Electronic Supplementary Material (ESI) for ChemComm.

Enantioselective Hydrogenation of Cyclic Tetrasubstituted-Olefinic Dehydroamino Acid Derivatives

Supporting Information

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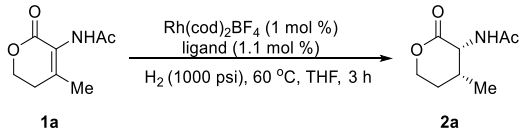
1. General Considerations

All reactions and manipulations were performed in a nitrogen-filled glove box or using standard Schlenk techniques, unless otherwise noted. All ligands and Rh precursors were stored in a nitrogen-filled glove box before use. Chiral ligand intermediates were prepared according to our reported procedures.

^{1}H NMR, ^{31}P NMR, ^{19}F NMR and ^{13}C NMR data were recorded on a Bruker-Ultrashield PLUS400 NMR or a 500 MHz Agilent spectrometer with CDCl3 or $(CD_3)_2SO$ as the solvent. ^{1}H chemical shifts were referenced to CDCl3 at 7.26 ppm and $(CD_3)_2SO$ at 2.50. ^{13}C chemical shifts were referenced to CDCl3 at 77.16 ppm and $(CD_3)_2SO$ at 39.52. ^{31}P chemical shifts were referenced to 85% H_3PO_4 in D_2O at 0.0 ppm as external standard and obtained with ^{1}H decoupling. Multiplicities are abbreviated as follows: singlet (s), doublet (d), triplet (t), quartet (q), doublet-doublet (dd), quintet (quint), sextet (sextet), septet (septet), multiplet (m), and broad (br). MS was measured on Agilent 7890A/5975C Series GC/MSD mass spectrometer. HPLC yield were determined on Agilent 1200 Infinity Series.

2. Attached Optimization

Table S1. Other investigation on asymmetric hydrogenation of *N*-(4-methyl-2-oxo-5,6-dihydro-2*H*-pyran-3-yl)acetamide (**1a**)

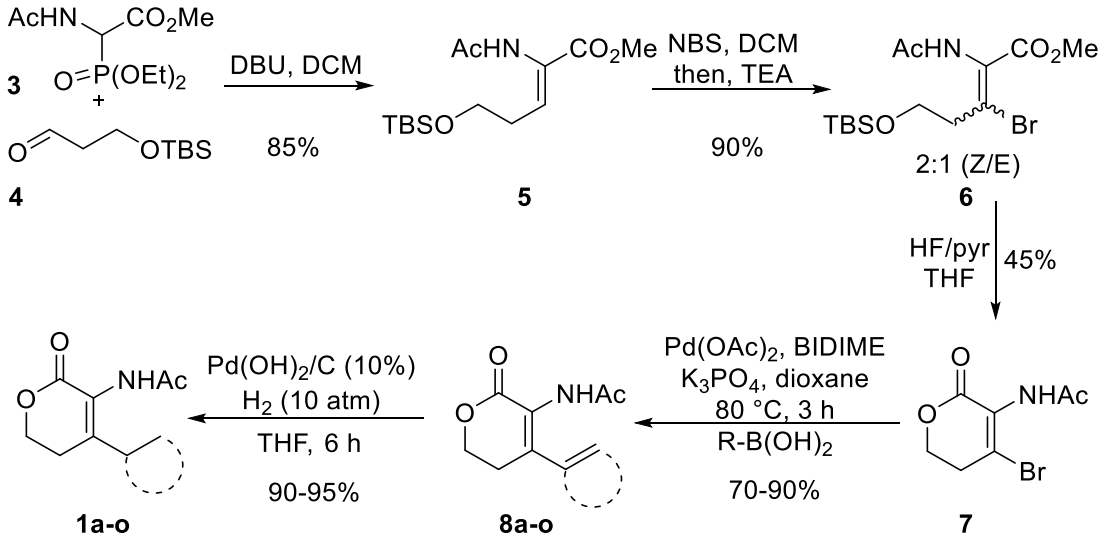


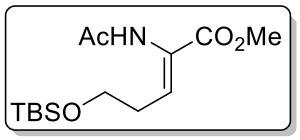
1a **2a**

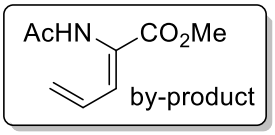
Entries[a]	Ligand	Solvent	Yields (%)	Ee (%)[b]
1	ArcPhos(**L1**)	THF	99	90
2	ArcPhos(**L1**)	DCM	99	70
3	ArcPhos(**L1**)	EtOAc	0	ND
4	ArcPhos(**L1**)	CH_3CN	0	ND
5	ArcPhos(**L1**)	DCE	99	62
6	ArcPhos(**L1**)	^{i}PrOH	25	70
7	ArcPhos(**L1**)	MTBE[c]	<5	ND
8	ArcPhos(**L1**)	CPME[c]	<5	ND

[a]Unless otherwise specified, the reactions were carried out at 60 °C under H_2 (1000 psi) in THF (0.5 mL) for 3 h with **2a** (0.1 mmol) in the presence of rhodium precursor (1 μmol, 1 mol %) and ligand (1.1 μmol, 1.1 mol %); [b]Determined by chiral HPLC using a Chiralpak OJ-3 column. [c]MTBE and CPME perform badly for poor solubility.

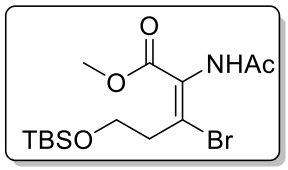
3. Substrate Preparation





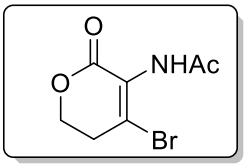


5: To a 150 mL Schlenk tube equipped with a mechanical stirrer was charged with compound **3** (1 equiv), dry DCM (30 mL), under N_2 atmosphere. By slowly adding DBU (2.1 equiv) in DCM via syringe at 0 °C, then the mixture was allowed to react at room temperature for ten minutes. Place the system at 0 °C and slowly drop 3-tert-butyldimethylsiloxypropionaldehyde **4** (1.5 equiv) in DCM for 5 minutes. Then the reaction was kept at 0°C for 10 minutes with TLC monitored (even room temperature or long reaction time will lead to increase of *β*-elimination by-products). DBU was washed with water, and the mixture was extracted with water (20 mL) and DCM (10 mL x 3), washed with saturated brine, dried over anhydrous sodium sulfate, concentrated, and column chromatography (PE:EA=1:1) to obtain desired product as white solid in 88% yield. ^{1}H NMR (500 MHz, $CDCl_3$) ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.37 (s, 1H), 6.62 (t, *J* = 7.5 Hz, 1H), 3.74 (s, 3H), 3.72 (t, *J* = 6.0 Hz, 2H), 2.35 (dd, *J* = 7.5, 6.0 Hz, 2H), 2.07 (s, 3H), 0.87 (s, 10H), 0.04 (s, 6H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.6 (s), 165.0 (s), 133.5 (s), 127.5 (s), 62.0 (s), 52.3 (s), 31.8 (s), 25.9 (s), 23.2 (s), 18.3 (s), -5.4 (s). ESI-MS: m/z 316. $[M+H]^+$, 254.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{13}H_{13}NNaO_3]^+$: 254.0788; found: 254.0788.

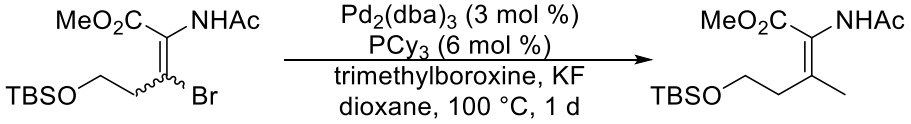


6: To a 250 mL Schlenk tube equipped with a mechanical stirrer was charged with compound **5** (1 equiv), DCM (30 mL), under N_2 atmosphere. By slowly adding NBS (1.1 equiv) in portions at 0 °C, the mixture turned pale yellow gradually and then was allowed to react at room temperature for 1 hour. Place the system at 0 °C and slowly drop TEA (1.5 equiv) for 5 minutes, and the addition should be very slow at first. The suspension would turn brown to black then pale-yellow solution. Then the reaction was kept at room temperature for 30 minutes with TLC monitored. The mixture was extracted with 1 N HCl solution (20 mL) and DCM (10 mL x 3), washed with saturated brine, dried over anhydrous sodium sulfate,

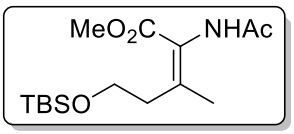
concentrated, and column chromatography (PE:EA=3:1) to obtain desired product as pale yellow solid in 90% yield. The *Z*/*E* ratio was 2:1 determined by ^{1}H-NMR. (*Z*)-**6**: ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.00 (s, 1H), 3.85 - 3.75 (m, 5H), 2.98 (t, *J* = 6.4 Hz, 2H), 2.11 (s, 3H), 0.88 (s, 9H), 0.05 (s, 5H). ^{13}C NMR (126 MHz, CDCl3) δ 167.9 (s), 162.8 (s), 123.7 (s), 123.2 (s), 61.2 (s), 52.7 (s), 39.7 (s), 25.8 (s), 22.9 (s), 18.2 (s), -5.4 (s). ESI-MS: m/z 394.2, 396.2 $[M+H]^+$; HRMS (ESI) calculated for [M+H, $C_{15}H_{29}BrNO_4Si]^+$: 394.1044, 396.1026; found: 394.1046, 396.025.



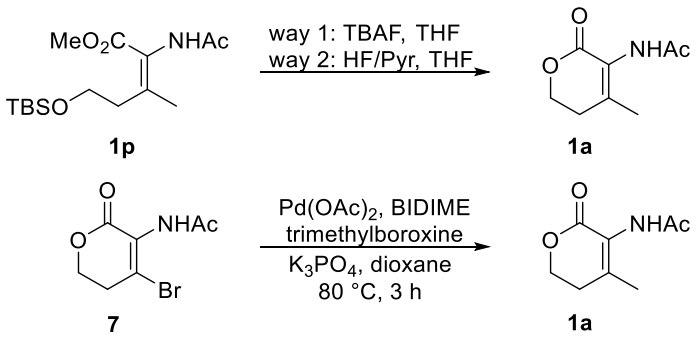
7: To a 250 mL Schlenk tube equipped with a mechanical stirrer was charged with Z/E mixture of compound **6** (1 equiv), dry THF (30 mL), under N_2 atmosphere. After slowly adding HF/pyr (2 equiv) through syringe at 0 °C, the mixture turned pale yellow gradually and then was allowed to react at room temperature for one day. The forming white salt removed through filtration and the organic layer was concentrated. The mixture was purified through column chromatography (PE:EA=1:4) to obtain desired product as white solid in 45% yield (No olefin isomerization and cyclization process of (*E*)-**7** was monitored).^{1}H NMR (500 MHz, DMSO) δ 9.38 (s, 1H), 4.36 (t, *J* = 6.0 Hz, 2H), 3.06 (t, *J* = 6.0 Hz, 2H), 1.93 (s, 3H). ^{13}C NMR (126 MHz, DMSO) δ 168.6 (s), 159.8 (s), 137.1 (s), 127.1 (s), 65.9 (s), 34.5 (s), 22.8 (s). ESI-MS: m/z 234.0, 236.0 $[M+H]^+$, 256.0, 258.0 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_7H_8BrNNaO_3]^+$: 255.9580; found: 255.9582.

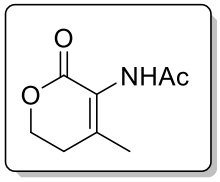


6 **1p**

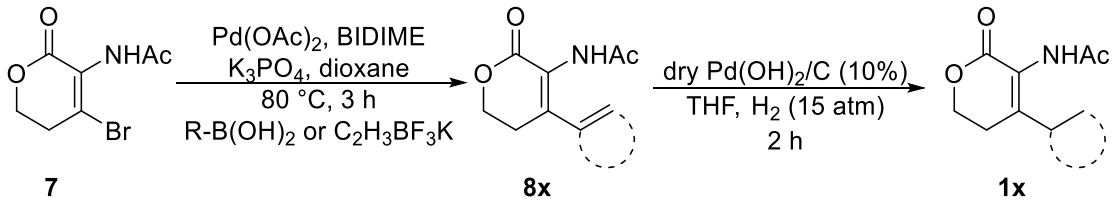


1p: To a 150 mL Schlenk tube equipped with a mechanical stirrer was charged with compound **6** (1.0 equiv), $Pd_2(dba)_3$ (0.03 equiv), PCy_3 (0.06 equiv), trimethylboroxine (2.0 equiv), KF (2.0 equiv) and dioxane (10 mL), the resulting mixture was purged with nitrogen and stirred under 100℃ for 1 day. After full conversion of starting material monitored by TLC, the solvent was removed under vacuum. The mixture was then extracted with H_2O/EtOAc (three times). The combined organic layers were concentrated and purified by silica gel column chromatography (PE/EA=1:1) to give the desired (*E*)-**1p** in 48% yield ((*Z*)-**1p** was obtained in 23% yield). (*E*)-**1p**: ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.57 (s, 1H), 3.74 (s, 3H), 3.64 (t, *J* = 6.4 Hz, 2H), 2.58 - 2.52 (m, 2H), 2.08 (s, 3H), 1.84 (s, 3H), 1.75 - 1.67 (m, 3H), 0.89 (s, 9H), 0.04 (s, 6H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.5 (s), δ 165.1 (s), 148.8 (s), 121.3 (s), 62.9 (s), 51.8 (s), 31.5 (s), 31.1 (s), 25.9 (s), 23.1 (s), 20.4 (s), 18.3 (s), -5.3 (s). ESI-MS: m/z 316.2 $[M+H]^+$, 338.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{15}H_{29}NNaO_4Si]^+$: 338.1758; found: 338.1763.





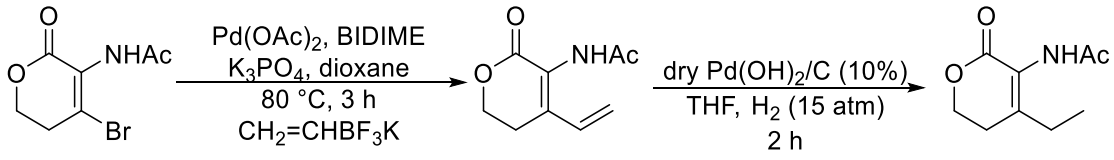
2a:① To a 150 mL Schlenk tube equipped with a mechanical stirrer was charged with compound **7** (1.0 equiv), $Pd(OAc)_2$ (0.03 equiv), BI-DIME (0.06 equiv), trimethylboroxine (2.0 equiv), K_3PO_4 (2.0 equiv) and dioxane (10 mL), the resulting mixture was purged with nitrogen and stirred under 80 ℃ for 3 h. After full conversion of starting material monitored by TLC, the solvent was removed under vacuum. The mixture was then extracted with H_2O/EtOAc (three times). The combined organic layers were concentrated and purified by silica gel column chromatography to give the desired product compound as white solid in 93% yield. ② To a 150 mL Schlenk tube equipped with a mechanical stirrer was charged with compound **7** (1.0 equiv), TBAF in THF (1.5 equiv.) and THF (10 mL). The solution was kept at r.t. for 3 h. The mixture was then extracted with H_2O/EtOAc (three times). The combined organic layers were concentrated and purified by silica gel column chromatography to give the desired product compound as white solid in 82% yield. ③ To a 150 mL Schlenk tube equipped with a mechanical stirrer was charged with compound **7** (1.0 equiv), HF/pyr (2.0 equiv.) and THF (10 mL). The solution was kept at r.t. for 24 h. The mixture was then extracted with H_2O/EtOAc (three times). The combined organic layers were concentrated and purified by silica gel column chromatography to give the desired product compound as white solid in 75% yield.^{1}H NMR (400 MHz, $CDCl_3$) δ 7.19 (s, 1H), 4.41 (t, *J* = 6.2 Hz, 2H), 2.59 (t, *J* = 6.2 Hz, 2H), 2.14 (s, 3H), 1.91 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.0 (s), 164.0 (s), 146.4 (s), 120.4 (s), 77.3 (s), 77.0 (s), 76.8 (s), 65.4 (s), 30.5 (s), 23.6 (s), 20.5 (s). ESI-MS: m/z 191.95 $[M+Na]^+$; HRMS (ESI) calculated for $[M+Na]^+$:192.0631; found: 192.0631.



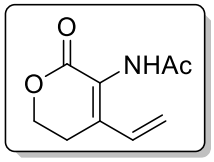
Produce A: To a 150 mL Schlenk tube equipped with a mechanical stirrer was charged with compound **7** (1.0 equiv), $Pd(OAc)_2$ (0.03 equiv), BI-DIME (0.06 equiv), alkenyl boric acid or vinylboronic acid trifluoroborate potassium (2.0 equiv), K_3PO_4 (2.0 equiv) and dioxane (10 mL), the resulting mixture was purged with nitrogen and stirred under 80℃ for 3h. After full conversion of starting material monitored by TLC, the solvent

was removed under vacuum. The mixture was then extracted with H_2O/EtOAc (three times). The combined organic layers were concentrated and purified by silica gel column chromatography to give the desired product compound **8x**.

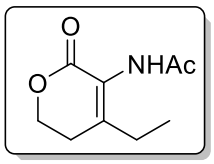
Produce B: To a 10 mL round-bottom flask equipped with a mechanical stirrer was charged with compound **8x** (**x**=**b-l**, 1 equiv), $Pd(OH)_2/C$ (20%, <0.5% H_2O, 10% wt%) and dry THF (2 ml), the resulting mixture was purged with hydrogen and stirred under 10 atm, 30 ℃ for 6 h. After full conversion of starting material monitored by TLC, the solid magazines were removed by filtration through kieselguhr and washed with THF, then the combined organic layer was concentrated to afford pure product.



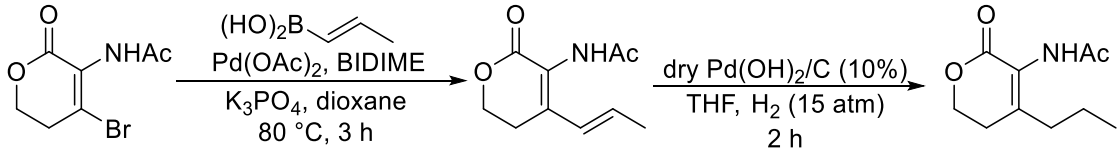
7 **8b** **1b**



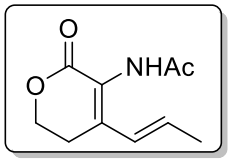
8b: Prepared according to procedure A with vinylboronic acid trifluoroborate potassium as white solid in 72% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31 (s, 1H), 6.55 (dd, *J* = 17.5, 10.8 Hz, 1H), 5.62 (d, *J* = 17.5 Hz, 1H), 5.56 (d, *J* = 10.8 Hz, 1H), 4.47 (t, *J* = 6.2 Hz, 2H), 2.74 (t, *J* = 6.2 Hz, 2H), 2.17 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.7 (s), 164.6 (s), 140.2 (s), 132.3 (s), 121.3 (s), 120.2 (s), 77.3 (s), 77.3 (s), 76.9 (d, *J* = 32.0 Hz), 65.6 (s), 24.1 (s), 23.7 (s). ESI-MS: m/z 182.0 $[M+H]^+$, 204.0 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_9H_{11}NNaO_3]^+$: 204.0631; found: 204.0634. bp 82-87 ºC



1b: Prepared according to procedure B as white solid in 95% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.15 (s, 1H), 4.40 (t, *J* = 6.2 Hz, 2H), 2.57 (t, *J* = 6.2 Hz, 2H), 2.28 (q, *J* = 7.6 Hz, 2H), 2.12 (s, 3H), 1.08 (t, *J* = 7.6 Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.4 (s), δ 164.2 (s), 151.6 (s), 119.4 (s), 65.5 (s), 27.5 (s), 26.6 (s), 23.6 (s), 10.4 (s). ESI-MS: m/z 184.0 $[M+H]^+$, 206.0 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_9H_{13}NNaO_3]^+$: 206.0788; found: 206.0791.

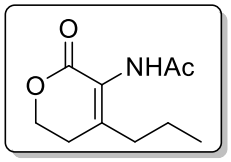


7 **8c** **1c**

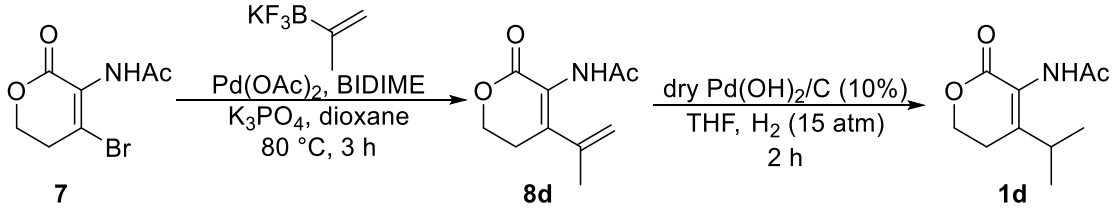


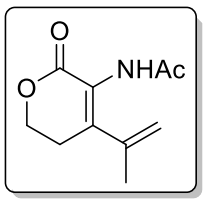
8c: Prepared according to procedure A as white solid in 84% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30 (s, 1H), 6.26 (m, 1H), 6.18 (m, 1H), 4.42 (t, *J* = 6.2 Hz, 2H), 2.70 (t, *J* = 6.2 Hz, 2H), 2.16 (s, 3H), 1.91 (d, *J* = 6.1 Hz, 3H).^{13}C NMR (126 MHz, $CDCl_3$) δ 168.7 (s), 164.9 (s), 141.6 (s), 135.3 (s), 127.2 (s), 118.1 (s), 65.4 (s), 24.8

(s), 23.7 (s), 19.2 (s). ESI-MS: m/z 196.1 $[M+H]^+$, 218.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{10}H_{13}NNaO_3]^+$: 218.0788; found: 218.0786.

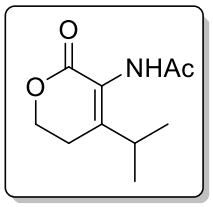


1c: Prepared according to procedure B as white solid in 97% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.19 (s, 1H), 4.39 (t, *J* = 6.1 Hz, 2H), 2.55 (t, *J* = 6.1 Hz, 2H), 2.27 - 2.20 (m, 2H), 2.11 (s, 3H), 1.50 (dd, *J* = 15.3, 7.5 Hz, 2H), 0.91 (t, *J* = 7.3 Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.5 (s), 164.1 (s), 150.9 (s), 120.0 (s), 77.2 (d, *J* = 32.0 Hz), 77.0 (s), 76.9 (d, *J* = 32.0 Hz), 65.5 (s), 35.5 (s), 28.0 (s), 23.5 (s), 19.4 (s), 14.1 (s). ESI-MS: m/z 198.1 $[M+H]^+$, 220.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{10}H_{15}NNaO_3]^+$: 220.0944; found: 220.0938.

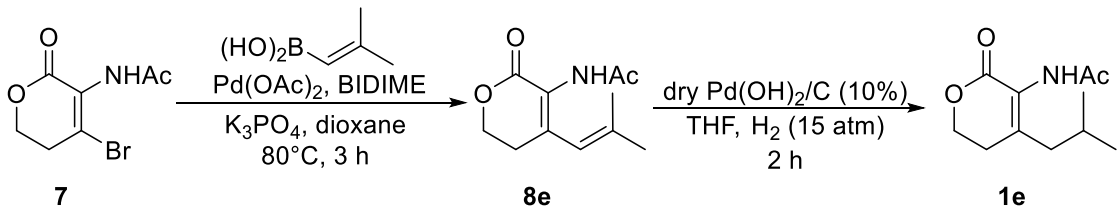


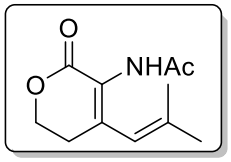


8d: Prepared according to procedure A as white solid in 35% yield (An undesired side product was formed with condition of procedure A). ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.21 (s, 1H), 5.13 (d, *J* = 20.9 Hz, 2H), 4.43 (t, *J* = 6.1 Hz, 2H), 2.67 (t, *J* = 6.1 Hz, 2H), 2.07 (s, 3H), 1.92 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.0 (s), 164.4 (s), 146.2 (s), 141.5 (s), 119.0 (s), 117.2 (s), 65.6 (s), 28.3 (s), 23.7 (s), 20.0 (s). ESI-MS: m/z 196.1 $[M+H]^+$, 218.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{10}H_{13}NNaO_3]^+$: 218.0788; found: 218.0792.



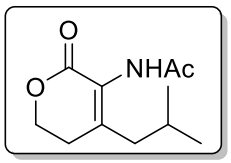
1d: Prepared according to procedure B as white solid in 96% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.96 (s, 1H), 4.39 (t, *J* = 6.1 Hz, 2H), 2.84 (m, 1H), 2.51 (t, *J* = 6.1 Hz, 2H), 2.12 (s, 3H), 1.08 (d, *J* = 6.8 Hz, 6H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.0 (s), 164.2 (s), 156.4 (s), 118.4 (s), 65.6 (s), 30.6 (s), 23.5 (s), 23.2 (s), 19.6 (s). ESI-MS: m/z 198.1 $[M+H]^+$, 220.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{10}H_{15}NNaO_3]^+$: 220.0944; found: 220.0946.



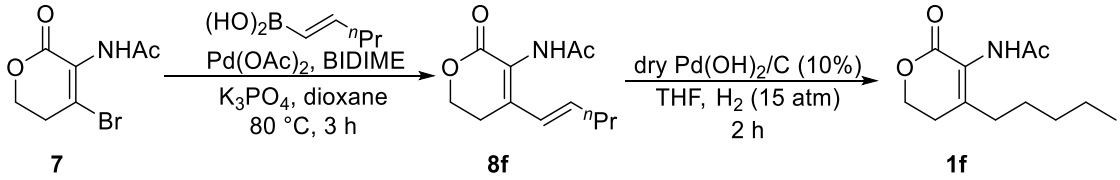


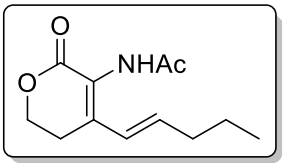
8e: Prepared according to procedure A as white solid in 98% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.35 (s, 1H), 5.84 (s, 1H), 4.35 (t, *J* = 6.1 Hz, 2H), 2.70 (t, *J* = 5.8 Hz, 2H), 2.05 (s, 3H), 1.82 (s, 3H), 1.73 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.3 (s), 164.2 (s),

144.7 (s), 142.3 (s), 121.4 (s), 119.7 (s), 77.4 (s), 77.1 (s), 76.9 (s), 65.6 (s), 29.2 (s), 27.7 (s), 23.3 (s), 20.8 (s). ESI-MS: m/z 210.1 $[M+H]^+$, 232.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_{11}H_{16}NO_3]^+$: 210.1125; found: 210.1130.

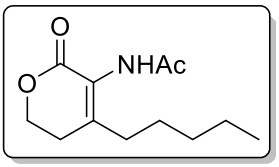


1e: Prepared according to procedure B as white solid in 95% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.16 (s, 1H), 4.38 (t, *J* = 6.1 Hz, 2H), 2.54 (t, *J* = 6.1 Hz, 2H), 2.17 (d, *J* = 7.4 Hz, 2H), 2.10 (s, 3H), 1.84 (td, *J* = 7.4, 8.3 Hz, 1H), 0.86 (t, *J* = 8.3 Hz, 6H).^{13}C NMR (126 MHz, $CDCl_3$) δ 168.5 (s), 164.0 (s), 150.5 (s), 120.7 (s), 65.5 (s), 42.7 (s), 28.5 (s), 25.8 (s), 23.5 (s), 22.5 (s).ESI-MS: m/z 212.1 $[M+H]^+$, 234.1$[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_{1q}H_{18}NO_3]^+$: 212.1281; found: 212.1281.

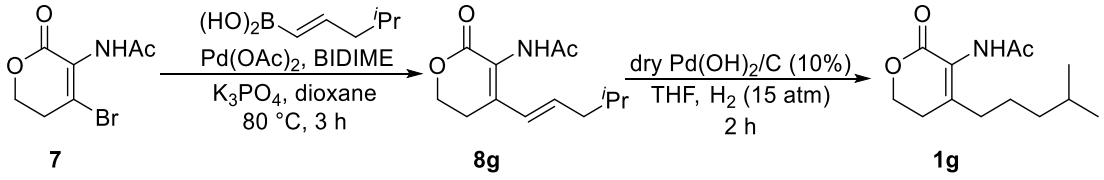


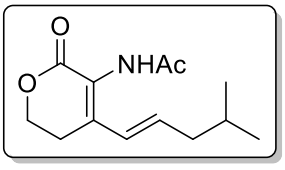


8f: Prepared according to procedure A as white solid in 91% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30 (s, 1H), 6.24 (d, *J* = 15.9 Hz, 1H), 6.19 - 6.11 (m, 1H), 4.43 (t, *J* = 6.2 Hz, 2H), 2.71 (t, *J* = 6.1 Hz, 2H), 2.20 (dd, *J* = 14.3, 7.1 Hz, 2H), 2.15 (s, 3H), 1.45 (dd, *J* = 14.8, 7.4 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.6 (s), 164.9 (s), 141.6 (s), 140.3 (s), 126.0 (s), 118.3 (s), 65.4 (s), 35.5 (s), 24.8 (s), 23.7 (s), 22.1 (s), 13.7 (s). ESI-MS: m/z 224.1 $[M+H]^+$, 246.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{12}H_{17}NNaO_3]^+$: 246.1101; found: 246.1106.



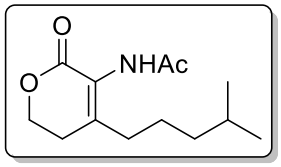
1f: Prepared according to procedure B as white solid in 95% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.22 (s, 1H), 4.38 (t, *J* = 6.2 Hz, 2H), 2.55 (t, *J* = 6.2 Hz, 2H), 2.24 (m, 2H), 2.11 (s, 3H), 1.45 (m, 2H), 1.32 - 1.22 (m, 5H), 0.87 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.6 (s), 164.2 (s), 151.4 (s), 119.8 (s), 65.5 (s), 33.4 (s), 31.7 (s), 28.0 (s), 25.7 (s), 23.5 (s), 22.4 (s), 13.9 (s).ESI-MS: m/z 226.1 $[M+H]^+$, 248.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{12}H_{19}NNaO_3]^+$: 248.1257; found: 248.1262.



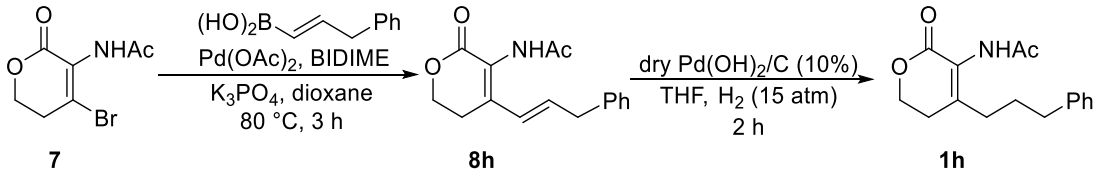


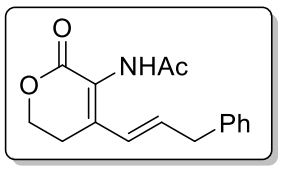
8g: Prepared according to procedure A as white solid in 92% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.32 (s, 1H), 6.22 (d, *J* = 15.9 Hz, 1H), 6.14 (dd, *J* = 15.0, 7.7 Hz, 1H), 4.43 (t, *J* = 6.2 Hz, 2H), 2.71 (t, *J* = 6.1 Hz, 2H), 2.15 (s, 3H), 2.11 (t, *J* = 6.9

Hz, 2H), 1.70 (dt, *J* = 13.4, 6.7 Hz, 1H), 0.90 (d, *J* = 6.6 Hz, 6H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.7 (s), 164.9 (s), 141.6 (s), 139.3 (s), 126.9 (s), 118.4 (s), 65.4 (s), 42.7 (s), 28.4 (s), 24.9 (s), 23.7 (s), 22.4 (s). ESI-MS: m/z 238.1 $[M+H]^+$, 260.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{13}H_{19}NNaO_3]^+$: 260.1257; found: 260.1256.

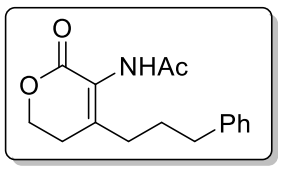


1g: Prepared according to procedure B as white solid in 96% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.12 (s, 1H), 4.39 (t, *J* = 6.1 Hz, 2H), 2.56 (t, *J* = 6.1 Hz, 2H), 2.23 (dd, *J* = 16.5, 8.6 Hz, 2H), 2.12 (s, 3H), 1.52 (d, *J* = 6.7 Hz, 1H), 1.46 (t, *J* = 7.9 Hz, 2H), 1.18 - 1.12 (m, 2H), 0.86 (d, *J* = 6.6 Hz, 6H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.4 (s), 164.2 (s), 150.9 (s), 119.8 (s), 77.1 (d, *J* = 31.9 Hz), 76.8 (s), 65.5 (s), 38.7 (s), 33.7 (s), 28.1 (s), 27.8 (s), 23.7 (d, *J* = 24.5 Hz), 22.5 (s).ESI-MS: m/z 240.2 $[M+H]^+$, 262.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{13}H_{21}NNaO_3]^+$: 262.1414; found: 262.1415.

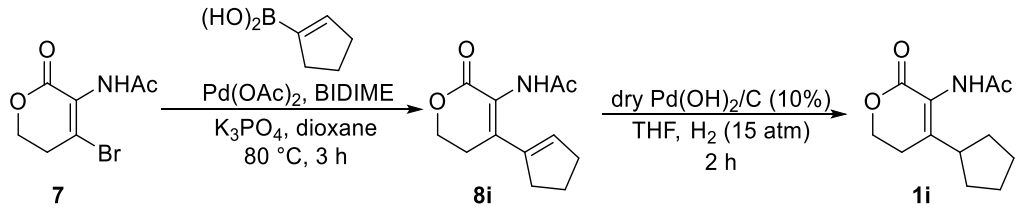


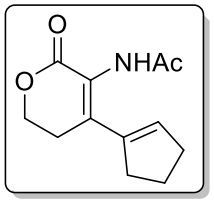


8h: Prepared according to procedure A as white solid in 83% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31 (t, *J* = 7.4 Hz, 3H), 7.21 (dd, *J* = 22.4, 7.3 Hz, 3H), 6.27 (d, *J* = 12.7 Hz, 2H), 4.42 (t, *J* = 6.2 Hz, 2H), 3.56 (d, *J* = 6.1 Hz, 2H), 2.70 (t, *J* = 6.2 Hz, 2H), 2.15 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.5 (s), 164.8 (s), 140.8 (s), 138.6 (s), 138.0 (s), 128.7 (d, *J* = 16.9 Hz), 127.0 (s), 126.5 (s), 119.0 (s), 77.3 (s), 76.9 (d, *J* = 32.0 Hz), 76.8 - 76.4 (m), 39.7 (s), 24.9 (s), 23.7 (s). ESI-MS: m/z 272.2 $[M+H]^+$, 294.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{16}H_{17}NNaO_3]^+$: 294.1101; found: 294.1105.

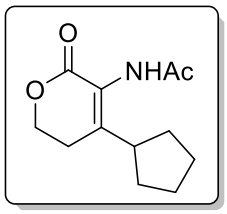


1h: Prepared according to procedure B as white solid in 98% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.35 (dd, *J* = 10.2, 4.8 Hz, 2H), 7.32 - 7.17 (m, 4H), 4.44 (t, *J* = 6.1 Hz, 2H), 2.68 (t, *J* = 7.5 Hz, 2H), 2.60 (t, *J* = 6.1 Hz, 2H), 2.40 - 2.32 (m, 2H), 2.13 (s, 3H), 1.91 - 1.84 (m, 2H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.6 (s), 164.0 (s), 150.8 (s), 141.3 (s), 128.4 (s), 128.4 (s), 126.1 (s), 120.2 (s), 77.3 (s), 77.1 (s), 76.8 (s), 65.4 (s), 35.6 (s), 32.9 (s), 28.0 (s), 27.6 (s), 23.4 (s). ESI-MS: m/z 274.2 $[M+H]^+$, 296.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{16}H_{19}NNaO_3]^+$: 296.1257; found: 296.1260.

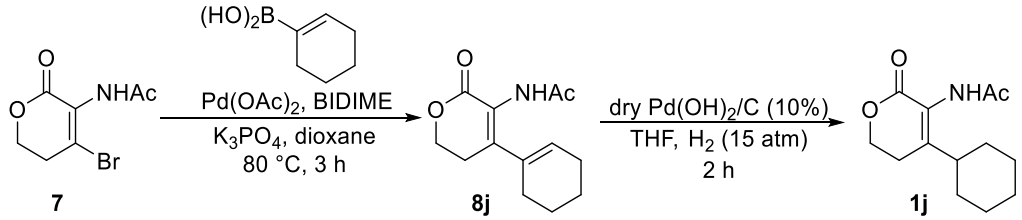


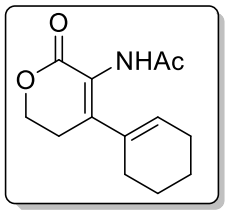


8i: Prepared according to procedure A as white solid in 72% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.16 (s, 1H), 6.29 (s, 1H), 4.42 (t, *J* = 6.1 Hz, 2H), 2.77 (t, *J* = 6.0 Hz, 2H), 2.52 (t, *J* = 6.4 Hz, 2H), 2.44 (s, 2H), 2.11 (s, 3H), 1.94 - 1.87 (m, 2H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.2 (s), 165.4 (s), 142.0 (s), 140.6 (s), 139.3 (s), 118.3 (s), 65.4 (s), 32.8 (d, *J* = 2.5 Hz), 28.4 (s), 23.9 (s), 23.7 (s). ESI-MS: m/z 222.1 $[M+H]^+$, 244.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{12}H_{15}NNaO_3]^+$: 244.0944; found: 244.0947. bp 186-189 °C

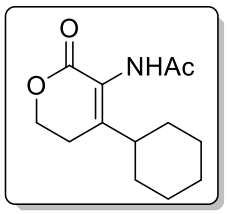


1i: Prepared according to procedure B as white solid in 96% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.08 (s, 1H), 4.39 (t, *J* = 6.1 Hz, 2H), 2.96 - 2.85 (m, 1H), 2.52 (t, *J* = 6.1 Hz, 2H), 2.11 (s, 3H), 1.95 - 1.87 (m, 2H), 1.73 - 1.66 (m, 2H), 1.63 (m, 2H), 1.39 (d, *J* = 2.4 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.1 (s), 164.1 (s), 155.2 (s), 119.4 (s), 65.7 (s), 42.3 (s), 30.4 (s), 26.0 (s), 24.4 (s), 23.6 (s). ESI-MS: m/z 246.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{12}H_{17}NNaO_3]^+$: 246.1101; found: 246.1104.

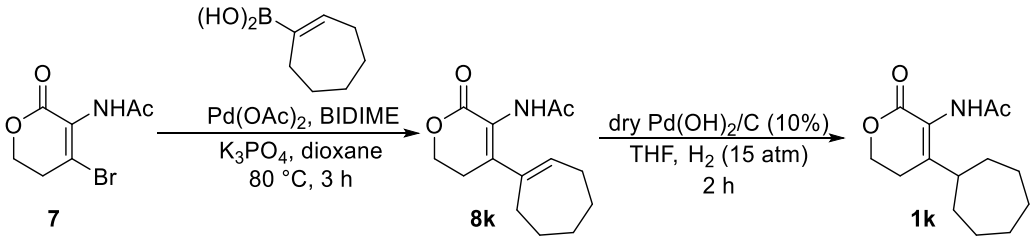


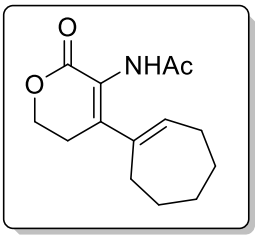


8j: Prepared according to procedure A as white solid in 92% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.12 (s, 1H), 5.90 (s, 1H), 4.40 (t, *J* = 6.1 Hz, 2H), 2.64 (t, *J* = 6.0 Hz, 2H), 2.12 (d, *J* = 5.8 Hz, 4H), 2.06 (s, 3H), 1.68 - 1.62 (m, 2H), 1.62 - 1.57 (m, 2H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.0 (s), 164.9 (s), 147.7 (s), 135.2 (s), 129.8 (s), 118.1 (s), 65.5 (s), 28.3 (s), 26.1 (s), 25.7 (s), 23.6 (s), 22.6 (s), 21.6 (s). ESI-MS: m/z 236.1 $[M+H]^+$, 258.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{10}H_{14}NNaO_3]^+$: 258.1101; found: 258.1106. bp 155-157 °C

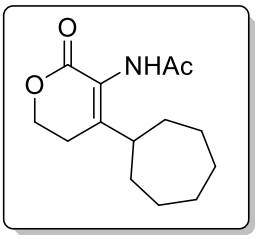


1j: Prepared according to procedure B as white solid in 95% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.03 (s, 1H), 4.37 (t, *J* = 6.1 Hz, 2H), 2.51 (t, *J* = 6.1 Hz, 2H), 2.46 (t, *J* = 11.7 Hz, 1H), 2.12 (s, 3H), 1.82 - 1.74 (m, 4H), 1.34 - 1.10 (m, 6H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.2 (s), 164.3 (s), 156.1 (s), 118.7 (s), 65.6 (s), 41.4 (s), 29.5 (s), 25.9 (s), 25.9 (s), 24.5 (s), 23.5 (s). ESI-MS: m/z 238.1 $[M+H]^+$, 260.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_{13}H_{20}NO_3]^+$: 238.1438; found: 238.1436.

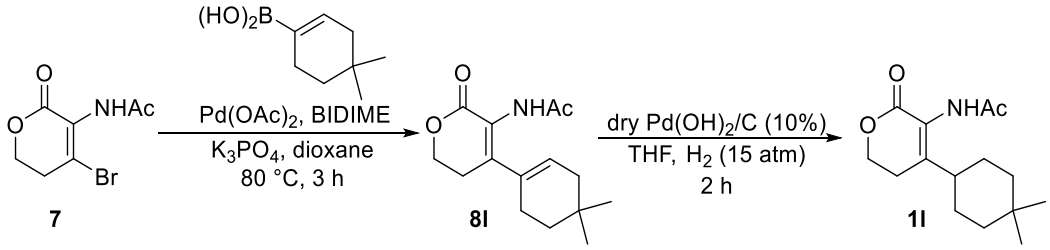


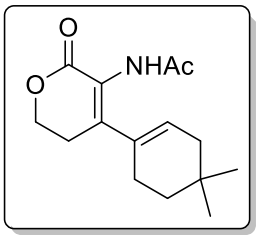


8k: Prepared according to procedure A as white solid in 82% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.15 (s, 1H), 6.00 (t, *J* = 6.4 Hz, 1H), 4.38 (t, *J* = 6.1 Hz, 2H), 2.63 (t, *J* = 6.0 Hz, 2H), 2.33 - 2.28 (m, 2H), 2.20 (dd, *J* = 10.6, 6.3 Hz, 2H), 2.04 (s, 3H), 1.74 (dt, *J* = 11.7, 5.9 Hz, 2H), 1.56 - 1.45 (m, 4H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 167.9 (s), 164.6 (s), 150.1 (s), 141.9 (s), 134.3 (s), 117.8 (s), 65.6 (s), 32.2 (s), 30.7 (s), 29.1 (s), 29.0 (s), 27.0 (s), 26.4 (s), 23.6 (s). ESI-MS: m/z 250.1 $[M+H]^+$, 272.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_{14}H_{19}NO_3]^+$: 272.1257; found: 272.1264.

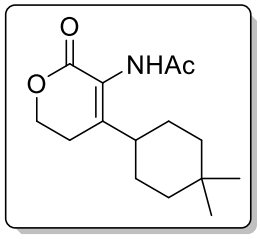


1k: Prepared according to procedure B as white solid in 98% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.99 (s, 1H), 4.36 (t, *J* = 6.1 Hz, 2H), 2.60 (t, *J* = 10.2 Hz, 1H), 2.53 (t, *J* = 6.1 Hz, 2H), 2.12 (s, 3H), 1.79 - 1.73 (m, 4H), 1.61 (d, *J* = 6.0 Hz, 2H), 1.55 - 1.45 (m, 4H), 1.42 (dd, *J* = 19.9, 8.6 Hz, 2H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.1 (s), 164.4 (s), 157.3 (s), 117.4 (s), 77.1 (d, *J* = 32.0 Hz), 76.8 (s), 76.8 (s), 65.7 (s), 42.3 (s), 32.0 (s), 27.8 (s), 27.6 (s), 24.4 (s), 23.5 (s). ESI-MS: m/z 252.1 $[M+H]^+$, 274.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{14}H_{21}NNaO_3]^+$: 274.1414; found: 274.1416.

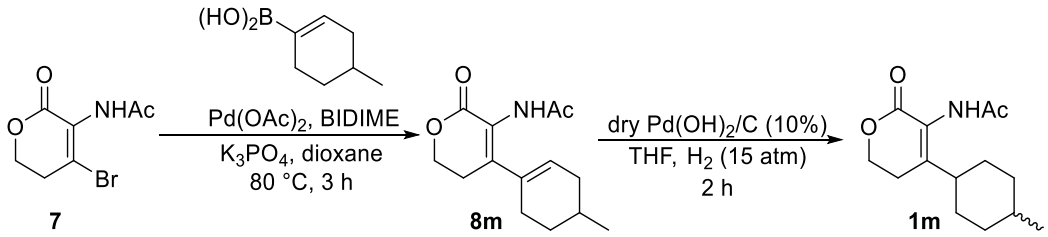


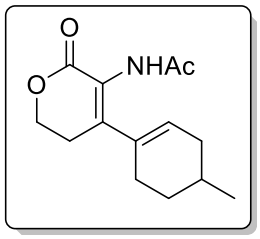


8l: Prepared according to procedure A as white solid in 76% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.18 (s, 1H), 5.83 (s, 1H), 4.40 (t, *J* = 6.1 Hz, 2H), 2.64 (t, *J* = 6.0 Hz, 2H), 2.15 (s, 2H), 2.04 (s, 3H), 1.90 (s, 2H), 1.40 (t, *J* = 6.3 Hz, 2H), 0.91 (s, 6H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.1 (s), 164.9 (s), 148.1 (s), 133.9 (s), 129.0 (s), 118.3 (s), 65.5 (s), 39.6 (s), 35.3 (s), 28.5 (s), 28.2 (s), 28.1 (s), 23.5 (s). ESI-MS: 264.3 $[M+H]^+$, 286.3 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{15}H_{21}NNaO_3]^+$: 286.1414; found: 286.1419.

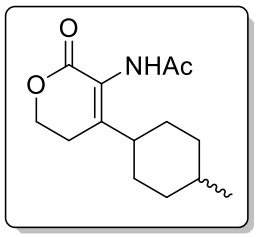


1l: Prepared according to procedure B as white solid in 92% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.42 (s, 1H), 4.76 (m, 1H), 4.44 - 4.26 (m, 2H), 2.85 (m, 1H), 2.09 (s, 3H), 2.04 - 1.95 (m, 1H), 1.88 (m, 1H), 1.45 - 1.32 (m, 5H), 1.18 (m, 2H), 1.07 (m, 2H), 0.87 (s, 3H), 0.82 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 173.7 (s), 170.1 (s), 65.8 (s), 50.5 (s), 39.1 (s), 38.6 (s), 37.4 (s), 36.6 (s), 32.9 (s), 29.8 (s), 26.1 (s), 23.8 (s), 23.1 (s), 21.3 (s). ESI-MS: m/z 266.3 $[M+H]^+$, 288.4 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{15}H_{23}NNaO_3]^+$: 288.1570; found: 288.1574.

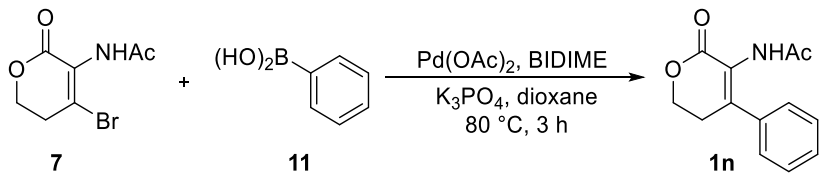


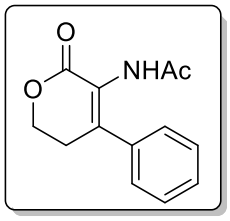


8m: Prepared according to procedure A as white solid in 86% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.24 (s, 1H), 5.86 (s, 1H), 4.42-4.34 (m, 2H), 2.60-2.65 (m, 2H), 2.08-2.25 (m, 3H), 2.03 (s, 3H), 1.76-1.59 (m, 3H), 1.23 (m, 1H), 0.93 (d, J = 6.5 Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.1 (s), 164.8 (s), 148.0 (s), 134.8 (s), 129.5 (s), 118.3 (s), 65.5 (s), 34.1 (s), 30.7 (s), 28.4 (s), 27.7 (s), 26.0 (s), 23.5 (s), 21.5 (s). ESI-MS: 272.3 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{14}H_{19}NNaO_3]^+$: 272.157; found: 272.1262.



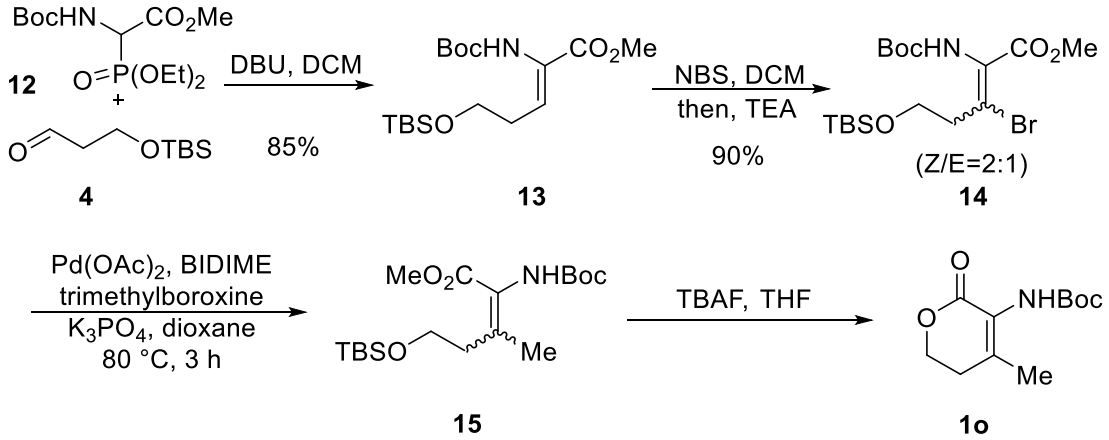
1m: Prepared according to procedure B as white solid in 98% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.00 (s, 1H), 4.37 (m, 2H), 2.55 (m, 2H), 2.42 (m, 1H), 2.12 (s, 3H), 1.80 - 1.66 (m, 3H), 1.50 (m, 2H), 1.26 (m, 1H), 0.93 (m, 4H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.15 (s), 164.21 (s), 156.19 (s), 119.0 (s), 118.8 (s), 65.6 (s), 41.6 (s), 41.0 (s), 34.5 (s), 32.2 (s), 31.1 (s), 29.4 (s), 26.3 (s), 24.7 (s), 24.5 (s), 23.5 (s), 23.4 (s), 22.5 (s), 17.4 (s). ESI-MS: 274.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{14}H_{21}NNaO_3]^+$: 274.1414; found: 274.1417.

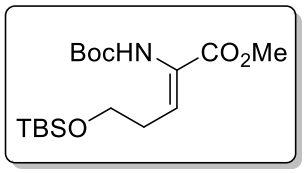




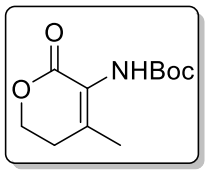
1n: Prepared according to procedure A with **11** (2 equiv) as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.51 - 7.28 (m, 5H), 7.10 (s, 1H), 4.56 (t, J = 6.1 Hz, 2H), 2.92 (t, J = 6.1 Hz, 2H), 1.95 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 167.9 (s), 164.2 (s), 145.5 (s), 137.0 (s), 129.3 (s), 128.6 (s), 126.8 (s), 120.3 (s), 65.6

(s), 30.1 (s), 23.3 (s). ESI-MS: m/z 232.1 $[M+H]^+$, 254.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{13}H_{13}NNaO_3$]$^+$: 254.0788; found: 254.0788.





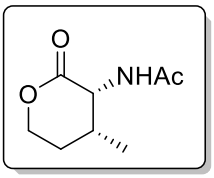
13: To a 150 mL Schlenk tube equipped with a mechanical stirrer was charged with compound **12** (1 equiv), dry DCM (30 mL), under N_2 atmosphere. By slowly adding DBU (2.1 equiv) in DCM via syringe at 0 °C, then the mixture was allowed to react at room temperature for ten minutes. Place the system at 0 °C and slowly drop 3-tert-butyldimethylsiloxypropionaldehyde **4** (1.5 equiv) in DCM for 5 minutes. Then the reaction was kept at 0°C for 10 minutes with TLC monitored (even room temperature or long reaction time will lead to increase of *β*-elimination by-products). DBU was washed with water, and the mixture was extracted with water (20 mL) and DCM (10 mL x 3), washed with saturated brine, dried over anhydrous sodium sulfate, concentrated, and column chromatography (PE:EA=5:1) to obtain desired product as white solid in 83% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.55 (s, 1H), 6.44 (s, 1H), 3.75 (s, 3H), 3.70 (t, *J* = 6.0 Hz, 2H), 2.39 (dd, *J* = 13.0, 6.0 Hz, 2H), 1.43 (s, 9H), 0.87 (s, 9H), 0.04 (s, 6H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 165.3 (s), 153.2 (s), 130.8 (s), 128.4 (s), 80.30 (s), 62.20 (s), 52.15 (s), 31.34 (s), 28.15 (s), 25.86 (s), 18.24 (s), -5.45 (s). ESI-MS: m/z 382.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{17}H_{33}NNaO_5Si$]$^+$: 382.2020; found: 382.2021.



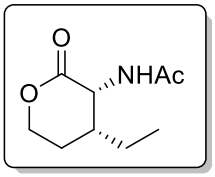
1o: To a 150 mL Schlenk tube equipped with a mechanical stirrer was charged with compound (*E*)-**15** (1 equiv), dry THF (30 mL), TBAF (2 equiv) in THF solution under N_2 atmosphere. The mixture was kept at room temperature overnight. The solution was concentrated and purified by column chromatography (PE:EA=1:1) to afford desired product as white solid in 83% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.36 (s, 1H), 4.35 (t, *J* = 6.2 Hz, 2H), 2.52 (t, *J* = 6.2 Hz, 2H), 1.91 (s, 3H), 1.44 (s, 9H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 164.0 (s), 153.0 (s), 144.9 (s), 121.0 (s), 80.5 (s), 65.3 (s), 30.3 (s), 28.1 (s), 19.9 (s). ESI-MS: m/z 250.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{11}H_{17}NNaO_4$]$^+$: 250.1050; found: 250.1054.

4. General procedures for asymmetric hydrogenation

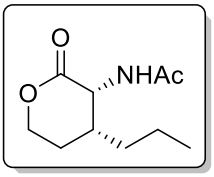
To a 4-mL vial equipped with a magnetic stirring bar was charged cyclic dehydroamino acid derivative (0.1 mmol), [Rh(**L1**)(cod)]BF_4 (1 mol %) and dry THF (0.5 mL) in glove box. After stirred for 5 min at room temperature, the reaction mixture was transferred to an autoclave. The autoclave was purged with hydrogen three times and charged to 1000 psi. The mixture was stirred at 60 ºC for 3 h, and depressurized carefully in a well-ventilated hood. A crude reaction sample was passed through celite to remove metal precipitate and directly analyzed by chiral HPLC to determine the conversions and ee values. The hydrogenation products were isolated in quantitative yields.



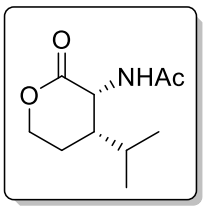
2a:Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, CDCl3) δ 6.39 (s, 1H), 4.79 (t, *J* = 6.5 Hz, 1H), 4.41 - 4.34 (m, 2H), 2.93 - 2.84 (m, 1H), 2.31 (m, 1H), 2.07 (s, 3H), 1.72 - 1.63 (m, 1H), 0.91 (d, *J* = 7.1 Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.2 (s), 170.0 (s), 65.9 (s), 52.4 (s), 29.3 (s), 28.0 (s), 23.0 (s), 16.8 (s). ESI-MS: m/z 172.00 $[M+H]^+$; HRMS (ESI) calculated for [M+H, $C_8H_{14}NO_3]^+$: 172.0968; found: 172.0960. 90% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 11.47 min (major), t_2 = 13.05 min. T = 20 min. $[\alpha]_D^{25}$ -103.6 (c 0.13, $CHCl_3$).



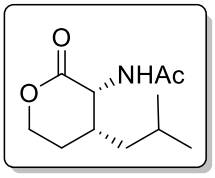
2b:Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.52 (s, 1H), 4.86 - 4.76 (m, 1H), 4.39 - 4.31 (m, 2H), 2.58 (m, 1H), 2.21 - 2.12 (m, 1H), 2.04 (s, 3H), 1.78 - 1.69 (m, 1H), 1.57 - 1.49 (m, 1H), 0.91 (m, 1H), 0.87 (m, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.5 (s), 170.0 (s), 77.3 (s), 52.0 (s), 34.4 (s), 26.3 (s), 23.2 (s), 23.0 (s), 10.8 (s). ESI-MS: m/z 208.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{10}H_{19}NNaO_4]^+$: 240.1206; found: 240.1214. 92% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 10.05 min (major), t_2 = 11.37 min. T = 20 min. $[\alpha]_D^{25}$ -30.9 (c 0.10, $CHCl_3$).



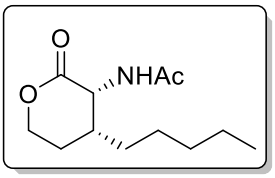
2c:Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.39 (s, 1H), 4.83 - 4.77 (m, 1H), 4.42 - 4.33 (m, 2H), 2.70 (m, 1H), 2.19 (m, 1H), 2.07 (s, 3H), 1.76 (m, 1H), 1.41 (m, 2H), 1.21 (m, 1H), 0.89 (m, 5H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.4 (s), 169.9 (s), 66.0 (s), 52.0 (s), 32.7 (s), 32.5 (s), 26.7 (s), 23.1 (s), 19.5 (s), 14.0 (s). ESI-MS: m/z 200.2 $[M+H]^+$, 222.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{11}H_{21}NNaO_4]^+$: 254.1363; found: 254.1370. 90% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 9.32 min (major), t_2 = 10.62 min. T = 20 min. $[\alpha]_D^{25}$ -117.7 (c 0.25, $CHCl_3$).



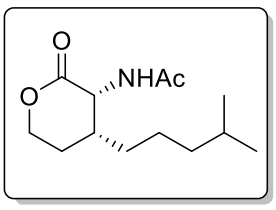
2d:Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.44 (m, 1H), 4.76 (m, 1H), 4.39 (m, 1H), 4.32 (m, 1H), 2.95 - 2.82 (m, 1H), 2.08 (s, 3H), 1.93 (m, 1H), 1.80 (m, 1H), 0.94 - 0.88 (m, 1H), 0.86 (d, *J* = 7.0 Hz, 3H), 0.70 (d, *J* = 7.0 Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 173.5 (s), 170.1 (s), 65.7 (s), 50.7 (s), 37.1 (s), 26.7 (s), 23.0 (s), 21.6 (s), 20.6 (s), 15.3 (s). ESI-MS: m/z 200.1 $[M+H]^+$, 222.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{10}H_{17}NNaO_3]^+$: 222.1101; found:222.1102. 90% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 9.03 min (major), t_2 = 10.57 min. T = 20 min. $[\alpha]_D^{25}$ -25.3 (c 0.24, $CHCl_3$).



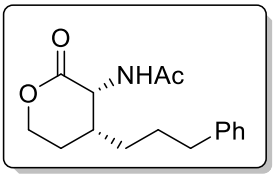
2e:Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.40 (s, 1H), 4.84 (m, *J* = 6.5 Hz, 1H), 4.46 - 4.36 (m, 2H), 2.85 - 2.76 (m, 1H), 2.22 (m, 1H), 2.09 (s, 3H), 1.78 (m, 1H), 1.19 (m, 1H), 1.00 - 0.95 (m, 1H), 0.93 (s, 3H), 0.85 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.4 (s), 169.8 (s), 66.0 (s), 52.0 (s), 39.4 (s), 30.8 (s), 26.8 (s), 24.8 (s), 24.0 (s), 23.1 (s), 20.8 (s). ESI-MS: m/z 214.1 $[M+H]^+$, 236.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_{11}H_{20}NO_3]^+$: 214.1438; found: 214.1440. 92% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 8.18 min (major), t_2 = 9.15 min. T = 20 min. $[\alpha]_D^{25}$ -178.1 (c 0.40, $CHCl_3$).



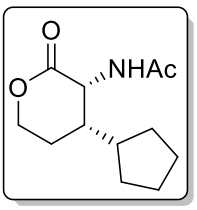
2f:Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.44 (d, *J* = 5.2 Hz, 1H), 4.82 - 4.77 (m, 1H), 4.37 (m, 2H), 2.66 (m, 1H), 2.21 - 2.14 (m, 1H), 2.06 (s, 3H), 1.76 (m, 1H), 1.43 (m, 1H), 1.26 (m, 6H), 0.86 (m, 4H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.4 (s), 169.9 (s), 66.0 (s), 52.0 (s), 32.9 (s), 31.7 (s), 30.3 (s), 26.8 (s), 26.0 (s), 23.0 (s), 22.5 (s), 13.9 (s). ESI-MS: m/z 228.2 $[M+H]^+$, 250.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{12}H_{21}NNaO_3]^+$: 250.1414; found: 250.1416. 92% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 8.00 min (major), t_2 = 9.82 min. T = 20 min. $[\alpha]_D^{25}$ -106.7 (c 0.42, $CHCl_3$)



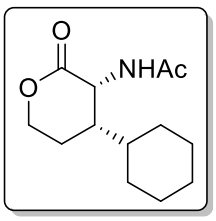
2g: Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.39 (s, 1H), 4.79 (t, *J* = 6.6 Hz, 1H), 4.38 (m, 2H), 2.69 (m, 1H), 2.23 - 2.16 (m, 1H), 2.07 (s, 3H), 1.81 - 1.71 (m, 1H), 1.54 - 1.46 (m, 1H), 1.41 (m, 1H), 1.34 (m, 1H), 1.14 (m, 4H), 0.85 (m, 6H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.4 (s), 169.9 (s), 66.0 (s), 52.1 (s), 38.8 (s), 32.9 (s), 30.6 (s), 27.8 (s), 26.8 (s), 24.1 (s), 23.1 (s), 22.7 (s), 22.4 (s). ESI-MS: m/z 242.1 $[M+H]^+$, 264.4 $[M+Na]^+$; HRMS (ESI) calculated for [M+MeOH, $C_{14}H_{27}NNaO_4]^+$: 296.1832; found: 296.1839. 91% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 7.47 min (major), t_2 = 8.56 min. T = 20 min. $[\alpha]_D^{25}$ -89.7 (c 0.25, $CHCl_3$).



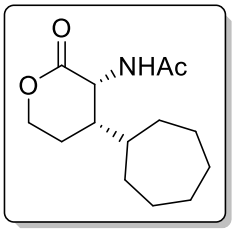
2h: Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.29 - 7.24 (m, 2H), 7.16 (m, 3H), 6.38 (d, *J* = 5.3 Hz, 1H), 4.79 (t, *J* = 6.6 Hz, 1H), 4.37 - 4.33 (m, 2H), 2.78 - 2.69 (m, 1H), 2.62 (m, 1H), 2.53 (m, 1H), 2.19 (m, 1H), 2.02 (s, 3H), 1.72 (m, 2H), 1.65 (m, 1H), 1.51 (m, 2H), 1.00 - 0.90 (m, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.3 (s), 169.9 (s), 141.7 (s), 128.4 (s), 128.3 (s), 125.9 (s), 66.0 (s), 51.9 (s), 35.5 (s), 32.6 (s), 29.7 (s), 28.1 (s), 26.8 (s), 23.0 (s). ESI-MS: m/z 276.3 $[M+H]^+$, 298.3 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{17}H_{25}NNaO_4]^+$: 330.1676; found: 330.1677. 70% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 14.00 min (major), t_2 = 17.89 min. T = 20 min. $[\alpha]_D^{25}$ -140.1 (c 0.28, $CHCl_3$).



2i: Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.49 (s, 1H), 4.80 (dd, *J* = 7.9, 6.2 Hz, 1H), 4.36 (m, 2H), 2.89 (m, 1H), 2.13 - 2.06 (m, 1H), 2.05 (s, 3H), 1.82 (m, 2H), 1.69 (m, 1H), 1.59 - 1.44 (m, 5H), 1.14 (m, 2H).^{13}C NMR (126 MHz, CDCl3) δ 173.1 (s), 170.1 (s), 66.0 (s), 51.9 (s), 40.1 (s), 35.8 (s), 30.6 (s), 27.2 (s), 25.2 (s), 25.2 (s), 24.1 (s), 23.0 (s). ESI-MS: m/z 226.1 $[M+H]^+$, 248.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+Na, $C_{12}H_{19}NNaO_3]^+$: 248.1257; found: 248.1260. 93% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 9.52 min (major), t_2 = 11.14 min. T = 20 min. $[\alpha]_D^{25}$ -87.4 (c 0.15, $CHCl_3$).

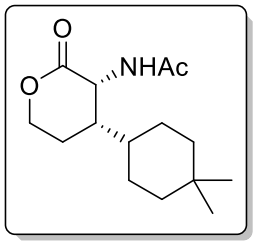


2j: Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.44 (d, *J* = 4.5 Hz, 1H), 4.76 (m, 1H), 4.38 (m, 1H), 4.33 - 4.26 (m, 1H), 2.80 (m, 1H), 2.09 (s, 3H), 1.94 (m, 1H), 1.86 (m, 1H), 1.71 (m, 2H), 1.67 - 1.61 (m, 1H), 1.52 - 1.39 (m, 2H), 1.24 (m, 2H), 1.14 (m, 2H), 1.07 - 1.00 (m, 2H). ^{13}C NMR (126 MHz, CDCl3) δ 173.7 (s), 170.1 (s), 65.8 (s), 50.4 (s), 37.4 (s), 37.0 (s), 30.6 (s), 26.5 (s), 26.2 (s), 26.0 (s), 25.7 (s), 23.0 (s), 22.9 (s). ESI-MS: m/z 240.1 $[M+H]^+$, 262.1 $[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_{13}H_{22}NO_3]^+$: 240.1594; found: 240.1601. 94% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 8.37 min (major), t_2 = 10.57 min. T = 20 min. $[\alpha]_D^{25}$ -112.3 (c 0.34, $CHCl_3$).

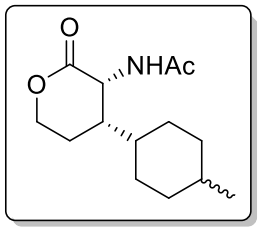


2k: Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.37 (s, 1H), 4.73 (m, 1H), 4.37 (m, 1H), 4.29 (m, 1H), 2.91 (m, 1H), 2.09 (s, 3H), 2.03 - 1.96 (m, 1H), 1.84 - 1.72 (m, 1H), 1.72 - 1.61 (m, 3H), 1.58 - 1.52 (m, 2H), 1.52 - 1.44 (m, 2H), 1.40 (m, 3H), 1.31 - 1.26 (m, 1H), 1.25 - 1.20 (m, 1H), 1.16 (m, 1H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 173.7 (s), 170.1 (s), 77.3 (s), 77.1 (s), 76.9 (d, *J* = 31.9 Hz), 65.9 (s), 50.6 (s), 38.8 (d, *J* = 15.5 Hz), 33.0 (s), 27.9 (s), 27.7 (d, *J* = 3.0 Hz), 27.4 (s), 27.2 (d, *J* = 37.7 Hz), 23.3 (s), 22.9 (s). ESI-MS: m/z 254.2 $[M+H]^+$, 276.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_{15}H_{27}NNaO_4]^+$: 308.1832; found: 308.1838. 92%

ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 8.21 min (major), t_2 = 9.54 min. T = 20 min. $[\alpha]_D^{25}$ -108.6 (c 0.54, $CHCl_3$).

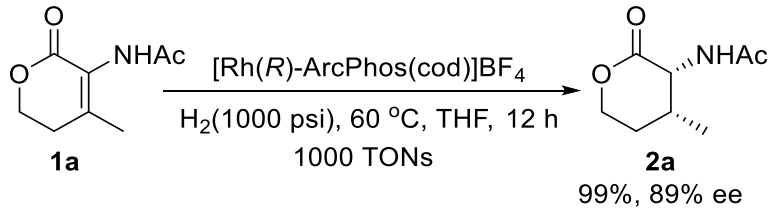


2l: Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.42 (s, 1H), 4.76 (m, 1H), 4.44 - 4.26 (m, 2H), 2.85 (m, 1H), 2.09 (s, 3H), 2.04 - 1.95 (m, 1H), 1.88 (m, 1H), 1.45 - 1.32 (m, 4H), 1.18 (m, 2H), 1.07 (m, 2H), 0.87 (s, 3H), 0.82 (s, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 173.7 (s), 170.1 (s), 65.8 (s), 50.5 (s), 39.1(s), 28.6 (s), 37.4 (s), 36.6 (s), 32.9 (s), 29.8 (s), 26.1 (s), 23.8 (s), 23.1 (s), 21.2 (s).ESI-MS: m/z 268.3 $[M+H]^+$, 290.3 $[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_{16}H_{29}NNaO_4]^+$: 322.1989; found: 322.1993. 95% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 7.28 min (major), t_2 = 8.21 min. T = 20 min. $[\alpha]_D^{25}$ -119.0 (c 0.32, $CHCl_3$).



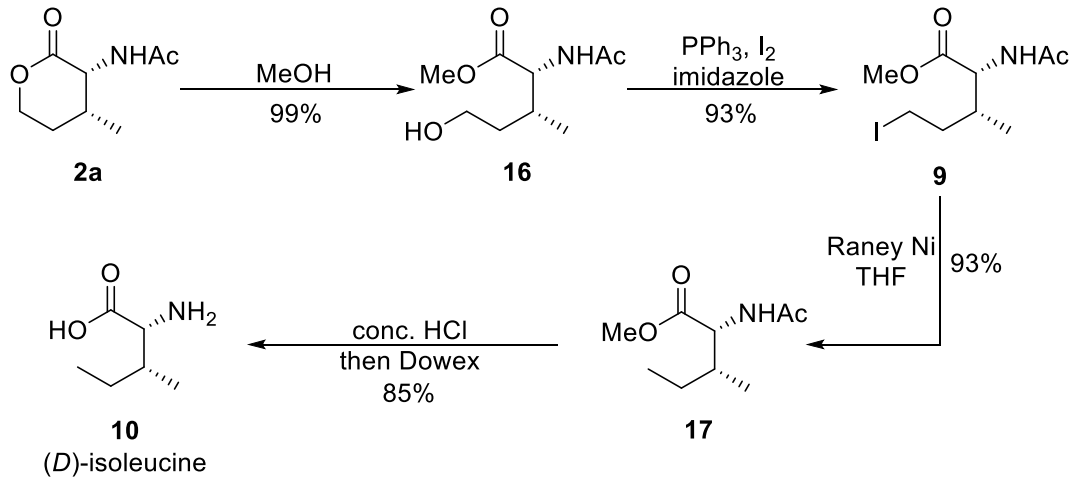
2m: Prepared according to general procedure for asymmetric hydrogenation as white solid in 99% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.40 (s, 1H), 4.76 (m, 1H), 4.39 (m, 1H), 4.31 (m, 1H), 2.83 (m, 1H), 2.09 (s, 3H), 2.02 - 1.93 (m, 1H), 1.93 - 1.78 (m, 2H), 1.72 - 1.64 (m, 1H), 1.55 - 1.39 (m, 4H), 1.35 - 1.28 (m, 1H), 1.20 (m, 1H), 1.08 - 0.99 (m, 1H), 0.88 (m, 4H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 173.6 (s), 170.1 (s), 77.3 (s), 77.0 (s), 76.7 (s), 65.9 (d, J = 5.4 Hz), 50.5 (d, J = 9.0 Hz), 37.6 (s), 37.1 (s), 36.7 (s), 36.6 (s), 35.1 (s), 34.5 (s), 32.5 (s), 31.6 (s), 31.1 (s), 30.4 (s), 26.7 (s), 25.4 (s), 24.4 (s), 23.1 (s), 23.0 (s), 22.9 (s), 22.5 (s), 19.9 (s), 17.4 (s). ESI-MS: m/z 254.2 $[M+H]^+$, 276.2 $[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_{15}H_{27}NNaO_4]^+$: 308.1832; found: 308.1838. 96% ee. Chiral HPLC conditions: OJ-3, *i*-PrOH-hexane 20/80, flow rate 0.7 mL/min, 210 nm. t_1 = 7.43 min (major), t_2 = 8.88 min (t_1 = 8.15 min (major), t_2 = 9.66 min) T = 20 min.

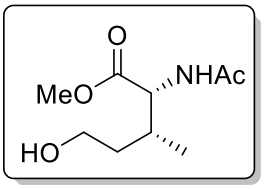
5. Transformation of 2a



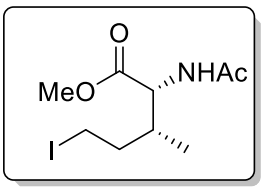
To a 25-mL vial equipped with a magnetic stirring bar was charged tetrasubstituted enamides **1a** (1.69 g, 10 mmol), [Rh(**L1**)(cod)]BF_4 (10 mg, 0.1 mol %, TONs = 1000) and dry THF (4 mL) under nitrogen. After stirred for 5 min at room temperature, the reaction mixture was transferred to an autoclave. The autoclave was purged with hydrogen three times and charged to 1000 psi. The mixture was stirred at room temperature for 12 h, and depressurized carefully in a well-ventilated hood. A crude reaction sample was passed through celite to remove metal precipitate and directly

analyzed by chiral HPLC to determine the conversions and ee values. The hydrogenation products were isolated in quantitative yields (1.69 g).

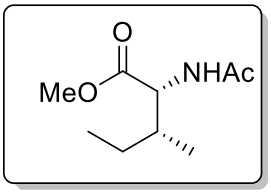




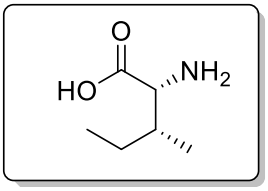
16: **2a** and dry MeOH (1 mL) was added to a dried Schlenk tube, the colorless transparent solution was stirred at room temperature for 1 h. The extra MeOH was removed in vacuo to give the desired product as colorless oil (99% yield). ^{1}H NMR (500 MHz, CD_3OD) δ 4.40 (d, *J* = 5.5 Hz, 1H), 3.72 (d, *J* = 3.3 Hz, 3H), 3.62 (dd, *J* = 6.8, 5.4 Hz, 1H), 3.57 (dd, *J* = 7.7, 6.4 Hz, 1H), 2.18 - 2.09 (m, 1H), 1.99 (s, 3H), 1.70 - 1.62 (m, 1H), 1.45 - 1.36 (m, 1H), 0.95 (d, *J* = 6.9 Hz, 3H). ^{13}C NMR (126 MHz, CD_3OD) δ 172.0 (s), 172.0 (s), 59.0 (s), 57.1 (s), 51.0 (s), 34.7 (s), 32.0 (s), 20.8 (s), 15.0 (s). ESI-MS: m/z 226.4 $[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_9H_{17}NNaO_4]^+$: 226.1050; found: 226.1056. $[\alpha]_D^{25}$ -409.8 (c 0.09, $CHCl_3$).



9: To a dry round-bottom bottle with a stirring bar was added I_2 (1.3 equiv) and DCM (2 mL), then PPh_3 (1.3 equiv) was added at 0 °C, the generated yellow solution was kept for 15 min, then imidazole (2.0 equiv) was added. After 15 min at room temperature, **16** (1.0 equiv) in DCM was added via syringe dropwise and the generated pale-yellow suspension was kept for about 3 hours. The mixture was concentrated, and column chromatography (PE:EA=3:1) to obtain desired product as white solid in 93% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.03 (d, *J* = 7.1 Hz, 1H), 4.61 (dd, *J* = 8.4, 5.0 Hz, 1H), 3.76 (s, 3H), 3.29 (d, *J* = 4.9 Hz, 1H), 3.12 (d, *J* = 9.1 Hz, 1H), 2.10 (s, 1H), 2.04 (s, 3H), 2.00 - 1.91 (m, 1H), 1.74 - 1.66 (m, 1H), 0.92 (d, *J* = 6.9 Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.1 (s), 169.8 (s), 55.9 (s), 52.4 (s), 37.4 (s), 36.5 (s), 23.3 (s), 15.1 (s), 3.5 (s). ESI-MS: m/z 314.1 $[M+H]^+$, 335.9 $[M+Na]^+$; HRMS (ESI) calculated for [M+H, $C_9H_{16}INNaO_3]^+$: 336.0067; found: 336.0071. $[\alpha]_D^{25}$ -163.3 (c 0.11, $CHCl_3$).

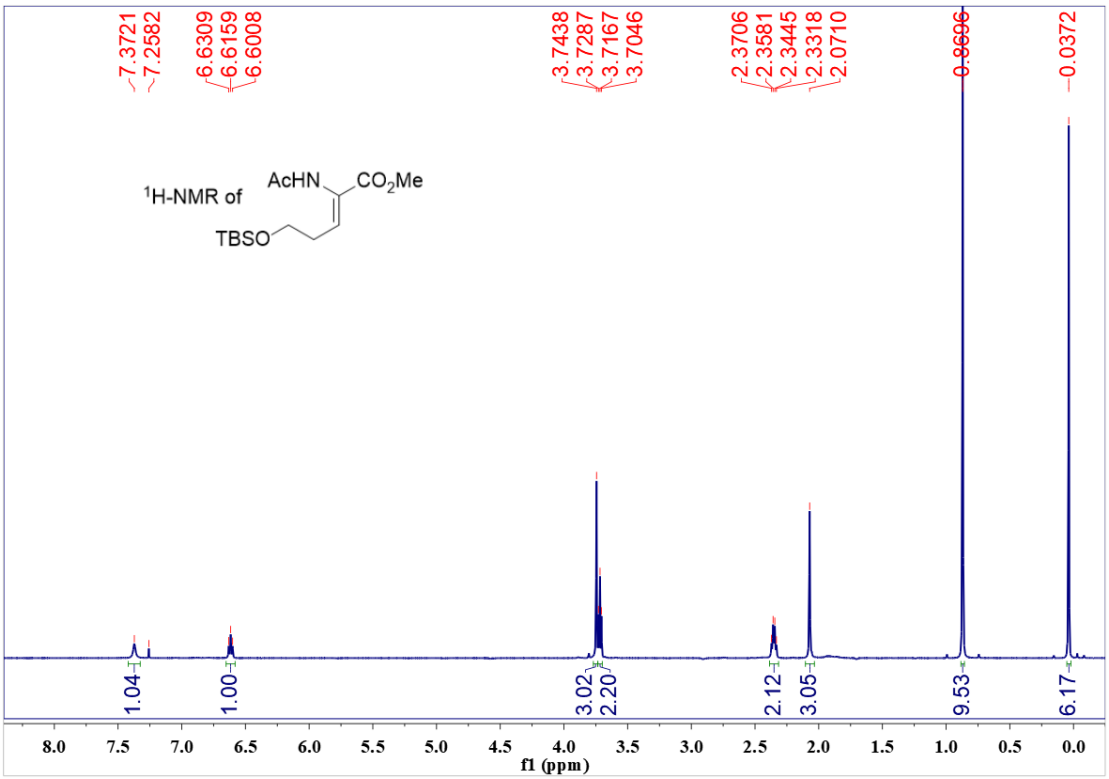


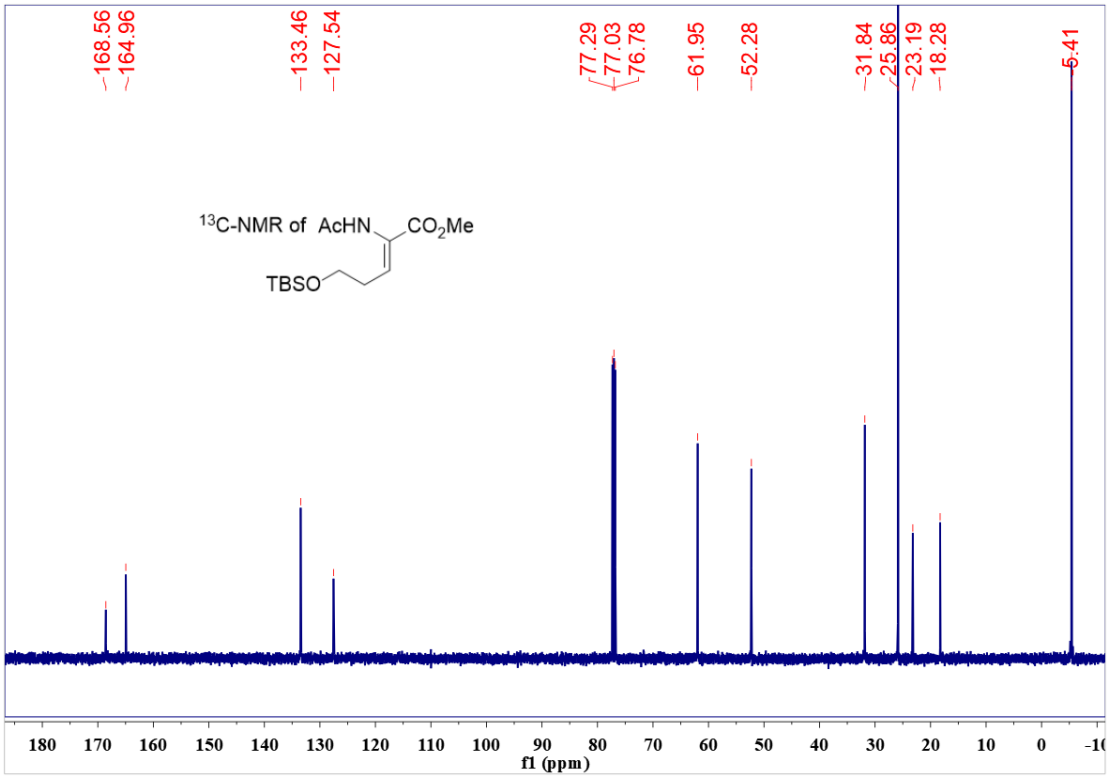
17: To a round-bottom bottle with a stirring bar was added **9** (1.0 equiv) in THF (2 mL) and then Raney Nickel (in H_2O, 2 equiv). The mixture was kept at room temperature for 1 h and extracted with H_2O/EtOAc (three times). The combined organic layers were concentrated and purified by silica gel column chromatography to give the desired product compound as white solid in 93% yield. ^{1}H NMR (500 MHz, $CDCl_3$) δ 6.05 (s, 1H), 4.70 (m, 1H), 3.71 (s, 3H), 2.02 (s, 3H), 1.93 - 1.86 (m, 1H), 1.43 - 1.34 (m, 1H), 1.19 - 1.09 (m, 1H), 0.92 (t, *J* = 6.4 Hz, 3H), 0.84 (d, *J* = 8.9 Hz, 3H). ^{13}C NMR (126 MHz, $CDCl_3$) δ 173.1 (s), 170.1 (s), 55.3 (s), 52.2 (s), 37.7 (s), 26.1 (s), 23.2 (s), 14.6 (s), 11.7 (s). $[\alpha]_D^{25}$ -333.8 (c 0.04, $CHCl_3$).

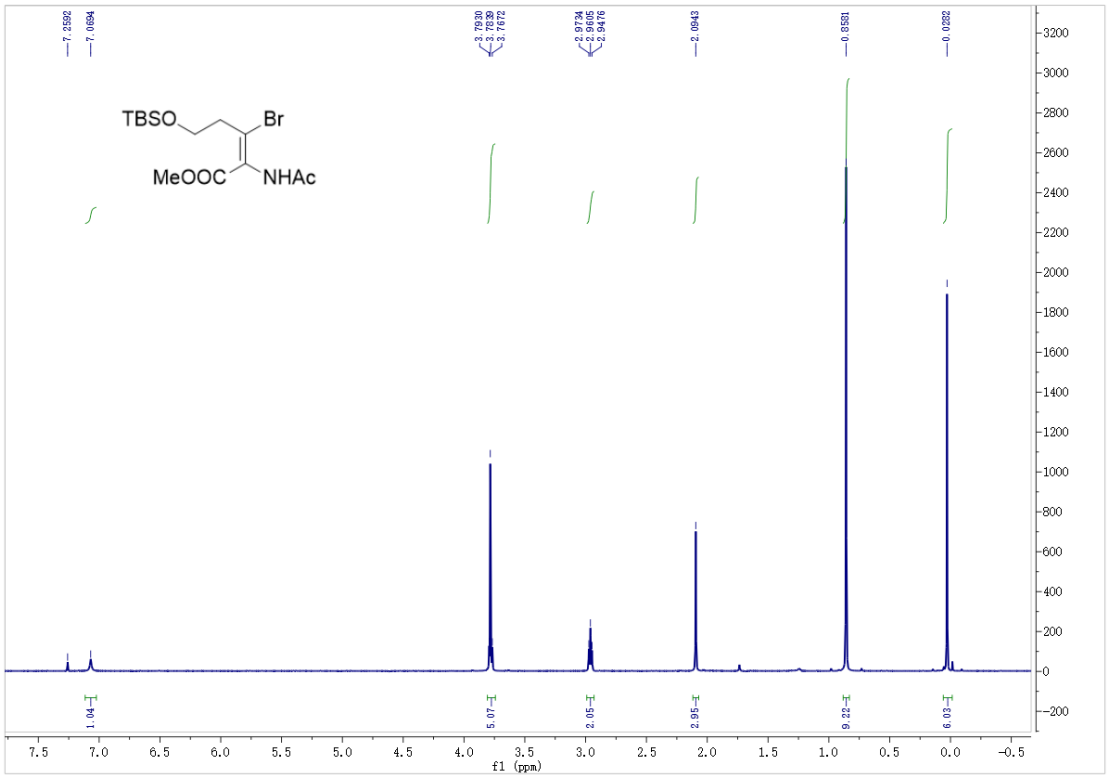


10: To a sealed tube with a stirring bar was added **17** and conc. HCl (2 mL). The mixture was kept at 80 °C for 3 h. Then, the solvent was removed in vacuo and the mixture was purified through Dowex (H^+ type) to obtain the desired product as white solid (85% yield). ^{1}H NMR (500 MHz, d_2o) δ 3.69 (d, *J* = 3.5 Hz, 1H), 2.02 (m, 1H), 1.39 - 1.34 (m, 1H), 1.34 - 1.25 (m, 1H), 0.94 - 0.88 (m, 6H). ^{13}C NMR (126 MHz, d_2o) δ 174.6 (s), 58.3 (s), 35.5 (s), 25.4 (s), 13.1 (s), 10.9 (s). $[\alpha]_D^{25}$ -121.4 (c 0.03, H_2O).

6. **Original NMR Data of substrates**



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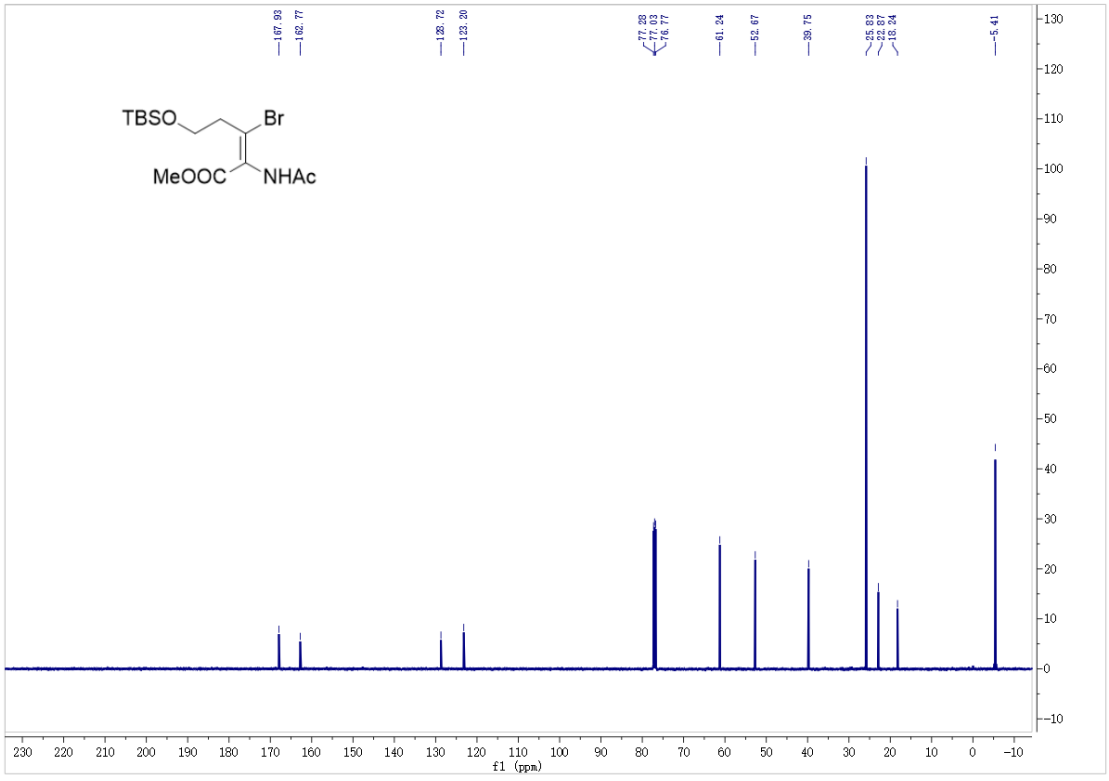
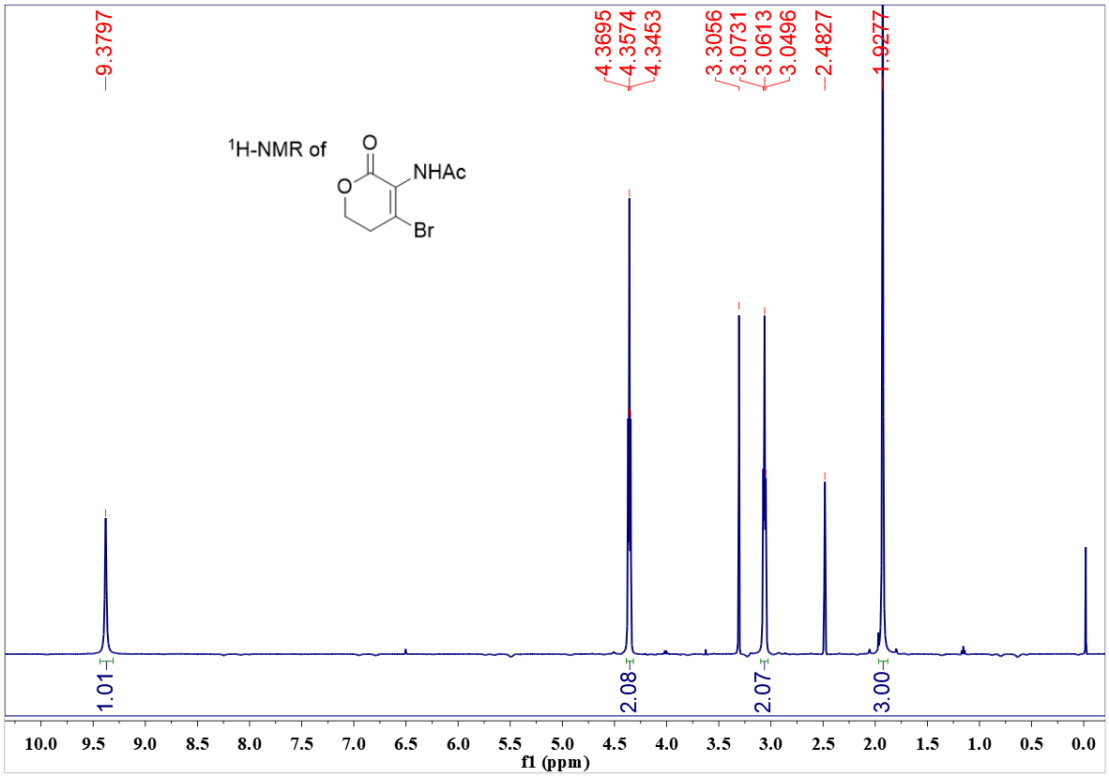
Br
MeOOC
NHAc
f1 (ppm)


TBSO
Br
MeOOC
NHAc
f1 (ppm)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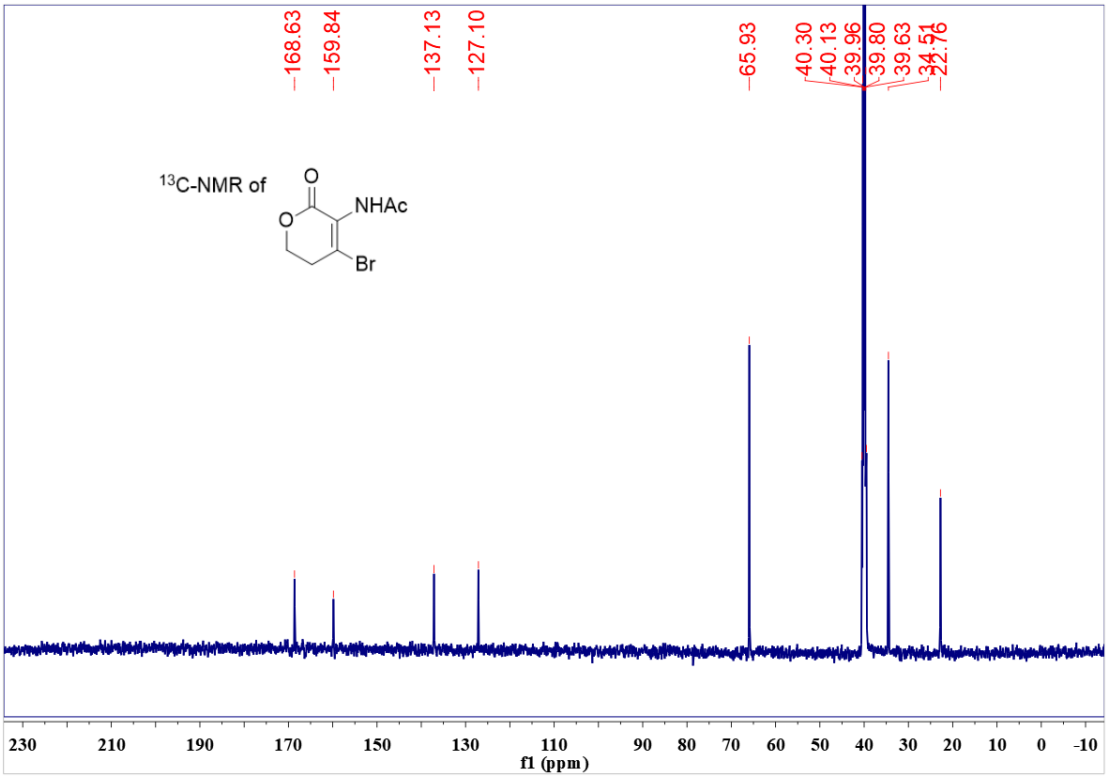
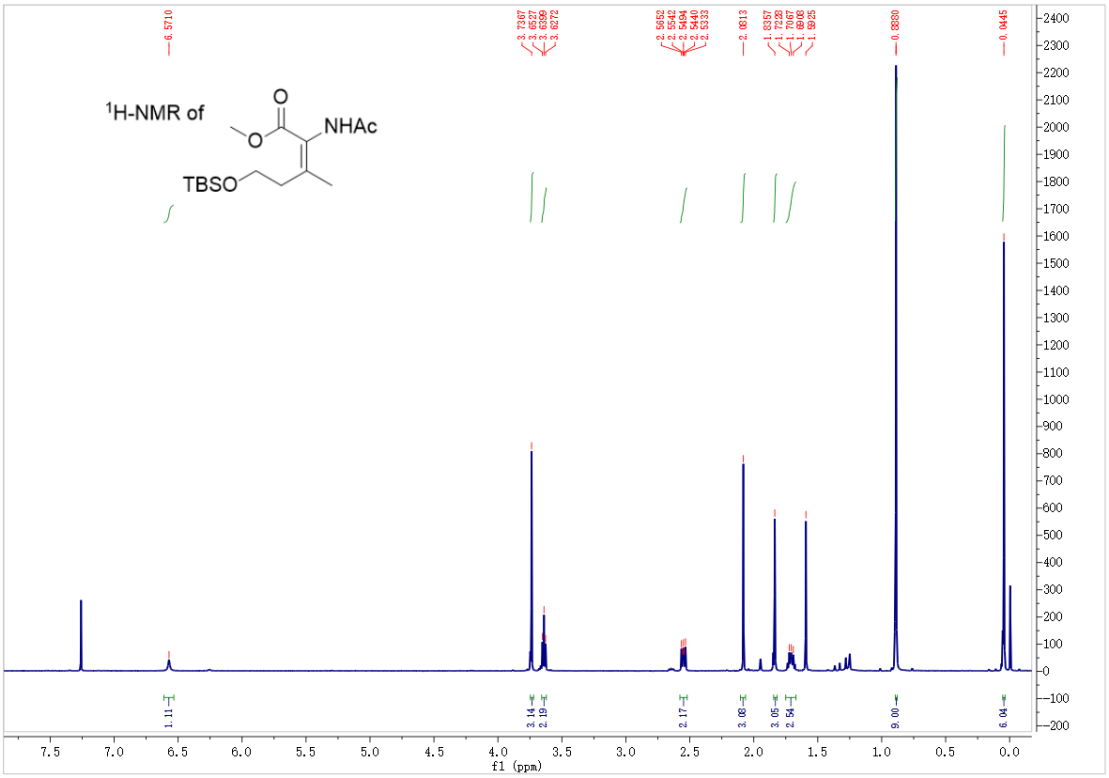
4.3695
4.3574
4.3453
3.3056
3.0731
3.0613
3.0496
2.4827
1.9277
1H-NMR of
O
NHAc
O
Br
1.01
2.08
2.07
3.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


168.63
159.84
137.13
127.10
65.93
40.30
40.13
39.96
39.80
39.63
34.51
22.76
13C-NMR of
O
NHAc
O
Br
230 210 190 170 150 130 110 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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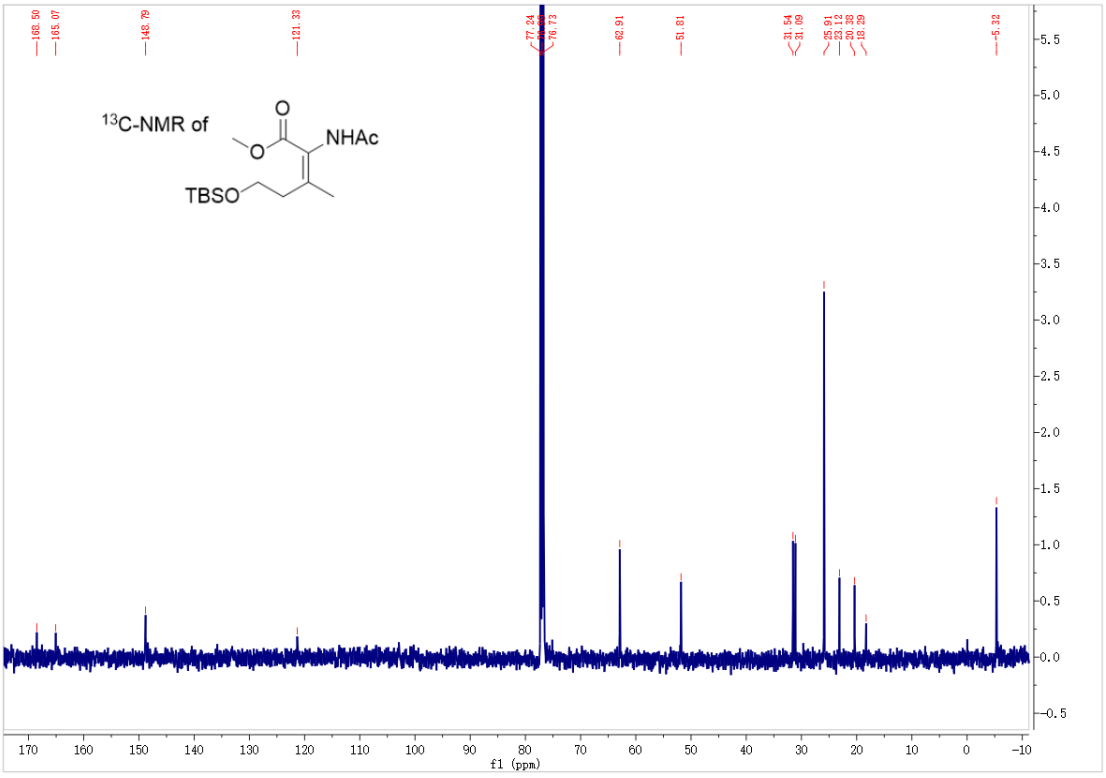
NHAc
TBSO
f1 (ppm)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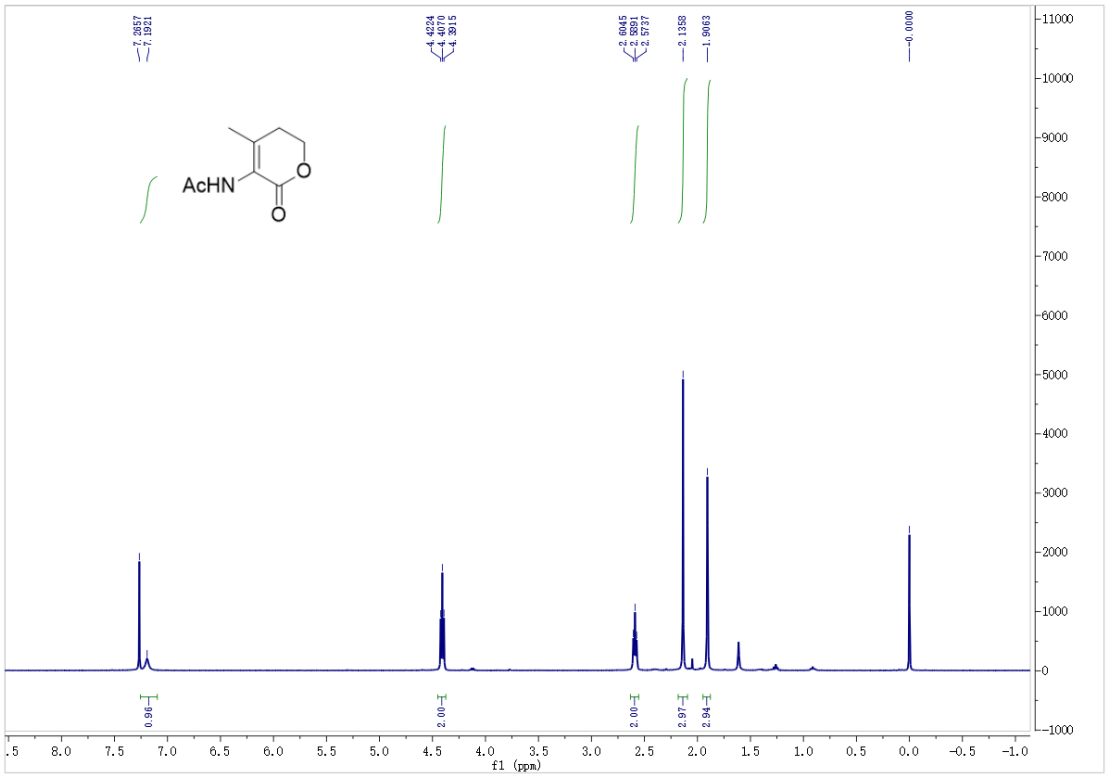
NHAc
TBSO
f1 (ppm)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4.4070
4.3915
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2.5891
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AcHN
O
O
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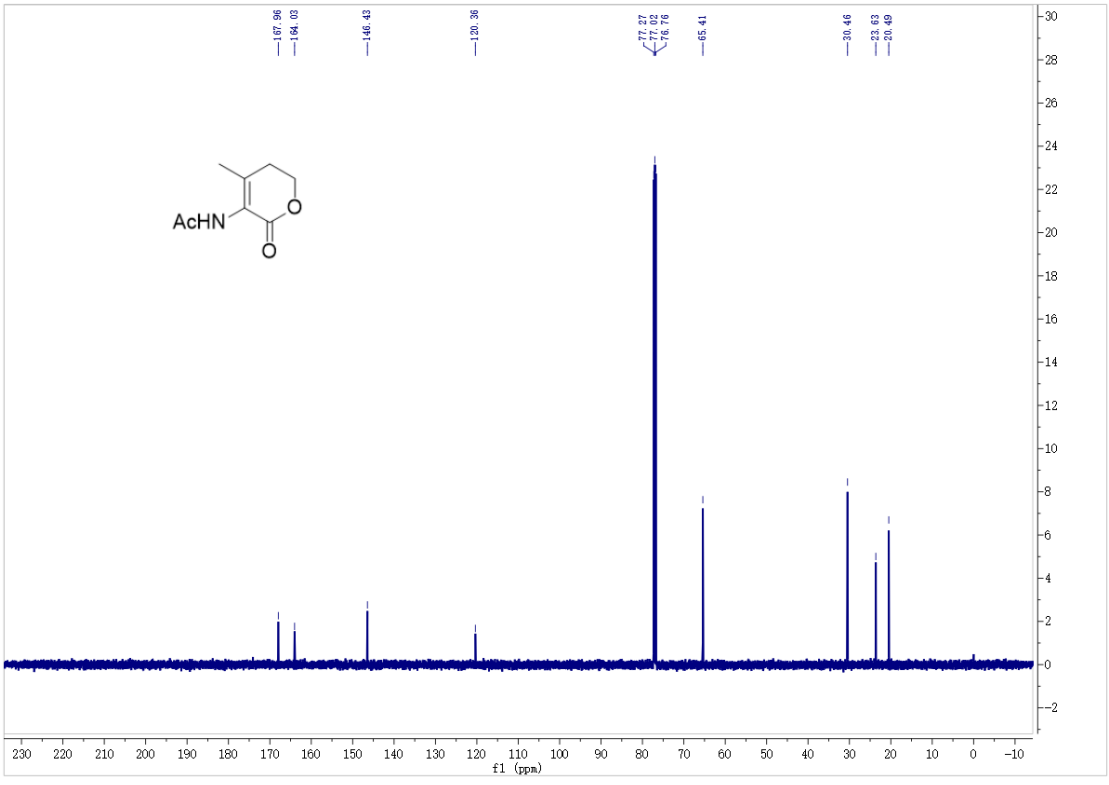
2.00
2.00
2.97
2.94
f1 (ppm)


167.96
164.03
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120.36
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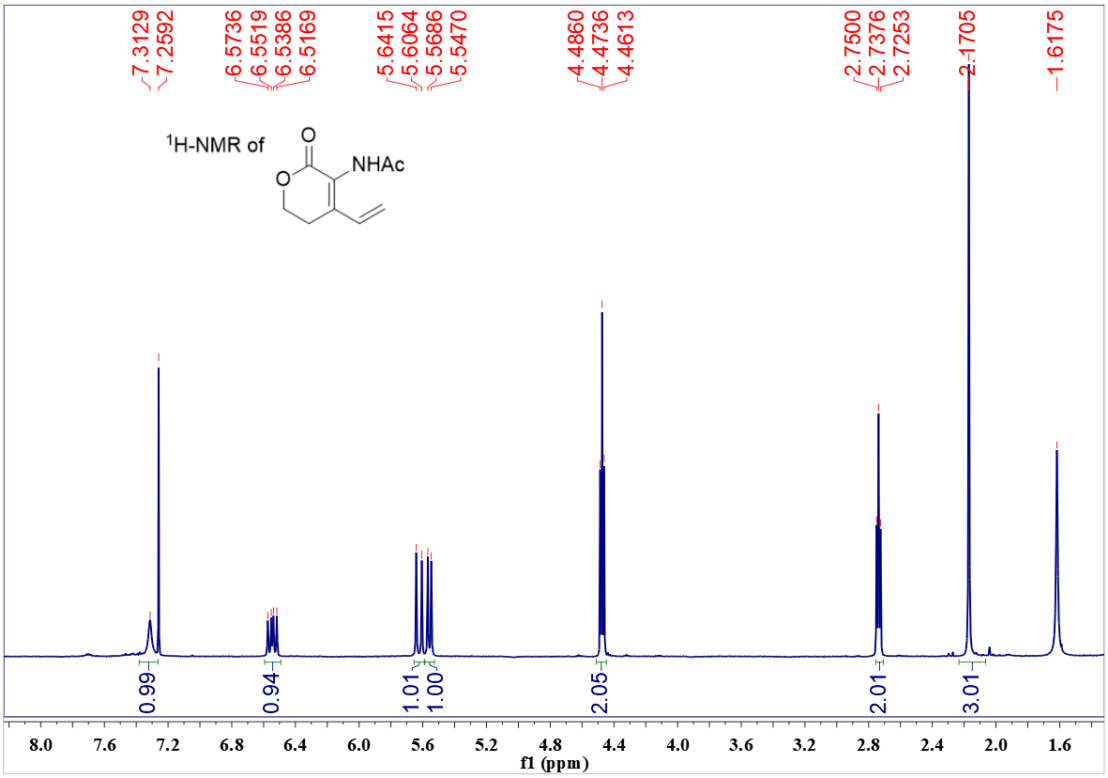
77.02
76.76
65.41
30.46
23.63
20.49
AcHN
O
O
f1 (ppm)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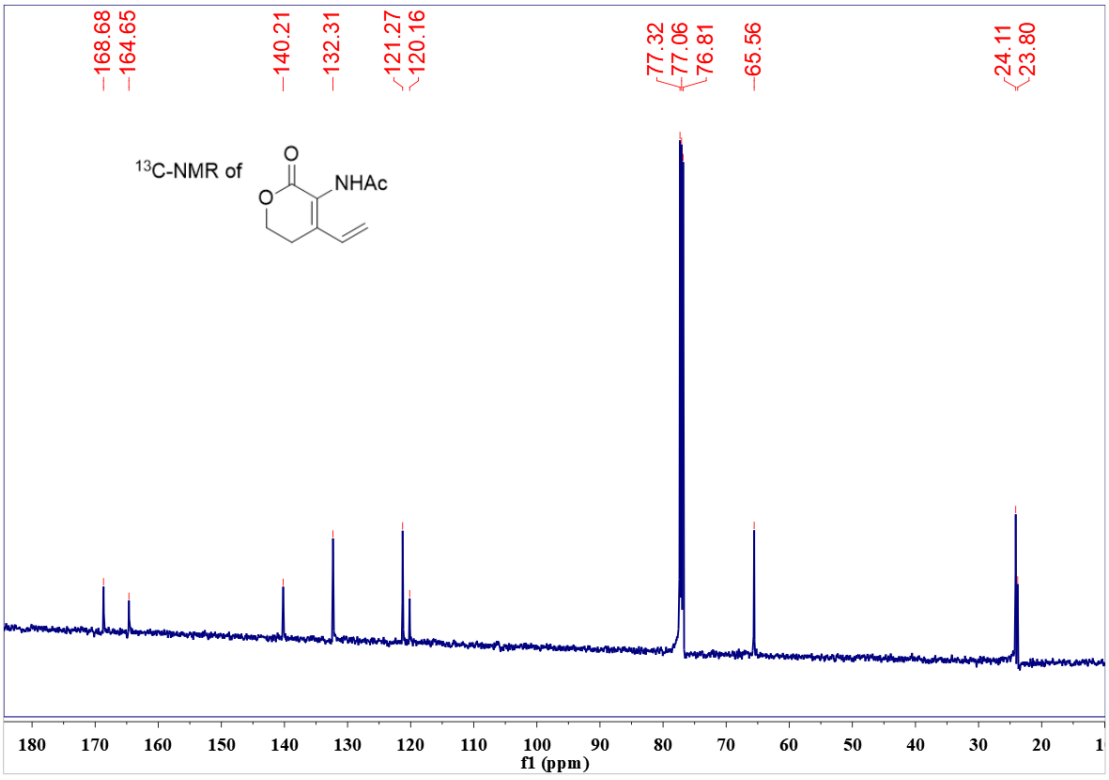
6.5519
6.5386
6.5169
5.6415
5.6064
5.5686
5.5470
4.4860
4.4736
4.4613
2.7500
2.7376
2.7253
2.1705
1.6175
1H-NMR of
NHAc
0.99
0.94
1.01
1.00
2.05
2.01
3.01
f1 (ppm)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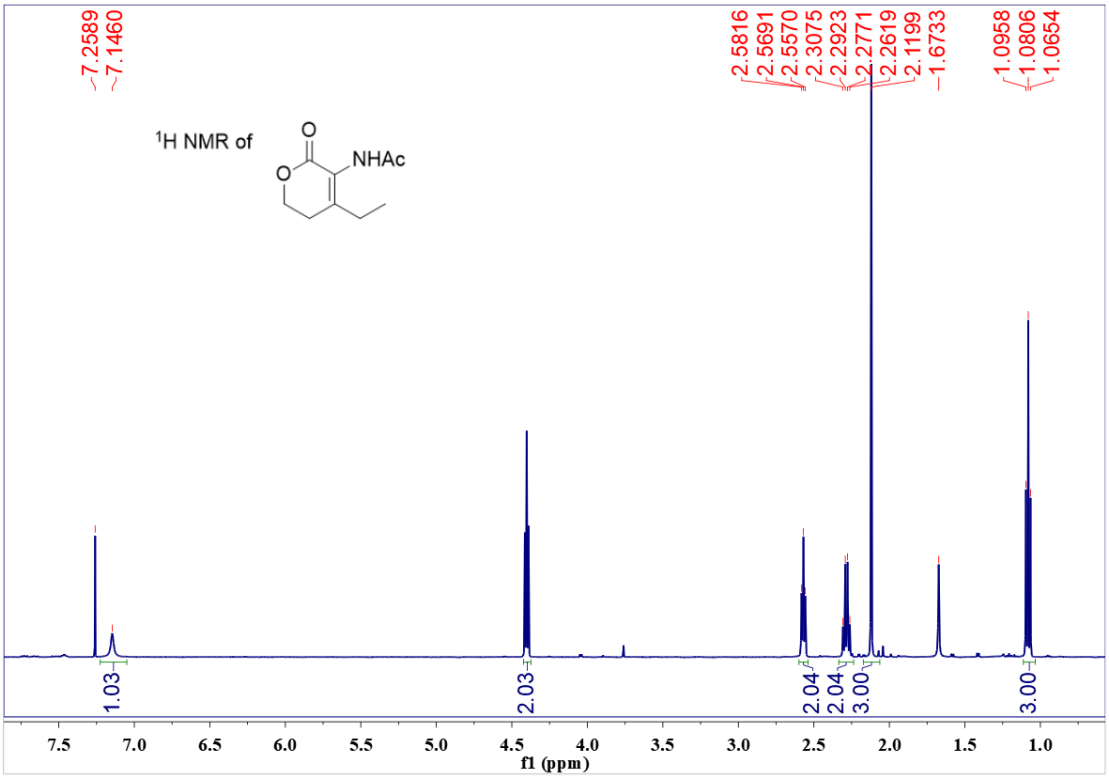
164.65
140.21
132.31
121.27
120.16
77.32
77.06
76.81
65.56
24.11
23.80
13C-NMR of
NHAc
f1 (ppm)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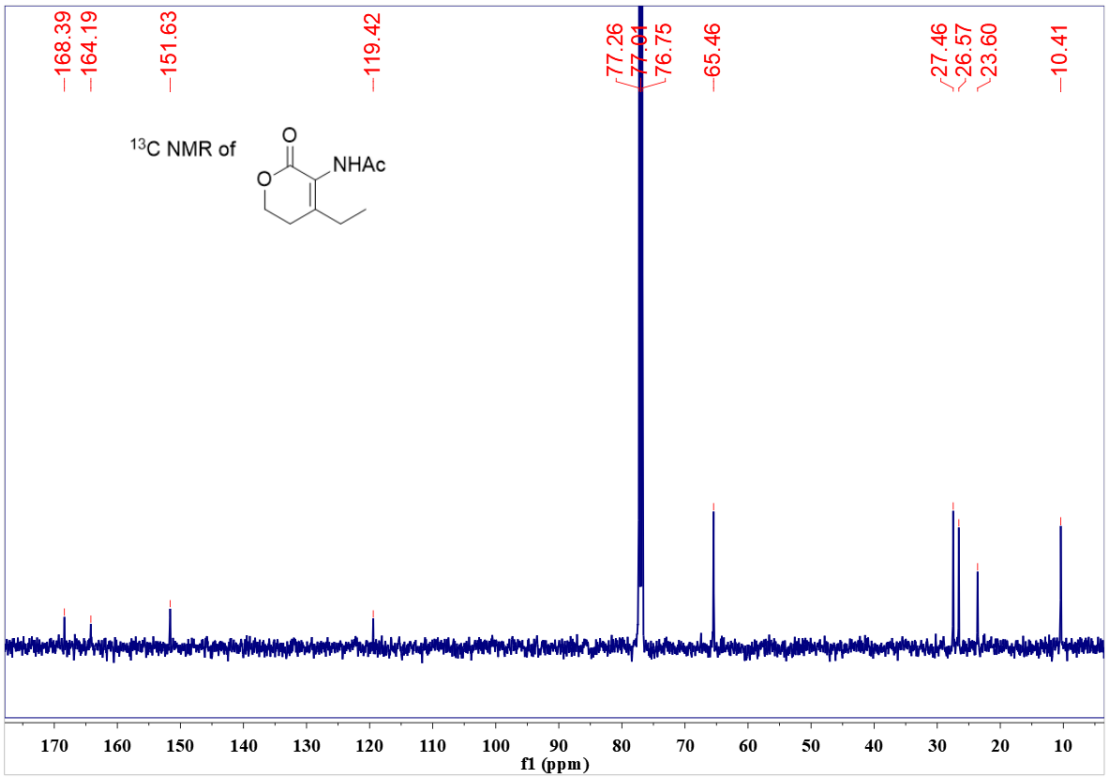
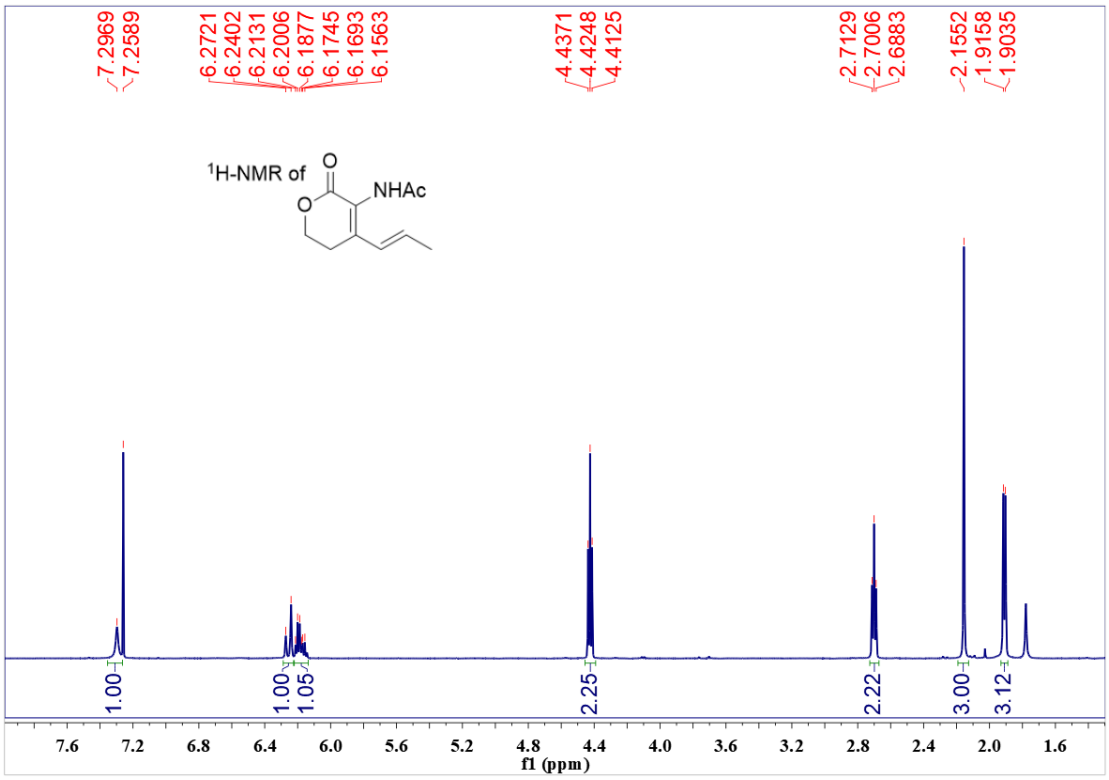
7.1460
2.5816
2.5691
2.5570
2.3075
2.2923
2.2771
2.2619
2.1199
1.6733
1.0958
1.0806
1.0654
1H NMR of
NHAc
1.03
2.03
2.04
2.04
3.00
3.00
f1 (ppm)


168.39
164.19
151.63
119.42
77.26
77.01
76.75
65.46
27.46
26.57
23.60
10.41
13C NMR of
NHAc
f1 (ppm)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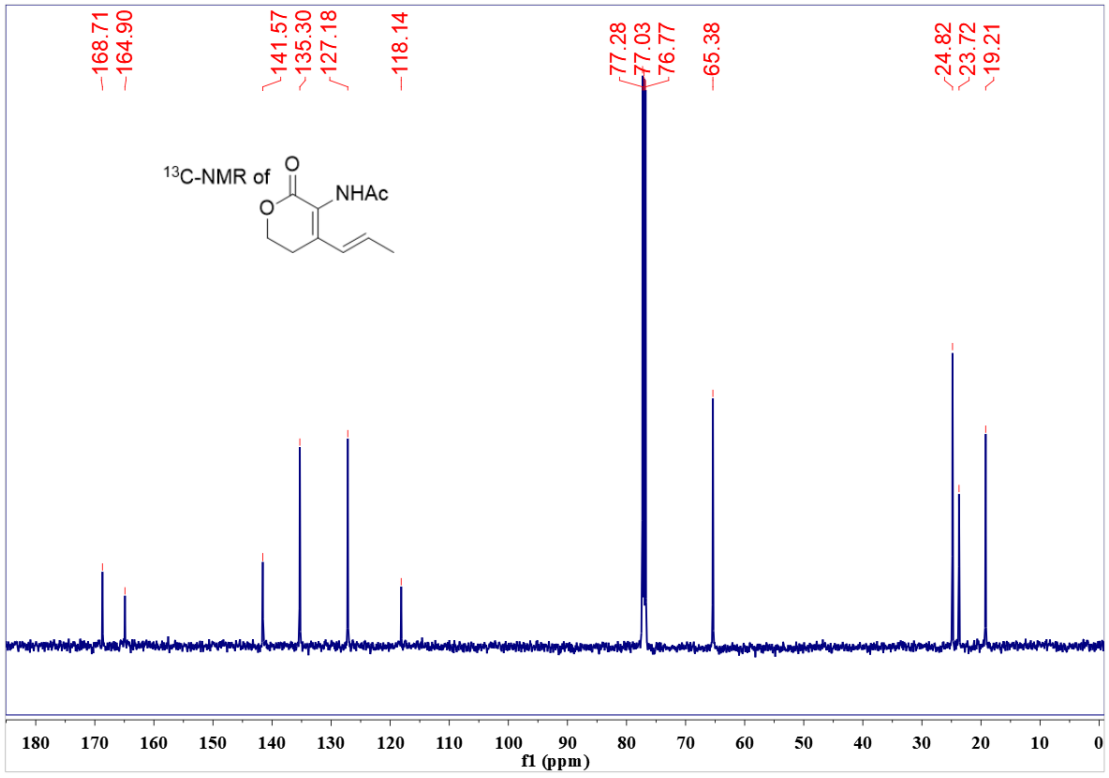
7.2589
6.2721
6.2402
6.2131
6.2006
6.1877
6.1745
6.1693
6.1563
4.4371
4.4248
4.4125
2.7129
2.7006
2.6883
2.1552
1.9158
1.9035
^{1}H-NMR of
O
O
NHAc
1.00
1.00
1.05
2.25
2.22
3.00
3.12
7.6
7.2
6.8
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
f1 (ppm)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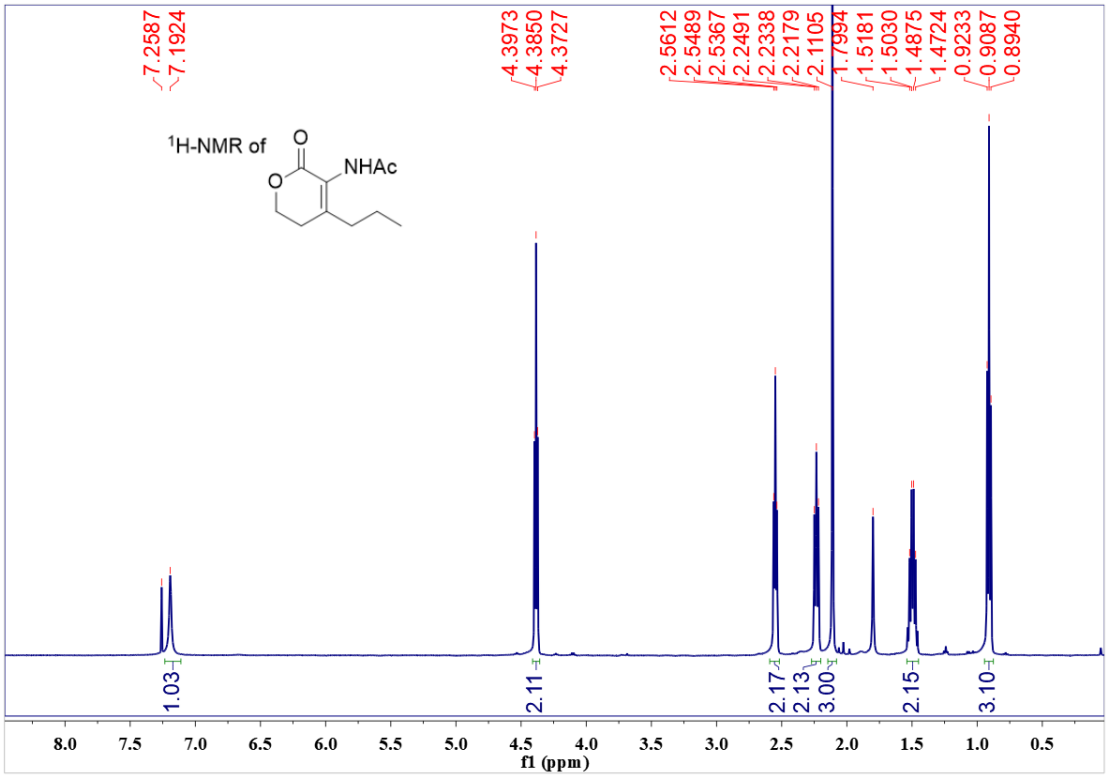
141.57
135.30
127.18
118.14
77.28
77.03
76.77
65.38
24.82
23.72
19.21
^{13}C-NMR of
O
O
NHAc
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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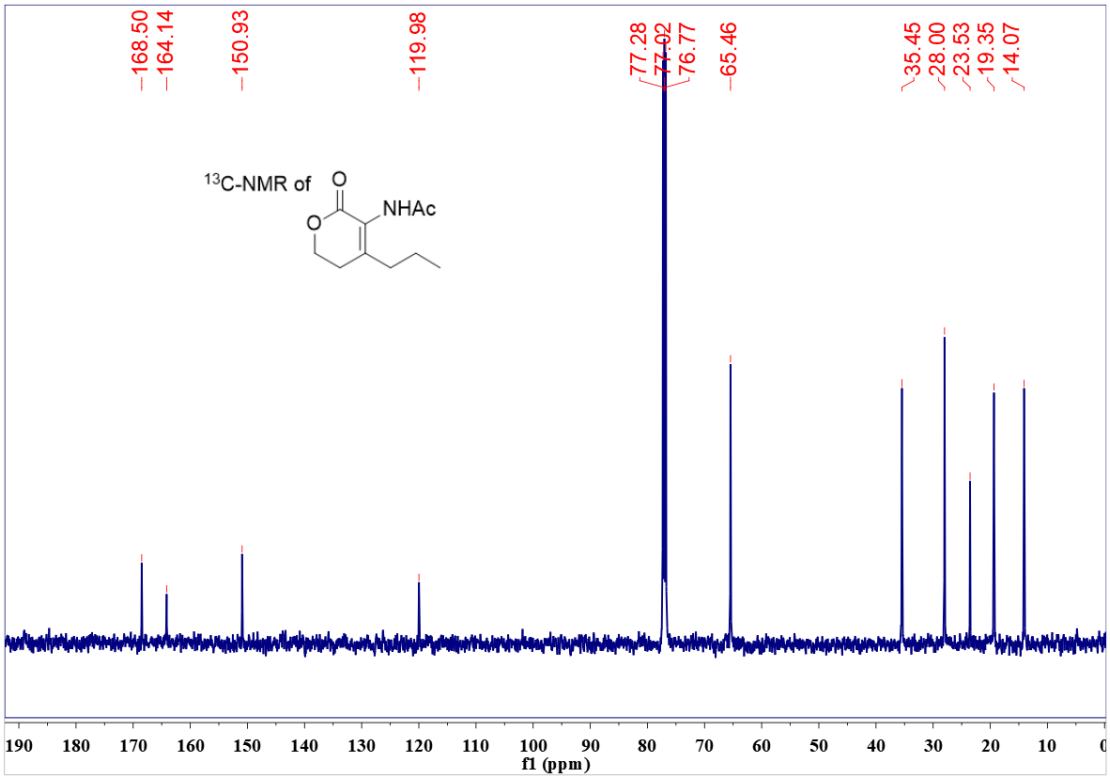
7.1924
4.3973
4.3850
4.3727
2.5612
2.5489
2.5367
2.2491
2.2338
2.2179
2.1105
1.7994
1.5181
1.5030
1.4875
1.4724
0.9233
0.9087
0.8940
^{1}H-NMR of
O
O
NHAc
1.03
2.11
2.17
2.13
3.00
2.15
3.10
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)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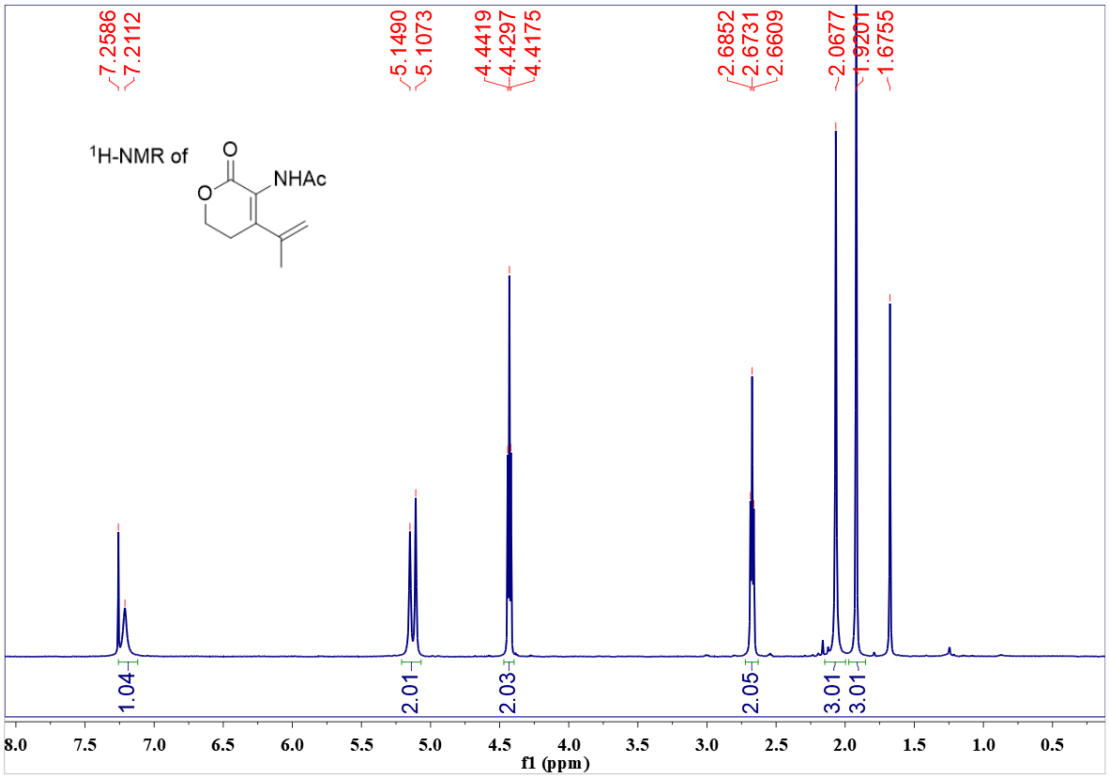
164.14
150.93
119.98
77.28
77.02
76.77
65.46
35.45
28.00
23.53
19.35
14.07
^{13}C-NMR of
O
O
NHAc
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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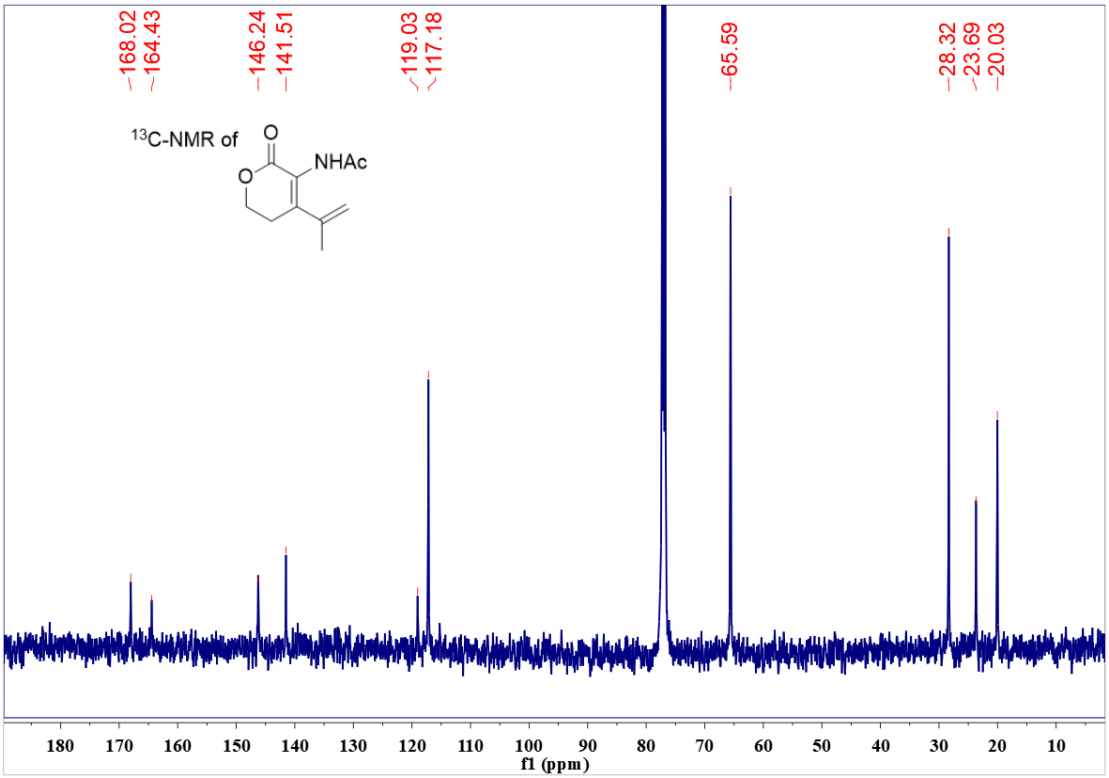
7.2112
5.1490
5.1073
4.4419
4.4297
4.4175
2.6852
2.6731
2.6609
2.0677
1.9201
1.6755
1H-NMR of
NHAc
1.04
2.01
2.03
2.05
3.01
3.01
f1 (ppm)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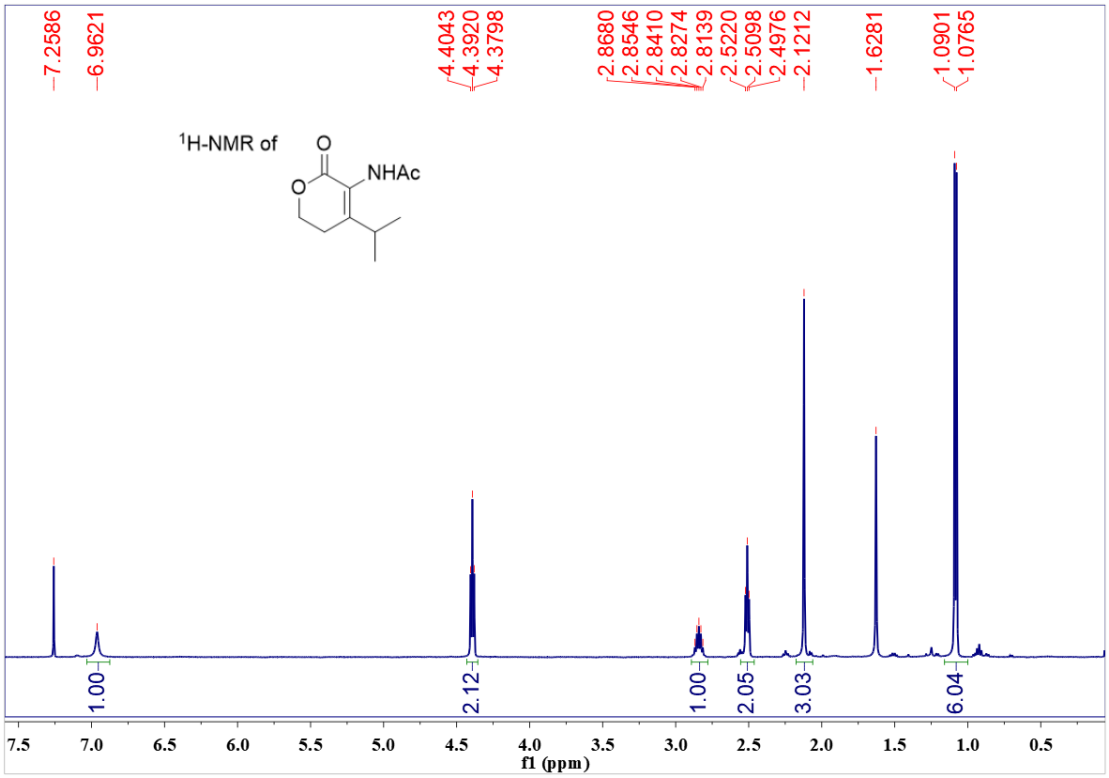
164.43
146.24
141.51
119.03
117.18
65.59
28.32
23.69
20.03
13C-NMR of
NHAc
f1 (ppm)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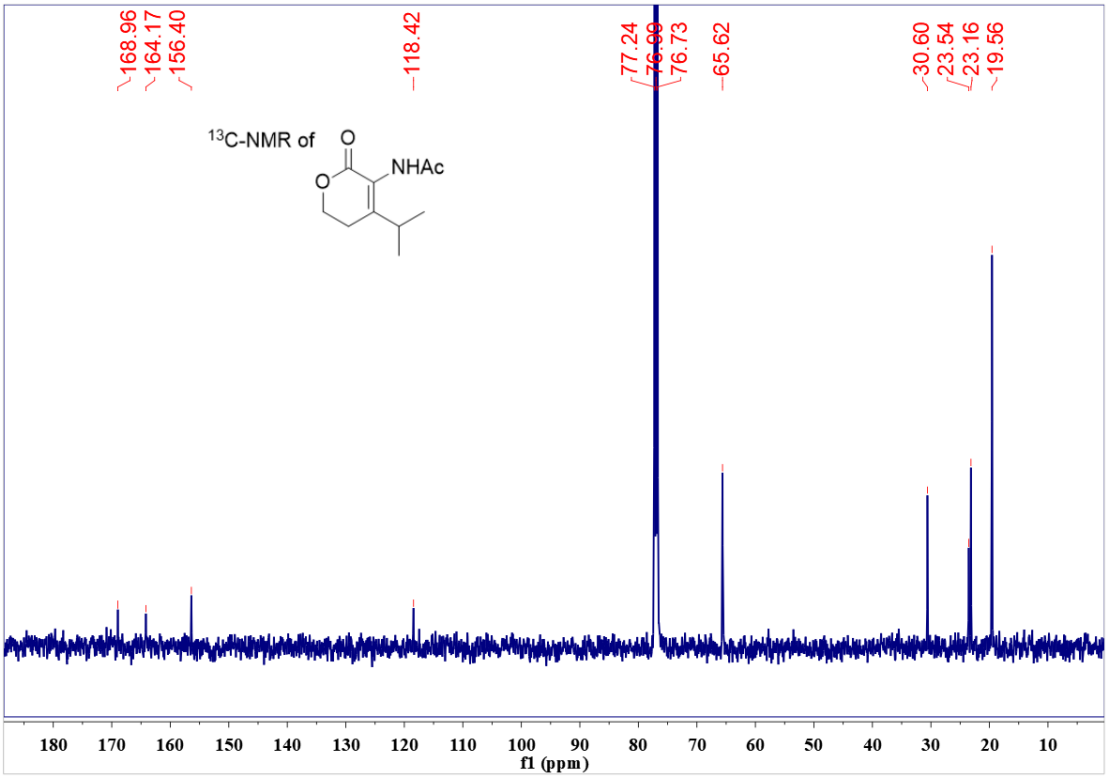
6.9621
4.4043
4.3920
4.3798
2.8680
2.8546
2.8410
2.8274
2.8139
2.5220
2.5098
2.4976
2.1212
1.6281
1.0901
1.0765
1H-NMR of
O
O
NHAc
1.00
2.12
1.00
2.05
3.03
6.04
7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)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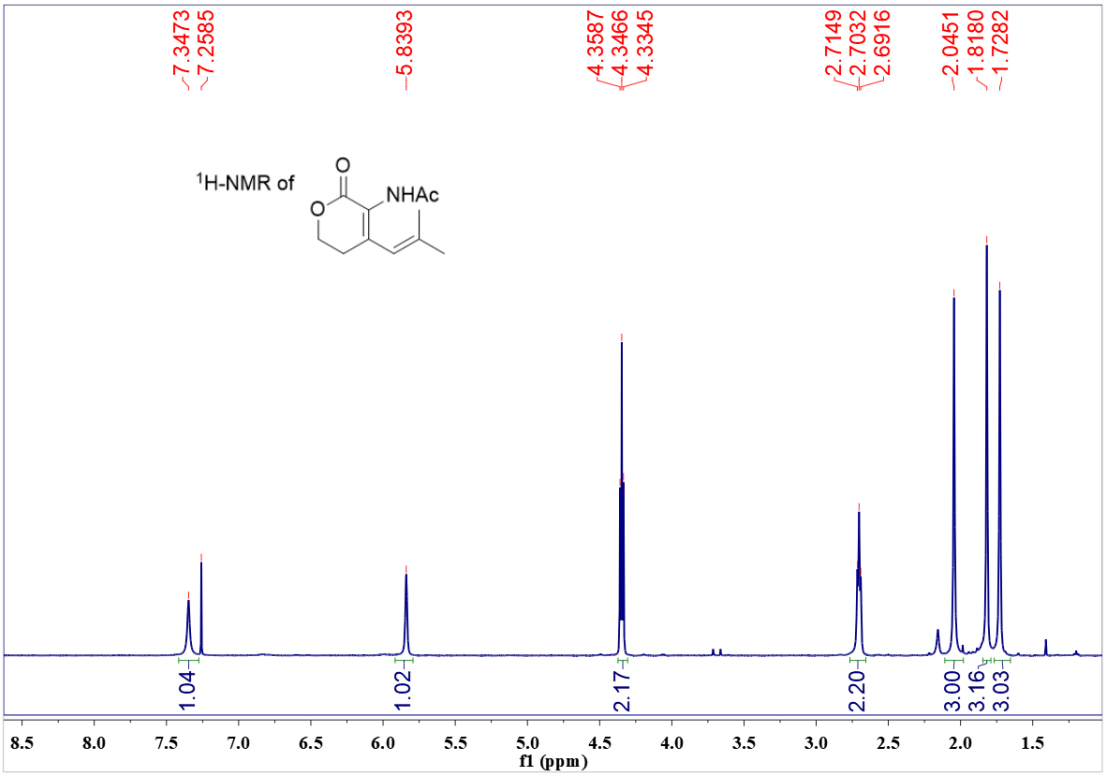
164.17
156.40
118.42
77.24
76.99
76.73
65.62
30.60
23.54
23.16
19.56
13C-NMR of
O
O
NHAc
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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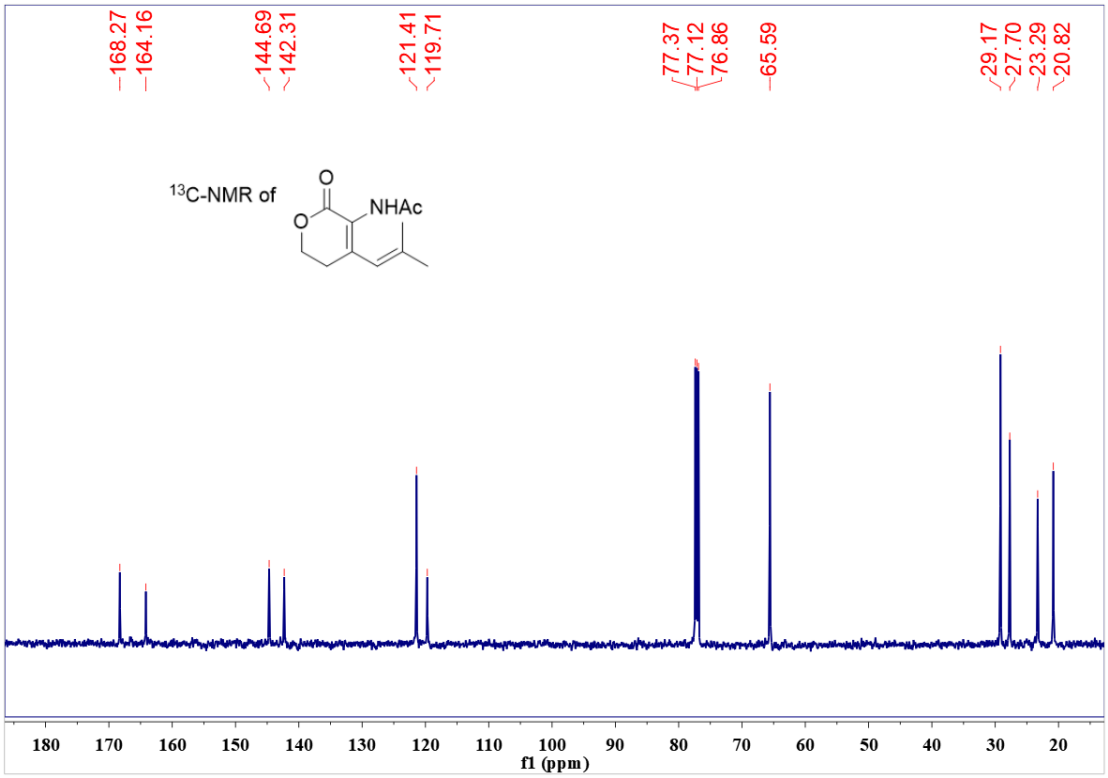
7.2585
5.8393
4.3587
4.3466
4.3345
2.7149
2.7032
2.6916
2.0451
1.8180
1.7282
1H-NMR of
O
O
NHAc
1.04
1.02
2.17
2.20
3.00
3.16
3.03
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5
f1 (ppm)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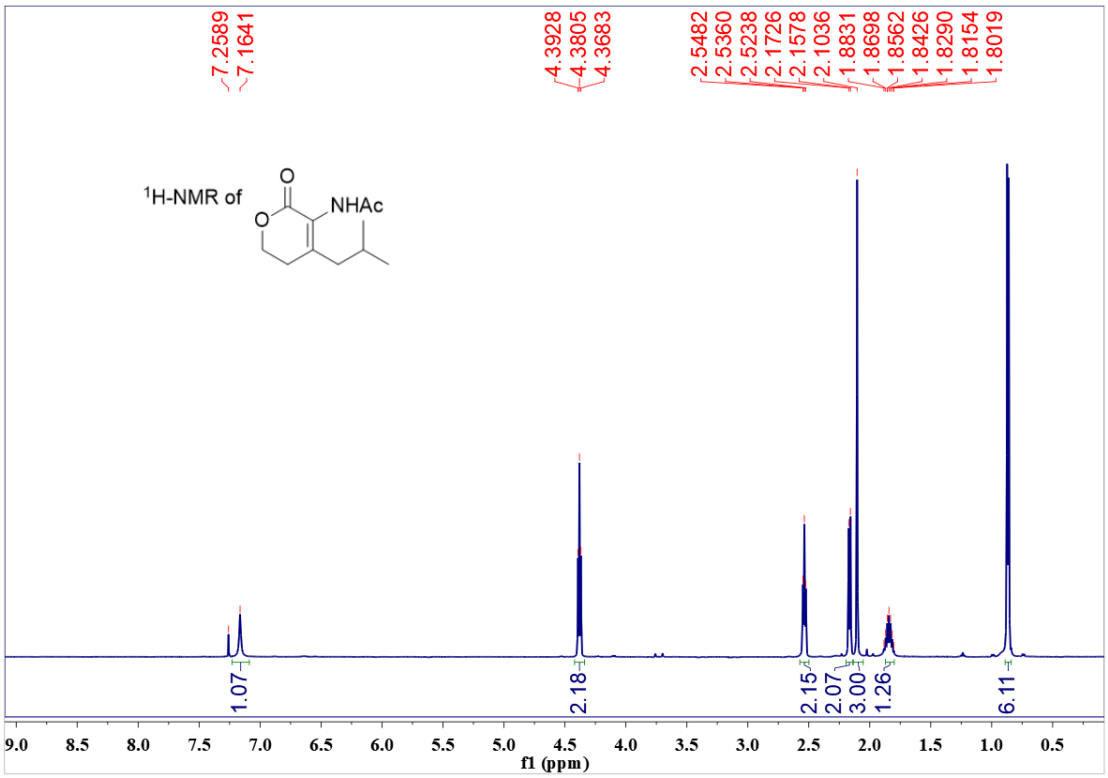
164.16
144.69
142.31
121.41
119.71
77.37
77.12
76.86
65.59
29.17
27.70
23.29
20.82
13C-NMR of
O
O
NHAc
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20
f1 (ppm)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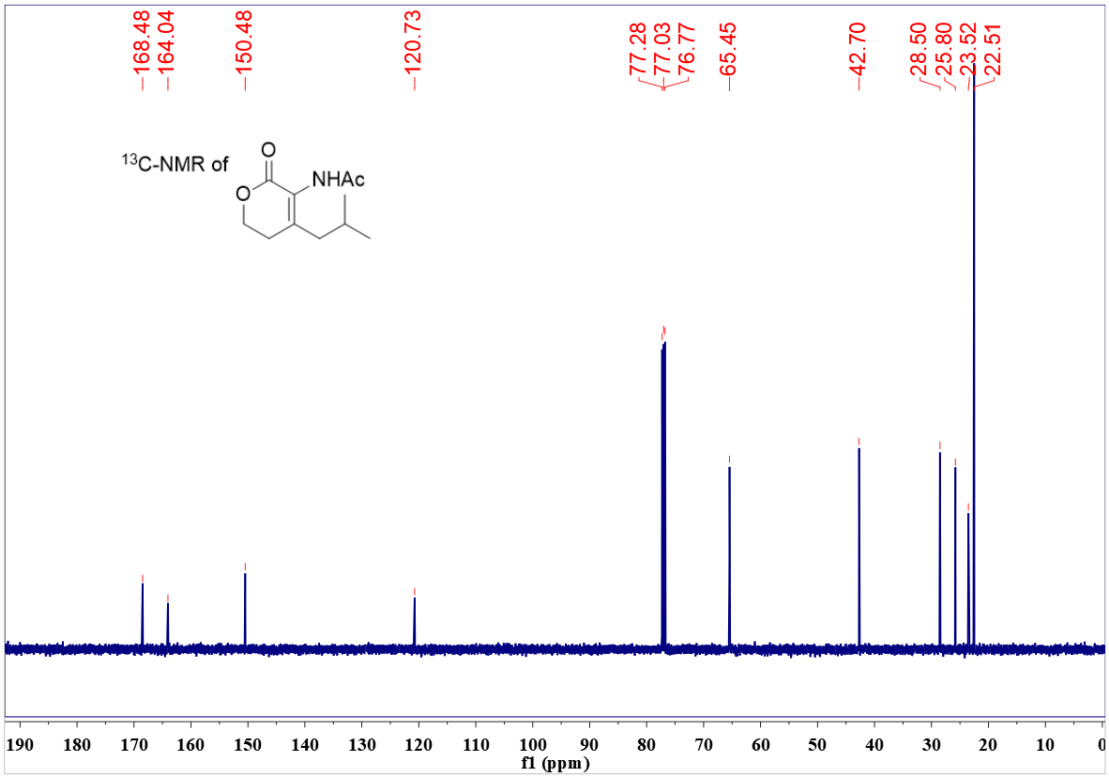
7.1641
4.3928
4.3805
4.3683
2.5482
2.5360
2.5238
2.1726
2.1578
2.1036
1.8831
1.8698
1.8562
1.8426
1.8290
1.8154
1.8019
1H-NMR of
NHAc
1.07
2.18
2.15
2.07
3.00
1.26
6.11
f1 (ppm)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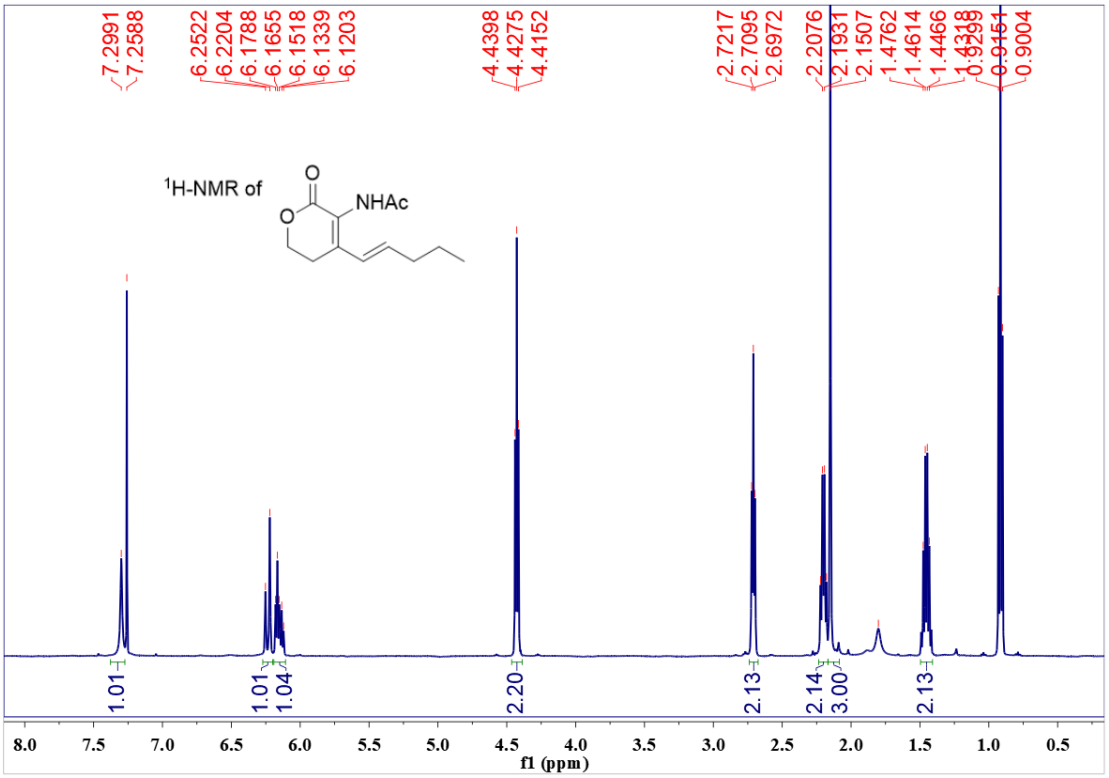
164.04
150.48
120.73
77.28
77.03
76.77
65.45
42.70
28.50
25.80
23.52
22.51
13C-NMR of
NHAc
f1 (ppm)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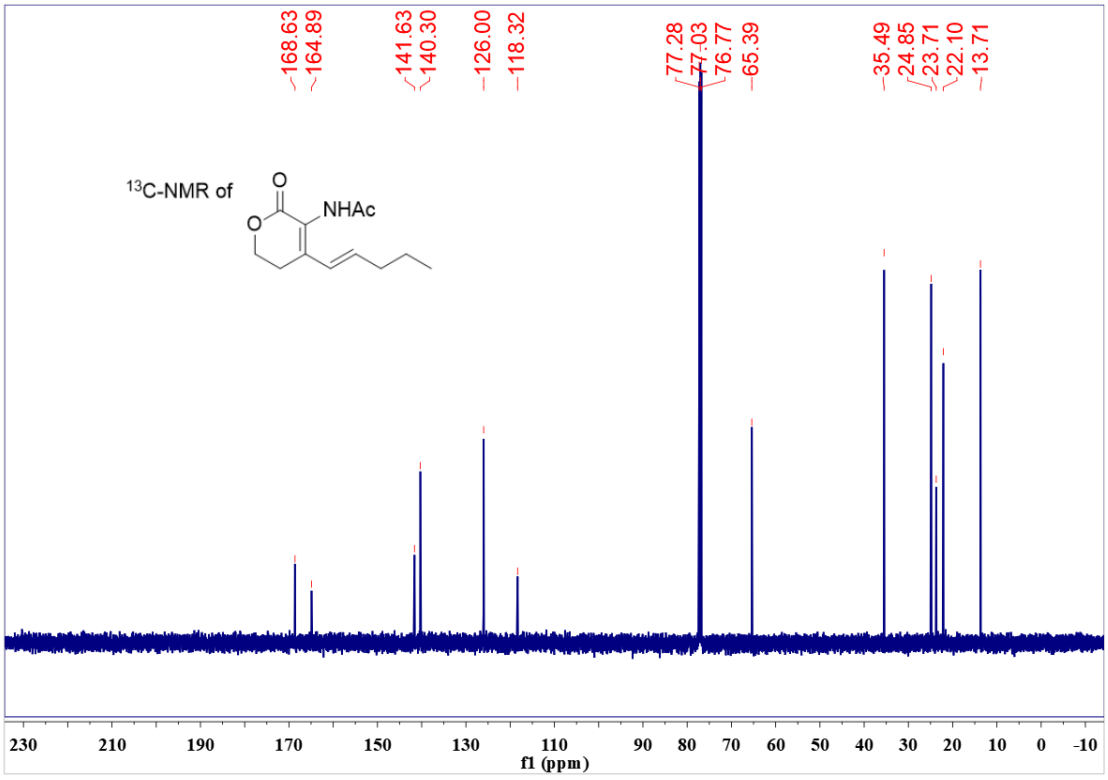
7.2588
6.2522
6.2204
6.1788
6.1655
6.1518
6.1339
6.1203
4.4398
4.4275
4.4152
2.7217
2.7095
2.6972
2.2076
2.1931
2.1507
1.4762
1.4614
1.4466
1.4318
0.9299
0.9161
0.9004
1H-NMR of
O
O
NHAc
1.01
1.01
1.04
2.20
2.13
2.14
3.00
2.13
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)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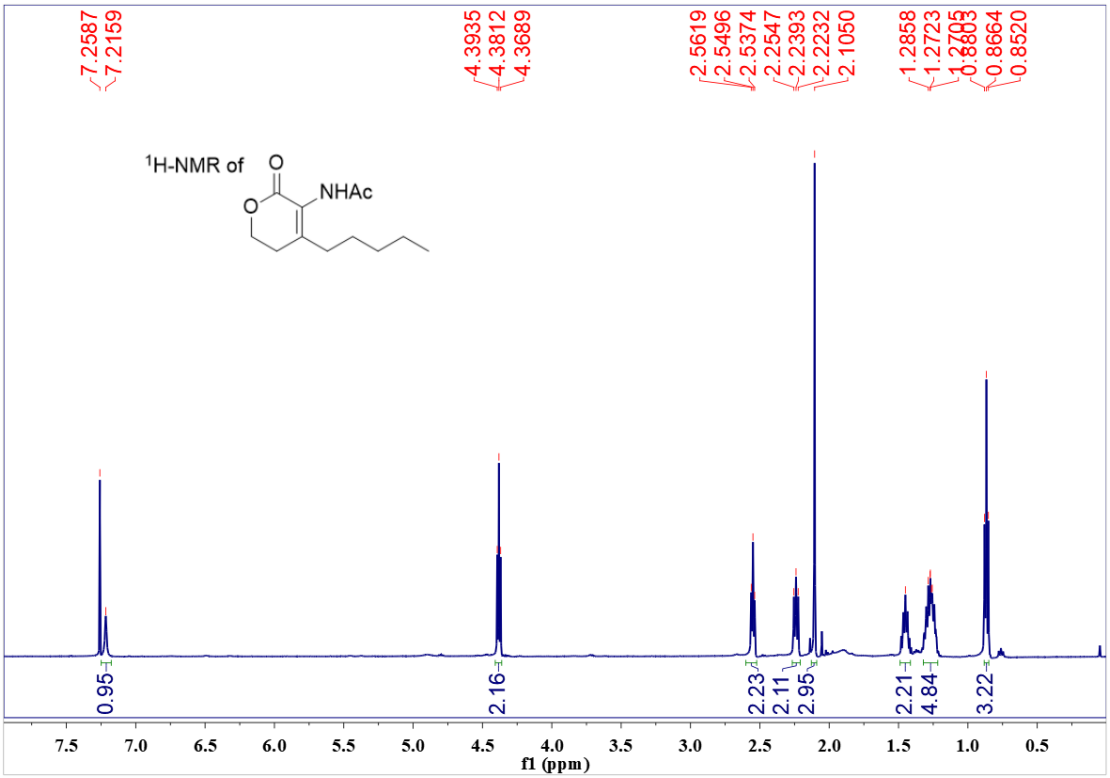
164.89
141.63
140.30
126.00
118.32
77.28
77.03
76.77
65.39
35.49
24.85
23.71
22.10
13.71
13C-NMR of
O
O
NHAc
230 210 190 170 150 130 110 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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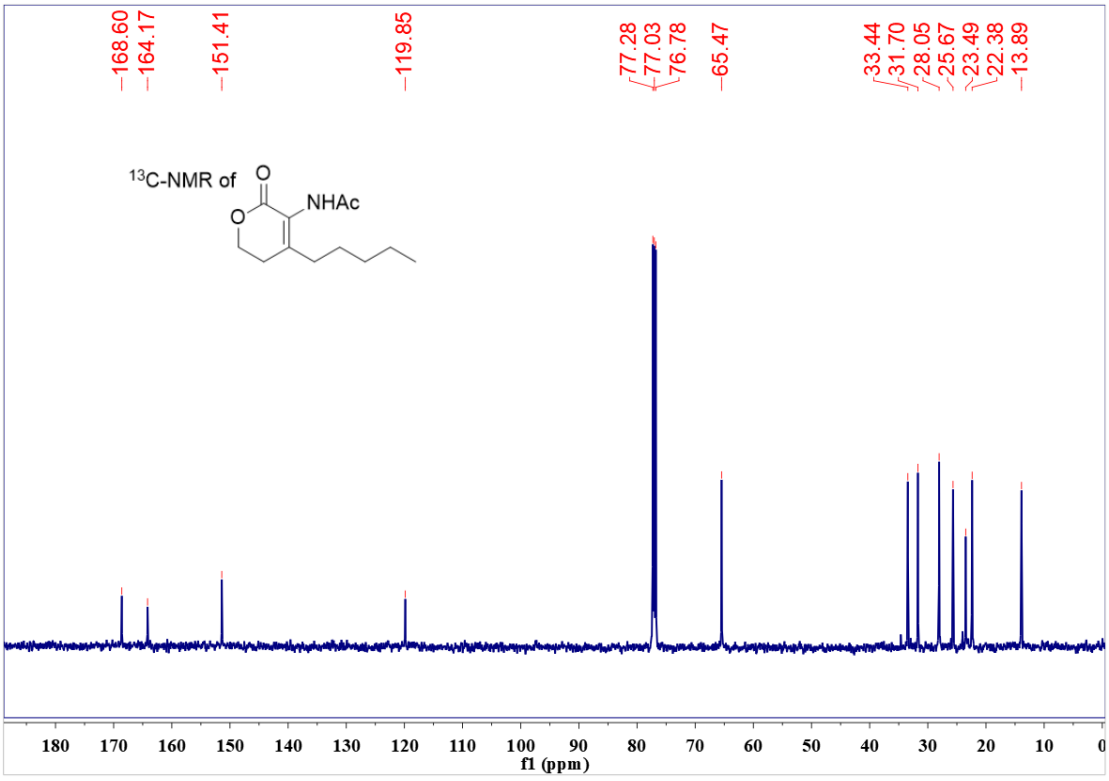
7.2159
4.3935
4.3812
4.3689
2.5619
2.5496
2.5374
2.2547
2.2393
2.2232
2.1050
1.2858
1.2723
1.2705
0.8803
0.8664
0.8520
1H-NMR of
O
O
NHAc
0.95
2.16
2.23
2.11
2.95
2.21
4.84
3.22
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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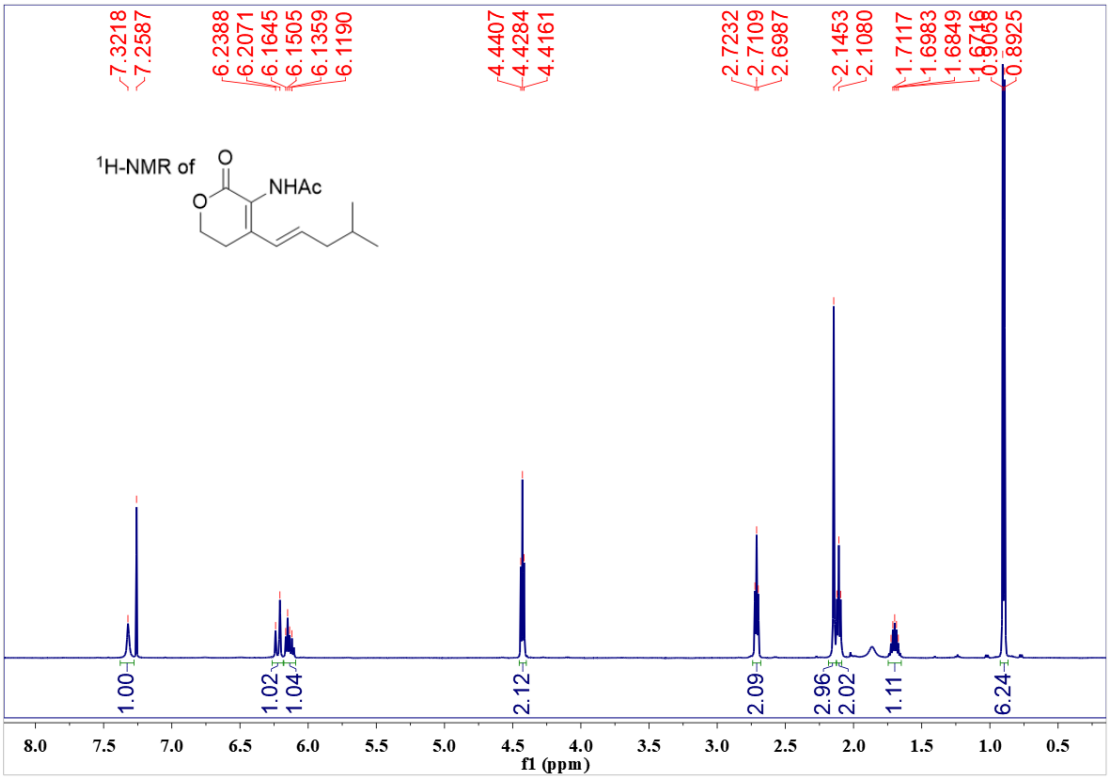
151.41
119.85
77.28
77.03
76.78
65.47
33.44
31.70
28.05
25.67
23.49
22.38
13.89
13C-NMR of
O
O
NHAc
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)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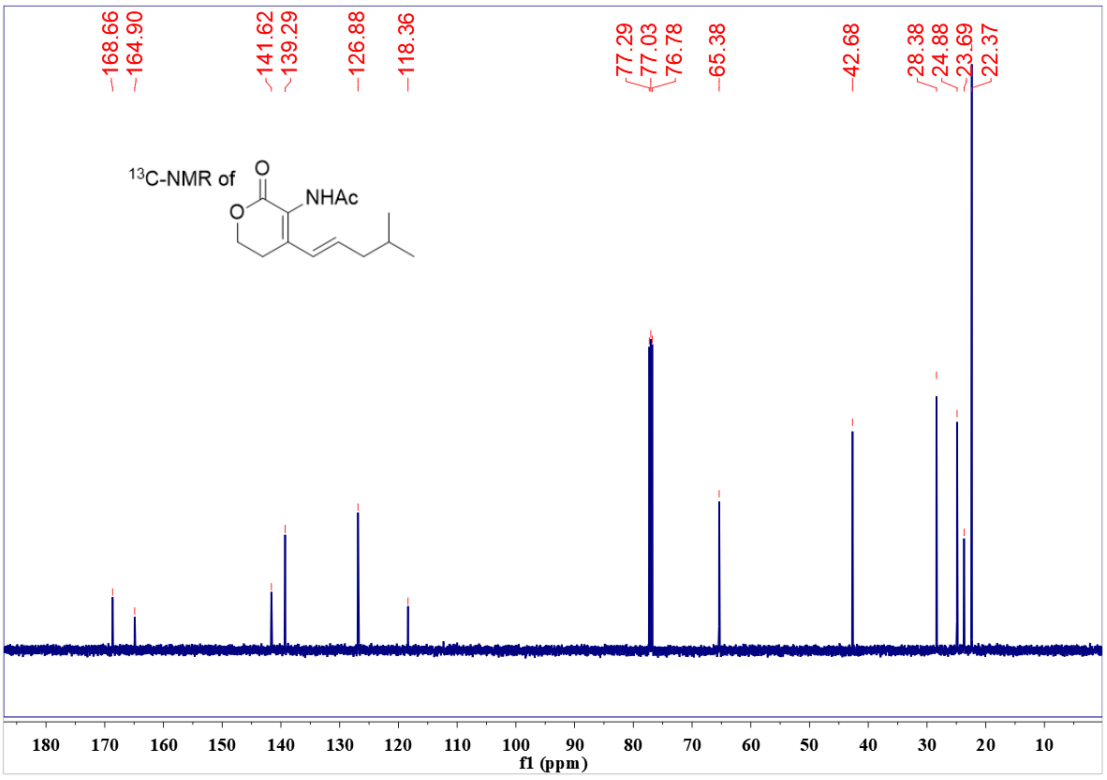
7.2587
6.2388
6.2071
6.1645
6.1505
6.1359
6.1190
4.4407
4.4284
4.4161
2.7232
2.7109
2.6987
2.1453
2.1080
1.7117
1.6983
1.6849
1.6716
0.9058
0.8925
1H-NMR of
NHAc
1.00
1.02
1.04
2.12
2.09
2.96
2.02
1.11
6.24
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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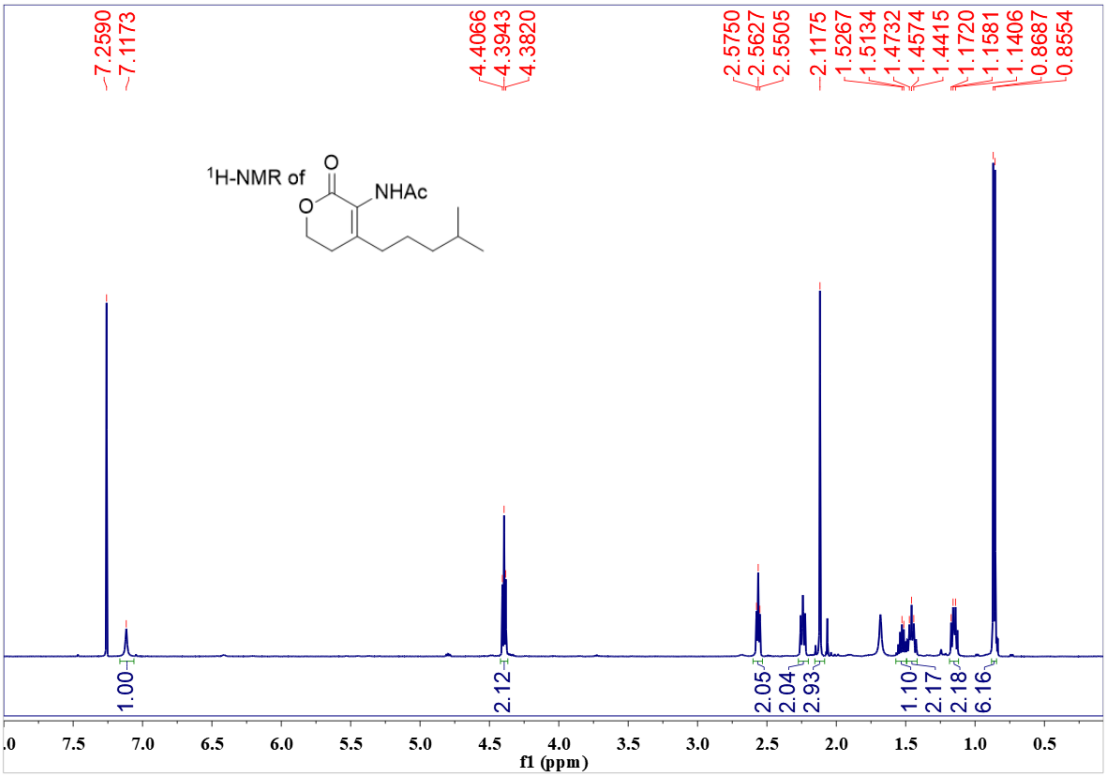
141.62
139.29
126.88
118.36
77.29
77.03
76.78
65.38
42.68
28.38
24.88
23.69
22.37
13C-NMR of
NHAc
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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4.3943
4.3820
2.5750
2.5627
2.5505
2.1175
1.5267
1.5134
1.4732
1.4574
1.4415
1.1720
1.1581
1.1406
0.8687
0.8554
1H-NMR of
NHAc
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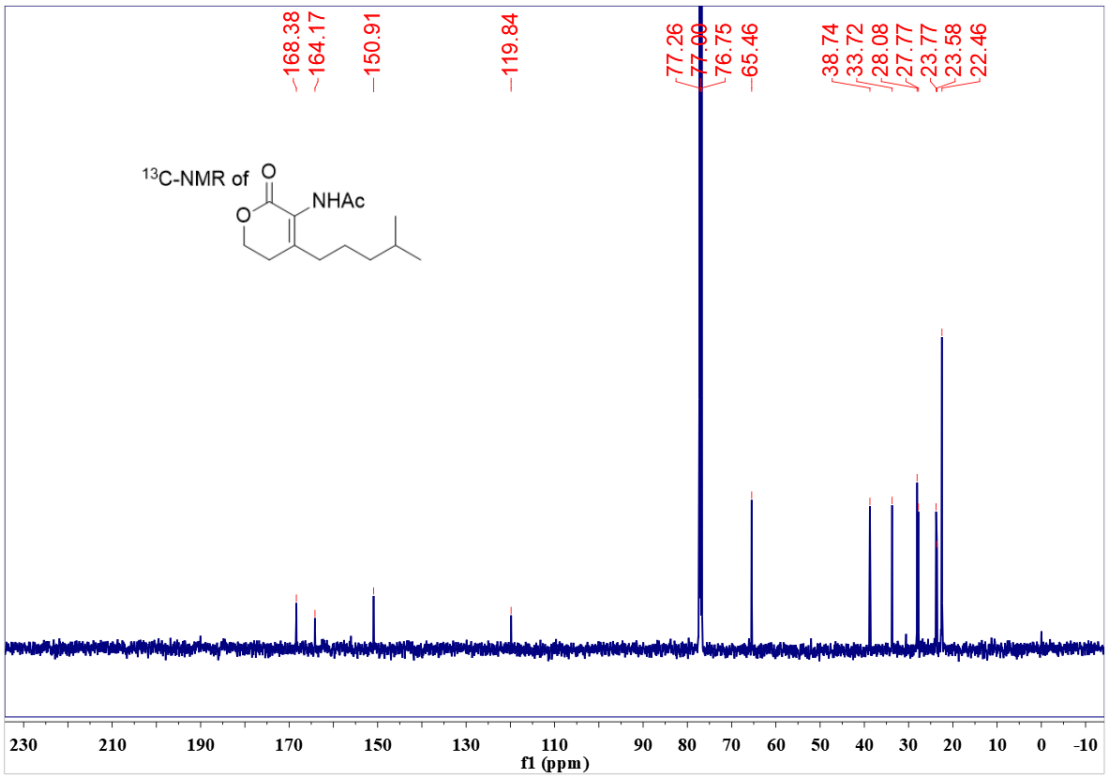
2.12
2.05
2.04
2.93
1.10
2.17
2.18
6.16
f1 (ppm)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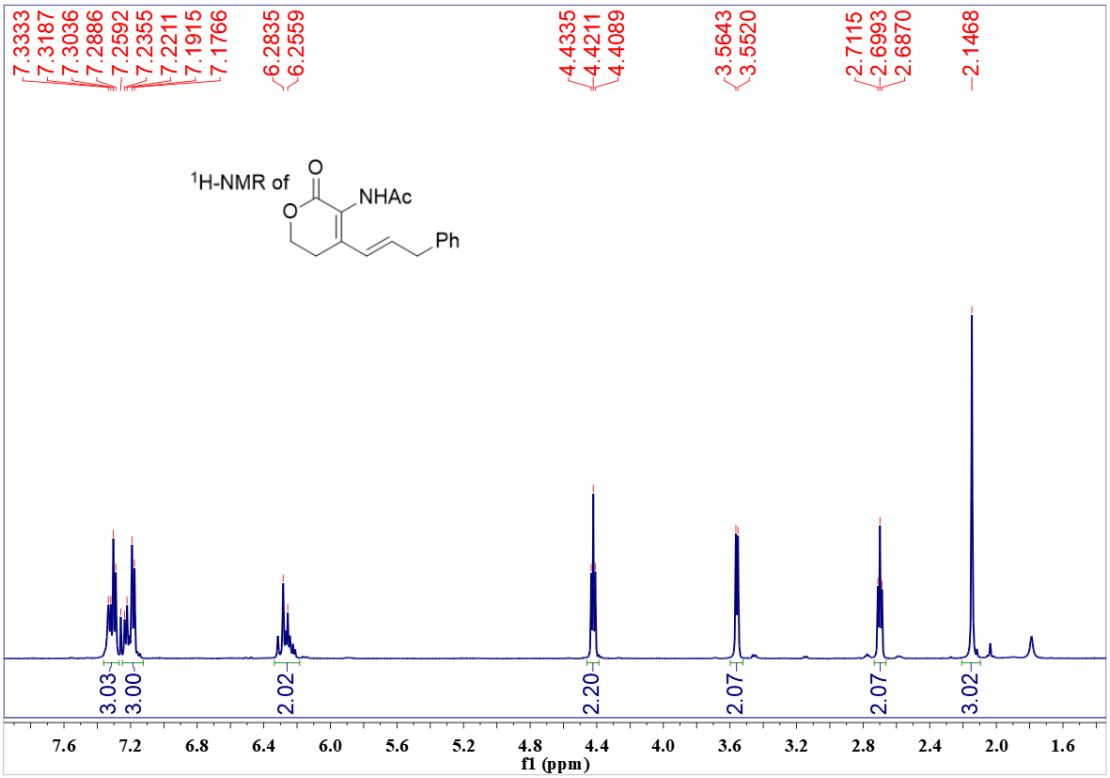
33.72
28.08
27.77
23.77
23.58
22.46
13C-NMR of
NHAc
f1 (ppm)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7.3036
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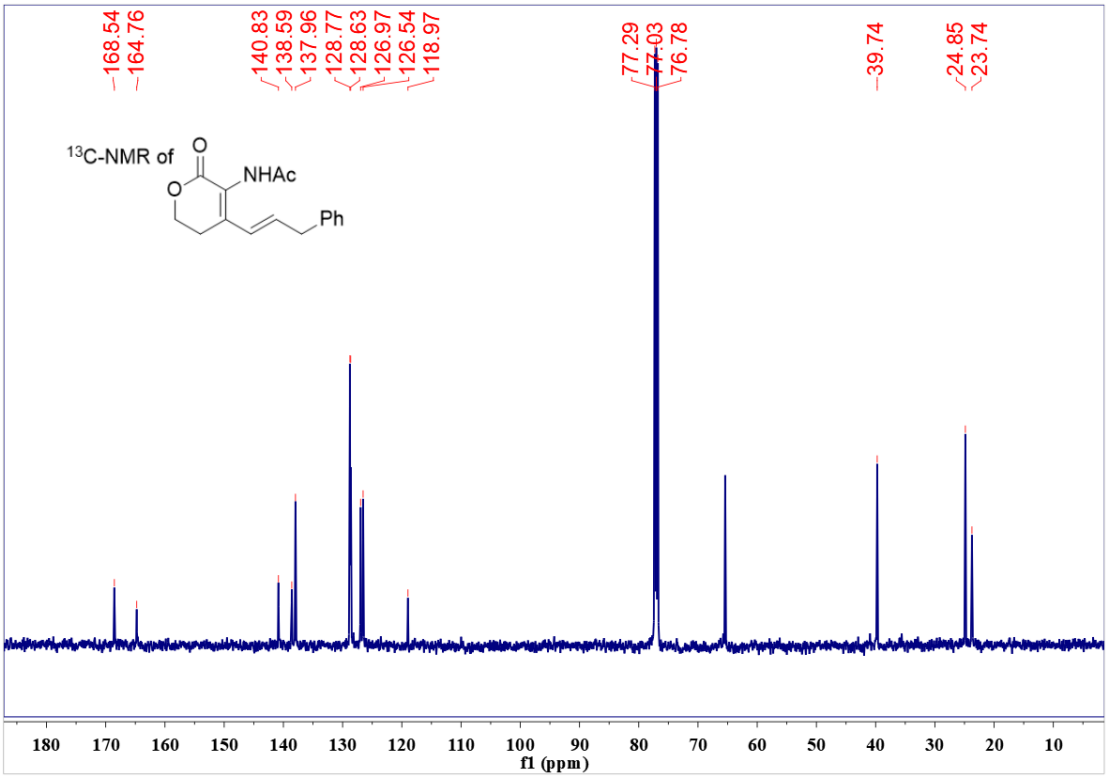
7.2355
7.2211
7.1915
7.1766
6.2835
6.2559
4.4335
4.4211
4.4089
3.5643
3.5520
2.7115
2.6993
2.6870
2.1468
1H-NMR of
O
O
NHAc
Ph
3.03
3.00
2.02
2.20
2.07
2.07
3.02
7.6
7.2
6.8
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
f1 (ppm)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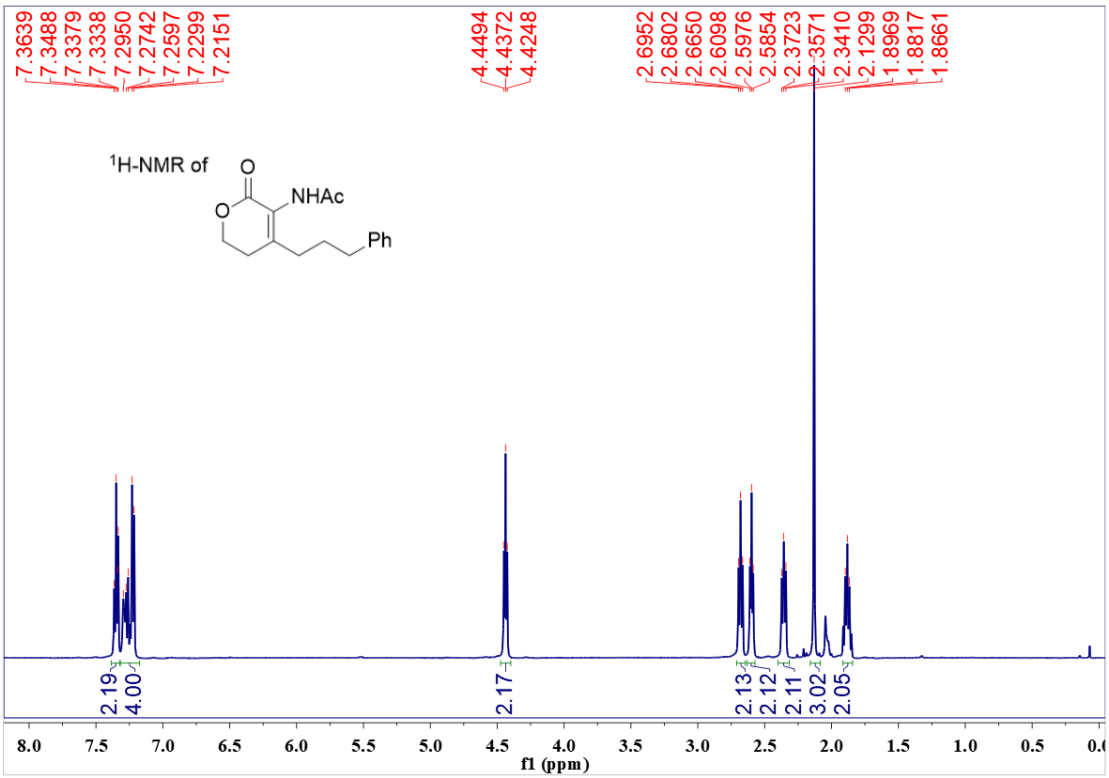
128.77
128.63
126.97
126.54
118.97
77.29
77.03
76.78
39.74
24.85
23.74
13C-NMR of
O
O
NHAc
Ph
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.3379
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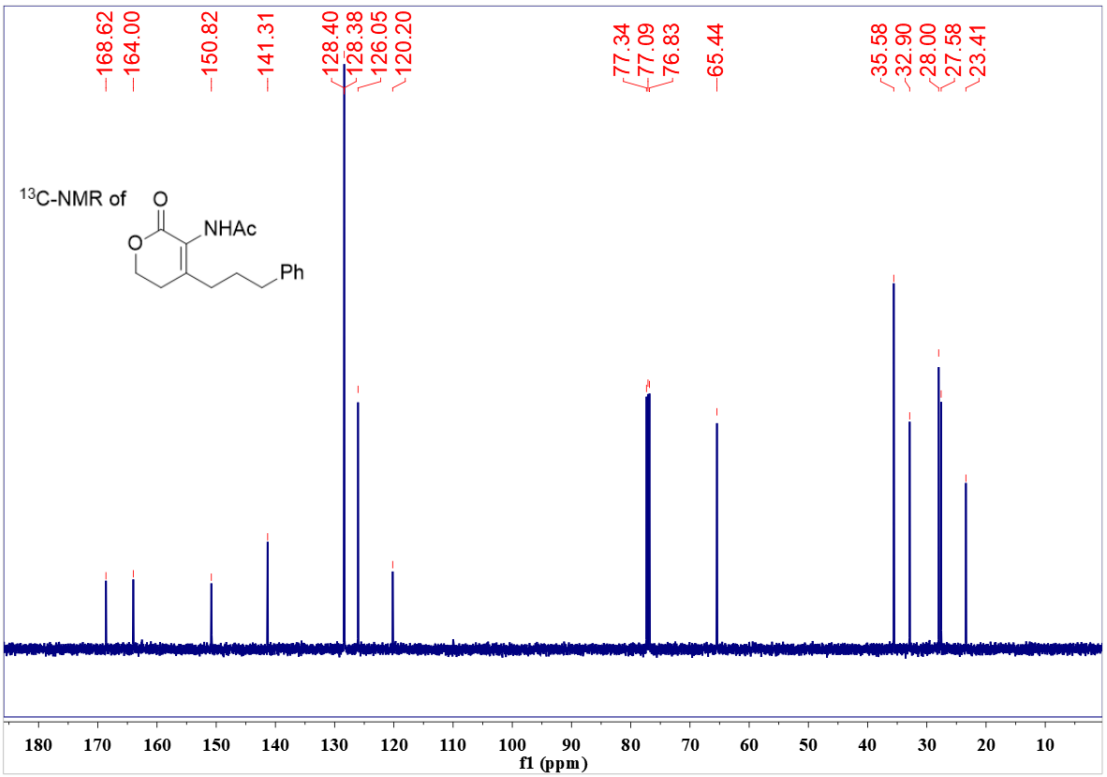
7.2151
4.4494
4.4372
4.4248
2.6952
2.6802
2.6650
2.6098
2.5976
2.5854
2.3723
2.3571
2.3410
2.1299
1.8969
1.8817
1.8661
1H-NMR of
O
NHAc
O
Ph
2.19
4.00
2.17
2.13
2.12
2.11
3.02
2.05
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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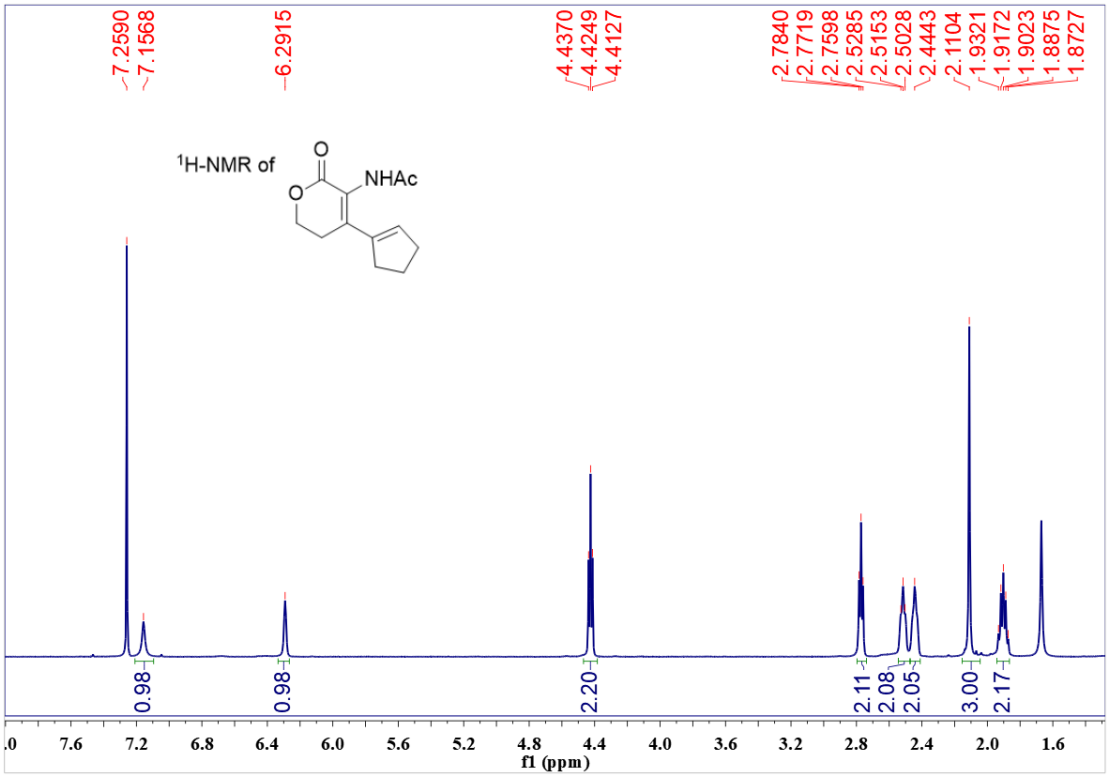
128.38
126.05
120.20
77.34
77.09
76.83
65.44
35.58
32.90
28.00
27.58
23.41
13C-NMR of
O
NHAc
O
Ph
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.1568
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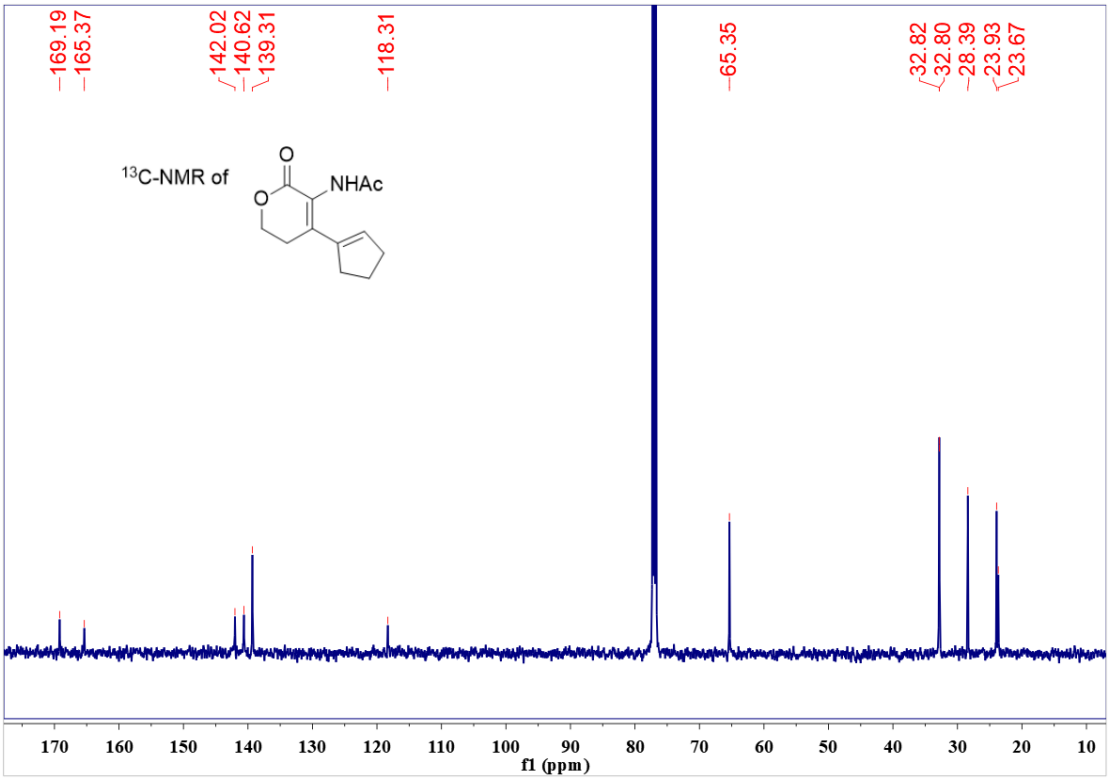
4.4249
4.4127
2.7840
2.7719
2.7598
2.5285
2.5153
2.5028
2.4443
2.1104
1.9321
1.9172
1.9023
1.8875
1.8727
1H-NMR of
NHAc
0.98
0.98
2.20
2.11
2.08
2.05
3.00
2.17
f1 (ppm)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165.37
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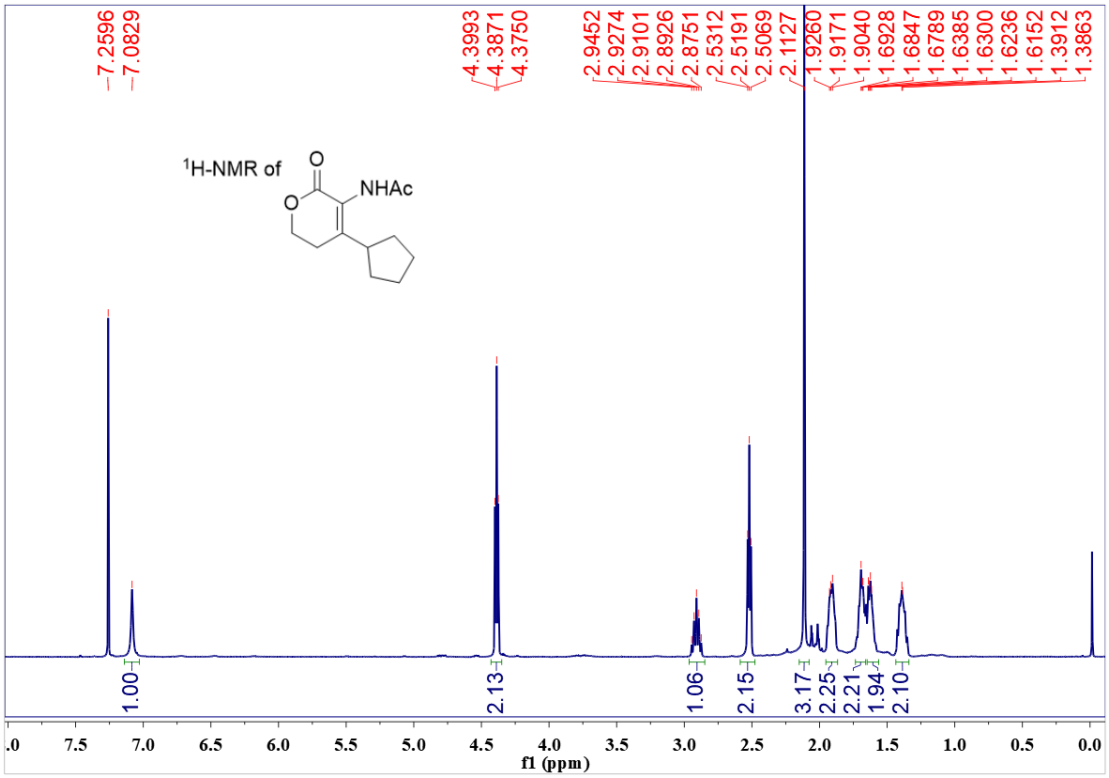
65.35
32.82
32.80
28.39
23.93
23.67
13C-NMR of
NHAc
f1 (ppm)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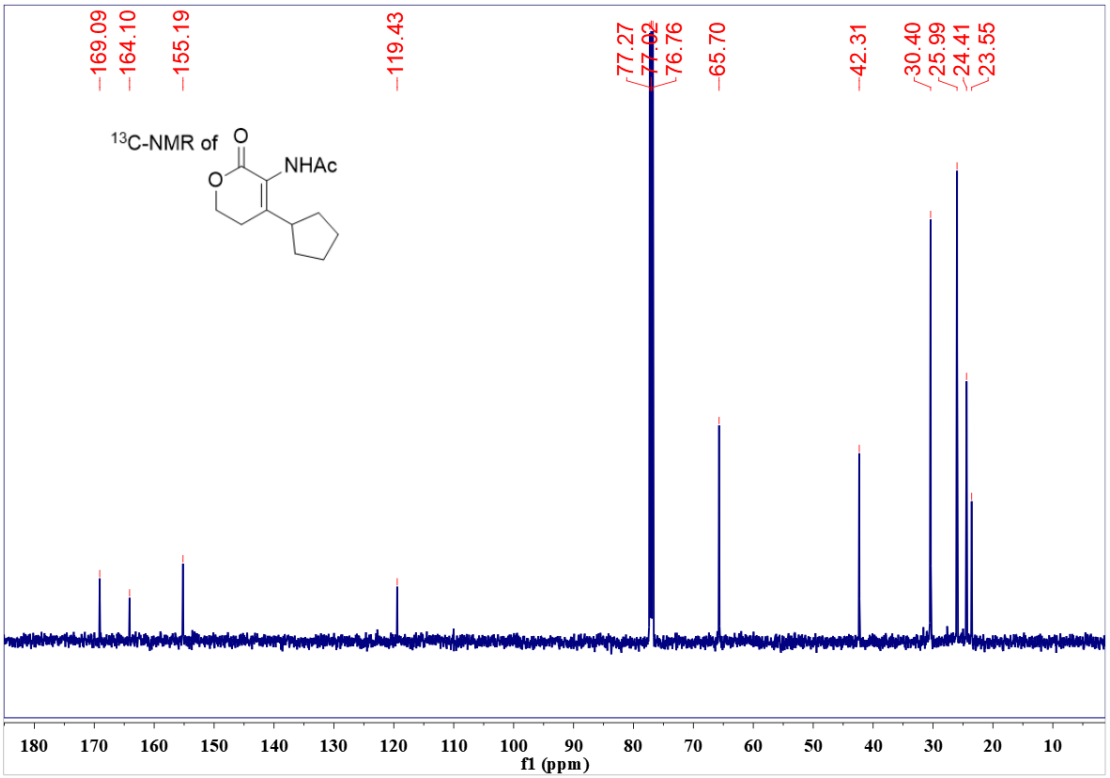
7.0829
4.3993
4.3871
4.3750
2.9452
2.9274
2.9101
2.8926
2.8751
2.5312
2.5191
2.5069
2.1127
1.9260
1.9171
1.9040
1.6928
1.6847
1.6789
1.6385
1.6300
1.6236
1.6152
1.3912
1.3863
1H-NMR of
NHAc
1.00
2.13
1.06
2.15
3.17
2.25
2.21
1.94
2.10
f1 (ppm)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164.10
155.19
119.43
77.27
77.02
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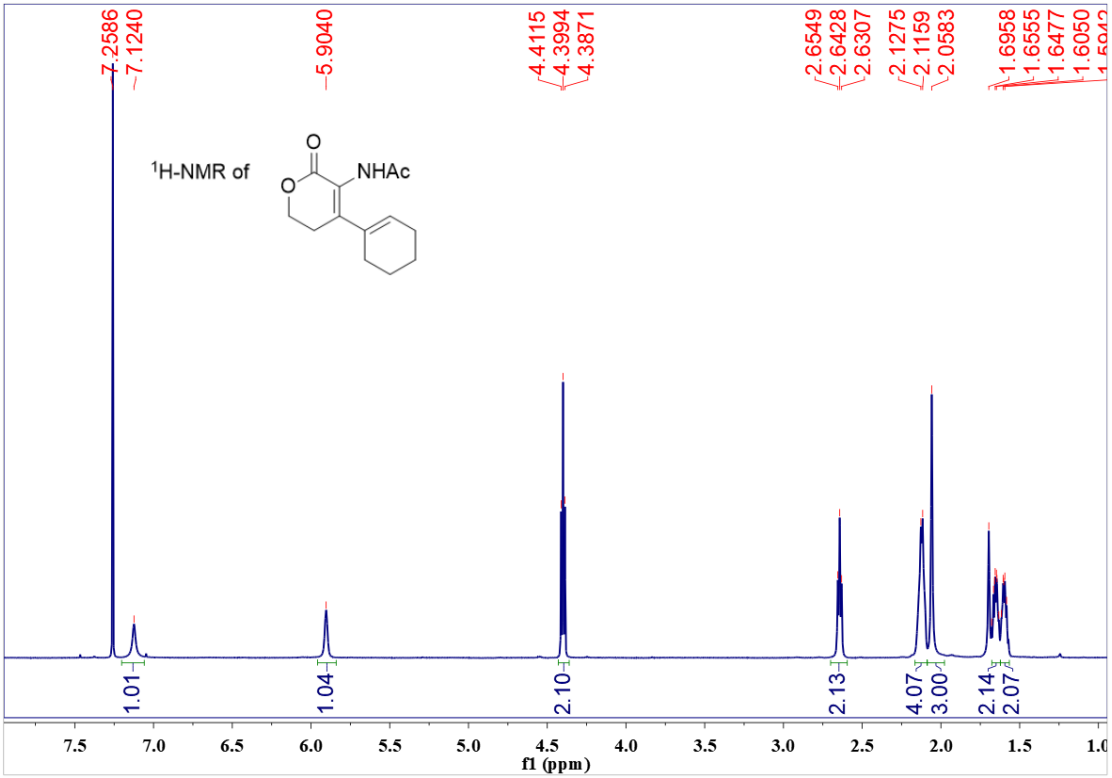
65.70
42.31
30.40
25.99
24.41
23.55
13C-NMR of
NHAc
f1 (ppm)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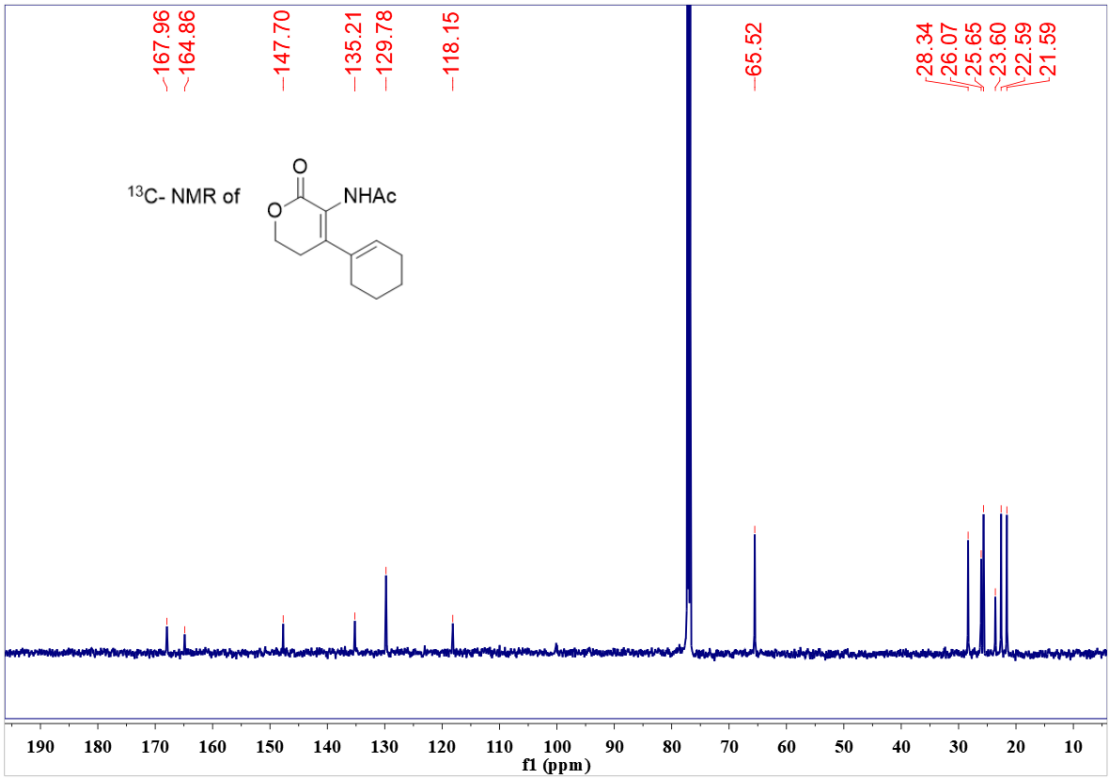
7.1240
5.9040
4.4115
4.3994
4.3871
2.6549
2.6428
2.6307
2.1275
2.1159
2.0583
1.6958
1.6555
1.6477
1.6050
1H-NMR of
O
O
NHAc
1.01
1.04
2.10
2.13
4.07
3.00
2.14
2.07
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
f1 (ppm)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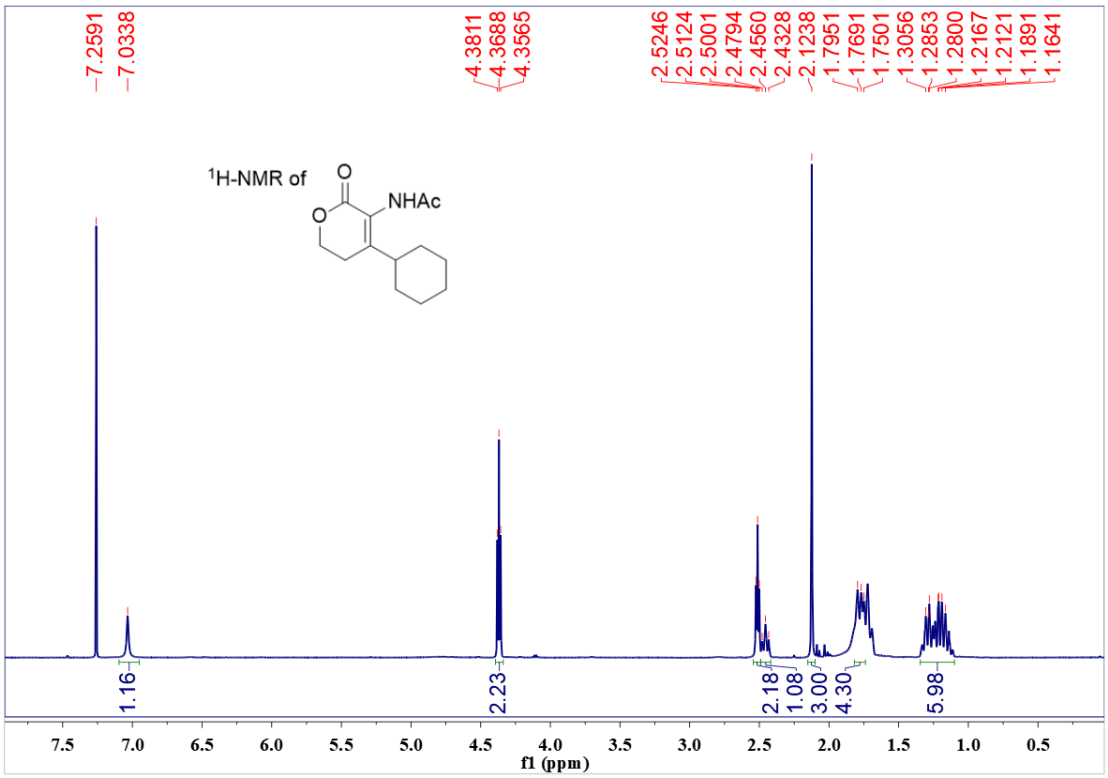
164.86
147.70
135.21
129.78
118.15
65.52
28.34
26.07
25.65
23.60
22.59
21.59
13C- NMR of
O
O
NHAc
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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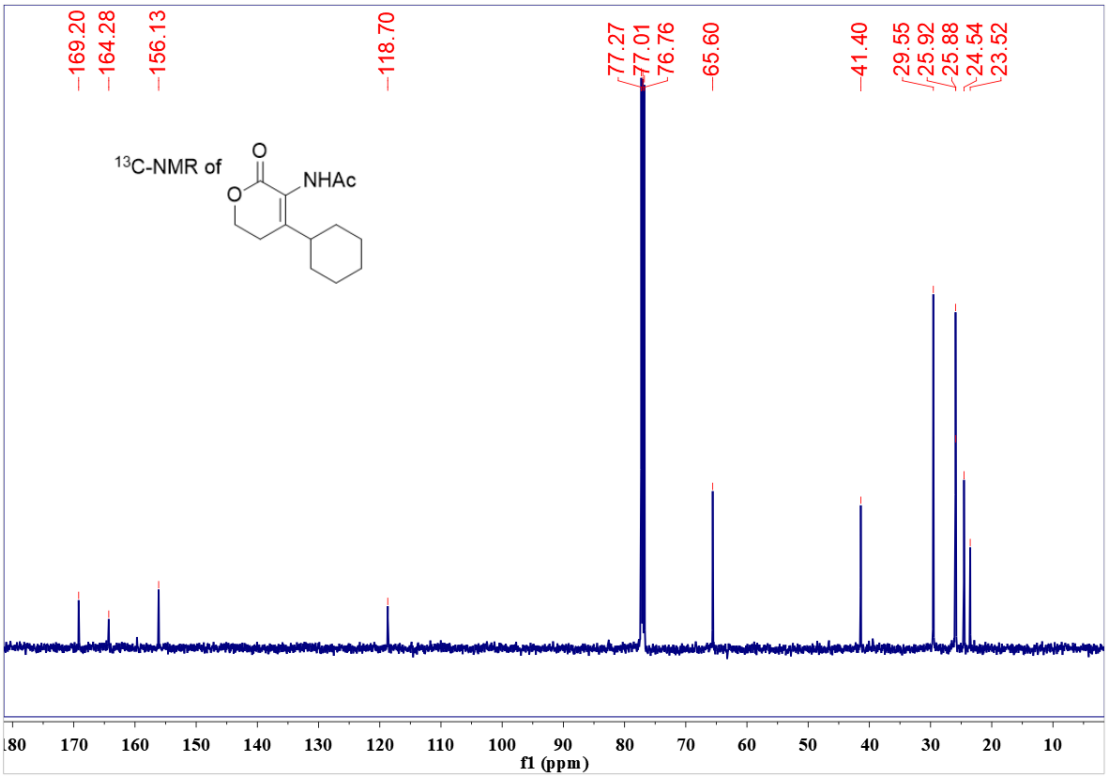
7.0338
4.3811
4.3688
4.3565
2.5246
2.5124
2.5001
2.4794
2.4660
2.4328
2.1238
1.7951
1.7691
1.7501
1.3056
1.2853
1.2800
1.2167
1.2121
1.1891
1.1641
1H-NMR of
O
O
NHAc
1.16
2.23
2.18
1.08
3.00
4.30
5.98
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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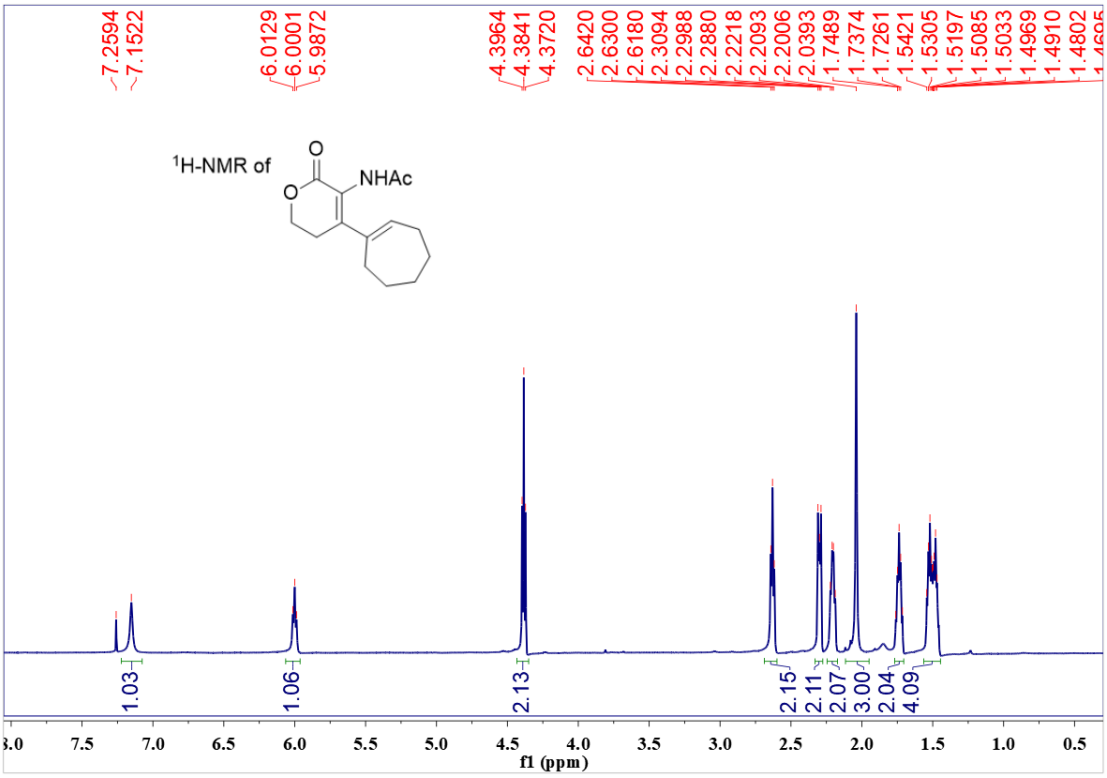
164.28
156.13
118.70
77.27
77.01
76.76
65.60
41.40
29.55
25.92
25.88
24.54
23.52
13C-NMR of
O
O
NHAc
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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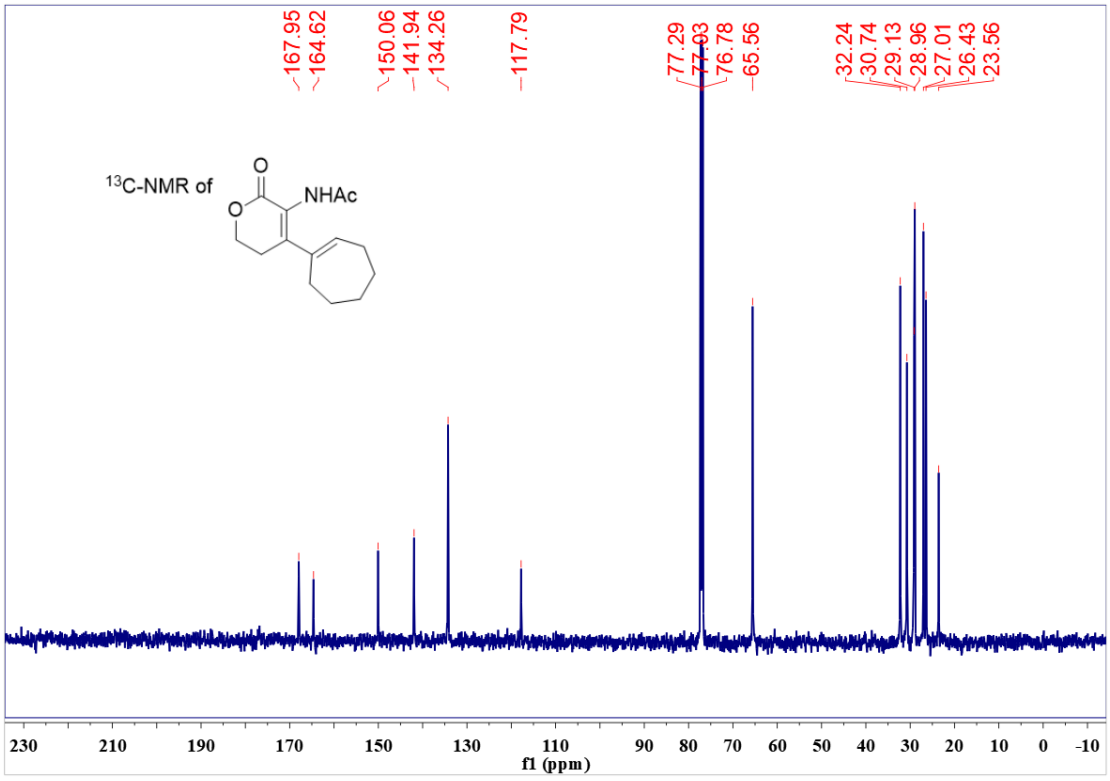
6.0001
5.9872
4.3964
4.3841
4.3720
2.6420
2.6300
2.6180
2.3094
2.2988
2.2880
2.2218
2.2093
2.2006
2.0393
1.7489
1.7374
1.7261
1.5421
1.5305
1.5197
1.5085
1.5033
1.4969
1.4910
1.4802
1H-NMR of
NHAc
1.03
1.06
2.13
2.15
2.11
2.07
3.00
2.04
4.09
f1 (ppm)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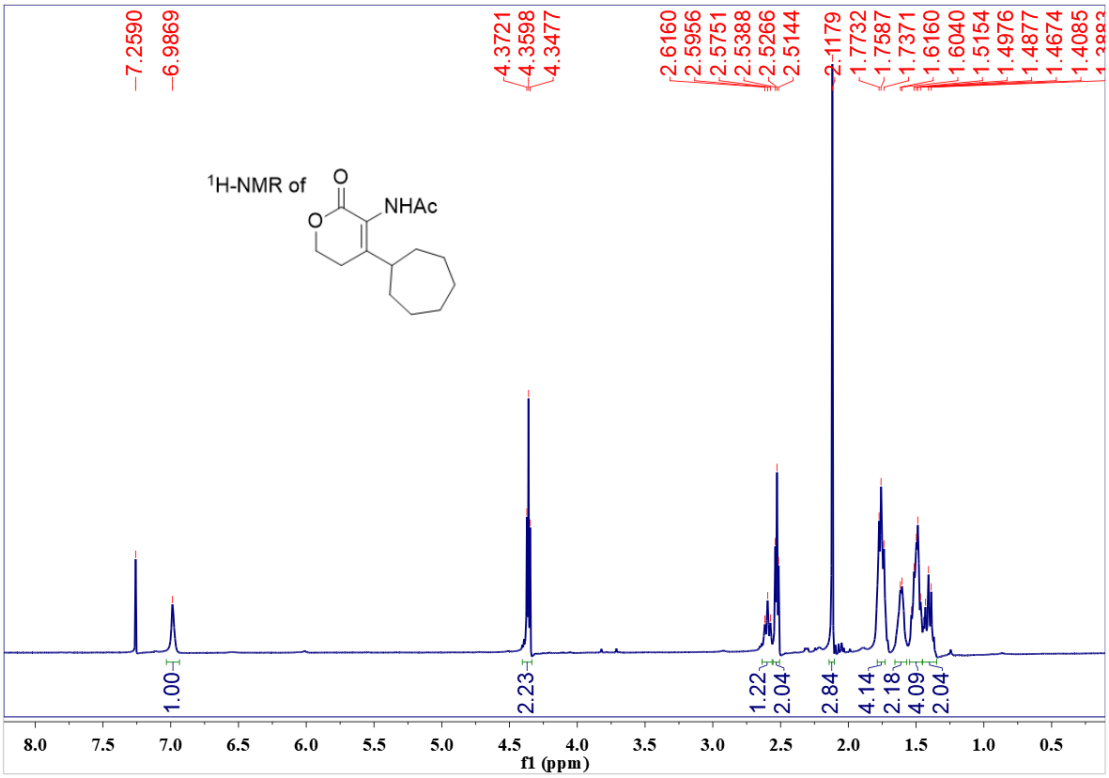
164.62
150.06
141.94
134.26
117.79
77.29
77.03
76.78
65.56
32.24
30.74
29.13
28.96
27.01
26.43
23.56
13C-NMR of
NHAc
f1 (ppm)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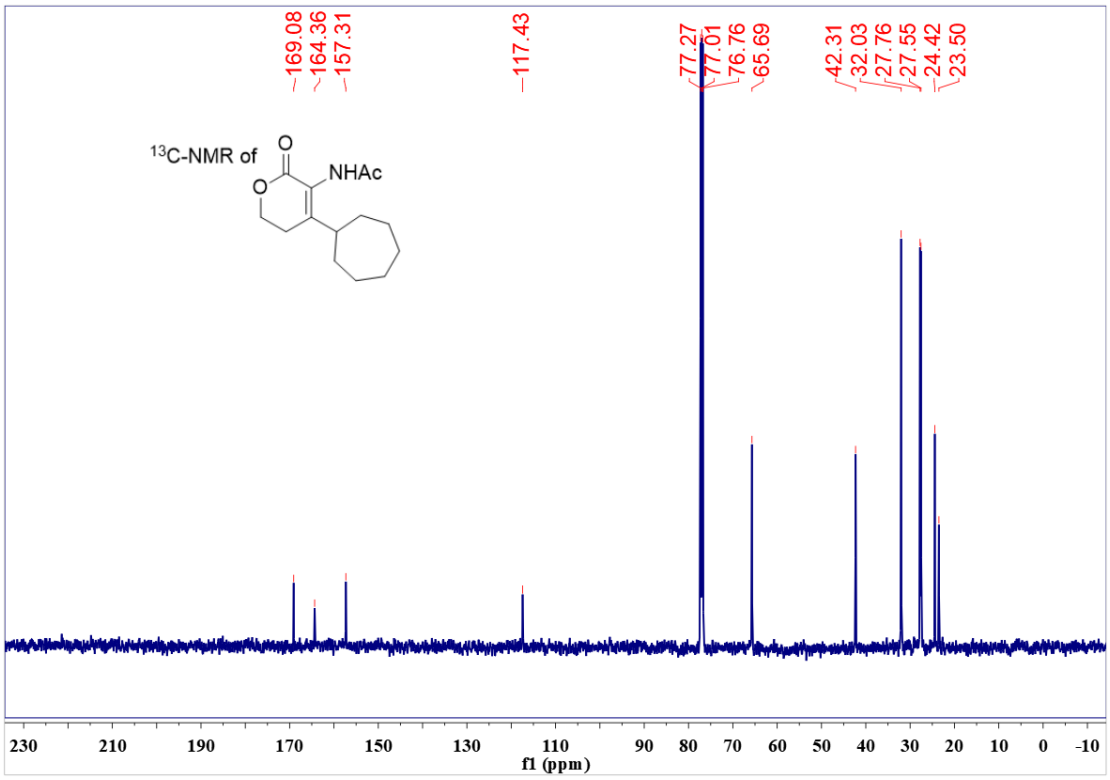
6.9869
4.3721
4.3598
4.3477
2.6160
2.5956
2.5751
2.5388
2.5266
2.5144
2.1179
1.7732
1.7587
1.7371
1.6160
1.6040
1.5154
1.4976
1.4877
1.4674
1.4085
1H-NMR of
NHAc
1.00
2.23
1.22
2.04
2.84
4.14
2.18
4.09
2.04
f1 (ppm)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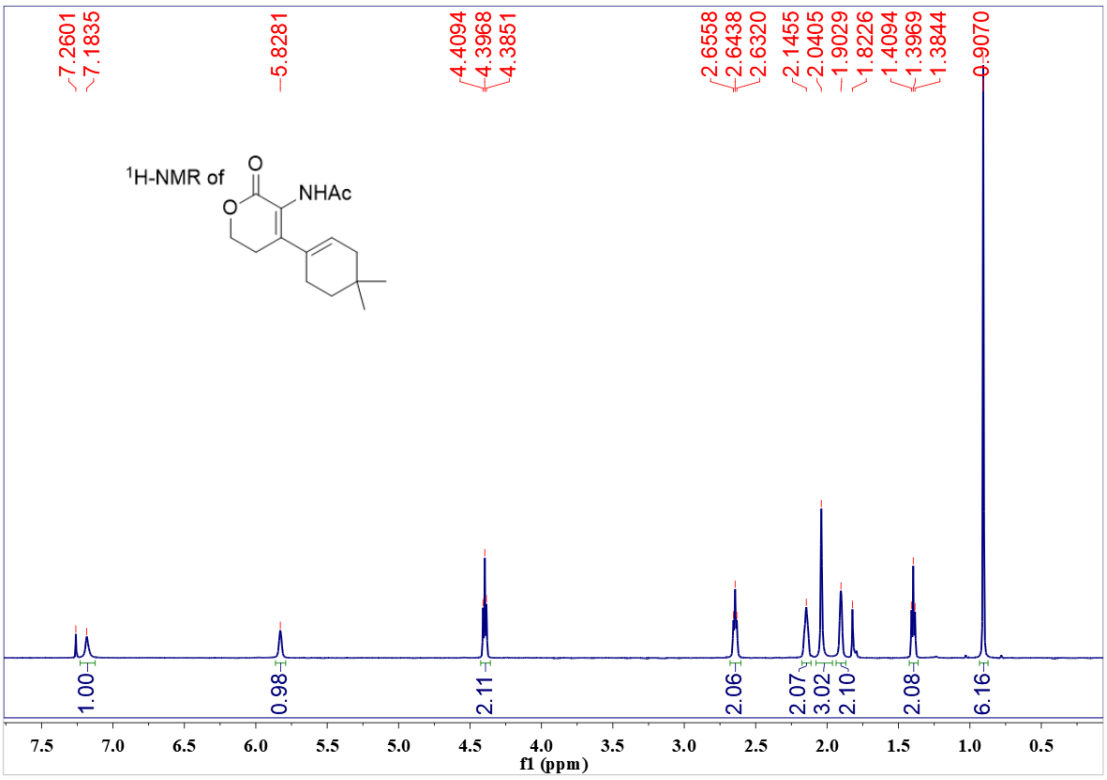
164.36
157.31
117.43
77.27
77.01
76.76
65.69
42.31
32.03
27.76
27.55
24.42
23.50
13C-NMR of
NHAc
f1 (ppm)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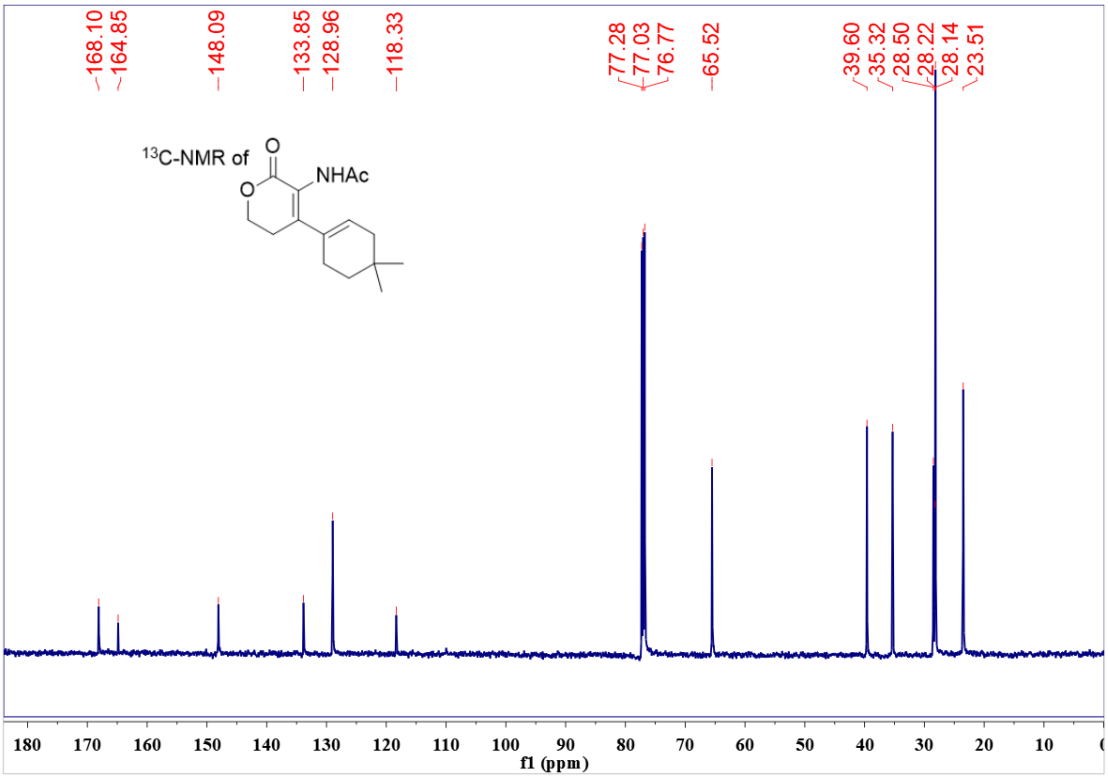
7.1835
5.8281
4.4094
4.3968
4.3851
2.6558
2.6438
2.6320
2.1455
2.0405
1.9029
1.8226
1.4094
1.3969
1.3844
0.9070
1H-NMR of
NHAc
1.00
0.98
2.11
2.06
2.07
3.02
2.10
2.08
6.16
f1 (ppm)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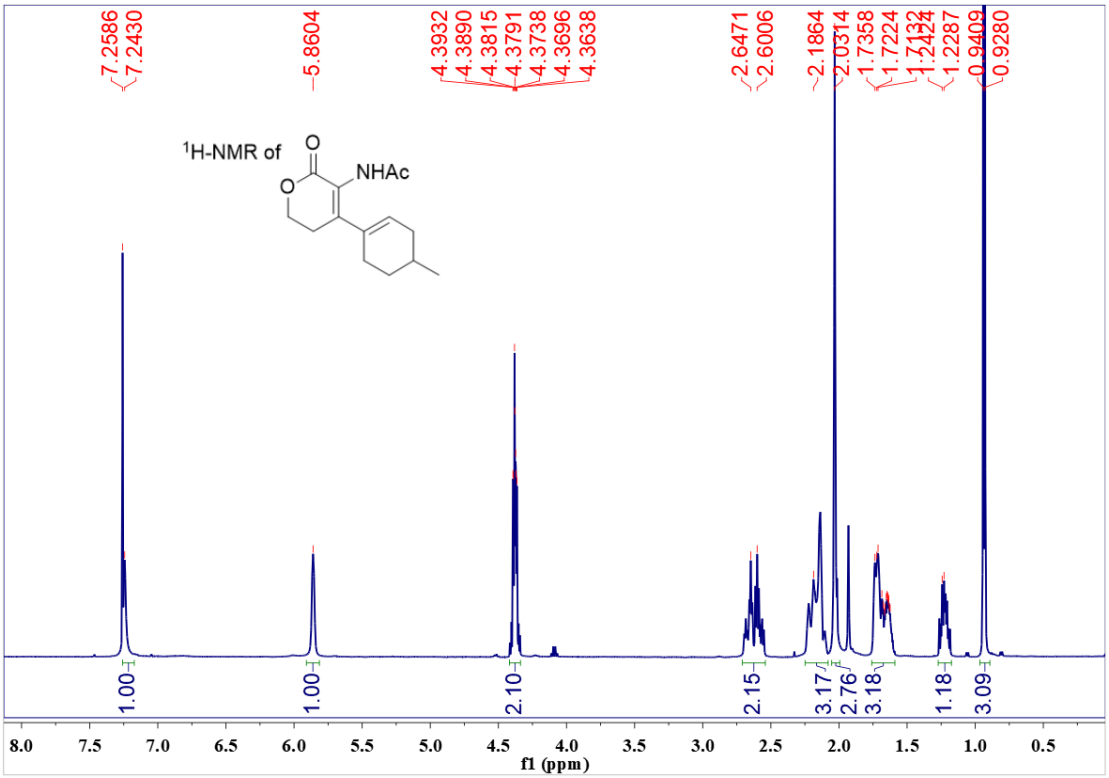
148.09
133.85
128.96
118.33
77.28
77.03
76.77
65.52
39.60
35.32
28.50
28.22
28.14
23.51
13C-NMR of
NHAc
f1 (ppm)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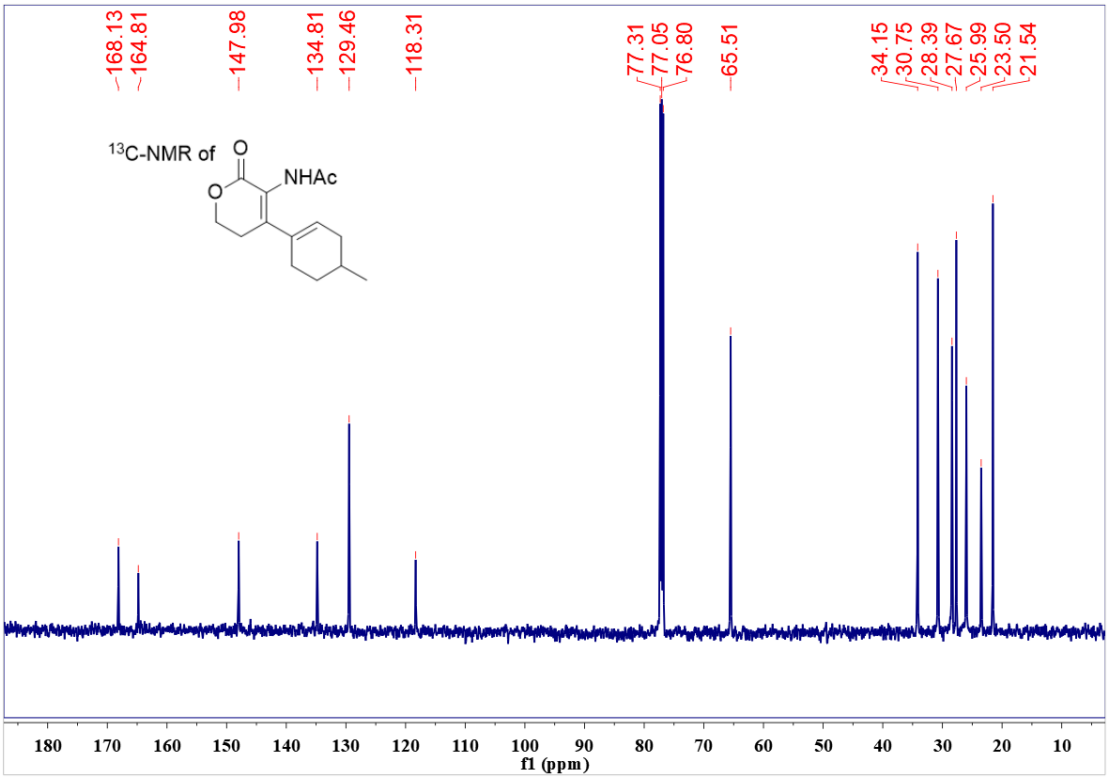
7.2430
5.8604
4.3932
4.3890
4.3815
4.3791
4.3738
4.3696
4.3638
2.6471
2.6006
2.1864
2.0314
1.7358
1.7224
1.7132
1.2424
1.2287
0.9409
0.9280
1H-NMR of
O
O
NHAc
1.00
1.00
2.10
2.15
3.17
2.76
3.18
1.18
3.09
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)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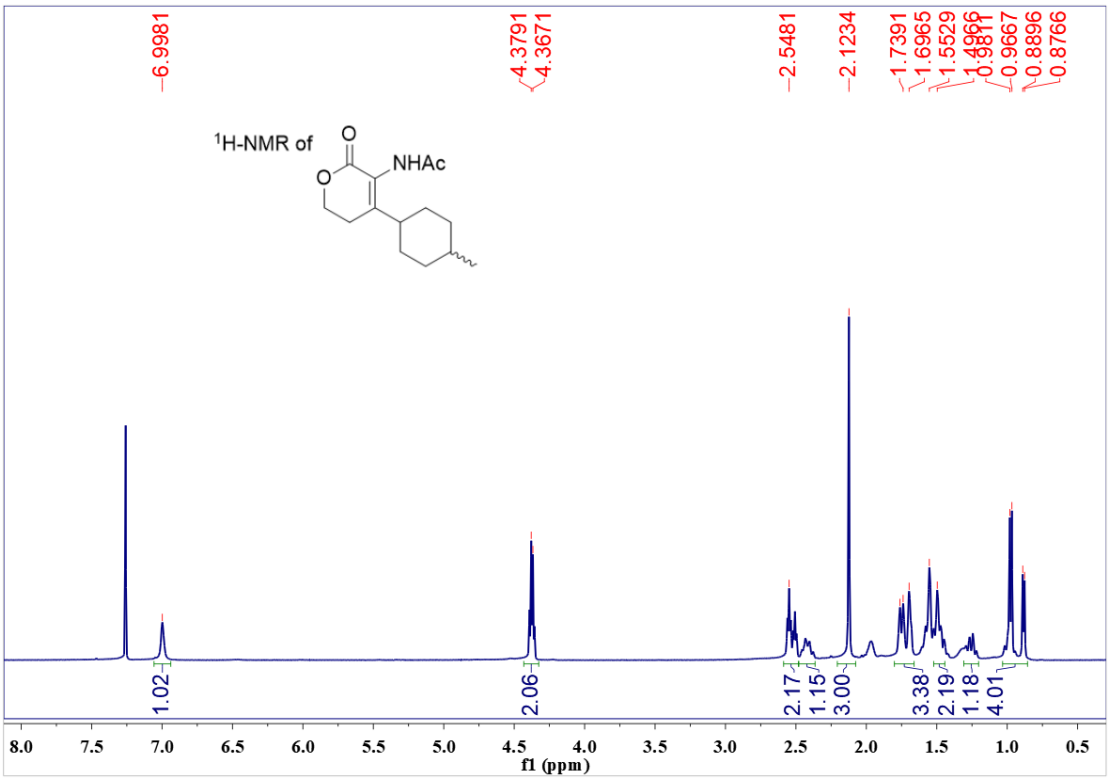
164.81
147.98
134.81
129.46
118.31
77.31
77.05
76.80
65.51
34.15
30.75
28.39
27.67
25.99
23.50
21.54
13C-NMR of
O
O
NHAc
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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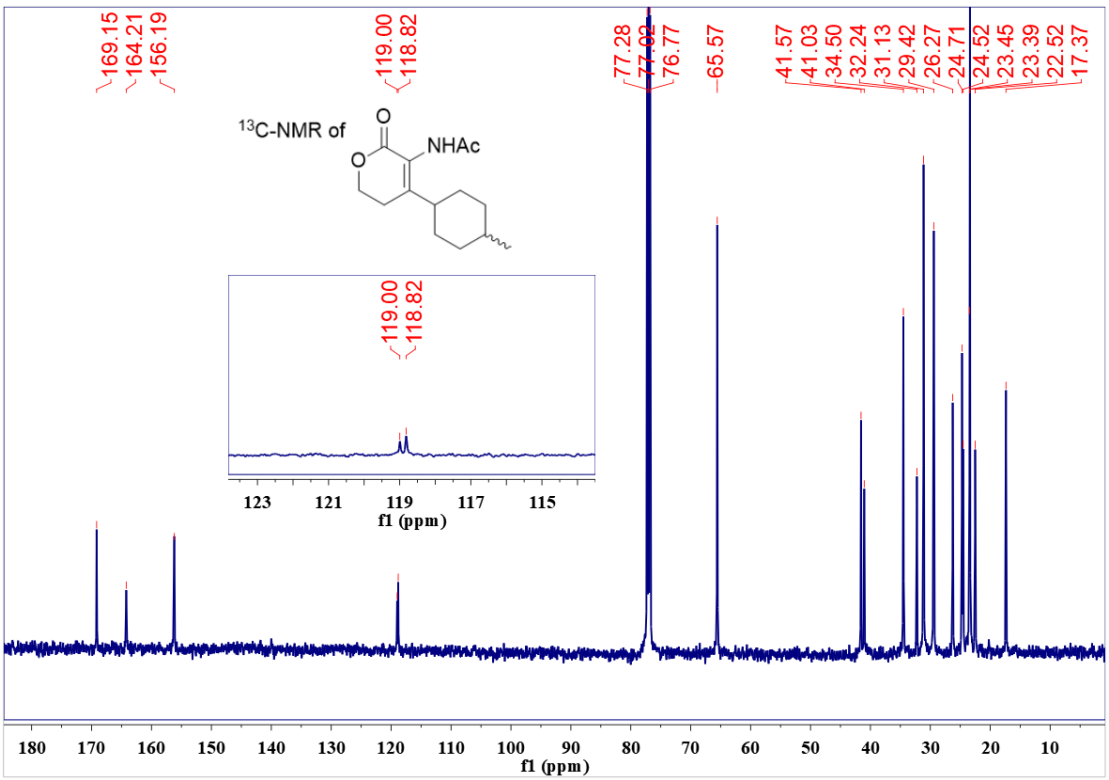
4.3791
4.3671
2.5481
2.1234
1.7391
1.6965
1.5529
1.4966
0.9811
0.9667
0.8896
0.8766
1H-NMR of
NHAc
1.02
2.06
2.17
1.15
3.00
3.38
2.19
1.18
4.01
f1 (ppm)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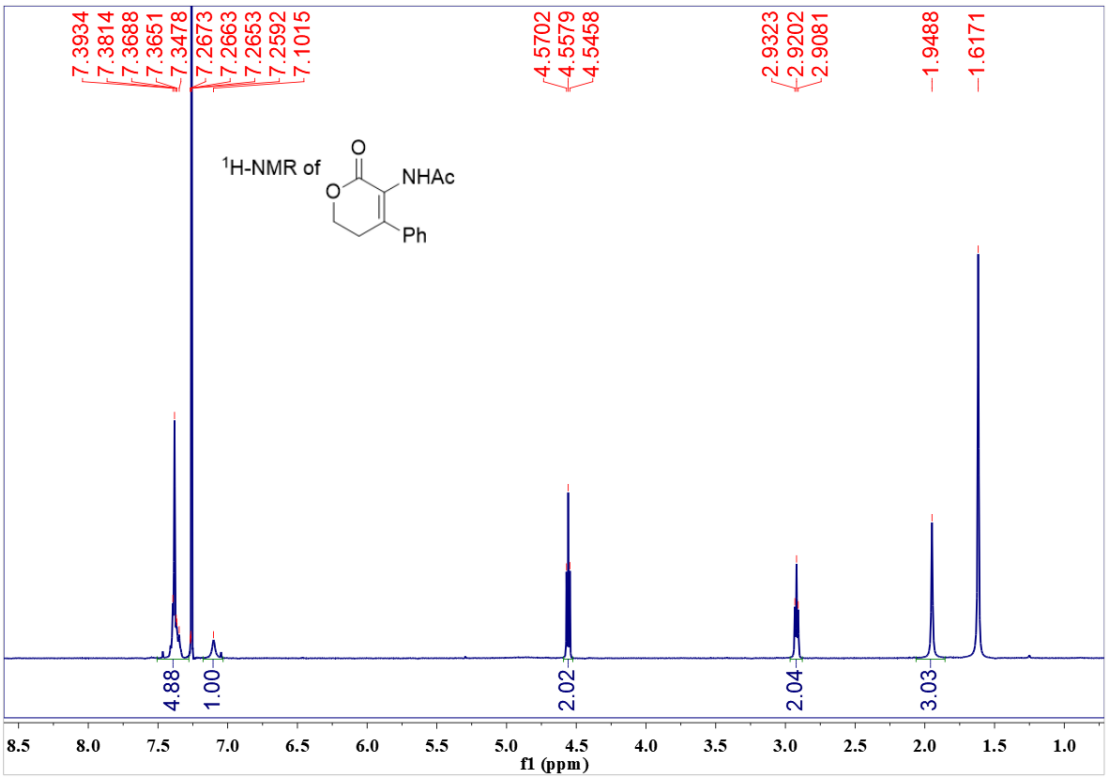
164.21
156.19
119.00
118.82
77.28
77.02
76.77
65.57
41.57
41.03
34.50
32.24
31.13
29.42
26.27
24.71
24.52
23.45
23.39
22.52
17.37
13C-NMR of
NHAc
119.00
118.82
f1 (ppm)
f1 (ppm)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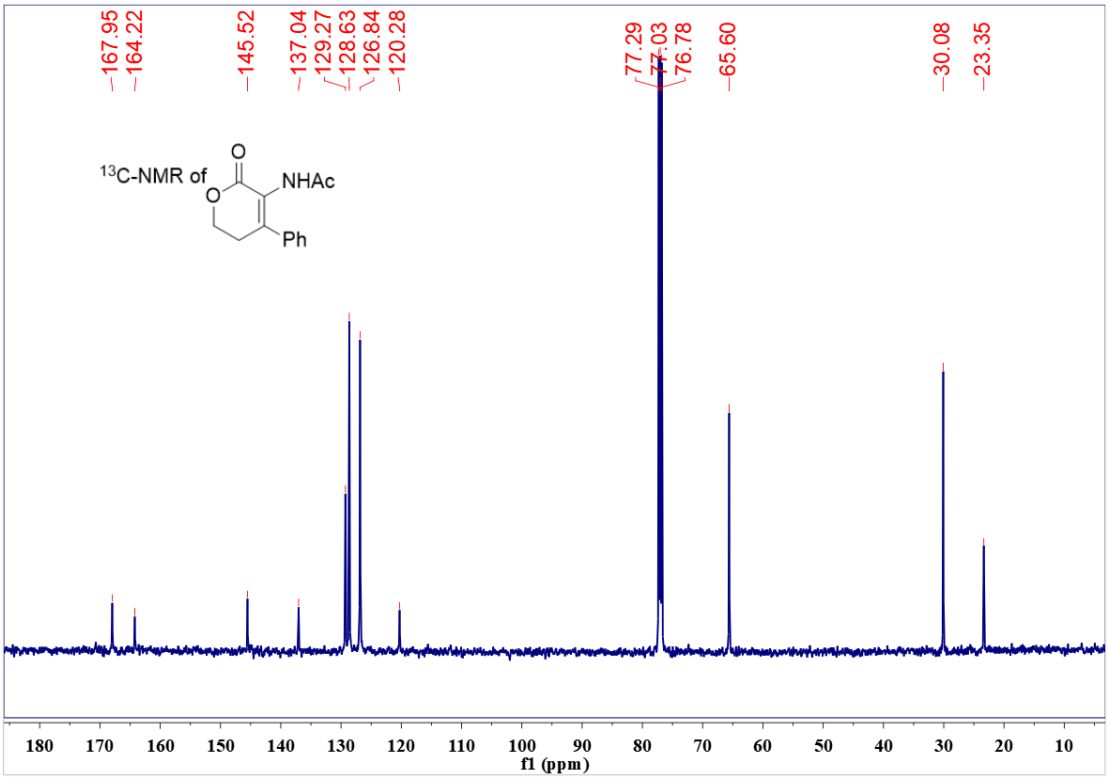
7.3814
7.3688
7.3651
7.3478
7.2673
7.2663
7.2653
7.2592
7.1015
4.5702
4.5579
4.5458
2.9323
2.9202
2.9081
1.9488
1.6171
^{1}H-NMR of
O
NHAc
O
Ph
4.88
1.00
2.02
2.04
3.03
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0
f1 (ppm)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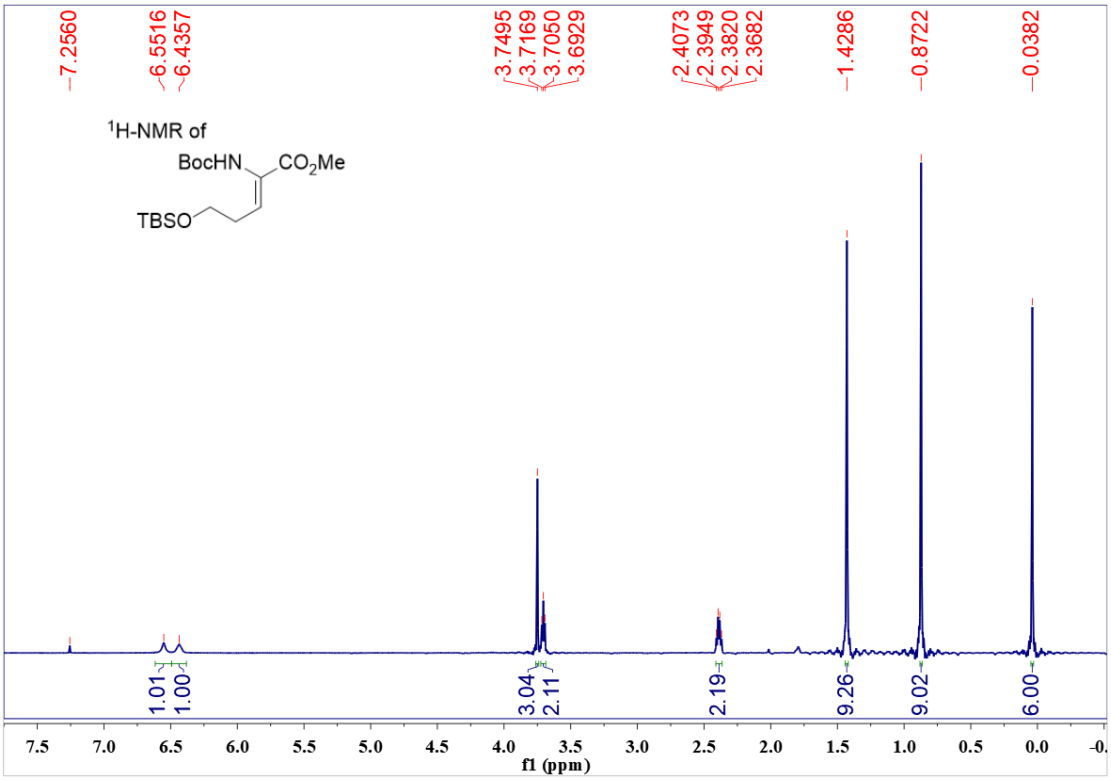
164.22
145.52
137.04
129.27
128.63
126.84
120.28
77.29
77.03
76.78
65.60
30.08
23.35
^{13}C-NMR of
O
NHAc
O
Ph
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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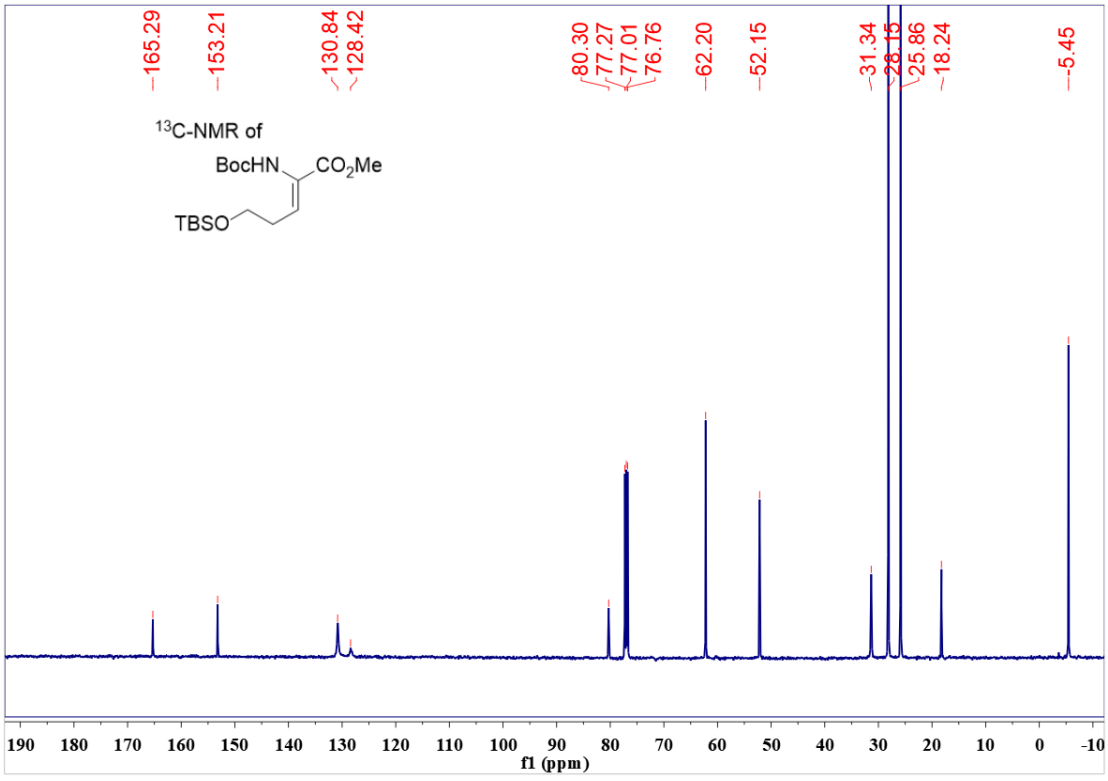
6.4357
3.7495
3.7169
3.7050
3.6929
2.4073
2.3949
2.3820
2.3682
1.4286
0.8722
0.0382
1H-NMR of
BocHN
CO2Me
TBSO
1.01
1.00
3.04
2.11
2.19
9.26
9.02
6.00
f1 (ppm)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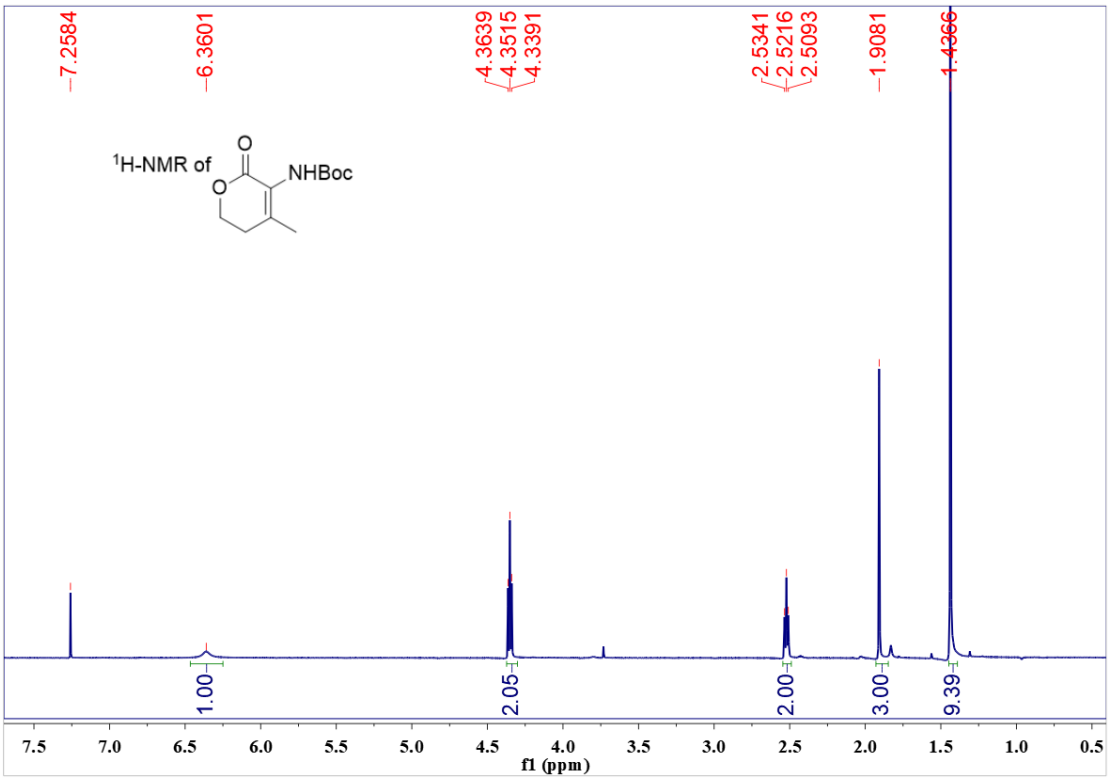
153.21
130.84
128.42
80.30
77.27
77.01
76.76
62.20
52.15
31.34
28.15
25.86
18.24
5.45
13C-NMR of
BocHN
CO2Me
TBSO
f1 (ppm)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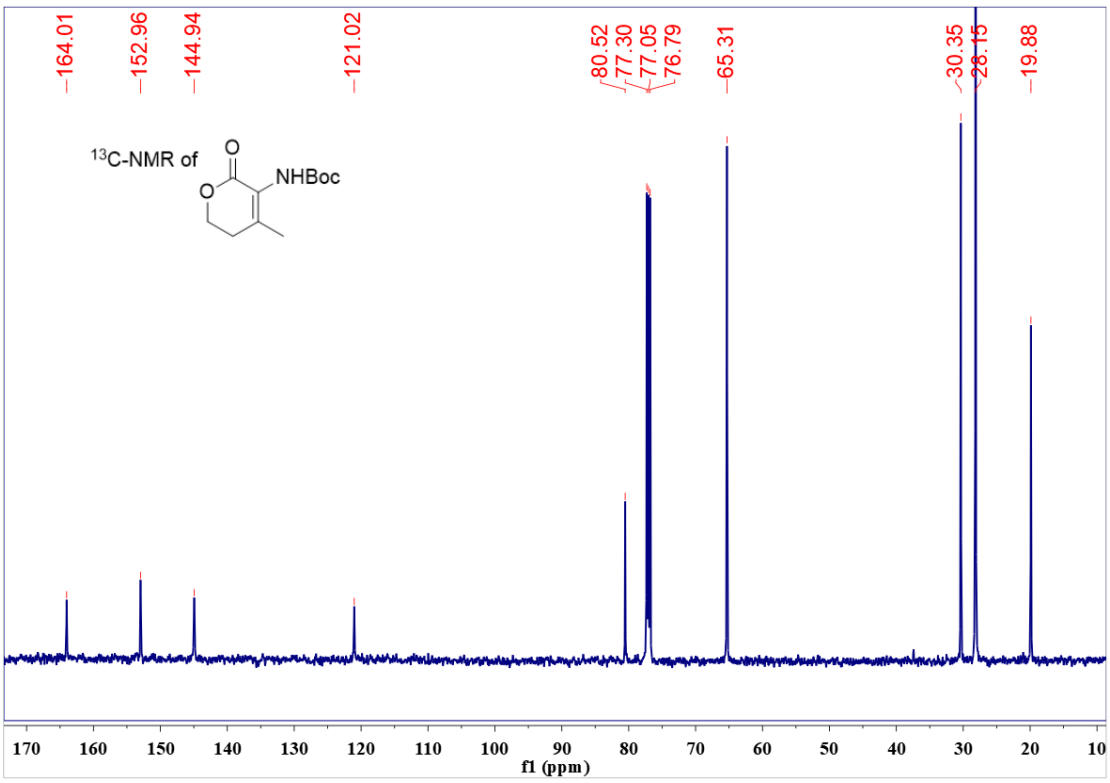
6.3601
4.3639
4.3515
4.3391
2.5341
2.5216
2.5093
1.9081
1.4366
^{1}H-NMR of
O
O
NHBoc
1.00
2.05
2.00
3.00
9.39
7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)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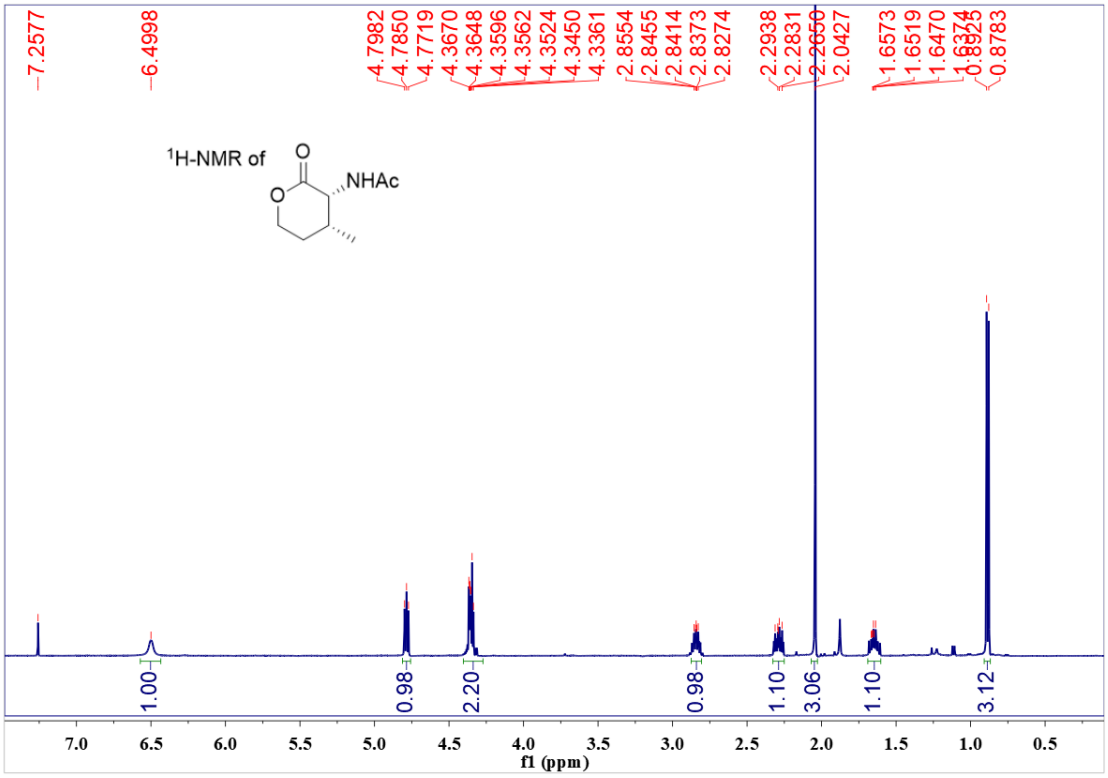
152.96
144.94
121.02
80.52
77.30
77.05
76.79
65.31
30.35
28.15
19.88
^{13}C-NMR of
O
O
NHBoc
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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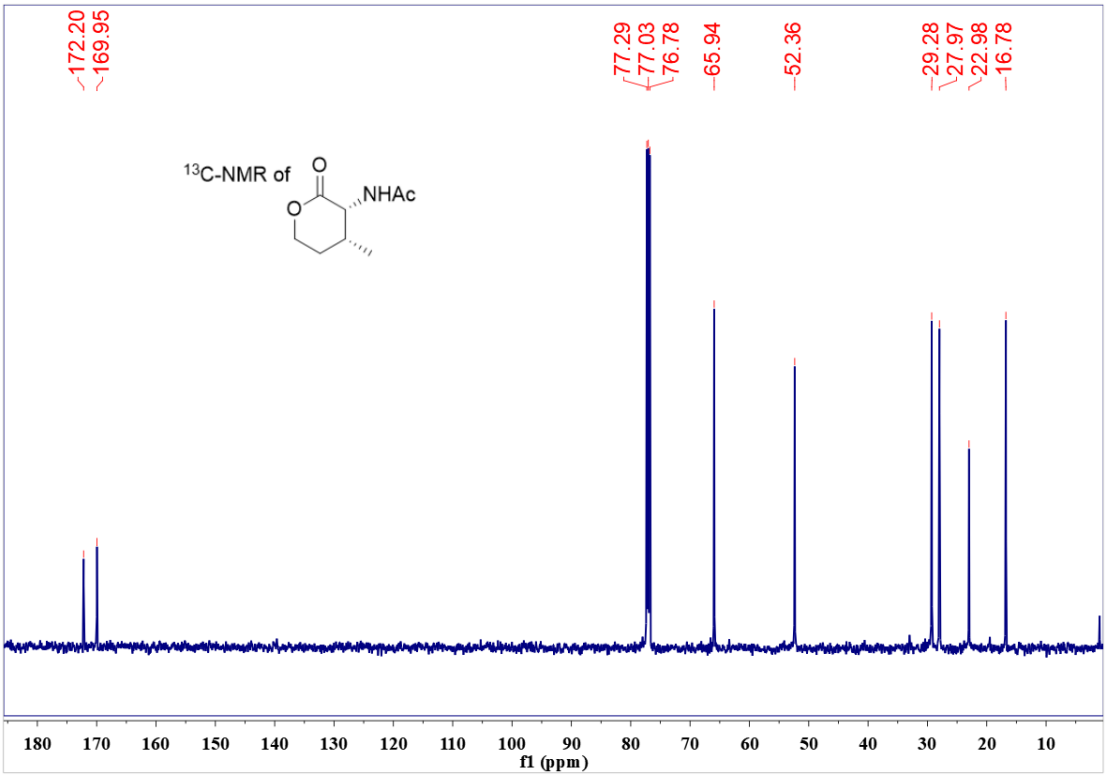
4.7982
4.7850
4.7719
4.3670
4.3648
4.3596
4.3562
4.3524
4.3450
4.3361
2.8554
2.8455
2.8414
2.8373
2.8274
2.2938
2.2831
2.2650
2.0427
1.6573
1.6519
1.6470
1.6374
0.8923
0.8783
1H-NMR of
NHAc
1.00
0.98
2.20
0.98
1.10
3.06
1.10
3.12
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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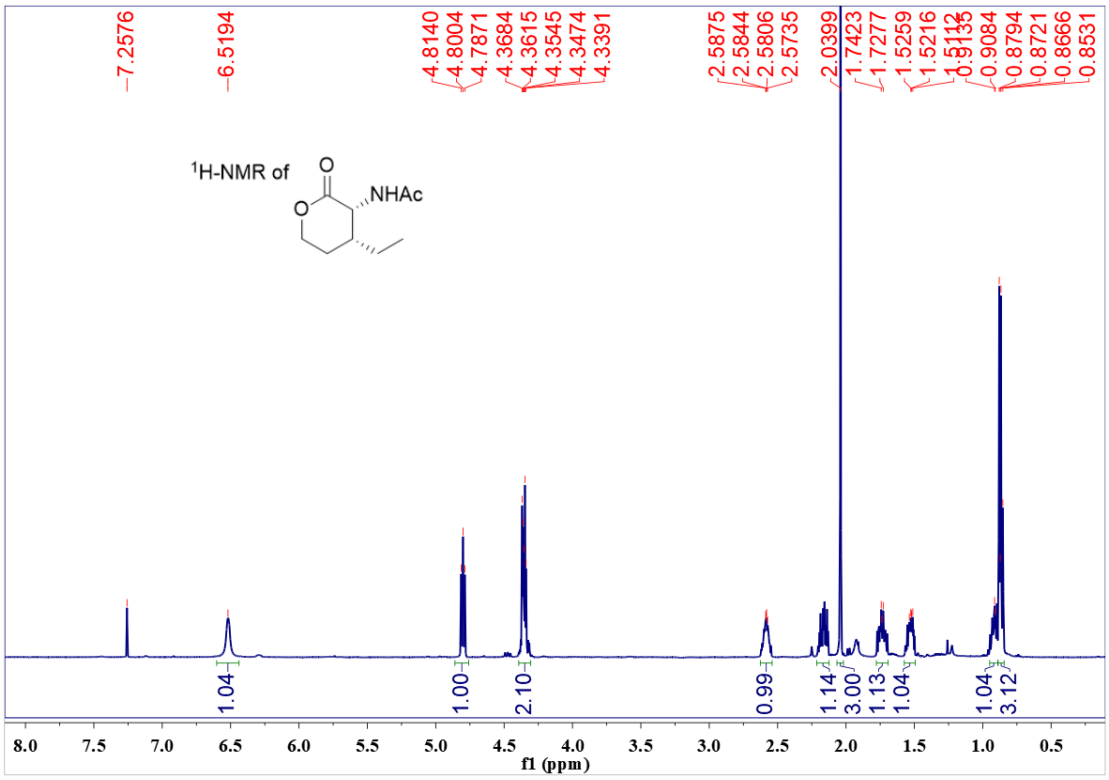
77.29
77.03
76.78
65.94
52.36
29.28
27.97
22.98
16.78
13C-NMR of
NHAc
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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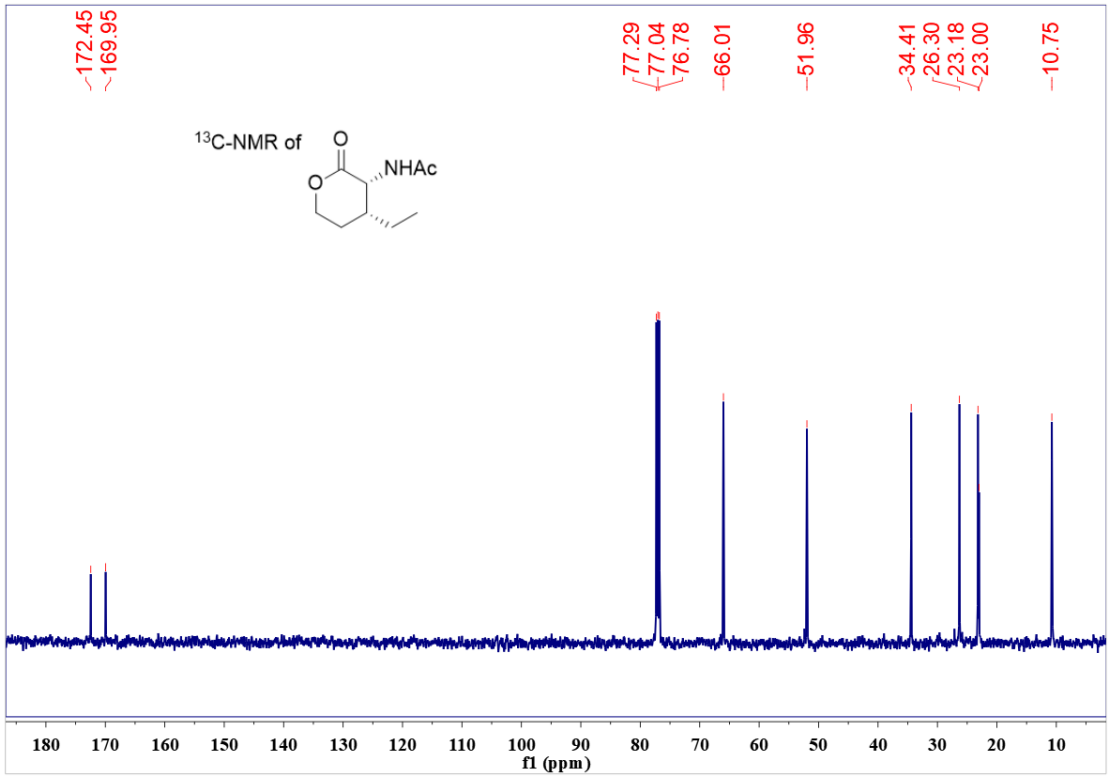
4.8140
4.8004
4.7871
4.3684
4.3615
4.3545
4.3474
4.3391
2.5875
2.5844
2.5806
2.5735
2.0399
1.7423
1.7277
1.5259
1.5216
1.5112
0.9135
0.9084
0.8794
0.8721
0.8666
0.8531
1H-NMR of
NHAc
1.04
1.00
2.10
0.99
1.14
3.00
1.13
1.04
1.04
3.12
f1 (ppm)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76.78
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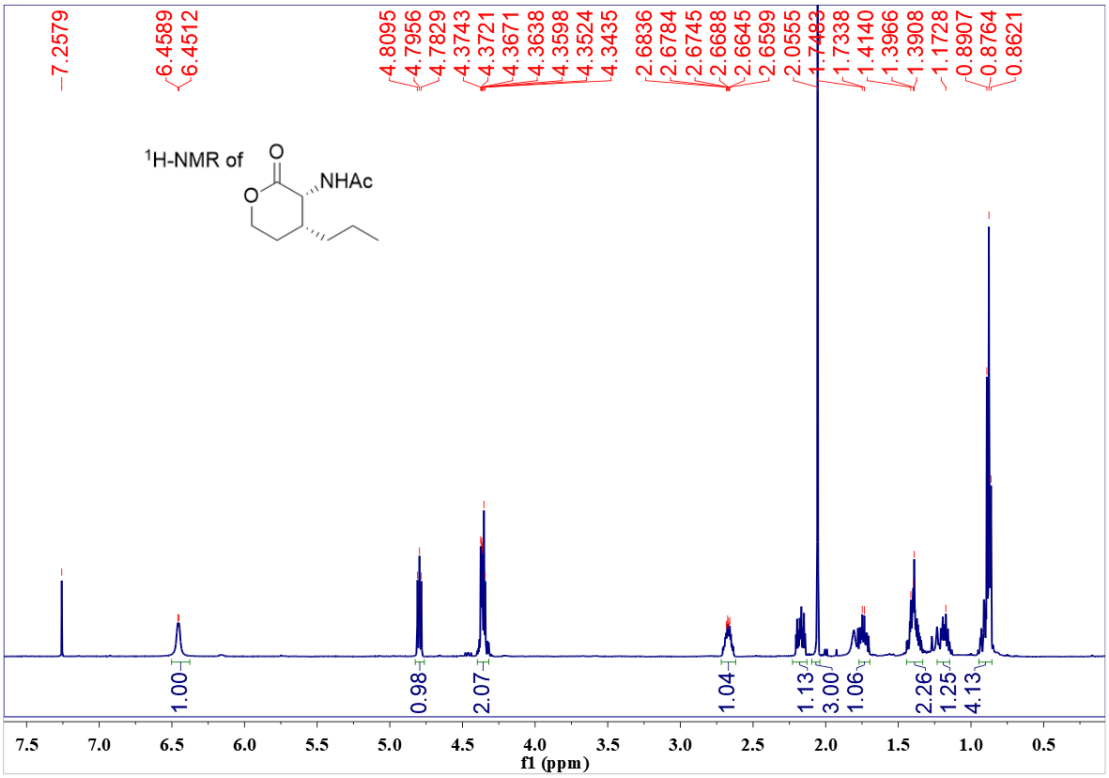
51.96
34.41
26.30
23.18
23.00
10.75
13C-NMR of
NHAc
f1 (ppm)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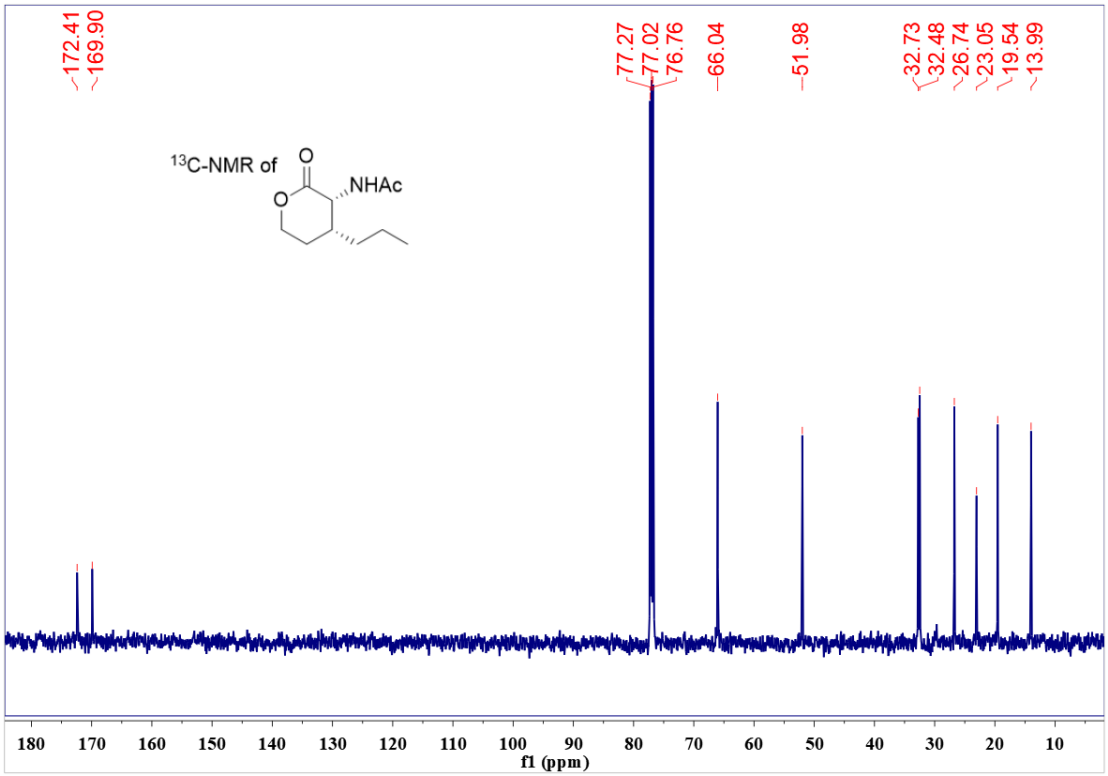
6.4512
4.8095
4.7956
4.7829
4.3743
4.3721
4.3671
4.3638
4.3598
4.3524
4.3435
2.6836
2.6784
2.6745
2.6688
2.6645
2.6599
2.0555
1.7483
1.7338
1.4140
1.3966
1.3908
1.1728
0.8907
0.8764
0.8621
1H-NMR of
NHAc
1.00
0.98
2.07
1.04
1.13
3.00
1.06
2.26
1.25
4.13
7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)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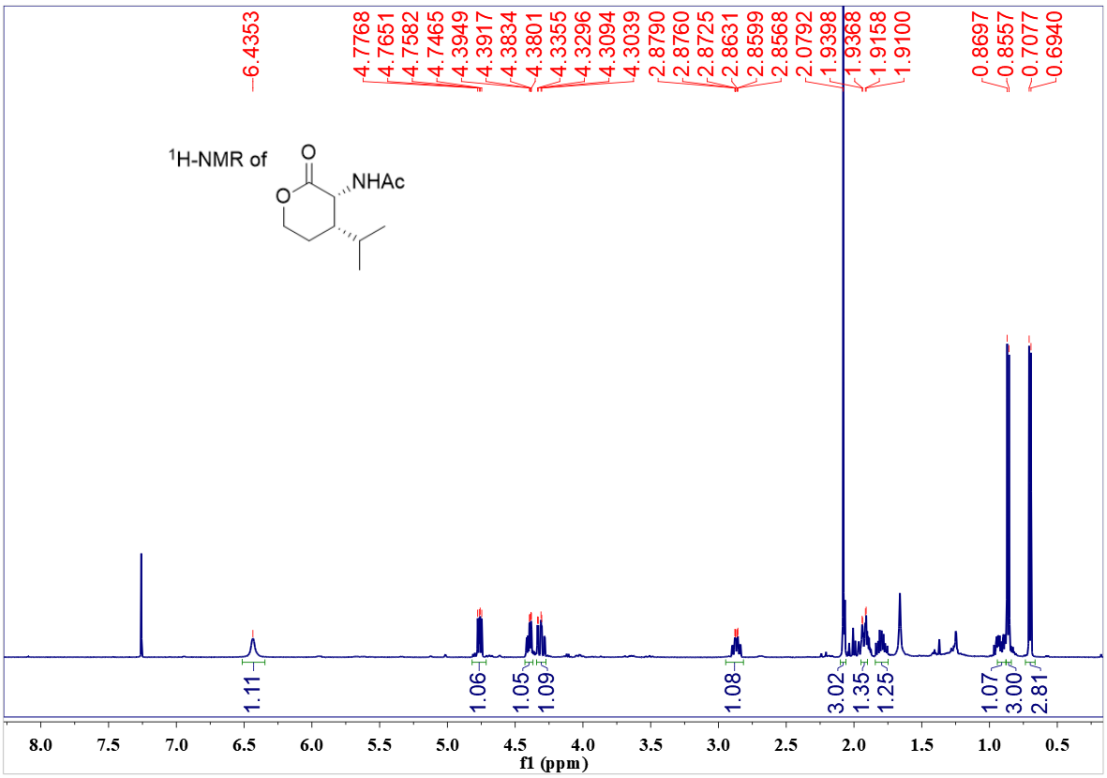
77.27
77.02
76.76
66.04
51.98
32.73
32.48
26.74
23.05
19.54
13.99
13C-NMR of
NHAc
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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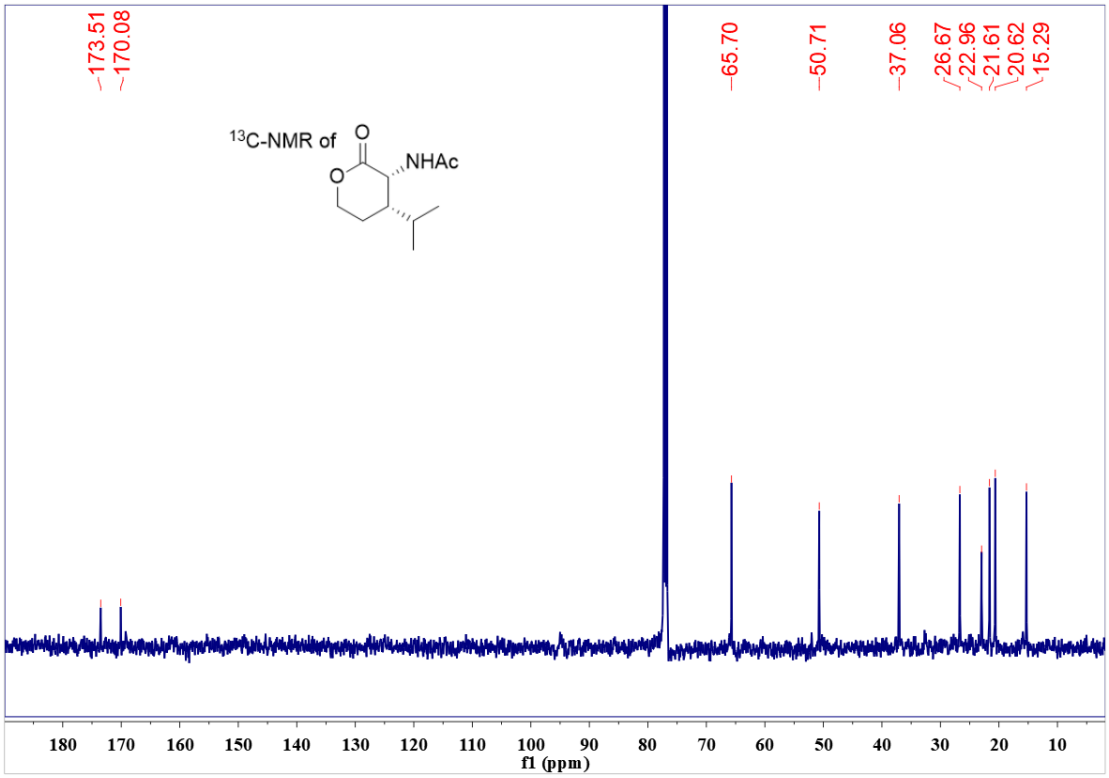
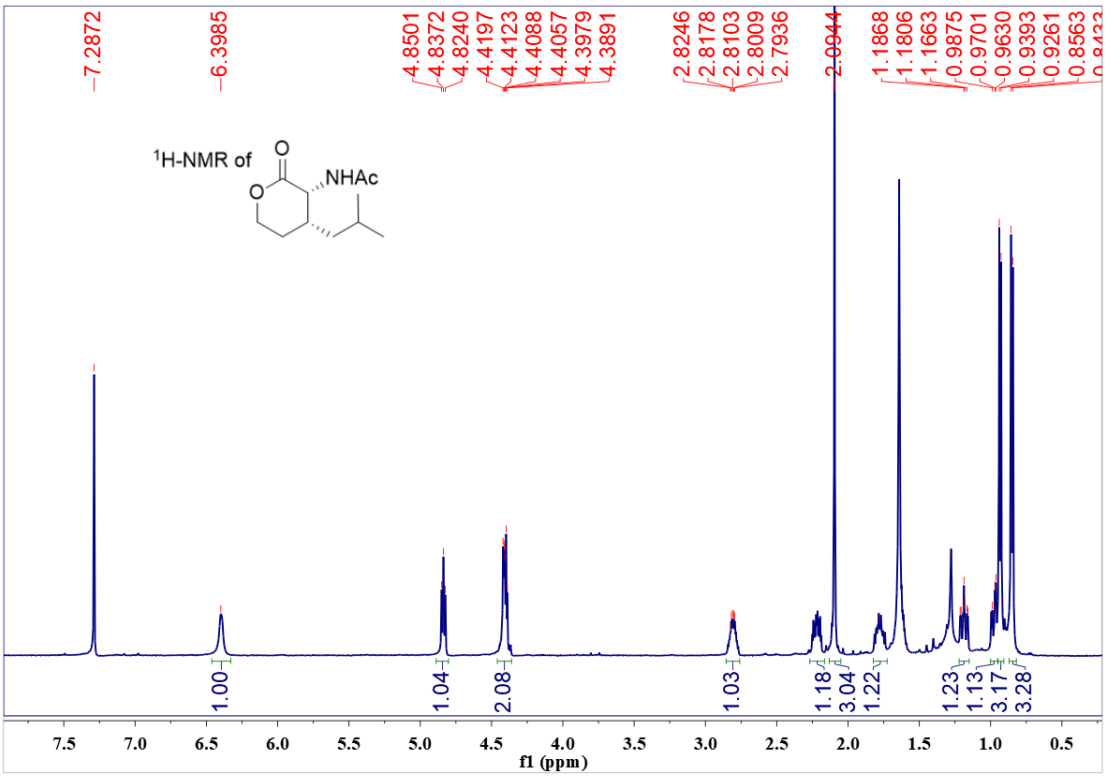
4.7768
4.7651
4.7582
4.7465
4.3949
4.3917
4.3834
4.3801
4.3355
4.3296
4.3094
4.3039
2.8790
2.8760
2.8725
2.8631
2.8599
2.8568
2.0792
1.9398
1.9368
1.9158
1.9100
0.8697
0.8557
0.7077
0.6940
1H-NMR of
NHAc
1.11
1.06
1.05
1.09
1.08
3.02
1.35
1.25
1.07
3.00
2.81
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


173.51
170.08
65.70
50.71
37.06
26.67
22.96
21.61
20.62
15.29
13C-NMR of
NHAc
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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4.8240
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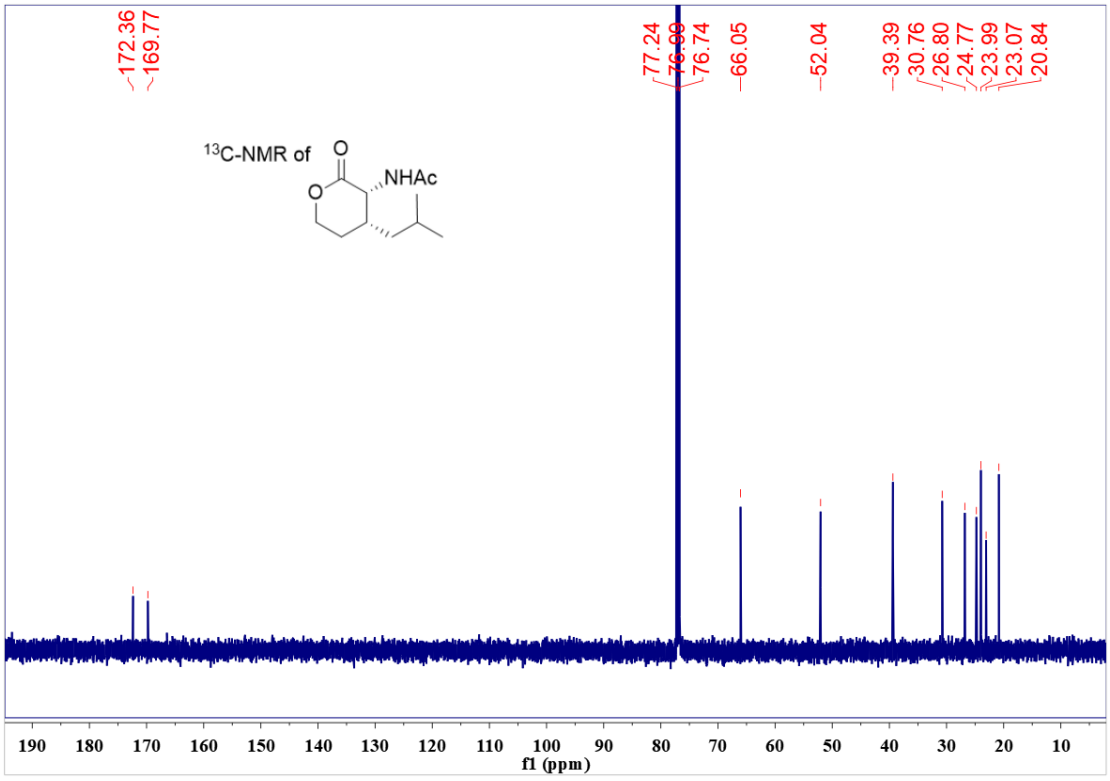
4.4123
4.4088
4.4057
4.3979
4.3891
2.8246
2.8178
2.8103
2.8009
2.7936
2.0944
1.1868
1.1806
1.1663
0.9875
0.9701
0.9630
0.9393
0.9261
0.8563
1H-NMR of
NHAc
1.00
1.04
2.08
1.03
1.18
3.04
1.22
1.23
1.13
3.17
3.28
f1 (ppm)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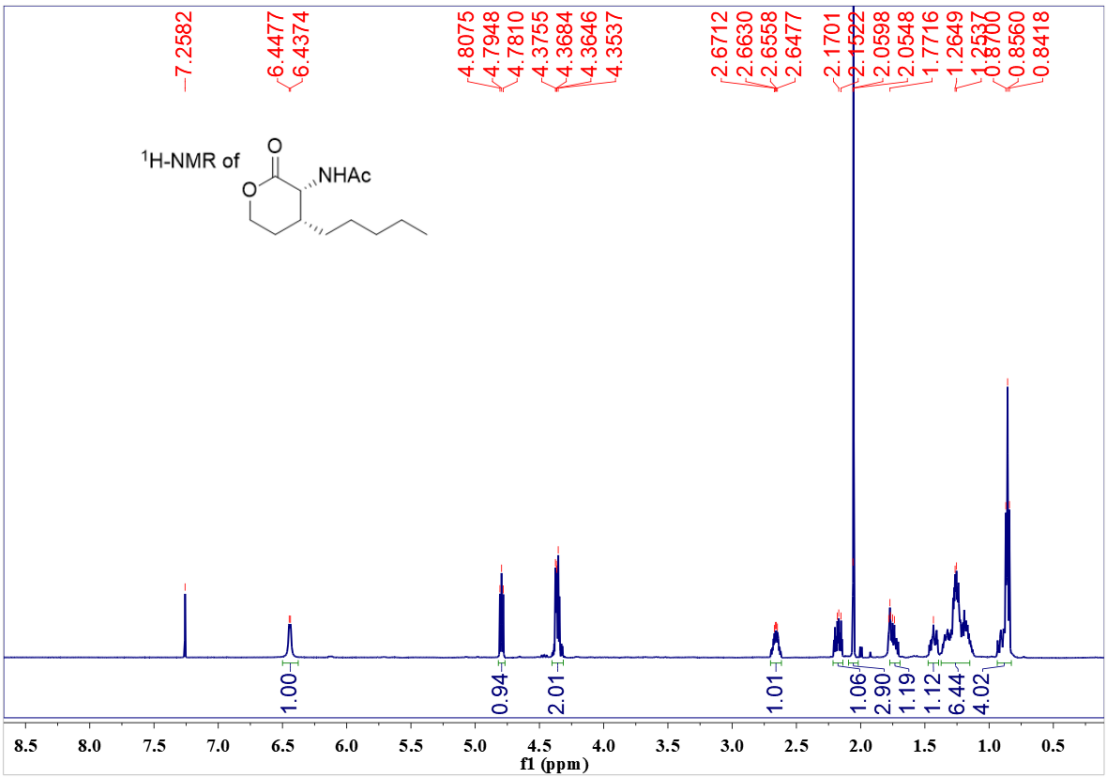
169.77
77.24
76.99
76.74
66.05
52.04
39.39
30.76
26.80
24.77
23.99
23.07
20.84
13C-NMR of
NHAc
f1 (ppm)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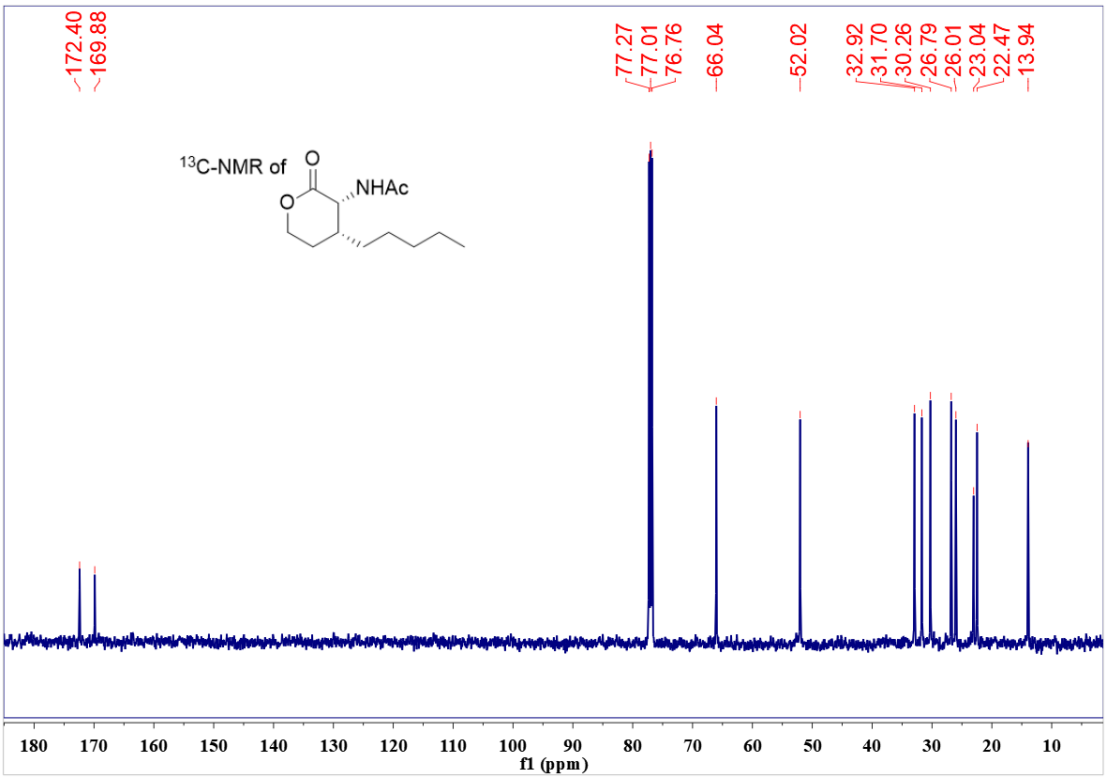
6.4374
4.8075
4.7948
4.7810
4.3755
4.3684
4.3646
4.3537
2.6712
2.6630
2.6558
2.6477
2.1701
2.1522
2.0598
2.0548
1.7716
1.2649
1.2537
0.8700
0.8560
0.8418
1H-NMR of
NHAc
1.00
0.94
2.01
1.01
1.06
2.90
1.19
1.12
6.44
4.02
f1 (ppm)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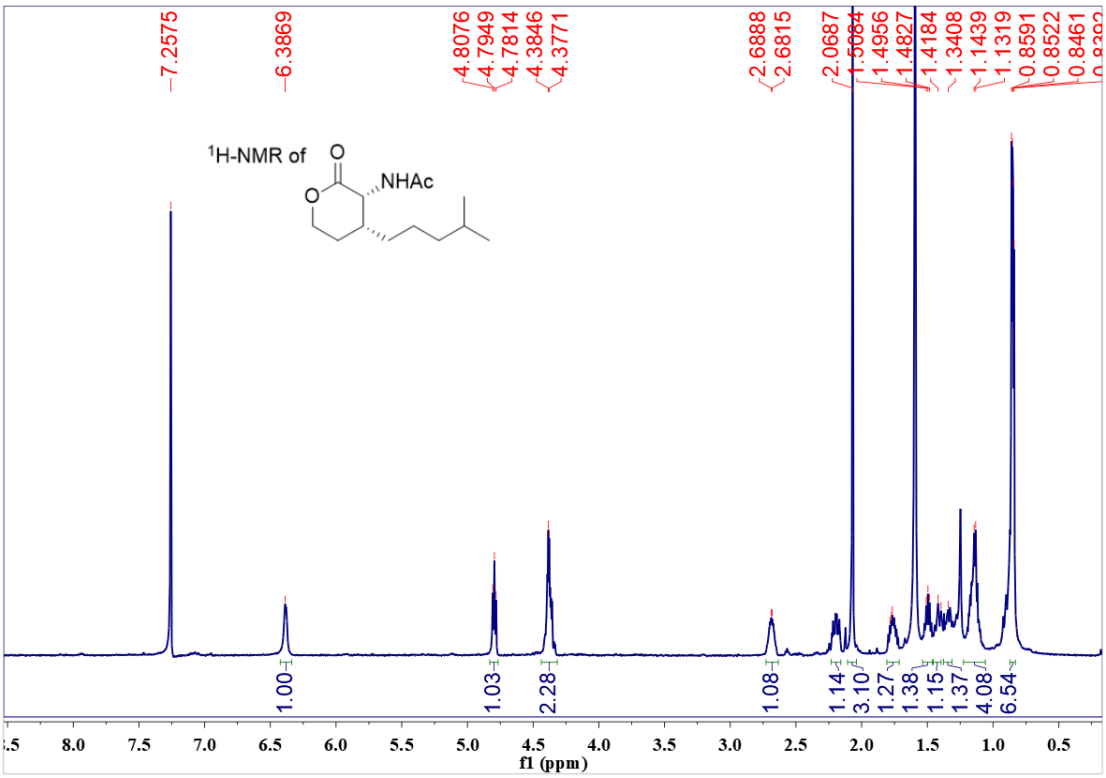
169.88
77.27
77.01
76.76
66.04
52.02
32.92
31.70
30.26
26.79
26.01
23.04
22.47
13.94
13C-NMR of
NHAc
f1 (ppm)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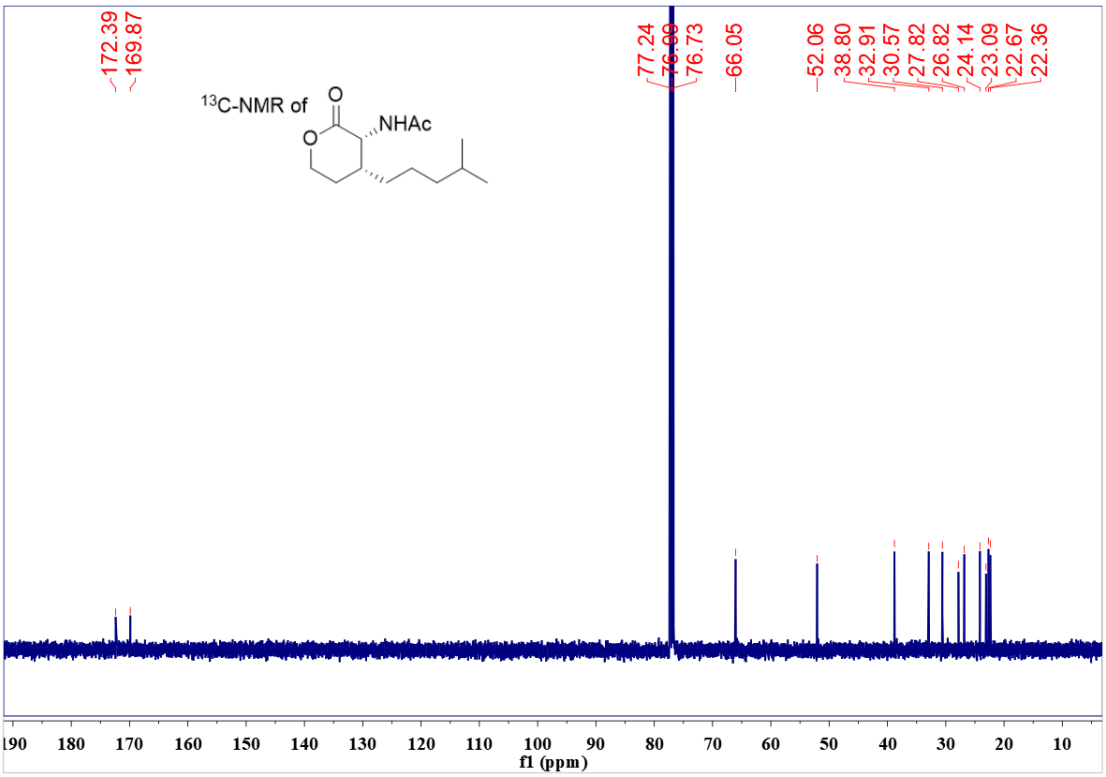
6.3869
4.8076
4.7949
4.7814
4.3846
4.3771
2.6888
2.6815
2.0687
1.5084
1.4956
1.4827
1.4184
1.3408
1.1439
1.1319
0.8591
0.8522
0.8461
1H-NMR of
NHAc
1.00
1.03
2.28
1.08
1.14
3.10
1.27
1.38
1.15
1.37
4.08
6.54
f1 (ppm)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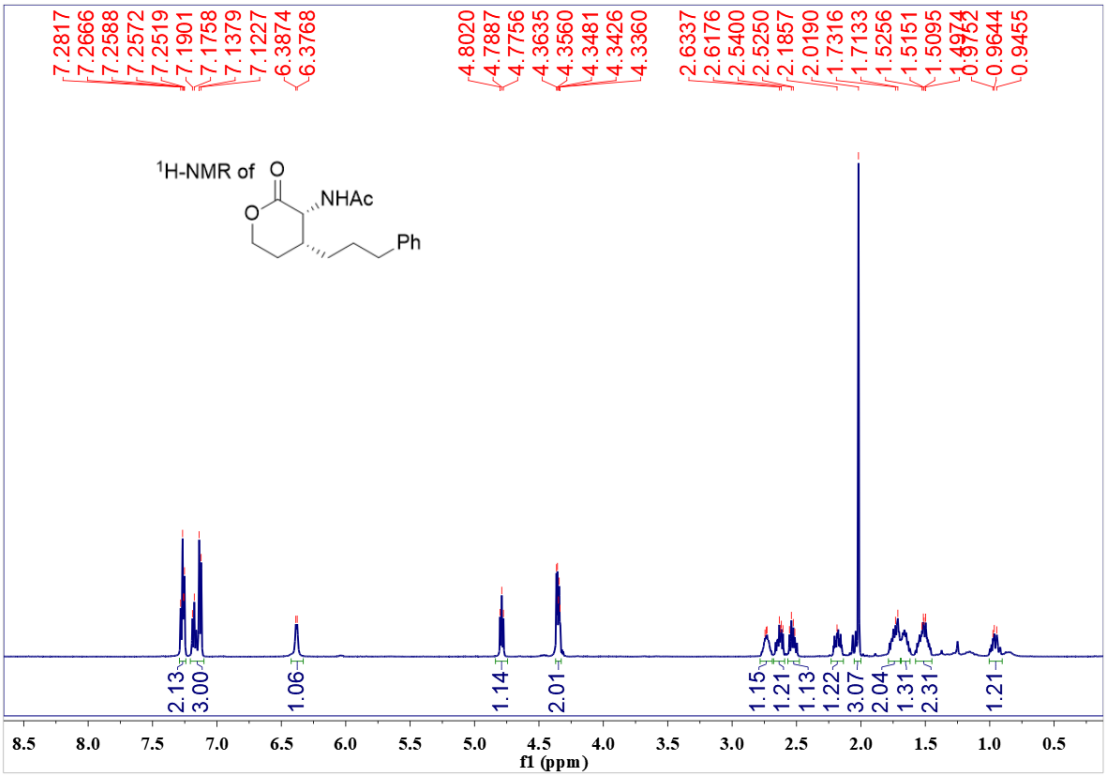
169.87
77.24
76.73
66.05
52.06
38.80
32.91
30.57
27.82
26.82
24.14
23.09
22.67
22.36
13C-NMR of
NHAc
f1 (ppm)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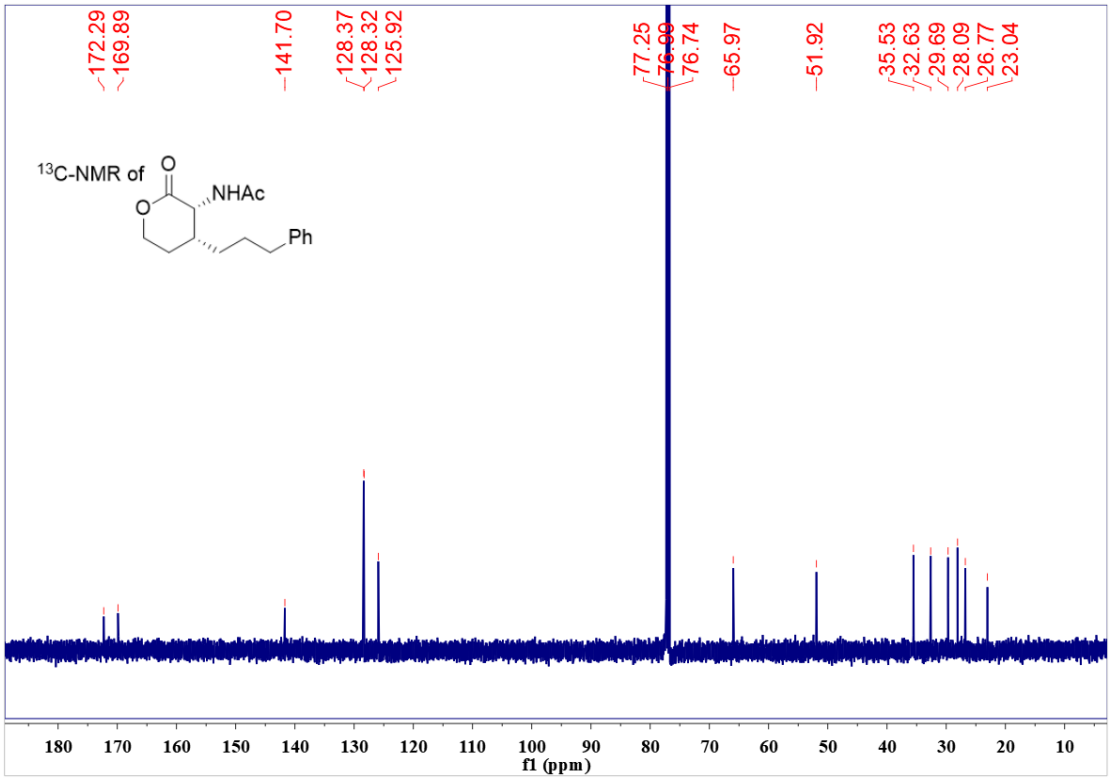
7.2588
7.2572
7.2519
7.1901
7.1758
7.1379
7.1227
6.3874
6.3768
4.8020
4.7887
4.7756
4.3635
4.3560
4.3481
4.3426
4.3360
2.6337
2.6176
2.5400
2.5250
2.1857
2.0190
1.7316
1.7133
1.5256
1.5151
1.5095
1.4974
0.9752
0.9644
0.9455
1H-NMR of
O
NHAc
O
Ph
2.13
3.00
1.06
1.14
2.01
1.15
1.21
1.13
1.22
3.07
2.04
1.31
2.31
1.21
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
f1 (ppm)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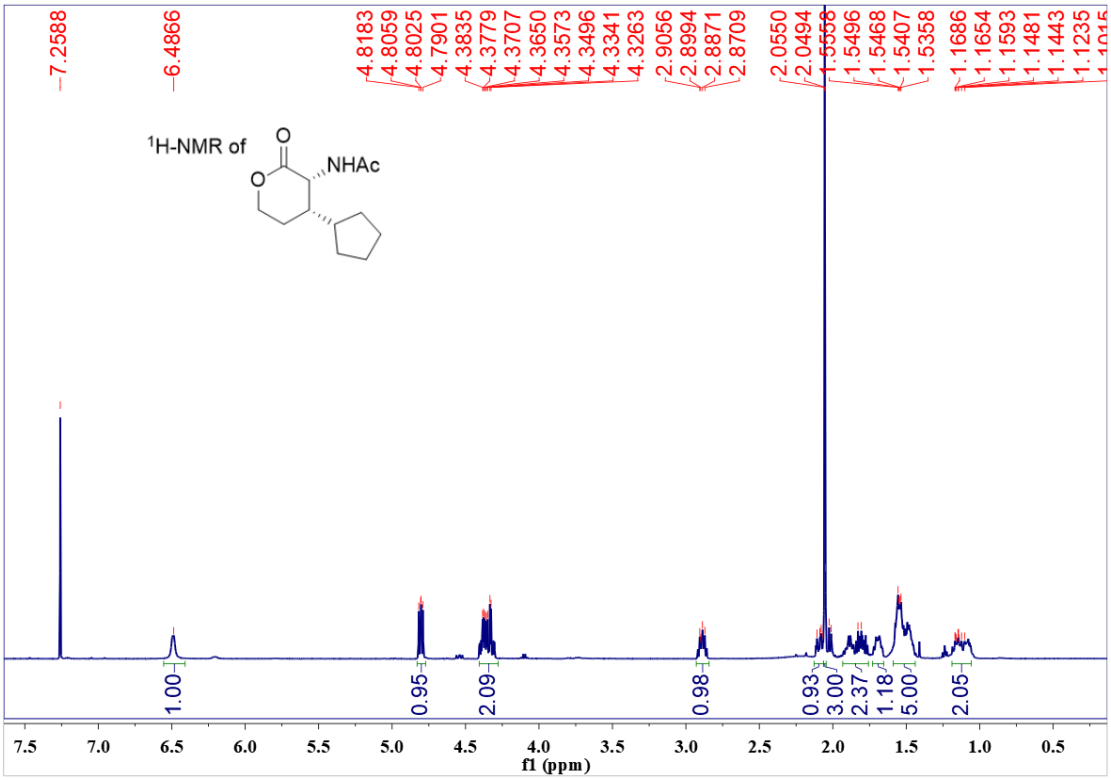
169.89
141.70
128.37
128.32
125.92
77.25
76.99
76.74
65.97
51.92
35.53
32.63
29.69
28.09
26.77
23.04
13C-NMR of
O
NHAc
O
Ph
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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6.4866
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4.8059
4.8025
4.7901
4.3835
4.3779
4.3707
4.3650
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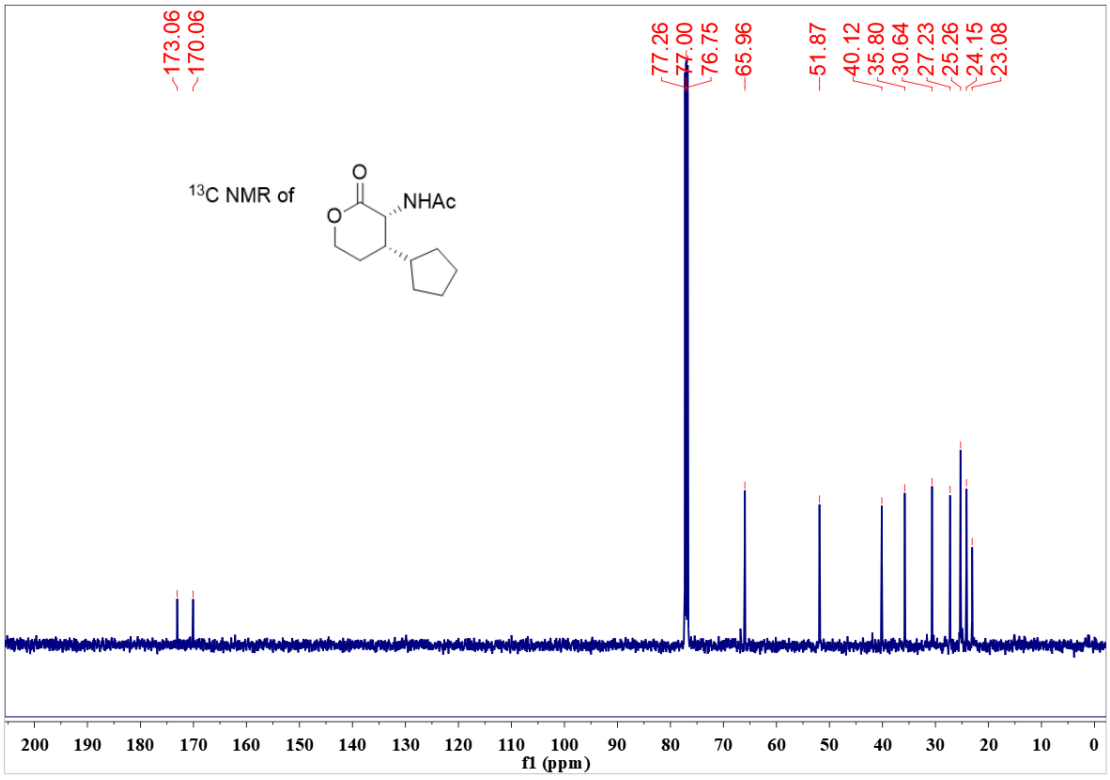
4.3496
4.3341
4.3263
2.9056
2.8994
2.8871
2.8709
2.0550
2.0494
1.5558
1.5496
1.5468
1.5407
1.5358
1.1686
1.1654
1.1593
1.1481
1.1443
1.1235
1H-NMR of
NHAc
1.00
0.95
2.09
0.98
0.93
3.00
2.37
1.18
5.00
2.05
f1 (ppm)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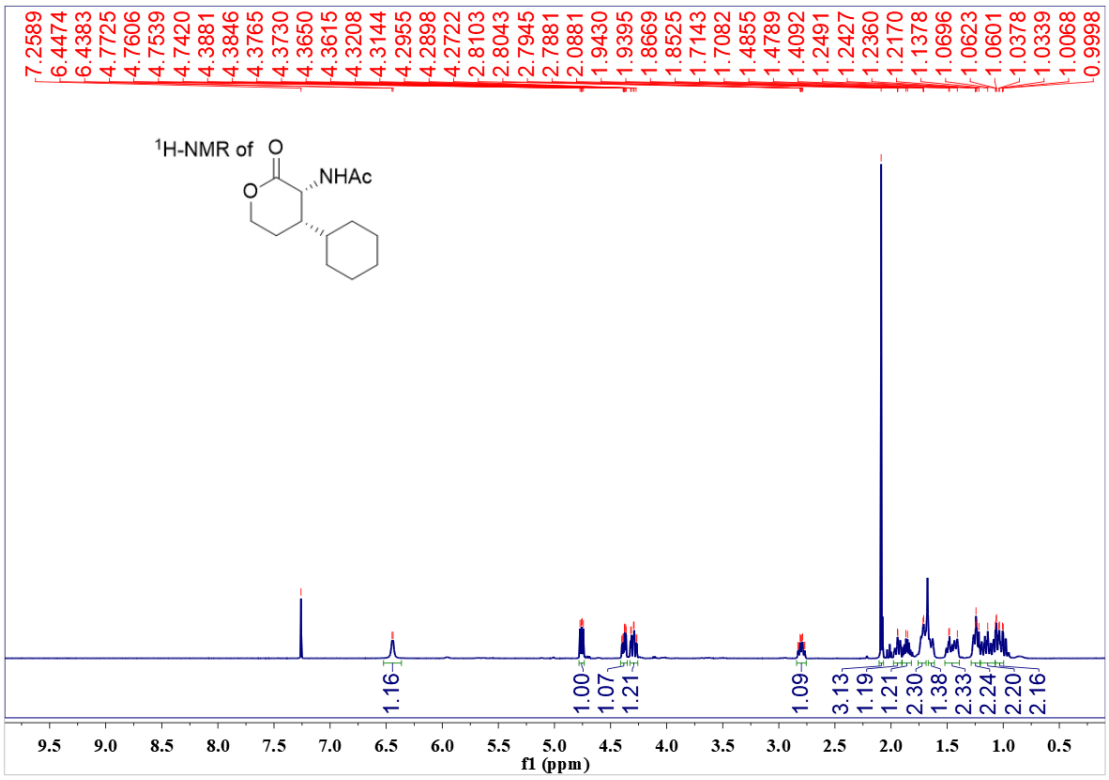
170.06
77.26
77.00
76.75
65.96
51.87
40.12
35.80
30.64
27.23
25.26
24.15
23.08
13C NMR of
NHAc
f1 (ppm)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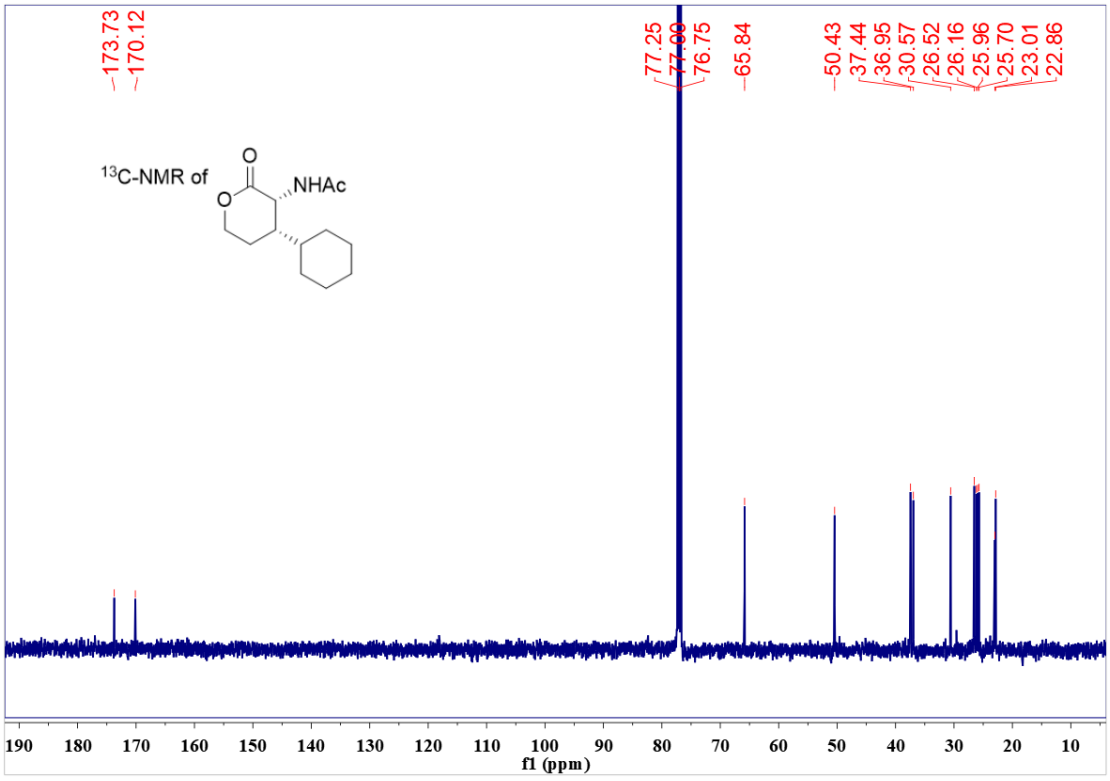
4.7420
4.3881
4.3846
4.3765
4.3730
4.3650
4.3615
4.3208
4.3144
4.2955
4.2898
4.2722
2.8103
2.8043
2.7945
2.7881
2.0881
1.9430
1.9395
1.8669
1.8525
1.7143
1.7082
1.4855
1.4789
1.4092
1.2491
1.2427
1.2360
1.2170
1.1378
1.0696
1.0623
1.0601
1.0378
1.0339
1.0068
0.9998
1H-NMR of
O
NHAc
O
1.16
1.00
1.07
1.21
1.09
3.13
1.19
1.21
2.30
1.38
2.33
2.24
2.20
2.16
9.5 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
f1 (ppm)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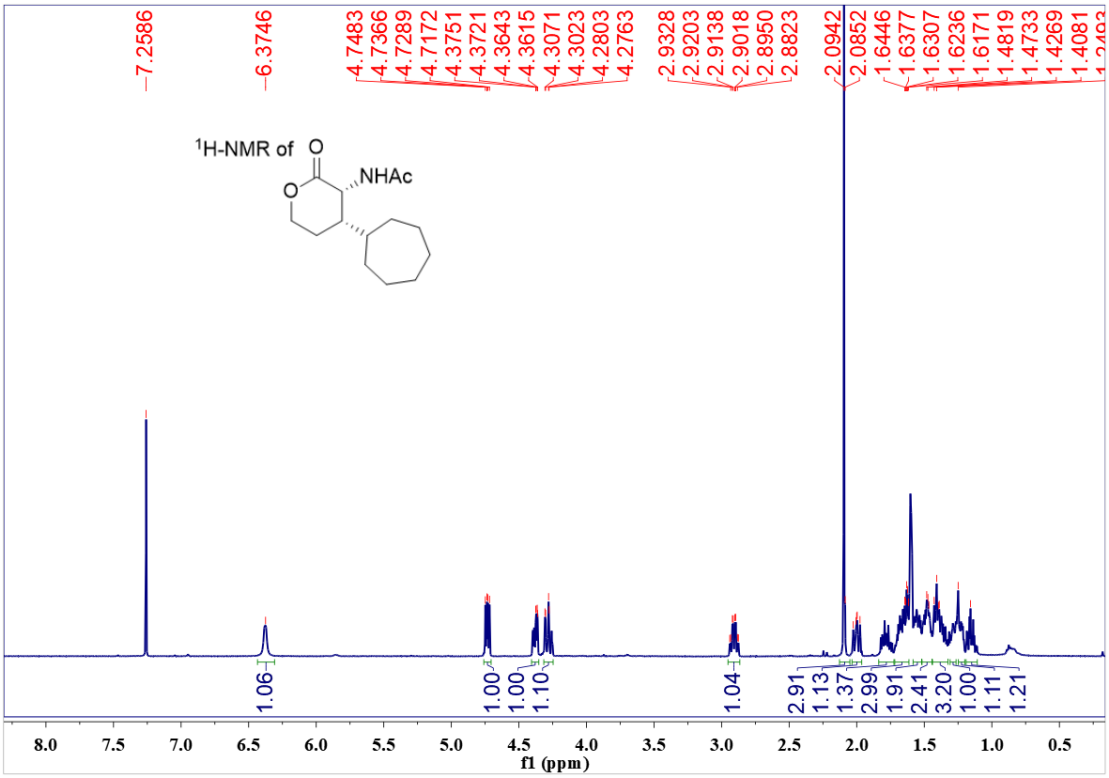
77.25
77.00
76.75
65.84
50.43
37.44
36.95
30.57
26.52
26.16
25.96
25.70
23.01
22.86
13C-NMR of
O
NHAc
O
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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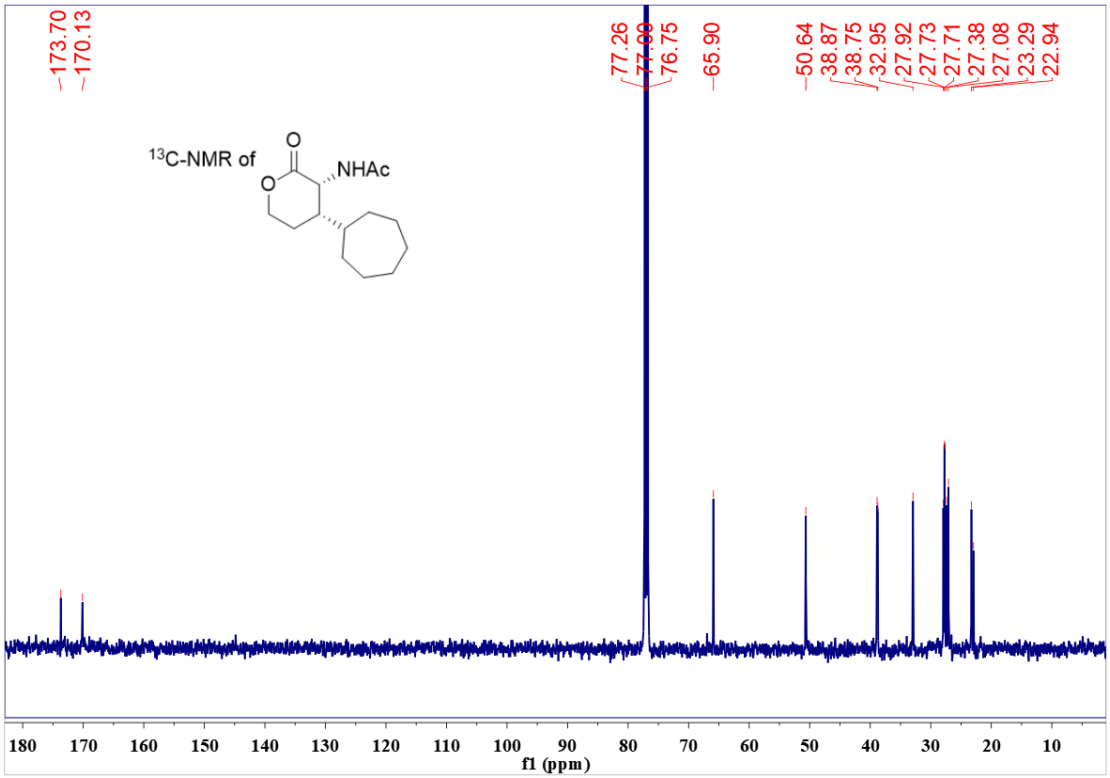
4.7289
4.7172
4.3751
4.3721
4.3643
4.3615
4.3071
4.3023
4.2803
4.2763
2.9328
2.9203
2.9138
2.9018
2.8950
2.8823
2.0942
2.0852
1.6446
1.6377
1.6307
1.6236
1.6171
1.4819
1.4733
1.4269
1.4081
1H-NMR of
NHAc
1.06
1.00
1.00
1.10
1.04
2.91
1.13
1.37
2.99
1.91
2.41
3.20
1.00
1.11
1.21
f1 (ppm)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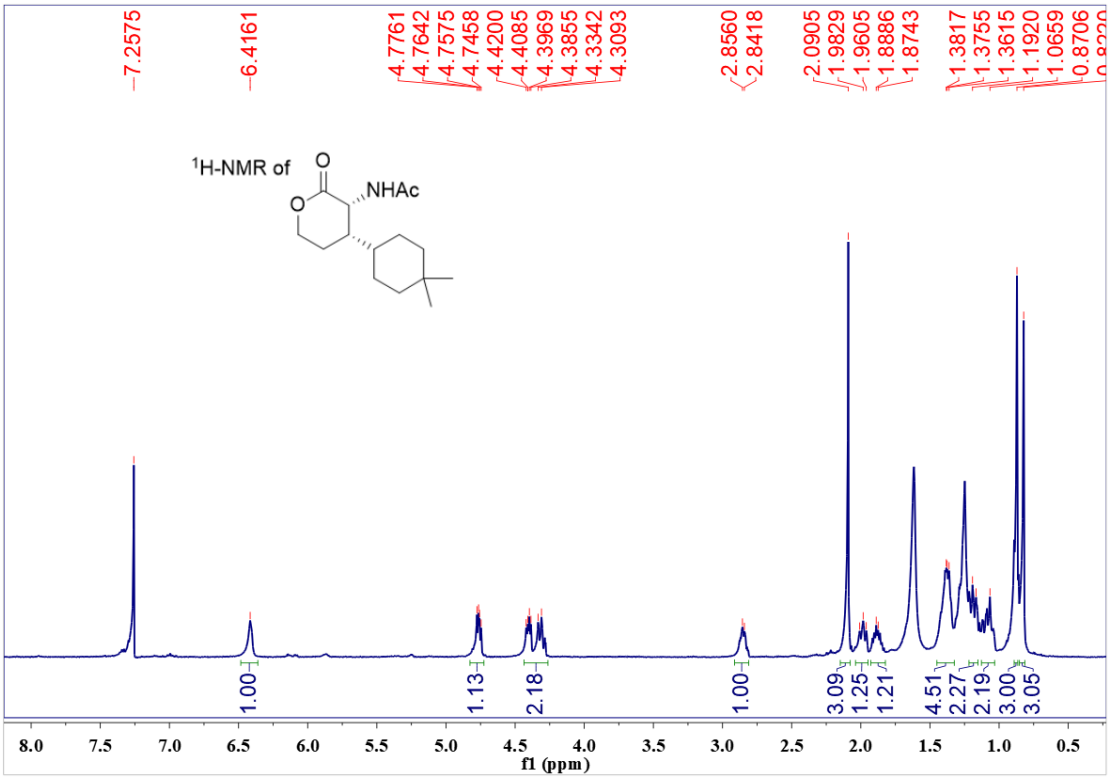
170.13
77.26
77.00
76.75
65.90
50.64
38.87
38.75
32.95
27.92
27.73
27.71
27.38
27.08
23.29
22.94
13C-NMR of
NHAc
f1 (ppm)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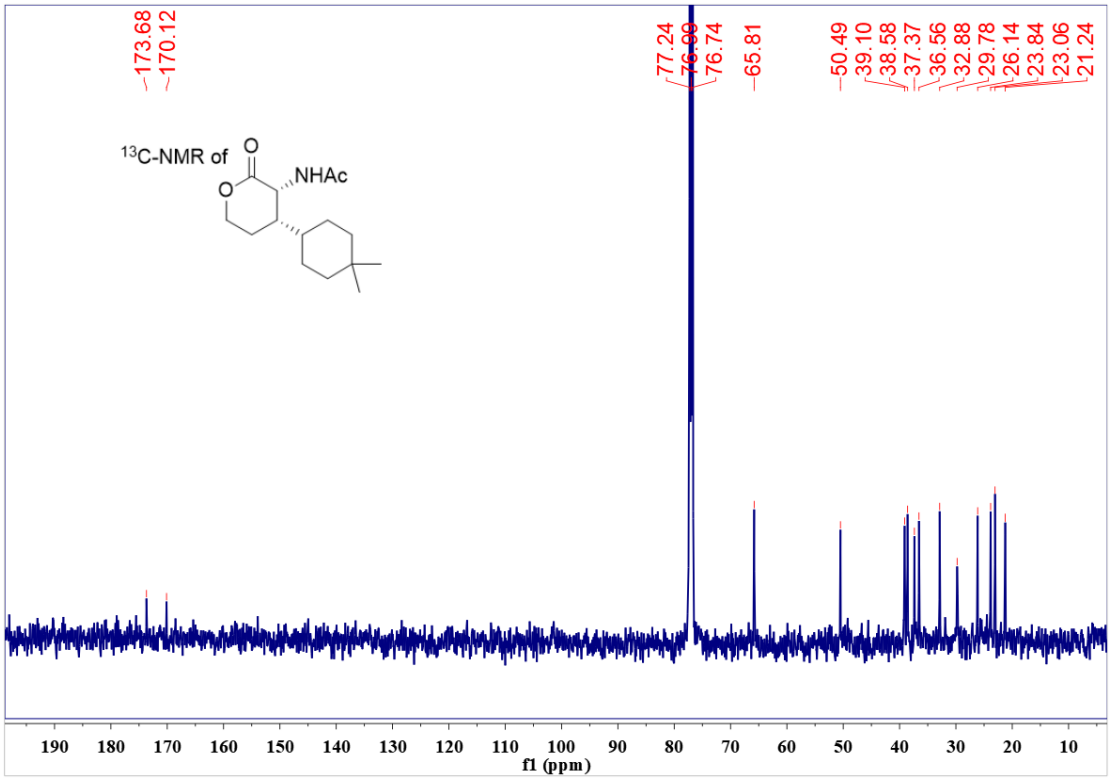
4.7642
4.7575
4.7458
4.4200
4.4085
4.3969
4.3855
4.3342
4.3093
2.8560
2.8418
2.0905
1.9829
1.9605
1.8886
1.8743
1.3817
1.3755
1.3615
1.1920
1.0659
0.8706
1H-NMR of
NHAc
O
O
1.00
1.13
2.18
1.00
3.09
1.25
1.21
4.51
2.27
2.19
3.00
3.05
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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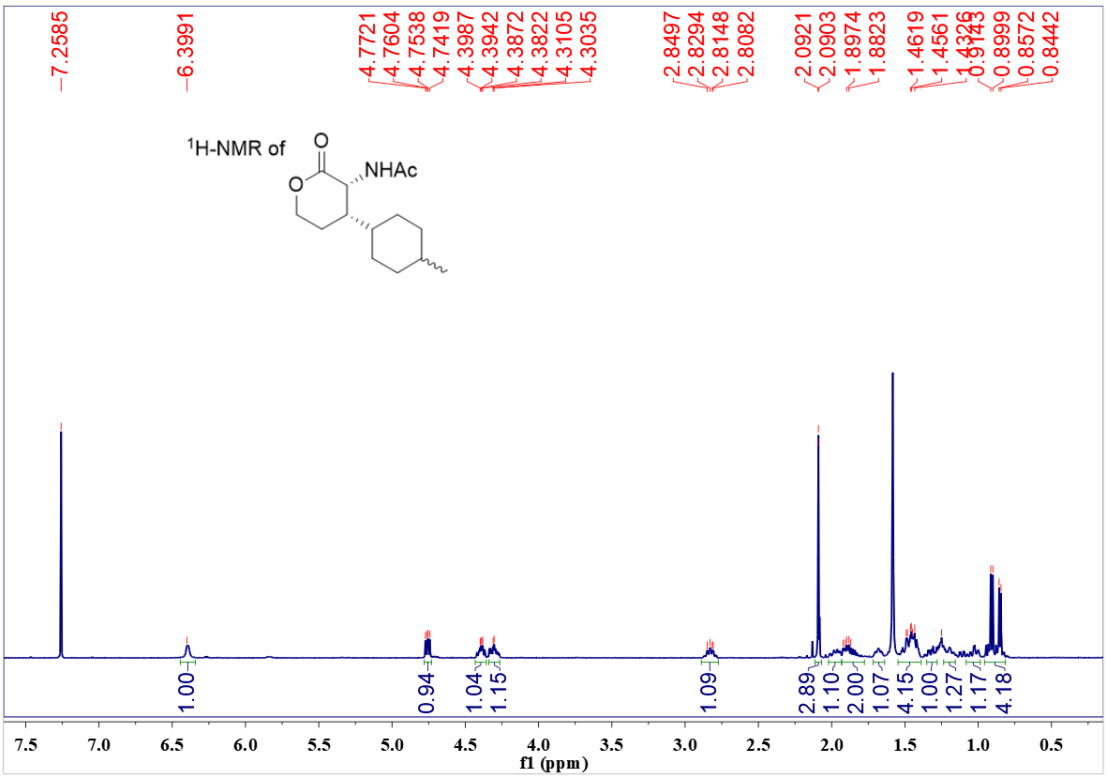
76.99
76.74
65.81
50.49
39.10
38.58
37.37
36.56
32.88
29.78
26.14
23.84
23.06
21.24
13C-NMR of
NHAc
O
O
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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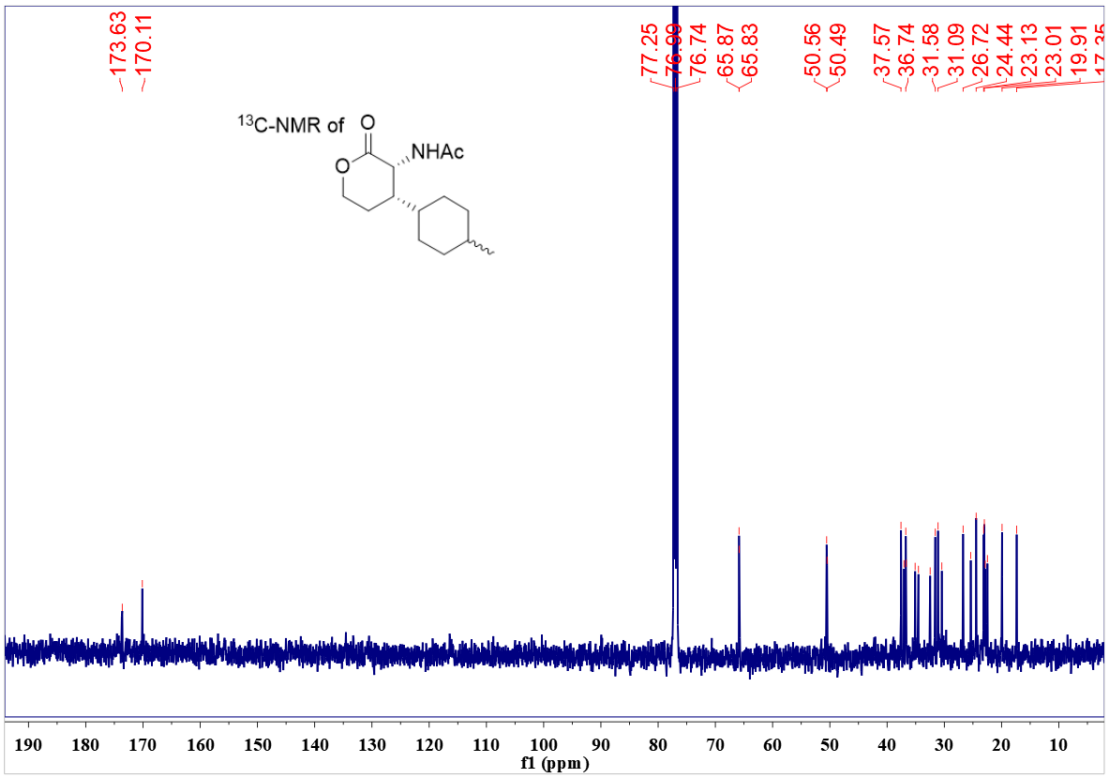
4.7538
4.7419
4.3987
4.3942
4.3872
4.3822
4.3105
4.3035
2.8497
2.8294
2.8148
2.8082
2.0921
2.0903
1.8974
1.8823
1.4619
1.4561
0.9143
0.8999
0.8572
0.8442
1H-NMR of
NHAc
1.00
0.94
1.04
1.15
1.09
2.89
1.10
2.00
1.07
4.15
1.00
1.27
1.17
4.18
f1 (ppm)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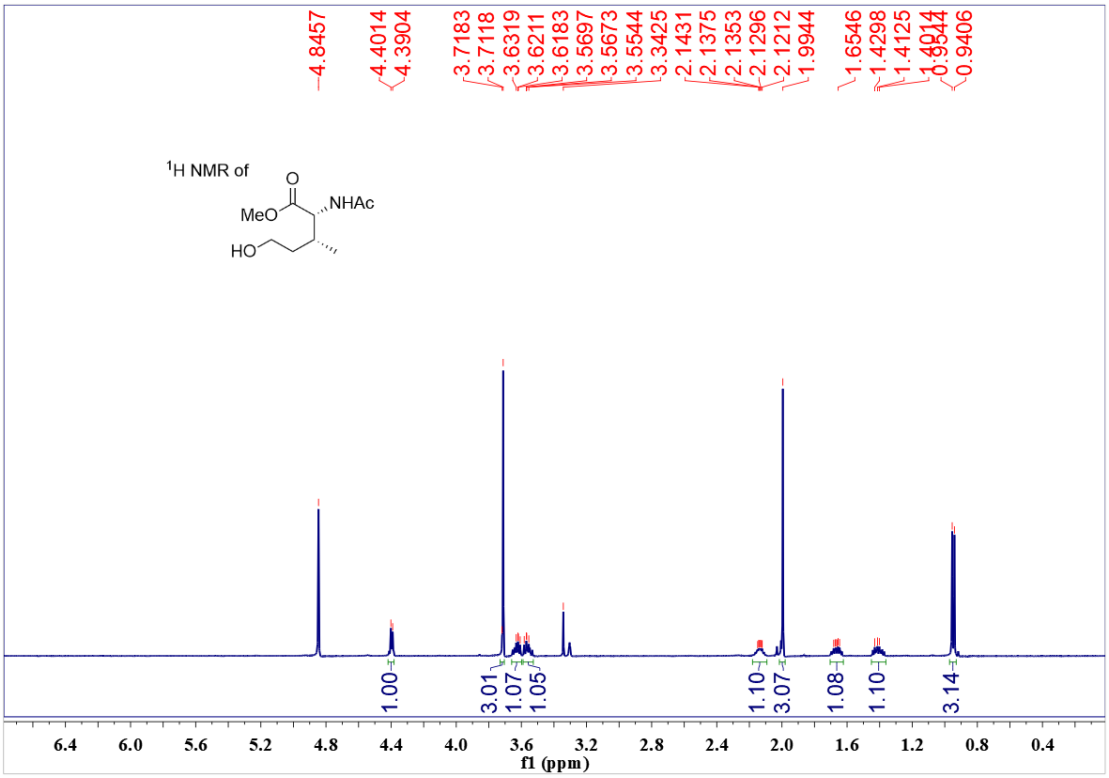
76.74
65.87
65.83
50.56
50.49
37.57
36.74
31.58
31.09
26.72
24.44
23.13
23.01
19.91
13C-NMR of
NHAc
f1 (ppm)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3.6211
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3.5673
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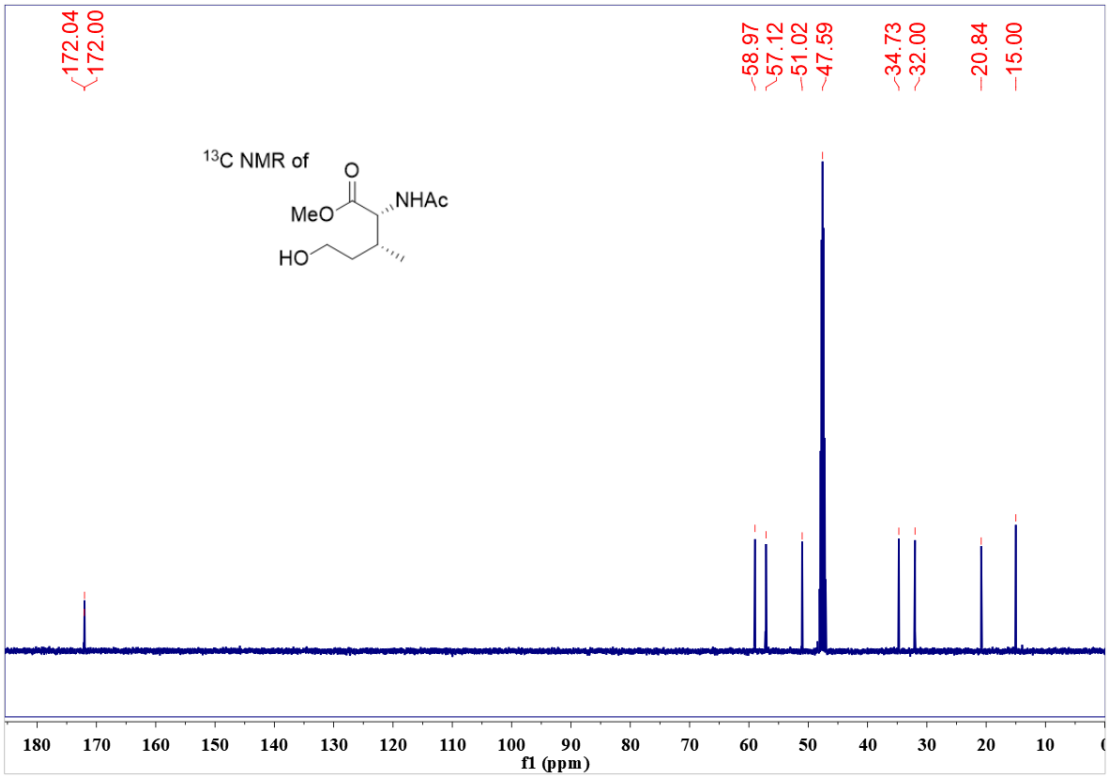
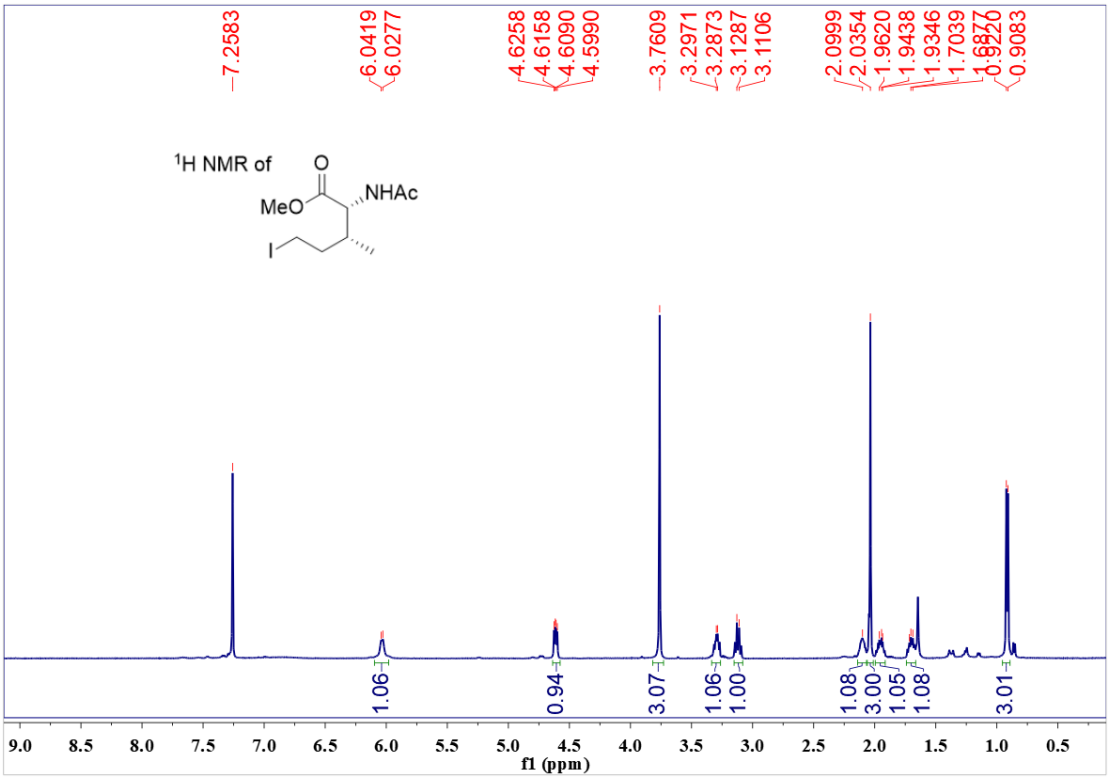
2.1431
2.1375
2.1353
2.1296
2.1212
1.9944
1.6546
1.4298
1.4125
1.4014
0.9544
0.9406
1H NMR of
O
MeO
NHAc
HO
1.00
3.01
1.07
1.05
1.10
3.07
1.08
1.10
3.14
6.4
6.0
5.6
5.2
4.8
4.4
4.0
3.6
3.2
2.8
2.4
2.0
1.6
1.2
0.8
0.4
f1 (ppm)


172.04
172.00
58.97
57.12
51.02
47.59
34.73
32.00
20.84
15.00
13C NMR of
O
MeO
NHAc
HO
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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4.5990
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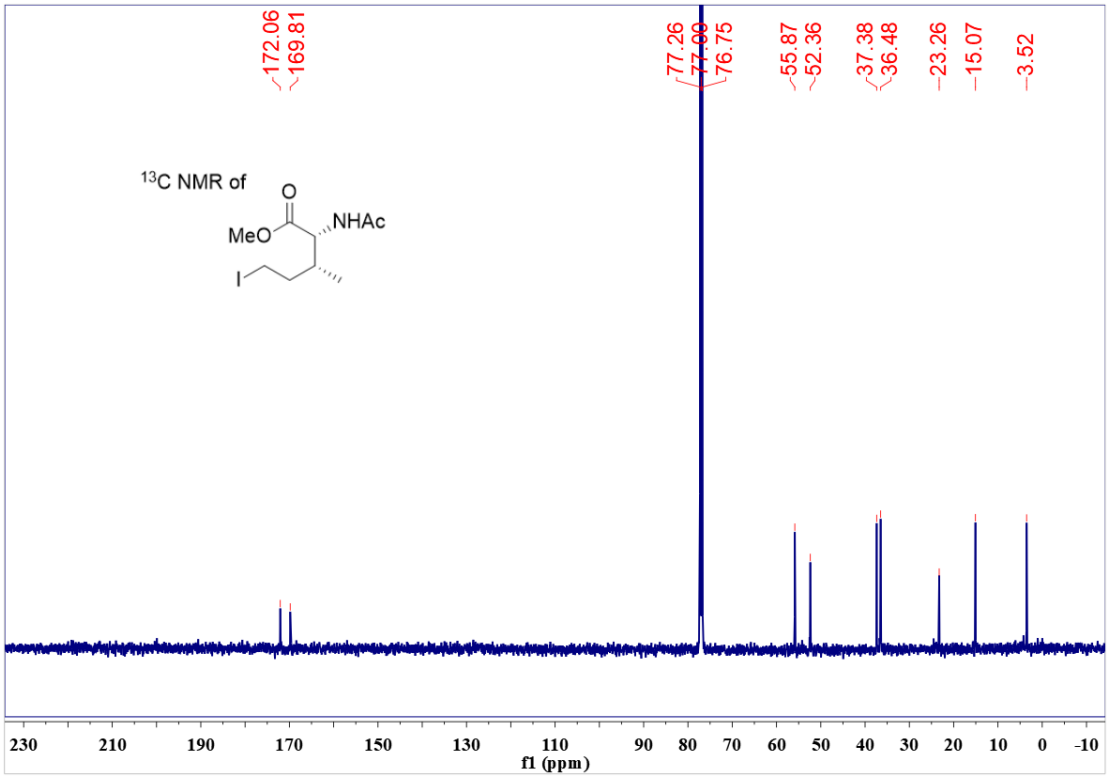
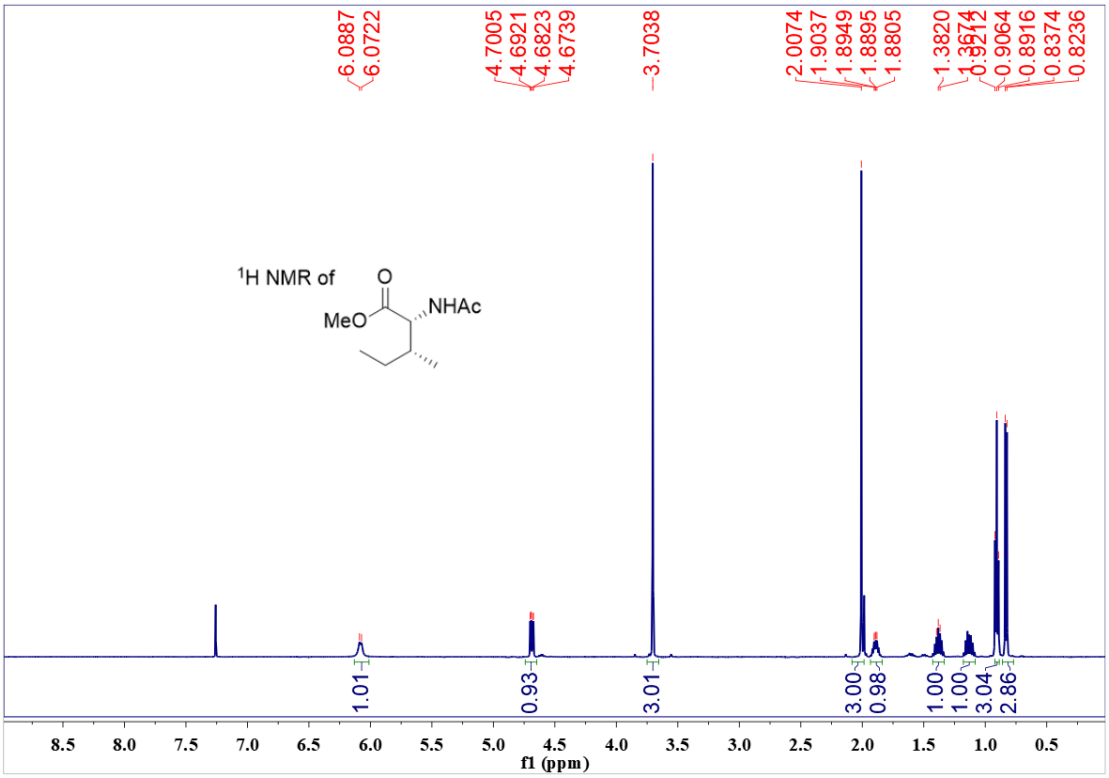
3.2971
3.2873
3.1287
3.1106
2.0999
2.0354
1.9620
1.9438
1.9346
1.7039
0.9220
0.9083
1H NMR of
MeO
O
NHAc
I
1.06
0.94
3.07
1.06
1.00
1.08
3.00
1.05
1.08
3.01
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)


172.06
169.81
77.26
77.00
76.75
55.87
52.36
37.38
36.48
23.26
15.07
3.52
13C NMR of
MeO
O
NHAc
I
230 210 190 170 150 130 110 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)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6.0722
4.7005
4.6921
4.6823
4.6739
3.7038
2.0074
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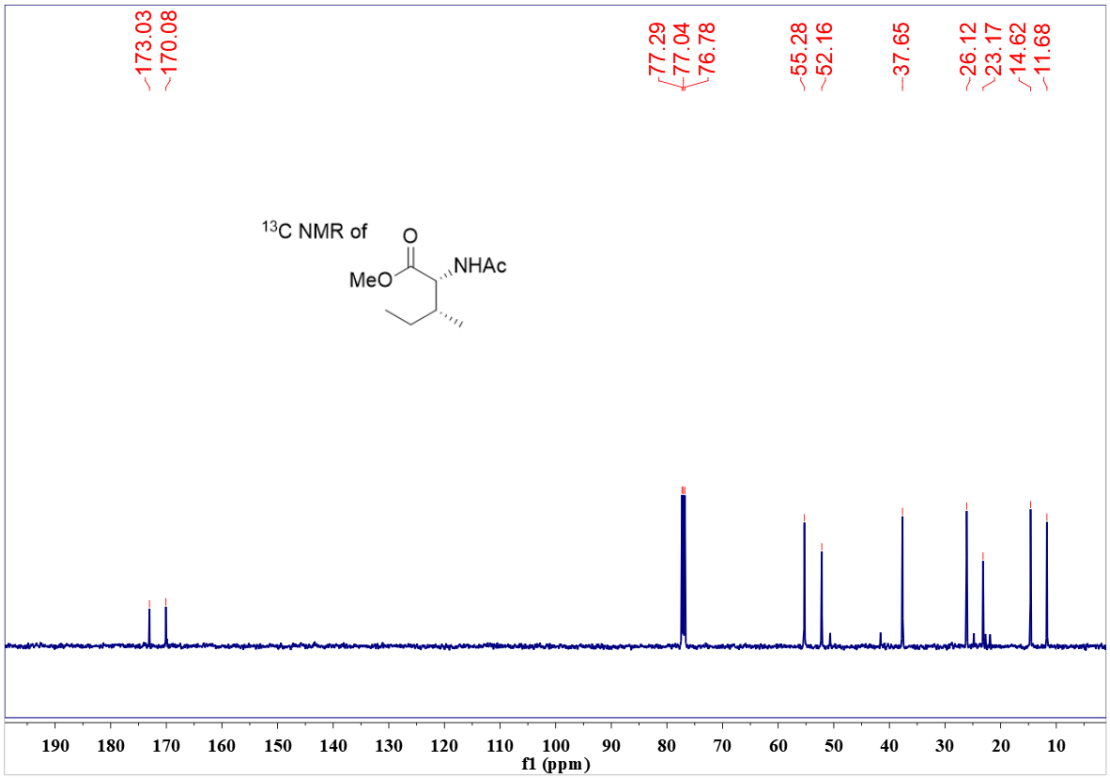
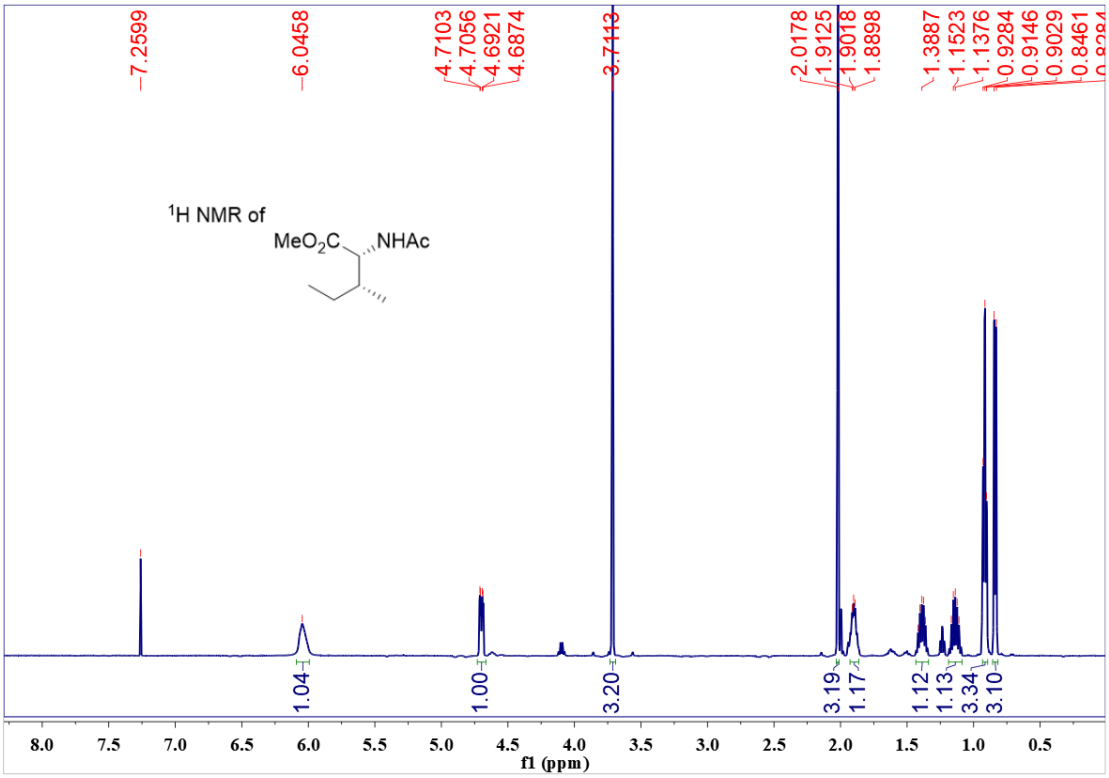
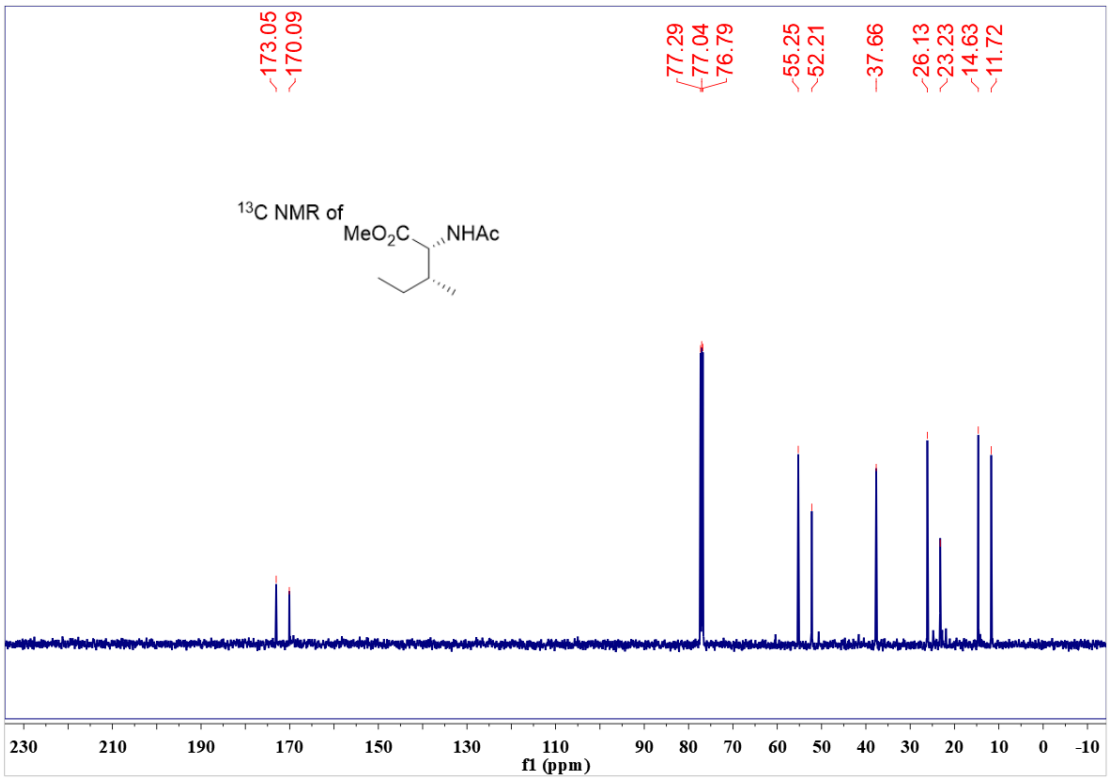
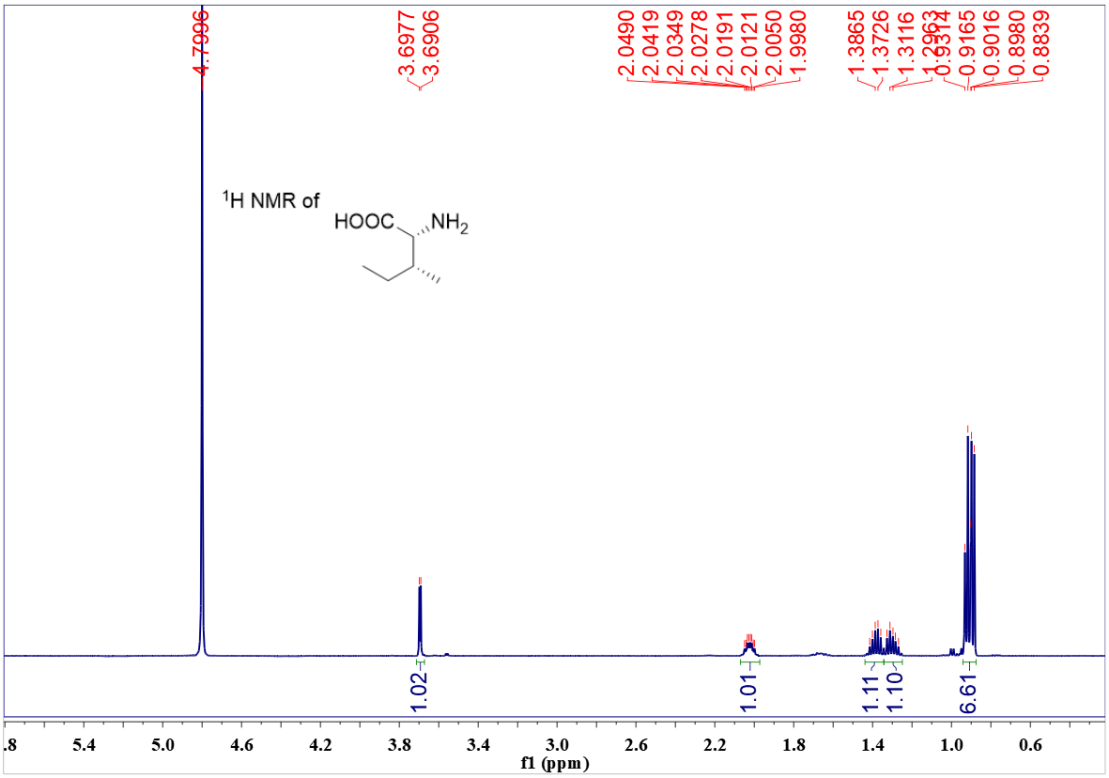
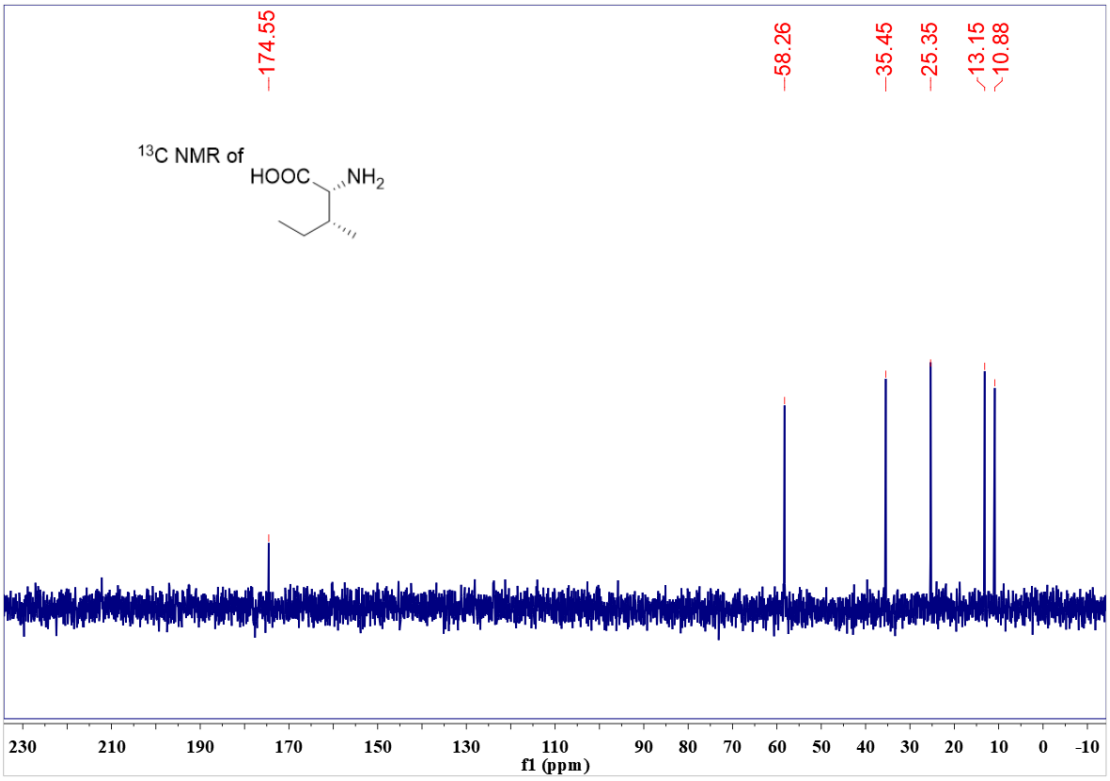
1.8949
1.8895
1.8805
1.3820
1.3674
0.9212
0.9064
0.8916
0.8374
0.8236
1H NMR of
MeO
NHAc
1.01
0.93
3.01
3.00
0.98
1.00
1.00
3.04
2.86
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)


173.03
170.08
77.29
77.04
76.78
55.28
52.16
37.65
26.12
23.17
14.62
11.68
13C NMR of
MeO
NHAc
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)


7.2599
6.0458
4.7103
4.7056
4.6921
4.6874
3.7413
2.0178
1.9125
1.9018
1.8898
1.3887
1.1523
1.1376
0.9284
0.9146
0.9029
0.8461
1H NMR of
MeO2C
NHAc
1.04
1.00
3.20
3.19
1.17
1.12
1.13
3.34
3.10
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
f1 (ppm)


173.05
170.09
77.29
77.04
76.79
55.25
52.21
37.66
26.13
23.23
14.63
11.72
13C NMR of
MeO2C
NHAc
230
210
190
170
150
130
110
90
80
70
60
50
40
30
20
10
0
-10
f1 (ppm)

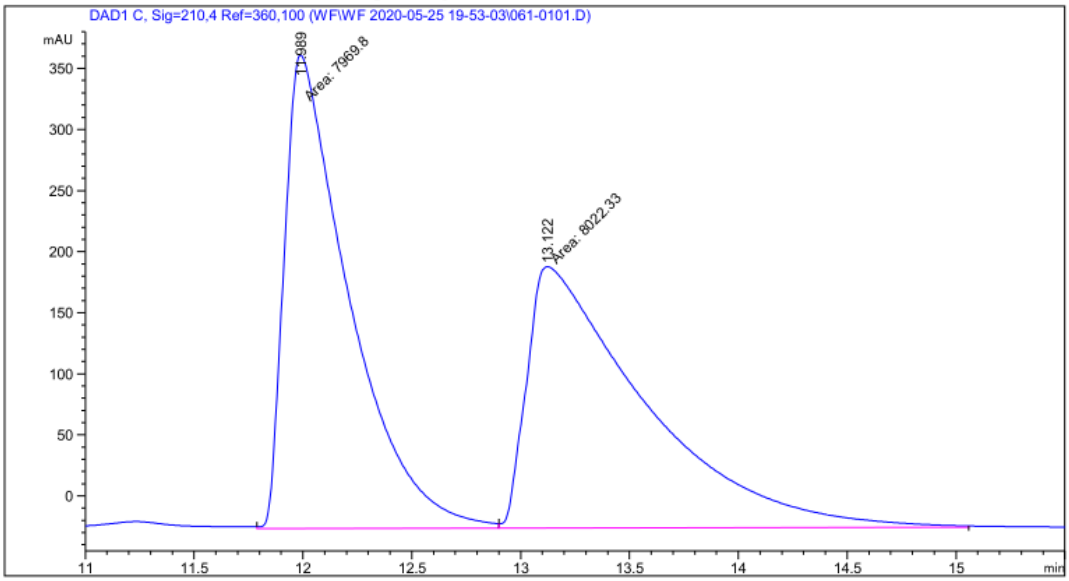

4.7996
3.6977
3.6906
2.0490
2.0419
2.0349
2.0278
2.0191
2.0121
2.0050
1.9980
1.3865
1.3726
1.3116
1.2963
0.9314
0.9165
0.9016
0.8980
0.8839
1H NMR of
HOOC
NH2
1.02
1.01
1.11
1.10
6.61
f1 (ppm)


174.55
58.26
35.45
25.35
13.15
10.88
13C NMR of
HOOC
NH2
f1 (ppm)

7. **Original HPLC Data of substrates**

Rac-**2a**

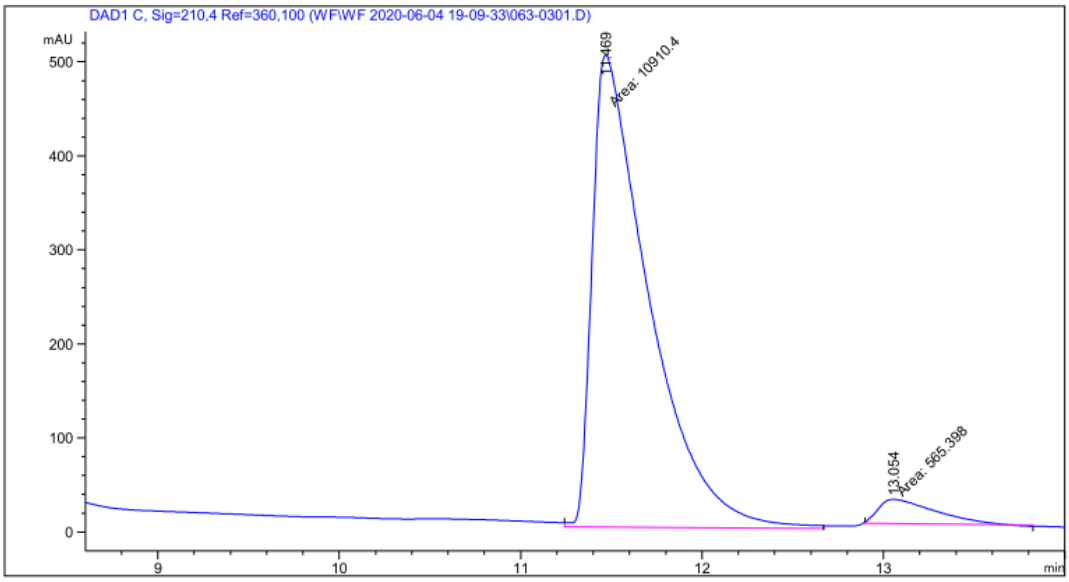
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-05-25 19-53-03\061-0101.D
Sample Name: Ac-Me-Rac

======================================================================
Acq. Operator   : 系统                          Seq. Line :   1
Acq. Instrument : LC2                           Location : Vial 61
Injection Date  : 5/25/2020 7:54:36 PM               Inj :   1
                                               Inj Volume : 5.000 µl
Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-05-25 19-53-03\WF-80-20-0.7-5UL-25MIN.M
Last changed    : 5/25/2020 7:53:03 PM by 系统
Analysis Method : C:\CHEM32\1\DATA\TYH\TYH 2020-07-13 15-10-31\TYH.M (Sequence Method)
Last changed    : 7/13/2020 3:10:31 PM by 系统
Additional Info : Peak(s) manually integrated
```




```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 C, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1  11.989 MF    0.3427 7969.80273  387.60199  49.8358
   2  13.122 FM    0.6256 8022.33447  213.73515  50.1642

Totals :                  1.59921e4   601.33714

======================================================================
                          *** End of Report ***

LC2 7/13/2020 10:16:47 PM 系统                          Page   1 of 1
```

Chiral-**2a**

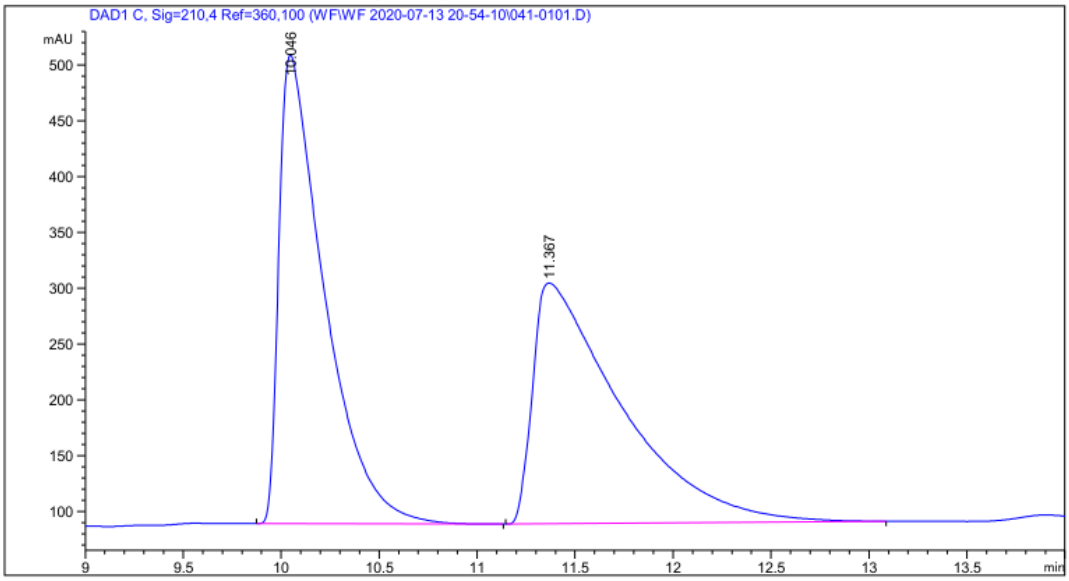
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-06-04 19-09-33\063-0301.D
Sample Name: Ac-Me-8-11-3

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   3
    Acq. Instrument : LC2                           Location : Vial 63
    Injection Date  : 6/4/2020 7:44:28 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 10.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-06-04 19-09-33\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 6/4/2020 7:09:33 PM by 系统
    Analysis Method : C:\CHEM32\1\DATA\KXH 2020-07-09 13-50-37\KXH.M (Sequence Method)
    Last changed    : 7/9/2020 1:50:37 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                            Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1  11.469 MM    0.3621 1.09104e4   502.17953  95.0731
       2  13.054 MM    0.3652  565.39850   25.80617   4.9269

    Totals :                  1.14758e4   527.98570

    ======================================================================

LC2 7/13/2020 10:02:04 PM 系统                                  Page   1 of 1
```

Rac-**2b**

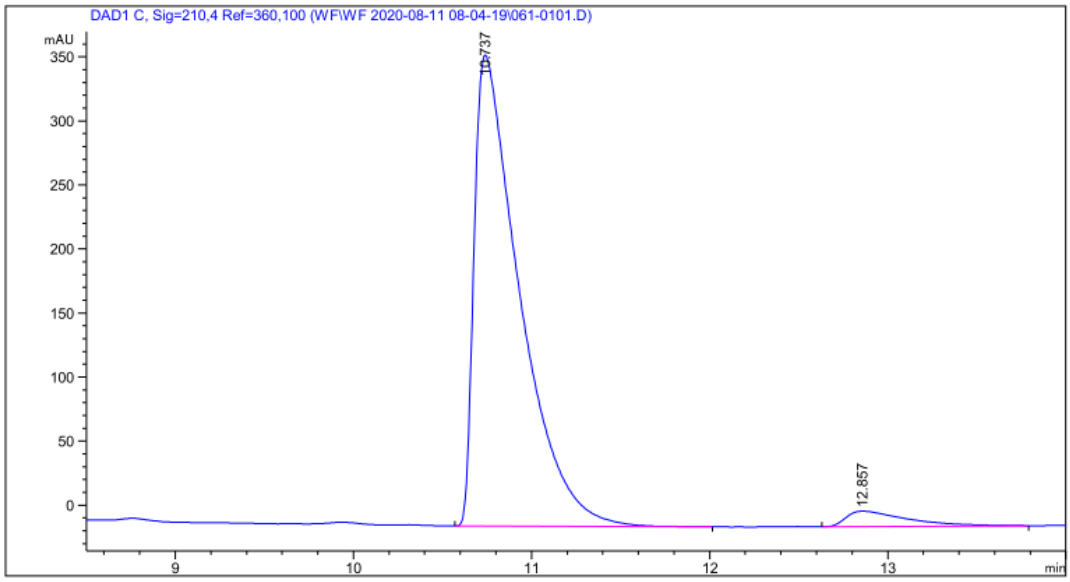
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-13 20-54-10\041-0101.D
Sample Name: 9-83-1Ac-Et-Rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   1
    Acq. Instrument : LC2                           Location : Vial 41
    Injection Date  : 7/13/2020 8:55:04 PM              Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-13 20-54-10\WF-80-20-0.7-5UL-25MIN.M
    Last changed    : 7/13/2020 9:12:33 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\KXH 2020-07-09 13-50-37\KXH.M (Sequence Method)
    Last changed    : 7/9/2020 1:50:37 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1  10.046 BB    0.2318 6763.83154  420.18231  50.1106
       2  11.367 BB    0.4361 6733.97607  215.76871  49.8894

    Totals :                  1.34978e4   635.95102

    ======================================================================

LC2 7/13/2020 9:33:35 PM 系统                                  Page   1 of 1
```

Chiral-**2b**

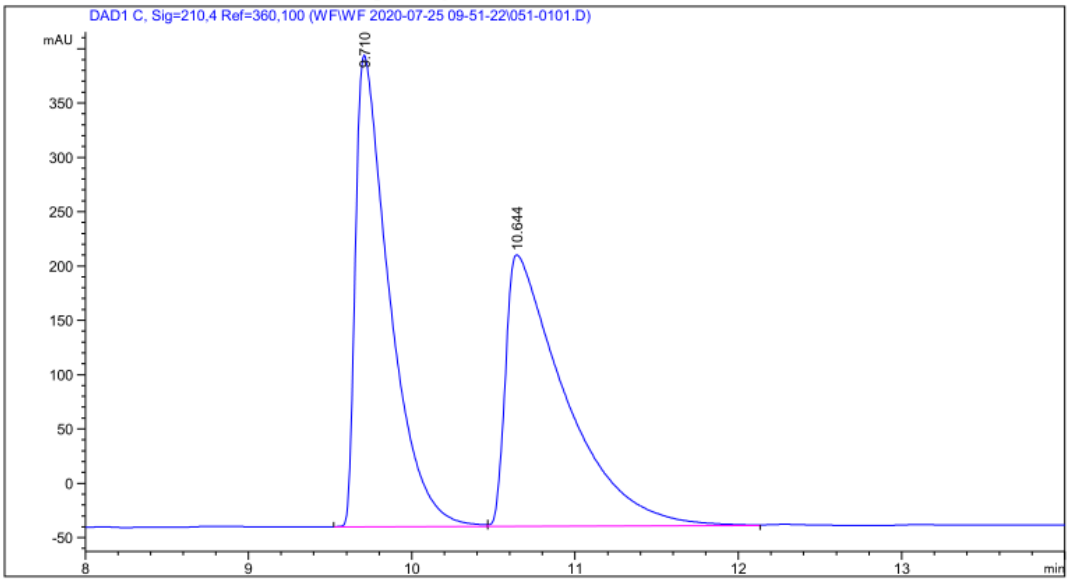
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-11 08-04-19\061-0101.D
Sample Name: zyx-2b

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   1
    Acq. Instrument : LC2                           Location : Vial 61
    Injection Date  : 8/11/2020 8:05:15 AM              Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-11 08-04-19\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 8/11/2020 8:04:19 AM by 系统
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-11 14-02-16\LBW2.M (Sequence Method)
    Last changed    : 8/11/2020 2:02:16 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1  10.737 BB    0.2561 6497.89063  367.77640  95.7953
       2  12.857 BB    0.3384  285.20709   12.03627   4.2047

    Totals :                  6783.09772  379.81266


    ======================================================================
                              *** End of Report ***

LC2 8/11/2020 8:34:10 PM 系统                                  Page   1 of 1
```

Rac-**2c**

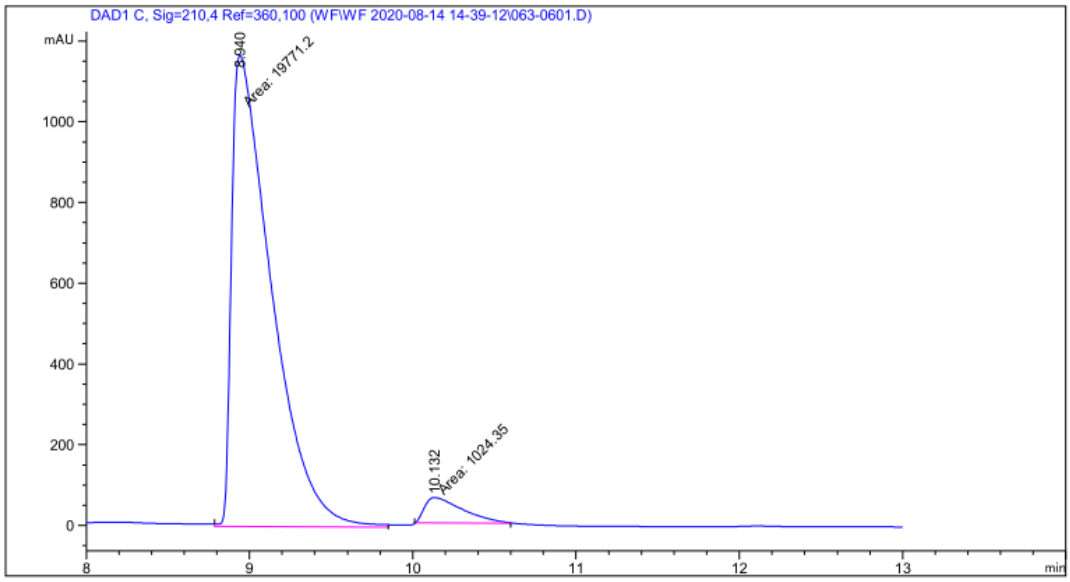
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-25 09-51-22\051-0101.D
Sample Name: Ac-nPr-9-23-rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   1
    Acq. Instrument : LC2                           Location : Vial 51
    Injection Date  : 7/25/2020 9:52:16 AM               Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-25 09-51-22\WF-80-20-0.7-5UL-25MIN.M
    Last changed    : 7/25/2020 9:51:22 AM by 系统
    Analysis Method : C:\CHEM32\1\METHODS\WT.M
    Last changed    : 7/16/2020 7:22:02 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   9.710 BV    0.2102 6257.71875  433.93262  49.7234
       2  10.644 VV    0.3534 6327.33594  249.92873  50.2766

    Totals :                  1.25851e4   683.86134

    ======================================================================
                              *** End of Report ***

LC2 7/25/2020 10:41:56 AM 系统                                  Page   1 of 1
```

Chiral-**2c**

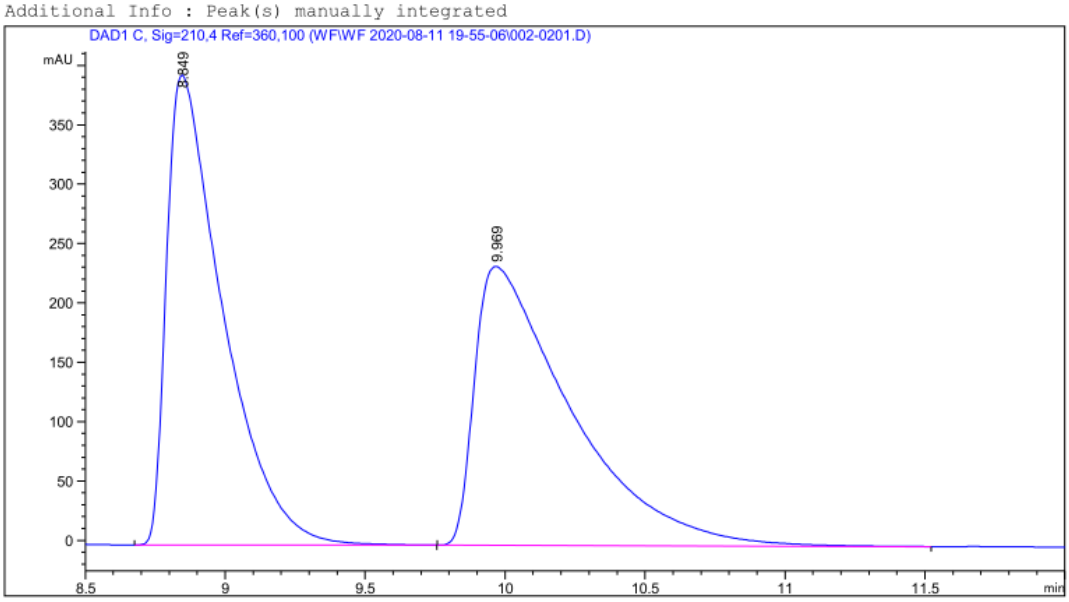
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-14 14-39-12\063-0601.D
Sample Name: 0814-2c

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   6
    Acq. Instrument : LC2                           Location : Vial 63
    Injection Date  : 8/14/2020 3:59:13 PM              Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-14 14-39-12\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 8/14/2020 3:43:30 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-14 13-51-26\LBW.M (Sequence Method)
    Last changed    : 8/14/2020 1:51:26 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                            Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   8.940 MM    0.2821 1.97712e4  1168.22510  95.0742
       2  10.132 MM    0.2723 1024.34680   62.70263   4.9258

    Totals :                  2.07956e4  1230.92772

    ======================================================================

LC2 8/14/2020 4:36:40 PM 系统                                  Page   1 of 1
```

Rac-**2d**

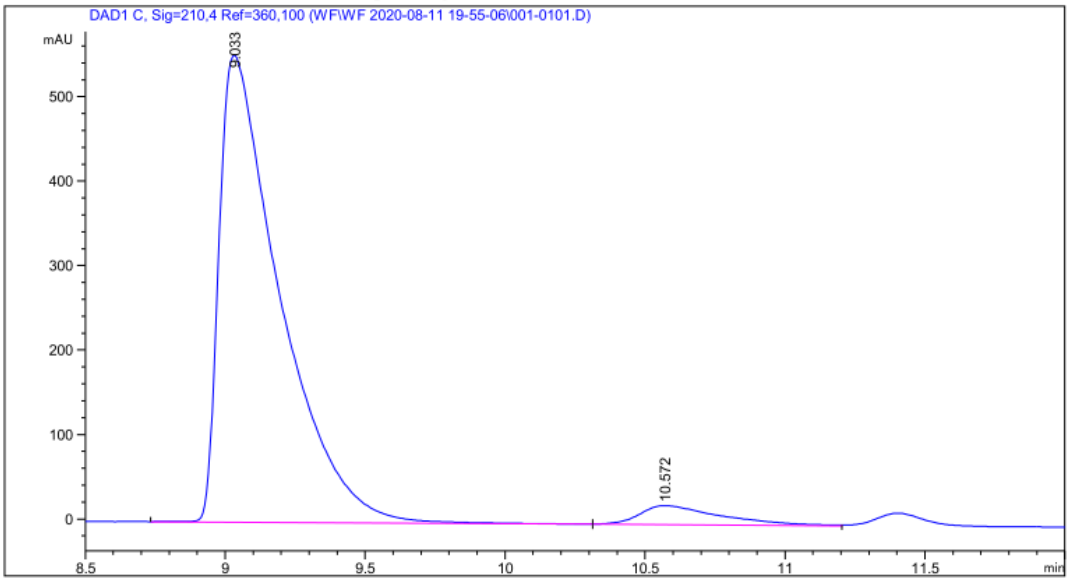
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-11 19-55-06\002-0201.D
Sample Name: Ac-iPr-rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   2
    Acq. Instrument : LC2                           Location : Vial 2
    Injection Date  : 8/11/2020 8:11:16 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 10.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-11 19-55-06\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 8/11/2020 8:22:46 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-11 14-02-16\LBW2.M (Sequence Method)
    Last changed    : 8/11/2020 2:02:16 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                            Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   8.849 BB    0.2031 5531.16895  395.73355  49.6491
       2   9.969 BB    0.3406 5609.36328  234.89215  50.3509

    Totals :                  1.11405e4   630.62570
```

Chiral-**2d**

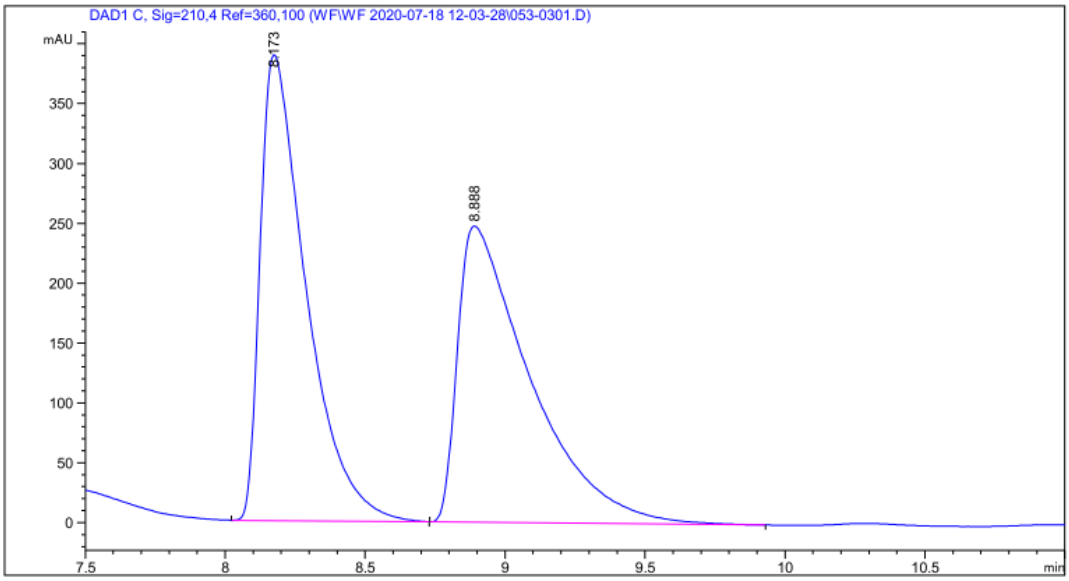
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-11 19-55-06\001-0101.D
Sample Name: Ac-iPr-chiral

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   1
    Acq. Instrument : LC2                           Location : Vial 1
    Injection Date  : 8/11/2020 7:56:01 PM              Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-11 19-55-06\WF-80-20-0.7-5UL-25MIN.M
    Last changed    : 8/11/2020 8:10:15 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-11 14-02-16\LBW2.M (Sequence Method)
    Last changed    : 8/11/2020 2:02:16 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                            Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   9.033 BV    0.2176 8322.12402  553.01227  94.8138
       2  10.572 VV    0.2854  455.20840   22.56281   5.1862

    Totals :                  8777.33243  575.57508

    ======================================================================

LC2 8/11/2020 8:29:24 PM 系统                                  Page   1 of 1
```

Rac-**2e**

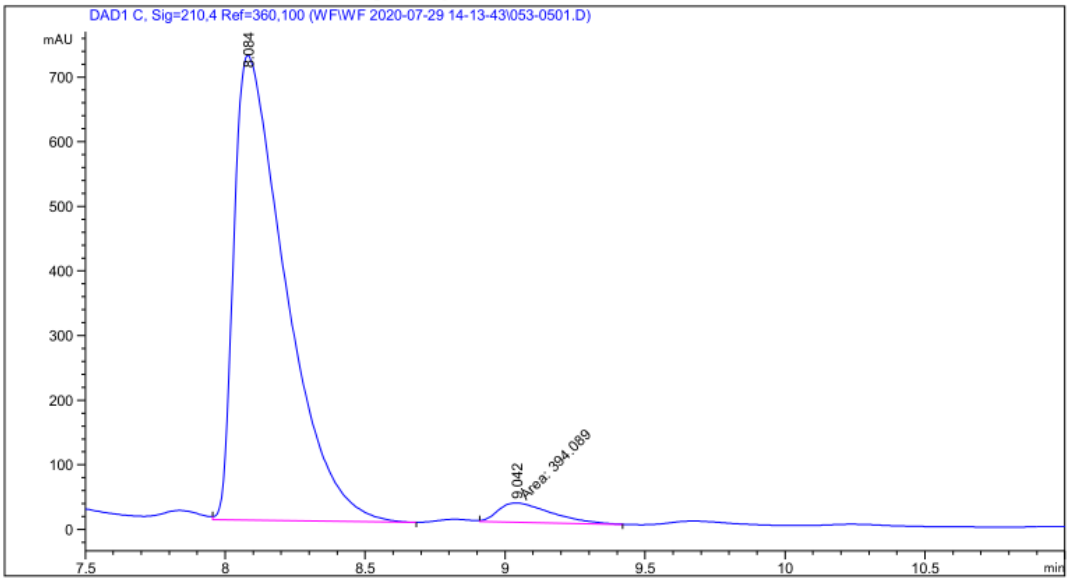
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-18 12-03-28\053-0301.D
Sample Name: Ac-i-Bu-9-101-3-rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   3
    Acq. Instrument : LC2                           Location : Vial 53
    Injection Date  : 7/18/2020 12:41:44 PM             Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-18 12-03-28\WF-80-20-0.7-5UL-25MIN.M
    Last changed    : 7/18/2020 12:04:15 PM by 系统
    Analysis Method : C:\CHEM32\1\DATA\TDS\TDS 2020-07-18 08-58-02\TDS.M (Sequence Method)
    Last changed    : 7/18/2020 8:58:02 AM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                               Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   8.173 BB    0.1689 4431.90479  389.08664  49.9567
       2   8.888 BB    0.2553 4439.58203  247.50140  50.0433

    Totals :                   8871.48682  636.58804


    ======================================================================
                               *** End of Report ***

LC2 7/20/2020 9:29:08 AM 系统                                  Page   1 of 1
```

Chiral-**2e**

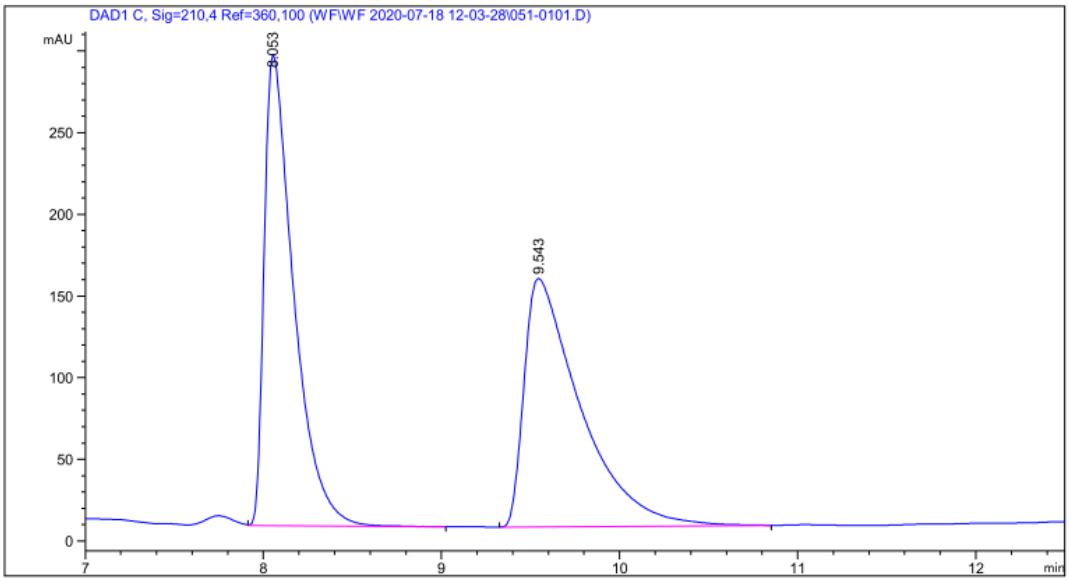
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-29 14-13-43\053-0501.D
Sample Name: Ac-iBu-2d

==================================================================
Acq. Operator   : 系统                          Seq. Line :   5
Acq. Instrument : LC2                           Location : Vial 53
Injection Date  : 7/29/2020 3:44:37 PM               Inj :   1
                                               Inj Volume : 10.000 µl
Different Inj Volume from Sequence !     Actual Inj Volume : 5.000 µl
Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-29 14-13-43\WF-80-20-0.7-10UL-20MIN.M
Last changed    : 7/29/2020 2:13:43 PM by 系统
Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-07-21 19-22-35\LBW.M (Sequence Method)
Last changed    : 7/21/2020 7:22:35 PM by 系统
Additional Info : Peak(s) manually integrated
```




```
==================================================================
                        Area Percent Report
==================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 C, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.084 VB    0.1912 9202.78027  719.83093  95.8936
   2   9.042 MM    0.2205  394.08899   29.78770   4.1064

Totals :                  9596.86926  749.61863


==================================================================

LC2 7/29/2020 4:42:07 PM 系统                          Page   1 of 1
```

Rac-**2f**

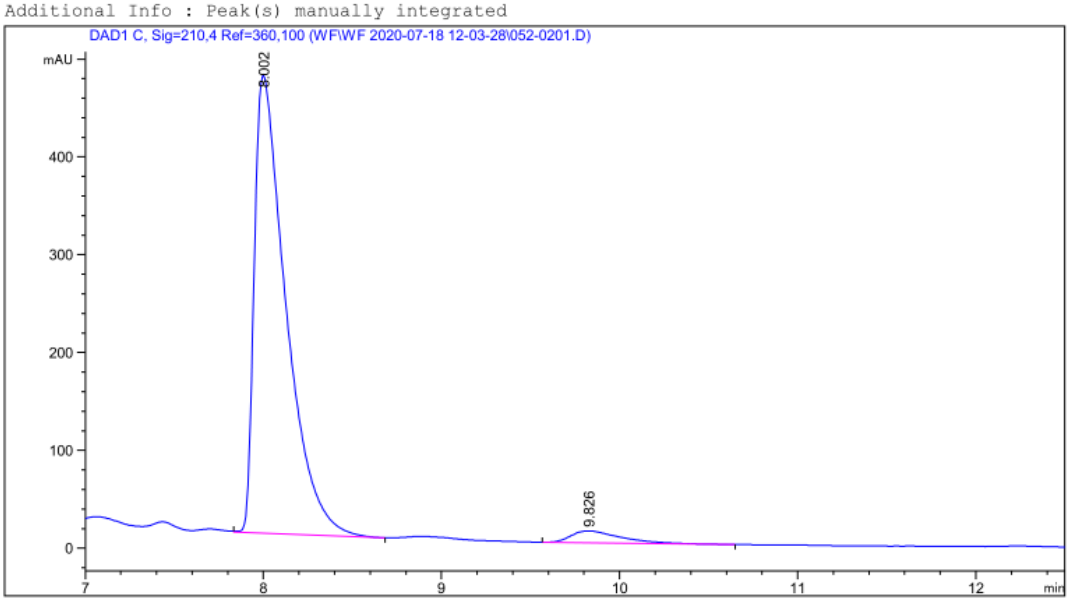
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-18 12-03-28\051-0101.D
Sample Name: Ac-n-Pent-RAC-9-101-1

======================================================================
Acq. Operator   : 系统                          Seq. Line :   1
Acq. Instrument : LC2                           Location : Vial 51
Injection Date  : 7/18/2020 12:04:22 PM              Inj :   1
                                               Inj Volume : 5.000 µl
Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-18 12-03-28\WF-80-20-0.7-5UL-30MIN.M
Last changed    : 7/18/2020 12:23:40 PM by 系统
                  (modified after loading)
Analysis Method : C:\CHEM32\1\DATA\TDS\TDS 2020-07-18 08-58-02\TDS.M (Sequence Method)
Last changed    : 7/18/2020 8:58:02 AM by 系统
Additional Info : Peak(s) manually integrated
```




```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 C, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.053 VB    0.1700 3308.05225  288.11914  49.8472
   2   9.543 BB    0.3135 3328.33325  151.98228  50.1528

Totals :                  6636.38550  440.10143


======================================================================
```

Chiral-**2f**

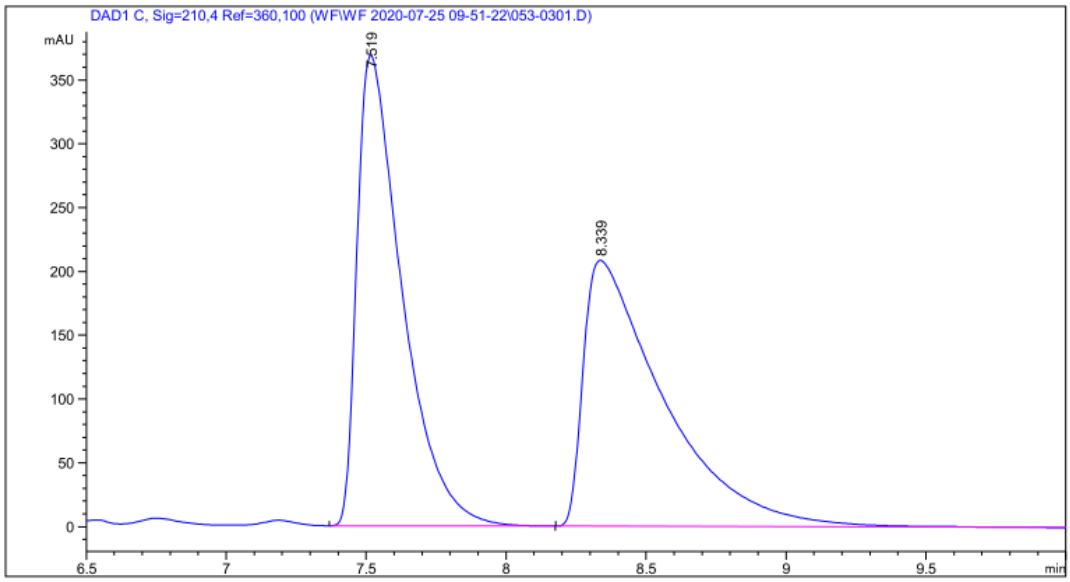
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-18 12-03-28\052-0201.D
Sample Name: Ac-n-Pent-9-101-2

======================================================================
Acq. Operator   : 系统                          Seq. Line :   2
Acq. Instrument : LC2                           Location : Vial 52
Injection Date  : 7/18/2020 12:24:42 PM              Inj :   1
                                               Inj Volume : 5.000 µl
Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-18 12-03-28\WF-80-20-0.7-5UL-15MIN.M
Last changed    : 7/18/2020 12:04:14 PM by 系统
Analysis Method : C:\CHEM32\1\DATA\TDS\TDS 2020-07-18 08-58-02\TDS.M (Sequence Method)
Last changed    : 7/18/2020 8:58:02 AM by 系统
Additional Info : Peak(s) manually integrated
```




```
======================================================================
                        Area Percent Report
======================================================================

Sorted By             :      Signal
Multiplier            :      1.0000
Dilution              :      1.0000
Use Multiplier & Dilution Factor with ISTDs


Signal 1: DAD1 C, Sig=210,4 Ref=360,100

Peak RetTime Type  Width     Area      Height     Area
  #   [min]        [min]   [mAU*s]     [mAU]       %
----|-------|----|-------|----------|----------|--------|
   1   8.002 VB    0.1815 5760.46484  468.31638  96.0190
   2   9.826 BB    0.2937  238.83366   12.13003   3.9810

Totals :                  5999.29851  480.44641

======================================================================
                        *** End of Report ***

LC2 7/20/2020 9:27:38 AM 系统                          Page   1 of 1
```

Rac-**2g**

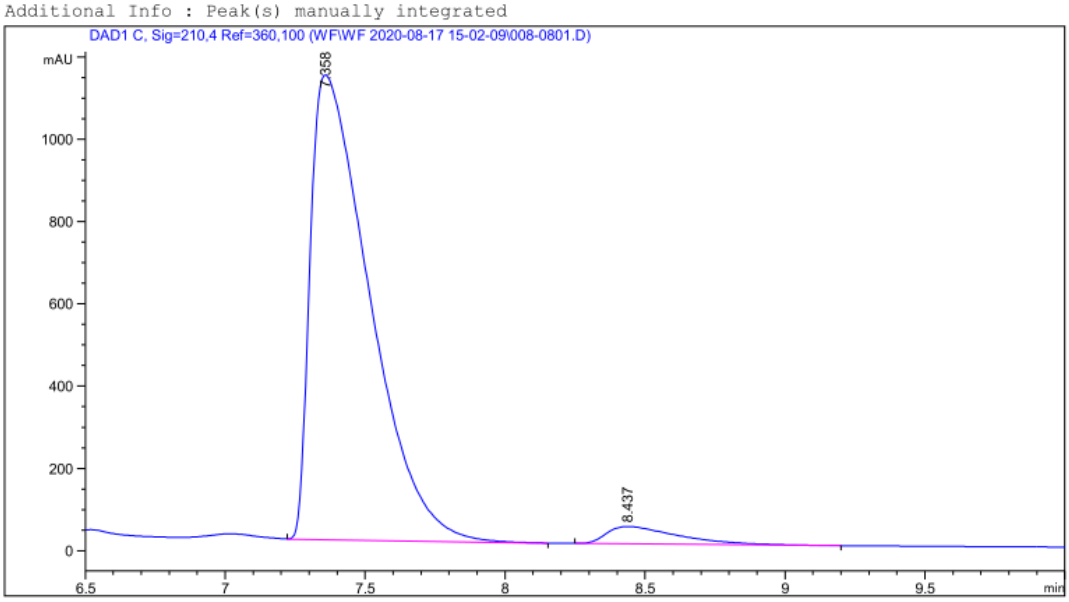
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-25 09-51-22\053-0301.D
Sample Name: Ac-异己基-9-24-rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   3
    Acq. Instrument : LC2                           Location : Vial 53
    Injection Date  : 7/25/2020 10:34:13 AM             Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-25 09-51-22\WF-80-20-0.7-5UL-25MIN.M
    Last changed    : 7/25/2020 9:51:22 AM by 系统
    Analysis Method : C:\CHEM32\1\METHODS\WT.M
    Last changed    : 7/16/2020 7:22:02 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.519 BB    0.1664 4127.68799  369.18008  49.8015
       2   8.339 BB    0.2850 4160.58936  208.33910  50.1985

    Totals :                   8288.27734  577.51918


    ======================================================================
                              *** End of Report ***

LC2 7/25/2020 11:09:53 AM 系统                                  Page   1 of 1
```

Chiral-**2g**

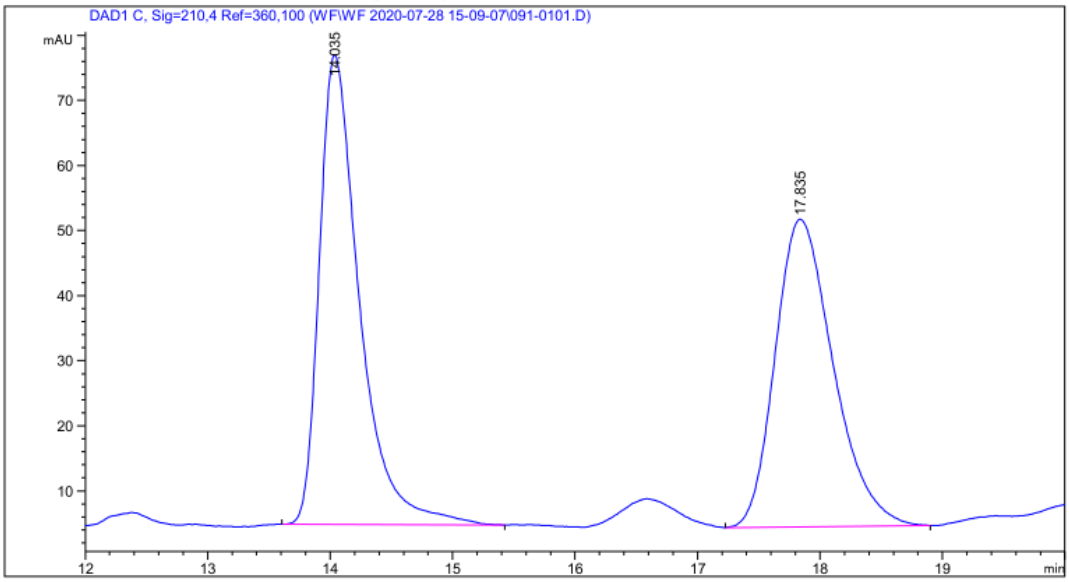
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-17 15-02-09\008-0801.D
Sample Name: 0817-Me-Pent

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   8
    Acq. Instrument : LC2                           Location : Vial 8
    Injection Date  : 8/17/2020 5:02:08 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 10.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-17 15-02-09\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 8/17/2020 3:57:00 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-15 23-43-02\LBW.M (Sequence Method)
    Last changed    : 8/15/2020 11:43:02 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                            Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.358 VB    0.2274 1.66038e4  1130.19458  95.6818
       2   8.437 BB    0.2576  749.34607   42.10359   4.3182

    Totals :                  1.73532e4  1172.29817


LC2 8/17/2020 6:45:28 PM 系统                                  Page   1 of 2
```

Rac-**2h**

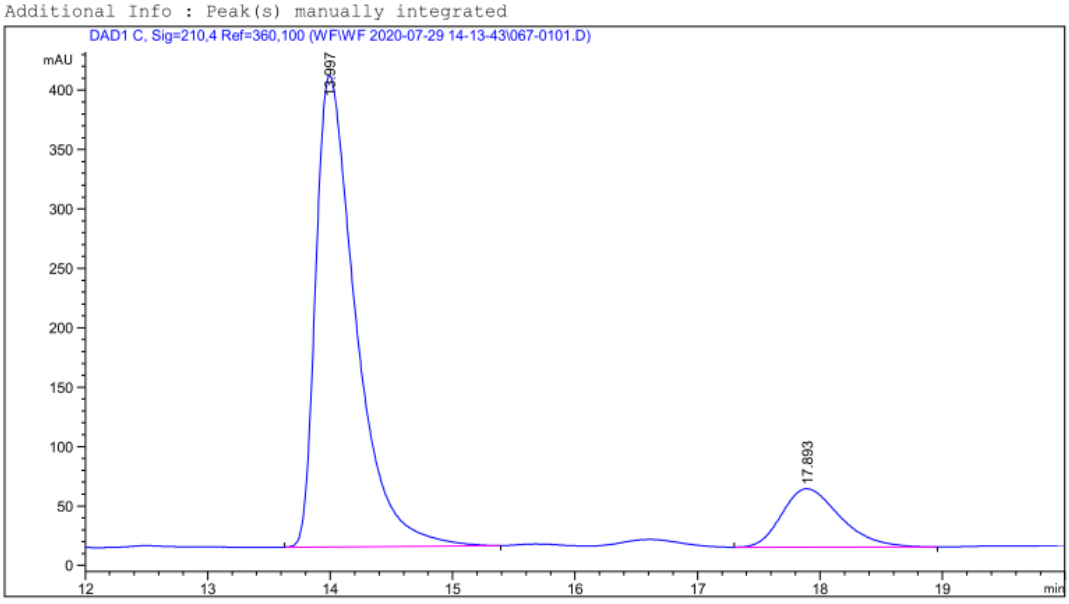
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-28 15-09-07\091-0101.D
Sample Name: Ac-benbingji-10-32-rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   1
    Acq. Instrument : LC2                           Location : Vial 91
    Injection Date  : 7/28/2020 3:10:02 PM              Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-28 15-09-07\WF-80-20-0.7-5UL-25MIN.M
    Last changed    : 7/28/2020 3:09:07 PM by 系统
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-07-21 19-22-35\LBW.M (Sequence Method)
    Last changed    : 7/21/2020 7:22:35 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1  14.035 BB    0.3440 1643.74500   72.09856  51.3429
       2  17.835 BB    0.5005 1557.76086   47.26683  48.6571

    Totals :                  3201.50586  119.36539


    ======================================================================
                              *** End of Report ***

LC2 7/28/2020 4:48:37 PM 系统                                  Page   1 of 1
```

Chiral-**2h**

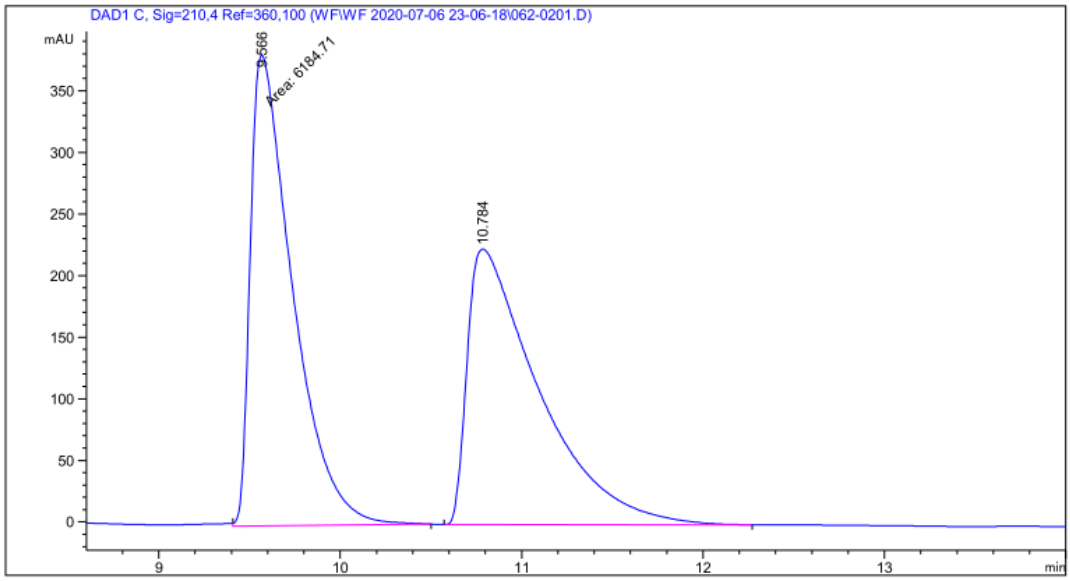
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-29 14-13-43\067-0101.D
Sample Name: Ac-bengbingji-2g

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   1
    Acq. Instrument : LC2                           Location : Vial 67
    Injection Date  : 7/29/2020 2:14:38 PM              Inj :   1
                                                   Inj Volume : 20.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-29 14-13-43\WF-80-20-0.7-20UL-30MIN.M
    Last changed    : 7/29/2020 2:40:35 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-07-21 19-22-35\LBW.M (Sequence Method)
    Last changed    : 7/21/2020 7:22:35 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                           Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1  13.997 BB    0.3404 8993.10547  396.84662  84.6858
       2  17.893 BB    0.5022 1626.27808   49.13386  15.3142

    Totals :                  1.06194e4   445.98048

LC2 7/29/2020 4:51:36 PM 系统                                  Page   1 of 2
```

Rac-**2i**

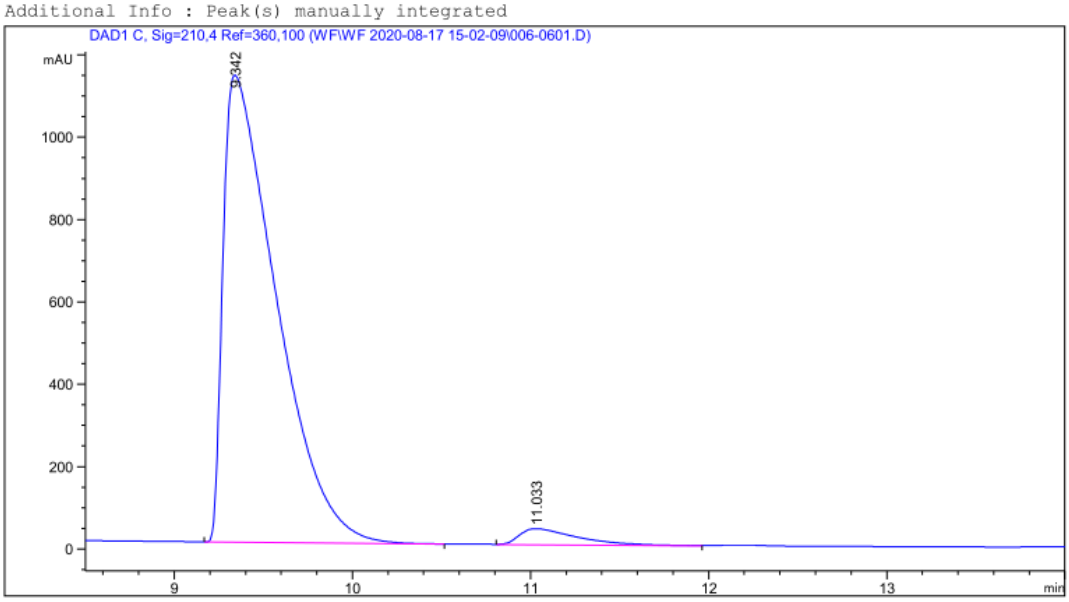
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-06 23-06-18\062-0201.D
Sample Name: Ac-Cp-Rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   2
    Acq. Instrument : LC2                           Location : Vial 62
    Injection Date  : 7/6/2020 11:39:02 PM              Inj :   1
                                                   Inj Volume : 20.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-06 23-06-18\WF-80-20-0.7-20UL-30MIN.M
    Last changed    : 7/6/2020 11:06:19 PM by 系统
    Analysis Method : C:\CHEM32\1\DATA\TYH\TYH 2020-07-13 15-10-31\TYH.M (Sequence Method)
    Last changed    : 7/13/2020 3:10:31 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   9.566 MM    0.2696 6184.71338  382.35037  50.1564
       2  10.784 BB    0.3906 6146.13477  223.64954  49.8436

    Totals :                  1.23308e4   605.99991


    ======================================================================

LC2 7/13/2020 10:42:56 PM 系统                                  Page   1 of 1
```

Chiral-**2i**

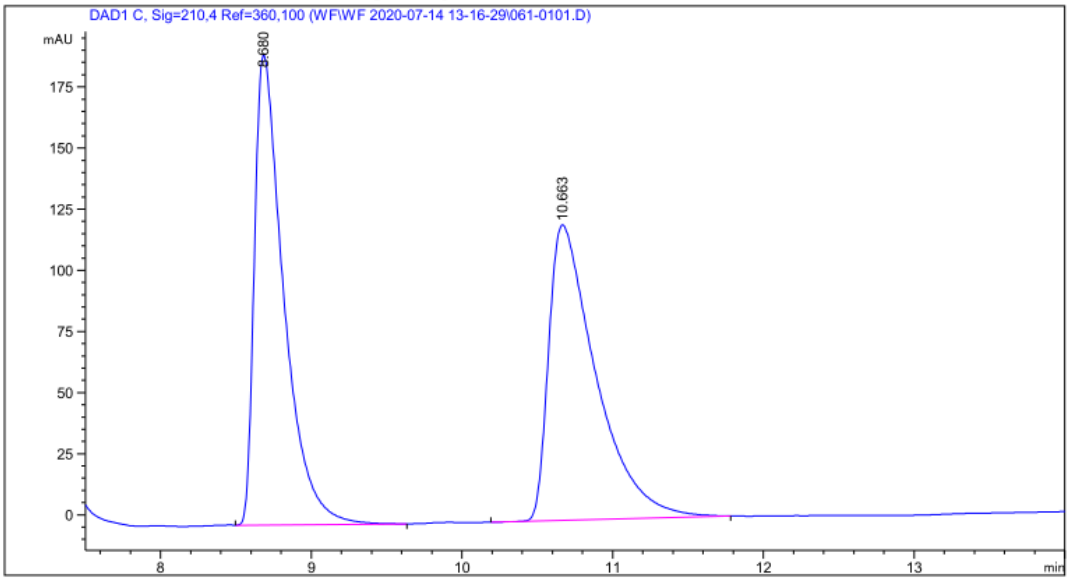
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-17 15-02-09\006-0601.D
Sample Name: 0817-Cp

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   6
    Acq. Instrument : LC2                           Location : Vial 6
    Injection Date  : 8/17/2020 4:30:05 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 10.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-17 15-02-09\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 8/17/2020 3:57:00 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-15 23-43-02\LBW.M (Sequence Method)
    Last changed    : 8/15/2020 11:43:02 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                            Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   9.342 BB    0.3163 2.35618e4  1134.53796  96.4964
       2  11.033 BV    0.3239  855.47681   38.40813   3.5036

    Totals :                  2.44173e4  1172.94610
```

Rac-**2j**

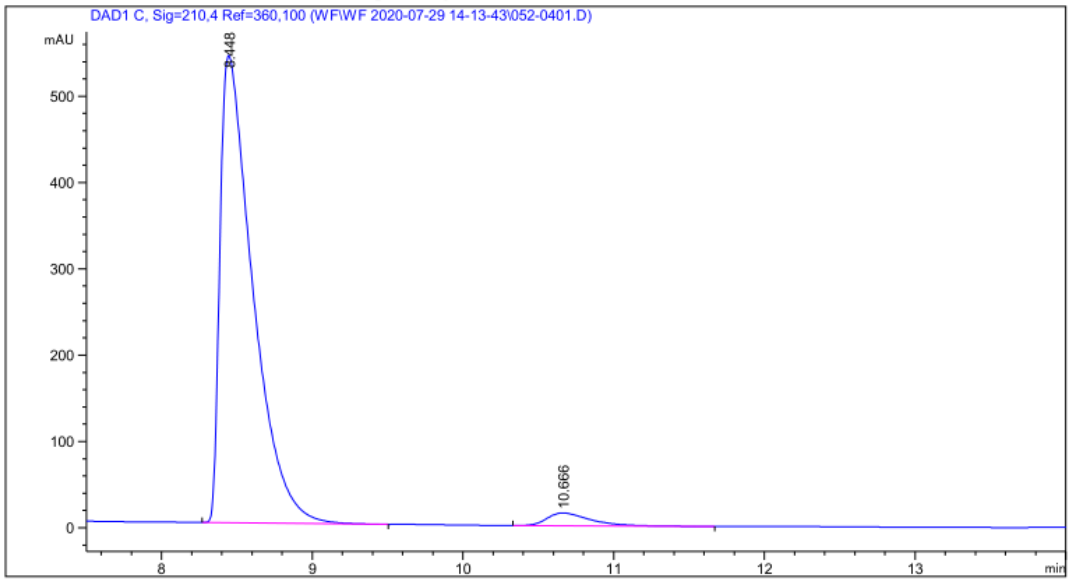
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-14 13-16-29\061-0101.D
Sample Name: Ac-Cy-Rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   1
    Acq. Instrument : LC2                           Location : Vial 61
    Injection Date  : 7/14/2020 1:17:25 PM              Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-14 13-16-29\WF-80-20-0.7-5UL-25MIN.M
    Last changed    : 7/14/2020 1:16:29 PM by 系统
    Analysis Method : C:\CHEM32\1\DATA\TYH\TYH 2020-07-13 15-10-31\TYH.M (Sequence Method)
    Last changed    : 7/13/2020 3:10:31 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   8.680 BB    0.1994 2596.59595  192.41283  49.6262
       2  10.663 BB    0.3205 2635.70801  120.84343  50.3738

    Totals :                  5232.30396  313.25626


    ======================================================================
                              *** End of Report ***

LC2 7/14/2020 2:33:51 PM 系统                                  Page   1 of 1
```

Chiral-**2j**

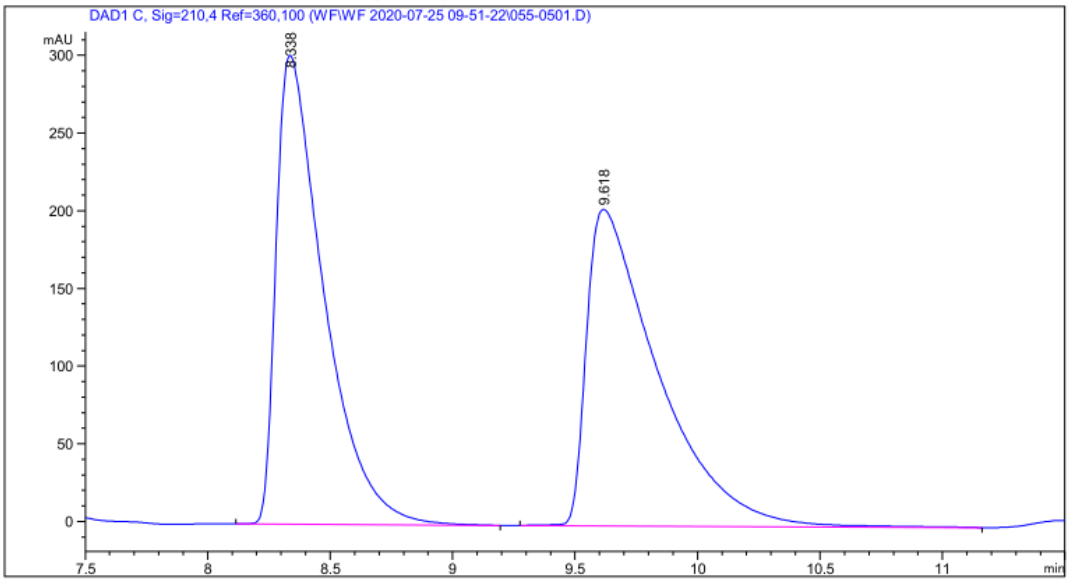
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-29 14-13-43\052-0401.D
Sample Name: Ac-cy-2i

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   4
    Acq. Instrument : LC2                           Location : Vial 52
    Injection Date  : 7/29/2020 3:23:39 PM               Inj :   1
                                                  Inj Volume : 10.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-29 14-13-43\WF-80-20-0.7-10UL-20MIN.M
    Last changed    : 7/29/2020 2:13:43 PM by 系统
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-07-21 19-22-35\LBW.M (Sequence Method)
    Last changed    : 7/21/2020 7:22:35 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   8.448 BB    0.2217 8156.06543  541.42072  96.4624
       2  10.666 BB    0.3002  299.11270   14.90228   3.5376

    Totals :                  8455.17813  556.32300

    ======================================================================

LC2 7/29/2020 4:39:26 PM 系统                                  Page   1 of 1
```

Rac-**2k**

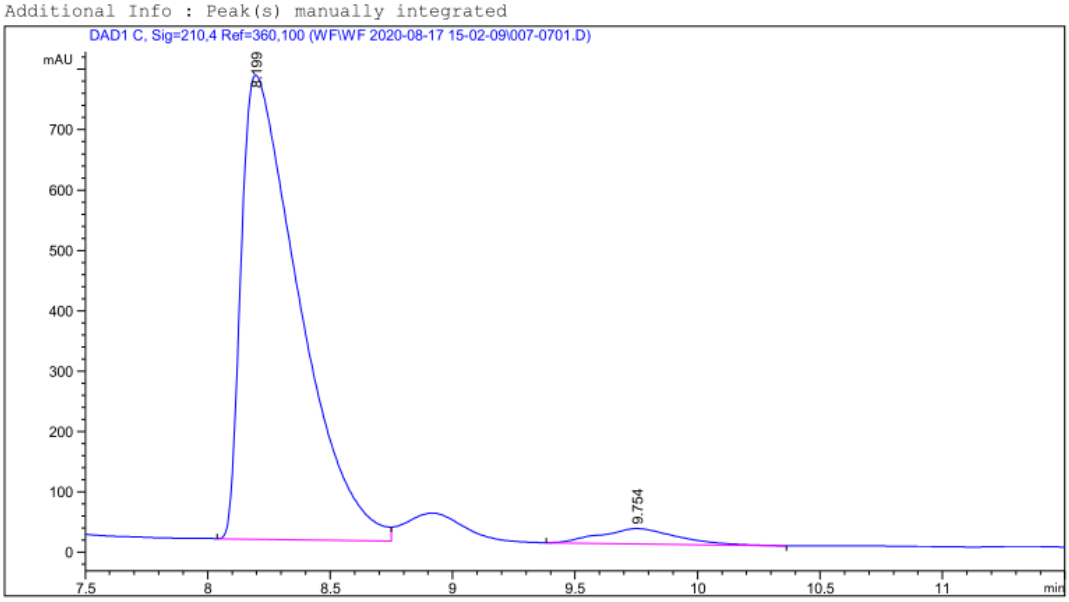
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-25 09-51-22\055-0501.D
Sample Name: Ac-cHep-9-25-rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   5
    Acq. Instrument : LC2                           Location : Vial 55
    Injection Date  : 7/25/2020 11:08:12 AM             Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-25 09-51-22\WF-80-20-0.7-5UL-25MIN.M
    Last changed    : 7/25/2020 11:08:21 AM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\METHODS\WT.M
    Last changed    : 7/16/2020 7:22:02 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   8.338 BB    0.1998 4083.20044  301.90570  49.7074
       2   9.618 BB    0.2905 4131.27246  203.80452  50.2926

    Totals :                   8214.47290  505.71022

    ======================================================================

LC2 7/25/2020 12:06:18 PM 系统                                  Page   1 of 1
```

Chiral-**2k**

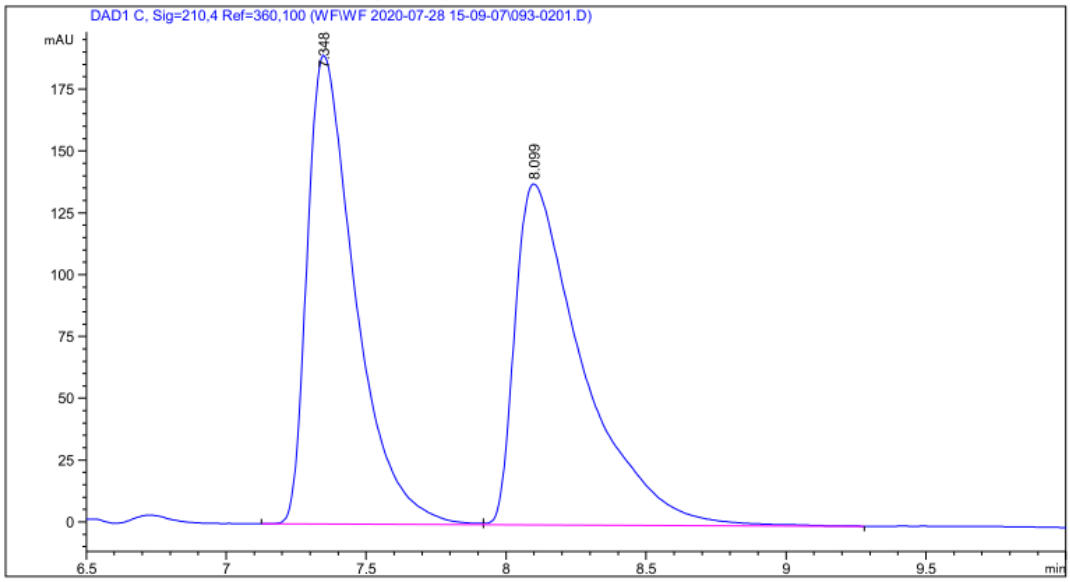
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-17 15-02-09\007-0701.D
Sample Name: 0817-cHep

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   7
    Acq. Instrument : LC2                           Location : Vial 7
    Injection Date  : 8/17/2020 4:46:05 PM              Inj :   1
                                                   Inj Volume : 5.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 10.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-17 15-02-09\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 8/17/2020 3:57:00 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-15 23-43-02\LBW.M (Sequence Method)
    Last changed    : 8/15/2020 11:43:02 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                           Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   8.199 BV    0.2472 1.26003e4   768.91077  95.7940
       2   9.754 VB    0.3125  553.23853   25.35692   4.2060

    Totals :                  1.31536e4   794.26768


LC2 8/17/2020 6:51:31 PM 系统                                  Page   1 of 2
```

Rac-**2l**

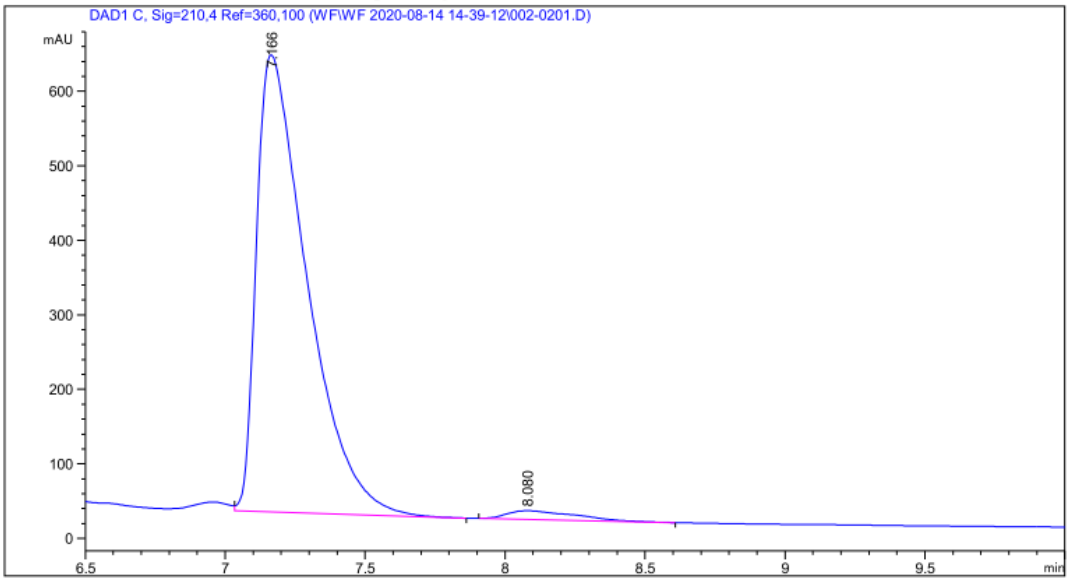
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-07-28 15-09-07\093-0201.D
Sample Name: Ac-diMe-Cy-10-33-rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   2
    Acq. Instrument : LC2                           Location : Vial 93
    Injection Date  : 7/28/2020 3:31:04 PM              Inj :   1
                                                   Inj Volume : 5.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-07-28 15-09-07\WF-80-20-0.7-5UL-25MIN.M
    Last changed    : 7/28/2020 3:09:07 PM by 系统
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-07-21 19-22-35\LBW.M (Sequence Method)
    Last changed    : 7/21/2020 7:22:35 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.348 BV    0.1790 2259.23193  189.57739  49.3162
       2   8.099 VB    0.2444 2321.87915  137.90988  50.6838

    Totals :                   4581.11108  327.48727


    ======================================================================
                              *** End of Report ***

LC2 7/28/2020 4:27:58 PM 系统                                  Page   1 of 1
```

Chiral-**2l**

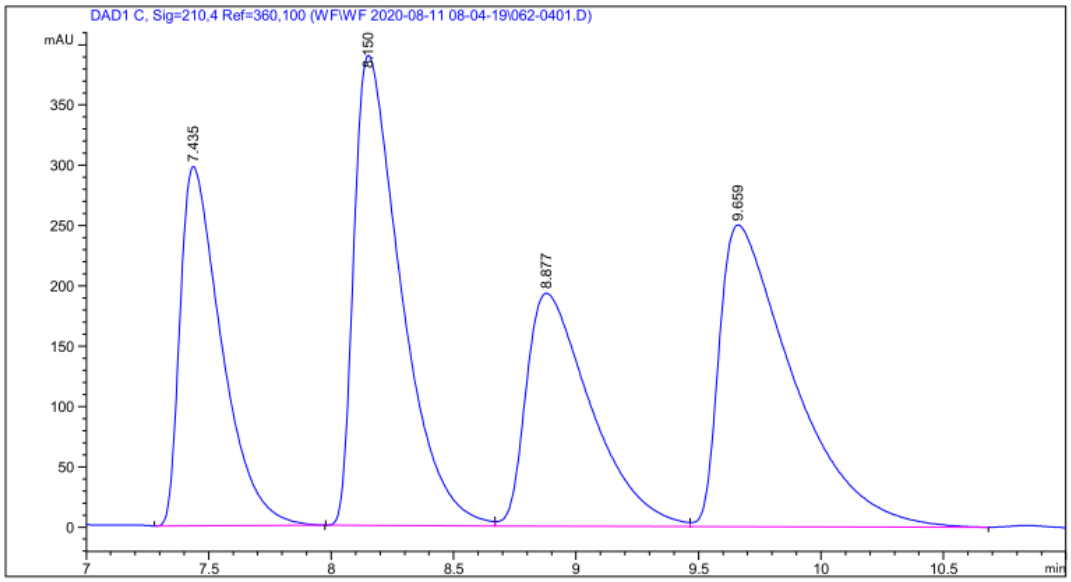
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-14 14-39-12\002-0201.D
Sample Name: 0814-2j

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   2
    Acq. Instrument : LC2                           Location : Vial 2
    Injection Date  : 8/14/2020 2:57:08 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 10.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-14 14-39-12\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 8/14/2020 2:39:12 PM by 系统
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-14 13-51-26\LBW.M (Sequence Method)
    Last changed    : 8/14/2020 1:51:26 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                            Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.166 VB    0.1888 7720.56543  613.55286  97.4269
       2   8.080 BB    0.2429  203.90529   11.72408   2.5731

    Totals :                   7924.47072  625.27694

    ======================================================================

LC2 8/14/2020 3:36:21 PM 系统                                  Page   1 of 1
```

Rac-**2m** (*cis+trans*)

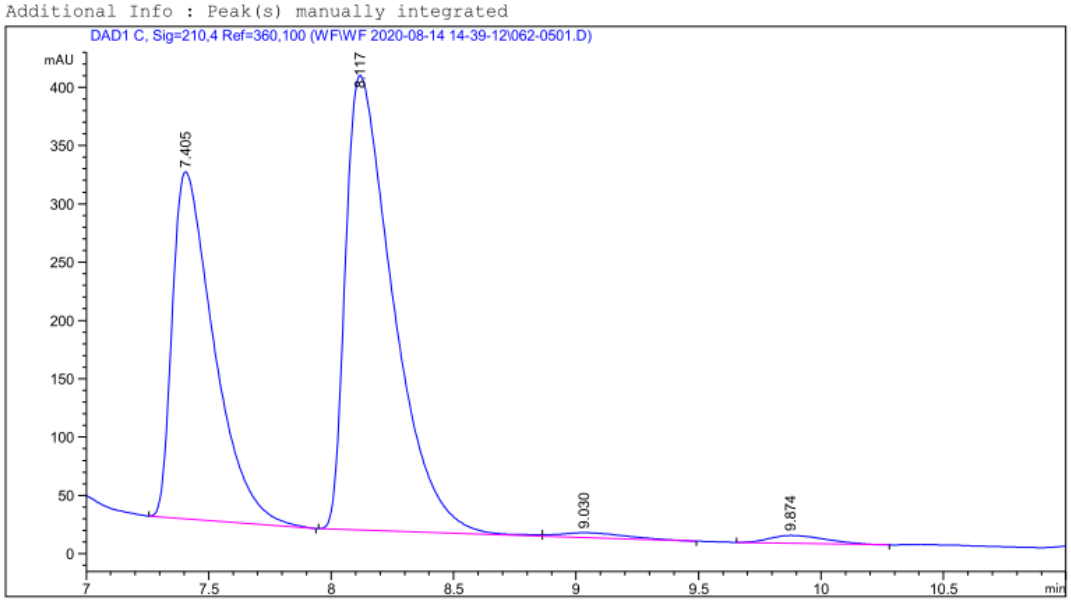
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-11 08-04-19\062-0401.D
Sample Name: zyx-2n-rac

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   4
    Acq. Instrument : LC2                           Location : Vial 62
    Injection Date  : 8/11/2020 8:56:16 AM              Inj :   1
                                                   Inj Volume : 2.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 10.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-11 08-04-19\WF-80-20-0.7-20UL-30MIN.M
    Last changed    : 8/11/2020 8:36:39 AM by 系统
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-14 13-51-26\LBW.M (Sequence Method)
    Last changed    : 8/14/2020 1:51:26 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.435 BB    0.1769 3498.80615  298.10947  20.0374
       2   8.150 BV    0.1998 5205.73633  389.86603  29.8128
       3   8.877 VV    0.2758 3537.16748  193.03447  20.2570
       4   9.659 VB    0.3055 5219.70898  250.11557  29.8928

    Totals :                  1.74614e4  1131.12553

LC2 8/14/2020 4:03:18 PM 系统                                  Page   1 of 2
```

Chiral-**2m** (*cis*+*trans*)

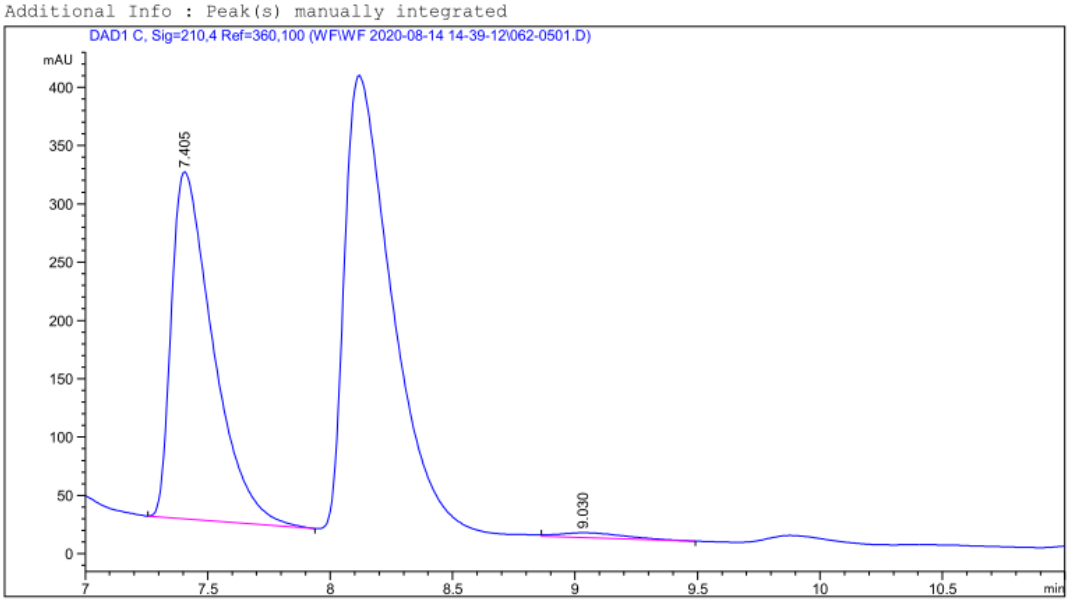
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-14 14-39-12\062-0501.D
Sample Name: 0814-2p

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   5
    Acq. Instrument : LC2                           Location : Vial 62
    Injection Date  : 8/14/2020 3:45:13 PM              Inj :   1
                                                   Inj Volume : 5.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 10.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-14 14-39-12\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 8/14/2020 3:43:30 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-14 13-51-26\LBW.M (Sequence Method)
    Last changed    : 8/14/2020 1:51:26 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                            Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.405 BB    0.1776 3510.71533  297.55807  39.2546
       2   8.117 BV    0.2031 5249.95801  389.88605  58.7017
       3   9.030 VB    0.2534   76.05803    4.04531   0.8504
       4   9.874 BB    0.2455  106.72096    6.64102   1.1933

    Totals :                  8943.45233  698.13045

LC2 8/14/2020 4:04:19 PM 系统                                  Page   1 of 2
```

Chiral-**2m**-isomer

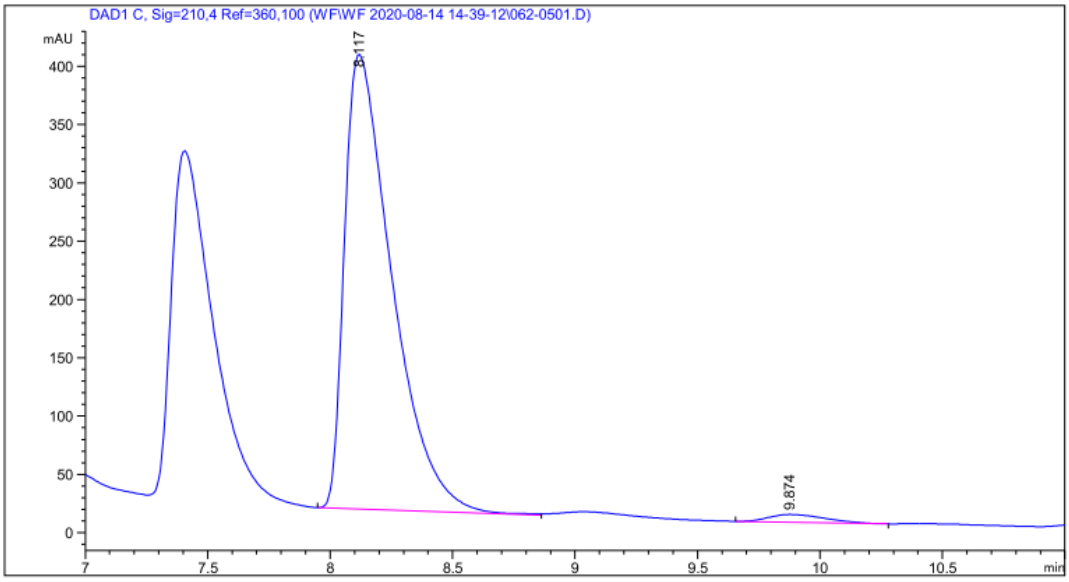
```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-14 14-39-12\062-0501.D
Sample Name: 0814-2p

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   5
    Acq. Instrument : LC2                           Location : Vial 62
    Injection Date  : 8/14/2020 3:45:13 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 10.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-14 14-39-12\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 8/14/2020 3:43:30 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-14 13-51-26\LBW.M (Sequence Method)
    Last changed    : 8/14/2020 1:51:26 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                            Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   7.405 BB    0.1776 3510.71533  297.55807  97.8795
       2   9.030 VB    0.2534   76.05803    4.04531   2.1205

    Totals :                  3586.77336  301.60339


LC2 8/14/2020 4:04:37 PM 系统                                  Page   1 of 2
```

Chiral-**2m**-isomer

```
Data File C:\CHEM32\1\DATA\WF\WF 2020-08-14 14-39-12\062-0501.D
Sample Name: 0814-2p

    ======================================================================
    Acq. Operator   : 系统                          Seq. Line :   5
    Acq. Instrument : LC2                           Location : Vial 62
    Injection Date  : 8/14/2020 3:45:13 PM               Inj :   1
                                                  Inj Volume : 5.000 µl
    Different Inj Volume from Sequence !     Actual Inj Volume : 10.000 µl
    Acq. Method     : C:\CHEM32\1\DATA\WF\WF 2020-08-14 14-39-12\WF-80-20-0.7-5UL-15MIN.M
    Last changed    : 8/14/2020 3:43:30 PM by 系统
                      (modified after loading)
    Analysis Method : C:\CHEM32\1\DATA\LBW\LBW 2020-08-14 13-51-26\LBW.M (Sequence Method)
    Last changed    : 8/14/2020 1:51:26 PM by 系统
    Additional Info : Peak(s) manually integrated
```




```
    ======================================================================
                              Area Percent Report
    ======================================================================

    Sorted By             :      Signal
    Multiplier            :      1.0000
    Dilution              :      1.0000
    Use Multiplier & Dilution Factor with ISTDs


    Signal 1: DAD1 C, Sig=210,4 Ref=360,100

    Peak RetTime Type  Width     Area      Height     Area
      #   [min]        [min]   [mAU*s]     [mAU]       %
    ----|-------|----|-------|----------|----------|--------|
       1   8.117 BV    0.2031 5249.95801  389.88605  98.0077
       2   9.874 BB    0.2455  106.72096    6.64102   1.9923

    Totals :                   5356.67897  396.52707


LC2 8/14/2020 4:05:01 PM 系统                                  Page   1 of 2
```