Supporting Information

Visible-Light-Induced Aerobic Dearomative Reaction of Indole Derivatives: Access to Heterocycle Fused or Spirocyclo Indolones

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General Information

All reactions were carried out under Ar atmosphere unless otherwise noted. All reagents and solvents were obtained from commercial suppliers and used without further purification. Reactions were monitored by TLC on silica gel plates (GF254), and the analytical thin- layer chromatography (TLC) was performed on precoated, glass-backed silica gel plates. ^{1}H NMR and ^{13}C NMR spectra were recorded on 400 MHz spectrometer at room temperature. Chemical shifts (δ) are reported in ppm downfield from tetramethylsilane. Abbreviations for signal couplings are: s, singlet; d, doublet; t, triplet; m, multiplet. Infrared (IR) spectra were recorded on a Nicolet 6700 spectrophotometer and are reported as wavenumber (cm^{-1}). UV-vis spectra was obtained on JASCO J-810 spectropolarimeter. High resolution mass spectra were obtained using an Agilent 6210 Series TOFLC-MS equipped with electrospray ionization (ESI) probe operating in positive ion mode. All the substrates were prepared according to the literature[1][2][3]. The 36W fluorescent light bulb was directly got from the supermarket.

2. Experimental details for products

2.1General procedure A for substrates 2

An oven-dried Schlenk tube (10 mL) was equipped with a magnetic stir bar, **2a-2o** (0.2 mmol, 1.0 equiv), Ru $(bpy)_3Cl_2$ (2.0 mol%), CsOAc (0.4mmol, 2.0 equiv). 1 mL dry CH_3CN was added with syringe and the

flask was filled with O_2. The tube was placed at a distance (app. 5 cm) from a 36W fluorescent light bulb, and the resulting solution was stirred at ambient temperature under visible- light irradiation. After the reaction was finished, the reaction mixture was diluted by adding EtOAc and brine. The aqueous layer was extracted with EtOAc. The combined organic layer was dried over Na_2SO_4, filtered and concentrated. The residue was purified by chromatography on silica gel to afford the **3a-o**.

2.2 Optimization of Reaction Conditions for 4a[a]

Entry	Catalyst	Base	solvent	Yield(%)[b]
1	Ru $(bpy)_3Cl_2$	CsOAc	CH_3CN	45
2	Ru $(bpy)_3Cl_2$	TMG	CH_3CN	40
3	Ru $(bpy)_3Cl_2$	DBU	CH_3CN	13
4	Ru $(bpy)_3Cl_2$	K_2CO_3	CH_3CN	47
5	Ru $(bpy)_3Cl_2$	DABCO	CH_3CN	65
6	$[Ir(ppy)_2(dtbbpy)]PF_6$	DABCO	CH_3CN	59
7	Ru $(bpy)_3Cl_2$	DABCO	CH_3CN	68
8	Ru $(bpy)_3Cl_2$	/	CH_3CN	trace
9[c]	none	CsOAc	CH_3CN	trace
10[d]	Ru $(bpy)_3Cl_2$	CsOAc	CH_3CN	trace

[a] Reaction conditions: **4a** (0.2mmol, 1.0 equiv), base (0.4mmol, 2.0 equiv), air and photocatalyst (0.004 mmol, 2.0 mol%) in dry CH_3CN(1.0 mL) were irradiated with a 36W CFL for 24h. [b] Isolated yield. [c] Without

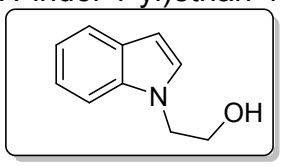
photocatalyst irradiation. [d] Without visible light irradiation.

2.3 General procedure B for substrates 4

An oven-dried Schlenk tube (10 mL) was equipped with a magnetic stir bar, **4a-f** (0.2 mmol, 1.0 equiv), Ru $(bpy)_3Cl_2$ (2.0 mol%), DABCO (0.4mmol, 2.0 equiv). 1 mL dry CH_3CN was added with syringe and the flask was filled with air. The tube was placed at a distance (app.5 cm) from a 36W fluorescent light bulb, and the resulting solution was stirred at ambient temperature under visible- light irradiation. After the reaction was finished, the reaction mixture was diluted by adding EtOAc and brine. The aqueous layer was extracted with EtOAc. The combined organic layer was dried over Na_2SO_4, filtered and concentrated. The residue was purified by chromatography on silica gel to afford the **5a-f**.

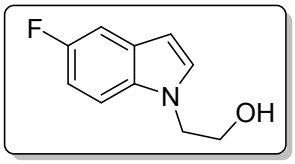
Characterization data of compounds

2-(1*H*-indol-1-yl)ethan-1-ol **2a**



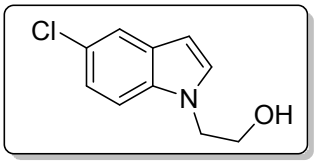
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.61-7.58 (m, 1H), 7.30-7.27 (m, 1H), 7.20-7.16 (m, 1H), 7.10-7.04 (m, 2H), 6.46 - 6.45 (m, 1H), 4.10 (t, *J* = 5.3 Hz, 2H), 3.73 (t, *J* = 5.3 Hz, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 136.11, 128.74, 128.46, 121.70, 121.11, 119.61, 109.42, 101.44, 61.80, 48.68.

2-(5-fluoro-1*H*-indol-1-yl)ethan-1-ol **2b**



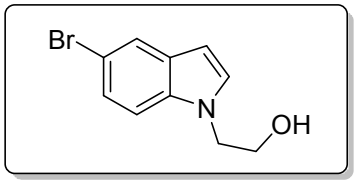
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.26-7.21 (m, 2H), 7.15-7.14 (m, 1H), 6.97- 6.92 (m, 1H), 6.44- 6.43(m, 1H), 4.18 (t, *J* = 5.2 Hz, 2H), 3.84 (t, *J* = 5.2 Hz, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 159.06, 156.73 , 132.77, 129.92, 128.91 (d, *J* = 10.3 Hz), 110.35-109.68 (m), 105.72, (d, *J* = 23.2 Hz), 101.44 (d, *J* = 4.7 Hz), 61.89 , 48.94.

2-(5-chloro-1*H*-indol-1-yl)ethan-1-ol **2c**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.56 (d, *J* = 1.9 Hz, 1H), 7.23-7.21 (m, 1H), 7.15- 7.11 (m, 2H), 6.41 (dd, *J* = 3.1, 0.7 Hz, 1H), 4.16 (t, *J* = 5.2 Hz, 2H), 3.82 (t, *J* = 5.2 Hz, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 134.56, 129.67, 125.30, 121.96, 120.37, 110.41, 101.17, 61.85, 48.83.

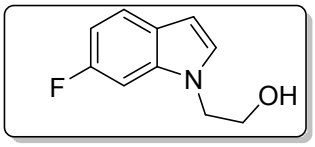
2-(5-bromo-1*H*-indol-1-yl)ethan-1-ol **2d**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.72 (d, *J* = 1.6 Hz, 1H), 7.27-7.24 (m,1H), 7.19-7.17 (m,1H), 7.09 (d, *J* = 3.1 Hz, 1H), 6.41 (dd, *J* = 3.1, 0.7 Hz,1H), 4.15 (t, *J* = 5.2 Hz, 2H), 3.81 (t, *J* = 5.2 Hz, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 134.82, 130.34, 129.53, 124.50,123.48, 112.86,

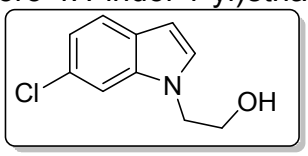
110.88, 101.10, 61.83, 48.81.

2-(6-fluoro-1*H*-indol-1-yl)ethan-1-ol **2e**



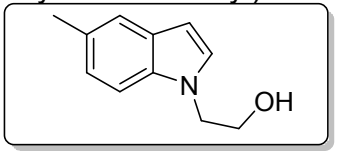
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.48 (dd, *J* = 8.6, 5.4 Hz, 1H), 7.05 (d, *J* = 3.2 Hz, 1H), 6.99 (dd, *J* = 9.9, 2.2 Hz, 1H), 6.88 - 6.83 (m, 1H), 6.44 (dd, *J* = 3.2, 0.7 Hz, 1H), 4.08 (t, *J* = 5.2 Hz, 2H), 3.77 (t, *J* = 5.2 Hz, 2H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 159.82 (d, *J* = 237.4 Hz), 136.16 (d, *J* = 11.9 Hz), 128.80 (d, *J* = 3.7 Hz), 125.08, 121.74 (d, *J* = 10.3 Hz), 108.35 (d, *J* = 24.6 Hz), 101.65, 95.89 (d, *J* = 26.4 Hz), 61.69 , 48.79 .

2-(6-chloro-1*H*-indol-1-yl)ethan-1-ol **2f**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.51 (d, *J* = 8.4 Hz,1H), 7.36-7.34 (m, 1H), 7.13 (d, *J* = 3.2 Hz, 1H), 7.07 (dd, *J* = 8.4, 1.8 Hz, 1H), 6.48-6.47 (m, 1H), 4.20 (t, *J* = 5.2 Hz,2H), 3.90 (t, *J* = 5.2 Hz, 2H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 136.54, 129.07, 127.74, 127.23, 121.87, 120.28, 109.43, 101.77, 61.83 , 48.78.

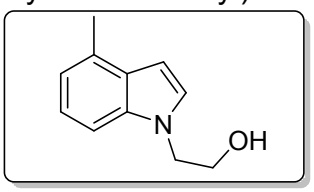
2-(5-methyl-1*H*-indol-1-yl)ethan-1-ol **2g**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.37 (s, 1H), 7.18 (d, *J* = 8.4 Hz, 1H), 7.02-7.00 (m, 2H), 6.37 (d, *J* = 3.0 Hz, 1H), 4.08 (t, *J* = 5.2 Hz, 2H),

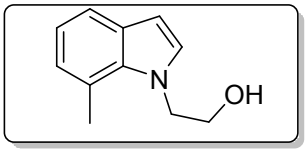
3.74 (t, *J* = 5.2 Hz, 2H), 2.43 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 134.51, 129.01, 128.82, 128.47, 123.35, 120.74, 109.09, 100.89, 61.85, 48.74, 21.43.

2-(4-methyl-1*H*-indol-1-yl)ethan-1-ol **2h**



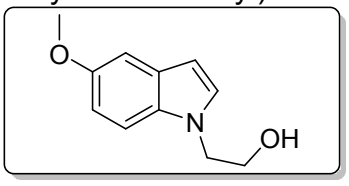
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.23-7.10(m, 3H), 6.92 (d, *J* = 7.0 Hz,1H), 6.52 (d, *J* = 3.1 Hz, 1H), 4.23 (t, *J* = 5.2 Hz, 2H), 3.89 (t, *J* = 5.2 Hz, 2H), 2.55 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 135.76, 130.62, 128.63, 127.77, 121.88, 119.79, 106.96, 100.04, 61.97, 48.87, 18.76.

2-(7-methyl-1*H*-indol-1-yl)ethan-1-ol **2i**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.46-7.44 (m, 1H), 7.05 (d, *J* = 3.1 Hz, 1H), 6.98 (t, *J* = 7.5 Hz, 1H), 6.91 (d, *J* = 7.0 Hz, 1H),6.47 (d, J = 3.1Hz, 1H) , 4.42 (t, *J* = 5.3 Hz, 2H), 3.81 (t, *J* = 5.3 Hz ,2H), 2.67 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 134.64, 129.89, 129.86, 124.90, 120.74, 119.80, 119.27, 101.95,

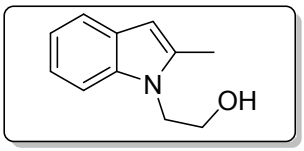
2-(5-methoxy-1*H*-indol-1-yl)ethan-1-ol **2j**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.17 (d, *J* = 8.9 Hz, 1H), 7.05 (d, *J*

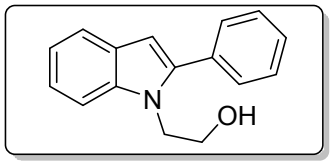
= 2.4 Hz, 1H), 7.04 (d, *J* = 3.1 Hz, 1H), 6.82 (s, 1H), 6.37 (s, 1H), 4.08 (t, *J* = 5.2 Hz, 2H), 3.80 (s, 3H), 3.74 (t, *J* = 5.2 Hz,2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 154.08, 131.44, 129.06, 128.97, 112.02, 110.16, 102.70, 100.96, 61.84, 55.94, 48.86 .

2-(2-methyl-1*H*-indol-1-yl)ethan-1-ol **2k**



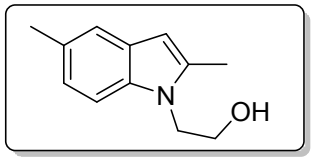
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.49 (d, *J* = 7.8 Hz, 1H), 7.25 (d, *J* = 8.1 Hz, 1H), 7.14-7.04 (m, 2H), 6.22 (s, 1H), 4.15 (t, *J* = 5.5 Hz, 1H), 3.80 (t, *J* = 5.5 Hz, 1H), 2.41 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 137.05, 136.83, 128.17, 120.69, 119.80, 119.57, 109.03 , 100.32, 61.72, 45.31, 12.98 .

2-(2-phenyl-1*H*-indol-1-yl)ethan-1-ol **2l**



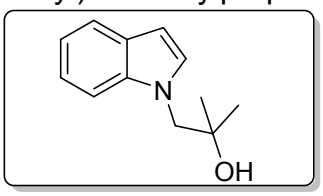
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.62 (d, *J* = 7.8 Hz, 1H), 7.52-7.50 (m, 2H), 7.47-7.38 (m，*4*H), 7.23 (t, *J* = 7.6 Hz, 1H), 7.14 (t, *J* = 7.4 Hz, 1H), 6.54 (s, 1H), 4.30 (t, *J* = 5.8 Hz,2H), 3.79 (t, *J* = 5.8 Hz, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 141.66, 137.68, 132.89, 129.73, 128.59, 128.26, 128.15, 121.86, 120.68, 120.16, 110.13, 102.79, 61.74, 45.97.

2-(2,5-dimethyl-1*H*-indol-1-yl)ethan-1-ol **2m**



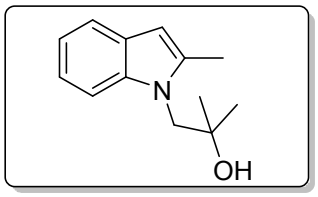
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.28 (s, 1H), 7.14 (d, *J* = 8.2 Hz, 1H), 6.94 (dd, *J* = 8.2, 1.7 Hz, 1H), 6.13 (t, *J* = 1.0 Hz,1H), 4.13 (t, *J* = 5.8 Hz, 1H), 3.80 (t, *J* =5.8 Hz, 1H), 2.42 (s, 3H), 2.39 (s, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 137.04, 135.22, 128.74, 128.43, 122.17, 119.60, 108.68, 99.84, 61.76, 45.35, 21.40, 12.96.

1-(1*H*-indol-1-yl)-2-methylpropan-2-ol **2n**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.61-7.59 (m, 1H), 7.36 (d, *J* = 8.2 Hz, 1H), 7.20-7.06 (m, 3H), 6.49 (d, *J* = 3.1, 1H), 3.99 (s, 2H), 1.18 (s, 6H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 137.11, 129.47, 128.36, 121.72, 120.91, 119.46, 110.21, 101.65, 72.16, 56.90, 27.43.

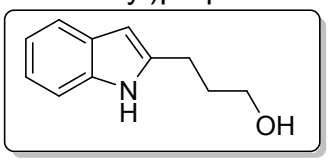
2-methyl-1-(2-methyl-1*H*-indol-1-yl)propan-2-ol **2o**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.47 (dd, *J* = 7.6, 1.2 Hz, 1H), 7.38 -7.33 (m, 1H), 7.13-7.01 (m, 2H), 6.23 (d, *J* = 1.2 Hz, 1H), 3.99 (s, 2H), 2.41 (s, 3H), 1.23 (s, 6H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 138.03, 137.76, 128.22, 120.61, 119.57, 119.53, 110.55, 100.99, 72.93, 53.71,

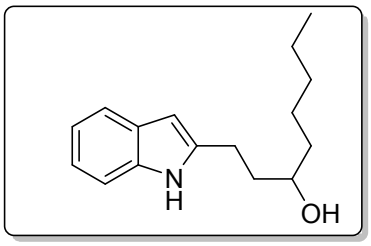
27.95 , 13.58 .

3-(1*H*-indol-2-yl)propan-1-ol **4a**



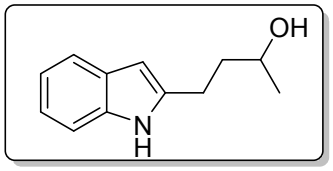
^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.21 (s, 1H), 7.53-7.52 (m, 1H), 7.29-7.24 (m, 1H), 7.15-7.02 (m, 2H), 6.24 (s, 1H), 3.72 (t, *J* = 6.0 Hz, 2H), 2.85 (t, *J* = 6.0 Hz, 2H), 1.98-1.91(m, 2H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 139.14, 135.95, 128.77, 121.06, 119.79, 119.61, 110.45, 99.59, 62.12, 31.75, 24.69.

1-(1*H*-indol-2-yl)octan-3-ol **4b**



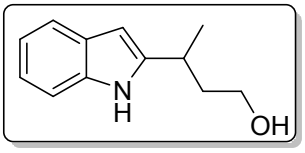
^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.28 (s, 1H), 7.52 (d, *J* = 7.6 Hz, 1H), 7.27 (d, *J* = 8.0 Hz, 1H), 7.13-7.03 (m, 2H), 6.23 (s, 1H), 3.73-3.62 (m, 1H), 2.95 – 2.81 (m, 2H),1.93-1.88 (m, 1H), 1.81-1.73 (m, 1H), 1.53 – 1.42 (m, 3H), 1.33-1.26 (m, 5H), 0.89 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 139.60, 135.93, 128.79, 120.98, 119.75, 119.55, 110.43, 99.44, 71.49, 37.84, 36.49, 31.88, 25.37, 24.55, 22.66, 14.07.

4-(1*H*-indol-2-yl)butan-2-ol **4c**



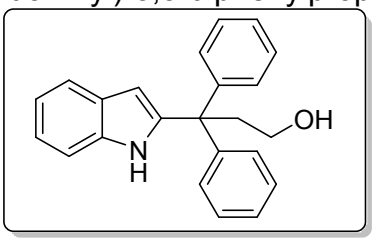
^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.39 (brs, 1H), 7.51 (d, *J* = 7.6 Hz, 1H), 7.27-7.26 (m, 1H), 7.15- 6.99 (m, 2H), 6.22 (s, 1H), 3.93-3.79 (m, 1H), 2.88 – 2.78 (m, 1H), 1.89-1.73 (m, 2H), 1.22 (d, *J* = 6.2 Hz, 1H). ^{13}C NMR (100MHz, Chloroform-*d*) δ 139.55, 135.96, 128.77, 120.95, 119.73, 119.52, 110.49, 99.37, 67.49, 38.25, 24.55, 23.82.

3-(1*H*-indol-2-yl)butan-1-ol **4d**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.31 (s, 1H), 7.54-7.52 (m, 1H), 7.29-7.27 (m, 1H), 7.15-7.03 (m, 2H), 6.25 (d, *J* = 2.1 Hz, 1H), 3.71-3.59 (m, 2H), 3.14-3.05 (m, 1H), 1.90-1.83 (m, 2H), 1.36 (d, *J* = 7.0 Hz, 3H). ^{13}C NMR (100MHz, Chloroform-*d*) δ 144.17, 135.72, 128.58, 121.08, 119.90, 119.59, 110.54, 98.01, 60.85, 39.73, 29.94, 20.70.

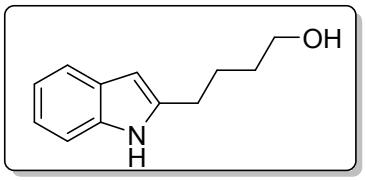
3-(1*H*-indol-2-yl)-3,3-diphenylpropan-1-ol **4e**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.71 (s, 1H), 7.52 (d, *J* = 7.7 Hz, 1H), 7.31-7.19 (m, 12H), 7.13-7.04 (m, 2H), 6.20-6.19 (m, 1H), 3.69 (t, *J* = 6.7 Hz, 2H), 2.95 (t, *J* = 6.7 Hz, 2H), 2.04 (s, 1H).^{13}C NMR (100 MHz,

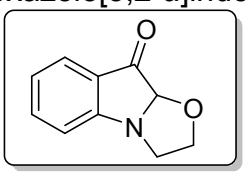
Chloroform-*d*) δ 145.91, 143.64, 136.09, 128.56, 128.26, 127.92, 121.57, 120.34, 119.64, 110.82, 102.52, 60.16 , 52.31, 42.68.

4-(1*H*-indol-2-yl)butan-1-ol **4f**



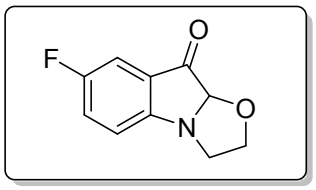
^{1}H NMR (400 MHz, Chloroform-*d*) δ 8.13 (brs, 1H), 7.52 (d, *J* = 8.3 Hz, 1H), 7.36-7.17 (m, 1H), 7.12-7.04 (m, 2H), 6.21 (s, 1H), 3.63 (t, *J* = 6.3 Hz, 2H), 2.72 (t, *J* = 7.5 Hz, 2H), 1.79-1.71 (m, 1H), 1.65-1.53 (m, 1H). ^{13}C NMR (100MHz, Chloroform-*d*) δ 139.64, 135.92, 128.78, 120.94, 119.75, 119.56, 110.44, 99.50, 62.53, 32.01, 27.89, 25.55.

2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3a**



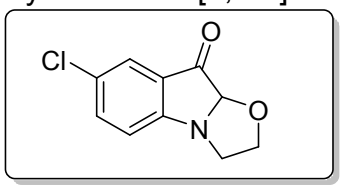
^{1}H NMR (400 MHz, Chloroform-*d*) δ7.56-7.63 (m, 2H), 7.02-7.05 (m, 2H), 4.88 (s, 1H), 4.03-4.08 (m, 1H), 3.87-3.92 (m, 2H), 3.55-3.88 (m, 2H). ^{13}C NMR (100MHz, Chloroform-*d*) δ 198.10, 137.86, 124.96, 122.40, 115.23, 92.56, 77.34, 67.40, 50.85. FTIR (film)：ν 2921，1721，1609, 1474，1317cm^{-1}. UV-vis spectra (methanol): λ_1=386nm, λ_2=334nm. HRMS (ESI, m/z): Calculated for [$C_{10}H_9NO_2$] $(M+H)^+$ 176.0706, found 176.0706.

7-fluoro-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3b**



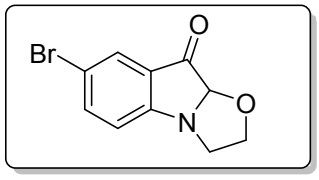
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.35-7.24 (m, 2H), 6.98-7.01 (m, 1H), 4.90 (s, 1H), 4.04-4.08 (m, 1H), 3.86-3.92 (m, 1H), 3.48-3.58 (m, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 197.51 (d, *J* = 2.9 Hz), 161.21 (d, *J* = 1.0 Hz), 159.68 , 157.25 , 130.22-119.76 (m), 116.53 (d, *J* = 7.7 Hz), 110.29 (d, *J* = 23.0 Hz), 96.73-84.53 (m), 67.40, 51.19. HRMS (ESI, m/z): Calculated for [$C_{10}H_9FNO_2$] $(M+H)^+$194.0612, found 194.0613.

7-chloro-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3c**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.62-7.48 (m, 2H), 6.97 (dd, *J* = 8.6, 0.5 Hz, 1H), 4.88 (s, 1H), 4.09-4.04 (m, 1H), 3.94-3.88(m, 1H), 3.63-3.46 (m, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.80, 163.21, 137.65, 128.01, 125.46, 124.42, 116.43, 92.83, 67.57, 50.82. HRMS (ESI, m/z): Calculated for [$C_{10}H_9ClNO_2$] $(M+H)^+$ 210.0316, found 210.0317.

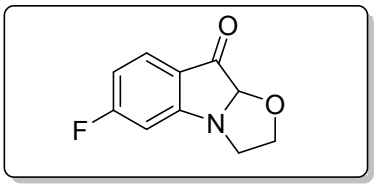
7-bromo-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3d**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.65-7.65 (m, 3H), 4.80 (s, 1H), 4.03-3.97 (m, 1H), 3.89-3.81 (m, 1H), 3.53-3.41 (m, 2H).^{13}C NMR

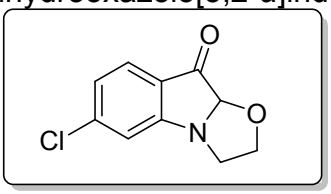
(100MHz, Chloroform-*d*) δ 195.62, 162.55, 139.32, 126.49, 124.89, 115.79, 114.05, 91.61, 66.56, 49.70. HRMS (ESI, m/z): Calculated for $[C_{10}H_9BrNO_2]$ $(M+H)^+$ 253.9811, found 253.9811.

6-fluoro-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3e**



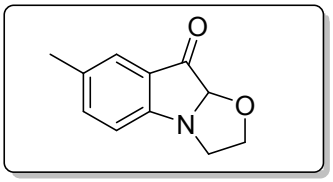
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.64-7.60 (m, 1H), 6.75-6.66 (m, 2H), 4.88 (s, 1H), 4.11-4.06 (m, 1H), 3.99-3.93 (m, 1H), 3.613.48 (m, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 195.94, 169.44 (d, *J* = 257.8 Hz), 167.02 (d, *J* = 13.1 Hz), 127.30 (d, *J* = 12.0 Hz), 120.68 (d, *J* = 1.5 Hz), 110.73 (d, *J* = 24.3 Hz), 102.21 (d, *J* = 25.5 Hz), 92.91, 67.72, 50.56 . HRMS (ESI, m/z): Calculated for $[C_{10}H_9FNO_2]$ $(M+H)^+$ 194.0612, found 194.0612.

6-chloro-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3f**



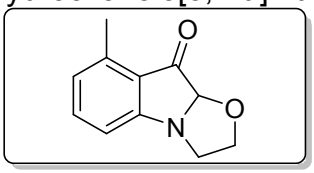
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.54 (d, *J* = 8.0 Hz, 1H), 7.01-6.99 (m, 2H), 4.88 (s, 1H), 4.10-4.05 (m, 1H), 3.97-3.92 (m, 1H), 3.61-3.50 (m, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 196.46, 165.56, 144.24, 125.94, 123.11, 122.73, 115.42, 92.68, 67.71, 50.59 .HRMS(ESI, m/z): Calculated for $[C_{10}H_9ClNO_2]$ $(M+H)^+$ 210.0316, found 210.0315.

7-methyl-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3g**



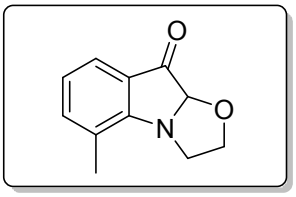
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.41-7.39 (m, 2H), 6.96-6.93 (m, 1H), 4.87 (s, 1H), 4.05-4.01 (m, 1H), 3.87-3.81 (m, 1H), 3.54-3.51 (m, 2H), 2.33 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 198.35, 163.19, 139.10, 132.26, 124.54, 124.46, 115.15, 92.98, 67.14, 51.10, 20.62. HRMS (ESI, m/z): Calculated for $[C_{11}H_{11}NO_2]$ $(M+H)^+$ 190.0863, found 190.0863.

8-methyl-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3h**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.41 (t, *J* = 7.8 Hz, 1H), 6.76-6.83 (m, 2H), 4.81 (s, 1H), 4.05-4.00 (m, 1H), 3.90-3.84 (m, 1H), 3.68-3.39 (m, 2H), 2.56 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 198.73, 165.52, 140.58, 137.14, 123.97, 122.13, 112.33, 92.46, 67.08, 50.96, 18.12. HRMS (ESI, m/z): Calculated for $[C_{11}H_{11}NO_2]$ $(M+H)^+$ 190.0863, found 190.0863.

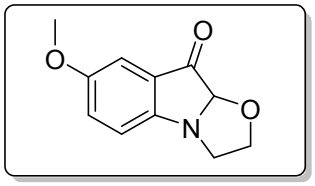
5-methyl-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3i**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.48 (d, *J* = 8.0 Hz, 1H), 7.41-7.39

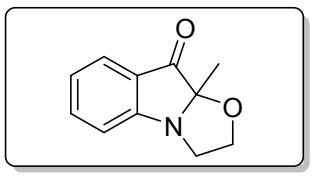
(m,1H), 6.99 (t, *J* = 7.5 Hz, 1H), 4.93 (s, 1H), 4.12-4.01 (m, 2H), 3.66-3.60 (m, 1H), 3.43-3.37 (m, 1H), 2.40 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 199.10, 139.39, 126.49, 125.15, 122.99, 122.35, 93.26, 68.33, 50.57, 17.38. HRMS (ESI, m/z): Calculated for [$C_{11}H_{11}NO_2$] $(M+H)^+$ 190.0863, found 190.0865.

7-methoxy-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3j**



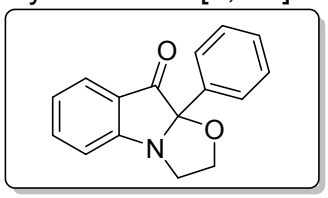
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.28-7.20 (m, 1H), 7.06 (d, *J* = 2.7 Hz, 1H), 6.99 (d, *J* = 8.8 Hz, 1H), 4.90 (s, 1H), 4.06-4.02 (m, 1H), 3.86-3.79 (m, 4H), 3.54-3.47 (m, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 198.58, 159.86, 155.72, 127.62, 124.89 , 116.72, 93.48, 67.04, 55.83, 51.36. HRMS (ESI, m/z): Calculated for [$C_{11}H_{11}NO_3$] $(M+H)^+$ 206.0812, found 206.0812.

9a-methyl-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3k**



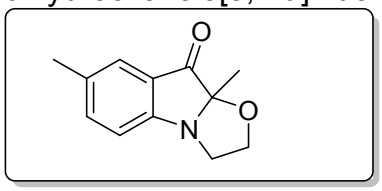
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.65-7.57 (m, 2H), 7.06-7.02 (m, 2H), 4.07-4.03 (m, 1H), 3.71-3.53 (m, 3H), 1.51 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 163.36, 137.75, 125.14, 124.03, 122.55, 115.29, 98.08, 66.76, 50.53, 19.38. HRMS (ESI, m/z): Calculated for [$C_{11}H_{11}NO_2$] $(M+H)^+$ 190.0863, found 190.0863.

9a-phenyl-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3l**



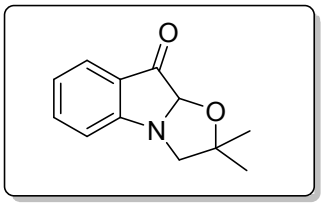
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.68-7.58 (m, 4H), 7.40-7.36 (m, 3H), 7.10-7.04 (m, 2H), 4.09-4.01(m, 2H),3.66-3.62 (m, 1H), 3.56-3.50 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 197.15, 163.96, 137.78, 136.06, 128.95, 128.40, 126.52, 125.64, 122.79, 122.61, 114.81, 67.96, 50.12. HRMS (ESI, m/z): Calculated for $[C_{16}H_{13}NO_2]$ $(M+H)^+$ 252.1019, found 252.1013.

7,9a-dimethyl-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3m**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.55-7.35 (m, 2H), 6.95 (d, J = 8.2 Hz, 1H), 4.05-4.01 (m, 1H), 3.68-3.51 (m, 3H), 2.33 (s, 3H), 1.50 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 199.62, 161.50, 138.99, 132.38, 124.71, 124.18, 115.20, 98.48, 66.61, 50.77, 20.64, 19.48. HRMS (ESI, m/z): Calculated for $[C_{12}H_{13}NO_2]$ $(M+H)^+$ 204.1019, found 204.1022.

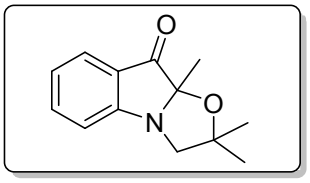
2,2-dimethyl-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3n**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.62-7.53 (m, 2H), 7.01- 6.92 (m,

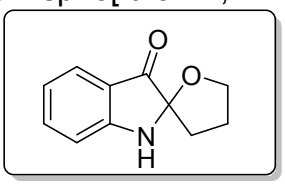
2H), 5.01 (s, 1H), 3.46-3.30 (m, 2H), 1.42 (s, 3H), 1.14 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 199.51, 165.72, 137.90, 125.17, 123.30, 121.80, 114.50, 92.40, 84.77, 61.66, 27.88, 26.32. HRMS (ESI, m/z): Calculated for [$C_{12}H_{13}NO_2$] $(M+H)^+$ 204.1019, found 204.1020.

2,2,9a-trimethyl-2,3-dihydrooxazolo[3,2-*a*]indol-9(9a*H*)-one **3o**



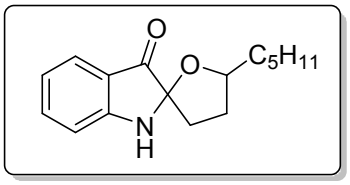
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.74-7.41 (m, 2H), 7.01- 6.93 (m, 2H), 3.68-3.30 (m, 2H), 1.48 (s, 3H), 1.37 (s, 3H), 0.88 (s, 3H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 201.25, 164.15, 137.78, 125.47, 122.34, 121.73, 114.06, 98.63, 83.84, 60.71, 28.21, 28.16, 20.69. HRMS (ESI, m/z): Calculated for [$C_{13}H_{15}NO_2$] $(M+H)^+$ 218.1176, found 218.1178.

4,5-dihydro-3*H*-spiro[furan-2,2'-indolin]-3'-one **5a**



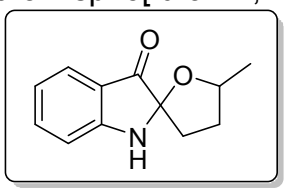
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.58-7.56 (m, 1H), 7.45-7.41 (m, 1H), 6.86 - 6.72 (m, 2H), 4.87 (s, 1H), 4.22-3.97 (m, 2H), 2.35-2.22 (m, 2H), 2.17-2.06 (m, 1H), 2.03-1.94 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 200.99, 159.72, 137.90, 125.09, 119.69, 112.22, 95.10, 69.28, 34.06, 25.79. HRMS (ESI, m/z): Calculated for [$C_{11}H_{11}NO_2$] $(M+H)^+$ 190.0863, found 190.0864.

5-pentyl-4,5-dihydro-3*H*-spiro[furan-2,2'-indolin]-3'-one **5b**



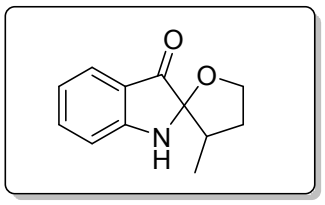
^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.56 (d, *J* = 7.7 Hz, 1H), 7.44-7.40 (m, 1H), 6.85 - 6.71 (m, 2H), 4.81 (s, 1H), 4.31- 4.19 (m, 1H), 2.41-2.12 (m, 2H), 2.03-1.98 (m, 1H), 1.78 - 1.61 (m, 2H), 1.59-1.47 (m, 1H), 1.45 -1.21 (m, 6H), 0.88 (t, *J* = 6.5 Hz, 3H). HRMS (ESI, m/z): Calculated for [C16H21NO2] $(M+H)^+$ 260.1645, found 260.1646.

5-methyl-4,5-dihydro-3*H*-spiro[furan-2,2'-indolin]-3'-one **5c**



δ 7.54 (d, *J* = 7.7 Hz, 1H), 7.44-7.37 (m, 1H), 6.82-6.71 (m, 2H), 5.02 (s, 1H), 4.43-4.37 (m, 1H), 2.39-2.24 (m, 2H), 2.22-2.15 (m, 0.45H), 2.07-1.93 (m, 1.64H), 1.73-1.61 (m, 0.65H), 1.34 (d, *J* = 1.7 Hz, 1.54H), 1.32(d, *J* = 1.7 Hz, 1.42H). HRMS (ESI, m/z): Calculated for [$C_{12}H_{13}NO_2$] $(M+H)^+$ 204.1019, found 204.1022.

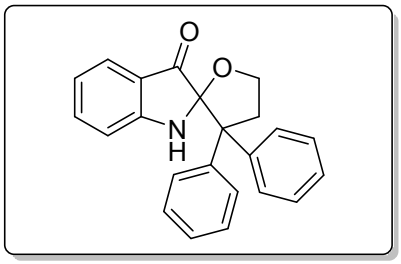
3-methyl-4,5-dihydro-3*H*-spiro[furan-2,2'-indolin]-3'-one **5d**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.55-7.50 (m, 1H), 7.44 - 7.37 (m, 1H), 6.80- 6.74 (m, 2H), 4.96- 4.87 (m, 1H), 4.28-3.93 (m, 2H), 2.63 - 2.46 (m, 0.76H), 2.41 - 2.23 (m, 1.38H), 2.19-2.11 (m, 0.30H), 1.80-1.65

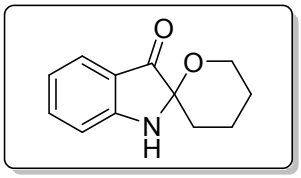
(m, 0.76H), 1.00 (t, *J* = 6.8 Hz, 3H).HRMS (ESI, m/z): Calculated for $[C_{12}H_{13}NO_2]$ $(M+H)^+$ 204.1019, found 204.1021.

3,3-diphenyl-4,5-dihydro-3*H*-spiro[furan-2,2'-indolin]-3'-one **5e**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.42-7.37 (m, 2H),7.36-7.33 (m, 1H), 7.32-7.26 (m, 3H), 7.21-7.16 (m, 6H), 6.77 (t, *J* = 7.3 Hz,1H), 6.69 (d, *J* = 8.1 Hz, 1H), 4.72 (s, 1H), 4.43 - 4.33 (m, 2H), 3.73-3.65(m,1H), 2.73-2.67 (m, 1H). ^{13}C NMR (100 MHz, Chloroform-*d*) δ 199.05, 158.79, 145.31, 142.28, 137.40, 128.48, 128.40, 128.18, 127.91, 126.95, 126.88, 125.15, 120.06, 119.67, 111.77, 97.95, 63.21, 56.26, 37.59

3',4',5',6'-tetrahydrospiro[indoline-2,2'-pyran]-3-one **5f**



^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.61 (d, *J* = 7.5 Hz, 1H), 7.47-7.44 (m, 1H), 6.87-6.83 (m, 2H), 5.16 (s, 1H),4.14- 4.09 (m, 1H), 3.85-3.78 (m, 1H), 2.15-2.09 (m, 1H), 2.06-1.99 (m, 1H), 1.86-1.81 (m, 1H), 1.75-1.69 (m, 1H), 1.62-1.54 (m, 2H).^{13}C NMR (100 MHz, Chloroform-*d*) δ 198.96, 159.45, 137.81, 125.48, 120.04, 119.84, 112.75, 87.54, 63.82, 30.58, 24.74, 19.26. HRMS (ESI, m/z): Calculated for $[C_{12}H_{13}NO_2]$ $(M+H)^+$ 204.1019, found 204.1020.

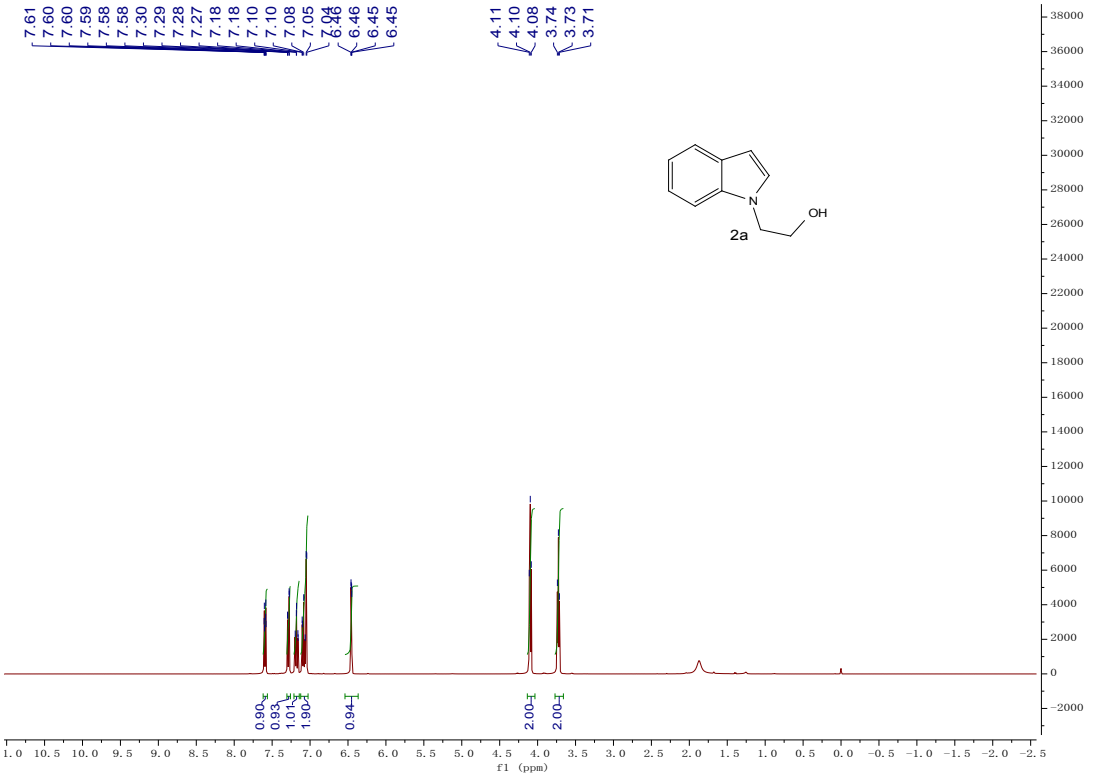
References

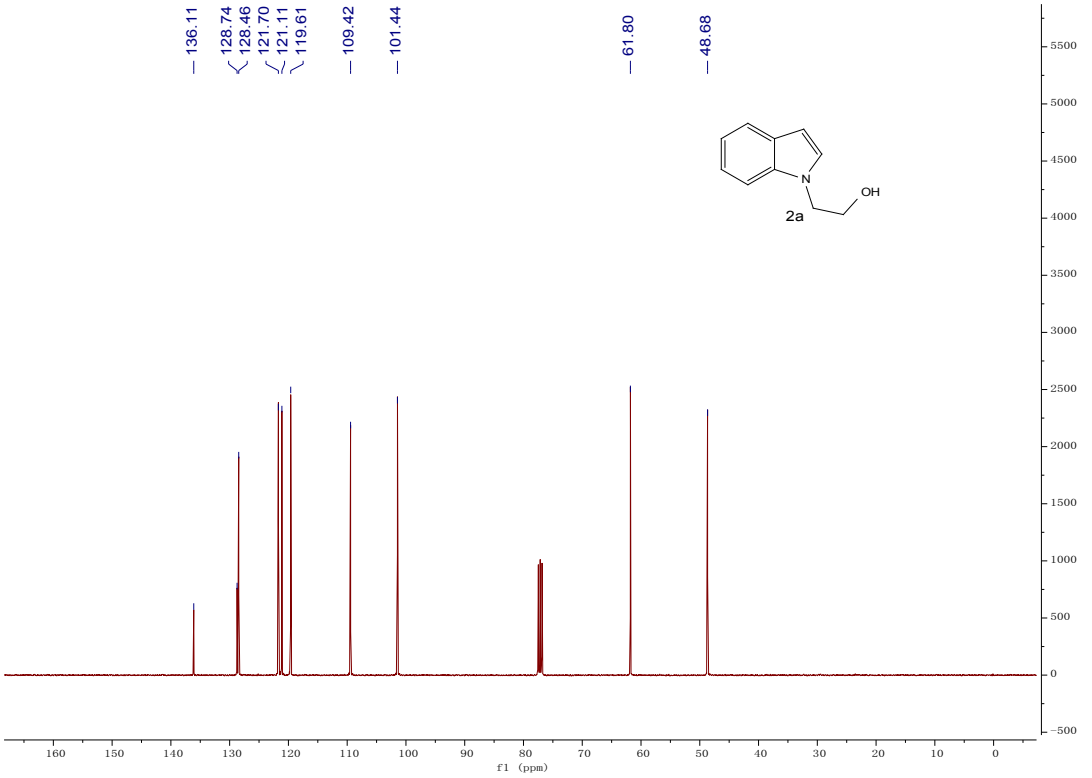
[1] Arun K. Ghosh and Zhi-Hua Chen, *Org. Biomol. Chem.,* 2014, **12**, 3567

[2] Nguyen Tuan Minh and Shuying Eileen Lau , *Chem. Commun.* 2013, **49**, 10602.

[3] Smith, Amos B., *Tetrahedron,* 1989, **45**, 2431.

Copies of ^{1}H NMR, ^{13}C NMR of substrates and products

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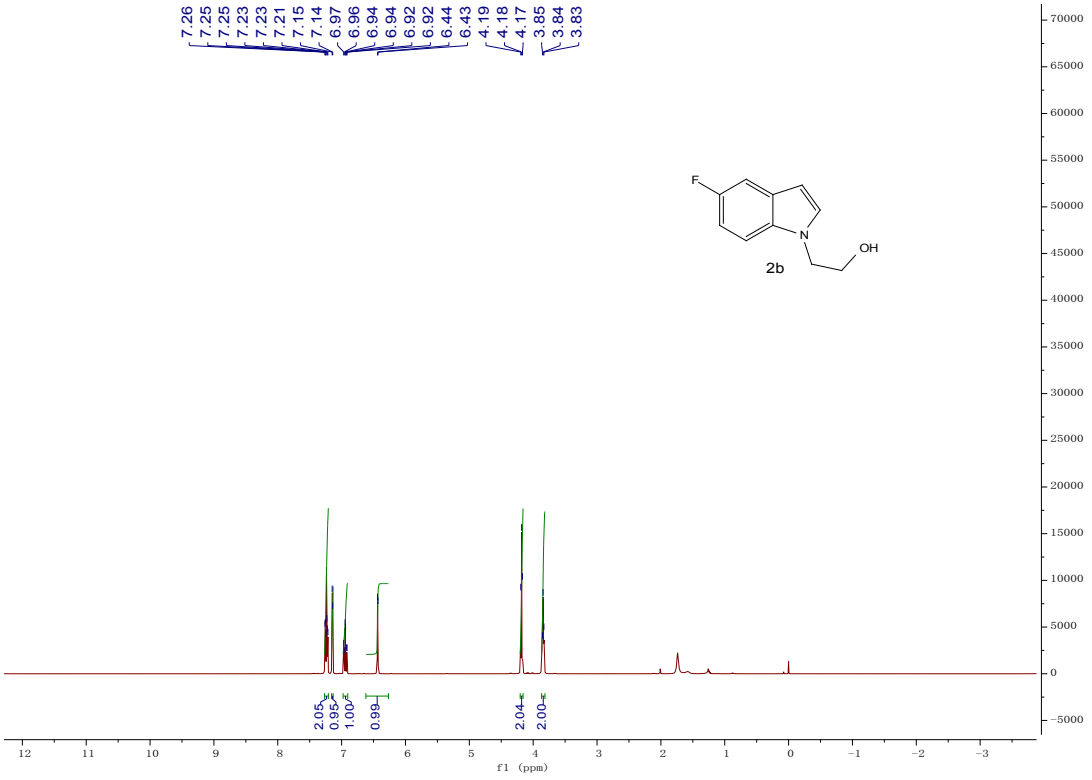
f1 (ppm)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6.92
6.92
6.44
6.43
4.19
4.18
4.17
3.85
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F
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OH
2b
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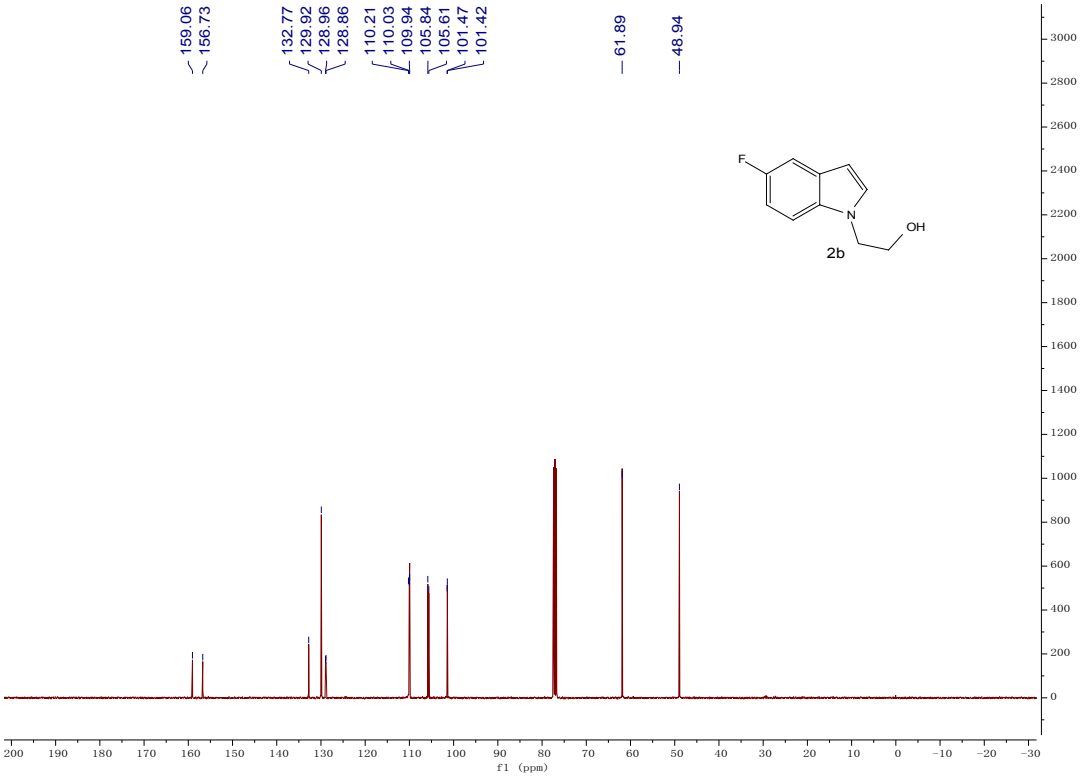
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F
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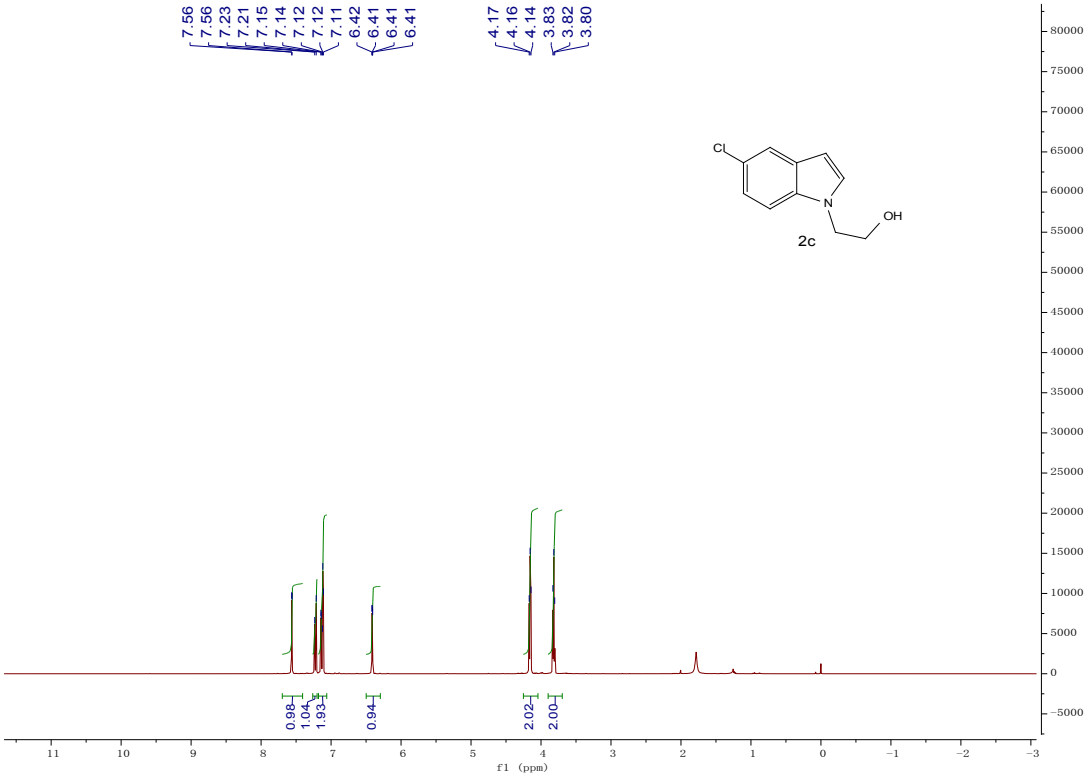
OH
2b
f1 (ppm)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4.16
4.14
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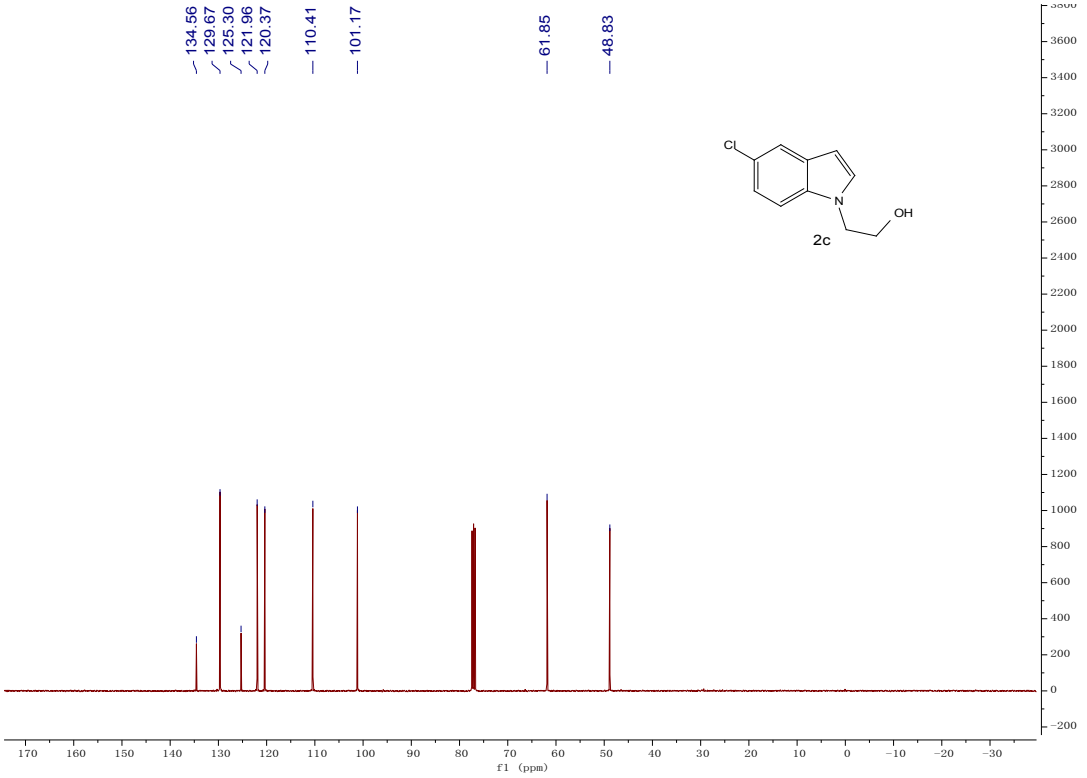
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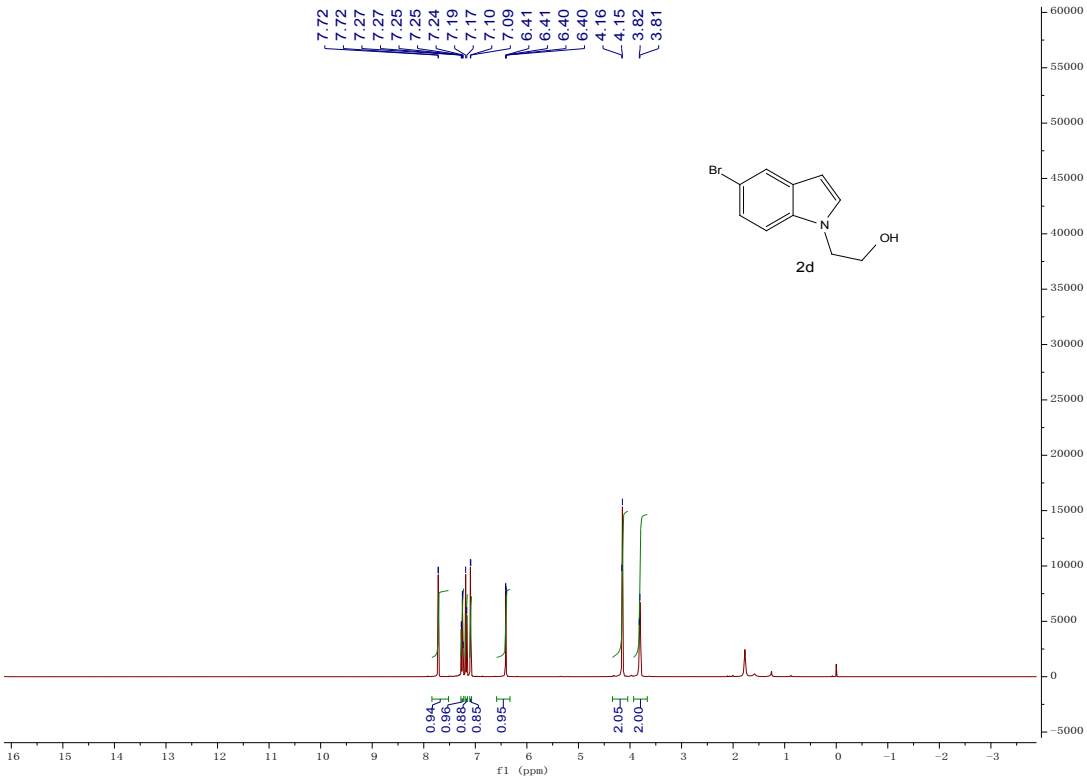
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6.40
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4.15
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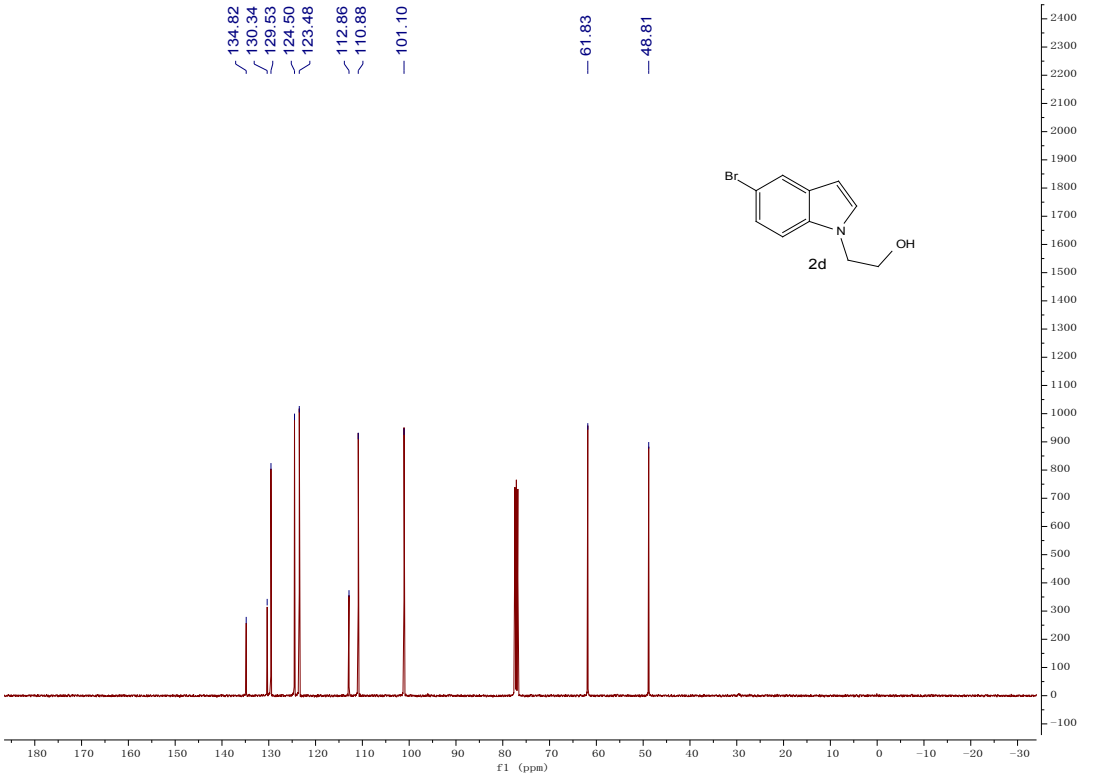
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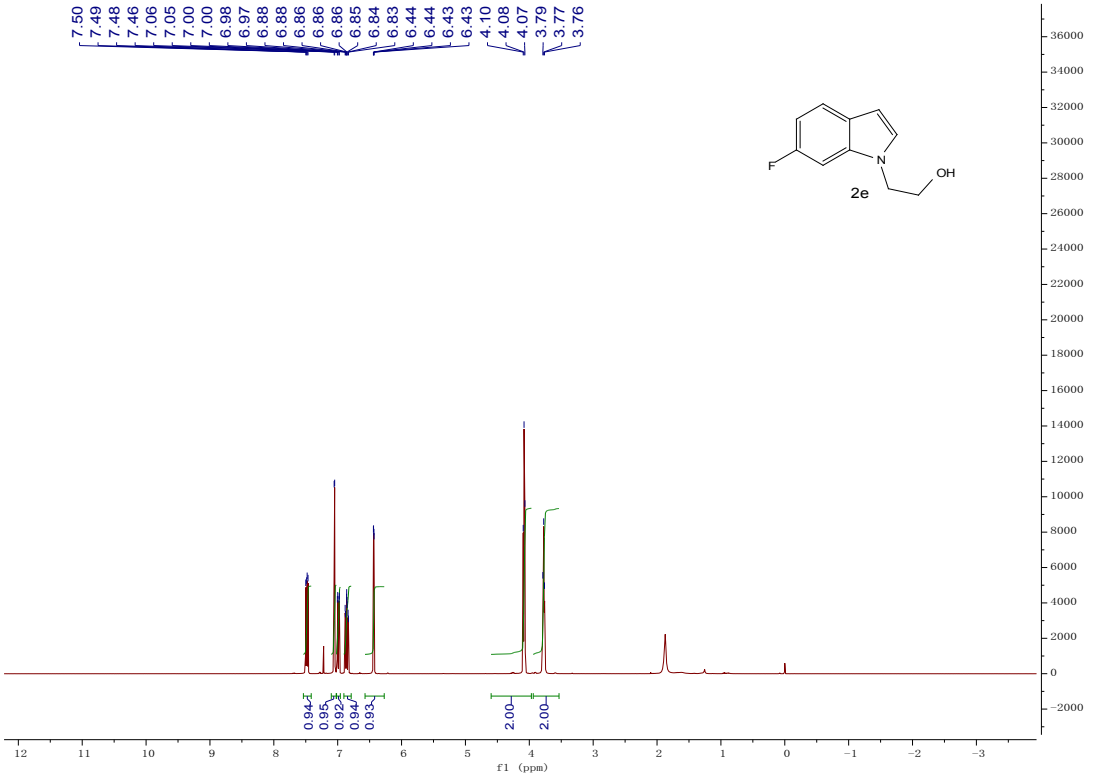
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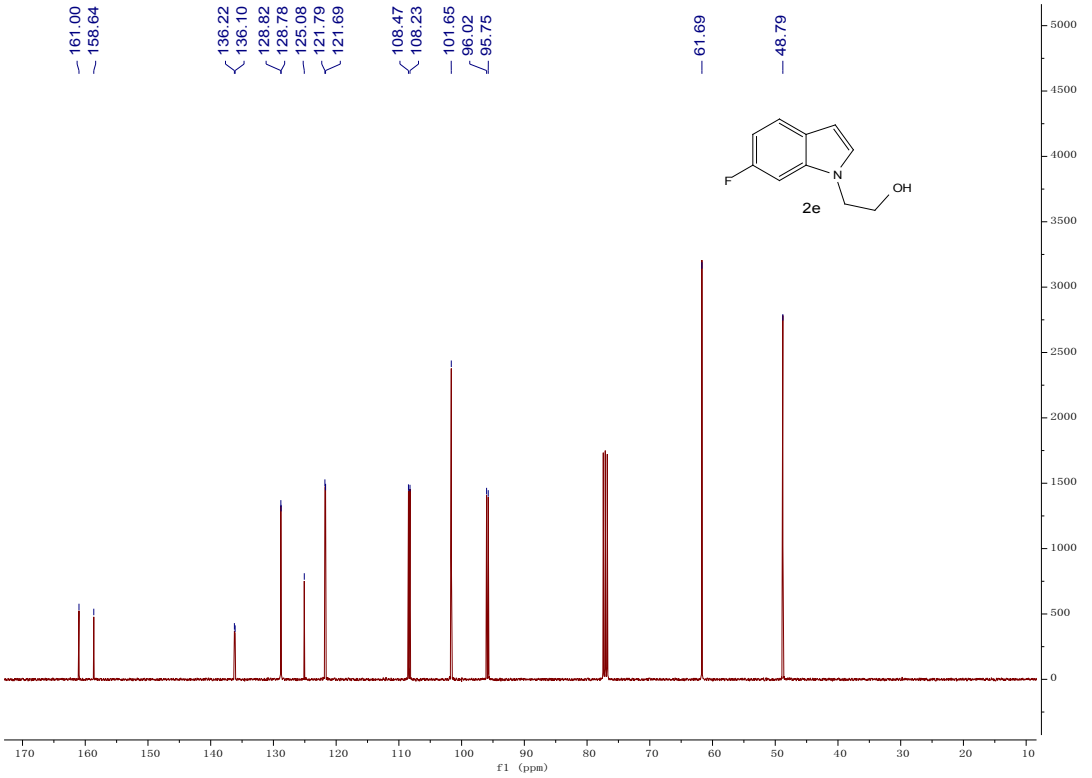
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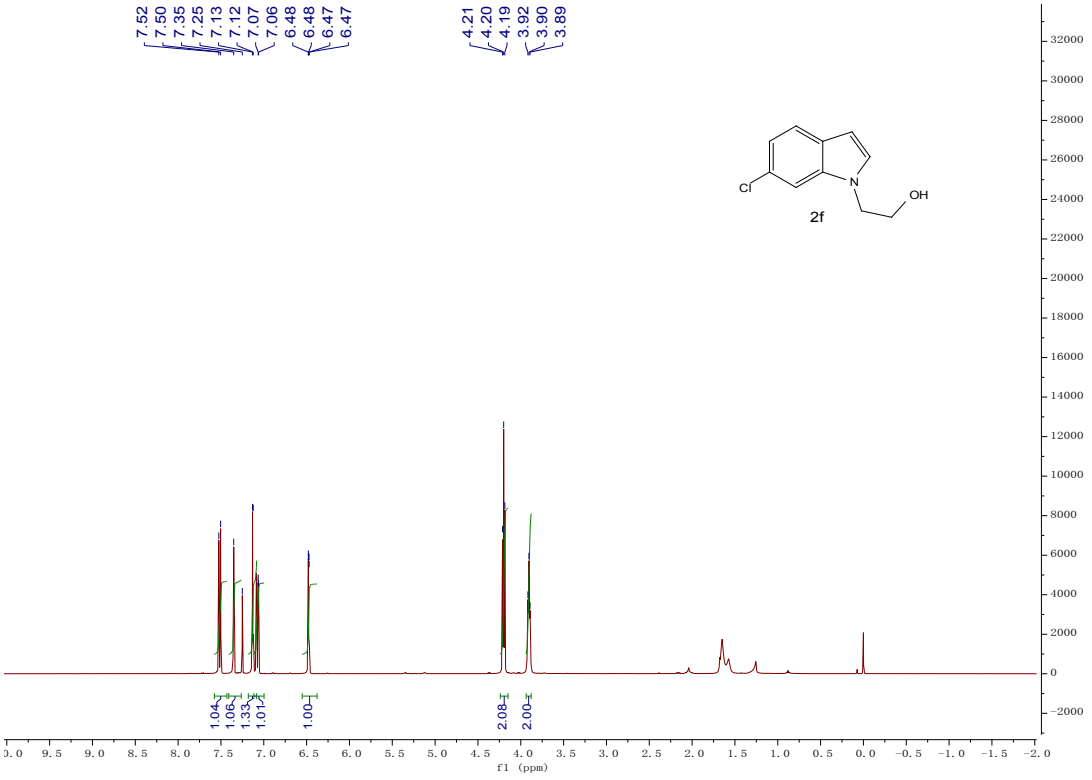
f1 (ppm)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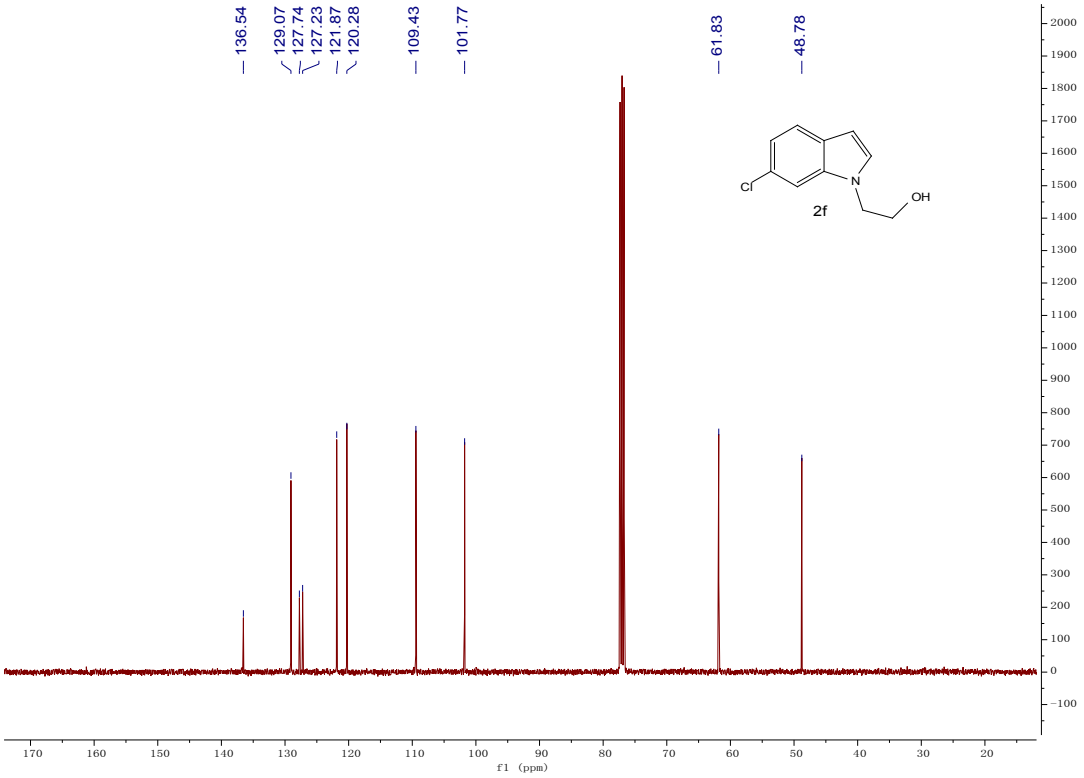
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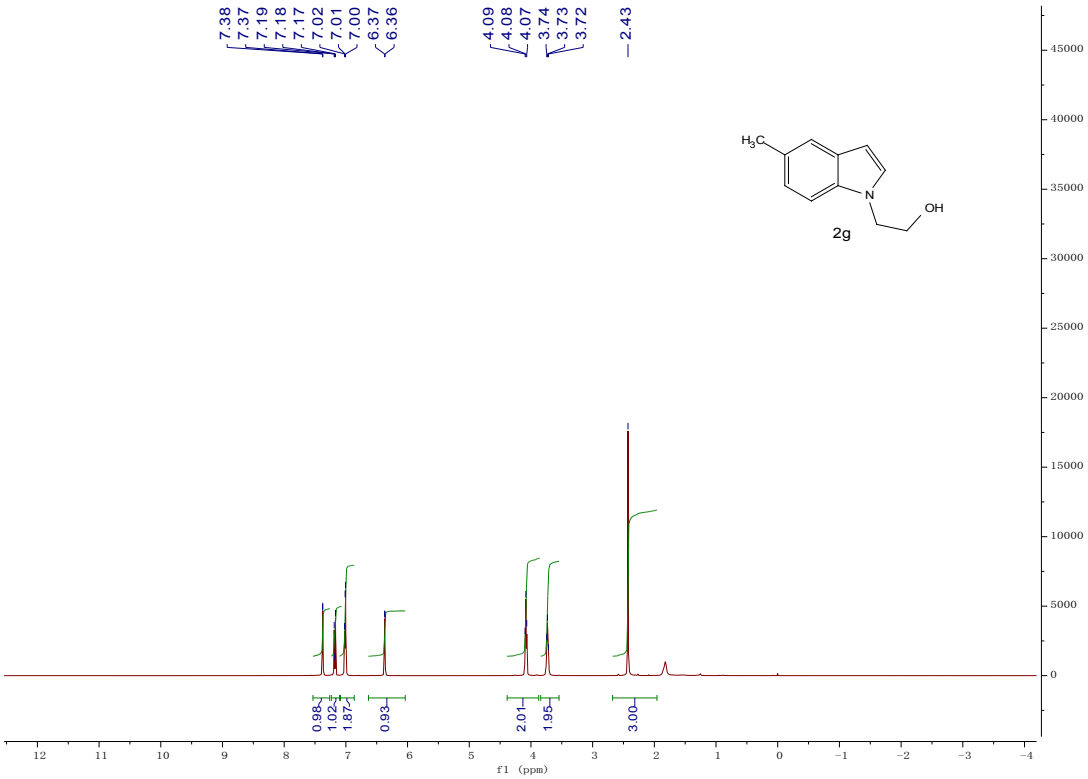
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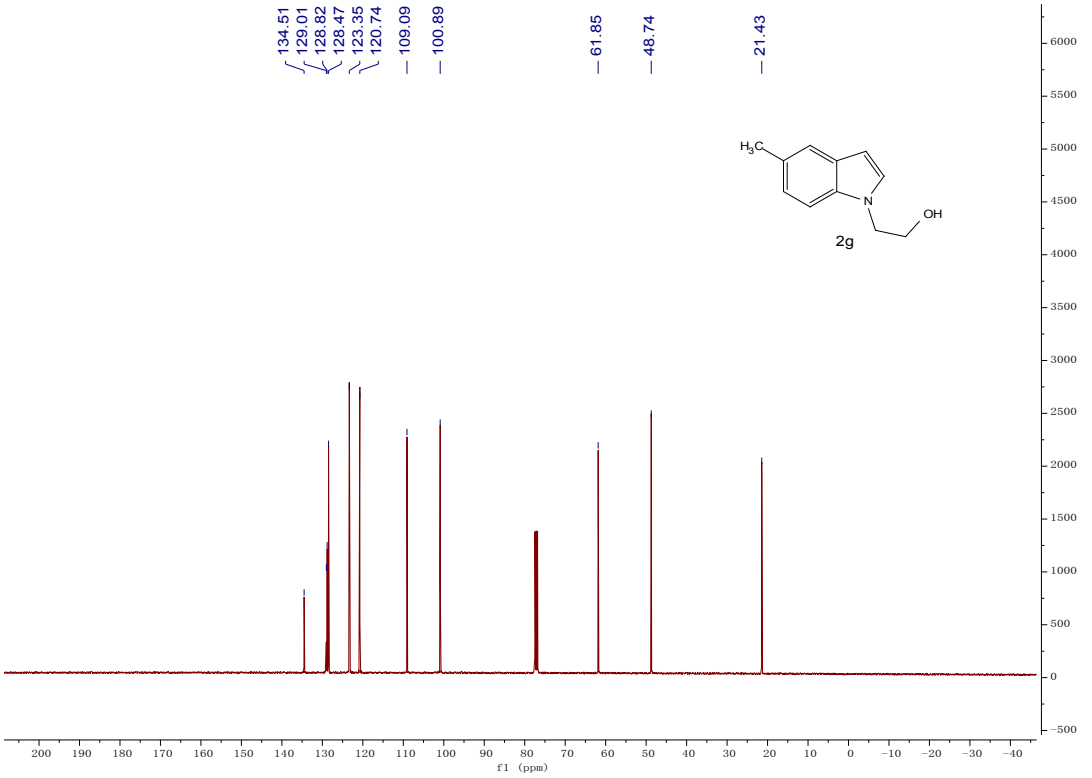
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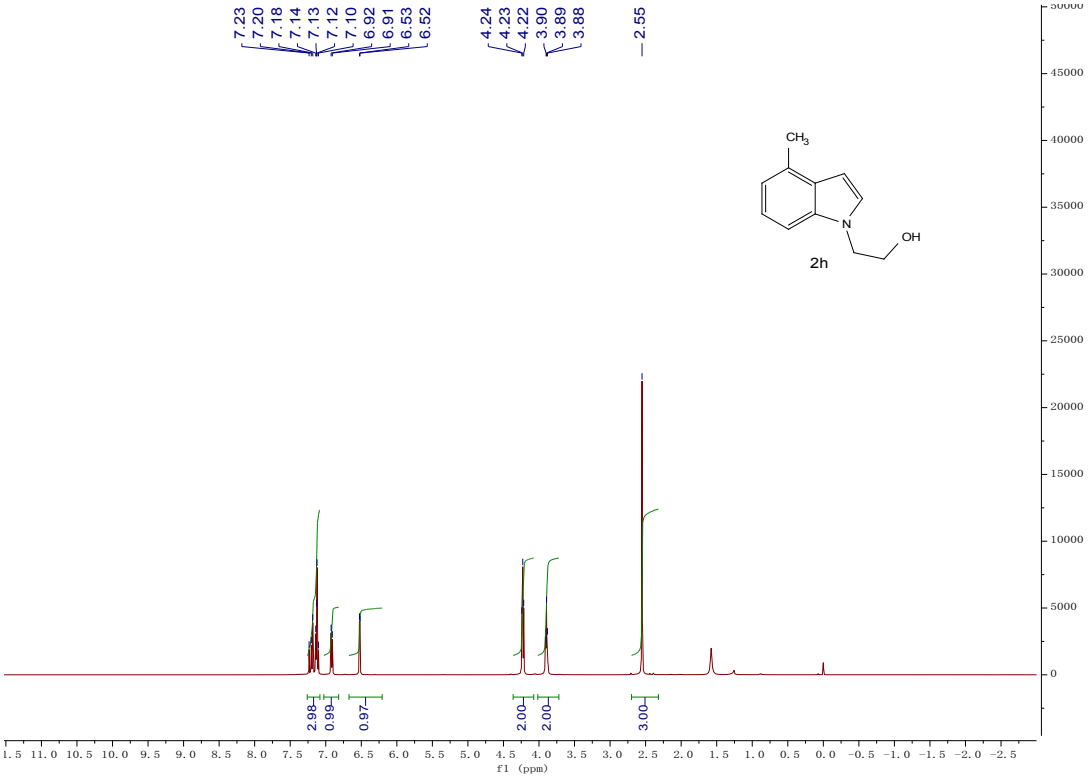
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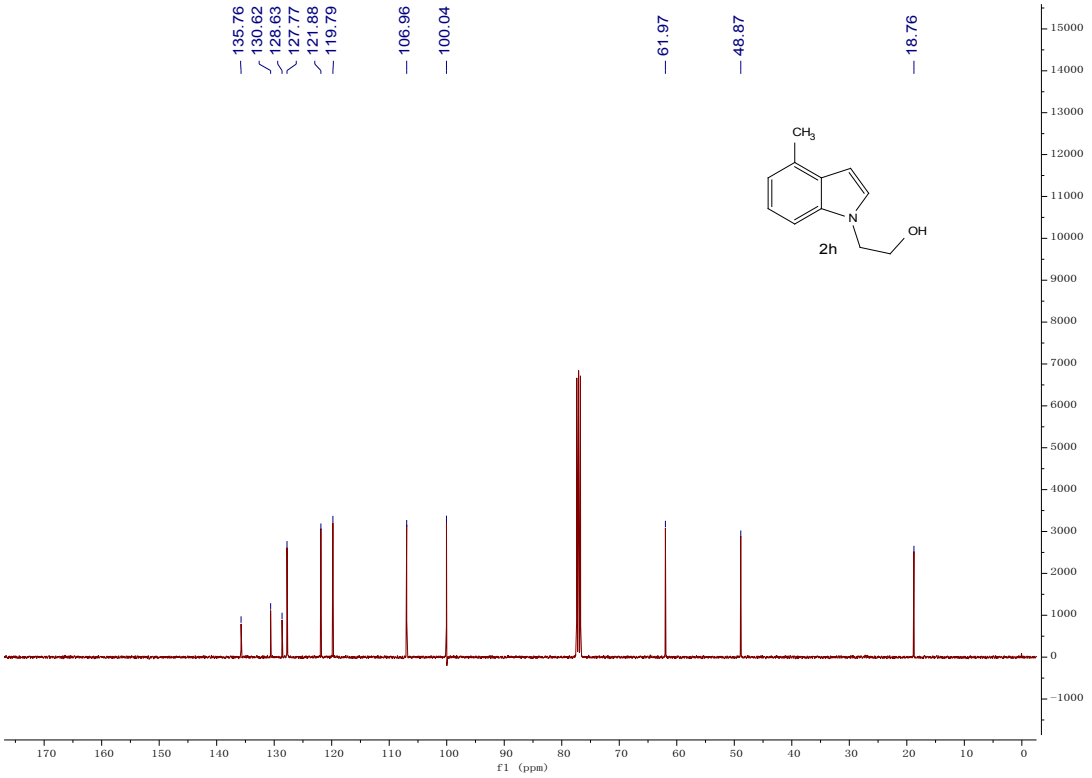
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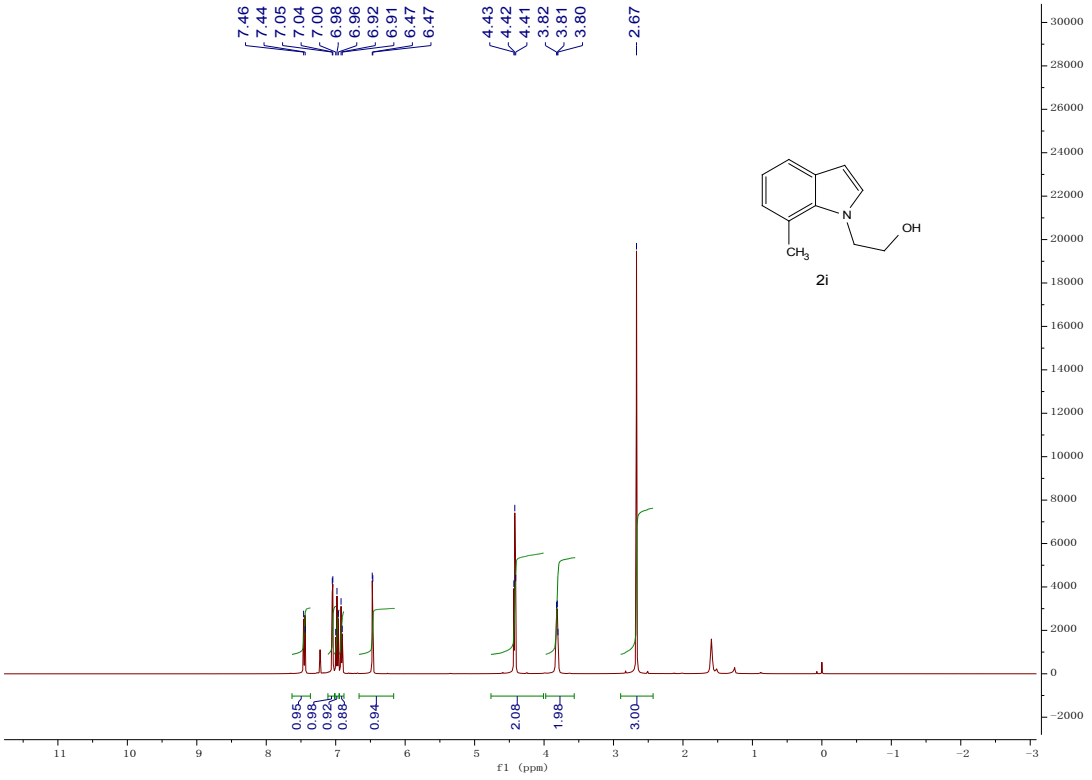
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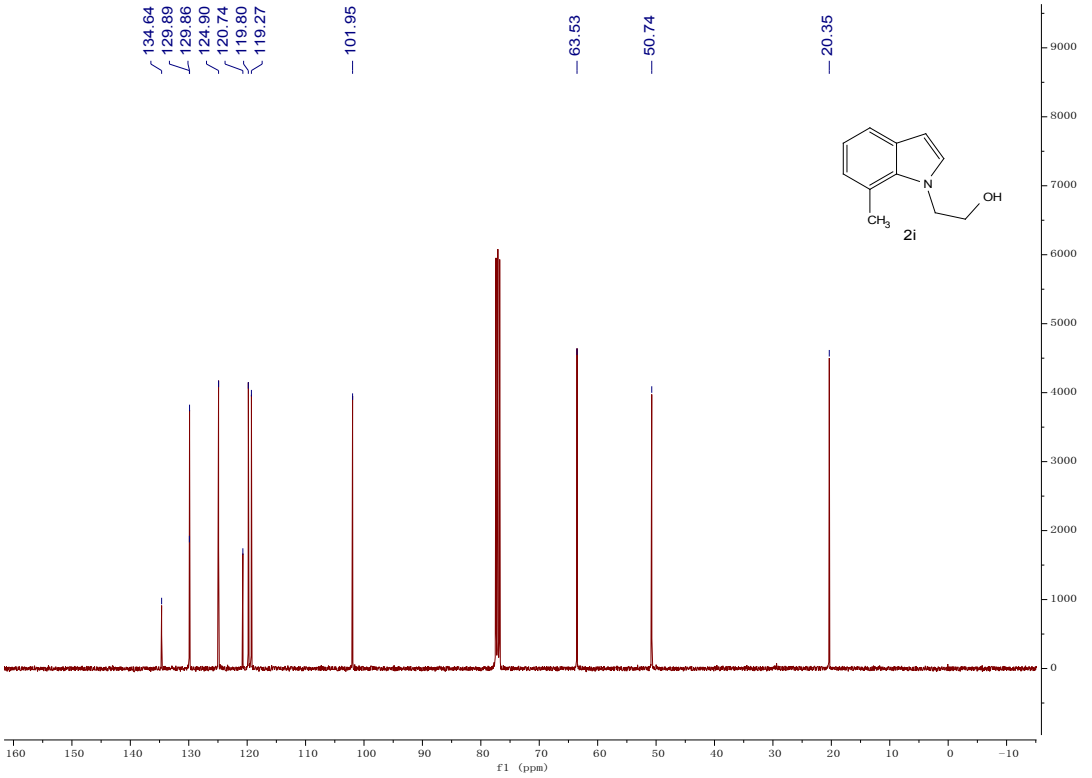
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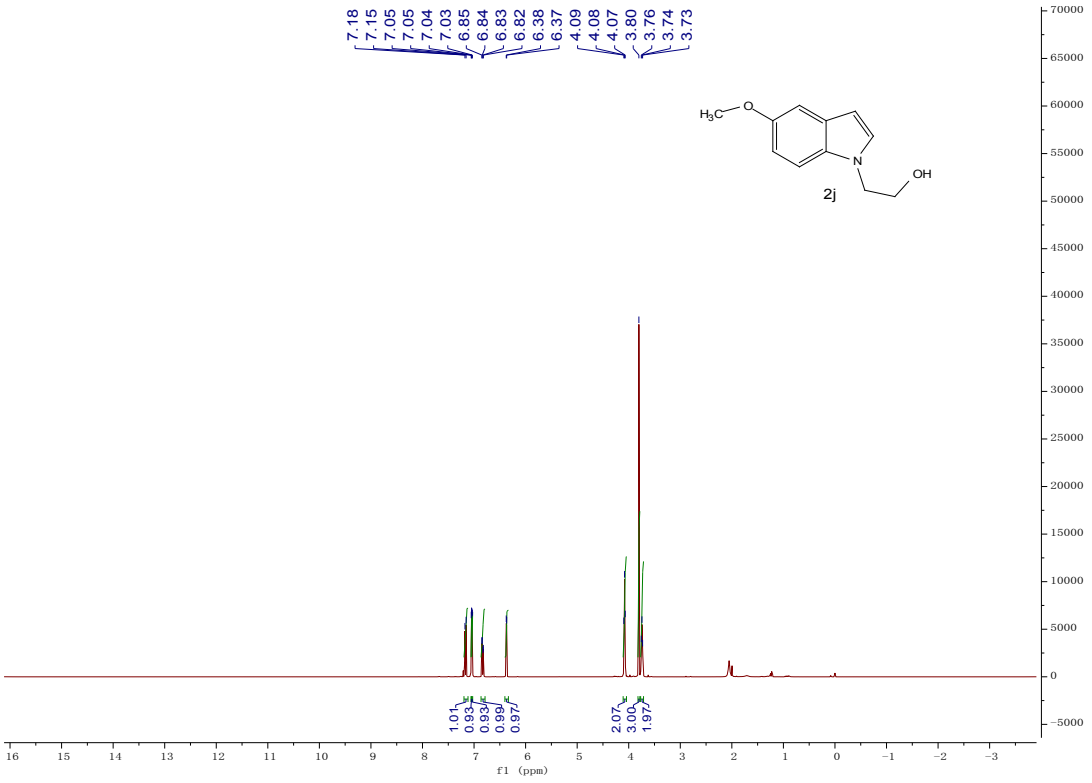
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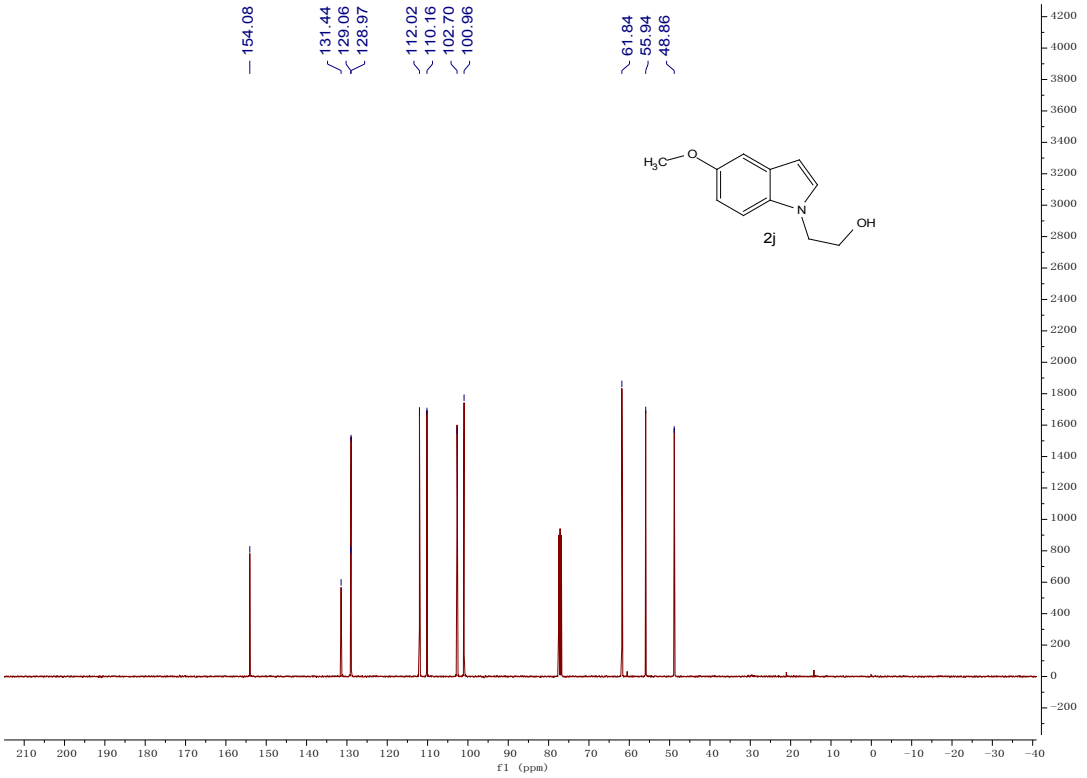
f1 (ppm)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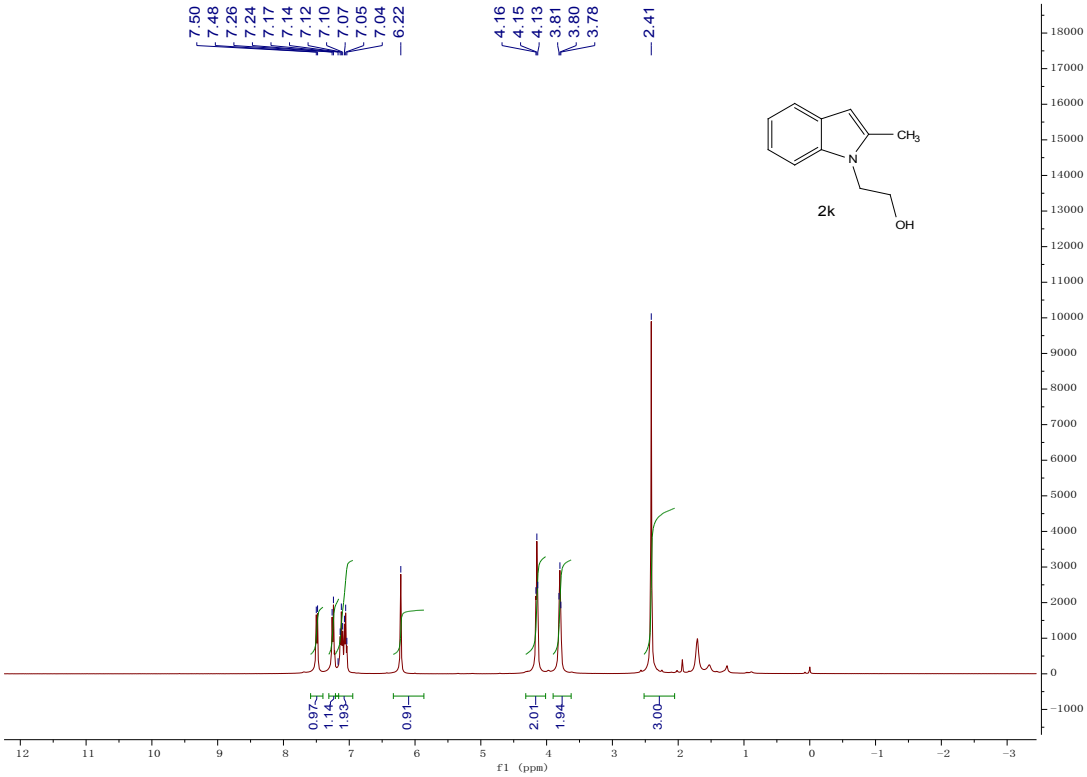
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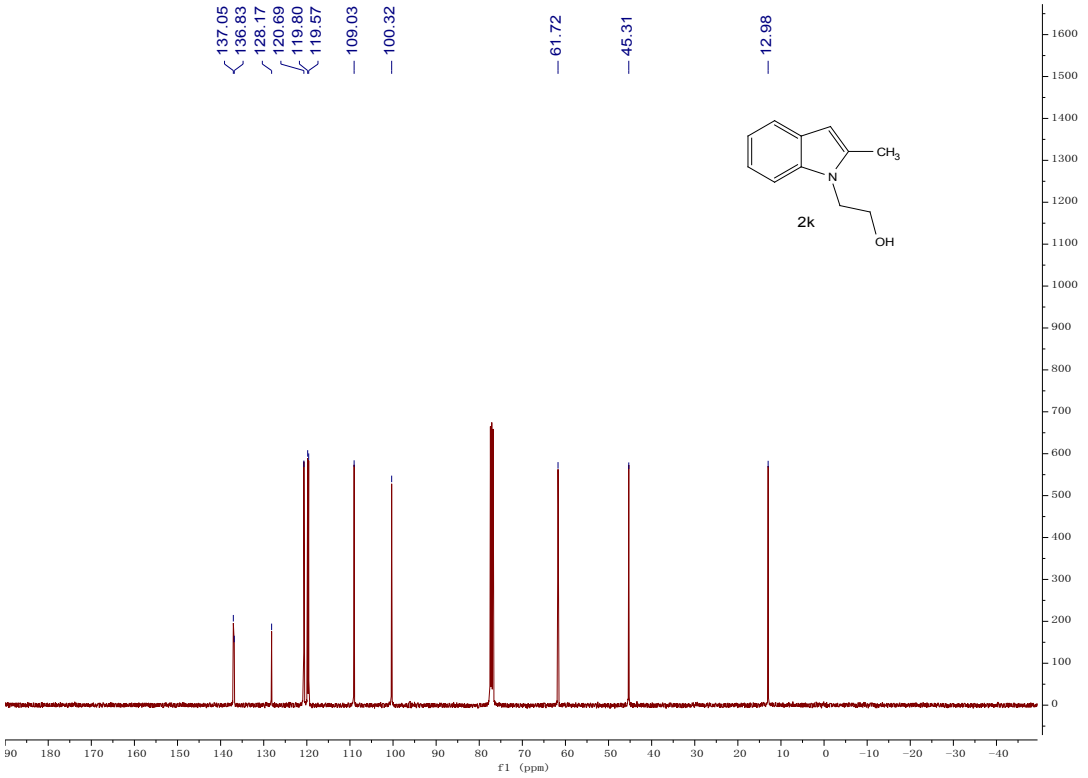
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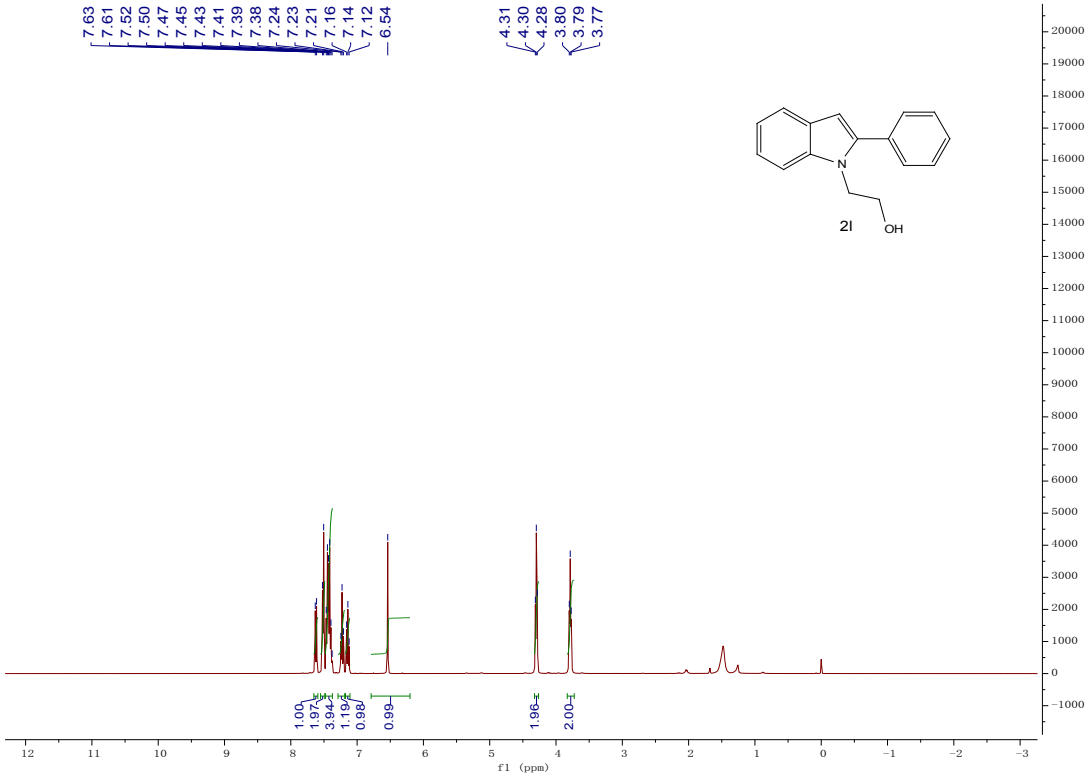
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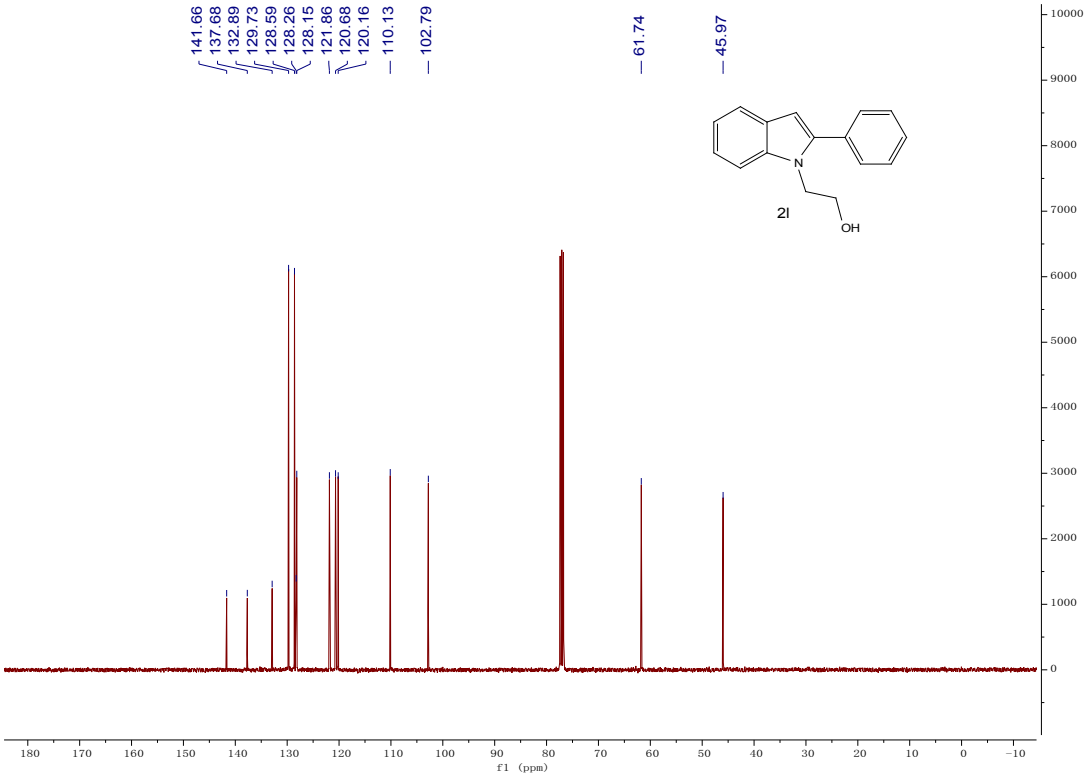
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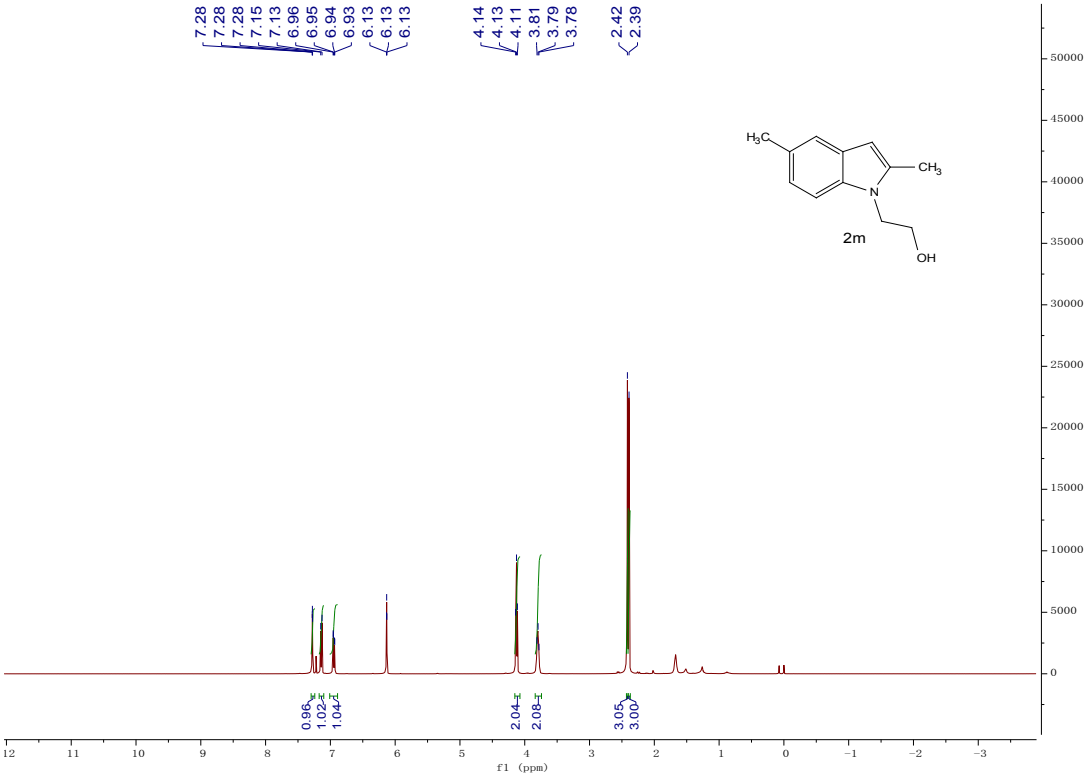
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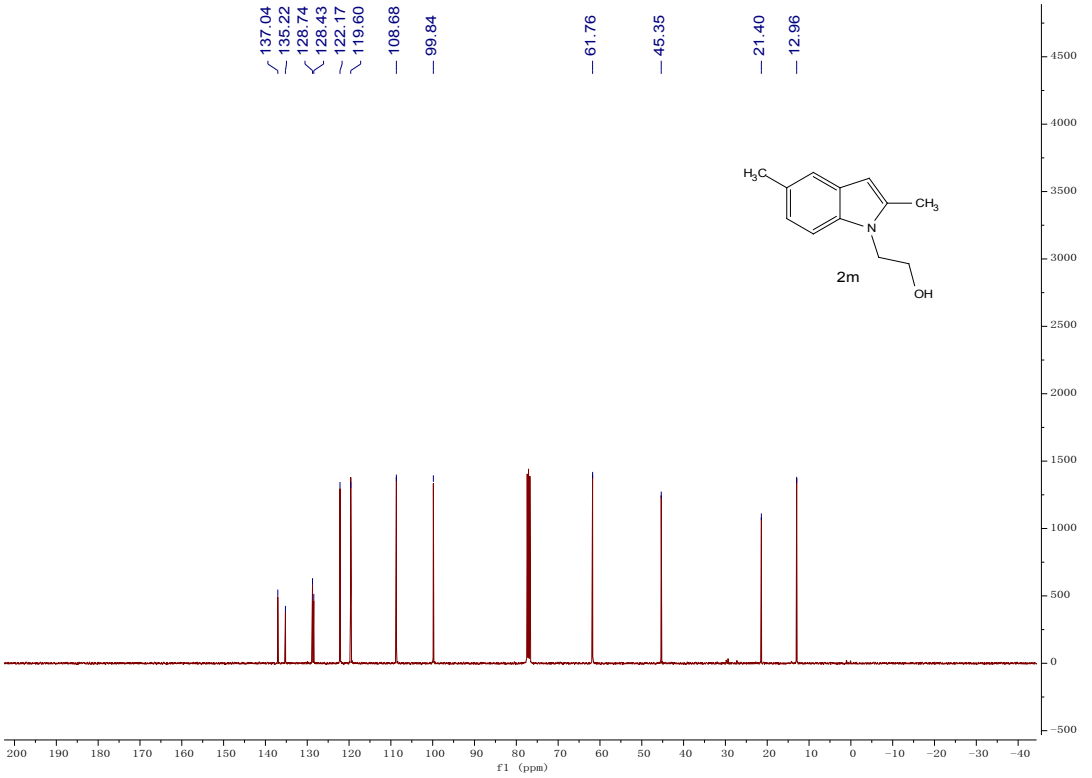
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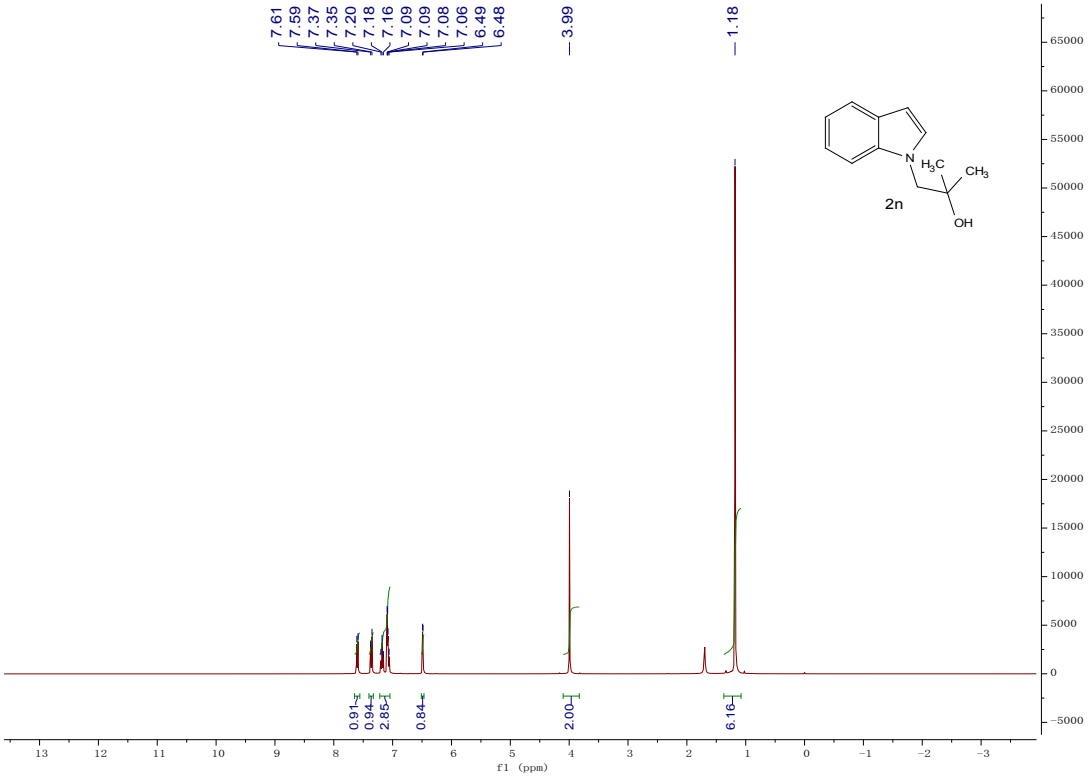
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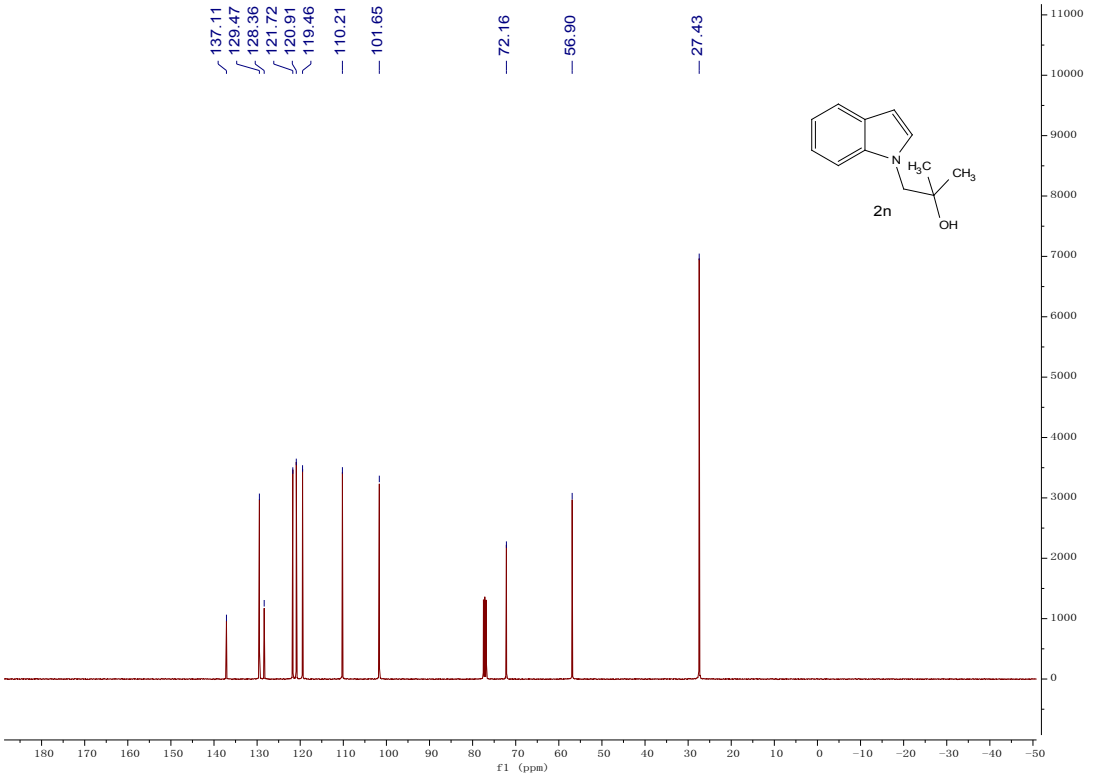
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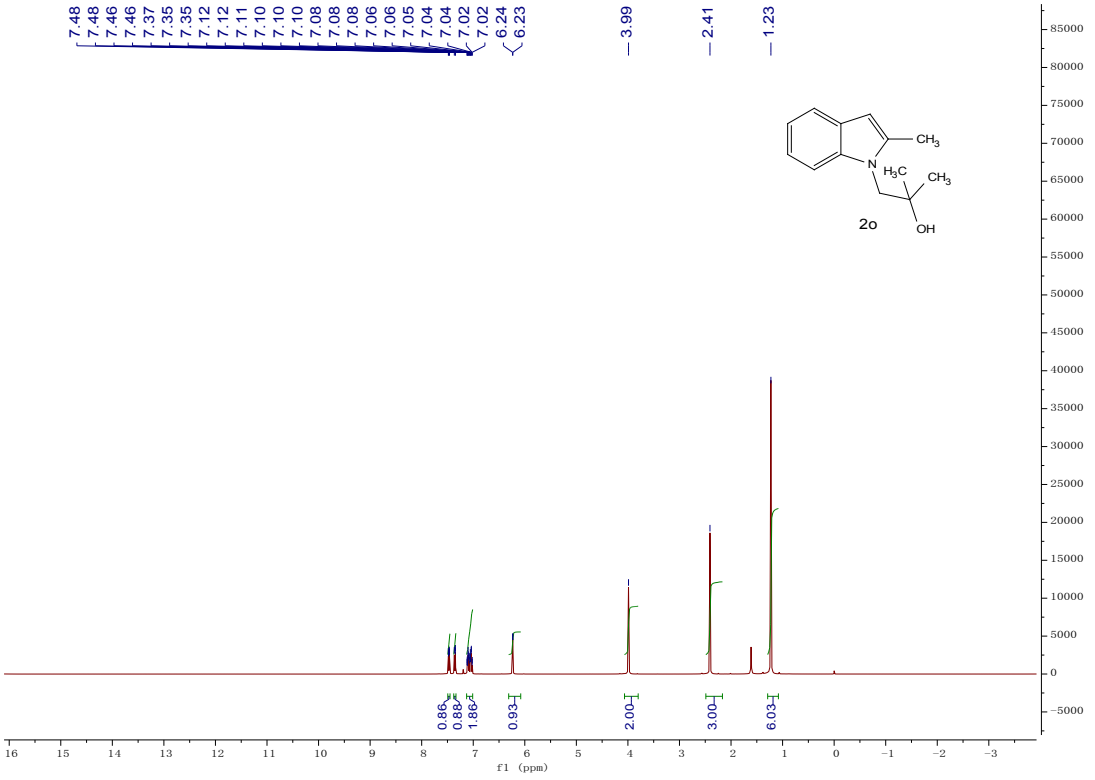
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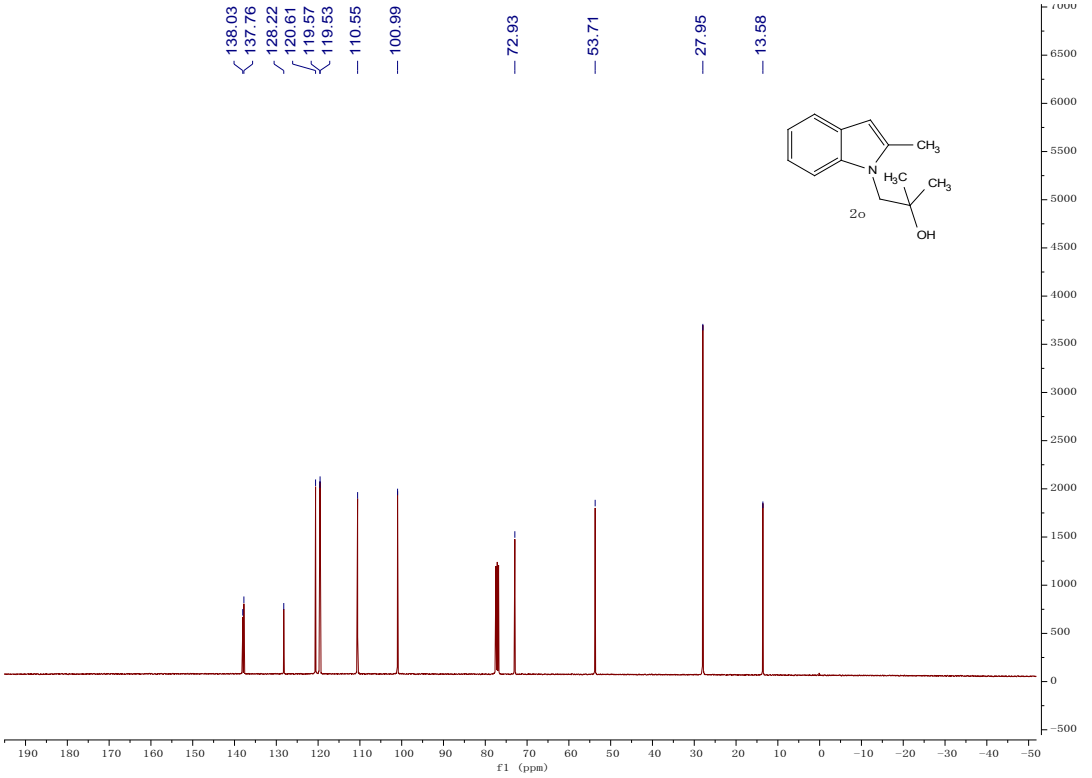
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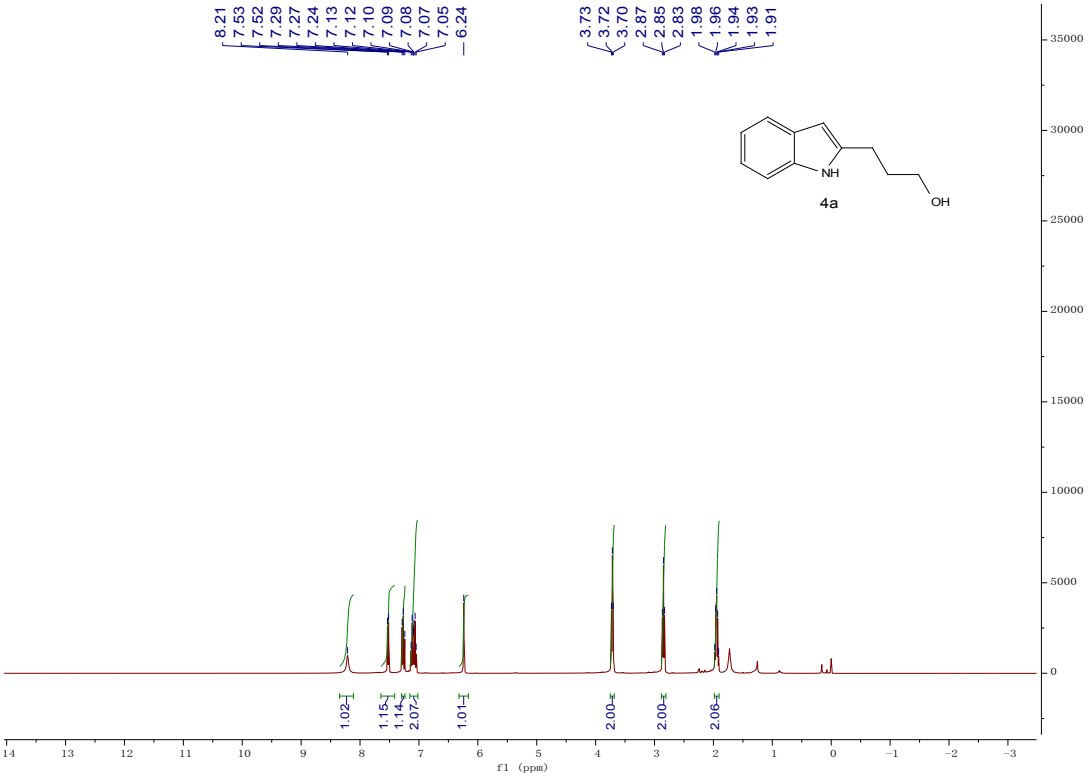
H3C
CH3
OH
2o
f1 (ppm)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7.07
7.05
6.24
3.73
3.72
3.70
2.87
2.85
2.83
1.98
1.96
1.94
1.93
1.91
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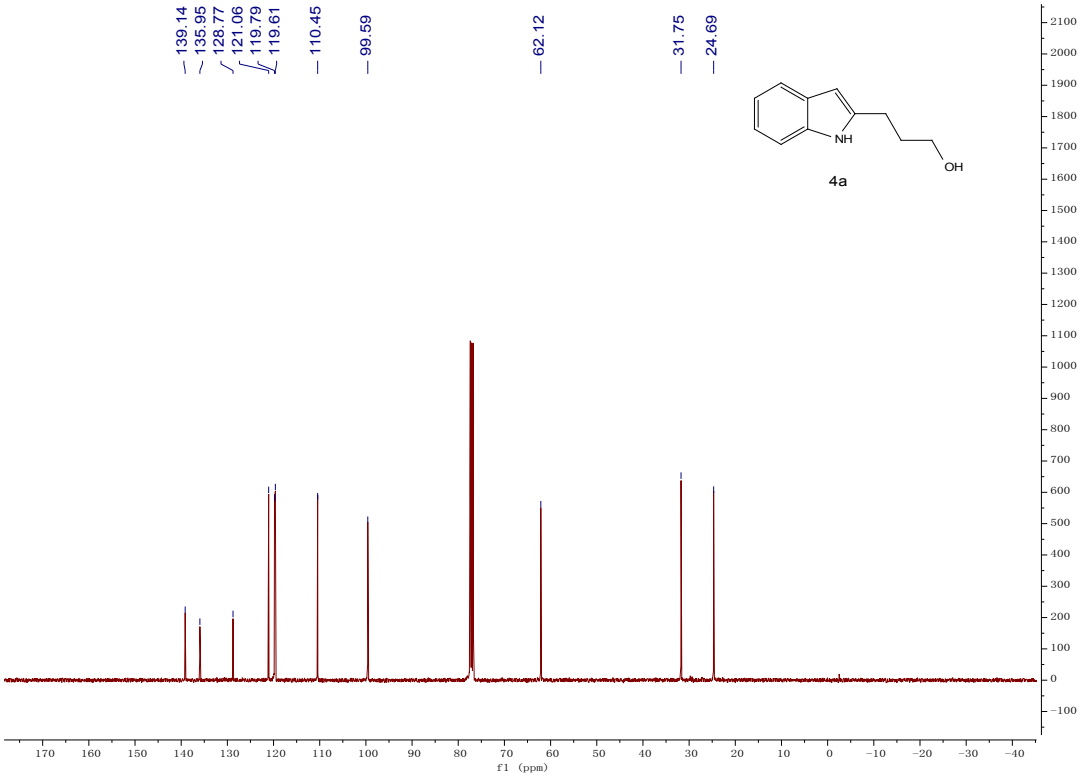
1.15
1.14
2.07
1.01
2.00
2.00
2.06
f1 (ppm)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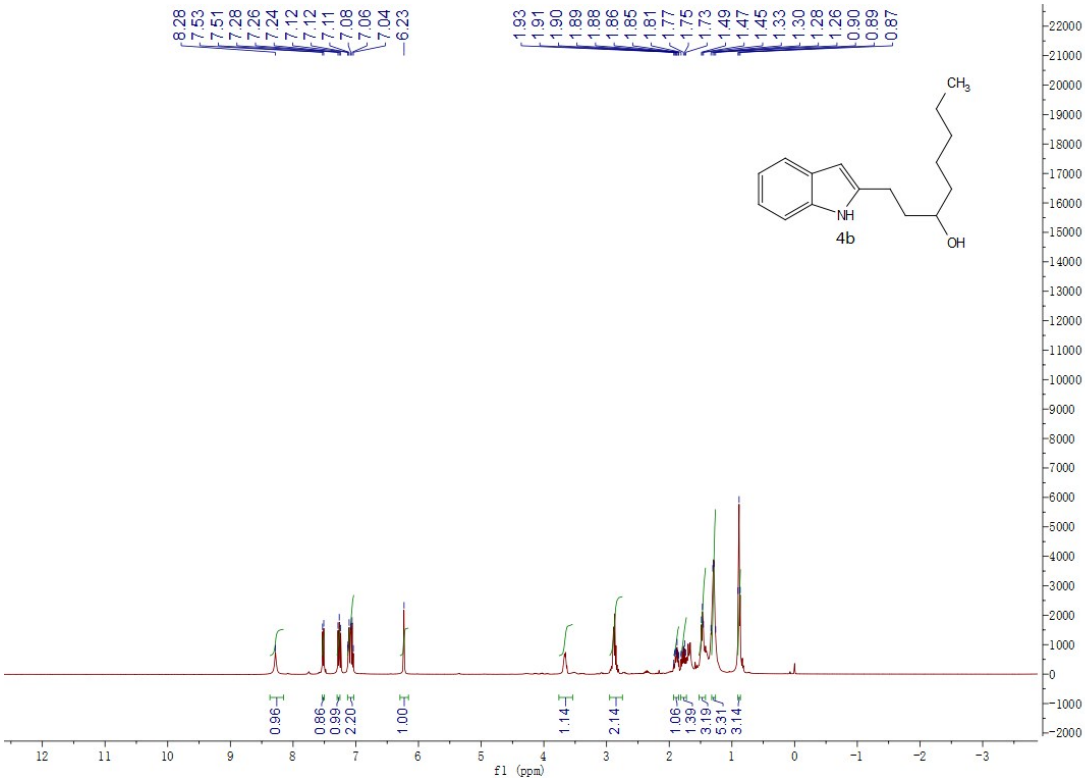
OH
4a
f1 (ppm)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7.04
6.23
1.93
1.91
1.90
1.89
1.88
1.86
1.85
1.81
1.77
1.75
1.73
1.49
1.47
1.45
1.33
1.30
1.28
1.26
0.90
0.89
0.87
CH3
NH
OH
4b
0.96
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2.14
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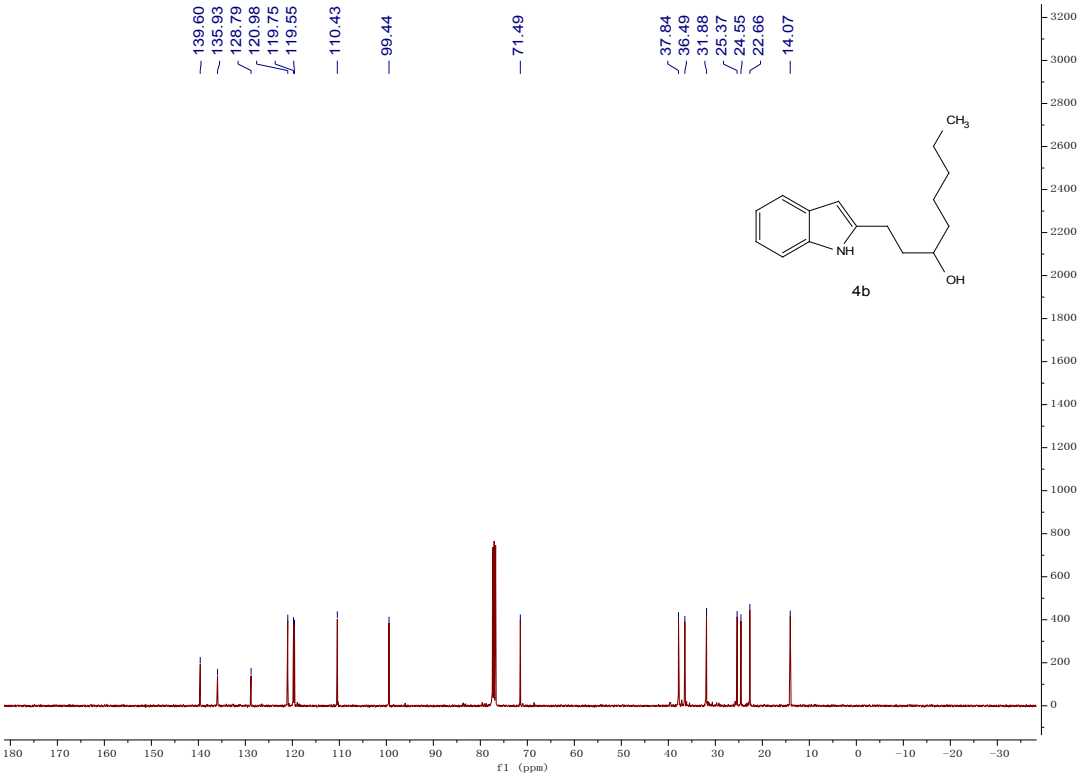
f1 (ppm)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24.55
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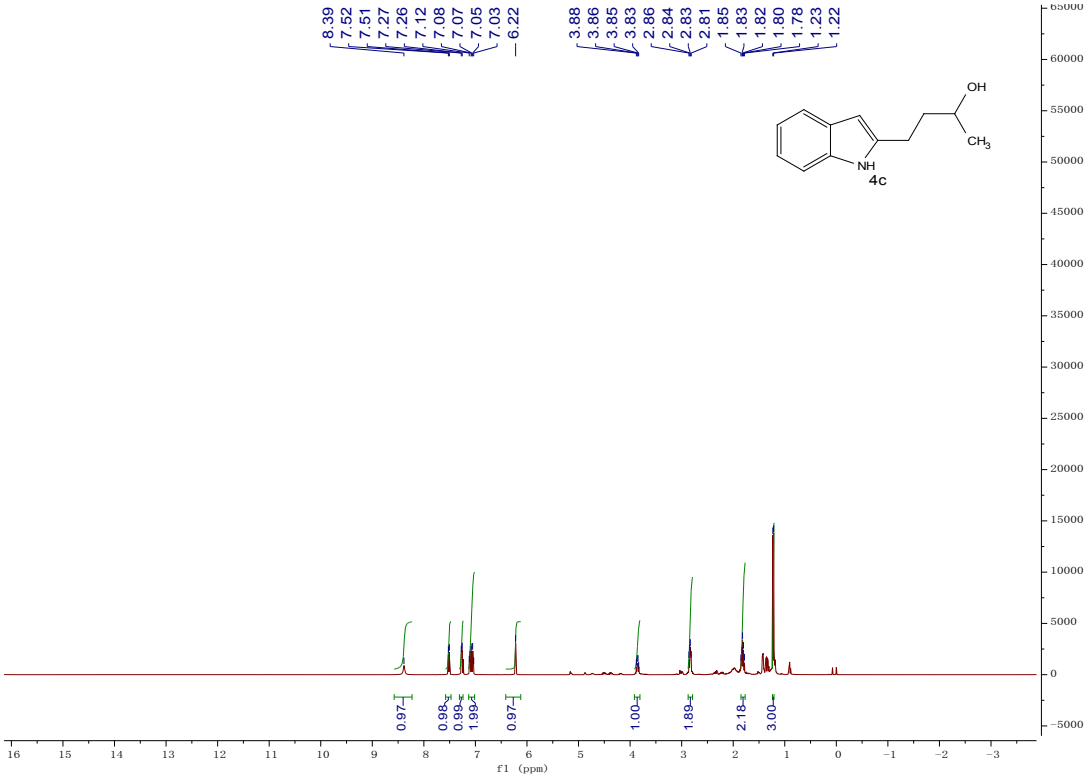
NH
OH
4b
f1 (ppm)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7.07
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7.03
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3.85
3.83
2.86
2.84
2.83
2.81
1.85
1.83
1.82
1.80
1.78
1.23
1.22
OH
CH3
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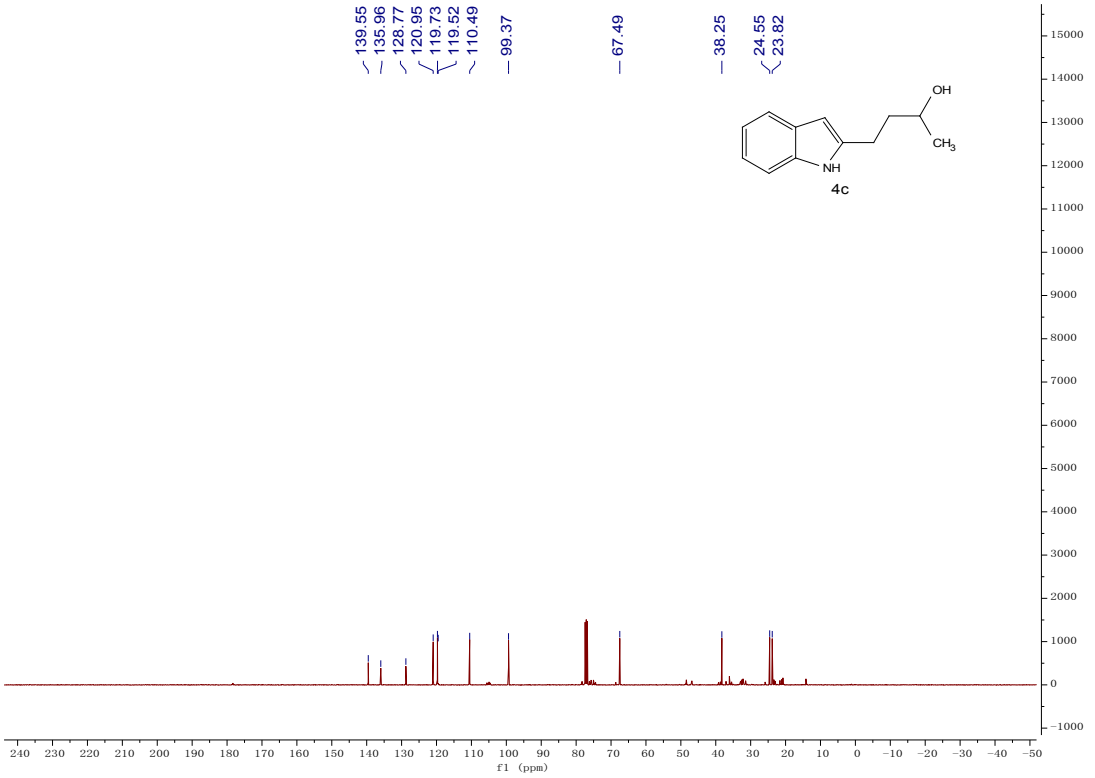
0.99
1.99
0.97
1.00
1.89
2.18
3.00
f1 (ppm)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24.55
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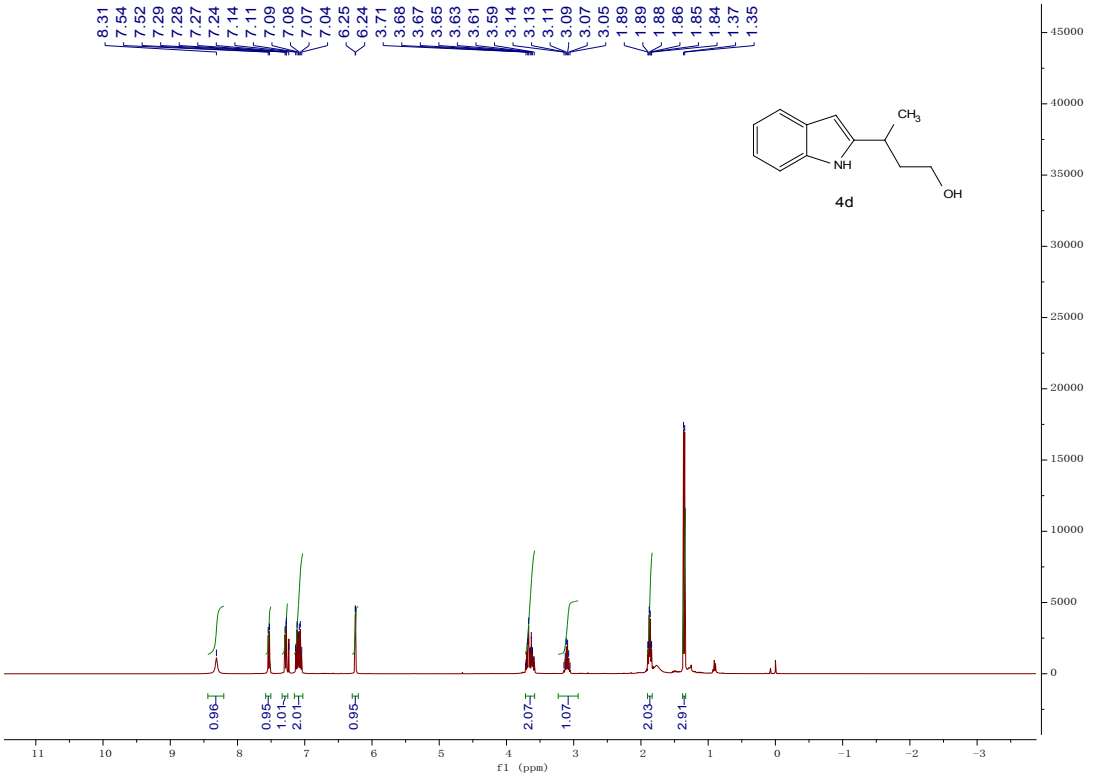
OH
CH3
NH
4c
f1 (ppm)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7.08
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7.04
6.25
6.24
3.71
3.68
3.67
3.65
3.63
3.61
3.59
3.14
3.13
3.11
3.09
3.07
3.05
1.89
1.89
1.88
1.86
1.85
1.84
1.37
1.35
CH3
NH
OH
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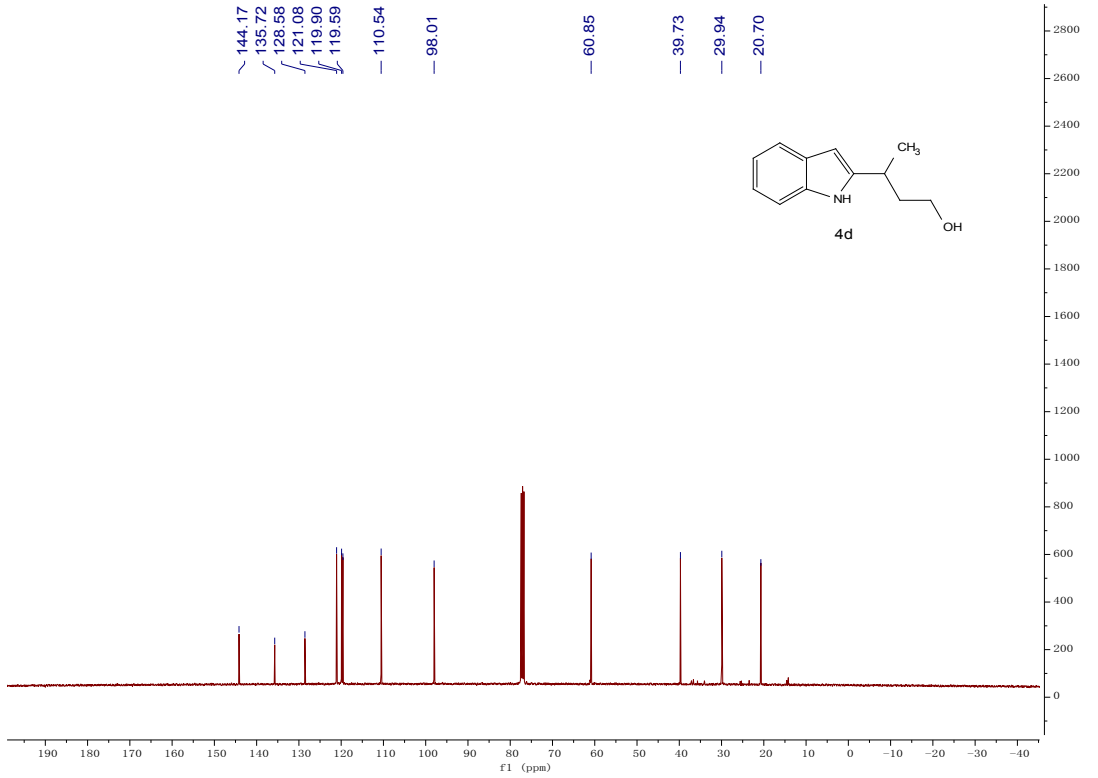
0.95
1.01
2.01
0.95
2.07
1.07
2.03
2.91
f1 (ppm)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98.01
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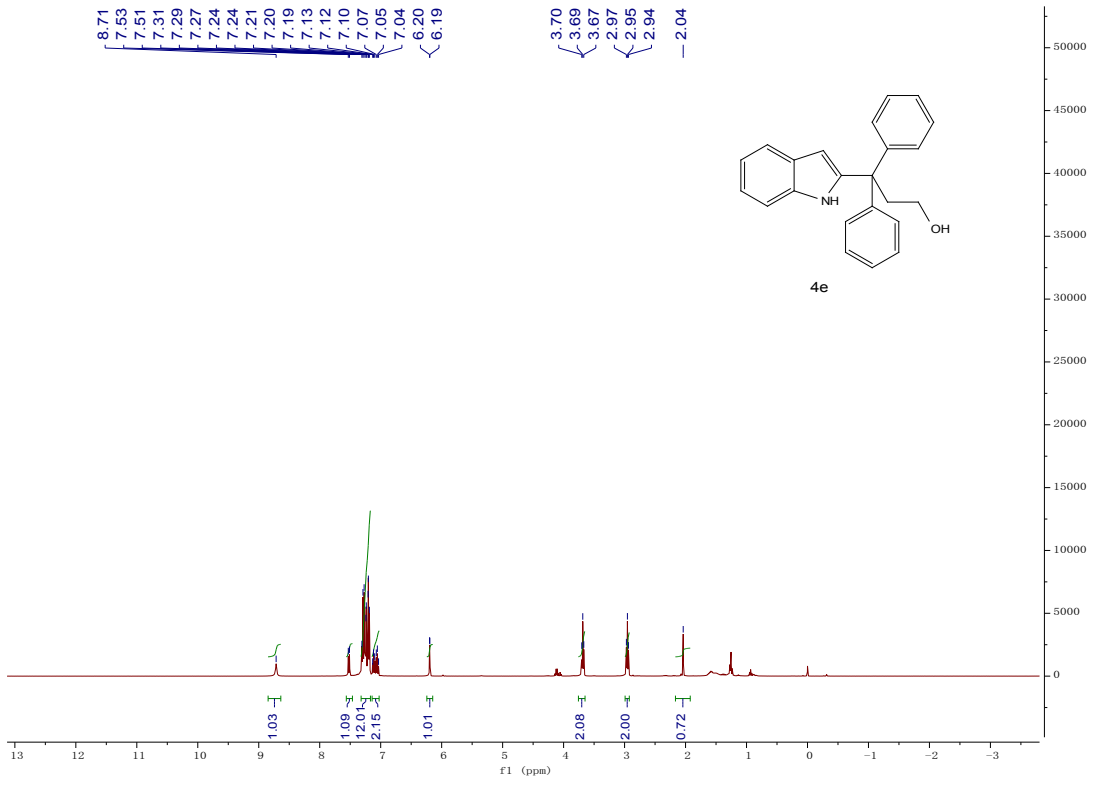
39.73
29.94
20.70
CH3
NH
OH
4d
f1 (ppm)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7.24
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7.13
7.12
7.10
7.07
7.05
7.04
6.20
6.19
3.70
3.69
3.67
2.97
2.95
2.94
2.04
NH
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1.03
1.09
12.01
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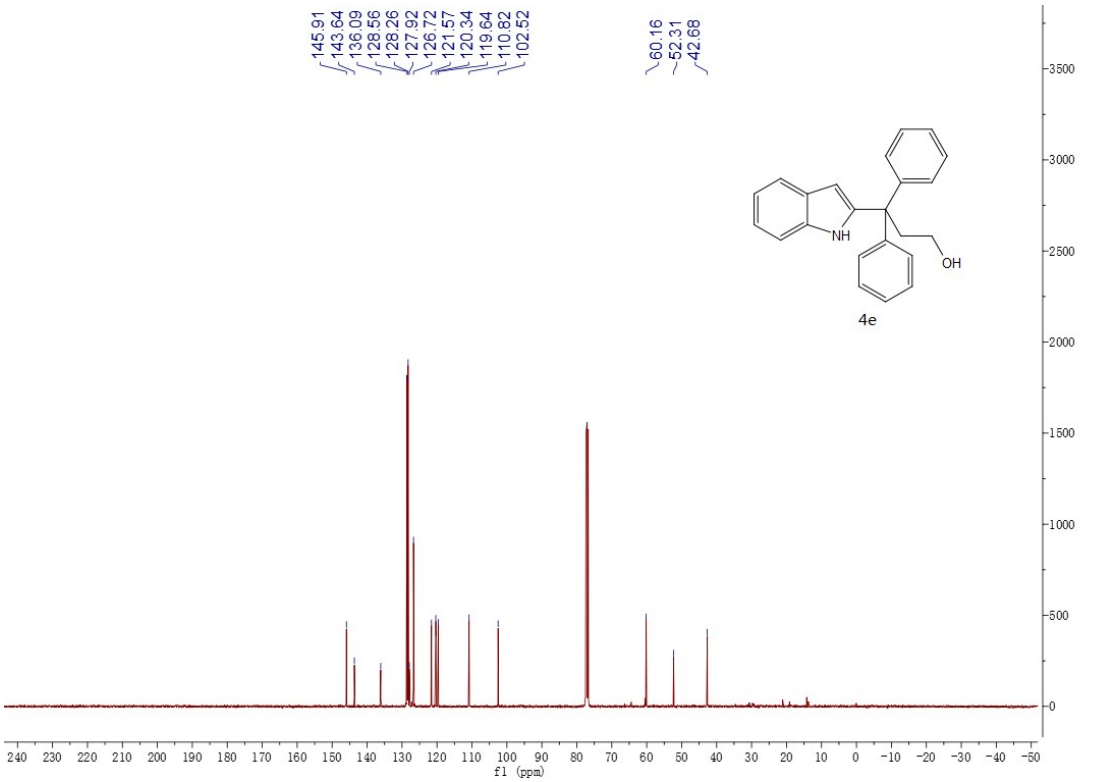
1.01
2.08
2.00
0.72
f1 (ppm)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127.92
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119.64
110.82
102.52
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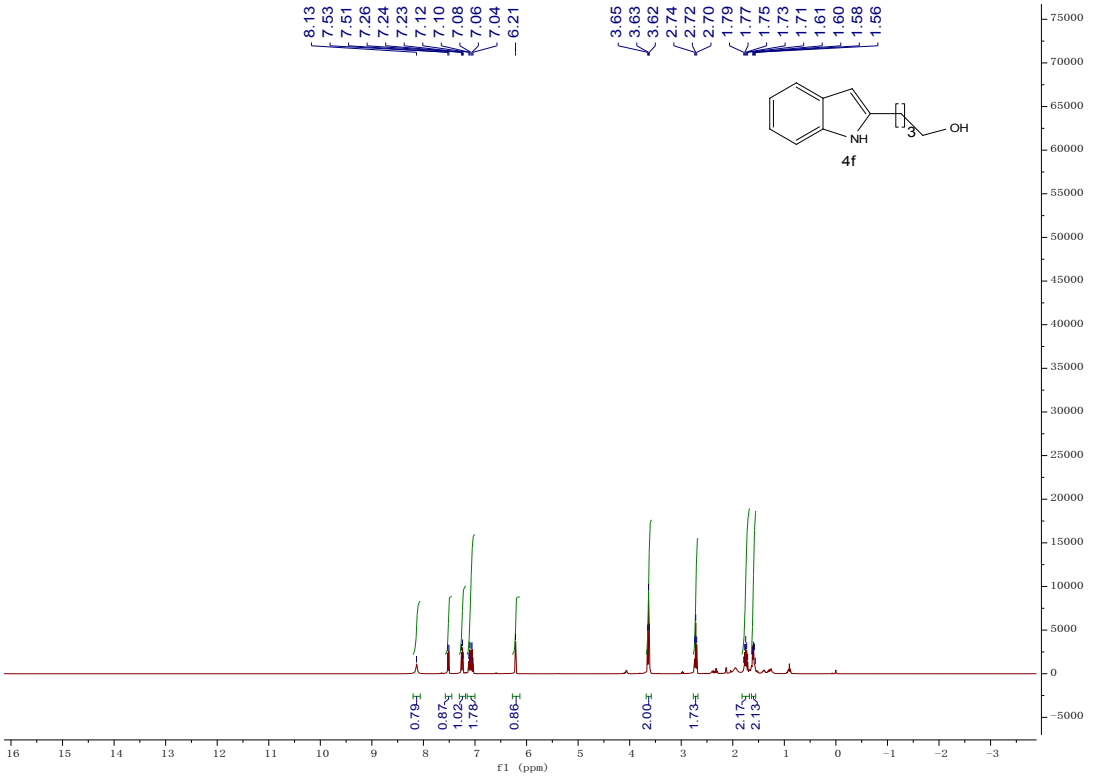
52.31
42.68
NH
OH
4e
f1 (ppm)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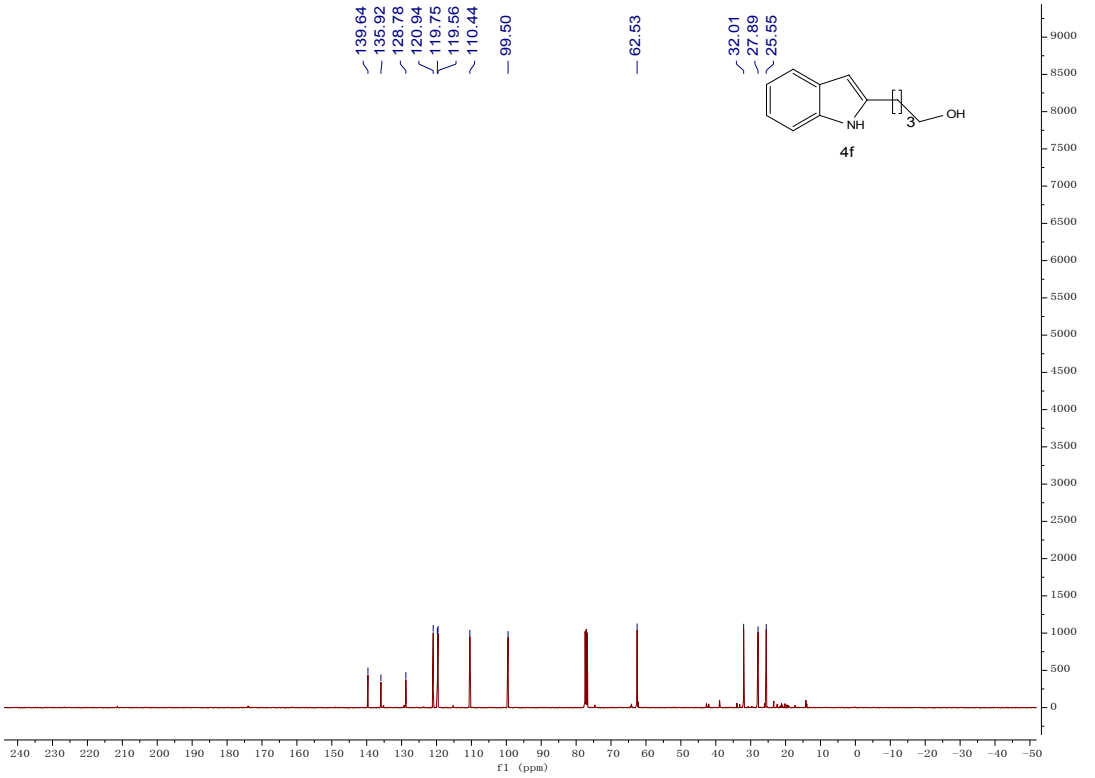
7.24
7.23
7.12
7.10
7.08
7.06
7.04
6.21
3.65
3.63
3.62
2.74
2.72
2.70
1.79
1.77
1.75
1.73
1.71
1.61
1.60
1.58
1.56
NH
3
OH
4f
0.79
0.87
1.02
1.78
0.86
2.00
1.73
2.17
2.13
f1 (ppm)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120.94
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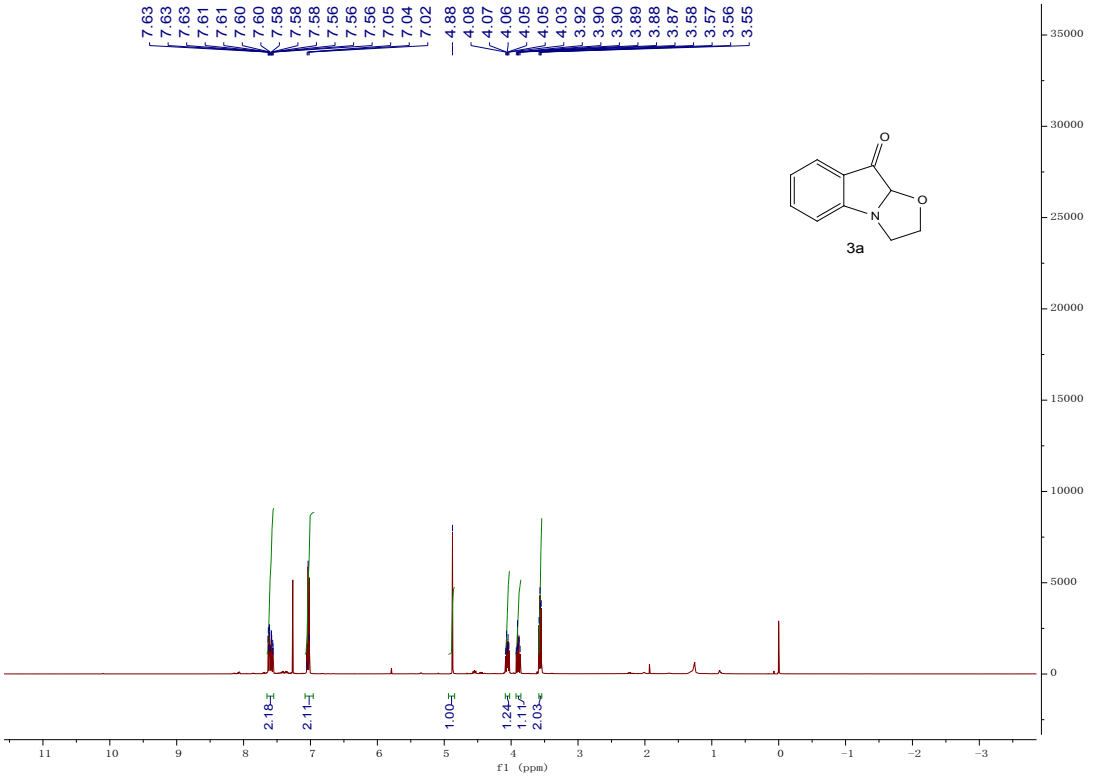
25.55
NH
3
OH
4f
f1 (ppm)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4.05
4.03
3.92
3.90
3.90
3.89
3.88
3.87
3.58
3.57
3.56
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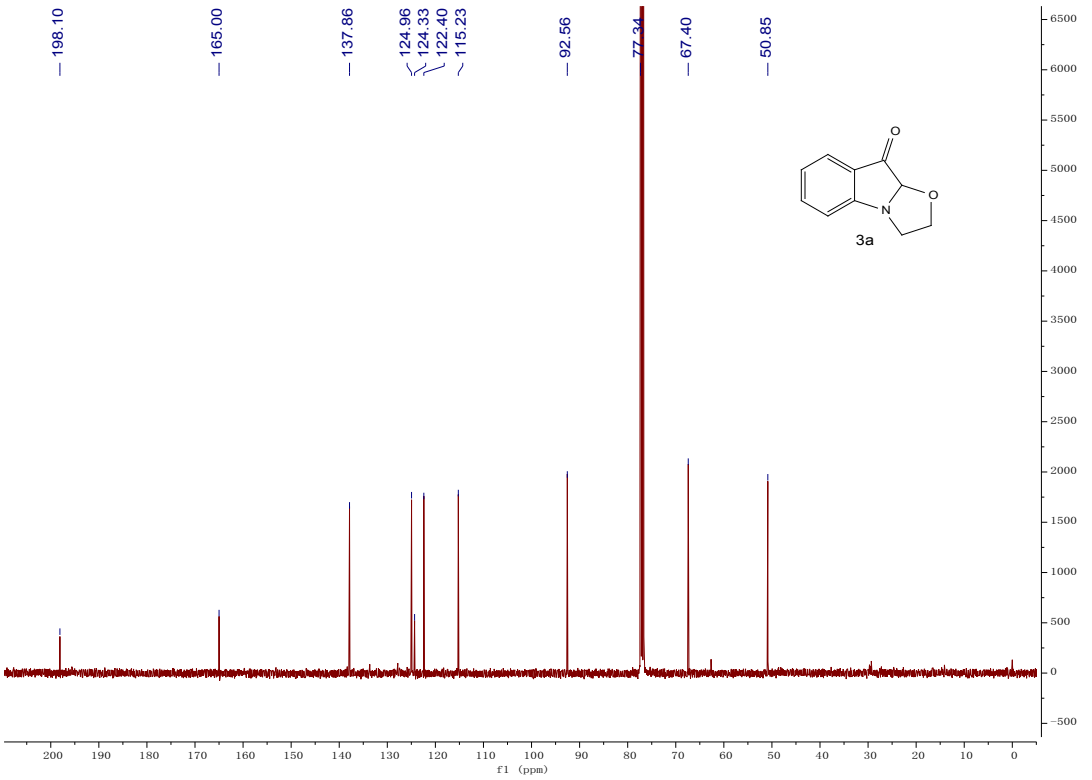
O
O
N
3a
2.18
2.11
1.00
1.24
1.11
2.03
f1 (ppm)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115.23
92.56
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50.85
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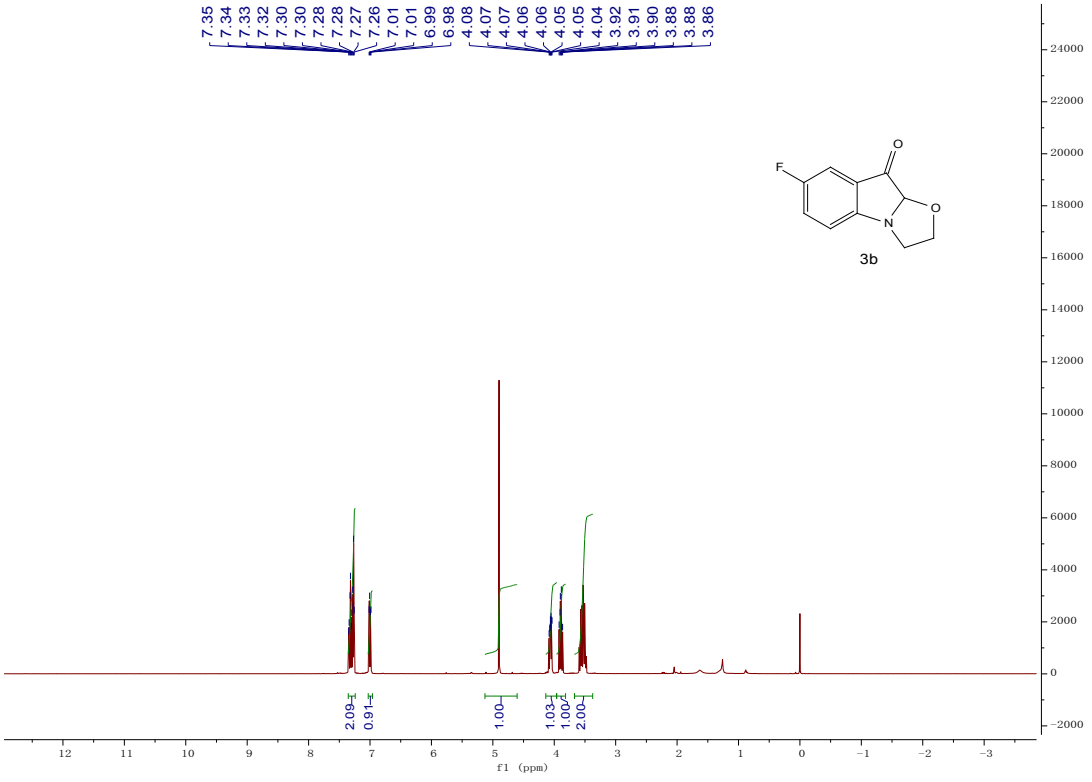
O
N
3a
f1 (ppm)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7.28
7.28
7.27
7.26
7.01
7.01
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6.98
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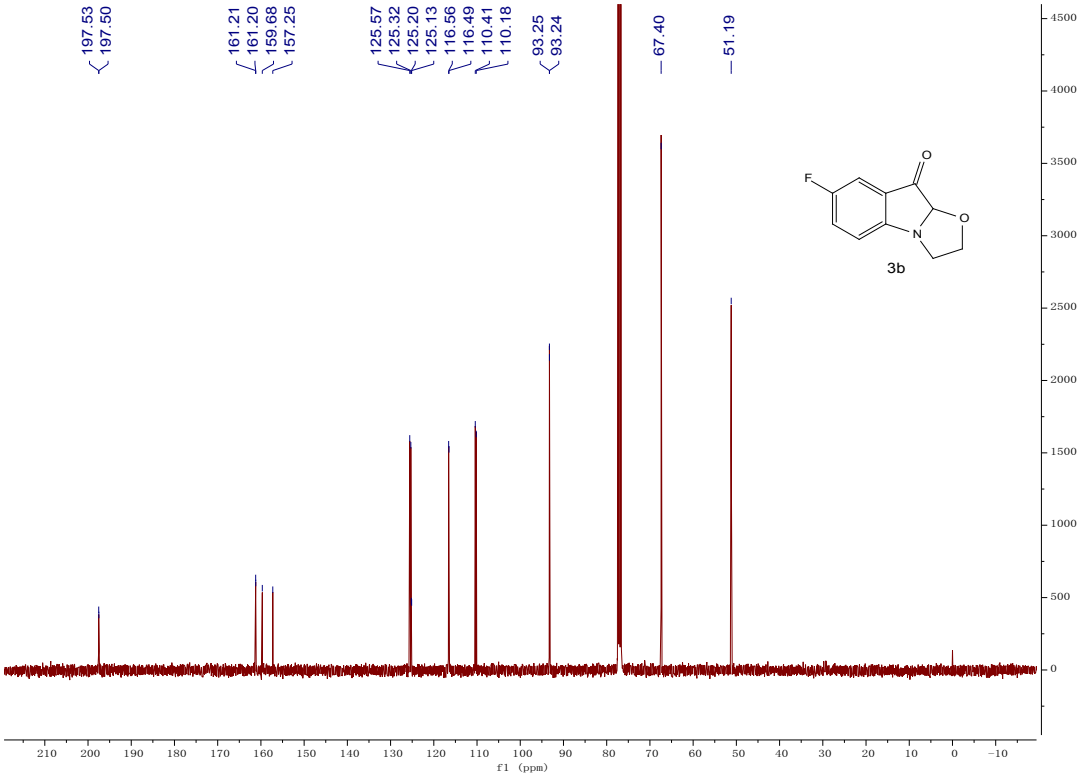
4.07
4.07
4.06
4.06
4.05
4.05
4.04
3.92
3.91
3.90
3.88
3.88
3.86
F
O
O
N
3b
2.09
0.91
1.00
1.03
1.00
2.00
f1 (ppm)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157.25
125.57
125.32
125.20
125.13
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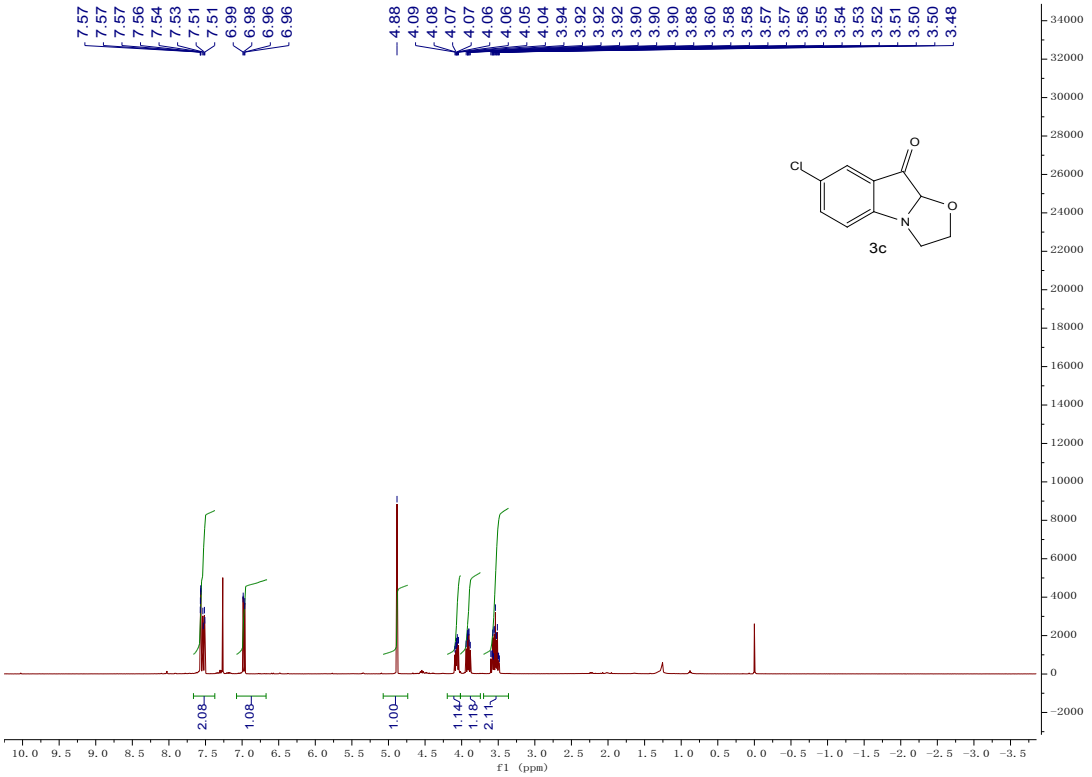
110.18
93.25
93.24
67.40
51.19
F
O
O
N
3b
f1 (ppm)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4.08
4.07
4.07
4.06
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4.04
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3.57
3.57
3.56
3.55
3.54
3.53
3.52
3.51
3.50
3.50
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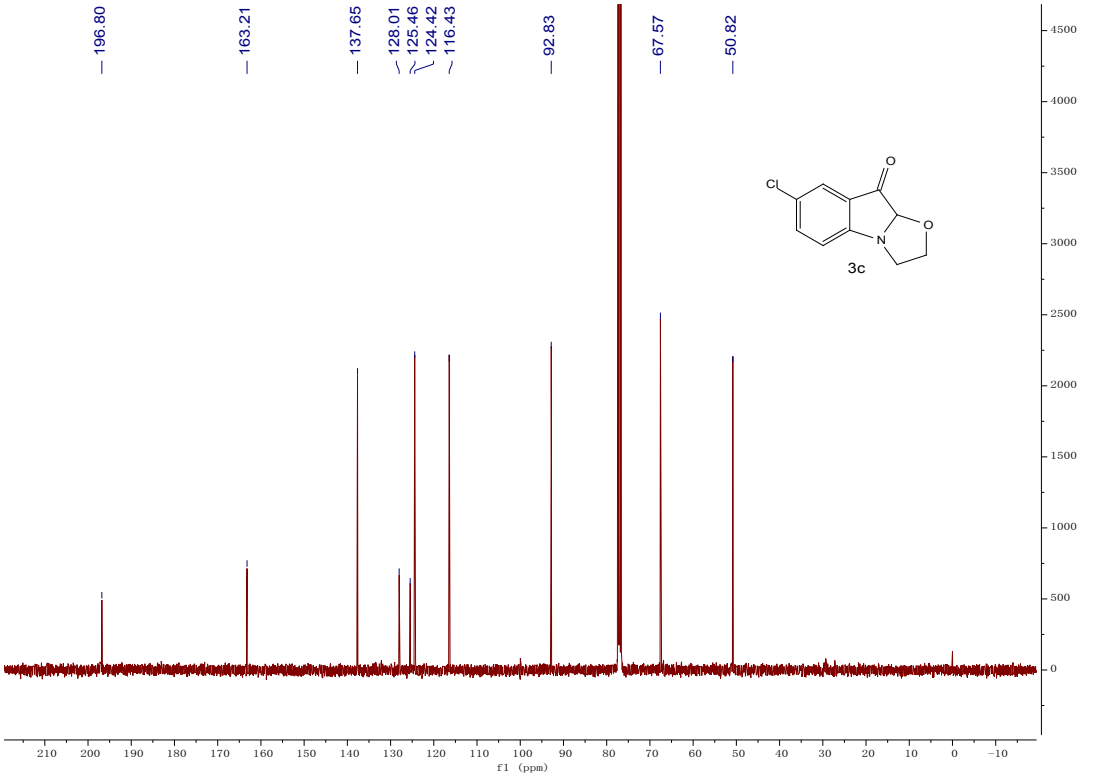
O
O
N
3c
2.08
1.08
1.00
1.14
1.18
2.11
f1 (ppm)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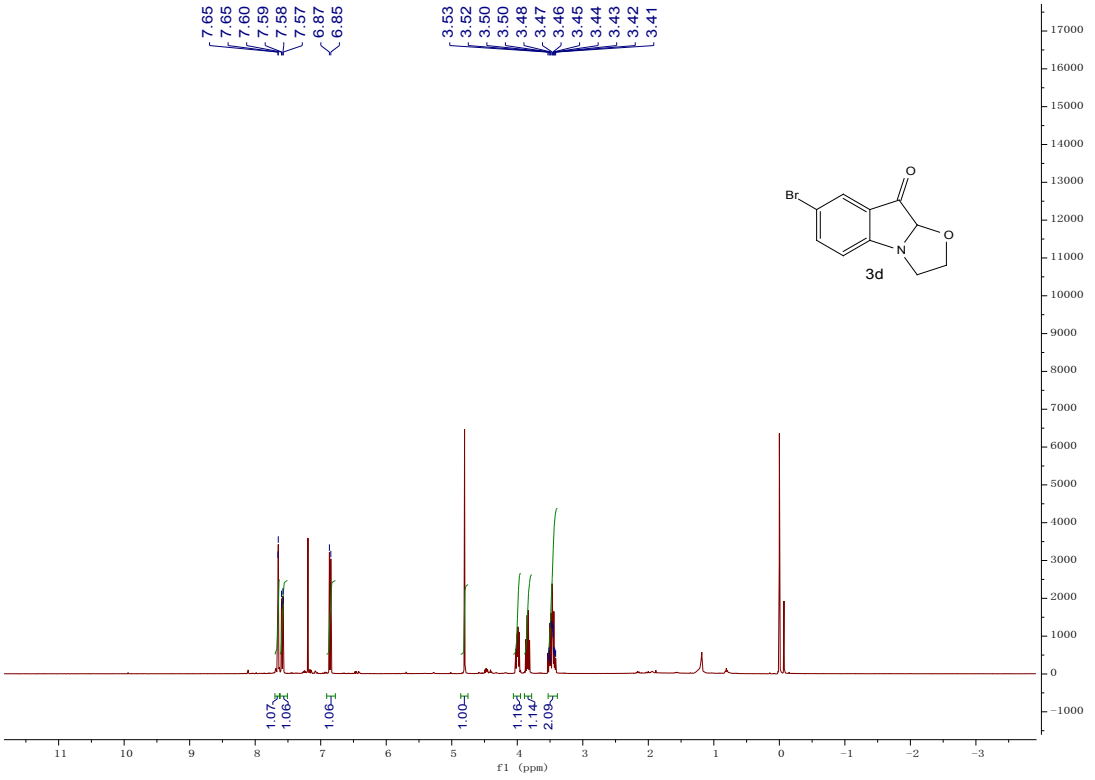
67.57
50.82
Cl
O
N
O
3c
f1 (ppm)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7.57
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6.85
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3.50
3.50
3.48
3.47
3.46
3.45
3.44
3.43
3.42
3.41
Br
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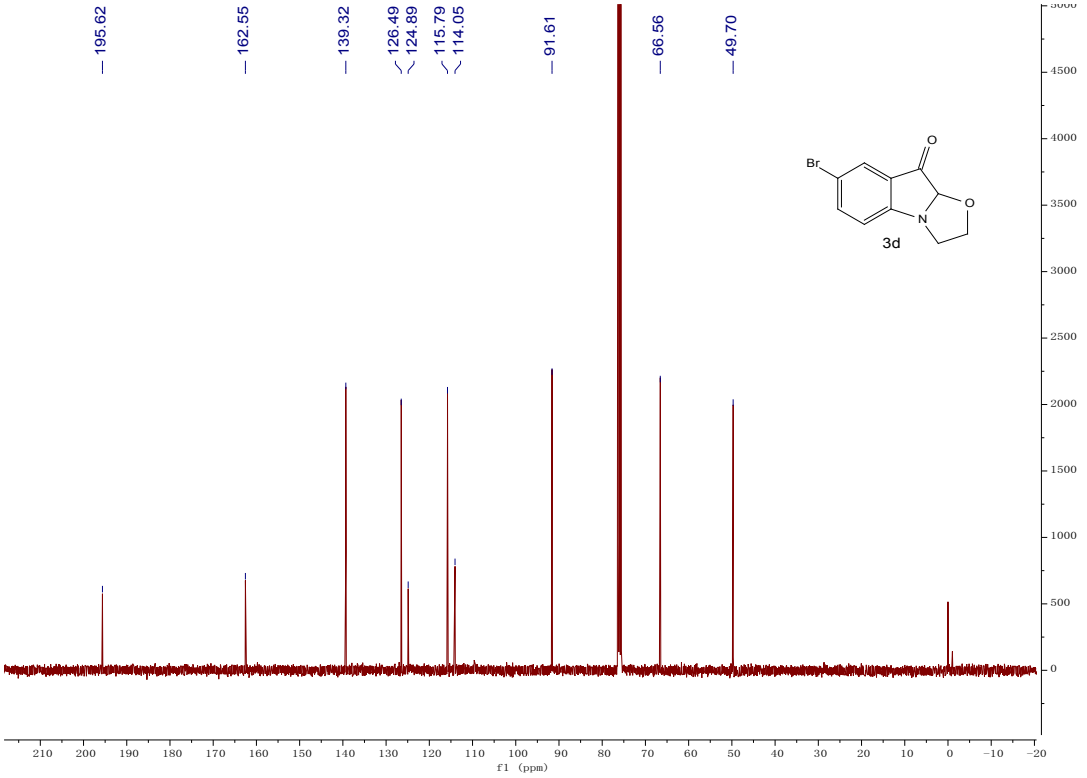
N
O
3d
1.07
1.06
1.06
1.00
1.16
1.14
2.09
f1 (ppm)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114.05
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66.56
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Br
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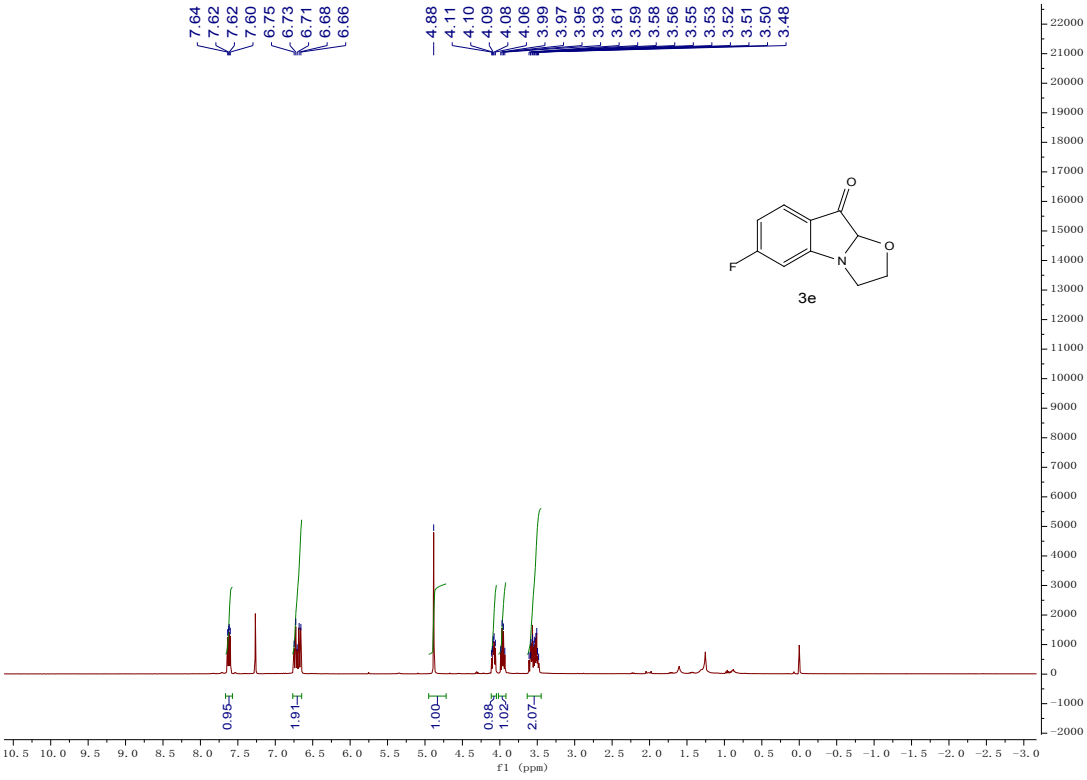
O
N
3d
f1 (ppm)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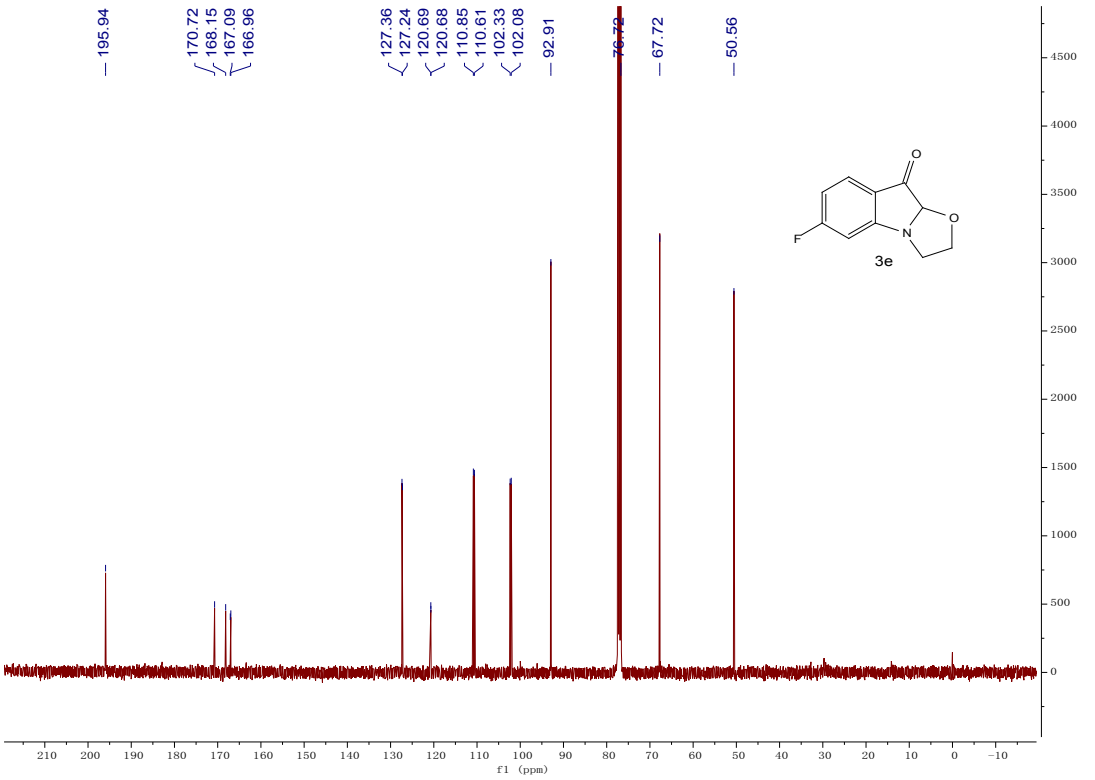
4.11
4.10
4.09
4.08
4.06
3.99
3.97
3.95
3.93
3.61
3.59
3.58
3.56
3.55
3.53
3.52
3.51
3.50
3.48
O
F
N
O
3e
0.95
1.91
1.00
0.98
1.02
2.07
f1 (ppm)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127.24
120.69
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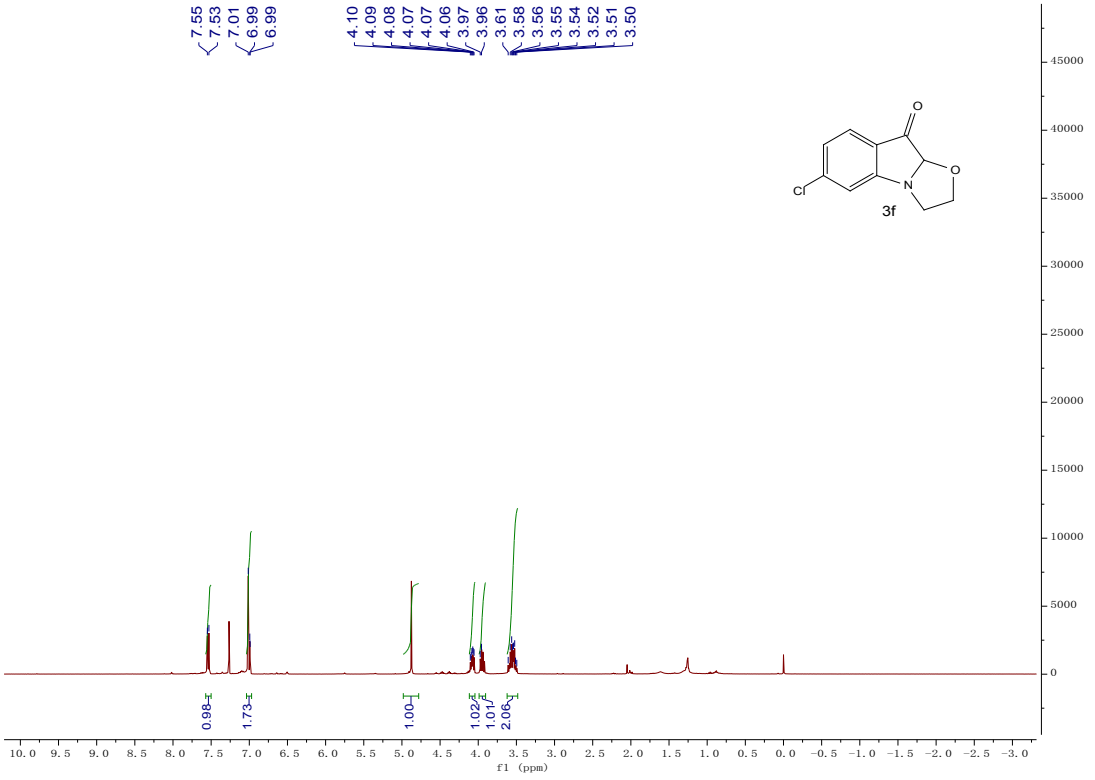
102.08
92.91
76.72
67.72
50.56
O
F
N
O
3e
f1 (ppm)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4.08
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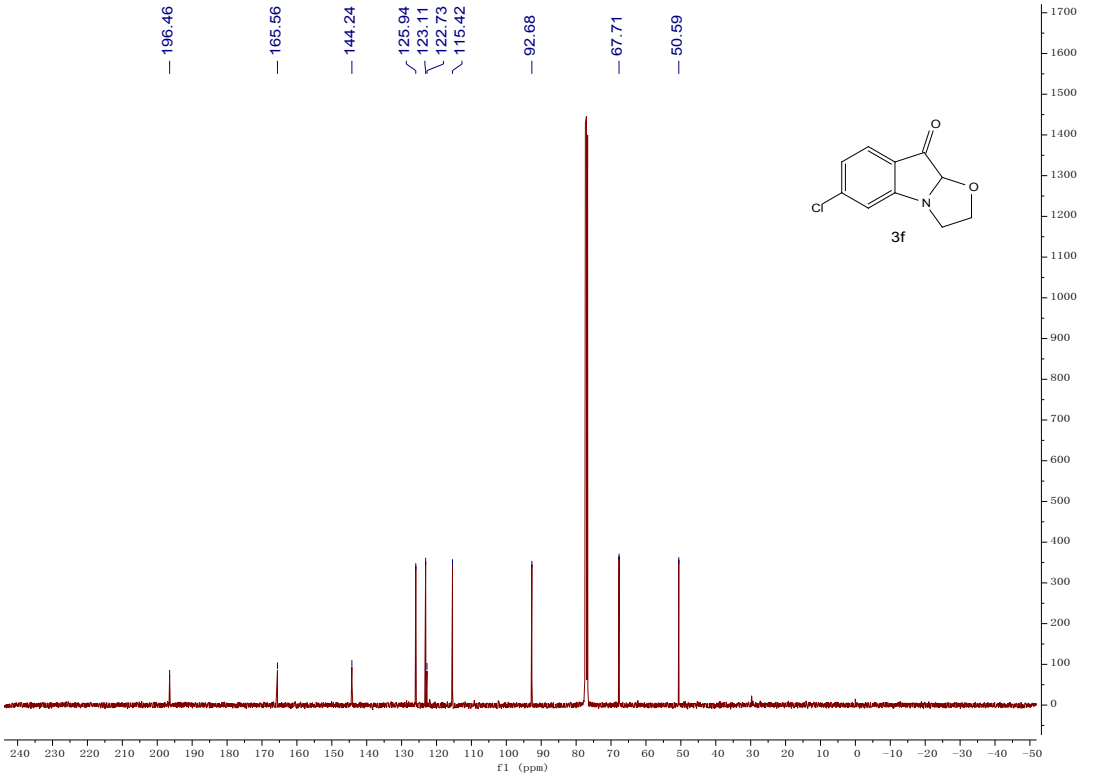
4.07
4.06
3.97
3.96
3.61
3.58
3.56
3.55
3.54
3.52
3.51
3.50
O
Cl
N
O
3f
0.98
1.73
1.00
1.02
1.01
2.06
f1 (ppm)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67.71
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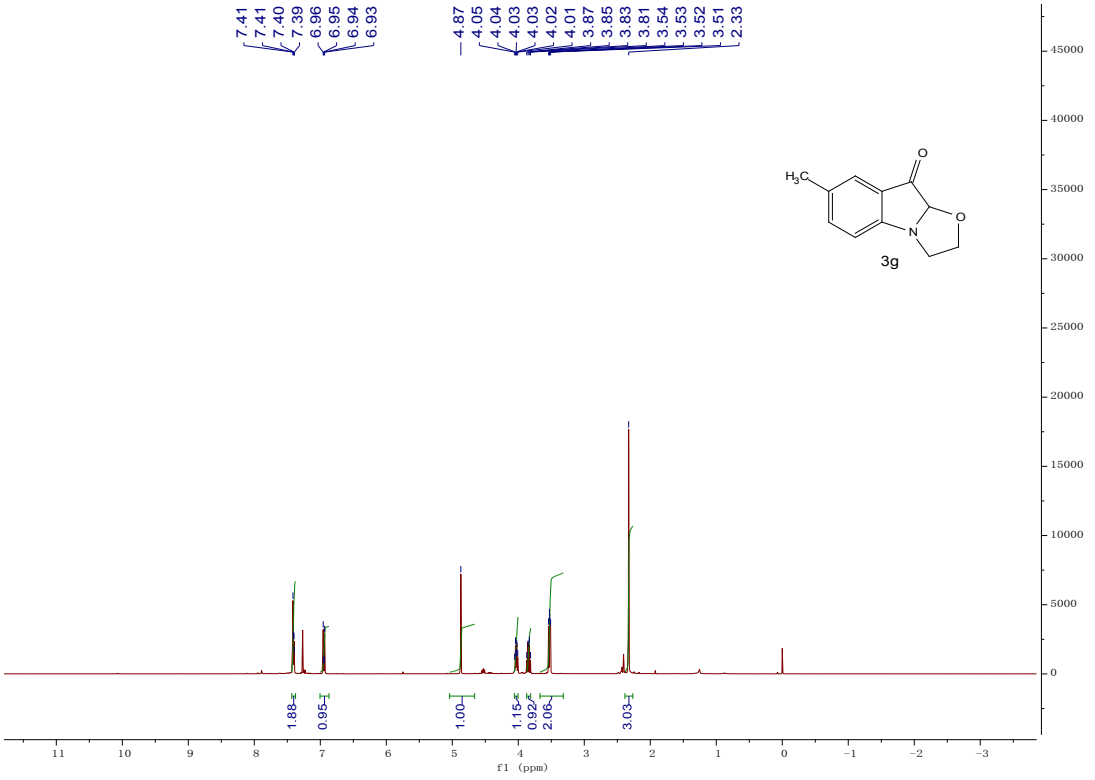
O
Cl
N
O
3f
f1 (ppm)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4.03
4.02
4.01
3.87
3.85
3.83
3.81
3.54
3.53
3.52
3.51
2.33
H3C
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1.00
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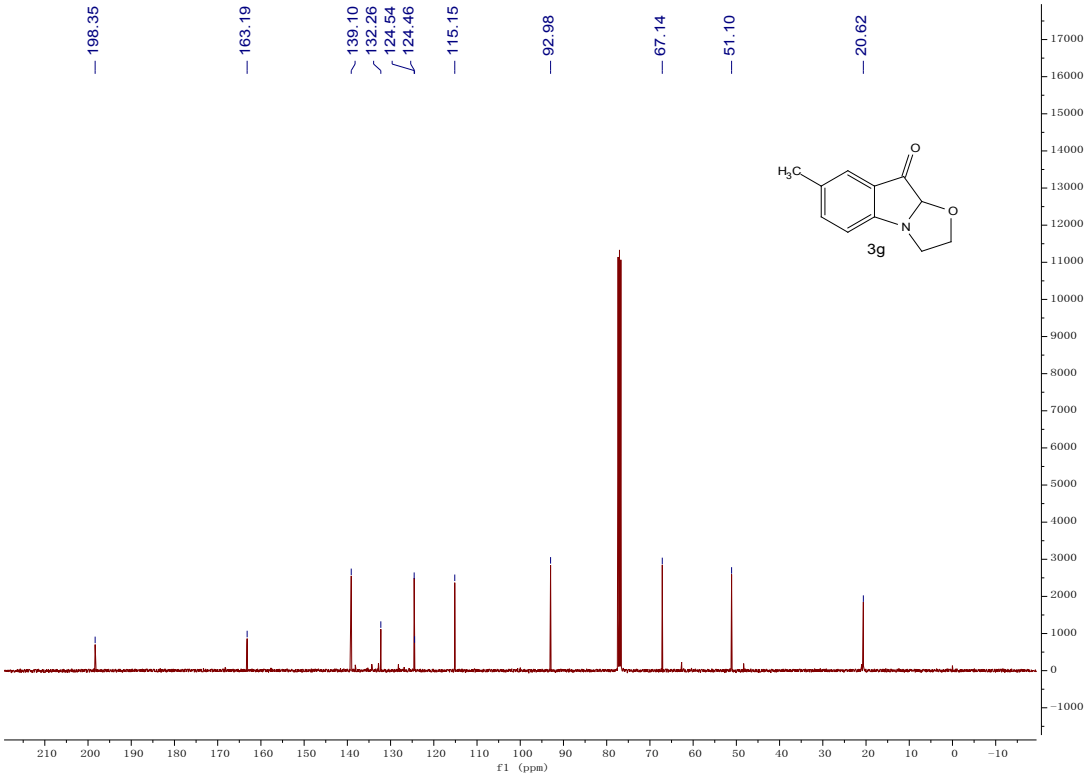
0.92
2.06
3.03
f1 (ppm)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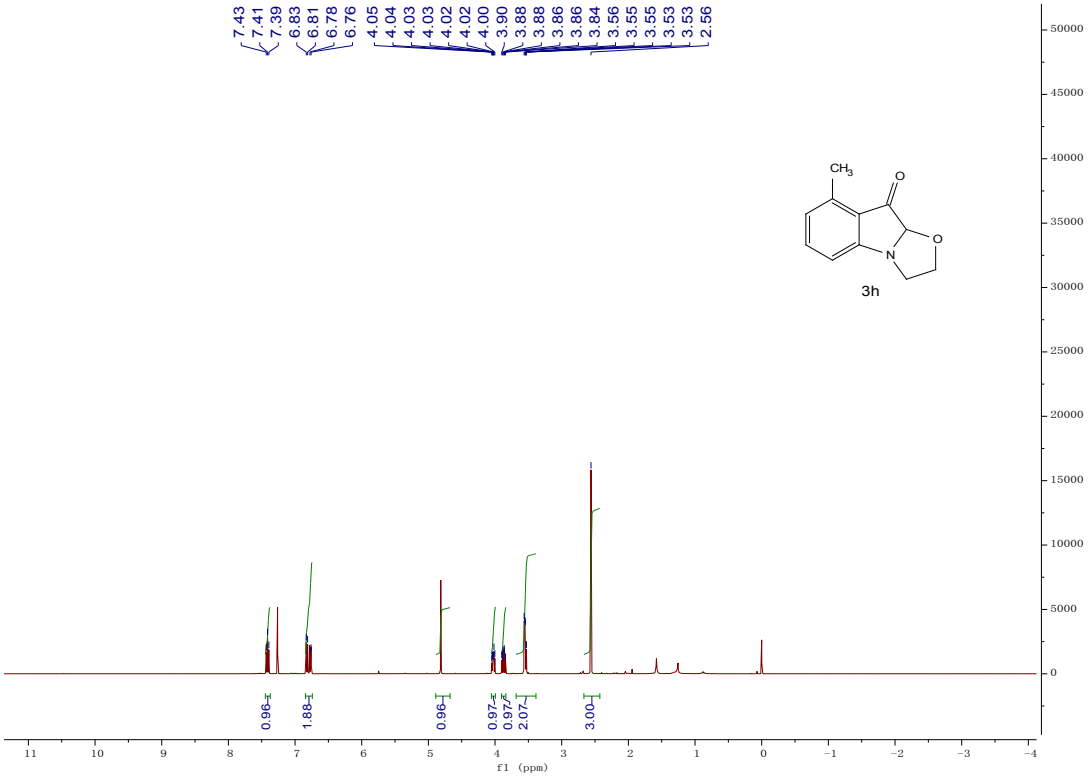
92.98
67.14
51.10
20.62
O
H3C
O
N
3g
f1 (ppm)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4.02
4.02
4.00
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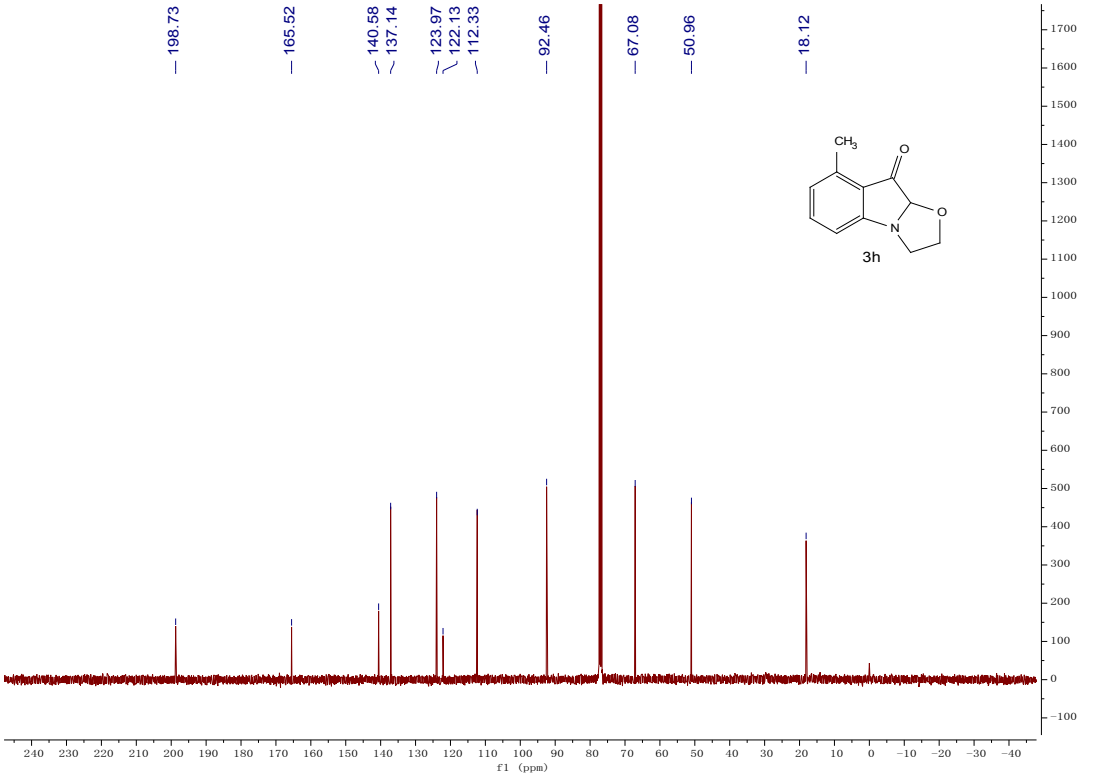
3.88
3.86
3.86
3.84
3.56
3.55
3.55
3.53
3.53
2.56
CH3
O
O
N
3h
0.96
1.88
0.96
0.97
0.97
2.07
3.00
f1 (ppm)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67.08
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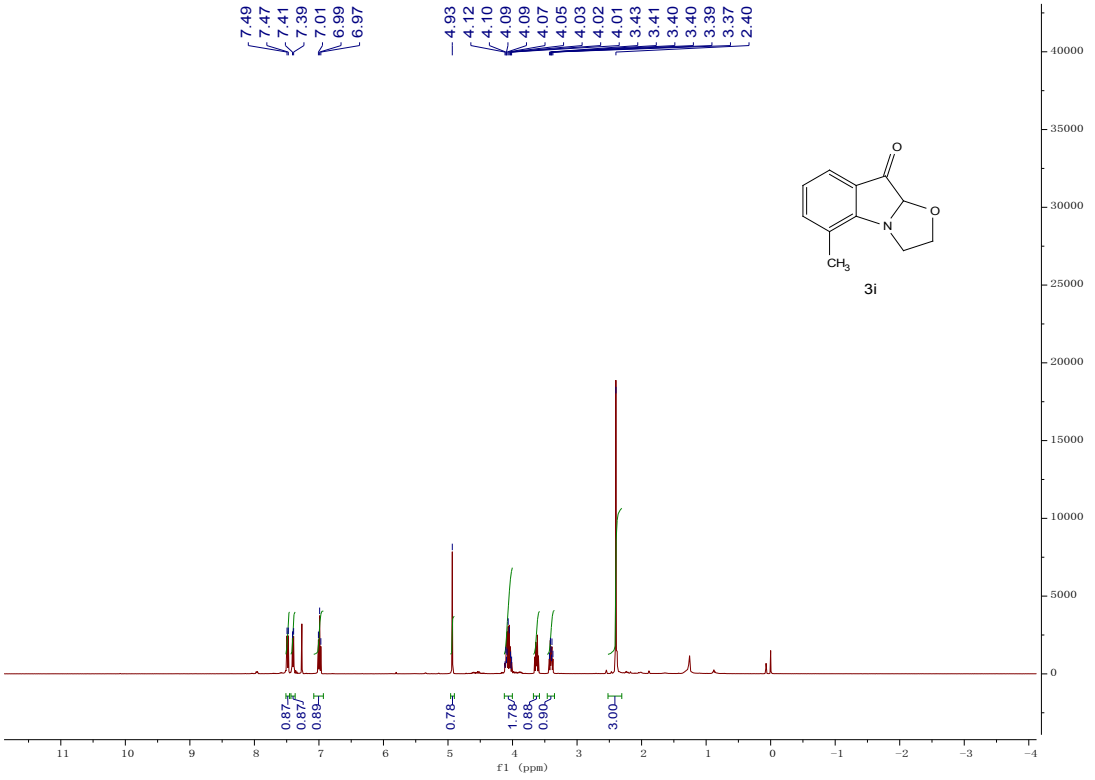
18.12
CH3
O
O
N
3h
f1 (ppm)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4.09
4.09
4.07
4.05
4.03
4.02
4.01
3.43
3.41
3.40
3.40
3.39
3.37
2.40
O
O
N
CH3
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0.87
0.89
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1.78
0.88
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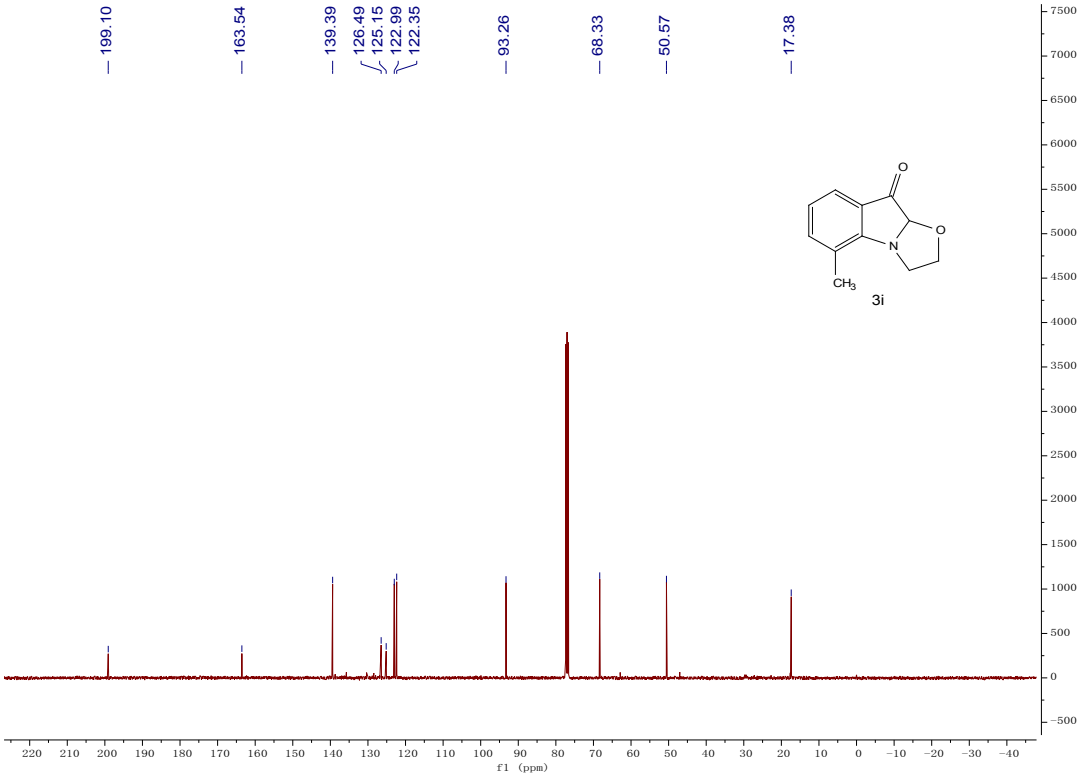
3.00
f1 (ppm)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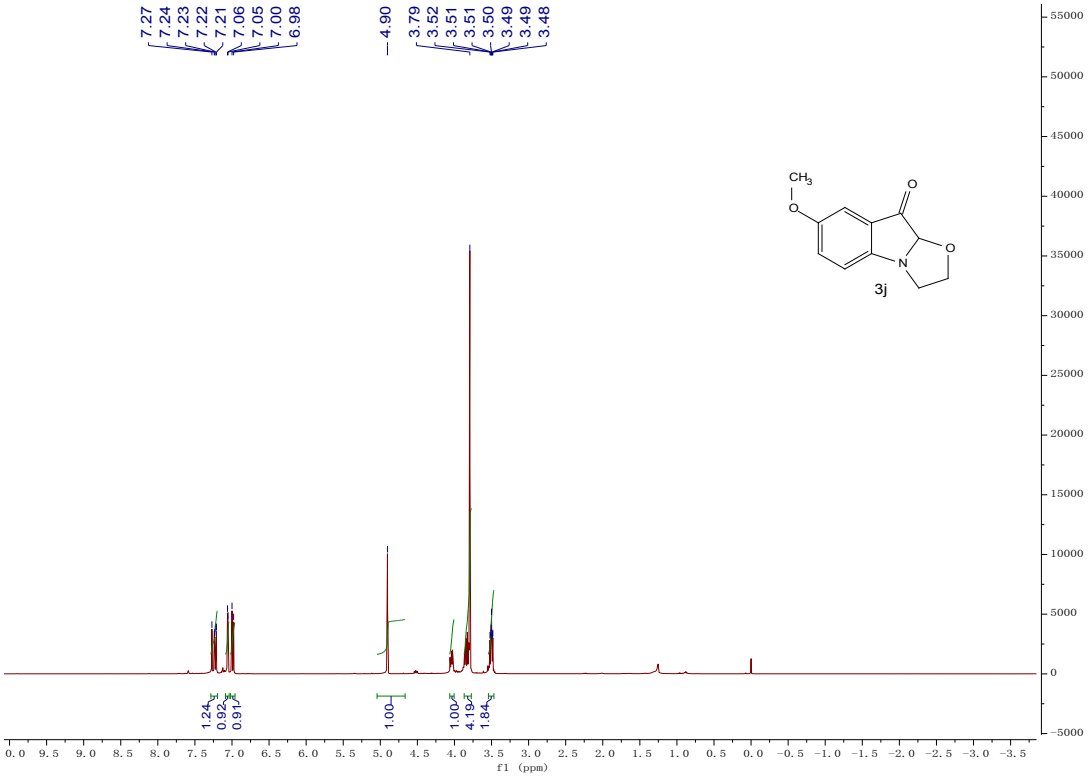
122.99
122.35
93.26
68.33
50.57
17.38
O
O
N
CH3
3i
f1 (ppm)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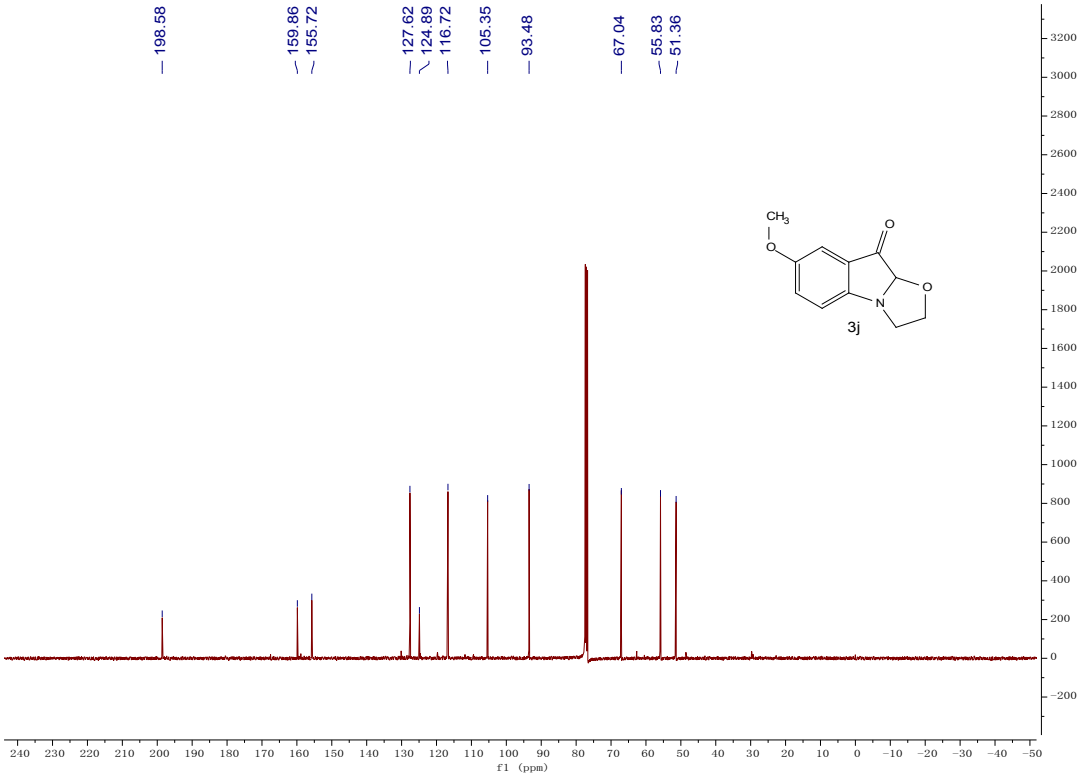
7.23
7.22
7.21
7.06
7.05
7.00
6.98
4.90
3.79
3.52
3.51
3.51
3.50
3.49
3.49
3.48
CH3
O
O
N
O
3j
1.24
0.92
0.91
1.00
1.00
4.19
1.84
f1 (ppm)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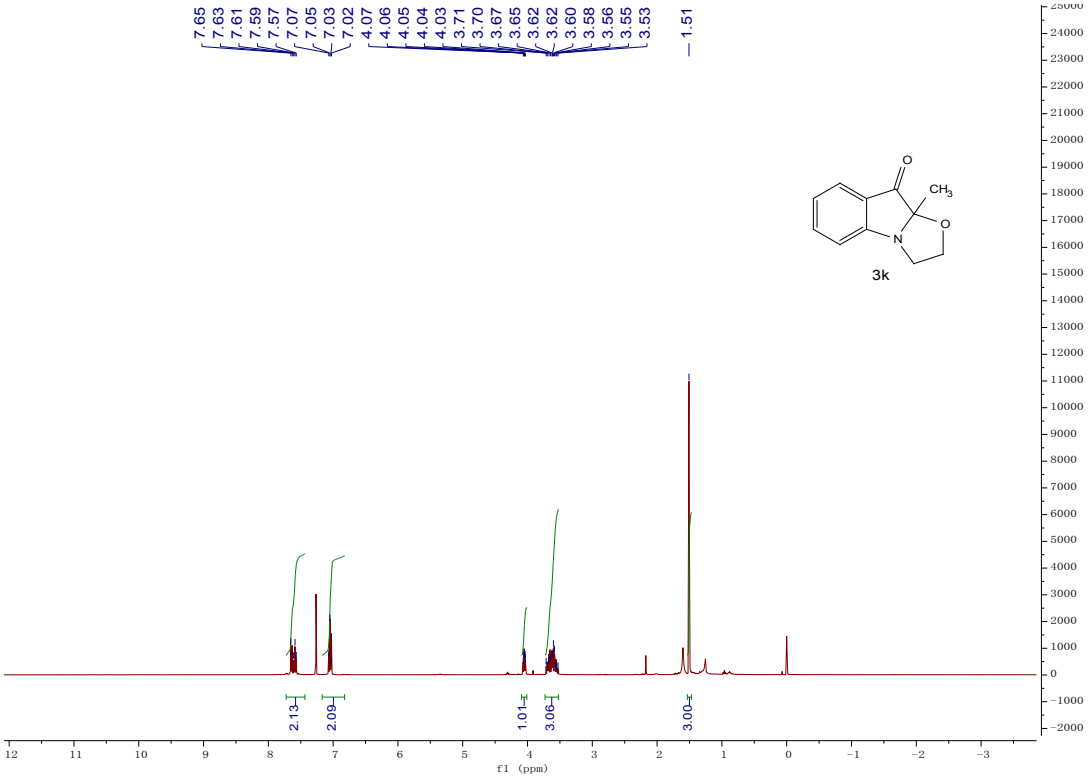
155.72
127.62
124.89
116.72
105.35
93.48
67.04
55.83
51.36
CH3
O
O
O
N
O
3j
f1 (ppm)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7.07
7.05
7.03
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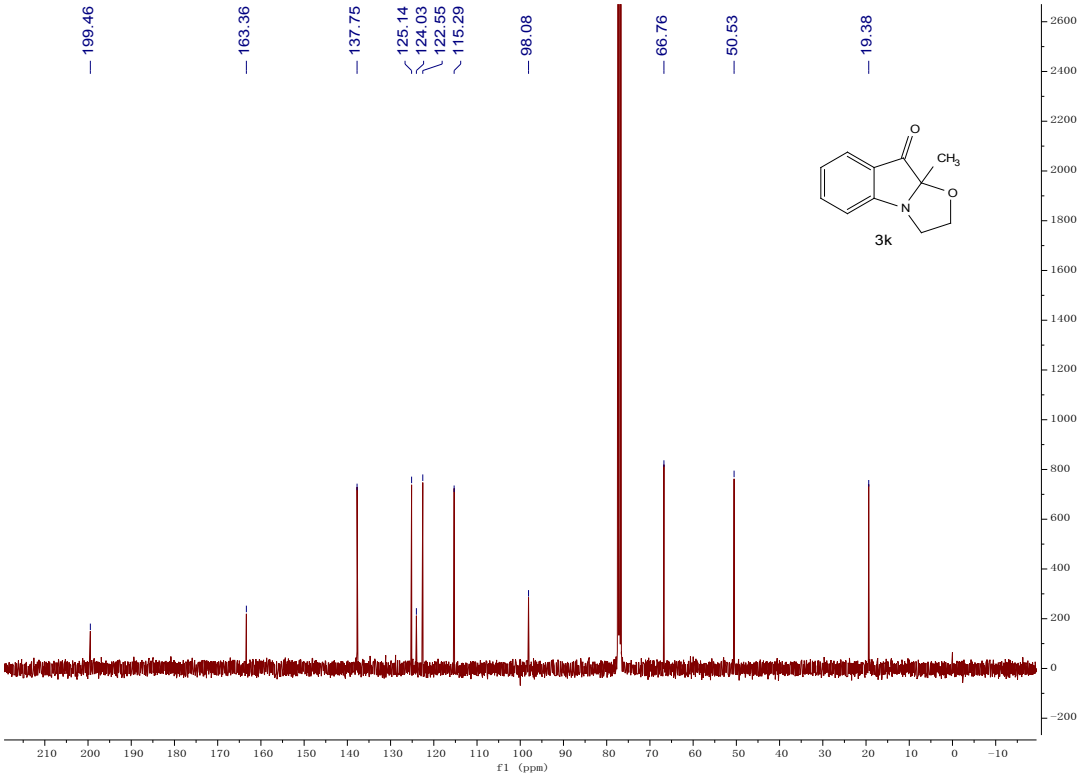
4.07
4.06
4.05
4.04
4.03
3.71
3.70
3.67
3.65
3.62
3.62
3.60
3.58
3.56
3.55
3.53
1.51
O
CH3
O
N
3k
2.13
2.09
1.01
3.06
3.00
f1 (ppm)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125.14
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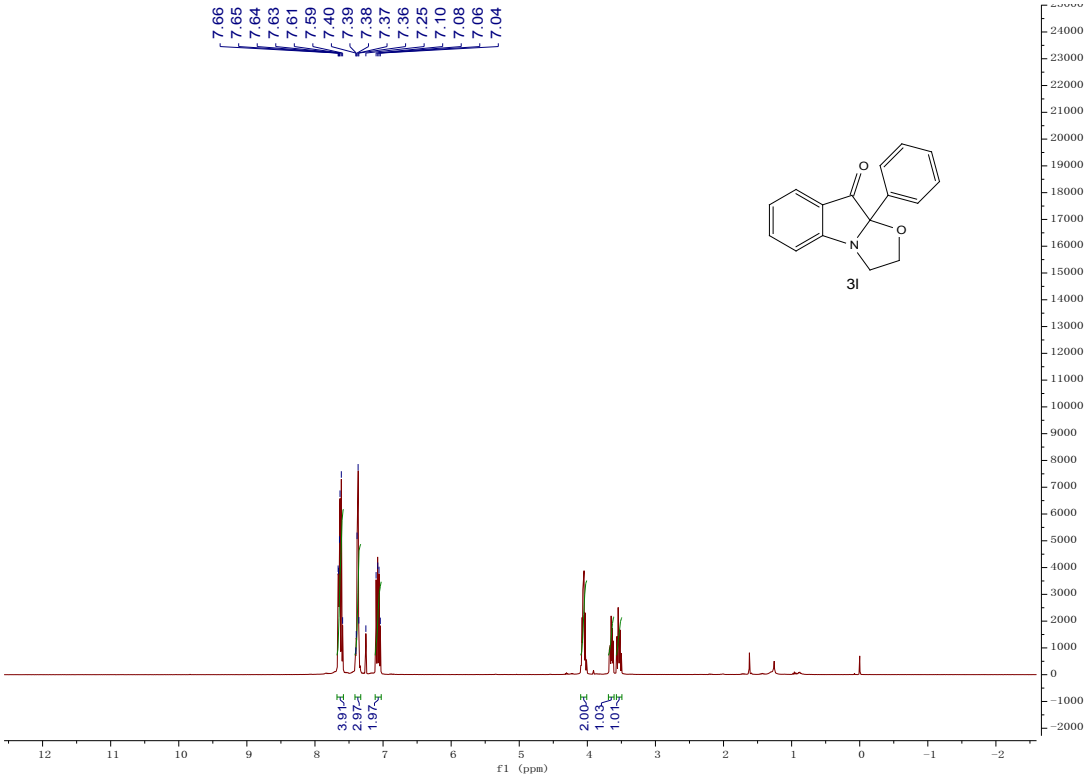
115.29
98.08
66.76
50.53
19.38
O
CH3
O
N
3k
f1 (ppm)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7.64
7.63
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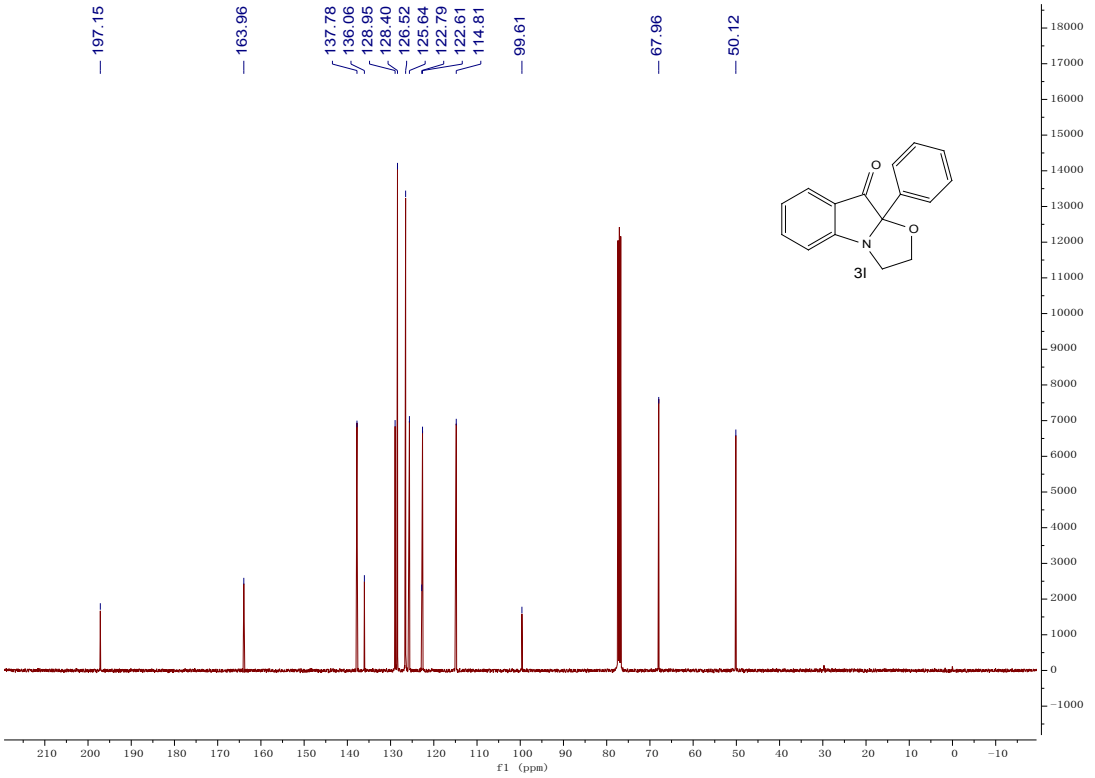
7.59
7.40
7.39
7.38
7.37
7.36
7.25
7.10
7.08
7.06
7.04
O
O
N
3l
3.91
2.97
1.97
2.00
1.03
1.01
f1 (ppm)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137.78
136.06
128.95
128.40
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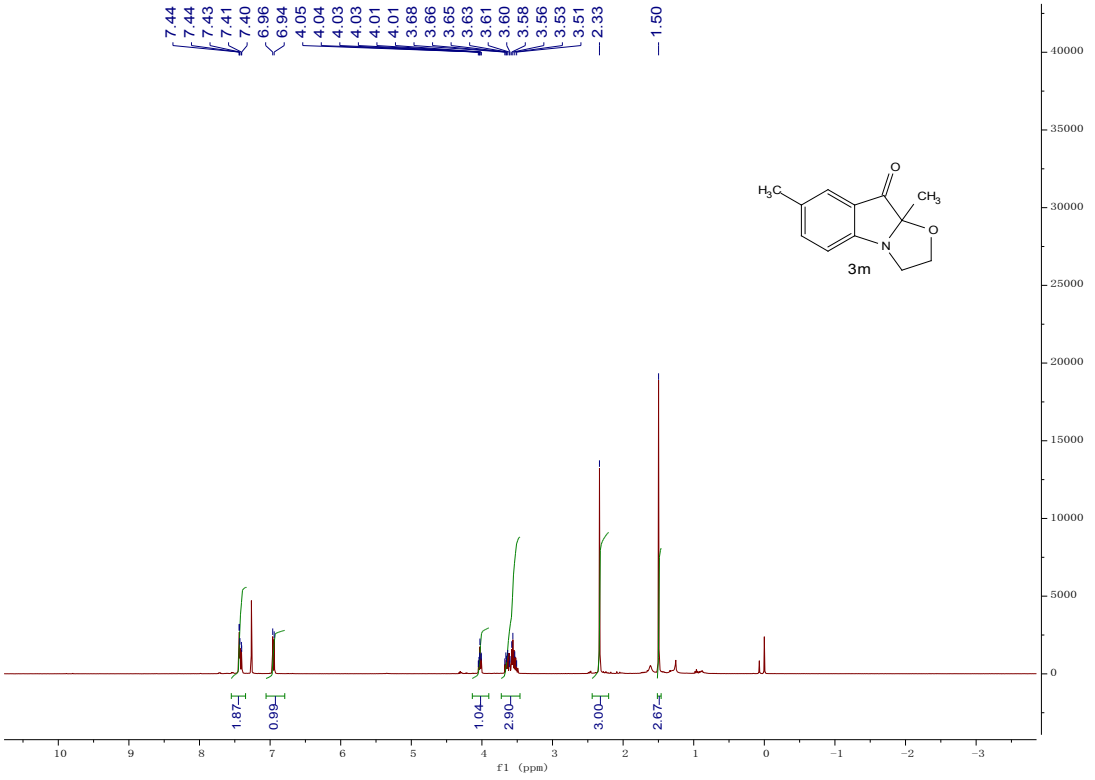
122.79
122.61
114.81
99.61
67.96
50.12
O
O
N
3l
f1 (ppm)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7.44
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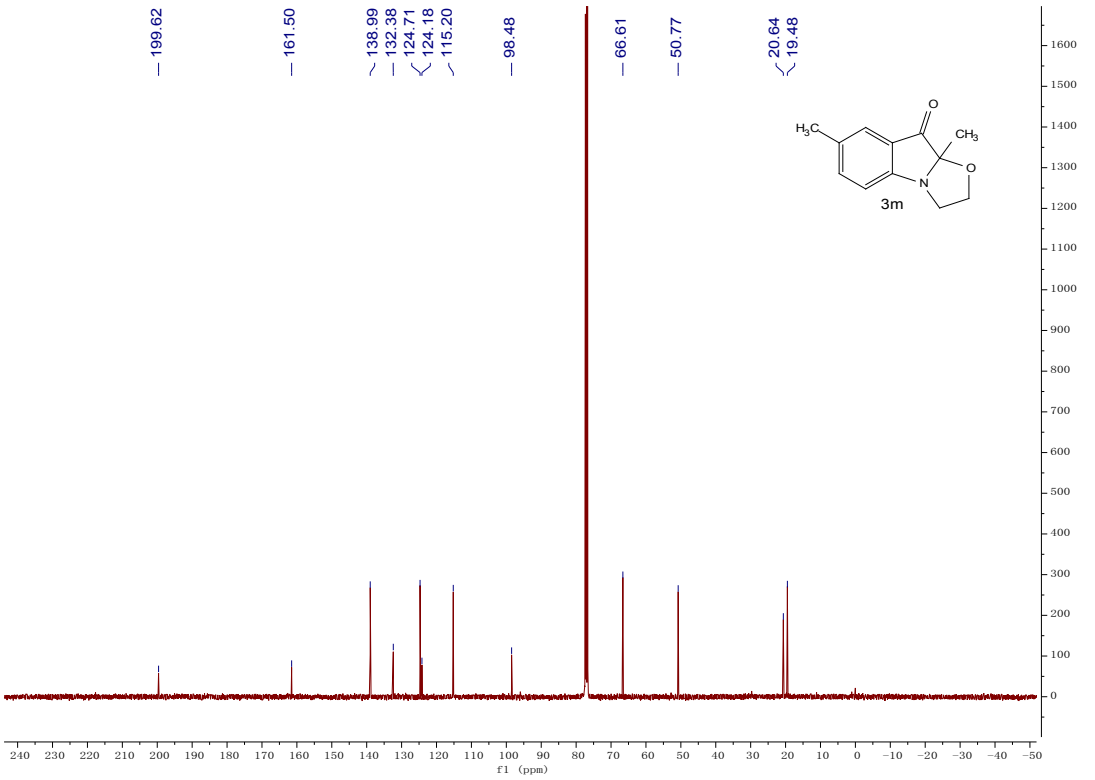
7.40
6.96
6.94
4.05
4.04
4.03
4.03
4.01
4.01
3.68
3.66
3.65
3.63
3.61
3.60
3.58
3.56
3.53
3.51
2.33
1.50
H3C
CH3
O
O
N
3m
1.87
0.99
1.04
2.90
3.00
2.67
f1 (ppm)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161.50
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132.38
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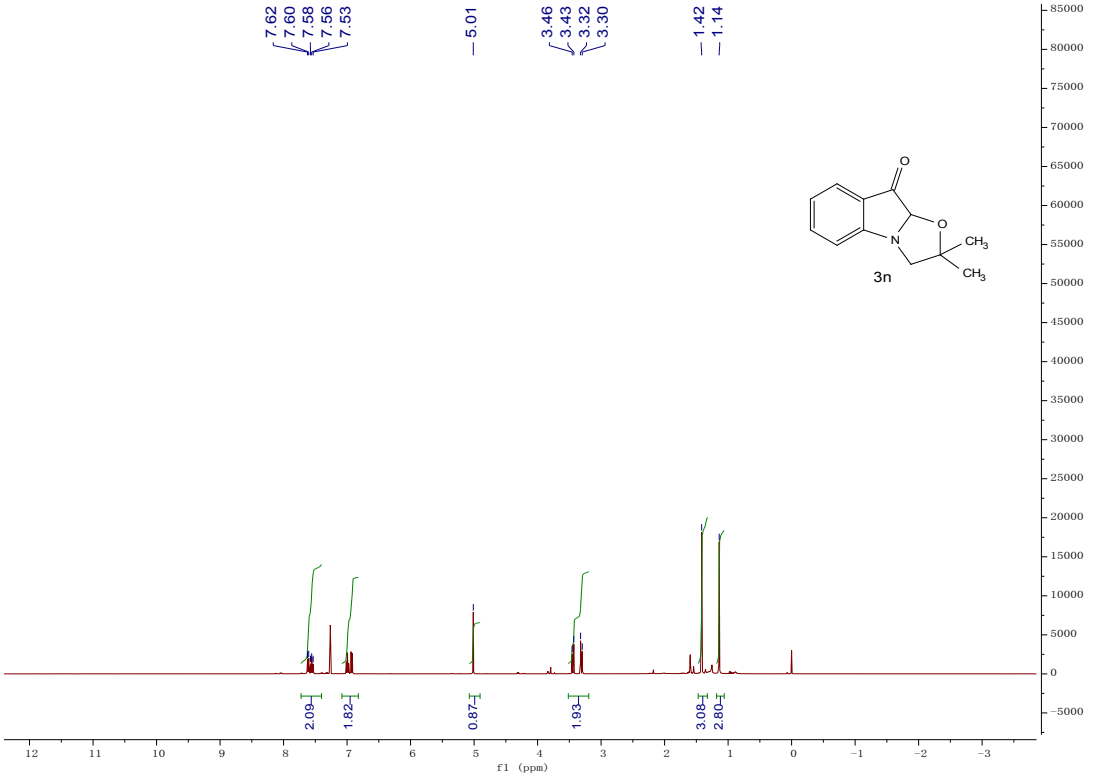
124.18
115.20
98.48
66.61
50.77
20.64
19.48
3m
f1 (ppm)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7.60
7.58
7.56
7.53
5.01
3.46
3.43
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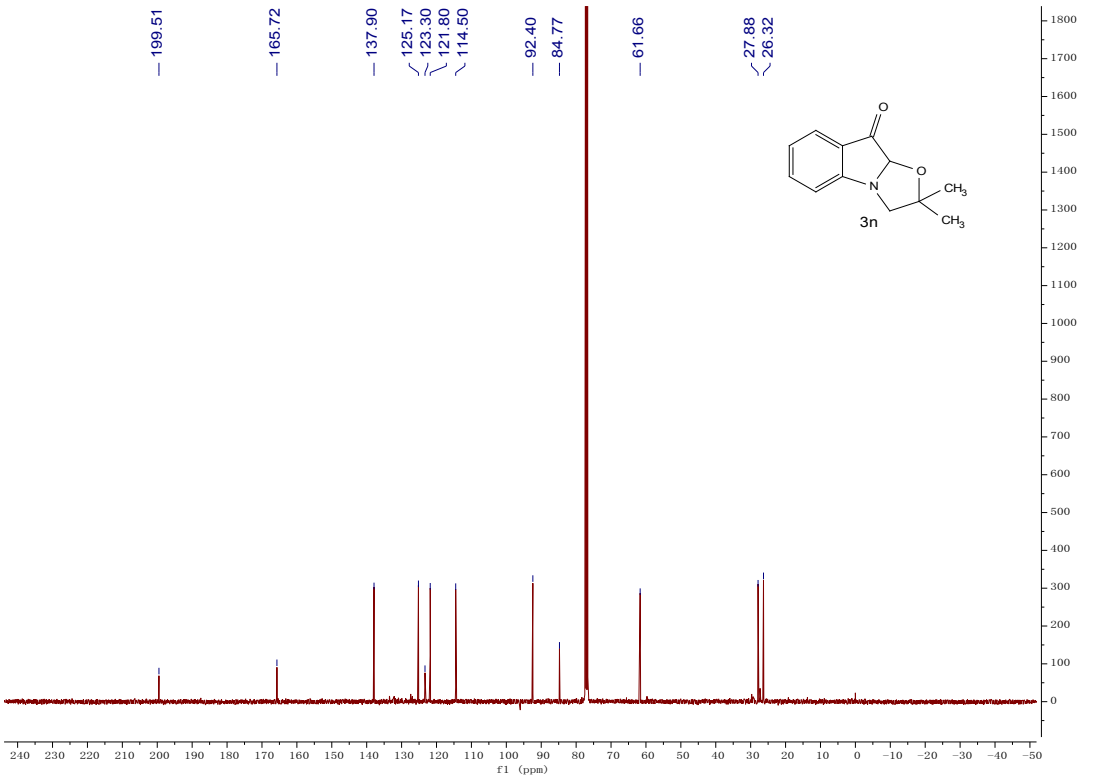
1.42
1.14
3n
2.09
1.82
0.87
1.93
3.08
2.80
f1 (ppm)


199.51
165.72
137.90
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123.30
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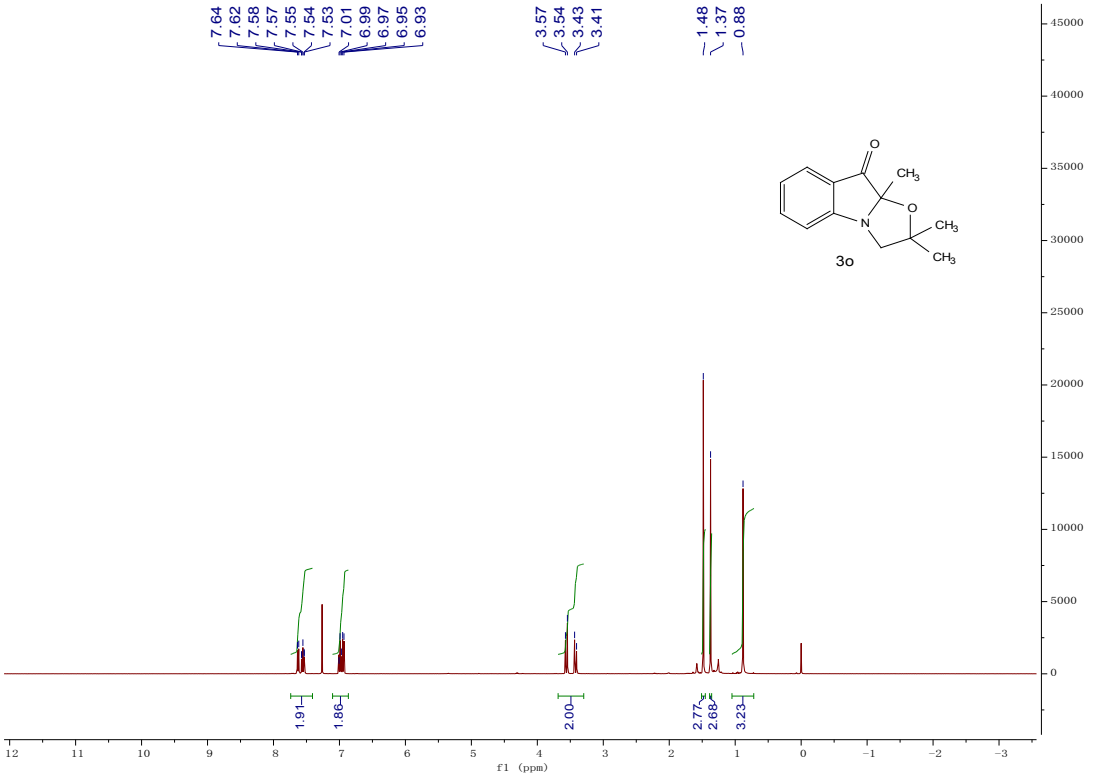
61.66
27.88
26.32
O
O
N
CH3
CH3
3n
f1 (ppm)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7.54
7.53
7.01
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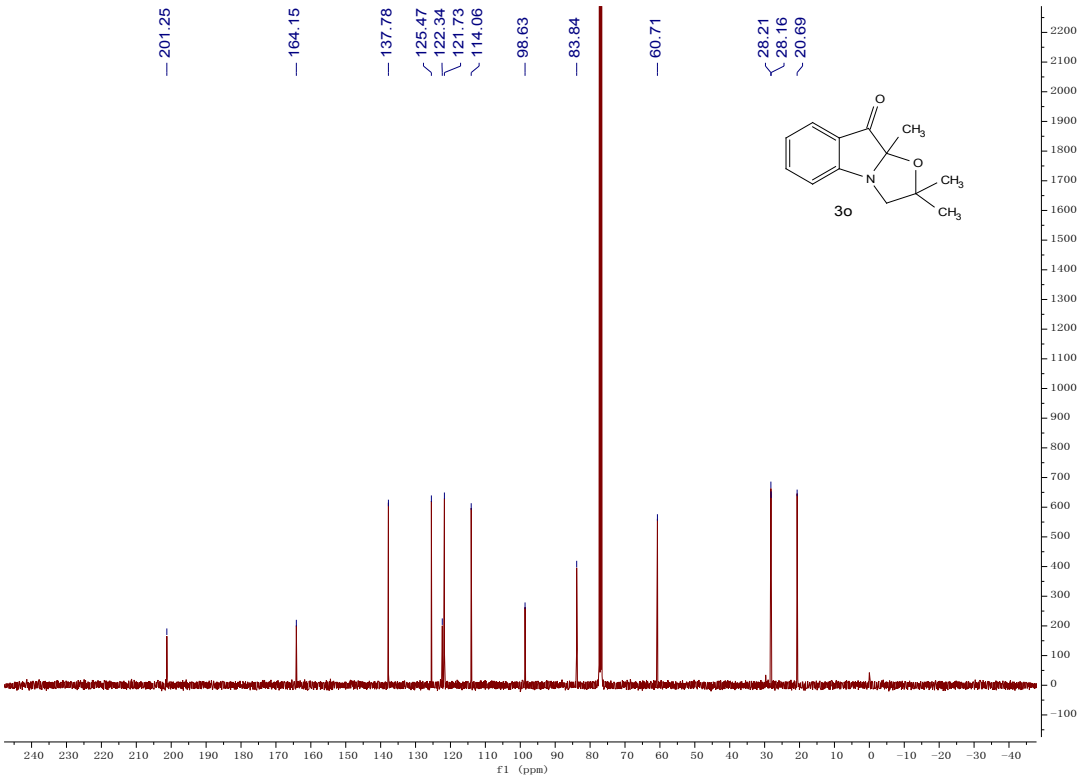
6.97
6.95
6.93
3.57
3.54
3.43
3.41
1.48
1.37
0.88
O
CH3
O
N
CH3
CH3
3o
1.91
1.86
2.00
2.77
2.68
3.23
f1 (ppm)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122.34
121.73
114.06
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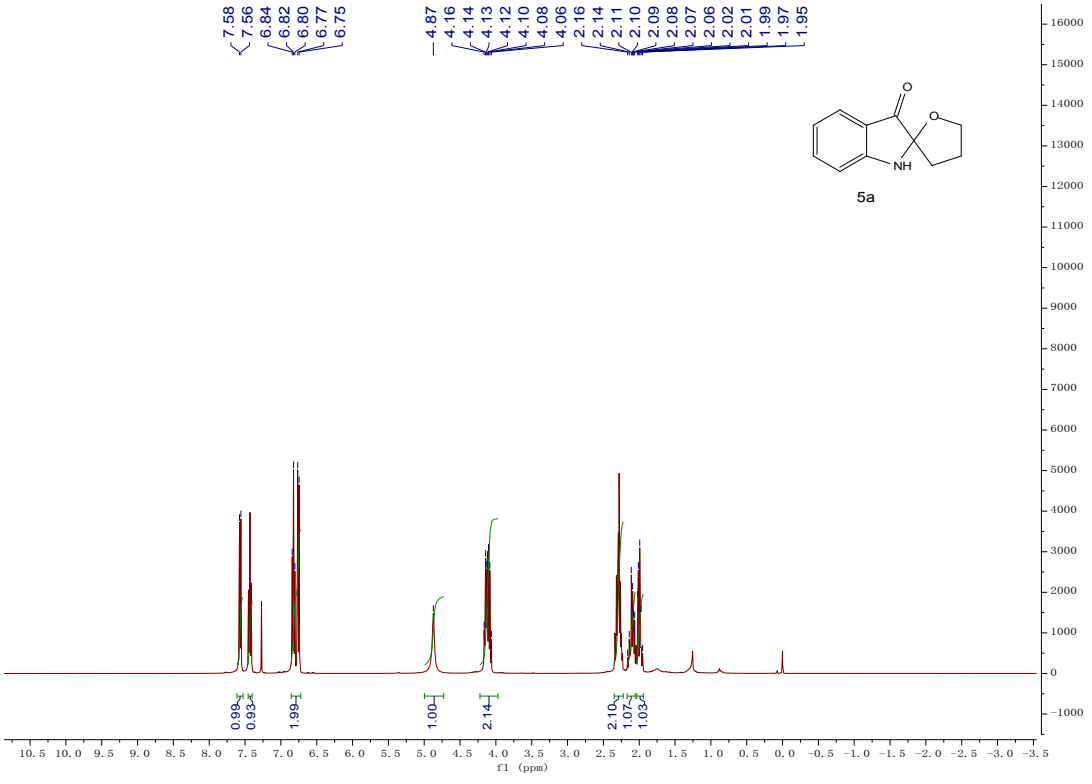
28.21
28.16
20.69
O
CH3
O
N
CH3
CH3
3o
f1 (ppm)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7.56
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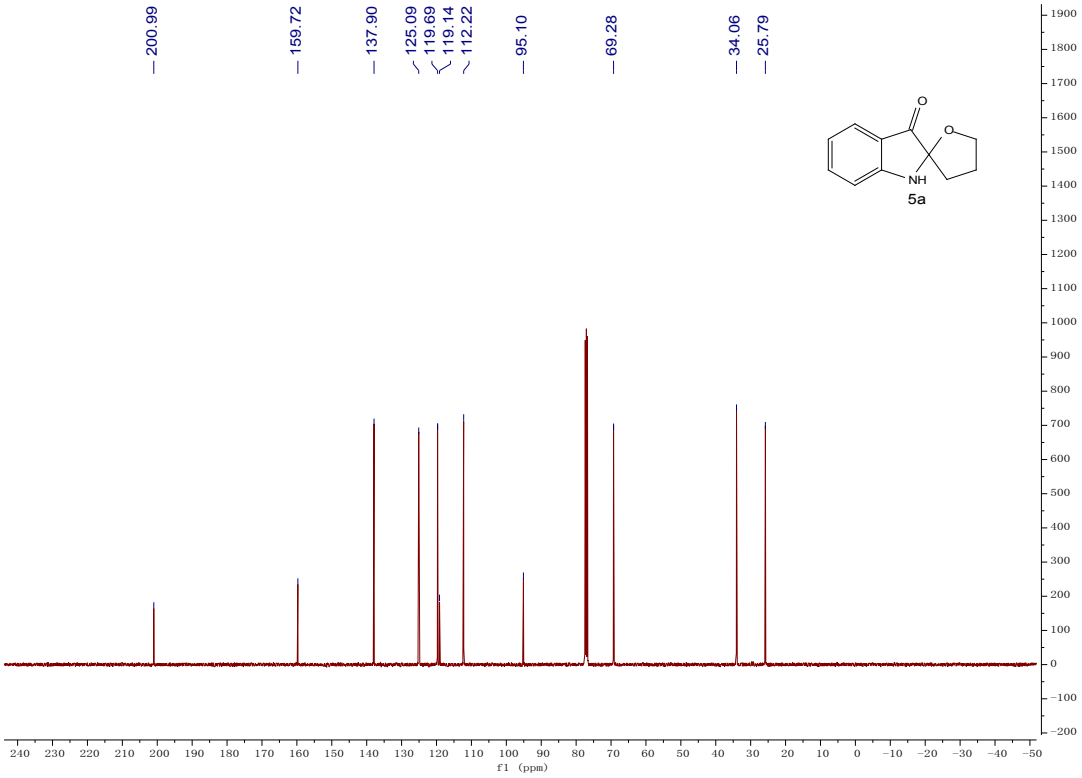
6.82
6.80
6.77
6.75
4.87
4.16
4.14
4.13
4.12
4.10
4.08
4.06
2.16
2.14
2.11
2.10
2.09
2.08
2.07
2.06
2.02
2.01
1.99
1.97
1.95
O
O
NH
5a
0.99
0.93
1.99
1.00
2.14
2.10
1.07
1.03
f1 (ppm)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137.90
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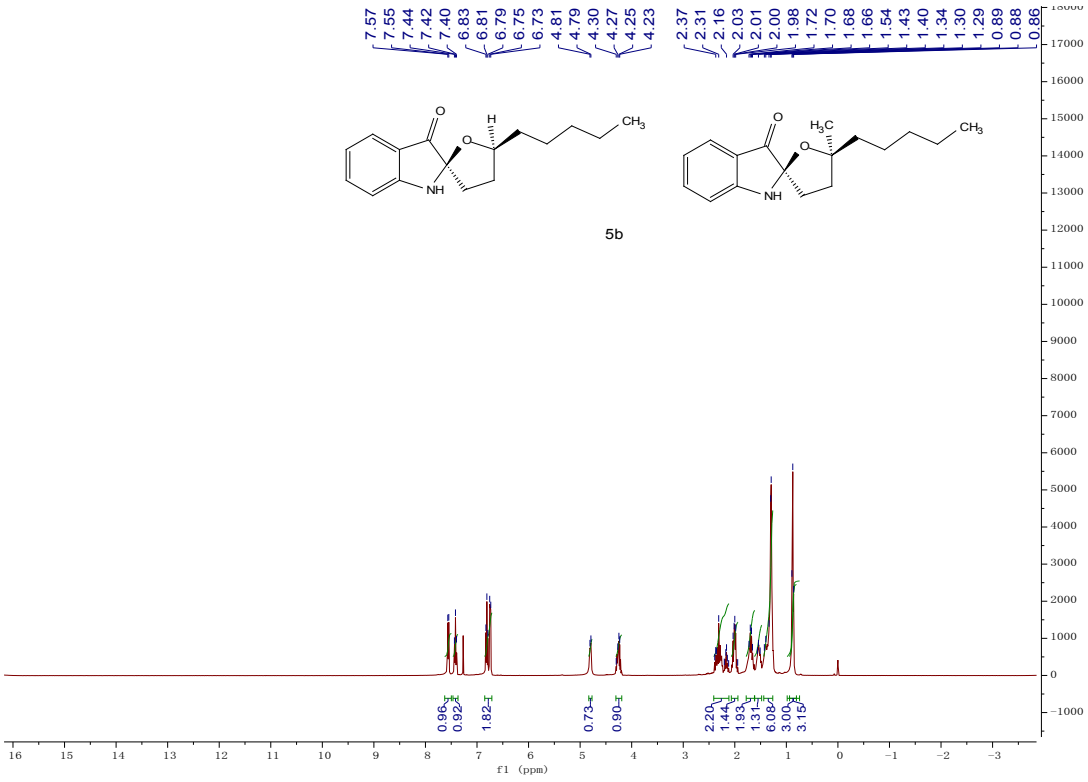
119.14
112.22
95.10
69.28
34.06
25.79
O
O
NH
5a
f1 (ppm)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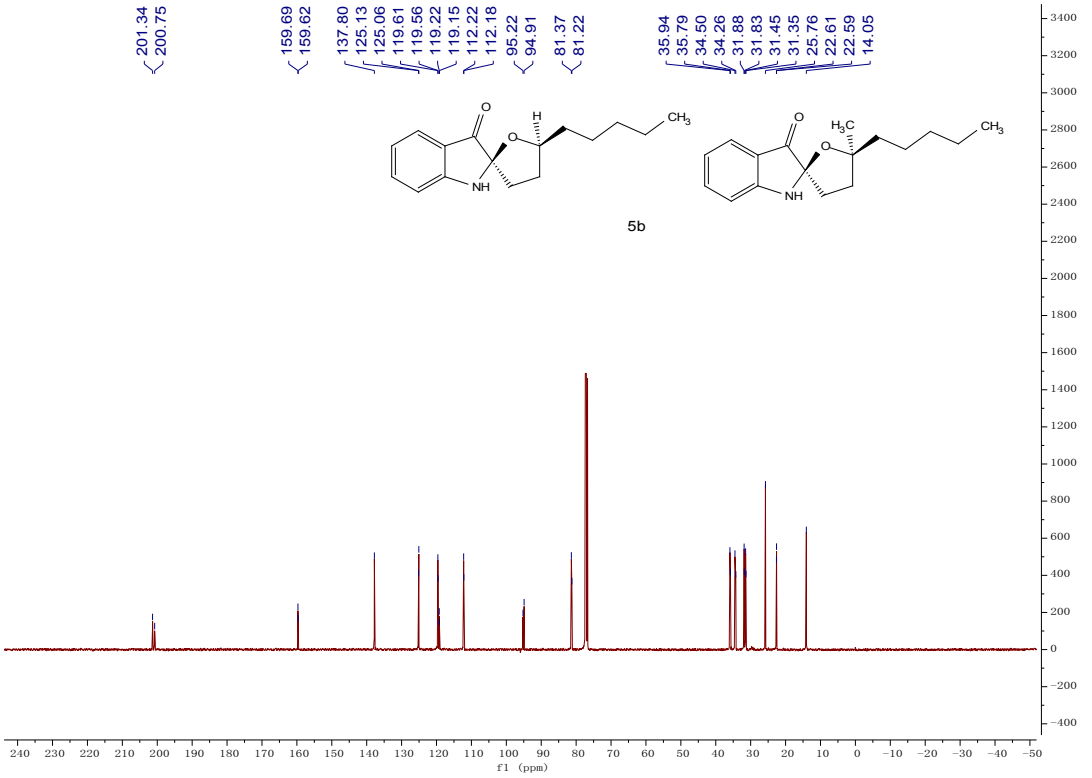
4.27
4.25
4.23
2.37
2.31
2.16
2.03
2.01
2.00
1.98
1.72
1.70
1.68
1.66
1.54
1.43
1.40
1.34
1.30
1.29
0.89
0.88
0.86
O
H
O
NH
CH3
O
H3C
O
NH
CH3
5b
0.96
0.92
1.82
0.73
0.90
2.20
1.44
1.93
1.31
6.08
3.00
3.15
f1 (ppm)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119.22
119.15
112.22
112.18
95.22
94.91
81.37
81.22
35.94
35.79
34.50
34.26
31.88
31.83
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22.61
22.59
14.05
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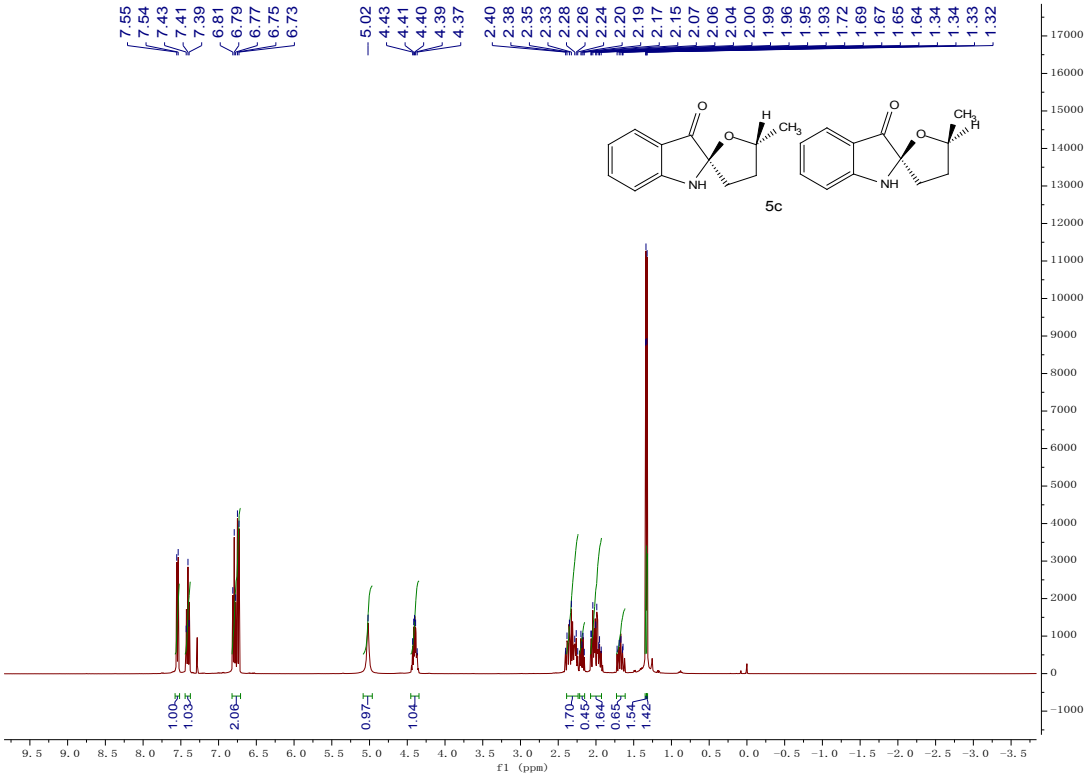
H
O
NH
CH3
H3C
5b
f1 (ppm)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6.75
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4.41
4.40
4.39
4.37
2.40
2.38
2.35
2.33
2.28
2.26
2.24
2.20
2.19
2.17
2.15
2.07
2.06
2.04
2.00
1.99
1.96
1.95
1.93
1.72
1.69
1.67
1.65
1.64
1.34
1.34
1.33
1.32
1.00
1.03
2.06
0.97
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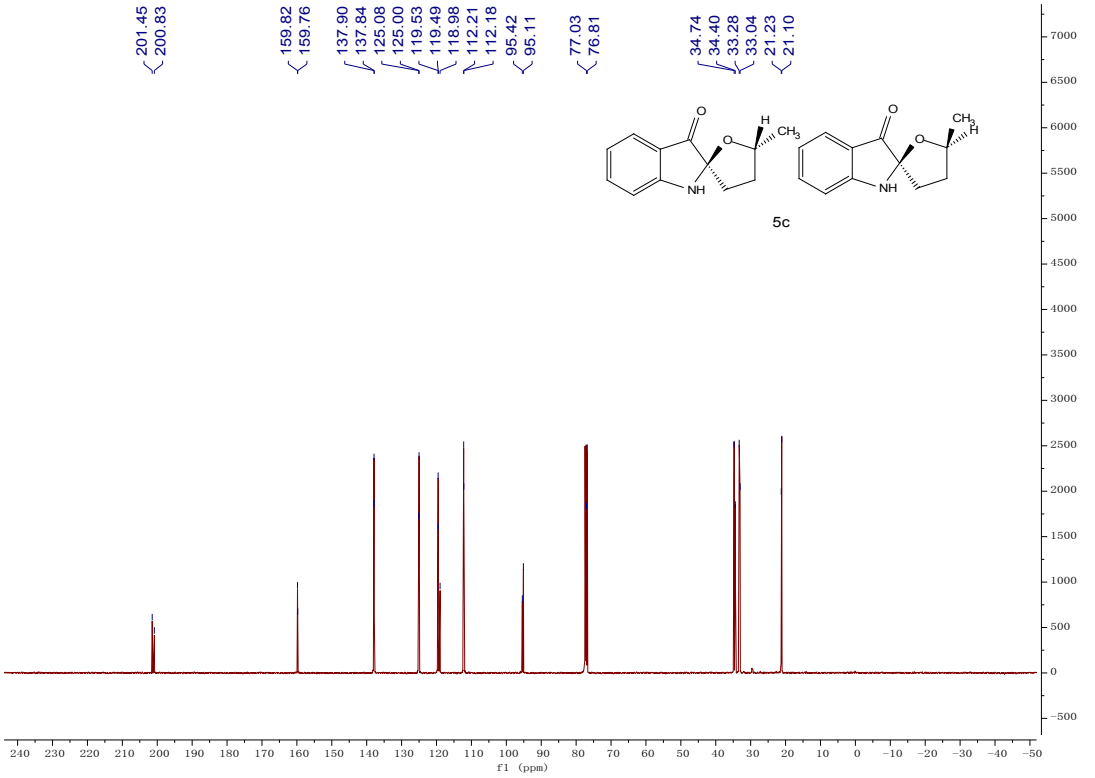
0.65
1.54
1.42
O
H
CH3
O
NH
5c
f1 (ppm)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112.21
112.18
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34.40
33.28
33.04
21.23
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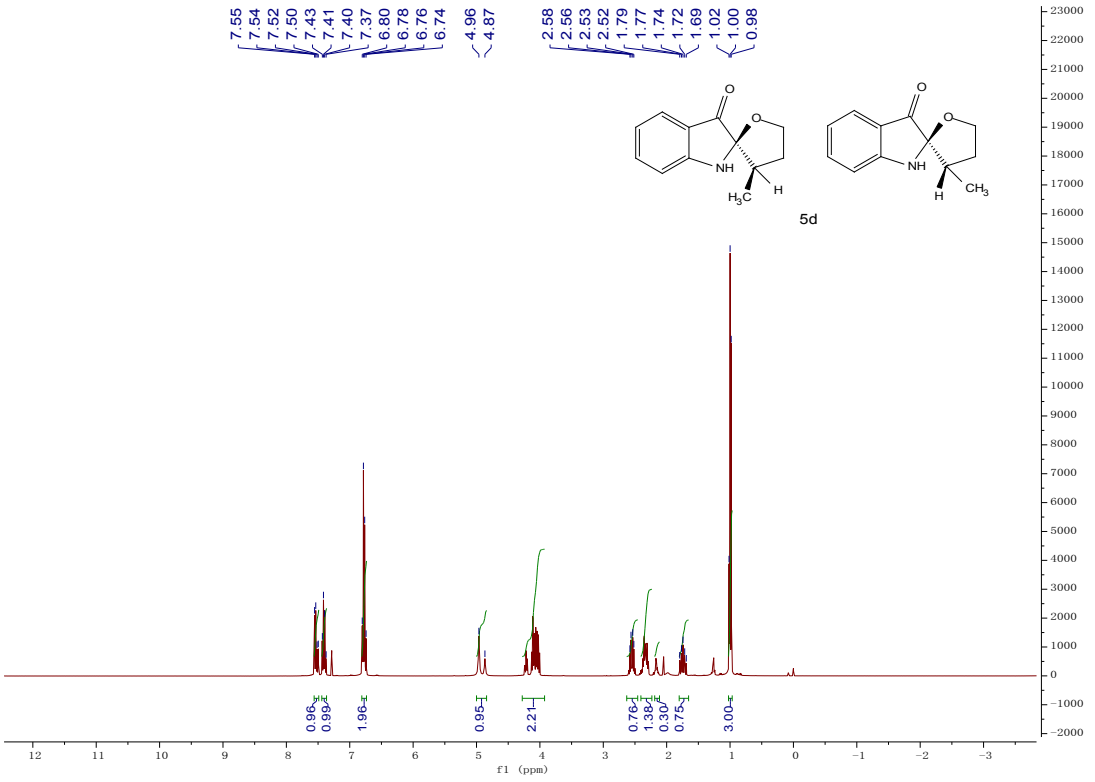
5c
f1 (ppm)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6.76
6.74
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4.87
2.58
2.56
2.53
2.52
1.79
1.77
1.74
1.72
1.69
1.02
1.00
0.98
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0.99
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0.95
2.21
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1.38
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0.75
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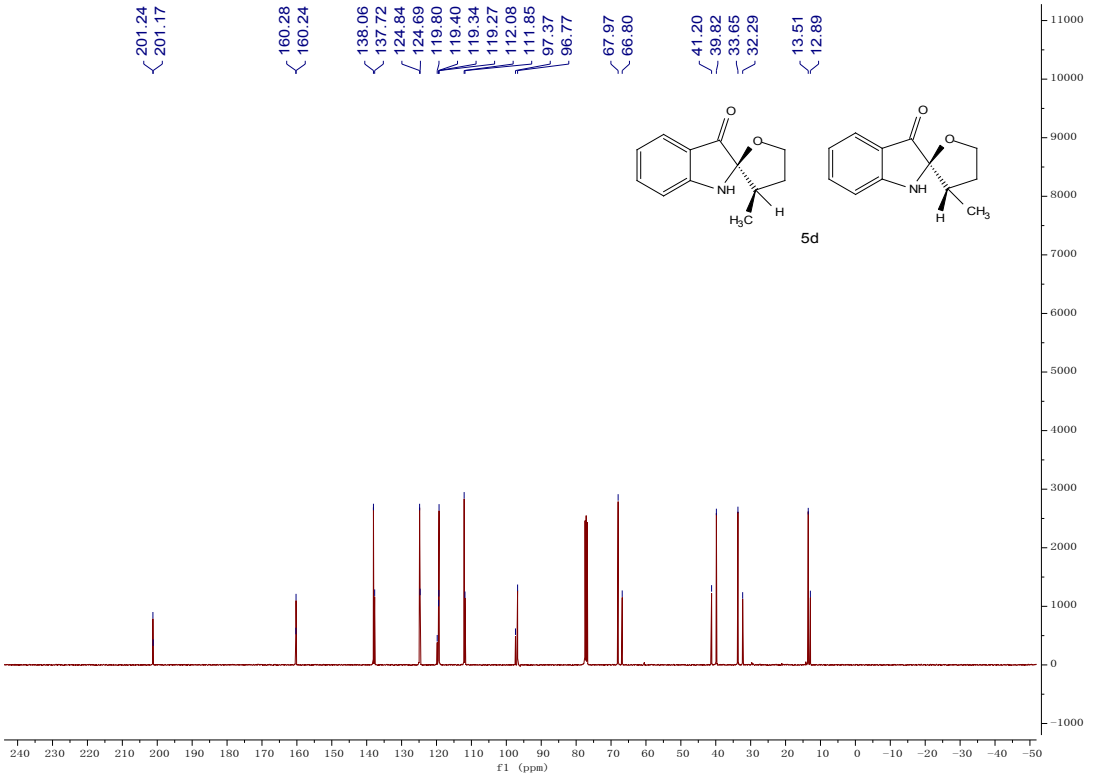
5d
f1 (ppm)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124.69
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119.40
119.34
119.27
112.08
111.85
97.37
96.77
67.97
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32.29
13.51
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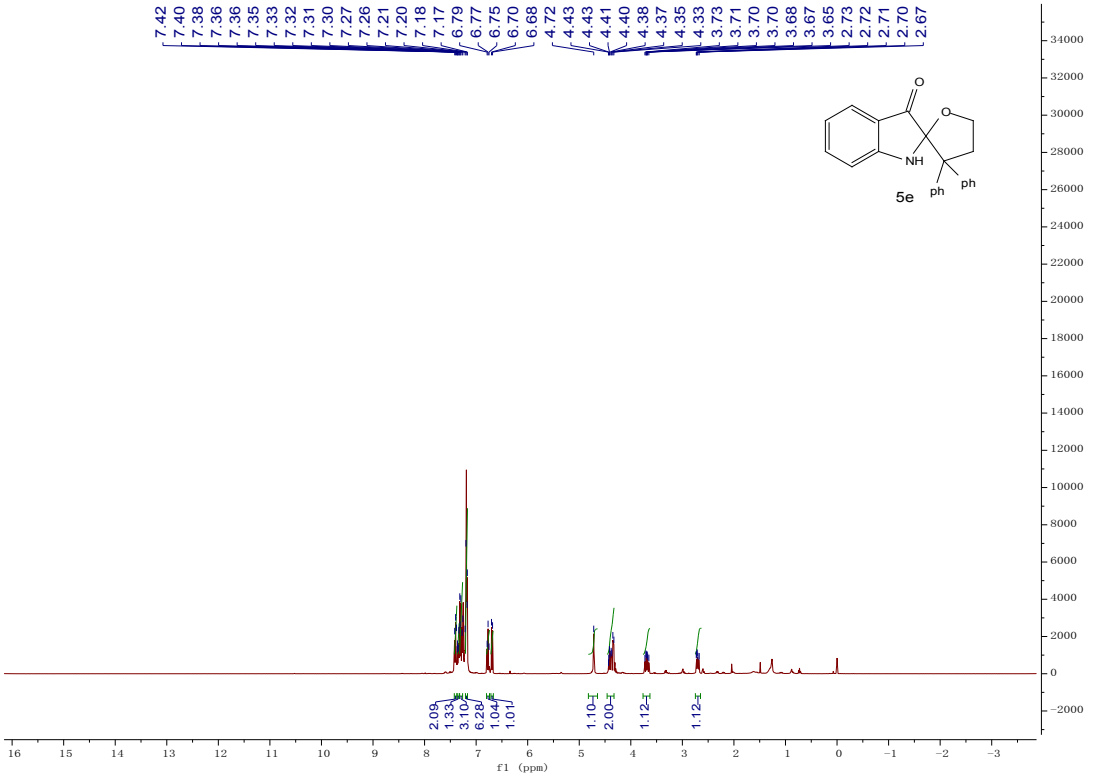
O
O
NH
H3C
H
5d
f1 (ppm)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7.20
7.18
7.17
6.79
6.77
6.75
6.70
6.68
4.72
4.43
4.41
4.40
4.38
4.37
4.35
4.33
3.73
3.71
3.70
3.70
3.68
3.67
3.65
2.73
2.72
2.71
2.70
2.67
O
O
NH
ph
ph
5e
2.09
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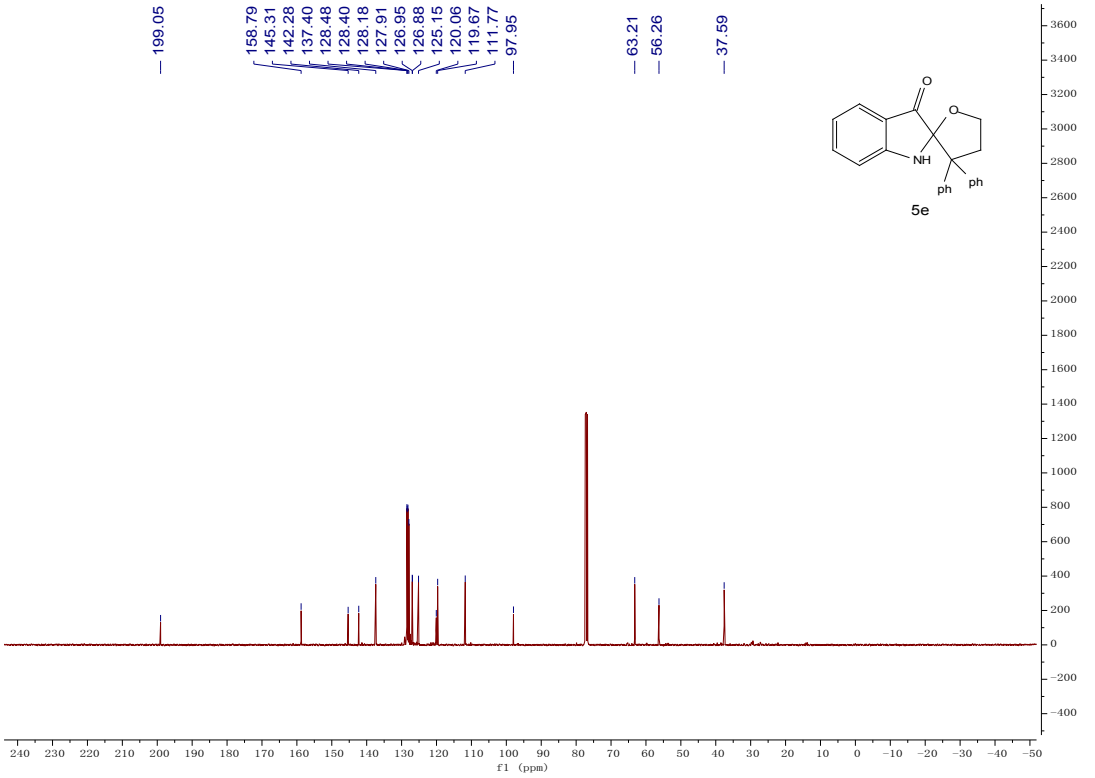
3.10
6.28
1.04
1.01
1.10
2.00
1.12
1.12
f1 (ppm)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126.88
125.15
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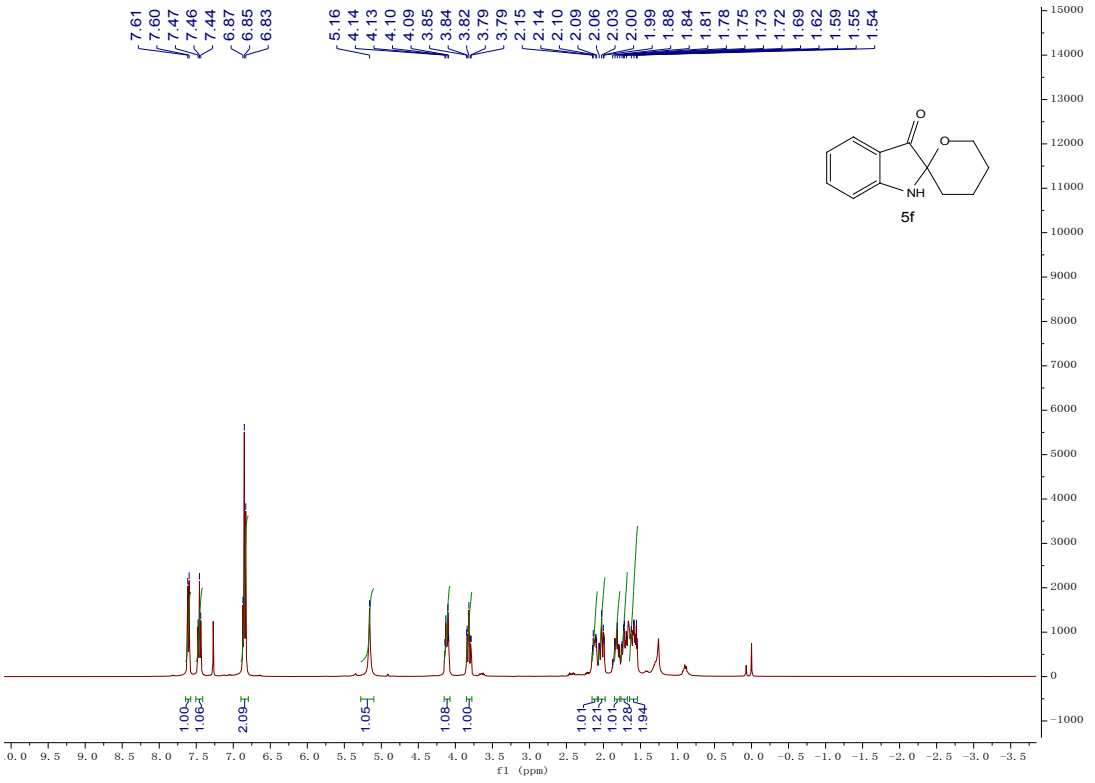
97.95
63.21
56.26
37.59
O
O
NH
ph
ph
5e
f1 (ppm)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4.13
4.10
4.09
3.85
3.84
3.82
3.79
3.79
2.15
2.14
2.10
2.09
2.06
2.03
2.00
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1.84
1.81
1.78
1.75
1.73
1.72
1.69
1.62
1.59
1.55
1.54
O
O
NH
5f
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1.00
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1.01
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1.94
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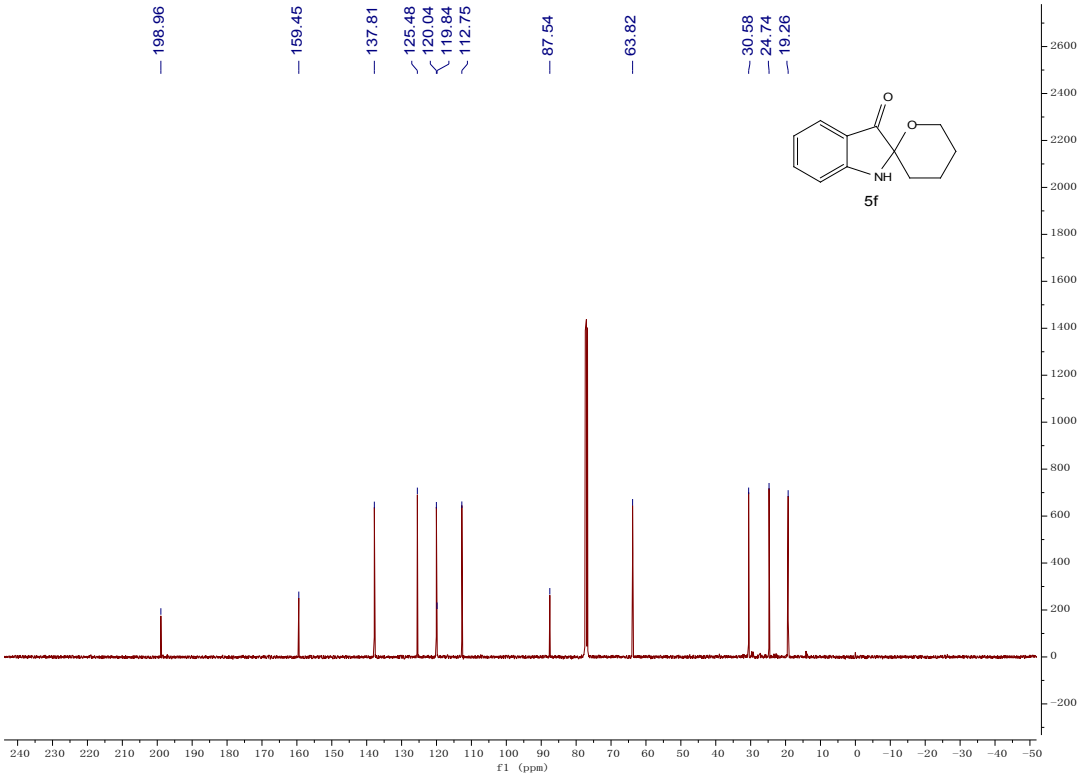
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87.54
63.82
30.58
24.74
19.26
O
O
NH
5f
f1 (ppm)