Formal oxygen atom insertion as a skeletal editing step: rapid access natural product-inspired bispiro[oxindole-oxazinane] hybrids

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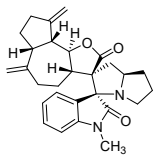
1. General information

Reactions were monitored by thin layer chromatography using UV light to visualize the course of reaction. Purification of reaction products was carried out by flash chromatography on silica gel or just by simple filtration and washing. ^{1}H and ^{13}CNMR spectra were obtained using a Bruker DPX-400 spectrometer. ^{1}H NMR chemical shifts are reported in ppm (δ) relative to tetramethylsilane (TMS) with the solvent resonance employed as the internal standard. Data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet), coupling constants (Hz) and integration. ^{13}C NMR chemical shifts are reported in ppm (δ) from tetramethylsilane (TMS) with the solvent resonance as the internal standard. Melting points were measured on an electrothermal digital melting point apparatus.

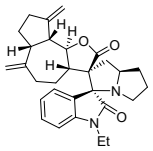
2. Synthesis synthesis of natural product-inspired hybrids 3

In a sealed tube equipped with a magnetic stirring bar, a mixture of 0.3 mmol of compound **1**, 0.2 mmol of compound **2**, 0.5 mmol of proline in 2.0 mL of CH_3CN was stirred at 80 °C for 3 h, and then was purified by flash chromatography to give the desired product **3**, using hexane/EtOAc (5/1, v/v) as the eluent.

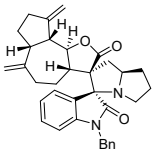
3. Characterization data of compounds 3



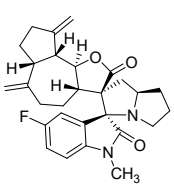
3aa: Light yellow solid, m.p. 257.3-258.8 °C; yield 67% (59.5 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.25-1.28 (m, 1H), 1.54-1.60 (m, 1H), 1.70-1.75 (m, 2H), 1.81-1.88 (m, 2H), 1.92-1.96 (m, 2H), 2.01-2.08 (m, 3H), 2.11-2.16 (m, 1H), 2.31-2.42 (m, 3H), 2.54-2.62 (m, 2H), 2.75-2.81 (m, 1H), 3.15 (s, 3H), 3.77-3.81 (m, 1H), 3.91-3.96 (m, 1H), 4.33-4.39 (m, 1H), 4.66 (s, 1H), 4.77 (s, 1H), 4.94 (s, 1H), 5.01 (s, 1H), 6.84 (d, J = 7.6 Hz, 1H), 7.05-7.09 (m, 1H), 7.36-7.40 (m, 1H), 7.63 (d, J = 8.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 25.9, 27.5, 29.5, 29.8, 32.1, 32.2, 34.8, 35.7, 44.2, 47.4, 49.3, 52.9, 59.8, 65.4, 76.3, 84.6, 108.1, 109.4, 112.0, 122.9, 123.4, 128.5, 130.1, 145.2, 149.3, 151.2, 176.3, 179.7; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{33}N_2O_3$ $[M+H]^+$: 445.2486; Found: 445.2489.



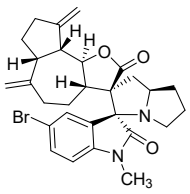
3ab: Light yellow solid, m.p. 193.3-194.6 °C; yield 61% (55.9 mg), 10:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.25-1.29 (m, 4H), 1.56-1.62 (m, 1H), 1.72-1.78 (m, 2H), 1.82-1.89 (m, 2H), 1.92-1.96 (m, 1H), 1.99-2.10 (m, 4H), 2.17-2.21 (m, 1H), 2.31-2.43 (m, 3H), 2.51-2.56 (m, 1H), 2.59-2.62 (m, 1H), 2.78-2.83 (m, 1H), 3.47-3.52 (m, 1H), 3.78-3.83 (m, 1H), 3.91-3.98 (m, 2H), 4.33-4.39 (m, 1H), 4.66 (s, 1H), 4.78 (s, 1H), 4.95 (s, 1H), 5.03 (s, 1H), 6.86 (d, J = 7.6 Hz, 1H), 7.05-7.09 (m, 1H), 7.36-7.40 (m, 1H), 7.66 (d, J = 7.6 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 13.0, 27.5, 29.8, 29.9, 32.0, 32.2, 34.6, 34.8, 44.3, 47.3, 49.3, 52.9, 60.0, 65.4, 76.1, 84.7, 108.1, 109.4, 112.1, 122.6, 123.6, 128.7, 130.0, 144.3, 149.2, 151.2, 175.9, 179.8; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{35}N_2O_3$ $[M+H]^+$: 459.2642; Found: 459.2644.



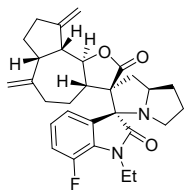
3ac: Light yellow solid, m.p. 195.7-196.8 °C; yield 55% (57.2 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.67-1.20 (m, 1H), 1.44-1.52 (m, 1H), 1.56-1.62 (m, 1H), 1.65-1.78 (m, 3H), 1.86-1.90 (m, 1H), 1.94-2.08 (m, 4H), 2.11-2.16 (m, 1H), 2.18-2.23 (m, 1H), 2.28-2.39 (m, 3H), 2.49-2.52 (m, 1H), 2.74-2.79 (m, 1H), 3.69-3.73 (m, 1H), 3.82-3.88 (m, 1H), 4.26-4.32 (m, 1H), 4.47 (s, 1H), 4.51 (s, 1H), 4.55 (s, 1H), 4.69 (s, 1H), 4.88 (d, J = 1.2Hz, 1H), 4.98 (d, J = 1.2 Hz, 1H), 5.03 (s, 1H), 5.07 (s, 1H), 6.72 (d, J = 8.0 Hz, 1H), 6.95-6.99 (m, 1H), 7.19-7.26 (m, 6H), 7.58-7.60 (m, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 26.4, 28.7, 29.4, 30.9, 31.4, 34.0, 36.2, 43.0, 43.8, 45.5, 48.3, 51.5, 58.8, 64.0, 75.2, 84.2, 108.0, 108.2, 110.4, 121.8, 122.4, 126.4, 126.8, 127.7, 127.8, 129.0, 135.0, 143.7, 148.6, 150.3, 175.3, 178.7; HRMS (ESI-TOF) m/z: Calcd. for $C_{34}H_{37}N_2O_3$ $[M+H]^+$: 521.2799; Found: 521.2797.



3ad: Light yellow solid, m.p. 237.7-238.4 °C; yield 68% (62.8 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.18-1.22 (m, 1H), 1.49-1.55 (m, 1H), 1.66-1.79 (m, 4H), 1.85-1.89 (m, 1H), 1.95-2.00 (m, 4H), 2.07-2.11 (m, 1H), 2.26-2.37 (m, 3H), 2.51-2.56 (m, 2H), 2.68-2.74 (m, 1H), 3.07 (s, 3H), 3.72-3.83 (m, 2H), 4.24-4.31 (m, 1H), 4.61 (s, 1H), 4.71 (s, 1H), 4.90 (s, 1H), 4.98 (s, 1H), 6.68-6.71 (m, 1H), 7.00-7.03 (m, 1H), 7.35-7.38 (m, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 24.7, 26.1, 28.1, 28.4, 30.6, 30.8, 33.4, 34.5, 43.1, 46.0, 47.8, 51.5, 58.7, 64.0, 74.9, 83.3, 106.9 (d, J_{CF} = 8.1 Hz), 108.0, 110.6, 115.0 (d, J_{CF} = 24.1 Hz), 115.4 (d, J_{CF} = 26.0 Hz), 123.7 (d, J_{CF} = 8.2 Hz), 139.8, 147.9, 149.7, 157.6 (d, J_{CF} = 240.2 Hz), 174.7, 177.9; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{32}FN_2O_3$ $[M+H]^+$: 463.2391; Found: 463.2390.

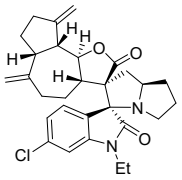


3ae: Light yellow solid, m.p. 214.1-214.8 °C; yield 91% (95.0 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.17-1.21 (m, 1H), 1.48-1.54 (m, 1H), 1.65-1.81 (m, 4H), 1.85-1.89 (m, 1H), 1.95-1.97 (m, 4H), 2.04-2.08 (m, 1H), 2.24-2.37 (m, 3H), 2.51-2.56 (m, 2H), 2.67-2.73 (m, 1H), 3.06 (s, 3H), 3.72-3.79 (m, 2H), 4.22-4.29 (m, 1H), 4.61 (s, 1H), 4.70 (s, 1H), 4.90 (s, 1H), 4.98 (s, 1H), 6.66 (d, J = 8.4 Hz, 1H), 7.44-7.46 (m, 1H), 7.68 (d, J = 2.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 23.8, 25.3, 27.1, 27.5, 29.7, 29.8, 32.5, 33.2, 42.2, 45.3, 47.0, 50.8, 57.8, 63.1, 73.9, 82.2, 107.2, 107.3, 109.9, 113.3, 123.3, 129.2, 130.8, 142.0, 147.0, 148.7, 173.5, 176.9; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{32}BrN_2O_3$ $[M+H]^+$: 523.1591; Found: 523.1594.

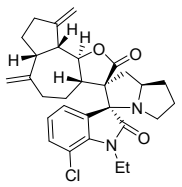


3af: Light yellow solid, m.p. 191.6-192.2 °C; yield 89% (84.7 mg), 19:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.18-1.23 (m, 4H), 1.51-1.57 (m, 1H), 1.66-1.82 (m, 4H), 1.84-1.88 (m, 1H), 1.96-2.01 (m, 4H), 2.09-2.13 (m, 1H), 2.28-2.37 (m, 3H), 2.48-2.55 (m, 2H), 2.69-2.75 (m, 1H), 3.64-3.70 (m, 1H), 3.71-3.74 (m, 1H), 3.78-3.84 (m, 1H), 3.90-3.95 (m, 1H), 4.24-4.31 (m, 1H), 4.61 (s, 1H), 4.72 (s, 1H), 4.88 (s, 1H), 4.95 (s, 1H), 6.91-6.96 (m, 1H), 7.03-7.08 (m, 1H), 7.38 (d, J = 7.6

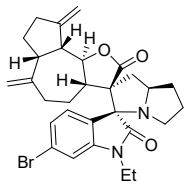
Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 13.2, 26.2, 28.5, 28.6, 30.6, 30.9, 33.5, 34.9, 35.5, 43.1, 45.9, 47.9, 51.6, 58.8, 64.0, 74.8, 83.4, 108.1, 110.9, 116.9 (d, J_{CF} = 20.1 Hz), 121.7 (d, J_{CF} = 6.4 Hz), 123.2, 125.1, 123.2, 125.1, 125.2, 129.9 (d, J_{CF} = 8.2 Hz), 146.8 (d, J_{CF} = 242.3 Hz), 147.8, 149.8, 174.3, 178.2; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{34}FN_2O_3$ $[M+H]^+$: 477.2548; Found: 477.2545.



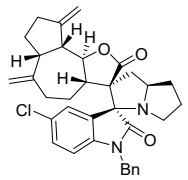
3ag: Light yellow solid, m.p. 197.3-197.8 °C; yield 50% (49.2 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.17-1.20 (m, 4H), 1.47-1.53 (m, 1H), 1.67-1.78 (m, 4H), 1.84-1.88 (m, 1H), 1.94-1.99 (m, 3H), 2.03-2.13 (m, 2H), 2.28-2.38 (m, 3H), 2.48-2.52 (m, 2H), 2.69-2.75 (m, 1H), 3.34-3.43 (m, 1H), 3.72-3.87 (m, 3H), 4.23-4.28 (m, 1H), 4.60 (s, 1H), 4.71 (s, 1H), 4.90 (s, 1H), 4.97 (s, 1H), 6.77 (s, 1H), 6.96 (d, J = 8.0 Hz, 1H), 7.51 (d, J = 8.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 11.9, 26.4, 28.8, 30.9, 31.2, 33.7, 35.4, 43.4, 46.1, 48.3, 51.8, 59.0, 64.2, 74.6, 83.9, 107.8, 108.3, 111.1, 121.0, 121.5, 128.8, 135.1, 144.6, 148.1, 150.2, 174.9, 178.5; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{34}ClN_2O_3$ $[M+H]^+$: 493.2252; Found: 493.2251.



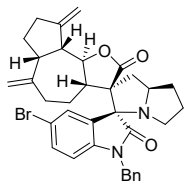
3ah: Light yellow solid, m.p. 207.8-208.7 °C; yield 90% (88.6 mg), 17:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.22-1.26 (m, 4H), 1.49-1.55 (m, 1H), 1.66-1.81 (m, 4H), 1.84-1.88 (m, 1H), 1.96-2.01 (m, 4H), 2.06-2.13 (m, 1H), 2.26-2.35 (m, 3H), 2.47-2.54 (m, 2H), 2.69-2.74 (m, 1H), 3.71-3.81 (m, 2H), 4.02-4.08 (m, 2H), 4.24-4.30 (m, 1H), 4.61 (s, 1H), 4.72 (s, 1H), 4.89 (s, 1H), 4.95 (s, 1H), 6.90-6.93 (m, 1H), 7.25 (d, J = 8.0 Hz, 1H), 7.51 (d, J = 7.6 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 14.1, 26.3, 28.6, 28.7, 30.8, 31.0, 33.7, 34.9, 43.2, 46.0, 47.9, 51.7, 59.0, 64.0, 74.1, 83.6, 108.2, 111.0, 113.7, 122.0, 125.4, 125.9, 131.5, 139.4, 147.9, 150.0, 175.2, 178.4; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{34}ClN_2O_3$ $[M+H]^+$: 493.2252; Found: 493.2253.



3ai: Light yellow solid, m.p. 208.4-209.8 °C; yield 84% (90.0 mg), 8:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.17-1.20 (m, 4H), 1.48-1.54 (m, 1H), 1.68-1.77 (m, 4H), 1.84-1.88 (m, 1H), 1.95-2.00 (m, 3H), 2.04-2.13 (m, 2H), 2.28-2.36 (m, 3H), 2.48-2.52 (m, 2H), 2.69-2.75 (m, 1H), 3.35-3.41 (m, 1H), 3.73-3.87 (m, 3H), 4.23-4.28 (m, 1H), 4.60 (s, 1H), 4.72 (s, 1H), 4.90 (s, 1H), 4.98 (s, 1H), 6.92 (d, J = 1.6 Hz, 1H), 7.11-7.13 (m, 1H), 7.45 (d, J = 8.4 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 10.8, 25.3, 27.7, 29.8, 30.1, 32.6, 34.4, 42.3, 45.0, 47.2, 50.7, 57.8, 63.1, 73.5, 82.9, 107.2, 109.4, 110.0, 120.4, 122.0, 123.3, 128.0, 143.6, 147.0, 149.1, 173.7, 177.4; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{34}BrN_2O_3$ $[M+H]^+$: 537.1747; Found: 537.1746.

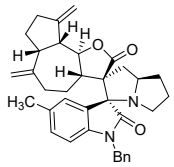


3aj: Light yellow solid, m.p. 207.8-208.3 °C; yield 45% (49.9 mg), 13:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.16-1.20 (m, 1H), 1.48-1.56 (m, 1H), 1.58-1.64 (m, 1H), 1.67-1.77 (m, 3H), 1.86-1.90 (m, 1H), 1.94-2.00 (m, 3H), 2.12-2.25 (m, 3H), 2.31-2.37 (m, 2H), 2.41-2.46 (m, 1H), 2.50-2.54 (m, 1H), 2.73-2.79 (m, 1H), 3.72-3.77 (m, 2H), 4.23-4.30 (m, 1H), 4.47 (d, J = 16.0 Hz, 1H), 4.58 (s, 1H), 4.70 (s, 1H), 4.91 (s, 1H), 5.00-5.06 (m, 2H), 6.63 (d, J = 8.4 Hz, 1H), 7.18-7.26 (m, 6H), 7.58 (d, J = 2.4 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 25.8, 28.1, 28.6, 30.3, 30.7, 33.3, 35.4, 42.4, 43.4, 45.0, 47.7, 50.9, 58.4, 63.4, 74.3, 83.5, 107.7, 108.3, 109.9, 123.6, 125.7, 126.3, 126.6, 127.3, 127.4, 128.4, 133.9, 141.6, 147.9, 149.5, 174.3, 177.5; HRMS (ESI-TOF) m/z: Calcd. for $C_{34}H_{36}ClN_2O_3$ $[M+H]^+$: 555.2409; Found: 555.2412.

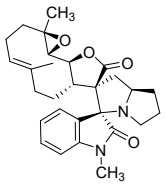


3ak: Light yellow solid, m.p. 205.4-206.7 °C; yield 79% (94.5 mg), 15:1 dr; ^{1}H NMR ($CDCl_3$,

400 MHz) δ: 1.16-1.20 (m, 1H), 1.48-1.56 (m, 1H), 1.58-1.64 (m, 1H), 1.67-1.77 (m, 3H), 1.86-1.90 (m, 1H), 1.94-1.99 (m, 3H), 2.12-2.24 (m, 3H), 2.30-2.37 (m, 2H), 2.41-2.45 (m, 1H), 2.50-2.54 (m, 1H), 2.73-2.78 (m, 1H), 3.72-3.79 (m, 2H), 4.23-4.29 (m, 1H), 4.46 (d, J = 16.0 Hz, 1H), 4.58 (s, 1H), 4.70 (s, 1H), 4.91 (d, J = 1.6 Hz, 1H), 5.01 (s, 1H), 5.02 (d, J = 16.0 Hz, 1H), 6.58 (d, J = 8.4 Hz, 1H), 7.19-7.26 (m, 5H), 7.32-7.35 (m, 1H), 7.71 (d, J = 2.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 26.4, 28.7, 29.2, 30.9, 31.3, 33.9, 36.0, 43.0, 44.0, 45.6, 48.3, 51.6, 59.1, 64.0, 74.9, 84.0, 108.4, 109.5, 110.6, 114.6, 124.6, 126.3, 126.9, 127.9, 130.6, 132.0, 134.5, 142.7, 148.5, 150.1, 174.8, 178.1; HRMS (ESI-TOF) m/z: Calcd. for $C_{34}H_{36}BrN_2O_3$ $[M+H]^+$: 599.1904; Found: 599.1906.

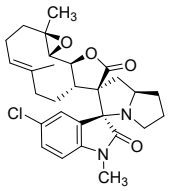


3al: Light yellow solid, m.p. 205.3-206.1 °C; yield 91% (97.2 mg), 19:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.13-1.20 (m, 1H), 1.44-1.51 (m, 1H), 1.56-1.62 (m, 1H), 1.65-1.77 (m, 3H), 1.85-1.89 (m, 1H), 1.95-2.01 (m, 3H), 2.06-2.24 (m, 6H), 2.29-2.41 (m, 3H), 2.50-2.53 (m, 1H), 2.74-2.79 (m, 1H), 3.69-3.73 (m, 1H), 3.82-3.88 (m, 1H), 4.26-4.31 (m, 1H), 4.46 (d, J = 15.6 Hz, 1H), 4.56 (s, 1H), 4.69 (s, 1H), 4.89 (d, J = 1.2 Hz, 1H), 4.97 (d, J = 1.2 Hz, 1H), 5.03 (d, J = 15.6 Hz, 1H), 6.61 (d, J = 7.6 Hz, 1H), 7.01 (d, J = 8.0 Hz, 1H), 7.18-7.25 (m, 5H), 7.40 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 19.4, 25.5, 27.8, 28.4, 30.0, 30.5, 33.0, 35.2, 42.1, 42.9, 44.6, 47.4, 50.6, 57.9, 63.1, 74.3, 83.2, 106.8, 107.2, 109.5, 121.5, 125.5, 125.8, 126.9, 127.5, 128.4, 130.3, 134.2, 140.4, 147.8, 149.5, 174.3, 177.8; HRMS (ESI-TOF) m/z: Calcd. for $C_{35}H_{39}N_2O_3$ $[M+H]^+$: 535.2955; Found: 535.2958.

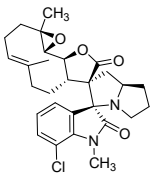


3ba: Light yellow solid, m.p. 207.8-208.1 °C; yield 77% (71.1 mg), 5:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.93-0.99 (m, 1H), 1.12 (s, 3H), 1.18 (d, J = 3.6 Hz, 1H), 1.43-1.47 (m, 2H), 1.55 (s, 3H), 1.75-1.80 (m, 1H), 1.84-1.88 (m, 1H), 1.93-2.03 (m, 6H), 2.18-2.23 (m, 2H), 2.32-2.38 (m,

1H), 2.56-2.60 (m, 1H), 2.71-2.77 (m, 1H), 3.10 (s, 3H), 3.57-3.62 (m, 1H), 3.93-3.99 (m, 1H), 4.35-4.38 (m, 1H), 4.80 (d, J = 6.8 Hz, 1H), 6.79 (d, J = 8.0 Hz, 1H), 7.00-7.04 (m, 1H), 7.31-7.35 (m, 1H), 7.61 (d, J = 8.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.1, 16.3, 22.7, 25.1, 26.0, 26.4, 31.1, 34.1, 35.4, 46.1, 48.3, 60.0, 60.4, 64.3, 65.9, 74.8, 81.3, 107.0, 122.3, 122.4, 123.0, 128.0, 129.2, 134.1, 144.1, 175.4, 177.5; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{35}N_2O_4$ $[M+H]^+$: 463.2591; Found: 463.2595.

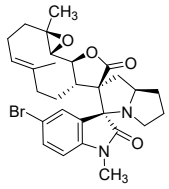


3bb: Light yellow solid, m.p. 223.1-224.2 °C; yield 73% (72.4 mg), 7:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.00-1.03 (m, 1H), 1.13 (s, 3H), 1.18-1.19 (m, 1H), 1.47 (d, J = 10.0 Hz, 2H), 1.56 (s, 3H), 1.76-1.79 (m, 1H), 1.87 (d, J = 12.0 Hz, 2H), 1.97-2.00 (m, 4H), 2.13-2.16 (m, 1H), 2.21-2.23 (m, 2H), 2.34-2.37 (m, 1H), 2.59-2.60 (m, 1H), 2.69-2.74 (m, 1H), 3.09 (s, 3H), 3.60-3.64 (m, 1H), 3.88-3.90 (m, 1H), 4.32-4.33 (m, 1H), 4.83 (d, J = 11.2 Hz, 1H), 6.73 (d, J = 8.4 Hz, 1H), 7.29-7.33 (m, 1H), 7.61 (d, J = 2.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.1, 16.3, 22.7, 25.3, 25.7, 26.4, 31.1, 34.1, 35.5, 46.4, 48.2, 60.2, 60.5, 64.2, 65.8, 74.5, 81.4, 107.9, 123.0, 124.1, 127.5, 128.4, 129.3, 134.1, 142.7, 175.1, 177.0; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{34}ClN_2O_4$ $[M+H]^+$: 497.2202; Found: 497.2206.

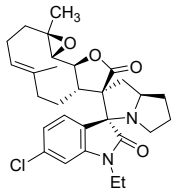


3bc: Light yellow solid, m.p. 264.4-265.2 °C; yield 91% (90.3 mg), 17:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.97-1.03 (m, 1H), 1.13-1.14 (m, 3H), 1.18-1.23 (m, 1H), 1.46 (s, 1H), 1.51-1.56 (m, 4H), 1.75-1.79 (m, 1H), 1.85 (d, J = 14.4 Hz, 1H), 1.95-2.09 (m, 6H), 2.19-2.32 (m, 3H), 2.56 (d, J = 6.4 Hz, 1H), 2.69-2.75 (m, 1H), 3.48-3.49 (m, 3H), 3.58-3.63 (m, 1H), 3.86-3.89 (m, 1H), 4.35 (s, 1H), 4.88 (d, J = 11.2 Hz, 1H), 6.91-6.96 (m, 1H), 7.25-7.28 (m, 1H), 7.54-7.55 (m, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 15.5, 15.6, 22.1, 25.4, 25.8, 28.2, 30.4, 33.5, 34.8, 45.5, 47.4, 59.7, 59.9, 63.6, 65.2, 73.4, 80.7, 113.8, 122.2, 122.5, 124.6, 125.8, 130.9, 133.4, 139.4, 175.0, 176.7;

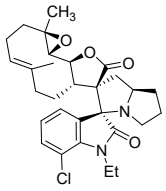
HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{34}ClN_2O_4$ $[M+H]^+$: 497.2202; Found: 497.2205.



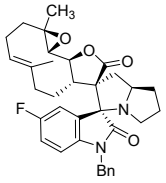
3bd: Light yellow solid, m.p. 221.8-222.4 °C; yield 88% (95.0 mg), 12:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.98-1.05 (m, 1H), 1.14 (s, 3H), 1.24-1.28 (m, 1H), 1.46-1.50 (m, 2H), 1.56 (s, 3H), 1.74-1.78 (m, 1H), 1.84-1.88 (m, 2H), 1.97-2.03 (m, 4H), 2.15-2.17 (m, 1H), 2.21-2.25 (m, 2H), 2.33-2.38 (m, 1H), 2.58-2.61 (m, 1H), 2.69-2.74 (m, 1H), 3.08 (s, 3H), 3.60-3.64 (m, 1H), 3.86-3.91 (m, 1H), 4.33 (d, J = 2.4 Hz, 1H), 4.85 (d, J = 15.6 Hz, 1H), 6.68 (d, J = 8.4 Hz, 1H), 7.45-7.48 (m, 1H), 7.74-7.75 (m, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.1, 16.3, 22.7, 25.2, 25.7, 26.4, 31.1, 34.1, 35.5, 46.4, 48.3, 60.2, 60.5, 64.2, 65.8, 74.4, 81.4, 108.4, 114.9, 123.0, 124.4, 131.1, 132.2, 134.1, 143.2, 175.0, 176.9; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{34}BrN_2O_4$ $[M+H]^+$: 541.1696; Found: 541.1693.



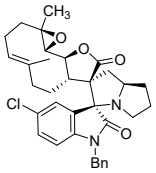
3be: Light yellow solid, m.p. 217.8-218.1 °C; yield 80% (81.6 mg), 15:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.96-1.04 (m, 1H), 1.14 (s, 3H), 1.22-1.26 (m, 4H), 1.46-1.51 (m, 1H), 1.56 (s, 3H), 1.61-1.66 (m, 1H), 1.75-1.80 (m, 1H), 1.84-1.88 (m, 2H), 1.95-2.03 (m, 4H), 2.15 (d, J = 8.8 Hz, 1H), 2.18-2.24 (m, 2H), 2.33-2.39 (m, 1H), 2.51-2.55 (m, 1H), 2.69-2.75 (m, 1H), 3.57-3.71 (m, 3H), 3.80-3.86 (m, 1H), 4.28-4.34 (m, 1H), 4.86 (d, J = 10.0 Hz, 1H), 6.80 (d, J = 1.6 Hz, 1H), 6.97 (d, J = 8.0 Hz, 1H), 7.54 (d, J = 8.4 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 10.6, 15.1, 21.8, 25.2, 30.0, 33.1, 33.3, 34.4, 39.9, 45.5, 47.2, 59.2, 59.6, 63.1, 64.7, 73.5, 80.2, 106.9, 119.9, 120.8, 122.4, 128.3, 132.9, 134.2, 143.6, 174.1, 176.4; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{36}ClN_2O_4$ $[M+H]^+$: 511.2358; Found: 511.2357.



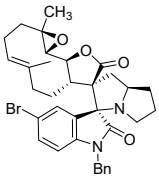
3bf: Light yellow solid, m.p. 223.8-224.2 °C; yield 75% (76.5 mg), 10:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.97-1.03 (m, 1H), 1.14 (s, 3H), 1.23 (s, 1H), 1.26-1.30 (m, 3H), 1.47-1.52 (m, 1H), 1.56 (s, 3H), 1.62-1.65 (m, 1H), 1.75-1.80 (m, 1H), 1.84-1.88 (m, 1H), 1.92-2.04 (m, 5H), 2.11 (d, J = 8.8 Hz, 1H), 2.19-2.56 (m, 2H), 2.31-2.37 (m, 1H), 2.51-2.55 (m, 1H), 2.69-2.74 (m, 1H), 3.58-3.63 (m, 1H), 3.79-3.85 (m, 1H), 4.03-4.09 (m, 2H), 4.29-4.34 (m, 1H), 4.89 (d, J = 10.0 Hz, 1H), 6.91-6.95 (m, 1H), 7.26 (d, J = 8.0 Hz, 1H), 7.54 (d, J = 8.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 14.0, 16.1, 22.8, 26.3, 26.4, 30.9, 34.3, 35.4, 36.0, 46.5, 47.9, 60.4, 60.5, 64.0, 65.7, 74.1, 81.1, 113.9, 122.6, 123.5, 125.6, 126.5, 131.7, 133.9, 139.5, 175.6, 177.3; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{36}ClN_2O_4$ $[M+H]^+$: 511.2358; Found: 511.2355.



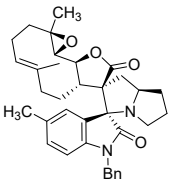
3bg: Light yellow solid, m.p. 216.2-216.8 °C; yield 77% (85.6 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.96-1.01 (m, 1H), 1.14 (s, 3H), 1.20-1.23 (m, 1H), 1.38-1.45 (m, 1H), 1.53 (s, 3H), 1.58-1.63 (m, 1H), 1.77-1.92 (m, 3H), 1.96-2.10 (m, 5H), 2.17-2.25 (m, 2H), 2.38-2.44 (m, 1H), 2.56-2.59 (m, 1H), 2.70-2.76 (m, 1H), 3.60-3.64 (m, 1H), 3.74-3.80 (m, 1H), 4.33-4.37 (m, 1H), 4.75 (d, J = 15.6 Hz, 2H), 4.83 (d, J = 16.0 Hz, 1H), 6.62-6.65 (m, 1H), 6.90-6.95 (m, 1H), 7.19-7.27 (m, 5H), 7.40-7.42 (m, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.0, 16.1, 22.9, 26.1, 26.5, 30.8, 35.0, 35.4, 40.3, 42.9, 47.0, 47.9, 60.6, 60.7, 64.0, 65.7, 75.3, 81.0, 108.5 (d, J_{CF} = 8.2 Hz), 115.5 (d, J_{CF} = 24.2 Hz), 116.6 (d, J_{CF} = 26.1 Hz), 123.5, 124.1 (d, J_{CF} = 8.0 Hz), 126.3, 126.8, 127.9, 133.9, 134.3, 139.4, 158.4 (d, J_{CF} = 239.4 Hz), 175.3, 177.3; HRMS (ESI-TOF) m/z: Calcd. for $C_{34}H_{38}FN_2O_4$ $[M+H]^+$: 557.2810; Found: 557.2805.



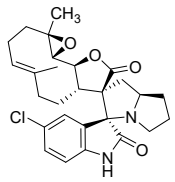
3bh: Light yellow solid, m.p. 230.6-231.5 °C; yield 88% (100.7 mg), 18:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.95-1.03 (m, 1H), 1.14 (s, 3H), 1.14-1.24 (m, 1H), 1.37-1.43 (m, 1H), 1.52 (s, 3H), 1.61-1.67 (m, 1H), 1.76-1.85 (m, 2H), 1.87-1.92 (m, 1H), 1.95-2.05 (m, 5H), 2.20-2.22 (m, 2H), 2.37-2.43 (m, 1H), 2.55-2.59 (m, 1H), 2.69-2.74 (m, 1H), 3.60-3.64 (m, 1H), 3.73-3.78 (m, 1H), 4.31-4.35 (m, 1H), 4.72-4.84 (m, 3H), 6.64 (d, J = 8.4 Hz, 1H), 7.17-7.24 (m, 6H), 7.61 (d, J = 2.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.1, 22.9, 26.1, 26.4, 30.8, 35.0, 35.4, 40.3, 42.9, 47.0, 48.0, 60.6, 60.7, 64.0, 65.6, 75.2, 81.0, 109.0, 123.5, 124.2, 126.3, 126.9, 127.5, 127.9, 128.6, 129.1, 134.1, 142.0, 175.0, 177.2; HRMS (ESI-TOF) m/z: Calcd. for $C_{34}H_{38}ClN_2O_4$ $[M+H]^+$: 573.2515; Found: 573.2512.



3bi: Light yellow solid, m.p. 216.7-217.2 °C; yield 89% (109.6 mg), 15:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.95-1.03 (m, 1H), 1.14 (s, 3H), 1.20-1.24 (m, 1H), 1.36-1.43 (m, 1H), 1.52 (s, 3H), 1.61-1.67 (m, 1H), 1.76-1.84 (m, 2H), 1.87-1.91 (m, 1H), 2.00-2.09 (m, 5H), 2.21 (d, J = 8.8 Hz, 1H), 2.37-2.43 (m, 1H), 2.55-2.59 (m, 1H), 2.69-2.74 (m, 1H), 3.60-3.64 (m, 1H), 3.72-3.77 (m, 1H), 4.31-4.35 (m, 1H), 4.72-4.84 (m, 3H), 6.60 (d, J = 8.4 Hz, 1H), 7.19-7.26 (m, 5H), 7.32-7.35 (m, 1H), 7.74 (d, J = 1.6 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.1, 22.9, 26.1, 26.3, 30.8, 35.0, 35.4, 40.2, 42.8, 47.0, 48.0, 60.6, 60.7, 64.0, 65.6, 75.1, 81.0, 109.5, 114.9, 123.5, 124.6, 126.3, 126.4, 126.9, 127.8, 127.9, 131.3, 132.1, 133.9, 134.1, 142.4, 174.9, 177.1; HRMS (ESI-TOF) m/z: Calcd. for $C_{34}H_{38}BrN_2O_4$ $[M+H]^+$: 617.2009; Found: 617.2014.



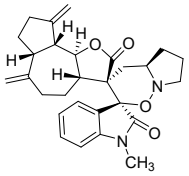
3bj: Light yellow solid, m.p. 220.8-221.1 °C; yield 91% (100.5 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.93-1.01 (m, 1H), 1.13 (s, 3H), 1.18-1.23 (m, 1H), 1.33-1.39 (m, 1H), 1.51 (s, 3H), 1.54-1.58 (m, 1H), 1.75-1.81 (m, 1H), 1.86-1.91 (m, 2H), 1.94-2.06 (m, 6H), 2.14 (d, J = 8.8 Hz, 1H), 2.21-2.24 (m, 1H), 2.25 (s, 3H), 2.35-2.40 (m, 1H), 2.55-2.58 (m, 1H), 2.71-2.76 (m, 1H), 3.57-3.62 (m, 1H), 3.83-3.89 (m, 1H), 4.35-4.40 (m, 1H), 4.70-4.83 (m, 3H), 6.62 (d, J = 8.0 Hz, 1H), 7.01 (d, J = 8.0 Hz, 1H), 7.17-7.26 (m, 5H), 7.43 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.0, 16.1, 20.4, 22.9, 26.1, 26.6, 30.8, 34.8, 35.4, 40.3, 42.8, 46.6, 48.1, 60.3, 60.5, 64.0, 65.7, 75.4, 81.0, 107.8, 122.4, 123.4, 126.4, 126.7, 127.8, 129.0, 129.4, 131.6, 134.0, 134.7, 141.1, 175.4, 177.7; HRMS (ESI-TOF) m/z: Calcd. for $C_{35}H_{41}N_2O_4$ $[M+H]^+$: 553.3061; Found: 553.3064.



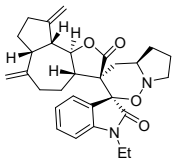
3bk: Light yellow solid, m.p. 232.8-233.1 °C; yield 90% (86.8 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.97-1.05 (m, 1H), 1.15 (s, 3H), 1.17-1.20 (m, 1H), 1.54 (s, 3H), 1.66-1.90 (m, 5H), 1.98-2.01 (m, 4H), 2.18-2.21 (m, 3H), 2.38-2.43 (m, 1H), 2.58-2.62 (m, 1H), 2.65-2.71 (m, 1H), 3.62-3.66 (m, 1H), 3.77-3.82 (m, 1H), 4.26-4.30 (m, 1H), 4.89 (d, J = 10.8 Hz, 1H), 6.81 (d, J = 8.4 Hz, 1H), 7.21-7.24 (m, 1H), 7.57 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 13.2, 16.1, 20.1, 22.8, 26.1, 26.4, 31.1, 34.4, 35.4, 40.7, 46.5, 48.0, 59.4, 60.4, 60.6, 64.1, 65.8, 75.4, 81.3, 110.0, 123.2, 124.7, 127.4, 128.6, 129.2, 134.1, 139.9, 176.9, 177.8; HRMS (ESI-TOF) m/z: Calcd. for $C_{27}H_{32}ClN_2O_4$ $[M+H]^+$: 483.2045; Found: 483.2044.

4. Synthesis synthesis of natural product-inspired hybrids 4

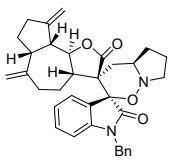
In a sealed tube equipped with a magnetic stirring bar, a mixture of 0.2 mmol of compound **3**, *m*-CPBA (2.2 eq) in 2.0 mL of $CHCl_3$ was stirred at rt for 30 min, and then was directly loaded onto a silica gel and purified by flash chromatography to give the desired product **4**, using MeOH/EtOAc (1/20, v/v) as the eluent.



4aa: Light yellow solid, m.p. 170.1-170.9 °C; yield 77% (70.8 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.25-1.30 (m, 1H), 1.54-1.70 (m, 6H), 1.84 (d, J = 14.0 Hz, 1H), 2.03 (s, 2H), 2.20-2.39 (m, 5H), 2.48 (s, 1H), 2.93 (s, 1H), 3.11-3.15 (m, 4H), 3.23-3.28 (m, 1H), 3.45 (s, 1H), 3.77-3.81 (m, 1H), 4.60 (s, 1H), 4.71 (s, 1H), 4.91 (s, 1H), 5.01 (s, 1H), 6.72 (d, J = 8.0 Hz, 1H), 6.95-6.99 (m, 1H), 7.26-7.30 (m, 1H), 7.50 (d, J = 5.2 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 23.3, 24.2, 26.0, 27.0, 28.6, 29.7, 32.2, 36.4, 45.4, 45.9, 47.1, 52.7, 58.3, 62.0, 80.0, 82.7, 107.8, 109.6, 111.7, 123.4, 125.4, 127.3, 130.6, 144.4, 149.6, 151.2, 171.6, 175.8; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{33}N_2O_4$ $[M+H]^+$: 461.2435; Found: 461.2438.

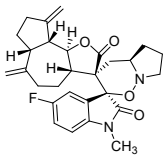


4ab: Light yellow solid, m.p. 168.1-168.8 °C; yield 78% (73.9 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.17-1.21 (m, 3H), 1.24-1.28 (m, 1H), 1.54-1.72 (m, 6H), 1.84 (d, J = 14.4 Hz, 1H), 2.07 (s, 2H), 2.22-2.39 (m, 4H), 2.41-2.47 (m, 2H), 2.89-2.93 (m, 1H), 3.16 (s, 1H), 3.24-3.29 (m, 1H), 3.46-3.53 (m, 2H), 3.77-3.82 (m, 1H), 3.83-3.88 (m, 1H), 4.59 (s, 1H), 4.71 (s, 1H), 4.91 (s, 1H), 5.02 (s, 1H), 6.74 (d, J = 8.0 Hz, 1H), 6.94-6.98 (m, 1H), 7.25-7.29 (m, 1H), 7.51 (d, J = 7.2 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 12.7, 23.1, 24.2, 27.1, 28.8, 29.8, 32.2, 34.4, 36.8, 45.6, 46.0, 46.9, 52.7, 58.3, 62.0, 79.9, 82.8, 107.9, 109.5, 111.8, 123.2, 125.6, 127.5, 130.6, 143.4, 149.6, 151.3, 171.2, 175.9; HRMS (ESI-TOF) m/z: Calcd. For $C_{29}H_{35}N_2O_4$ $[M+H]^+$: 475.2591; Found: 475.2595.

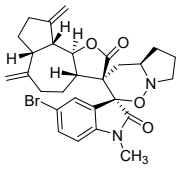


4ac: Light yellow solid, m.p. 188.1-188.5 °C; yield 70% (75.0 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.20-1.24 (m, 1H), 1.44 (s, 1H), 1.60-1.75 (m, 5H), 1.85 (d, J = 14.4 Hz, 1H), 2.04 (s,

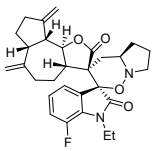
1H), 2.15-2.51 (m, 7H), 2.91-2.96 (m, 1H), 3.20 (s, 1H), 3.26-3.31 (m, 1H), 3.47 (s, 1H), 3.76-3.81 (m, 1H), 4.58 (s, 1H), 4.61 (d, J = 16.0 Hz, 1H), 4.69 (s, 1H), 4.92 (s, 1H), 5.01 (d, J = 16.0 Hz, 1H), 5.02-5.03 (m, 1H), 6.68 (d, J = 8.0 Hz, 1H), 6.91-6.95 (m, 1H), 7.16-7.26 (m, 6H), 7.52 (d, J = 7.2 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 23.1, 24.3, 27.1, 29.2, 29.7, 32.4, 37.1, 43.7, 45.5, 46.3, 46.7, 52.5, 58.4, 62.1, 79.8, 82.9, 108.9, 109.6, 111.5, 123.5, 125.3, 127.6, 127.8, 128.9, 130.6, 135.8, 143.9, 149.8, 151.3, 171.6, 175.9; HRMS (ESI-TOF) m/z: Calcd. For $C_{34}H_{37}N_2O_4$ $[M+H]^+$: 537.2748; Found: 537.2752.



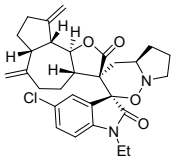
4ad: Light yellow solid, m.p. 178.1-178.7 °C; yield 74% (70.7 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.26-1.29 (m, 1H), 1.56-1.74 (m, 6H), 1.85 (d, J = 14.4 Hz, 1H), 2.15 (s, 3H), 2.28-2.36 (m, 4H), 2.52 (s, 1H), 2.89-2.92 (m, 1H), 3.09-3.11 (m, 4H), 3.23 (s, 1H), 3.42 (s, 1H), 3.79-3.84 (m, 1H), 4.62 (s, 1H), 4.72 (s, 1H), 4.92 (s, 1H), 5.02 (s, 1H), 6.65-6.68 (m, 1H), 6.96-7.01 (m, 1H), 7.33 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 23.0, 24.2, 26.2, 26.9, 28.6, 29.7, 32.2, 36.5, 45.6, 46.0, 47.0, 52.6, 58.3, 61.9, 79.7, 82.6, 108.3, 108.4, 109.7, 111.8, 115.7, 116.8, 126.7 (d, J_{CF} = 20.0 Hz), 140.3, 149.6, 151.1, 159.6 (d, J_{CF} = 240.4 Hz), 171.3, 175.6; HRMS (ESI-TOF) m/z: Calcd. For $C_{28}H_{32}FN_2O_4$ $[M+H]^+$: 479.2341; Found: 479.2341.



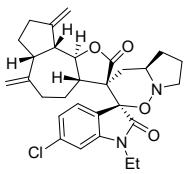
4ae: Light yellow solid, m.p. 171.2-171.8 °C; yield 67% (72.1 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.26-1.29 (m, 1H), 1.62-1.75 (m, 6H), 1.85 (d, J = 14.4 Hz, 1H), 2.02-2.17 (m, 3H), 2.31-2.39 (m, 4H), 2.53 (s, 1H), 2.92 (s, 1H), 3.06-3.13 (m, 4H), 3.22-3.27 (m, 1H), 3.42 (s, 1H), 3.79-3.84 (m, 1H), 4.63 (s, 1H), 4.72 (s, 1H), 4.94 (d, J = 1.6 Hz, 1H), 5.04 (d, J = 1.6 Hz, 1H), 6.03 (d, J = 8.4 Hz, 1H), 7.41-7.43 (m, 1H), 7.66 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 23.1, 24.2, 26.1, 26.9, 28.7, 29.7, 32.1, 36.3, 38.1, 46.2, 47.2, 52.7, 57.3, 62.0, 81.0, 82.6, 109.2, 109.8, 111.8, 115.9, 130.6, 133.4, 143.4, 149.6, 151.1, 160.7, 171.1, 175.4; HRMS (ESI-TOF) m/z: Calcd. For $C_{28}H_{31}BrN_2NaO_4$ $[M+H]^+$: 561.1359; Found: 561.1362.



4af: Light yellow solid, m.p. 181.7-181.3 °C; yield 77% (75.8 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.20-1.24 (m, 3H), 1.28-1.32 (m, 1H), 1.50-1.79 (m, 7H), 1.84 (d, J = 14.0 Hz, 1H), 2.09-2.15 (m, 2H), 2.20 (s, 1H), 2.30-2.38 (m, 3H), 2.51 (s, 1H), 2.91-2.93 (m, 1H), 3.15 (s, 1H), 3.23-3.29 (m, 1H), 3.45 (s, 1H), 3.71-3.76 (m, 1H), 3.78-3.83 (m, 1H), 3.93-3.98 (m, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 13.2, 21.9, 23.3, 26.1, 27.8, 28.3, 28.8, 31.2, 35.7, 44.7, 45.9, 51.7, 57.1, 60.9, 65.3, 78.7, 81.8, 108.6, 110.9, 117.7 (d, J_{CF} = 21.2 Hz), 122.6, 122.7, 127.1, 129.4, 145.7 (d, J_{CF} = 242.3 Hz), 148.4, 150.2, 169.7, 174.7; HRMS (ESI-TOF) m/z: Calcd. For $C_{29}H_{34}FN_2O_4$ $[M+H]^+$: 493.2497; Found: 493.2496.

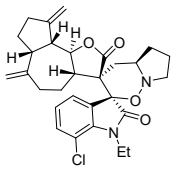


4ag: Light yellow solid, m.p. 176.2-176.8 °C; yield 75% (76.2 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.23-1.27 (m, 3H), 1.33-1.41 (m, 1H), 1.70-1.82 (m, 6H), 1.92 (d, J = 14.4 Hz, 1H), 2.13-2.25 (m, 3H), 2.39-2.46 (m, 4H), 2.58 (s, 1H), 2.99 (s, 1H), 3.20 (s, 1H), 3.30-3.35 (m, 1H), 3.51-3.58 (m, 2H), 3.87-3.91 (m, 2H), 4.69 (s, 1H), 4.79 (s, 1H), 5.01 (d, J = 1.6 Hz, 1H), 5.11 (d, J = 1.6 Hz, 1H), 6.75 (d, J = 7.6 Hz, 1H), 7.31-7.34 (m, 1H), 7.61 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 12.6, 22.5, 24.5, 27.0, 28.8, 29.8, 32.2, 34.6, 36.7, 45.3, 46.0, 47.0, 52.8, 58.3, 62.0, 79.9, 82.3, 108.9, 109.7, 111.9, 128.0, 128.4, 128.6, 130.6, 142.0, 149.6, 151.1, 170.8, 175.5; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{34}ClN_2O_4$ $[M+H]^+$: 509.2202; Found: 509.2199.

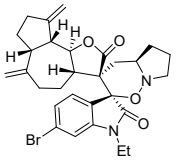


4ah: Light yellow solid, m.p. 183.2-183.8 °C; yield 69% (70.1 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.17-1.21 (m, 3H), 1.25-1.29 (m, 1H), 1.51-1.79 (m, 6H), 1.84 (d, J = 14.4 Hz, 1H), 2.05 (s, 1H), 2.17 (s, 2H), 2.31-2.39 (m, 3H), 2.51 (s, 2H), 2.92 (s, 1H), 3.14 (s, 1H), 3.14-3.27 (m,

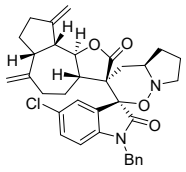
1H), 3.44-3.49 (m, 2H), 3.79-3.87 (m, 2H), 4.62 (s, 1H), 4.72 (s, 1H), 4.93 (s, 1H), 5.02 (s, 1H), 6.73 (d, J = 1.6 Hz, 1H), 6.93 (d, J = 8.0 Hz, 1H), 7.44 (d, J = 7.6 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 12.7, 22.9, 24.2, 26.9, 29.0, 29.8, 32.3, 34.6, 36.9, 45.5, 46.9, 52.7, 58.5, 62.0, 79.4, 82.9, 108.6, 109.6, 111.8, 123.0, 123.9, 128.8, 136.6, 144.8, 149.4, 151.3, 171.1, 175.8; HRMS (ESI-TOF) m/z: Calcd. For $C_{29}H_{34}ClN_2O_4$ $[M+H]^+$: 509.2202; Found: 509.2206.



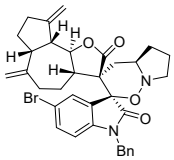
4ai: Light yellow solid, m.p. 194.2-195.1 °C; yield 76% (77.2 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.22-1.26 (m, 3H), 1.27-1.31 (m, 1H), 1.54-1.77 (m, 6H), 1.84 (d, J = 14.0 Hz, 1H), 2.08-2.11 (m, 2H), 2.19 (s, 1H), 2.29-2.40 (m, 3H), 2.52 (s, 2H), 2.91-2.93 (m, 1H), 3.15 (s, 1H), 3.22-3.28 (m, 1H), 3.45 (s, 1H), 3.77-3.82 (m, 1H), 4.02-4.16 (m, 2H), 4.62 (s, 1H), 4.73 (s, 1H), 4.92 (s, 1H), 5.01 (s, 1H), 6.86-6.90 (m, 1H), 7.20-7.22 (m, 1H), 7.46 (d, J = 6.4 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 14.0, 22.1, 23.2, 26.1, 27.8, 28.7, 31.2, 35.4, 35.6, 44.7, 44.9, 45.9, 51.7, 57.2, 60.9, 78.2, 81.8, 108.6, 110.9, 135.6, 122.9, 125.0, 127.5, 132.1, 138.7, 148.3, 150.2, 170.5, 174.7; HRMS (ESI-TOF) m/z: Calcd. For $C_{29}H_{34}ClN_2O_4$ $[M+H]^+$: 509.2202; Found: 509.2203.



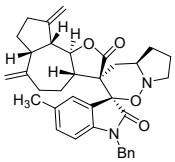
4aj: Light yellow solid, m.p. 167.7-168.2 °C; yield 68% (75.1 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.17-1.21 (m, 3H), 1.25-1.31 (m, 1H), 1.53-1.78 (m, 6H), 1.84 (d, J = 14.8 Hz, 1H), 2.05 (s, 1H), 2.18 (s, 2H), 2.31-2.39 (m, 4H), 2.52 (s, 1H), 2.92 (s, 1H), 3.14 (s, 1H), 3.21-3.27 (m, 1H), 3.43-3.49 (m, 2H), 3.79-3.87 (m, 2H), 4.62 (s, 1H), 4.73 (s, 1H), 4.93 (d, J = 1.6 Hz, 1H), 5.03 (d, J = 1.6 Hz, 1H), 6.88 (d, J = 2.0 Hz, 1H), 7.08-7.10 (m, 1H), 7.38 (d, J = 7.6 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 12.7, 22.6, 24.2, 26.9, 29.0, 29.8, 32.3, 34.6, 37.0, 45.6, 46.2, 46.9, 52.6, 58.3, 61.8, 79.7, 82.9, 109.6, 111.4, 111.8, 124.7, 126.0, 128.9, 129.1, 144.9, 149.4, 151.3, 171.0, 175.8; HRMS (ESI-TOF) m/z: Calcd. For $C_{29}H_{34}BrN_2O_4$ $[M+H]^+$: 553.1696; Found: 553.1700.



4ak: Light yellow solid, m.p. 175.2-175.7 °C; yield 73% (83.2 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.24-1.27 (m, 1H), 1.52-1.69 (m, 5H), 1.75-1.80 (m, 1H), 1.86 (d, J = 14.0 Hz, 1H), 2.06 (s, 1H), 2.24-2.42 (m, 6H), 2.48 (s, 1H), 2.93 (s, 1H), 3.18 (s, 1H), 3.25-3.30 (m, 1H), 3.45 (s, 1H), 3.79-3.84 (m, 1H), 4.59 (d, J = 12.8 Hz, 1H), 4.61 (s, 1H), 4.72 (s, 1H), 4.95-5.04 (m, 3H), 6.59 (d, J = 8.4 Hz, 1H), 7.15-7.25 (m, 6H), 7.55 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 23.3, 24.3, 26.9, 29.2, 29.7, 32.3, 37.0, 43.8, 45.7, 46.2, 46.7, 52.5, 58.5, 61.8, 79.9, 82.8, 109.9, 111.6, 116.4, 127.4, 128.0, 129.0, 130.5, 135.2, 142.3, 149.8, 151.1, 171.2, 175.5; HRMS (ESI-TOF) m/z: Calcd. For $C_{34}H_{36}ClN_2O_4$ $[M+H]^+$: 571.2358; Found: 571.2361.

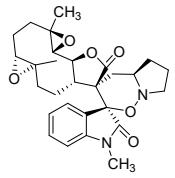


4al: Light yellow solid, m.p. 184.0-184.5 °C; yield 69% (84.7 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.21-1.26 (m, 1H), 1.48-1.70 (m, 5H), 1.74-1.80 (m, 1H), 1.86 (d, J = 14.0 Hz, 1H), 2.03 (s, 1H), 2.23-2.48 (m, 7H), 2.93 (s, 1H), 3.18 (s, 1H), 3.24-3.30 (m, 1H), 3.44 (s, 1H), 3.79-3.84 (m, 1H), 4.58 (d, J = 14.8 Hz, 1H), 4.61 (s, 1H), 4.71 (s, 1H), 4.95-5.04 (m, 3H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 23.0, 24.1, 26.9, 29.2, 29.7, 32.2, 37.0, 43.8, 45.6, 46.3, 46.7, 52.5, 58.2, 61.9, 79.9, 82.7, 109.8, 110.4, 111.6, 116.1, 127.4, 128.0, 129.0, 130.6, 133.5, 135.2, 143.0, 149.8, 151.1, 171.1, 175.5; HRMS (ESI-TOF) m/z: Calcd. For $C_{34}H_{36}BrN_2O_4$ $[M+H]^+$: 615.1853; Found: 615.1853.

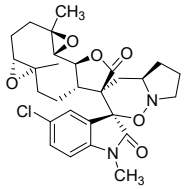


4am: Light yellow solid, m.p. 165.5-165.9 °C; yield 70% (77.0 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 1.23-1.27 (m, 1H), 1.44 (s, 1H), 1.56-1.76 (m, 6H), 1.84 (d, J = 14.4 Hz, 1H), 2.01-2.05 (m, 1H), 2.15-2.52 (m, 11H), 2.92-2.97 (m, 1H), 3.21 (s, 1H), 3.28-3.33 (m, 1H), 3.48 (d, J = 6.8 Hz, 1H), 3.76-3.81 (m, 1H), 4.58 (s, 1H), 4.60 (d, J = 15.6 Hz, 1H), 4.70 (s, 1H), 4.93 (d, J =

1.2 Hz, 1H), 5.00 (d, J = 15.6 Hz, 1H), 5.02 (s, 1H), 6.58 (d, J = 8.0 Hz, 1H), 6.98-7.00 (m, 1H), 7.19-7.25 (m, 5H), 7.34 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 21.3, 23.1, 24.3, 27.1, 29.2, 29.7, 32.3, 37.0, 43.7, 45.6, 46.3, 46.6, 52.5, 58.3, 62.1, 79.7, 82.8, 108.7, 109.5, 111.4, 125.3, 127.5, 127.7, 128.1, 128.8, 130.9, 133.1, 135.9, 141.5, 149.9, 151.4, 171.6, 175.9; HRMS (ESI-TOF) m/z: Calcd. For $C_{35}H_{38}N_2NaO_4$ $[M+H]^+$: 573.2724; Found: 573.2727.

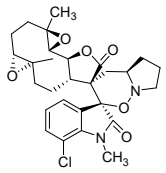


4ba: Light yellow solid, m.p. 271.0-271.5 °C; yield 76% (75.1 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.38-0.40 (m, 1H), 0.89-0.97 (m, 1H), 1.09-1.14 (m, 1H), 1.19 (s, 3H), 1.26 (s, 3H), 1.33-1.43 (m, 2H), 1.65-1.67 (m, 2H), 1.83 (d, J = 14.0 Hz, 1H), 1.93-1.97 (m, 1H), 2.08-2.12 (m, 1H), 2.23-2.31 (m, 4H), 2.43 (d, J = 10.8 Hz, 2H), 2.90-2.98 (m, 1H), 3.08 (s, 3H), 3.20-3.32 (m, 2H), 3.52-3.54 (m, 1H), 3.73-3.78 (m, 1H), 6.70 (d, J = 8.0 Hz, 1H), 6.96-7.00 (m, 1H), 7.26-7.30 (m, 1H), 7.52 (d, J = 7.6 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 15.0, 15.5, 17.6, 20.5, 21.1, 22.4, 24.2, 25.3, 33.6, 38.7, 44.4, 46.9, 56.5, 58.4, 58.5, 59.0, 60.0, 60.9, 63.4, 77.7, 106.1, 121.9, 123.0, 125.9, 129.1, 142.3, 169.4, 172.6; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{35}N_2O_6$ $[M+H]^+$: 495.2490; Found: 495.2494.

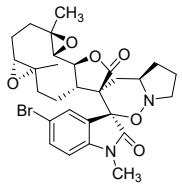


4bb: Light yellow solid, m.p. 267.1-267.7 °C; yield 75% (79.2 mg), 20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.39-0.40 (m, 1H), 0.93-0.95 (m, 1H), 1.13-1.17 (m, 1H), 1.21 (s, 3H), 1.27 (s, 3H), 1.34-1.44 (m, 2H), 1.67 (s, 2H), 1.85 (d, J = 14.0 Hz, 1H), 1.94-1.97 (m, 1H), 2.10-2.14 (m, 1H), 2.20-2.32 (m, 3H), 2.40 (d, J = 8.8 Hz, 2H), 2.49 (d, J = 10.4 Hz, 1H), 2.89-2.95 (m, 1H), 3.07 (s, 3H), 3.14-3.16 (m, 1H), 3.25-3.30 (m, 1H), 3.50-3.53 (m, 1H), 3.76-3.80 (m, 1H), 6.65 (d, J = 8.0 Hz, 1H), 7.25-7.28 (m, 1H), 7.54 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 15.8, 16.3, 18.3, 21.2, 22.0, 23.1, 25.2, 26.0, 34.4, 39.5, 45.2, 47.9, 57.3, 59.3, 59.4, 59.8, 60.9, 61.8, 64.1, 78.6, 108.0, 125.4, 127.4, 128.0, 129.9, 141.7, 169.8, 173.2; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{34}ClN_2O_6$

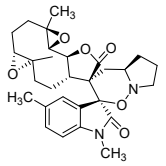
$[M+H]^+$: 529.2100; Found: 529.2098.



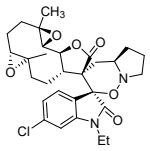
4bc: Light yellow solid, m.p. 246.0-246.9 °C; yield 79% (83.4 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.48-0.51 (m, 1H), 0.93-0.96 (m, 1H), 1.14-1.17 (m, 1H), 1.21 (s, 3H), 1.27 (s, 3H), 1.33-1.43 (m, 2H), 1.64-1.70 (m, 2H), 1.83 (d, J = 10.8 Hz, 1H), 1.97-2.01 (m, 1H), 2.09-2.36 (m, 6H), 2.53 (d, J = 10.4 Hz, 1H), 2.90-2.97 (m, 1H), 3.17-3.19 (m, 1H), 3.25-3.30 (m, 1H), 3.47 (s, 3H), 3.50-3.54 (m, 1H), 3.74-3.79 (m, 1H), 6.87-6.91 (m, 1H), 7.20-7.23 (m, 1H), 7.48 (d, J = 7.6 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.9, 17.4, 19.6, 22.4, 23.0, 24.2, 27.1, 29.5, 35.4, 40.5, 46.5, 48.9, 58.4, 60.3, 60.7, 61.8, 63.0, 65.1, 79.5, 115.2, 124.3, 126.4, 127.6, 133.3, 140.0, 171.3, 174.3; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{34}ClN_2O_6$ $[M+H]^+$: 529.2100; Found: 529.2097.



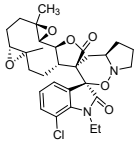
4bd: Light yellow solid, m.p. 270.4-271.0 °C; yield 57% (65.2 mg), 14:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.38-0.40 (m, 1H), 0.89-0.95 (m, 1H), 1.15-1.17 (m, 1H), 1.21 (s, 3H), 1.28 (s, 3H), 1.33-1.42 (m, 1H), 1.57-1.59 (m, 1H), 1.65-1.68 (m, 2H), 1.83-1.88 (m, 1H), 1.95-1.99 (m, 1H), 2.11-2.15 (m, 1H), 2.22-2.32 (m, 3H), 2.40-2.50 (m, 3H), 2.92-2.95 (m, 1H), 3.07 (s, 3H), 3.14-3.17 (m, 1H), 3.26-3.31 (m, 1H), 3.49-3.53 (m, 1H), 3.75-7.80 (m, 1H), 6.59 (d, J = 8.4 Hz, 1H), 7.41-7.44 (m, 1H), 7.68 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 15.2, 15.7, 17.8, 20.5, 21.3, 22.5, 24.5, 25.3, 33.8, 38.9, 44.7, 47.3, 56.8, 58.6, 58.8, 59.2, 60.3, 61.1, 61.2, 63.5, 78.0, 107.8, 109.5, 114.8, 129.5, 132.2, 141.5, 169.1, 172.5; HRMS (ESI-TOF) m/z: Calcd. for $C_{28}H_{34}BrN_2O_6$ $[M+H]^+$: 573.1595; Found: 573.1597.



4be: Light yellow solid, m.p. 263.5-263.9 °C; yield 73% (74.2 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.37-0.42 (m, 1H), 0.88-0.95 (m, 1H), 1.11-1.15 (m, 1H), 1.20 (s, 3H), 1.26 (s, 3H), 1.33-1.43 (m, 2H), 1.62-1.70 (m, 2H), 1.82 (d, J = 14.4 Hz, 1H), 1.93-1.97 (m, 1H), 2.09-2.13 (m, 1H), 2.23 (s, 3H), 2.25-2.35 (m, 4H), 2.45 (d, J = 10.8 Hz, 2H), 2.91-2.98 (m, 1H), 3.06 (s, 3H), 3.20-3.25 (m, 1H), 3.27-3.33 (m, 1H), 3.51-3.56 (m, 1H), 3.73-3.78 (m, 1H), 6.59 (d, J = 8.0 Hz, 1H), 7.07 (d, J = 7.6 Hz, 1H), 7.33 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 15.8, 16.3, 18.3, 20.3, 21.2, 22.0, 23.2, 25.0, 26.1, 34.4, 39.5, 45.2, 47.7, 57.4, 59.2, 59.4, 59.9, 60.9, 61.7, 64.3, 78.6, 106.8, 123.8, 127.4, 130.2, 132.4, 140.7, 170.2, 173.4; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{37}N_2O_6$ $[M+H]^+$: 509.2646; Found: 509.2642.

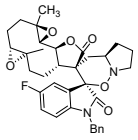


4bf: Light yellow solid, m.p. 276.4-277.2 °C; yield 62% (67.2 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.46-0.49 (m, 1H), 0.97-0.99 (m, 1H), 1.13-1.17 (m, 1H), 1.20 (s, 6H), 1.27 (s, 3H), 1.34-1.43 (m, 2H), 1.65-1.68 (m, 2H), 1.85 (d, J = 14.4 Hz, 1H), 1.97-2.00 (m, 1H), 2.10-2.31 (m, 4H), 2.37-3.41 (m, 2H), 2.52 (d, J = 10.8 Hz, 1H), 2.91-2.95 (m, 1H), 3.16-3.19 (m, 1H), 3.25-3.30 (m, 1H), 3.46-3.54 (m, 2H), 3.70-3.80 (m, 2H), 6.73 (s, 1H), 6.93 (d, J = 8.4 Hz, 1H), 7.47 (d, J = 8.4 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 10.8, 15.3, 15.8, 18.2, 20.7, 21.5, 22.6, 25.5, 33.4, 33.8, 39.0, 44.8, 47.3, 56.8, 58.8, 58.9, 59.1, 60.2, 61.6, 63.4, 77.9, 107.3, 121.7, 122.1, 127.6, 135.3, 143.1, 169.3, 172.8; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{36}ClN_2O_6$ $[M+H]^+$: 543.2256; Found: 543.2253.

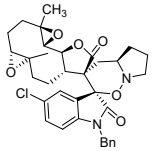


4bg: Light yellow solid, m.p. 268.5-269.7 °C; yield 63% (68.2 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.56-0.58 (m, 1H), 0.97-1.03 (m, 1H), 1.12-1.18 (m, 1H), 1.20 (s, 3H), 1.23-1.27 (m, 6H), 1.34-1.45 (m, 2H), 1.65-1.68 (m, 2H), 1.85 (d, J = 15.2 Hz, 1H), 1.97-2.00 (m, 2H), 2.10-2.14 (m, 1H), 2.22-2.38 (m, 4H), 2.53 (d, J = 10.8 Hz, 1H), 2.92-2.95 (m, 1H), 3.15-3.18 (m, 1H), 3.26-2.31 (m, 1H), 3.52 (s, 1H), 3.76-3.80 (m, 1H), 4.01-4.06 (m, 2H), 6.88-6.92 (m, 1H), 7.21-

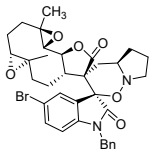
7.24 (m, 1H), 7.50 (d, J = 7.2 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 13.8, 15.9, 16.4, 19.0, 21.6, 22.2, 23.1, 26.2, 34.3, 35.8, 39.5, 45.6, 47.8, 57.3, 59.4, 59.5, 59.7, 60.7, 62.4, 63.8, 78.4, 113.7, 123.2, 125.4, 127.0, 132.4, 138.5, 170.5, 173.2; HRMS (ESI-TOF) m/z: Calcd. for $C_{29}H_{36}ClN_2O_6$ $[M+H]^+$: 543.2256; Found: 543.2259.



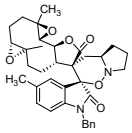
4bh: Light yellow solid, m.p. 277.7-278.2 °C; yield 70% (82.3 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.44-0.47 (m, 1H), 1.01-1.04 (m, 1H), 1.12-1.16 (m, 1H), 1.20 (s, 3H), 1.28 (s, 3H), 1.33-1.52 (m, 2H), 1.69-1.77 (m, 2H), 1.88-1.99 (m, 2H), 2.10-2.24 (m, 4H), 2.39-2.51 (m, 3H), 2.94-2.95 (m, 1H), 3.20-3.22 (m, 1H), 3.29-3.34 (m, 1H), 3.50-3.52 (m, 1H), 3.79-3.84 (m, 1H), 4.39 (d, J = 14.8 Hz, 1H), 5.14 (d, J = 14.8 Hz, 1H), 6.53-6.57 (m, 1H), 6.84-6.89 (m, 1H), 7.17-7.26 (m, 5H), 7.35 (d, J = 8.0 Hz, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.9, 17.4, 19.6, 22.3, 23.1, 23.8, 27.0, 35.4, 40.3, 43.7, 46.5, 49.1, 58.3, 60.4, 60.5, 60.8, 61.8, 63.2, 65.0, 79.5, 109.7 (d, J_{CF} = 7.2 Hz), 116.4 (d, J_{CF} = 20.2 Hz), 117.0 (d, J_{CF} = 24.0 Hz), 126.4, 127.4, 128.0, 129.0, 134.7, 139.3, 159.6 (d, J_{CF} = 240.0 Hz), 171.2, 174.3; HRMS (ESI-TOF) m/z: Calcd. for $C_{34}H_{38}FN_2O_6$ $[M+H]^+$: 589.2708; Found: 589.2712.



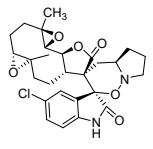
4bi: Light yellow solid, m.p. 264.5-265.4 °C; yield 68% (82.1 mg), >20:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.42-0.46 (m, 1H), 0.97-1.00 (m, 1H), 1.14-1.17 (m, 1H), 2.00 (s, 3H), 1.28 (s, 3H), 1.34-1.37 (m, 1H), 1.53-1.68 (m, 3H), 1.89 (d, J = 14.4 Hz, 1H), 1.96-1.99 (m, 1H), 2.10-2.23 (m, 4H), 2.43-2.51 (m, 3H), 2.93-2.95 (m, 1H), 3.17-3.20 (m, 1H), 3.29-3.32 (m, 1H), 3.51 (s, 1H), 3.78-3.83 (m, 1H), 4.38 (d, J = 16.4 Hz, 1H), 5.14 (d, J = 16.4 Hz, 1H), 6.55 (d, J = 8.4 Hz, 1H), 7.12-7.23 (m, 6H), 7.56 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.9, 17.4, 19.4, 22.8, 23.1, 24.0, 27.0, 35.4, 40.3, 43.7, 46.4, 49.1, 58.3, 60.4, 60.8, 61.9, 63.2, 64.9, 79.5, 110.1, 127.4, 128.0, 128.5, 129.0, 130.8, 134.5, 141.9, 171.0, 174.2; HRMS (ESI-TOF) m/z: Calcd. for $C_{34}H_{38}ClN_2O_6$ $[M+H]^+$: 605.2413; Found: 605.2417.



4bj: Light yellow solid, m.p. 277.1-277.7 °C; yield 62% (80.4 mg), 19:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.42-0.46 (m, 1H), 0.98-1.04 (m, 1H), 1.14-1.16 (m, 1H), 1.20 (s, 3H), 1.28 (s, 3H), 1.34-1.55 (m, 2H), 1.67-1.71 (m, 2H), 1.89 (d, J = 14.0 Hz, 1H), 1.97-2.00 (m, 1H), 2.11-2.23 (m, 4H), 2.43-2.52 (m, 3H), 2.94-2.96 (m, 1H), 3.17-3.20 (m, 1H), 3.29-3.34 (m, 1H), 3.50-3.53 (m, 1H), 3.78-3.83 (m, 1H), 4.38 (d, J = 15.2 Hz, 1H), 5.14 (d, J = 15.2 Hz, 1H), 6.51 (d, J = 8.4 Hz, 1H), 7.18-7.30 (m, 6H), 7.69 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 14.5, 14.9, 17.0, 20.1, 20.6, 21.6, 24.5, 32.9, 37.9, 41.2, 43.9, 46.6, 55.8, 58.0, 58.1, 58.3, 59.4, 60.7, 62.5, 77.1, 108.1, 114.0, 124.9, 125.6, 126.5, 126.6, 128.7, 131.3, 132.0, 139.9, 168.4, 171.7; HRMS (ESI-TOF) m/z: Calcd. for $C_{34}H_{38}BrN_2O_6$ $[M+H]^+$: 649.1908; Found: 649.1903.



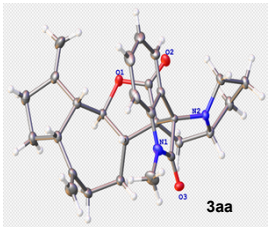
4bk: Light yellow solid, m.p. 261.7-262.1 °C; yield 71% (82.9 mg), 18:1 dr; ^{1}H NMR ($CDCl_3$, 400 MHz) δ: 0.40-0.44 (m, 1H), 0.92-0.99 (m, 1H), 1.11-1.16 (m, 1H), 1.18 (s, 3H), 1.27 (s, 3H), 1.33-1.39 (m, 1H), 1.50-1.52 (m, 1H), 1.66-1.70 (m, 2H), 1.85 (d, J = 14.4 Hz, 1H), 1.94-1.96 (m, 1H), 2.09-2.15 (m, 1H), 2.18-2.37 (m, 7H), 2.46 (d, J = 10.8 Hz, 2H), 2.92-3.00 (m, 1H), 3.24-3.28 (m, 1H), 3.31-3.36 (m, 1H), 3.53-3.56 (m, 1H), 3.75-3.80 (m, 1H), 4.36 (d, J = 15.2 Hz, 1H), 5.13 (d, J = 15.2 Hz, 1H), 6.53 (d, J = 8.0 Hz, 1H), 6.95 (d, J = 8.0 Hz, 1H), 7.16-7.22 (m, 5H), 7.34 (s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 16.9, 17.4, 19.7, 21.3, 22.5, 23.1, 24.3, 27.2, 35.4, 40.4, 43.6, 46.4, 48.8, 58.3, 60.4, 60.8, 62.0, 63.1, 65.1, 79.5, 108.9, 124.8, 127.5, 127.8, 128.4, 128.8, 131.2, 133.3, 135.1, 141.0, 171.4, 174.5; HRMS (ESI-TOF) m/z: Calcd. for $C_{35}H_{41}N_2O_6$ $[M+H]^+$: 585.2959; Found: 585.2963.

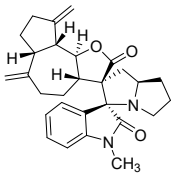


4bl: Light yellow solid, m.p. 273.5-273.9 °C; yield 51% (52.4 mg), 10:1 dr; ^{1}H NMR ($CDCl_3$,

400 MHz) δ: 0.76-0.81 (m, 1H), 0.94-1.02 (m, 1H), 1.17-1.19 (m, 1H), 1.22 (s, 3H), 1.29 (s, 3H), 1.34-1.42 (m, 1H), 1.54-1.56 (m, 1H), 1.63-1.66 (m, 2H), 1.86 (d, J = 14.4 Hz, 1H), 1.99-2.24 (m, 1H), 2.13-2.17 (m, 1H), 2.25-2.35 (m, 3H), 2.40-2.44 (m, 2H), 2.64 (d, J = 10.4 Hz, 1H), 2.92-2.99 (m, 1H), 3.10-3.14 (m, 1H), 3.32-3.38 (m, 1H), 3.47-3.51 (m, 1H), 3.76-3.81 (m, 1H), 6.76 (d, J = 8.4 Hz, 1H), 7.18-7.21 (m, 1H), 7.51 (s, 1H), 9.08 (br s, 1H); ^{13}C NMR ($CDCl_3$, 100 MHz) δ: 15.8, 16.4, 18.8, 21.1, 22.0, 26.0, 34.4, 35.5, 39.6, 45.0, 47.8, 57.1, 59.3, 59.4, 60.6, 62.5, 64.1, 78.7, 110.0, 125.8, 127.6, 130.0, 139.7, 161.7, 172.0, 173.1; HRMS (ESI-TOF) m/z: Calcd. for $C_{27}H_{32}ClN_2O_6$ $[M+H]^+$: 515.1943; Found: 515.1948.

5. X-ray crystal data for compounds 3aa, 3ad, 3bc, 4ah, 4ai and 4bh





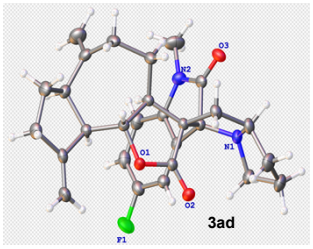
3aa

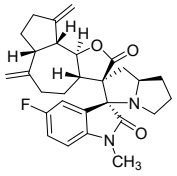
CCDC 2210637

Table S1 Crystal data and structure refinement for 3aa

Identification code	**3aa**
Empirical formula	$C_{28}H_{32}N_2O_3$
Formula weight	444.55
Temperature/K	169.99(10)
Crystal system	orthorhombic
Space group	$P2_12_12_1$
a/Å, b/Å, c/Å	10.4023(2), 12.1374(2), 18.3815(3)
α/°, β/°, γ/°,	90, 90, 90
Volume/Å^3	2320.79(7)
Z	4
ρ_{calc}g/cm^3	1.272
μ/mm^{-1}	0.654
F(000)	952.0
Radiation	Cu Kα (λ = 1.54184)
Crystal size/mm^3	0.14 × 0.13 × 0.1
2Θ range for data collection/°	8.73 to 148.396
Index ranges	-11 ≤ h ≤ 12, -14 ≤ k ≤ 15, -22 ≤ l ≤ 22
Reflections collected	26407
Independent reflections	4640 [R_{int} = 0.0481, R_{sigma} = 0.0235]
Data/restraints/parameters	4640/0/300
Goodness-of-fit on F^2	1.037
Final R indexes [I>=2σ (I)]	R_1 = 0.0368, wR_2 = 0.0979
Final R indexes [all data]	R_1 = 0.0376, wR_2 = 0.0985
Largest diff. peak/hole / e Å^{-3}	0.21/-0.15
Flack parameter	-0.07(9)/-0.07(6)

Crystal Data for $C_{28}H_{32}N_2O_3$ (*M* =444.55 g/mol): orthorhombic, space group $P2_12_12_1$ (no. 19), *a* = 10.4023(2) Å, *b* = 12.1374(2) Å, *c* = 18.3815(3) Å, *V* = 2320.79(7) Å^3, *Z* = 4, *T* = 169.99(10) K, μ(Cu Kα) = 0.654 mm^{-1}, *Dcalc* = 1.272 g/cm^3, 26407 reflections measured (8.73° ≤ 2Θ ≤ 148.396°), 4640 unique (R_{int} = 0.0481, R_{sigma} = 0.0235) which were used in all calculations. The final R_1 was 0.0368 (I > 2σ(I)) and wR_2 was 0.0985 (all data).



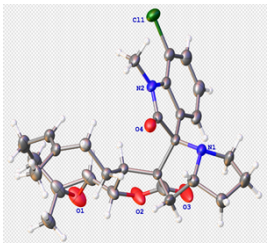


CCDC 2210638

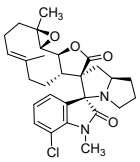
Table S2 Crystal data and structure refinement for 3ad

Identification code	**3ad**
Empirical formula	$C_{28}H_{31}FN_2O_3$
Formula weight	462.55
Temperature/K	169.99(10)
Crystal system	orthorhombic
Space group	$P2_12_12_1$
a/Å, b/Å, c/Å	8.1582(2), 12.2142(3), 23.4451(6)
α/°, β/°, γ/°,	90, 90, 90
Volume/Å^3	2336.21(10)
Z	4
ρ_{calc}g/cm^3	1.315
μ/mm^{-1}	0.735
F(000)	984.0
Radiation	Cu Kα (λ = 1.54184)
Crystal size/mm^3	0.15 × 0.1 × 0.08
2Θ range for data collection/°	7.542 to 147.686
Index ranges	-10 ≤ h ≤ 5, -15 ≤ k ≤ 14, -28 ≤ l ≤ 28
Reflections collected	8947
Independent reflections	4602 [R_{int} = 0.0247, R_{sigma} = 0.0298]
Data/restraints/parameters	4602/0/325
Goodness-of-fit on F^2	0.993
Final R indexes [I>=2σ (I)]	R_1 = 0.0318, wR_2 = 0.0868
Final R indexes [all data]	R_1 = 0.0325, wR_2 = 0.0877
Largest diff. peak/hole / e Å^{-3}	0.24/-0.15
Flack parameter	-0.03(7)/-0.01(6)

Crystal Data for $C_{28}H_{31}FN_2O_3$ (M =462.55 g/mol): orthorhombic, space group $P2_12_12_1$ (no. 19), a = 8.1582(2) Å, b = 12.2142(3) Å, c = 23.4451(6) Å, V = 2336.21(10) Å^3, Z = 4, T = 169.99(10) K, μ(Cu Kα) = 0.735 mm^{-1}, *Dcalc* = 1.315 g/cm^3, 8947 reflections measured (7.542° ≤ 2Θ ≤ 147.686°), 4602 unique (R_{int} = 0.0247, R_{sigma} = 0.0298) which were used in all calculations. The final R_1 was 0.0318 (I > 2σ(I)) and wR_2 was 0.0877 (all data).



CCDC 2210762 **3bc**

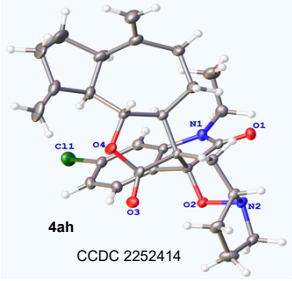


3bc

Table S3 Crystal data and structure refinement for 3bc

Identification code	**3bc**
Empirical formula	$C_{28}H_{33}ClN_2O_4$
Formula weight	497.01
Temperature/K	169.99(10)
Crystal system	monoclinic
Space group	$P2_1$
a/Å, b/Å, c/Å	11.6575(6), 8.6324(4), 13.3107(8)
α/°, β/°, γ/°,	90, 110.860(6), 90
Volume/Å^3	1251.69(12)
Z	2
ρ_{calc}g/cm^3	1.319
μ/mm^{-1}	1.652
F(000)	528.0
Radiation	Cu Kα (λ = 1.54184)
Crystal size/mm^3	0.15 × 0.1 × 0.08
2Θ range for data collection/°	7.106 to 148.982
Index ranges	-13 ≤ h ≤ 14, -10 ≤ k ≤ 9, -15 ≤ l ≤ 16
Reflections collected	7809
Independent reflections	4348 [R_{int} = 0.0275, R_{sigma} = 0.0351]
Data/restraints/parameters	4348/1/320
Goodness-of-fit on F^2	1.020
Final R indexes [I>=2σ (I)]	R_1 = 0.0565, wR_2 = 0.1520
Final R indexes [all data]	R_1 = 0.0619, wR_2 = 0.1587
Largest diff. peak/hole / e Å^{-3}	0.29/-0.28
Flack parameter	0.031(15)/0.050(9)

Crystal Data for $C_{28}H_{33}ClN_2O_4$ (M =497.01 g/mol): monoclinic, space group $P2_1$ (no. 4), a = 11.6575(6) Å, b = 8.6324(4) Å, c = 13.3107(8) Å, β = 110.860(6)°, V = 1251.69(12) Å^3, Z = 2, T = 169.99(10) K, μ(Cu Kα) = 1.652 mm^{-1}, *Dcalc* = 1.319 g/cm^3, 7809 reflections measured (7.106° ≤ 2Θ ≤ 148.982°), 4348 unique (R_{int} = 0.0275, R_{sigma} = 0.0351) which were used in all calculations. The final R_1 was 0.0565 (I > 2σ(I)) and wR_2 was 0.1587 (all data).



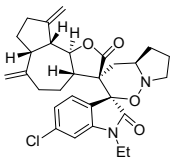
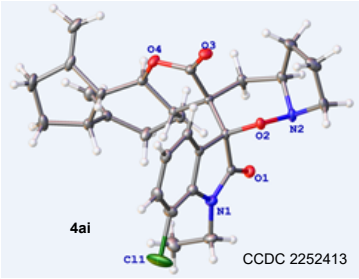
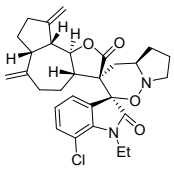


Table S4 Crystal data and structure refinement for 4ah

Identification code	**4ah**
Empirical formula	$C_{30.5}H_{39}ClN_2O_{5.5}$
Formula weight	557.08
Temperature/K	169.99(10)
Crystal system	monoclinic
Space group	$P2_1$
a/Å, b/Å, c/Å	11.0498(3), 23.4112(5), 11.1022(3)
α/°, β/°, γ/°,	90, 101.820(2), 90
Volume/Å^3	2811.12(12)
Z	4
ρ_{calc}g/cm^3	1.316
μ/mm^{-1}	1.569
F(000)	1188.0
Radiation	Cu Kα (λ = 1.54184)
Crystal size/mm^3	0.14 × 0.12 × 0.1
2Θ range for data collection/°	7.552 to 147.48
Index ranges	-13 ≤ h ≤ 13, -25 ≤ k ≤ 29, -13 ≤ l ≤ 13
Reflections collected	24029
Independent reflections	10004 [R_{int} = 0.0395, R_{sigma} = 0.0388]
Data/restraints/parameters	10004/1/709
Goodness-of-fit on F^2	1.102
Final R indexes [I>=2σ (I)]	R_1 = 0.0742, wR_2 = 0.1939
Final R indexes [all data]	R_1 = 0.0764, wR_2 = 0.1950
Largest diff. peak/hole / e Å^{-3}	1.31/-1.26
Flack/Hooft parameter	0.046(15)/0.038(6)

Crystal Data for $C_{30.5}H_{39}ClN_2O_{5.5}$ (*M* =557.08 g/mol): monoclinic, space group $P2_1$ (no. 4), *a* = 11.0498(3) Å, *b* = 23.4112(5) Å, *c* = 11.1022(3) Å, *β* = 101.820(2)°, *V* = 2811.12(12) Å^3, *Z* = 4, *T* = 169.99(10) K, μ(Cu Kα) = 1.569 mm^{-1}, *Dcalc* = 1.316 g/cm^3, 24029 reflections measured (7.552° ≤ 2Θ ≤ 147.48°), 10004 unique (R_{int} = 0.0395, R_{sigma} = 0.0388) which were used in all calculations. The final R_1 was 0.0742 (I > 2σ(I)) and wR_2 was 0.1950 (all data).



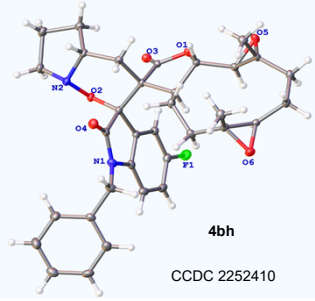


4ai

Table S5 Crystal data and structure refinement for 4ai

Identification code	**4ai**
Empirical formula	$C_{29}H_{33}ClN_2O_4$
Formula weight	509.02
Temperature/K	170.00(10)
Crystal system	monoclinic
Space group	$P2_1$
a/Å, b/Å, c/Å	10.4206(3), 14.8796(6), 16.2050(6)
α/°, β/°, γ/°,	90, 88.739(3), 90
Volume/Å^3	2512.05(16)
Z	4
ρ_{calc}g/cm^3	1.346
μ/mm^{-1}	1.661
F(000)	1080.0
Radiation	Cu Kα (λ = 1.54184)
Crystal size/mm^3	0.15 × 0.13 × 0.1
2Θ range for data collection/°	5.454 to 148.066
Index ranges	-12 ≤ h ≤ 12, -18 ≤ k ≤ 18, -20 ≤ l ≤ 17
Reflections collected	20363
Independent reflections	9869 [R_{int} = 0.0424, R_{sigma} = 0.0540]
Data/restraints/parameters	9869/1/651
Goodness-of-fit on F^2	1.045
Final R indexes [I>=2σ (I)]	R_1 = 0.0464, wR_2 = 0.1178
Final R indexes [all data]	R_1 = 0.0514, wR_2 = 0.1216
Largest diff. peak/hole / e Å^{-3}	0.46/-0.39
Flack/Hooft parameter	0.017(10)/0.022(9)

Crystal Data for $C_{29}H_{33}ClN_2O_4$ (M =509.02 g/mol): monoclinic, space group $P2_1$ (no. 4), a = 10.4206(3) Å, b = 14.8796(6) Å, c = 16.2050(6) Å, β = 88.739(3)°, V = 2512.05(16) Å^3, Z = 4, T = 170.00(10) K, μ(Cu Kα) = 1.661 mm^{-1}, *Dcalc* = 1.346 g/cm^3, 20363 reflections measured (5.454° ≤ 2Θ ≤ 148.066°), 9869 unique (R_{int} = 0.0424, R_{sigma} = 0.0540) which were used in all calculations. The final R_1 was 0.0464 (I > 2σ(I)) and wR_2 was 0.1216 (all data).



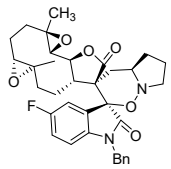


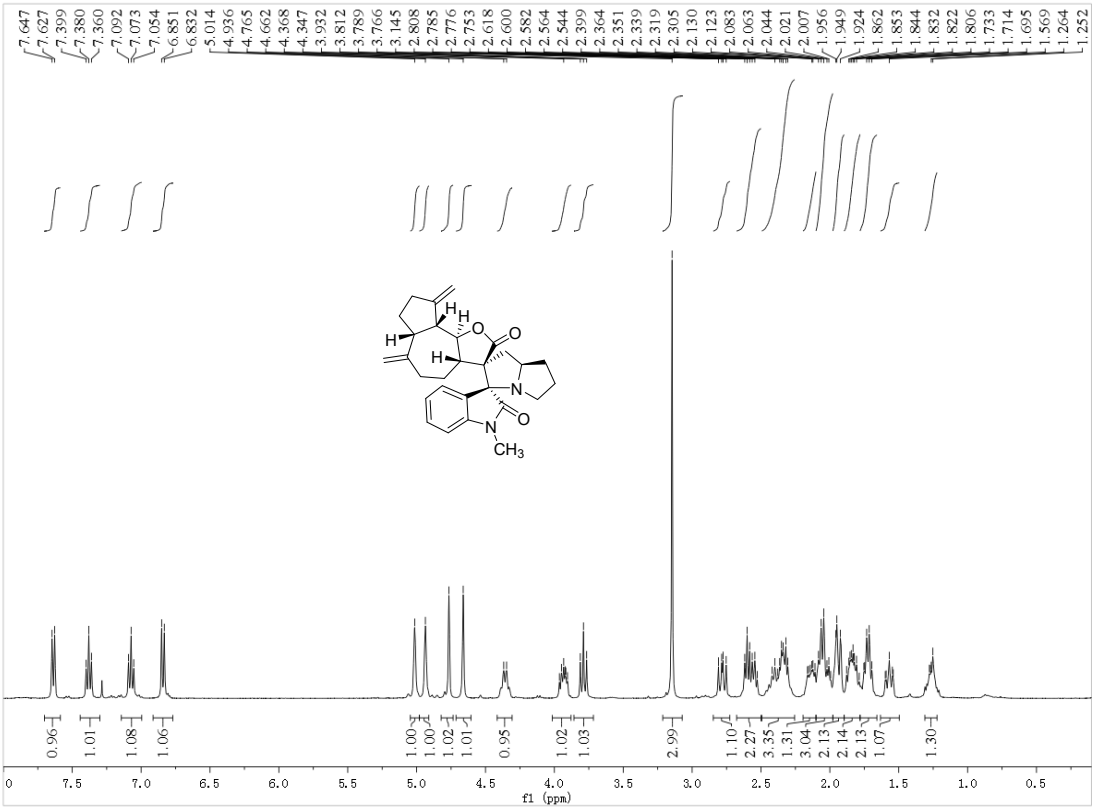
Table S6 Crystal data and structure refinement for 4bh

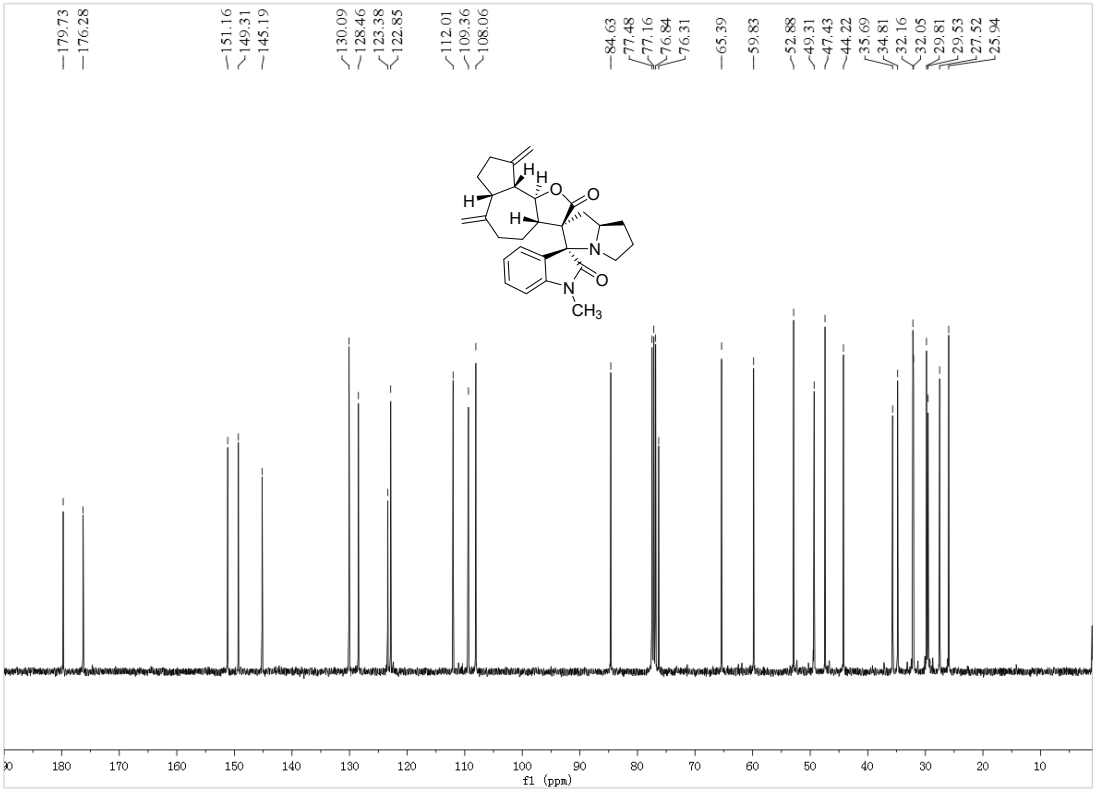
Identification code	**4bh**
Empirical formula	$C_{34}H_{37}FN_2O_6$
Formula weight	588.65
Temperature/K	294.68(10)
Crystal system	monoclinic
Space group	$P2_1$
a/Å, b/Å, c/Å	11.3543(2), 10.6060(2), 11.9316(2)
α/°, β/°, γ/°,	90, 96.4800(10), 90
Volume/Å^3	1427.67(4)
Z	2
ρ_{calc}g/cm^3	1.369
μ/mm^{-1}	0.805
F(000)	624.0
Radiation	Cu Kα (λ = 1.54184)
Crystal size/mm^3	0.14 × 0.11 × 0.09
2Θ range for data collection/°	7.456 to 151.376
Index ranges	-14 ≤ h ≤ 14, -13 ≤ k ≤ 9, -14 ≤ l ≤ 14
Reflections collected	12592
Independent reflections	4618 [R_{int} = 0.0481, R_{sigma} = 0.0367]
Data/restraints/parameters	4618/1/390
Goodness-of-fit on F^2	1.045
Final R indexes [I>=2σ (I)]	R_1 = 0.0481, wR_2 = 0.1269
Final R indexes [all data]	R_1 = 0.0495, wR_2 = 0.1285
Largest diff. peak/hole / e Å^{-3}	0.32/-0.32
Flack/Hooft parameter	-0.05(14)/-0.00(9)

Crystal Data for $C_{34}H_{37}FN_2O_6$ (M =588.65 g/mol): monoclinic, space group $P2_1$ (no. 4), a = 11.3543(2) Å, b = 10.6060(2) Å, c = 11.9316(2) Å, β = 96.4800(10)°, V = 1427.67(4) Å^3, Z = 2, T = 294.68(10) K, μ(Cu Kα) = 0.805 mm^{-1}, $Dcalc$ = 1.369 g/cm^3, 12592 reflections measured (7.456° ≤ 2Θ ≤ 151.376°), 4618 unique (R_{int} = 0.0481, R_{sigma} = 0.0367) which were used in all calculations. The final R_1 was 0.0481 (I > 2σ(I)) and wR_2 was 0.1285 (all data).

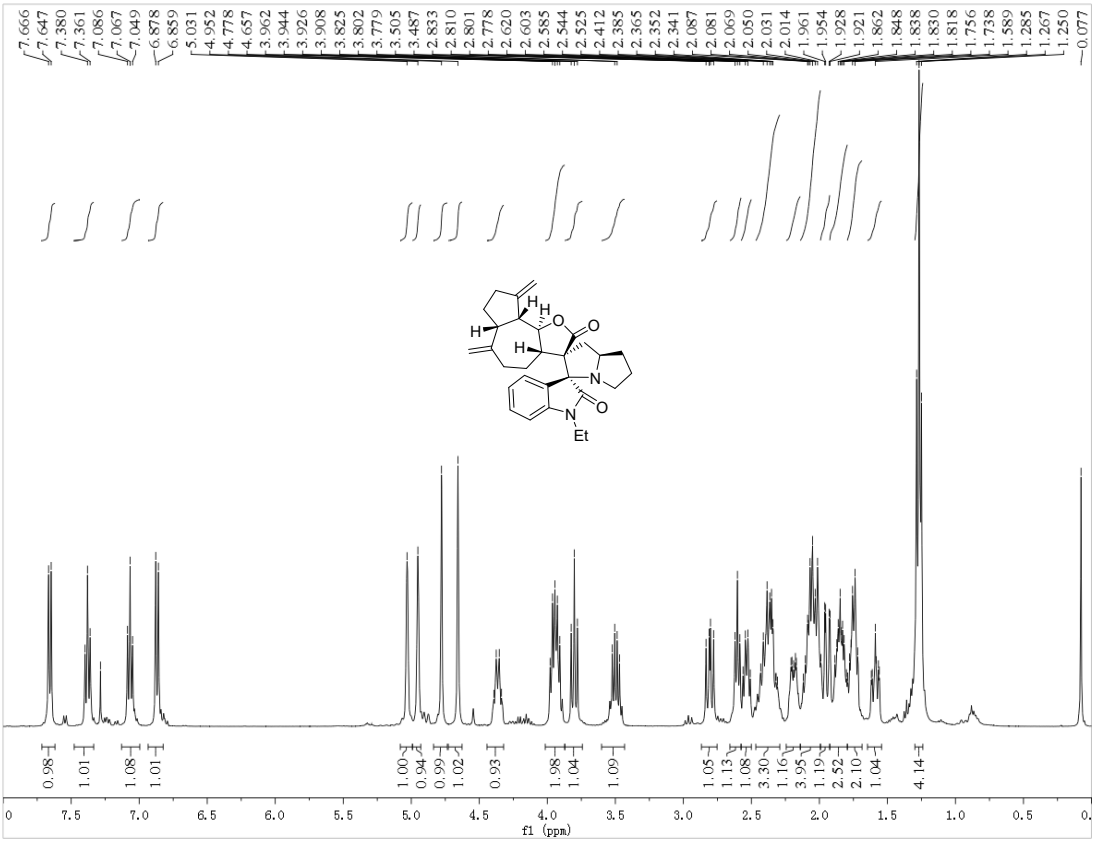
6. The copies of ^{1}H NMR and ^{13}C NMR spectra for compounds 3 and 4

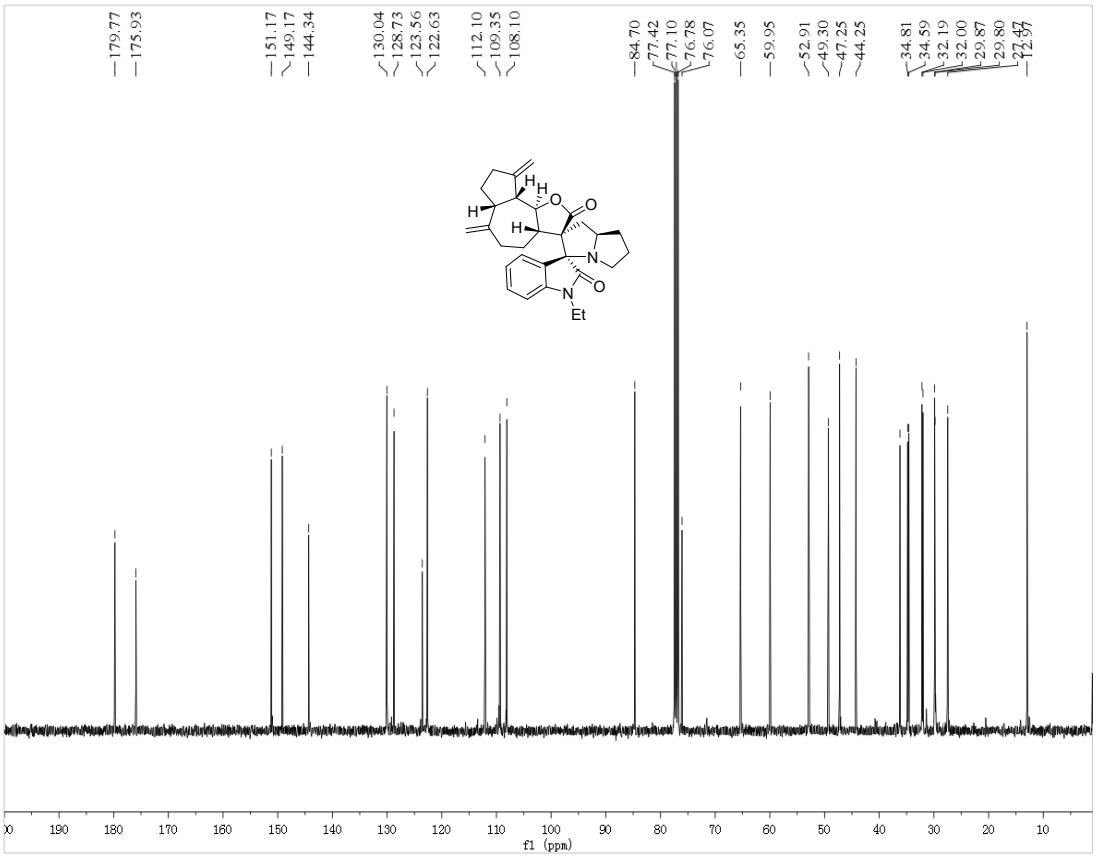
^{1}H and ^{13}C NMR of 3aa



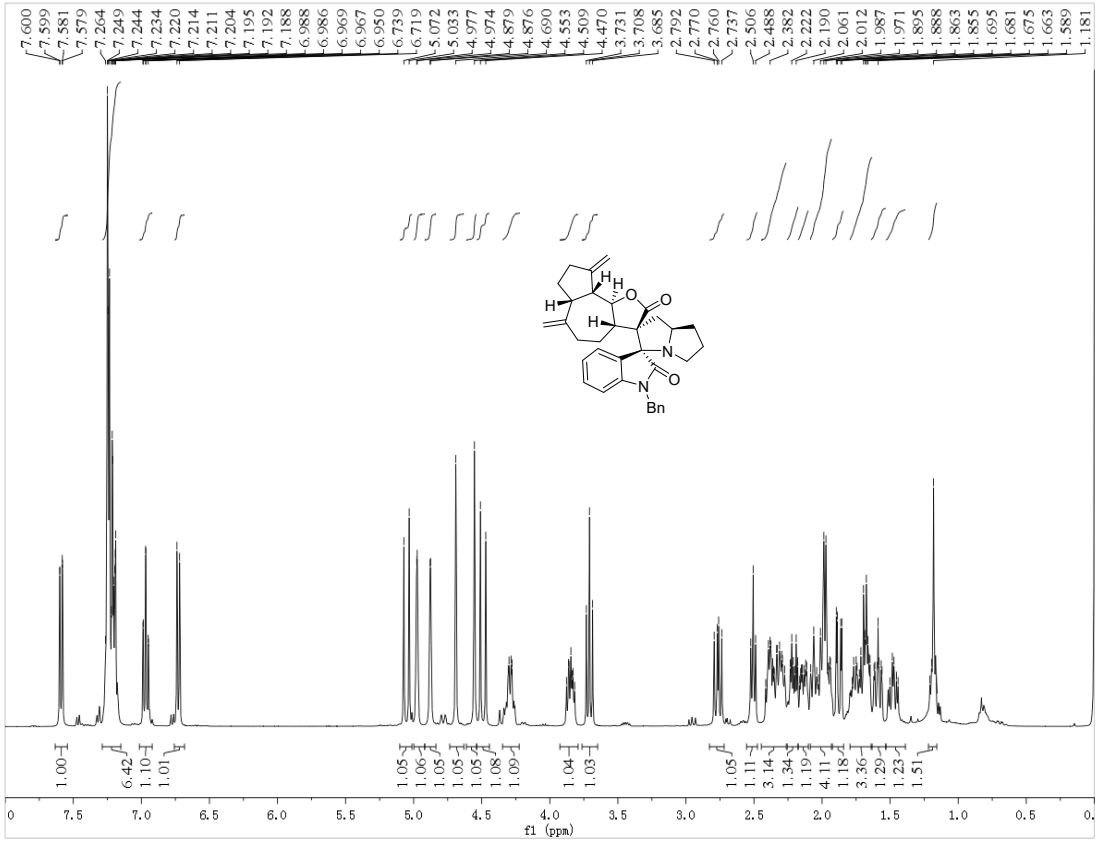


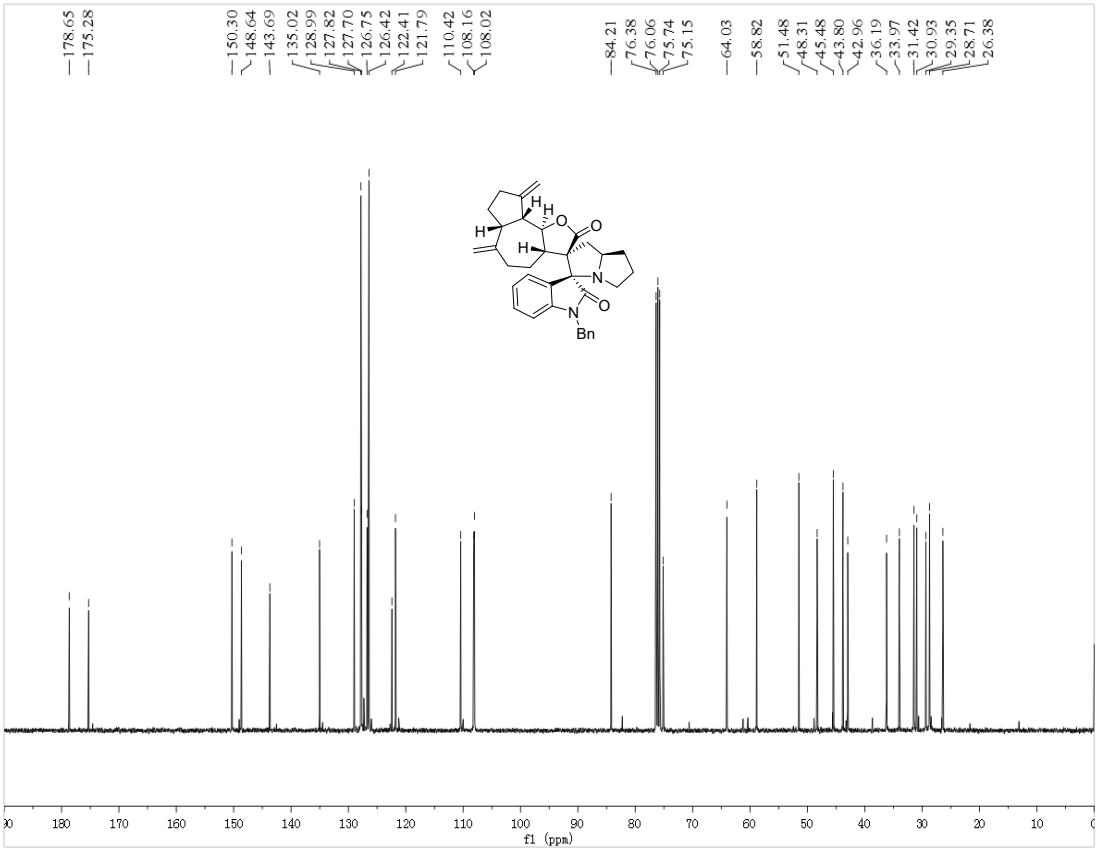
^{1}H and ^{13}C NMR of 3ab



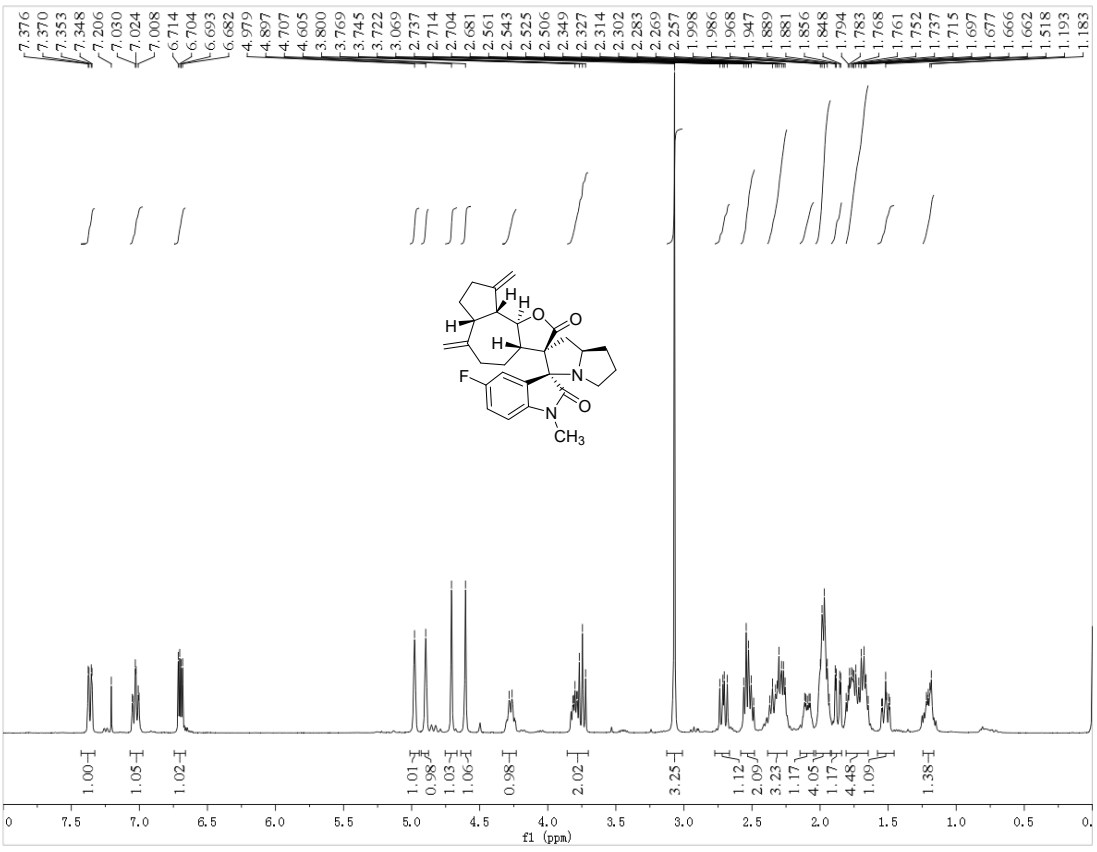


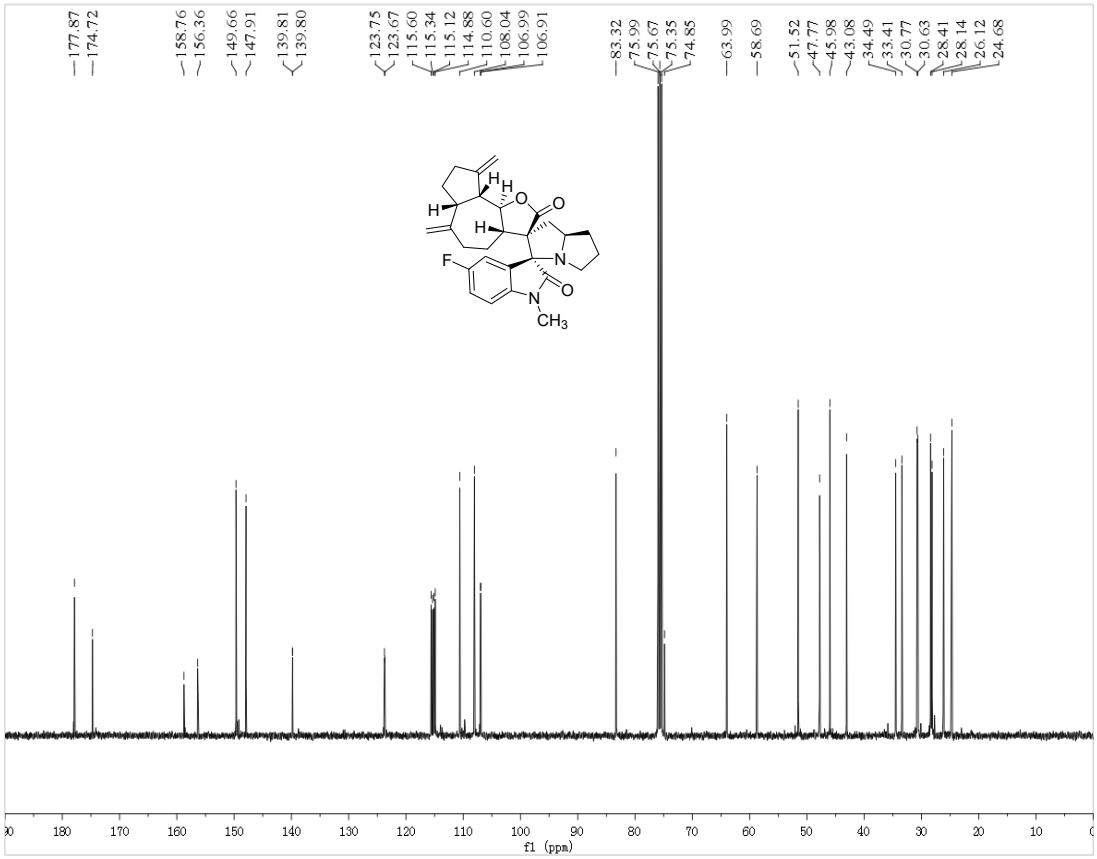
^{1}H and ^{13}C NMR of 3ac



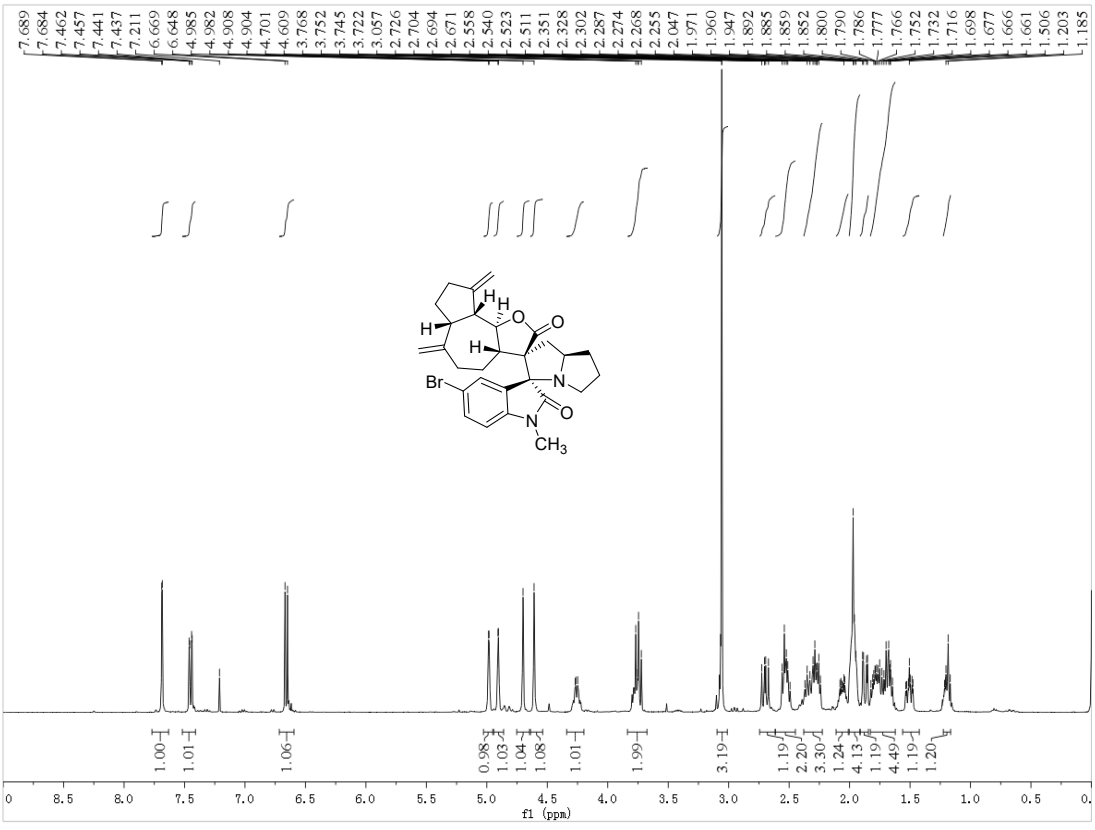


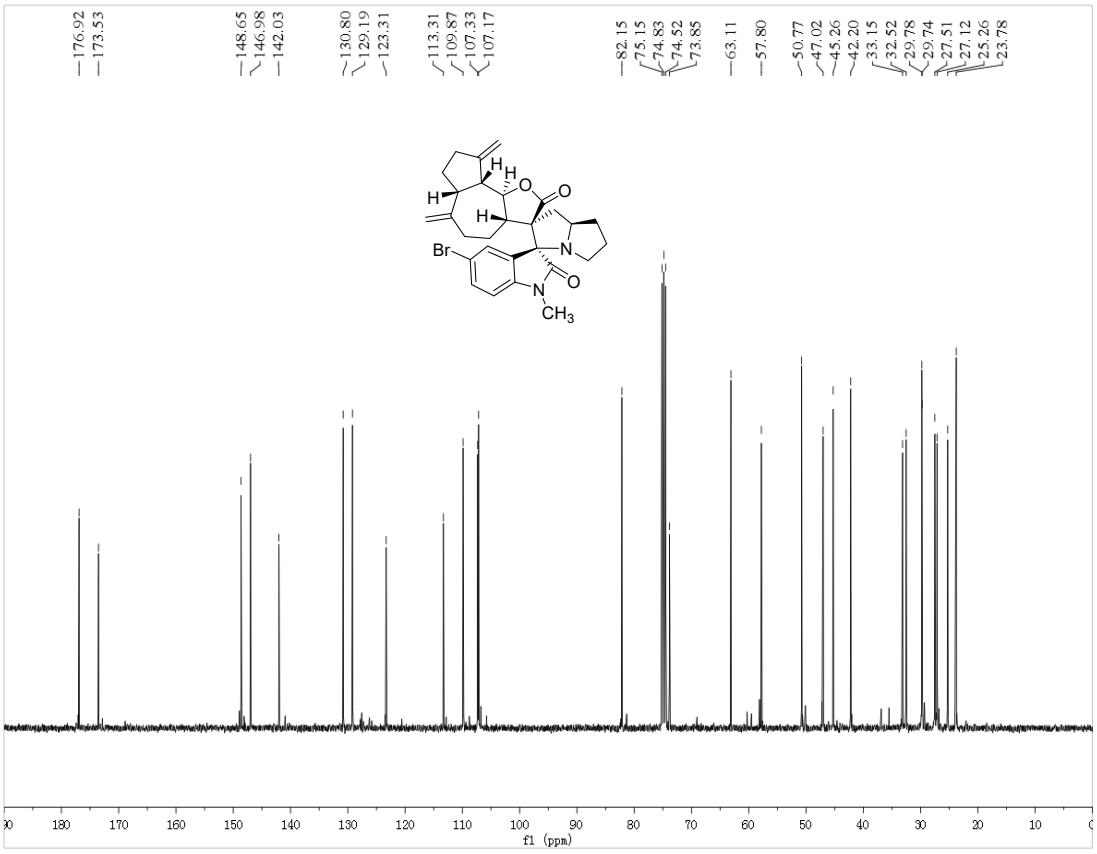
^{1}H and ^{13}C NMR of 3ad





^{1}H and ^{13}C NMR of 3ae





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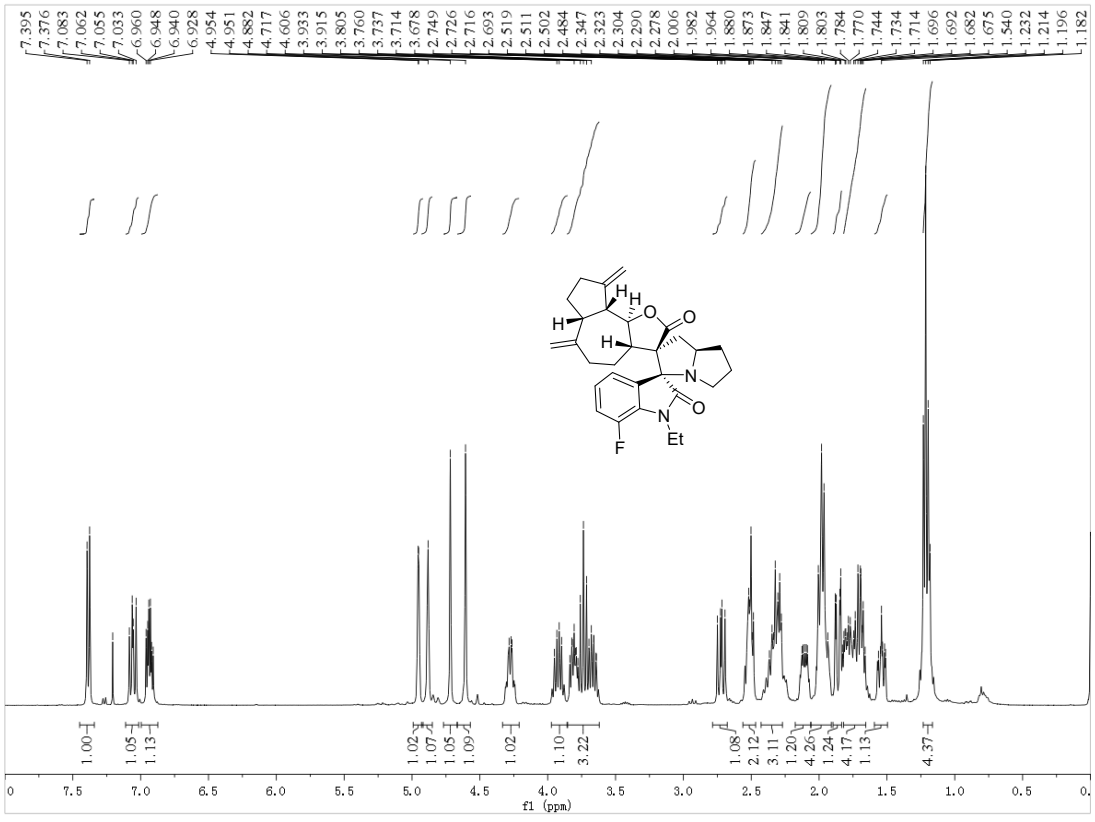
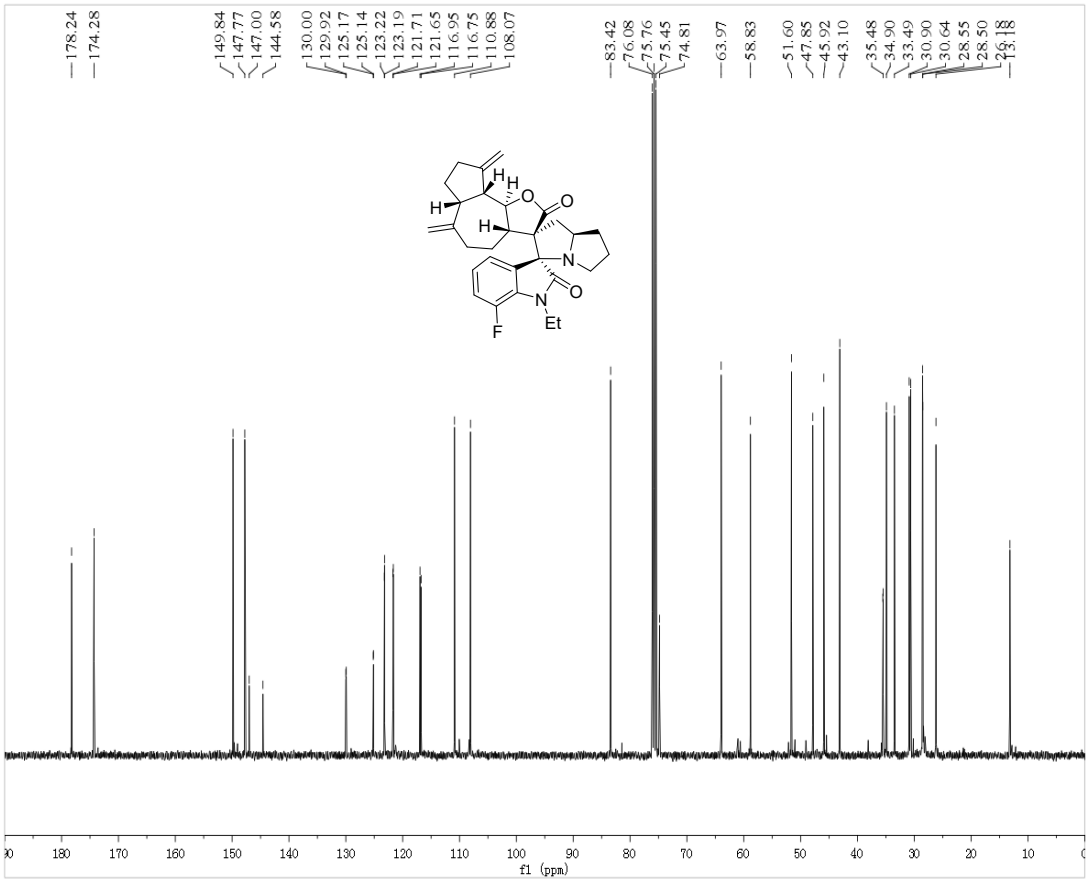
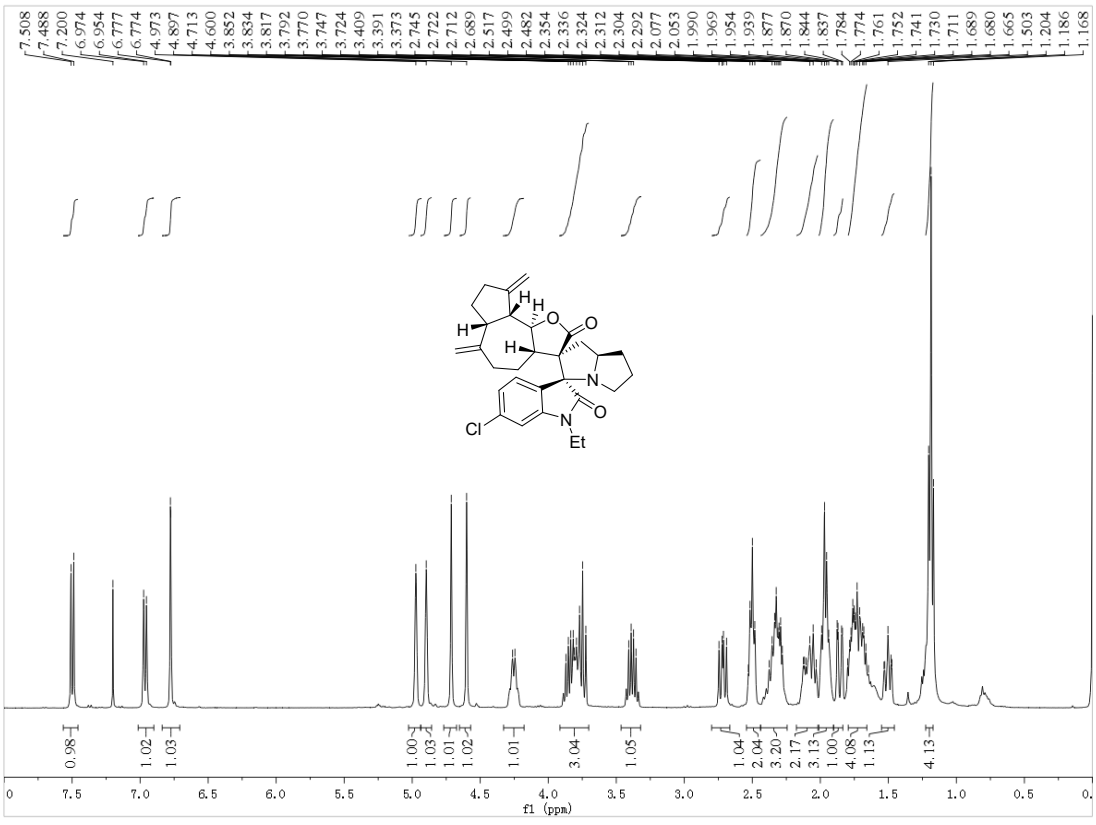
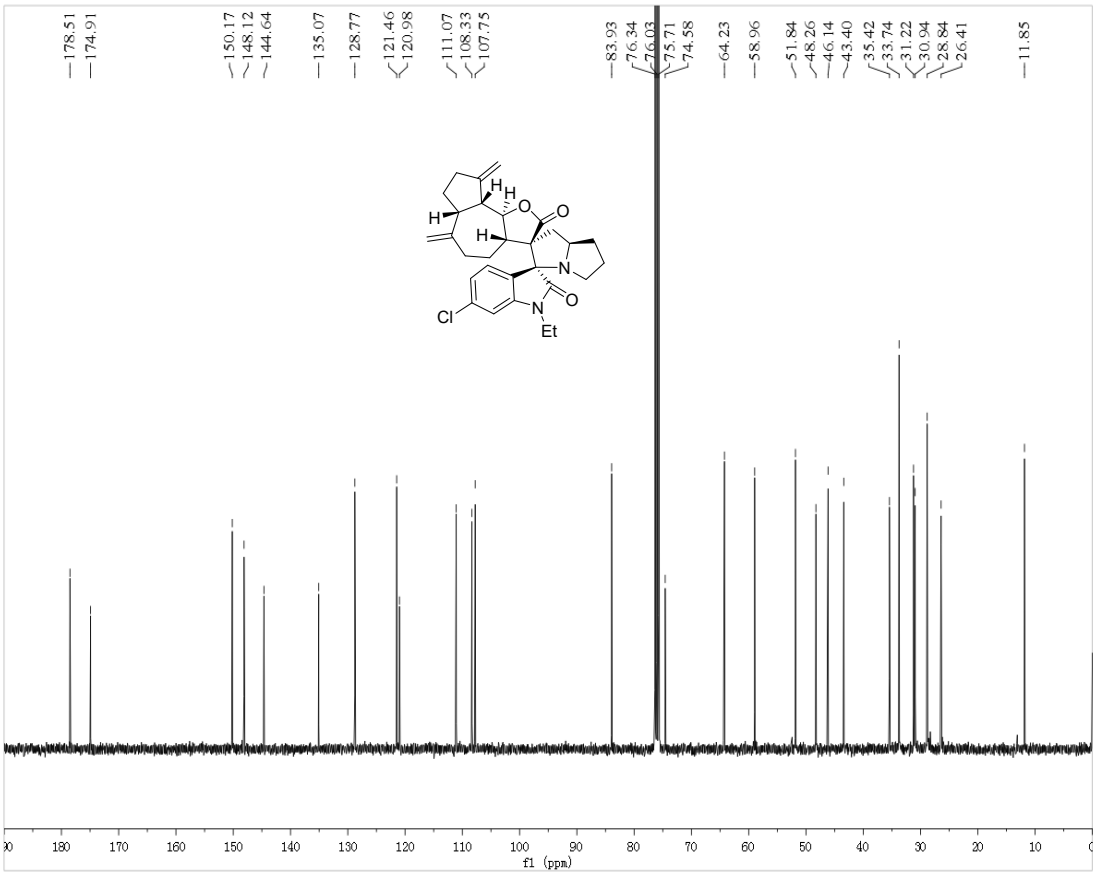


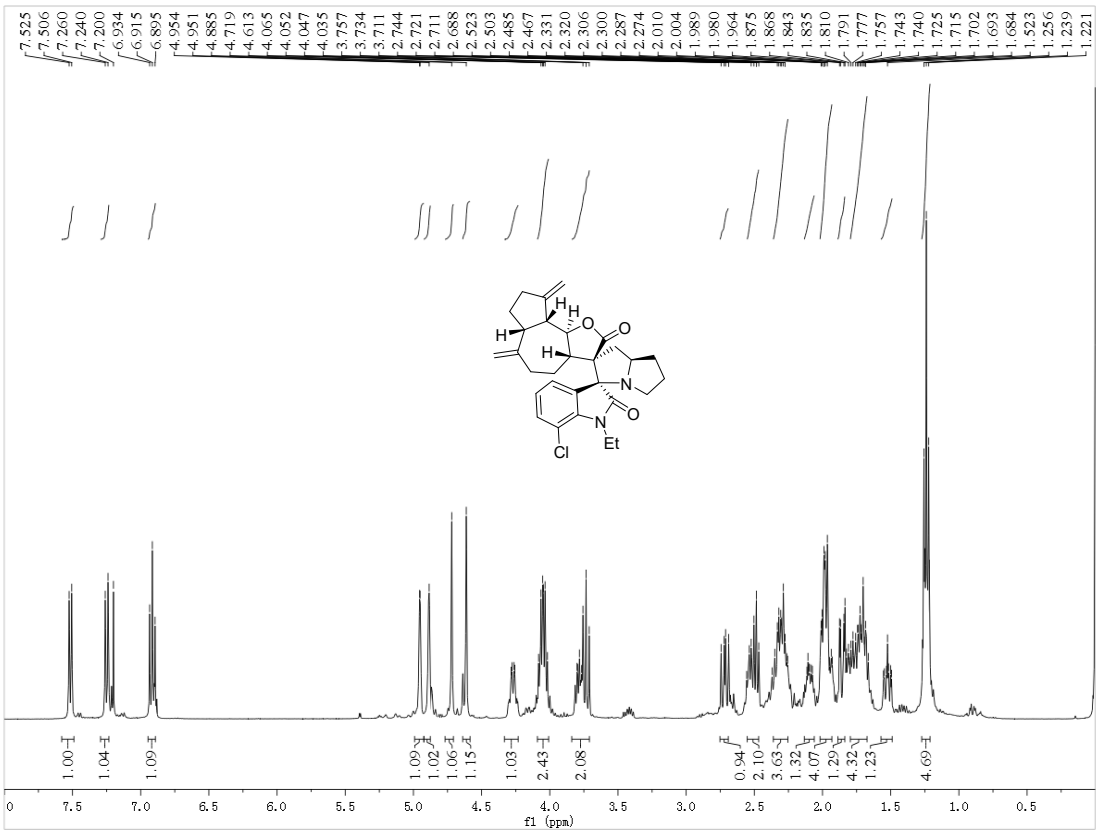


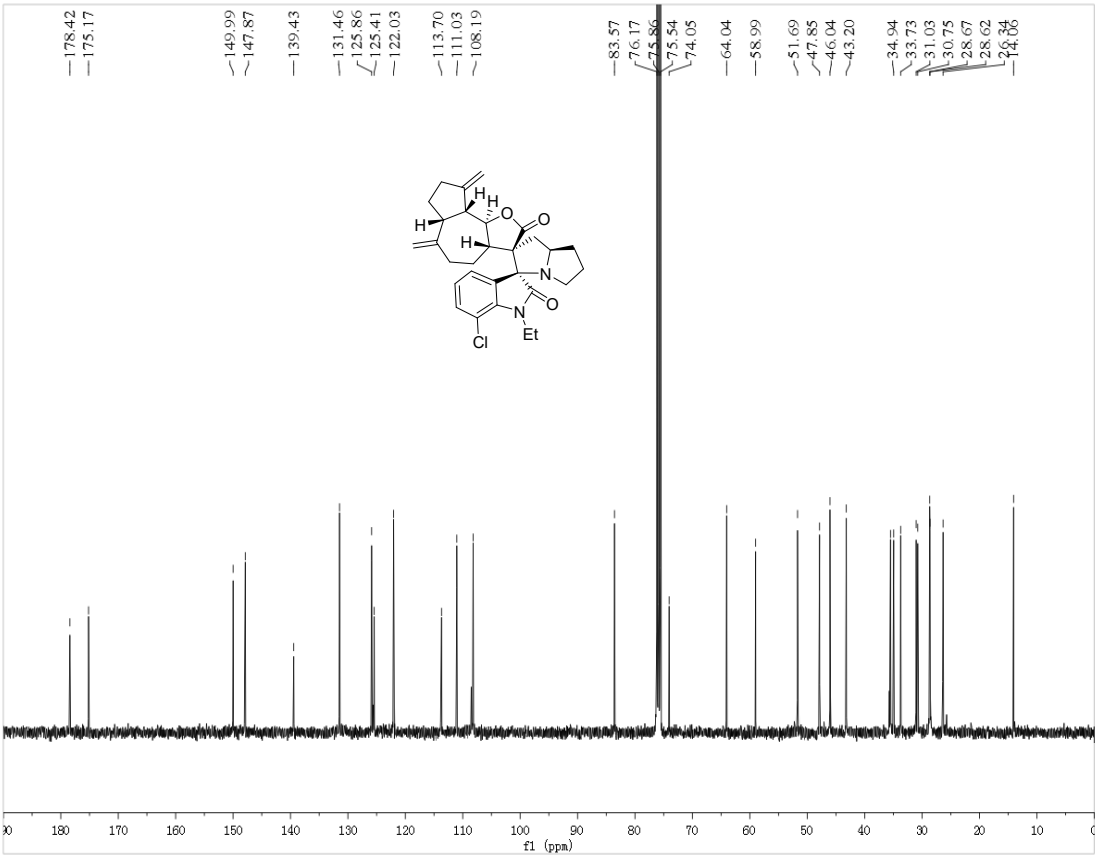
^{1}H and ^{13}C NMR of 3ag



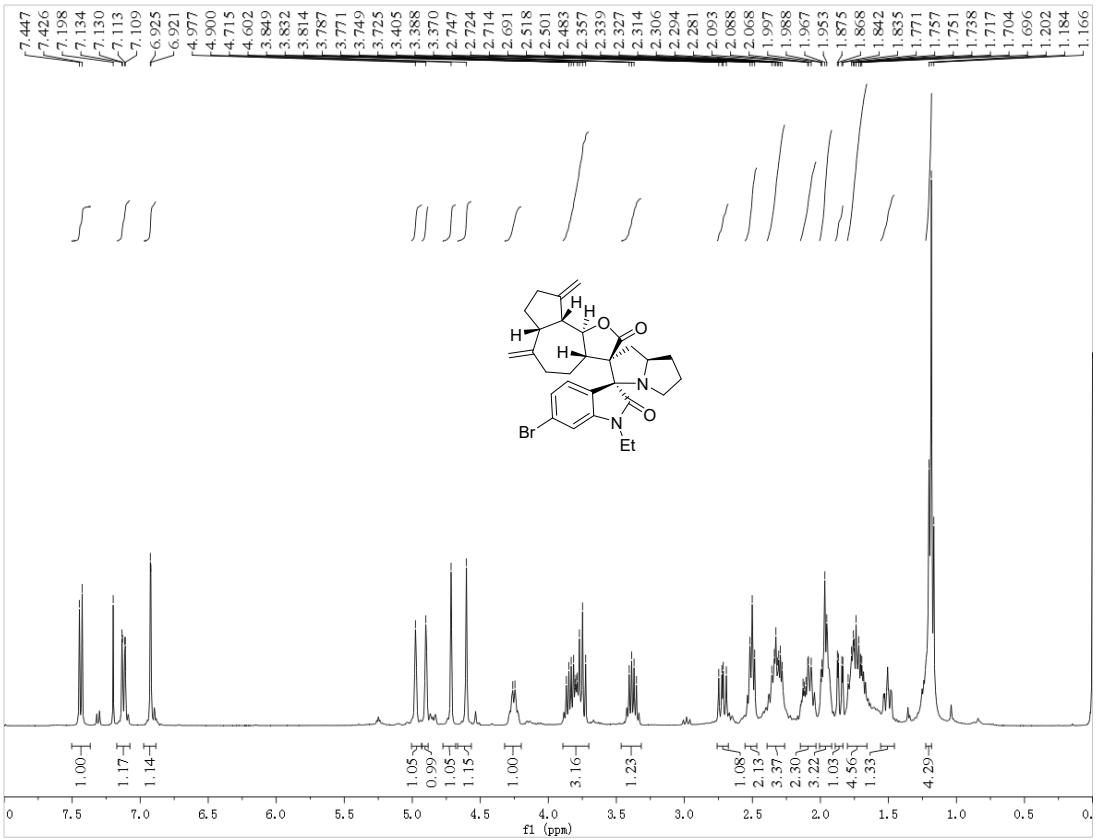


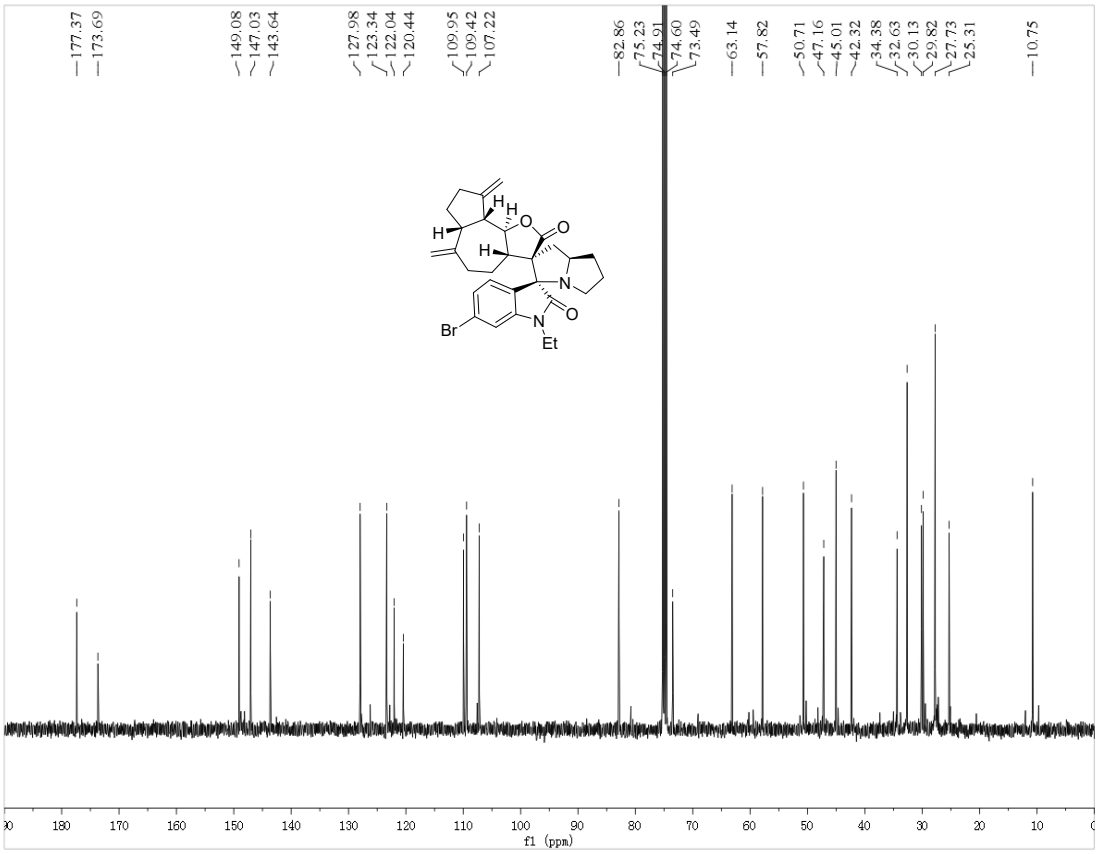
^{1}H and ^{13}C NMR of 3ah



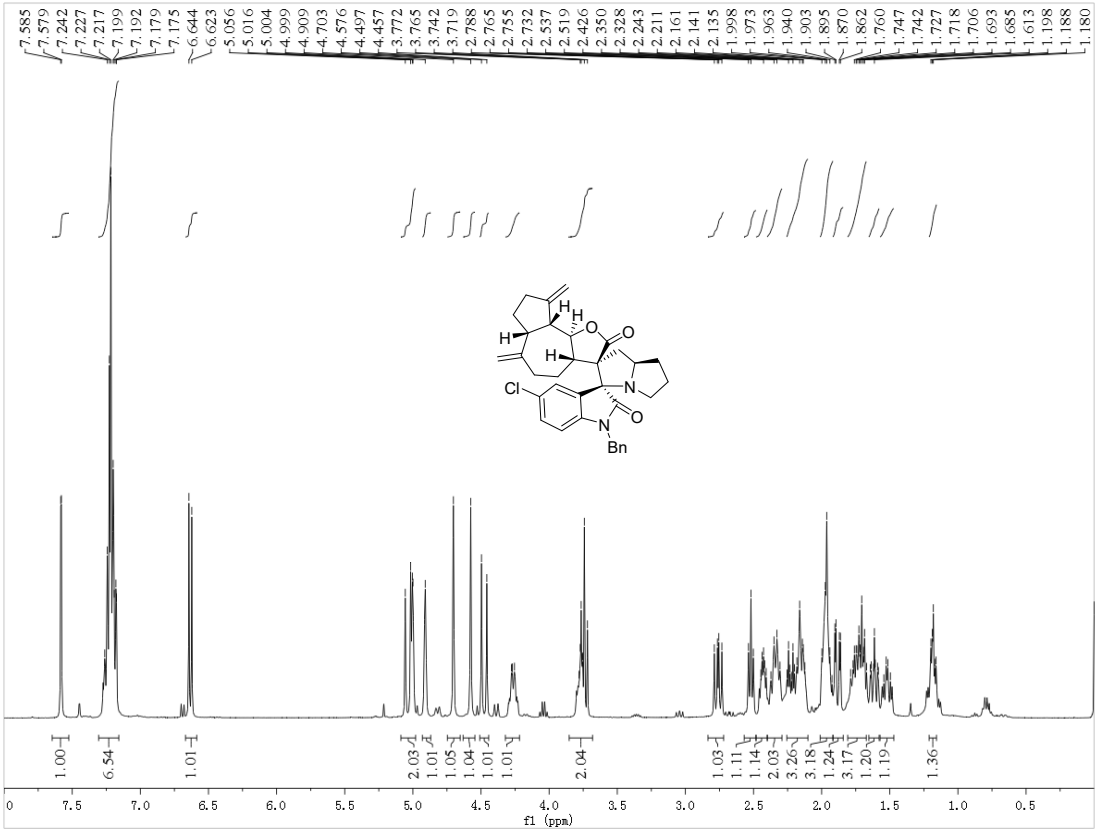


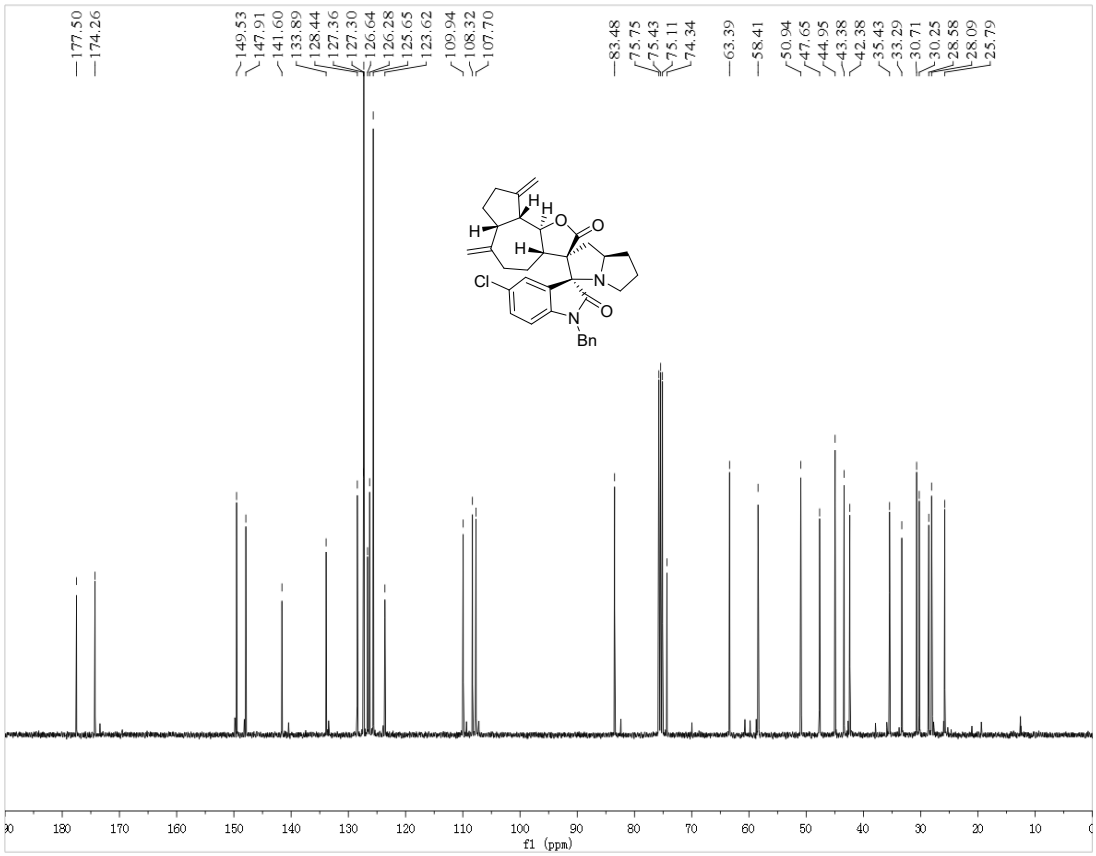
^{1}H and ^{13}C NMR of 3ai



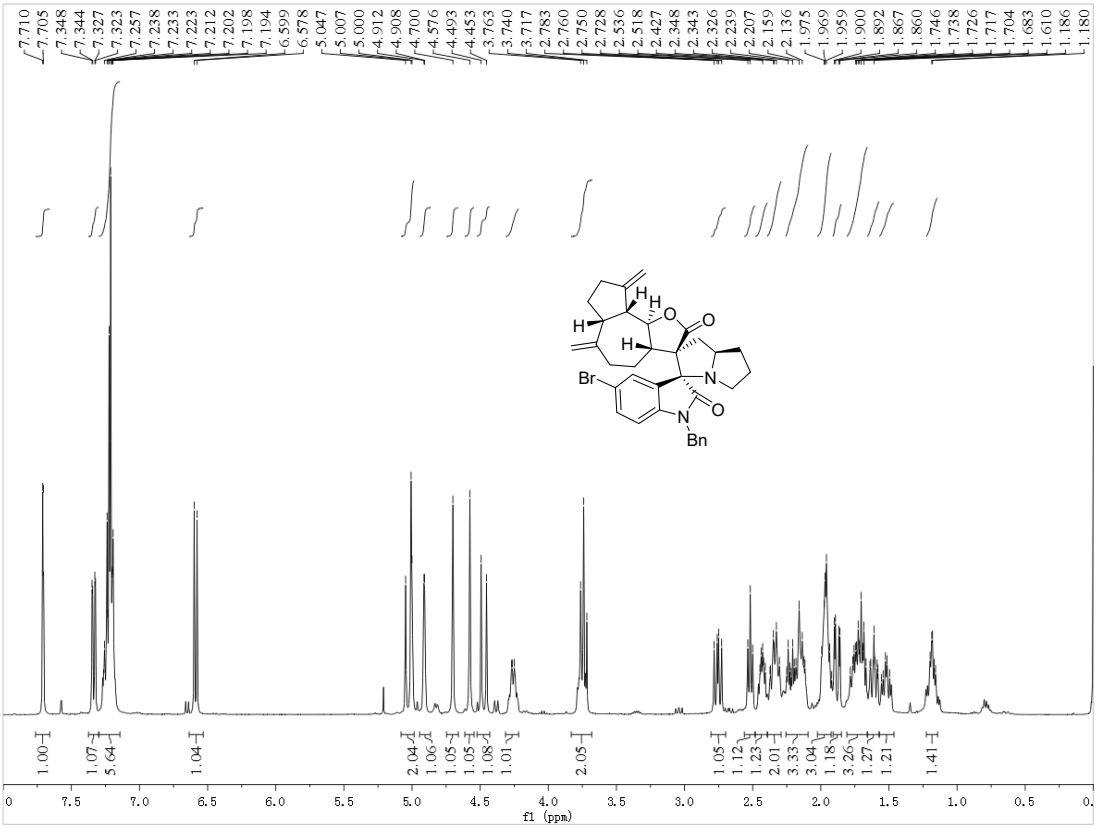


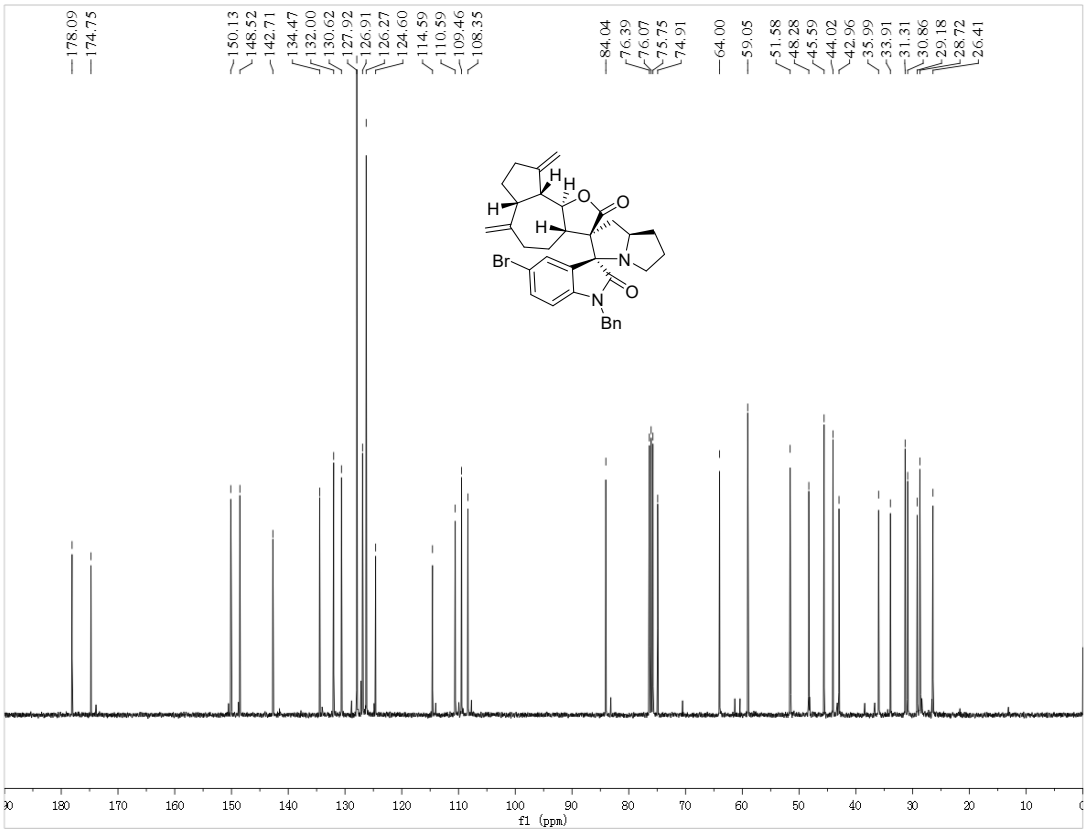
^{1}H and ^{13}C NMR of 3aj



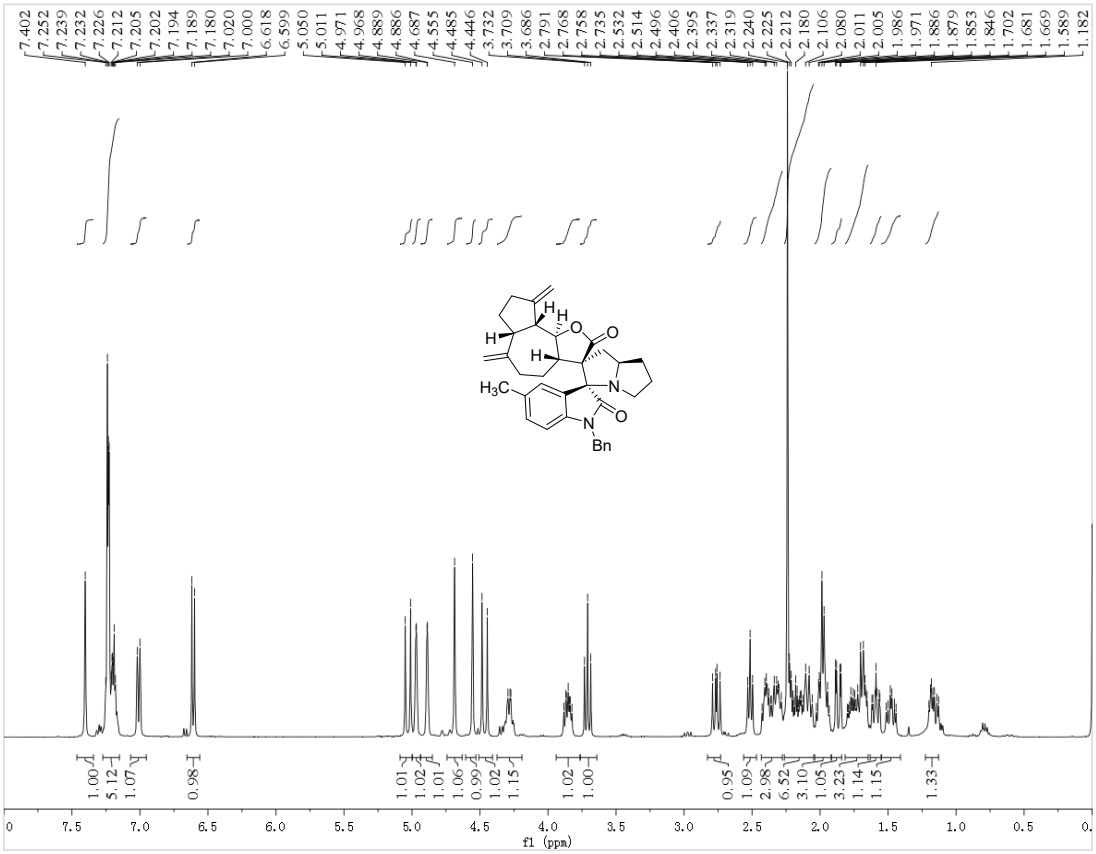


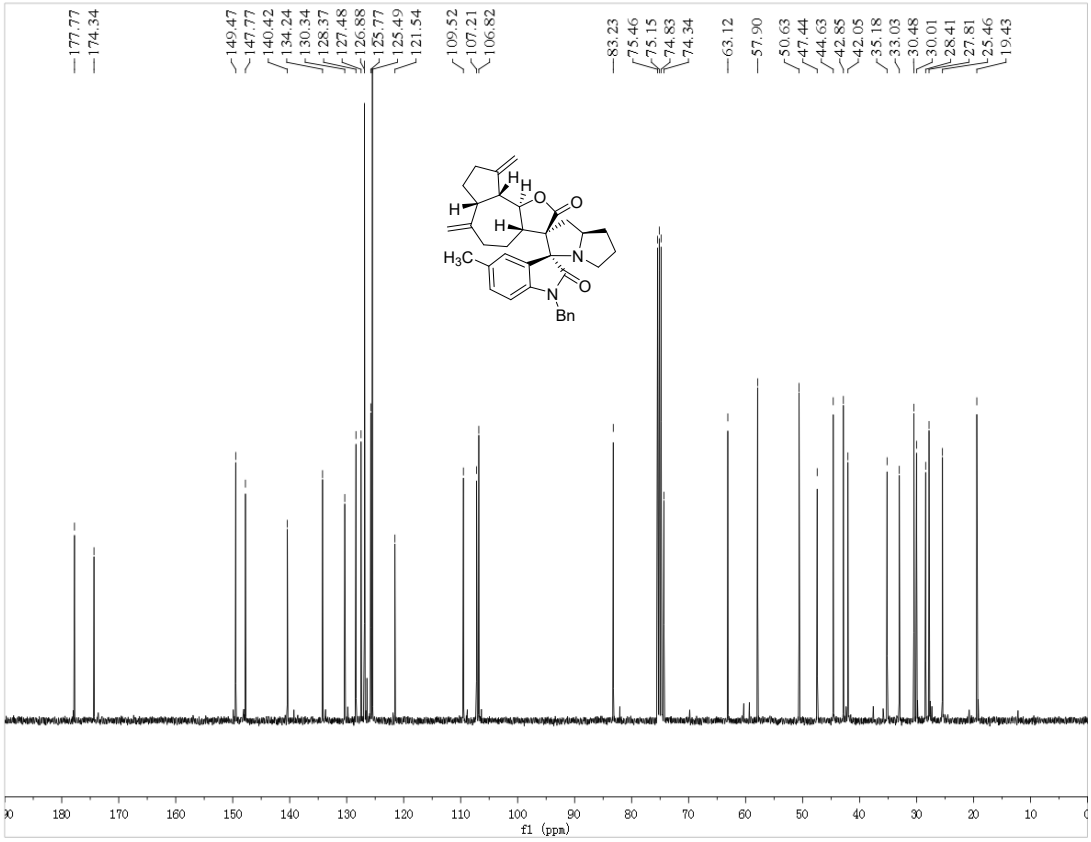
^{1}H and ^{13}C NMR of 3ak



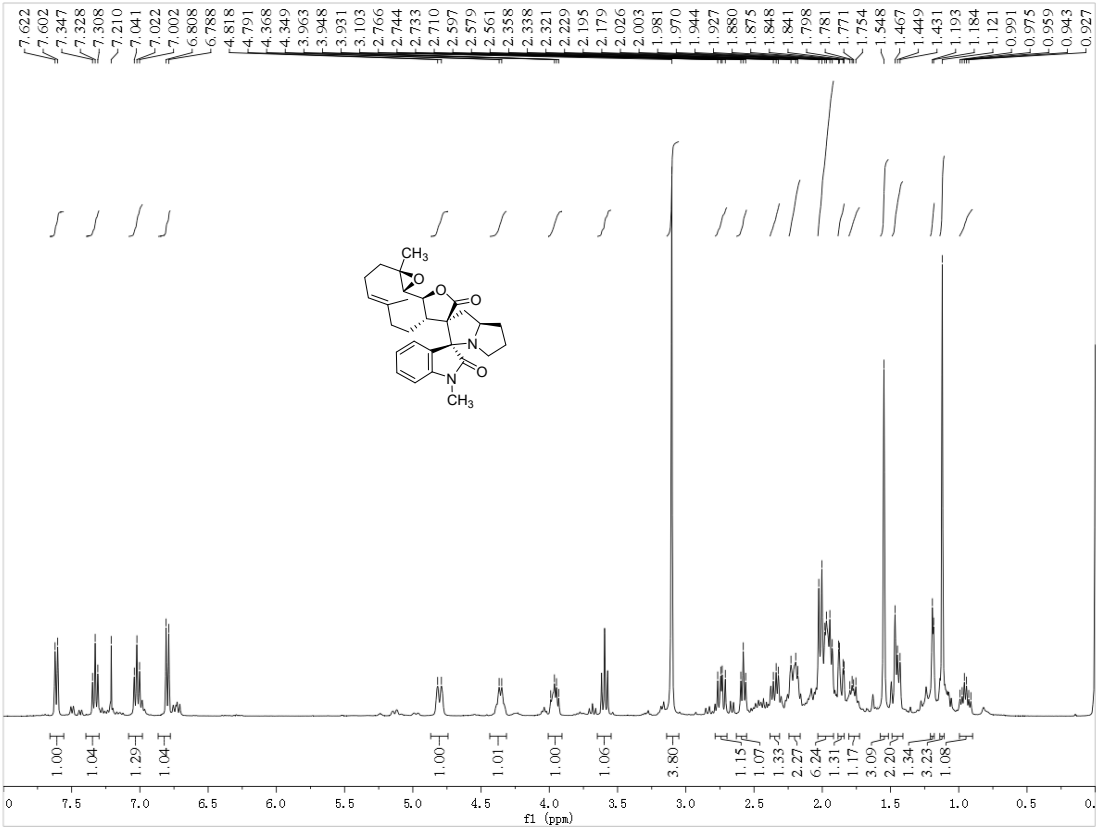


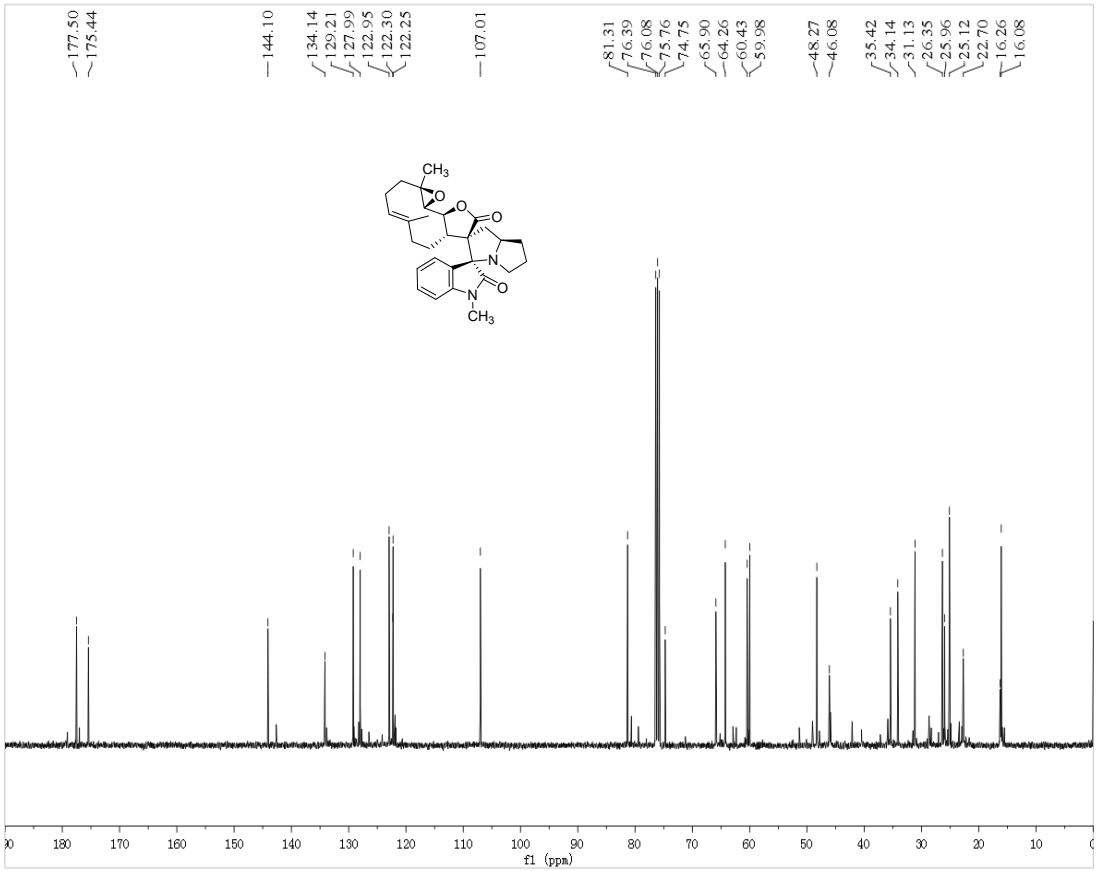
^{1}H and ^{13}C NMR of 3al



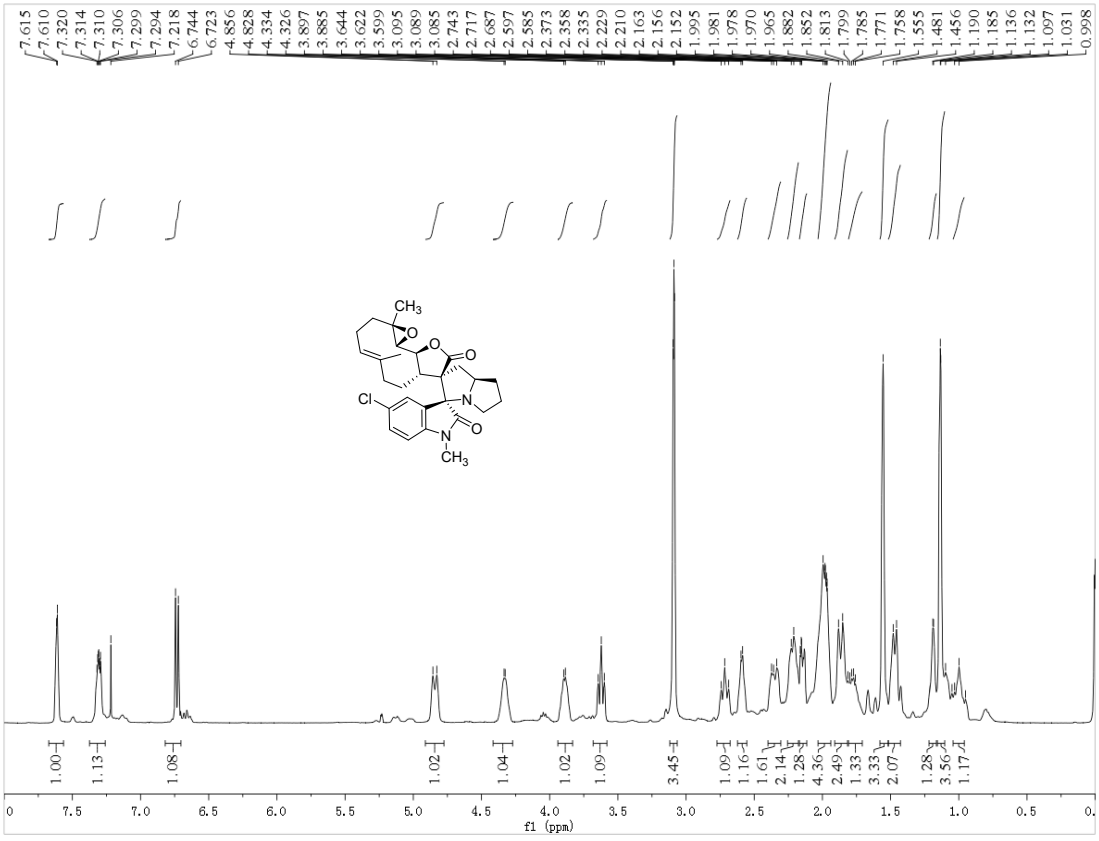


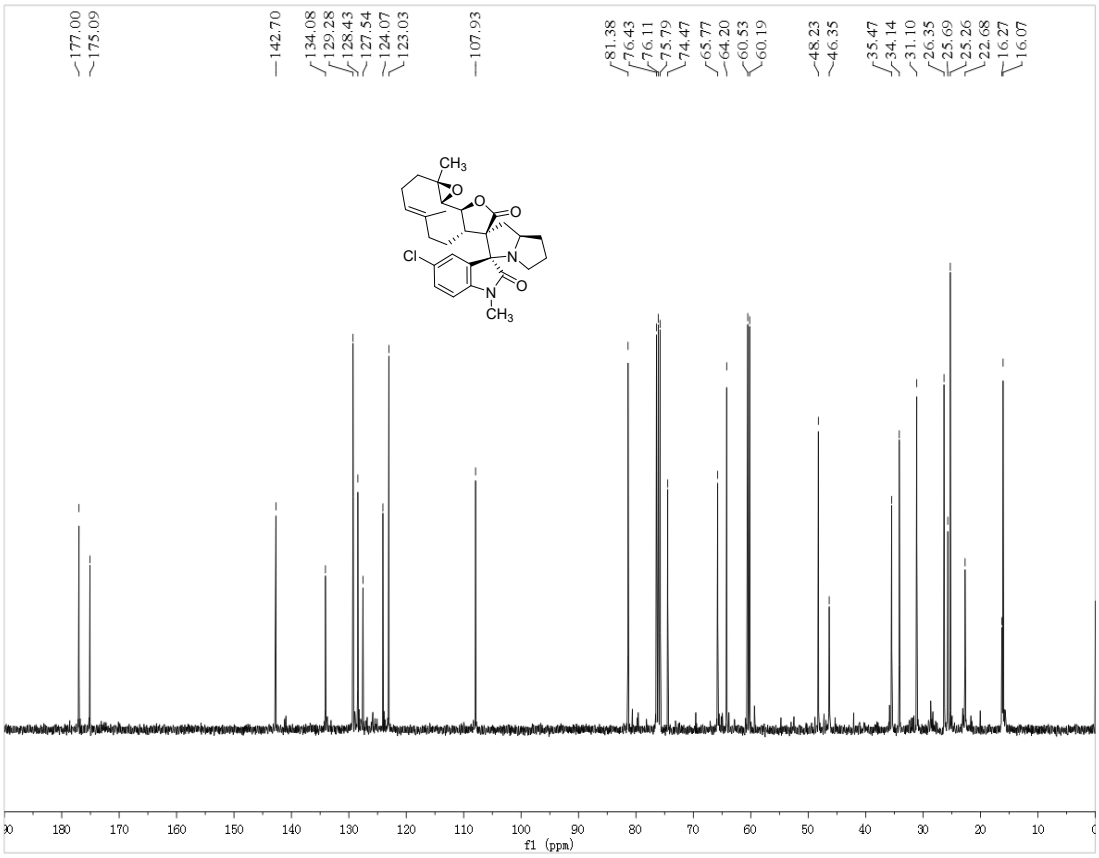
^{1}H and ^{13}C NMR of 3ba



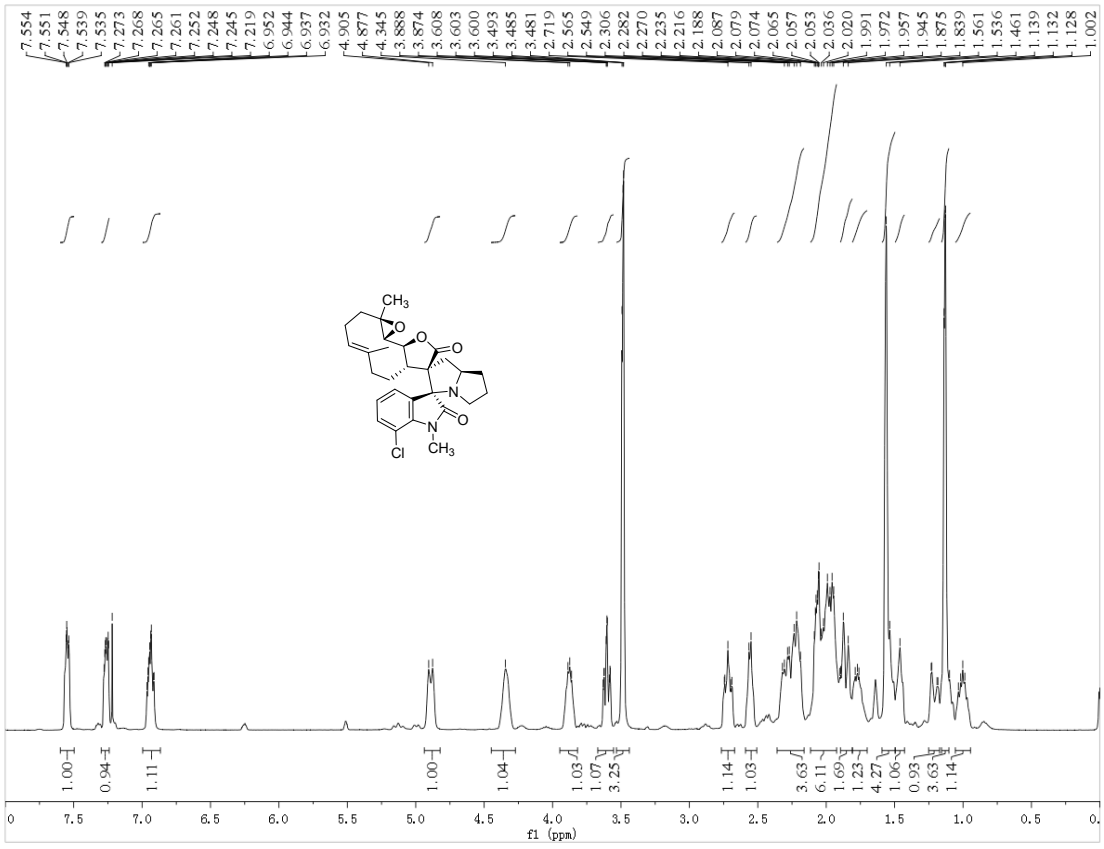


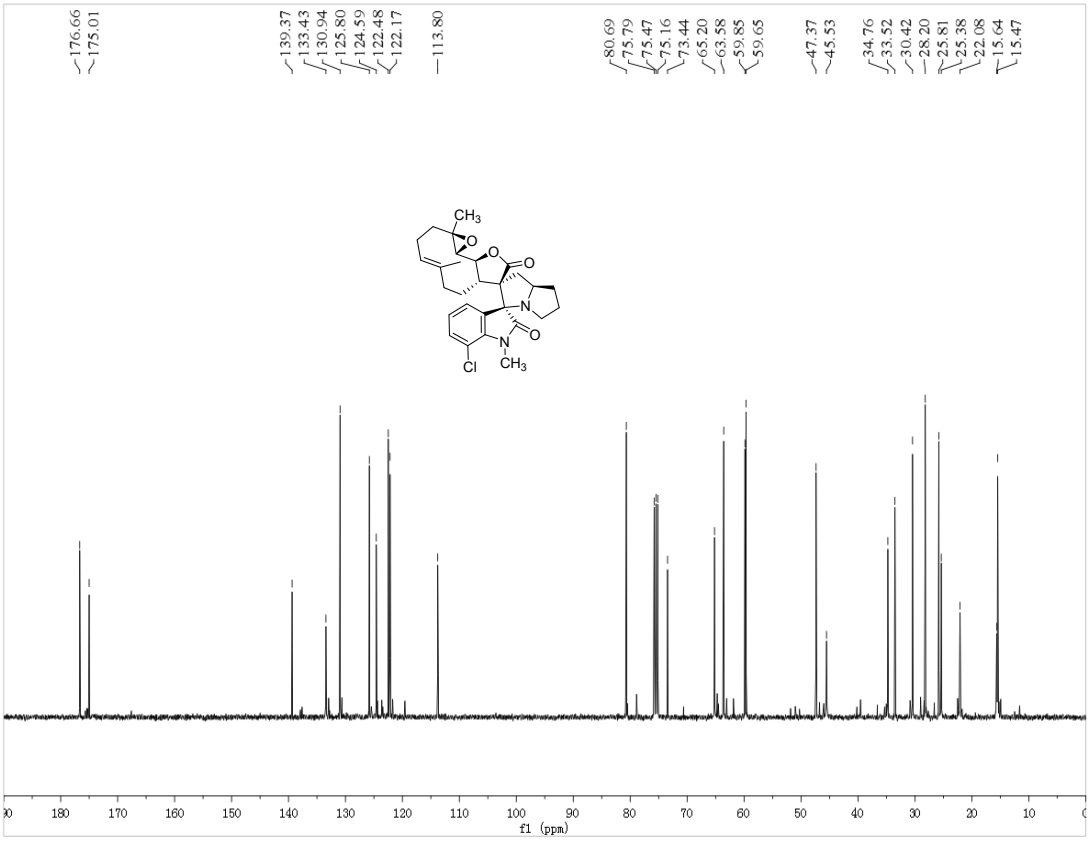
^{1}H and ^{13}C NMR of 3bb



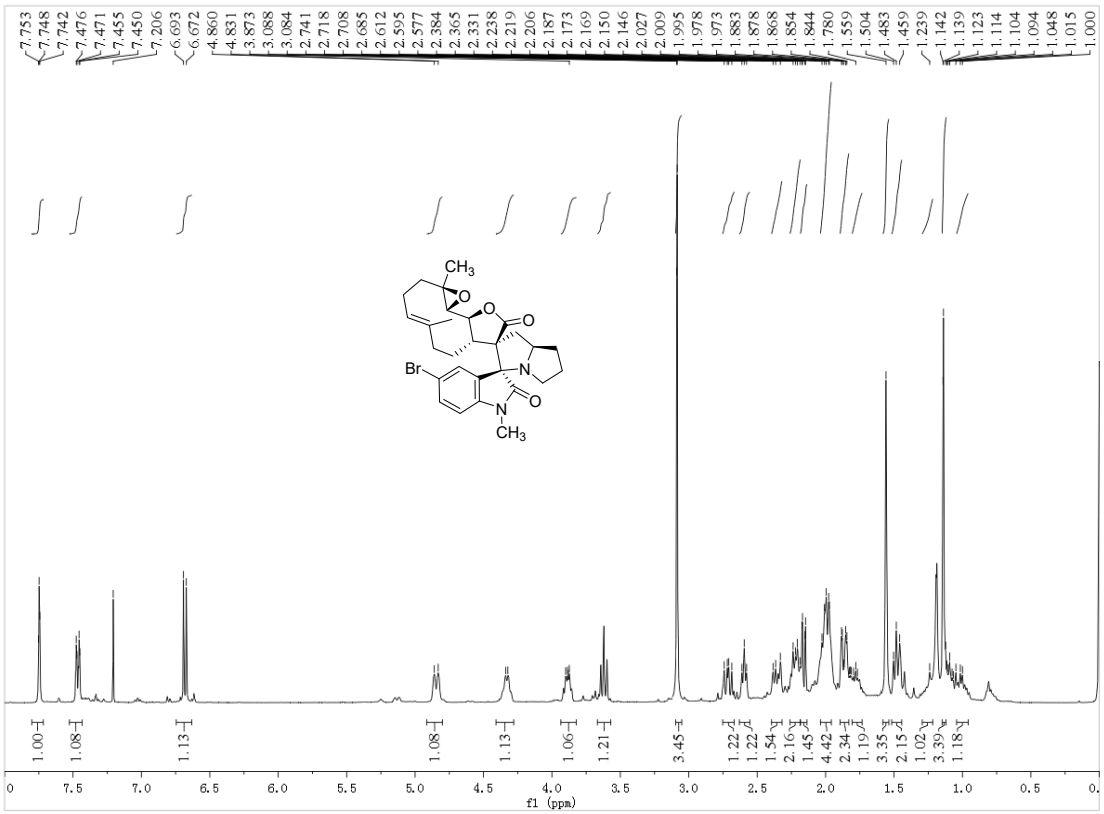


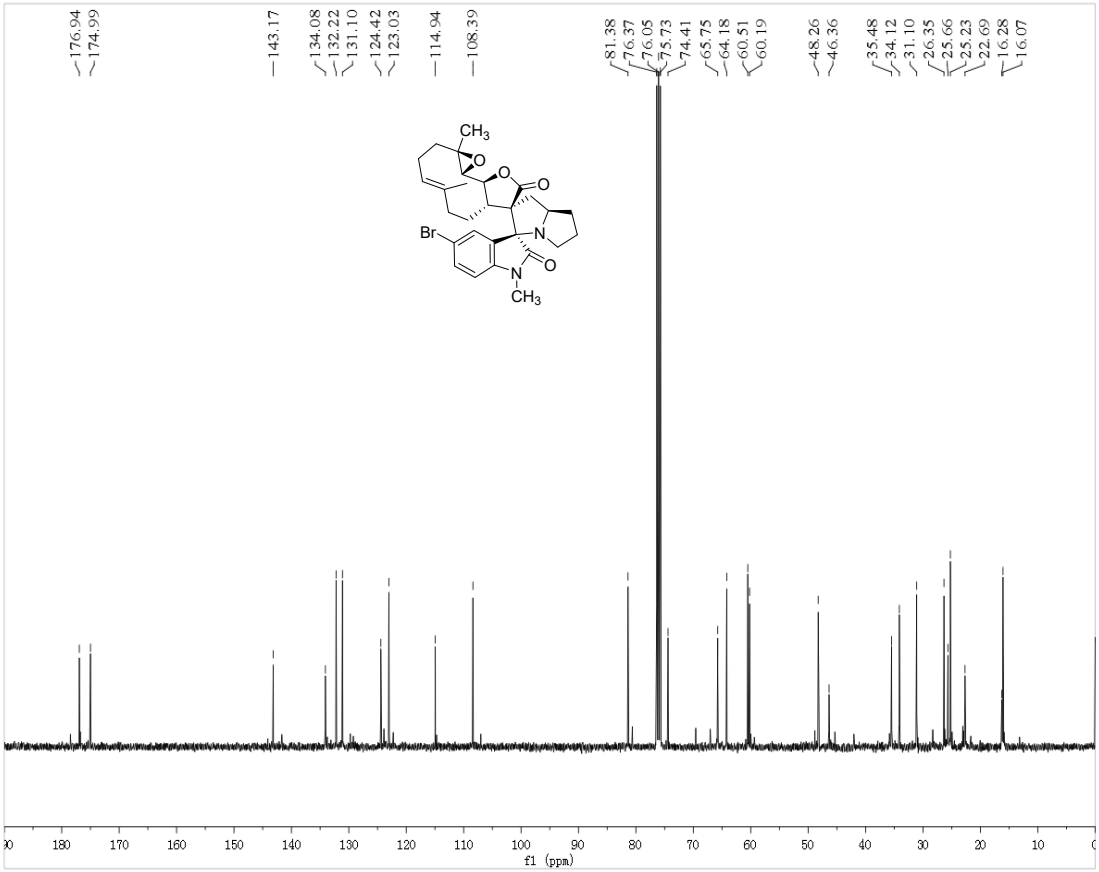
^{1}H and ^{13}C NMR of 3bc



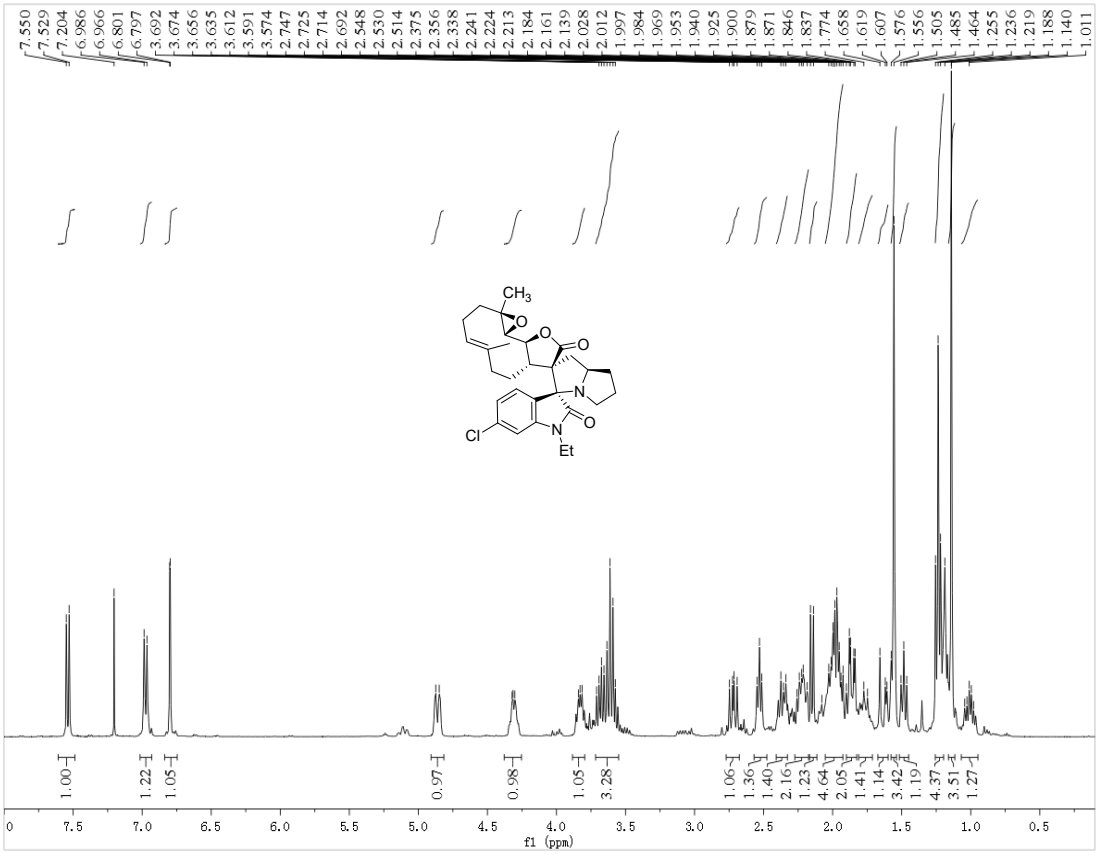


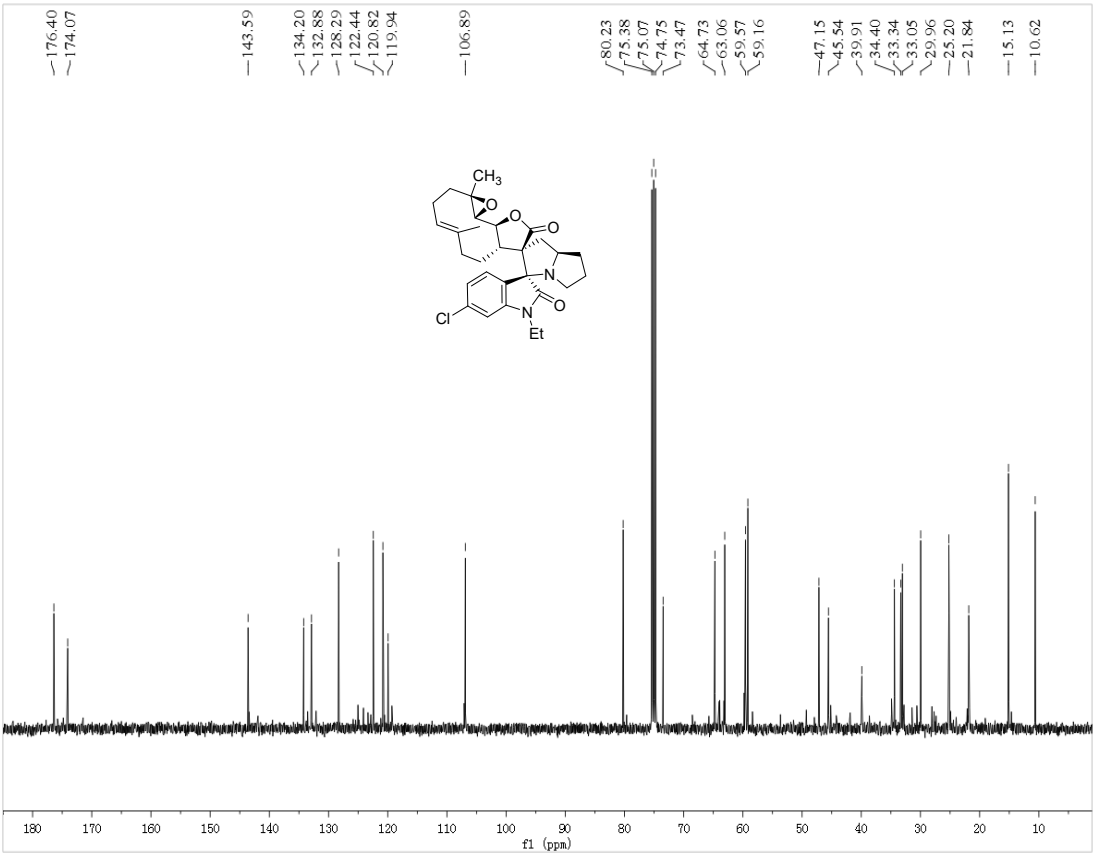
^{1}H and ^{13}C NMR of 3bd



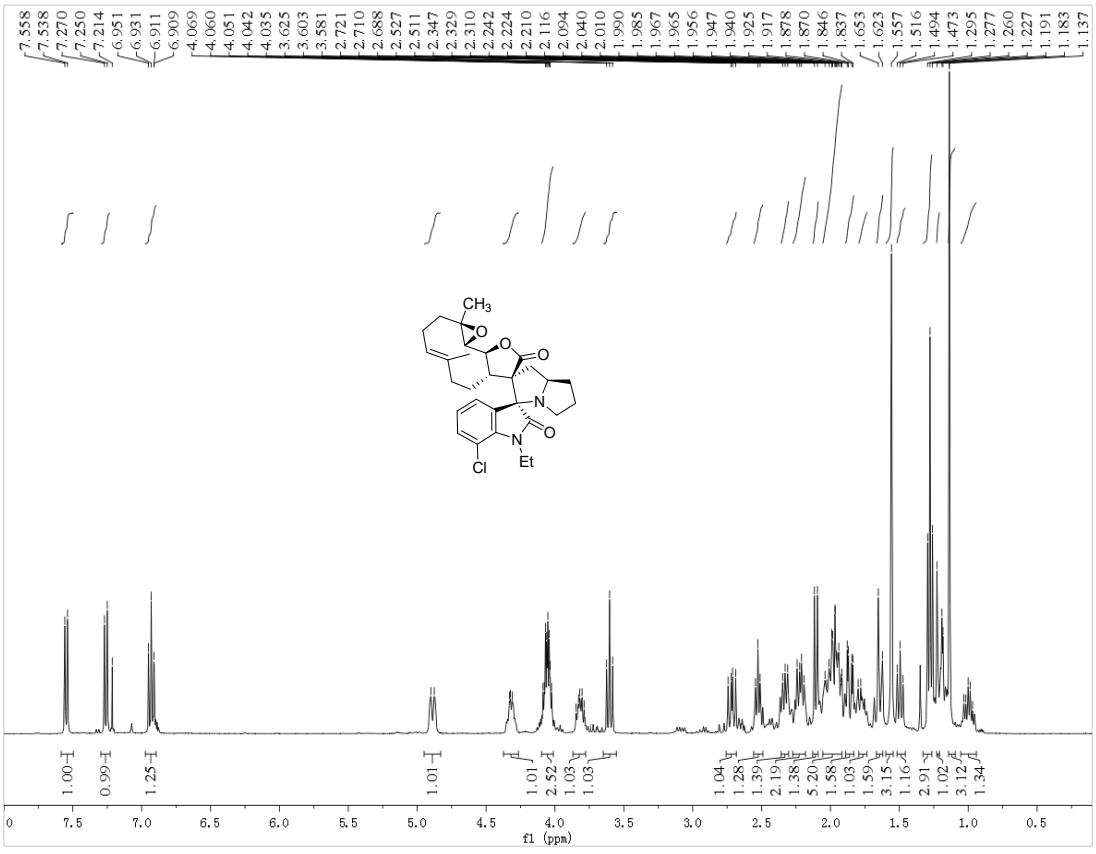


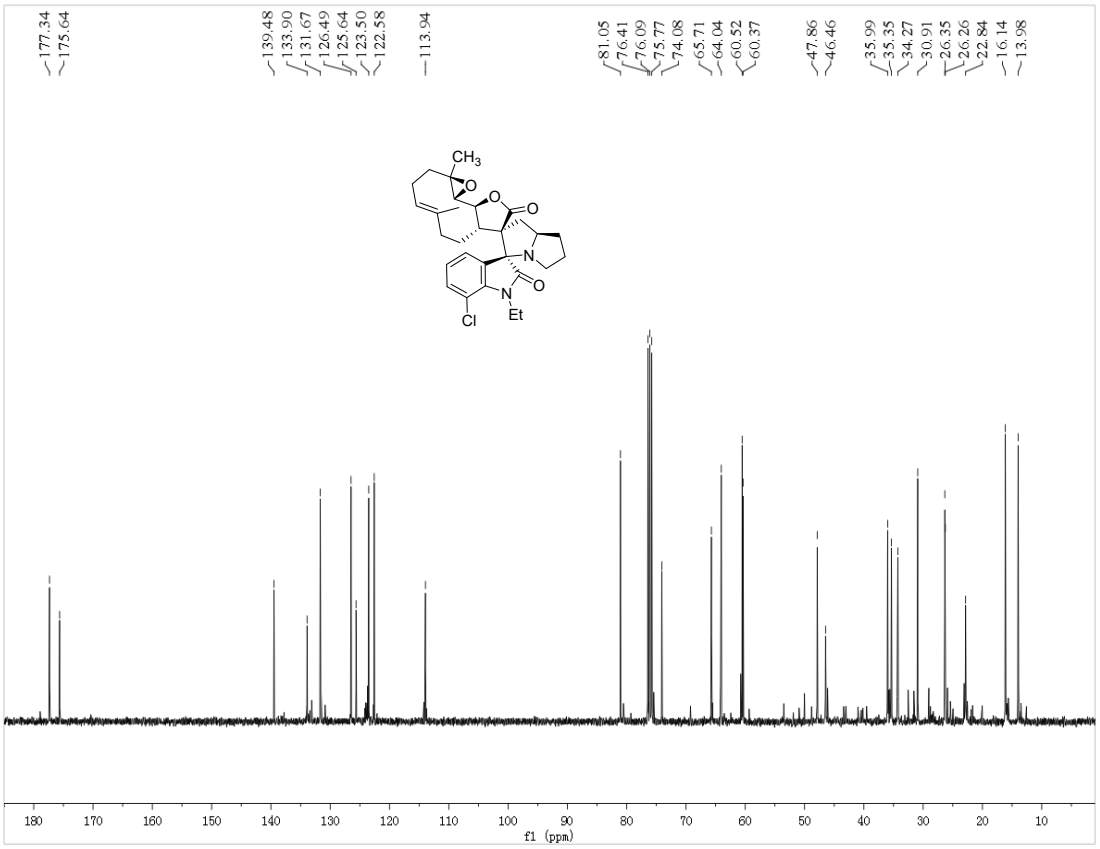
^{1}H and ^{13}C NMR of 3be



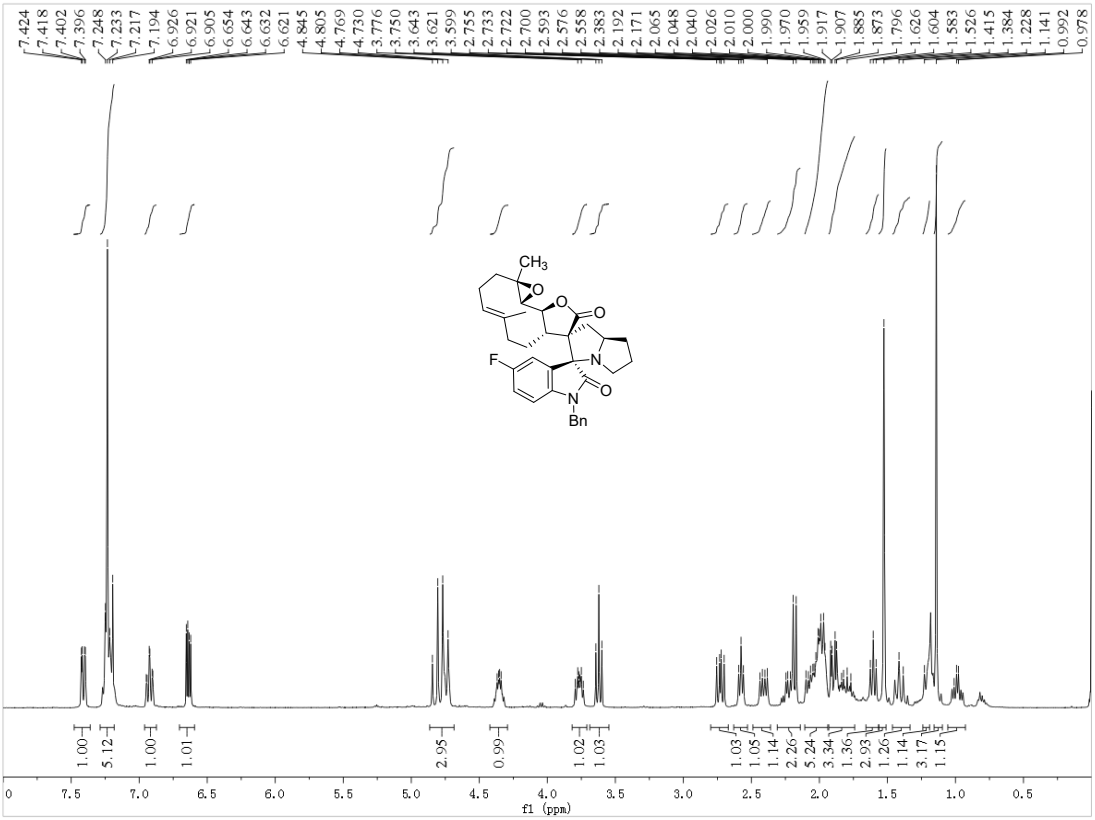


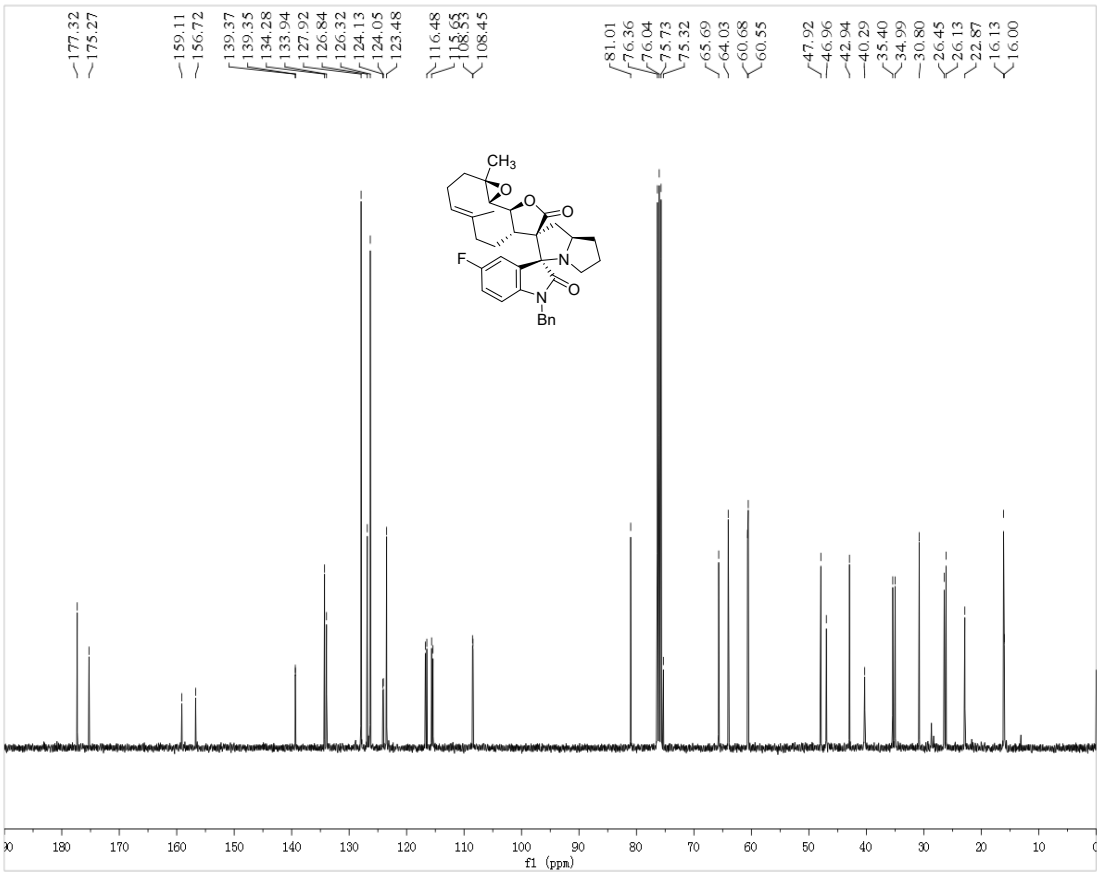
^{1}H and ^{13}C NMR of 3bf



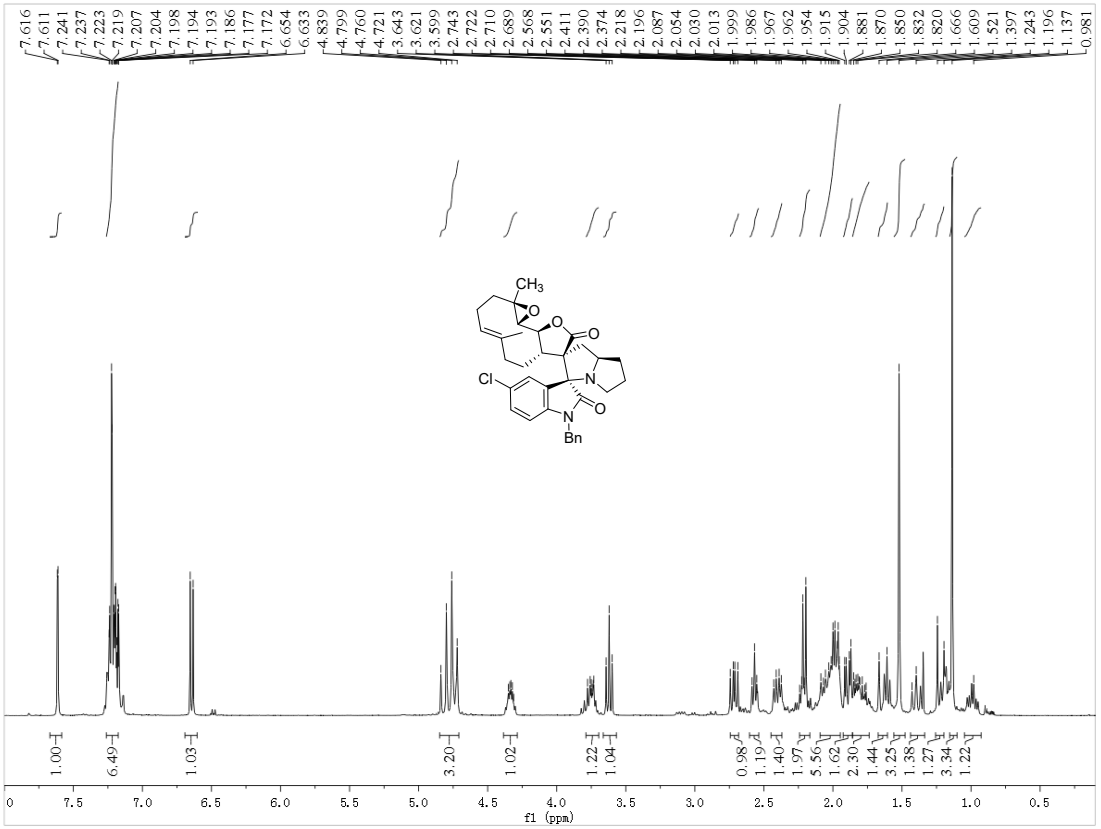


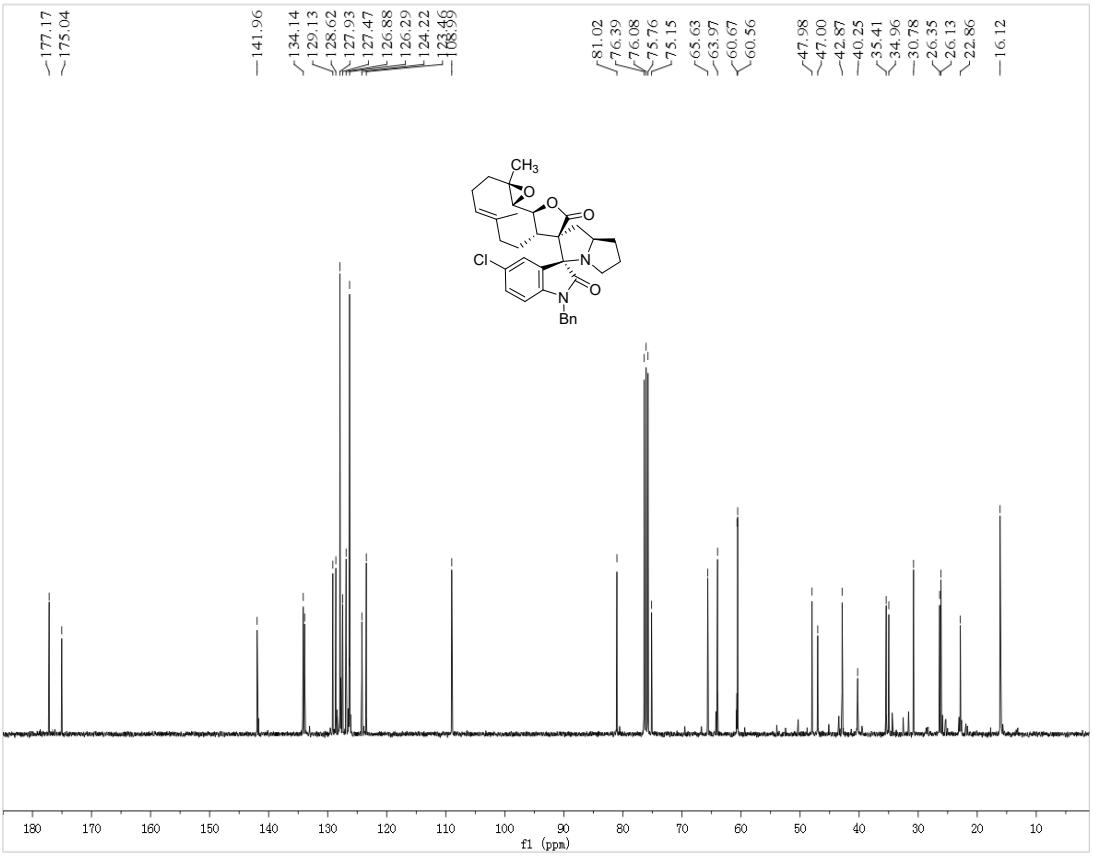
^{1}H and ^{13}C NMR of 3bg



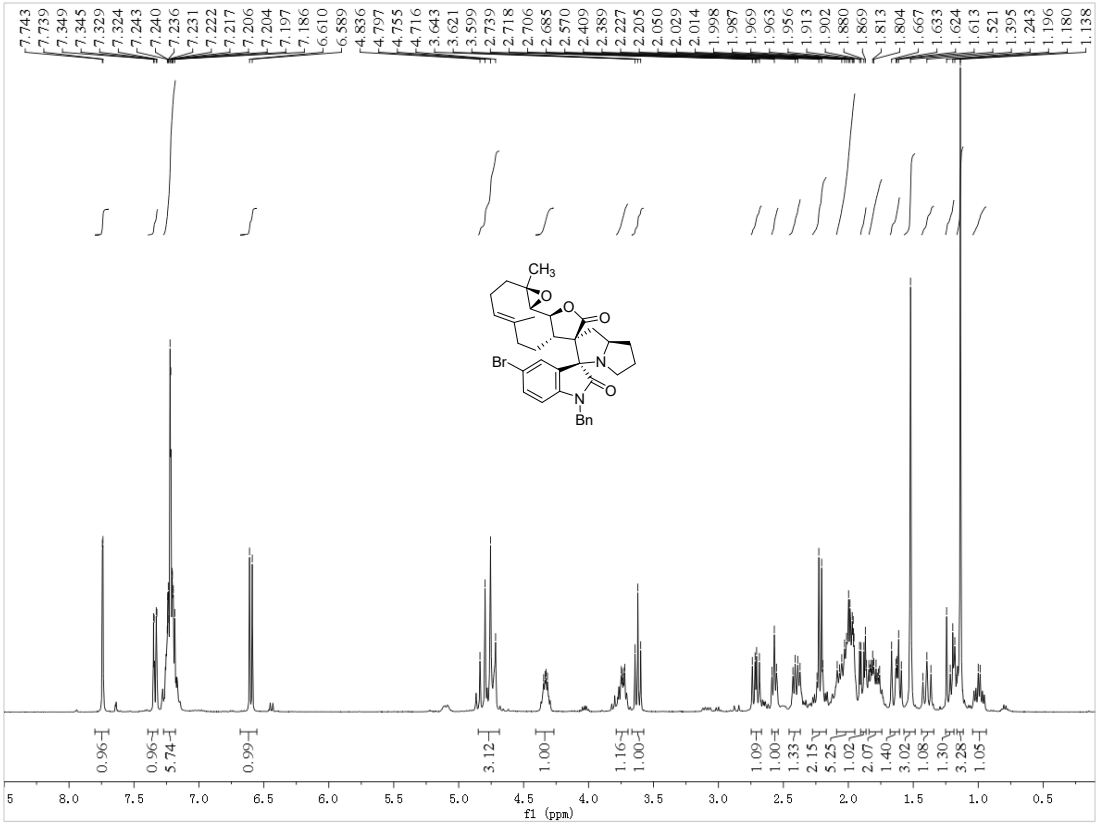


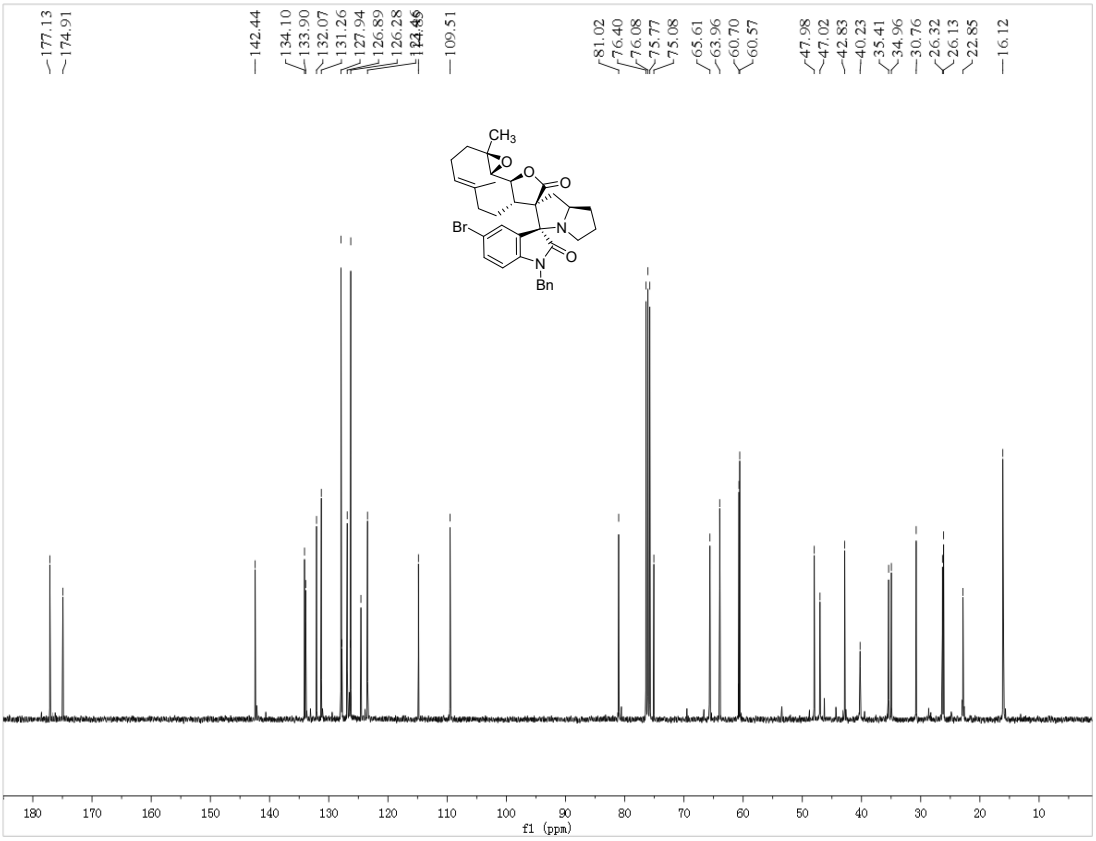
^{1}H and ^{13}C NMR of 3bh



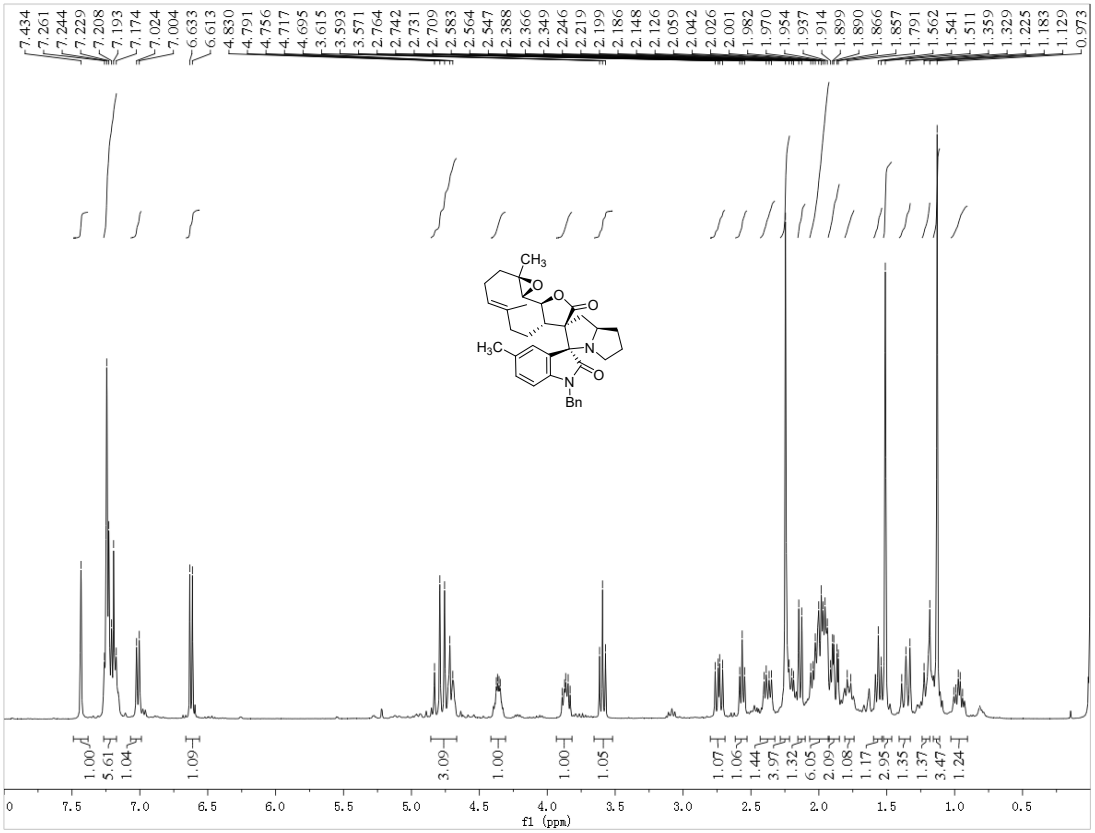


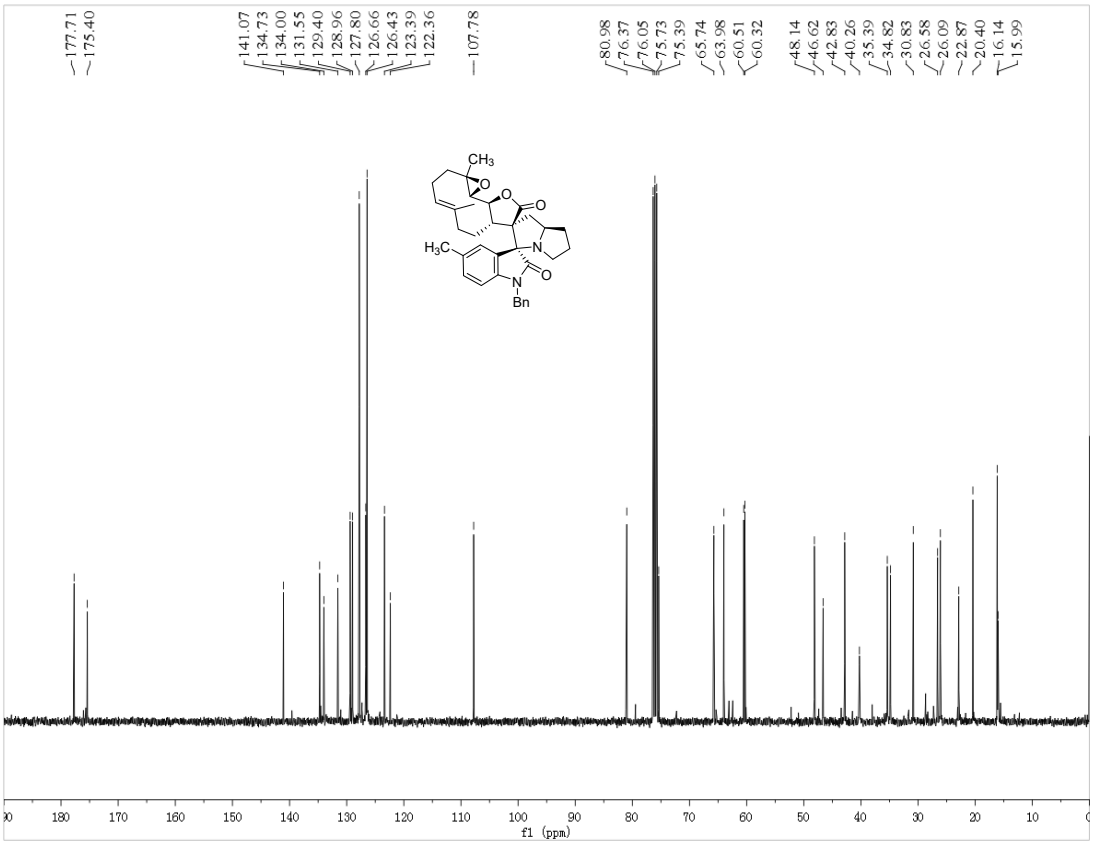
^{1}H and ^{13}C NMR of 3bi



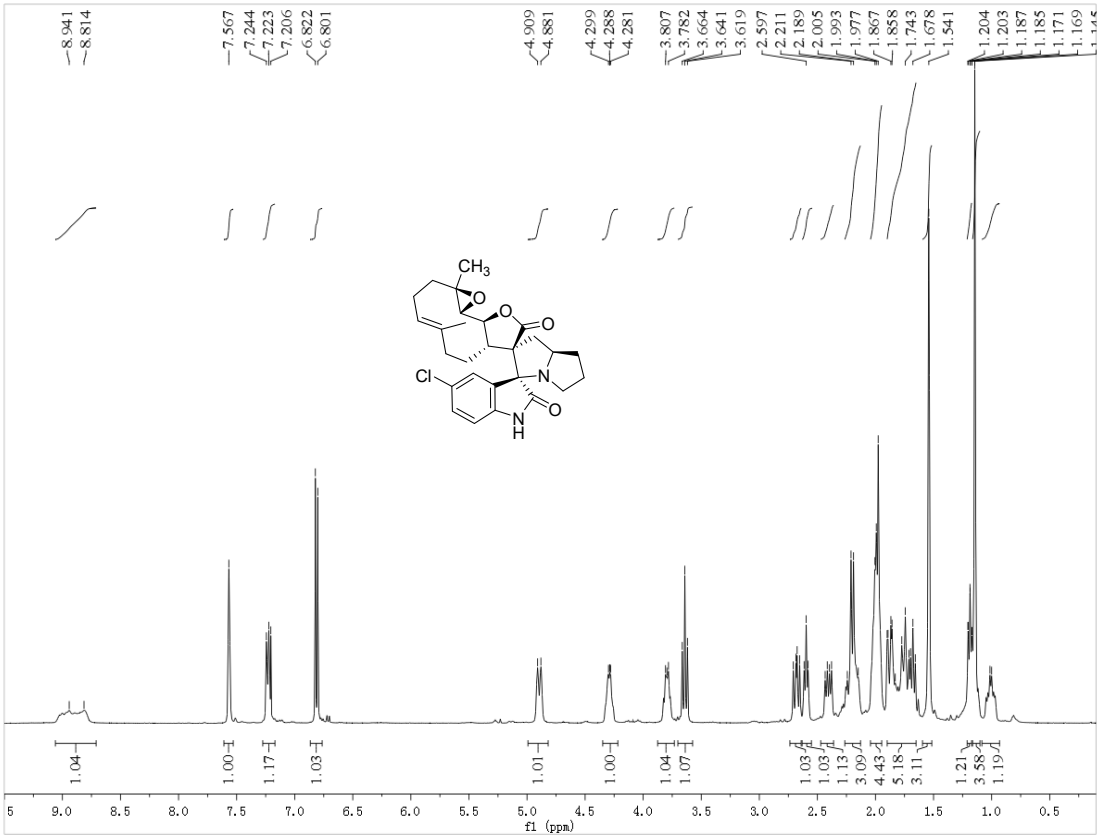


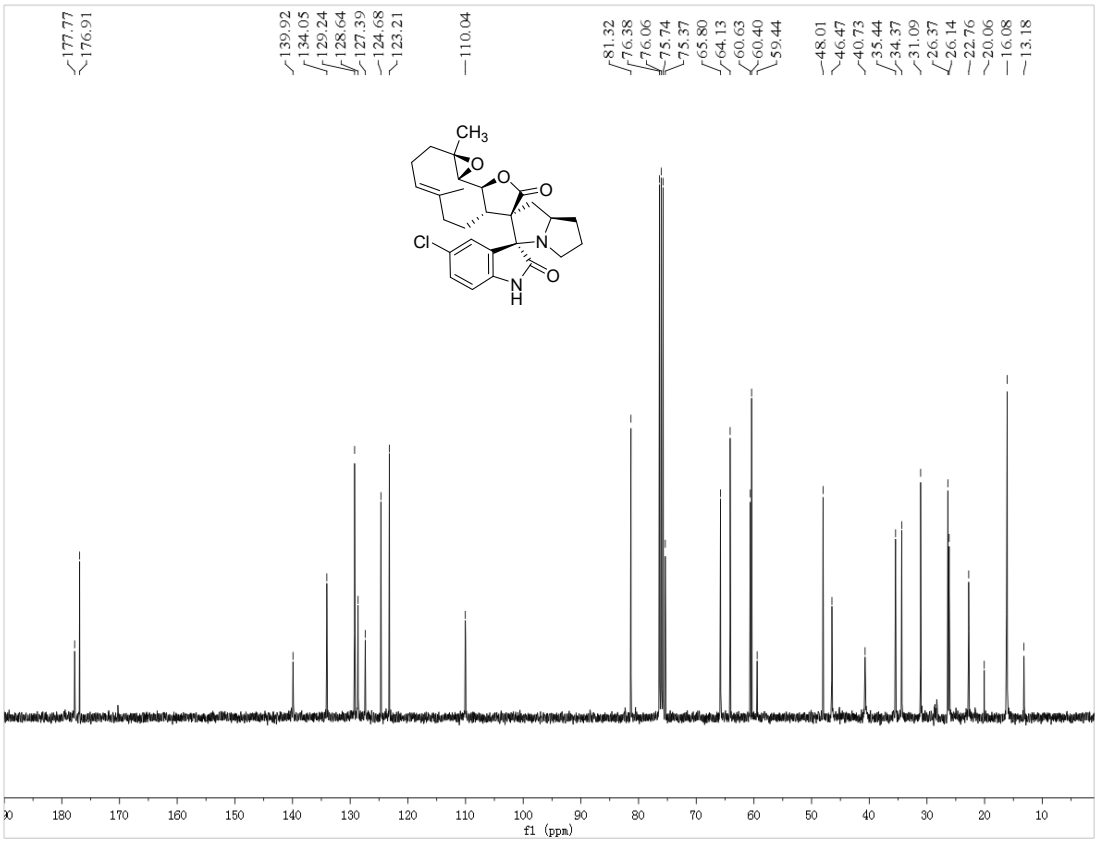
^{1}H and ^{13}C NMR of 3bj



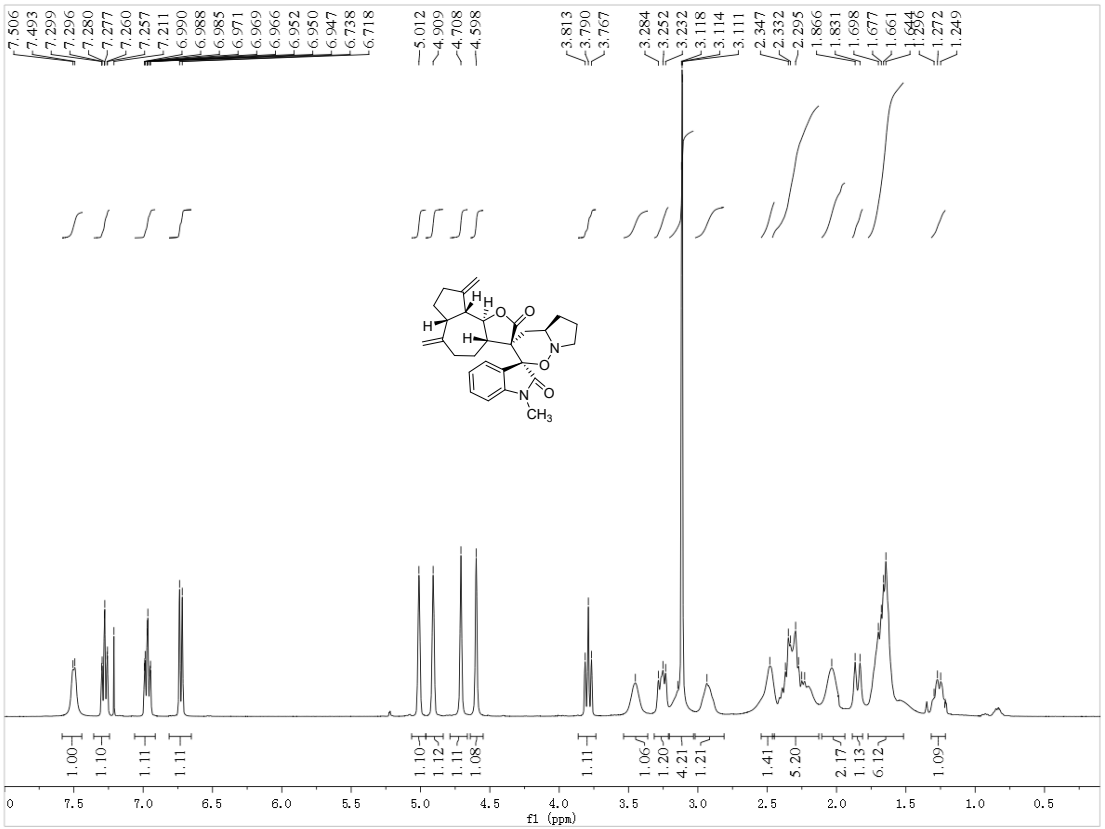


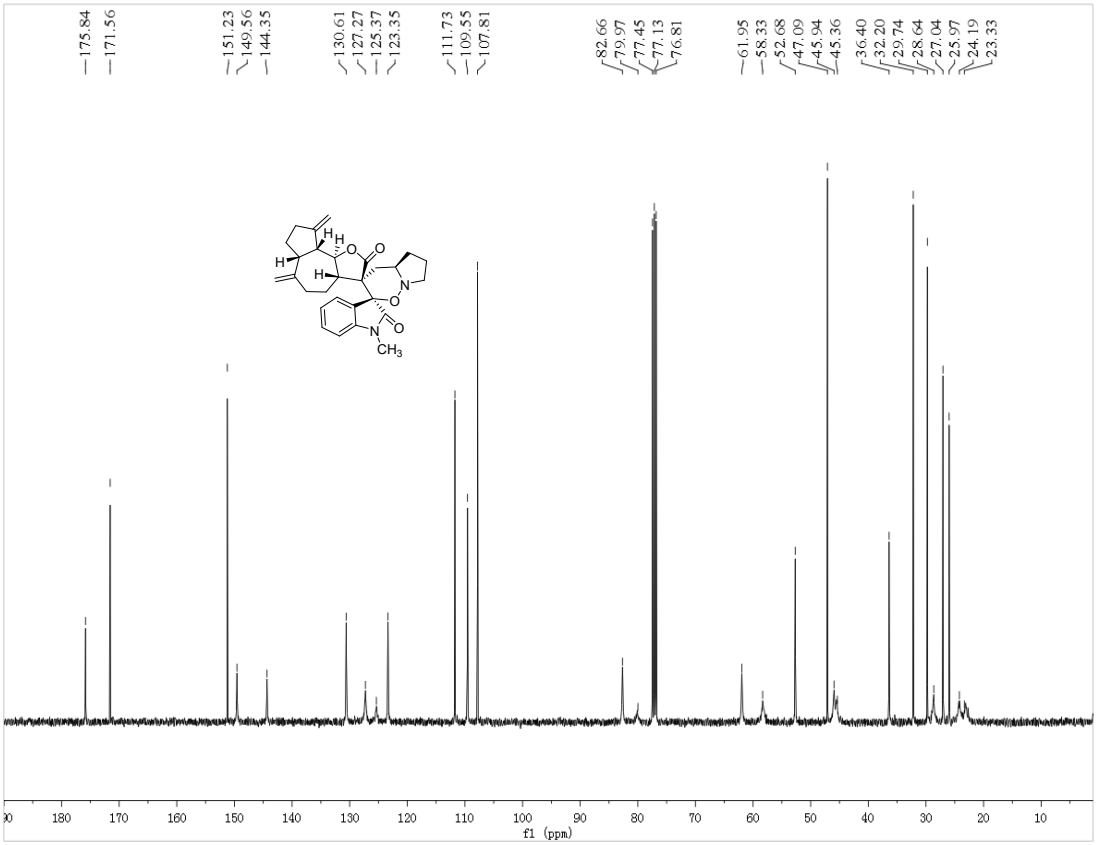
^{1}H and ^{13}C NMR of 3bk



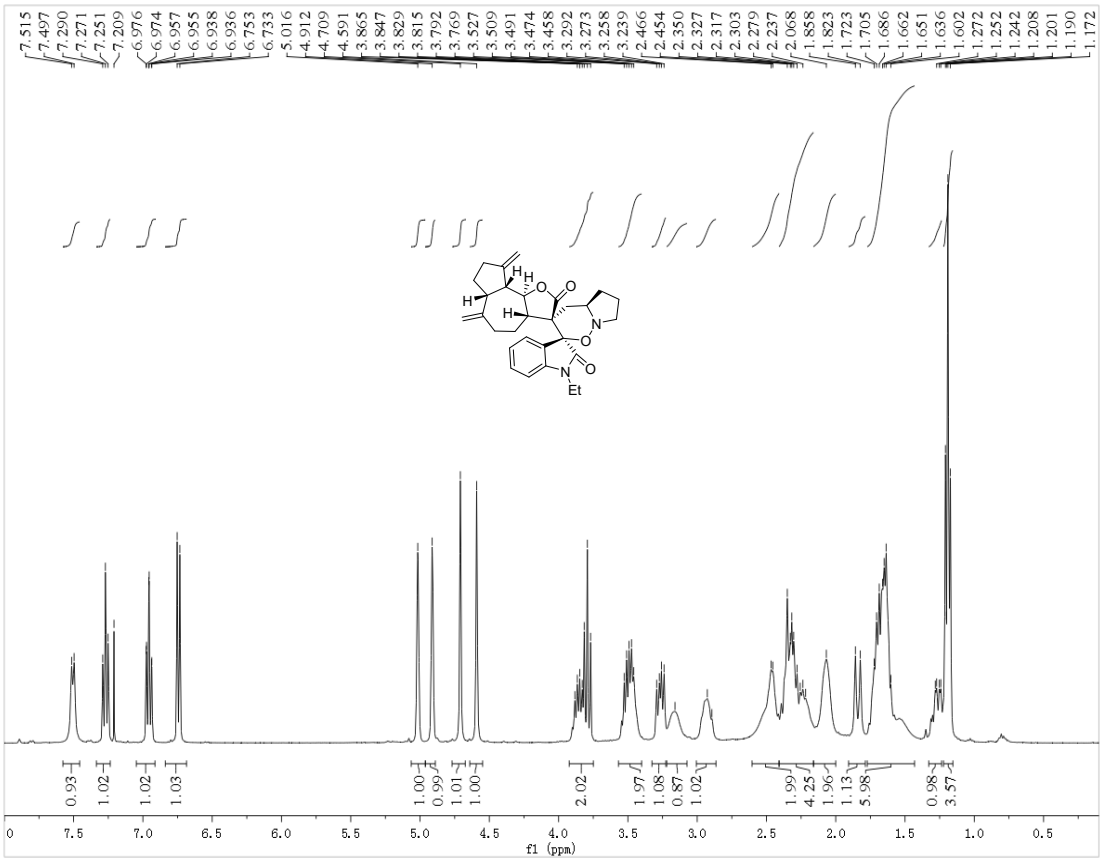


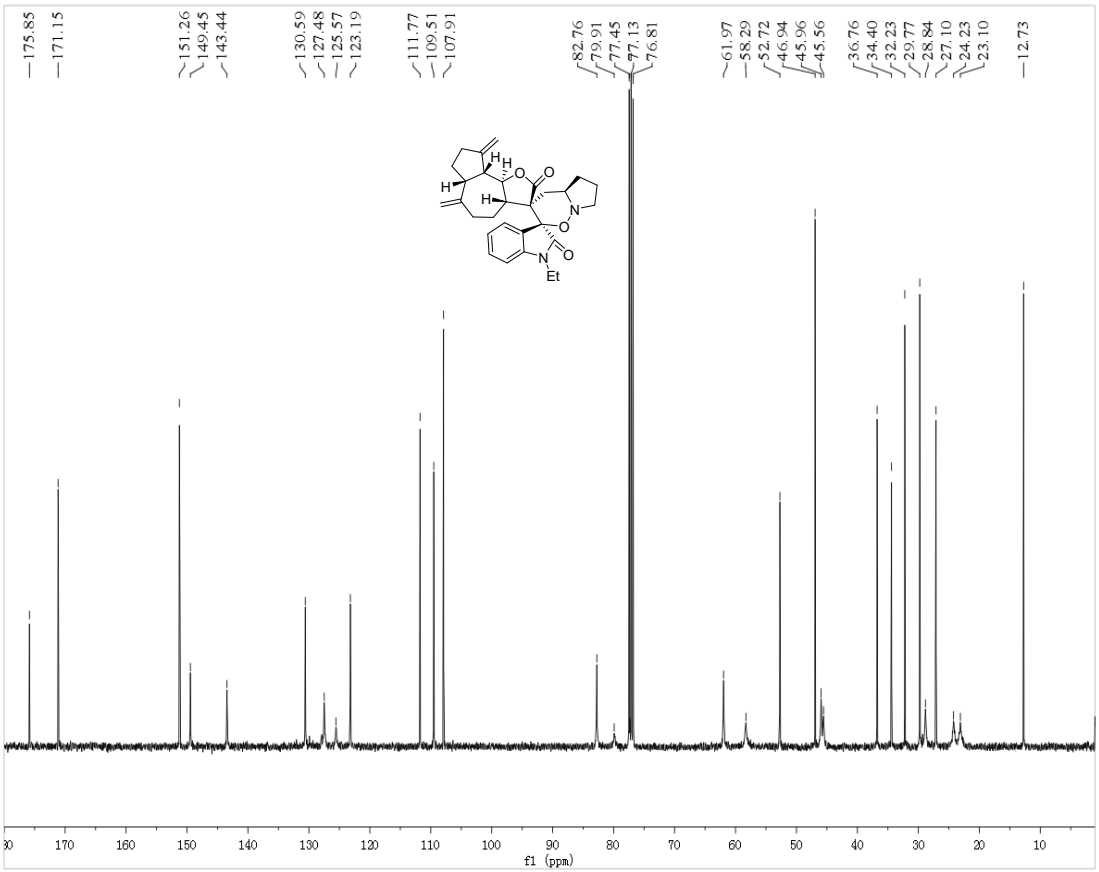
^{1}H and ^{13}C NMR of 4aa



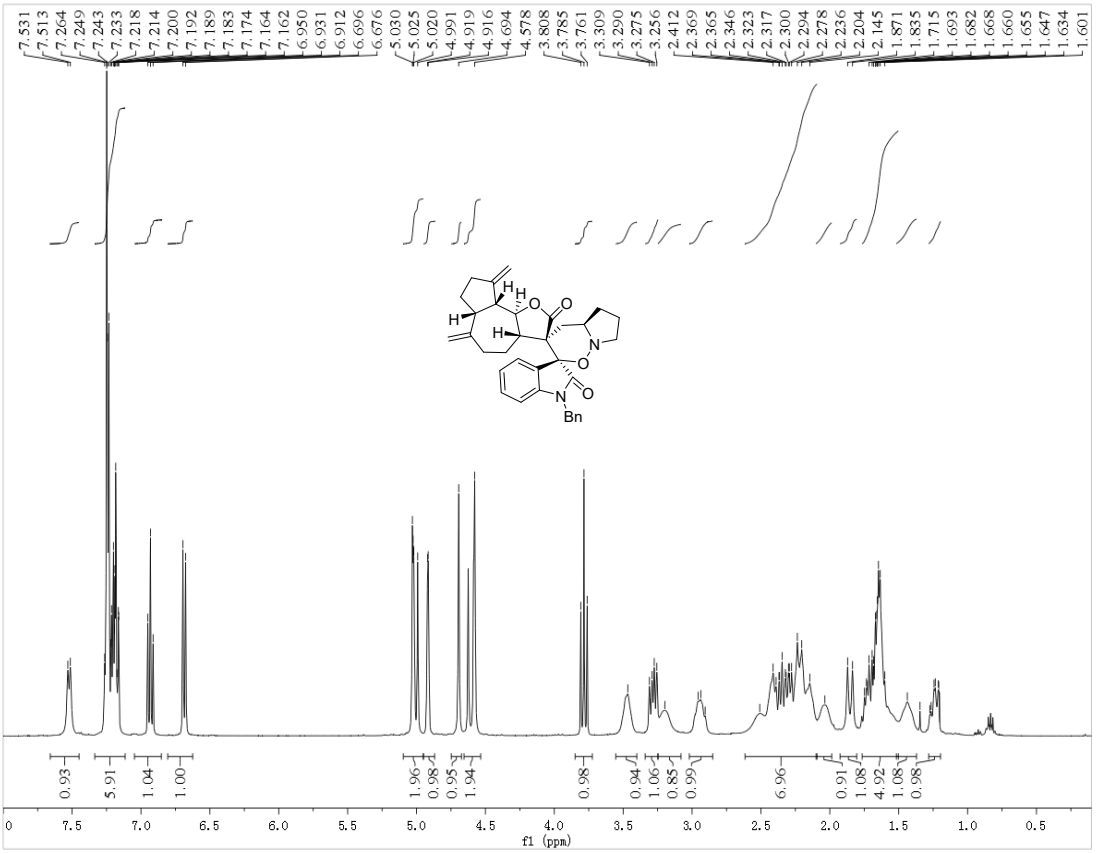


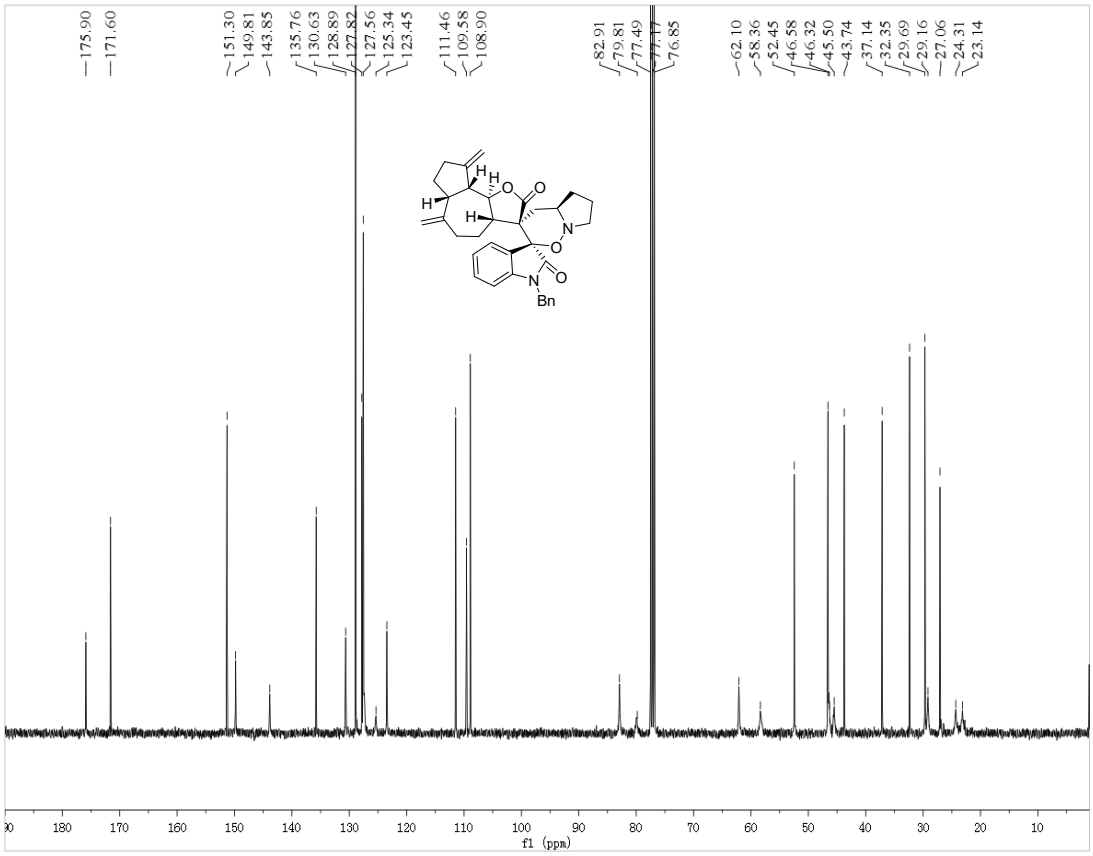
^{1}H and ^{13}C NMR of 4ab



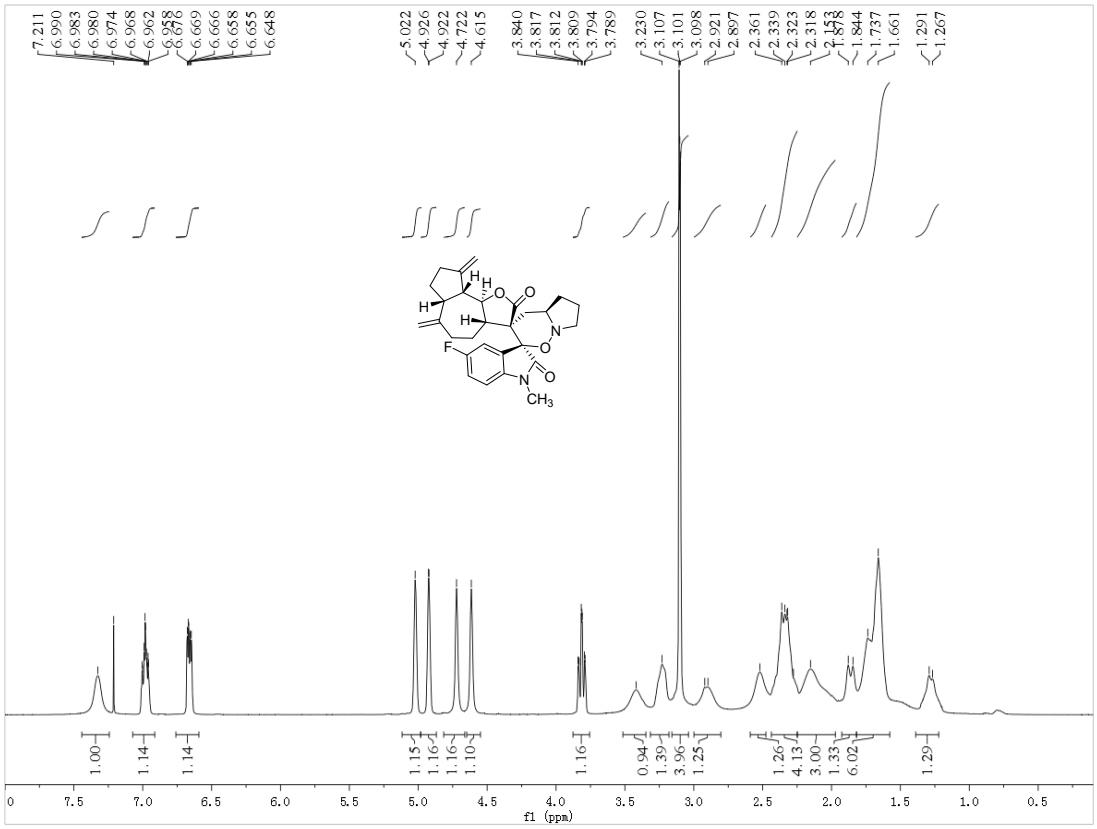


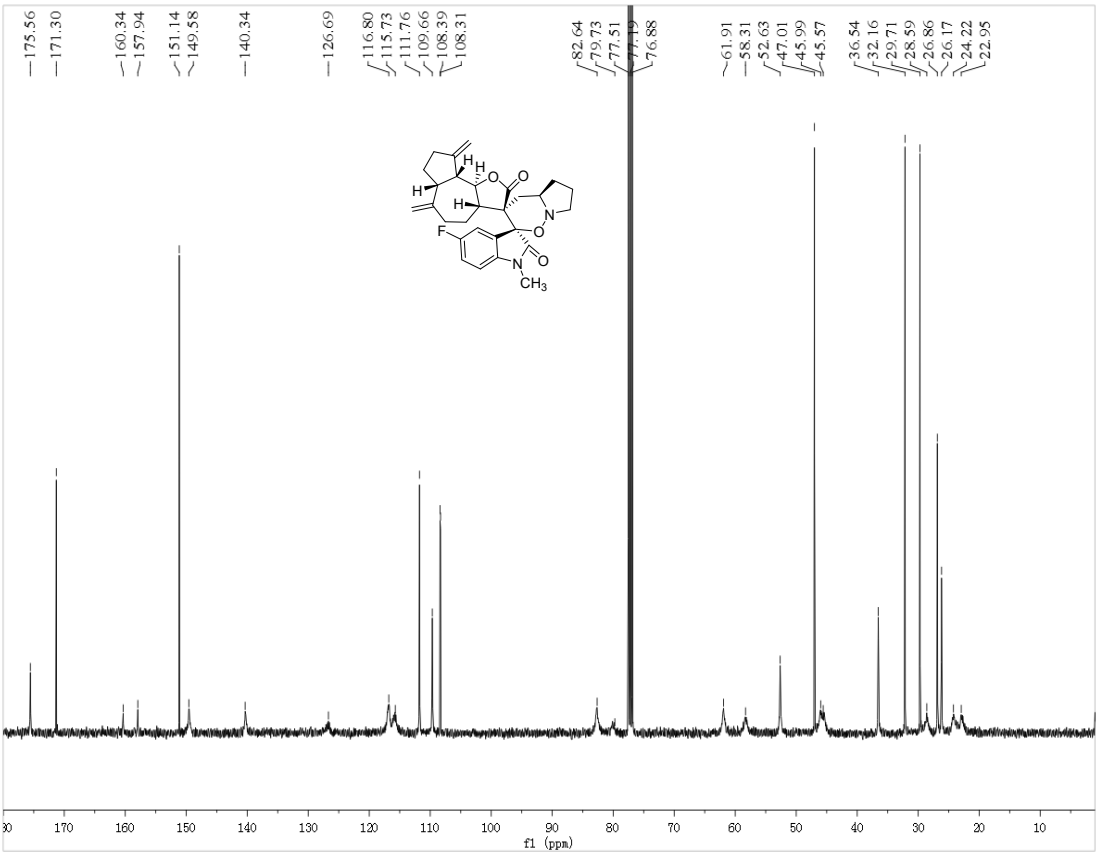
^{1}H and ^{13}C NMR of 4ac



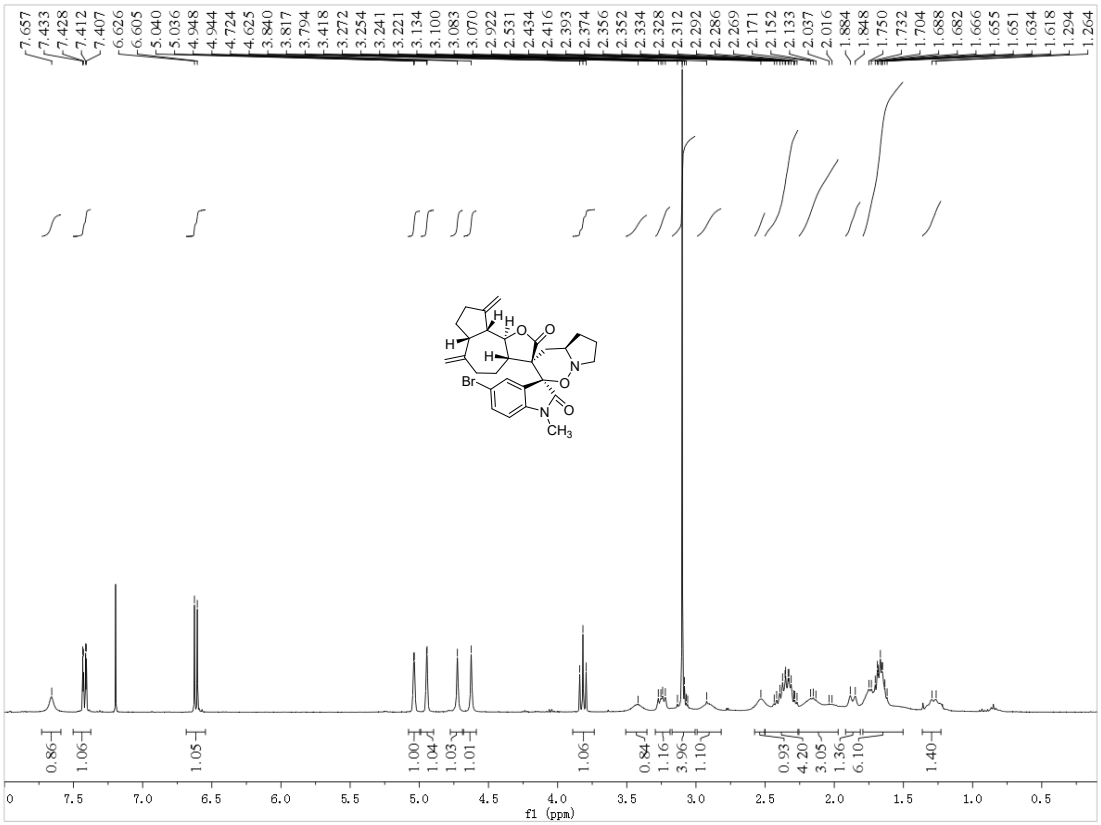


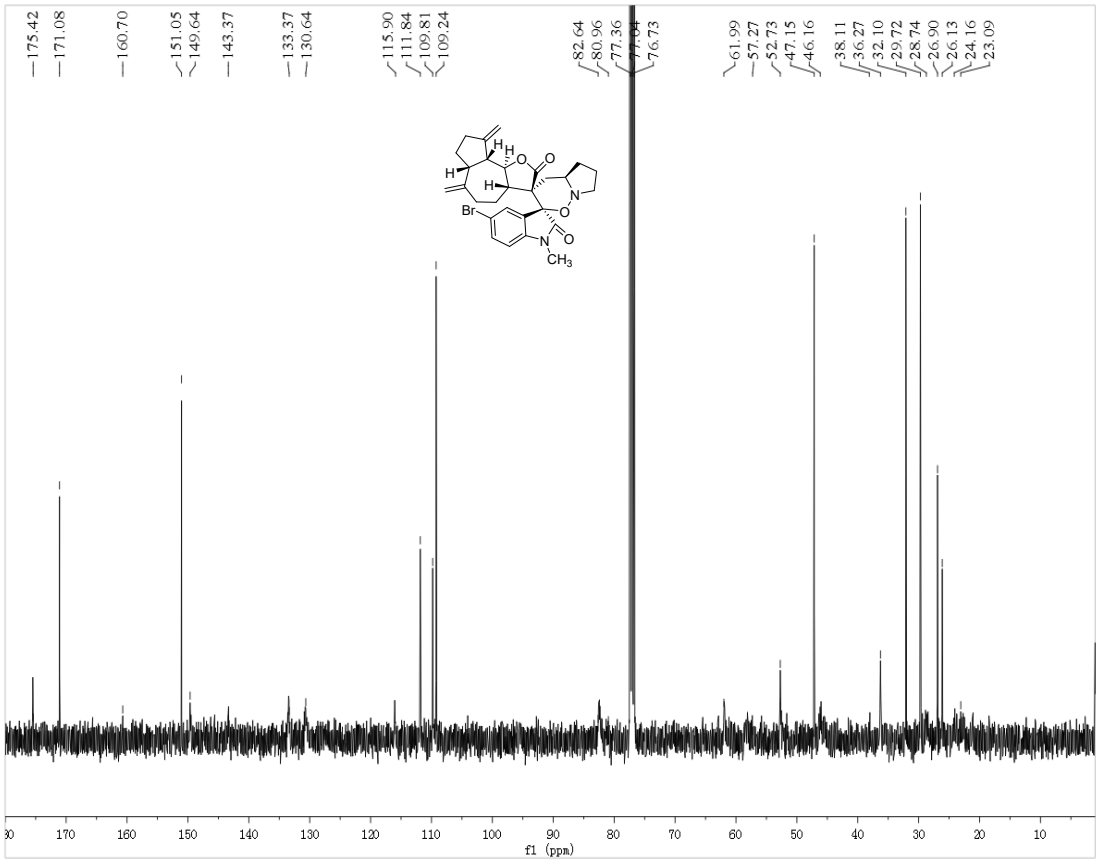
^{1}H and ^{13}C NMR of 4ad



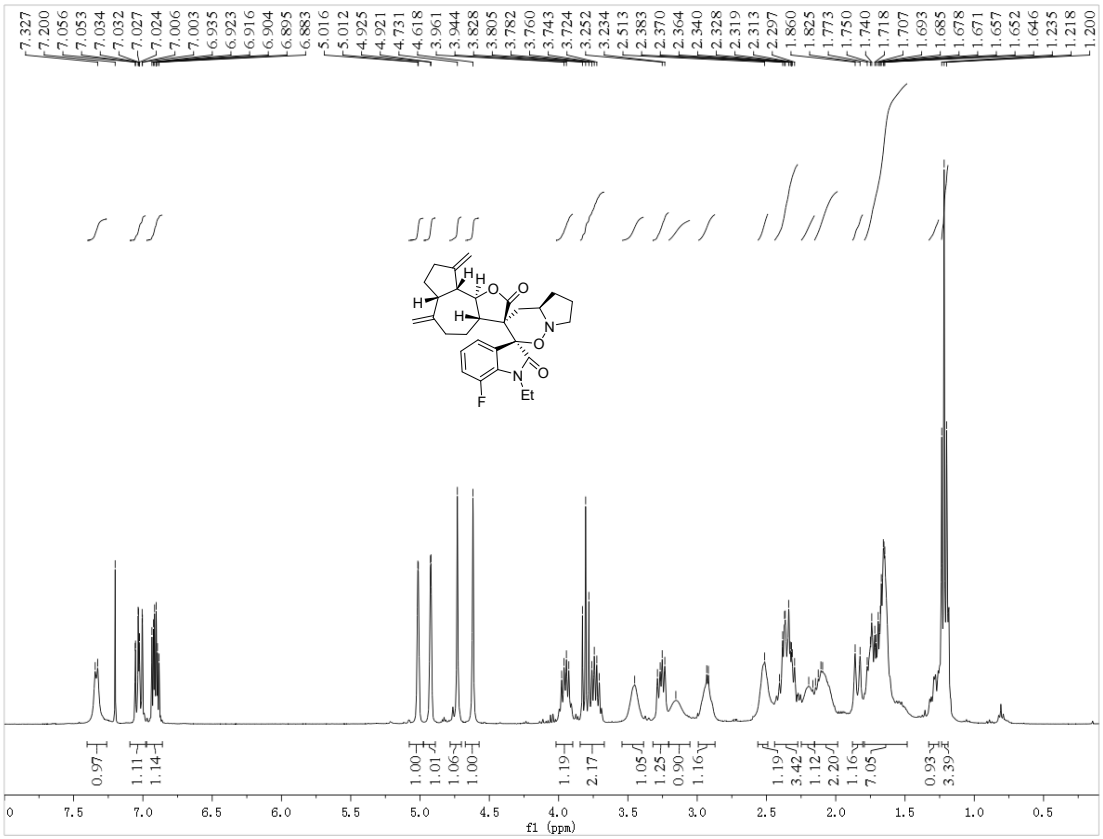


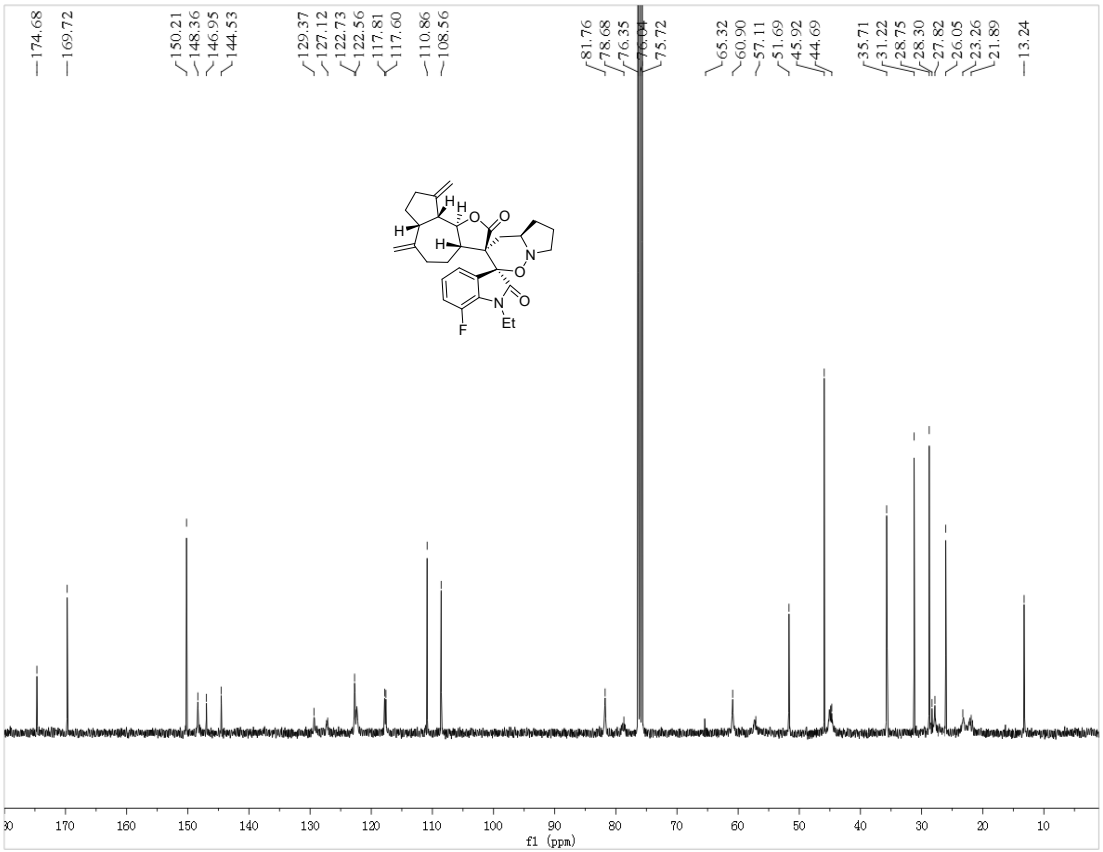
^{1}H and ^{13}C NMR of 4ae



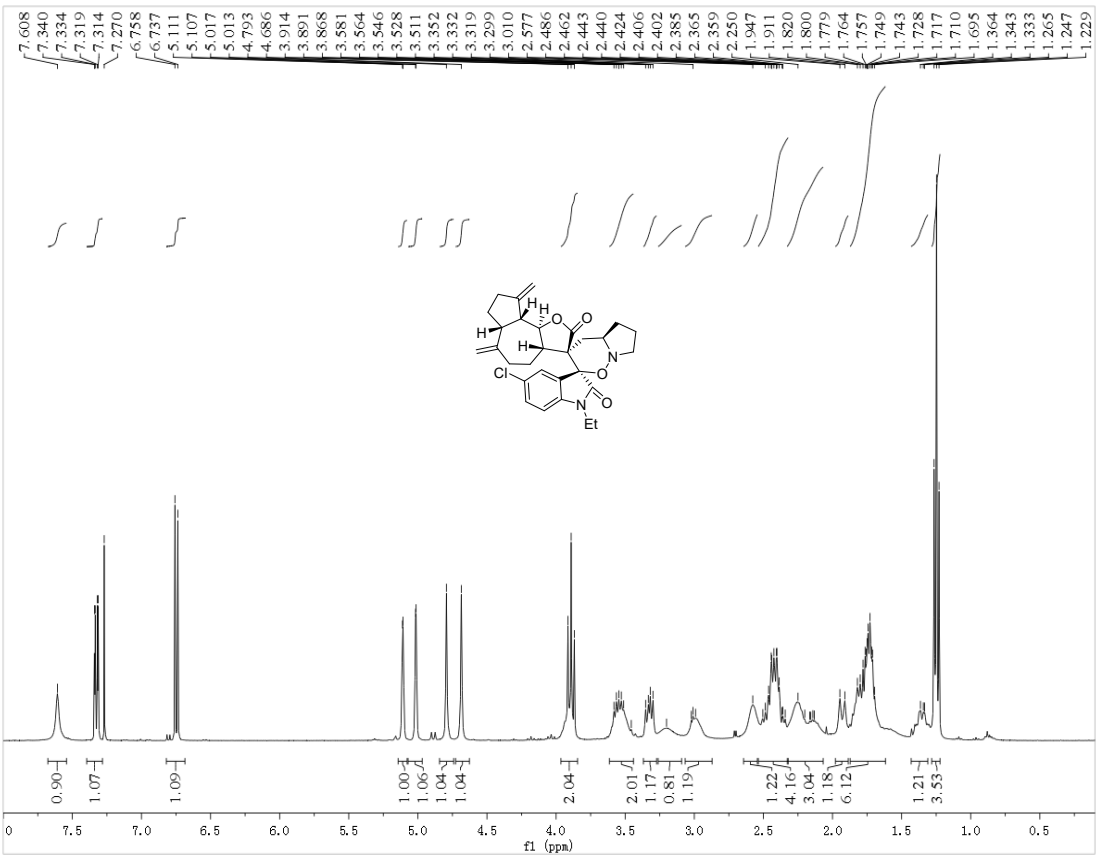


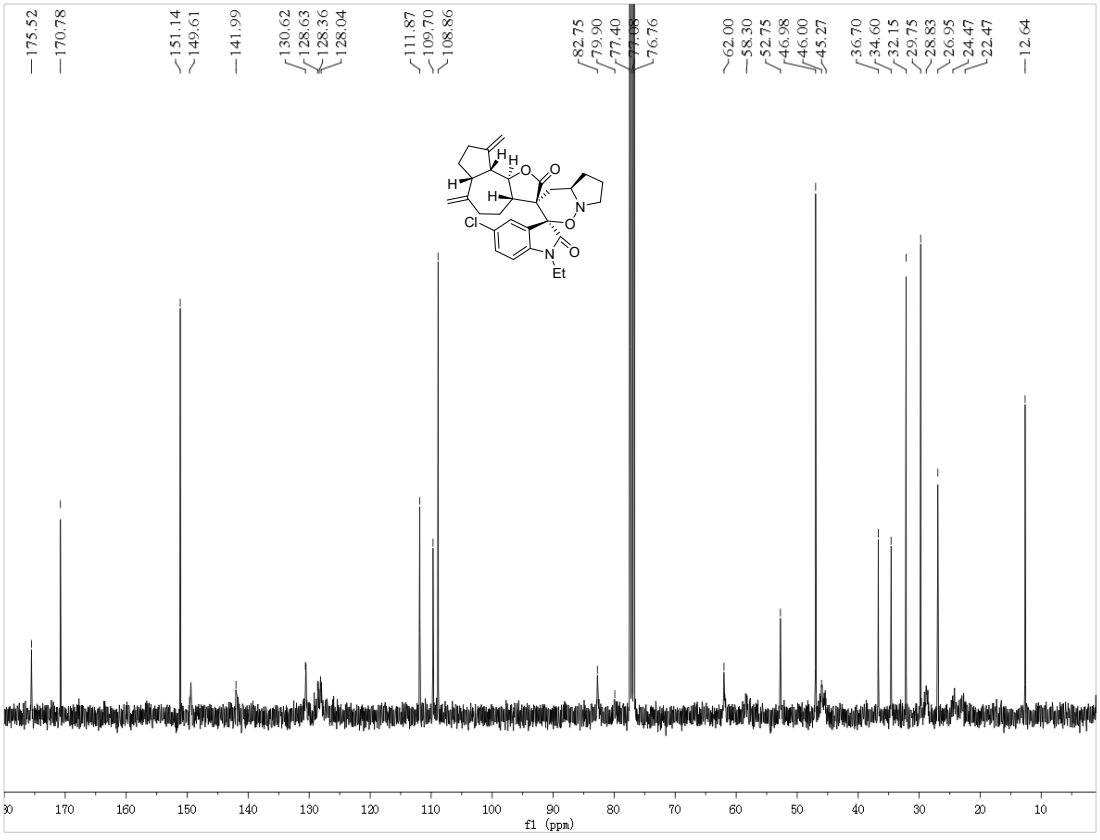
^{1}H and ^{13}C NMR of 4af



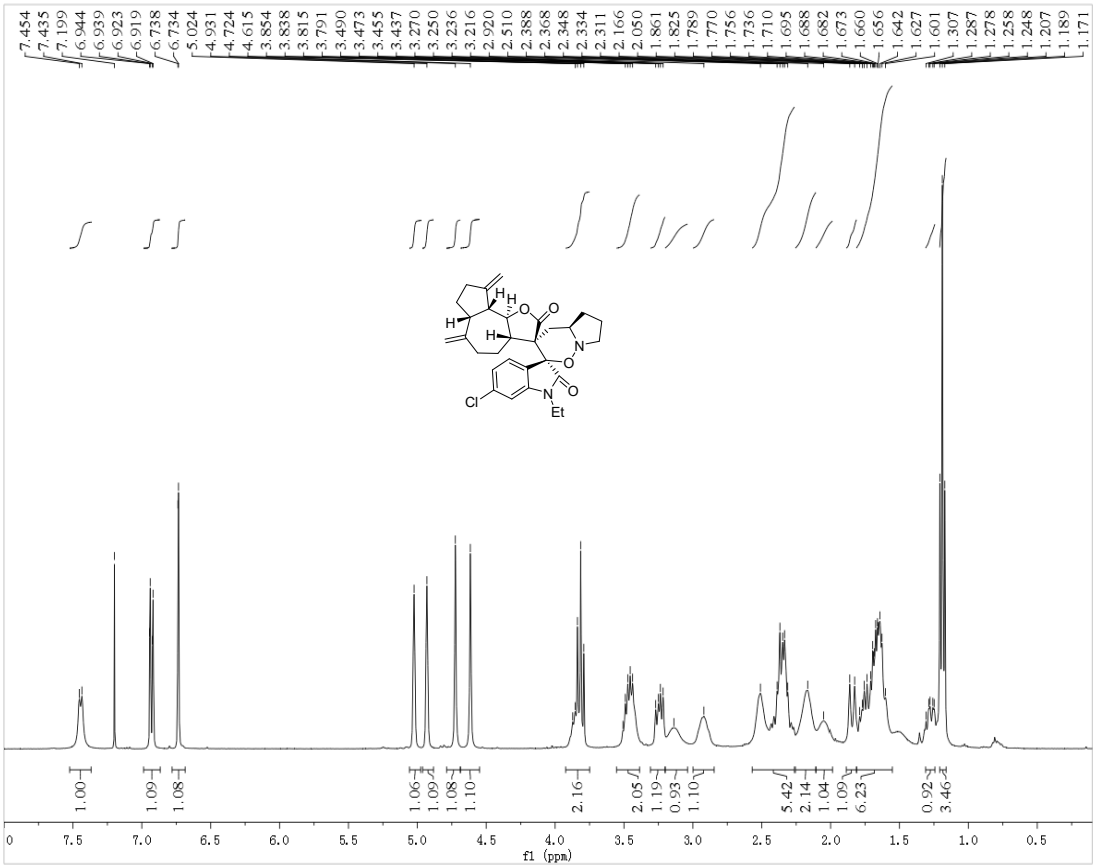


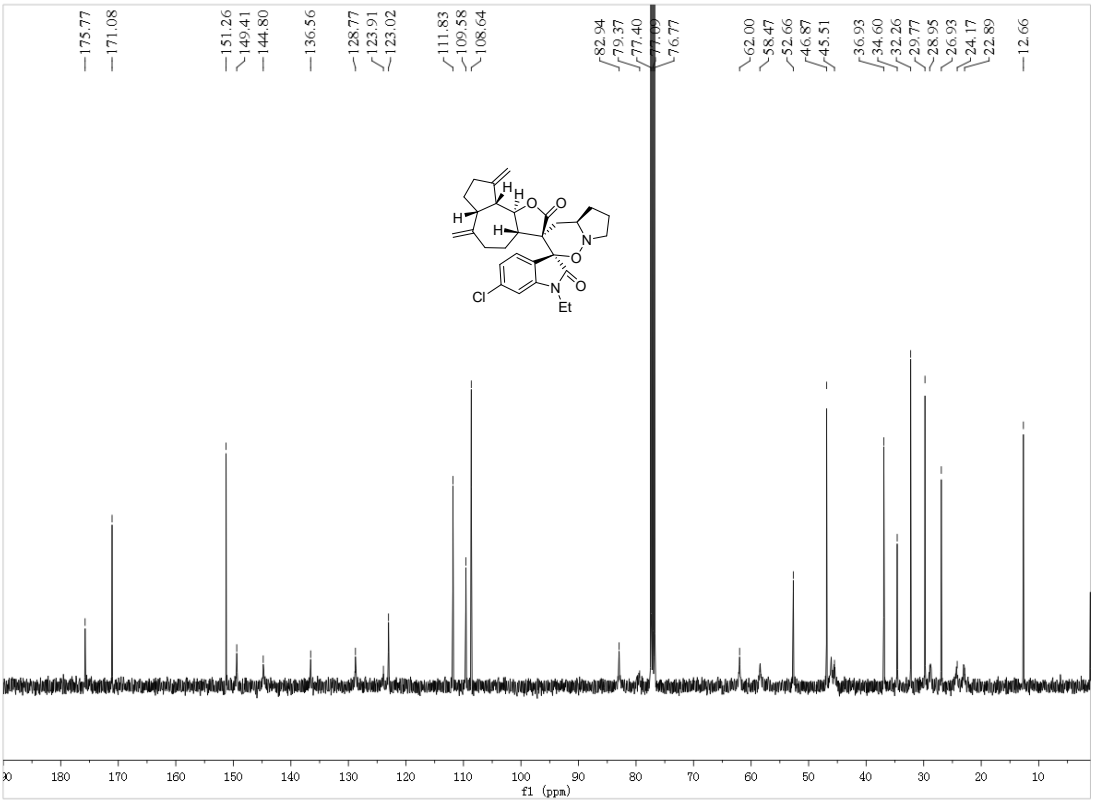
^{1}H and ^{13}C NMR of 4ag



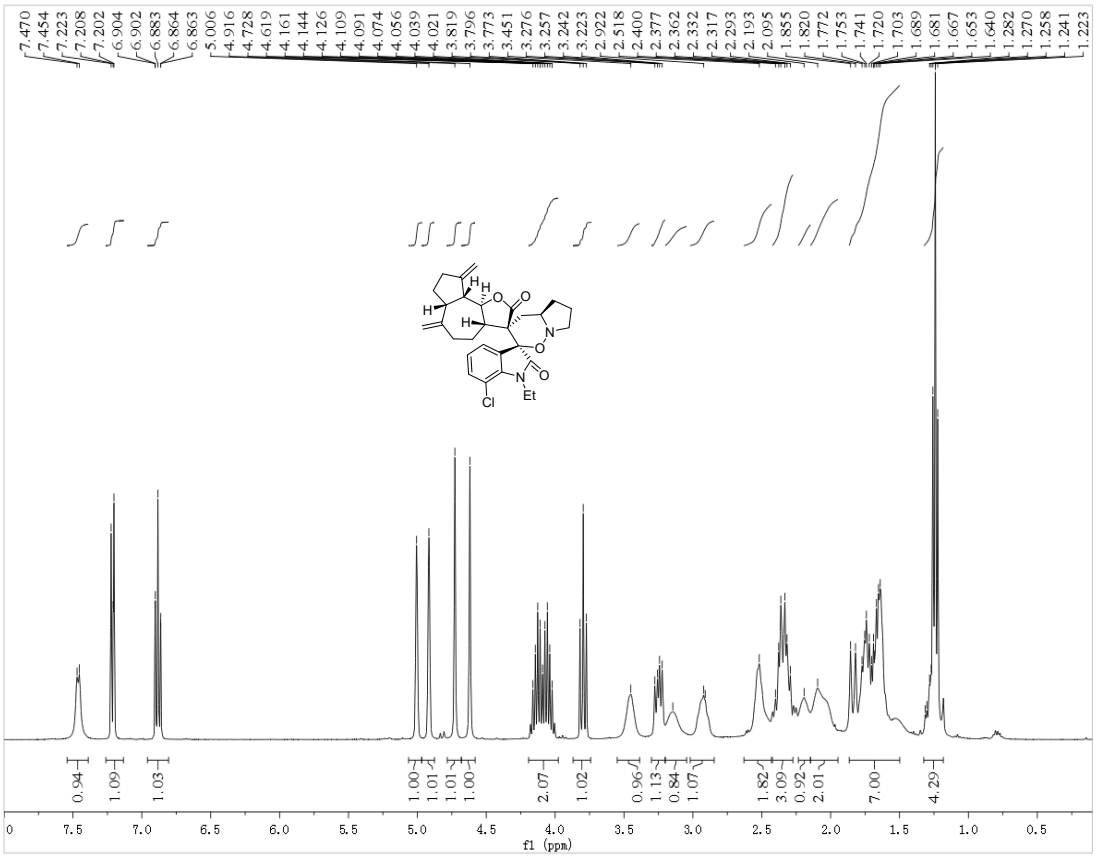


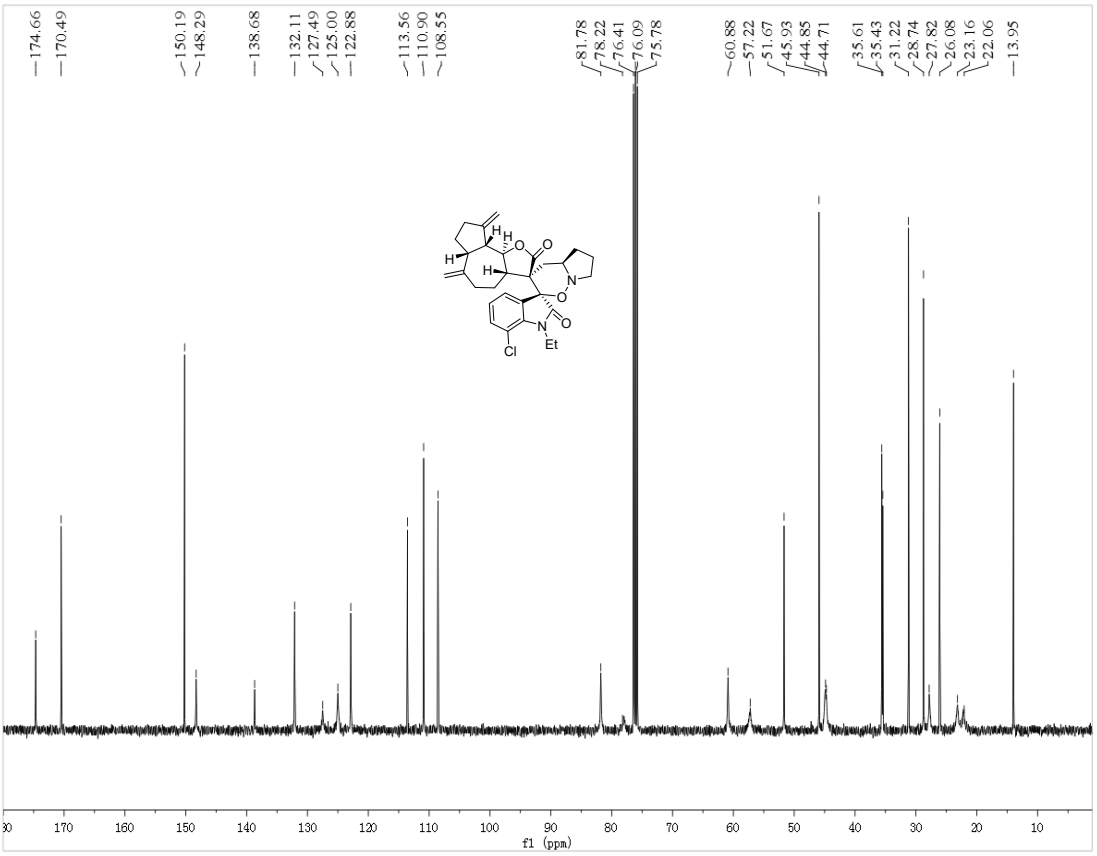
^{1}H and ^{13}C NMR of 4ah



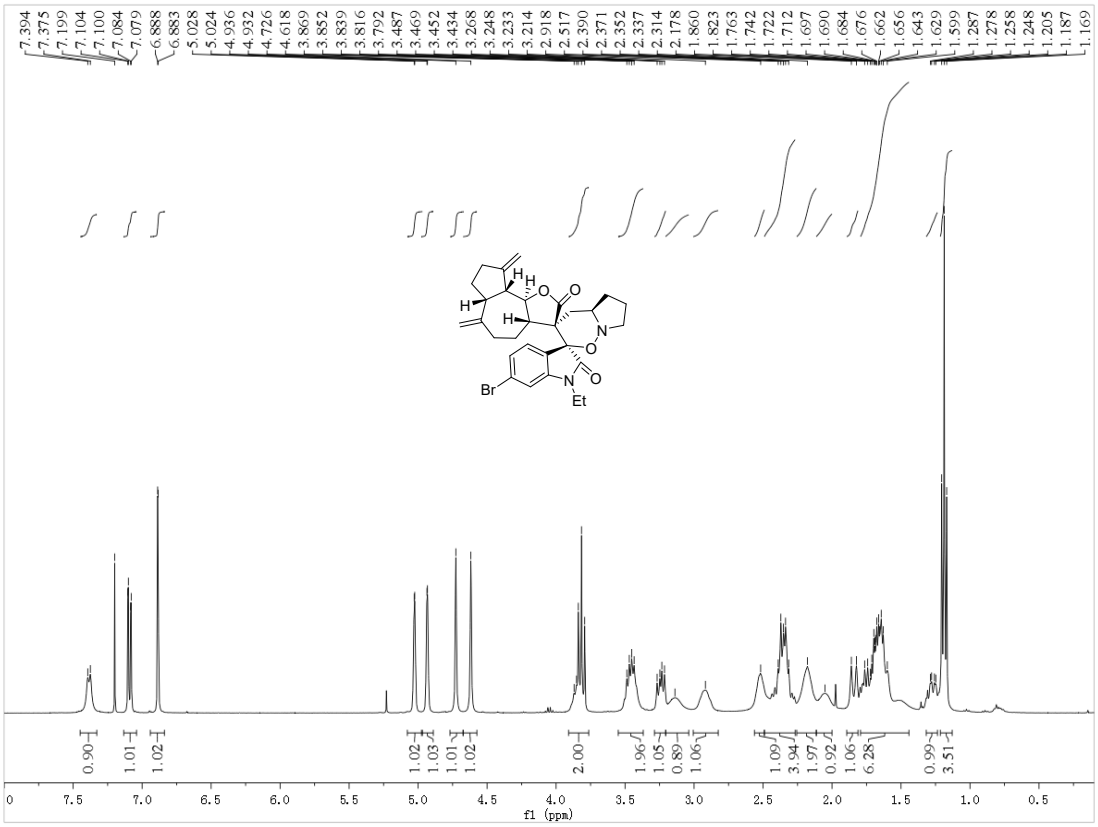


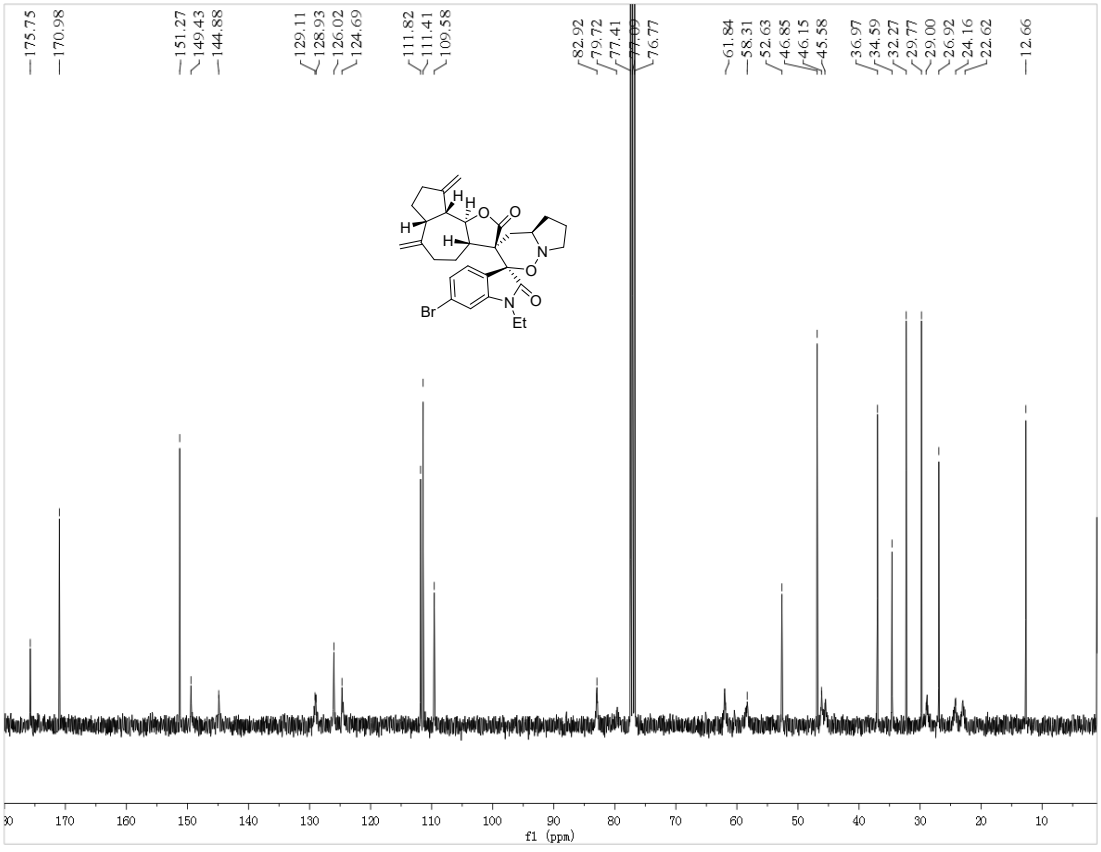
^{1}H and ^{13}C NMR of 4ai



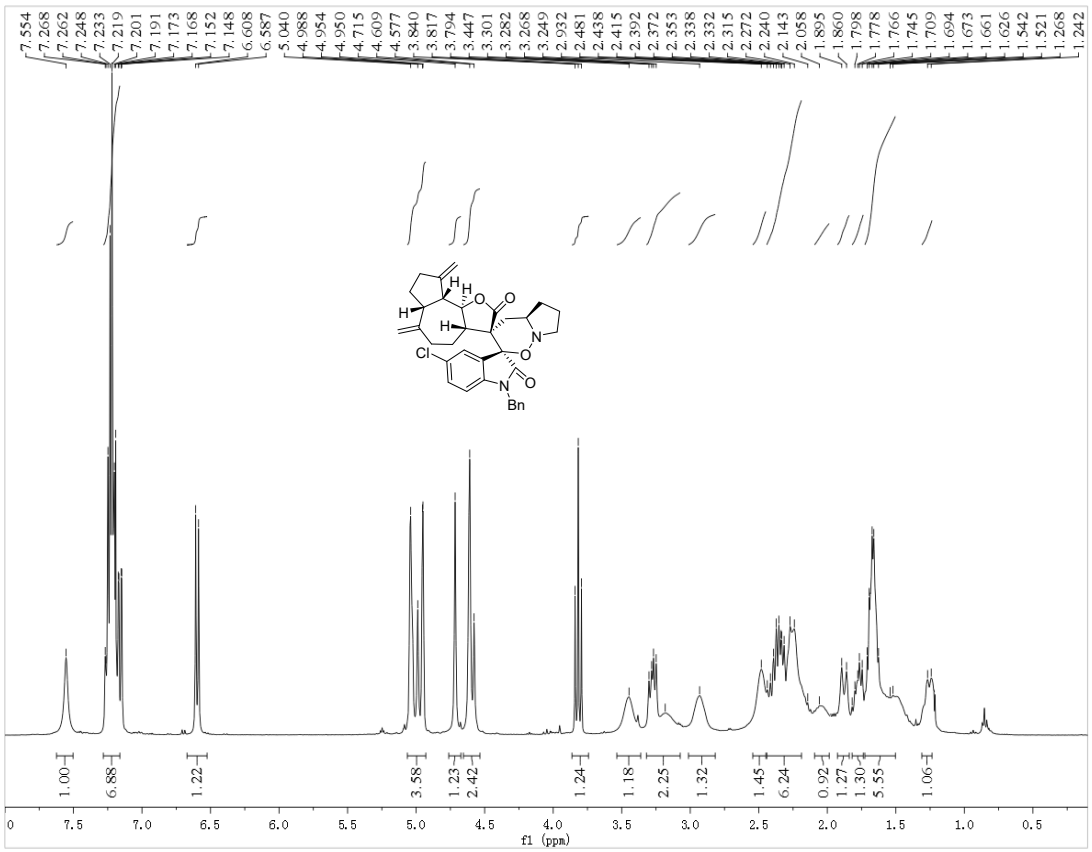


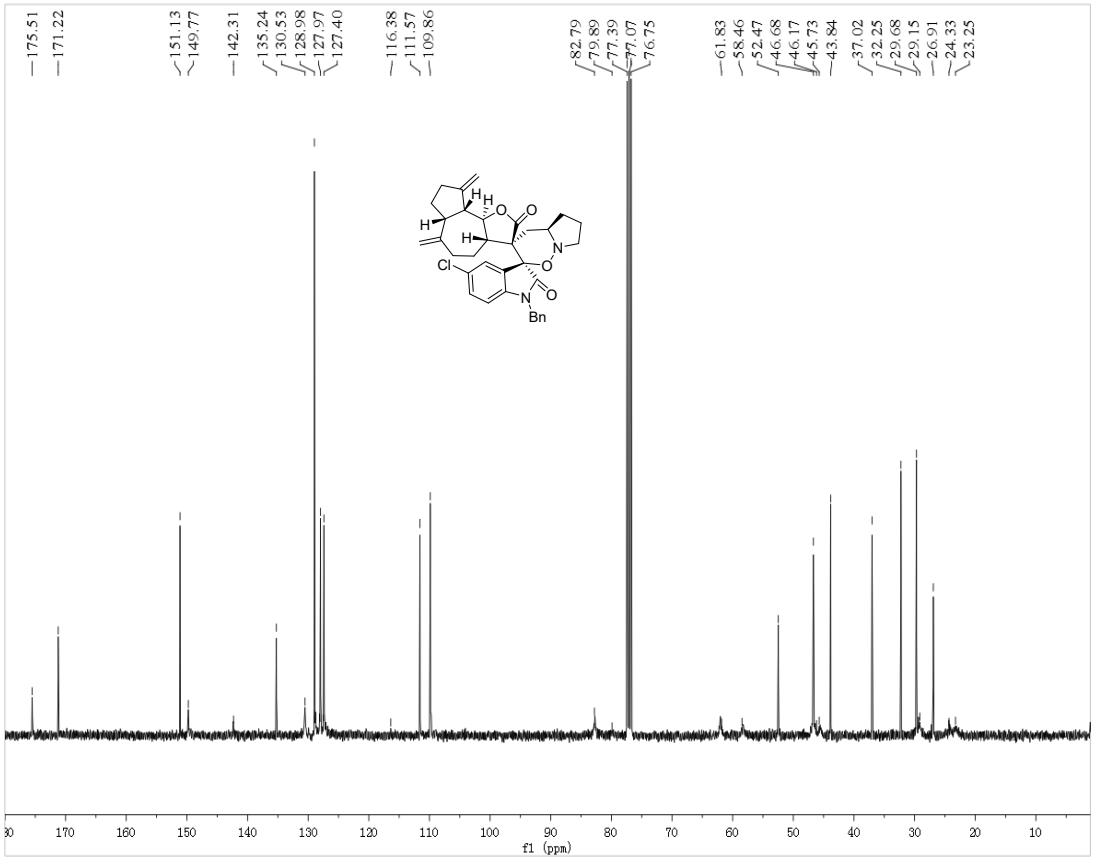
^{1}H and ^{13}C NMR of 4aj



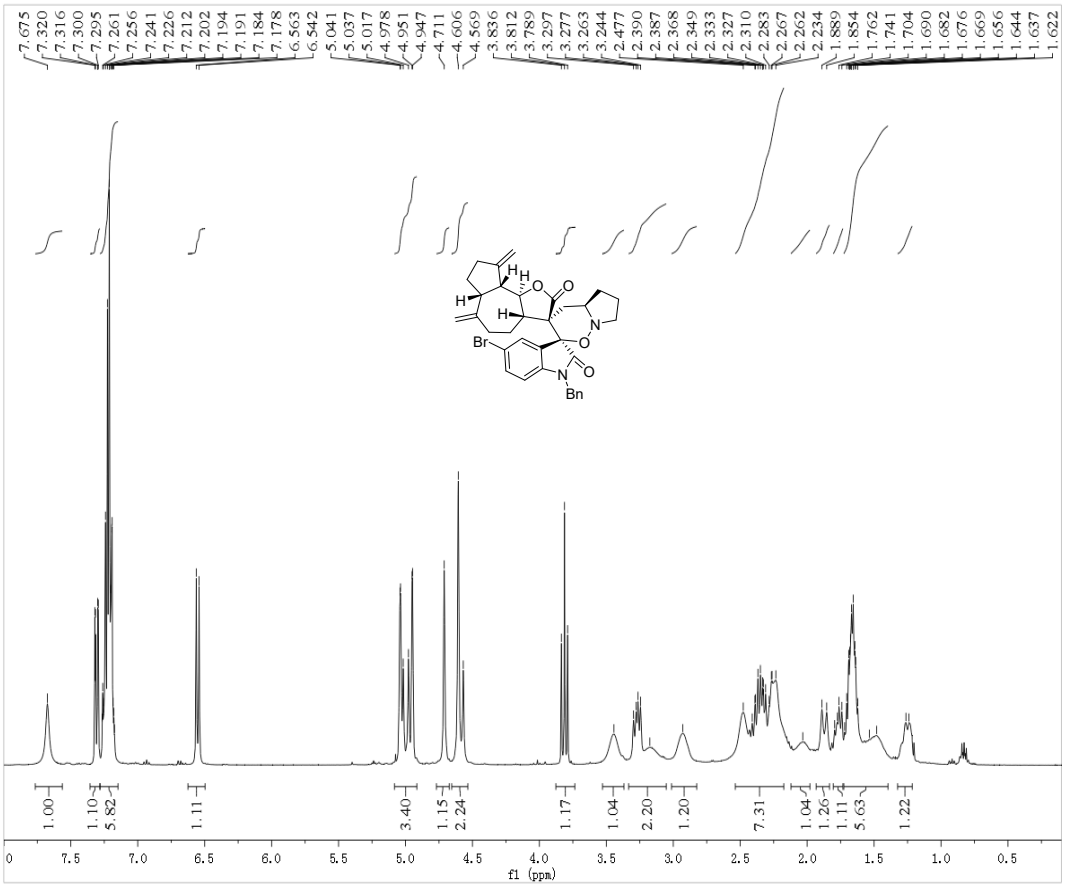


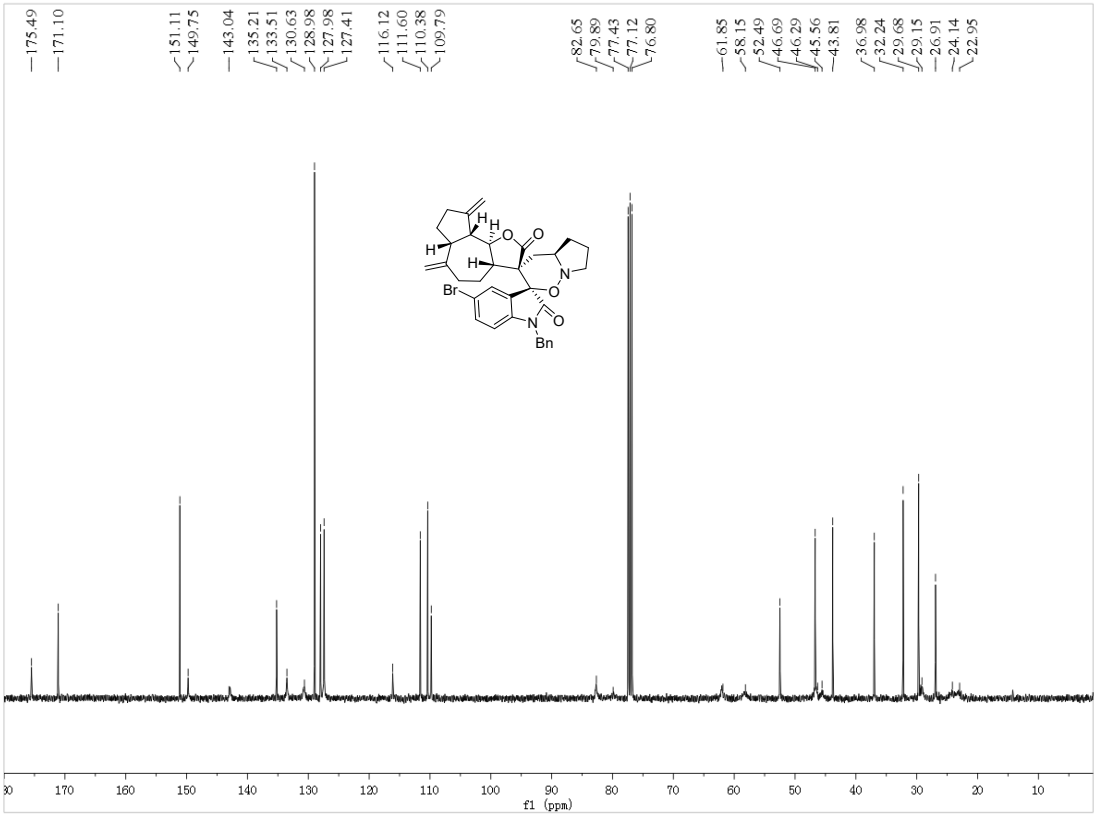
^{1}H and ^{13}C NMR of 4ak



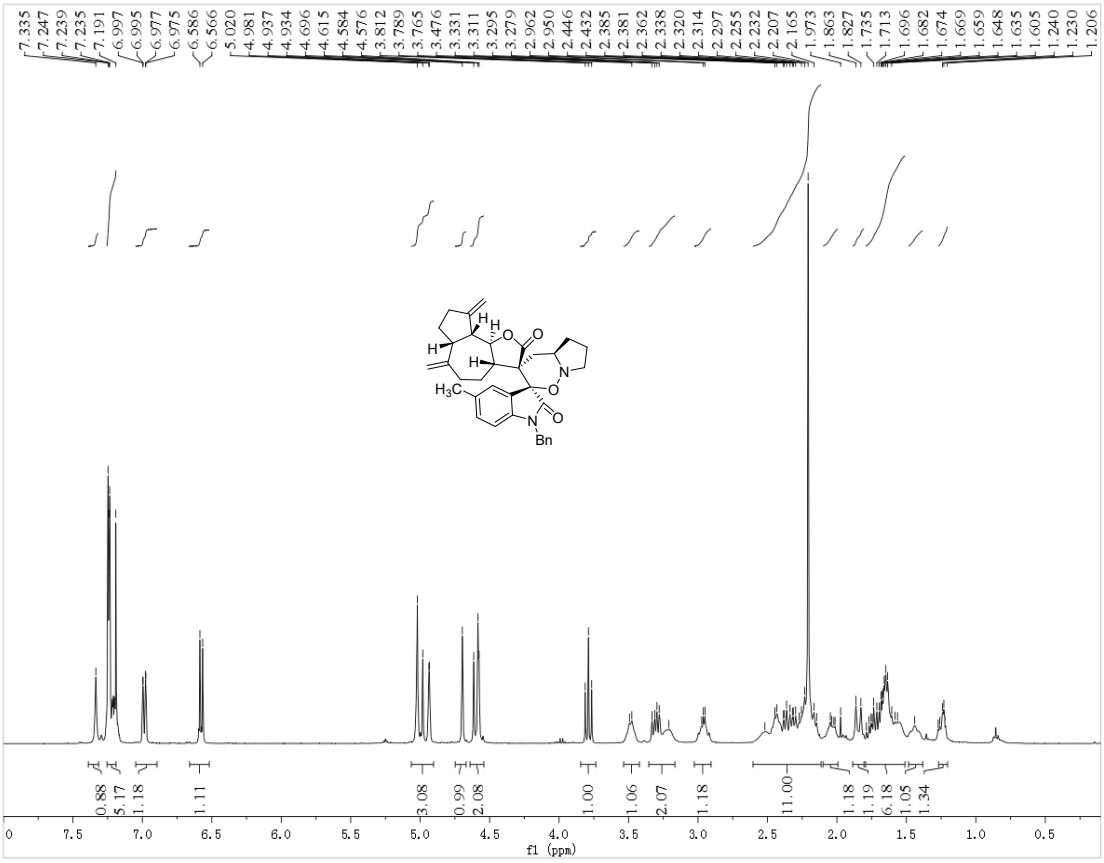


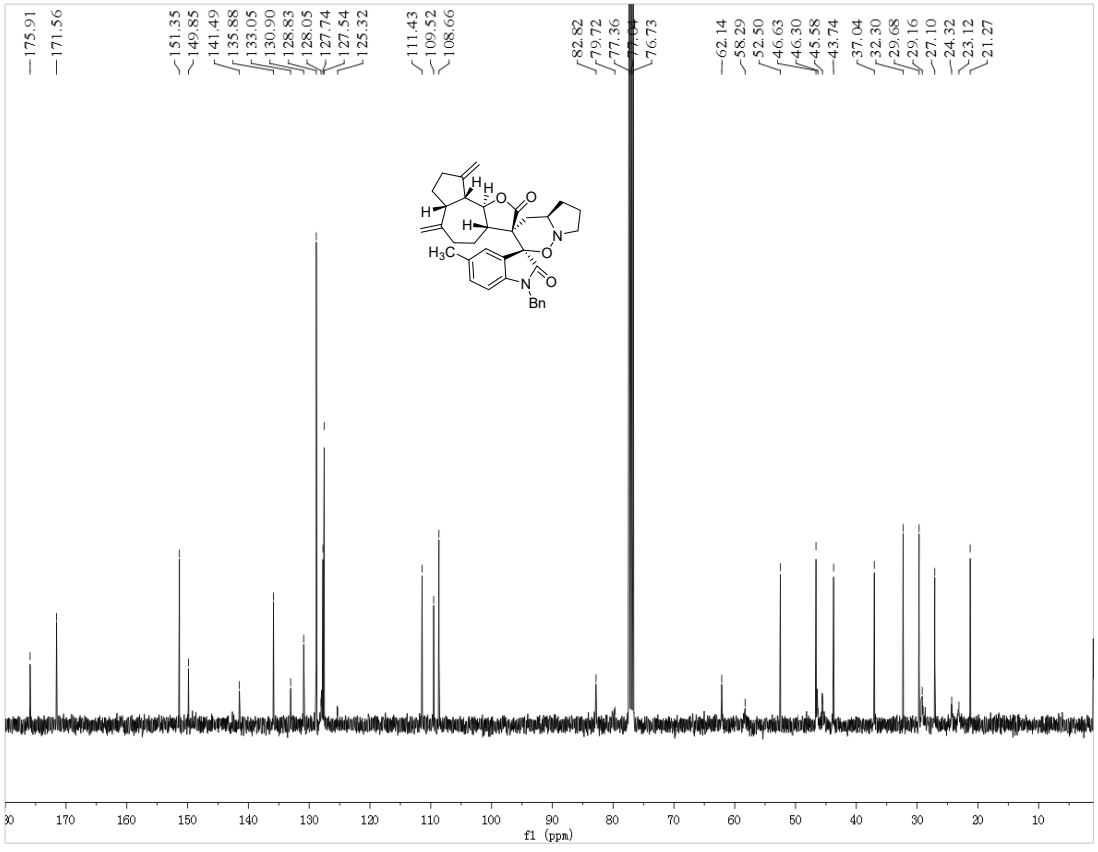
^{1}H and ^{13}C NMR of 4al



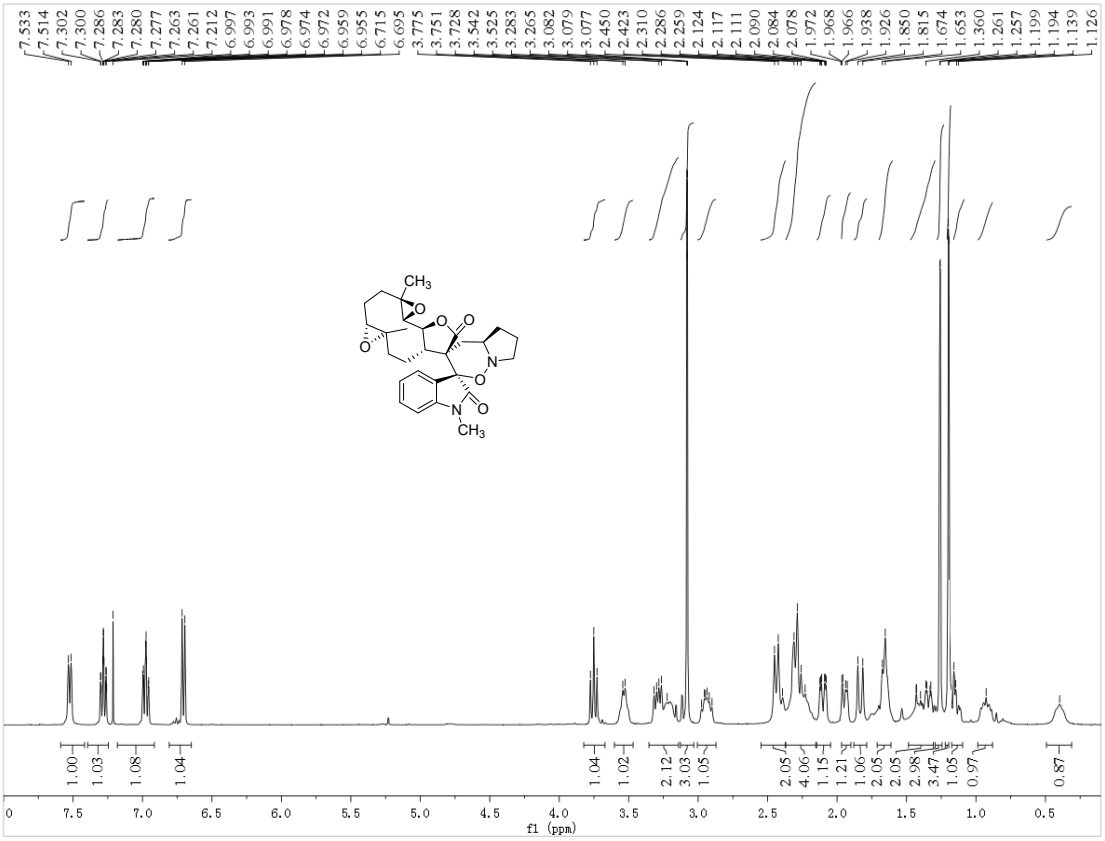


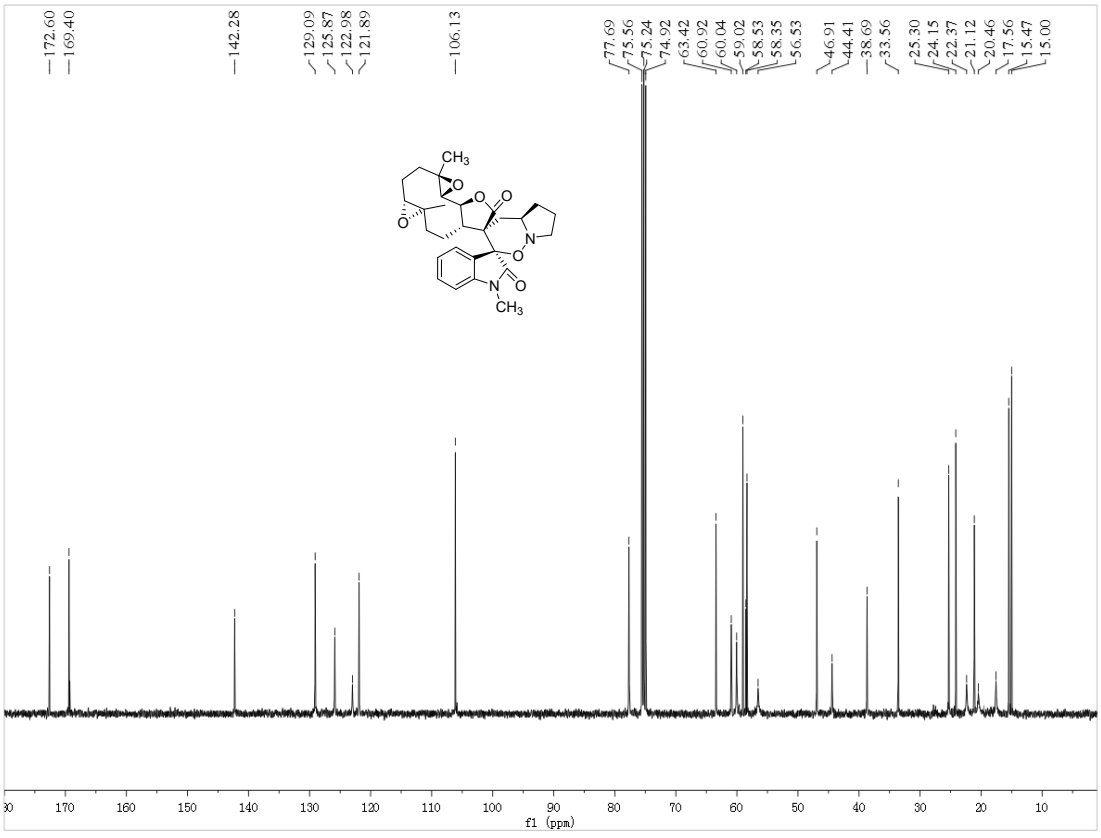
^{1}H and ^{13}C NMR of 4am



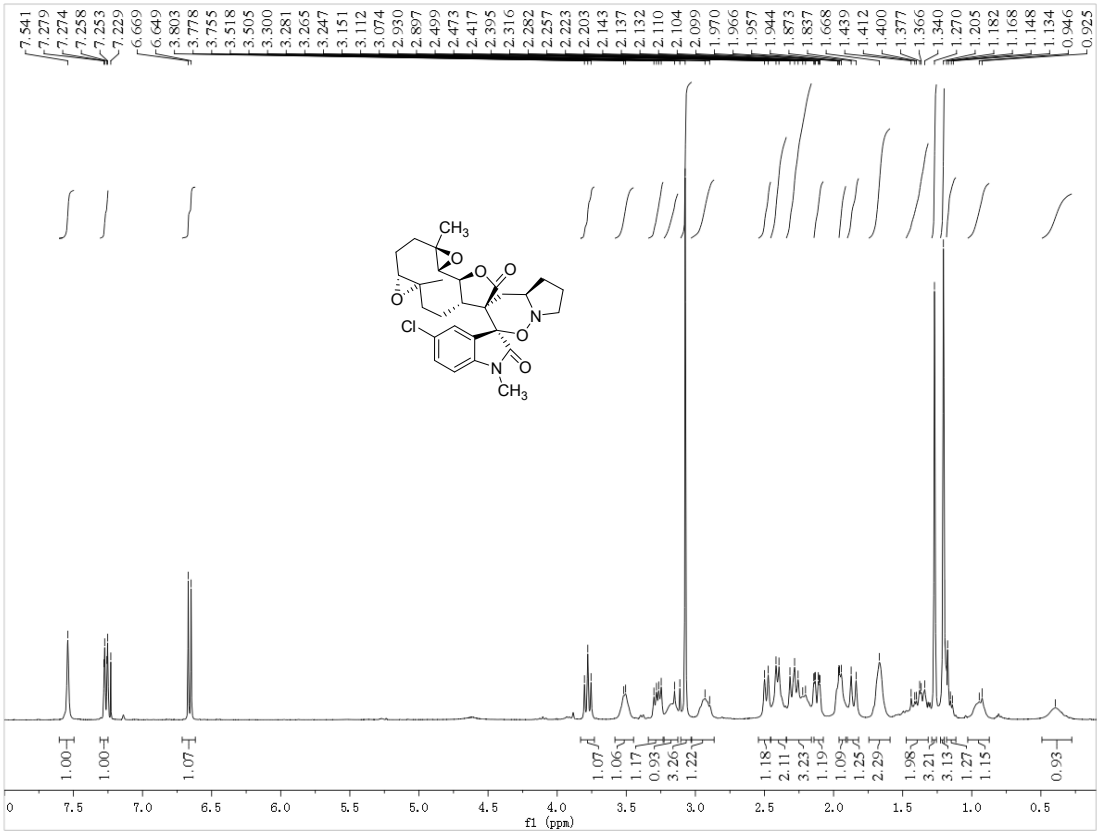


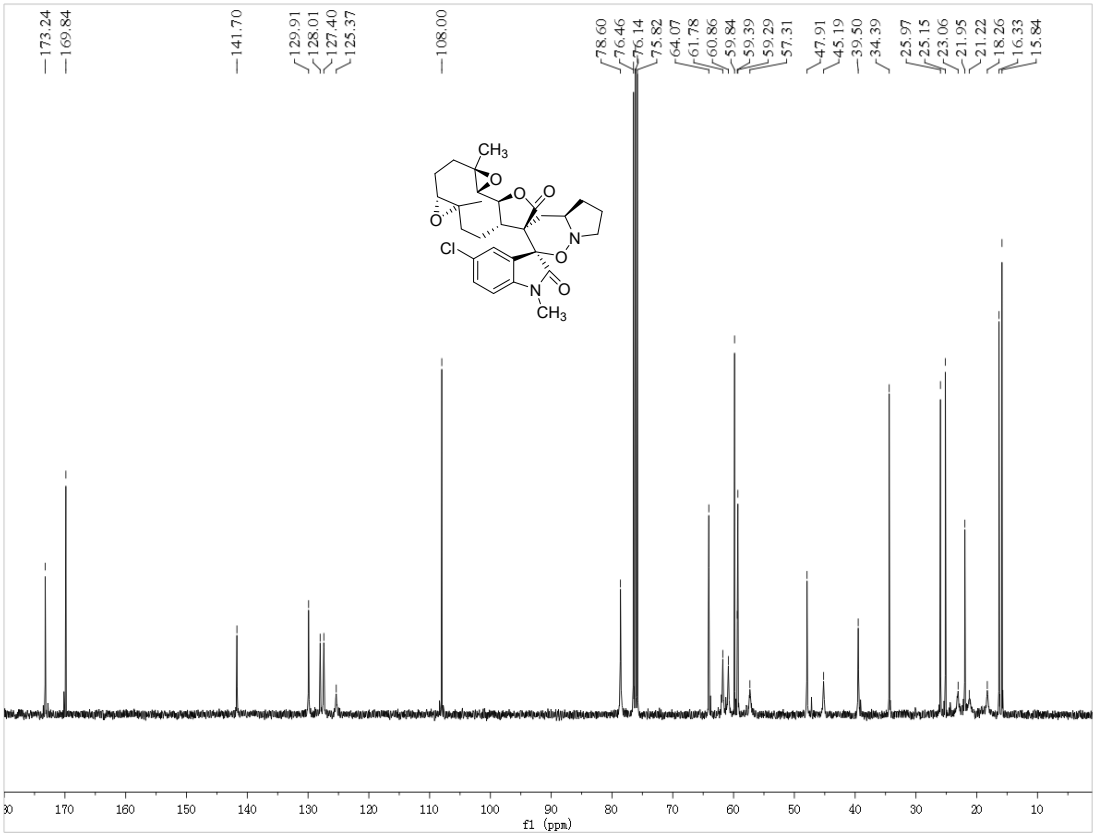
^{1}H and ^{13}C NMR of 4ba



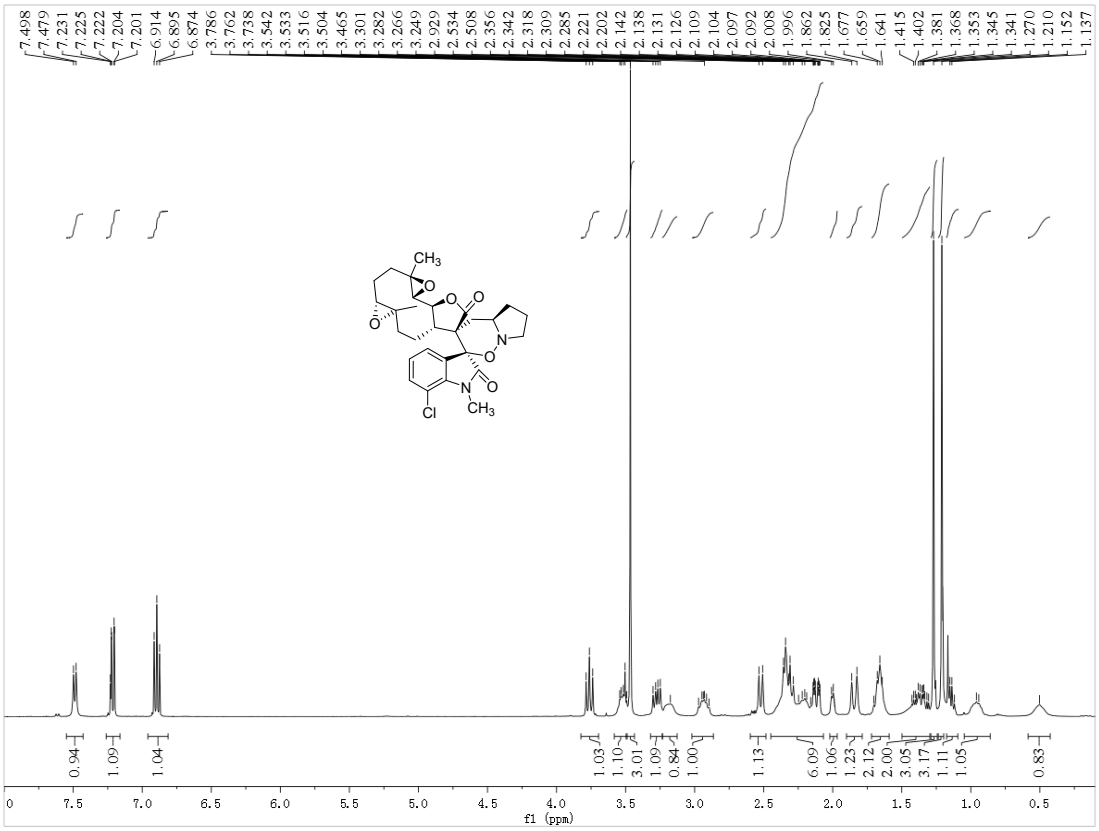


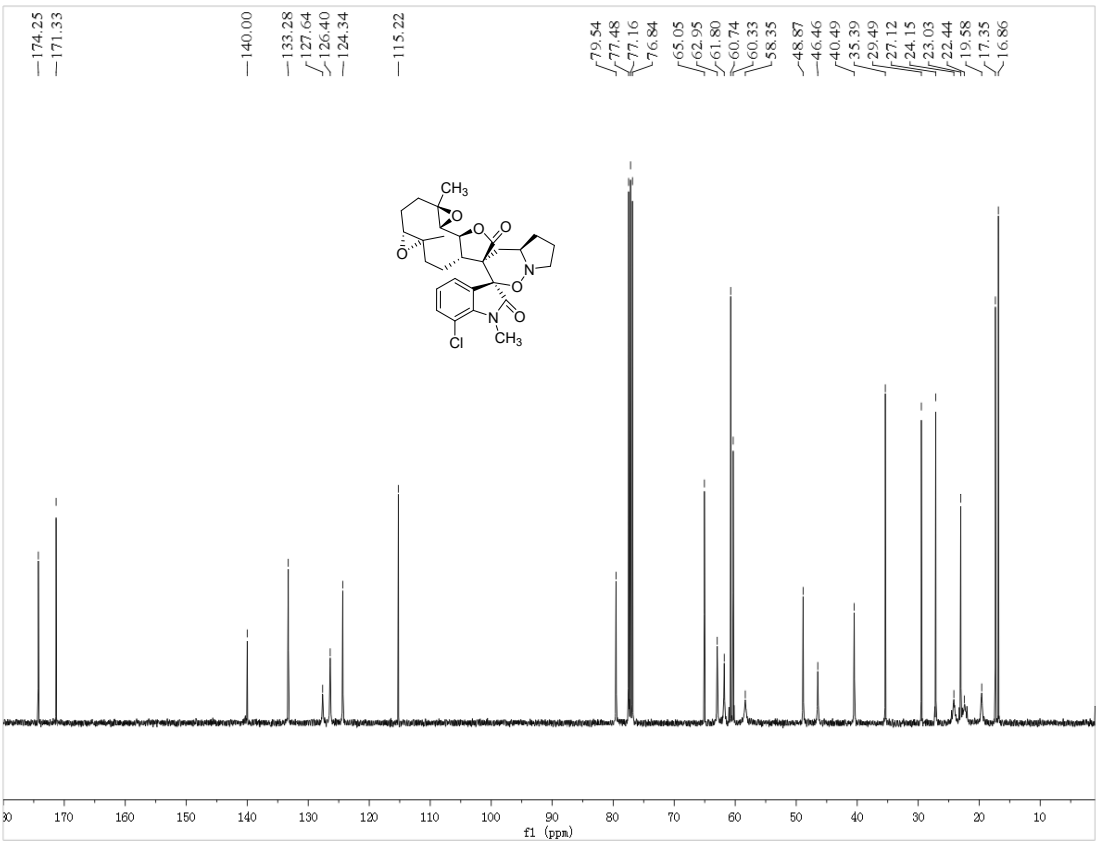
^{1}H and ^{13}C NMR of 4bb



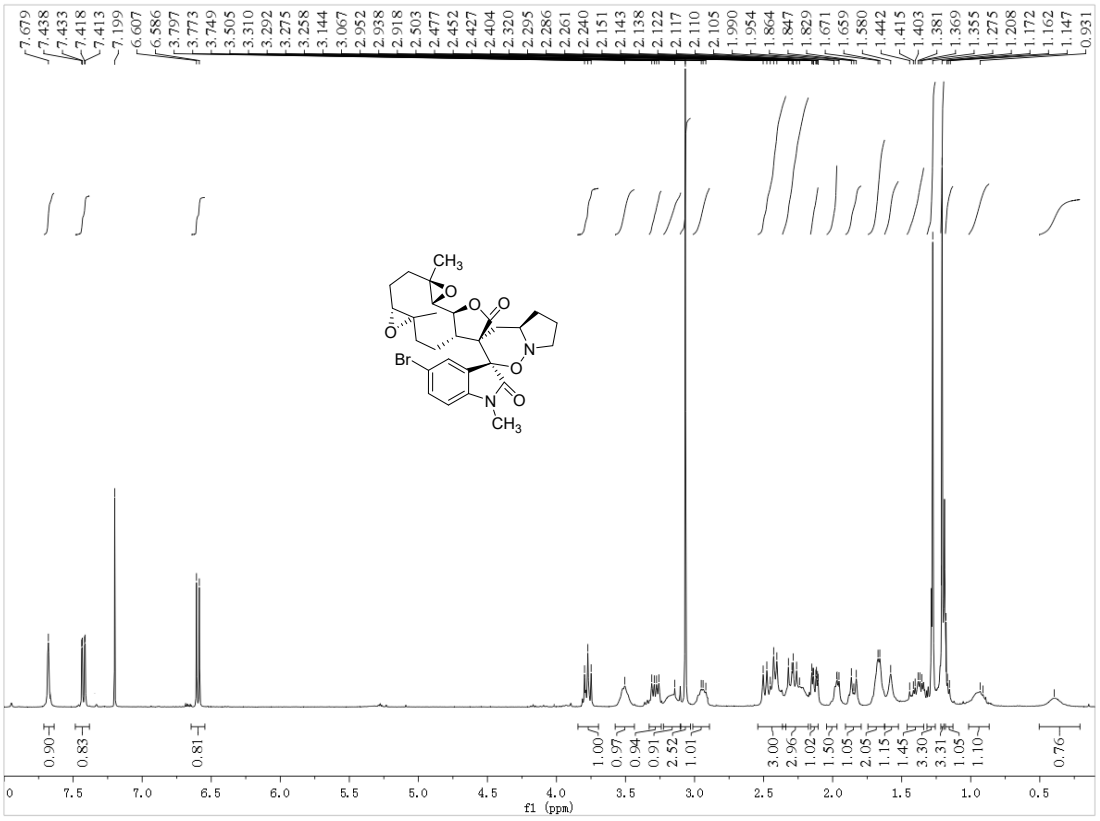


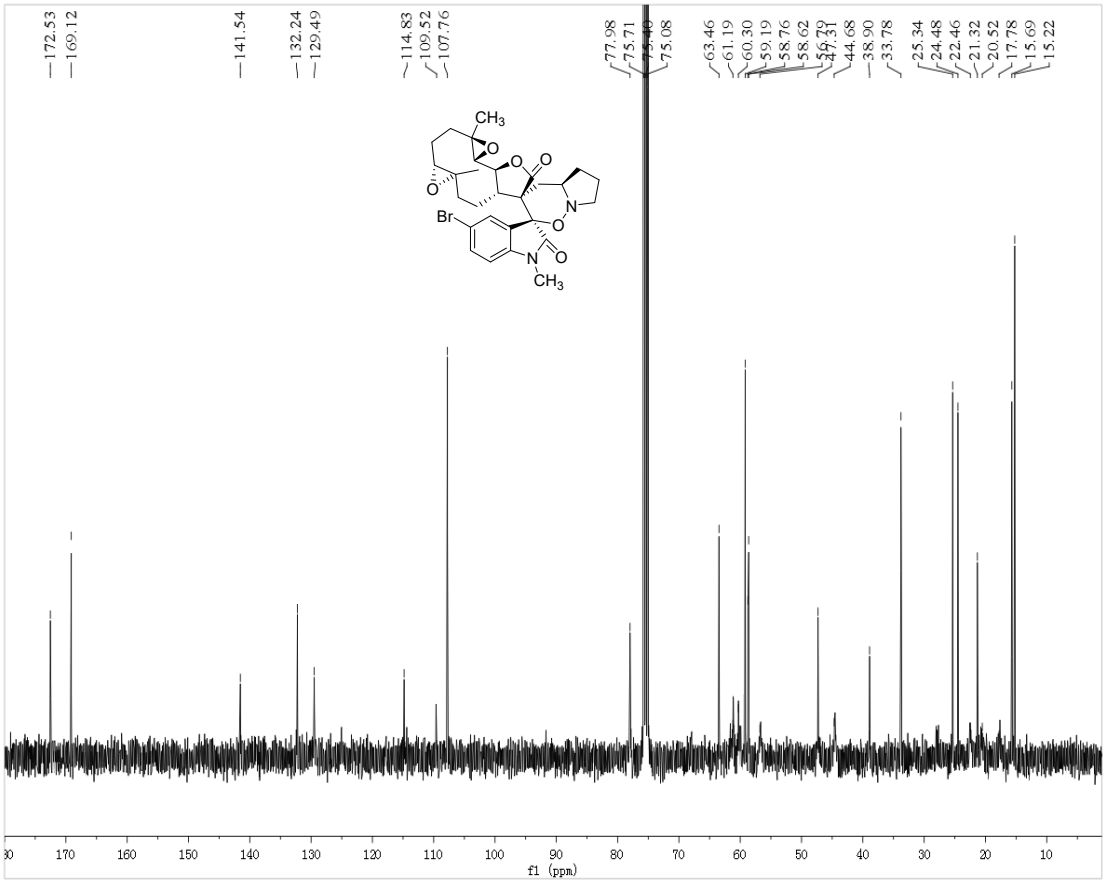
^{1}H and ^{13}C NMR of 4bc



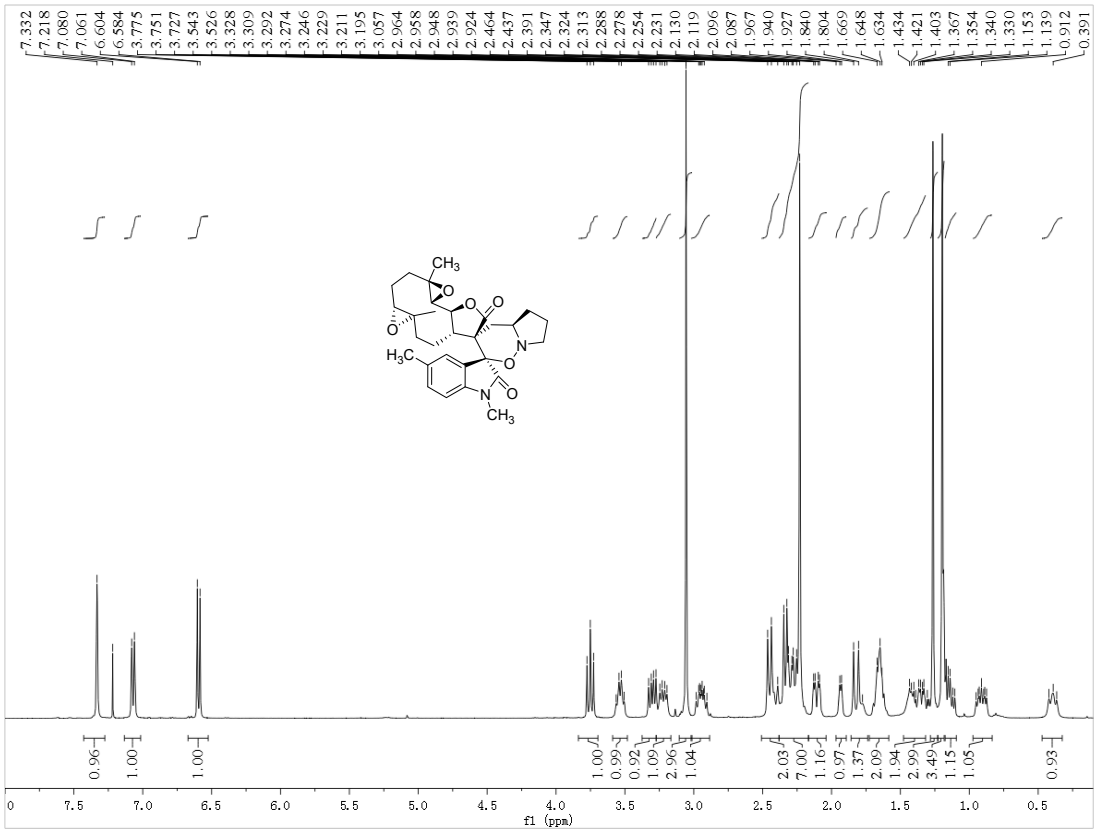


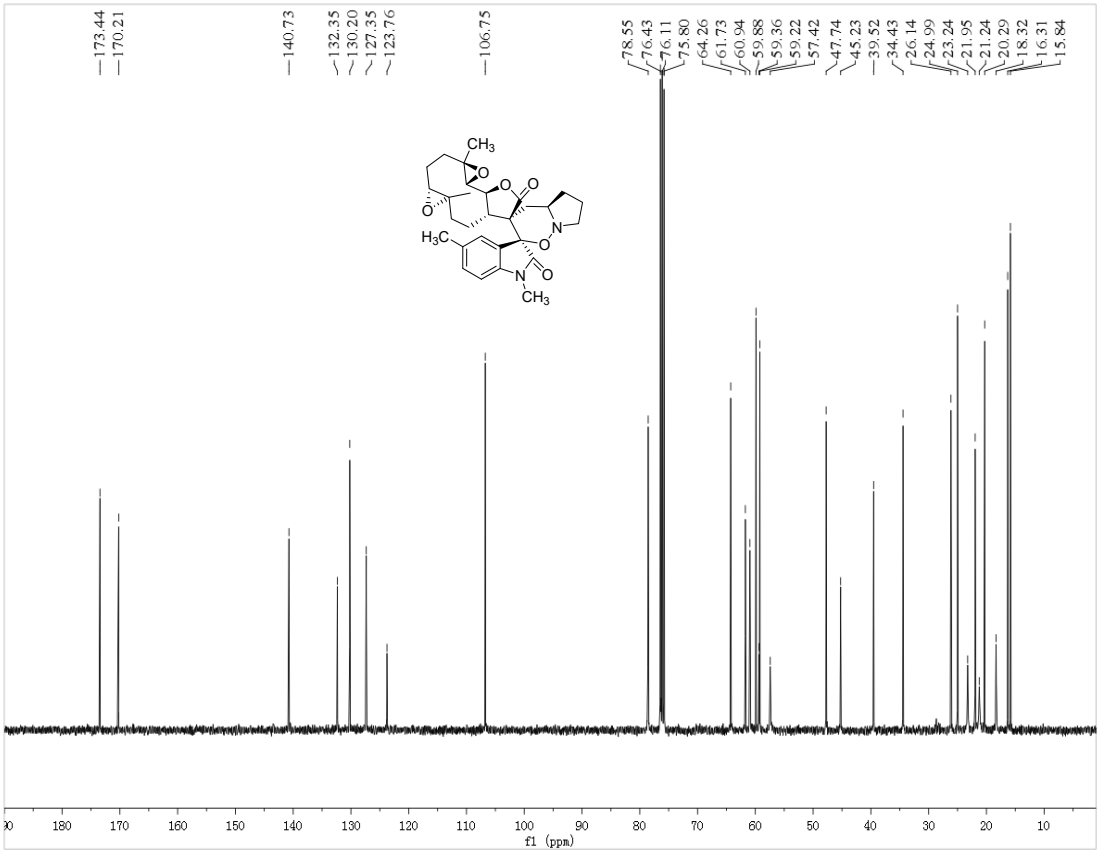
^{1}H and ^{13}C NMR of 4bd



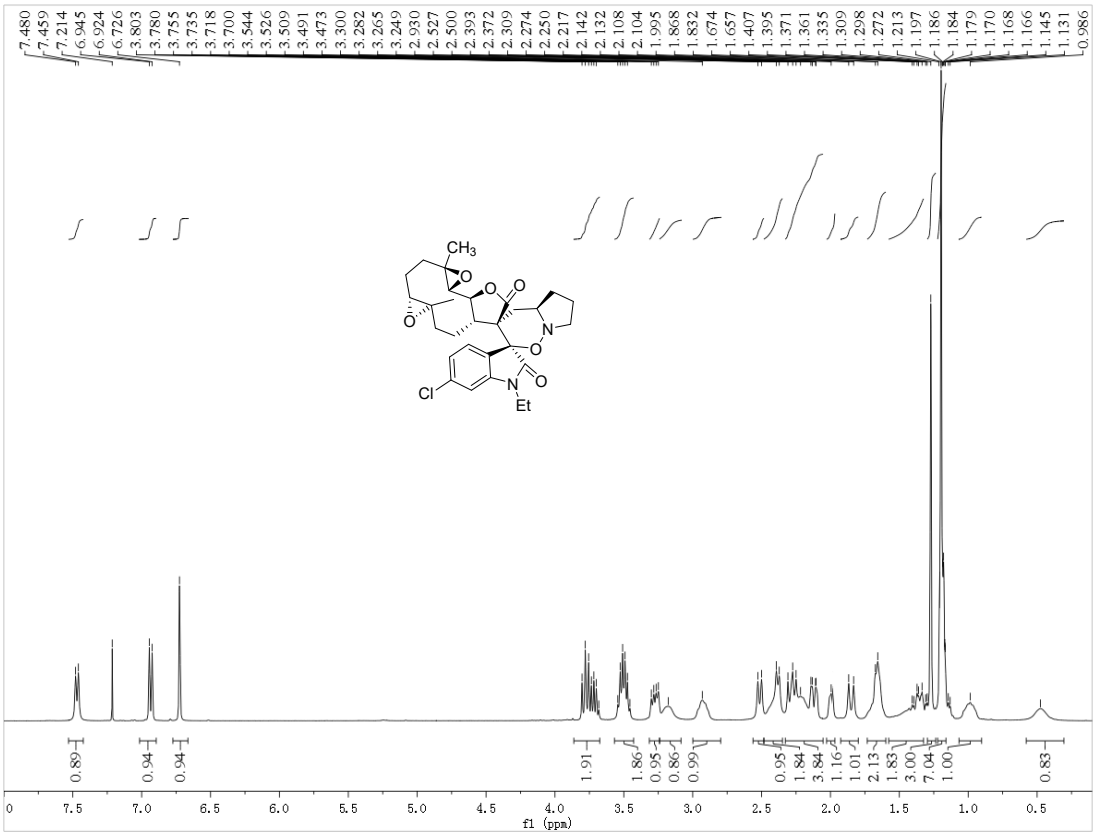


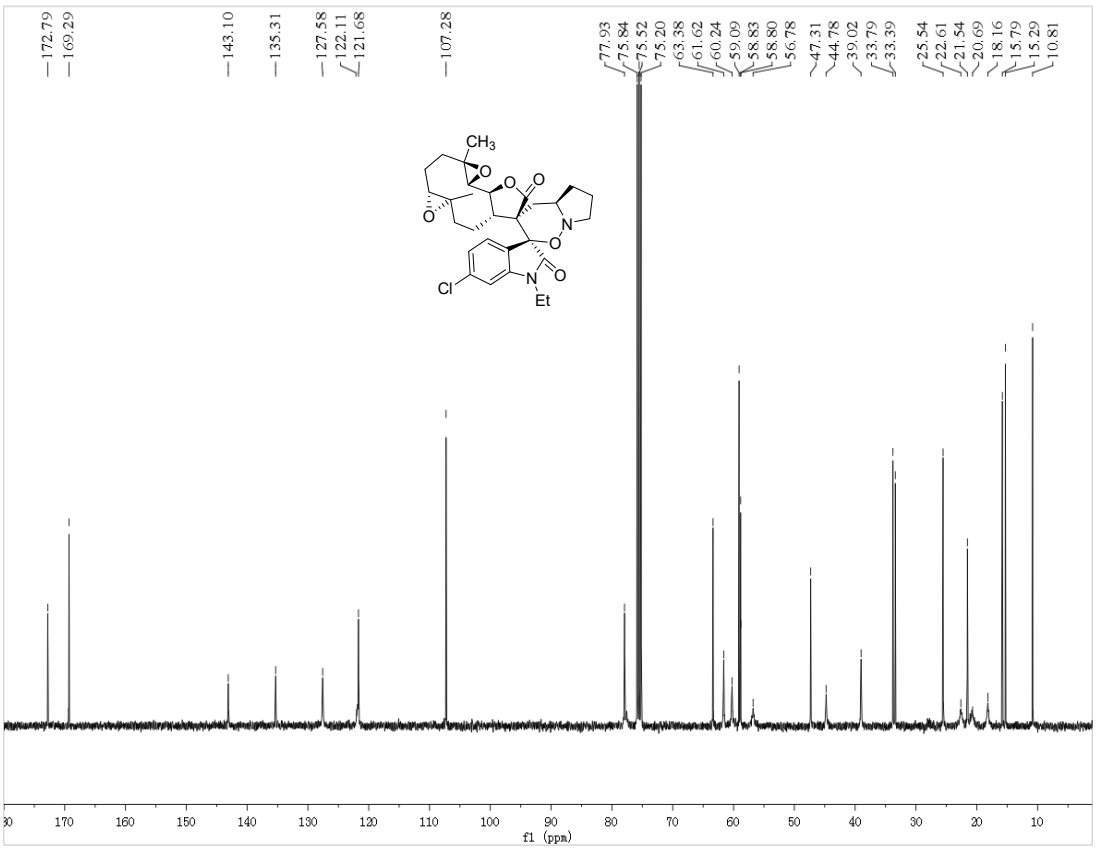
^{1}H and ^{13}C NMR of 4be



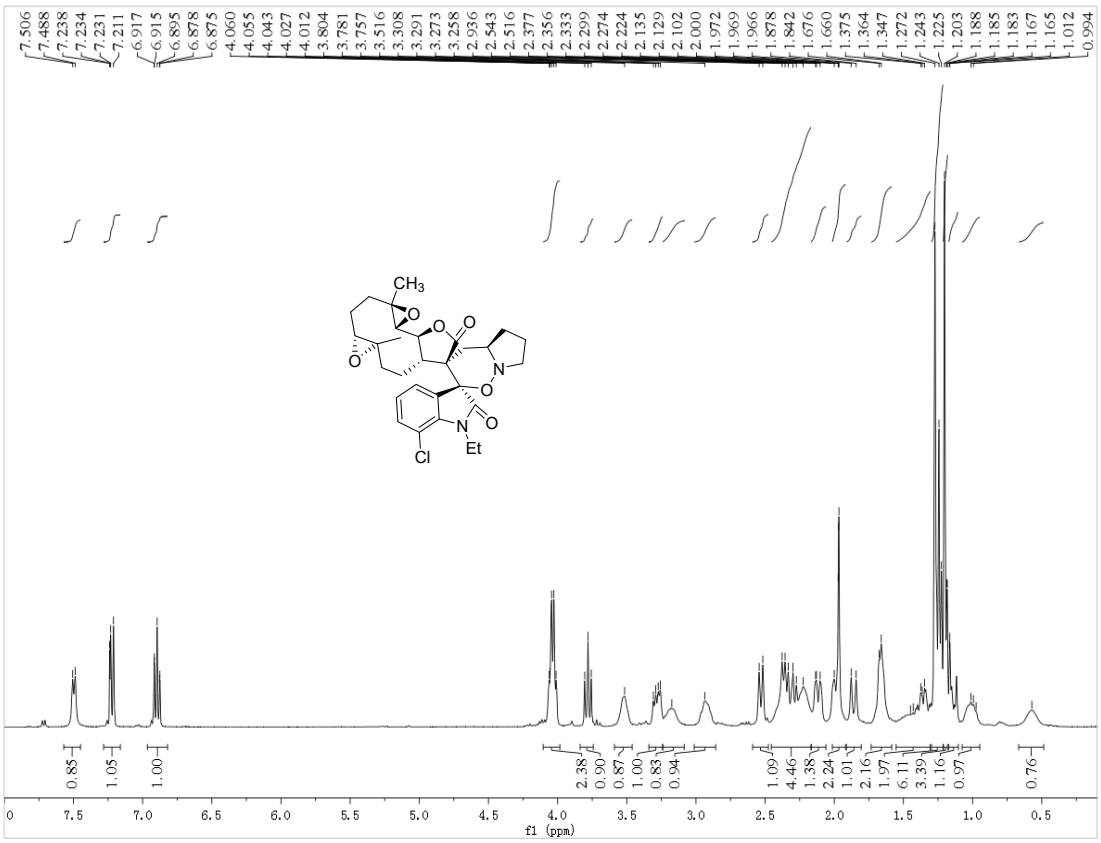


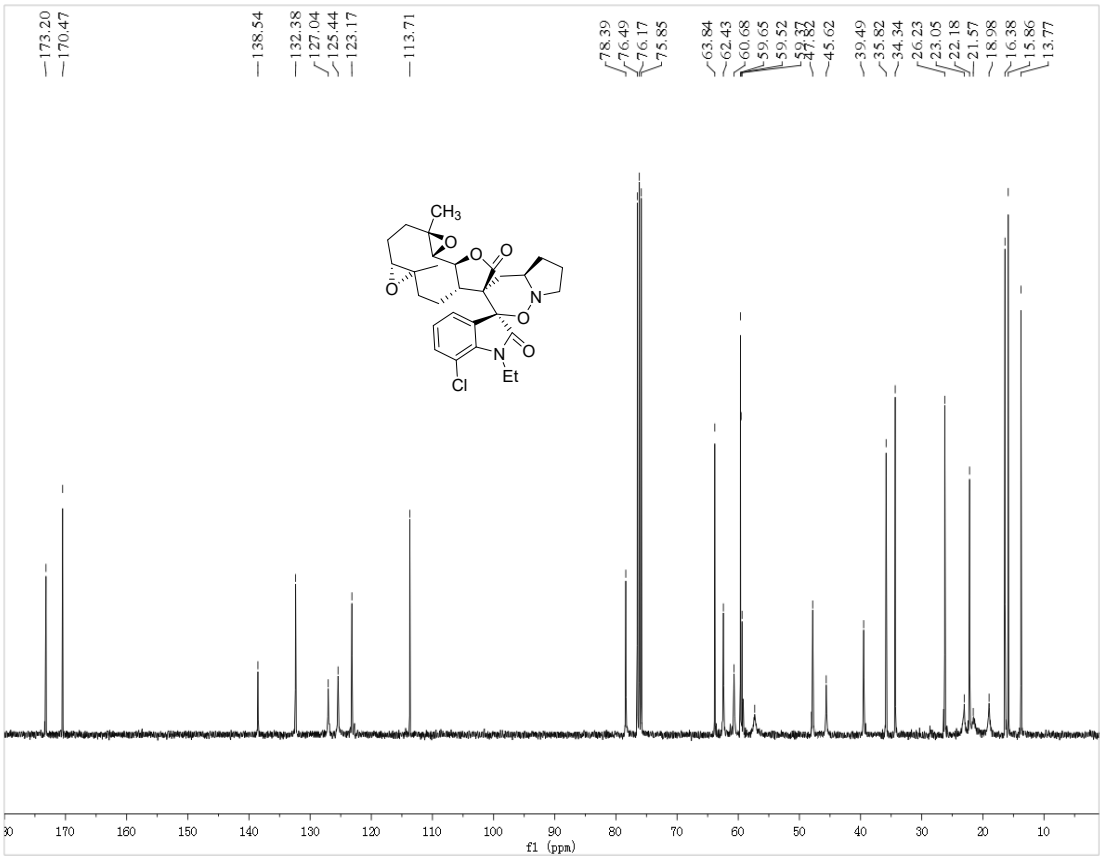
^{1}H and ^{13}C NMR of 4bf



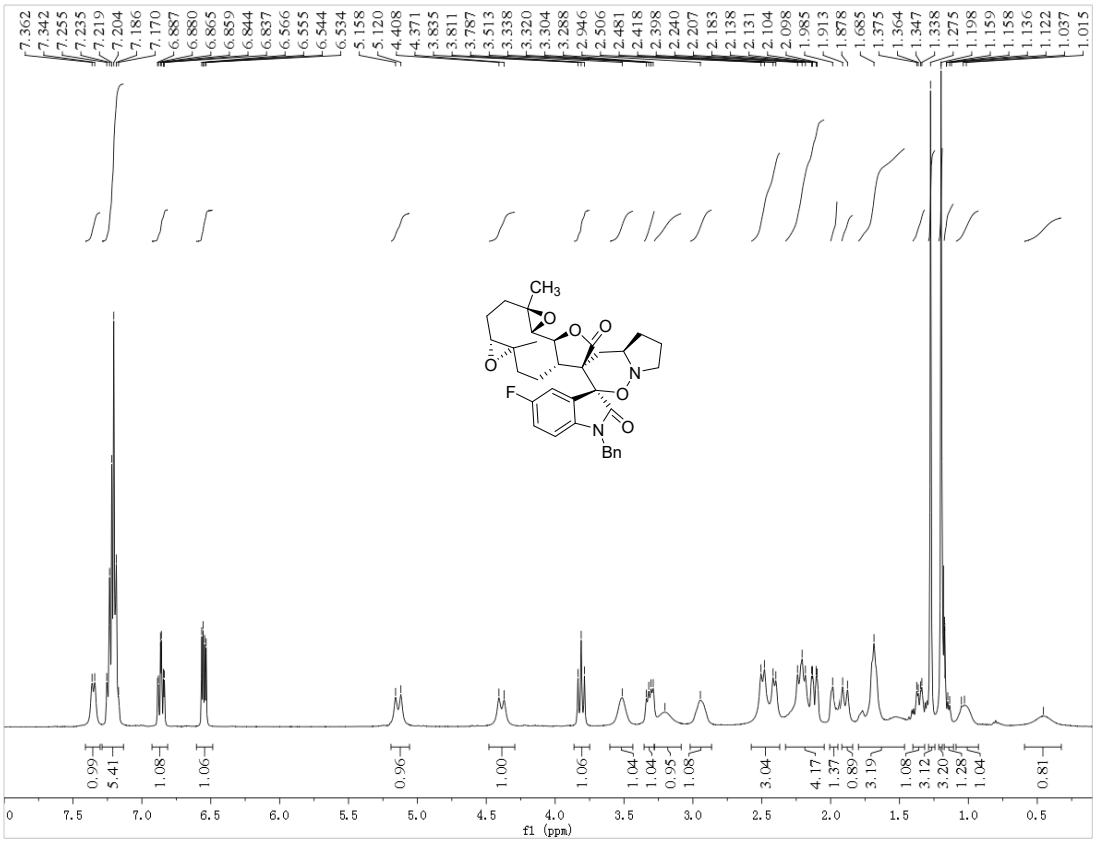


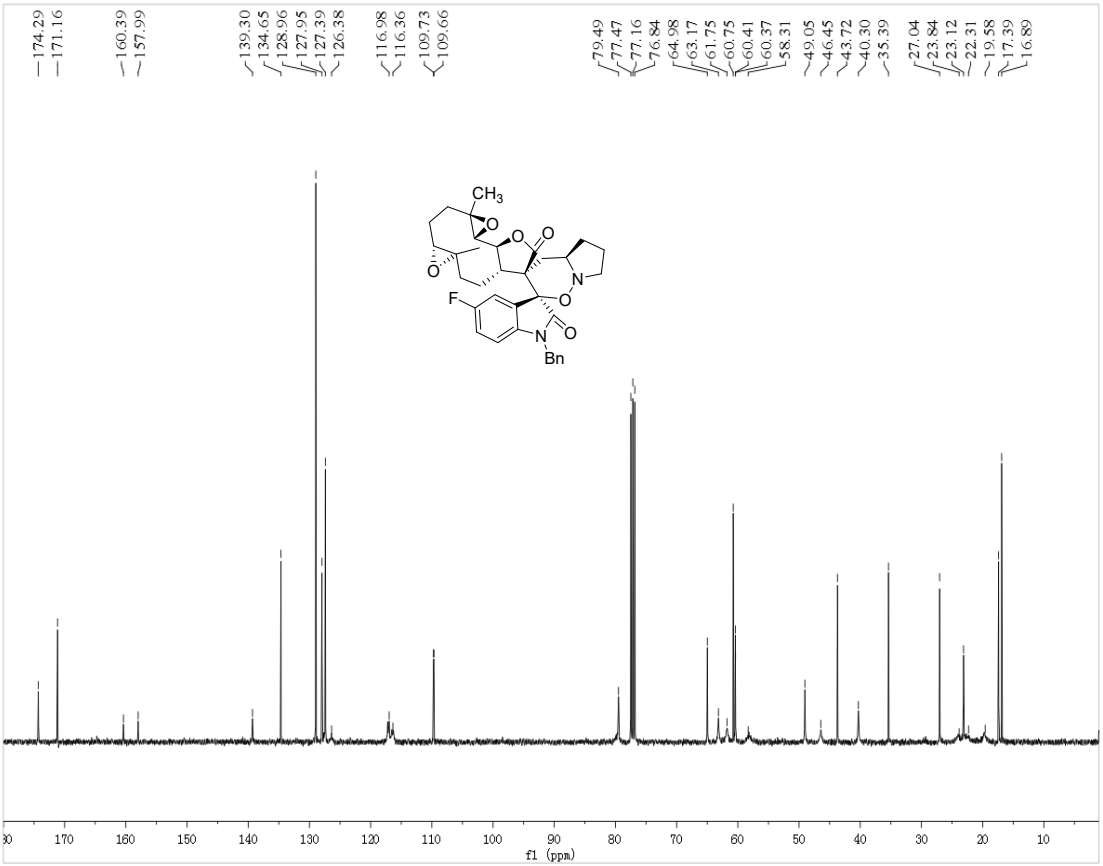
^{1}H and ^{13}C NMR of 4bg



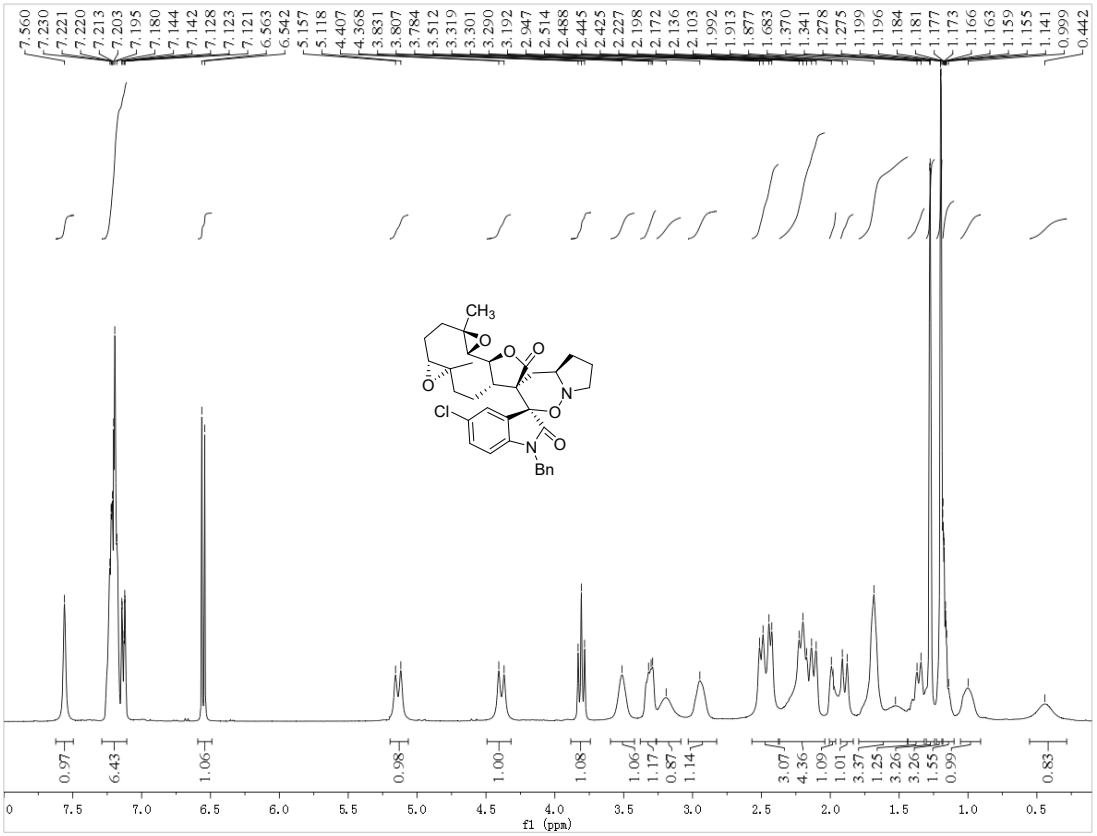


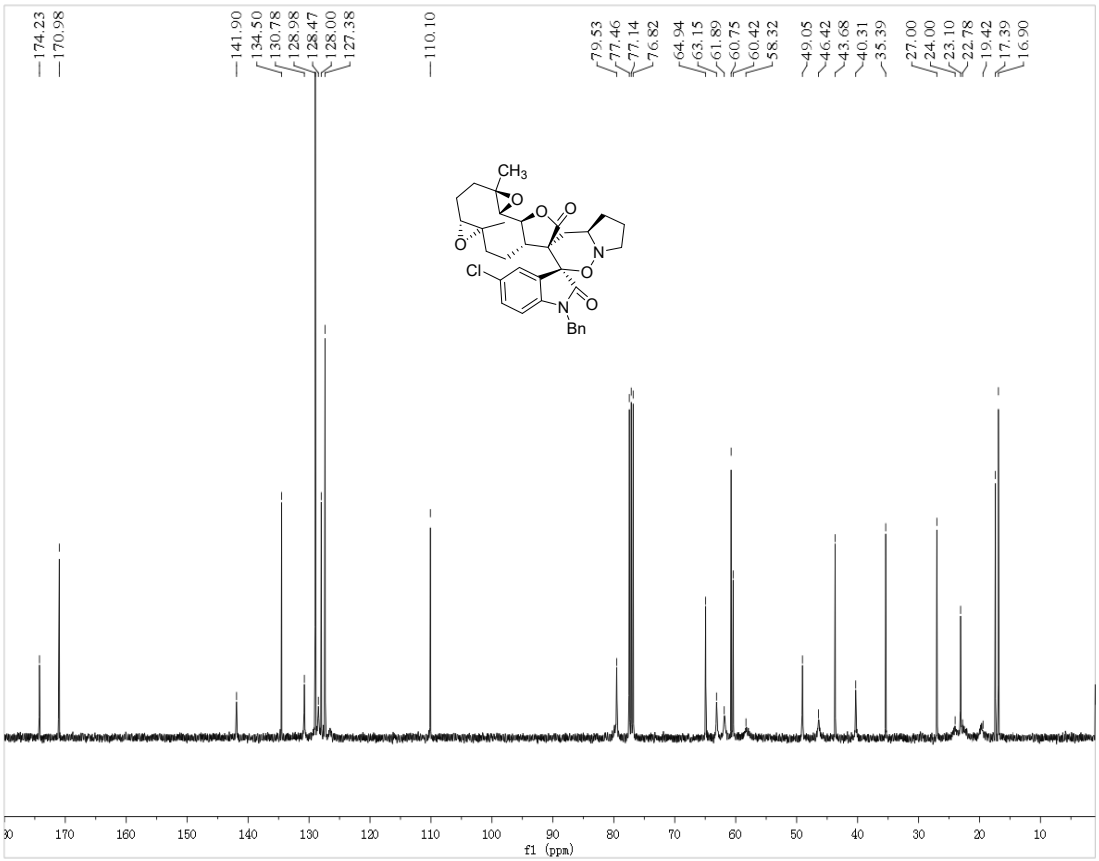
^{1}H and ^{13}C NMR of 4bh



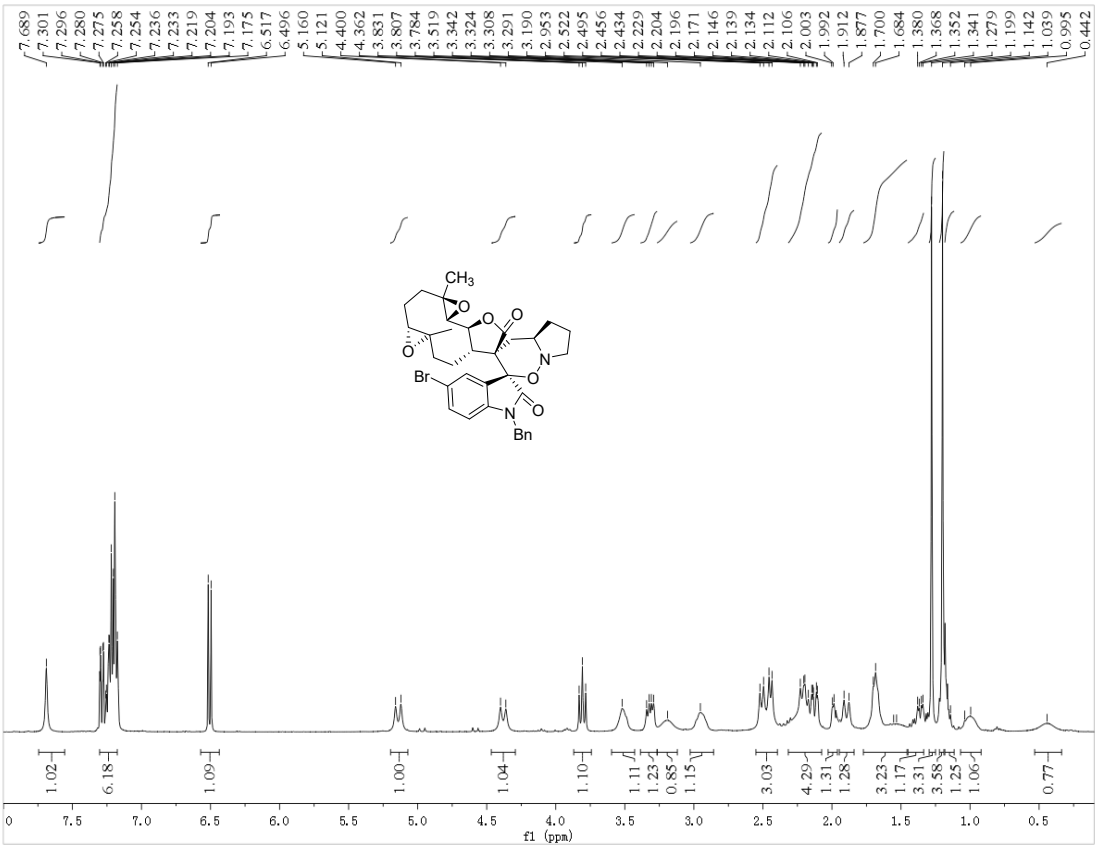


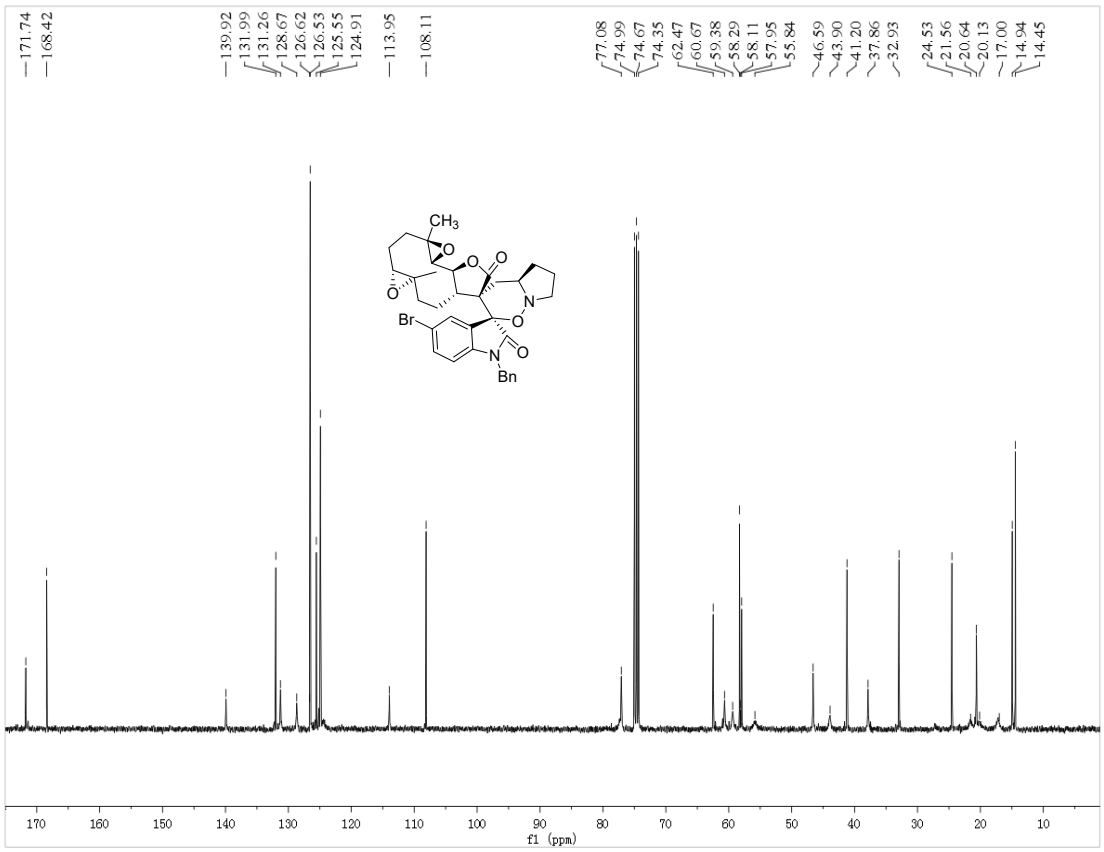
^{1}H and ^{13}C NMR of 4bi



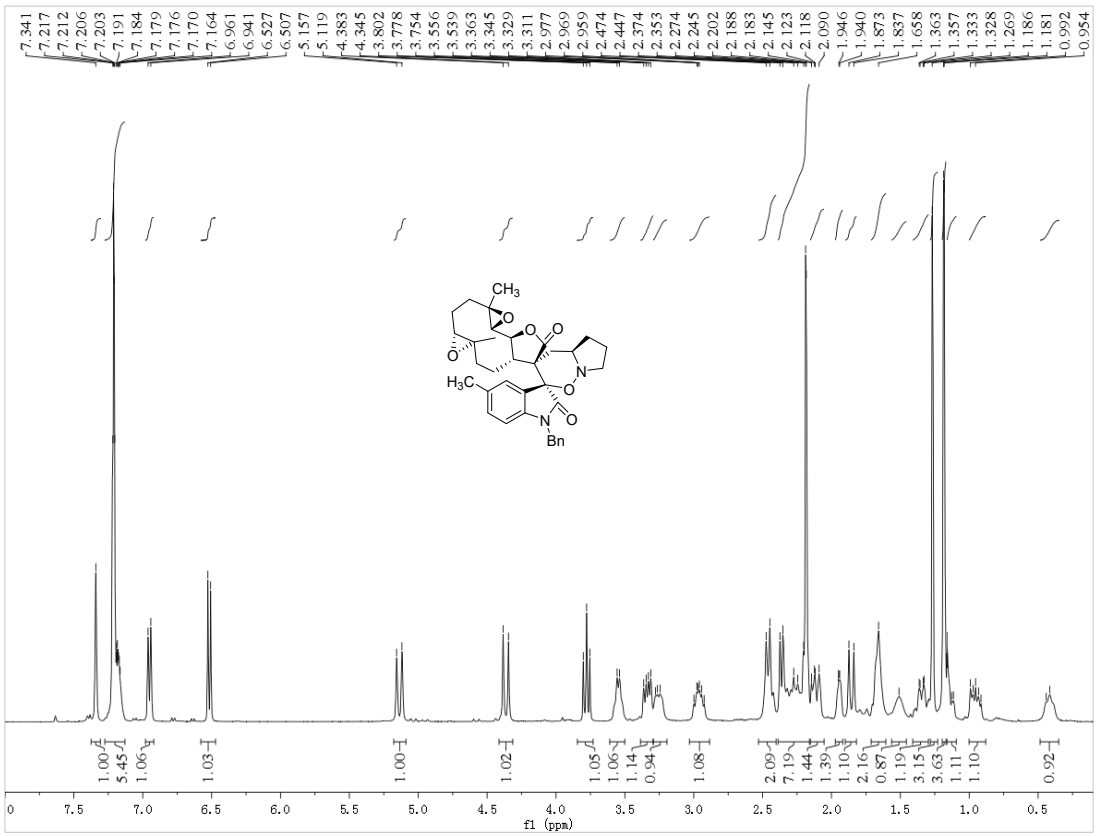


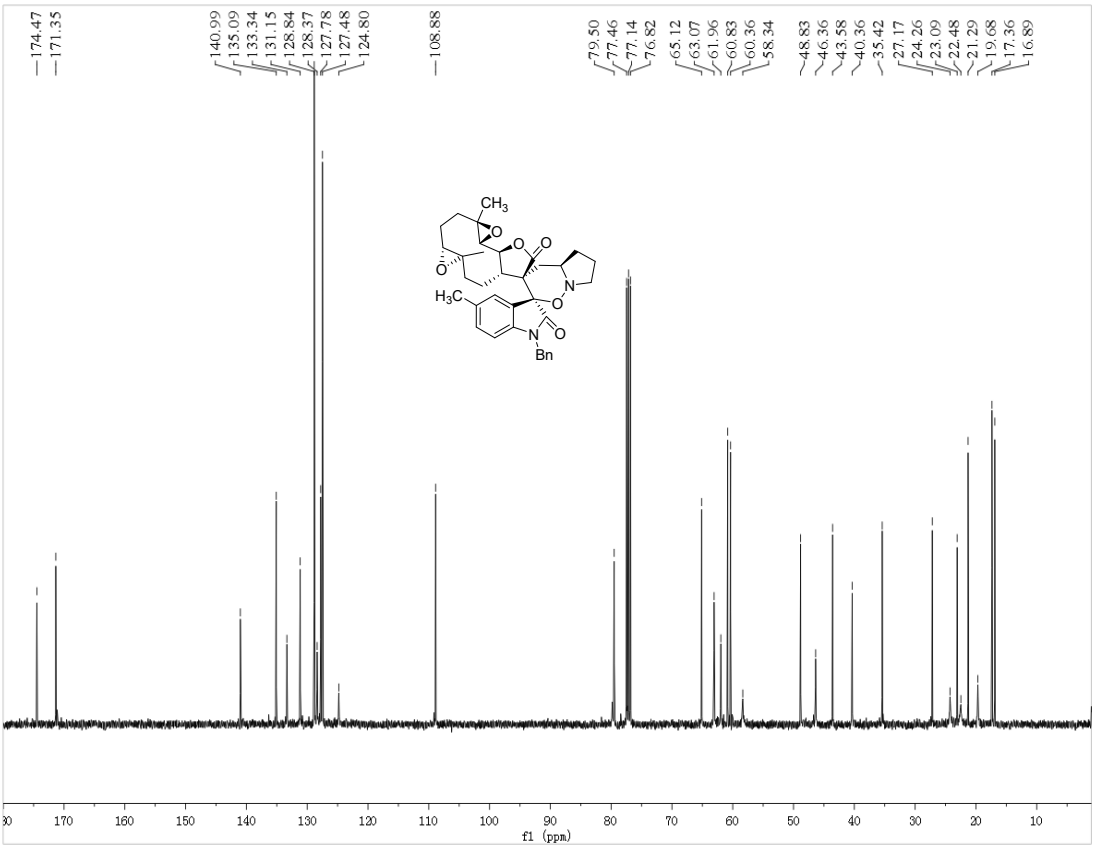
^{1}H and ^{13}C NMR of 4bj



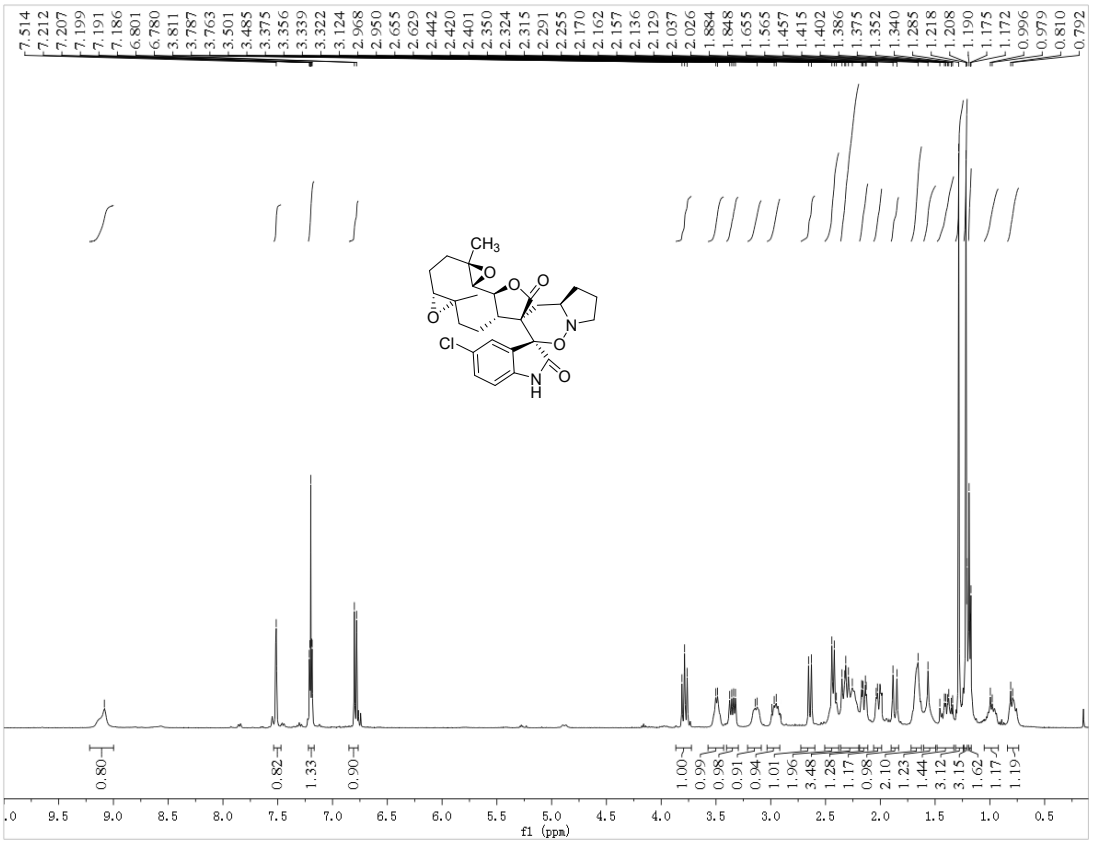


^{1}H and ^{13}C NMR of 4bk





^{1}H and ^{13}C NMR of 4bl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7.199
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7.186
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6.780
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3.787
3.763
3.501
3.485
3.375
3.356
3.339
3.322
3.124
2.968
2.950
2.655
2.629
2.442
2.420
2.401
2.350
2.324
2.315
2.291
2.255
2.170
2.162
2.157
2.136
2.129
2.037
2.026
1.884
1.848
1.655
1.565
1.457
1.415
1.402
1.386
1.375
1.352
1.340
1.285
1.218
1.208
1.190
1.175
1.172
0.996
0.979
0.810
0.792
0.80
0.82
1.33
0.90
1.00
0.99
0.98
0.91
0.94
1.01
1.96
3.48
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1.17
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2.10
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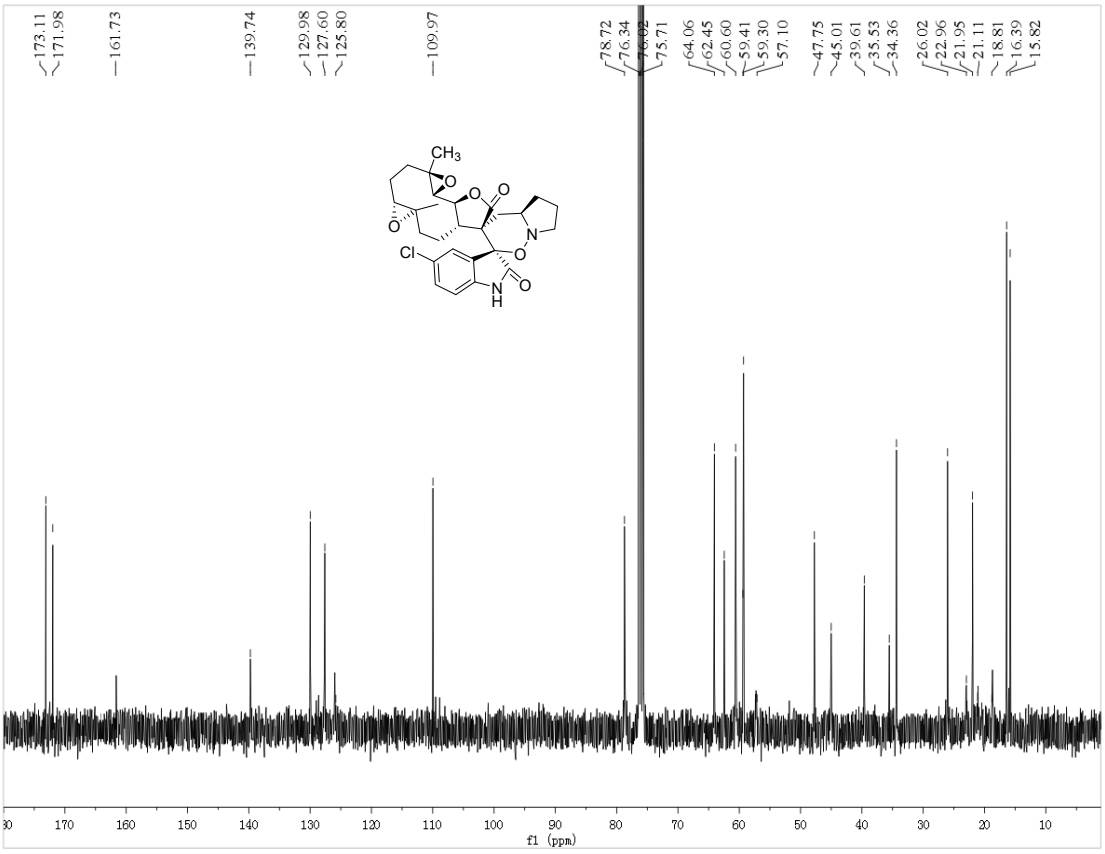
1.44
3.12
3.15
1.62
1.17
1.19
f1 (ppm)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171.98
161.73
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129.98
127.60
125.80
109.97
78.72
76.34
75.71
64.06
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60.60
59.41
59.30
57.10
47.75
45.01
39.61
35.53
34.36
26.02
22.96
21.95
21.11
18.81
16.39
15.82
f1 (ppm)