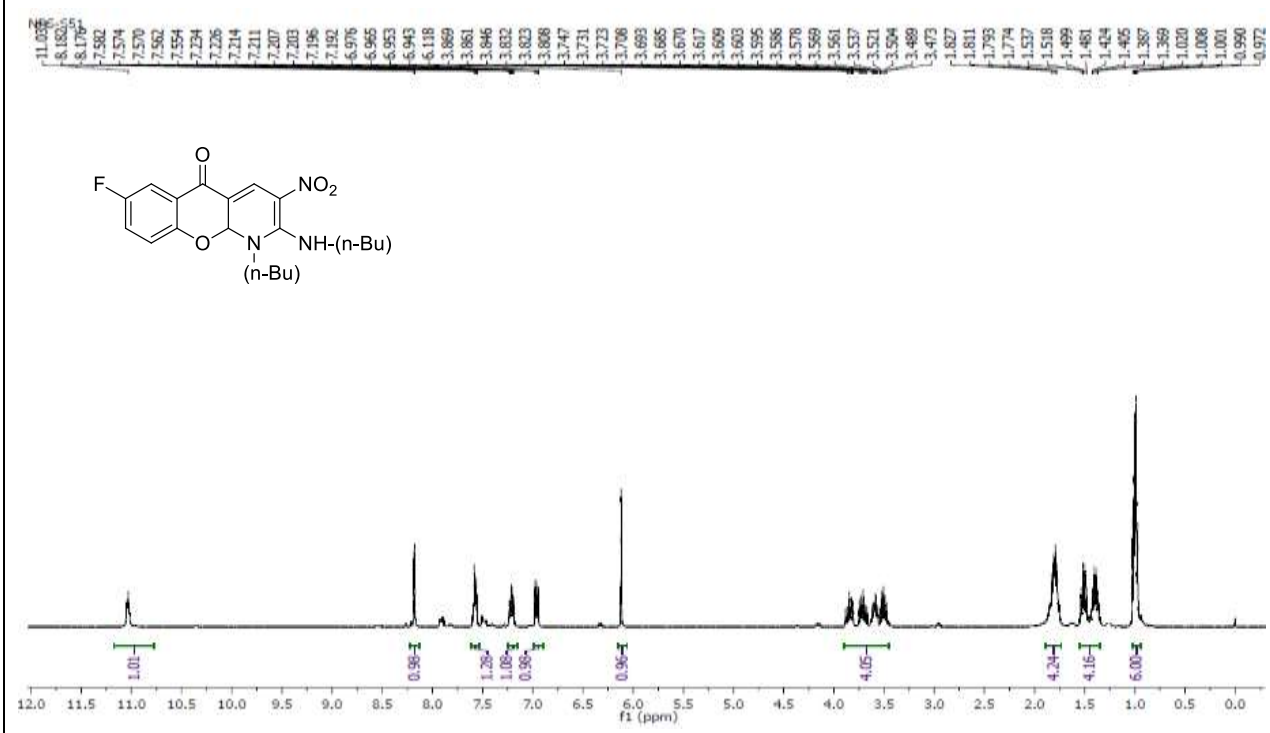
^{1}H and ^{13}C NMR Spectra of Compound (5g)

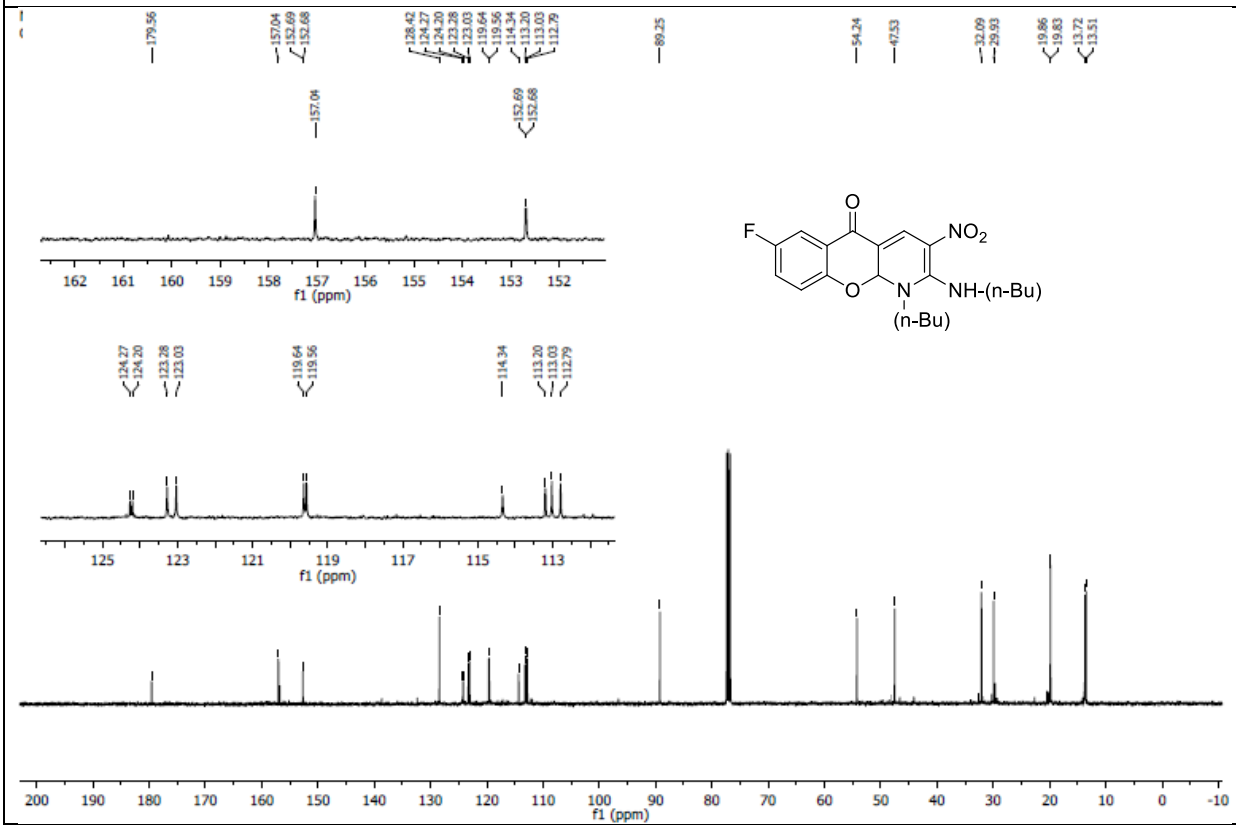


^{1}H and ^{13}C NMR Spectra of Compound (5h)

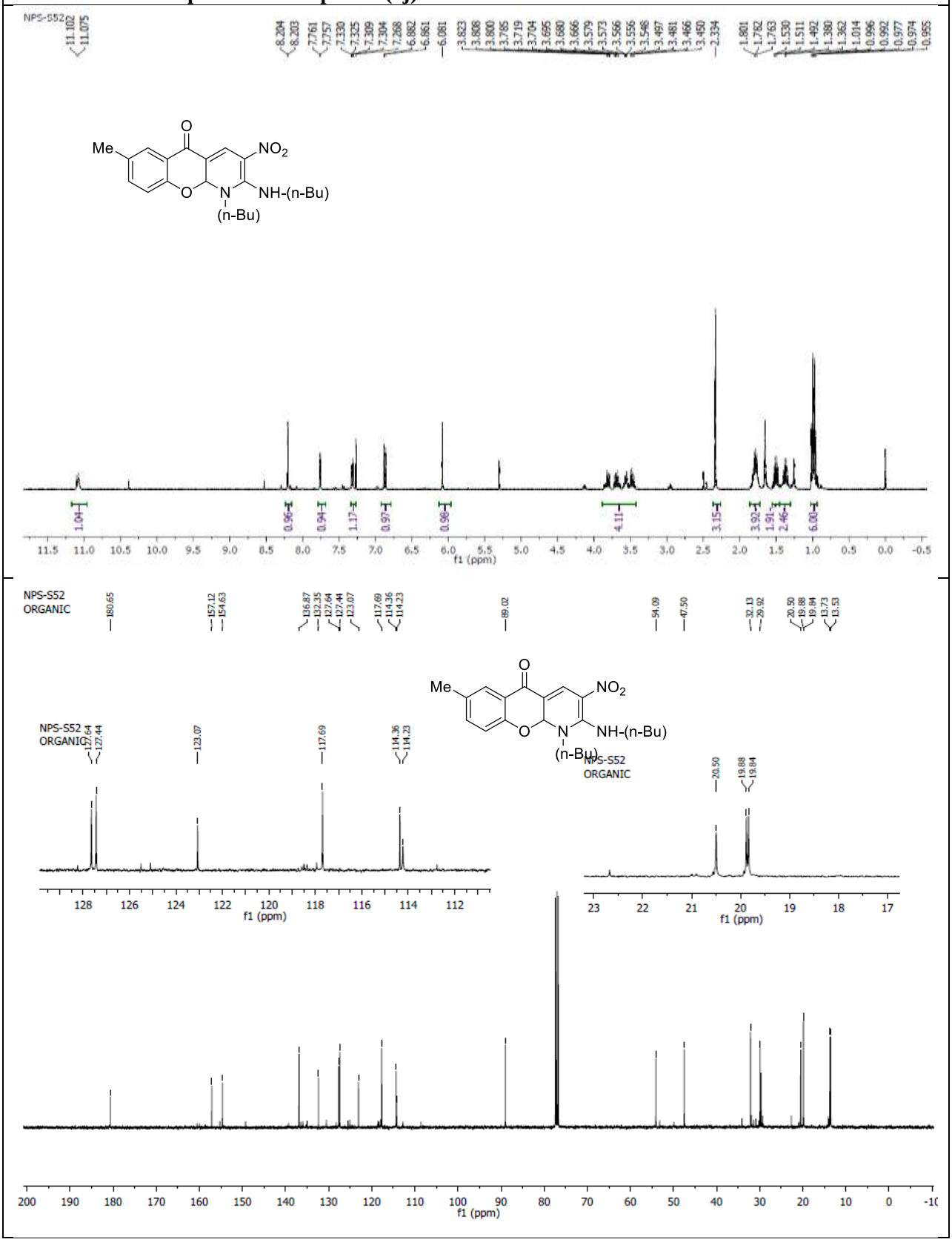


^{1}H and ^{13}C NMR Spectra of Compound (5i)

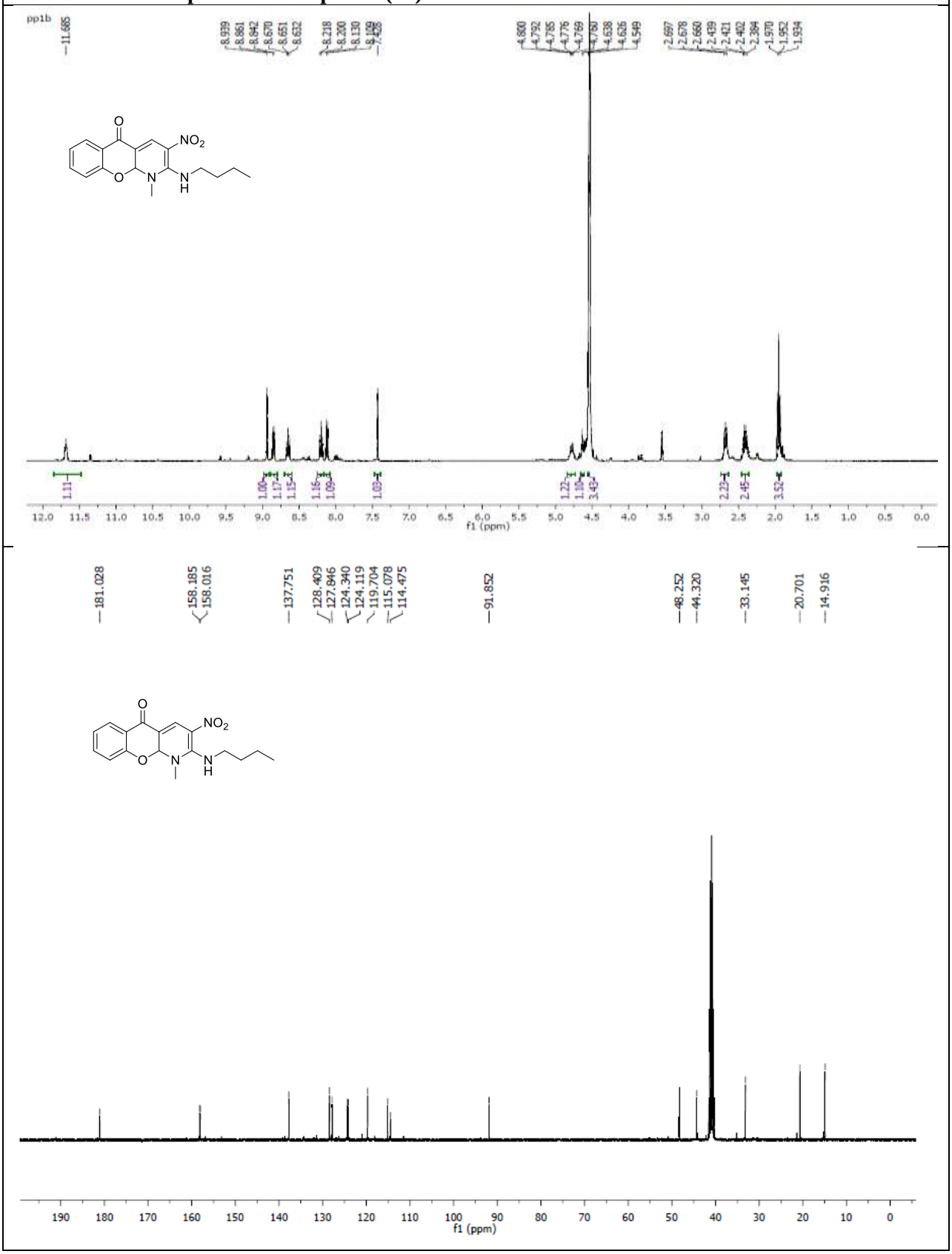




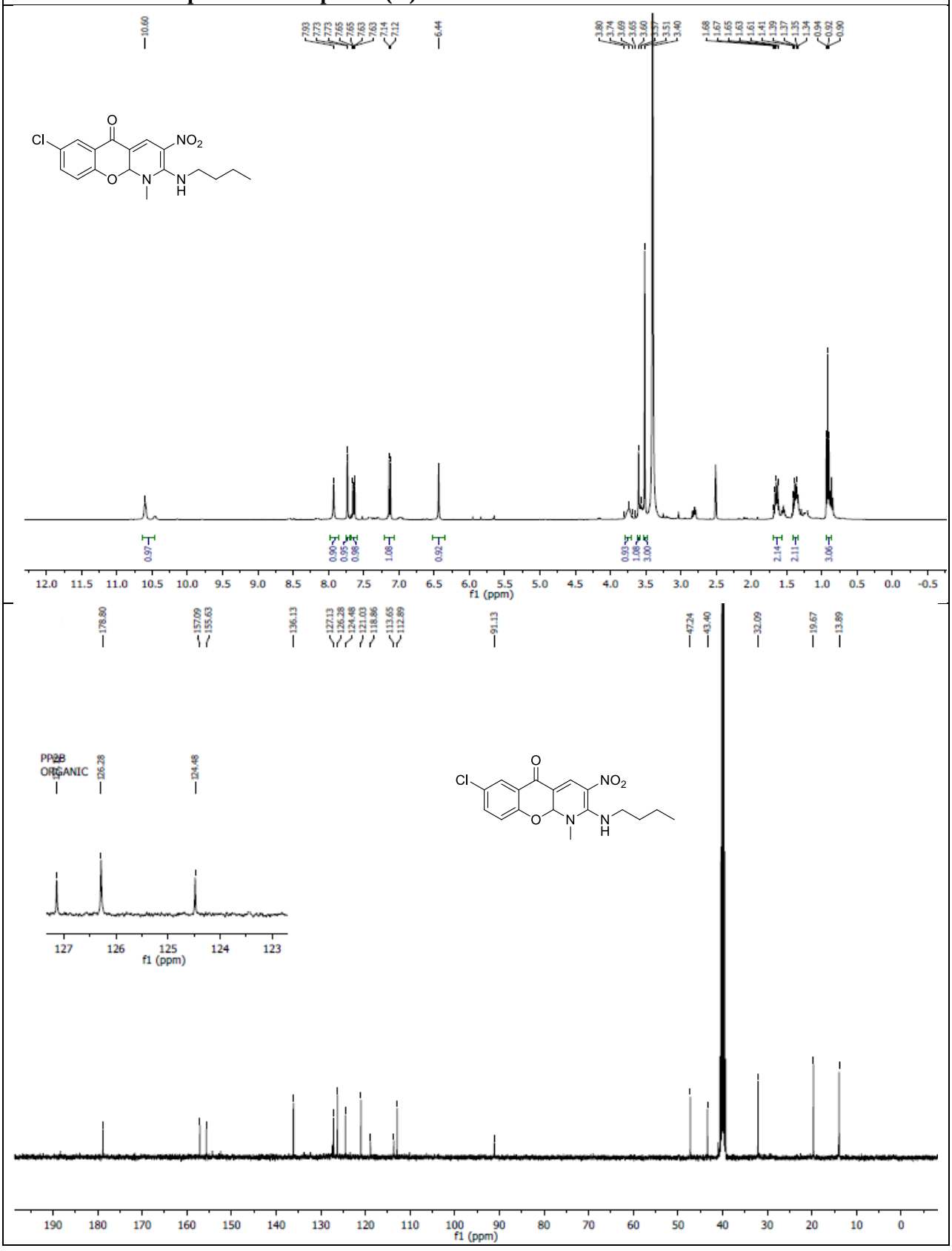
^{1}H and ^{13}C NMR Spectra of Compound (5j)



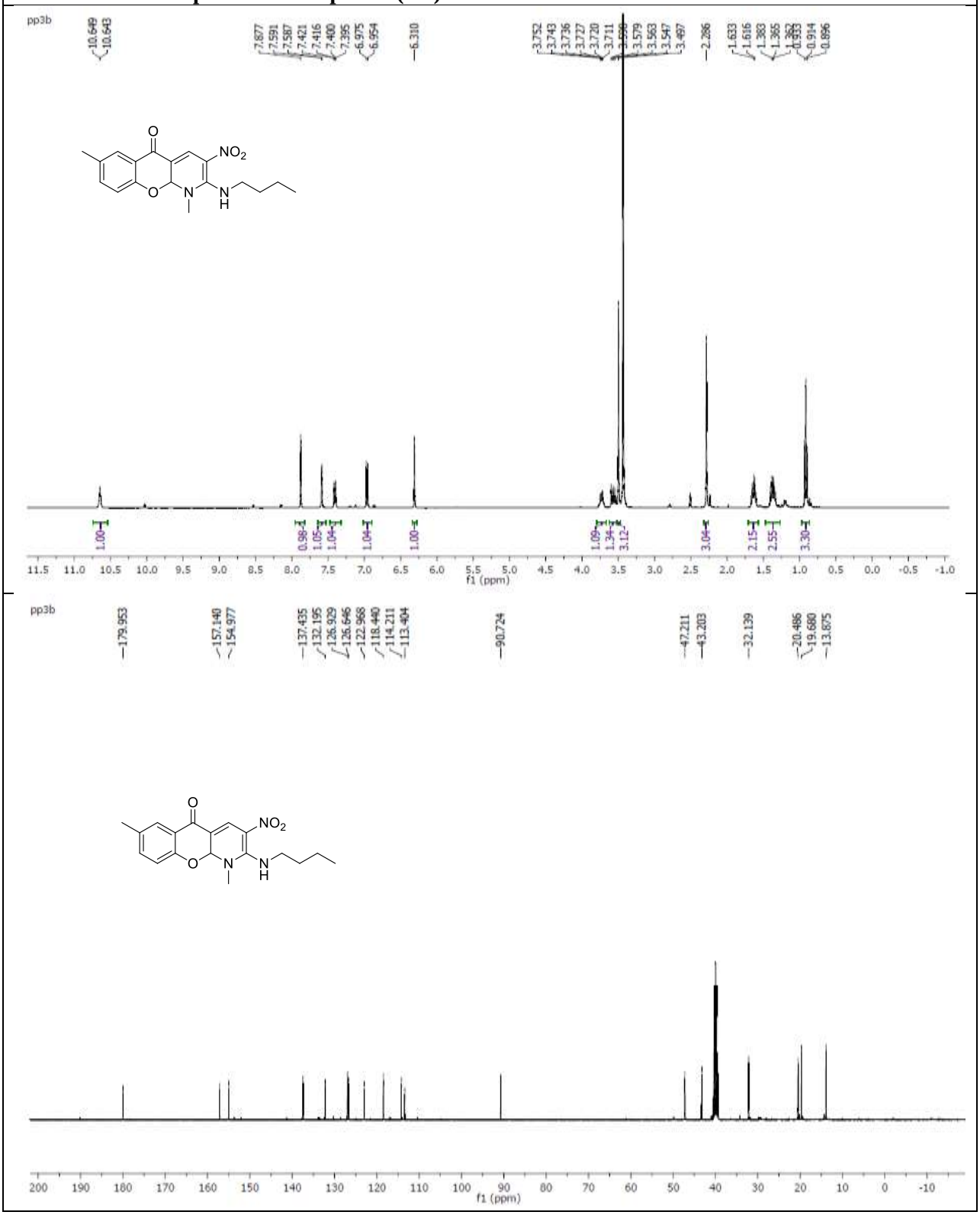
^{1}H and ^{13}C NMR Spectra of Compound (5k)



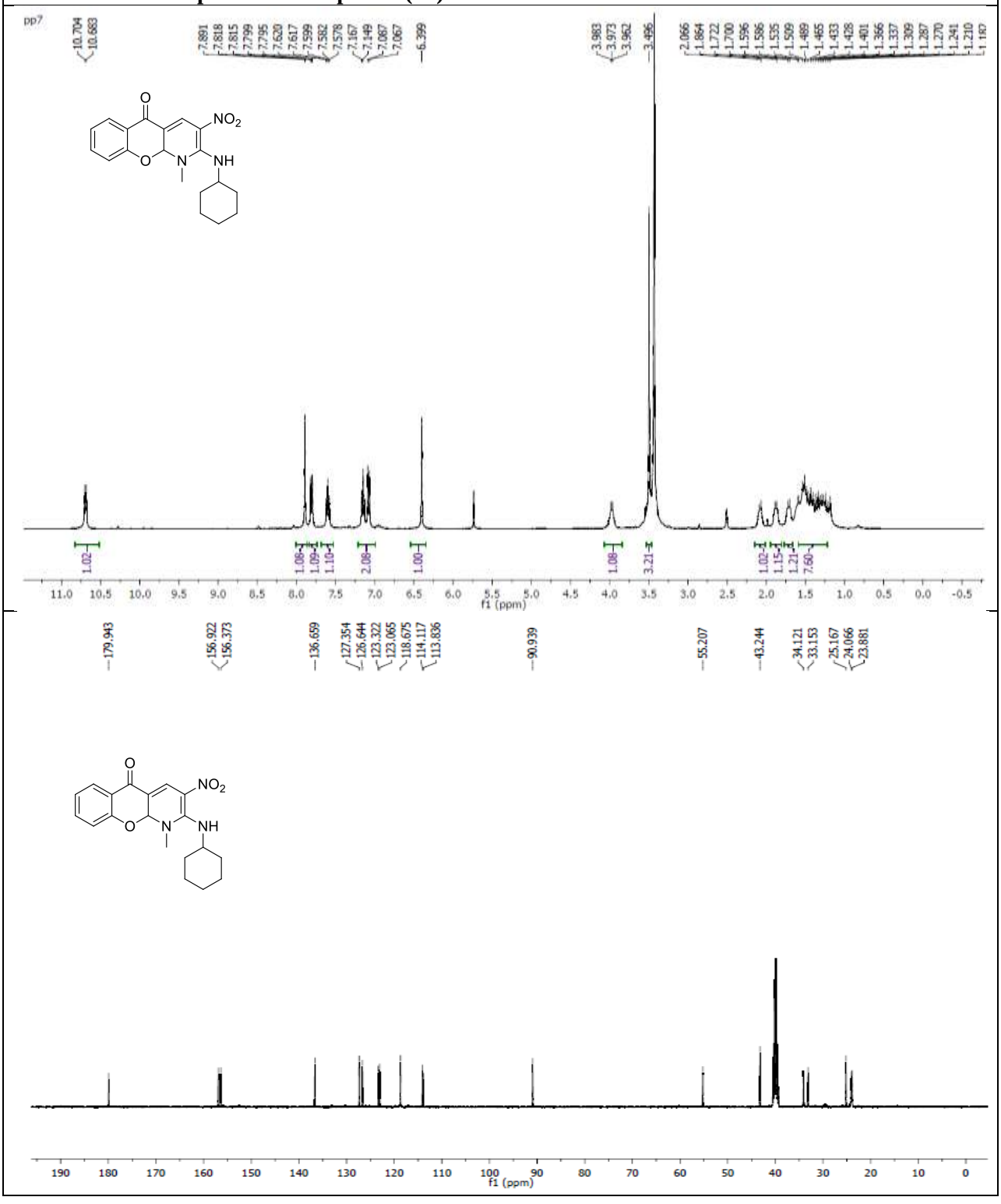
^{1}H and ^{13}C NMR Spectra of Compound (5l)



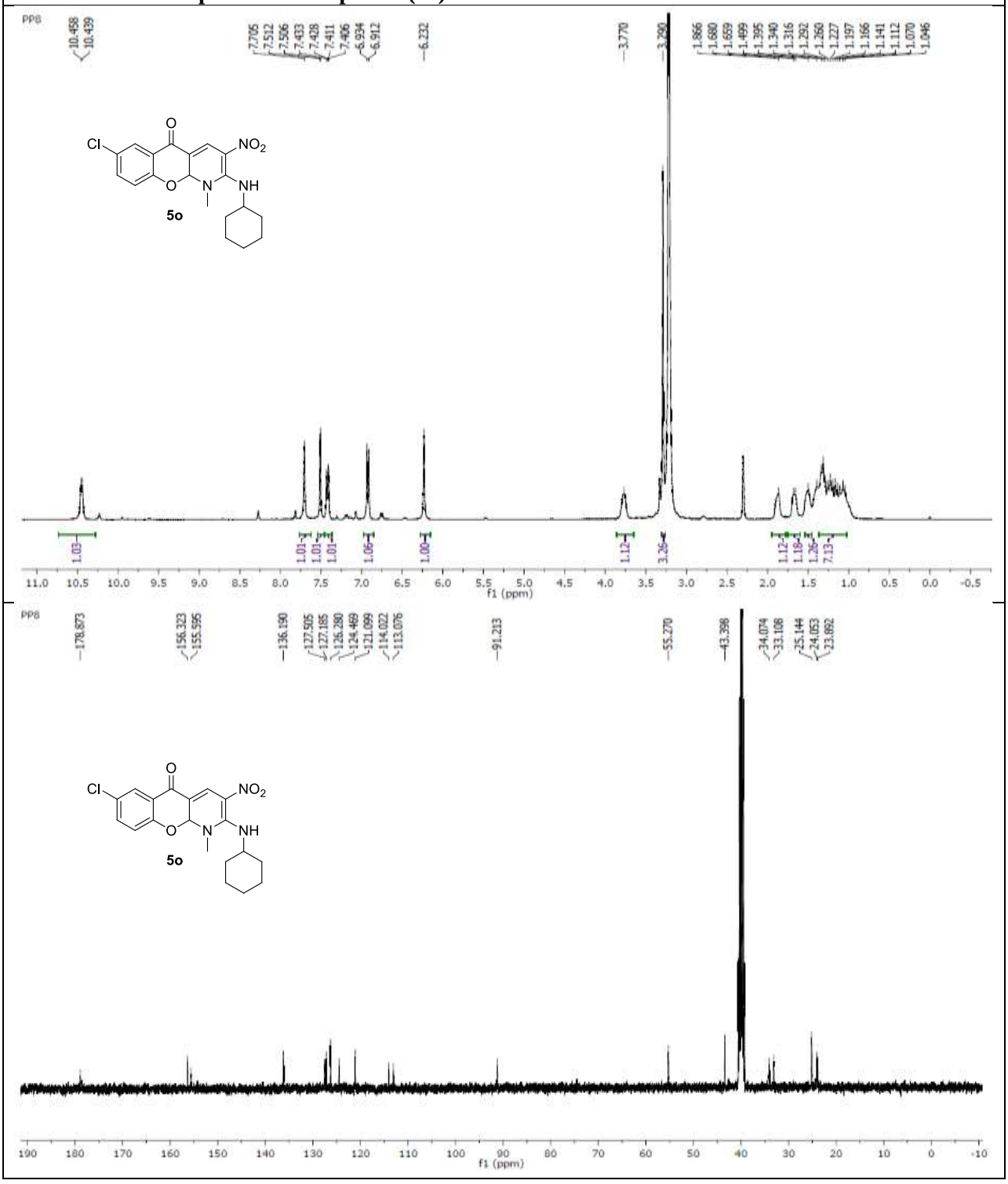
^{1}H and ^{13}C NMR Spectra of Compound (5m)



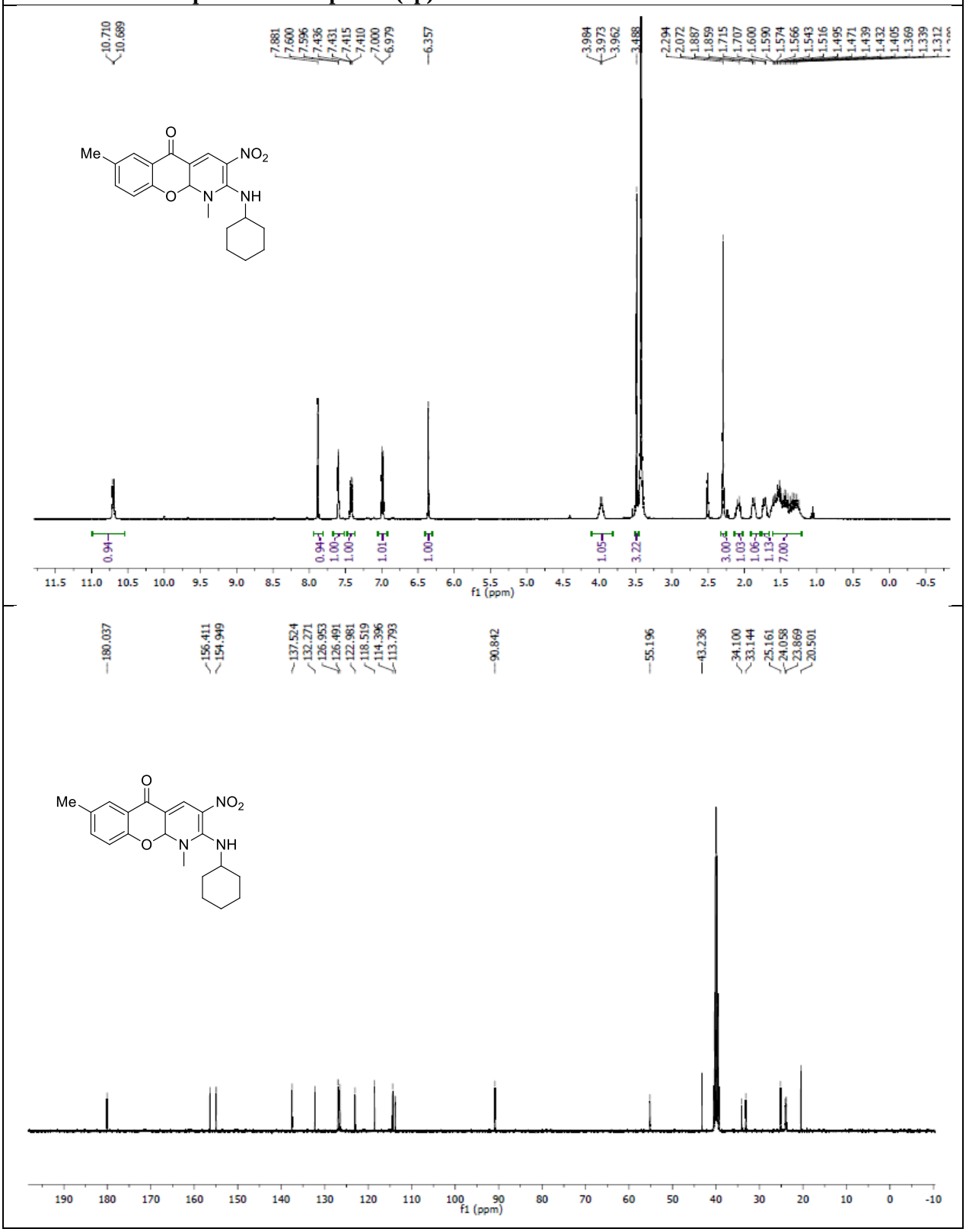
^{1}H and ^{13}C NMR Spectra of Compound (5n)



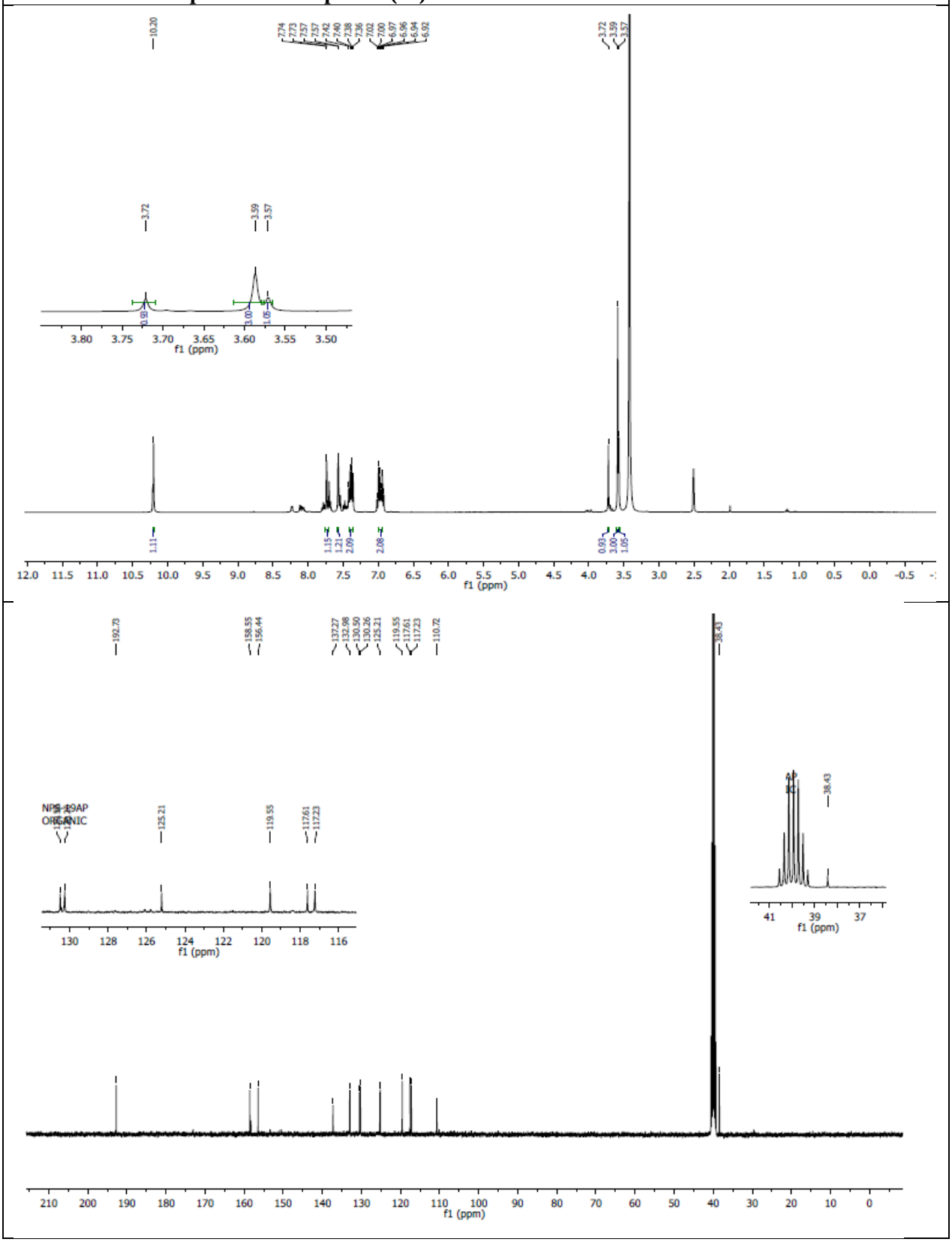
^{1}H and ^{13}C NMR Spectra of Compound (5o)



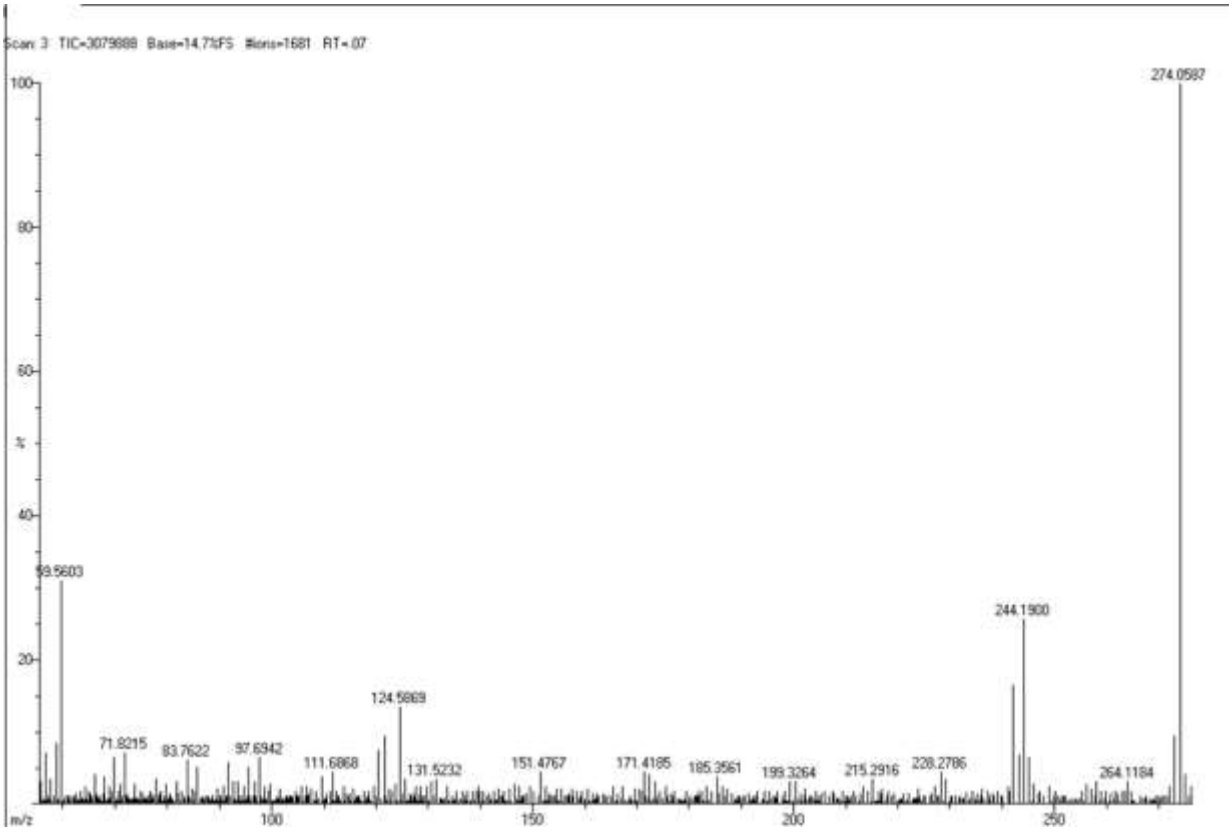
^{1}H and ^{13}C NMR Spectra of Compound (5p)



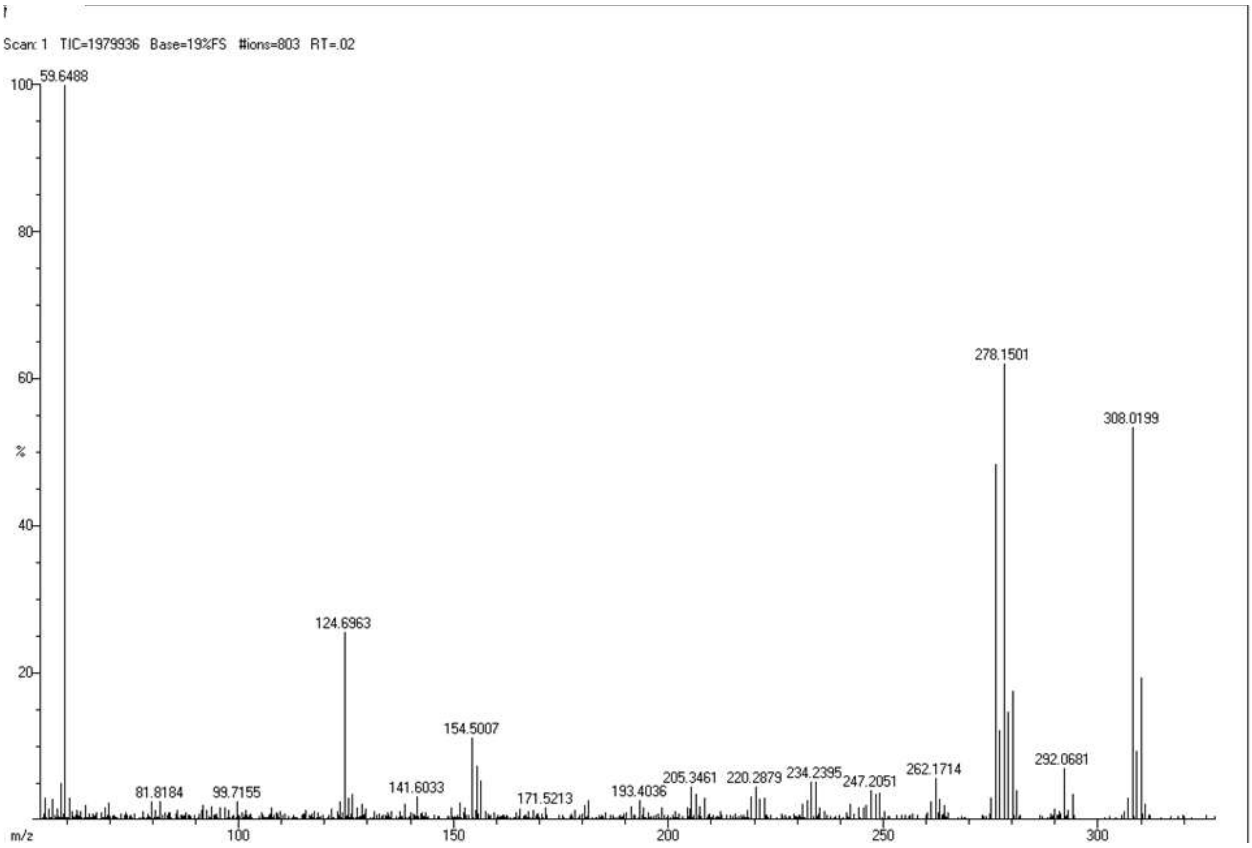
^{1}H and ^{13}C NMR Spectra of Compound (14)



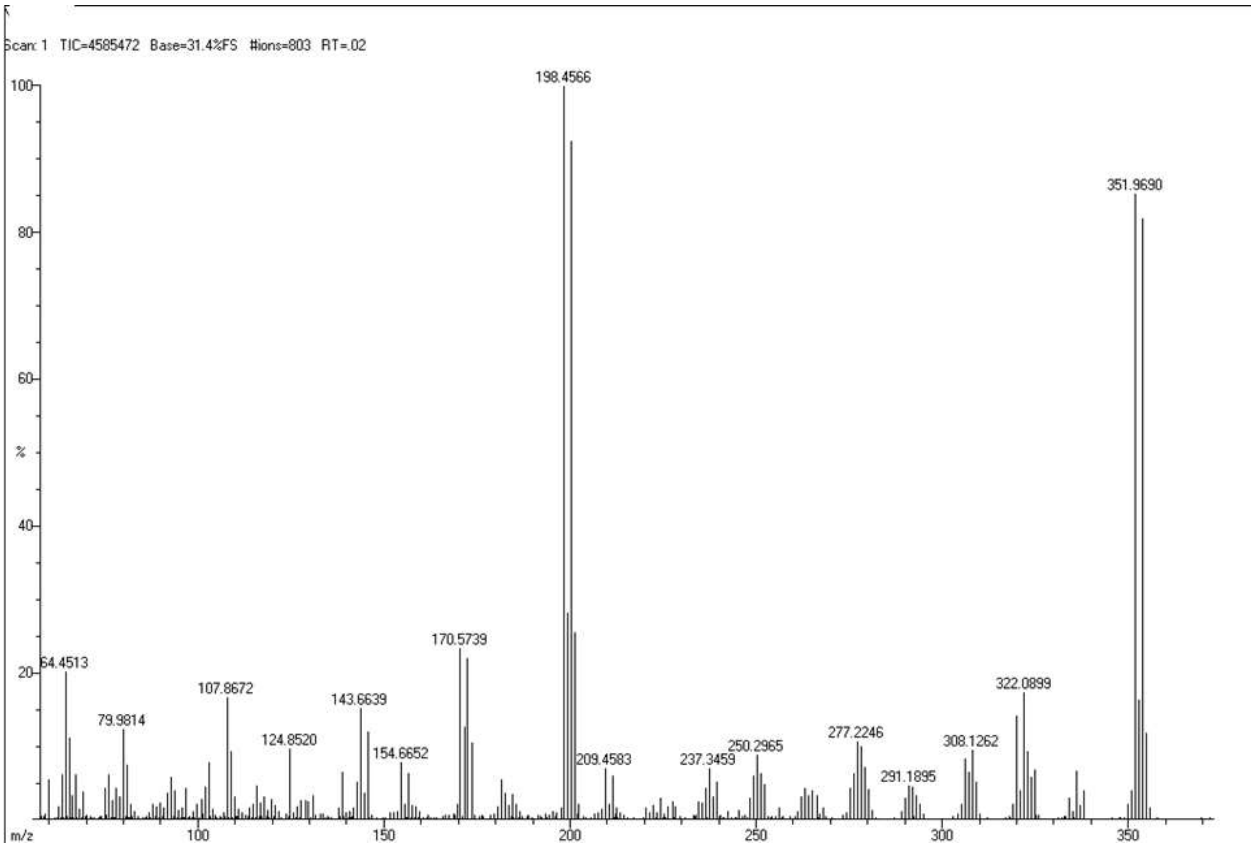
EI-HRMS Spectrum:



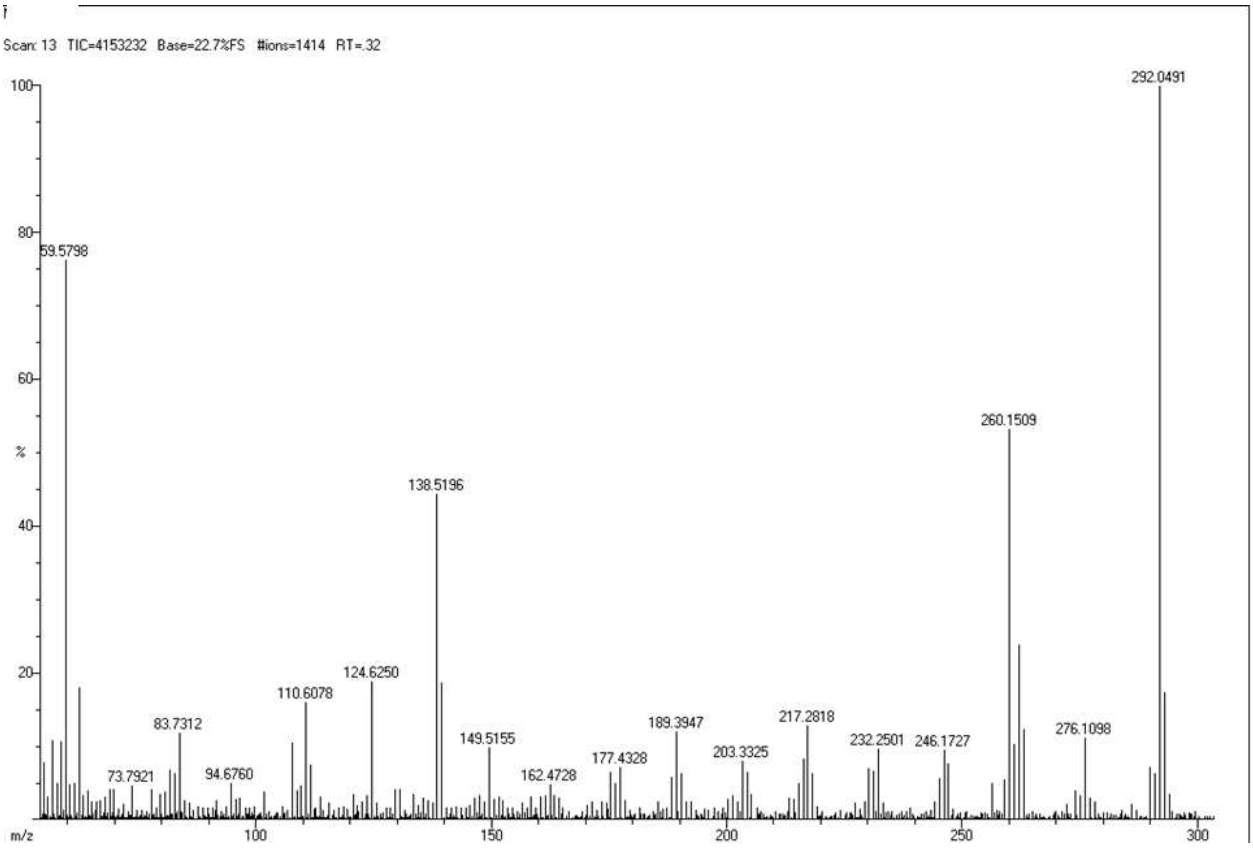
EI-HRMS spectrum of compound 3a



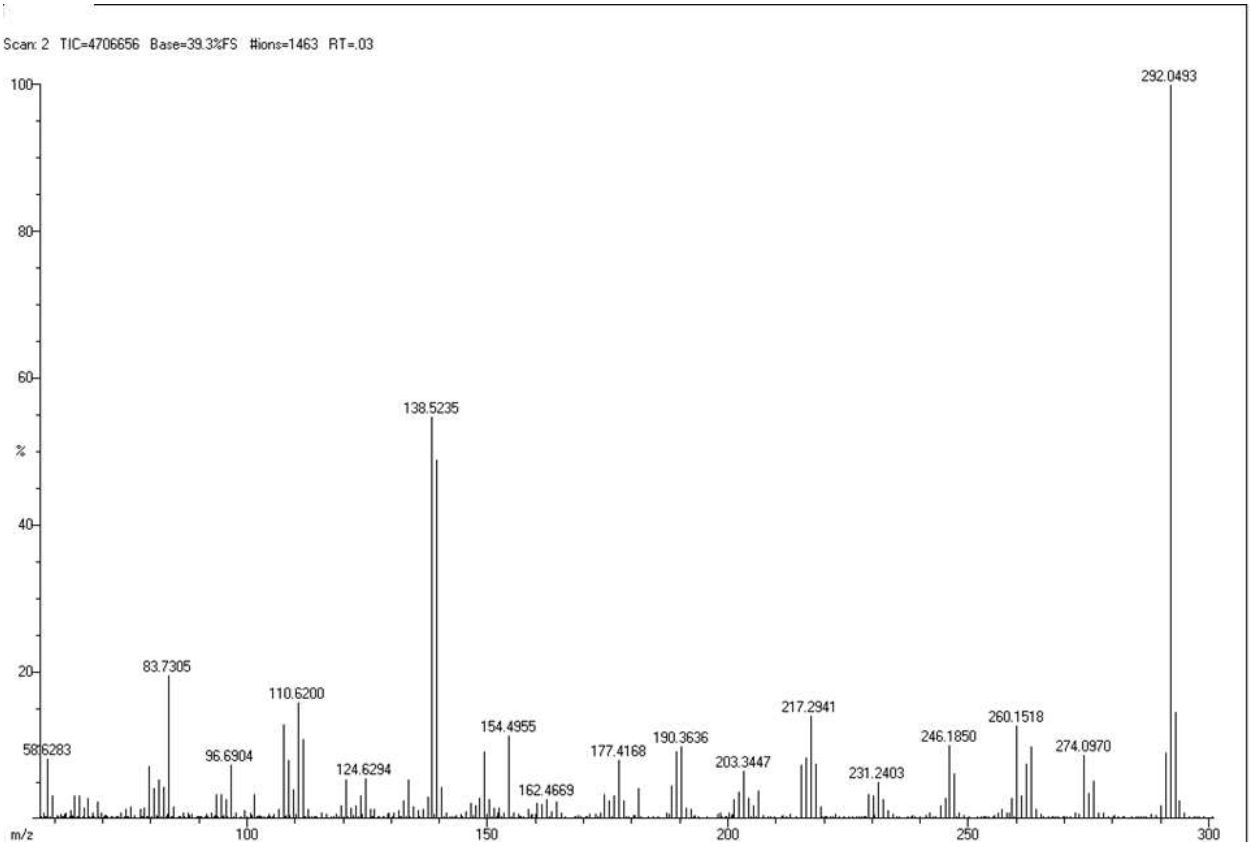
EI-HRMS spectrum of compound 3b



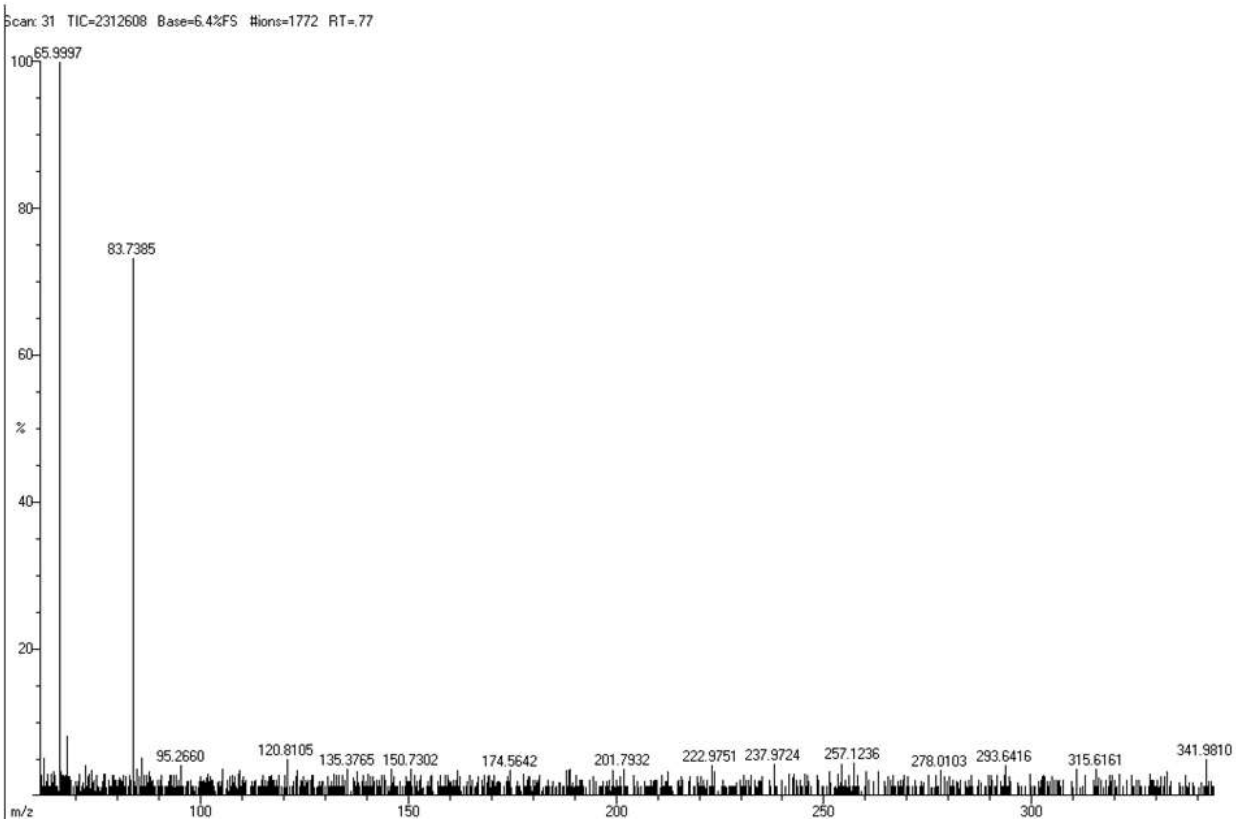
EI-HRMS spectrum of compound 3c



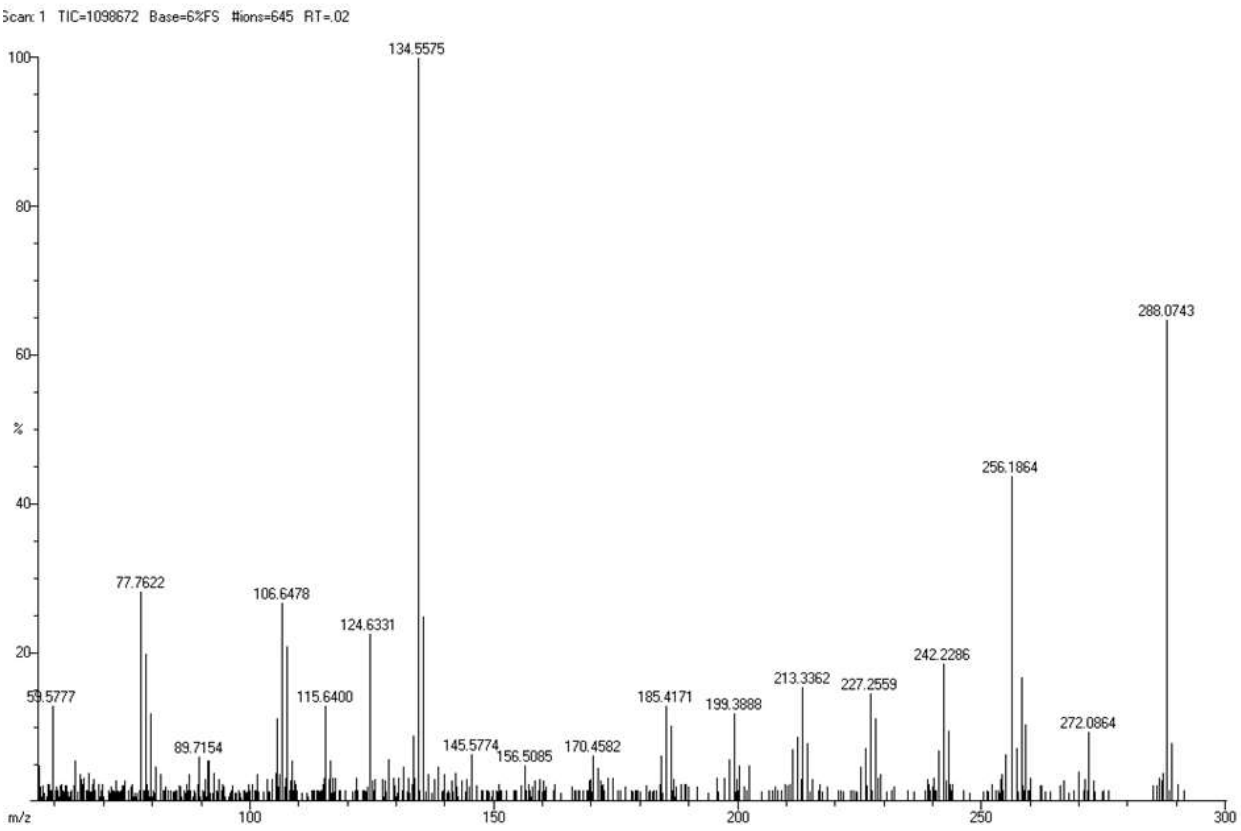
EI-HRMS spectrum of compound 3d



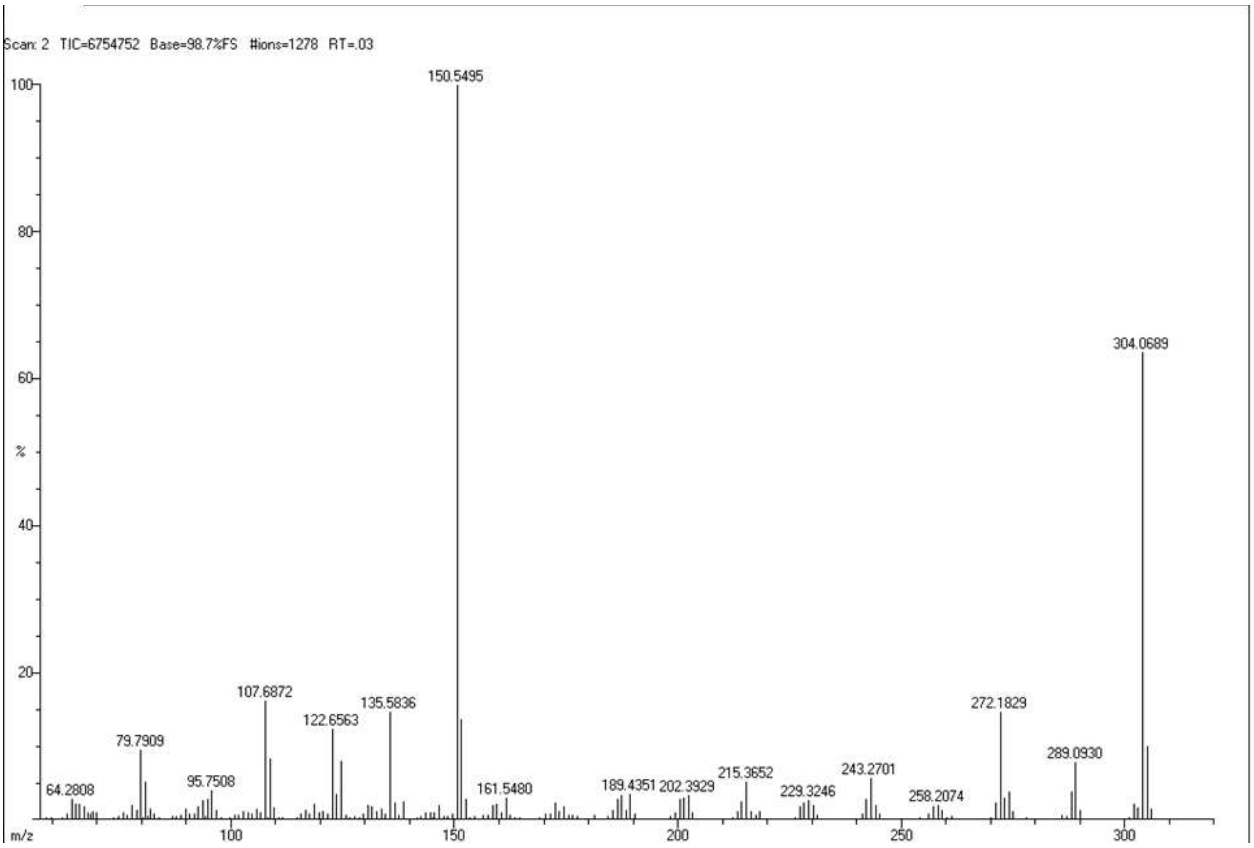
EI-HRMS spectrum of compound 3e



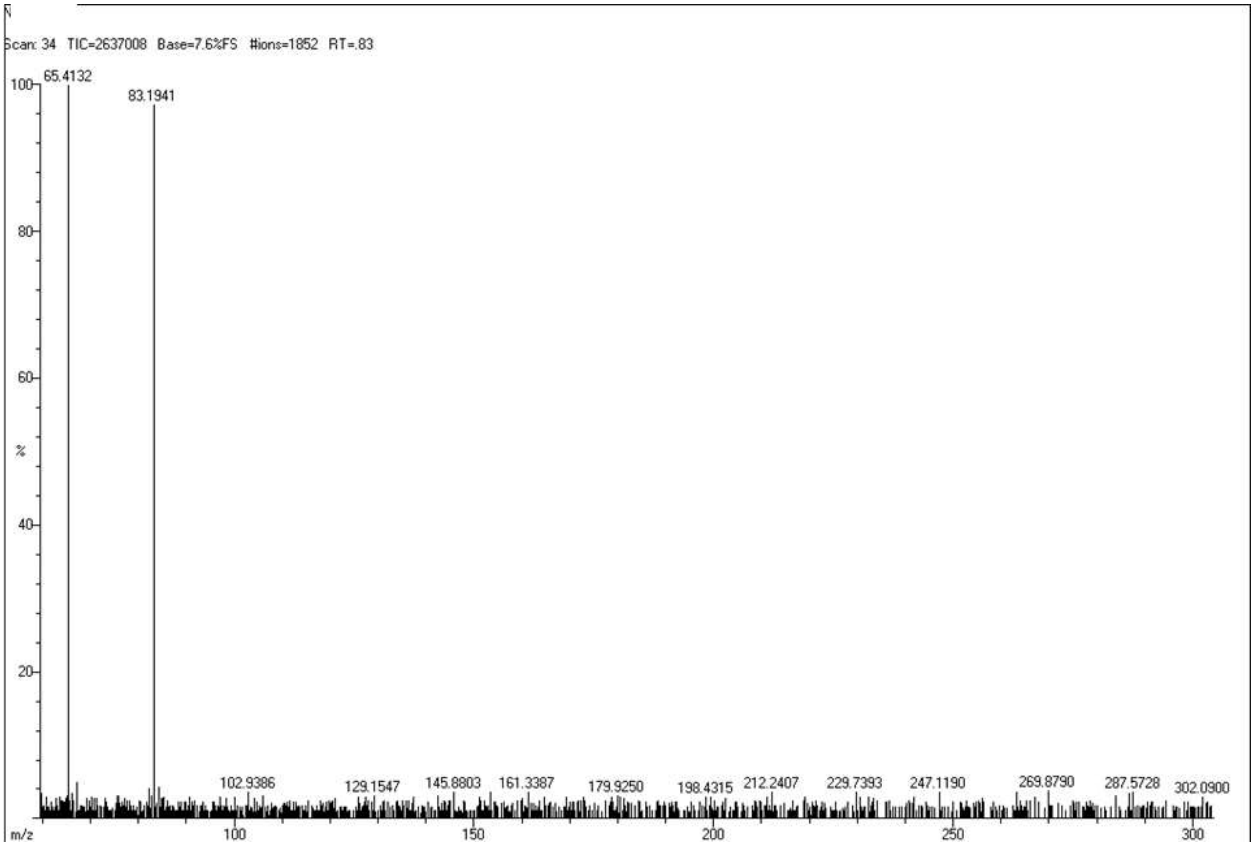
EI-HRMS spectrum of compound 3f



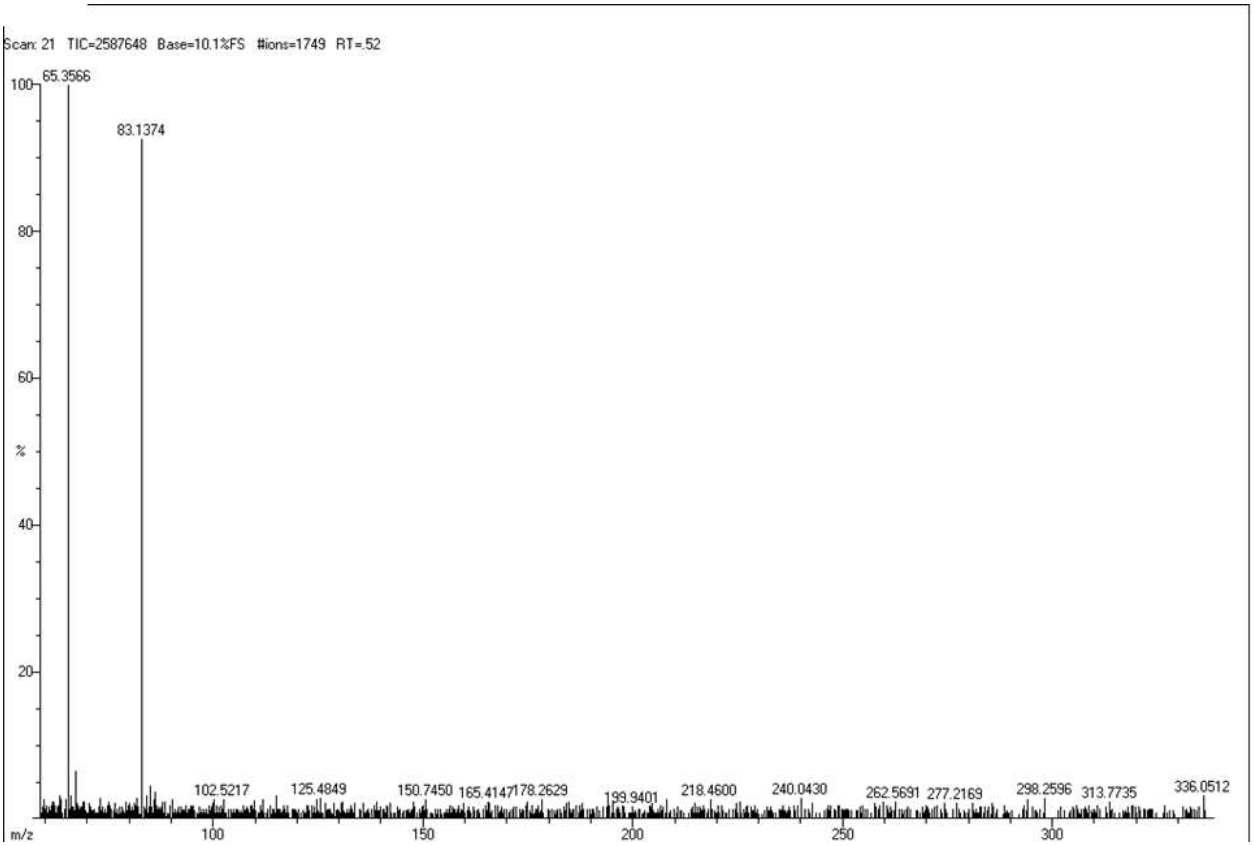
EI-HRMS spectrum of compound 3g



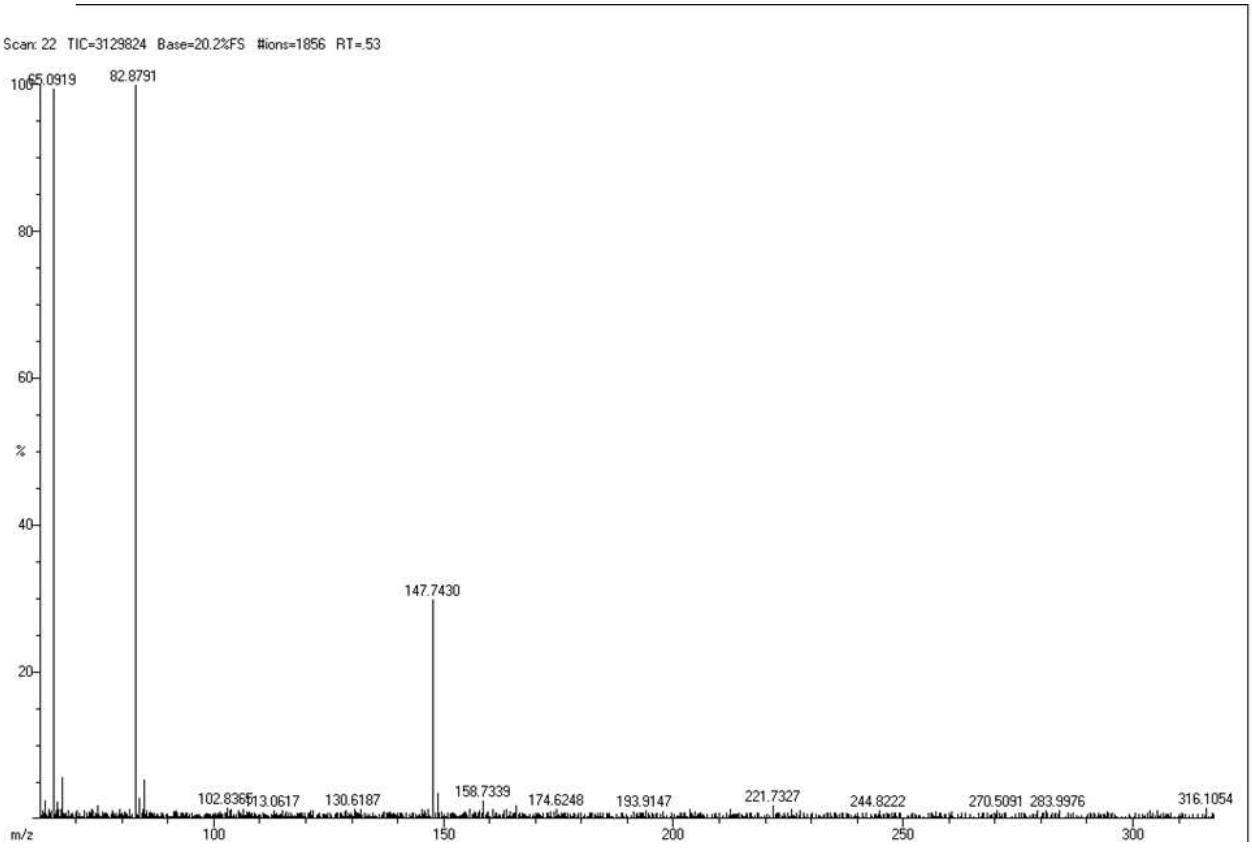
EI-HRMS spectrum of compound 3h



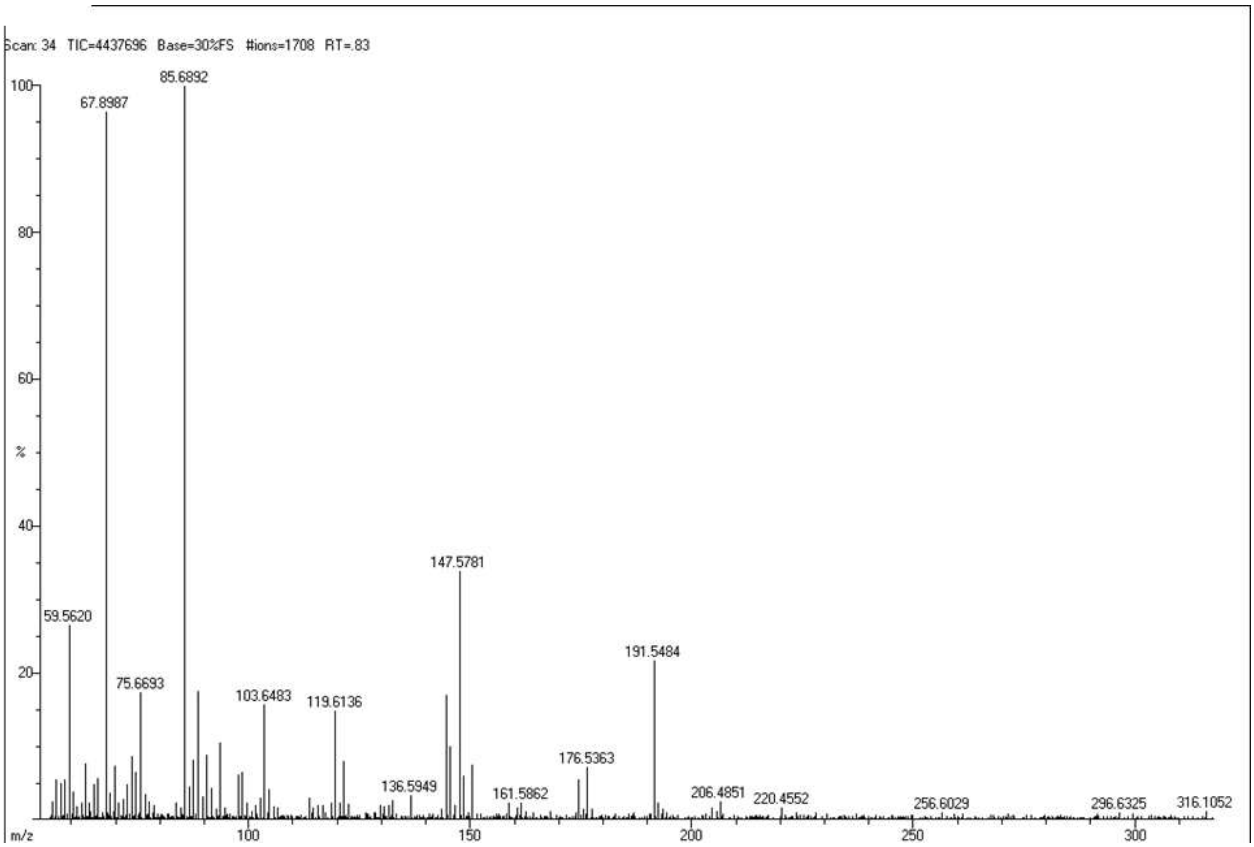
EI-HRMS spectrum of compound 3i



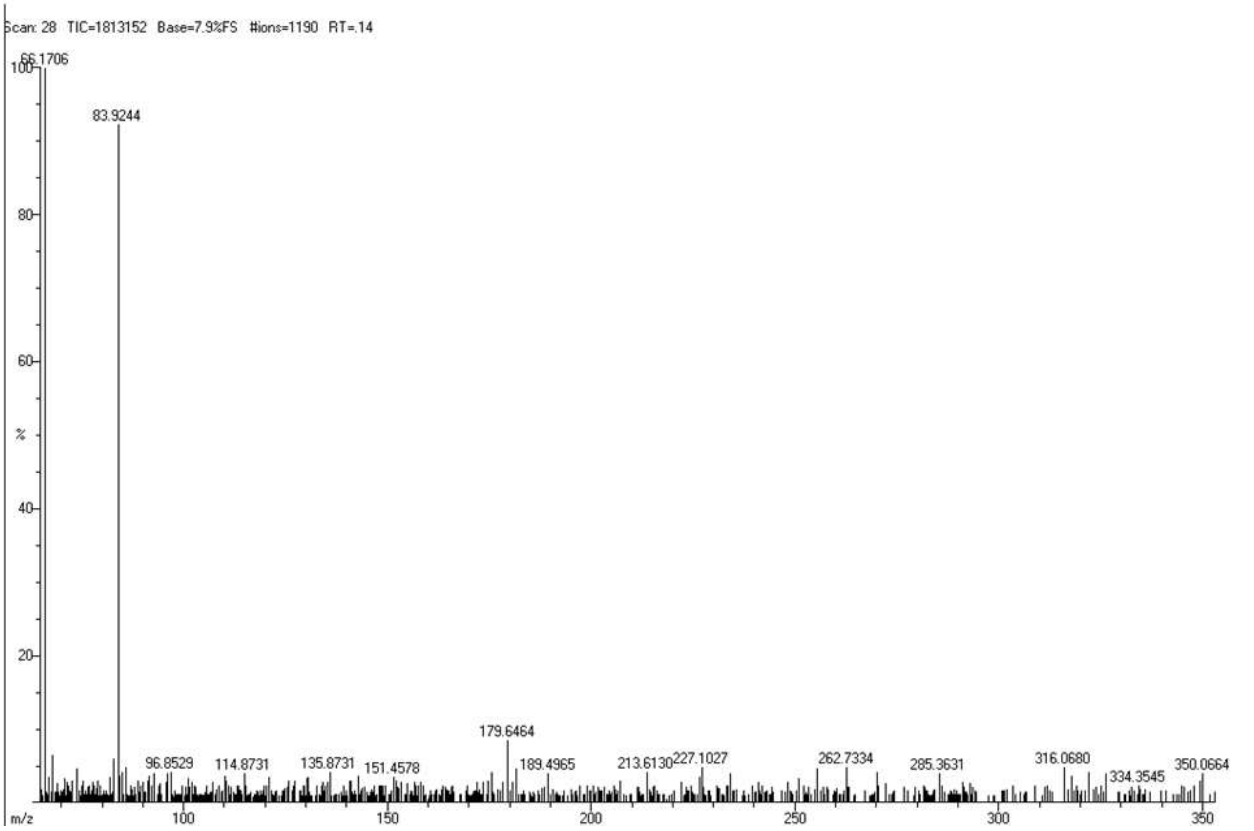
EI-HRMS spectrum of compound 3j



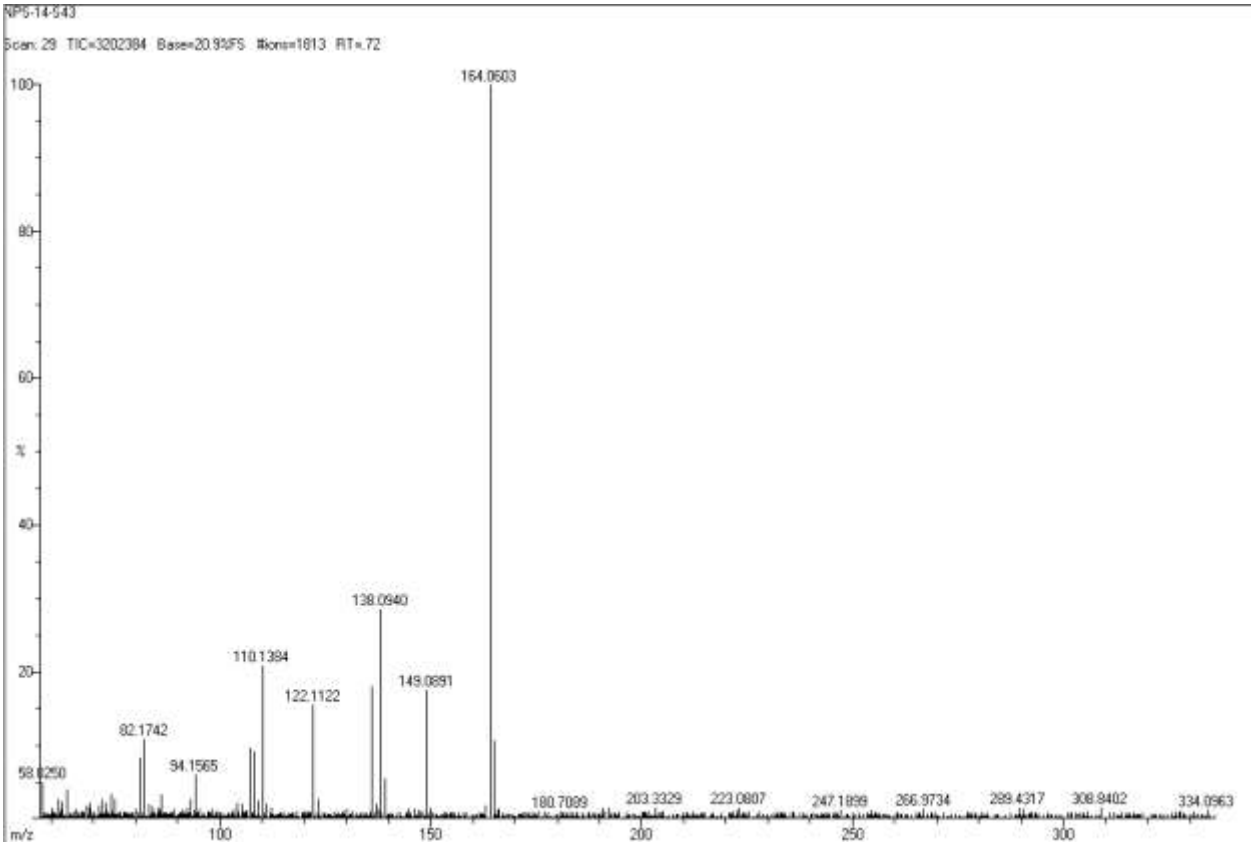
EI-HRMS spectrum of compound 3k



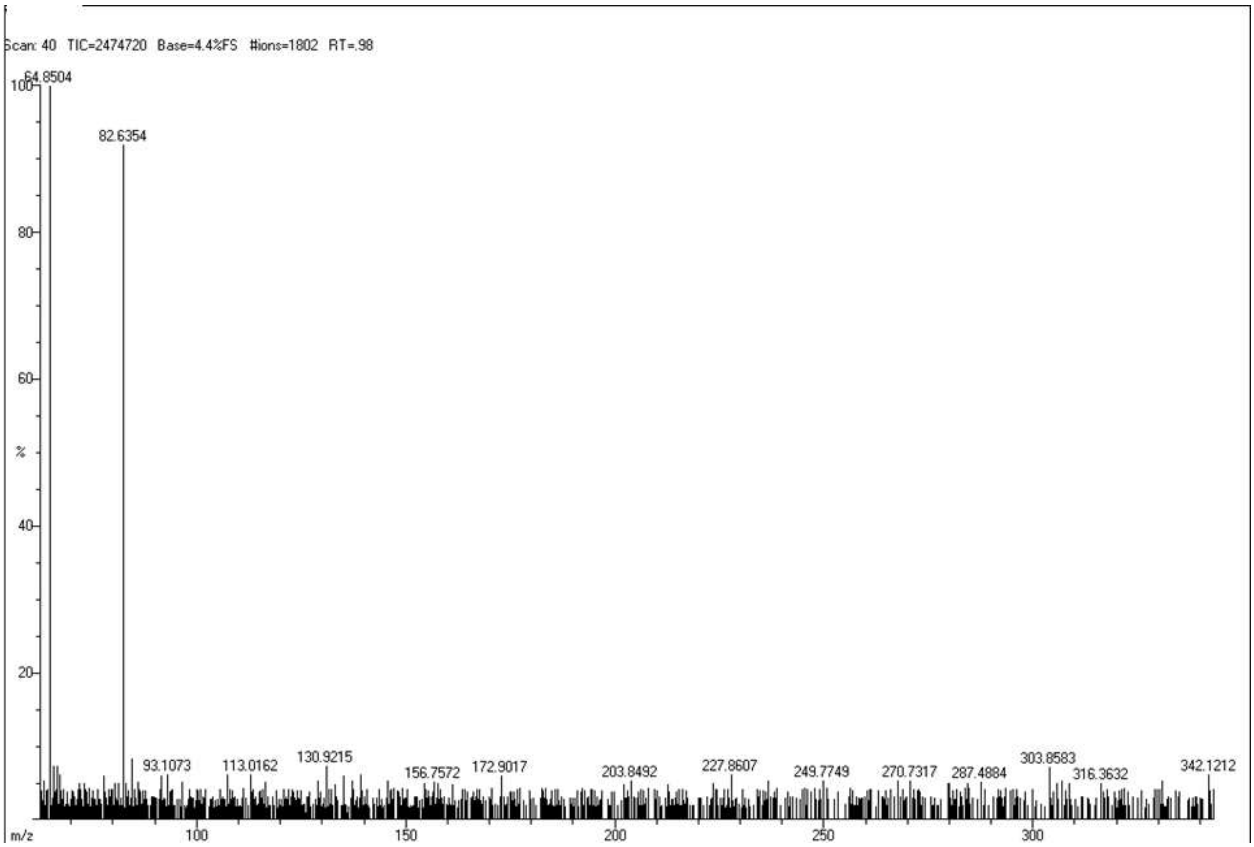
EI-HRMS spectrum of compound 3l



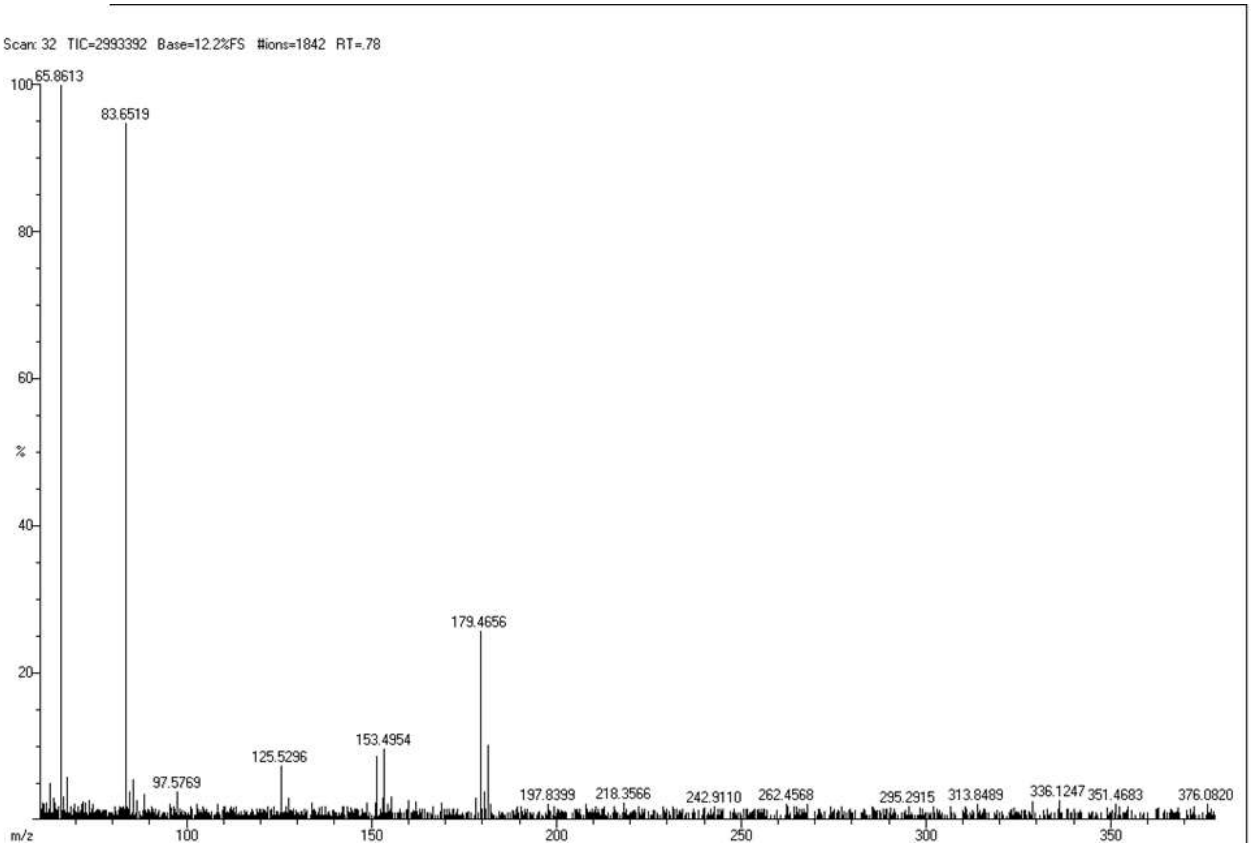
EI-HRMS spectrum of compound 3m



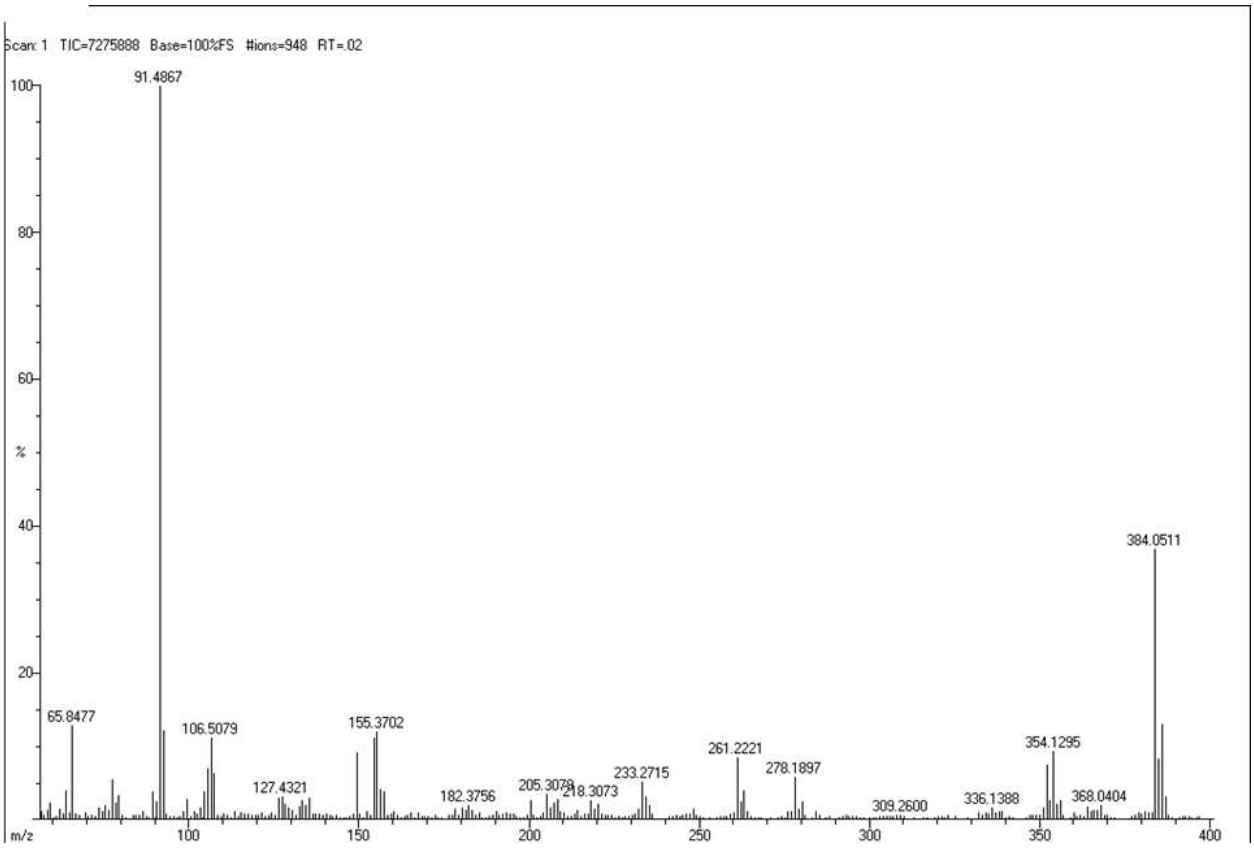
EI-HRMS spectrum of compound 3n



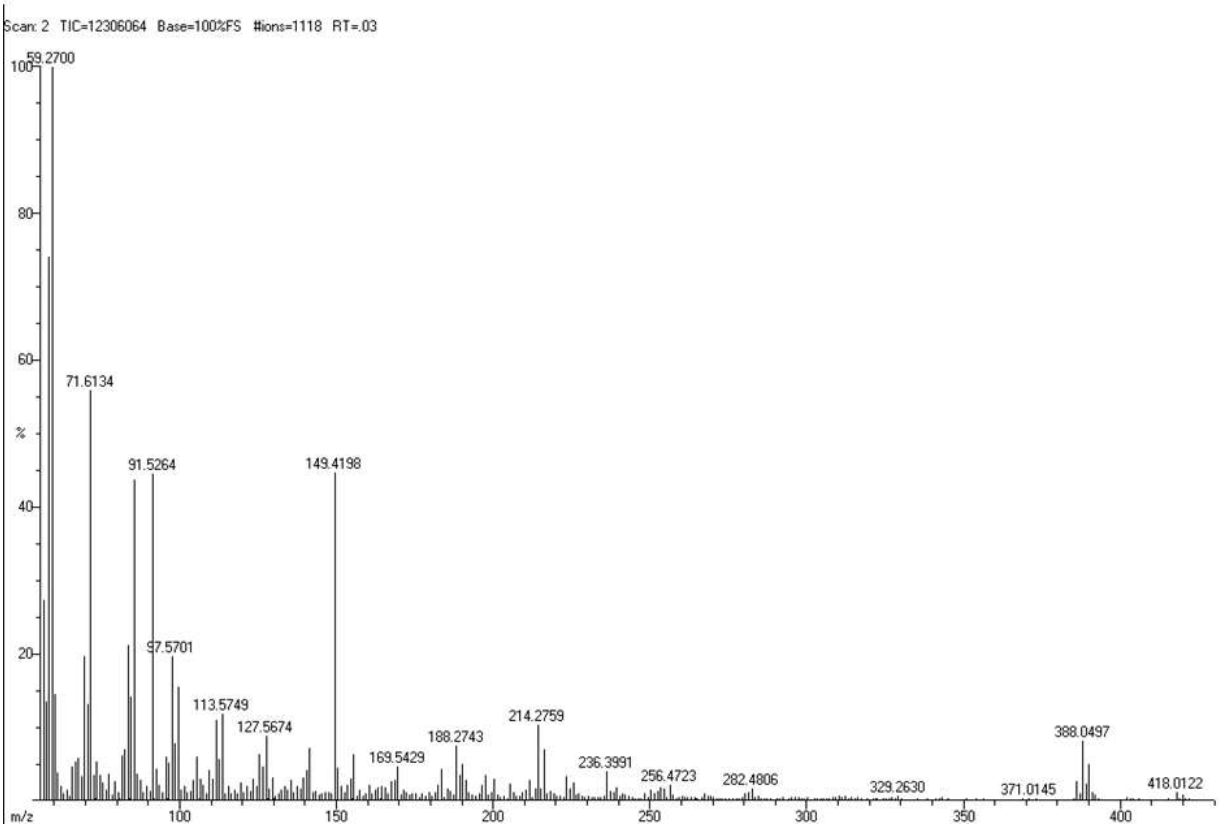
EI-HRMS spectrum of compound 3o



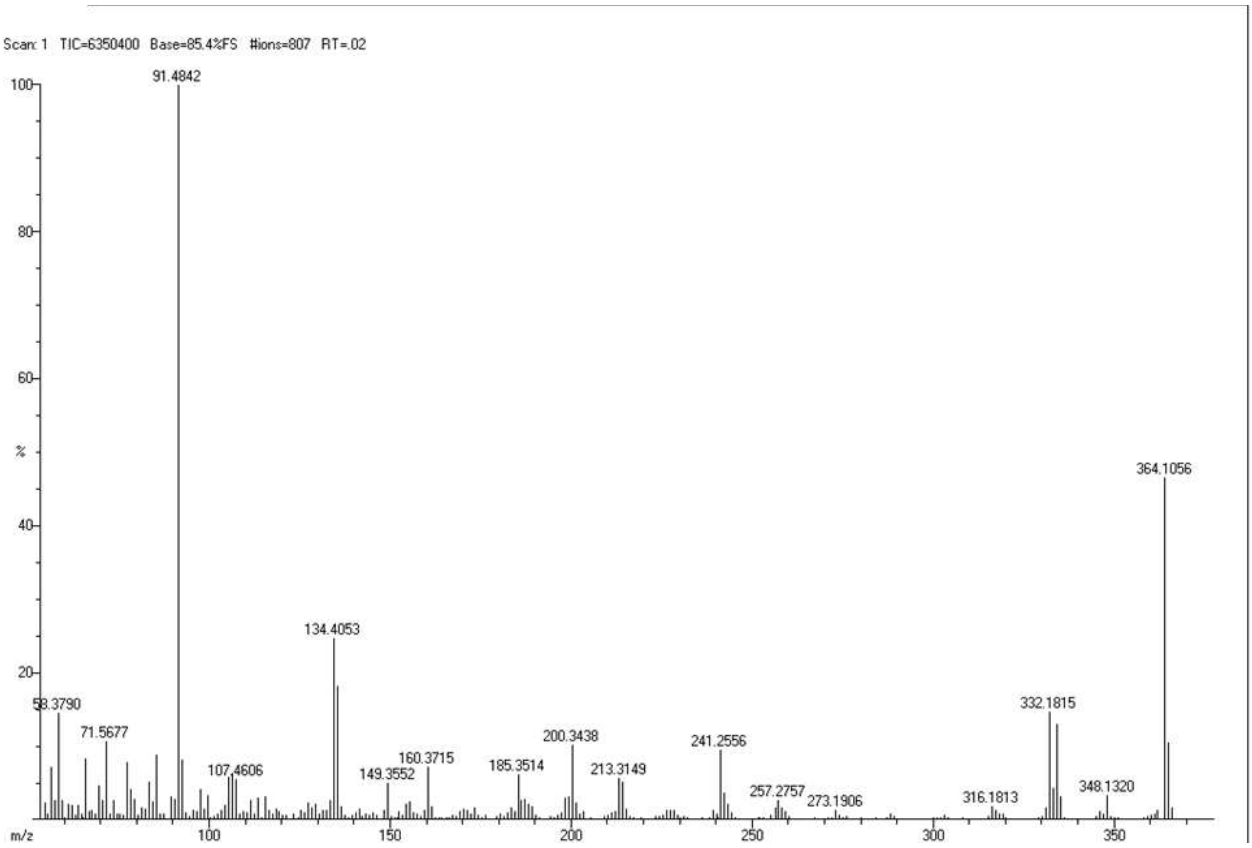
EI-HRMS spectrum of compound 3p



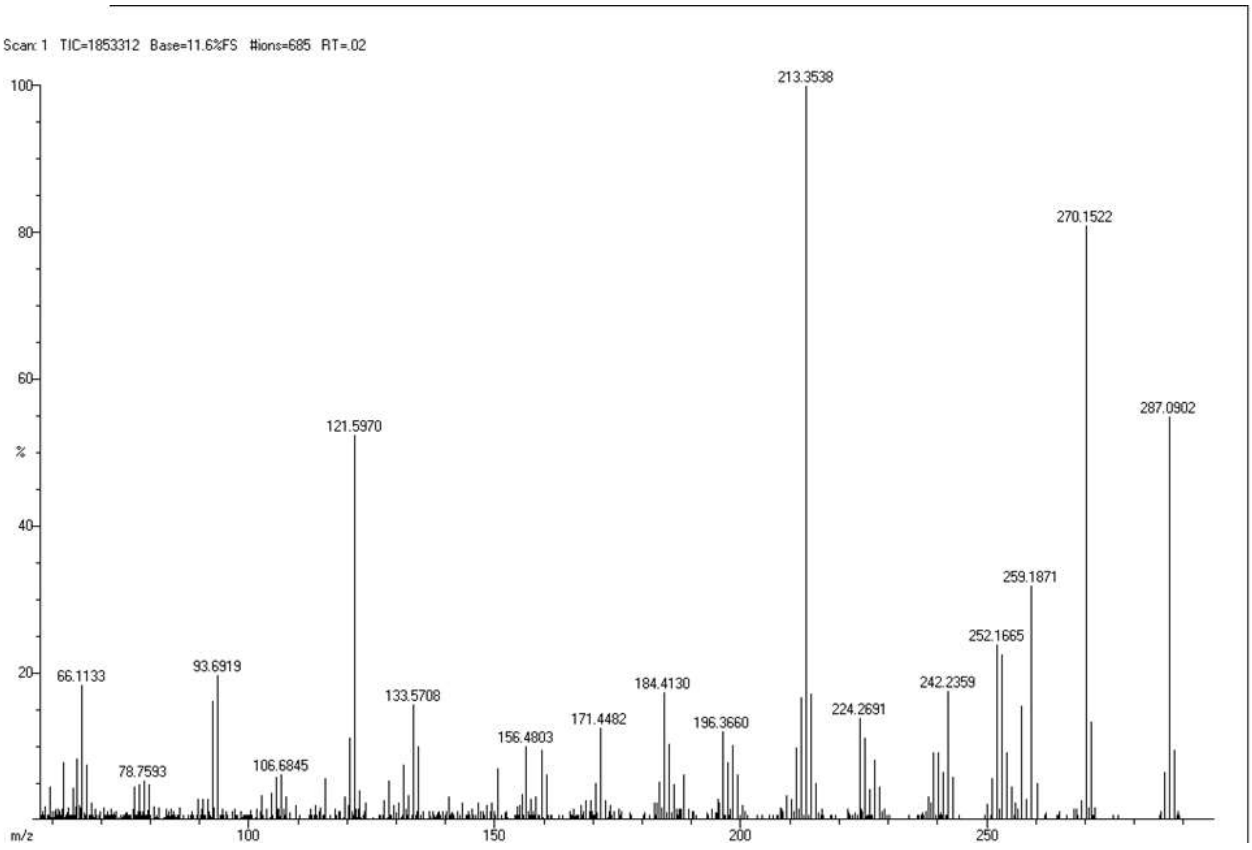
EI-HRMS spectrum of compound 3q



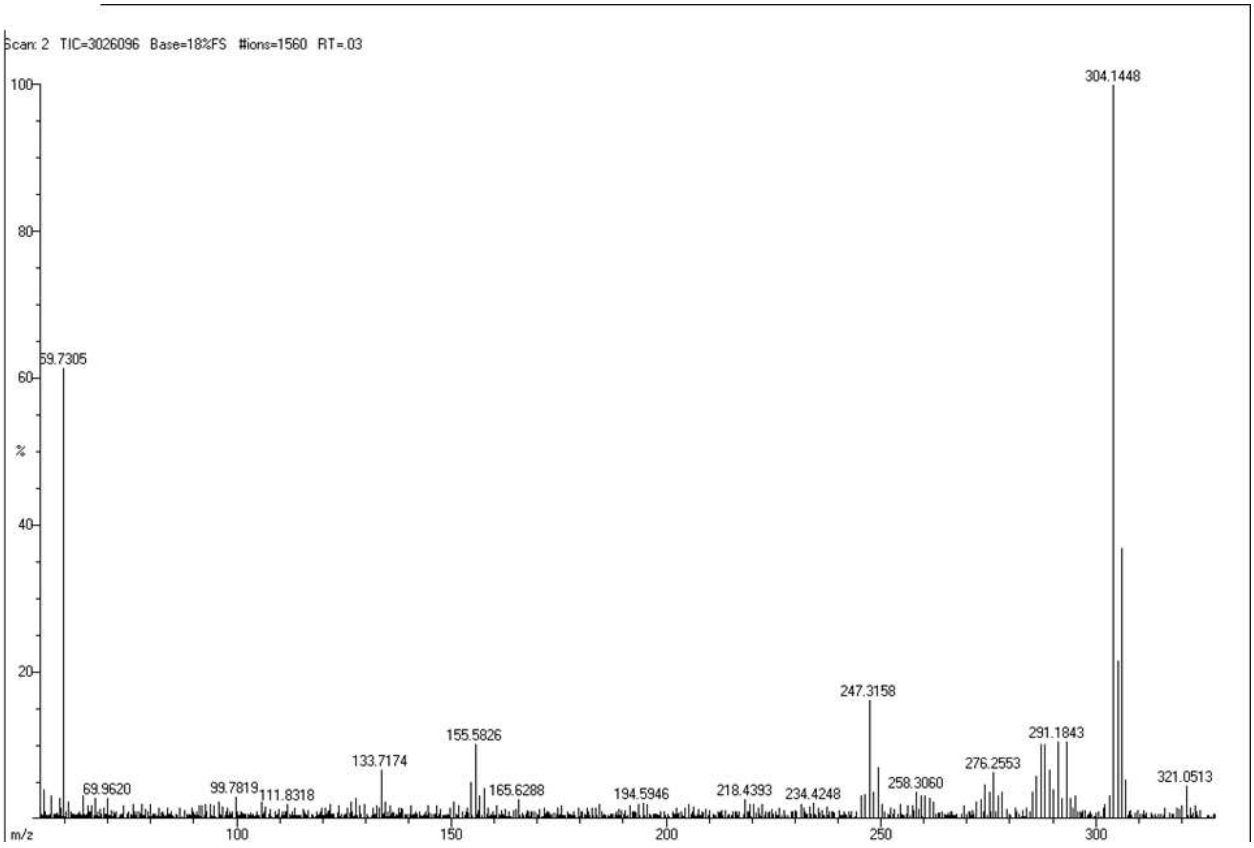
EI-HRMS spectrum of compound 3r



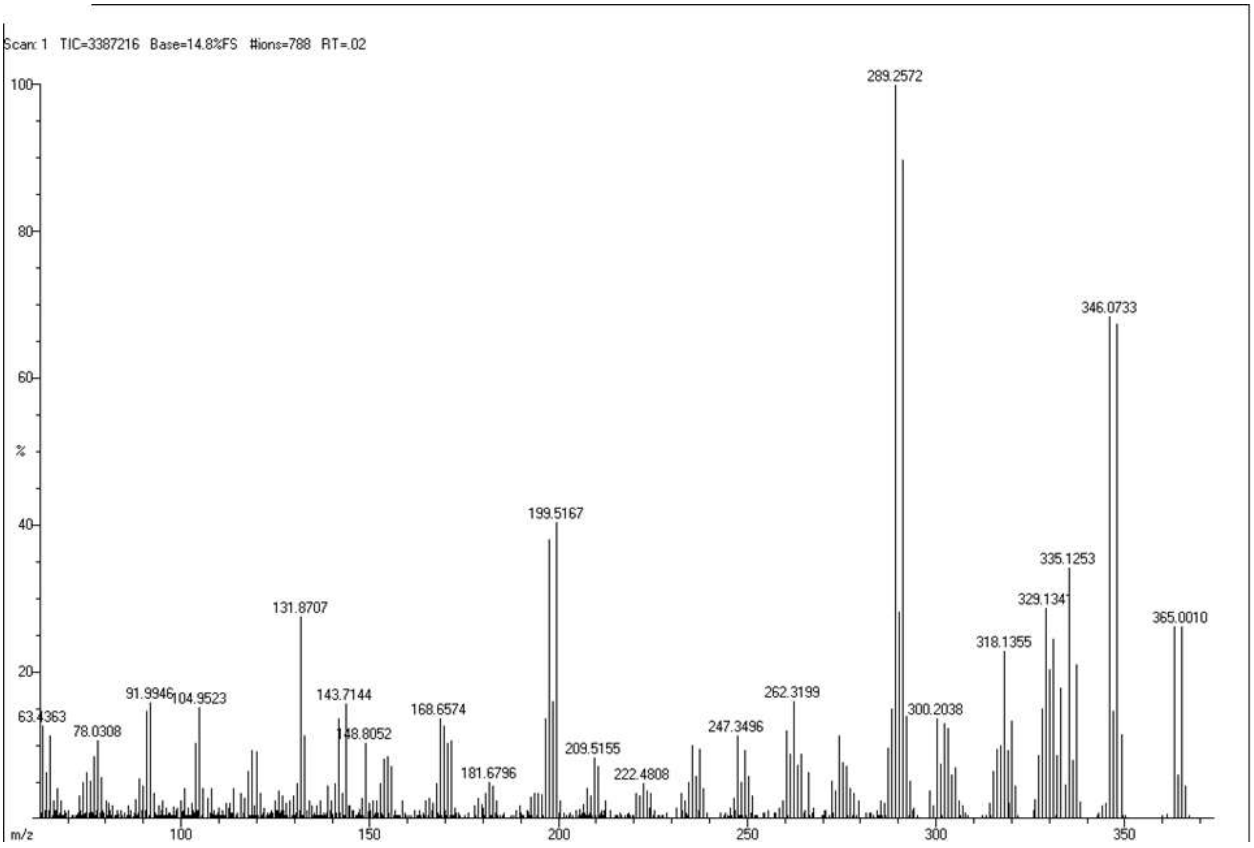
EI-HRMS spectrum of compound 3s



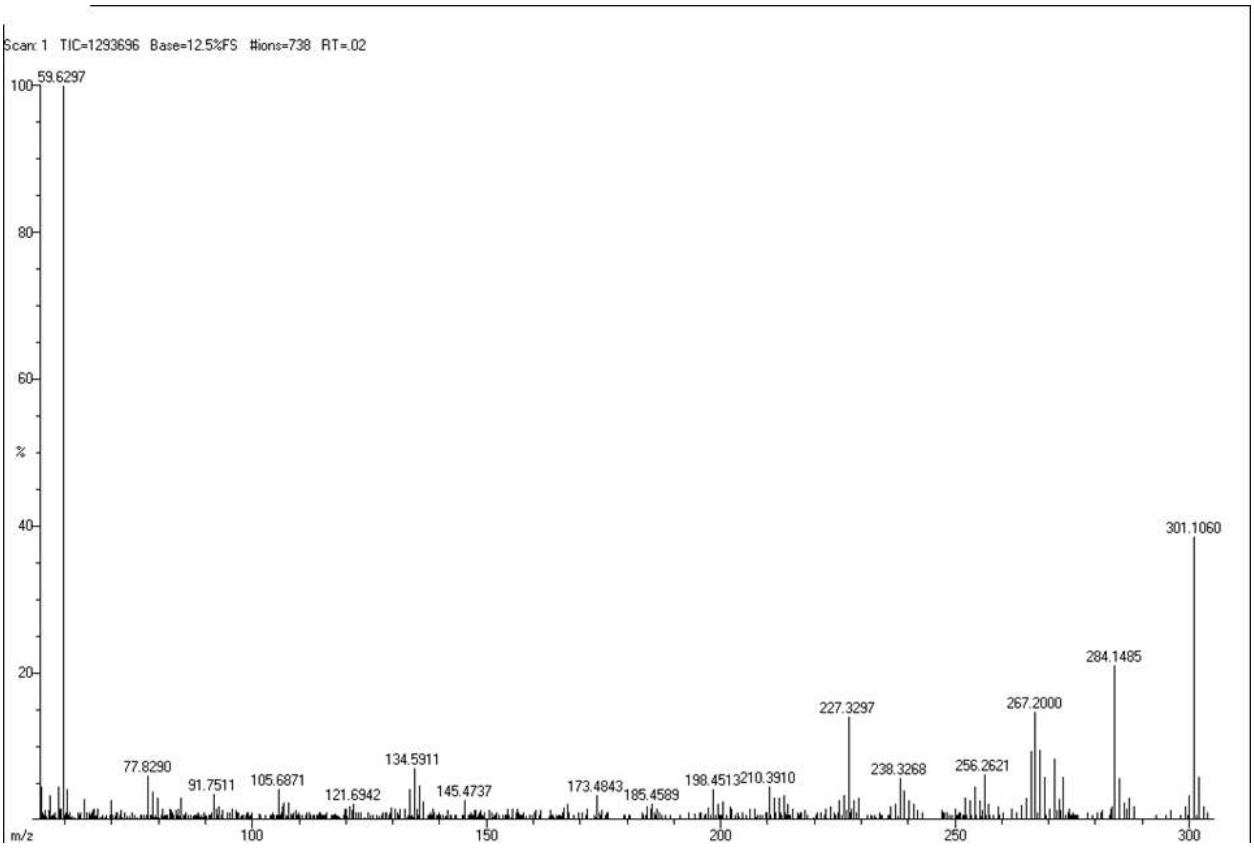
EI-HRMS spectrum of compound 5a



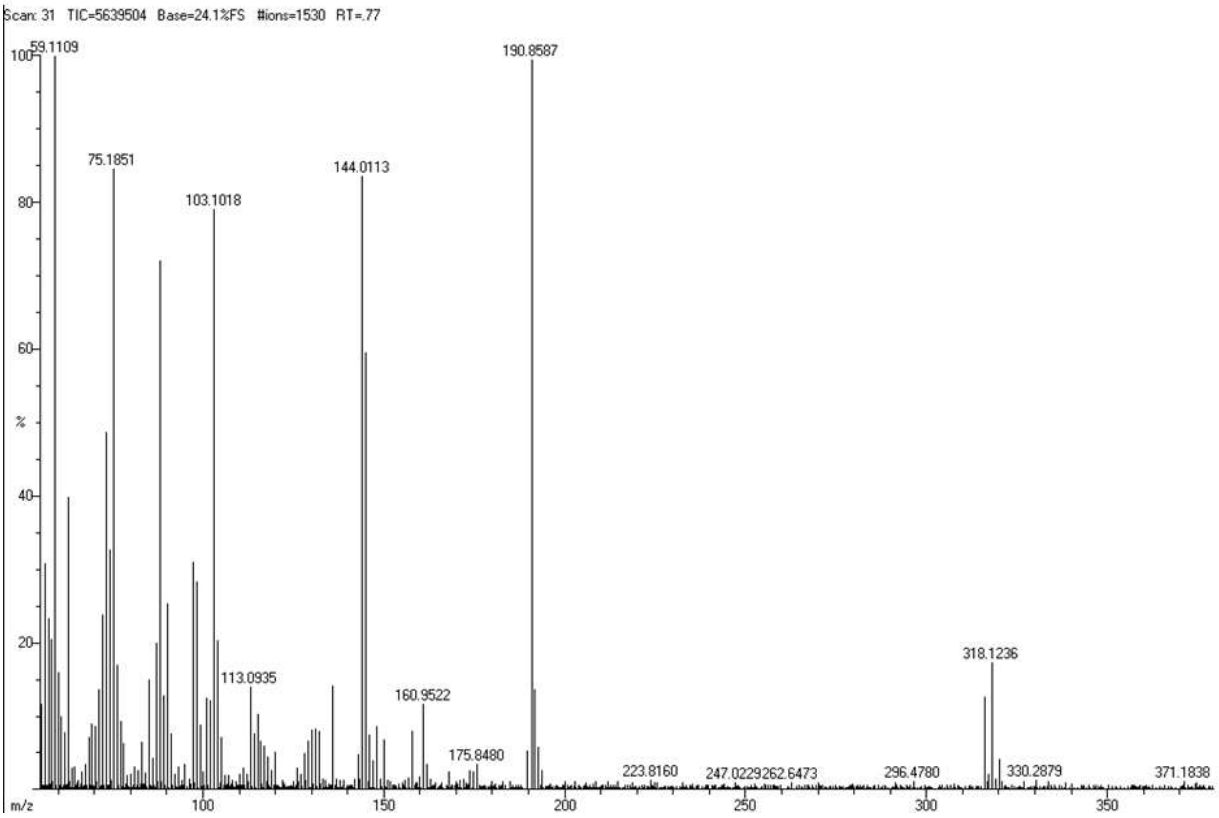
EI-HRMS spectrum of compound 5b



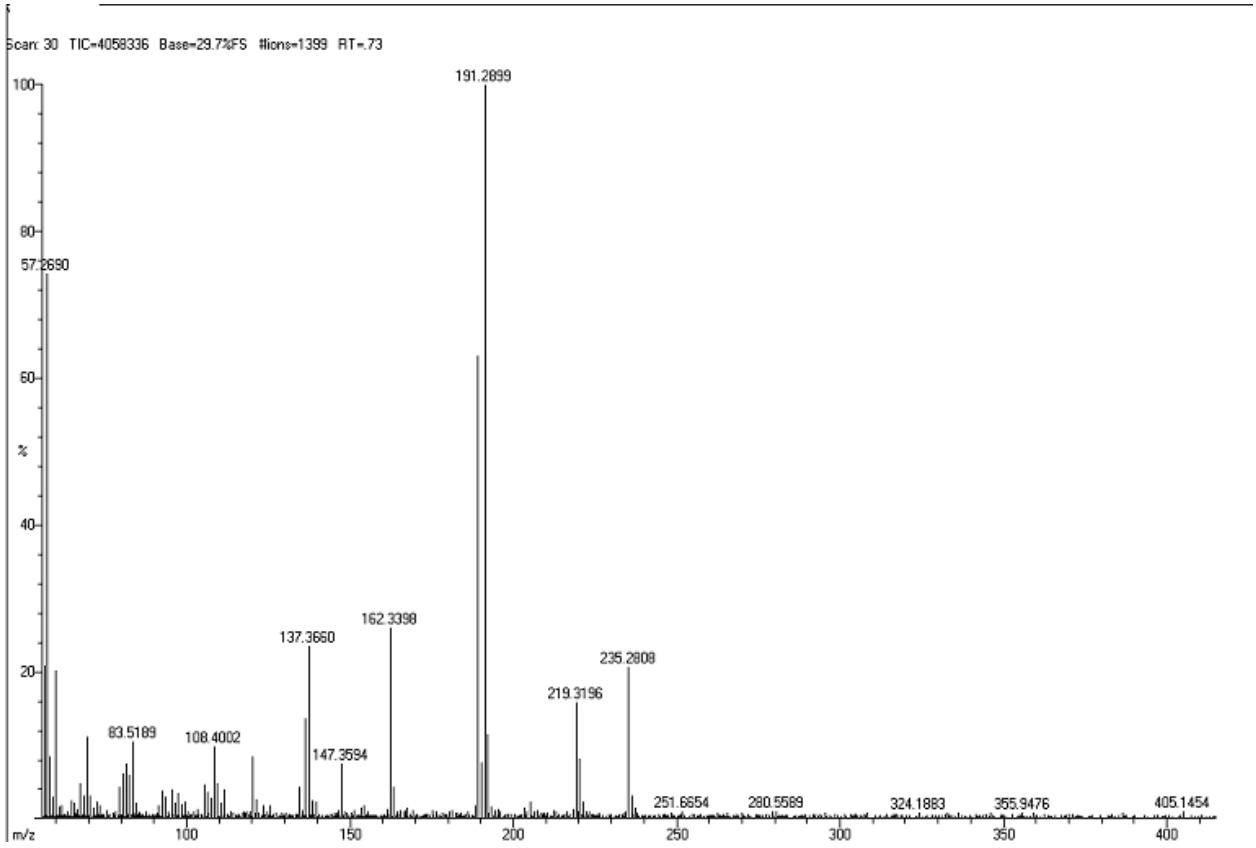
EI-HRMS spectrum of compound 5c



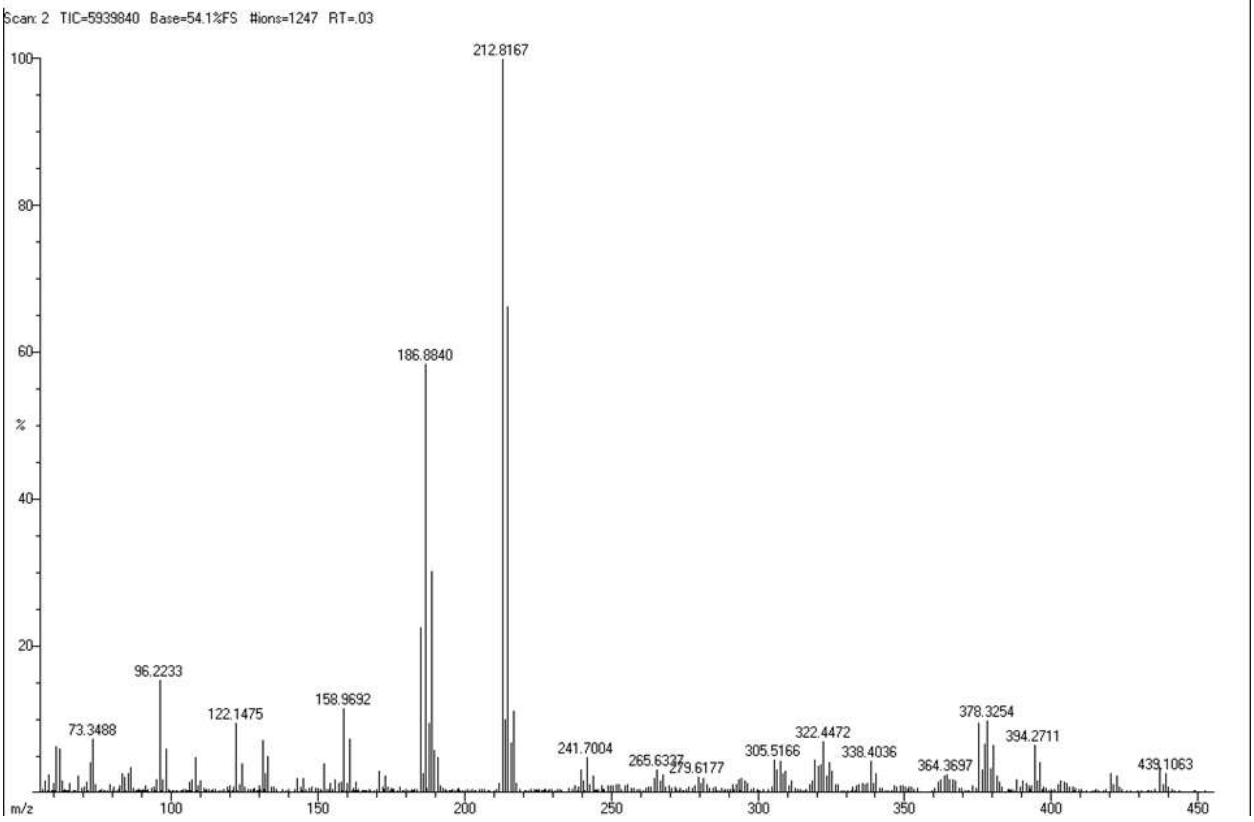
EI-HRMS spectrum of compound 5d



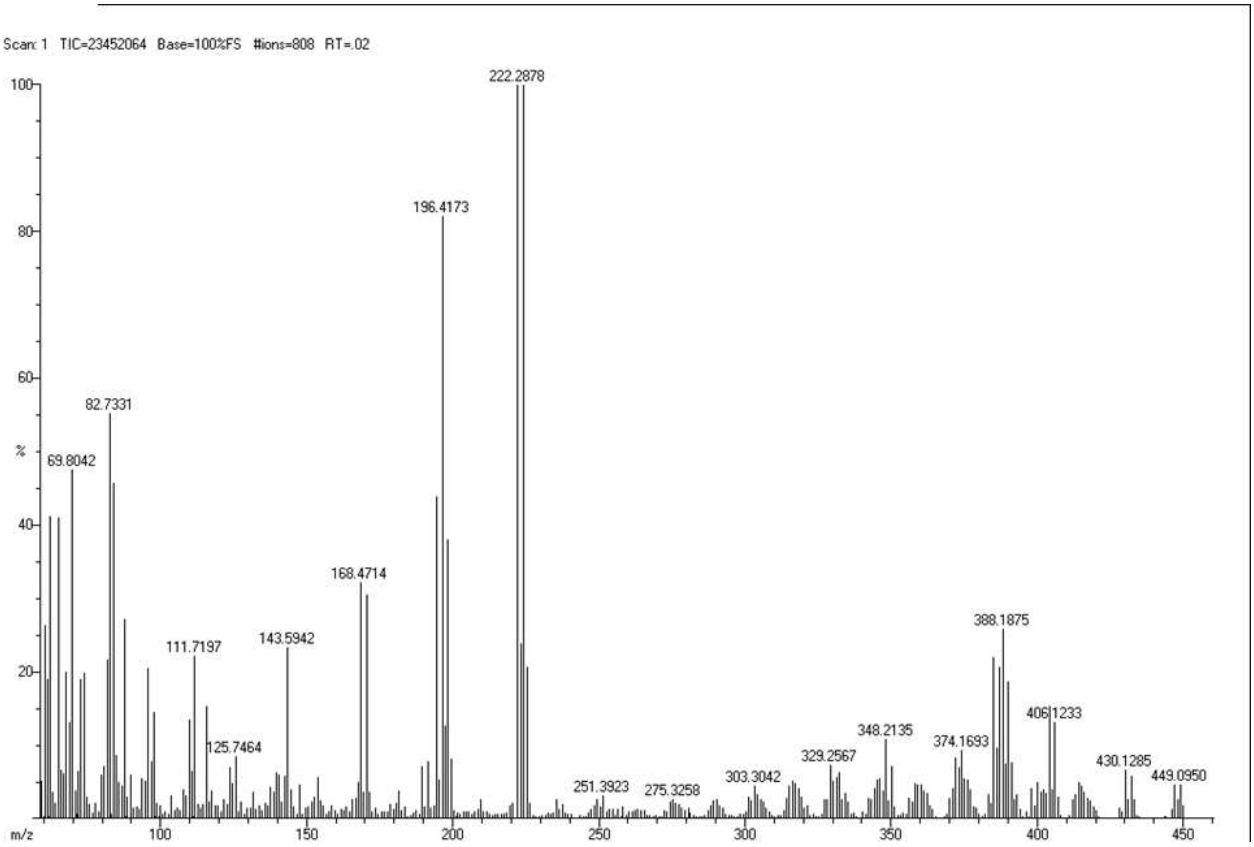
EI-HRMS spectrum of compound 5e



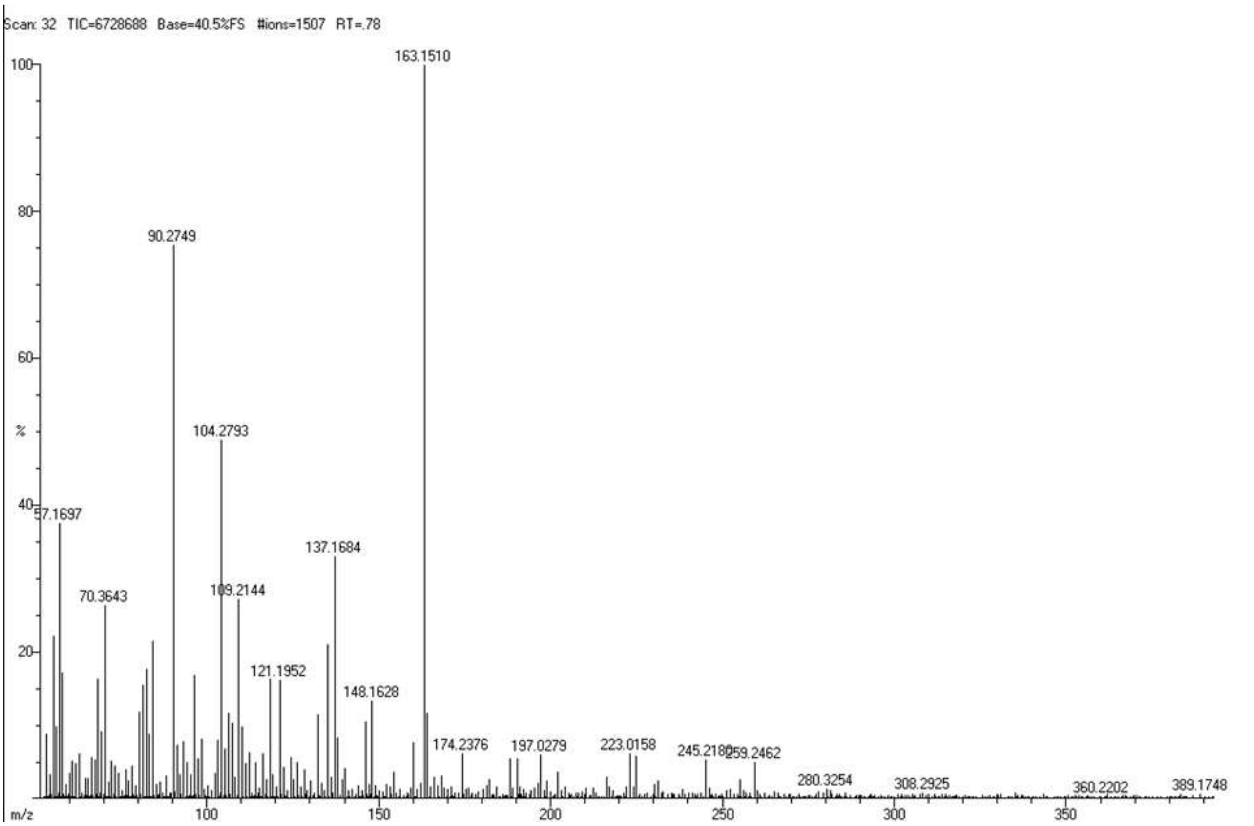
EI-HRMS spectrum of compound 5f



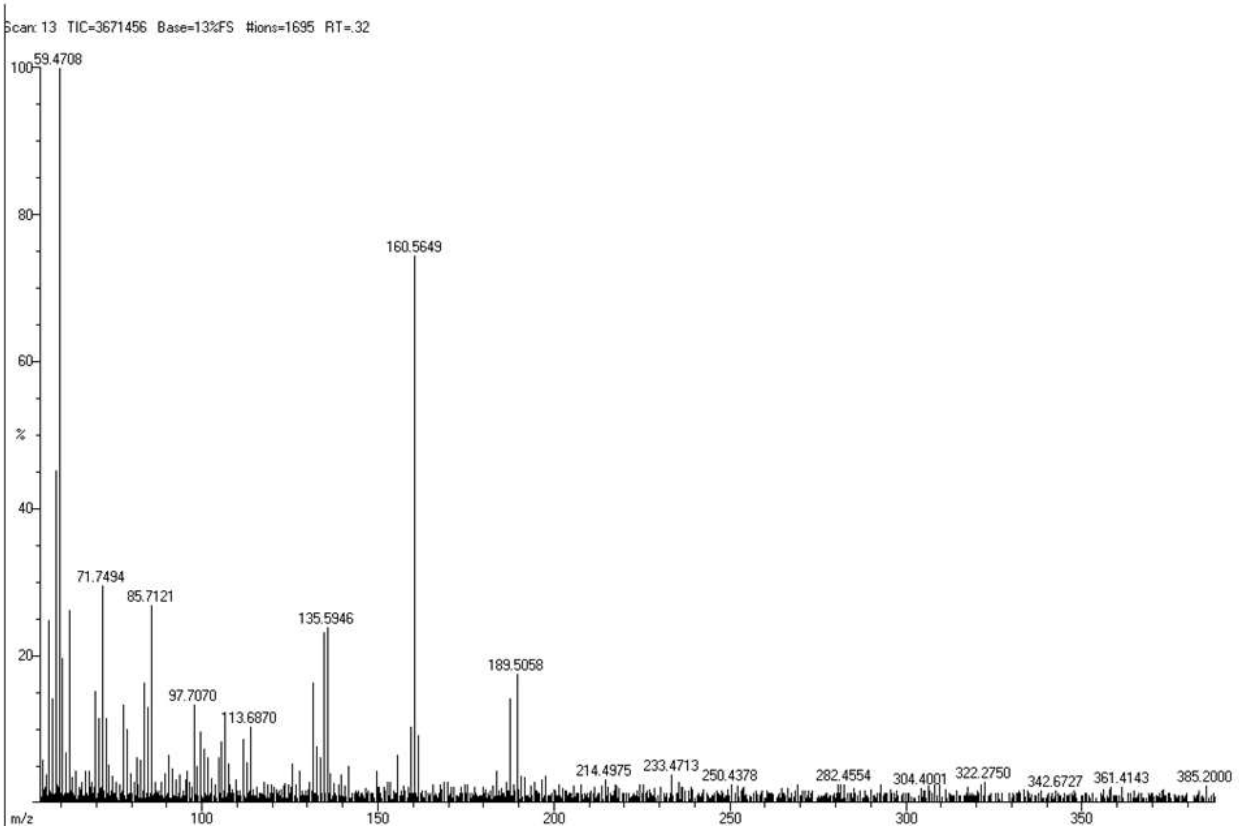
EI-HRMS spectrum of compound 5g



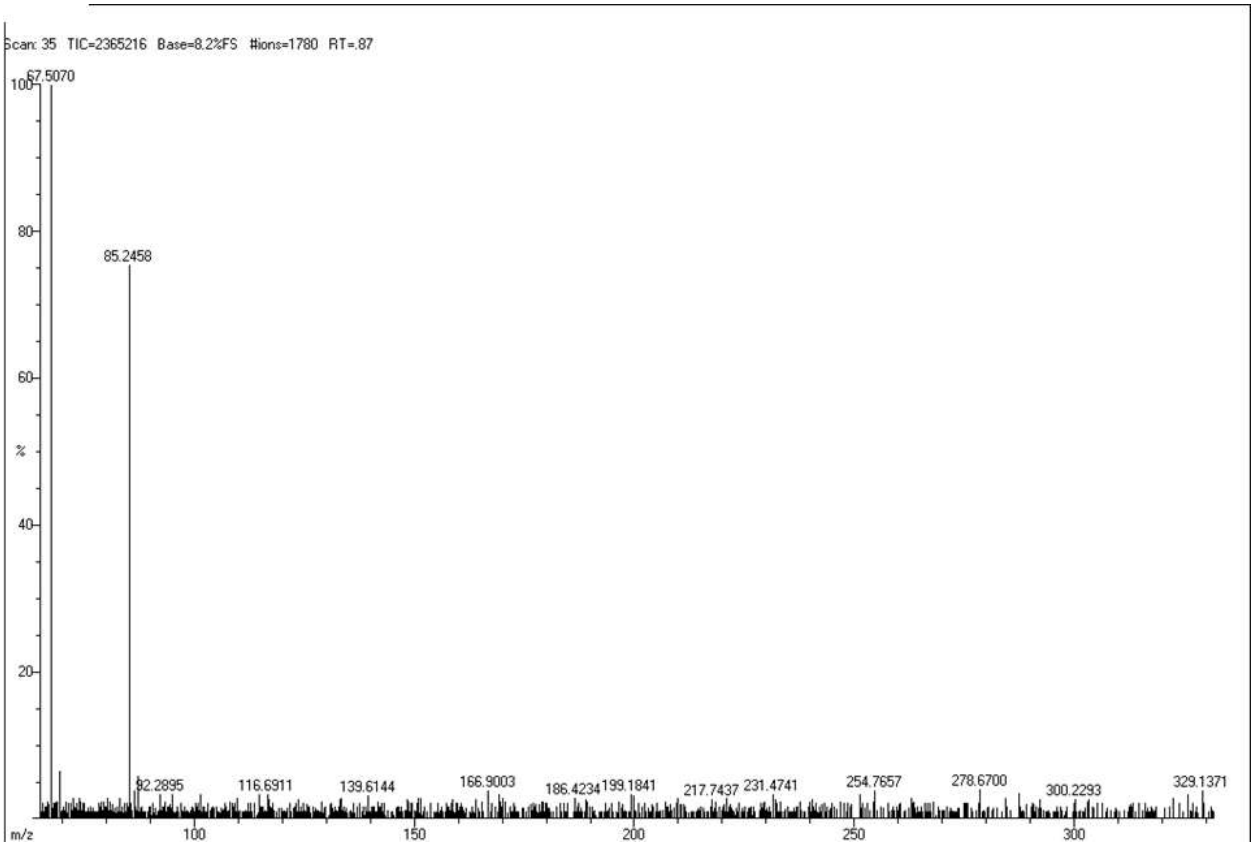
EI-HRMS spectrum of compound 5h



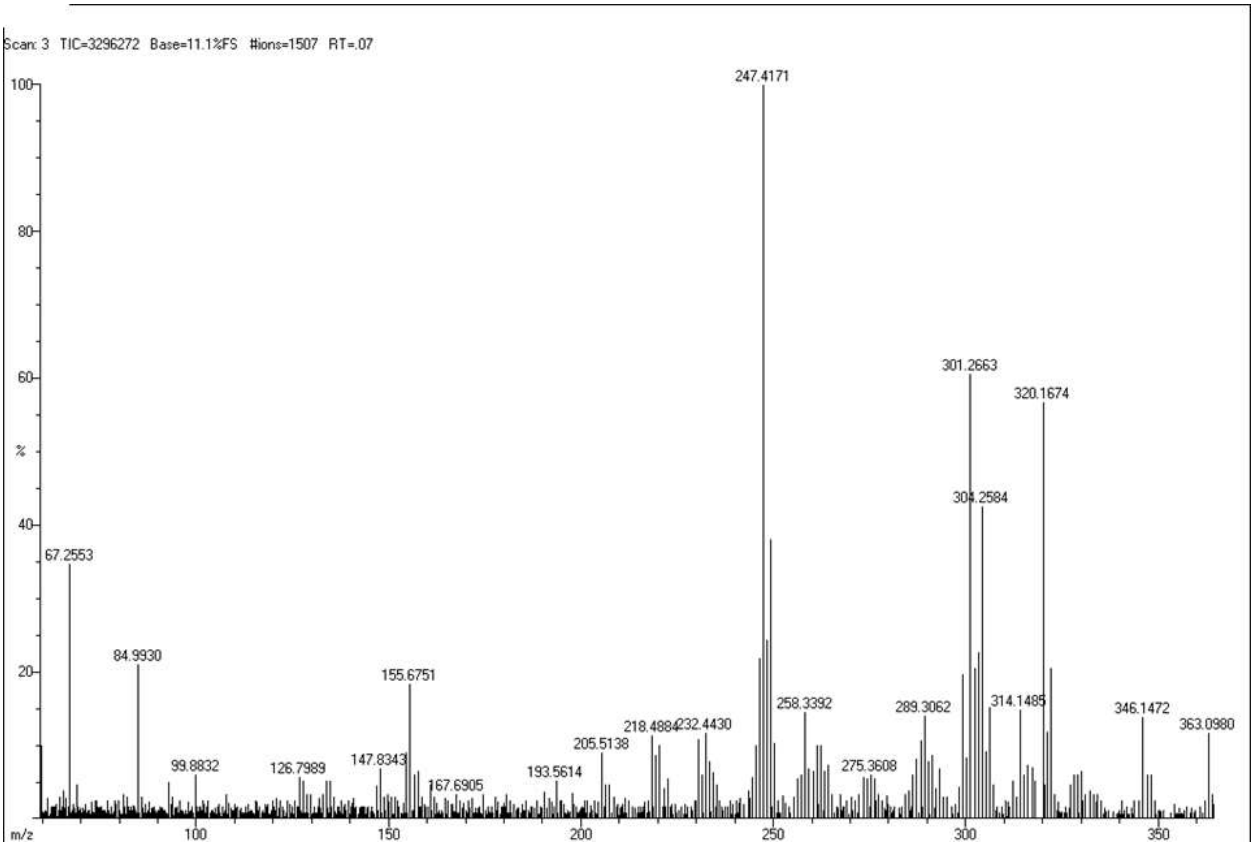
EI-HRMS spectrum of compound 5i



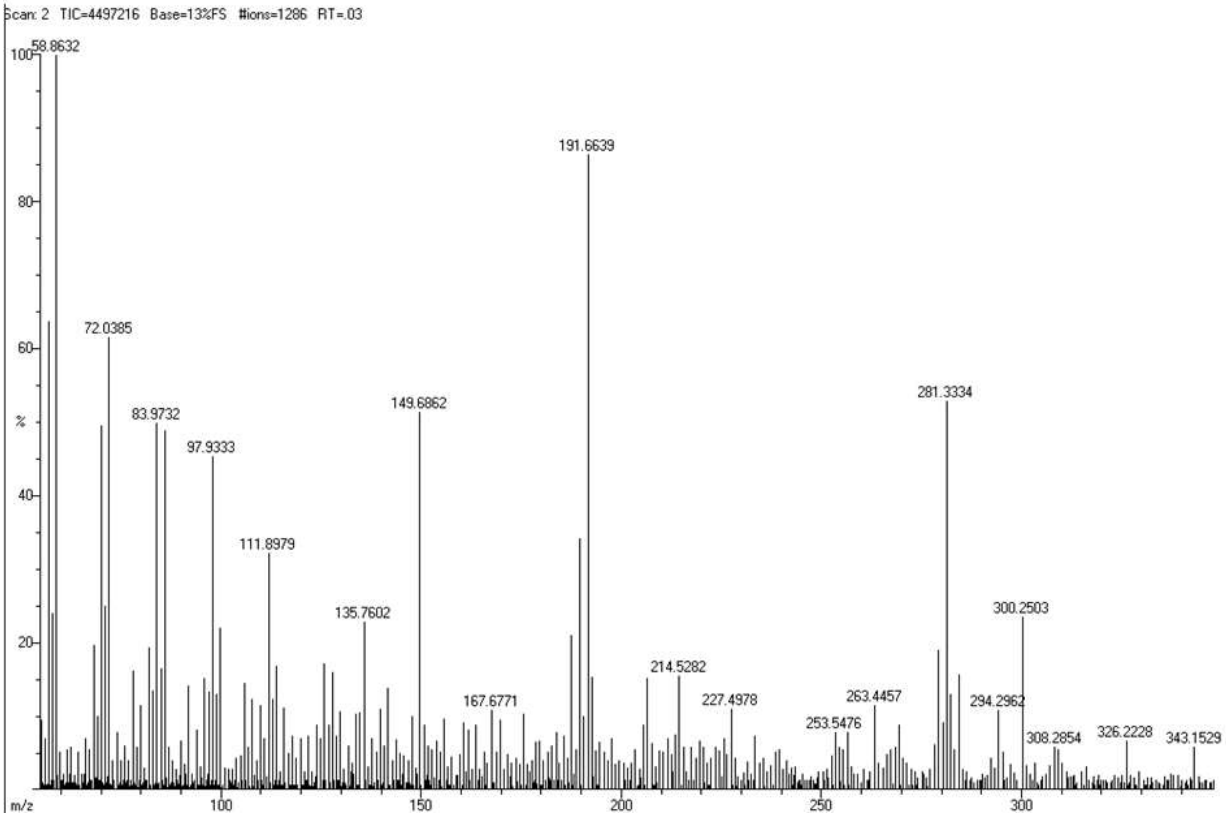
EI-HRMS spectrum of compound 5j



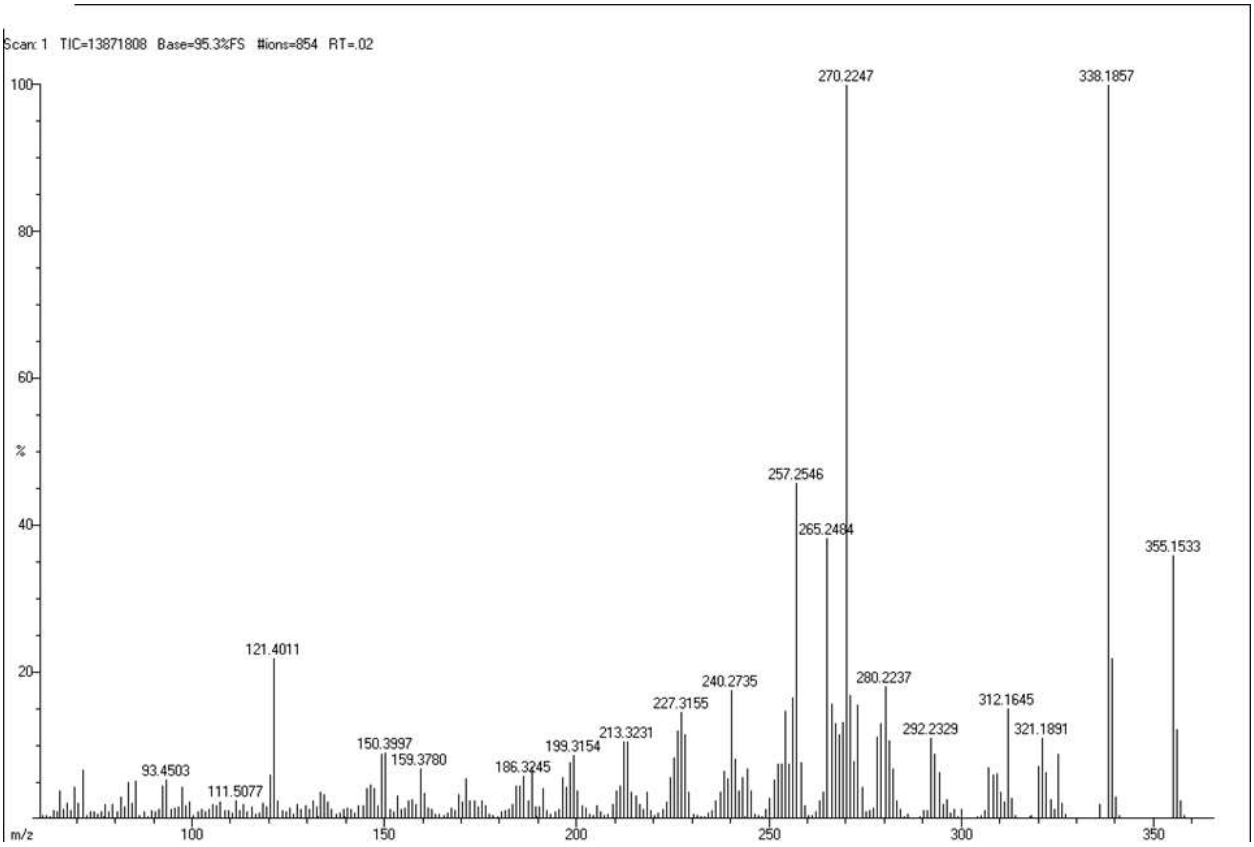
EI-HRMS spectrum of compound 5k



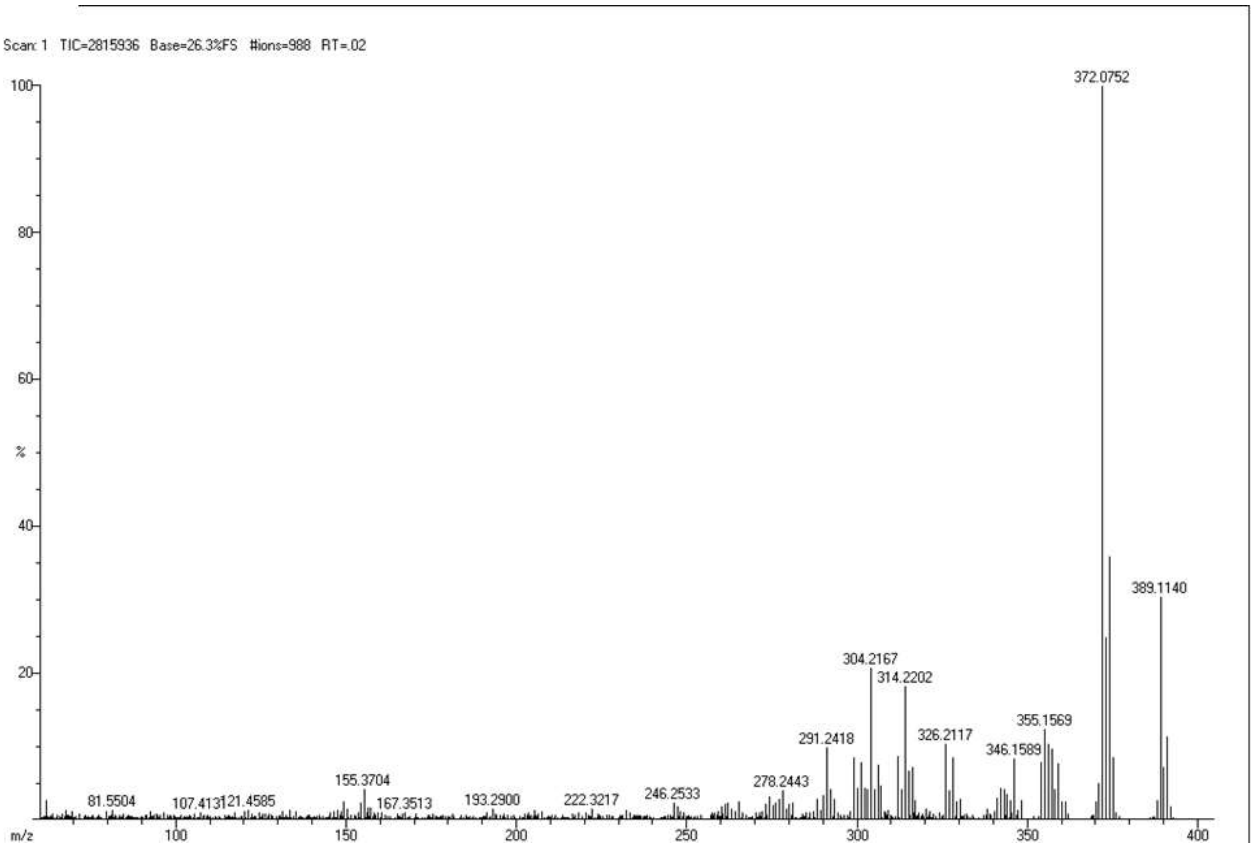
EI-HRMS spectrum of compound 5l



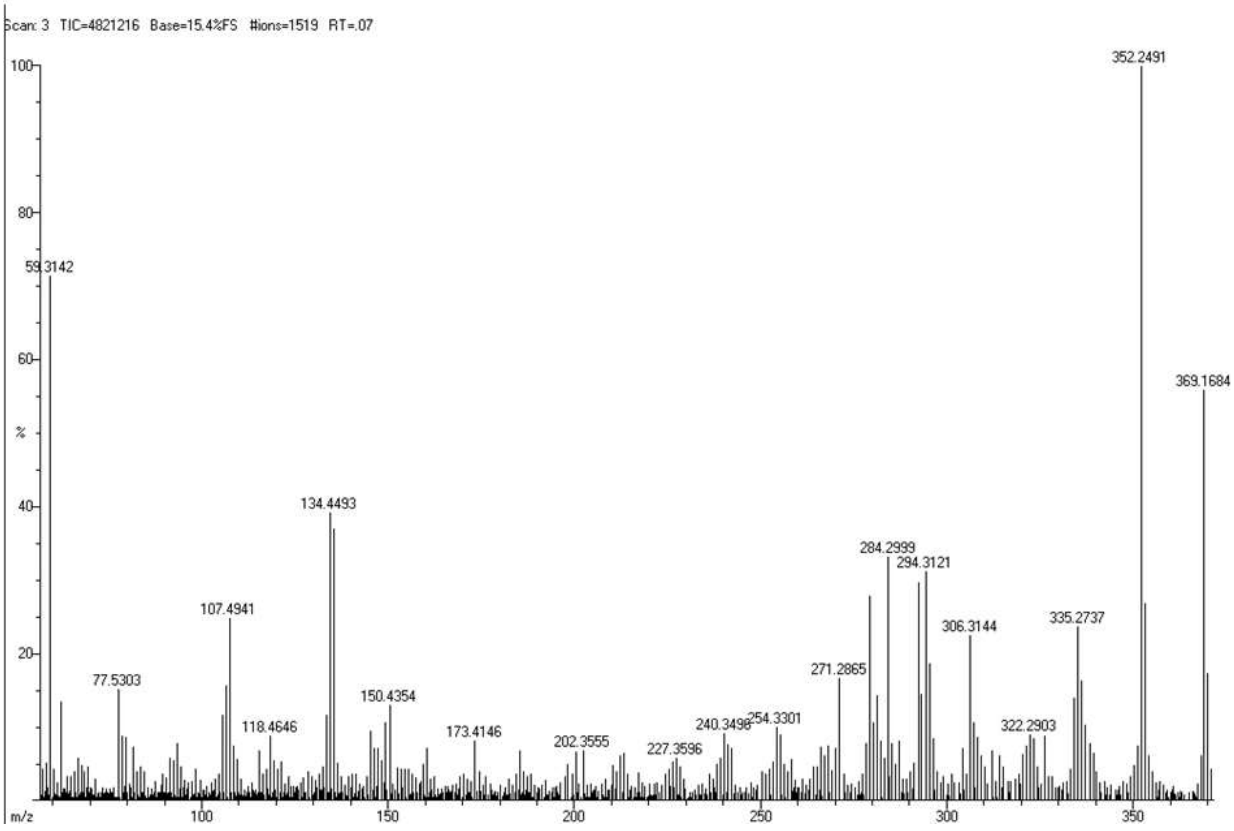
EI-HRMS spectrum of compound 5m



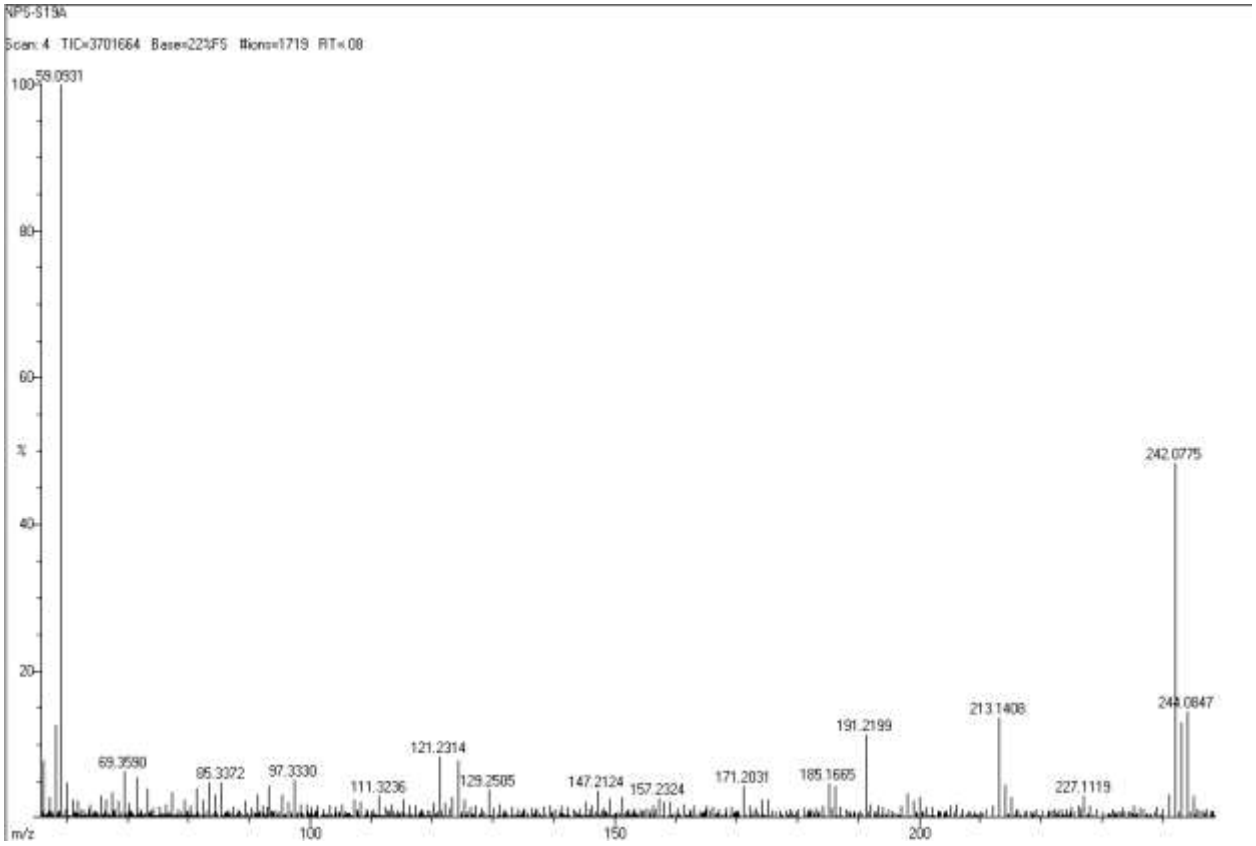
EI-HRMS spectrum of compound 5n



EI-HRMS spectrum of compound 5o



EI-HRMS spectrum of compound 5p



EI-HRMS spectrum of compound 14