Electronic Supplementary Material (ESI) for ChemComm.

Supporting Information

Total Syntheses of Wentilactone A & B, and Related Norditerpene Dilactones

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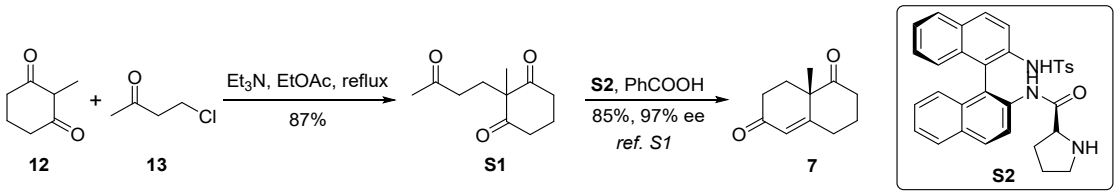
General procedure

All reactions were carried out under an argon atmosphere with dry solvents under anhydrous conditions, unless otherwise noted. Tetrahydrofuran (THF) and diethyl ether (Et_2O) was distilled immediately before use from sodium. Methylene chloride (CH_2Cl_2), *N*,*N*-dimethylformamide (DMF), dimethyl sulfoxide (DMSO), and toluene were dried with activated 4Å molecular sieves and stored under an argon atmosphere. Reagents were purchased at the highest commercial quality and used without further purification, unless otherwise stated. Solvents for chromatography were used as supplied by Adamas-beta®. Reactions were monitored by thin layer chromatography (TLC) carried out on Millipore Sigma glass TLC plates (silica gel 60 coated with F_{254}, 250 µm). Visualization was performed by ultraviolet light as visualizing agent and/or by staining with ceric ammonium molybdate or potassium permanganate solution as developing agents. Normal phase HPLC analyses were performed on an OD-H for enantiomeric excess. SiliaFlash® P60 silica gel (particle size: 40–63 µm, pore size: 60 Å) was used for flash column chromatography. NMR spectra were recorded on an Agilent DD2 500 MHz or a Bruker Advance III HD 600 MHz NMR spectrometer. The spectra were calibrated by using residual undeuterated solvents (for ^{1}H NMR) and deuterated solvents (for ^{13}C NMR) as internal references: $CHCl_3$ (δ_H = 7.26 ppm) and $CDCl_3$ (δ_C = 77.16 ppm); acetone-d6 (δ_C = 29.84 ppm); DMSO-d_6 (δ_C = 39.52 ppm). The following abbreviations are used to designate multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, br = broad. High-resolution mass spectra (HRMS) were recorded on a Bruker maXis 4G (ESI-TOF) mass spectrometer. Specific rotations were recorded on an Anton Paar MPC 5500 polarimeter.

Experimental Procedures and Spectroscopic Data

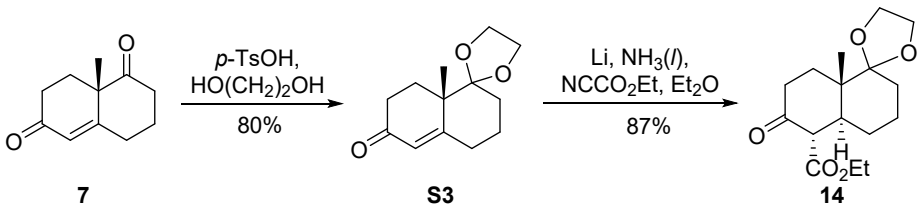


To a solution of 2-methyl-1,3-cyclohexanedione (**12**) (100.0 g, 0.793 mol) in dry ethyl acetate (600 mL) and Et_3N (560 mL, 3.96 mol) was added 1-chloro-3-pentanone [S2] (**13**) (127.0 g, 1.19 mol) at room temperature. The mixture was refluxed for 15 hr. After cooled to room temperature, the triethylamine hydrochloride salt was filtered and washed with dry ethyl acetate. The combined filtrate was distilled under reduced pressure to remove ethyl acetate and excess triethyl amine. The residue was diluted with EtOAc, washed with HCl (1 M aq.), water, and brine sequentially, then dried over anhydrous Na_2SO_4, filtered and concentrated under vacuum. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 2:1) to afford triketone (**S1**) as a pale yellow oil (135.6 g, 87%).

To triketone (**S1**) (135.6 g, 0.691 mol) were added **S2**[S3] (3.70 g, 6.91 mmol) and PhCOOH (2.11 g, 17.28 mmol). The mixture was allowed to stir at room temperature for 7 days. The reaction mixture was diluted with EtOAc and then washed with saturated aq. sodium bicarbonate and brine. The aq. layer was back extracted with EtOAc. The combined organic layers were dried over anhydrous Na_2SO_4, filtered and concentrated under vacuum. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 2:1) to afford **7**[S4] (104.7 g, 85% yield, 97% ee) as a pale yellow solid.

Compound **S1**: ^{1}H NMR (500 MHz, $CDCl_3$) δ 2.72 (ddd, *J* = 16.0, 8.9, 5.4 Hz, 2H), 2.63 (ddd, *J* = 16.1, 7.6, 5.2 Hz, 2H), 2.34 (dd, *J* = 8.1, 6.8 Hz, 2H), 2.10 (s, 3H), 2.07–1.97 (m, 3H), 1.90 (dtt, *J* = 14.1, 8.9, 5.3 Hz, 1H), 1.24 (s, 3H).

Compound **9**: ^{1}H NMR (500 MHz, $CDCl_3$) δ 5.84 (d, *J* = 1.9 Hz, 1H), 2.71 (m, 2H), 2.54–2.41 (m, 4H), 2.17–2.07 (m, 3H), 1.69 (qt, *J* = 13.4, 4.3 Hz, 1H), 1.43 (s, 3H).

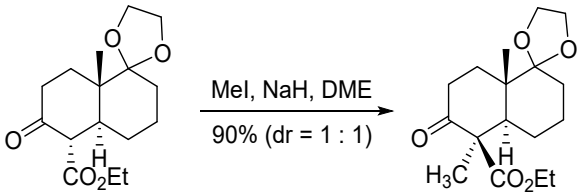


Literature procedure[S5] was followed to convert **7** (143.7 g, 0.806 mol) to **S3** (143.4 g, 80%) as a colorless oil after flash chromatography (petroleum ether/EtOAc, 5:1).

Literature procedure[S6] was followed to convert **S3** (49.0 g, 0.220 mol) to **14** (57.2 g, 87%) as a colorless oil after flash chromatography (petroleum ether/EtOAc, 8:1).

Compound **S3**: ^{1}H NMR (600 MHz, $CDCl_3$) δ 5.77 (d, *J* = 2.0 Hz, 1H), 4.01–3.91 (m, 4H), 2.44 (dddd, *J* = 15.2, 13.2, 6.0, 2.1 Hz, 1H), 2.41–2.35 (m, 2H), 2.33–2.23 (m, 2H), 1.89 (td, *J* = 13.4, 4.2 Hz, 1H), 1.79 (dddt, *J* = 13.1, 6.4, 4.5, 1.8 Hz, 1H), 1.75–1.61 (m, 3H), 1.36 (d, *J* = 0.8 Hz, 3H).

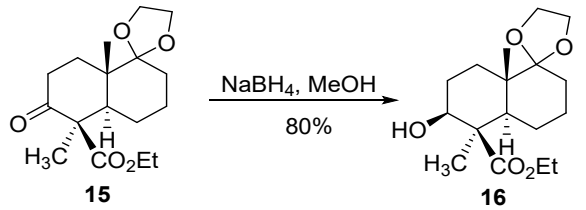
Compound **14**: $[\alpha]_D^{25}$ 0.2 (*c* 1.2, $CHCl_3$); ^1H NMR (600 MHz, $CDCl_3$) δ 4.19 (qd, *J* = 7.1, 2.7 Hz, 2H), 3.98–3.91 (m, 2H), 3.91–3.84 (m, 2H), 3.17 (d, *J* = 13.0 Hz, 1H), 2.47–2.37 (m, 3H), 1.97 (dt, *J* = 13.3, 9.8 Hz, 1H), 1.77–1.69 (m, 2H), 1.64 (m, 1H), 1.60–1.50 (m, 2H), 1.36–1.27 (m, 3H), 1.25 (t, *J* = 7.1 Hz, 3H), 1.19 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 205.9, 169.9, 112.1, 65.3, 65.1, 61.0, 60.0, 43.7, 41.6, 37.5, 30.3, 29.8, 26.1, 22.5, 14.3, 14.0; HRMS (ESI-TOF) *m/z* $[M + Na]^+$ calcd for $C_{16}H_{24}O_5Na^+$ 319.1516, found 319.1521.



14 **15**

To a mixture of **14** (99.2 g, 0.335 mol) in dry DME (500 mL) and *t*-BuOH (10 drops) was added NaH (14.72 g, 0.368 mol, 60% weight). The mixture was stirred for 30 min at 0 °C, to which MeI (23 mL, 0.368 mol) was added. After being refluxed for 2 hr, the mixture was cooled to room temperature and quenched with saturated aq. NH_4Cl until no gas was released. The mixture was diluted with EtOAc, wash with water and brine, dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 8:1) to afford **15** as a pale yellow oil (43.0 g , 45%).

Compound **15**: $[\alpha]_D^{25}$ -25.9 (*c* 0.8, $CHCl_3$); ^1H NMR (500 MHz, $CDCl_3$) δ 4.13 (qq, *J* = 10.8, 7.1 Hz, 2H), 3.97–3.83 (m, 4H), 2.92 (td, *J* = 14.8, 6.4 Hz, 1H), 2.41 (ddd, *J* = 14.5, 4.8, 2.6 Hz, 1H), 1.96–1.84 (m, 2H), 1.81 (dd, *J* = 12.4, 2.5 Hz, 1H), 1.78–1.62 (m, 4H), 1.57–1.50 (m, 1H), 1.42 (qt, *J* = 12.4, 4.0 Hz, 1H), 1.33 (s, 3H), 1.25 (t, *J* = 7.1 Hz, 3H), 1.16 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 208.8, 173.6, 112.7, 65.3, 65.1, 61.2, 57.5, 52.0, 43.2, 36.8, 30.9, 30.3, 23.2, 23.1, 21.3, 14.7, 14.0; HRMS (ESI-TOF) *m/z* $[M +Na]^+$ calcd for $C_{17}H_{26}O_5Na^+$ 333.1672, found 333.1670.

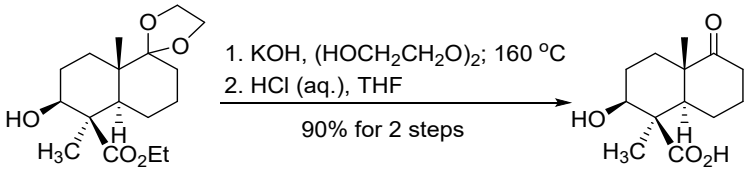


15 **16**

To a stirred solution of **15** (89.5g, 0.288 mol) in MeOH (500 mL) was added $NaBH_4$ (3.27 g, 86.51 mmol) under argon at -78 °C. The mixture was allowed to warm naturally to room temperature before it was quenched with saturated aq. NH_4Cl. The mixture was diluted with EtOAc, washed with water and brine, dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 8:1) to afford **16** as a pale yellow solid

(72.0 g, 80%).

Compound **16**: $[\alpha]_D^{25}$ -18.1 (*c* 0.4, $CHCl_3$); ^1H NMR (600 MHz, $CDCl_3$) δ 4.17–4.12 (m, 2H), 3.98–3.82 (m, 4H), 3.28 (d, *J* = 11.8 Hz, 1H), 3.11 (td, *J* = 11.4, 4.3 Hz, 1H), 2.04 (m, 1H), 1.82 (m, 2H), 1.75–1.57 (m, 4H), 1.54–1.40 (m, 4H), 1.39 (s, 3H), 1.30 (t, *J* = 7.1 Hz, 3H), 0.92 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.7, 112.8, 78.2, 65.2, 64.9, 60.4, 50.4, 49.2, 43.3, 30.4, 29.0, 27.9, 23.8, 23.2, 22.7, 14.6, 14.1; HRMS (ESI-TOF) *m/z* $[M + Na]^+$ calcd for $C_{17}H_{28}O_5Na^+$ 335.1829, found 335.1832.

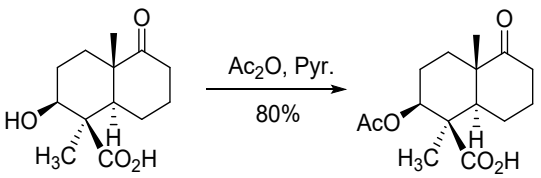


16 **17**

To a stirred solution of **16** (68.6 g, 0.219 mol) in diethylene glycol (500 mL) was added KOH (124 g, 2.20 mol) under argon at room temperature. The mixture was heated with heating mantle to 160 °C for 5 h. The reaction mixture was poured into ice-aq. HCl carefully and acidified with conc. HCl to pH = 1, then diluted with CH_2Cl_2, and stirred for 30 min. The aqueous phase was washed with CH_2Cl_2. The combined organic phase was concentrated under vaccum to give the corresponding acid as a brown oil, which was used directly in the next step without further purification.

The crude acid was dissolved in THF (500 mL), to which was added aq. HCl (6 N). The mixture was stirred at room temperature for 12 hr, and was then washed with CH_2Cl_2. The combined organic phase was concentrated under vaccum. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 2:1) to afford **17** as a brown solid (47.5 g, 90%).

Compound **17**: $[\alpha]_D^{25}$ -32.8 (*c* 2.9, $CHCl_3$); ^1H NMR (600 MHz, $CDCl_3$) δ 3.17 (dd, *J* = 12.0, 4.5 Hz, 1H), 2.58 (td, *J* = 14.2, 6.6 Hz, 1H), 2.31–2.19 (m, 2H), 2.17–1.97 (m, 3H), 1.93 (dq, *J* = 13.2, 4.2 Hz, 1H), 1.80 (dt, *J* = 14.3, 3.5 Hz, 1H), 1.66 (td, *J* = 14.1, 4.4 Hz, 1H), 1.49 (s, 4H), 1.41–1.33 (m, 1H), 1.11 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 214.8, 181.5, 77.6, 53.9, 49.3, 49.1, 37.9, 31.9, 27.9, 26.4, 24.1, 22.8, 17.2; HRMS (ESI-TOF) *m/z* $[M + Na]^+$ calcd for $C_{13}H_{19}O_4Na_2^+$ 285.1073, found 285.1068.

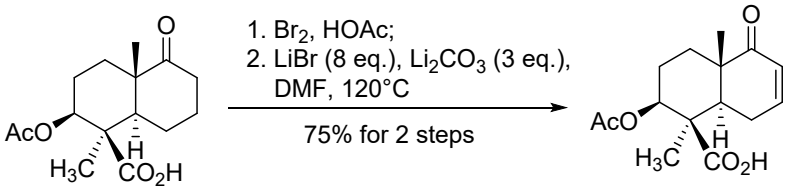


17 **18**

To a stirred solution of **17** (48 g, 0.199 mol) in pyridine (250 mL) was added Ac_2O (28 mL, 0.30 mol) under argon at room temperature. The mixture was stirred at room temperature for 12 hr. The reaction mixture was diluted with CH_2Cl_2, washed with dil.

aq. HCl, dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 2:1) to afford **18** as a pale yellow solid (45 g, 80%).

Compound **18**: $[\alpha]_D^{25}$ -13.6 (*c* 3.5, $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$) δ 4.56 (dd, *J* = 12.1, 4.6 Hz, 1H), 2.58 (td, *J* = 14.2, 6.8 Hz, 1H), 2.38 (dtd, *J* = 13.6, 12.4, 4.0 Hz, 1H), 2.30–2.24 (m, 1H), 2.15–2.03 (m, 5H), 2.01–1.93 (m, 1H), 1.88–1.71 (m, 3H), 1.54 (tt, *J* = 13.5, 4.5 Hz, 1H), 1.48 (dd, *J* = 12.5, 3.0 Hz, 1H), 1.32 (s, 3H), 1.17 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 214.2, 179.4, 170.9, 78.3, 53.2, 48.8, 48.3, 37.4, 31.3, 25.9, 24.0, 23.7, 22.4, 21.3, 16.9; HRMS (ESI-TOF) *m/z* $[M + Na]^+$ calcd for $C_{15}H_{21}O_5Na_2^+$ 327.1179, found 327.1176.

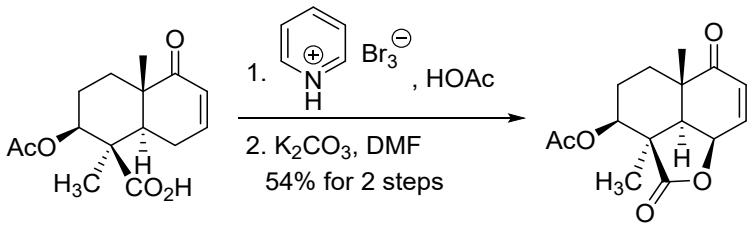


18 **19**

To a stirred solution of **18** (42.6 g, 0.151 mol) in HOAc (300 mL) was added dropwise a solution of Br_2 (7.8 mL, 0.151 mol) in HOAc (40 mL) under argon at room temperature. The mixture was stirred at room temperature for 30 min. The reaction mixture was diluted with CH_2Cl_2, washed with ice-water, water and brine sequentially, dried over anhydrous Na_2SO_4, and filtered. The filtrate was concentrated under reduce pressure to give the crude product as a yellow foam, which was used directly in the next step without further purification.

To a solution of the above residue in dry DMF (350 mL) were added LiBr (105 g, 1.21 mol) and Li_2CO_3 (34 g, 0.452 mol) at room temperature. The mixture was heated with heating mantle to 120 °C and stirred for 3 h at the same temperature. The mixture was cooled to room temperature, diluted with CH_2Cl_2, washed with aq. HCl and brine sequentially, dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 2:1) to afford **19** as a pale yellow solid (31.7 g, 75%).

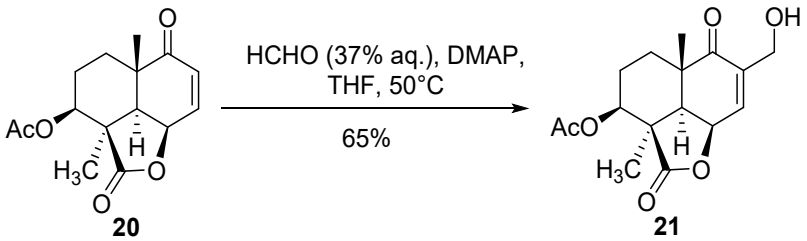
Compound **19**: $[\alpha]_D^{25}$ -15.5 (*c* 0.6, $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.96 (ddd, *J* = 10.1, 5.9, 2.2 Hz, 1H), 5.93 (ddd, *J* = 10.0, 2.9, 1.1 Hz, 1H), 4.60 (dd, *J* = 12.1, 4.5 Hz, 1H), 2.68 (ddt, *J* = 19.7, 11.5, 2.6 Hz, 1H), 2.60 (dt, *J* = 19.7, 5.2 Hz, 1H), 2.47–2.38 (m, 1H), 2.08 (m, 4H), 1.92 (dd, *J* = 11.5, 4.3 Hz, 1H), 1.89–1.84 (m, 1H), 1.59 (td, *J* = 14.3, 4.2 Hz, 1H), 1.32 (s, 3H), 1.08 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 203.9, 178.8, 170.8, 148.8, 127.5, 78.4, 49.0, 48.2, 45.3, 31.3, 25.5, 23.9, 23.6, 21.3, 15.7; HRMS (ESI-TOF) *m/z* $[M + Na]^+$ calcd for $C_{15}H_{19}O_5Na_2^+$ 325.1022, found 325.1021.



To a stirred solution of **19** (55.35 g, 0.197 mol) in HOAc (650 mL) was added pyridinium tribromide (63.2 g, 0.197 mol) under argon at room temperature. The mixture was stirred at room temperature for 18 hr, and was then diluted with CH_2Cl_2. The mixture was washed with ice-water, water and brine sequentially, dried over anhydrous Na_2SO_4, and filtered. The filtrate was concentrated under reduce pressure to give the crude product as a yellow foam, which was used directly in the next step without further purification.

To a solution of the above residue in dry DMF (650 mL) was added K_2CO_3 (27.3 g, 0.197 mol) at room temperature. The mixture was stirred for 24 h at same temperature, and was then diluted with CH_2Cl_2. The mixture was washed with aq. HCl and brine sequentially, dried over anhydrous Na_2SO_4, and filtered. The filtrate was concentrated under reduce pressure. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 2:1) to afford **20** as a pale yellow solid (29.5 g, 54%).

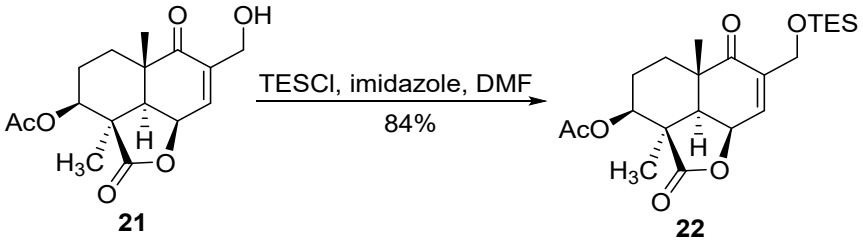
Compound **20**: $[\alpha]_D^{25}$ -25.4 (*c* 3.1, $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.86 (dd, *J* = 9.9, 4.6 Hz, 1H), 6.13 (dd, *J* = 9.9, 1.0 Hz, 1H), 5.08 (dd, *J* = 7.1, 4.9 Hz, 1H), 4.93 (td, *J* = 4.5, 1.0 Hz, 1H), 2.18 (d, *J* = 4.5 Hz, 1H), 2.09 (s, 3H), 1.90–1.79 (m, 3H), 1.66–1.60 (m, 1H), 1.39 (s, 3H), 1.35 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 203.9, 178.8, 170.8, 148.8, 127.5, 78.4, 49.0, 48.2, 45.3, 31.3, 25.5, 23.9, 23.6, 21.3, 15.7; HRMS (ESI-TOF) *m/z* $[M + Na]^+$ calcd for $C_{15}H_{18}O_5Na^+$ 301.1046, found 301.1051.



To a solution of **20** (8.0 g, 28.75 mmol) in THF (32 mL) were added DMAP (702 mg, 5.75 mmol) and aq. HCHO (32 mL, 431.18 mmol, 37% aq.) at room temperature. The mixture was heated with heating mantle to 50 °C and stirred for 48 h at the same temperature. The mixture was diluted with CH_2Cl_2, washed with aq. HCl and brine sequentially, dried over anhydrous Na_2SO_4, and filtered. The filtrate was concentrated under reduce pressure. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 2:1) to afford **21** as a pale yellow solid (5.76 g, 65%).

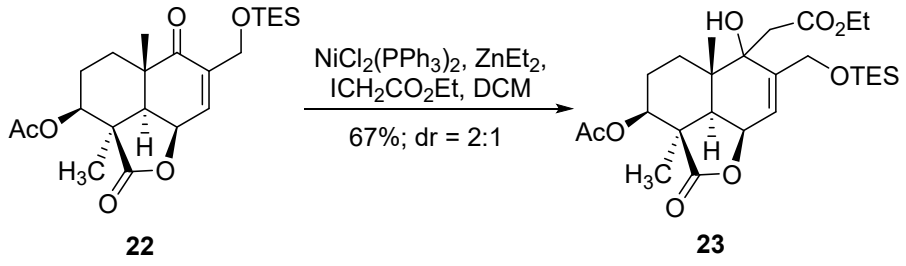
Compound **21**: $[\alpha]_D^{25}$ -16.0 (*c* 2.5, $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.83 (dq, *J* = 3.3,

2.2, 1.7 Hz, 1H), 5.13–5.08 (m, 1H), 5.01 (tt, *J* = 4.6, 1.6 Hz, 1H), 4.43–4.26 (m, 2H), 2.20 (d, *J* = 4.4 Hz, 1H), 2.12 (s, 3H), 1.93–1.80 (m, 3H), 1.68–1.62 (m, 1H), 1.41 (s, 3H), 1.36 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 202.4, 175.6, 170.7, 141.1, 131.3, 71.8, 70.4, 60.9, 48.4, 46.3, 42.1, 25.4, 23.9, 23.4, 22.1, 21.2; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{16}H_{20}O_6Na^+$ 331.1152, found 331.1151.



To a solution of **21** (3.0 g, 9.73 mmol) and imidazole (1.66 g, 24.32 mmol) in DMF (100 mL) was added TESCl (3.3 mL, 19.46 mmol) at room temperature. The mixture was stirred for 12 h at the same temperature. The mixture was diluted with CH_2Cl_2, washed with aq. HCl and brine sequentially, dried over anhydrous Na_2SO_4, and filtered. The filtrate was concentrated under reduce pressure. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 8:1) to afford **22** as a pale yellow solid (3.45 g, 84%).

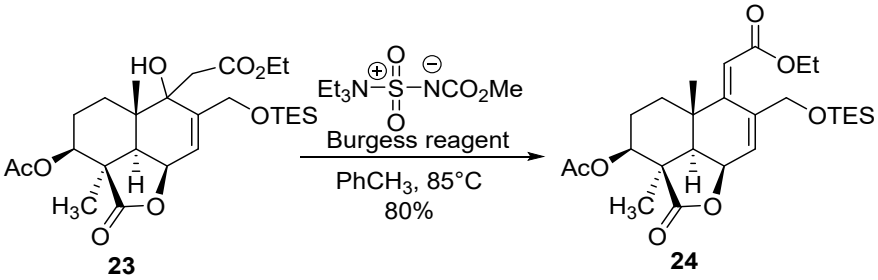
Compound **22**: $[\alpha]_D^{25}$ +3.0 (*c* 1.0, $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.87 (dt, *J* = 4.6, 2.2 Hz, 1H), 5.12–5.09 (m, 1H), 5.01 (tdd, *J* = 4.5, 2.8, 1.5 Hz, 1H), 4.47 (dt, *J* = 16.7, 2.6 Hz, 1H), 4.27 (ddd, *J* = 16.7, 2.1, 1.4 Hz, 1H), 2.18 (d, *J* = 4.4 Hz, 1H), 2.13 (s, 3H), 1.92–1.84 (m, 3H), 1.69–1.64 (m, 1H), 1.42 (s, 3H), 1.37 (s, 3H), 0.95 (t, *J* = 8.0 Hz, 9H), 0.62 (q, *J* = 8.0 Hz, 6H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 201.8, 175.6, 170.6, 141.8, 129.9, 71.9, 70.4, 60.1, 48.7, 46.3, 42.2, 25.6, 23.9, 23.3, 22.2, 21.3, 6.8, 6.8, 4.5; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{22}H_{34}O_6SiNa^+$ 445.2017, found 445.2005.



To a solution of **22** (2.8 g, 6.63 mmol) and $NiCl_2(PPh_3)_2$ (1.08 g, 1.66 mmol) in CH_2Cl_2 (330 mL) was added ICH_2CO_2Et (6.5 mL, 33.13 mmol) at 0 °C. After being stirred at 0 °C for 10 min, a solution of $ZnEt_2$ (67 mL, 66.26 mmol, 1 M in hexane) was added dropwise. After being stirred at the same temperature for 2 h, the reaction was allowed warm to room temperature. The reaction was quenched by aq. NH_4Cl at 0 °C. The mixture was diluted with CH_2Cl_2, washed with water and brine sequentially, dried over anhydrous Na_2SO_4, and filtered. The filtrate was concentrated under reduce pressure. The residue was purified by silica gel chromatography (petroleum

ether/EtOAc, 4:1) to afford **23** as a pale yellow solid (2.43 g, 67%).

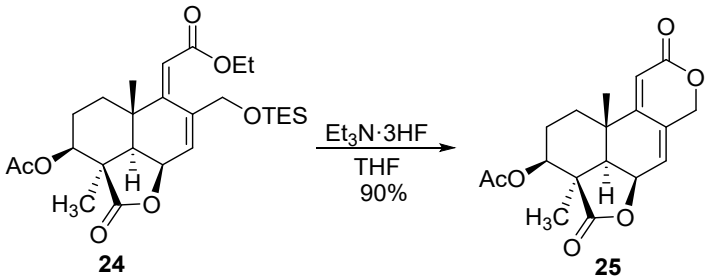
Compound **23**: ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.09–5.98 (m, 1H), 5.04–4.79 (m, 3H), 4.38 (m, 1H), 4.28–4.13 (m, 3H), 2.72–2.58 (m, 2H), 2.19 (m, 3H), 2.11–2.00 (m, 1H), 2.01–1.90 (m, 1H), 1.88–1.76 (m, 1H), 1.70 (m, 1H), 1.40 (s, 3H), 1.34–1.22 (m, 5H), 1.16 (d, *J* = 17.3 Hz, 3H), 0.97 (m, 9H), 0.61 (m, 6H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 176.0, 175.7, 173.5, 173.3, 171.2, 149.0, 148.5, 120.3, 117.6, 77.8, 77.0, 73.9, 73.8, 70.9, 70.7, 63.4, 62.3, 61.9, 61.7, 48.3, 48.3, 45.5, 45.5, 40.2, 40.1, 38.1, 37.6, 29.4, 28.5, 28.3, 25.0, 23.2, 23.1, 21.3, 21.2, 18.3, 18.3, 14.1, 14.1, 6.8, 6.7, 5.9, 4.4; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{26}H_{42}O_8SiNa^+$ 533.2541, found 533.2538.



23 **24**

To a solution of **23** (2.0 g, 3.92 mmol) in $PhCH_3$ (40 mL) was added Burgess reagent (1.87 g, 7.83 mmol) at room temperature. The mixture was heated with heating mantle to 85 °C and stirred for 24 h at the same temperature. The mixture was cooled to room temperature, diluted with CH_2Cl_2, washed with water and brine sequentially. The organic layer was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (petroleum ether/EtOAc, 4:1) to afford **24** as a pale yellow solid (1.54 g, 80%).

Compound **24**: $[\alpha]_D^{25}$ -104.5 (*c* 3.6, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.36 (dd, *J* = 3.9, 1.9 Hz, 1H), 5.62 (d, *J* = 1.3 Hz, 1H), 4.98 (tt, *J* = 4.5, 1.9 Hz, 1H), 4.92 (dd, *J* = 11.4, 6.4 Hz, 1H), 4.58 (dt, *J* = 14.3, 2.1 Hz, 1H), 4.20–4.11 (m, 3H), 2.17 (s, 3H), 2.11–2.00 (m, 1H), 1.95 (d, *J* = 4.2 Hz, 1H), 1.89–1.82 (m, 1H), 1.71 (m, 1H), 1.55 (td, *J* = 12.9, 4.0 Hz, 1H), 1.34 (s, 3H), 1.28 (t, *J* = 7.2 Hz, 3H), 1.19 (s, 3H), 0.92 (t, *J* = 8.0 Hz, 9H), 0.57 (q, *J* = 8.0 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 175.5, 171.2, 167.2, 154.4, 142.6, 122.4, 114.2, 74.0, 72.1, 62.8, 60.9, 52.1, 45.7, 38.5, 32.0, 25.1, 22.1, 21.8, 21.3, 14.2, 6.8, 4.5; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{26}H_{40}O_7SiNa^+$ 515.2436, found 515.2433.

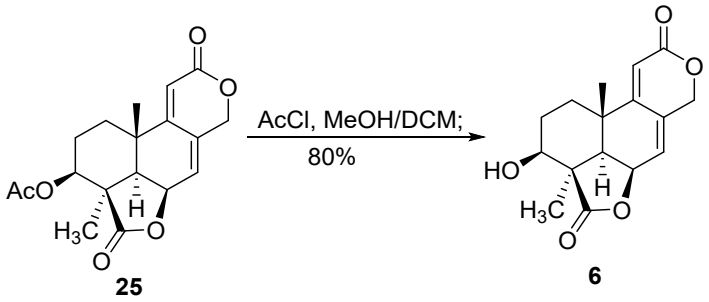


24 **25**

To a solution of **24** (1.2 g, 2.44 mmol) in THF (25 mL) was added $Et_3N{\cdot}3HF$ (2.5 mL, 24.36 mmol) at room temperature. The mixture was stirred for 12 h at the same temperature. The mixture was diluted with CH_2Cl_2, washed with water and brine sequentially. The organic layer was dried over anhydrous Na_2SO_4, filtered, and

concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 2:1) to afford **25** as a pale yellow solid (728 mg, 90%).

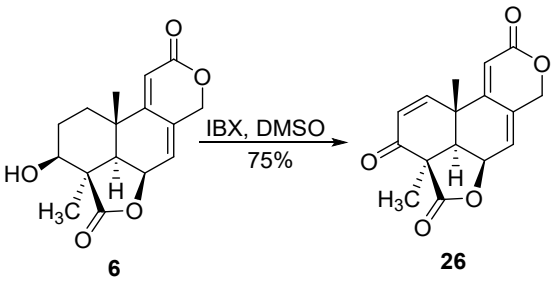
Compound **25**: $[\alpha]_D^{25}$ -229.4 (*c* 0.5, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.19 (dt, *J* = 4.5, 1.9 Hz, 1H), 5.78 (d, *J* = 1.8 Hz, 1H), 5.08–5.04 (m, 1H), 5.03–4.98 (m, 2H), 4.93–4.88 (m, 1H), 2.18 (s, 3H), 2.13–2.05 (m, 1H), 2.00 (d, *J* = 4.1 Hz, 1H), 1.97–1.83 (m, 2H), 1.73–1.65 (m, 1H), 1.41 (s, 3H), 1.32 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 175.3, 170.9, 163.5, 158.0, 132.9, 121.5, 111.9, 72.8, 70.6, 69.6, 49.7, 45.5, 35.4, 29.3, 24.4, 23.5, 22.4, 21.3; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{18}H_{20}O_6Na^+$ 355.1152, found 355.1146.



25 **6**

To a solution of **25** (1.2 g, 3.61 mmol) in MeOH (10 mL) and CH_2Cl_2 (20 mL) was added AcCl (0.4 mL, 5.42 mmol) at room temperature.[S7] The mixture was stirred for 48 h at the same temperature. The mixture was diluted with CH_2Cl_2, and washed water and brine sequentially. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 4:1) to afford **6** as a pale yellow solid (838 mg, 80%).

Compound **6**: $[\alpha]_D^{25}$ -274.1 (*c* 0.5, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.21 (dd, *J* = 4.7, 2.3 Hz, 1H), 5.77 (d, *J* = 1.7 Hz, 1H), 5.07 (td, *J* = 4.5, 1.5 Hz, 1H), 5.01 (dt, *J* = 13.7, 2.0 Hz, 1H), 4.90 (dd, *J* = 13.7, 0.9 Hz, 1H), 3.74 (td, *J* = 10.0, 6.7 Hz, 1H), 3.64 (d, *J* = 9.7 Hz, 1H), 2.23–2.16 (m, 1H), 1.95 (d, *J* = 4.0 Hz, 1H), 1.90–1.79 (m, 2H), 1.55 (m, 4H), 1.26 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 180.0, 163.4, 158.0, 133.6, 121.2, 111.7, 73.3, 72.0, 69.6, 50.1, 45.1, 35.7, 29.6, 28.7, 23.3, 22.3; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{16}H_{18}O_5Na^+$ 313.1046, found 313.1051.

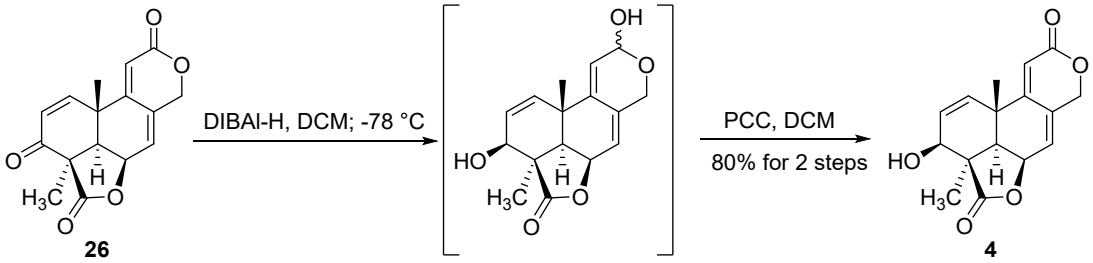


6 **26**

To a solution of **6** (200 mg, 0.689 mmol) in DMSO (30 mL) was added IBX (1.16 g, 4.13 mmol) at room temperature. The mixture was heated with heating mantle to 80 °C and stirred for 24 h at the same temperature. The mixture was cooled to room

temperature, diluted with CH_2Cl_2, and washed with water and brine sequentially. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 8:1) to afford **26** as a pale yellow solid (148 mg, 75%).

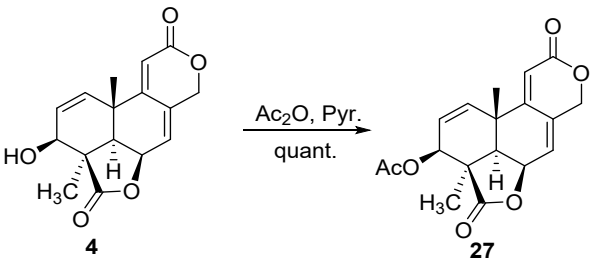
Compound **26**: $[\alpha]_D^{25}$ -342.8 (*c* 0.4, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.42 (d, *J* = 10.0 Hz, 1H), 6.32 (dt, *J* = 4.6, 1.9 Hz, 1H), 6.14 (d, *J* = 9.9 Hz, 1H), 6.07 (d, *J* = 1.8 Hz, 1H), 5.10–5.03 (m, 2H), 4.99–4.94 (m, 1H), 2.77 (d, *J* = 4.7 Hz, 1H), 1.61 (s, 3H), 1.40 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 191.6, 172.6, 162.6, 152.0, 148.4, 132.7, 129.2, 121.8, 112.8, 70.5, 69.6, 52.4, 49.1, 36.9, 28.4, 21.6; HRMS (ESI-TOF) *m/z* $[M + Na]^+$ calcd for $C_{16}H_{14}O_5Na^+$ 309.0733, found 309.0728.



To a stirred solution of **26** (50 mg, 0.175 mmol) in CH_2Cl_2 (2 mL) was added DIBAl-H (1.0 mL, 1.0 mmol, 1M in $PhCH_3$) under argon at -78 °C. The mixture was allowed to warm naturally to room temperature before it was quenched with saturated aq. NH_4Cl. The mixture was diluted with CH_2Cl_2, and washed with water and brine. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure to give the crude intermediate as a white amorphous solid, which was used directly in the next step without further purification.

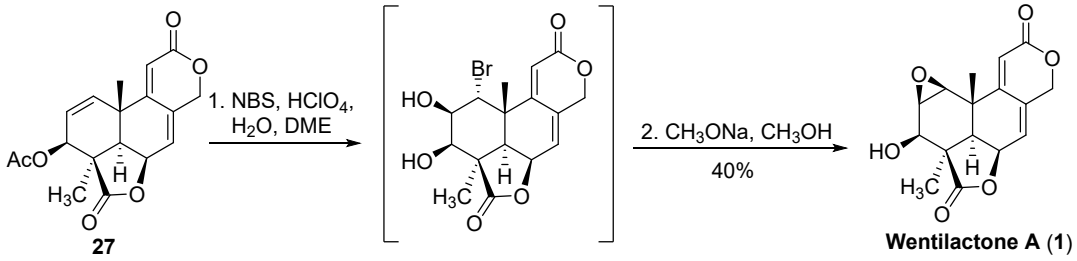
To a solution of the above residue in CH_2Cl_2 (50 mL) was added PCC (36 mg, 0.168 mmol) at room temperature. After being stirred for 2 h at the same temperature, the mixture was diluted with CH_2Cl_2, and washed with water and brine sequentially. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 4:1) to afford **4** as a pale yellow solid (38 mg, 80%).

Compound **4**: $[\alpha]_D^{25}$ -495.4 (*c* 0.2, MeOH); lit.[S8] $[\alpha]_D^{25}$ -267 (*c* 0.17, MeOH); ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.62 (d, *J* = 9.8 Hz, 1H), 6.24 (dt, *J* = 4.2, 1.7 Hz, 1H), 6.08 (dd, *J* = 9.8, 5.7 Hz, 1H), 6.01 (d, *J* = 1.8 Hz, 1H), 5.06–4.98 (m, 2H), 4.94–4.88 (m, 1H), 4.43 (d, *J* = 5.7 Hz, 1H), 4.03 (s, 1H), 2.30 (d, *J* = 4.9 Hz, 1H), 1.49 (s, 3H), 1.48 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 179.3, 163.0, 154.2, 134.5, 132.5, 128.8, 121.1, 111.5, 71.2, 69.4, 69.3, 52.0, 46.4, 36.4, 26.1, 24.5; HRMS (ESI-TOF) *m/z* $[M + Na]^+$ calcd for $C_{16}H_{16}O_5Na^+$ 311.0890, found 311.0888.



To a stirred solution of **4** (40 mg, 0.138 mmol) in pyridine (1.5 mL) was added Ac_2O (0.15 mL, 1.39 mmol) under argon at room temperature. After being stirred at room temperature for 12 hr, the mixture was diluted with CH_2Cl_2, and washed with dil. aq. HCl. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 5:1) to afford **27** as a white amorphous solid (45 mg, 100%).

Compound **27**: $[\alpha]_D^{25}$ -109.3 (*c* 0.1, $CHCl_3$); lit.[S8] $[\alpha]_D^{25}$ -267 (*c* 0.17, MeOH); ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.71 (d, *J* = 9.7 Hz, 1H), 6.28–6.22 (m, 1H), 6.01 (d, *J* = 1.8 Hz, 1H), 5.89 (dd, *J* = 9.7, 6.0 Hz, 1H), 5.61 (d, *J* = 6.0 Hz, 1H), 5.05–5.00 (m, 1H), 4.96–4.86 (m, 2H), 2.33 (d, *J* = 4.9 Hz, 1H), 2.15 (s, 3H), 1.58 (s, 3H), 1.41 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 175.0, 170.8, 162.9, 153.7, 136.5, 131.9, 126.0, 121.6, 111.7, 69.8, 69.3, 68.1, 52.2, 44.8, 36.1, 25.9, 24.5, 20.9; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{18}H_{18}O_6Na^+$ 353.0996, found 353.0994.

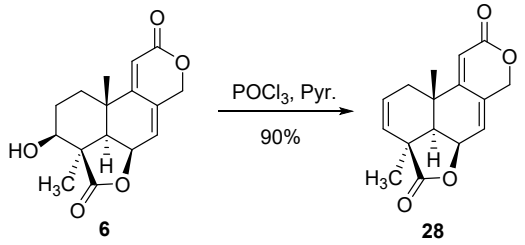


To a stirred solution of **27** (17 mg, 51.46 mol) in DME (2.6 mL) were added NBS (74 mg, 411 μmol), H_2O (1.7 mL), and $HClO_4$ (0.2 mL, 10% aq.) under argon at room temperature. After being stirred at room temperature for 48 hr, the reaction mixture was diluted with CH_2Cl_2, and washed with dil. aq. HCl. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure to give the crude intermediate as a white amorphous solid, which was used directly in the next step without further purification.

To a solution of the above residue in CH_3OH (2 mL) was added CH_3ONa (5 mg, 93.6 μmol) at room temperature. After being stirred for 24 h at the same temperature, the mixture was diluted with CH_2Cl_2, and washed with water and brine sequentially. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 1:1) to afford **1** as a white amorphous solid (6 mg, 40%).

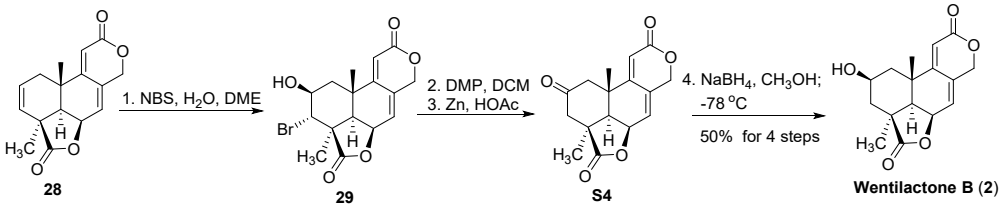
Compound **1**: $[\alpha]_D^{25}$ -595.1 (*c* 0.1, MeOH); lit.[S8] $[\alpha]_D^{25}$ -248 (*c* 0.19, MeOH); ^{1}H NMR (600

MHz, DMSO-d_6) δ 6.36 (dt, *J* = 4.4, 1.8 Hz, 1H), 6.22 (d, *J* = 1.7 Hz, 1H), 5.36 (d, *J* = 5.0 Hz, 1H), 5.09–5.03 (m, 2H), 5.01–4.97 (m, 1H), 4.27 (dd, *J* = 6.2, 5.0 Hz, 1H), 3.62 (d, *J* = 4.3 Hz, 1H), 3.39–3.37 (m, 1H), 2.23 (d, *J* = 5.2 Hz, 1H), 1.35 (s, 3H), 1.07 (s, 3H); ^{13}C NMR (151 MHz, DMSO) δ 176.7, 163.8, 157.3, 131.9, 122.6, 112.6, 70.1, 69.5, 67.4, 55.3, 50.8, 48.8, 48.3, 36.2, 25.5, 19.2; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{16}H_{16}O_6Na^+$ 327.0839, found 327.0838.



To a stirred solution of **6** (100 mg, 0.344 mmol) in pyridine (5.0 mL) was added $POCl_3$ (1.0 mL) under argon at room temperature. After being stirred at 80 °C for 8 hr, the mixture was cooled to room temperature, and diluted with CH_2Cl_2. The organic phase was washed with dil. aq. HCl, dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 5:1) to afford **28** as a white amorphous solid (85 mg, 90%).

Compound **28**: $[\alpha]_D^{25}$ -282.1 (*c* 0.3, $CHCl_3$); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.23 (dt, *J* = 4.4, 1.8 Hz, 1H), 5.96–5.86 (m, 2H), 5.76 (d, *J* = 1.8 Hz, 1H), 5.08–4.99 (m, 2H), 4.91 (d, *J* = 13.5 Hz, 1H), 2.26–2.11 (m, 3H), 1.40 (s, 3H), 1.19 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 178.3, 163.6, 157.6, 132.5, 128.2, 126.5, 121.8, 112.0, 70.7, 69.7, 47.6, 44.8, 34.9, 33.0, 23.3, 22.4; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{16}H_{16}O_4Na^+$ 295.0941, found 295.0935.



To a stirred solution of **28** (100 mg, 367 μmol) in DME (19 mL) were added NBS (525 mg, 2.94 mmol) and H_2O (12 mL) under argon at room temperature. After being stirred at room temperature for 24 hr, the reaction mixture was diluted with CH_2Cl_2, washed with dil. aq. HCl, dried over anhydrous Na_2SO_4, and filtered. The filtrate was concentrated under reduce pressure to give the corresponding crude halohydrins as a white amorphous solid **29**, which was used directly in the next step without further purification.

To a solution of the above residue in CH_2Cl_2 (25 mL) was added DMP (206 mg, 0.487 mmol) at room temperature. After being stirred for 2 h at the same temperature, the mixture was diluted with CH_2Cl_2, and washed with water and brine

sequentially. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure to give the corresponding crude 2-keto-3-bromo-derivative intermediate as a white amorphous solid, which was used directly in the next step without further purification.

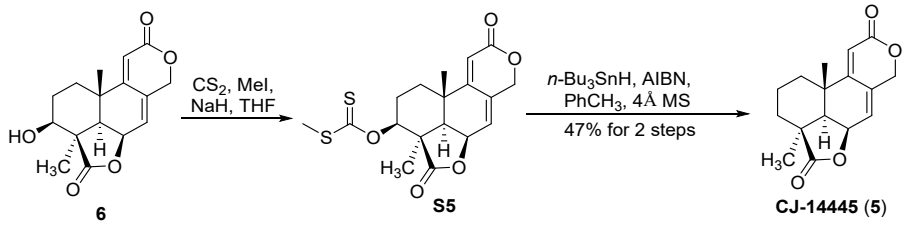
To a solution of the above residue in HOAc (16 mL) was added dust Zn (32 mg, 490 μmol) at room temperature. After being stirred for 1 h at the same temperature, the mixture was diluted with CH_2Cl_2, and washed with water and brine sequentially. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure to give the crude **S4** as a white amorphous solid, which was used directly in the next step without further purification.

To a stirred solution of **S4** in MeOH (16 mL) was added $NaBH_4$ (16 mg, 444 μmol) under argon at -78 °C. The mixture was allowed to warm naturally to room temperature before it was quenched with saturated aq. NH_4Cl. The mixture was diluted with CH_2Cl_2, and washed with water and brine. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 2:1) to afford **2** as a white amorphous solid (52 mg, 50%).

Compound **29**: $[\alpha]_D^{25}$ -110.0 (*c* 0.5, $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.23 (dt, *J* = 4.3, 2.0 Hz, 1H), 5.83 (d, *J* = 1.8 Hz, 1H), 5.07 (td, *J* = 4.9, 1.8 Hz, 1H), 4.99 (dt, *J* = 13.7, 2.0 Hz, 1H), 4.93 – 4.87 (m, 2H), 4.03 (ddd, *J* = 11.8, 9.6, 6.4 Hz, 1H), 2.77 (s, 1H), 2.56 (dd, *J* = 13.9, 9.6 Hz, 1H), 2.24 (d, *J* = 5.2 Hz, 1H), 1.91 (dd, *J* = 13.8, 6.5 Hz, 1H), 1.61 (s, 3H), 1.31 (d, *J* = 0.9 Hz, 3H). ^{13}C NMR (151 MHz, $CDCl_3$) δ 177.6, 163.0, 156.7, 131.8, 121.3, 112.8, 71.4, 69.4, 68.1, 60.4, 48.4, 45.8, 39.2, 34.6, 27.5, 22.4; HRMS (ESI-TOF) *m/z* [M + Na]+ calcd for $C_{16}H_{17}O_5BrNa^+$ 391.0152, found 391.0145.

Compound **S4**: $[\alpha]_D^{25}$ -112.6 (*c* 0.3, $CHCl_3$); ^{1}H NMR (600 MHz, DMSO-d_6) δ 6.43 (dt, *J* = 3.9, 1.8 Hz, 1H), 5.83 (d, *J* = 1.7 Hz, 1H), 5.36 (td, *J* = 4.8, 1.6 Hz, 1H), 5.05 (dt, *J* = 13.6, 1.9 Hz, 1H), 5.02 – 4.97 (m, 1H), 2.95 (d, *J* = 19.2 Hz, 1H), 2.67 (d, *J* = 16.3 Hz, 1H), 2.59 – 2.52 (m, 2H), 2.43 (d, *J* = 19.2 Hz, 1H), 1.37 (s, 3H), 0.97 (d, *J* = 1.2 Hz, 3H); ^{13}C NMR (151 MHz, DMSO-d_6) δ 206.2, 180.3, 163.2, 155.8, 131.6, 122.0, 112.0, 71.1, 69.0, 46.8, 46.5, 44.3, 42.3, 35.7, 24.2, 22.7; HRMS (ESI-TOF) *m/z* [M +Na]$^+$ calcd for $C_{16}H_{16}O_5Na^+$ 311.0890, found 311.0886.

Compound **2**: $[\alpha]_D^{25}$ -319.0 (*c* 0.3, MeOH); lit.[S8] $[\alpha]_D^{25}$ -214 (*c* 0.58, MeOH); ^{1}H NMR (600 MHz, acetone-d_6) δ 6.39–6.33 (m, 1H), 5.74 (d, *J* = 1.8 Hz, 1H), 5.18 (td, *J* = 4.9, 1.8 Hz, 1H), 5.04 (dt, *J* = 13.5, 2.0 Hz, 1H), 5.00–4.93 (m, 1H), 4.17–4.07 (m, 2H), 2.42 (dd, *J* = 13.5, 8.7 Hz, 1H), 2.15 (d, *J* = 5.2 Hz, 1H), 2.10 (t, *J* = 13.0 Hz, 1H), 1.86–1.81 (m, 1H), 1.56 (dd, *J* = 13.4, 6.9 Hz, 1H), 1.39 (s, 3H), 1.23 (s, 3H); ^{13}C NMR (151 MHz, acetone-d_6) δ 181.8, 164.1, 159.5, 132.9, 122.9, 112.9, 72.5, 70.3, 64.6, 46.5, 43.3, 40.9, 37.9, 36.6, 28.0, 23.6; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{16}H_{18}O_5Na^+$ 313.1046, found 313.1040.

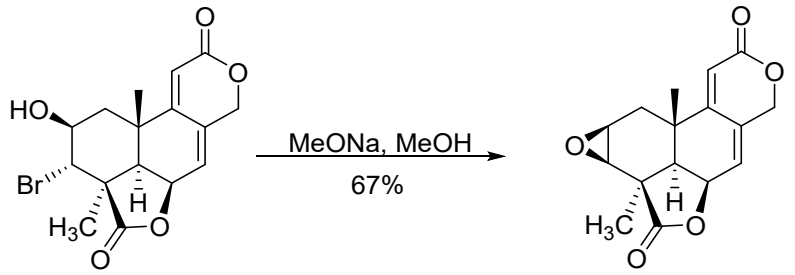


To a stirred solution of **6** (30 mg, 103.34 µmol) in THF (5.0 mL) were added NaH (5 mg, 0.124 mmol, 60%) under argon at 0 °C. After being stirred 30 min, the reaction mixture was added CS_2 (0.2 mL, 2.07 mmol) at the same temperature. After being stirred 30 min, the reaction mixture was added MeI (0.3 mL, 4.13 mmol) at the room temperature. After being stirred at room temperature for 12 hr, the reaction mixture was diluted with CH_2Cl_2, washed with water and brine, dried over anhydrous Na_2SO_4, and filtered, concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 4:1) to afford **S5** as a yellow solid (52 mg, 50%).

To a stirred solution of **S5** (13 mg, 34.17 µmol) in $PhCH_3$ (2.0 mL) on seal tube was added AIBN (5 mg, 27.33 µmol), n-Bu_3SnH (0.1 mL, 273.34 µmol) and 4Å MS under argon at room temperature. After being stirred at room temperature for 1.5 hr, the mixture was allowed to heat to 150 °C. After being stirred for 12 h at the same temperature, the mixture was cooled to room temperature. The mixture was filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 4:1) to afford **5** as a white amorphous solid (8 mg, 90%).

Compound **S5:** $[\alpha]_D^{25}$ -90.9 (*c* 0.2, $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.23–6.20 (m, 1H), 5.78 (d, *J* = 1.7 Hz, 1H), 5.03 (t, *J* = 4.8 Hz, 1H), 4.99 (dt, *J* = 13.5, 2.1 Hz, 1H), 4.89 (d, *J* = 13.6 Hz, 1H), 2.30–2.23 (m, 1H), 1.94 (d, *J* = 4.7 Hz, 1H), 1.90–1.83 (m, 1H), 1.77–1.72 (m, 1H), 1.71–1.67 (m, 1H), 1.67–1.61 (m, 1H), 1.56–1.52 (m, 1H), 1.34 (s, 3H), 1.19 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 181.0, 163.8, 158.9, 132.4, 121.9, 112.0, 71.4, 69.7, 48.0, 42.9, 35.2, 29.8, 27.9, 24.9, 24.3, 17.5; HRMS (ESI-TOF) *m/z* [M +Na]$^+$ calcd for $C_{16}H_{18}O_4Na^+$ 297.1097, found 297.1089.

Compound **5**: $[\alpha]_D^{25}$ -90.9 (*c* 0.2, $CHCl_3$); lit.[S9] $[\alpha]_D^{25}$ -325.9 (*c* 1.0, $CHCl_3$); ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.23–6.20 (m, 1H), 5.78 (d, *J* = 1.7 Hz, 1H), 5.03 (t, *J* = 4.8 Hz, 1H), 4.99 (dt, *J* = 13.5, 2.1 Hz, 1H), 4.89 (d, *J* = 13.6 Hz, 1H), 2.30–2.23 (m, 1H), 1.94 (d, *J* = 4.7 Hz, 1H), 1.90–1.83 (m, 1H), 1.77–1.72 (m, 1H), 1.71–1.67 (m, 1H), 1.67–1.61 (m, 1H), 1.56–1.52 (m, 1H), 1.34 (s, 3H), 1.19 (s, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 181.0, 163.8, 158.9, 132.4, 121.9, 112.0, 71.4, 69.7, 48.0, 42.9, 35.2, 29.8, 27.9, 24.9, 24.3, 17.5; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{16}H_{18}O_4Na^+$ 297.1097, found 297.1089.

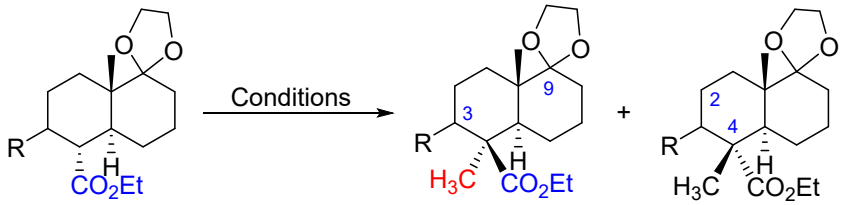


29 **Asperolide B** (**3**)

To a solution of **29** (12 mg, 32.50 μmol) in CH_3OH (3.2 mL) was added CH_3ONa (8 mg, 162.51 μmol) at room temperature. After being stirred for 24 h at the same temperature, the mixture was diluted with CH_2Cl_2, and washed with water and brine sequentially. The organic phase was dried over anhydrous Na_2SO_4, filtered, and concentrated under reduce pressure. The residue was purified by silica gel chromatography (CH_2Cl_2/EtOAc, 5:1) to afford **3** as a white amorphous solid (6 mg, 67%).

Compound **29**: $[\alpha]_D^{25}$ -590.8 (*c* 0.1, MeOH); lit.[S8] $[\alpha]_D^{25}$ -142 (*c* 0.20, MeOH); ^{1}H NMR (600 MHz, $CDCl_3$) δ 6.20 (dt, *J* = 4.5, 1.9 Hz, 1H), 5.75 (d, *J* = 1.8 Hz, 1H), 5.02 (td, *J* = 4.7, 1.7 Hz, 1H), 4.97 (dt, *J* = 13.6, 2.0 Hz, 1H), 4.91–4.87 (m, 1H), 3.48 (dt, *J* = 3.8, 1.9 Hz, 1H), 3.23 (d, *J* = 3.7 Hz, 1H), 2.36 (dd, *J* = 14.5, 2.2 Hz, 1H), 1.94–1.88 (m, 3H), 1.82 (d, *J* = 4.6 Hz, 1H), 1.54 (s, 3H), 1.34 (d, *J* = 0.9 Hz, 3H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 176.6, 163.3, 157.9, 132.0, 121.4, 111.4, 71.7, 69.6, 52.7, 51.4, 47.6, 43.5, 34.6, 31.0, 24.8, 21.6; HRMS (ESI-TOF) *m/z* [M + Na]$^+$ calcd for $C_{16}H_{16}O_5Na^+$ 311.0890, found 311.0888.

Table S1. Screening of conditions for C4 methylation



Entry	R group	Conditions	Results
1		MeI, LDA, THF, -78°C (10 min)	N.R.
2		**MeI, NaH (1.2 eq.), *t*-BuOH (cat.), DME**	90%; *dr* = 1:1
3	R = O	**MeI, t-BuOK (1.2 eq.), *t*-BuOH, rt.**	80%; *dr* = 1:2
4		MeI, Cs_2CO_3 (2 eq.), CH_3CN, 60°C	*dr* = 1:5
5		MeI, LiHMDS, THF, -78°C~0°C	*dr* = 1:2
6	R = O	2-chloro-1,3-dithiane, LDA, *t*-BuOH	N.D.
7		2-chloro-1,3-dithiane, NaH (1.2 eq.), *t*-BuOH (cat.), DME	N.D.
8		Me_2Zn, Koser's reagent, $MgSO_4$, $PhCH_3$	N.D.
9	R = β-OH	MeI, LDA, THF, -78°C	N.R.
10		MeI, LDA, THF, 50°C	complex
11		MeI, LDA, HMPA, THF, -78°C	N.R.
12		MeI, NaH (> 2 eq.), DMF, 0°C	C3-O-methylation
13		MeI, LiHMDS, HMPA, THF, -78°C~0°C	C3-O-methylation
14	R = β-OMe	MeI, LDA, THF, -78°C -78°C, 0°C, rt., 30°C, 50°C (10 min, 30 min, 1h, 2h)	N.R.
15		MeI,NaH, *t*-BuOH (cat.), DME	N.R.
16		MeI,NaH, DME, reflux	N.R.
17		MeI, LiHMDS,THF	N.R.

II Comparison of the Spectroscopic Data of the Authentic and Synthetic Wentilactones

Table S2. Comparison of the ^{1}H NMR spectroscopic data (DMSO-d_6) of the authentic and synthetic wentilactone A (**1**).

Authentic δ_H (ppm) [S8]	Synthetic δ_H (ppm)	Err (Synthetic − Authentic) δ H (ppm)
3.61	3.62	0.01
3.37	3.38	0.01
4.27	4.27	0.00
2.23	2.23	0.00
5.07	5.05	-0.02
6.35	6.36	0.01
6.21	6.22	0.01
5.12	5.07	-0.05
4.98	4.99	0.01
1.06	1.07	0.01
1.35	1.35	0.00
4.13	5.36	C3-OH

Table S3. Comparison of the ^{13}C NMR spectroscopic data (DMSO-d_6) of the authentic and synthetic wentilactone A (**1**).

Authentic δ_H (ppm) [S8]	Synthetic δ_H (ppm)	Err (Synthetic − Authentic) δ H (ppm)
50.2	50.8	0.6
54.7	55.3	0.6
66.9	67.4	0.5
47.8	48.3	0.5
48.2	48.8	0.6
69.6	70.1	0.5
121.9	122.6	0.7
131.3	131.9	0.6
156.7	157.3	0.6
35.6	36.2	0.6
112.0	112.6	0.6
163.1	163.8	0.7
68.9	69.5	0.6
18.6	19.2	0.6
176.1	176.7	0.6
24.9	25.5	0.6

Table S4. Comparison of the ^{1}H NMR spectroscopic data (acetone-d_6) of the authentic and synthetic wentilactone B (**2**).

Authentic δ_H (ppm)[S8]	Synthetic δ_H (ppm)	Err (Synthetic − Authentic) δ H (ppm)
1.54	1.56	0.02
2.39	2.42	0.03
4.12	4.12	0.00
1.81	1.83	0.02
2.11	2.10	-0.01
2.15	2.15	0.00
5.17	5.18	0.01
6.35	6.36	0.01
5.74	5.74	0.00
4.93	4.95	0.02
5.02	5.04	0.02
1.39	1.39	0.00
1.23	1.23	0.00

Table S5. Comparison of the ^{13}C NMR spectroscopic data (acetone-d_6) of the authentic and synthetic wentilactone B (**2**).

Authentic δ_H (ppm) [S8]	Synthetic δ_H (ppm)	Err (Synthetic − Authentic) δ H (ppm)
40.8	40.9	0.1
64.7	64.6	-0.1
37.8	37.9	0.1
43.2	43.3	0.1
49.4	/	/
72.4	72.5	0.1
122.8	122.9	0.1
132.9	132.9	0.0
159.4	159.5	0.1
36.5	36.6	0.1
112.8	112.9	0.1
163.9	164.1	0.2
70.2	70.3	0.1
23.6	23.6	0.0
181.6	181.8	0.2
27.8	28.0	0.2

Table S6. Comparison of the ^{1}H NMR spectroscopic data ($CDCl_3$) of the authentic and synthetic compound **4**

Authentic[S8] δ_H (ppm)	synthetic δ_H (ppm)	Err (Synthetic − Authentic) ⍰δ H (ppm)
6.60	6.62	0.02
6.06	6.08	0.02
4.41	4.43	0.02
2.29	2.30	0.01
5.02	5.02	0.00
6.23	6.24	0.01
6.00	6.01	0.01
4.89	4.91	0.02
4.99	4.99	0.00
1.47	1.48	0.01
1.48	1.49	0.01

Table S7 Comparison of the ^{13}C NMR spectroscopic data ($CDCl_3$) of the authentic and synthetic compound **4**.

Authentic[S8] δ_H (ppm)	synthetic δ_H (ppm)	Err (Synthetic − Authentic) ⍰δ H (ppm)
134.7	134.5	-0.2
128.9	128.8	-0.1
69.5	69.4	-0.1
46.5	46.4	-0.1
52.3	52.0	-0.3
71.3	71.2	-0.1
121.3	121.1	-0.2
132.7	132.5	-0.2
154.4	154.2	-0.2
36.6	36.4	-0.2
111.7	111.5	-0.2
163.0	163.0	0.0
69.5	69.3	-0.2
24.7	24.5	-0.2
179.4	179.3	-0.1
26.3	26.1	-0.2

T**able S8**. Comparison of the ^{1}H NMR spectroscopic data ($CDCl_3$) of the authentic and synthetic CJ-14445 (**5**).

Authentic[S9] δ_H (ppm)	synthetic δ_H (ppm)	Err (Synthetic − Authentic) δ H (ppm)
6.19	6.21	0.02
5.74	5.78	0.04
5.01	5.03	0.02
4.96	4.99	0.03
4.86	4.89	0.03
2.23	2.26	0.03
1.92	1.94	0.02
1.90-1.75(1 H)	1.90-1.83(1 H)	-
1.75-1.55(3 H)	1.77-1.55(3 H)	-
1.55-1.45(1 H)	1.56-1.52	-
1.31	1.34	0.02
1.16	1.19	0.03

Table S9. Comparison of the ^{13}C NMR spectroscopic data ($CDCl_3$) of the authentic and synthetic CJ-14445 (**5**).

Authentic[S9] δ_H (ppm)	synthetic δ_H (ppm)	Err (Synthetic − Authentic) δ H (ppm)
181.0	181.0	0.0
163.9	163.8	-0.1
158.9	158.9	0.0
132.4	132.4	0.0
122.0	121.9	-0.1
111.9	112.0	0.1
71.5	71.4	-0.1
69.8	69.7	-0.0
48.0	48.0	0.0
43.0	42.9	-0.1
35.3	35.2	-0.1
29.8	29.8	0.0
27.9	27.9	0.0
24.9	24.9	0.0
24.3	24.3	0.0
17.5	17.5	0.0

Table S10. Comparison of the ^{1}H NMR spectroscopic data ($CDCl_3$) of the authentic and synthetic asperolide B (**3**).

Authentic[S8] δ_H (ppm)	synthetic δ_H (ppm)	Err (Synthetic − Authentic) ⍰δ H (ppm)
1.89	1.91	0.02
2.34	2.36	0.02
3.46	3.48	0.02
3.22	3.23	0.01
1.81	1.82	0.01
5.00	5.02	0.02
6.19	6.20	0.01
5.74	5.75	0.01
4.87	4.89	0.02
4.95	4.97	0.02
1.53	1.54	0.01
1.34	1.34	0.00

Table **S11.** Comparison of the ^{13}C NMR spectroscopic data ($CDCl_3$) of the authentic and synthetic asperolide B (**3**).

Authentic[S8] δ_H (ppm)	synthetic δ_H (ppm)	Err (Synthetic − Authentic) ⍰δ H (ppm)
31.0	31.0	0.0
51.4	51.4	0.0
52.7	52.7	0.0
43.5	43.5	0.0
47.6	47.6	0.0
71.6	71.7	0.1
121.4	121.4	0.0
132.0	1332.0	0.0
157.9	157.9	0.0
34.6	34.6	0.0
111.4	111.4	0.0
163.2	163.3	0.1
69.6	69.6	0.0
21.6	21.6	0.0
176.5	176.5	0.0
24.7	24.8	0.1

III References

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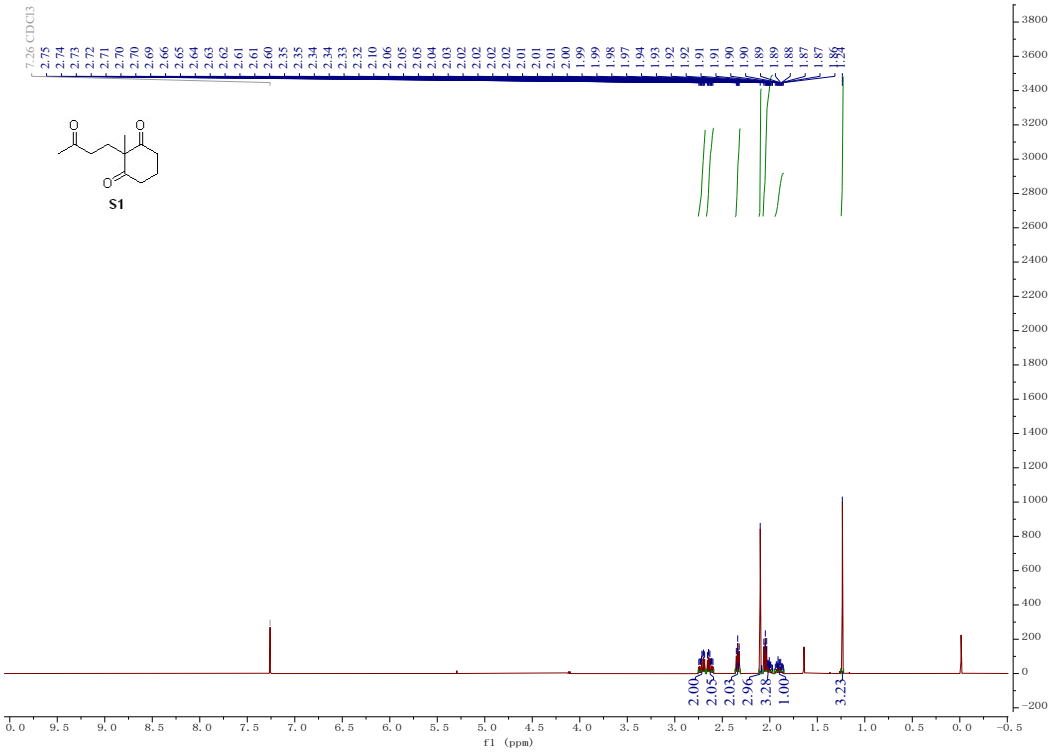
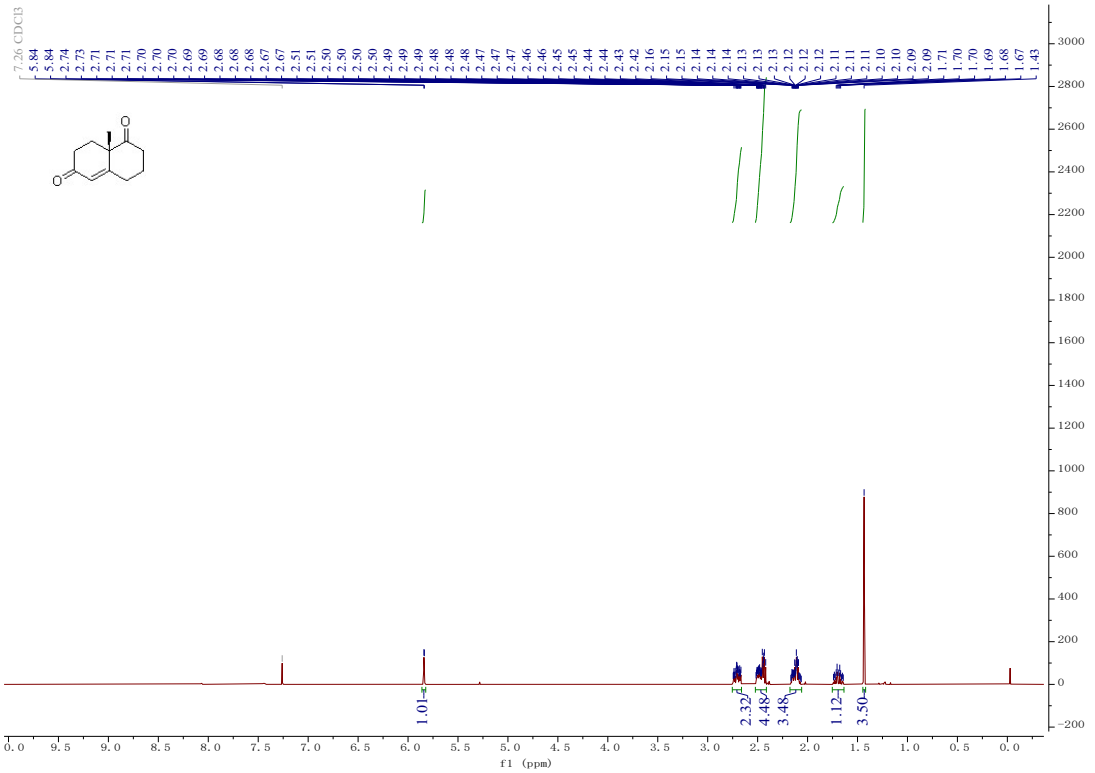
IV ^{1}H and ^{13}C NMR Spectra of Compounds



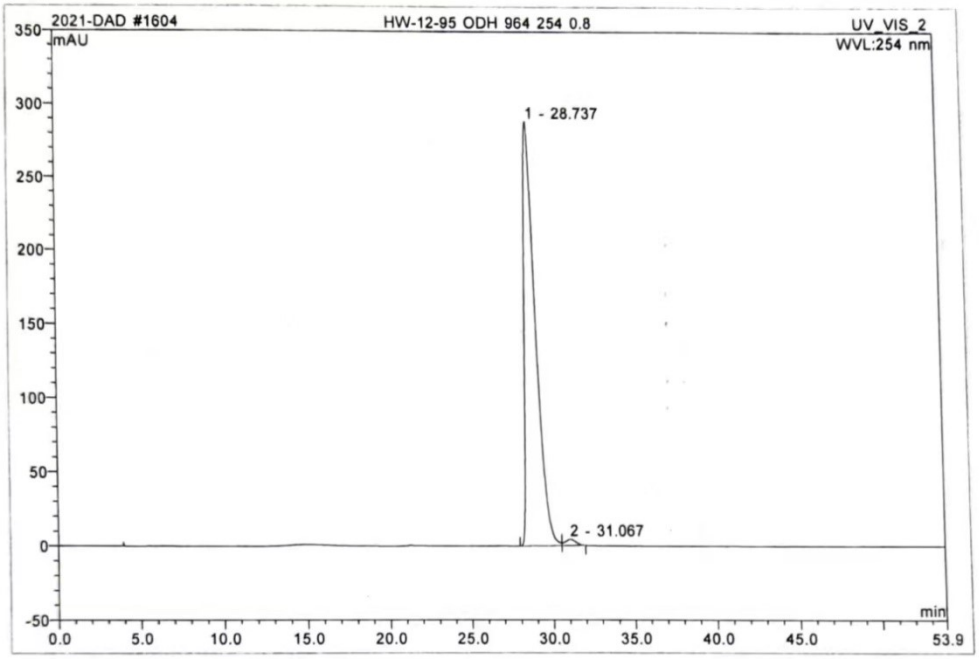
^{1}H NMR spectrum of compound **S1** (500 MHz, $CDCl_3$)



^{1}H NMR spectrum of compound **7** (500 MHz, $CDCl_3$)

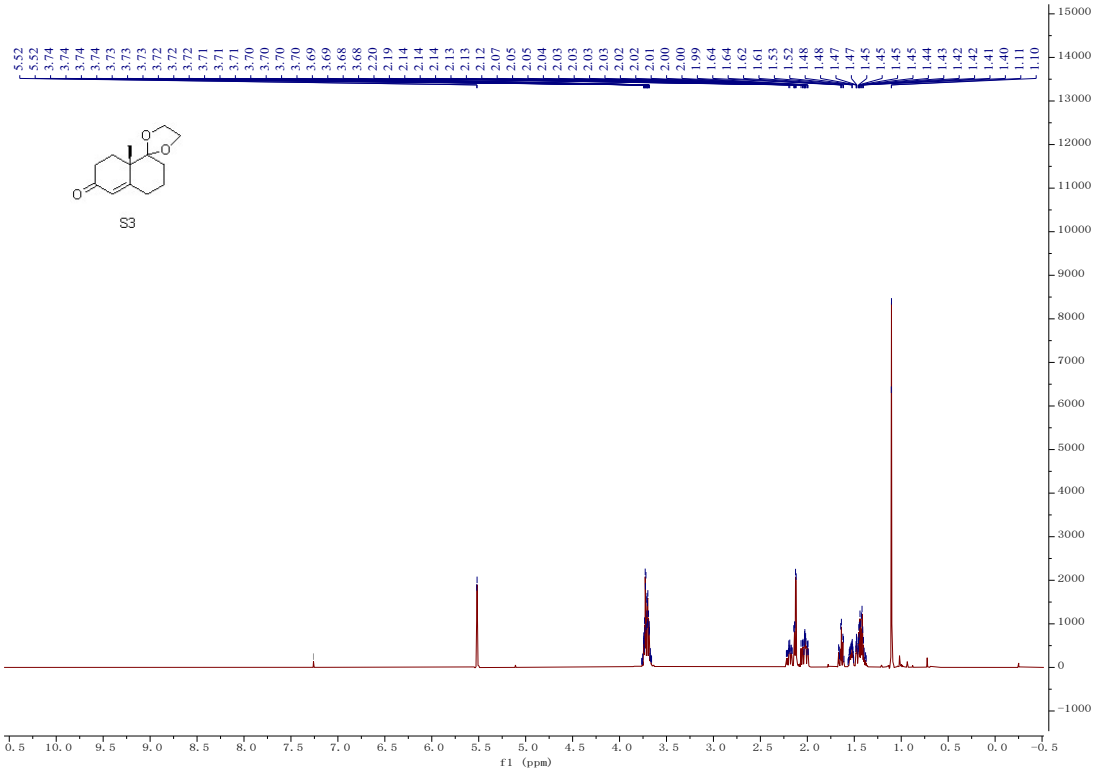
1604 HW-12-95 ODH 964 254 0.8

Sample Name:	**HW-12-95 ODH 964 254 0.8**	*Injection Volume:*	**2.0**
Vial Number:	**BC7**	*Channel:*	**UV_VIS_2**
Sample Type:	**unknown**	*Wavelength:*	**254.0**
Control Program:	**test-dad3**	*Bandwidth:*	**4**
Quantif. Method:	**WXL**	*Dilution Factor:*	**1.0000**
Recording Time:	**2022-3-4 9:46**	*Sample Weight:*	**1.0000**
Run Time (min):	**53.88**	*Sample Amount:*	**1.0000**

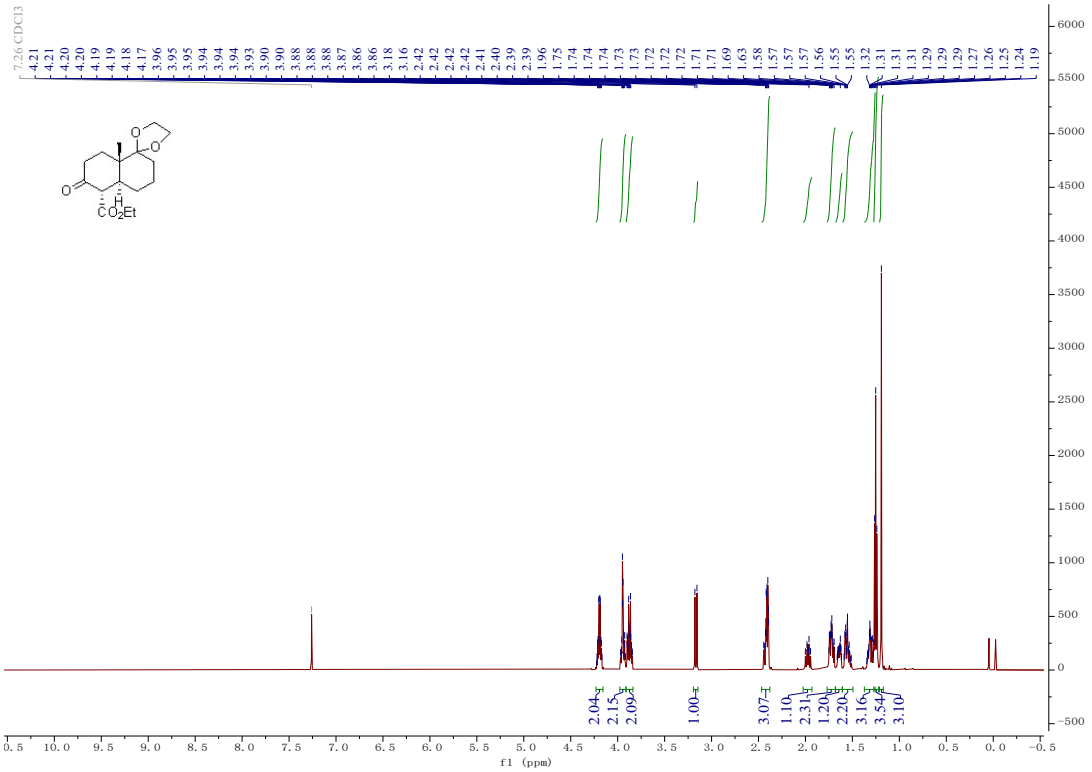


No.	Ret.Time min	Peak Name	Height mAU	Area mAU*min	Rel.Area %	Amount	Type
1	28.74	n.a.	288.635	226.816	98.58	n.a.	BM
2	31.07	n.a.	4.444	3.279	1.42	n.a.	MB
Total:			293.078	230.094	100.00	0.000	

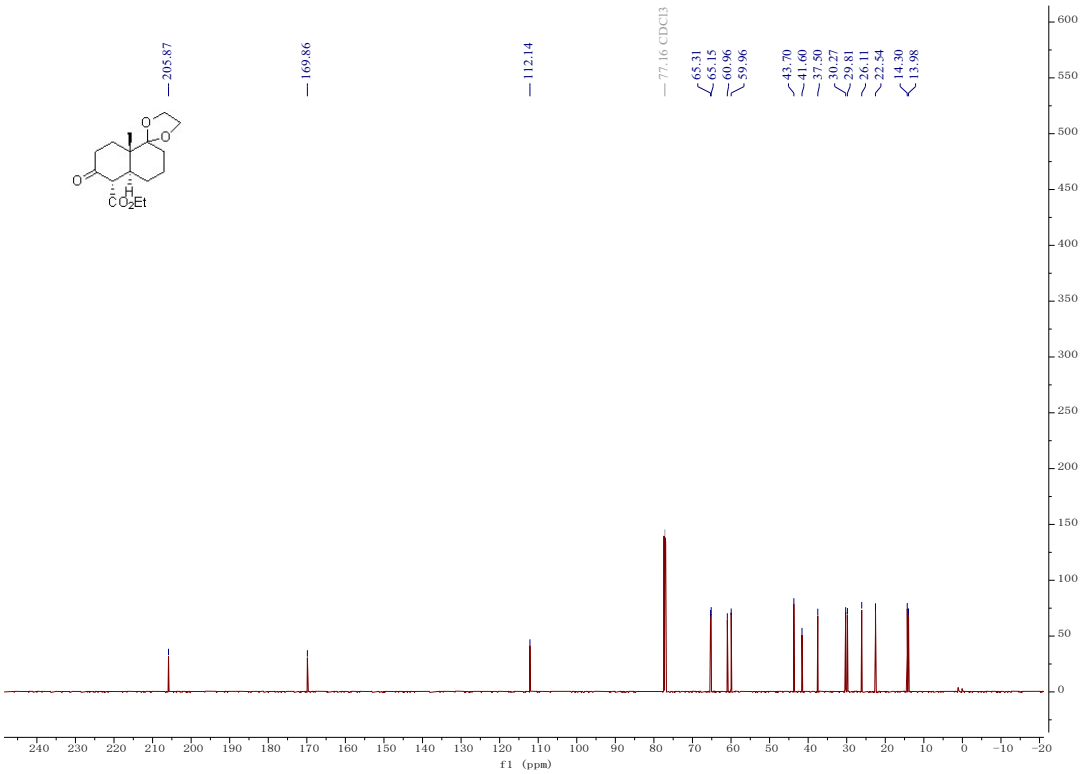
HPLC of compound **7**



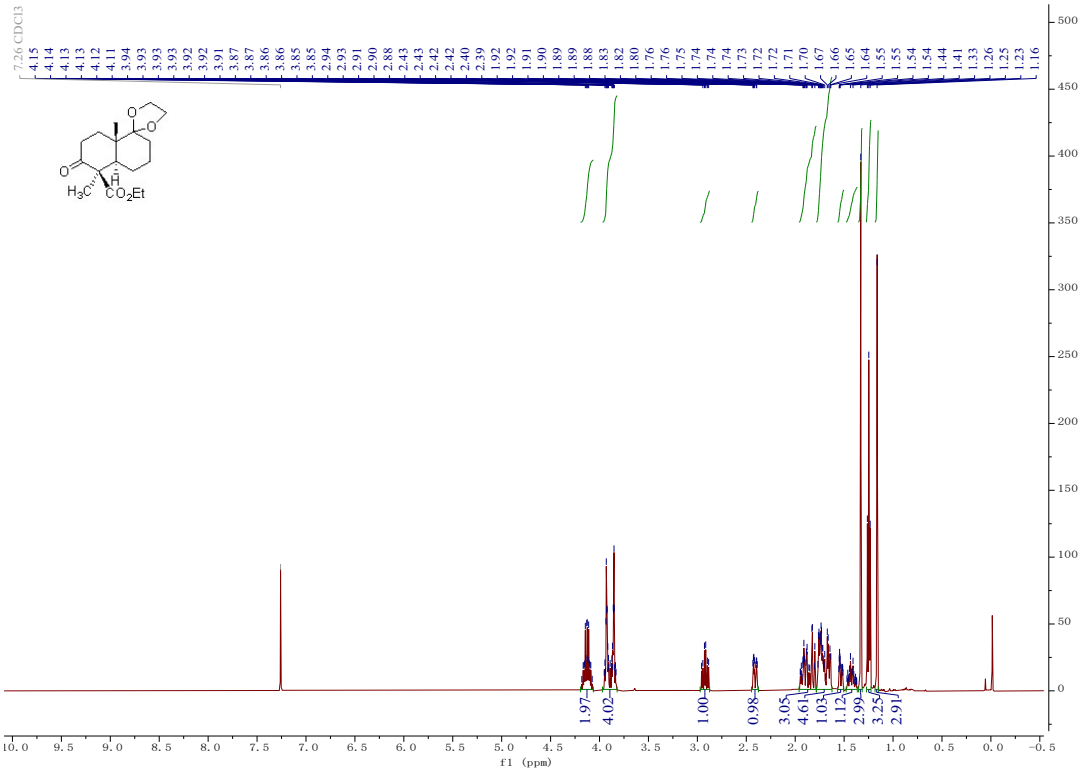
^{1}H NMR spectrum of compound **S3** (600 MHz, $CDCl_3$)



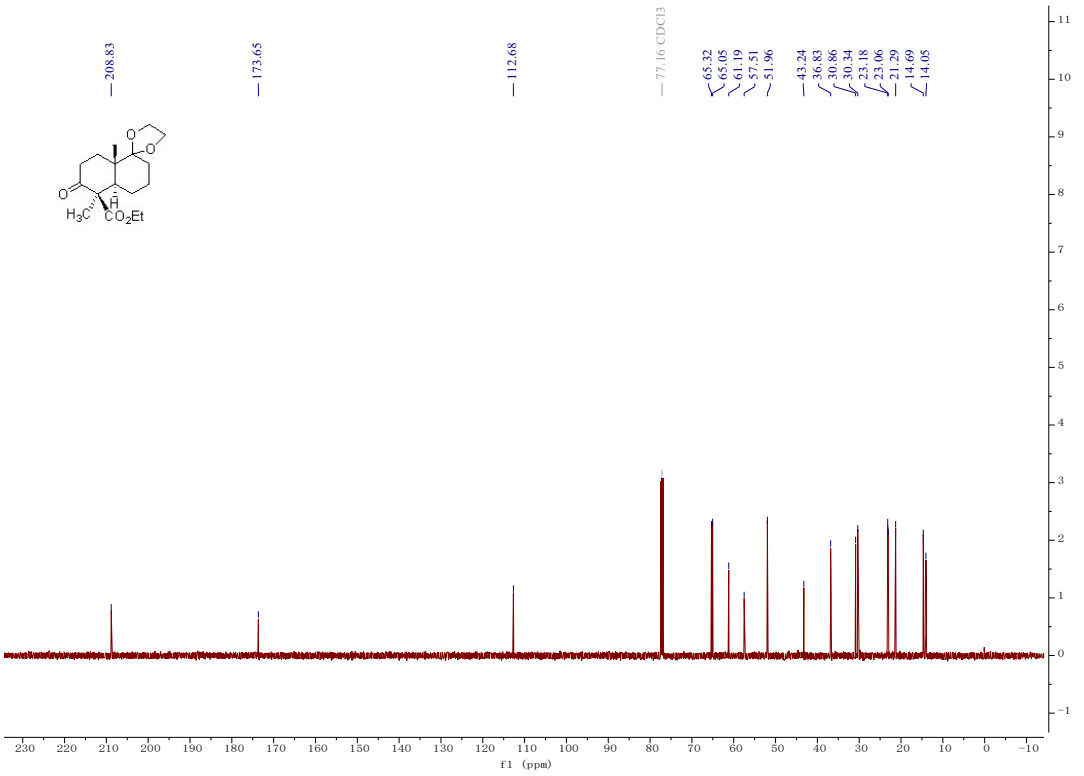
^{1}H NMR spectrum of compound **14** (600 MHz, $CDCl_3$)



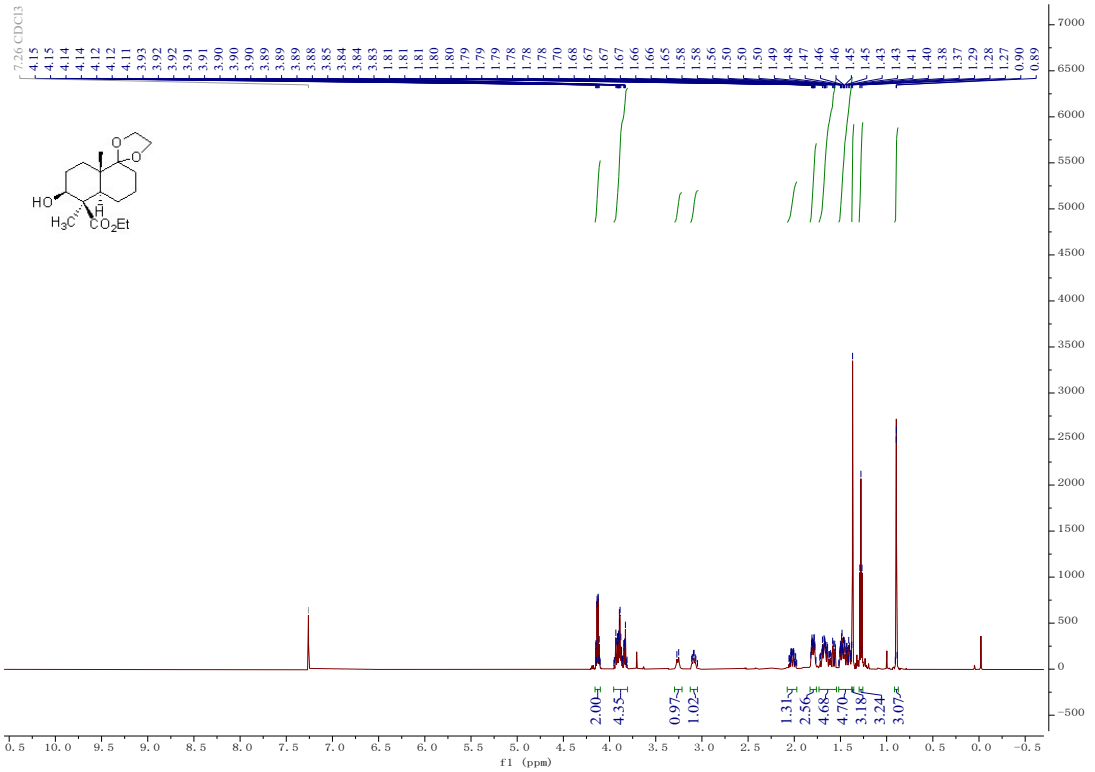
^{13}C NMR spectrum of compound **14** (151 MHz, $CDCl_3$)



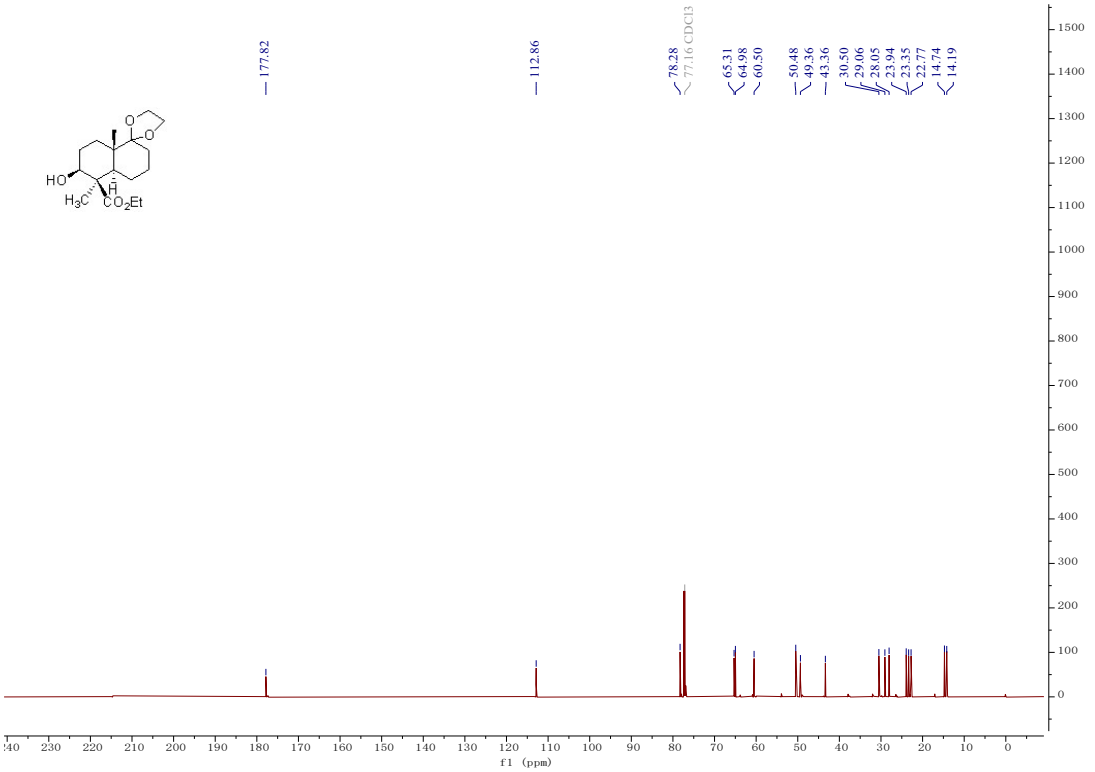
^{1}H NMR spectrum of compound **15** (500 MHz, $CDCl_3$)



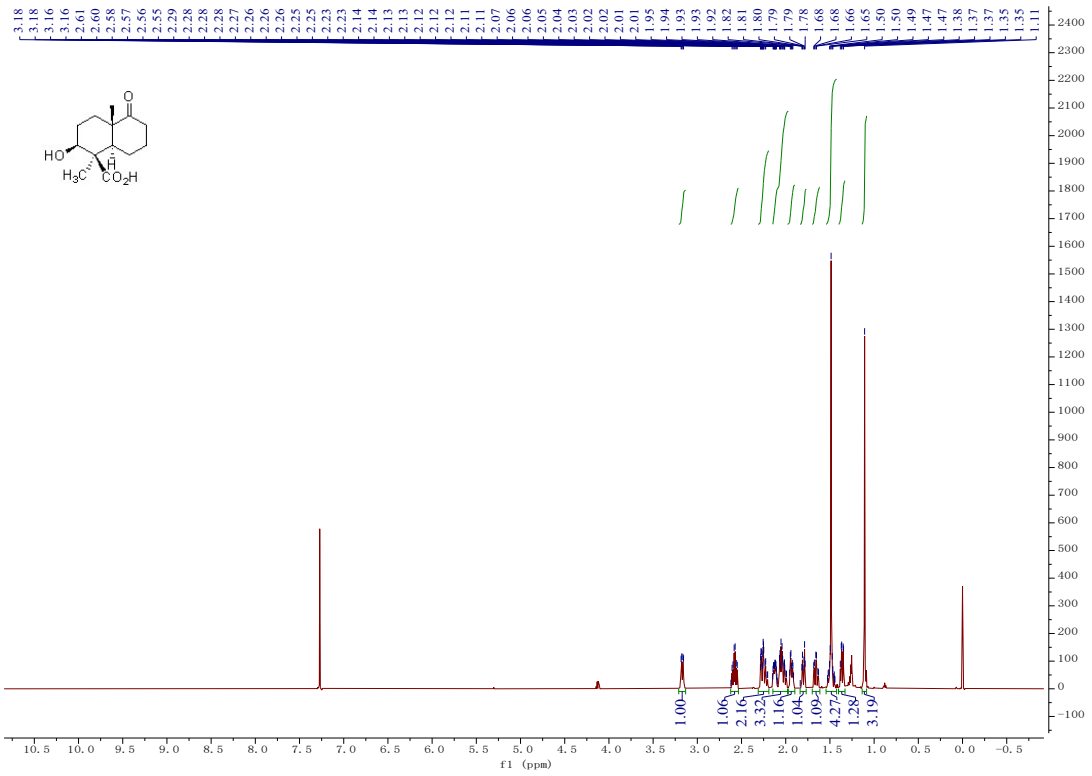
^{13}C NMR spectrum of compound **15** (126 MHz, $CDCl_3$)



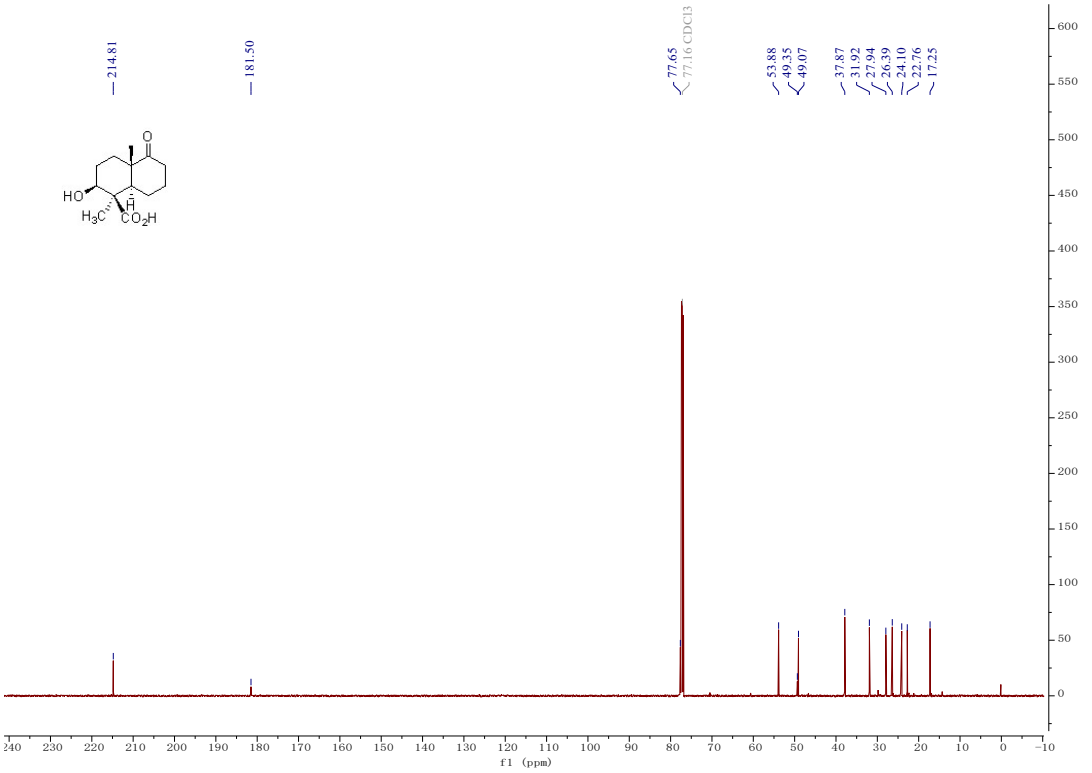
^{1}H NMR spectrum of compound **16** (600 MHz, $CDCl_3$)



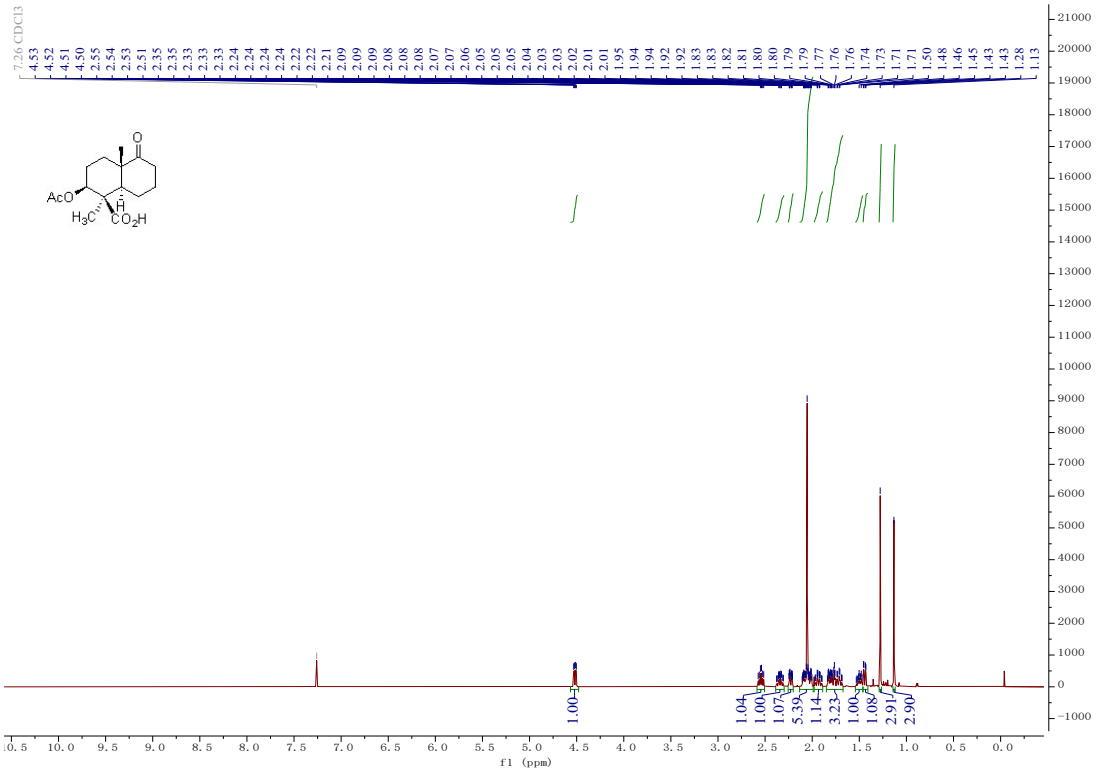
^{13}C NMR spectrum of compound **16** (151 MHz, $CDCl_3$)



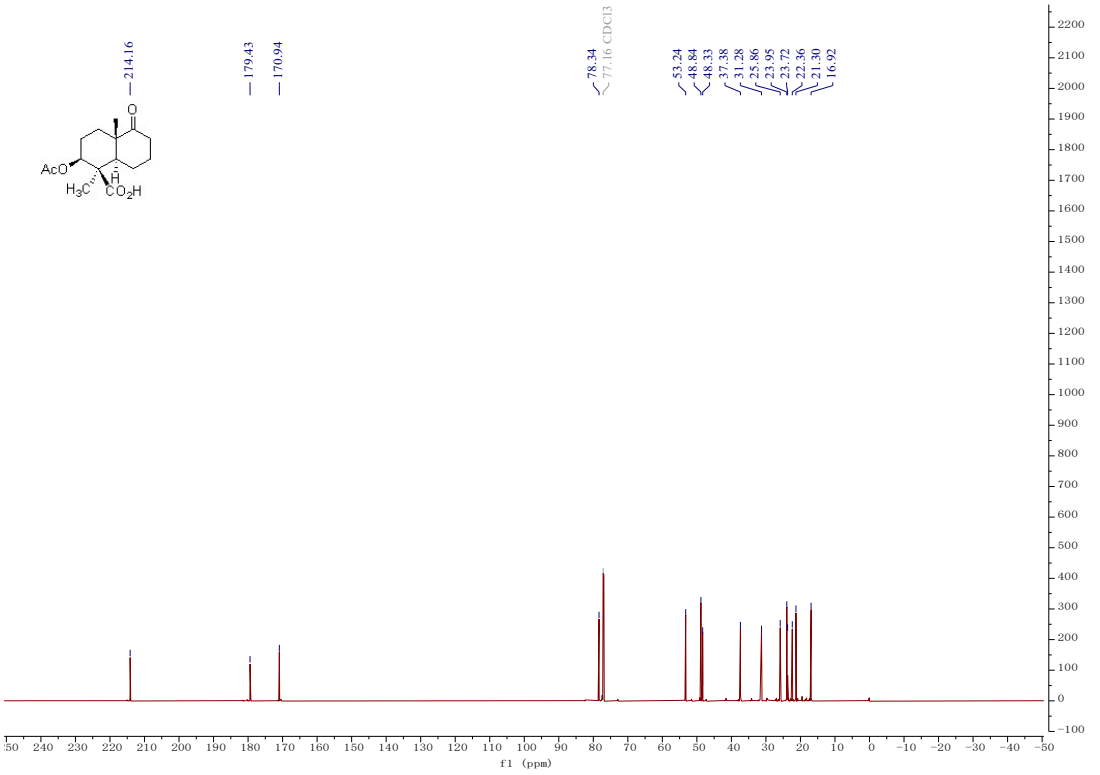
^{1}H NMR spectrum of compound **17** (600 MHz, $CDCl_3$)



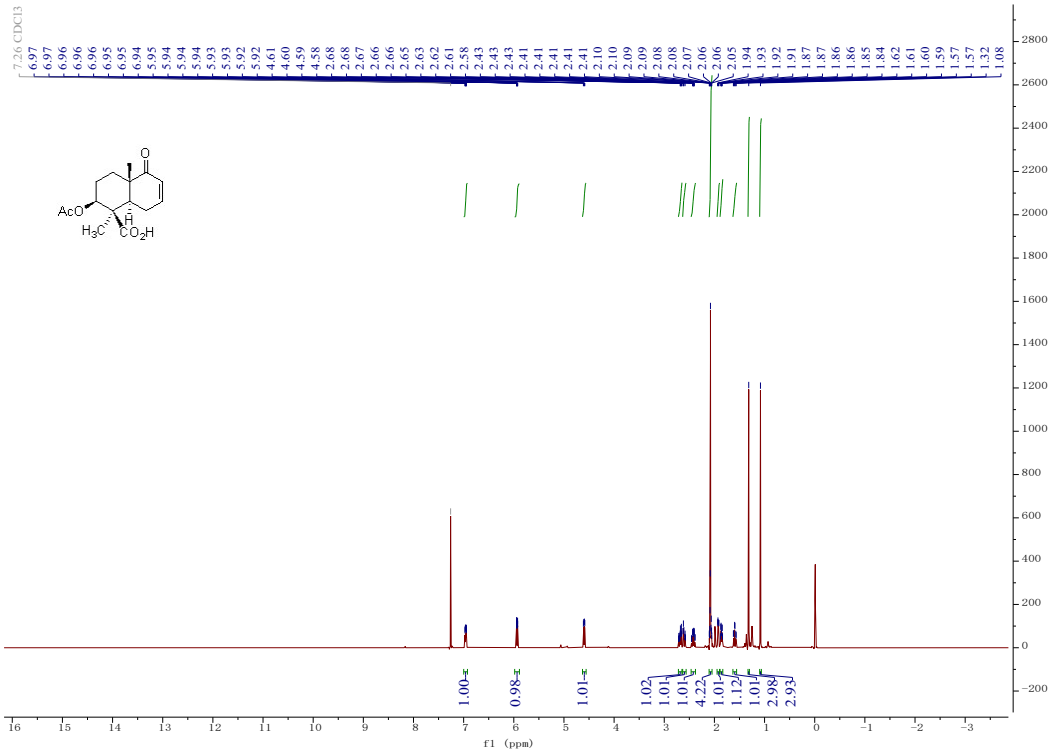
^{13}C NMR spectrum of compound **17** (151 MHz, $CDCl_3$)



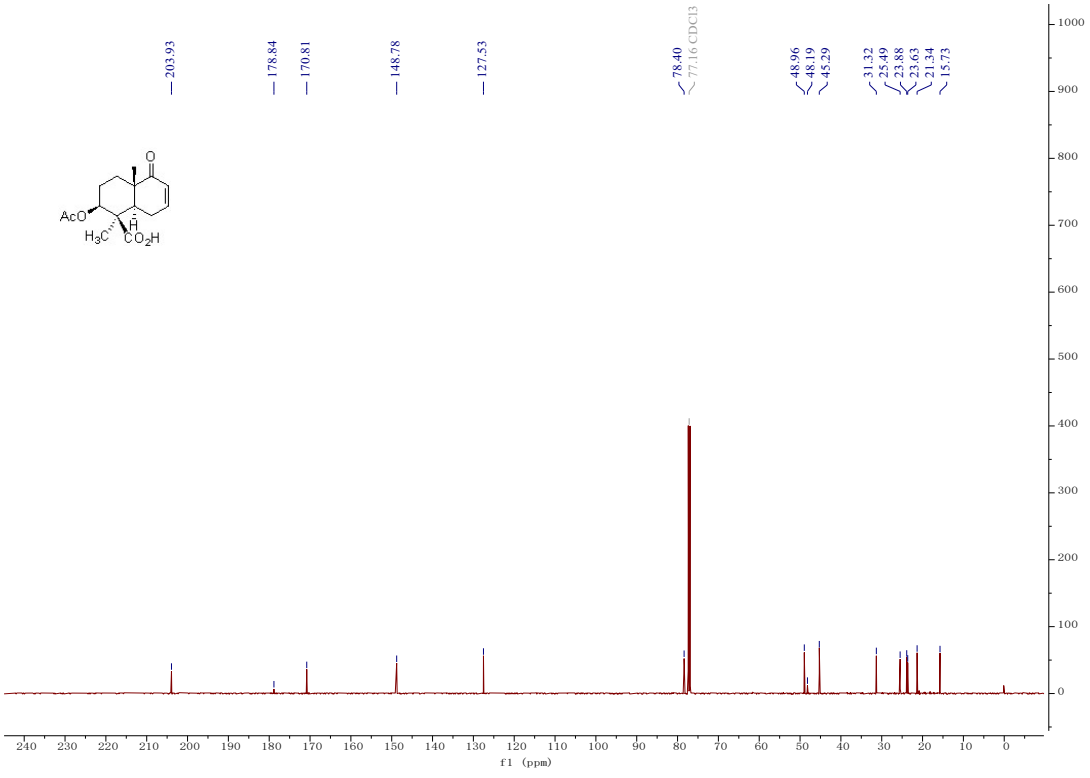
^{1}H NMR spectrum of compound **18** (600 MHz, $CDCl_3$)



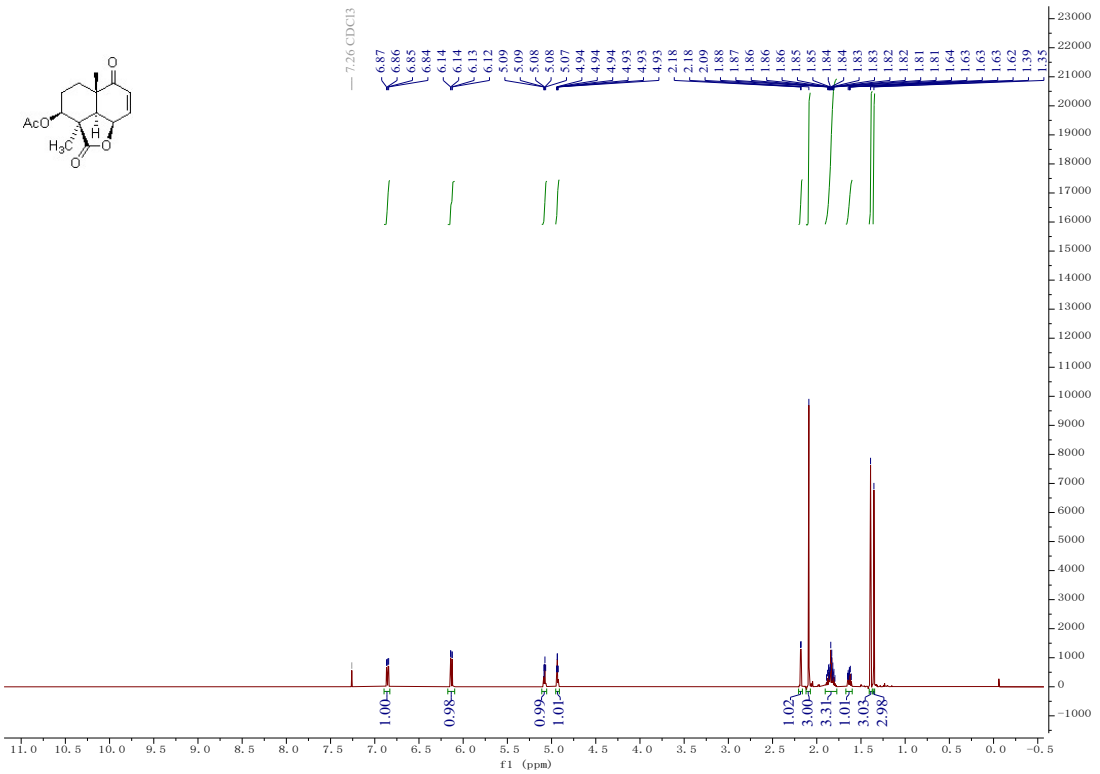
^{13}C NMR spectrum of compound **18** (151 MHz, $CDCl_3$)



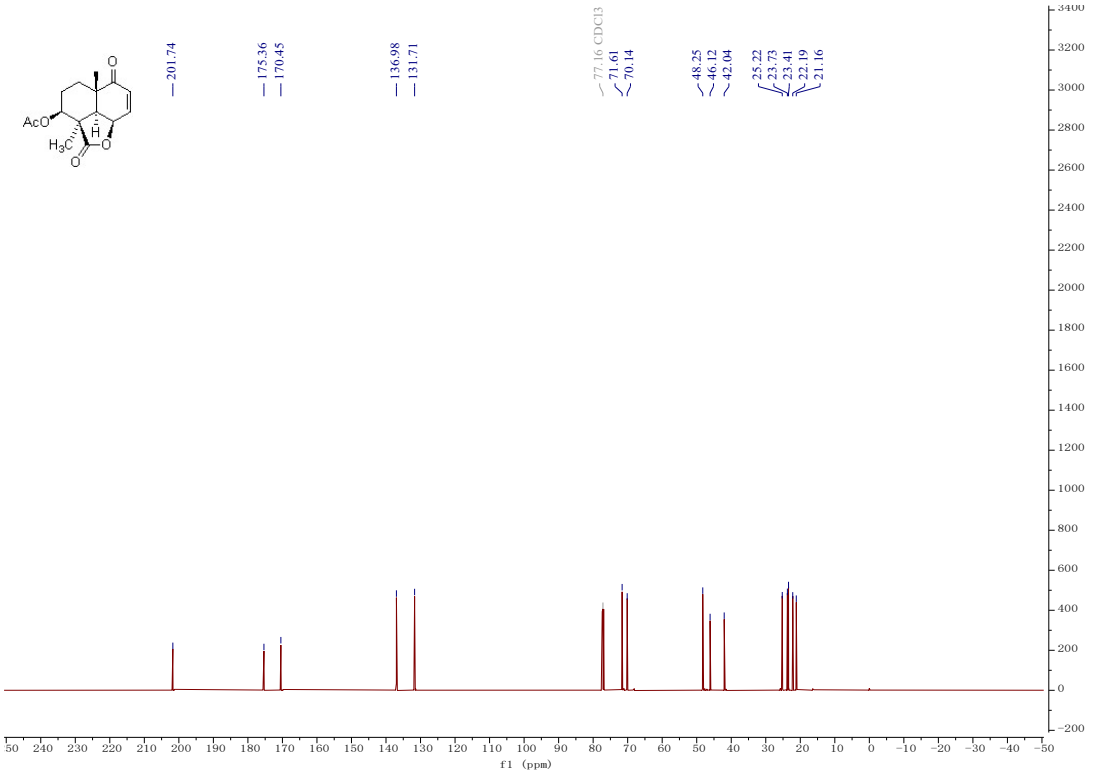
^{1}H NMR spectrum of compound **19** (600 MHz, $CDCl_3$)



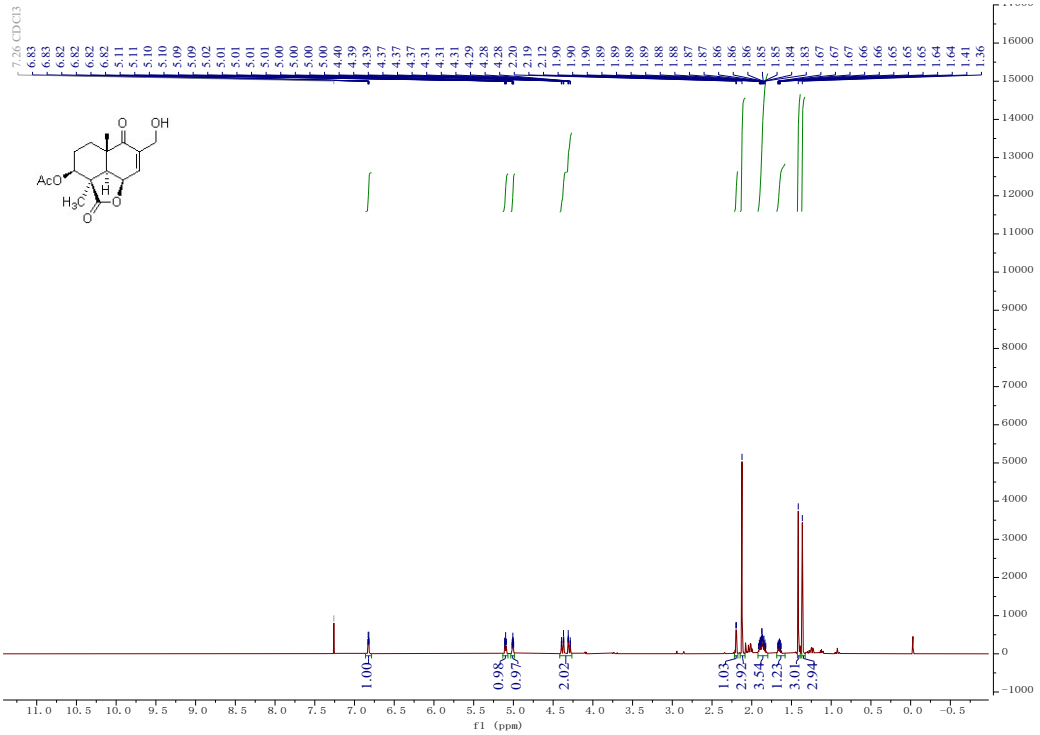
^{13}C NMR spectrum of compound **19** (151 MHz, $CDCl_3$)



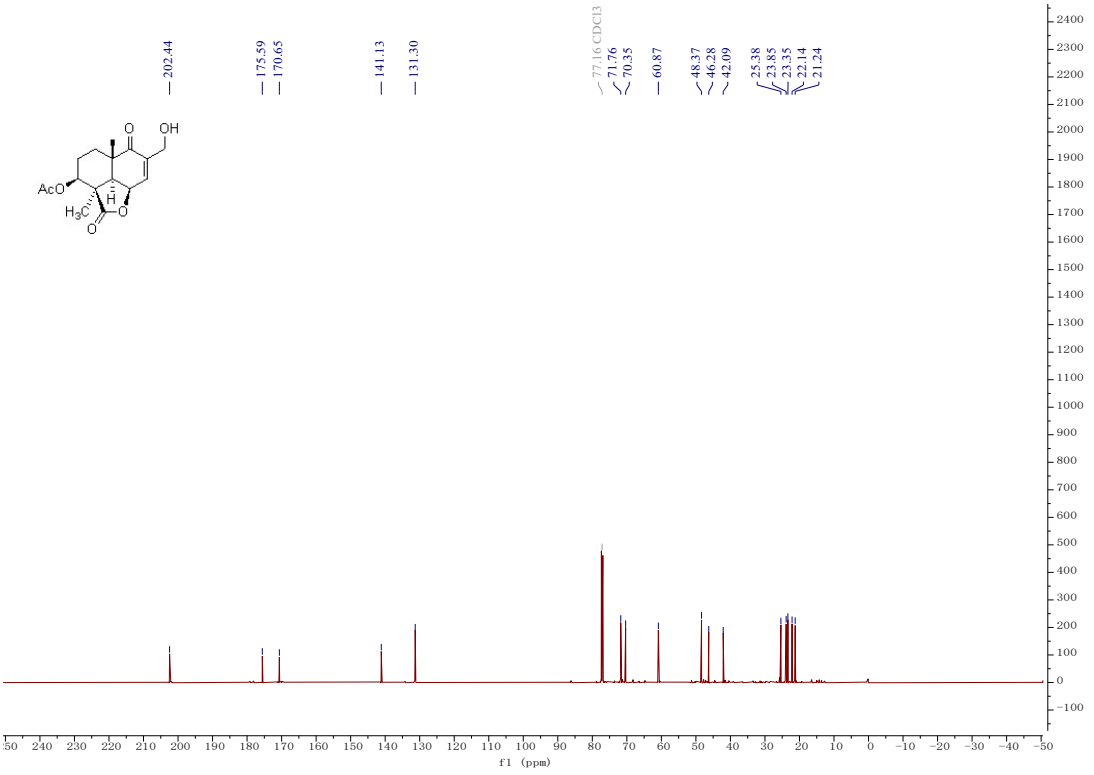
^{1}H NMR spectrum of compound **20** (600 MHz, $CDCl_3$)



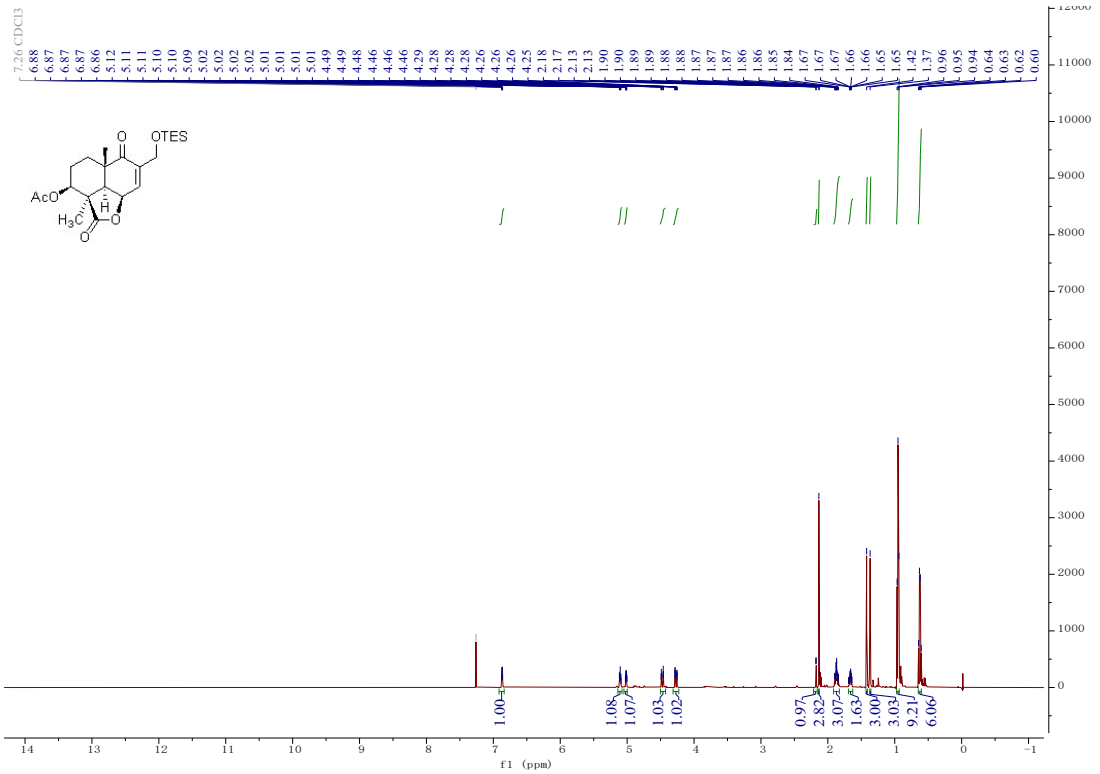
^{13}C NMR spectrum of compound **20** (151 MHz, $CDCl_3$)



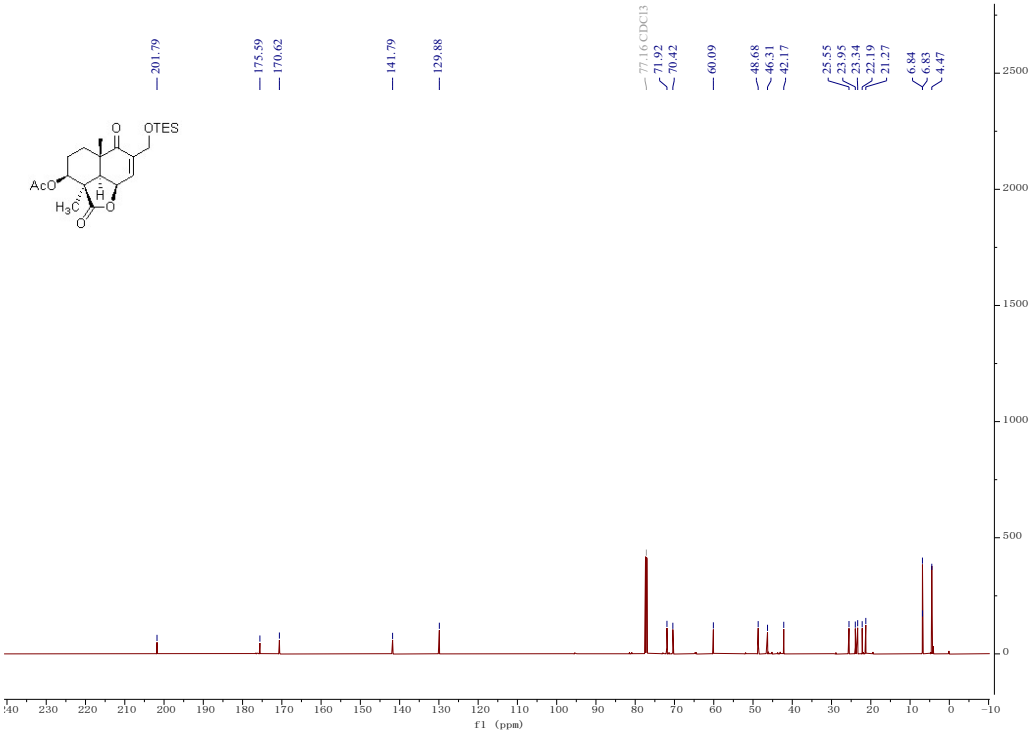
^{1}H NMR spectrum of compound **21** (600 MHz, $CDCl_3$)



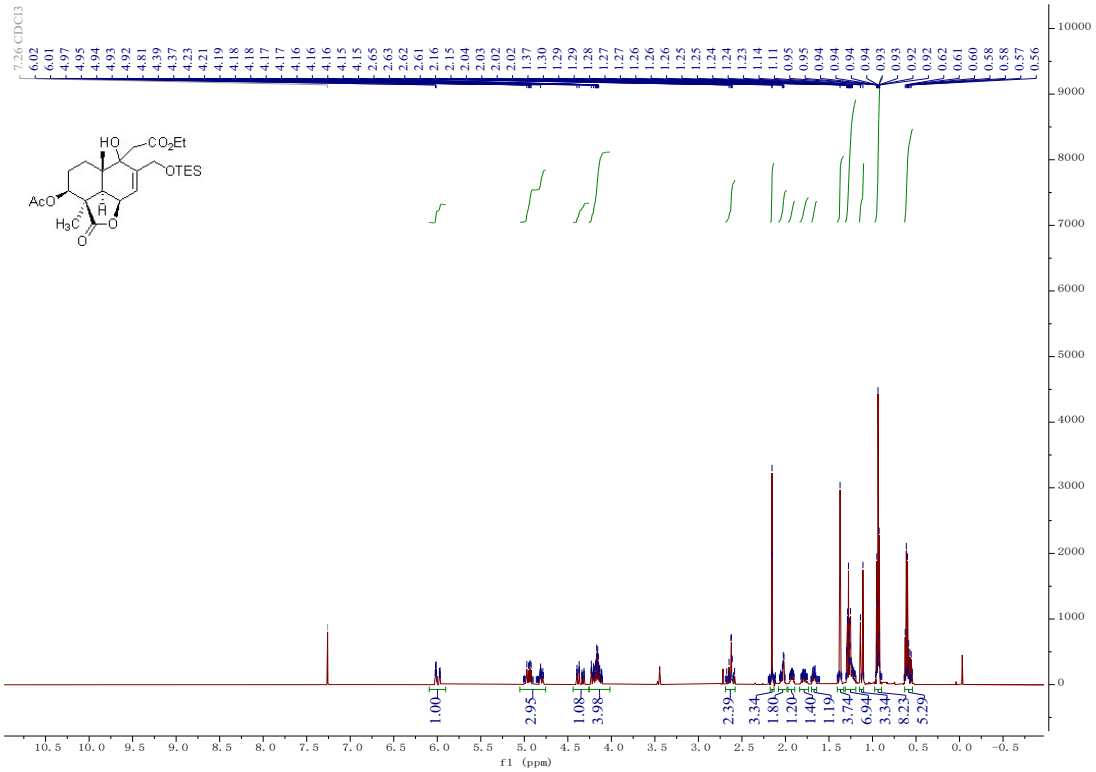
^{13}C NMR spectrum of compound **21** (151 MHz, $CDCl_3$)



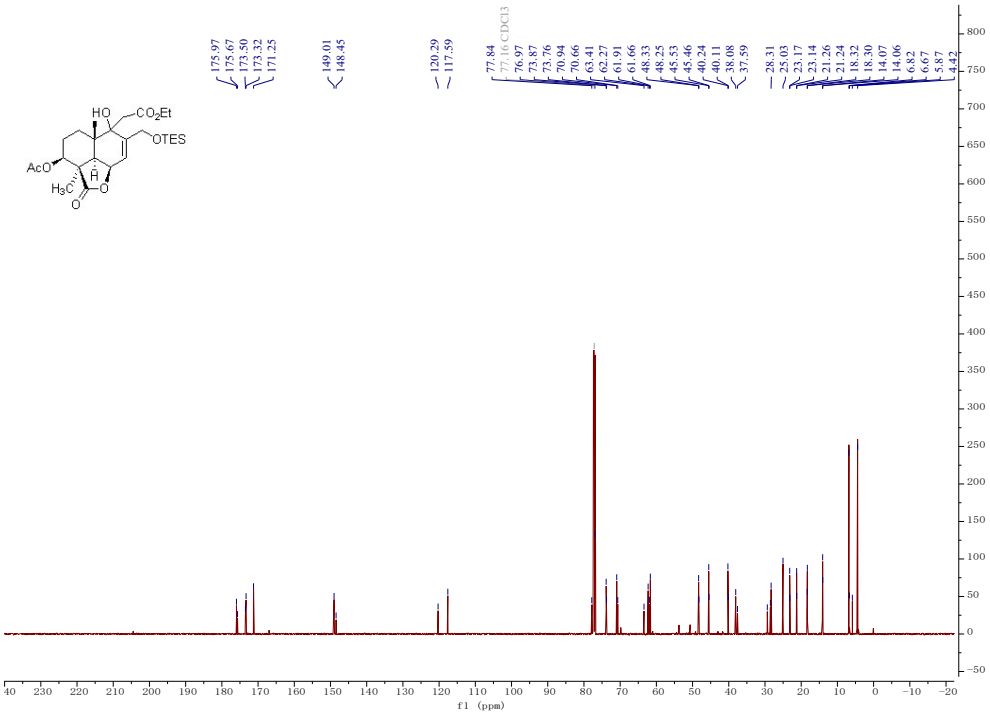
^{1}H NMR spectrum of compound **22** (600 MHz, $CDCl_3$)



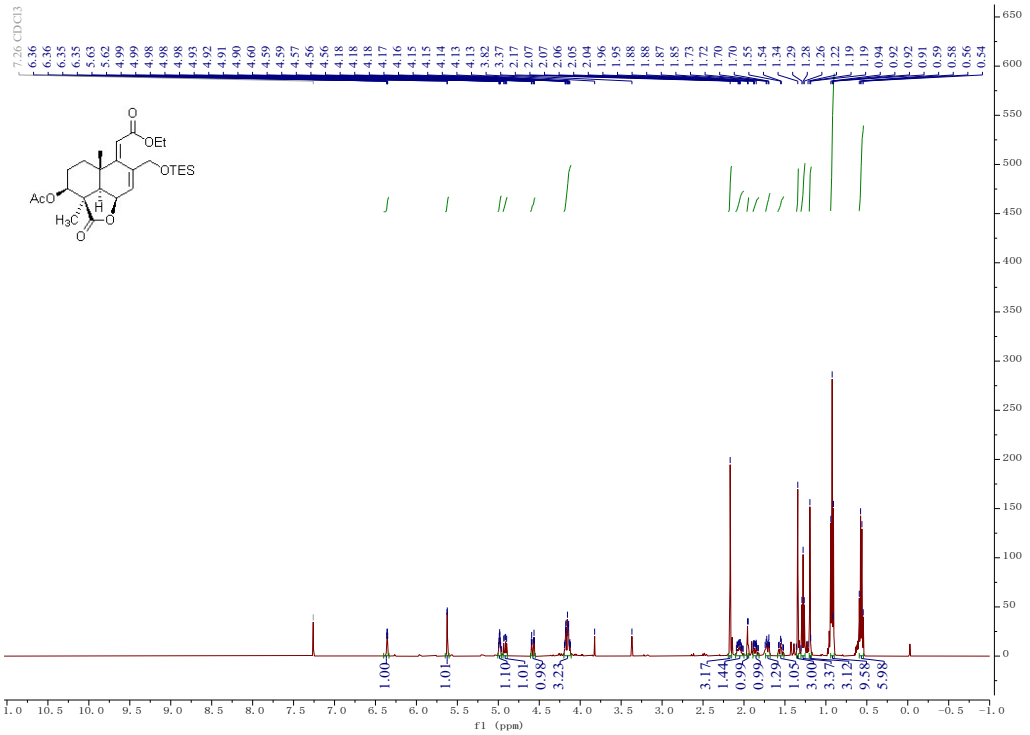
^{13}C NMR spectrum of compound **22** (151 MHz, $CDCl_3$)



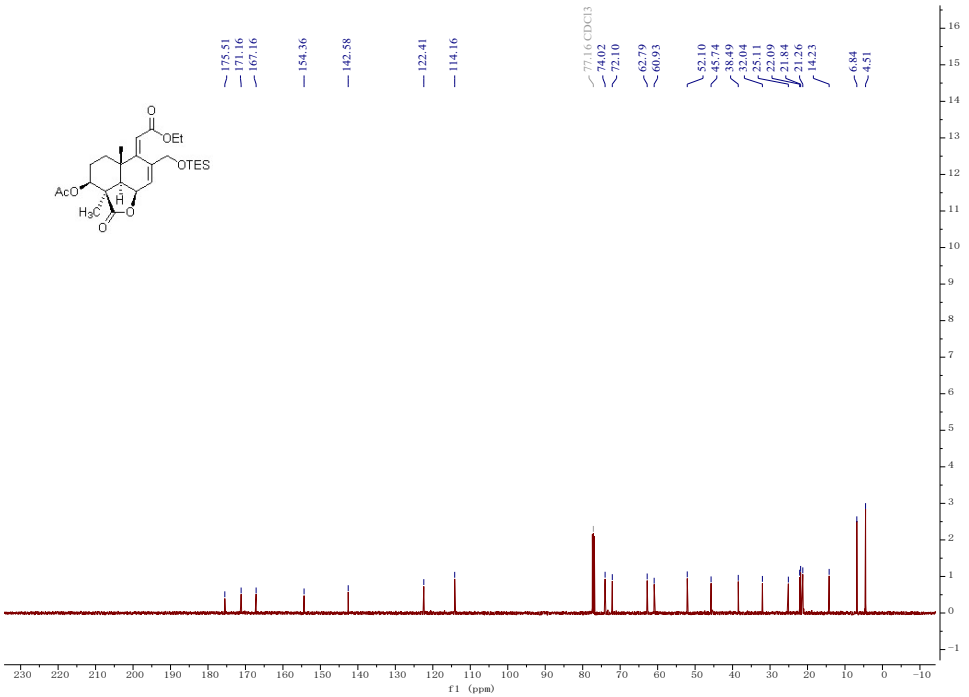
^{1}H NMR spectrum of compound **23** (151 MHz, $CDCl_3$)



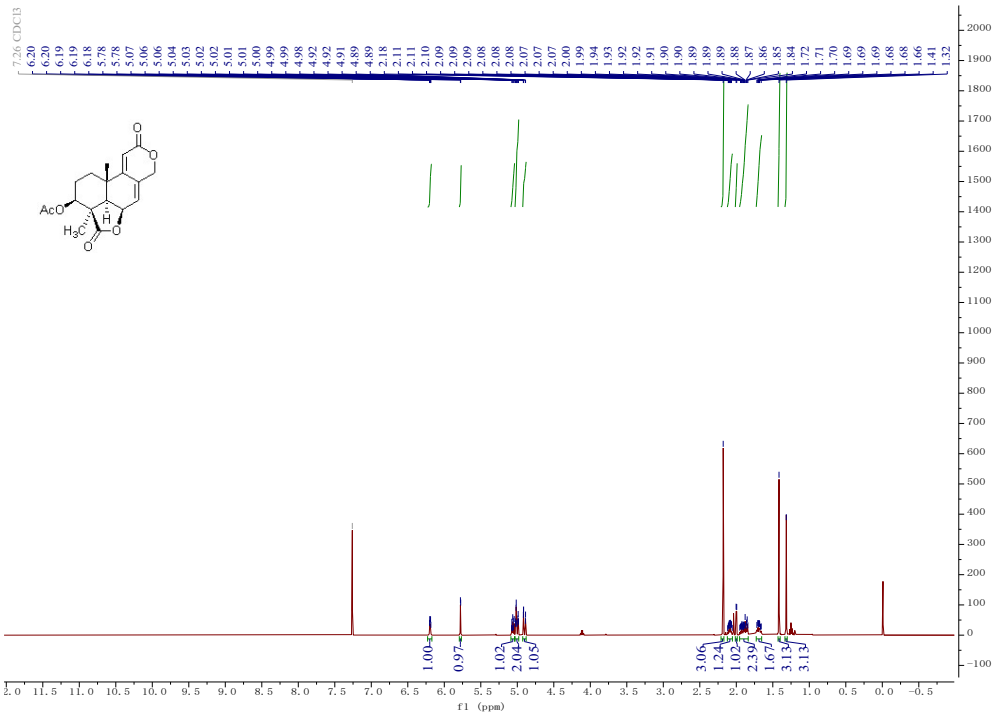
^{13}C NMR spectrum of compound **23** (151 MHz, $CDCl_3$)



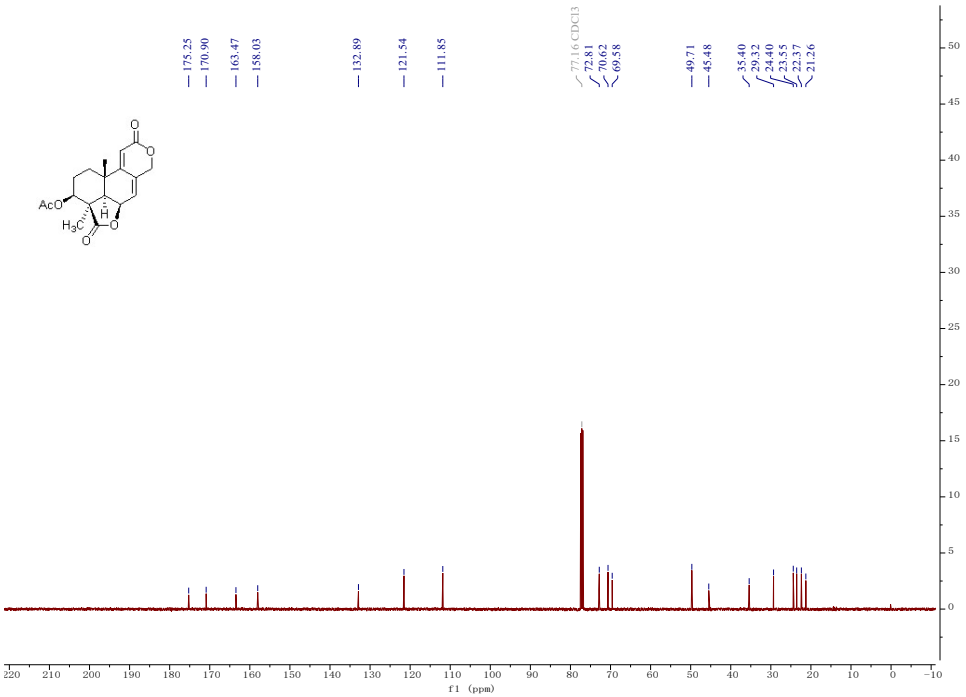
^{1}H NMR spectrum of compound **24** (600 MHz, $CDCl_3$)



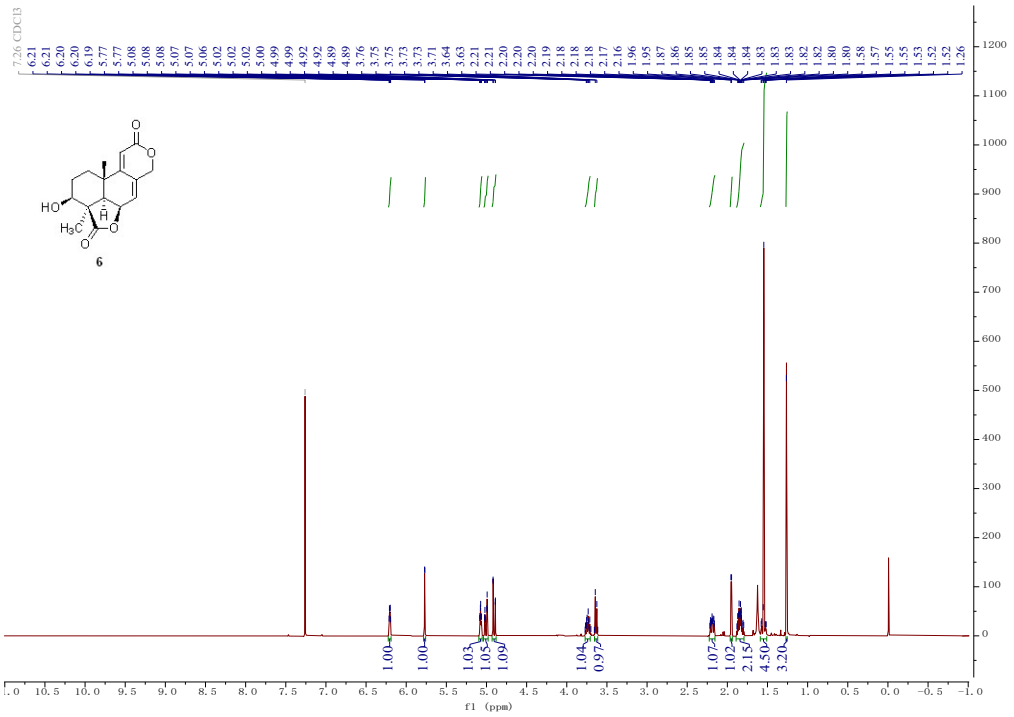
^{13}C NMR spectrum of compound **24** (151 MHz, $CDCl_3$)



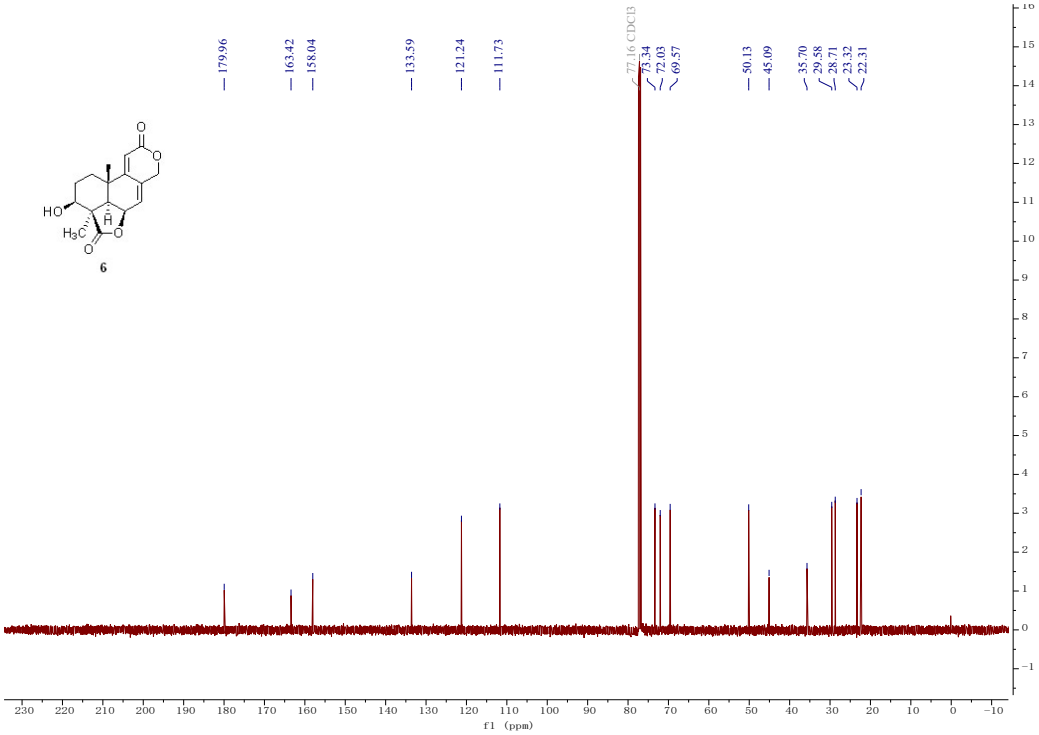
^{1}H NMR spectrum of compound **25** (500 MHz, $CDCl_3$)



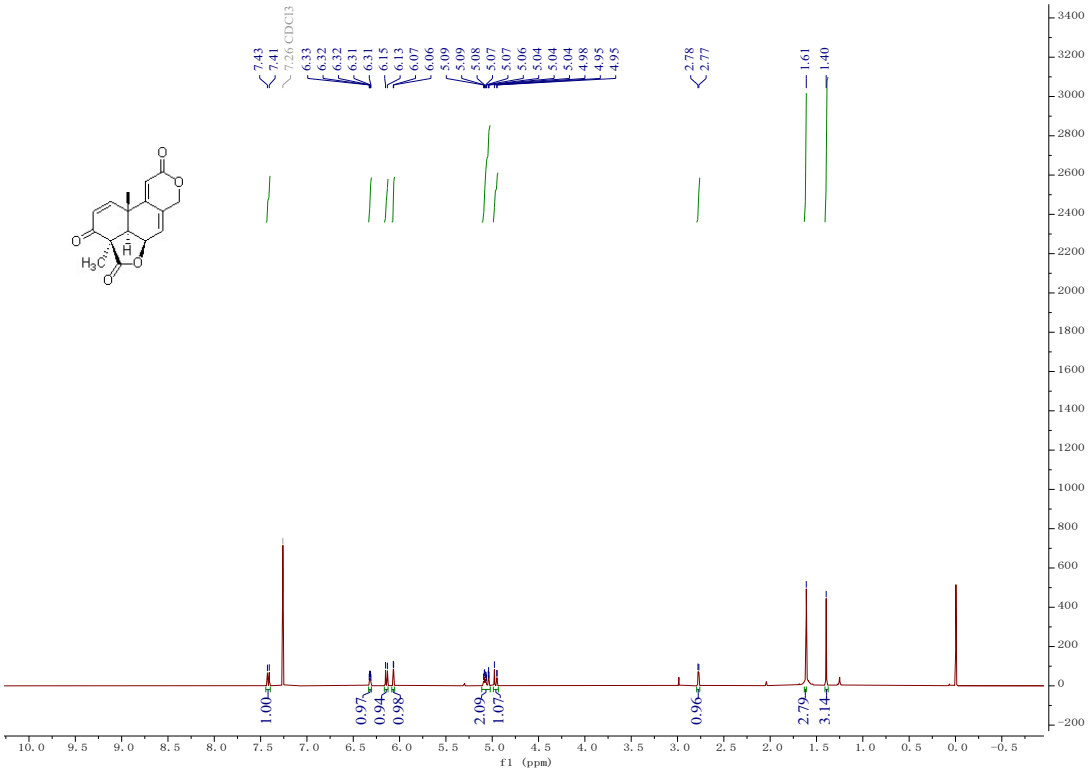
^{13}C NMR spectrum of compound **25** (126 MHz, $CDCl_3$)



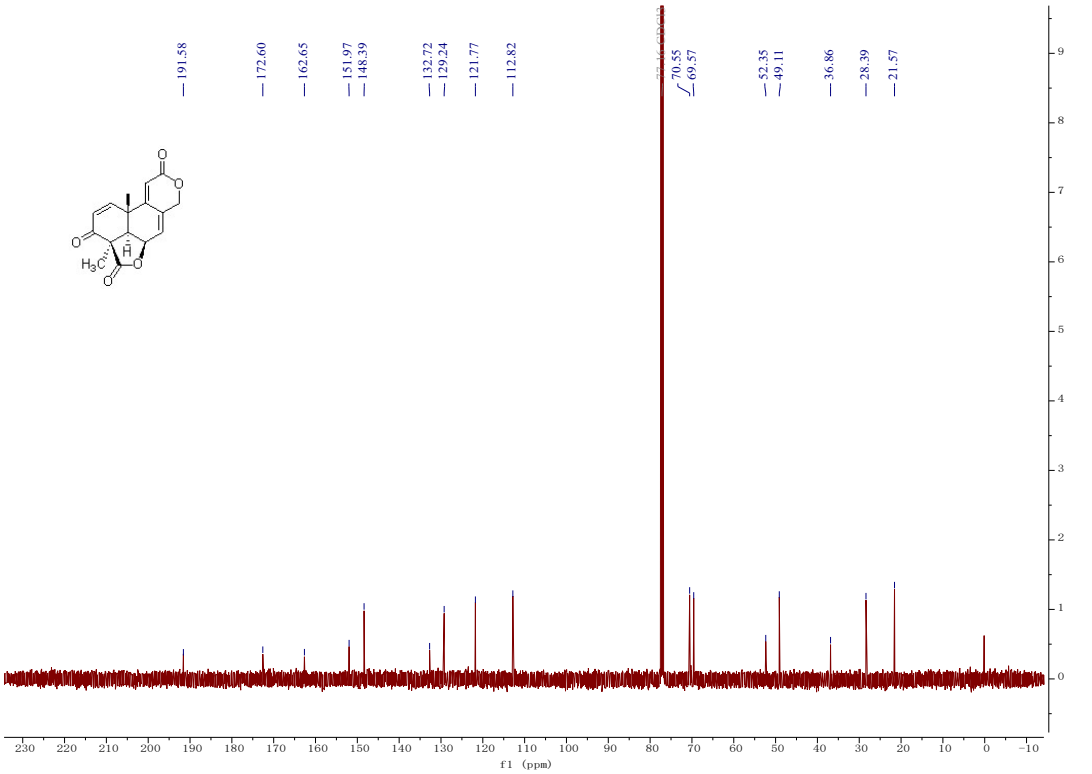
^{1}H NMR spectrum of compound **6** (500 MHz, $CDCl_3$)



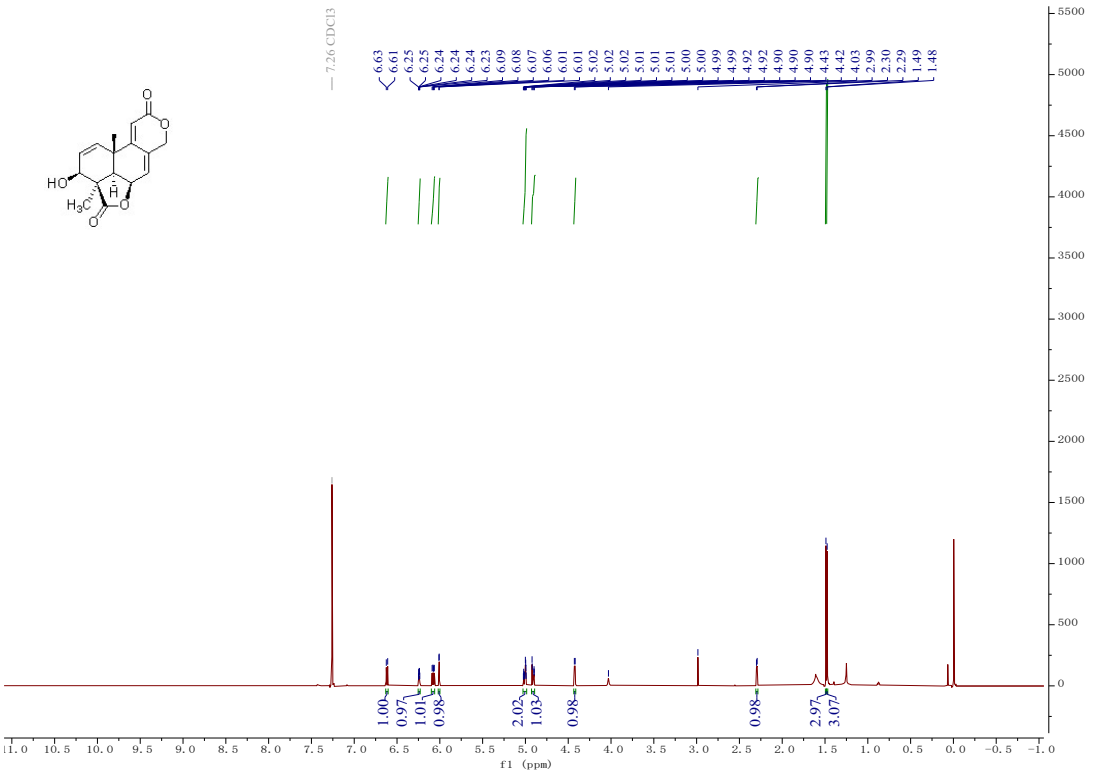
^{13}C NMR spectrum of compound **6** (126 MHz, $CDCl_3$)



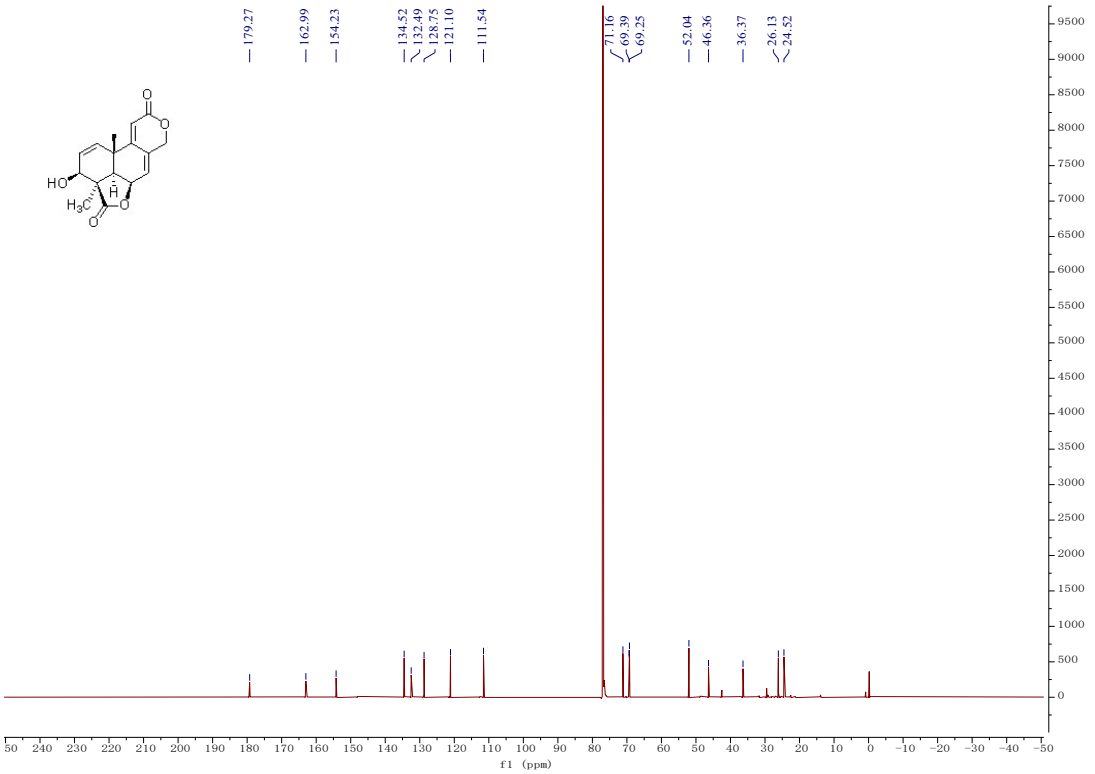
^{1}H NMR spectrum of compound **26** (500 MHz, $CDCl_3$)



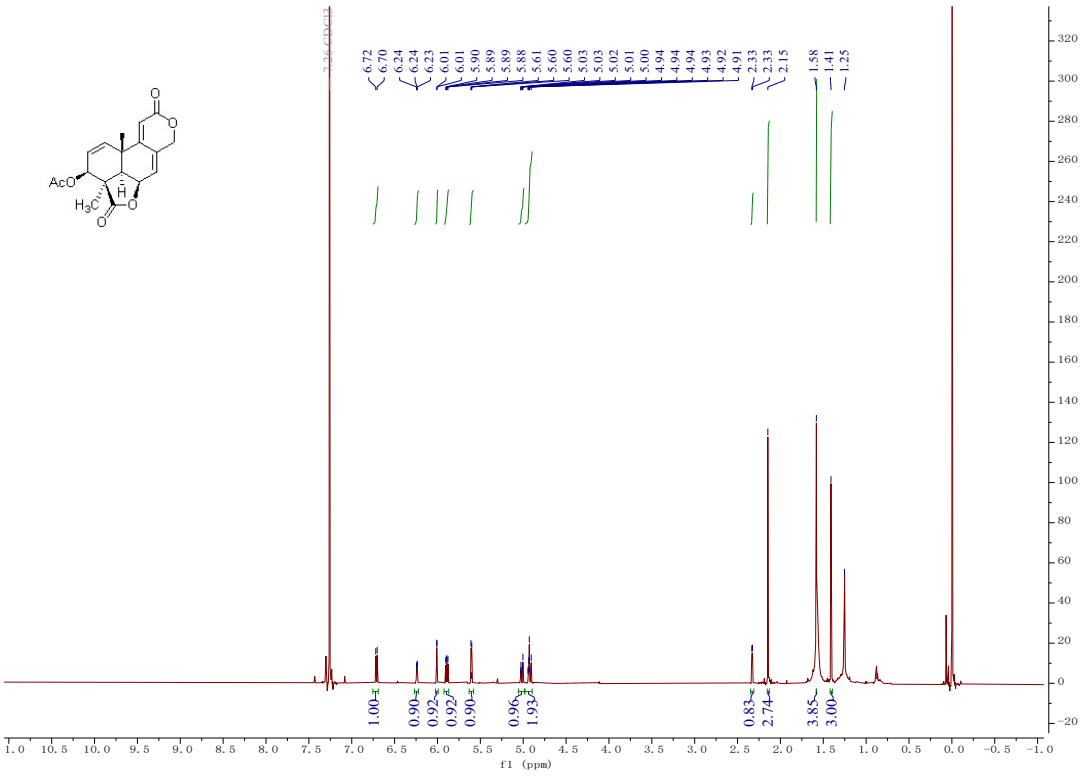
^{13}C NMR spectrum of compound **26** (126 MHz, $CDCl_3$)



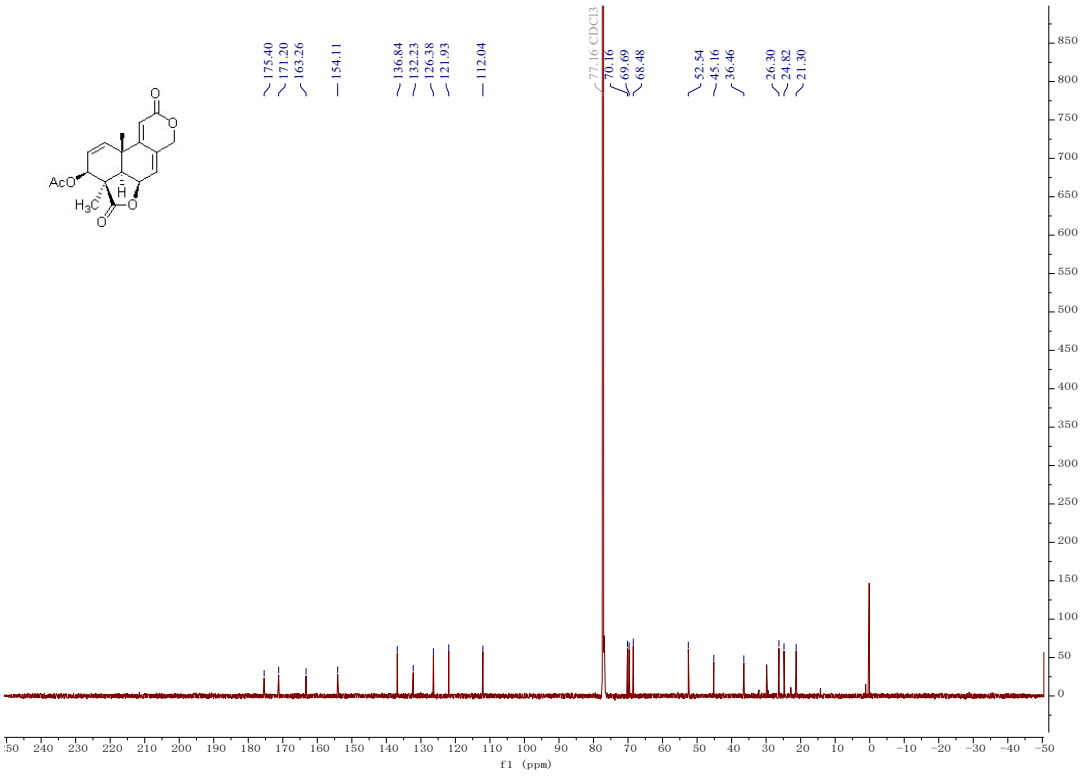
^{1}H NMR spectrum of compound **4** (600 MHz, $CDCl_3$)



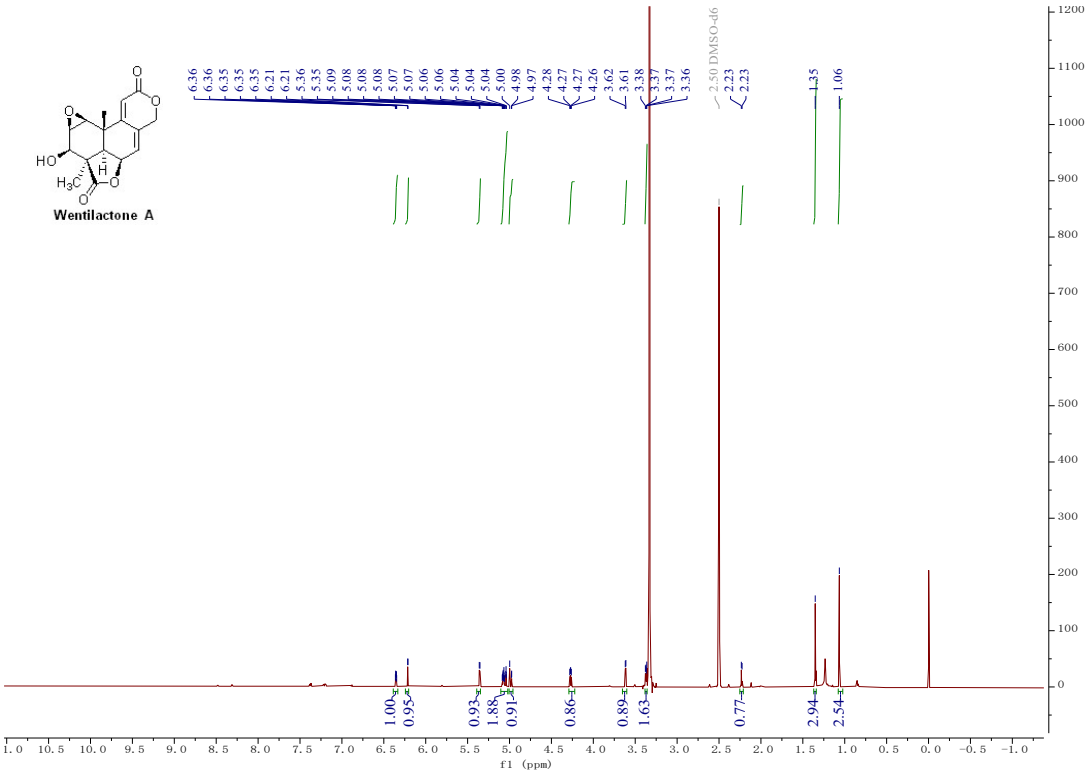
^{13}C NMR spectrum of compound **4** (151 MHz, $CDCl_3$)



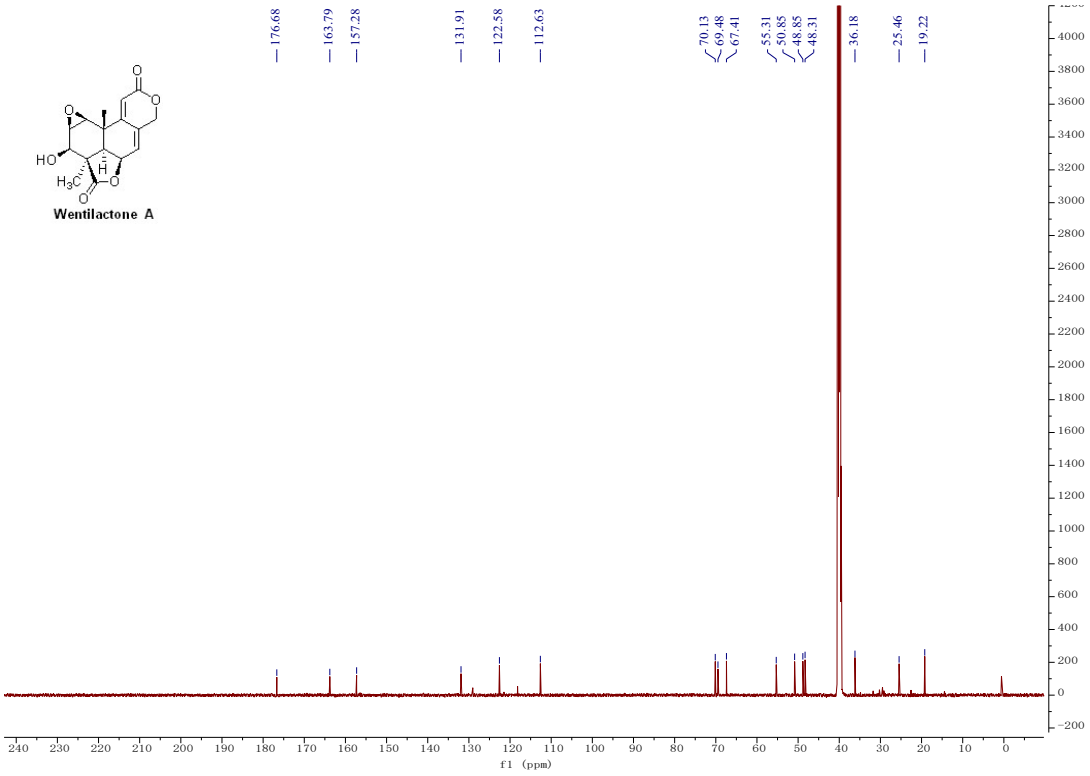
^{1}H NMR spectrum of compound **27** (600 MHz, $CDCl_3$)



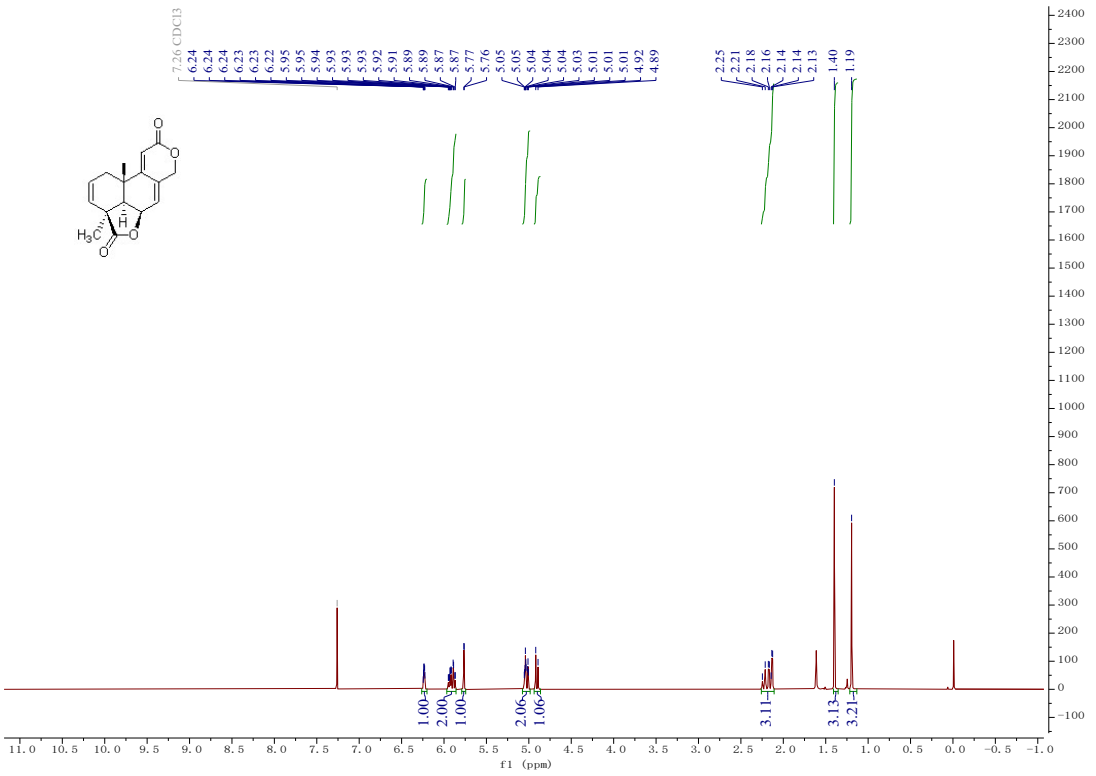
^{13}C NMR spectrum of compound **27** (151 MHz, $CDCl_3$)



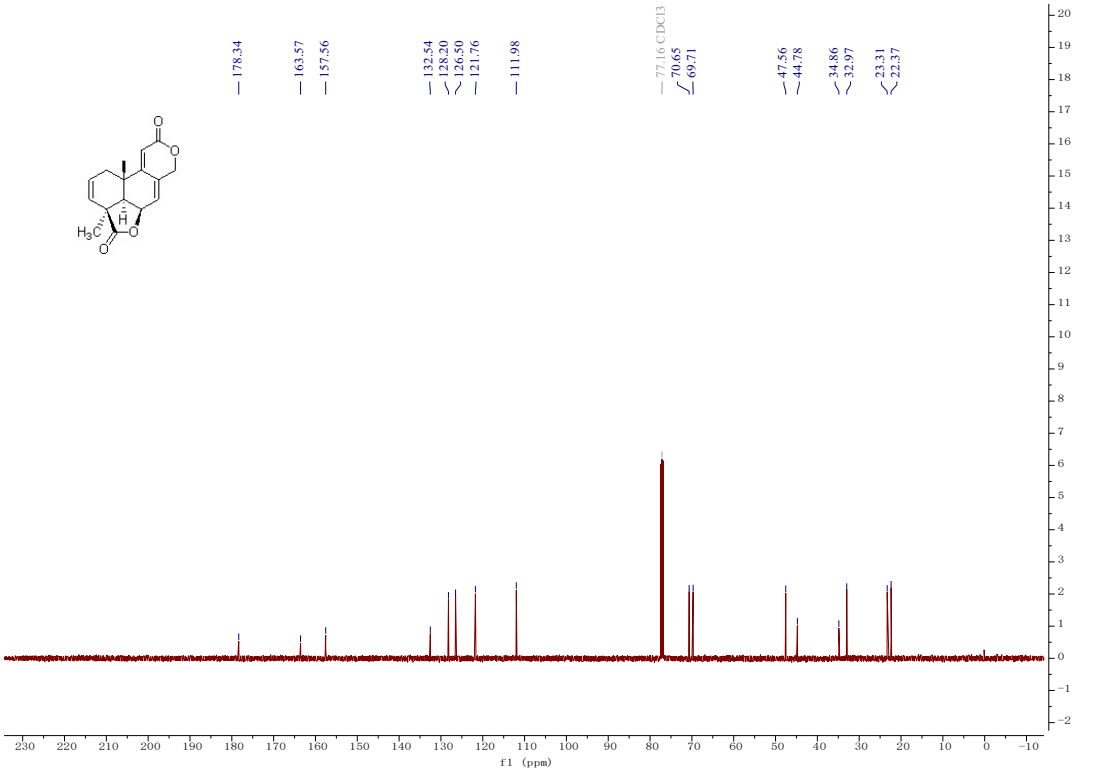
^{1}H NMR spectrum of compound **1** (600 MHz, DMSO-d_6)



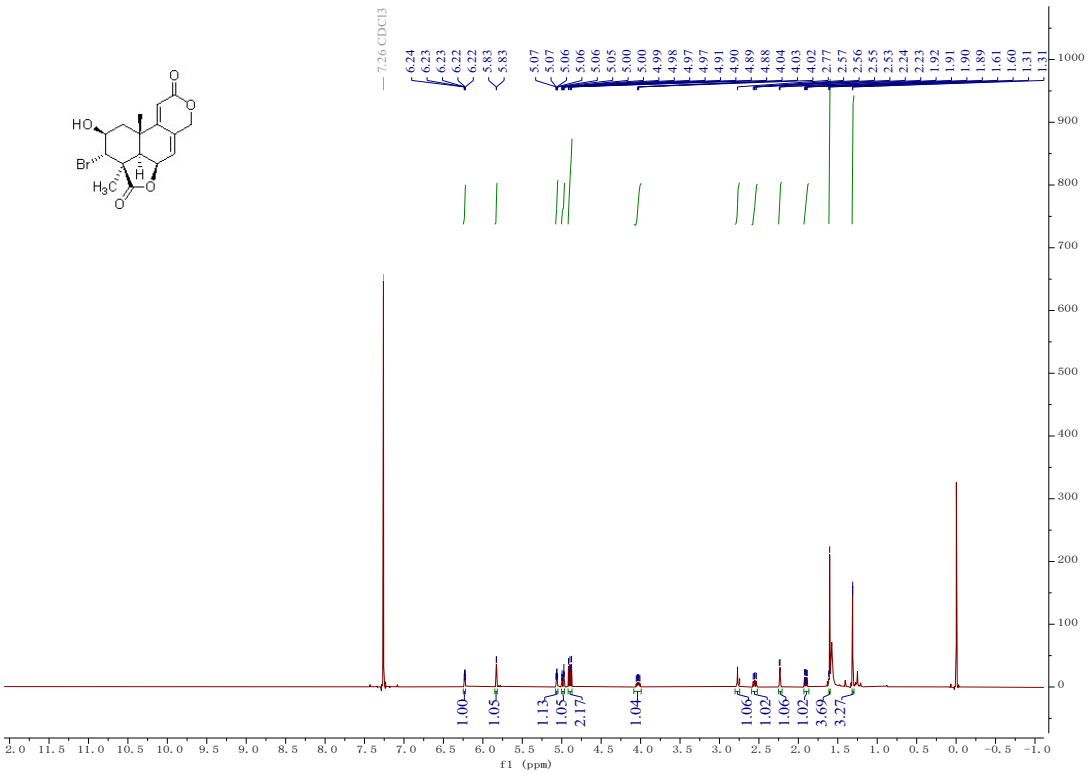
^{13}C NMR spectrum of compound **1** (151 MHz, DMSO-d_6)



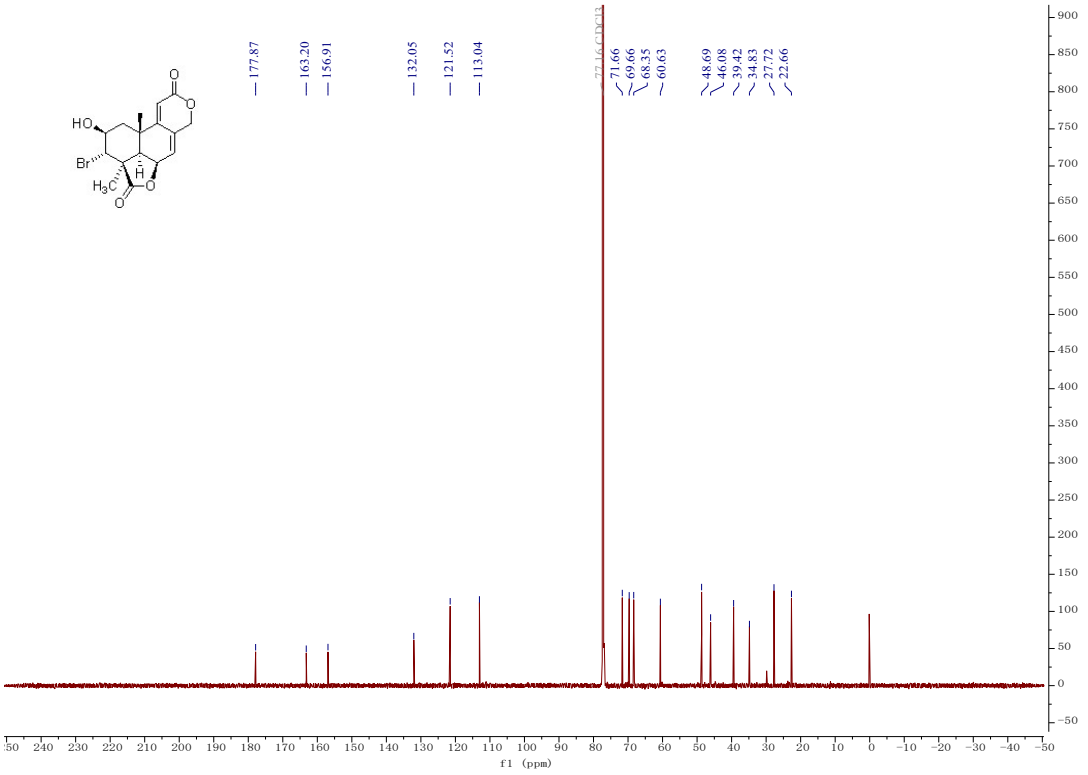
^{1}H NMR spectrum of compound **28** (500 MHz, $CDCl_3$)



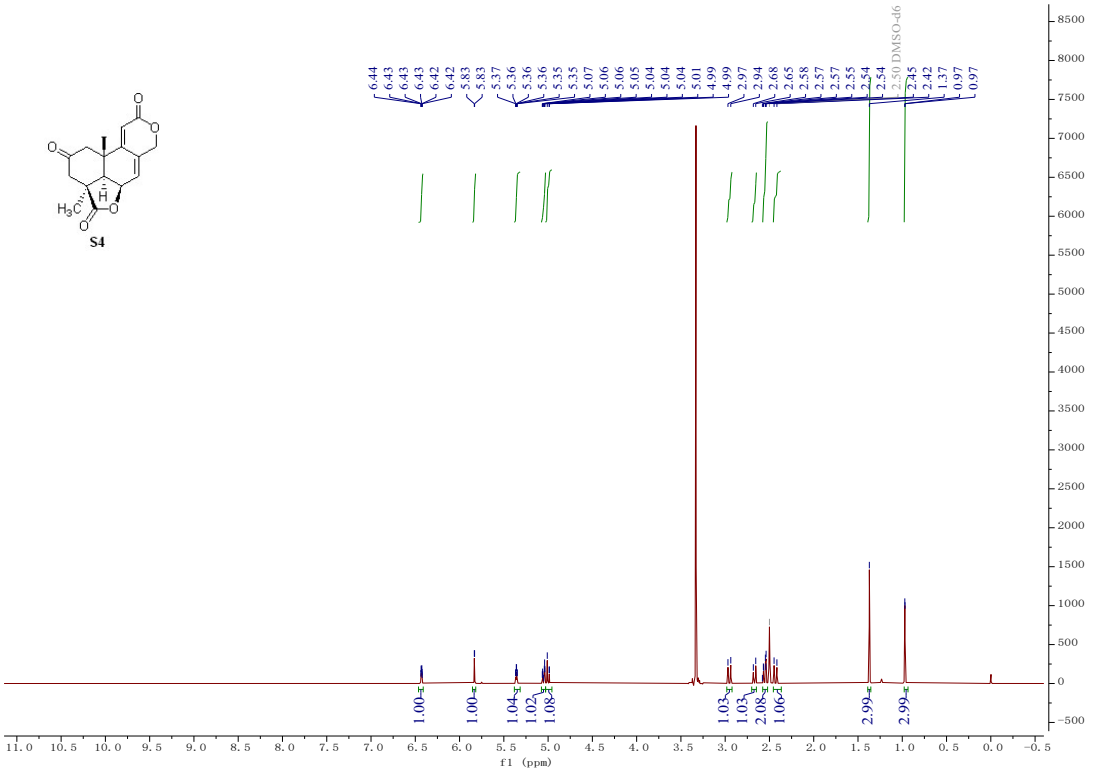
^{13}C NMR spectrum of compound **28** (126 MHz, $CDCl_3$)



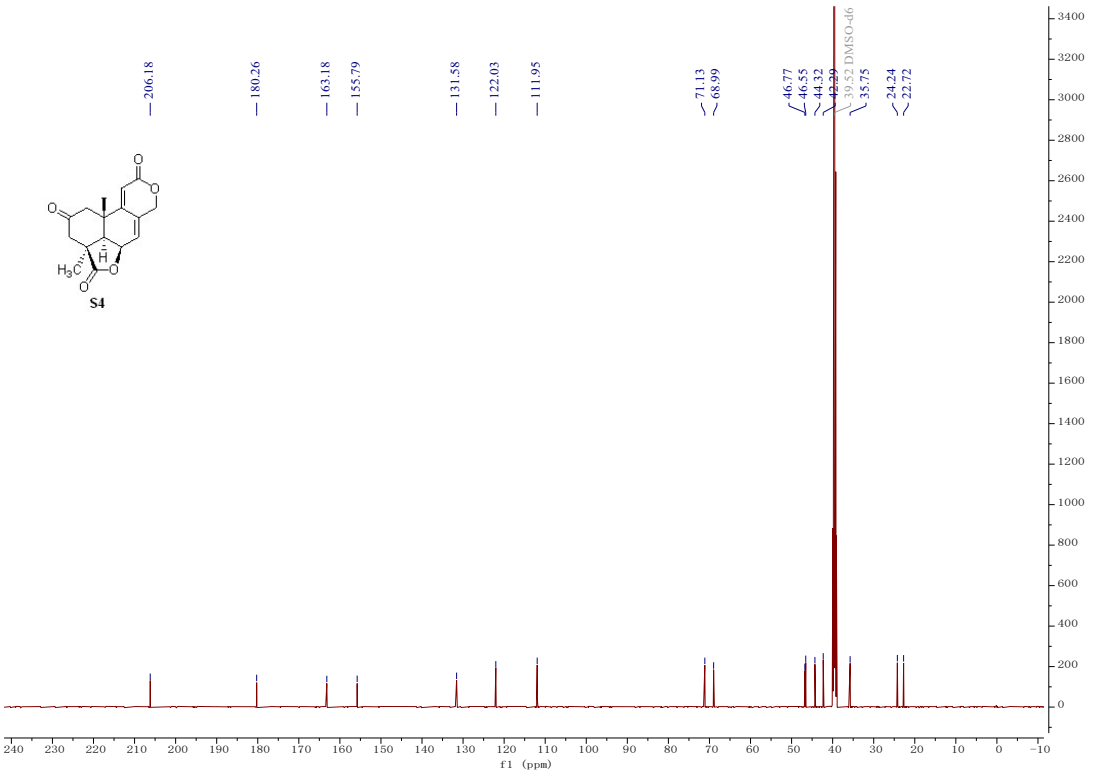
^{1}H NMR spectrum of compound **29** (600 MHz, $CDCl_3$)



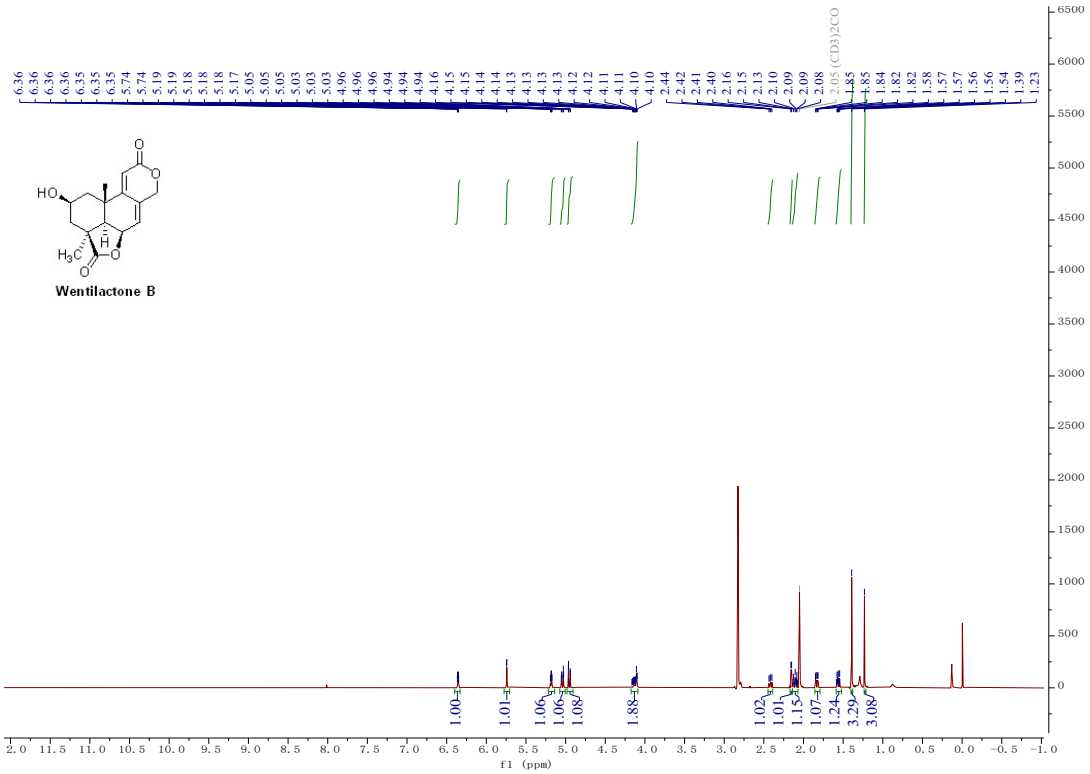
^{13}C NMR spectrum of compound **29** (151 MHz, $CDCl_3$)



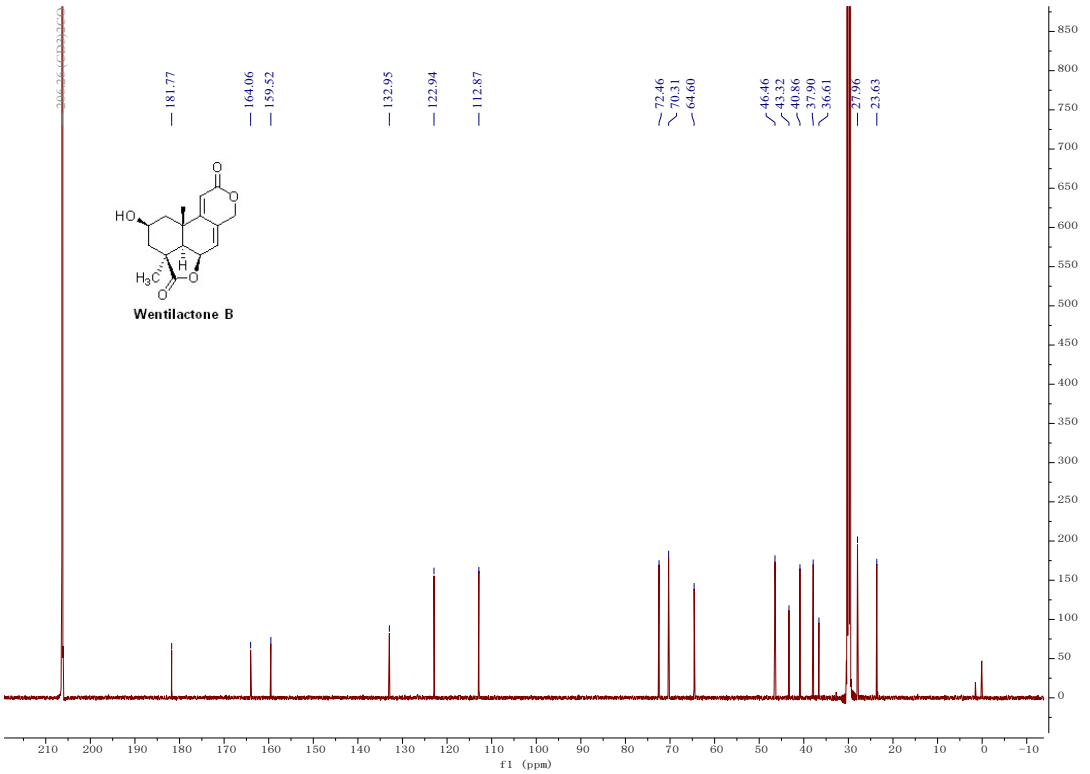
^{1}H NMR spectrum of compound **S4** (600 MHz, DMSO-d_6)



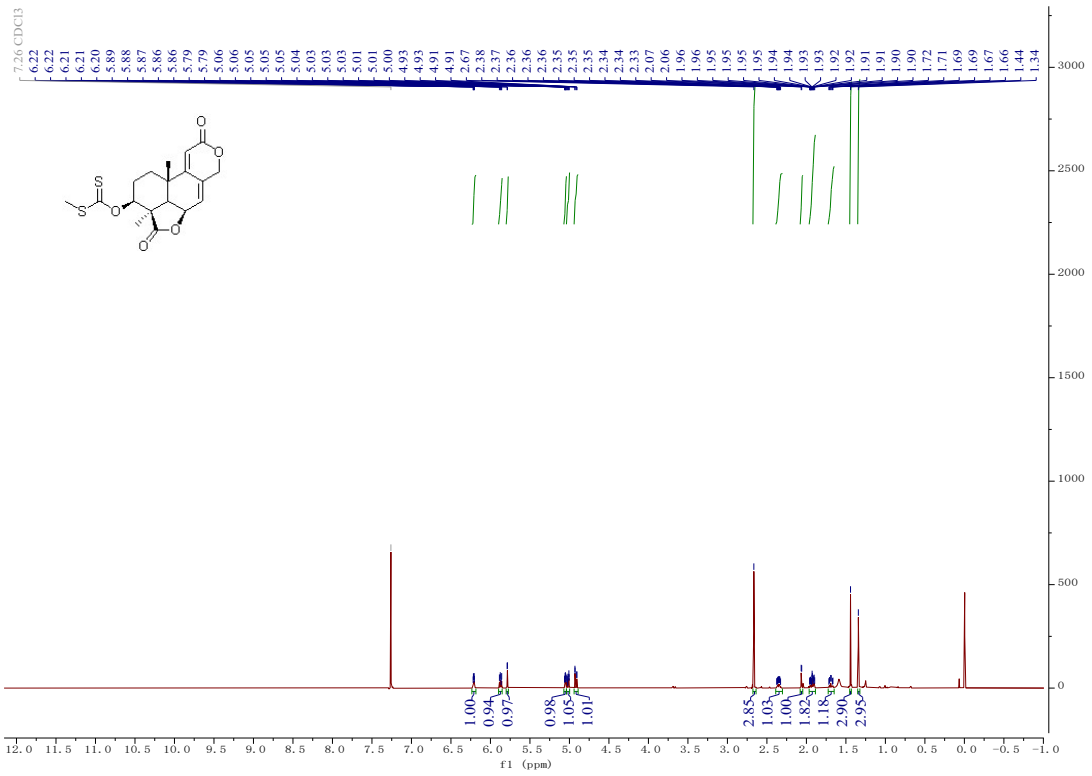
^{13}C NMR spectrum of compound **S4** (151 MHz, DMSO-d_6)



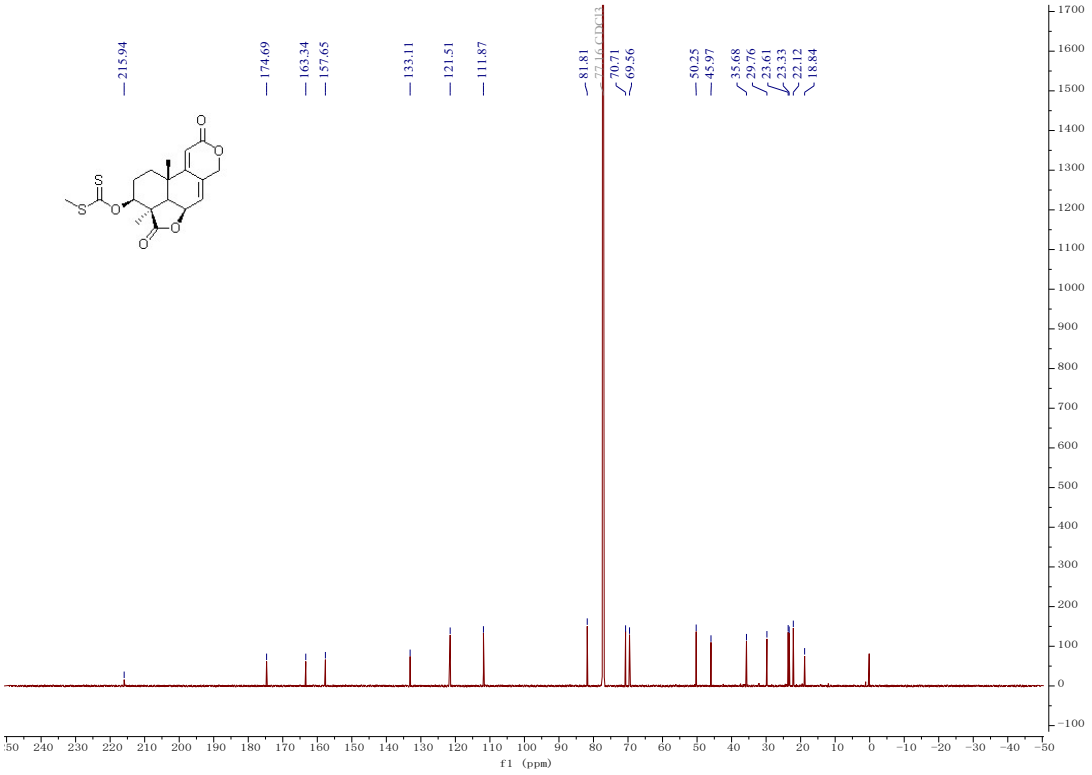
^{1}H NMR spectrum of compound **2** (600 MHz, acetone)



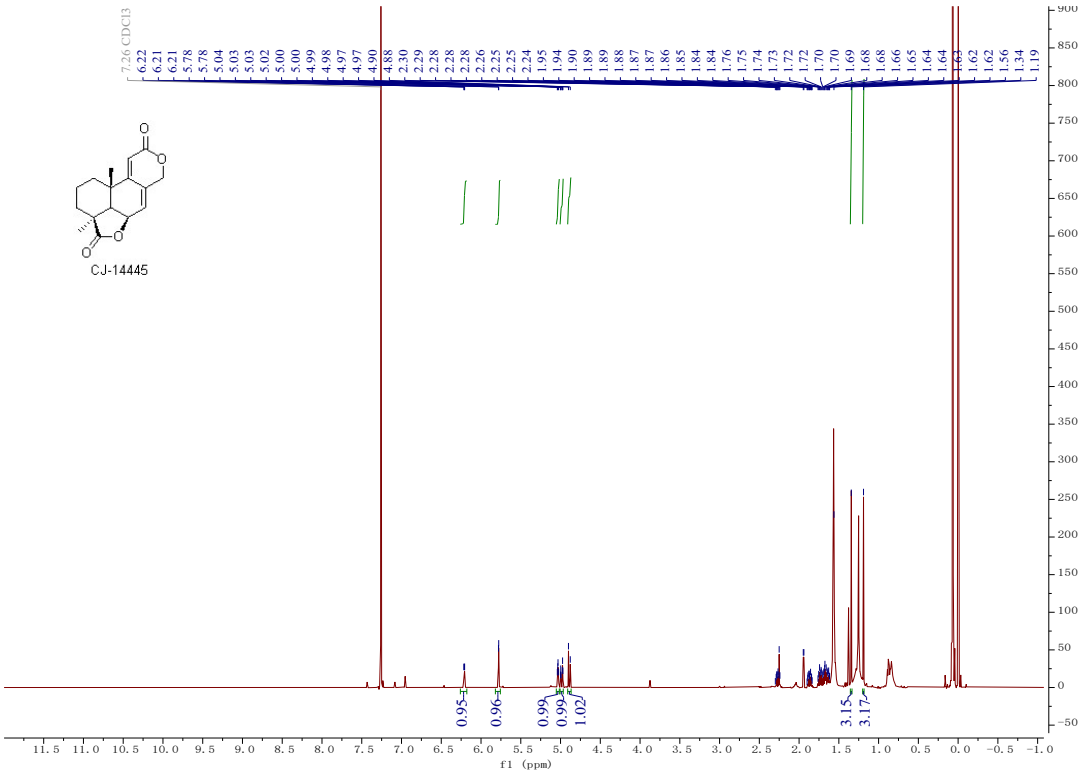
^{13}C NMR spectrum of compound **2** (151 MHz, acetone)



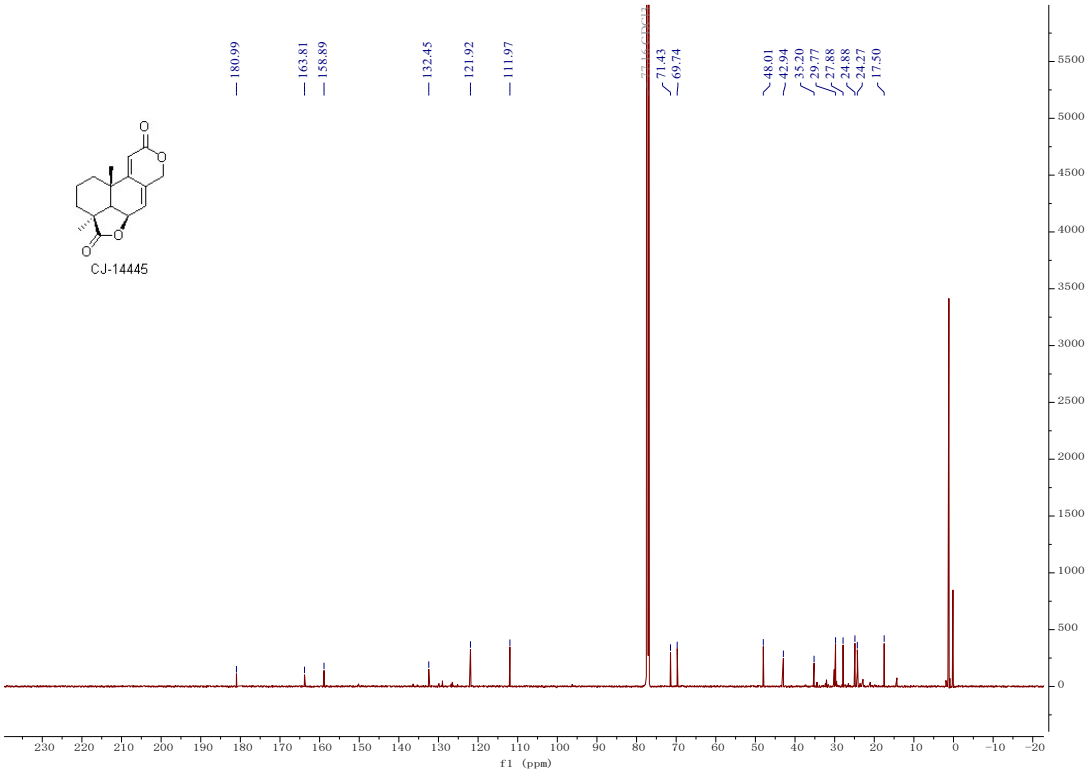
^{1}H NMR spectrum of compound **S5** (600 MHz, $CDCl_3$)



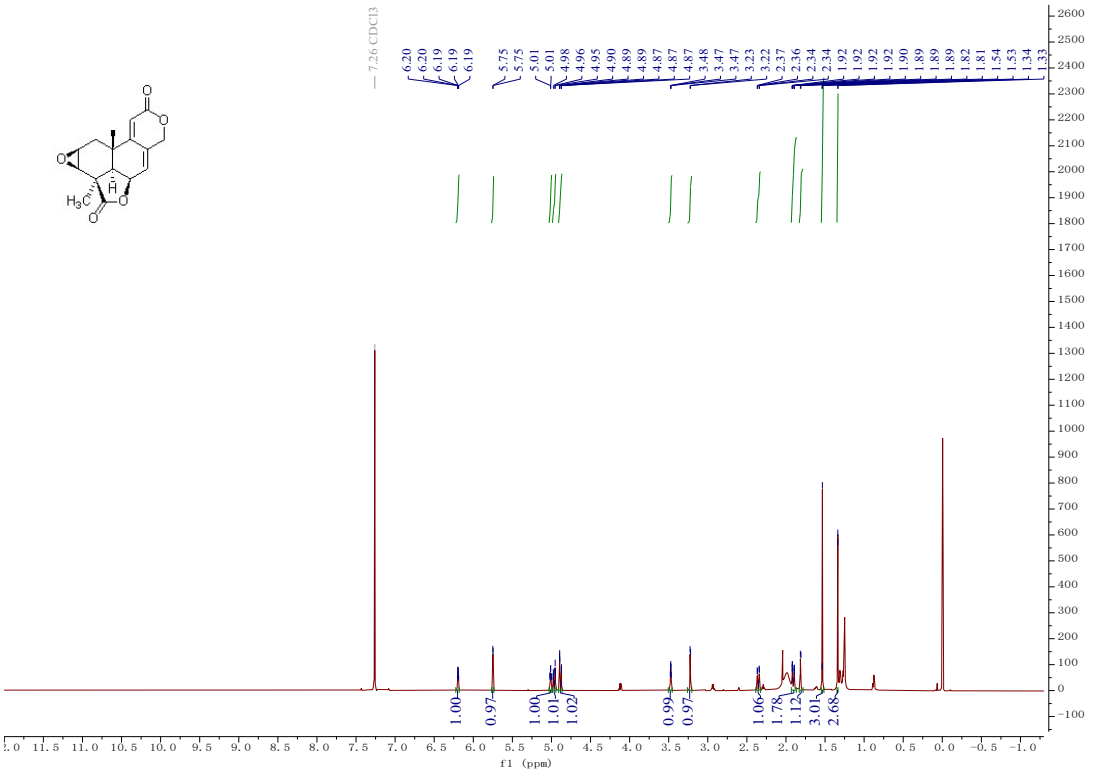
^{13}C NMR spectrum of compound **S5** (151 MHz, $CDCl_3$)



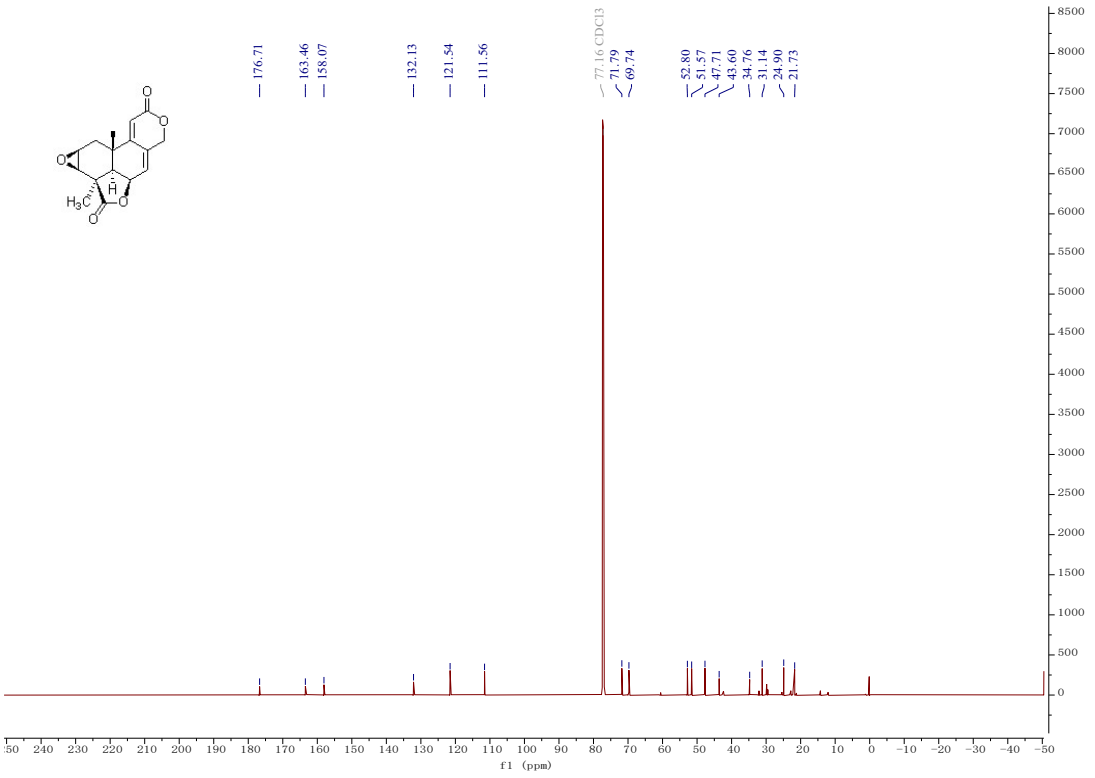
^{1}H NMR spectrum of compound **5** (600 MHz, $CDCl_3$)



^{13}C NMR spectrum of compound **5** (151 MHz, $CDCl_3$)



^{1}H NMR spectrum of compound **3** (600 MHz, $CDCl_3$)



^{13}C NMR spectrum of compound **3** (151 MHz, $CDCl_3$)