Supporting Information

Rhodium-catalyzed C7-alkylation of indolines with maleimides

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1. General experimental details

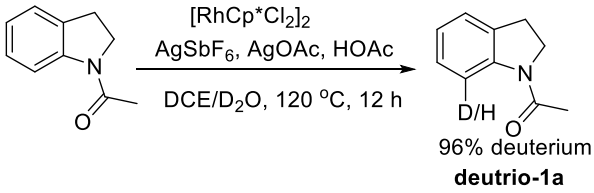
General Information: All chemicals were used as received without further purification unless stated otherwise. NMR spectra were recorded at ambient temperature on a 300 or 400 MHz NMR spectrometer. Chemical shifts (δ) are given in ppm relative to TMS, the coupling constants *J* are given in Hz. HRMS were recorded on a TOF LC/MS equipped with electrospray ionization (ESI) probe operating in positive or negative ion mode.

Experimental procedure for rhodium-catalyzed coupling of maleimides with *N*-acyl indoline: Under N_2, the mixture of *N*-acyl indoline **1** (0.2 mmol), maleimide **2** (0.4 mmol), $[RhCp^*Cl_2]_2$ (5 mol%, 6.2 mg), $AgSbF_6$ (20 mol%, 13.6 mg), AgOAc (20 mol%, 6.7 mg), HOAc (0.4 mmol, 24 mg) and DCE (2 mL) were added into the tube and sealed. The reaction mixture was vigorously stirred at 120 ^oC for 24 h. Then, the solvent was evaporated under reduced pressure and the residue was purified by flash column chromatography on silica gel to give the product.

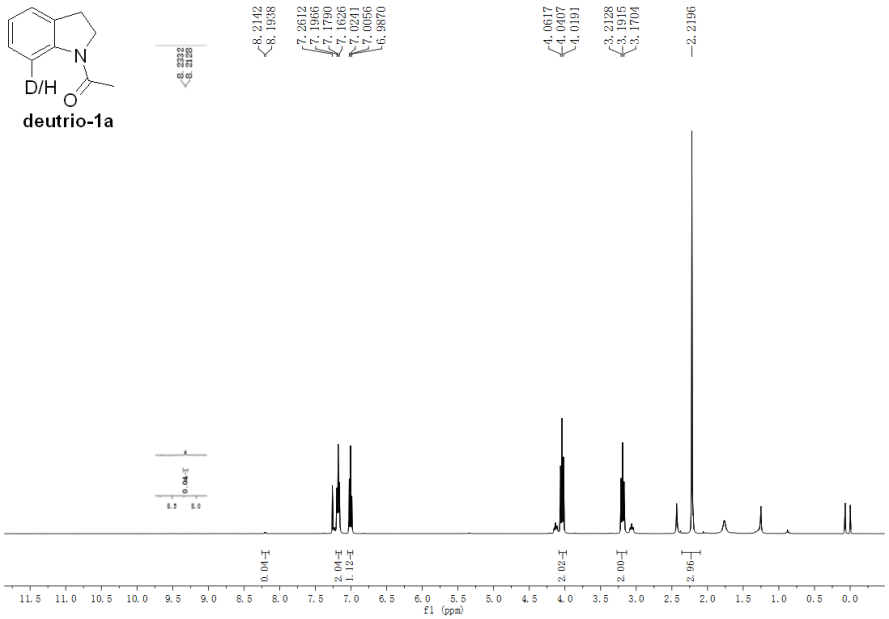
2. Mechanistic Investigation

The reaction of *N*-Acetylindoline with D_2O to give deutrio-1a:

Under N_2, the mixture of *N*-Acetylindoline **1a** (0.1 mmol, 16.1mg), $[RhCp^*Cl_2]_2$ (5 mol%, 3.1 mg), $AgSbF_6$ (20 mol%, 3.4 mg), AgOAc (20 mol%, 3.3 mg), HOAc (0.2 mmol, 12 mg), DCE (1 mL) and D_2O (10 equiv, 200 mg) were added into the tube and sealed. The reaction mixture was vigorously stirred at 120 ^oC for 12 h. Then, the solvent was evaporated under reduced pressure and the residue was purified by flash column chromatography on silica gel to give the **deutrio-1a** in 99% yield.

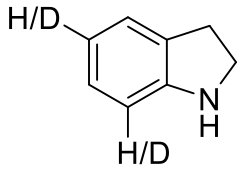


^1H NMR ($CDCl_3$, 400 MHz): δ 8.20 (d, *J* = 8.1 Hz, 0.04H), 7.19-7.16 (m, 2H), 7.00 (t, *J* = 7.4 Hz, 1H), 4.04 (t, *J* = 8.4 Hz, 2H), 3.19 (t, *J* = 8.4 Hz, 2H), 2.22 (s, 3H).



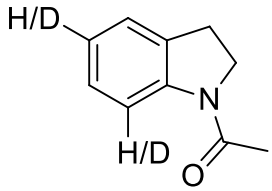
The synthesis of 1a′′ [1]

In an oven-dried Schlenk flask, indoline (5 mmol) was added to DCl (20 % in D_2O) under nitrogen atmosphere, and the reaction mixture was refluxed for 24 h under nitrogen. The solvent was evaporated in vacuo and the residue was dried for 2 h in vacuo. The resulting residue was dissolved in DCl (20 % in D_2O). The resulting solution was refluxed for 24 h again. After 6 repetitions, the reaction mixture was cooled to room temperature and neutralized with $NaHCO_3$, extracted with ethyl acetate, dried over anhydrous Na_2SO_4. The organic solvent was evaporated and a crude product **1a′** was obtained and the percentage of D atom at C5 and C7 position was 99%. Then, **1a′′** was prepared by **1a′** with acetylchloride and the percentage of D atom at C5 and C7 position was 99%.



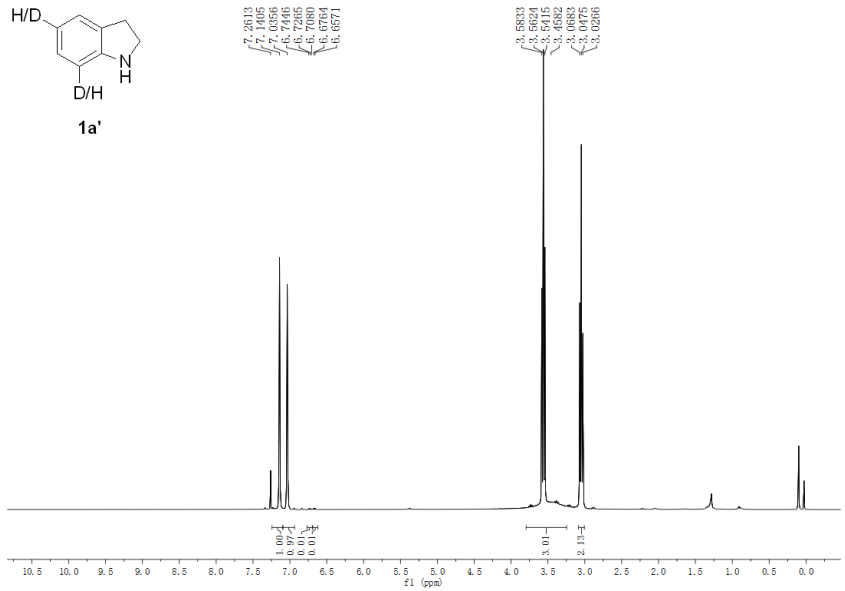
1a'

^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.14 (s, 1H), 7.03 (s, 1H), 6.73 (t, *J* = 7.2 Hz, 0.01H), 6.67 (d, *J* = 7.7 Hz, 0.01H), 3.56 (t, *J* = 8.4 Hz, 2H), 3.46 (s, 1H),3.05 (t, *J* = 8.3 Hz, 2H), 2.18 (s, 3H), 2.03 (s, 3H).

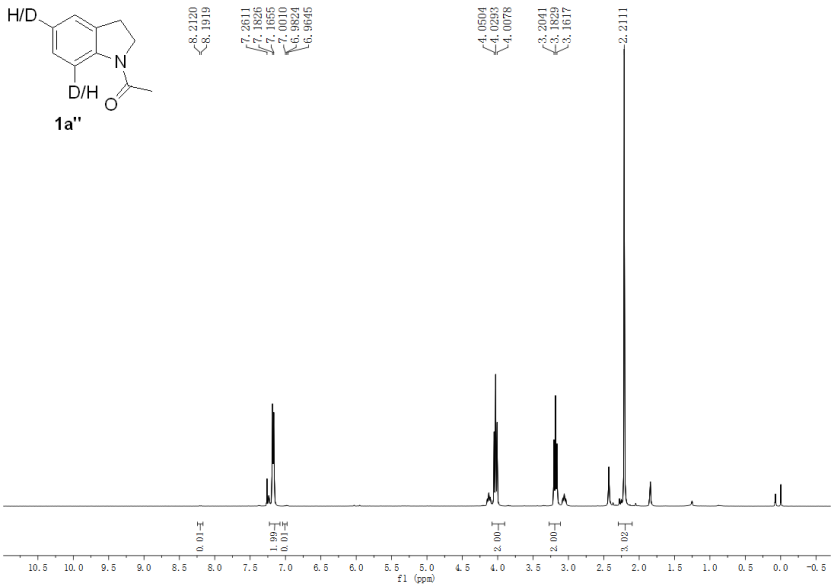


1a"

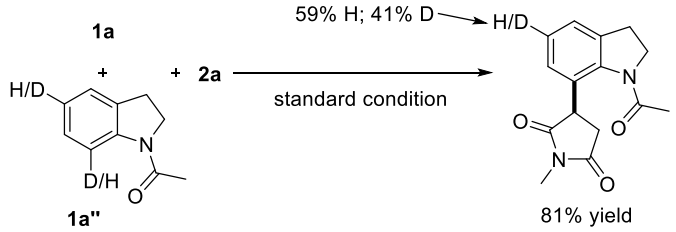
^{1}H NMR ($CDCl_3$, 400 MHz): δ 8.20 (d, *J* = 8.0 Hz, 0.01H), 7.18-7.16 (m, 2H), 6.98 (t, *J* = 7.4 Hz, 0.01H), 4.03 (t, *J* = 8.4 Hz, 2H), 3.18 (t, *J* = 8.4 Hz, 2H), 2.21 (s, 3H).



[1] Pan, C.; Abdukader, A.; Han, J.; Cheng, Y.; Zhu, C. *Chem.–Eur. J.* **2014**, *20*, 3606.

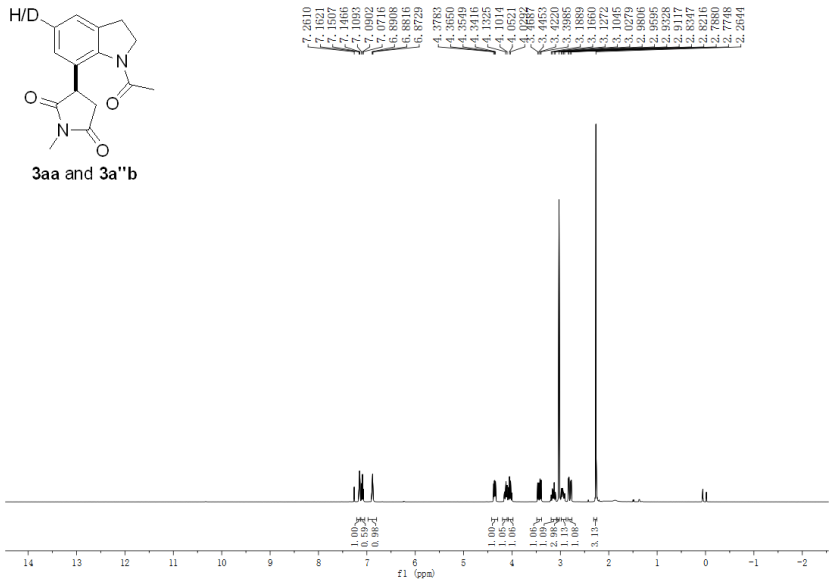


Intermolecular competition experiment with isotopically labeled 1a''



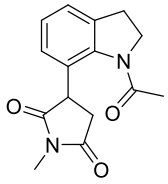
Under N_2, the mixture of **1a** (16.1 mg, 0.1 mmol), **1a''** (16.2 mg, 0.1 mmol), **2a** (44.4 mg, 0.4 mmol), $[RhCp^*Cl_2]_2$ (5 mol%, 6.2 mg), $AgSbF_6$ (20 mol%, 13.6 mg), AgOAc (20 mol%, 6.7 mg), HOAc (0.4 mmol, 24 mg) and DCE (2 mL) were added into the tube and sealed. The mixture was stirred at 120 ^oC for 24 h. After the completion of the reaction, the solvent was evaporated under reduced pressure and the residue was purified by flash column chromatography on silica gel to give the **3aa** and **3a''b** in total 81% yield.

^1H NMR ($CDCl_3$, 400 MHz): δ 7.16-7.14 (m, 1H), 7.09 (t, *J* = 7.6 Hz, 0.59H), 6.89-6.87 (m, 1H), 4.38-4.34 (m, 1H), 4.16-4.10 (m, 1H), 4.07-4.00 (m, 1H), 3.47-3.40 (m, 1H), 3.19-3.10 (m, 1H), 3.03 (s, 3H), 2.98-2.91 (m, 1H), 2.83-2.77 (m, 1H).



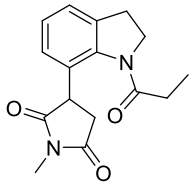
3. Experimental characterization data for compounds

3-(1-acetylindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3aa)



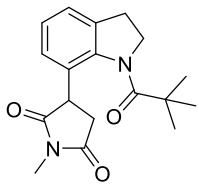
^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.16 (d, *J* = 7.3 Hz, 1H), 7.10 (t, *J* = 7.5 Hz, 1H), 6.89 (d, *J* = 7.7 Hz, 1H), 4.37-4.35 (m, 1H), 4.17-4.11 (m, 1H), 4.08-4.01 (m, 1H), 3.48-3.41 (m, 1H), 3.20-3.11 (m, 1H), 3.04 (s, 3H), 2.99-2.92 (m, 1H), 2.85-2.78 (m, 1H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.8, 177.3, 169.4, 141.1, 135.4, 128.8, 126.4, 126.3, 124.1, 51.0, 44.6, 37.5, 29.7, 25.1, 24.1. HRMS (ESI) *m/z* calcd for $C_{15}H_{17}N_2O_3$ $(M+H)^+$ 273.1234, found 273.1236.

1-methyl-3-(1-propionylindolin-7-yl)pyrrolidine-2,5-dione (3ba)



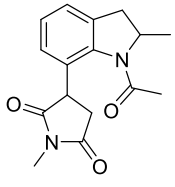
^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.17 (d, *J* = 7.2 Hz, 1H), 7.09 (t, *J* = 7.6 Hz, 1H), 6.90 (d, *J* = 7.7 Hz, 1H), 4.37-4.33 (m, 1H), 4.17-4.11 (m, 1H), 4.06-3.99 (m, 1H), 3.47-3.40 (m, 1H), 3.18-3.09 (m, 1H), 3.04 (s, 3H), 2.99-2.92 (m, 1H), 2.86-2.80 (m, 1H), 2.58-2.47 (m, 2H), 1.21 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.8, 177.4, 173.0, 141.3, 135.4, 128.7, 126.4, 126.2, 124.0, 50.2, 44.7, 37.4, 29.8, 29.4, 25.0, 9.7. HRMS (ESI) *m/z* calcd for $C_{16}H_{19}N_2O_3$ $(M+H)^+$ 287.1390, found 287.1387.

1-methyl-3-(1-pivaloylindolin-7-yl)pyrrolidine-2,5-dione (3ca)



^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.17 (d, *J* = 7.3 Hz, 1H), 7.09 (t, *J* = 7.6 Hz, 1H), 6.93 (d, *J* = 7.8 Hz, 1H), 4.34-4.28 (m, 1H), 4.05-3.98 (m, 1H), 3.39-3.32 (m, 1H), 3.15-3.08 (m, 1H), 3.05 (s, 3H), 2.97-2.90 (m, 1H), 2.85-2.79 (m, 1H), 1.35 (s, 9H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.9, 178.6, 177.4, 142.9, 135.3, 129.3, 126.4, 125.9, 123.9, 51.1, 44.5, 39.8, 36.5, 30.9, 28.4, 25.1. HRMS (ESI) *m/z* calcd for $C_{18}H_{23}N_2O_3$ $(M+H)^+$ 315.1703, found 315.1704.

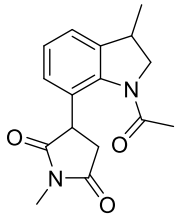
3-(1-acetyl-2-methylindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3da)



^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.28 (d, *J* =7.6 Hz, 0.47H), 7.18 (d, *J* =7.3 Hz, 1H), 7.14-7.09 (m, 1H), 6.86 (d, *J* =7.6 Hz, 0.56H), 4.81-4.78 (m, 0.38H), 4.55-4.50 (m, 1H), 4.30-4.26 (m, 0.57H), 3.54-3.38 (m, 1.6H), 3.03 (s, 3H), 3.00-2.88 (m, 1H), 2.59-2.49 (m, 1.4H), 2.28 (s, 3H), 1.34 (d, *J* = 6.6 Hz, 1.66H), 1.27 (d, *J* = 6.6 Hz, 1.38H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 178.8,

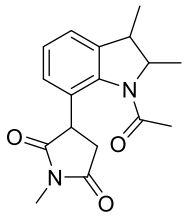
177.5, 177.3, 176.6, 169.1, 168.1, 139.8, 138.8, 134.6, 134.3, 129.5, 128.4, 126.8, 126.5, 126.1, 125.8, 124.7, 124.5, 58.1, 58.0, 44.5, 43.9, 36.9, 36.7, 25.0, 24.9, 23.2, 23.1, 20.8, 20.4. HRMS (ESI) *m/z* calcd for $C_{16}H_{19}N_2O_3$ $(M+H)^+$ 287.1390, found 287.1391.

3-(1-acetyl-3-methylindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3ea)



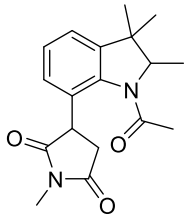
^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.15-7.09 (m, 2H), 6.94-6.92 (m, 0.47H), 6.87-6.85 (m, 0.49H), 4.44-4.40 (m, 0.47H), 4.33-4.30 (m, 0.5H), 4.25-4.17 (m, 1.0H), 3.68-3.64 (m, 0.49H), 3.60-3.55 (m, 0.53H), 3.51-3.32 (m, 1.53H), 3.27-3.21 (m, 0.5H), 3.03 (s, 3H), 2.86-2.77 (m, 1H), 2.26 (s, 3H), 1.31 (d, *J* = 6.7 Hz, 1.57H), 1.26 (d, *J* = 6.9 Hz, 1.59H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 178.9, 178.6, 177.7, 177.2, 169.5, 169.3, 141.0, 140.6, 140.5, 140.4, 128.8, 128.7, 126.6, 126.5, 126.4, 126.2, 123.1, 122.5, 58.8, 58.5, 44.5, 44.4, 37.5, 37.4, 36.3, 36.2, 25.1, 25.0, 24.02, 24.00, 19.4, 16.8. HRMS (ESI) *m/z* calcd for $C_{16}H_{19}N_2O_3$ $(M+H)^+$ 287.1390, found 287.1391.

3-(1-acetyl-2,3-dimethylindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3fa)



^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.24 (s, 0.27H), 7.13-7.06 (m, 2H), 6.84-6.83 (m, 0.71H), 4.78-4.75 (m, 0.27H), 4.27-4.23 (m, 0.7H), 4.02-3.98 (m, 1H), 3.49-3.43 (m, 0.74H), 3.00 (s, 3H), 2.92-2.86 (m, 1H), 2.77-2.69 (m, 1H), 2.51-2.45 (m, 0.29H), 2.22 (s, 3H), 1.29 (d, *J* = 6.6 Hz, 2H), 1.23-1.19 (m, 4H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 178.8, 177.5, 177.3, 176.6, 169.5, 168.5, 139.9, 139.6, 138.9, 134.3, 138.0, 129.5, 128.5, 126.9, 126.6, 126.3, 125.9, 124.0, 123.8, 65.8, 44.5, 43.9, 43.8, 43.6, 36.9, 25.0, 24.9, 23.2, 23.1, 20.8, 20.7, 20.3, 20.0. HRMS (ESI) *m/z* calcd for $C_{17}H_{21}N_2O_3$ $(M+H)^+$ 301.1547, found 301.1550.

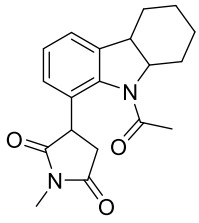
3-(1-acetyl-2,3,3-trimethylindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3ga)



^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.28 (d, *J* = 6.1 Hz, 0.25H), 7.18-7.12 (m, 1H), 7.7 (d, *J* = 7.4 Hz, 1H), 6.86 (d, *J* = 7.4 Hz, 0.72H), 4.81-4.78 (m, 0.23H), 4.31-4.27 (m, 0.7H), 4.07-4.02 (m, 1H), 3.52-3.45 (m, 0.73H), 3.04 (s, 3H), 3.01-2.89 (m, 1H), 2.54-2.48 (m, 0.25H), 1.30 (s, 3H), 1.24-1.16 (m, 6H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 178.8, 177.5, 177.2, 176.5, 169.2, 168.2, 143.6, 143.3, 139.1, 138.1, 129.4, 128.5, 126.9, 126.7, 126.2, 125.9, 121.8, 121.5, 69.7,

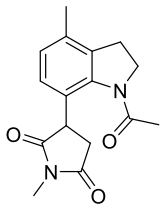
44.3, 44.2, 44.0, 43.7, 36.8, 36.7, 29.6, 29.5, 25.0, 24.9, 23.24, 23.2, 20.3, 20.2, 16.3, 16.1. HRMS (ESI) *m/z* calcd for $C_{18}H_{23}N_2O_3$ $(M+H)^+$ 315.1703, found 315.1706.

3-(9-acetyl-2,3,4,4a,9,9a-hexahydro-1*H*-carbazol-8-yl)-1-methylpyrrolidine-2,5-dione (3ha)



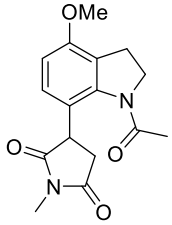
^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.24 (d, *J* = 7.3 Hz, 0.27H), 7.18-7.09 (m, 2H), 6.84 (d, *J* = 7.6 Hz, 0.69H), 4.81-4.77 (m, 0.26H), 4.35-4.28 (m, 1.66H), 3.54-3.43 (m, 1.76H), 3.02 (s, 3H), 2.93-2.86 (m, 1H), 2.55-2.49 (m, 0.35H), 2.32-2.27 (m, 4H), 2.01-1.97 (m, 1H), 1.84-1.74 (m, 1H), 1.64-1.50 (m, 1H), 1.45-1.34 (m, 0.85H), 1.26-1.09 (m, 2.28H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 178.8, 177.7, 177.3, 176.6, 168.5, 141.1, 140.1, 138.0, 137.8, 129.7, 128.7, 126.6, 125.9, 125.7, 122.2, 122.0, 63.9, 44.2, 43.8, 41.1, 40.8, 36.8, 36.7, 27.6, 25.0, 24.9, 24.5, 24.4, 23.3, 23.2, 22.9, 22.8, 20.4, 20.3. HRMS (ESI) *m/z* calcd for $C_{19}H_{23}N_2O_3$ $(M+H)^+$ 327.1703, found 327.1707.

3-(1-acetyl-4-methylindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3ia)



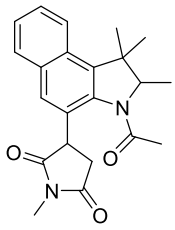
^{1}H NMR ($CDCl_3$, 400 MHz): δ 6.92 (d, *J* = 7.9 Hz, 1H), 6.79 (d, *J* = 7.9 Hz, 1H), 4.33-4.29 (m, 1H), 4.17-4.11 (m, 1H), 4.06-3.99 (m, 1H), 3.46-3.39 (m, 1H), 3.06-2.98 (m, 1H), 3.02 (s, 3H), 2.90-2.76 (m, 2H), 2.25 (s, 3H), 2.20 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 179.1, 177.5, 169.4, 140.7, 133.9, 133.5, 127.4, 126.2, 126.0, 50.7, 44.4, 37.6, 28.4, 25.0, 24.1, 18.5. HRMS (ESI) *m/z* calcd for $C_{16}H_{19}N_2O_3$ $(M+H)^+$ 287.1390, found 287.1392.

3-(1-acetyl-4-methoxyindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3ja)



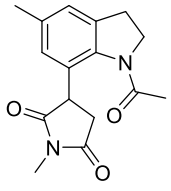
^{1}H NMR ($CDCl_3$, 400 MHz): δ 6.86 (d, *J* = 8.6 Hz, 1H), 6.66 (d, *J* = 8.6 Hz, 1H), 4.34-4.30 (m, 1H), 4.16-4.11 (m, 1H), 4.08-4.00 (m, 1H), 3.80 (s, 3H), 3.45-3.38 (m, 1H), 3.03 (s, 3H), 2.99-2.88 (m, 2H), 2.81-2.75 (m, 1H), 2.25 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 179.3, 177.5, 169.5, 155.1, 142.4, 127.7, 122.4, 121.2, 108.6, 55.5, 51.2, 44.1, 37.7, 26.5, 25.0, 24.2. HRMS (ESI) *m/z* calcd for $C_{16}H_{19}N_2O_4$ $(M+H)^+$ 303.1339, found 303.1341.

3-(3-acetyl-1,1,2-trimethyl-2,3-dihydro-1*H*-benzo[e]indol-4-yl)-1-methylpyrrolidine-2,5-dione (3ka)



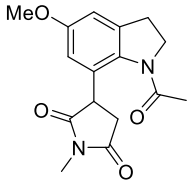
^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.99 (d, *J* = 8.4 Hz, 1H), 7.87 (s, 0.19H), 7.82 (d, *J* = 8.1 Hz, 0.2H), 7.74 (d, *J* = 8.1 Hz, 0.78H), 7.45-7.33 (m, 2.77H), 5.00-4.97 (m, 0.17H), 4.36-4.32 (m, 0.75H), 4.10-4.05 (m, 1H), 3.56-3.49 (m, 0.86H), 3.10-3.04 (m, 4H), 2.49-2.43 (m, 0.22H), 2.29 (s, 3H), 1.64-1.62 (m, 3H), 1.43 (s, 3H), 1.32 (d, *J* = 6.6 Hz, 2.46H), 1.24 (d, *J* = 7.0 Hz, 0.59H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 178.6, 177.6, 177.3, 176.2, 169.6, 137.8, 136.9, 136.3, 135.8, 133.1, 132.7, 129.6, 129.5, 129.2, 129.1, 128.8, 128.3, 126.5, 126.4, 126.3, 126.1, 125.1, 124.9, 122.7, 122.5, 70.6, 70.5, 46.5, 46.2, 43.9, 43.3, 37.3, 36.8, 27.6, 25.1, 25.0, 23.2, 23.1, 22.3, 16.2, 16.1. HRMS (ESI) *m/z* calcd for $C_{22}H_{25}N_2O_3$ $(M+H)^+$ 365.1860, found 365.1867.

3-(1-acetyl-5-methylindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3la)



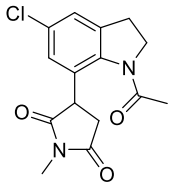
^{1}H NMR ($CDCl_3$, 400 MHz): δ 6.96 (s, 1H), 6.65 (s, 1H), 4.37-4.34 (m, 1H), 4.14-4.08 (m, 1H), 4.05-3.98 (m, 1H), 3.46-3.39 (m, 1H), 3.14-3.06 (m, 1H), 3.04 (s, 3H), 2.93-2.86 (m, 1H), 2.82-2.76 (m, 1H), 2.26 (s, 3H), 2.25 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.9, 177.4, 169.3, 138.8, 136.2, 135.5, 128.3, 126.5, 124.9, 51.2, 44.5, 37.6, 29.7, 25.1, 24.0, 21.0. HRMS (ESI) *m/z* calcd for $C_{16}H_{19}N_2O_3$ $(M+H)^+$ 287.1390, found 287.1391.

3-(1-acetyl-5-methoxyindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3ma)



^{1}H NMR ($CDCl_3$, 400 MHz): δ 6.72 (s, 1H), 6.38 (s, 1H), 4.39-4.36 (m, 1H), 4.13-3.99 (m, 2H), 3.72 (s, 3H), 3.44-3.37 (m, 1H), 3.15-3.07 (m, 1H), 3.02 (s, 3H), 2.94-2.87 (m, 1H), 2.82-2.76 (m, 1H), 2.24 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.6, 177.2, 169.1, 137.0, 134.6, 129.5, 111.3, 109.9, 55.7, 51.2, 44.5, 37.4, 30.1, 25.1, 23.8. HRMS (ESI) *m/z* calcd for $C_{16}H_{19}N_2O_4$ $(M+H)^+$ 303.1339, found 303.1341.

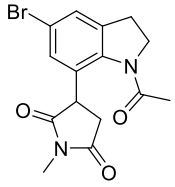
3-(1-acetyl-5-chloroindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3na)



^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.12 (s, 1H), 6.87 (s, 1H), 4.34-4.31 (m, 1H), 4.13-4.00 (m, 2H), 3.42-3.35 (m, 1H), 3.16-3.07 (m, 1H), 3.02 (s, 3H), 2.97-2.90 (m, 1H), 2.79-2.73 (m, 1H), 2.24 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.1, 176.8, 169.5, 139.9, 137.4,

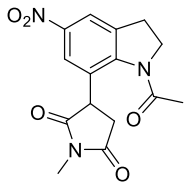
131.3, 129.9, 126.3, 124.3, 51.1, 44.1, 37.1, 29.6, 25.1, 23.9. HRMS (ESI) *m/z* calcd for $C_{15}H_{16}ClN_2O_3$ $(M+H)^+$ 307.0844, found 307.0846.

3-(1-acetyl-5-bromoindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3oa)



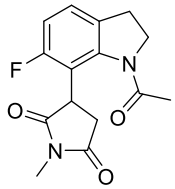
^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.28 (s, 1H), 7.02 (s, 1H), 4.35-4.31 (m, 1H), 4.16-4.02 (m, 2H), 3.44-3.37 (m, 1H), 3.21-3.09 (m, 1H), 3.04 (s, 3H), 2.99-2.92 (m, 1H), 2.81-2.74 (m, 1H), 2.26 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.1, 176.8, 169.4, 140.5, 137.7, 130.4, 129.2, 127.2, 118.9, 51.0, 44.4, 37.1, 29.5, 25.2, 23.9. HRMS (ESI) *m/z* calcd for $C_{15}H_{16}BrN_2O_3$ $(M+H)^+$ 351.0339, found 351.0344.

3-(1-acetyl-5-nitroindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3pa)



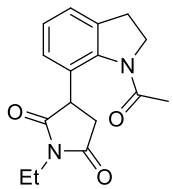
^{1}H NMR ($CDCl_3$, 400 MHz): δ 8.00 (s, 1H), 7.85 (s, 1H), 4.38-4.34 (m, 1H), 4.25-4.13 (m, 2H), 3.48-3.41 (m, 1H), 3.30-3.20 (m, 1H), 3.13-3.08 (m, 1H), 3.05 (s, 3H), 2.86-2.79 (m, 1H), 2.30 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 177.6, 176.3, 169.8, 146.8, 145.6, 137.3, 129.0, 123.4, 119.4, 51.2, 44.6, 36.9, 29.2, 25.3, 24.1. HRMS (ESI) *m/z* calcd for $C_{15}H_{16}N_3O_5$ $(M+H)^+$ 318.1084, found 318.1083.

3-(1-acetyl-6-fluoroindolin-7-yl)-1-methylpyrrolidine-2,5-dione (3pa)



^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.12-7.09 (m, 1H), 6.83-6.78 (m, 1H), 4.21-4.03 (m, 3H), 3.54-3.47 (m, 1H), 3.19-3.10 (m, 1H), 3.02 (s, 3H), 2.92-2.84 (m, 2H), 2.26 (s, 3H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 173.4, 176.9, 169.7, 160.9 (d, J_{C-F} = 240.9 Hz), 142.8 (d, J_{C-F} = 8.2 Hz), 130.5 (d, J_{C-F} = 2.6 Hz), 124.6 (d, J_{C-F} = 10.6 Hz), 117.1 (d, J_{C-F} = 18.0 Hz), 112.3 (d, J_{C-F} = 23.0 Hz), 51.6, 41.5, 36.0, 29.1, 24.9, 23.9. HRMS (ESI) *m/z* calcd for $C_{15}H_{16}FN_2O_3$ $(M+H)^+$ 291.1139, found 291.1137.

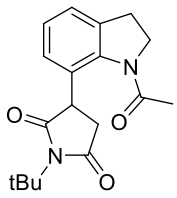
3-(1-acetylindolin-7-yl)-1-ethylpyrrolidine-2,5-dione (3ab)



^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.16 (d, *J* = 7.2 Hz, 1H), 7.10 (t, *J* = 7.6 Hz, 1H), 6.87 (d, *J* = 7.7 Hz, 1H), 4.36-4.32 (m, 1H), 4.14-4.01 (m, 2H), 3.63-3.58 (m, 2H), 3.46-3.39 (m,

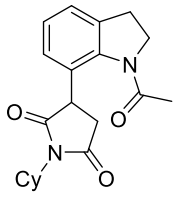
1H), 3.20-3.12 (s, 1H), 2.99-2.92 (m, 1H), 2.83-2.76 (m, 1H), 2.28 (s, 3H), 1.19 (t, *J* = 7.2 Hz, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.5, 177.1, 169.4, 141.1, 135.4, 129.1, 126.4, 126.1, 124.0, 51.0, 44.4, 37.6, 33.9, 29.8, 24.1, 13.1. HRMS (ESI) *m/z* calcd for $C_{16}H_{19}N_2O_3$ $(M+H)^+$ 287.1390, found 287.1391.

3-(1-acetylindolin-7-yl)-1-(*tert*-butyl)pyrrolidine-2,5-dione (3ac)



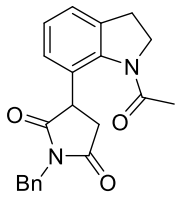
^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.15 (d, *J* = 7.1 Hz, 1H), 7.15 (t, *J* = 7.5 Hz, 1H), 6.88 (d, *J* = 7.5 Hz, 1H), 4.22-4.10 (m, 2H), 4.08-3.99 (m, 1H), 3.33-3.26 (m, 1H), 3.19-3.11 (m, 1H), 2.96-2.89 (m, 1H), 2.75-2.68 (m, 1H), 2.27 (s, 3H), 1.59 (s, 9H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 179.8, 178.2, 169.3, 141.2, 135.3, 129.7, 126.4, 125.9, 123.8, 58.5, 51.0, 44.4, 37.8, 29.8, 28.4, 24.1. HRMS (ESI) *m/z* calcd for $C_{18}H_{23}N_2O_3$ $(M+H)^+$ 315.1703, found 315.1701.

3-(1-acetylindolin-7-yl)-1-cyclohexylpyrrolidine-2,5-dione (3ad)



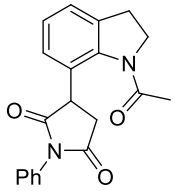
^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.14 (d, *J* = 7.2 Hz, 1H), 7.08 (t, *J* = 7.6 Hz, 1H), 6.85 (d, *J* = 7.6 Hz, 1H), 4.29-4.25 (m, 1H), 4.15-3.97 (m, 3H), 3.39-3.32 (m, 1H), 3.18-3.10 (m, 1H), 2.97-2.90 (m, 1H), 2.77-2.71 (m, 1H), 2.26 (s, 3H), 2.20-2.12 (m, 2H), 1.82-1.79 (m, 2H), 1.63-1.61 (m, 3H), 1.35-1.18 (m, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.8, 177.3, 169.3, 141.2, 135.4, 129.5, 126.3, 125.9, 123.9, 51.8, 51.0, 44.1, 37.4, 29.8, 28.9, 28.8, 25.9, 25.1, 24.1. HRMS (ESI) *m/z* calcd for $C_{20}H_{25}N_2O_3$ $(M+H)^+$ 341.1860, found 341.1863.

3-(1-acetylindolin-7-yl)-1-benzylpyrrolidine-2,5-dione (3ae)



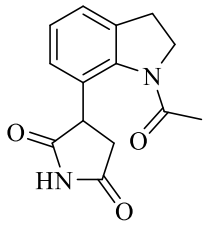
^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.42 (d, *J* = 6.9 Hz, 2H), 7.35-7.28 (m, 3H), 7.16 (d, *J* = 7.3 Hz, 1H), 7.07 (t, *J* = 7.6 Hz, 1H), 6.81 (d, *J* = 7.7 Hz, 1H), 4.77-4.68 (m, 2H), 4.40-4.36 (m, 1H), 4.17-4.11 (m, 1H), 4.07-4.00 (m, 1H), 3.51-3.43 (m, 1H), 3.21-3.12 (m, 1H), 2.99-2.92 (m, 1H), 2.87-2.81 (m, 1H), 2.26 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.4, 176.8, 169.4, 141.1, 136.0, 135.4, 128.9, 128.8, 128.7, 127.9, 126.4, 126.1, 124.1, 51.0, 44.5, 42.5, 37.6, 29.8, 24.0. HRMS (ESI) *m/z* calcd for $C_{21}H_{21}N_2O_3$ $(M+H)^+$ 349.1547, found 349.1551.

3-(1-acetylindolin-7-yl)-1-phenylpyrrolidine-2,5-dione (3af)



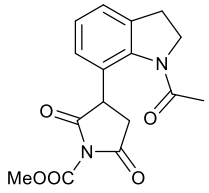
^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.49-7.45 (m, 2H), 7.40-7.33 (m, 3H), 7.20-7.12 (m, 2H), 7.06 (d, *J* = 7.4 Hz, 1H), 4.57-4.54 (m, 1H), 4.15-4.00 (m, 2H), 3.60-3.53 (m, 1H), 3.18-2.93 (m, 3H), 2.28 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 177.5, 176.2, 169.5, 141.0, 135.6, 132.3, 129.2, 128.6, 128.5, 126.8, 126.7, 126.3, 124.2, 50.9, 44.9, 37.4, 29.7, 24.1. HRMS (ESI) *m/z* calcd for $C_{20}H_{19}N_2O_3$ $(M+H)^+$ 335.1390, found 335.1393.

3-(1-acetylindolin-7-yl)pyrrolidine-2,5-dione (3ag)



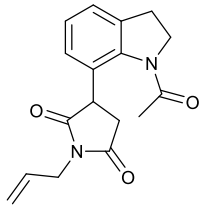
^{1}H NMR ($CDCl_3$, 400 MHz): δ 8.28 (s, 1H), 7.22-7.14 (m, 2H), 7.02 (d, *J* = 7.4 Hz, 1H), 4.48-4.44 (m, 1H), 4.20-4.14 (m, 1H), 4.12-4.03 (m, 1H), 3.55-3.48 (m, 1H), 3.24-3.16 (m, 1H), 3.01-2.88 (m, 2H), 2.32 (s, 3H). ^{13}C NMR ($CDCl_3$, 100 MHz): δ 178.8, 177.0, 169.6, 141.0, 135.5, 128.4, 126.5, 126.4, 124.2, 50.9, 46.0, 38.6, 29.7, 24.1. HRMS (ESI) *m/z* calcd for $C_{14}H_{15}N_2O_3$ $(M+H)^+$ 259.1077, found 259.1078.

methyl 3-(1-acetylindolin-7-yl)-2,5-dioxopyrrolidine-1-carboxylate (3ah)



^{1}H NMR ($CDCl_3$, 300 MHz): δ 7.20 (d, *J* = 7.4 Hz, 1H), 7.13 (t, *J* = 7.5 Hz, 1H), 6.99 (d, *J* = 7.4 Hz, 1H), 4.49-4.44 (m, 1H), 4.19-4.04 (m, 2H), 3.99 (s, 3H), 3.53-3.44 (m, 1H), 3.22-3.10 (m, 1H), 3.06-2.98 (m, 2H), 2.28 (s, 3H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 173.8, 172.4, 169.5, 149.0, 140.9, 135.6, 127.2, 127.1, 126.3, 124.4, 54.9, 50.9, 45.3, 37.4, 29.6, 24.0. HRMS (ESI) *m/z* calcd for $C_{16}H_{17}N_2O_5$ $(M+H)^+$ 317.1132, found 317.1134.

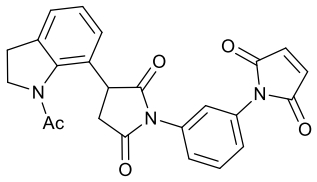
3-(1-acetylindolin-7-yl)-1-allylpyrrolidine-2,5-dione (3ai)



^{1}H NMR ($CDCl_3$, 300 MHz): δ 7.18-7.08 (m, 2H), 6.89 (d, *J* = 7.2 Hz, 1H), 5.89-5.76 (m, 1H), 5.29-5.23 (m, 1H), 5.22-5.18 (m, 1H), 4.42-4.37 (m, 1H), 4.17-4.09 (m, 3H), 4.07-4.00 (m, 1H), 3.51-3.41 (m, 1H), 3.22-3.10 (m, 1H), 3.00-2.86 (m, 1H), 2.88-2.79 (m, 1H), 2.28 (s, 3H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 178.2, 176.7, 169.3, 141.1, 135.4, 130.9, 128.9, 126.4,

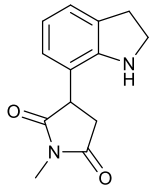
126.1, 124.1, 118.4, 51.0, 44.5, 41.0, 37.5, 29.7, 24.1. HRMS (ESI) *m/z* calcd for $C_{17}H_{19}N_2O_3$ $(M+H)^+$ 299.1390, found 299.1391.

1-(3-(3-(1-acetylindolin-7-yl)-2,5-dioxopyrrolidin-1-yl)phenyl)-1H-pyrrole-2,5-dione (3aj)



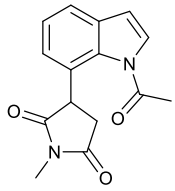
^{1}H NMR ($CDCl_3$, 300 MHz): δ 7.52-7.47 (m, 1H), 7.43-7.42 (m, 1H), 7.39-7.31 (m, 2H), 7.15-7.06 (m, 2H), 7.01-6.98 (m, 1H), 6.78 (s, 2H), 4.50-4.45 (m, 1H), 4.12-3.95 (m, 2H), 3.54-3.44 (m, 1H), 3.15-3.03 (m, 2H), 2.97-2.88 (m, 1H), 2.32 (s, 3H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 177.0, 175.7, 169.5, 169.0, 140.9, 135.6, 134.3, 132.8, 131.9, 129.5, 128.1, 127.2, 126.3, 125.6, 125.3, 124.3, 123.5, 50.9, 45.0, 37.2, 29.7, 24.1. HRMS (ESI) *m/z* calcd for $C_{24}H_{20}N_3O_5$ $(M+H)^+$ 430.1397, found 430.1402.

3-(indolin-7-yl)-1-methylpyrrolidine-2,5-dione (4)



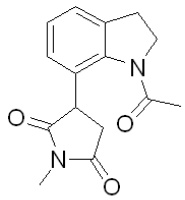
^{1}H NMR ($CDCl_3$, 300 MHz): δ 7.09-7.07 (m, 1H), 6.81-6.70 (m, 2H), 4.08-4.04 (m, 1H), 3.64-3.58 (m, 2H), 3.50 (s, 1H), 3.14-3.02 (m, 7H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 178.6, 176.4, 150.9, 131.1, 124.2, 123.8, 119.6, 117.9, 46.8, 41.8, 34.1, 30.2, 25.1. HRMS (ESI) *m/z* calcd for $C_{13}H_{15}N_2O_2$ $(M+H)^+$ 231.1128, found 231.1129.

3-(1-acetyl-1H-indol-7-yl)-1-methylpyrrolidine-2,5-dione (5)



^{1}H NMR ($CDCl_3$, 400 MHz): δ 7.51 (d, *J* = 7.2 Hz, 1H), 7.43 (d, *J* = 3.9 Hz, 1H), 7.29 (t, *J* = 7.6 Hz, 1H), 7.03 (d, *J* = 7.2 Hz, 1H), 6.67 (d, *J* = 3.9 Hz, 1H), 5.10-5.07 (m, 1H), 3.48-3.41 (m, 1H), 3.08 (s, 3H), 2.92-2.88 (m, 1H), 2.65 (s, 3H). ^{13}C NMR ($CDCl_3$, 75 MHz): δ 179.1, 177.1, 169.0, 133.2, 127.3, 124.9, 120.9, 109.6, 38.6, 25.1, 24.8. HRMS (ESI) *m/z* calcd for $C_{15}H_{15}N_2O_3$ $(M+H)^+$ 271.1077, found 271.1079.

4. Copies of ^{1}H NMR and ^{13}C NMR spectra of the products



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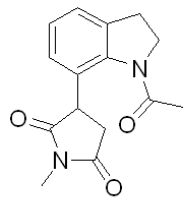

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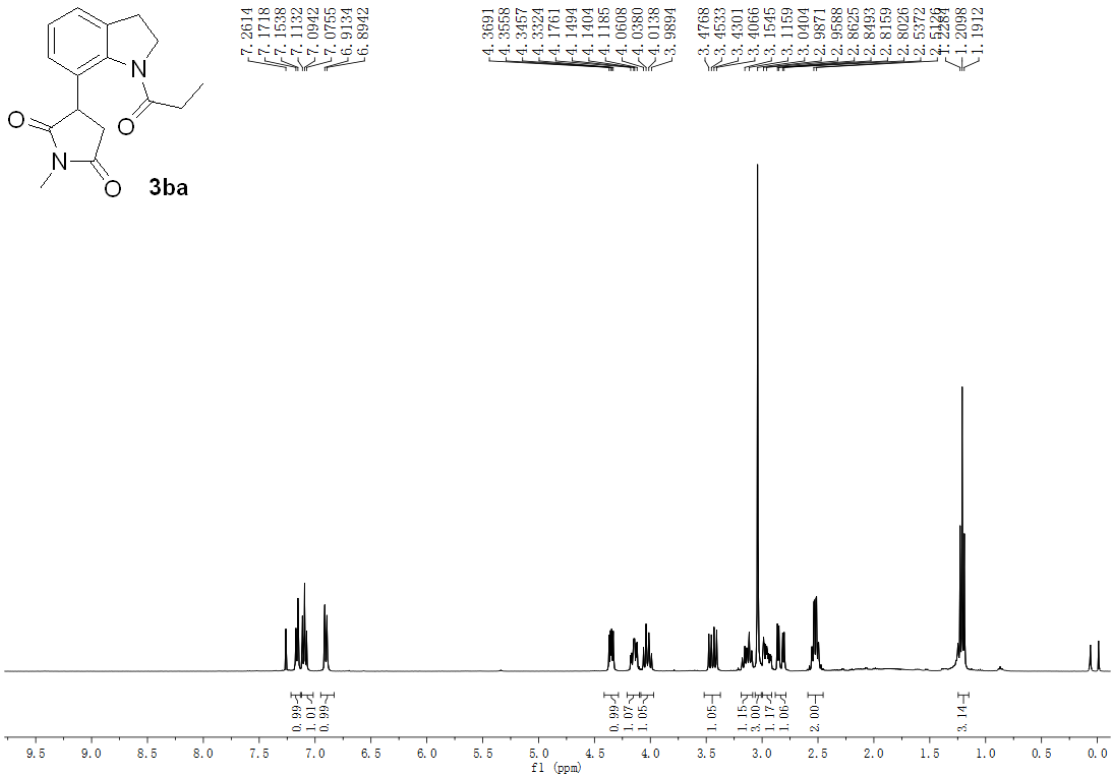
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7.1132
7.0942
7.0755
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6.8942
4.3691
4.3558
4.3457
4.3324
4.1761
4.1494
4.1404
4.1185
4.0608
4.0380
4.0138
3.9894
3.4768
3.4533
3.4301
3.4066
3.1545
3.1159
3.0404
2.9871
2.9588
2.8625
2.8493
2.8159
2.8026
2.5372
2.5126
1.2284
1.2098
1.1912
0.99
1.01
0.99
0.99
1.07
1.05
1.05
1.15
3.00
1.17
1.06
2.00
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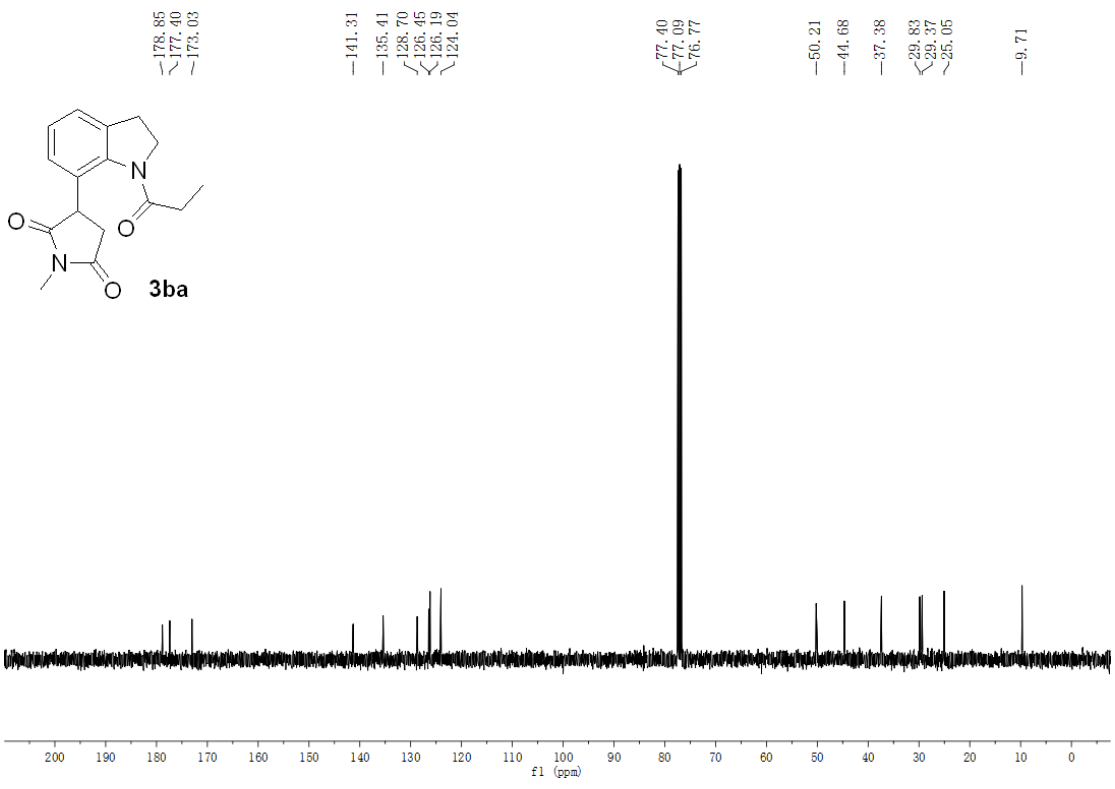
f1 (ppm)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135.41
128.70
126.45
126.19
124.04
77.40
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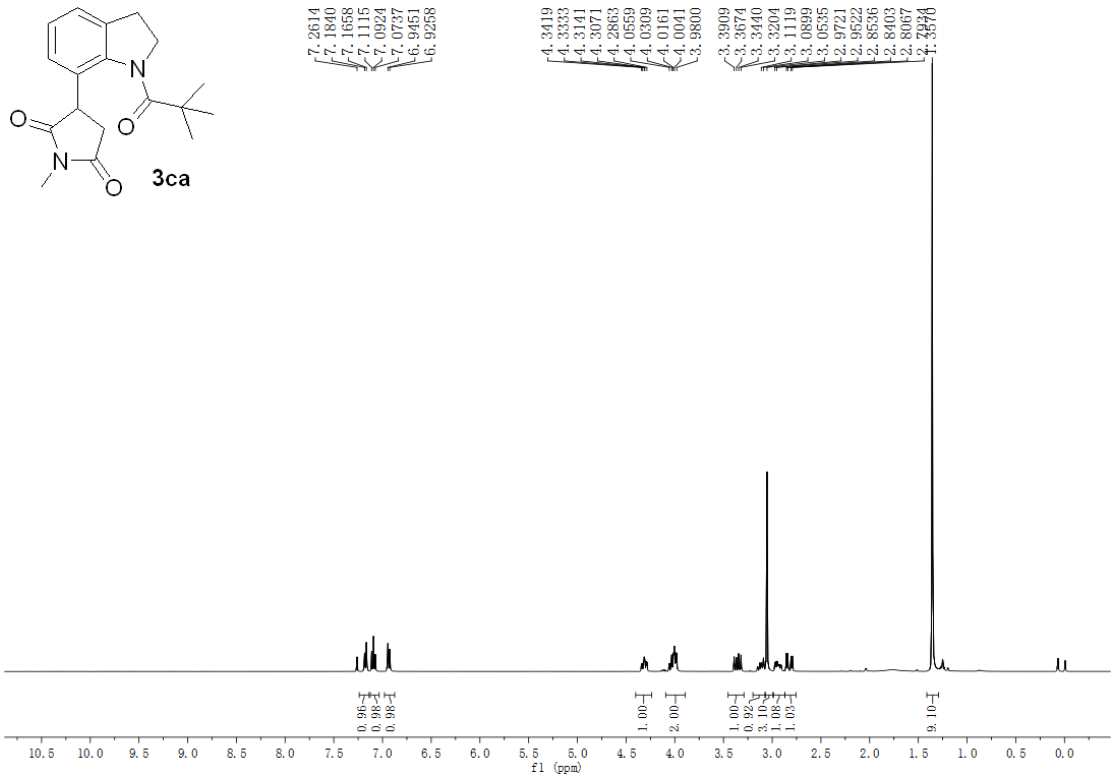
76.77
50.21
44.68
37.38
29.83
29.37
25.05
9.71
f1 (ppm)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7.0737
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6.9258
4.3419
4.3333
4.3141
4.3071
4.2863
4.0559
4.0309
4.0161
4.0041
3.9800
3.3909
3.3674
3.3440
3.3204
3.1119
3.0899
3.0535
2.9721
2.9522
2.8536
2.8403
2.8067
2.7934
1.3570
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0.98
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2.00
1.00
0.92
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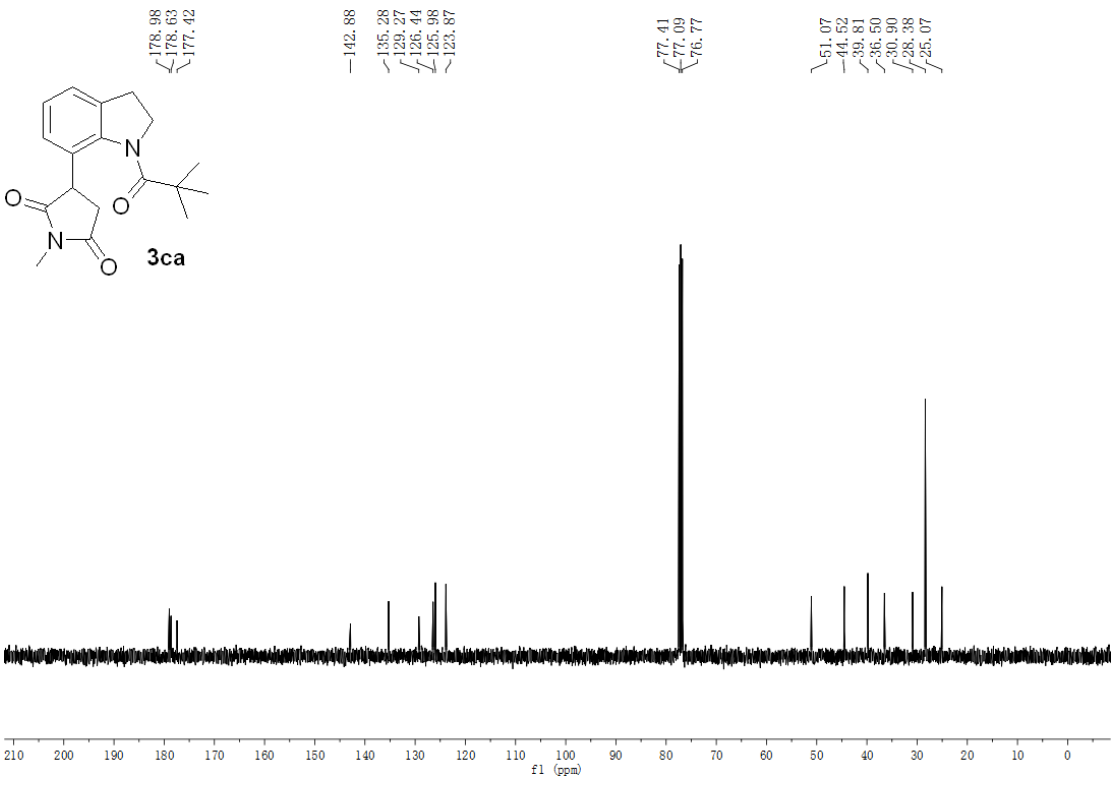
1.08
1.03
9.10
f1 (ppm)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142.88
135.28
129.27
126.44
125.98
123.87
77.41
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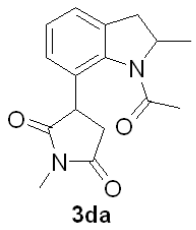
36.50
30.90
28.38
25.07
f1 (ppm)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N
O
N
O

3da

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7.1436
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7.1061
7.0873
6.8742
6.8553
4.8170
4.8029
4.7934
4.7795
4.5725
4.5557
4.5382
4.5207
4.5040
4.2990
4.2860
4.2758
4.2628
3.4443
3.4238
3.4053
3.3854
3.0427
3.0354
2.9405
2.5862
2.5583
2.5473
2.5209
2.2800
1.3320
1.2832
1.2668
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0.98
0.97
0.56
0.38
0.99
0.57
1.60
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1.00
1.40
3.00
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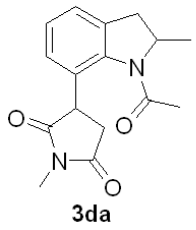
1.38
f1 (ppm)


O
N
O
N
O

3da

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168.12
139.77
138.83
134.59
134.26
129.48
128.46
126.80
126.48
126.07
125.83
124.66
124.47
77.52
77.10
76.68
58.09
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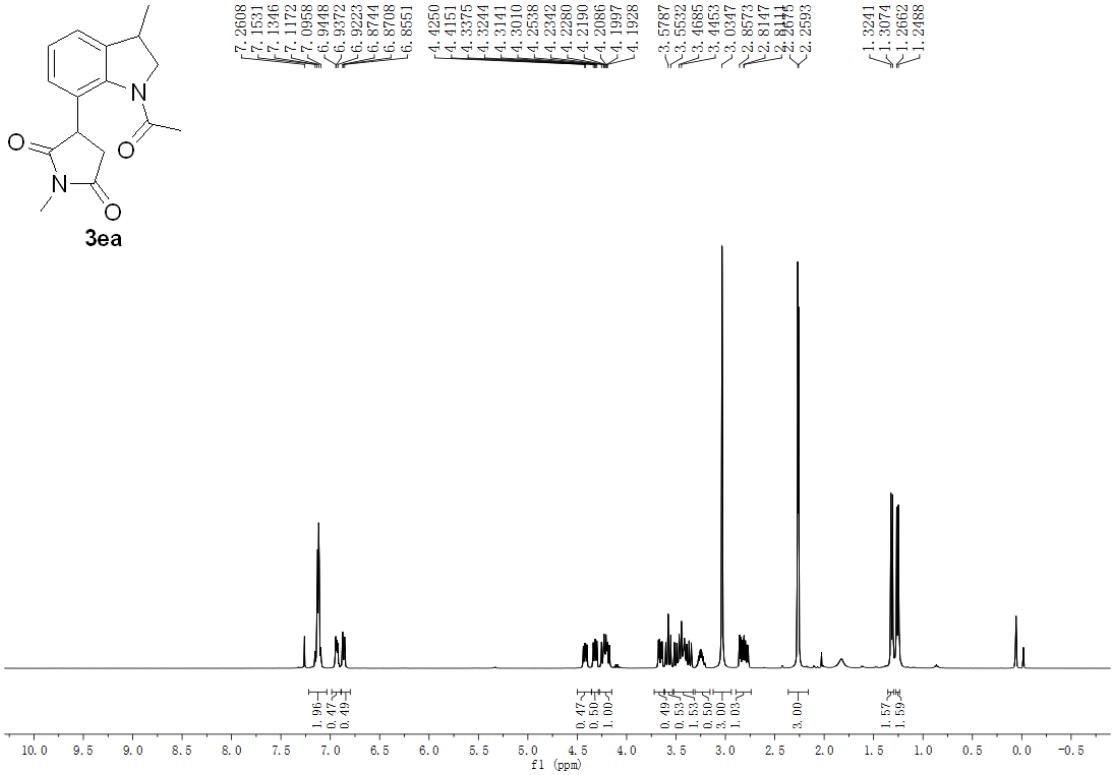
25.03
24.92
23.23
23.18
20.77
20.45
f1 (ppm)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6.8551
4.4250
4.4151
4.3375
4.3244
4.3141
4.3010
4.2538
4.2342
4.2280
4.2190
4.2086
4.1997
4.1928
3.5787
3.5532
3.4685
3.4453
3.0347
2.8573
2.8147
2.8111
2.2675
2.2593
1.3241
1.3074
1.2662
1.2488
1.96
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0.49
0.47
0.50
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0.53
1.53
0.50
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1.03
3.00
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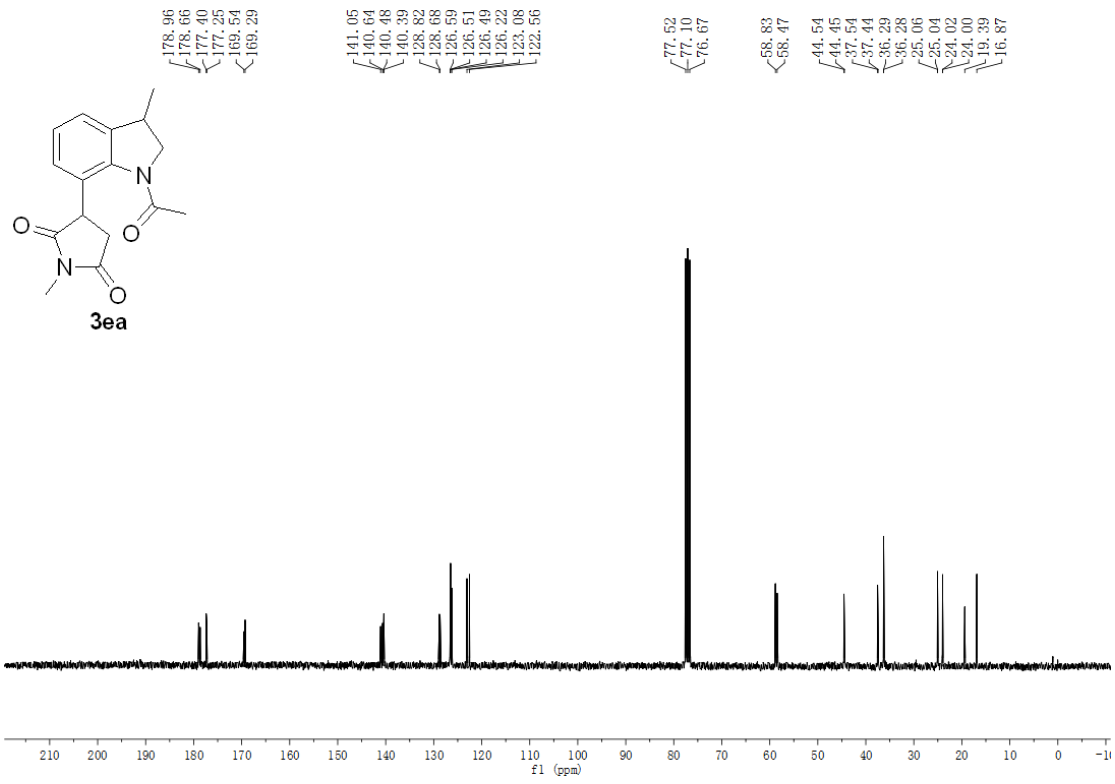
1.59
f1 (ppm)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169.54
169.29
141.05
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140.48
140.39
128.82
128.68
126.59
126.51
126.49
126.22
123.08
122.56
77.52
77.10
76.67
58.83
58.47
44.54
44.45
37.54
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36.29
36.28
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25.04
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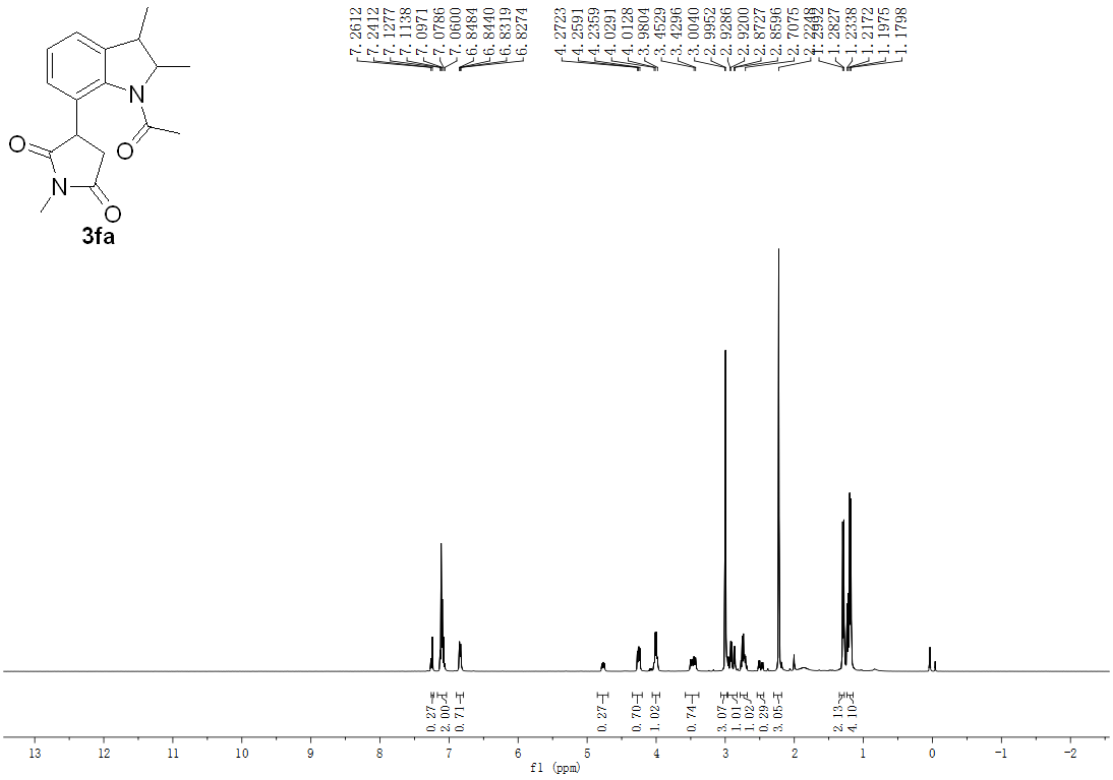
16.87
f1 (ppm)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6.8319
6.8274
4.2723
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4.2359
4.0291
4.0128
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3.4529
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2.9200
2.8727
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2.7075
2.2248
2.2092
1.2827
1.2338
1.2172
1.1975
1.1798
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2.00
0.71
0.27
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1.02
0.29
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4.10
f1 (ppm)
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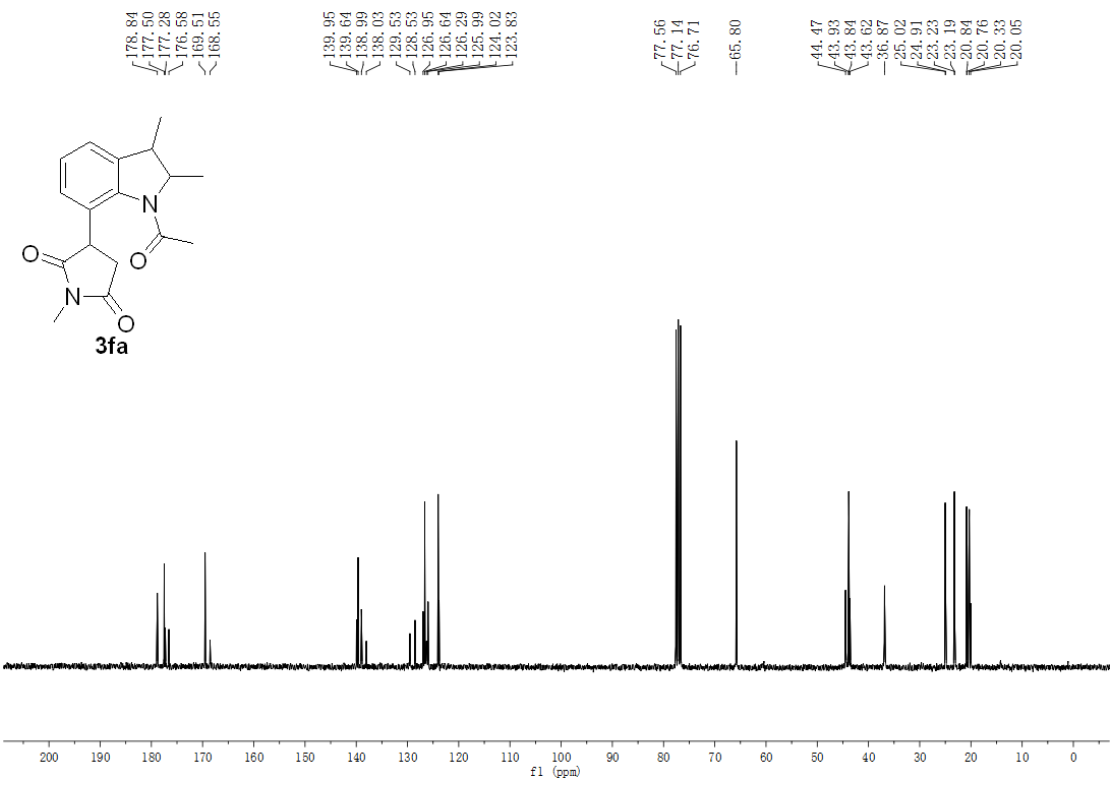
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176.58
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168.55
139.95
139.64
138.99
138.03
129.53
128.53
126.95
126.64
126.29
125.99
124.02
123.83
77.56
77.14
76.71
65.80
44.47
43.93
43.84
43.62
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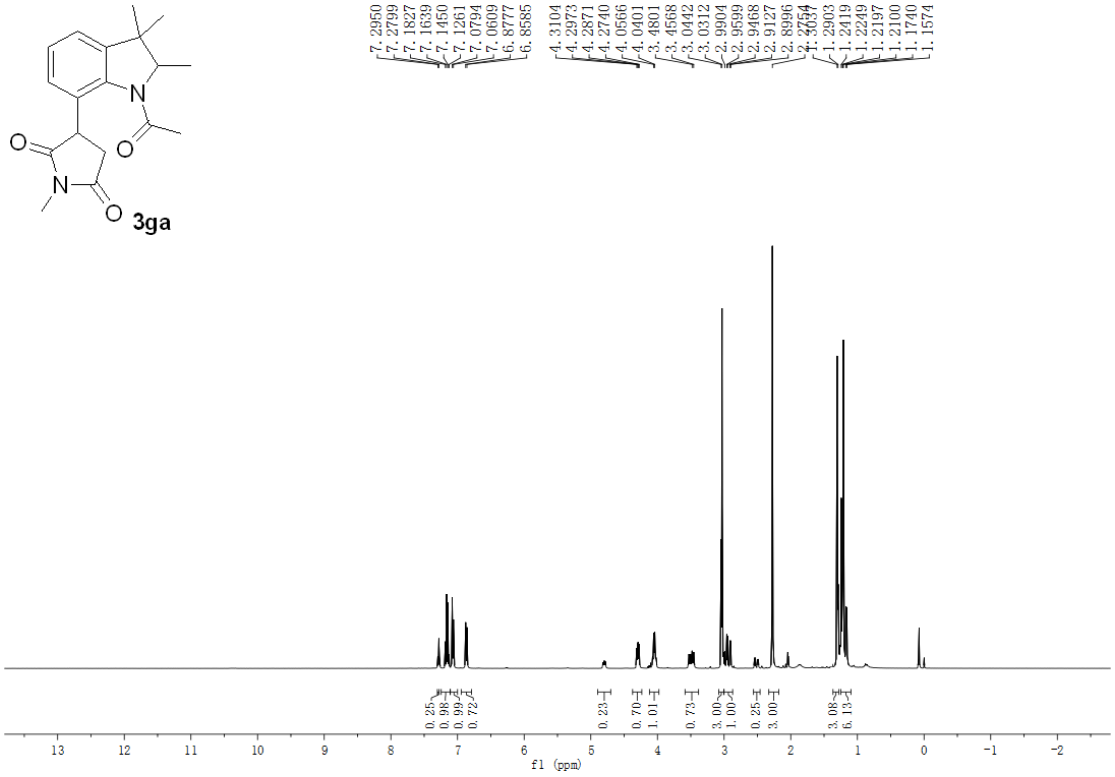
23.19
20.84
20.76
20.33
20.05
f1 (ppm)
3fa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6.8585
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4.2973
4.2871
4.2740
4.0566
4.0401
3.4801
3.4568
3.0442
3.0312
2.9904
2.9599
2.9468
2.9127
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1.2419
1.2249
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1.2100
1.1740
1.1574
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0.98
0.99
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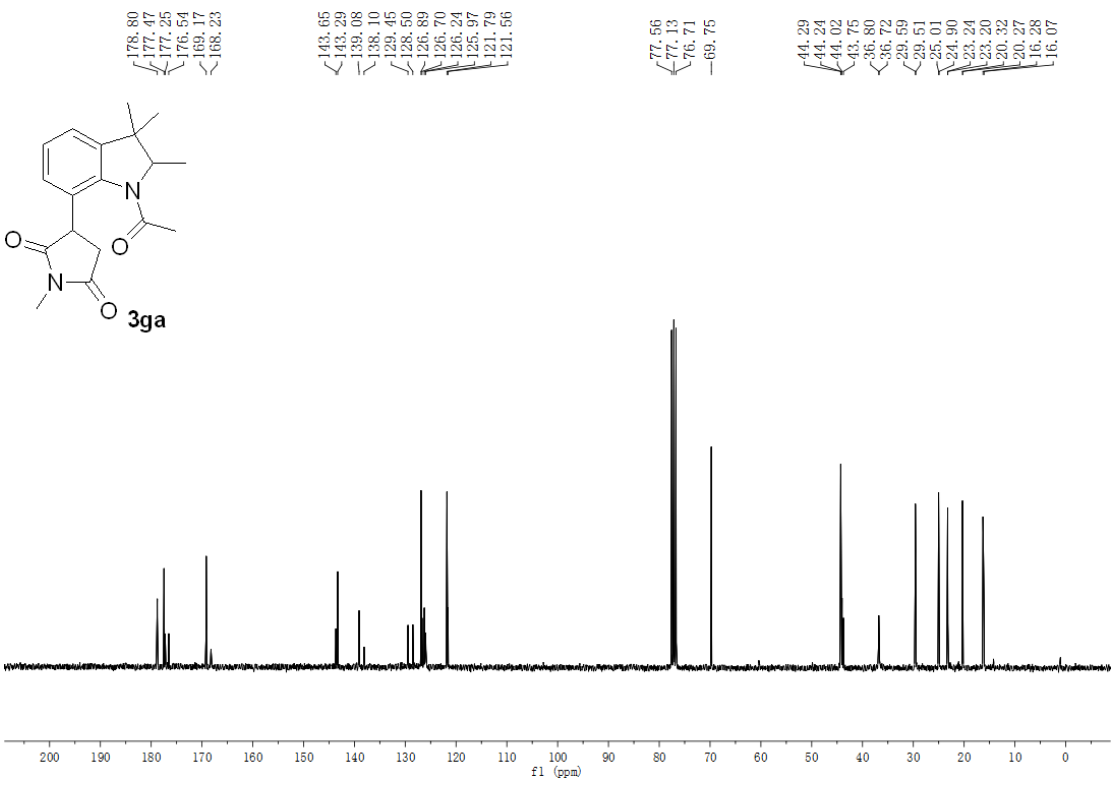
6.13
f1 (ppm)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143.65
143.29
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138.10
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126.70
126.24
125.97
121.79
121.56
77.56
77.13
76.71
69.75
44.29
44.24
44.02
43.75
36.80
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25.01
24.90
23.24
23.20
20.32
20.27
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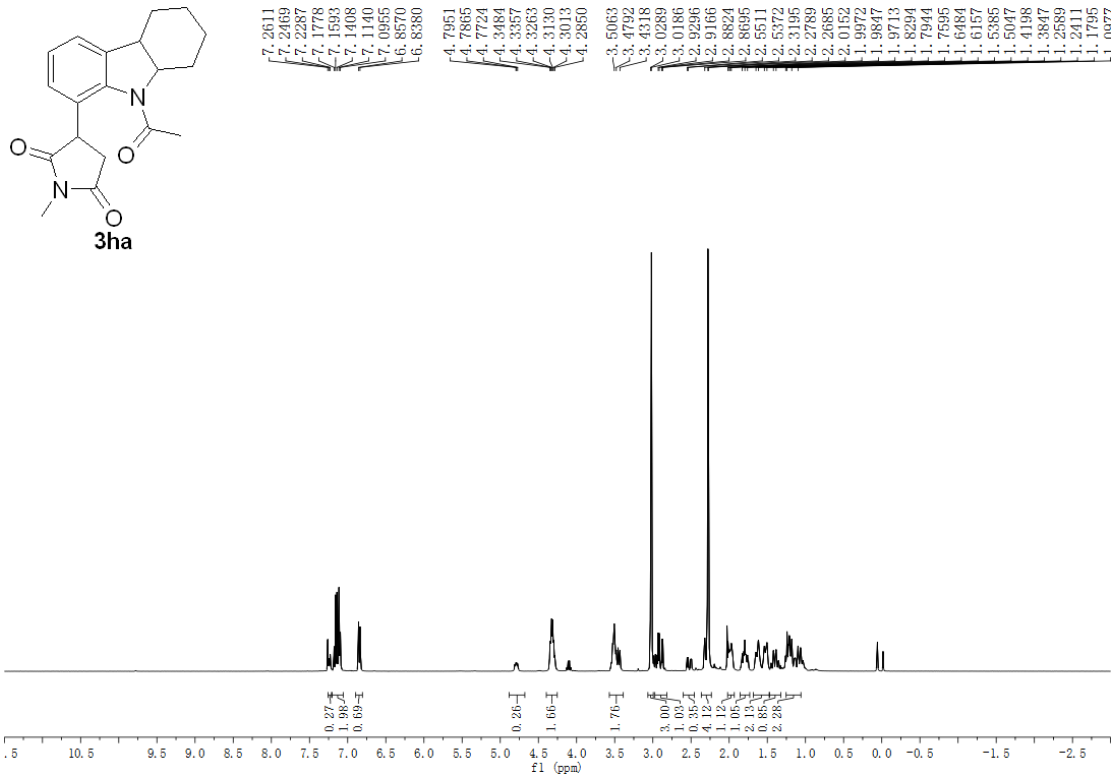
16.07
f1 (ppm)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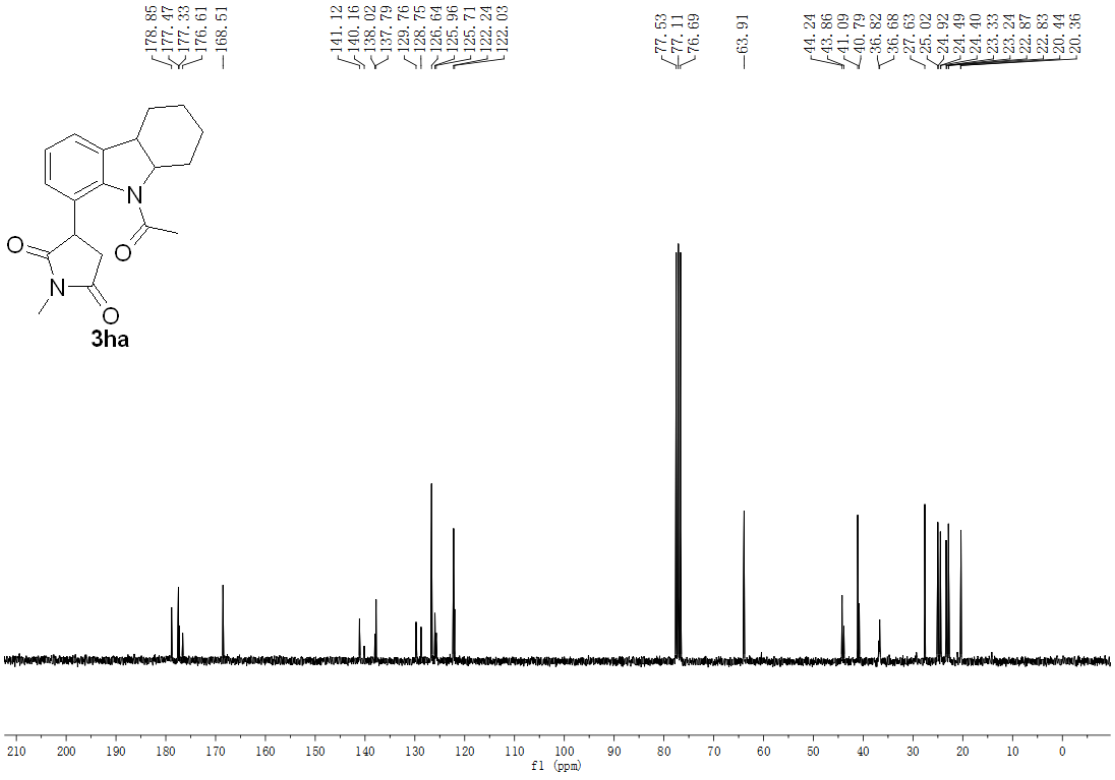
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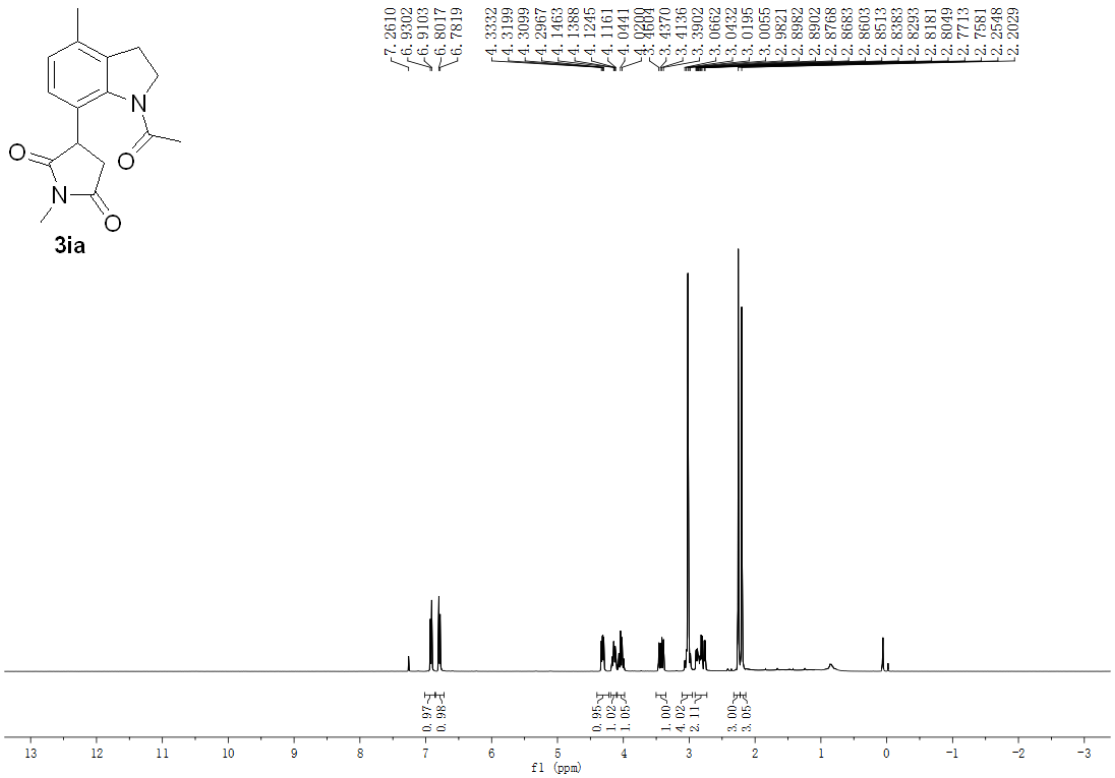
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4.1388
4.1245
4.1161
4.0441
4.0289
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3.4136
3.3902
3.0662
3.0432
3.0195
3.0055
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2.8293
2.8181
2.8049
2.7713
2.7581
2.2548
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0.95
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1.05
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2.11
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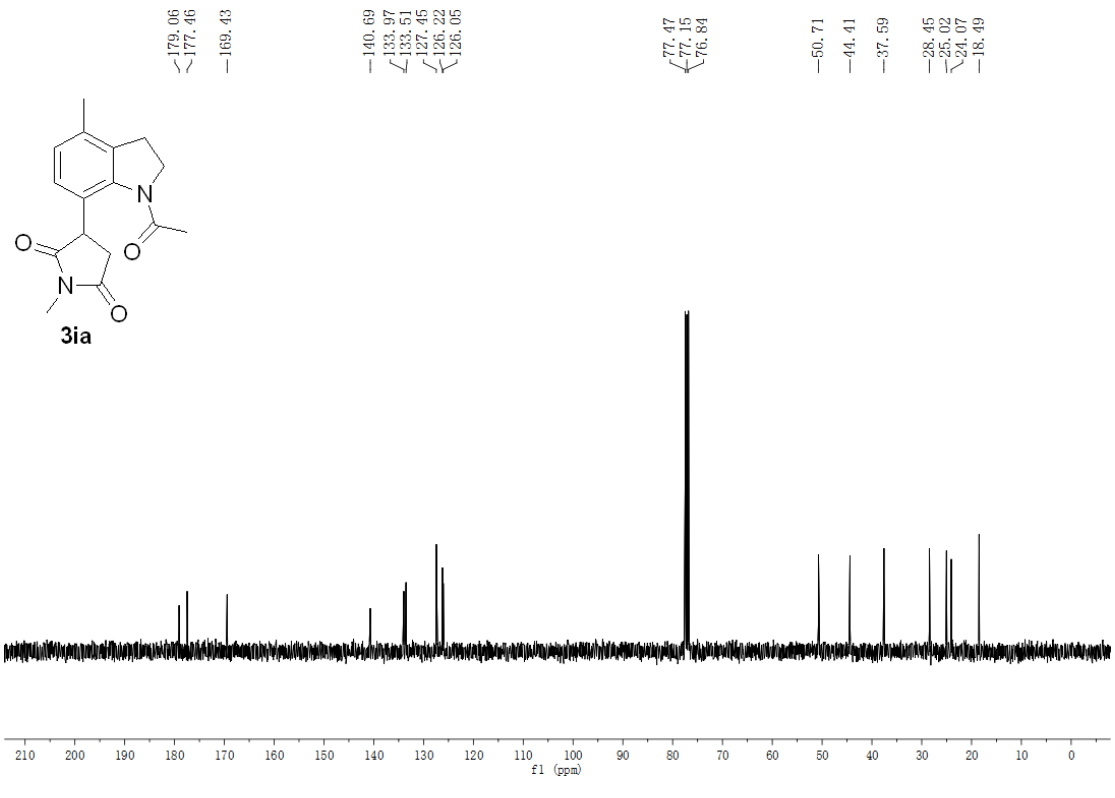
f1 (ppm)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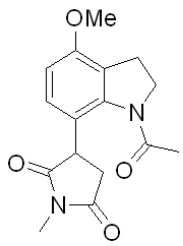
44.41
37.59
28.45
25.02
24.07
18.49
f1 (ppm)


OMe
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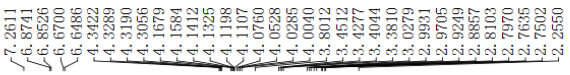
O
O
N
O

3ja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4.1584
4.1412
4.1325
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4.1107
4.0760
4.0528
4.0285
4.0040
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3.4512
3.4277
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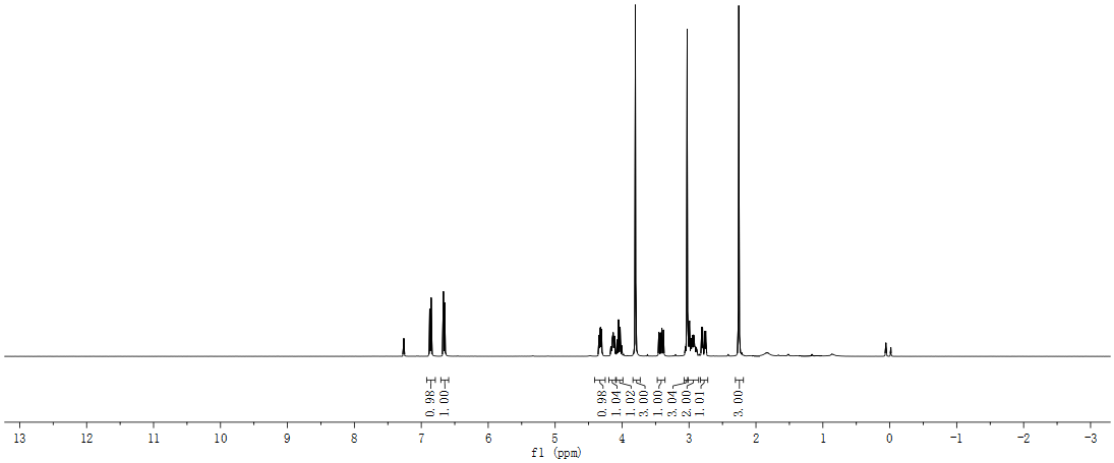
2.2550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3.00
1.00
3.04
2.00
1.01
3.00
f1 (ppm)


179.27
177.47
169.49
155.09
142.39
127.69
122.45
121.23
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77.11
76.79
55.54
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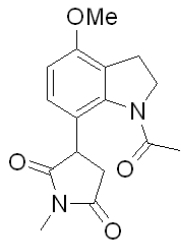
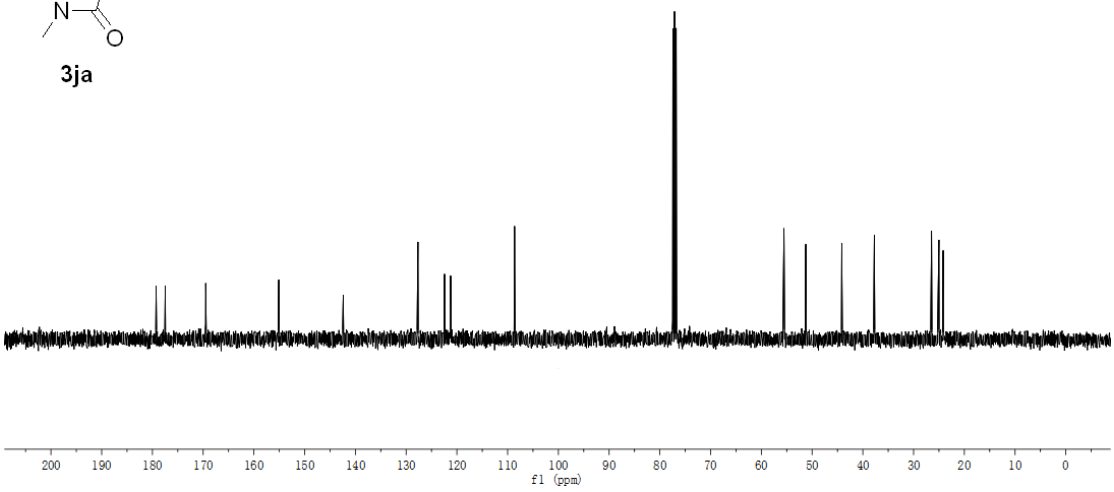
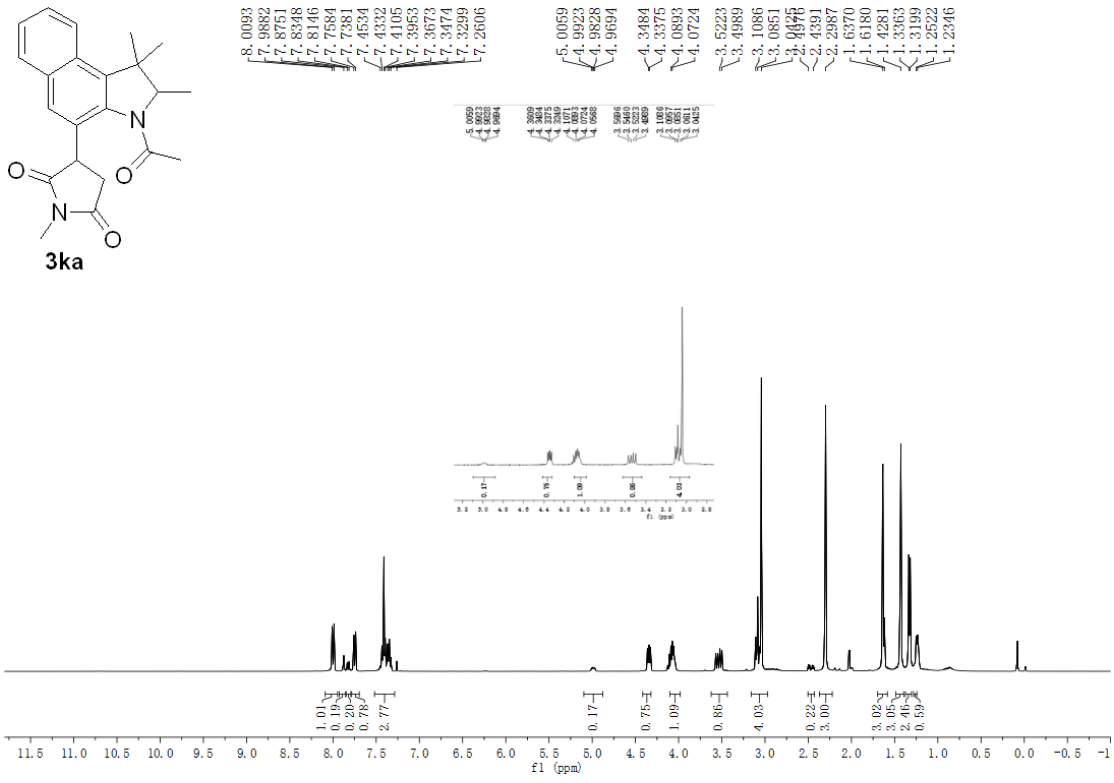
44.15
37.73
26.46
25.02
24.17


OMe
N
O
O
N
O

3ja


f1 (ppm)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7.3474
7.3299
7.2606
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4.3484
4.3375
4.0893
4.0724
3.5223
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3.1086
3.0851
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1.3199
1.2522
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3.05
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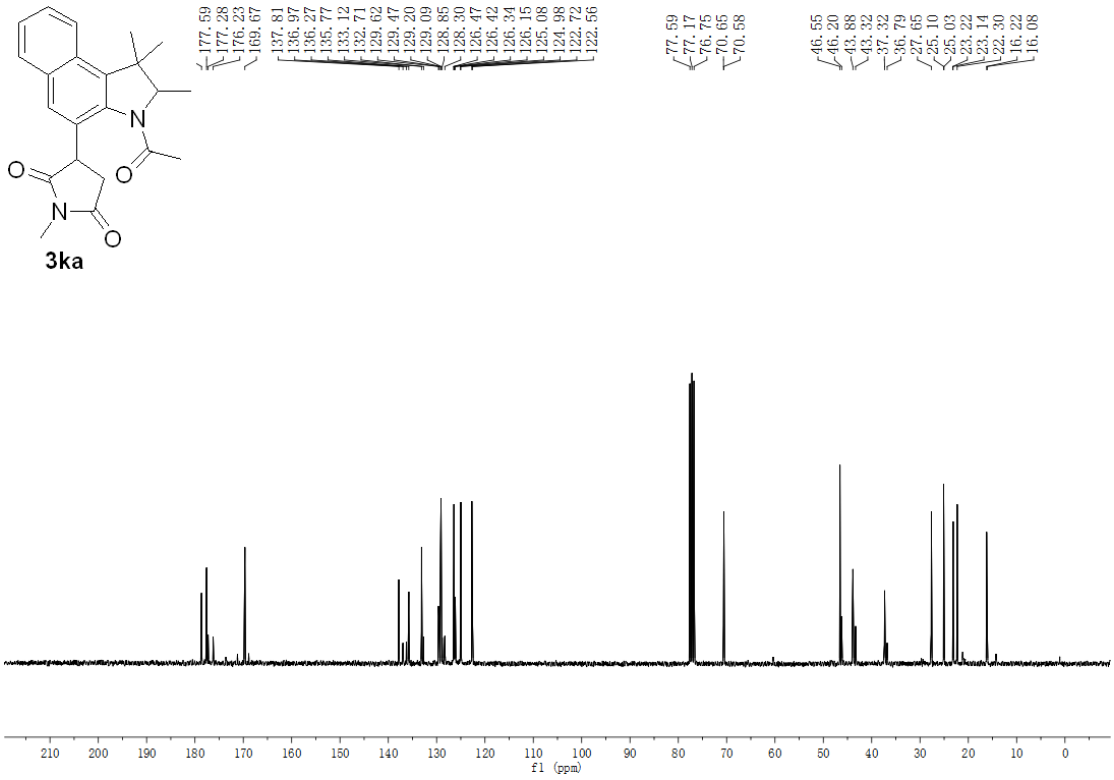
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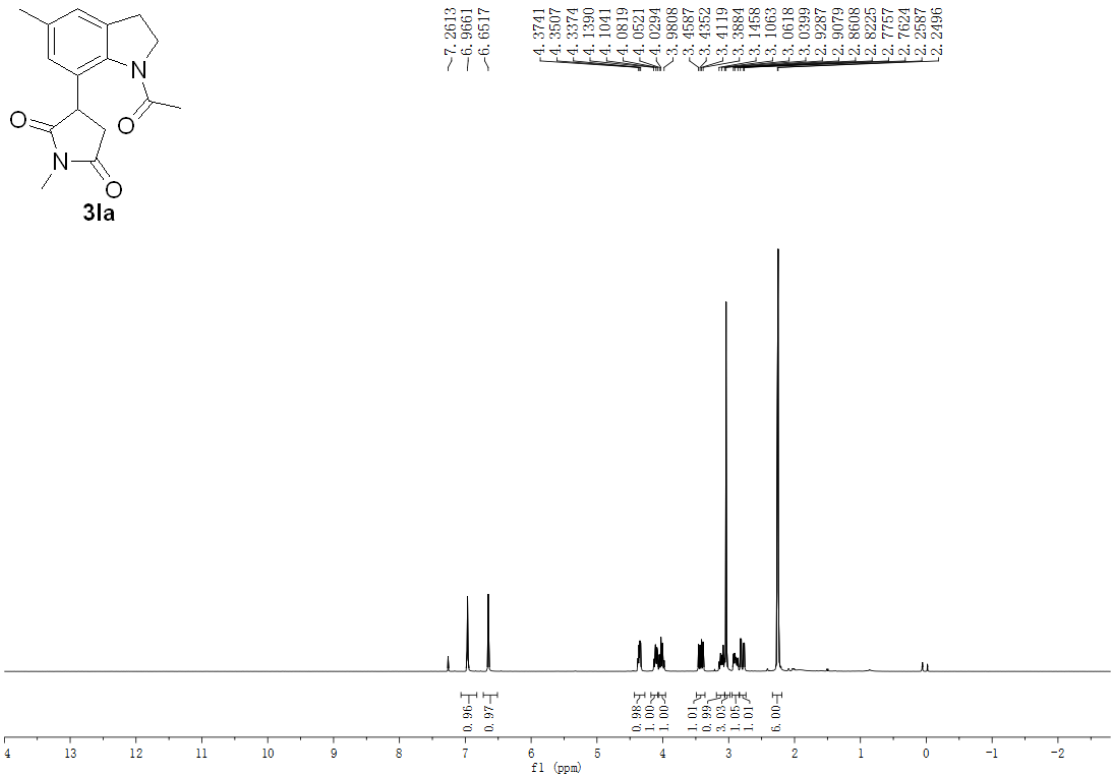
129.47
129.20
129.09
128.85
128.30
126.47
126.42
126.34
126.15
125.08
124.98
122.72
122.56
77.59
77.17
76.75
70.65
70.58
46.55
46.20
43.88
43.32
37.32
36.79
27.65
25.10
25.03
23.22
23.14
22.30
16.22
16.08
f1 (ppm)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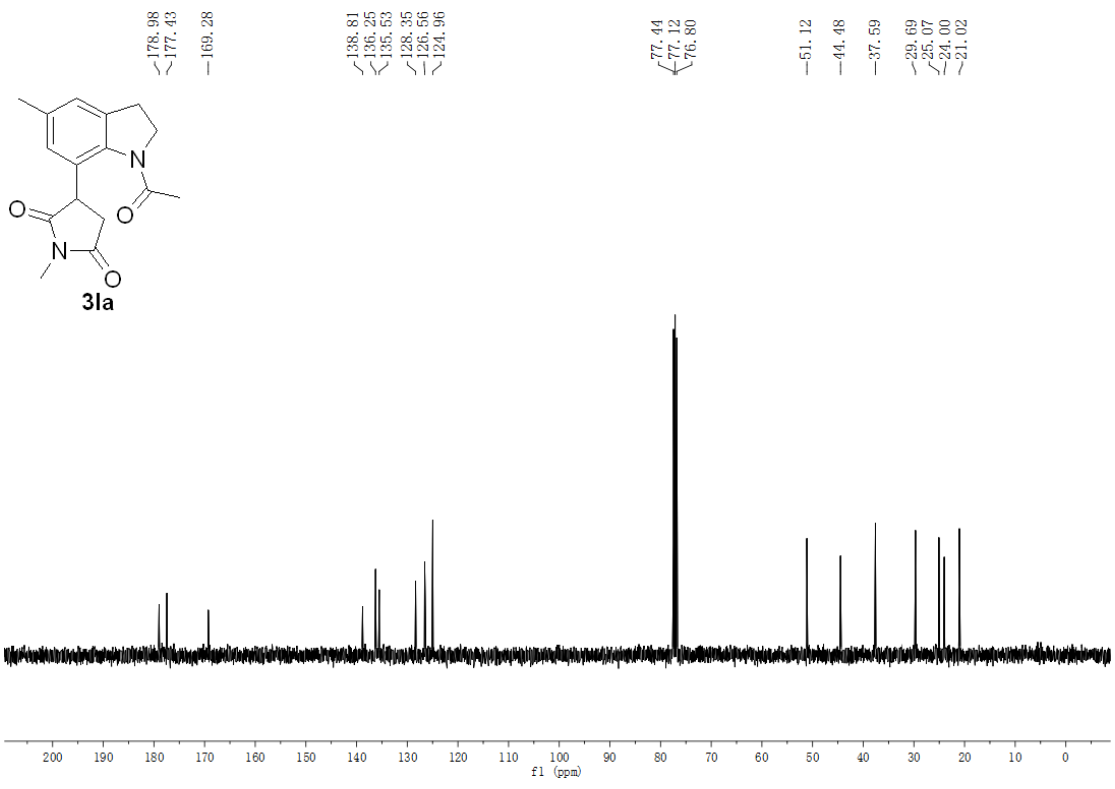
3.4119
3.3884
3.1458
3.1063
3.0618
3.0399
2.9287
2.9079
2.8608
2.8225
2.7757
2.7624
2.2587
2.2496
0.96
0.97
0.98
1.00
1.00
1.01
0.99
3.03
1.05
1.01
6.00
f1 (ppm)

3la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169.28
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135.53
128.35
126.56
124.96
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77.12
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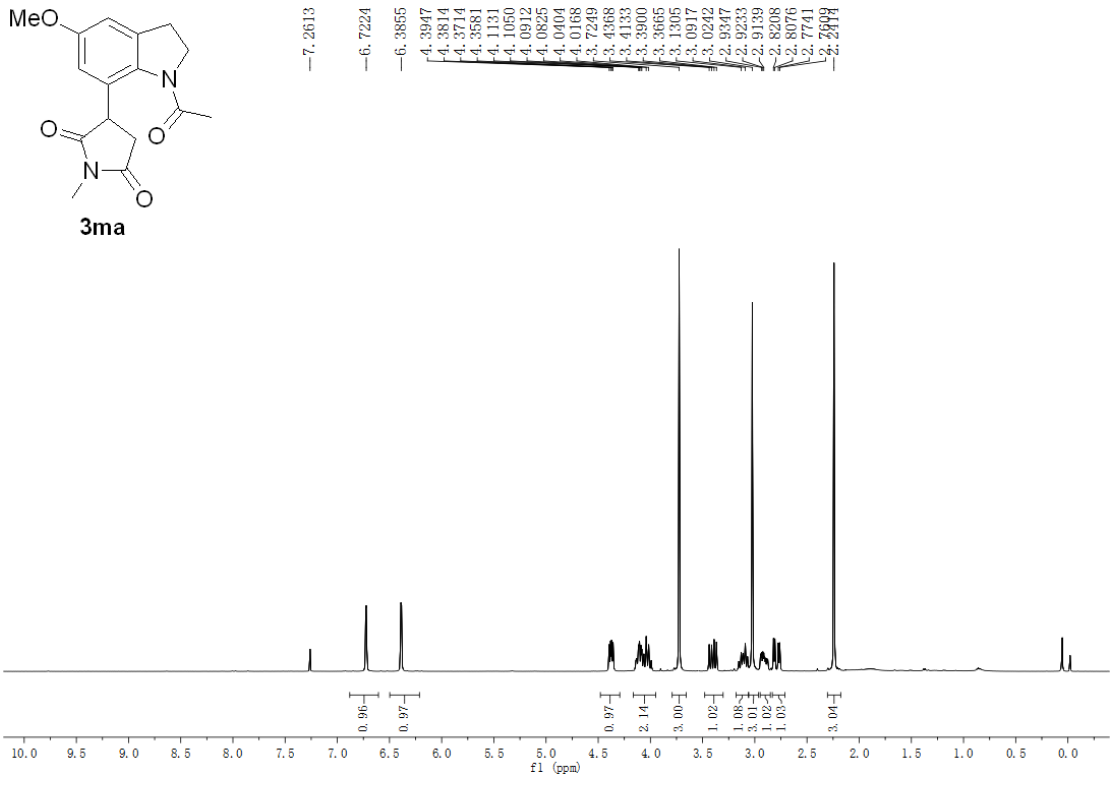
51.12
44.48
37.59
29.69
25.07
24.00
21.02
f1 (ppm)

3la


MeO
N
O
O
N
O
O
3ma
7.2613
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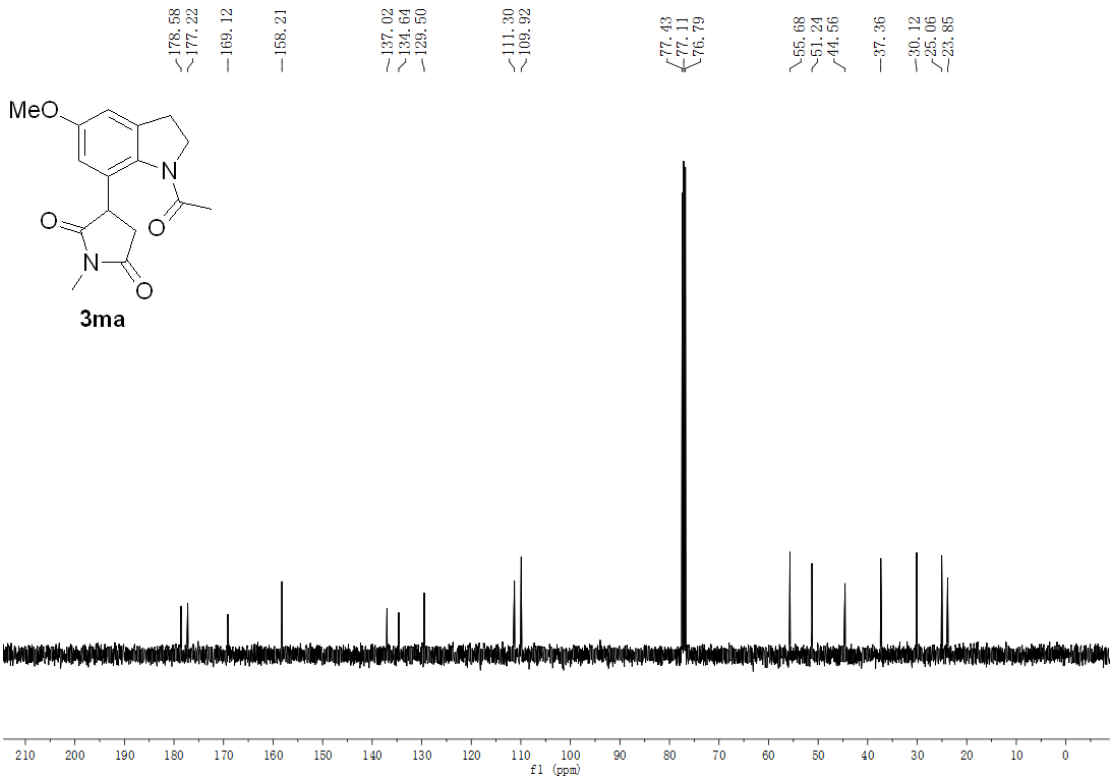
6.3855
4.3947
4.3814
4.3714
4.3581
4.1131
4.1050
4.0912
4.0825
4.0404
4.0168
3.7249
3.4368
3.4133
3.3900
3.3665
3.1305
3.0917
3.0242
2.9347
2.9233
2.9139
2.8208
2.8076
2.7741
2.7609
0.96
0.97
0.97
2.14
3.00
1.02
1.08
3.01
1.02
1.03
3.04
f1 (ppm)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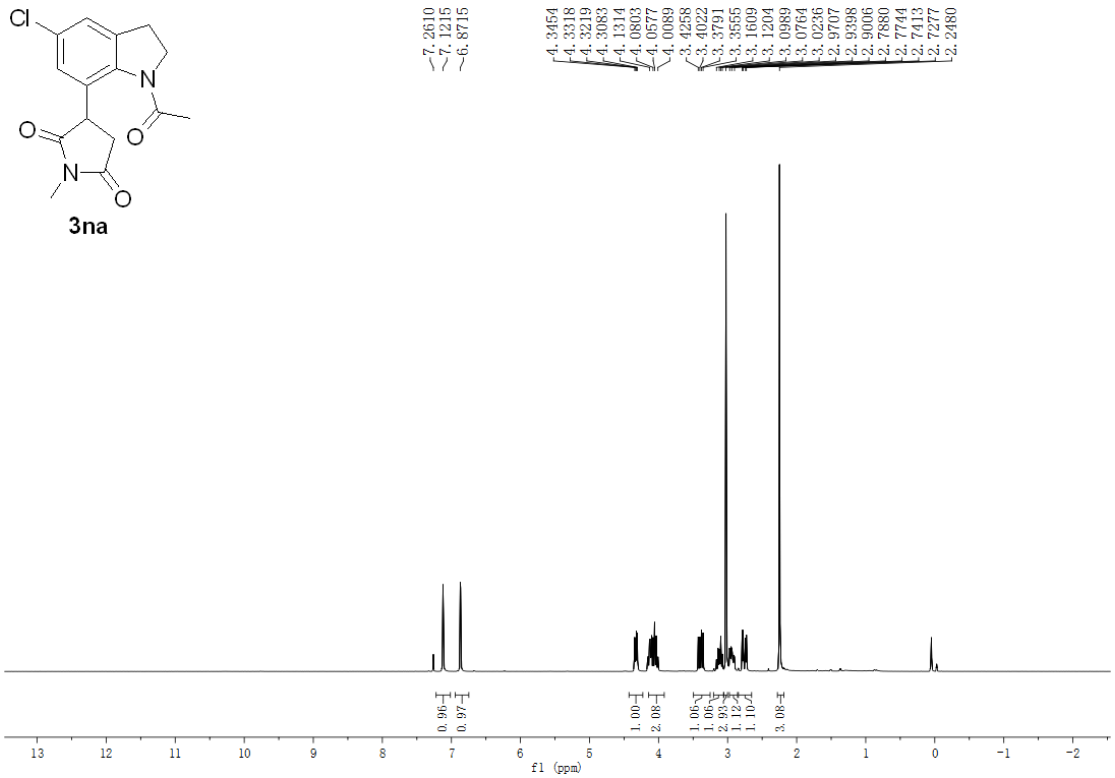
169.12
158.21
137.02
134.64
129.50
111.30
109.92
77.43
77.11
76.79
55.68
51.24
44.56
37.36
30.12
25.06
23.85
MeO
N
O
O
N
O
O
3ma
f1 (ppm)


Cl
N
O
O
N
O
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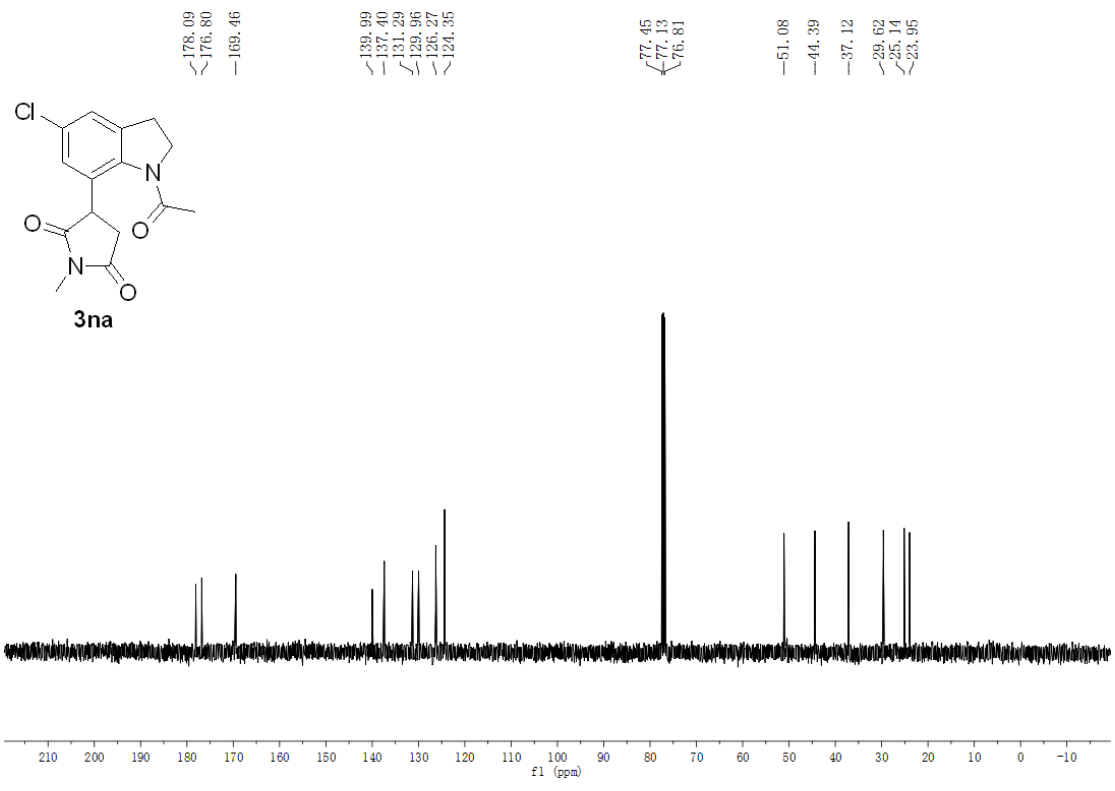
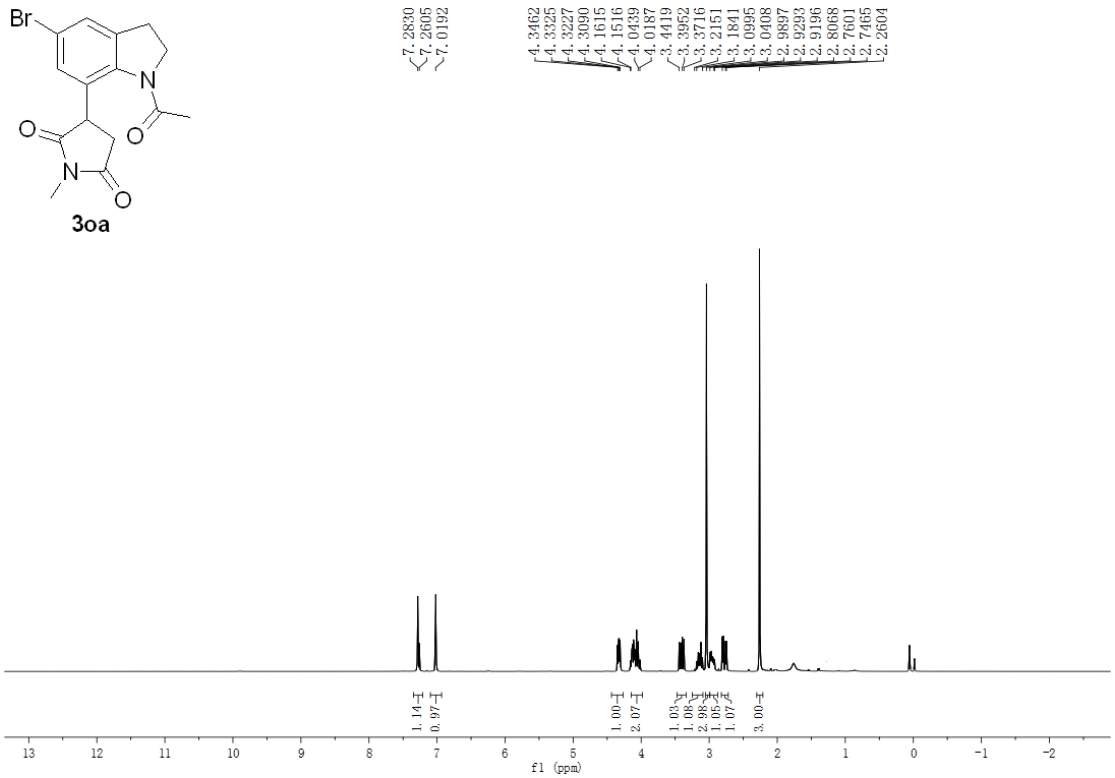
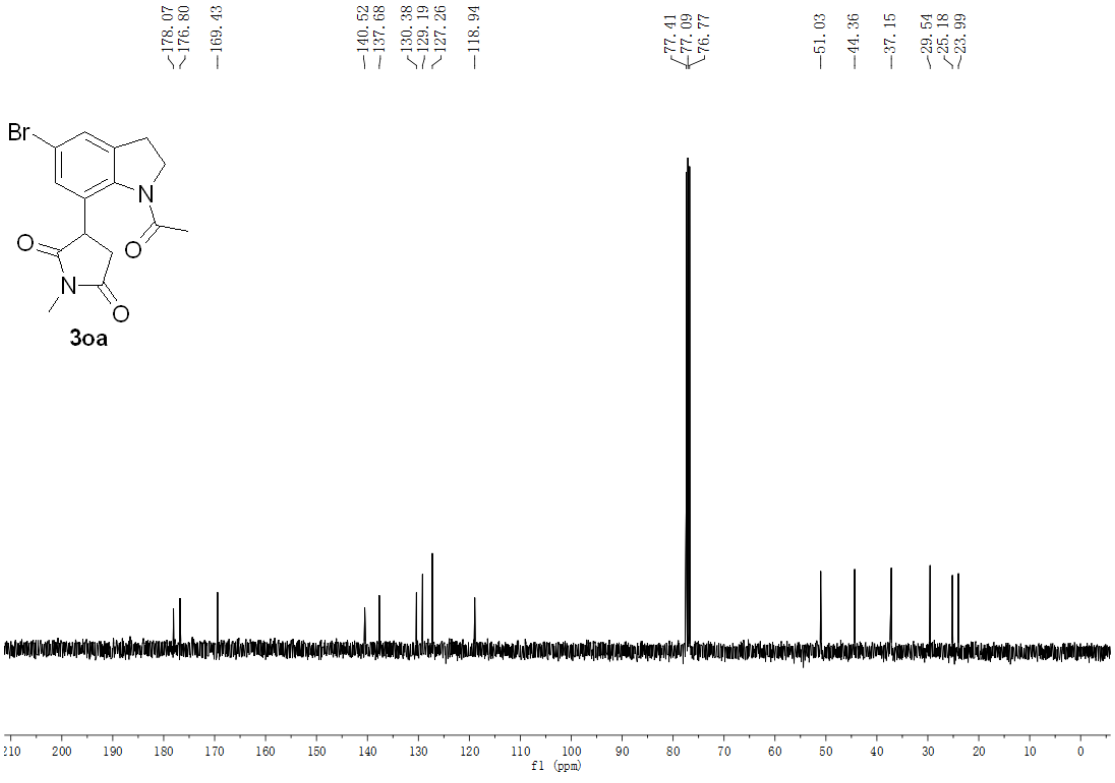
7.1215
6.8715
4.3454
4.3318
4.3219
4.3083
4.1314
4.0803
4.0577
4.0089
3.4258
3.4022
3.3791
3.3555
3.1609
3.1204
3.0989
3.0764
3.0236
2.9707
2.9398
2.9006
2.7880
2.7744
2.7413
2.7277
2.2480
0.96
0.97
1.00
2.08
1.06
1.06
2.93
1.12
1.10
3.08
f1 (ppm)


Cl
N
O
O
N
O
3na
178.09
176.80
169.46
139.99
137.40
131.29
129.96
126.27
124.35
77.45
77.13
76.81
51.08
44.39
37.12
29.62
25.14
23.95
f1 (ppm)


Br
N
O
O
N
O
3oa
7.2830
7.2605
7.0192
4.3462
4.3325
4.3227
4.3090
4.1615
4.1516
4.0439
4.0187
3.4419
3.3952
3.3716
3.2151
3.1841
3.0995
3.0408
2.9897
2.9293
2.9196
2.8068
2.7601
2.7465
2.2604
1.14
0.97
1.00
2.07
1.03
1.08
2.98
1.05
1.07
3.00
f1 (ppm)


Br
N
O
O
N
O
3oa
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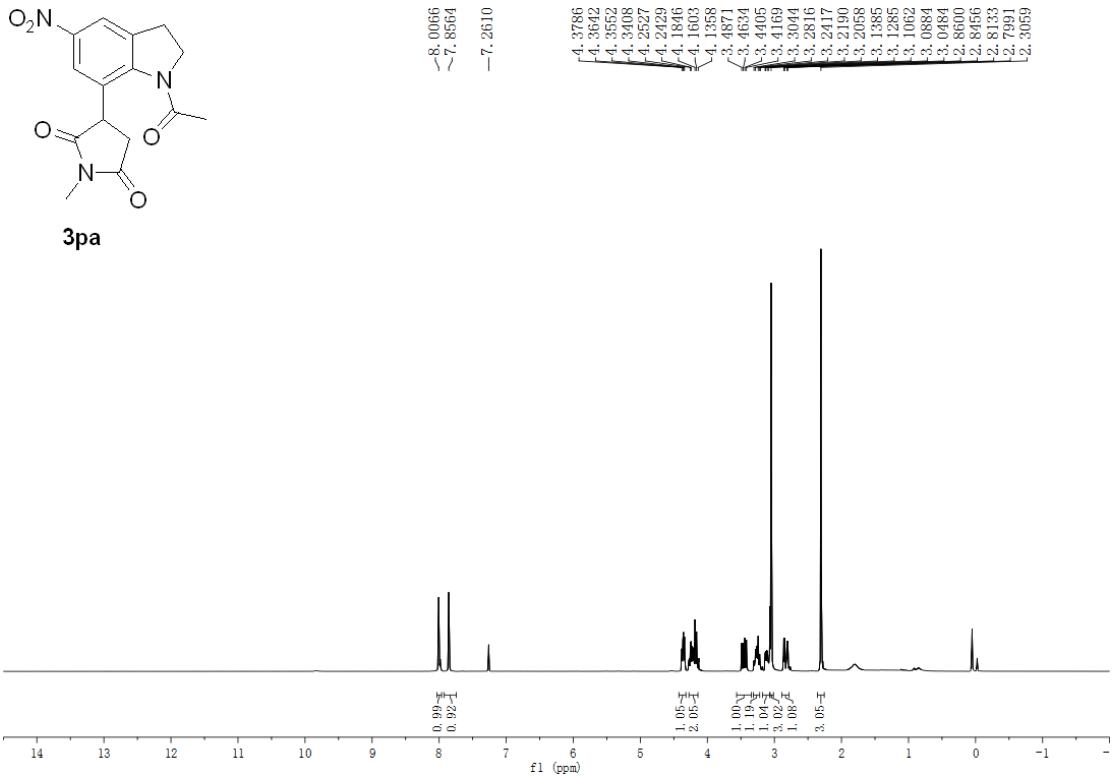
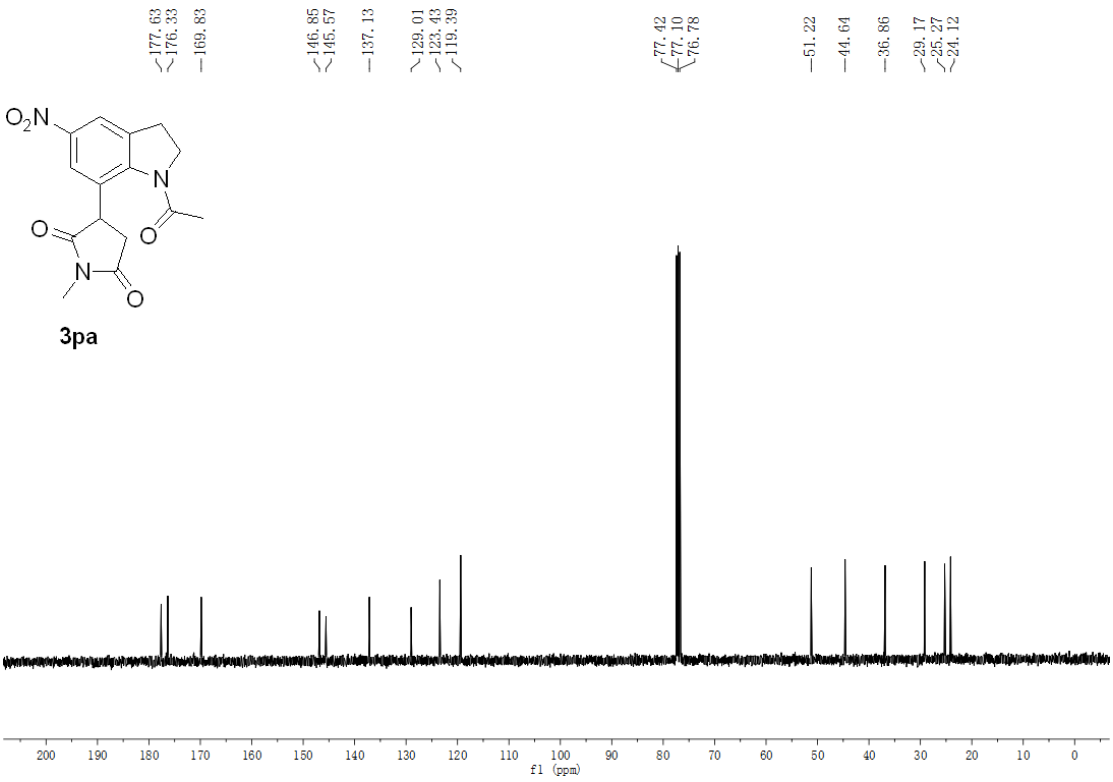
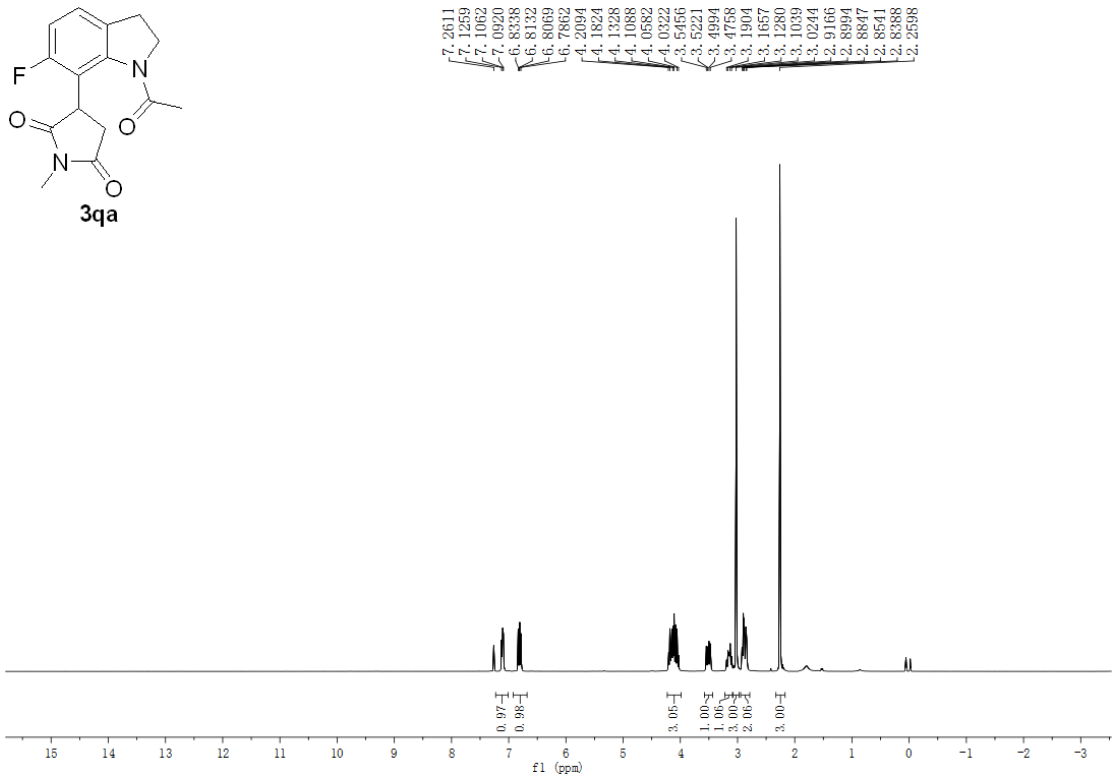
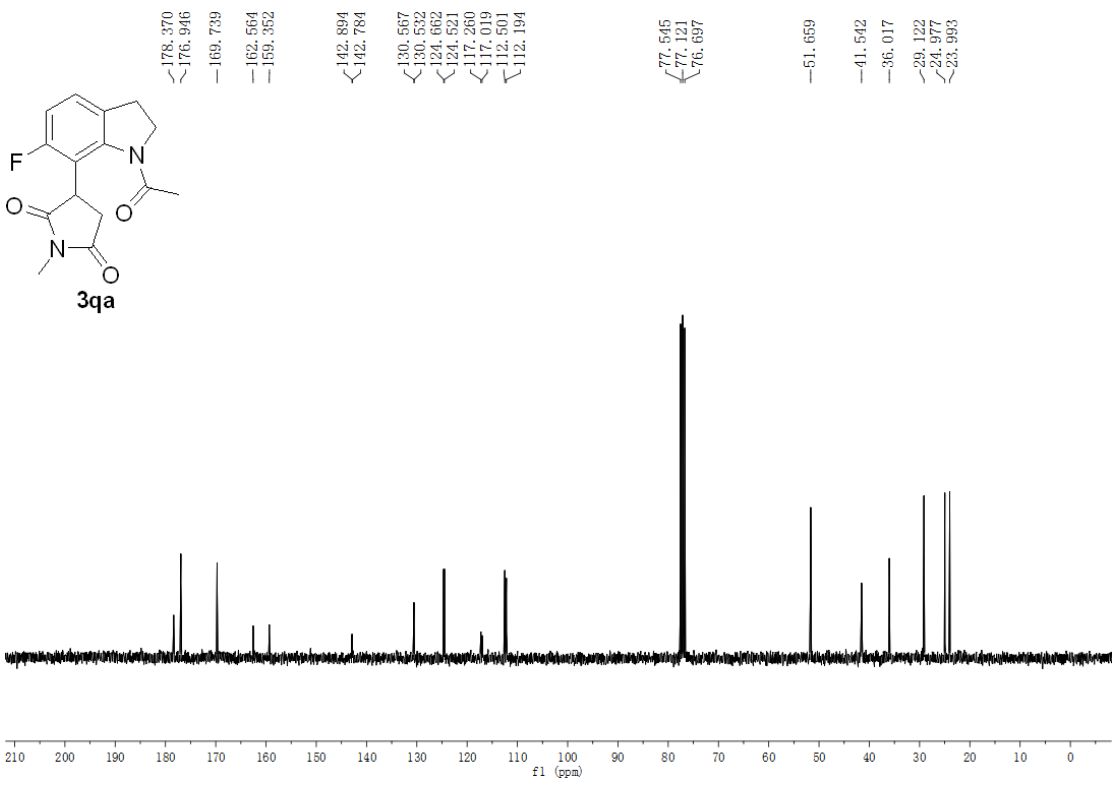
176.80
169.43
140.52
137.68
130.38
129.19
127.26
118.94
77.41
77.09
76.77
51.03
44.36
37.15
29.54
25.18
23.99
f1 (ppm)


3pa
8.0066
7.8564
7.2610
4.3786
4.3642
4.3552
4.3408
4.2527
4.2429
4.1846
4.1603
4.1358
3.4871
3.4634
3.4405
3.4169
3.3044
3.2816
3.2417
3.2190
3.2058
3.1385
3.1285
3.1062
3.0884
3.0484
2.8600
2.8456
2.8133
2.7991
2.3059
0.99
0.92
1.05
2.05
1.00
1.19
1.04
3.02
1.08
3.05
f1 (ppm)


3pa
177.63
176.33
169.83
146.85
145.57
137.13
129.01
123.43
119.39
77.42
77.10
76.78
51.22
44.64
36.86
29.17
25.27
24.12
f1 (ppm)


3qa
7.2611
7.1259
7.1062
7.0920
6.8338
6.8132
6.8069
6.7862
4.2094
4.1824
4.1328
4.1088
4.0582
4.0322
3.5456
3.5221
3.4994
3.4758
3.1904
3.1657
3.1280
3.1039
3.0244
2.9166
2.8994
2.8847
2.8541
2.8388
2.2598
0.97
0.98
3.05
1.00
1.05
3.00
2.06
3.00
f1 (ppm)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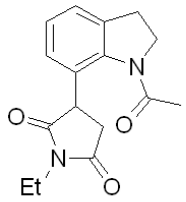
176.946
169.739
162.564
159.352
142.894
142.784
130.567
130.532
124.662
124.521
117.260
117.019
112.501
112.194
77.545
77.121
76.697
51.659
41.542
36.017
29.122
24.977
23.993
f1 (ppm)


O
N
O
N
Et
O

3ab

7.2615
7.1729
7.1548
7.1226
7.1036
7.0850
6.8842
6.8650
4.3614
4.3484
4.3249
4.1435
4.1138
4.0632
4.0146
3.6352
3.5993
3.5815
3.4612
3.4144
3.3909
3.1422
3.1193
2.9901
2.9305
2.9219
2.8266
2.7988
2.7688
1.2172
1.1993
1.1813
0.96
1.00
0.98
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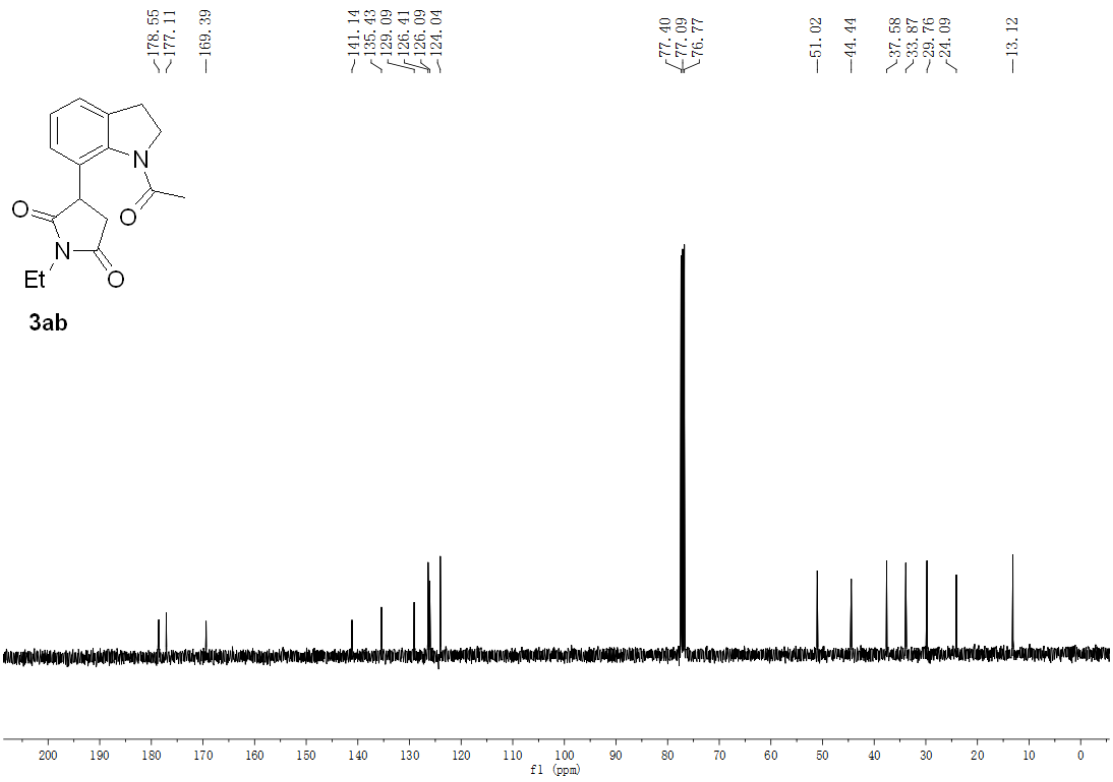
2.07
2.01
1.02
1.01
1.02
1.02
3.00
3.12
f1 (ppm)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177.11
169.39
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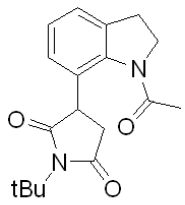
135.43
129.09
126.41
126.09
124.04
77.40
77.09
76.77
51.02
44.44
37.58
33.87
29.76
24.09
13.12
f1 (ppm)

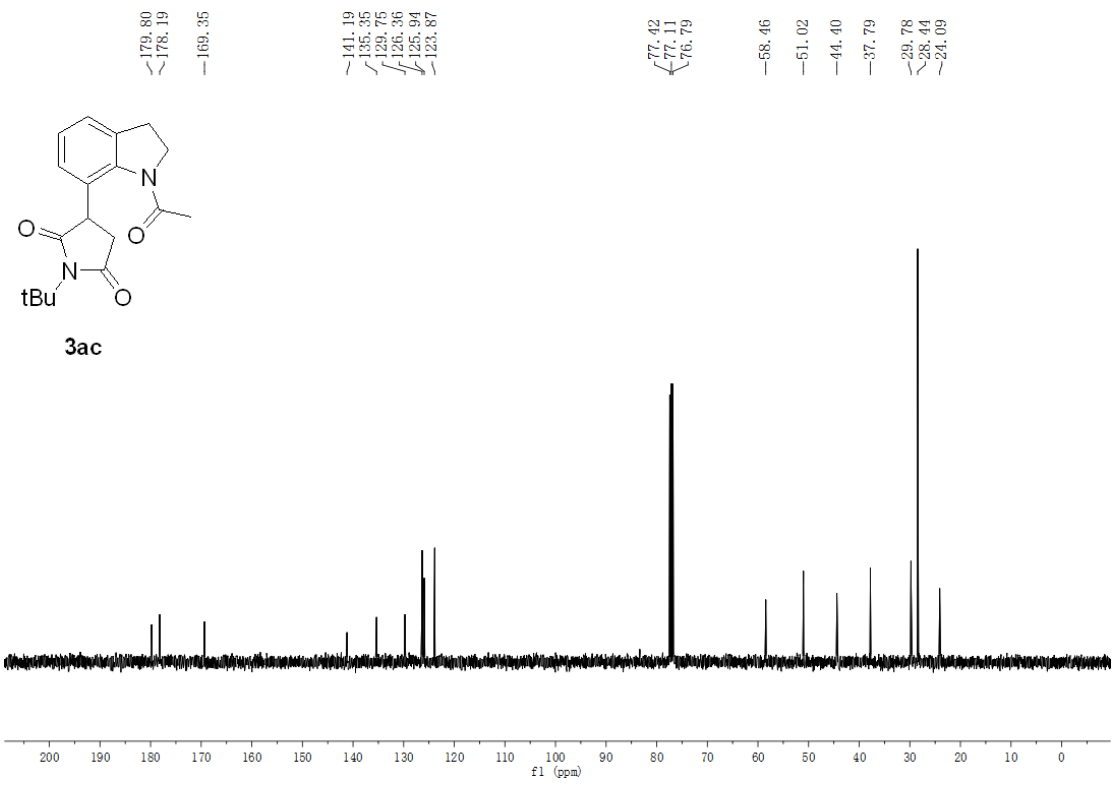
O
N
O
N
Et
O

3ab


O
N
O
N
tBu
O

3ac

7.2612
7.1595
7.1417
7.1252
7.1064
7.0879
6.8966
6.8778
4.2202
4.1817
4.1622
4.1056
4.0804
4.0616
4.0376
4.0147
3.9895
3.3307
3.3061
3.2845
3.2599
3.1314
2.7476
2.7015
2.6875
1.6973
0.97
0.99
0.98
2.00
1.02
1.00
1.02
1.01
1.01
3.00
9.00
f1 (ppm)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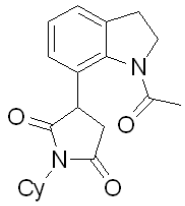
129.75
126.36
125.94
123.87
77.42
77.11
76.79
58.46
51.02
44.40
37.79
29.78
28.44
24.09
f1 (ppm)

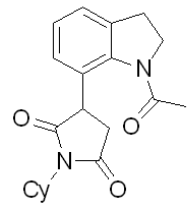
O
N
O
N
tBu
O

3ac



3ad

7.2613
7.1532
7.1351
7.1040
7.0851
7.0665
6.8668
6.8477
4.2928
4.2798
4.2692
4.2561
4.1545
4.1459
4.0460
4.0204
3.9785
3.9696
3.3939
3.3701
3.3473
3.3235
3.1628
3.1463
3.1242
3.1014
2.9716
2.9635
2.9338
2.9122
2.7681
2.7551
2.7214
2.7084
2.2651
2.2002
2.1592
2.1282
1.8269
1.7947
1.6323
1.6097
1.3195
1.2415
0.97
1.00
0.98
0.99
3.05
1.00
1.01
1.00
1.00
3.00
2.03
2.18
3.05
3.32
f1 (ppm)



3ad

178.78
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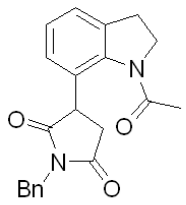
129.47
126.35
125.91
123.93
77.44
77.12
76.81
51.77
51.01
44.07
37.45
29.76
28.85
28.79
25.88
25.08
24.11
f1 (ppm)


O
N
O
N
Bn
O

3ae

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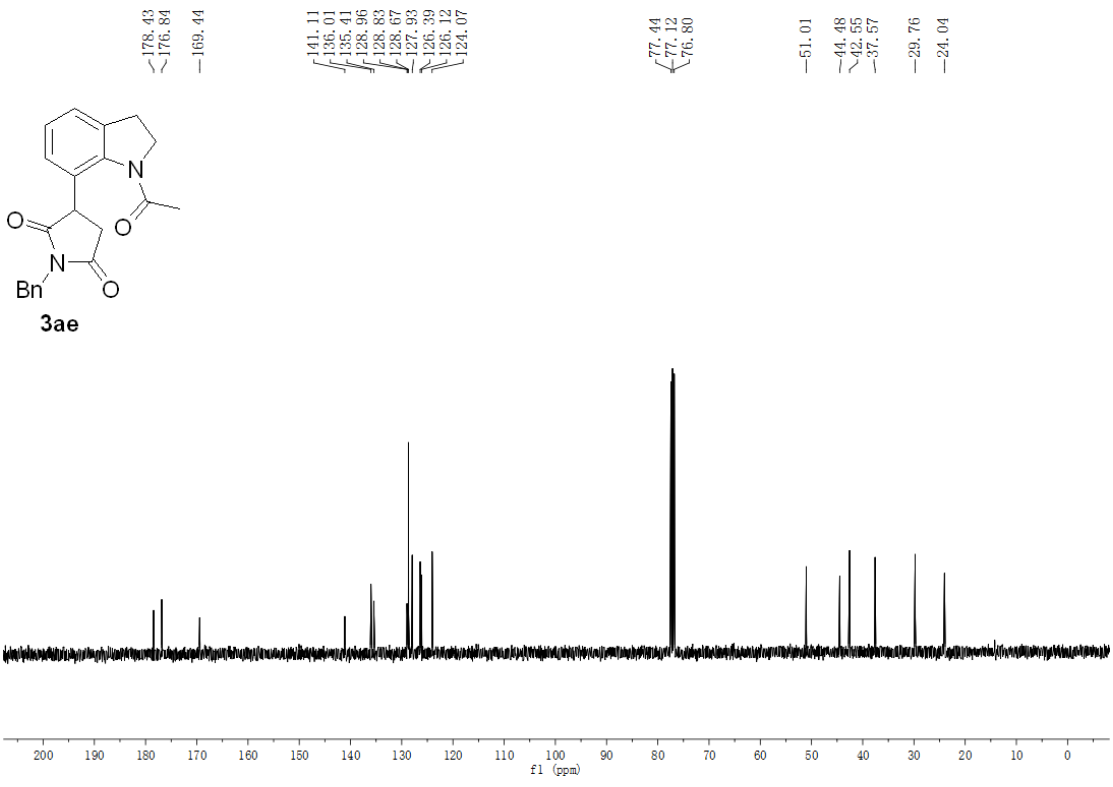
7.2926
7.2797
7.1761
7.1578
7.0915
7.0724
7.0537
6.8228
6.8034
4.7715
4.7364
4.7156
4.6805
4.4003
4.3871
4.3768
4.3637
4.1737
4.1428
4.1252
4.1169
4.0766
4.0536
4.0298
4.0047
3.5073
3.4837
3.4604
3.4368
3.2080
3.1463
3.1234
2.9890
2.9508
2.9212
2.8688
2.8087
2.2657
2.07
3.21
1.06
1.04
1.00
2.13
1.02
1.18
1.02
1.10
1.10
1.11
1.09
3.08
f1 (ppm)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135.41
128.96
128.83
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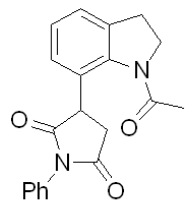
127.93
126.39
126.12
124.07
77.44
77.12
76.80
51.01
44.48
42.55
37.57
29.76
24.04
f1 (ppm)

O
N
O
N
Bn
O

3ae


O
N
O
N
Ph
O

3af

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7.4027
7.3844
7.3507
7.3325
7.2611
7.2008
7.1831
7.1439
7.1255
7.0759
7.0573
4.5776
4.5634
4.5536
4.5394
4.1575
4.0991
4.0742
4.0038
3.6023
3.5782
3.5315
3.1865
3.1033
3.0854
3.0245
3.0025
2.9329
2.2789
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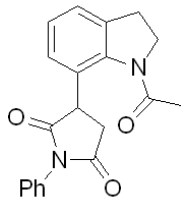
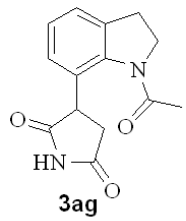
2.00
2.00
1.01
0.95
2.10
1.00
3.10
3.01
f1 (ppm)


O
N
O
N
Ph
O

3af

177.49
176.21
169.47
141.01
135.64
132.27
129.18
128.58
128.46
126.85
126.67
126.33
124.21
77.47
77.15
76.83
50.98
44.97
37.38
29.70
24.10
f1 (ppm)


O
HN
O
N
O

3ag

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7.2005
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7.1613
7.1427
7.0338
7.0153
4.4770
4.4627
4.4532
4.4390
4.2058
4.1792
4.1484
4.1299
4.1075
4.0828
4.0609
4.0352
3.5536
3.5298
3.5064
3.4826
3.2443
3.2210
3.1833
3.1594
3.0154
2.9943
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2.9400
2.9258
2.8928
2.8785
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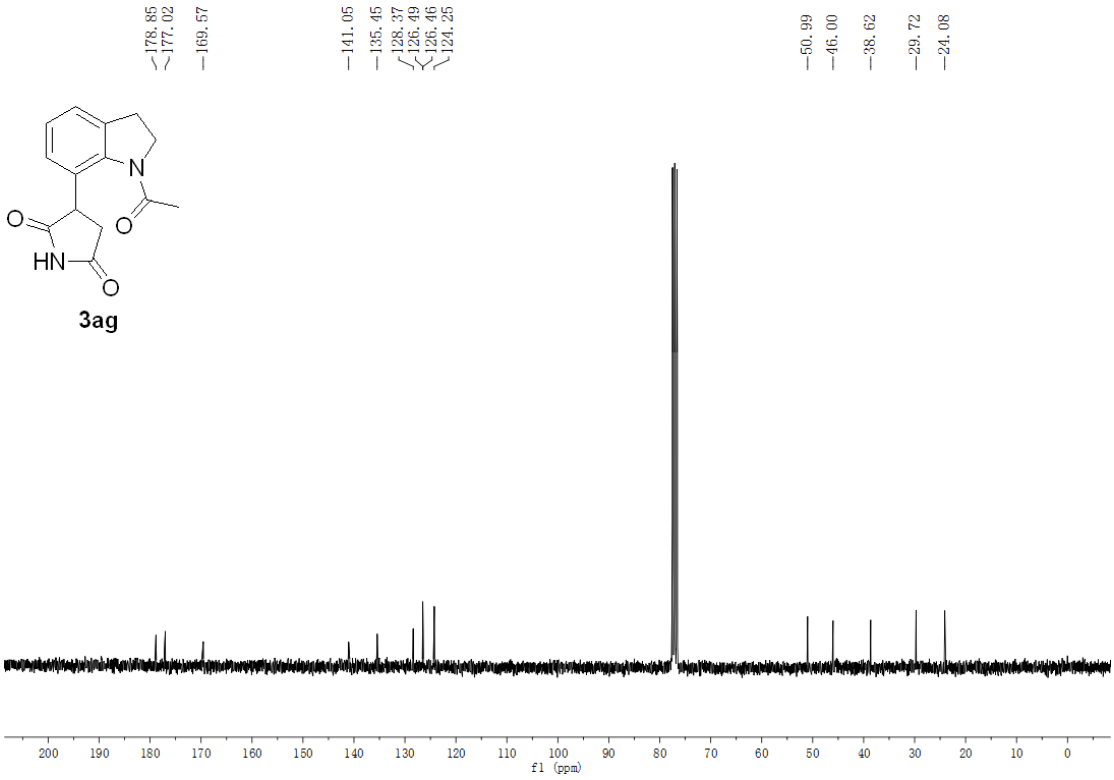
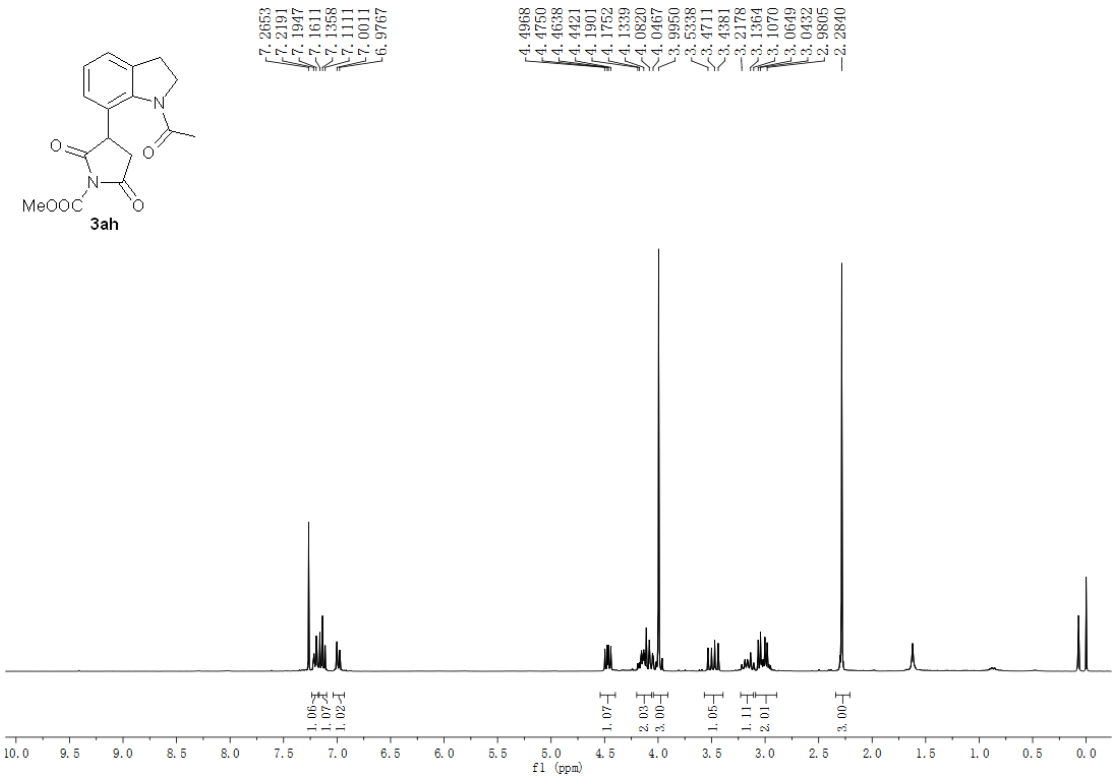
2.10
1.07
1.00
1.08
1.15
1.10
1.30
2.15
3.00
f1 (ppm)


178.85
177.02
169.57
141.05
135.45
128.37
126.49
126.46
124.25
50.99
46.00
38.62
29.72
24.08
f1 (ppm)

O
HN
O
N
O

3ag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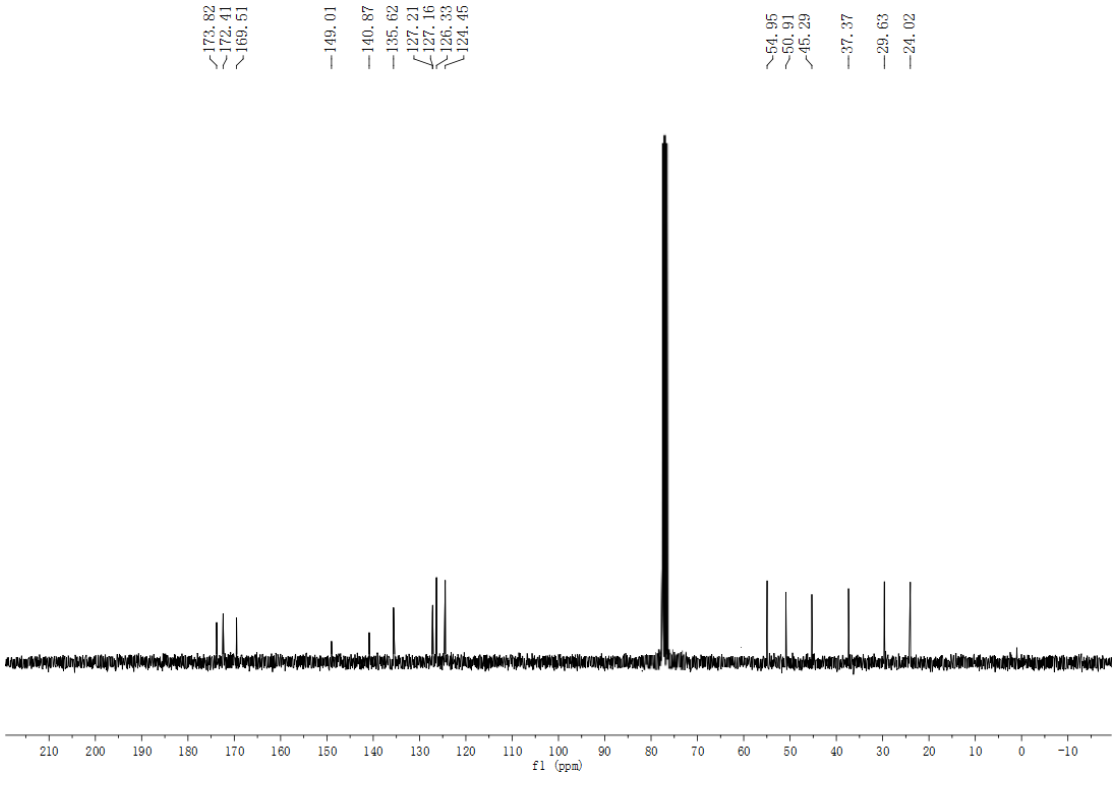
7.1358
7.1111
7.0011
6.9767
4.4968
4.4750
4.4638
4.4421
4.1901
4.1752
4.1339
4.0820
4.0467
3.9950
3.5338
3.4711
3.4381
3.2178
3.1364
3.1070
3.0649
3.0432
2.9805
2.2840
O
N
O
O
N
O
MeOOC
3ah
1.06
1.07
1.02
1.07
2.03
3.00
1.05
1.11
2.01
3.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


173.82
172.41
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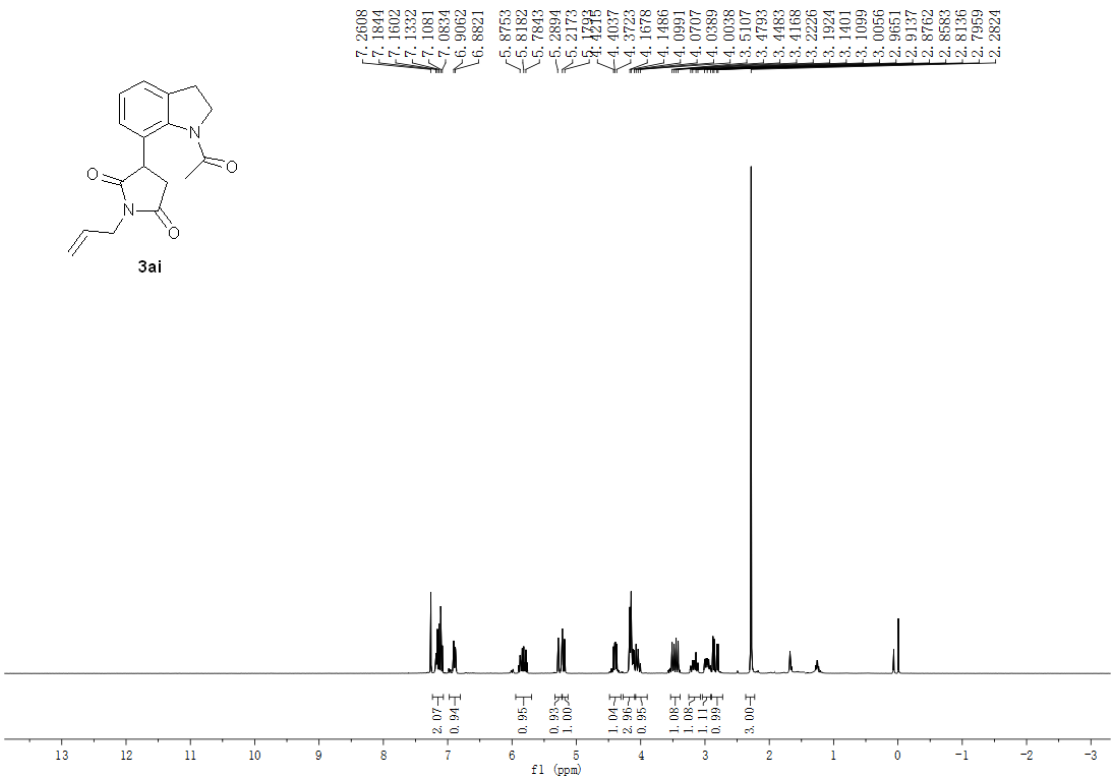
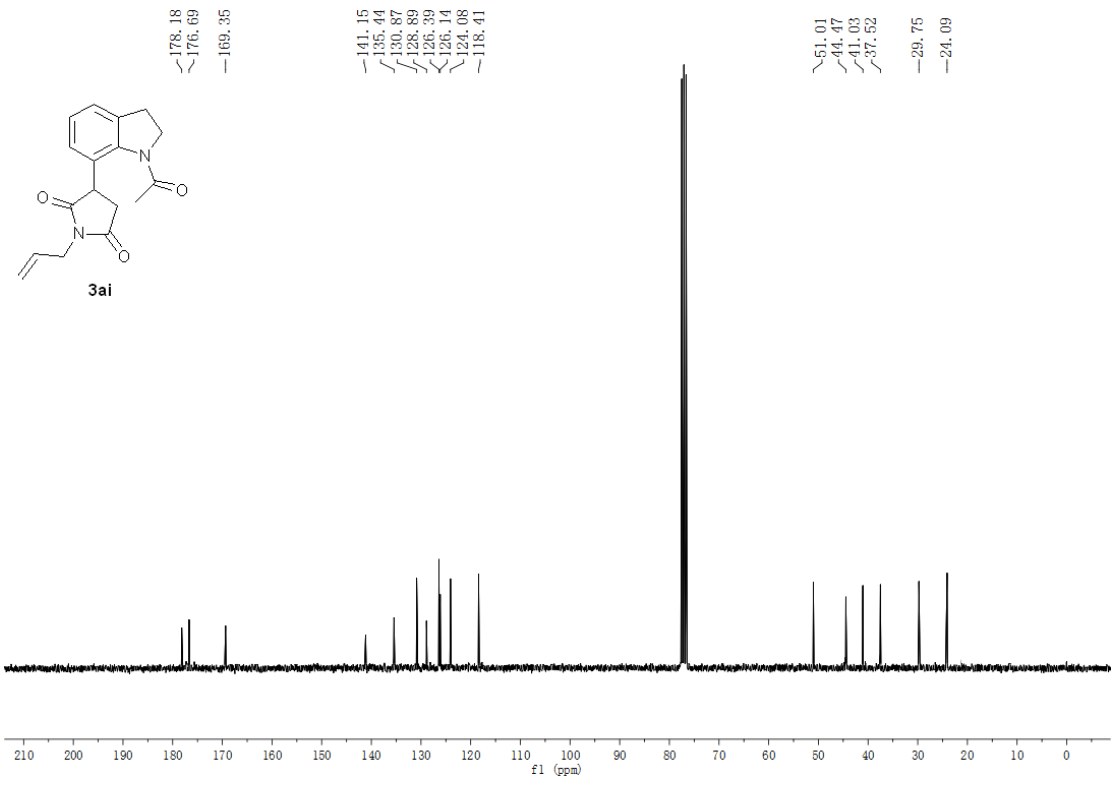
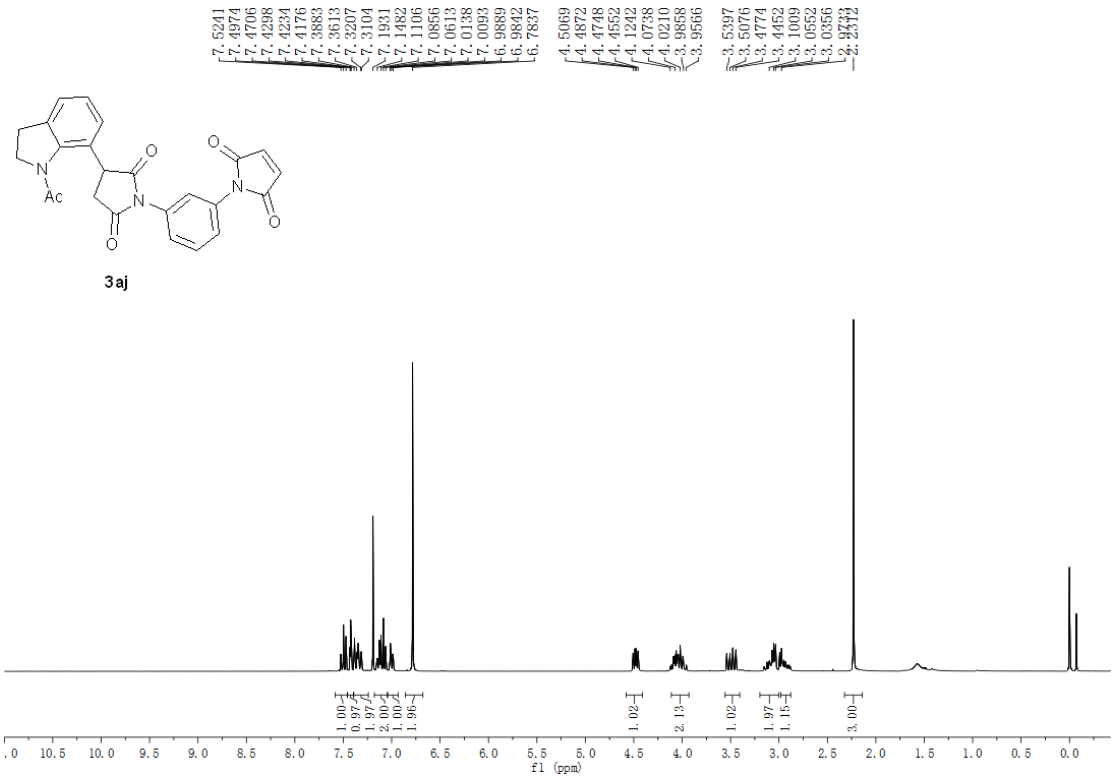
149.01
140.87
135.62
127.21
127.16
126.33
124.45
54.95
50.91
45.29
37.37
29.63
24.02
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)

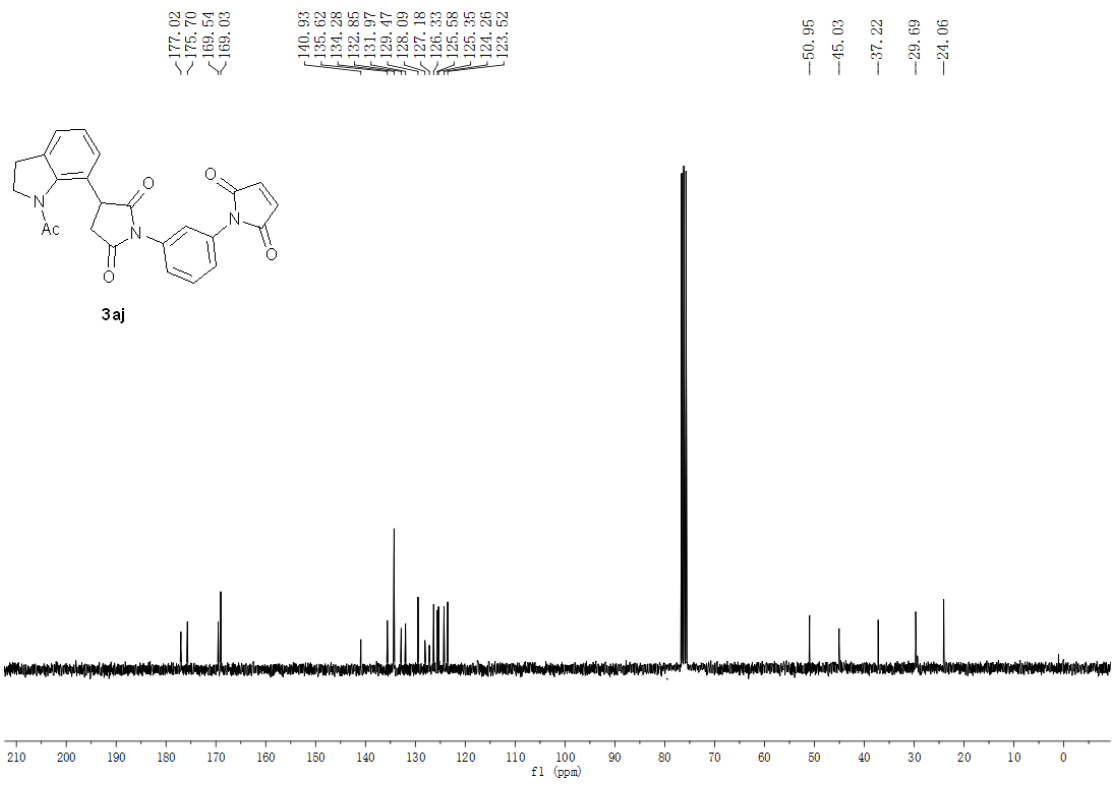

7.2608
7.1844
7.1602
7.1332
7.1081
7.0834
6.9062
6.8821
5.8753
5.8182
5.7843
5.2894
5.2173
5.1793
5.1215
4.4037
4.3723
4.1678
4.1486
4.0991
4.0707
4.0389
4.0038
3.5107
3.4793
3.4483
3.4168
3.2226
3.1924
3.1401
3.1099
3.0056
2.9651
2.9137
2.8762
2.8583
2.8136
2.7959
2.2824
2.07
0.94
0.95
0.93
1.00
1.04
2.96
0.95
1.08
1.08
1.11
0.99
3.00
f1 (ppm)

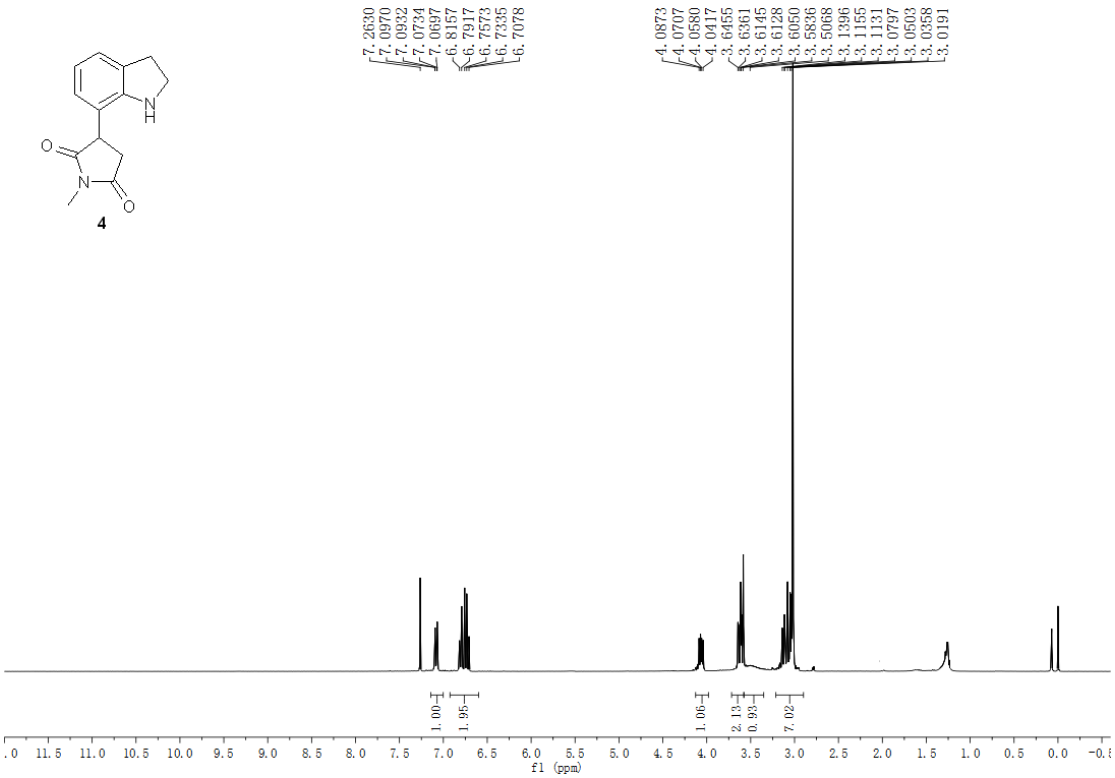
3ai

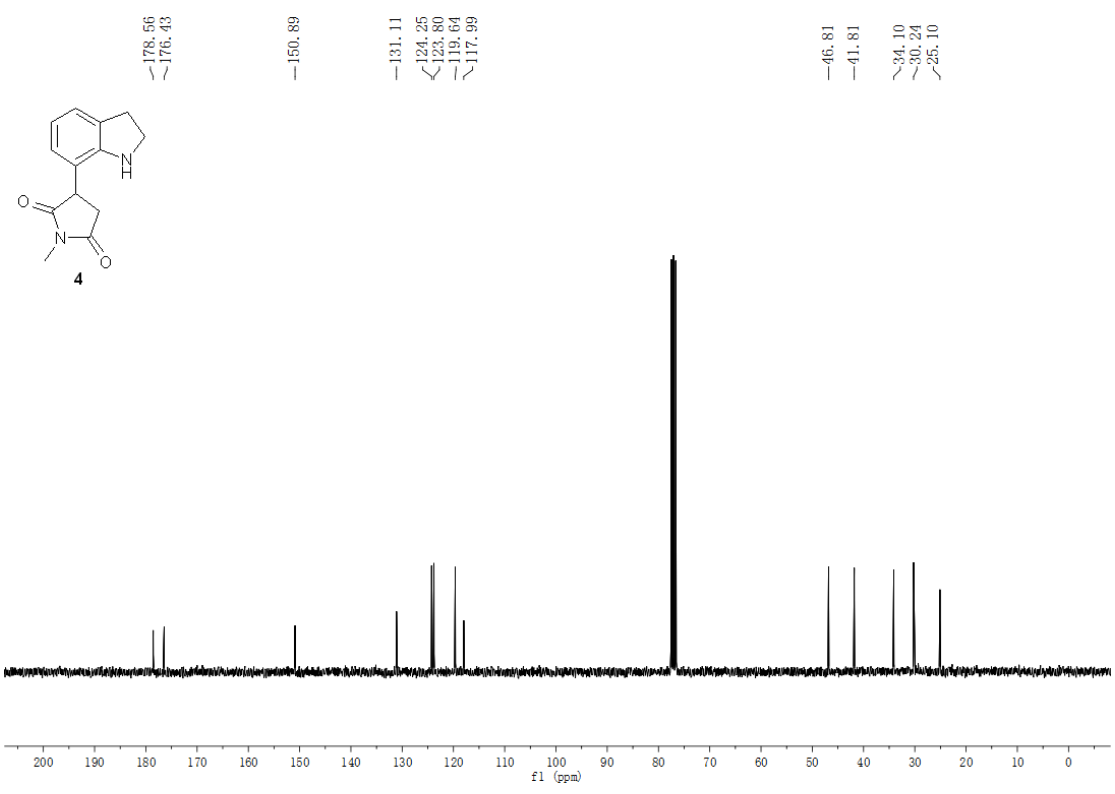

178.18
176.69
169.35
141.15
135.44
130.87
128.89
126.39
126.14
124.08
118.41
51.01
44.47
41.03
37.52
29.75
24.09
f1 (ppm)

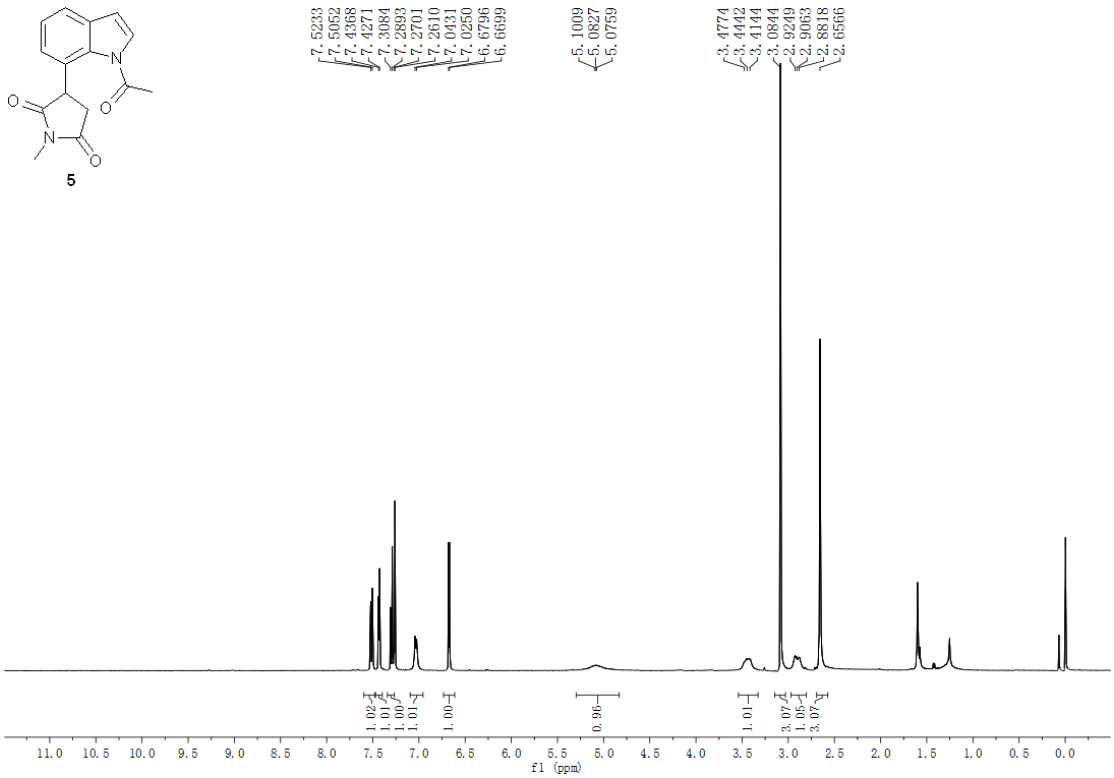
3ai

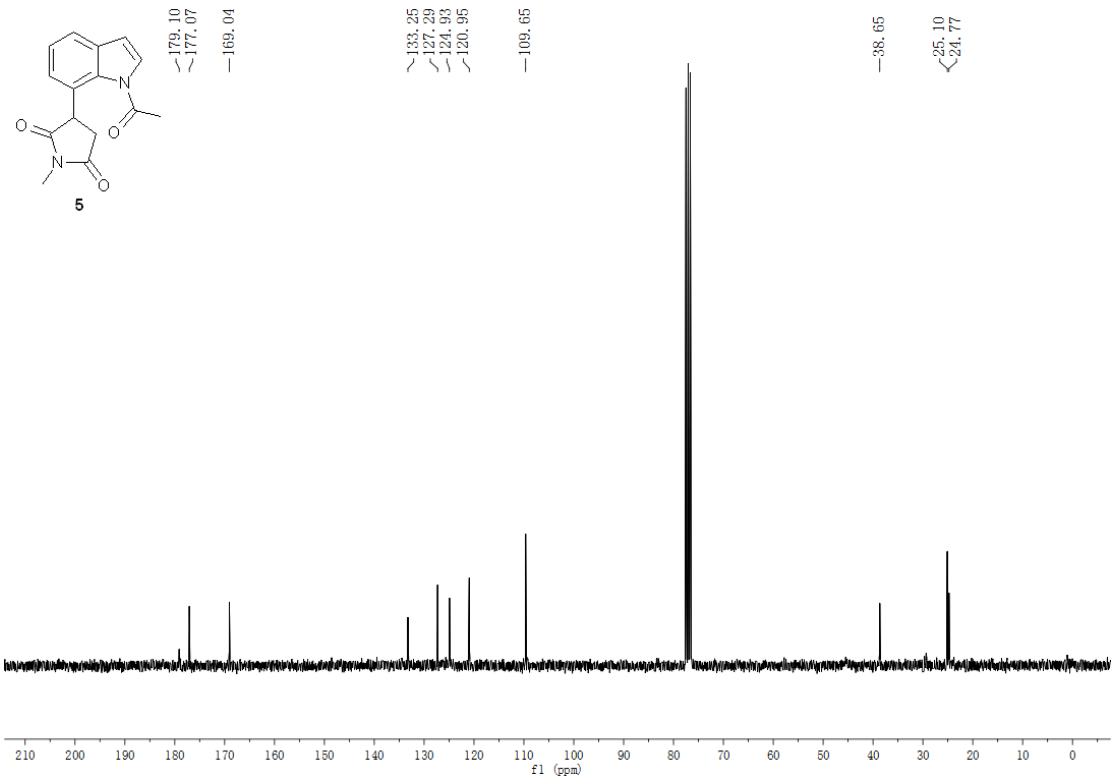

7.5241
7.4974
7.4706
7.4298
7.4234
7.4176
7.3883
7.3613
7.3207
7.3104
7.1931
7.1482
7.1106
7.0856
7.0613
7.0138
7.0093
6.9889
6.9842
6.7837
4.5069
4.4872
4.4748
4.4552
4.1242
4.0738
4.0210
3.9858
3.9566
3.5397
3.5076
3.4774
3.4452
3.1009
3.0552
3.0356
Ac
O
N
3aj
1.00
0.97
1.97
2.00
1.00
1.96
1.02
2.13
1.02
1.97
1.16
3.00
f1 (ppm)


177.02
175.70
169.54
169.03
140.93
135.62
134.28
132.85
131.97
129.47
128.09
127.18
126.33
125.58
125.35
124.26
123.52
50.95
45.03
37.22
29.69
24.06
Ac
O
N
3aj
f1 (ppm)


7.2630
7.0970
7.0932
7.0734
7.0697
6.8157
6.7917
6.7573
6.7335
6.7078
4.0873
4.0707
4.0580
4.0417
3.6455
3.6361
3.6145
3.6128
3.6050
3.5836
3.5068
3.1396
3.1155
3.1131
3.0797
3.0503
3.0358
3.0191
1.00
1.95
1.06
2.13
0.93
7.02
f1 (ppm)
4


178.56
176.43
150.89
131.11
124.25
123.80
119.64
117.99
46.81
41.81
34.10
30.24
25.10
f1 (ppm)
4


5
7.5233
7.5052
7.4368
7.4271
7.3084
7.2893
7.2701
7.2610
7.0431
7.0250
6.6796
6.6699
5.1009
5.0827
5.0759
3.4774
3.4442
3.4144
3.0844
2.9249
2.9063
2.8818
2.6566
1.02
1.01
1.00
1.01
1.00
0.96
1.01
3.07
1.05
3.07
f1 (ppm)


5
179.10
177.07
169.04
133.25
127.29
124.93
120.95
109.65
38.65
25.10
24.77
f1 (ppm)