Supplementary Information (SI) for ChemComm.

Supplementary Information

Asymmetric synthesis of venezuelaene's core with a *trans*-fused [5-5] ring system

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I. General Information

All air and moisture-sensitive reactions were carried out under an argon atmosphere with dry solvents under anhydrous conditions, unless otherwise noted. All the chemicals were purchased commercially and used without further purification. Dry dichloromethane (DCM) was distilled from calcium hydride; dry tetrahydrofuran (THF), and toluene (PhMe) were distilled from sodium-benzophenone. Other solvents purification was conducted according to *Purification of Laboratory Chemicals* (Perrin, D. D.; Armarego, W. L. and Perrins, D. R., Pergamon Press: Oxford, 1980). Yields refer to chromatographic materials, unless otherwise stated. Lower temperatures were maintained using acetone/CO_2(s) (−78 °C) and water/ice (0 °C) baths. Higher temperatures were maintained using oil bath. Azide compounds used in this study, such as the *p* - toluenesulfonyl azide, are highly reactive and potentially explosive. Extreme care should be taken during handling, storage, and disposal. They should be kept away from heat, sparks, and strong oxidizing agents.

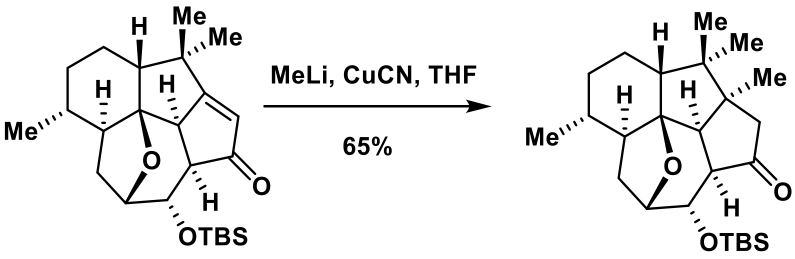
Reactions were monitored by thin-layer chromatography (TLC) carried out on 0.25 mm Tsingdao silica gel plates (60F-254) that were analyzed by fluorescence upon 254 nm irradiation or staining with basic aqueous potassium permanganate ($KMnO_4$) or an ethanolic solution of phosphomolybdic acid, and heat as developing agents. If not specially mentioned, flash column chromatography uses silica gel (200-300 mesh) supplied by Tsingtao Haiyang Chemicals (China).

NMR spectra were recorded on either a Brüker Avance 400 (^{1}H: 400 MHz, ^{13}C: 100 MHz), Brüker Avance 500 (^{1}H: 500 MHz, ^{13}C: 125 MHz) or Brüker Avance 600 (^{1}H: 600 MHz, ^{13}C: 150 MHz), and calibrated using residual undeuterated solvent as an internal reference ($CDCl_3$, δ 7.26 ppm ^{1}H NMR, δ 77.2 ppm ^{13}C NMR). The following abbreviations were used to explain the multiplicities: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, b = broad. Structural assignments were made with additional information from gCOSY, gHSQC, and gHMBC experiments.

High-resolution mass spectra (HRMS) were recorded on a Brüker Apex IV FTMS mass spectrometer (orbitrap) using ESI (electrospray ionization). Infrared spectra were recorded on a Shimadzu IR Prestige 21, using thin films of the sample on KBr plates. Optical rotations were recorded on a Perkin-Elmer 351 polarimeter at 589 nm, 100 mm cell at 25 °C. Data were reported as follow: optical rotation (*c*, g/100 mL) in solvent. Single-crystal diffraction were recorded on a Brüker D8 VENTURE.

II. Experimental Details

Synthesis of compound 7a



6 **7a**

To a stirred solution of CuCN (20 mg, 0.225 mmol, 3.0 equiv.) and compound **6**[1] (30 mg, 0.075 mmol, 1.0 equiv.) in dry Et_2O (5 mL) cooled to −78 °C was added MeLi (140 µL, 1.6 M in Et_2O, 0.225 mmol, 3.0 equiv.) was added dropwise and the reaction was stirred for 1 h. It was quenched with a saturated aqueous solution of NH_4Cl (2 mL) and extracted with EtOAc (3 mL × 3). The combined organic layers were washed with brine (2 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated under reduced pressure. The residue was purified by flash column chromatography over silica gel (5% EtOAc in hexane) to afford compound **7a** (20 mg, 65%) as a colorless oil.

TLC: $R_f = 0.6$ (hexane: EtOAc = 10: 1);

$[\alpha]_D^{22} = +6.0$ (*c* 0.11, CH_2Cl_2);

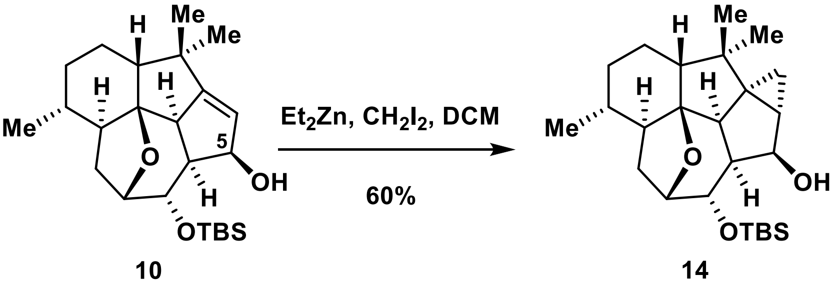
IR (film) λ_{max} 2953, 2928, 2857, 1737, 1732, 1446, 1390, 1259, 1076, 1026, 920, 775 cm^{-1};

^{1}H NMR (600 MHz, $CDCl_3$) δ 4.55 (d, *J* = 7.8 Hz, 1H), 4.09 (td, *J* = 8.2, 2.4 Hz, 1H), 2.47 (ddd, *J* = 13.6, 8.6, 2.4 Hz, 1H), 2.43 – 2.33 (m, 1H), 2.23 (d, *J* = 8.1 Hz, 1H), 2.17 – 2.03 (m, 2H), 1.91 – 1.83 (m, 1H), 1.66 (m, 2H), 1.63 – 1.47 (m, 3H), 1.31 – 1.19 (m, 2H), 1.12 – 1.01 (m, 1H), 0.98 (s, 3H), 0.96 – 0.79 (m, 17H), 0.10 (s, 3H), 0.08 (s, 3H);

^{13}C NMR (150 MHz, $CDCl_3$) δ 217.8, 86.8, 72.9, 70.0, 54.8, 53.9, 52.7, 49.7, 46.7, 46.2, 45.5, 34.5, 32.2, 26.9, 26.0, 22.0, 21.6, 21.4, 20.7, 20.1, 18.2, –4.6, –4.7 ppm;

HRMS (ESI) Calcd for $C_{25}H_{43}O_3Si$ $[M+H]^+$: 419.2976; Found: 419.2975.

Synthesis of compound 14



10 14

To a stirred solution of CH_2I_2 (28 μL, 0.35 mmol, 5.0 equiv.) in dry DCM (2 mL) was added Et_2Zn (340 μL, 1.0 M in Et_2O, 0.34 mmol, 4.8 equiv.) at 0 °C. The reaction was stirred for 2 h before compound **10**[1] (28 mg, 0.07 mmol, 1.0 equiv.) in dry DCM (1 mL) was added. The mixture was stirred for 1 h. It was quenched with a saturated aqueous solution of NH_4Cl (5 mL) and extracted with EtOAc (3 mL × 3). The combined organic layers were washed with brine (3 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by flash column chromatography over silica gel (3% EtOAc in hexane) to afford compound **14** (17.0 mg, 60%) as a white solid.

TLC: $R_f = 0.7$ (hexane: EtOAc = 8:1);

$[\alpha]_D^{22} = +10.0$ (*c* 0.1, CH_2Cl_2);

IR (film) λ_{max} 2953, 2924, 2868, 1709, 1456, 1373, 1261, 1107, 1051, 1016, 798 cm^{-1};

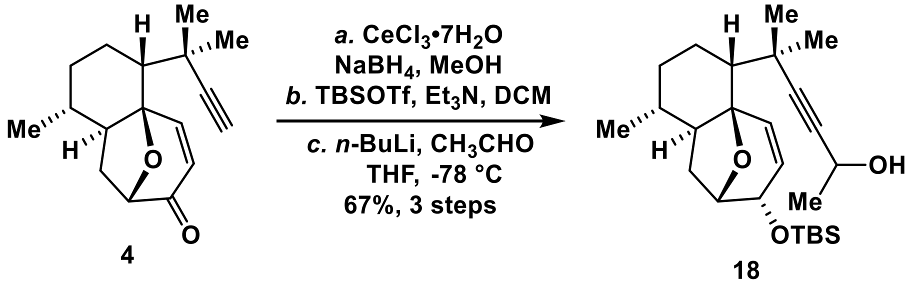
^{1}H NMR (400 MHz, $CDCl_3$) δ 4.48 (d, *J* = 7.8 Hz, 1H), 4.12 (td, *J* = 8.3, 2.4 Hz, 1H), 4.05 – 3.98 (m, 2H), 2.50 (ddd, *J* = 13.8, 8.5, 2.4 Hz, 1H), 2.13 – 2.03 (m, 2H), 1.82 (dd, *J* = 8.3, 5.1 Hz, 1H), 1.63 – 1.48 (m, 2H), 1.36 – 1.23 (m, 3H), 1.17 – 1.05 (m, 1H), 1.04 – 0.95 (m, 2H), 0.93 (s, 3H), 0.88 (s, 12H), 0.67 (s, 3H), 0.59 (dd, *J* = 9.0, 5.5 Hz, 1H), 0.17 (dd, *J* = 5.5, 4.1 Hz, 1H), 0.04 (s, 3H), 0.03 (s, 3H);

^{13}C NMR (100 MHz, $CDCl_3$) δ 87.0, 75.7, 73.1, 65.9, 52.4, 52.3, 49.1, 48.6, 45.8, 40.5, 34.5, 32.3, 28.6, 26.7, 26.0, 23.1, 22.4, 21.5, 19.9, 18.2, 7.8, –4.6, –4.7 ppm;

HRMS (ESI) Calcd for $C_{25}H_{43}O_3Si$ $[M+H]^+$: 419.2976, found 419.2980;

Crystal preparation: Slow evaporation of DCM/hexane (1:2) at 25 °C to yield suitable single crystals for X-ray diffraction.

Synthesis of compound 18



To a stirred solution of compound **4**[1] (258 mg, 1.0 mmol, 1.0 equiv.) in MeOH (5 mL) at 0 °C was added $CeCl_3{\cdot}7H_2O$ (410 mg, 1.1 mmol, 1.1 equiv.) and the reaction was stirred for 0.5 h before $NaBH_4$ (38 mg, 1.0 mmol, 1.0 equiv.) was added. The reaction was stirred for 15 min. It was quenched with a saturated aqueous solution of NH_4Cl (5 mL) and extracted with EtOAc (5 mL × 3). The combined organic layers were washed with brine (3 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated without further purification to afford compound **S1** as a pale-yellow oil.

To a stirred solution of compound **S1** in dry DCM (5 mL) was added Et_3N (277 μL, 2.0 mmol, 2.0 equiv.) and TBSOTf (345 μL, 1.5 mmol, 1.5 equiv.) and the reaction was stirred for 0.5 h at 0 °C. It was quenched with a saturated aqueous solution of NH_4Cl (5 mL) and extracted with DCM (5 mL × 3). The combined organic layers were washed with brine (3 mL) and were then dried over anhydrous Na_2SO_4, filtered, and concentrated. And the residue was purified by flash column chromatography over silica gel (20% EtOAc in hexane) to afford compound **S2** as a yellow oil.

To a stirred solution of compound **S2** in dry THF (3 mL) was added *n*-BuLi (890 μL, 2.5 M in Et_2O, 2.5 mmol, 2.5 equiv.). The reaction was stirred for 1 h at −78 °C before CH_3CHO (1.0 mL, 5.0 M in hexane, 5.0 mmol, 5.0 equiv.) was added. The reaction was stirred for 2 h at 0 °C. The reaction was quenched with a saturated aqueous solution of NH_4Cl (20 mL) and extracted with EtOAc (15 mL × 3). The combined organic layers were washed with brine (10 mL) and were then dried over anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by flash column chromatography over silica gel (10% EtOAc in hexane) to afford compound **18** (280 mg, 67%, 3 steps) as a colorless oil.

TLC: R$_f$ = 0.5 (hexane: EtOAc = 5:1);

$[\alpha]_D^{22}$ = +20.0 (*c* 0.1, CH_2Cl_2);

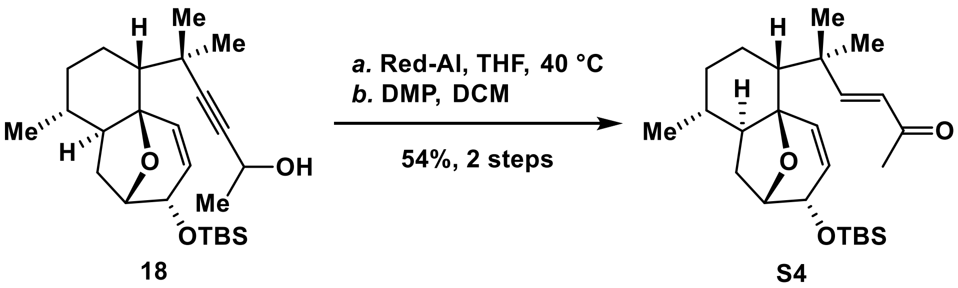
IR (film) λ_{max} 2957, 2926, 2854, 2265, 1716, 1456, 1361, 1259, 1095, 802, 549 cm^{-1};

^{1}H NMR (400 MHz, $CDCl_3$) δ 6.12 (ddd, *J* = 9.9, 8.1, 1.8 Hz, 1H), 5.72 (dd, *J* = 15.2, 7.1 Hz, 1H), 5.37 (ddd, *J* = 15.8, 6.7, 2.6 Hz, 1H), 5.32 – 5.23 (m, 1H), 4.56 (d, *J* = 4.4 Hz, 1H), 4.34 – 4.22 (m, 2H), 2.36 (dd, *J* = 12.6, 8.2 Hz, 1H), 1.73 (tq, *J* = 8.6, 4.3 Hz, 1H), 1.65 – 1.53 (m, 4H), 1.53 – 1.43 (m, 3H), 1.17 – 1.08 (m, 5H), 1.04 (d, *J* = 3.8 Hz, 3H), 0.88 (s, 9H), 0.81 (d, *J* = 6.4 Hz, 3H), 0.07 (s, 3H), 0.05 (s, 3H) ppm;

^{13}C NMR (100 MHz, $CDCl_3$) δ 134.0, 133.6, 130.7, 125.7, 125.6, 84.8, 78.5, 69.6, 68.2, 53.4, 49.5, 38.1, 31.5, 29.8, 28.7, 27.4, 26.0, 23.6, 21.1, 19.6, 18.3, –4.5 (×2) ppm;

HRMS (ESI) Calcd for $C_{25}H_{43}O_3Si$ $[M+H]^+$: 419.2976; Found: 419.2977.

Synthesis of compound S4



To a stirred solution of compound **18** (1.13 g, 2.7 mmol, 1.0 equiv.) in dry THF (50 mL) was added Red-Al (2.7 mL, 3.5 M in THF, 9.4 mmol, 3.5 equiv.) at 0 °C. The reaction was stirred for 18 h at 40 °C. It was quenched slowly with a saturated aqueous solution of NH_4Cl (30 mL) and extracted with EtOAc (20 mL × 3). The combined organic layers were washed with brine (10 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated without further purification to afford compound **S3**.

To a stirred solution of compound **S3** and $NaHCO_3$ (907.0 mg, 10.8 mmol, 4.0 equiv.) in DCM (30 mL) was added DMP (2.27 g, 5.4 mmol, 2.0 equiv.). The reaction was stirred for 0.5 h at room temperature. It was quenched with a saturated aqueous solution of Na_2SO_3 (30 mL) and extracted with DCM (15 mL × 3). The combined organic layers were washed with brine (10 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by flash column chromatography over silica gel (10% EtOAc in hexane) to afford **S4** (613 mg, 54%, 2 steps) as a pale-yellow oil.

TLC: R*f* = 0.5 (hexane: EtOAc = 10:1);

$[\alpha]^{22}_{D}$ = +11.0 (*c* 0.1, CH_2Cl_2);

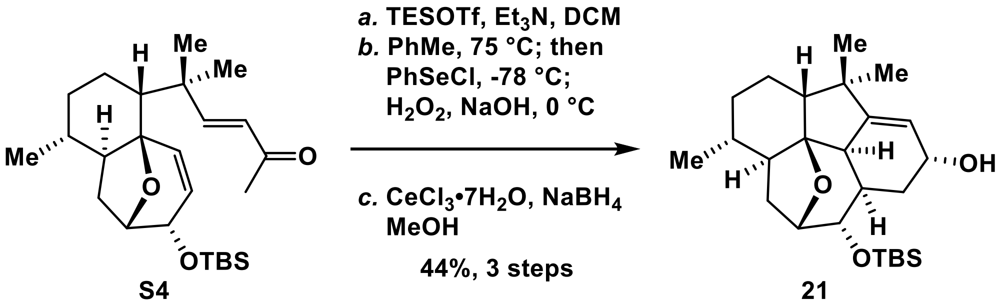
IR (film) λ_{max} 3361, 2953, 2920, 2850, 1683, 1635, 1506, 1257, 966, 879, 835, 775 cm^{-1};

^{1}H NMR (600 MHz, $CDCl_3$) δ 6.97 (d, *J* = 16.3 Hz, 1H), 6.00 (d, *J* = 10.1 Hz, 1H), 5.94 (d, *J* = 16.2 Hz, 1H), 5.29 (d, *J* = 10.0 Hz, 1H), 4.52 (d, *J* = 3.1 Hz, 1H), 4.27 (t, *J* = 6.7 Hz, 1H), 2.35 (dd, *J* = 13.3, 9.0 Hz, 1H), 2.31 – 2.20 (m, 3H), 1.83 – 1.70 (m, 1H), 1.65 (ddd, *J* = 12.3, 9.0, 2.9 Hz, 1H), 1.59 (dd, *J* = 12.6, 8.3 Hz, 2H), 1.52 (ddd, *J* = 12.7, 8.3, 3.0 Hz, 1H), 1.40 (dt, *J* = 12.9, 4.9 Hz, 1H), 1.20 – 1.12 (m, 5H), 1.09 (s, 3H), 0.87 (d, *J* = 1.7 Hz, 9H), 0.81 (d, *J* = 6.4 Hz, 3H), 0.07 (s, 3H), 0.05 (s, 3H) ppm;

^{13}C NMR (150 MHz, $CDCl_3$) δ 199.4, 157.4, 132.7, 127.7, 126.6, 84.5, 78.5, 68.1, 53.3, 49.5, 39.3, 31.3, 29.5, 27.4, 27.0, 26.9, 25.9, 20.9, 19.5, 18.2, –4.6 (×2) ppm;

HRMS (ESI) Calcd for $C_{25}H_{43}O_3Si$ $[M+H]^+$: 419.2976; Found: 419.2974.

Synthesis of compound 21



To a stirred solution of **S4** (1.13 g, 2.7 mmol, 1.0 equiv.) in dry DCM (30 mL) was added Et_3N (1.1 mL, 8.1 mmol, 3.0 equiv.) and TESOTf (1.2 mL, 5.4 mmol, 2.0 equiv.) at 0 °C. The reaction was stirred for 0.5 h at 0 °C. It was quenched with a saturated aqueous solution of $NaHCO_3$ (30 mL) and was extracted with DCM (15 mL × 3). The combined organic layers were washed with brine (10 mL) and were then dried over anhydrous Na_2SO_4, filtered, and concentrated without further purification to afford compound **19** **(**compounds **19** is air-sensitive and prone to hydrolysis; as a result, after obtaining these crude products, we did not proceed with further purification but instead directly advanced to the subsequent step).

The solution of compound **19** in dry toluene (25 mL) was heated overnight at 75 °C. Toluene was removed under vacuum to afford compound **20** **(**compounds **20** is air-sensitive and prone to hydrolysis; as a result, after obtaining these crude products, we did not proceed with further purification but instead directly advanced to the subsequent step). Which was dissolved in dry DCM (10 mL), a solution of PhSeCl (766 mg, 4.0 mmol, 1.5 equiv.) in dry DCM (3 mL) was added dropwise at −78 °C. The reaction was stirred for 0.5 h before 30% solution of hydrogen peroxide (1 mL) was added. The reaction was stirring for another 0.5 h at 0 °C. It was quenched with a saturated aqueous solution of 1.5 M NaOH (20 mL) and extracted with DCM (10 mL × 3). The combined organic layers were washed with brine (10 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated without further purification to afford compound **S5** as a colorless oil.

To a stirred solution of compound **S5** in MeOH (15 mL) was added $CeCl_3{\cdot}7H_2O$ (1.12 g, 3.0 mmol, 1.1 equiv.). The reaction was stirred for 0.5 h before $NaBH_4$ (204 mg, 5.4 mmol, 2.0 equiv.) was added at 0 °C. The reaction was stirred for 15 min. It was quenched with a saturated aqueous solution of NH_4Cl (10 mL). The MeOH was removed under vacuum, and the reaction mixture was extracted with EtOAc (15 mL × 3). The combined organic layers were washed with brine (10 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by flash column chromatography over silica gel (20% EtOAc in hexane) to afford compound **21** (305 mg, 27%, 3 steps) as a yellow oil.

TLC: $R_f = 0.5$ (hexane: EtOAc = 5:1);

$[\alpha]_D^{22} = -14.6$ (*c* 0.15, CH_2Cl_2);

IR (film) λ_{max} 3429, 2953, 2927, 2904, 2856, 1683, 1568, 1456, 1257, 1095, 889, 837, 775 cm^{-1};

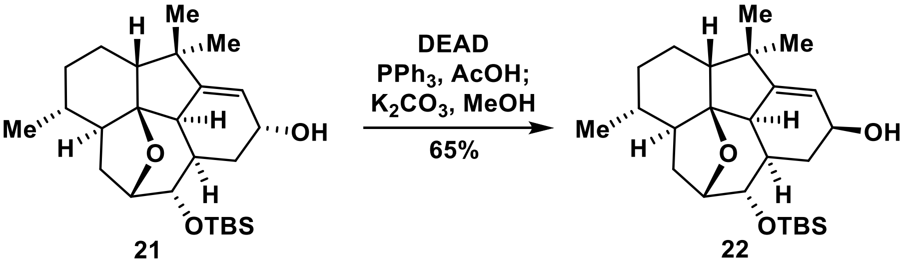
^{1}H NMR (500 MHz, $CDCl_3$) δ 5.43 (t, *J* = 3.1 Hz, 1H), 4.46 – 4.30 (m, 1H), 4.00 (dd,

J = 8.3, 4.7 Hz, 1H), 3.53 (dd, J = 9.1, 4.7 Hz, 1H), 2.43 (dt, J = 6.7, 3.1 Hz, 1H), 2.37 – 2.26 (m, 1H), 2.18 – 2.07 (m, 1H), 2.07 – 1.98 (m, 1H), 1.85 – 1.76 (m, 1H), 1.66 – 1.57 (m, 4H), 1.57 – 1.48 (m, 3H), 1.47 – 1.34 (m, 2H), 1.34 – 1.23 (m, 3H), 1.19 (s, 3H), 1.01 – 0.93 (m, 2H), 0.93 – 0.81 (m, 10H), 0.07 (s, 3H), 0.05 (s, 3H) ppm;

^{13}C NMR (125 MHz, $CDCl_3$) δ 154.5, 118.2, 90.0, 76.8, 69.1, 66.2, 50.9, 45.7, 45.6, 41.9, 35.2, 33.1, 31.3, 30.8, 30.0, 26.8, 25.9, 25.5, 22.2, 19.7, 18.1, –4.0, –4.6 ppm;

HRMS (ESI) Calcd for $C_{25}H_{43}O_3Si$ $[M+H]^+$: 419.2976; Found: 419.2978.

Synthesis of compound 22



To a stirred solution of compound **21** (201 mg, 0.48 mmol, 1.0 equiv.), DEAD (418 mg, 2.4 mmol, 5.0 equiv.) and PPh_3 (630 mg, 2.4 mmol, 5.0 equiv.) in dry toluene (30 mL) was added AcOH (120 µL, 2.1 mmol, 4.4 equiv.). The reaction was stirred for 18 h at 25 °C. The solvent was removed under reduced pressure to afford **S6**.

To a stirred solution of **S6** in MeOH (15 mL) was added K_2CO_3 (99.4 mg, 1.2 mmol, 2.5 equiv.). The reaction was stirred for 3 h at 25 °C. It was quenched with a saturated aqueous solution of NH_4Cl (10 mL). The MeOH was removed under vacuum, and the reaction mixture was extracted with EtOAc (5 mL × 3). The combined organic layers were washed with brine (10 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by flash column chromatography over silica gel (20% EtOAc in hexane) to afford compound **22** (130 mg, 65%, 2 steps) as a white solid.

TLC: R_f = 0.7 (hexane: EtOAc = 5:1);

$[\alpha]_D^{22}$ = –4.9 (c 0.1, CH_2Cl_2);

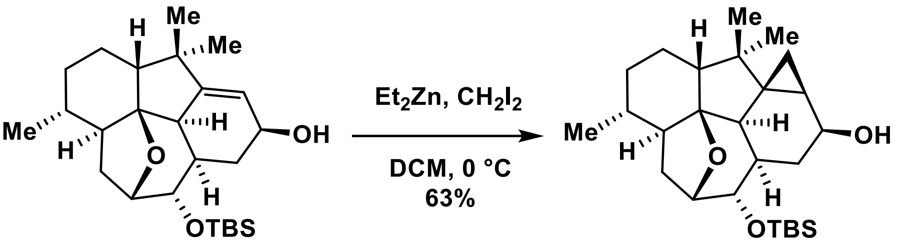
IR (film) λ_{max} 3360, 2953, 2926, 2854, 1635, 1558, 1506, 1456, 1259, 1095, 889, 837, 775 cm^{-1};

^{1}H NMR (600 MHz, $CDCl_3$) δ 5.55 (s, 1H), 4.31 (s, 1H), 4.19 (dd, J = 9.1, 4.7 Hz, 1H), 4.03 (dd, J = 7.9, 5.1 Hz, 1H), 2.42 (d, J = 8.2 Hz, 1H), 2.18 – 2.11 (m, 2H), 1.90 –1.83 (m, 1H), 1.83 – 1.77 (m, 2H), 1.59 (s, 3H), 1.49 – 1.47 (m, 1H), 1.28 – 1.26 (m, 1H), 1.22 (s, 3H), 0.94 (s, 3H), 1.89 – 1.83 (m, 15H), 0.11 (s, 3H), 0.04 (s, 3H) ppm;

^{13}C NMR (150 MHz, $CDCl_3$) δ 155.5, 116.4, 90.3, 77.7, 69.5, 65.2, 50.7, 46.3, 45.9, 42.3, 32.0, 31.4, 30.9, 30.3, 30.2, 26.7, 26.0, 25.7, 22.2, 19.7, 18.1, –4.2 ppm;

HRMS (ESI) Calcd for $C_{25}H_{43}O_3Si$ $[M+H]^+$: 419.2976, found 419.2971.

Synthesis of compounds 23



22 23

To a stirred solution of CH_2I_2 (48 µL, 0.6 mmol, 5.0 equiv.) in dry DCM (2 mL) was added Et_2Zn (580 µL, 1.0 M in Et_2O, 0.58 mmol, 4.8 equiv.) at 0 °C. The reaction was stirred for 1 h at 0 °C before the solution of compound **22** (50 mg, 0.12 mmol, 1.0 equiv.) in dry DCM (3 mL). The reaction was stirred for 1 h. It was quenched with a saturated aqueous solution of NH_4Cl (5 mL) and extracted with EtOAc (5 mL × 3). The combined organic layers were washed with brine (5 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by flash column chromatography over silica gel (10% EtOAc in hexane) to afford compound **23** (33 mg, 63%) as a pale-yellow oil.

TLC: R_f = 0.4 (hexane: EtOAc = 8:1);

$[\alpha]_D^{23}$ = −5.0 (c 0.11, CH_2Cl_2);

IR (film) λ_{max} 2953, 2929, 2904, 2856, 2683, 1558, 1456, 1254, 1096, 1026, 881, 835, 775, 671 cm^{-1};

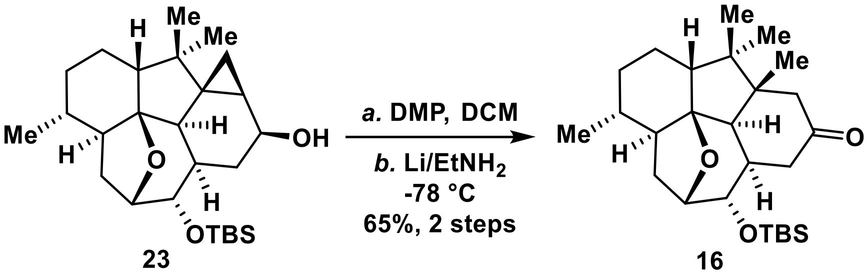
^{1}H NMR (600 MHz, $CDCl_3$) δ 4.28 (dt, J = 10.1, 4.9 Hz, 1H), 4.11 – 4.05 (m, 1H), 3.68 (dd, J = 7.9, 5.5 Hz, 1H), 2.15 (dd, J = 14.8, 8.6 Hz, 2H), 1.86 – 1.63 (m, 5H), 1.51 – 1.38 (m, 3H), 1.34 (dt, J = 9.5, 5.1 Hz, 2H), 1.29 – 1.11 (m, 2H), 1.05 (m, 1H), 0.98 (s, 3H), 0.94 – 0.81 (m, 11H), 0.72 (s, 3H), 0.46 (dd, J = 9.1, 4.9 Hz, 1H), 0.31 (t, J =

5.2 Hz, 1H), 0.08 (s, 6H) ppm;

^{13}C NMR (150 MHz, $CDCl_3$) δ 90.5, 76.1, 70.4, 64.9, 52.3, 49.3, 47.1, 41.4, 35.9, 33.8, 32.0, 31.7, 29.4, 29.2, 26.7, 25.9, 24.6, 23.5, 22.4, 19.6, 18.1, 10.0, –4.1, –4.5 ppm;

HRMS (ESI) Calcd for $C_{26}H_{45}O_3Si$ $[M+H]^+$: 433.3132, found 433.3135.

Synthesis of compound 16



To a stirred solution of compound **23** (30 mg, 0.069 mmol, 1.0 equiv.) and in DCM (3 mL) was added DMP (57 mg, 0.139 mmol, 2.0 equiv.) at 0 °C. The reaction was stirred for 1 h at room temperature. It was quenched with a saturated aqueous solution of Na_2SO_3 (5 mL) and was extracted with DCM (5 mL × 3). The combined organic layers were washed with brine (5 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by flash column chromatography over silica gel (10% EtOAc in hexane) to afford compound **S7** as a pale yellow solid.

Compound **S7** (30 mg, 0.069 mmol) was dissolved in freshly prepared pure ethylamine (3 mL) under −78 °C. A lithium block (50.0 mg, 7.1 mmol, 102 equiv.) was added to the stirred solution at −78 °C. The reaction mixture turned into a dark blue solution when the reactant consumed completely. The 2-methyl-1,3-butadiene (1 mL) was added to the reaction mixture to quench the reaction process. The reaction was neutralized with a saturated aqueous solution of NH_4Cl (20 mL) and the reaction mixture was extracted with EtOAc (5 mL × 3). The combined organic layers were washed with brine (5 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by flash column chromatography over silica gel (5% EtOAc in hexane) to afford compound **16** (20 mg, 65%, 2 steps) as a white solid.

TLC: R_f = 0.7 (hexane: EtOAc = 5:1);

$[\alpha]_D^{23}$ = –4.0 (*c* 0.1, CH_2Cl_2);

IR (film) λmax 2954, 2929, 2906, 2856, 1683, 1647, 1558, 1456, 1259, 1099, 1022, 877, 837, 804, 775 cm^{-1};

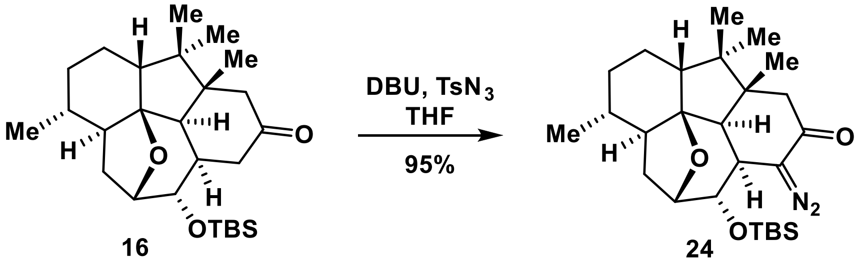
^{1}H NMR (500 MHz, $CDCl_3$) δ 4.06 – 3.97 (m, 1H), 3.70 (dd, *J* = 9.5, 4.3 Hz, 1H), 2.61 – 2.54 (m, 1H), 2.42 – 2.36 (m, 1H), 2.31 (qd, *J* = 9.6, 4.4 Hz, 1H), 2.22 (dd, *J* = 14.3, 9.3 Hz, 1H), 2.12 (d, *J* = 3.5 Hz, 2H), 2.08 (t, *J* = 7.6 Hz, 1H), 1.95 (d, *J* = 9.5 Hz, 1H), 1.65 – 1.56 (m, 3H), 1.42 – 1.33 (m, 2H), 1.20 (ddt, *J* = 10.9, 8.1, 6.2 Hz, 1H), 1.06 – 1.03 (m, 4H), 0.91 (d, *J* = 6.6 Hz, 6H), 0.86 (s, 9H), 0.80 (s, 3H), 0.07 (s, 3H), 0.04 (s, 3H) ppm;

^{13}C NMR (125 MHz, $CDCl_3$) δ 212.9, 87.6, 75.8, 75.6, 74.3, 51.2, 50.7, 49.6, 49.5, 45.9, 45.2, 40.3, 33.7, 32.5, 31.5, 28.9, 25.7, 23.8, 21.3, 21.2, 20.6, 17.9, −4.2, −4.6 ppm;

HRMS (ESI) Calcd for $C_{26}H_{45}O_3Si$ $[M+H]^+$: 433.3132, found 433.3130.

Crystal preparation: Slow evaporation of EA/hexane (1:2) at 25 °C to yield suitable single crystals for X-ray diffraction.

Synthesis of compound 24



To a stirred solution of compound **16** (20 mg, 0.046 mmol, 1.0 equiv.) was added TsN_3 (224 mg, 0.92 mmol, 20.0 equiv.) in THF (3 mL) and DBU (206 μL, 1.38 mmol, 30.0 equiv.). The reaction was stirred for 12 h at room temperature. The reaction was quenched with water (3 mL) and extracted with EtOAc (3 mL × 3). The combined organic layers were washed with brine (3 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by flash column chromatography over silica gel (5% EtOAc in hexane) to afford compound **24** (20 mg, 95%) as a brown oil.

TLC: R$_f$ = 0.5 (hexane: EtOAc = 5:1);

$[\alpha]_D^{23}$ = +13.0 (*c* 0.1, CH_2Cl_2);

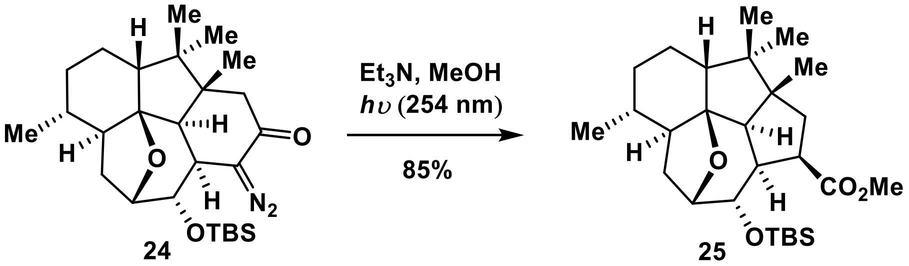
IR (film) λmax 2960, 2926, 2856, 1699, 1662, 1558, 1456, 1261, 1022, 798 cm^{-1};

^{1}H NMR (500 MHz, $CDCl_3$) δ 4.11 (dd, *J* = 7.5, 3.9 Hz, 1H), 4.04 (dd, *J* = 9.0, 4.2 Hz, 1H), 3.19 (t, *J* = 8.9 Hz, 1H), 2.29 (ddd, *J* = 13.6, 8.5, 1.6 Hz, 1H), 2.16 (s, 2H), 2.04 (t, *J* = 7.8 Hz, 1H), 1.89 (d, *J* = 8.8 Hz, 1H), 1.69 – 1.60 (m, 2H), 1.43 (ddd, *J* = 11.1, 6.4, 2.7 Hz, 2H), 1.39 – 1.32 (m, 2H), 1.33 – 1.29 (m, 1H), 1.14 (s, 3H), 0.95 – 0.91 (m, 6H), 0.87 (s, 9H), 0.79 (s, 3H), 0.09 (s, 3H), 0.09 (s, 3H) ppm;

^{13}C NMR (125 MHz, $CDCl_3$) δ 195.8, 88.2, 75.4, 73.1, 49.6, 49.5, 49.4, 48.0, 46.0, 44.1, 34.1, 33.5, 31.4, 29.9, 29.1, 26.0, 24.3, 21.3, 20.8, 18.1, −3.6, −4.9 ppm;

HRMS (ESI) Calcd for $C_{26}H_{43}N_2O_3Si$ $[M+H]^+$: 459.3037, found 459.3041.

Synthesis of compound 25



To a stirred solution of compound **24** (10 mg, 0.022 mmol, 1.0 equiv.) in dry MeOH (10 mL) was added Et_3N (6 μL, 0.044 mmol, 2.0 equiv.). The reaction was exposed to UV light (254 nm) and stirred for 4 h at 0 °C. It was quenched with a saturated aqueous solution of NH_4Cl (1 mL). Menthol was removed under vacuum and the reaction mixture was extracted with EtOAc (3 mL × 3) and water (5 mL). The combined organic layers were washed with brine (3 mL) and then dried over anhydrous Na_2SO_4, filtered, and concentrated. The residue was purified by flash column chromatography over silica gel (5% EtOAc in hexane) to afford compound **25** (8 mg, 85%) as a colorless oil.

TLC: R_f = 0.8 (hexane: EtOAc = 5:1);

$[\alpha]_D^{23}$ = −12.0 (*c* 0.1, CH_2Cl_2);

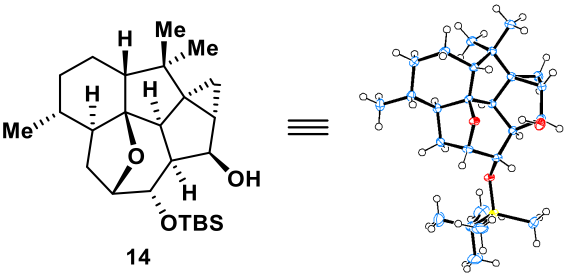
IR (film) λmax 2960, 2926, 2912, 1789, 1683, 1653, 1558, 1456, 1269, 1192, 1049, 1016, 798 cm^{-1};

^{1}H NMR (500 MHz, $CDCl_3$) δ 3.99 (ddd, *J* = 8.4, 4.5, 2.1 Hz, 1H), 3.87 (dd, *J* = 7.5, 4.4 Hz, 1H), 3.65 (s, 3H), 3.27 (ddd, *J* = 9.6, 7.4, 4.7 Hz, 1H), 2.33 (d, *J* = 10.6 Hz, 1H), 2.21 – 2.03 (m, 4H), 1.69 – 1.64 (m, 1H), 1.55 – 1.52 (m, 2H), 1.51 – 1.46 (m, 1H), 1.43 – 1.39 (m, 1H), 1.34 – 1.31 (m, 2H), 1.30 – 1.28 (m, 1H), 1.13 (s, 3H), 1.02 (s, 3H), 0.88 (d, *J* = 6.4 Hz, 3H), 0.86 (s, 3H), 0.85 (s, 9H), 0.04 (s, 3H), 0.03 (s, 3H) ppm; **^{13}C NMR** (125 MHz, $CDCl_3$) δ 177.2, 84.7, 77.3, 74.5, 59.8, 57.3, 54.7, 54.0, 51.8, 46.0, 43.3, 39.6, 38.9, 30.4, 30.0, 28.1, 26.0, 25.8, 23.7, 21.3, 20.5, 18.0, –4.3, –4.8 ppm;

HRMS (ESI) Calcd for $C_{27}H_{47}O_4Si$ $[M+H]^+$: 463.3238, found 463.3238.

III. X-ray Crystallographic Data

X-ray data for compound 14

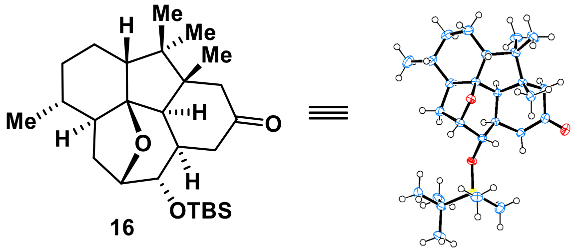


14

Table S1. Crystal data and structure refinement for compound 14

CCDC number	2422356
Empirical formula	$C_{25}H_{42}O_3Si$
Formula weight	418.67
Temperature/K	100.0
Crystal system	orthorhombic
Space group	$P2_12_12_1$
a/Å	9.6772(4)
b/Å	10.2693(4)
c/Å	24.1618(9)
α/°	90
β/°	90
γ/°	90
Volume/Å^3	2401.15(16)
Z	4
ρ_{calc}g/cm^3	1.158
μ/mm^{-1}	1.026
F(000)	920.0
Crystal size/mm^3	0.41 × 0.36 × 0.29
Radiation	CuKα (λ = 1.54178)
2Θ range for data collection/°	7.318 to 136.848
Index ranges	$-11 \leq h \leq 11$, $-11 \leq k \leq 12$, $-28 \leq l \leq 29$
Reflections collected	19049
Independent reflections	4411 [R_{int} = 0.0347, R_{sigma} = 0.0256]
Data/restraints/parameters	4411/0/272
Goodness-of-fit on F^2	1.046
Final R indexes [I>=2σ (I)]	R_1 = 0.0287, wR_2 = 0.0721
Final R indexes [all data]	R_1 = 0.0296, wR_2 = 0.0728
Largest diff. peak/hole / e Å^{-3}	0.28/-0.16
Flack parameter	0.064(11)

X-ray data for compound 16

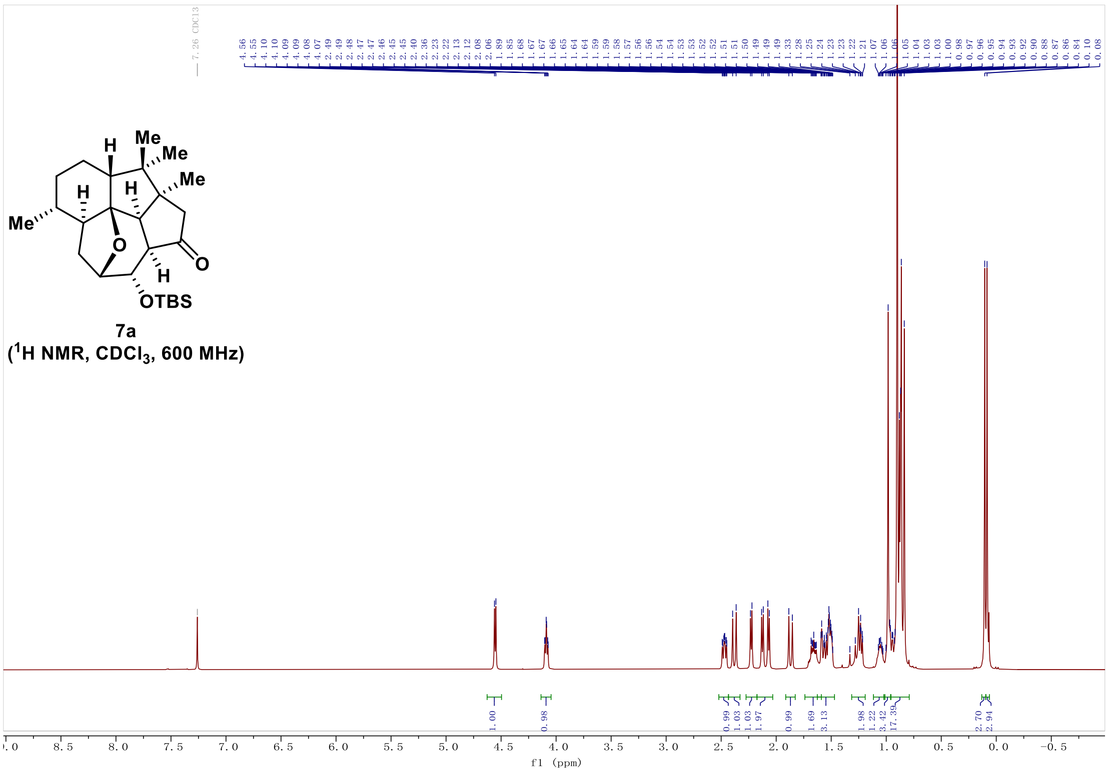


16

Table S6. Crystal data and structure refinement for compound 16

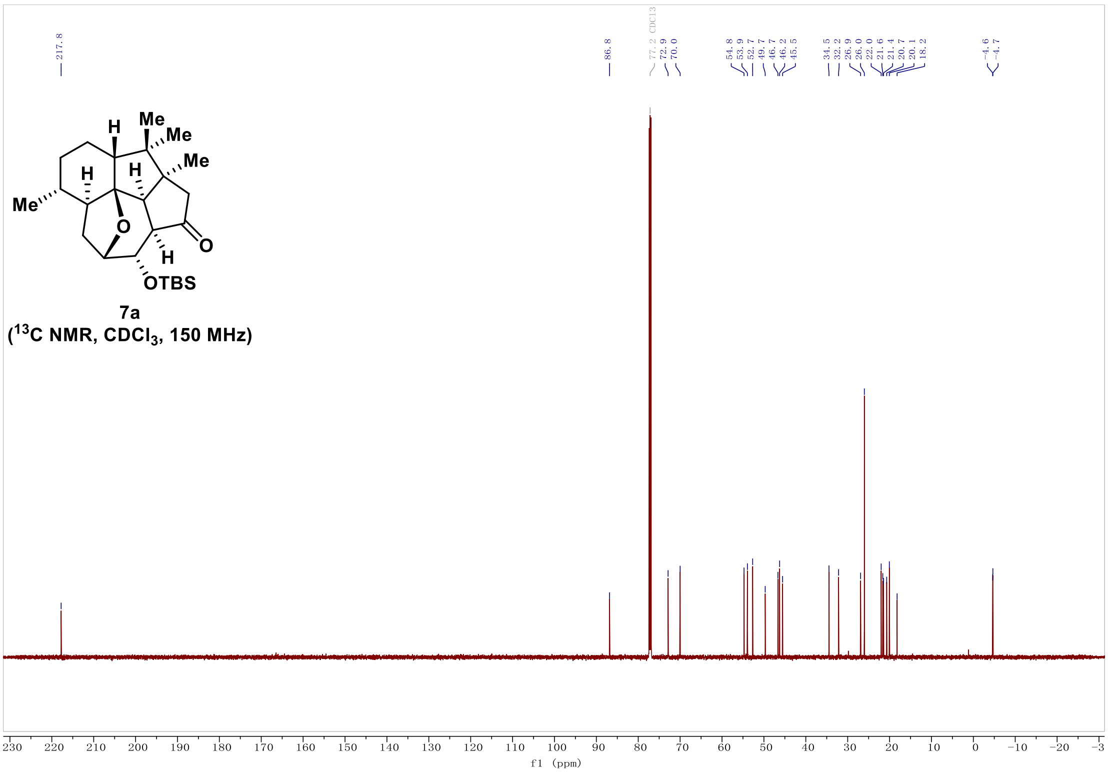
CCDC number	2422357
Empirical formula	$C_{26}H_{44}O_3Si$
Formula weight	432.70
Temperature/K	100.0(2)
Crystal system	triclinic
Space group	P1
a/Å	11.0269(10)
b/Å	11.0409(10)
c/Å	12.3804(11)
α/°	75.509(3)
β/°	65.961(3)
γ/°	67.425(3)
Volume/Å^3	1263.2(2)
Z	2
ρ_{calc}g/cm^3	1.138
μ/mm^{-1}	0.640
F(000)	476.0
Crystal size/mm^3	0.26 × 0.18 × 0.12
Radiation	GaKα (λ = 1.34139)
2Θ range for data collection/°	6.844 to 114.164
Index ranges	$-13 \le h \le 13$, $-13 \le k \le 13$, $-15 \le l \le 15$
Reflections collected	50323
Independent reflections	10149 [R_{int} = 0.0500, R_{sigma} = 0.0336]
Data/restraints/parameters	10149/3/559
Goodness-of-fit on F^2	1.024
Final R indexes [I>=2σ (I)]	R_1 = 0.0390, wR_2 = 0.1014
Final R indexes [all data]	R_1 = 0.0399, wR_2 = 0.1021
Largest diff. peak/hole / e Å^{-3}	0.40/-0.28
Flack parameter	0.011(18)

IV. ^{1}H, ^{13}C NMR and 2D-NMR Spectra



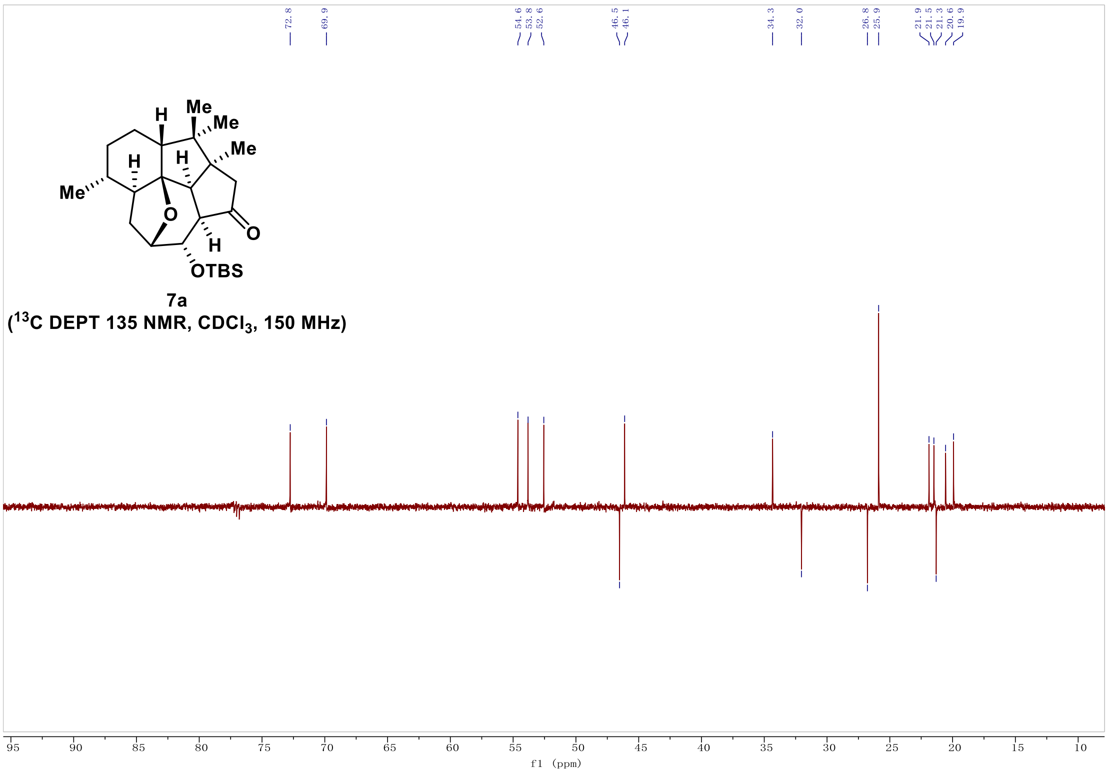
7a

(^{1}H NMR, CDCl$_3$, 600 MHz)

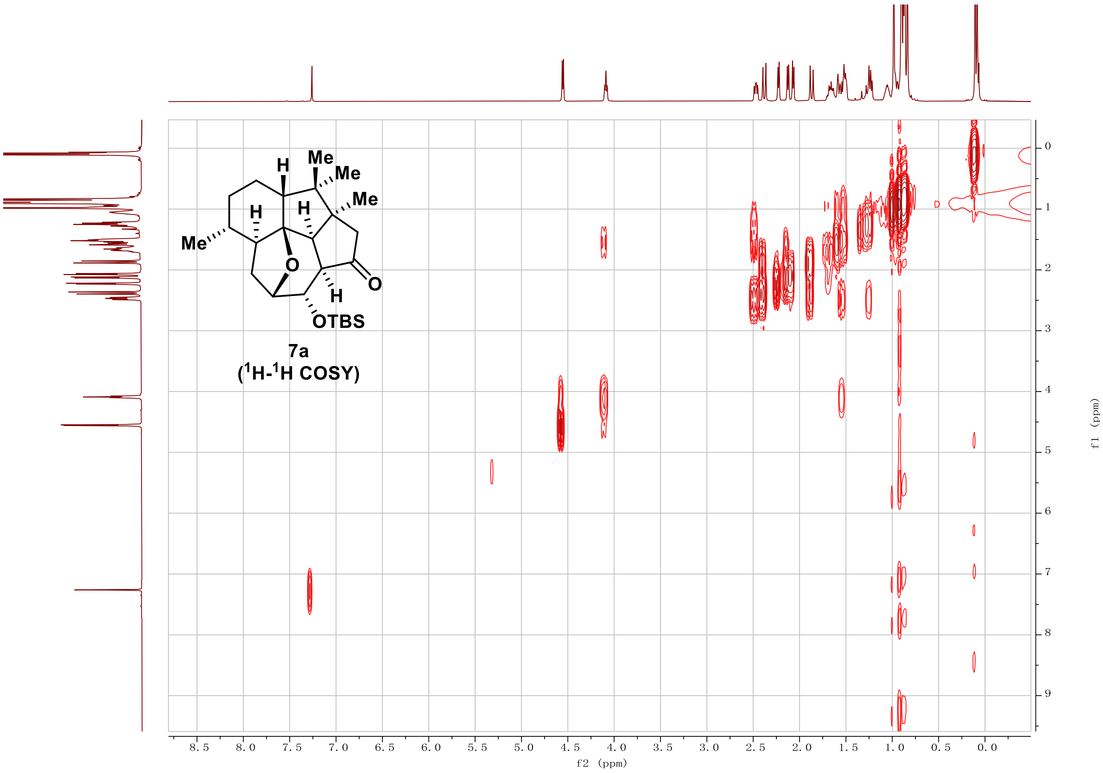


7a

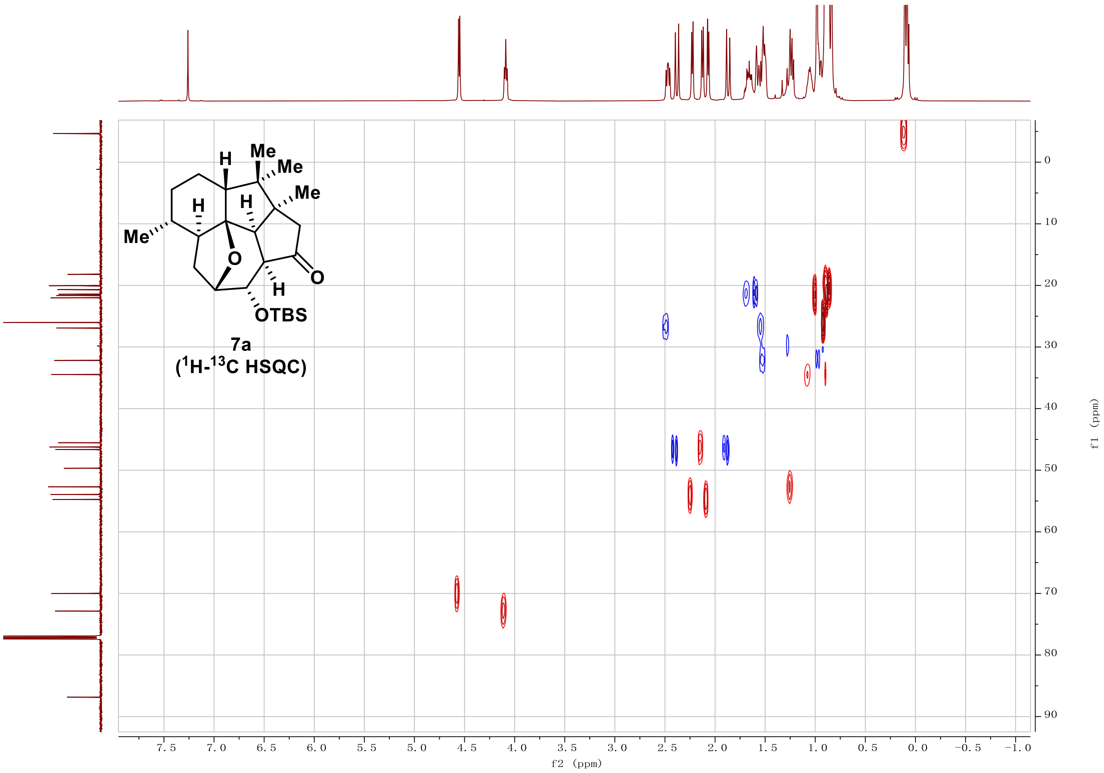
(^{13}C NMR, CDCl$_3$, 150 MHz)



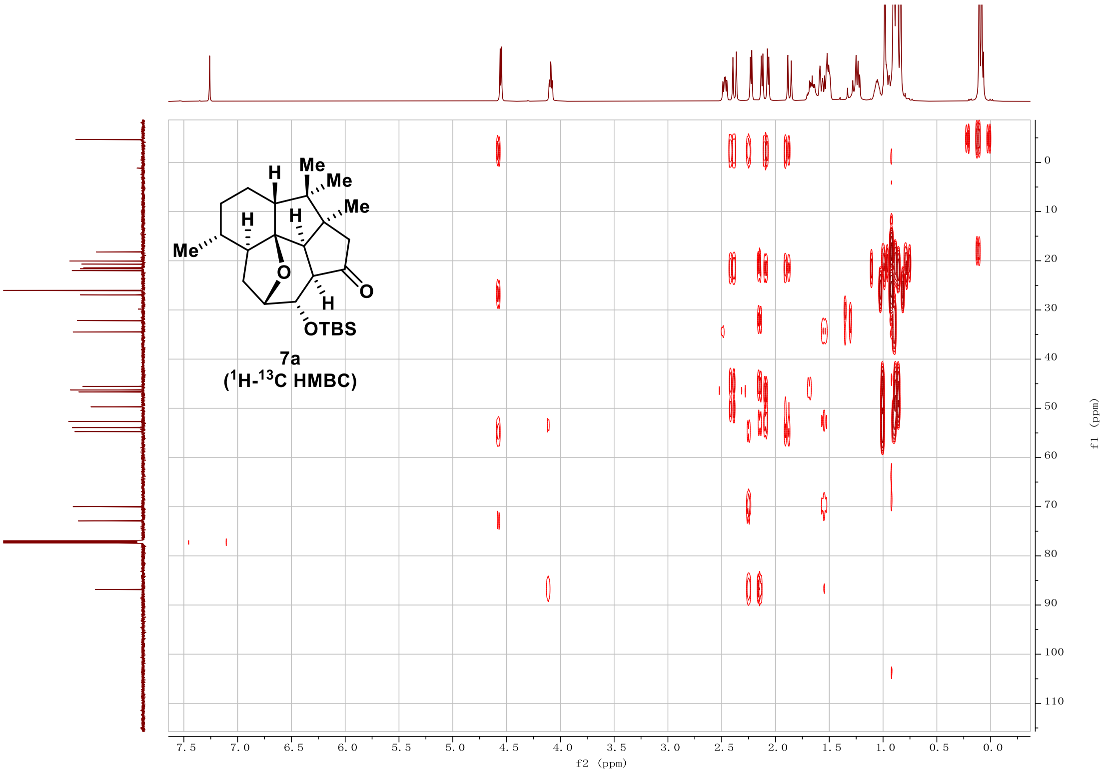
7a
(^{13}C DEPT 135 NMR, CDCl$_3$, 150 MHz)



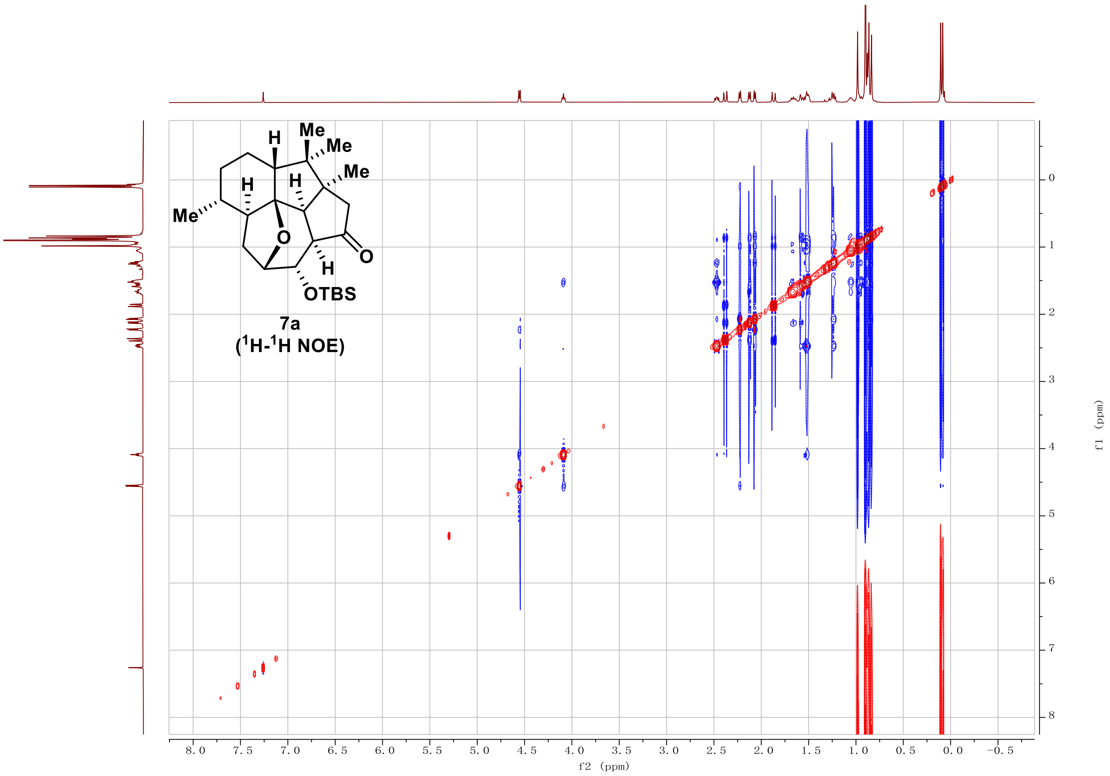
7a
(^{1}H-^{1}H COSY)



7a
(^{1}H-^{13}C HSQC)

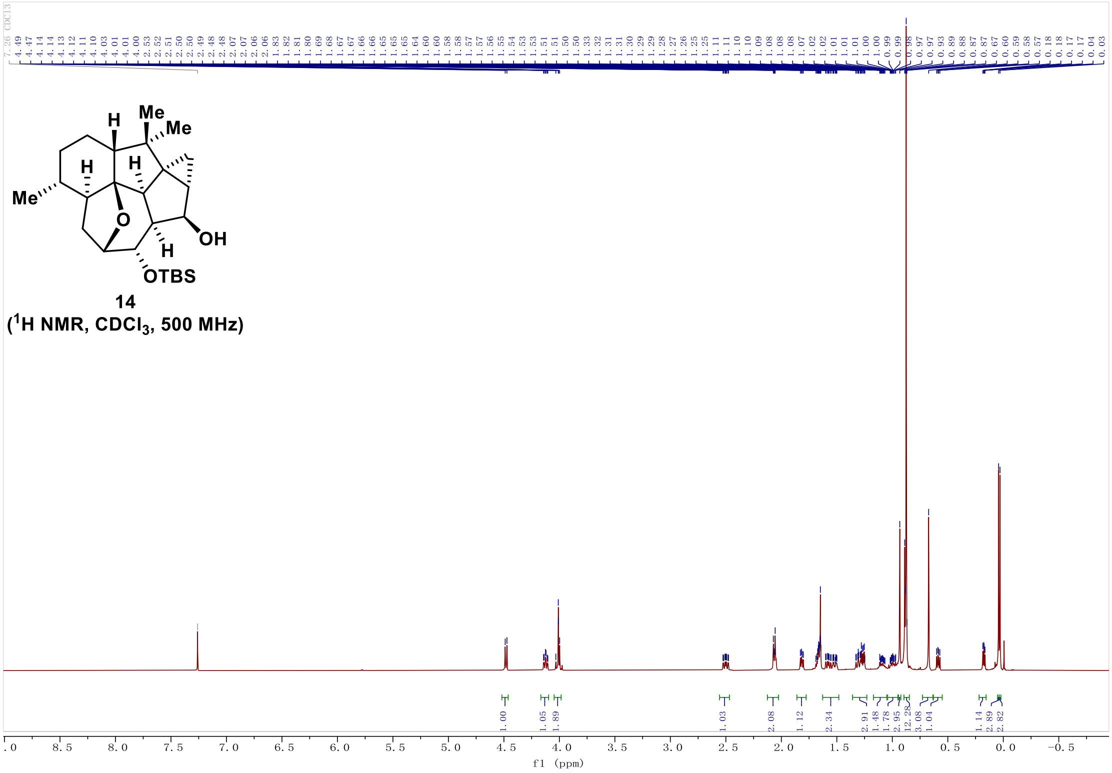


7a
(^{1}H-^{13}C HMBC)

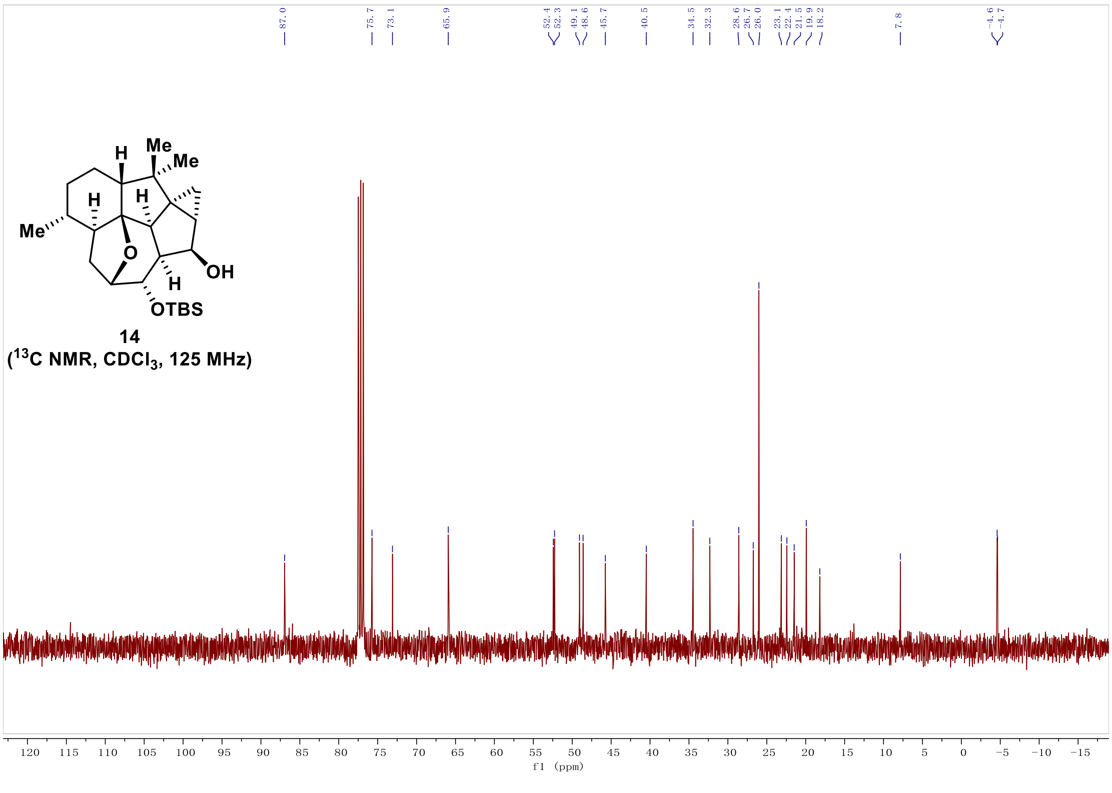


7a
(^{1}H-^{1}H NOE)

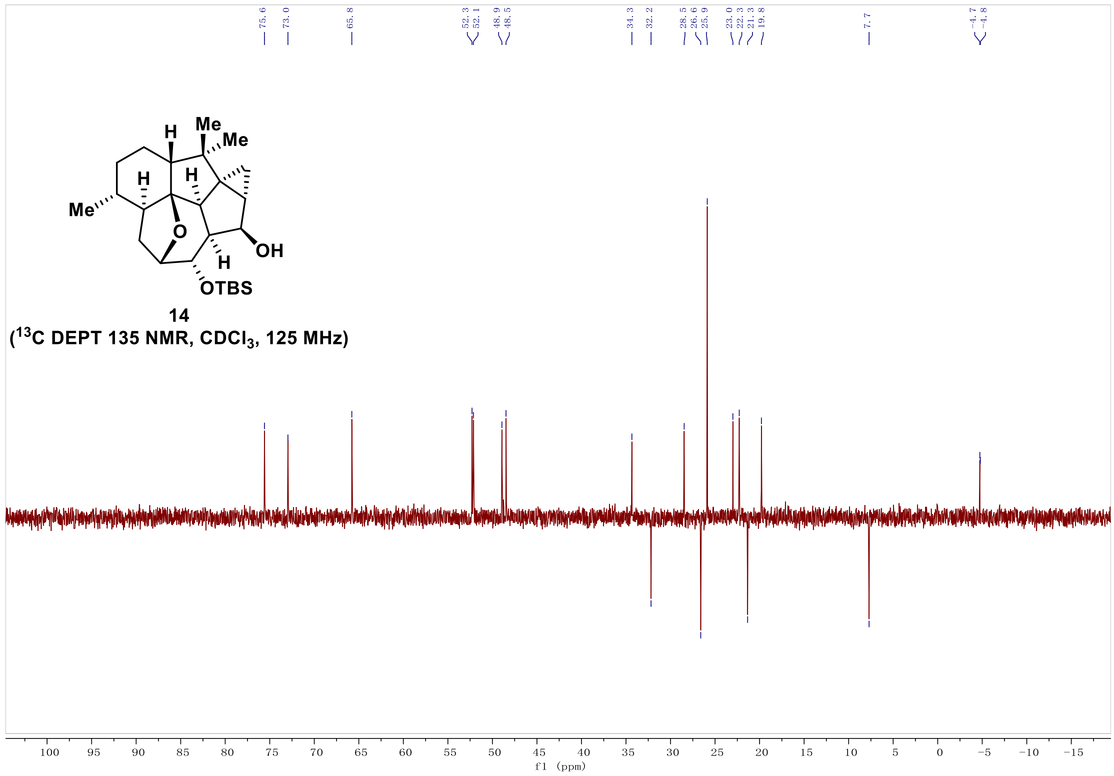
H
Me
Me
Me
H
H
Me
O
O
H
OTBS
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f2 (ppm)
0
1
2
3
4
5
6
7
8
f1 (ppm)

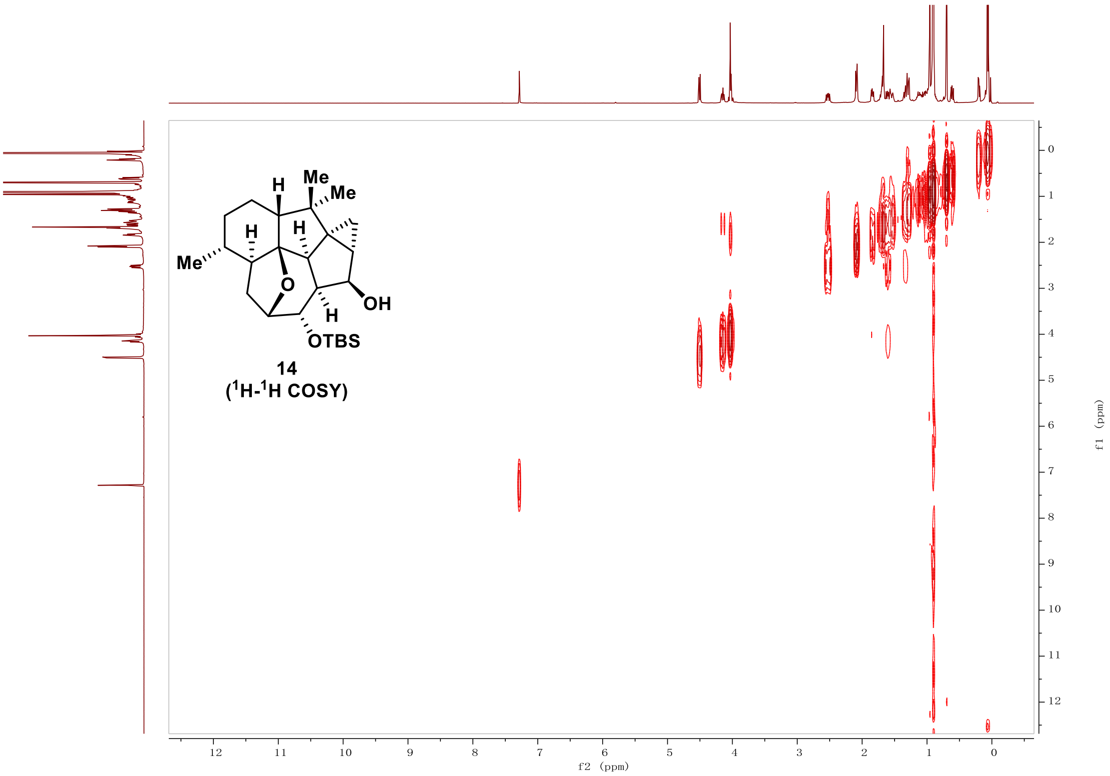


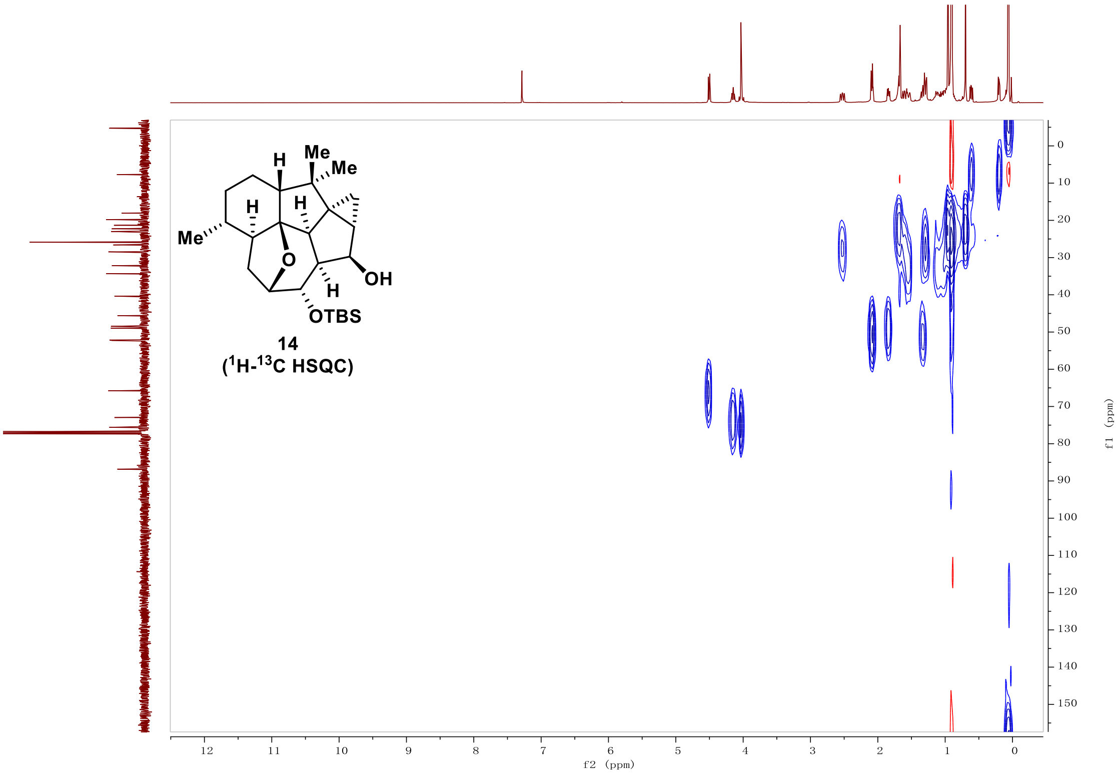
14
(^{1}H NMR, CDCl$_3$, 500 MHz)



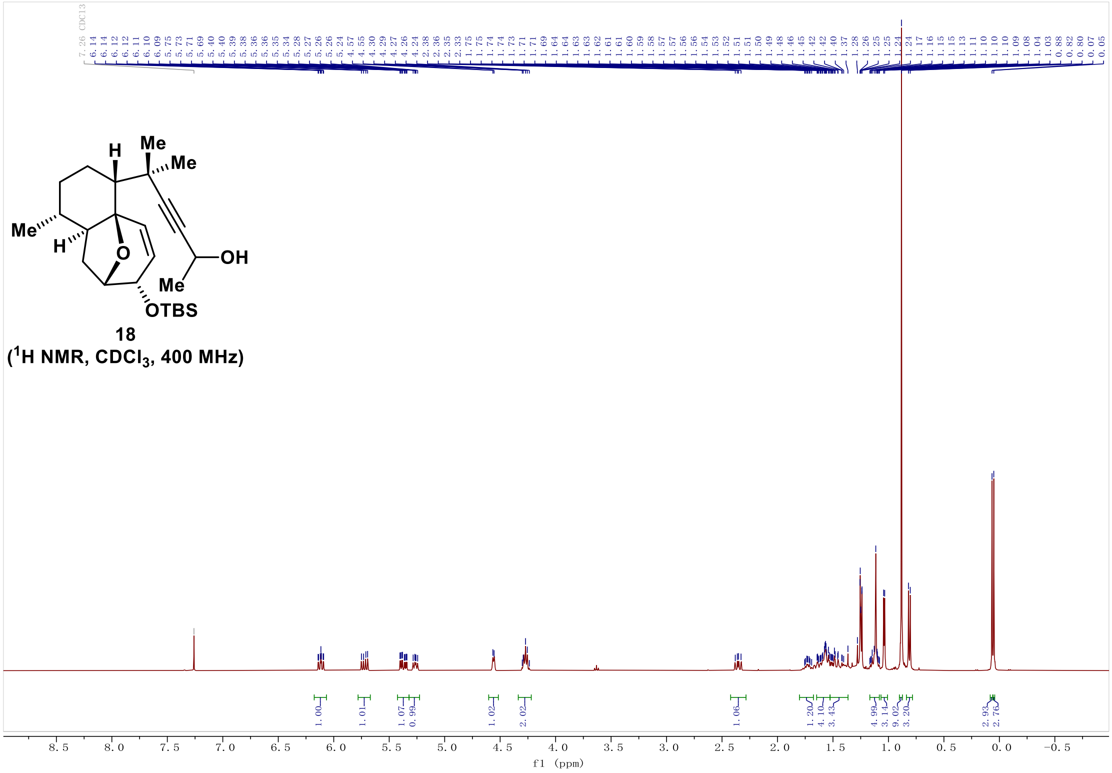
14
(^{13}C NMR, CDCl$_3$, 125 MHz)


14
(^{13}C DEPT 135 NMR, CDCl$_3$, 125 MHz)


14
(^{1}H-^{1}H COSY)

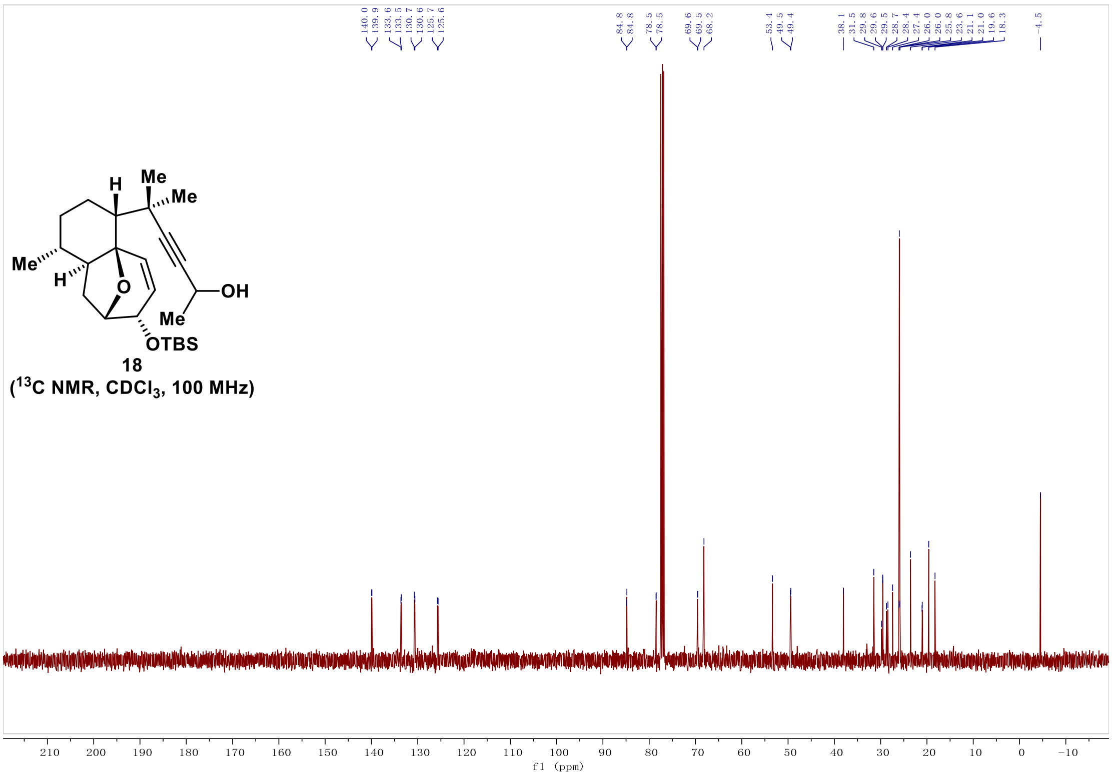


14
(^{1}H-^{13}C HSQC)



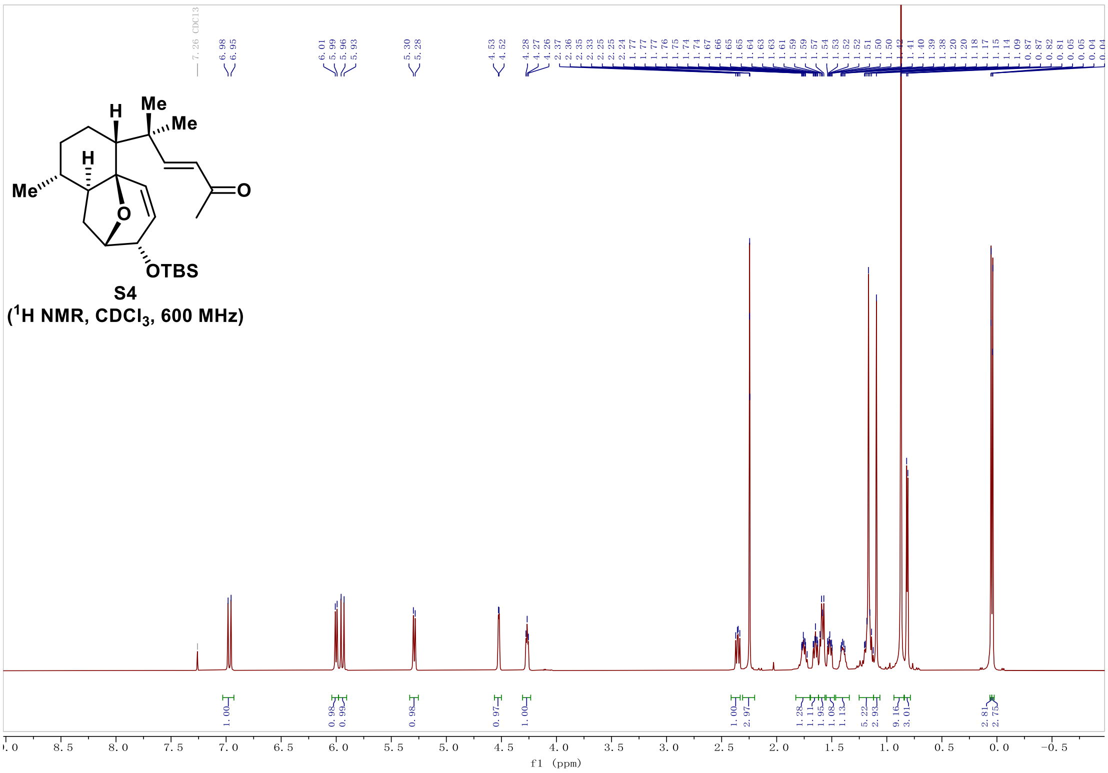
18

(^{1}H NMR, CDCl$_3$, 400 MHz)

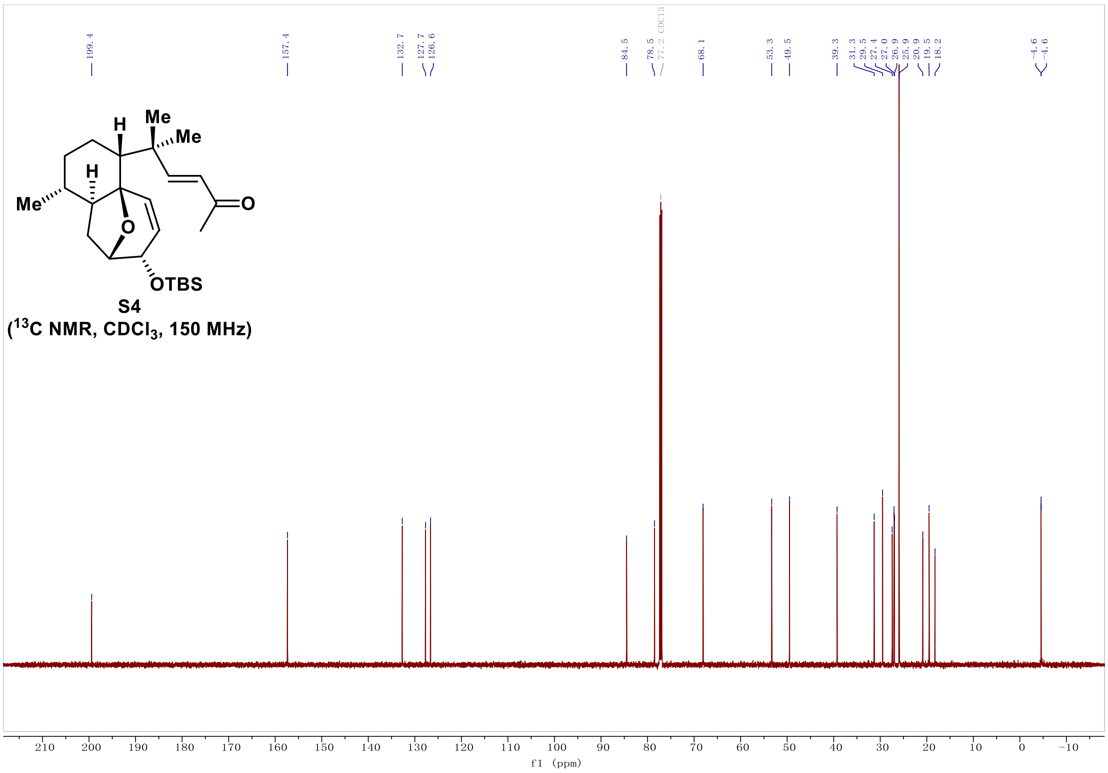


18

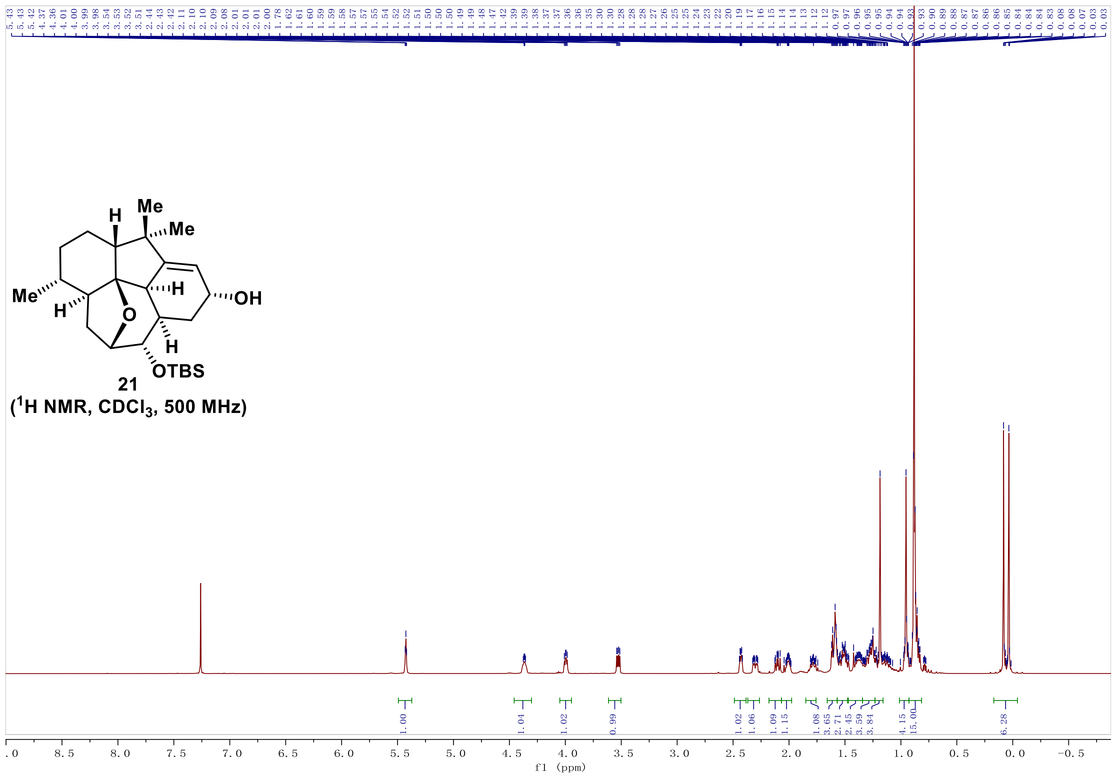
(^{13}C NMR, CDCl$_3$, 100 MHz)



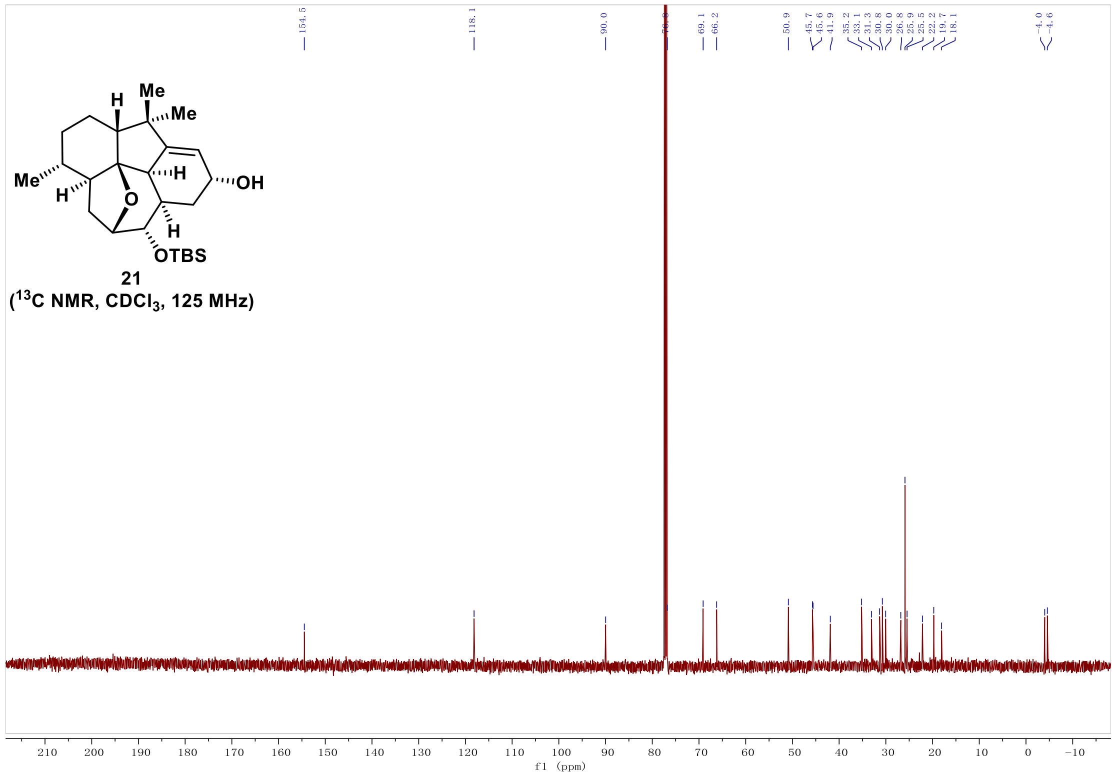
S4
(^{1}H NMR, CDCl$_3$, 600 MHz)



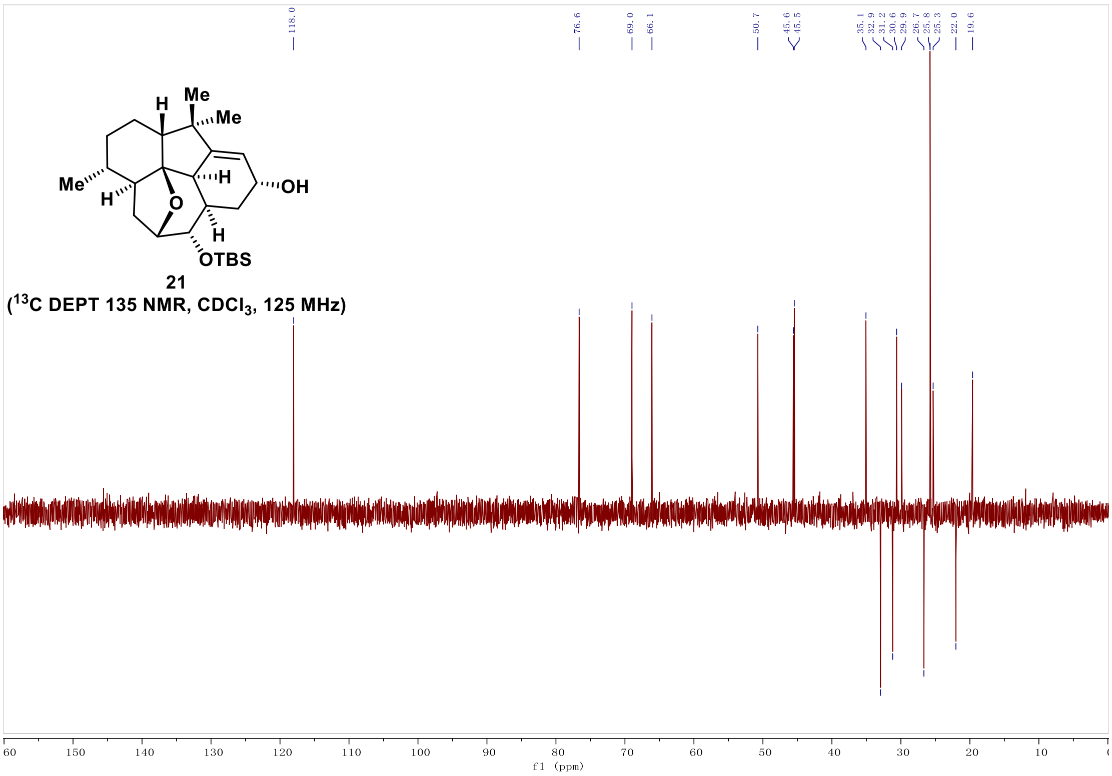
S4
(^{13}C NMR, CDCl$_3$, 150 MHz)



21
(^{1}H NMR, CDCl$_3$, 500 MHz)

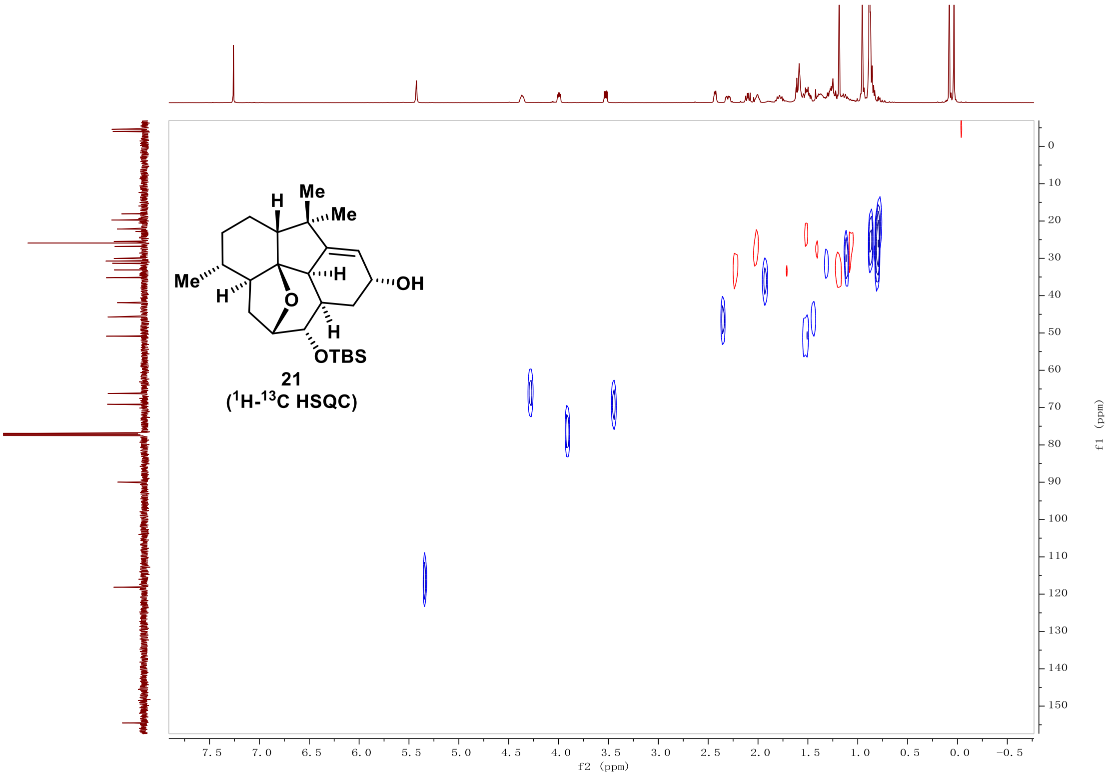


21
(^{13}C NMR, CDCl$_3$, 125 MHz)



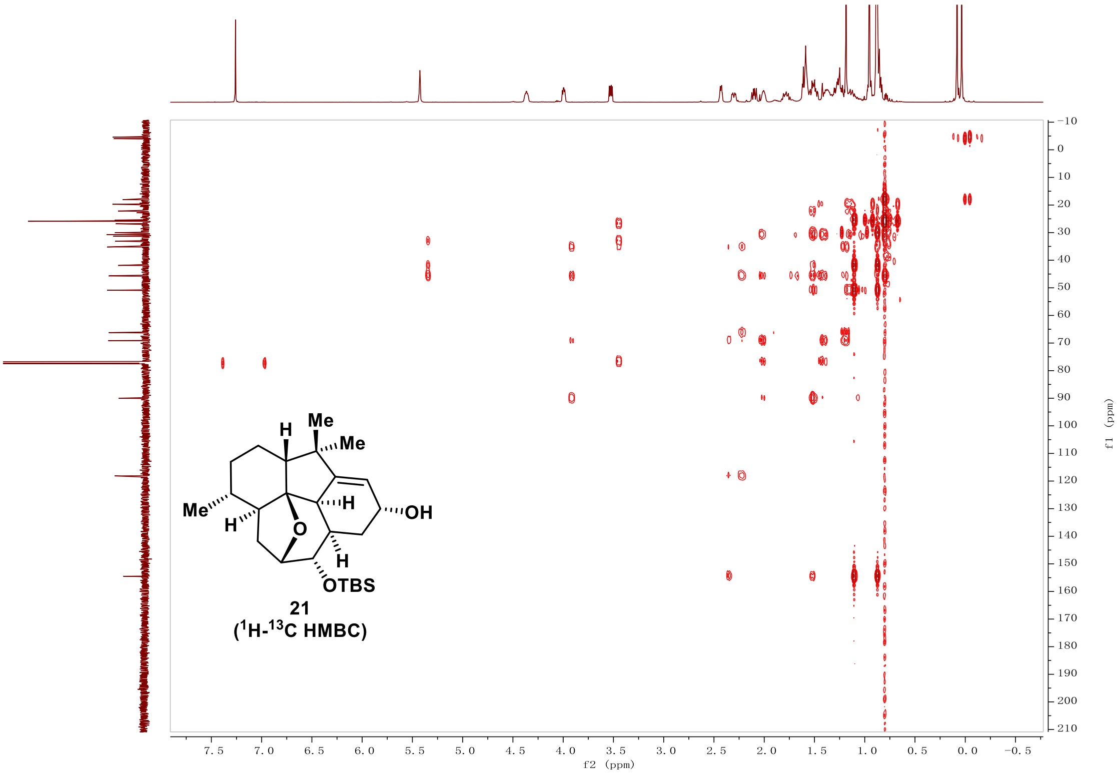
21

(^{13}C DEPT 135 NMR, CDCl$_3$, 125 MHz)

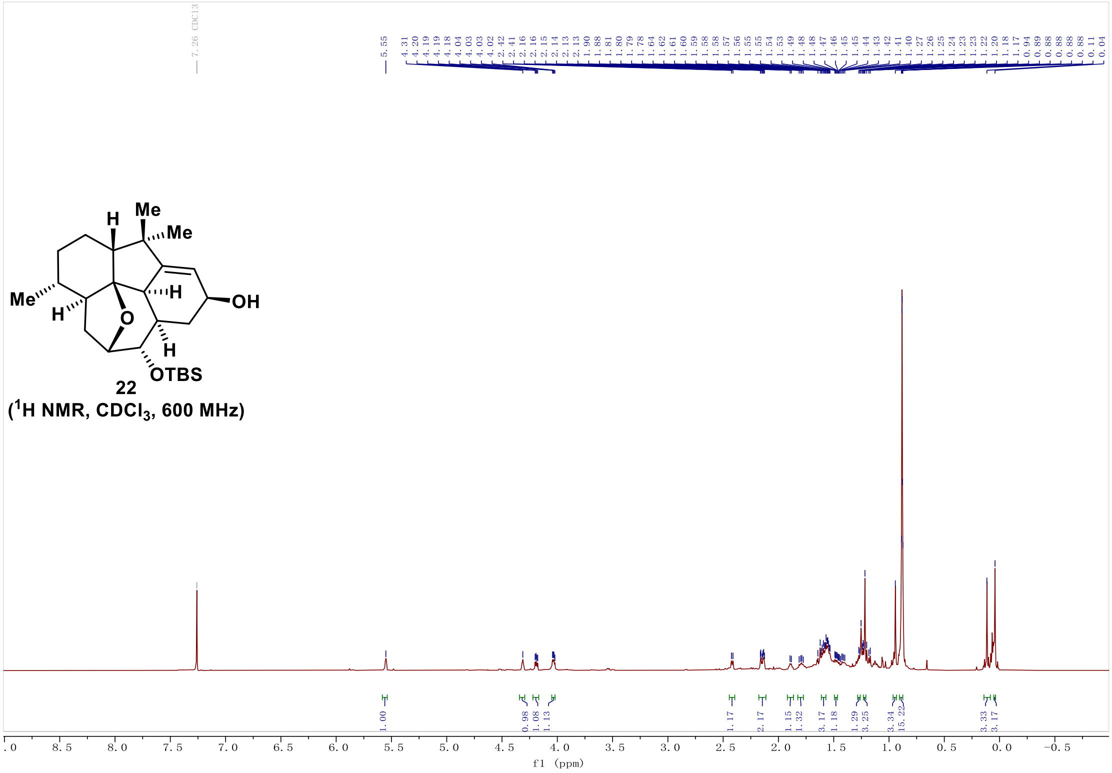


21

(^{1}H-^{13}C HSQC)

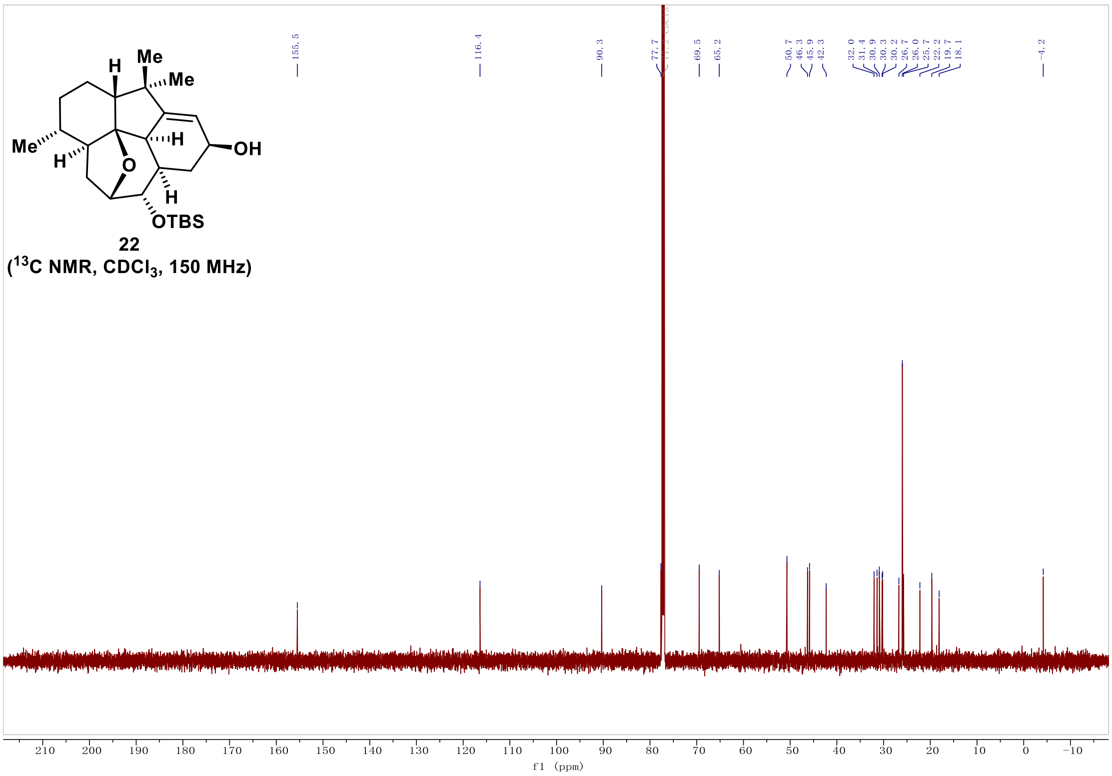


21
(^{1}H-^{13}C HMBC)



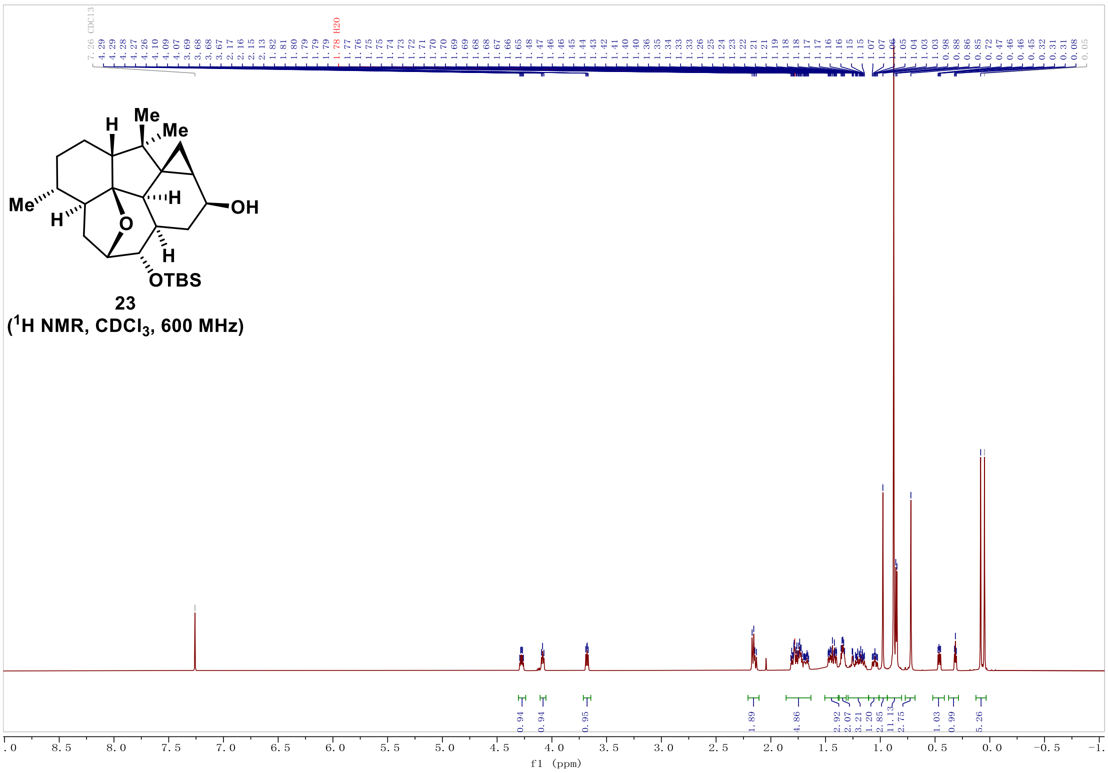
22

(^{1}H NMR, $CDCl_3$, 600 MHz)



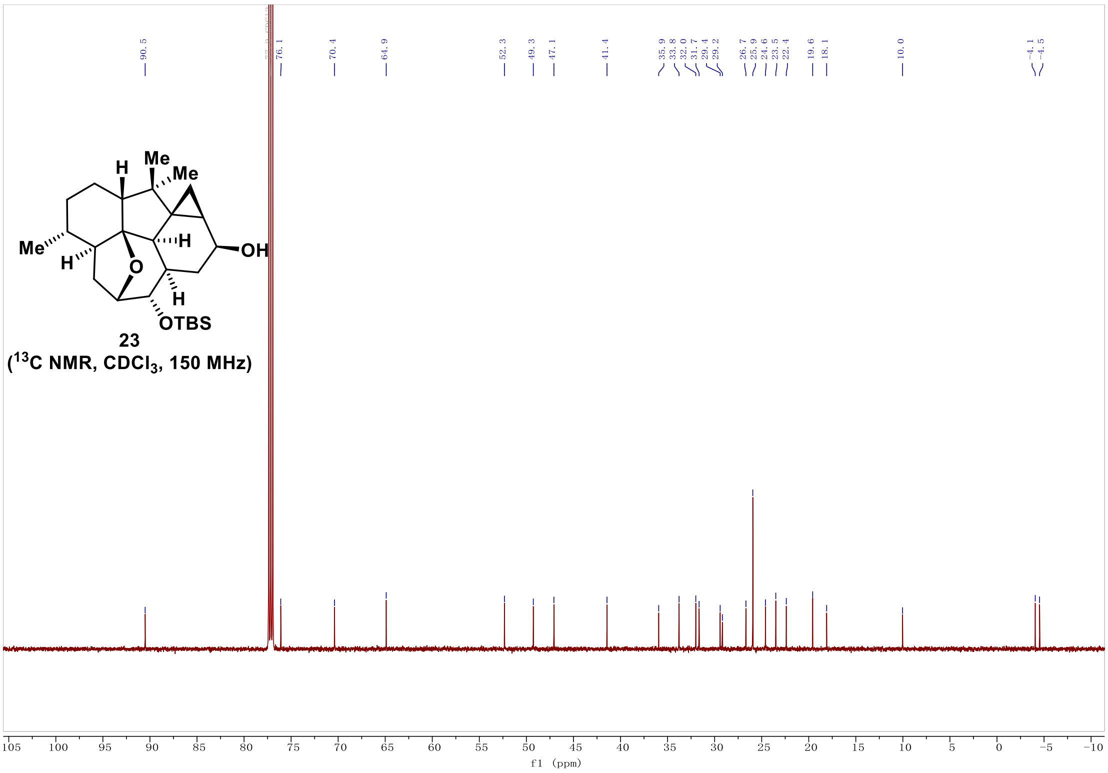
22

(^{13}C NMR, $CDCl_3$, 150 MHz)



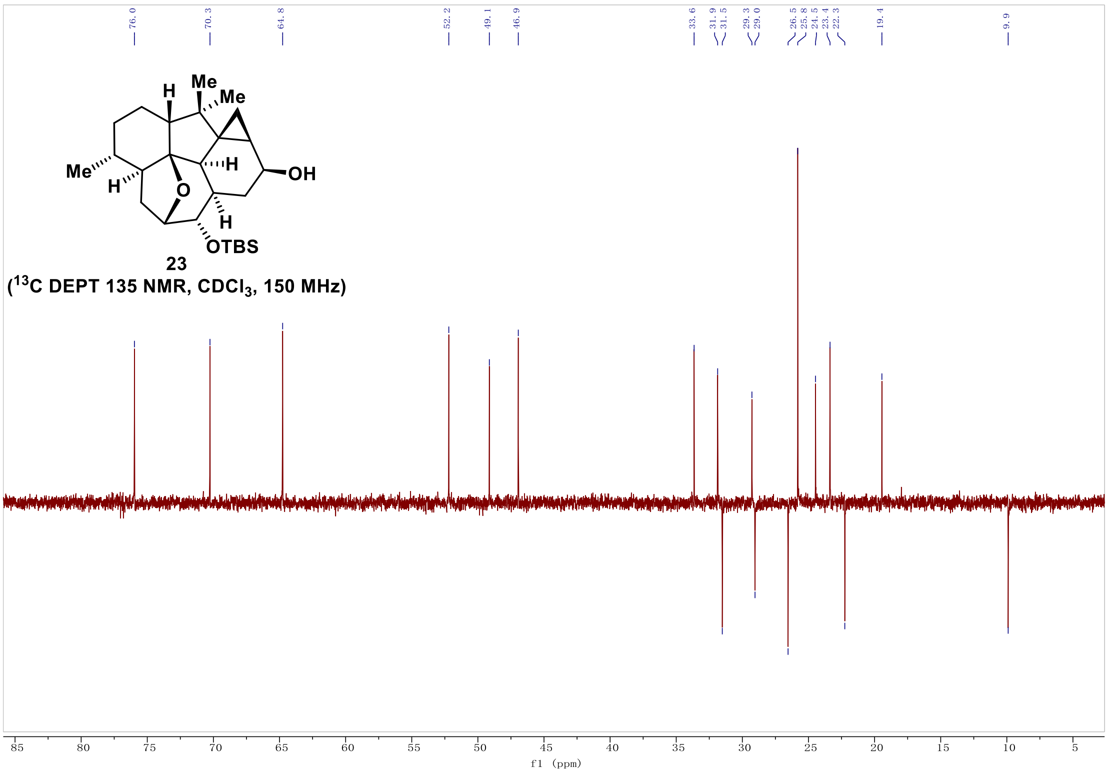
23

(^{1}H NMR, $CDCl_3$, 600 MHz)



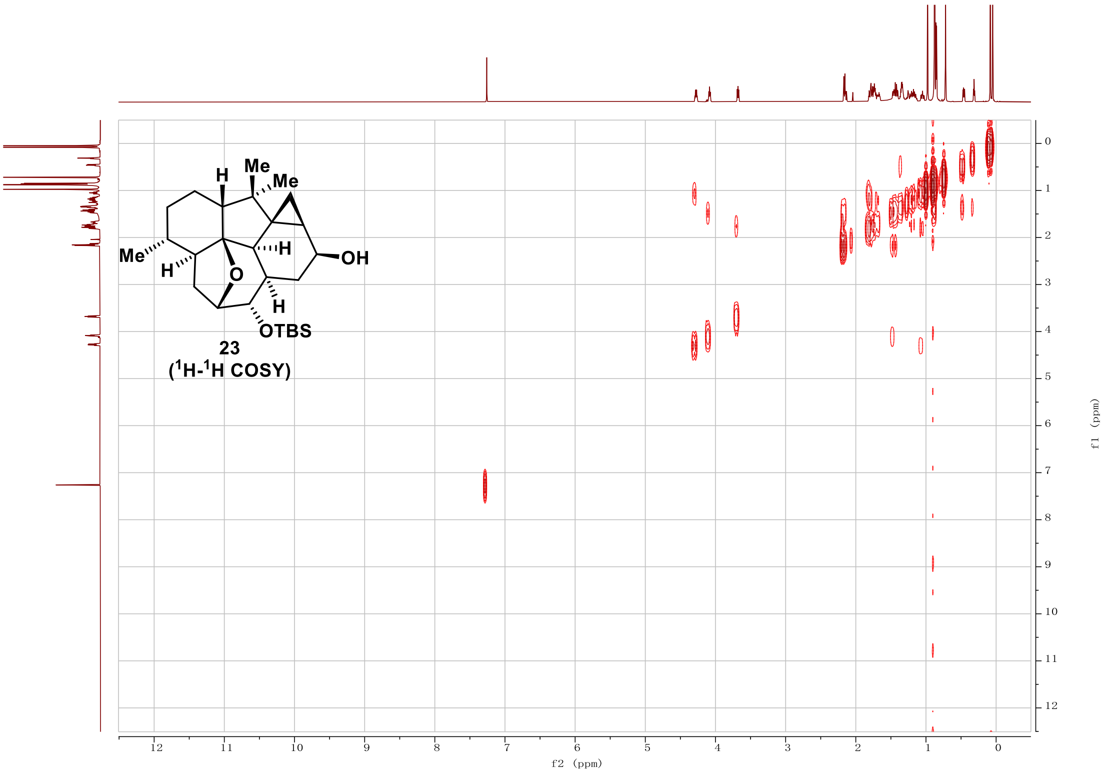
23

(^{13}C NMR, $CDCl_3$, 150 MHz)



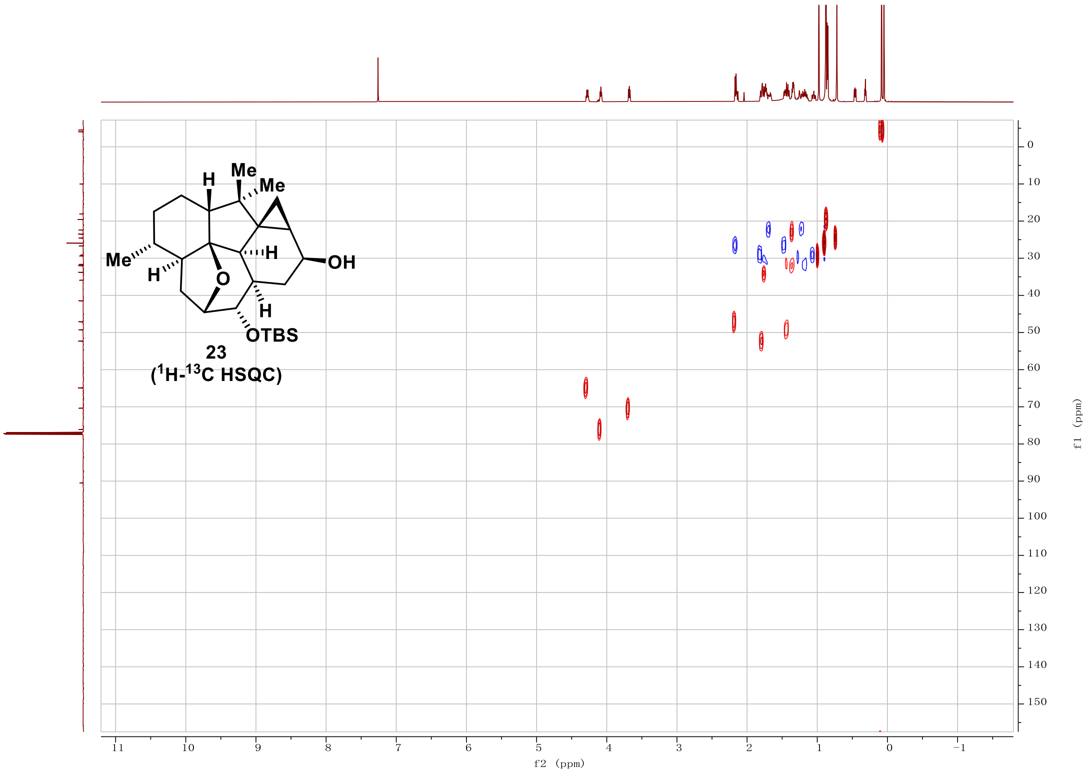
23

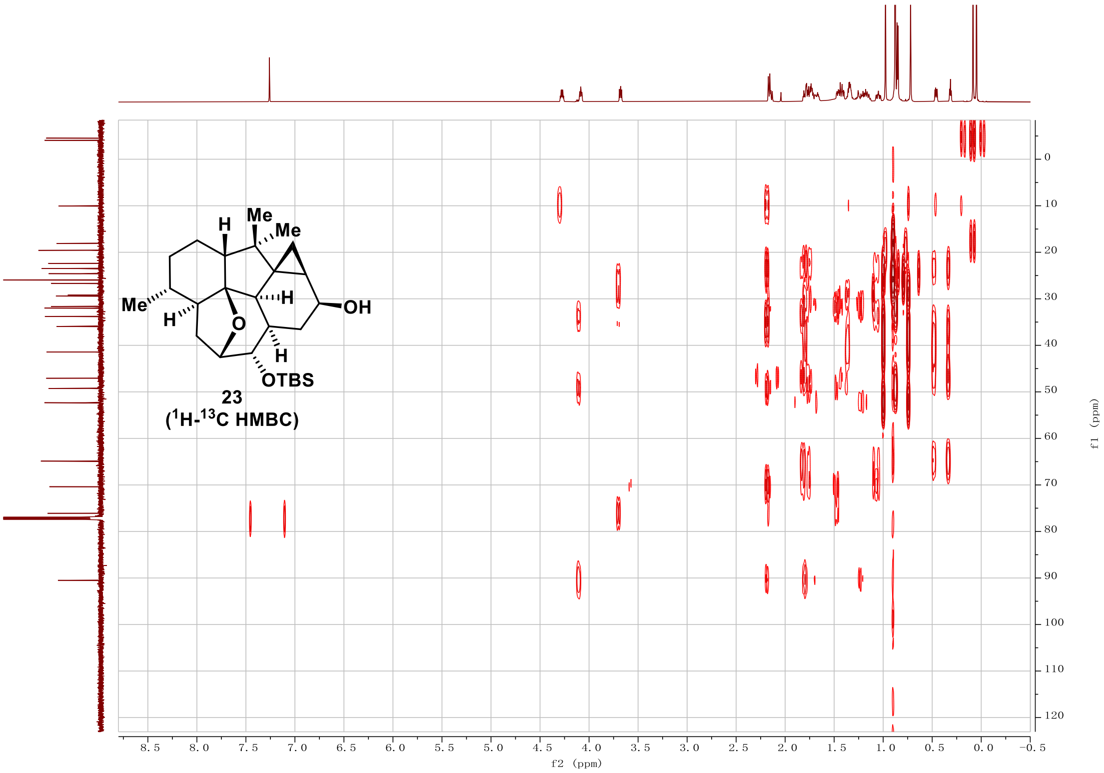
(^{13}C DEPT 135 NMR, CDCl$_3$, 150 MHz)

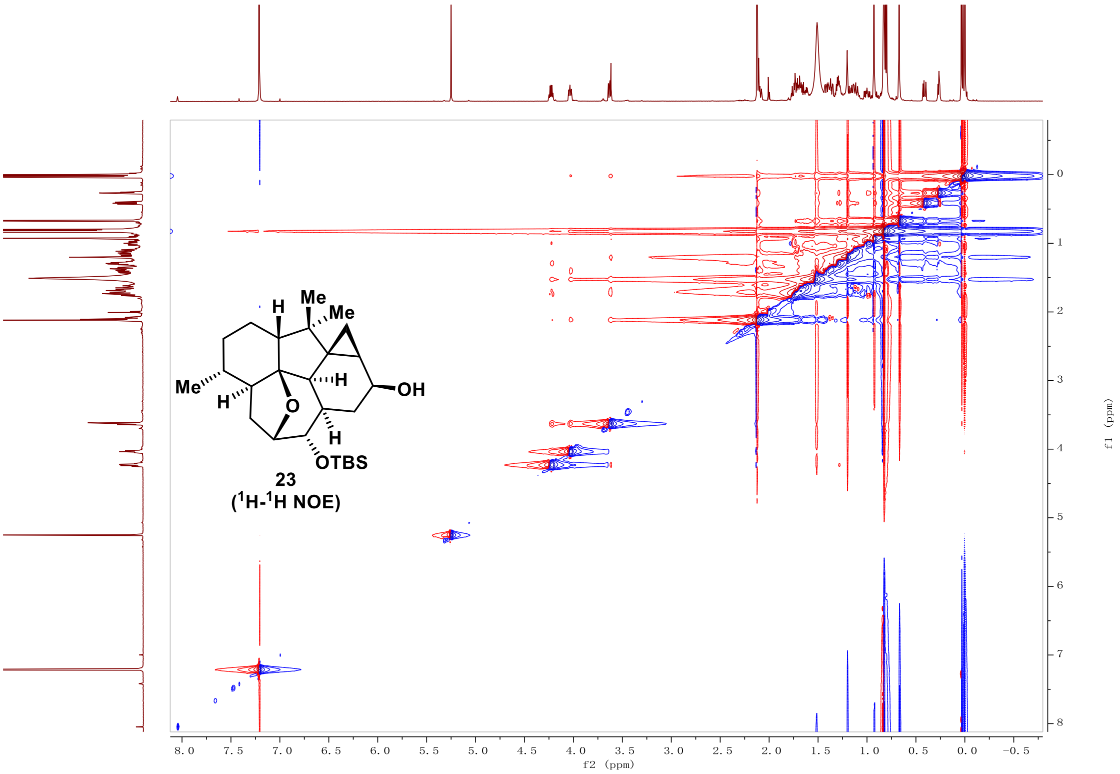


23

(^{1}H-^{1}H COSY)

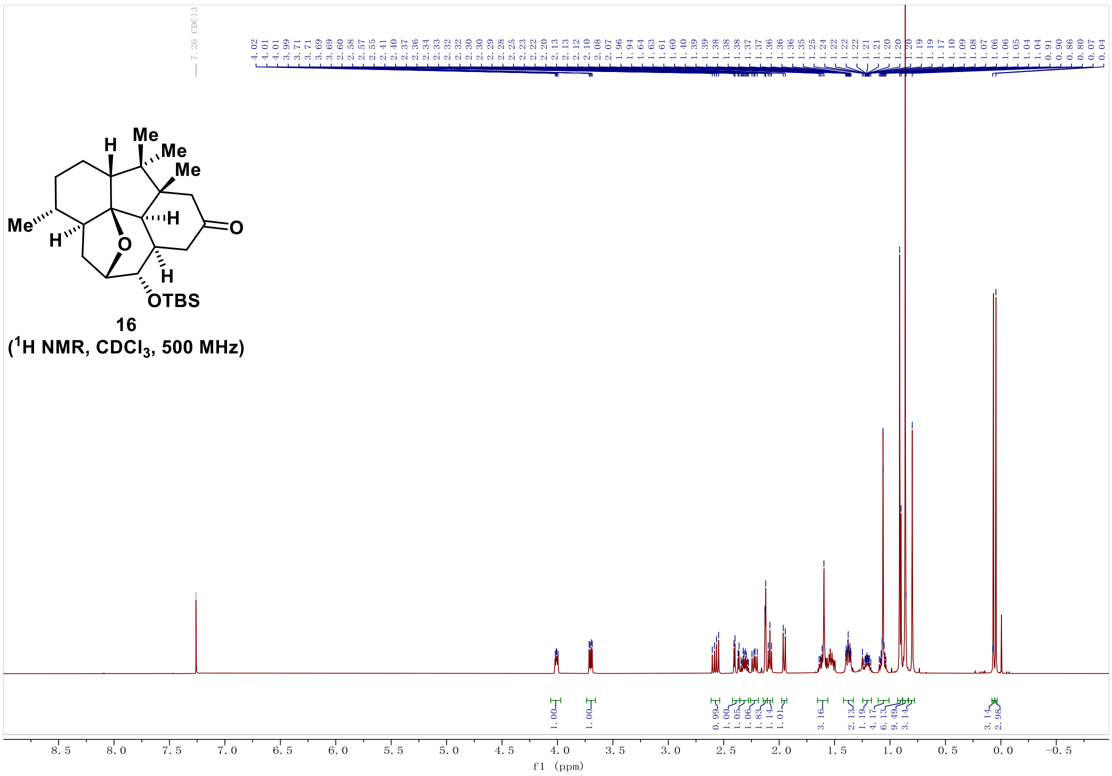

Me
H
Me
Me
H
H
OH
O
H
OTBS
23
(^{1}H-^{13}C HSQC)
f2 (ppm)
f1 (ppm)
11 10 9 8 7 6 5 4 3 2 1 0 −1
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

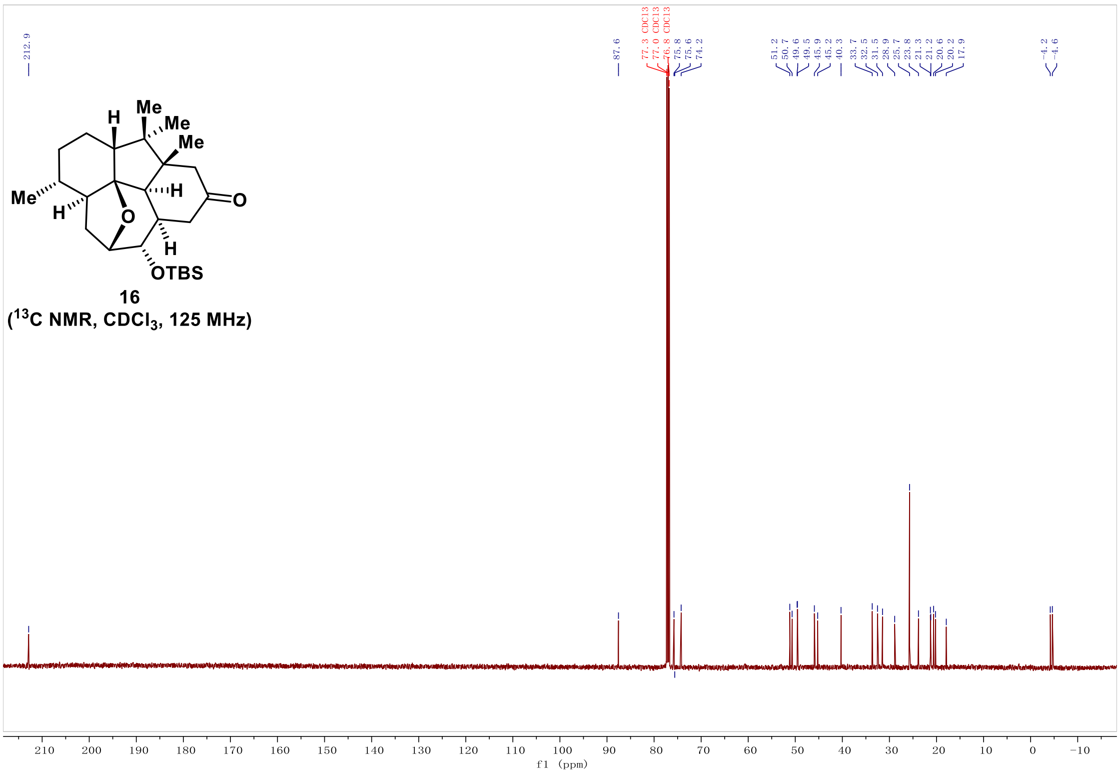

Me
H
Me
Me
H
H
OH
O
H
OTBS
23
(^{1}H-^{13}C HMBC)
f2 (ppm)
f1 (ppm)
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 −0.5
0 10 20 30 40 50 60 70 80 90 100 110 120

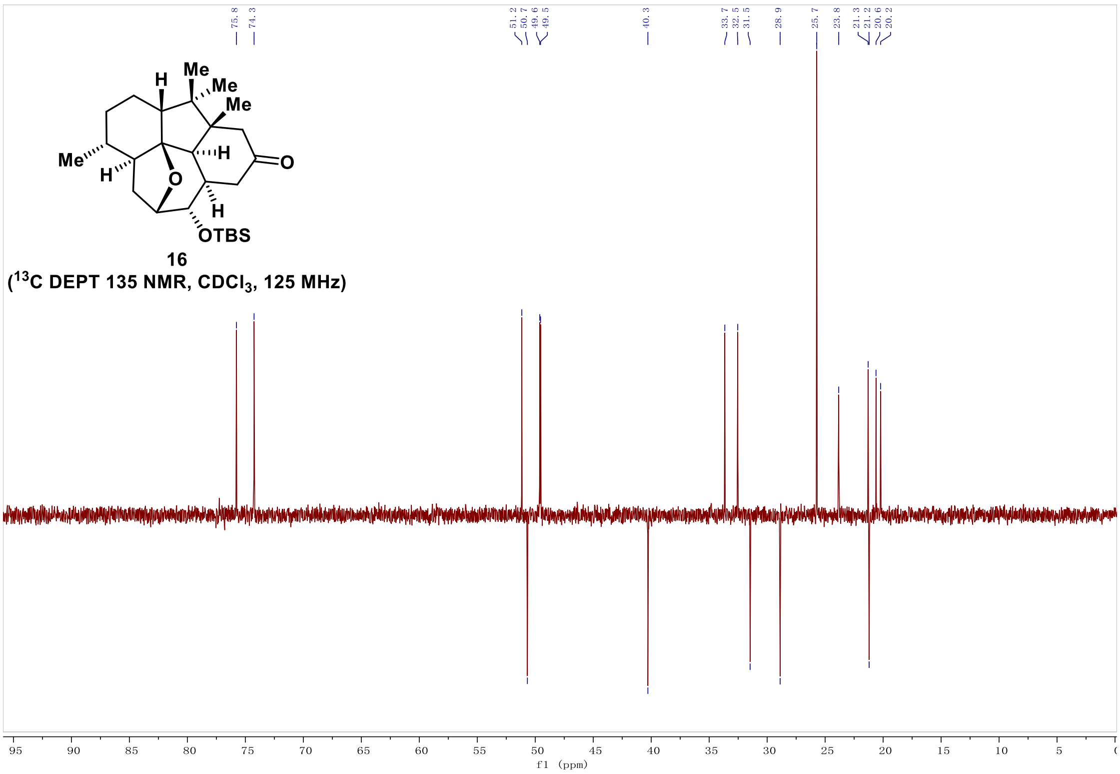


23
(^{1}H-^{1}H NOE)

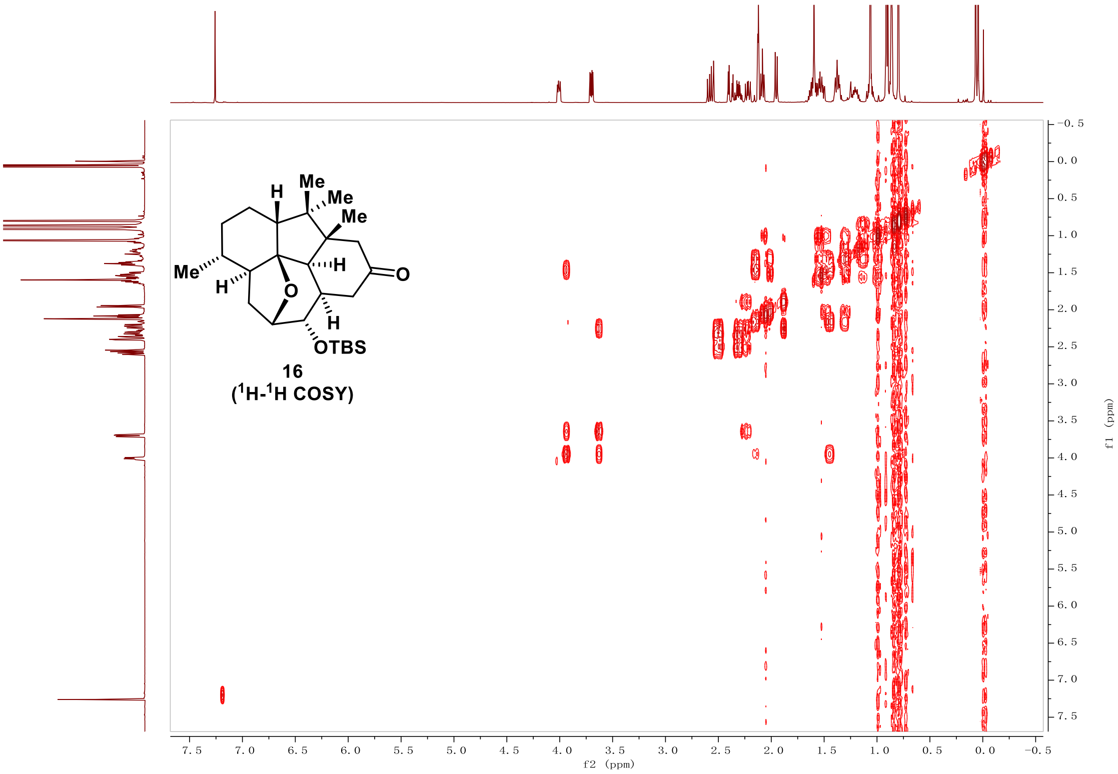
Me
H
Me
Me
H
H
O
OH
H
OTBS
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f2 (ppm)
0
1
2
3
4
5
6
7
8
f1 (ppm)


16
(^{1}H NMR, $CDCl_3$, 500 MHz)

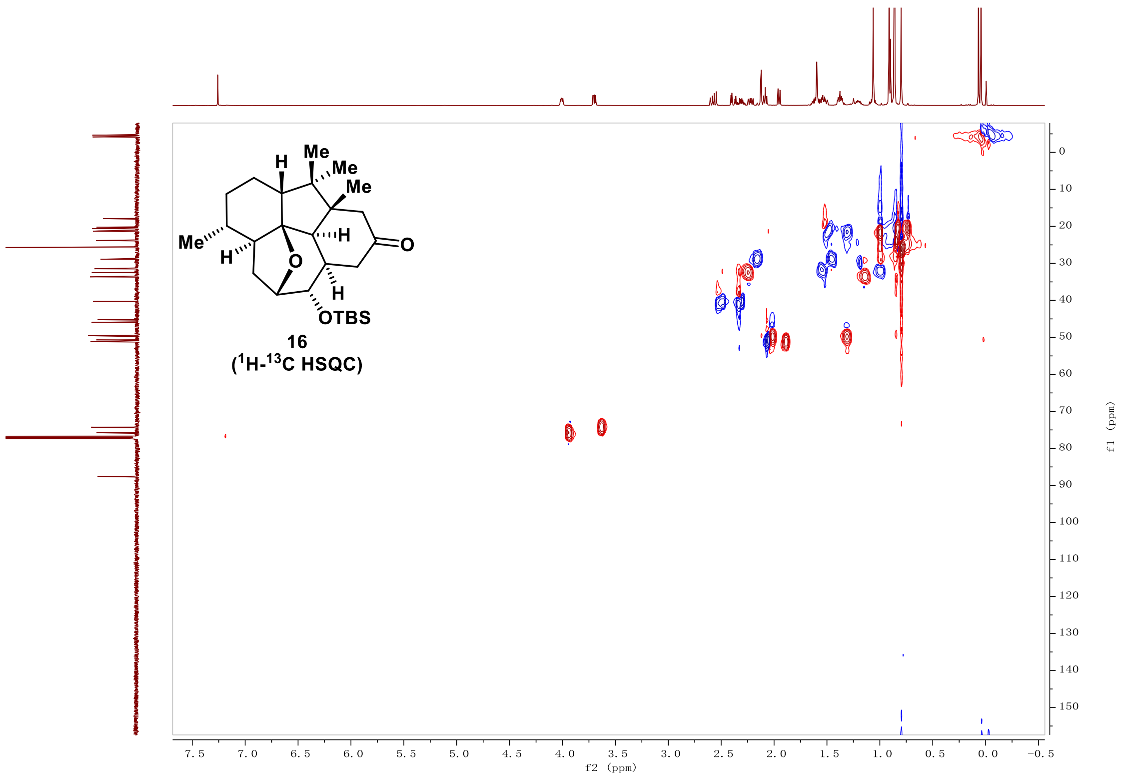

16
(^{13}C NMR, $CDCl_3$, 125 MHz)



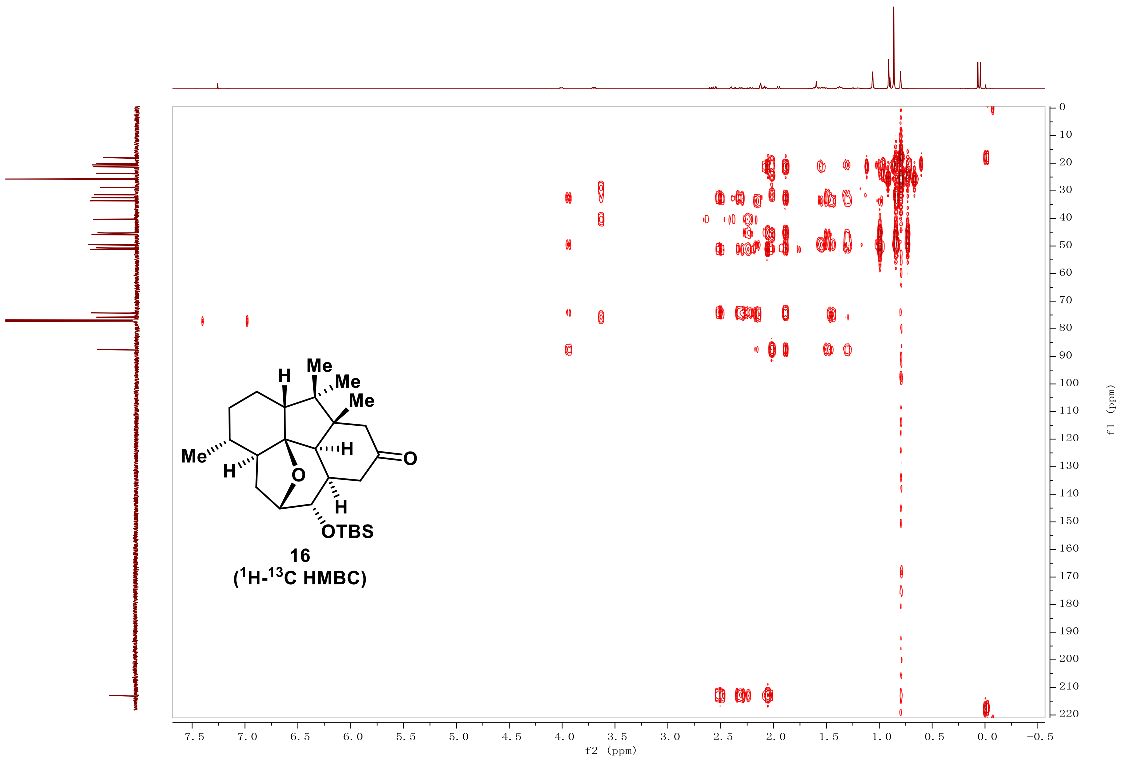
16
(^{13}C DEPT 135 NMR, CDCl$_3$, 125 MHz)



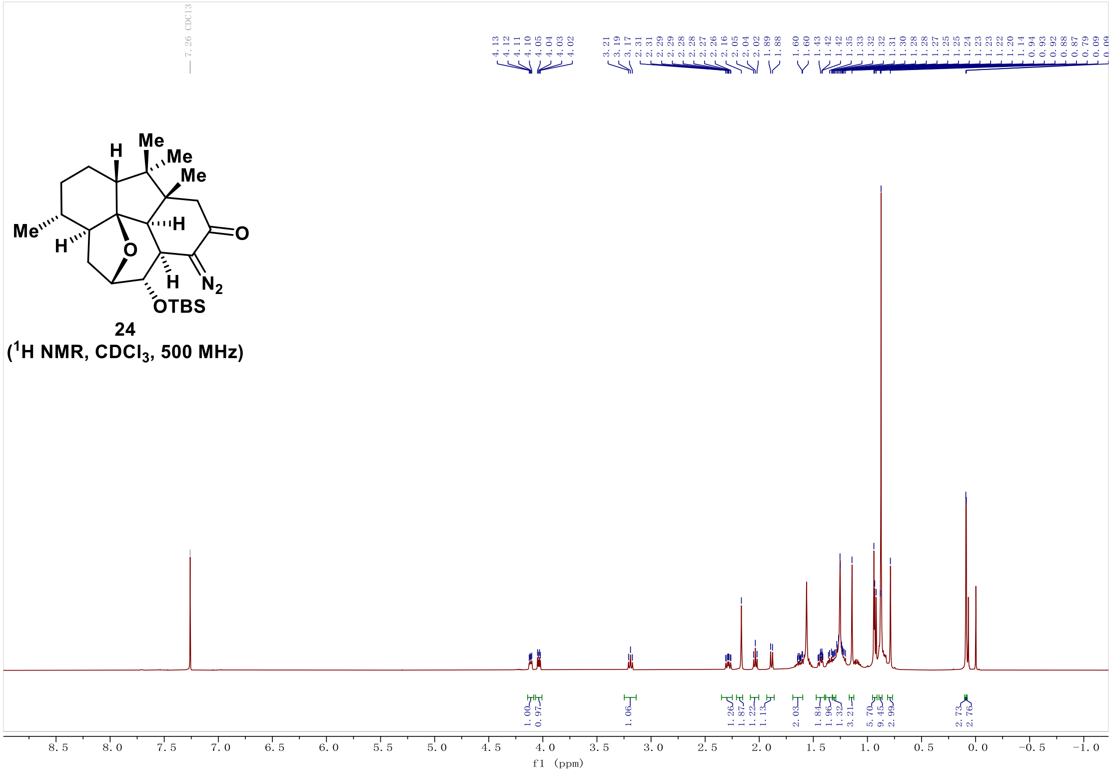
16
(^{1}H-^{1}H COSY)



16
(^{1}H-^{13}C HSQC)

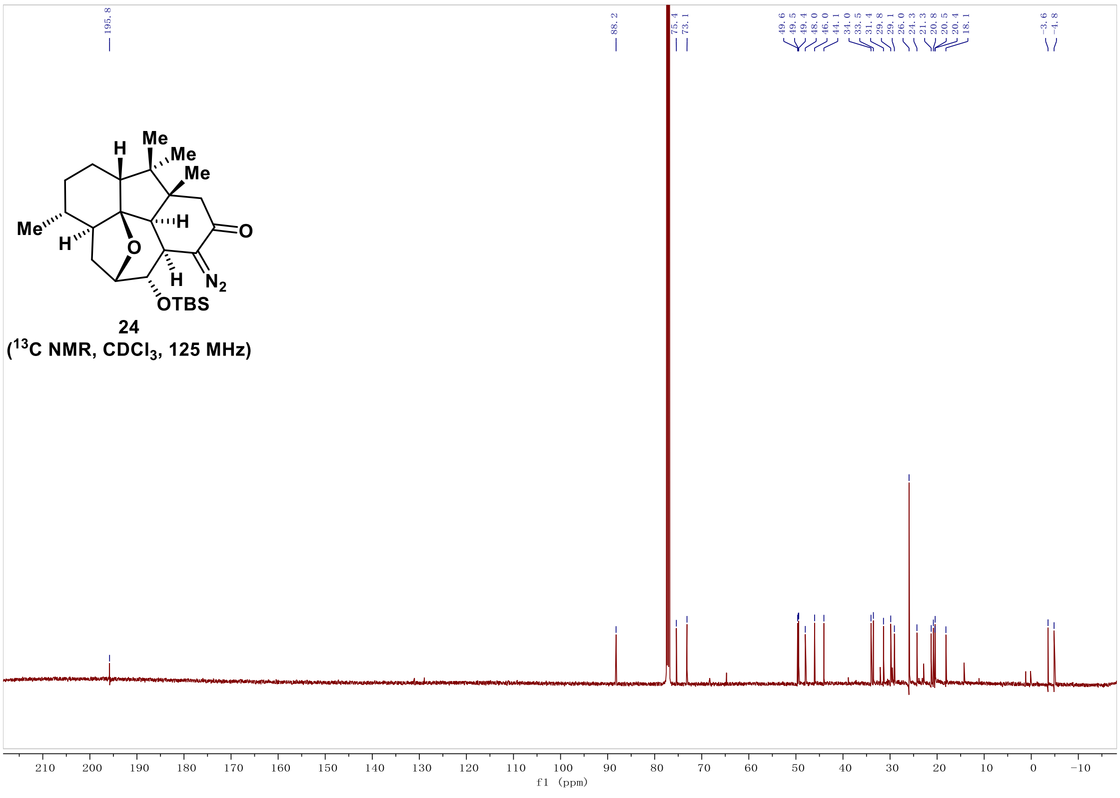


16
(^{1}H-^{13}C HMBC)



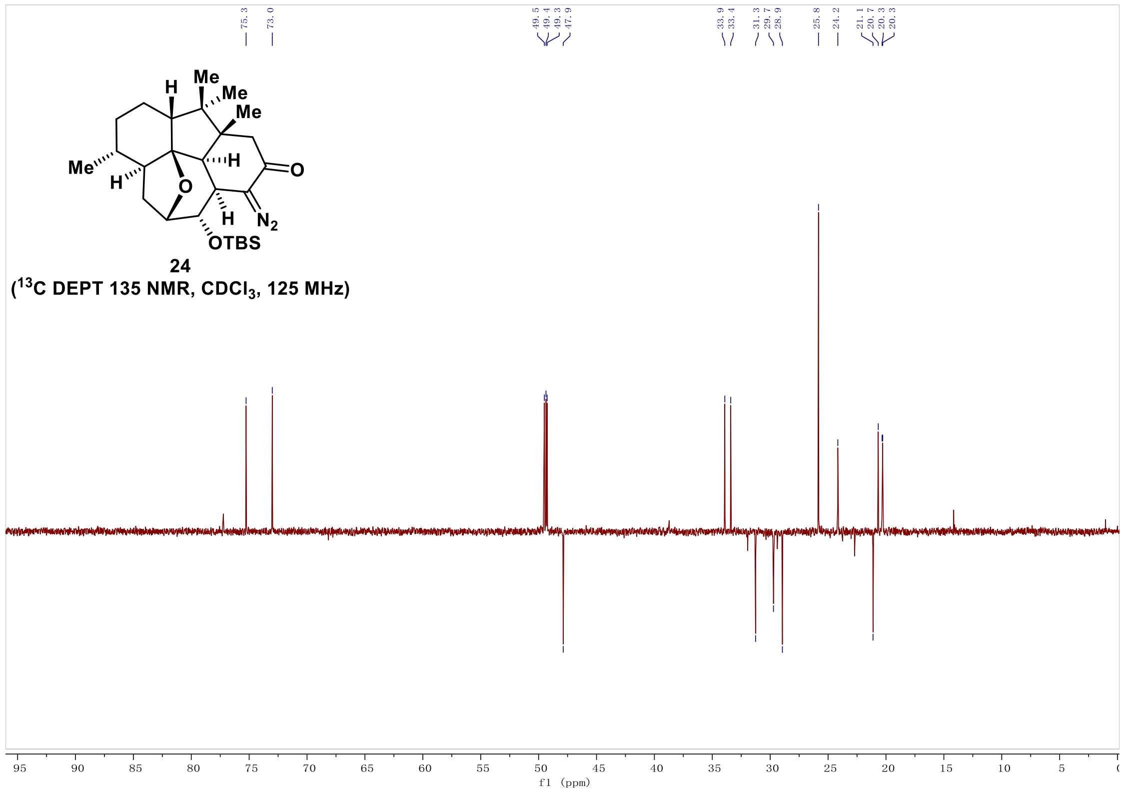
24

(^{1}H NMR, $CDCl_3$, 500 MHz)



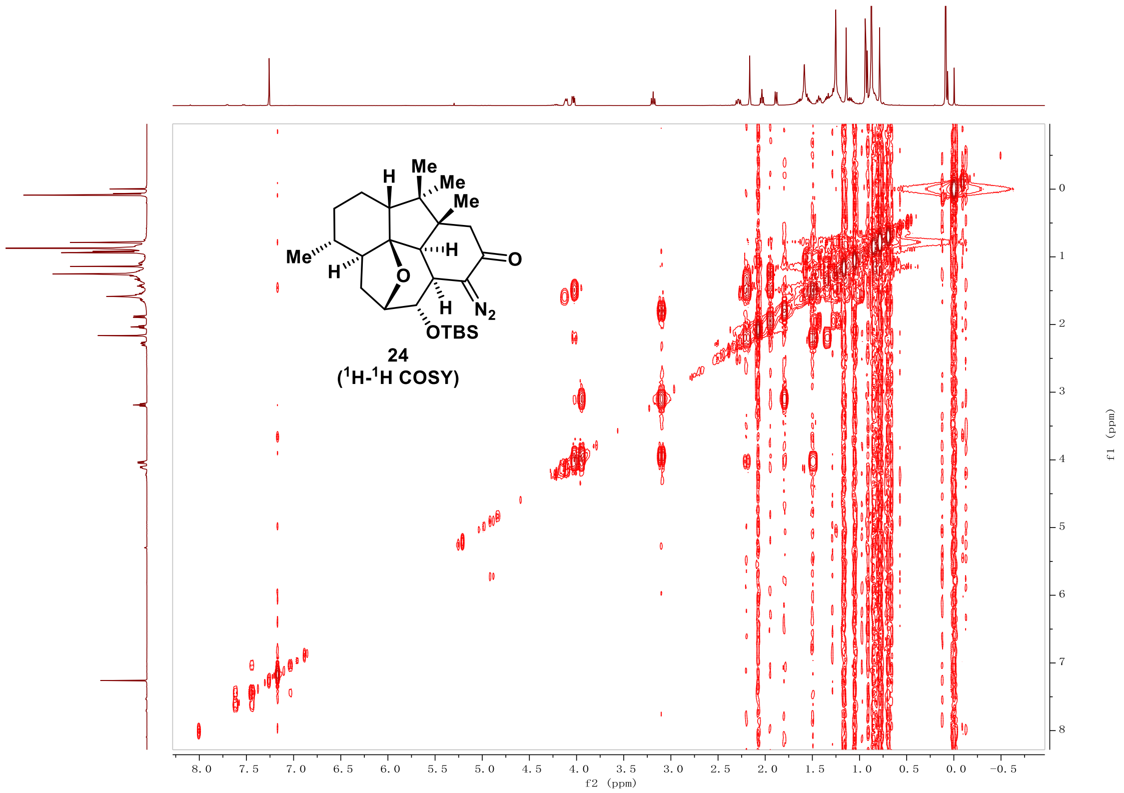
24

(^{13}C NMR, $CDCl_3$, 125 MHz)



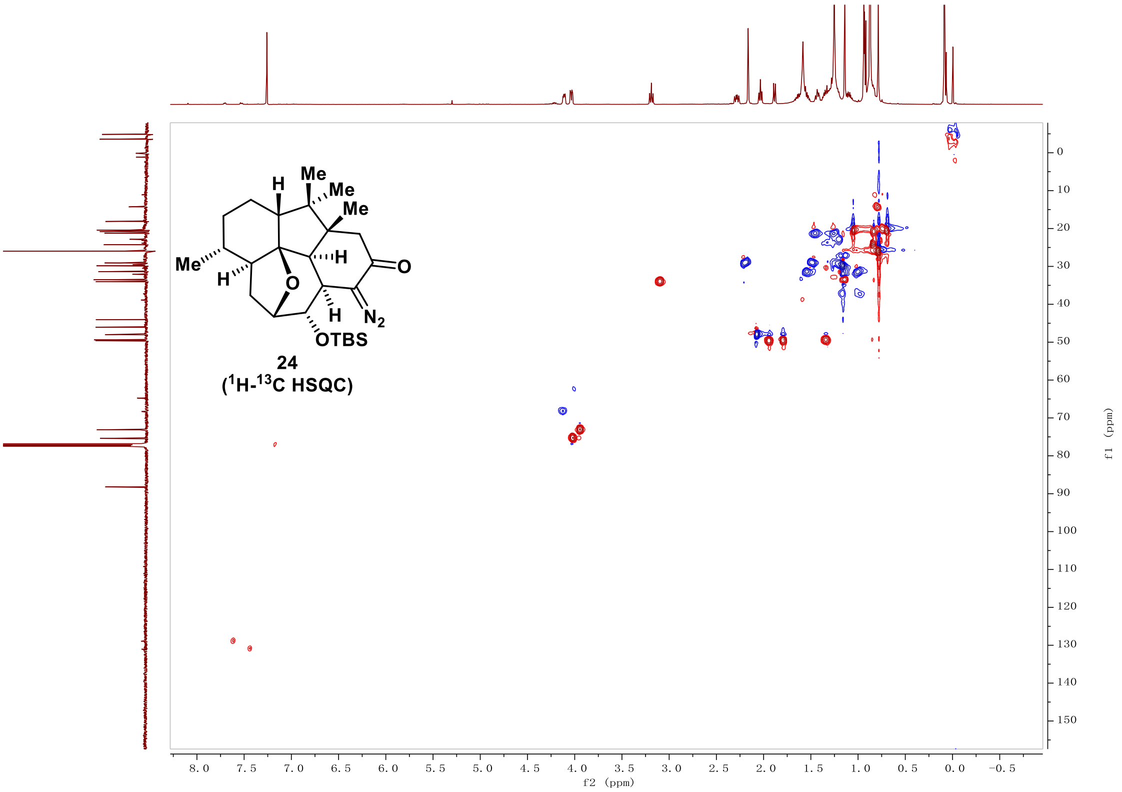
24

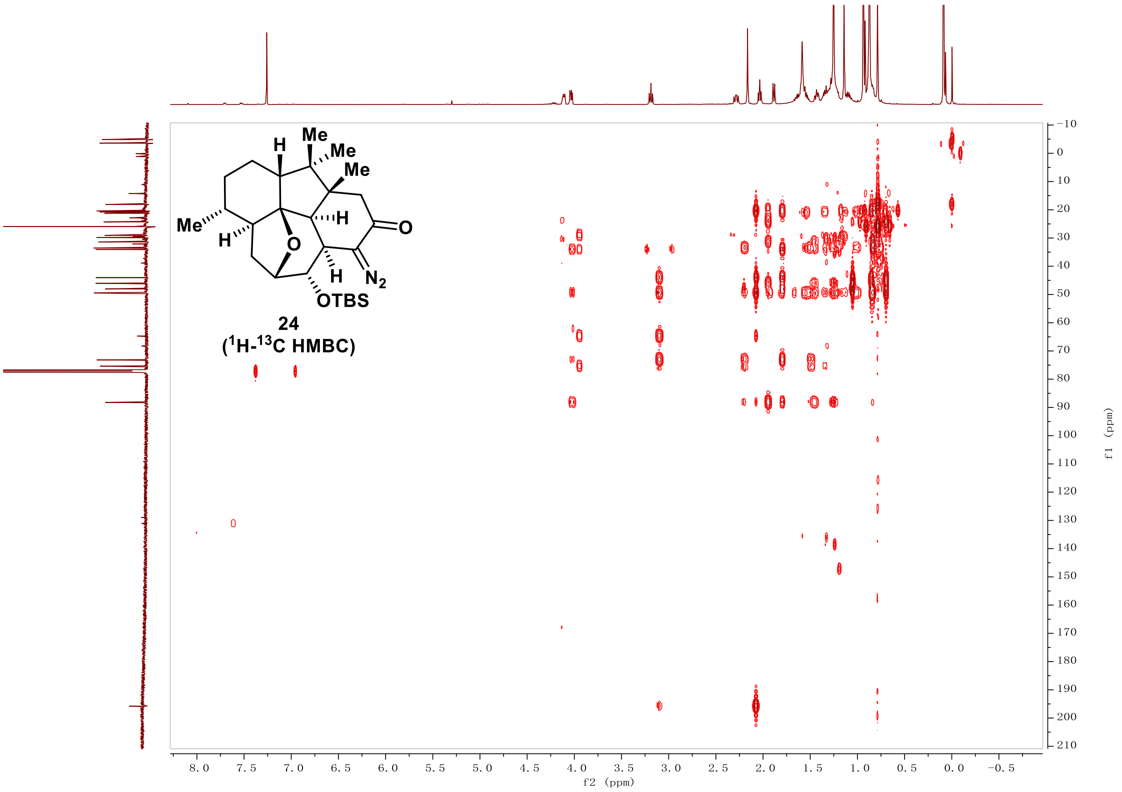
(^{13}C DEPT 135 NMR, CDCl$_3$, 125 MHz)

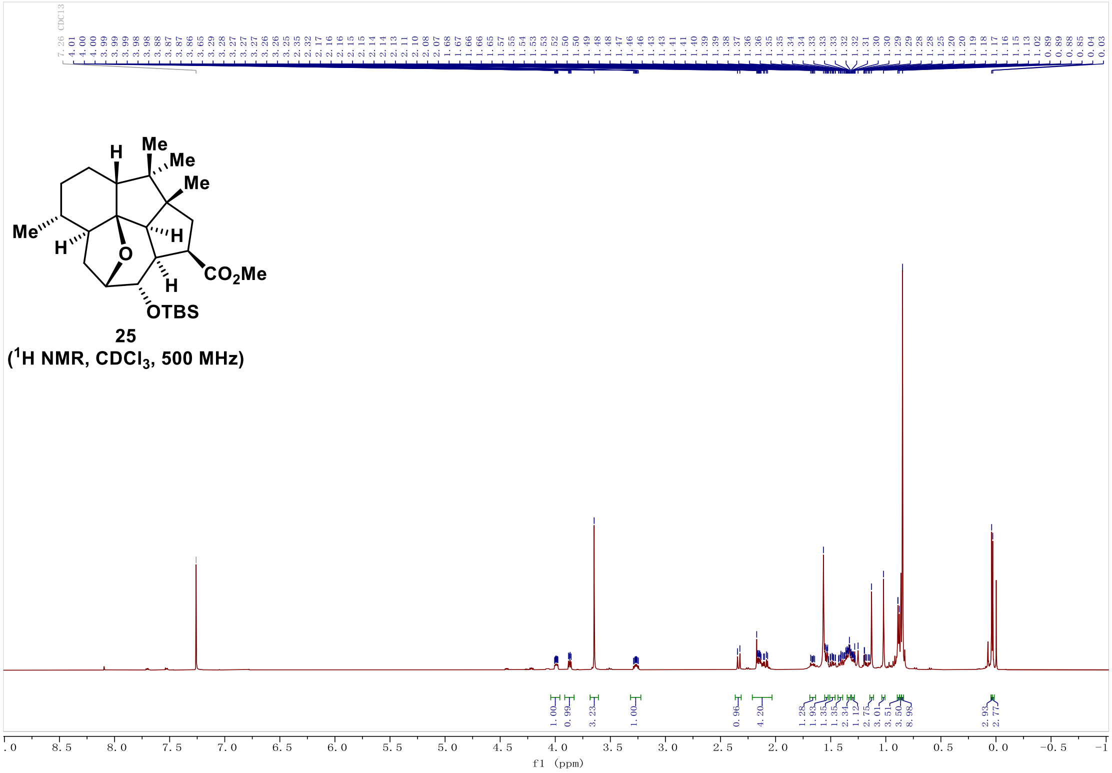


24

(^{1}H-^{1}H COSY)

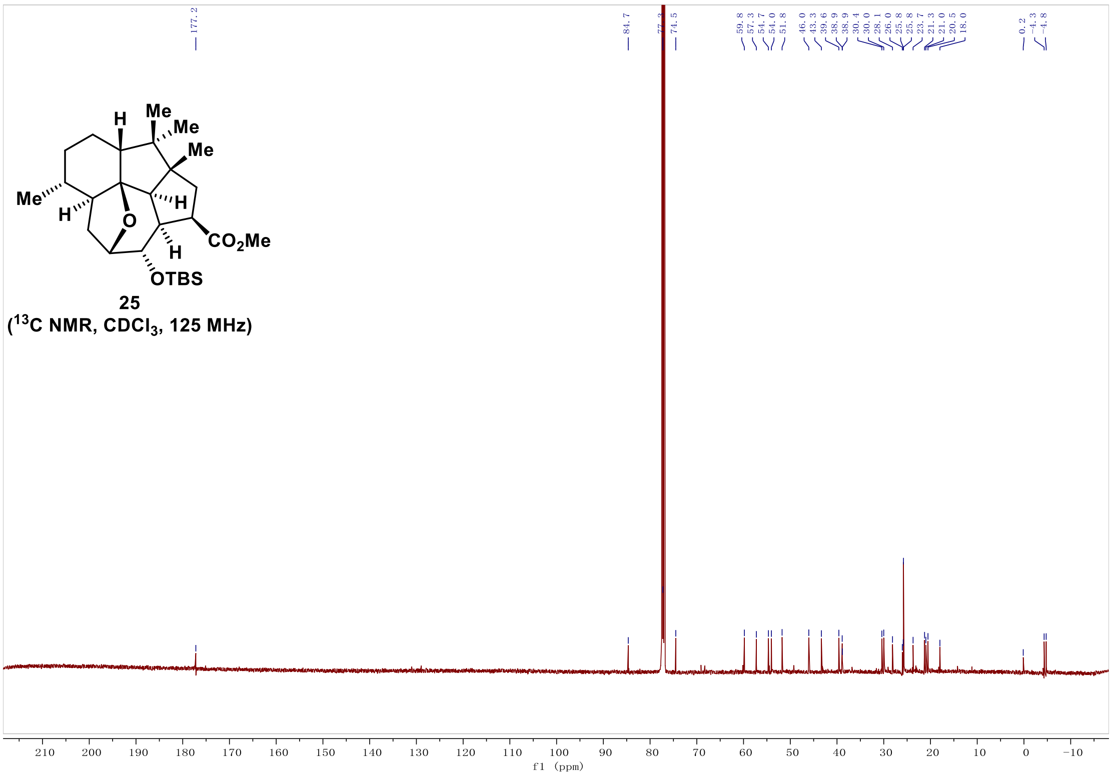

Me
Me
Me
H
Me
H
O
H
O
H
N2
OTBS
24
(1H-13C HSQC)
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f2 (ppm)
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
f1 (ppm)


Me
Me
Me
H
Me
H
O
H
O
H
N2
OTBS
24
(1H-13C HMBC)
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
f2 (ppm)
-10
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
f1 (ppm)



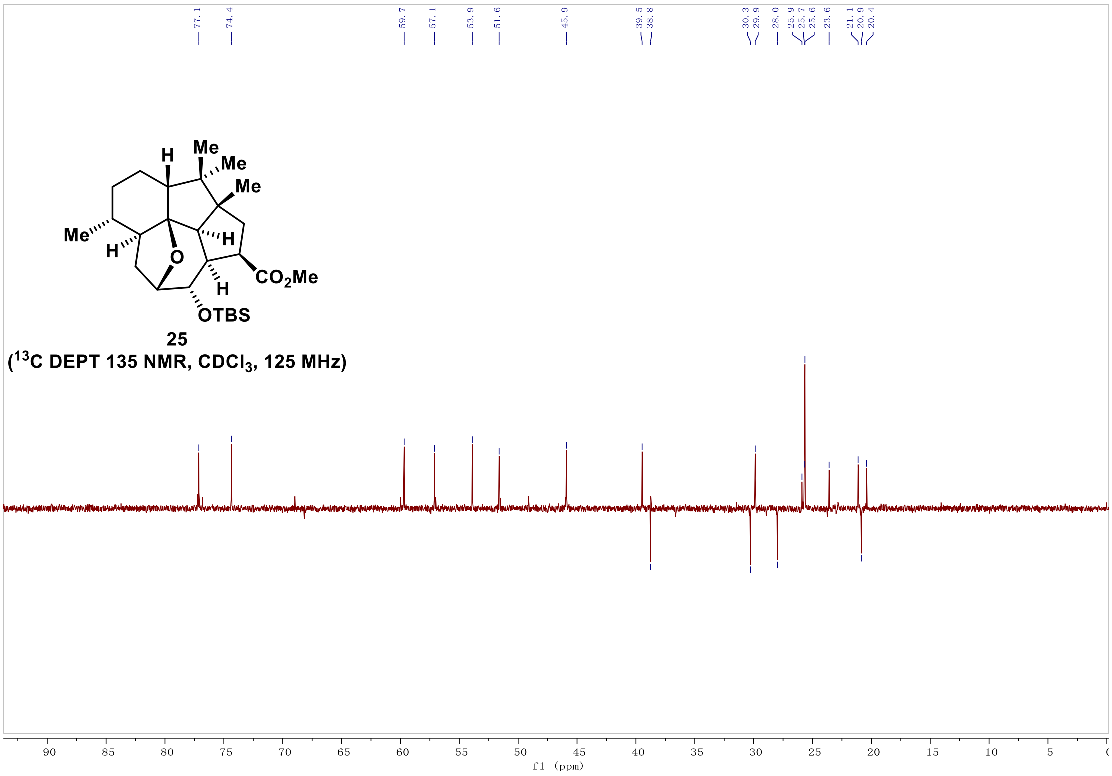
25

(${}^{1}H$ NMR, $CDCl_3$, 500 MHz)



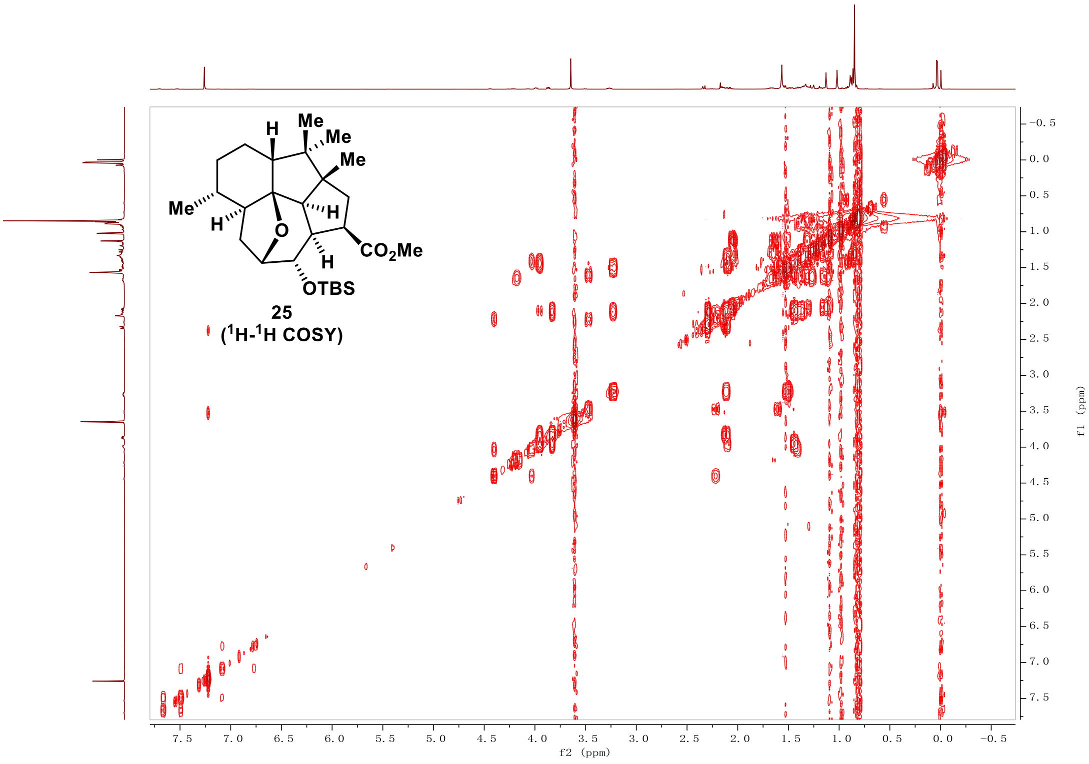
25

(${}^{13}C$ NMR, $CDCl_3$, 125 MHz)



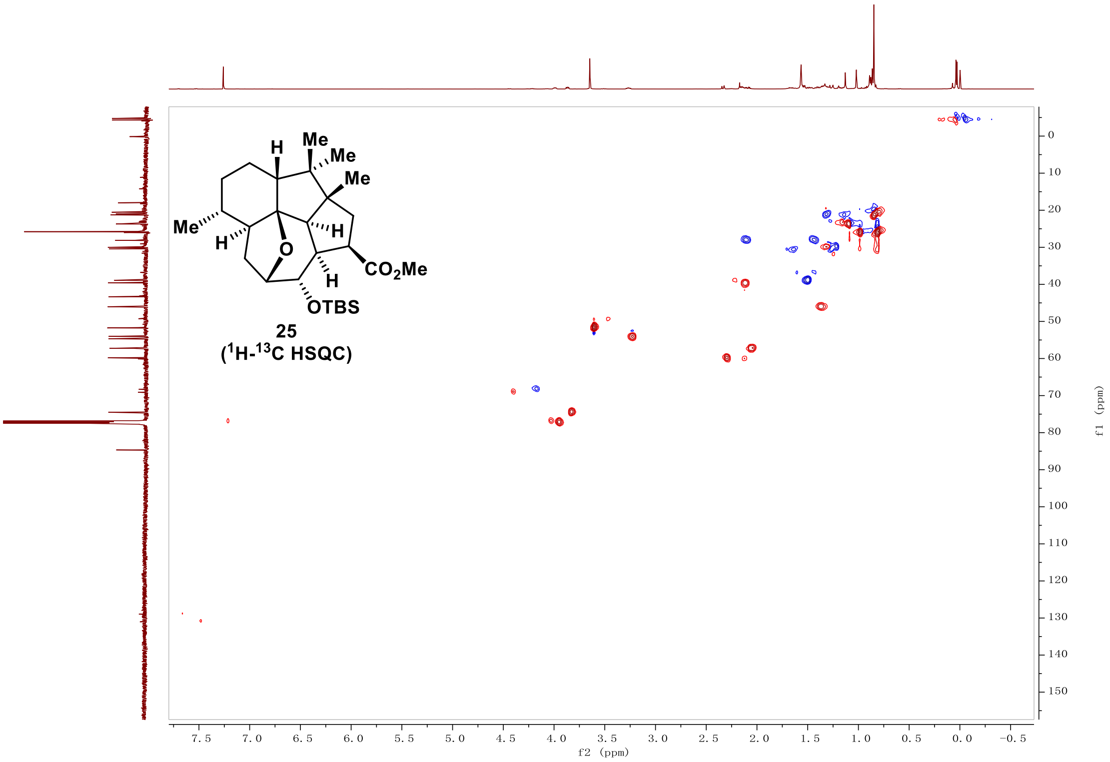
25

(^{13}C DEPT 135 NMR, CDCl$_3$, 125 MHz)

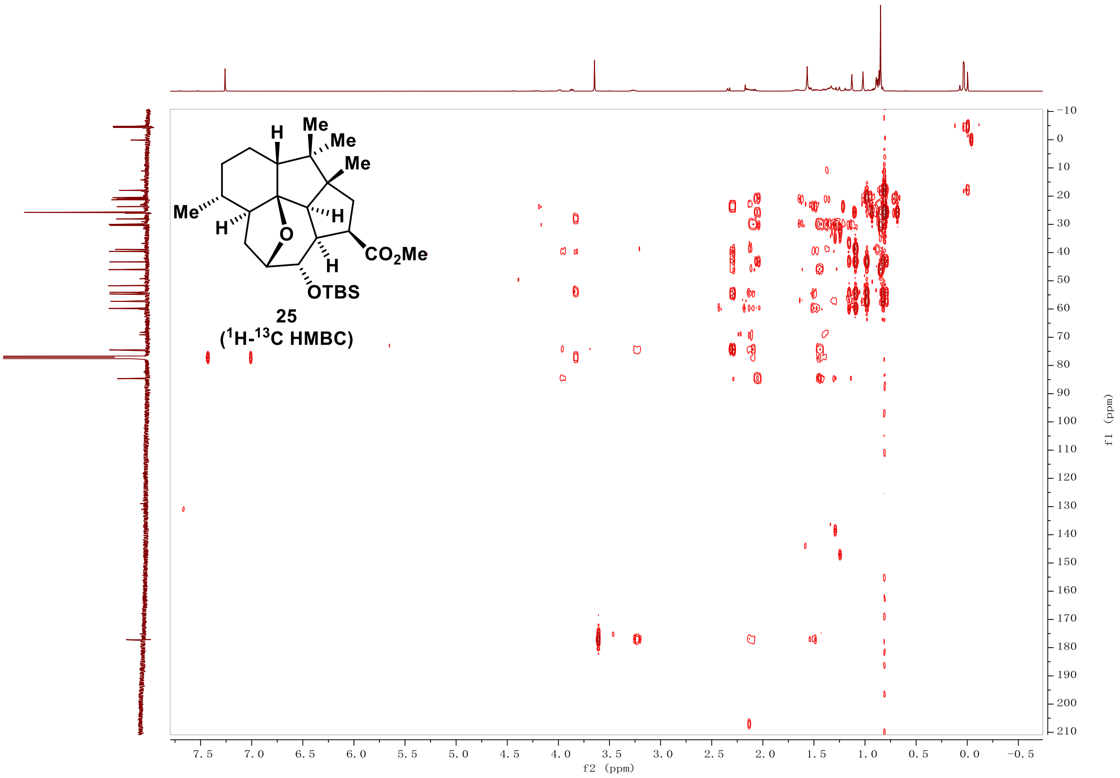


25

(^{1}H-^{1}H COSY)



25
(^{1}H-^{13}C HSQC)



25
(^{1}H-^{13}C HMBC)

V. References

1. L. Chen, C.-H. Zhang, J. Liu, J. Sun and C.-C. Li, *Org. Lett.*, 2025, **27**, 3517-3520.