Supporting Information

Photo-induced synthesis, stereochemistry and antitumor activity of valine-based small cyclopeptides

Xu Han,[†a] Yujun Bao,[†b] Xiong Zhang,[a] Tong Li,[a] Rui Yan[a] and Zhiqiang Wang[*a] and Yingxue Jin[*a,b]

a. Key Laboratory for Photonic and Electronic Bandgap Materials (Ministry of Education), College of Chemistry & Chemical Engineering, Harbin Normal University, Harbin 150025, P. R. China.

b. Key Laboratory of Molecular Cytogenetics and Genetic Breeding of Heilongjiang province, College of Life Science and Technology, Harbin Normal University, Harbin, 150025, China.

***Corresponding author.** E-mail: wangzq@hrbnu.edu.cn (Z. Q. Wang), jyxprof@163.com (Y. X. Jin).

† These authors contributed equally to this work

Contents

1．Experimental Section

1.1 General Experimental Procedures

Boc-D-Valine (22838-58-0), Boc-L-Valine (13734-41-3), N-Ethoxycarbonyl-2-ethoxy-1, 2-dihydroquinline (EEDQ, 16357-59-8), N-[(Trimethylsilyl)methyl]-benzylamine (53215-95-5), Phthalylglycyl chloride (6780-38-7) and Trifluoroacetic acid (TFA, 76-05-1) were purchased from Energy Chemical. Dichloromethane, methanol, ethyl acetate, petroleum ether, 1, 4-Dioxane were analytical reagent. Dulbecco's modied eagle medium (DMEM), penicillin, fetal bovine serum (FBS), and streptomycin were purchased from Beijing Dingguo Biotechnology Co. Phosphatebuffered saline (PBS) purchased from Invitrogen (10010) was used as a balanced salt solution in cell culture. All the solvents were distilled and puried by standard procedures. All the above chemicals reagents were used without further purification. ^{1}H and ^{13}C-NMR spectra were recorded at 400 and 100 MHz, respectively, on an AMX400 spectrometer (Bruker, Bremen, Germany) with tetramethylsilane (TMS) as an internal standard. Mass spectra were recorded on a JEOL JMS-700 spectrometer using the fast atom bombardment (FAB) or electron impact (EI) mode.

1.2 Preparation of trimethylsilylbenzylamido dipeptides

The Boc-Valine (2.17 g, 10 mmol) and N-[(Trimethylsilyl)methyl]-benzylamine (1.93 g, 10 mmol) was dissolved in 50 mL of anhydrous dichloromethane, EEDQ (3.78 g, 15 mmol in 10 mL of THF) was added dropwise with stirring at room temperature. Bi drops continue stirring 72 h. After the reaction, the reaction solution was washed twice with 16 mL of water, the organic layer was dried over anhydrous sodium sulfate and concentrated, the residue was purified by silica gel column chromatography (mobile phase V_{EA}/V_{PE} = 2:1) to obtain pure N-Boc-Val-Si$(CH_3)_3$ (a while solid). The N-Boc-Val-Si$(CH_3)_3$ was dissolved in 20 mL of anhydrous dichloromethane and added dropwise 10 mL of trifluoroacetic acid, then stirred for 3 h. After removal of trifluoroacetic acid and dichloromethane was concentrated, the residue was dispersed in 20 mL of dichloromethane, washed twice with 10 mL of water, dried over anhydrous sodium sulfate and concentrated to give a chemically pure Val-Si$(CH_3)_3$ 2.61 g (yellow oil). The Val-Si$(CH_3)_3$ (2.61 g, 7 mmol) and Boc-Val (1.52 g, 7 mmol) was dissolved in 20 mL of anhydrous dichloromethane. EEDQ (2.59 g, 10.5 mmol in 10 ml of THF) was added dropwise with stirring at room temperature for 72h. After completion of the reaction, the

reaction solution was washed twice with 10 mL of water, the organic layer was dried over anhydrous sodium sulfate and concentrated, and the residue was dissolved in 10 mL of anhydrous dichloromethane, added dropwise 3 mL of trifluoroacetic acid and stirred for 3h. After removal of trifluoroacetic acid methylene chloride, the residue was dispersed in 10 mL of dichloromethane, washed twice with 10 mL of water, dried over anhydrous sodium sulfate and concentrated to give Val-Val-Si(CH_3)$_3$ 2.41 g (a while solid). The same method was used for synthesis of Val-Si(CH_3)$_3$, Val-Val-Val-Si(CH_3)$_3$.

1.3 Synthesis of the Photoreaction Precursor Linear Peptides (1a-14a)

The synthesis of linear peptides is similar to our previous report. Generally, N-Boc-amino acid (10 mmol) was used as the starting material, N-benzyl-1-(trimethylsilyl)-methanamine (1 equivalent, 10 mmol) was used as a masking agent for the carboxyl end group, 2-ethoxy-1-ethoxycarbonyl-1, 2-dihydroquinoline (EEDQ) (1.5 molar equivalents, 15 mmol in 10 mL of THF) was used as a condensing agent, and trifluoroacetic acid (TFA) (3 molar equivalents) was used as a deprotecting agent to prepare the N-benzyl1-(trimethylsilyl)-methanamine-substituted linear peptides (Scheme 1). Finally, the electron acceptor phthalimide glycine (1.1 molar equivalent, using dichloromethane as solvent) was introduced to obtain the photoreaction precursor N-phthalimide-peptides (1a-14a).

Phth-Gly-L-Val-N(Bn)CH_2SiMe_3(1a)

White solid (yield 67%). ^{1}H NMR ($CDCl_3$, 300 MHz) δ: 0.03-0.16 (m, 9H, $SiMe_3$), 0.90-0.98 (m, 6H, CH_3), 2.02-2.12 (m, 2H, **CH_2**$SiMe_3$), 2.69-3.08 (m, 1H, CH**CH**(CH_3)$_2$), 4.32-4.36 (m, 1H, **CH**$CH(CH_3)_2$), 4.40-4.48 (m, 2H, **CH_2**Ph), 4.73-4.96 (m, 2H, N**CH_2**CO), 6.72-6.91 (m, 2H, ArH), 7.13-7.34 (m, 3H, ArH), 7.73-7.90 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: -1.4, 1.2, 16.7, 17.3, 17.9, 18.0, 19.1, 19.8, 31.6, 32.0, 32.1, 40.6, 40.6, 50.2, 53.1, 53.6, 53.7, 58.6, 77.8(solvent peak), 123.5, 123.5, 126.7, 127.5, 127.9, 127.9, 128.6, 128.9, 132.1, 134.1, 136.0, 136.8, 165.9, 167.7, 170.4, 170.4. HRMS (ESI) m/z calcd for $C_{26}H_{33}N_3O_4SiNa^+$ $(M+Na)^+$ 502.22403, found 502.21359.

Phth-Gly-D-Val-N(Bn)CH_2SiMe_3(2a)

White solid (yield 66%). ^{1}H NMR ($CDCl_3$, 300 MHz) δ: 0.05-0.17 (m, 9H, $SiMe_3$), 0.87-1.01 (m, 6H, CH_3), 2.04-2.11 (m, 2H, **CH_2**$SiMe_3$), 2.89-3.05 (m, 1H, CH**CH**(CH_3)$_2$), 4.41-4.51 (m, 2H, **CH_2**Ph), 4.64-4.79 (m, 2H, N**CH_2**CO), 4.90-4.94 (m, 1H, **CH**$CH(CH_3)_2$), 7.21-7.27 (m, 2H, ArH), 7.33-7.43 (m, 3H, ArH), 7.77-7.94 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: -1.4, -1.2, 17.1, 17.7,

19.7, 20.0, 31.6, 31.9, 39.2, 40.6, 50.5, 53.6, 53.9, 54.2, 77.8(solvent peak), 123.6, 127.1, 127.7, 128.0, 128.7, 129.0, 132.1, 134.1, 135.9, 136.5, 166.0, 166.2, 167.7, 171.1. HRMS (ESI) m/z calcd for $C_{26}H_{33}N_3O_4SiNa^+$ $(M+Na)^+$ 502.22403, found 502.21375.

Phth-Gly-L-Val-L-Val-N(Bn)CH$_2$SiMe$_3$(3a)

White solid (yield 69%). ^{1}H NMR ($CDCl_3$, 300 MHz) δ: 0.06-0.13 (m, 9H, $SiMe_3$), 0.88-1.02 (m, 12H, CH_3), 2.03-2.10 (m, 2H, **CH$_2$**$SiMe_3$), 2.82-2.99 (m, 2H, CH**CH**$(CH_3)_2$), 4.35-4.43 (m, 2H, **CH**$CH(CH_3)_2$), 4.47-4.67 (m, 2H, **CH$_2$**Ph), 4.88-4.92 (m, 2H, N**CH$_2$**CO), 7.17-7.19 (m, 2H, ArH), 7.27-7.38 (m, 3H, ArH), 7.72-7.89 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ:-1.5, -1.1, 17.0, 17.5, 19.8, 20.0, 31.9, 32.0, 38.5, 40.5, 50.3, 53.2, 53.9, 54.1, 77.8(solvent peak), 123.5, 127.0, 127.4, 127.6, 127.8, 128.6, 128.9, 132.1, 132.1, 134.0, 134.1, 136.1, 136.7, 165.7, 165.8, 167.7, 167.7, 170.6. HRMS (ESI) m/z calcd for $C_{31}H_{42}N_4O_5SiNa^+$ $(M+Na)^+$ 601.29245, found 601.28180.

Phth-Gly-D-Val-L-Val-N(Bn)CH$_2$SiMe$_3$(4a)

White solid (yield 71%). ^{1}H NMR ($CDCl_3$, 300 MHz) δ: 0.04-0.15 (m, 9H, $SiMe_3$), 0.92-0.98 (m, 12H, CH_3), 2.06-2.18 (m, 2H, **CH$_2$**$SiMe_3$), 2.60-3.08 (m, 2H, CH**CH**$(CH_3)_2$), 4.32-4.44 (m, 2H, **CH**$CH(CH_3)_2$), 4.47-4.50 (m, 2H, **CH$_2$**Ph), 4.72-4.95 (m, 2H, N**CH$_2$**CO), 6.86-7.22 (m, 2H, ArH), 7.24-7.31 (m, 3H, ArH), 7.72-7.87 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: -1.4, -1.2, 17.4, 17.6, 19.4, 20.1, 31.9, 32.3, 38.2, 40.4, 53.1, 53.9, 58.44, 77.8(solvent peak), 123.4, 123.5, 126.7, 127.8, 127.9, 128.6, 128.8, 132.1, 134.0, 134.0, 135.9, 136.8, 165.9, 167.7, 170.3, 170.3, 170.6.HRMS (ESI) m/z calcd for $C_{31}H_{42}N_4O_5SiNa^+$ $(M+Na)^+$ 601.29245, found 601.28210.

Phth-Gly-D-Val-D-Val-N(Bn)CH$_2$SiMe$_3$(5a)

White solid (yield 69%). ^{1}H NMR ($CDCl_3$, 300 MHz) δ: 0.01-0.13 (m, 9H, $SiMe_3$), 0.88-0.97 (m, 12H, CH_3), 2.00-2.09 (m, 2H, **CH$_2$**$SiMe_3$), 2.67-3.05 (m, 2H, CH**CH**$(CH_3)_2$), 4.29-4.45 (m, 2H, **CH**$CH(CH_3)_2$), 4.70-4.74 (m, 2H, **CH$_2$**Ph), 4.89-4.93 (m, 2H, N**CH$_2$**CO), 6.67-7.16 (m, 2H, ArH), 7.25-7.32 (m, 3H, ArH), 7.71-7.87 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: -1.4, -1.2, 16.7, 17.2, 17.9, 18.0, 19.1, 19.8, 20.0, 32.0, 32.0, 38.3, 40.5, 53.0, 53.6, 53.7, 58.5, 77.8(solvent peak), 123.5, 126.7, 126.7, 127.8, 127.9, 128.6, 128.8, 132.1, 132.1, 134.1, 165.8, 167.6, 167.7, 170.3, 170.4.HRMS (ESI) m/z calcd for $C_{31}H_{42}N_4O_5SiNa^+$ $(M+Na)^+$ 601.29245, found 601.28210.

Phth-Gly-L-Val-D-Val-N(Bn)CH$_2$SiMe$_3$(6a)

White solid (yield 70%). 1H NMR ($CDCl_3$, 300 MHz) δ: 0.05-0.15 (m, 9H, $SiMe_3$), 0.92-1.02 (m, 12H, CH_3), 2.07-2.20 (m, 2H, **CH_2**$SiMe_3$), 2.73-3.05 (m, 2H, CH**CH**$(CH_3)_2$), 4.40-4.42 (m, 2H, **CH**$CH(CH_3)_2$), 4.46-4.75 (m, 2H, **CH_2**Ph), 4.88-4.92 (m, 2H, N**CH_2**CO), 7.00-7.18 (m, 2H, ArH), 7.20-7.34 (m, 3H, ArH), 7.74-7.89 (m, 4H, Phthaloyl); 13C NMR ($CDCl_3$, 300 MHz) δ: -1.4, -1.2, 17.0, 17.6, 17.6, 19.3, 19.4, 20.0, 20.1, 31.6, 31.8, 32.0, 38.7, 40.5, 53.3, 54.1, 58.4, 77.8(solvent peak), 123.5, 123.5, 126.8, 127.9, 127.9, 128.7, 128.9, 132.1, 132.1, 134.0, 134.0, 134.1, 135.8, 166.1, 167.7, 170.5, 170.6, 170.7 .HRMS (ESI) m/z calcd for $C_{31}H_{42}N_4O_5SiNa^+$ $(M+Na)^+$ 601.29245, found 601.28229.

Phth-Gly-L-Val-L-Val-L-Val-N(Bn)CH_2SiMe_3(7a)

White solid (yield 72%). 1H NMR ($CDCl_3$, 300 MHz) δ: 0.06-0.14 (m, 9H, $SiMe_3$), 0.89-0.98 (m, 18H, CH_3), 1.95-2.14 (m, 3H, CH**CH**$(CH_3)_2$), 2.66-3.18 (m, 2H, **CH_2**$SiMe_3$), 4.37-4.50 (m, 2H, **CH**$CH(CH_3)_2$), 4.77-4.88 (m, 2H, **CH_2**Ph), 5.03-5.07 (m, 2H, N**CH_2**CO), 7.11-7.232 (m, 2H, ArH), 7.26-7.36 (m, 3H, ArH), 7.68-7.86 (m, 4H, Phthaloyl); 13C NMR ($CDCl_3$, 300 MHz) δ: -1.4, -1.3, 0.0, 17.7, 18.3, 18.3, 19.0, 19.0, 19.1, 19.5, 31.2, 32.0, 32.3, 38.1, 40.2, 53.1, 53.6, 58.4, 58.6, 77.8(solvent peak), 123.4, 126.8, 127.2, 127.9, 128.6, 128.9, 132.2, 132.2, 133.9, 135.9, 136.4, 166.5, 167.7, 170.8, 171.3, 171.6, 171.9 .HRMS (ESI) m/z calcd for $C_{36}H_{51}N_5O_6SiNa^+$ $(M+Na)^+$ 700.36086, found 700.34998.

Phth-Gly-D-Val-L-Val-L-Val-N(Bn)CH_2SiMe_3(8a)

White solid (yield 69%). 1H NMR ($CDCl_3$, 300 MHz) δ: 0.01-0.11 (m, 9H, $SiMe_3$), 0.90-1.02 (m, 18H, CH_3), 2.01-2.16 (m, 3H, CH**CH**$(CH_3)_2$), 2.81-2.90 (m, 2H, **CH_2**$SiMe_3$), 4.41-4.52 (m, 2H, **CH**$CH(CH_3)_2$), 4.56-4.60 (m, 2H, **CH_2**Ph), 4.70-4.88 (m, 2H, N**CH_2**CO), 7.13-7.19 (m, 2H, ArH), 7.22-7.32 (m, 3H, ArH), 7.69-7.86 (m, 4H, Phthaloyl); 13C NMR ($CDCl_3$, 300 MHz) δ: -1.5, -1.1, 17.4, 18.2, 18.3, 19.1, 19.9, 31.7, 32.1, 32.3, 38.7, 40.3, 53.4, 54.1, 58.2, 58.4, 77.8(solvent peak), 123.4, 127.1, 127.6, 127.7, 128.6, 128.7, 132.2, 133.9, 136.5, 136.7, 166.2, 167.7, 167.7, 170.7, 170.7, 170.8.HRMS (ESI) m/z calcd for $C_{36}H_{51}N_5O_6SiNa$+ (M+Na)+ 700.36086, found 700.35046.

Phth-Gly-L-Val-D-Val-L-Val-N(Bn)CH_2SiMe_3(9a)

White solid (yield 68%). 1H NMR ($CDCl_3$, 300 MHz) δ: 0.04-0.16 (m, 9H, $SiMe_3$), 0.92-1.05 (m, 18H, CH_3), 2.07-2.22 (m, 3H, CH**CH**$(CH_3)_2$), 2.87-3.10 (m, 2H, **CH_2**$SiMe_3$), 4.37-4.45 (m, 2H, **CH**$CH(CH_3)_2$), 4.49-4.68 (m, 2H, **CH_2**Ph), 4.83-4.87 (m, 2H, N**CH_2**CO), 6.95-7.12 (m, 2H, ArH),

7.22-7.39 (m, 3H, ArH), 7.73-7.88 (m, 4H, Phthaloyl); 13C NMR ($CDCl_3$, 300 MHz) δ: -1.5, -1.3, 18.0, 18.1, 18.1, 19.2, 19.2, 19.6, 31.2, 31.4, 31.6, 39.3, 40.5, 53.6, 54.3, 58.1, 58.1, 59.2, 77.8(solvent peak), 123.4, 123.5, 126.9, 127.0, 128.0, 128.6, 128.9, 132.1, 132.1, 134.0, 134.0, 135.9, 159.6, 166.8, 167.6, 170.9, 171.0, 171.2.HRMS (ESI) m/z calcd for $C_{36}H_{51}N_5O_6SiNa+$ (M+Na)+ 700.36086, found 700.35022.

Phth-Gly-D-Val-D-Val-L-Val-N(Bn)CH_2SiMe_3(10a)

White solid (yield 69%). 1H NMR ($CDCl_3$, 300 MHz) δ: 0.05-0.17 (m, 9H, $SiMe_3$), 0.89-1.03 (m, 18H, CH_3), 2.01-2.15 (m, 3H, CH**CH**$(CH_3)_2$), 2.81-3.10 (m, 2H, **CH_2**$SiMe_3$), 4.33-4.50 (m, 2H, **CH**$CH(CH_3)_2$), 4.59-4.79 (m, 2H, **CH_2**Ph), 4.83-4.92 (m, 2H, N**CH_2**CO), 7.10-7.29 (m, 2H, ArH), 7.31-7.37 (m, 3H, ArH), 7.68-7.87 (m, 4H, Phthaloyl); 13C NMR ($CDCl_3$, 300 MHz) δ: -1.4, -1.1, 18.0, 18.1, 18.6, 19.3, 19.5, 19.6, 31.2, 31.9, 38.8, 40.2, 53.8, 58.7, 77.8(solvent peak), 123.3, 127.0, 127.1, 127.7, 128.5, 128.8, 132.2, 132.3, 133.8, 136.4, 166.3, 167.7, 167.7, 170.7, 171.0, 171.2.HRMS (ESI) m/z calcd for $C_{36}H_{51}N_5O_6SiNa^+$ $(M+Na)^+$ 700.36086, found 700.35083.

Phth-Gly-D-Val-D-Val-D-Val-N(Bn)CH_2SiMe_3(11a)

White solid (yield 70%). 1H NMR ($CDCl_3$, 300 MHz) δ: 0.06-0.13 (m, 9H, $SiMe_3$), 0.90-1.00 (m, 18H, CH_3), 1.97-2.16 (m, 3H, CH**CH**$(CH_3)_2$), 2.68-3.12 (m, 2H, **CH_2**$SiMe_3$), 4.37-4.45 (m, 2H, **CH**$CH(CH_3)_2$), 4.84-4.88 (m, 2H, **CH_2**Ph), 4.90-5.11 (m, 2H, N**CH_2**CO), 7.10-7.34 (m, 2H, ArH), 7.63-7.70 (m, 3H, ArH), 7.80-7.85 (m, 4H, Phthaloyl); 13C NMR ($CDCl_3$, 300 MHz) δ: -1.4, -1.2, 17.4, 17.6, 19.4, 20.1, 31.9, 32.3, 38.2, 40.4, 53.1, 53.9, 58.4, 77.8(solvent peak), 123.4, 123.5, 126.7, 127.8, 127.9, 128.6, 128.8, 132.1, 134.0, 134.0, 134.0, 135.9, 136.8, 165.9, 167.7, 170.3, 170.3, 170.6, 170.6. HRMS (ESI) m/z calcd for $C_{36}H_{51}N_5O_6SiNa^+$ $(M+Na)^+$ 700.36086, found 700.35016.

Phth-Gly-L-Val-D-Val-D-Val-N(Bn)CH_2SiMe_3(12a)

White solid (yield 71%). 1H NMR ($CDCl_3$, 300 MHz) δ: 0.02-0.12 (m, 9H, $SiMe_3$), 0.89-1.03 (m, 18H, CH_3), 2.03-2.15 (m, 3H, CH**CH**$(CH_3)_2$), 2.80-3.03 (m, 2H, **CH_2**$SiMe_3$), 4.36-4.51 (m, 2H, **CH**$CH(CH_3)_2$), 4.62-4.66 (m, 2H, **CH_2**Ph), 4.73-4.90 (m, 2H, N**CH_2**CO), 7.14-7.19 (m, 2H, ArH), 7.25-7.31 (m, 3H, ArH), 7.70-7.86 (m, 4H, Phthaloyl); 13C NMR ($CDCl_3$, 300 MHz) δ: -1.5, -1.1, 14.1, 18.1, 18.2, 19.1, 19.2, 19.3, 19.8, 22.6, 26.9, 31.6, 32.0, 34.6, 38.6, 40.3, 53.4, 54.1, 58.6, 77.8(solvent peak), 123.4, 127.1, 127.4, 127.6, 127.8, 128.6, 128.8, 132.1, 134.0, 136.1, 166.4, 167.7,

167.7, 170.9, 171.0, 171.1.HRMS (ESI) m/z calcd for $C_{36}H_{51}N_5O_6SiNa^+$ $(M+Na)^+$ 700.36086, found 700.35059.

Phth-Gly-D-Val-L-Val-D-Val-N(Bn)CH_2SiMe_3(13a)

White solid (yield 72%). 1H NMR ($CDCl_3$, 300 MHz) δ: 0.04-0.16 (m, 9H, $SiMe_3$), 0.99-1.08 (m, 18H, CH_3), 2.10-2.22 (m, 3H, CH**C**H$(CH_3)_2$), 2.85-3.04 (m, 2H, **C**$\mathbf{H_2}$$SiMe_3$), 4.35-4.52 (m, 2H, **C**HCH$(CH_3)_2$), 4.56-4.66 (m, 2H, **C**$\mathbf{H_2}$Ph), 4.86-5.12 (m, 2H, N**C**$\mathbf{H_2}$CO), 7.06-7.30 (m, 2H, ArH), 7.32-7.38 (m, 3H, ArH), 7.67-7.86 (m, 4H, Phthaloyl); 13C NMR ($CDCl_3$, 300 MHz) δ: -1.5, -1.4, 18.2, 18.4, 18.6, 18.7, 18.8, 18.9, 19.0, 19.9, 20.3, 31.3, 32.3, 32.5, 38.5, 40.4, 53.2, 53.9, 57.3, 59.3, 77.8(solvent peak), 123.3, 126.9, 127.8, 128.5, 128.8, 132.3, 133.8, 136.5, 166.3, 167.6, 170.0, 170.4, 170.8, 171.0.HRMS (ESI) m/z calcd for $C_{36}H_{51}N_5O_6SiNa^+$ $(M+Na)^+$ 700.36086, found 700.35034.

Phth-Gly-L-Val-L-Val-D-Val-N(Bn)CH_2SiMe_3(14a)

White solid (yield 71%). 1H NMR ($CDCl_3$, 300 MHz) δ: 0.06-0.18 (m, 9H, $SiMe_3$), 0.88-1.03 (m, 18H, CH_3), 2.00-2.17 (m, 3H, CH**C**H$(CH_3)_2$), 2.90-3.00 (m, 2H, **C**$\mathbf{H_2}$$SiMe_3$), 4.33-4.50 (m, 2H, **C**HCH$(CH_3)_2$), 4.63-4.71 (m, 2H, **C**$\mathbf{H_2}$Ph), 4.75-4.98 (m, 2H, N**C**$\mathbf{H_2}$CO), 7.11-7.19 (m, 2H, ArH), 7.20-7.26 (m, 3H, ArH), 7.30-7.39 (m, 4H, Phthaloyl); 13C NMR ($CDCl_3$, 300 MHz) δ: -1.4, -1.2, -1.2, 17.9, 18.0, 18.6, 19.3, 19.3, 19.5, 31.7, 32.0, 32.0, 38.9, 40.2, 53.3, 53.4, 53.9, 54.0, 58.3, 58.7, 77.8(solvent peak), 123.4, 126.9, 127.0, 128.0, 128.6, 128.9, 128.9, 132.2, 133.9, 135.9, 166.8, 167.7, 170.9, 171.0, 171.2, 171.5.HRMS (ESI) m/z calcd for $C_{36}H_{51}N_5O_6SiNa^+$ $(M+Na)^+$ 700.36086, found 700.35034.

1.4 Preparation of cyclopeptides (1-14)

Linear peptide (0.5 g) was dissolved in 250 mL of methanol and purged with nitrogen for 30 min. Upon maintaining the ventilation of nitrogen, the solutions in a water-cooled immersion reactor were irradiated by ultraviolet light (Pyrex tube filtered-light λ > 290 nm) for 30 min. The obtained reaction mixture was concentrated and purified by silica gel column chromatography (mobile phase: V ethyl acetate /V petroleum ether = 3:1) to obtain 3-hydroxy-isoindolinone-cyclopeptids (1-4). The purity of cyclic peptides was analyzed by high performance liquid chromatography (HPLC). Identification of compound 1a and 3a can be found in our previous study.

HPLC conditions: Shiseido Capcell PAK C18 (150×4.0 mm, 5 μm) was used as the column at 30 ˚C, and the mobile phase flow rate was 1 mL/min. During the analytical run, the elution was carried out

using mobile phases A (Ultrapure water) and B (acetonitrile), the percentage of mobile phases B was 50%, while the detection wavelength was 260 nm.

3-Hydroxy-isoindolinone-cyclo-Gly-Val (1)

White solid (yield 37%). $[a]_D^{20}$ = -41.49 (C = 0.24 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.76-0.92 (m, 6H, CH_3), 1.96-2.06 (m, 1H, CH**C**H$(CH_3)_2$), 3.57-4.02 (m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.09-4.38 (m, 3H, CH**C**HNH(CO) and **C**H$_2$Ph), 7.14-7.32 (m, 5H, ArH), 7.46-7.70 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: -1.1, -1.1, 0.0, 14.2, 17.6, 19.6, 22.7, 27.4, 29.4, 29.7, 29.7, 31.9, 40.6, 51.3, 54.2, 77.8 (solvent peak), 88.9, 123.6, 126.5, 127.0, 127.2, 127.9, 128.1, 128.8, 128.9, 129.6, 132.2, 134.1, 166.3, 167.7, 167.8. EI-MS (ESI) m/z calcd for $C_{23}H_{25}N_3O_4Na^+$ $(M+Na)^+$ 430.1, found 430.2.

3-Hydroxy-isoindolinone-cyclo-Gly-Val (2)

White solid (yield 39%). $[a]_D^{20}$ = +244.90 (C = 0.24 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.79-0.95 (m, 6H, CH_3), 1.94-2.07 (m, 1H, CH**C**H$(CH_3)_2$), 3.86-4.40 (m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.75-4.92 (m, 3H, CH**C**HNH(CO) and **C**H$_2$Ph), 7.15-7.33 (m, 5H, ArH), 7.47-7.85 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: 14.2, 17.6, 18.4, 19.1, 22.7, 27.4, 29.7, 31.9, 40.7, 51.3, 54.2, 77.8 (solvent peak), 89.0, 123.6, 126.5, 127.1, 127.9, 128.5, 128.8, 128.9, 129.6, 132.1, 132.2, 134.1, 134.1, 167.7, 167.8, 167.8. EI-MS (ESI) m/z calcd for $C_{23}H_{25}N_3O_4Na^+$ $(M+Na)^+$ 430.1, found 430.2.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val (3)

White solid (yield 40%). $[a]_D^{20}$ = -57.92 (C = 0.25 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.88-1.10 (m, 12H, CH_3), 2.06-2.09 (m, 2H, CH**C**H$(CH_3)_2$), 3.99-4.41 (m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.53-5.39 (m, 4H, CH**C**HNH(CO) and **C**H$_2$Ph), 7.10-7.23 (m, 5H, ArH), 7.27-7.87 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: 18.5, 18.7, 19.3, 19.7, 26.3, 28.8, 29.7, 43.9, 46.9, 48.4, 55.4, 59.8, 77.8 (solvent peak), 89.2, 122.3, 124.1, 125.9, 127.5, 128.5, 129.0, 130.3, 133.6, 135.9, 147.3, 170.8, 171.5, 172.2, 174.1. EI-MS (ESI) m/z calcd for $C_{28}H_{34}N_4O_5Na^+$ $(M+Na)^+$ 529.2, found 529.2.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val (4)

White solid (yield 42%). $[a]_D^{20}$ = -69.17 (C = 0.25 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.850-1.042 (m, 12H, CH_3), 2.068-2.165 (m, 2H, CH**C**H$(CH_3)_2$), 3.498-4.310 (m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.659-5.510 (m, 4H, CH**C**HNH(CO) and **C**H$_2$Ph), 7.147-7.247 (m, 5H, ArH), 7.311-7.588 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: 18.5, 18.7, 19.3, 19.3, 19.6, 19.8, 26.4, 28.6, 29.4, 29.7, 31.4, 36.5, 43.9, 48.4, 53.8, 55.2, 57.0, 77.8 (solvent peak), 89.1, 122.3, 126.0, 126.8, 127.4, 128.0,

128.5, 129.0, 129.6, 130.2, 133.6, 147.5, 162.6, 170.4, 172.0, 172.2. EI-MS (ESI) m/z calcd for $C_{28}H_{34}N_4O_5Na^+$ $(M+Na)^+$ 529.2, found 529.1.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val (5)

White solid (yield 39%). $[a]_D^{20}$ = +62.24 (C = 0.24 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.71-1.02 (m, 12H, CH_3), 2.21 (m, 2H, CH**C**H$(CH_3)_2$), 3.48-4.30 (m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.44-4.76 (m, 4H, CH**C**HNH(CO) and **C**H$_2$Ph), 7.06-7.45 (m, 5H, ArH), 7.46-7.60 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: 18.0, 18.7, 19.3, 19.6, 19.7, 19.8, 29.0, 29.4, 29.7, 43.9, 53.8, 54.1, 55.2, 58.1, 77.8 (solvent peak), 88.9, 127.4, 128.0, 128.1, 129.0, 129.2, 129.4, 132.3, 133.6, 136.8, 137.8, 170.3, 170.4, 171.8, 175.0. EI-MS (ESI) m/z calcd for $C_{28}H_{34}N_4O_5Na^+$ $(M+Na)^+$ 529.2, found 529.2.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val (6)

White solid (yield 37%). $[a]_D^{20}$ = +120.97 (C = 0.24 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.71-1.02 (m, 12H, CH_3), 2.21 (m, 2H, CH**C**H$(CH_3)_2$), 3.50-4.25 (m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.64-5.51 (m, 4H, CH**C**HNH(CO) and **C**H$_2$Ph), 7.14-7.36 (m, 5H, ArH), 7.45-7.60 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: 18.5, 18.7, 19.3, 19.3, 19.6, 26.4, 28.6, 29.4, 29.7, 31.4, 36.5, 43.9, 48.4, 53.8, 55.2, 57.0, 77.8(solvent peak), 89.2, 122.3, 126.0, 126.8, 127.4, 128.0, 128.5, 129, 0, 130.2, 133.6, 162.6, 170.4, 172.0, 172.2. EI-MS (ESI) m/z calcd for $C_{28}H_{34}N_4O_5Na^+$ $(M+Na)^+$ 529.2, found 529.2.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val-Val (7)

White solid (yield 38%). $[a]_D^{20}$ = +140.16 (C = 0.24 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.80-1.02 (m, 18H, CH_3), 1.91-2.08 (m, 3H, CH**C**H$(CH_3)_2$), 3.42-3.96(m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.66-5.39 (m, 4H, CH**C**HNH(CO) and **C**H$_2$Ph), 7.24-7.29 (m, 5H, ArH), 7.34-7.67 (m, 4H, Phthaloyl);^{13}C NMR ($CDCl_3$, 300 MHz) δ: 14.1, 18.2, 19.5, 19.6, 19.6, 19.8, 22.7, 29.3, 29.7, 30.0, 30.6, 31.9, 37.1, 51.7, 53.0, 53.4, 54.3, 62.7, 77.8(solvent peak), 90.3, 121.7, 123.7, 126.6, 127.7, 128.9, 129.3, 129.7, 132.8, 137.4, 148.3, 167.4, 171.9, 172.3, 172.6, 173.7. EI-MS (ESI) m/z calcd for $C_{33}H_{43}N_5O_6Na^+$ $(M+Na)^+$ 628.3, found 628.2.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val-Val (8)

White solid (yield 36%). $[a]_D^{20}$ = -98.43 (C = 0.25 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.81-1.09 (m, 18H, CH_3), 2.09-2.22 (m, 3H, CH**C**H$(CH_3)_2$), 3.63-4.23 (m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.27-4.95 (m, 4H, CH**C**HNH(CO) and **C**H$_2$Ph), 7.21-7.31 (m, 5H, ArH), 7.36-7.92 (m, 4H, Phthaloyl); ^{13}CNMR($CDCl_3$, 300 MHz)δ: 17.4, 18.2, 18.9, 19.1, 19.2, 19.4, 19.5, 20.0, 29.2, 29.7, 30.6, 31.9, 45.9,

52.2, 54.4, 59.6, 61.8, 77.8(solventpeak), 89.8, 121.8, 123.7, 125.6, 127.2, 128.8, 128.9, 130.2, 134.7, 146.1, 170.5, 171.6, 172.0, 172.4, 173.9. EI-MS (ESI) m/z calcd for $C_{33}H_{43}N_5O_6H^+$ $(M+H)^+$ 605.7, found 606.2.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val-Val (9)

White solid (yield 39%).$[a]_D^{20}$ = +18.77 (C = 0.26 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.90-1.05 (m, 18H, CH_3), 2.02-2.17 (m, 3H, CH**C**H$(CH_3)_2$), 4.03-4.48 (m, 4H, N**C**$\mathbf{H_2}$C(OH) and N**C**$\mathbf{H_2}$CO), 4.68-5.41 (m, 4H, CH**C**HNH(CO) and **C**$\mathbf{H_2}$Ph), 7.06-7.43 (m, 5H, ArH), 7.49-7.80 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: 17.4, 18.9, 19.1, 19.2, 19.5, 20.0, 29.2, 29.7, 30.6, 31.9, 45.9, 52.2, 54.4, 59.6, 61.8, 77.8(solventpeak), 89.8, 121.8, 123.7, 125.6, 126.1, 126.6, 127.2, 128.8, 128.9, 129.0, 130.2, 130.3, 132.5, 134.7, 146.1, 170.5, 171.6, 172.0, 172.4, 173.9. EI-MS (ESI) m/z calcd for $C_{33}H_{43}N_5O_6Na^+$ $(M+Na)^+$ 628.3, found 628.2.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val-Val (10)

White solid (yield 38%).$[a]_D^{20}$ = -19.69 (C = 0.25 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.87-1.05 (m, 18H, CH_3), 2.02-2.24 (m, 3H, CH**C**H$(CH_3)_2$), 3.88-4.45 (m, 4H, N**C**$\mathbf{H_2}$C(OH) and N**C**$\mathbf{H_2}$CO), 4.56-5.12 (m, 4H, CH**C**HNH(CO) and **C**$\mathbf{H_2}$Ph), 7.13-7.23 (m, 5H, ArH), 7.27-7.56 (m, 4H, Phthaloyl);^{13}CNMR($CDCl_3$, 300 MHz)δ: 17.6, 18.2, 18.3, 18.8, 19.0, 19.4, 19.6, 19.8, 27.6, 29.7, 30.1, 30.7, 41.0, 52.5, 52.8, 54.4, 58.8, 63.9, 77.8(solventpeak), 88.8, 121.9, 123.5, 126.5, 126.7, 127.6, 128.8, 129.8, 132.6, 137.9, 147.2, 167.3, 171.2, 172.0, 173.5, 174.6. EI-MS (ESI) m/z calcd for $C_{33}H_{43}N_5O_6Na^+$ $(M+Na)^+$ 628.3, found 628.3.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val-Val (11)

White solid (yield 36%). $[a]_D^{20}$ = -18.80 (C = 0.26 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.84-1.06 (m, 18H, CH_3), 2.02-2.06 (m, 3H, CH**C**H$(CH_3)_2$), 3.92-4.50 (m, 4H, N**C**$\mathbf{H_2}$C(OH) and N**C**$\mathbf{H_2}$CO), 4.65-5.33 (m, 4H, CH**C**HNH(CO) and **C**$\mathbf{H_2}$Ph), 7.22-7.28 (m, 5H, ArH), 7.33-7.62 (m, 4H, Phthaloyl);^{13}CNMR($CDCl_3$, 300 MHz)δ: 17.5, 18.2, 19.2, 19.4, 19.5, 19.7, 19.8, 20.1, 29.4, 29.7, 30.4, 30.6, 43.1, 51.8, 53.0, 54.4, 77.8(solventpeak), 90.4, 121.9, 123.6, 126.3, 126.6, 127.6, 128.8, 128.9, 129.3, 129.6, 132.8, 137.5, 148.0, 167.5, 169.9, 172.0, 172.5, 173.7. EI-MS (ESI) m/z calcd for $C_{33}H_{43}N_5O_6Na^+$ $(M+Na)^+$ 628.3, found 628.2.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val-Val (12)

White solid (yield 33%). $[a]_D^{20}$ = +132.58 (C = 0.26 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.90-1.05 (m, 18H, CH_3), 2.02-2.17 (m, 3H, CH**C**H(CH_3)$_2$), 4.03-4.48 (m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.68-5.41 (m, 4H, CH**C**HNH(CO) and **C**H$_2$Ph), 7.06-7.43 (m, 5H, ArH), 7.49-7.80 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: 17.4, 18.9, 19.1, 19.2, 19.5, 20.0, 29.2, 29.7, 30.6, 31.9, 45.9, 52.2, 54.4, 59.6, 61.8, 77.8(solventpeak), 89.8, 121.8, 123.7, 125.6, 126.1, 126.6, 127.2, 128.8, 128.9, 129.0, 130.2, 130.3, 132.5, 134.7, 146.1, 170.5, 171.6, 172.0, 172.4, 173.2, 173.9. EI-MS (ESI) m/z calcd for $C_{33}H_{43}N_5O_6Na^+$ $(M+Na)^+$ 628.3, found 628.2.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val-Val (13)

White solid (yield 35%). $[a]_D^{20}$ = -138.34 (C = 0.25 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.83-1.04 (m, 18H, CH_3), 2.09-2.18 (m, 3H, CH**C**H(CH_3)$_2$), 4.02-4.49 (m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.60-5.35 (m, 4H, CH**C**HNH(CO) and **C**H$_2$Ph), 6.98-7.03 (m, 5H, ArH), 7.30-7.79 (m, 4H, Phthaloyl);^{13}CNMR($CDCl_3$, 300 MHz)δ: 14.1, 17.6, 18.6, 18.7, 19.0, 19.5, 19.5, 19.6, 22.7, 27.9, 29.5, 29.6, 29.7, 29.7, 30.3, 31.9, 54.8, 59.4, 60.1, 77.8(solventpeak), 89.9, 121.8, 124.0, 126.4, 126.9, 127.5, 128.6, 129.0, 129.6, 130.1, 168.5, 169.9, 171.3, 171.3, 173.2. EI-MS (ESI) m/z calcd for $C_{33}H_{43}N_5O_6Na^+$ $(M+Na)^+$ 628.3, found 628.3.

3-Hydroxy-isoindolinone-cyclo-Gly-Val-Val-Val (14)

White solid (yield 37%). $[a]_D^{20}$ = -59.06 (C = 0.25 g/100mL) ^{1}H NMR ($CDCl_3$) δ: 0.93-1.16 (m, 18H, CH_3), 2.17-2.21 (m, 3H, CH**C**H(CH_3)$_2$), 3.95-4.14 (m, 4H, N**C**H$_2$C(OH) and N**C**H$_2$CO), 4.43-5.25 (m, 4H, CH**C**HNH(CO) and **C**H$_2$Ph), 7.18-7.35 (m, 5H, ArH), 7.41-7.63 (m, 4H, Phthaloyl); ^{13}C NMR ($CDCl_3$, 300 MHz) δ: 17.4, 18.9, 19.1, 19.26, 19.5, 20.0, 29.2, 29.7, 30.6, 31.9, 45.9, 54.4, 59.6, 61.8, 77.8 (solvent peak), 89.8, 121.8, 123.7, 125.6, 126.6, 127.2, 128.8, 128.9, 129.0, 130.2, 130.3, 132.5, 134.7, 136.9, 146.1, 170.5, 171.6, 172.0, 172.4, 173.9. EI-MS (ESI) m/z calcd for $C_{33}H_{43}N_5O_6Na^+$ $(M+Na)^+$ 628.3, found 628.2.

2. The absolute configurations, relative free energies and populations of the conformations as determined in methanol.

The absolute configuration of the cyclopeptides was determined by experimental and experimental ECD analysis. Conformational search was firstly performed to define stable conformations before ECD simulation. Due to the conformational restriction of the cyclic structures, only a few stable low energy conformers for each configuration of the fourteen compounds were found. The obtained stable molecules were directly optimized with B3LYP/6-31G (d, p) and the circular dichroism (CD) spectra were simulated by time-dependent density functional theory method (TDDFT) at the CAM-B3LYP/cc-pVDZ level. The AC of C-3 would be determined when the theoretical spectrum of a selected configuration is accordant with the experimental one.

Table S1. The absolute configurations, relative free energies and populations of the conformations in methanol.

Compounds	Stable conformers*	ΔG**	P%***	Determined absolute configuration of C-3
1	R-1	0.00	95.40	***R***
	R-2	7.17	0.00	
	R-3	1.79	4.60	
2	S-1	3.54	0.25	
	S-2	10.71	0.00	
	S-3	0.00	99.75	***S***
3	R-1	1.01	14.75	
	R-2	0.00	82.12	***R***
	R-3	1.93	3.12	
	R-4	5.07	0.02	
4	S-1	0.00	85.26	***S***
	S-2	1.98	3.00	
	S-3	1.17	11.74	
5	R-1	0.23	40.37	
	R-2	0.00	59.63	***R***
6	R-1	0.00	96.04	***R***
	R-2	1.98	3.38	
	R-3	3.03	0.57	
7	R-1	3.03	0.59	
	R-2	0.00	98.57	***R***
	R-3	2.82	0.84	
8	S-1	0.70	20.53	
	S-2	0.00	67.87	***S***
	S-3	1.04	11.60	
9	R-1	0.00	71.84	***R***
	R-2	1.33	7.55	
	R-3	0.73	20.61	
10	S-1	0.00	92.14	***S***
	S-2	1.45	7.86	
11	R-1	0.00	100.00	***R***
12	R-1	0.70	20.53	
	R-2	0.00	67.87	***R***
	R-3	1.04	11.60	
13	S-1	1.19	11.49	
	S-2	2.35	1.64	
	S-3	0.00	86.87	***S***
14	R-1	0.00	92.14	***R***
	R-2	1.45	7.86	

*See **Figure S1** for the structures of the most stable conformers.

**The unit for ΔG is kcal mol^{-1}.

***Populations are based on ΔG values.

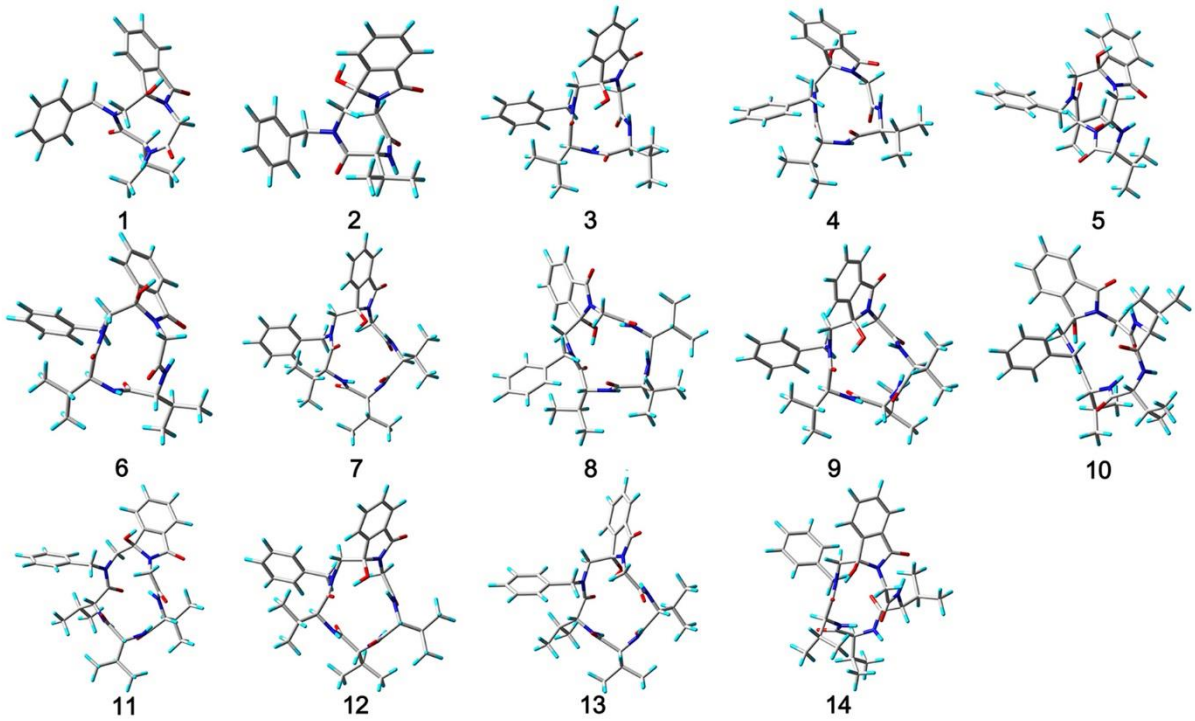
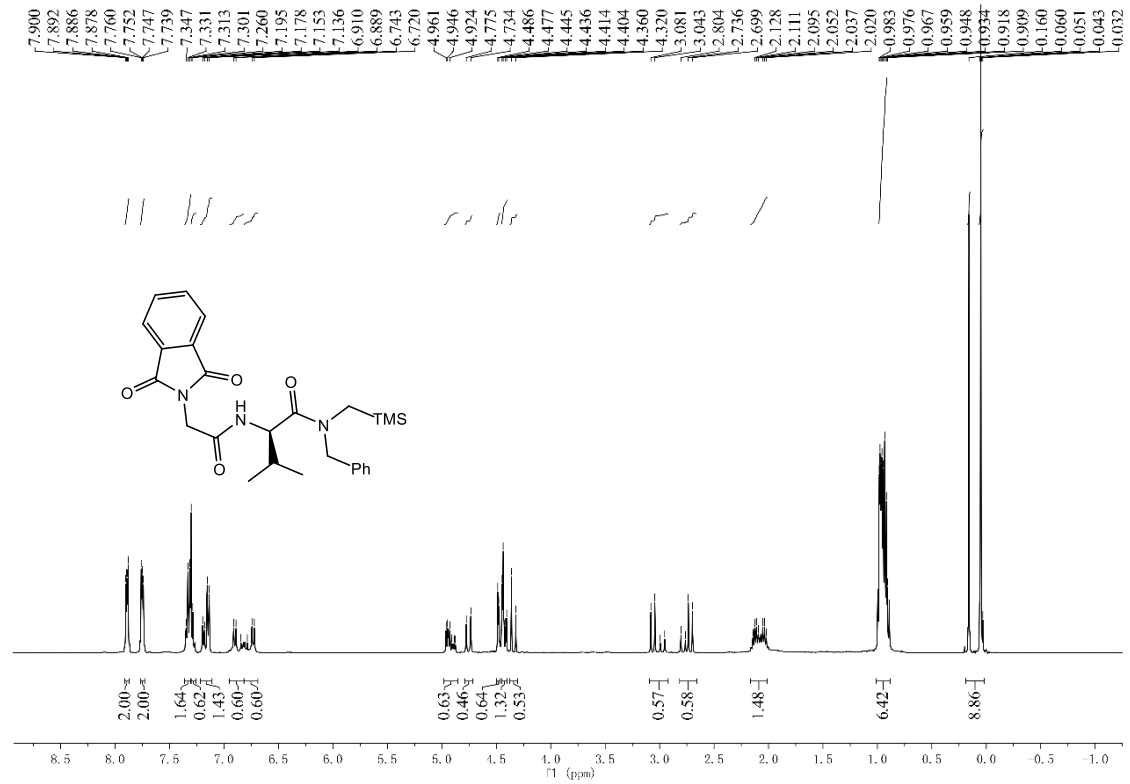
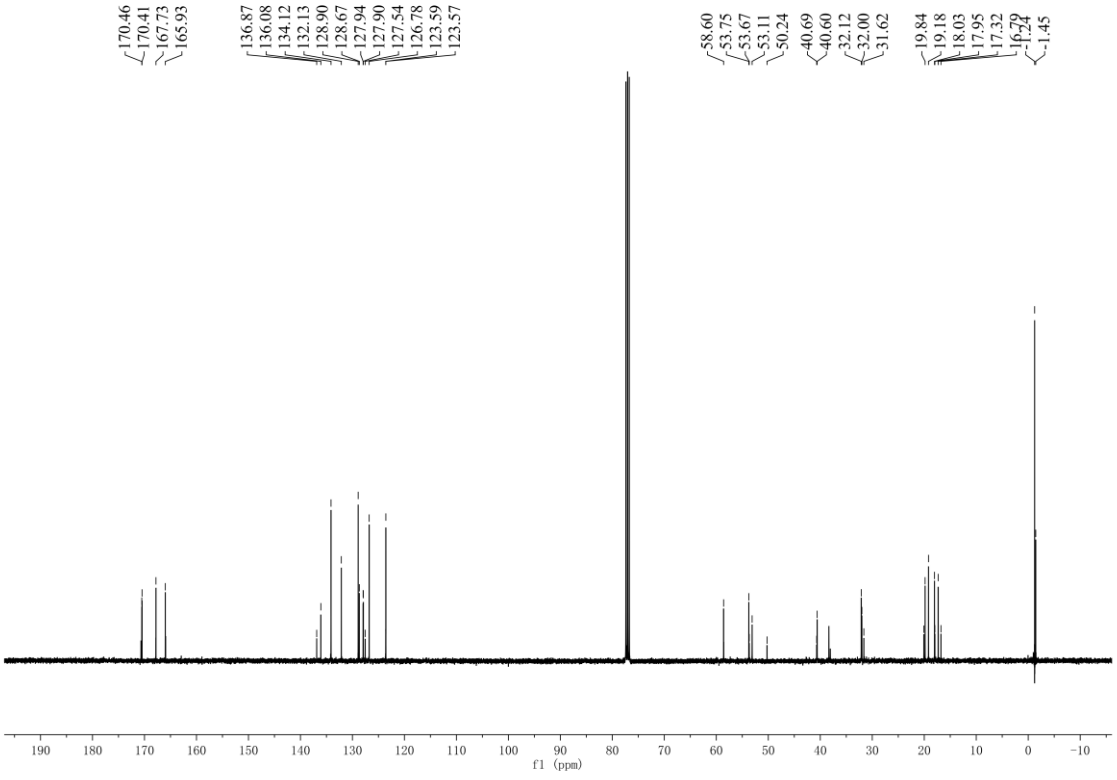


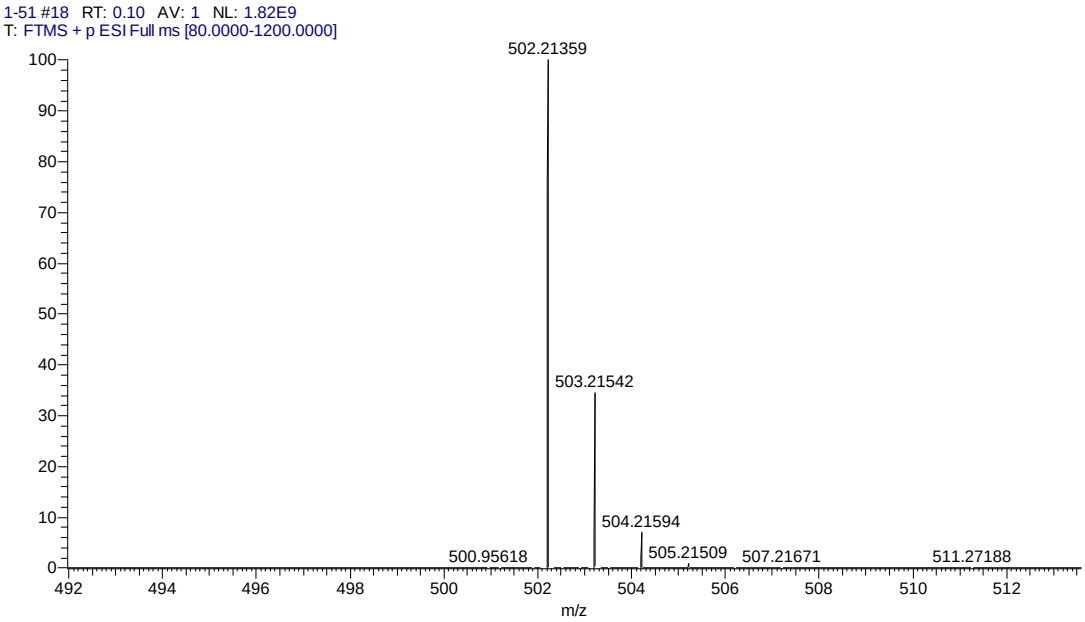
Figure S1. The most stable conformers of the synthesized compounds in methanol (DFT/B3LYP/6-31G（d, p）.

3.Nuclear Magnetic Resonance (NMR) and High Resolution Mass Spectrometry (HRMS) of linear peptides.

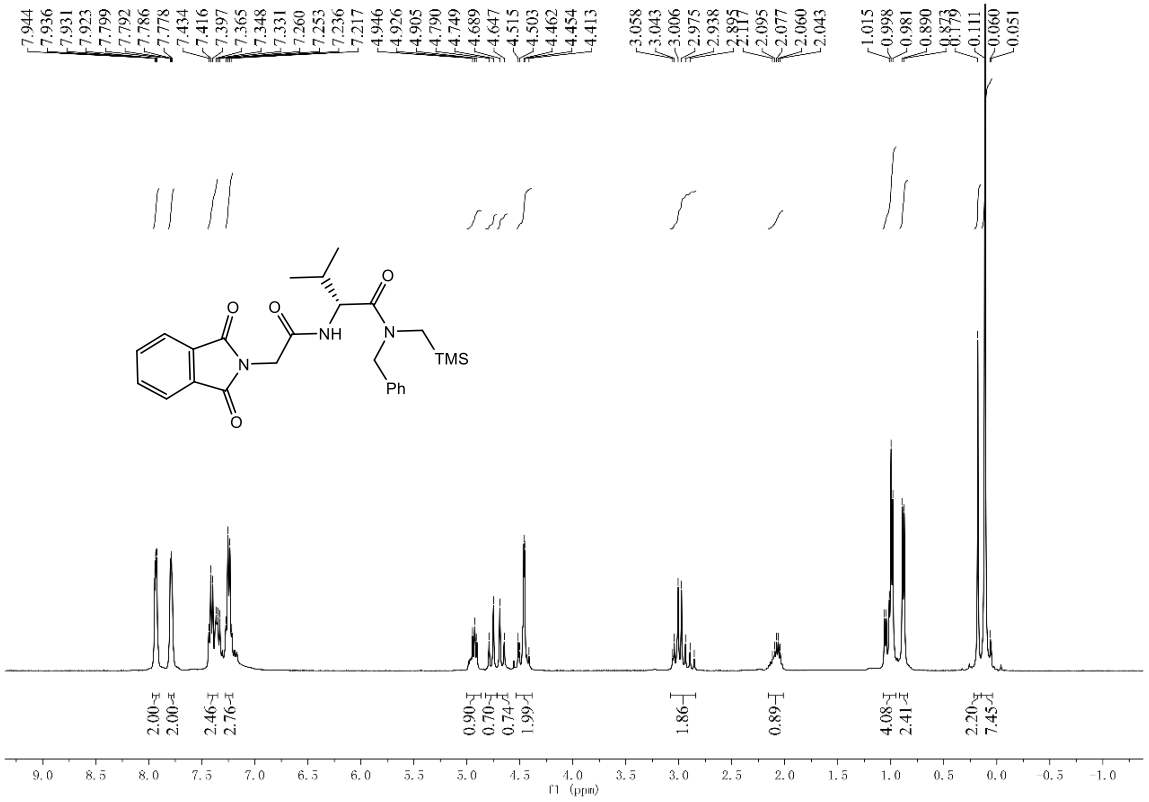
3.1 ^{1}H-NMR, ^{13}C-NMR and HRMS of 1a.

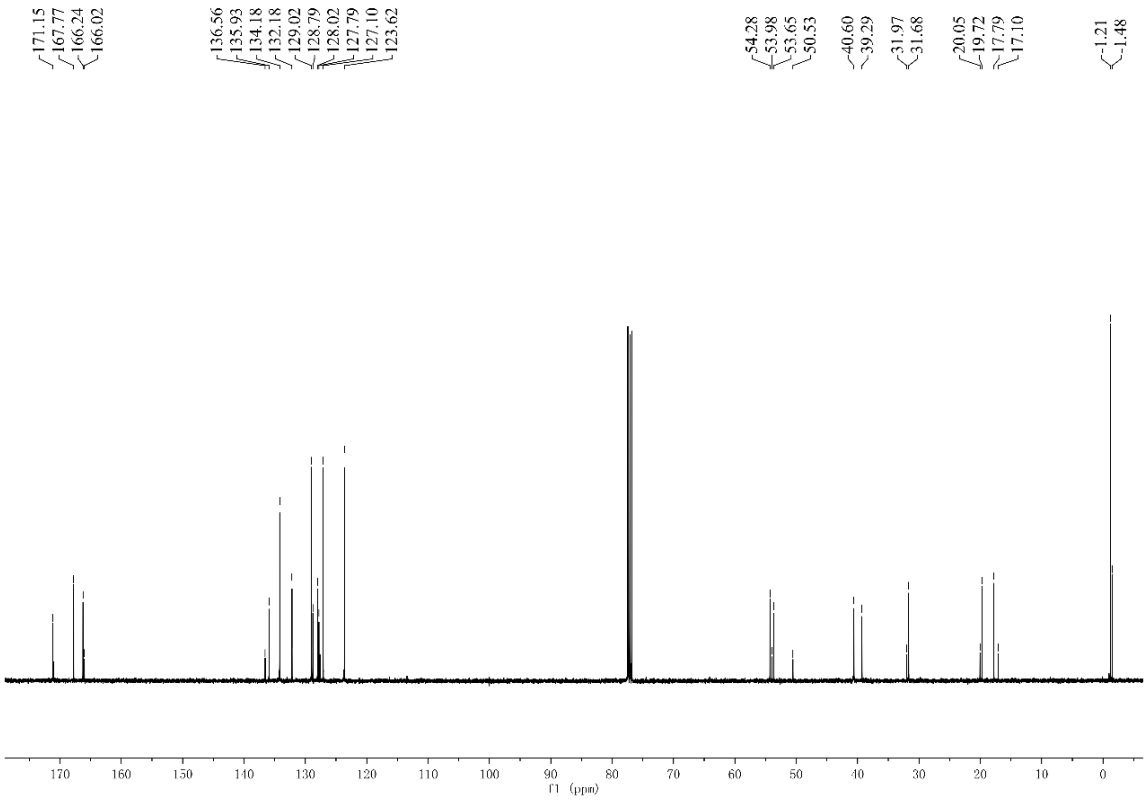


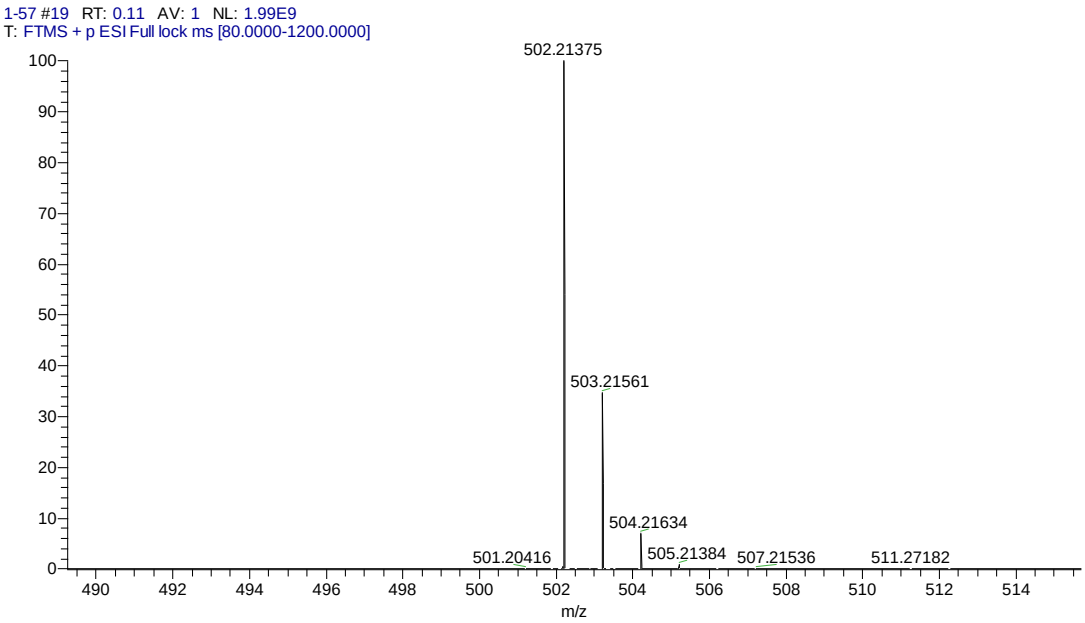




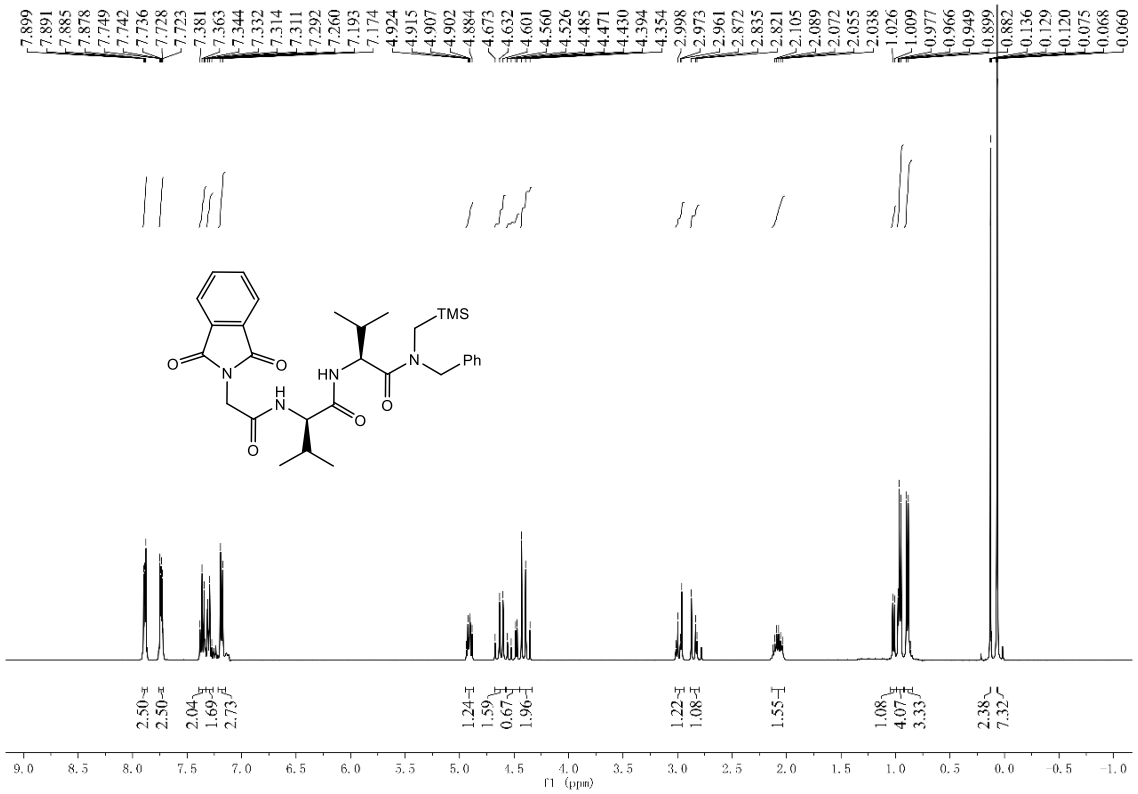
3.2 ^{1}H-NMR ^{13}C-NMR and HRMS of 2a.







3.3 ^{1}H-NMR, ^{13}C-NMR and HRMS of 3a.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0.899
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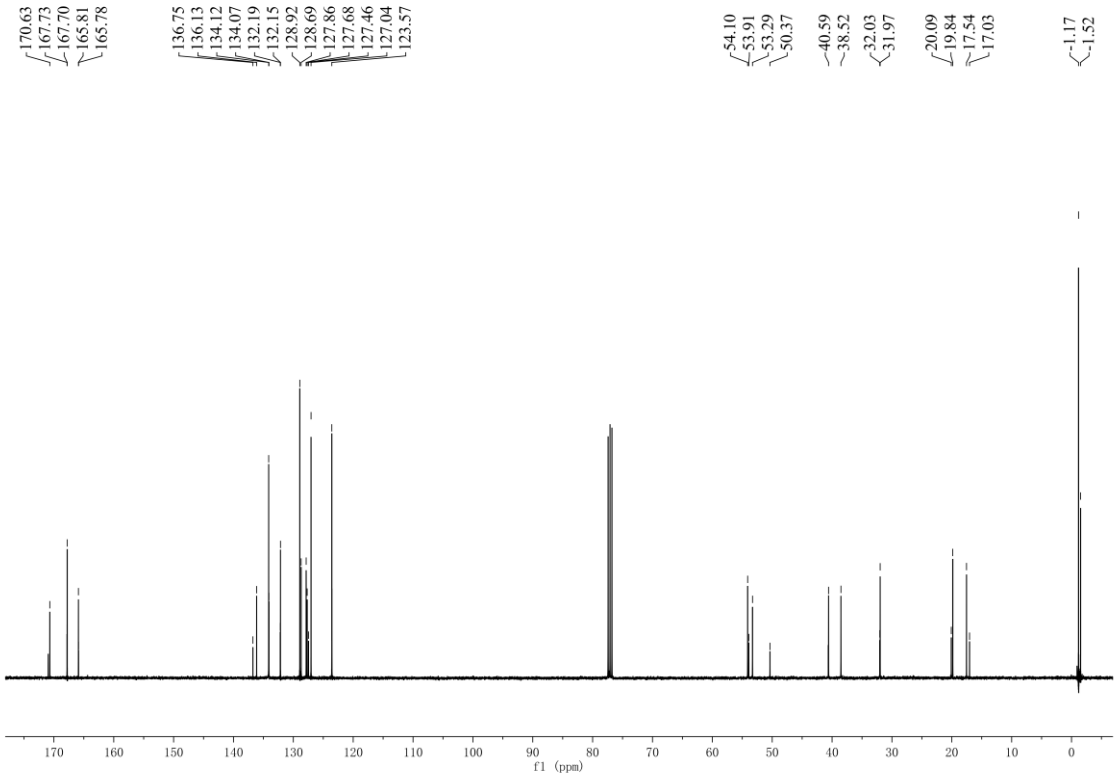
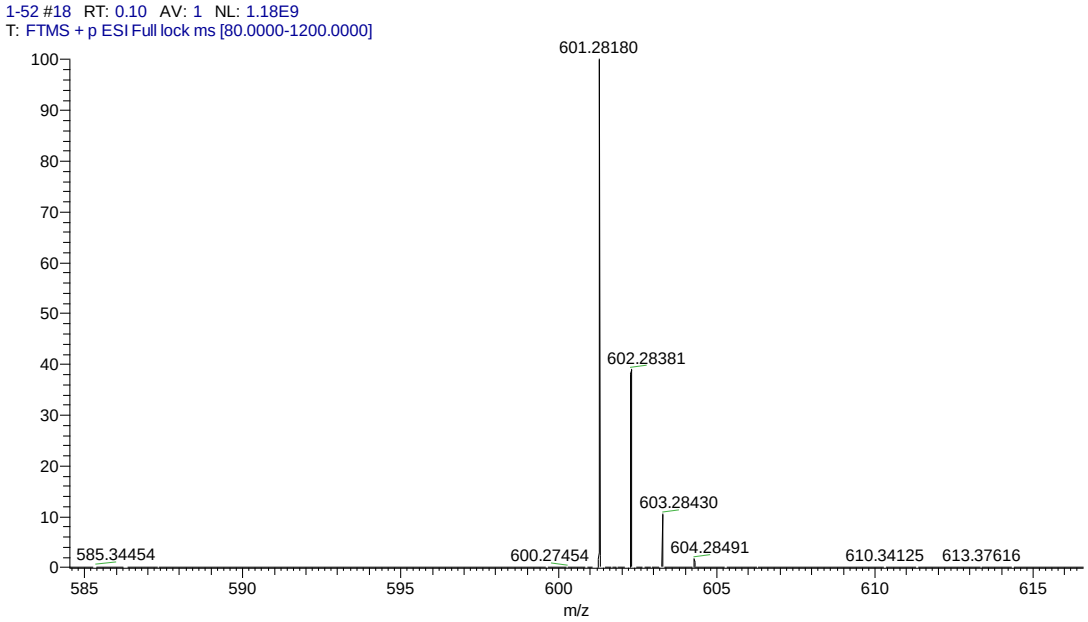
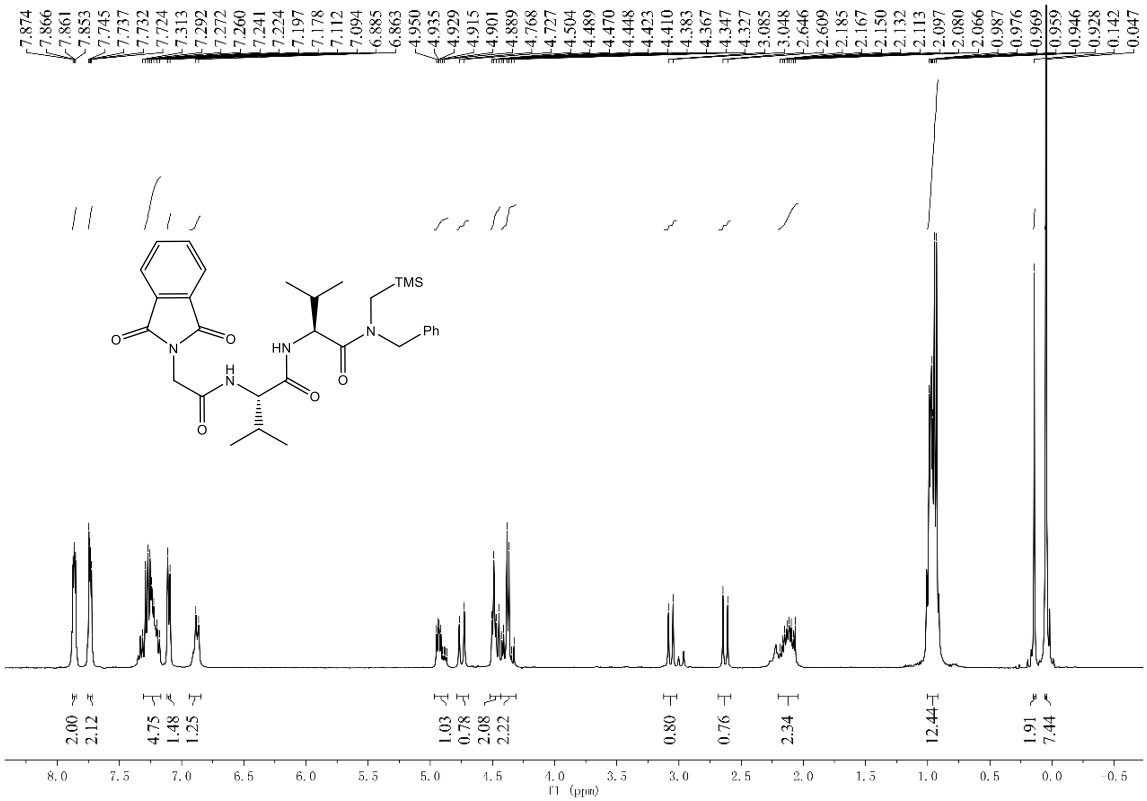
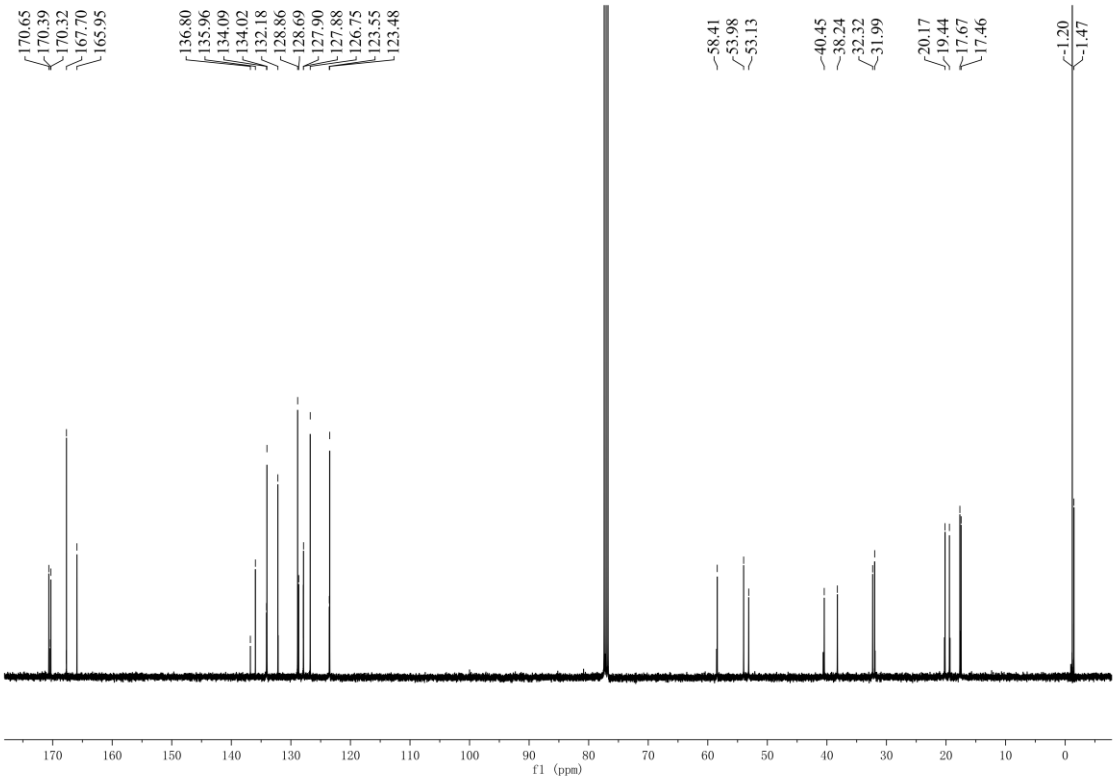
0.136
0.129
0.120
0.075
0.068
0.060
TMS
Ph
2.50
2.50
2.04
1.69
2.73
1.24
1.59
0.67
1.96
1.22
1.08
1.55
1.08
4.07
3.33
2.38
7.32
f1 (ppm)

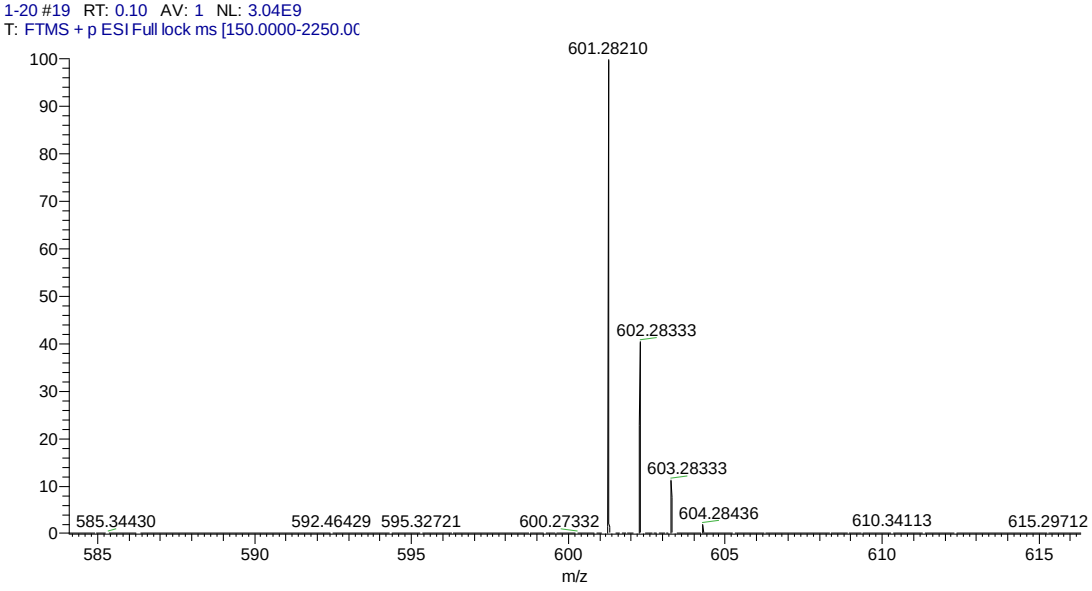

170.63
167.73
167.70
165.81
165.78
136.75
136.13
134.12
134.07
132.19
132.15
128.92
128.69
127.86
127.68
127.46
127.04
123.57
54.10
53.91
53.29
50.37
40.59
38.52
32.03
31.97
20.09
19.84
17.54
17.03
-1.17
-1.52
f1 (ppm)



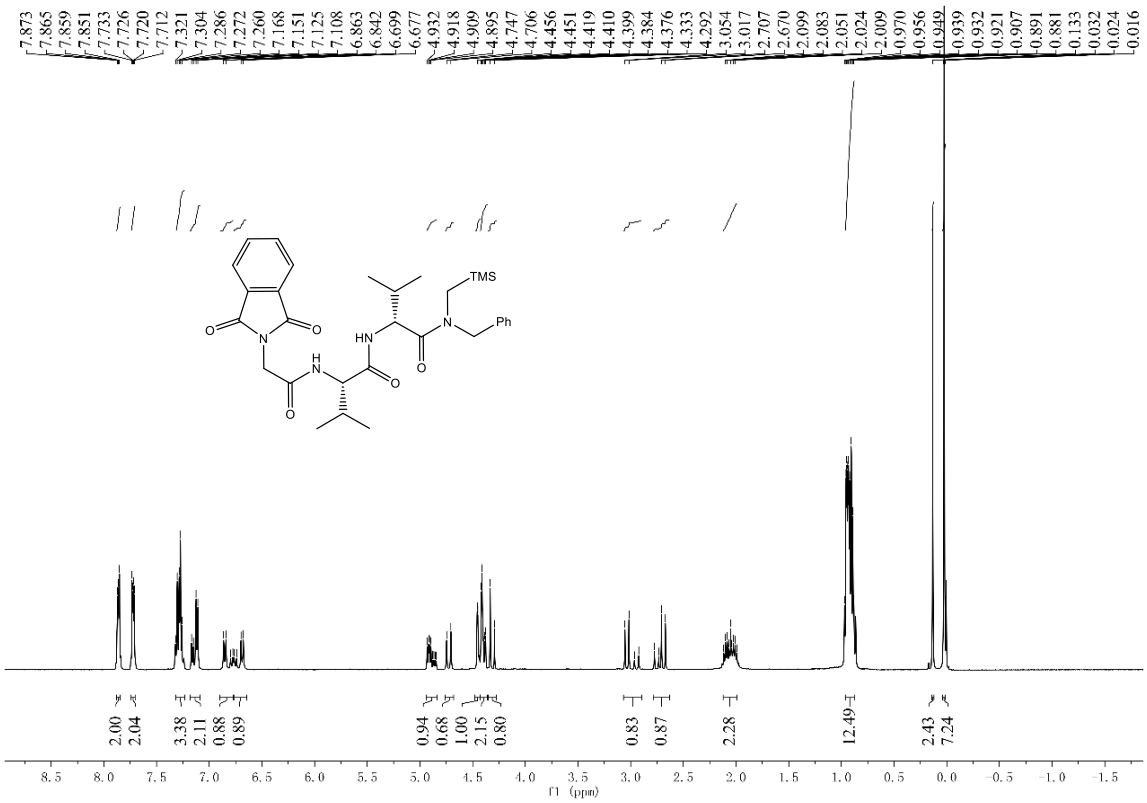
3.4 ^{1}H-NMR, ^{13}C-NMR and HRMS of 4a.

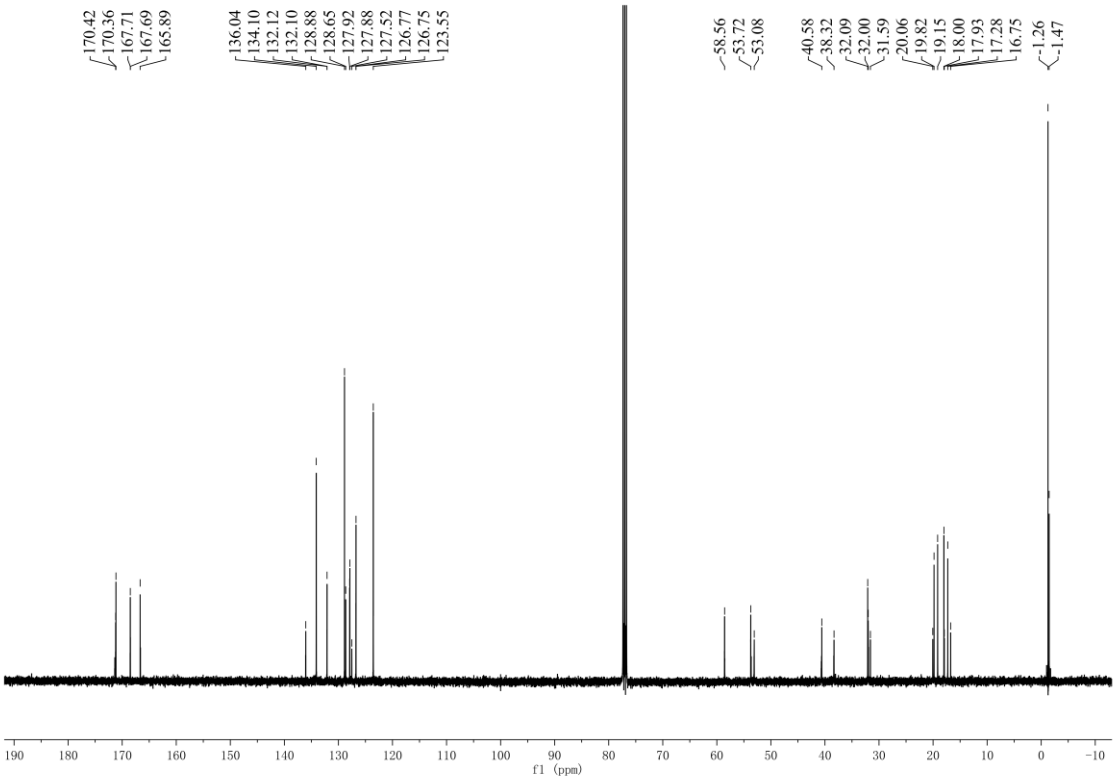


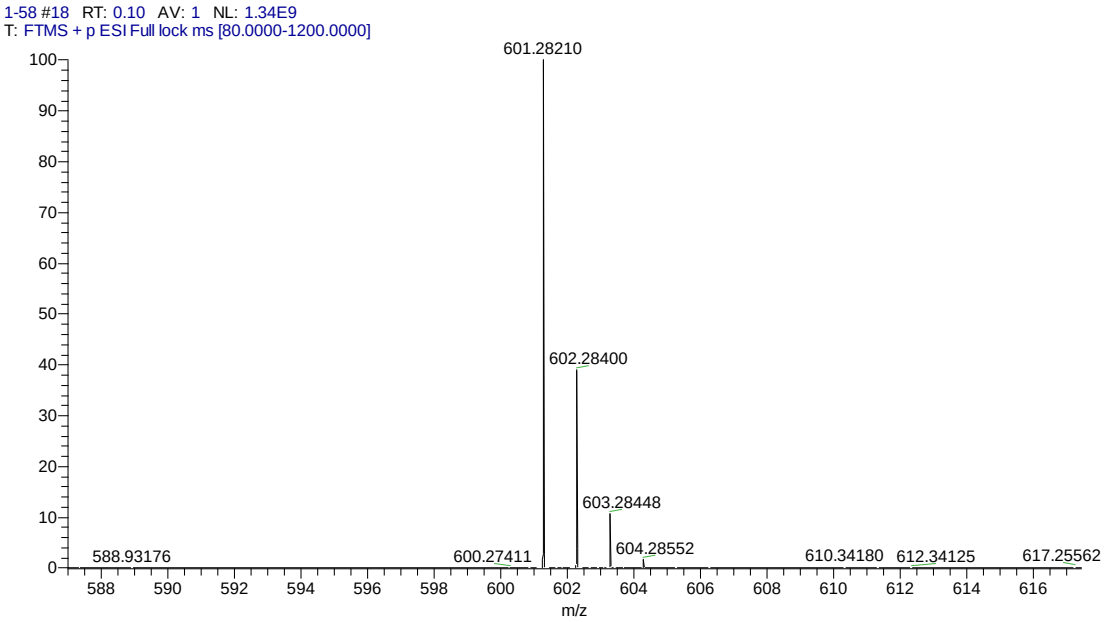

170.65
170.39
170.32
167.70
165.95
136.80
135.96
134.09
134.02
132.18
128.86
128.69
127.90
127.88
126.75
123.55
123.48
58.41
53.98
53.13
40.45
38.24
32.32
31.99
20.17
19.44
17.67
17.46
1.20
1.47
f1 (ppm)


1-20 #19 RT: 0.10 AV: 1 NL: 3.04E9
T: FTMS + p ESI Full lock ms [150.0000-2250.0(
601.28210
602.28333
603.28333
604.28436
585.34430
592.46429
595.32721
600.27332
610.34113
615.29712
m/z

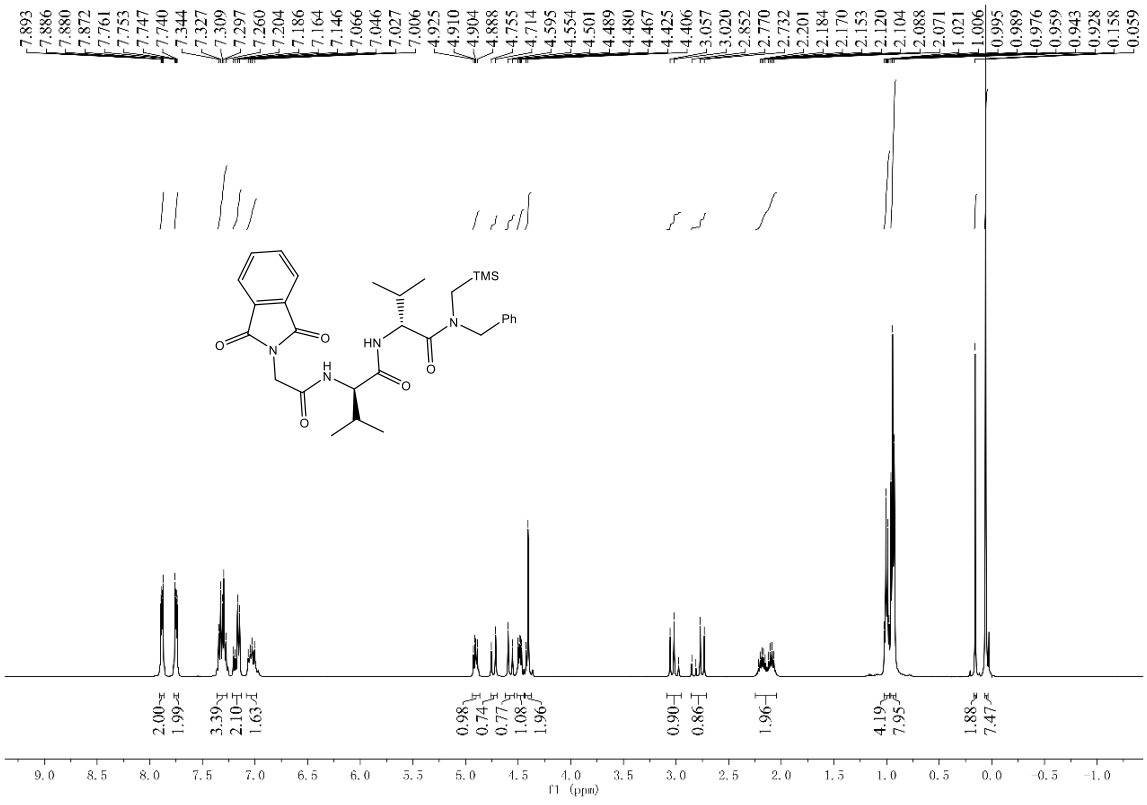
3.5 ^{1}H-NMR, ^{13}C-NMR and HRMS of 5a.

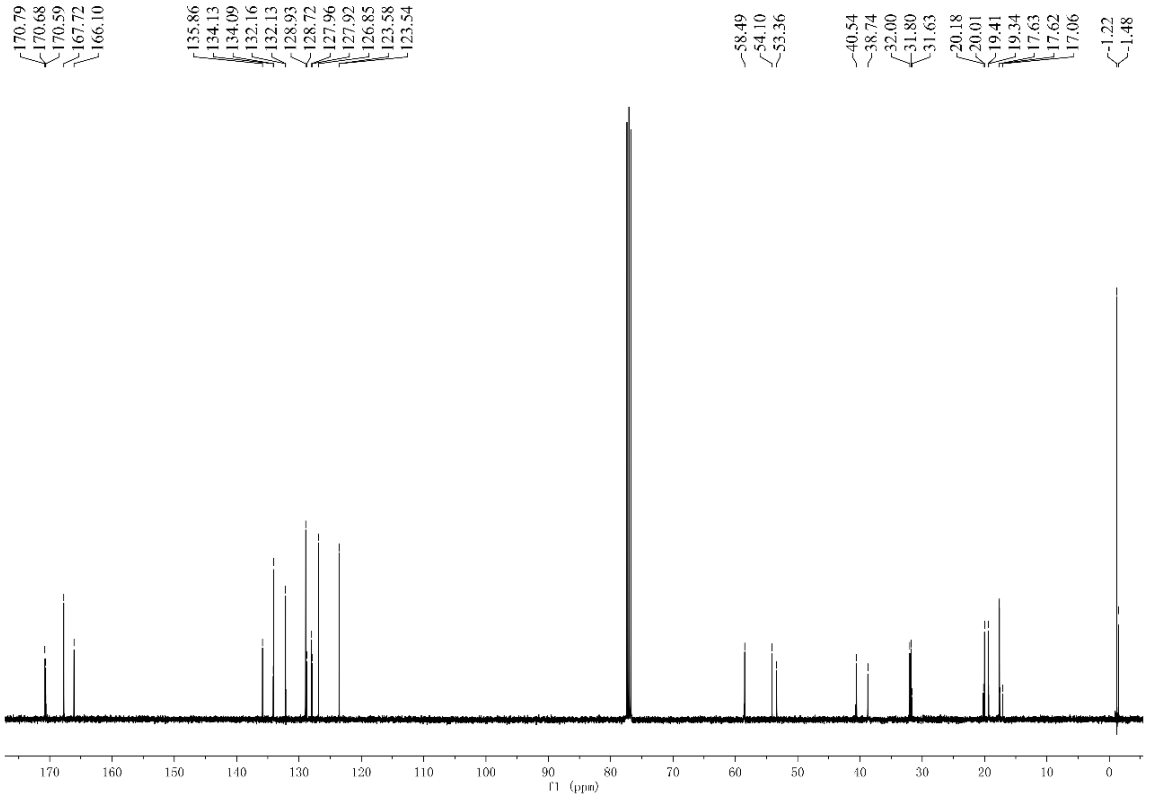


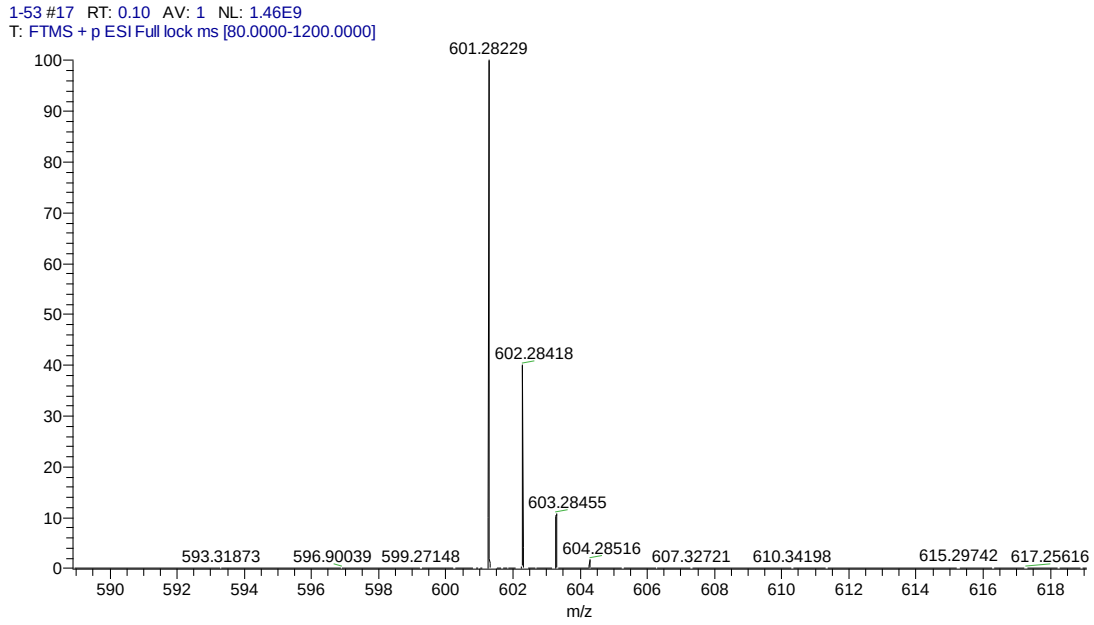




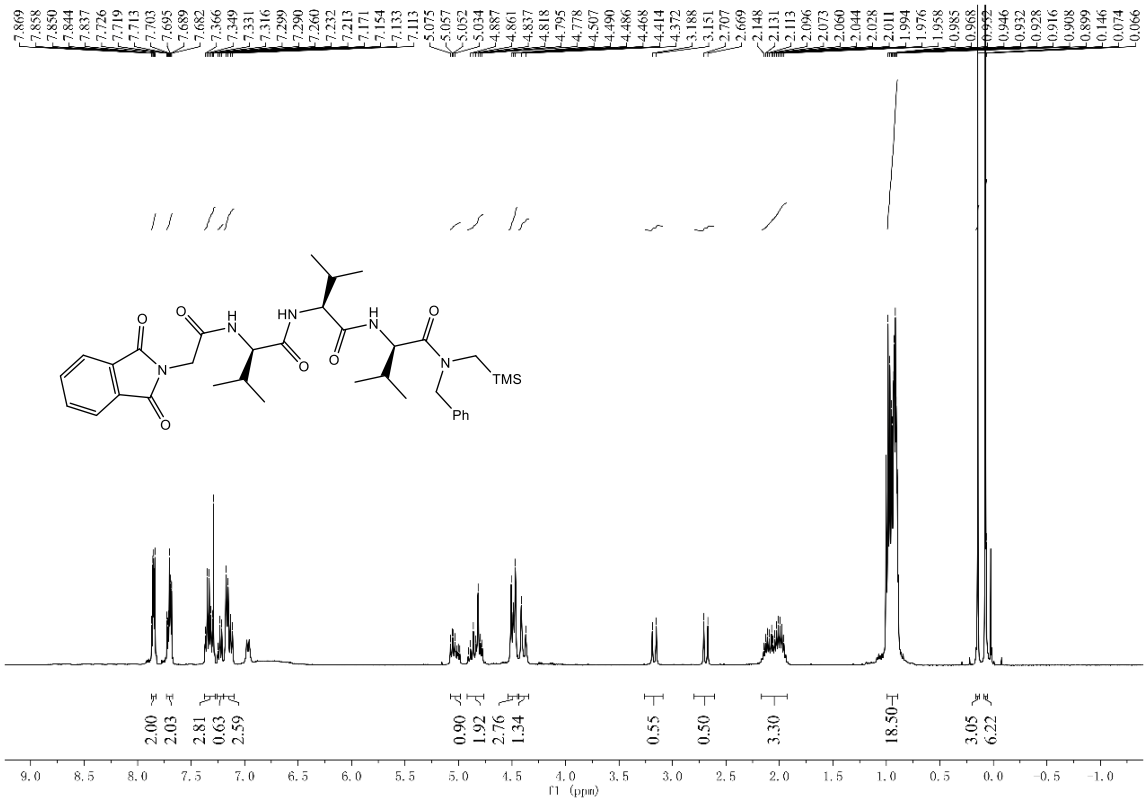
3.6 ^{1}H-NMR, ^{13}C-NMR and HRMS of 6a.

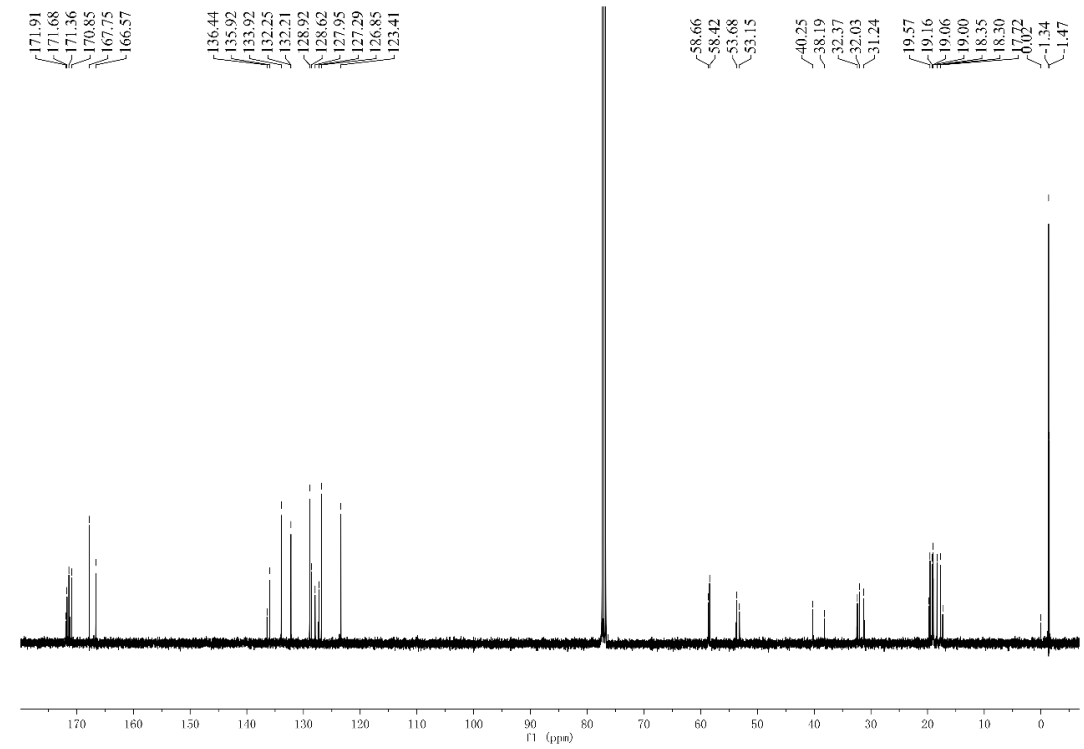


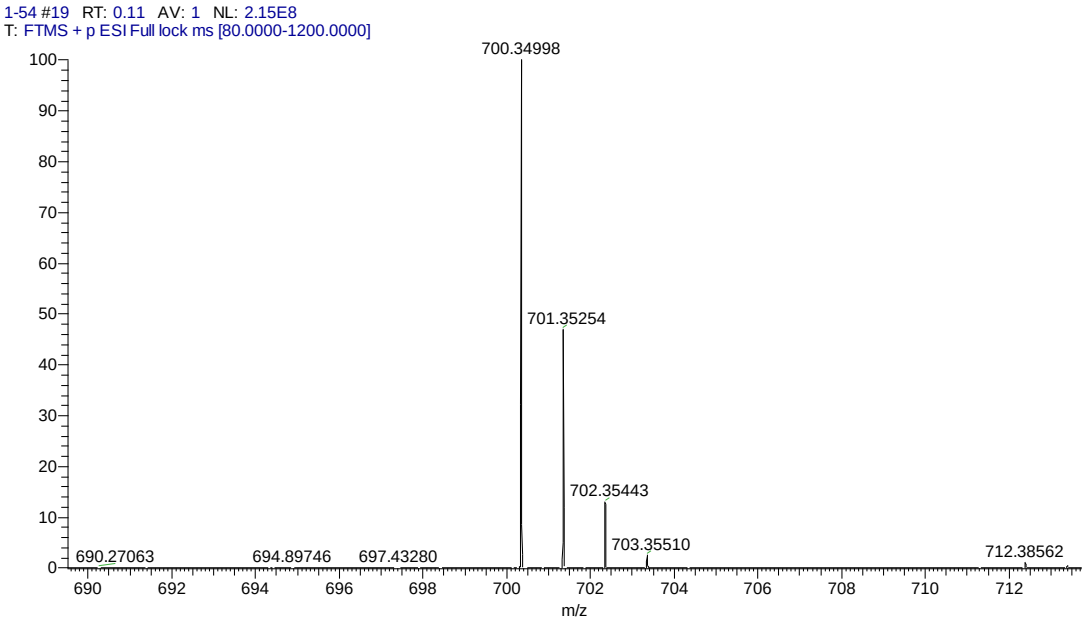




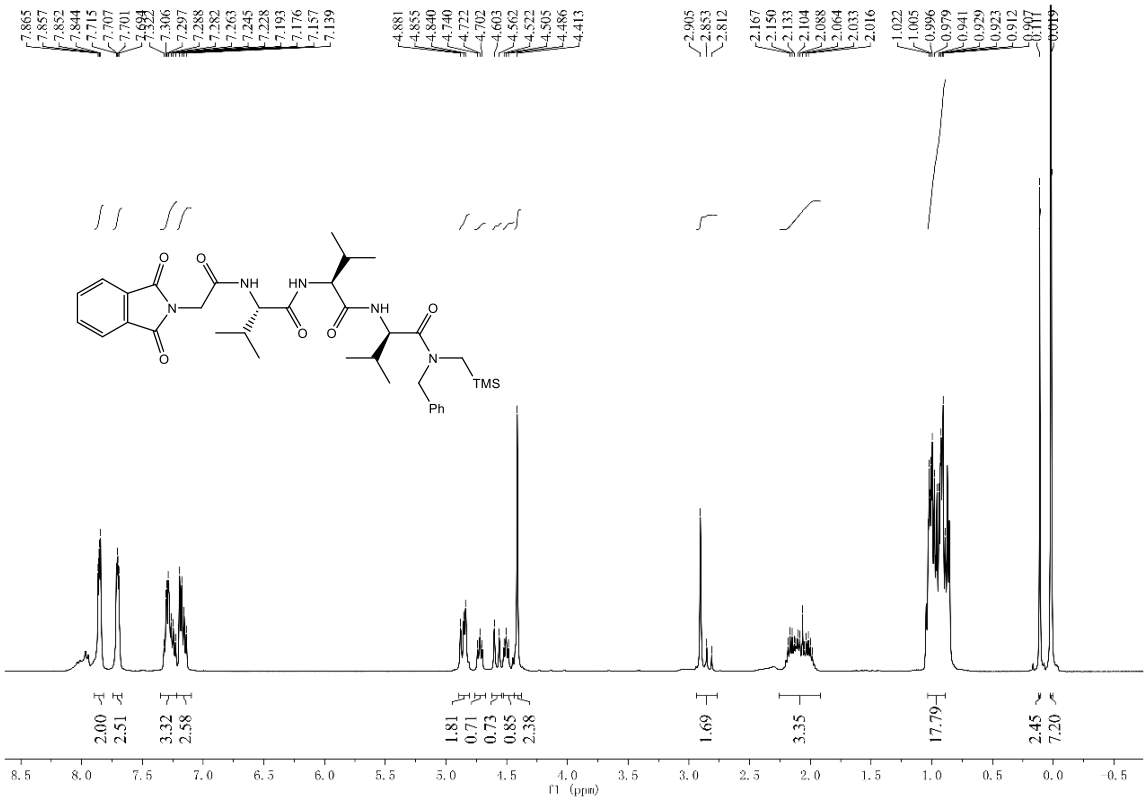
3.7 ^{1}H-NMR, ^{13}C-NMR and HRMS of 7a.

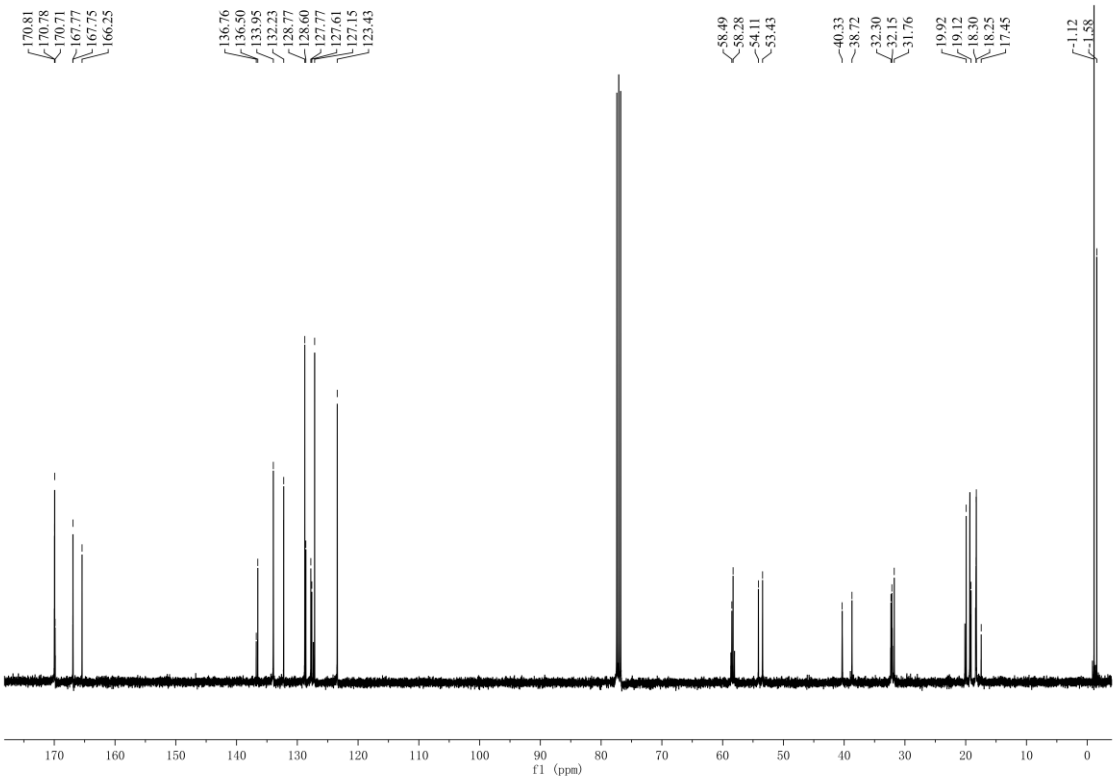

7.869
7.858
7.850
7.844
7.837
7.726
7.719
7.713
7.703
7.695
7.689
7.682
7.366
7.349
7.331
7.316
7.299
7.290
7.260
7.232
7.213
7.171
7.154
7.133
7.113
5.075
5.057
5.052
5.034
4.887
4.861
4.837
4.818
4.795
4.778
4.507
4.490
4.486
4.468
4.414
4.372
3.188
3.151
2.707
2.669
2.148
2.131
2.113
2.096
2.073
2.060
2.044
2.028
2.011
1.994
1.976
1.958
0.985
0.968
0.952
0.946
0.932
0.928
0.916
0.908
0.899
0.146
0.074
0.066
TMS
Ph
2.00
2.03
2.81
0.63
2.59
0.90
1.92
2.76
1.34
0.55
0.50
3.30
18.50
3.05
6.22
F1 (ppm)

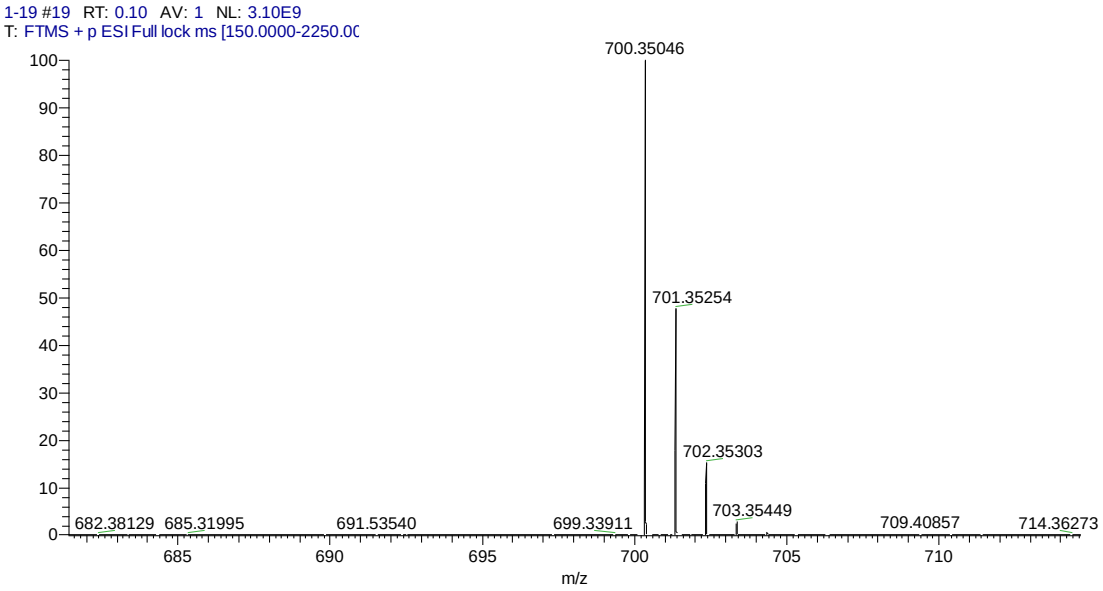

171.91
171.68
171.36
170.85
167.75
166.57
136.44
135.92
133.92
132.25
132.21
128.92
128.62
127.95
127.29
126.85
123.41
58.66
58.42
53.68
53.15
40.25
38.19
32.37
32.03
31.24
19.57
19.16
19.06
19.00
18.35
18.30
0.72
0.02
-1.34
-1.47
F1 (ppm)



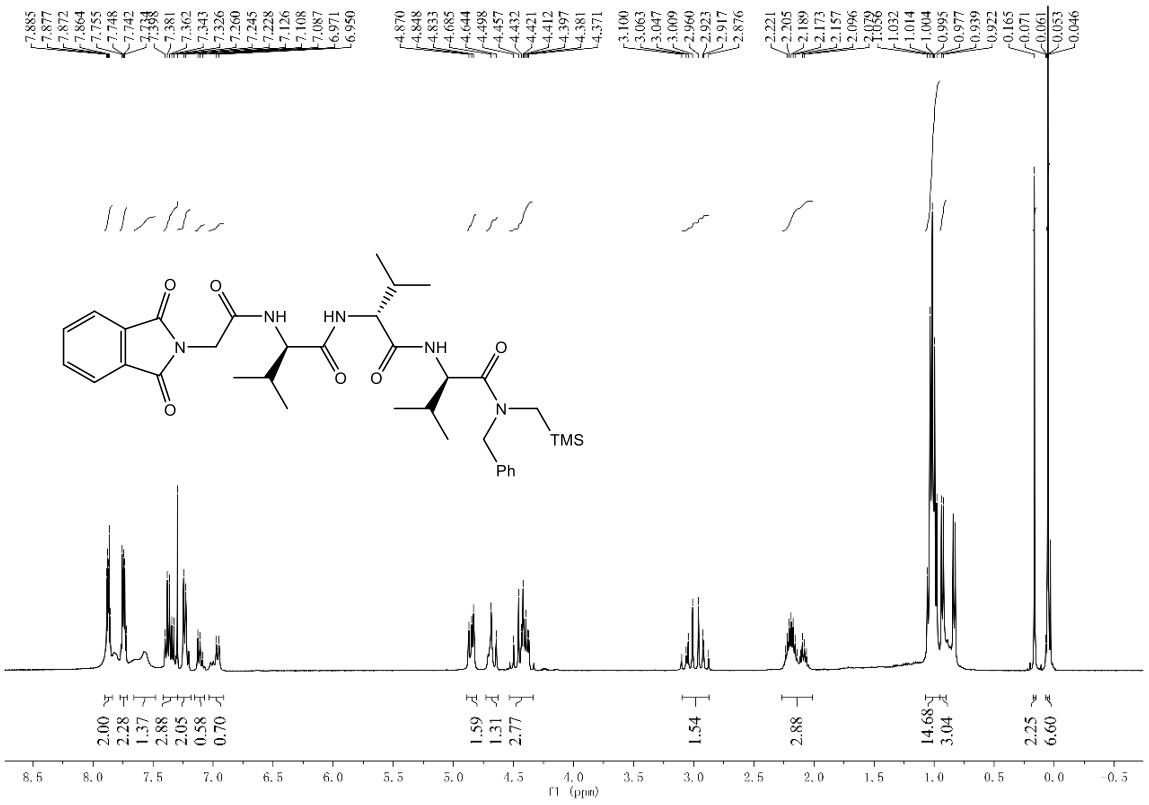
3.8 ^{1}H-NMR, ^{13}C-NMR and HRMS of 8a.

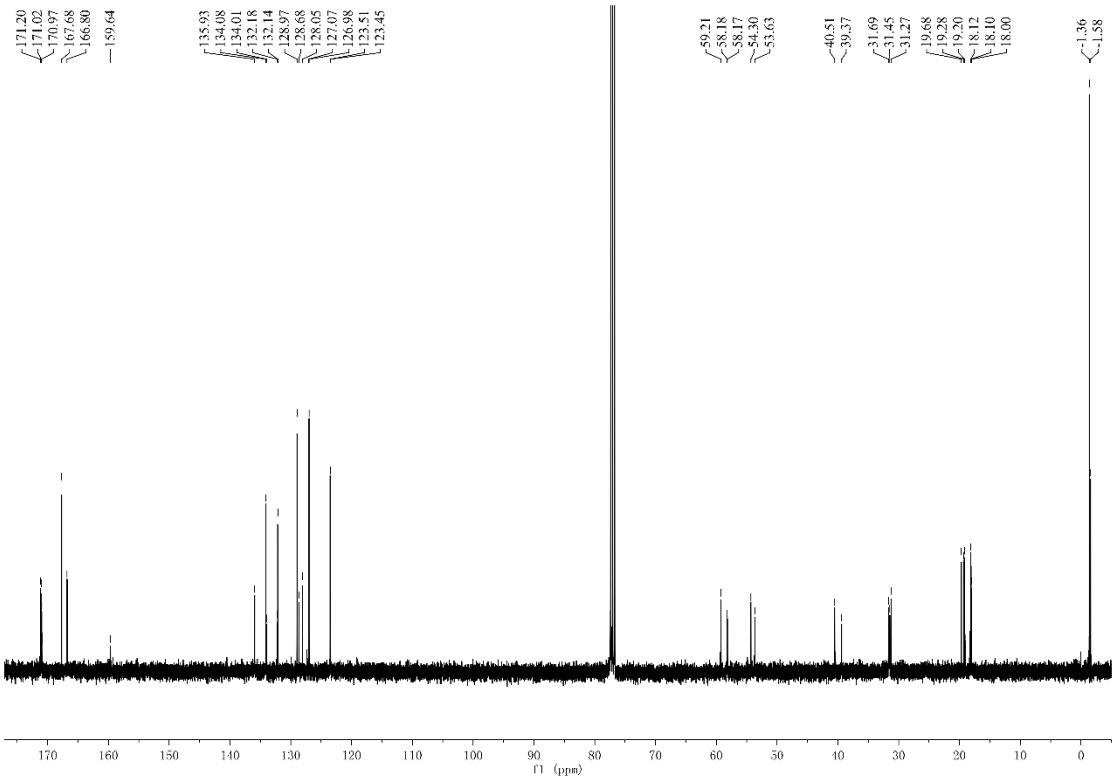


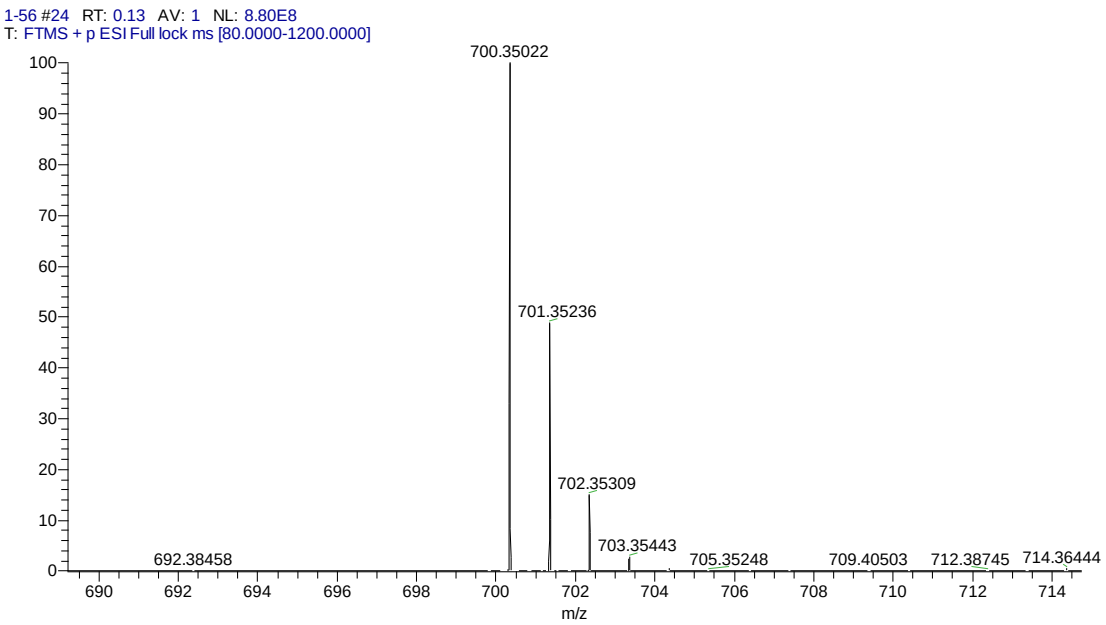




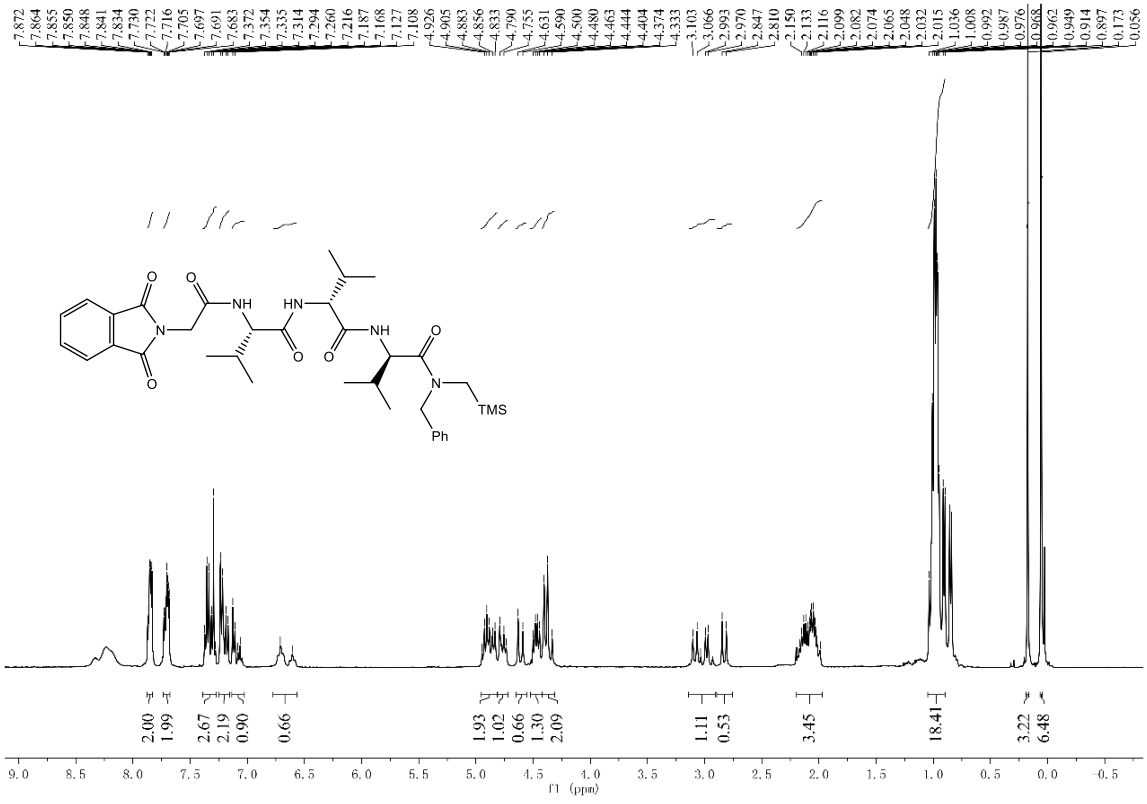
3.9 ^{1}H-NMR, ^{13}C-NMR and HRMS of 9a.

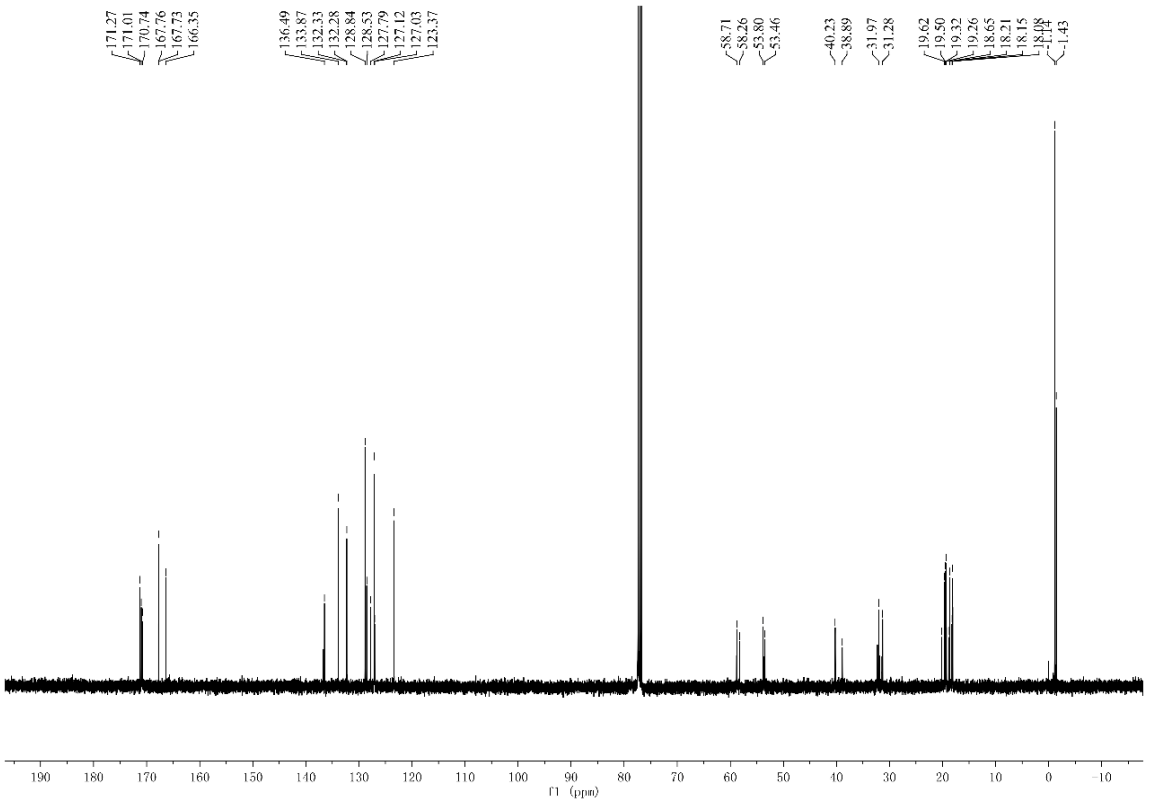

7.885
7.877
7.872
7.864
7.755
7.748
7.742
7.381
7.362
7.343
7.326
7.260
7.245
7.228
7.126
7.108
7.087
6.971
6.950
4.870
4.848
4.833
4.685
4.644
4.498
4.457
4.432
4.421
4.412
4.397
4.381
4.371
3.100
3.063
3.047
3.009
2.960
2.923
2.917
2.876
2.221
2.205
2.189
2.173
2.157
2.096
2.079
2.058
1.032
1.014
1.004
0.995
0.977
0.939
0.922
0.165
0.071
0.061
0.053
0.046
O
O
N
NH
HN
NH
O
O
O
O
N
TMS
Ph
2.00
2.28
1.37
2.88
2.05
0.58
0.70
1.59
1.31
2.77
1.54
2.88
14.68
3.04
2.25
6.60
f1 (ppm)

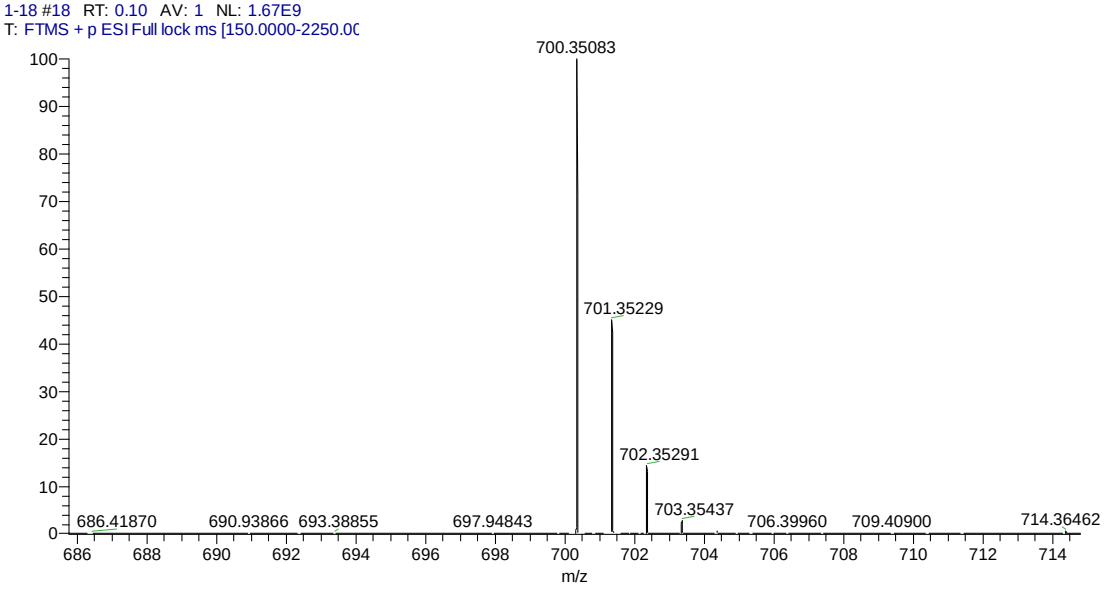

171.20
171.02
170.97
167.68
166.80
159.64
135.93
134.08
134.01
132.18
132.14
128.97
128.68
128.05
127.07
126.98
123.51
123.45
59.21
58.18
58.17
54.30
53.63
40.51
39.37
31.69
31.45
31.27
19.68
19.28
19.20
18.12
18.10
18.00
1.36
1.58
f1 (ppm)



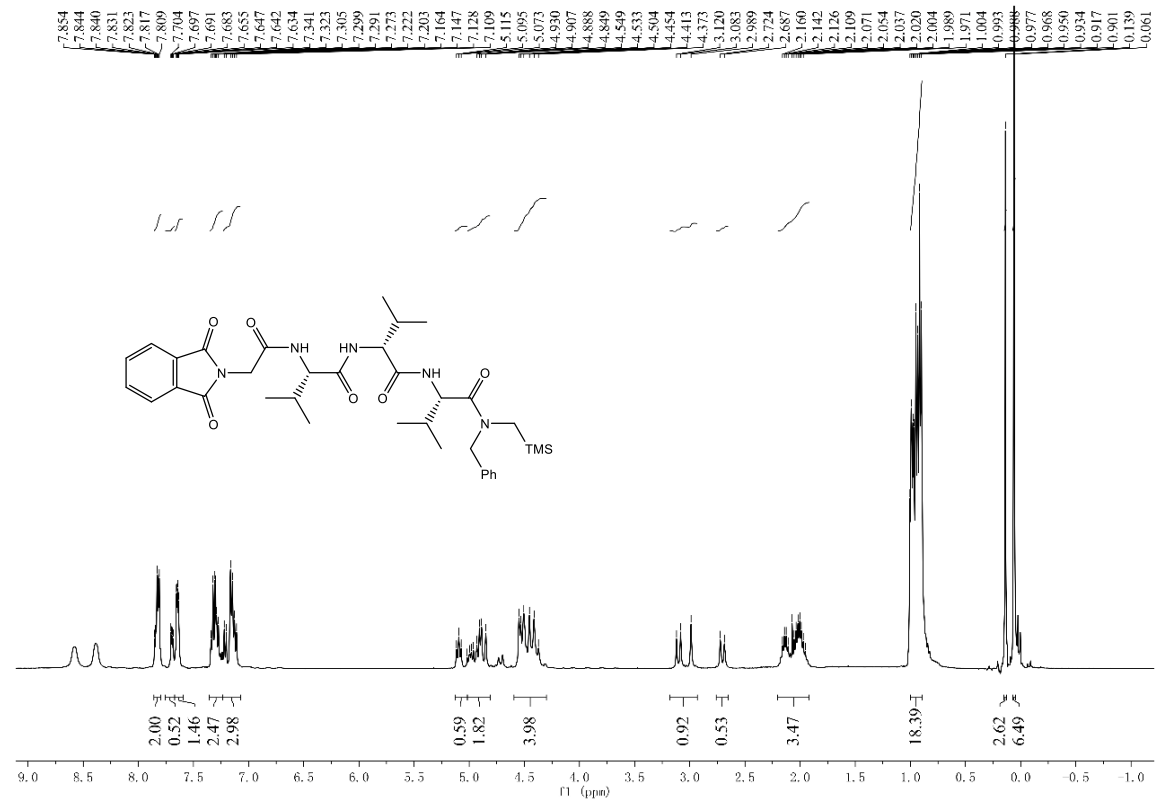
3.10 ^{1}H-NMR, ^{13}C-NMR and HRMS of 10a.

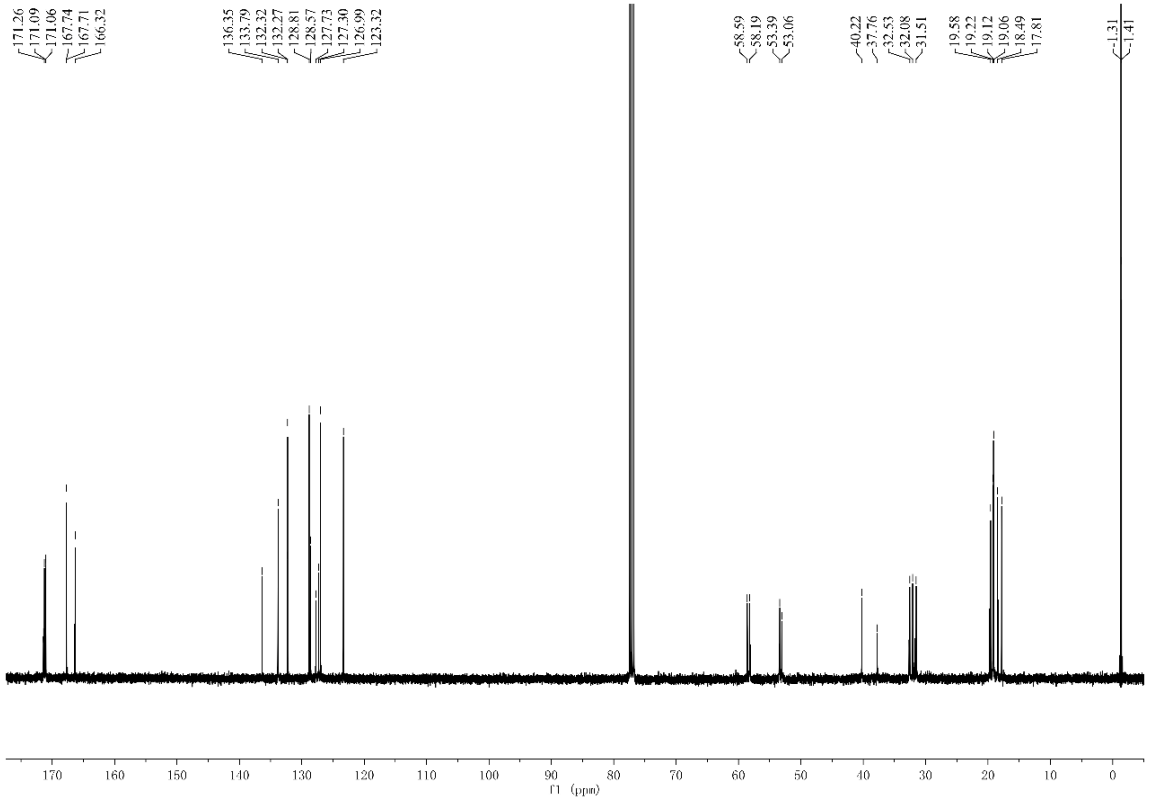


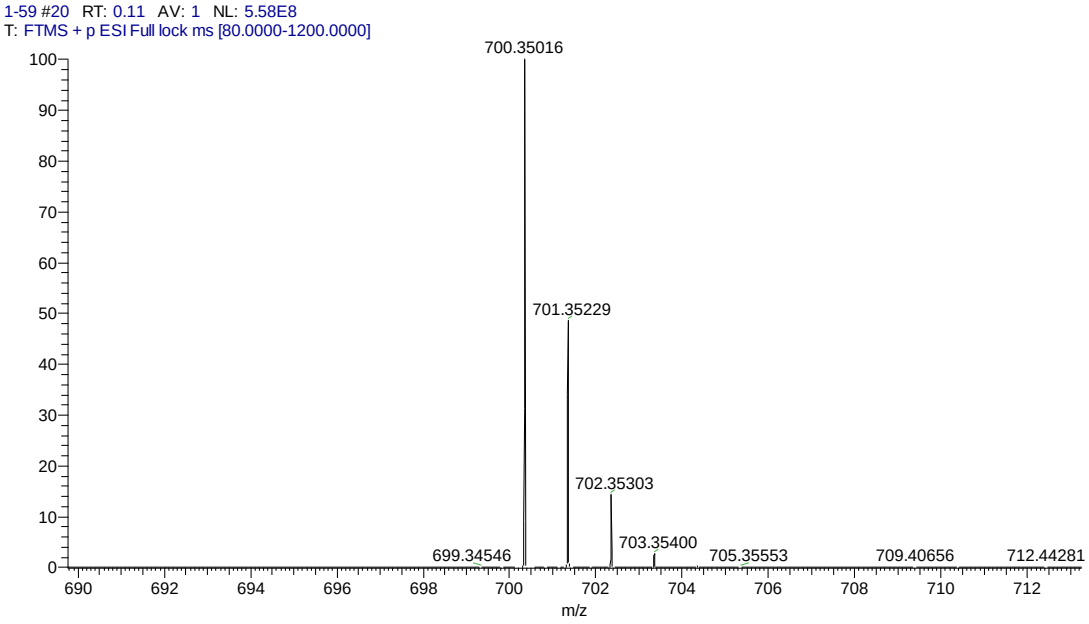




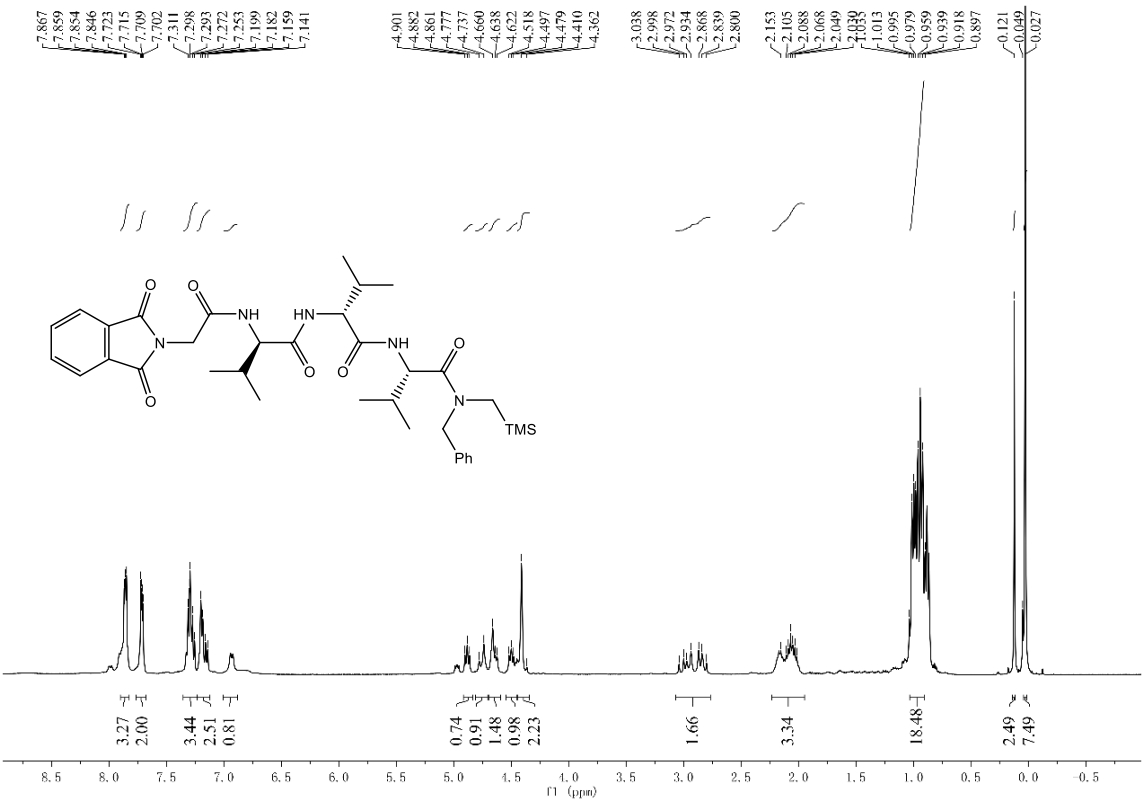
3.11 ^{1}H-NMR, ^{13}C-NMR and HRMS of 11a.

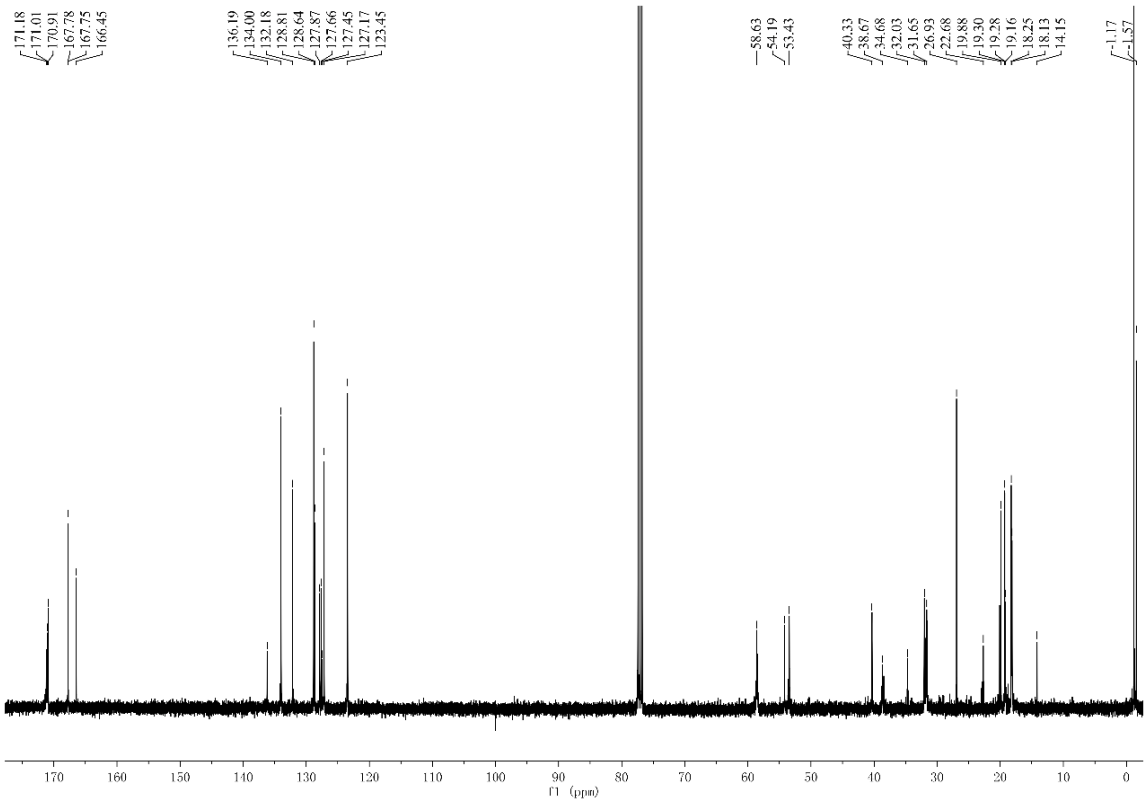

7.854
7.844
7.840
7.831
7.823
7.817
7.809
7.704
7.697
7.691
7.683
7.655
7.647
7.642
7.634
7.341
7.323
7.305
7.299
7.291
7.273
7.222
7.203
7.164
7.147
7.128
7.109
5.115
5.095
5.073
4.930
4.907
4.888
4.849
4.549
4.533
4.504
4.454
4.413
4.373
3.120
3.083
2.989
2.724
2.687
2.160
2.142
2.126
2.109
2.071
2.054
2.037
2.020
2.004
1.989
1.971
1.004
0.993
0.988
0.977
0.968
0.950
0.934
0.917
0.901
0.139
0.061
O
O
N
O
NH
HN
O
NH
O
O
N
TMS
Ph
2.00
0.52
1.46
2.47
2.98
0.59
1.82
3.98
0.92
0.53
3.47
18.39
2.62
6.49
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
f1 (ppm)

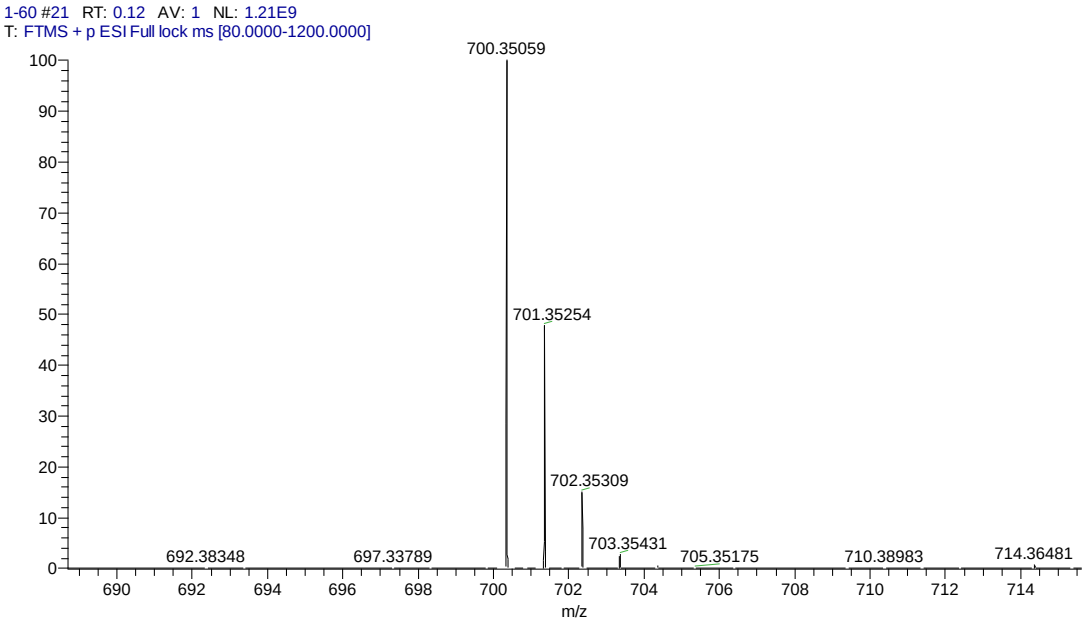

171.26
171.09
171.06
167.74
167.71
166.32
136.35
133.79
132.32
132.27
128.81
128.57
127.73
127.30
126.99
123.32
58.59
58.19
53.39
53.06
40.22
37.76
32.53
32.08
31.51
19.58
19.22
19.12
19.06
18.49
17.81
-1.31
-1.41
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



3.12 ^{1}H-NMR, ^{13}C-NMR and HRMS of 12a.




171.18
171.01
170.91
167.78
167.75
166.45
136.19
134.00
132.18
128.81
128.64
127.87
127.66
127.45
127.17
123.45
58.63
54.19
53.43
40.33
38.67
34.68
32.03
31.65
26.93
22.68
19.88
19.30
19.28
19.16
18.25
18.13
14.15
1.17
0.57
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


1-60 #21 RT: 0.12 AV: 1 NL: 1.21E9
T: FTMS + p ESI Full lock ms [80.0000-1200.0000]
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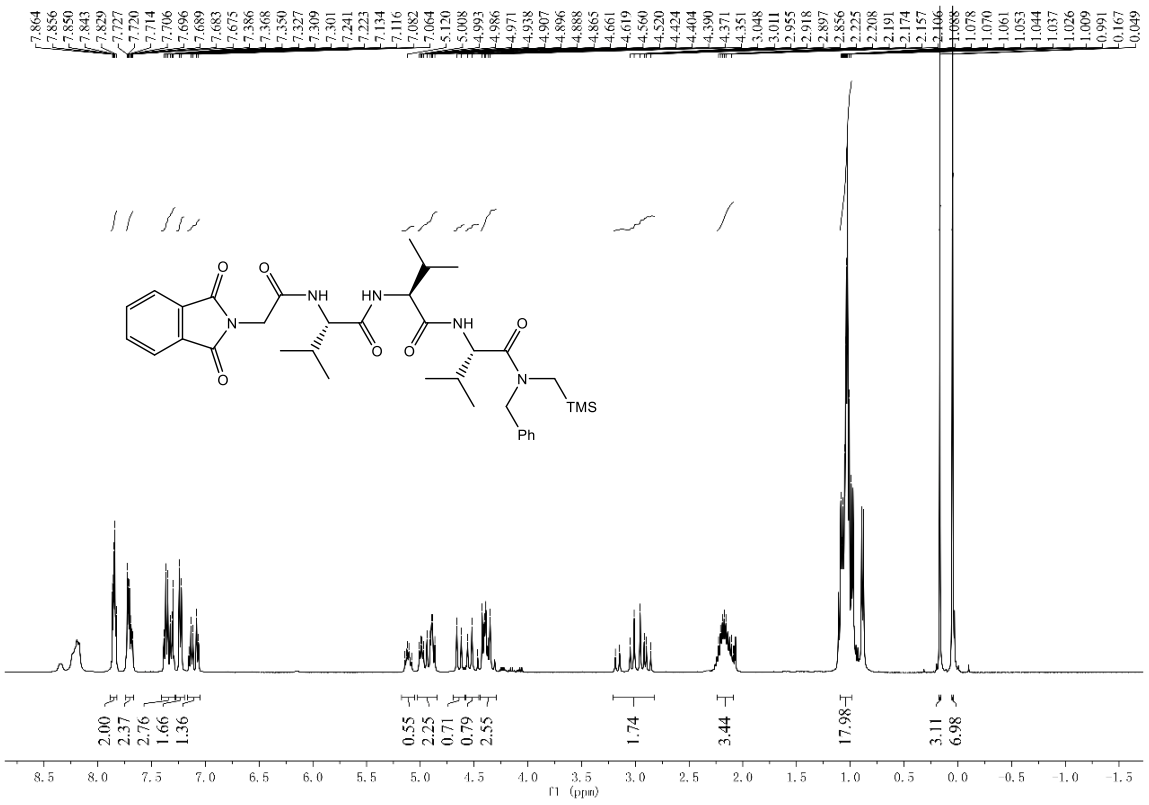
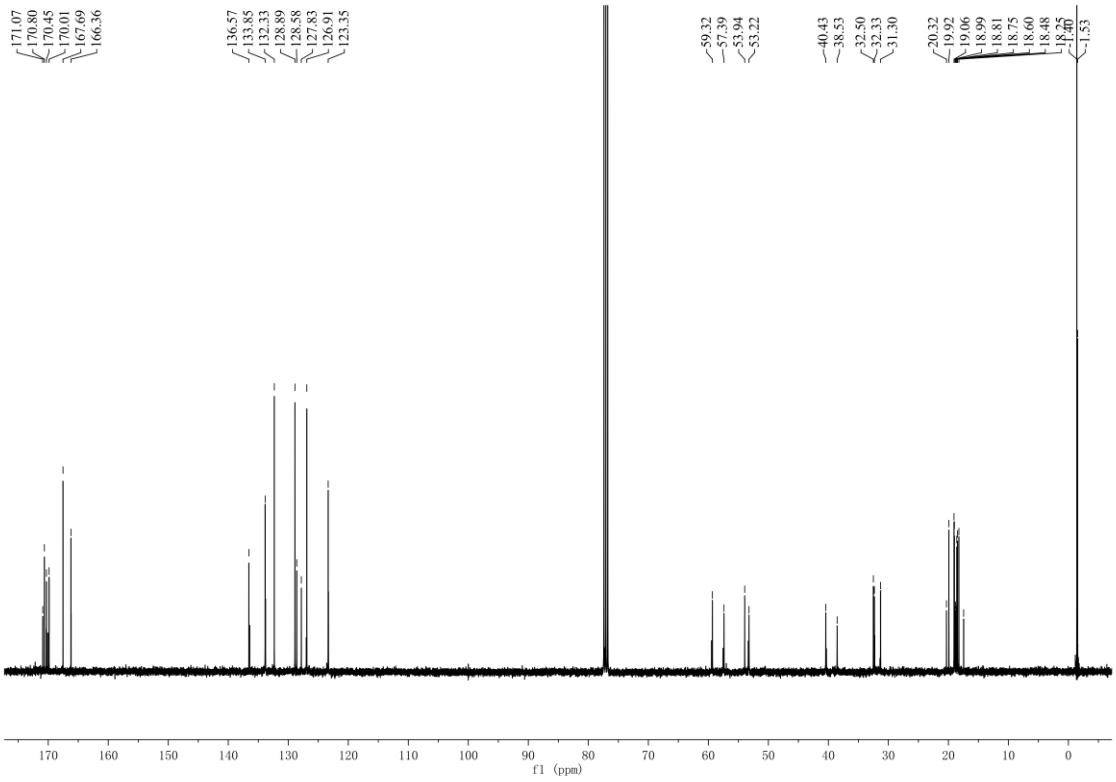
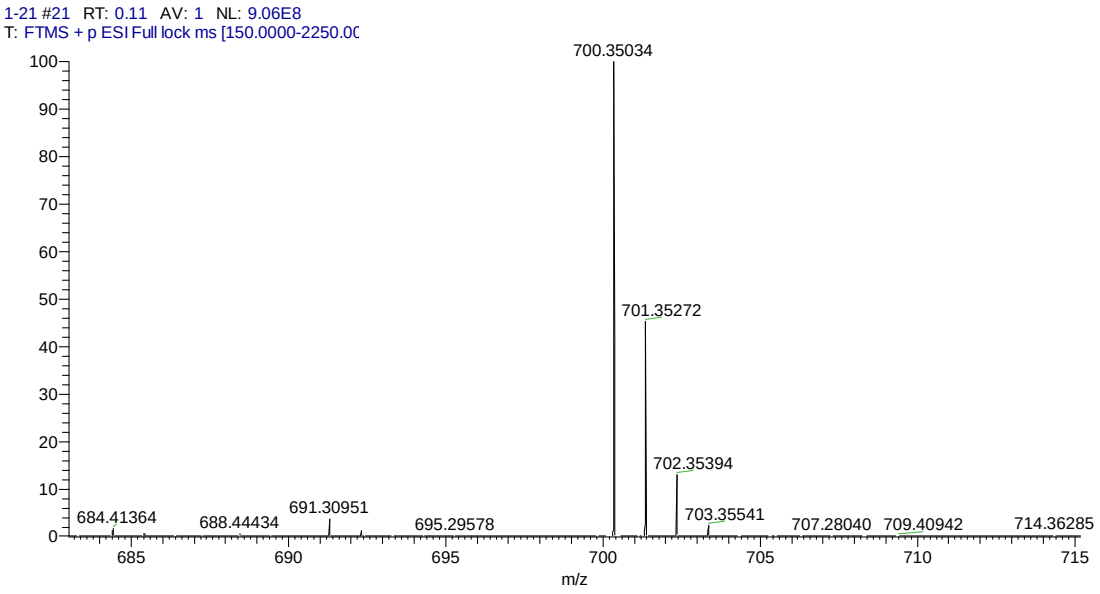
701.35254
702.35309
703.35431
692.38348
697.33789
705.35175
710.38983
714.36481
100
90
80
70
60
50
40
30
20
10
0
690 692 694 696 698 700 702 704 706 708 710 712 714
m/z

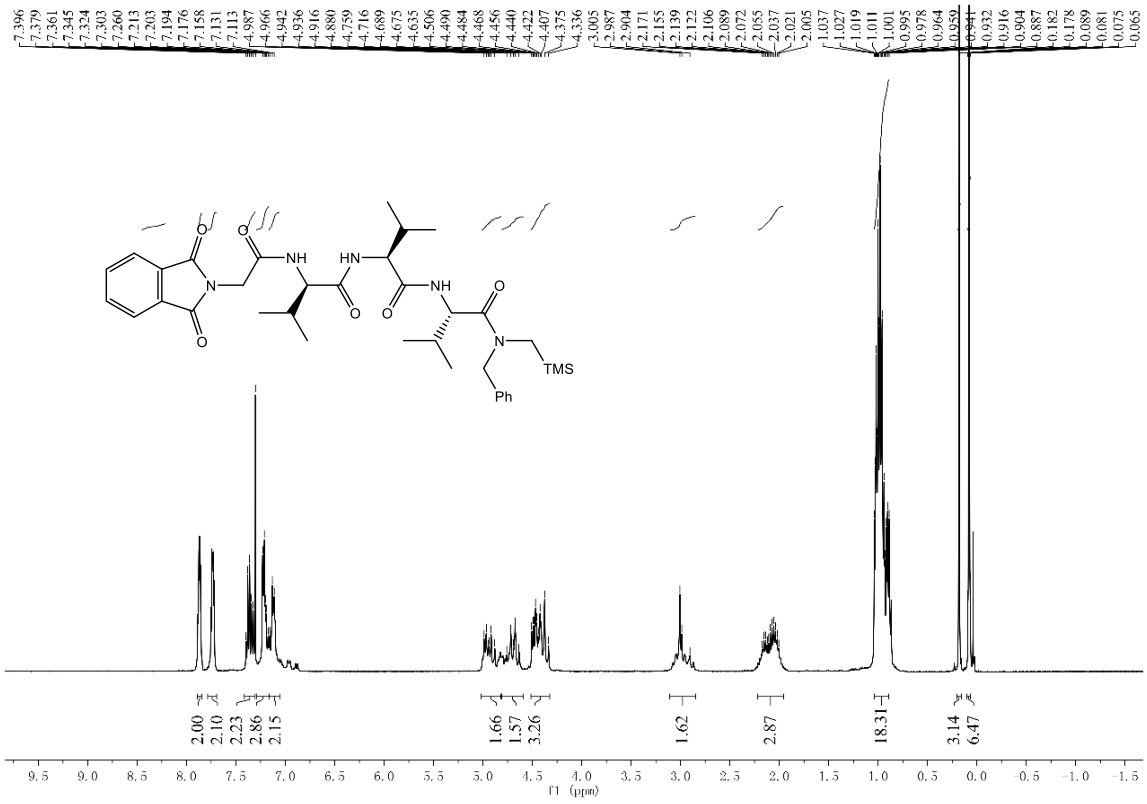
3.13 ^{1}H-NMR, ^{13}C-NMR and HRMS of 13a.

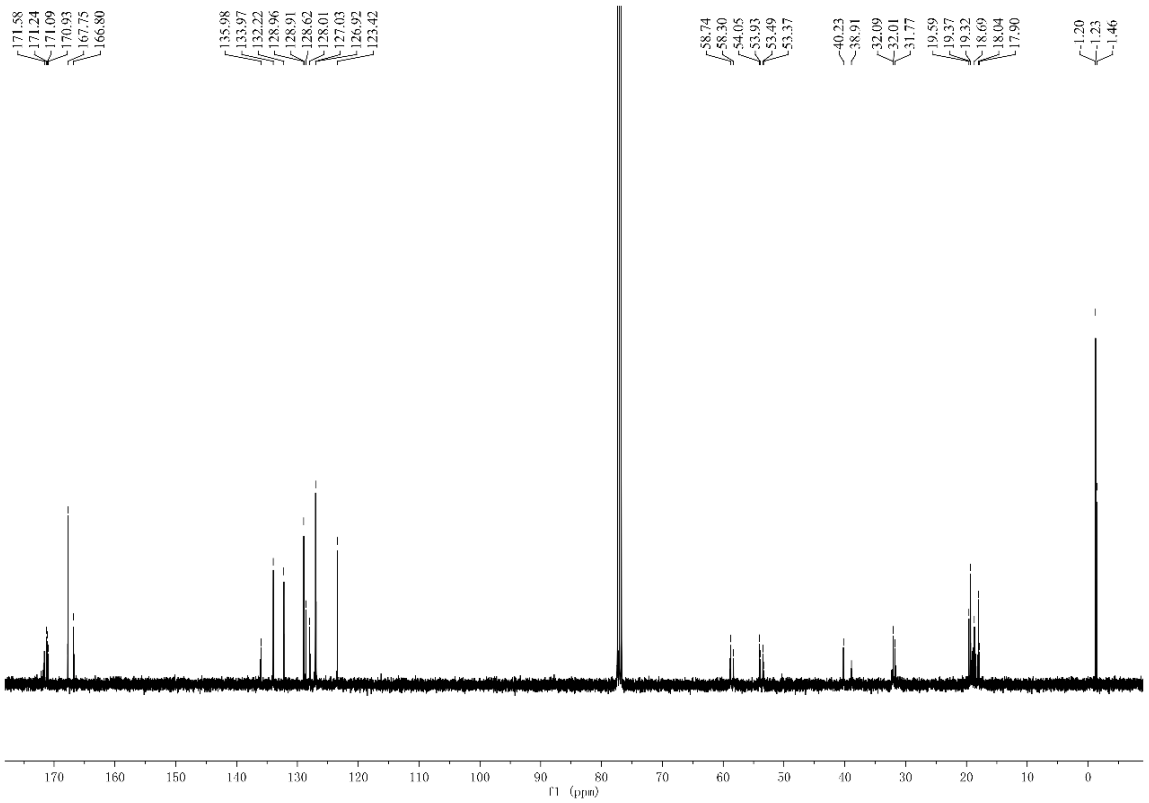


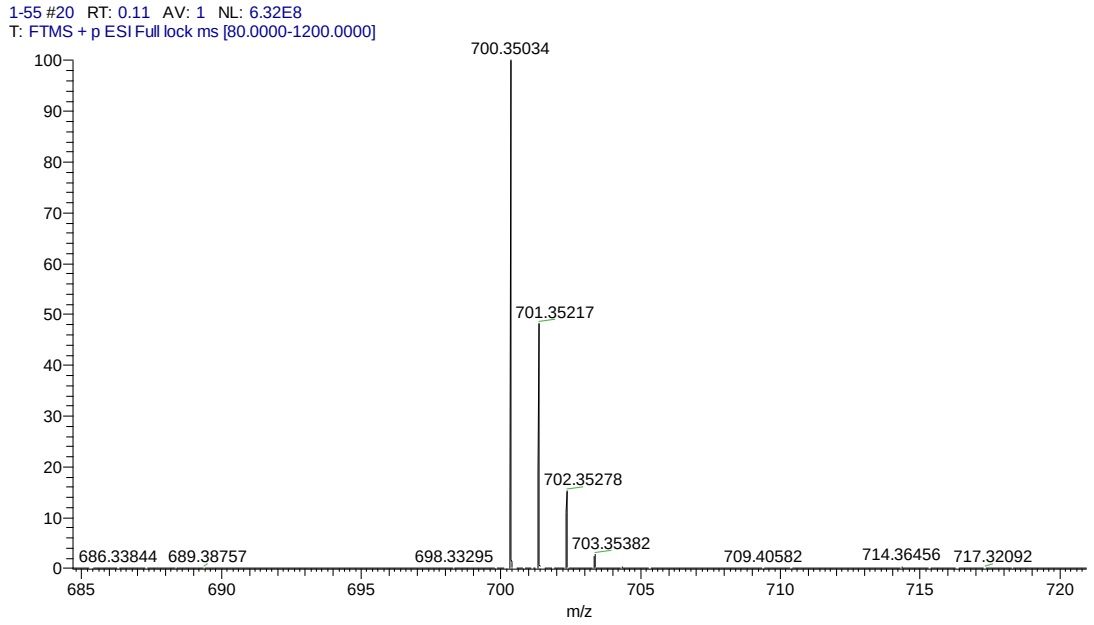




3.14 ^{1}H-NMR, ^{13}C-NMR and HRMS of 14a.

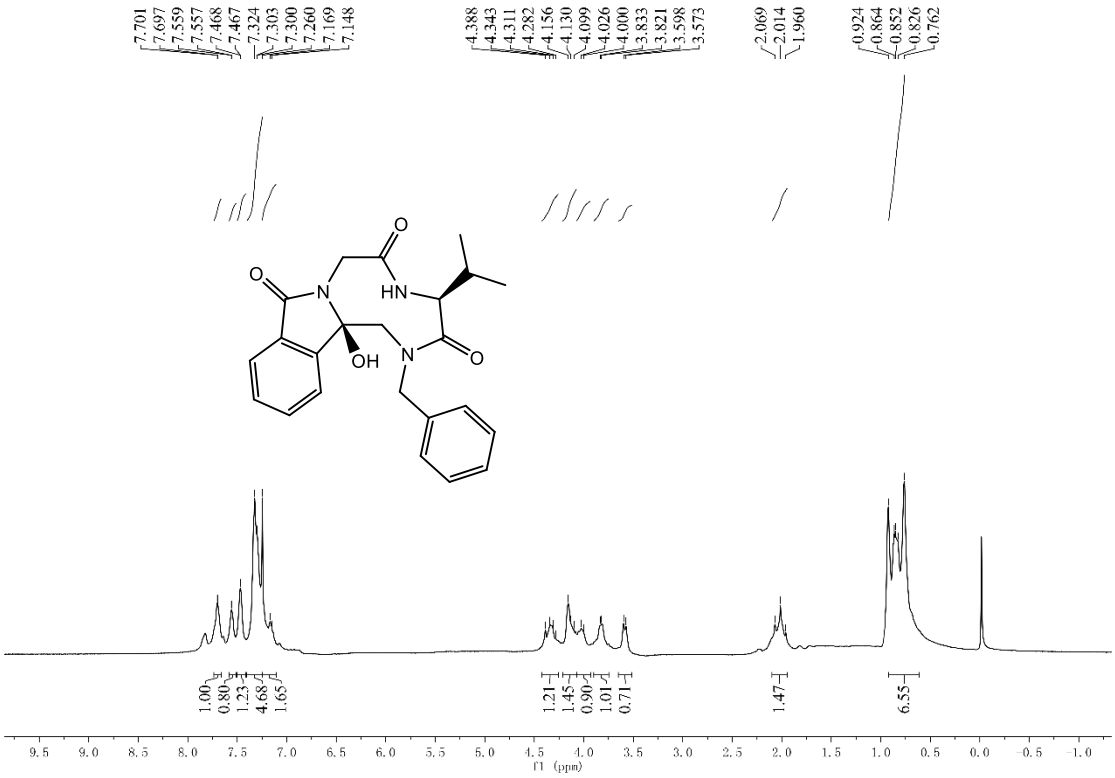


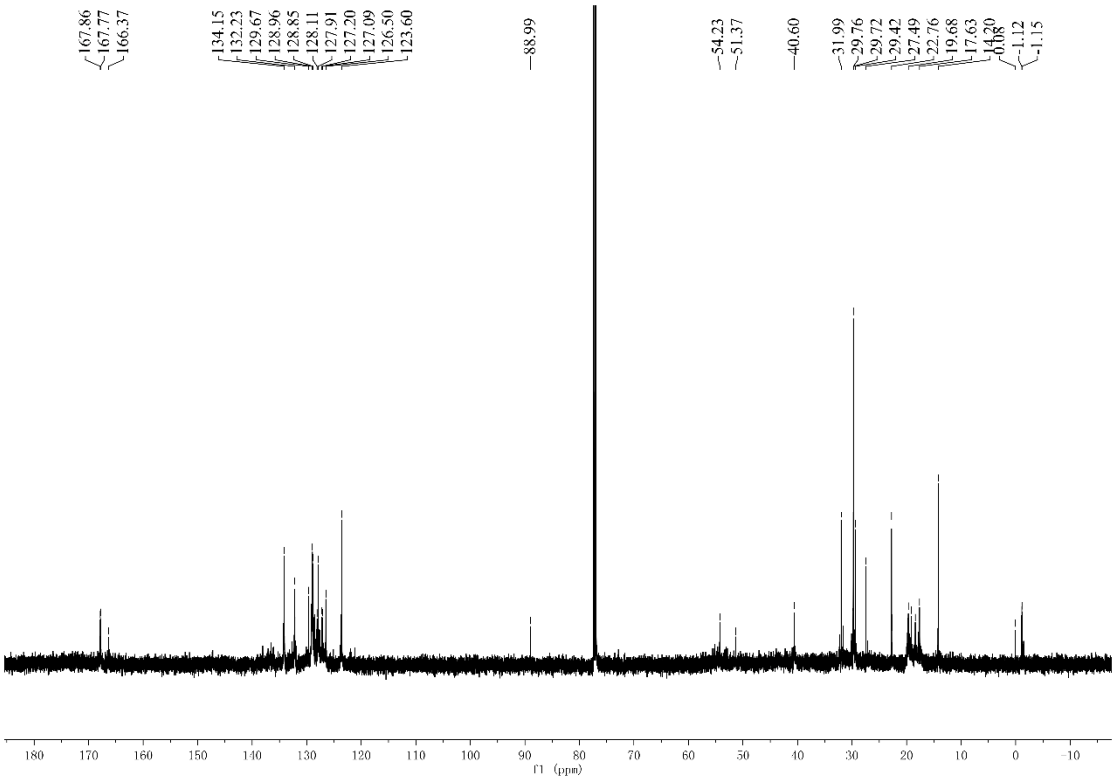

171.58
171.24
171.09
170.93
167.75
166.80
135.98
133.97
132.22
128.96
128.91
128.62
128.01
127.03
126.92
123.42
58.74
58.30
54.05
53.93
53.49
53.37
40.23
38.91
32.09
32.01
31.77
19.59
19.37
19.32
18.69
18.04
17.90
-1.20
-1.23
-1.46
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

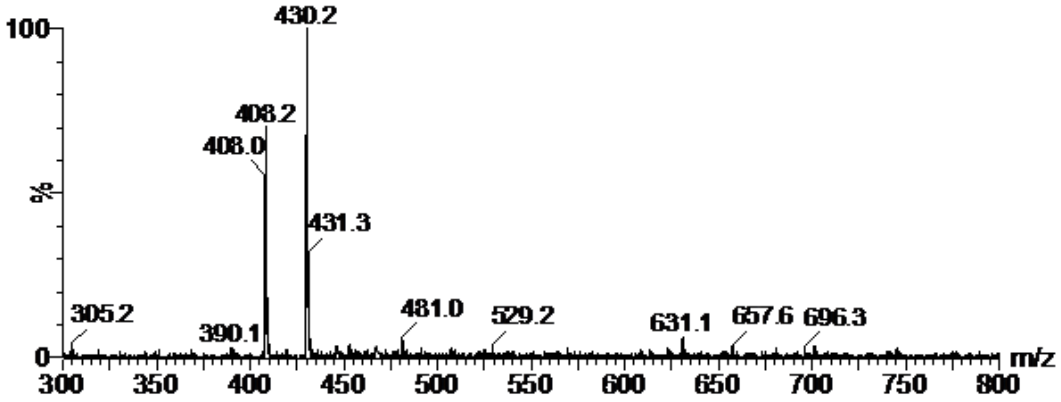

1-55 #20 RT: 0.11 AV: 1 NL: 6.32E8
T: FTMS + p ESI Full lock ms [80.0000-1200.0000]
700.35034
701.35217
702.35278
703.35382
686.33844
689.38757
698.33295
709.40582
714.36456
717.32092
100
90
80
70
60
50
40
30
20
10
0
685
690
695
700
705
710
715
720
m/z

4.^{1}H-NMR, ^{13}C-NMR, EI-MS and HPLC spectra of cyclic peptides.

4.1 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 1.



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%
0
430.2
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408.0
431.3
305.2
390.1
481.0
529.2
631.1
657.6
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m/z
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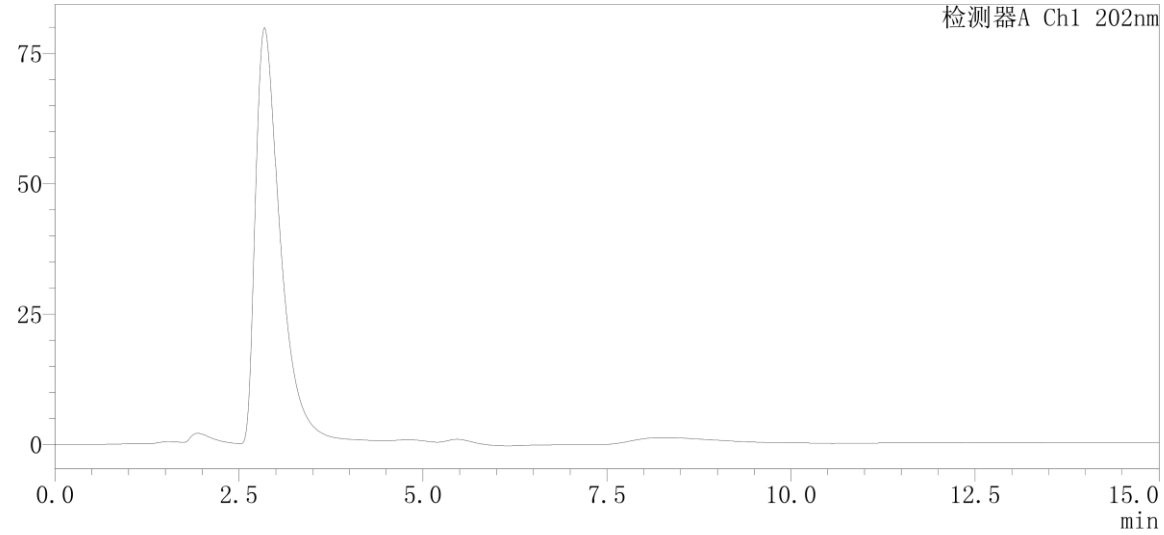
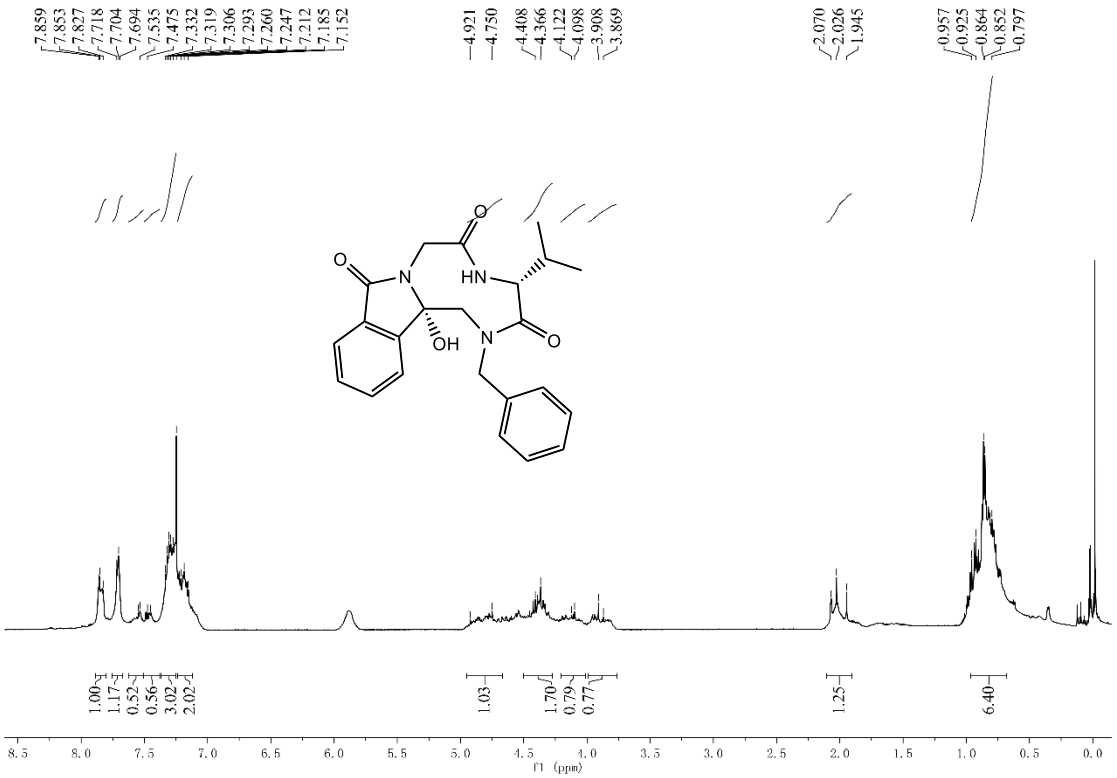
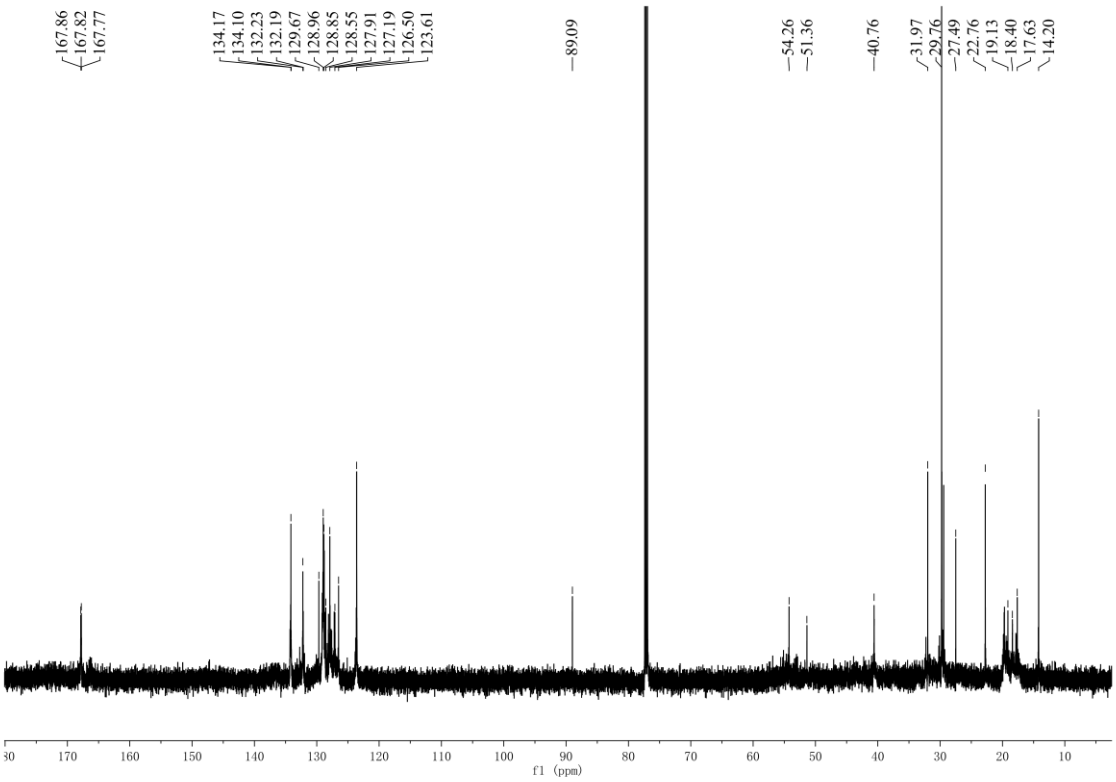
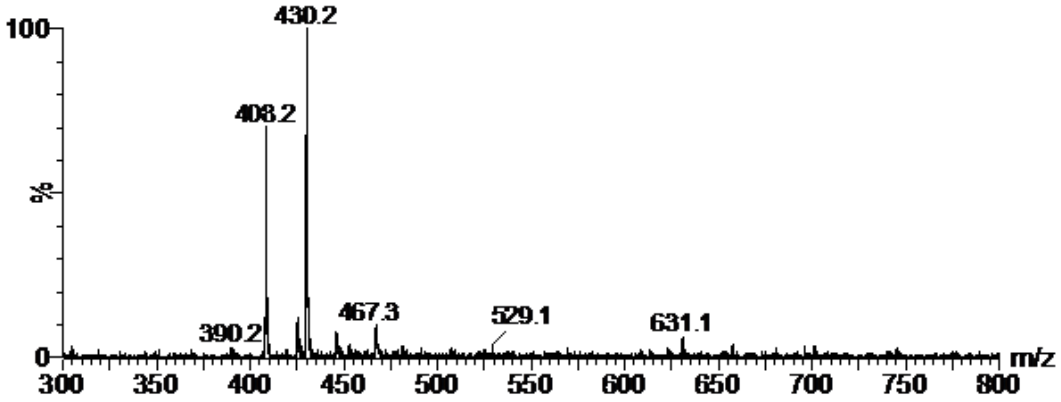
350
400
450
500
550
600
650
700
750
800

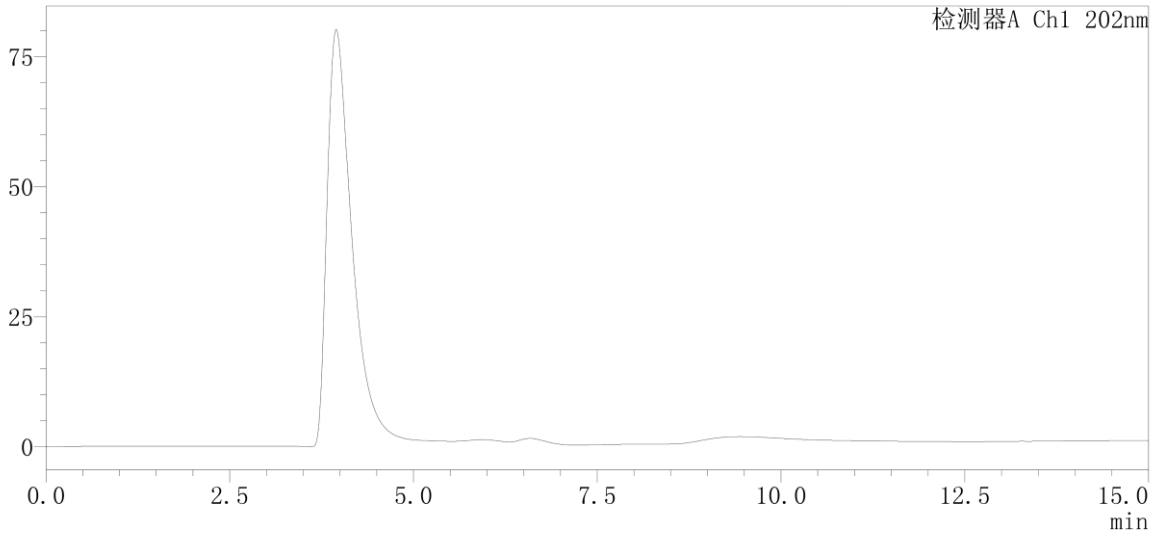

检测器A Ch1 202nm
75
50
25
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
min

4.2 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 2.

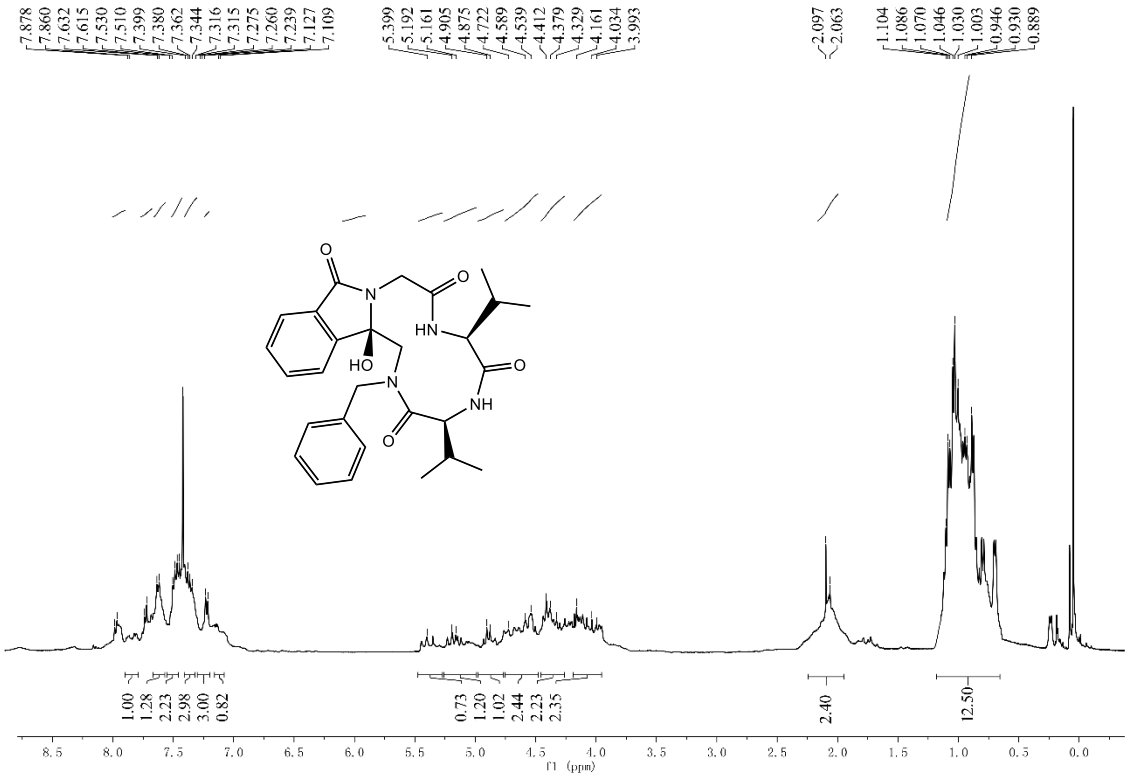


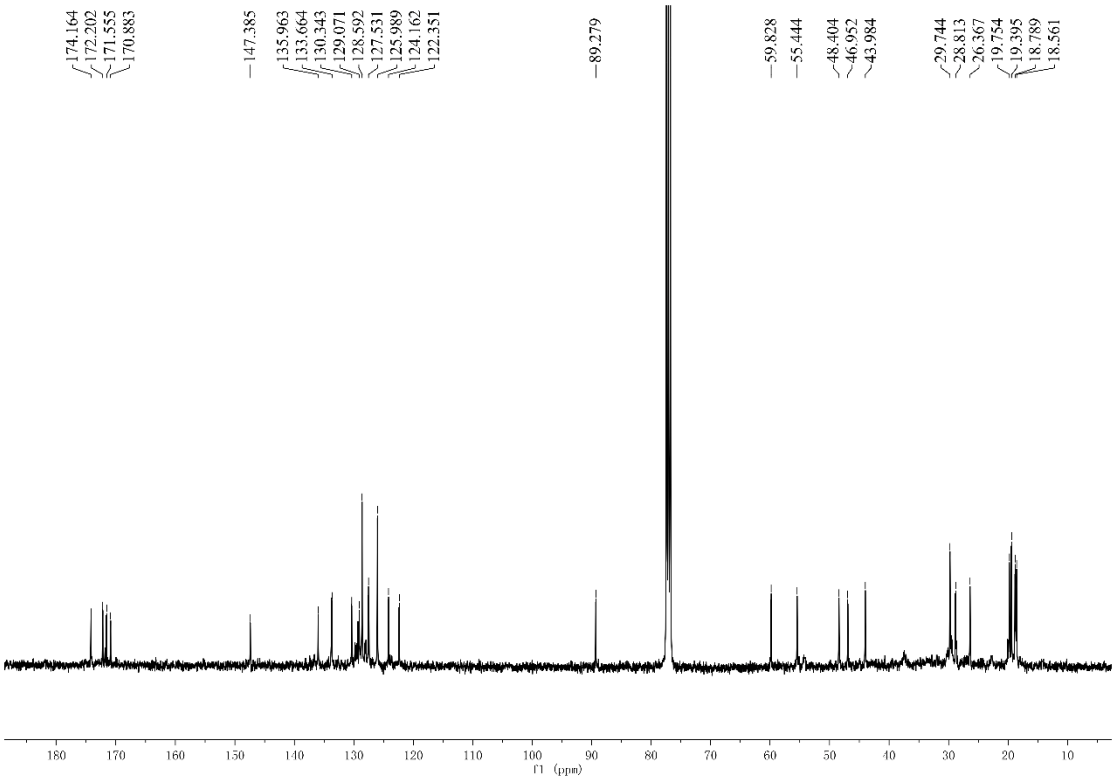


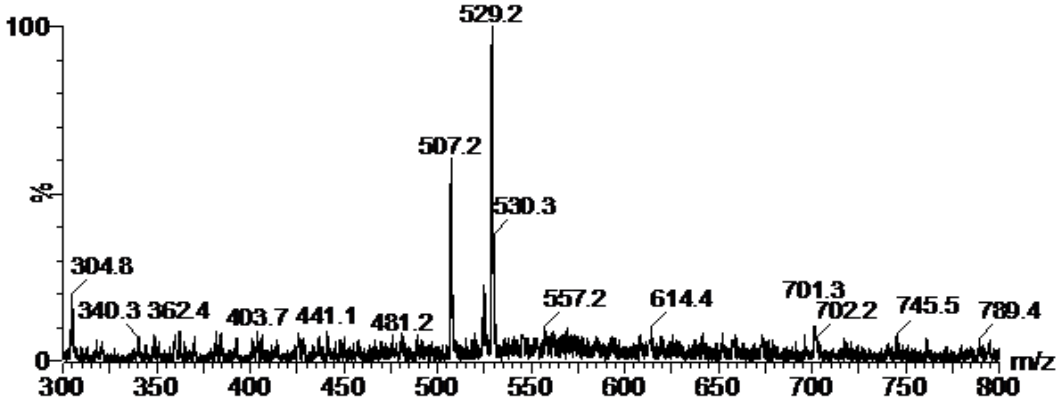

100
%
0
430.2
408.2
390.2
467.3
529.1
631.1
m/z
300
350
400
450
500
550
600
650
700
750
800


检测器A Ch1 202nm
75
50
25
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
min

4.3 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 3.



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%
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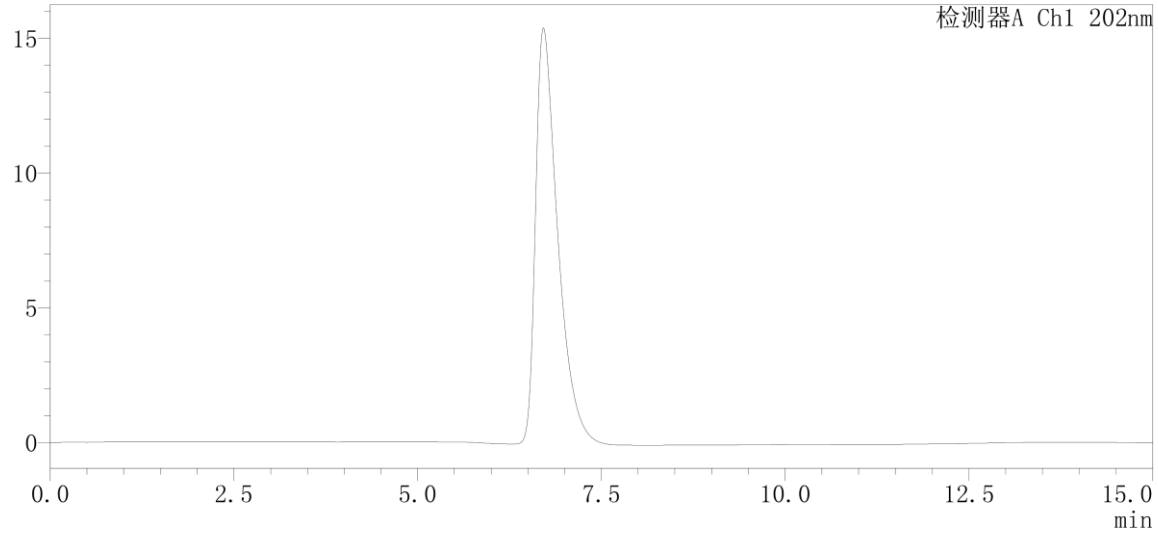
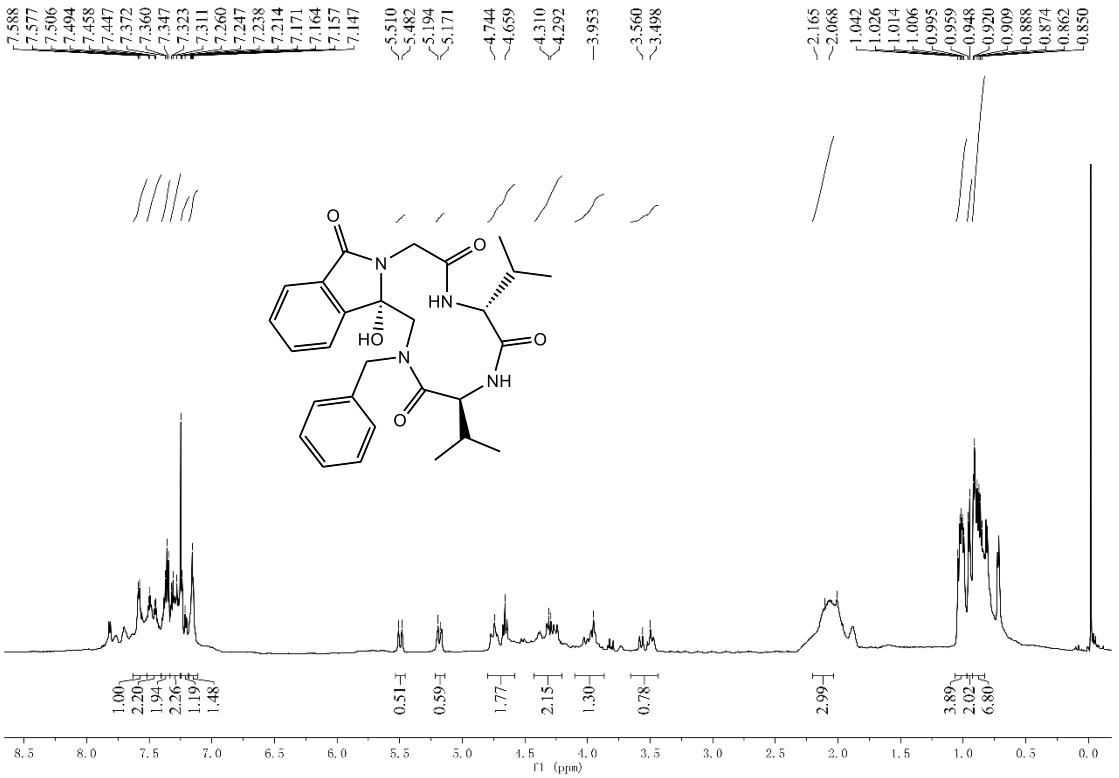
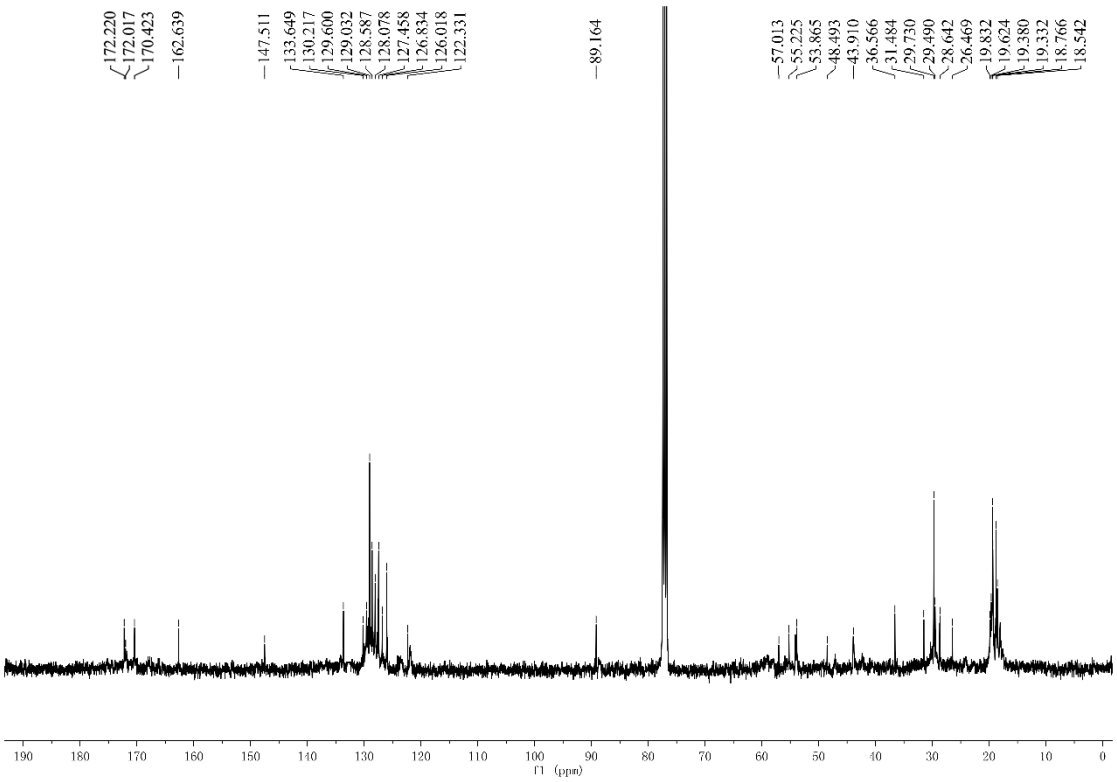
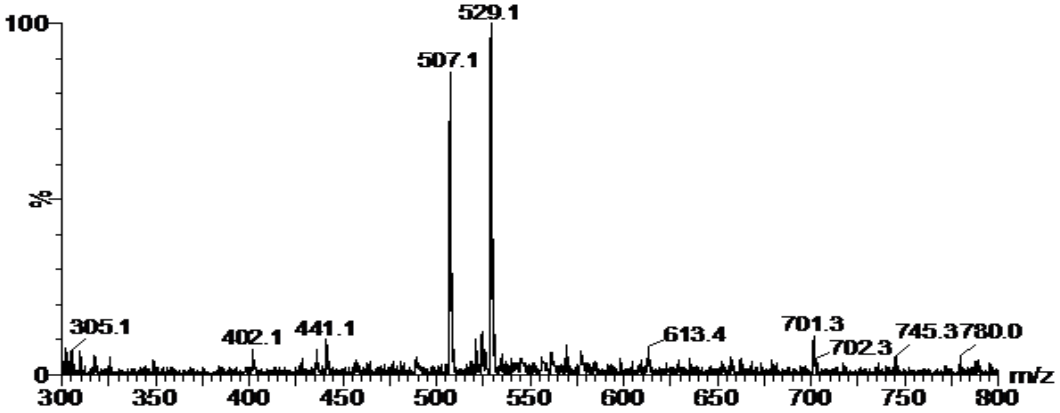
530.3
304.8
340.3
362.4
403.7
441.1
481.2
557.2
614.4
701.3
702.2
745.5
789.4
m/z
300
350
400
450
500
550
600
650
700
750
800


检测器A Ch1 202nm
15
10
5
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
min

4.4 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 4.






100
%
0
529.1
507.1
305.1
402.1
441.1
613.4
701.3
702.3
745.3
780.0
m/z
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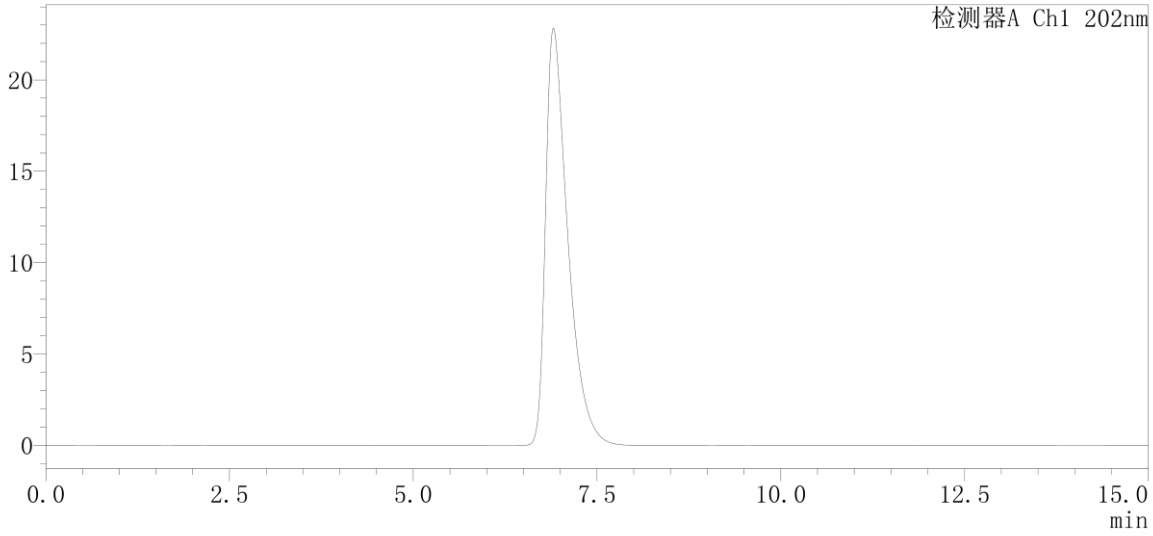
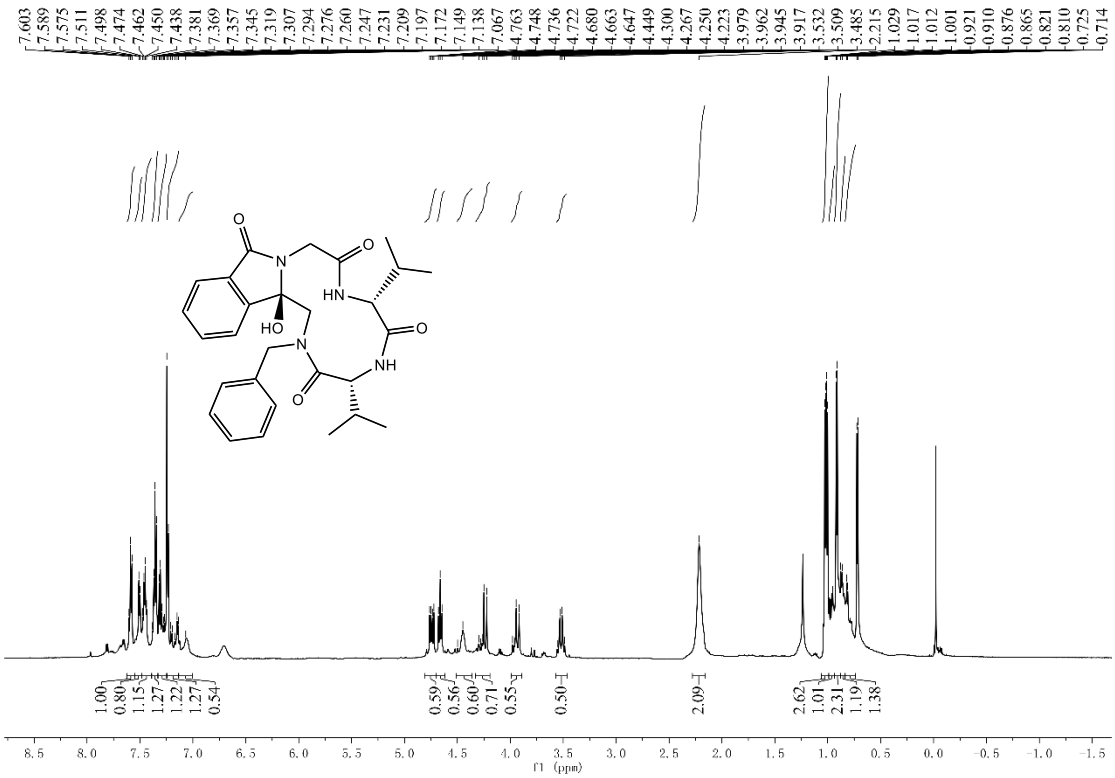
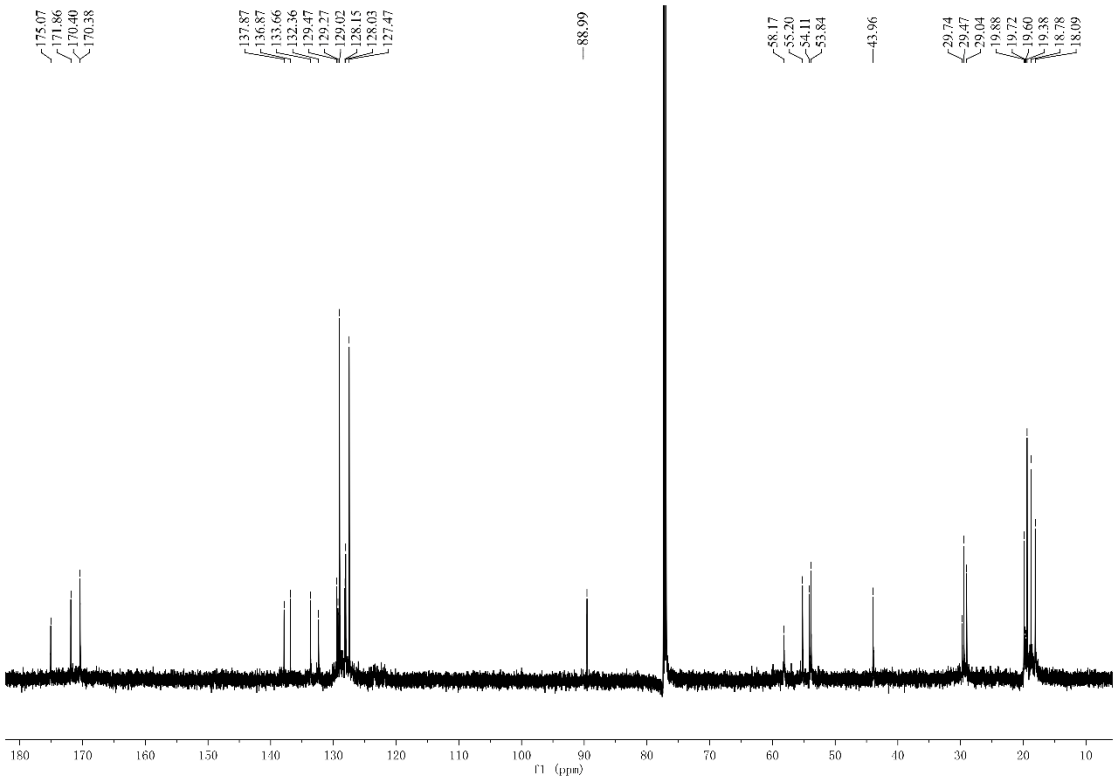
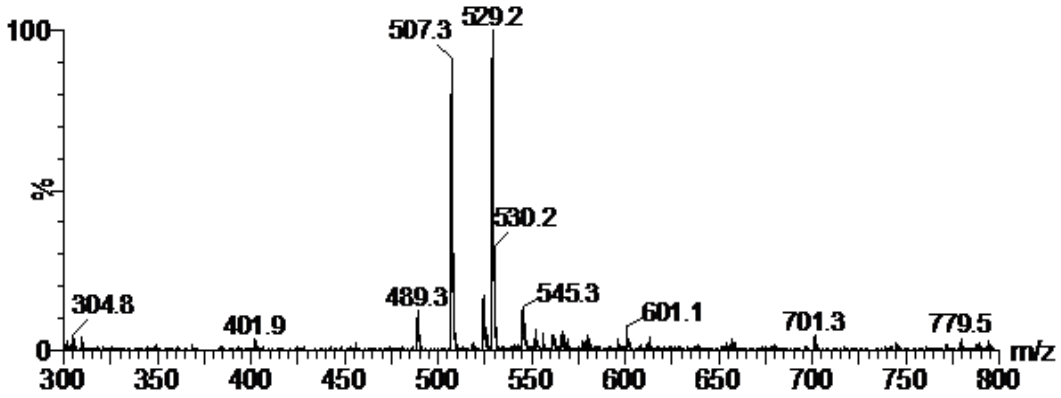
350
400
450
500
550
600
650
700
750
800


检测器A Ch1 202nm
20
15
10
5
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
min

4.5 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 5.






100
%
0
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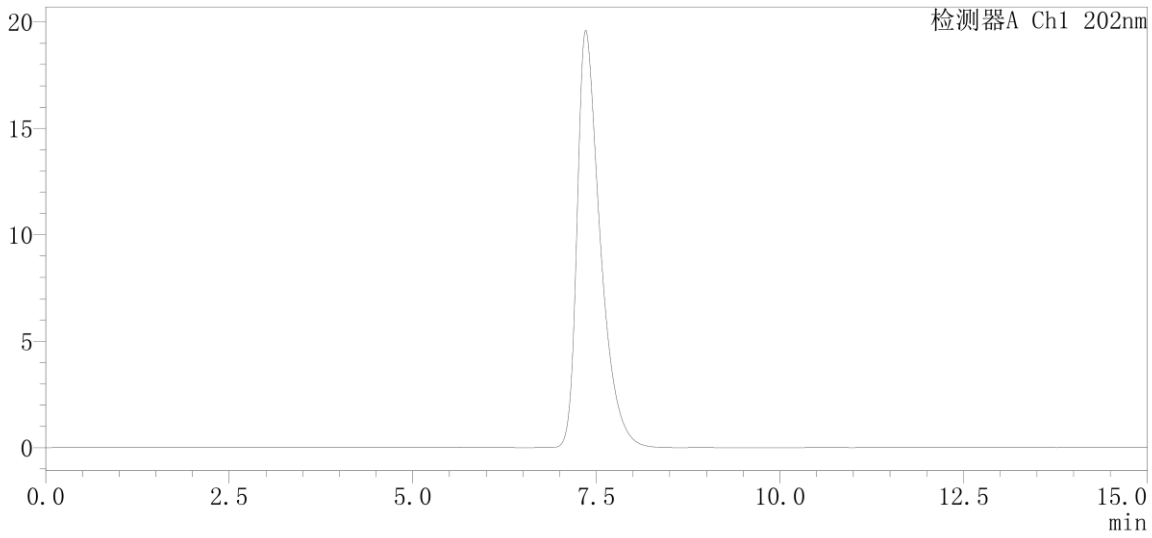
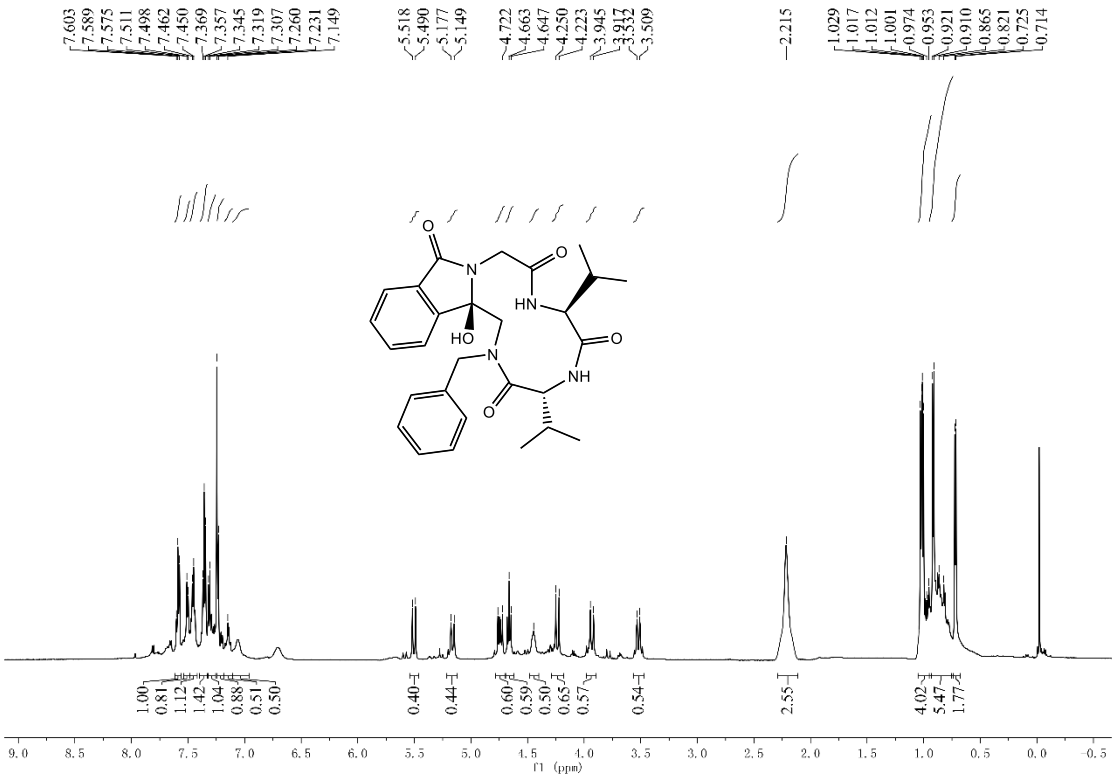
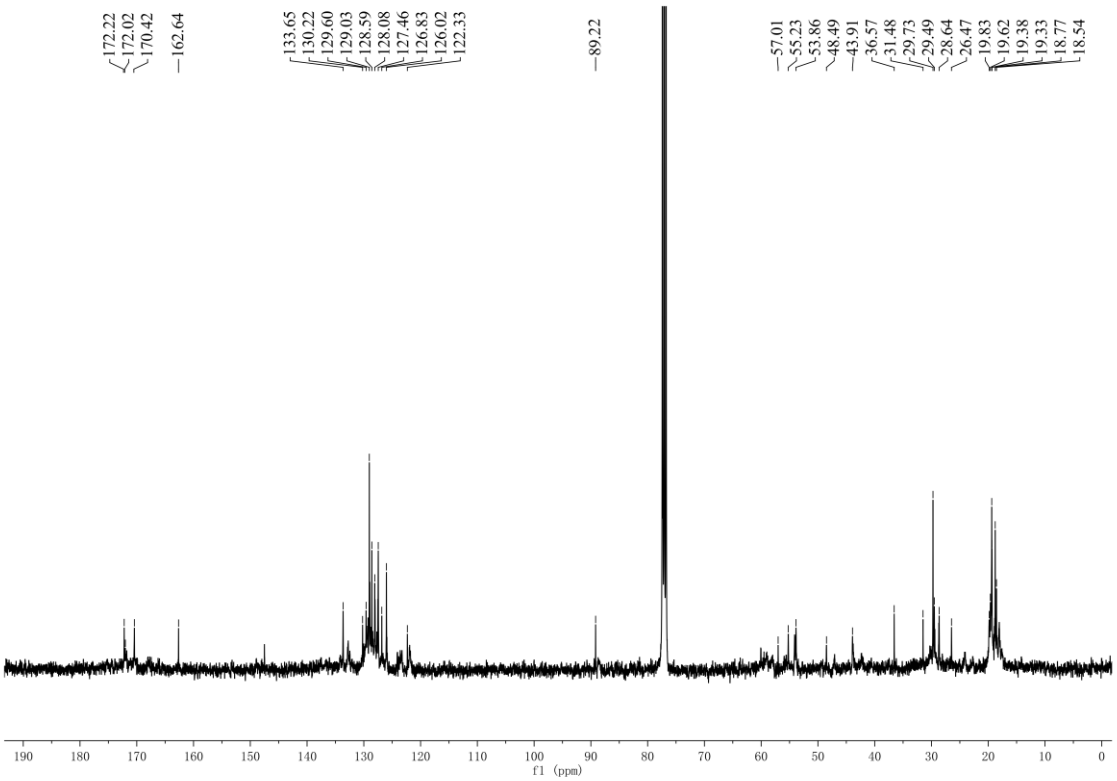
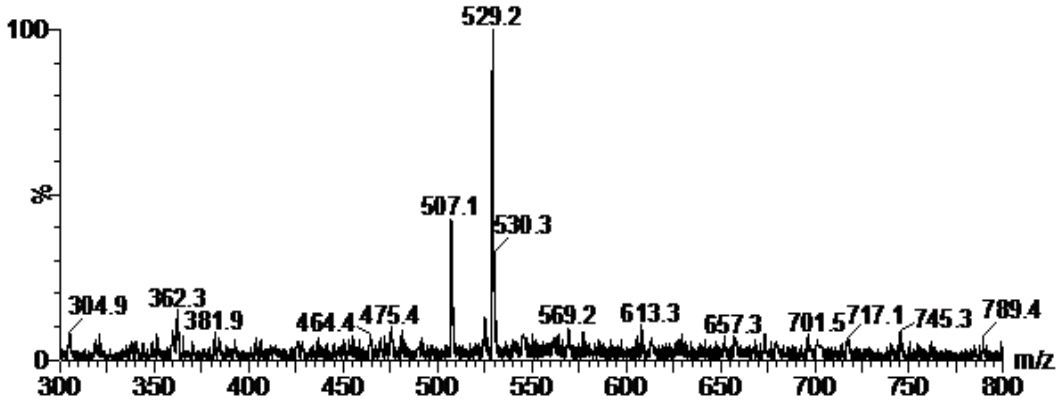
529.2
530.2
304.8
489.3
545.3
401.9
601.1
701.3
779.5
m/z
300
350
400
450
500
550
600
650
700
750
800


检测器A Ch1 202nm
20
15
10
5
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
min

4.6 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 6.



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%
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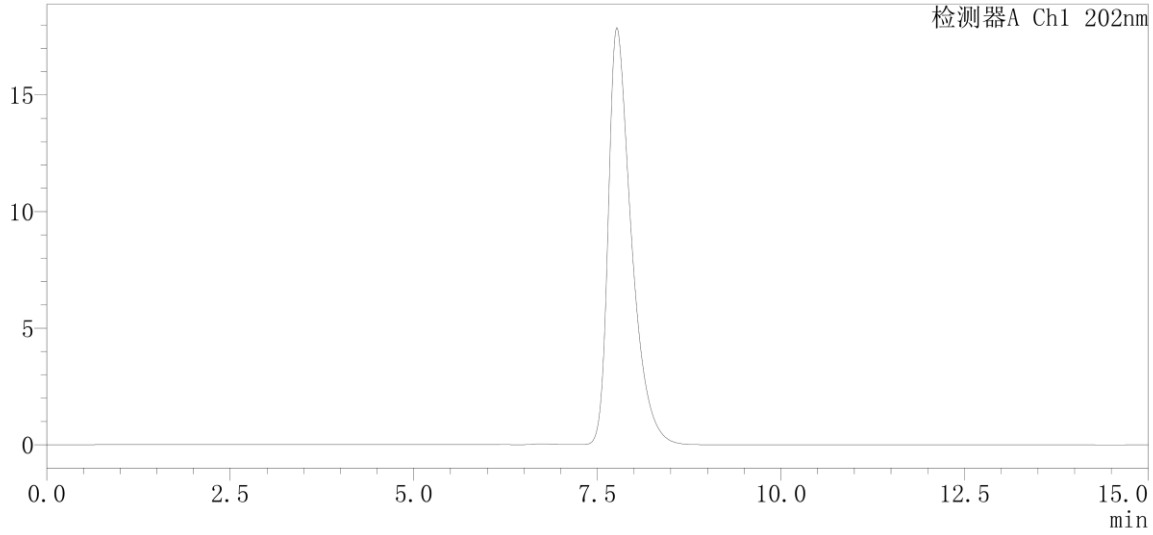
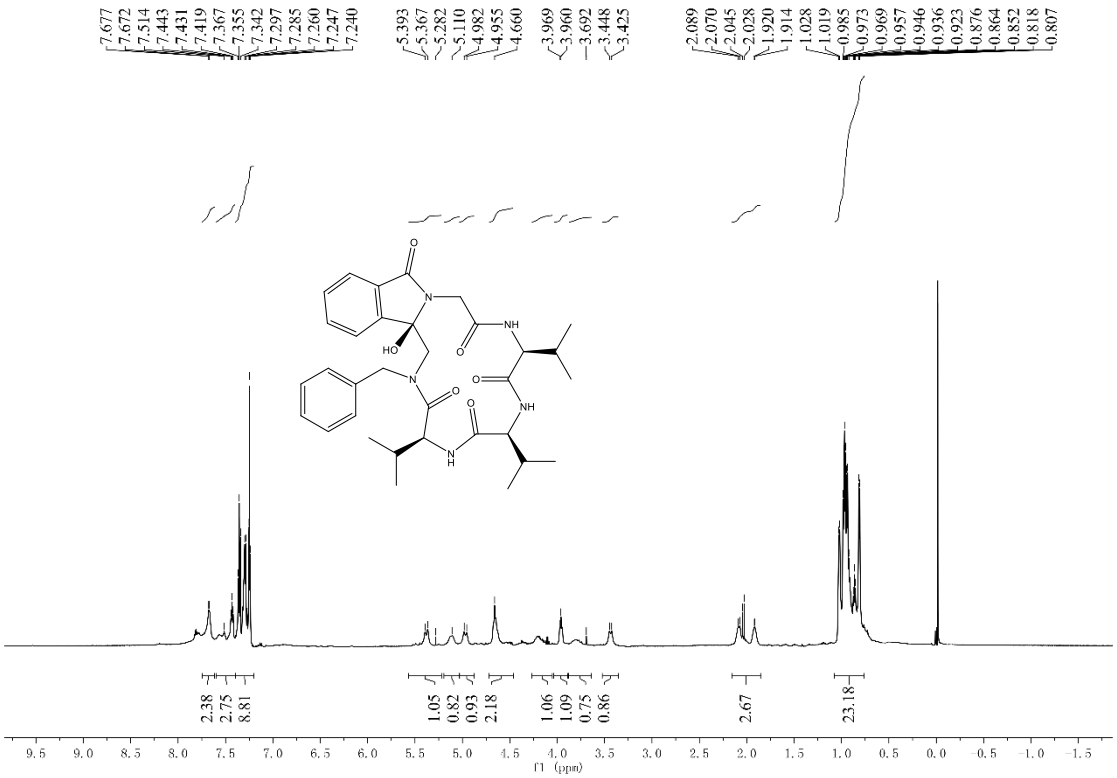
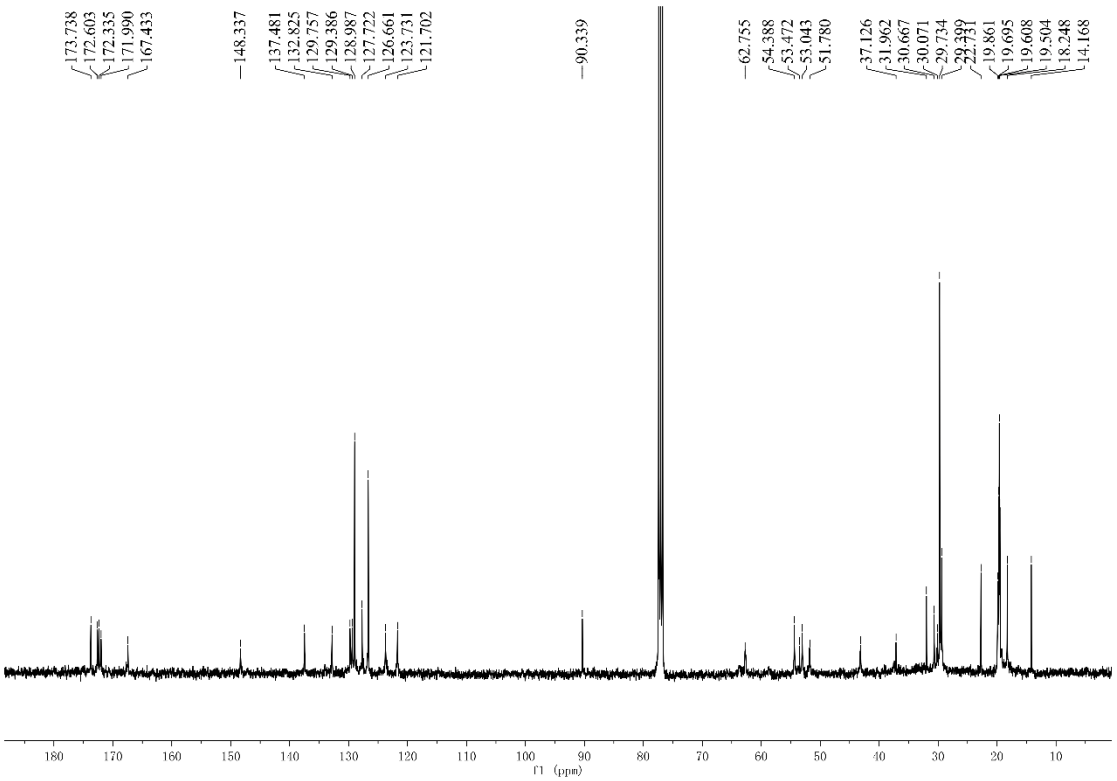
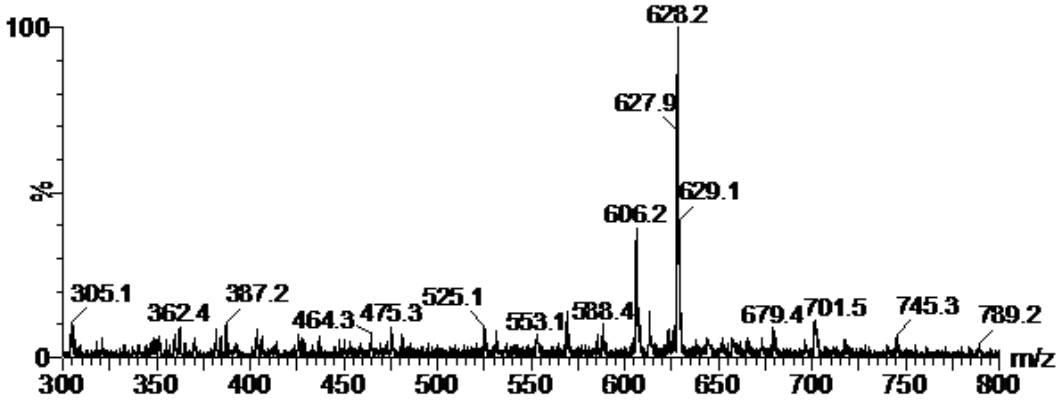
507.1
530.3
304.9
362.3
381.9
464.4
475.4
569.2
613.3
657.3
701.5
717.1
745.3
789.4
m/z
300
350
400
450
500
550
600
650
700
750
800


检测器A Ch1 202nm
15
10
5
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
min

4.7 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 7.



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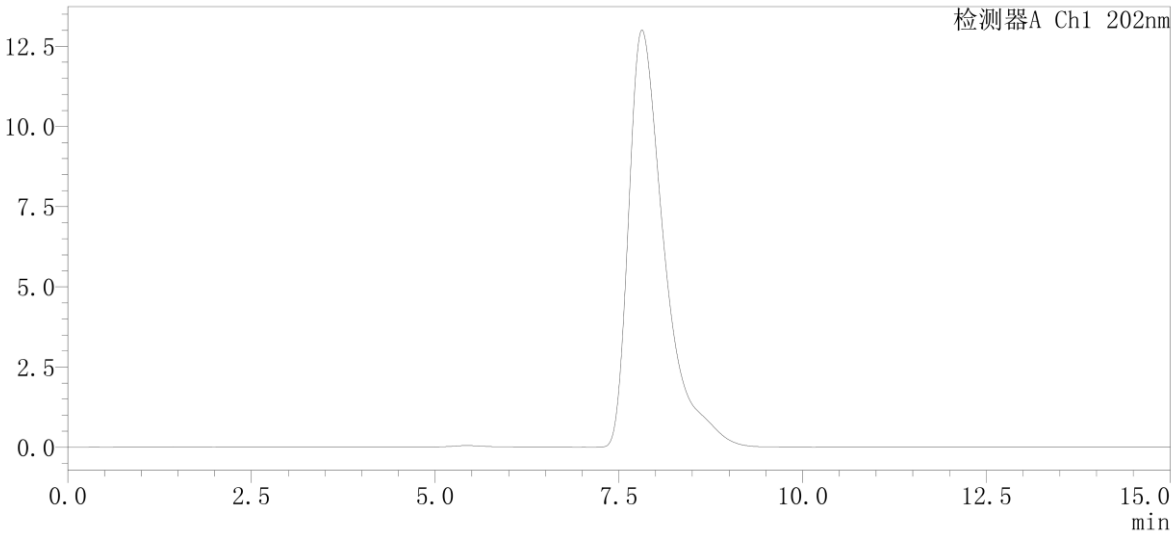
629.1
606.2
305.1
362.4
387.2
464.3
475.3
525.1
553.1
588.4
679.4
701.5
745.3
789.2
m/z
300
350
400
450
500
550
600
650
700
750
800


检测器A Ch1 202nm
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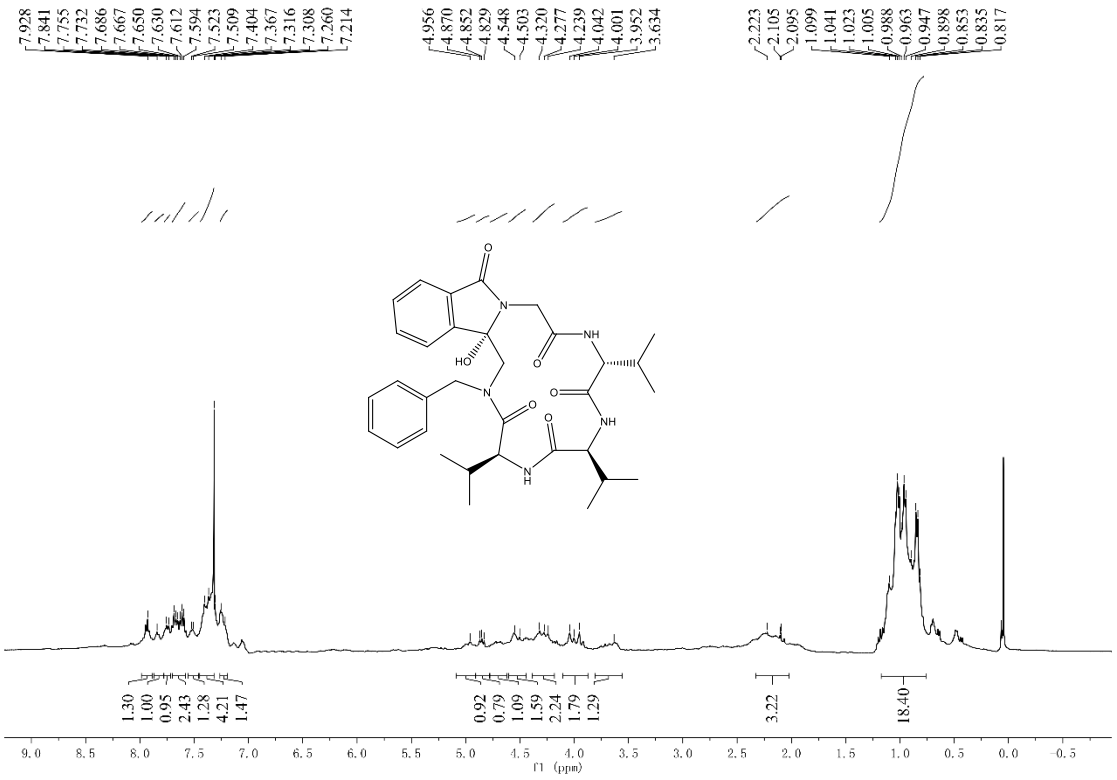
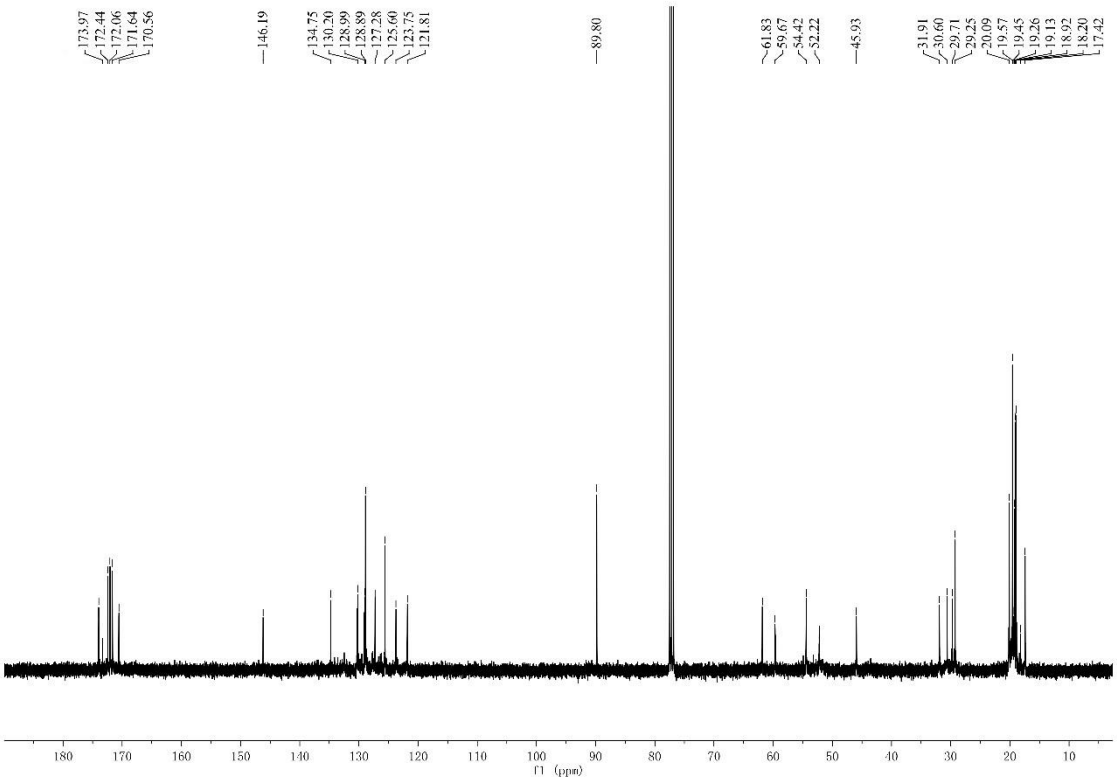
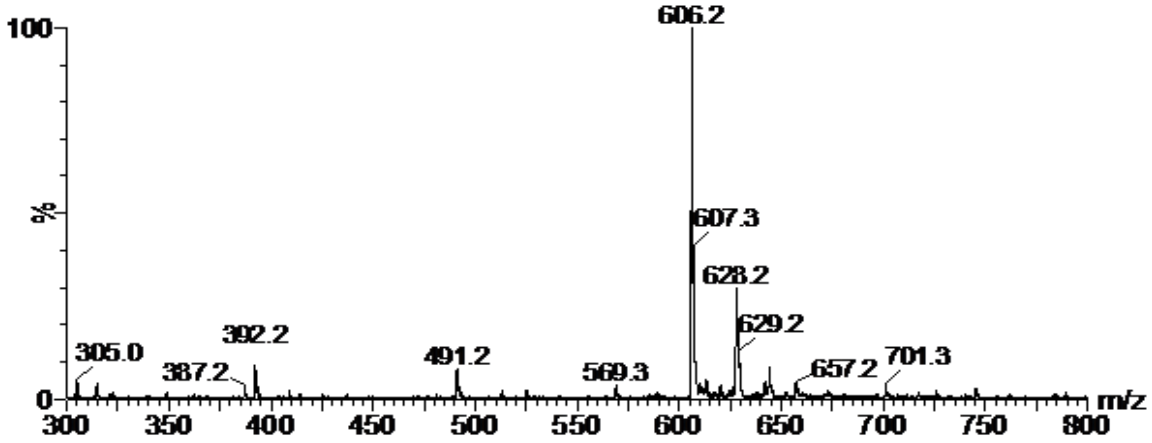
10.0
7.5
5.0
2.5
0.0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
min

4.8 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 8.



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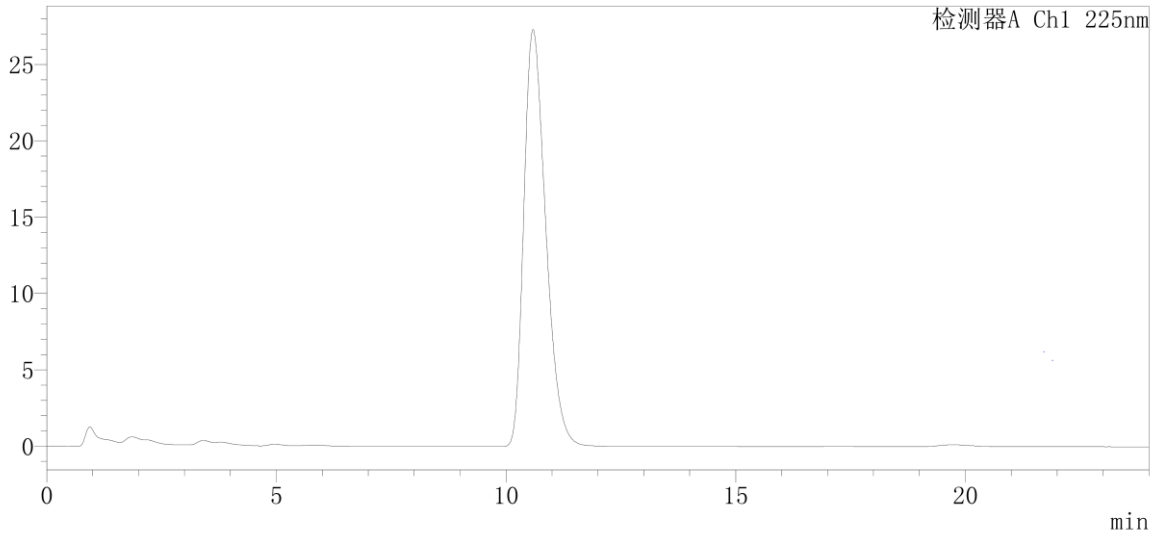
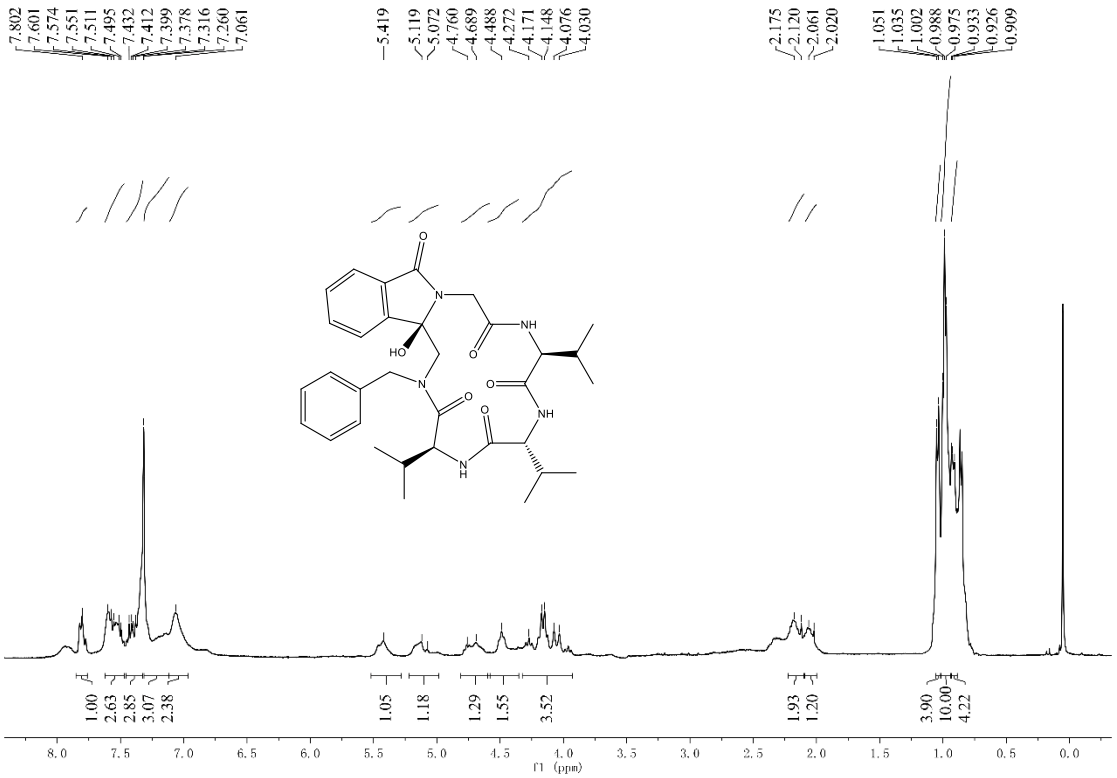
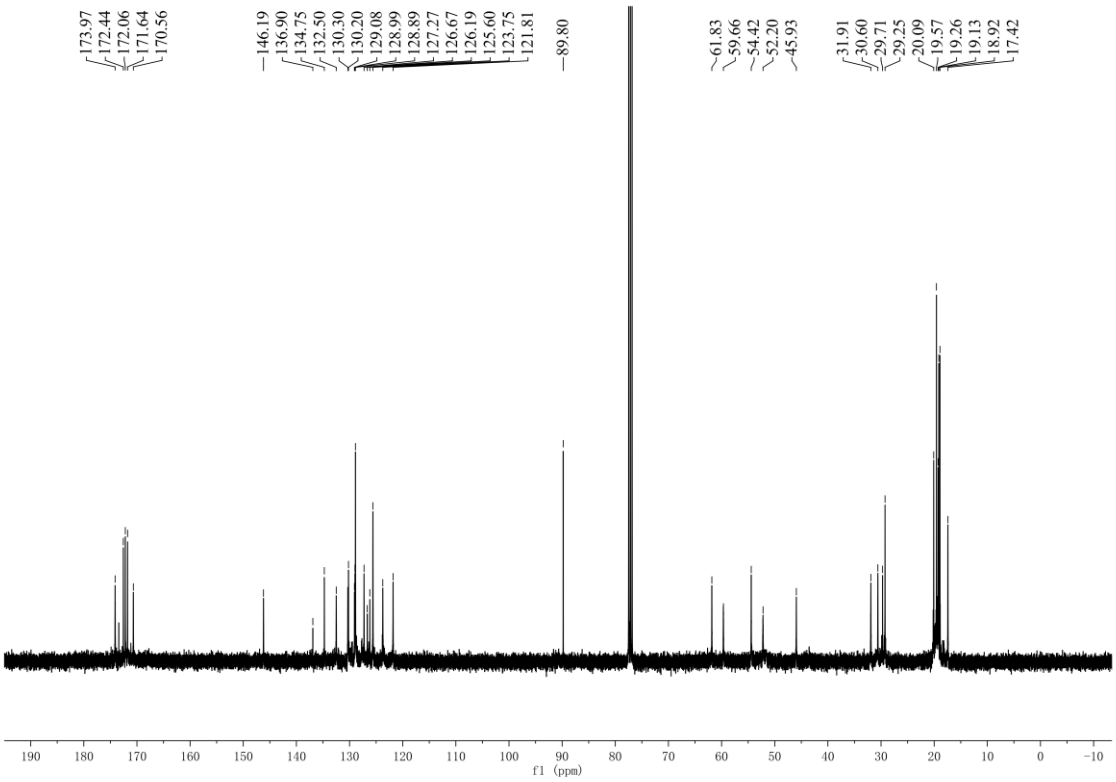
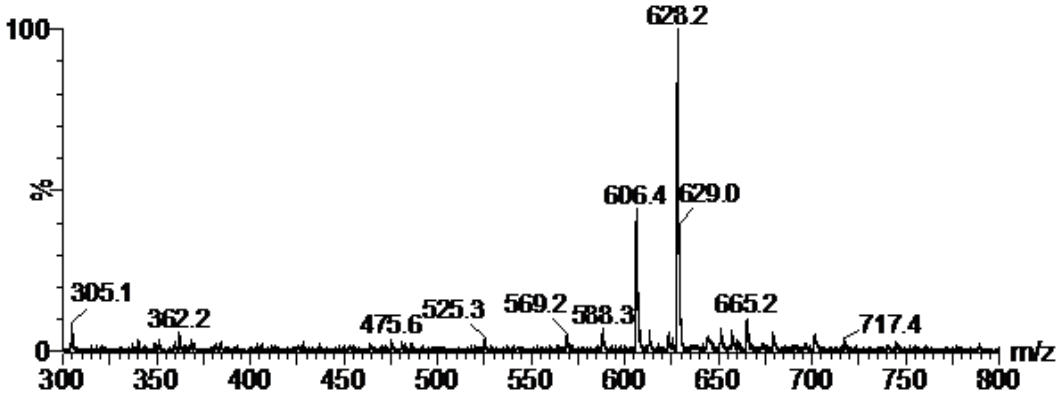
607.3
628.2
629.2
305.0
387.2
392.2
491.2
569.3
657.2
701.3
100
%
0
300
350
400
450
500
550
600
650
700
750
800
m/z


检测器A Ch1 225nm
25
20
15
10
5
0
0
5
10
15
20
min

4.9 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 9.



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%
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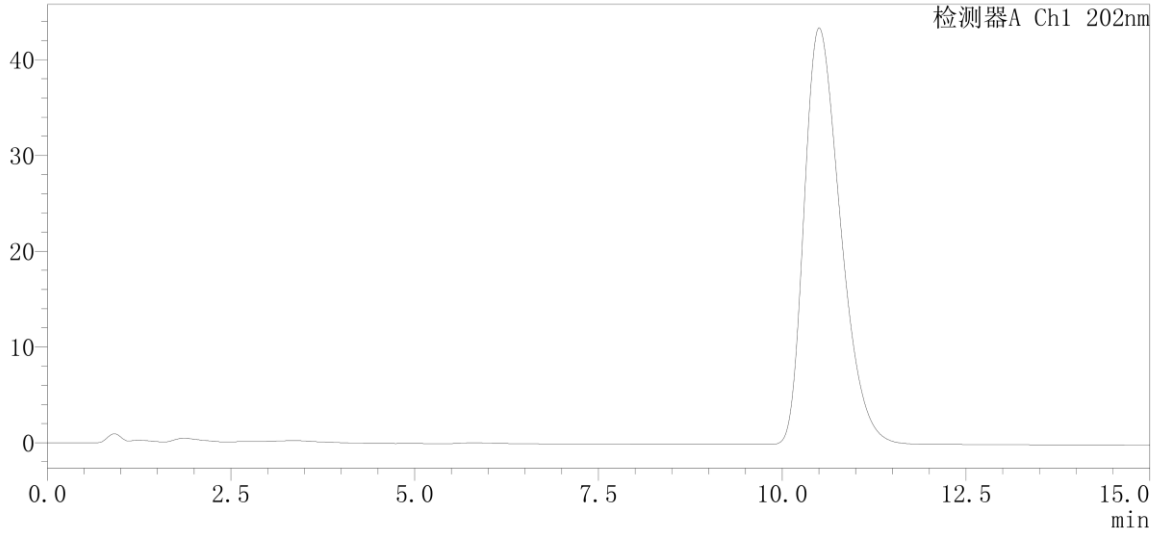
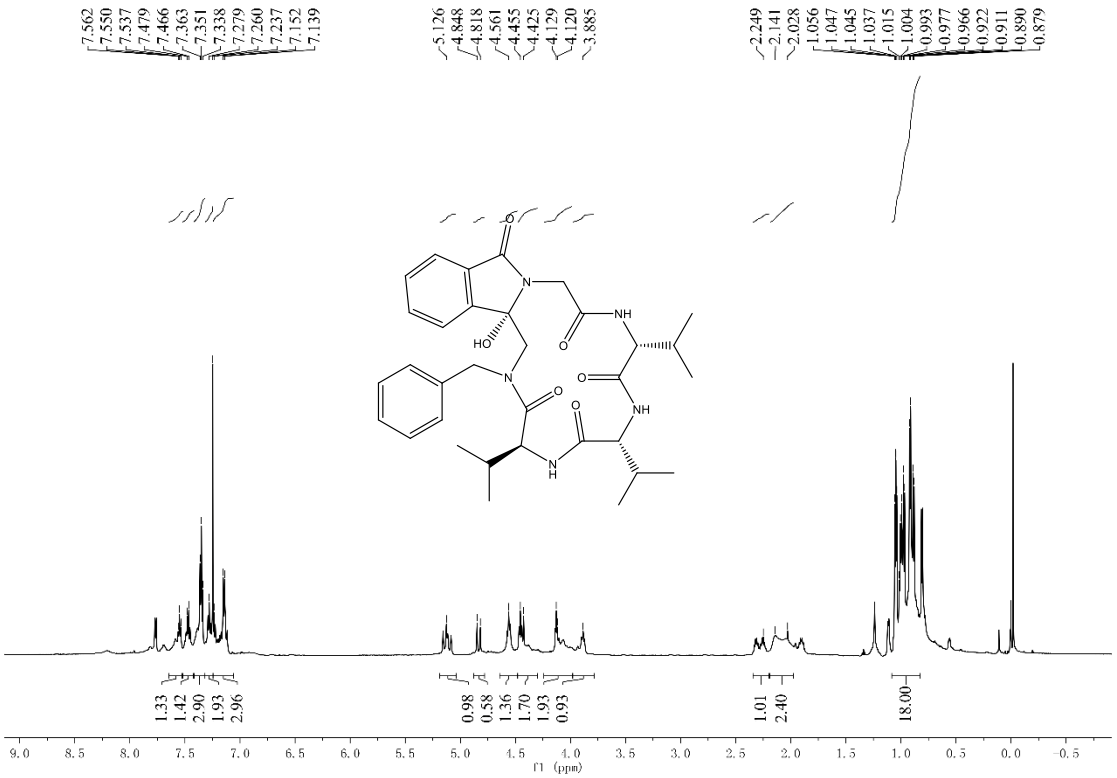
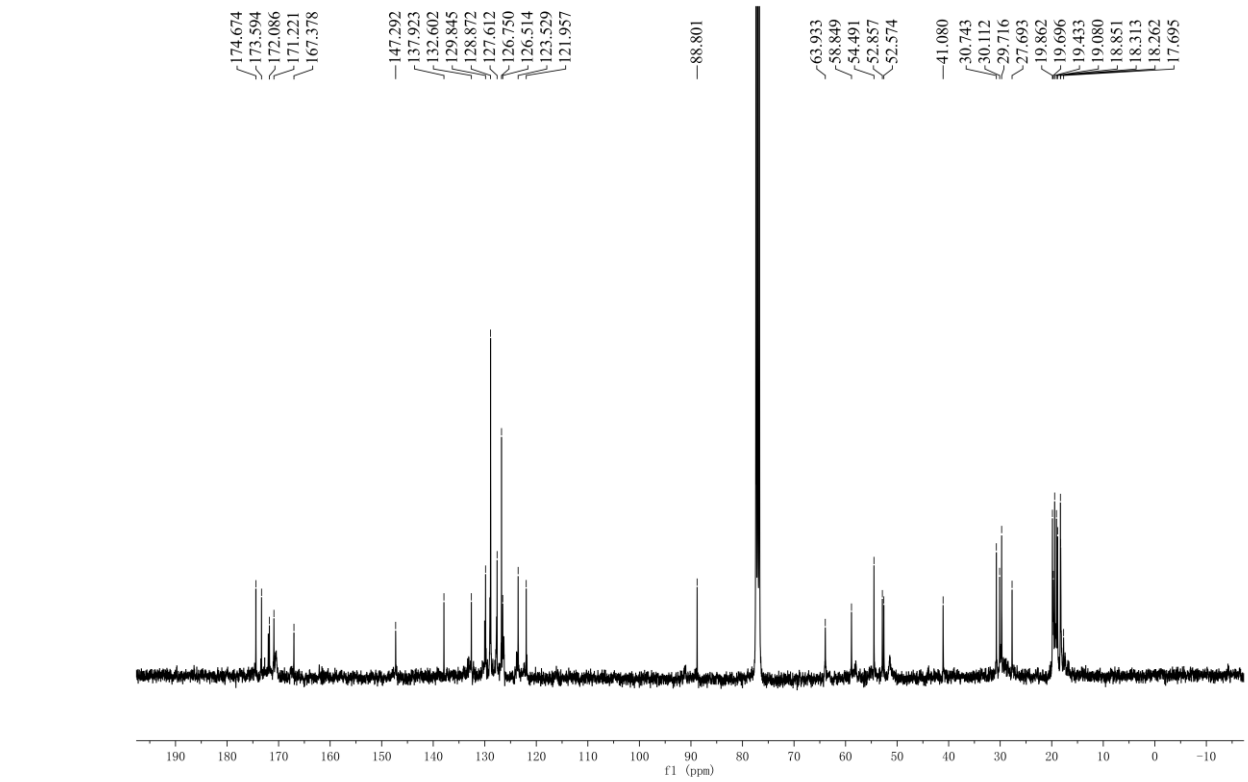
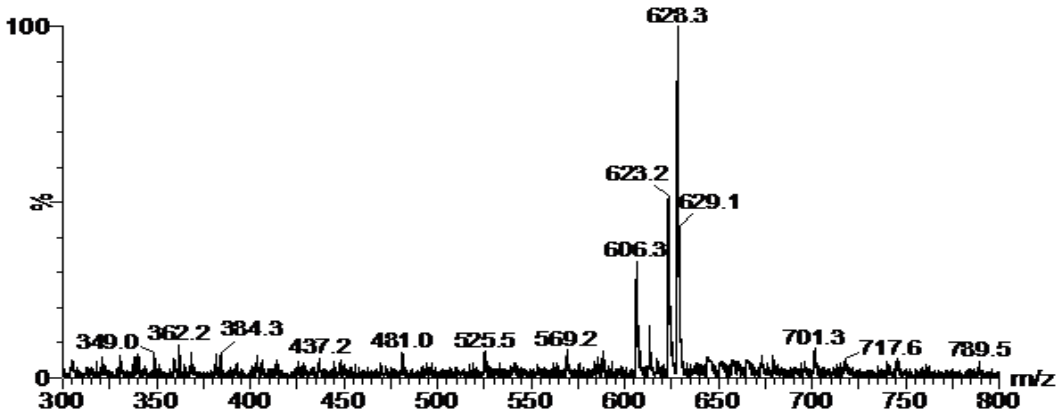
628.2
606.4
629.0
305.1
362.2
475.6
525.3
569.2
588.3
665.2
717.4
m/z
300
350
400
450
500
550
600
650
700
750
800


检测器A Ch1 202nm
40
30
20
10
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
min

4.10 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 10.



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%
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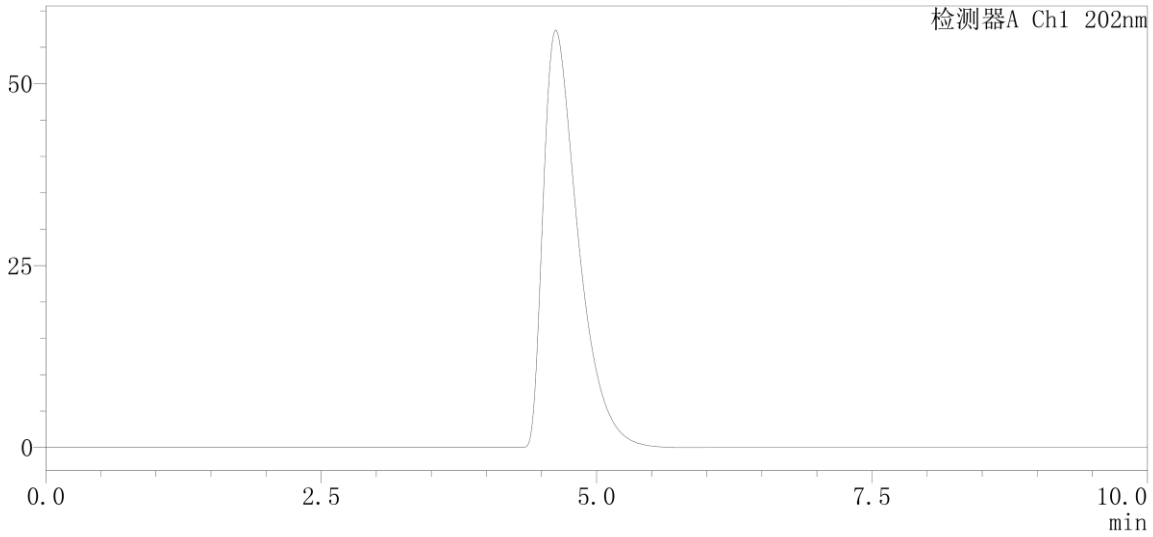
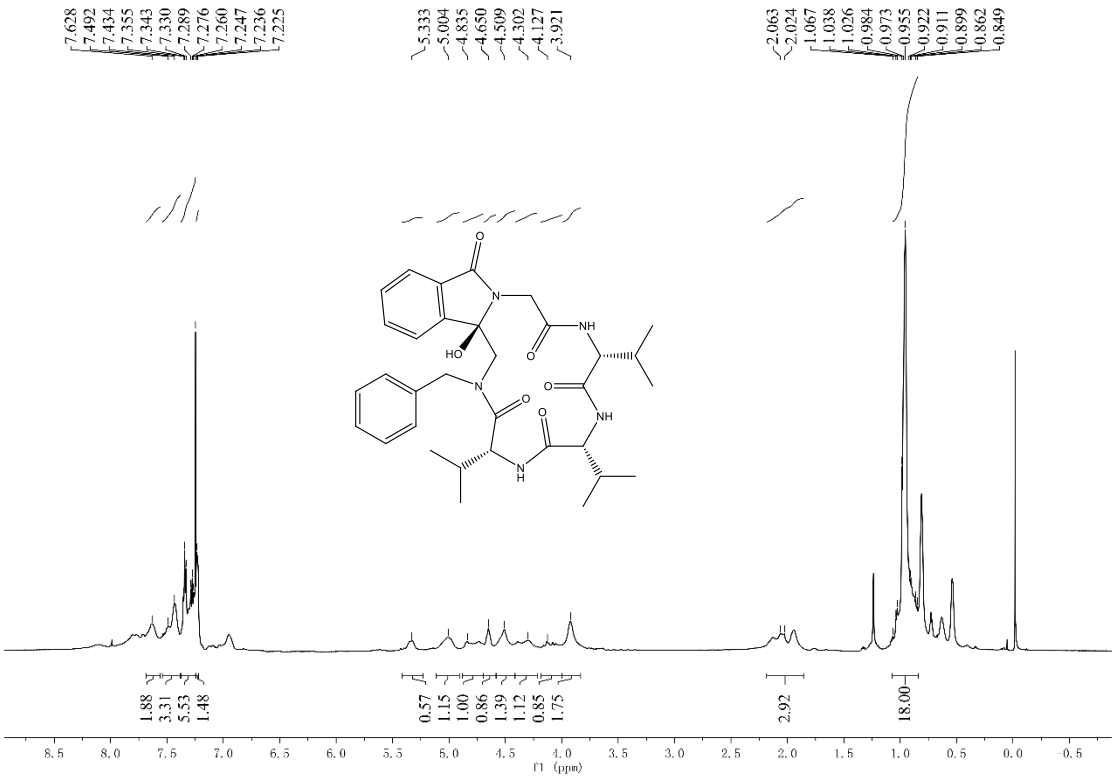
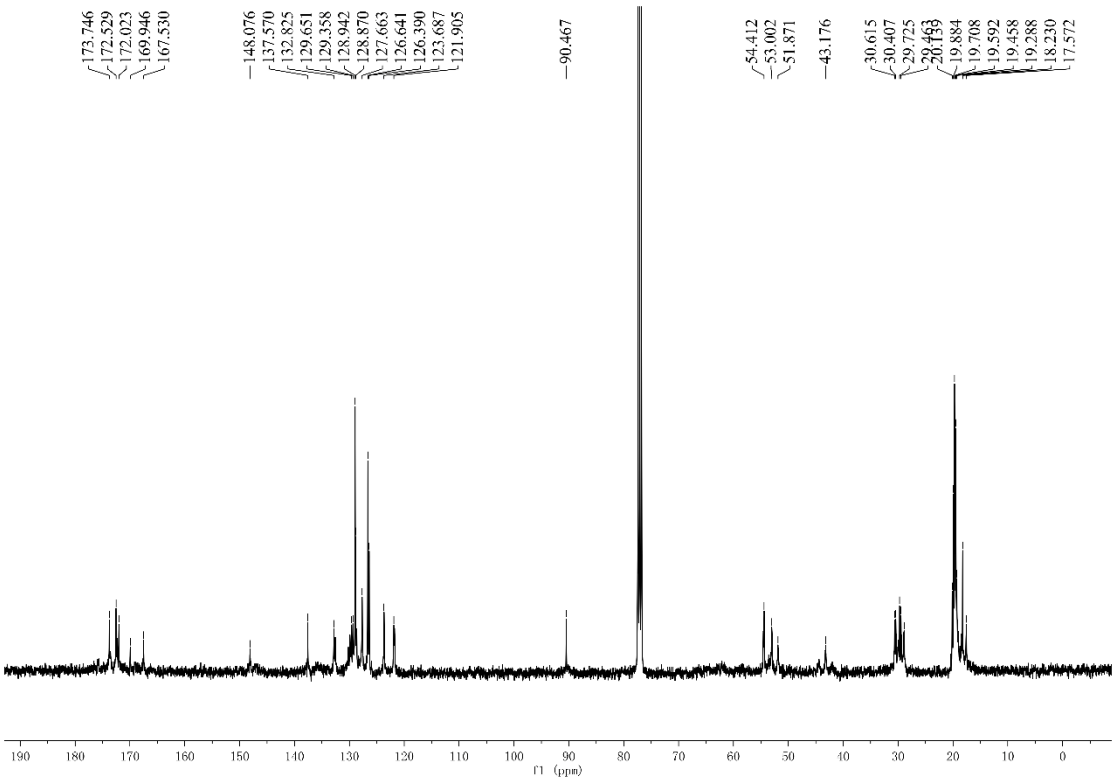
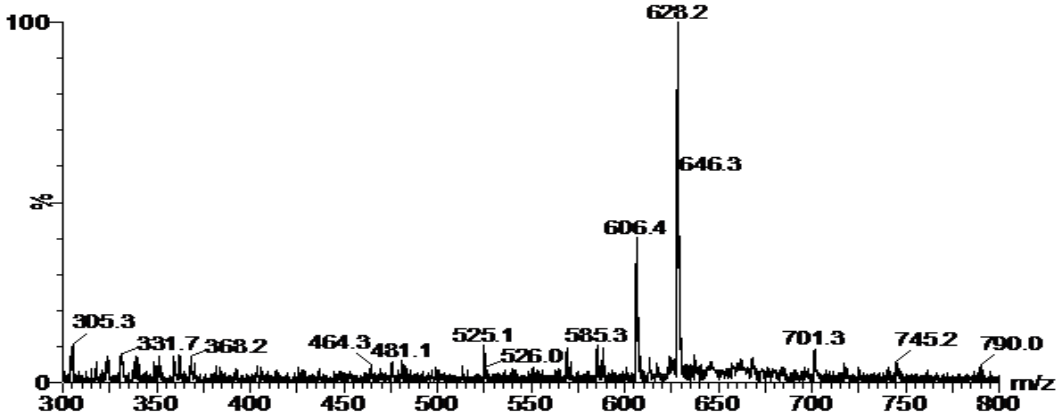
629.1
606.3
349.0
362.2
384.3
437.2
481.0
525.5
569.2
701.3
717.6
789.5
m/z
300
350
400
450
500
550
600
650
700
750
800


检测器A Ch1 202nm
50
25
0
0.0
2.5
5.0
7.5
10.0
min

4.11 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 11.






100
%
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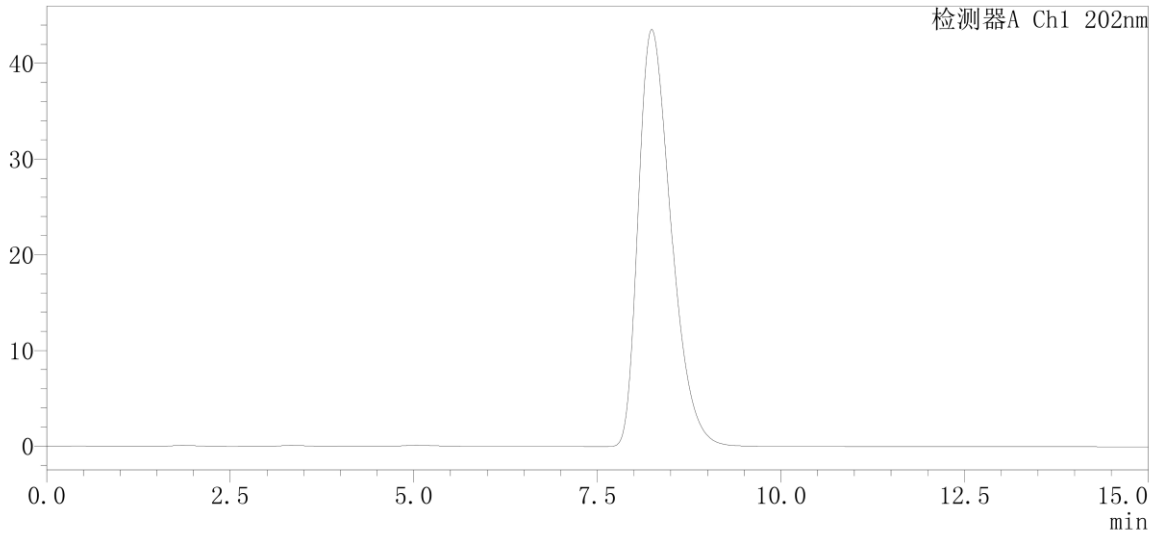
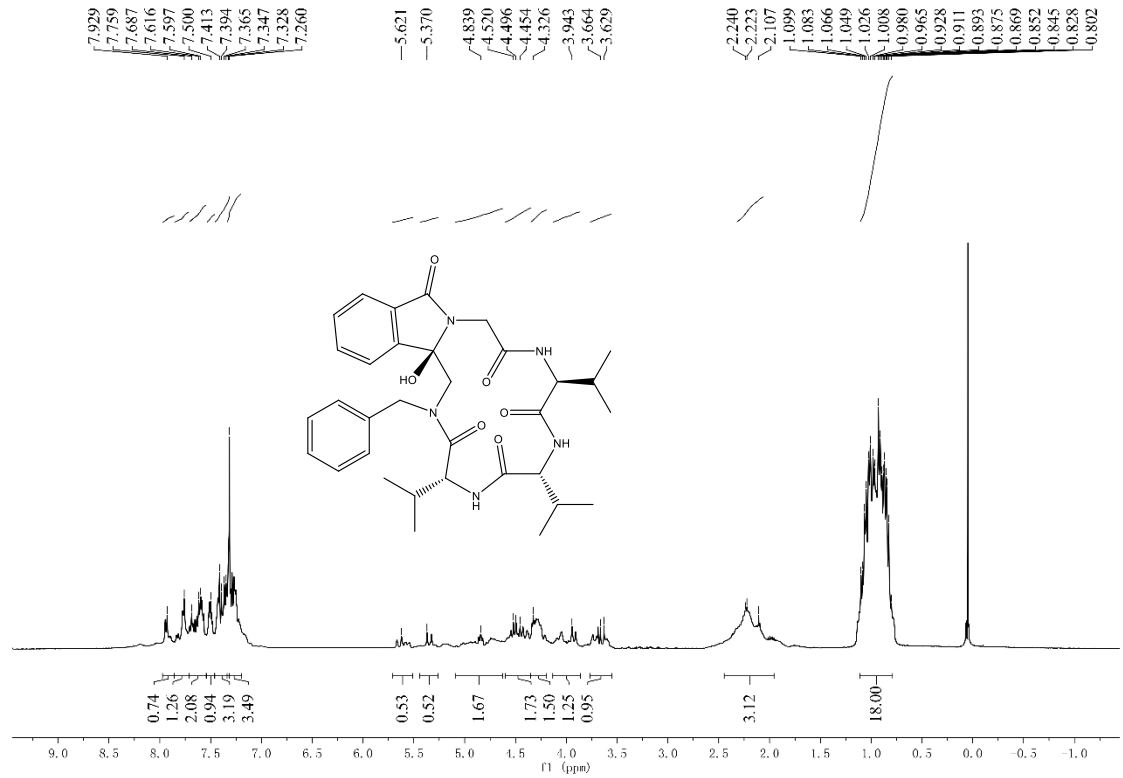
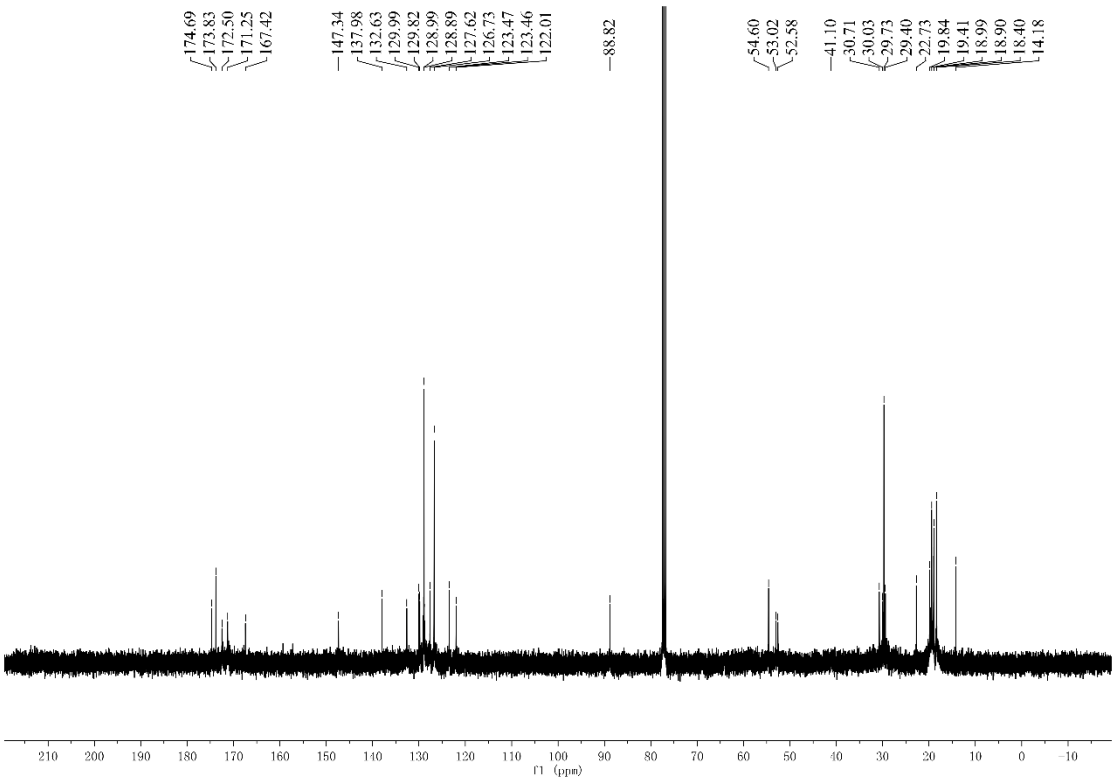
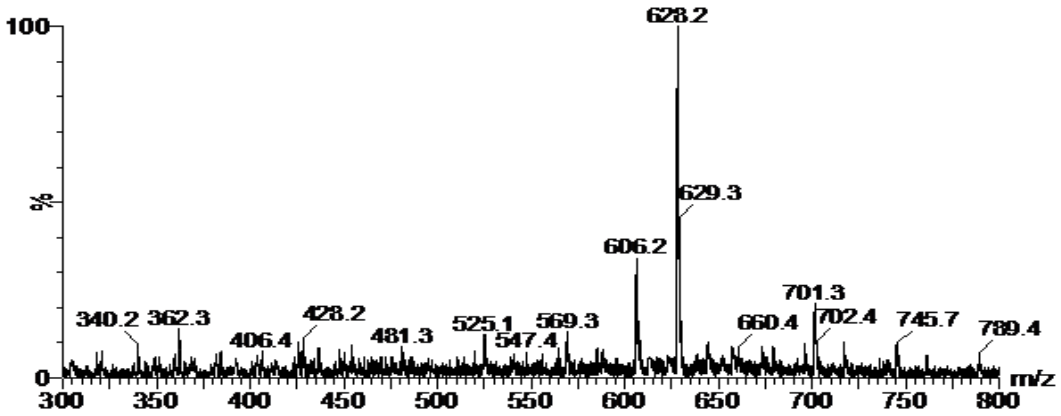
628.2
646.3
606.4
305.3
331.7
368.2
464.3
481.1
525.1
526.0
585.3
701.3
745.2
790.0
300
350
400
450
500
550
600
650
700
750
800
m/z


检测器A Ch1 202nm
40
30
20
10
0
0.0
2.5
5.0
7.5
10.0
12.5
15.0
min

4.12 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 12.



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702.4
660.4
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406.4
428.2
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547.4
569.3
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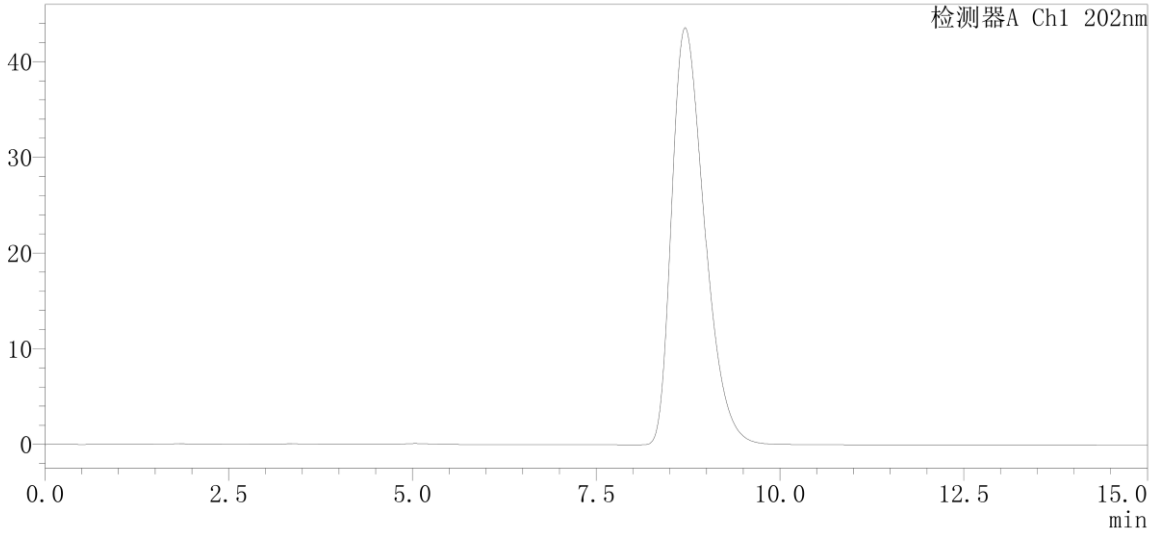
400
450
500
550
600
650
700
750
800
m/z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20
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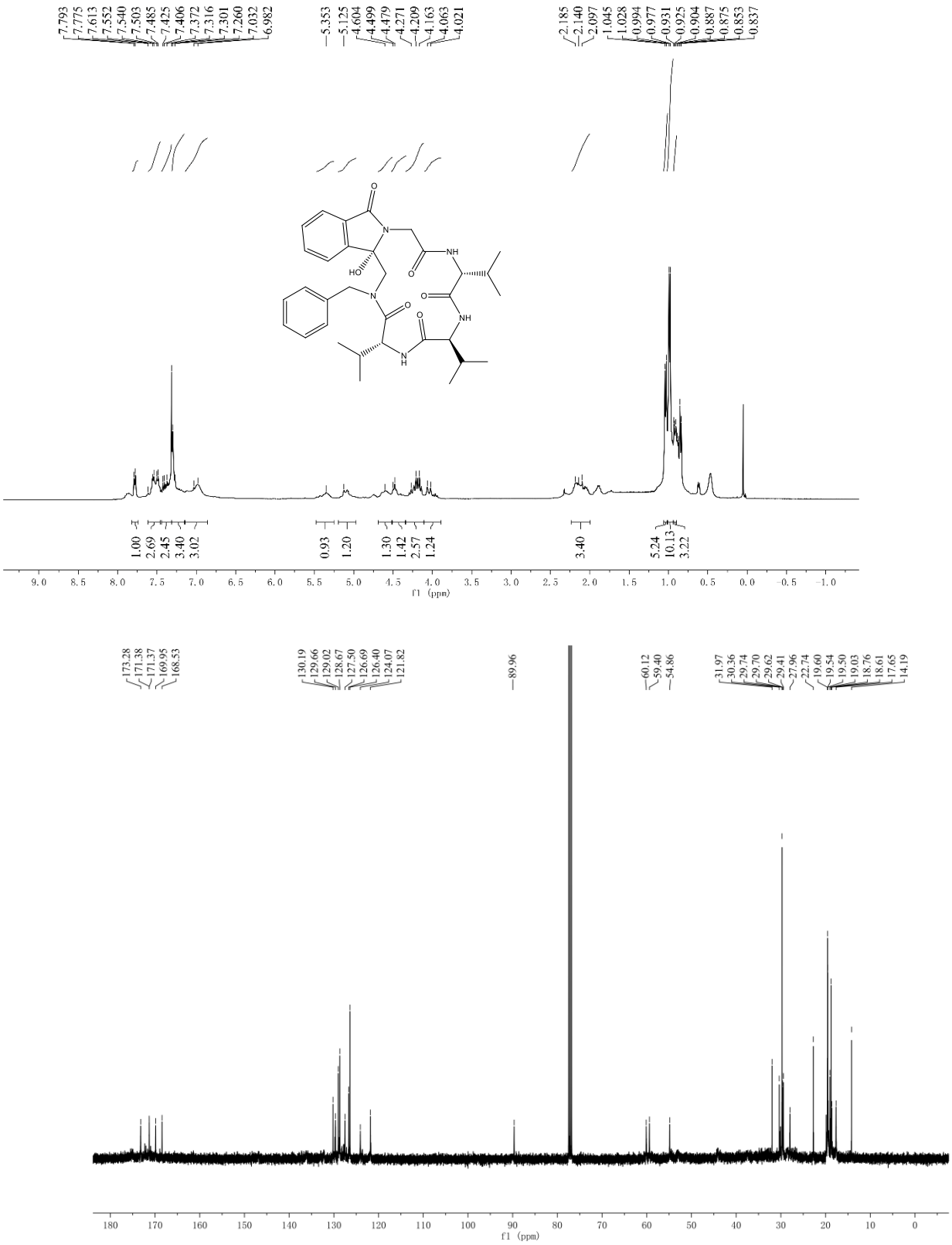
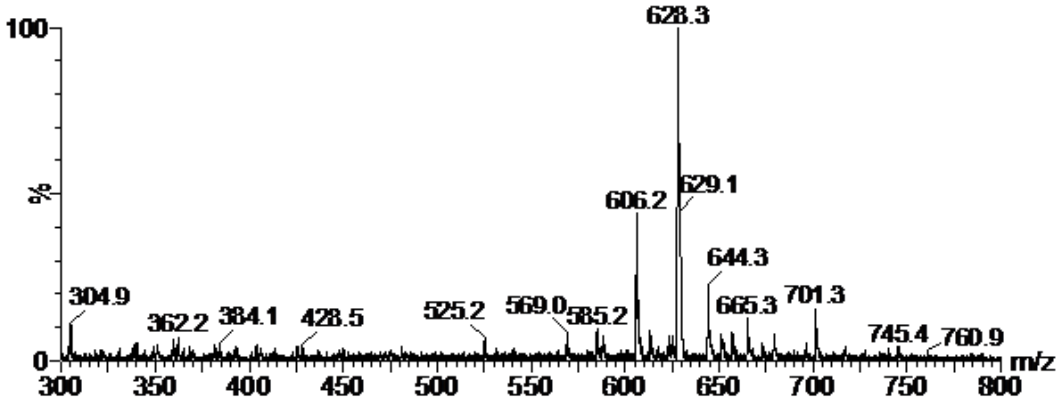
min

4.13 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 13.

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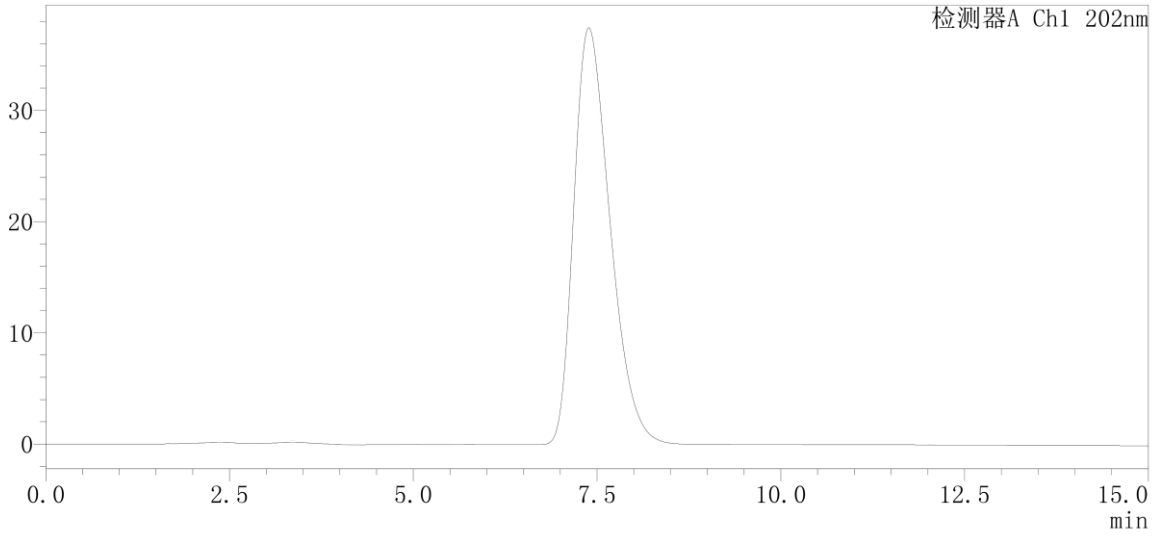
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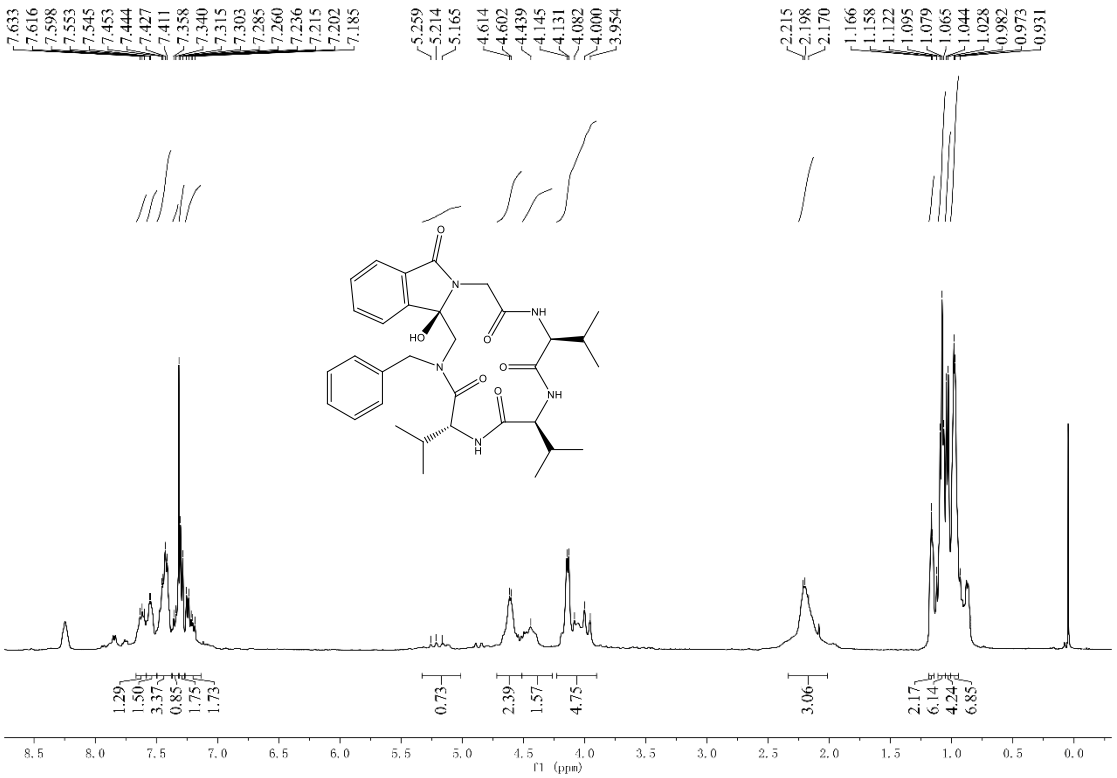
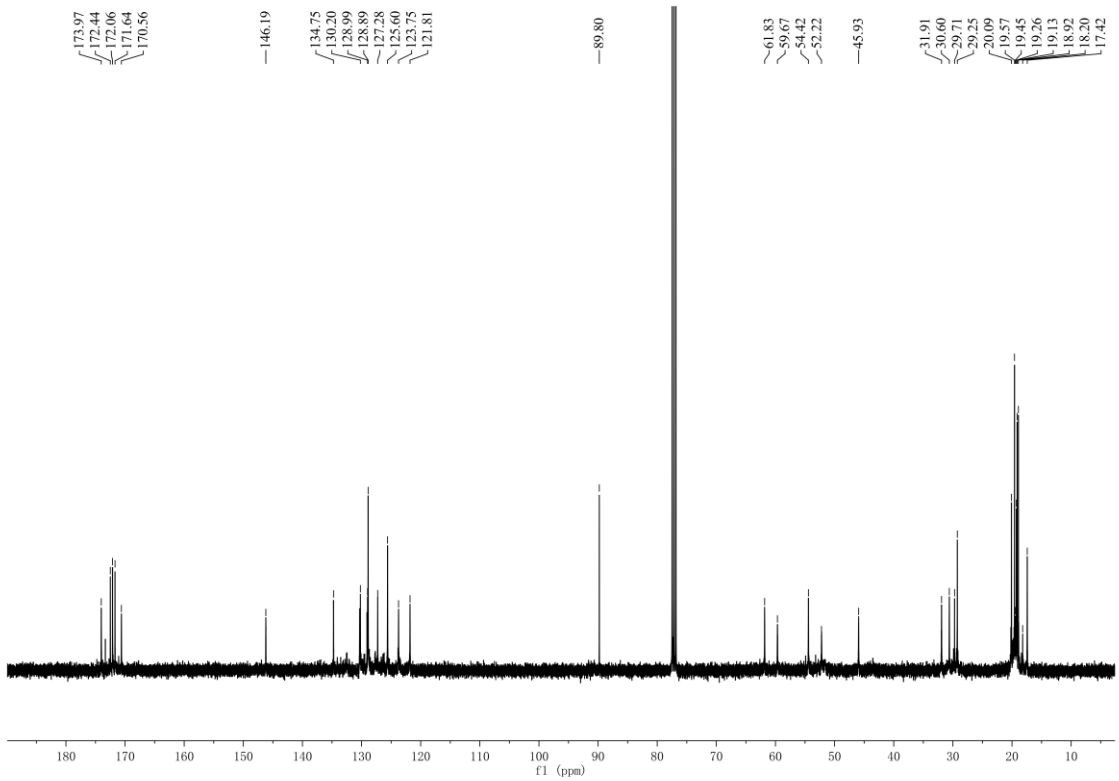
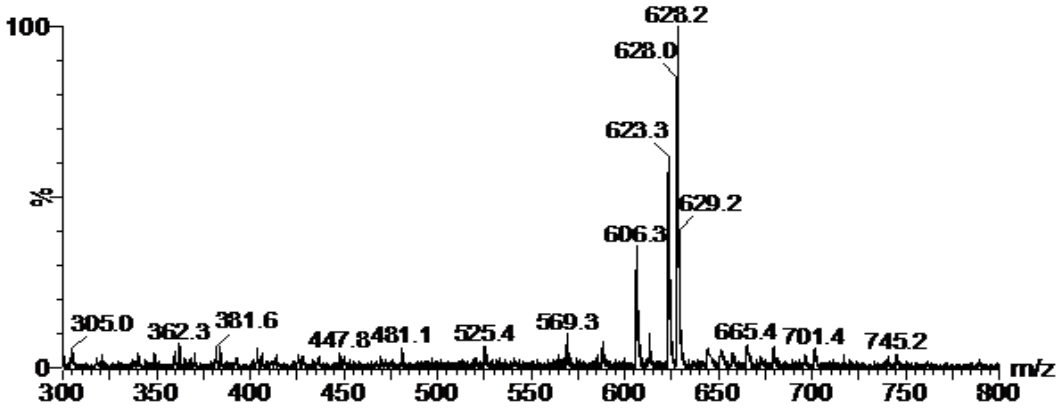
12.5
15.0
min

4.14 ^{1}H-NMR, ^{13}C-NMR, HRMS and HPLC spectra of 14.



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525.4
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745.2
m/z
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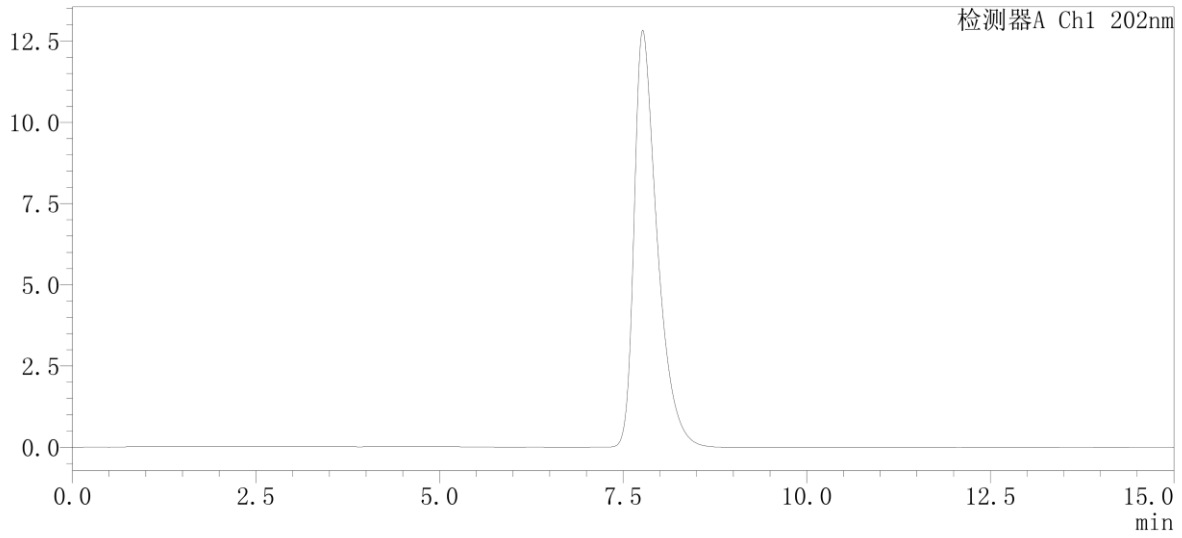
700
750
800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2.5
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2.5
5.0
7.5
10.0
12.5
15.0
min