Electronic Supplementary Material (ESI) for Organic Chemistry Frontiers.

Support Information

Visible Light-Induced Deoxygenative Amidation Protocol for Synthesis of Dipeptide and Amide

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Table of Contents

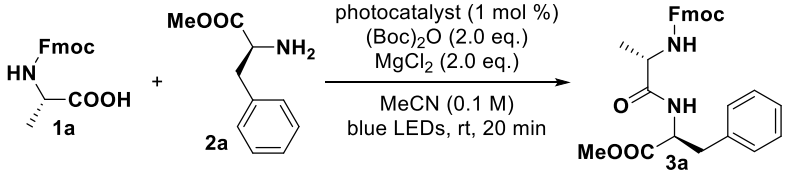
1. General experimental information

Unless otherwise noted, all the substrates and reagents were purchased from commercial suppliers and used without further purification, which were known compounds. ^{1}H NMR spectra were recorded at 500 MHz. The chemical shifts were recorded in ppm relative to tetramethylsilane and with the solvent resonance as the internal standard. Data were reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet), coupling constants (Hz), integration. ^{13}C NMR data were collected at 125 MHz with complete proton decoupling. Chemical shifts were reported in ppm from the tetramethylsilane with the solvent resonance as internal standard. High resolution mass spectroscopy (HRMS) was performed on Thermo Q Exactive Plus (FTMS ESI) mass spectrometer and acetonitrile was used to dissolve the sample. Column chromatography was carried out on silica gel (200-300 mesh).

2. Experimental procedures and characterization data

2.1. Optimization studies

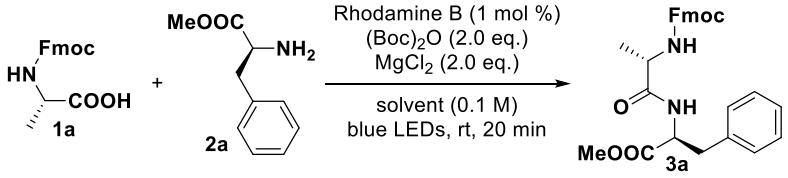
Table S1. The effects of photocatalyst[a]



Entry	Photocatalyst	Yield (%)[b]
1	$Ru(bpy)_3(PF_6)_2$	74
2	$Ru(bpz)_3(PF_6)_2$	70
3	$Ir(ppy)_2(dtbbpy)PF_6$	79
4	$Ir(dF(CF_3)ppy)_2(bpy)PF_6$	38
5	$Ir(dF(CF_3)ppy)_2(dtbbpy)PF_6$	52
6	*fac*-$Ir(ppy)_3$	41
7	Rose Bengal	68
8	Eosin Y	76
9	**Rhodamine B**	**83**
10	DCA	82

[a]Unless otherwise noted, all reactions were carried out using amino acid **1a** (0.2 mmol, 1.0 equiv.), amino acid ester **2a** (0.24 mmol, 1.2 equiv.), photocatalyst (1 mol %), $(Boc)_2O$ (0.4 mmol, 2.0 equiv.) and $MgCl_2$ (0.4 mmol, 2.0 equiv.) in acetonitrile (2.0 mL) at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). [b]Isolated yield with >20:1 *dr* determined by ^1H NMR.

Table S2. The effects of solvent[a]

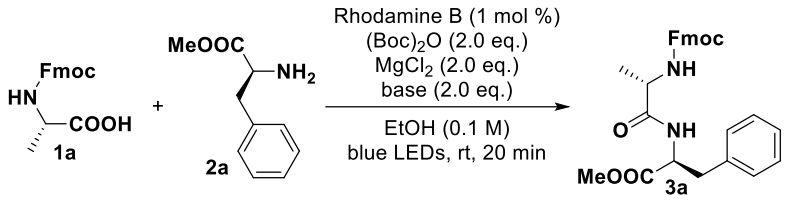


Entry	Solvent	Yield (%)[b]
1	**MeCN**	**83**
2	DCE	71
3	DMF	77

4	**EtOH**	**83**
5	THF	80
6	toluene	80
7	1,4-Dioxane	77

[a]Unless otherwise noted, all reactions were carried out using amino acid **1a** (0.2 mmol, 1.0 equiv.), amino acid ester **2a** (0.24 mmol, 1.2 equiv.), rhodamine B (1 mol %), $(Boc)_2O$ (0.4 mmol, 2.0 equiv.) and $MgCl_2$ (0.4 mmol, 2.0 equiv.) in solvent (2.0 mL) at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). [b]Isolated yield with >20:1 *dr* determined by ^1H NMR.

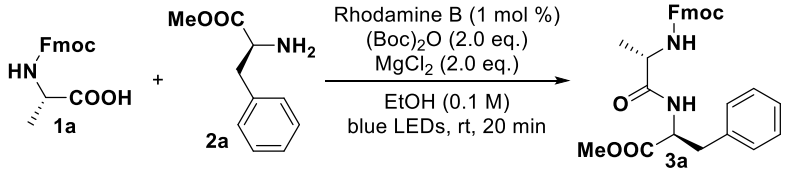
Table S3. The effects of base[a]



Entry	Base	Yield (%)[b]
1	**-**	**83**
2	**K_2HPO_4**	**83**
3	$NaHCO_3$	70
4	Na_2CO_3	65
5	K_2CO_3	46
6	K_3PO_4	trace

[a]Unless otherwise noted, all reactions were carried out using amino acid **1a** (0.2 mmol, 1.0 equiv.), amino acid ester **2a** (0.24 mmol, 1.2 equiv.), rhodamine B (1 mol %), $(Boc)_2O$ (0.4 mmol, 2.0 equiv.), $MgCl_2$ (0.4 mmol, 2.0 equiv.) and base (0.4 mmol, 2.0 equiv.) in ethanol (2.0 mL) at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). [b]Isolated yield with >20:1 *dr* determined by ^1H NMR.

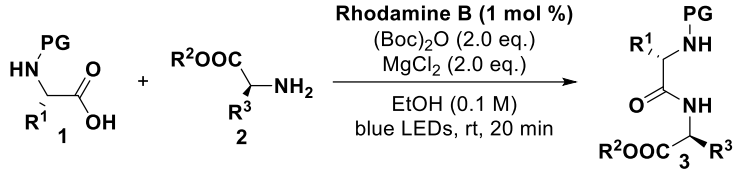
Table S4. Control experiments[a]



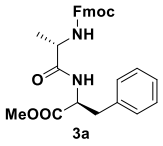
Entry	Variation from the standard conditions	Yield (%)[b]
1	5 mol % of rhodamine B	84
2	no photocatalyst	trace
3	in dark	trace
4	no $(Boc)_2O$ or $MgCl_2$	NR

[a]Unless otherwise noted, all reactions were carried out using amino acid **1a** (0.2 mmol, 1.0 equiv.), amino acid ester **2a** (0.24 mmol, 1.2 equiv.), rhodamine B (1 mol %), $(Boc)_2O$ (0.4 mmol, 2.0 equiv.) and $MgCl_2$ (0.4 mmol, 2.0 equiv.) in ethanol (2.0 mL) at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). [b]Isolated yield with >20:1 *dr* determined by ^1H NMR.

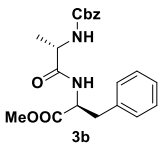
2.2. General procedure for the synthesis of dipeptides 3



N-protected amino acids **1** (0.2 mmol, 1.0 equiv.), amino acid esters **2** (0.24 mmol, 1.2 equiv.), rhodamine B (1 mol %), $(Boc)_2O$ (0.4 mmol, 2.0 equiv.) and $MgCl_2$ (0.4 mmol, 2.0 equiv.) were well mixed in ethanol (2.0 mL). The resulting mixture was stirred at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). The reaction mixture was concentrated under reduced pressure and purified by flash column chromatography on silica gel (EtOAc/PE = 20%-40%) to yield dipeptides **3**.

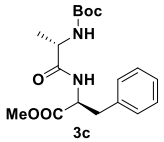


Dipeptide 3a[1]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (78.5 mg, 83% yield, >20:1 dr); ^1H NMR (500 MHz, $CDCl_3$) δ 7.77 (d, J = 7.5 Hz, 2H), 7.59 (d, J = 7.0 Hz, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.31 (t, J = 7.5 Hz, 2H), 7.23 (t, J = 7.0 Hz, 2H), 7.18 (t, J = 7.0 Hz, 1H), 7.07 (d, J = 7.0 Hz, 2H), 6.40 (d, J = 6.0 Hz, 1H), 5.29 (d, J = 6.0 Hz, 1H), 4.84-4.88 (m, 1H), 4.38-4.42 (m, 1H), 4.32-4.36 (m, 1H), 4.19-4.22 (m, 2H), 3.72 (s, 3H), 3.16 (dd, J = 14.0, 6.0 Hz, 1H), 3.07 (dd, J = 14.0, 6.0 Hz, 1H), 1.35 (d, J = 6.0 Hz, 3H).

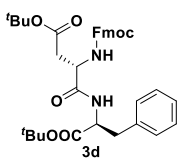


Dipeptide 3b[2]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (61.4 mg, 80% yield, >20:1 dr); ^1H NMR (500 MHz, $CDCl_3$) δ 7.32-7.35 (m, 5H), 7.21-7.27 (m, 3H), 7.08 (d, J = 7.0 Hz, 2H), 6.46 (d, J = 4.0 Hz, 1H), 5.26 (d, J = 4.5

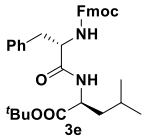
Hz, 1H), 5.06-5.13 (m, 2H), 4.83-4.87 (m, 1H), 4.21-4.22 (m, 1H), 3.72 (s, 3H), 3.14 (dd, J = 14.0, 6.0 Hz, 1H), 3.07 (dd, J = 14.0, 6.0 Hz, 1H), 1.33 (d, J = 7.0 Hz, 3H).



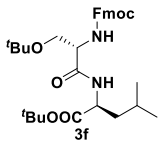
Dipeptide 3c[3]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (52.7 mg, 75% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.22-7.30 (m, 3H), 7.10 (d, J = 7.0 Hz, 2H), 6.56 (d, J = 7.5 Hz, 1H), 4.97 (*br* s, 1H), 4.83-4.87 (m, 1H), 4.15 (*br* s, 1H), 3.71 (s, 3H), 3.16 (dd, J = 13.5, 6.0 Hz, 1H), 3.08 (dd, J = 13.5, 6.0 Hz, 1H), 1.44 (s, 9H), 1.31 (d, J = 7.0 Hz, 3H).



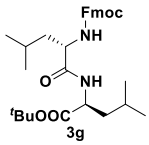
Dipeptide 3d[4]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (101.8 mg, 83% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.77 (d, J = 7.5 Hz, 2H), 7.58 (d, J = 7.0 Hz, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.31 (t, J = 7.5 Hz, 2H), 7.24-7.27 (m, 2H), 7.18-7.21 (m, 3H), 7.00 (d, J = 7.0 Hz, 1H), 5.93 (d, J = 8.0 Hz, 1H), 4.66-4.70 (m, 1H), 4.53 (d, J = 3.5 Hz, 1H), 4.33-4.41 (m, 2H), 4.22 (t, J = 7.0 Hz, 1H), 3.08 (d, J = 6.0 Hz, 2H), 2.90 (dd, J = 17.0, 3.5 Hz, 1H), 2.61 (dd, J = 17.0, 6.5 Hz, 1H), 1.44 (s, 9H), 1.38 (s, 9H).



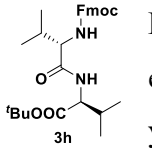
Dipeptide 3e[4]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (95.4 mg, 86% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, J = 7.5 Hz, 2H), 7.54 (t, J = 7.0 Hz, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.31 (t, J = 7.5 Hz, 2H), 7.27 (d, J = 9.0 Hz, 2H), 7.23 (d, J = 7.5 Hz, 1H), 7.18 (d, J = 4.5 Hz, 2H), 6.16 (d, J = 4.5 Hz, 1H), 5.34 (d, J = 6.0 Hz, 1H), 4.40-4.46 (m, 3H), 4.31 (*br* s, 1H), 4.19 (t, J = 6.5 Hz, 1H), 3.06-3.12 (m, 2H), 1.54-1.56 (m, 2H), 1.44-1.46 (m, 10H), 0.90 (d, J = 6.0 Hz, 3H), 0.88 (d, J = 6.5 Hz, 3H).



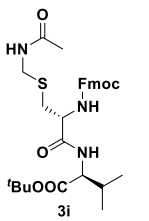
Dipeptide 3f[4]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (90.6 mg, 82% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, J = 7.5 Hz, 2H), 7.60-7.62 (m, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.32 (t, J = 7.5 Hz, 2H), 7.22 (d, J = 6.0 Hz, 1H), 5.78 (d, J = 4.0 Hz, 1H), 4.47-4.48 (m, 1H), 4.39-4.40 (m, 2H), 4.22-4.25 (m, 2H), 3.83 (dd, J = 8.5, 3.5 Hz, 1H), 3.39 (t, J = 8.0 Hz, 1H), 1.62-1.71 (m, 2H), 1.49-1.55 (m, 1H), 1.46 (s, 9H), 1.23 (s, 9H), 0.95 (d, J = 6.0 Hz, 6H).



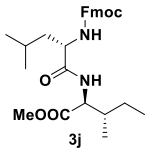
Dipeptide 3g[4]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (89.2 mg, 85% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, J = 8.0 Hz, 2H), 7.58 (d, J = 7.5 Hz, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.31 (t, J = 7.5 Hz, 2H), 6.26 (d, J = 7.5 Hz, 1H), 5.24 (d, J = 8.0 Hz, 1H), 4.46-4.50 (m, 1H), 4.36-4.43 (m, 2H), 4.21 (t, J = 7.0 Hz, 2H), 1.50-1.67 (m, 6H), 1.45 (s, 9H), 0.95 (s, 6H), 0.91 (dd, J = 6.0, 2.0 Hz, 6H).



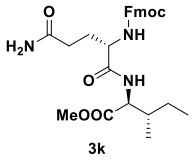
Dipeptide 3h[4]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (77.4 mg, 78% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, J = 7.5 Hz, 2H), 7.60 (d, J = 7.0 Hz, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.29-7.32 (m, 2H), 6.24 (d, J = 8.5 Hz, 1H), 5.44 (d, J = 8.5 Hz, 1H), 4.41-4.44 (m, 2H), 4.35-4.38 (m, 1H), 4.23 (t, J = 7.0 Hz, 1H), 4.04 (t, J = 7.5 Hz, 1H), 2.11-2.17 (m, 2H), 1.46 (s, 9H), 0.97 (t, J = 7.5 Hz, 6H), 0.91 (dd, J = 10.0, 7.0 Hz, 6H).



Dipeptide 3i[5]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (91.0 mg, 80% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, J = 7.5 Hz, 2H), 7.61 (d, J = 7.5 Hz, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.31 (t, J = 7.5 Hz, 2H), 7.16 (d, J = 8.0 Hz, 1H), 6.64 (d, J = 0.5 Hz, 1H), 5.96 (d, J = 7.5 Hz, 1H), 4.79 (dd, J = 14.0, 7.5 Hz, 1H), 4.68 (d, J = 4.5 Hz, 1H), 4.35-4.41 (m, 3H), 4.23-4.26 (m, 2H), 3.01 (dd, J = 14.0, 3.5 Hz, 1H), 2.73 (dd, J = 14.0, 7.5 Hz, 1H), 2.19-2.26 (m, 1H), 2.05 (s, 3H), 1.46 (s, 9H), 0.97 (t, J = 7.0 Hz, 6H).

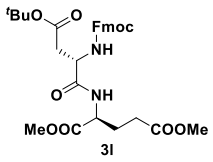


Dipeptide 3j: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (83.6 mg, 87% yield, >20:1 dr); m.p. 122-123 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.74 (d, J = 7.5 Hz, 2H), 7.57 (d, J = 6.5 Hz, 2H), 7.38 (t, J = 7.5 Hz, 2H), 7.28 (td, J = 7.5, 1.0 Hz, 2H), 6.71 (d, J = 8.5 Hz, 1H), 5.49 (d, J = 8.5 Hz, 1H), 4.58 (dd, J = 8.5, 5.0 Hz, 1H), 4.34-4.42 (m, 2H), 4.29-4.31 (m, 1H), 4.20 (t, J = 7.0 Hz, 1H), 3.70 (s, 3H), 1.88 (*br* s, 1H), 1.63-1.71 (m, 2H), 1.54-1.57 (m, 1H), 1.38-1.42 (m, 1H), 1.13-1.19 (m, 1H), 0.94 (s, 6H), 0.85-0.88 (m, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.2(2), 172.1(9), 156.3, 143.9, 143.8, 141.3, 127.8, 127.1, 125.1, 120.0(1), 119.9(9), 67.1, 56.5, 53.5, 52.1, 47.1, 41.5, 37.8, 25.2, 24.7, 22.9, 22.1, 15.4, 11.6; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{28}H_{36}N_2NaO_5^+$ 503.2516, found 503.2538.



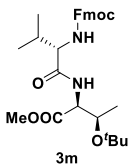
3k

Dipeptide 3k: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (84.2 mg, 85% yield, >20:1 dr); m.p. 206-207 °C; ^{1}H NMR (500 MHz, CD_3OD) δ 7.81 (d, J = 7.5 Hz, 2H), 7.68 (t, J = 7.5 Hz, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.32 (t, J = 7.5 Hz, 2H), 4.33-4.42 (m, 3H), 4.22-4.24 (m, 2H), 3.72 (s, 3H), 2.34 (t, J = 7.5 Hz, 2H), 2.04-2.11 (m, 1H), 1.88-1.96 (m, 2H), 1.46-1.51 (m, 1H), 1.23-1.38 (m, 2H), 0.90-0.94 (m, 6H); ^{13}C NMR (125 MHz, CD_3OD) δ 176.5, 173.1, 172.1, 157.0, 143.9, 143.8, 141.2, 127.4, 126.8, 124.9, 124.8, 119.5, 66.6, 56.9, 54.2, 51.1, 47.0, 37.0, 31.1, 27.7, 24.9, 14.6, 10.4; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{27}H_{34}N_3O_6^+$ 496.2442, found 496.2439.



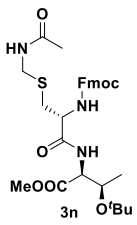
3l

Dipeptide 3l: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (100.2 mg, 88% yield, >20:1 dr); m.p. 105-106 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.77 (d, J = 7.5 Hz, 2H), 7.61 (d, J = 6.0 Hz, 2H), 7.41 (t, J = 7.5 Hz, 2H), 7.32 (t, J = 7.5 Hz, 2H), 7.20 (d, J = 7.0 Hz, 1H), 5.98 (d, J = 8.0 Hz, 1H), 4.56-4.62 (m, 2H), 4.40-4.46 (m, 2H), 4.25 (t, J = 7.0 Hz, 1H), 3.73 (s, 3H), 3.65 (s, 3H), 2.98 (dd, J = 17.5, 3.5 Hz, 1H), 2.60 (dd, J = 17.5, 6.0 Hz, 1H), 2.34-2.47 (m, 2H), 2.20-2.27 (m, 1H), 1.96-2.04 (m, 1H), 1.46 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.2, 171.7, 171.5, 170.6, 156.0, 143.9, 143.7, 141.3(3), 141.3(2), 127.8, 127.1, 125.1, 120.0, 82.0, 67.3, 52.6, 51.9, 51.8, 51.0, 47.1, 37.4, 29.9, 28.0, 27.2; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{30}H_{36}N_2NaO_9^+$ 591.2313, found 591.2323.

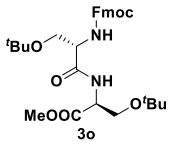


3m

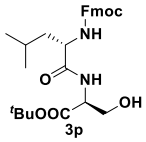
Dipeptide 3m: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (84.0 mg, 82% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, J = 7.5 Hz, 2H), 7.60 (d, J = 7.0 Hz, 2H), 7.39 (t, J = 7.3 Hz, 2H), 7.31 (t, J = 7.3 Hz, 2H), 6.41 (d, J = 9.0 Hz, 1H), 5.52 (d, J = 8.5 Hz, 1H), 4.49 (d, J = 9.0 Hz, 1H), 4.40-4.43 (m, 1H), 4.34-4.37 (m, 1H), 4.22-4.27 (m, 2H), 4.14-4.16 (m, 1H), 3.71 (s, 3H), 2.13-2.17 (m, 1H), 1.17 (d, J = 6.0 Hz, 3H), 1.11 (s, 9H), 1.02 (dd, J = 12.5, 7.0 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 171.5, 171.0, 156.3, 144.0, 143.9, 141.3, 127.7, 127.1, 125.1(9), 125.1(5), 120.0, 74.3, 67.2, 67.1, 60.1, 57.9, 52.2, 47.2, 31.9, 28.3, 21.1, 18.9, 17.8; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{29}H_{38}N_2NaO_6^+$ 533.2622, found 533.2609.



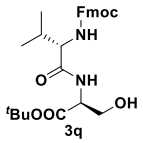
Dipeptide 3n: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (97.2 mg, 83% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, J = 7.5 Hz, 2H), 7.61 (dd, J = 7.5, 3.5 Hz, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.30-7.33 (m, 3H), 6.94 (*br* s, 1H), 6.05 (d, J = 7.0 Hz, 1H), 4.58-4.66 (m, 2H), 4.46 (d, J = 9.0 Hz, 1H), 4.39-4.42 (m, 2H), 4.34 (dd, J = 14.0, 5.5 Hz, 1H), 4.23-4.28 (m, 2H), 3.71 (s, 3H), 3.02 (dd, J = 14.5, 6.5 Hz, 1H), 2.85 (dd, J = 14.5, 5.0 Hz, 1H), 2.03 (s, 3H), 1.21 (d, J = 6.5 Hz, 3H), 1.13 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 171.1, 170.6, 156.4, 143.8, 143.7, 141.3(2), 141.3(0), 127.8, 127.1, 125.2, 120.0, 74.3, 67.4, 67.0, 58.4, 53.7, 52.3, 47.1, 40.6, 34.1, 28.3, 23.2, 21.3; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{30}H_{39}N_3NaO_7S^+$ 608.2401, found 608.2405.



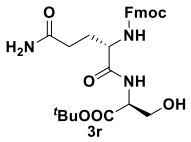
Dipeptide 3o: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (94.4 mg, 87% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, J = 7.5 Hz, 2H), 7.69 (d, J = 8.0 Hz, 1H), 7.60-7.62 (m, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.31 (t, J = 7.5 Hz, 2H), 5.85 (d, J = 3.5 Hz, 1H), 4.71-4.73 (m, 1H), 4.38 (d, J = 7.0 Hz, 2H), 4.30 (*br* s, 1H), 4.24 (t, J = 7.5 Hz, 1H), 3.85-3.87 (m, 1H), 3.80-3.82 (m, 1H), 3.74 (s, 3H), 3.56 (dd, J = 9.0, 3.0 Hz, 1H), 3.45 (t, J = 8.5 Hz, 1H), 1.26 (s, 9H), 1.14 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 170.5(3), 170.4(5), 156.0, 144.0, 143.8, 141.3(1), 141.3(0), 127.7, 127.1, 125.2, 120.0, 74.4, 73.5, 67.1, 62.0, 61.8, 54.0, 53.2, 52.3, 47.2, 27.4(1), 27.3(5); HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{30}H_{41}N_2O_7^+$ 541.2908, found 541.2900.



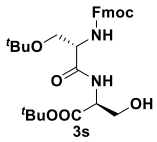
Dipeptide 3p: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (78.3 mg, 79% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.72 (dd, J = 7.5, 3.0 Hz, 2H), 7.55 (t, J = 7.0 Hz, 2H), 7.33-7.37 (m, 2H), 7.25 (td, J = 7.5, 2.0 Hz, 2H), 5.78 (*br* s, 1H), 4.52-4.54 (m, 1H), 4.37-4.41 (m, 1H), 4.27-4.34 (m, 2H), 4.15 (t, J = 7.0 Hz, 1H), 3.87 (s, 2H), 3.51 (*br* s, 1H), 2.34 (*br* s, 1H), 1.63-1.73 (m, 2H), 1.55-1.61 (m, 1H), 1.44 (s, 9H), 0.93 (t, J = 5.8 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.9, 169.3, 156.7, 143.9, 143.7, 141.3, 127.7, 127.0(9), 127.0(7), 125.1, 119.9(7), 119.9(5), 82.6, 67.2, 63.1, 55.4, 53.7, 47.1, 41.7, 28.0, 24.7, 23.0, 21.9; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{28}H_{36}N_2NaO_6^+$ 519.2466, found 519.2469.



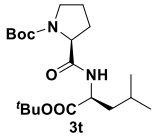
Dipeptide 3q: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (72.4 mg, 75% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.69-7.71 (m, 2H), 7.54 (t, J = 7.0 Hz, 2H), 7.31-7.36 (m, 3H), 7.23-7.25 (m, 2H), 6.01 (d, J = 8.5 Hz, 1H), 4.58-4.60 (m, 1H), 4.37-4.41 (m, 1H), 4.23-4.26 (m, 1H), 4.19 (t, J = 7.5 Hz, 1H), 4.14 (t, J = 7.5 Hz, 1H), 3.86 (d, J = 3.5 Hz, 2H), 2.08-2.14 (m, 1H), 1.43 (s, 10H), 0.98 (dd, J = 13.8, 6.8 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.0, 169.3, 157.0, 144.0, 143.7, 141.3, 127.7, 127.0(7), 127.0(6), 125.2, 125.1, 120.0, 119.9, 82.5, 67.3, 63.1, 60.4, 55.2, 47.1, 31.4, 28.0, 19.3, 18.1; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{27}H_{34}N_2NaO_6^+$ 505.2309, found 505.2306.



Dipeptide 3r: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (83.0 mg, 81% yield, >20:1 dr); ^{1}H NMR (500 MHz, CD_3OD) δ 7.81 (d, J = 7.5 Hz, 2H), 7.68 (t, J = 8.0 Hz, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.33 (t, J = 7.5 Hz, 2H), 4.38-4.42 (m, 3H), 4.22-4.25 (m, 2H), 3.90 (dd, J = 11.3, 4.8 Hz, 1H), 3.81 (dd, J = 11.0, 3.5 Hz, 1H), 2.36 (t, J = 7.5 Hz, 2H), 2.11-2.18 (m, 1H), 1.91-1.98 (m, 1H), 1.48 (s, 9H); ^{13}C NMR (125 MHz, CD_3OD) δ 176.5, 172.9, 169.4, 157.1, 143.9, 143.8, 141.2, 127.4, 126.8(1), 126.7(9), 124.9, 124.8, 119.5, 81.9, 66.7, 61.5, 55.5, 54.5, 47.0, 31.2, 27.9, 26.9; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{27}H_{34}N_3O_7^+$ 512.2391, found 512.2386.

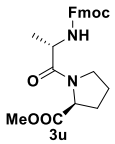


Dipeptide 3s: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (84.1 mg, 80% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, J = 7.5 Hz, 2H), 7.60-7.62 (m, 2H), 7.57 (d, J = 4.5 Hz, 1H), 7.40 (t, J = 7.5 Hz, 2H), 7.32 (t, J = 7.5 Hz, 2H), 5.75 (d, J = 3.0 Hz, 1H), 4.49-4.52 (m, 1H), 4.40 (d, J = 6.0 Hz, 2H), 4.31 (*br* s, 1H), 4.24 (t, J = 7.0 Hz, 1H), 3.96-3.98 (m, 1H), 3.88-3.91 (m, 1H), 3.83-3.84 (m, 1H), 3.43-3.46 (m, 1H), 2.57 (*br* s, 1H), 1.48 (s, 9H), 1.22 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 170.8, 169.0, 156.1, 143.9, 143.7, 141.3, 127.7, 127.1, 125.2, 120.0, 82.9, 74.4, 67.3, 63.6, 61.9, 55.8, 54.7, 47.1, 28.0, 27.4; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{29}H_{39}N_2O_7^+$ 527.2752, found 527.2750.

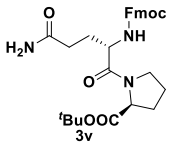


Dipeptide 3t[3]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (66.2 mg, 86% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.53-7.28 (m, 1H),

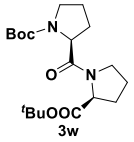
4.23-4.50 (m, 2H), 3.34-3.48 (m, 2H), 1.88-2.33 (m, 4H), 1.57-1.65 (m, 2H), 1.46-1.52 (m, 19H), 0.94 (d, J = 5.0 Hz, 6H).



Dipeptide 3u[1]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (71.0 mg, 84% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.75 (d, J = 7.5 Hz, 2H), 7.59 (dd, J = 7.5, 3.5 Hz, 2H), 7.38 (t, J = 7.5 Hz, 2H), 7.30 (t, J = 7.5 Hz, 2H), 5.78-5.79 (m, 1H), 4.51-4.57 (m, 2H), 4.34 (d, J = 7.5 Hz, 2H), 4.20 (t, J = 7.5 Hz, 1H), 3.67-3.73 (m, 4H), 3.59-3.64 (m, 1H), 2.18-2.24 (m, 1H), 1.96-2.09 (m, 3H), 1.41 (d, J = 7.0 Hz, 3H).

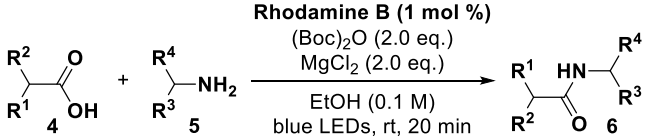


Dipeptide 3v: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (82.6 mg, 79% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.73 (d, J = 7.5 Hz, 2H), 7.58 (t, J = 7.0 Hz, 2H), 7.37 (td, J = 7.5, 2.5 Hz, 2H), 7.28-7.31 (m, 2H), 6.46 (*br* s, 1H), 6.14 (d, J = 8.0 Hz, 1H), 5.96 (*br* s, 1H), 4.54-4.58 (m, 1H), 4.40 (dd, J = 8.5, 4.5 Hz, 1H), 4.32-4.34 (m, 2H), 4.18 (t, J = 7.0 Hz, 1H), 3.69 (t, J = 6.5 Hz, 2H), 2.28-2.37 (m, 2H), 2.14-2.24 (m, 2H), 1.89-2.02 (m, 4H), 1.45 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 175.2, 171.3, 170.2, 156.5, 143.9, 143.7, 141.2(9), 141.2(6), 127.7, 127.1, 125.2, 119.9(8), 119.9(6), 81.7, 67.1, 59.8, 51.5, 47.1, 31.2, 29.1, 29.0, 28.0, 27.8, 24.9; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{29}H_{36}N_3O_6^+$ 522.2599, found 522.2588.

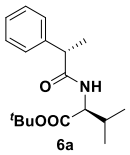


Dipeptide 3w: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (58.9 mg, 80% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 4.38-4.51 (m, 2H), 3.56-3.76 (m, 3H), 3.36-3.47 (m, 1H), 1.82-2.22 (m, 8H), 1.39-1.45 (m, 18H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 171.6, 171.3, 170.8, 154.5, 153.7, 81.1, 80.9, 79.4, 79.3, 59.5, 57.7(2), 57.6(8), 46.8, 46.6, 46.5, 46.4, 30.0, 29.1, 28.9, 28.8, 28.5, 28.3, 27.9, 24.9, 24.8, 24.0, 23.5; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{19}H_{33}N_2O_5^+$ 369.2384, found 369.2371.

2.3. General procedure for the synthesis of chiral amides 6

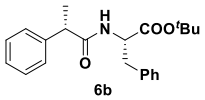


Chiral carboxylic acids **4** (0.2 mmol, 1.0 equiv.), chiral amines **5** (0.24 mmol, 1.2 equiv.), rhodamine B (1 mol %), $(Boc)_2O$ (0.4 mmol, 2.0 equiv.) and $MgCl_2$ (0.4 mmol, 2.0 equiv.) were well mixed in ethanol (2.0 mL). The resulting mixture was stirred at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). The reaction mixture was concentrated under reduced pressure and purified by flash column chromatography on silica gel (EtOAc/PE = 20%-40%) to yield chiral amides **6**.



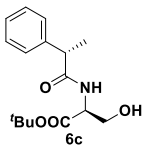
6a

Chiral amide 6a: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (53.9 mg, 88% yield, >20:1 dr); m.p. 53-54 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.32-7.37 (m, 4H), 7.25-7.29 (m, 1H), 5.86 (d, J = 8.5 Hz, 1H), 4.39 (dd, J = 8.5, 4.5 Hz, 1H), 3.63 (q, J = 7.0 Hz, 1H), 2.05-2.12 (m, 1H), 1.55 (d, J = 7.0 Hz, 3H), 1.39 (s, 9H), 0.87 (d, J = 7.0 Hz, 3H), 0.79 (d, J = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 174.0, 170.7, 140.9, 128.9, 127.7, 127.3, 81.8, 57.4, 47.2, 31.4, 28.0, 18.8, 18.4, 17.6; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{28}NO_3^+$ 306.2064, found 306.2051.



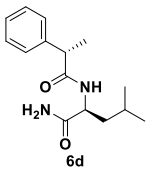
6b

Chiral amide 6b[5]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (62.9 mg, 89% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31-7.34 (m, 2H), 7.25-7.28 (m, 3H), 7.20-7.21 (m, 3H), 6.98-7.00 (m, 2H), 5.80 (d, J = 7.5 Hz, 1H), 4.66-4.70 (m, 1H), 3.55 (q, J = 7.5 Hz, 1H), 2.98-3.07 (m, 2H), 1.52 (d, J = 7.5 Hz, 3H), 1.35 (s, 9H).



6c

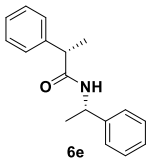
Chiral amide 6c: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (46.8 mg, 80% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31-7.36 (m, 4H), 7.25-7.28 (m, 1H), 6.43 (d, J = 6.5 Hz, 1H), 4.46-4.49 (m, 1H), 3.86 (s, 2H), 3.63 (q, J = 7.0 Hz, 1H), 3.04 (*br* s, 1H), 1.53 (d, J = 7.0 Hz, 3H), 1.40 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 174.7, 169.2, 140.9, 128.9, 127.6, 127.4, 82.8, 63.9, 55.6, 47.0, 27.9, 18.6; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{16}H_{23}NNaO_4^+$ 316.1519, found 316.1535.



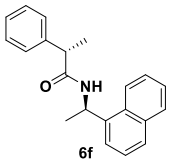
6d

Chiral amide 6d: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (44.1 mg, 84% yield, >20:1 dr); ^{1}H NMR (500 MHz, CD_3OD) δ 7.23-7.25 (m, 2H), 7.16-7.19 (m, 2H), 7.08-7.12 (m, 1H), 4.31 (dd, J = 9.3, 5.8 Hz, 1H), 3.62

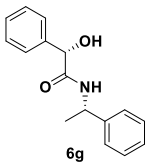
(q, J = 7.0 Hz, 1H), 1.51-1.59 (m, 1H), 1.45-1.49 (m, 2H), 1.34 (d, J = 7.0 Hz, 3H), 0.84 (d, J = 6.5 Hz, 3H), 0.82 (d, J = 6.5 Hz, 3H); ^{13}C NMR (125 MHz, CD_3OD) δ 176.0, 175.6, 141.3, 128.2, 127.1, 126.6, 51.4, 45.8, 40.7, 24.6, 22.1, 20.6, 17.5; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{15}H_{23}N_2O_2^+$ 263.1754, found 263.1730.



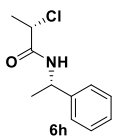
Chiral amide 6e: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (41.7 mg, 82% yield, >20:1 dr); m.p. 131-132 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30-7.33 (m, 2H), 7.22-7.27 (m, 5H), 7.17-7.21 (m, 1H), 7.07-7.09 (m, 2H), 5.60 (d, J = 7.0 Hz, 1H), 5.05-5.11 (m, 1H), 3.57 (q, J = 7.0 Hz, 1H), 1.51 (d, J = 7.0 Hz, 3H), 1.39 (d, J = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.2, 143.3, 141.4, 128.9, 128.5, 127.7, 127.3, 127.1, 125.8, 48.7, 47.1, 21.9, 18.5; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{17}H_{19}NNaO^+$ 276.1359, found 276.1357.



Chiral amide 6f: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (52.7 mg, 87% yield, >20:1 dr); m.p. 164-165 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.03 (d, J = 8.0 Hz, 1H), 7.82-7.84 (m, 1H), 7.74 (d, J = 8.0 Hz, 1H), 7.45-7.51 (m, 2H), 7.28-7.39 (m, 4H), 7.22-7.26 (m, 3H), 5.82-5.88 (m, 1H), 5.74 (d, J = 8.0 Hz, 1H), 3.44 (q, J = 7.0 Hz, 1H), 1.48 (d, J = 6.5 Hz, 3H), 1.46 (d, J = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.0, 141.6, 138.4, 133.9, 131.1, 128.9, 128.8, 128.3, 127.6, 127.2, 126.5, 125.9, 125.2, 123.5, 122.5, 47.0, 44.8, 20.5, 18.7; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{22}NO^+$ 304.1696, found 304.1705.

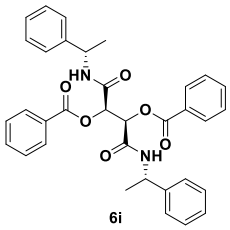


Chiral amide 6g: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (39.4 mg, 77% yield, >20:1 dr); m.p. 104-105 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30-7.36 (m, 5H), 7.22-7.29 (m, 3H), 7.14-7.16 (m, 2H), 6.60 (d, J = 8.0 Hz, 1H), 5.00-5.06 (m, 1H), 4.91 (d, J = 2.5 Hz, 1H), 3.86 (d, J = 3.0 Hz, 1H), 1.42 (d, J = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 171.4, 142.8, 139.6, 128.8, 128.7, 128.6, 127.4, 126.8, 125.9, 74.1, 48.9, 21.9; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{16}H_{18}NO_2^+$ 256.1332, found 256.1325.



Chiral amide 6h: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); Colorless oil (35.0 mg, 83% yield, >20:1 dr); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.27-7.37 (m, 5H), 6.79

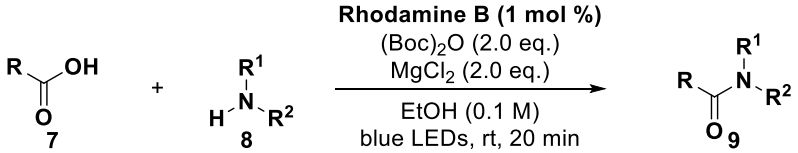
(d, J = 2.5 Hz, 1H), 5.06-5.12 (m, 1H), 4.40 (q, J = 7.0 Hz, 1H), 1.76 (d, J = 7.0 Hz, 3H), 1.53 (d, J = 7.0 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 168.6, 142.5, 128.8, 127.6, 126.1, 56.0, 49.3, 22.7, 21.7; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{11}H_{14}ClNNaO^+$ 234.0656, found 234.0660.



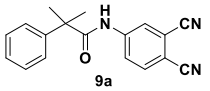
6i

Chiral amide 6i: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-40% (v/v); White solid (95.2 mg, 84% yield, >20:1 dr); m.p. 208-209 °C; ^{1}H NMR (500 MHz, Acetone-d_6) δ 8.01 (d, J = 8.0 Hz, 2H), 7.95-7.97 (m, 4H), 7.52-7.56 (m, 2H), 7.36-7.39 (m, 4H), 7.11-7.12 (m, 4H), 6.88-6.96 (m, 6H), 5.93 (s, 2H), 4.92-4.98 (m, 2H), 1.22 (d, J = 7.0 Hz, 6H); ^{13}C NMR (125 MHz, Acetone-d_6) δ 165.2, 165.1, 143.6, 133.5, 130.0, 129.7, 128.5, 128.1, 126.6, 126.0, 73.7, 48.6, 21.1; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{34}H_{33}N_2O_6^+$ 565.2333, found 565.2336.

2.4. General procedure for the synthesis of racemic amides 9

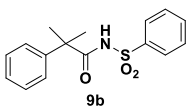


Hindered carboxylic acid **7** (0.2 mmol, 1.0 equiv.), amines **8** (0.24 mmol, 1.2 equiv.), rhodamine B (1 mol %), $(Boc)_2O$ (0.4 mmol, 2.0 equiv.) and $MgCl_2$ (0.4 mmol, 2.0 equiv.) were well mixed in ethanol (2.0 mL). The resulting mixture was stirred at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). The reaction mixture was concentrated under reduced pressure and purified by flash column chromatography on silica gel (EtOAc/PE = 30%-50%) to yield amides **9**.



9a

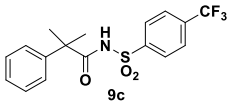
Racemic amide 9a[5]: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 30%-50% (v/v); White solid (39.9 mg, 69% yield); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.98 (s, 1H), 7.65-7.68 (m, 2H), 7.39-7.46 (m, 4H), 7.35-7.38 (m, 1H), 7.09 (s, 1H), 1.68 (s, 6H).



9b

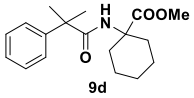
Racemic amide 9b: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 30%-50% (v/v); Colorless oil (37.7 mg, 62% yield); ^{1}H NMR (500 MHz, Acetone-d_6) δ 7.77-7.79 (m, 2H), 7.38-7.41 (m, 1H), 7.30-7.34 (m, 4H), 7.14-7.17 (m, 2H), 7.07-7.10 (m, 1H), 2.89 (s, 1H), 1.43 (s, 6H); ^{13}C NMR (125 MHz, Acetone-d_6) δ 183.9, 148.7, 146.3,

129.9, 127.7, 127.5, 126.0(9), 126.0(8), 125.1, 48.2, 27.3; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{16}H_{17}NNaO_3S^+$ 326.0821, found 326.0835.



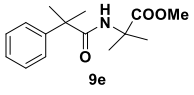
9c

Racemic amide 9c: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 30%-50% (v/v); Colorless oil (44.5 mg, 60% yield); ^{1}H NMR (500 MHz, Acetone-d_6) δ 7.95 (d, J = 8.0 Hz, 2H), 7.62 (d, J = 8.0 Hz, 2H), 7.26-7.29 (m, 2H), 7.13-7.16 (m, 2H), 7.07-7.11 (m, 1H), 2.95 (d, J = 14.0 Hz, 1H), 1.44 (s, 6H); ^{13}C NMR (125 MHz, Acetone-d_6) δ 184.3, 149.8, 148.3, 131.0 (q, $^1J_{C\text{-}F}$ = 32.5 Hz), 127.5, 127.0, 126.0, 125.2, 124.8 (q, $^2J_{C\text{-}F}$ = 3.8 Hz), 48.2, 27.0; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{17}H_{17}F_3NO_3S^+$ 372.0876, found 372.0883.



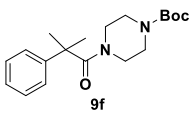
9d

Racemic amide 9d: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 30%-50% (v/v); Colorless oil (34.7 mg, 57% yield); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.43-7.45 (m, 2H), 7.37-7.40 (m, 2H), 7.28-7.31 (m, 1H), 5.21 (s, 1H), 3.70 (s, 3H), 1.91 (d, J = 13.5 Hz, 2H), 1.71 (td, J = 13.0, 3.5 Hz, 2H), 1.58 (s, 6H), 1.47-1.55 (m, 3H), 1.14-1.20 (m, 1H), 0.99-1.07 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 176.6, 174.5, 145.1, 128.7, 127.1, 126.5, 58.5, 52.1, 47.1, 32.1, 26.8, 25.1, 21.4; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{18}H_{26}NO_3^+$ 304.1907, found 304.1903.



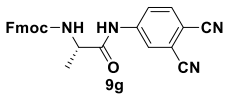
9e

Racemic amide 9e: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 30%-50% (v/v); Colorless oil (31.6 mg, 60% yield); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.35-7.40 (m, 4H), 7.26-7.29 (m, 1H), 5.65 (s, 1H), 3.70 (s, 3H), 1.55 (s, 6H), 1.43 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 176.7, 174.9, 145.1, 128.7, 127.0, 126.3, 56.3, 52.5, 47.0, 27.0, 24.7; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{15}H_{21}NNaO_3^+$ 286.1414, found 286.1403.



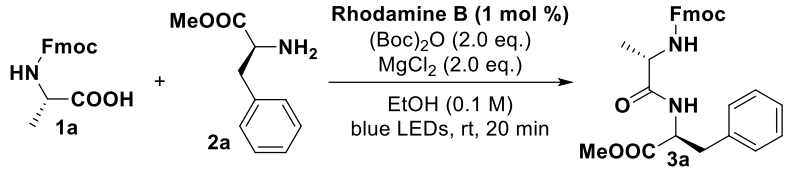
9f

Racemic amide 9f: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 30%-50% (v/v); Colorless oil (36.6 mg, 55% yield); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33-7.36 (m, 2H), 7.22-7.24 (m, 3H), 2.97-3.59 (m, 8H), 1.54 (s, 6H), 1.41 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 175.1, 154.5, 146.1, 129.0, 126.6, 124.8, 80.1, 47.0, 46.0, 42.6, 28.3(4), 28.3(3); HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{19}H_{28}N_2NaO_3^+$ 355.1992, found 355.2016.



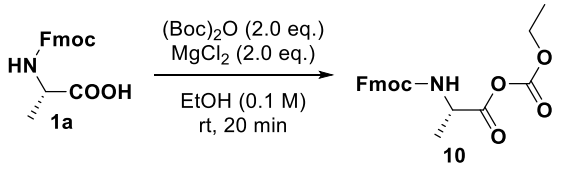
Amide 9g: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 30%-40% (v/v); White solid (67.9 mg, 78% yield); m.p. 204-205 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.75-8.77 (m, 1H), 8.48 (*br* s, 1H), 8.37 (dd, J = 8.5, 2.0 Hz, 1H), 8.28 (d, J = 8.5 Hz, 1H), 7.45 (d, J = 7.5 Hz, 2H), 7.29 (dd, J = 7.5, 2.5 Hz, 2H), 7.09 (t, J = 7.5 Hz, 2H), 7.00 (t, J = 7.5 Hz, 2H), 5.74 (d, J = 8.0 Hz, 1H), 4.83-4.87 (m, 1H), 4.34 (d, J = 7.5 Hz, 2H), 4.21 (t, J = 7.5 Hz, 1H), 1.42 (d, J = 6.5 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 176.4, 155.9, 143.8, 143.3, 142.6, 135.6, 134.3, 129.3, 127.9, 126.3, 123.5, 122.9, 120.0, 116.7, 115.5, 115.2, 109.6, 58.8, 52.3, 48.5, 26.8; HRMS (FTMS-ESI) m/z: $[M+Na]^+$ calcd for $C_{26}H_{20}N_4NaO_3^+$ 459.1428, found 459.1439.

2.5. Synthetic procedure of 5 mmol scale model reaction



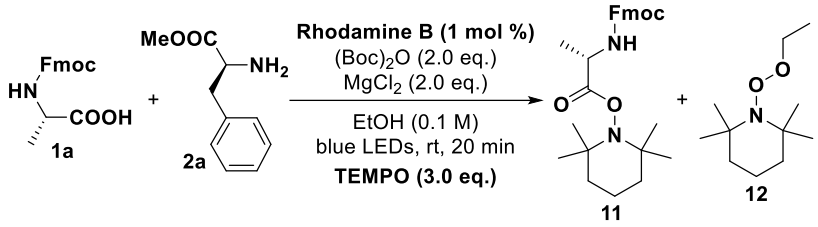
N-protected amino acid **1a** (1.56 g, 5.0 mmol, 1.0 equiv.), amino acid ester **2a** (1.08 g, 6.0 mmol, 1.2 equiv.), rhodamine B (24.0 mg, 0.05 mmol, 1 mol %), $(Boc)_2O$ (2.18 g, 10.0 mmol, 2.0 equiv.) and $MgCl_2$ (0.95 g, 10.0 mmol, 2.0 equiv.) were well mixed in ethanol (50.0 mL). The resulting mixture was stirred at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). The reaction mixture was concentrated under reduced pressure and purified by flash column chromatography on silica gel (EtOAc/PE = 20%-40%) to yield dipeptide **3a** in 85% yield (2.01 g, white solid) with >20:1 dr.

2.6. Mechanistic experiments



N-protected amino acid **1a** (0.2 mmol, 1.0 equiv.), $(Boc)_2O$ (0.4 mmol, 2.0 equiv.) and $MgCl_2$ (0.4 mmol, 2.0 equiv.) were well mixed in ethanol (2.0 mL). The resulting mixture was stirred at room temperature for 20 min. The reaction mixture was concentrated under reduced pressure and purified by flash column chromatography on silica gel (EtOAc/PE = 20%-30%) to yield anhydride **10** (65.9 mg, 86% yield) as

colorless oil.



N-protected amino acid **1a** (0.2 mmol, 1.0 equiv.), amino acid ester **2a** (0.24 mmol, 1.2 equiv.), rhodamine B (1 mol %), $(Boc)_2O$ (0.4 mmol, 2.0 equiv.), $MgCl_2$ (0.4 mmol, 2.0 equiv.) and TEMPO (0.6 mmol, 3.0 equiv.) were well mixed in ethanol (2.0 mL). The resulting mixture was stirred at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). The reaction mixture was concentrated under reduced pressure and purified by flash column chromatography on silica gel (EtOAc/PE = 20%-30%) to yield corresponding product. No desired product was formed and the corresponding radical-trapping product **11** (69.1 mg, 77% yield) was isolated and detected by NMR and HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{27}H_{35}N_2O_4^+$ 451.2591, found 451.2568 (Figure S1); and **12** was detected by HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{11}H_{24}NO_2^+$ 202.1802, found 202.1795 (Figure S2).

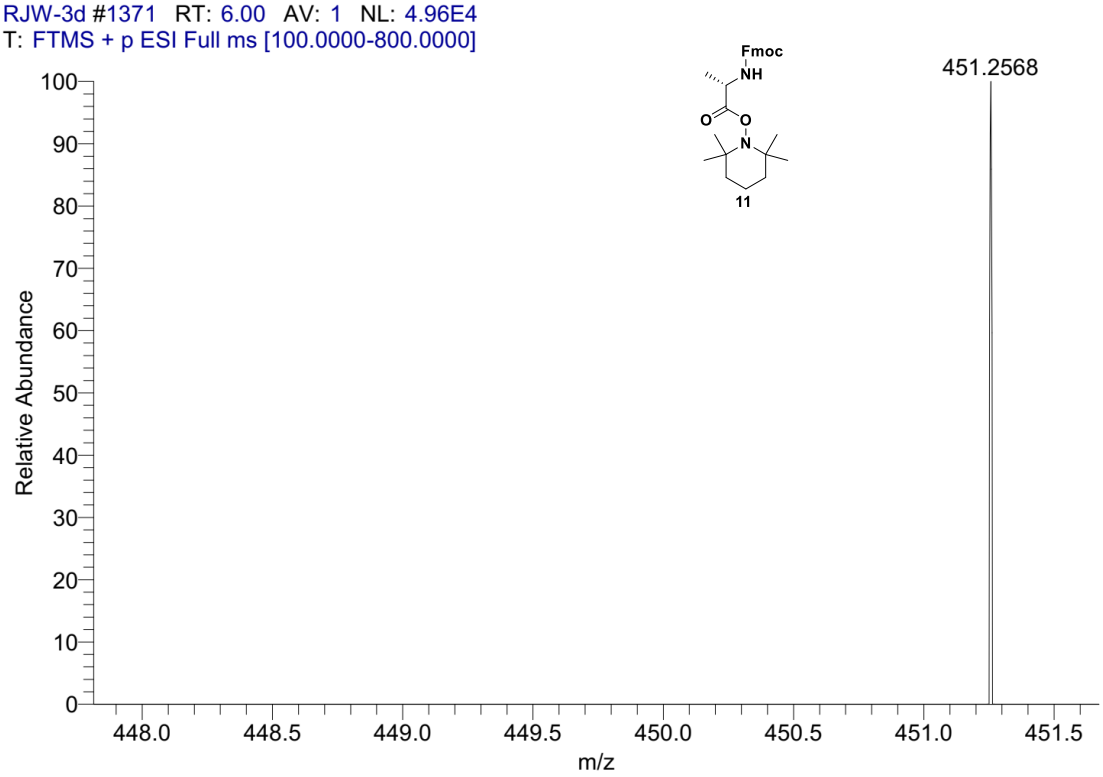


Figure S1. High-resolution mass spectrometry of radical-trapping product **11**

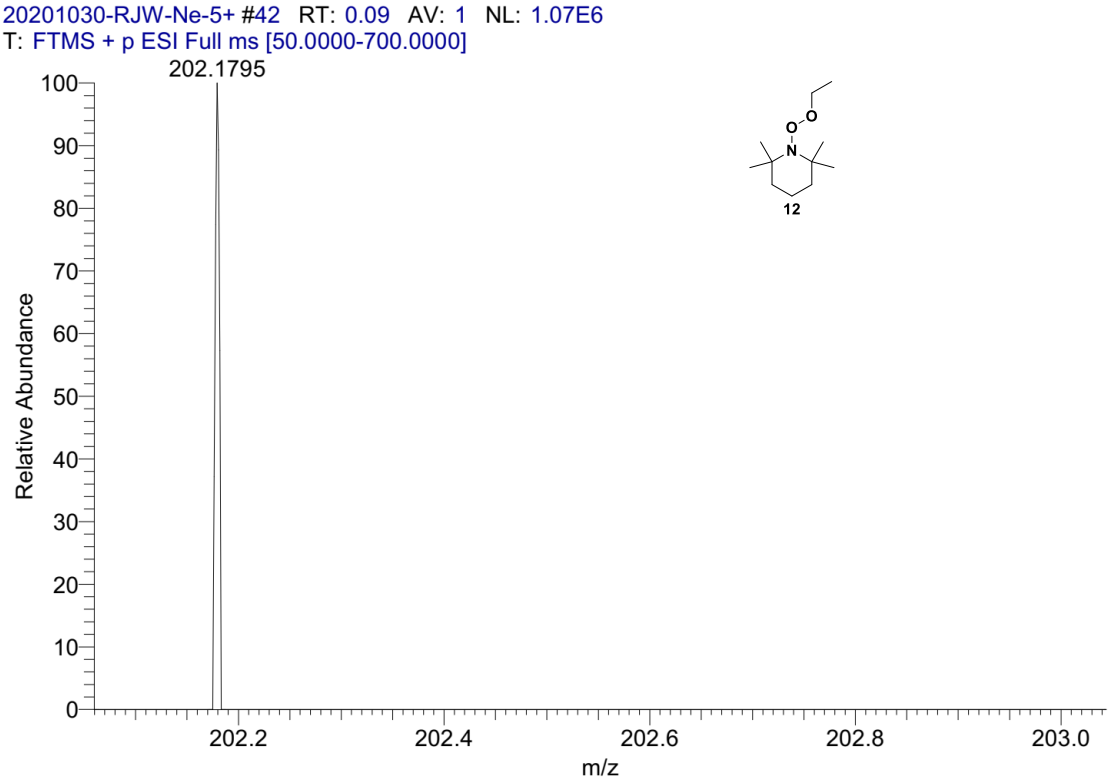
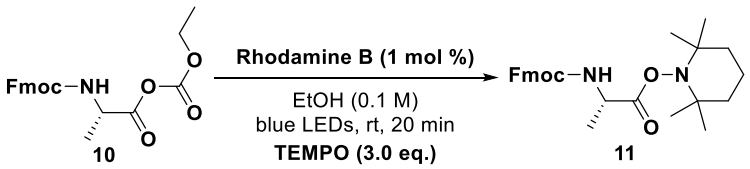
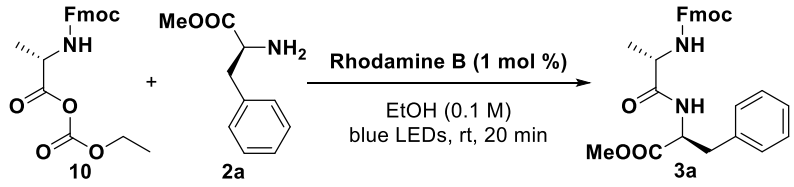


Figure S2. High-resolution mass spectrometry of radical-trapping product **12**

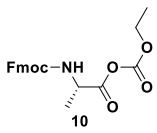


Anhydride **10** (0.2 mmol, 1.0 equiv.), rhodamine B (1 mol %), and TEMPO (0.6 mmol, 3.0 equiv.) were well mixed in ethanol (2.0 mL). The resulting mixture was stirred at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). The reaction mixture was concentrated under reduced pressure and purified by flash column chromatography on silica gel (EtOAc/PE = 20%-30%) to yield corresponding radical-trapping product **11** (65.9 mg, 73% yield).

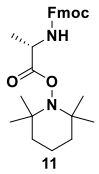


Anhydride **10** (0.2 mmol, 1.0 equiv.), amino acid ester **2a** (0.24 mmol, 1.2 equiv.) and rhodamine B (1 mol %) were well mixed in ethanol (2.0 mL). The resulting mixture was stirred at room temperature for 20 min under the irradiation of 440 nm blue LEDs (10 W). The reaction mixture was concentrated under reduced pressure and purified by flash column chromatography on silica gel (EtOAc/PE = 20%-40%) to yield dipeptide

3a (70.9 mg, 75% yield).



Anhydride 10: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-30% (v/v); Colorless oil (65.9 mg, 86% yield); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.75 (d, J = 7.5 Hz, 2H), 7.58-7.61 (m, 2H), 7.39 (t, J = 7.5 Hz, 2H), 7.30 (td, J = 7.5, 0.5 Hz, 2H), 5.42 (d, J = 7.5 Hz, 1H), 4.34-4.42 (m, 3H), 4.18-4.23 (m, 3H), 1.42 (d, J = 7.0 Hz, 3H), 1.27 (t, J = 7.5 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.1, 155.7, 144.0, 143.8, 141.3, 127.7, 127.1, 125.2, 125.1, 120.0, 67.0, 61.6, 49.7, 47.2, 18.8, 14.2; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{21}H_{22}NO_6^+$ 384.1442, found 384.1438.



Radical-trapping product 11: Purified by flash chromatography on silica gel, eluting with ethyl acetate/petroleum ether 20%-30% (v/v); Colorless oil (69.1 mg, 77% yield); ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (d, J = 7.5 Hz, 2H), 7.59-7.61 (m, 2H), 7.40 (t, J = 7.5 Hz, 2H), 7.31 (t, J = 7.5 Hz, 2H), 5.56 (d, J = 6.5 Hz, 1H), 5.52 (d, J = 6.5 Hz, 1H), 5.40 (d, J = 7.5 Hz, 1H), 4.35-4.45 (m, 3H), 4.22 (t, J = 7.0 Hz, 1H), 1.43-1.50 (m, 7H), 1.16 (s, 6H), 1.09 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.3, 155.6, 143.9, 143.8, 141.3, 127.7, 127.1, 125.1, 120.0, 95.1, 67.0, 59.9, 59.8, 49.8, 47.2, 39.7, 33.3(0), 33.2(5), 20.2, 18.7, 17.1; HRMS (FTMS-ESI) m/z: $[M+H]^+$ calcd for $C_{27}H_{35}N_2O_4^+$ 451.2591, found 451.2568.

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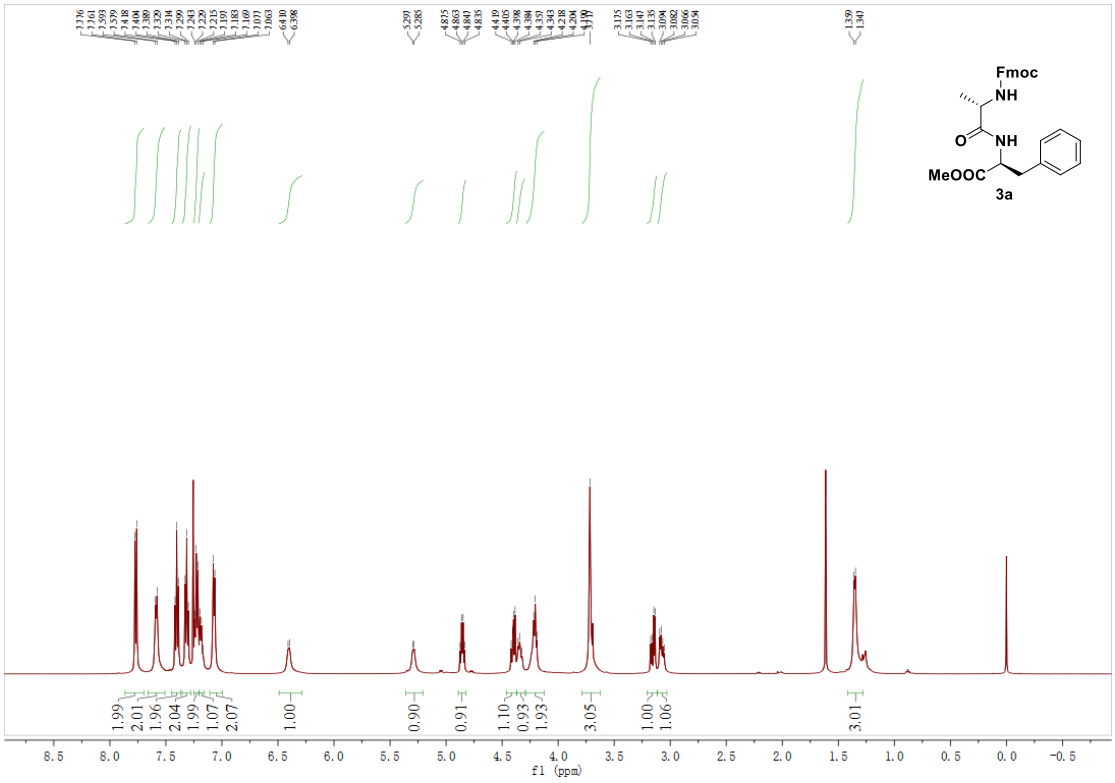
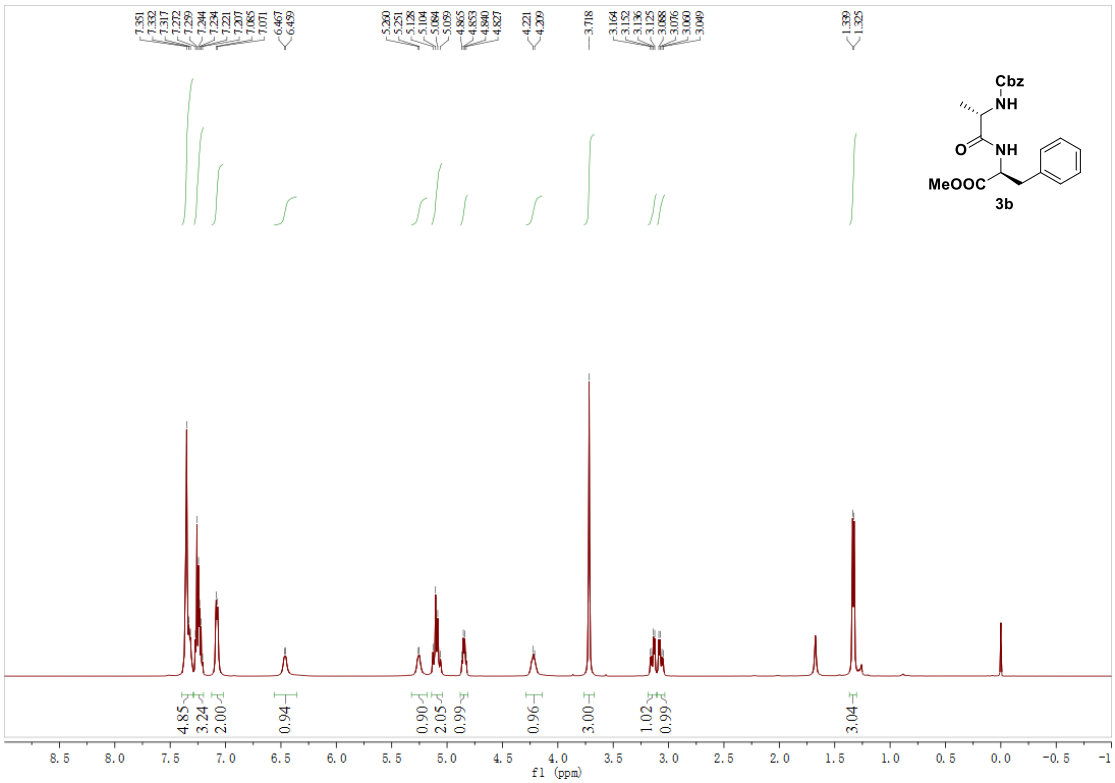
3. NMR Spectra

500 MHz, $CDCl_3$, ^1H NMR



500 MHz, $CDCl_3$, ^1H NMR



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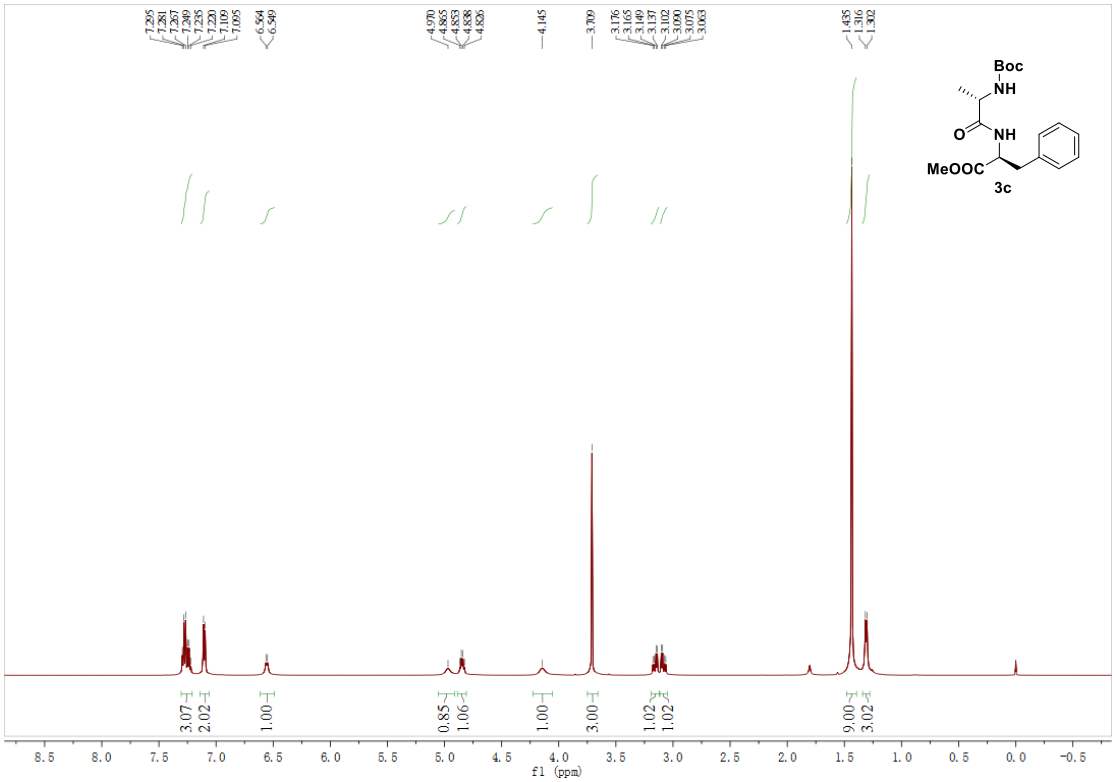

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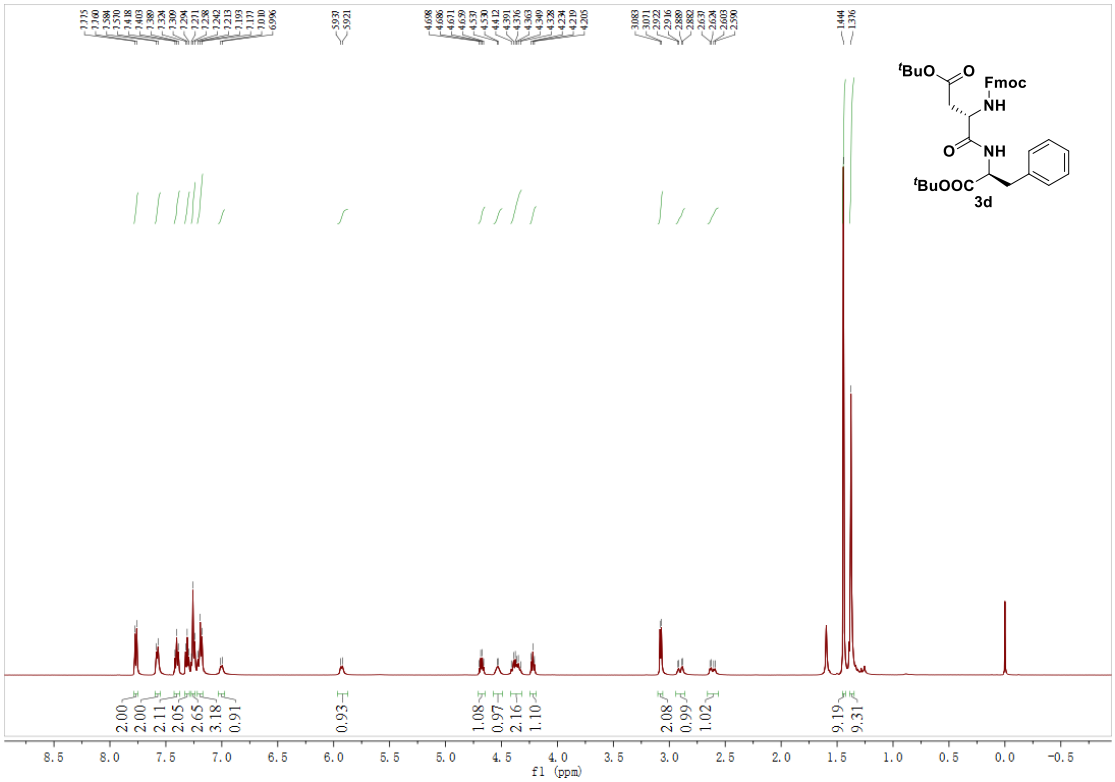

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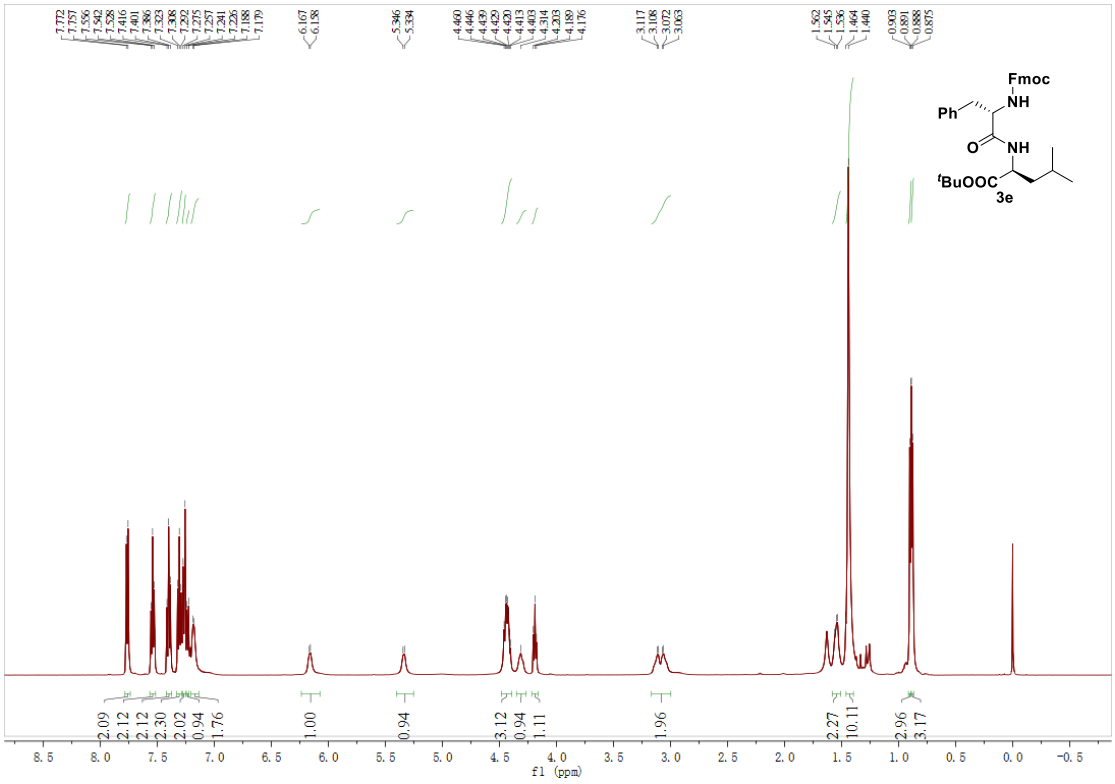

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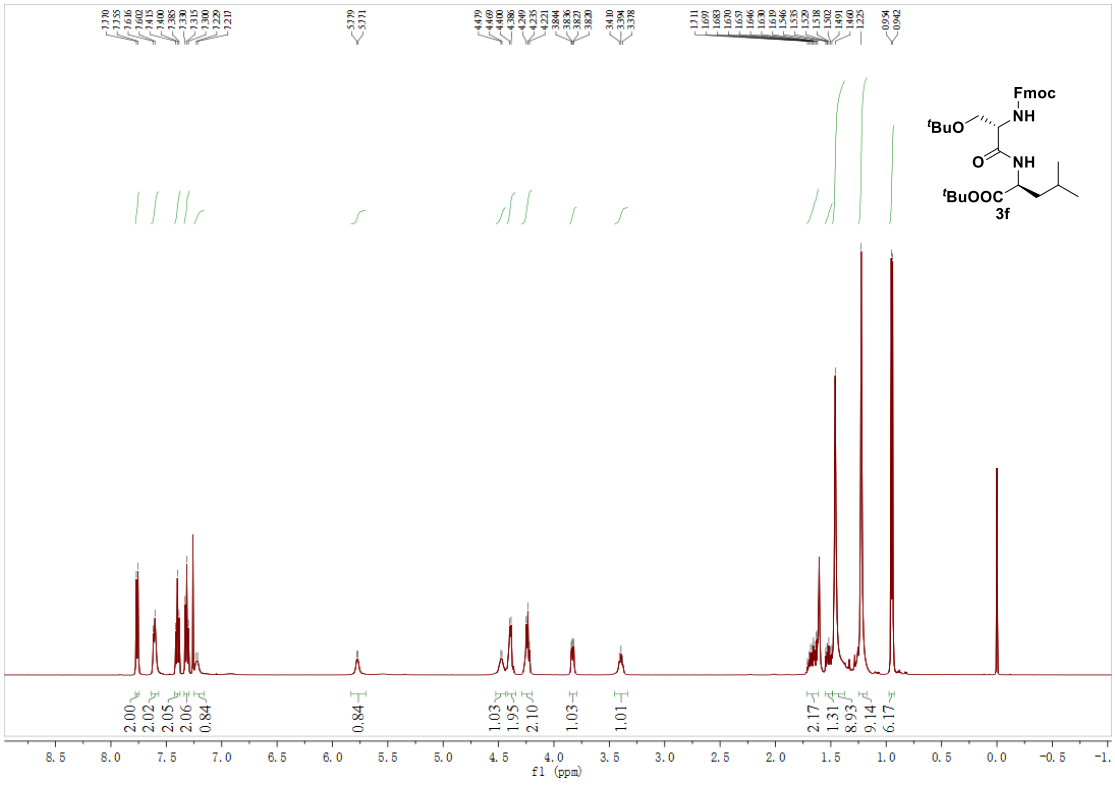

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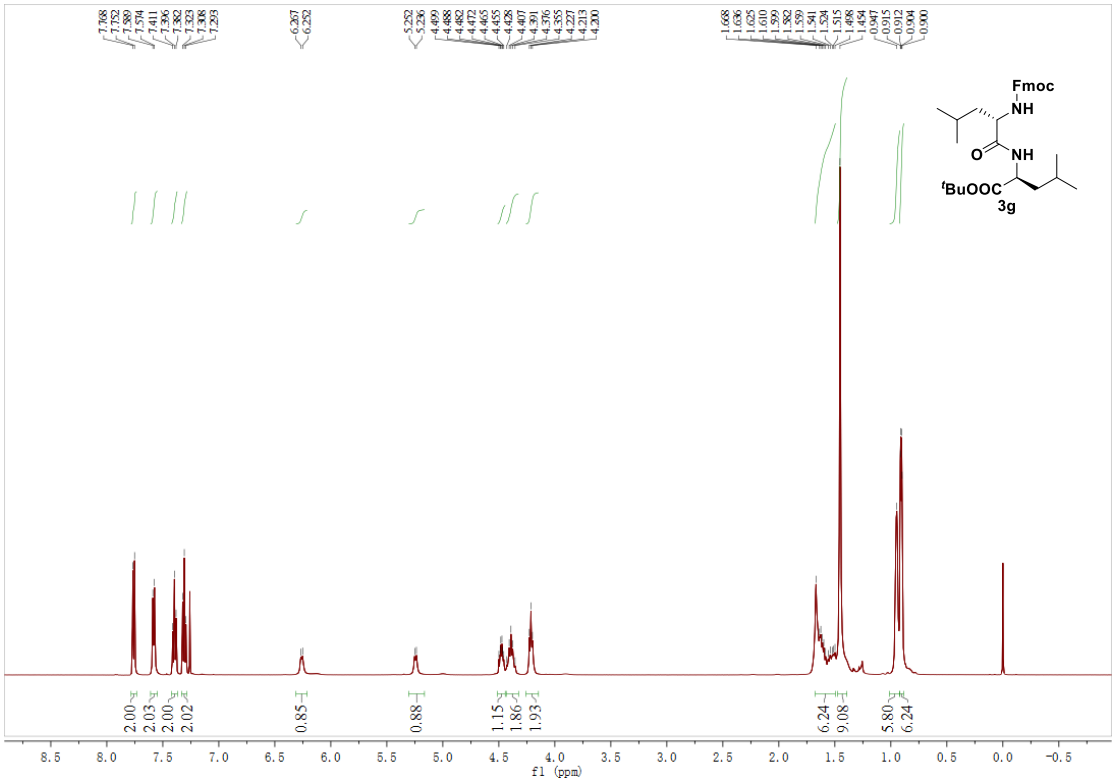
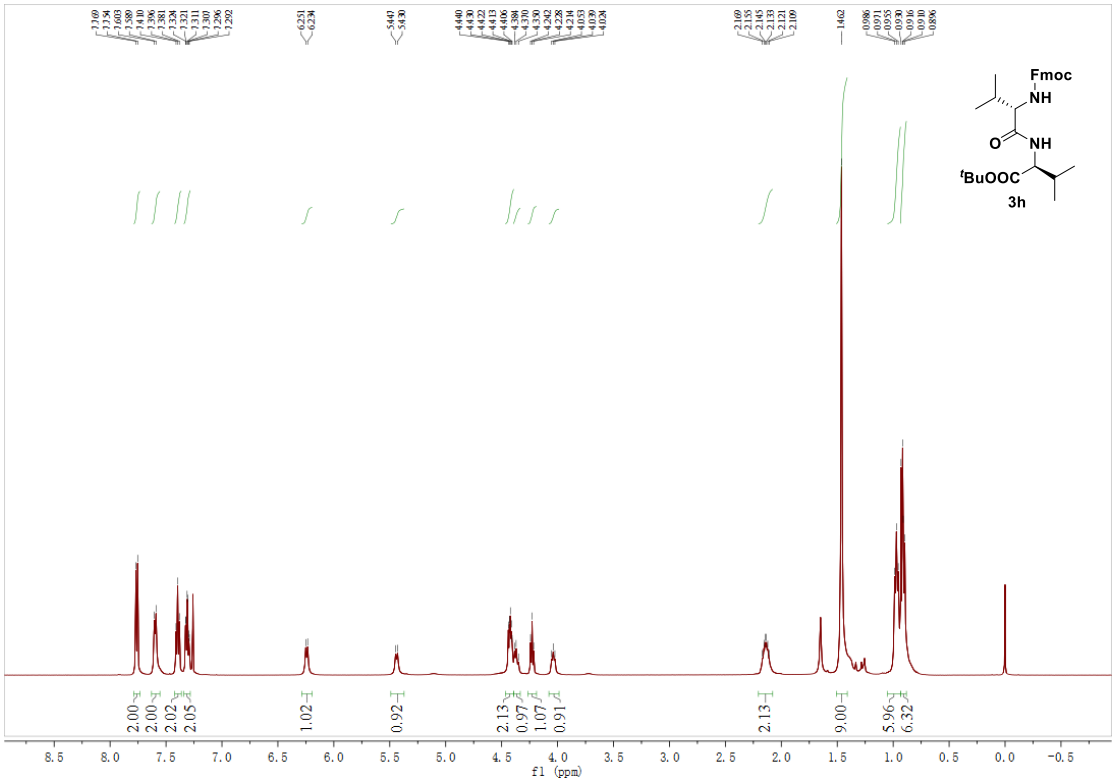


500 MHz, $CDCl_3$, ^1H NMR



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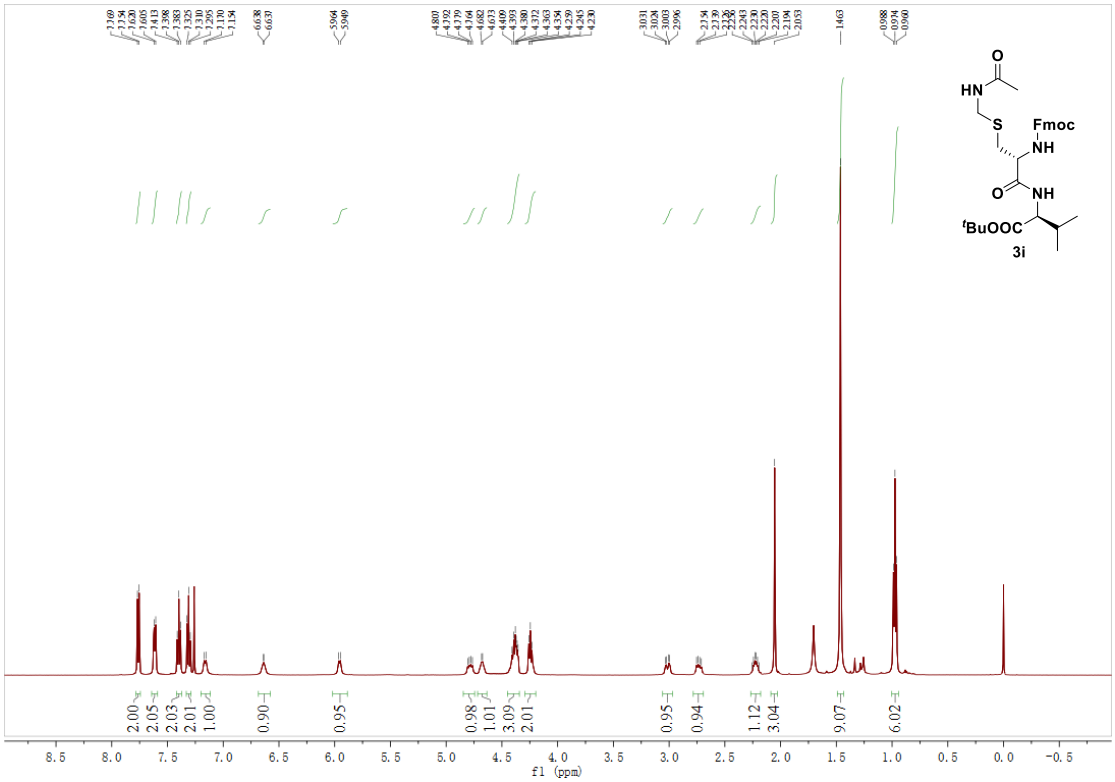
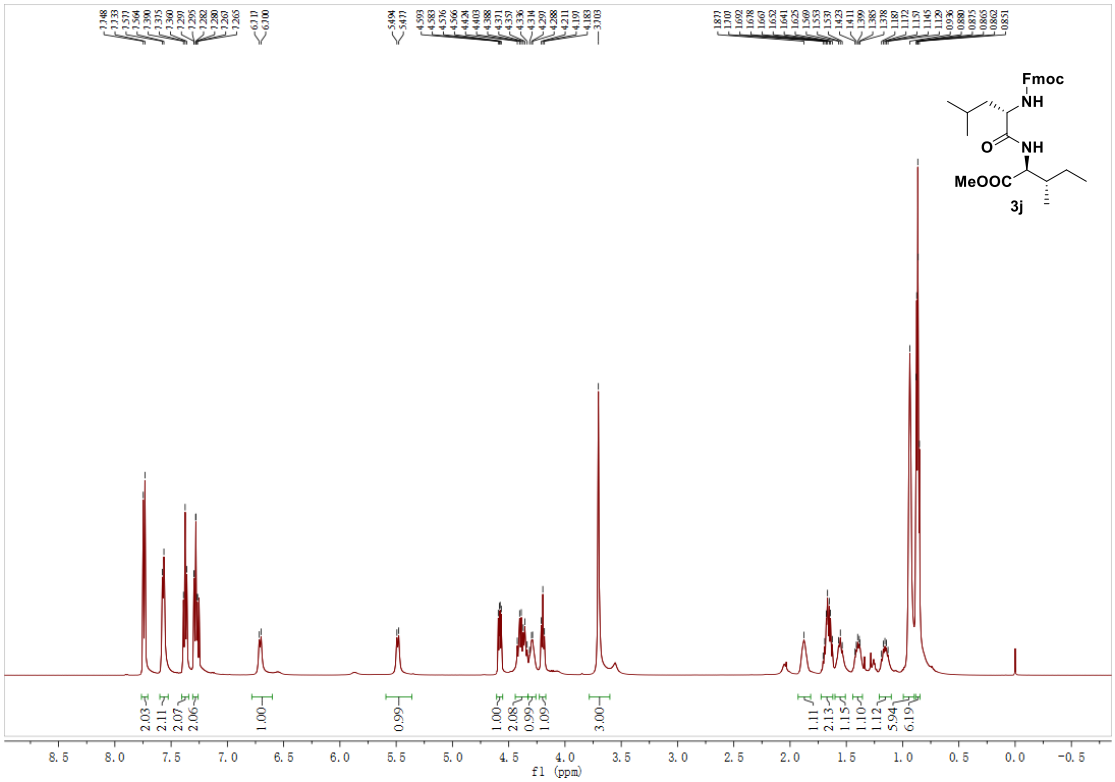
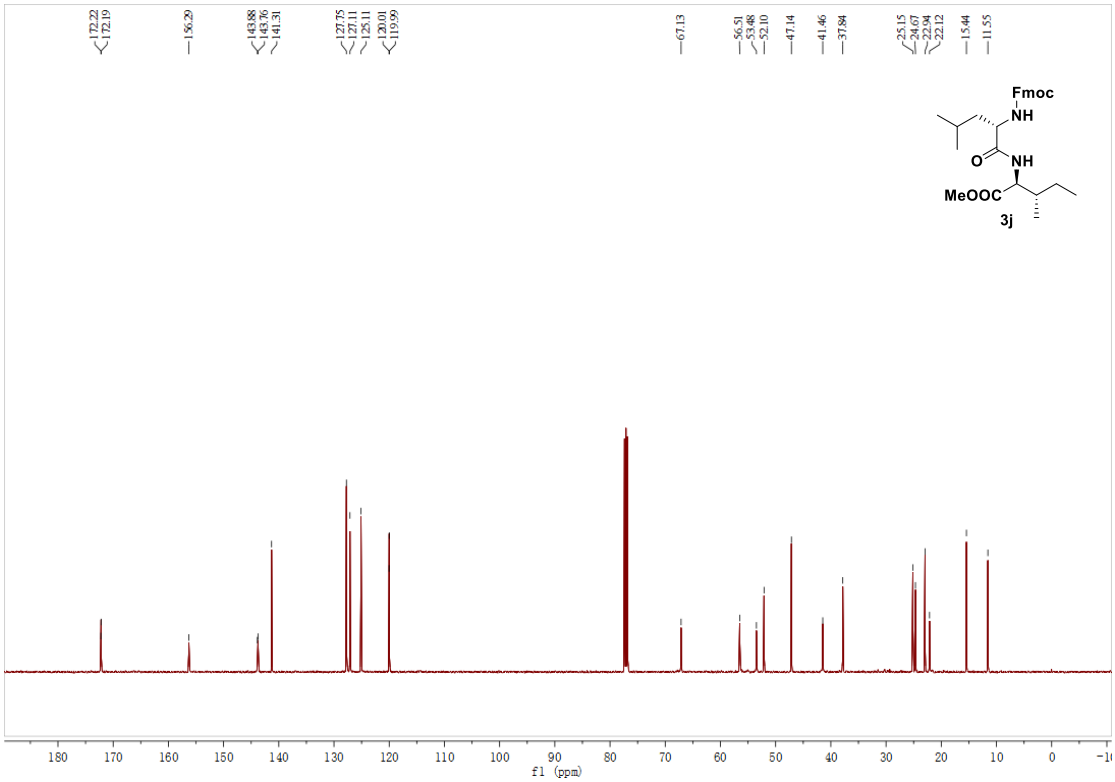


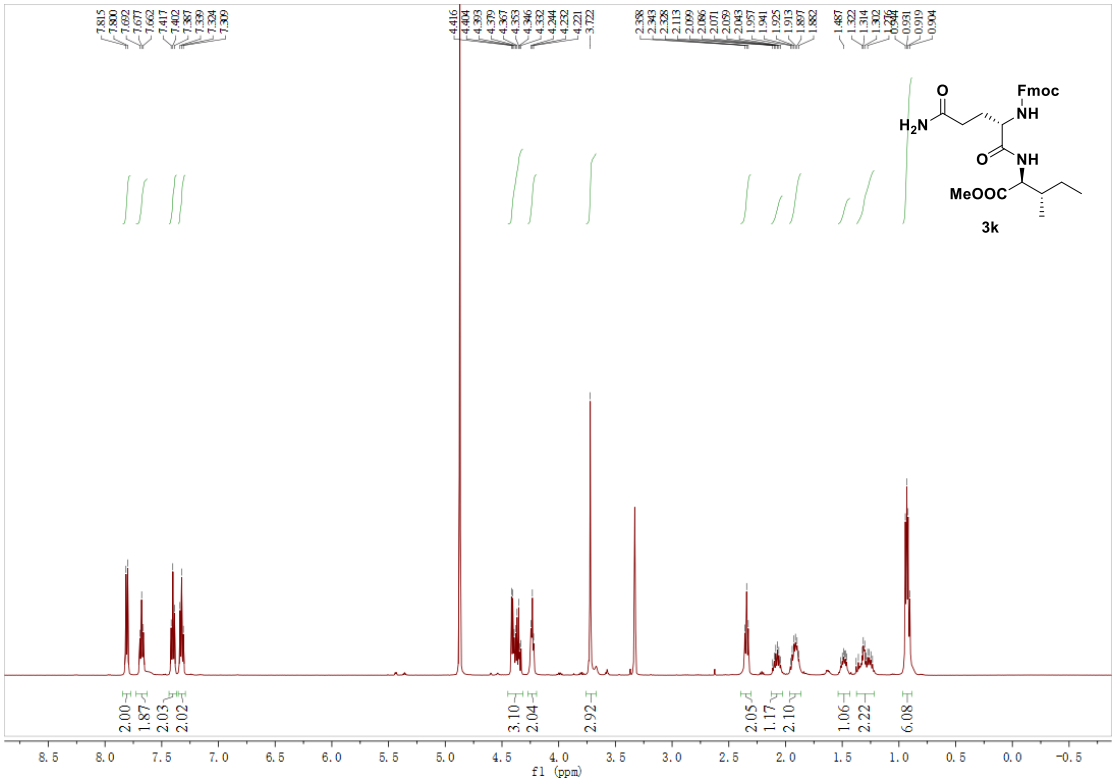
500 MHz, $CDCl_3$, ^1H NMR



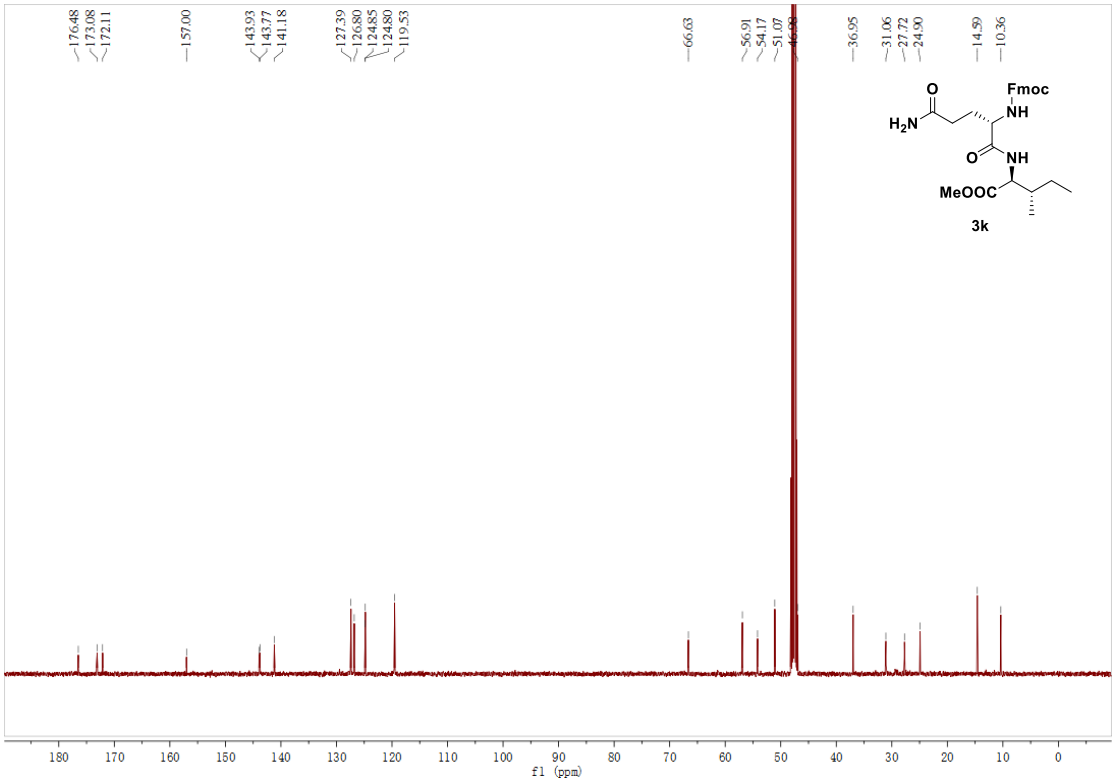
125 MHz, $CDCl_3$, ^{13}C NMR



500 MHz, CD_3OD, ^1H NMR



125 MHz, CD_3OD, ^{13}C NMR



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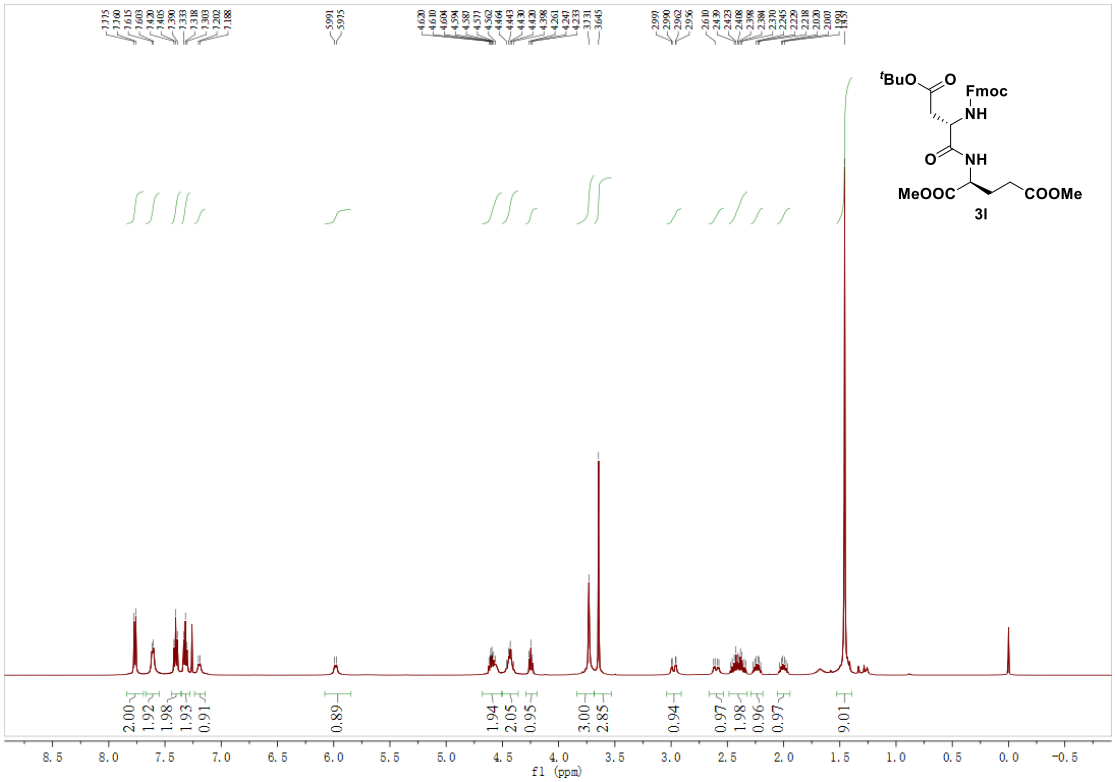

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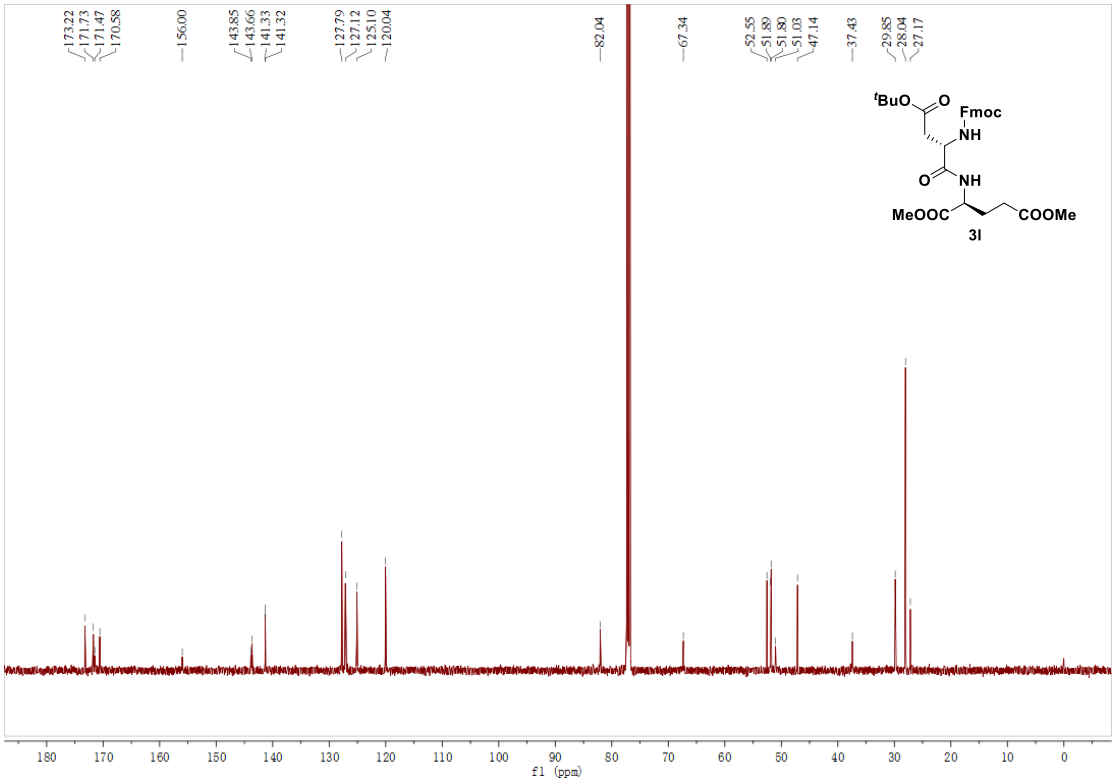

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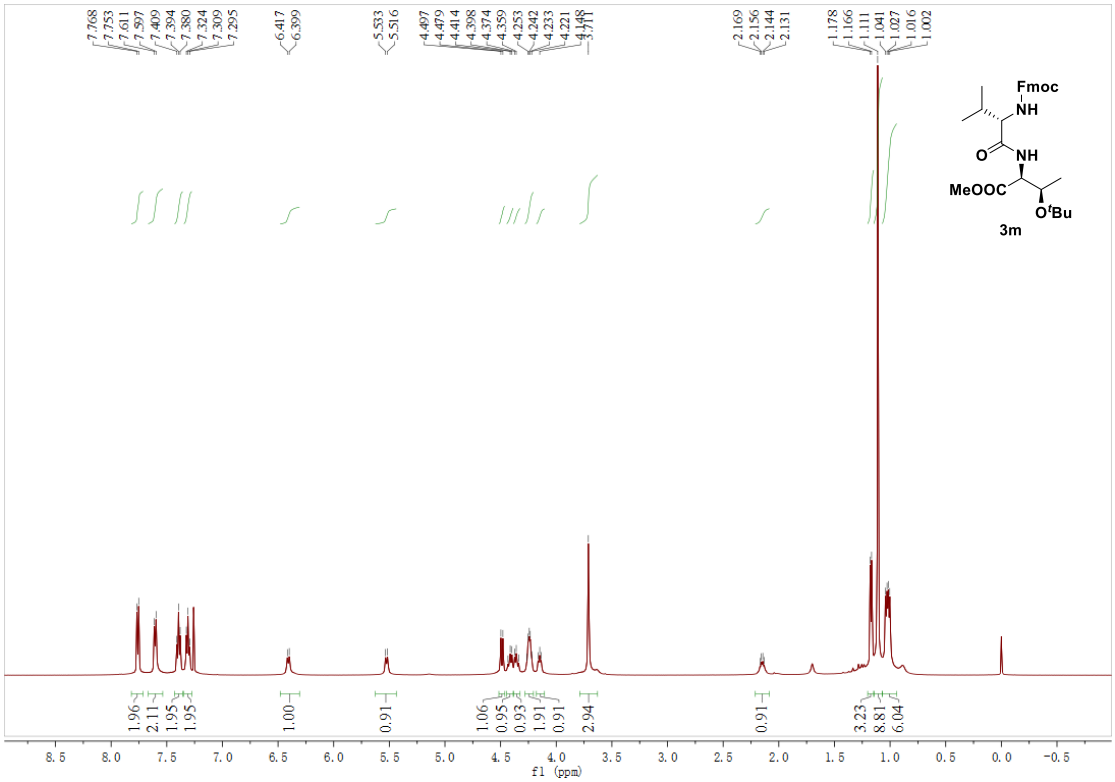

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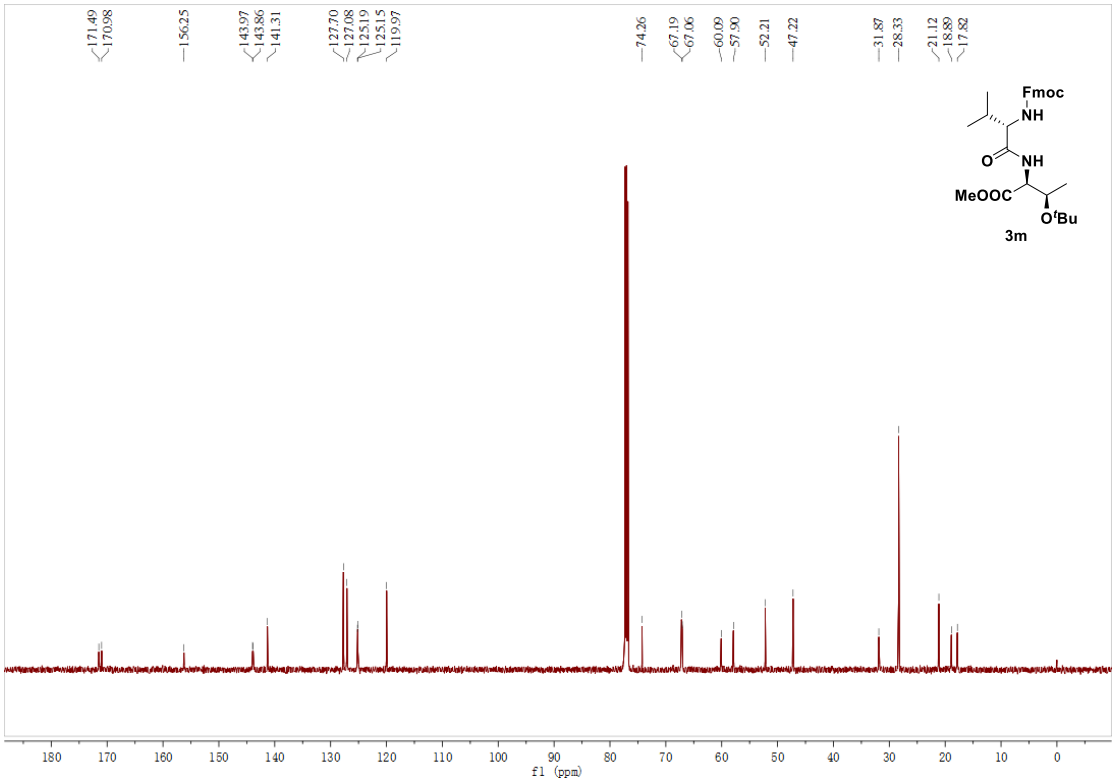

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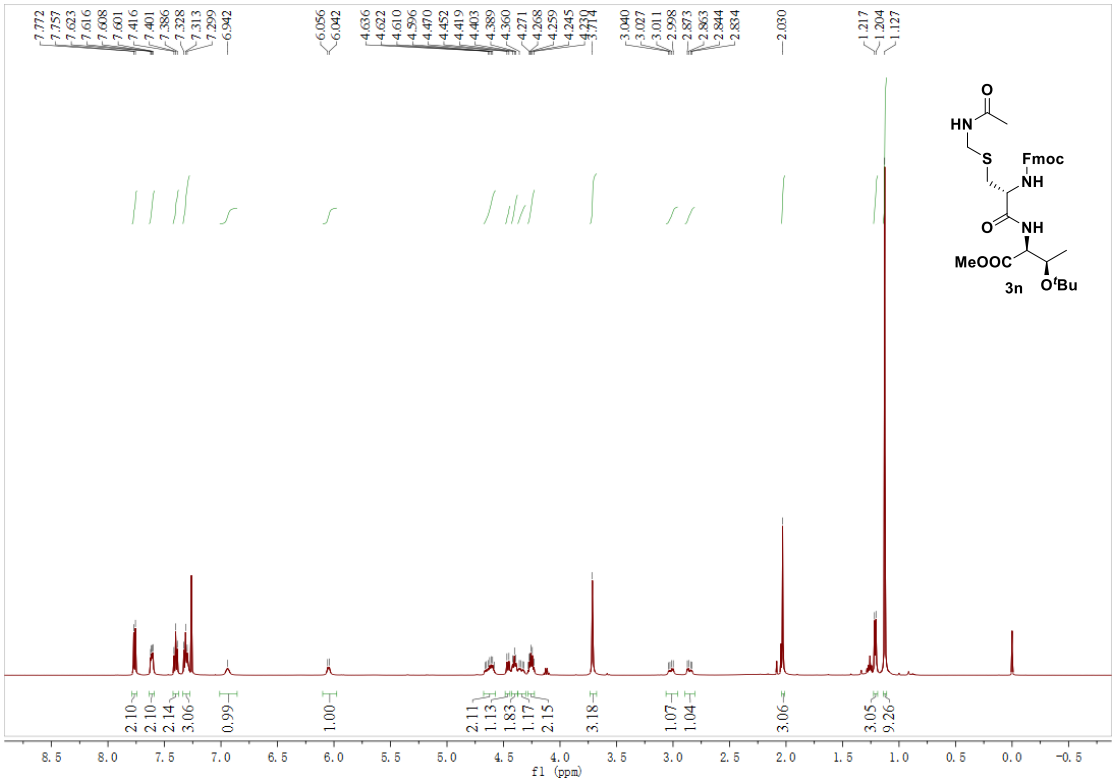

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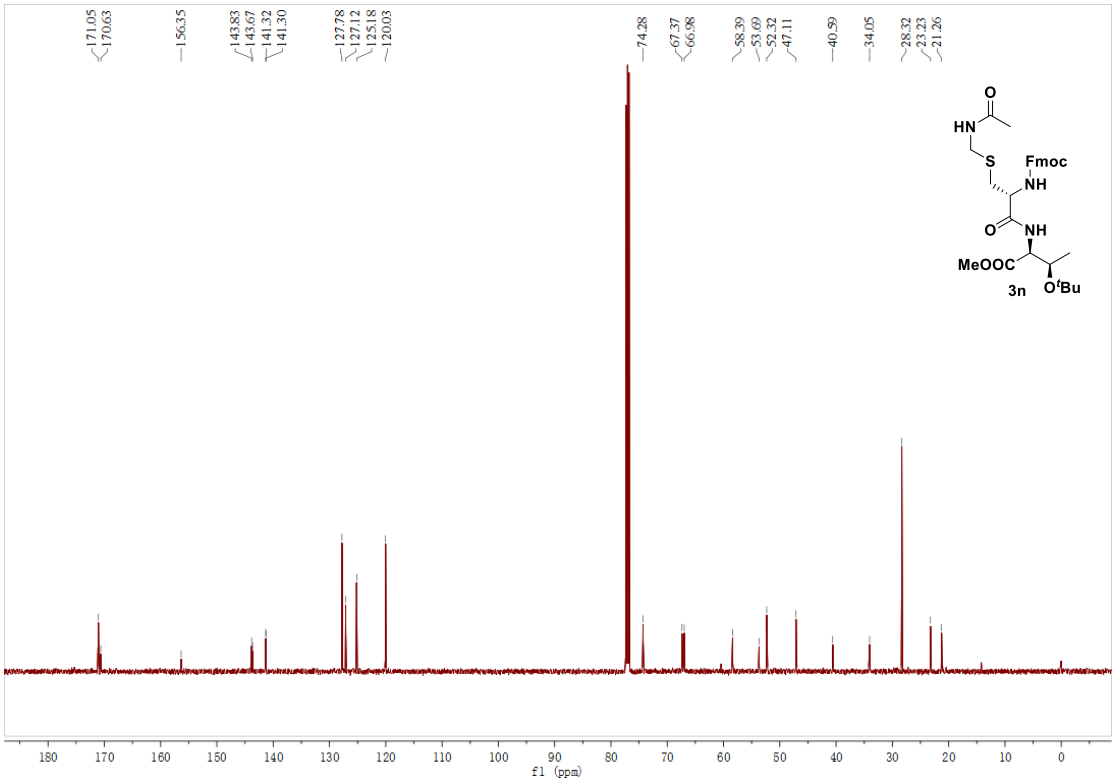

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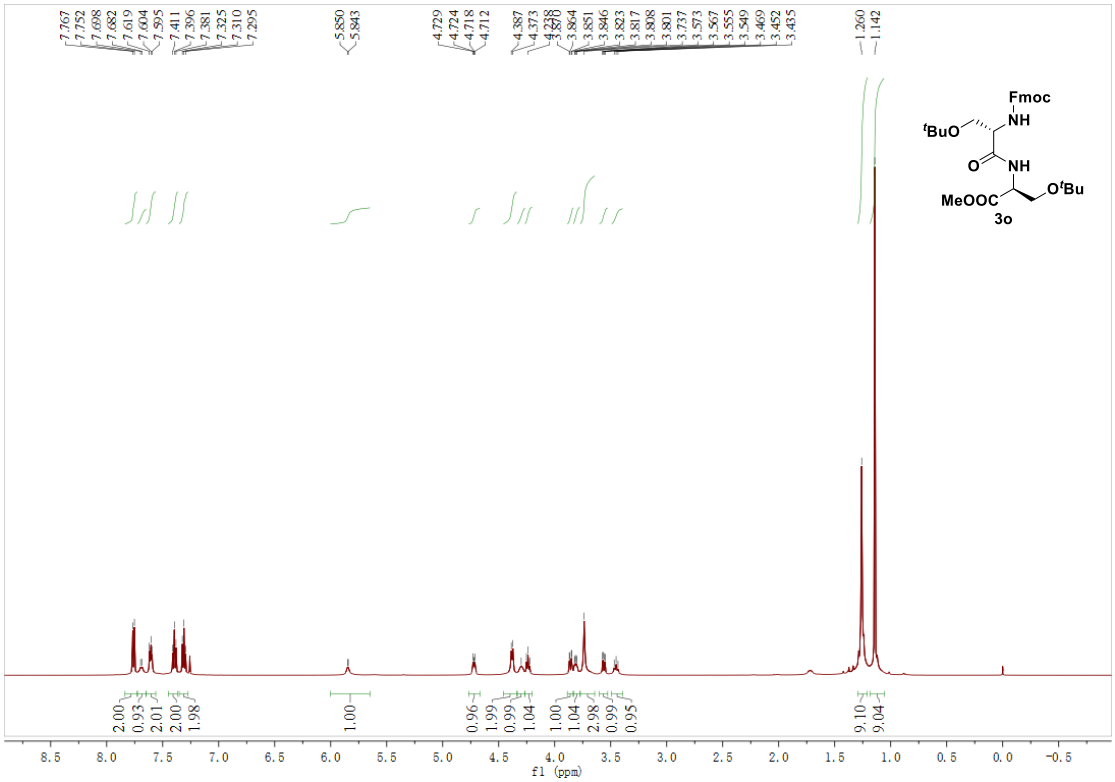

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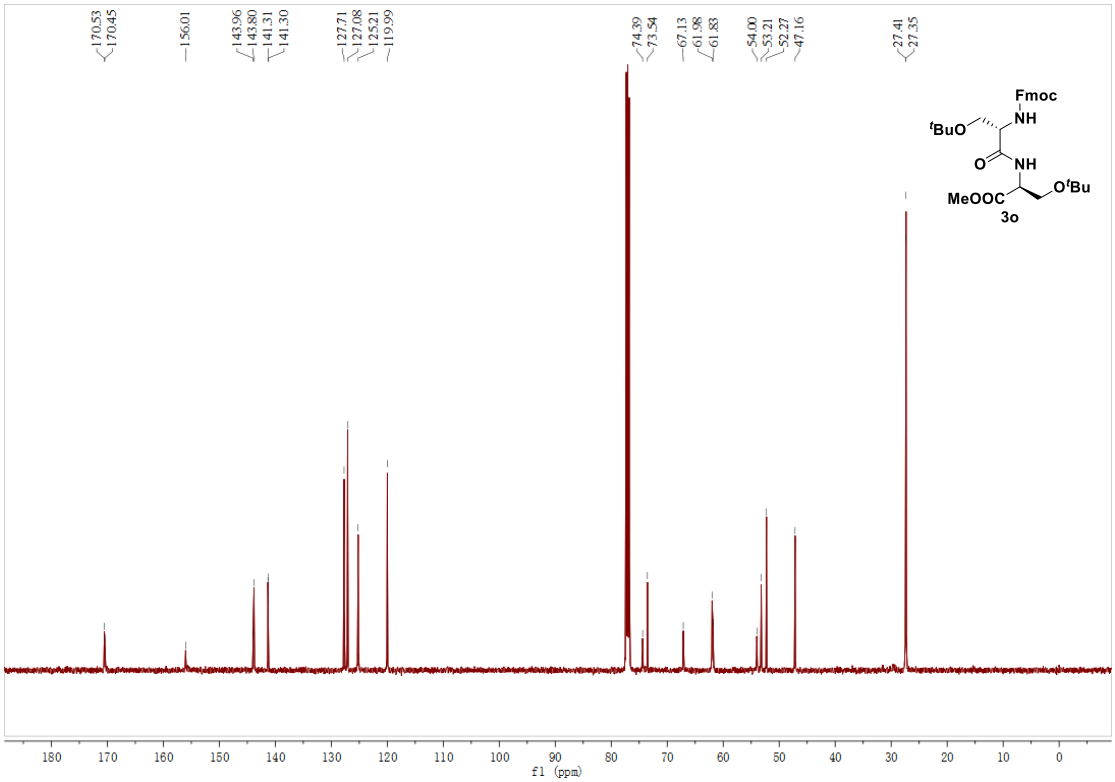

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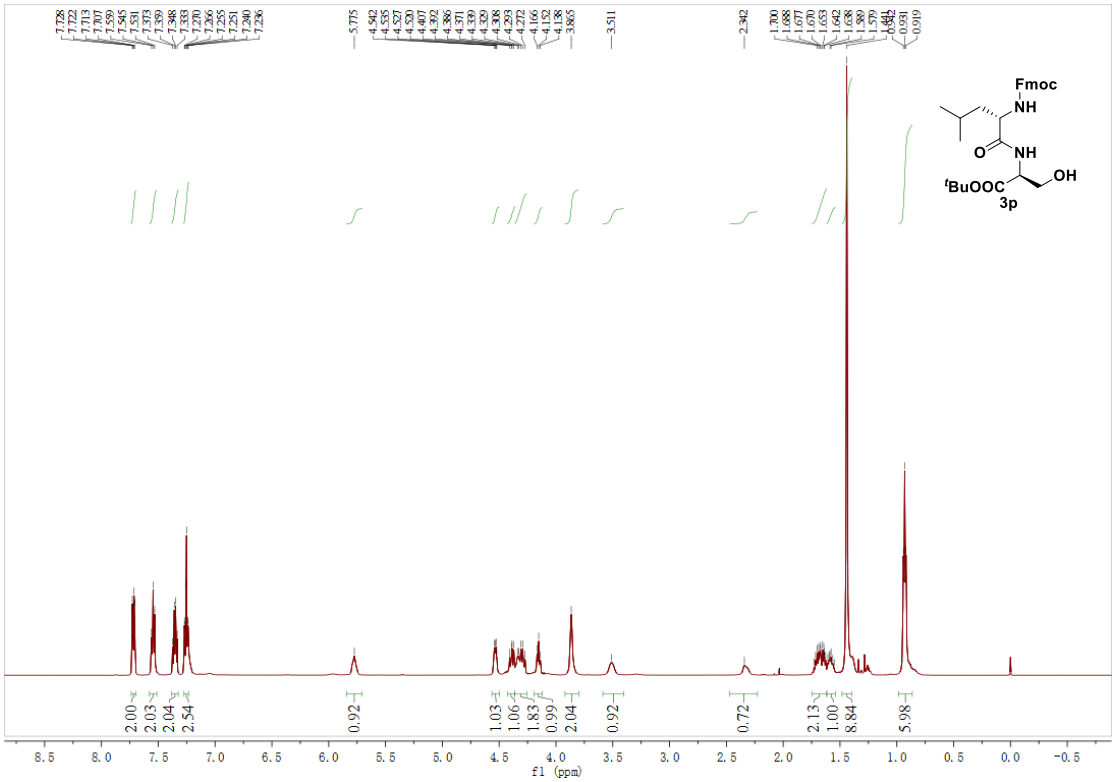

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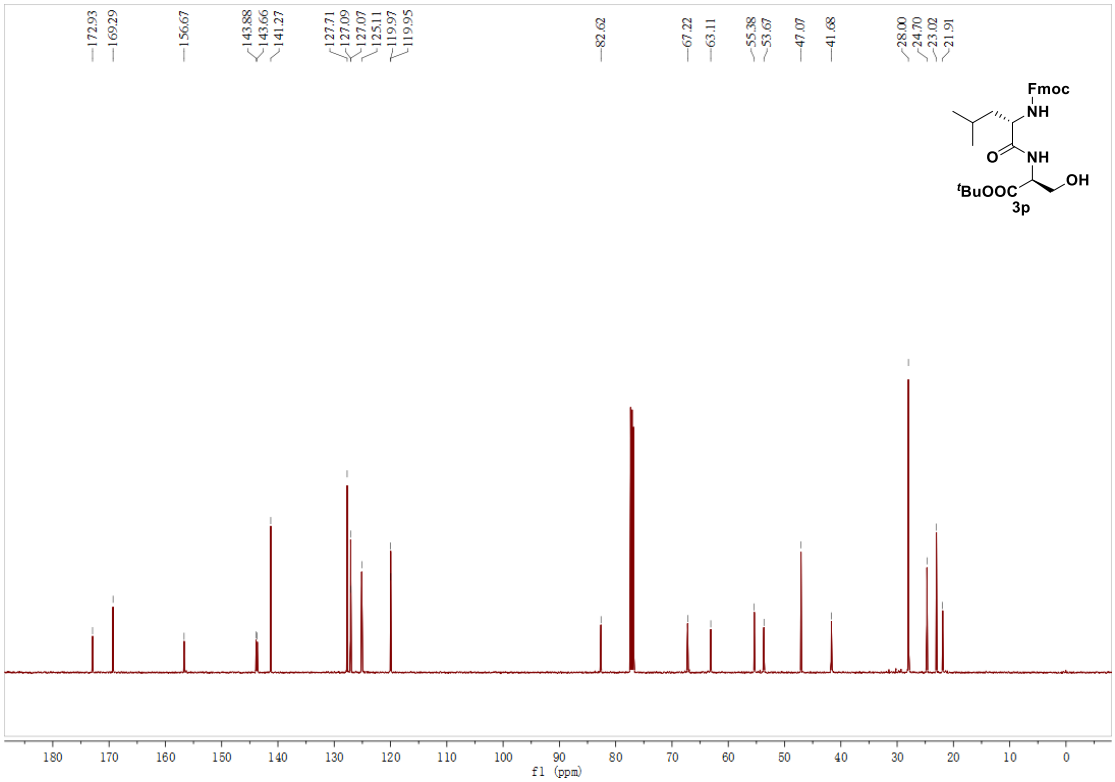

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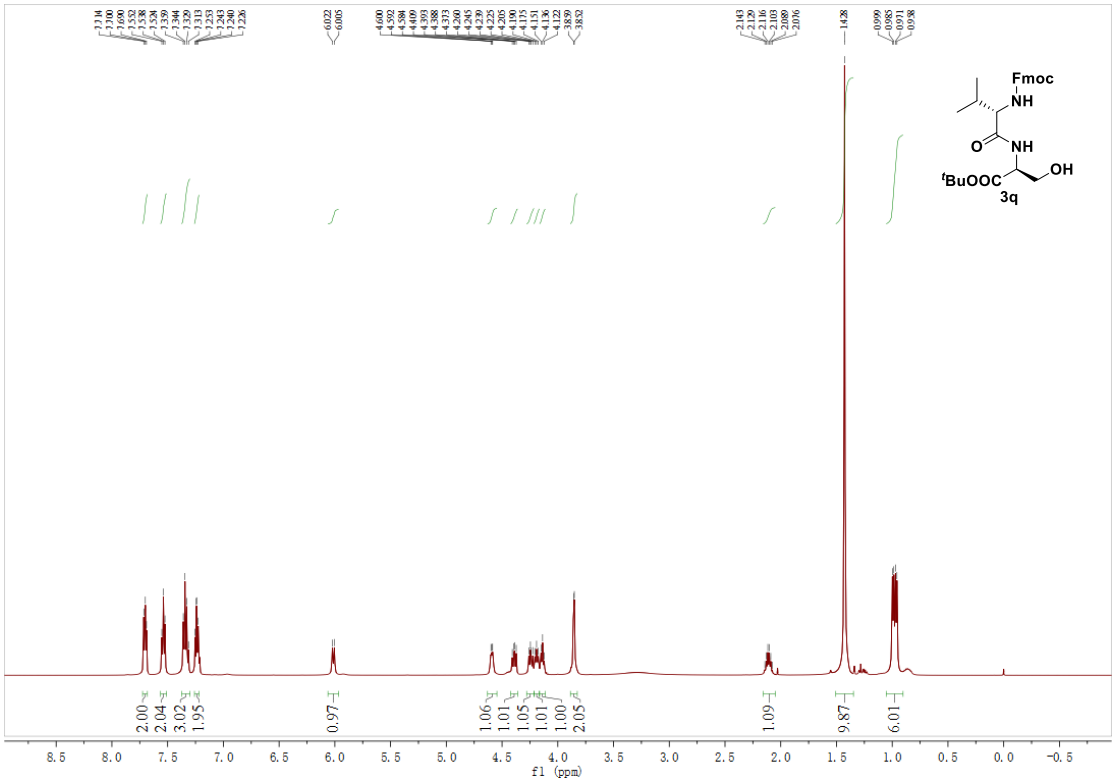

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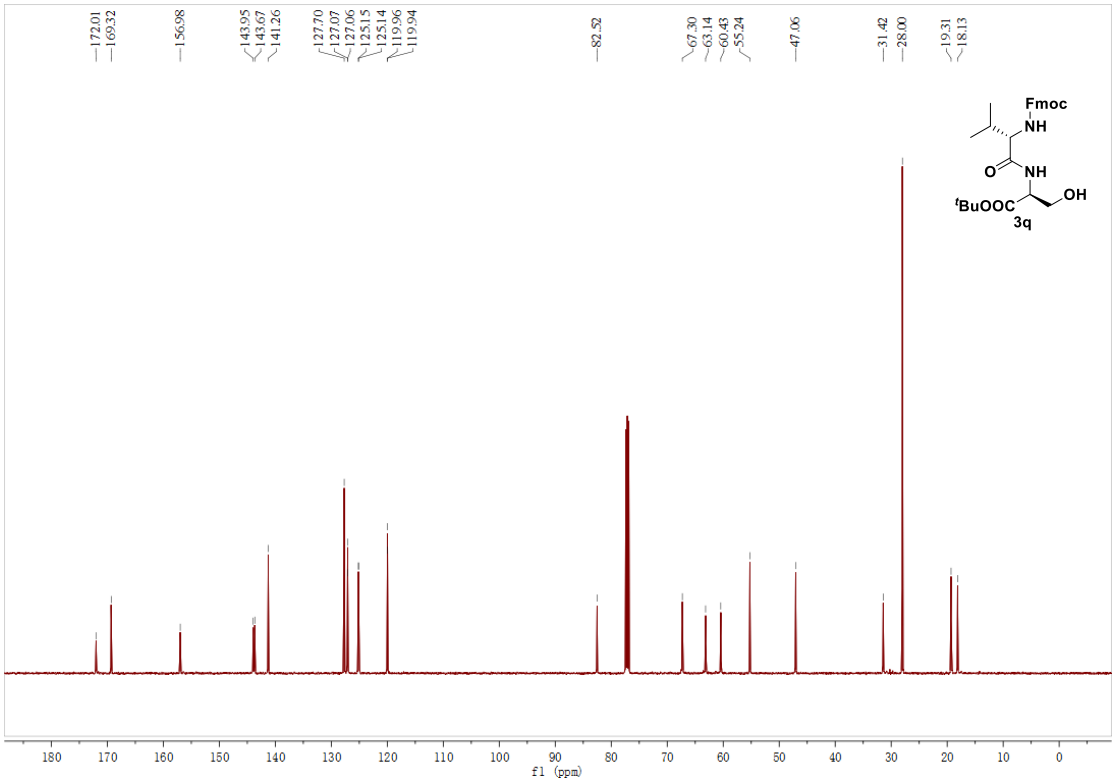

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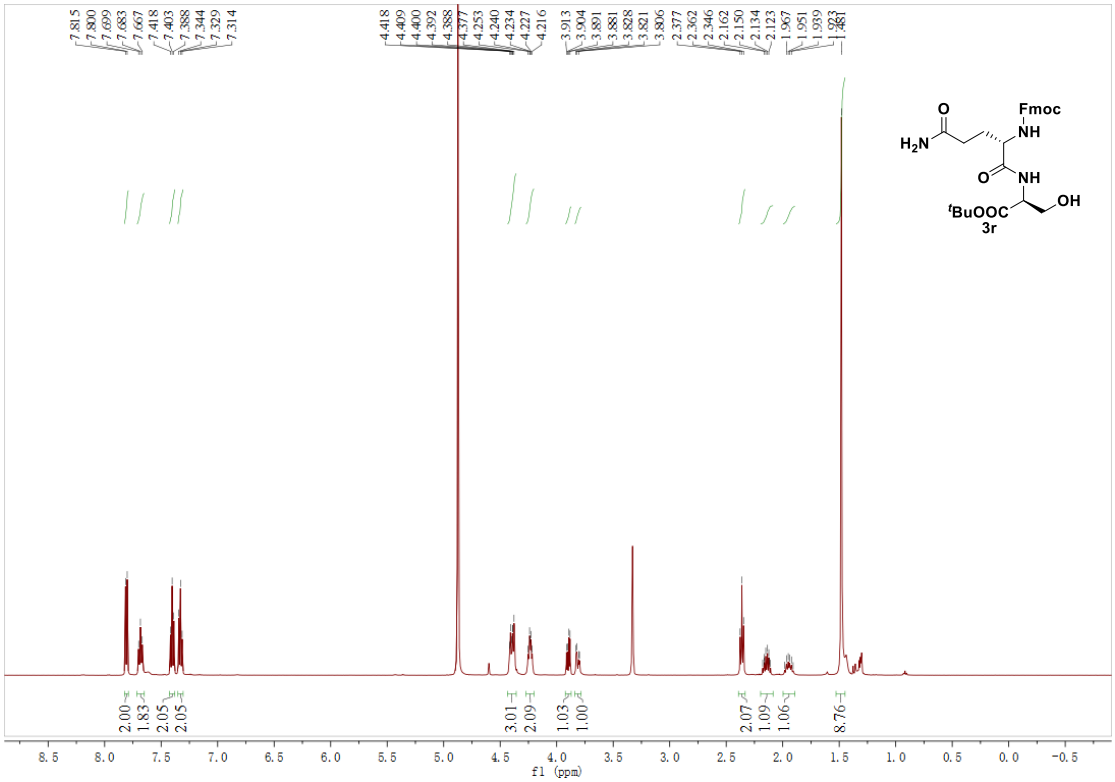

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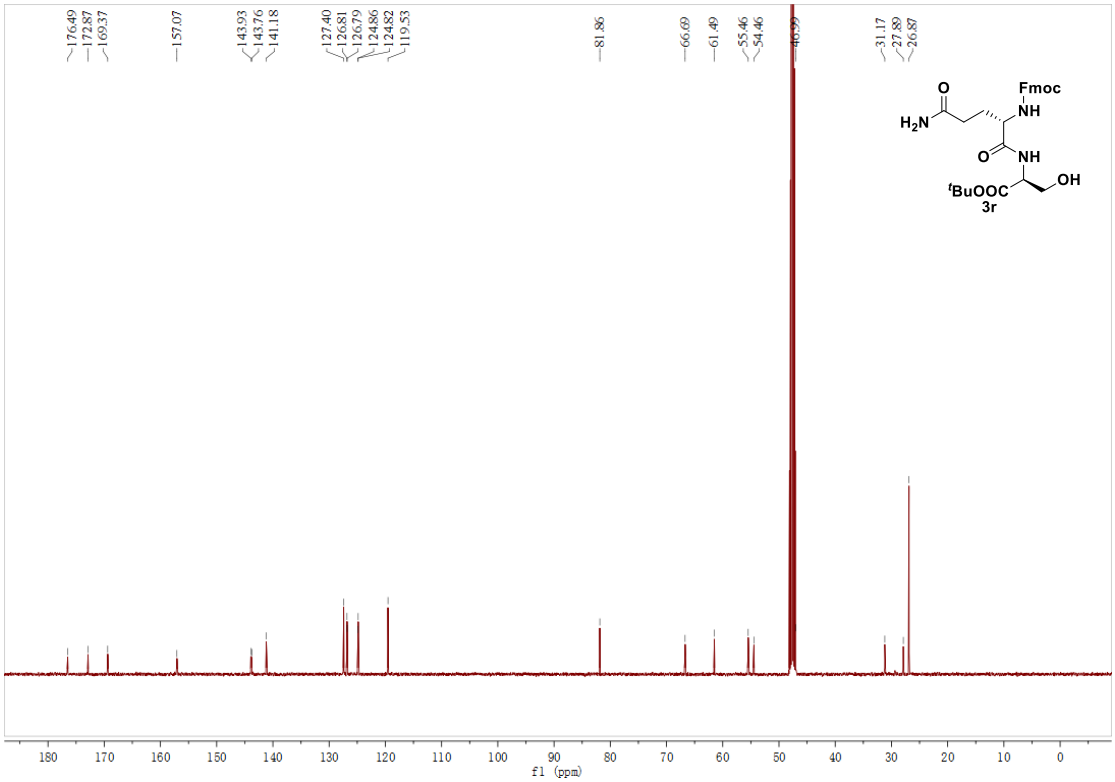
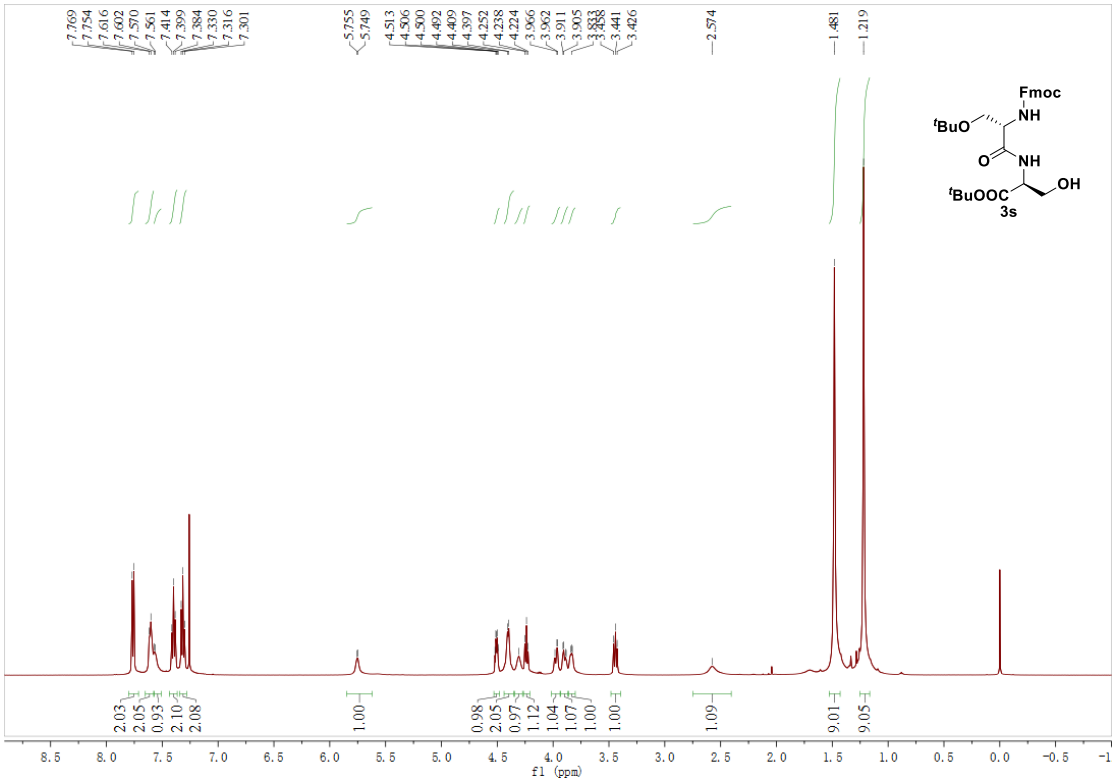


500 MHz, $CDCl_3$, ^1H NMR



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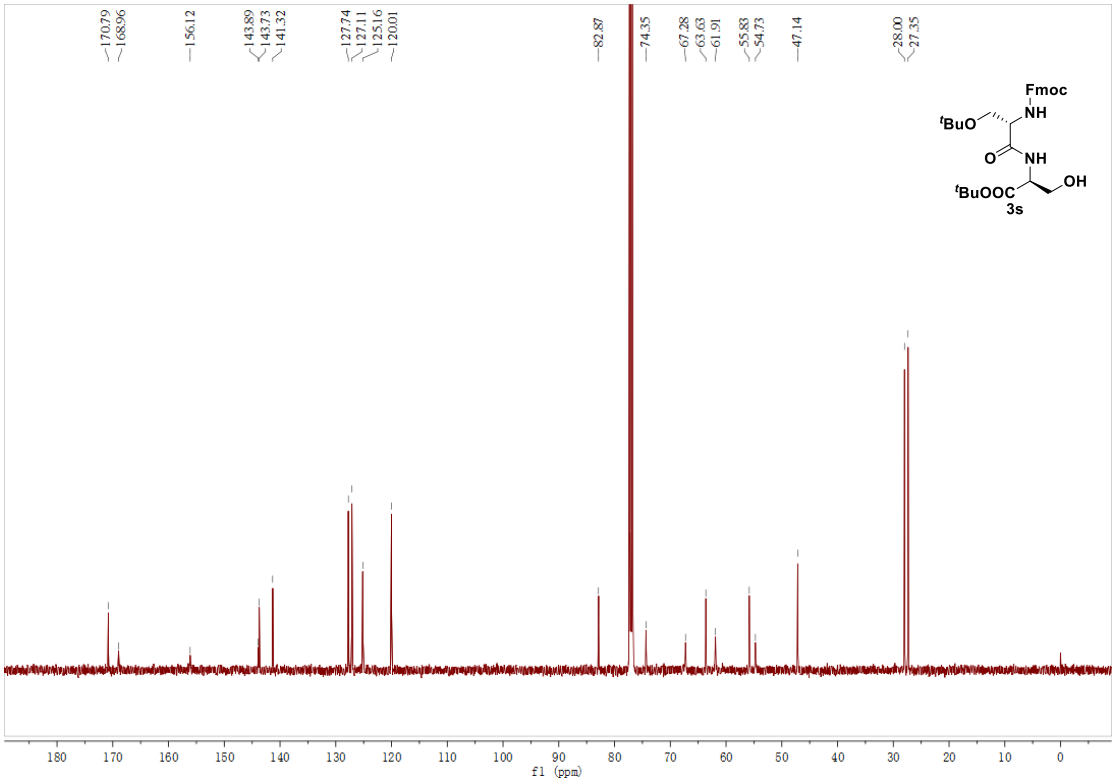

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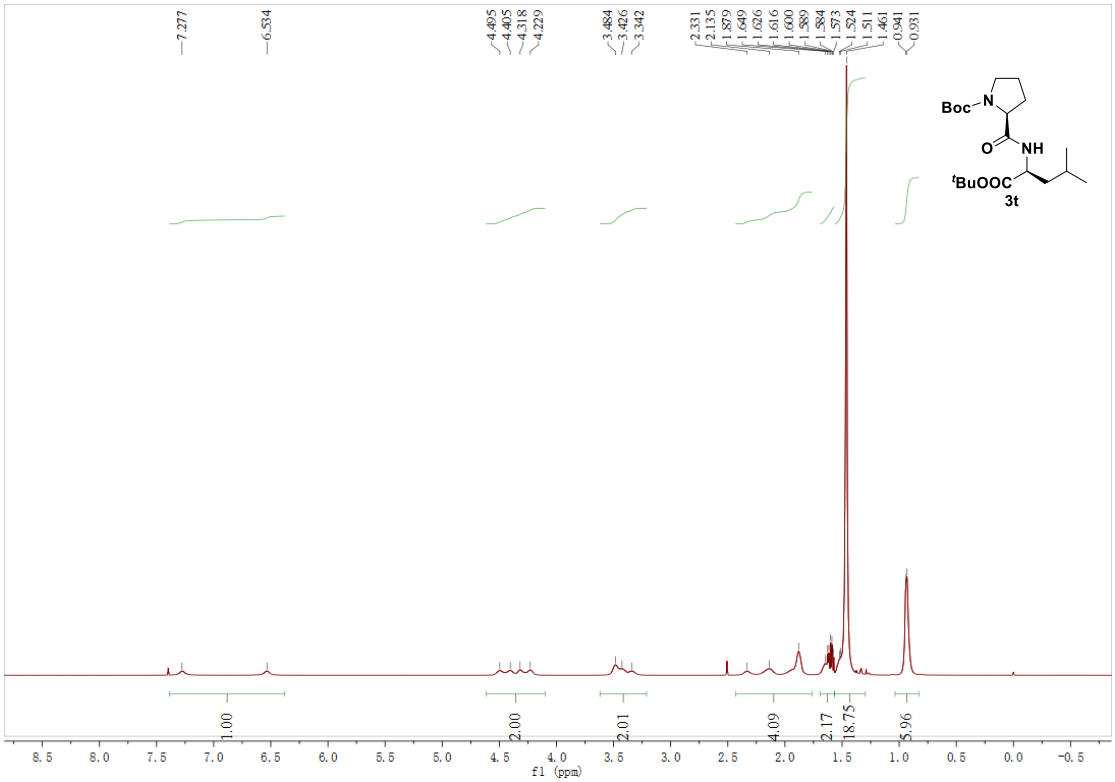

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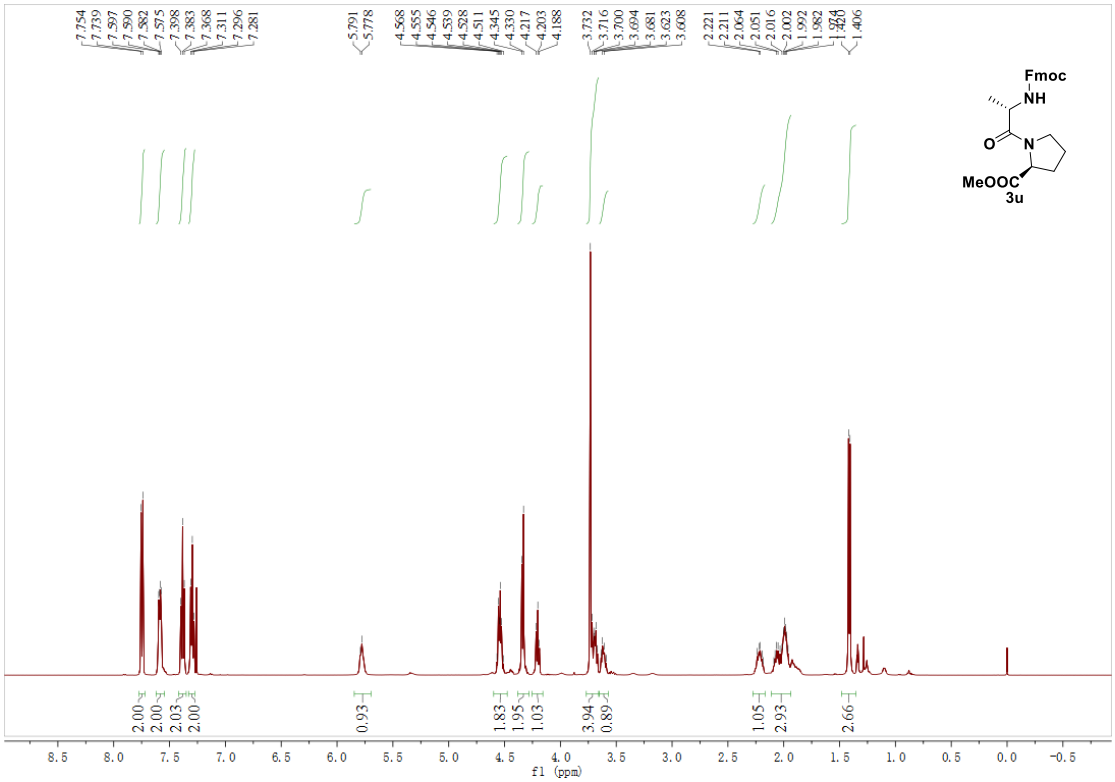

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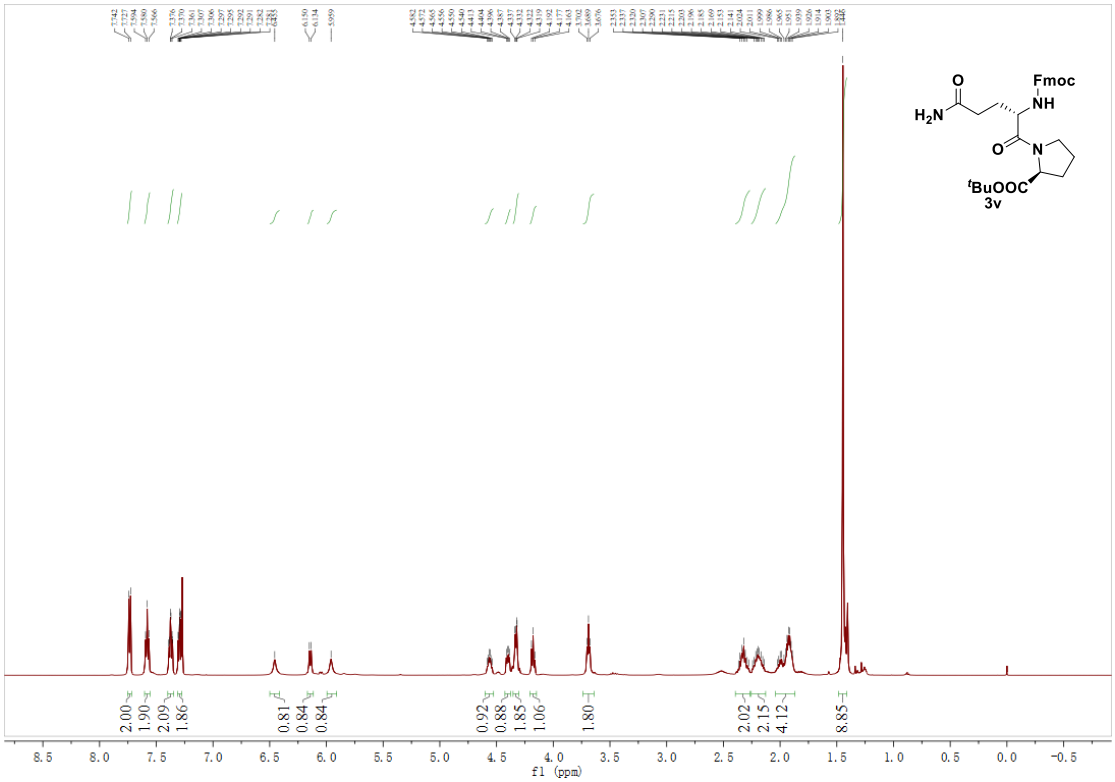

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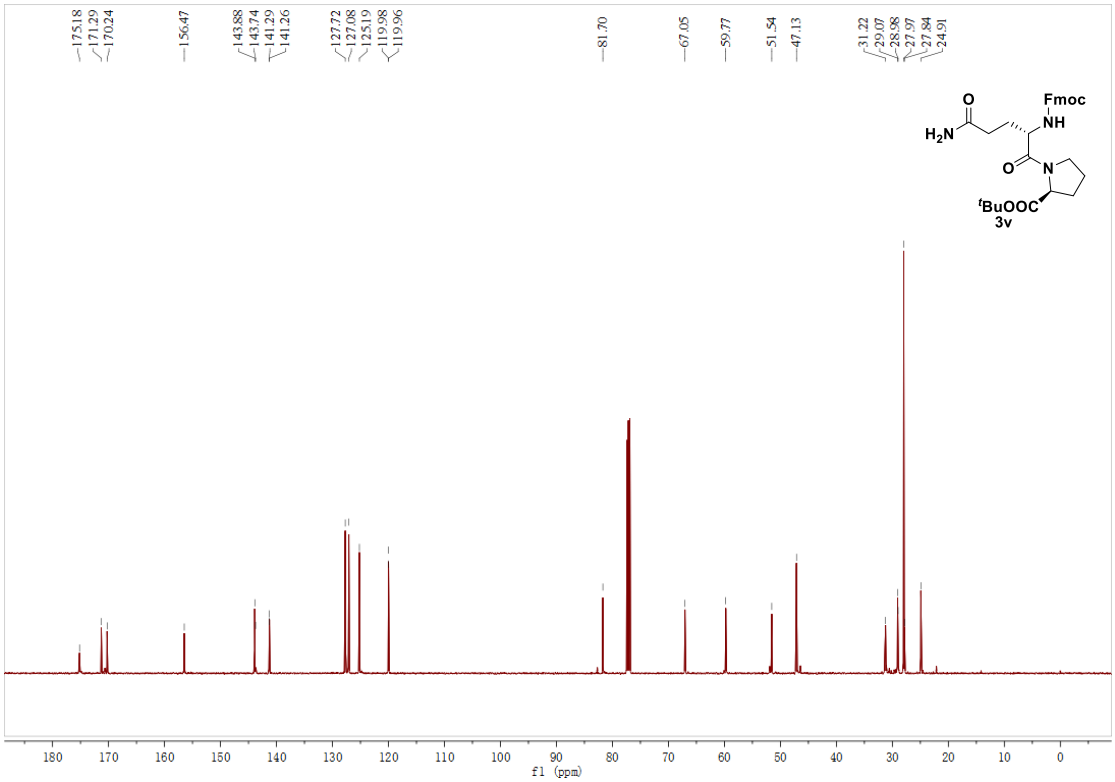

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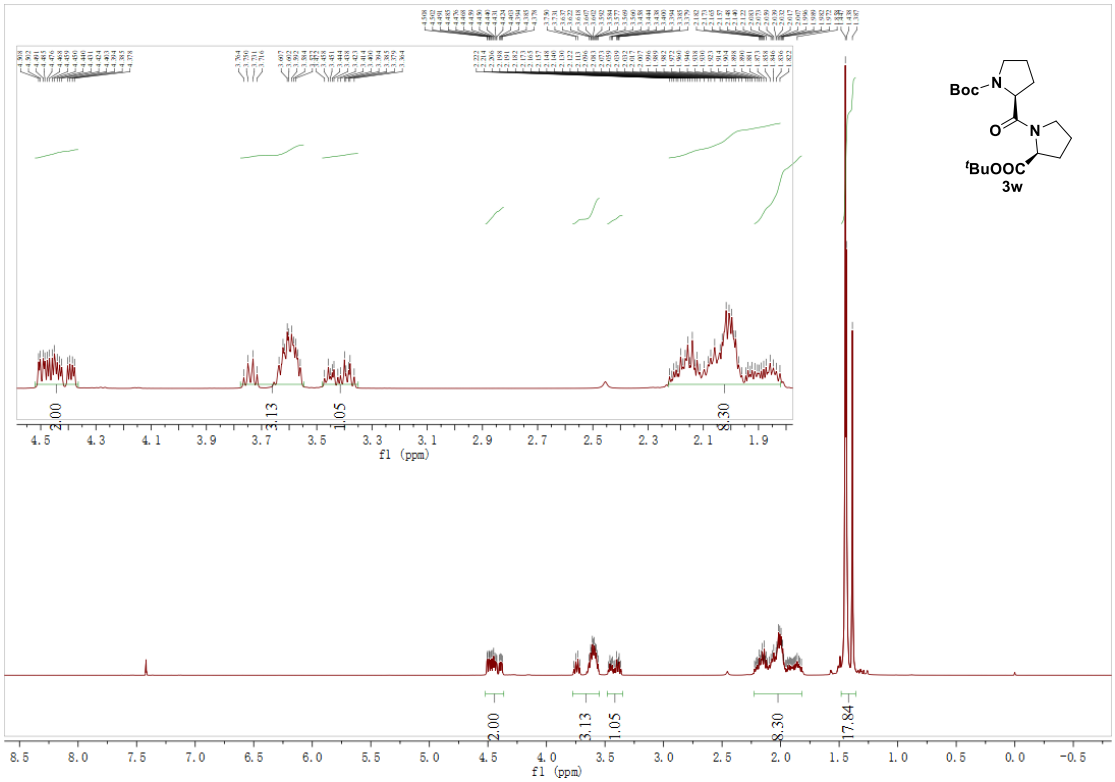

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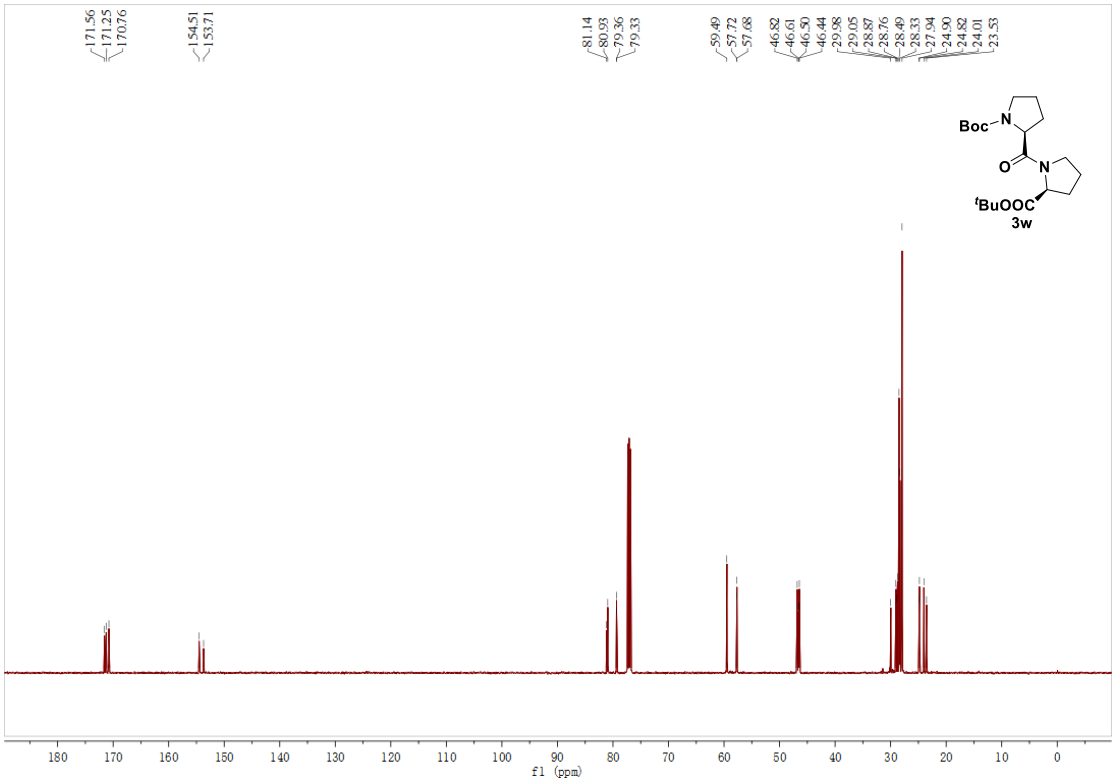

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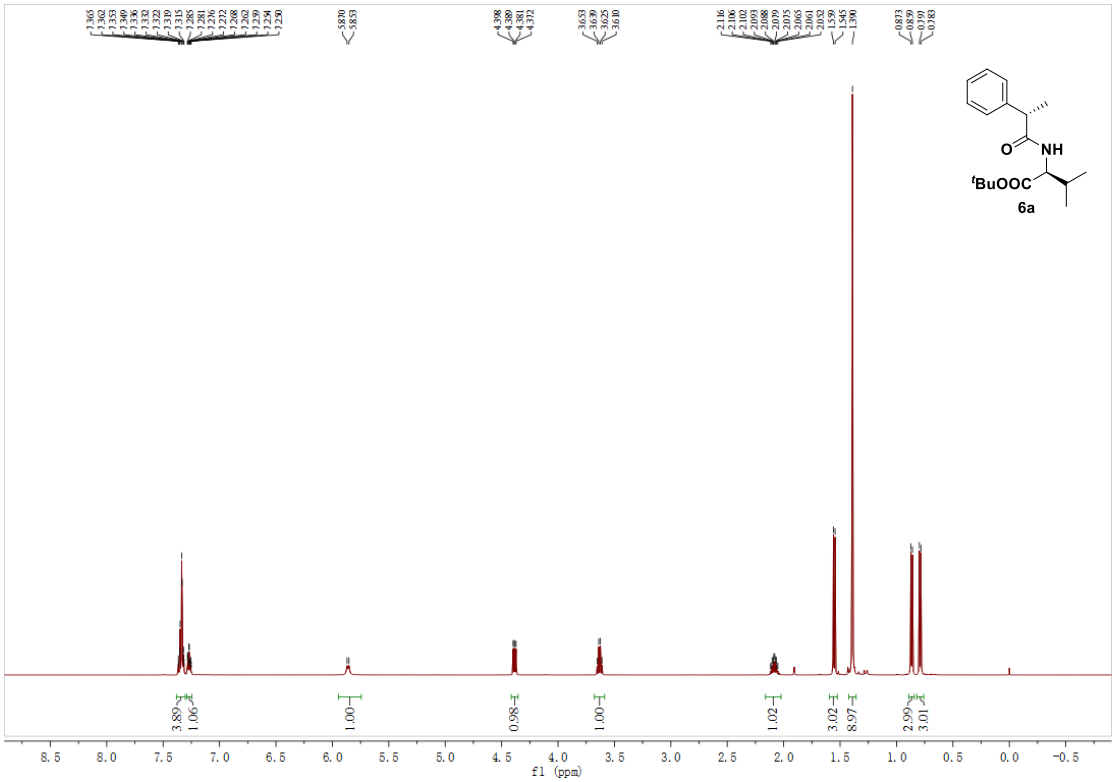

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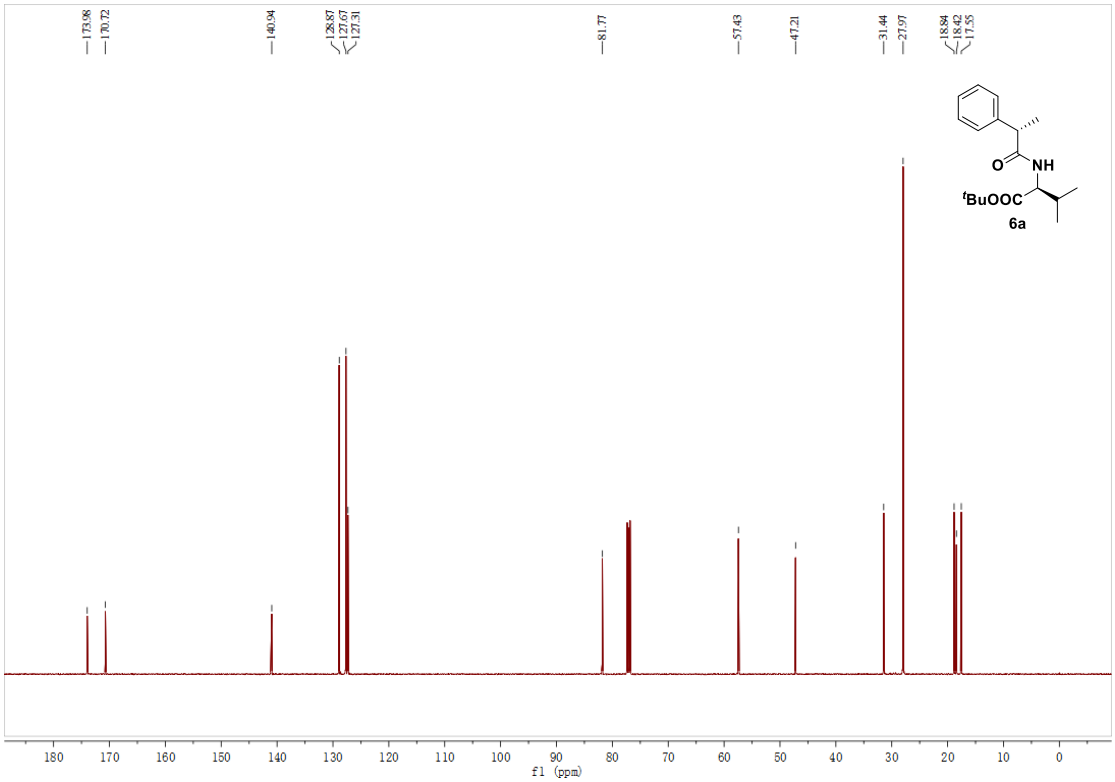

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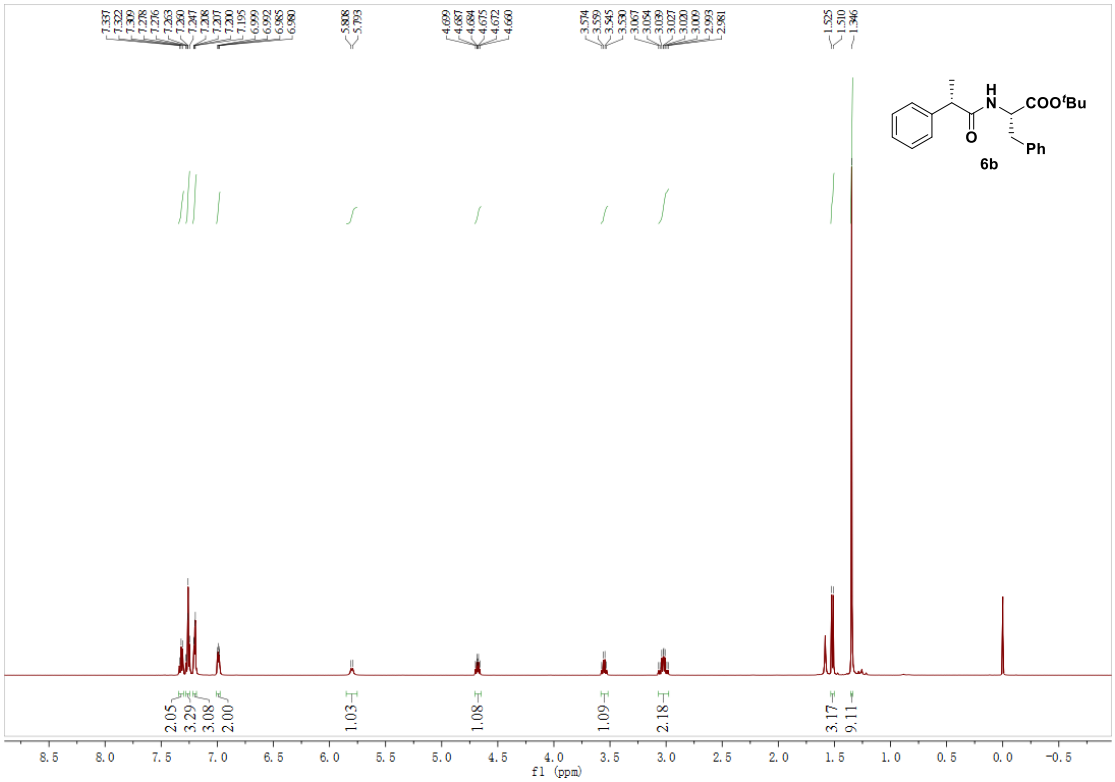

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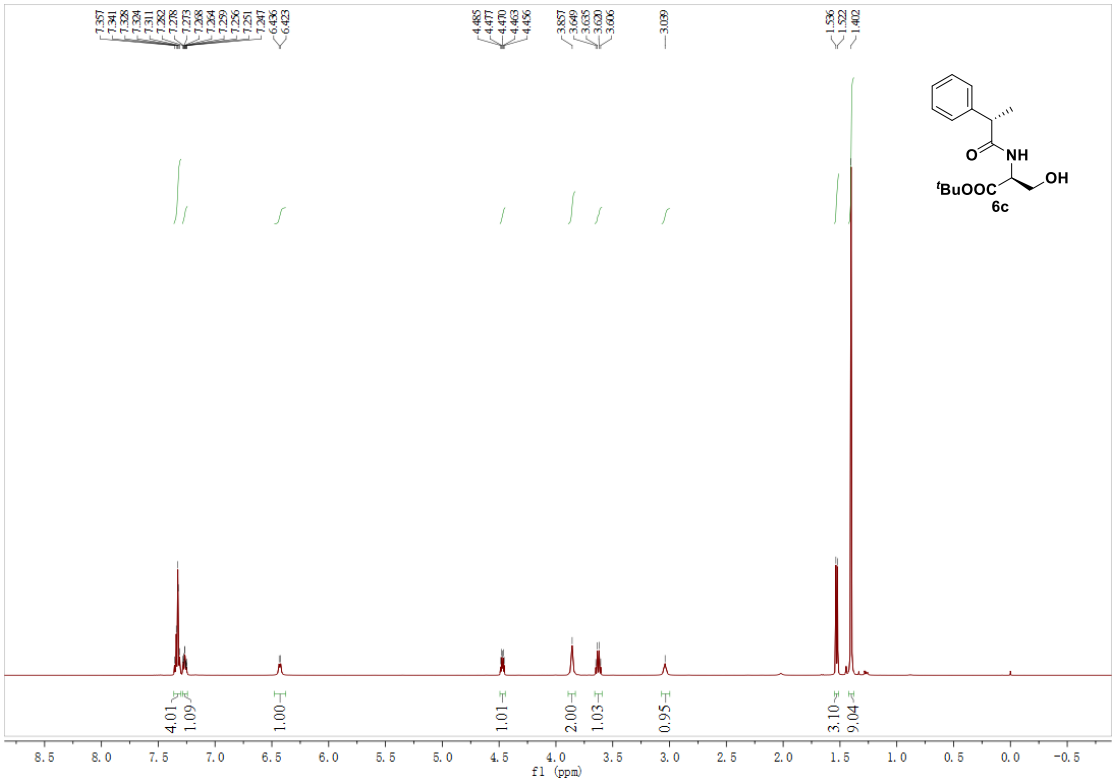

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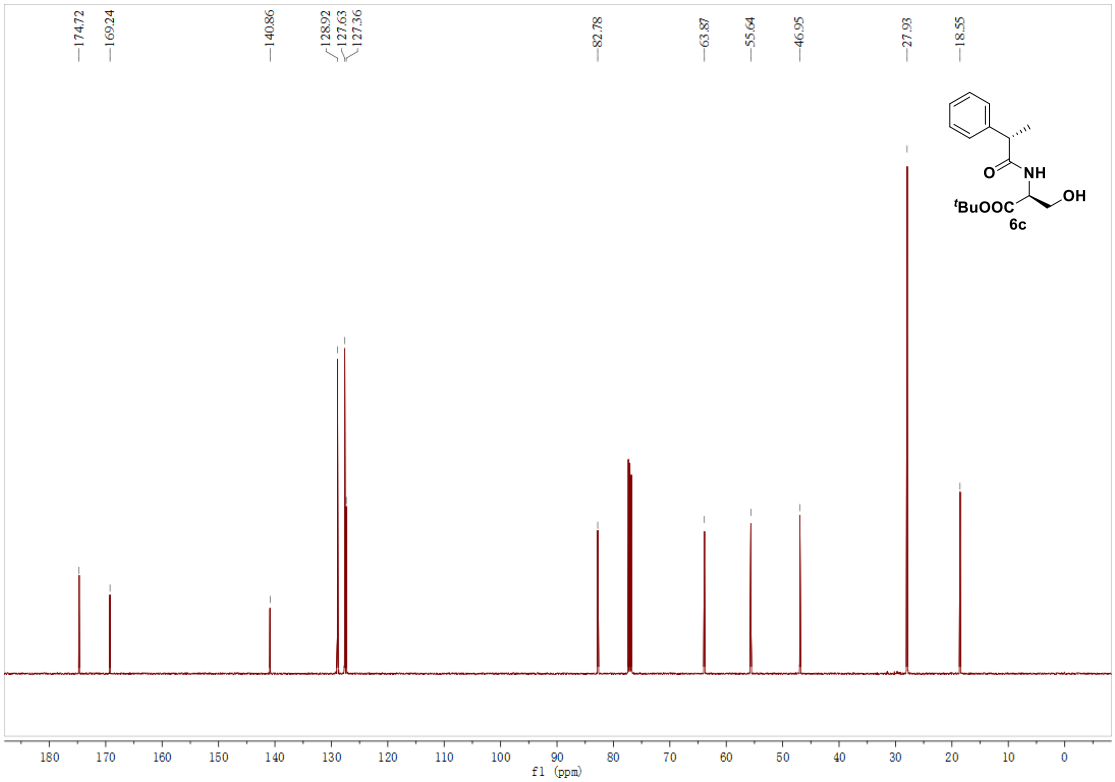
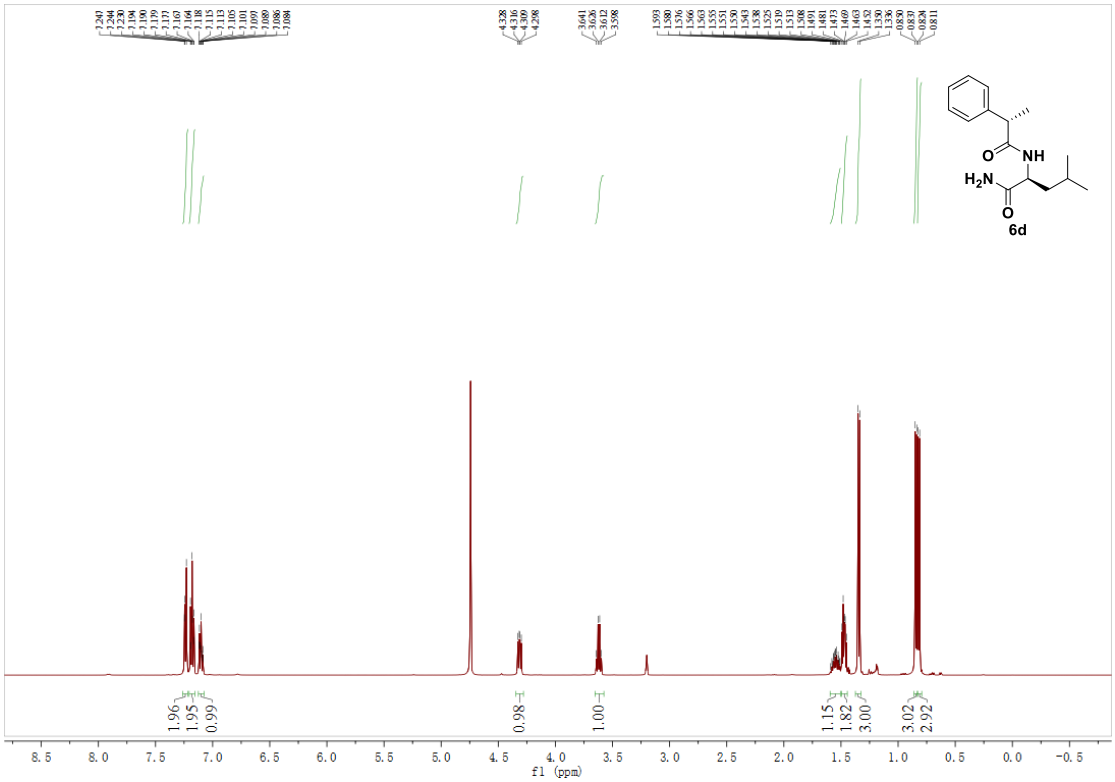
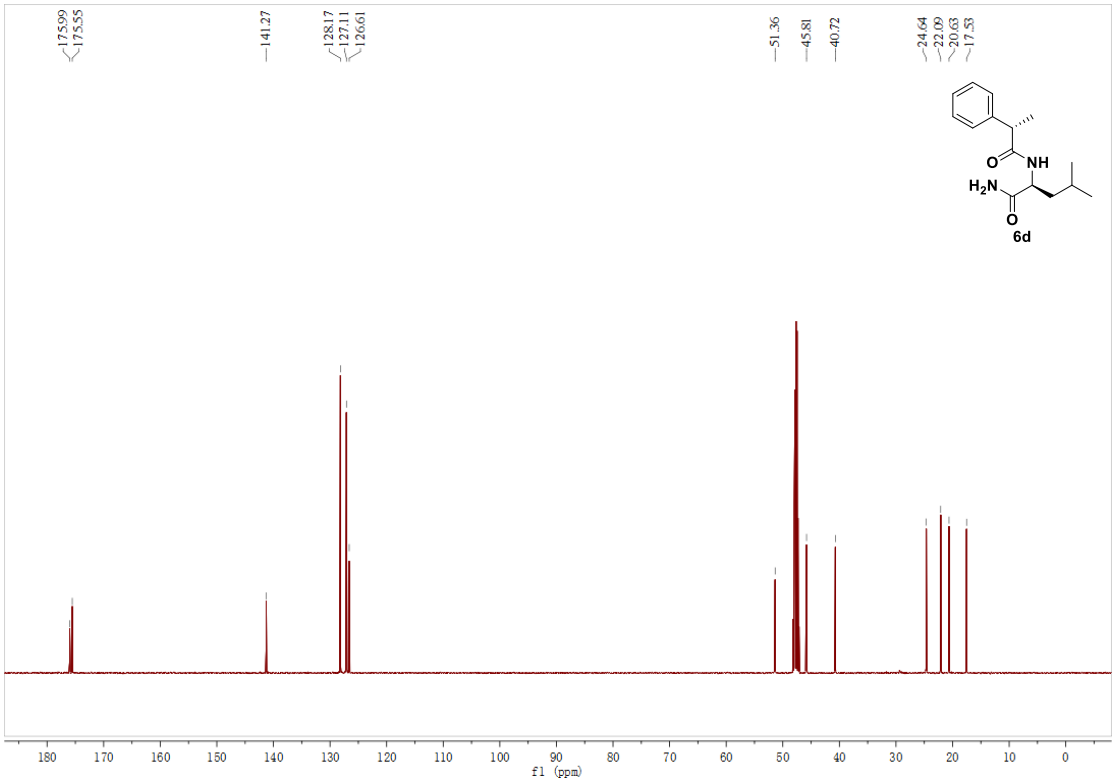


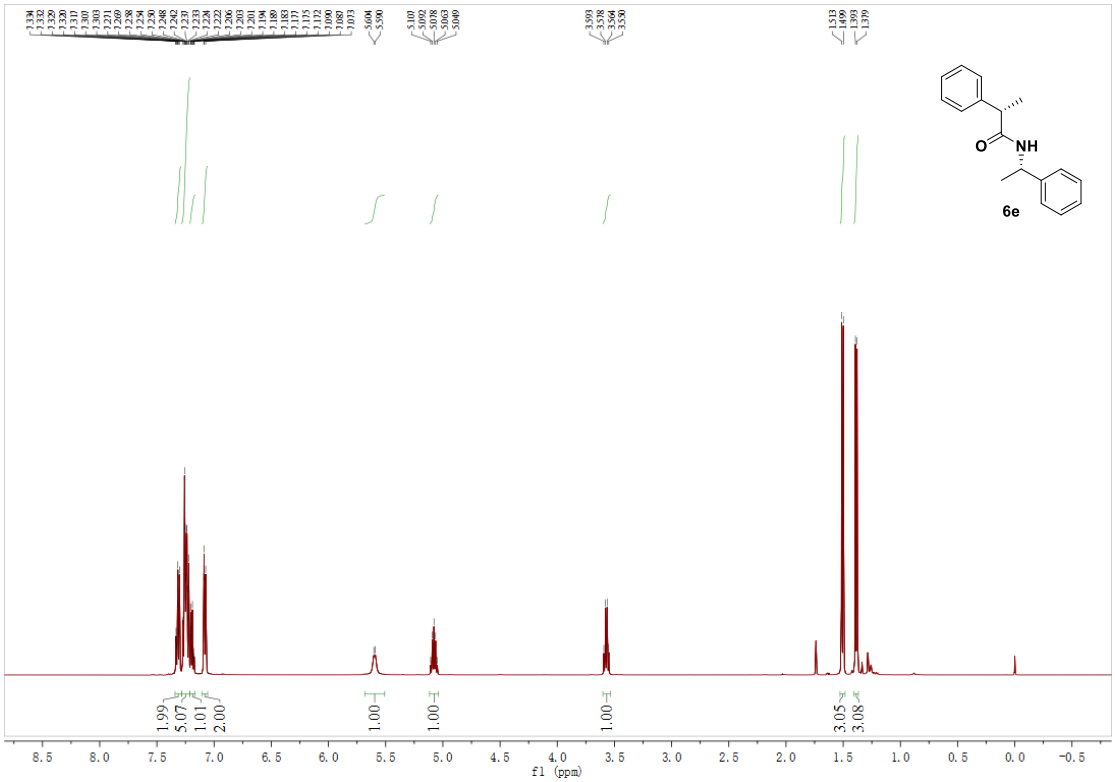
500 MHz, CD_3OD, ^1H NMR



125 MHz, CD_3OD, ^{13}C NMR



500 MHz, $CDCl_3$, ^1H NMR



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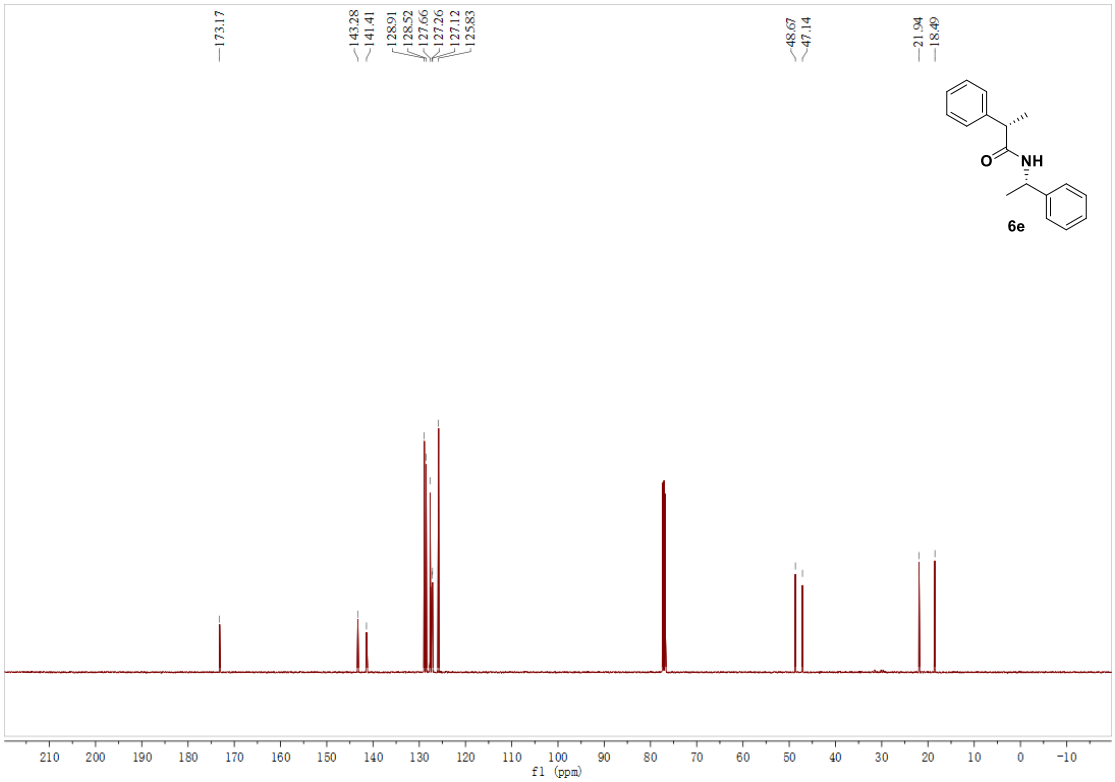

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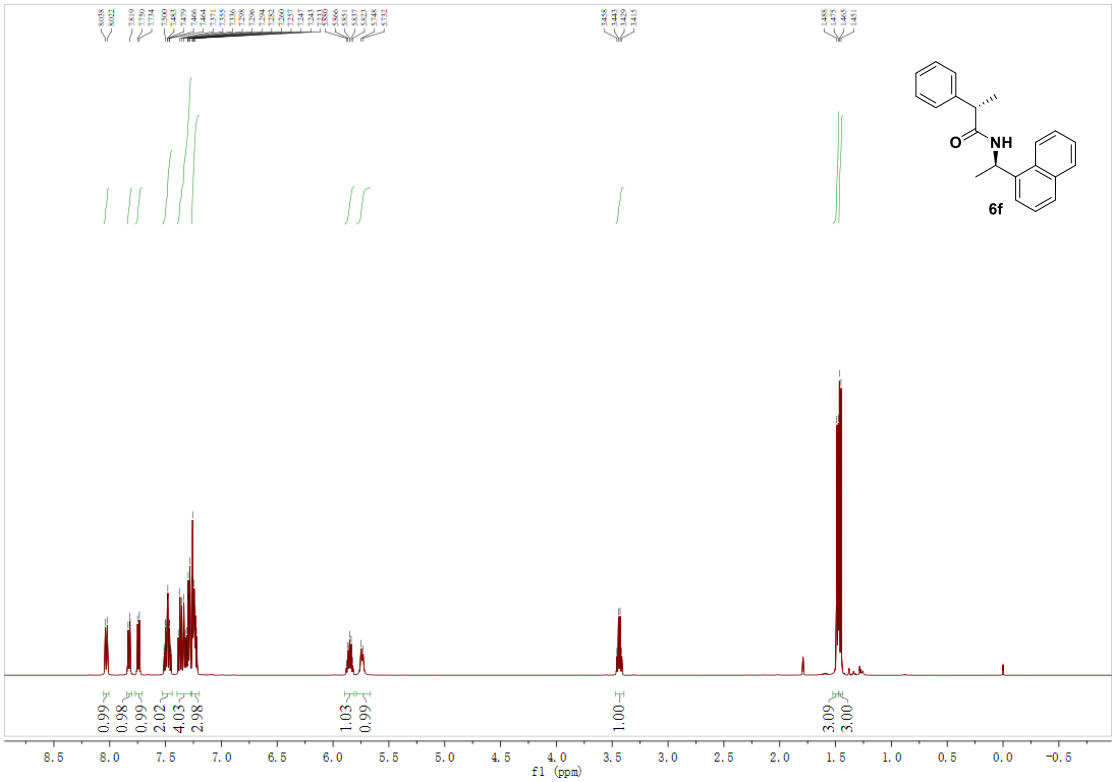

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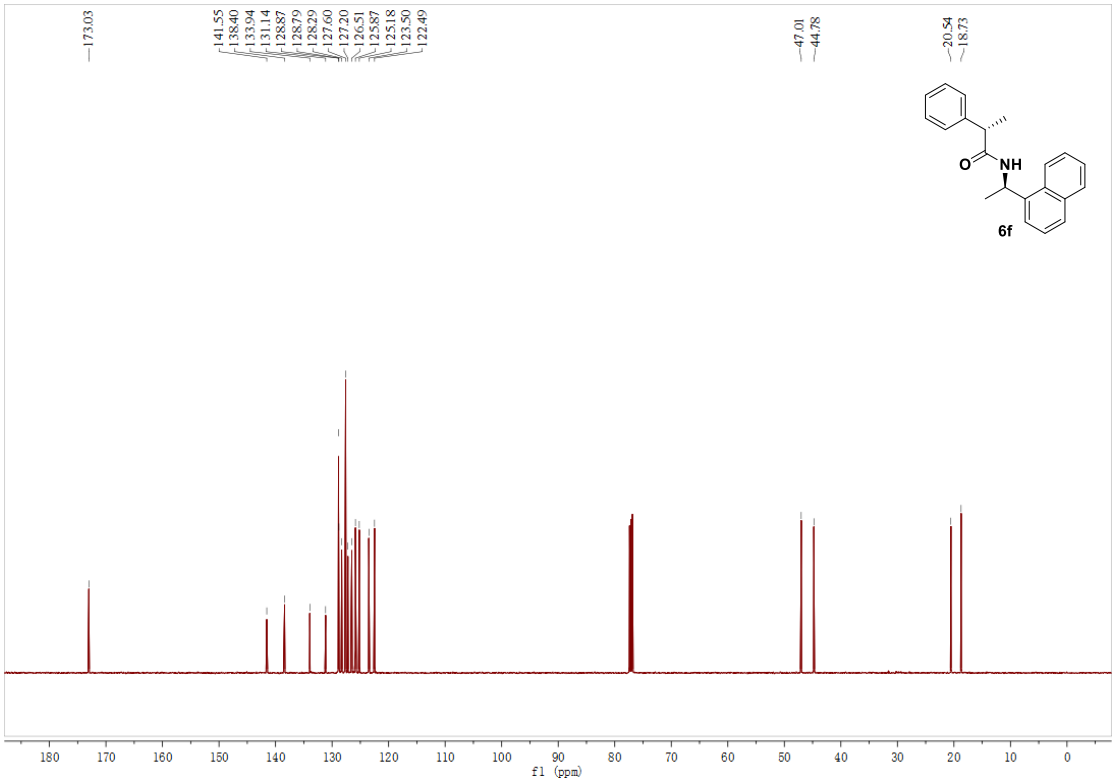

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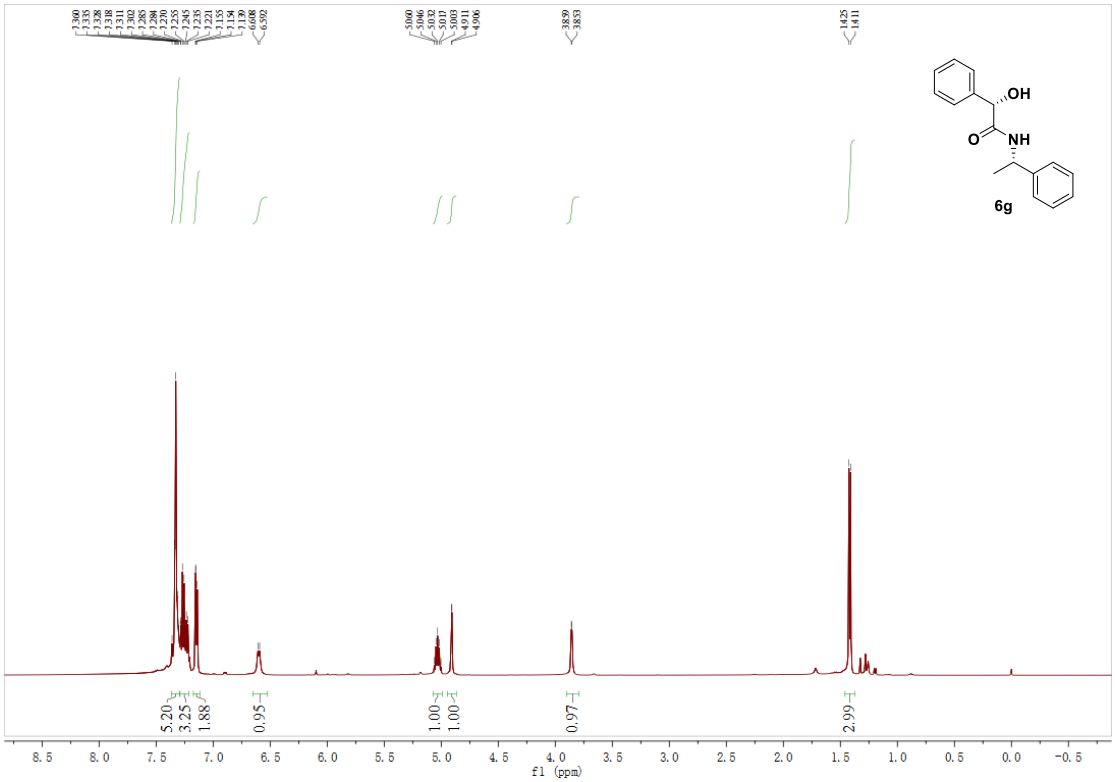

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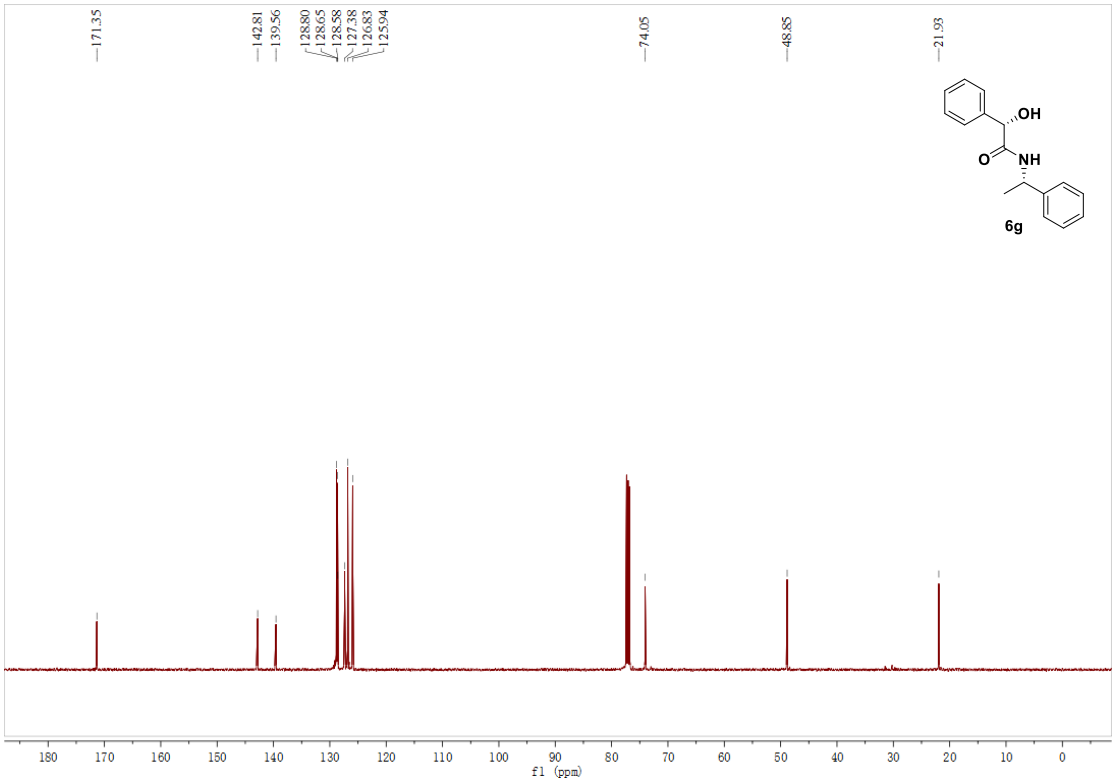
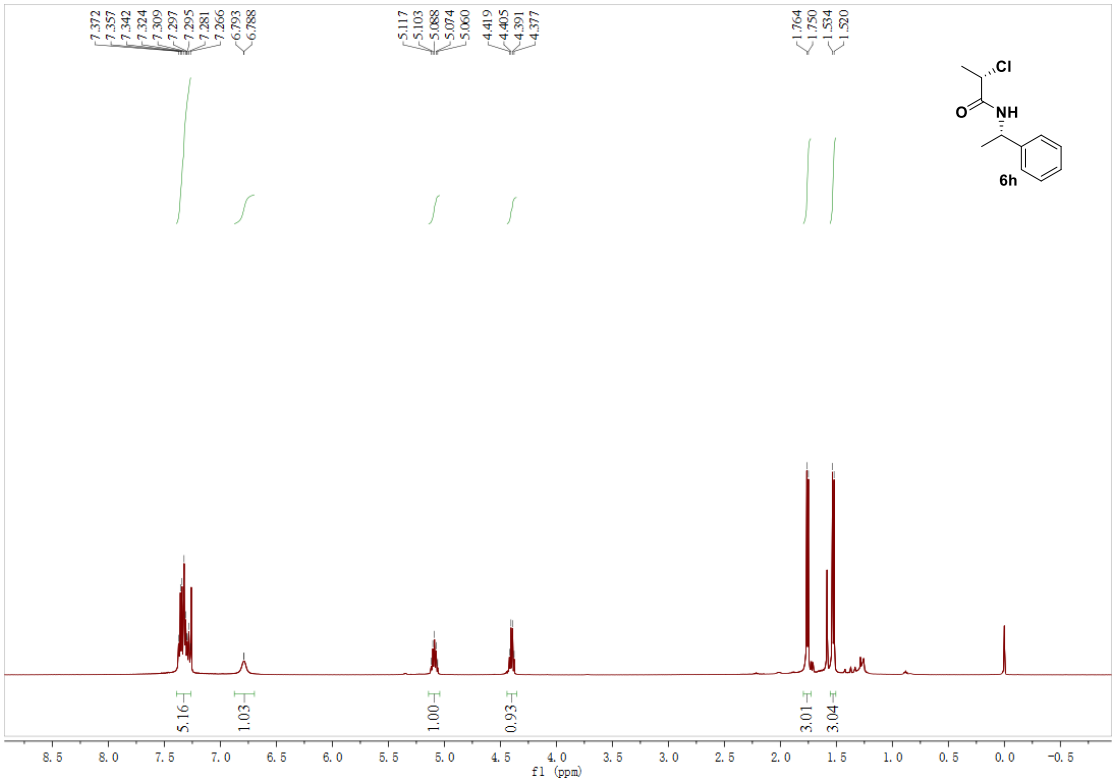
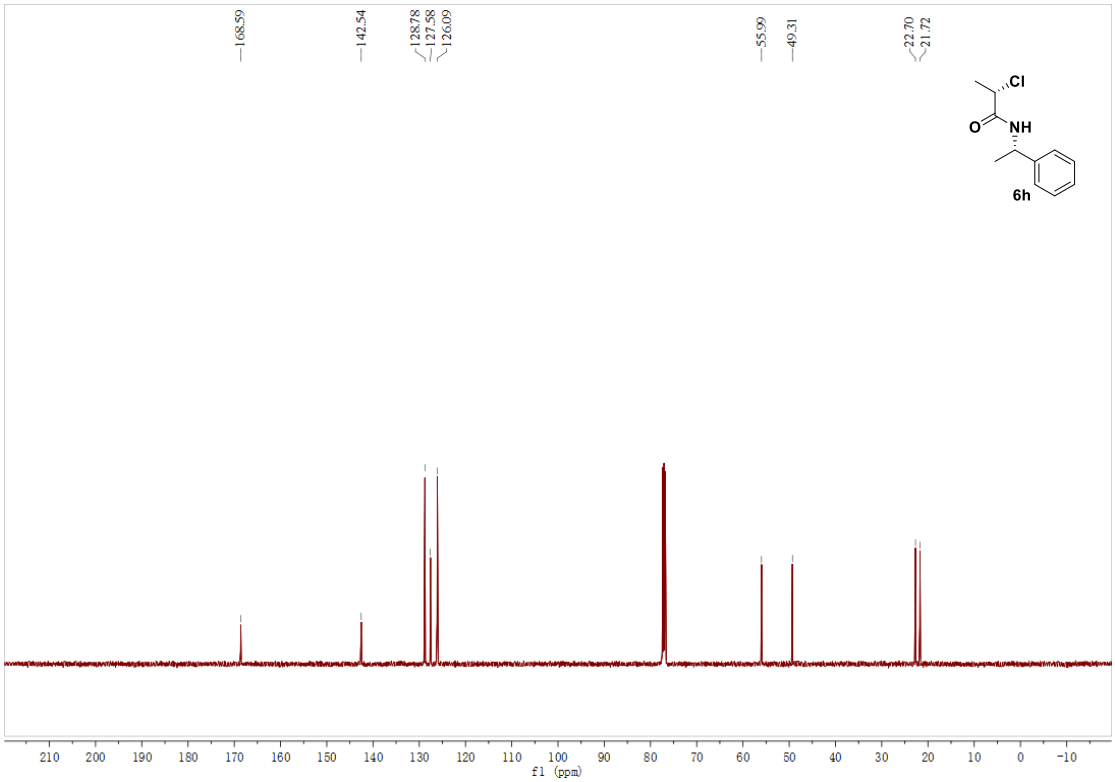


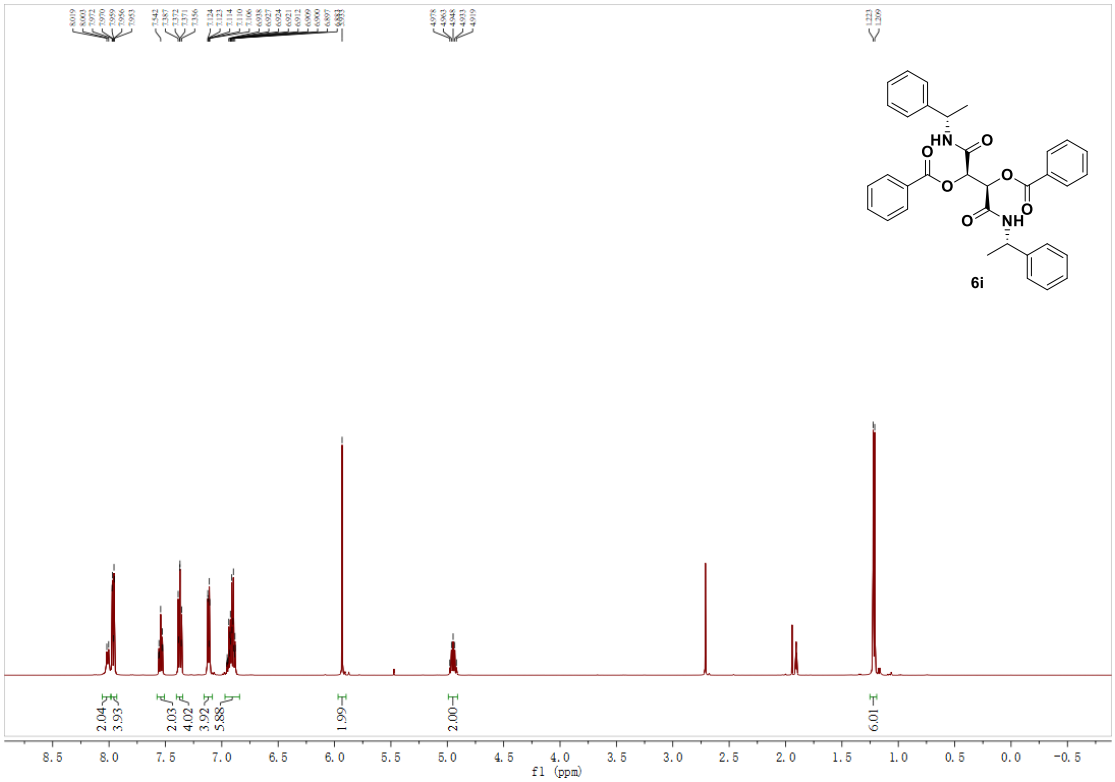
500 MHz, $CDCl_3$, ^1H NMR



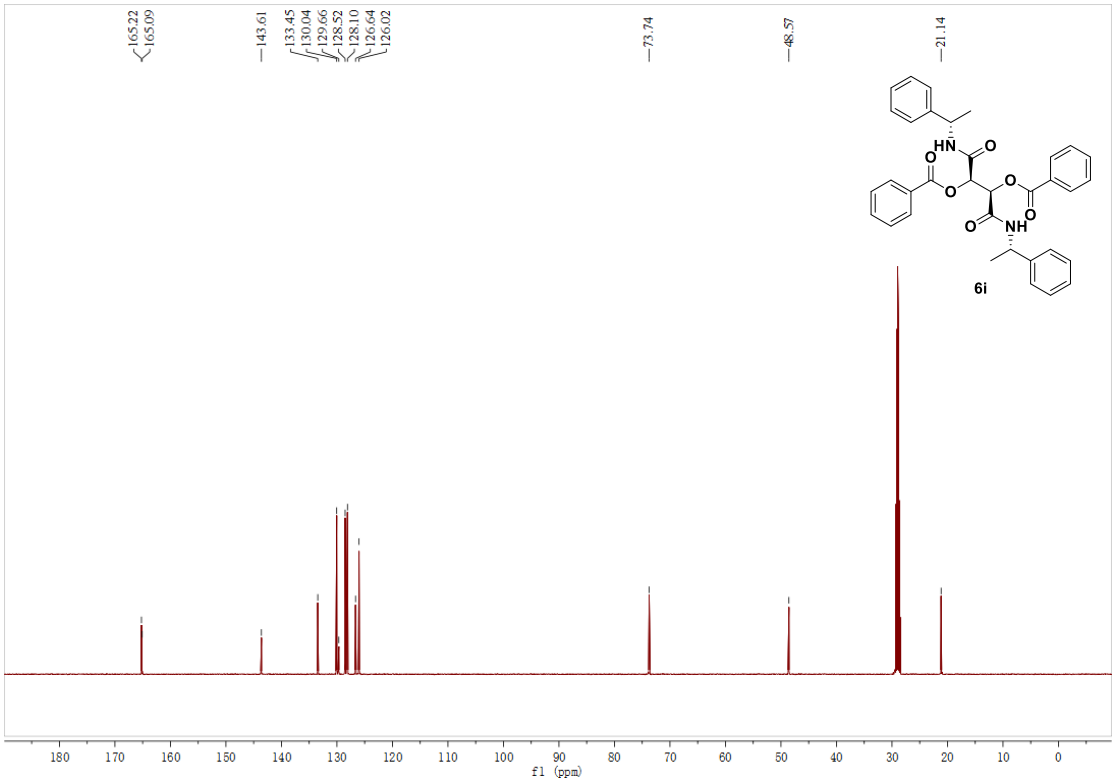
125 MHz, $CDCl_3$, ^{13}C NMR



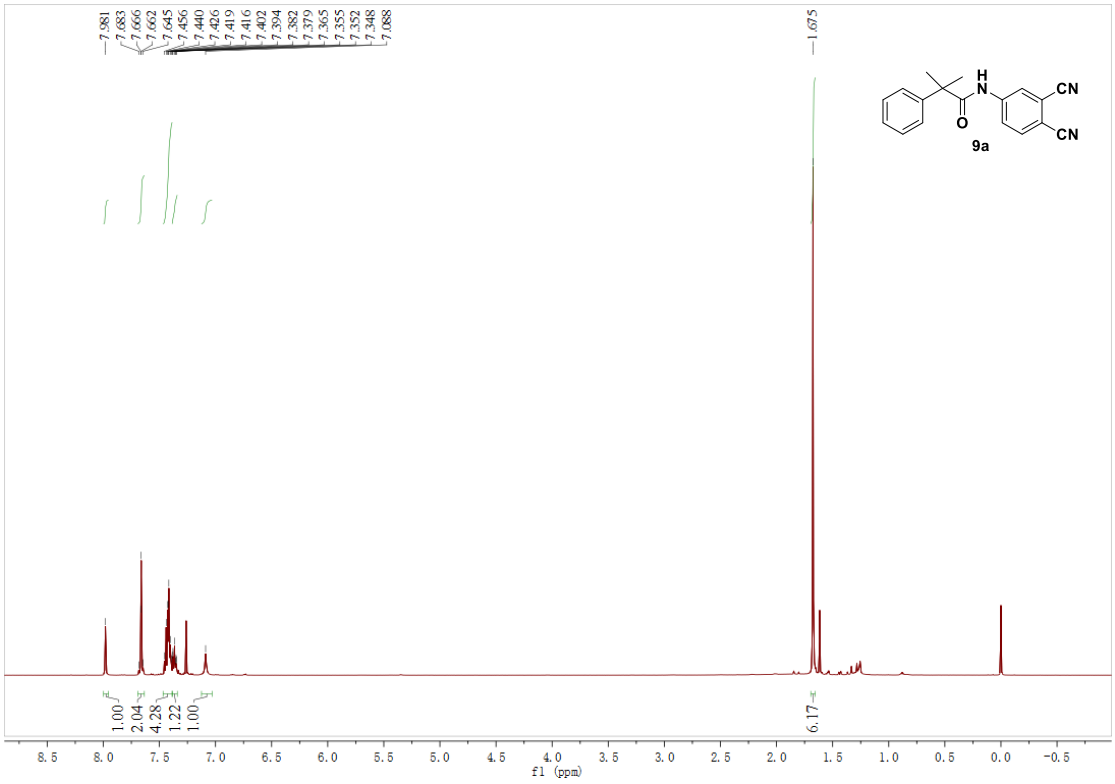
500 MHz, acetone-d_6, ^{1}H NMR



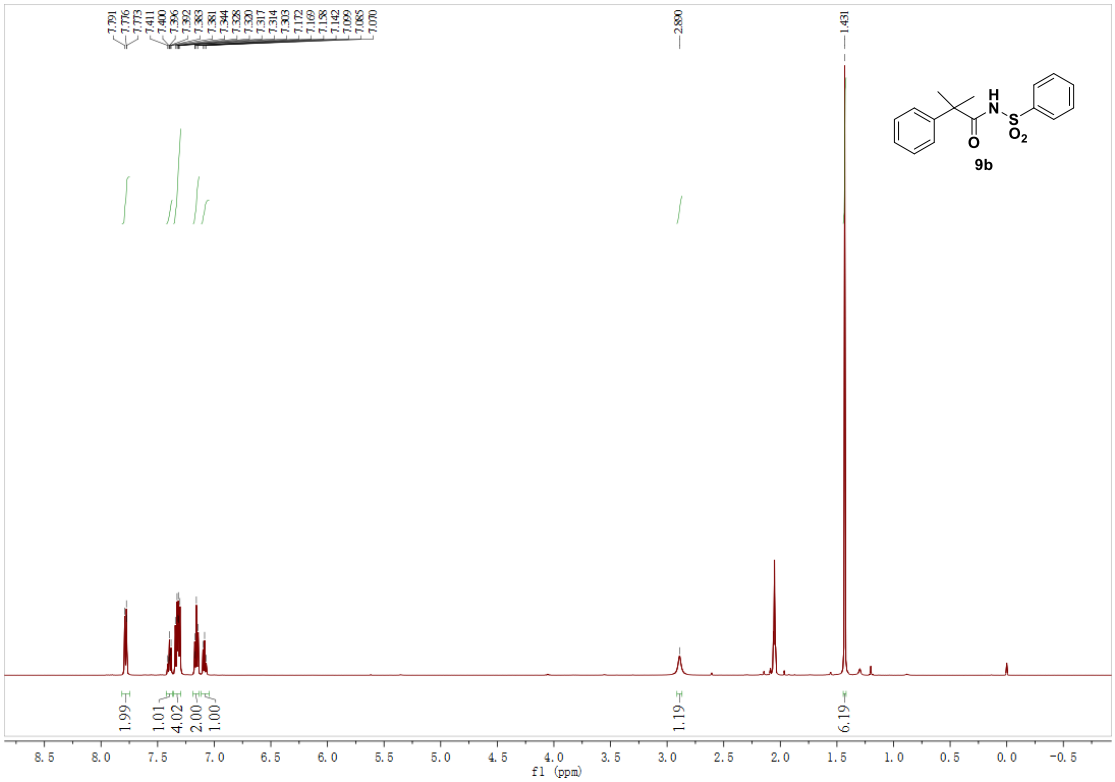
125 MHz, acetone-d_6, ^{13}C NMR



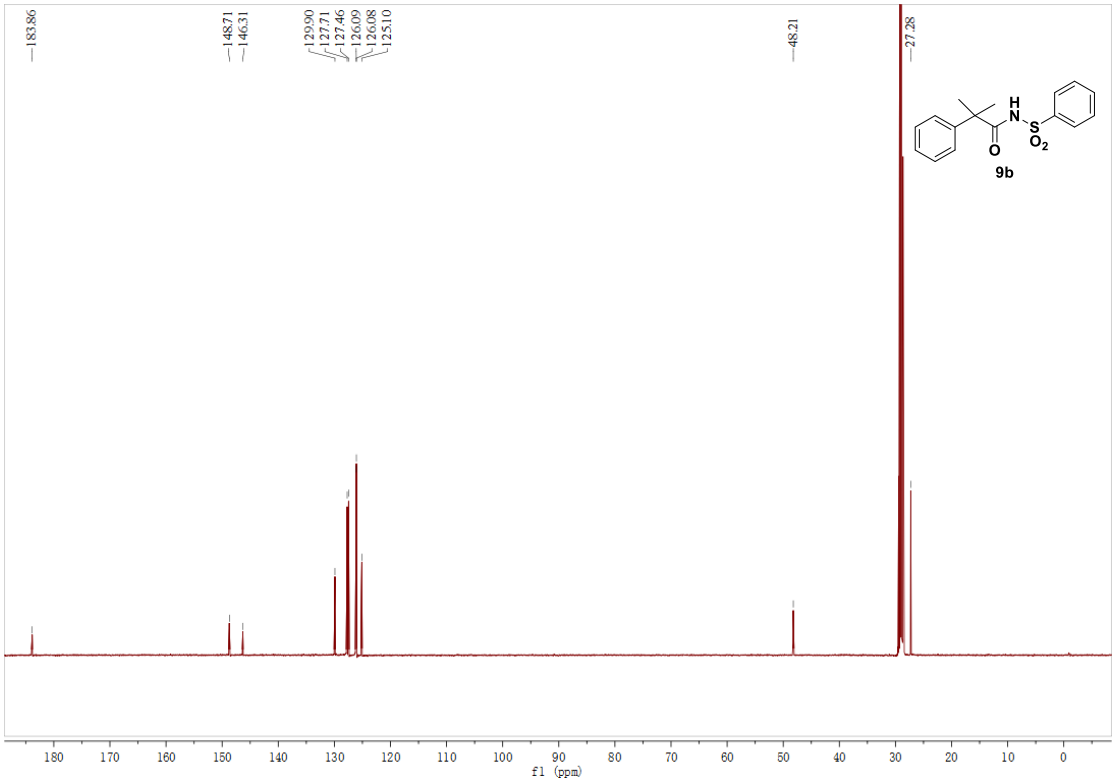
500 MHz, $CDCl_3$, ^1H NMR



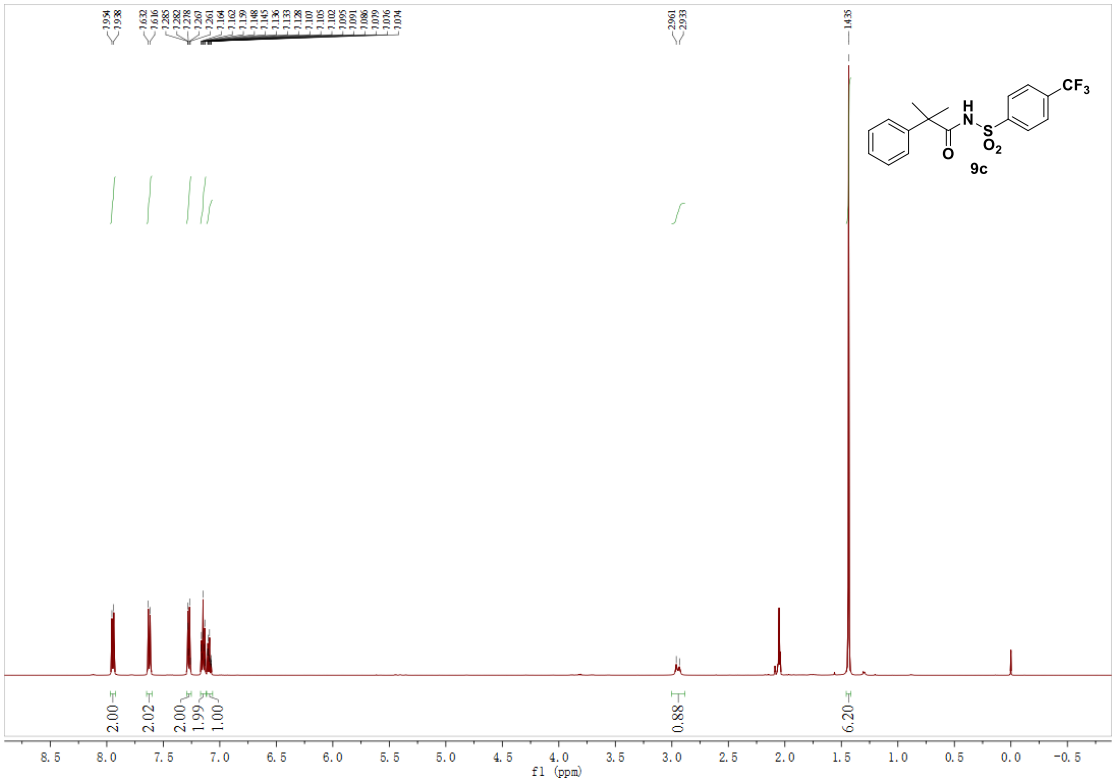
500 MHz, acetone-d_6, ^{1}H NMR



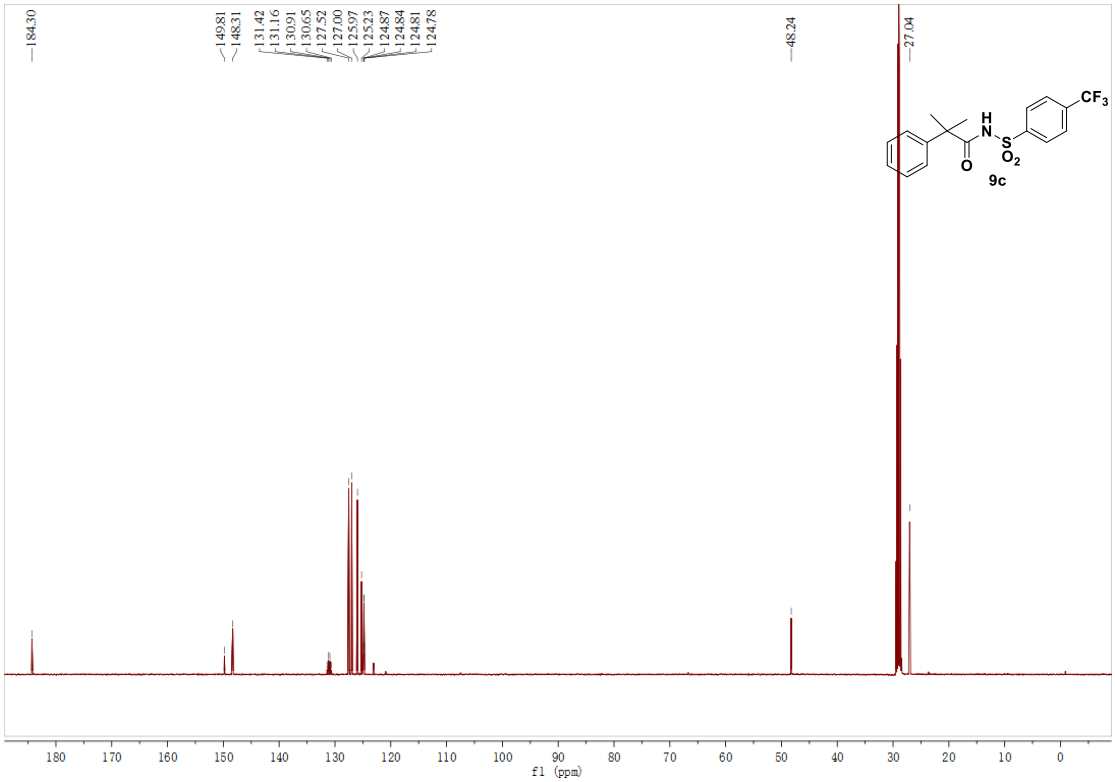
125 MHz, acetone-d_6, ^{13}C NMR



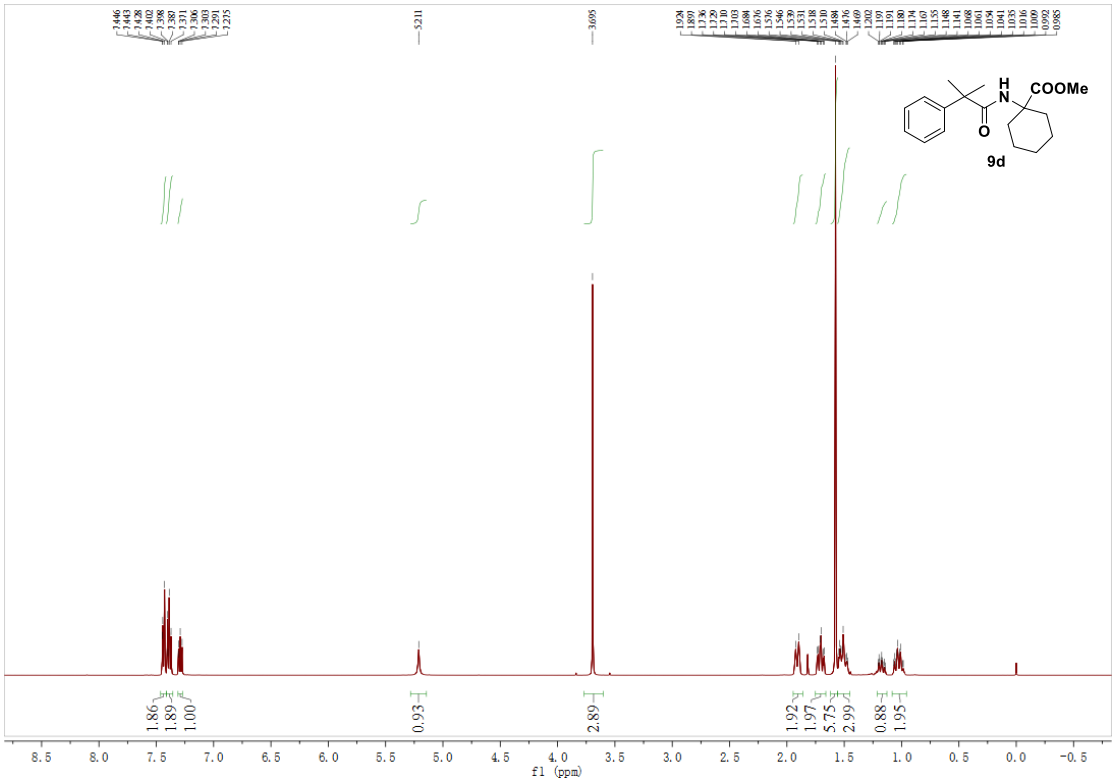
500 MHz, acetone-d_6, ^{1}H NMR



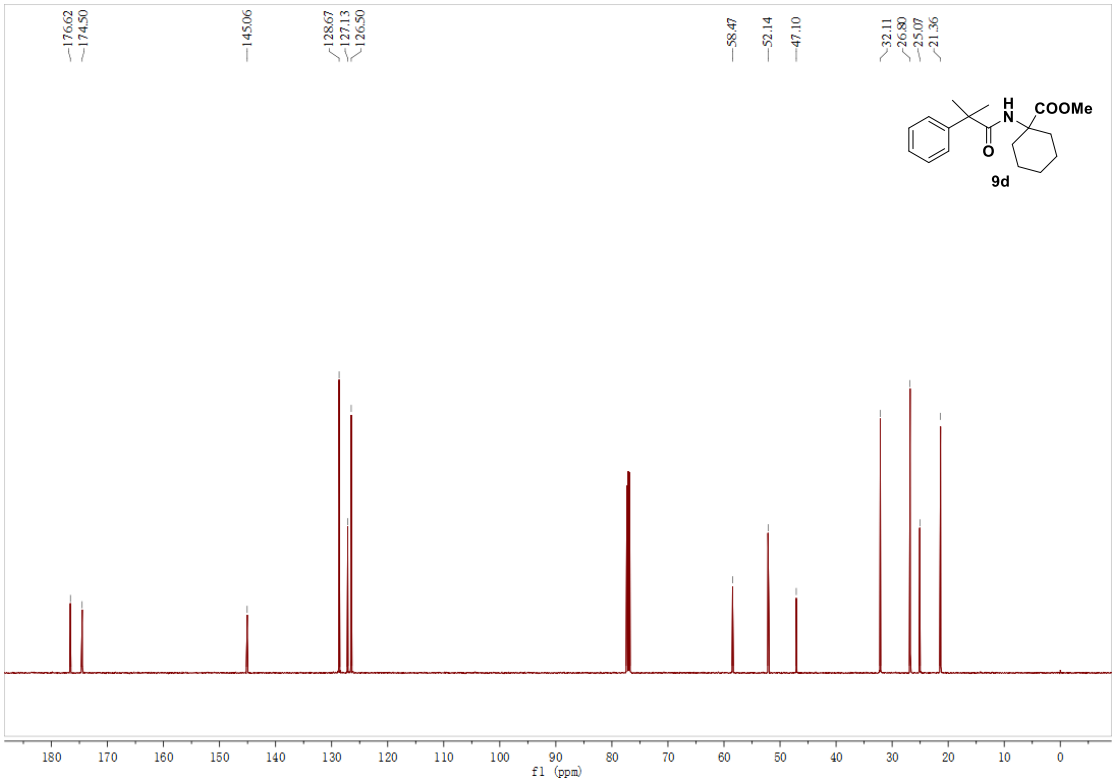
125 MHz, acetone-d_6, ^{13}C NMR



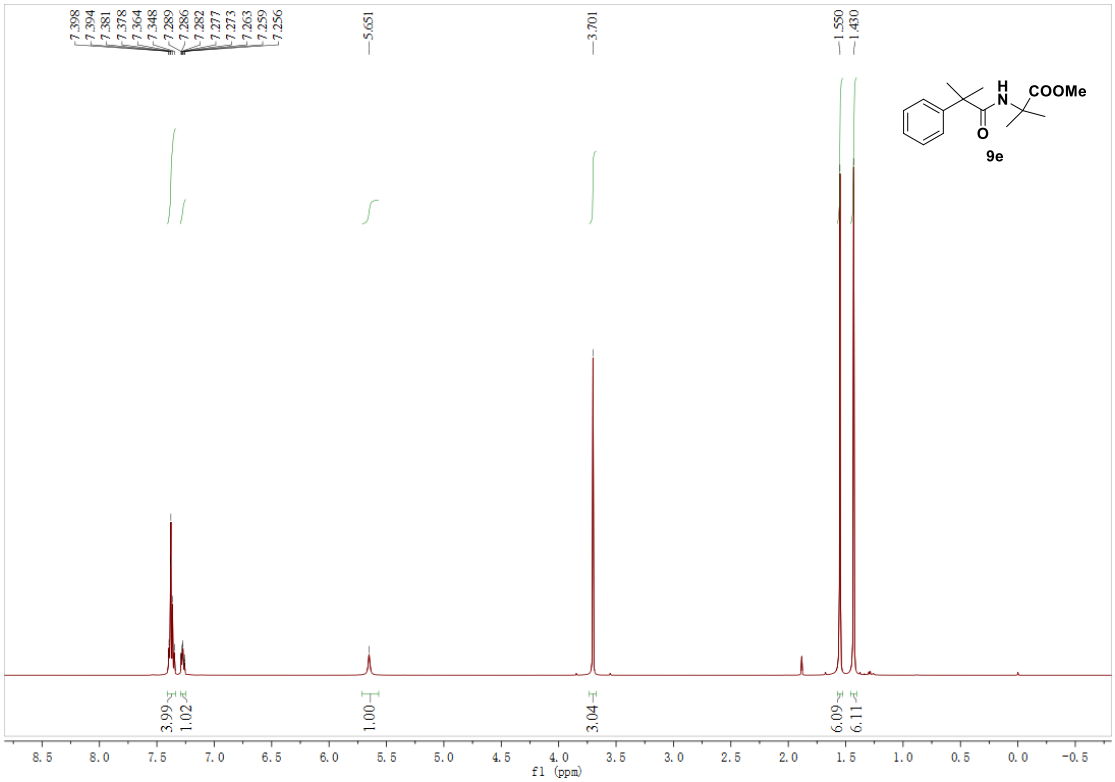
500 MHz, $CDCl_3$, ^1H NMR



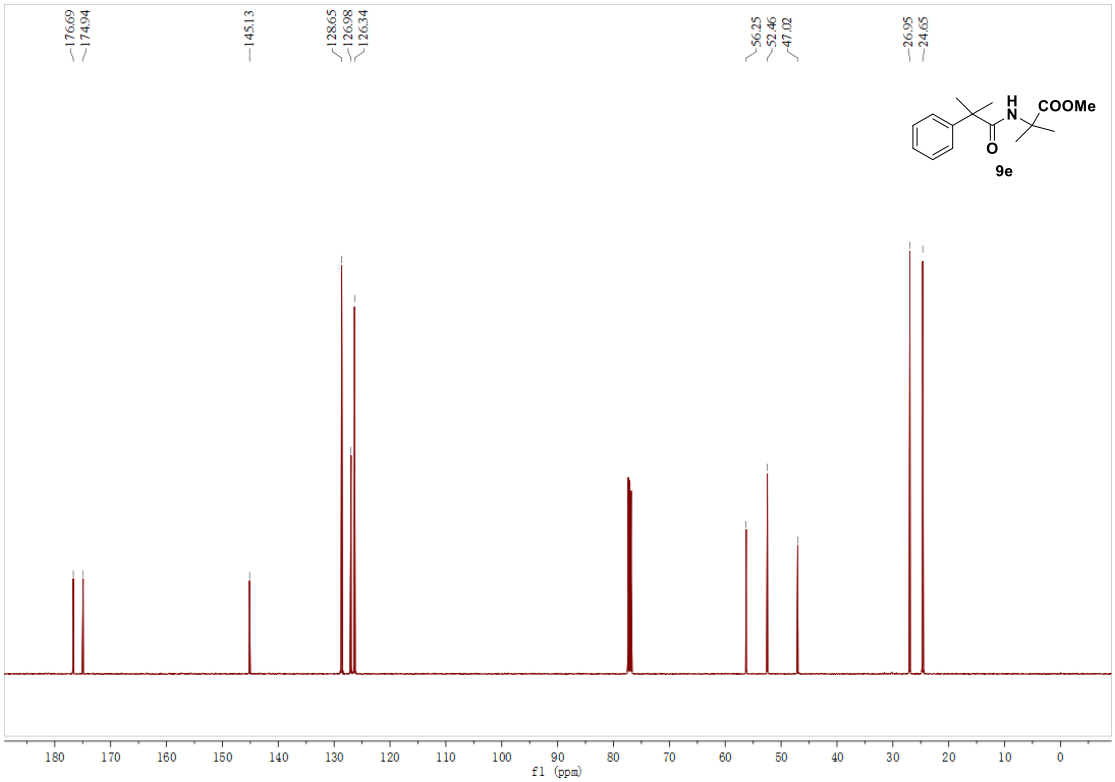
125 MHz, $CDCl_3$, ^{13}C NMR



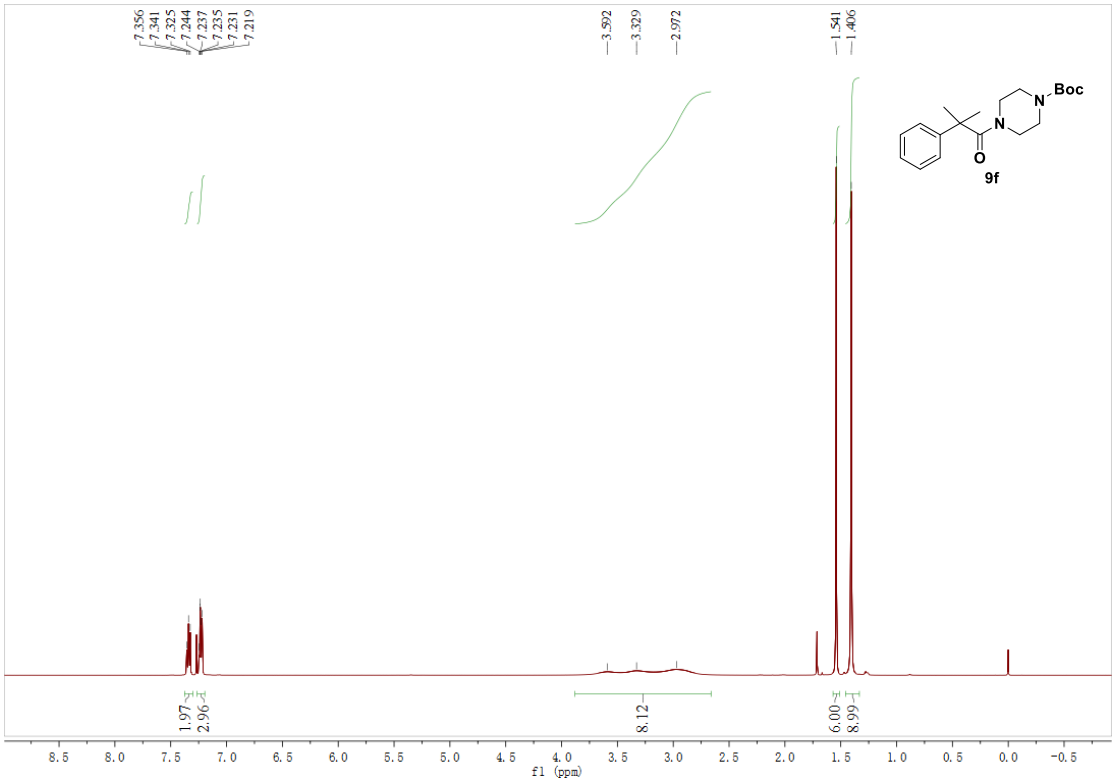
500 MHz, $CDCl_3$, ^1H NMR



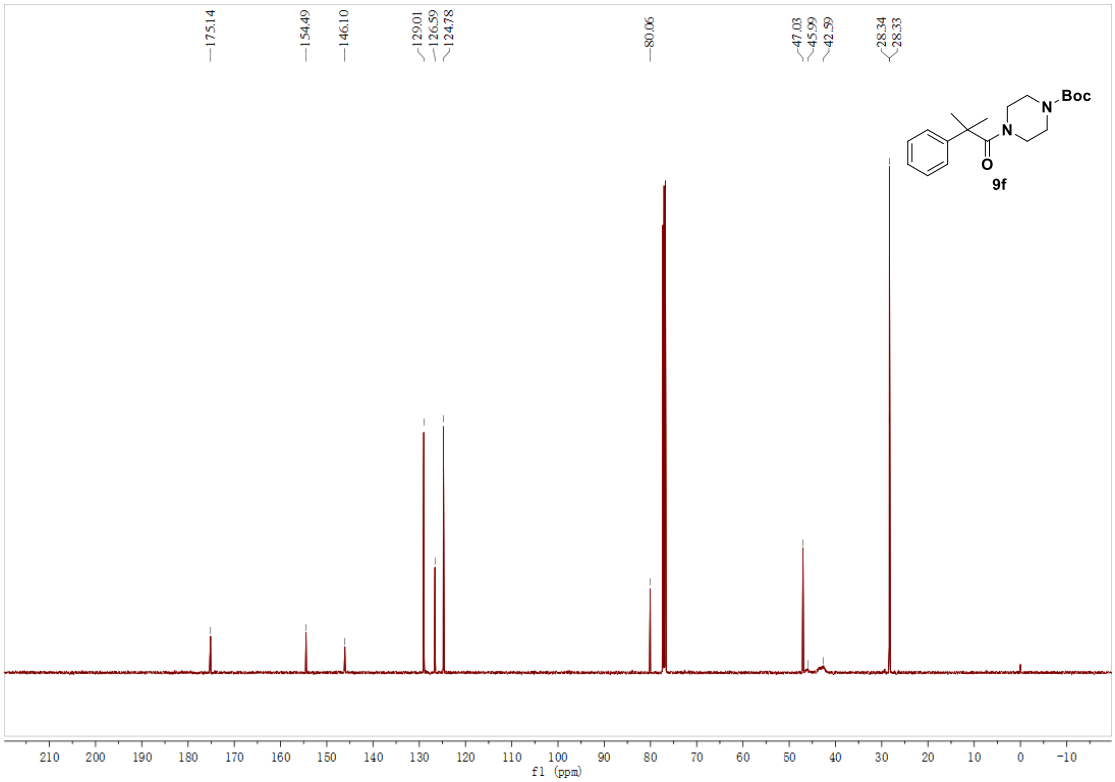
125 MHz, $CDCl_3$, ^{13}C NMR



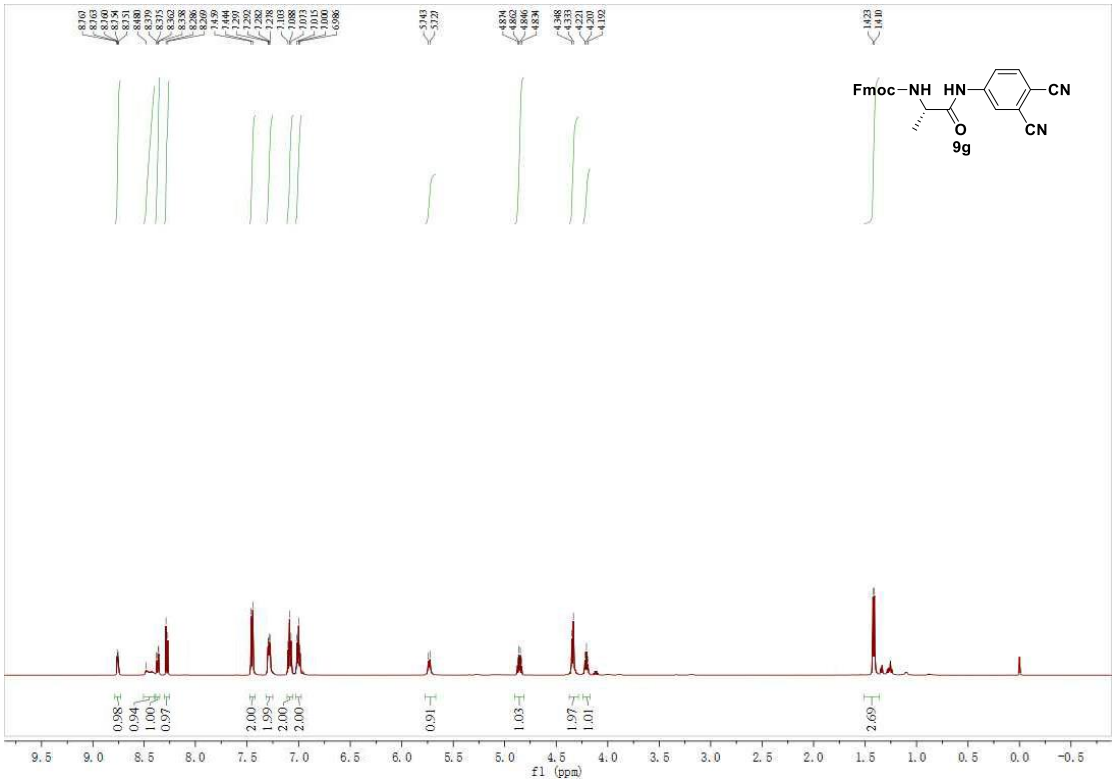
500 MHz, $CDCl_3$, ^1H NMR



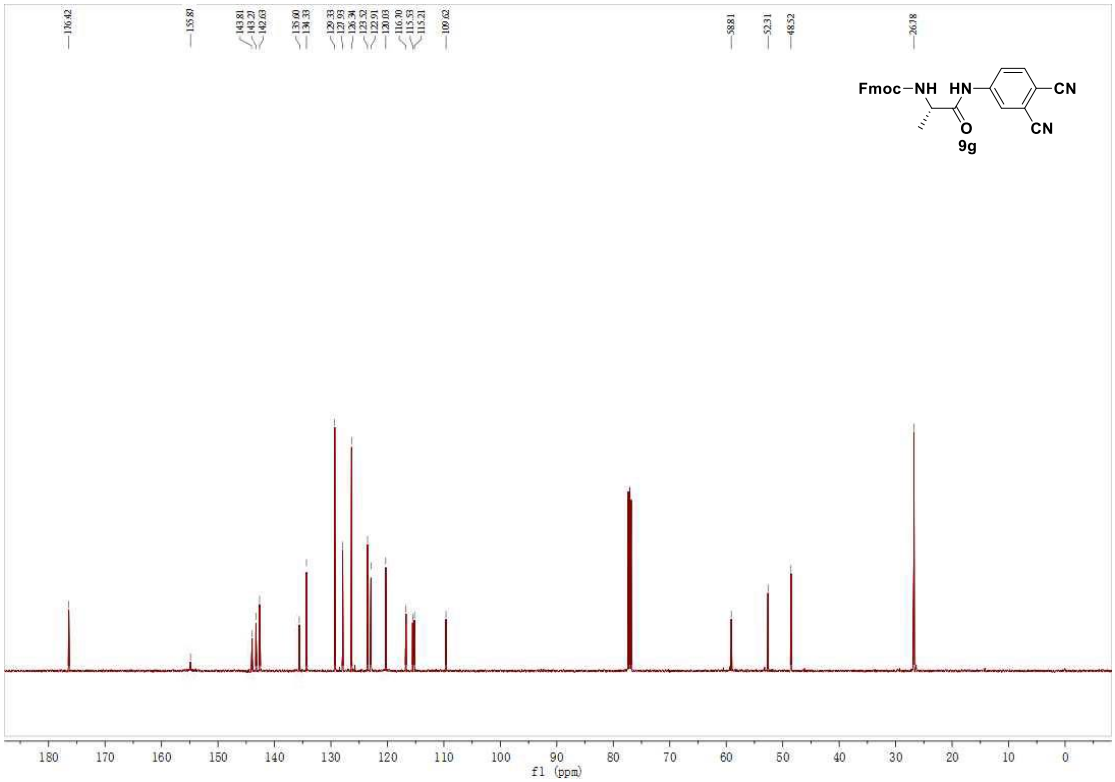
125 MHz, $CDCl_3$, ^{13}C NMR



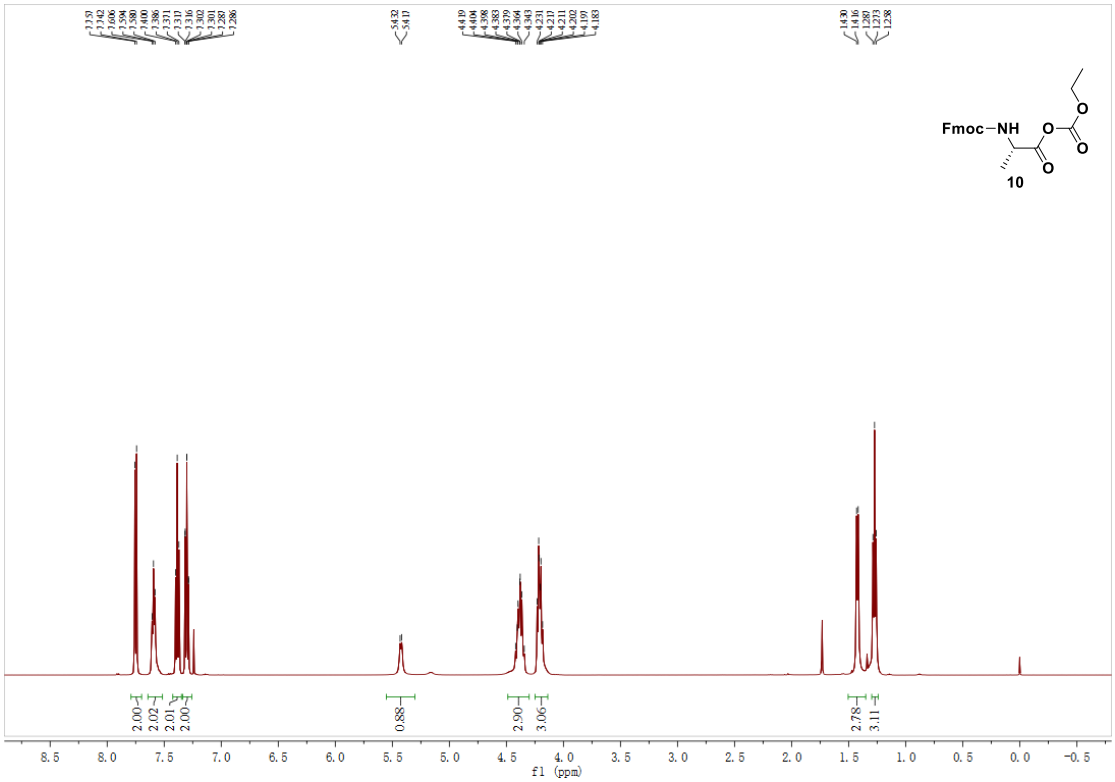
500 MHz, $CDCl_3$, ^1H NMR



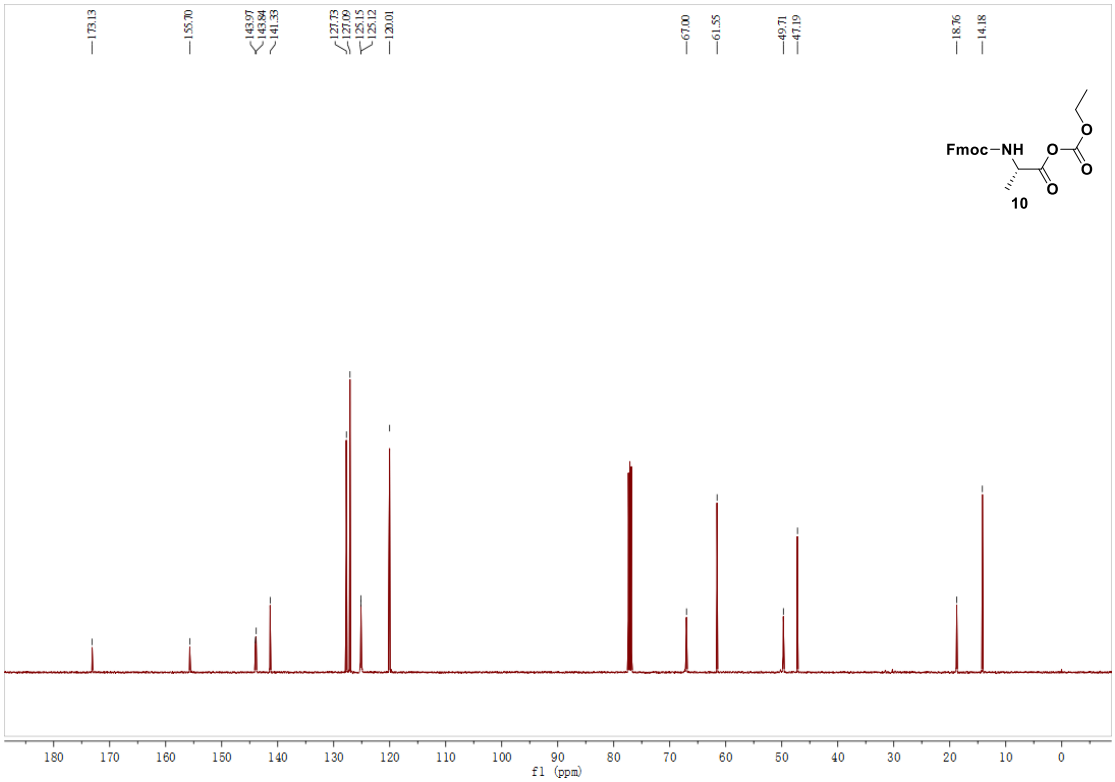
125 MHz, $CDCl_3$, ^{13}C NMR



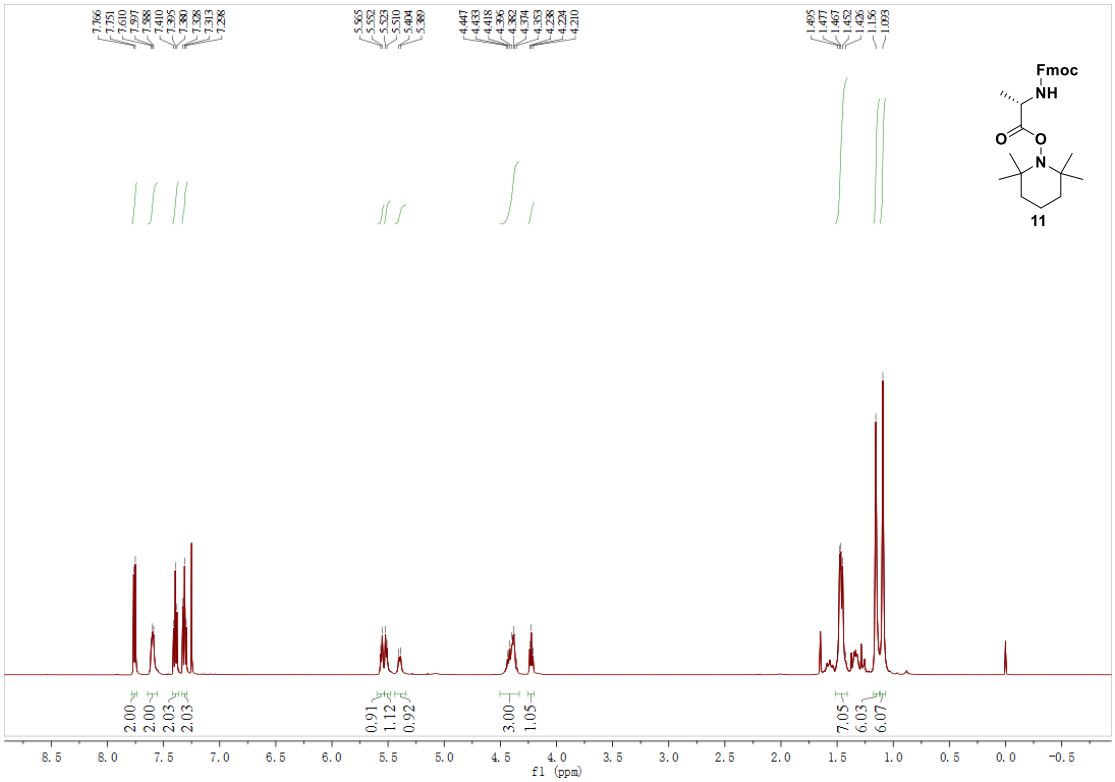
500 MHz, $CDCl_3$, ^1H NMR



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



500 MHz, $CDCl_3$, ^1H NMR



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