Supporting Information

Decarboxylative C–H Alkylation of Heteroarenes by Copper Catalysis

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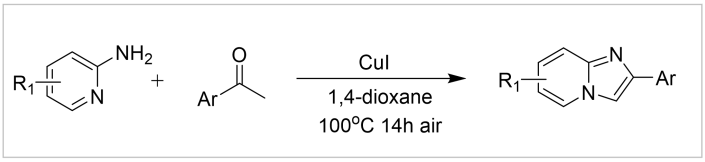
1. General considerations

All reagents and solvents were obtained from commercial suppliers and used without further purification. Flash chromatography was performed on silica gel (200~300 mesh). ^{1}H NMR and ^{13}C NMR spectra were recorded at 500 and 125 MHz on a BRUKER 500 spectrometer. Chemical shifts (δ) are expressed in parts per million (ppm), coupling constants (J) are in Hz. Proton and carbon magnetic resonance spectra (^{1}H NMR and ^{13}C NMR) were recorded using tetramethylsilane (TMS) as the internal standard in DMSO-d_6 or in $CDCl_3$. Mass analyses and HRMS were obtained by ESI on a TOF mass analyzer.

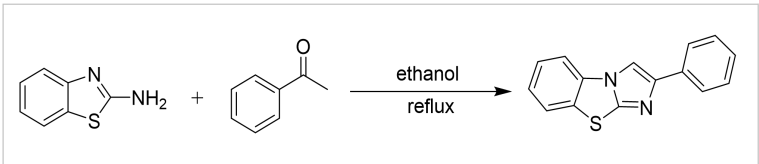
2. Experimental procedures

2.1 Typical procedure for the preparation of imidazo[1,2-*a*]pyridines[1]



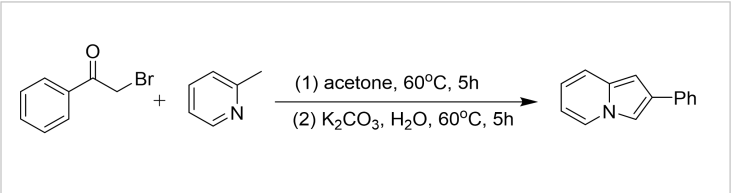
A clean oven-dried 100 mL RB flask was charged with acetophenone (10 mmol, 1.0 equiv), 2-amino pyridine (12 mmol, 1.2 equiv), CuI (2 mmol) and 1,4-dioxane (30 mL). The resulting solution was stirred at 100 °C under ambient air until TLC indicated that the reaction was completed. Then, the reaction mixture was concentrated in *vacuo*. The crude residue was purified by chromatography on silica gel, eluting with EtOAc/ hexanes (1/2) to afford the desired product.

2.2 Typical procedure for the preparation of 2-phenyl imidazo [2,1-*b*] benzothiazole[2]



A mixture of 2-aminobenzothiazole (3g, 20 mmol) and 2-bromoacetophenone (3.96 g, 20 mmol) was refluxed in ethanol (50 mL) for 3-4 h. After cooling to room temperature, the solution was concentrated in vacuo and the residue diluted in water. The solution was made basic with sodium bicarbonate (15 mL) and extracted with dichloromethane. The dried organic layer was evaporated and then the residue was purified by column chromatography over silica gel (100-200 mesh) with (eluent hexane-ethyl acetate 60:40) to obtain the corresponding compound as a white solid.

2.3 Typical procedure for preparation of 2*H*-Indazole[3]



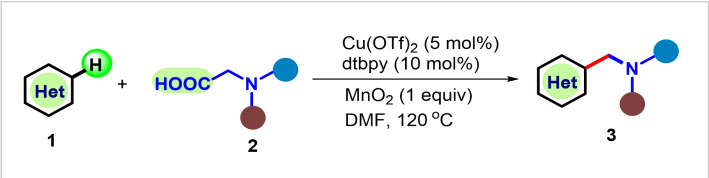
A solution of 2-picoline (0.93 g, 10 mmol, 1.0 equiv) and 2-bromoacetophenone (1.99 g, 10 mmol, 1.0 equiv) in acetone (50 mL) were added to a 100 mL round bottom flask and heated for 5 hours at 60 °C. The precipitate obtained by filtration separation. Then, the crude product was redissolved in 20 mL of hot water (60 °C). After that, K_2CO_3 (1.38 g, 10 mmol, 1.0 equiv) was added and heated at 60 °C for 5 hours. After filtration and drying in vacuo, a white solid compound was obtained in 50% overall yield (965 mg, 5 mmol) without further purification.

2.4 Typical procedure for preparation of 2-(methyl(phenyl)amino) acetic acid[4]

2-Chloroacetic acid (7.0 g, 74 mmol) was dissolved in a solution of K_2CO_3 (11.17 g,

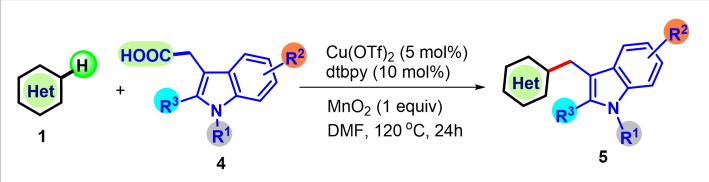
80.8 mmol) in 30 mL of water, and then *N*-methylaniline (7.9 g, 73.7 mmol) in 25 mL of ethanol was slowly added to the above soultuon. After complete addition, the mixture was refluxed for 72 h under nitrogen atmosphere. The ethanol was then removed using a rotary evaporator. Then, HCl (10%) was added until the pH was ca 1. The precipitate was filtered off, washed with ethanol and then dried under vacuum. A white powder (6.4 g) was obtained (yield: 59%).

2.5 General procedure for the synthesis of 3



A 25 ml Schlenk tube equipped with a magnetic stirring bar was charged with Heterocyclic compound **1** (0.2 mmol), carboxylic acid **2** (0.3 mmol), $Cu(OTf)_2$ (5 mol%), dtbpy (10mol%), MnO_2 (0.2 mmol). The tube was evacuated twice and backfilled with nitrogen, and 2 mL DMF was added to the tube under nitrogen atmosphere. The tube was sealed with a nitrogen balloon and then the resulting mixture was heated in 120 ºC stirring for 24 h. The cooled mixture was partitioned between water and ethyl acetate. The organic layer was separated, and the aqueous layer was extracted with ethyl acetate. The combined organic layers were dried over Na_2SO_4, and concentrated in vacuo. The residue was purified by flash chromatography using petroleum ether/ethyl acetate as eluent to affording **3**. In general, the identity and purity of the products were confirmed by ^1H and ^{13}C NMR spectroscopy.

2.6 General procedure for the synthesis of 5

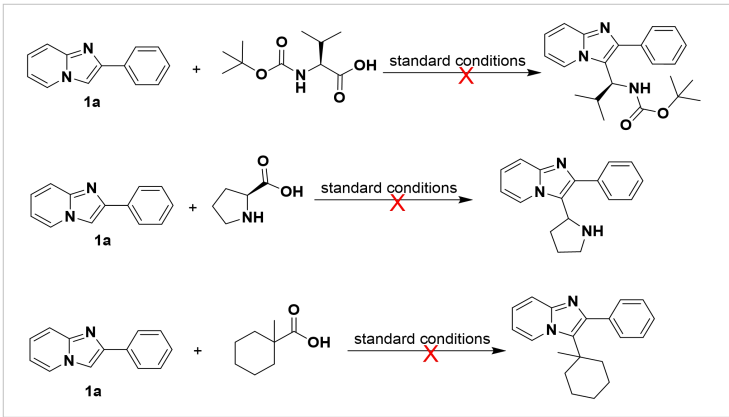


A 25 ml Schlenk tube equipped with a magnetic stirring bar was charged with Heterocyclic compound **1** (0.2 mmol), carboxylic acid **4** (0.3 mmol), $Cu(OTf)_2$ (5 mol%), dtbpy (10 mol%), MnO_2 (0.2 mmol). The tube was evacuated twice and backfilled with nitrogen, and 2 mL DMF was added to the tube under nitrogen atmosphere. The tube was sealed with a nitrogen balloon and then the resulting mixture was heated in 120 °C stirring for 24 h. The cooled mixture was partitioned between water and ethyl acetate. The organic layer was separated, and the aqueous layer was extracted with ethyl acetate. The combined organic layers were dried over Na_2SO_4, and concentrated in vacuo. The residue was purified by flash chromatography using petroleum ether/ethyl acetate as eluent to affording **5**. In general, the identity and purity of the products were confirmed by ^1H and ^{13}C NMR spectroscopy.

2.7 Investigation of branched alkyl carboxylic acids under the standard conditions

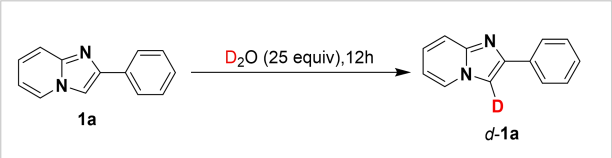
A 25 ml Schlenk tube equipped with a magnetic stirring bar was charged with 2-phenylimidazo[1,2-*a*]pyridine **1a** (0.2 mmol), carboxylic acids (0.3 mmol), $Cu(OTf)_2$ (5 mol%), dtbpy (10mol%), MnO_2 (0.2 mmol). The tube was evacuated twice and backfilled with nitrogen, and 2 mL DMF was added to the tube under nitrogen atmosphere. The tube was sealed with a nitrogen balloon and then the resulting mixture was heated in 120 °C stirring for 24 h. No desired product was

detected by TLC.



3. Mechanistic Experiments

General procedure for the synthesis of *d*-1a



Under air, a sealed reaction tube was charged with 1a (0.2 mmol), D_2O (25.0 equiv) and 1.5 mL of toluene. The reaction mixture was stirred at 110 °C for 12 h. After the completion of the reaction, the solvent was evaporated under reduced pressure and the residue was purified by flash column chromatography on a silica gel to give the product. The mixture was analyzed using ^1H NMR spectrometer.

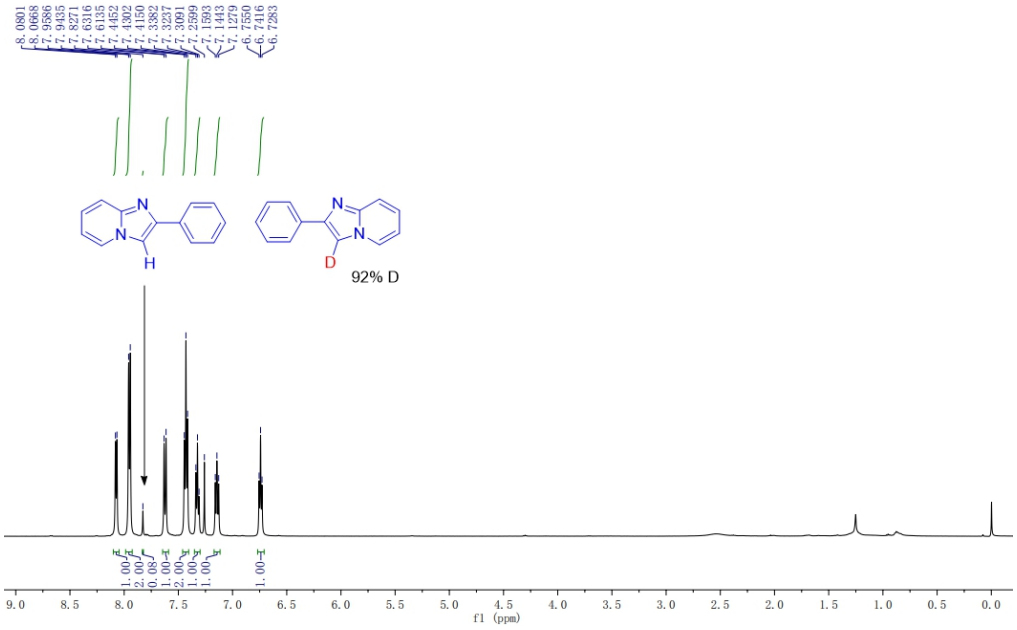


Figure S1 ^{1}H NMR spectra of **1a**-d_1

Kinetic isotope effect experiments

Two flame dried reaction tubes equipped with magnetic stirring bars were each charged with indole-3-acetic acid (**4a**, 52.6 mg, 0.300 mmol), $Cu(OTf)_2$ (3.6 mg, 0.010 mmol), dtbpy (5.4 mg, 0.020 mmol), MnO_2 (17.4 mg, 0.020 mmol), respectively. 2-phenylimidazo[1,2-*a*]pyridine **1a** (38.8 mg, 0.200mmol) and ***d*-1a** (40.0 mg, 0.200 mmol) were added to the above two reaction tubes, respectively. The tube was evacuated twice and backfilled with nitrogen, and 2 mL DMF was added to the tube under nitrogen atmosphere. The tube was sealed with a nitrogen balloon and then the resulting mixture was heated in 120 °C stirring for 0.5 h, then a small portion of the solution of the reaction **1** and reaction **2** were taken out via syringe for ^{1}H NMR analysis. Samples of 1 h, 2 h, 6 h, 10 h, 13 h were also made by the same procedure. Yields of the product were determined by ^{1}H NMR in $CDCl_3$ using1,3,5-trimethoxybenzene as an internal standard.

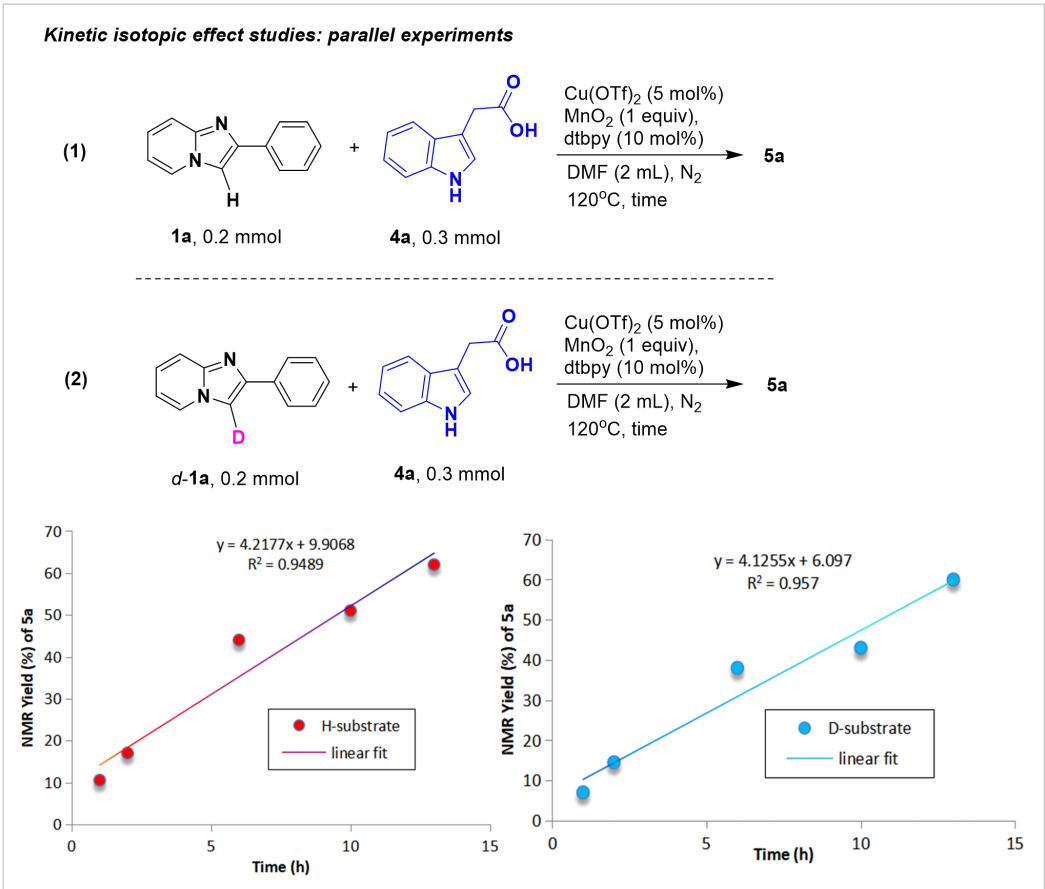
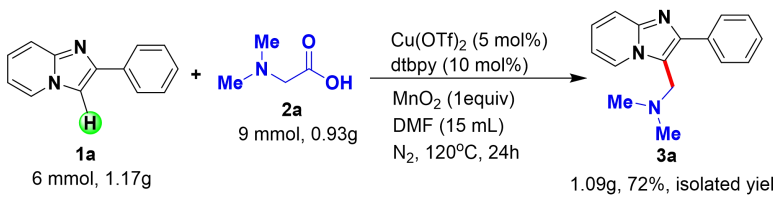


Figure S2. Kinetic isotopic effect studies: parallel experiments.

Time (h)	**5a** (%) of Reaction 1	**5a** (%) of Reaction 2
0.5	trace	trace
1	10.5	7
2	17	14.5
6	44	38
10	51	43
13	62	60

Synthesis of 3a on a gram scale.

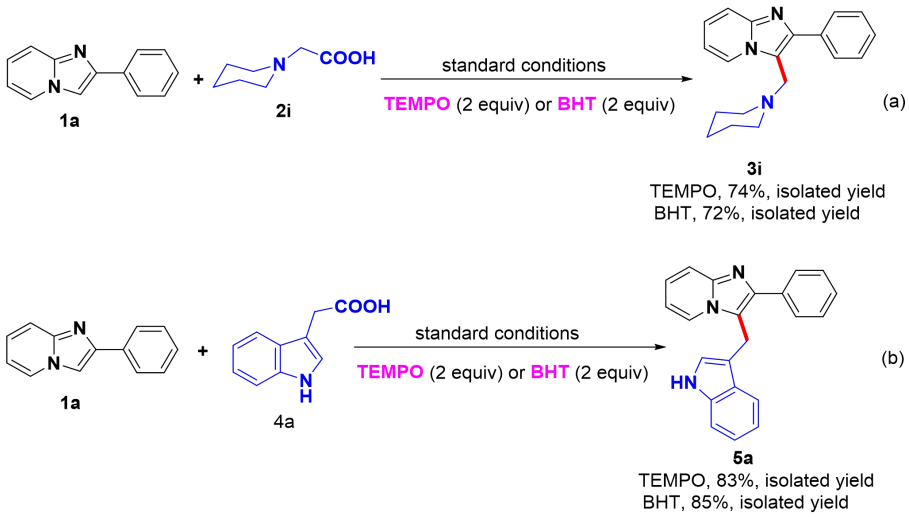


A 50 ml oven-dried Schlenk bottle equipped with a magnetic stirring bar was charged

with imidazo[1,2-*a*]pyridine **1a** (6 mmol, 1.17 g), dimethylglycine **2a** (9 mmol, 0.93 g), $Cu(OTf)_2$ (5 mol%), dtbpy (10 mol%), MnO_2 (0.2 mmol). The tube was evacuated and backfilled with nitrogen (three times), and 15 mL DMF was added to the tube under nitrogen atmosphere. The tube was sealed with a nitrogen balloon and then the resulting mixture was heated in 120 ^oC stirring for 24 h. The cooled mixture was partitioned between water and ethyl acetate. The organic layer was separated, and the aqueous layer was extracted with ethyl acetate. The combined organic layers were dried over Na_2SO_4, and concentrated in vacuo. The residue was purified by column chromatography on silica gel using petroleum ether/ethyl acetate as eluent to give the corresponding product **3a** in 72% yield, 1.09 g.

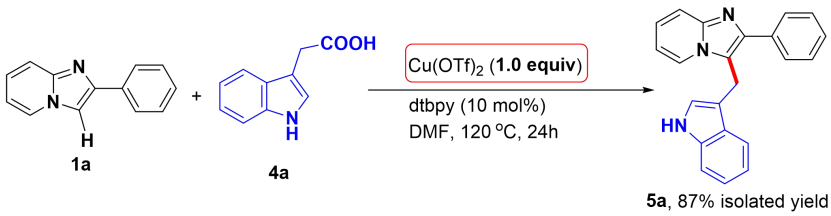
Radical-trapping experiments

A 25 ml Schlenk tube equipped with a magnetic stirring bar was charged with **1a** (0.2 mmol), **2i** or **4a** (0.3 mmol), $Cu(OTf)_2$ (5 mol%), dtbpy (10mol%), MnO_2 (0.2 mmol), and TEMPO or BHT (0.4 mmol). The tube was evacuated twice and backfilled with nitrogen, and 2 mL DMF was added to the tube under nitrogen atmosphere. The tube was sealed with a nitrogen balloon and then the resulting mixture was heated in 120 ^oC stirring for 24 h. The cooled mixture was partitioned between water and ethyl acetate. The organic layer was separated, and the aqueous layer was extracted with ethyl acetate. The combined organic layers were dried over Na_2SO_4, and concentrated in vacuo. The residue was purified by flash chromatography using petroleum ether/ethyl acetate as eluent to affording the desired products.



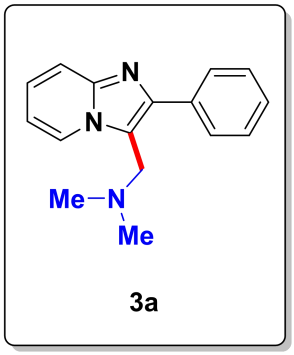
Stoichiometric reaction

A 25 ml Schlenk tube equipped with a magnetic stirring bar was charged with **1a** (0.2 mmol), **4a** (0.3 mmol), $Cu(OTf)_2$ (0.2 mmol), dtbpy (10mol%). The tube was evacuated twice and backfilled with nitrogen, and 2 mL DMF was added to the tube under nitrogen atmosphere. The tube was sealed with a nitrogen balloon and then the resulting mixture was heated in 120 °C stirring for 24 h. The cooled mixture was partitioned between water and ethyl acetate. The organic layer was separated, and the aqueous layer was extracted with ethyl acetate. The combined organic layers were dried over Na_2SO_4, and concentrated in vacuo. The residue was purified by flash chromatography using petroleum ether/ethyl acetate as eluent to affording the **5a** in 87% yield.



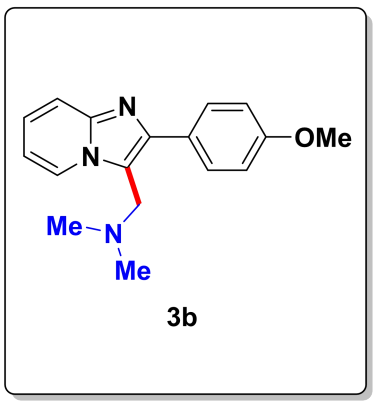
Characterization of products

Characterization data of compounds 3a-5ab



3a

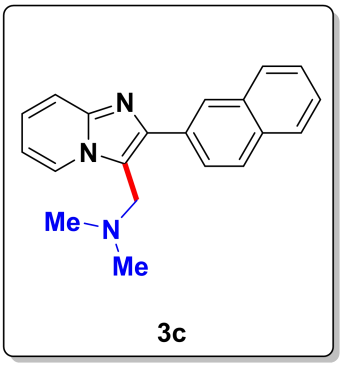
***N,N*-Dimethyl-1-(2-phenylimidazo[1,2-*a*]pyridin-3-yl) methanamine (3a).**[5] Eluent petroleum ether/ethyl acetate (1:1). Yellow oil, 44 mg, 87% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.35 (d, *J* = 6.8 Hz, 1H), 7.79 (d, *J* = 7.5 Hz, 2H), 7.60 (d, *J* = 9.0 Hz, 1H), 7.43 (t, *J* = 7.6 Hz, 2H), 7.33 (t, *J* = 7.3 Hz, 1H), 7.18 – 7.13 (m, 1H), 6.76 (t, *J* = 6.8 Hz, 1H), 3.84 (s, 2H), 2.21 (s, 6H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 145.0, 144.8, 134.6, 128.9, 128.4, 127.6, 125.4, 124.5, 117.3, 117.1, 111.8, 52.8, 45.0. HRMS calcd for $C_{16}H_{18}N_3^+$ $[M+H]^+$: 252.1495; found 252.1502.



3b

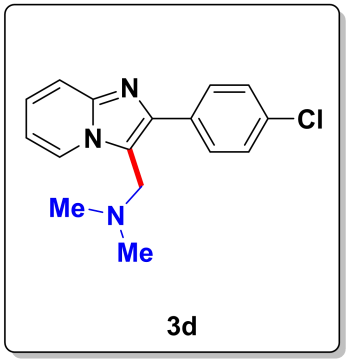
1-(2-(4-Methoxyphenyl)imidazo[1,2-*a*]pyridin-3-yl)-*N,N*-dimethylmethanamine (3b).[5] Eluent petroleum ether/ethyl acetate (1:1). Yellow solid, 50 mg, 89% yield. ^{1}H

NMR ($CDCl_3$, 500 MHz, ppm) δ 8.35 (d, J = 6.8 Hz, 1H), 7.73 (d, J = 7.6 Hz, 2H), 7.60 (d, J = 9.0 Hz, 1H), 7.17 (t, J = 7.8 Hz, 1H), 7.01 – 6.96 (m, 2H), 6.77 (t, J = 6.7 Hz, 1H), 3.84 (d, J = 2.4 Hz, 5H), 2.23 (d, J = 1.7 Hz, 6H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 159.4, 145.0, 144.8, 130.2, 127.3, 125.4, 124.5, 117.1, 116.9, 114.0, 111.9, 60.5, 55.4, 45.1. HRMS calcd for $C_{17}H_{20}N_3O^+$ $[M+H]^+$: 282.1601; found 282.1604.



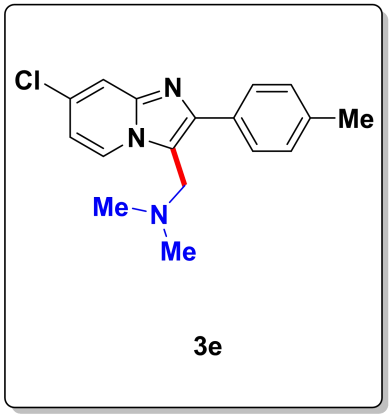
3c

***N,N*-Dimethyl-1-(2-(naphthalen-2-yl)imidazo[1,2-*a*]pyridin-3-yl)methanamine (3c).**[5] Eluent petroleum ether/ethyl acetate (1:1). Yellow solid, 45 mg, 75% yield. ^1H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.41 (d, J = 6.8 Hz, 1H), 8.29 (s, 1H), 7.98 (d, J = 8.4 Hz, 1H), 7.94-7.92 (m, 2H), 7.89 – 7.85 (m, 1H), 7.68 (d, J = 9.0 Hz, 1H), 7.53 – 7.47 (m, 2H), 7.25 – 7.20 (m, 1H), 6.83 (t, J = 6.7 Hz, 1H), 3.96 (s, 2H), 2.27 (s, 6H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 145.2, 144.8, 133.5, 132.9, 132.1, 128.4, 128.1, 128.0, 127.8, 127.0, 126.2, 126.2, 125.5, 124.8, 117.8, 117.3, 112.1, 53.0, 45.1. HRMS calcd for $C_{20}H_{20}N_3^+$ $[M+H]^+$: 302.1652; found 302.1650.



3d

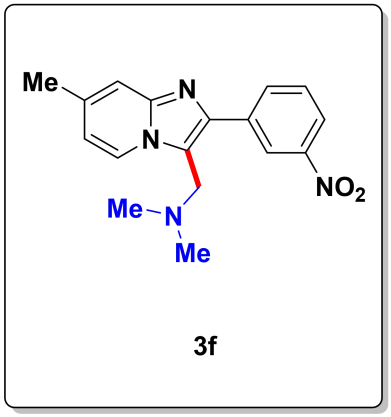
1-(2-(4-Chlorophenyl)imidazo[1,2-*a*]pyridin-3-yl)-*N*,*N*-dimethylmethanamine (3d).[5] Eluent petroleum ether/ethyl acetate (1:1). Light brown solid, 43 mg, 75% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.37 (d, J = 6.8 Hz, 1H), 7.76 (d, J = 8.5 Hz, 2H), 7.61 (d, J = 9.1 Hz, 1H), 7.42 (d, J = 8.4 Hz, 2H), 7.23–7.17 (m, 1H), 6.81 (t, J = 6.8 Hz, 1H), 3.84 (s, 2H), 2.23 (s, 6H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 145.1, 143.8, 133.7, 133.3, 130.2, 128.7, 125.4, 124.8, 117.6, 117.3, 112.1, 52.9, 45.1. HRMS calcd for $C_{16}H_{17}ClN_3^+$ $[M+H]^+$: 286.1106; found 286.1110.



3e

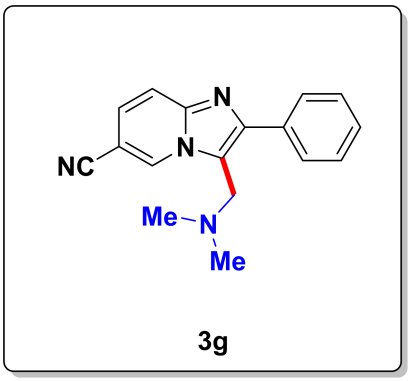
1-(7-Chloro-2-(p-tolyl)imidazo[1,2-*a*]pyridin-3-yl)-*N*,*N*-dimethylmethanamine (3e).[6] Eluent petroleum ether/ethyl acetate (2:1). Yellow oil, 48 mg, 80% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.36 (d, J = 7.3 Hz, 1H), 7.65 (d, J = 8.3 Hz, 2H), 7.61 (s, 1H), 7.29–7.23 (m, 2H), 6.78–6.76 (m, 1H), 3.86 (s, 2H), 2.40 (s, 3H), 2.23 (s, 6H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 145.7, 144.7, 137.8, 131.3, 131.0, 129.3,

128.8, 126.0, 117.3, 115.9, 113.3, 52.9, 45.0, 21.4. HRMS calcd for $C_{17}H_{19}ClN_3^+$ $[M+H]^+$: 300.1262; found 300.1269.



3f

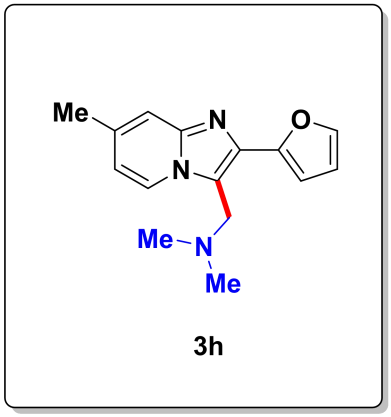
***N,N*-Dimethyl-1-(7-methyl-2-(3-nitrophenyl)imidazo[1,2-*a*]pyridin-3-yl)methanamine (3f).** Eluent petroleum ether/ethyl acetate (1:1). Yellow solid, 46 mg, 74% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.76 (s, 1H), 8.22 (t, *J* = 7.2 Hz, 2H), 8.18-8.16 (m, 1H), 7.59 (t, *J* = 7.9 Hz, 1H), 7.37 (s, 1H), 6.68–6.66 (m, 1H), 3.82 (s, 2H), 2.40 (s, 3H), 2.27 (s, 6H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 148.5, 145.6, 142.0, 136.7, 136.2, 134.6, 129.4, 124.4, 123.5, 122.2, 118.0, 115.9, 115.1, 52.7, 45.1, 21.5. HRMS calcd for $C_{17}H_{19}N_4O_2^+$ $[M+H]^+$: 311.1503; found 311.1506.



3g

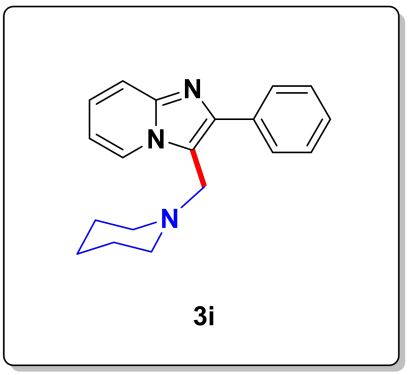
3-((Dimethylamino)methyl)-2-phenylimidazo[1,2-*a*]pyridine-6-carbonitrile (3g). Eluent petroleum ether/ethyl acetate (1:1). Brown solid, 23 mg, 41% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 9.02 (s, 1H), 7.76–7.73 (m, 2H), 7.68 (d, *J* = 9.3 Hz, 1H),

7.48 (t, J = 7.5 Hz, 2H), 7.41 (t, J = 7.4 Hz, 1H), 7.32–7.30 (m, 1H), 3.94 (s, 2H), 2.26 (s, 6H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 147.0, 144.3, 133.5, 132.7, 129.0, 128.8, 128.6, 124.4, 118.7, 118.2, 117.4, 97.9, 53.01, 45.1. HRMS calcd for $C_{17}H_{17}N_4^+$ $[M+H]^+$: 277.1448; found 277.1454.



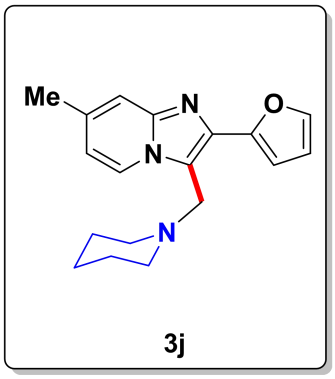
3h

1-(2-(Furan-2-yl)-7-methylimidazo[1,2-*a*]pyridin-3-yl)-*N*,*N*-dimethylmethanamine (3h). Eluent petroleum ether/ethyl acetate (1:1). Yellow solid, 32 mg, 63% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.18 (d, J = 6.9 Hz, 1H), 7.51 (s, 1H), 7.34 (s, 1H), 6.90 (d, J = 3.2 Hz, 1H), 6.64 (d, J = 6.9 Hz, 1H), 6.53 – 6.49 (m, 1H), 4.02 (s, 2H), 2.39 (s, 3H), 2.29 (s, 6H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 150.3, 146.0, 142.1, 136.3, 135.8, 124.5, 116.2, 115.5, 114.9, 111.5, 108.1, 52.4, 45.1, 21.5. HRMS calcd for $C_{15}H_{18}N_3O^+$ $[M+H]^+$: 256.1444; found 256.1451.



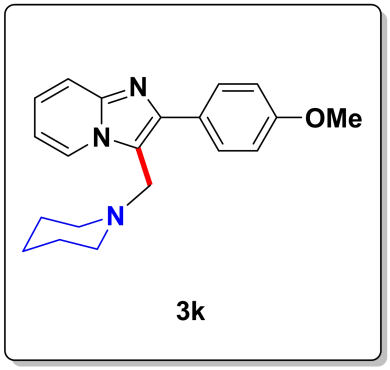
3i

2-Phenyl-3-(piperidin-1-ylmethyl) imidazo[1,2-*a*]pyridine (3i).[7] Eluent petroleum ether/ethyl acetate (1:1). Yellow oil, 44 mg, 76% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.47 (d, *J* = 6.8 Hz, 1H), 7.81 (d, *J* = 7.5 Hz, 2H), 7.61 (d, *J* = 9.0 Hz, 1H), 7.44 (t, *J* = 7.6 Hz, 2H), 7.34 (t, *J* = 7.3 Hz, 1H), 7.20 – 7.14 (m, 1H), 6.77 (t, *J* = 6.7 Hz, 1H), 3.89 (s, 2H), 2.40 (s, 4H), 1.54 – 1.48 (m, 4H), 1.41 (s, 2H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 145.1, 144.9, 134.8, 129.0, 128.5, 127.7, 125.8, 124.4, 117.2, 111.7, 54.3, 52.7, 26.1, 24.5. HRMS calcd for $C_{19}H_{22}N_3^+$ $[M+H]^+$: 292.1808; found 292.1816.



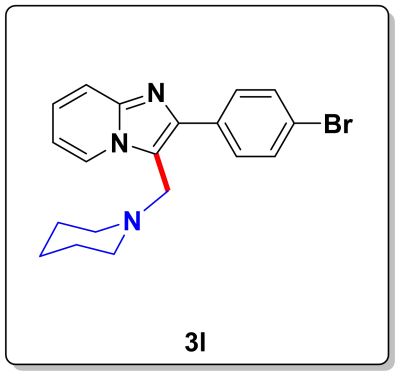
3j

2-(Furan-2-yl)-7-methyl-3-(piperidin-1-ylmethyl)imidazo[1,2-*a*]pyridine (3j). Eluent petroleum ether/ethyl acetate (3:1). Yellow solid, 51 mg, 86% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.26 (d, *J* = 7.0 Hz, 1H), 7.51 (s, 1H), 7.32 (s, 1H), 6.87 (d, *J* = 3.4 Hz, 1H), 6.63–6.61 (m, 1H), 6.51-6.50 (m, 1H), 4.02 (s, 2H), 2.44 (s, 4H), 2.39 (s, 3H), 1.54–1.50 (m, 4H), 1.43 (s, 2H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 150.4, 146.0, 142.0, 135.9, 124.9, 115.5, 114.6, 111.5, 107.9, 54.3, 52.2, 26.1, 24.5, 21.5. HRMS calcd for $C_{18}H_{22}N_3O^+$ $[M+H]^+$: 296.1757; found 296.1760.



3k

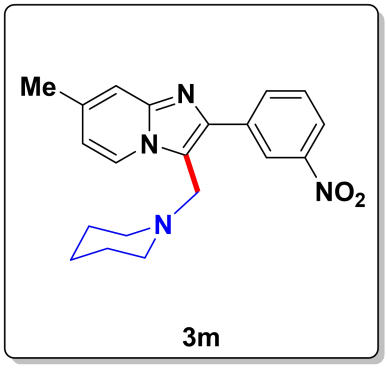
2-(4-Methoxyphenyl)-3-(piperidin-1-ylmethyl)imidazo[1,2-*a*]pyridine (3k).[8] Eluent petroleum ether/ethyl acetate (2:1). Yellow oil, 56 mg, 87% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.44 (d, J = 6.8 Hz, 1H), 7.75 (d, J = 8.6 Hz, 2H), 7.60 (d, J = 9.0 Hz, 1H), 7.19–7.14 (m, 1H), 6.98 (d, J = 8.6 Hz, 2H), 6.77 (t, J = 6.7 Hz, 1H), 3.88 (s, 2H), 3.84 (s, 3H), 2.40 (s, 4H), 1.54–1.49 (m, 4H), 1.41 (s, 2H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 159.3, 144.9, 144.7, 130.2, 127.3, 125.6, 124.3, 117.0, 116.5, 113.9, 111.6, 55.4, 54.3, 52.6, 26.1, 24.5. HRMS calcd for $C_{20}H_{24}N_3O^+$ $[M+H]^+$: 322.1914; found 322.1919.



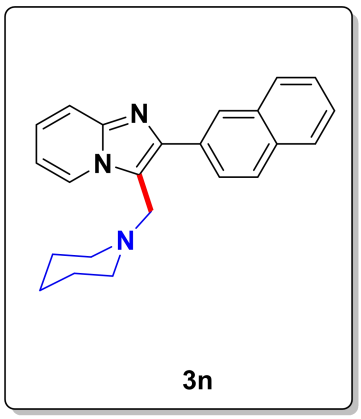
3l

2-(4-Bromophenyl)-3-(piperidin-1-ylmethyl)imidazo[1,2-*a*]pyridine (3l). Eluent petroleum ether/ethyl acetate (2:1). Yellow oil, 59 mg, 80% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.46 (d, J = 6.8 Hz, 1H), 7.73 (d, J = 8.3 Hz, 2H), 7.61 (d, J = 9.1 Hz, 1H), 7.58 (d, J = 8.4 Hz, 2H), 7.23–7.18 (m, 1H), 6.81 (t, J = 6.7 Hz, 1H), 3.87 (s, 2H), 2.40 (s, 4H), 1.56–1.51 (m, 4H), 1.43 (s, 2H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm)

δ 145.2, 143.8, 133.9, 132.5, 131.7, 130.6, 125.7, 124.7, 121.9, 117.3, 112.0, 54.4, 52.6, 26.2, 24.5. HRMS calcd for $C_{19}H_{21}BrN_3^+$ $[M+H]^+$: 370.0913; found 370.0920.

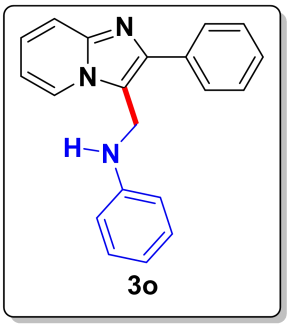


7-Methyl-2-(3-nitrophenyl)-3-(piperidin-1-ylmethyl)imidazo[1,2-*a*]pyridine (3m). Eluent petroleum ether/ethyl acetate (1:1). Yellow solid, 60 mg, 86% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.88 (s, 1H), 8.26 (t, *J* = 7.0 Hz, 2H), 8.16 (d, *J* = 8.1 Hz, 1H), 7.58 (t, *J* = 7.9 Hz, 1H), 7.36 (s, 1H), 6.67 (d, *J* = 7.0 Hz, 1H), 3.82 (s, 2H), 2.44 (s, 4H), 2.40 (s, 3H), 1.59–1.53 (m, 4H), 1.43 (s, 2H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 148.5, 145.6, 142.1, 136.8, 136.0, 134.5, 129.3, 124.3, 123.8, 122.1, 117.9, 115.8, 115.0, 54.3, 52.2, 26.1, 24.4, 21.5. HRMS calcd for $C_{20}H_{23}N_4O_2^+$ $[M+H]^+$: 351.1816; found 351.1827.



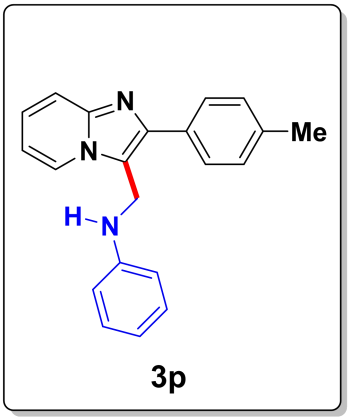
2-(Naphthalen-2-yl)-3-(piperidin-1-ylmethyl)imidazo[1,2-*a*]pyridine (3n). Eluent petroleum ether/ethyl acetate (1:1). Yellow oil, 60 mg, 88% yield. ^{1}H NMR ($CDCl_3$,

500 MHz, ppm) δ 8.48 (d, J = 6.9 Hz, 1H), 8.34 (s, 1H), 8.03–7.99 (m, 1H), 7.94–7.90 (m, 2H), 7.88–7.84 (m, 1H), 7.67 (d, J = 9.0 Hz, 1H), 7.51–7.46 (m, 2H), 7.23–7.18 (m, 1H), 6.80 (t, J = 6.8 Hz, 1H), 3.96 (s, 2H), 2.44 (s, 4H), 1.57–1.52 (m, 4H), 1.43 (s, 2H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 145.2, 144.9, 133.5, 132.9, 132.3, 128.4, 128.1, 128.0, 127.8, 127.0, 126.2, 126.1, 125.6, 124.5, 117.6, 117.2, 111.8, 54.4, 52.6, 26.2, 24.5. HRMS calcd for $C_{23}H_{24}N_3^+$ $[M+H]^+$: 342.1965; found 342.1970.



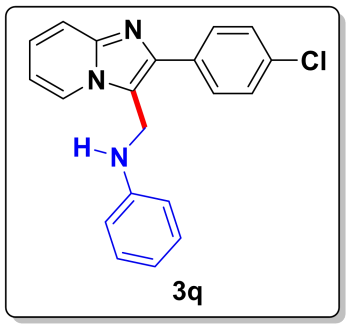
3o

***N*-((2-Phenylimidazo[1,2-*a*]pyridin-3-yl)methyl)aniline (3o).**[9] Eluent petroleum ether/ethyl acetate (5:1). Light yellow solid, 37 mg, 61% yield. ^{1}H NMR (DMSO-d6, 500 MHz, ppm) δ 8.34 (d, J = 6.8 Hz, 1H), 7.81 (d, J = 7.6 Hz, 2H), 7.65 (d, J = 9.0 Hz, 1H), 7.48 (t, J = 7.6 Hz, 2H), 7.38 (t, J = 7.3 Hz, 1H), 7.33–7.29 (m, 1H), 7.08 (t, J = 7.7 Hz, 2H), 6.97 (t, J = 6.7 Hz, 1H), 6.67 (d, J = 7.9 Hz, 2H), 6.59 (t, J = 7.2 Hz, 1H), 6.17 (br, t, J = 4.3 Hz, 1H), 4.63 (d, J = 4.5 Hz, 2H). ^{13}C NMR (DMSO-d6, 125 MHz, ppm) δ 148.5, 144.1, 143.2, 134.4, 128.9, 128.6, 128.1, 127.7, 125.1, 124.9, 117.5, 116.7, 116.3, 112.5, 112.2, 37.0. HRMS calcd for $C_{20}H_{18}N_3^+$ $[M+H]^+$: 300.1495; found 300.1498.



3p

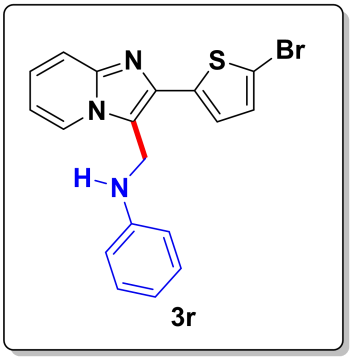
***N*-((2-(P-tolyl)imidazo[1,2-*a*]pyridin-3-yl)methyl)aniline (3p).**[9] Eluent petroleum ether/ethyl acetate (5:1). White solid, 53 mg, 84% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.10 (d, *J* = 6.8 Hz, 1H), 7.68 (d, *J* = 7.9 Hz, 3H), 7.28 (m, 2H), 7.26–7.22 (m, 3H), 6.83 (t, *J* = 7.0 Hz, 2H), 6.76 (d, *J* = 8.0 Hz, 2H), 4.69 (s, 2H), 3.82 (br, s, 1H), 2.39 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 147.7, 145.2, 144.8, 138.1, 131.0, 129.6, 128.4, 125.1, 124.2, 118.5, 117.6, 116.3, 113.3, 112.6, 38.4, 21.4. HRMS calcd for $C_{21}H_{20}N_3^+$ $[M+H]^+$: 314.1652; found 314.1654.



3q

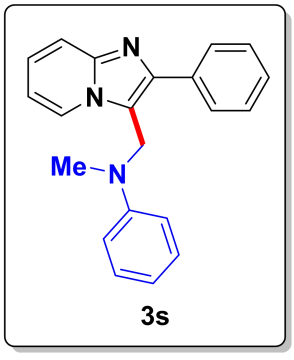
***N*-((2-(4-Chlorophenyl)imidazo[1,2-*a*]pyridin-3-yl)methyl)aniline (3q).**[9] Eluent petroleum ether/ethyl acetate (5:1). White solid, 50 mg, 75% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.05 (d, *J* = 6.8 Hz, 1H), 7.68 (d, *J* = 8.3 Hz, 2H), 7.64 (d, *J* = 9.1 Hz, 1H), 7.36 (d, *J* = 8.3 Hz, 2H), 7.30-7.21 (m, 3H), 6.86–6.76 (m, 4H), 4.63 (s, 2H), 4.01 (br, s, 1H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 147.6, 145.2, 143.5, 134.1,

132.4, 129.6, 129.5, 129.0, 125.3, 124.1, 118.6, 117.6, 116.6, 113.2, 112.8, 38.3. HRMS calcd for $C_{20}H_{17}ClN_3^+$ $[M+H]^+$: 334.1106; found 334.1115.



3r

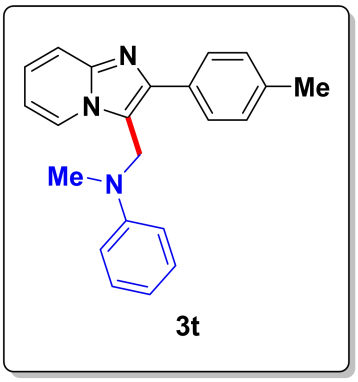
***N*-((2-(5-Bromothiophen-2-yl)imidazo[1,2-*a*]pyridin-3-yl)methyl)aniline (3r).** Eluent petroleum ether/ethyl acetate (5:1). White solid, 66 mg, 86% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 7.98 (d, J = 6.8 Hz, 1H), 7.53 (d, J = 9.0 Hz, 1H), 7.30 (t, J = 7.7 Hz, 2H), 7.19–7.15 (m, 1H), 7.00 (d, J = 3.8 Hz, 1H), 6.92 (d, J = 3.9 Hz, 1H), 6.86–6.82 (m, 3H), 6.76 (t, J = 6.7 Hz, 1H), 4.63 (s, 2H), 4.24 (br, s, 1H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 147.8, 145.1, 138.5, 138.0, 130.8, 129.6, 125.5, 125.2, 124.0, 118.5, 117.3, 115.8, 113.2, 112.9, 112.8, 38.0. HRMS calcd for $C_{18}H_{15}BrN_3S^+$ $[M+H]^+$: 384.0165; found 384.0170.



3s

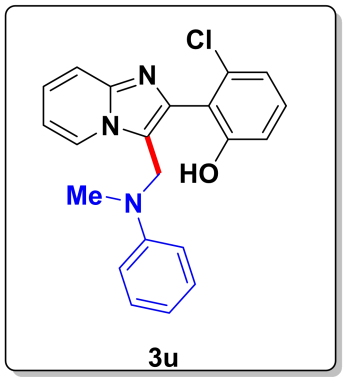
***N*-Methyl-*N*-((2-phenylimidazo[1,2-*a*]pyridin-3-yl)methyl)aniline (3s).**[10] Eluent petroleum ether/ethyl acetate (5:1). Yellow oil, 43 mg, 73% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.06 (d, J = 6.8 Hz, 1H), 7.80 (d, J = 7.5 Hz, 2H), 7.69 (d, J = 9.0

Hz, 1H), 7.47 (t, *J* = 7.6 Hz, 2H), 7.39 (t, *J* = 7.4 Hz, 1H), 7.32 (t, *J* = 7.8 Hz, 2H), 7.25–7.21 (m, 1H), 6.99 (d, *J* = 8.2 Hz, 2H), 6.88 (t, *J* = 7.3 Hz, 1H), 6.78 (t, *J* = 6.8 Hz, 1H), 4.83 (s, 2H), 2.70 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 150.4, 145.6, 145.3, 134.2, 129.5, 128.8, 128.7, 128.1, 124.9, 124.7, 118.7, 117.5, 116.3, 114.6, 112.6, 46.0, 36.2. HRMS calcd for $C_{21}H_{20}N_3^+$ $[M+H]^+$: 314.1652; found 314.1655.



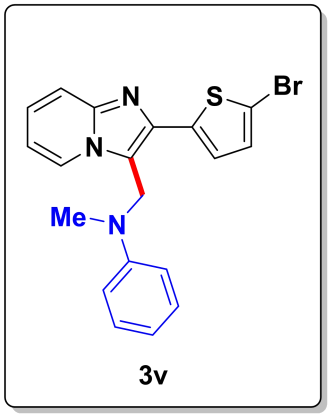
3t

***N*-Methyl-*N*-((2-(p-tolyl)imidazo[1,2-*a*]pyridin-3-yl)methyl)aniline (3t).** Eluent petroleum ether/ethyl acetate (5:1). Yellow oil, 52 mg, 80% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.03 (d, *J* = 6.8 Hz, 1H), 7.67-7.65 (m, *J* = 8.4, 5.2 Hz, 3H), 7.31–7.29 (m, 2H), 7.24 (d, *J* = 2.8 Hz, 2H), 7.22–7.18 (m, 1H), 6.97 (d, *J* = 8.2 Hz, 2H), 6.85 (t, *J* = 7.3 Hz, 1H), 6.75 (t, *J* = 6.8 Hz, 1H), 4.80 (s, 2H), 2.68 (s, 3H), 2.39 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 150.5, 145.8, 145.3, 137.9, 131.4, 129.5, 129.4, 128.7, 124.8, 124.6, 118.7, 117.5, 116.1, 114.6, 112.5, 46.1, 36.2, 21.4. HRMS calcd for $C_{22}H_{22}N_3^+$ $[M+H]^+$: 328.1808; found 328.1819.



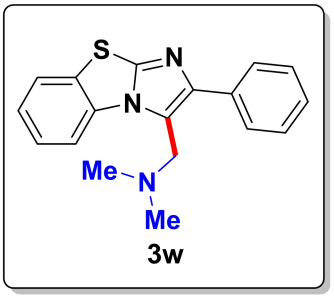
3u

3-Chloro-2-(3-((methyl(phenyl)amino)methyl)imidazo[1,2-*a*]pyridin-2-yl)phenol (3u). Eluent petroleum ether/ethyl acetate (8:1). Yellow oil, 31 mg, 43% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.11 (d, *J* = 6.8 Hz, 1H), 7.65-7.63 (m, 2H), 7.38–7.30 (m, 3H), 7.21–7.19 (m, 1H), 7.04–7.02 (m, 3H), 6.94–6.87 (m, 2H), 4.88 (s, 2H), 2.75 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 156.4, 150.3, 143.4, 142.2, 129.7, 129.6, 127.2, 126.0, 124.5, 123.8, 119.6, 119.2, 118.4, 116.9, 116.4, 115.3, 113.6, 46.6, 36.8. HRMS calcd for $C_{21}H_{19}ClN_3O^+$ $[M+H]^+$: 364.1211; found 364.1216.



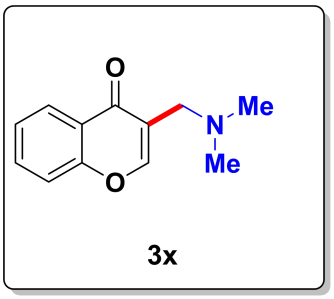
3v

***N*-((2-(5-Bromothiophen-2-yl)imidazo[1,2-*a*]pyridin-3-yl)methyl)-*N*-methylanilin e (3v).** Eluent petroleum ether/ethyl acetate (5:1). Light yellow solid, 60 mg, 75% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 7.99 (d, J = 6.9 Hz, 1H), 7.62 (d, J = 9.2 Hz, 1H), 7.34 (t, J = 7.9 Hz, 2H), 7.24–7.20 (m, 2H), 7.05 (d, J = 3.9 Hz, 1H), 7.02 (d, J = 8.2 Hz, 2H), 6.90 (t, J = 7.3 Hz, 1H), 6.77 (t, J = 6.8 Hz, 1H), 4.81 (s, 2H), 2.70 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 150.4, 145.3, 139.0, 138.9, 130.7, 129.6, 125.6, 125.4, 124.6, 119.1, 117.4, 115.9, 114.9, 113.0, 112.9, 46.1, 36.7. HRMS calcd for $C_{19}H_{17}BrN_3S^+$ $[M+H]^+$: 398.0321; found 398.0328.



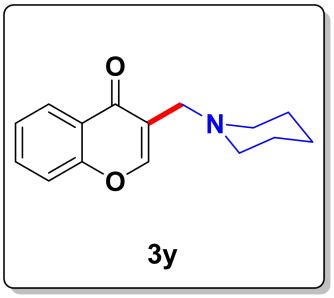
3w

***N,N*-Dimethyl-1-(2-phenylbenzo[d]imidazo[2,1-*b*]thiazol-3-yl)methanamine (3w).**[11] Eluent petroleum ether/ethyl acetate (8:1). Red solid, 25 mg, 41% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.06 (d, J = 8.2 Hz, 1H), 7.72 (d, J = 7.5 Hz, 2H), 7.67 (d, J = 7.9 Hz, 1H), 7.44 (t, J = 6.7 Hz, 3H), 7.37–7.29 (m, 2H), 3.92 (s, 2H), 2.32 (s, 6H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 147.9, 146.5, 134.6, 133.7, 130.4, 128.7, 128.5, 127.5, 126.2, 124.5, 123.9, 122.4, 115.5, 52.8, 44.8. HRMS calcd for $C_{18}H_{18}N_3S^+$ $[M+H]^+$: 308.1216; found 308.1227.



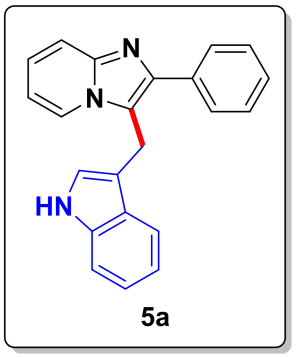
3x

3-((Dimethylamino)methyl)-4*H*-chromen-4-one (3x). Eluent petroleum ether/ethyl acetate (1:1). Yellow solid, 30 mg, 73% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.22 (d, J = 7.9 Hz, 1H), 7.95 (s, 1H), 7.64 (t, J = 7.7 Hz, 1H), 7.44 (d, J = 8.4 Hz, 1H), 7.38 (t, J = 7.5 Hz, 1H), 3.39 (s, 2H), 2.30 (s, 6H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 177.6, 156.5, 154.7, 133.6, 126.1, 125.1, 124.1, 121.1, 118.2, 53.7, 45.5. HRMS calcd for $C_{12}H_{14}NO_2^+$ $[M+H]^+$: 204.1019; found 204.1024.



3y

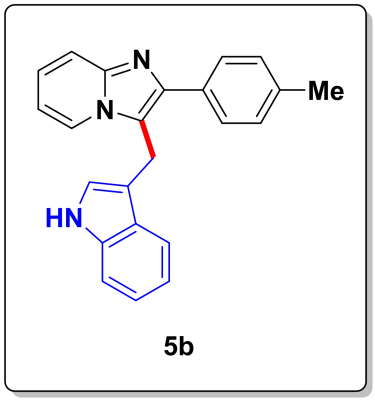
3-(Piperidin-1-ylmethyl)-4*H*-chromen-4-one (3y). Eluent petroleum ether/ethyl acetate (1:1). Yellow oil, 28 mg, 58% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.24-8.22 (m, 1H), 8.00 (s, 1H), 7.67–7.63 (m, 1H), 7.45 (d, J = 8.4 Hz, 1H), 7.39 (t, J = 7.5 Hz, 1H), 3.46 (s, 2H), 2.49 (s, 4H), 1.63–1.57 (m, 4H), 1.46–1.42 (m, 2H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 178.0, 156.6, 154.7, 133.5, 126.1, 125.1, 124.0, 120.8, 118.2, 54.7, 53.2, 26.1, 24.3. HRMS calcd for $C_{15}H_{18}NO_2^+$ $[M+H]^+$: 244.1332; found 244.1338.



5a

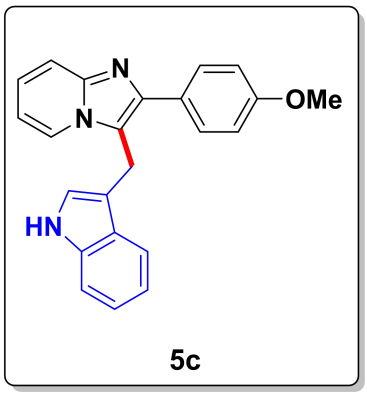
3-((1*H*-Indol-3-yl)methyl)-2-phenylimidazo[1,2-*a*]pyridine (5a).[12] Eluent petroleum ether/ethyl acetate (2:1). White solid, 56 mg, 86% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.60 (s, 1H), 7.83 (d, *J* = 7.4 Hz, 2H), 7.78 (d, *J* = 6.7 Hz, 1H), 7.68–7.64 (m, 2H), 7.38 (t, *J* = 6.9 Hz, 3H), 7.31 (t, *J* = 7.2 Hz, 1H), 7.26–7.24 (m, 1H), 7.19–7.14 (m, 2H), 6.66 (t, *J* = 6.6 Hz, 1H), 6.57 (s, 1H), 4.54 (s, 2H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 144.9, 143.2, 136.9, 134.6, 128.8, 128.3, 127.8, 127.1,

124.3, 123.9, 122.6, 122.2, 119.8, 118.7, 118.4, 117.4, 112.2, 111.6, 111.2, 20.8. HRMS calcd for $C_{22}H_{18}N_3^+$ $[M+H]^+$: 324.1495; found 324.1498.



5b

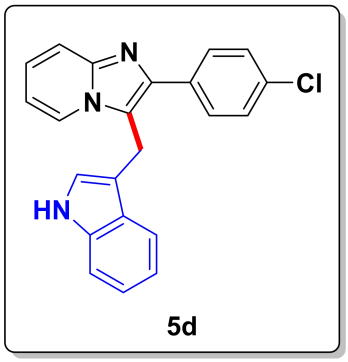
3-((1*H*-Indol-3-yl)methyl)-2-(p-tolyl)imidazo[1,2-*a*]pyridine (5b). Eluent petroleum ether/ethyl acetate (1:1). White solid, 55 mg, 82% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.42 (s, 1H), 7.77 (d, *J* = 6.9 Hz, 1H), 7.73 (d, *J* = 8.0 Hz, 2H), 7.68–7.64 (m, 2H), 7.39 (d, *J* = 8.1 Hz, 1H), 7.25 (t, *J* = 7.5 Hz, 1H), 7.21–7.13 (m, 4H), 6.66 (t, *J* = 6.6 Hz, 1H), 6.60 (s, 1H), 4.53 (s, 2H), 2.36 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 144.9, 143.4, 137.5, 136.9, 131.8, 129.5, 128.2, 127.1, 124.0, 123.8, 122.6, 122.2, 119.8, 118.8, 118.0, 117.4, 112.0, 111.6, 111.3, 21.4, 20.9. HRMS calcd for $C_{23}H_{20}N_3^+$ $[M+H]^+$: 338.1652; found 338.1658.



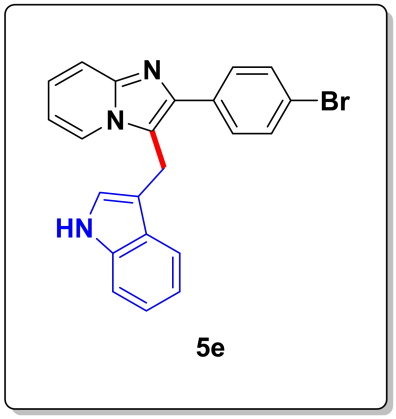
5c

3-((1*H*-Indol-3-yl)methyl)-2-(4-methoxyphenyl)imidazo[1,2-*a*]pyridine (5c). Eluent petroleum ether/ethyl acetate (2:1). Yellow solid, 56 mg, 79% yield. ^{1}H NMR

($CDCl_3$, 500 MHz, ppm) δ 8.55 (s, 1H), 7.76–7.73 (m, 3H), 7.68–7.64 (m, 2H), 7.38 (d, J = 8.1 Hz, 1H), 7.24 (d, J = 7.8 Hz, 1H), 7.19–7.12 (m, 2H), 6.92 (d, J = 8.7 Hz, 2H), 6.65 (t, J = 6.7 Hz, 1H), 6.56 (s, 1H), 4.50 (s, 2H), 3.80 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 159.5, 144.6, 142.8, 136.9, 129.5, 127.0, 126.9, 124.3, 123.8, 122.5, 122.2, 119.7, 118.6, 117.7, 117.0, 114.3, 112.2, 111.6, 111.0, 55.4, 20.8. HRMS calcd for $C_{23}H_{20}N_3O^+$ $[M+H]^+$: 354.1601; found 354.1606.

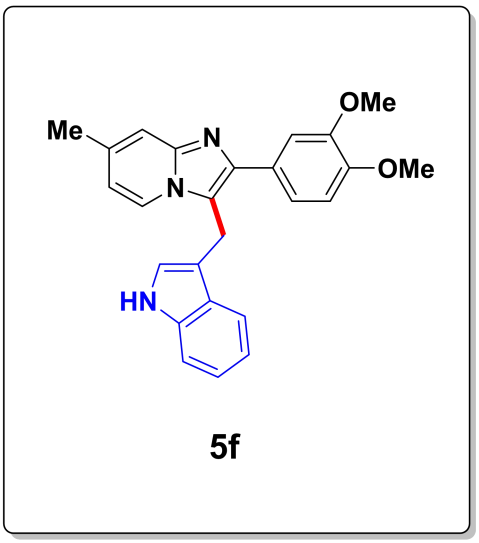


3-((1*H*-Indol-3-yl)methyl)-2-(4-chlorophenyl)imidazo[1,2-*a*]pyridine (5d). Eluent petroleum ether/ethyl acetate (2:1). White solid, 60 mg, 84% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 10.89 (s, 1H), 8.18 (d, J = 6.8 Hz, 1H), 7.86 (d, J = 8.3 Hz, 2H), 7.61 (d, J = 9.0 Hz, 1H), 7.52 (d, J = 8.3 Hz, 2H), 7.34–7.30 (m, 2H), 7.26–7.22 (t, J = 15.7 Hz 1H), 7.06 (t, J = 7.5 Hz, 1H), 6.91 (m, 2H), 6.85 (t, J = 6.7 Hz, 1H), 4.59 (s, 2H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 143.9, 140.3, 136.6, 133.8, 132.1, 129.3, 128.7, 126.6, 124.6, 124.4, 122.8, 121.3, 119.3, 118.6, 118.2, 116.8, 112.1, 111.6, 109.4, 20.8. HRMS calcd for $C_{22}H_{17}ClN_3^+$ $[M+H]^+$: 358.1106; found 358.1112.



5e

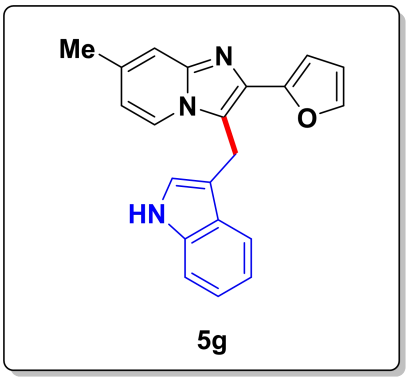
3-((1*H*-Indol-3-yl)methyl)-2-(4-bromophenyl)imidazo[1,2-*a*]pyridine (5e). Eluent petroleum ether/ethyl acetate (2:1). White solid, 52 mg, 65% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 10.89 (s, 1H), 8.17 (d, J = 6.8 Hz, 1H), 7.80 (d, J = 8.4 Hz, 2H), 7.63 (m, 3H), 7.35-7.30 (m, 2H), 7.26–7.22 (m, 1H), 7.06 (t, J = 7.5 Hz, 1H), 6.94–6.88 (m, 2H), 6.85 (t, J = 6.8 Hz, 1H), 4.58 (s, 2H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 143.8, 140.3, 136.6, 134.1, 131.6, 129.7, 126.6, 124.6, 124.5, 122.8, 121.3, 120.7, 119.3, 118.6, 118.2, 116.8, 112.1, 111.6, 109.4, 20.0. HRMS calcd for $C_{22}H_{17}BrN_3^+$ $[M+H]^+$: 402.0600; found 402.0606.



5f

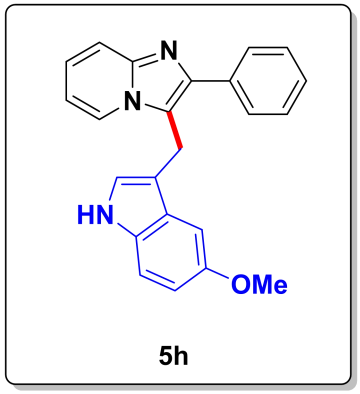
3-((1*H*-Indol-3-yl)methyl)-2-(3,4-dimethoxyphenyl)-7-methylimidazo[1,2-*a*]pyridine (5f). Eluent petroleum ether/ethyl acetate (1:1). White solid, 64 mg, 80% yield. ^{1}H

NMR ($CDCl_3$, 500 MHz, ppm) δ 8.65 (s, 1H), 7.68–7.64 (m, 2H), 7.45 (s, 1H), 7.42–7.36 (m, 2H), 7.27–7.22 (m, 2H), 7.16 (t, *J* = 7.4 Hz, 1H), 6.82 (d, *J* = 8.3 Hz, 1H), 6.59 (s, 1H), 6.50 (d, *J* = 6.9 Hz, 1H), 4.50 (s, 2H), 3.85 (s, 3H), 3.74 (s, 3H), 2.36 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 149.2, 148.7, 145.1, 142.6, 136.9, 135.2, 127.6, 127.0, 123.0, 122.5, 122.2, 120.4, 119.7, 118.7, 117.3, 115.6, 114.7, 111.6, 111.5, 111.4, 111.2, 56.0, 55.8, 21.4, 20.8. HRMS calcd for $C_{25}H_{24}N_3O_2^+$ $[M+H]^+$: 398.1863; found 398.1870.



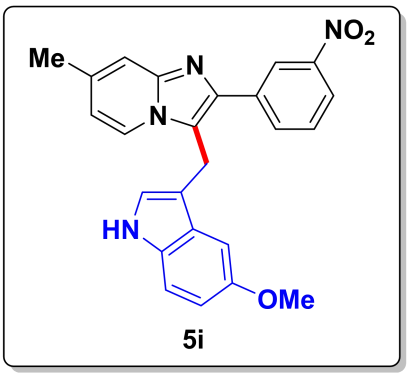
5g

3-((1*H*-Indol-3-yl)methyl)-2-(furan-2-yl)-7-methylimidazo[1,2-*a*]pyridine (5g). Eluent petroleum ether/ethyl acetate (2:1). White solid, 52 mg, 80% yield. ^1H NMR (DMSO-d_6, 500 MHz, ppm) δ 10.87 (s, 1H), 8.11 (d, *J* = 7.0 Hz, 1H), 7.81 (s, 1H), 7.32–7.28 (m, 3H), 7.11 (d, *J* = 1.1 Hz, 1H), 7.02 (t, *J* = 7.6 Hz, 1H), 6.86–6.83 (m, 2H), 6.67–6.63 (m, 2H), 4.69 (s, 2H), 2.29 (s, 3H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 150.6, 144.5, 142.6, 136.5, 135.0, 133.0, 126.7, 123.8, 123.3, 121.1, 118.5, 118.4, 118.3, 114.8, 114.4, 111.7, 111.5, 109.6, 107.4, 20.7, 19.6. HRMS calcd for $C_{21}H_{18}N_3O^+$ $[M+H]^+$: 328.1444; found 328.1452.



5h

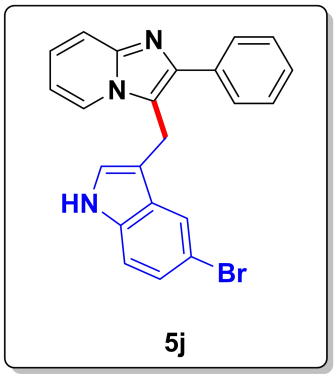
3-((5-Methoxy-1*H*-indol-3-yl)methyl)-2-phenylimidazo[1,2-*a*]pyridine (5h).[12] Eluent petroleum ether/ethyl acetate (2:1). Yellow solid, 45 mg, 63% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 8.59 (s, 1H), 7.84–7.80 (m, 3H), 7.68 (d, *J* = 9.0 Hz, 1H), 7.39 (t, *J* = 7.5 Hz, 2H), 7.33 (d, *J* = 7.4 Hz, 1H), 7.24 (d, *J* = 8.8 Hz, 1H), 7.21–7.10 (m, 1H), 6.99 (s, 1H), 6.89-6.87 (m, 1H), 6.67 (t, *J* = 6.7 Hz, 1H), 6.59 (s, 1H), 4.50 (s, 2H), 3.80 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 154.2, 144.8, 143.0, 134.5, 132.0, 128.8, 128.4, 127.8, 127.3, 124.4, 123.9, 122.9, 118.5, 117.3, 112.8, 112.3, 112.2, 110.5, 100.3, 56.0, 20.8. HRMS calcd for $C_{23}H_{20}N_3O^+$ $[M+H]^+$: 354.1601; found 354.1604.



5i

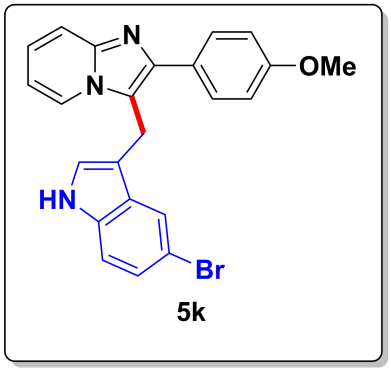
3-((5-Methoxy-1*H*-indol-3-yl)methyl)-7-methyl-2-(3-nitrophenyl)imidazo[1,2-*a*]pyridine (5i). Eluent petroleum ether/ethyl acetate (2:1). Yellow solid, 37 mg, 45% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 10.73 (s, 1H), 8.69 (s, 1H), 8.29 (d, *J* = 7.7 Hz, 1H), 8.18 (d, *J* = 7.3 Hz, 2H), 7.74 (t, *J* = 8.0 Hz, 1H), 7.42 (s, 1H), 7.21 (d, *J*

= 8.4 Hz, 1H), 6.97 (s, 1H), 6.75 (d, *J* = 7.0 Hz, 1H), 6.68 (d, *J* = 8.3 Hz, 2H), 4.60 (s, 2H), 3.53 (s, 3H), 2.34 (s, 3H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 153.0, 148.2, 144.4, 138.6, 136.8, 135.4, 133.5, 131.6, 130.3, 126.8, 124.1, 123.6, 121.9, 121.8, 119.9, 115.2, 114.9, 112.3, 111.5, 109.1, 99.8, 54.9, 20.8, 20.0. HRMS calcd for $C_{24}H_{21}N_4O_3^+$ $[M+H]^+$: 413.1608; found 413.1609.



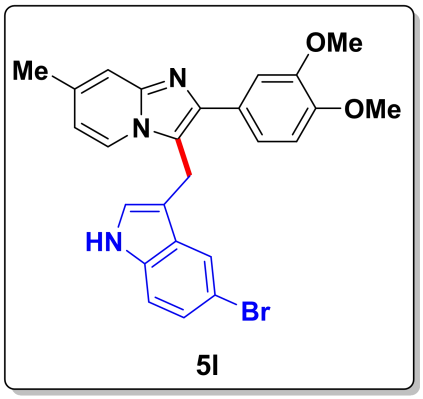
5j

3-((5-Bromo-1*H*-indol-3-yl)methyl)-2-phenylimidazo[1,2-*a*]pyridine (5j). Eluent petroleum ether/ethyl acetate (2:1). White solid, 70 mg, 87% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 11.08 (s, 1H), 8.20 (d, *J* = 6.7 Hz, 1H), 7.83 (d, *J* = 7.5 Hz, 2H), 7.62 (d, *J* = 9.0 Hz, 1H), 7.49–7.45 (m, 3H), 7.37 (t, *J* = 7.4 Hz, 1H), 7.30 (d, *J* = 8.6 Hz, 1H), 7.26–7.21 (m, 1H), 7.17–7.15 (m, 1H), 6.99 (s, 1H), 6.86 (t, *J* = 6.7 Hz, 1H), 4.58 (s, 2H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 143.8, 141.6, 135.2, 134.8, 128.7, 128.4, 127.8, 127.5, 124.5, 124.4, 124.2, 123.7, 120.8, 118.6, 116.7, 113.5, 112.0, 111.2, 109.6, 19.7. HRMS calcd for $C_{22}H_{17}BrN_3^+$ $[M+H]^+$: 402.0600; found 402.0603.



5k

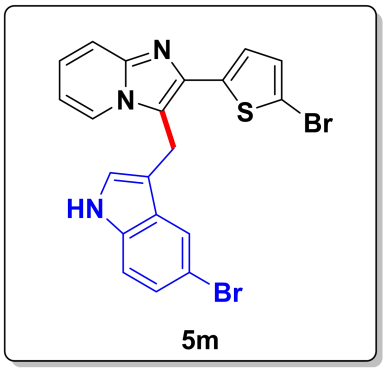
3-((5-Bromo-1*H*-indol-3-yl)methyl)-2-(4-methoxyphenyl)imidazo[1,2-*a*]pyridine (5k). Eluent petroleum ether/ethyl acetate (2:1). White solid, 74 mg, 85% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 11.07 (s, 1H), 8.18 (d, *J* = 6.8 Hz, 1H), 7.75 (d, *J* = 8.7 Hz, 2H), 7.58 (d, *J* = 9.1 Hz, 1H), 7.44 (s, 1H), 7.29 (d, *J* = 8.6 Hz, 1H), 7.24–7.19 (m, 1H), 7.17-7.15 (m, 1H), 7.04 (d, *J* = 8.6 Hz, 2H), 6.98 (s, 1H), 6.83 (t, *J* = 6.7 Hz, 1H), 4.54 (s, 2H), 3.78 (s, 3H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 158.8, 143.7, 141.6, 135.2, 129.0, 128.5, 127.2, 124.4, 124.4, 124.0, 123.7, 120.8, 117.8, 116.5, 114.2, 113.5, 111.8, 111.2, 109.7, 55.1, 19.7. HRMS calcd for $C_{23}H_{19}BrN_3O^+$ $[M+H]^+$: 432.0706; found 432.0711.



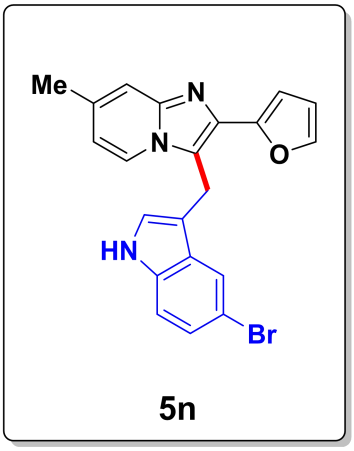
5l

3-((5-Bromo-1*H*-indol-3-yl)methyl)-2-(3,4-dimethoxyphenyl)-7-methylimidazo[1,2-*a*]pyridine (5l). Eluent petroleum ether/ethyl acetate (1:1). Brown solid, 80 mg, 84% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 11.09 (s, 1H), 8.12 (d, *J* = 6.7 Hz, 1H), 7.47–7.35 (m, 3H), 7.30 (d, *J* = 8.3 Hz, 2H), 7.16 (d, *J* = 8.3 Hz, 1H), 7.04–7.01

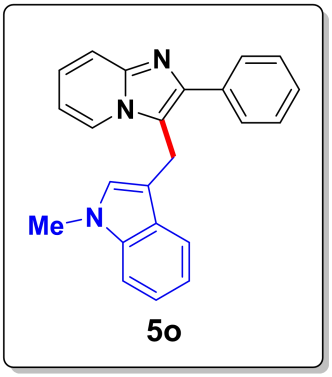
(m, 2H), 6.69 (d, J = 6.5 Hz, 1H), 4.53 (s, 2H), 3.78 (s, 3H), 3.72 (s, 3H), 2.34 (s, 3H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 148.9, 148.3, 144.0, 141.3, 135.2, 134.4, 128.5, 127.7, 124.5, 123.7, 120.9, 119.8, 117.4, 114.8, 114.3, 113.5, 111.9, 111.4, 111.2, 110.0, 55.5, 55.3, 20.8, 19.8. HRMS calcd for $C_{25}H_{23}BrN_3O_2^+$ $[M+H]^+$: 476.0968; found 476.0973.



3-((5-Bromo-1*H*-indol-3-yl)methyl)-2-(5-bromothiophen-2-yl)imidazo[1,2-*a*]pyridine (5m). Eluent petroleum ether/ethyl acetate (2:1). Red solid, 87 mg, 89% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 11.09 (s, 1H), 8.28 (d, J = 6.8 Hz, 1H), 7.58 (d, J = 9.0 Hz, 1H), 7.52 (s, 1H), 7.31–7.24 (m, 4H), 7.17-7.15 (m, 1H), 7.02 (s, 1H), 6.88 (t, J = 6.5 Hz, 1H), 4.60 (s, 2H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 143.8, 140.1, 135.4, 135.2, 131.4, 128.4, 124.9, 124.6, 123.70, 120.8, 118.4, 116.5, 113.6, 112.4, 111.3, 111.2, 109.1, 19.5. HRMS calcd for $C_{20}H_{14}Br_2N_3S^+$ $[M+H]^+$: 485.9270; found 485.9276.

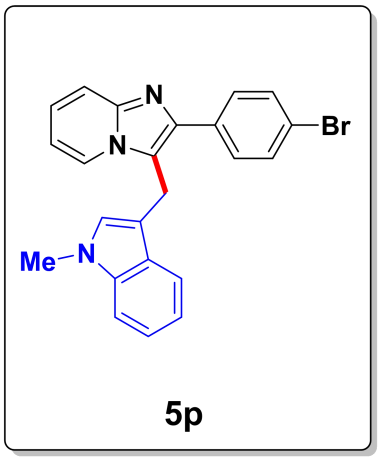


3-((5-Bromo-1*H*-indol-3-yl)methyl)-2-(furan-2-yl)-7-methylimidazo[1,2-*a*]pyridin e (5n). Eluent petroleum ether/ethyl acetate (2:1). White solid, 66 mg, 81% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 11.08 (s, 1H), 8.14 (d, *J* = 7.0 Hz, 1H), 7.82 (s, 1H), 7.47 (d, *J* = 1.1 Hz, 1H), 7.31–7.27 (m, 2H), 7.17 (d, *J* = 1.5 Hz, 1H), 7.14-7.12 (m, 1H), 6.87 (d, *J* = 3.2 Hz, 1H), 6.68 (d, *J* = 7.0 Hz, 1H), 6.66-6.65 (m, 1H), 4.66 (s, 2H), 2.30 (s, 3H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 150.4, 144.5, 142.6, 135.1, 135.1, 133.1, 128.5, 124.9, 123.8, 123.6, 120.8, 118.0, 114.8, 114.5, 113.5, 111.7, 111.1, 109.6, 107.5, 20.8, 19.3. HRMS calcd for $C_{21}H_{17}BrN_3O^+$ $[M+H]^+$: 406.0550; found 406.0552 .



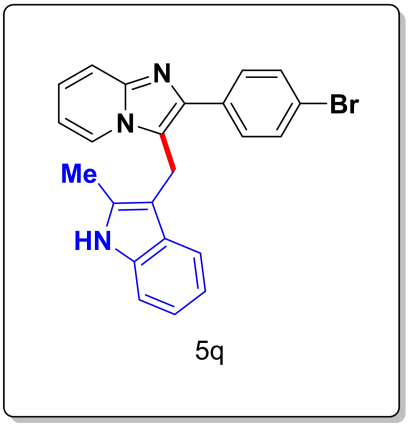
3-((1-Methyl-1*H*-indol-3-yl)methyl)-2-phenylimidazo[1,2-*a*]pyridine (5o).[12] Eluent petroleum ether/ethyl acetate (2:1). Yellow solid, 39 mg, 58% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 7.86 (d, *J* = 7.6 Hz, 2H), 7.81 (d, *J* = 6.8 Hz, 1H), 7.71 (d, *J* = 9.0

Hz, 1H), 7.66 (d, J = 7.9 Hz, 1H), 7.42 (t, J = 7.5 Hz, 2H), 7.36–7.28 (m, 3H), 7.19 (t, J = 7.6 Hz, 2H), 6.70 (t, J = 6.7 Hz, 1H), 6.51 (s, 1H), 4.55 (s, 2H), 3.67 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 144.9, 143.3, 137.6, 134.7, 128.8, 128.3, 127.8, 127.5, 126.8, 124.1, 123.9, 122.2, 119.3, 118.9, 118.4, 117.6, 112.1, 109.7, 109.6, 32.9, 20.8. HRMS calcd for $C_{23}H_{20}N_3^+$ $[M+H]^+$: 338.1652; found 338.1655.

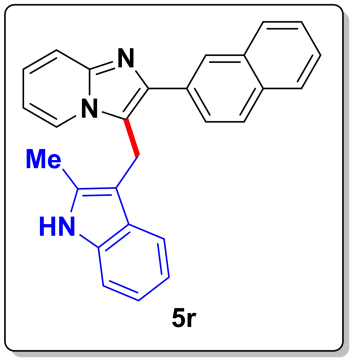


5p

2-(4-Bromophenyl)-3-((1-methyl-1*H*-indol-3-yl)methyl)imidazo[1,2-*a*]pyridine (5p). Eluent petroleum ether/ethyl acetate (2:1). Yellow solid, 54 mg, 65% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 7.81 (d, J = 6.9 Hz, 1H), 7.74–7.62 (m, 4H), 7.53 (d, J = 8.3 Hz, 2H), 7.36–7.29 (m, 2H), 7.21-7.17 (m, 2H), 6.71 (t, J = 6.7 Hz, 1H), 6.48 (s, 1H), 4.52 (s, 2H), 3.67 (s, 3H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 145.0, 142.2, 137.6, 133.7, 131.9, 129.8, 127.4, 126.7, 124.4, 123.9, 122.3, 121.9, 119.4, 118.8, 118.7, 117.6, 116.0, 112.3, 111.9, 109.7, 109.4, 32.9, 20.8. HRMS calcd for $C_{23}H_{19}BrN_3^+$ $[M+H]^+$: 416.0757; found 416.0760.

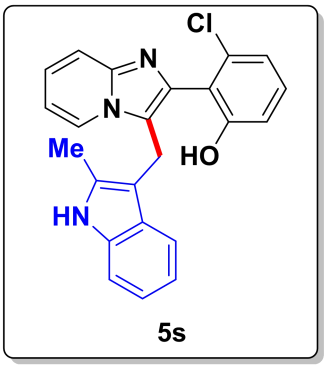


2-(4-Bromophenyl)-3-((2-methyl-1*H*-indol-3-yl)methyl)imidazo[1,2-*a*]pyridine (5q). Eluent petroleum ether/ethyl acetate (2:1). White solid, 74 mg, 89% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 10.88 (s, 1H), 7.94 (d, *J* = 6.8 Hz, 1H), 7.81 (d, *J* = 8.3 Hz, 2H), 7.65 (d, *J* = 8.3 Hz, 2H), 7.60 (d, *J* = 9.0 Hz, 1H), 7.23–7.17 (m, 2H), 6.90 (t, *J* = 7.5 Hz, 1H), 6.81–6.77 (m, 2H), 6.70 (t, *J* = 7.4 Hz, 1H), 4.54 (s, 2H), 2.18 (s, 3H).^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 143.7, 140.6, 135.2, 134.2, 132.4, 131.6, 130.0, 127.8, 124.4, 120.7, 120.1, 119.4, 118.4, 116.9, 116.8, 112.1, 110.6, 104.1, 19.6, 11.2. HRMS calcd for $C_{23}H_{19}BrN_3^+$ $[M+H]^+$: 416.0757; found 416.0766.

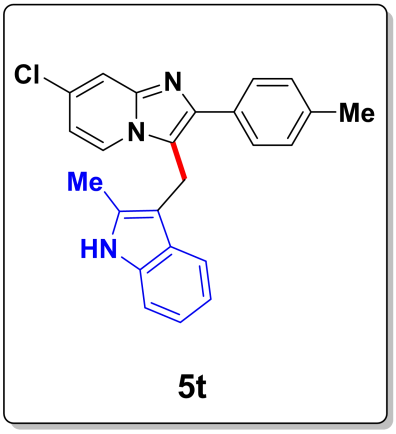


3-((2-Methyl-1*H*-indol-3-yl)methyl)-2-(naphthalen-2-yl)imidazo[1,2-*a*]pyridine (5r). Eluent petroleum ether/ethyl acetate (2:1). White solid, 71 mg, 91% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 10.87 (s, 1H), 8.38 (s, 1H), 8.09 (d, *J* = 8.5 Hz,

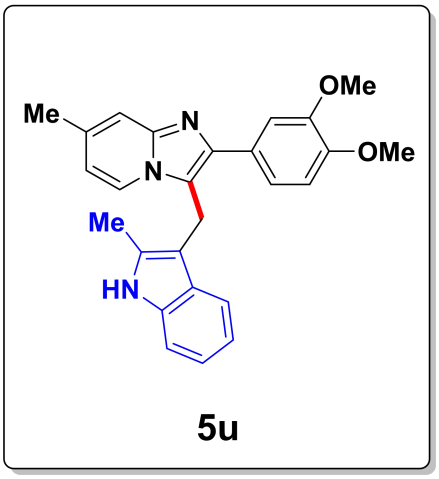
1H), 8.01 (t, J = 7.5 Hz, 2H), 7.94-7.91 (m, 2H), 7.64 (d, J = 9.1 Hz, 1H), 7.52–7.50 (m, 2H), 7.25–7.18 (m, 2H), 6.91–6.86 (m, 2H), 6.82 (t, J = 6.8 Hz, 1H), 6.70 (t, J = 7.5 Hz, 1H), 4.68 (s, 2H), 2.21 (s, 3H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 143.7, 141.6, 135.2, 133.1, 132.5, 132.4, 132.2, 128.1, 128.0, 127.9, 127.6, 126.6, 126.4, 126.1, 124.4, 124.2, 120.1, 119.6, 118.4, 117.1, 116.8, 112.0, 110.6, 104.6, 19.7, 11.3. HRMS calcd for $C_{27}H_{22}N_3^+$ $[M+H]^+$: 388.1808; found 388.1819.



3-Chloro-2-(3-((2-methyl-1*H*-indol-3-yl)methyl)imidazo[1,2-*a*]pyridin-2-yl)phenol (5s). Eluent petroleum ether/ethyl acetate (5:1). White solid, 26 mg, 34% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 12.39 (s, 1H), 10.89 (s, 1H), 8.26 (d, J = 6.7 Hz, 1H), 7.72 (d, J = 9.0 Hz, 1H), 7.58 (s, 1H), 7.36 (t, J = 7.8 Hz, 1H), 7.22 (t, J = 8.7 Hz, 2H), 7.00–6.96 (m, 2H), 6.91–6.88 (m, 1H), 6.69 (d, J = 3.0 Hz, 2H), 4.57 (s, 2H), 2.26 (s, 3H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 155.4, 142.1, 138.3, 135.2, 132.5, 128.7, 127.6, 127.4, 125.5, 124.4, 122.4, 120.2, 120.1, 120.0, 118.5, 116.8, 116.2, 113.1, 110.6, 104.2, 19.8, 11.3. HRMS calcd for $C_{23}H_{19}ClN_3O^+$ $[M+H]^+$: 388.1211; found 388.1221.

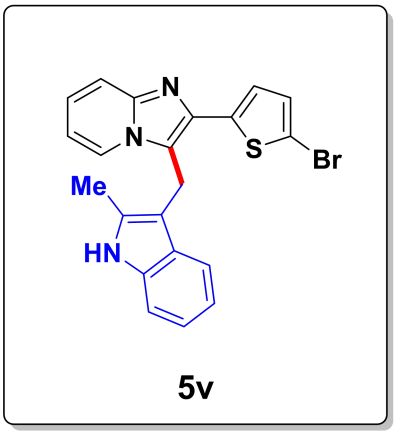


7-Chloro-3-((2-methyl-1*H*-indol-3-yl)methyl)-2-(p-tolyl)imidazo[1,2-*a*]pyridine (5t). Eluent petroleum ether/ethyl acetate (2:1). White solid, 66 mg, 85% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 10.87 (s, 1H), 7.90 (d, *J* = 7.4 Hz, 1H), 7.74 (d, *J* = 8.0 Hz, 3H), 7.28 (d, *J* = 7.9 Hz, 2H), 7.20 (d, *J* = 8.0 Hz, 1H), 6.92–6.85 (m, 2H), 6.76 (d, *J* = 7.9 Hz, 1H), 6.70 (t, *J* = 7.4 Hz, 1H), 4.54 (s, 2H), 2.34 (s, 3H), 2.18 (s, 3H).^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 143.2, 142.8, 136.9, 135.2, 132.4, 131.7, 129.3, 129.0, 128.0, 127.7, 125.2, 120.1, 119.3, 118.4, 116.9, 115.3, 112.9, 110.6, 104.0, 20.8, 19.6, 11.2. HRMS calcd for $C_{24}H_{21}ClN_3^+$ $[M+H]^+$: 386.1419; found 386.1422.



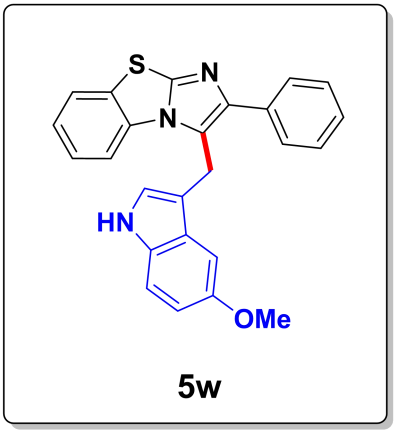
2-(3,4-Dimethoxyphenyl)-7-methyl-3-((2-methyl-1*H*-indol-3-yl)methyl)imidazo[1,2-*a*]pyridine (5u). Eluent petroleum ether/ethyl acetate (1:1). Yellow solid, 63 mg,

76% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 10.83 (s, 1H), 7.82 (d, *J* = 7.1 Hz, 1H), 7.43–7.31 (m, 3H), 7.20 (d, *J* = 8.1 Hz, 1H), 7.01 (d, *J* = 8.3 Hz, 1H), 6.93–6.83 (m, 2H), 6.72 (t, *J* = 7.7 Hz, 1H), 6.61 (d, *J* = 7.0 Hz, 1H), 4.50 (s, 2H), 3.77 (s, 3H), 3.70 (s, 3H), 2.30 (s, 3H), 2.14 (s, 3H).^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 148.7, 148.2, 143.8, 141.5, 135.1, 134.1, 132.2, 127.9, 123.4, 120.1, 118.3, 117.6, 117.1, 114.8, 114.2, 111.8, 111.6, 110.5, 104.7, 55.5, 55.3, 20.7, 19.7, 11.2. HRMS calcd for $C_{26}H_{26}N_3O_2^+$ $[M+H]^+$: 412.2020; found 412.2026.



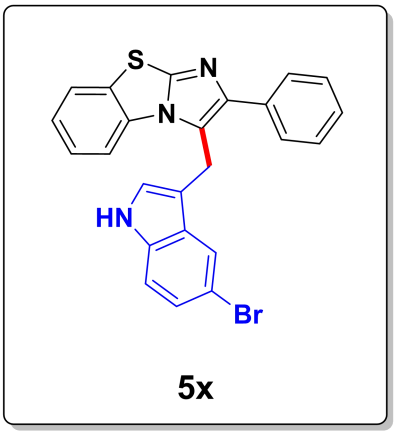
5v

2-(5-Bromothiophen-2-yl)-3-((2-methyl-1*H*-indol-3-yl)methyl)imidazo[1,2-*a*]pyridine (5v). Eluent petroleum ether/ethyl acetate (2:1). White solid, 76 mg, 90% yield. ^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 10.89 (s, 1H), 7.93 (d, *J* = 6.9 Hz, 1H), 7.56 (d, *J* = 9.0 Hz, 1H), 7.33 (d, *J* = 3.9 Hz, 1H), 7.26–7.12 (m, 3H), 6.91 (t, *J* = 8.1 Hz, 2H), 6.81 (t, *J* = 6.7 Hz, 1H), 6.74 (t, *J* = 7.5 Hz, 1H), 4.56 (s, 2H), 2.24 (s, 3H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 143.6, 140.4, 135.6, 135.2, 132.5, 131.4, 127.8, 124.8, 124.7, 124.3, 120.2, 118.7, 118.5, 117.0, 116.5, 112.4, 111.2, 110.6, 104.0, 19.3, 11.3. HRMS calcd for $C_{21}H_{17}BrN_3S^+$ $[M+H]^+$: 422.0321; found 422.0331.



5w

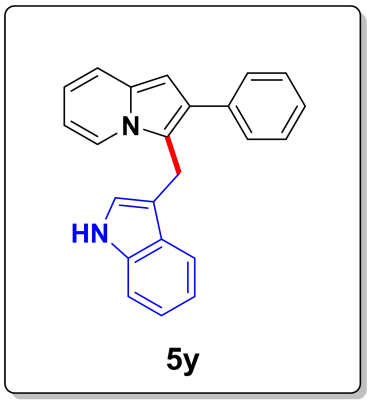
3-((5-Methoxy-1*H*-indol-3-yl)methyl)-2-phenylbenzo[*d*]imidazo[2,1-*b*]thiazole (5w). Eluent petroleum ether/ethyl acetate (3:1). Brown solid, 35 mg, 43% yield. ^{1}H NMR (DMSO-d$_6$, 500 MHz, ppm) δ 10.75 (s, 1H), 8.00–7.98 (m, 1H), 7.70 (d, *J* = 7.7 Hz, 2H), 7.55–7.53 (m, 1H), 7.42 (t, *J* = 7.5 Hz, 2H), 7.31 (t, *J* = 3.7 Hz, 3H), 7.25 (d, *J* = 8.8 Hz, 1H), 7.00 (s, 1H), 6.92 (s, 1H), 6.75 (d, *J* = 8.8 Hz, 1H), 4.63 (s, 2H), 3.69 (s, 3H).^{13}C NMR (DMSO-d$_6$, 125 MHz, ppm) δ 153.2, 145.9, 143.2, 134.5, 132.4, 131.8, 129.4, 128.6, 127.1, 127.0, 126.7, 126.3, 124.9, 124.6, 123.7, 123.2, 113.6, 112.4, 111.6, 110.1, 100.0, 55.3, 21.7. HRMS calcd for $C_{25}H_{20}N_3OS^+$ $[M+H]^+$: 410.1322; found 410.1328.



5x

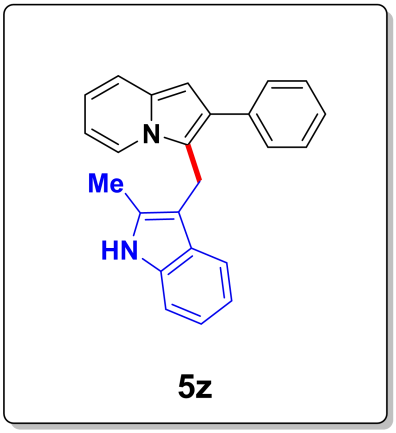
2-(5-Bromothiophen-2-yl)-3-((2-methyl-1*H*-indol-3-yl)methyl)imidazo[1,2-*a*]pyridine (5x). Eluent petroleum ether/ethyl acetate (3:1). Brown solid, 47 mg, 51% yield.

^{1}H NMR (DMSO-d_6, 500 MHz, ppm) δ 11.12 (s, 1H), 8.01–7.96 (m, 1H), 7.77 (s, 1H), 7.67 (d, *J* = 7.7 Hz, 2H), 7.50–7.46 (m, 1H), 7.41 (t, *J* = 7.6 Hz, 2H), 7.36–7.28 (m, 4H), 7.25-7.22 (m, 1H), 7.00 (s, 1H), 4.64 (s, 2H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 146.0, 143.3, 135.5, 134.4, 132.4, 129.4, 128.7, 128.2, 127.2, 127.0, 126.4, 124.8, 124.6, 124.0, 122.6, 113.7, 113.5, 111.4, 110.5, 21.4. HRMS calcd for $C_{24}H_{17}BrN_3S^+$ $[M+H]^+$: 458.0321; found 458.0327.



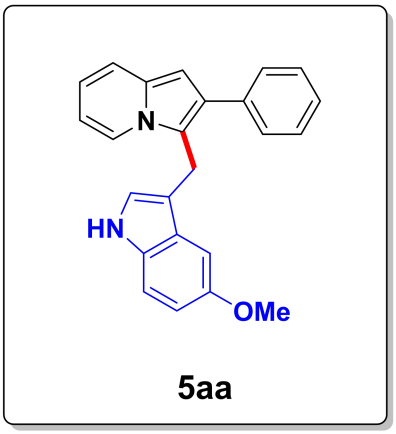
5y

3-((2-Phenylindolizin-3-yl)methyl)-1*H*-indole (5y). Eluent petroleum ether/ethyl acetate (8:1). Blue solid, 57 mg, 88% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 7.84 (s, 1H), 7.62–7.56 (m, 2H), 7.53 (d, *J* = 7.5 Hz, 2H), 7.41 (d, *J* = 8.9 Hz, 1H), 7.34 (t, *J* = 7.1 Hz, 3H), 7.25–7.20 (m, 2H), 7.15 (t, *J* = 7.4 Hz, 1H), 6.69–6.59 (m, 2H), 6.51 (s, 1H), 6.33 (t, *J* = 6.7 Hz, 1H), 4.43 (s, 2H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 136.8, 136.7, 132.4, 128.8, 128.7, 128.4, 127.2, 126.5, 122.8, 122.4, 122.2, 119.6, 119.0, 118.9, 118.5, 116.6, 112.5, 111.4, 110.2, 98.4, 21.4. HRMS calcd for $C_{23}H_{19}N_2^+$ $[M+H]^+$: 323.1543; found 323.1557.



5z

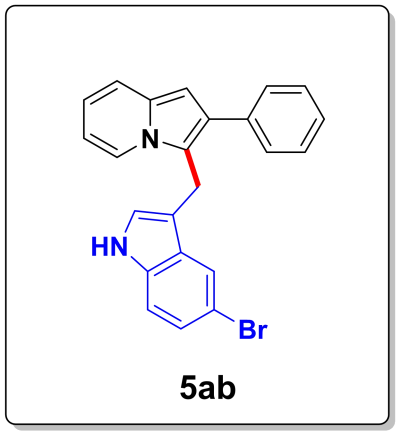
2-Methyl-3-((2-phenylindolizin-3-yl)methyl)-1*H*-indole (5z). Eluent petroleum ether/ethyl acetate (8:1). Red solid, 51 mg, 76% yield. ^{1}H NMR (DMSO-d$_6$, 500 MHz, ppm) δ 10.80 (s, 1H), 7.62 (d, *J* = 7.1 Hz, 1H), 7.56 (d, *J* = 7.6 Hz, 2H), 7.46-7.41 (m, 3H), 7.29 (t, *J* = 7.4 Hz, 1H), 7.20 (d, *J* = 8.0 Hz, 1H), 6.90 (t, *J* = 7.5 Hz, 1H), 6.77 (d, *J* = 7.9 Hz, 1H), 6.70 (t, *J* = 7.5 Hz, 1H), 6.67–6.60 (m, 2H), 6.43 (t, *J* = 6.7 Hz, 1H), 4.43 (s, 2H), 2.08 (s, 3H). ^{13}C NMR (DMSO-d$_6$, 125 MHz, ppm) δ 136.5, 135.1, 132.0, 131.3, 128.7, 128.6, 128.0, 127.5, 126.3, 122.6, 120.0, 118.7, 118.3, 117.2, 116.3, 110.4, 110.1, 104.9, 98.3, 20.3, 11.0. HRMS calcd for $C_{24}H_{21}N_2^+$ $[M+H]^+$: 337.1699; found 337.1704.



5aa

5-Methoxy-3-((2-phenylindolizin-3-yl)methyl)-1*H*-indole (5aa). Eluent petroleum ether/ethyl acetate (8:1). Blue solid, 58 mg, 82% yield. ^{1}H NMR (DMSO-d$_6$, 500

MHz, ppm) δ 10.67 (s, 1H), 7.90 (d, J = 7.1 Hz, 1H), 7.58 (d, J = 7.5 Hz, 2H), 7.44 (t, J = 7.8 Hz, 3H), 7.30 (t, J = 7.4 Hz, 1H), 7.19 (d, J = 8.7 Hz, 1H), 6.89 (s, 1H), 6.70–6.44 (m, 3H), 6.60 (d, J = 1.9 Hz, 1H), 6.50 (t, J = 6.7 Hz, 1H), 4.45 (s, 2H), 3.55 (s, 3H). ^{13}C NMR (DMSO-d_6, 125 MHz, ppm) δ 152.9, 136.4, 131.6, 131.5, 128.7, 128.4, 127.0, 126.9, 126.3, 123.4, 122.9, 118.9, 118.6, 116.4, 112.1, 111.3, 110.0, 109.9, 100.0, 98.2, 55.1, 20.7. HRMS calcd for $C_{24}H_{21}N_2O^+$ $[M+H]^+$: 353.1648; found 353.1650.



5ab

5-Bromo-3-((2-phenylindolizin-3-yl)methyl)-1*H*-indole (5ab). Eluent petroleum ether/ethyl acetate (8:1). Blue solid, 54 mg, 67% yield. ^{1}H NMR ($CDCl_3$, 500 MHz, ppm) δ 7.96 (s, 1H), 7.74 (s, 1H), 7.59 (d, J = 7.1 Hz, 1H), 7.55 (d, J = 7.6 Hz, 2H), 7.45 (d, J = 8.9 Hz, 1H), 7.40 (t, J = 7.5 Hz, 2H), 7.33–7.29(m, 2H), 7.20 (d, J = 8.6 Hz, 1H), 6.71–6.66 (m, 2H), 6.52 (s, 1H), 6.40 (t, J = 6.7 Hz, 1H), 4.40 (s, 2H). ^{13}C NMR ($CDCl_3$, 125 MHz, ppm) δ 136.5, 135.3, 132.44, 128.9, 128.8, 128.7, 128.5, 126.6, 125.2, 123.4, 122.6, 121.5, 119.1, 118.0, 116.6, 112.9, 112.8, 112.3, 110.3, 98.5, 21.1. HRMS calcd for $C_{23}H_{18}BrN_2^+$ $[M+H]^+$: 401.0648; found 401.0649.

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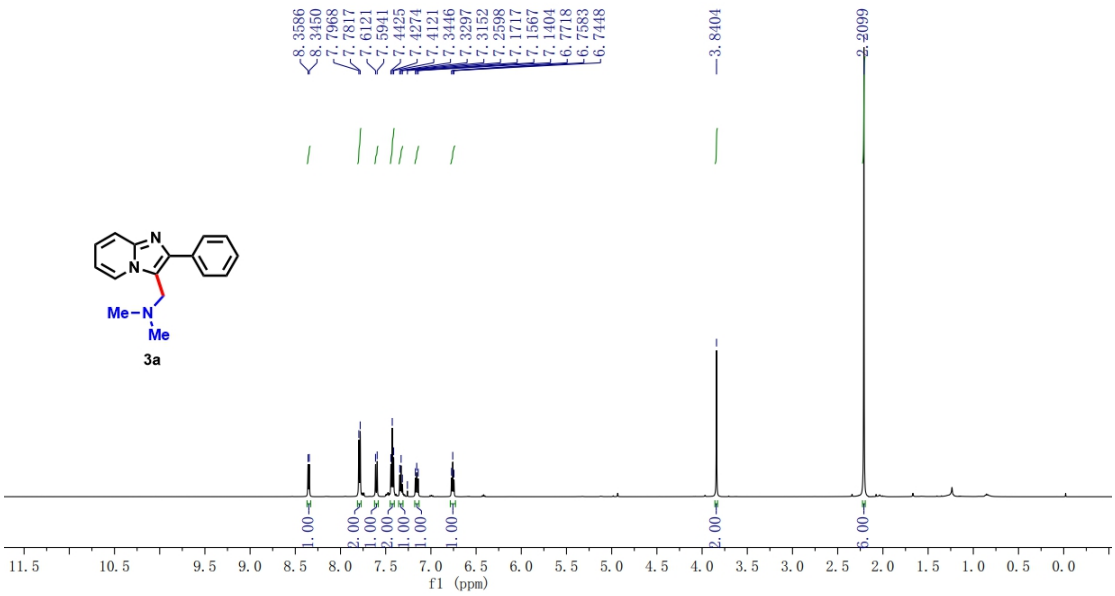
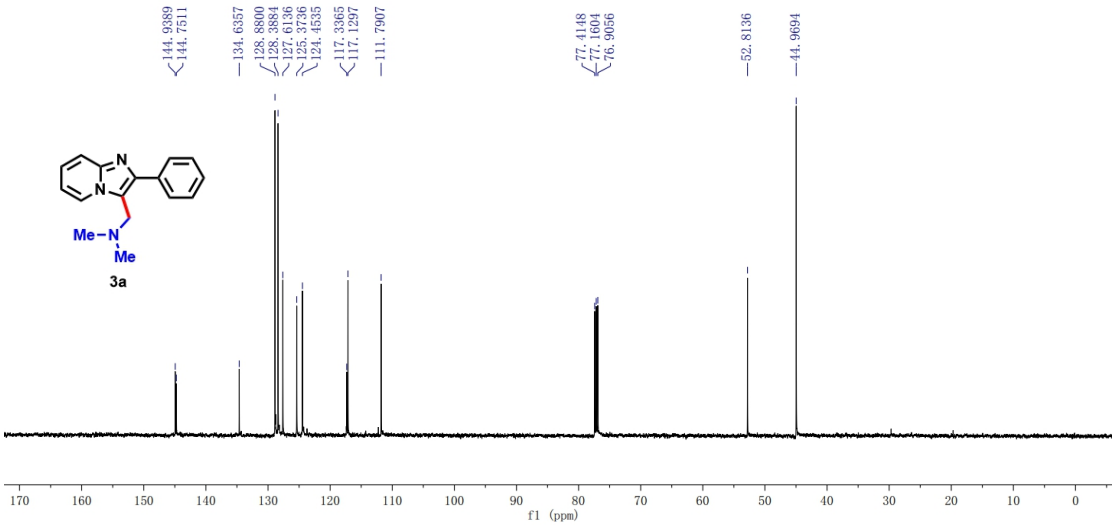
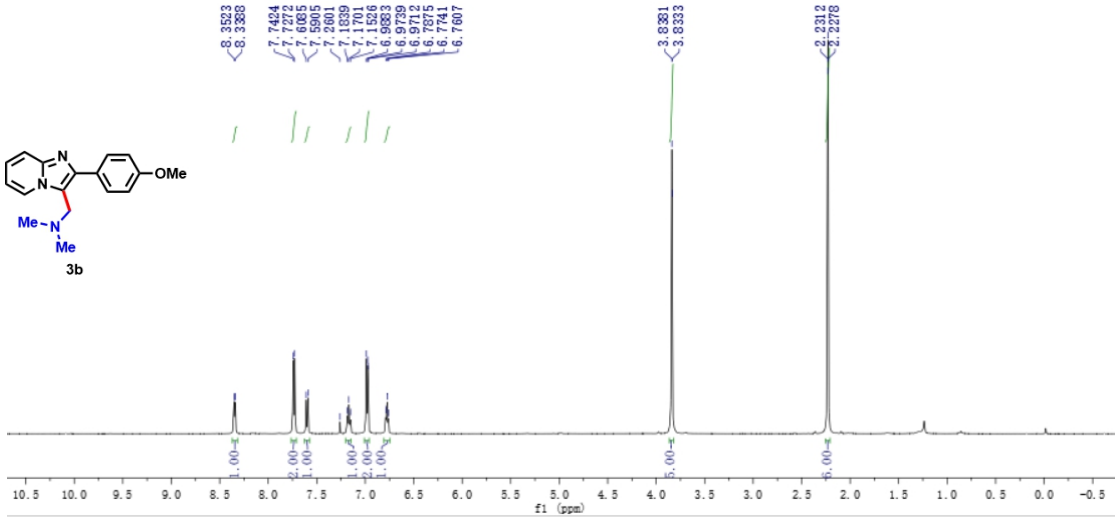
NMR spectra of the products



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7.2601
7.1839
7.1701
7.1526
6.9683
6.9739
6.9712
6.7875
6.7741
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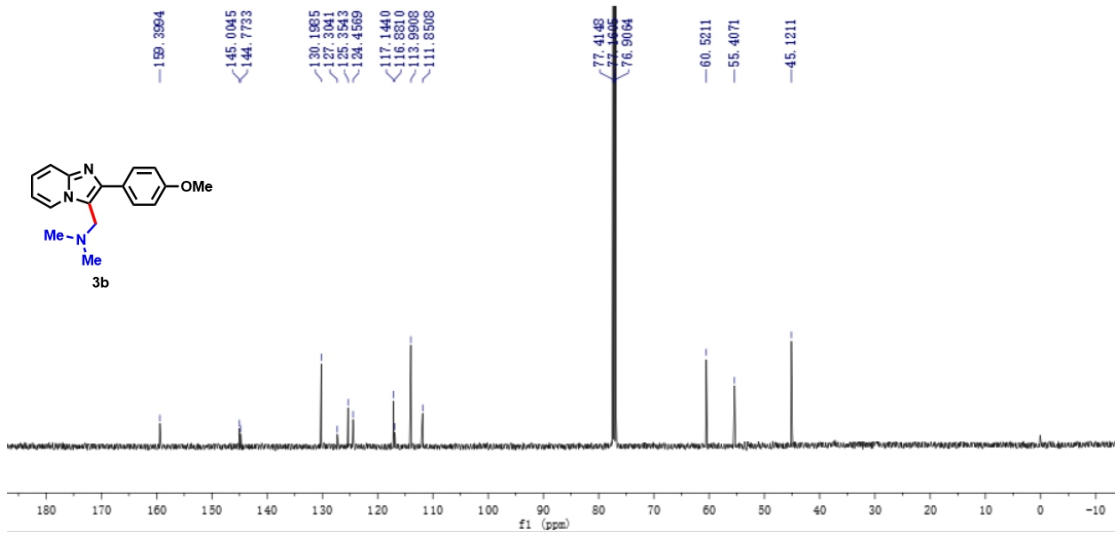
3.8333
2.2312
2.2278
OMe
Me
N
Me
3b
f1 (ppm)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113.9908
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76.9064
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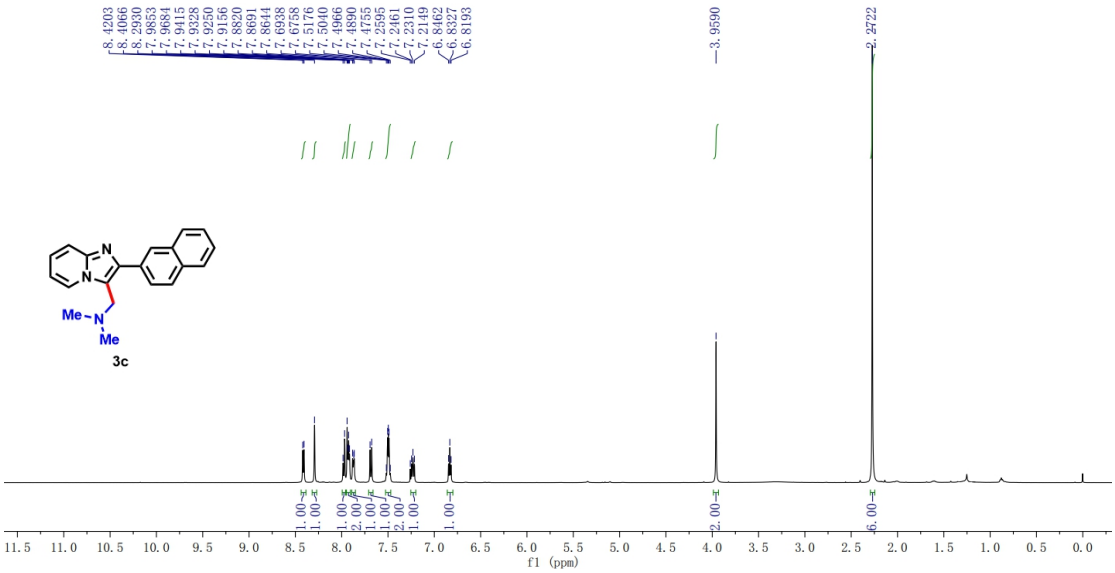
55.4071
45.1211
OMe
Me
N
Me
3b
f1 (ppm)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7.9415
7.9328
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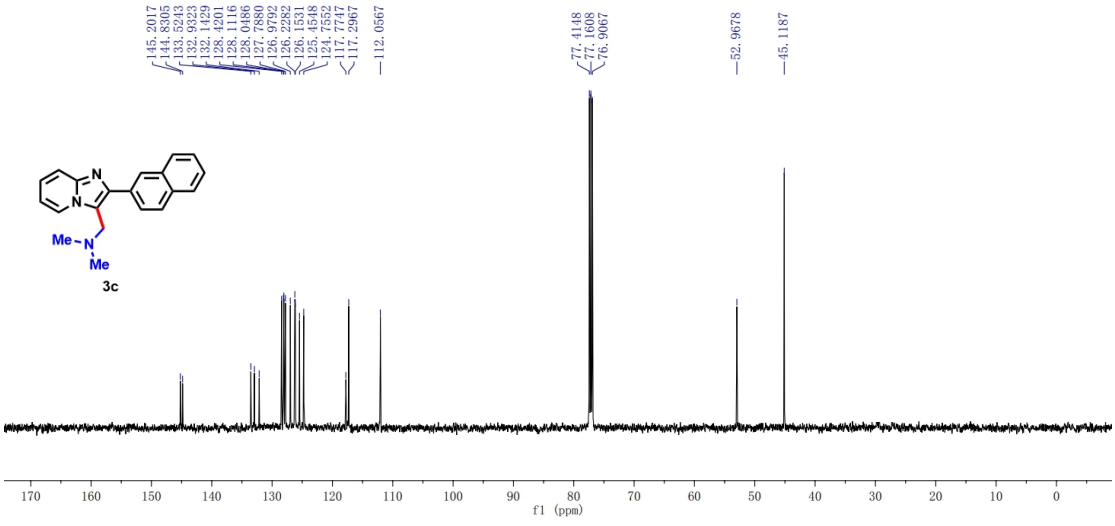
7.9156
7.8820
7.8691
7.8644
7.6938
7.6758
7.5176
7.5040
7.4966
7.4890
7.4755
7.2595
7.2461
7.2310
7.2149
6.8462
6.8327
6.8193
3.9590
2.2722
Me
N
Me
3c
1.00
1.00
1.00
2.00
1.00
1.00
2.00
1.00
1.00
2.00
6.00
f1 (ppm)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125.4548
124.7552
117.7747
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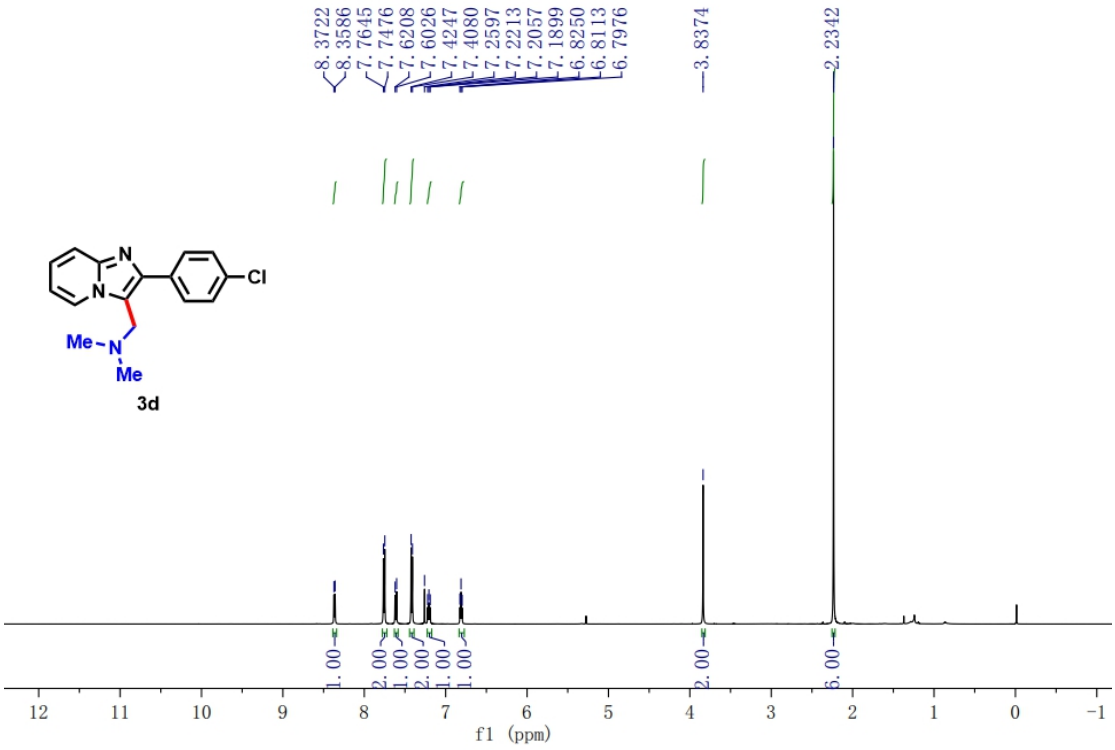
77.1608
76.9067
52.9678
45.1187
Me
N
Me
3c
f1 (ppm)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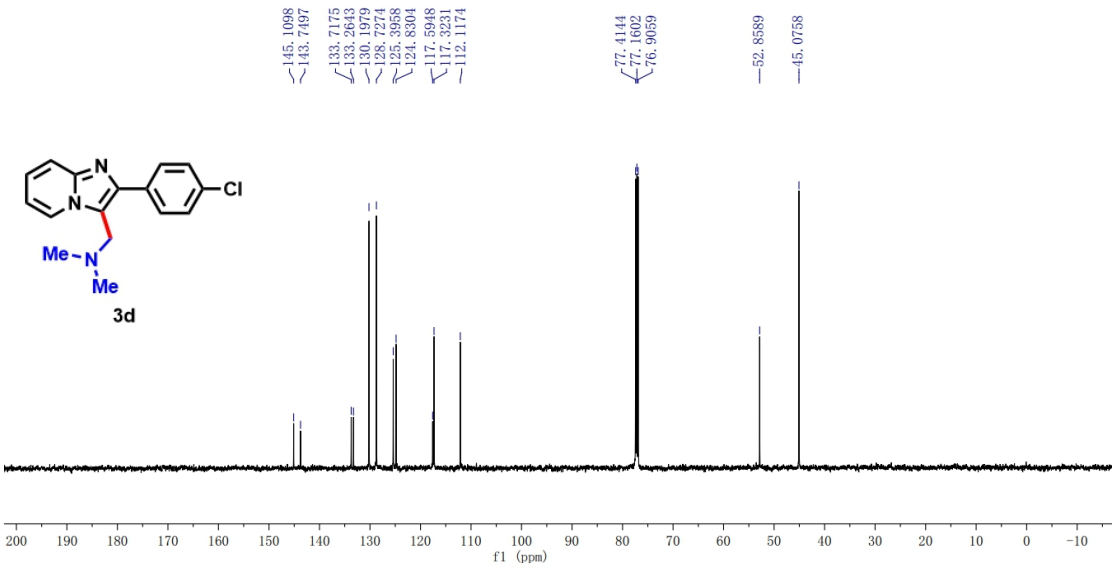
7.6208
7.6026
7.4247
7.4080
7.2597
7.2213
7.2057
7.1899
6.8250
6.8113
6.7976
3.8374
2.2342
Cl
Me
N
Me
3d
1.00
2.00
1.00
2.00
1.00
1.00
2.00
6.00
12
11
10
9
8
7
6
5
4
3
2
1
0
−1
f1 (ppm)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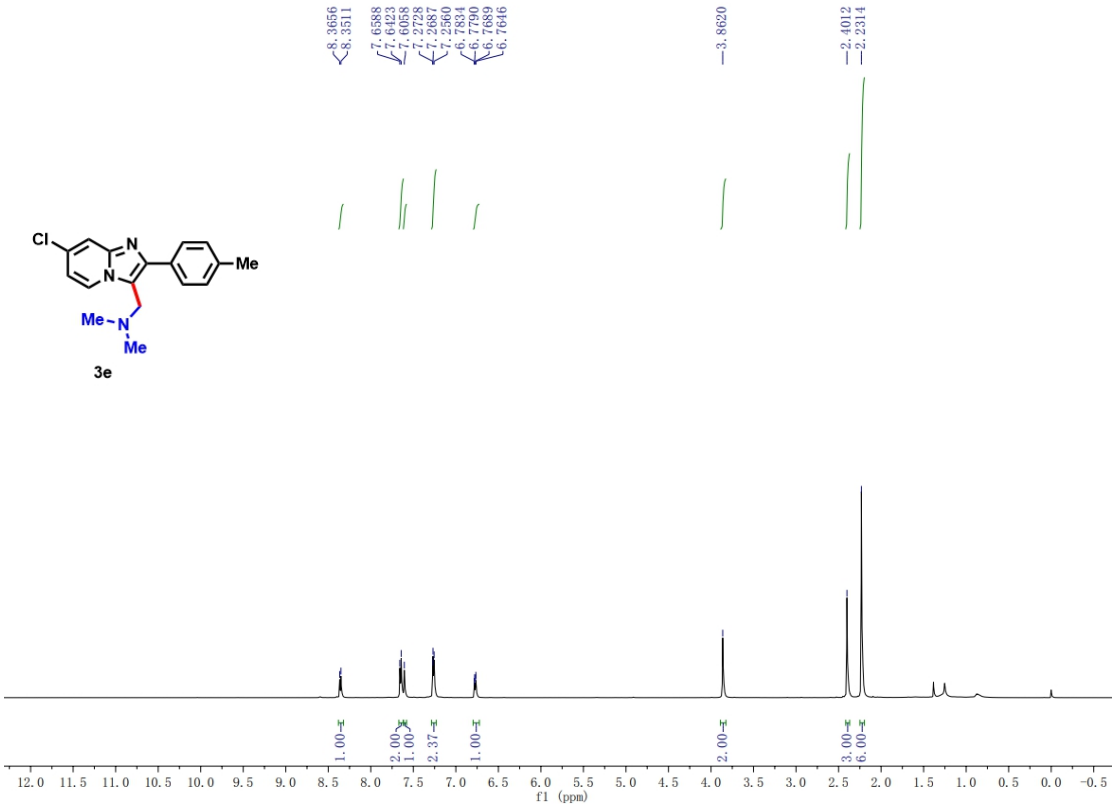
112.1174
77.4144
77.1602
76.9059
52.8589
45.0758
Cl
Me
N
Me
3d
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)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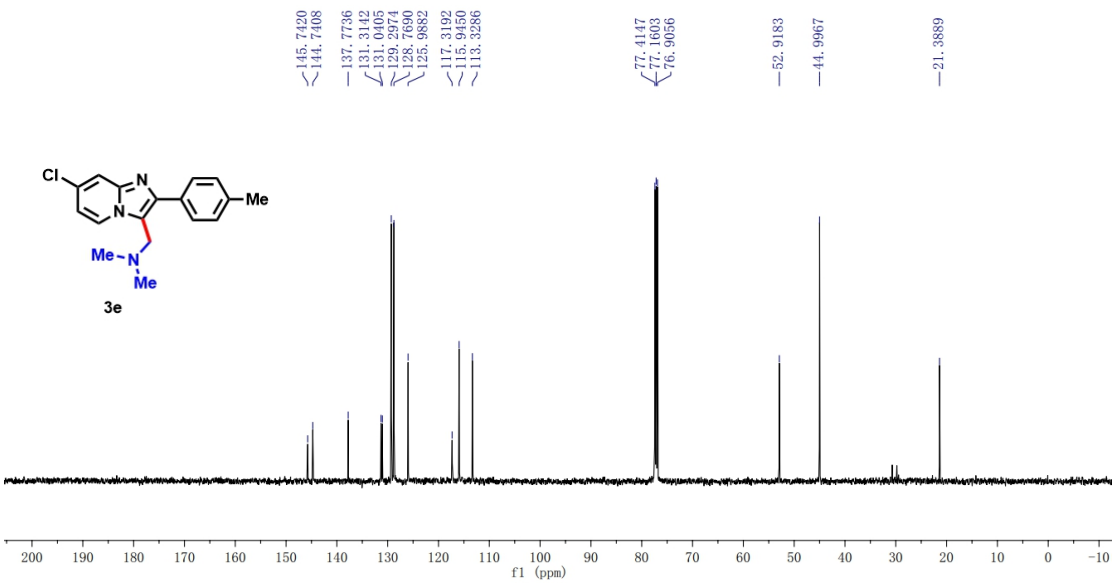
7.6058
7.2728
7.2687
7.2560
6.7834
6.7790
6.7689
6.7646
3.8620
2.4012
2.2314
Cl
N
N
Me
Me
N
Me
3e
1.00
2.00
1.00
2.37
1.00
2.00
3.00
6.00
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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137.7736
131.3142
131.0405
129.2974
128.7690
125.9882
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115.9450
113.3286
77.4147
77.1603
76.9056
52.9183
44.9967
21.3889
Cl
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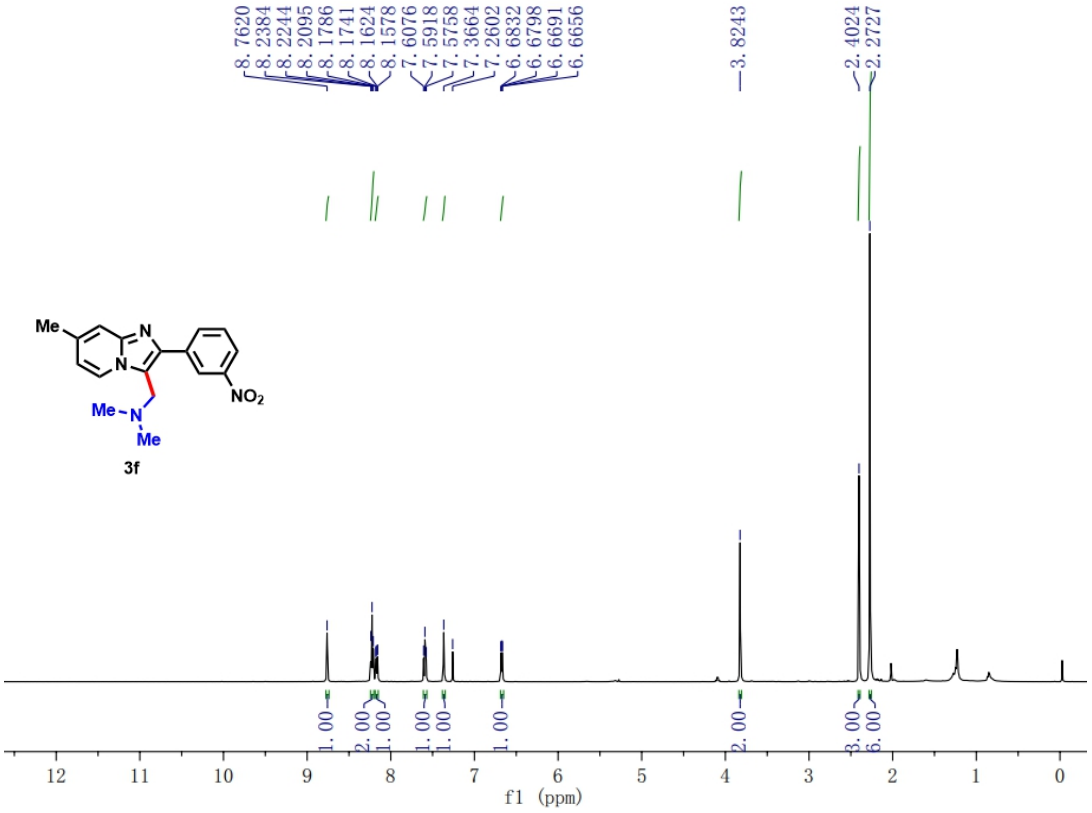
N
Me
Me
N
Me
3e
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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8.1741
8.1624
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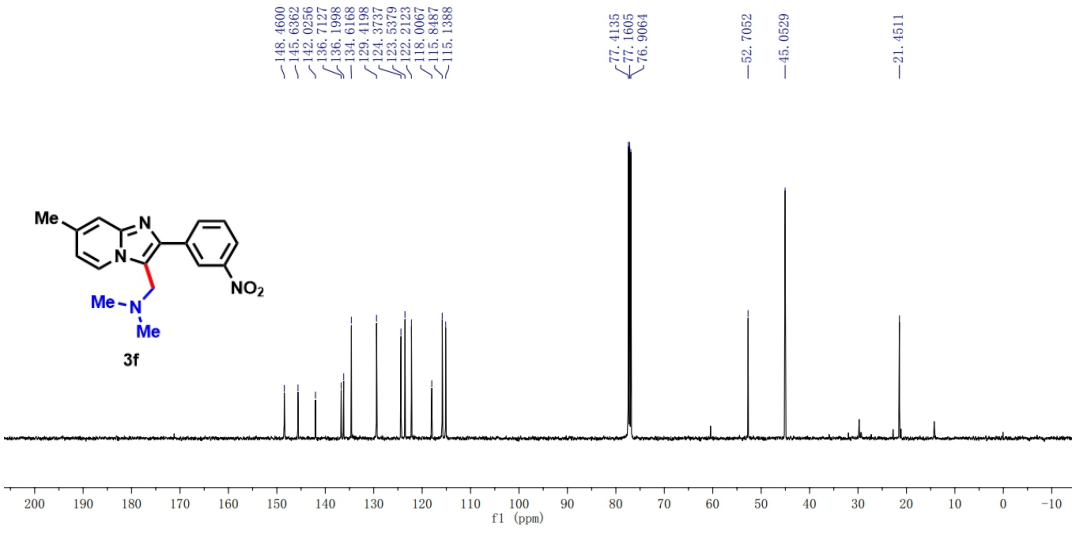
7.6076
7.5918
7.5758
7.3664
7.2602
6.6832
6.6798
6.6691
6.6656
3.8243
2.4024
2.2727
Me
N
N
NO2
Me
N
Me
3f
1.00
2.00
1.00
1.00
1.00
1.00
2.00
3.00
6.00
12
11
10
9
8
7
6
5
4
3
2
1
0
f1 (ppm)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134.6168
129.4198
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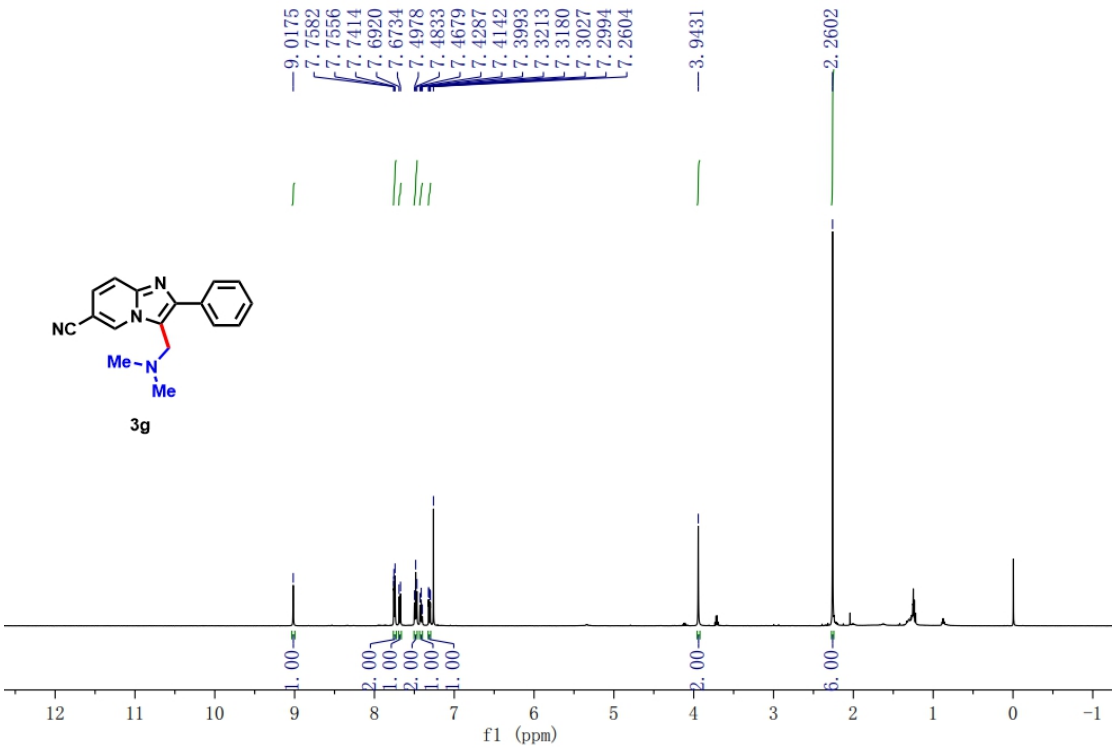
123.5379
122.2123
118.0067
115.8487
115.1388
77.4135
77.1605
76.9064
52.7052
45.0529
21.4511
Me
N
N
NO2
Me
N
Me
3f
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)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7.4679
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7.4142
7.3993
7.3213
7.3180
7.3027
7.2994
7.2604
3.9431
2.2602
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Me
N
Me
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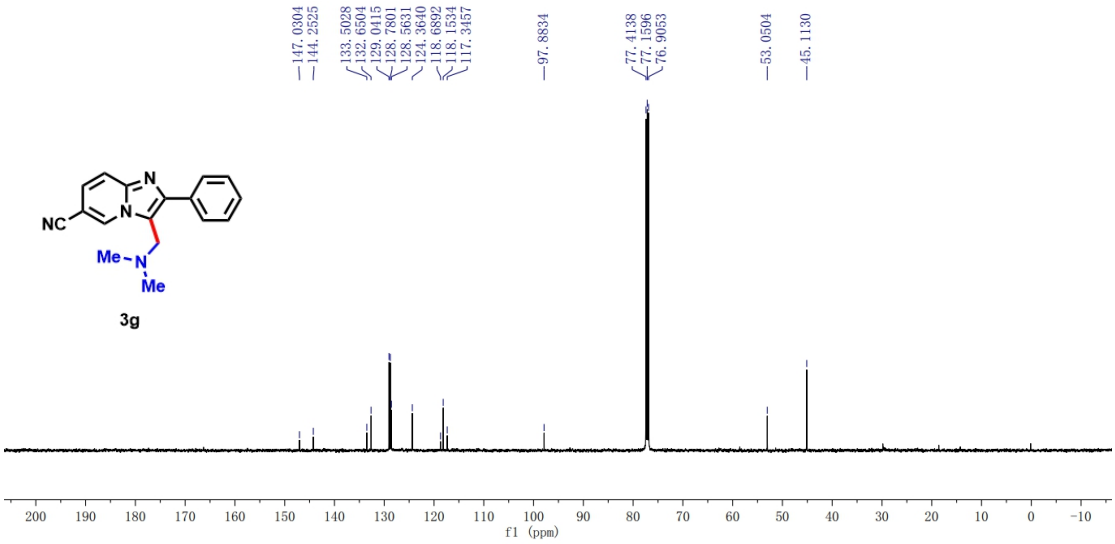
2.00
1.00
2.00
1.00
1.00
2.00
6.00
f1 (ppm)

3g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132.6504
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128.7801
128.5631
124.3640
118.6892
118.1534
117.3457
97.8834
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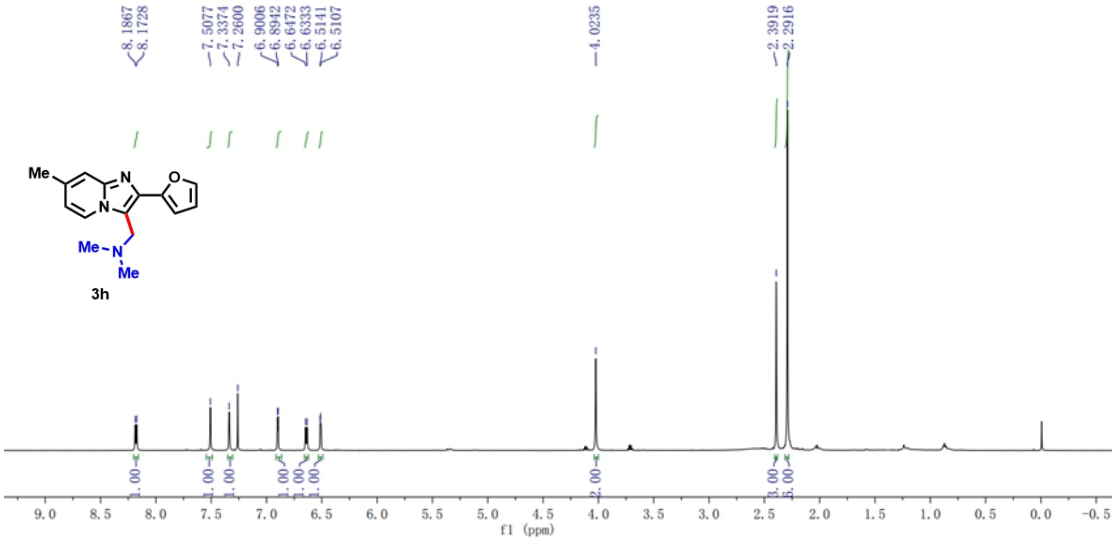
77.1596
76.9053
53.0504
45.1130
NC
Me
N
Me
f1 (ppm)

3g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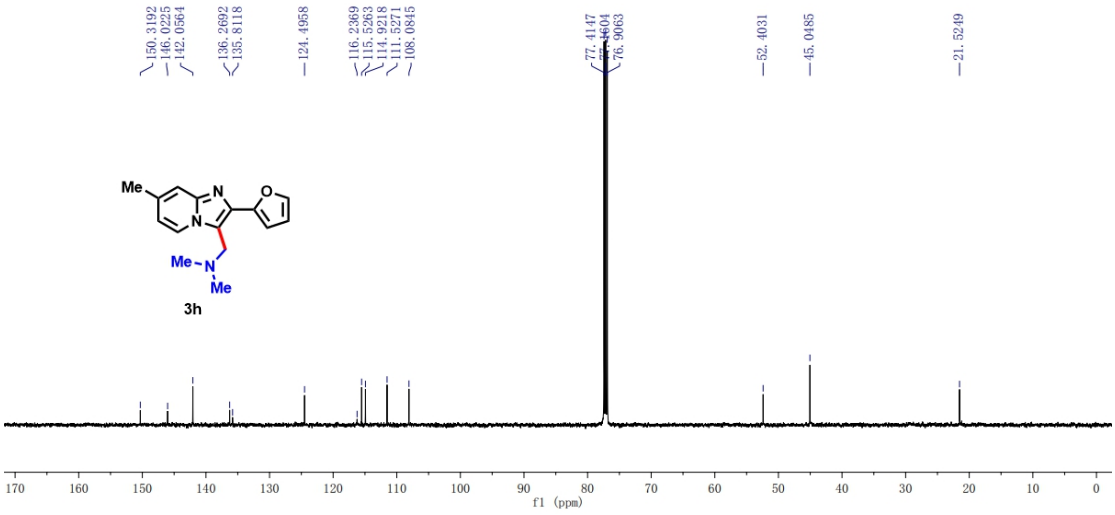
7.2600
6.9006
6.8942
6.6472
6.6333
6.5141
6.5107
4.0235
2.3919
2.2916
Me
N
O
Me
N
Me
3h
1.00
1.00
1.00
1.00
1.00
1.00
2.00
3.00
5.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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114.9218
111.5271
108.0845
77.4147
77.1604
76.9063
52.4031
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Me
N
O
Me
N
Me
3h
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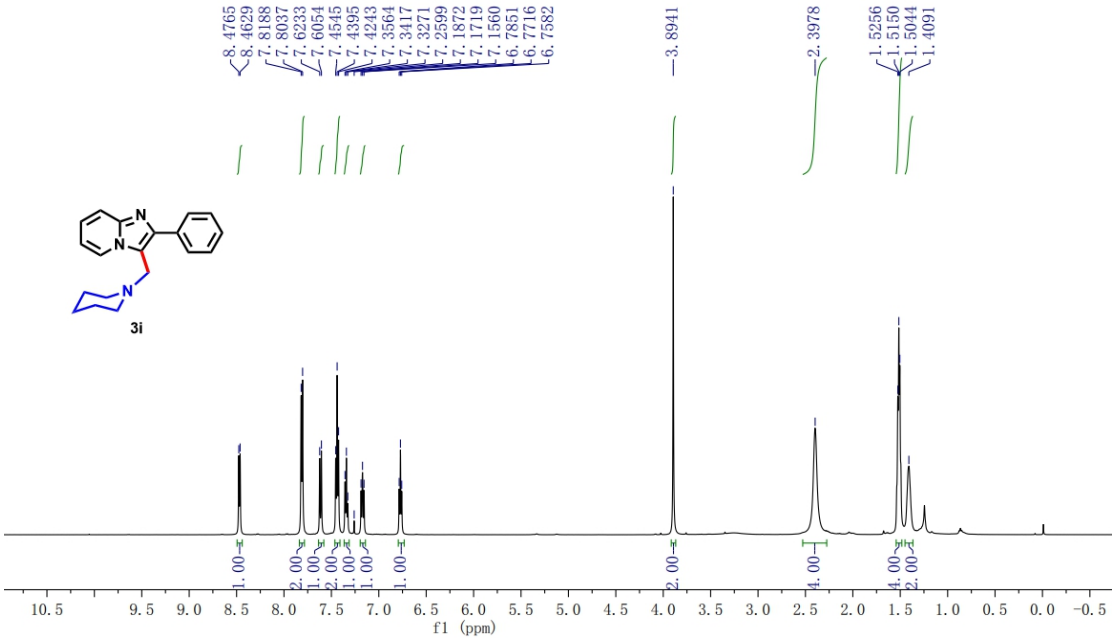
f1 (ppm)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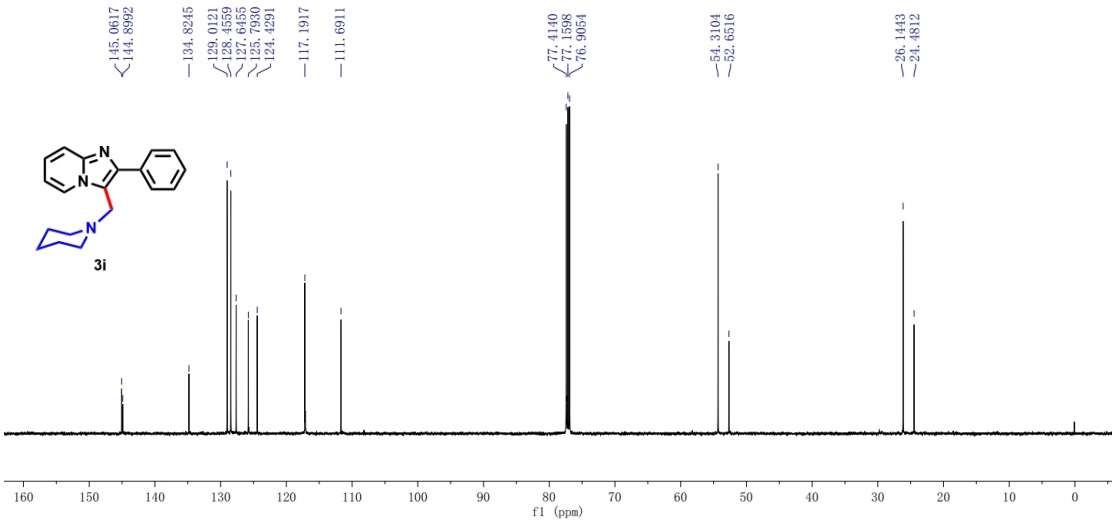
7.3271
7.2599
7.1872
7.1719
7.1560
6.7851
6.7716
6.7582
3.8941
2.3978
1.5256
1.5150
1.5044
1.4091
3i
1.00
2.00
1.00
2.00
1.00
1.00
1.00
2.00
4.00
4.00
2.00
f1 (ppm)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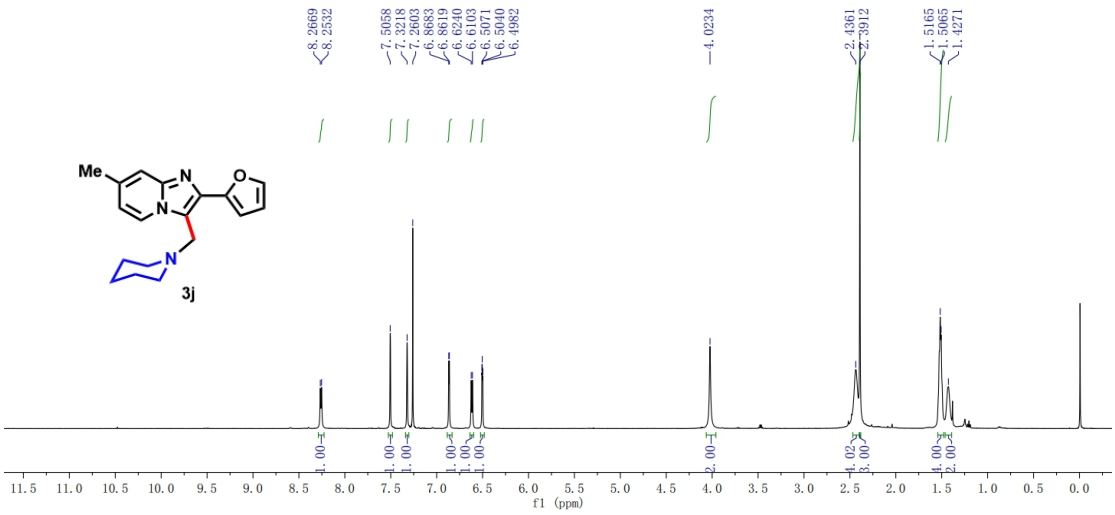
3i
f1 (ppm)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6.5040
6.4982
4.0234
2.4361
2.3912
1.5165
1.5065
1.4271
Me
N
O
N
3j
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1.00
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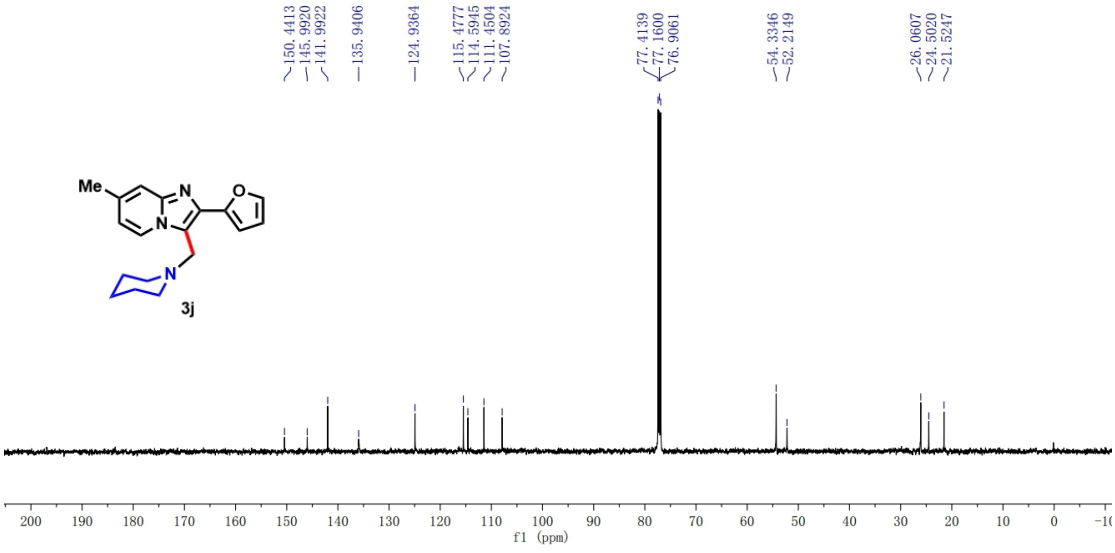
1.00
1.00
1.00
2.00
4.02
3.00
4.00
2.00
f1 (ppm)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77.1600
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Me
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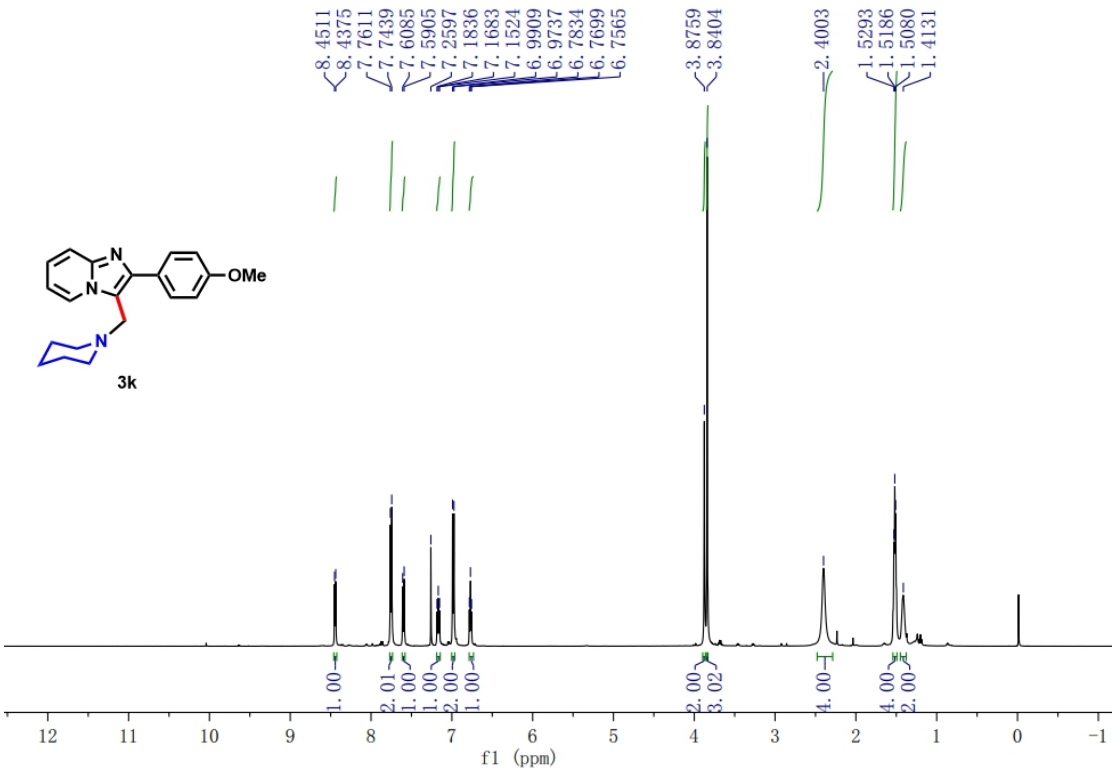
O
N
3j
f1 (ppm)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6.9737
6.7834
6.7699
6.7565
3.8759
3.8404
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1.5186
1.5080
1.4131
OMe
3k
1.00
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2.00
1.00
2.00
3.02
4.00
4.00
2.00
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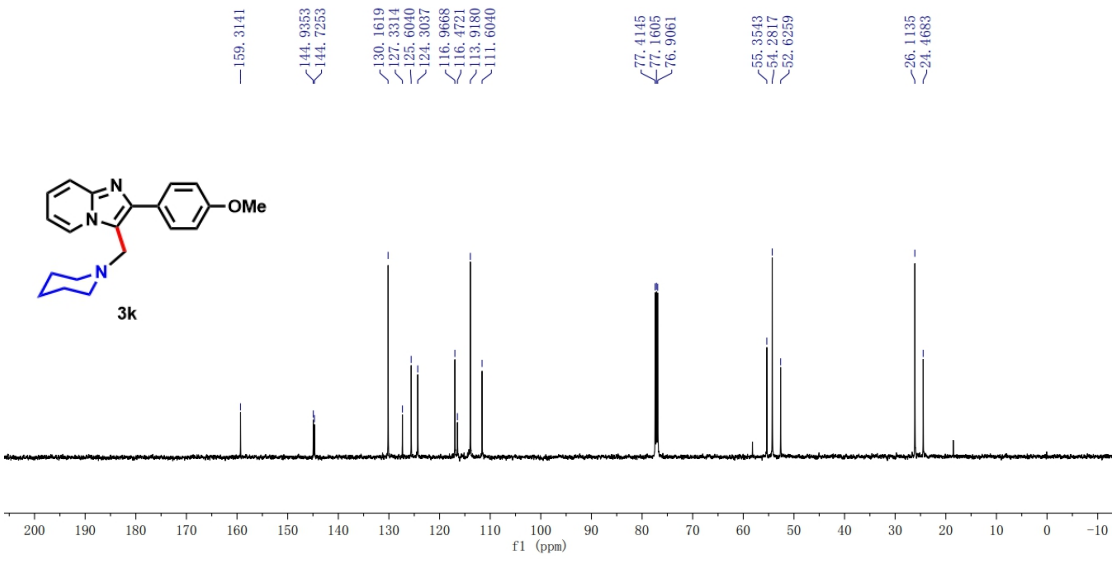
11
10
9
8
7
6
5
4
3
2
1
0
−1
f1 (ppm)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113.9180
111.6040
77.4145
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76.9061
55.3543
54.2817
52.6259
26.1135
24.4683
OMe
3k
200
190
180
170
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140
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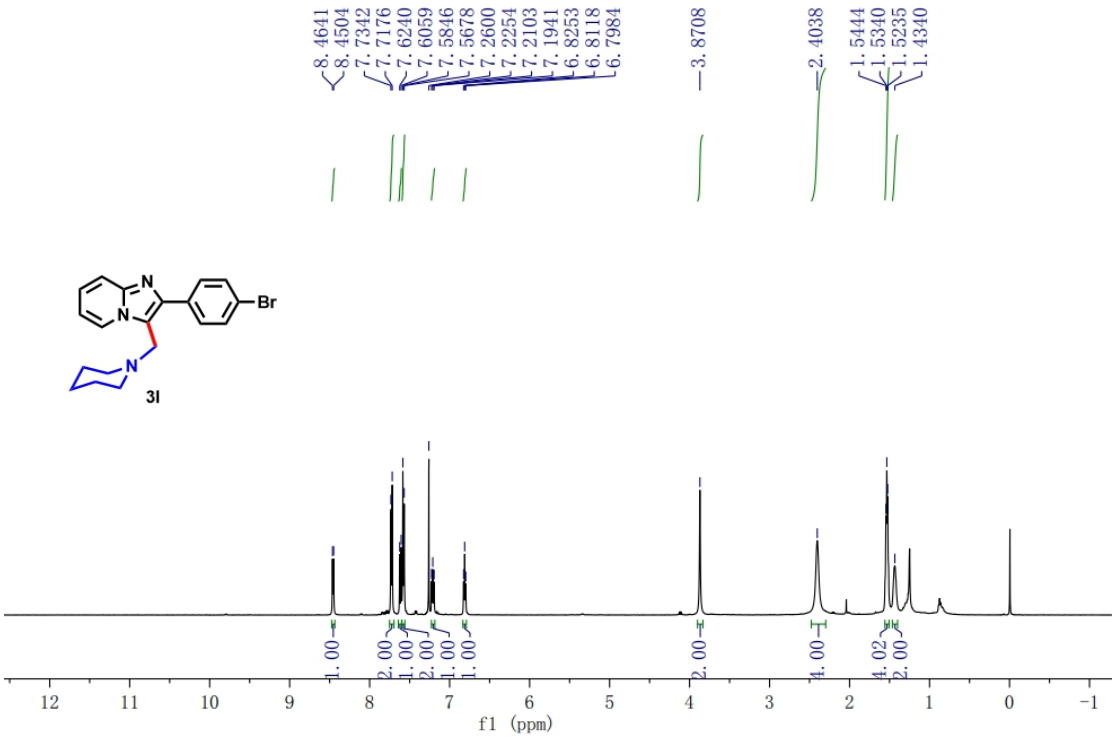
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)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7.1941
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6.7984
3.8708
2.4038
1.5444
1.5340
1.5235
1.4340
Br
N
N
N
3l
1.00
2.00
1.00
2.00
1.00
1.00
2.00
4.00
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2.00
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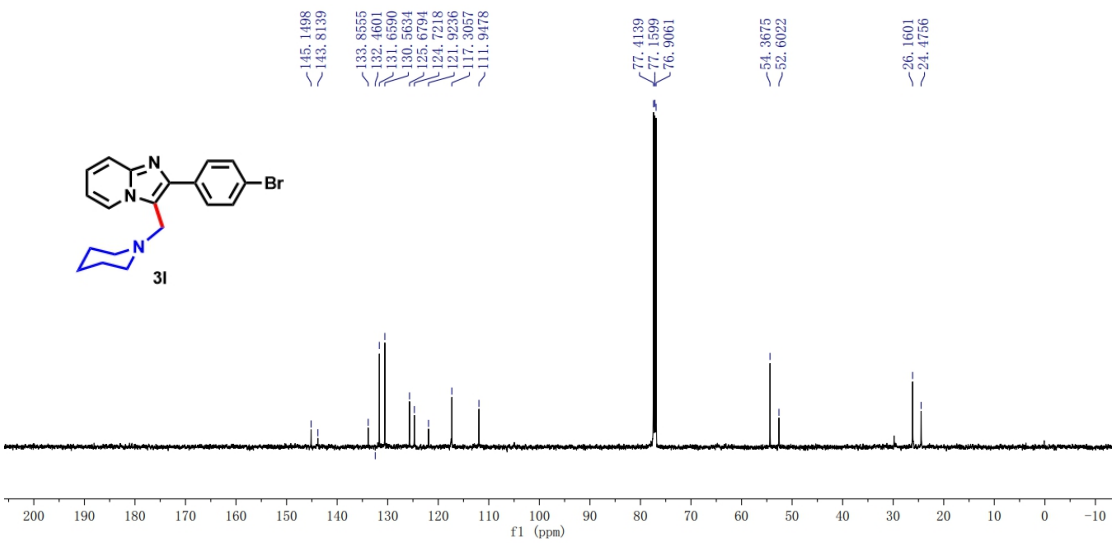
11
10
9
8
7
6
5
4
3
2
1
0
−1
f1 (ppm)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77.4139
77.1599
76.9061
54.3675
52.6022
26.1601
24.4756
Br
N
N
N
3l
200
190
180
170
160
150
140
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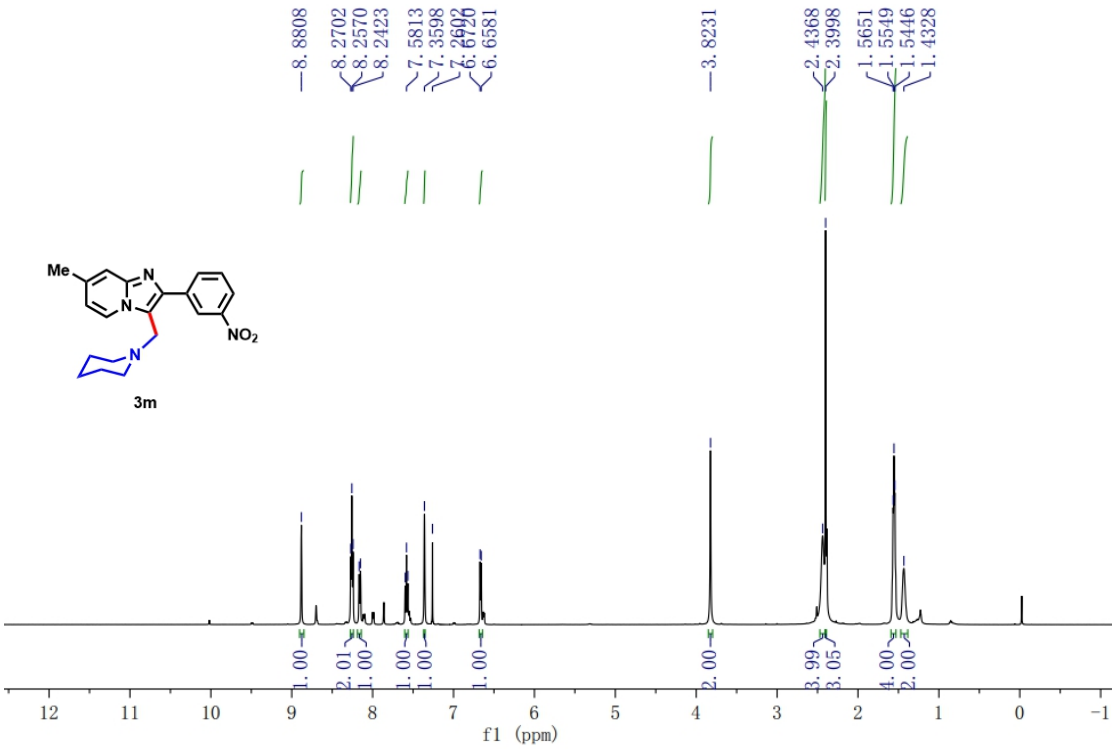
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)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1.5549
1.5446
1.4328
Me
N
NO2
3m
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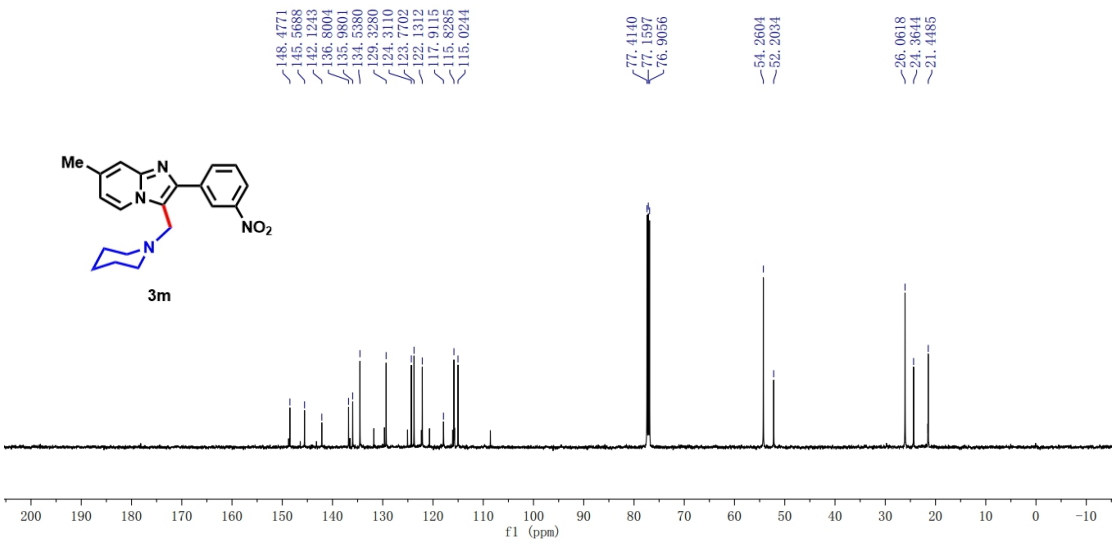
1.00
1.00
1.00
1.00
2.00
3.99
3.05
4.00
2.00
f1 (ppm)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115.0244
77.4140
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52.2034
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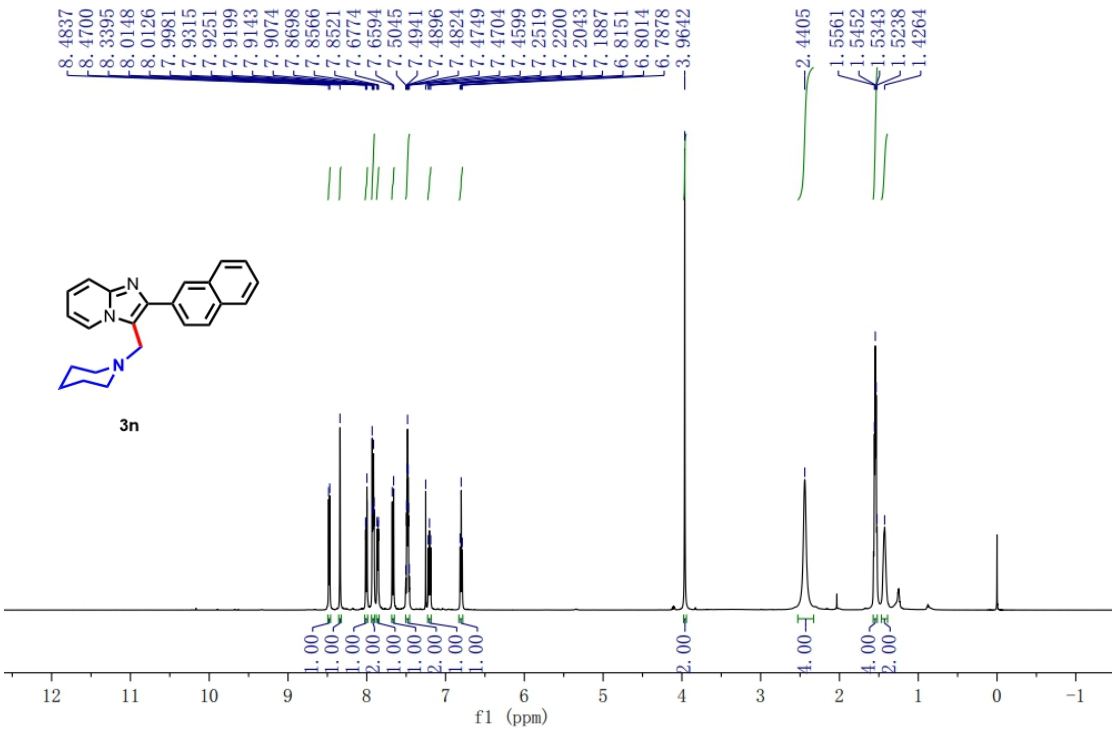
24.3644
21.4485
Me
N
NO2
3m
f1 (ppm)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7.6774
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7.4941
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7.4749
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3.9642
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1.5561
1.5452
1.5343
1.5238
1.4264
3n
1.00
1.00
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2.00
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1.00
2.00
1.00
1.00
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4.00
4.00
2.00
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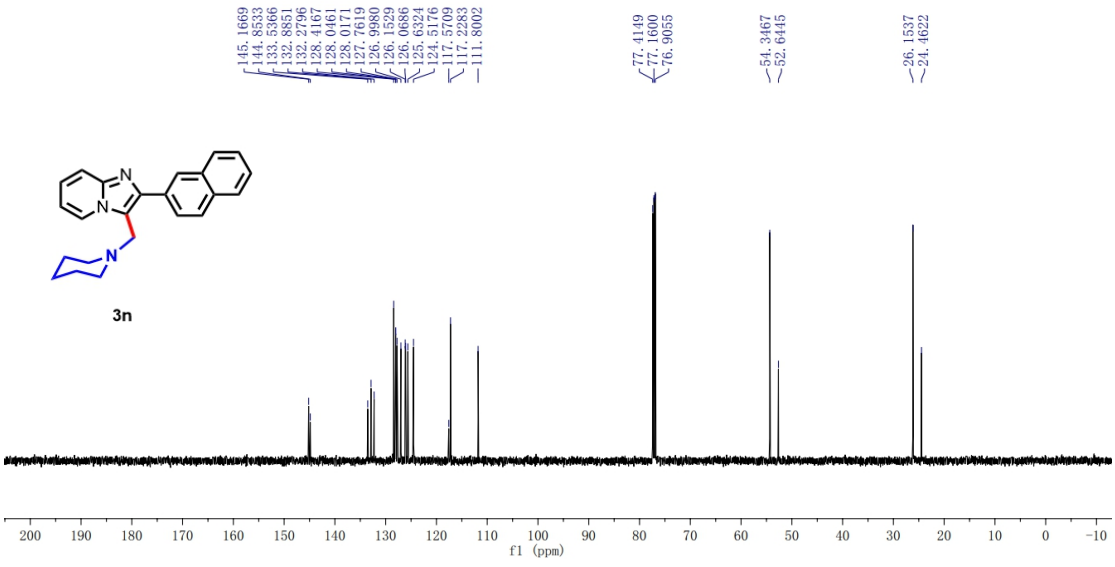
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125.6324
124.5176
117.5709
117.2283
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77.1600
76.9055
54.3467
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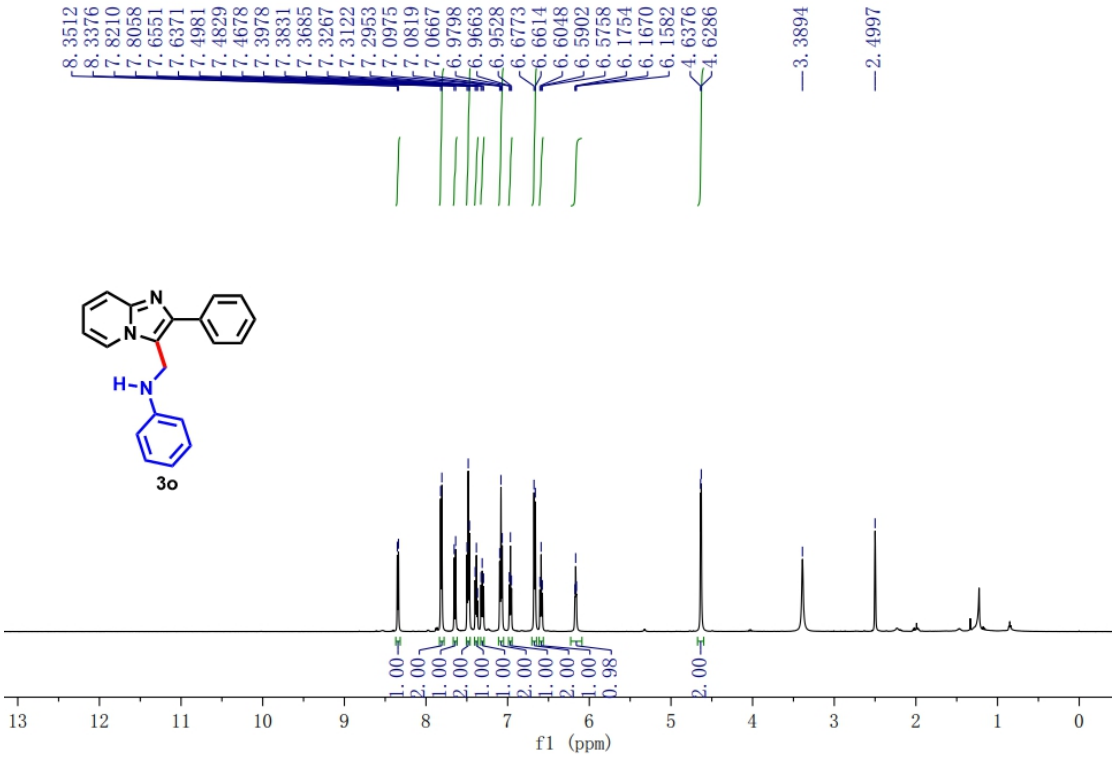
26.1537
24.4622
3n
f1 (ppm)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7.3831
7.3685
7.3267
7.3122
7.2953
7.0975
7.0819
7.0667
6.9798
6.9663
6.9528
6.6773
6.6614
6.6048
6.5902
6.5758
6.1754
6.1670
6.1582
4.6376
4.6286
3.3894
2.4997
3o
1.00
2.00
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2.00
1.00
1.00
2.00
2.00
1.00
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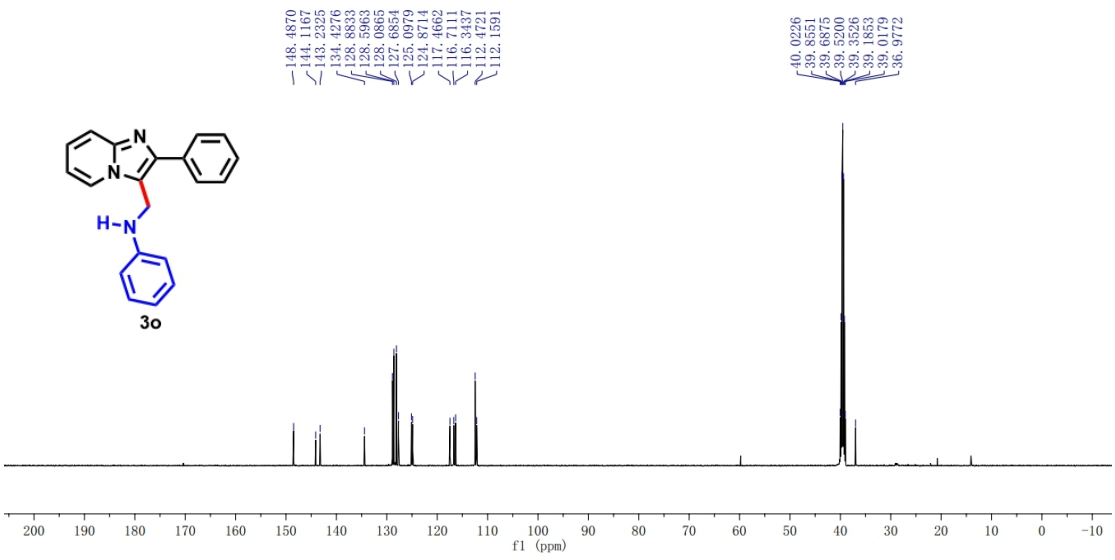
2.00
f1 (ppm)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116.7111
116.3437
112.4721
112.1591
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39.0179
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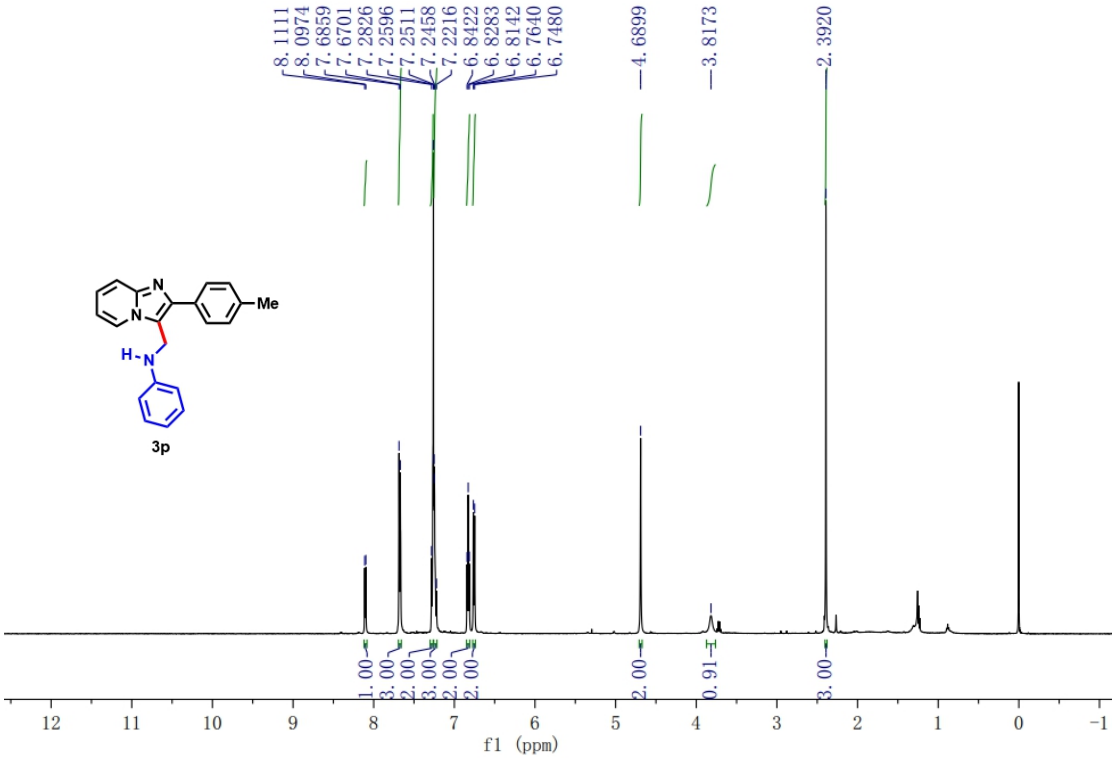
3o
f1 (ppm)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6.8283
6.8142
6.7640
6.7480
4.6899
3.8173
2.3920
Me
H
N
3p
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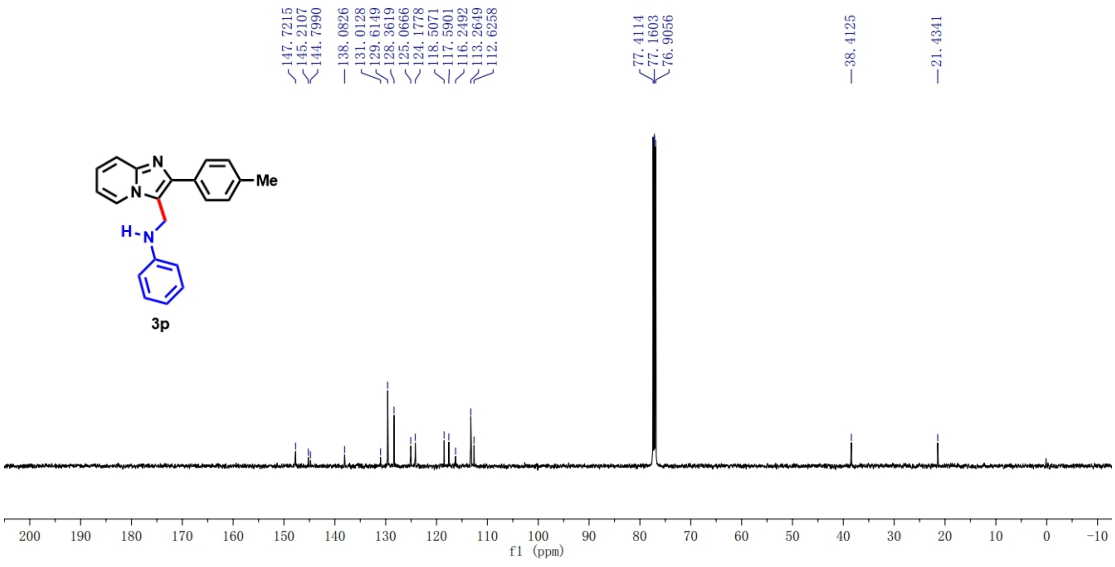
3.00
2.00
3.00
2.00
2.00
2.00
0.91
3.00
f1 (ppm)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117.5901
116.2492
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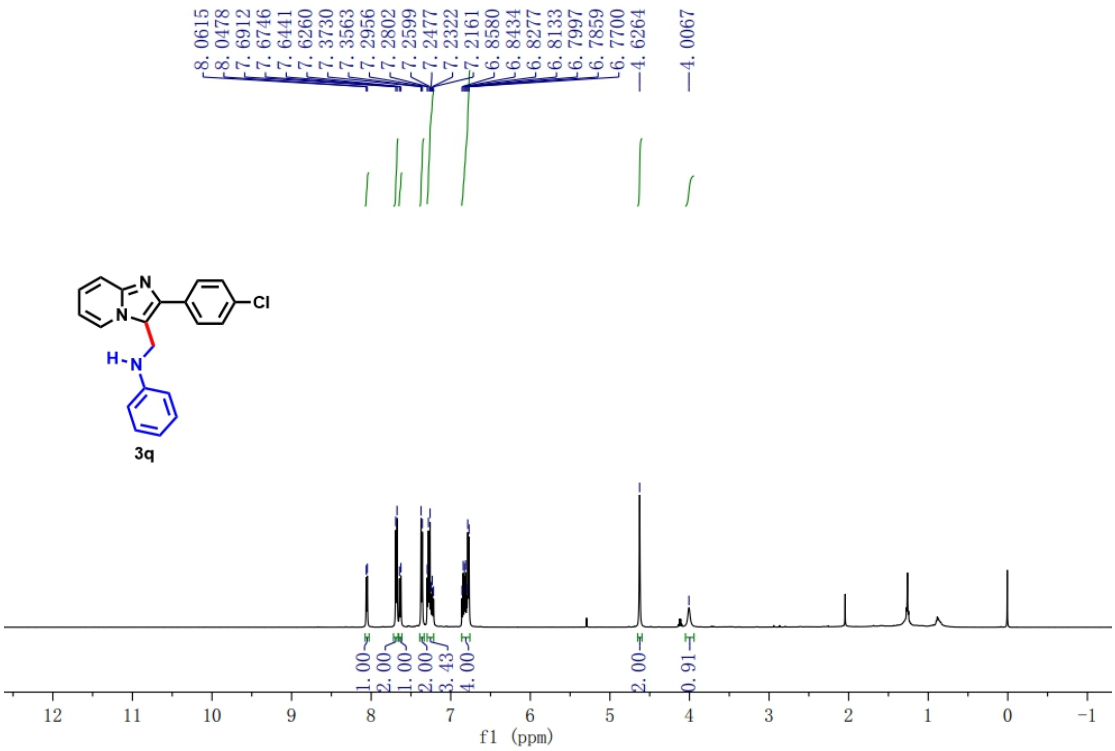
77.1603
76.9056
38.4125
21.4341
Me
H
N
3p
f1 (ppm)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7.2956
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7.2599
7.2477
7.2322
7.2161
6.8580
6.8434
6.8277
6.8133
6.7997
6.7859
6.7700
4.6264
4.0067
Cl
H
N
3q
1.00
2.00
1.00
2.00
3.43
4.00
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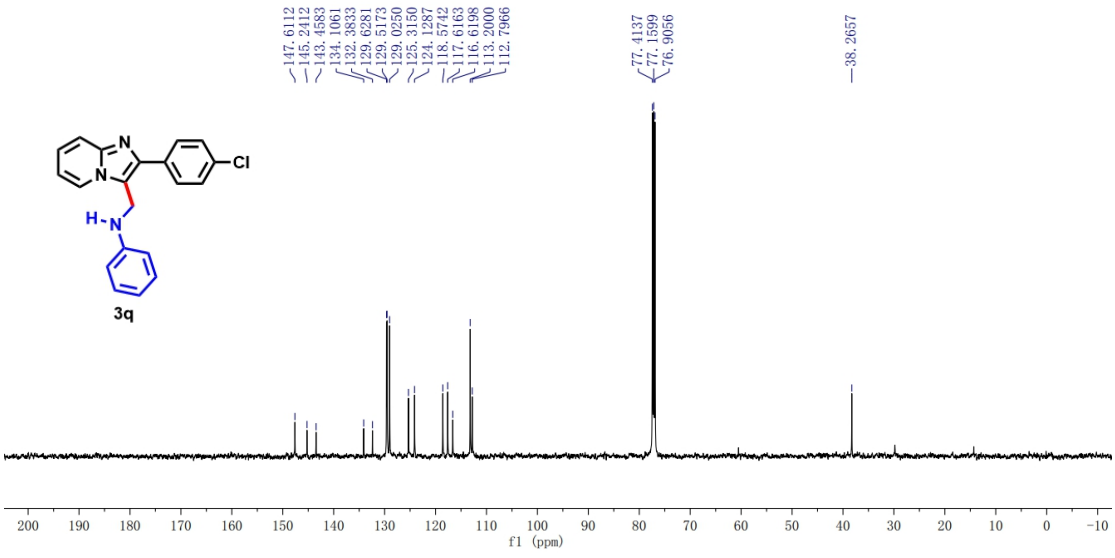
12
11
10
9
8
7
6
5
4
3
2
1
0
−1
f1 (ppm)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129.5173
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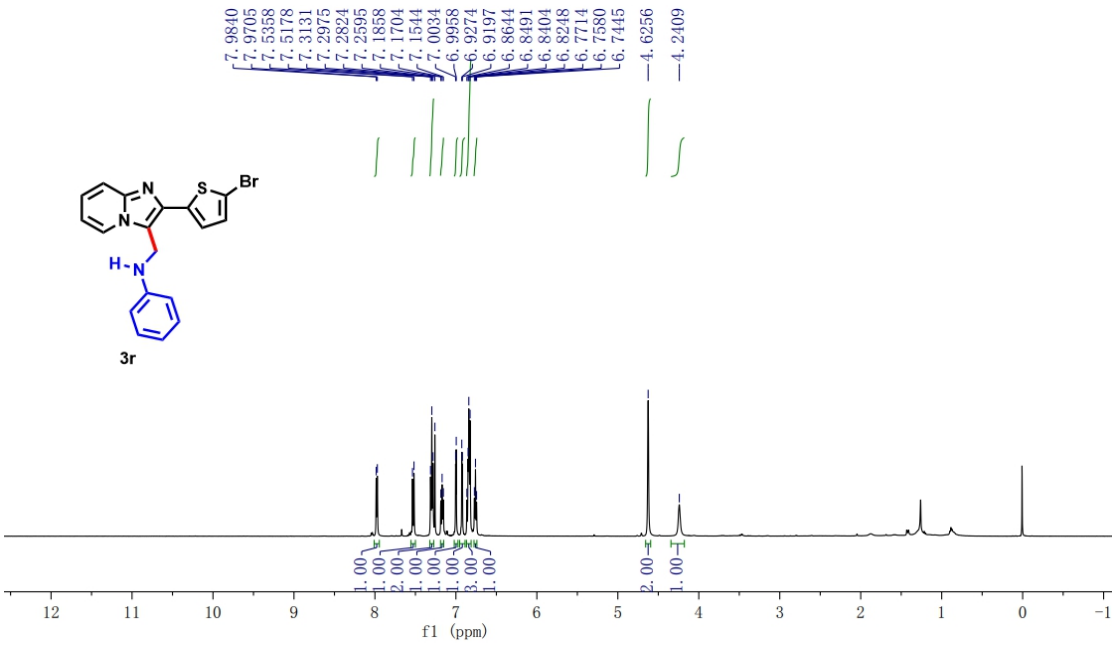
124.1287
118.5742
117.6163
116.6198
113.2000
112.7966
77.4137
77.1599
76.9056
38.2657
Cl
H
N
3q
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)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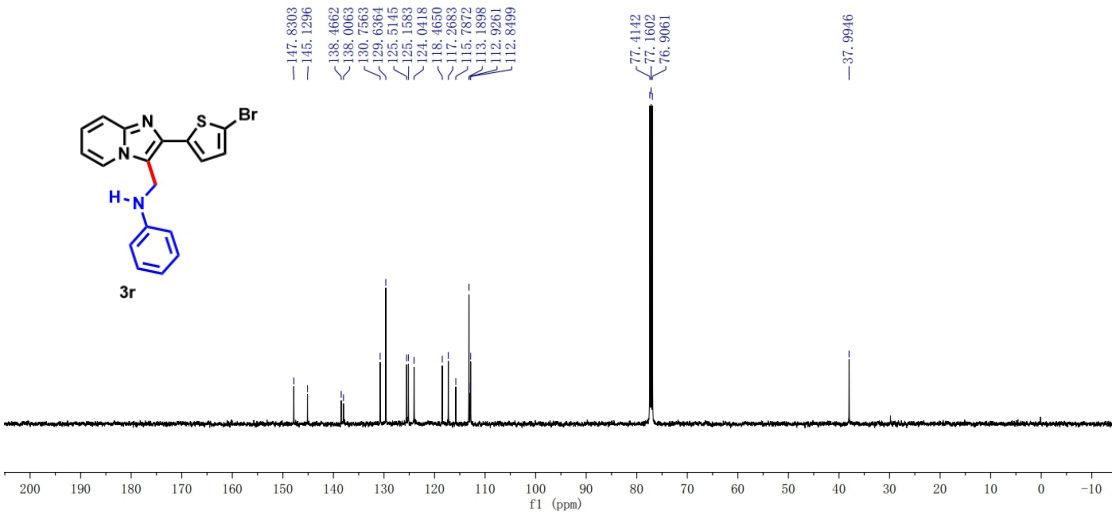
7.5358
7.5178
7.3131
7.2975
7.2824
7.2595
7.1858
7.1704
7.1544
7.0034
6.9958
6.9274
6.9197
6.8644
6.8491
6.8404
6.8248
6.7714
6.7580
6.7445
4.6256
4.2409
Br
S
N
H-N
3r
1.00
1.00
2.00
1.00
1.00
1.00
3.00
1.00
2.00
1.00
12
11
10
9
8
7
6
5
4
3
2
1
0
−1
f1 (ppm)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129.6364
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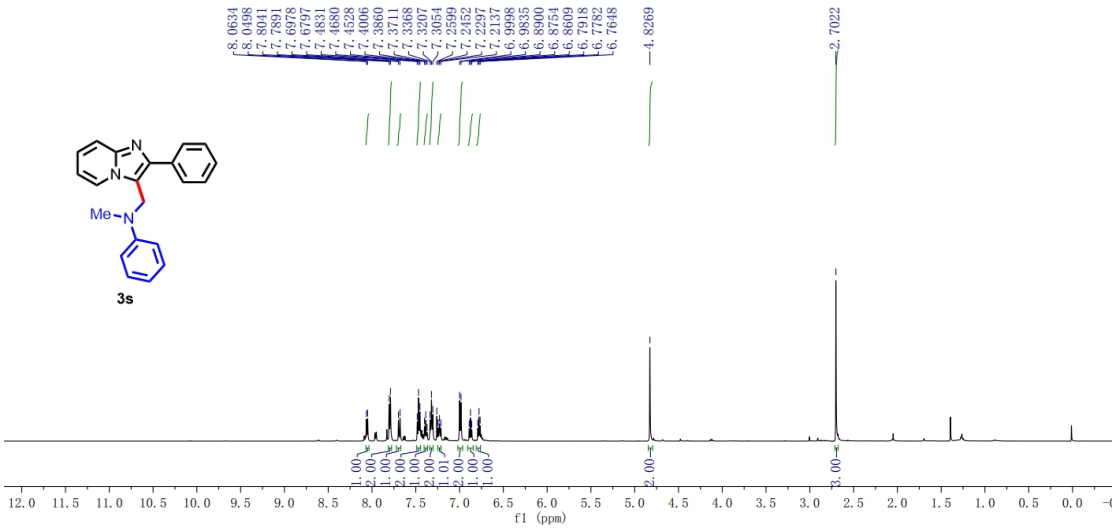
117.2683
115.7872
113.1898
112.9261
112.8499
77.4142
77.1602
76.9061
37.9946
Br
S
N
H-N
3r
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
−10
f1 (ppm)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7.4831
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7.3860
7.3711
7.3368
7.3207
7.3054
7.2399
7.2452
7.2297
7.2137
6.9998
6.9835
6.8900
6.8754
6.8609
6.7918
6.7782
6.7648
4.8269
2.7022
Me
N
3s
1.00
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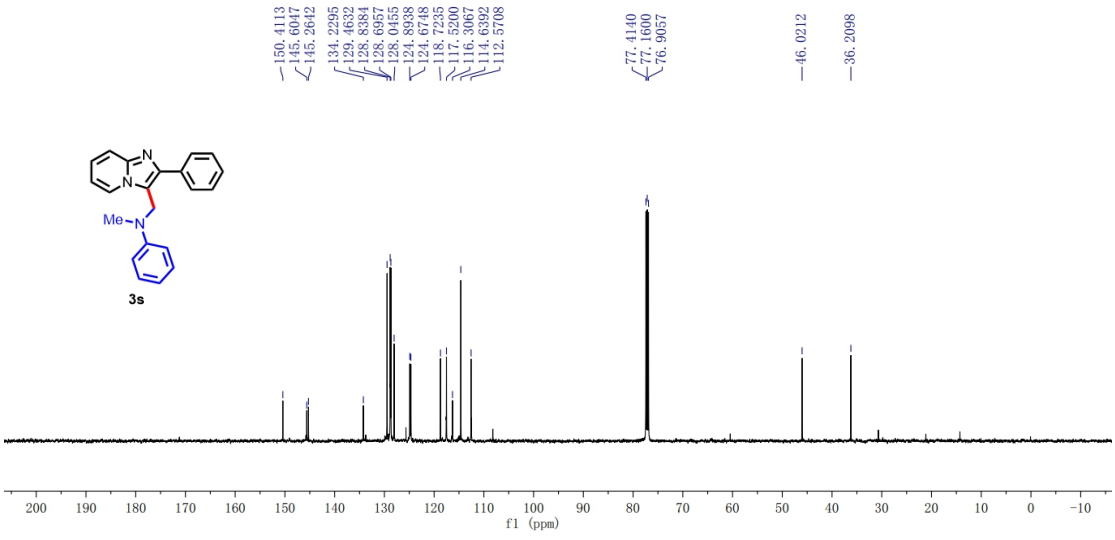
2.00
1.00
2.00
1.01
2.00
1.00
1.00
2.00
3.00
f1 (ppm)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124.6748
118.7235
117.5200
116.3067
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77.4140
77.1600
76.9057
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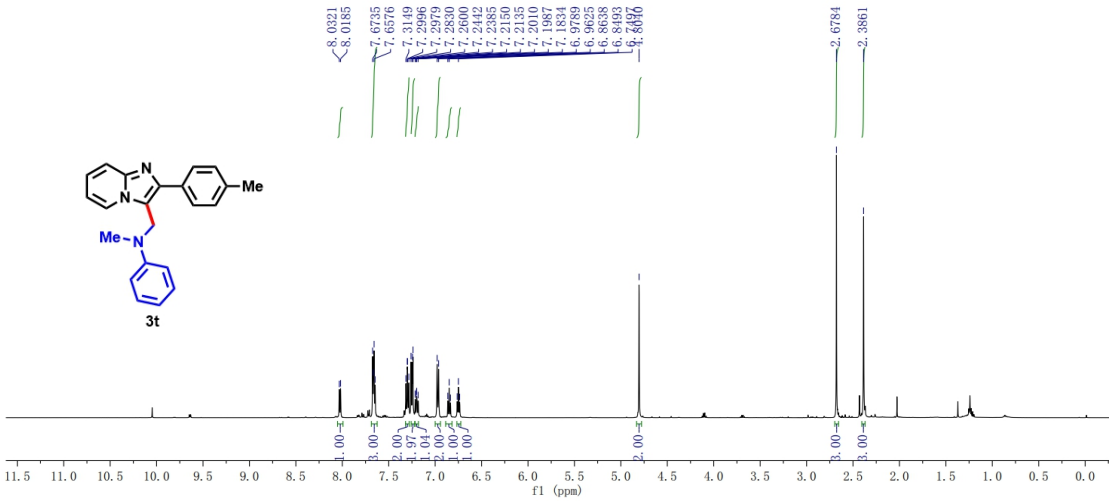
36.2098
Me
N
3s
f1 (ppm)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7.2996
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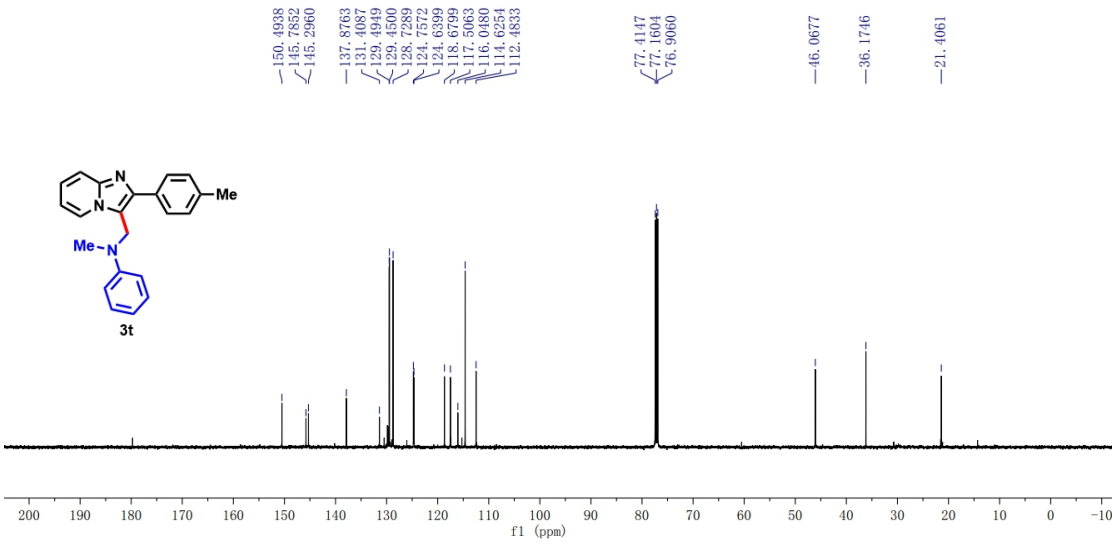
7.2385
7.2150
7.2135
7.2010
7.1987
7.1834
6.9789
6.9625
6.8638
6.8493
6.8347
6.8040
2.6784
2.3861
Me
Me
N
3t
1.00
3.00
2.00
4.97
1.04
2.00
1.00
1.00
2.00
3.00
3.00
11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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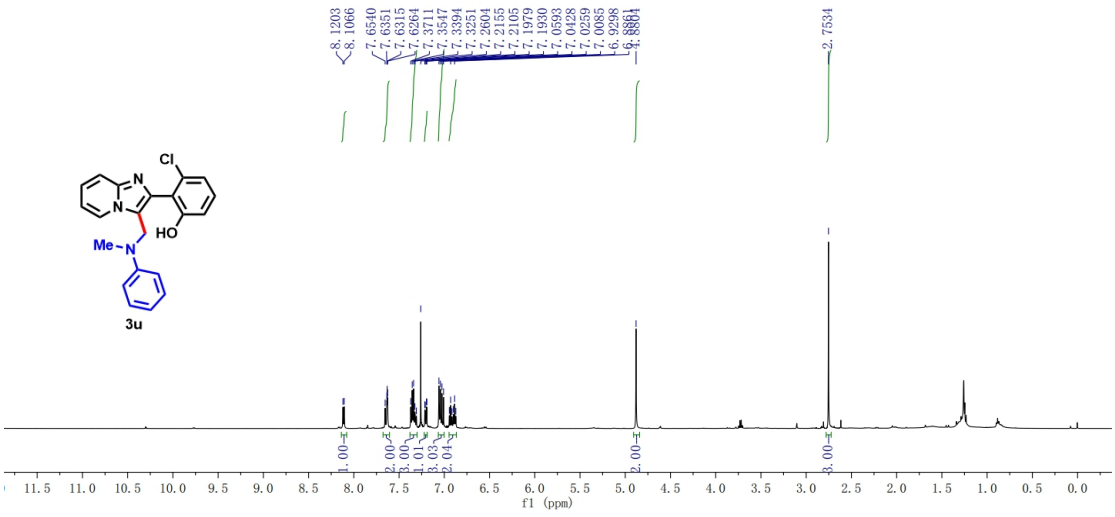
117.5063
116.0480
114.6254
112.4833
77.4147
77.1604
76.9060
46.0677
36.1746
21.4061
Me
Me
N
3t
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 −10
f1 (ppm)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7.3394
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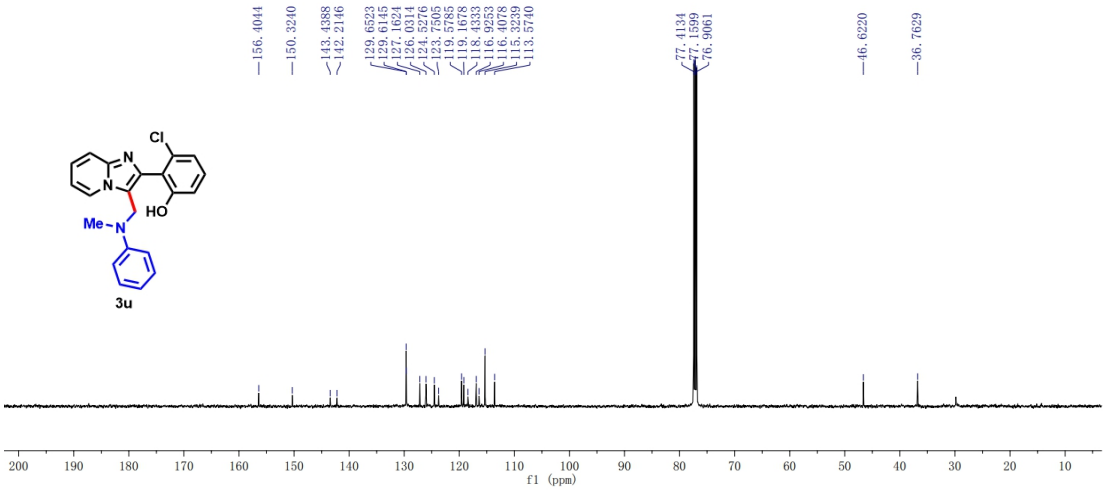
7.2604
7.2155
7.2105
7.1979
7.1930
7.0593
7.0428
7.0259
7.0085
6.9298
6.8861
6.8804
2.7534
Cl
N
N
HO
Me
N
3u
1.00
2.00
3.00
1.01
3.03
2.04
2.00
3.00
11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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124.5276
123.5765
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119.1678
118.4333
116.9253
116.4078
115.3239
113.5740
77.4134
77.1599
76.9061
46.6220
36.7629
Cl
N
N
HO
Me
N
3u
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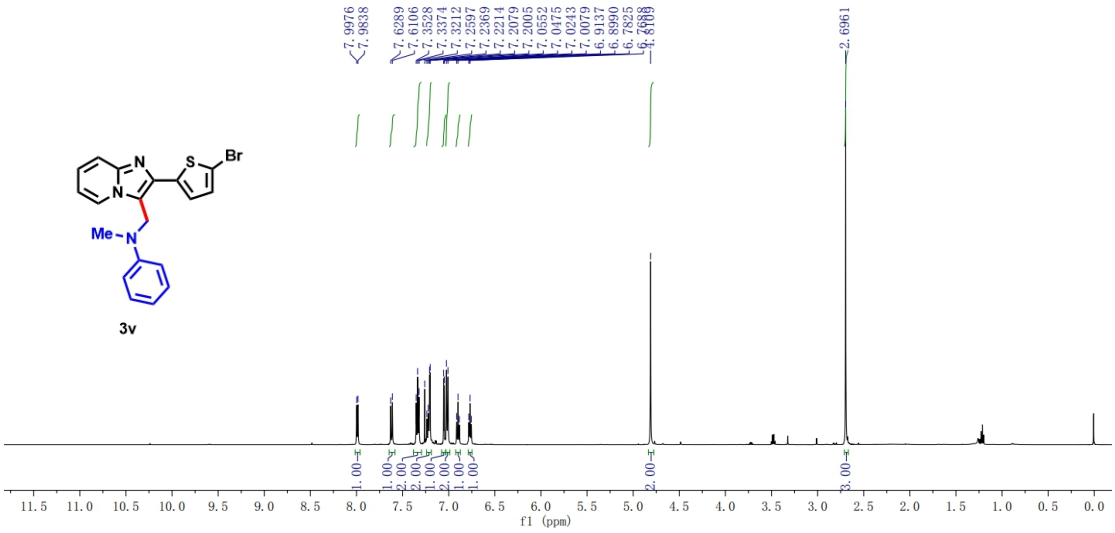
f1 (ppm)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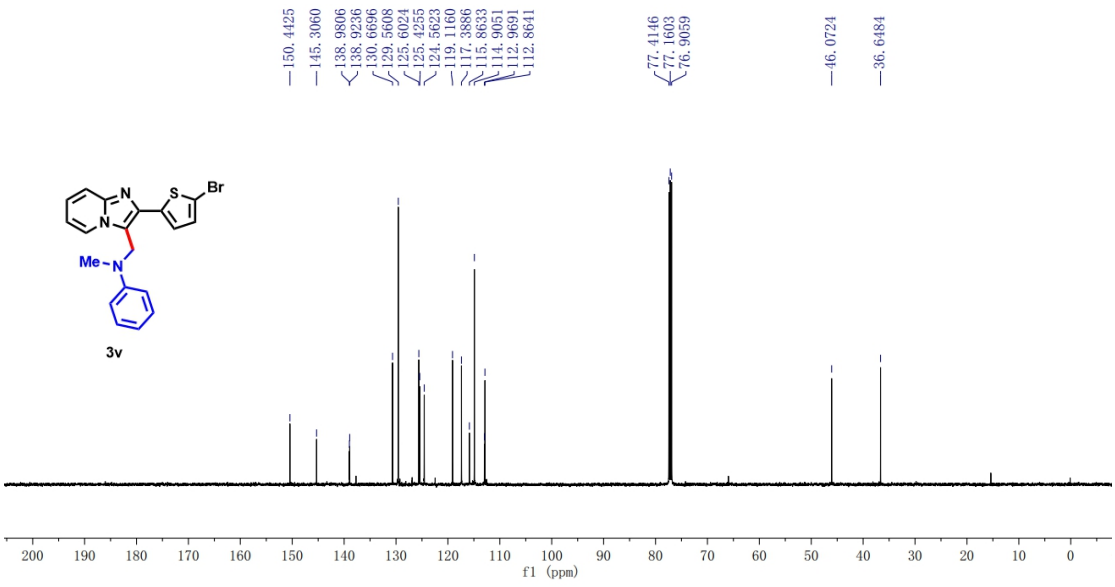
7.2005
7.0552
7.0475
7.0243
7.0079
6.9137
6.8990
6.7825
6.7688
4.8109
2.6961
N
S
Br
Me
N
3v
1.00
1.00
2.00
2.00
1.00
2.00
1.00
1.00
2.00
3.00
11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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117.3886
115.8633
114.9051
112.9691
112.8641
77.4146
77.1603
76.9059
46.0724
36.6484
N
S
Br
Me
N
3v
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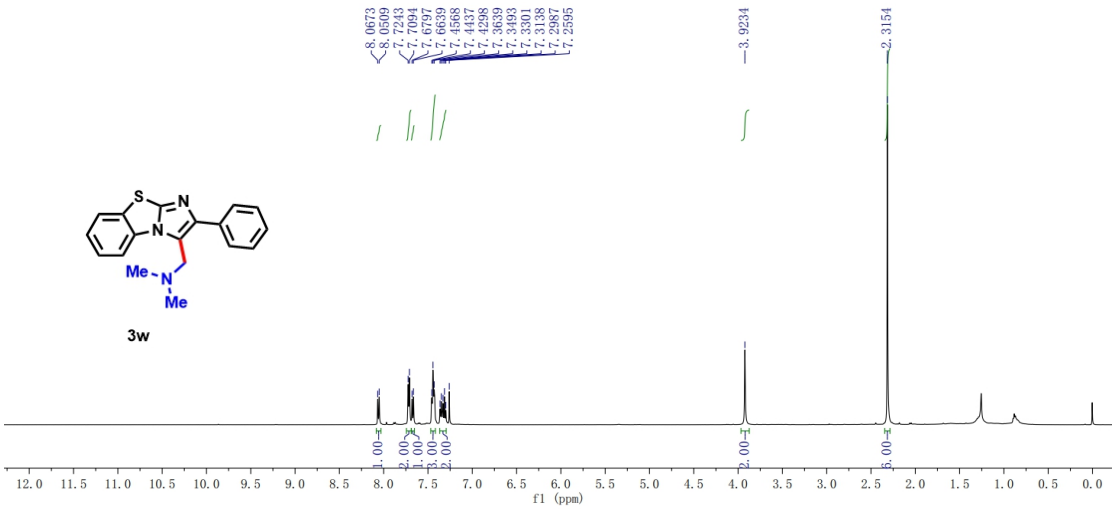
f1 (ppm)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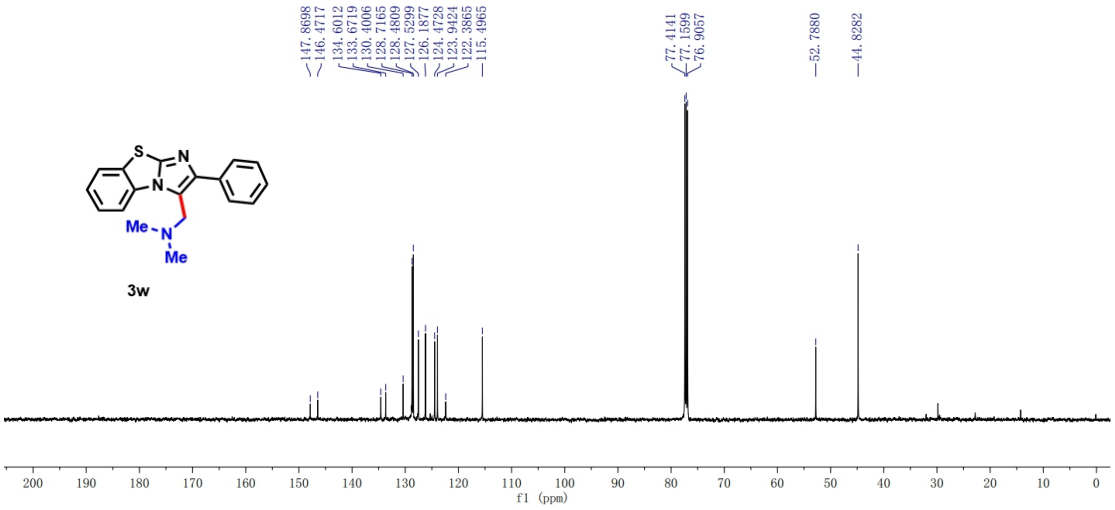
7.3301
7.3138
7.2987
7.2595
3.9234
2.3154
1.00
2.00
1.00
3.00
2.00
2.00
6.00
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)
S
N
Me
N
Me
3w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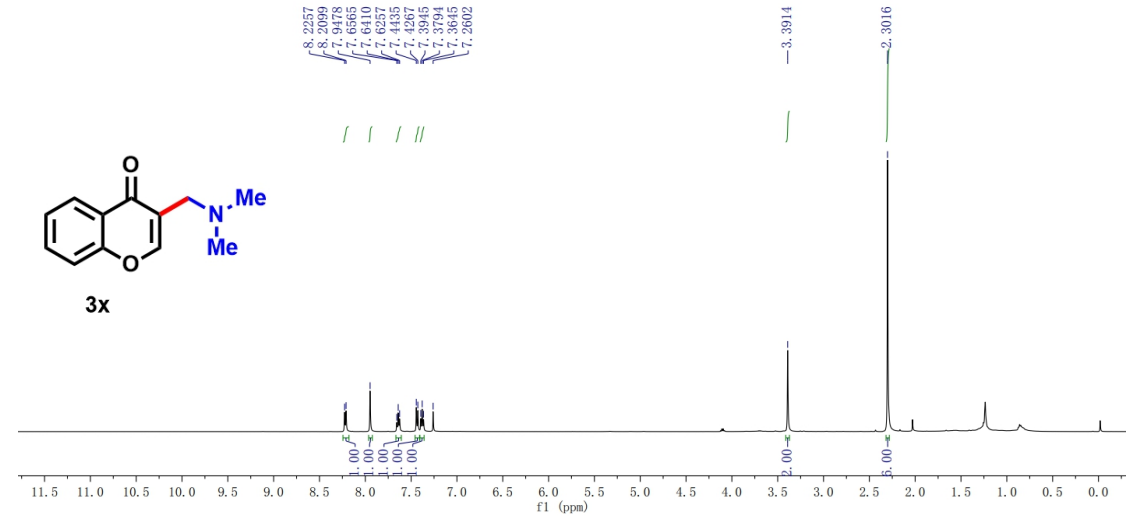
123.9424
122.3865
115.4965
77.4141
77.1599
76.9057
52.7880
44.8282
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)
S
N
Me
N
Me
3w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7.3645
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2.3016
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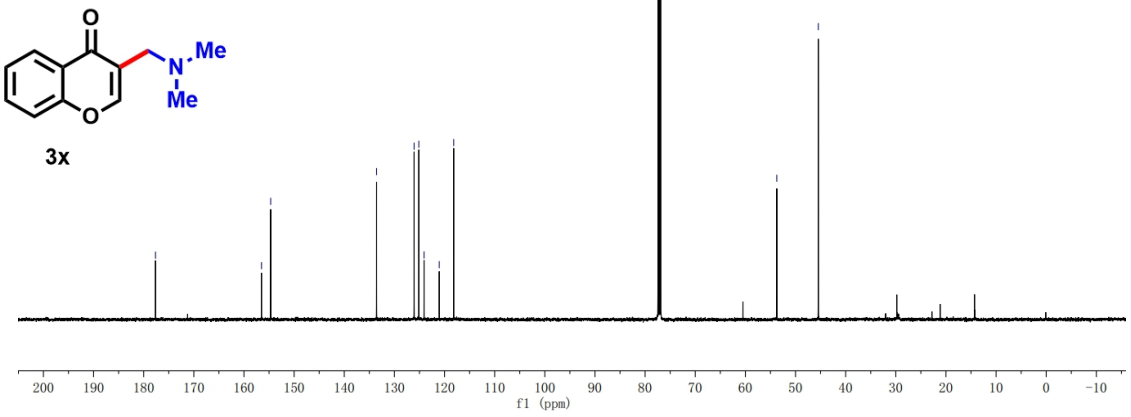
1.00
1.00
1.00
1.00
2.00
3.00
f1 (ppm)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76.9054
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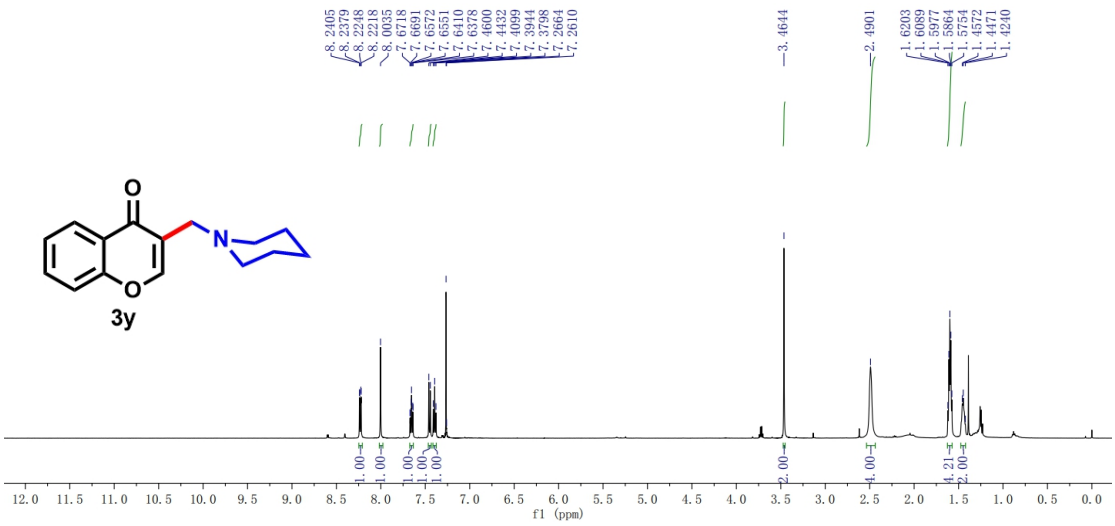
45.4521
f1 (ppm)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7.4099
7.3944
7.3798
7.2664
7.2610
3.4644
2.4901
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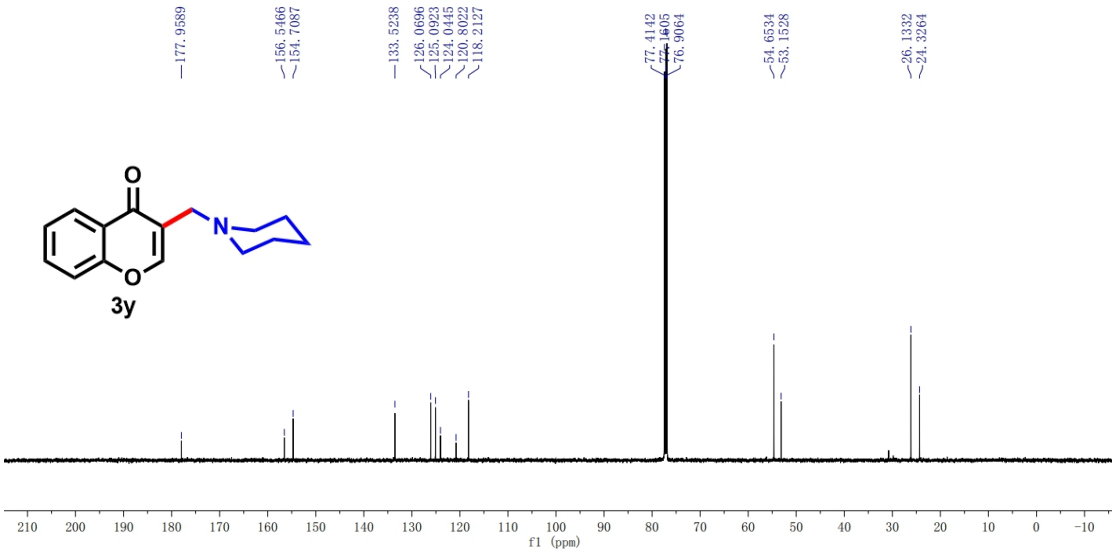
1.6089
1.5977
1.5864
1.5754
1.4572
1.4471
1.4240
O
N
O
3y
1.00
1.00
1.00
1.00
1.00
2.00
4.00
4.21
2.00
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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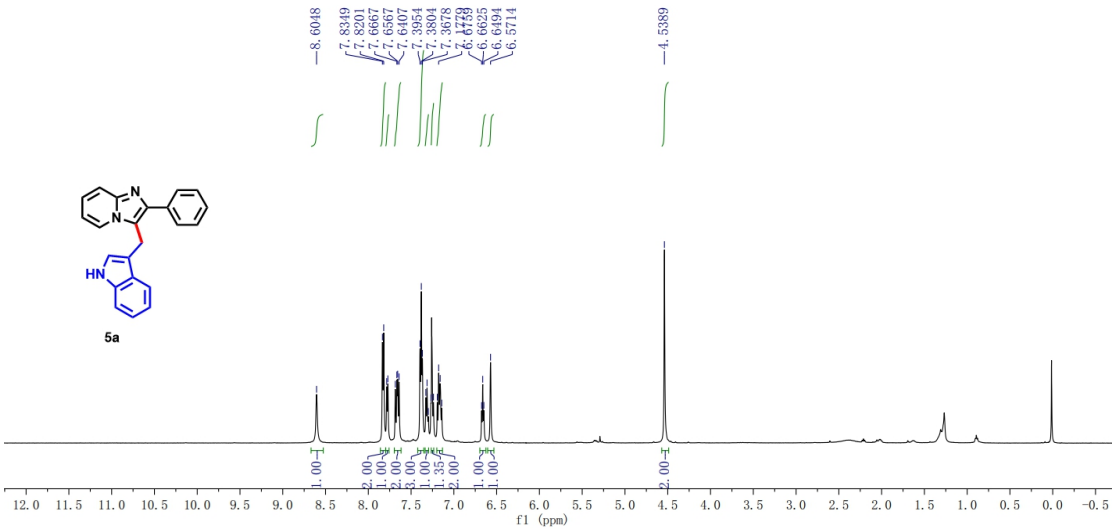
54.6534
53.1528
26.1332
24.3264
O
N
O
3y
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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6.6759
6.6625
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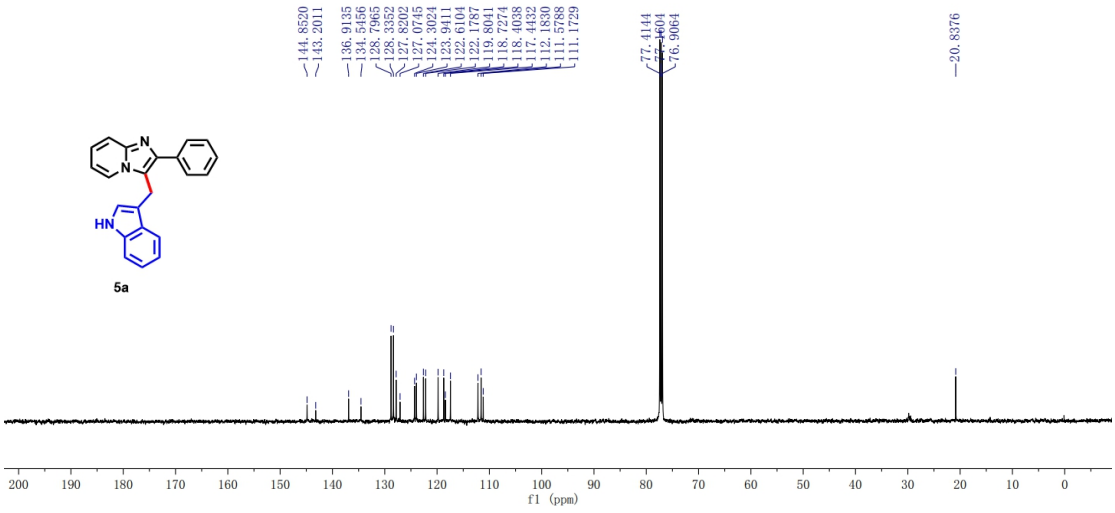
6.5714
4.5389
HN
5a
1.00
2.00
1.00
2.00
3.00
1.00
1.35
2.00
1.00
1.00
2.00
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5
f1 (ppm)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118.4038
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HN
5a
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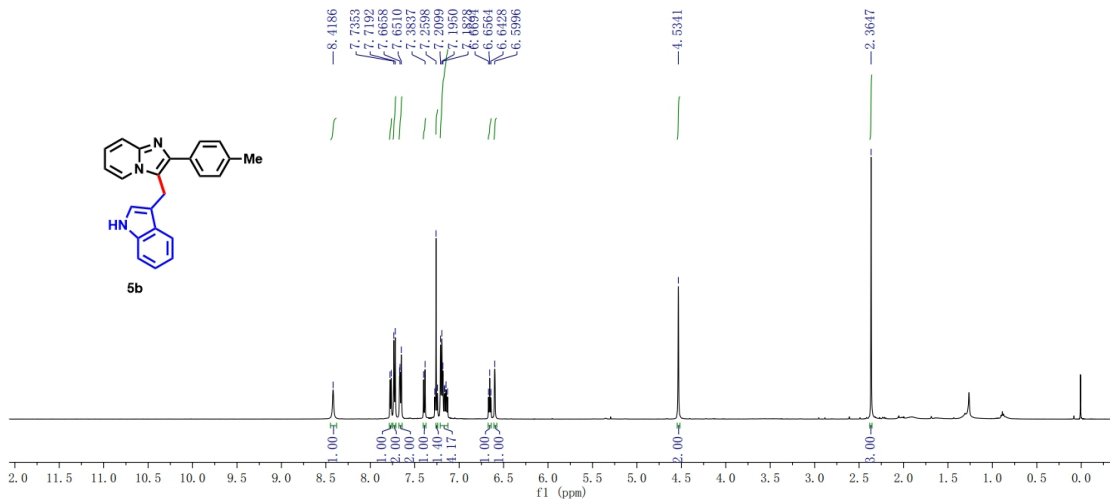
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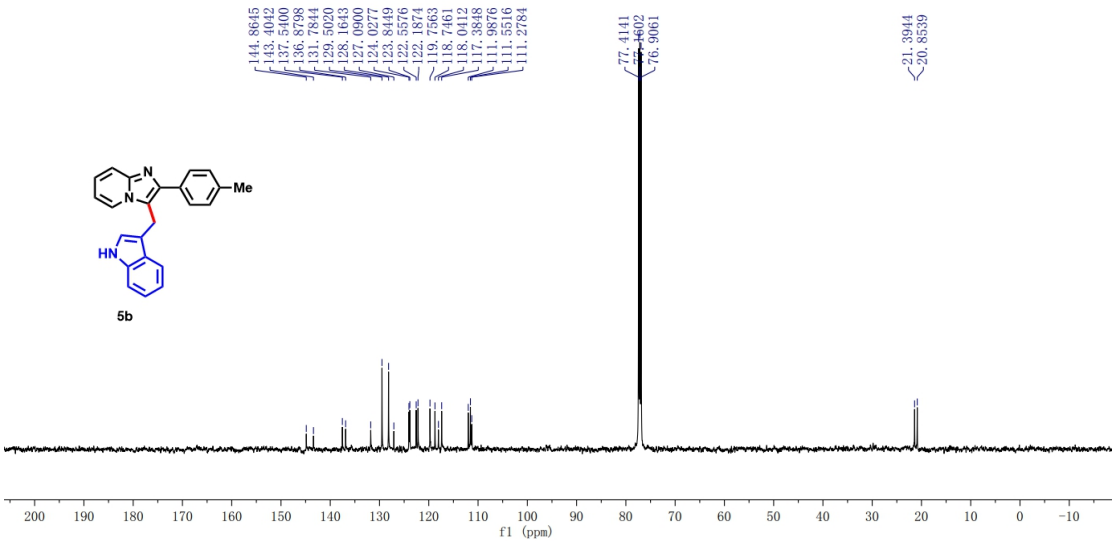
Me
HN
5b
f1 (ppm)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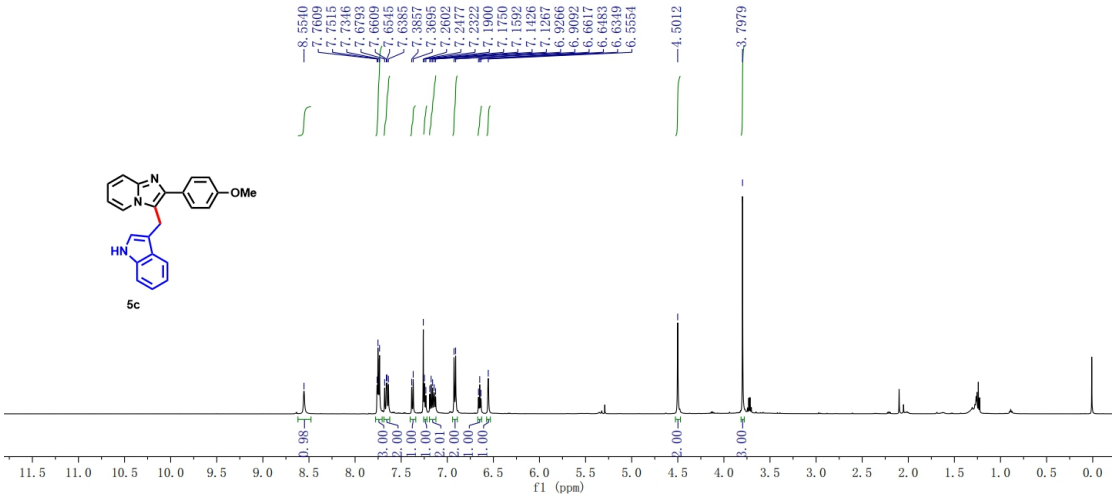
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OMe
HN
5c
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2.00
1.00
1.00
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2.00
1.00
1.00
2.00
3.00
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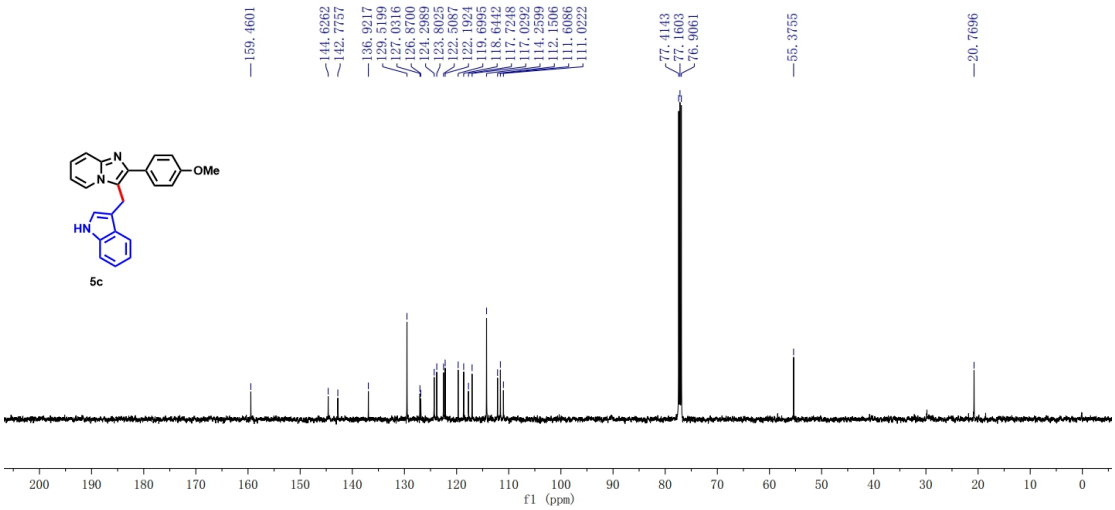
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HN
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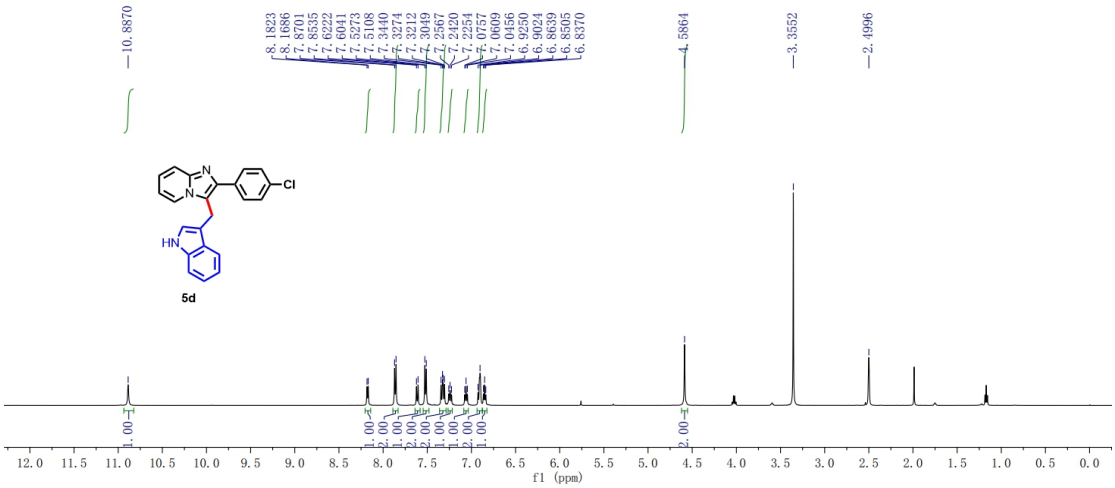
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6.8370
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3.3552
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Cl
HN
5d
1.00
1.00
2.00
1.00
2.00
2.00
1.00
1.00
2.00
1.00
2.00
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
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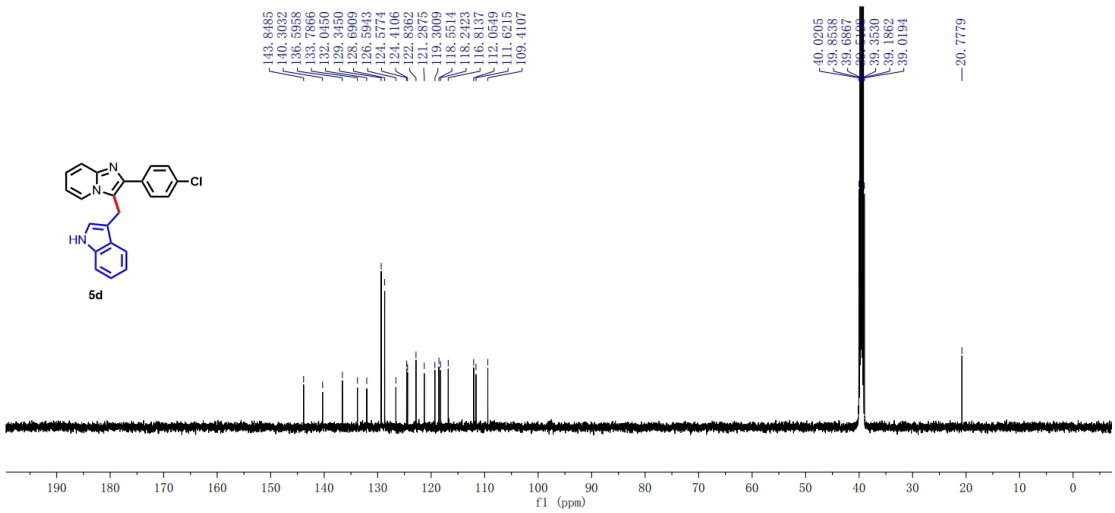
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118.5514
118.2423
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111.6215
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40.0205
39.8538
39.6867
39.5196
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Cl
HN
5d
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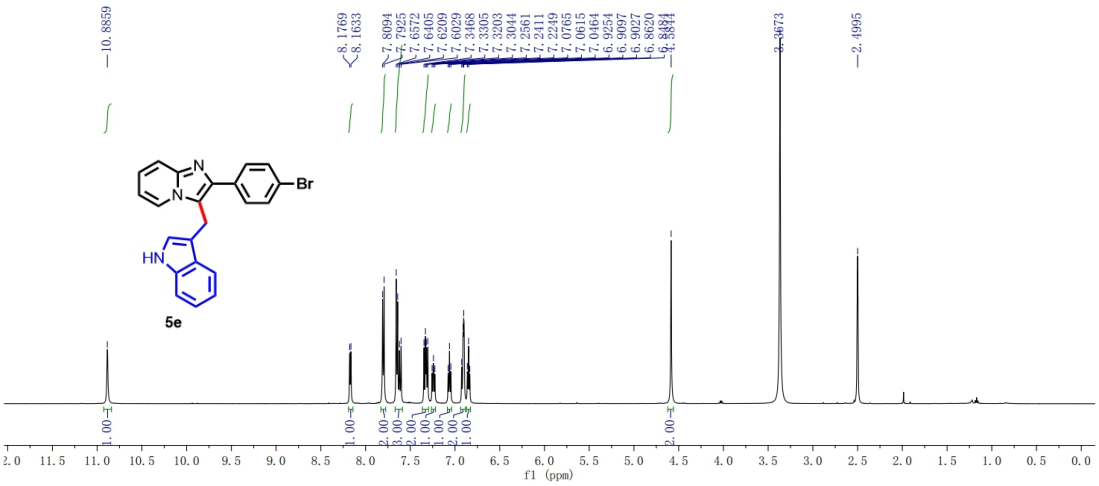
f1 (ppm)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7.0464
6.9254
6.9097
6.9027
6.8820
6.8684
6.8541
3.5673
2.4995
Br
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HN
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2.00
3.00
2.00
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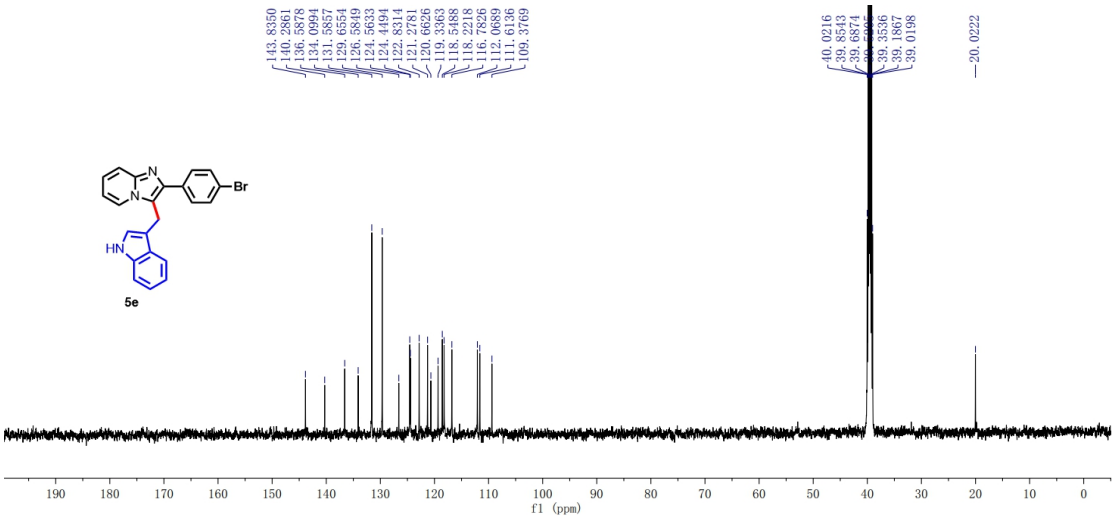
2.00
f1 (ppm)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Br
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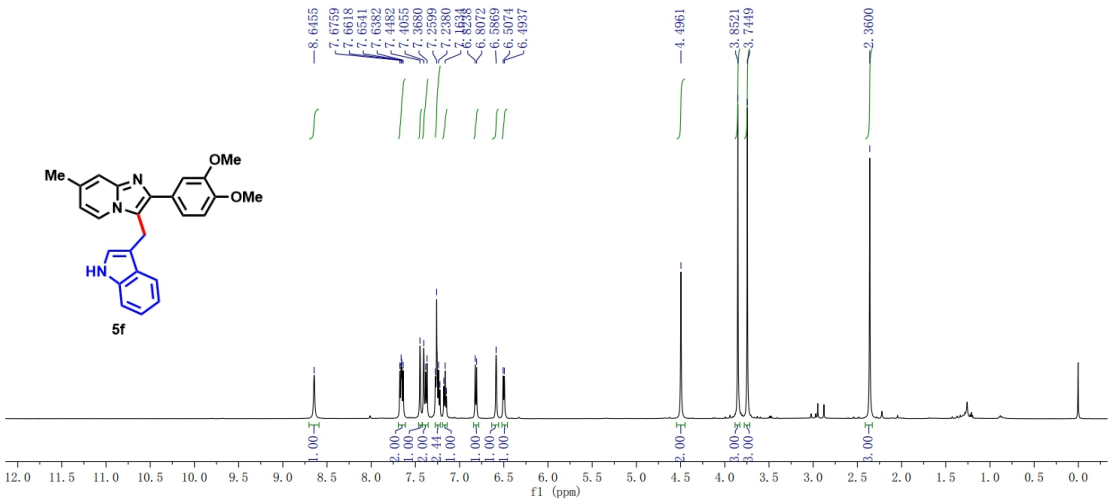
HN
5e
f1 (ppm)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3.7449
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Me
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OMe
N
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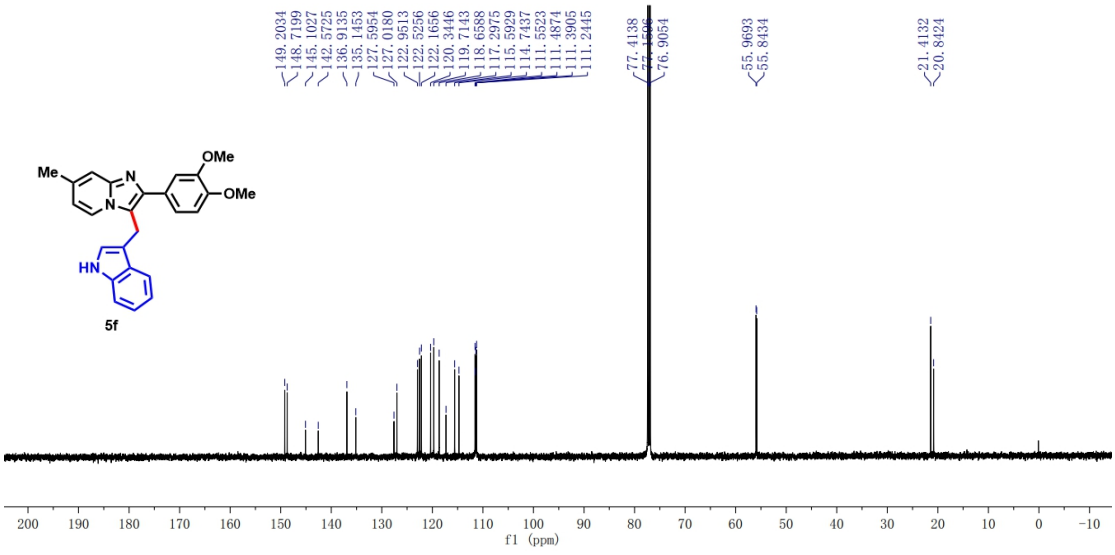
HN
5f
f1 (ppm)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OMe
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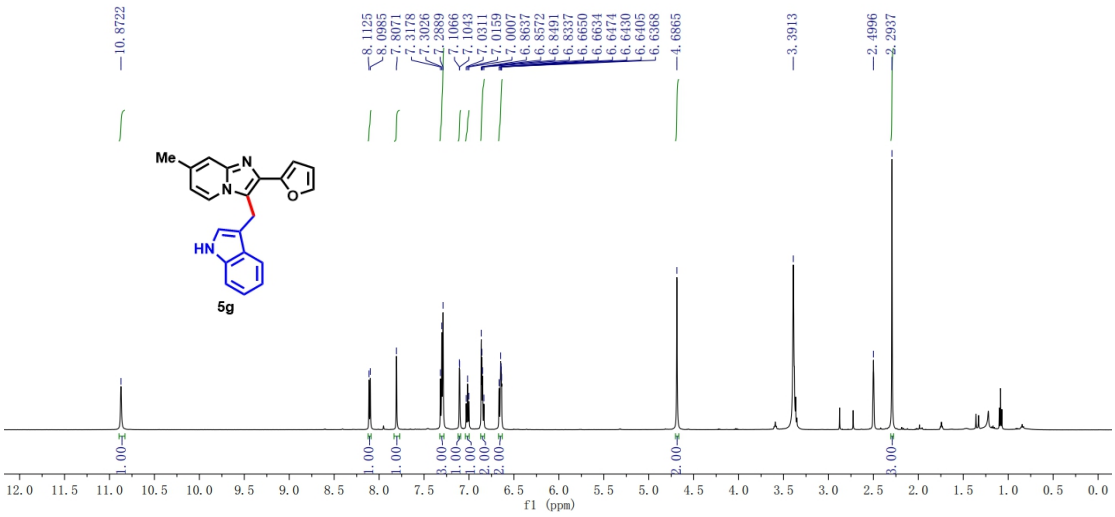
5f
f1 (ppm)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O
HN
5g
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1.00
1.00
3.00
1.00
1.00
2.00
2.00
2.00
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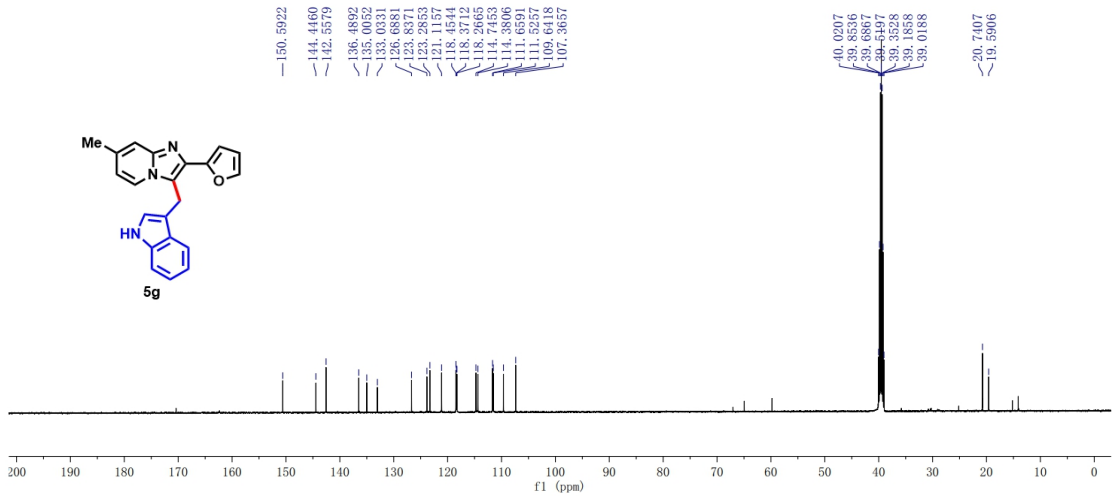
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39.3528
39.1858
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HN
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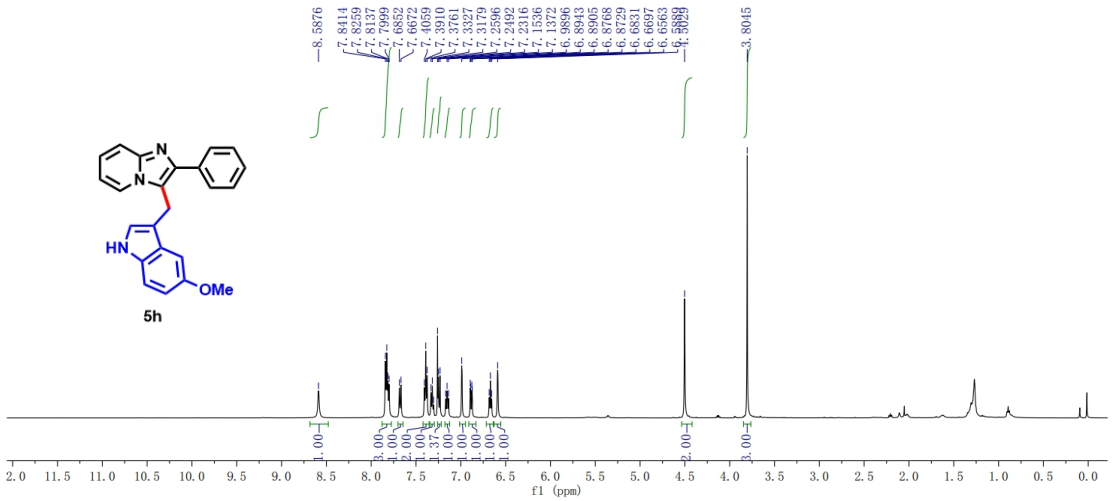
f1 (ppm)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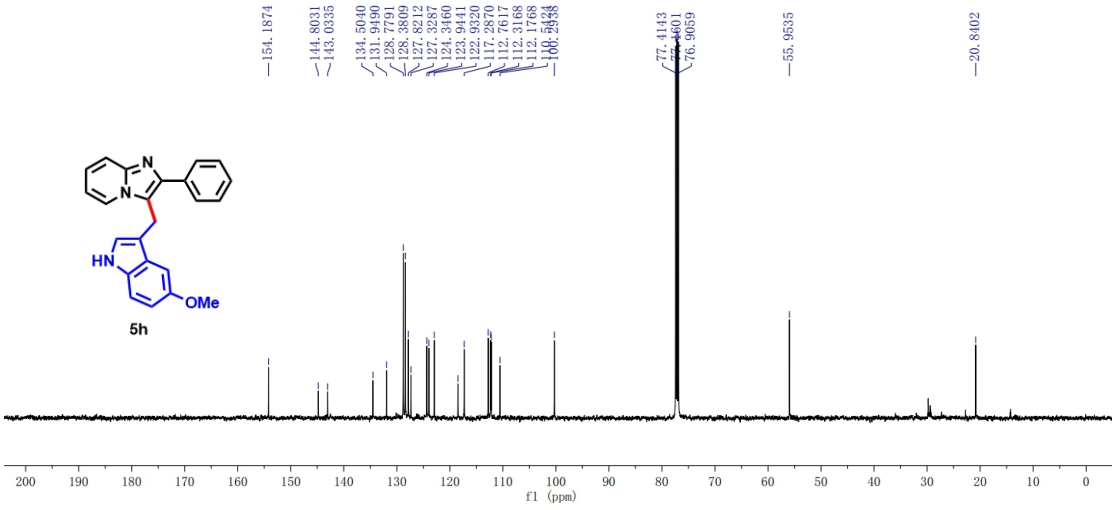
f1 (ppm)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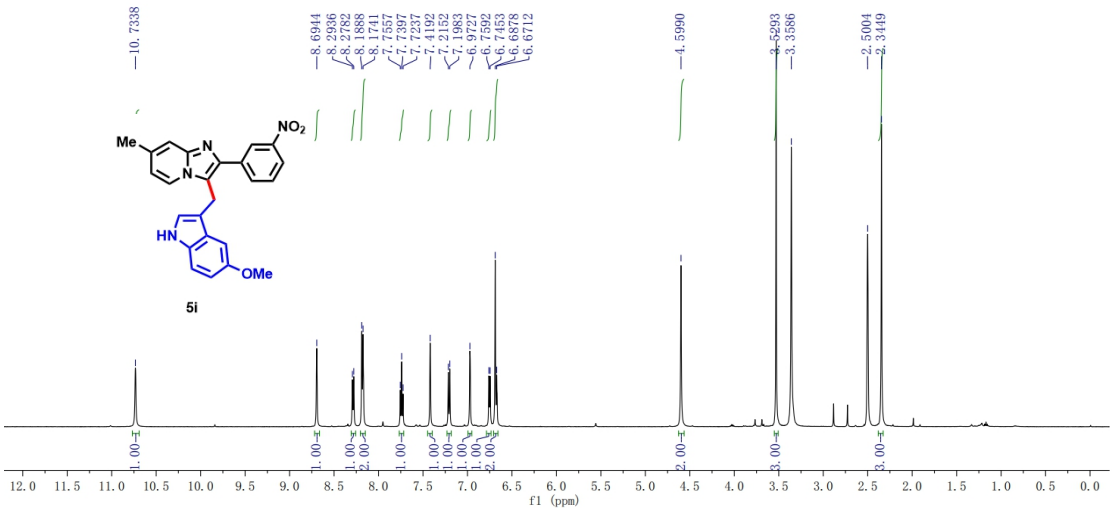
f1 (ppm)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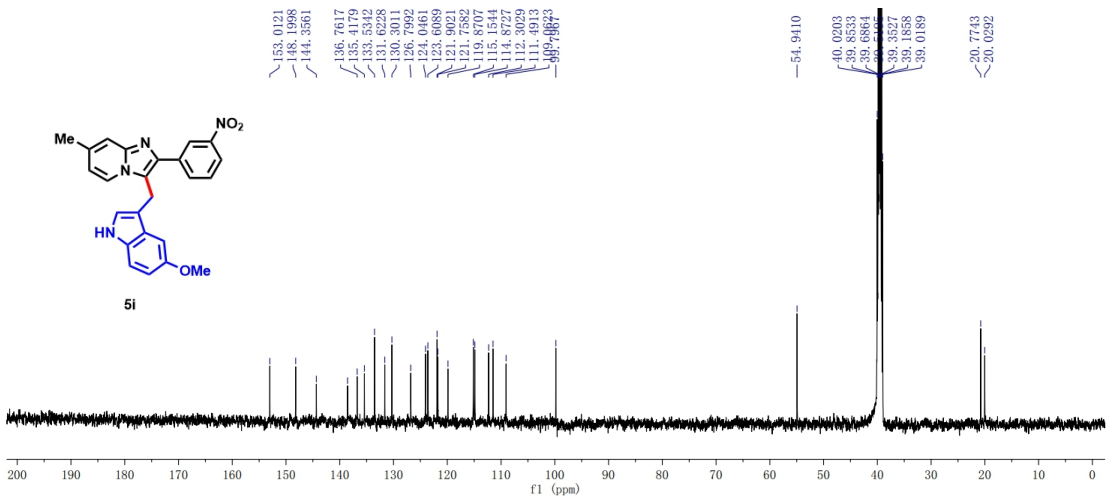
f1 (ppm)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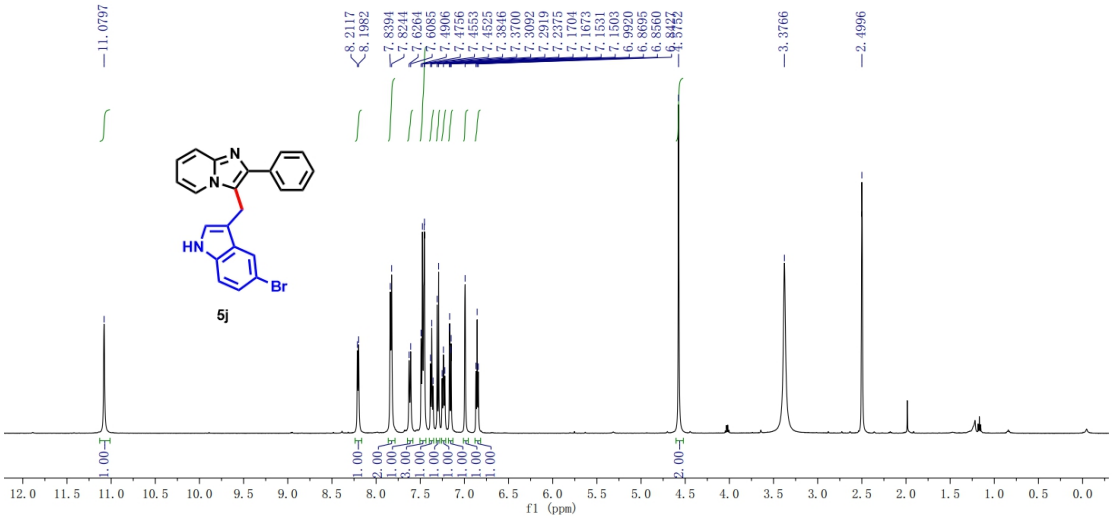
f1 (ppm)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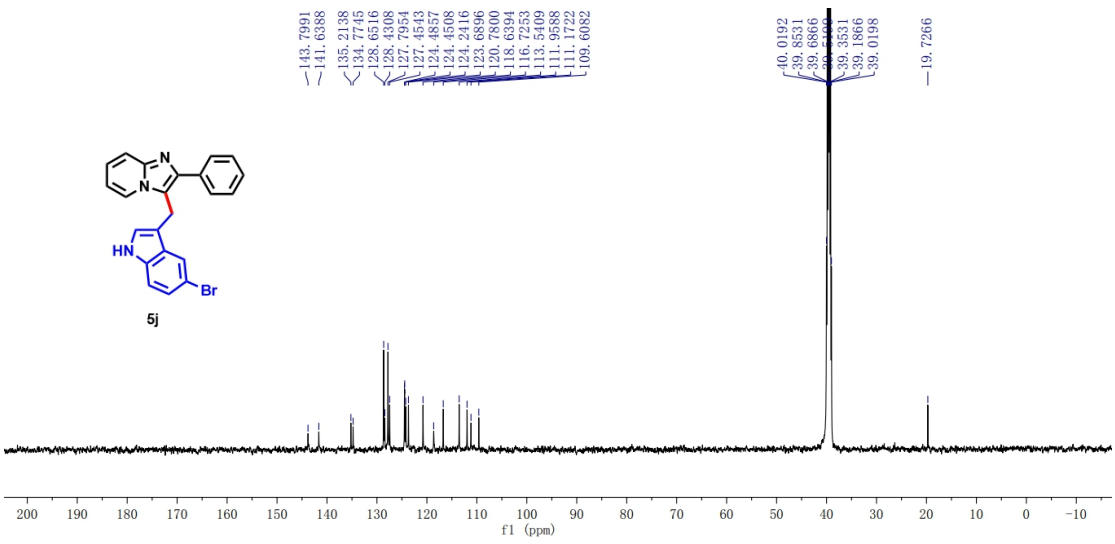
Br
5j
f1 (ppm)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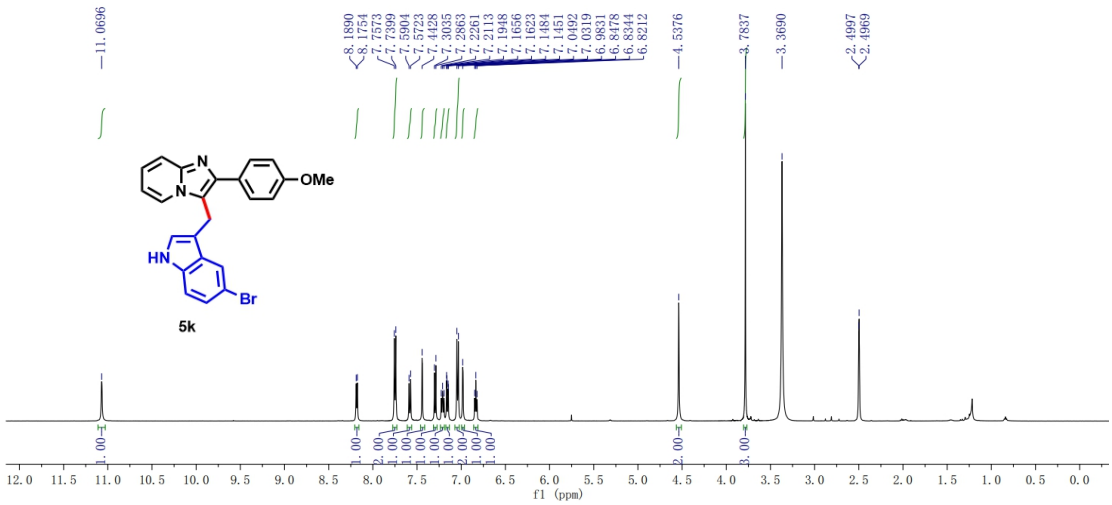
f1 (ppm)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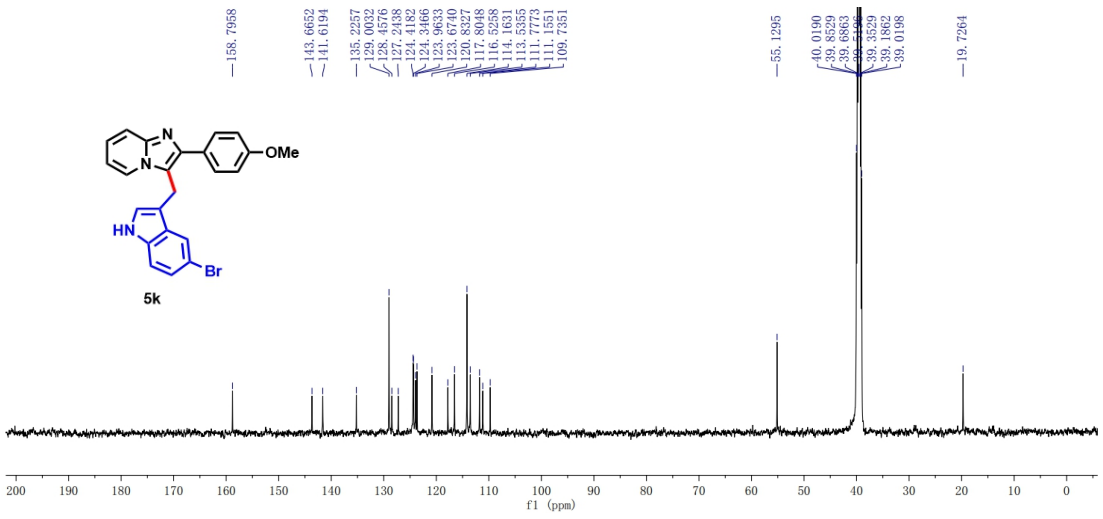
5k
f1 (ppm)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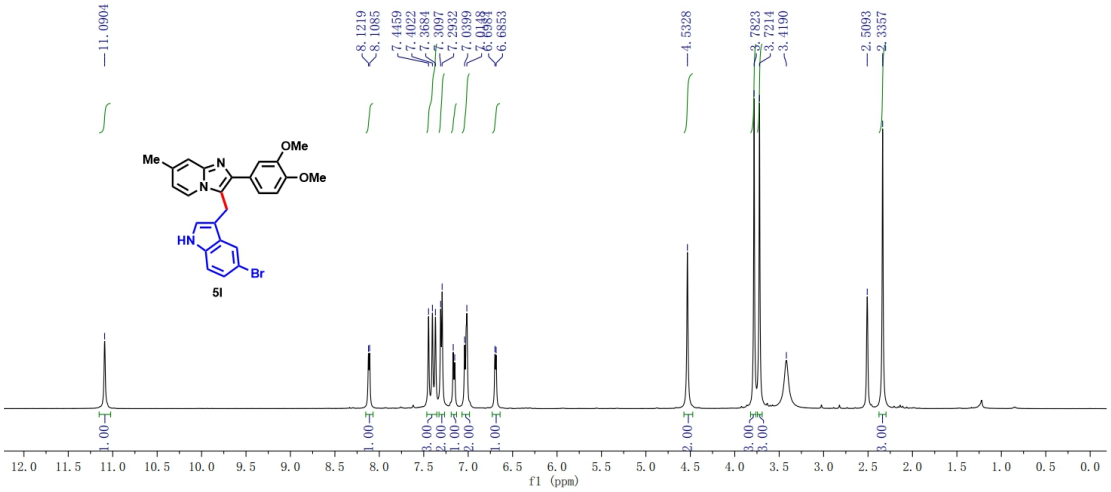
f1 (ppm)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OMe
OMe
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Br
5l
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3.00
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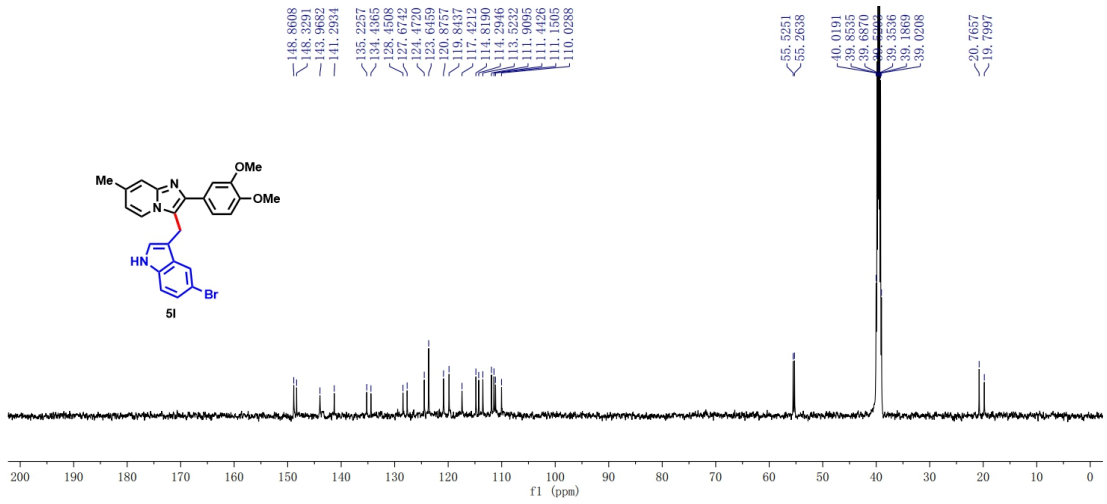
3.00
f1 (ppm)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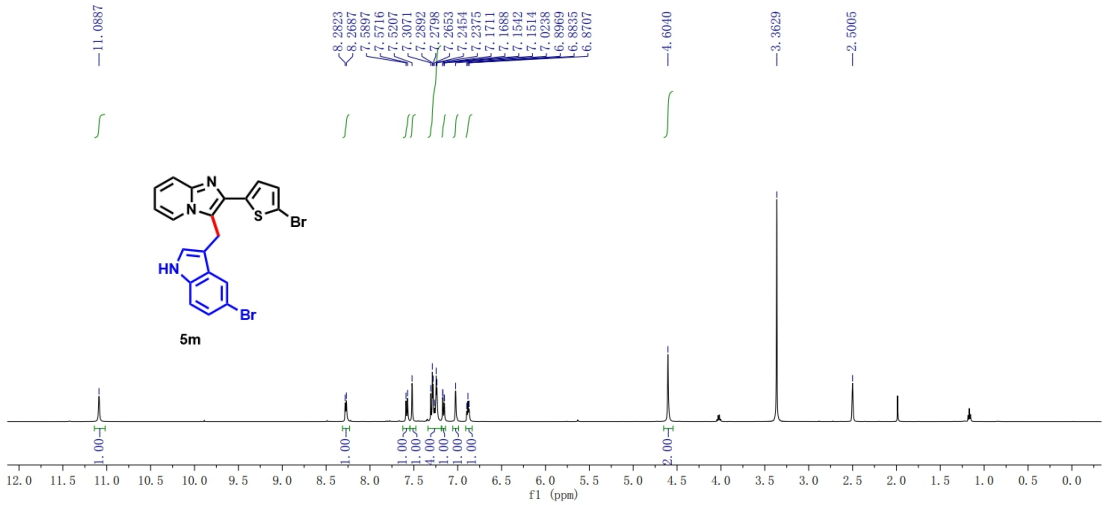
5l
f1 (ppm)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2.00
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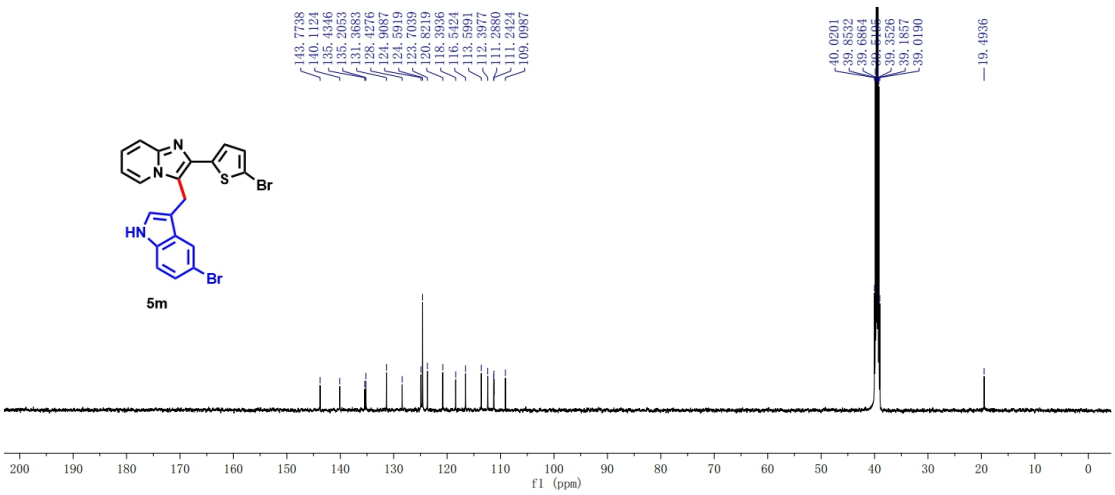
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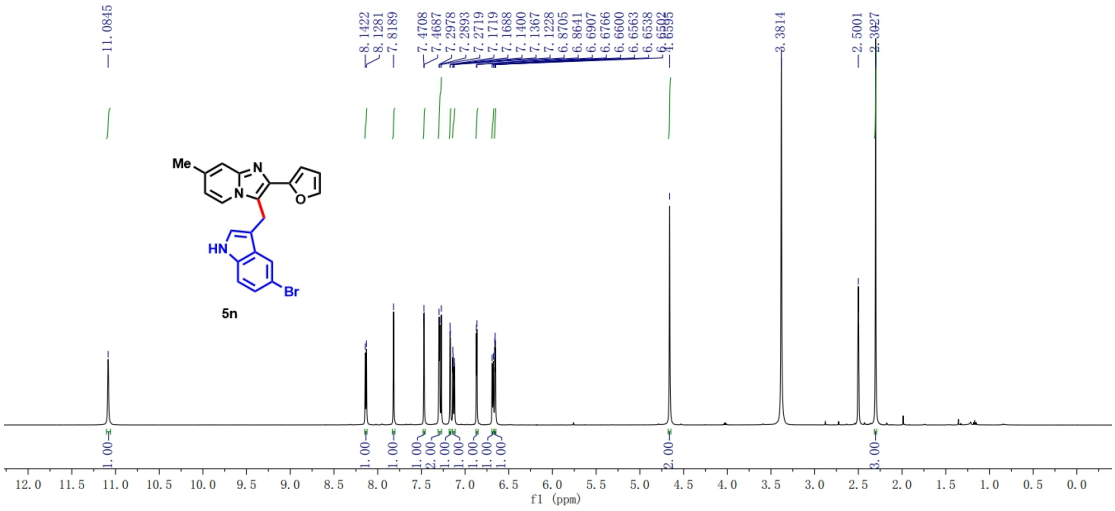
HN
Br
5m
f1 (ppm)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7.1400
7.1367
7.1228
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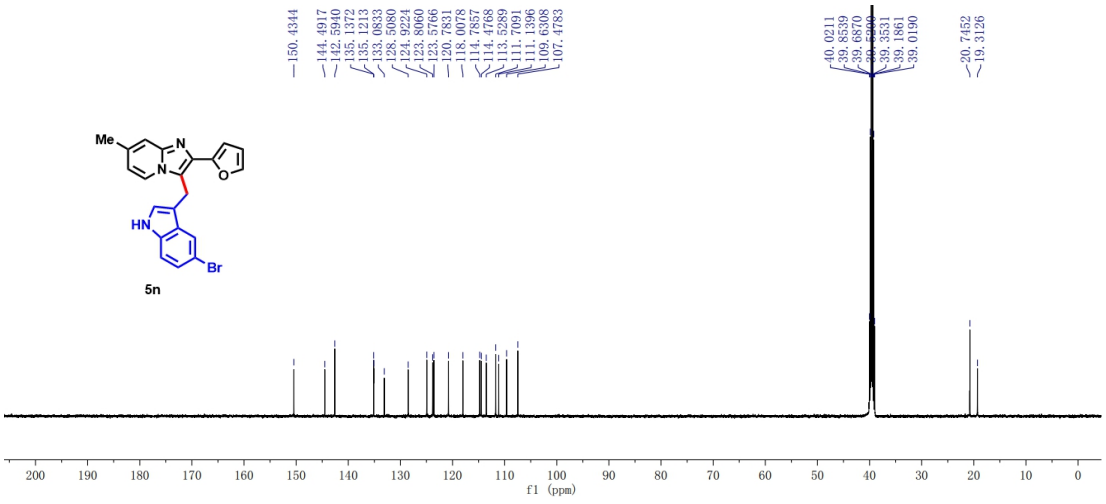
6.8641
6.6907
6.6766
6.6600
6.6563
6.6538
6.6393
3.3814
2.5001
2.3027
Me
N
O
HN
Br
5n
1.00
1.00
1.00
2.00
1.00
1.00
1.00
1.00
1.00
2.00
3.00
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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113.5289
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107.4783
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39.8539
39.6870
39.5200
39.3531
39.1861
39.0190
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Me
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O
HN
Br
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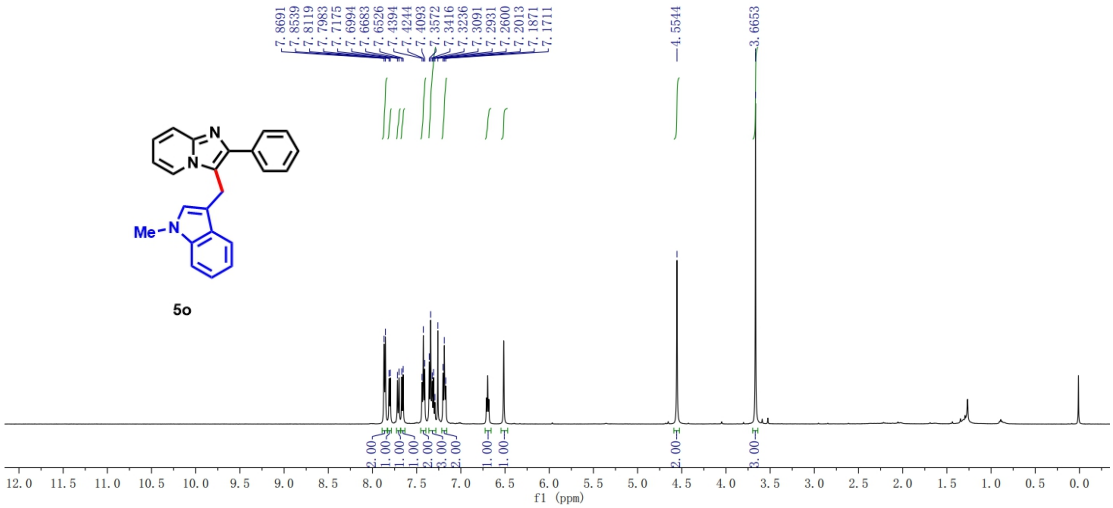
f1 (ppm)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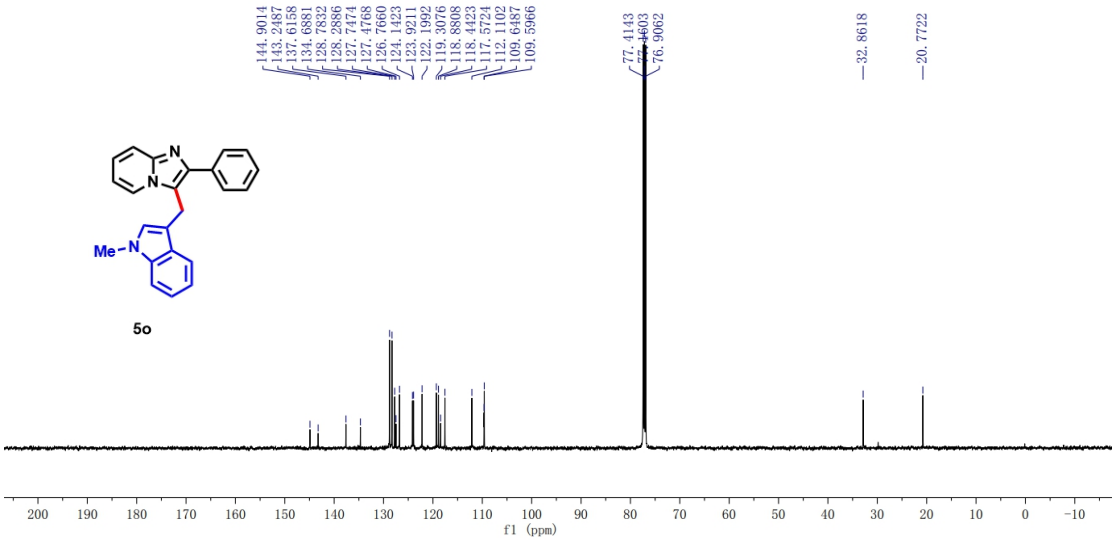
7.1871
7.1711
4.5544
3.6653
Me
N
5o
2.00
1.00
1.00
1.00
2.00
3.00
2.00
1.00
1.00
2.00
3.00
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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112.1102
109.6487
109.5966
77.4143
77.1603
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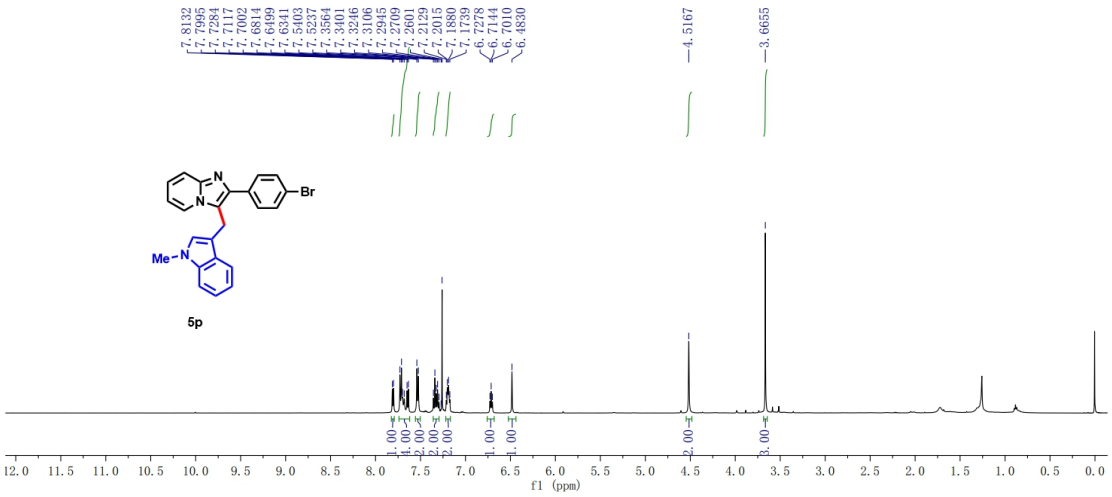
Me
N
5o
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.3401
7.3246
7.3106
7.2945
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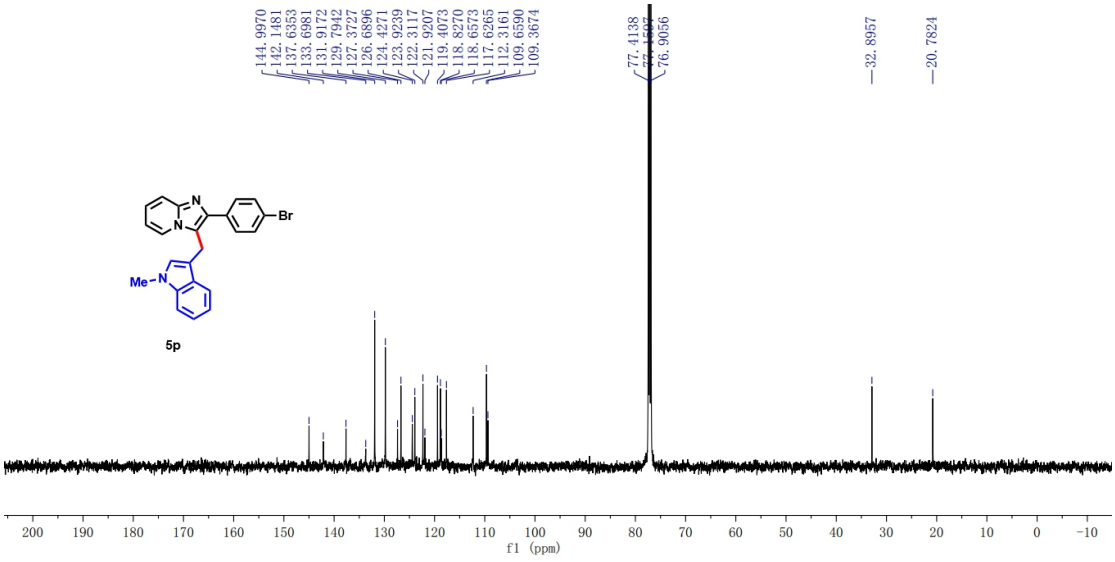
7.2601
7.2129
7.2015
7.1880
7.1739
6.7278
6.7144
6.7010
6.4830
4.5167
3.6655
Br
Me
N
5p
1.00
1.00
1.00
2.00
2.00
1.00
1.00
2.00
3.00
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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117.6265
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109.6590
109.3674
77.4138
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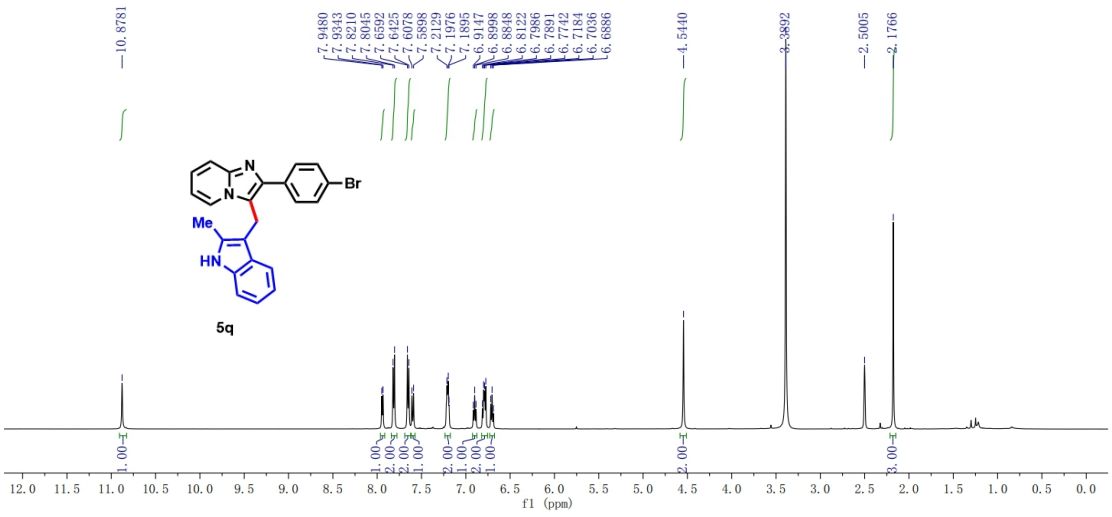
Br
Me
N
5p
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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7.1895
6.9147
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6.8848
6.8122
6.7986
6.7891
6.7742
6.7184
6.7036
6.6886
4.5440
3.3892
2.5005
2.1766
Br
N
Me
HN
5q
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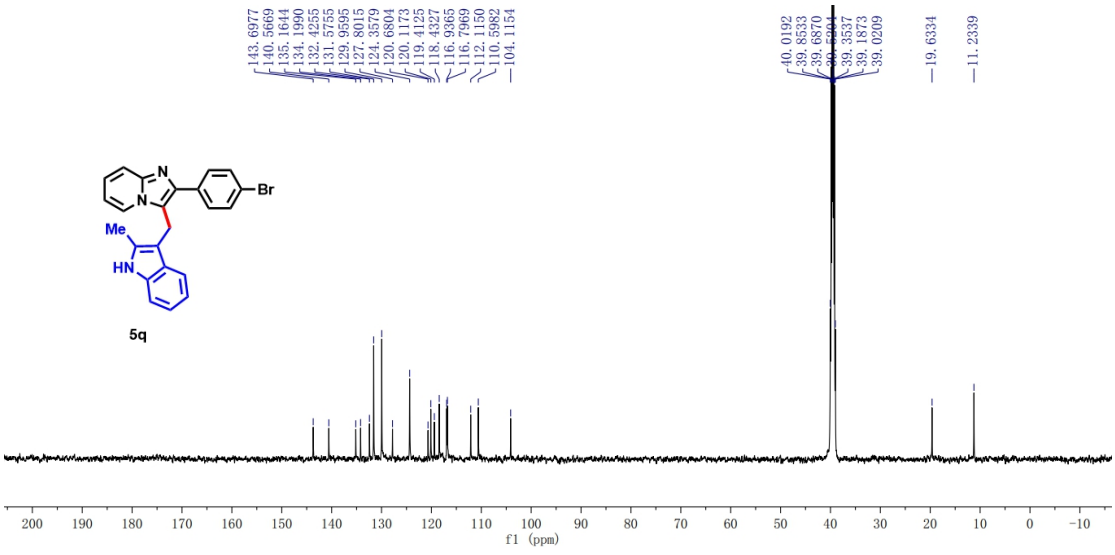
2.00
1.00
2.00
1.00
2.00
1.00
2.00
3.00
f1 (ppm)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39.8533
39.6870
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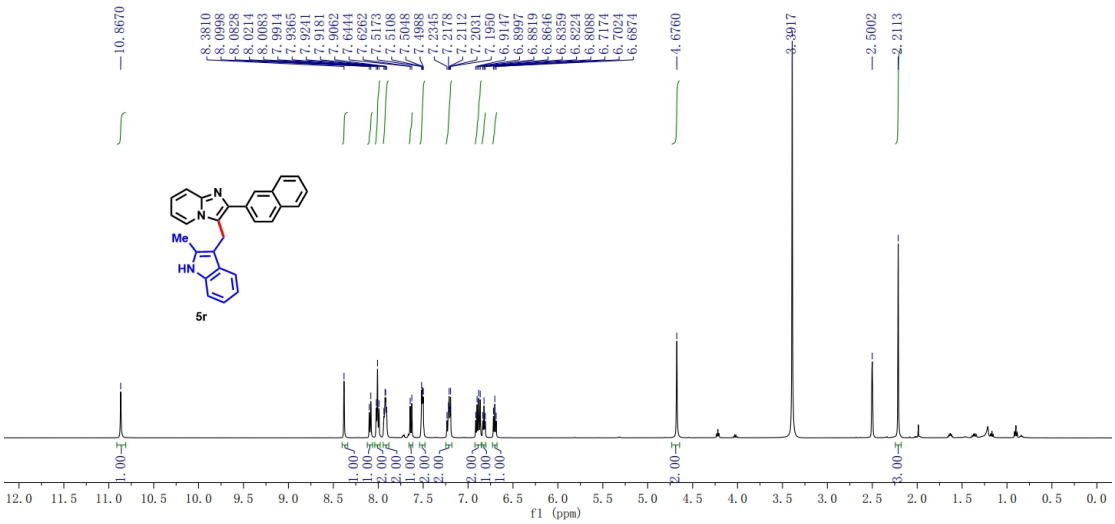
Br
N
Me
HN
5q
f1 (ppm)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7.9062
7.6444
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7.5173
7.5108
7.5048
7.4988
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6.8224
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6.6874
4.6760
3.3917
2.5002
2.2113
Me
HN
5r
1.00
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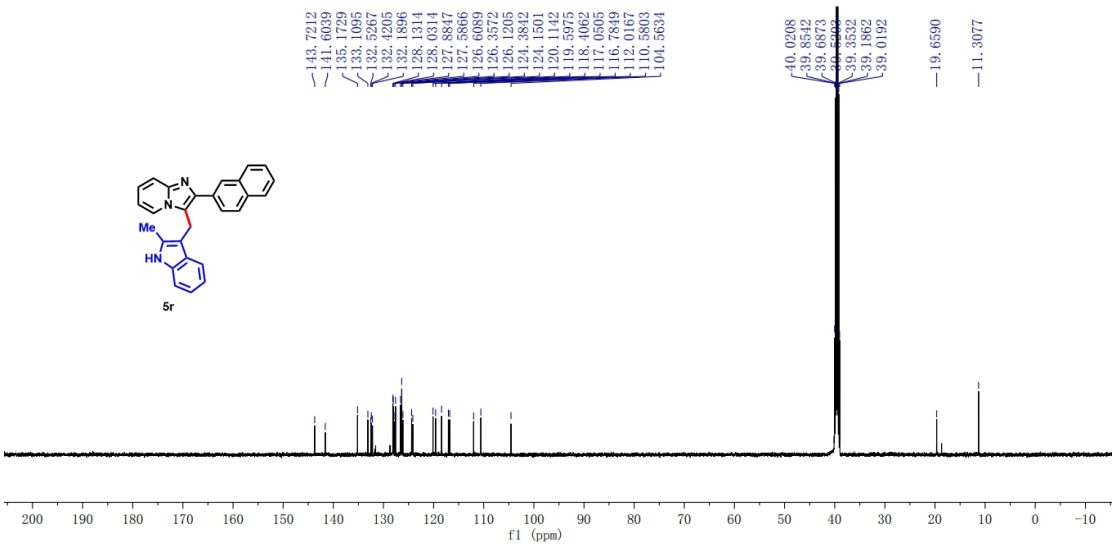
1.00
1.00
2.00
1.00
2.00
2.00
1.00
1.00
2.00
3.00
f1 (ppm)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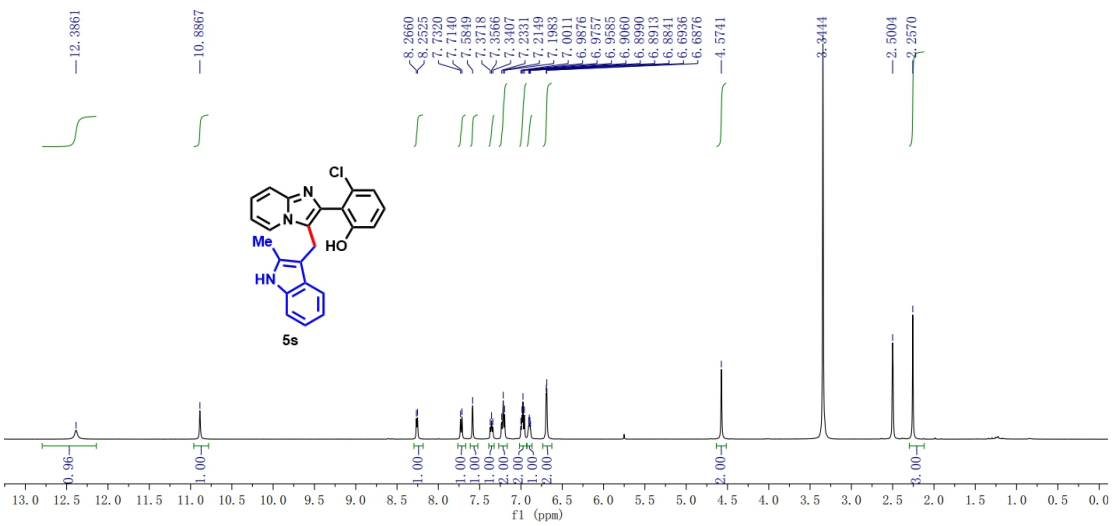
Me
HN
5r
f1 (ppm)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6.8990
6.8913
6.8841
6.6936
6.6876
4.5741
3.3444
2.5004
2.2570
Cl
N
N
Me
HO
HN
5s
0.96
1.00
1.00
1.00
1.00
1.00
2.00
2.00
1.00
2.00
3.00
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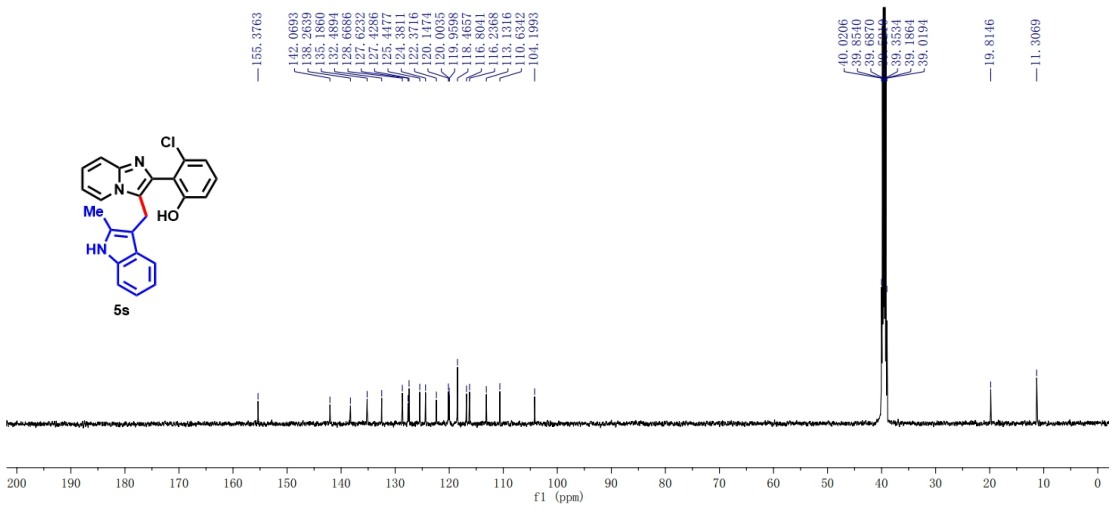
f1 (ppm)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N
Me
HO
HN
5s
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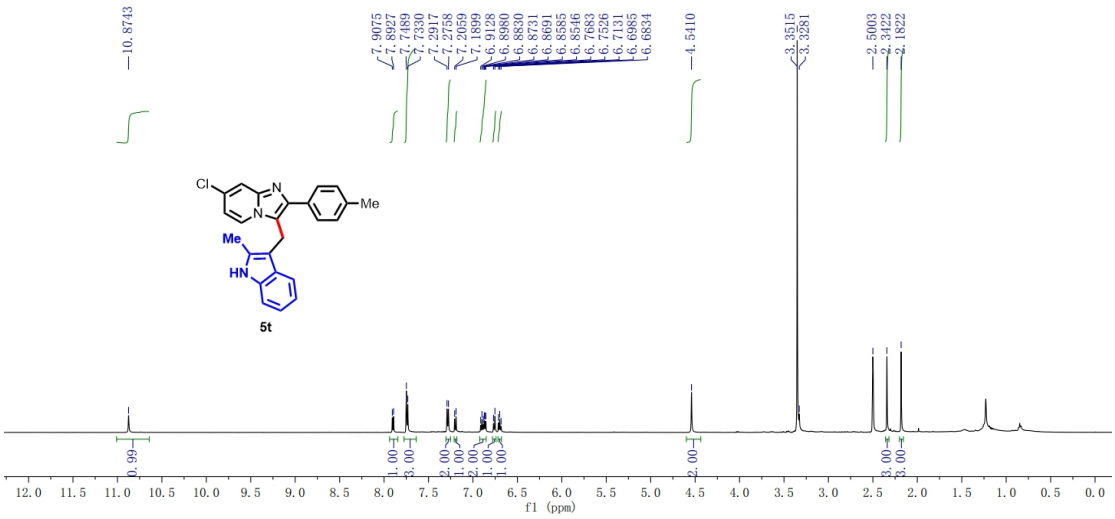
f1 (ppm)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6.6834
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3.3515
3.3281
2.5003
2.3422
2.1822
Cl
N
Me
Me
HN
5t
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2.00
1.00
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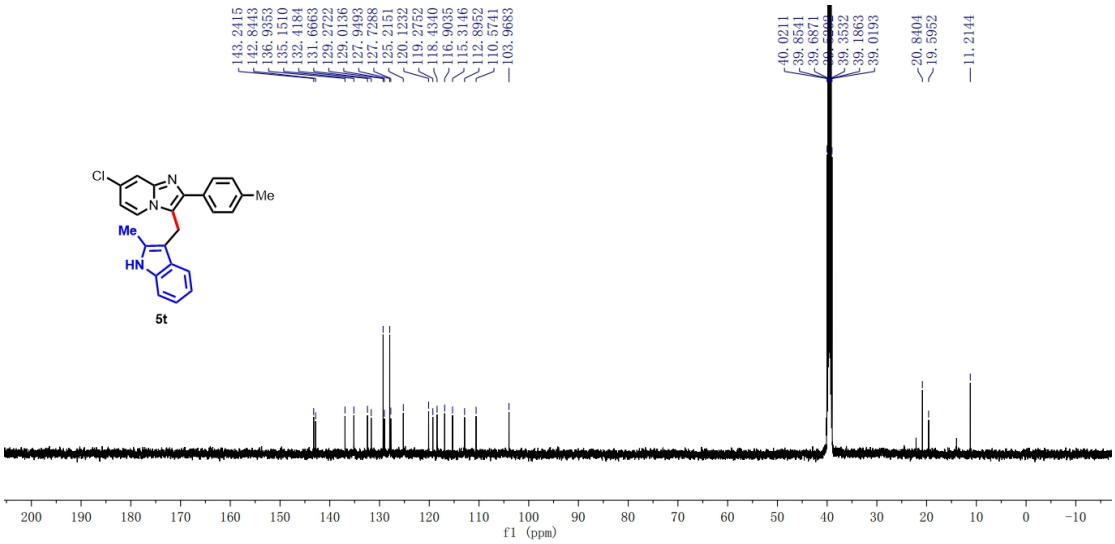
2.00
3.00
3.00
f1 (ppm)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Cl
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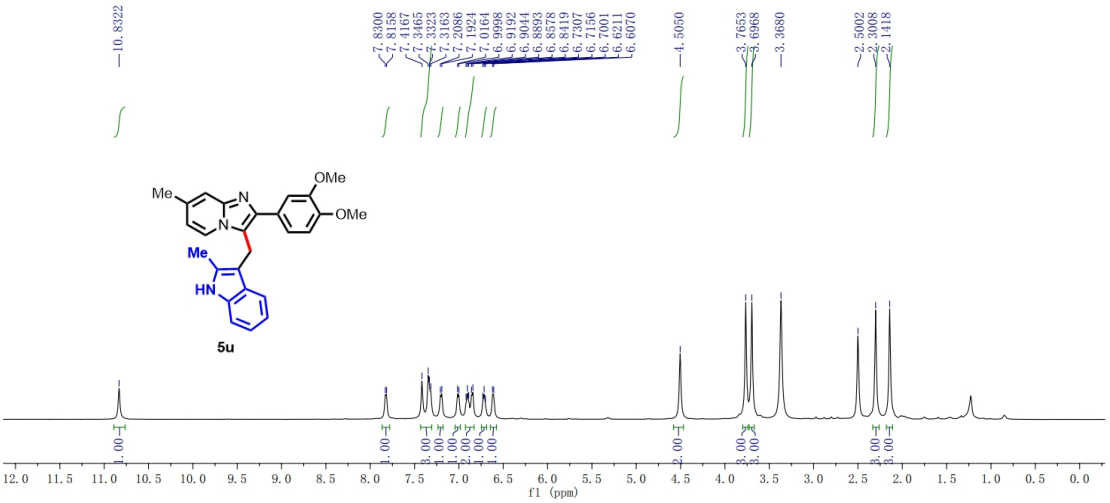
Me
Me
HN
5t
f1 (ppm)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6.6070
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3.7653
3.6968
3.3680
2.5002
2.3008
2.1418
Me
N
OMe
OMe
Me
HN
5u
1.00
1.00
3.00
1.00
2.00
1.00
1.00
2.00
3.00
3.00
1.00
3.00
3.00
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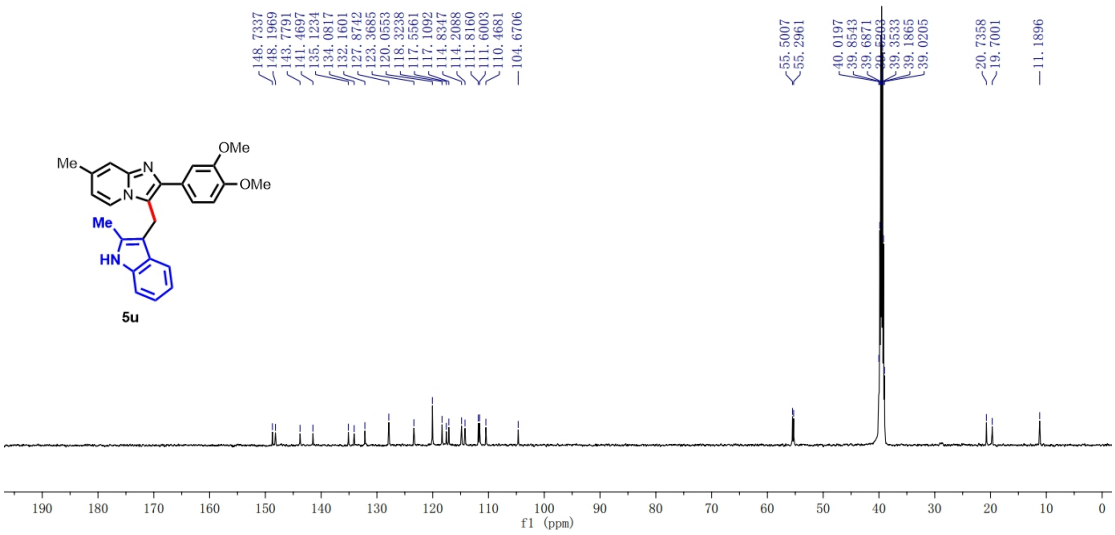
f1 (ppm)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Me
N
OMe
OMe
Me
HN
5u
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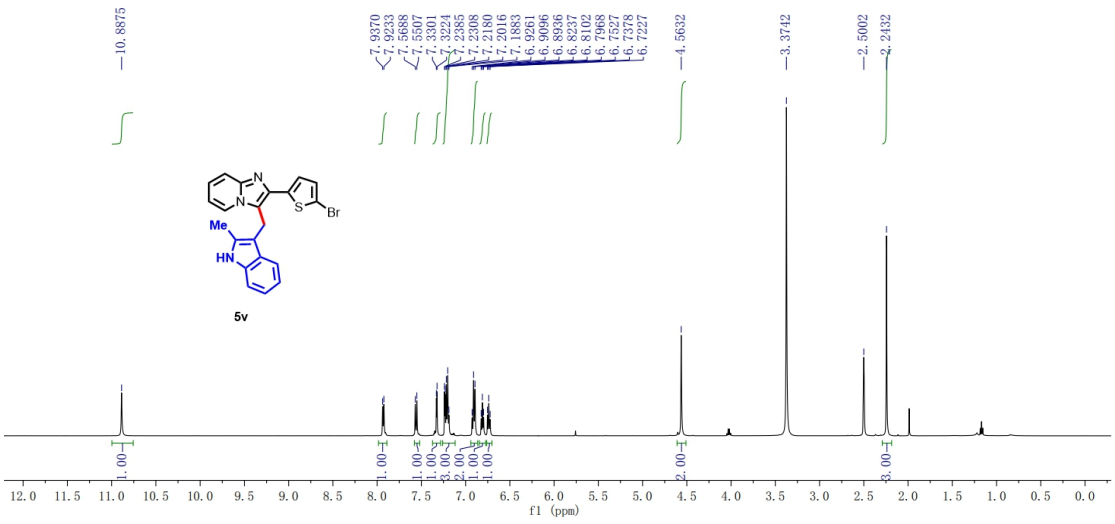
f1 (ppm)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Br
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HN
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1.00
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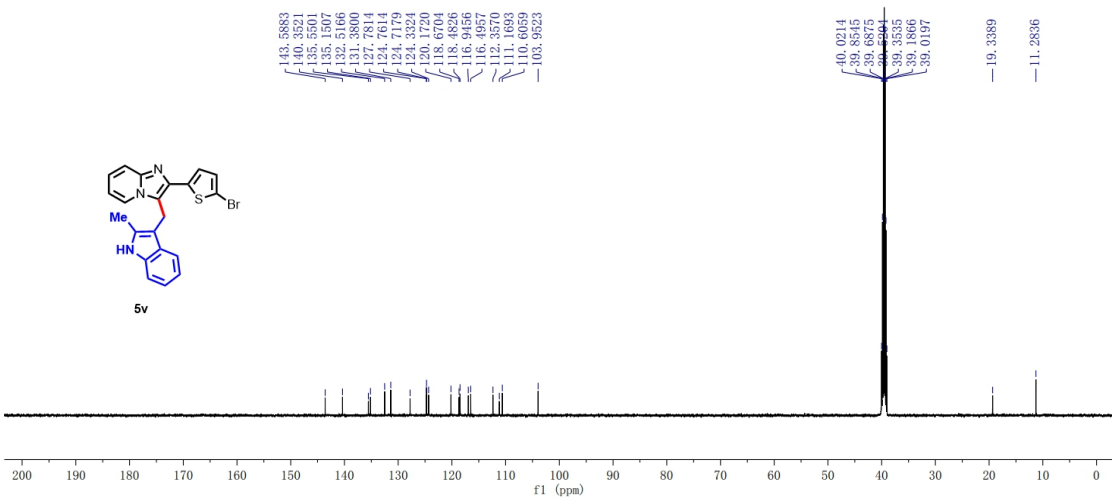
1.00
1.00
2.00
3.00
f1 (ppm)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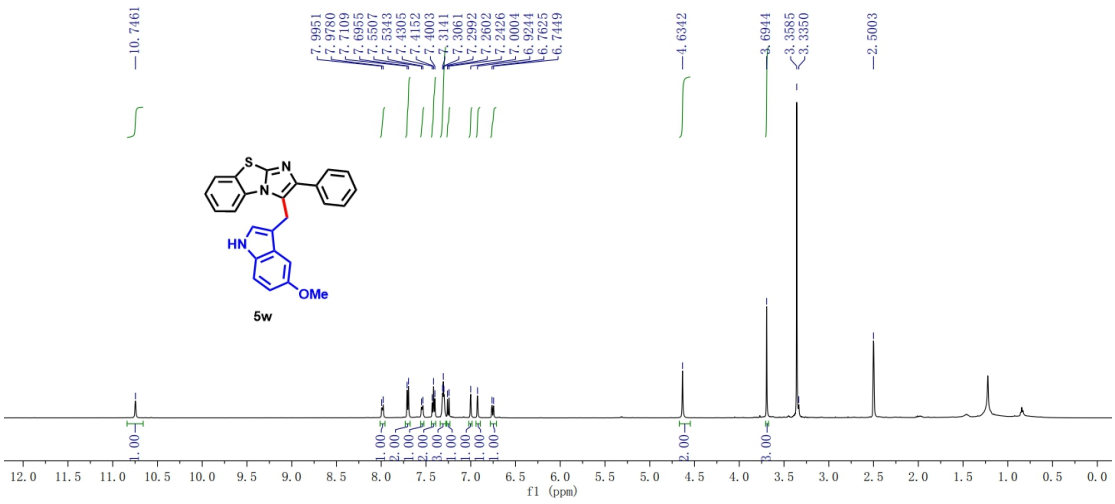
Br
Me
HN
5v
f1 (ppm)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3.3350
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1.00
2.00
1.00
1.00
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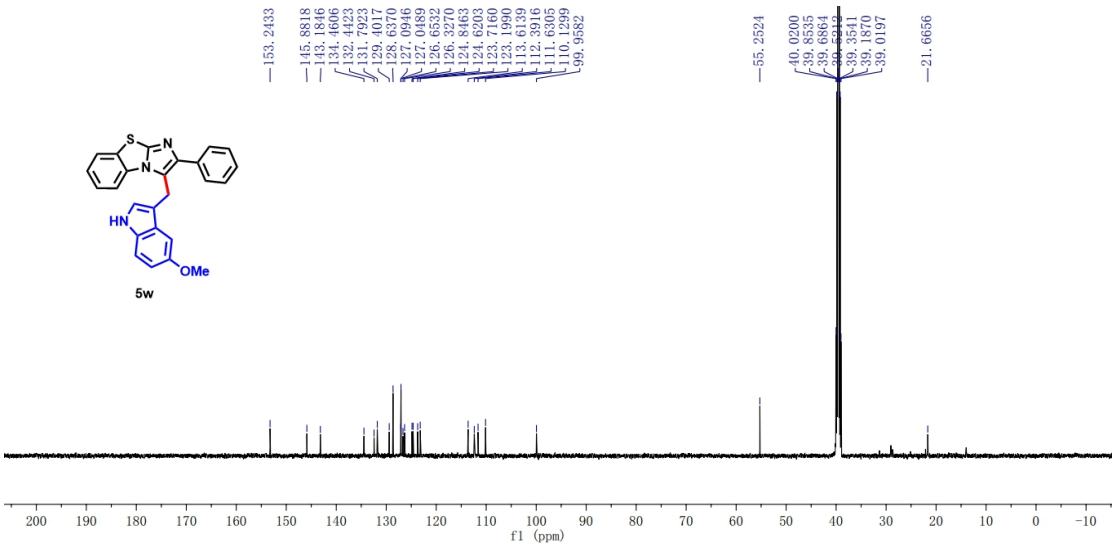
1.00
1.00
1.00
2.00
3.00
f1 (ppm)

S
N
HN
OMe

5w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113.6139
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111.6305
110.1299
99.9582
55.2524
40.0200
39.8535
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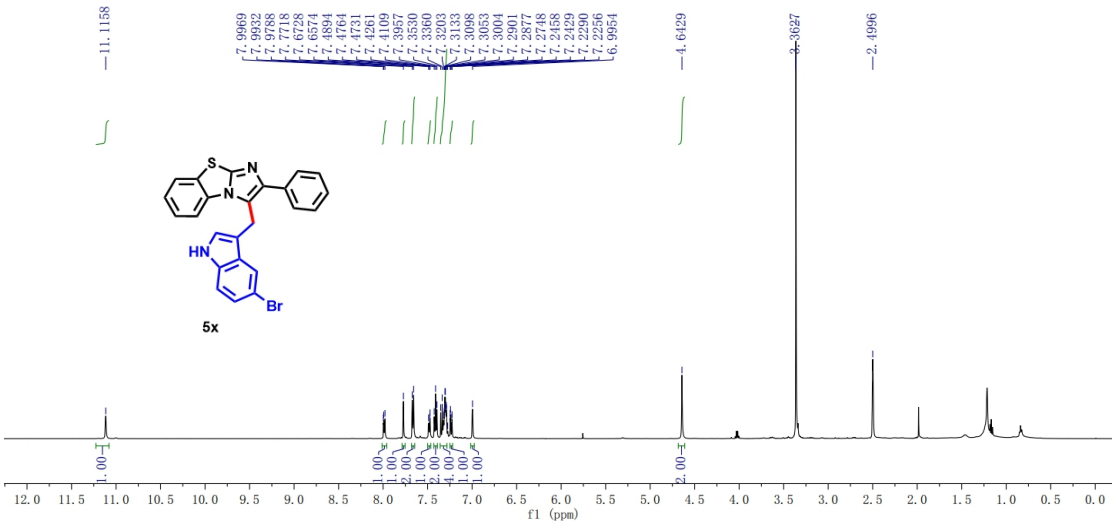
39.3541
39.1870
39.0197
21.6656
f1 (ppm)

S
N
HN
OMe

5w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7.2748
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7.2429
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HN
Br
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1.00
1.00
1.00
2.00
1.00
2.00
2.00
4.00
1.00
1.00
2.00
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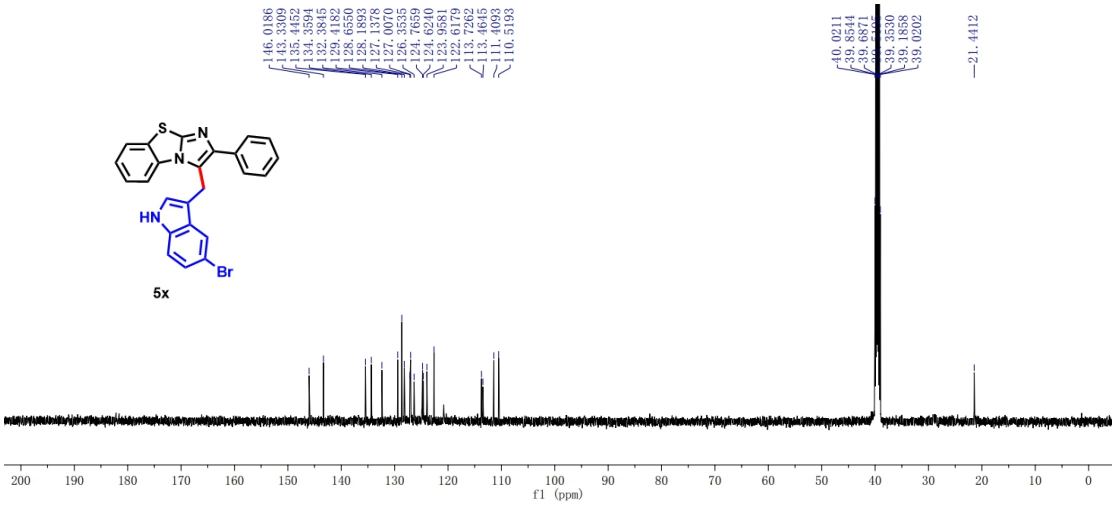
f1 (ppm)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124.6240
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113.7262
113.4645
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39.8544
39.6871
39.3530
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Br
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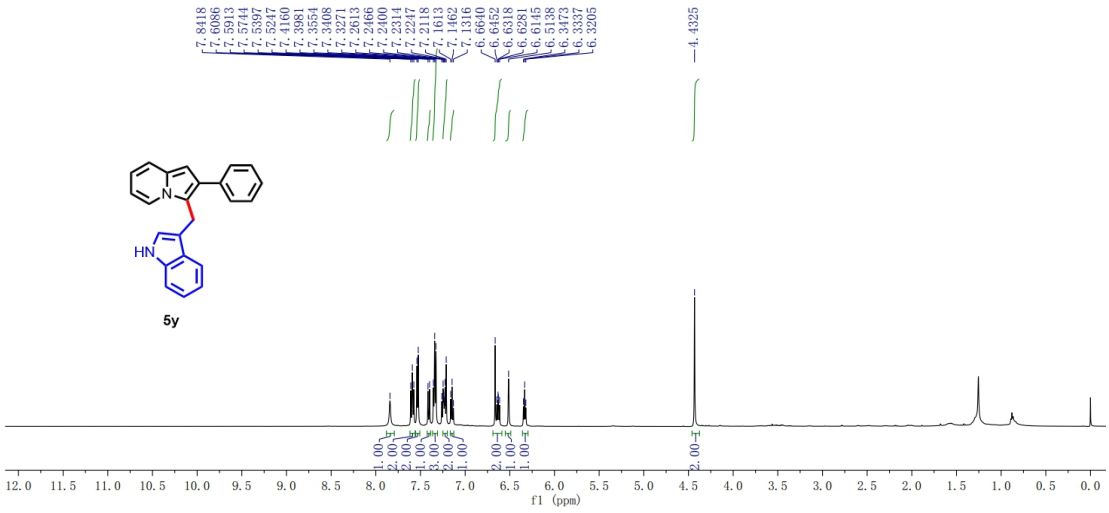
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7.2466
7.2400
7.2314
7.2247
7.2118
7.1613
7.1462
7.1316
6.6640
6.6452
6.6318
6.6281
6.6145
6.5138
6.3473
6.3337
6.3205
4.4325
HN
5y
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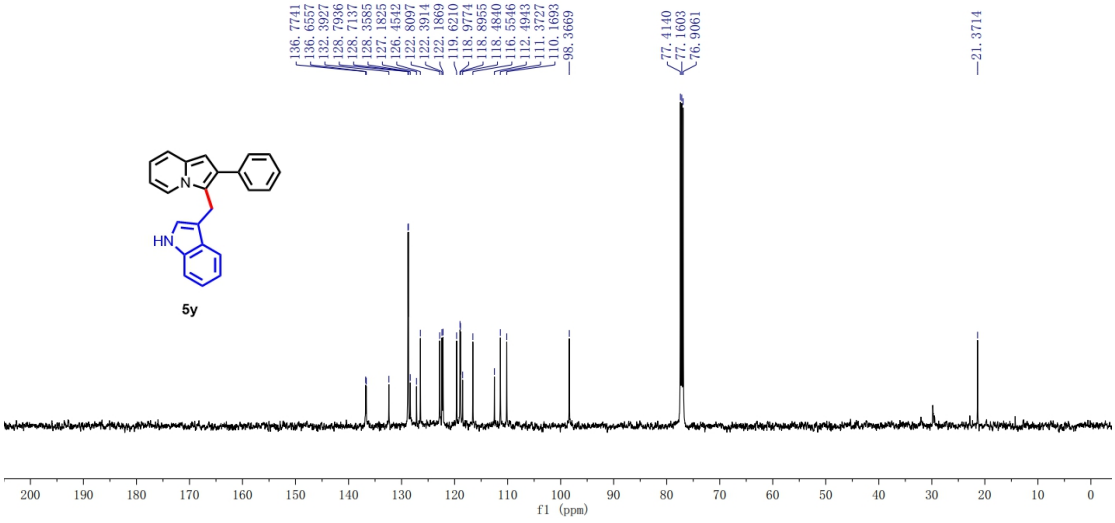
2.00
1.00
2.00
1.00
2.00
1.00
1.00
2.00
f1 (ppm)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118.8955
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116.5546
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76.9061
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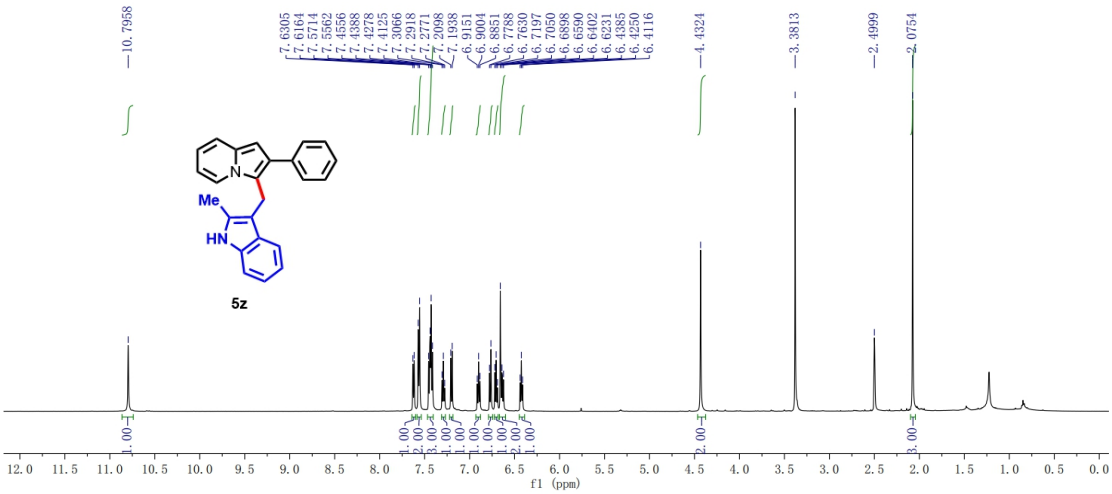
HN
5y
f1 (ppm)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7.2918
7.2771
7.2098
7.1938
6.9151
6.9004
6.8851
6.7788
6.7630
6.7197
6.7050
6.6898
6.6590
6.6402
6.6231
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Me
HN
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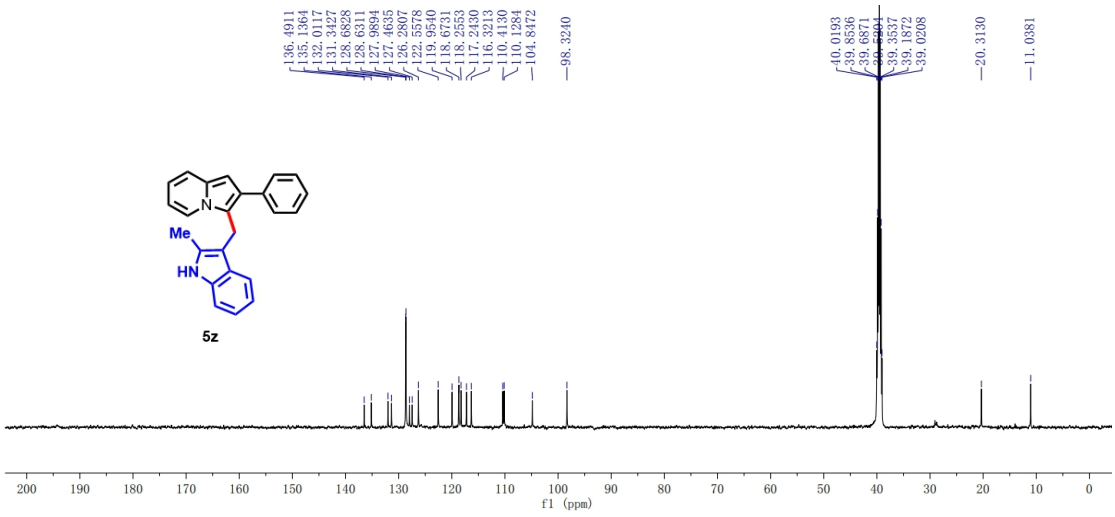
f1 (ppm)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104.8472
98.3240
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39.8536
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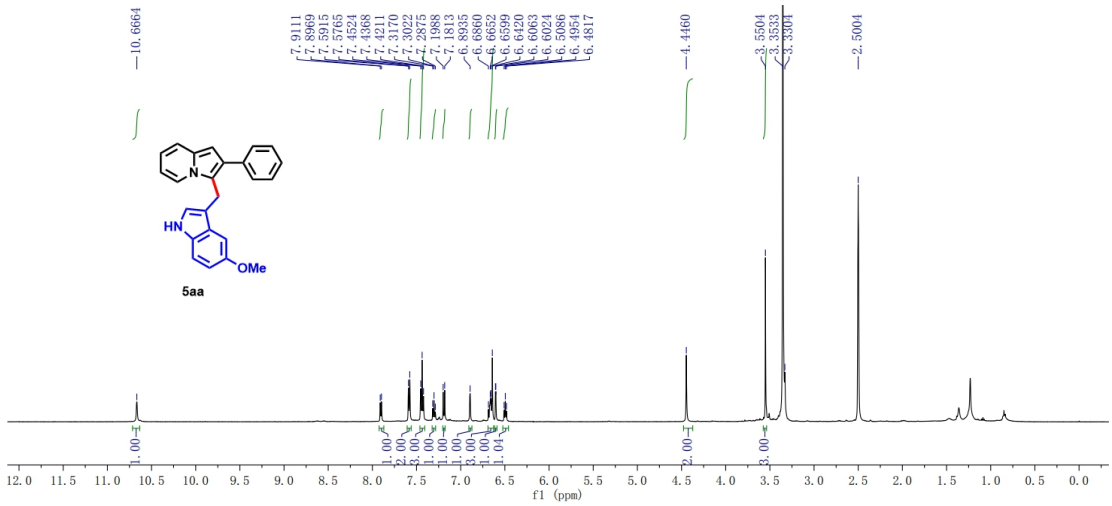
Me
HN
5z
f1 (ppm)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7.3170
7.3022
7.2875
7.1988
7.1813
6.8935
6.8860
6.8652
6.6599
6.6420
6.6063
6.6024
6.5086
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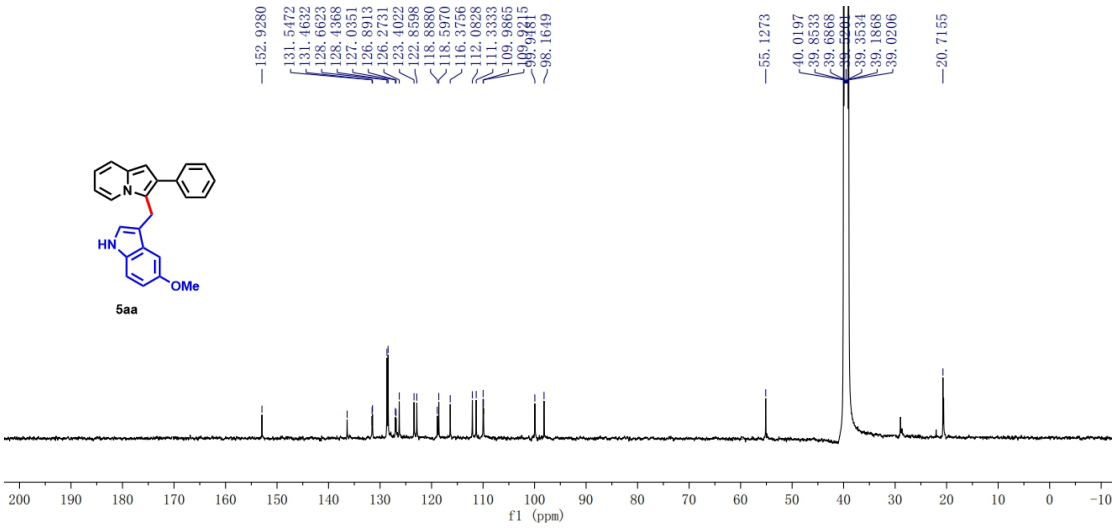
3.5504
3.5333
3.3301
2.5004
HN
OMe
5aa
f1 (ppm)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118.5970
116.3756
112.0828
111.3333
109.9865
55.1273
40.0197
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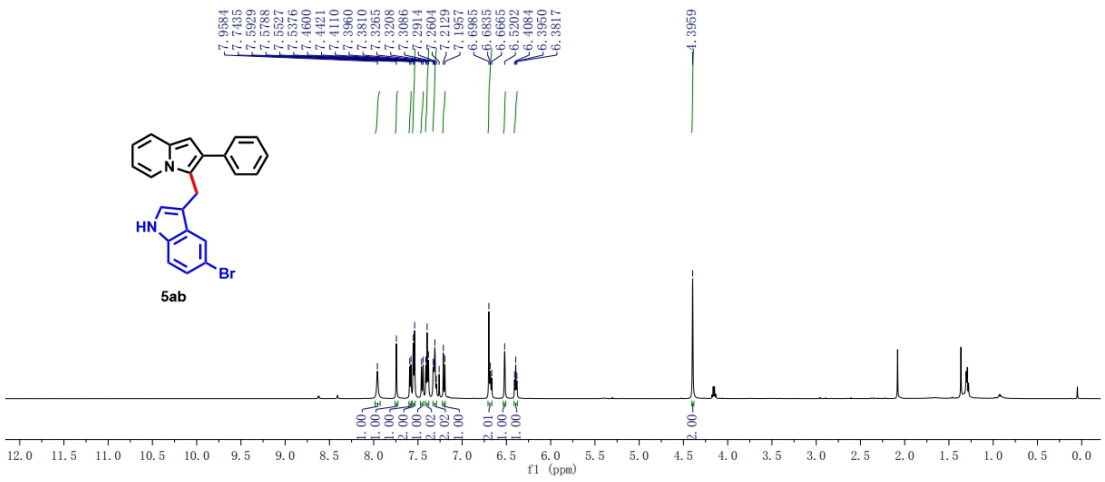
20.7155
HN
OMe
5aa
f1 (ppm)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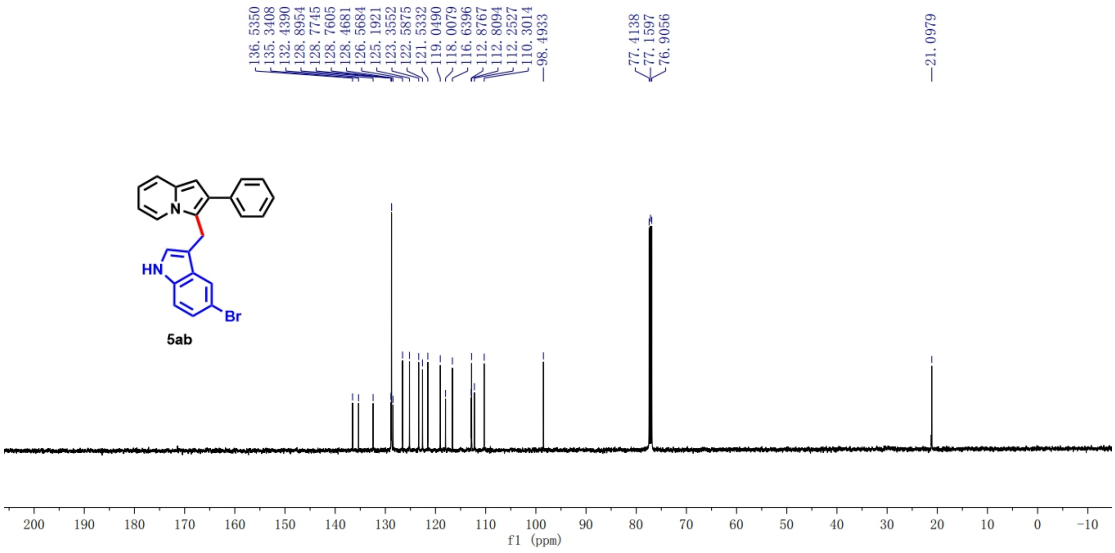
7.3265
7.3208
7.3086
7.2914
7.2604
7.2129
7.1957
6.6985
6.6835
6.6665
6.5302
6.4084
6.3950
6.3817
4.3959
HN
Br
5ab
1.00
1.00
1.00
1.00
2.00
1.00
2.02
2.02
1.00
2.01
1.00
1.00
2.00
12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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121.5332
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116.6396
112.8767
112.8094
112.2527
110.3014
98.4933
77.4138
77.1597
76.9056
21.0979
HN
Br
5ab
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)