Supporting Information

Synthesis of Rutaecarpine Alkaloids via Electrochemical Cross Dehydrogenation Coupling Reaction

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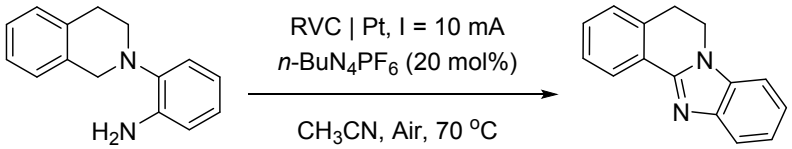
1. General Information

Unless otherwise noted, all reagents and solvents were obtained commercially and used without further purification. Column chromatography on silica gel (300-400 mesh) was carried out using technical grade 60-90 ^{o}C petroleum ether and analytical grade EtOAc (without further purification). ^{1}H and ^{13}C spectra were recorded on a 400 MHz, 500 MHz or 600 MHz spectrometer. Chemical shifts were reported in ppm. ^{1}H NMR spectra were referenced to $CDCl_3$ (7.26 ppm) or d_6-DMSO (2.50 ppm), and ^{13}C NMR spectra were referenced to $CDCl_3$ (77.0 ppm) or d_6-DMSO (39.5 ppm). Peak multiplicities were designated by the following abbreviations: s, singlet; d, doublet; t, triplet; m, multiplet; brs, broad singlet and J, coupling constant in Hz. HRMS spectra were recorded with Micromass QTOF2 Quadrupole/Time-of-Flight Tandem mass spectrometer using electron spray ionization. All devices of the electrolysis were purchased according to our previous work.

2. Experimental Section

2.1 Optimization of phosphates and other electrolytes

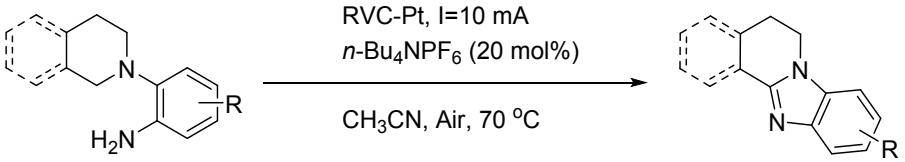
Table S1. Optimization of reaction conditions[a,b]



Entry	Deviation from standard condition	Yield (%) [b]
1	none	85
2	$Na_3PO_4 \cdot 12H_2O$ as the electrolyte	NR
3	$Na_2HPO_4 \cdot 5H_2O$ as the electrolyte	NR
4	$K_2HPO_4 \cdot 3H_2O$ as the electrolyte	Trace
5	Pb | Pt	60
6	RVC | Pb	36

[a] Reaction conditions: RVC anode (100 PPI, 1 cm × 1 cm × 1.2 cm), Pt plate cathode (1 cm × 1 cm), undivided cell, constant current = 10 mA, **2b** (0.3 mmol), *n*-Bu_4NPF_6 (20 mol%), and CH_3CN (5 mL), under air atmosphere at 70 °C for 4 h. [b] Isolated yield.

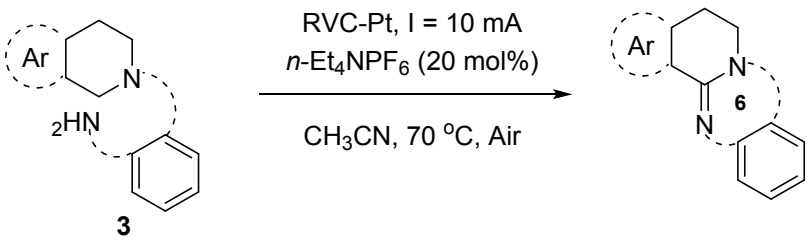
2.2 Synthesis of benzimidazole by dehydrogenation cross-coupling



2b **2ba-2bk**

2b (0.3 mmol, 1.0 equiv) and *n*-Bu_4NPF_6 (20 mol%) were placed in 10 mL three-necked round-bottomed flask. A RVC (100 PPI, 1 cm x 1 cm x 1.2 cm) anode and a platinum plate (1 cm x 1 cm) cathode, CH_3CN (5.0 mL) were added. The electrolysis was carried out at 70 °C using a constant current of 10 mA until complete consumption of the substrate (monitored by TLC). The reaction mixture was concentrated and the residue was chromatographed through silica gel eluting with ethyl acetate/petroleum ether to give the products **2ba-2bk**.

2.3 Synthesis of benzoquinolinone by dehydrogenation cross-coupling

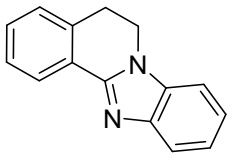


3

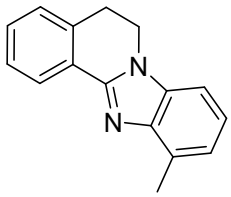
3 (0.3 mmol, 1.0 equiv) and *n*-Bu_4NPF_6 (20 mol%) were placed in 10 mL three-

necked round-bottomed flask. A RVC (100 PPI, 1 cm x 1 cm x 1.2 cm) anode and a platinum plate (1 cm x 1 cm) cathode, CH_3CN (5.0 mL) were added. The electrolysis was carried out at 70 °C using a constant current of 10 mA until complete consumption of the substrate (monitored by TLC). The reaction mixture was concentrated and the residue was chromatographed through silica gel eluting with ethyl acetate/petroleum ether to give the products.

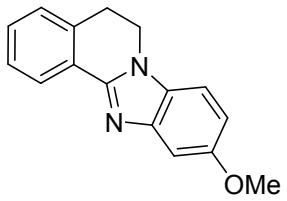
3. ^{1}H and ^{13}C NMR of all products



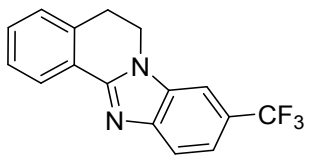
5,6-Dihydrobenzo[4,5]imidazo[2,1-*a*]isoquinoline (2ba) White solid, mp 146.5 – 147.8 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.32 – 8.27 (m, 1H), 7.85 – 7.80 (m, 1H), 7.43 – 7.37 (m, 2H), 7.36 – 7.27 (m, 4H), 4.30 (t, *J* = 6.8 Hz, 2H), 3.26 (t, *J* = 6.8 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 149.1, 143.9, 134.6, 134.2, 130.1, 128.0, 127.7, 126.6, 125.6, 122.6, 122.4, 119.7, 109.0, 40.3, 28.2. **HRMS** (*m/z*) (ESI) calculated for $C_{15}H_{13}N_2^+$ 221.1073 [M+H$^+$]; found: 221.1071.



11-Methyl-5,6-dihydrobenzo[4,5]imidazo[2,1-*a*]isoquinoline (2bb) White solid, mp 134.5 – 136.2 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.35 (d, *J* = 7.3 Hz, 1H), 7.44 – 7.35 (m, 2H), 7.30 (d, *J* = 7.0 Hz, 1H), 7.19 (d, *J* = 4.2 Hz, 2H), 7.11 – 7.06 (m, 1H), 4.29 (t, *J* = 6.8 Hz, 2H), 3.26 (t, *J* = 6.8 Hz, 2H), 2.75 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 148.4, 143.3, 134.3, 134.1, 129.9, 127.9, 127.6, 126.9, 125.7, 122.7, 122.5, 106.4, 40.4, 28.3, 16.8. **HRMS** (*m/z*) (ESI) calculated for $C_{16}H_{15}N_2^+$ 235.1230 [M+H$^+$]; found: 235.1206.

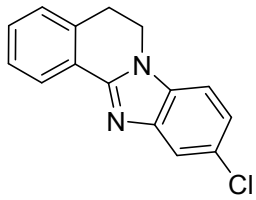


10-methoxy-5,6-dihydrobenzo[4,5]imidazo[2,1-*a*]isoquinoline (2bc) White solid, mp 155.1 – 156.9 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.29 – 8.24 (m, 1H), 7.44 – 7.36 (m, 2H), 7.34 – 7.29 (m, 2H), 7.24 (d, *J* = 8.8 Hz, 1H), 6.94 (dd, *J* = 8.7, 2.3 Hz, 1H), 4.30 (t, *J* = 6.9 Hz, 2H), 3.88 (s, 3H), 3.28 (t, *J* = 6.8 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 156.4, 149.3, 144.6, 133.9, 129.9, 129.3, 128.0, 127.7, 126.7, 125.4, 112.8, 109.4, 101.9, 55.8, 40.5, 28.2. **HRMS** (*m/z*) (ESI) calculated for $C_{16}H_{15}N_2O^+$ 251.1179 [M+H$^+$]; found: 251.1179.

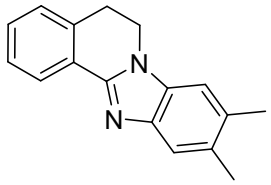


9-(Trifluoromethyl)-5,6-dihydrobenzo[4,5]imidazo[2,1-*a*]isoquinoline (2bd) White solid, mp 185.1 – 186.7 °C; **^{1}H NMR** (400 MHz, $CDCl_3$)

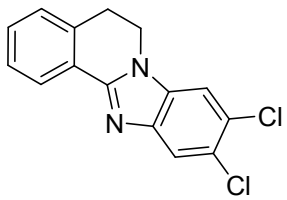
δ 8.27– 8.22 (m, 1H), 7.83 (d, *J* = 8.5 Hz, 1H), 7.60 (s, 1H), 7.50 (dd, *J* = 8.5, 1.2 Hz, 1H), 7.42 – 7.36 (m, 2H), 7.30 – 7.25 (m, 1H), 4.31 (t, *J* = 6.9 Hz, 2H), 3.27 (t, *J* = 6.9 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 151.4, 146.0, 134.4, 134.0, 130.8, 128.1, 127.7, 125.8, 125.8, 124.8 (q, *J* = 271.1 Hz), 124.5 (q, *J* = 31.8 Hz), 119.8, 119.3 (q, *J* = 3.6 Hz), 106.7 (q, *J* = 4.4 Hz), 40.5, 27.9. **HRMS** (*m/z*) (ESI) calculated for $C_{16}H_{12}F_3N_2^+$ 289.0947 [M+H$^+$]; found: 289.0938.



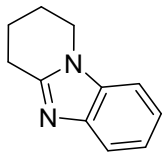
10-Chloro-5,6-dihydrobenzo[4,5]imidazo[2,1-*a*]isoquinoline (2be) Yellow solid, mp 176.3 – 178.1 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.25 – 8.20 (m, 1H), 7.68 (d, *J* = 10 Hz, 1H), 7.40 – 7.36 (m, 2H), 7.30 (d, *J* = 1.9 Hz, 1H), 7.29 – 7.26 (m, 1H), 7.21 (dd, *J* = 8.6, 2.0 Hz, 1H), 4.24 (t, *J* = 6.9 Hz, 2H), 3.25 (t, *J* = 6.9 Hz, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 149.8, 142.4, 135.2, 134.1, 130.4, 128.2, 128.1, 127.7, 126.2, 125.6, 123.0, 120.4, 109.2, 40.4, 28.0. **HRMS** (*m/z*) (ESI) calculated for $C_{15}H_{12}ClN_2^+$ 255.0684 [M+H$^+$]; found: 255.0678.



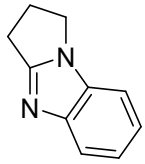
9,10-Dimethyl-5,6-dihydrobenzo[4,5]imidazo[2,1-*a*]isoquinoline (2bf) White solid, mp 195.9 – 198.1 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.26 (dd, *J* = 7.5, 1.4 Hz, 1H), 7.57 (s, 1H), 7.40 – 7.34 (m, 2H), 7.30 – 7.27 (m, 1H), 7.11 (s, 1H), 4.26 (t, *J* = 6.9 Hz, 2H), 3.24 (t, *J* = 6.8 Hz, 2H), 2.40 (s, 3H), 2.39 (s, 3H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 148.3, 142.5, 134.0, 133.2, 131.8, 131.2, 129.7, 127.9, 127.6, 126.9, 125.4, 119.8, 109.3, 40.3, 28.3, 20.6, 20.4. **HRMS** (*m/z*) (ESI) calculated for $C_{17}H_{17}N_2^+$ 249.1386 [M+H$^+$]; found: 249.1379.



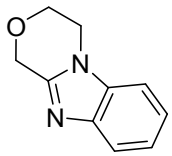
9,10-Dichloro-5,6-dihydrobenzo[4,5]imidazo[2,1-*a*]isoquinoline (2bg) White solid, mp 157.1 – 159.0 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.26 – 8.19 (m, 1H), 7.85 (s, 1H), 7.45 – 7.39 (m, 3H), 7.33 – 7.30 (m, 1H), 4.27 (t, *J* = 6.9 Hz, 2H), 3.29 (t, *J* = 6.9 Hz, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 150.9, 143.2, 134.2, 133.9, 130.8, 128.2, 127.9, 126.5, 126.3, 125.9, 125.8, 120.7, 110.4, 40.6, 28.0. **HRMS** (*m/z*) (ESI) calculated for $C_{15}H_{11}Cl_2N_2^+$ 289.0294 [M+H$^+$]; found: 289.0274.



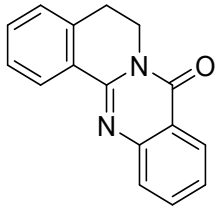
1,2,3,4-Tetrahydrobenzo[4,5]imidazo[1,2-*a*]pyridine (2bh) White solid, mp 62.0 – 64.6 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 7.61 (dd, *J* = 6.3, 2.5 Hz, 1H), 7.24 – 7.20 (m, 1H), 7.19 – 7.13 (m, 2H), 4.01 (t, *J* = 6.1 Hz, 2H), 3.02 (t, *J* = 6.4 Hz, 2H), 2.10 – 2.02 (m, 2H), 1.99 – 1.92 (m, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 151.7, 142.8, 134.6, 122.1, 121.6, 118.9, 108.7, 42.4, 25.4, 22.7, 20.8. **HRMS** (*m/z*) (ESI) calculated for $C_{11}H_{13}N_2^+$ 173.1073 [M+H$^+$]; found: 173.1068.



2,3-Dihydro-1*H*-benzo[*d*]pyrrolo[1,2-*a*]imidazole (2bi) White solid, mp 106.7 – 107.3 °C; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.71 – 7.67 (m, 1H), 7.30 – 7.27 (m, 1H), 7.23 – 7.17 (m, 2H), 4.09 (t, *J* = 6.1 Hz, 2H), 3.05 (t, *J* = 6.8 Hz, 2H), 2.74 – 2.67 (m, 2H). **^{13}C NMR** (125 MHz, $CDCl_3$) δ 161.1, 148.8, 132.3, 121.7, 121.6, 119.5, 109.4, 42.7, 26.0, 23.4. **HRMS** (*m/z*) (ESI) calculated for $C_{10}H_{11}N_2^+$ 159.0917 [M+H$^+$]; found: 159.0912.

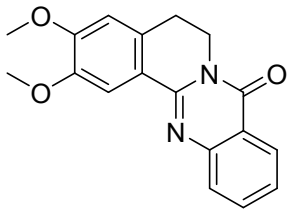


3,4-dihydro-1*H*-benzo[4,5]imidazo[2,1-c][1,4]oxazine (2bj) White solid, mp 73.7 – 75.6 °C; **^{1}H NMR** (600 MHz, $CDCl_3$) δ 7.75 – 7.71 (m, 1H), 7.36 – 7.32 (m, 1H), 7.31 – 7.27 (m, 2H), 5.04 (s, 2H), 4.22 – 4.19 (m, 2H), 4.19 – 4.16 (m, 2H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 147.8, 142.6, 134.0, 122.6, 122.3, 119.5, 108.7, 65.5, 64.0, 42.0. **HRMS** (*m/z*) (ESI) calculated for $C_{10}H_{11}N_2O^+$ 175.0866 [M+H$^+$]; found: 175.0860.

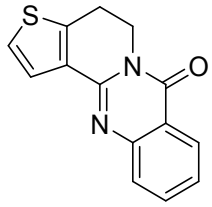


5,6-Dihydro-8*H*-isoquinolino[1,2-*b*]quinazolin-8-one (3aa) White solid, mp 193.8 – 195.0 °C; **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.49 (dd, *J* = 7.6, 1.0 Hz, 1H), 8.32 (dd, *J* = 11.1, 3.8 Hz, 1H), 7.79 – 7.73 (m, 2H), 7.50 – 7.42 (m, 3H), 7.29 (d, *J* = 7.3 Hz, 1H), 4.42 (t, *J* = 6.0 Hz, 2H), 3.10 (t, *J* = 6.5 Hz, 2H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 161.7, 149.4, 147.8, 137.0, 134.2, 131.7, 129.5, 128.0, 127.6, 127.6, 127.5, 126.8,

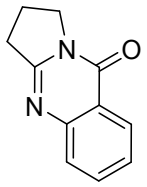
126.5, 120.7, 39.6, 27.4. **HRMS** (*m/z*) (ESI) calculated for $C_{16}H_{13}N_2O^+$ 249.1022 [M+H$^+$]; found: 249.1008.



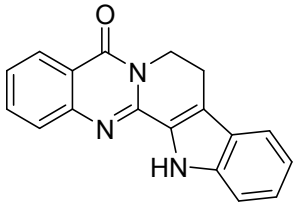
2,3-Dimethoxy-5,6-dihydro-8*H*-isoquinolino[1,2-*b*]quinazolin-8-one (3ab) White solid, mp 207.7 – 209.1 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.30 (d, *J* = 8.4 Hz, 1H), 7.99 (s, 1H), 7.77 – 7.71 (m, 2H), 7.45 – 7.41 (m, 1H), 6.74 (s, 1H), 4.43 – 4.38 (m, 2H), 4.04 (s, 3H), 3.97 (s, 3H), 3.04 (t, *J* = 6.5 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 161.8, 152.2, 149.5, 148.6, 147.9, 134.2, 131.0, 127.3, 126.9, 126.1, 121.8, 120.5, 110.0, 109.7, 56.2, 39.7, 29.7, 27.1. **HRMS** (*m/z*) (ESI) calculated for $C_{18}H_{17}N_2O_3^+$ 309.1234 [M+H$^+$]; found: 309.1240.



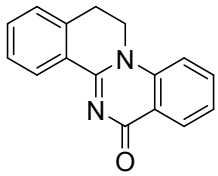
4,5-Dihydro-7*H*-thieno[3',2':3,4]pyrido[2,1-*b*]quinazolin-7-one (3ac) Light yellow solid, mp 184.4 – 186.0 °C; **^{1}H NMR** (600 MHz, $CDCl_3$) δ 8.28 (dd, *J* = 7.8, 0.6 Hz, 1H), 7.75 – 7.66 (m, 3H), 7.45 – 7.40 (m, 1H), 7.23 (d, *J* = 5.2 Hz, 1H), 4.53 (t, *J* = 13.8 Hz, 2H), 3.21 (t, *J* = 13.8 Hz, 2H). **^{13}C NMR** (150 MHz, $CDCl_3$) δ 161.7, 147.7, 146.8, 143.0, 134.2, 132.2, 127.2, 126.9, 126.3, 125.9, 124.4, 120.8, 40.6, 23.3. **HRMS** (*m/z*) (ESI) calculated for $C_{14}H_{11}ON_2S^+$ 255.0587 [M+H$^+$]; found: 255.0574.



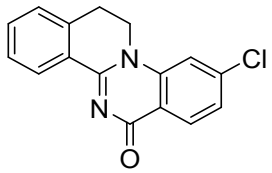
2,3-Dihydropyrrolo[2,1-*b*]quinazolin-9(1*H*)-one (3ad) White solid, mp 112.1 – 113.3 °C; **^{1}H NMR** (400 MHz, d_6-DMSO) δ 8.11 (dd, *J* = 7.9, 1.1 Hz, 1H), 7.81 – 7.73 (m, 1H), 7.60 (d, *J* = 8.1 Hz, 1H), 7.47 (t, *J* = 12.0 Hz, 1H), 4.05 (t, *J* = 7.9 Hz, 2H), 3.08 (t, *J* = 7.9 Hz, 2H), 2.21 – 2.13 (m, 2H). **^{13}C NMR** (100 MHz, d_6-DMSO) δ 160.4, 160.0, 149.0, 134.0, 126.6, 125.9, 125.7, 120.1, 46.3, 31.8, 18.9. **HRMS** (*m/z*) (ESI) calculated for $C_{11}H_{11}N_2O^+$ 187.0866 [M+H$^+$]; found: 187.0853.



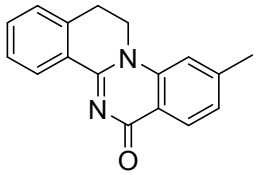
8,13-Dihydroindolo[2',3':3,4]pyrido[2,1-*b*]quinazolin-5(7*H*)-one (2ae) White solid, mp 270.9 – 273.2 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 9.52 (s, 1H), 8.33 (dd, J = 8.0, 1.1 Hz, 1H), 7.73 – 7.60 (m, 3H), 7.45 – 7.28 (m, 3H), 7.20 – 7.15 (m, 1H), 4.59 (t, J = 6.9 Hz, 2H), 3.24 (t, J = 6.9 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 161.6, 147.5, 145.0, 138.3 134.4, 127.3, 127.2, 126.6, 126.2, 125.7, 125.6, 121.2, 120.6, 120.1, 118.4, 112.1, 41.2, 19.7. **HRMS** (*m/z*) (ESI) calculated for $C_{18}H_{14}N_3O^+$ 288.1131 [M+H$^+$]; found: 288.1115.



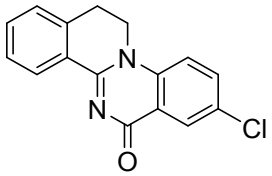
12,13-Dihydro-6*H*-isoquinolino[2,1-*a*]quinazolin-6-one (3ba) White solid, mp 260.3 – 261.9 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.54 (dd, *J* = 7.9, 0.9 Hz, 1H), 8.39 (dd, *J* = 7.9, 1.5 Hz, 1H), 7.75 – 7.71 (m, 1H), 7.56 – 7.36 (m, 4H), 7.27 (d, *J* = 2.0 Hz, 1H), 4.34 (t, *J* = 6.7 Hz, 2H), 3.25 (t, *J* = 6.7 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 169.3, 155.0, 140.7, 135.7, 133.7, 132.7, 129.6, 129.1, 128.9, 127.8, 126.9, 125.7, 120.4, 113.8, 43.2, 27.1. **HRMS** (*m/z*) (ESI) calculated for $C_{16}H_{13}N_2O^+$ 249.1022 [M+H$^+$]; found: 249.1027.



9-chloro-12,13-dihydro-6*H*-isoquinolino[2,1-*a*]quinazolin-6-one (3ca) Light yellow solid, mp 223.3 – 225.4 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.48 (t, *J* = 7.6 Hz, 2H), 7.79 (s, 1H), 7.66 (d, *J* = 7.9 Hz, 1H), 7.52 (t, *J* = 7.0 Hz, 1H), 7.39 (t, *J* = 7.2 Hz, 1H), 7.31 (d, *J* = 7.1 Hz, 1H), 4.39 (t, *J* = 6.1 Hz, 2H), 3.32 (d, *J* = 5.8 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ68.2, 156.0, 140.8, 135.8, 133.2, 130.1, 129.8, 128.6, 127.9, 127.1, 122.4, 122.1, 122.0, 111.5, 43.6, 27.0. **HRMS** (*m/z*) (ESI) calculated for $C_{16}H_{12}ClN_2O^+$ 283.0633 [M+H$^+$]; found: 283.0645.



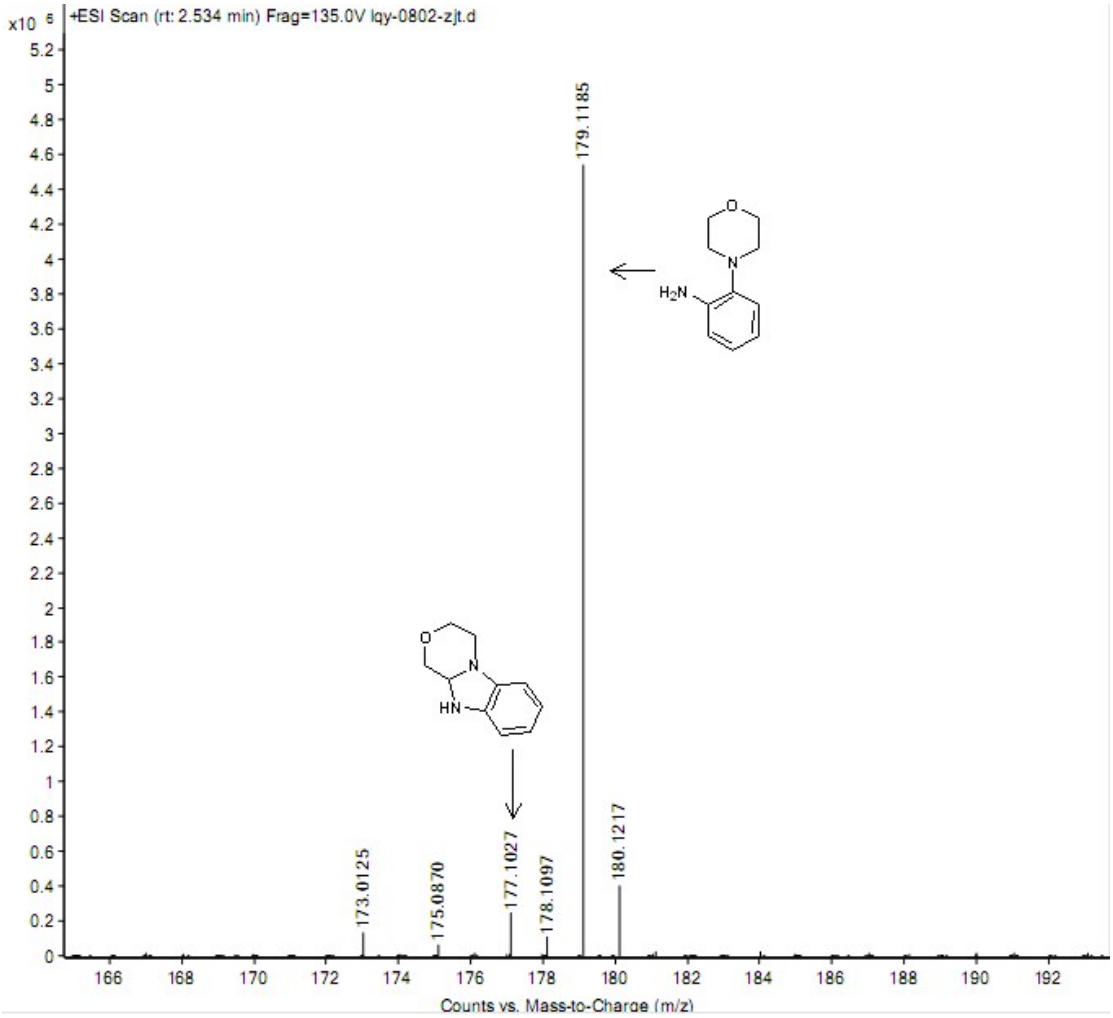
9-Methyl-12,13-dihydro-6*H*-isoquinolino[2,1-*a*]quinazolin-6-one (3da) White solid, mp 261.4 – 263.0 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.51 (d, *J* = 7.8 Hz, 1H), 8.24 (d, *J* = 8.1 Hz, 1H), 7.47 (t, *J* = 7.2 Hz, 1H), 7.36 (t, *J* = 16.0 Hz, 1H), 7.29 (d, *J* = 20.0 Hz, 2H), 7.24 (t, *J* = 20.0 Hz, 1H), 4.32 (t, *J* = 6.7 Hz, 2H), 3.24 (t, *J* = 6.7 Hz, 2H), 2.51 (s, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 169.3, 154.8, 144.7, 140.7, 135.7, 132.5, 129.4, 129.1, 128.6, 127.6, 127.1, 126.9, 118.1, 113.9, 43.1, 27.0, 22.3. **HRMS** (*m/z*) (ESI) calculated for $C_{17}H_{15}N_2O^+$ 263.1179 [M+H$^+$]; found: 263.1170.



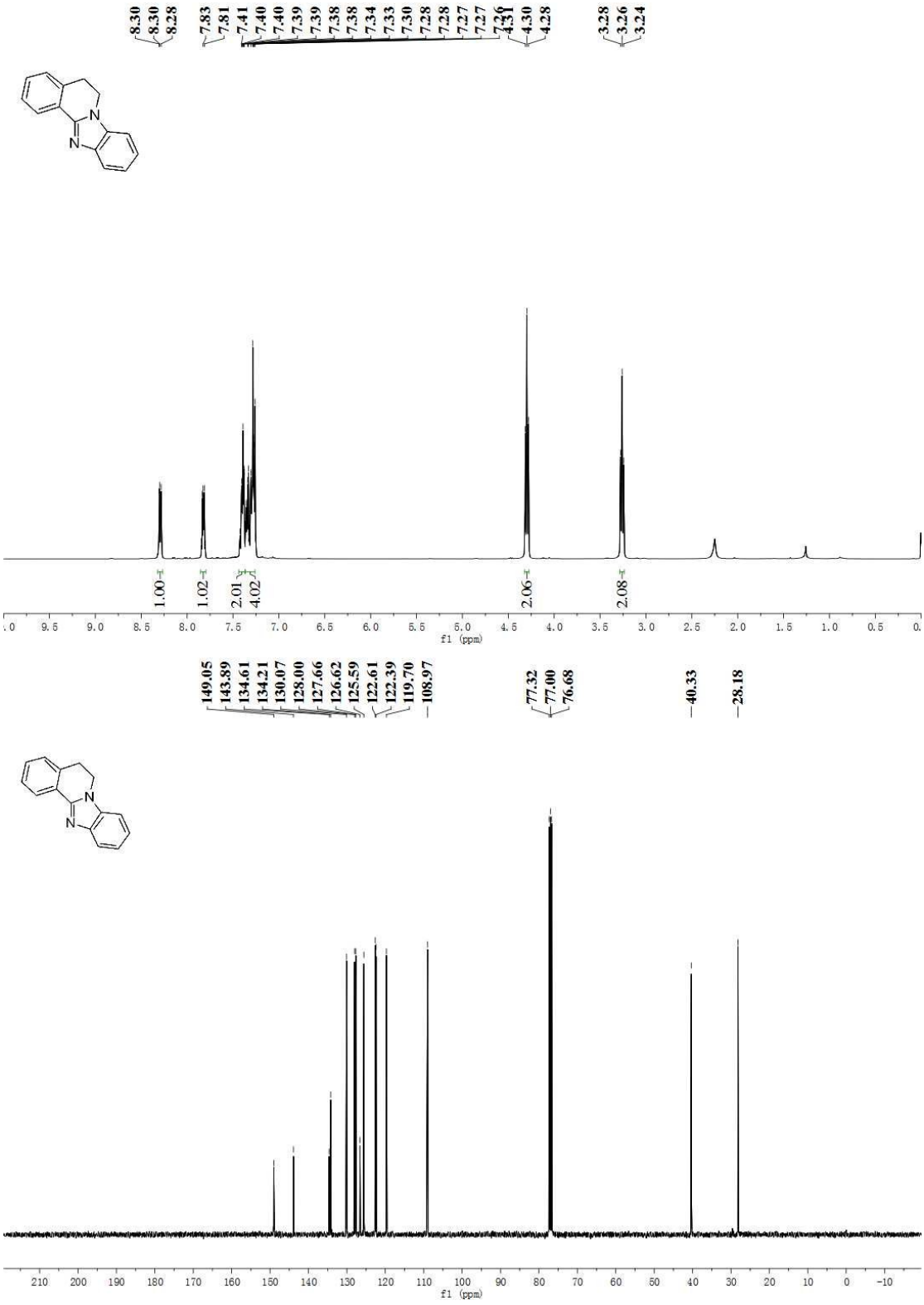
8-Chloro-12,13-dihydro-6*H*-isoquinolino[2,1-*a*]quinazolin-6-one (3ea) White solid, mp 221.6 – 223.0 °C; **^{1}H NMR** (400 MHz, $CDCl_3$) δ 8.53 (d, *J* = 7.8 Hz, 1H), 8.37 (d, *J* = 7.9 Hz, 1H), 7.76 – 7.69 (m, 1H), 7.53 (d, *J* = 8.6 Hz, 1H), 7.44 (t, *J* = 7.5 Hz, 1H), 7.37 (t, *J* = 7.6 Hz, 1H), 7.27 (d, *J* = 2.0 Hz, 1H), 4.34 (t, *J* = 6.7 Hz, 2H), 3.26 (t, *J* = 6.6 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ 140.7, 135.7, 133.7, 132.7, 129.6, 129.0, 128.9, 128.2, 127.8, 126.9, 125.8, 120.4, 113.8, 43.2, 27.1. **HRMS** (*m/z*) (ESI) calculated for $C_{16}H_{12}ClN_2O^+$ 283.0633 [M+H$^+$]; found: 283.0651.

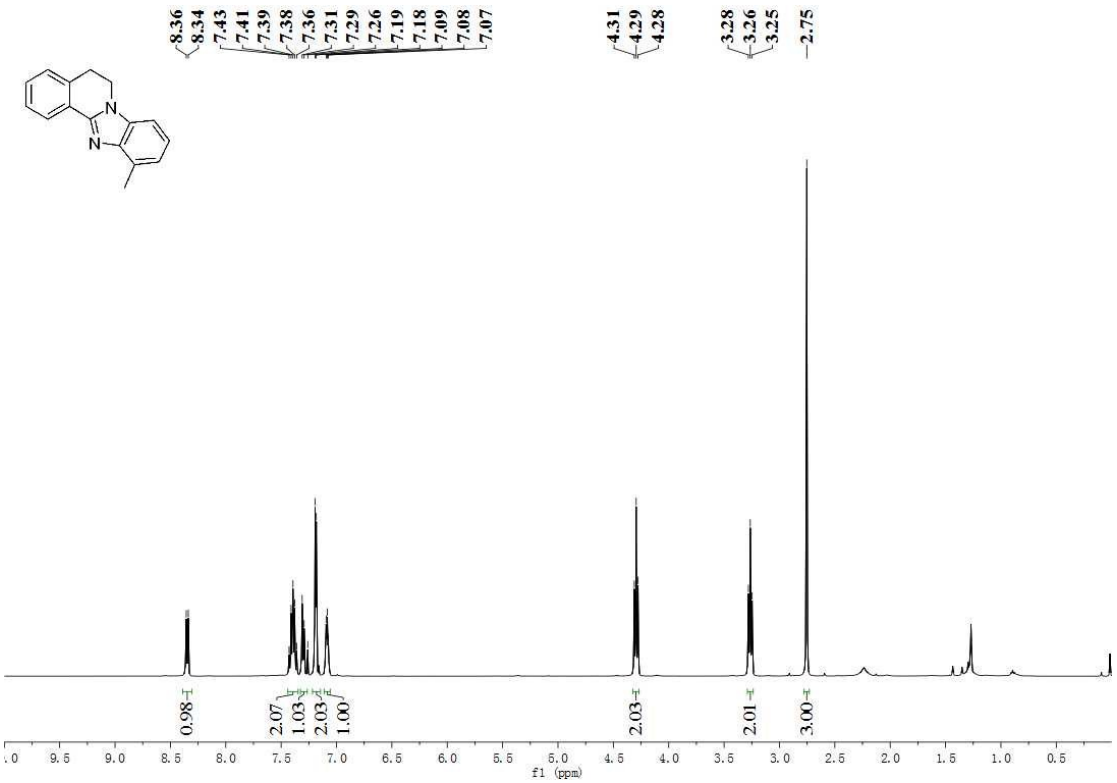
4. ESI-HRMS analysis for the 2bj-1

HRMS (*m/z*) (ESI): calculated for $C_{10}H_{13}N_2O^+$ 177.1022 $[M+H]^+$; found: 177.1027.



5. Copies of ^{13}C and ^{1}H NMR spectra for all products

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7.08
7.07
4.31
4.29
4.28
3.28
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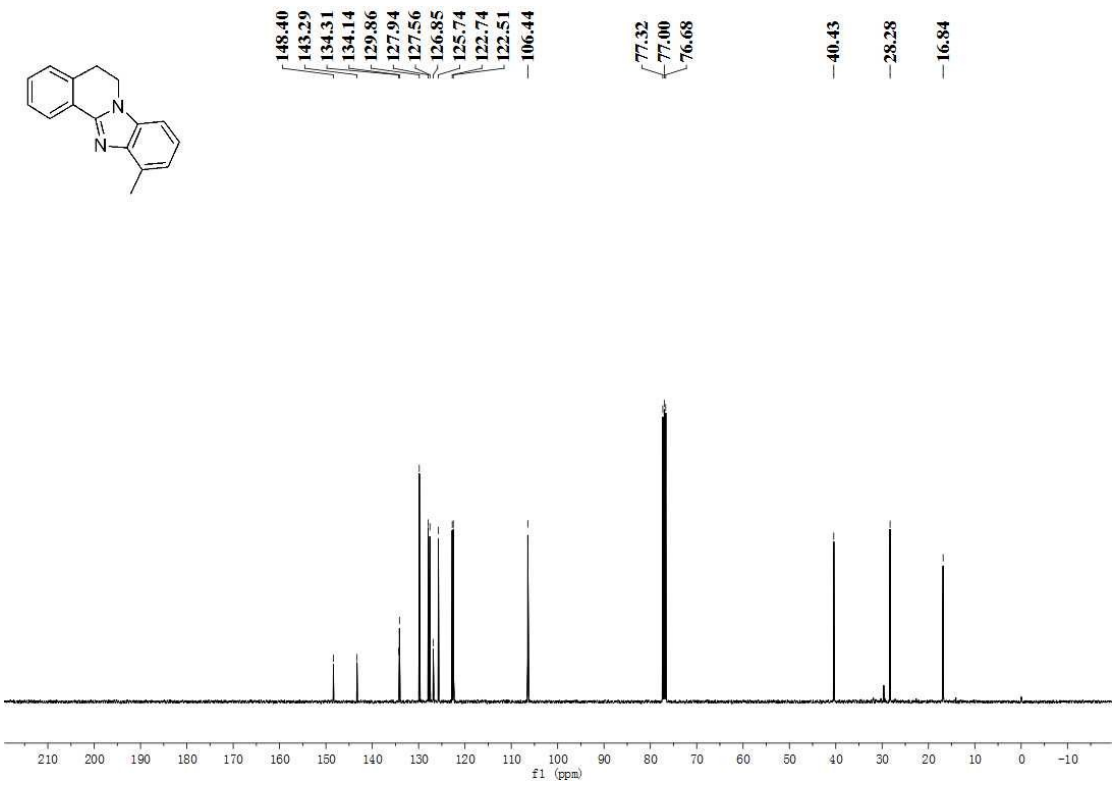
3.00
f1 (ppm)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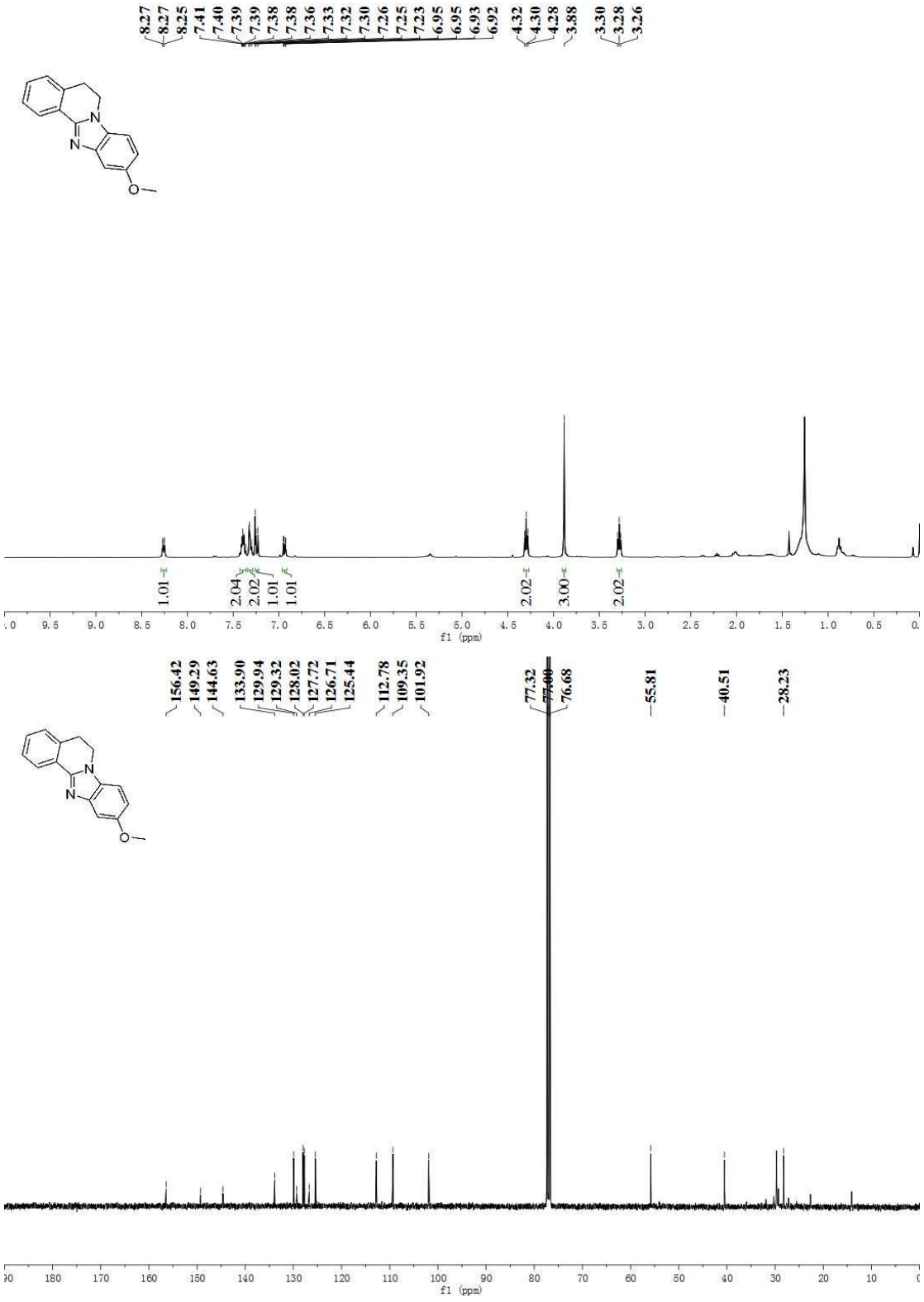
f1 (ppm)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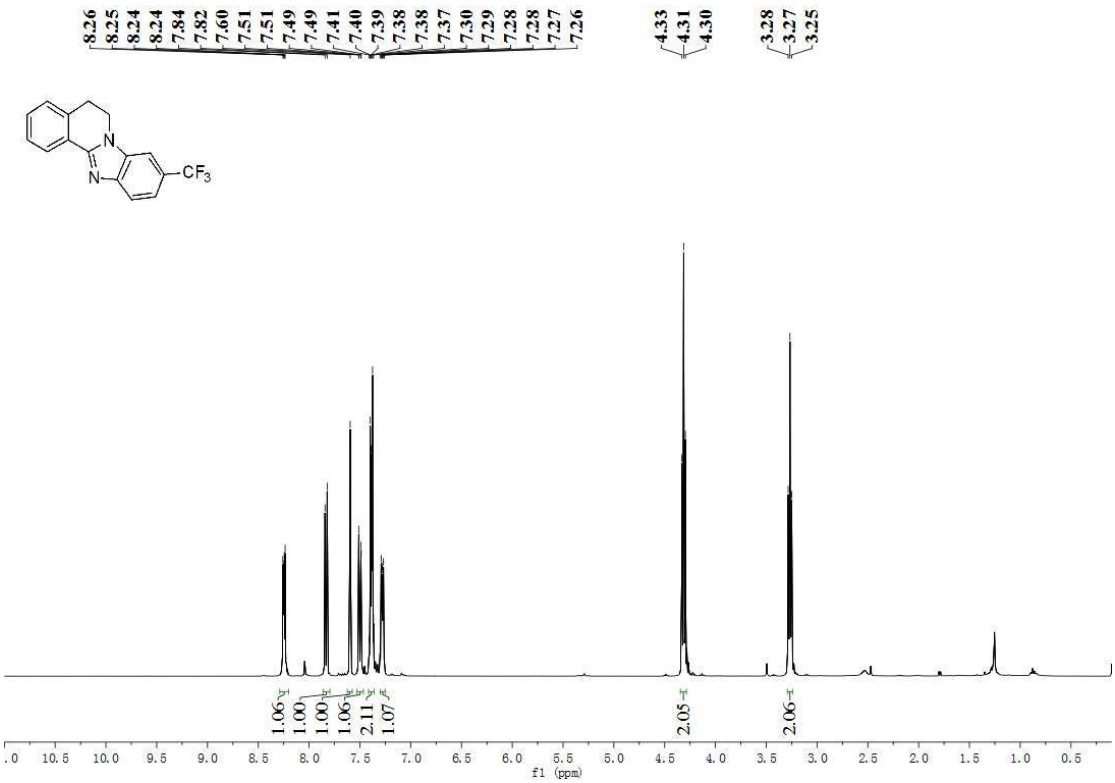
f1 (ppm)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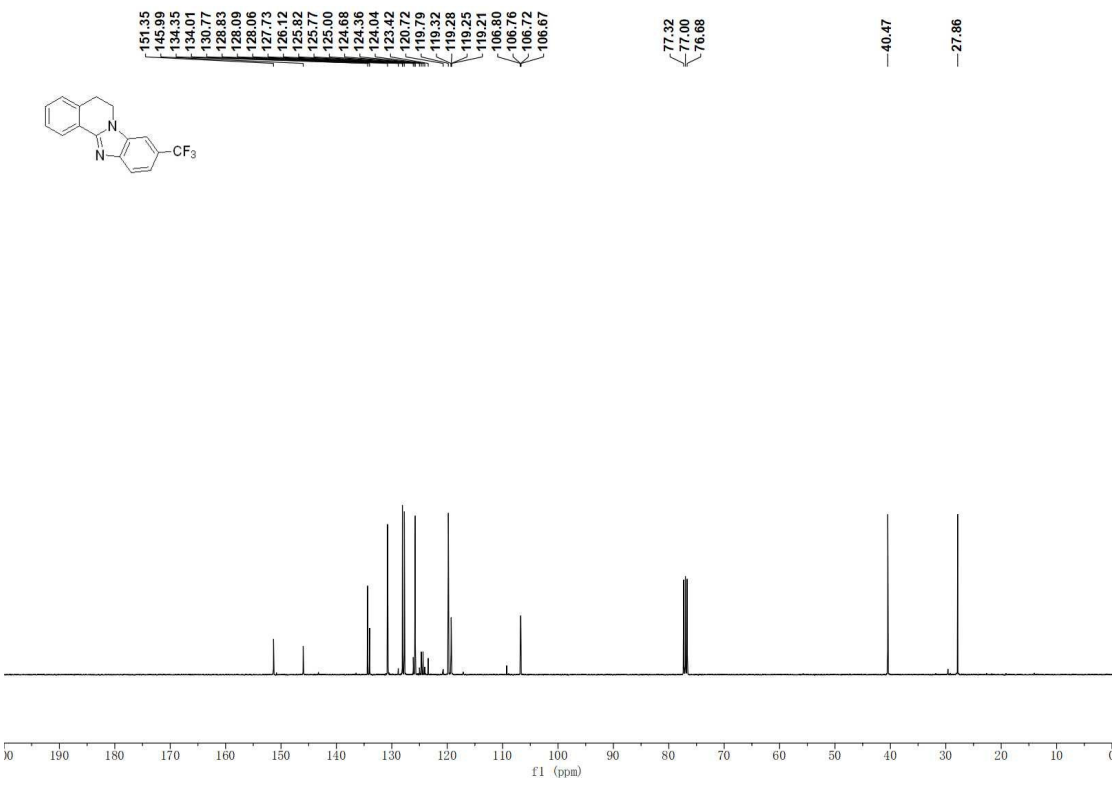
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f1 (ppm)


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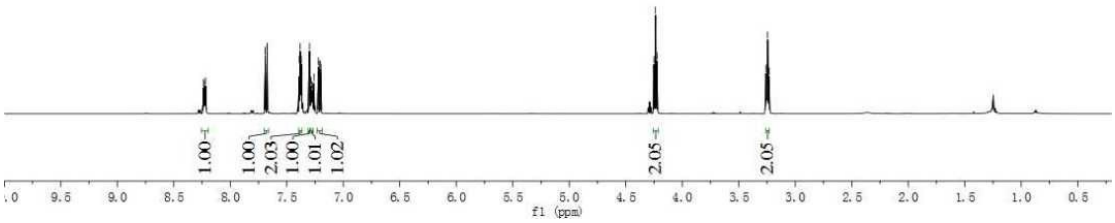
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2.05
f1 (ppm)


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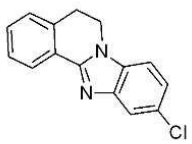
28.01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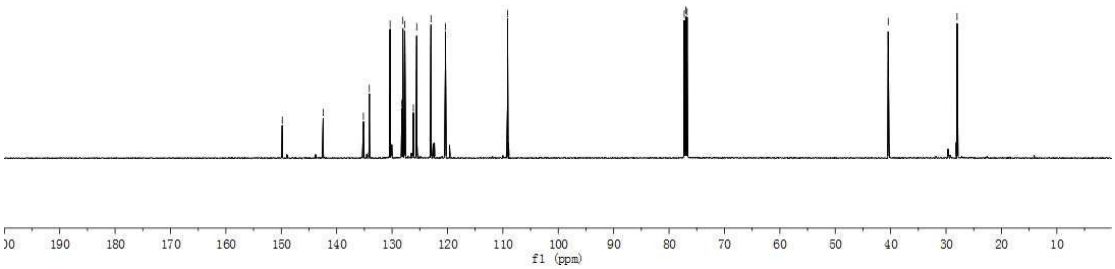
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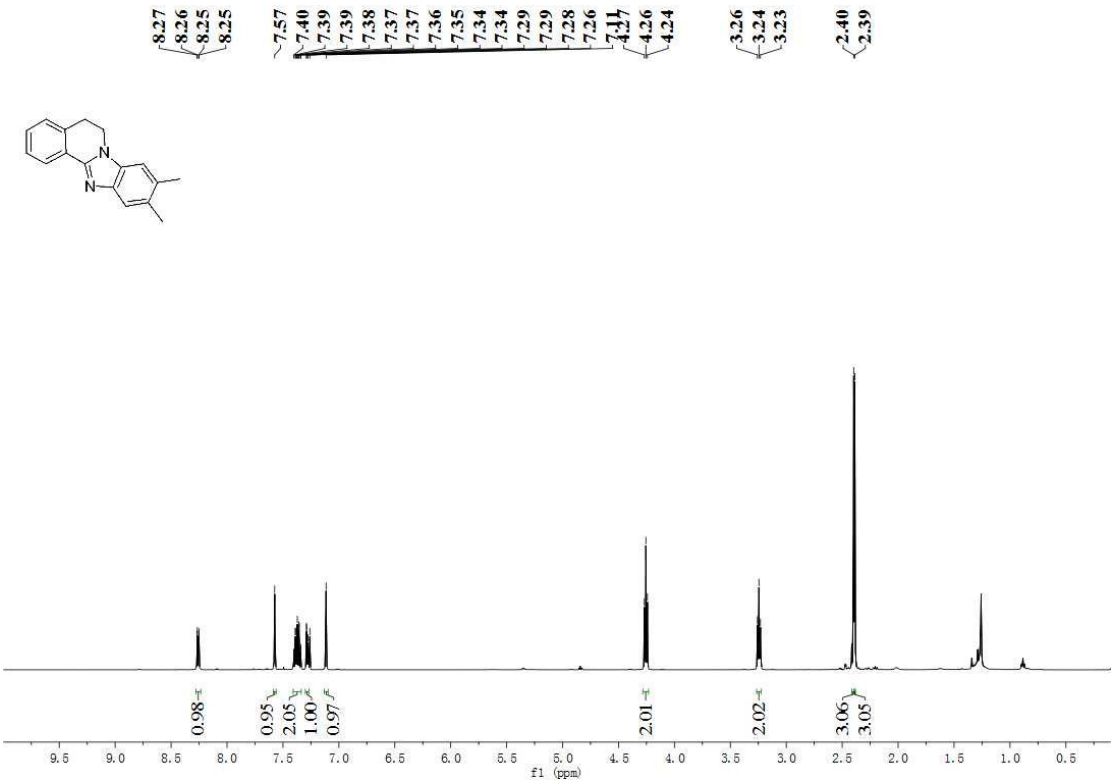
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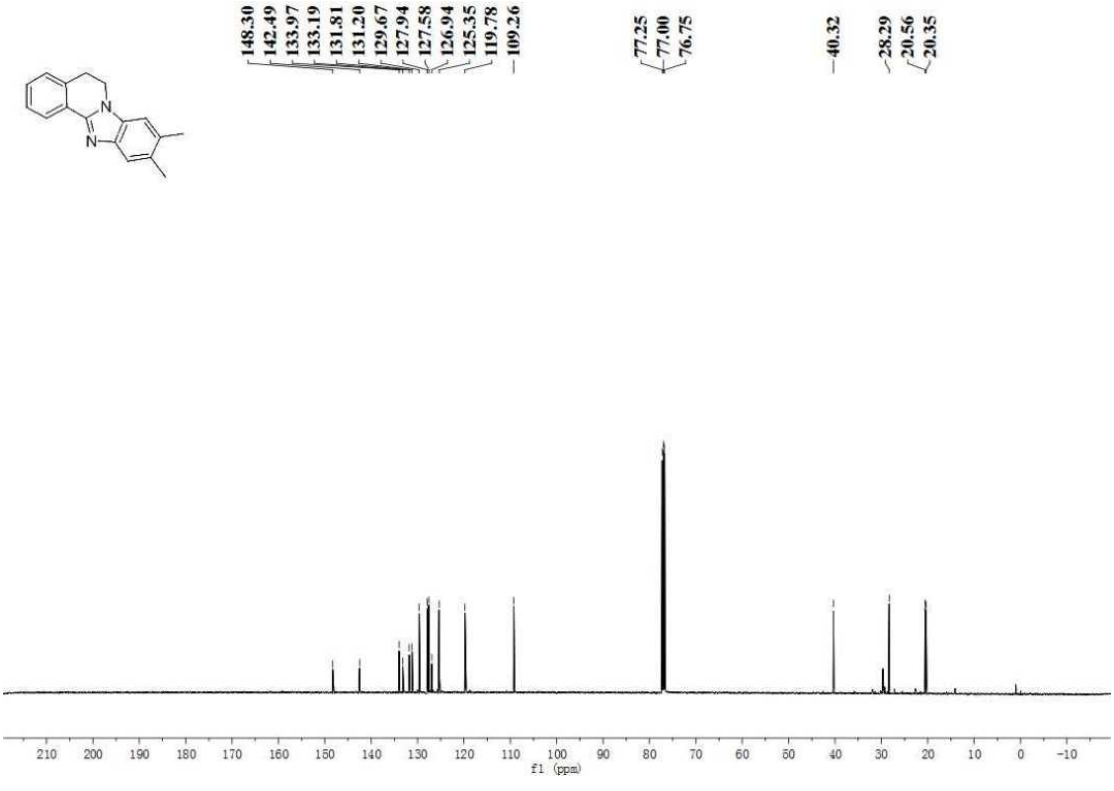
3.05
f1 (ppm)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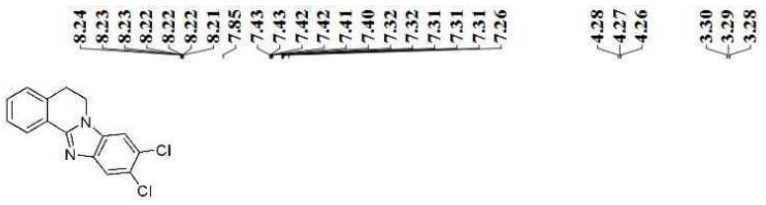
f1 (ppm)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Cl
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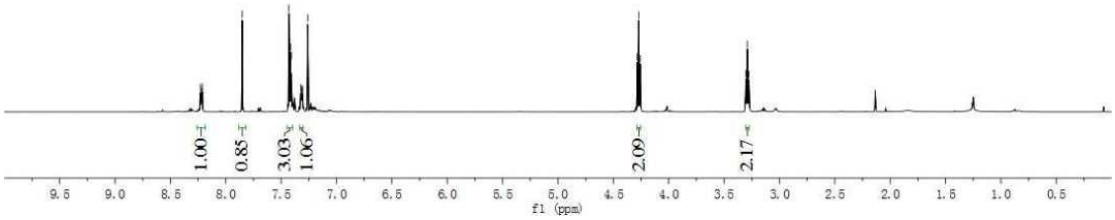
N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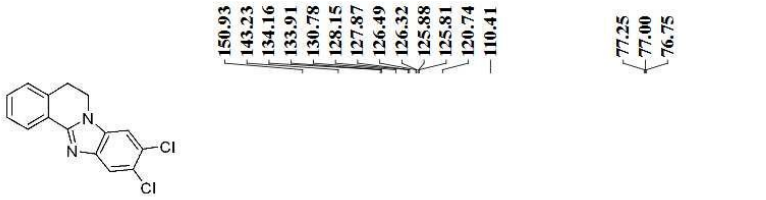
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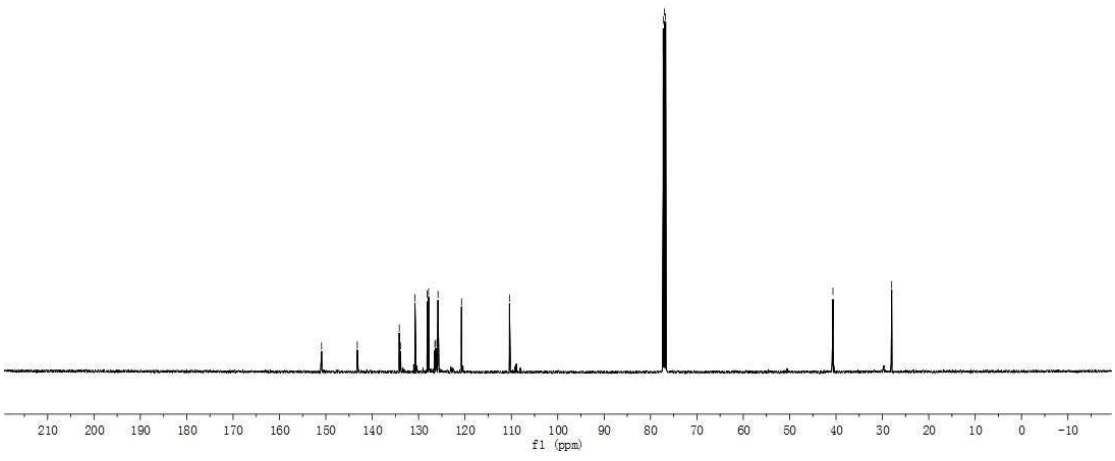
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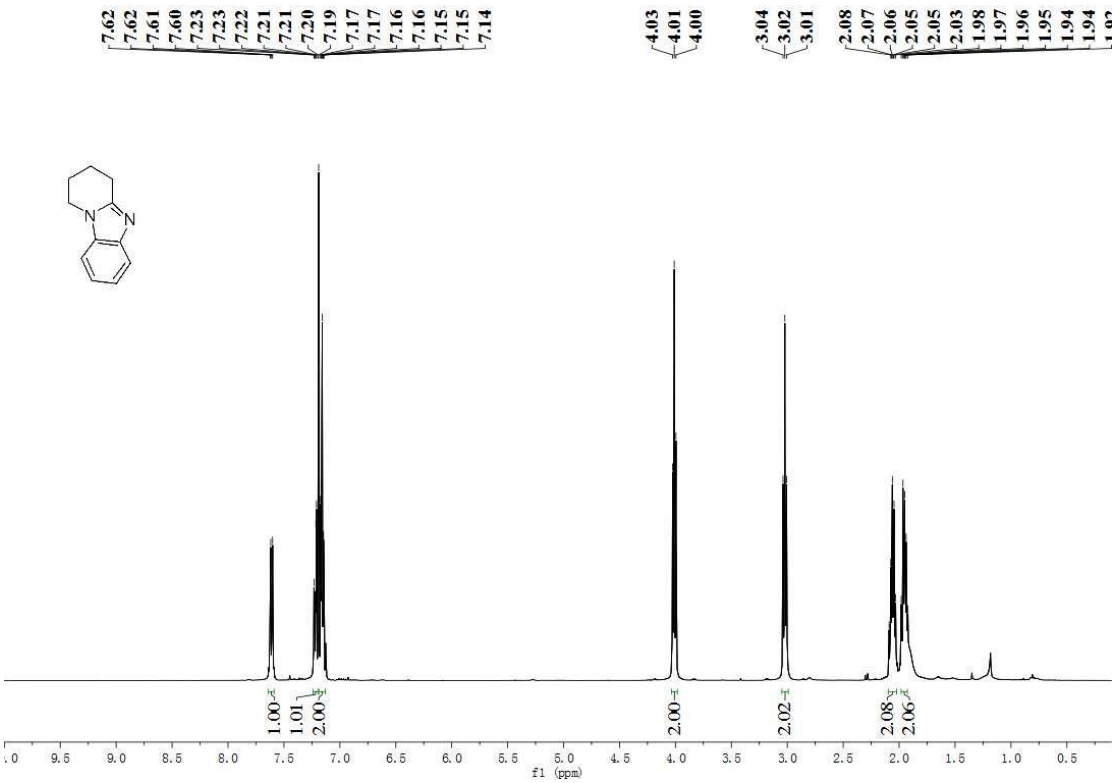
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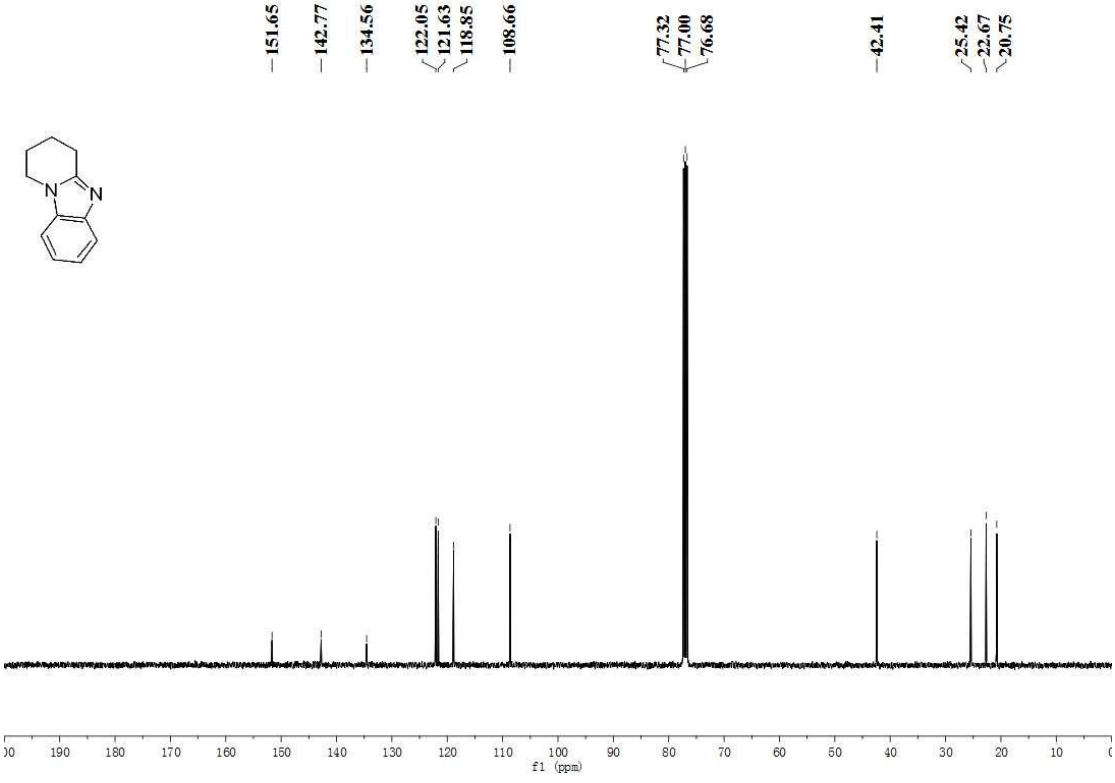
f1 (ppm)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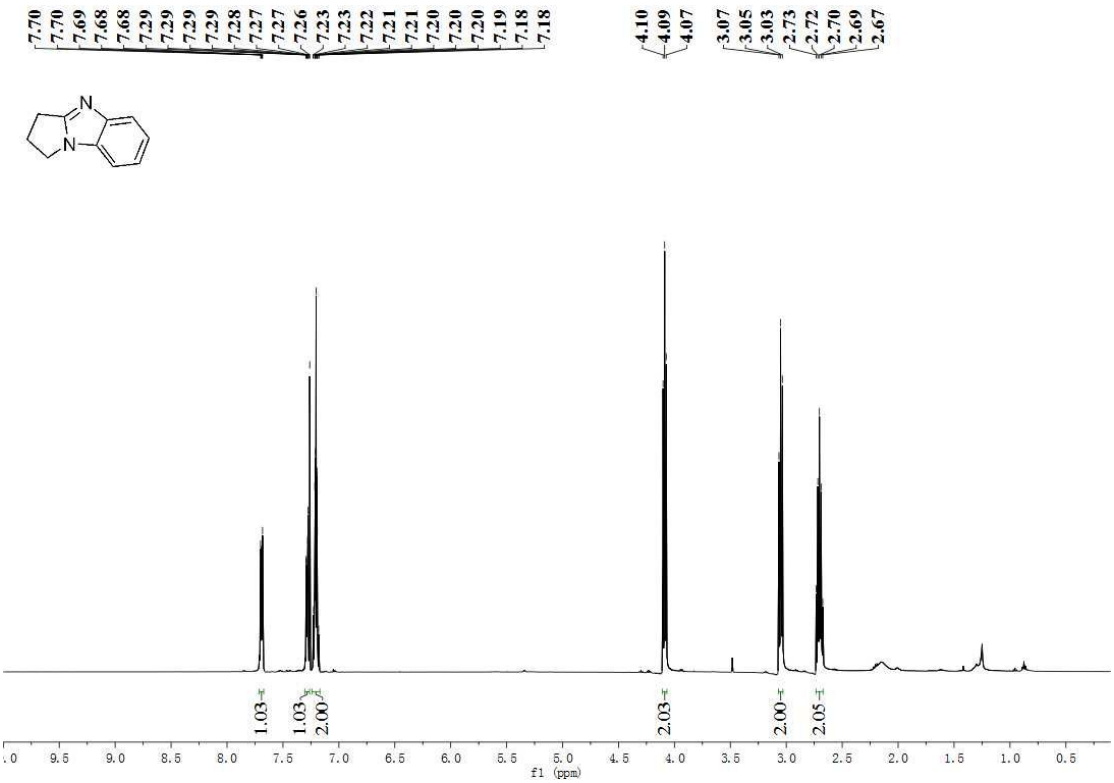
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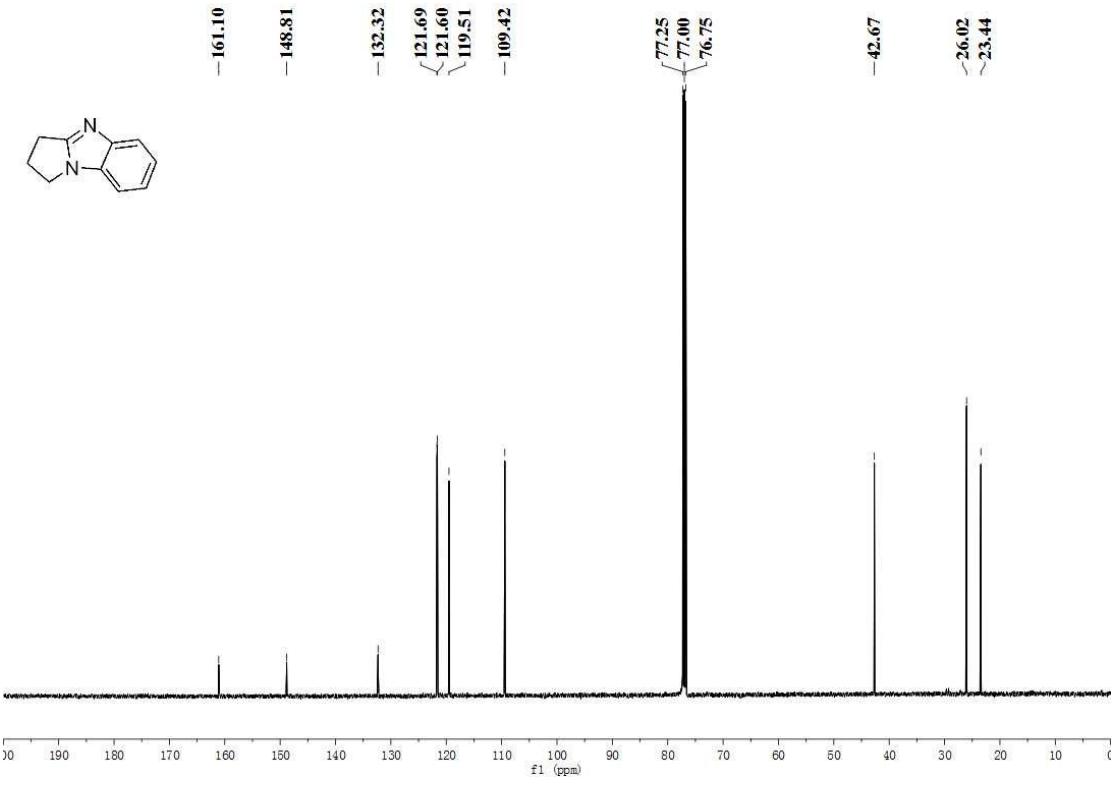
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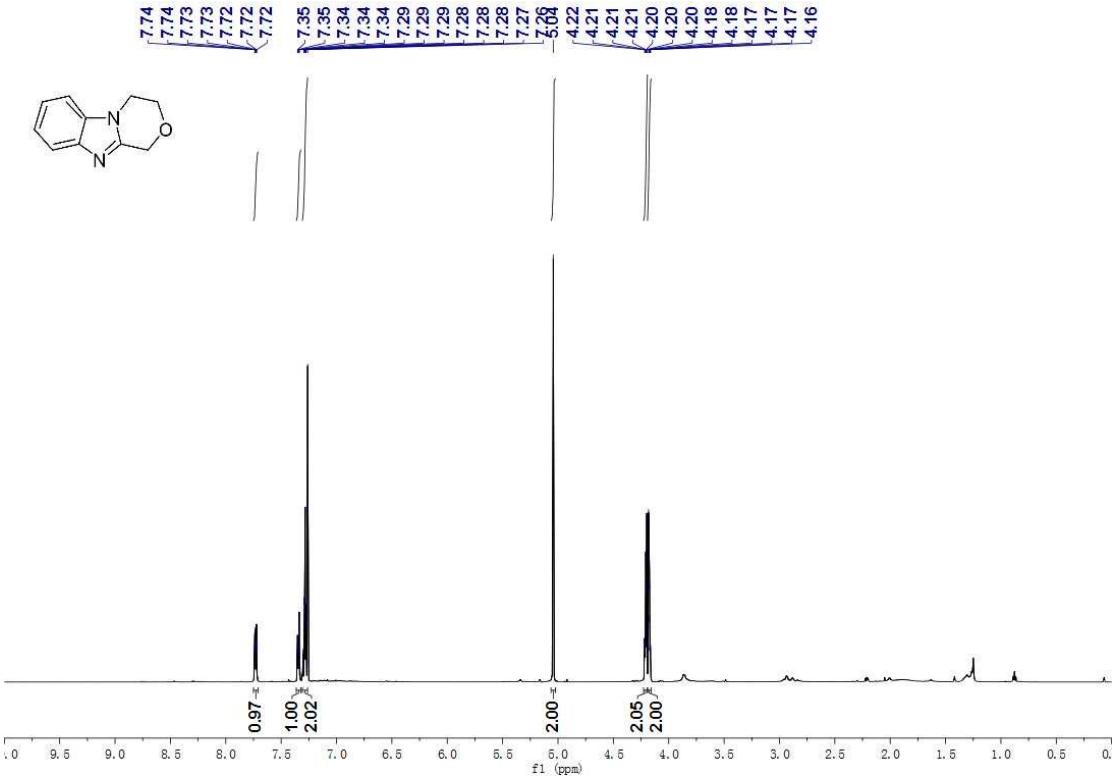
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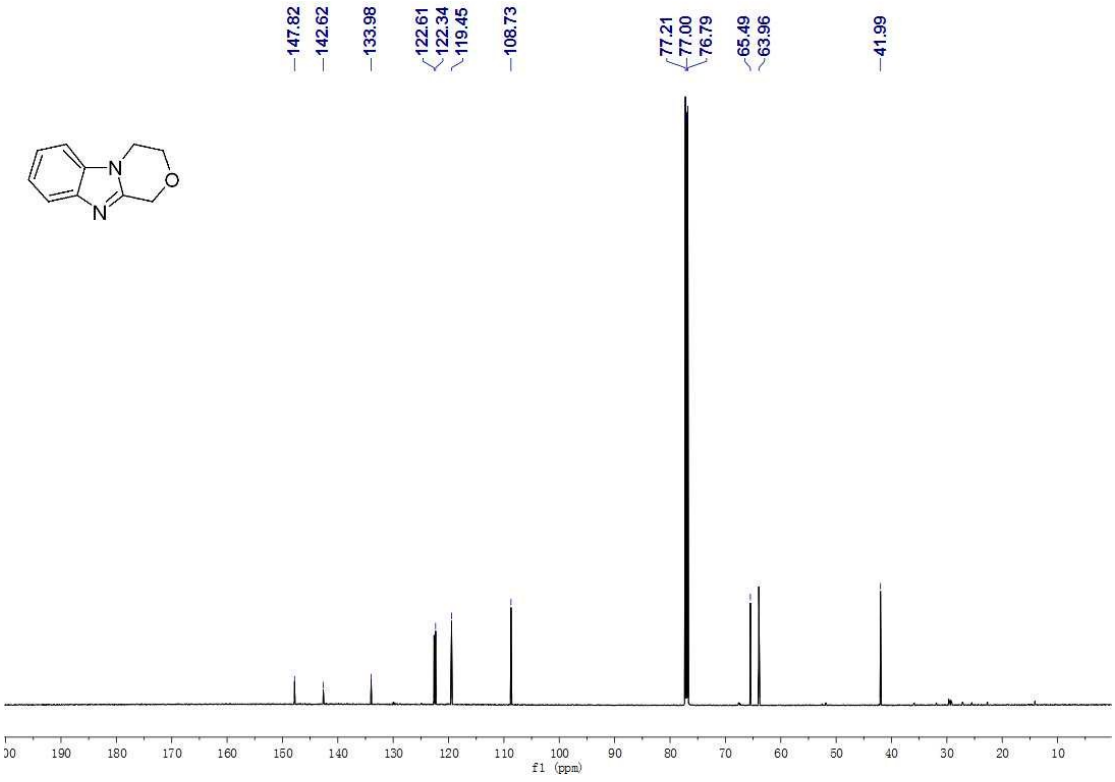
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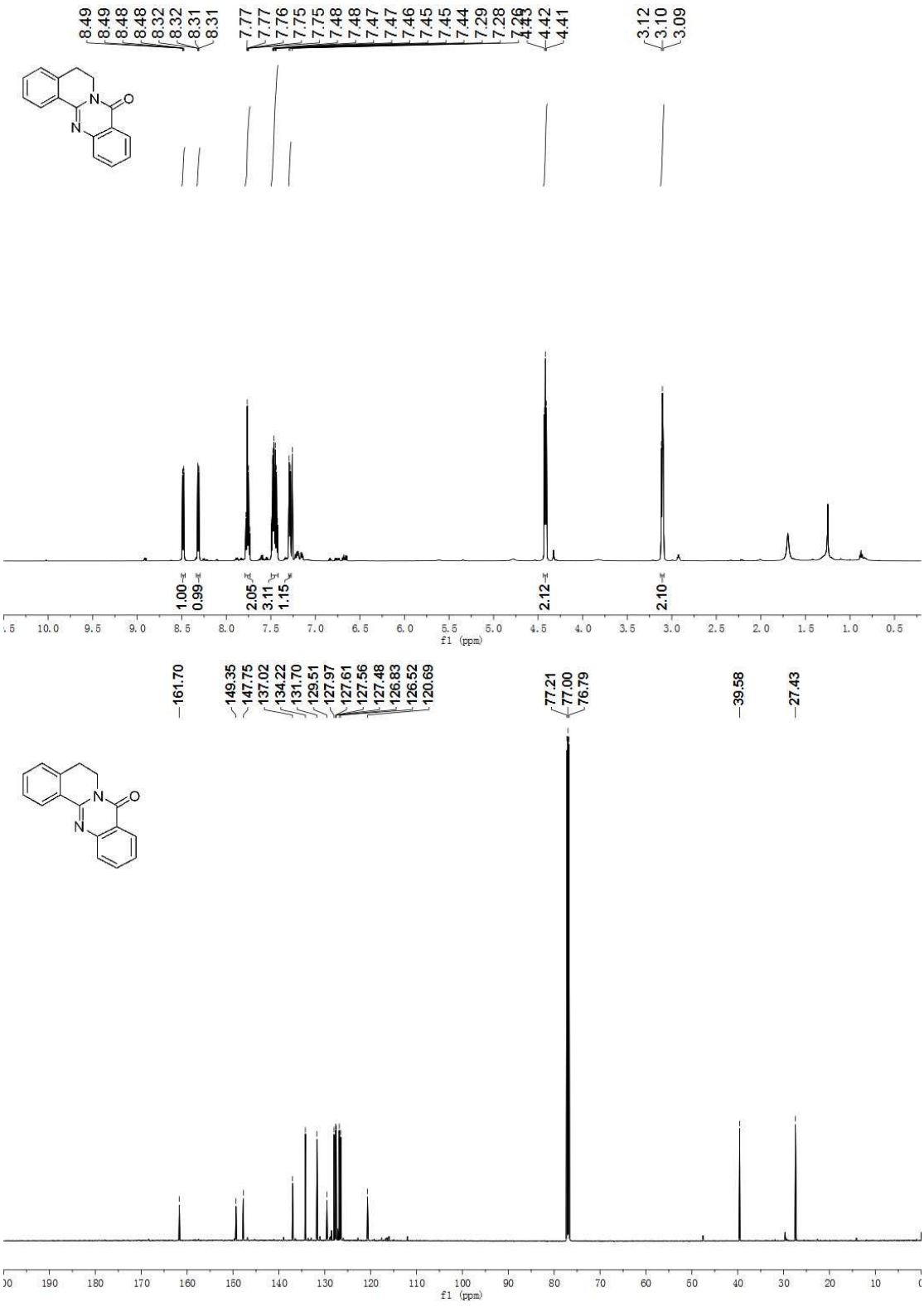
f1 (ppm)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7.77
7.76
7.75
7.75
7.48
7.48
7.47
7.47
7.46
7.45
7.45
7.44
7.29
7.28
7.26
4.43
4.42
4.41
3.12
3.10
3.09
1.00
0.99
2.05
3.11
1.15
2.12
2.10
f1 (ppm)
161.70
149.35
147.75
137.02
134.22
131.70
129.51
127.97
127.61
127.56
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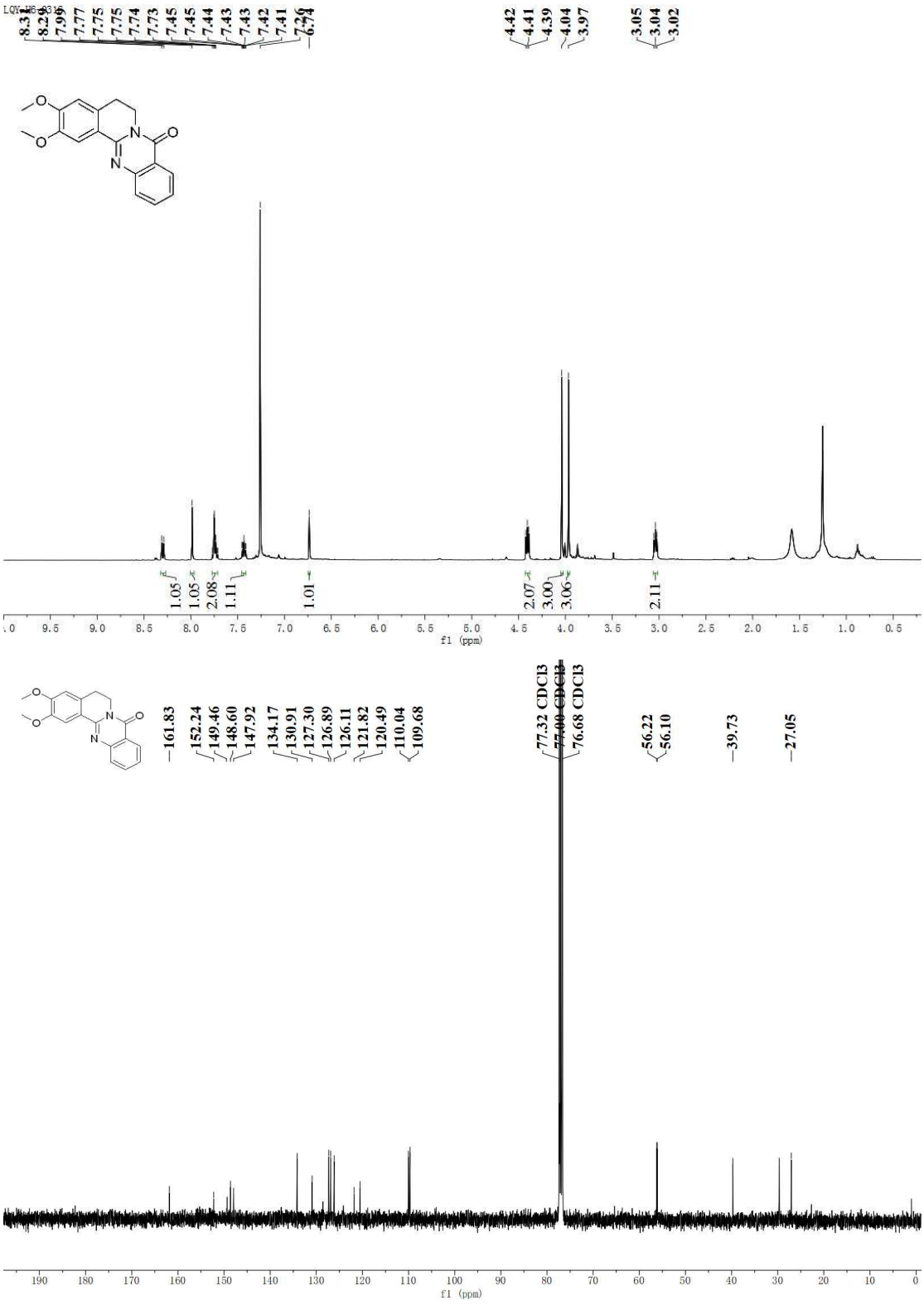
126.83
126.52
120.69
77.21
77.00
76.79
39.58
27.43
f1 (ppm)


8.31
8.29
7.99
7.77
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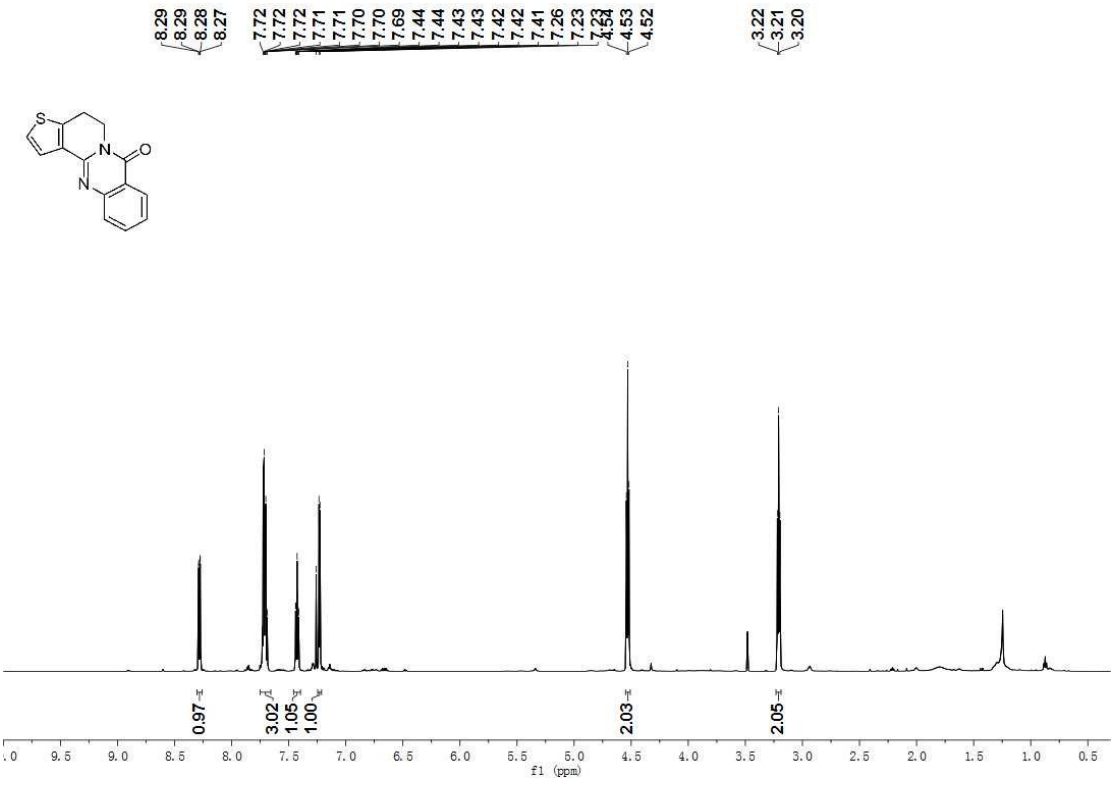
7.75
7.74
7.73
7.45
7.45
7.44
7.43
7.43
7.42
7.41
7.26
6.74
4.42
4.41
4.39
4.04
3.97
3.05
3.04
3.02
1.05
1.05
2.08
1.11
1.01
2.07
3.00
3.06
2.11
f1 (ppm)
161.83
152.24
149.46
148.60
147.92
134.17
130.91
127.30
126.89
126.11
121.82
120.49
110.04
109.68
77.32 CDCl3
77.00 CDCl3
76.68 CDCl3
56.22
56.10
39.73
27.05
f1 (ppm)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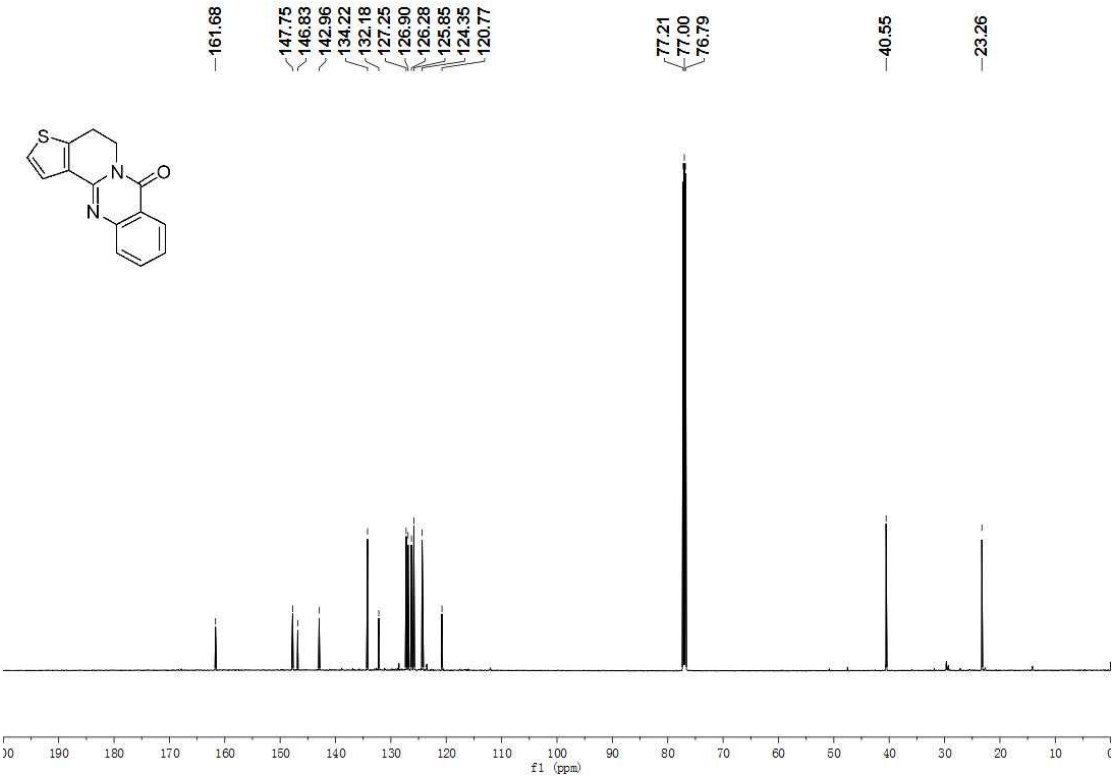
7.72
7.72
7.71
7.71
7.70
7.70
7.69
7.44
7.44
7.43
7.43
7.42
7.42
7.41
7.26
7.23
4.54
4.53
4.52
3.22
3.21
3.20
S
N
O
N
0.97
3.02
1.05
1.00
2.03
2.05
f1 (ppm)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146.83
142.96
134.22
132.18
127.25
126.90
126.28
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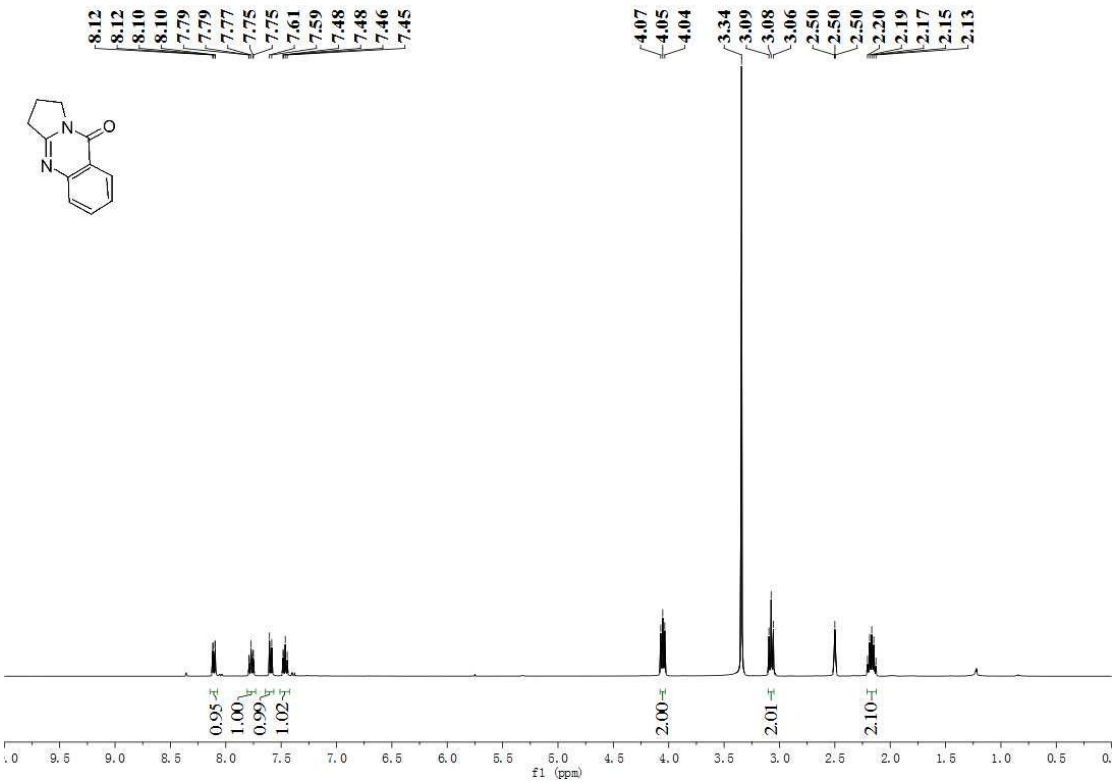
124.35
120.77
77.21
77.00
76.79
40.55
23.26
S
N
O
N
f1 (ppm)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8.12
8.10
8.10
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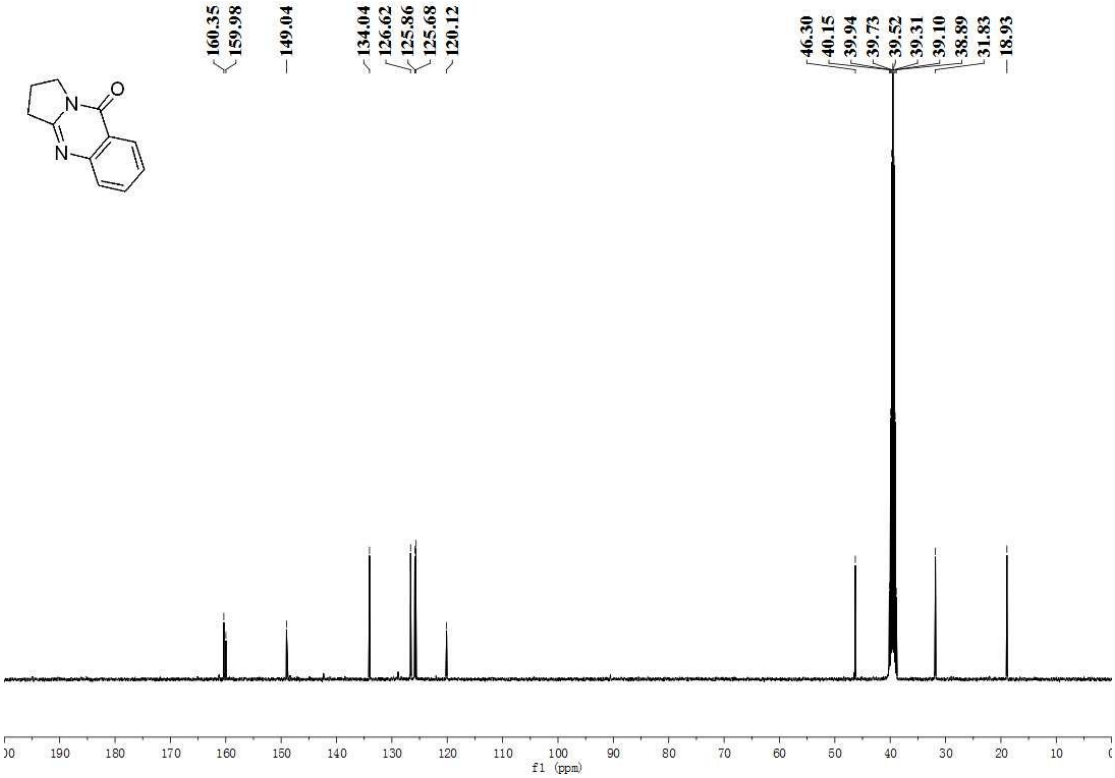
7.79
7.77
7.75
7.75
7.61
7.59
7.48
7.48
7.46
7.45
4.07
4.05
4.04
3.34
3.09
3.08
3.06
2.50
2.50
2.50
2.20
2.19
2.17
2.15
2.13
0.95
1.00
0.99
1.02
2.00
2.01
2.10
f1 (ppm)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134.04
126.62
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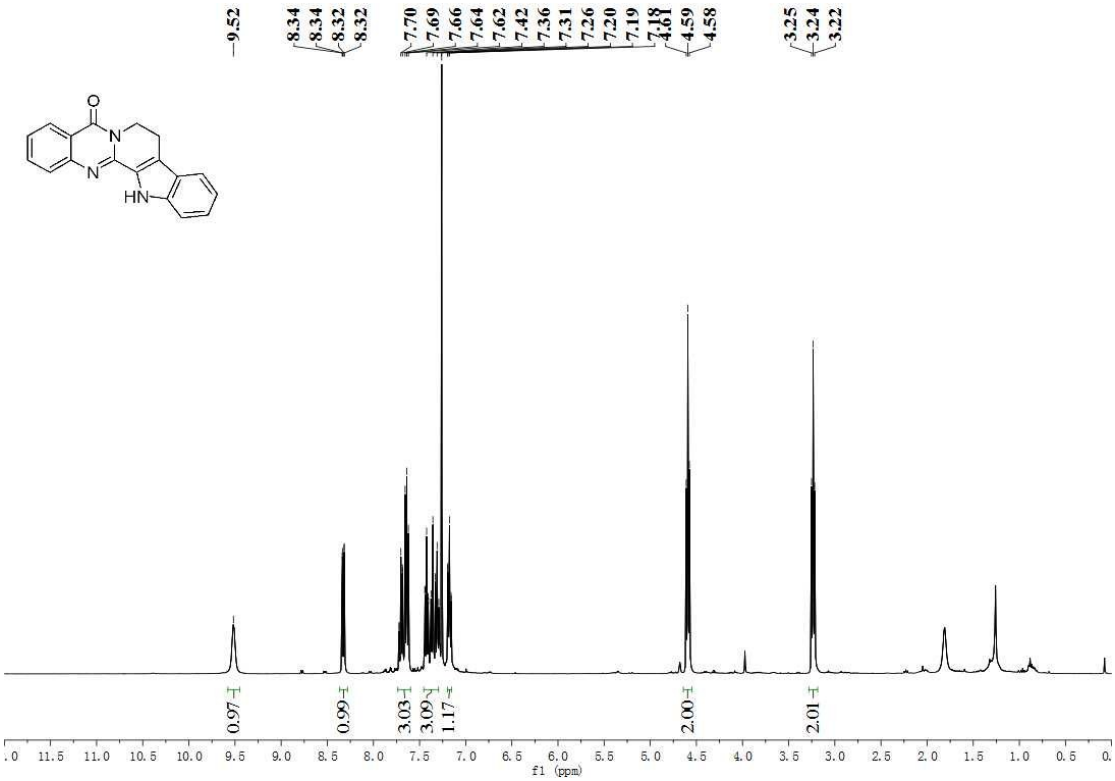
39.94
39.73
39.52
39.31
39.10
38.89
31.83
18.93
f1 (ppm)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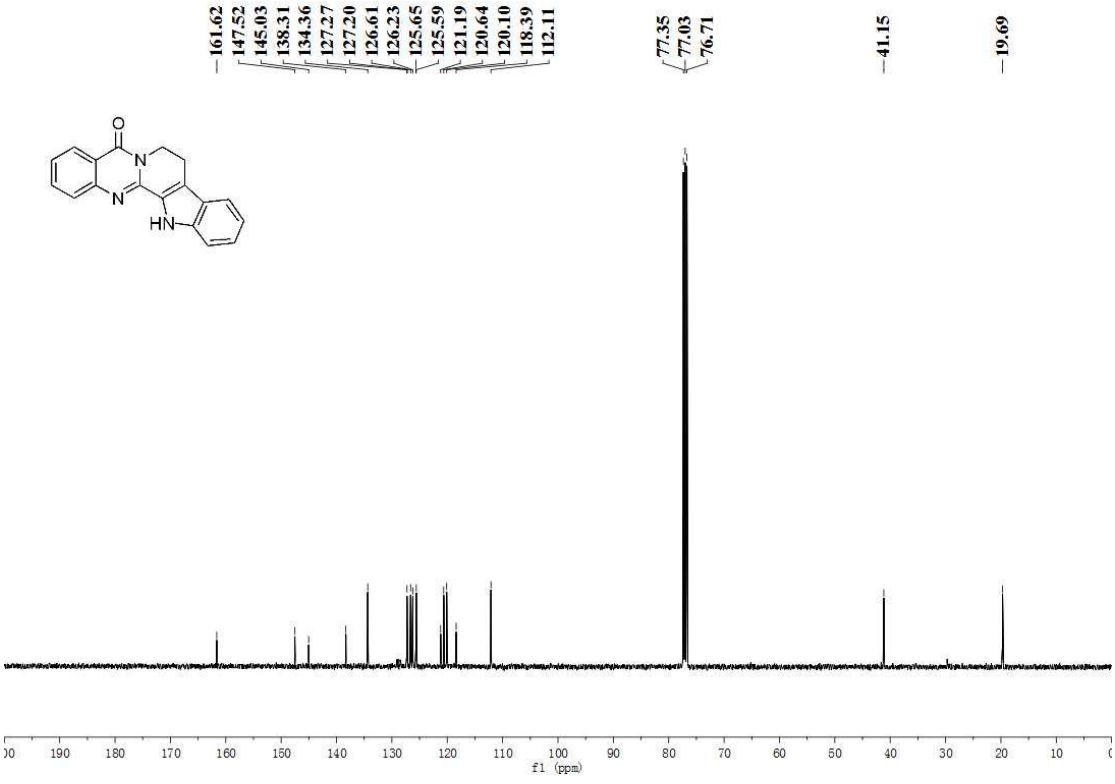
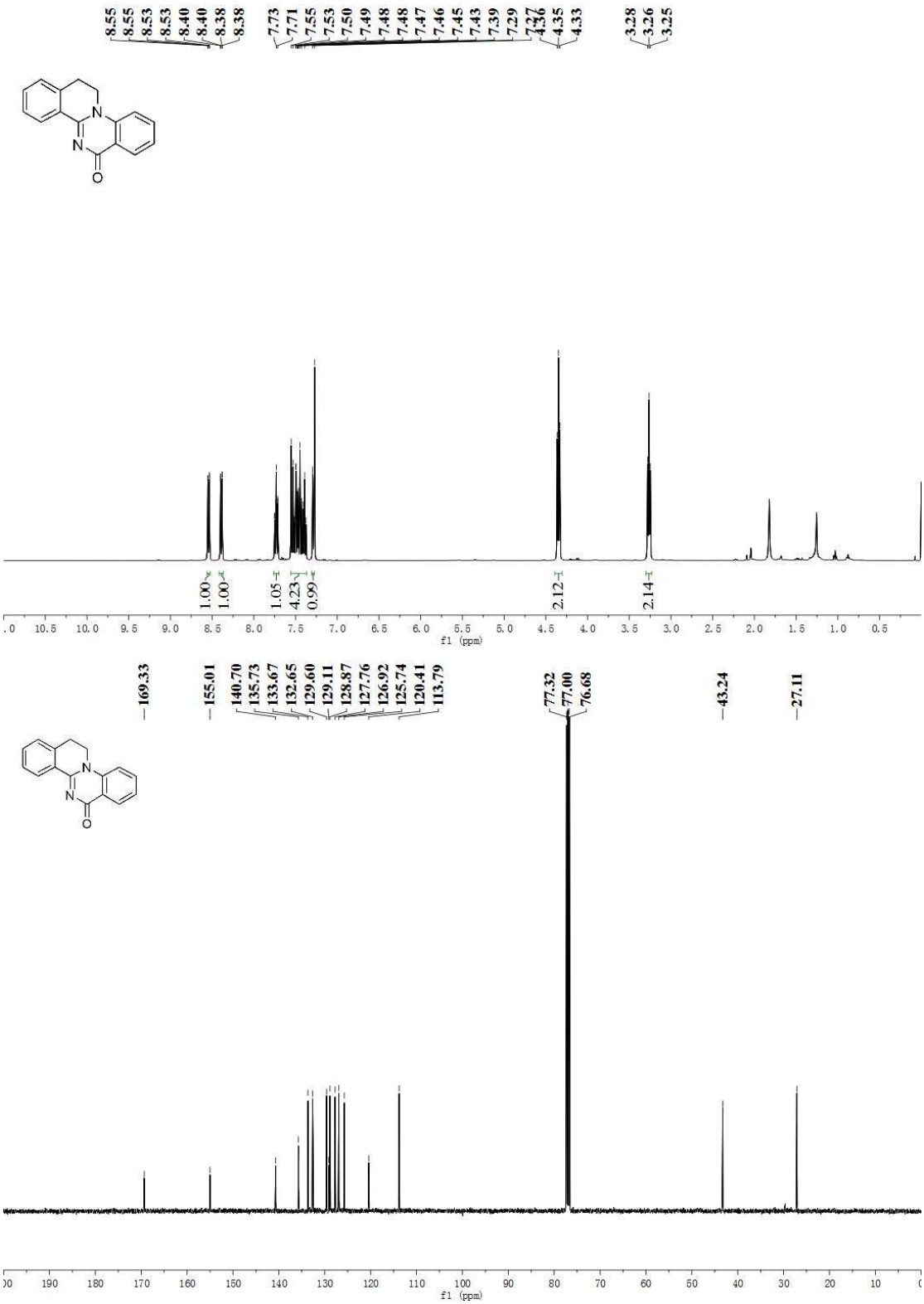
7.70
7.69
7.66
7.64
7.62
7.42
7.36
7.31
7.26
7.20
7.19
7.18
4.61
4.59
4.58
3.25
3.24
3.22
0.97
0.99
3.03
3.09
1.17
2.00
2.01
f1 (ppm)


161.62
147.52
145.03
138.31
134.36
127.27
127.20
126.61
126.23
125.65
125.59
121.19
120.64
120.10
118.39
112.11
77.35
77.03
76.71
41.15
19.69
f1 (ppm)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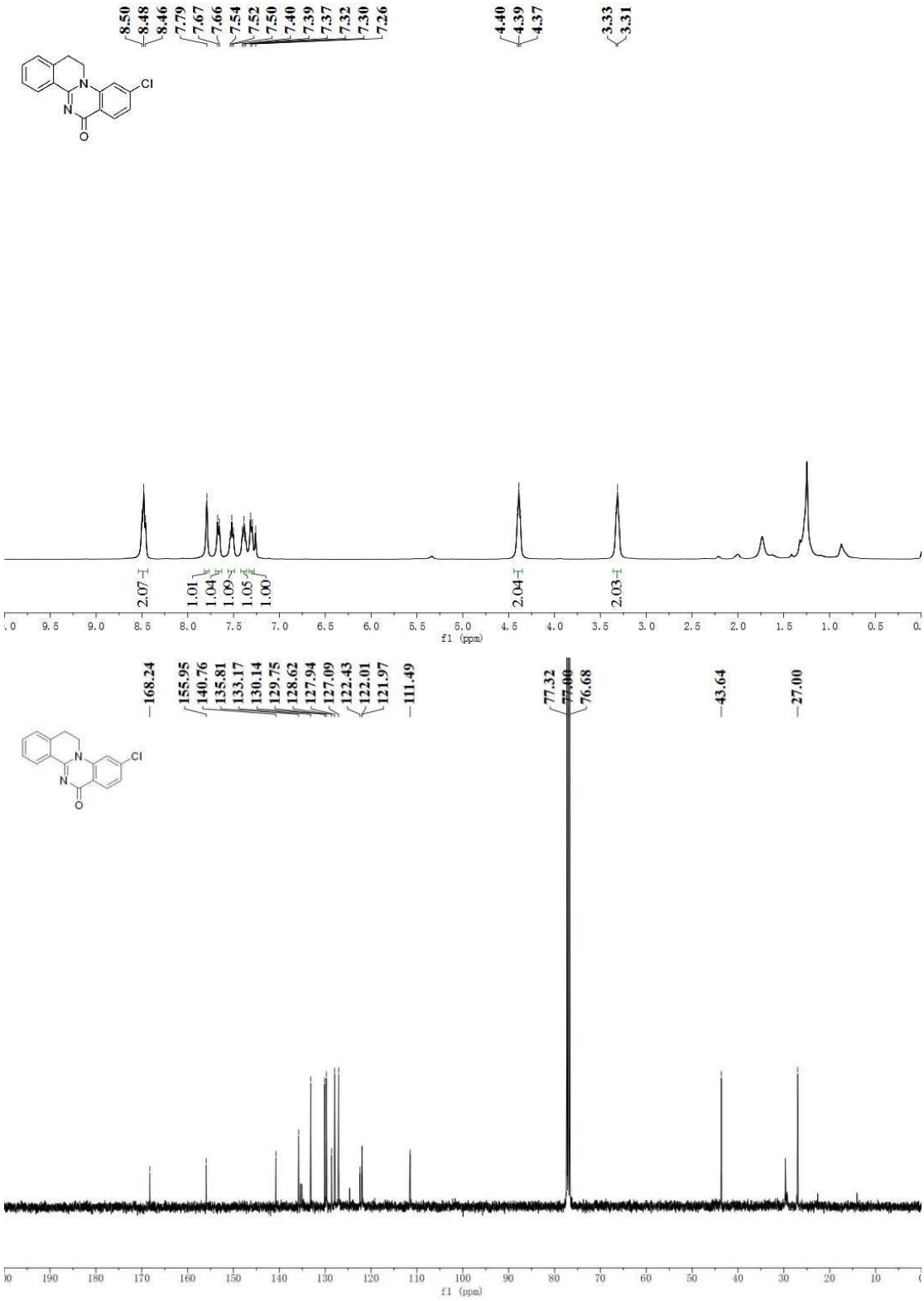
8.38
8.38
7.73
7.71
7.55
7.53
7.50
7.49
7.48
7.48
7.47
7.46
7.45
7.43
7.39
7.29
7.27
4.36
4.35
4.33
3.28
3.26
3.25
1.00
1.00
1.05
4.23
0.99
2.12
2.14
f1 (ppm)
169.33
155.01
140.70
135.73
133.67
132.65
129.60
129.11
128.87
127.76
126.92
125.74
120.41
113.79
77.32
77.00
76.68
43.24
27.11
f1 (ppm)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8.46
7.79
7.67
7.66
7.54
7.52
7.50
7.40
7.39
7.37
7.32
7.30
7.26
4.40
4.39
4.37
3.33
3.31
Cl
N
N
O
2.07
1.01
1.04
1.09
1.05
1.00
2.04
2.03
f1 (ppm)
168.24
155.95
140.76
135.81
133.17
130.14
129.75
128.62
127.94
127.09
122.43
122.01
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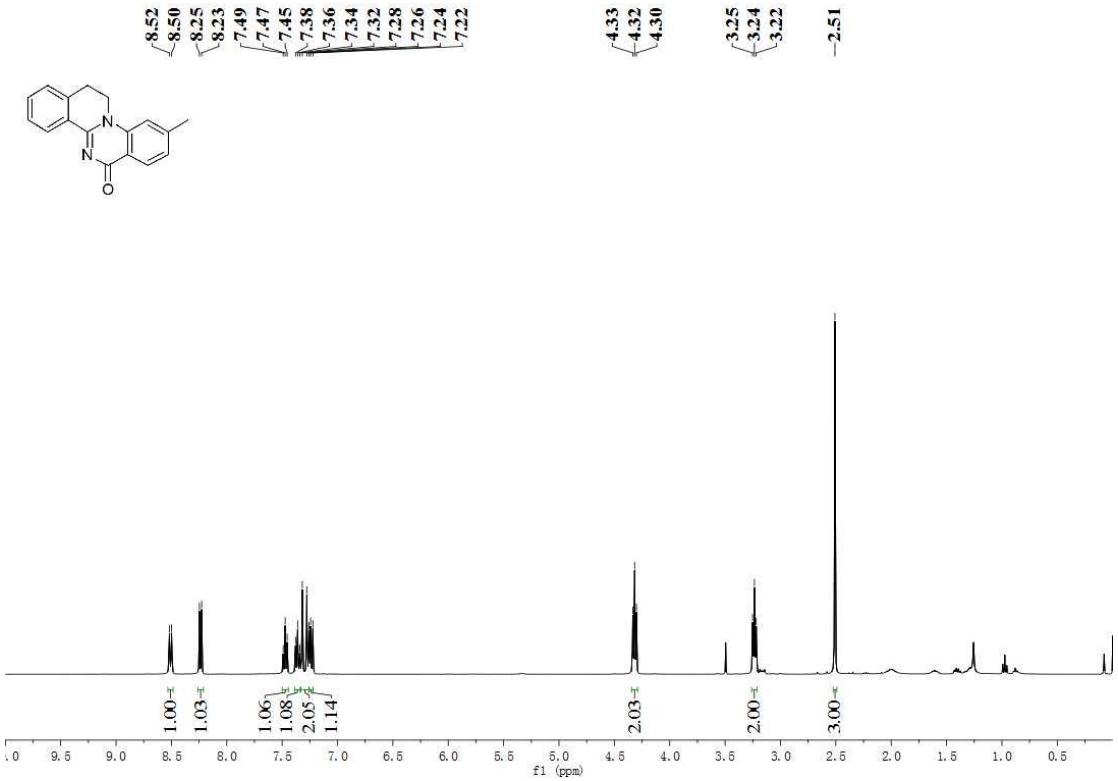
111.49
77.32
77.00
76.68
43.64
27.00
Cl
N
N
O
f1 (ppm)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8.50
8.25
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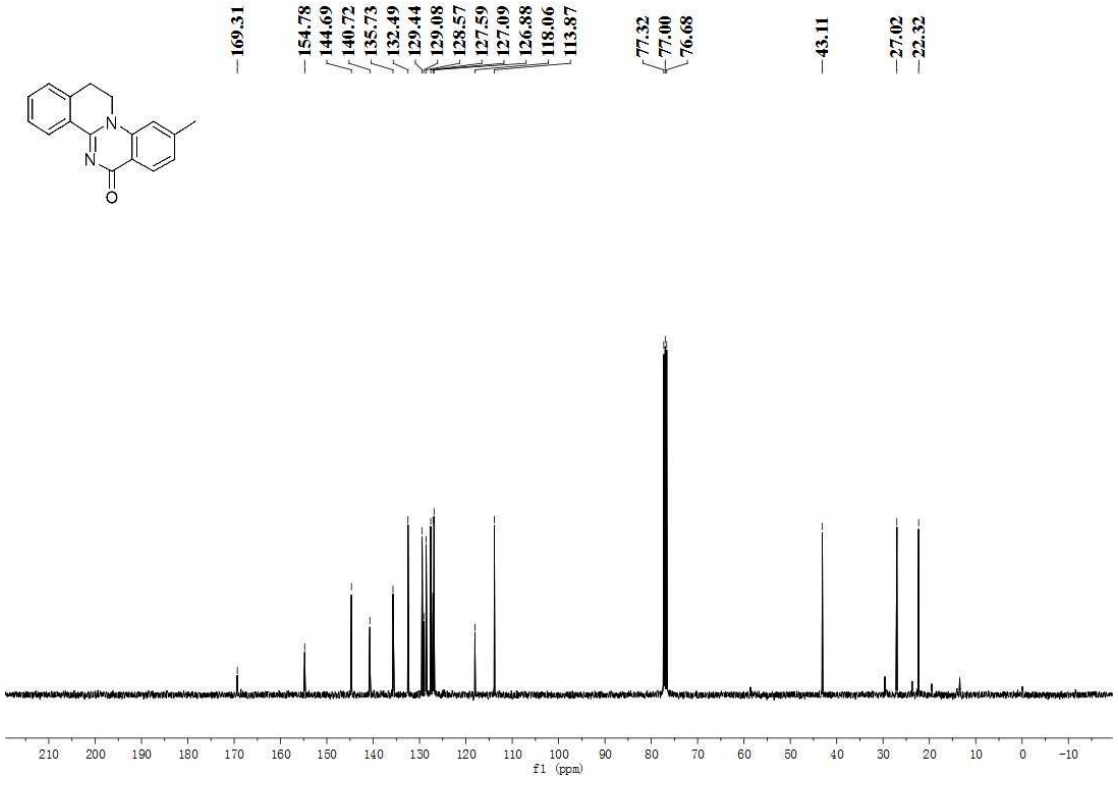
7.45
7.38
7.36
7.34
7.32
7.28
7.26
7.24
7.22
4.33
4.32
4.30
3.25
3.24
3.22
2.51
1.00
1.03
1.06
1.08
2.05
1.14
2.03
2.00
3.00
f1 (ppm)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132.49
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129.08
128.57
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127.09
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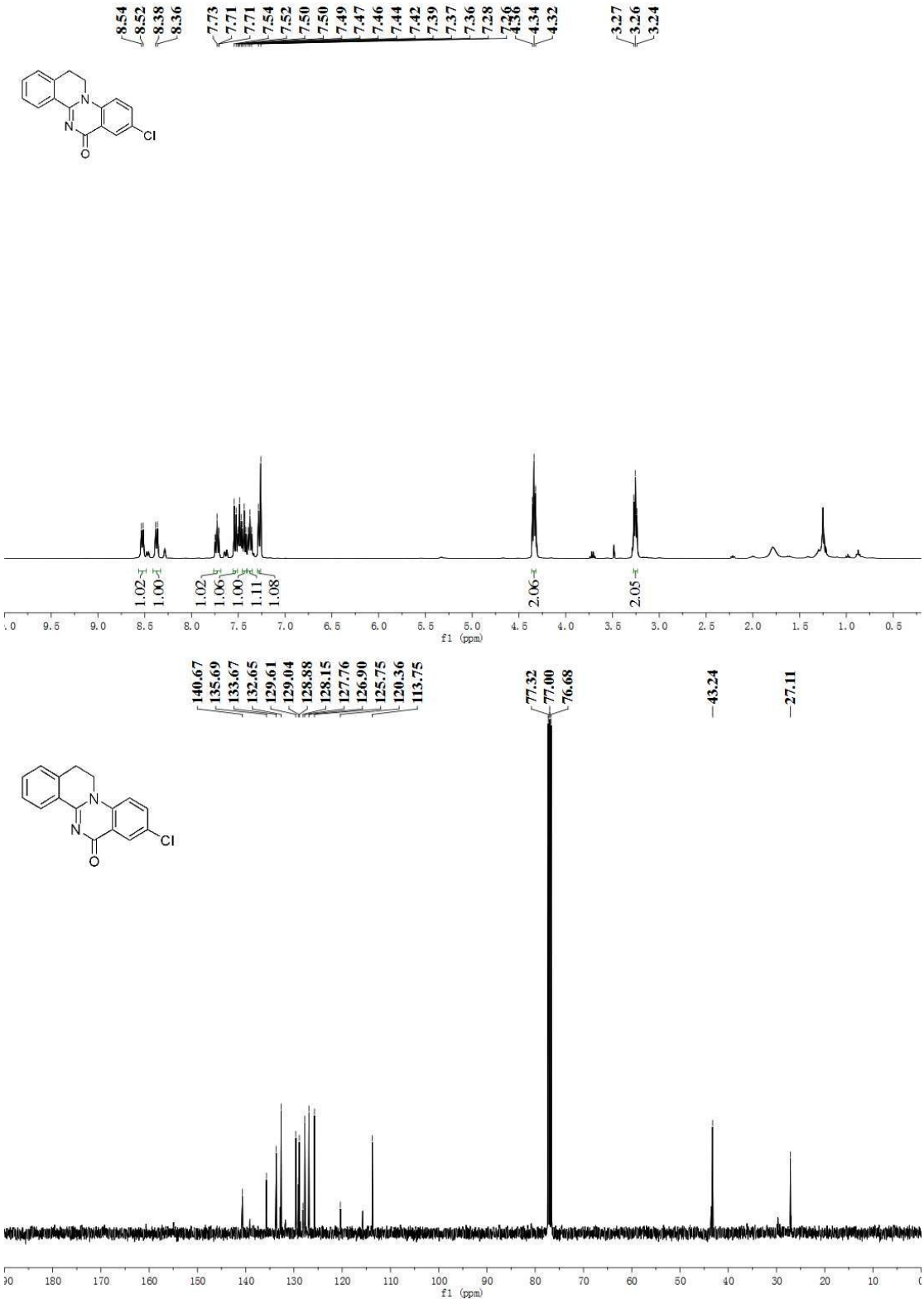
118.06
113.87
77.32
77.00
76.68
43.11
27.02
22.32
f1 (ppm)


8.54
8.52
8.38
8.36
7.73
7.71
7.71
7.54
7.52
7.50
7.50
7.49
7.47
7.46
7.44
7.42
7.39
7.37
7.36
7.28
4.36
4.34
4.32
3.27
3.26
3.24
Cl
O
N
1.02
1.00
1.02
1.06
1.00
1.11
1.08
2.06
2.05
f1 (ppm)
140.67
135.69
133.67
132.65
129.61
129.04
128.88
128.15
127.76
126.90
125.75
120.36
113.75
77.32
77.00
76.68
43.24
27.11
f1 (ppm)