Supporting Information for

Phenanthroline-^{t}BuOK Promoted Intramolecular C-H Arylation of Indoles with ArI under Transition Metal-Free Conditions

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1. General information

Solvents were predried over activated 4 Å molecular sieves and further dried by refluxing and distilling over sodium (1,4-dioxane), CaH_2 (toluene, octane, CH_3CN, CH_2Cl_2 and DMF) or P_2O_5 (PhCl) under argon atmosphere. ^1H, $^{13}C\{^1H\}$ NMR spectra were recorded on a Bruker 400 spectrometer. Chemical shifts are reported in δ units relative to $CDCl_3$ [^1H δ = 7.26, ^{13}C δ = 77.16], DMSO-d_6 [^1H δ = 2.50, ^{13}C δ = 39.52].

2. General procedures

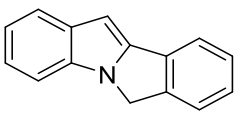
2.1. Intramolecular Cyclization

2.1.1. Screening reaction conditions (Table 1)

The starting material **1a** (0.5 mmol, 167 mg), 1,10-phenanthroline (0.05 mmol, 9 mg) and ^{t}BuOK (1.0 mmol, 112 mg) were weighed directly into a Schlenk tube and dried under high vacuum for 15 min. Solvent(10 mL) was added and stirred at 90 °C, monitored by TLC. The reaction mixture was directly examined by ^1H NMR spectrometer to determine the conversion and selectivity by using dibenzyl ether (24 μL) as an internal standards.

2.2. General procedure

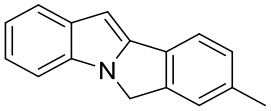
The starting material **1** (0.5 mmol), 1,10-phenanthroline (0.05 mmol, 9 mg) and ^{t}BuOK (1.0 mmol, 112 mg) were weighed directly into a Schlenk tube and dried under high vacuum for 15 min. PhCl (10 mL) was added and stirred at 90 °C and the reaction was monitored by TLC. Upon completion, the reaction mixture was directly prified by silica gel column (EtOAc/CH_2Cl_2/petroleum ether as eluent) to give the target product.



6*H*-isoindolo[2,1-*a*]indole (2a)

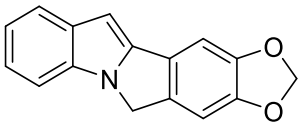
This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product, white solid, 85.2 mg, 83%, mp 184−185 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 7.72 (d, *J* = 7.6 Hz, 1H), 7.67 (d, *J* = 8.0 Hz, 1H), 7.48 (d, *J* = 7.6 Hz, 1H), 7.43-7.36 (m, 2H), 7.32 (t, *J* = 7.6 Hz, 1H), 7.21 (t, *J* = 7.6 Hz, 1H), 7.12 (t, *J* = 7.6 Hz, 1H), 6.64 (s, 1H),

5.08 (s, 2H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 144.1, 141.8, 134.0, 133.2, 132.9, 128.3, 127.2, 123.7, 121.8, 121.6, 121.1, 119.7, 109.4, 91.4, 48.5.[6]



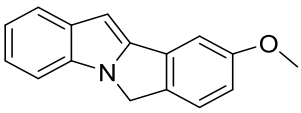
8-methyl-6*H*-isoindolo[2,1-*a*]indole (2b)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product, white solid, 88.8 mg, 81%, mp 177−178 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 7.66 (d, *J* = 8.0 Hz, 1H), 7.60 (d, *J* = 8.0 Hz, 1H), 7.35 (d, *J* = 8.0 Hz, 1H), 7.28 (s, 1H), 7.23-7.17 (m, 2H), 7.11 (t, *J* = 7.6 Hz, 1H), 6.58 (s, 1H), 5.02 (s, 2H), 2.44 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 144.3, 142.2, 137.3, 133.9, 133.0, 130.5, 129.0, 124.3, 121.6, 121.4, 120.8, 119.6, 109.2, 90.7, 48.4, 21.8. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{16}H_{14}N$ 220.1121, found 220.1123.



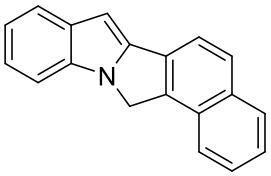
5*H*-[1,3]dioxolo[4',5':5,6]isoindolo[2,1-*a*]indole (2c)

This compound was prepared according to the general procedure method. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (100:10:1) to give the product, white solid, 103.5 mg, 83%, mp 207−208 °C. ^1H NMR (400 MHz, DMSO-d_6) δ 7.55 (d, *J* = 8.0 Hz, 1H), 7.40-7.38 (m, 2H), 7.21 (s, 1H), 7.09 (t, *J* = 7.6 Hz, 1H), 7.00 (t, *J* = 7.6 Hz, 1H), 6.51 (s, 1H), 6.11 (s, 2H), 5.06 (s, 2H). $^{13}C\{^1H\}$ NMR (100 MHz, DMSO-d_6) δ 147.6, 147.3, 143.7, 136.0, 133.7, 132.2, 125.8, 121.0, 120.8, 119.2, 109.5, 105.1, 101.6, 101.5, 89.7, 48.4. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{16}H_{12}NO_2$ 250.0863, found 250.0869.



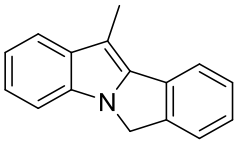
9-methoxy-6*H*-isoindolo[2,1-*a*]indole (2d)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product, yellow solid, 71.8 mg, 61%, mp 168−169 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, *J* = 7.6 Hz, 1H), 7.36 (d, *J* = 8.0 Hz, 2H), 7.24 (d, *J* = 2.4 Hz, 1H), 7.22-7.18 (m, 1H), 7.11 (t, *J* = 7.2 Hz, 1H), 6.87 (dd, *J* = 8.0, 2.4 Hz, 1H), 6.62 (s, 1H), 5.00 (s, 2H), 3.90 (s, 3H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 160.1, 144.0, 134.4, 134.1, 133.9, 132.8, 124.3, 121.8, 121.7, 119.7, 113.6, 109.3, 106.0, 91.4, 55.7, 48.1. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{16}H_{14}NO$ 236.1070, found 236.1073.



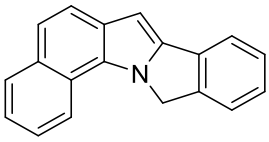
13*H*-benzo[4,5]isoindolo[2,1-*a*]indole (2e)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product, white solid, 53.6 mg, 42%, mp 98−99 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 7.93-7.88 (m, 2H), 7.82-7.79 (m, 2H), 7.69 (d, *J* = 7.6 Hz, 1H), 7.57 (t, *J* = 7.2 Hz, 1H), 7.50 (t, *J* = 7.2 Hz, 1H), 7.42 (d, *J* = 8.0 Hz, 1H), 7.23 (t, *J* = 7.6 Hz, 1H), 7.13 (t, *J* = 7.2 Hz, 1H), 6.66 (s, 1H), 5.34 (s, 2H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 145.1, 138.0, 134.5, 133.0, 132.8, 130.7, 129.3, 129.2, 129.1, 127.3, 125.9, 123.3, 121.9, 121.8, 119.7, 119.2, 109.2, 91.6, 48.0. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{19}H_{14}N$ 256.1121, found 256.1126.



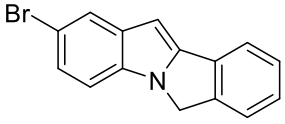
11-methyl-6H-isoindolo[2,1-a]indole (2f)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product,white solid, 93.2 mg, 85%, mp 95−96 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.70 (d, *J* = 7.6 Hz, 1H), 7.58 (d, *J* = 7.6 Hz, 1H), 7.35 (t, *J* = 8.4 Hz, 2H), 7.23 (t, *J* = 7.6 Hz, 2H), 7.16 (t, *J* = 7.2 Hz, 1H), 7.09 (t, *J* = 7.2 Hz, 1H), 4.89 (s, 2H), 2.51 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 141.8, 140.2, 133.8, 133.7, 133.2, 128.1, 126.4, 123.6, 121.5, 120.9, 119.7, 118.9, 109.1, 102.1, 48.1, 9.1. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{16}H_{14}N$ 220.1121, found 220.1119.



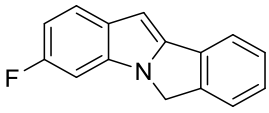
12*H*-benzo[*g*]isoindolo[2,1-*a*]indole (2g)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product, white solid, 111.1 mg, 87%, mp 145−146 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.01 (d, *J* = 8.0 Hz, 1H), 7.91 (d, *J* = 7.2 Hz, 1H), 7.77 (d, *J* = 8.8 Hz, 1H), 7.62-7.54 (m, 3H), 7.48-7.38 (m, 3H), 7.24 (d, *J* = 2.4 Hz, 1H), 6.71 (d, *J* = 3.2 Hz, 1H), 5.21 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 141.1, 135.5, 133.7, 133.0, 132.5, 131.3, 128.8, 128.5, 128.0, 127.2, 126.5, 125.5, 124.0, 121.6, 121.3 (two peaks), 102.9, 54.1. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{19}H_{14}N$ 256.1121, found 256.1123.



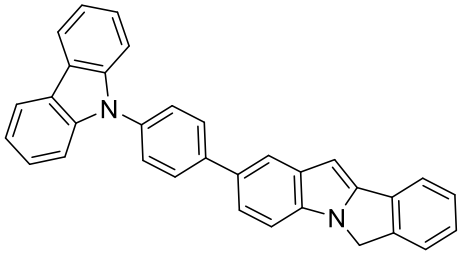
2-bromo-6*H*-isoindolo[2,1-*a*]indole (2h)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (100:10:1) to give the product, white solid, 99.5 mg, 70%, mp 197−198 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (s, 1H), 7.70 (d, *J* = 7.6 Hz, 1H), 7.48 (d, *J* = 7.2 Hz, 1H), 7.41 (t, *J* = 7.6 Hz, 1H), 7.33 (t, *J* = 7.2 Hz, 1H), 7.26-7.20 (m, 2H), 6.55 (s, 1H), 5.05 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 145.3, 141.8, 134.5, 132.7 (two peaks), 128.4, 127.6, 124.4, 124.1, 123.7, 121.3, 112.9, 110.7, 91.0, 48.7. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{11}BrN$ 284.0069, found 284.0070.



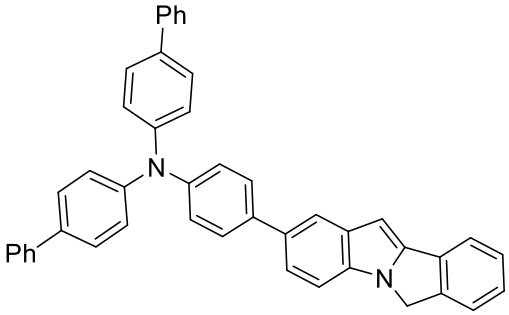
3-fluoro-6*H*-isoindolo[2,1-*a*]indole (2i)

This compound was prepared according to the general procedure method. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (100:10:1) to give the product, white solid, 105.0 mg, 90%, mp 172−173 °C. ^{1}H NMR (400 MHz, DMSO-d_6) δ 7.80 (d, *J* = 7.6 Hz, 1H), 7.62-7.58 (m, 2H), 7.45 (t, *J* = 7.2 Hz, 1H), 7.39-7.32 (m, 2H), 6.93-6.87 (m, 1H), 6.70 (s, 1H), 5.19 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, DMSO-d_6) δ 158.7 (d, *J* = 234.0 Hz), 144.2 (d, *J* = 3.6 Hz), 142.0, 133.4 (d, *J* = 12.9 Hz), 131.9, 128.9, 128.1, 127.4, 124.1, 122.2 (d, *J* = 10.1Hz), 120.6, 107.8 (d, *J* = 24.4 Hz), 96.4 (d, *J* = 25.8 Hz), 91.2, 48.5. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{11}FN$ 224.0870, found 224.0872.



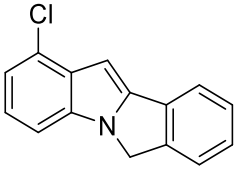
2-(4-(9H-carbazol-9-yl)phenyl)-6H-isoindolo[2,1-a]indole (2j)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product, yellow solid, 185.3 mg, 83%, mp 248−249 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.19 (d, *J* = 7.6 Hz, 2H), 7.99 (s, 1H), 7.90 (d, *J* = 8.0 Hz, 2H), 7.76 (d, *J* = 7.2 Hz, 1H), 7.64 (d, *J* = 8.0 Hz, 2H), 7.57-7.43 (m, 8H), 7.37-7.30 (m, 3H), 6.73 (s, 1H), 5.12 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 145.0, 141.9, 141.8, 141.3, 136.0, 133.7, 133.6, 133.0, 132.3, 128.7, 128.4, 127.4, 126.1, 123.7, 123.5, 121.4, 121.2, 120.4 (two peaks), 120.0, 110.1, 109.8, 91.9, 48.7. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{33}H_{23}N_2$ 447.1856, found 447.1861.



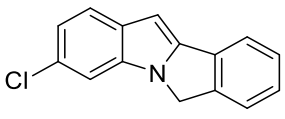
***N*-(4-(6*H*-isoindolo[2,1-*a*]indol-2-yl)phenyl)-*N*-([1,1'-biphenyl]-4-yl)-[1,1'-biphenyl]-4-amine (2k)**

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product, yellow solid, 210.3 mg, 70%, mp 252−253 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 1.2 Hz, 1H), 7.72 (d, *J* = 7.6 Hz, 1H), 7.62-7.59 (m, 6H), 7.54-7.51 (m, 4H), 7.49-7.40 (m, 8H), 7.34-7.29 (m, 3H), 7.27-7.24 (m, 6H), 6.67 (s, 1H), 5.10 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 147.2, 146.0, 144.8, 141.9, 140.8, 137.6, 135.4, 133.5, 133.4, 133.1, 132.7, 128.9, 128.3, 128.2, 128.0, 127.3, 127.0, 126.8, 125.1, 124.3, 123.7, 121.2, 121.1, 119.9, 109.6, 91.7, 48.6. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{45}H_{33}N_2$ 601.2638, found 601.2631.



1-chloro-6*H*-isoindolo[2,1-a]indole (2l)

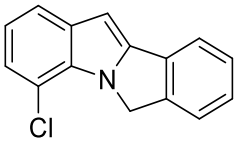
This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product, white solid, 95.9 mg, 80%, mp 142−143 °C. ^{1}H NMR (400 MHz, DMSO–d_6) δ 7.86 (d, *J* = 7.2 Hz, 1H), 7.59 (d, *J* = 7.6 Hz, 1H), 7.48-7.38 (m, 3H), 7.13 (d, *J* = 2.0 Hz, 1H), 7.12 (s, 1H), 6.74 (s, 1H), 5.19 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, DMSO–d_6) δ 144.3, 142.2, 134.2, 131.5, 130.4, 128.1, 127.7, 124.8, 124.0, 121.8, 121.1, 118.9, 109.0, 89.2, 48.8. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{11}NCl$ 240.0580; found 240.0579.



3-chloro-6*H*-isoindolo[2,1-a]indole (2m)

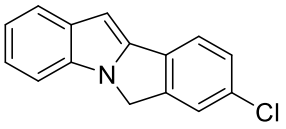
This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product, white solid, 87.5 mg, 73%, mp 182−183 °C. ^{1}H NMR (400 MHz, DMSO–d_6) δ 7.81 (d, *J* = 7.2 Hz, 1H), 7.61-7.59

(m, 3H), 7.45 (t, *J* = 6.8 Hz, 1H), 7.38 (t, *J* = 7.2 Hz, 1H), 7.04 (d, *J* = 8.0 Hz, 1H), 6.70 (s, 1H), 5.20 (s, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, DMSO–d_6) δ 144.4, 142.1, 133.8, 131.7, 130.9, 128.1, 127.6, 125.7, 124.1, 122.5, 120.9, 119.6, 109.9, 91.2, 48.6. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{11}NCl$ 240.0580; found 240.0580.



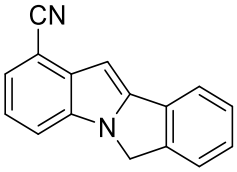
4-chloro-6*H*-isoindolo[2,1-a]indole (2n)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (100:10:1) to give the product, white solid, 86.3 mg, 72%, mp 111−112 °C. ^{1}H NMR (400 MHz, DMSO–d_6) δ 7.80 (d, *J* = 7.6 Hz, 1H), 7.59 (d, *J* = 7.2 Hz, 1H), 7.54 (d, *J* = 8.0 Hz, 1H), 7.44 (t, *J* = 7.2 Hz, 1H), 7.38 (td, *J* = 7.2, 1.2 Hz, 1H), 7.15 (d, *J* = 7.6 Hz, 1H), 6.99 (t, *J* = 7.6 Hz, 1H), 6.73 (s, 1H), 5.45 (s, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, DMSO–d_6) δ 144.9, 142.2, 134.4, 131.0, 130.1, 128.1, 127.7, 123.9, 121.1, 120.8, 120.3, 120.2, 115.4, 91.8, 51.0. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{11}NCl$ 240.0580; found 240.0582.



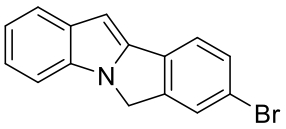
8-chloro-6*H*-isoindolo[2,1-a]indole (2o)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (100:10:1) to give the product, yellow solid, 77.9 mg, 65%, mp 180−181 °C. ^{1}H NMR (400 MHz, DMSO–d_6) δ 7.81 (d, *J* = 8.0 Hz, 1H), 7.70 (s, 1H), 7.61 (d, *J* = 8.0 Hz, 1H), 7.50 (d, *J* = 8.0 Hz, 1H), 7.46 (d, *J* = 8.0 Hz, 1H), 7.15 (t, *J* = 7.6 Hz, 1H), 7.05 (t, *J* = 7.6 Hz, 1H), 6.70 (s, 1H), 5.21 (s, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, DMSO–d_6) δ 144.3, 142.2, 133.6, 132.1, 131.6, 131.1, 128.2, 124.4, 122.0, 121.4 (two peaks), 119.5, 110.0, 91.6, 48.3. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{11}NCl$ 240.0580; found 240.0576.



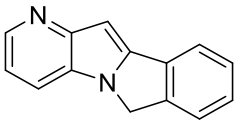
6*H*-isoindolo[2,1-*a*]indole-1-carbonitrile (2p)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (50:5:1) to give the product, yellow solid, 54.1 mg, 47%, mp 181−182 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 7.6 Hz, 1H), 7.49-7.34 (m, 5H), 7.16 (t, *J* = 7.6 Hz, 1H), 6.75 (s, 1H), 5.00 (s, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 146.6, 141.8, 134.2, 133.5, 132.0, 128.6, 128.3, 125.0, 123.7, 121.7, 120.9, 119.0, 113.7, 103.4, 90.5, 48.8. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{16}H_{11}N_2$ 231.0917, found 231.0925.



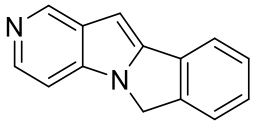
8-bromo-6*H*-isoindolo[2,1-a]indole (2q)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (100:10:1) to give the product, white solid, 59.7 mg, 42%, mp 87−88 °C. This compound was prepared according to the general procedure, white solid (1.85 g, 90%). ^{1}H NMR (400 MHz, DMSO–d_6) δ 7.83 (s, 1H), 7.75 (d, *J* = 8.0 Hz, 1H), 7.62 (t, *J* = 7.2 Hz, 2H), 7.45 (d, *J* = 8.0 Hz, 1H), 7.15 (t, *J* = 7.2 Hz, 1H), 7.05 (t, *J* = 7.2 Hz, 1H), 6.71 (s, 1H), 5.21 (s, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, DMSO–d_6) δ 144.6, 142.2, 133.5, 132.1, 131.5, 131.0, 127.2, 122.3, 121.5, 121.4, 120.0, 119.5, 110.0, 91.7, 48.2. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{11}NBr$ 284.0075; found 284.0071.



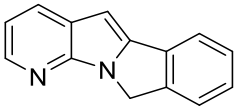
6*H*-pyrido[2',3':4,5]pyrrolo[2,1-a]isoindole (2r)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (10:5:1) to give the product, white solid, 65.0 mg, 63%, mp 173−174 °C. ^{1}H NMR (400 MHz, DMSO–d_6) δ 8.33 (dd, *J* = 4.8, 2.0 Hz, 1H), 7.88 (d, *J* = 7.2 Hz, 1H), 7.85 (d, *J* = 8.0 Hz, 1H), 7.63 (d, *J* = 7.6 Hz, 1H), 7.48 (t, *J* = 7.2 Hz, 1H), 7.42 (t, *J* = 7.2 Hz, 1H), 7.11 (dd, *J* = 8.4, 4.8 Hz, 1H), 6.82 (s, 1H), 5.25 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, DMSO–d_6) δ 149.8, 146.1, 142.5, 141.9, 131.7, 128.2 (two peaks), 127.0, 124.0, 121.5, 116.8, 115.9, 91.7, 49.1. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{14}H_{11}N_2$ 207.0922; found 207.0917.



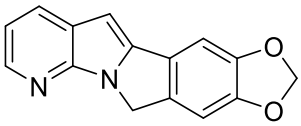
6*H*-pyrido[3',4':4,5]pyrrolo[2,1-*a*]isoindole (2s)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (10:5:1) to give the product, white solid, 84.5 mg, 82%, mp 188−189 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.92 (d, *J* = 0.8 Hz, 1H), 8.29 (d, *J* = 6.4 Hz, 1H), 7.71 (d, *J* = 7.2 Hz, 1H), 7.47-7.40 (m, 2H), 7.35 (td, *J* = 7.6, 1.2 Hz, 1H), 7.22 (d, *J* = 6.0 Hz, 1H), 6.64 (s, 1H), 5.01 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 145.0, 144.5, 141.6, 140.6, 137.1, 131.9, 129.7, 128.5, 128.0, 123.7, 121.5, 104.6, 90.5, 48.4. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{14}H_{11}N_2$ 207.0917, found 207.0919.



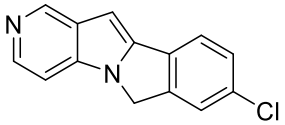
10*H*-pyrido[3',2':4,5]pyrrolo[2,1-*a*]isoindole (2t)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (10:5:1) to give the product, yellow solid, 75.5 mg, 73%, mp 180−181 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.27 (d, *J* = 4.8 Hz, 1H), 7.92 (d, *J* = 7.6 Hz, 1H), 7.75 (d, *J* = 7.6 Hz, 1H), 7.53 (d, *J* = 7.6 Hz, 1H), 7.43 (t, *J* = 7.6 Hz, 1H), 7.36 (t, *J* = 7.6 Hz, 1H), 7.06 (dd, *J* = 7.6, 4.8 Hz, 1H), 6.59 (s, 1H), 5.23 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 145.7, 144.4, 142.5, 142.1, 132.4, 129.4, 128.4, 128.0, 125.6, 124.0, 121.3, 116.0, 89.8, 48.0. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{14}H_{11}N_2$ 207.0917, found 207.0920.



5*H*-[1,3]dioxolo[4,5-f]pyrido[3',2':4,5]pyrrolo[2,1-a]isoindole (2u)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (10:5:1) to give the product, white solid, 105.1 mg, 84%, mp 193−194 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.22 (d, *J* = 4.8 Hz, 1H), 7.87 (d, *J* = 8.0 Hz, 1H), 7.15 (s, 1H), 7.03 (dd, *J* = 7.6, 4.8 Hz, 1H), 6.97 (s, 1H), 6.41 (s, 1H), 6.04 (s, 2H), 5.09 (s, 2H). ^{13}C{^{1}H} NMR ($CDCl_3$, 100 MHz) δ 148.3 (two peaks), 145.9, 144.6, 142.0, 136.2, 129.0, 126.1, 125.6, 115.9, 104.9, 101.8, 88.4, 47.9. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{11}N_2O_2$ 251.0821; found 251.0820.

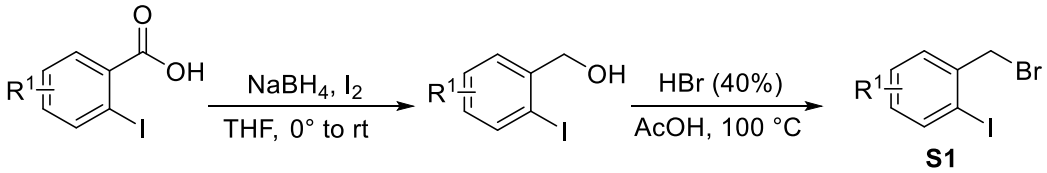


8-chloro-6*H*-pyrido[3',4':4,5]pyrrolo[2,1-a]isoindole (2v)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (10:5:1) to give the product, white solid, 71.0 mg, 59%, mp 137−138 °C. ^{1}H NMR (400 MHz, DMSO–d_6) δ 8.89 (s, 1H), 8.22 (d, J = 6.0 Hz, 1H), 7.89 (d, J = 8.0 Hz, 1H), 7.72 (s, 1H), 7.51 (d, J = 7.6 Hz, 2H), 6.87 (s, 1H), 5.26 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, DMSO–d_6) δ 144.4, 143.7, 143.3, 139.3, 136.7, 132.6, 129.9, 129.0, 128.3, 124.5, 122.7, 105.6, 91.0, 48.6. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{14}H_{10}N_2Cl$ 241.0533; found 241.0537.

2.3 Preparation of starting materials

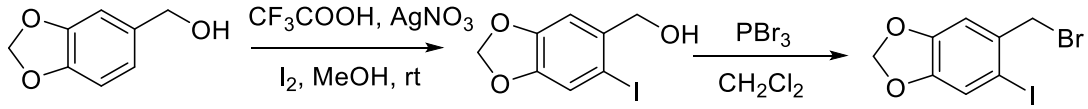
2.3.1. General procedure for synthesis of S1



S1

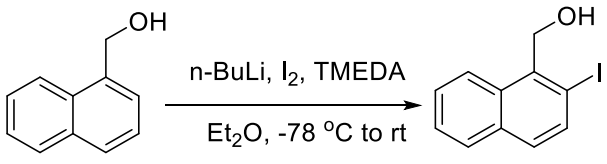
A 100 mL round-bottom flask was charged with benzoic acid (8 mmol) and THF (20 mL, pre-dried over sodium). $NaBH_4$ (2.5 equiv) was added and cooled in an ice bath. A solution of I_2 (1.0 equiv) in THF (10 mL) was added dropwise over 30 min with vigorous evolution of hydrogen. After the flask was heated to reflux for 12 h and then cooled to room temperature, diluted with methanol until the solid disappeared. After stirring 30 min, the solvent was removed by rotary evaporation leaving a white paste which was dissolved by addition of 20% aqueous KOH (20 mL). The solution was stirred for 4 h and extracted with ethyl acetate. The combined organic extracts were washed with brine, dried over anhydrous Na_2SO_4, filtered, and concentrated under vacuum. The residue benzyl alcohol was used in the next step without purification.[1]

A solution of 40% W/V hydrogen bromide-H_2O (10 equiv, 6.5 mL) was added dropwise to the cooled benzyl alcohol (5 mmol) over 15 min. The mixture was heated reflux for 2 h and then cooled to room temperature, after which it was added to 30% aqueous NaOH to make the PH > 10. The solution was extracted with ethyl acetate. The combined organic extracts were washed with brine, dried over anhydrous Na_2SO_4, filtered, and concentrated under vacuum. The residue benzyl bromide was used in the next step without purification.[5]



S2

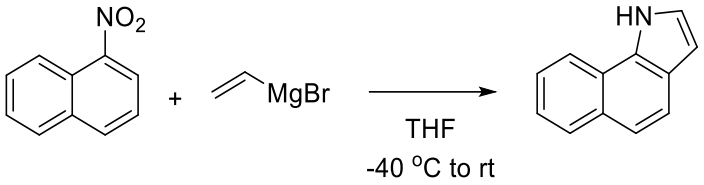
A 100 mL round-bottom flask was charged with benzyl alcohol (10 mmol), CF_3COOH (13 mmol) and $AgNO_3$ (13 mmol). Then MeOH (15 mL) was added and cooled in an ice bath. A solution of I_2 (1.0 equiv) in MeOH (25 mL) was added dropwise over 30 min. The resulting reaction mixture was monitored by TLC. Then filtered and concentrated under vacuum. The residue benzyl alcohol was used in the next step without purification. PBr_3 (1.5 mL, 16 mmol) was added over a solution of alcohols (8 mmol) in dry CH_2Cl_2 (100 mL), and the reaction mixture was stirred at rt for 16 h. Solvent was evaporated, and the resulting oil was treated with saturated $NaHCO_3$. The resulting aqueous phase was extracted with CH_2Cl_2. The combined organic extracts were dried Na_2SO_4 and concentrated in vacuo, yielding bromides, which were crystallised from Et_2O. White solid, 2.25g, 82%, mp 73−74 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.24 (s, 1H), 6.96 (s, 1H), 5.99 (s, 2H), 4.55 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 148.8 (two peaks), 133.5, 119.2, 110.1, 102.1, 88.9, 39.7.[2]



S3

To a cold -78°C stirred solution of n-BuLi (30 mmol) in dry Et_2O was added TMEDA (30 mmol) followed 10 min later by a solution of 1-naphthalenemethanol (12 mmol) in dry Et_2O (50 mL). The pale green mixture was warmed to rt, becoming deep blue, and was stirred for 4 h. The reaction mixture was treated with a solution of resublimed iodine (14.4 mmol) in dry Et_2O (50 mL), becoming colorless. To the mixture was

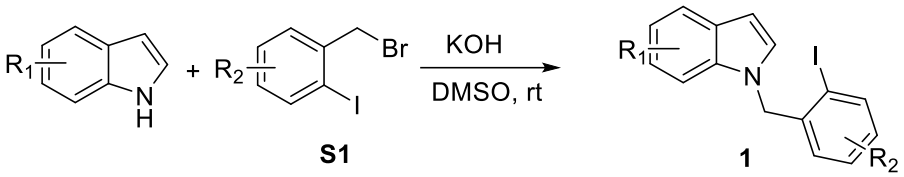
added 75 mL of saturated aqueous $Na_2S_2O_3$. The aqueous phase was extracted with Et_2O (75 mL). The combined organic extracts were dried Na_2SO_4 and concentrated. Purified on silica gel chromatography using petroleum ether/EtOAc (10:1) to give the product. White solid, 1.23g, 36%, mp 134−135 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.23 (d, *J* = 8.4 Hz, 1H), 7.85 (d, *J* = 8.8 Hz, 1H), 7.81 (d, *J* = 7.6 Hz, 1H), 7.58-7.48 (m, 3H), 5.28 (s, 2H), 2.03 (s, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 138.5, 136.1, 133.6, 132.7, 130.4, 128.7, 127.5, 126.6, 124.6, 99.9, 67.4.[3]



S4

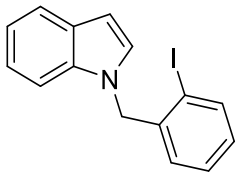
A 100 mL round-bottom flask was charged with 1-nitronaphthalene (10 mmol) under Ar. Then THF (70 mL) was added in -40 °C. Vinylmagnesium bromide (30 mmol) was added dropwise over 30 min. The resulting reaction mixture was monitored by TLC. After which it was added to saturated NH_4Cl. The solution was extracted with ethyl acetate. The combined organic extracts were washed with brine, dried over anhydrous Na_2SO_4, filtered, concentrated and purified on silica gel chromatography using petroleum ether/EtOAc (20:1) to give the product. Yellow solid, 650 mg, 39%, mp 158−159 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.78 (s, 1H), 7.92 (d, *J* = 8.8 Hz, 2H), 7.72 (d, *J* = 8.4 Hz, 1H), 7.51 (t, *J* = 8.4 Hz, 2H), 7.42 (t, *J* = 7.6 Hz, 1H), 7.23-7.21 (m, 1H), 6.69 (t, *J* = 2.4 Hz, 1H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 130.5, 129.0, 125.6, 124.0, 123.9, 122.4, 121.8, 120.9, 120.8, 119.5, 104.4.[4]

2.3.2. General procedure for the synthesis of 1



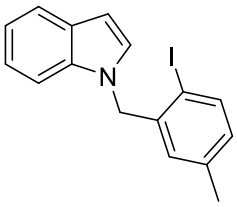
S1 **1**

KOH (2 equiv) was weighed directly into a schlenk tube and dried under vacuum for 15 min. Then DMSO (10 mL) was added and stirred for 5 minutes, indole (5 mmol) was slowly added. After stirring for 30 min, **S1** or **S2** (1.2 equiv) was added. The resulting reaction mixture was monitored by TLC. The reaction was quenched by H_2O and extracted with Et_2O. The combined organic extracts were washed with brine, dried over anhydrous Na_2SO_4, filtered, concentrated and purified on silica gel chromatography (EtOAc/CH_2Cl_2/petroleum ether as eluent) to give the product.[5]



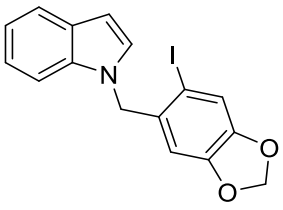
1-(2-iodobenzyl)-1*H*-indole (1a)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/EtOAc (30:1) to give the product, white solid (1.23 g, 74%), mp 75−76 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 8.0 Hz, 1H), 7.67 (d, *J* = 7.6 Hz, 1H), 7.22-7.10 (m, 5H), 6.94 (t, *J* = 7.6 Hz, 1H), 6.59 (d, *J* = 2.8 Hz, 1H), 6.45 (d, *J* = 8.0 Hz, 1H), 5.28 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 139.6, 139.5, 136.3, 129.4, 128.8 (two peaks), 128.4, 127.7, 122.0, 121.2, 119.9, 109.8, 102.2, 97.2, 55.2. [6]



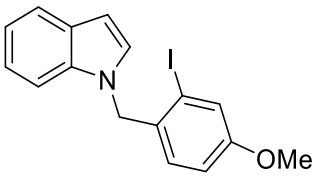
1-(2-iodo-5-methylbenzyl)-1*H*-indole (1b)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/EtOAc (30:1) to give the product, white solid (1.74 g, 100%), mp 83−84 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.77 (d, *J* = 8.0 Hz, 1H), 7.71 (d, *J* = 7.6 Hz, 1H), 7.28 (d, *J* = 8.0 Hz, 1H), 7.18 (td, *J* = 7.2, 1.2 Hz, 1H), 7.16 (td, *J* = 7.6, 1.2 Hz, 1H), 7.13 (d, *J* = 2.8 Hz, 1H), 6.82 (d, *J* = 8.8 Hz, 1H), 6.61 (d, *J* = 2.8 Hz, 1H), 6.42 (s, 1H), 5.29 (s, 2H), 2.13 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 139.3, 139.2, 139.0, 136.4, 130.4, 128.7, 128.6, 128.4, 122.0, 121.1, 119.8, 109.8, 102.1, 93.4, 55.1, 21.2. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{16}H_{15}IN$ 348.0244, found 348.0245.



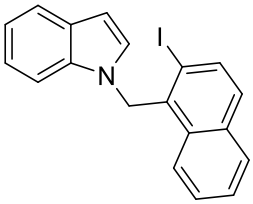
1-((6-iodobenzo[d][1,3]dioxol-5-yl)methyl)-1*H*-indole (1c)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/EtOAc (20:1) to give the product, white solid (1.62 g, 86%), mp 128−129 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.66 (d, *J* = 7.6 Hz, 1H), 7.29 (s, 1H), 7.25-7.10 (m, 4H), 6.58 (s, 1H), 6.03 (s, 1H), 5.88 (s, 2H), 5.22 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 149.0, 148.0, 136.2, 133.1, 128.8, 128.2, 122.1, 121.21, 119.9, 118.7, 109.8, 108.1, 102.3, 101.8, 85.0, 55.1. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{16}H_{13}INO_2$ 377.9985, found 377.9991.



1-(2-iodo-4-methoxybenzyl)-1*H*-indole (1d)

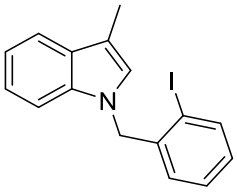
This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/EtOAc (20:1) to give the product, white solid (1.36 g, 77%), mp 85−86 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67 (d, *J* = 7.6 Hz, 1H), 7.43 (d, *J* = 2.8 Hz, 1H), 7.24 (s, 1H), 7.19 (td, *J* = 7.6, 1.2 Hz, 1H), 7.17-7.11 (m, 1H), 7.09 (d, *J* = 3.2 Hz, 1H), 6.71 (dd, *J* = 8.8, 2.4 Hz, 1H), 6.57 (d, *J* = 3.2 Hz, 1H), 6.46 (d, *J* = 8.8 Hz, 1H), 5.25 (s, 2H), 3.74 (s, 3H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 159.3, 136.3, 131.5, 128.8, 128.4, 128.3, 124.8, 121.9, 121.1, 119.8, 114.6, 109.9, 102.0, 97.5, 55.6, 54.4. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{16}H_{15}INO$ 364.0193, found 364.0196.



1-((2-iodonaphthalen-1-yl)methyl)-1*H*-indole (1e)

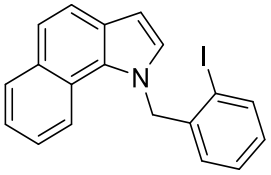
This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/EtOAc (30:1) to give the product, white solid (1.65 g, 86%), mp 108−109 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.00 (d, *J* = 8.8 Hz, 1H), 7.86 (d, *J* = 8.0 Hz, 1H),

7.83 (d, *J* = 8.4 Hz, 1H), 7.67 (d, *J* = 8.0 Hz, 2H), 7.61 (d, *J* = 8.4 Hz, 1H), 7.50 (t, *J* = 7.6 Hz, 1H), 7.42-7.33 (m, 2H), 7.20 (t, *J* = 7.6 Hz, 1H), 6.66 (d, *J* = 2.8 Hz, 1H), 6.40 (d, *J* = 3.2 Hz, 1H), 5.86 (s, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 136.4 (two peaks), 134.2, 133.5, 133.2, 130.8, 128.9 (two peaks), 128.1, 126.8, 126.4, 124.0, 121.8, 121.2, 119.9, 109.4, 102.5, 101.7, 52.3. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{19}H_{15}IN$ 384.0244, found 384.0248.



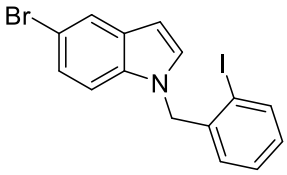
1-(2-iodobenzyl)-3-methyl-1*H*-indole (1f)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/EtOAc (30:1) to give the product, white solid (1.5 g, 86%), mp 103−104 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 7.6 Hz, 1H), 7.66 (d, *J* = 7.6 Hz, 1H), 7.22-7.15 (m, 4H), 6.98 (t, *J* = 7.6 Hz, 1H), 6.90 (s, 1H), 6.51 (d, *J* = 7.6 Hz, 1H), 5.26 (s, 2H), 2.40 (s, 3H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 139.9, 139.4, 136.7, 129.3, 129.0, 128.8, 127.7, 125.9, 122.0, 119.2, 119.1, 111.4, 109.6, 97.2, 54.9, 9.8. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{16}H_{15}IN$ 348.0244, found 348.0246.



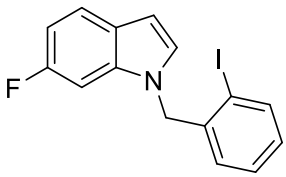
1-(2-iodobenzyl)-1*H*-benzo[*g*]indole (1g)

This compound was prepared according to the general procedure from **S4**. Purified on silica gel chromatography using petroleum ether/EtOAc (30:1) to give the product, white solid (1.63 g, 85%), mp 138−139 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86 (d, *J* = 7.6 Hz, 2H), 7.72 (d, *J* = 8.4 Hz, 2H), 7.51 (d, *J* = 8.8 Hz, 1H), 7.30-7.28 (m, 2H), 7.04 (d, *J* = 2.8 Hz, 1H), 6.97 (t, *J* = 7.6 Hz, 1H), 6.85 (t, *J* = 7.6 Hz, 1H), 6.70 (d, *J* = 2.8 Hz, 1H), 6.33 (d, *J* = 7.6 Hz, 1H), 5.59 (s, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 139.6, 139.4, 131.5, 129.4, 129.2, 129.0, 128.9, 127.5, 126.2, 125.6, 123.5, 122.6, 121.7, 121.1, 120.5, 103.6, 96.4, 59.1. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{19}H_{15}IN$ 384.0244, found 384.0246.



5-bromo-1-(2-iodobenzyl)-1*H*-indole (1h)

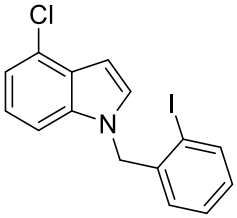
This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (30:2:1) to give the product, white solid (1.69 g, 82%), mp 91−92 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 (d, *J* = 8.0 Hz, 1H), 7.78 (s, 1H), 7.24 (t, *J* =4.4 Hz, 1H), 7.15 (t, *J* = 7.6 Hz, 1H), 7.09-7.05 (m, 2H), 6.96 (t, *J* = 7.6 Hz, 1H), 6.51 (d, *J* = 2.8 Hz, 1H), 6.42 (d, *J* = 7.6 Hz, 1H), 5.25 (s, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 139.6, 139.1, 135.1, 130.4, 129.6, 128.8, 127.6, 124.9, 123.7, 113.2, 111.3, 101.8, 97.3, 55.4. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{12}BrIN$ 411.9192, found 411.09201.



6-fluoro-1-(2-iodobenzyl)-1*H*-indole (1i)

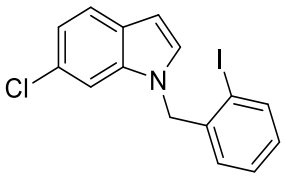
This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/EtOAc (30:1) to

give the product, white solid (1.55 g, 88%), mp 71−72 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 7.6 Hz, 1H), 7.59 (dd, *J* = 9.2, 5.6 Hz, 1H), 7.18 (t, *J* = 7.6 Hz, 1H), 7.10 (d, *J* = 3.2 Hz, 1H), 6.99 (t, *J* = 7.6 Hz, 1H), 6.92 (t, *J* = 8.4 Hz, 2H), 6.59 (d, *J* = 3.2 Hz, 1H), 6.49 (d, *J* = 7.6 Hz, 1H), 5.25 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 160.0 (d, *J* = 236.4 Hz), 139.6, 139.1, 136.4 (d, *J* = 12.0 Hz), 129.5, 128.8, (d, *J* = 3.7 Hz), 127.6, 126.8, 125.2, 121.9 (d, *J* = 9.1 Hz), 108.7 (d, *J* = 24.2 Hz), 102.4, 97.3, 96.3 (d, *J* = 26.2 Hz), 55.4. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{12}FIN$ 351.9993, found 351.9998.



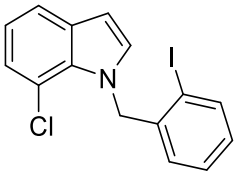
4-chloro-1-(2-iodobenzyl)-1*H*-indole (1l)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (30:2:1) to give the product, white solid (1.31 g, 71%), mp 109−110 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.82 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.11-6.99 (m, 5H), 6.89 (td, *J* = 8.8, 1.6 Hz, 1H), 6.66 (dd, *J* = 3.2, 0.8 Hz, 1H), 6.38 (d, *J* = 7.6 Hz, 1H), 5.18 (s, 2H). ^{13}C{^{1}H} NMR ($CDCl_3$, 100 MHz) δ 139.7, 139.1, 137.2, 129.6, 129.0, 128.9, 127.7, 127.6, 126.5, 122.7, 119.7, 108.6, 101.0, 97.3, 55.6. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{12}NClI$ 367.9703; found 367.9707.



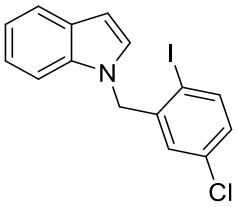
6-chloro-1-(2-iodobenzyl)-1*H*-indole (1m)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (30:2:1) to give the product, white solid (1.47 g, 80%), mp 71−72 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.85 (dd, *J* = 8.0, 0.8 Hz, 1H), 7.54 (d, *J* = 8.4 Hz, 1H), 7.19 (s, 1H), 7.12 (td, *J* = 8.0, 0.8 Hz, 1H), 7.07 (dd, *J* = 8.4, 2.0 Hz, 1H), 7.04 (d, *J* = 3.2 Hz, 1H), 6.93 (t, *J* = 7.6 Hz, 1H), 6.54 (d, *J* = 3.2 Hz, 1H), 6.42 (d, *J* = 7.6 Hz, 1H), 5.19 (s, 2H). ^{13}C{^{1}H} NMR ($CDCl_3$, 100 MHz) δ 139.7, 139.1, 136.9, 129.6, 129.1, 128.9, 128.2, 127.7, 127.3, 122.1, 120.7, 109.9, 102.5, 97.4, 55.4. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{12}NClI$ 367.9703; found 367.9707.



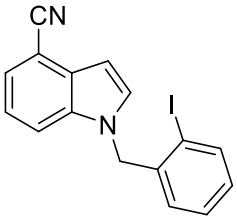
7-chloro-1-(2-iodobenzyl)-1*H*-indole (1n)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (30:2:1) to give the product, white solid (1.71 g, 93%), mp 98−99 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.53 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.11-7.07 (m, 2H), 7.02-6.98 (m, 2H), 6.90 (td, *J* = 8.8, 1.6 Hz, 1H), 6.58 (d, *J* = 3.2 Hz, 1H), 6.24 (d, *J* = 7.6 Hz, 1H), 5.63 (s, 2H). ^{13}C{^{1}H} NMR ($CDCl_3$, 100 MHz) δ 141.3, 139.4, 131.9, 131.6, 131.1, 129.1, 128.8, 127.0, 123.8, 120.8, 120.1, 117.0, 102.9, 96.2, 57.5. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{12}NClI$ 367.9703; found 367.9707.



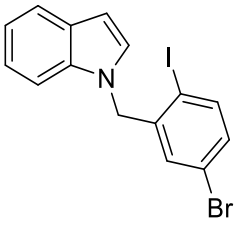
1-(5-chloro-2-iodobenzyl)-1*H*-indole (1o)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (30:2:1) to give the product, white solid (1.75 g, 95%), mp 57−58 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 (d, *J* = 8.4 Hz, 1H), 7.67 (dt, *J* = 7.6, 1.2 Hz, 1H), 7.19-7.12 (m, 3H), 7.07 (d, *J* = 3.2 Hz, 1H), 6.94 (dd, *J* = 8.4, 2.8 Hz, 1H), 6.60 (dd, *J* =3.2, 0.4 Hz, 1H), 6.47 (d, *J* = 2.4 Hz, 1H), 5.22 (s, 2H). ^{13}C{^{1}H} NMR ($CDCl_3$, 100 MHz) δ 141.5, 140.5, 136.3, 135.5, 129.7, 128.8, 128.1, 127.8, 122.3, 121.3, 120.1, 109.6, 102.8, 94.1, 55.0. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{12}NClI$ 367.9703; found 367.9700.



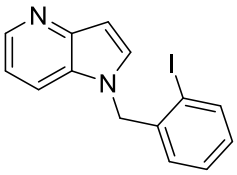
1-(2-iodobenzyl)-1*H*-indole-4-carbonitrile (1p)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (20:2:1) to give the product, white solid (1.41 g, 79%), mp 103−104 °C . ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.90 (d, *J* = 8.0 Hz, 1H), 7.47 (dd, *J* = 11.6, 7.6 Hz, 2H), 7.28 (d, *J* = 3.2 Hz, 1H), 7.23-7.17 (m, 2H), 7.00 (t, *J* = 8.0 Hz, 1H), 6.80 (d, *J* = 3.2 Hz, 1H), 6.48 (d, *J* = 7.6 Hz, 1H), 5.34 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 139.7, 138.5, 136.0, 131.0, 129.9, 129.8, 128.9, 127.6, 125.3, 121.6, 118.7, 114.6, 103.5, 101.2, 97.4, 55.4. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{12}IN_2$ 359.0040, found 359.0045.



1-(5-bromo-2-iodobenzyl)-1*H*-indole (1q)

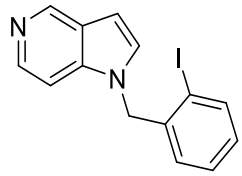
This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (30:2:1) to give the product, white solid (1.85 g, 90%), mp 86−87 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.69-7.66 (m, 2H), 7.21-7.16 (m, 2H), 7.15-7.11 (m, 1H), 7.08-7.04 (m, 2H), 6.63 (d, *J* = 2.4 Hz, 1H), 6.60 (d, *J* = 3.2 Hz, 1H), 5.21 (s, 2H). ^{13}C{^{1}H} NMR ($CDCl_3$, 100 MHz) δ 141.7, 140.8, 136.3, 132.6, 130.7, 128.8, 128.1, 123.4, 122.3, 121.3, 120.1, 109.6, 102.8, 95.1, 54.9. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{12}NBrI$ 411.9198; found 411.9200.



1-(2-iodobenzyl)-1*H*-pyrrolo[3,2-b]pyridine (1r)

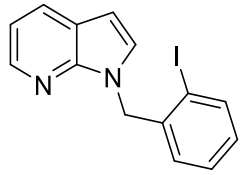
This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (10:2:1) to give the product, brown solid (0.84 g, 50%), mp 132−133 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.48 (dd, *J* = 4.8, 1.6 Hz, 1H), 7.88 (dd, *J* = 8.0, 1.2 Hz, 1H), 7.51 (dt, *J* = 8.4, 1.2 Hz, 1H), 7.34 (d, *J* = 3.2 Hz, 1H), 7.17 (td, *J* = 7.6, 1.2 Hz, 1H), 7.08 (dd, *J* = 8.4, 4.8 Hz, 1H), 6.98

(td, *J* = 8.0, 1.6 Hz, 1H), 6.79 (dd, *J* = 3.2, 0.8 Hz, 1H), 6.49 (d, *J* = 8.0 Hz, 1H), 5.30 (s, 2H). $^{13}C\{^{1}H\}$ NMR ($CDCl_3$, 100 MHz) δ 147.1, 143.7, 139.8, 138.9, 131.6, 129.7, 129.4, 128.9, 127.8, 117.1, 116.8, 103.5, 97.4, 55.5. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{14}H_{12}N_2I$ 335.0045; found 335.0048.



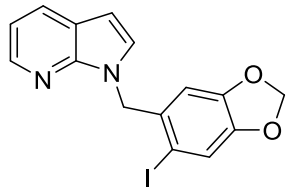
1-(2-iodobenzyl)-1*H*-pyrrolo[3,2-*c*]pyridine (1s)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (10:2:1) to give the product, yellow solid (1.42 g, 85%), mp 124−125 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.95 (s, 1H), 8.28 (d, *J* = 6.0 Hz, 1H), 7.87 (d, *J* = 7.6 Hz, 1H), 7.18-7.10 (m, 3H), 6.97 (t, *J* = 7.6 Hz, 1H), 6.66 (d, *J* = 1.2 Hz, 1H), 6.49 (d, *J* = 7.6 Hz, 1H), 5.28 (s, 2H)). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 144.1, 141.1, 140.0, 139.7, 138.6, 129.7, 129.2, 128.8, 127.7, 125.5, 105.1, 102.0, 97.4, 55.0. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{14}H_{12}IN_2$ 335.0040, found 335.0045.



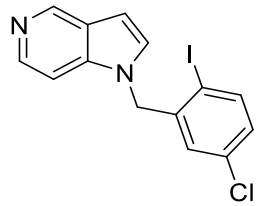
1-(2-iodobenzyl)-1*H*-pyrrolo[2,3-*b*]pyridine (1t)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (10:2:1) to give the product, white solid (1.62 g, 97%), mp 81−82 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 (dd, *J* = 4.8, 1.2 Hz, 1H), 7.96 (dd, *J* = 7.6, 1.6 Hz, 1H), 7.87 (dd, *J* = 8.0, 0.8 Hz, 1H), 7.21 (d, *J* = 3.6 Hz, 1H), 7.18 (t, *J* = 7.6 Hz, 1H), 7.10 (dd, *J* = 8.0, 4.4 Hz, 1H), 6.95 (t, *J* = 7.6 Hz, 1H), 6.69 (d, *J* = 7.6 Hz, 1H), 6.53 (d, *J* = 3.6 Hz, 1H), 5.53 (s, 2H). $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$) δ 147.8, 143.3, 140.0, 139.6, 129.3, 129.0, 128.7, 128.3, 128.1, 120.5, 116.2, 100.5, 98.0, 52.8. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{14}H_{12}IN_2$ 335.0040, found 335.0044.



1-((6-iodobenzo[d][1,3]dioxol-5-yl)methyl)-1*H*-pyrrolo[2,3-b]pyridine (1u)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (10:2:1) to give the product, white solid (1.51 g, 80%), mp 106−107 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.34 (dd, *J* = 4.4, 1.6 Hz, 1H), 7.92 (d, *J* = 8.0 Hz, 1H), 7.25 (s, 1H), 7.21 (d, *J* = 3.2 Hz, 1H), 7.09-7.06 (m, 1H), 6.49-6.48 (m, 1H), 6.34 (s, 1H), 5.86-5.84 (m, 2H), 5.43 (s, 2H). $^{13}C\{^{1}H\}$ NMR ($CDCl_3$, 100 MHz) δ 148.9, 148.1, 147.8, 143.3, 133.6, 129.1, 127.9, 120.6, 118.8, 116.2, 109.0, 101.8, 100.6, 86.0, 52.6. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{15}H_{12}N_2O_2I$ 378.9943; found 378.9945.

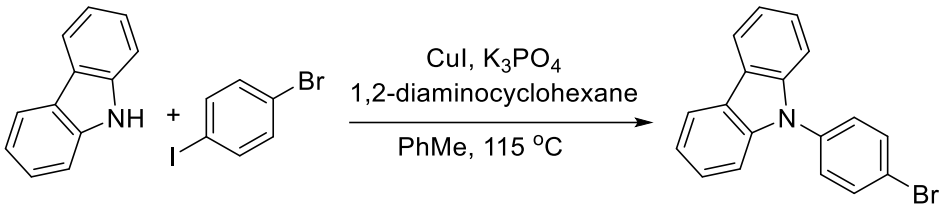


1-(5-chloro-2-iodobenzyl)-1*H*-pyrrolo[3,2-c]pyridine (1v)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (10:2:1) to give the product, yellow solid (1.29 g, 70%), mp 124−125 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.98 (d, *J* = 0.8 Hz, 1H), 8.33 (d, *J* =

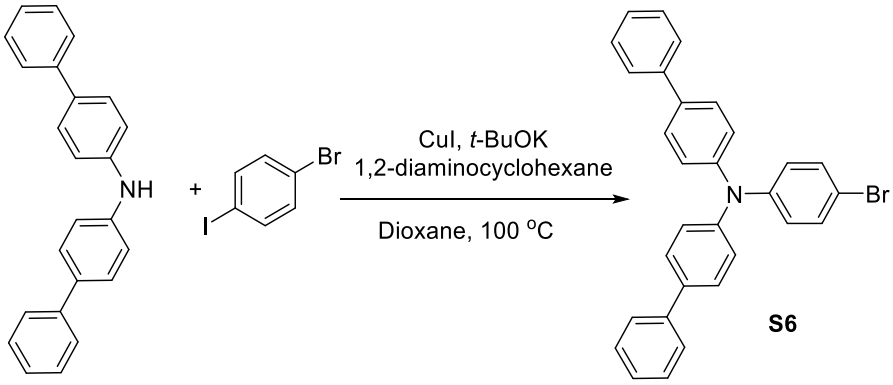
6.0 Hz, 1H), 7.80 (d, *J* = 8.4 Hz, 1H), 7.15 (td, *J* = 6.4, 1.2 Hz, 1H), 7.12 (d, *J* = 3.2 Hz, 1H), 7.00 (dd, *J* = 8.4, 2.4 Hz, 1H), 6.71 (dd, *J* = 3.2, 1.2 Hz, 1H), 6.47 (d, *J* = 2.4 Hz, 1H), 5.26 (s, 2H). $^{13}C\{^1H\}$ NMR ($CDCl_3$, 100 MHz) δ 144.4, 141.4, 140.8, 140.6, 140.0, 135.6, 130.0, 129.0, 127.8, 125.6, 105.0, 102.6, 94.3, 54.7. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{14}H_{11}N_2ClI$ 368.9655; found 368.9659.

General procedure for 1j and 1k



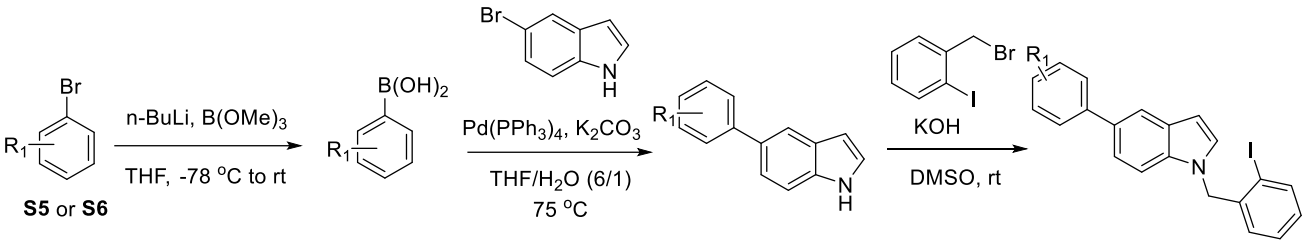
S5

To tube were added CuI (0.3 mmol), carbazole (20 mmol), K_3PO_4 (60 mmol), followed by Ar for 15 min. 1-bromo-4-iodobenzene (21 mmol) and trans-1,2-diaminocyclohexane (5 mmol) were added. Then toluene (60 mL) was added. The reaction tube was sealed and the contents stirred while being heating in an oil bath at 115 °C for 24 h. The reaction mixture was cooled to ambient temperature, diluted with ethyl acetate and filtered through a plug of celites, eluting with additional ethyl acetate. The filtrate was concentrated and the resulting residue purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (30:2:1) to give the product. White solid, 5.35 g, 83%, mp 138−139 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 8.12 (d, *J* = 7.6 Hz, 2H), 7.70 (d, *J* = 8.4 Hz, 2H), 7.41 (t, *J* = 7.6 Hz, 3H), 7.36 (t, *J* = 7.6 Hz, 3H), 7.28 (t, *J* = 7.6 Hz, 2H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 140.7, 136.9, 133.2, 128.8, 126.2, 123.6, 121.0, 120.5, 120.3, 109.7.[4]



S6

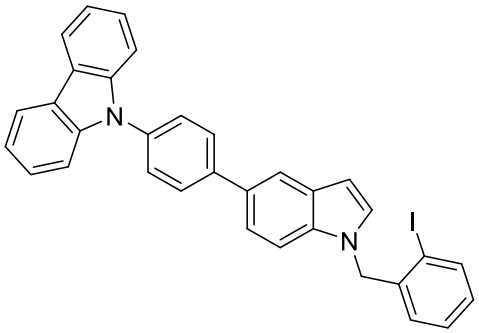
Bis(biphenyl-4-yl)amine (30 mmol), 1-bromo-4-iodobenzene (30 mmol), CuI (0.3 mmol), ^{t}BuOK (45 mmol), trans-1,2-cyclohexanediamine (3 mmol) were added to 1,4-dioxane (50 mL). The mixture was stirred at 100℃ for 12 h, then cooled to room temperature. Water (100 mL) and toluene (100 mL) were added to the mixture. The organic later was separated, dried $NaSO_4$ and concentrated. The residue was washed with methanol and then purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (30:2:1) to give the product. White solid, 10.3 g, 72%, mp 169−170 °C. ^1H NMR (400 MHz, $CDCl_3$) δ 7.61 (d, *J* = 7.6 Hz, 4H), 7.54 (d, *J* = 8.4 Hz, 4H), 7.48 (t, *J* = 8.0 Hz, 4H), 7.40 (d, *J* = 8.4 Hz, 2H), 7.36 (t, *J* = 7.2 Hz, 2H), 7.21 (d, *J* = 8.4 Hz, 4H), 7.08 (d, *J* = 8.8 Hz, 2H). $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$) δ 146.8, 146.6, 140.5, 136.1, 132.4, 128.9, 128.1, 127.1, 126.8, 125.7, 124.5, 115.4.[6]



n-BuLi (7.5 mL, 12 mmol) was added dropwise to a solution of Bromobenzene (10 mmol) in dry THF (40 mL) at -78℃ in Ar. After 10 minutes, trimethyl borate (1.4 mL, 12 mmol) was added dropwise. The mixture was stirred for another 10 minutes at -78℃, and then allowed to warm to rt. The resulting mixture was neutralized with aqueous hydrochloric acid and stirred for 3 hours at room temperature. The product was extracted with chloroform, concentrated, washed with toluene, The residue product was used in the next step without purification.

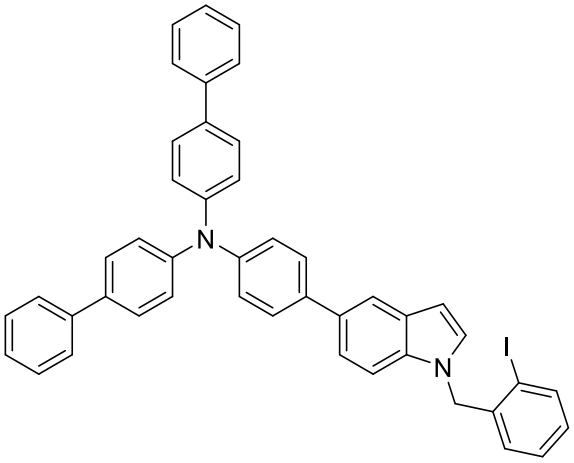
K_2CO_3 (2.76 g, 20 mmol) was added to a suspension of indole (5.5 mmol), phenylboronic acid (5 mmol) and $Pd(PPh_3)_4$ (0.25 mmol) at RT. Then THF/H_2O (30/5 mL) was added. After the mixture was stirred for 15 hours at 75ºC, the solution was extracted with ethyl acetate. The combined organic extracts were washed with brine, dried over anhydrous Na_2SO_4, filtered, concentrated and purified on silica gel chromatography (EtOAc/petroleum ether as eluent) to give the product. The residue product was used in the next step without purification.

KOH (2 equiv) was weighed directly into a Schlenk tube and dried under vacuum for 15 min. Then DMSO (10 mL) was added and stirred for 5 minutes, indole (5 mmol) was slowly added. After stirring for 30 min, 1-(bromomethyl)-2-iodobenzene (1.2 equiv) was added. The resulting reaction mixture was monitored by TLC. The reaction was quenched by H_2O and extracted with Et_2O. The combined organic extracts were washed with brine, dried over anhydrous Na_2SO_4, filtered, concentrated and purified on silica gel chromatography (EtOAc/petroleum ether as eluent) to give the product.



9-(4-(1-(2-iodobenzyl)-1*H*-indol-5-yl)phenyl)-9*H*-carbazole (1j)

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (20:2:1) to give the product, white solid (2.01 g, 70%), mp 219−220 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.19 (d, *J* = 8.0 Hz, 2H), 8.01 (d, *J* = 1.2 Hz, 1H), 7.93 (dd, *J* = 7.6, 0.8 Hz, 1H), 7.90-7.86 (m, 2H), 7.65-7.63 (m, 2H), 7.56-7.51 (m, 3H), 7.46 (td, *J* = 7.2, 1.2 Hz, 2H), 7.37-7.31 (m, 3H), 7.23-7.19 (m, 2H), 7.01 (td, *J* = 8.0, 1.6 Hz, 1H), 6.72 (d, *J* = 2.4 Hz, 1H), 6.58 (dd, *J* = 8.0, 1.2 Hz, 1H), 5.37 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 141.7, 141.1, 139.6, 139.4, 136.1, 136.0, 132.5, 129.5, 129.4, 129.3, 128.9, 128.7, 127.7, 127.4, 126.0, 123.5, 121.8, 120.4, 120.0, 119.8, 110.3, 110.1, 102.8, 97.3, 55.4. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{33}H_{24}IN_2$ 575.0979, found 575.0989.



***N*-([1,1'-biphenyl]-4-yl)-*N*-(4-(1-(2-iodobenzyl)-1*H*-indol-5-yl)phenyl)-[1,1'-biphenyl]-4-amine (1k)**

This compound was prepared according to the general procedure. Purified on silica gel chromatography using petroleum ether/CH_2Cl_2/EtOAc (20:2:1) to give the product, white solid (2.37 g, 65%), mp 100−101 °C. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.88 (d, *J* = 6.8 Hz, 2H), 7.57 (t, *J* = 8.0 Hz, 6H), 7.51 (d, *J* = 8.4 Hz, 4H), 7.41 (t, *J* = 7.6 Hz, 5H), 7.30 (t, *J* = 7.6 Hz, 2H), 7.26-7.22 (m, 7H), 7.17-7.11 (m, 2H), 6.95 (t, *J* = 7.6 Hz, 1H), 6.62 (d, *J* = 2.8 Hz, 1H), 6.51 (d, *J* = 7.6 Hz, 1H), 5.30 (s, 2H). ^{13}C{^{1}H} NMR (100 MHz, $CDCl_3$) δ 147.1, 146.1, 140.8, 139.6, 139.5, 137.4, 135.8, 135.5, 132.9, 129.5, 129.3, 129.1, 128.9 (two peaks), 128.2, 128.0, 127.8, 127.0, 126.8, 125.0, 124.3, 121.7, 119.3, 110.1, 102.6, 97.3, 55.4. HRMS (ESI–TOF) m/z: $[M+H]^+$ calcd for $C_{45}H_{34}IN_2$ 729.1761, found 729.1749.

3. X-Ray Crystallographic Data

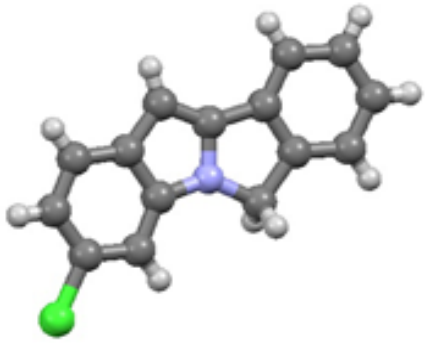


Table S1 Crystal data and structure refinement for 3-chloro-6*H*-isoindolo[2,1-a]indole

Empirical formula	$C_{15}H_{10}ClN$
Formula weight	239.69
Temperature/K	290(2)
Crystal system	monoclinic
Space group	P21/c
a/Å	21.7792(5)
b/Å	5.94230(10)
c/Å	17.7812(4)
α/°	90
β/°	103.244(2)

γ/°	90
Volume/Å^3	2240.01(8)
Z	8
ρcalcg/cm^3	1.421
μ/mm^{-1}	2.774
F(000)	992.0
Crystal size/mm^3	0.250 × 0.240 × 0.200
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	8.342 to 142.732
Index ranges	-19 ≤ h ≤ 26, -5 ≤ k ≤ 6, -21 ≤ l ≤ 21
Reflections collected	7681
Independent reflections	4170 [Rint = 0.0258, Rsigma = 0.0309]
Data/restraints/parameters	4170/0/307
Goodness-of-fit on F^2	1.070
Final R indexes [I>=2σ (I)]	R_1 = 0.0436, wR_2 = 0.1186
Final R indexes [all data]	R_1 = 0.0487, wR_2 = 0.1235
Largest diff. peak/hole / e Å^{-3}	0.25/-0.27

4. Reference

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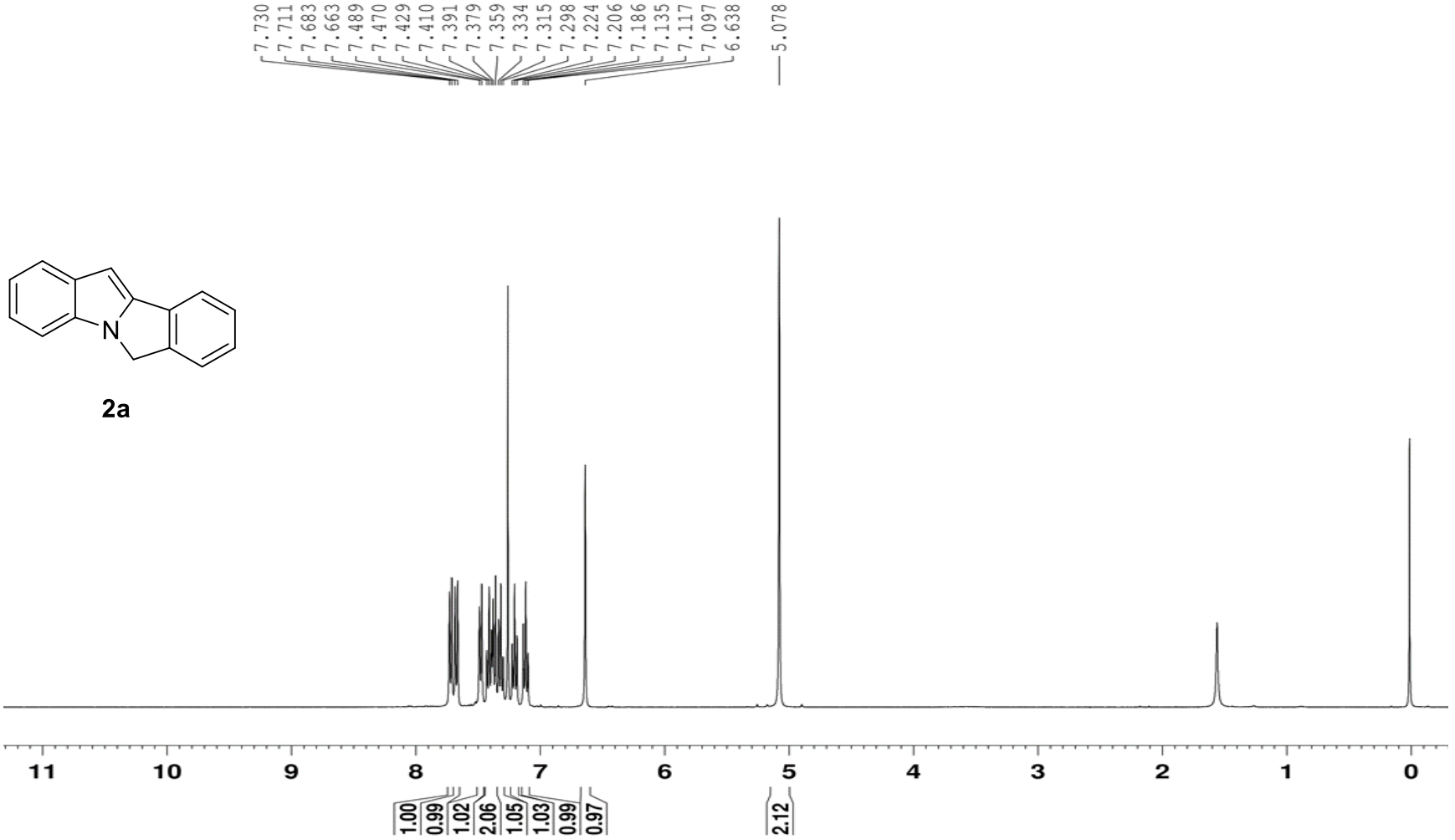
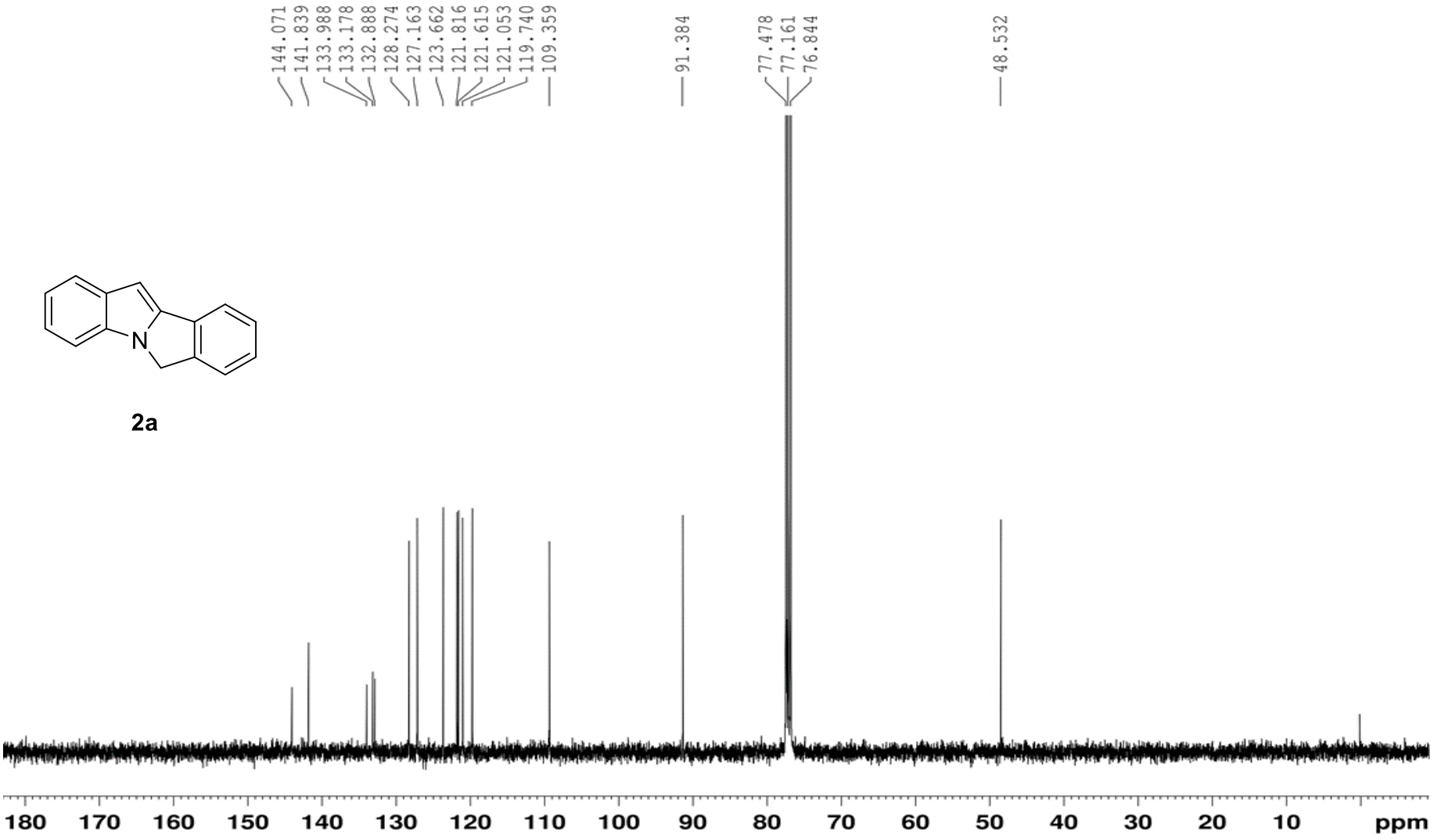
5. NMR spectra

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109.359
91.384
77.478
77.161
76.844
48.532
N
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140
130
120
110
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80
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60
50
40
30
20
10
ppm

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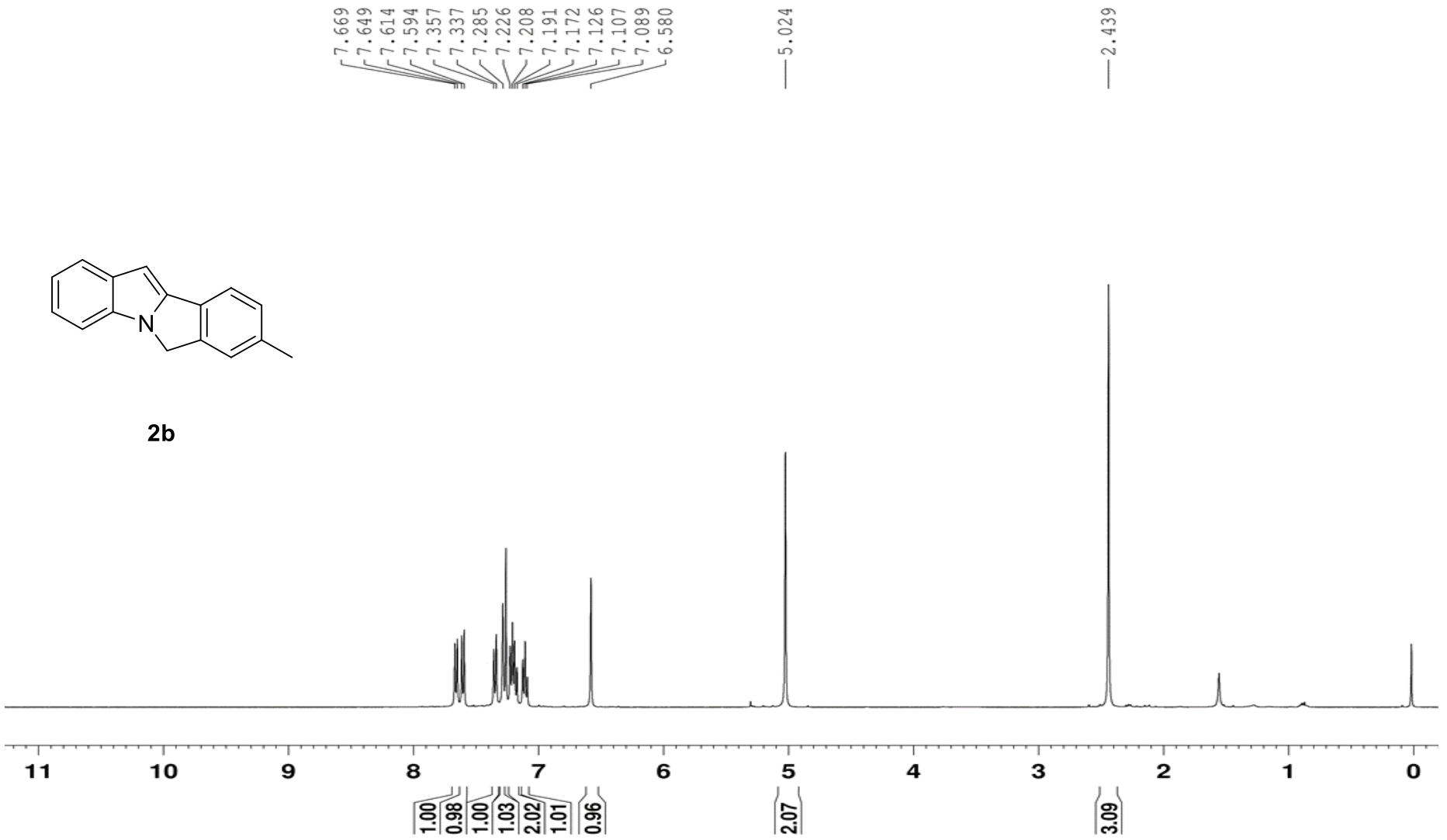
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6.580
5.024
2.439
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11
10
9
8
7
6
5
4
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1.01
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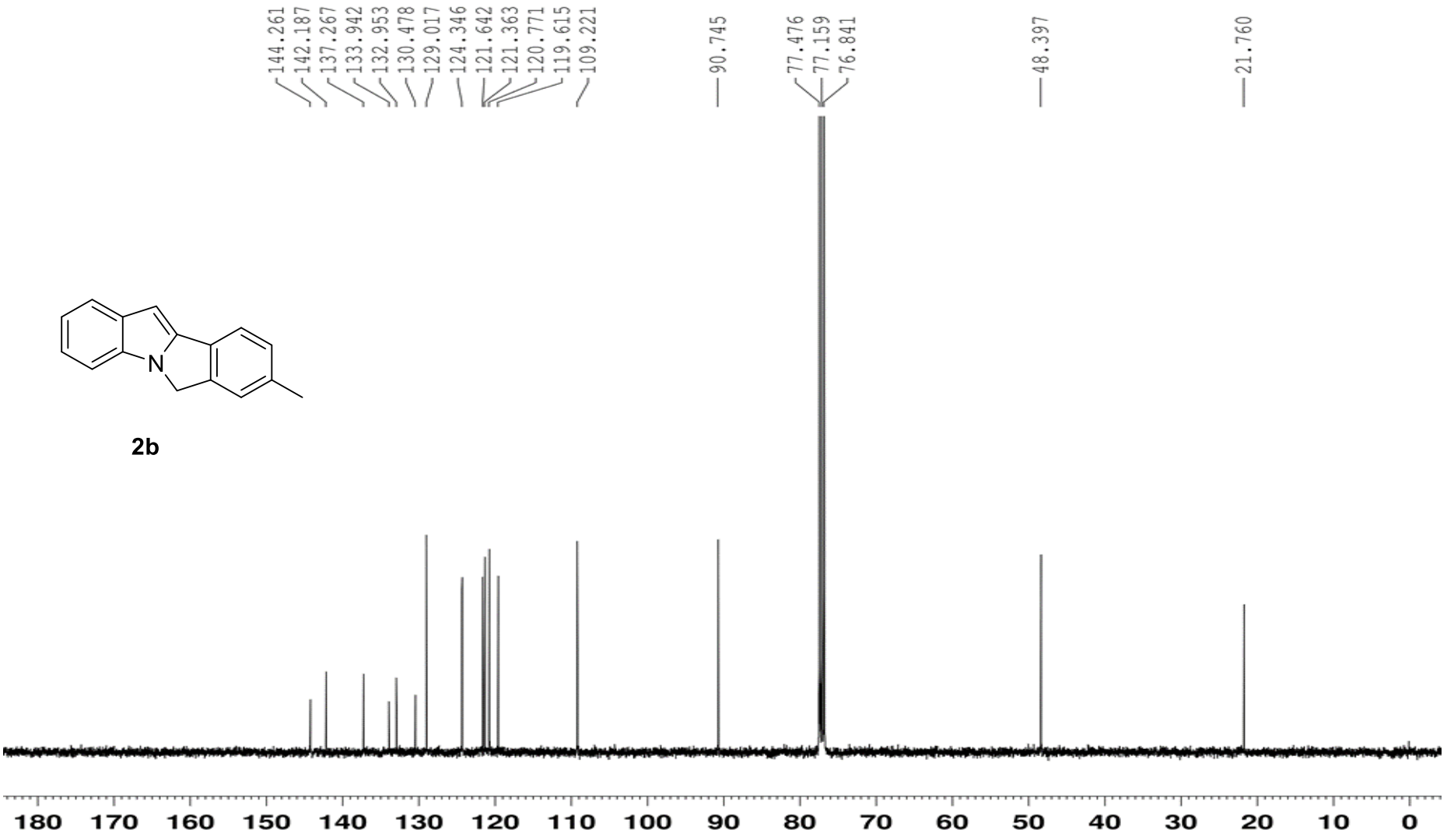
3.09

2b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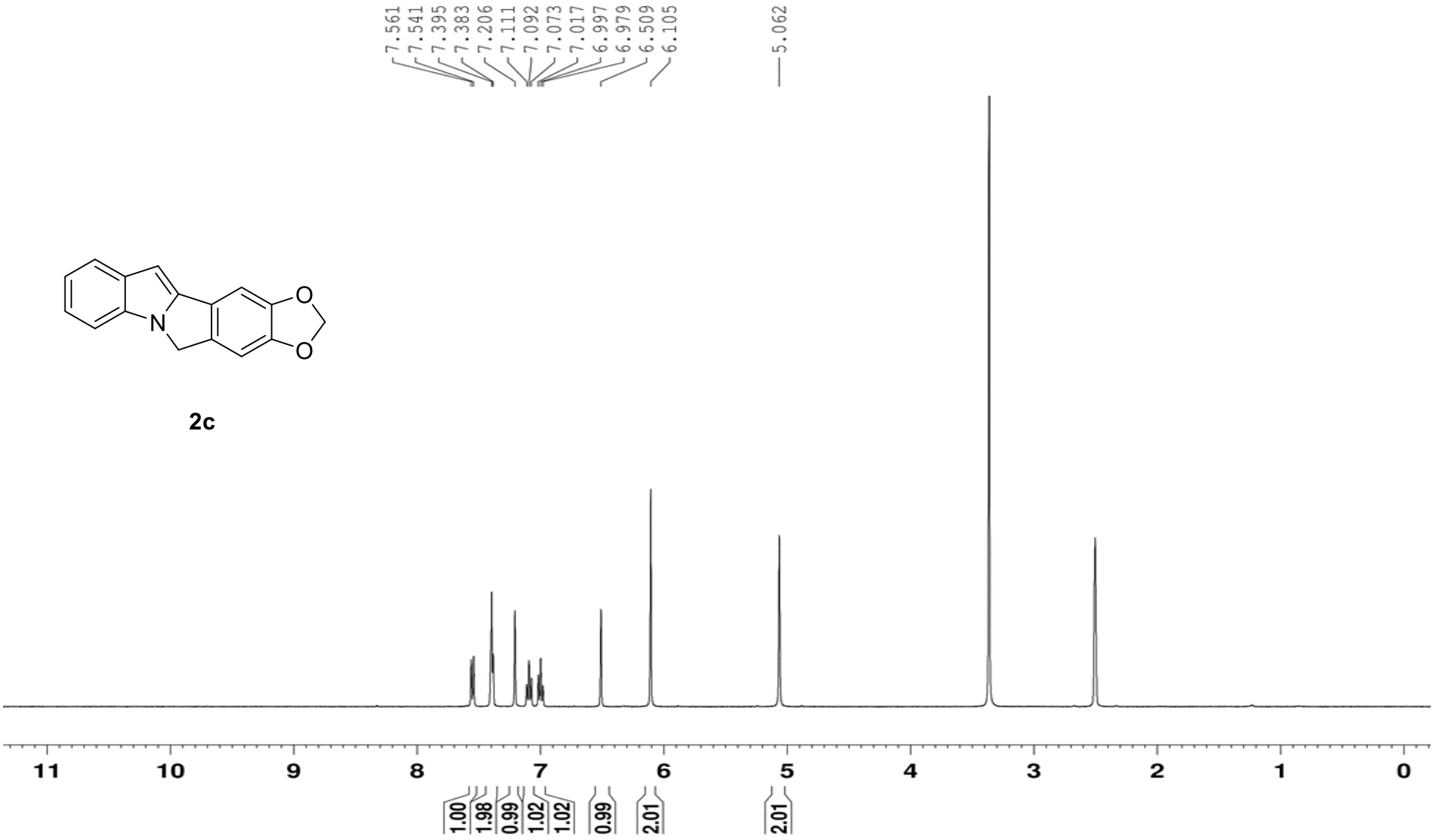
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5.062
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N
O
11
10
9
8
7
6
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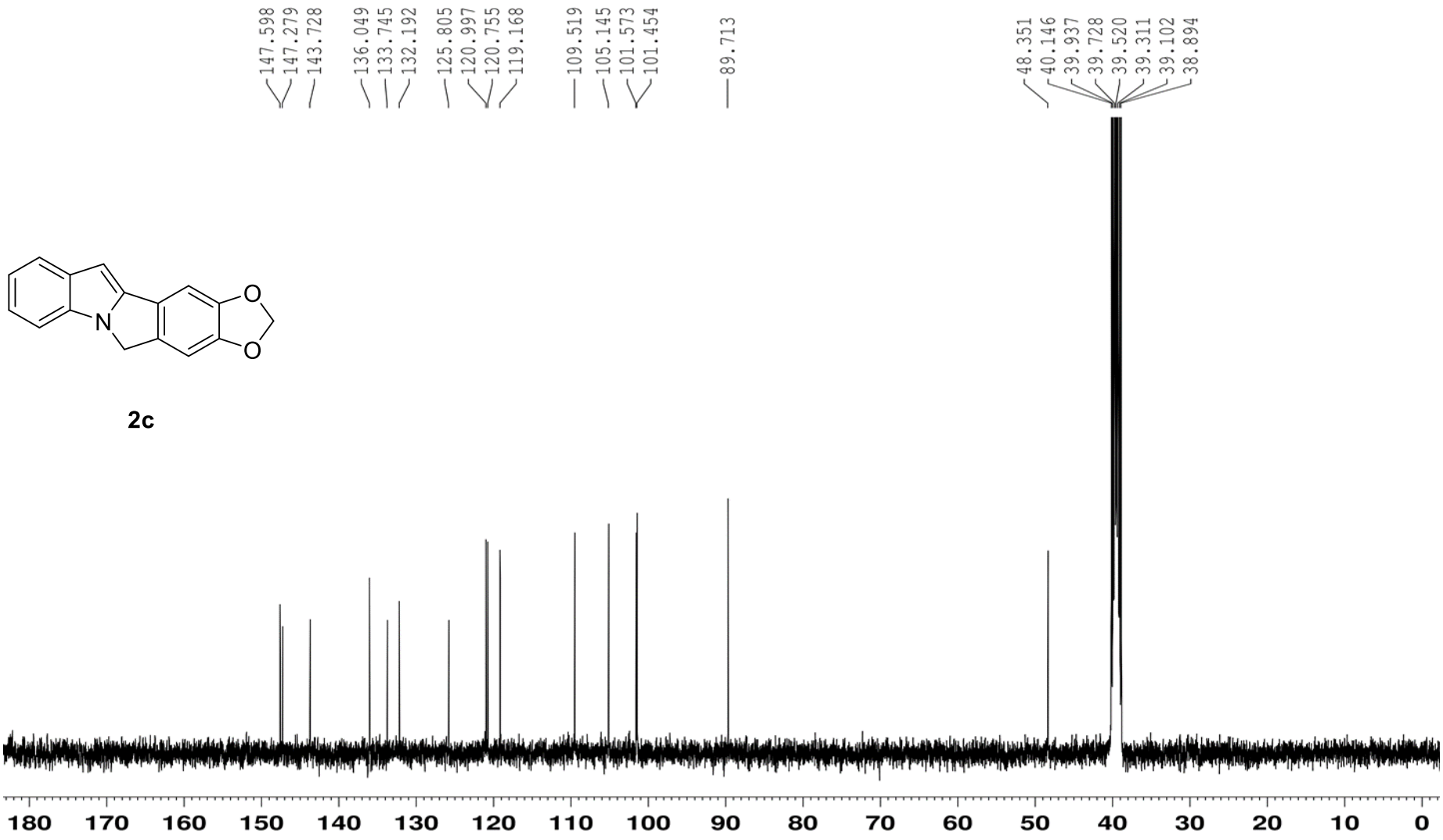
2.01

2c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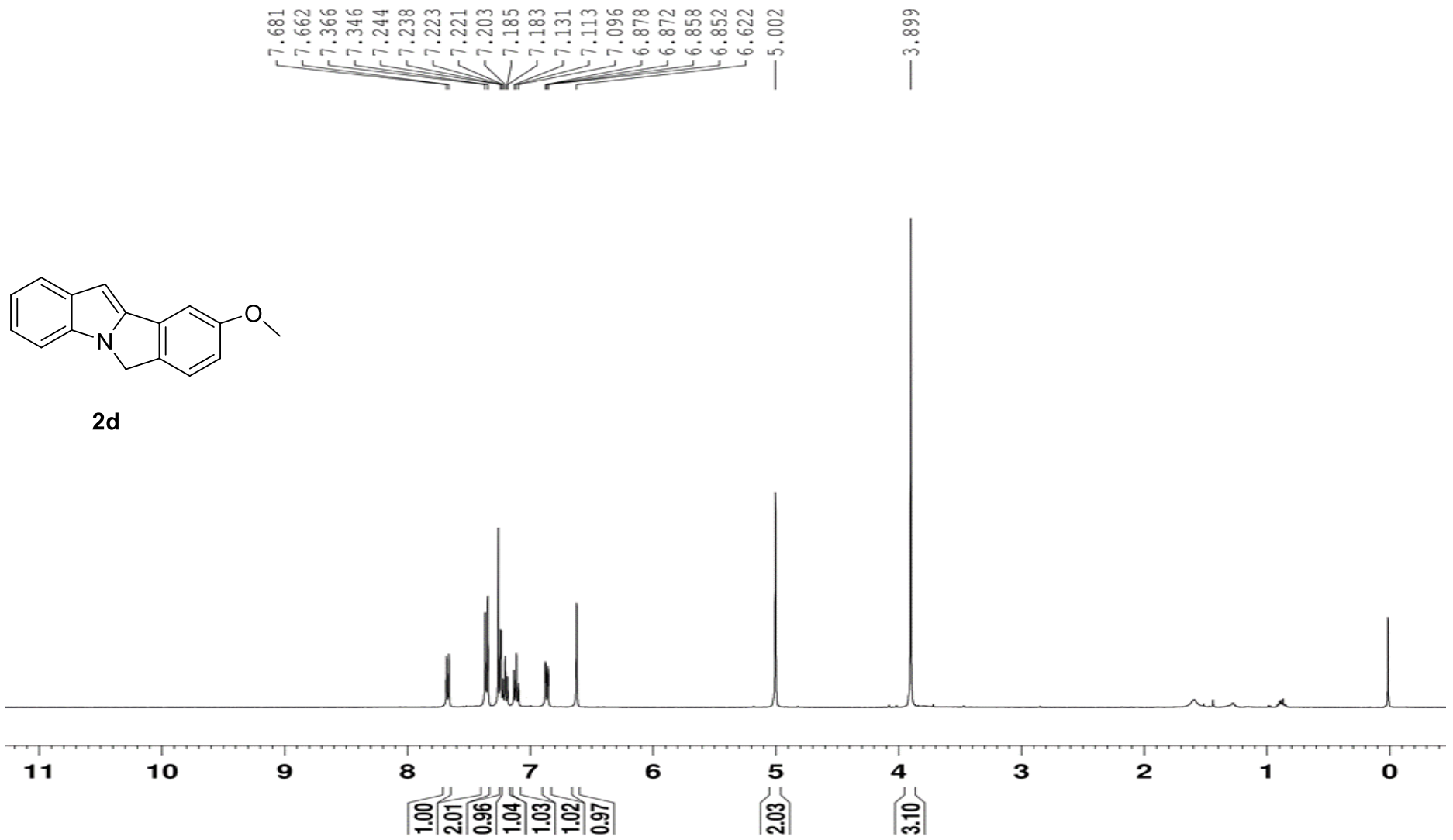
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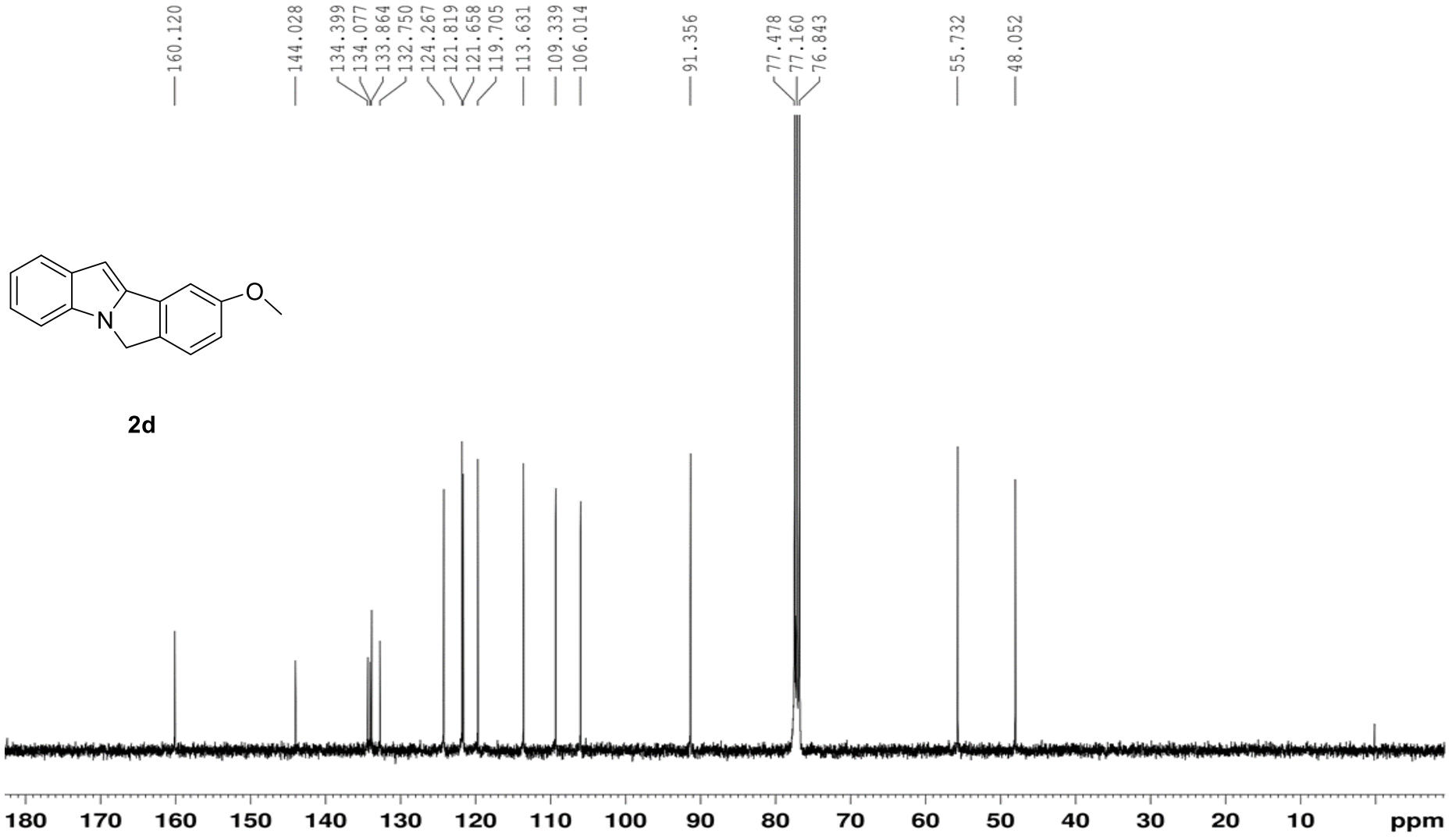
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91.356
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77.160
76.843
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48.052
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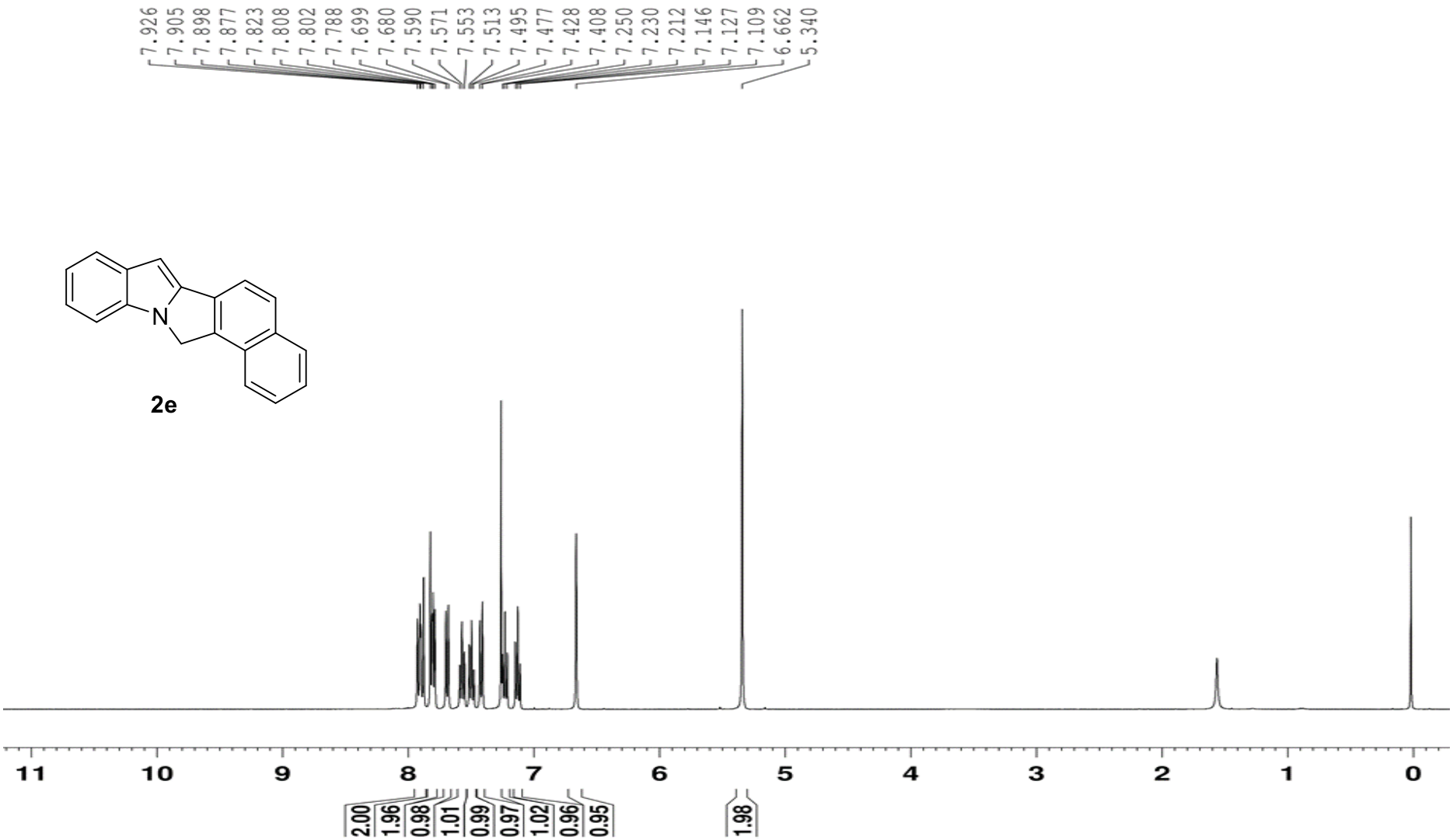
20
10
ppm

2d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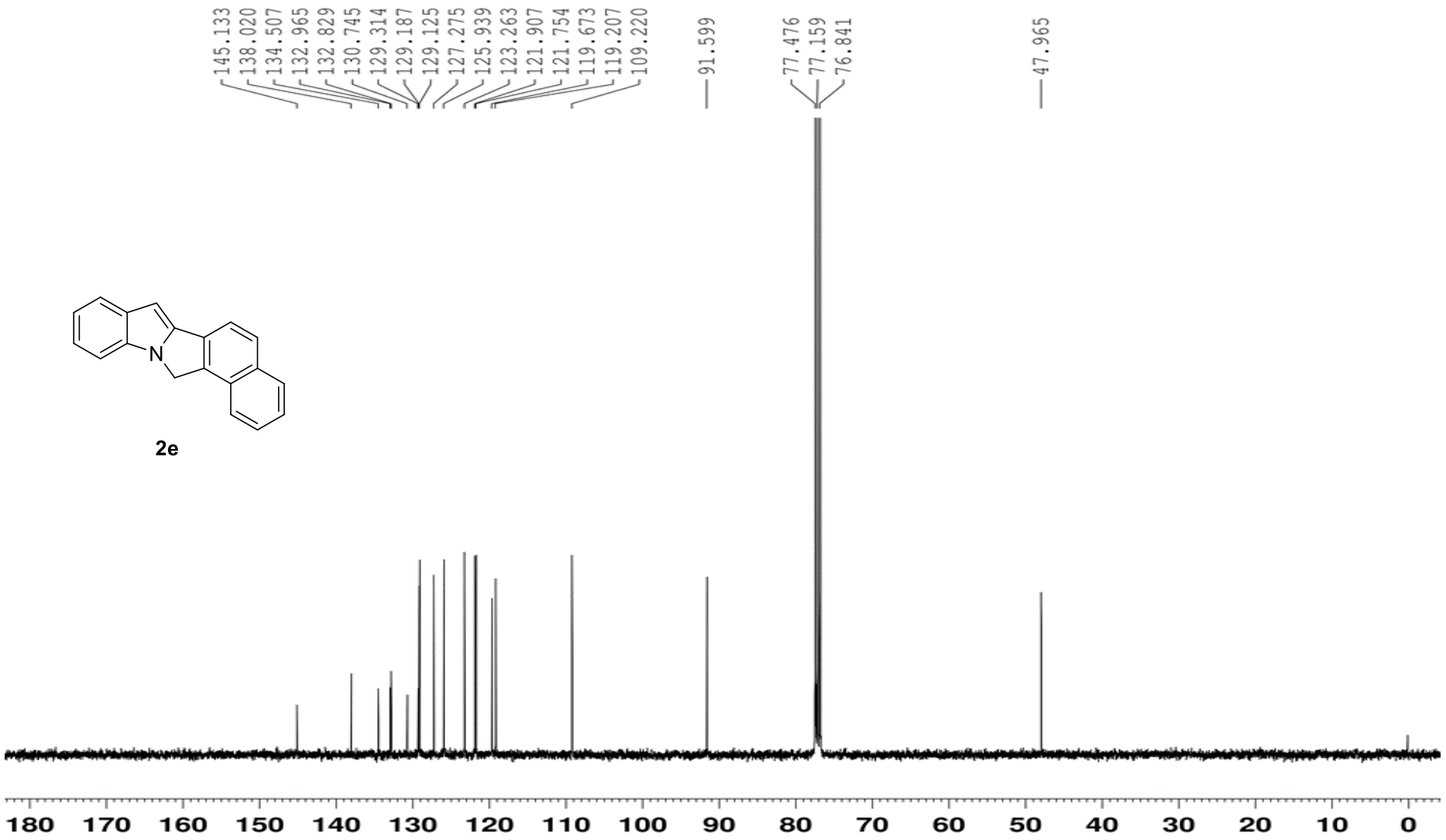
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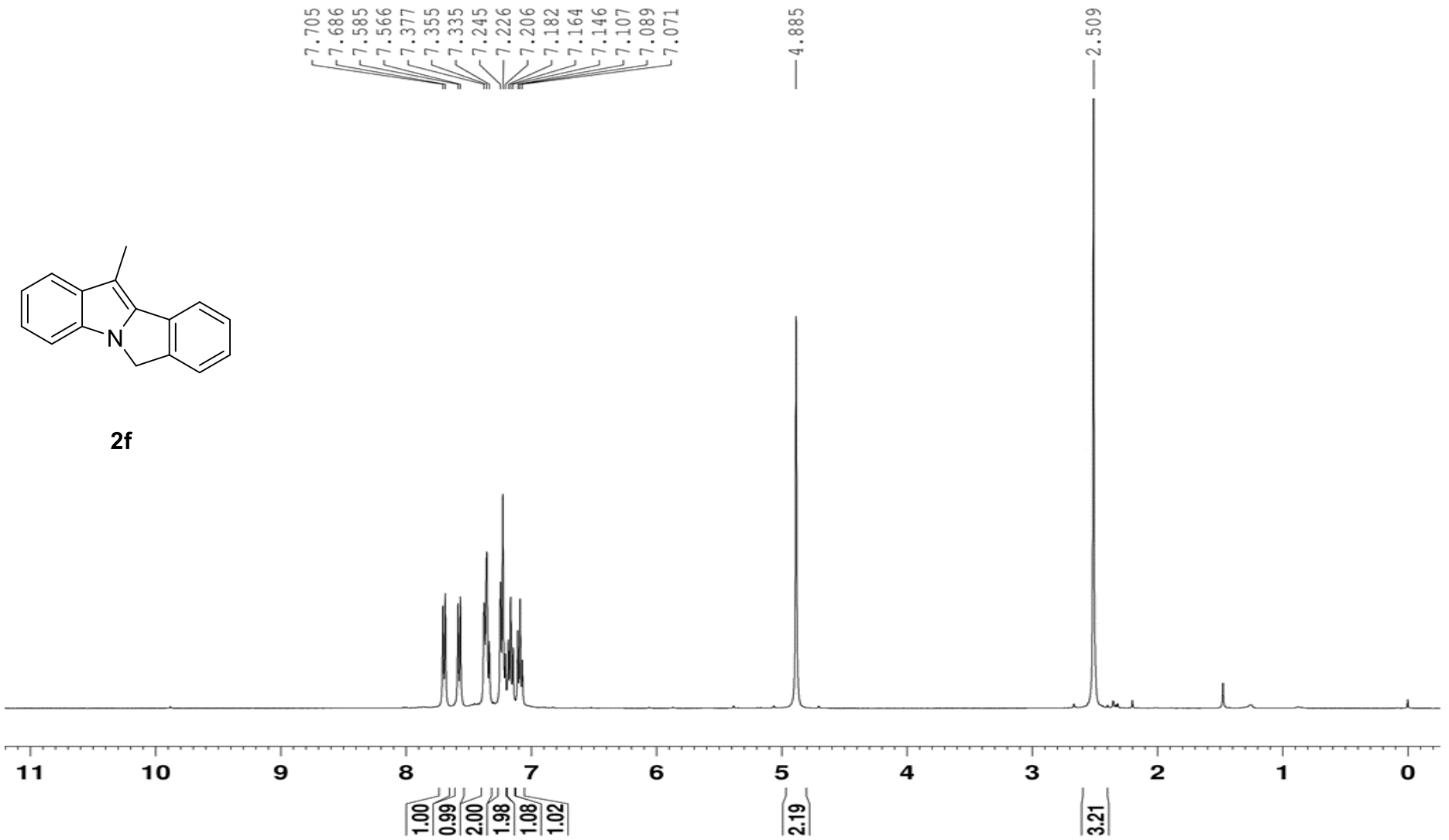
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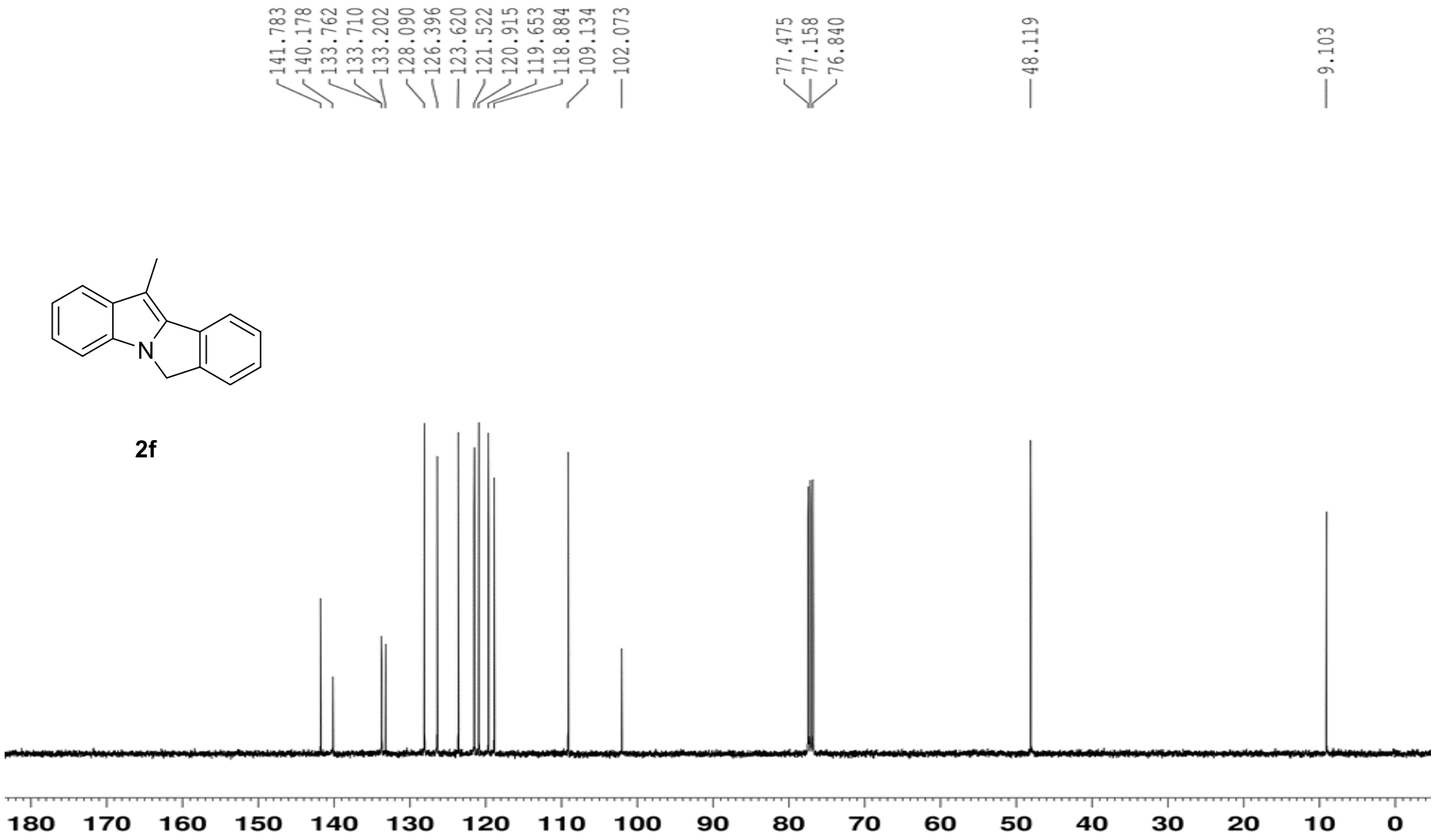
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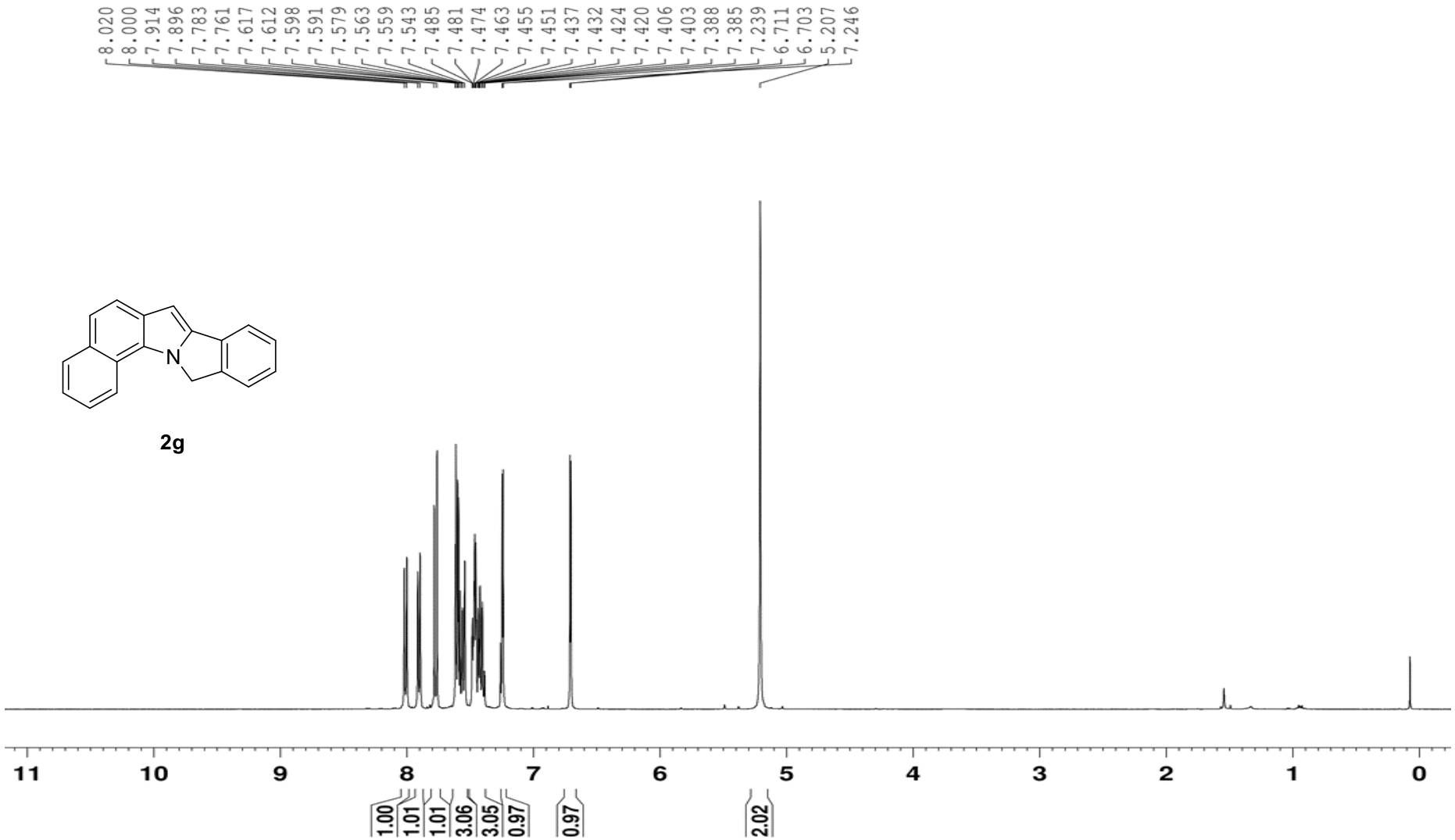
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5.207
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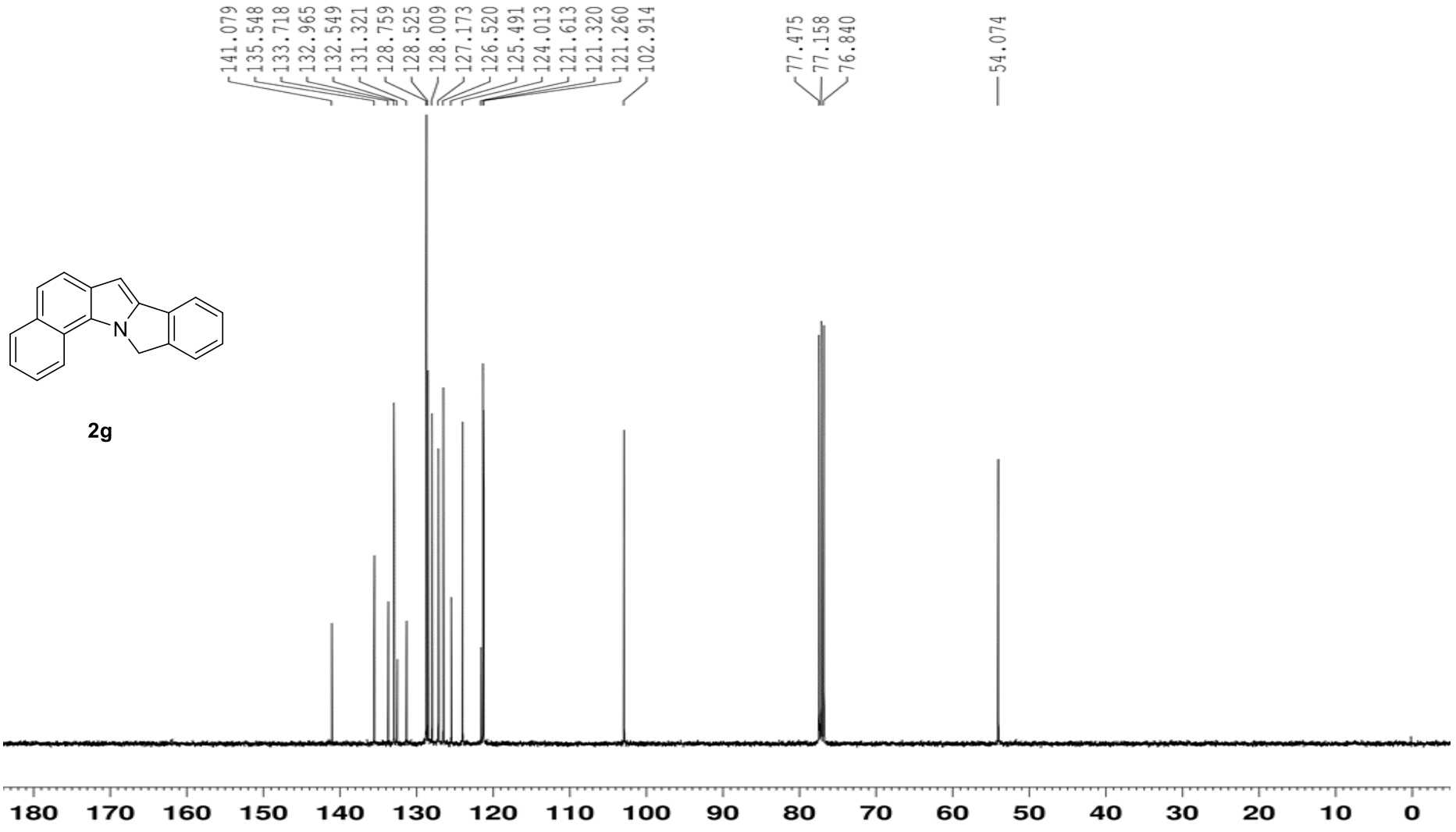
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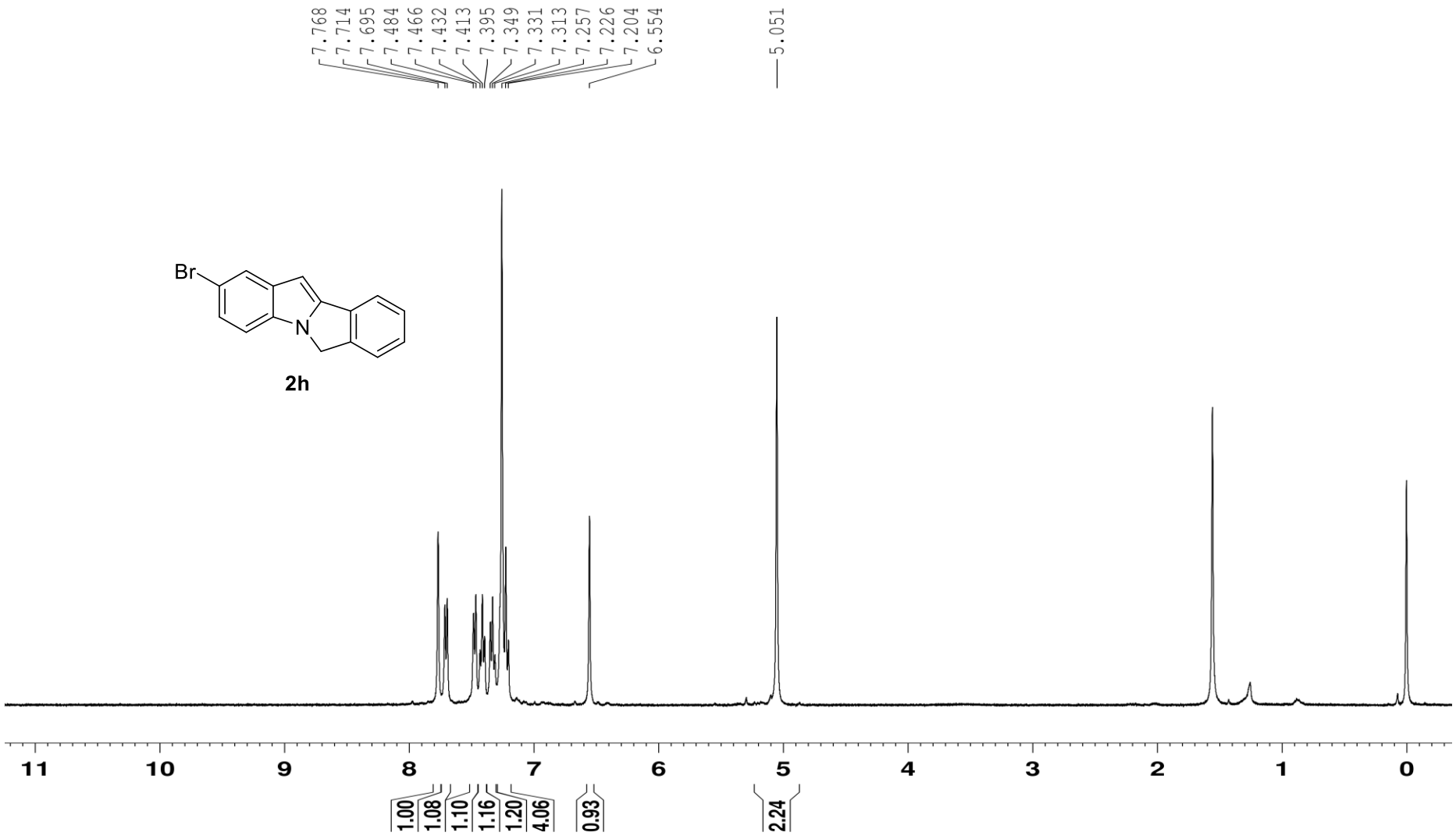
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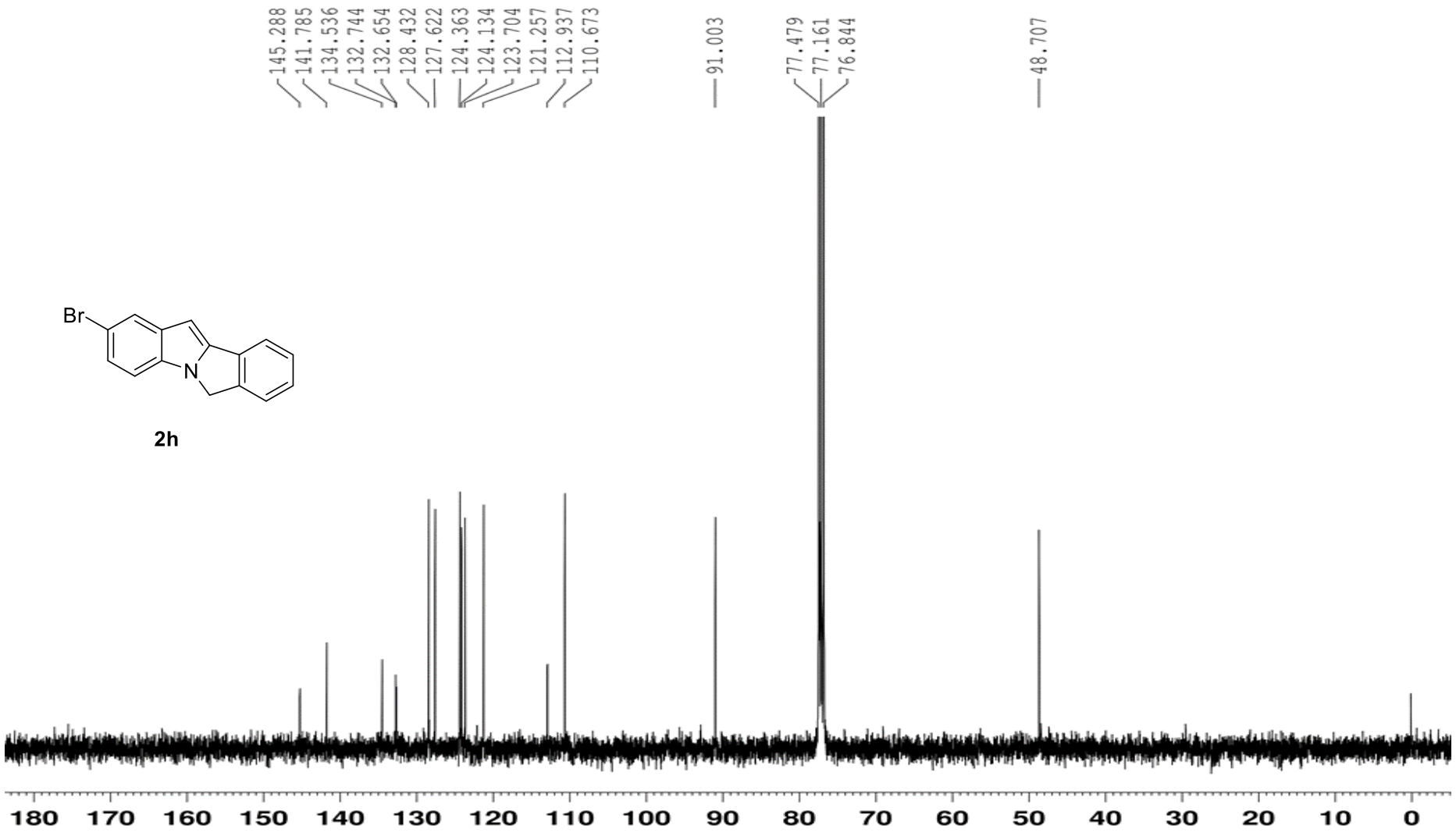
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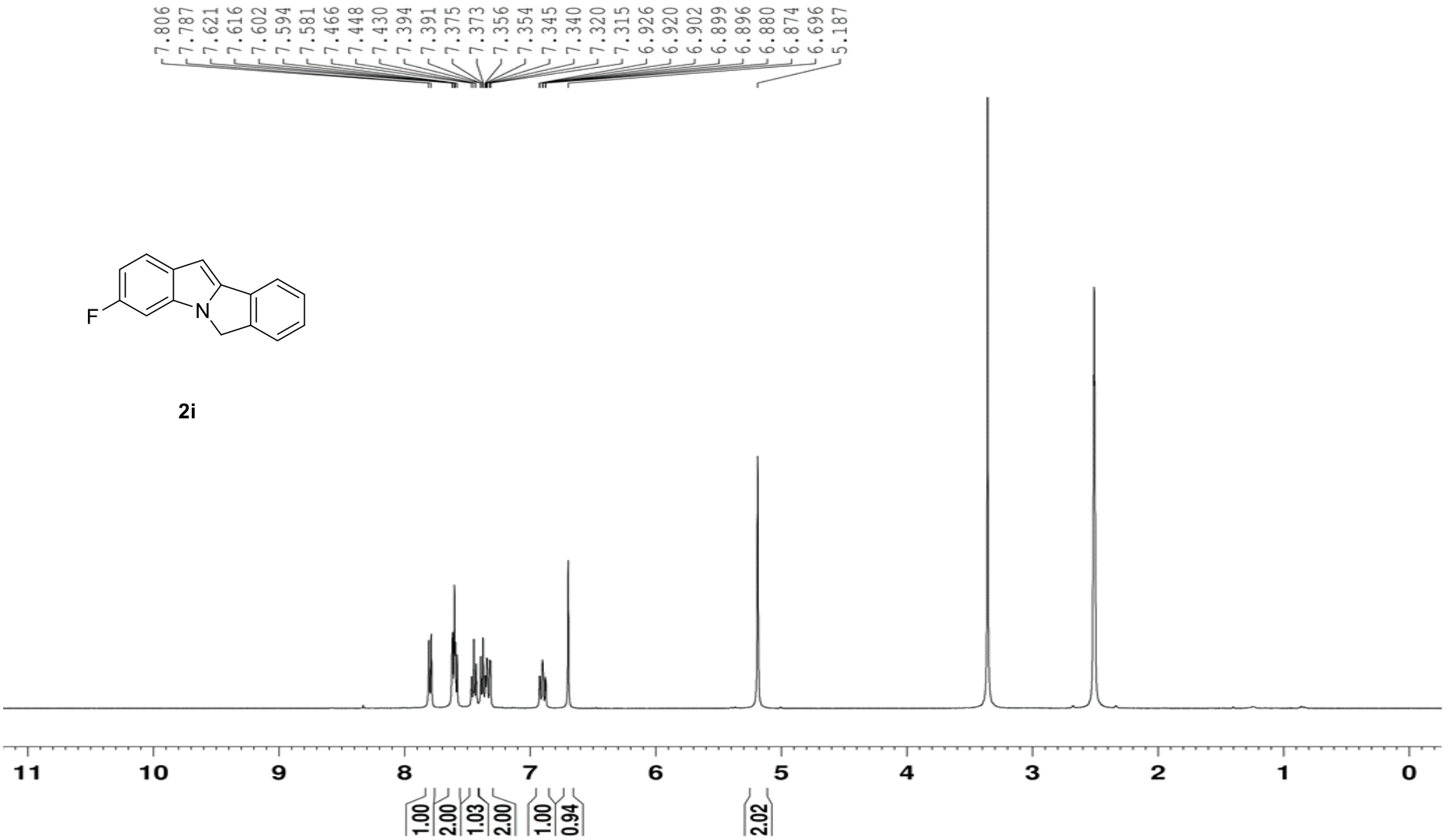
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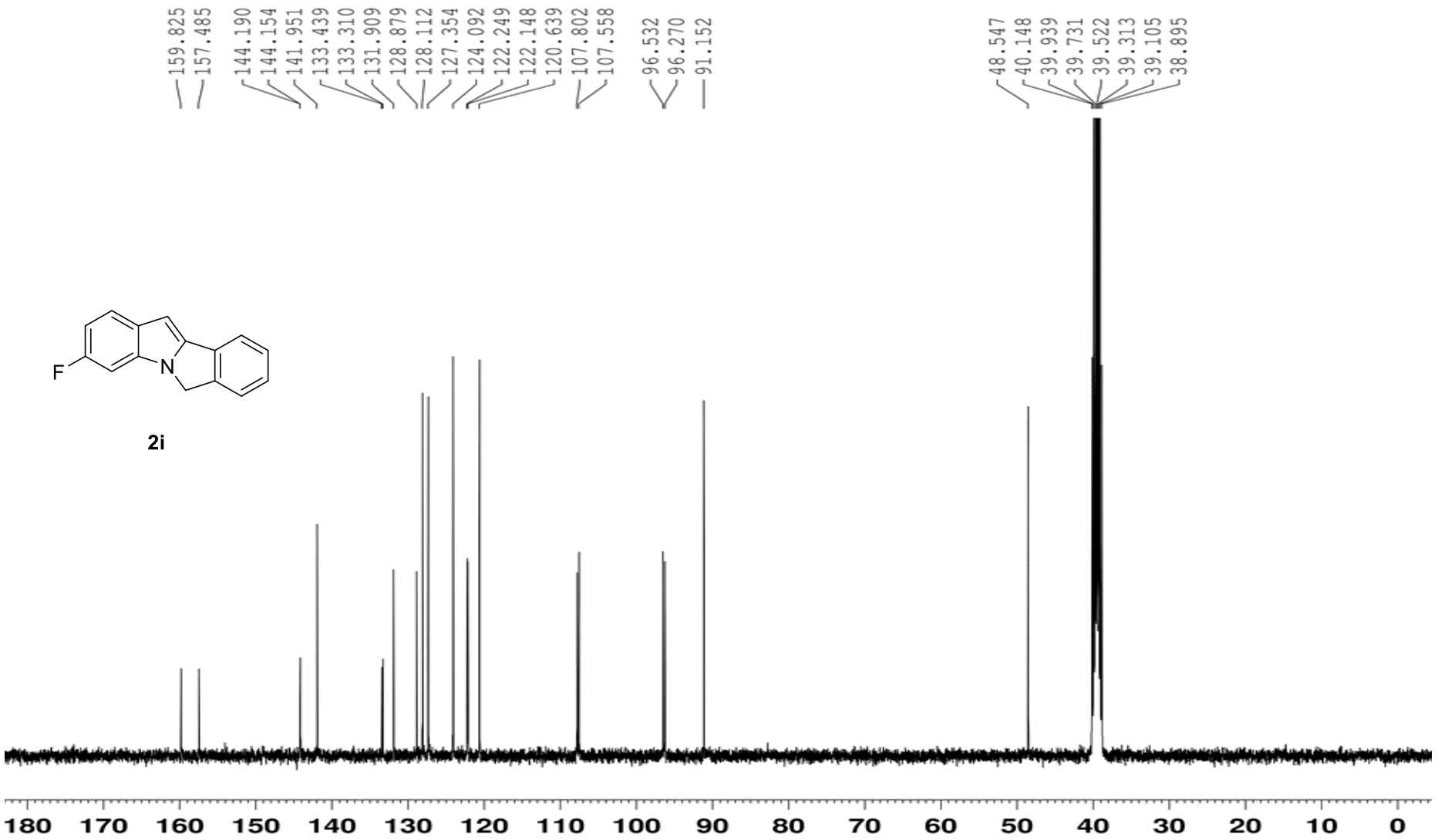
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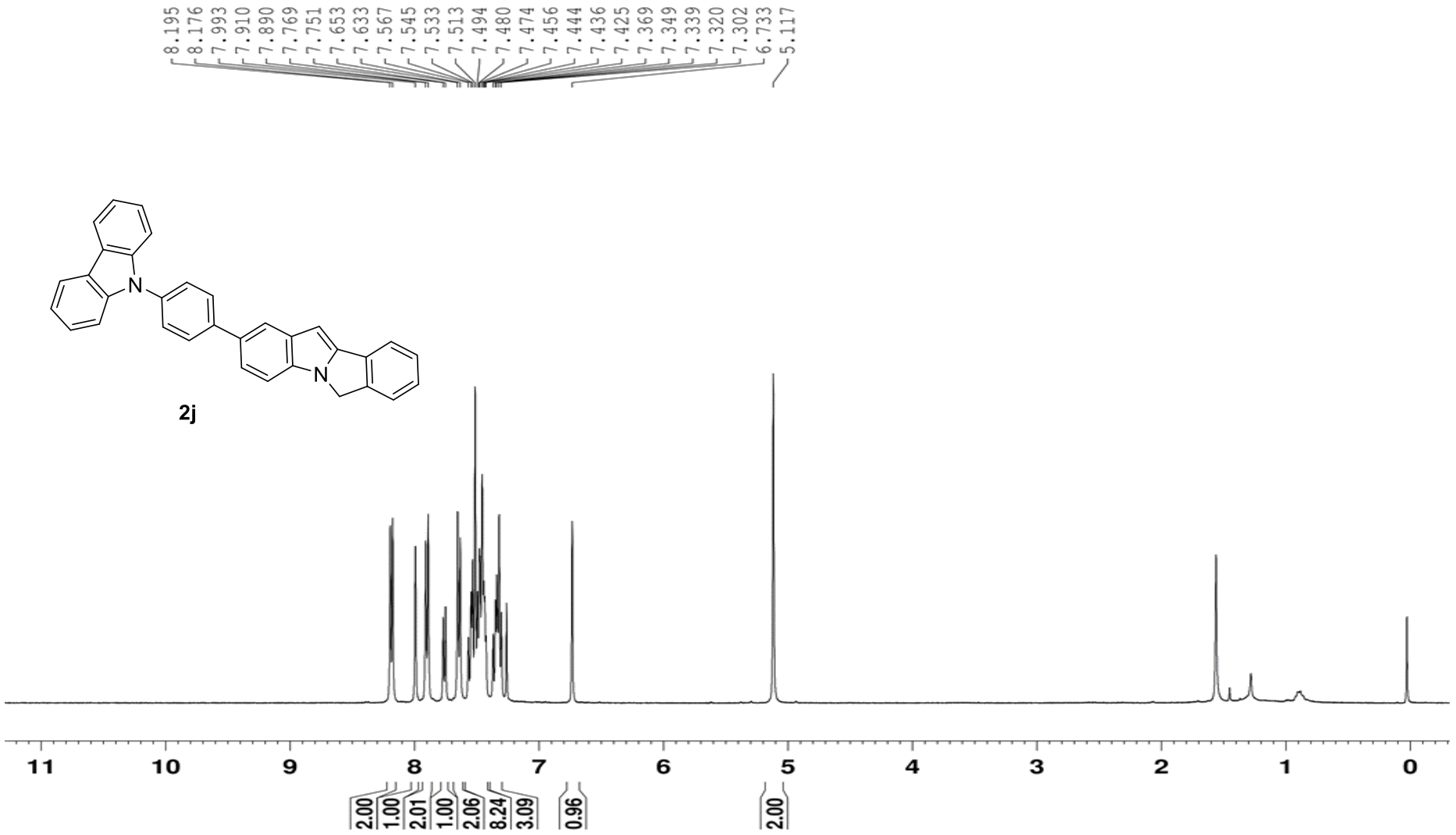
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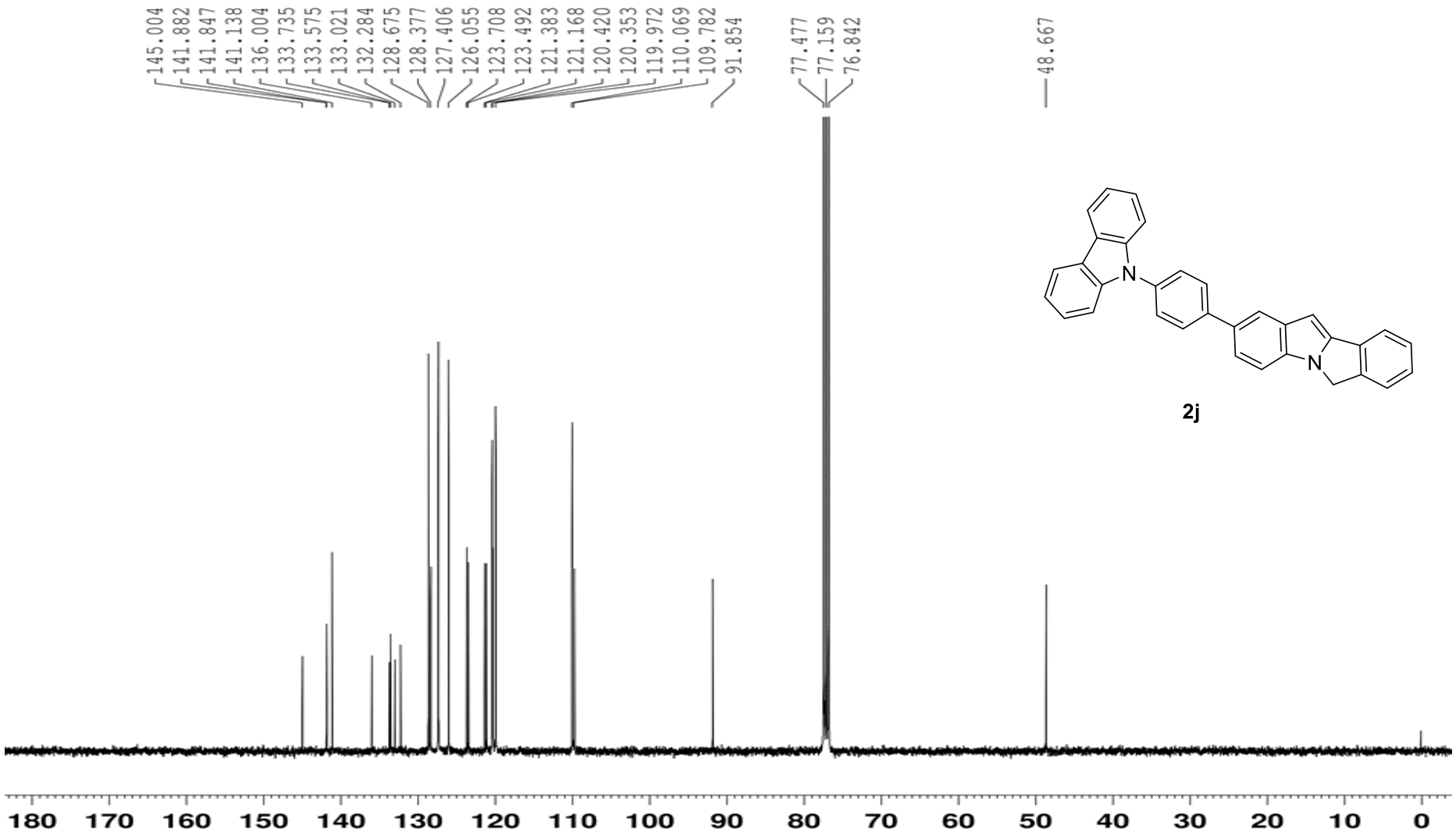
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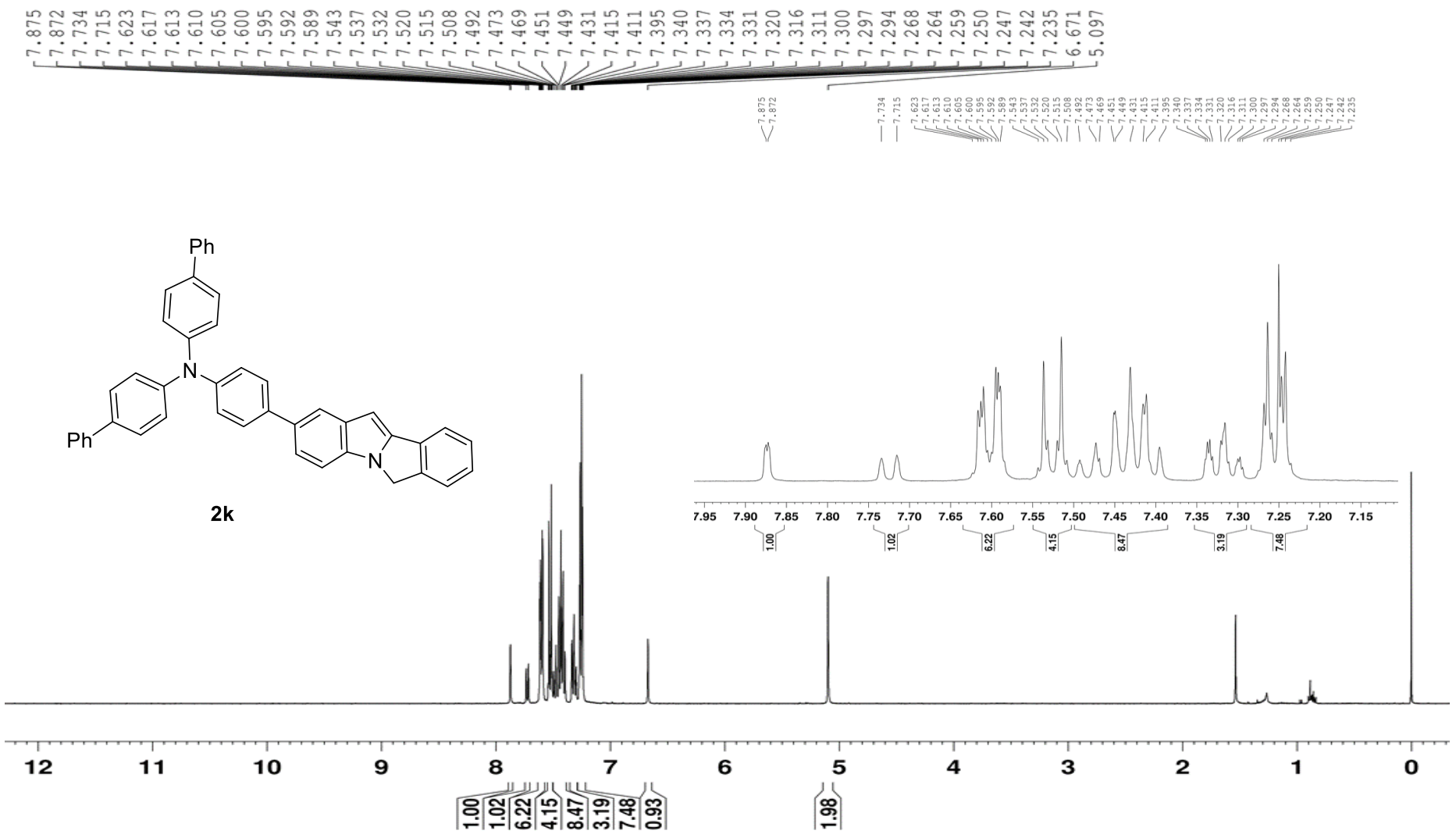
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Ph
N
Ph
N
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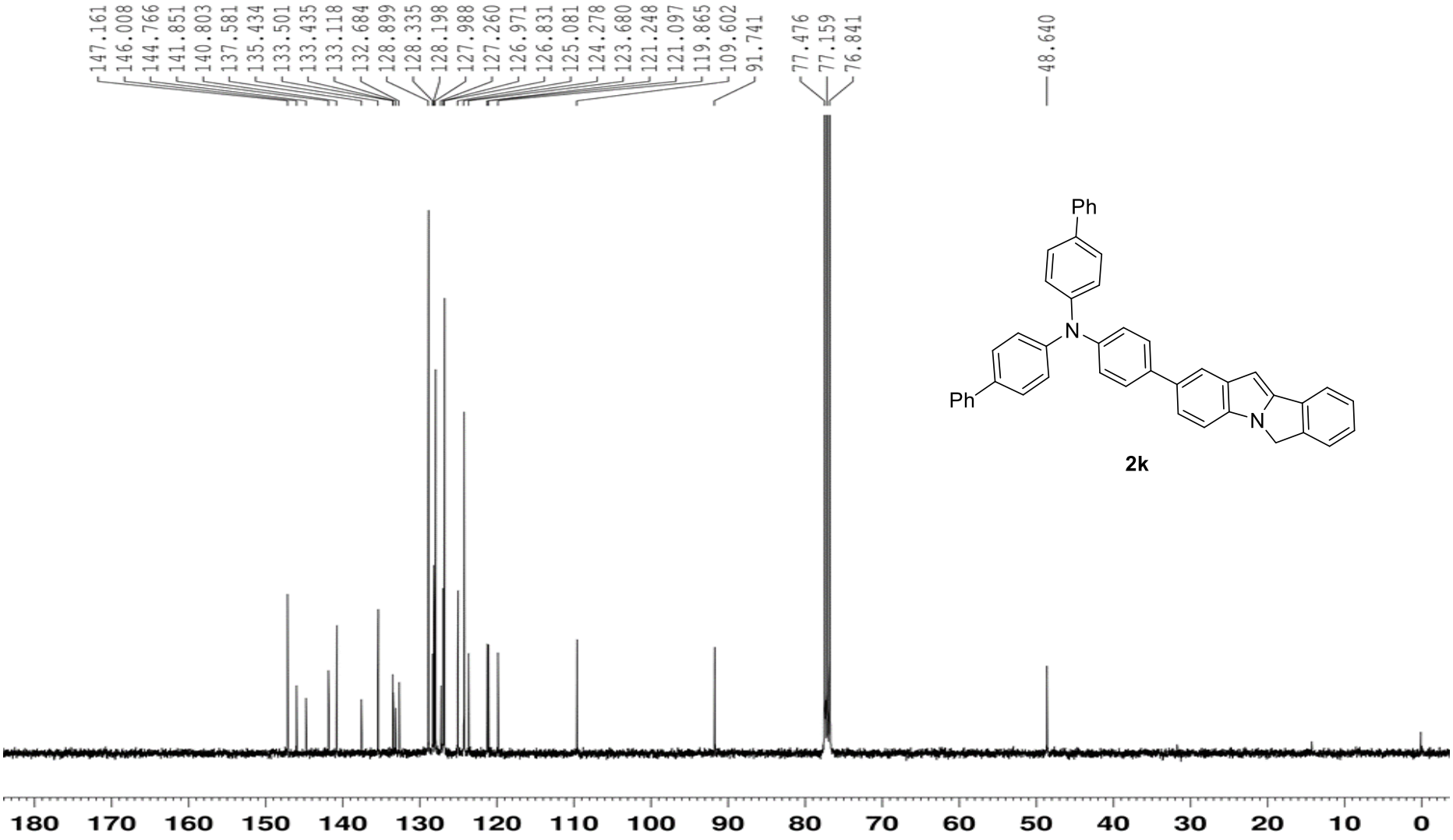
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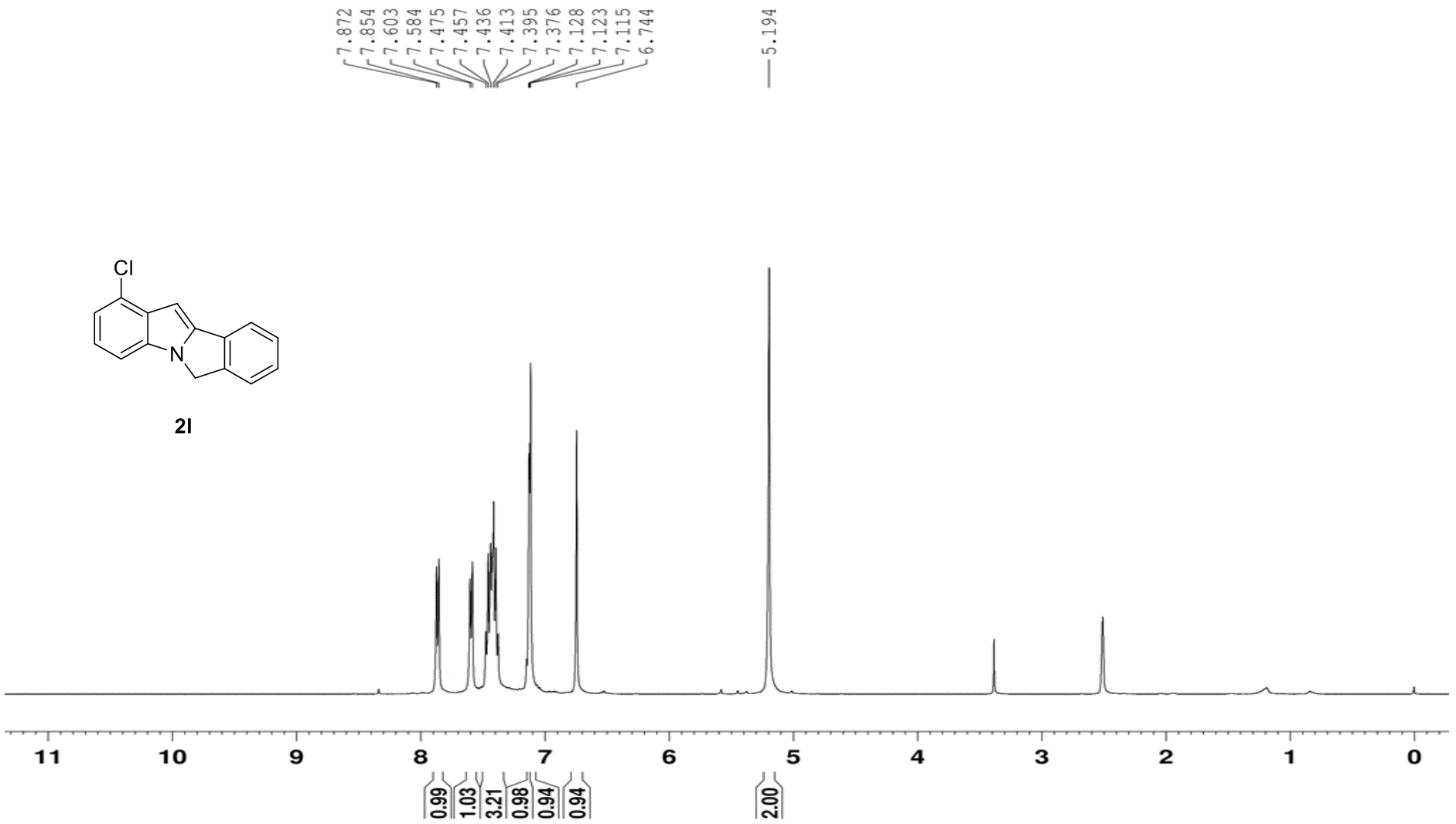
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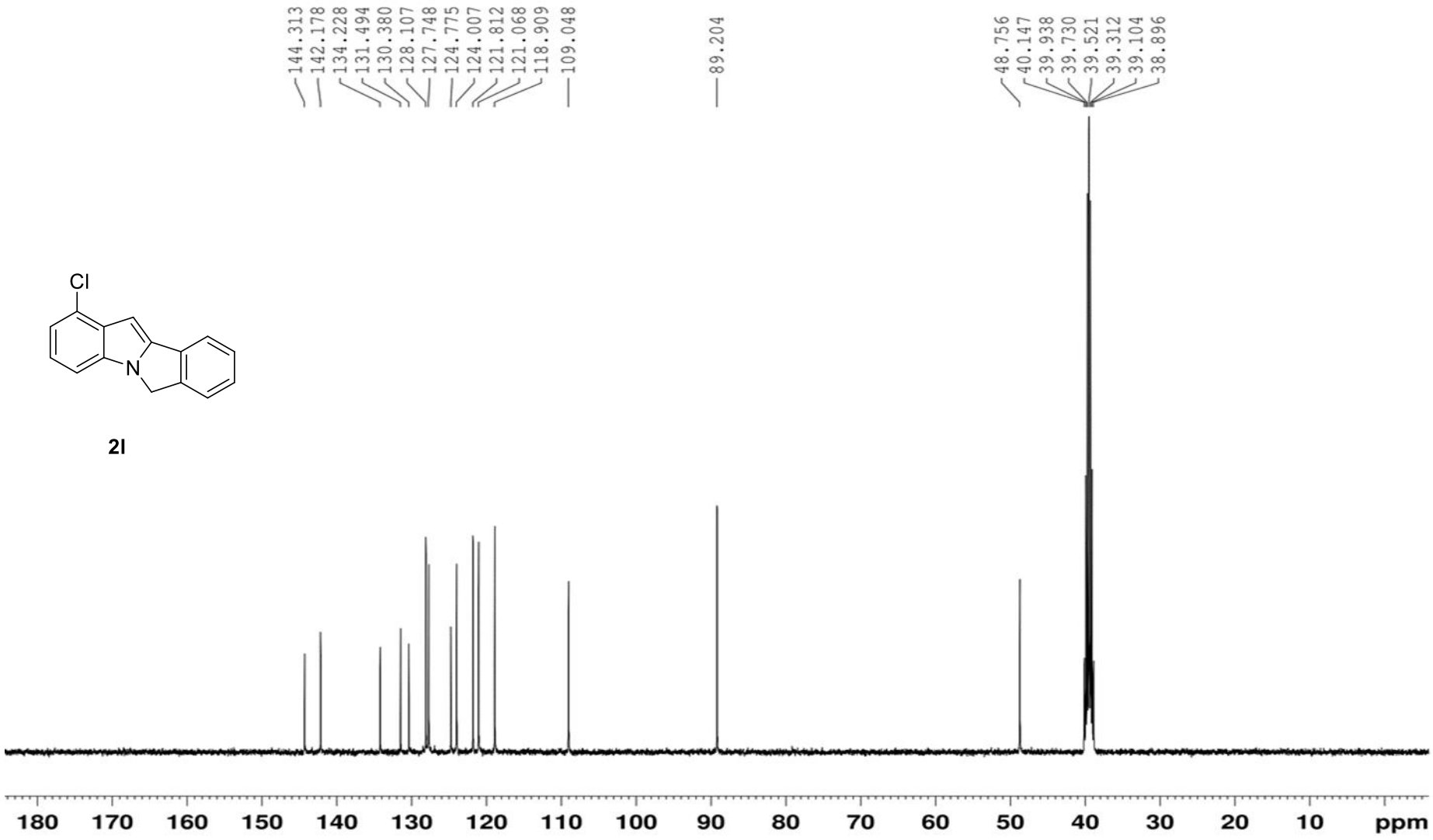
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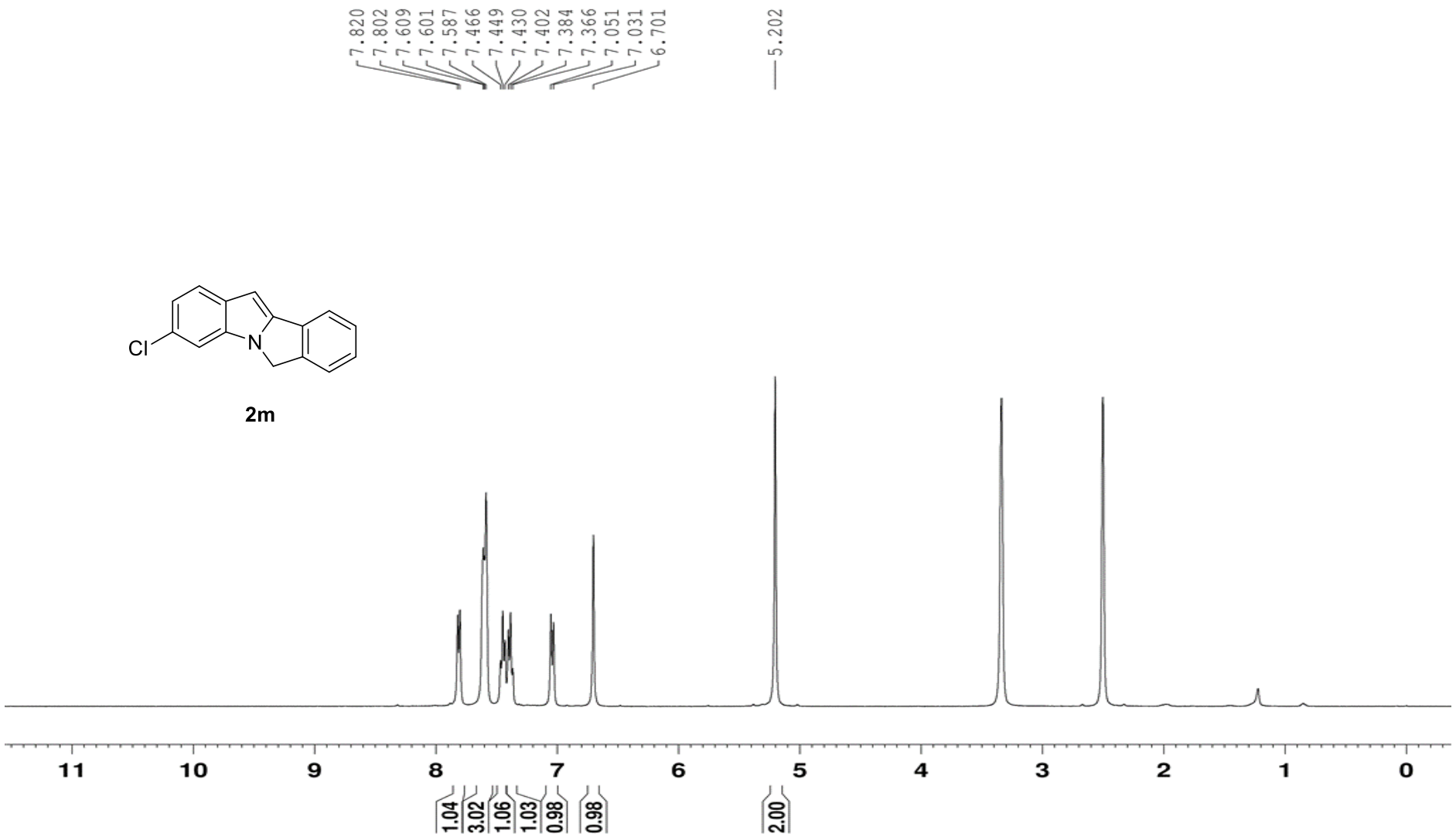
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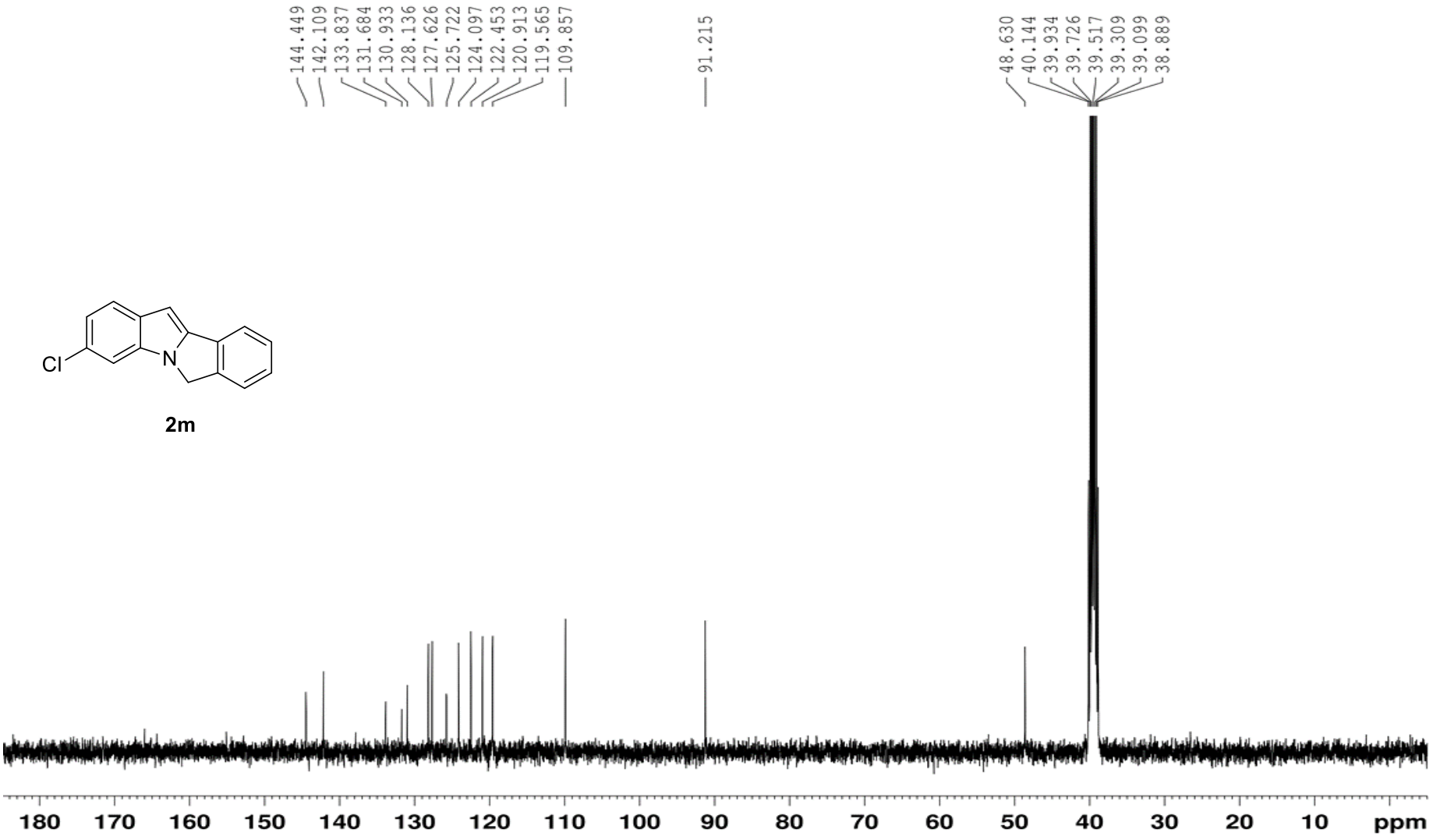
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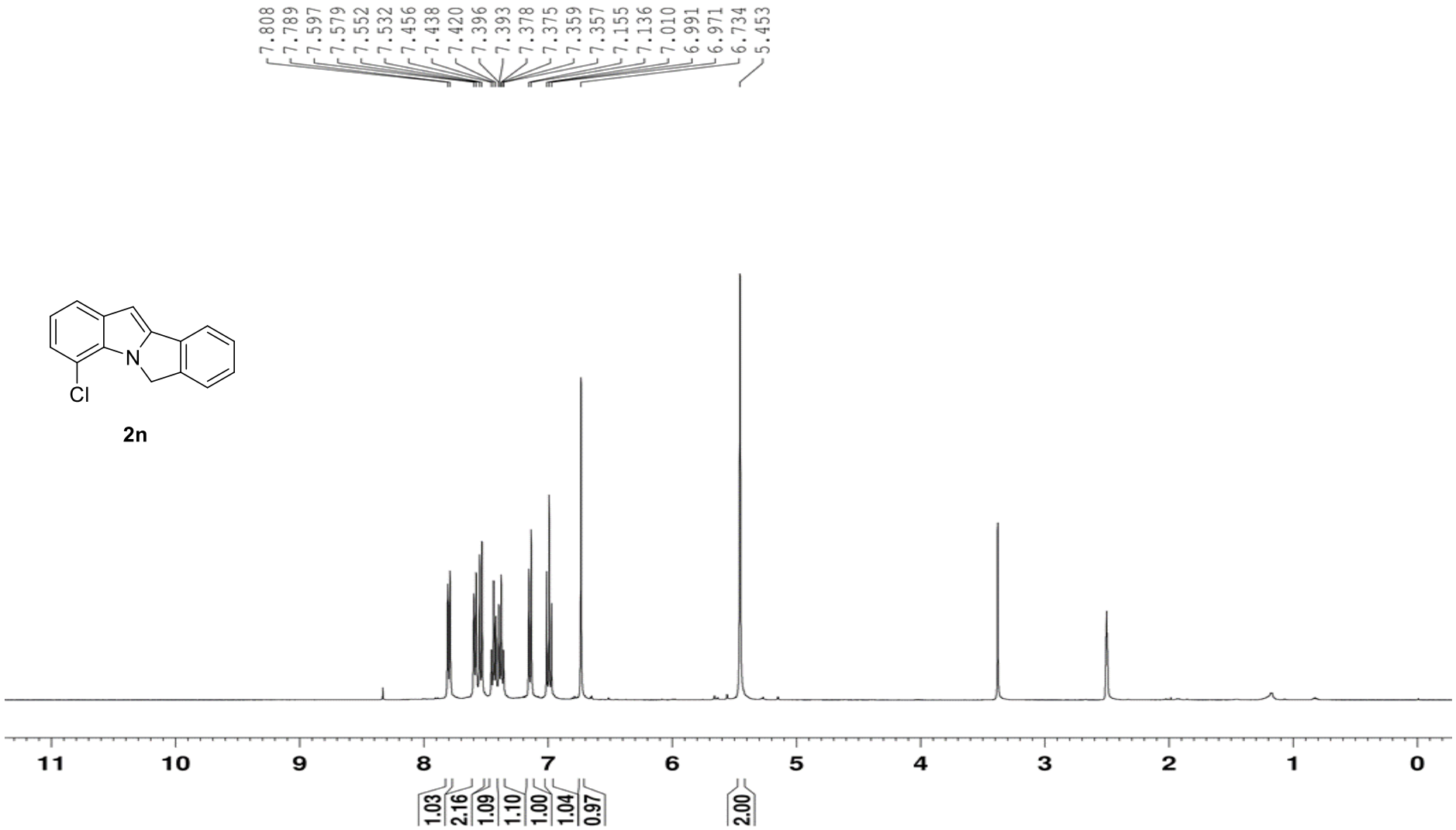
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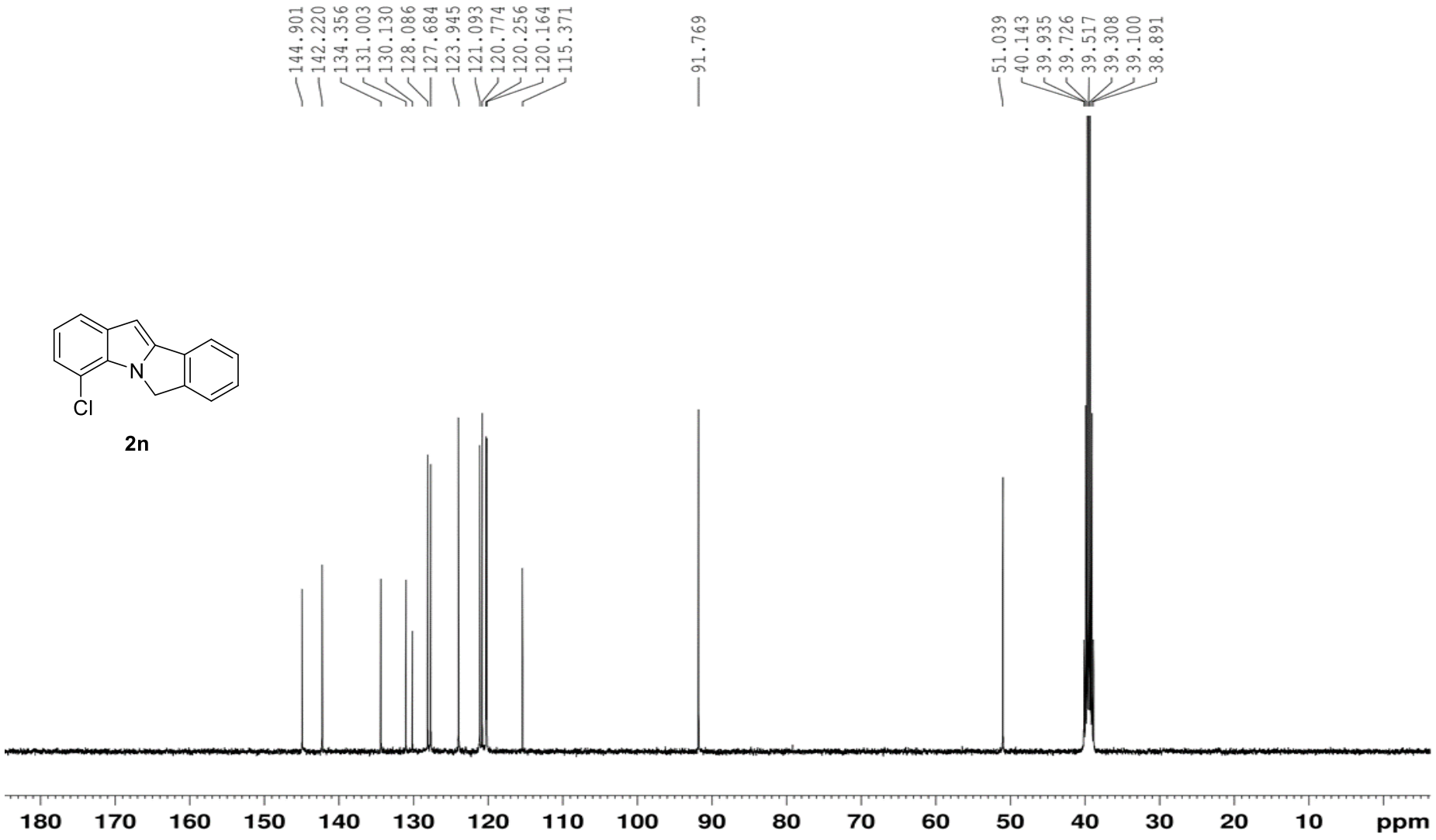
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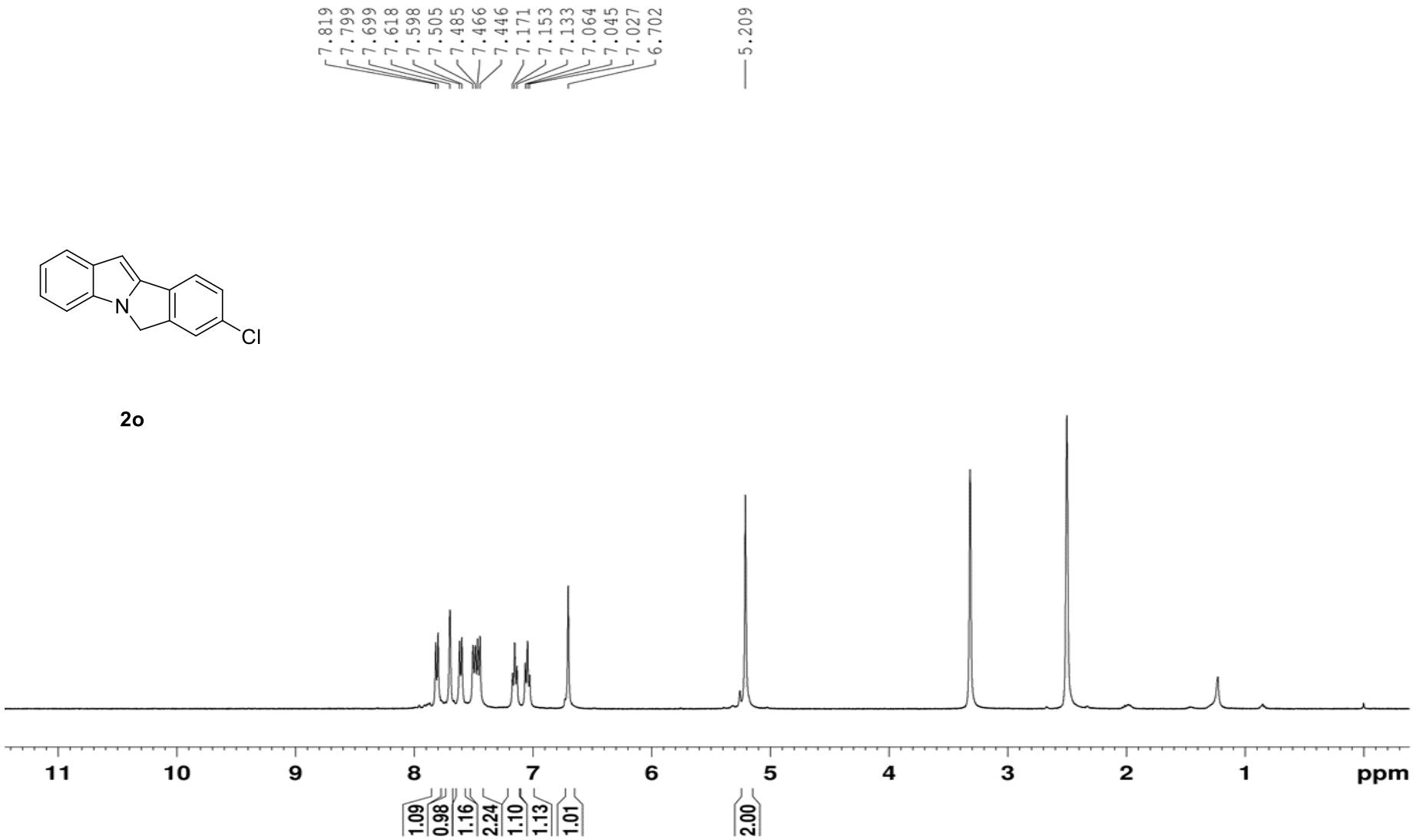
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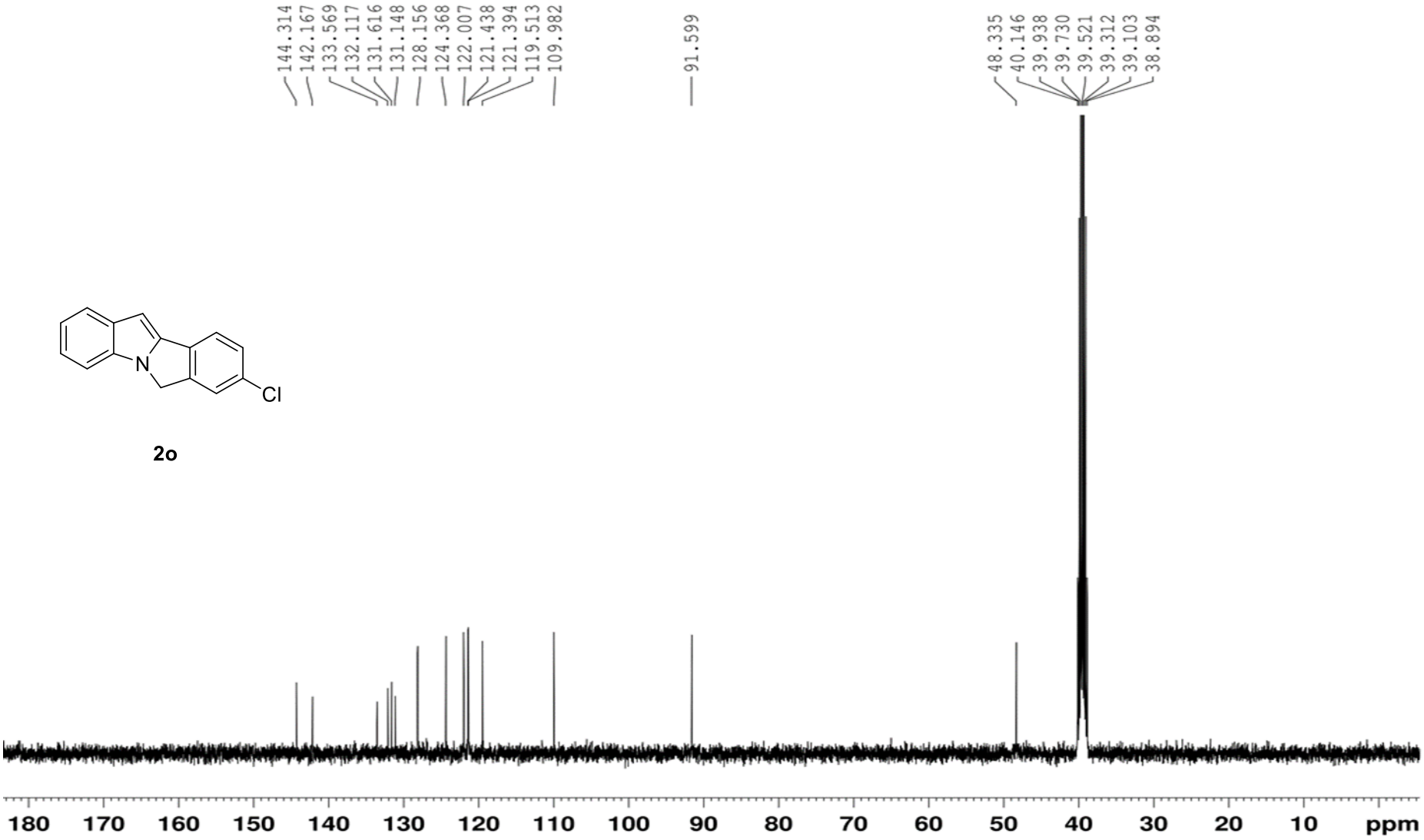
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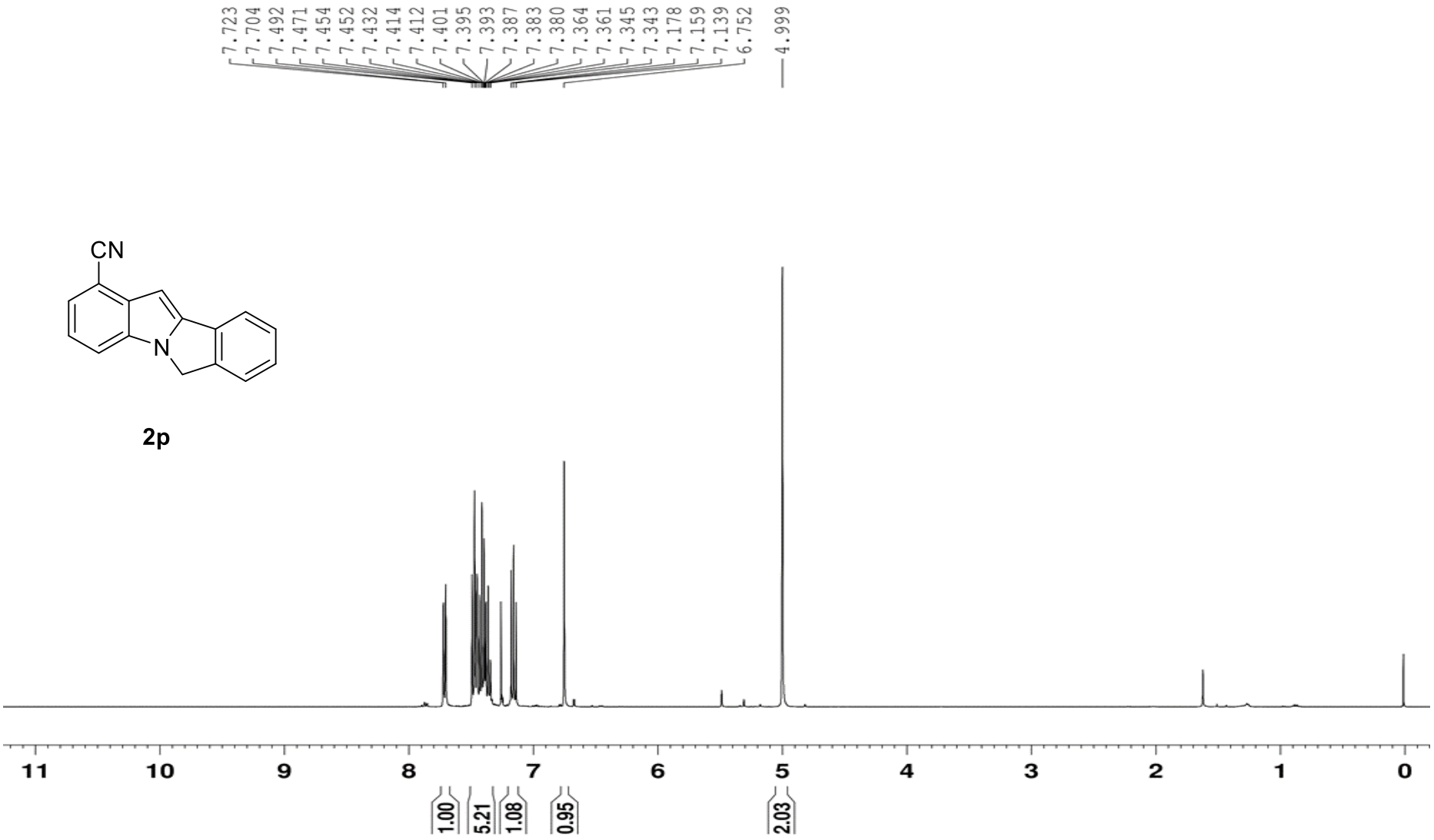
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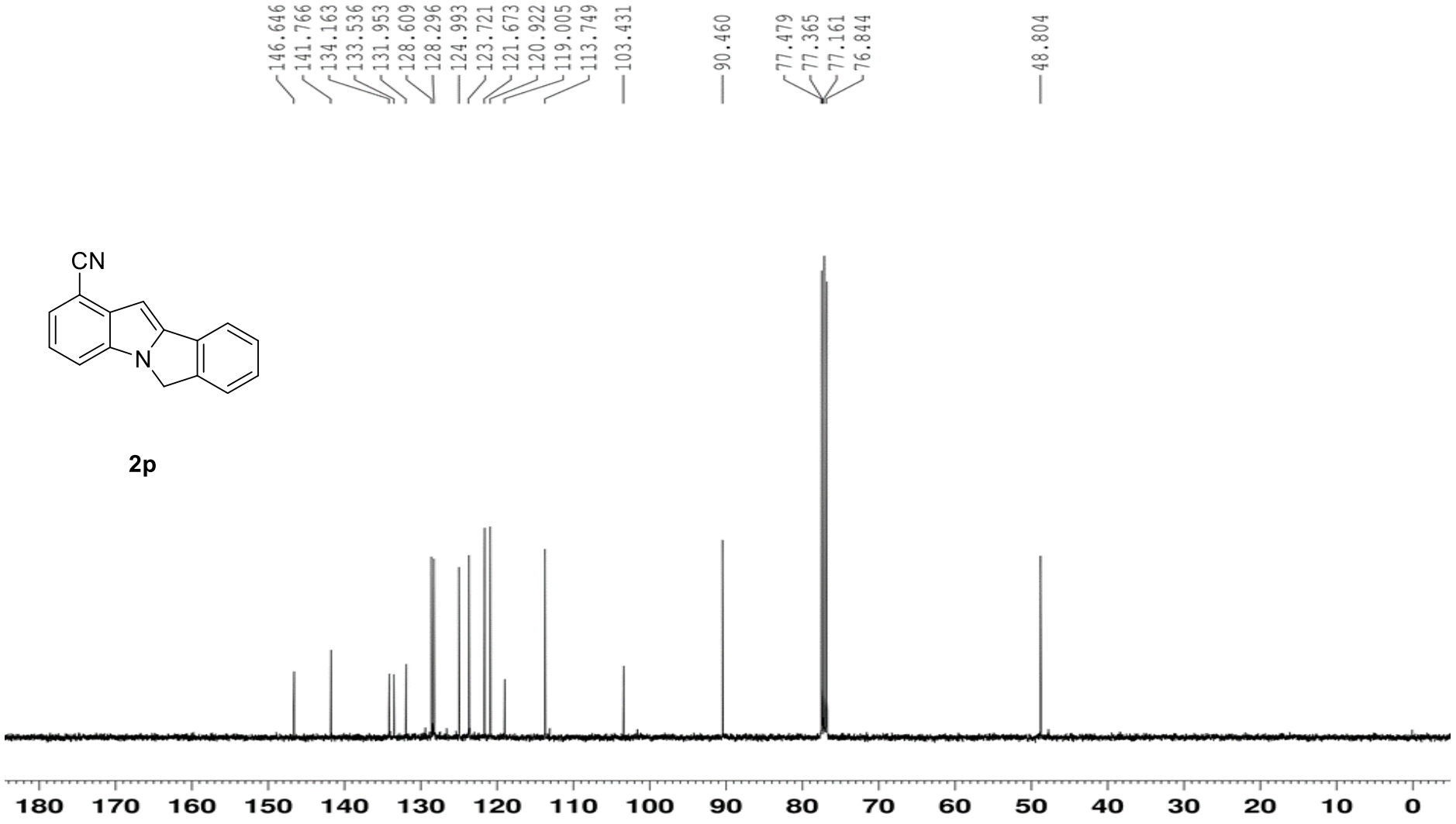
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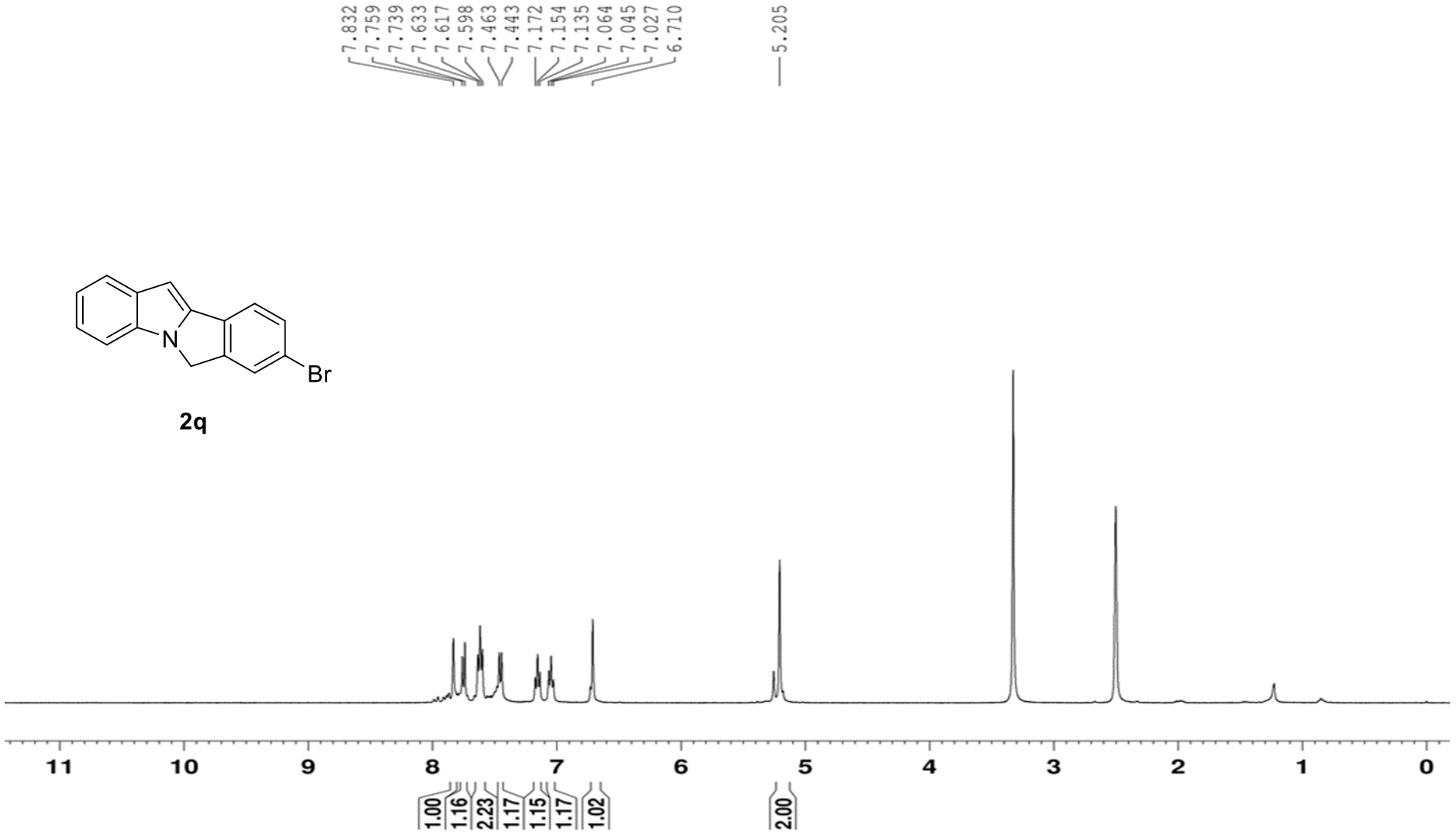
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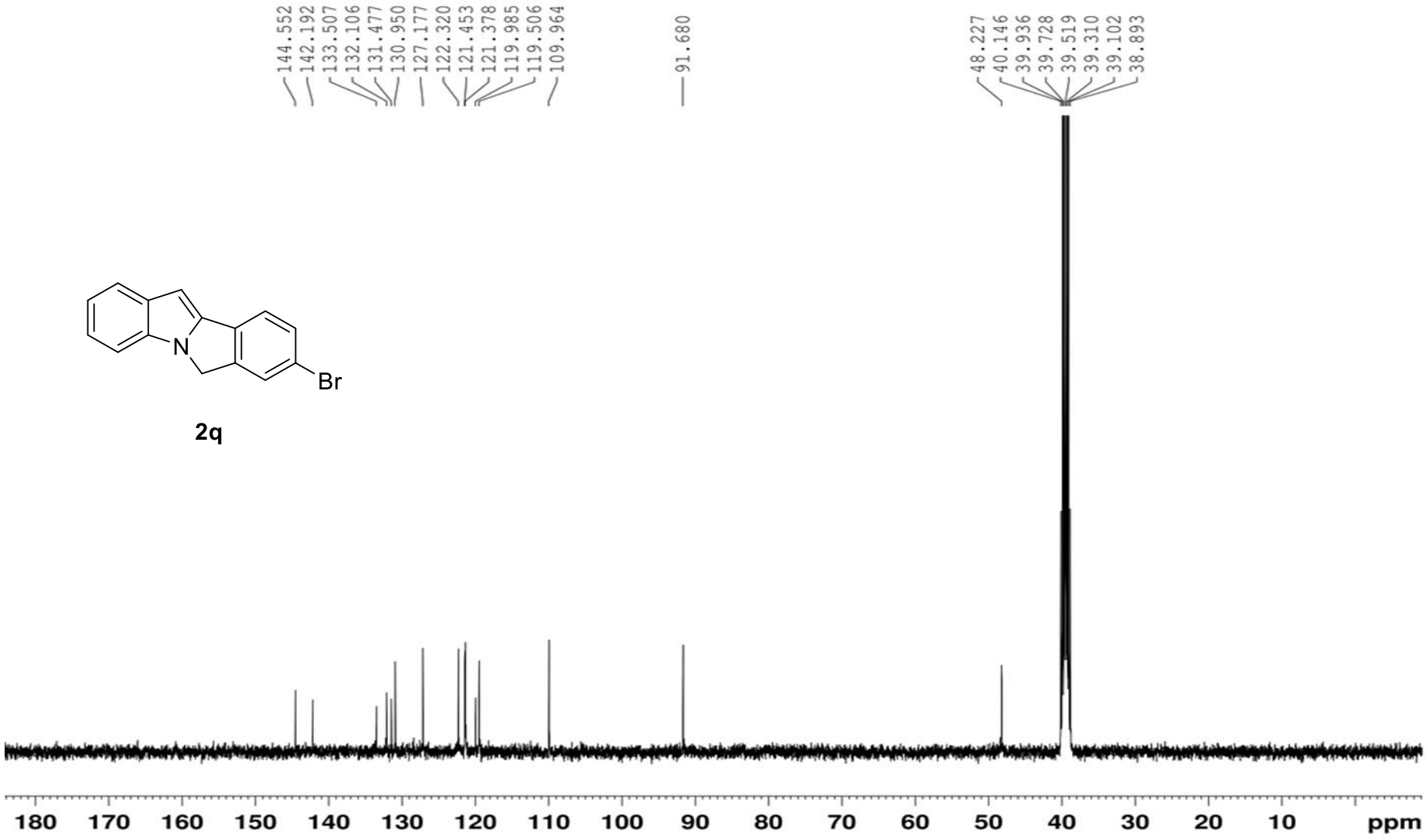
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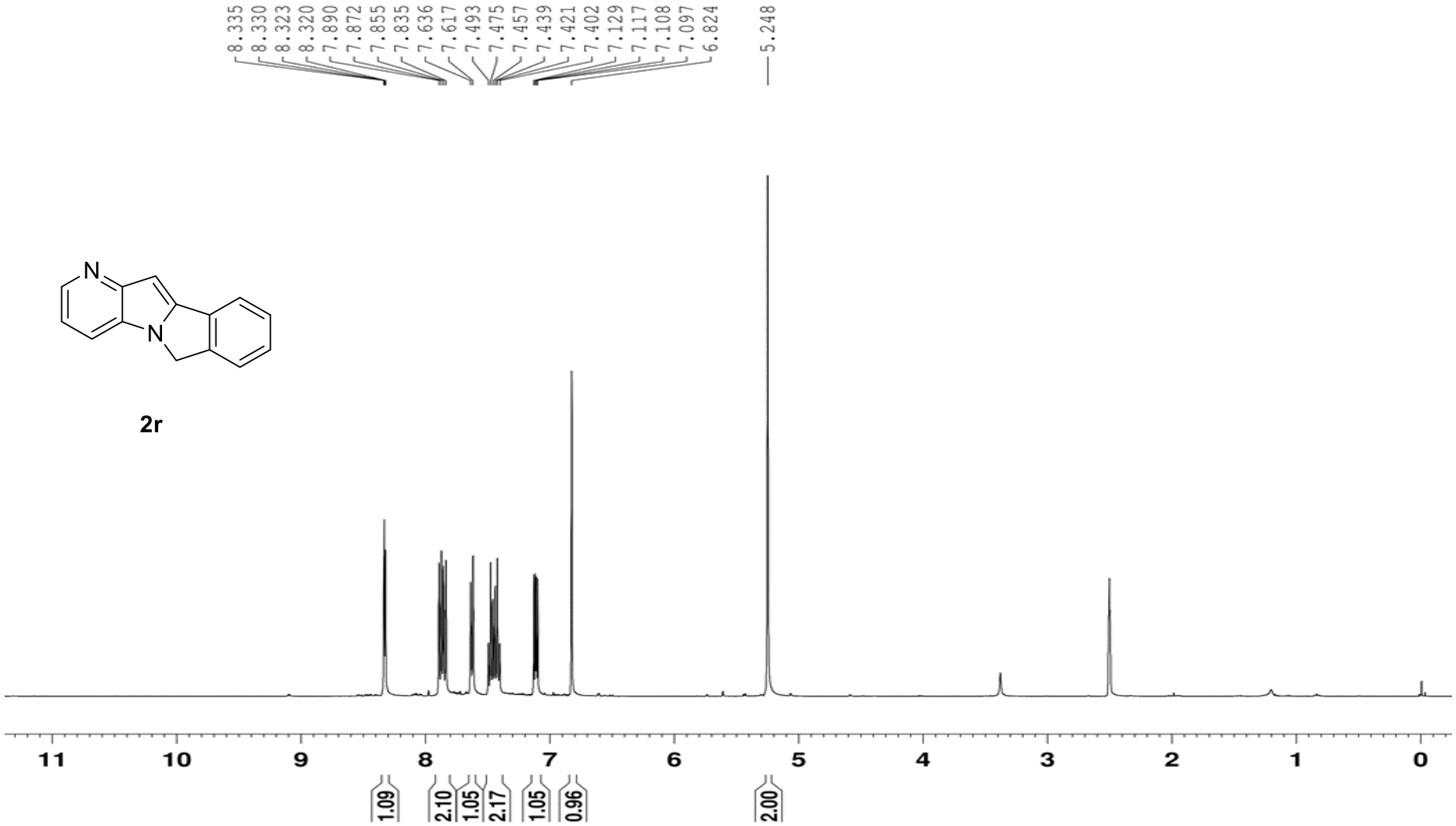
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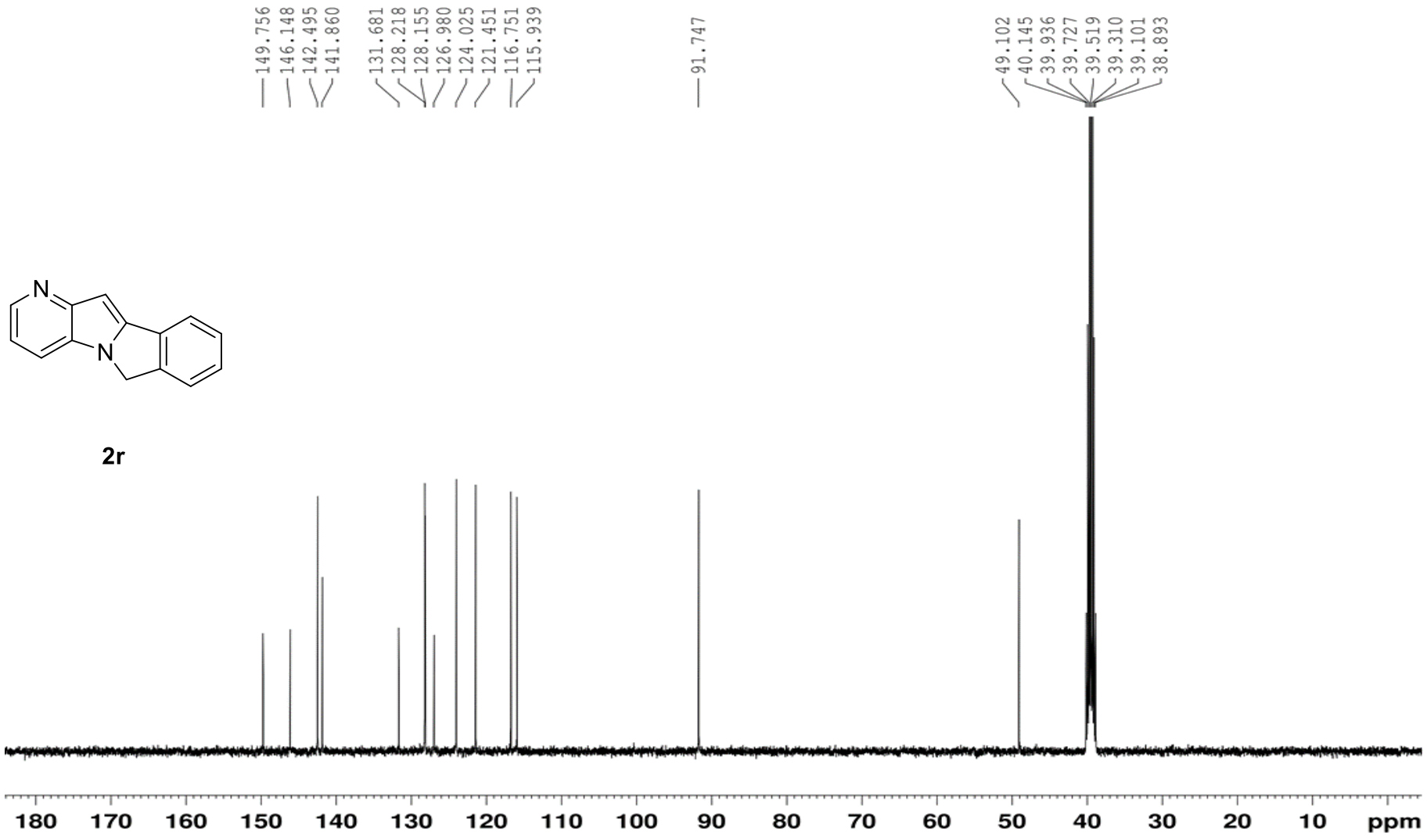
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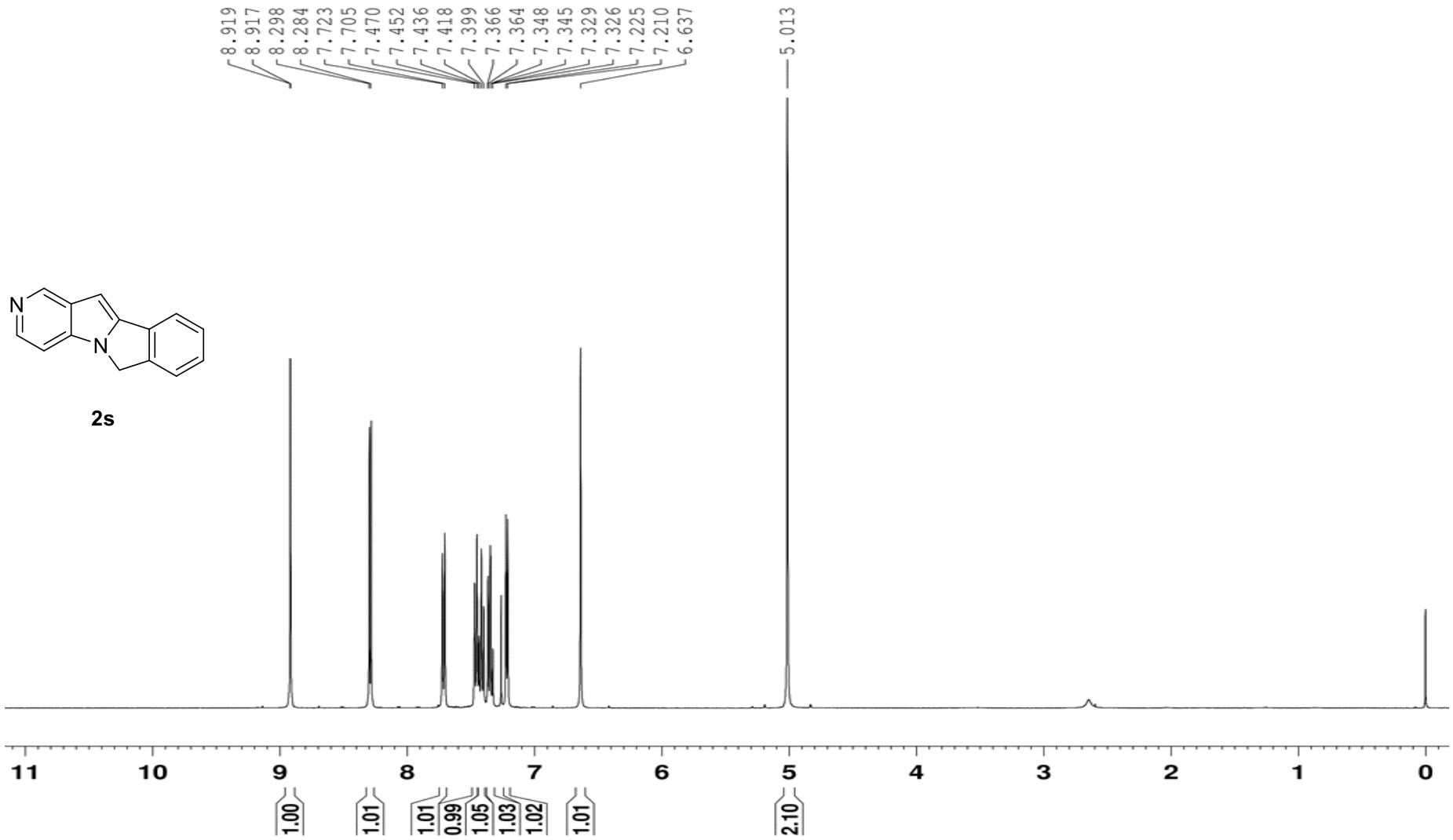
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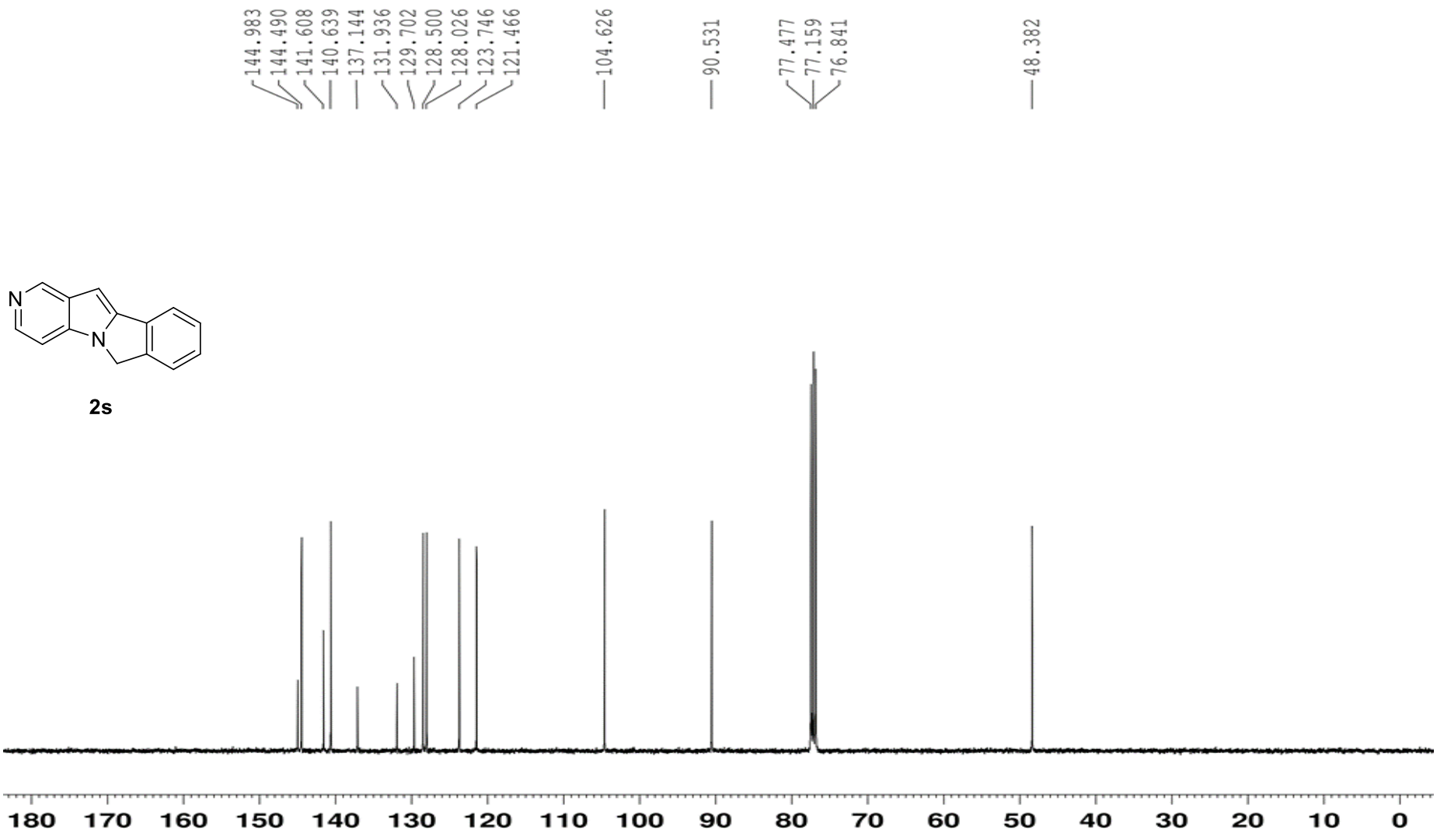
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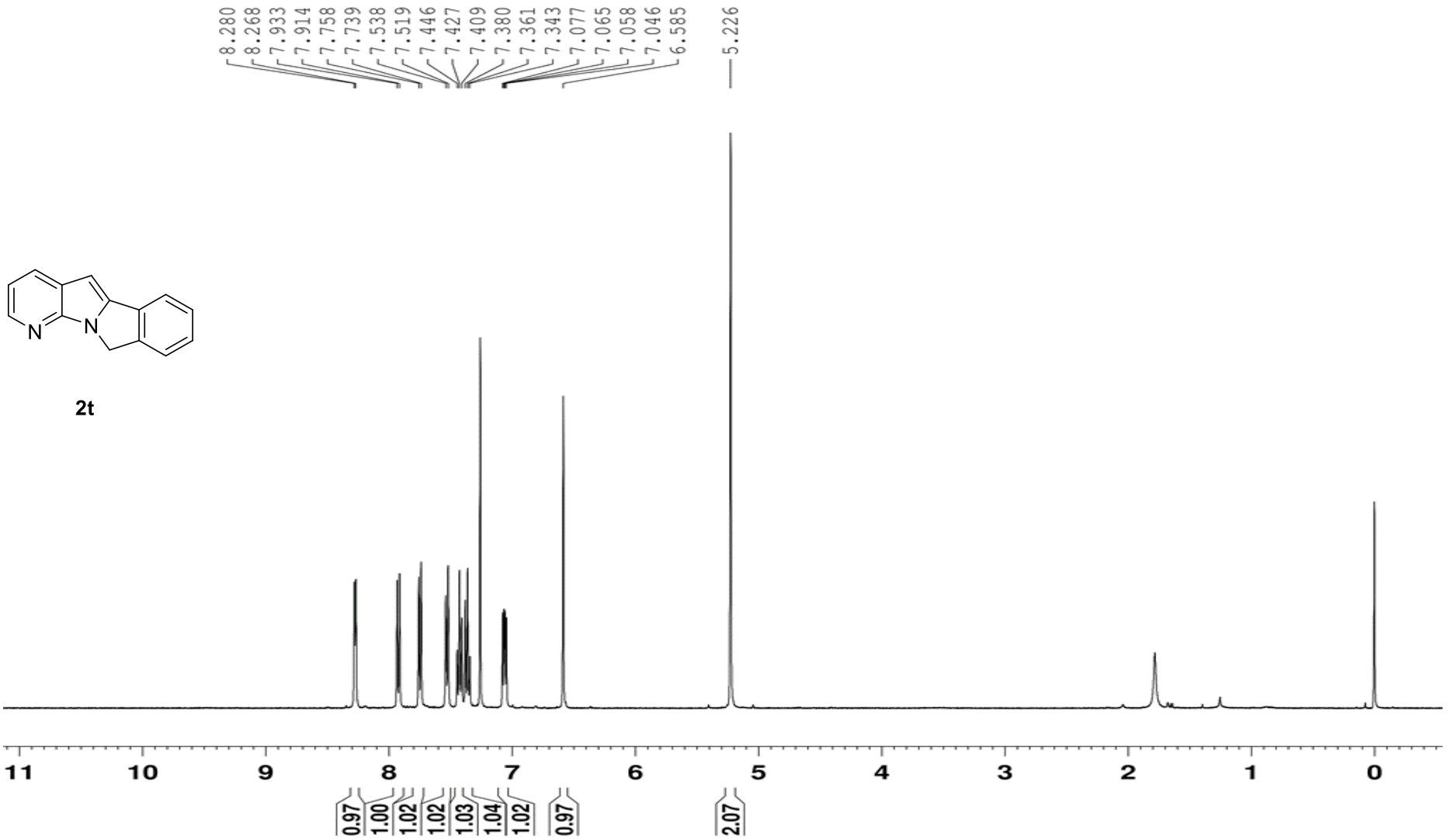
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7.058
7.046
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6
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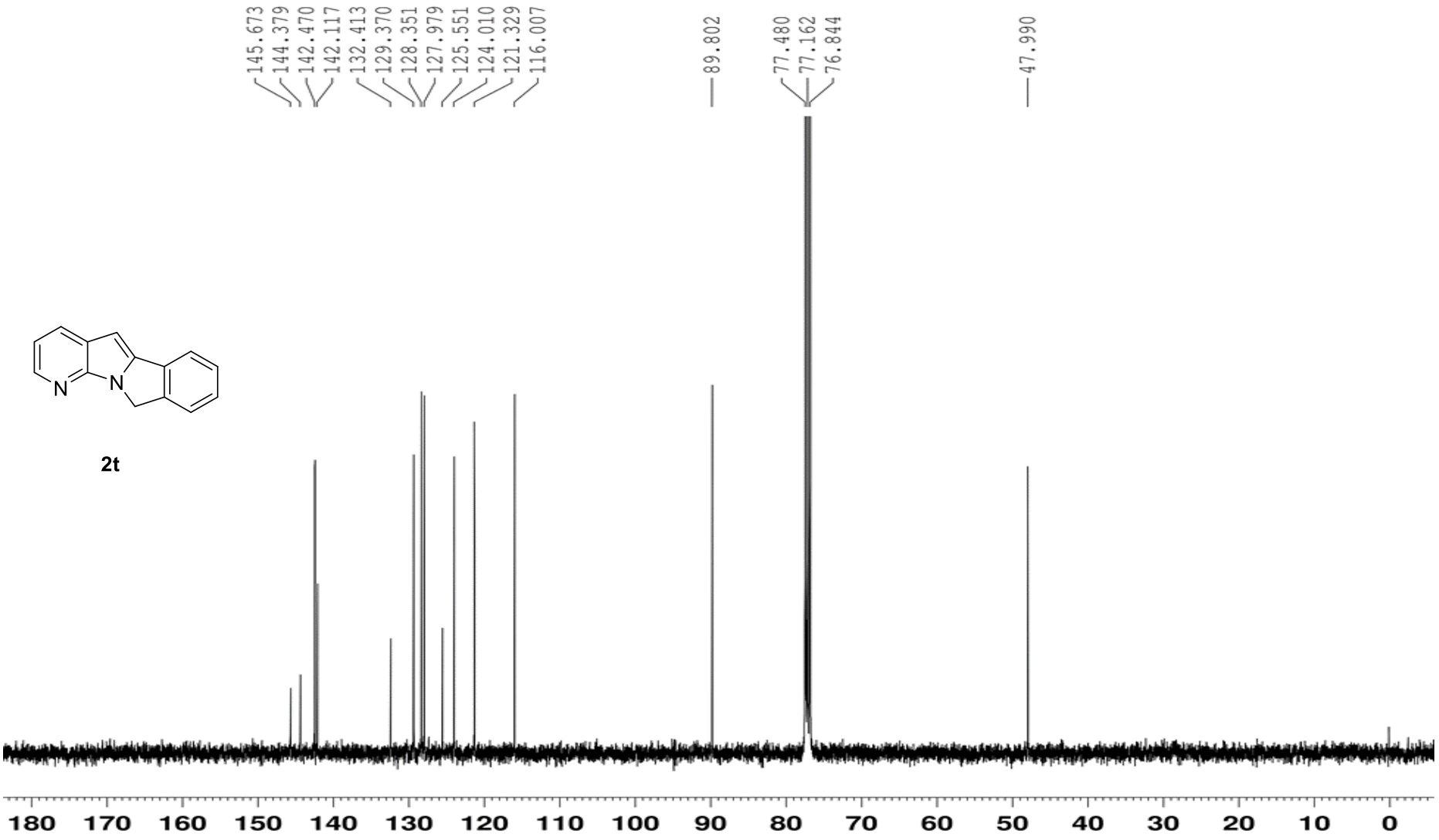
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77.480
77.162
76.844
47.990
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N
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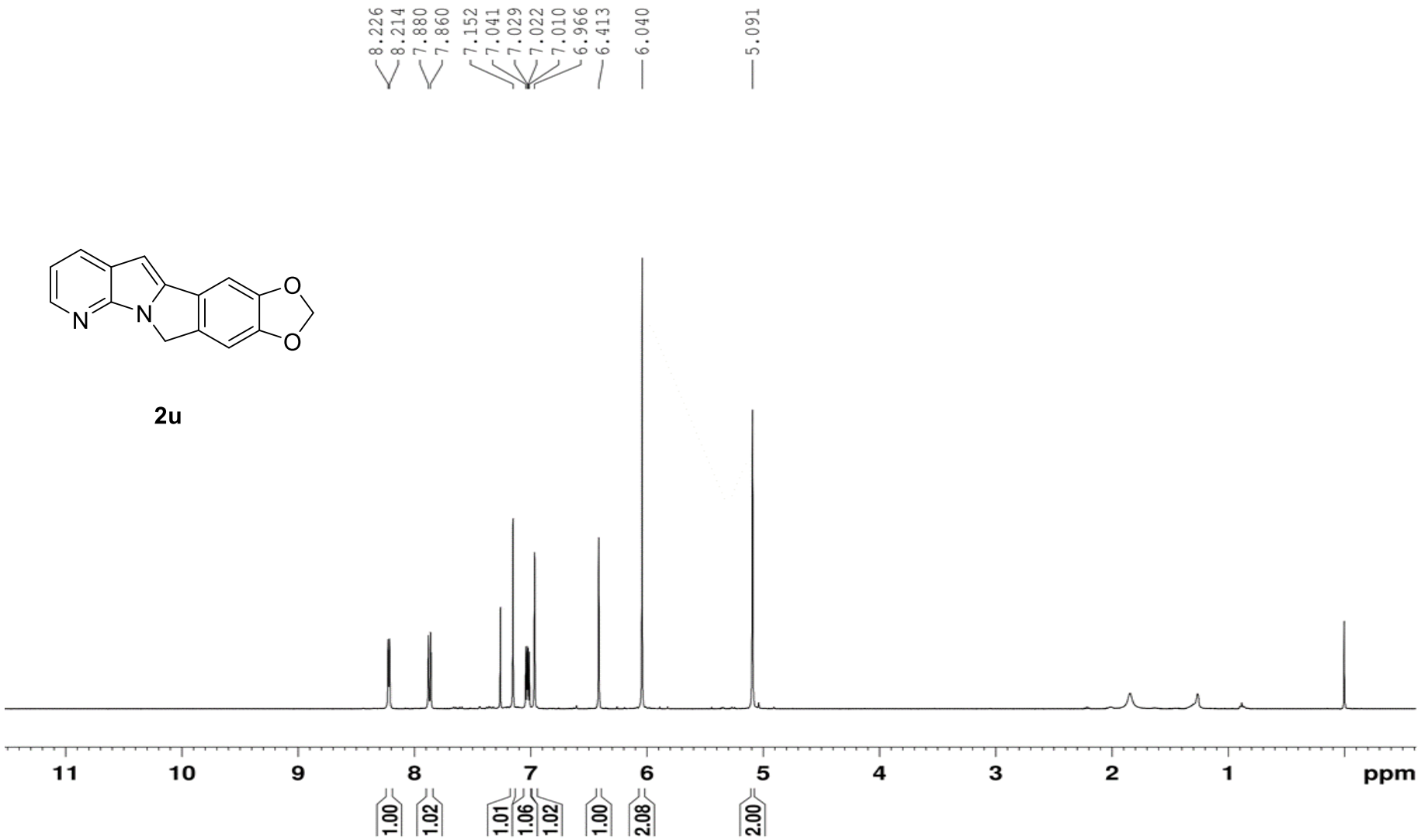
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6.040
5.091
N
N
O
O
2u
11
10
9
8
7
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ppm
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1.02
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1.06
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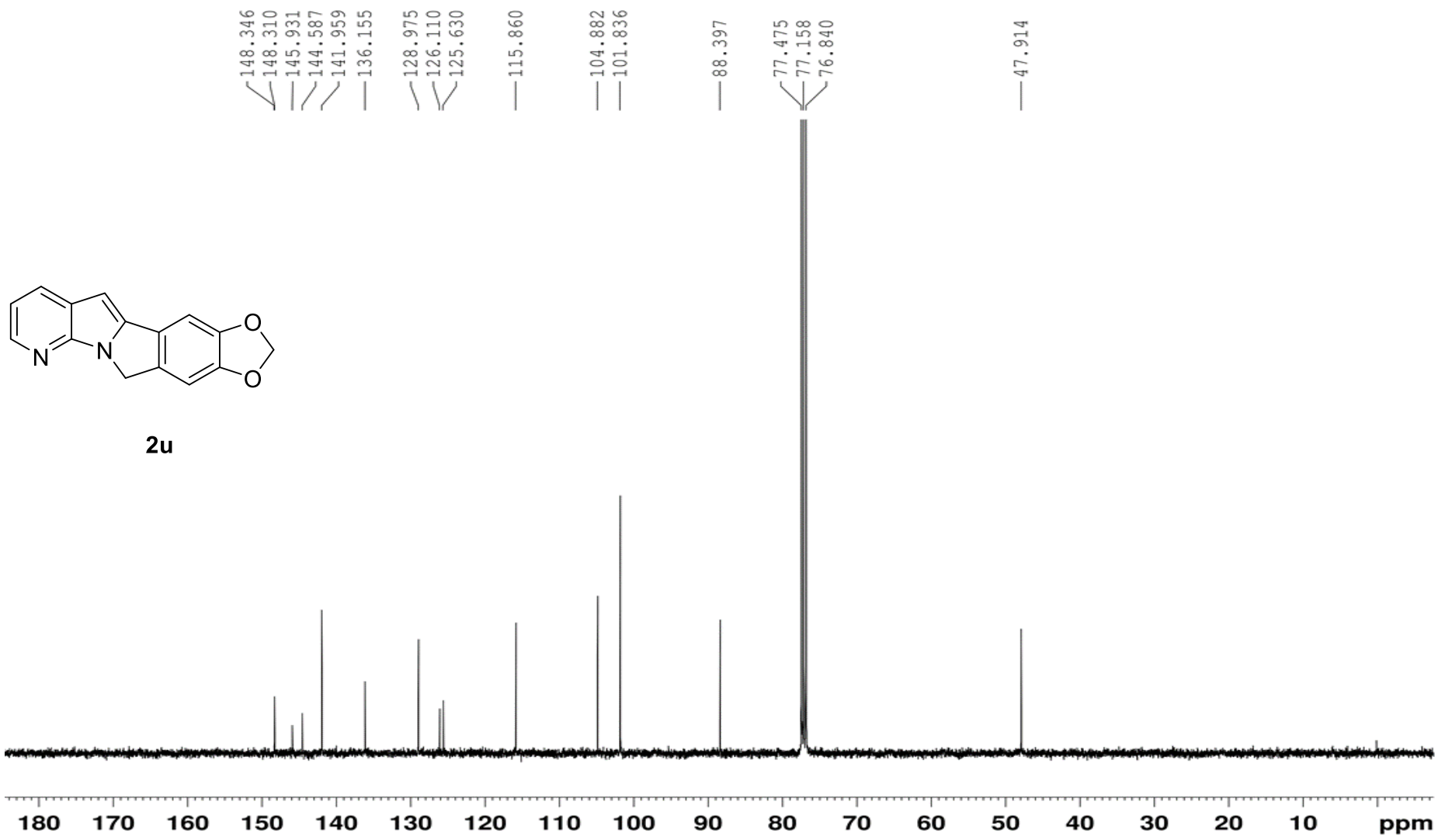
2.00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77.475
77.158
76.840
47.914
N
N
O
O
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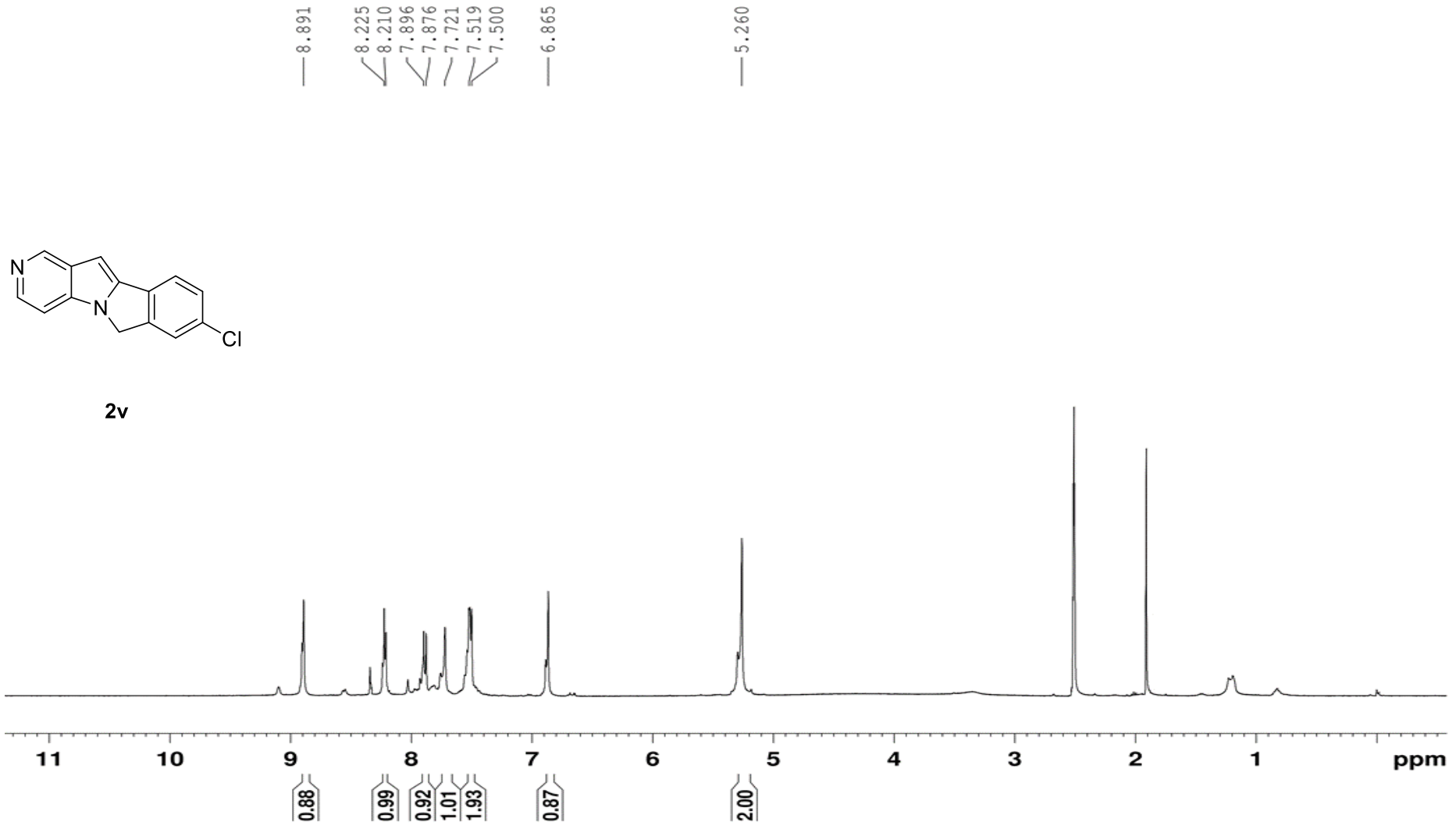
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Cl
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10
9
8
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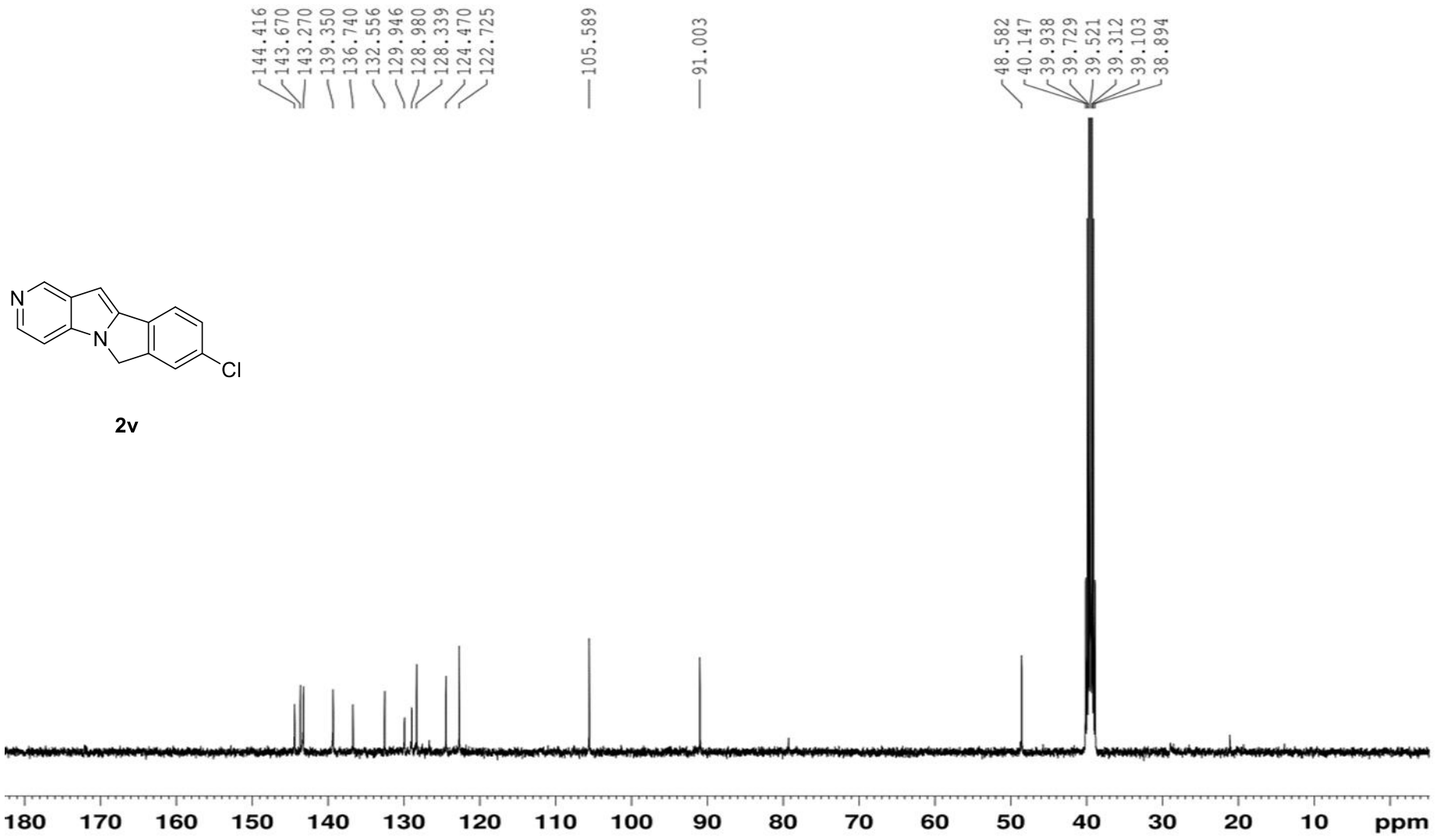
2v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39.729
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39.103
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N
N
Cl
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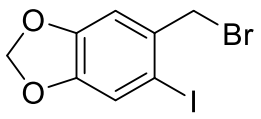
ppm

2v



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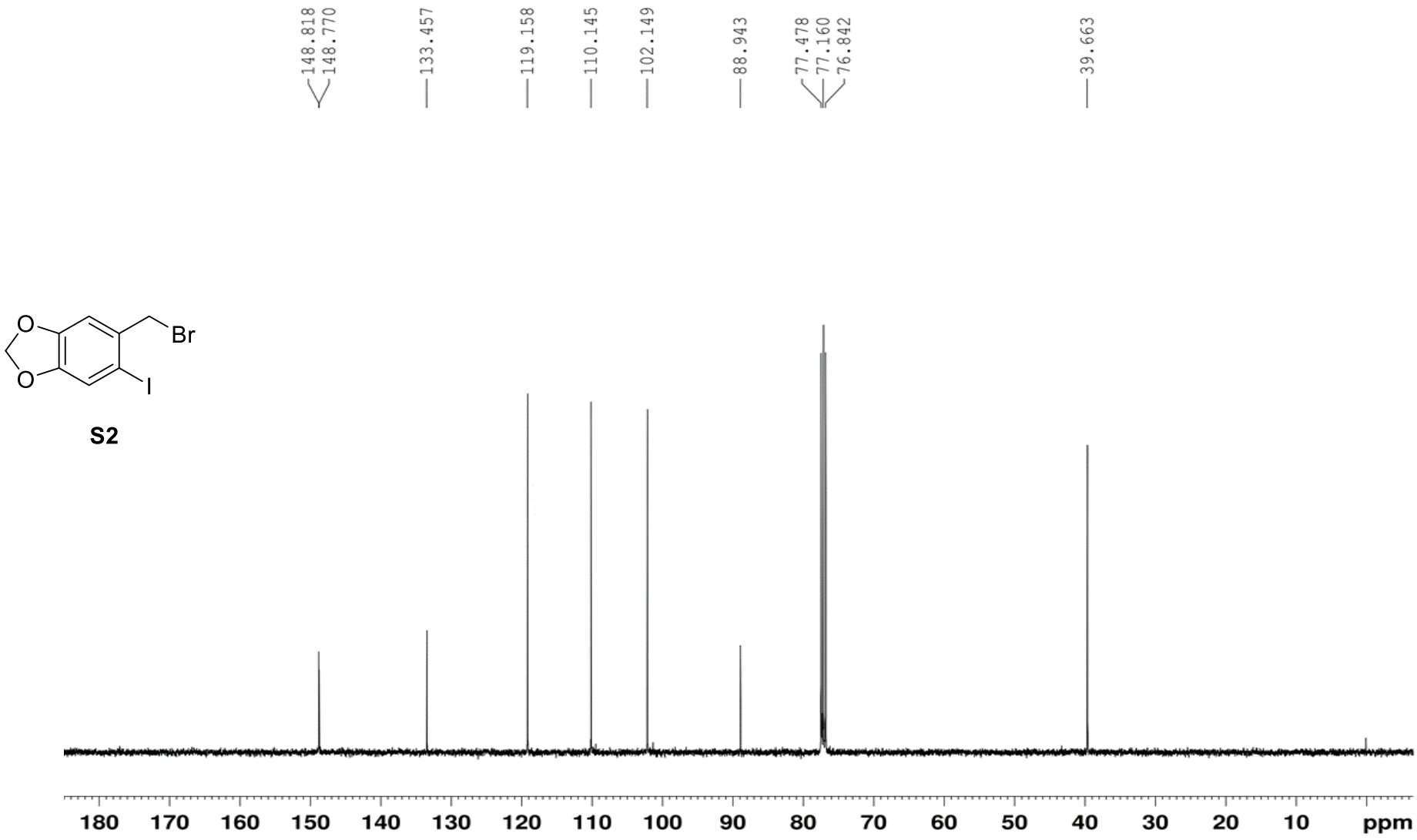
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76.842
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O
Br
I
S2
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140
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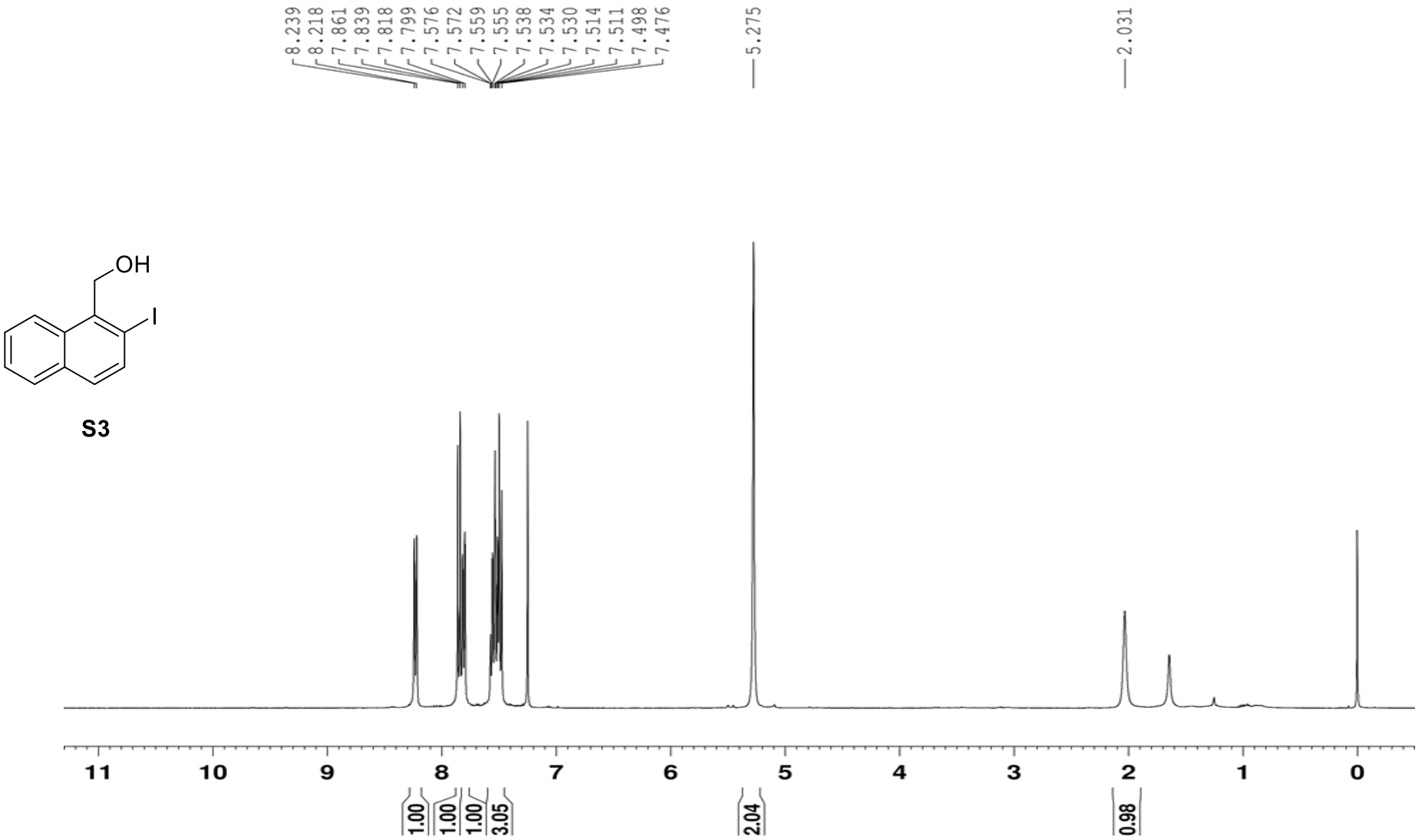
10
ppm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7.572
7.559
7.555
7.538
7.534
7.530
7.514
7.511
7.498
7.476
5.275
2.031
OH
I
S3
11
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1.00
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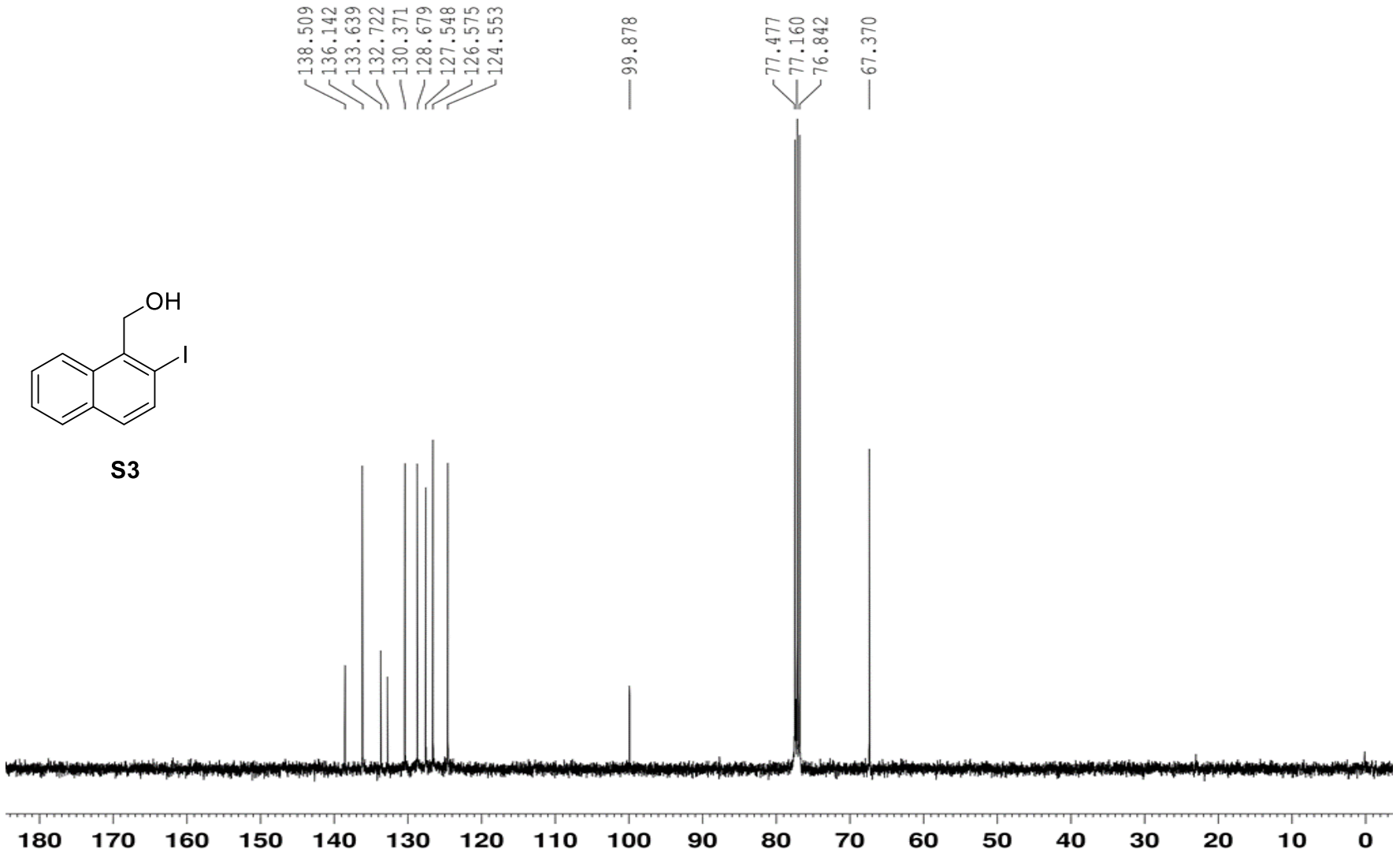
0.98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126.575
124.553
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77.477
77.160
76.842
67.370
OH
I
S3
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150
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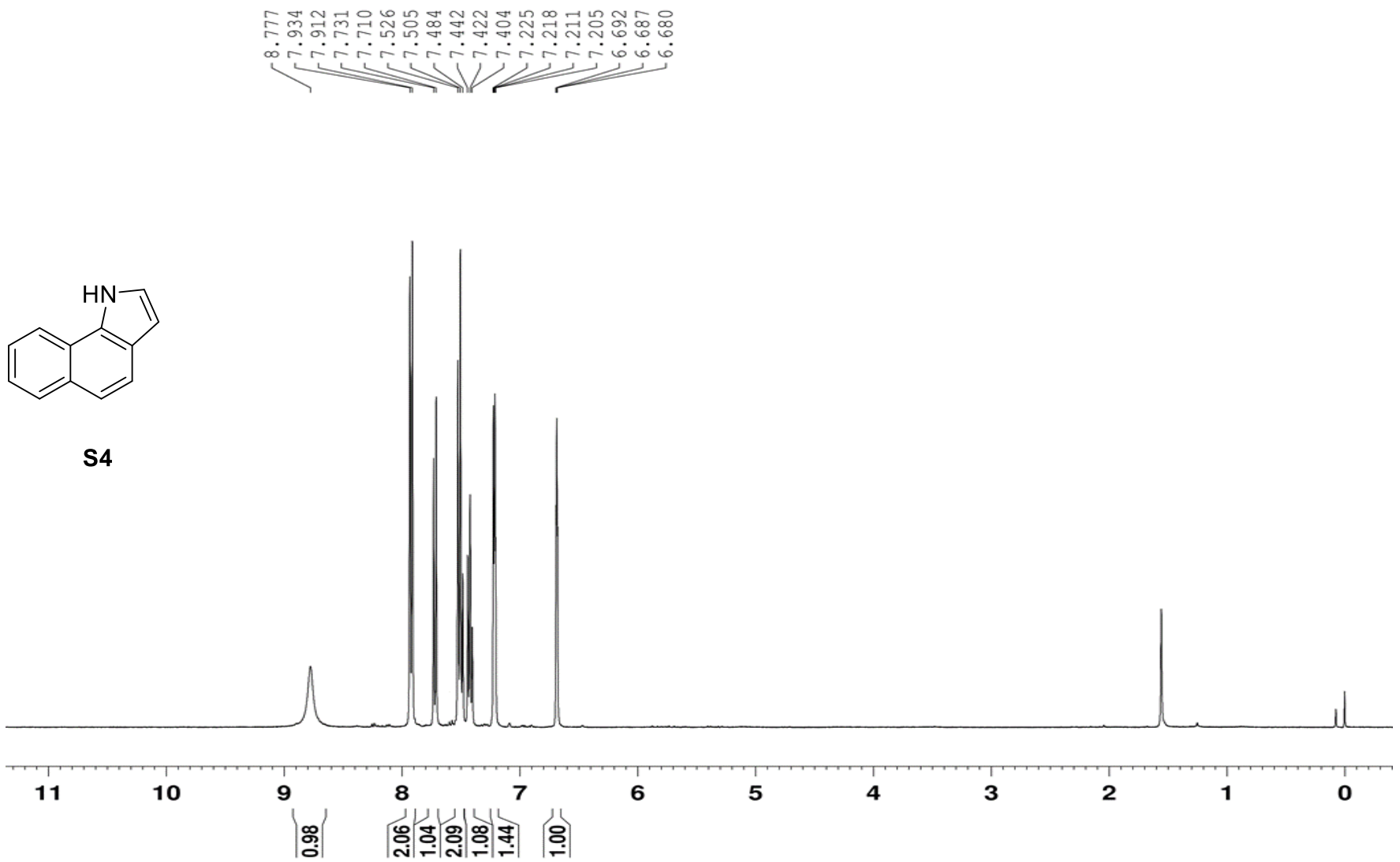
10
0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7.225
7.218
7.211
7.205
6.692
6.687
6.680
HN
S4
11
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9
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1.04
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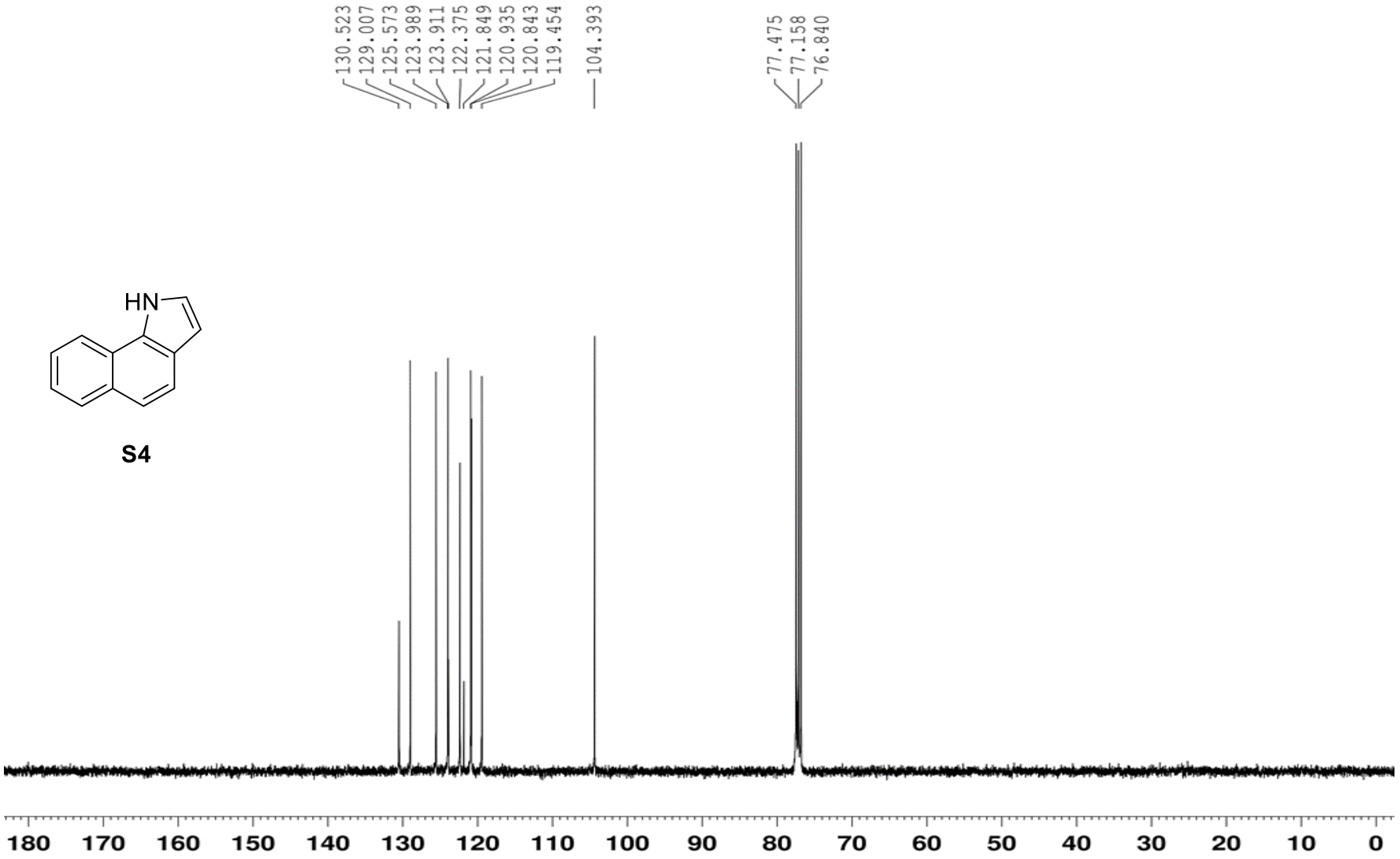
1.44
1.00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77.158
76.840
HN
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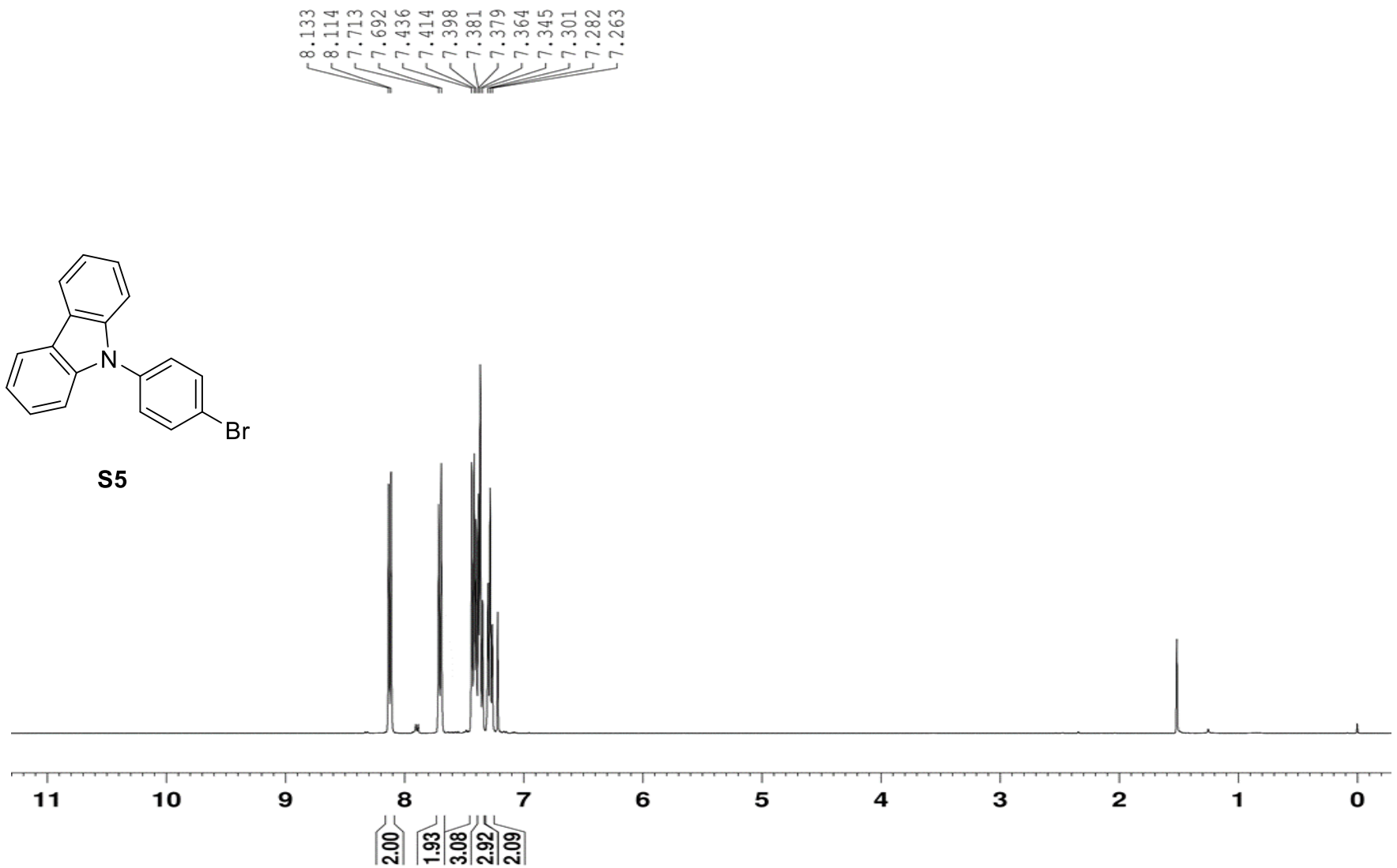
S4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7.282
7.263
N
Br
S5
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2.00
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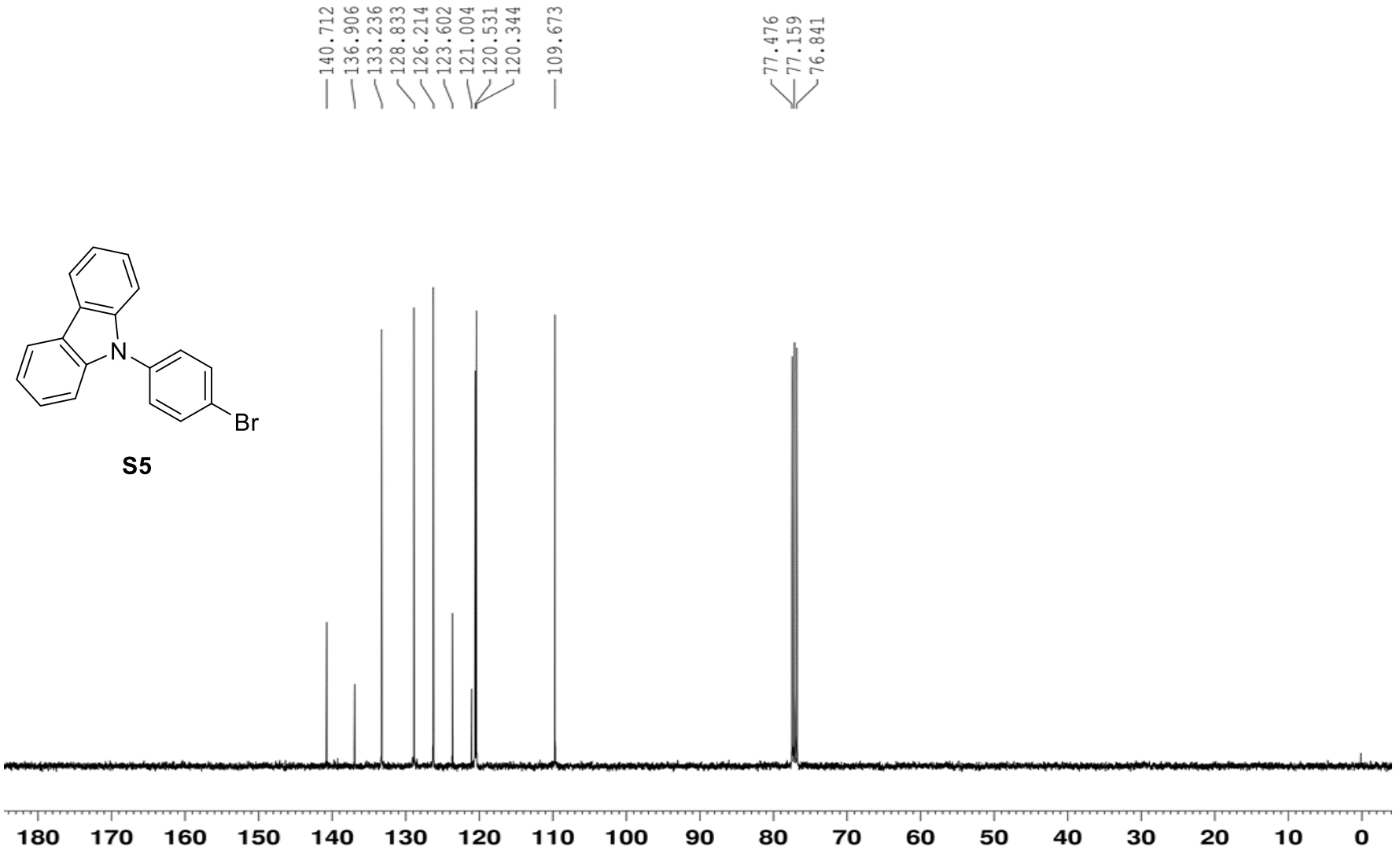
3.08
2.92
2.09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76.841
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Br
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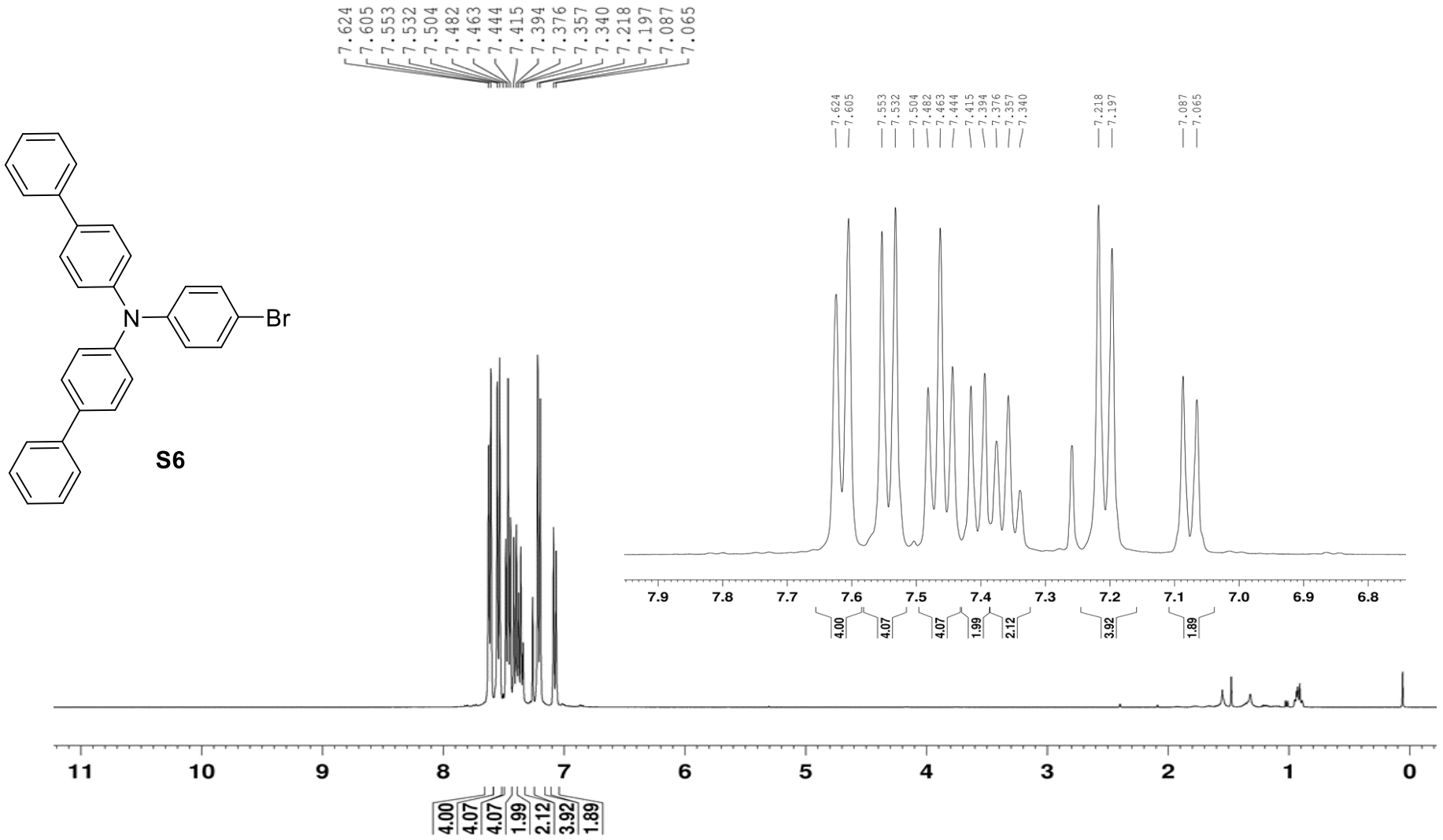
0

S5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S6
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4.07
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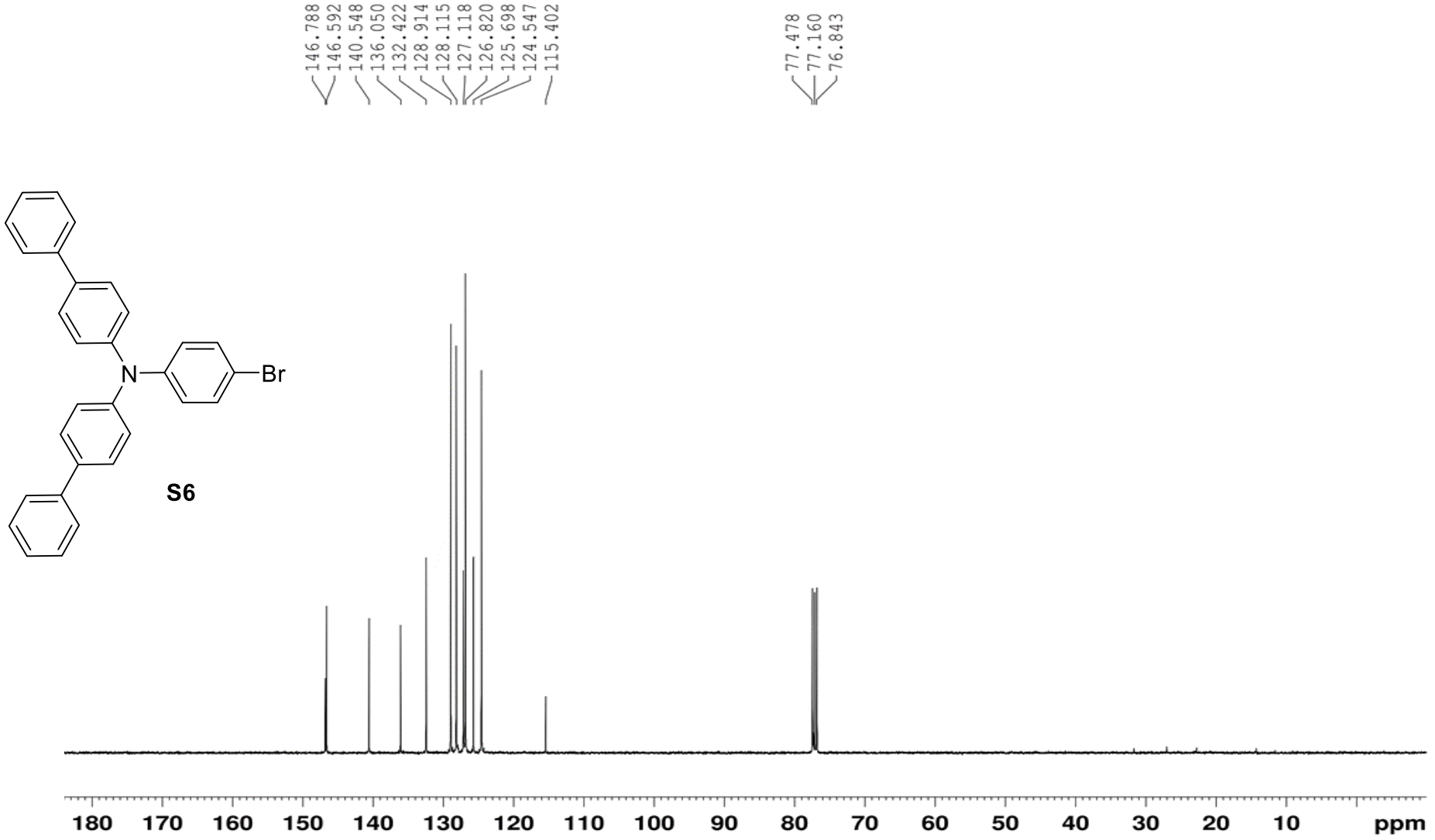
3.92
1.89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Br
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30
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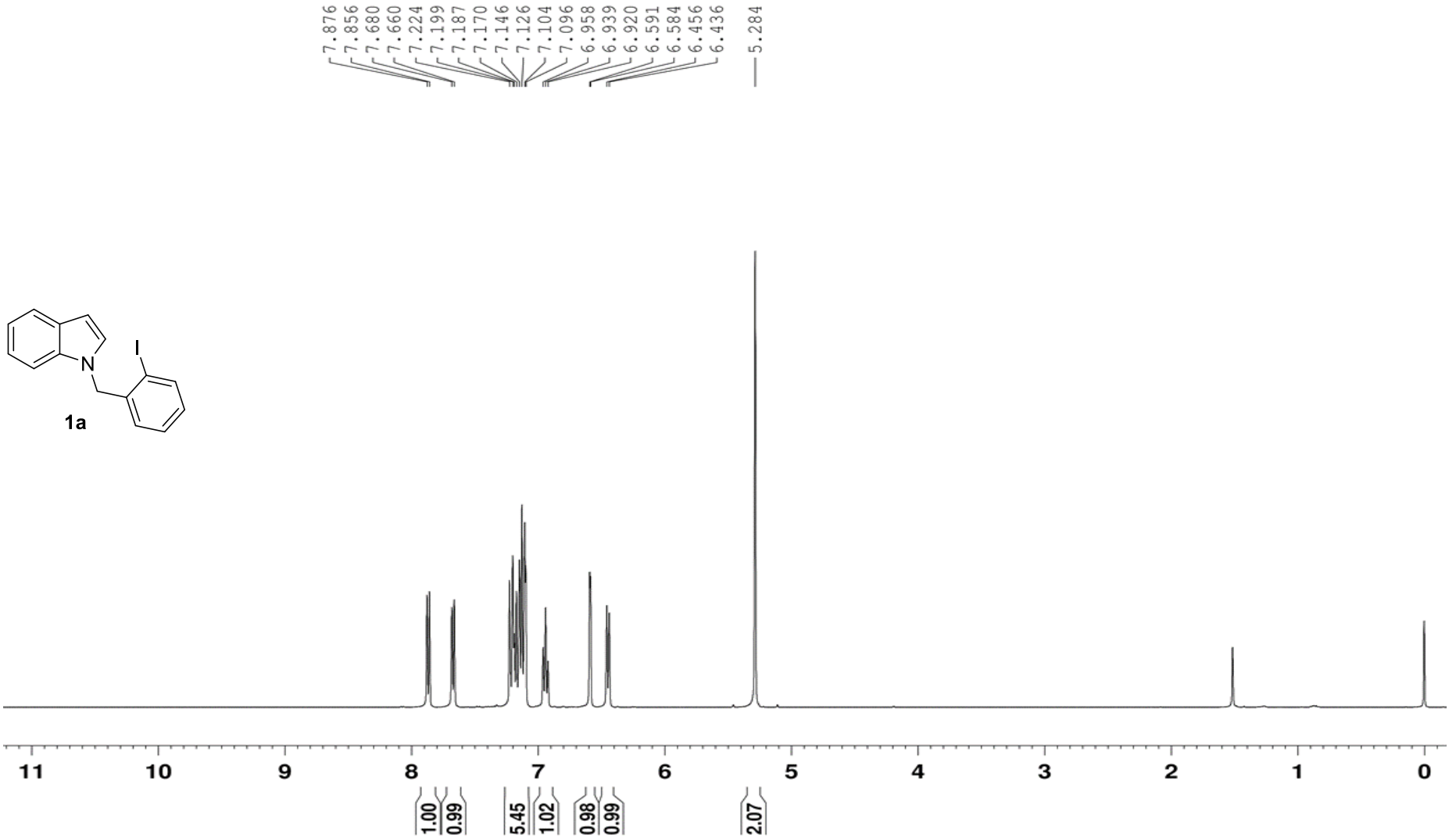
10
ppm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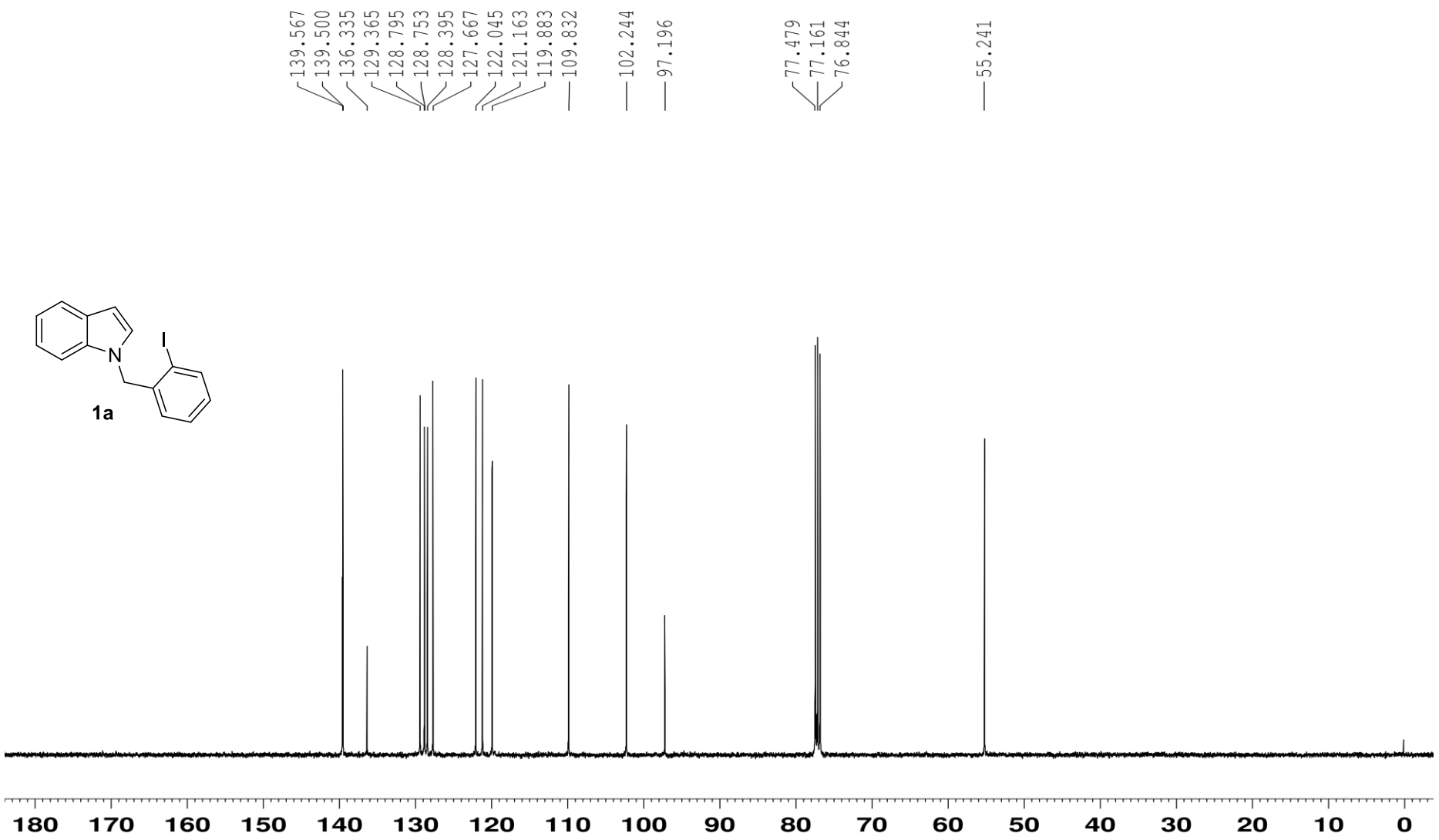
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77.479
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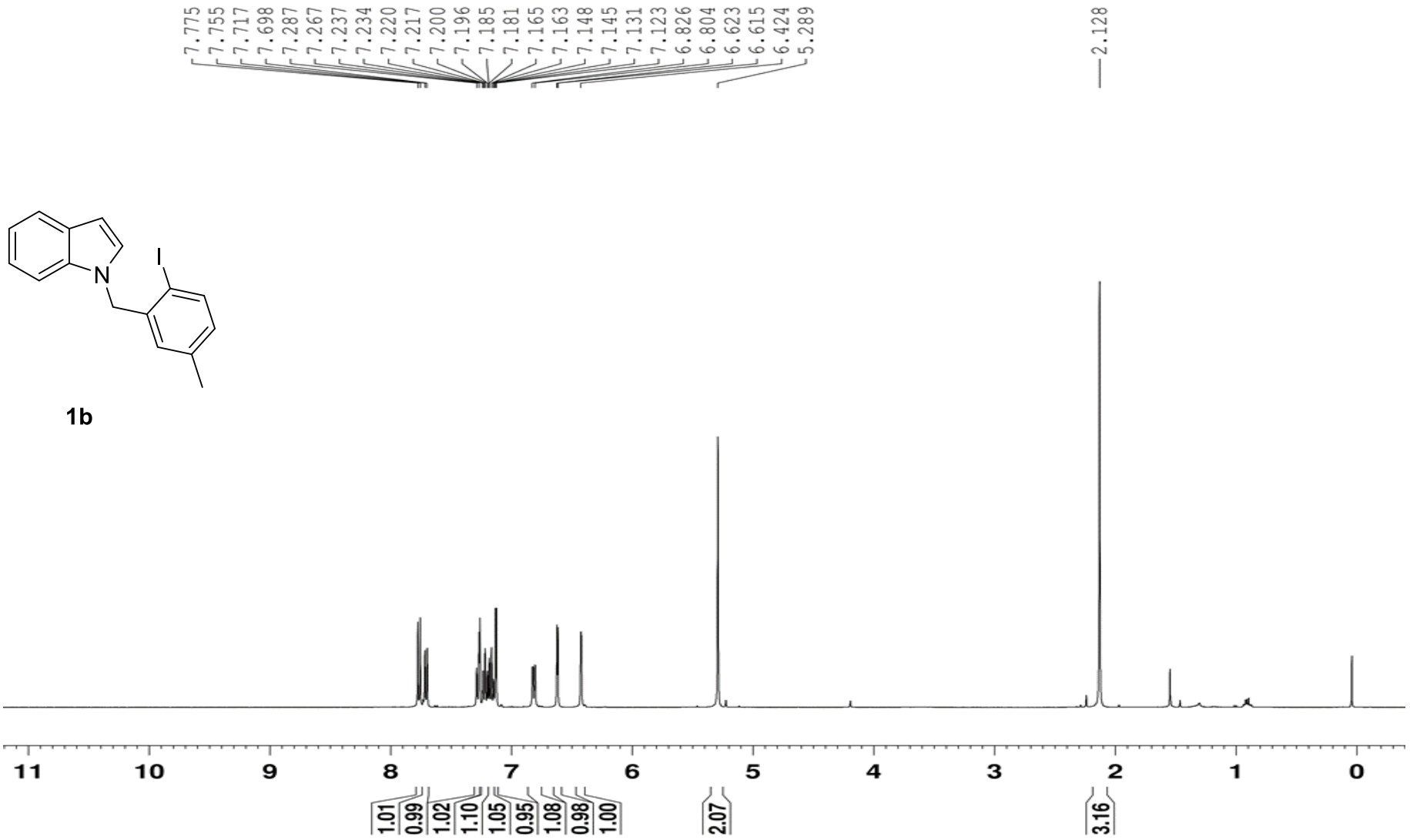
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6.615
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1b
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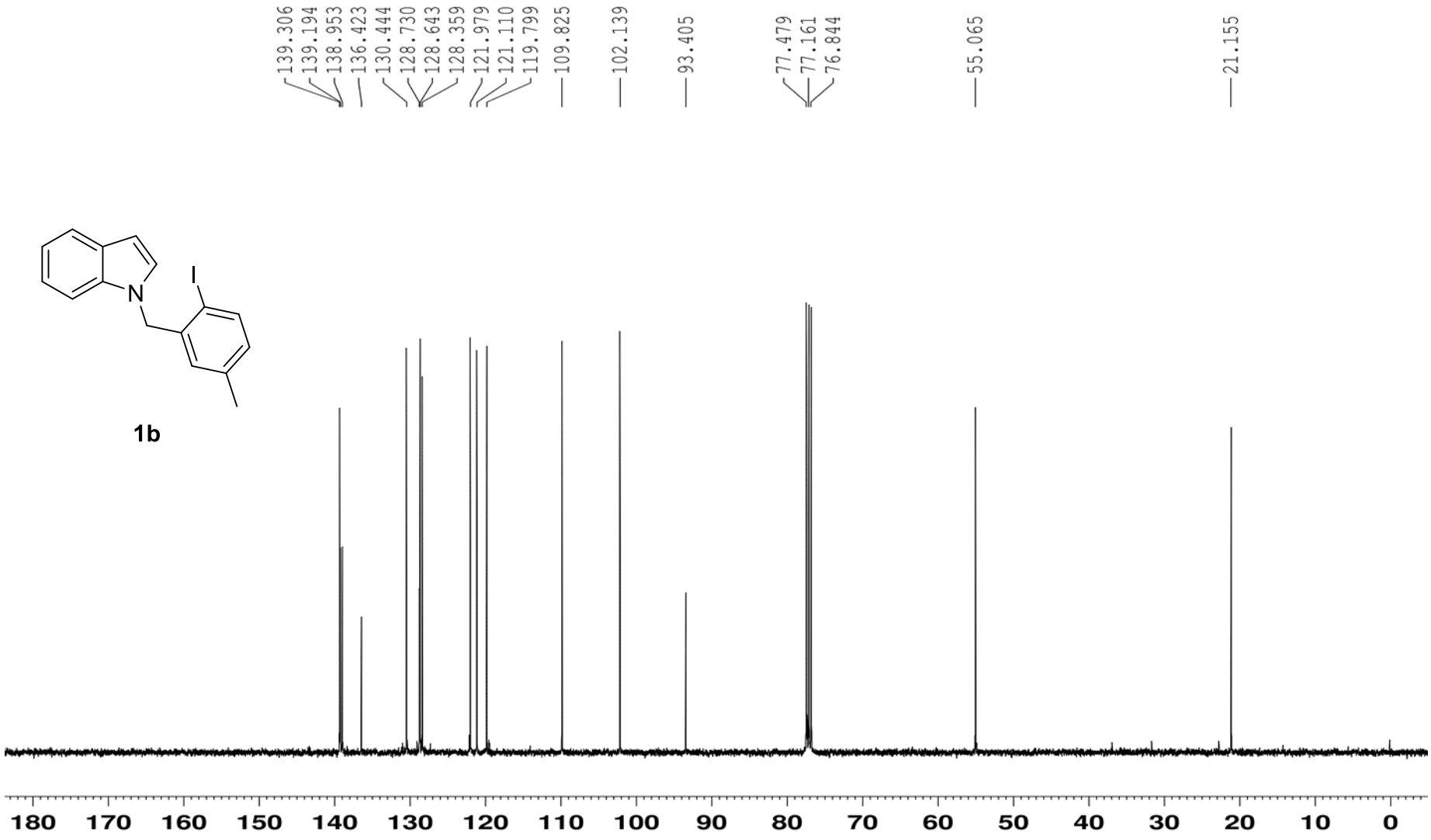
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77.479
77.161
76.844
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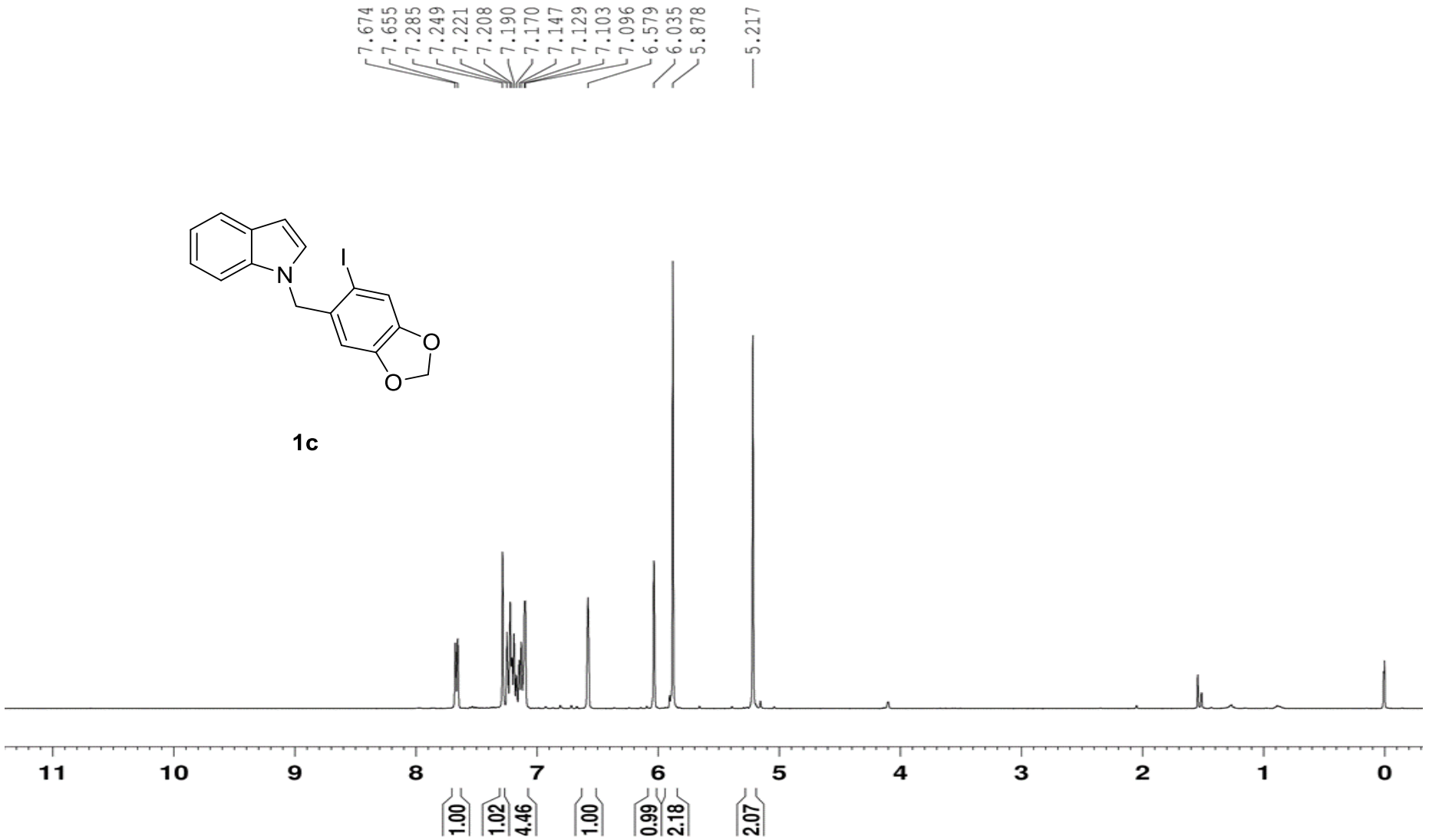
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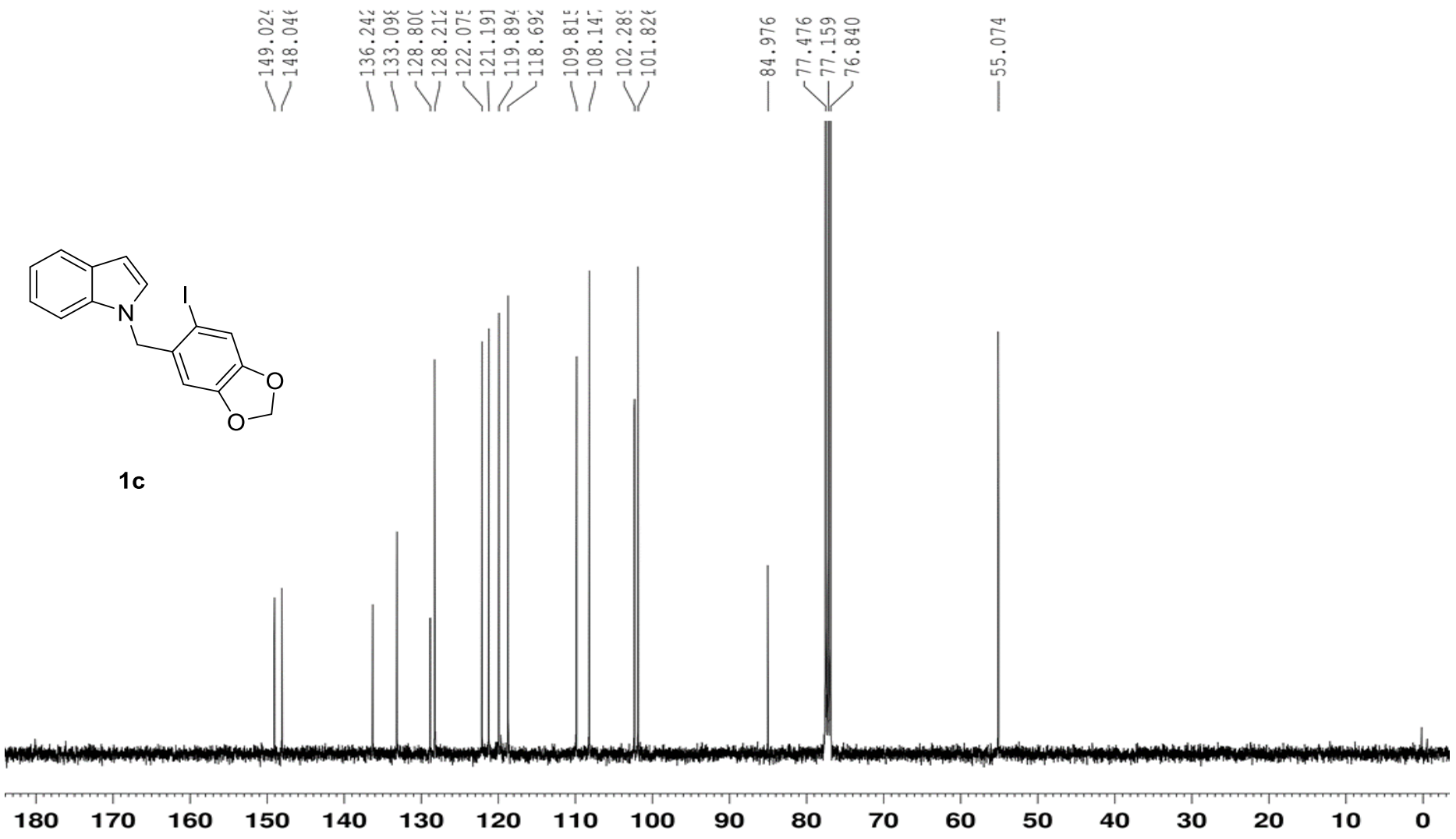
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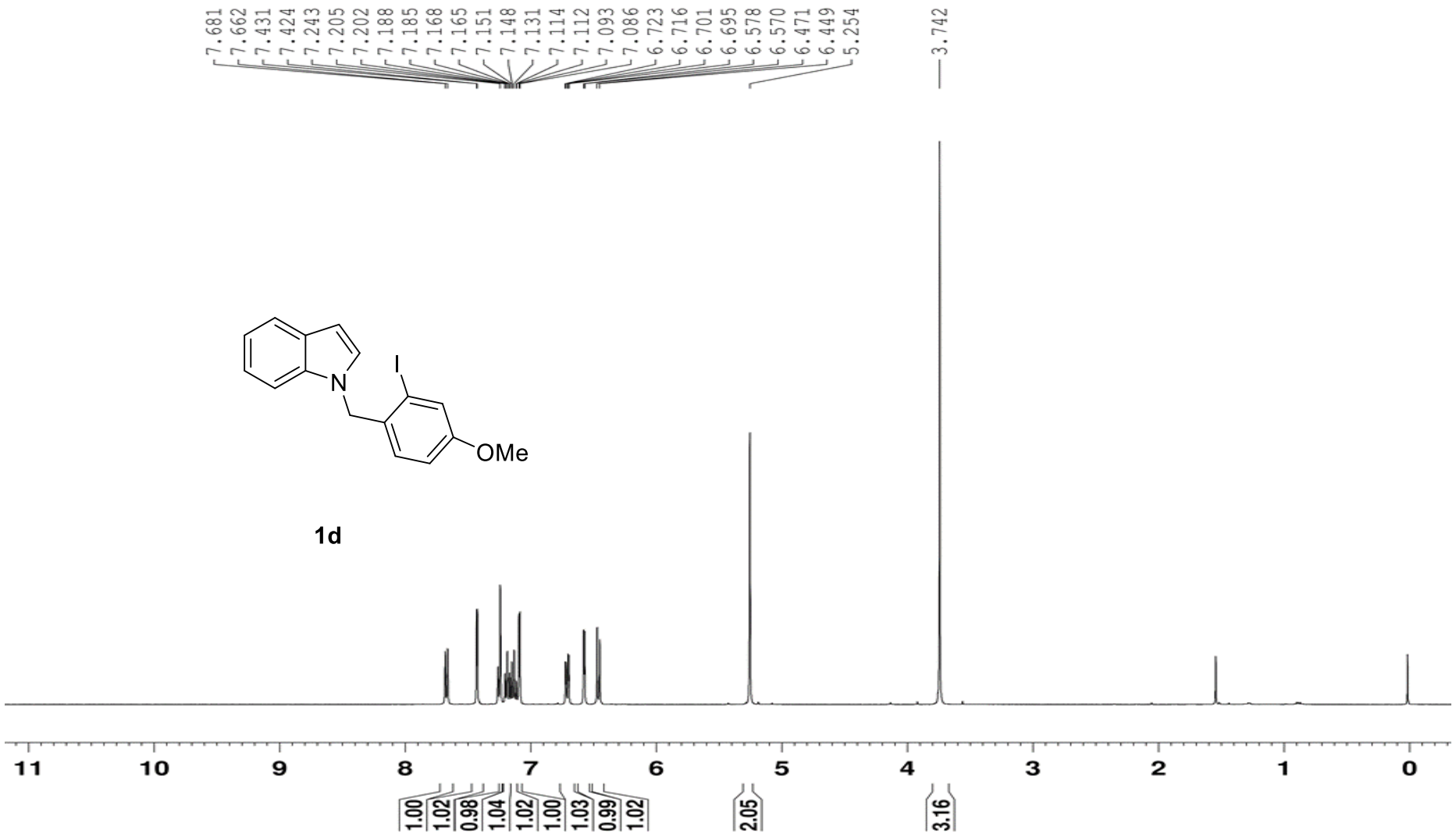
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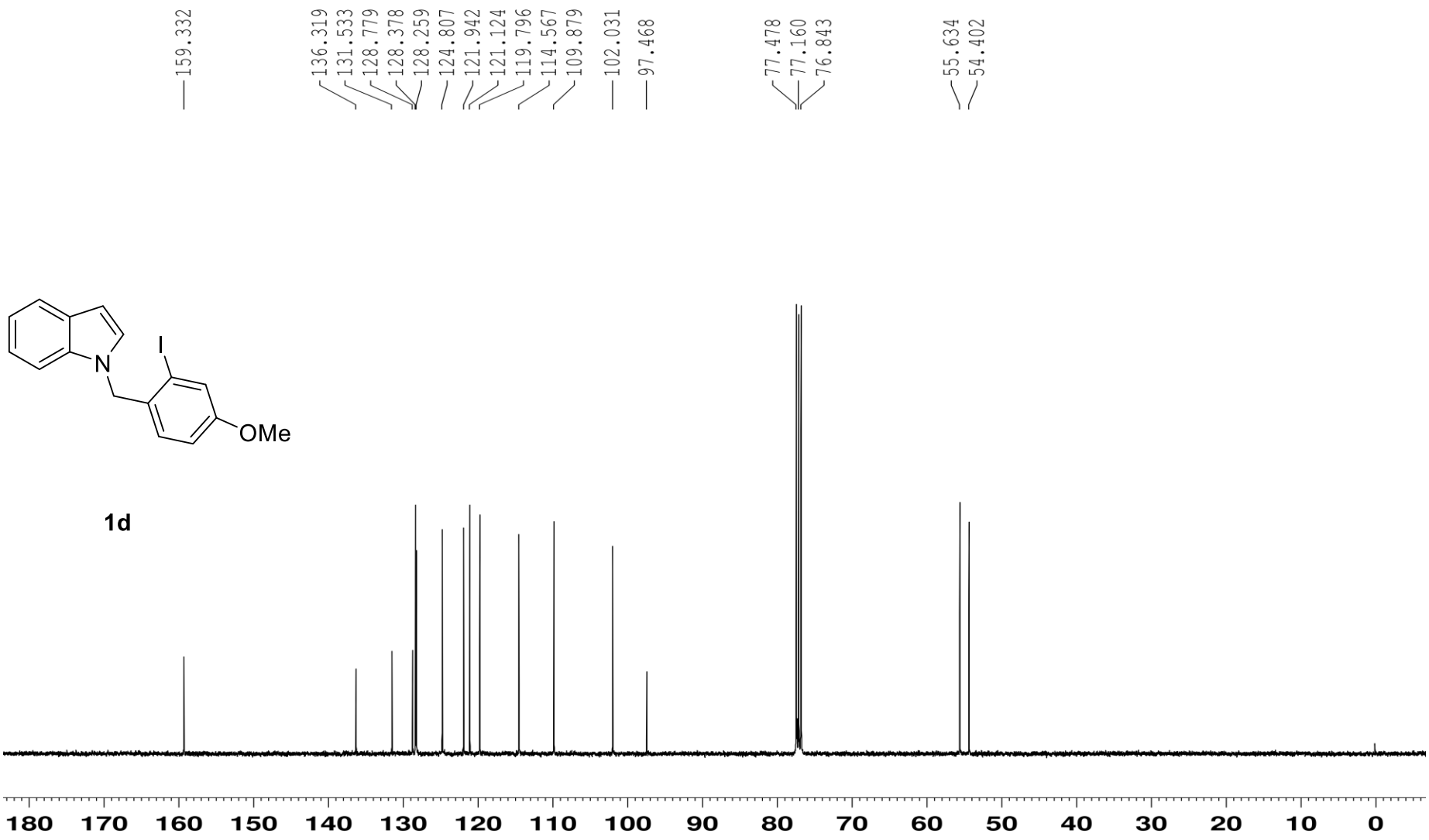
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N
OMe
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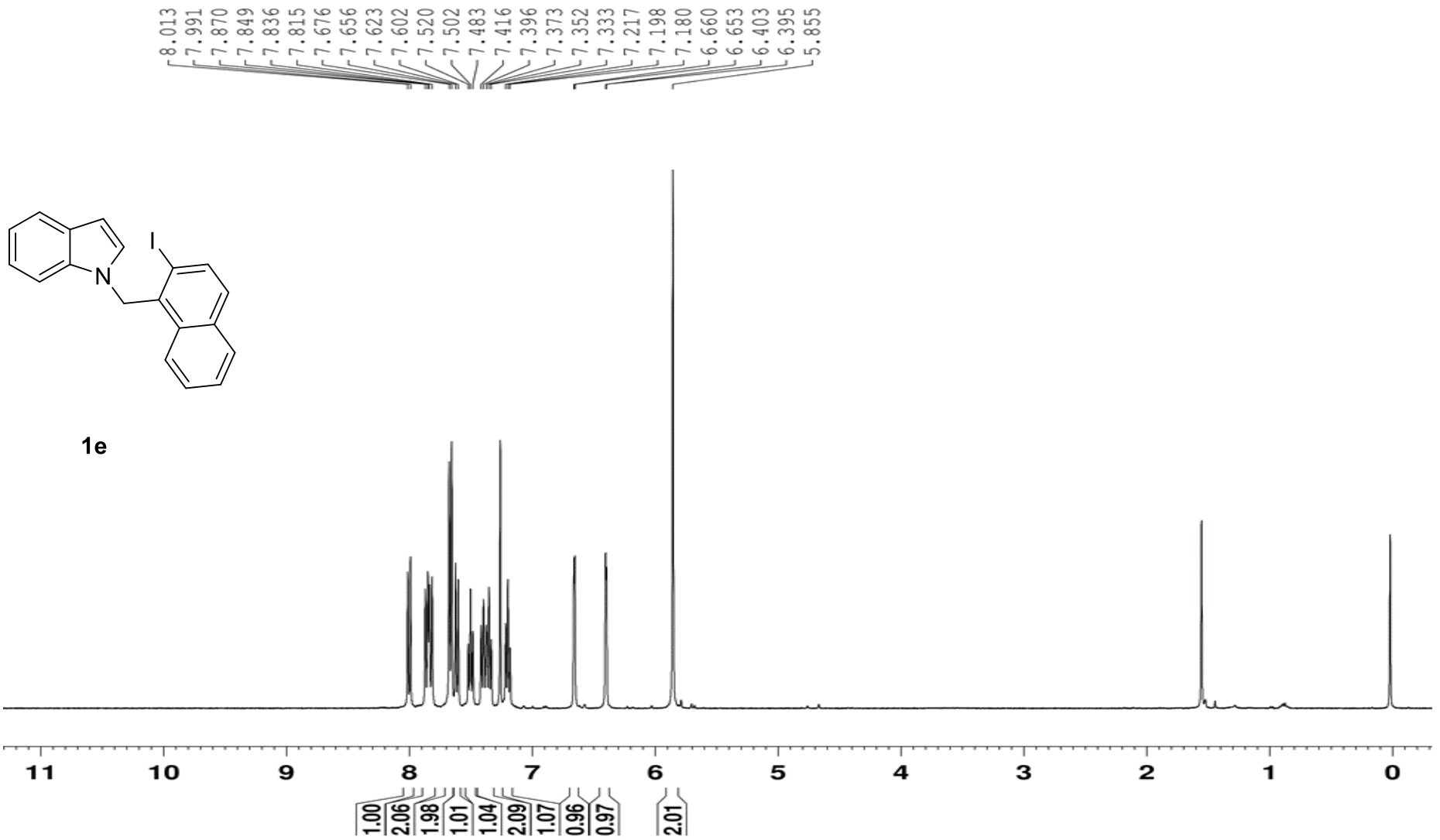
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5.855
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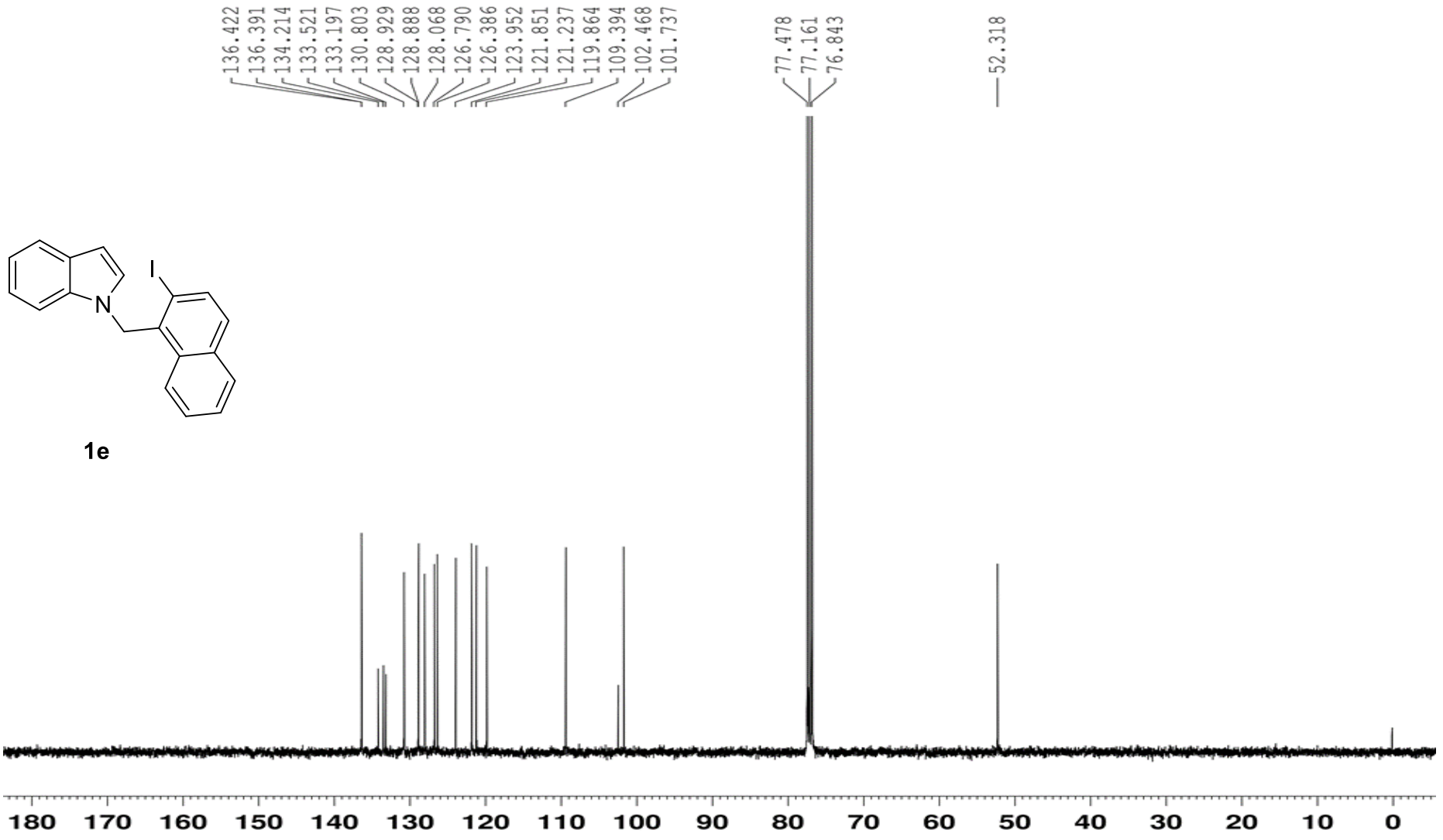
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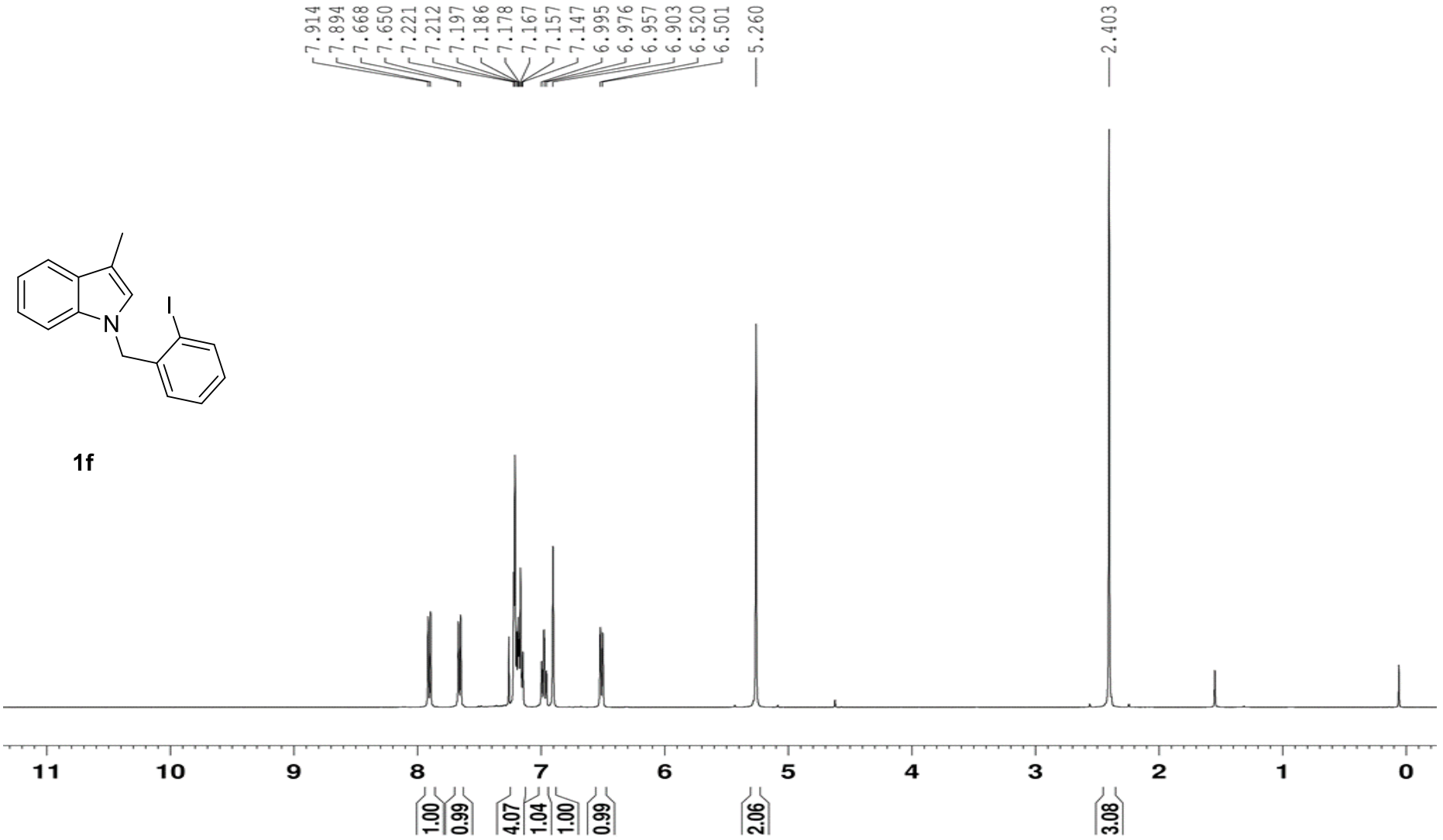
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6.501
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N
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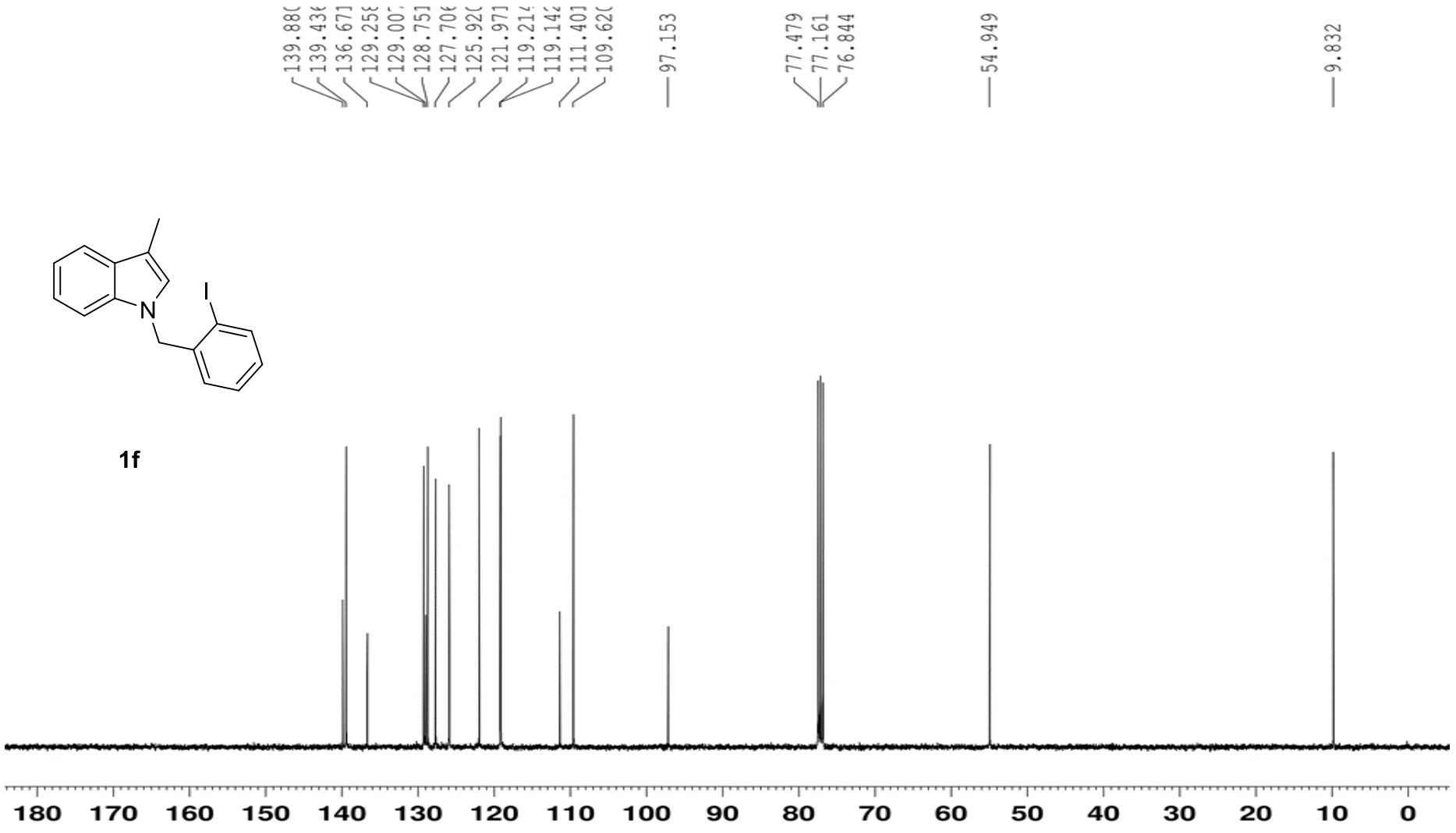
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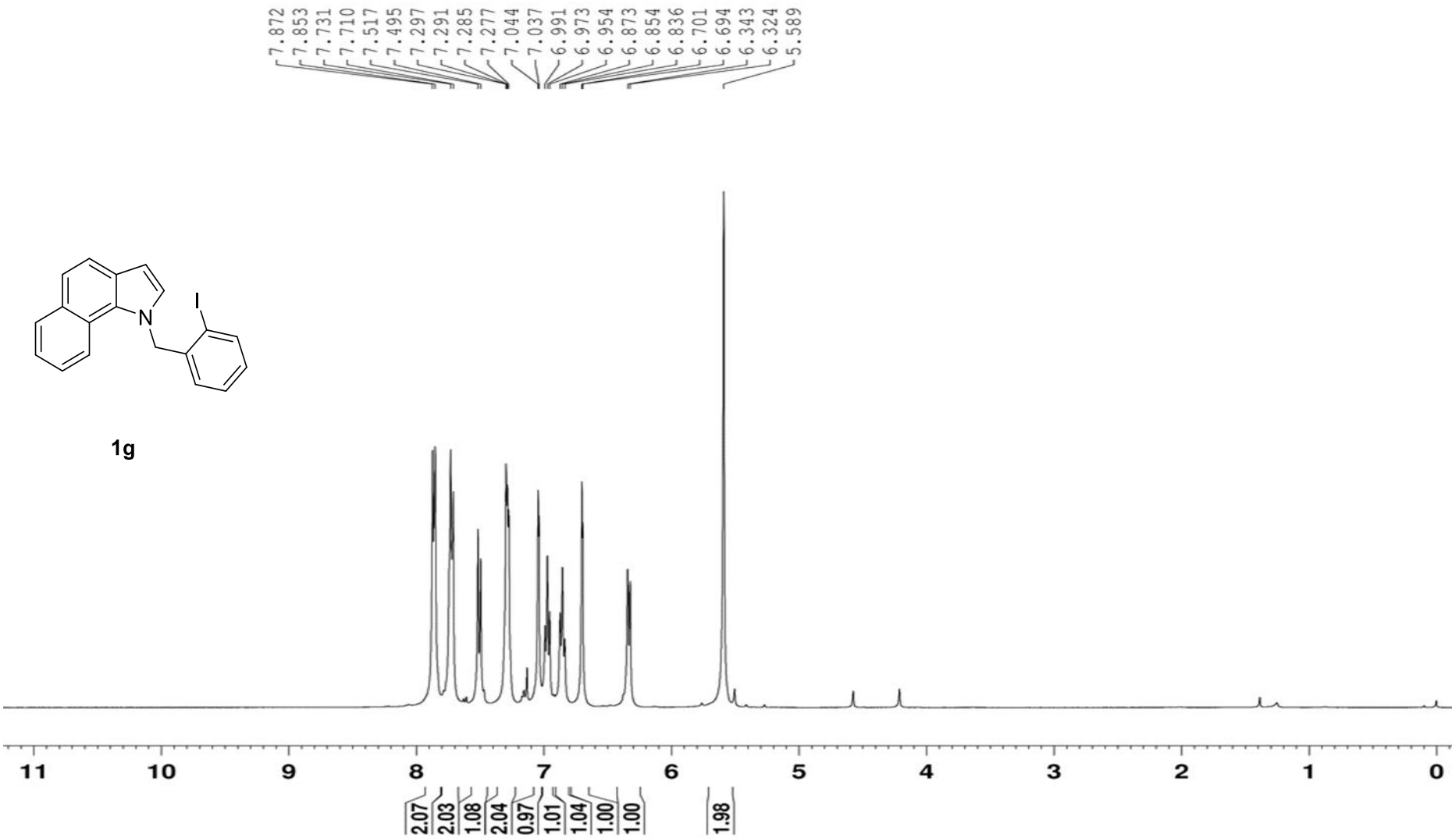
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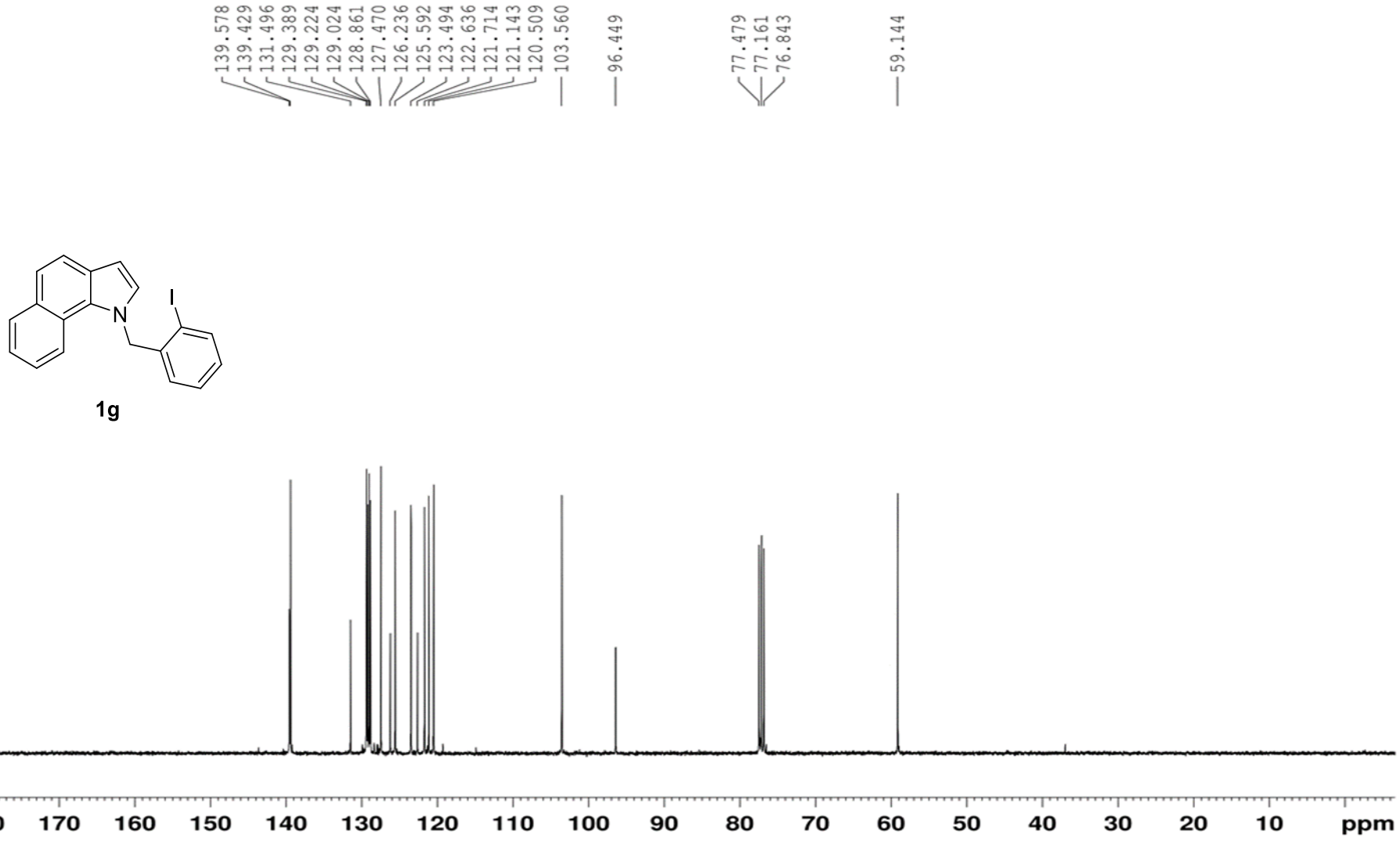
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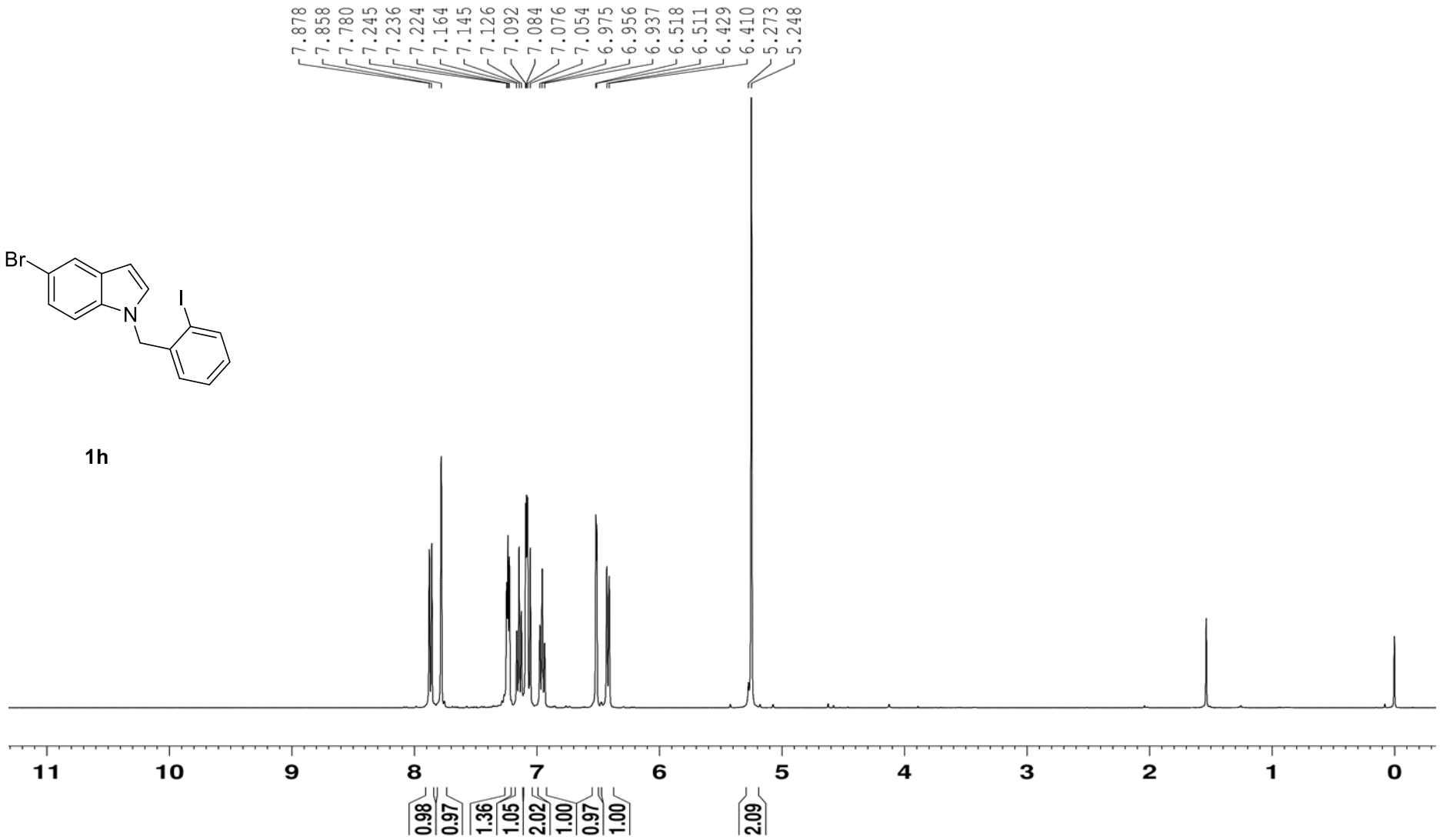
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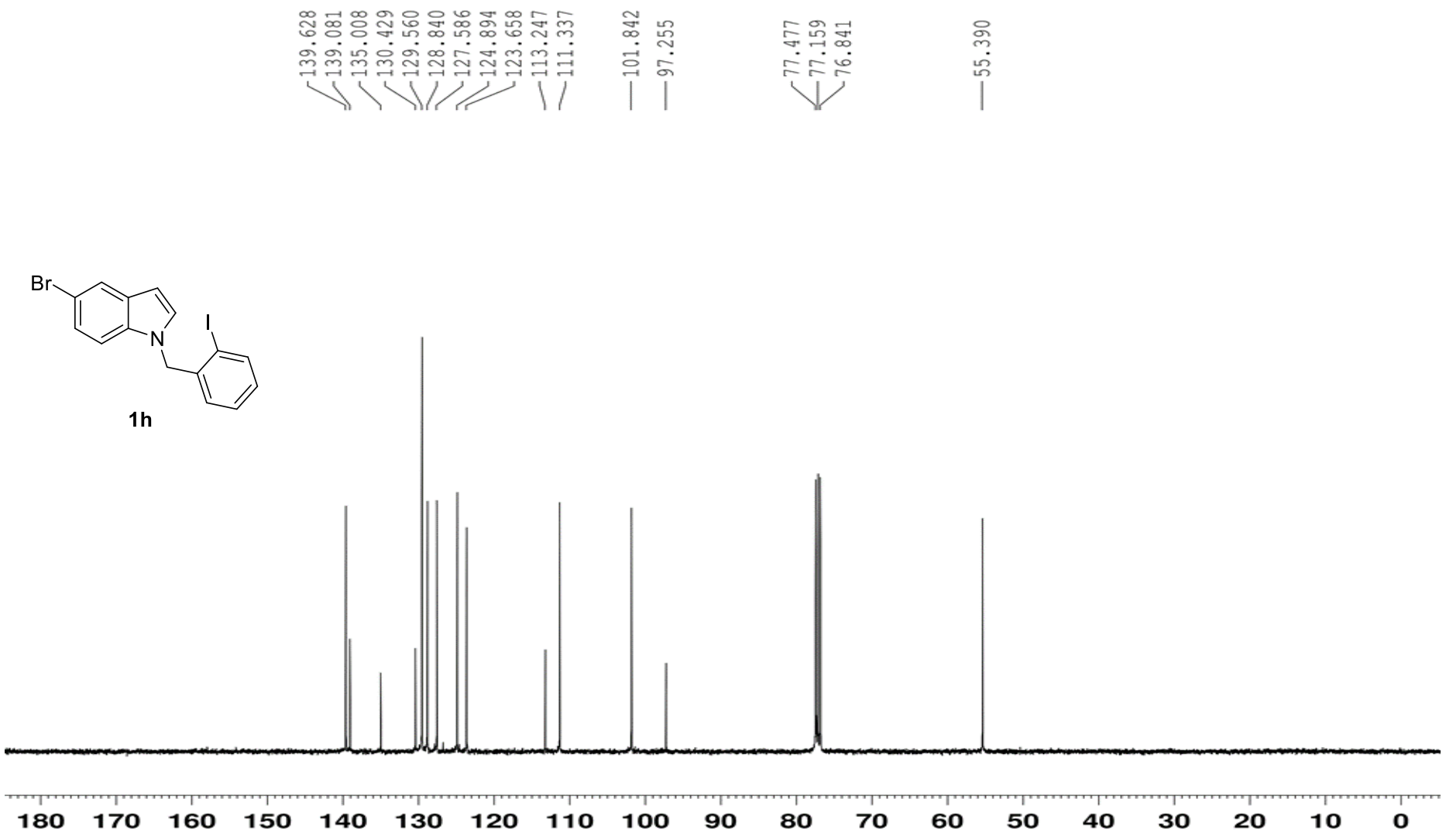
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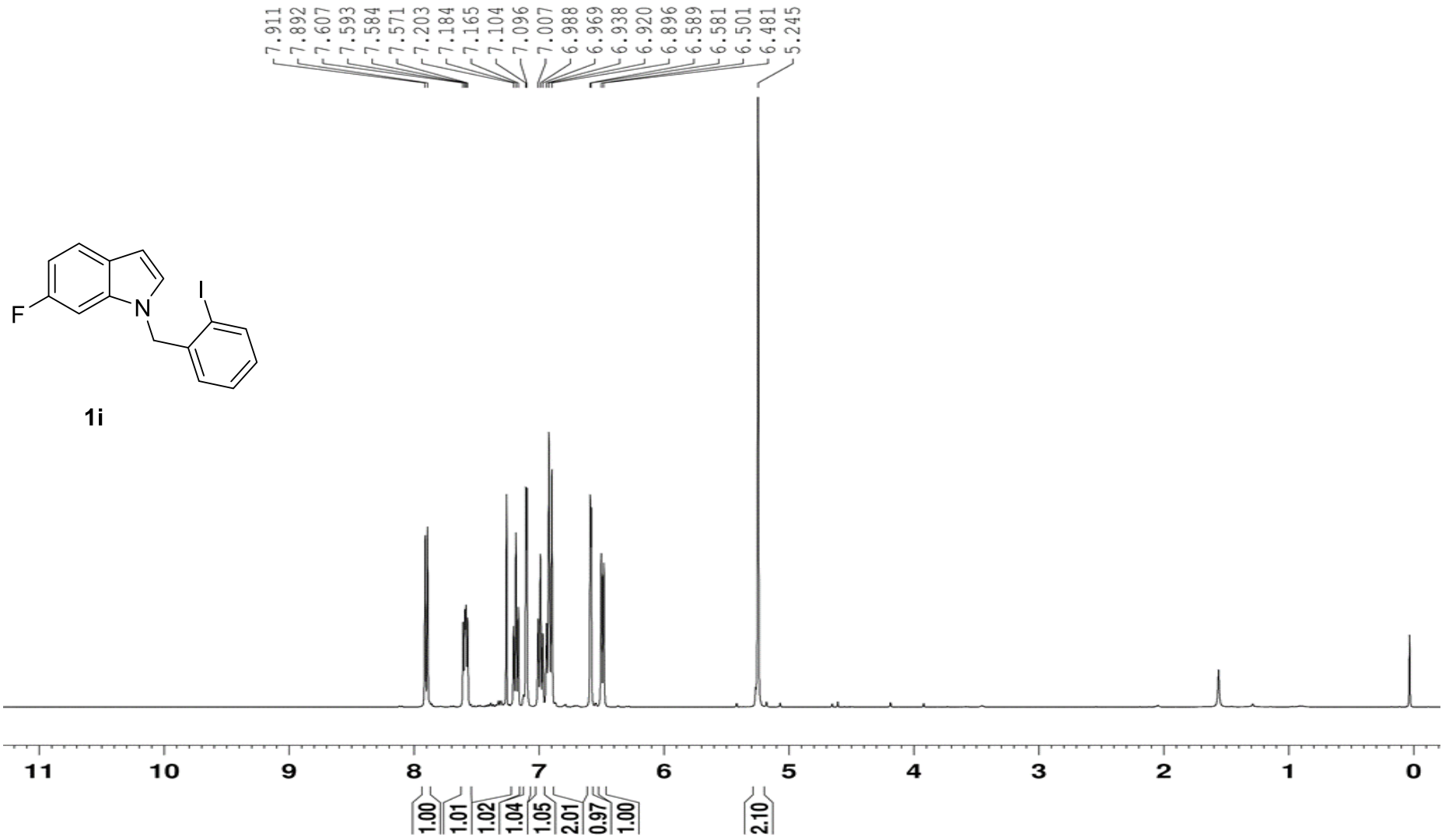
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N
I
1i
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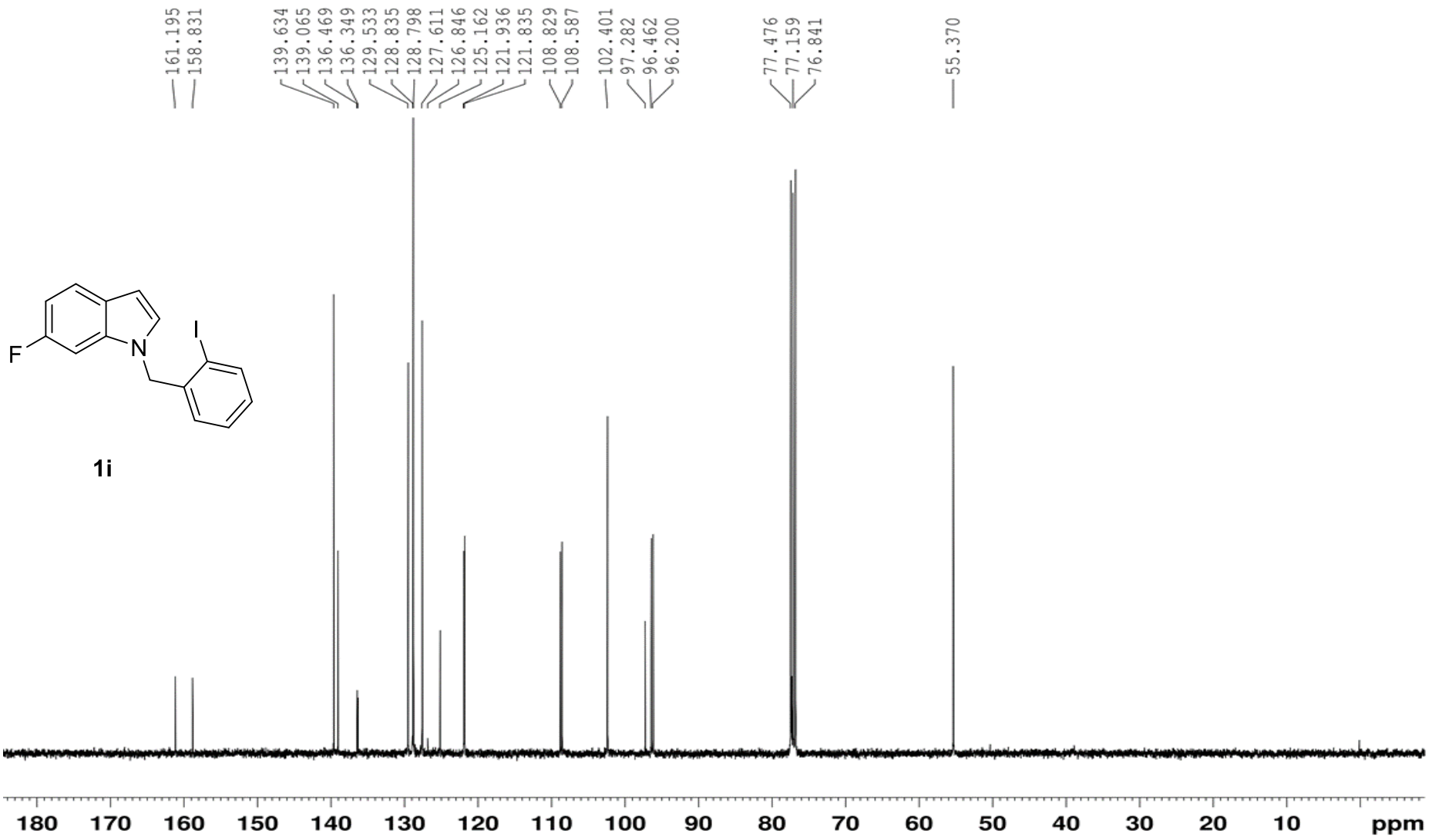
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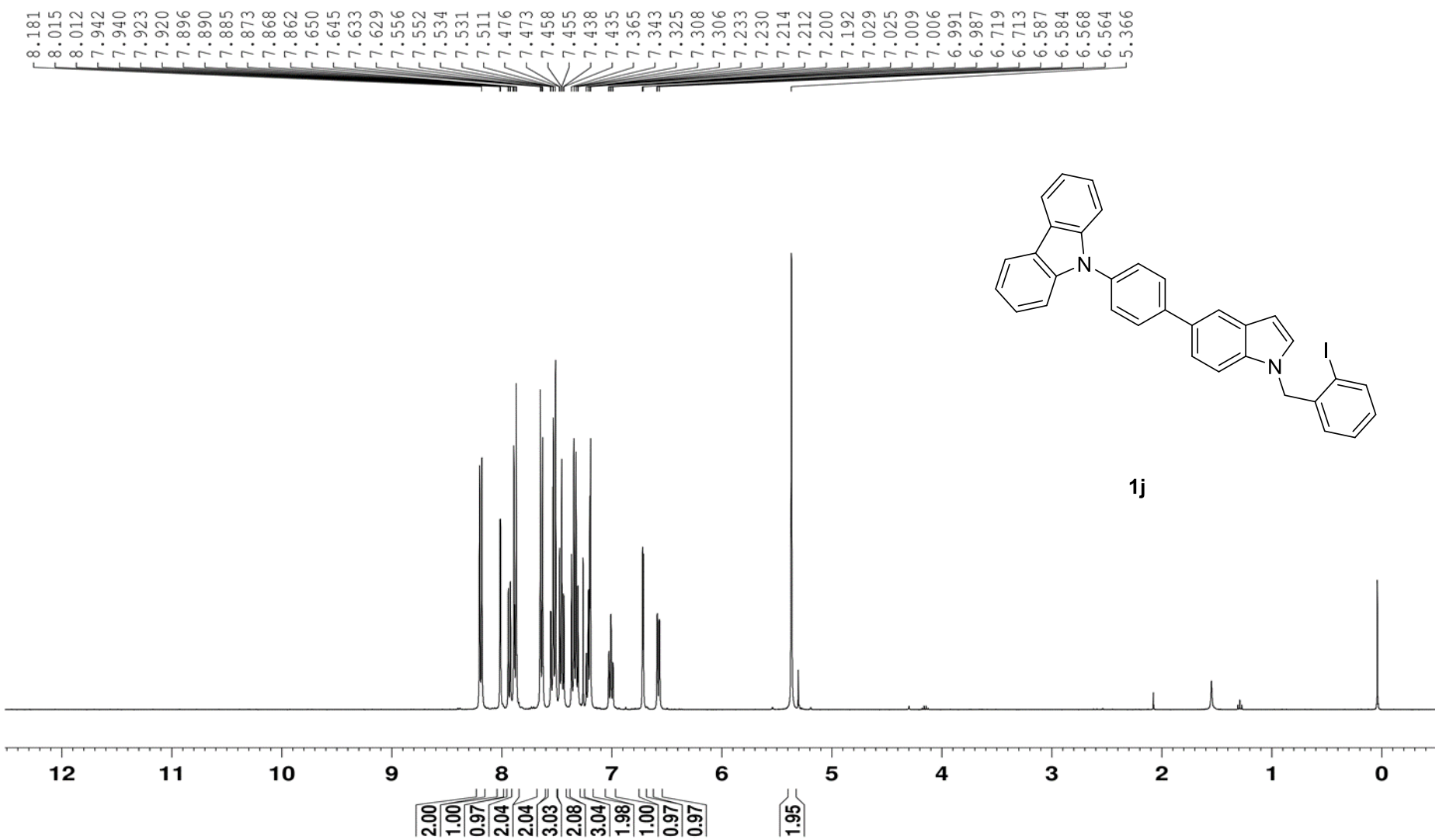
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7.534
7.531
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7.476
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7.435
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7.325
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7.212
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5.366
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1j
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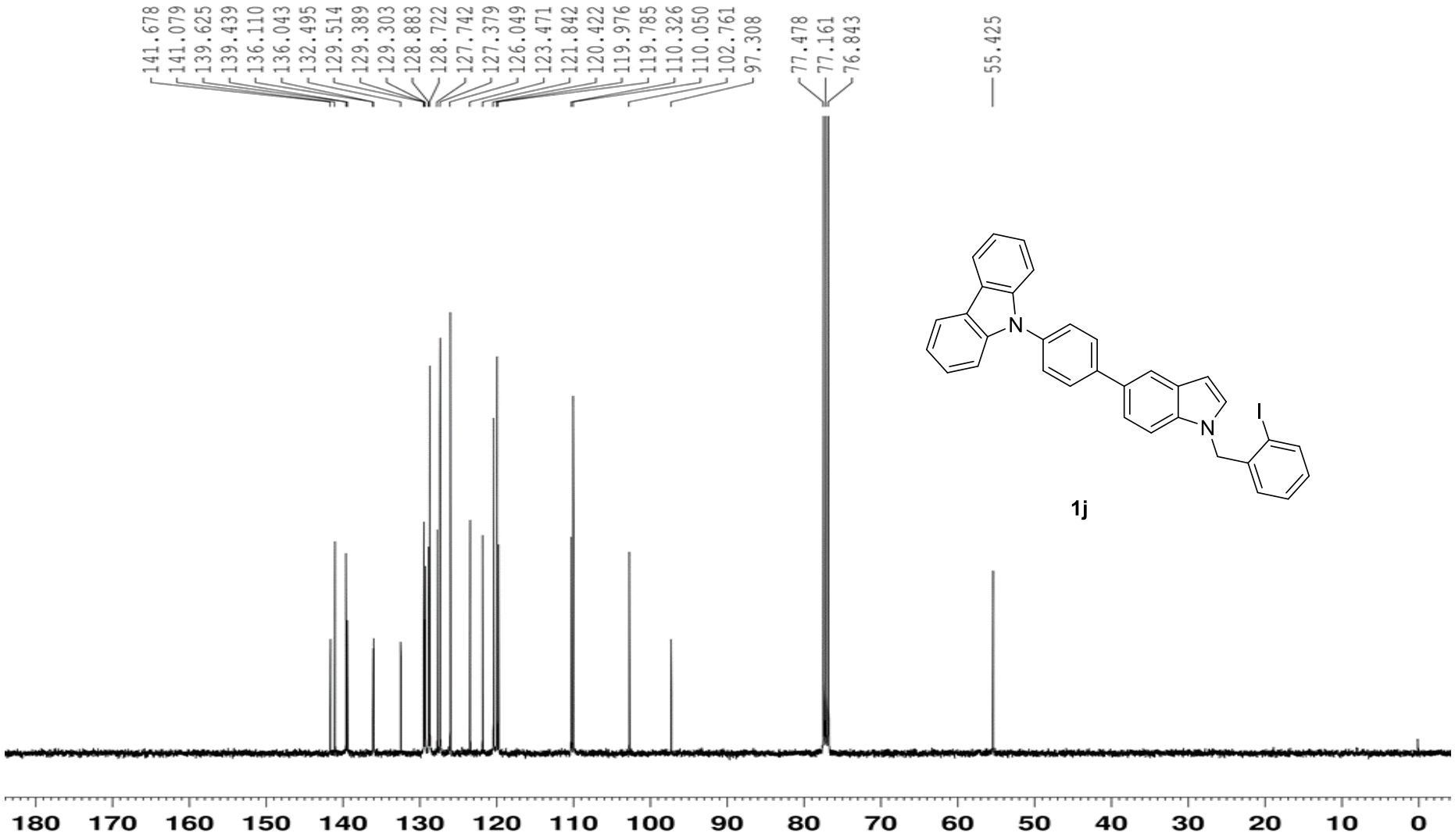
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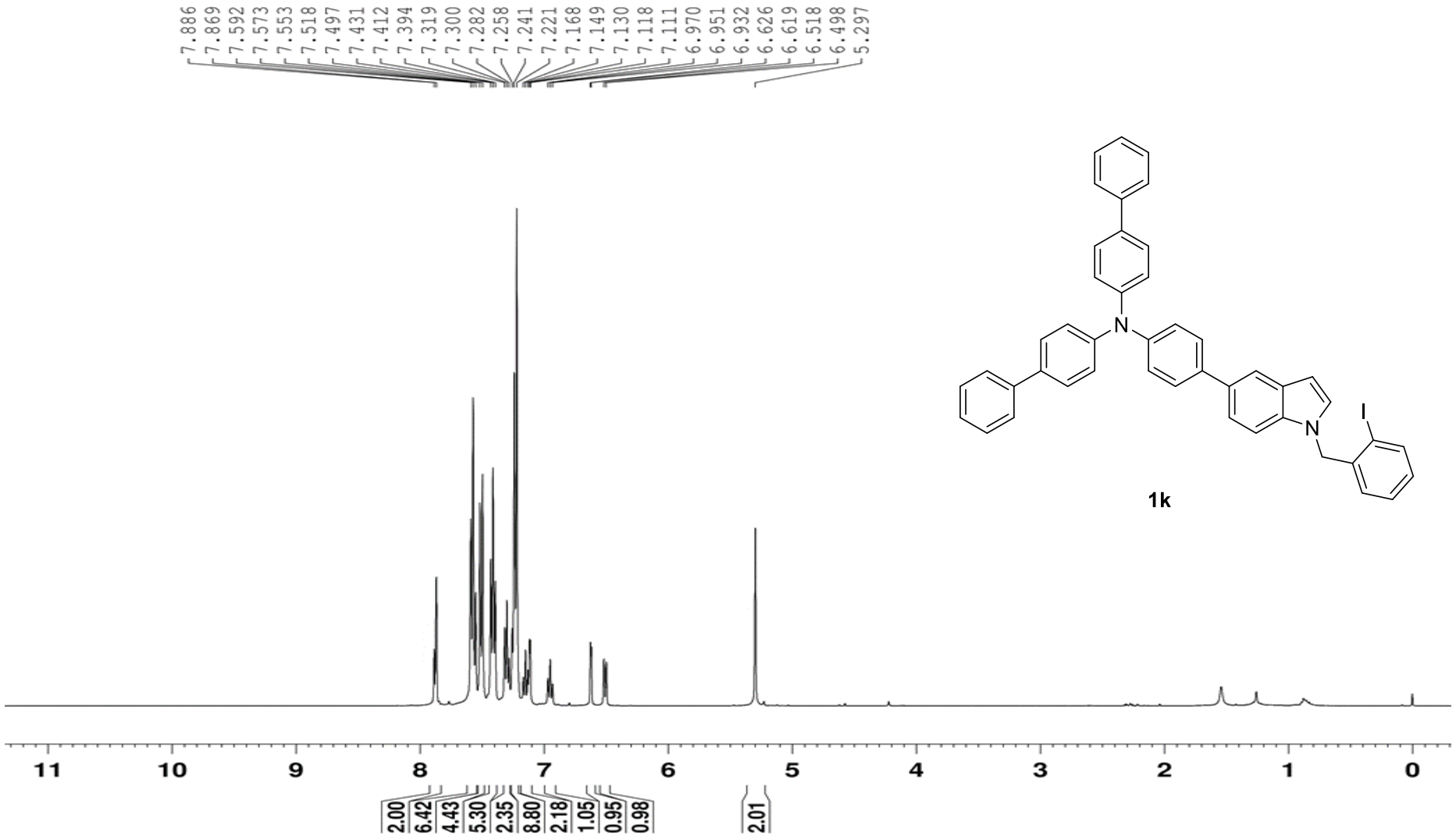
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6.951
6.932
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5.297
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N
I
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7
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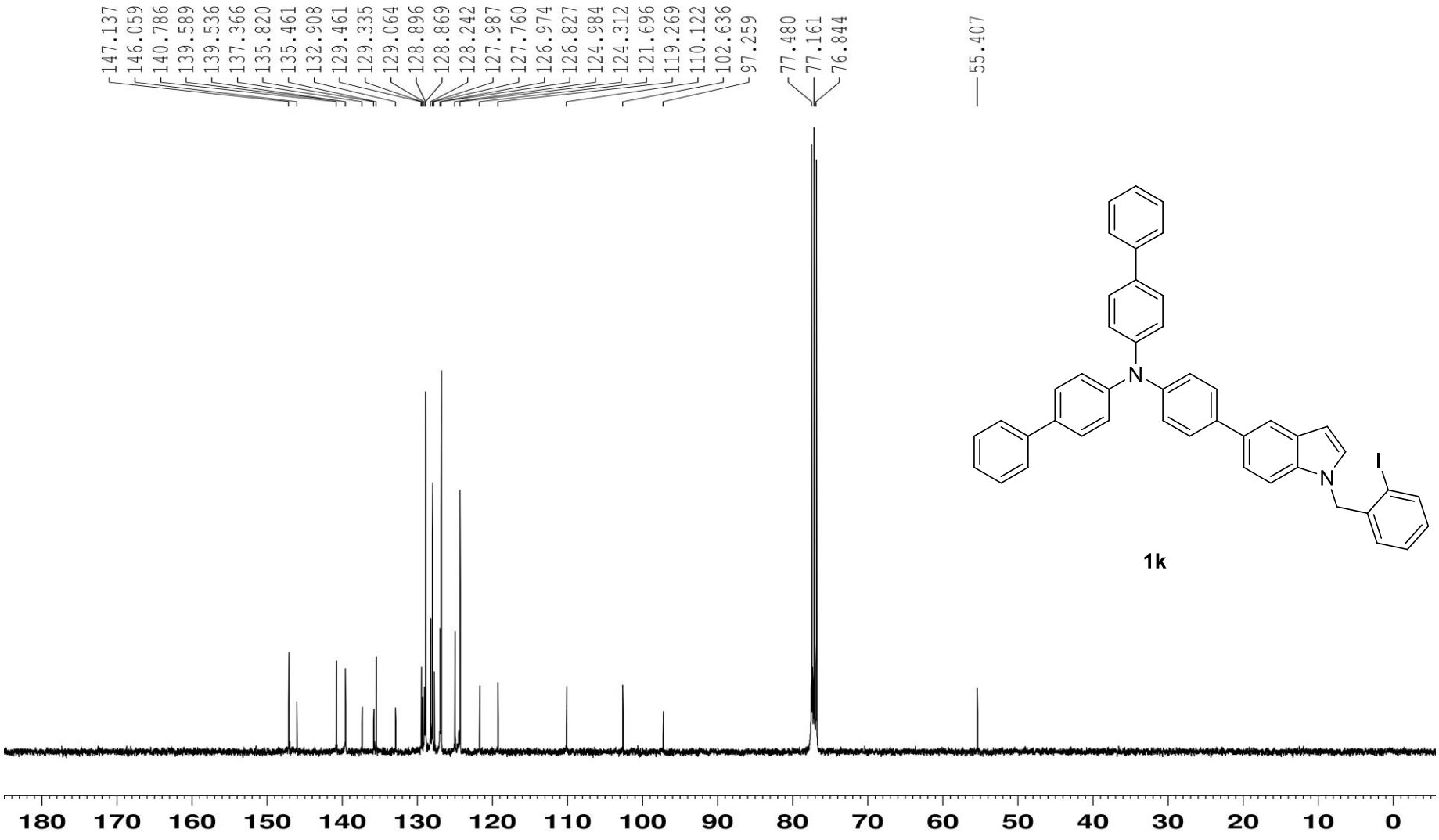
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N
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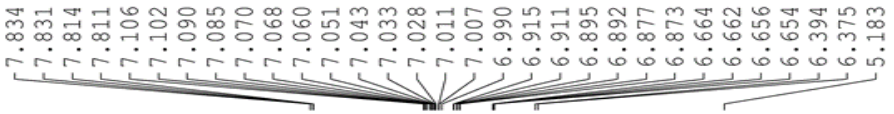
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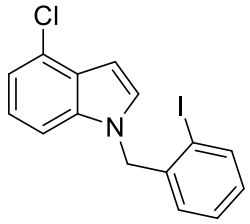
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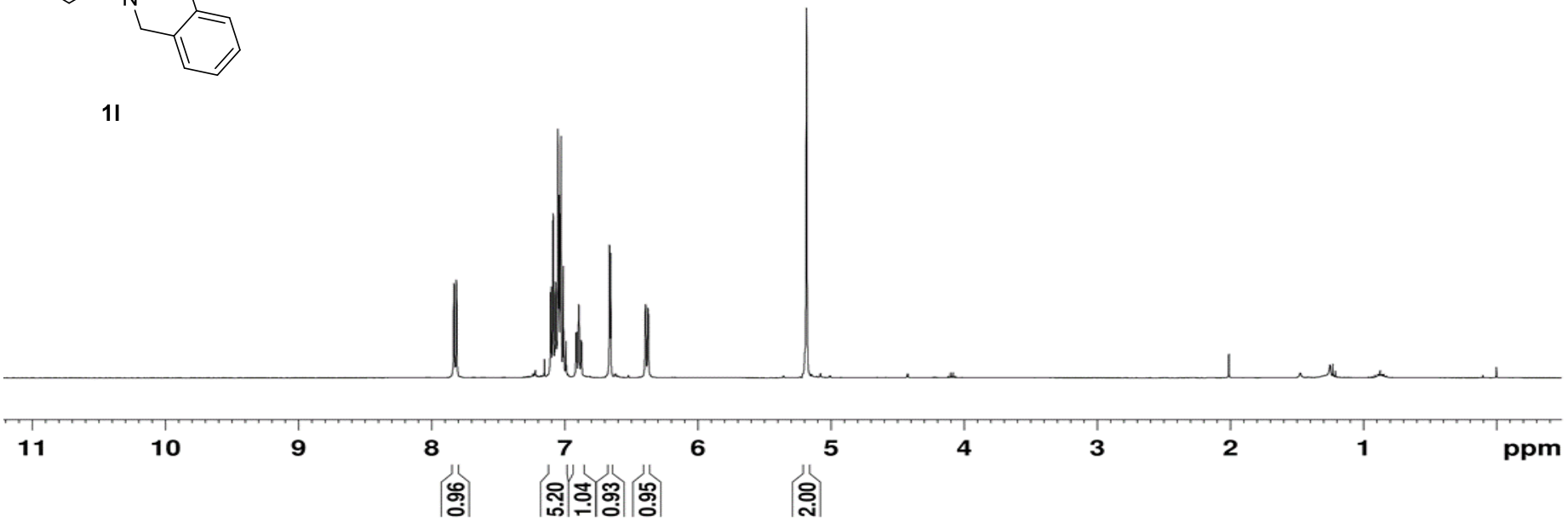
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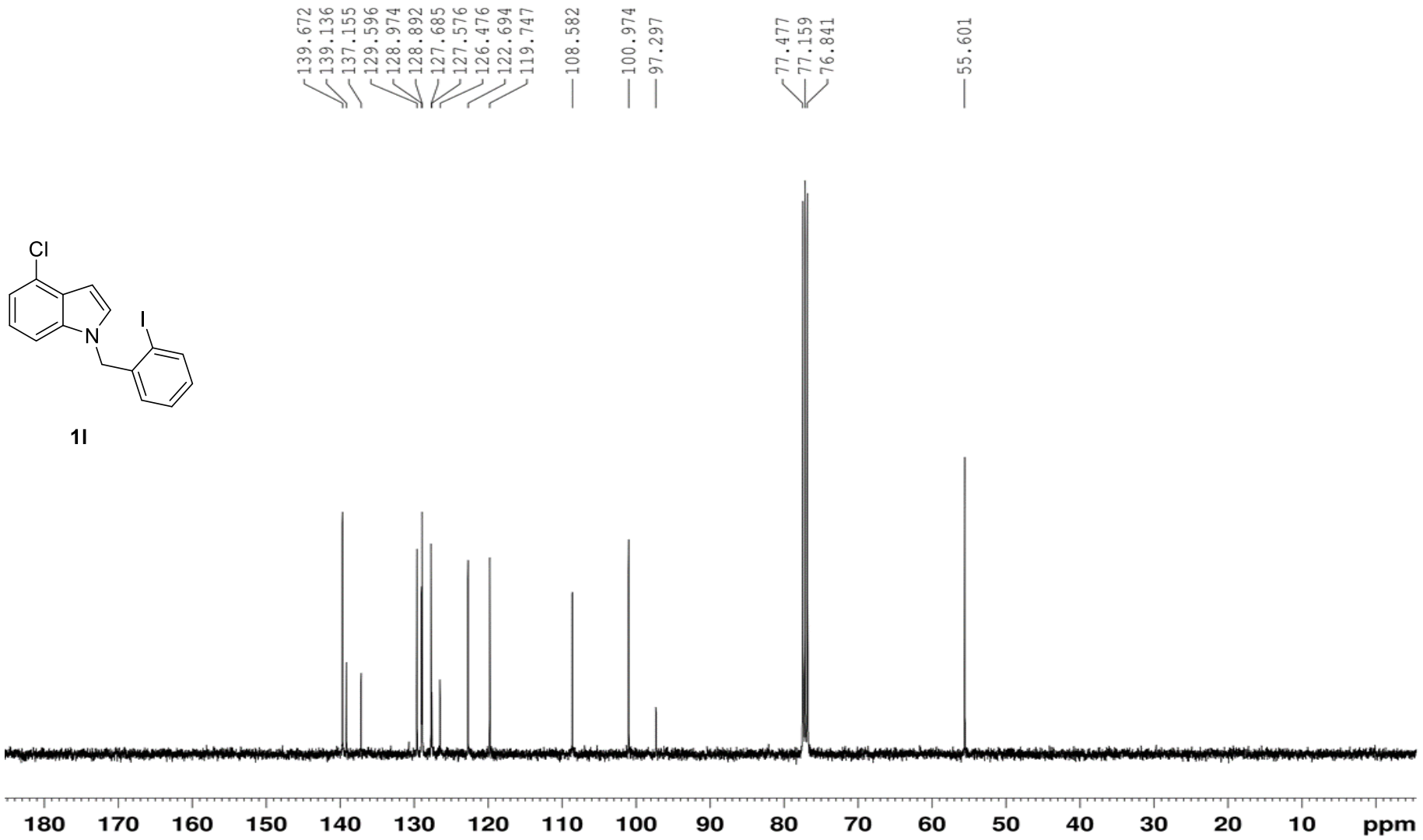
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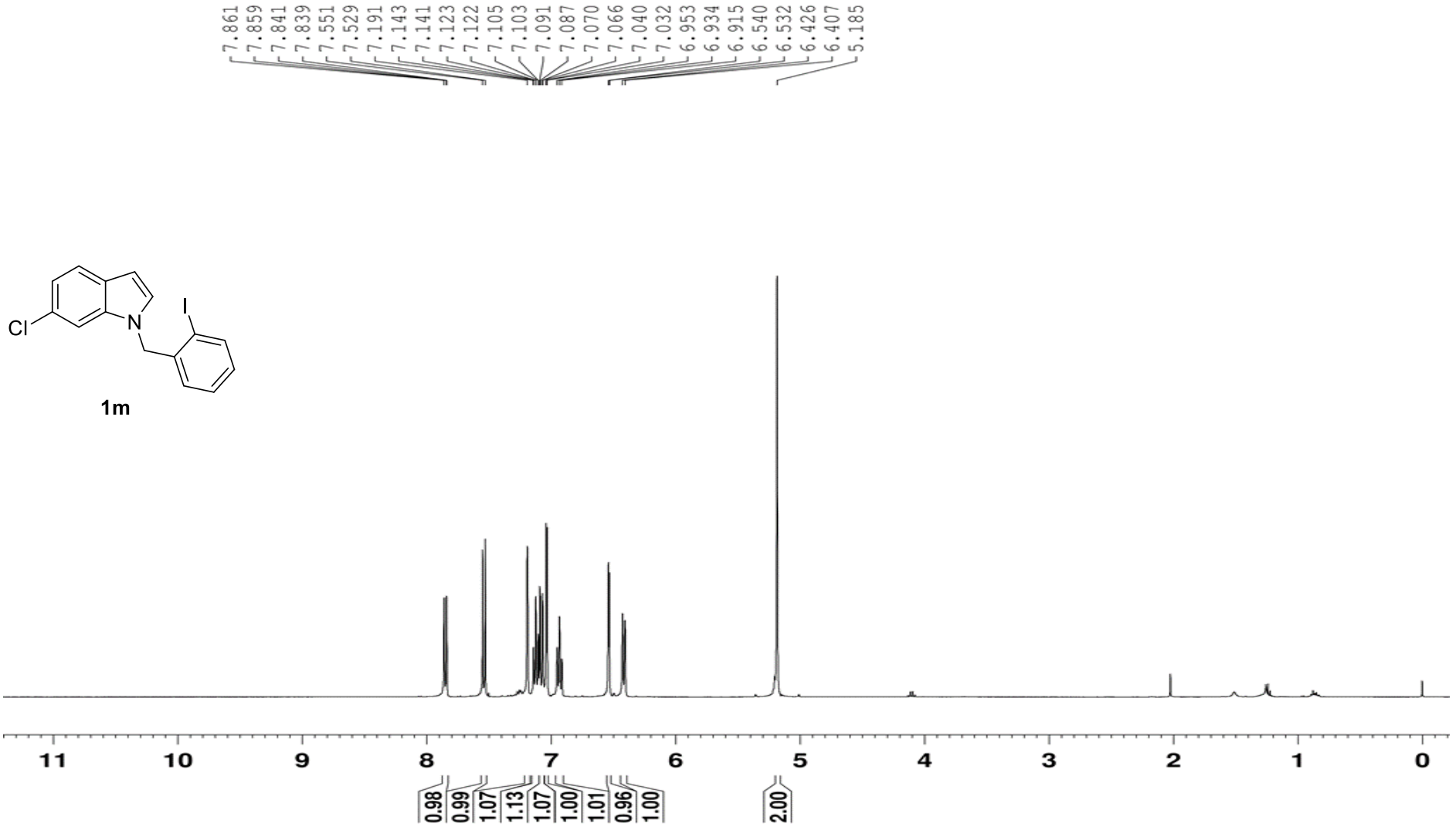
ppm

1l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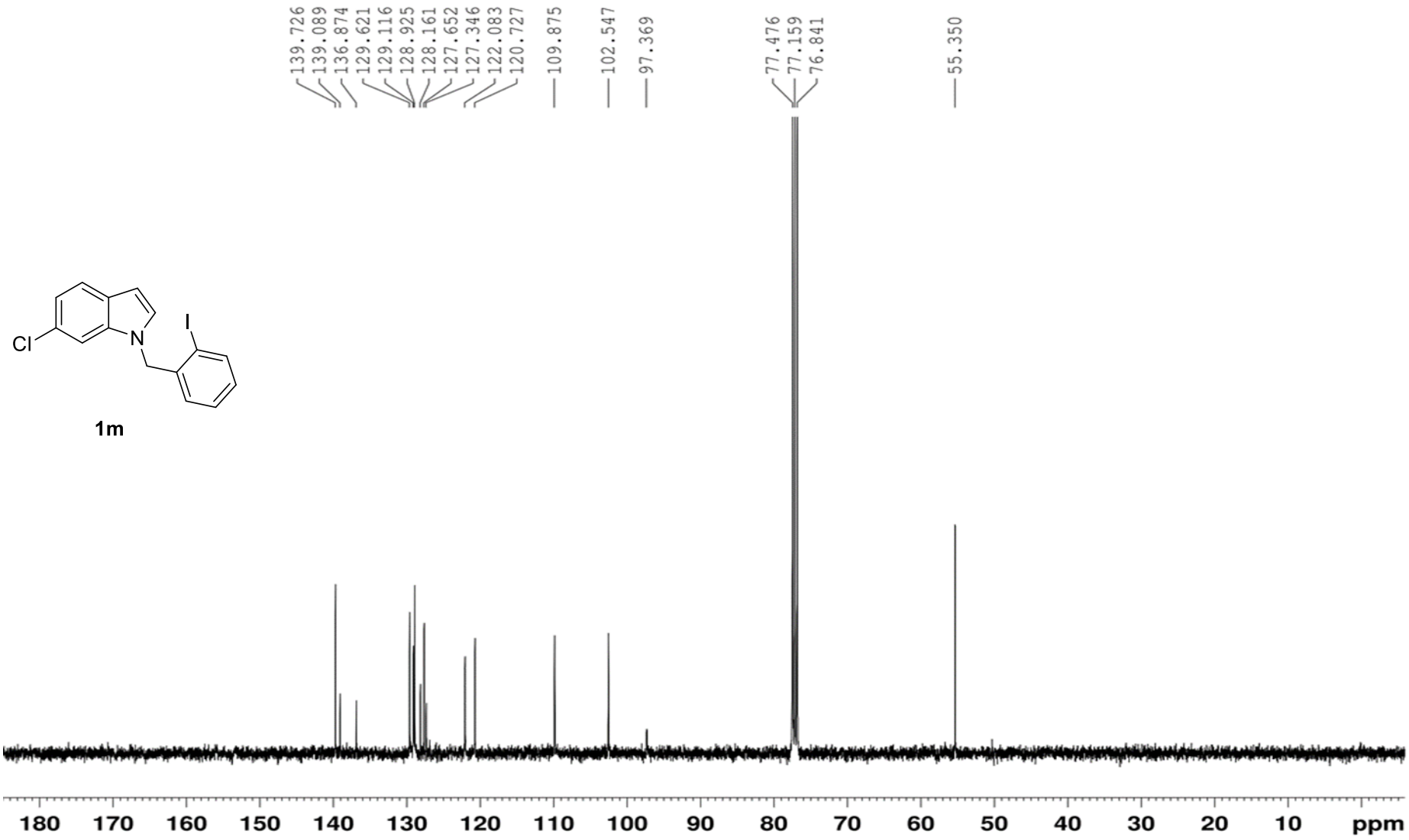
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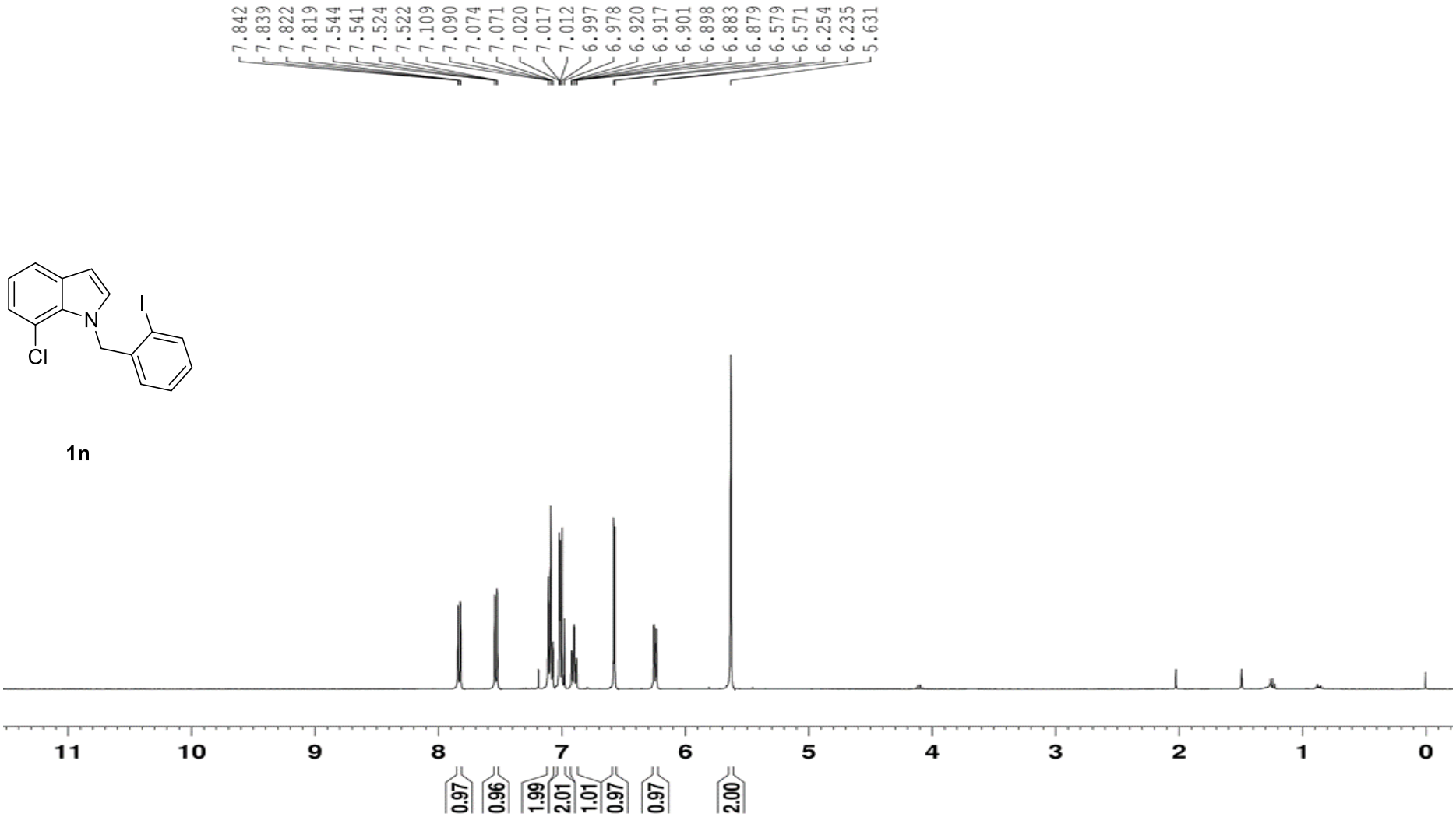
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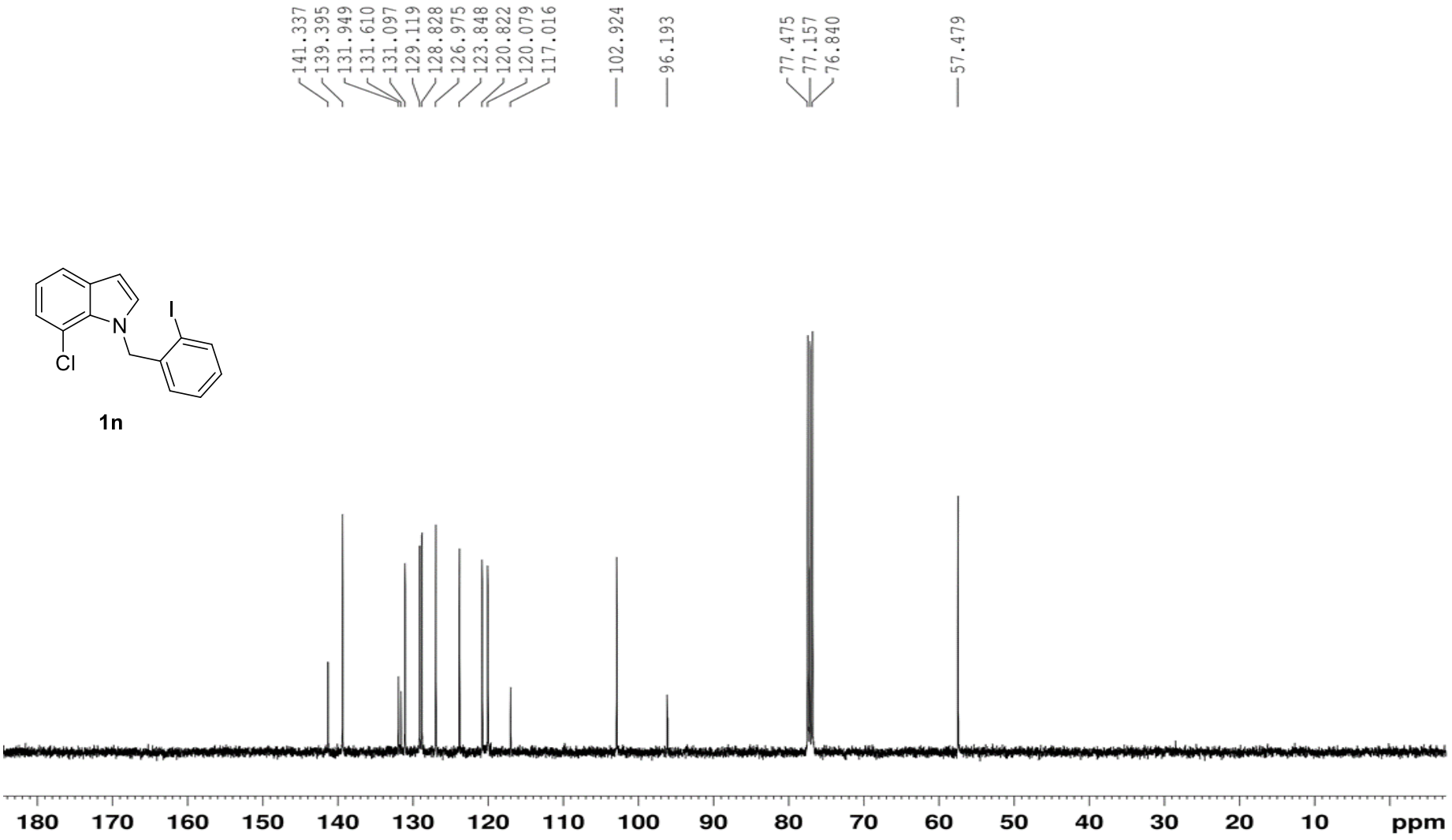
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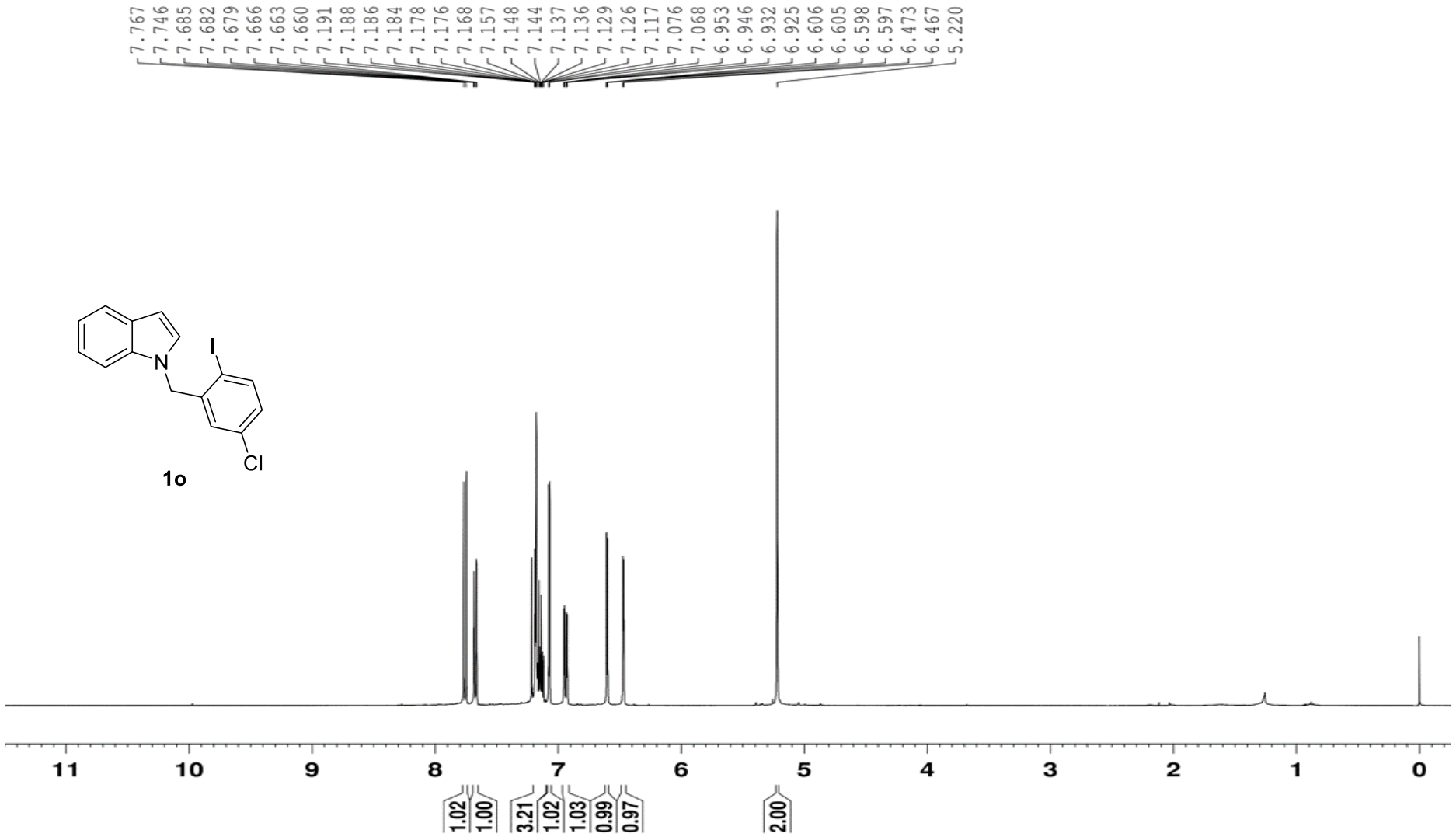
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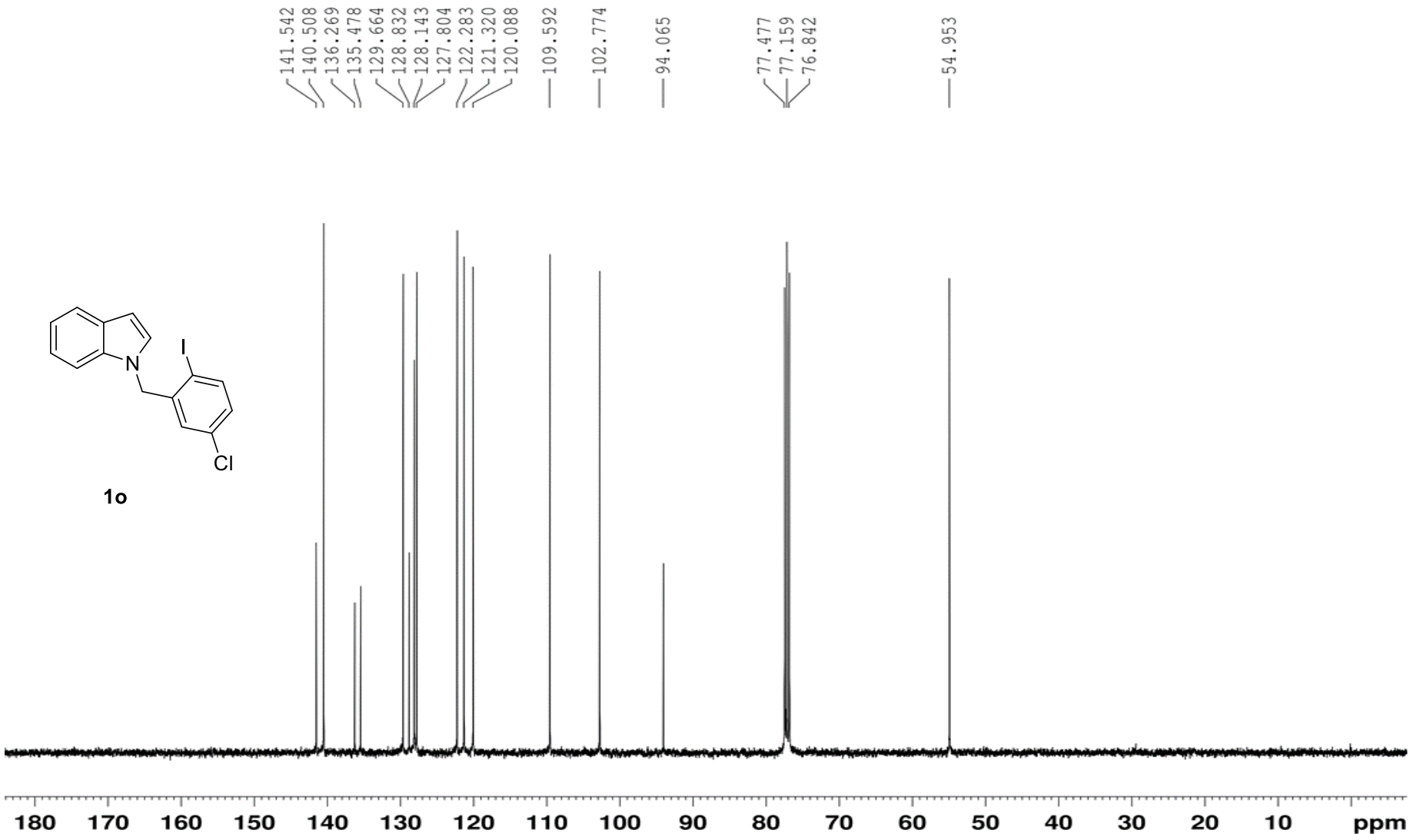
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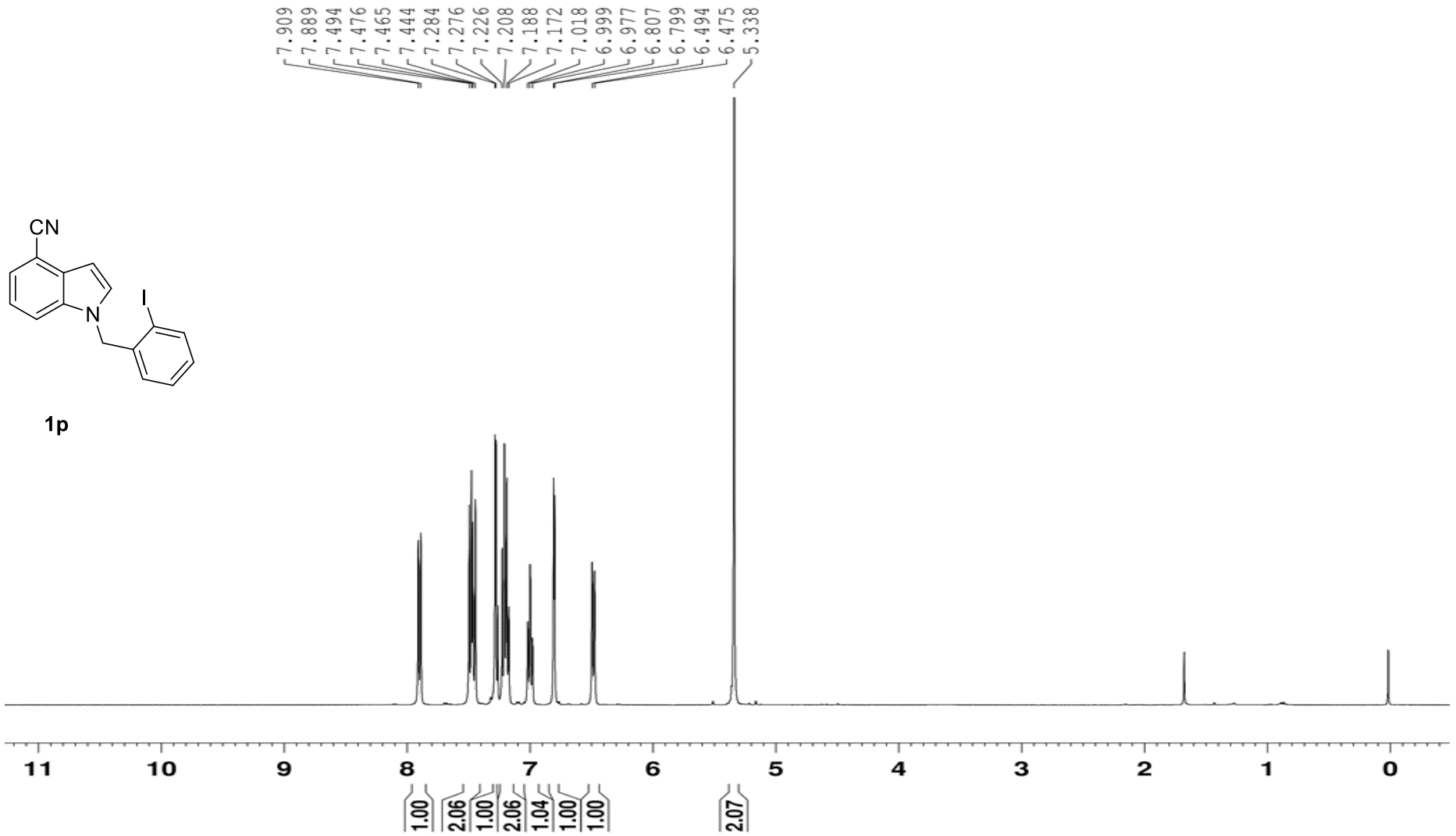
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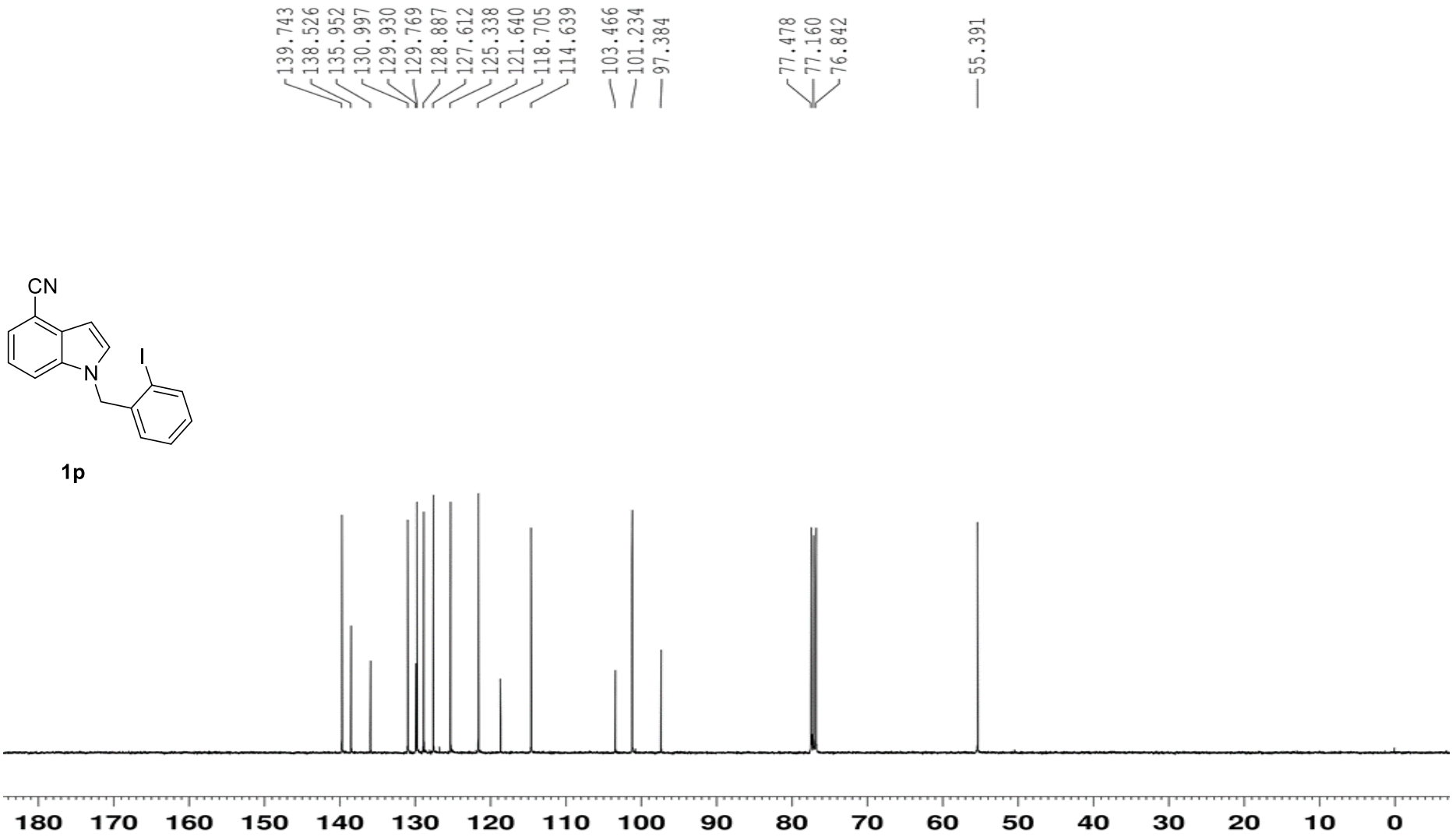
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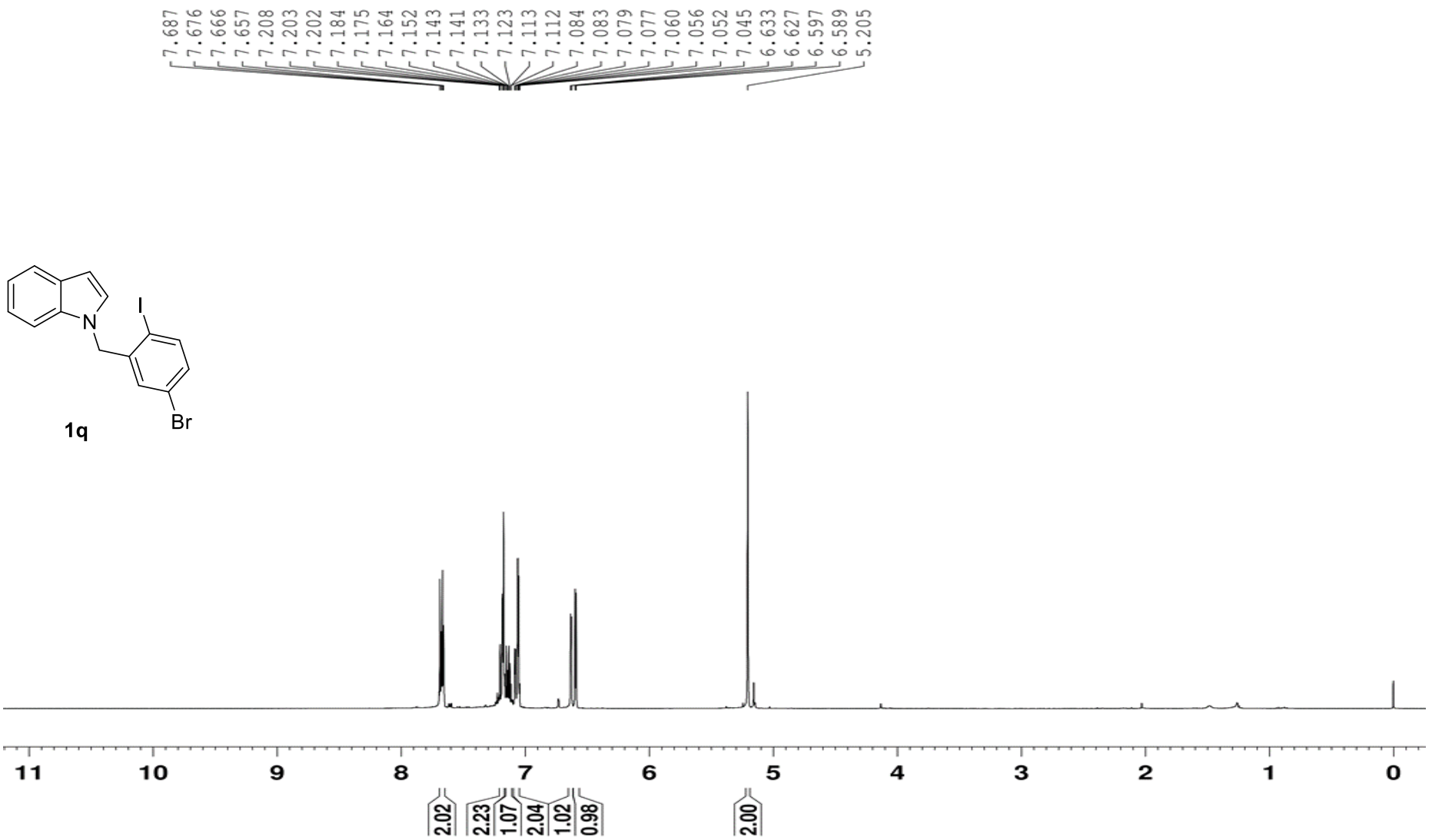
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Br
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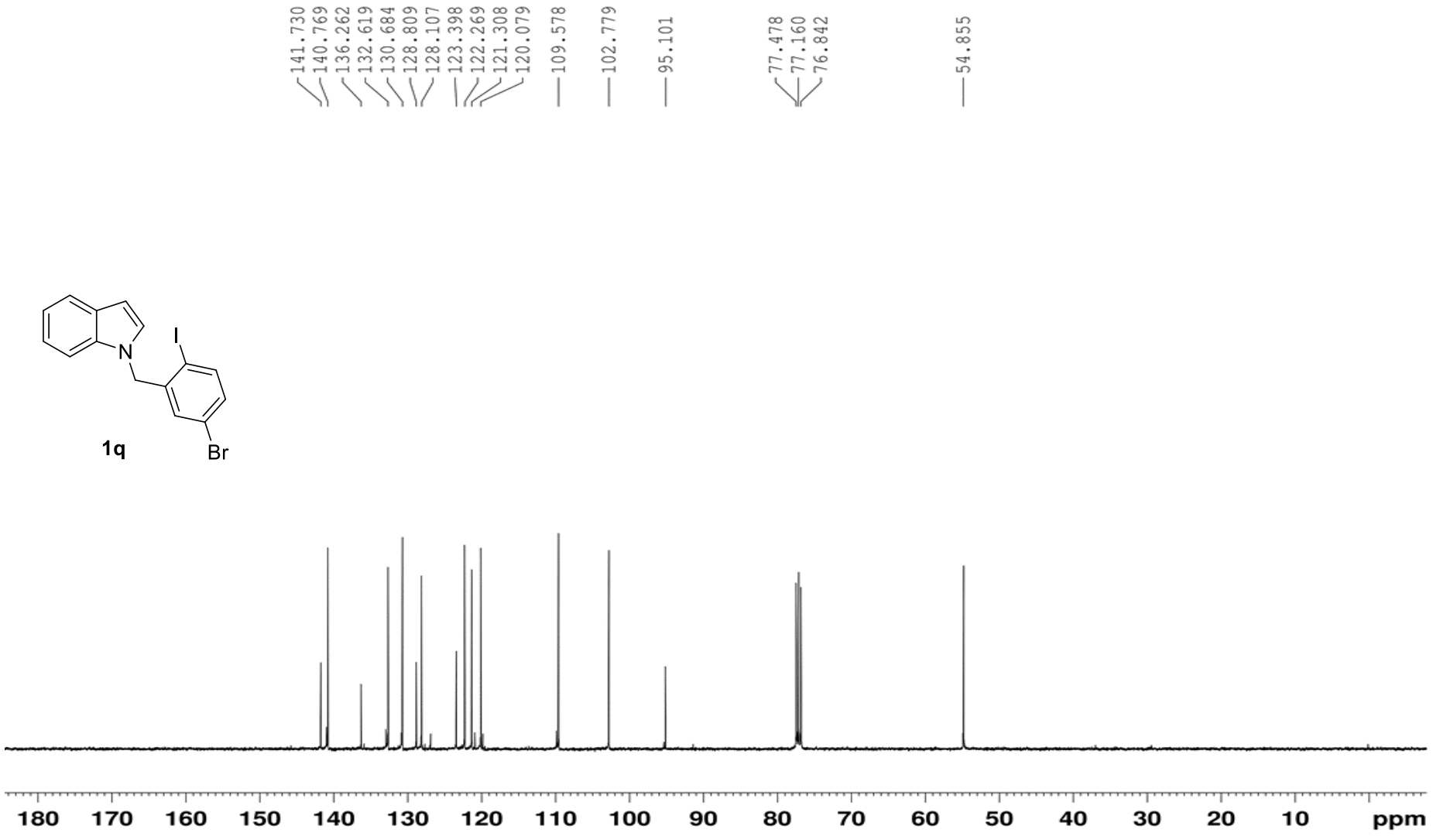
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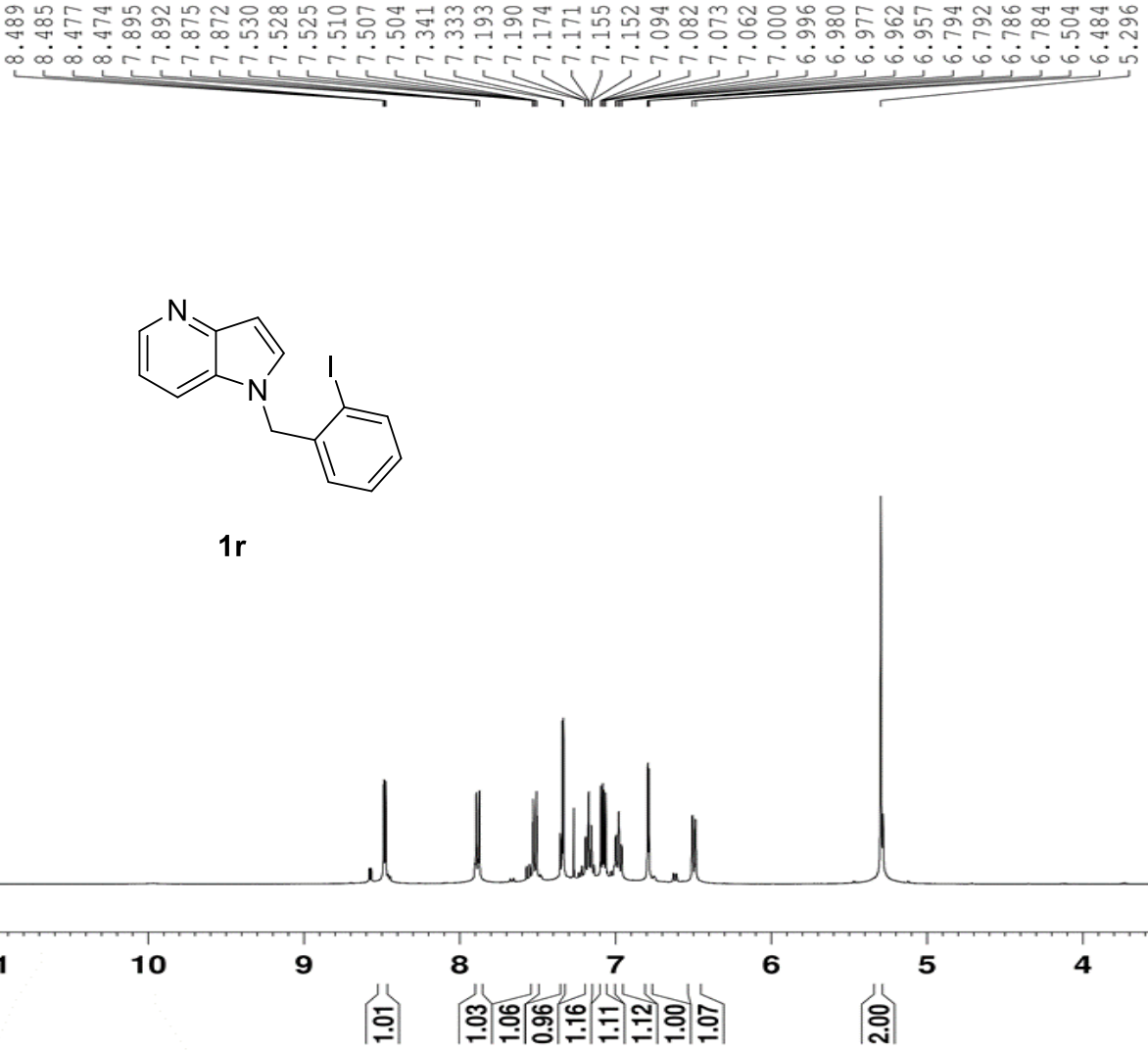
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7.082
7.073
7.062
7.000
6.996
6.980
6.977
6.962
6.957
6.794
6.792
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6.784
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6.484
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N
I
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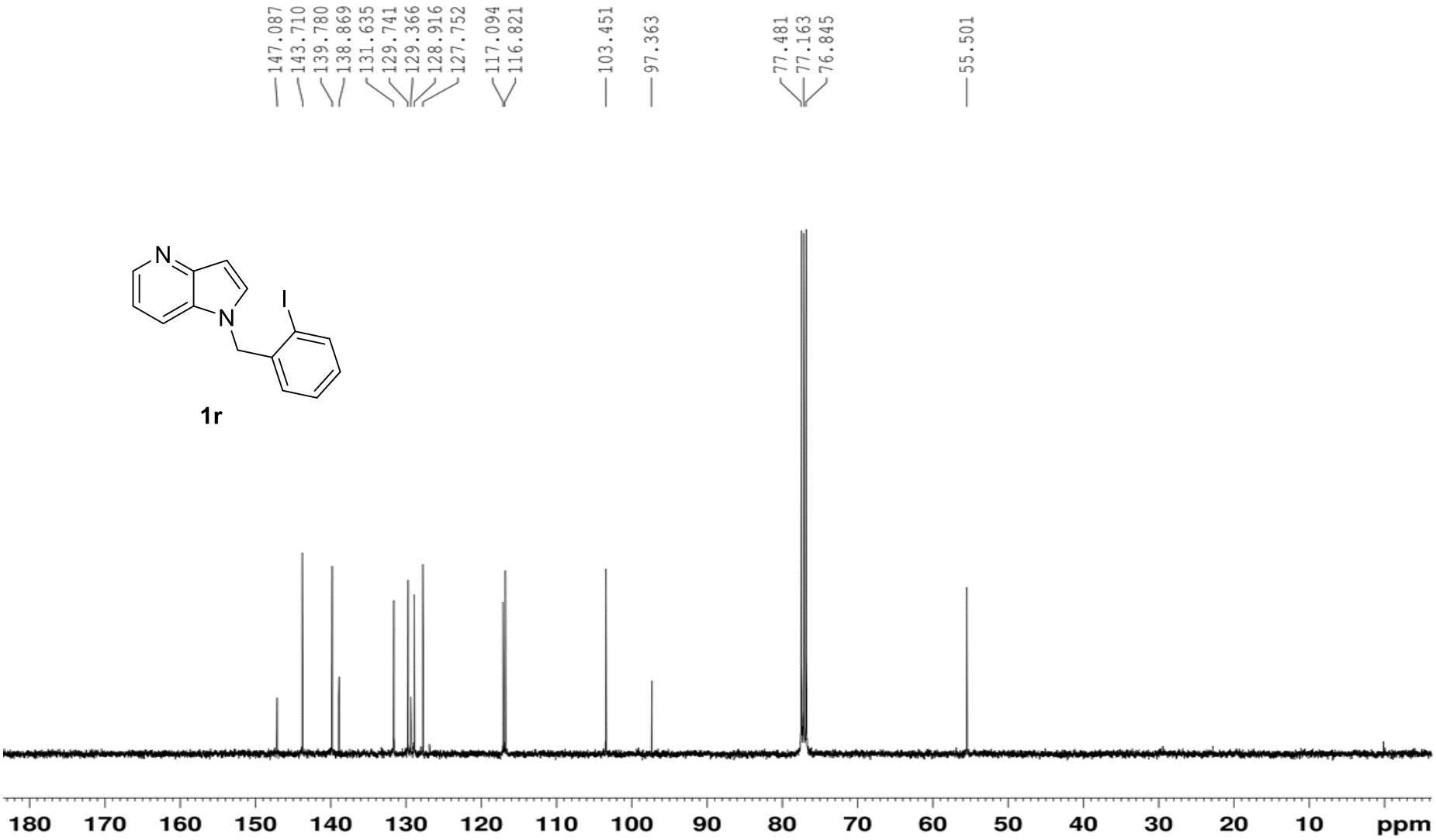
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77.163
76.845
55.501
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N
I
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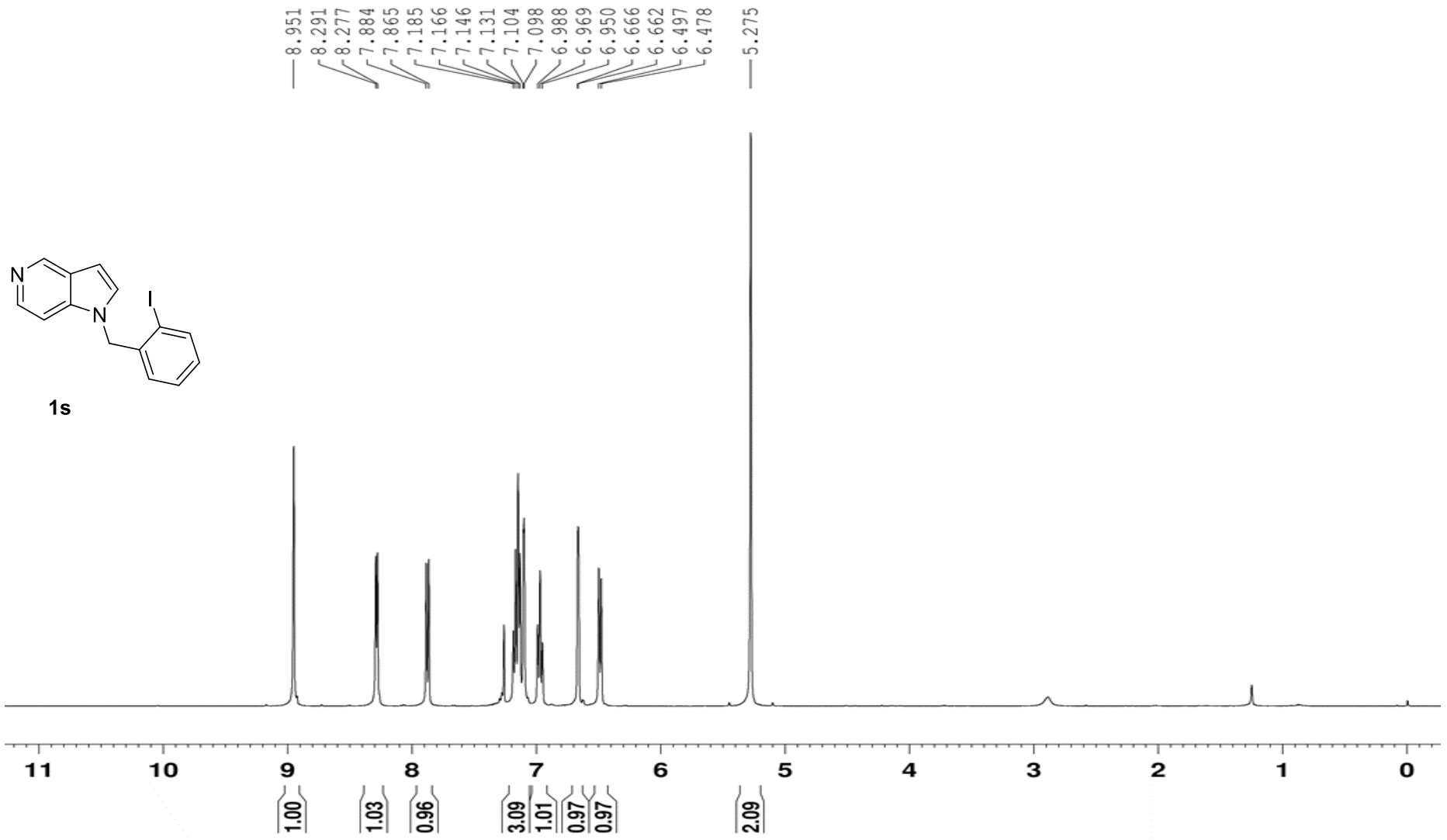
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6.969
6.950
6.666
6.662
6.497
6.478
5.275
N
N
I
1s
11
10
9
8
7
6
5
4
3
2
1
0
1.00
1.03
0.96
3.09
1.01
0.97
0.97
2.09


144.147
141.104
139.968
139.720
138.564
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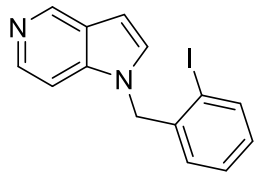
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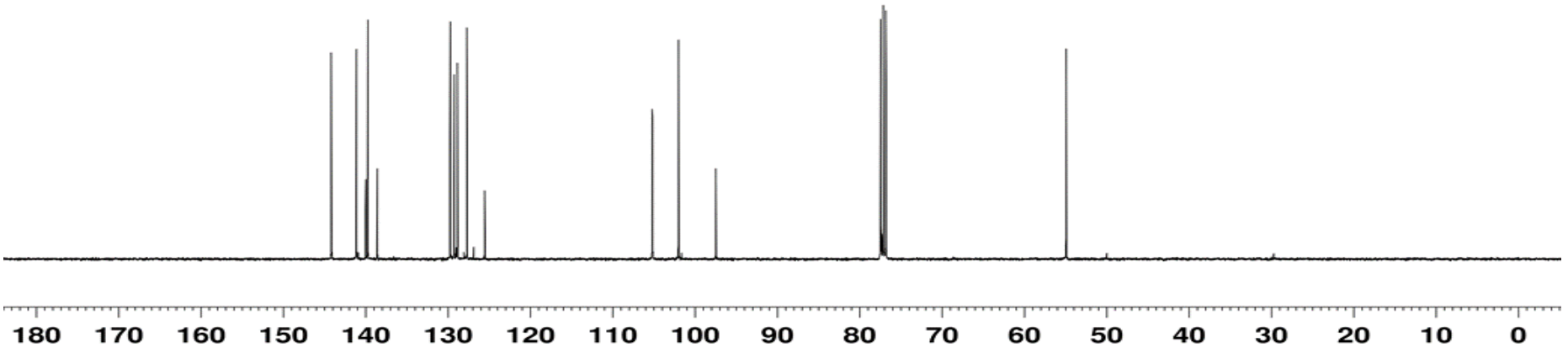
I

1s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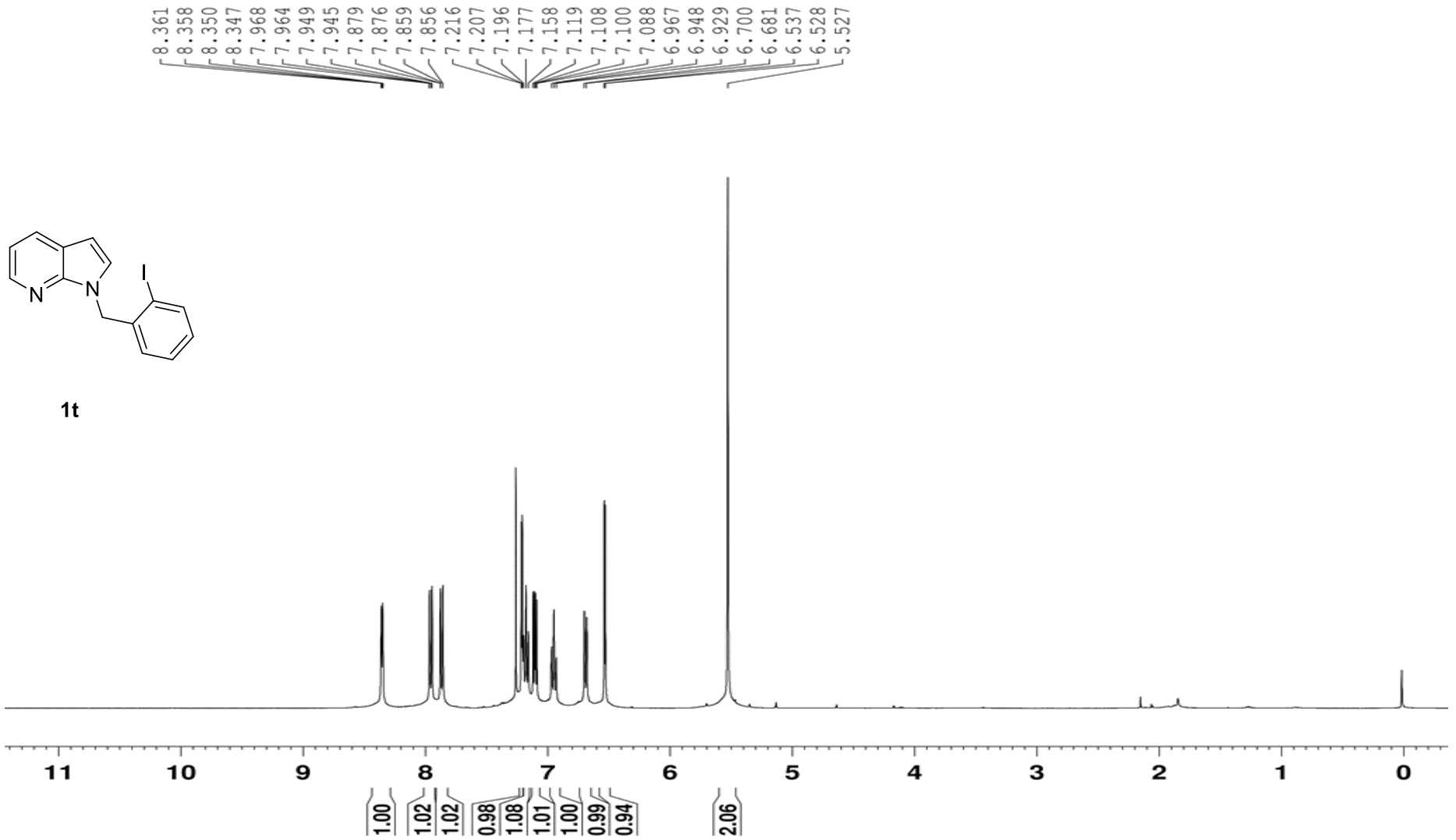
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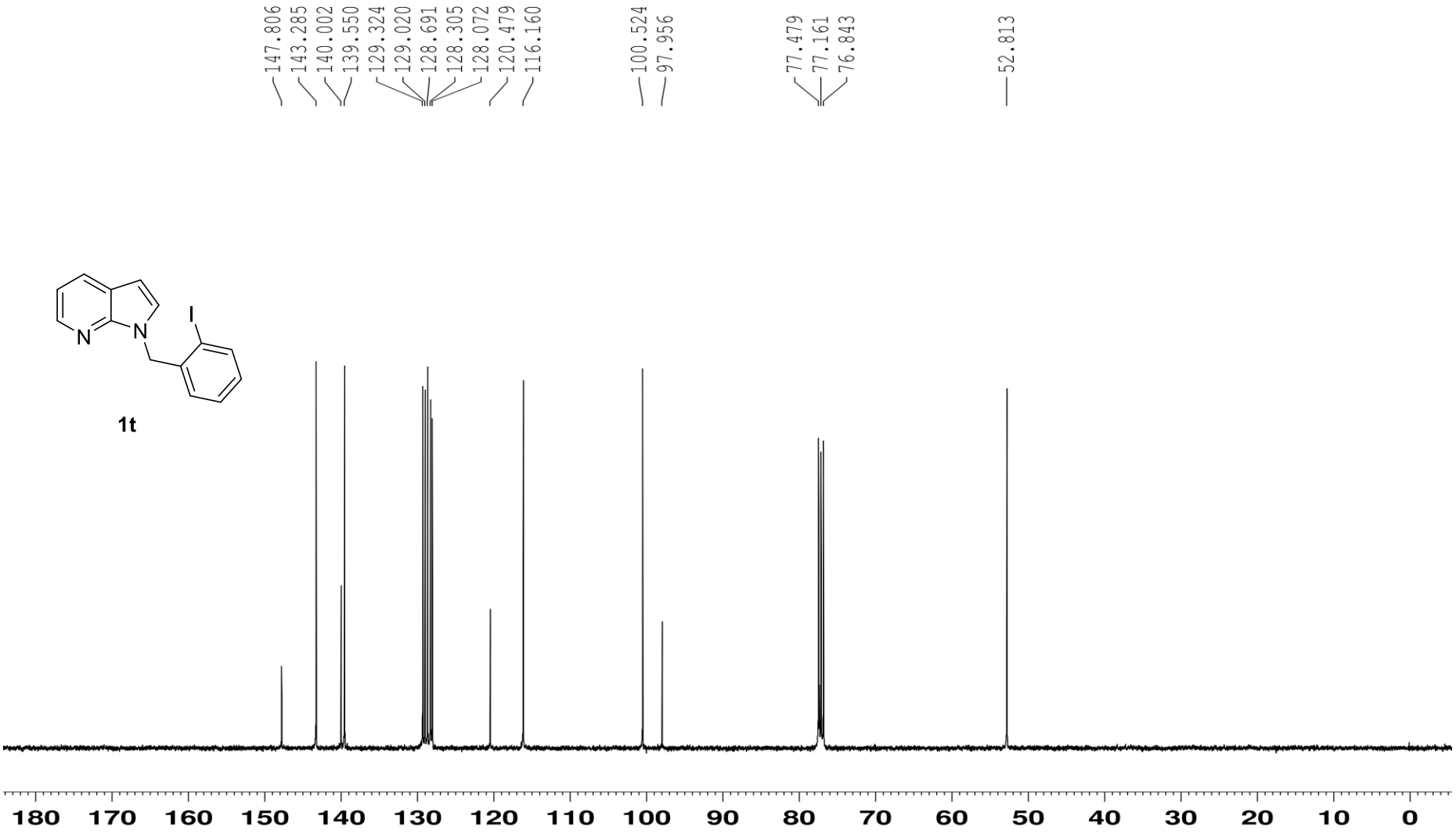
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76.843
52.813
N
N
I
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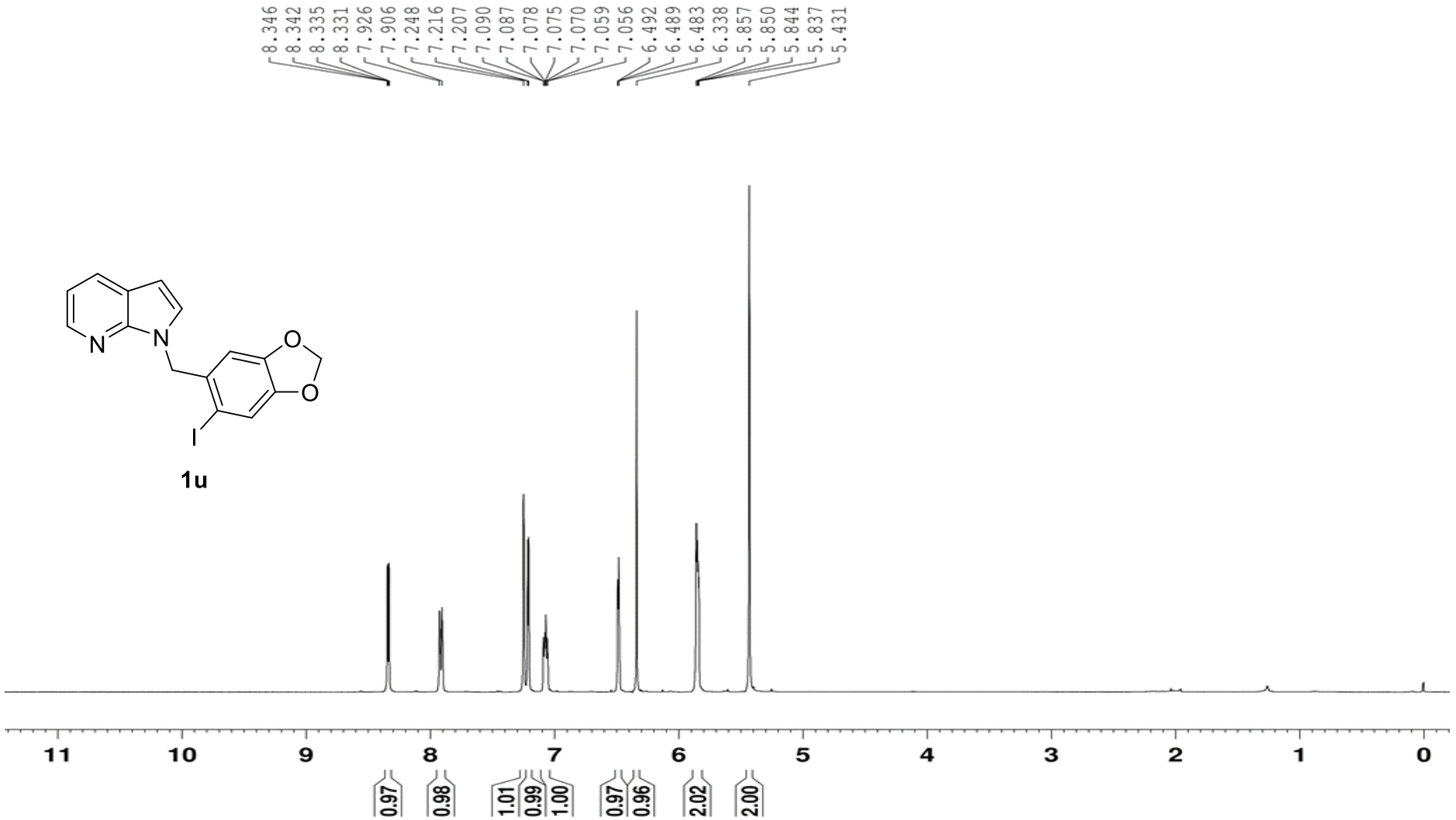
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7.070
7.059
7.056
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6.489
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5.857
5.850
5.844
5.837
5.431
N
N
O
O
I
1u
11
10
9
8
7
6
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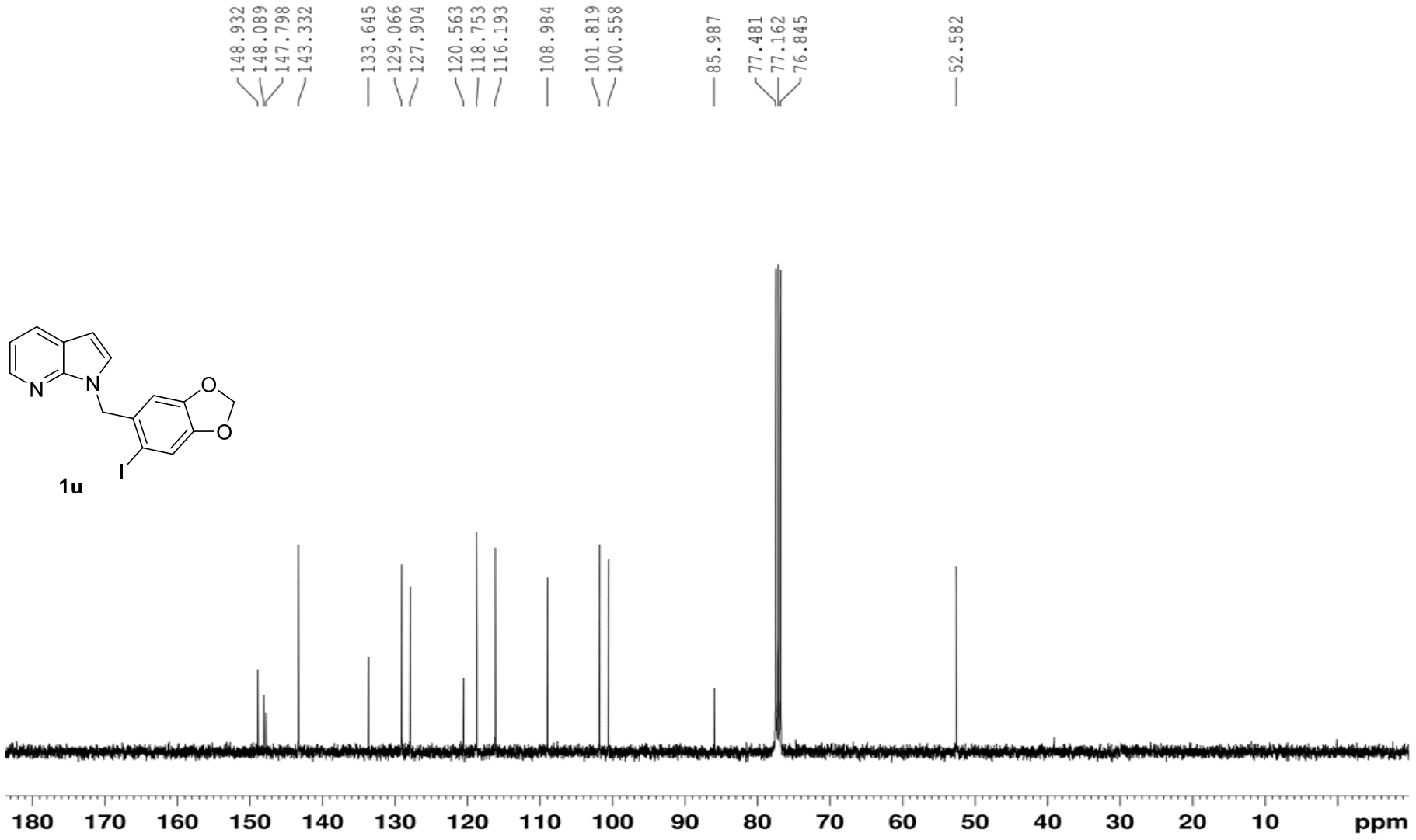
2.02
2.00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85.987
77.481
77.162
76.845
52.582
N
N
O
O
I
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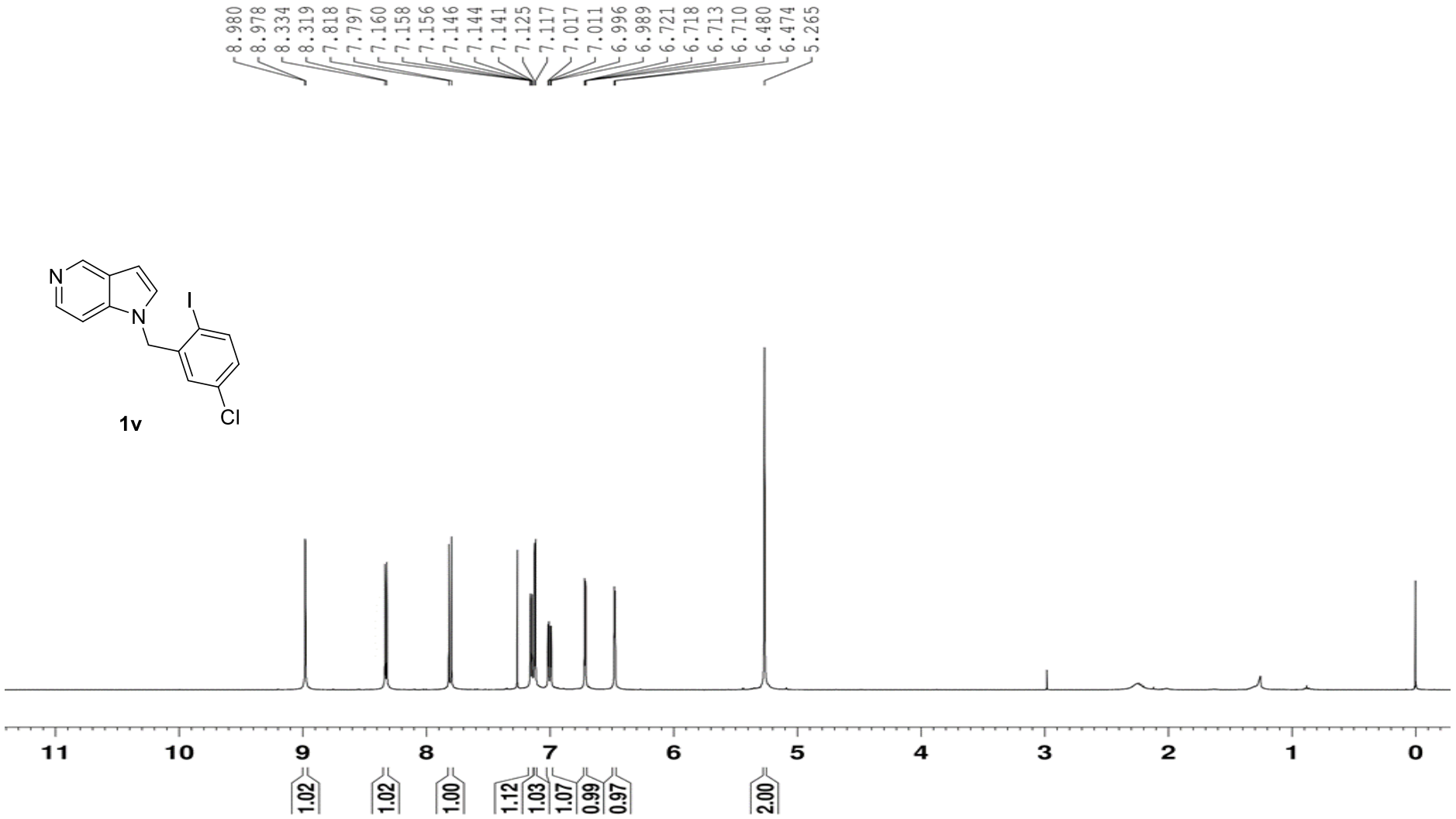
ppm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7.141
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7.017
7.011
6.996
6.989
6.721
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6.713
6.710
6.480
6.474
5.265
N
N
I
Cl
1v
11
10
9
8
7
6
5
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3
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1.02
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1.00
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1.03
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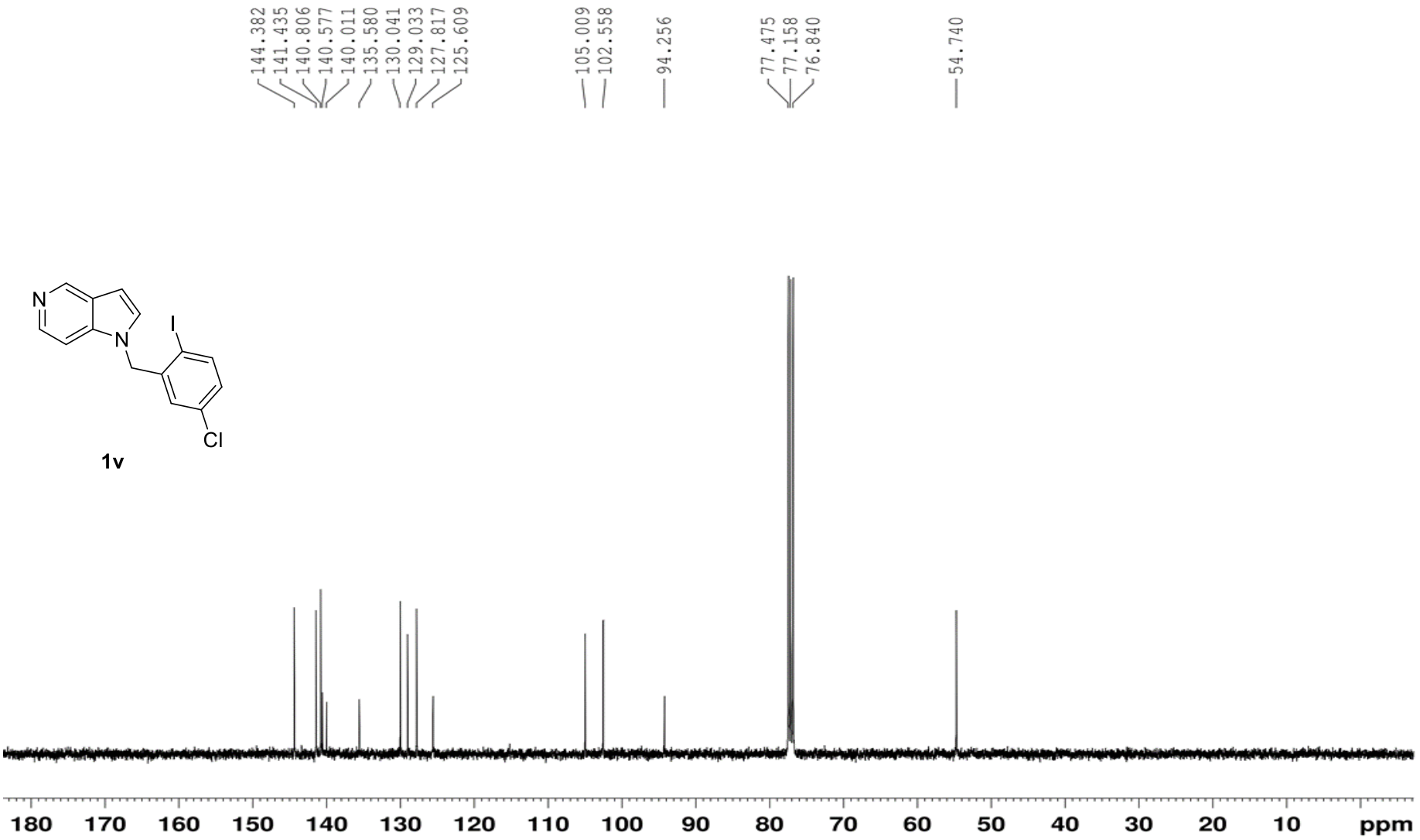
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77.158
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N
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1v
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170
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150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm