Electronic Supplementary Material (ESI) for RSC Advances.

Palladium-Catalyzed Highly Practicable Oxygenation of C(sp^2)-H and C(sp^3)-H Bonds under Assistance of Oxalyl Amied

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Supporting information

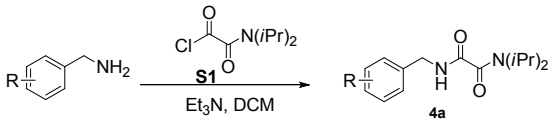
General Information and Procedure for the Reaction

General information:

1. Reagents: Unless otherwise noted, all reagents were purchased from commercial suppliers and used without further purification. Column chromatography purifications were performed using 300–400 mesh silica gel.

2. Instruments: NMR spectra were recorded on Varian Inova-400 MHz, Inova-300 MHz, Bruker DRX-400 or Bruker DRX-500 instruments and calibrated using residual solvent peaks as internal reference. Multiplicities are recorded as: s = singlet, d = doublet, t = triplet, dd = doublet of doublets, br = broad singlet, m = multiplet. HRMS analyses were carried out using a Bruker micrOTOF-Q instrument or a TOF-MS instrument.

3. Preparation of oxalamide substrates



3.1. Preparation of N, N–Diisopropyloxamoyl chloride S1[1,2]

A solution of Diisopropylamine (7.01 mL, 50 mmol, 1.0 equiv) in CH_2Cl_2 (50 mL) was added dropwise to a solution of oxalyl chloride (6.44 ml, 75 mmol, 1.5 equiv) in CH_2Cl_2 (100 mL) at 0 °C, after stirring for 5 min, triethylamine (7.30 mL, 52.5 mmol, 1.05 equiv) was added dropwise. The solution was warmed to room temperature and stirred for 6 hours. The excess of oxalyl chloride and the solvent were removed under reduce pressure and CH_2Cl_2 (30 mL) was added and evaporated. This operation was performed twice to give **S1** as a pale yellow solid. The crude product was used in the next step without any purification.

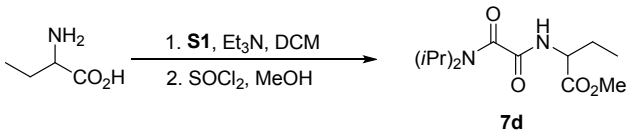
3.2. General procedures for the preparation of oxalamide substrates (4a-4n, 7a-7f, except 7c-7e)[3]

A solution of amine (20 mmol, 1.0 eq) in CH_2Cl_2 (40 mL) was added dropwise to a solution of N,N–Diisopropyloxamoyl chloride **S1** (25 mmol, 1.25 equiv) in CH_2Cl_2 (50 mL) at 0 °C, after stirring for 5 min, triethylamine (2.92 ml, 21 mmol, 1.05 equiv) was added dropwise and then the mixture was stirred for 6 hours at room temperature before quenched by water (50 mL). The organic layer was separated and the aqueous layer was extracted with CH_2Cl_2 (20 mL × 2). The combined organic phase was washed with brine (30 mL), and then dried over anhydrous Na_2SO_4. Evaporation and column chromatography on silica gel afforded corresponding amide substrates as white solid with good yields.

3.3. preparation of oxalamide substrates 7c[4]

The first step using 2-aminobutan-1-ol (1.78 g, 20 mmol, 1.0 eq) as starting material followed the general oxalamide coupling procedure, affording white solid. The solid and Et_3N (5.56 mL, 40 mmol, 2.0 eq) were dissolved in DCM (30 mL) then dropped by TBSCl (3.32g, 22 mmol, 1.1 eq) at room temperature overnight. The reaction was quenched by saturated NH_4Cl(aq) and the mixture was extracted with DCM. The combined organic layers was washed with water and brine, dried over anhydrous Na_2SO_4, and concentrated in vacuo. The resulting residue was purified by column chromatography on silica gel to give the product **7c** 5.29 g, 74% yield.

3.4. Preparation of oxalamide substrates 7d[5]



7d

To a solution of 2-aminobutanoic acid (2.06 g, 20 mmol, 1.0 eq) in MeOH (30 mL) was added dropwise $SOCl_2$ (4.35 mL, 60 mmol, 3.0 eq) at 0 °C,. The resulting mixture was allowed to stir from 0 °C to room temperature overnight. The solvent was removed under reduced pressure afford a white solid, which was used directly for next step. The second step followed the general oxalamide coupling procedure, to give compound **7d** 3.69 g, 68% yield.

3.5. Preparation of oxalamide substrates 7e[5]

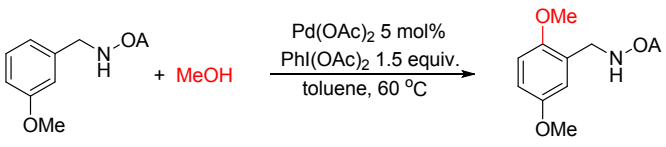
7e

The first step using 2-aminobutan-1-ol (1.78 g, 20 mmol, 1.0 eq) as starting material followed the general oxalamide coupling procedure, affording white solid. The solid was dissolved in DCM (30 mL) and treated with AcCl (1.56 mL, 22 mmol, 1.1 eq) and Et_3N (5.56 mL, 40 mmol, 2.0 eq) at room temperature overnight. Water was added and the mixture was extracted with DCM. The combined organic layers was washed with water and brine, dried over anhydrous Na_2SO_4, and concentrated in vacuo. The resulting residue was purified by column chromatography on silica gel to give the product **7e** 4.06 g, 71% yield.

Procedure for the Reaction

4. Standard procedure for Pd-catalyzed alkoxylation /acetoxylation reaction of amides

4.1 Standard procedure for Pd-catalyzed C(sp^2)-H alkoxylation of Benzylamines

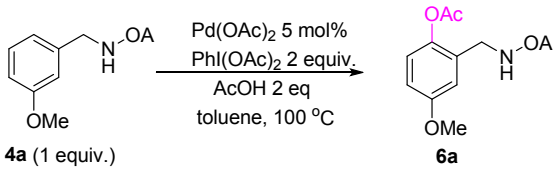


4a (1 equiv.) **5a**

A mixture of benzylamine **4a** (87.6 mg, 0.3 mmol), MeOH (0.15 mL), $Pd(OAc)_2$ (3.3 mg, 0.015 mmol, 0.05 equiv.), and $PhI(OAc)_2$ (145 mg, 0.45 mmol, 1.5 equiv.) in anhydrous toluene (0.9 mL)

in a 25 mL glass vial (sealed with PTFE cap) was heated at 60-110 °C with vigorous stirring for 8-22 hours. The reaction mixture was cooled to room temperature, and concentrated in vacuo. The resulting residue was purified by column chromatography on silica gel to give the alkoxylation product **5a** in 83% yield.

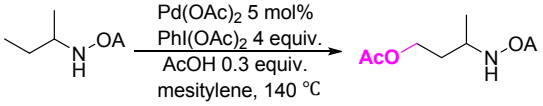
4.2 Standard procedure for Pd-catalyzed C(sp^2)-H acetoxylation of Benzylamines



4a (1 equiv.) **6a**

A mixture of benzylamine **4a** (87.6 mg, 0.3 mmol), $Pd(OAc)_2$ (3.3 mg, 0.015 mmol, 0.05 equiv.), $PhI(OAc)_2$ (193 mg, 0.6 mmol, 2 equiv.) and AcOH (36 mg, 0.6 mmol, 2 equiv.) in anhydrous toluene (0.9 mL) in a 25 mL glass vial (sealed with PTFE cap) was heated at 100 °C with vigorous stirring for 22 hours. The reaction mixture was cooled to room temperature, and concentrated in vacuo. The resulting residue was purified by column chromatography on silica gel to give the acetoxylation product **6a** in 58% yield.

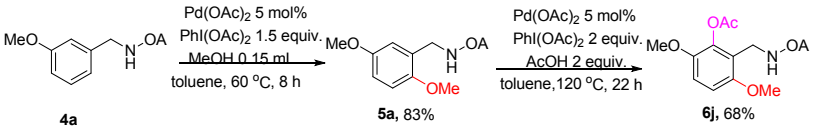
4.3 Standard procedure for Pd-catalyzed C(sp^3)-H acetoxylation of alkylamides



7a (1 equiv.) **8a**

A mixture of alkylamide **7a** (68.4 mg, 0.3 mmol), $Pd(OAc)_2$ (3.3 mg, 0.015 mmol, 0.05 equiv.), $PhI(OAc)_2$ (387 mg, 1.2 mmol, 4 equiv.) and AcOH (5.4 mg, 0.9 mmol, 0.3 equiv.) in anhydrous mesitylene (0.9 mL) in a 25 mL glass vial (sealed with PTFE cap) was heated at 140 °C with vigorous stirring for 22 hours. The reaction mixture was cooled to room temperature, and concentrated in vacuo. The resulting residue was purified by column chromatography on silica gel to give the acetoxylation product **8a** in 68% yield.

5. Synthesis of compound 6j by sequential C-H alkoxylation/acetoxylation reaction



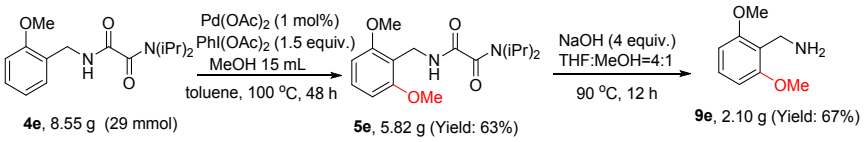
4a **5a**, 83% **6j**, 68%

Compound **5a**: A mixture of m-methyoxy-benzylamine **4a** (87.6 mg, 0.3 mmol), MeOH (0.15mL), $Pd(OAc)_2$ (3.3 mg, 0.015 mmol, 0.05 equiv.), and $PhI(OAc)_2$ (144.9 mg, 0.45 mmol, 1.5 equiv.) in anhydrous toluene (0.9 mL) in a 25 mL glass vial (sealed with PTFE cap) was heated at 60 °C with vigorous stirring for 8 hours. The reaction mixture was cooled to room temperature, and concentrated in vacuo. The resulting residue was purified by column chromatography on silica gel to give the alkoxylation product **5a** in 83% yield.

Compound **6j**: A mixture of Compound **5a** (87.6 mg, 0.3 mmol), $Pd(OAc)_2$ (3.3 mg, 0.015 mmol, 0.05 equiv.), $PhI(OAc)_2$ (193.2 mg, 0.6 mmol, 2 equiv.) and AcOH (36 mg, 0.6 mmol, 2 equiv.) in anhydrous toluene (0.9 mL) in a 25 mL glass vial (sealed with PTFE cap) was heated at 100 °C

with vigorous stirring for 22 hours. The reaction mixture was cooled to room temperature, and concentrated in vacuo. The resulting residue was purified by column chromatography on silica gel to give the product **6j** in 68% yield.

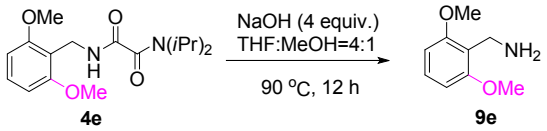
6. Gram Reaction



4e, 8.55 g (29 mmol) **5e**, 5.82 g (Yield: 63%) **9e**, 2.10 g (Yield: 67%)

A mixture of **4e** (8.55 g, 29 mmol, 1.0 equiv.), $Pd(OAc)_2$ (64 mg, 0.01 equiv.), $PhI(OAc)_2$ (1.5 equiv.) and toluene (30 mL) in a 100 mL boiling flask (sealed with vacuum plug) was heated at 100 °C with vigorous stirring for 48 hours. The reaction mixture was cooled to room temperature, and concentrated in vacuo. The resulting residue was purified by column chromatography on silica gel to give **9e** as pale yellow solid in 67% yield.

7. Removal of the Directing Group

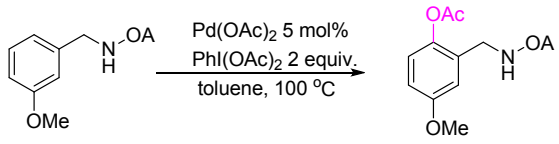


4e **9e**

Compound **4e** (0.16g, 0.5 mmol, 1.0 equiv.) was dissolved in a mixture of THF/MeOH (0.4/0.1 mL); NaOH (80 mg, 2.0 mmol, 4.0 equiv.) was then added. The mixture was heated to 90 °C with vigorous stirring and stirred for 12 hours. Water was added and the mixture was extracted with DCM. The combined organic layers was washed with water and brine, dried over anhydrous Na_2SO_4, and concentrated in vacuo. The residue was purified by column chromatography on silica gel to give the desired product **9e** in 88% yield.

8. Experiments about the mechanism

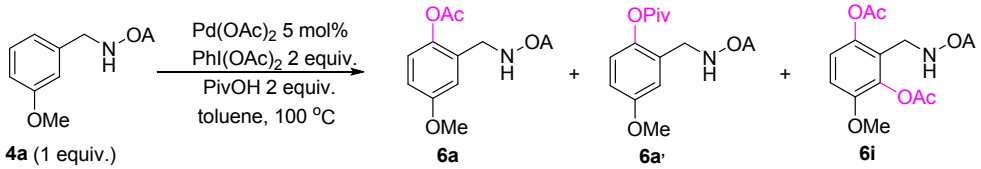
8.1 Pd-catalyzed C(sp^2)-H acetoxylation of Benzylamines without AcOH



4a (1 equiv.) **6a**

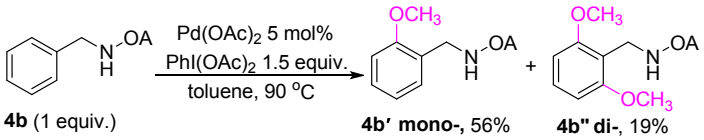
A mixture of benzylamine **4a** (87.6 mg, 0.3 mmol), $Pd(OAc)_2$ (3.3 mg, 0.015 mmol, 0.05 equiv.), $PhI(OAc)_2$ (193 mg, 0.6 mmol, 2 equiv.) in anhydrous toluene (0.9 mL) in a 25 mL glass vial (sealed with PTFE cap) was heated at 100 °C with vigorous stirring for 22 hours. The reaction mixture was cooled to room temperature, and concentrated in vacuo. The resulting residue was purified by column chromatography on silica gel to give the acetoxylation product **6a** in 45% yield.

8.2 Pd-catalyzed C(sp^2)-H acetoxylation of Benzylamines with PivOH



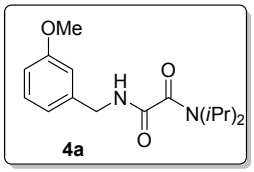
As predicted by GC-MS, the result gave ratio of 6a:6a':6i was 21:12:1, so acetic acid might be acted as a stabilizer during the catalytic cycle.

9. Selectivity of an un-substituted phenyl derivative

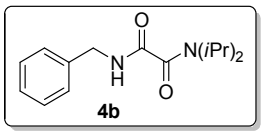


The un-substituted phenyl derivative afforded a mixture mono and di alkoylated products without selectivity. The mono-alkoxylated product was in 56% yield, and di-alkoxylated product in 19% yield.

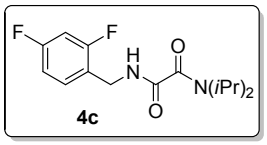
Analytic Data of Products



Yield: 82% (4.79g). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (br, 1H), 7.21 (t, J = 7.8 Hz, 1H), 6.86 (d, J = 7.6 Hz, 1H), 6.79 (m, 2H), 4.74–4.64 (m, 1H), 4.39 (d, J = 6.0 Hz, 2H), 3.76 (s, 3H), 3.52–3.45 (m, 1H), 1.38 (d, J = 6.8 Hz, 6H), 1.21 (d, J = 6.7 Hz, 6H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 163.23, 163.17, 163.09, 159.94, 139.17, 139.12, 129.81, 129.79, 120.07, 113.35, 113.22, 55.28, 49.76, 49.75, 46.61, 46.57, 43.30, 43.27, 20.93,20.19, 20.12. HRMS Calcd for $C_{16}H_{24}N_2O_3$ [M+Na]: 315.1685; Found: 315.1673.

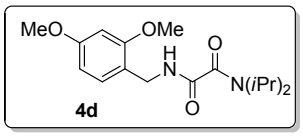


Yield: 93% (4.87g). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39–7.27 (m, 5H), 7.20 (br, 1H), 4.87–4.80 (m, 1H), 4.46 (d, J = 6.0 Hz, 2H), 3.56–3.49 (m, 1H), 1.42 (d, J = 6.8 Hz, 6H), 1.24 (d, J = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.16, 163.04, 137.53, 128.84, 127.90, 127.70, 49.75, 46.69, 43.41, 20.97, 20.15. HRMS Calcd for $C_{15}H_{22}N_2O_2$ [M+Na]: 285.1579; Found: 285.1579.



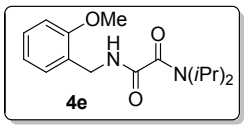
4c

Yield: 90% (5.36g). 1H NMR (400 MHz, CDCl3) δ 7.52 (s, 1H), 7.34–7.28 (M, 1H), 6.83–6.75 (m, 2H), 4.71–4.65 (m, 1H), 4.44 (d, J = 6.1 Hz, 2H), 3.52–3.45 (m, 1H), 1.37 (d, J = 6.8 Hz, 6H), 1.20 (d, J = 6.7 Hz, 6H). 13C NMR (101 MHz, CDCl3) δ 163.88, 163.76, 163.25, 162.95, 162.34, 162.22, 161.41, 161.29, 159.87, 159.75, 131.17, 131.11, 131.07, 131.01, 120.79, 120.75, 120.64, 120.60, 111.58, 111.54, 111.36, 111.33, 104.26, 104.00, 103.75, 49.78, 46.67, 36.79, 36.75, 20.91, 20.10. HRMS Calcd for $C_{15}H_{20}F_2N_2O_4$ [M+Na]: 321.1391; Found: 321.1394.



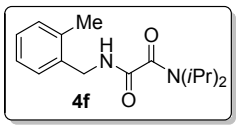
4d

Yield: 85% (5.47g). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.18 (m, 2H), 6.43 (m, 2H), 4.80–4.73 (m, 1H), 4.38 (d, *J* = 6.0 Hz, 2H), 3.82 (s, 3H), 3.79 (s, 3H), 3.52–3.45 (m, 1H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.20, 162.85, 160.73, 158.70, 130.50, 118.09, 103.98, 98.59, 55.44, 55.42, 49.59, 46.49, 38.76, 20.90, 20.12. HRMS Calcd for $C_{17}H_{26}N_2O_4$ [M+Na]: 345.1790; Found: 345.1783.



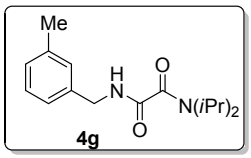
4e

Yield: 78% (4.56g). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 (br, 1H), 7.26 (m, 2H), 6.89 (m, 2H), 4.79–4.69 (m, 1H), 4.46 (d, *J* = 5.8 Hz, 2H), 3.85 (s, 3H), 3.53–3.45 (m, 1H), 1.41 (d, *J* = 6.6 Hz, 6H), 1.21 (d, *J* = 6.5 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.12, 162.91, 157.63, 129.69, 129.07, 125.49, 120.61, 110.30, 55.37, 49.60, 46.49, 39.13, 20.88, 20.10. HRMS Calcd for $C_{16}H_{24}N_2O_3$ [M+Na]: 315.1685; Found: 315.1678.



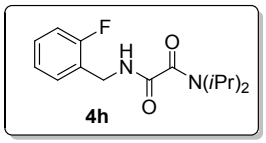
4f

Yield: 91% (5.02g). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29–7.26 (m, 1H), 7.23–7.17 (m, 3H), 7.13 (br, 1H), 4.83–4.76 (m, 1H), 4.47 (d, *J* = 5.7 Hz, 2H), 3.57–3.50 (m, 1H), 2.36 (s, 3H), 1.43 (d, *J* = 6.8 Hz, 6H), 1.26 (d, *J* = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.02, 162.98, 136.51, 135.18, 130.65, 128.62, 128.01, 126.38, 49.76, 46.70, 41.59, 20.99, 20.17, 19.12. HRMS Calcd for $C_{16}H_{24}N_2O_2$ [M+Na]: 299.1735; Found: 299.1729.



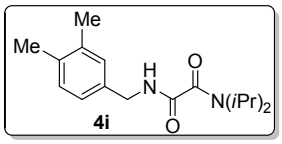
4g

Yield: 81% (4.47g). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 (br, 1H), 7.22 (m, 1H), 7.09 (m, 3H), 4.81–4.73 (m, 1H), 4.41 (d, *J* = 5.9 Hz, 2H), 3.55–3.47 (m, 1H), 2.34 (s, 3H), 1.41 (d, *J* = 6.8 Hz, 6H), 1.24 (d, *J* = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.10, 163.04, 138.53, 137.38, 128.73, 128.65, 128.45, 124.95, 49.75, 46.66, 43.39, 21.47, 20.96, 20.14. HRMS Calcd for $C_{16}H_{24}N_2O_2$ [M+Na]: 299.1735; Found: 299.1731.



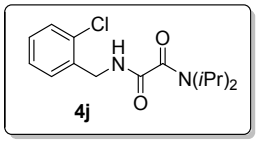
4h

Yield: 87% (4.87g). 1H NMR (400 MHz, $CDCl_3$) δ 7.36–7.32 (m, 1H), 7.31–7.26 (m, 2H), 7.13–7.09 (m, 1H), 7.07–7.02 (m, 1H), 4.83–4.76 (m, 1H), 4.52 (d, *J* = 6.2 Hz, 2H), 3.55–3.49 (m, *J* = 13.6, 6.8 Hz, 1H), 1.42 (d, *J* = 6.8 Hz, 6H), 1.23 (d, *J* = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.19, 162.76, 135.93, 131.42, 128.36, 127.87,126.18,125.98, 49.77, 46.78, 39.93, 20.97, 20.16. HRMS Calcd for $C_{15}H_{21}FN_2O_2$ [M+Na]: 303.1485; Found: 303.1485.



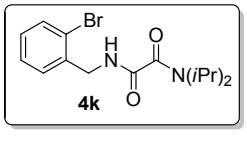
4i

Yield: 87% (5.05g). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 (br, 1H), 7.08–6.95 (m, 3H), 4.79–4.68 (m, 1H), 4.33 (d, *J* = 5.7 Hz, 2H), 3.50–3.43 (m, 1H), 2.20 (s, 6H), 1.36 (d, *J* = 6.8 Hz, 6H), 1.19 (d, *J* = 6.6 Hz, 6H); ^{13}C NMR (151 MHz, $CDCl_3$) δ 163.04, 137.05, 136.02, 134.87, 130.02, 129.26, 125.36, 49.70, 46.66, 43.21, 20.98, 20.16, 19.82, 19.51. HRMS Calcd for $C_{17}H_{26}N_2O_2$ [M+Na]: 313.1892; Found: 313.1877.



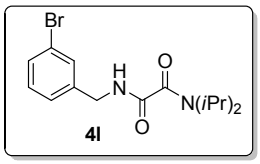
4j

Yield: 92% (5.45g). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.52 (br, 1H), 7.40–7.31 (m, 2H), 7.25–7.18 (m, 2H), 4.73–4.63 (m, 1H), 4.54 (d, *J* = 6.2 Hz, 2H), 3.53–3.44 (m, 1H), 1.38 (d, *J* = 6.8 Hz, 6H), 1.20 (d, *J* = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.20,162.95. 134.95, 133.68, 129.89, 129.62, 129.08, 127.16, 49.76, 46.61, 41.22, 20.90, 20.11. HRMS Calcd for $C_{15}H_{21}ClN_2O_2$ [M+Na]: 319.1189; Found: 319.1188.

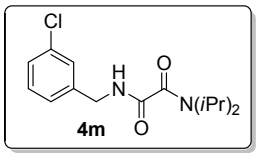


4k

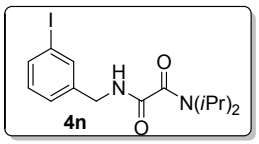
Yield: 85% (5.78g). 1H NMR (400 MHz, $CDCl_3$) δ 7.56–7.54 (m, 1H), 7.40–7.37 (m, 1H), 7.35 (br, 1H), 7.31–7.24 (m, 1H), 7.17–7.13 (m, 1H), 4.79–4.73 (m, 1H), 4.54 (d, *J* = 6.3 Hz, 2H), 3.55–3.48 (m, 1H), 1.41 (d, *J* = 6.8 Hz, 6H), 1.22 (d, *J* = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.14, 162.82, 136.64, 133.00, 130.15, 129.44, 127.89, 123.85, 49.75, 46.75, 43.70, 20.99, 20.18. HRMS Calcd for $C_{15}H_{21}BrN_2O_2$ [M+Na]: 363.0684; Found: 363.0677.



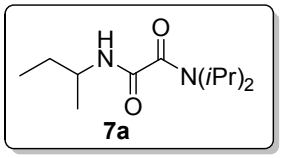
Yield: 82% (5.58g). ^1H NMR (400 MHz, $CDCl_3$) δ 7.44 (br, 1H), 7.42–7.39 (m, 2H), 7.25–7.16 (m, 2H), 4.82–4.75 (m, 1H), 4.42 (d, *J* = 6.1 Hz, 2H), 3.56–3.49 (m, 1H), 1.41 (d, *J* = 6.8 Hz, 6H), 1.24 (d, *J* = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.25, 163.01, 140.01, 130.81, 130.77, 130.38, 126.46, 122.81, 49.84, 46.72, 42.70, 20.96, 20.15. HRMS Calcd for $C_{15}H_{21}BrN_2O_2$ [M+Na]: 363.0684; Found: 363.0677.



Yield: 86% (5.09g). ^1H NMR (400 MHz, $CDCl_3$) δ 7.28–7.27 (m, 2H), 7.27–7.24 (m, 2H), 7.20–7.16 (m, 1H), 4.87–4.80 (m, 1H), 4.44 (d, *J* = 6.1 Hz, 2H), 3.57–3.50 (m, 1H), 1.43 (d, *J* = 6.8 Hz, 6H), 1.25 (d, *J* = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.22, 162.89, 139.69, 134.67, 130.12, 127.92, 127.88, 125.97, 49.82, 46.78, 42.80, 20.98, 20.16. HRMS Calcd for $C_{15}H_{21}ClN_2O_2$ [M+Na]: 319.1189; Found: 319.1173.

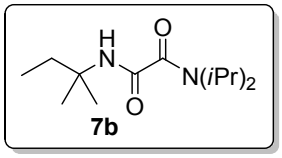


Yield: 85% (6.60g). 1H NMR (400 MHz, $CDCl_3$) δ 7.66 (m, 2H), 7.61 (d, *J* = 7.9 Hz, 1H), 7.28 (d, *J* = 6.6 Hz, 1H), 7.07 (t, *J* = 7.8 Hz, 1H), 4.74–4.67 (m, 1H), 4.39 (d, *J* = 6.1 Hz, 2H), 3.56–3.49 (m, 1H), 1.41 (d, *J* = 6.8 Hz, 6H), 1.25 (d, *J* = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.24, 163.07, 140.06, 136.70, 130.52, 127.12, 94.63, 49.86, 46.68, 42.55, 20.95, 20.14. HRMS Calcd for $C_{15}H_{21}IN_2O_2$ [M+Na]: 411.0545; Found: 411.0551.



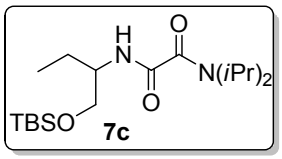
Yield: 84% (3.83g). 1H NMR (400 MHz, $CDCl_3$) δ 6.85 (br, 1H), 4.75-4.68 (m, 1H), 3.89-3.81 (m, 1H), 3.52-3.45 (m, 1H), 1.53 – 1.46 (m, 2H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H), 1.15 (d, *J* = 6.6 Hz, 3H), 0.90 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.51, 162.77, 49.71, 46.85,

46.57, 29.49, 20.22, 20.18, 20.13, 10.45. HRMS Calcd for $C_{12}H_{24}N_2O_2$ [M+Na]: 251.1735; Found: 251.1740.



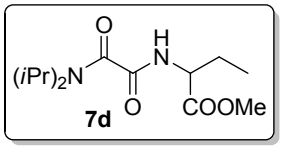
7b

Yield: 87% (4.21g). ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.60 (br, 1H), 4.74-4.64 (m, 1H), 3.52-3.42 (m, 1H), 1.76-1.70 (m, 2H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.31 (s, 6H), 1.21 (d, *J* = 6.7 Hz, 6H), 0.85 (t, *J* = 7.5 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.82, 162.76, 54.35, 49.68, 46.45, 32.63, 26.14, 20.91, 20.15, 8.39. HRMS Calcd for $C_{13}H_{26}N_2O_2$ [M+Na]: 265.1892; Found: 265.1891.



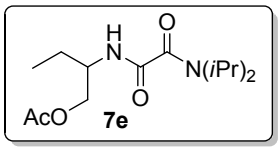
7c

Yield: 74% (5.29g). ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.82 (d, *J* = 8.8 Hz, 1H), 4.71-4.65 (m, 1H), 3.87 – 3.80 (m, 1H), 3.66-3.59 (m, 2H), 3.55-3.45 (m, 1H), 1.68 – 1.61 (m, 1H), 1.55-1.48 (m, 1H), 1.43-1.41 (m, 6H), 1.22 (t, *J* = 6.2 Hz, 6H), 0.93 (t, *J* = 7.5 Hz, 3H), 0.88 (s, 9H), 0.04 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.38, 163.17, 64.06, 52.30, 49.75, 46.57, 26.00, 24.29, 21.02, 20.22, 18.42, 10.58, -5.32, -5.35. HRMS Calcd for $C_{18}H_{38}IN_2O_3Si$ [M+Na]: 381.2549; Found: 381.2555.



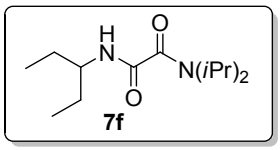
7d

Yield: 68% (3.69g). 1H NMR (400 MHz, $CDCl_3$) δ 7.29 (d, *J* = 7.2 Hz, 1H), 4.65-4.58 (m, 1H), 4.51-4.46 (m, 1H), 3.73 (s, 3H), 3.54–3.45 (m, 1H), 1.94–1.88 (m, 1H), 1.82–1.71 (m, 1H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.20 (dd, *J* = 6.6, 2.6 Hz, 6H), 0.93 (t, *J* = 7.5 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 175.38, 163.67, 163.20, 52.03, 49.80, 46.50, 41.50, 39.36, 20.89, 20.12, 14.93. HRMS Calcd for $C_{13}H_{24}N_2O_4$ [M+Na]: 295.1634; Found: 295.1638.



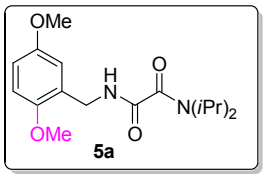
7e

Yield: 71% (4.06g). 1H NMR (400 MHz, $CDCl_3$) δ 6.99 (d, *J* = 7.8 Hz, 1H), 4.73–4.63 (m, 1H), 4.13-4.10 (m, 2H), 4.07–4.01 (m, 1H), 3.54-3.47 (m, 1H), 2.05 (s, 3H), 1.64–1.51 (m, 2H), 1.41 (d, *J* = 6.8 Hz, 6H), 1.21 (dd, *J* = 6.6, 3.8 Hz, 6H), 0.95 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.02, 163.21, 163.09, 65.39, 49.83, 46.66, 24.47, 20.96, 20.94(-CH_3, -CH_3), 20.91, 20.23, 20.16, 10.43. HRMS Calcd for $C_{14}H_{26}N_2O_4$ [M+H]: 287.1971; Found: 287.1969.



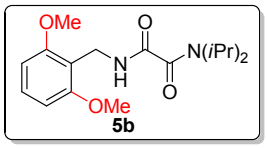
7f

Yield: 89% (4.31g). 1H NMR (400 MHz, $CDCl_3$) δ 6.88 (br, 1H), 4.64–4.57 (m, 1H), 3.75–3.66 (m, 1H), 3.51–3.41 (m, 1H), 1.59–1.52 (m, 2H), 1.44–1.37 (m, 8H), 1.19 (d, J = 6.7 Hz, 6H), 0.88 (t, J = 7.4 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.90, 163.48, 52.35, 49.82, 46.42, 27.39, 20.89, 20.18, 10.40. HRMS Calcd for $C_{13}H_{26}N_2O_2$ [M+H]: 243.2073; Found: 243.2069.



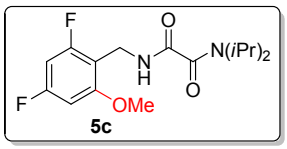
5a

Yield: 83% (80.2 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 (br, 1H), 6.85 (s, 1H), 6.77 (s, J = 1.5 Hz, 2H), 4.76–4.68 (m,1H), 4.42 (d, J = 6.1 Hz, 2H), 3.80 (s, 3H), 3.74 (s, 3H), 3.55–3.34 (m, 1H), 1.40 (d, J = 6.8 Hz, 6H), 1.21 (d, J = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.19, 162.79, 158.38, 138.48, 128.70, 123.96, 123.01, 108.16, 55.67, 49.66, 46.60, 35.13, 21.01, 20.20, 19.68. HRMS Calcd for $C_{17}H_{26}N_2O_4$ [M+Na]: 345.1790; Found: 345.1789.



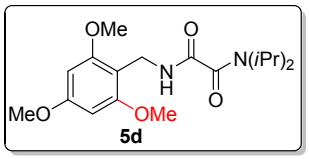
5b

Yield: 87% (84.0 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.20 (t, J = 8.4 Hz, 1H), 7.11 (br, 1H), 6.53 (d, J = 8.4 Hz, 2H), 4.82–4.72 (m, 1H), 4.56 (d, J = 5.7 Hz, 2H), 3.82 (s, 6H), 3.52–3.42 (m, 1H), 1.38 (d, J = 6.8 Hz, 6H), 1.20 (d, J = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.40, 162.69, 158.72, 129.29, 113.26, 103.80, 55.94, 49.60, 46.49, 32.20, 20.97, 20.17. HRMS Calcd for $C_{17}H_{26}N_2O_4$ [M+H]: 323.1971; Found: 323.1979.



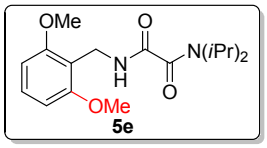
5c

Yield: 66% (64.9 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.18 (br, 1H), 6.48–6.40 (m, 2H), 4.85–4.77 (m, 1H), 4.47 (d, J = 5.9 Hz, 2H), 3.84 (s, 3H), 3.53–3.44 (m, 1H), 1.39 (d, J = 6.8 Hz, 6H), 1.21 (d, J = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 164.58, 164.42, 162.89, 162.83, 162.74, 162.60, 162.12, 161.96, 160.44, 160.28, 160.07, 159.97, 159.84, 109.28, 109.24, 109.09, 109.05, 96.43, 96.42, 95.48, 95.22, 56.40, 49.66, 46.73, 31.44, 31.39, 21.01, 20.19. HRMS Calcd for $C_{16}H_{22}F_2N_2O_3$ [M+Na]: 351.1496; Found: 351.1497.



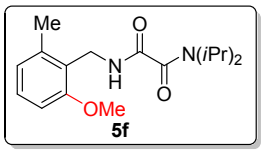
5d

Yield: 86% (83.2 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 6.99 (br, 1H), 6.10 (s, 2H), 4.82–4.72 (m, 1H), 4.47 (d, *J* = 5.6 Hz, 2H), 3.81 (d, *J* = 3.8 Hz, 9H), 3.52–3.42 (m, 1H), 1.39 (d, *J* = 6.8 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.52, 162.72, 161.17, 159.46, 105.96, 90.56, 55.91, 55.50, 49.64, 46.50, 32.07, 21.00, 20.21. HRMS Calcd for $C_{18}H_{28}N_2O_5$ [M+H]: 353.2076; Found: 353.2079.



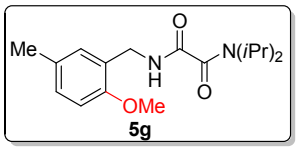
5e

Yield: 82% (79.2 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.20 (t, *J* = 8.4 Hz, 1H), 7.11 (br, 1H), 6.53 (d, *J* = 8.4 Hz, 2H), 4.82–4.72 (m, 1H), 4.56 (d, *J* = 5.7 Hz, 2H), 3.82 (s, 6H), 3.52–3.42 (m, 1H), 1.38 (d, *J* = 6.8 Hz, 6H), 1.20 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.40, 162.69, 158.72, 129.29, 113.26, 103.80, 55.94, 49.60, 46.49, 32.20, 20.97, 20.17. HRMS Calcd for $C_{17}H_{26}N_2O_4$ [M+H]: 323.1971; Found: 323.1979.



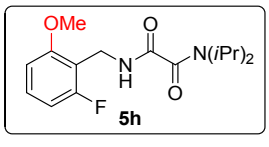
5f

Yield: 98% (90.0 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.16 (t, *J* = 7.9 Hz, 1H), 7.09 (br, 1H), 6.79 (d, *J* = 7.6 Hz, 1H), 6.73 (d, *J* = 8.3 Hz, 1H), 4.84–4.74 (m,1H), 4.53 (d, *J* = 5.8 Hz, 2H), 3.84 (s, 3H), 3.53–3.44 (m,1H), 2.41 (s, 3H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.22 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.19, 162.79, 158.38, 138.48, 128.70, 123.96, 123.01, 108.16, 55.67, 49.66, 46.60, 35.13, 21.01, 20.20, 19.68. HRMS Calcd for $C_{17}H_{26}N_2O_3$ [M+H]: 307.2022; Found: 307.2024.



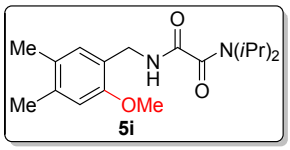
5g

Yield: 81% (74.4 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30 (br, 1H), 7.09–7.03 (m, 2H), 6.75 (d, *J* = 8.2 Hz, 1H), 4.79–4.69 (m, 1H), 4.41 (d, *J* = 6.1 Hz, 2H), 3.81 (s, 3H), 3.54–3.43 (m, 1H), 2.25 (s, 3H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.19, 162.90, 155.60, 130.52, 129.86, 129.29, 125.18, 110.29, 55.51, 49.65, 46.54, 39.22, 20.92, 20.47, 20.14, 20.11. HRMS Calcd for $C_{17}H_{26}N_2O_3$ [M+H]: 307.2022; Found: 307.2027.



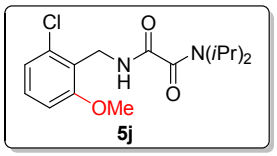
5h

Yield: 68% (63.2 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25–7.19 (m, 2H), 6.74–6.63 (m, 2H), 4.86–4.80 (m, 1H), 4.54 (d, *J* = 5.9 Hz, 2H), 3.87 (s, 3H), 3.53–3.46 (m, 1H), 1.39 (d, *J* = 6.8 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.93, 162.73, 162.60, 160.28, 159.30, 159.23, 129.68, 129.57,113.12, 112.94, 108.35, 108.12, 106.35, 106.33, 56.18, 49.63, 46.67, 31.77, 31.72, 21.01, 20.20. HRMS Calcd for $C_{16}H_{23}FN_2O_3$ [M+Na]: 333.1590; Found: 333.1582.



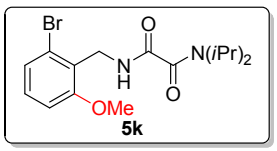
5i

Yield: 81% (84.7 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.24 (br, 1H), 7.02 (s, 1H), 6.66 (s, 1H), 4.82–4.72 (m, 1H), 4.39 (d, *J* = 6.1 Hz, 2H), 3.82 (s, 3H), 3.52–3.43 (m, 1H), 2.24 (s, 3H), 2.17 (s, 3H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.16, 162.82, 155.79, 137.34, 131.25, 128.36, 122.60, 112.18, 55.60, 49.66, 46.62, 39.06, 21.00, 20.20, 20.16, 18.79. HRMS Calcd for $C_{18}H_{28}N_2O_3$ [M+H]: 321.2178; Found: 321.2178.



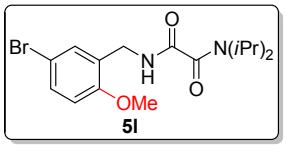
5j

Yield: 81% (84.7 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.18 (t, *J* = 8.2 Hz, 1H), 7.11 (br, 1H), 6.97 (d, *J* = 8.1 Hz, 1H), 6.78 (d, *J* = 8.3 Hz, 1H), 4.82–4.72 (m, 1H), 4.66 (d, *J* = 5.8 Hz, 2H), 3.84 (s, 3H), 3.53–3.42 (m, 1H), 1.38 (d, *J* = 6.8 Hz, 6H), 1.20 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.10, 162.64, 159.12, 135.39, 129.64, 129.61, 123.60, 121.90, 109.20, 56.10, 49.67, 46.58, 35.60, 20.96, 20.15. HRMS Calcd for $C_{16}H_{23}ClN_2O_3$ [M+H]: 327.1475; Found: 327.1487.



5k

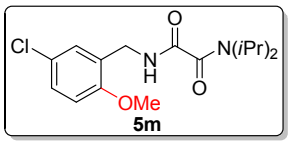
Yield: 80% (88.8 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.15–7.08 (m, 3H), 6.81 (d, *J* = 7.9 Hz, 1H), 4.81–4.71 (m, 1H), 4.67 (d, *J* = 5.7 Hz, 2H), 3.83 (s, 3H), 3.52–3.41 (m, 1H), 1.37 (d, *J* = 6.8 Hz, 6H), 1.20 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.11, 162.59, 159.07, 130.06, 125.09, 109.81 , 56.08, 49.66, 46.54, 38.33, 20.96, 20.14. HRMS Calcd for $C_{16}H_{23}BrN_2O_3$ [M+H]: 371.0970; Found: 371.0970.



5l

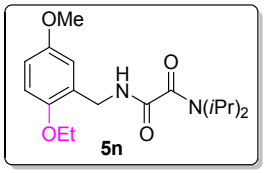
Yield: 59% (64.5 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38–7.34 (m, 2H), 7.32 (br, 1H), 6.74 (d, *J* = 8.5 Hz, 1H), 4.81–4.72 (m, 1H), 4.41 (d, *J* = 6.3 Hz, 2H), 3.83 (s, 3H), 3.56–3.45 (m, 1H), 1.41 (d, *J* = 6.8 Hz, 6H), 1.23 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.95, 162.88, 156.81, 132.32,

131.73, 127.82, 112.85, 112.14, 55.80, 49.74, 46.74, 38.73, 21.01, 20.21. HRMS Calcd for $C_{16}H_{23}BrN_2O_3$ [M+H]: 371.0970; Found: 371.0975.



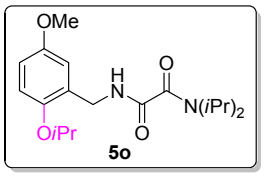
5m

Yield: 73% (71.4 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 (br, 1H), 7.24–7.19 (m, 2H), 6.78 (d, J = 8.6 Hz, 1H), 4.82–4.72 (m, 1H), 4.41 (d, J = 6.3 Hz, 2H), 3.84 (s, 3H), 3.56–3.46 (m, 1H), 1.41 (d, J = 6.8 Hz, 6H), 1.23 (d, J = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.98, 162.90, 156.29, 129.48, 128.69, 127.41, 125.57, 111.61, 55.84, 49.72, 46.72, 38.75, 21.00, 20.20.HRMS Calcd for $C_{16}H_{23}ClN_2O_3$ [M+H]: 327.1475; Found: 327.1478.



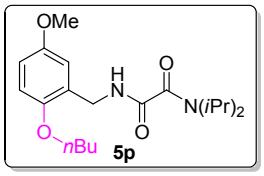
5n

Yield: 85% (85.6 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31 (br, 1H), 6.84 (d, J = 2.5 Hz, 1H), 6.76–6.75 (m, 2H), 4.77–4.69(m, 1H), 4.43 (d, J = 6.1 Hz, 2H), 4.03–3.98 (m, 2H), 3.73 (s, 3H), 3.54–3.44 (m, 1H), 1.42–1.38 (m, 9H), 1.21 (d, J = 6.7 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.11, 162.98, 153.51, 151.20, 126.71, 115.66, 113.46, 112.47, 64.29, 55.85, 49.67, 46.60, 39.37, 20.97, 20.15, 15.11. HRMS Calcd for $C_{18}H_{28}N_2O_4$ [M+H]: 337.2127; Found: 337.2133.



5o

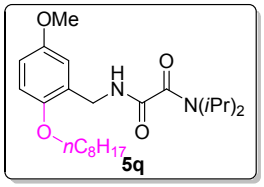
Yield: 69% (72.5 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28 (br, 1H), 6.85 (d, J = 2.5 Hz, 1H), 6.78–6.73 (m, 2H), 4.78–4.68 (m, 1H), 4.44 (d, J = 6.1 Hz, 2H), 3.90 (t, J = 6.5 Hz, 2H), 3.74 (s, 3H), 3.54–3.44 (m,1H), 1.85–1.76 (m,2H), 1.40 (d, J = 6.8 Hz, 6H), 1.21 (d, J = 6.7 Hz, 6H), 1.03 (t, J = 7.4 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.09, 163.00, 153.50, 151.32, 126.66, 115.65, 113.44, 112.35, 70.22, 55.85, 49.64, 46.58, 39.34, 22.80, 20.96, 20.13, 10.77. HRMS Calcd for $C_{19}H_{30}N_2O_4$ [M+H]: 351.2284; Found: 351.2282.



5p

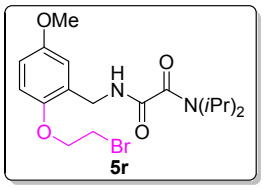
Yield: 76% (83.0 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28 (br,1H), 6.84 (s, 1H), 6.78–6.73(m, 2H), 4.76–4.68 (m, 1H), 4.43 (d, J = 6.0 Hz, 2H), 3.93 (t, J = 6.4 Hz, 2H), 3.73 (s, 3H), 3.54–3.44 (m, 1H), 1.79–1.72 (m,2H), 1.51–1.45 (m, 2H), 1.40 (d, J = 6.8 Hz, 6H), 1.20 (d, J = 6.6 Hz, 6H), 0.96 (t, J =

7.4 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.10, 163.02, 153.47, 151.33, 126.63, 115.63, 113.43, 112.30, 68.40, 55.87, 49.68, 46.60, 39.35, 31.53, 20.97, 20.15, 19.48, 13.99. HRMS Calcd for $C_{20}H_{32}N_2O_4$ [M+H]: 365.2440; Found: 365.2444.



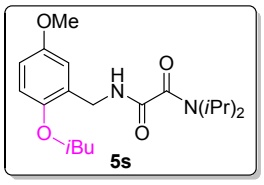
5q

Yield: 58% (73.1 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 (br, 1H), 6.85 (d, *J* = 2.4 Hz, 1H), 6.78–6.73 (m, 2H), 4.81–4.71(m,1H), 4.44 (d, *J* = 6.1 Hz, 2H), 3.93 (t, *J* = 6.5 Hz, 2H), 3.74 (s, 3H), 3.54–3.44 (m, 1H), 1.81–1.74 (m, 2H), 1.51–1.43 (m, 2H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.33–1.27(m, 8H), 1.21 (d, *J* = 6.7 Hz, 6H), 0.88 (t, *J* = 6.9 Hz, 3H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.01, 162.97, 153.47, 151.36, 126.66, 115.62, 113.44, 112.32, 68.76, 55.88, 49.64, 46.62, 39.36, 31.96, 29.51, 29.36, 26.27, 22.78, 20.99, 20.17, 14.23. HRMS Calcd for $C_{24}H_{40}N_2O_4$ [M+H]: 421.3066; Found: 421.3066.



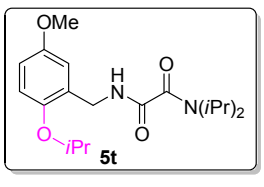
5r

Yield: 50% (62.2 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33 (br, 1H), 6.88 (s, 1H), 6.76 (d, *J* = 1.5 Hz, 2H), 4.67–4.58 (m, 1H), 4.47 (d, *J* = 6.2 Hz, 2H), 4.29 (t, *J* = 5.8 Hz, 2H), 3.75 (s, 3H), 3.67 (t, *J* = 5.8 Hz, 2H), 3.54–3.44 (m, 1H), 1.40 (d, *J* = 6.7 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.29, 163.25, 154.24, 150.32, 127.35, 115.99, 113.62, 112.84, 68.54, 55.89, 49.75, 46.55, 39.32, 30.00, 20.99, 20.18. HRMS Calcd for $C_{18}H_{27}BrN_2O_4$ [M+H]: 415.1232; Found: 415.1241.



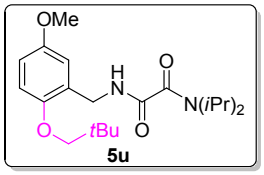
5s

Yield: 65% (71.0 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26 (s, 1H), 6.85 (s, 1H), 6.76 (d, *J* = 2.1 Hz, 2H), 4.79–4.69(m, 1H), 4.46 (d, *J* = 6.0 Hz, 2H), 3.75 (s, 3H), 3.71 (d, *J* = 6.4 Hz, 2H), 3.53–3.44 (m, 1H), 2.13–2.06 (m,1H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H), 1.03 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.07, 163.04, 153.47, 151.36, 126.54, 115.64, 113.42, 112.19, 75.02, 55.88, 49.66, 46.59, 39.34, 28.48, 20.96, 20.13, 19.48. HRMS Calcd for $C_{20}H_{32}N_2O_4$ [M+H]: 365.2440; Found: 365.2442.

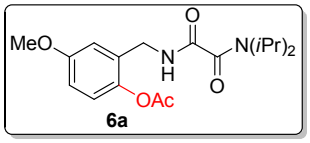


5t

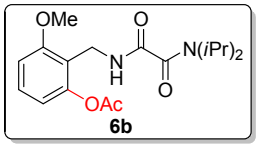
Yield: 60% (63.0 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28(br, 1H), 6.84–6.75(m, 3H), 4.74–4.71(m, 1H), 4.48–4.41(m,1H), 4.42 (d, *J* = 6.1 Hz, 2H), 3.74 (s, 3H), 3.54–3.44(m, 1H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.32 (d, *J* = 6.1 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.12, 163.02, 153.53, 150.02, 127.77, 115.48, 114.56, 113.68, 71.12, 55.84, 49.66, 46.59, 39.47, 22.34, 20.98, 20.15. HRMS Calcd for $C_{19}H_{30}N_2O_4$ [M+H]: 351.2284; Found: 351.2284.



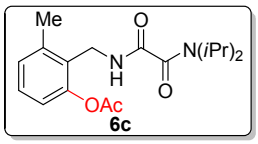
Yield: 54% (61.6 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.23(br, 1H), 6.85 (s, 1H), 6.75 (s, 2H), 4.77–4.68 (m, 1H), 4.47 (d, *J* = 6.0 Hz, 2H), 3.74 (s, 3H), 3.57 (s, 2H), 3.47–3.43 (m, 1H), 1.39 (d, *J* = 6.8 Hz, 6H), 1.20 (d, *J* = 6.7 Hz, 6H), 1.04 (s, 9H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 163.10, 163.02, 153.46, 151.47, 126.45, 115.58, 113.37, 112.04, 78.47, 55.88, 49.64, 46.56, 39.31, 32.05, 26.86, 20.95, 20.10. HRMS Calcd for $C_{21}H_{34}N_2O_4$ [M+H]: 379.2597; Found: 379.2607.



Yield: 58% (60.9 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.22 (br, 1H), 6.96 (d, *J* = 8.8 Hz, 1H), 6.88 (d, *J* = 3.0 Hz, 1H), 6.83–6.80 (m, 1H), 4.69–4.59 (m, 1H), 4.34 (d, *J* = 6.1 Hz, 2H), 3.76 (s, 3H), 3.54–3.43 (m, 1H), 2.30 (s, 3H), 1.39 (d, *J* = 6.8 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.05, 163.17, 157.64, 142.38, 130.46, 123.39, 114.92, 114.19, 55.70, 49.78, 46.59, 38.47, 20.96, 20.91, 20.11. HRMS Calcd for $C_{18}H_{26}N_2O_5$ [M+H]: 351.1920; Found: 351.1927.

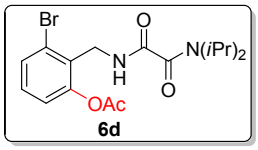


Yield: 96% (100.8 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 (d, *J* = 8.3 Hz, 1H), 6.99 (br, 1H), 6.79 (d, *J* = 8.3 Hz, 1H), 6.70 (d, *J* = 8.2 Hz, 1H), 4.64–4.54 (m, 1H), 4.46 (d, *J* = 6.1 Hz, 2H), 3.87 (s, 3H), 3.52–3.42 (m, 1H), 2.36 (s, 3H), 1.39 (d, *J* = 6.8 Hz, 6H), 1.20 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.89, 163.42, 162.87, 159.04, 149.80, 129.32, 118.41, 115.05, 108.24, 55.96, 49.66, 46.42, 32.22, 21.05, 20.88, 20.13. HRMS Calcd for $C_{18}H_{26}N_2O_5$ [M+H]: 351.1920; Found: 351.1929.



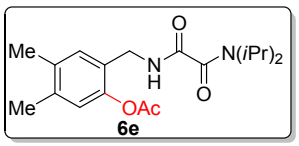
Yield: 65% (65.1 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.22 (t, *J* = 7.8 Hz, 1H), 7.08 (d, *J* = 7.6 Hz, 1H), 6.91–6.86 (m, 2H), 4.68–4.59 (m, 1H), 4.41 (d, *J* = 5.6 Hz, 2H), 3.52–3.42 (m, 1H), 2.38 (s, 3H), 2.33 (s, 3H), 1.38 (d, *J* = 6.8 Hz, 6H), 1.22 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.10,

163.03, 162.99, 149.92, 139.37, 128.95, 128.53, 127.61, 120.20, 49.76, 46.57, 35.11, 21.09, 20.94, 20.13, 19.44. HRMS Calcd for $C_{18}H_{26}N_2O_4$ [M+H]: 335.1971; Found: 335.1972.



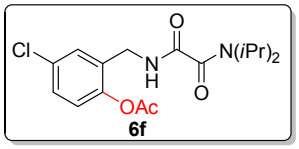
6d

Yield: 72% (86.0 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49–7.47 (m, 1H), 7.21 (t, *J* = 8.1 Hz, 1H), 7.05–7.03 (m, 1H), 6.98 (br, 1H), 4.64–4.57 (m, 3H), 3.53–3.42 (m, 1H), 2.37 (s, 3H), 1.39 (d, *J* = 6.8 Hz, 6H), 1.20 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.74, 163.00, 162.85, 150.25, 130.80, 130.14, 129.84, 125.88, 122.50, 49.76, 46.60, 37.74, 21.11, 20.93, 20.16. HRMS Calcd for $C_{17}H_{23}BrN_2O_4$ [M+H]: 399.0919; Found: 399.0923.



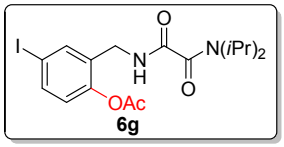
6e

Yield: 72% (75.2 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.10 (s, 2H), 6.82 (s, 1H), 4.70–4.64 (m, 1H), 4.31 (d, *J* = 6.0 Hz, 2H), 3.51–3.43 (m, 1H), 2.30 (s, 3H), 2.21 (d, *J* = 3.1 Hz, 6H), 1.39 (d, *J* = 6.8 Hz, 6H), 1.21 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.99, 163.04, 146.79, 137.86, 135.00, 131.12, 126.38, 123.44, 49.72, 46.56, 38.09, 21.00, 20.92, 20.11, 19.66, 19.24. HRMS Calcd for $C_{19}H_{28}N_2O_4$ [M+H]: 349.2127; Found: 349.2120.



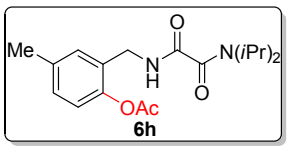
6f

Yield: 77% (81.8 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (br, 1H), 7.34 (d, *J* = 2.3 Hz, 1H), 7.23 (d, *J* = 8.6 Hz, 1H), 6.99 (d, *J* = 8.6 Hz, 1H), 4.55–4.50 (m, 1H), 4.33 (d, *J* = 6.1 Hz, 2H), 3.50–3.44 (m, 1H), 2.30 (s, 3H), 1.37 (d, *J* = 6.7 Hz, 6H), 1.20 (d, *J* = 6.6 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.28, 163.31, 147.30, 131.62, 129.61, 128.79, 123.93, 49.90, 46.51, 37.74, 20.92, 20.81, 20.05. HRMS Calcd for $C_{17}H_{23}ClN_2O_4$ [M+H]: 355.1425; Found: 355.1438.



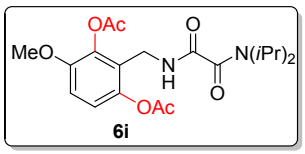
6g

Yield: 68% (91.0 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (d, *J* = 2.1 Hz, 1H), 7.62–7.60 (m, 1H), 7.32 (br, 1H), 6.83 (d, *J* = 8.5 Hz, 1H), 4.70–4.59 (m, 1H), 4.34 (d, *J* = 6.2 Hz, 2H), 3.55–3.45 (m, 1H), 2.32 (s, 3H), 1.40 (d, *J* = 6.8 Hz, 6H), 1.23 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.22, 163.15, 162.88, 148.88, 138.65, 138.07, 132.15, 124.74, 90.54, 49.85, 46.69, 37.77, 21.03, 20.96, 20.15. HRMS Calcd for $C_{17}H_{23}IN_2O_4$ [M+H]: 447.0781; Found: 447.0783.



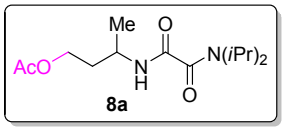
6h

Yield: 73% (73.2 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.16–7.09 (m, 3H), 6.94 (d, J = 8.2 Hz, 1H), 4.73–4.63 (m, 1H), 4.35 (d, J = 6.0 Hz, 2H), 3.54–3.44 (m, 1H), 2.31 (s, 6H), 1.40 (d, J = 6.8 Hz, 6H), 1.22 (d, J = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.88, 163.08, 163.00, 146.78, 136.35, 130.60, 129.74, 129.05, 122.36, 49.75, 46.62, 38.37, 21.03, 20.96, 20.93, 20.13. HRMS Calcd for $C_{18}H_{26}N_2O_4$ [M+H]: 335.1971; Found: 335.1978.



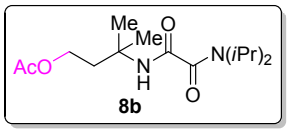
6i

Yield: 54% (61.6 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 6.95–6.88 (m, 2H), 6.83 (br, 1H), 4.52–4.42 (m, 1H), 4.34 (d, J = 6.1 Hz, 2H), 3.79 (s, 3H), 3.49–3.40 (m, 1H), 2.32 (d, J = 9.4 Hz, 6H), 1.37 (d, J = 6.8 Hz, 6H), 1.18 (d, J = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.11, 168.97, 163.23, 162.99, 149.51, 142.63, 139.16, 124.19, 120.28, 111.87, 56.29, 49.73, 46.41, 32.64, 20.96, 20.82, 20.61, 20.08. HRMS Calcd for $C_{20}H_{28}N_2O_7$ [M+H]: 409.1975; Found: 409.1986.



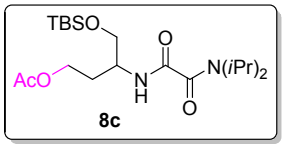
8a

Yield: 68% (58.4 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.02 (d, J = 8.5 Hz, 1H), 4.80–4.70 (m, 1H), 4.13–4.10 (m, 3H), 3.53–3.45 (m, 1H), 2.05 (s, 3H), 1.85–1.80 (m, 2H), 1.40 (d, J = 6.8 Hz, 6H), 1.22 (d, J = 6.7 Hz, 9H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.19, 163.06, 162.63, 61.52, 49.73, 46.70, 42.97, 35.21, 21.08, 20.99, 20.94(-CH_3, -CH_3), 20.57, 20.20, 20.15(-CH_3, -CH_3). HRMS Calcd for $C_{14}H_{26}N_2O_4$ [M+H]: 287.1971; Found: 287.1980.



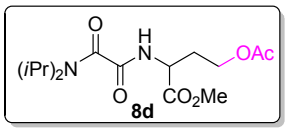
8b

Yield: 76% (68.4 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 6.99 (br, 1H), 4.78–4.68 (m, 1H), 4.14 (t, J = 6.7 Hz, 2H), 3.52–3.44 (m, 1H), 2.10 (t, J = 6.7 Hz, 2H), 2.04 (s, 3H), 1.40 (d, J = 7.0 Hz, 12H), 1.23 (d, J = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.18, 163.41, 162.75, 61.24, 53.18, 49.77, 46.70, 38.11, 26.96, 21.11, 20.99, 20.17. HRMS Calcd for $C_{15}H_{28}N_2O_4$ [M+H]: 301.2127; Found: 301.2131.



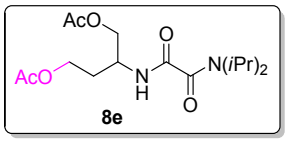
8c

Yield: 66% (79.6 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.02 (d, *J* = 9.1 Hz, 1H), 4.76–4.66 (m, 1H), 4.17–4.10 (m, 2H), 4.09–4.03 (m, 1H), 3.65 (t, *J* = 3.9 Hz, 2H), 3.55–3.45 (m, 1H), 2.04 (s, 3H), 2.00-1.92 (m, 1H), 1.89–1.82 (m, 1H), 1.42–1.39 (m, 6H), 1.23–1.20 (m, 6H), 0.88 (s, 9H), 0.05 (s, 6H).^{13}C NMR (101 MHz, $CDCl_3$) δ 171.16, 162.95, 162.88, 64.39, 61.56, 49.68, 48.14, 46.65, 30.39, 25.97, 21.07, 20.98, 20.18, 20.13(-CH_3, -CH_3), 18.38, -5.37. HRMS Calcd for $C_{20}H_{40}N_2O_5Si$ [M+H]: 403.2628; Found: 403.2637.



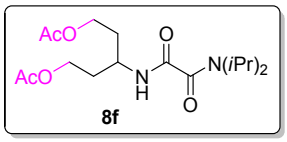
8d

Yield: 78% (77.2 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 (d, *J* = 7.8 Hz, 1H), 4.66–4.58 (m, 2H), 4.17–4.08 (m, 2H), 3.74 (s, 3H), 3.53–3.43 (m, 1H), 2.26–2.20 (m, 1H), 2.13–2.08 (m, 1H), 2.02 (s, 3H), 1.39 (d, *J* = 6.8 Hz, 6H), 1.21–1.18 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.54, 170.87, 163.17, 162.45, 60.46, 52.68, 49.80, 46.63, 30.69, 20.89, 20.87, 20.10, 20.04. HRMS Calcd for $C_{15}H_{26}N_2O_6$ [M+H]: 331.1869; Found: 331.1860.



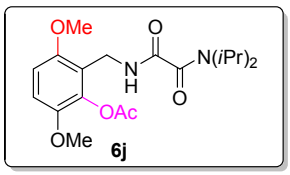
8e

Yield: 71% (73.3 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.30–7.28 (m, 1H), 4.70–4.60 (m, 1H), 4.32–4.24 (m, 1H), 4.14–4.10 (m, 4H), 3.55–3.44 (m, 1H), 2.04 (d, *J* = 6.3 Hz, 6H), 1.92–1.86 (m, 2H), 1.39 (d, *J* = 6.8 Hz, 6H), 1.20 (m, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.05, 170.85, 163.10, 162.89, 65.51, 60.97, 49.85, 46.64, 45.78, 30.28, 20.99, 20.89, 20.85, 20.14, 20.12(-CH_3, -CH_3). HRMS Calcd for $C_{16}H_{28}N_2O_6$ [M+H]: 345.2016; Found: 345.2011.



8f

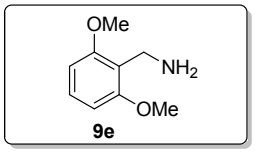
Yield: 84% (90.2 mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.05 (d, *J* = 9.1 Hz, 1H), 4.84–4.71 (m, 1H), 4.17–4.09 (m, 5H), 3.54–3.47 (m, 1H), 2.06 (s, 6H), 1.96–1.90 (m, 2H), 1.86–1.79 (m, 2H), 1.41 (d, *J* = 6.8 Hz, 6H), 1.22 (d, *J* = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.13, 162.92, 162.69, 61.30, 49.73, 46.79, 44.54, 33.64, 21.08, 20.99, 20.18. HRMS Calcd for $C_{17}H_{30}N_2O_6$ [M+H]: 359.2182; Found: 359.2183.



6j

Yield: 68% (77.6 mg). ^{1}H NMR (400 MHz, $CDCl_3$) δ 6.96 (d, *J* = 6.1 Hz, 1H), 6.84 (d, *J* = 9.0 Hz, 1H), 6.69 (d, *J* = 9.0 Hz, 1H), 4.59–4.53 (m, 1H), 4.45 (d, *J* = 5.9 Hz, 2H), 3.79 (s, 3H), 3.75 (s, 3H), 3.48-

3.41 (m, 1H), 2.34 (s, 3H), 1.37 (d, J = 6.8 Hz, 6H), 1.17 (d, J = 6.7 Hz, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.23, 163.39, 162.82, 152.29, 145.77, 139.15, 119.96, 111.87, 107.82, 56.54, 56.04, 49.69, 46.45, 32.41, 20.91, 20.70, 20.16. HRMS Calcd for $C_{19}H_{28}N_2O_6$ [M+Na]: 403.1845; Found: 403.1851.



9e

Yield: 88% (73.5mg).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.22 (t, J = 8.4 Hz, 1H), 6.56 (d, J = 8.4 Hz, 2H), 4.53 (d, J = 5.3 Hz, 2H), 3.84 (s, 6H), 1.94 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.62, 158.75, 129.18, 114.16, 103.96, 55.99, 32.68, 23.59.

10. References

[1] Mei, T.-S.; Wang, X.; Yu, J.-Q. *J. Am. Chem. Soc.* **2009**, *131*, 10806.

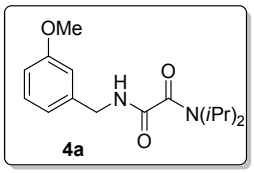
[2] C. Wang.; C. P. Chen.; J. Y. Zhang.; Y. M. Yao and Y. S. Zhao. *Angew. Chem. Int. Ed.* **2014**, *53*, 9884.

[3] Xu, G.; Gilbertson, S. R. *Org. Lett.* **2005**, *7*, 4605.

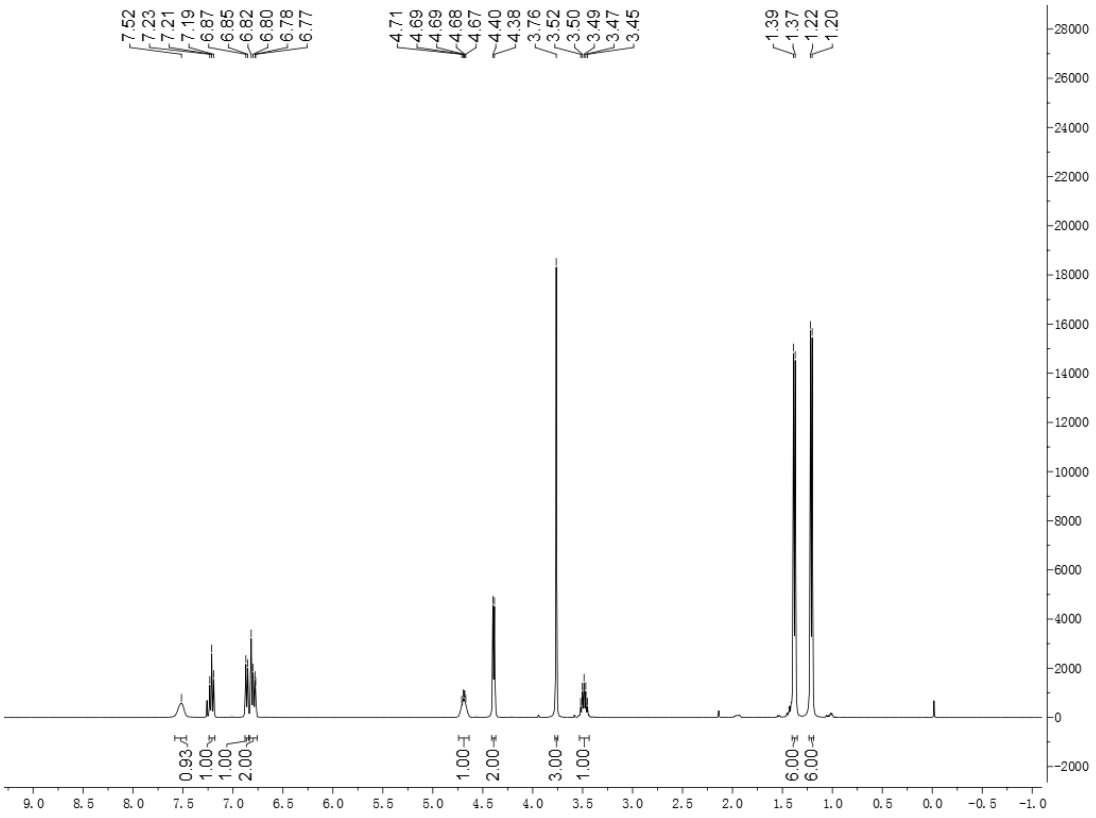
[4] S.-Y. Zhang, G. He, W. A. Nack, Y. Zhao, Q. Li, G. Chen, *J. Am. Chem. Soc.* **2013,***135*, 2124.

[5] S.-Y. Zhang, G. He, Y. Zhao, K.Wright, W. A. Nack, G. Chen, *J. Am. Chem. Soc.* **2012,** *134*, 7313.

NMR Spectra



4a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4.38
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3.47
3.45
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1.37
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2.00
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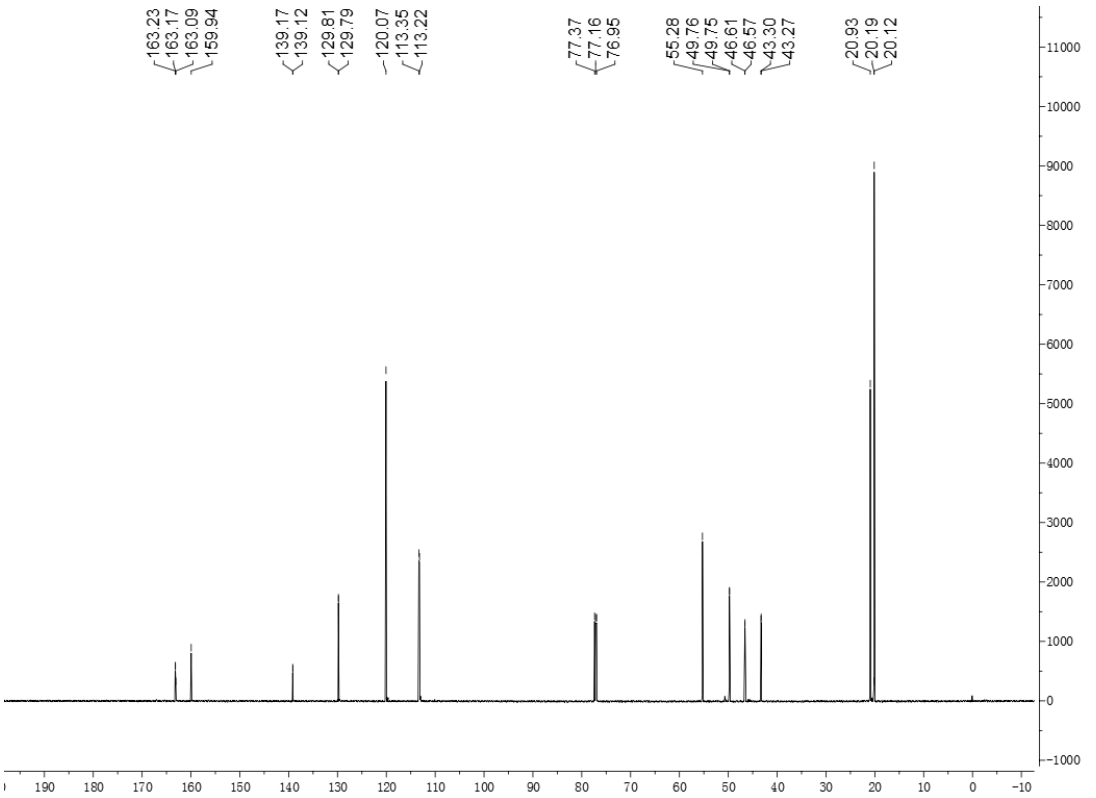
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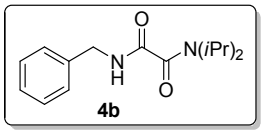
20.12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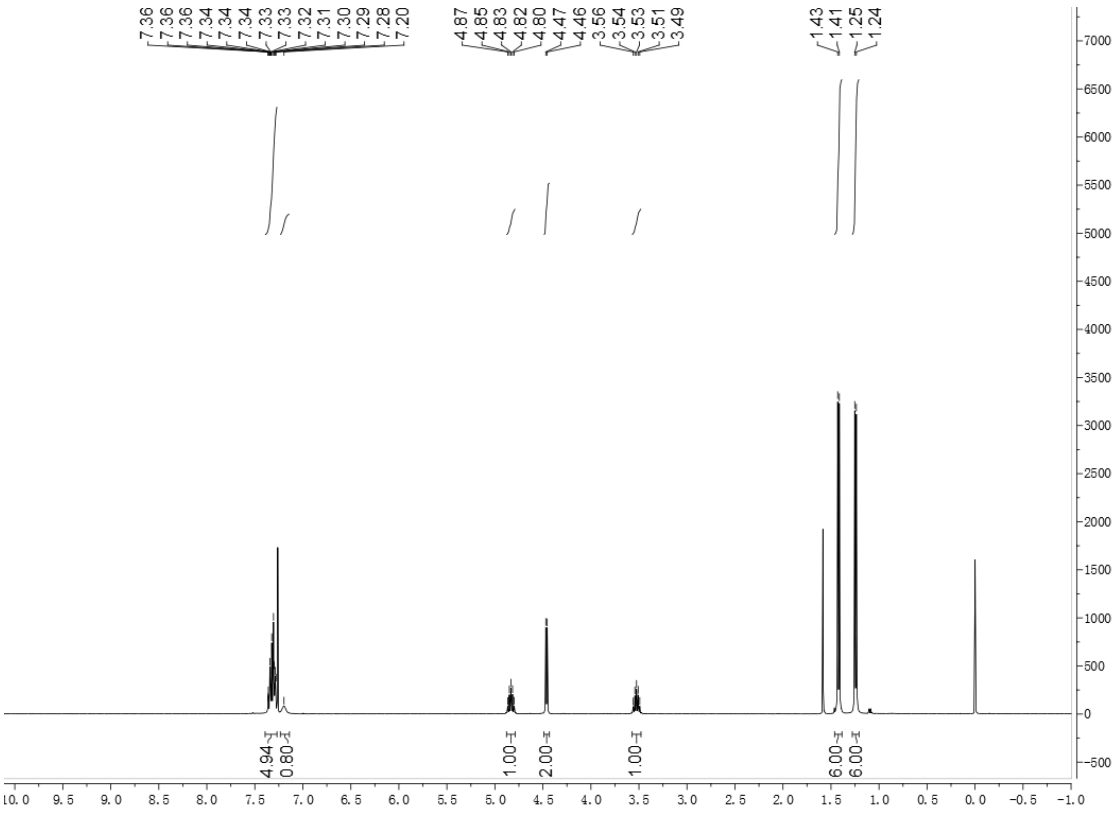
N(iPr)2
N
H
O

4b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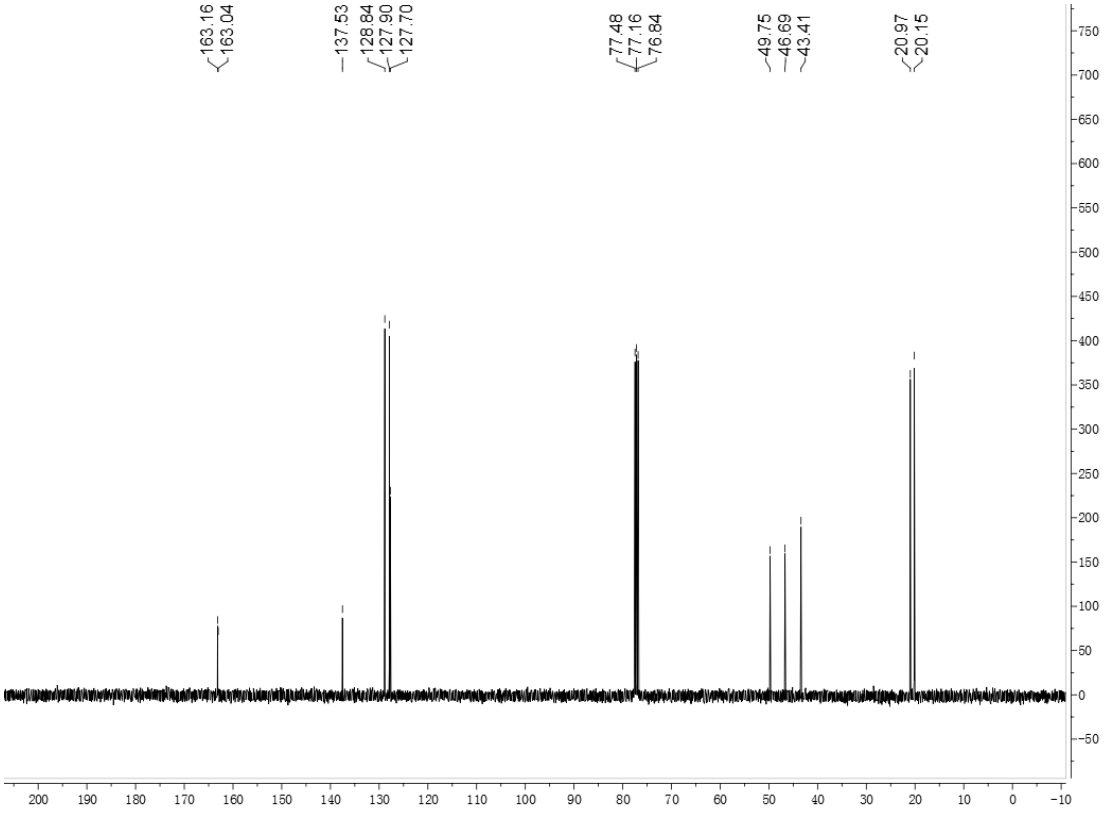
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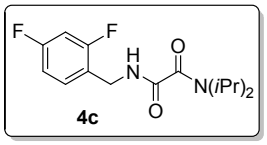
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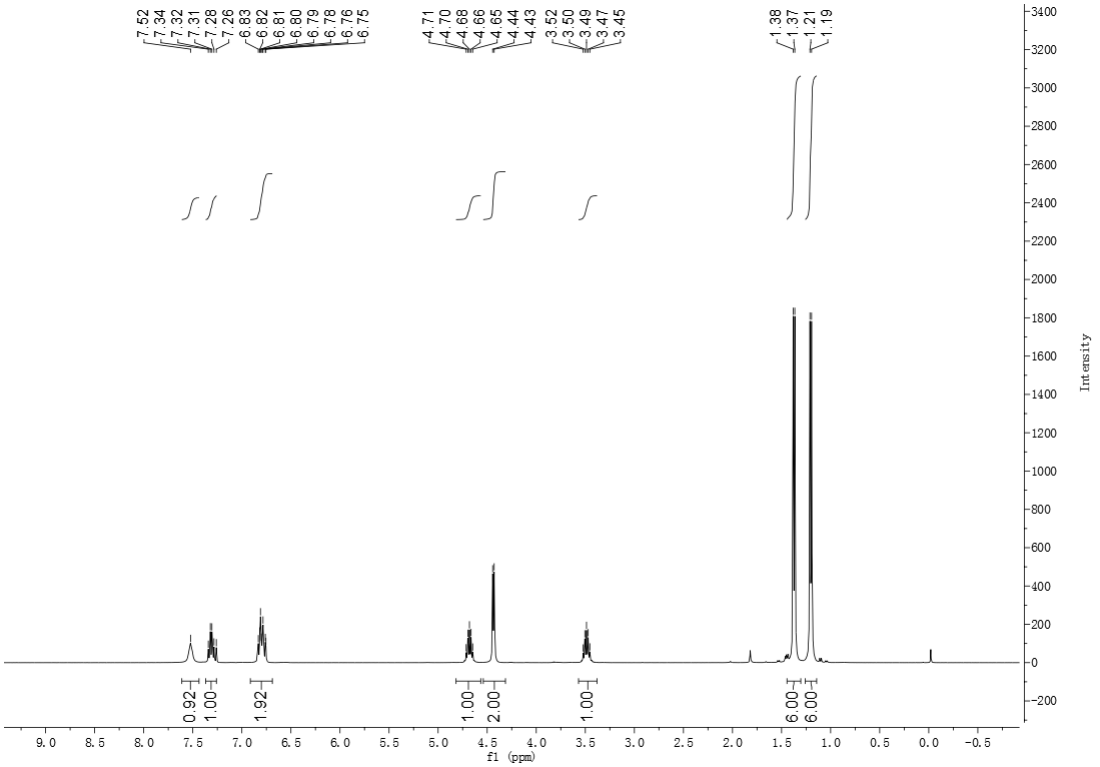
O
O
N(iPr)2
4c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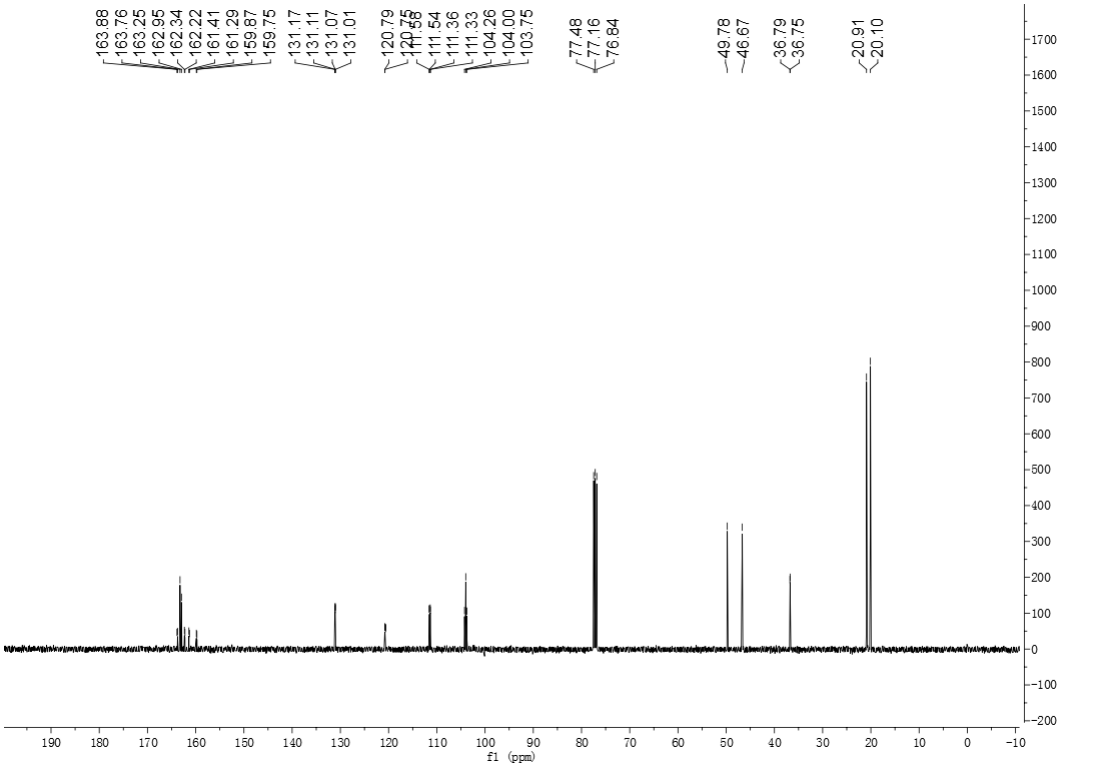
Intensity
f1 (ppm)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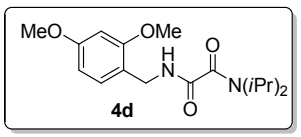
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O
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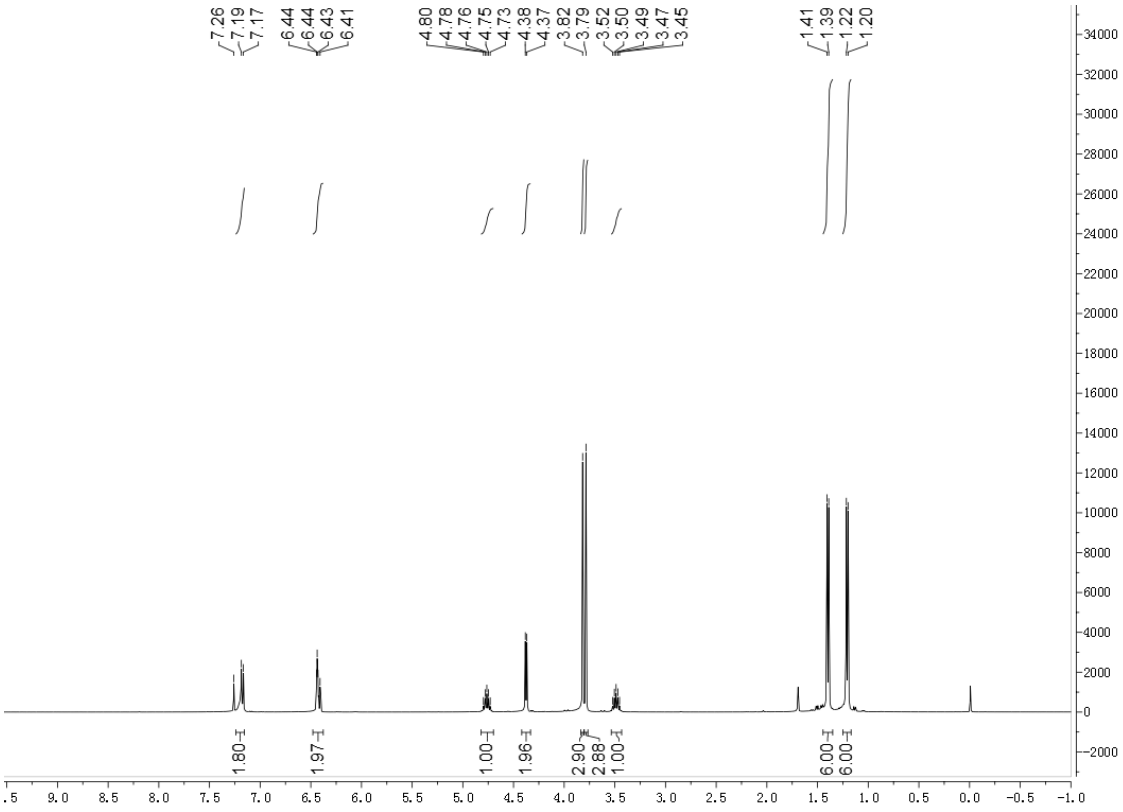
O

4d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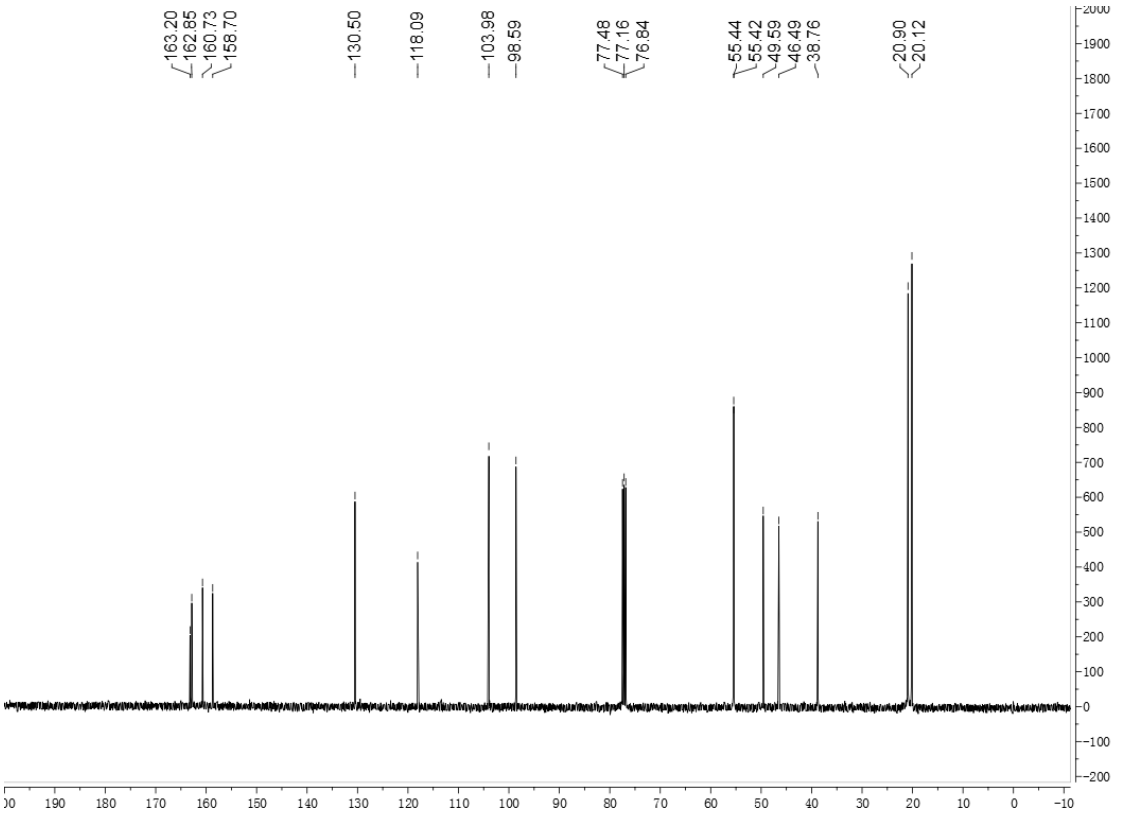
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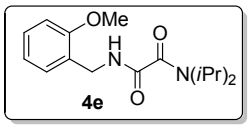
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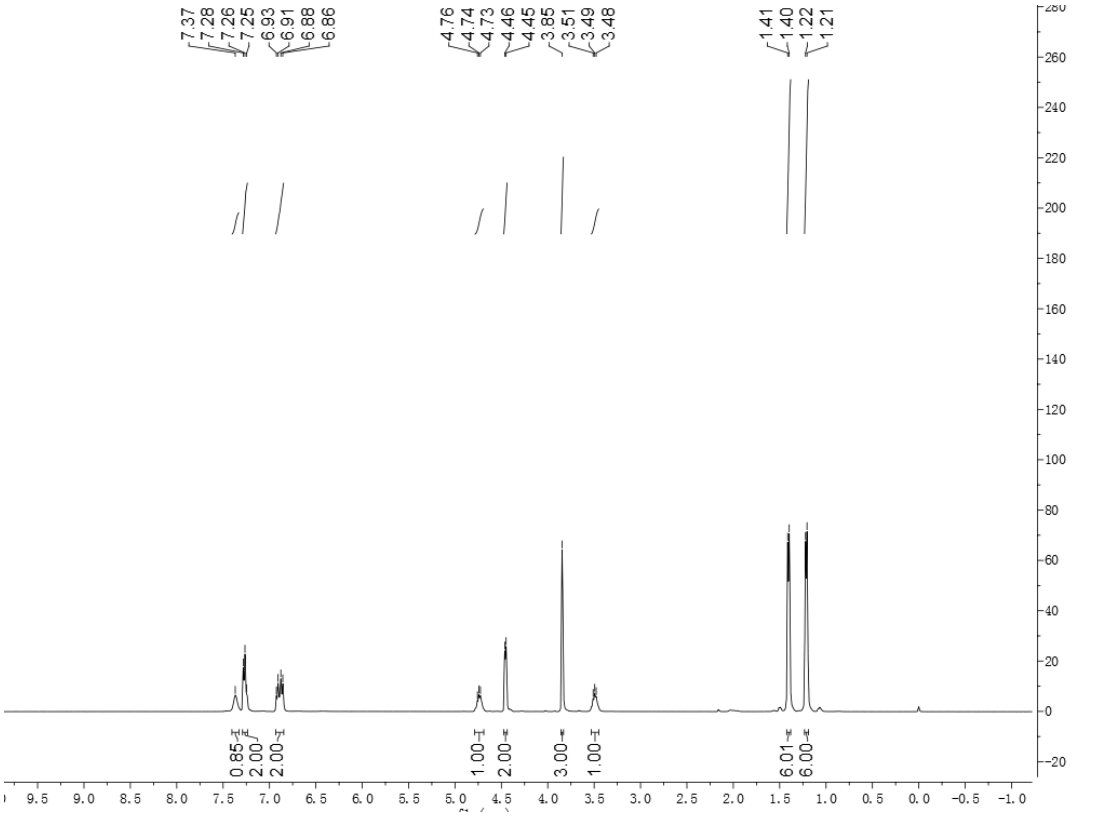
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3.85
3.51
3.49
3.48
1.41
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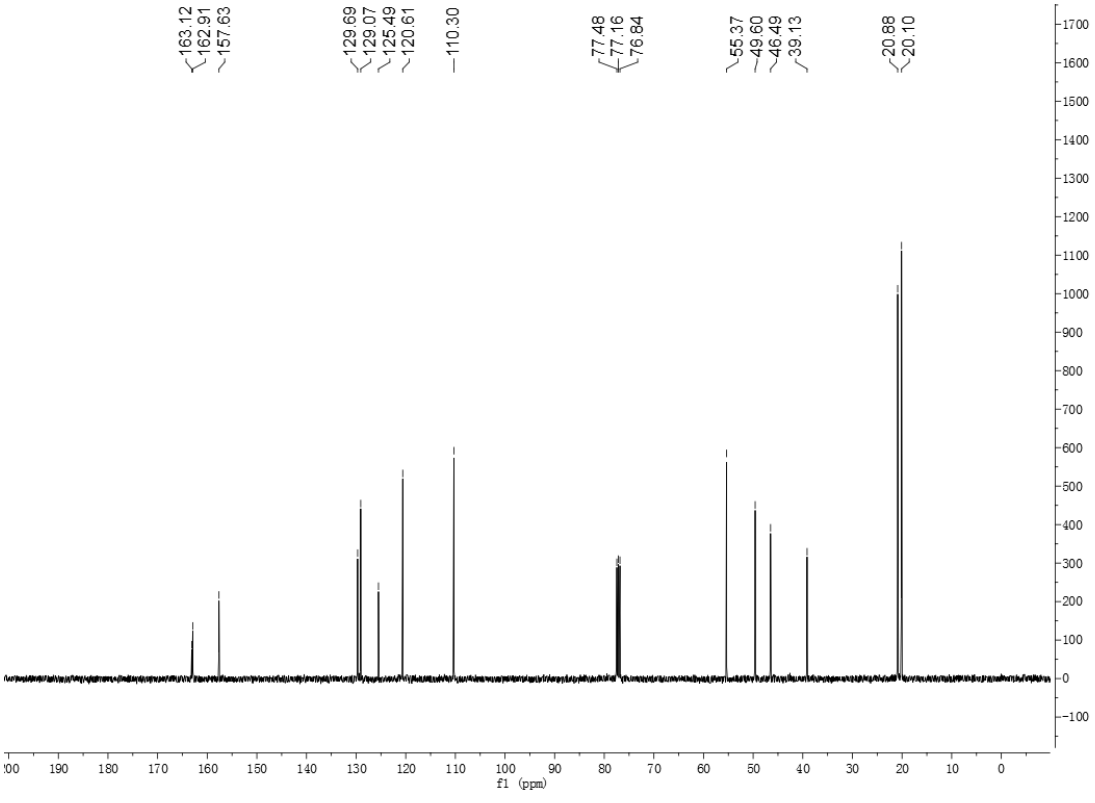
6.00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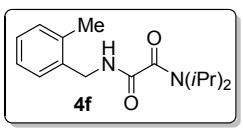
f1 (ppm)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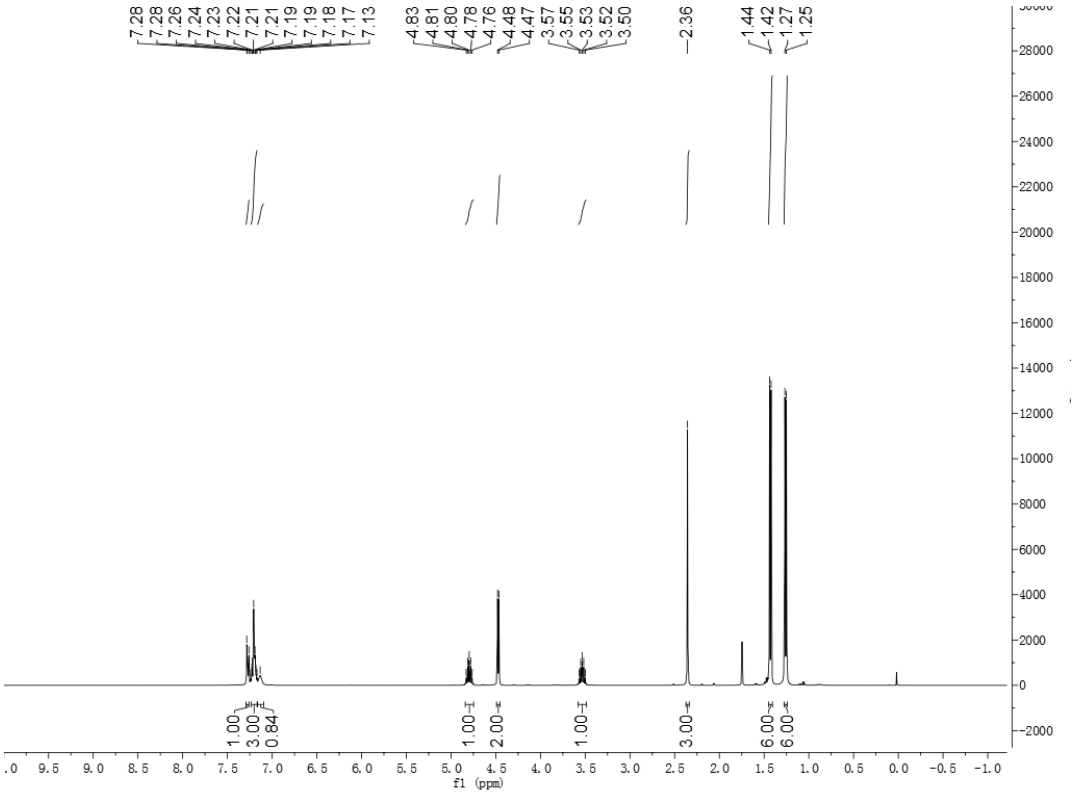
O
N(iPr)2
O

4f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4.47
3.57
3.55
3.53
3.52
3.50
2.36
1.44
1.42
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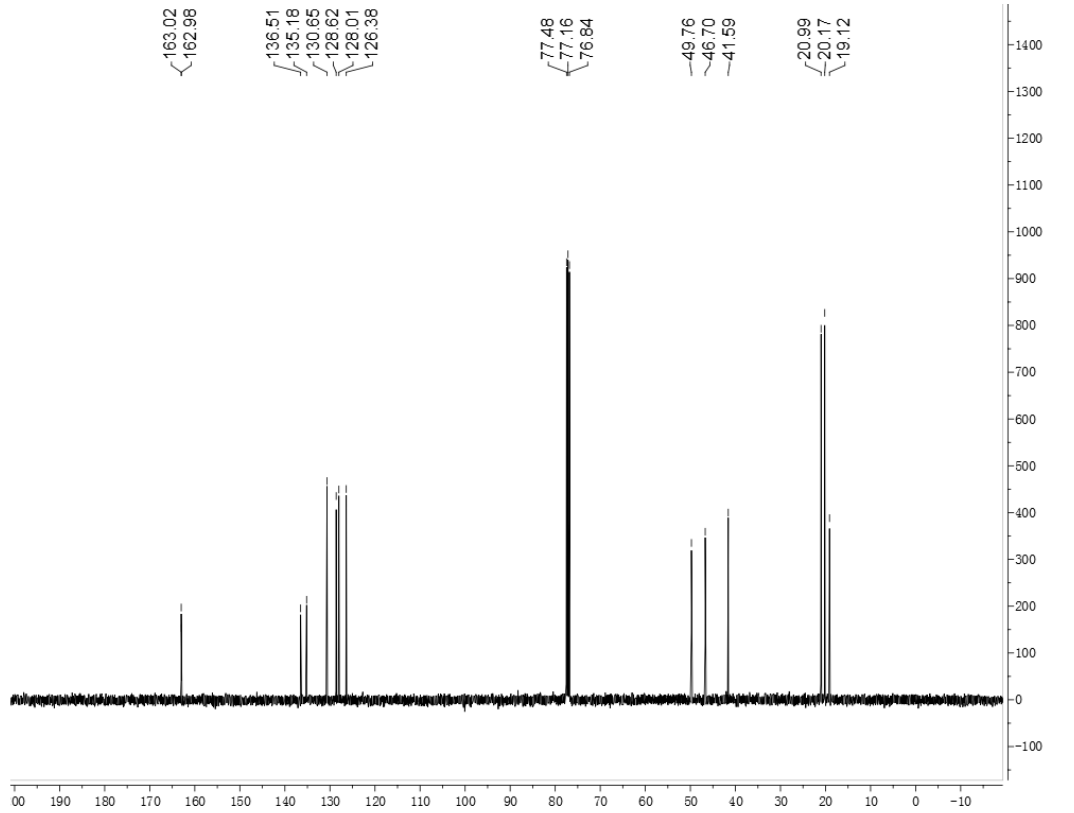
f1 (ppm)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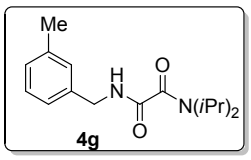
19.12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O
N(iPr)2
O
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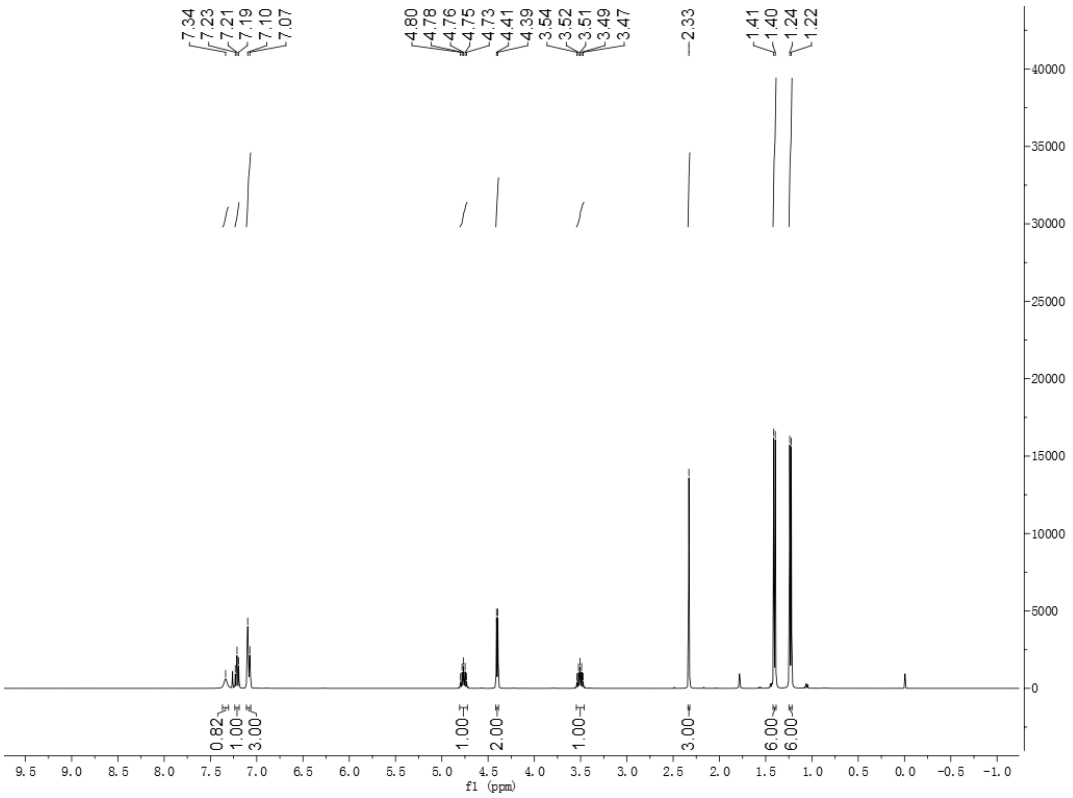
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4.39
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3.52
3.51
3.49
3.47
2.33
1.41
1.40
1.24
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1.00
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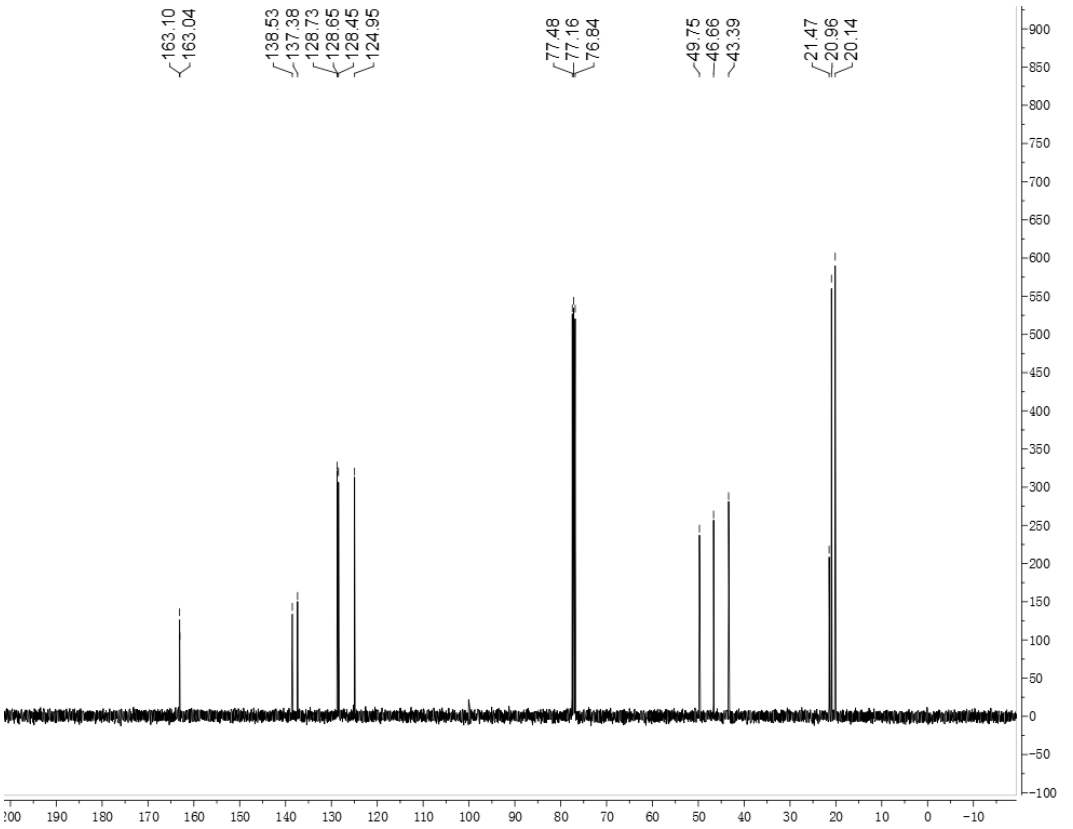
6.00
f1 (ppm)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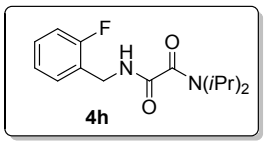
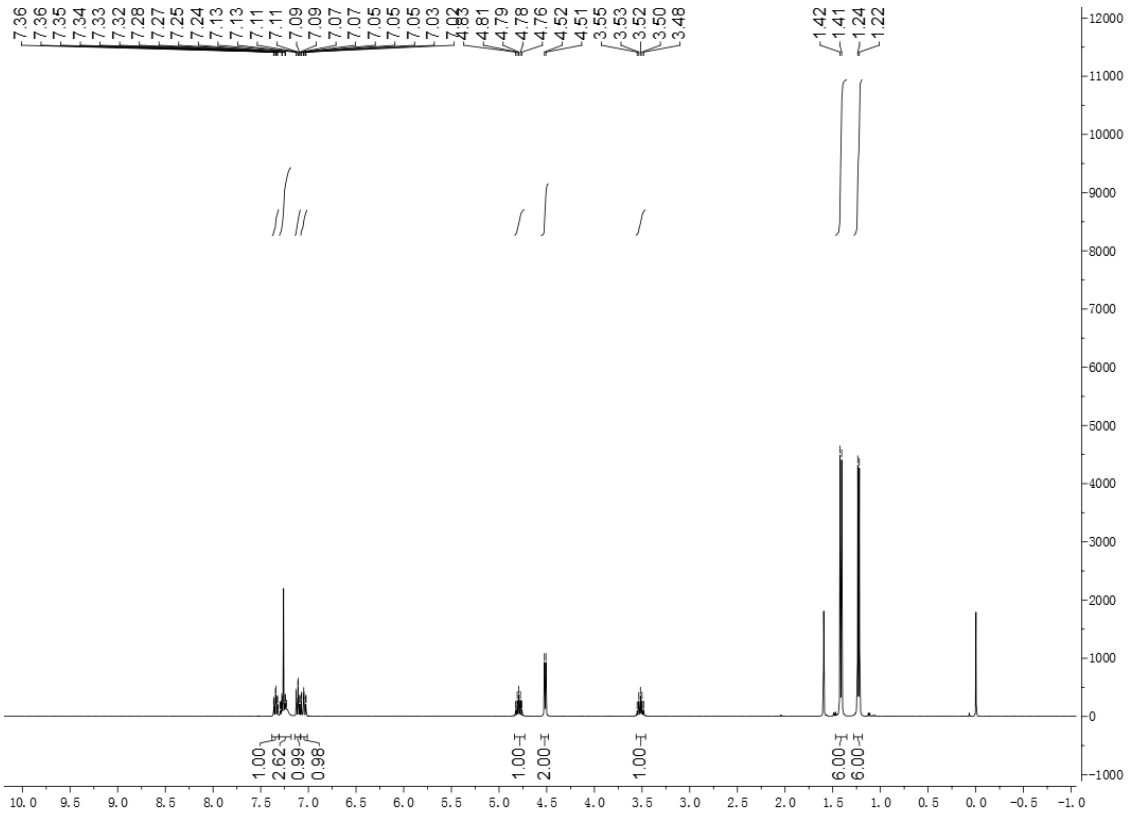
20.14


F
H
N
O
O
N(iPr)2
O

4h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7.07
7.07
7.05
7.05
7.05
7.03
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4.79
4.78
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4.51
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3.48
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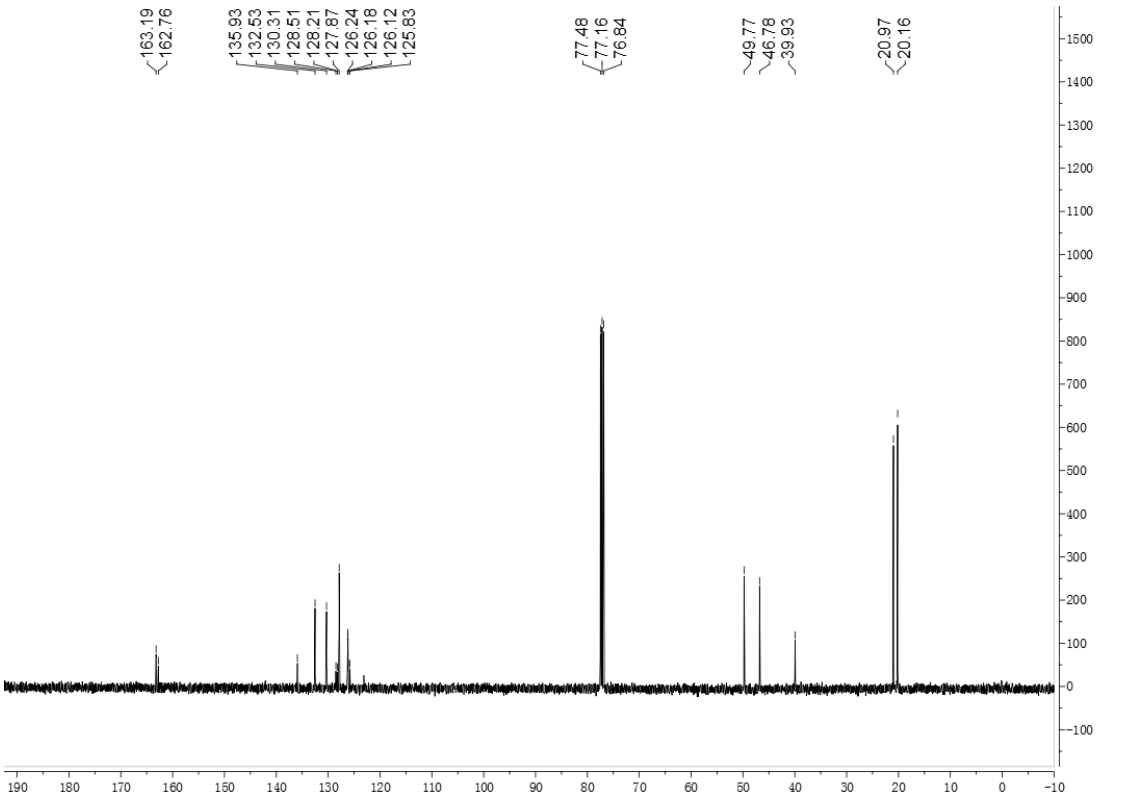
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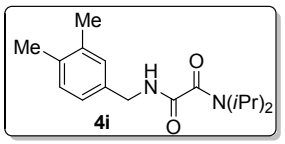
39.93
20.97
20.16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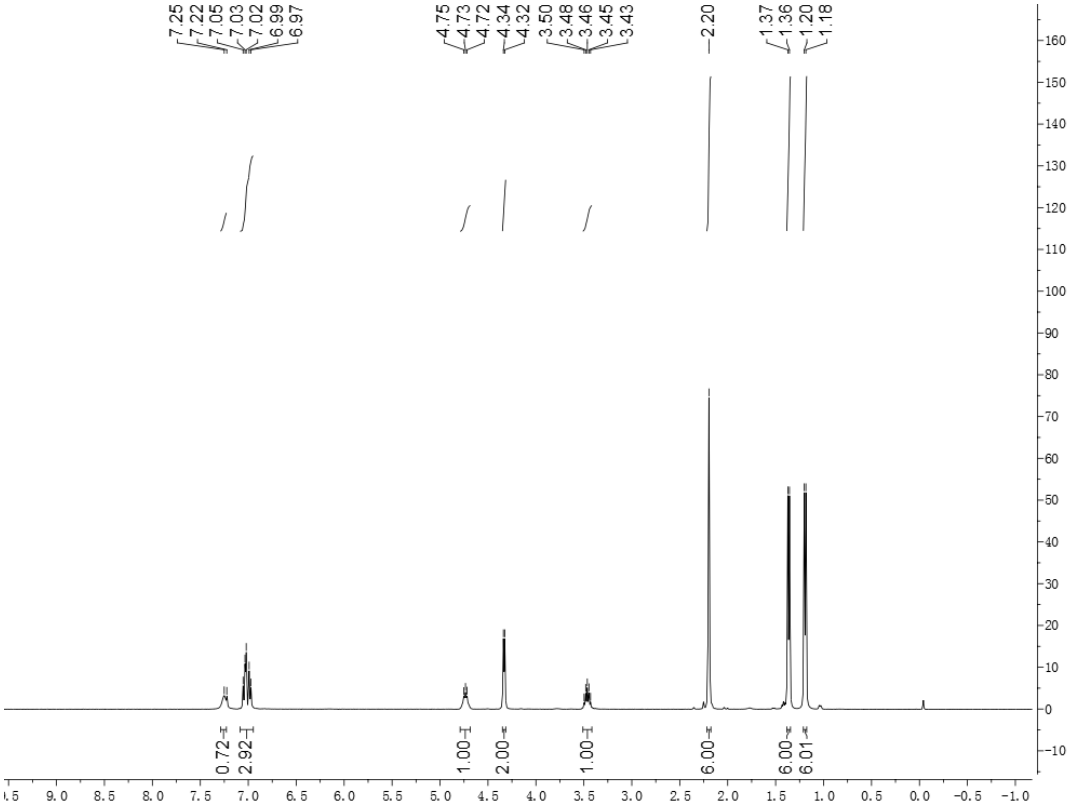
Me
H
N
O
O
N(iPr)2
4i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6.97
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4.34
4.32
3.50
3.48
3.46
3.45
3.43
2.20
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1.36
1.20
1.18
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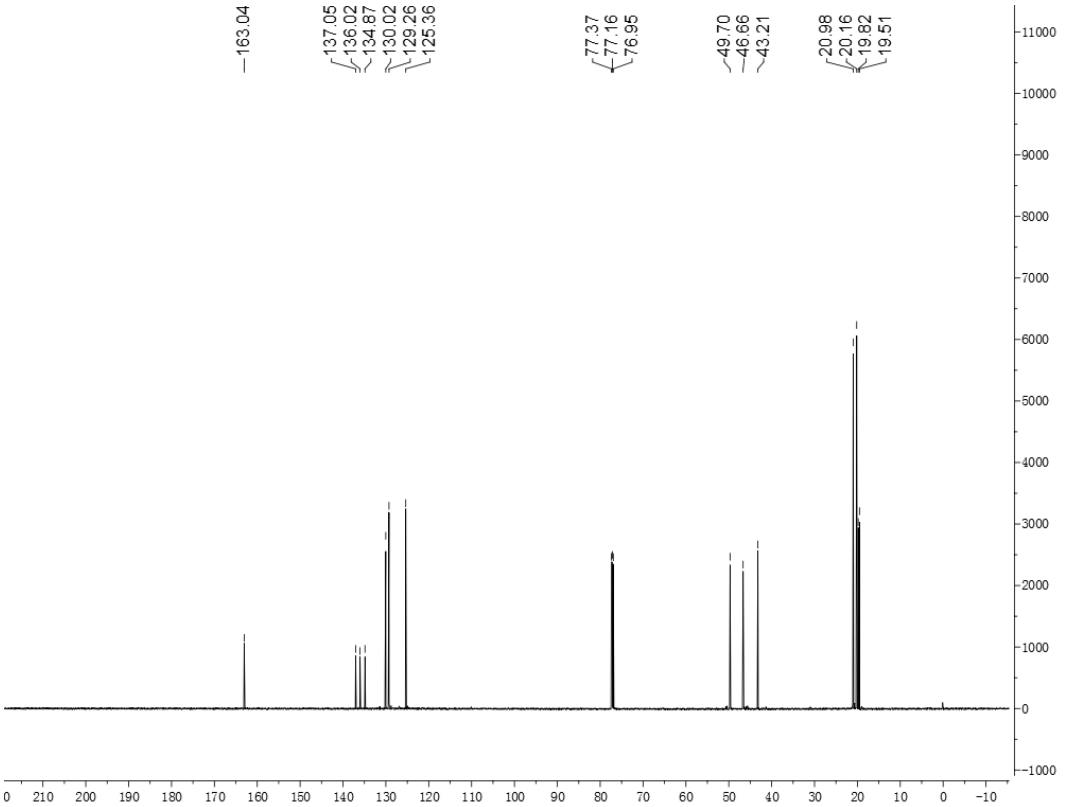
2.00
1.00
6.00
6.00
6.01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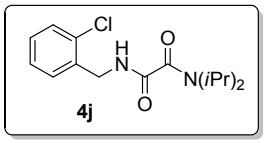
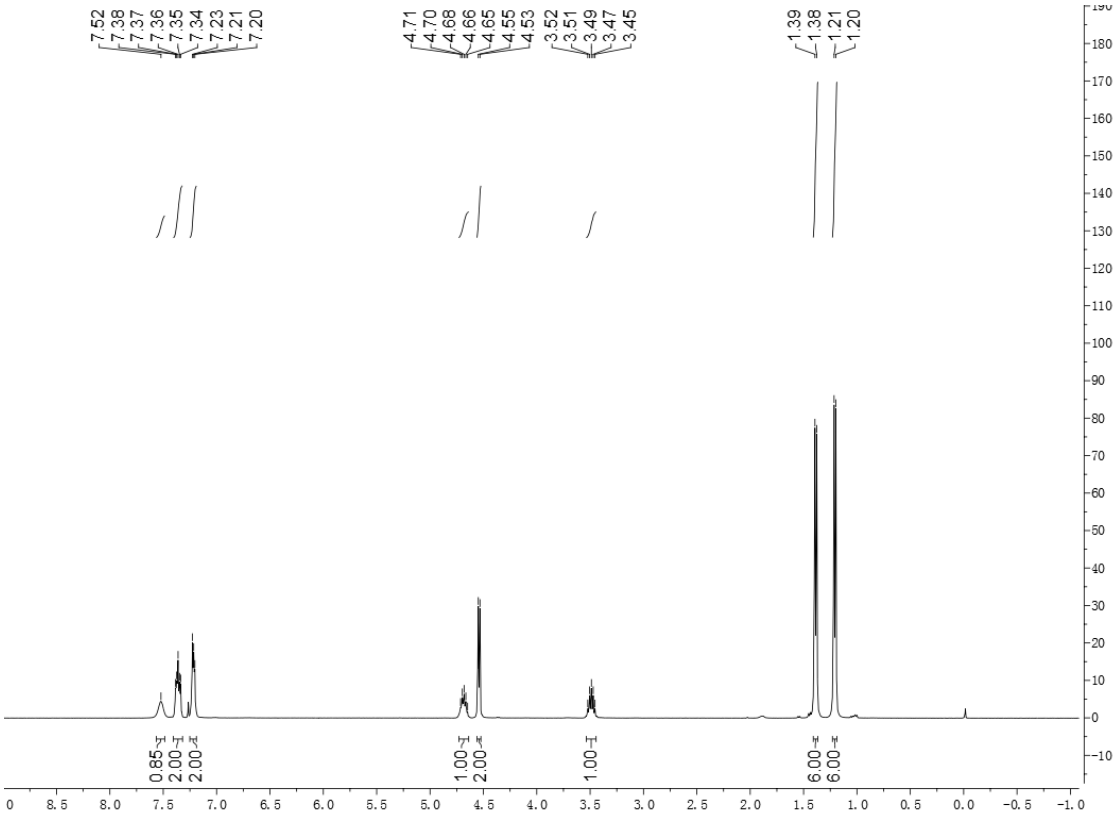
20.16
19.82
19.51


Cl
H
N
O
O
N(iPr)2
O

4j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4.65
4.55
4.53
3.52
3.51
3.49
3.47
3.45
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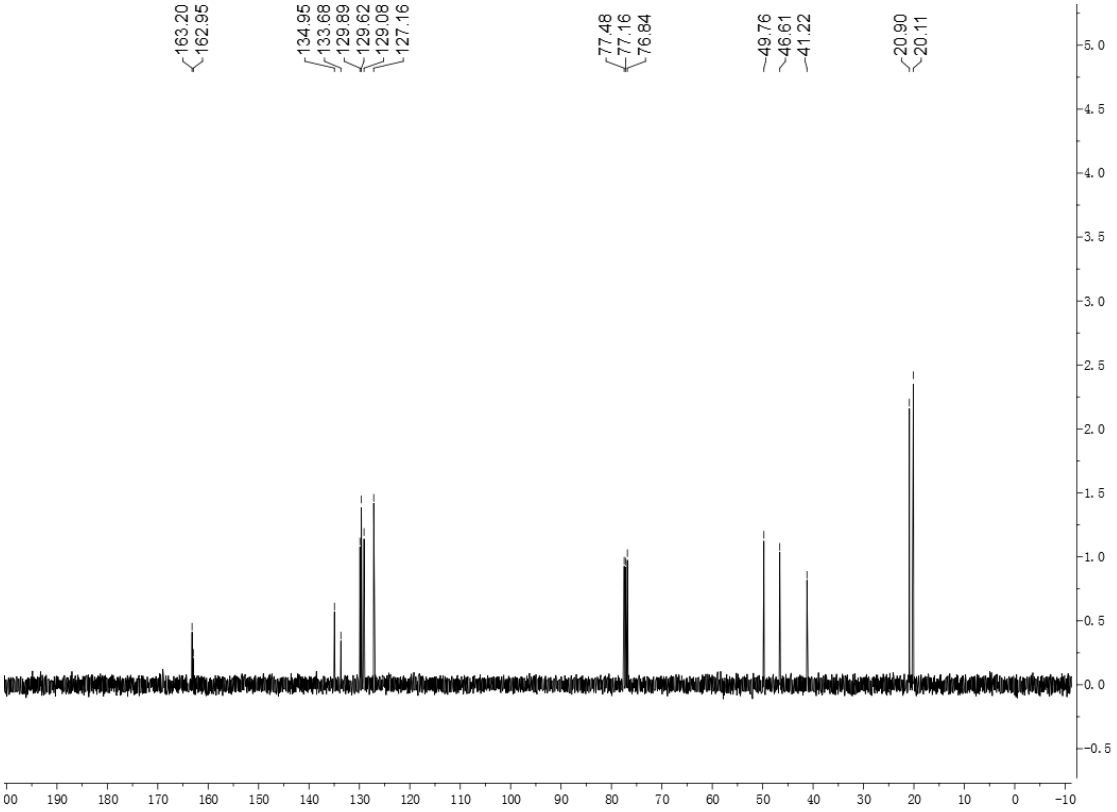
2.00
1.00
2.00
1.00
6.00
6.00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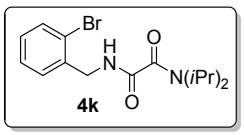
20.11


Br
H
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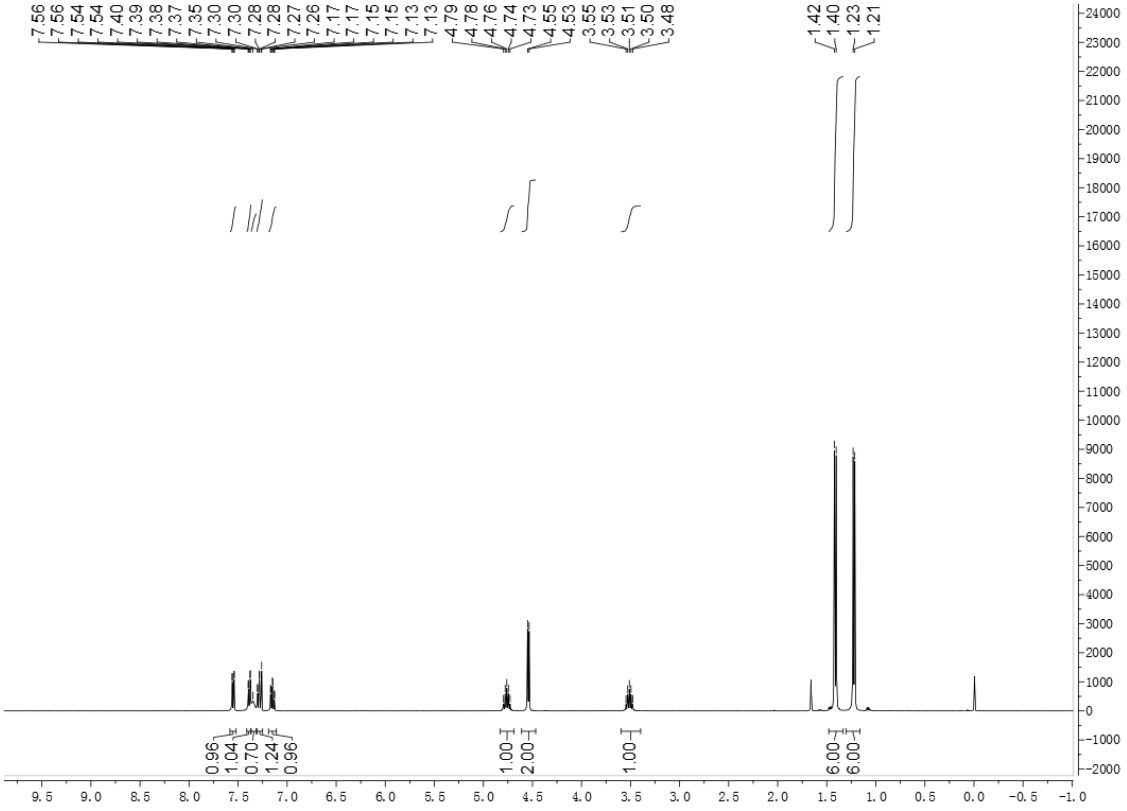
O
O
N(iPr)2
4k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7.26
7.17
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7.15
7.13
7.13
4.79
4.78
4.76
4.74
4.73
4.55
4.53
3.55
3.53
3.51
3.50
3.48
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1.40
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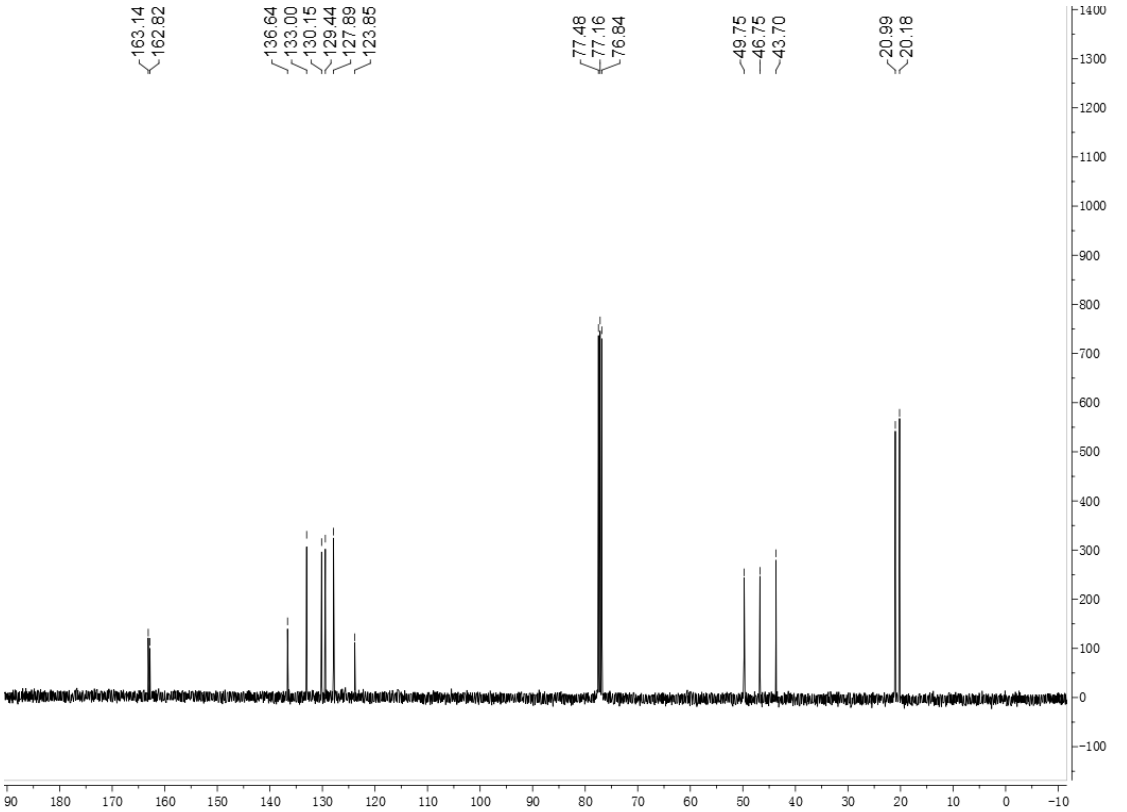
1.00
6.00
6.00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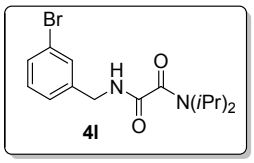
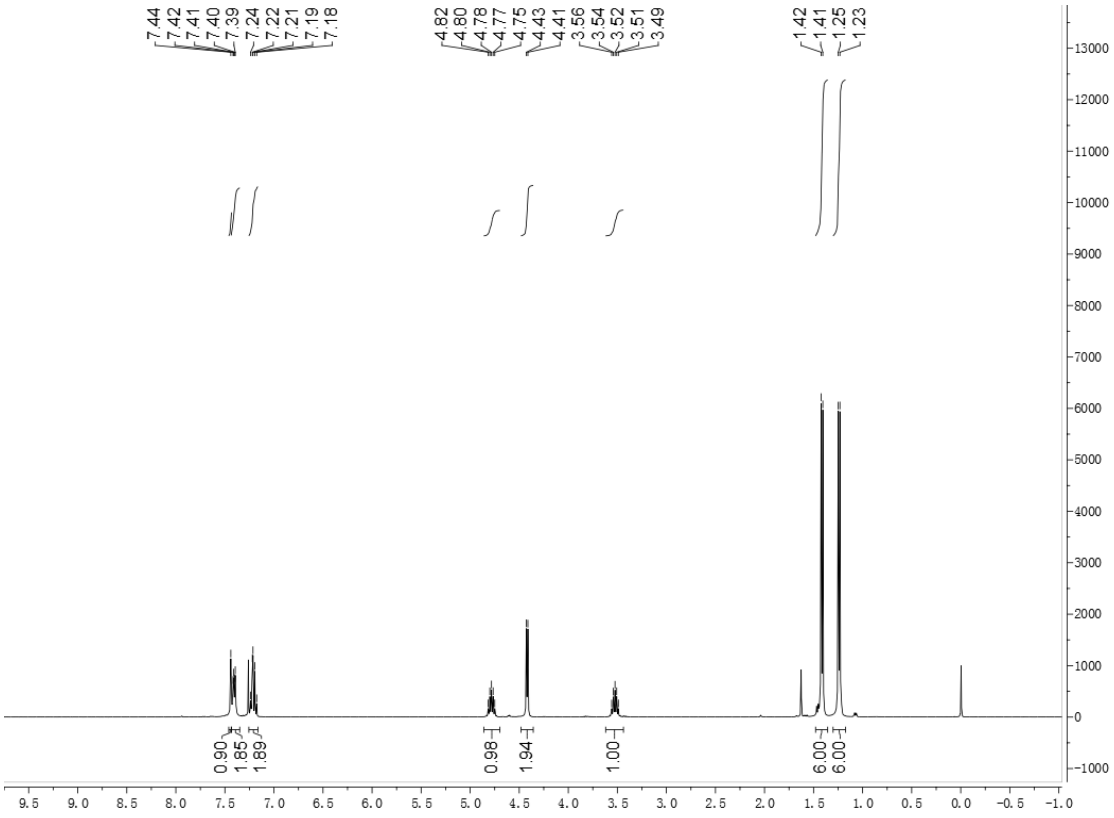
20.18


Br
H
N
O
O
N(iPr)2
O

4l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7.18
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4.75
4.43
4.41
3.56
3.54
3.52
3.51
3.49
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1.41
1.25
1.23
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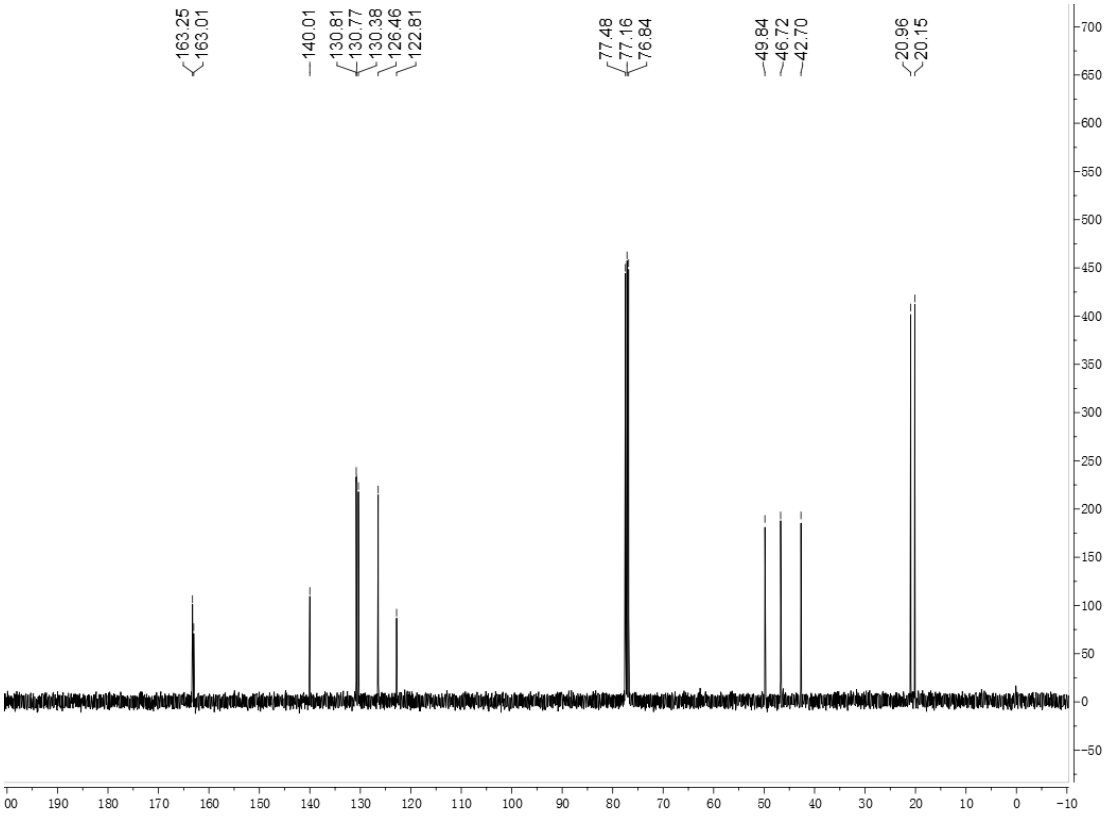
1.89
0.98
1.94
1.00
6.00
6.00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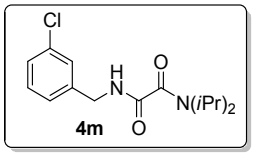
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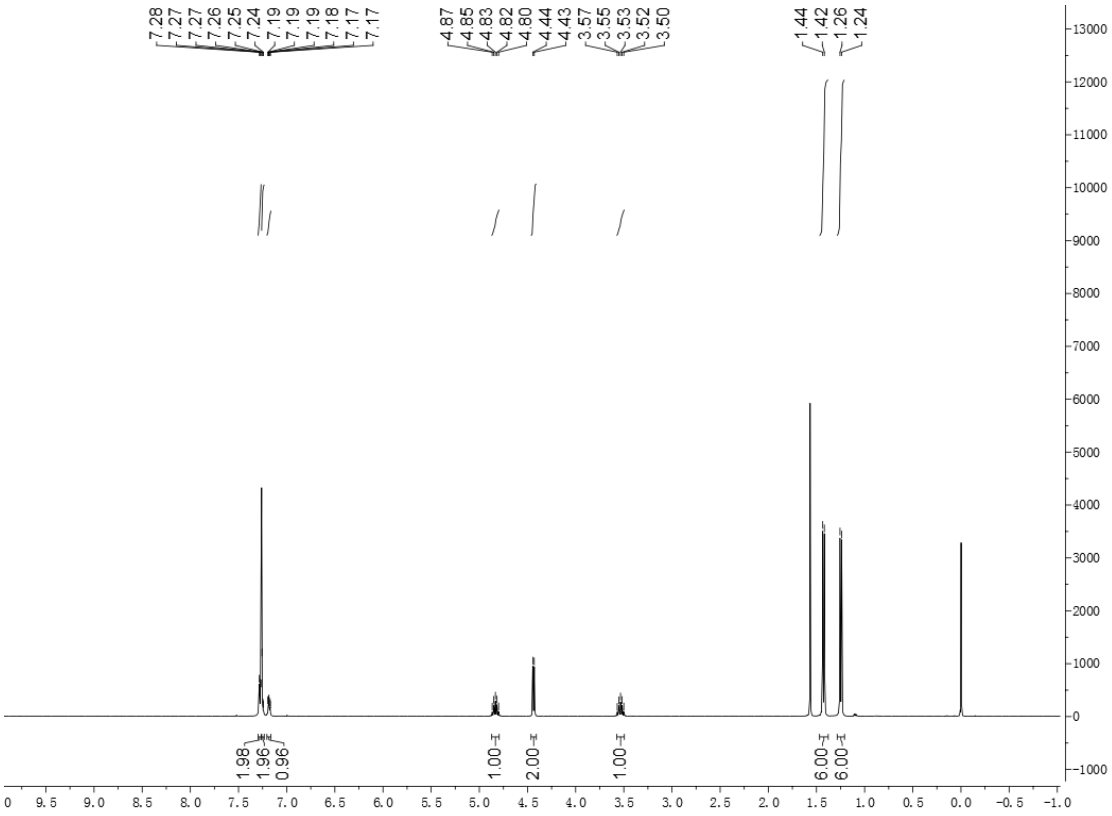
O
O
N(iPr)2
4m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4.43
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3.55
3.53
3.52
3.50
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1.24
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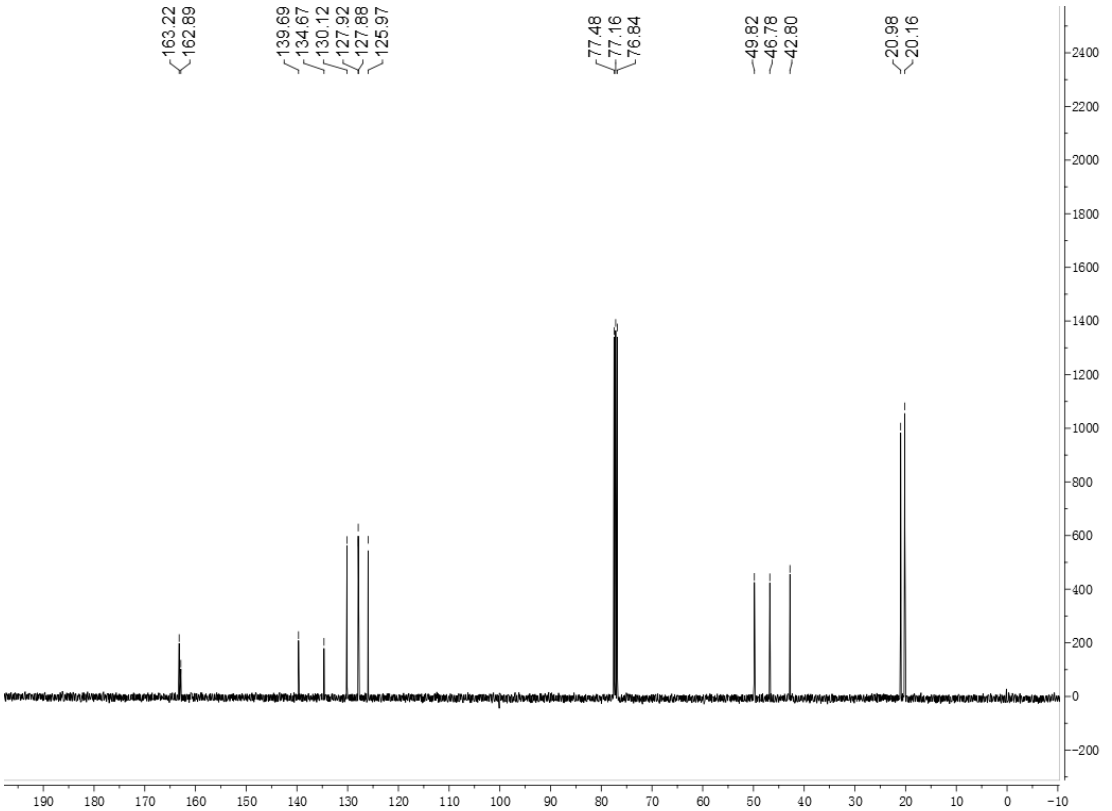
1.00
6.00
6.00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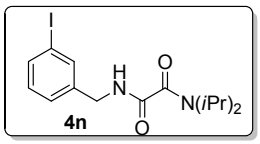
20.16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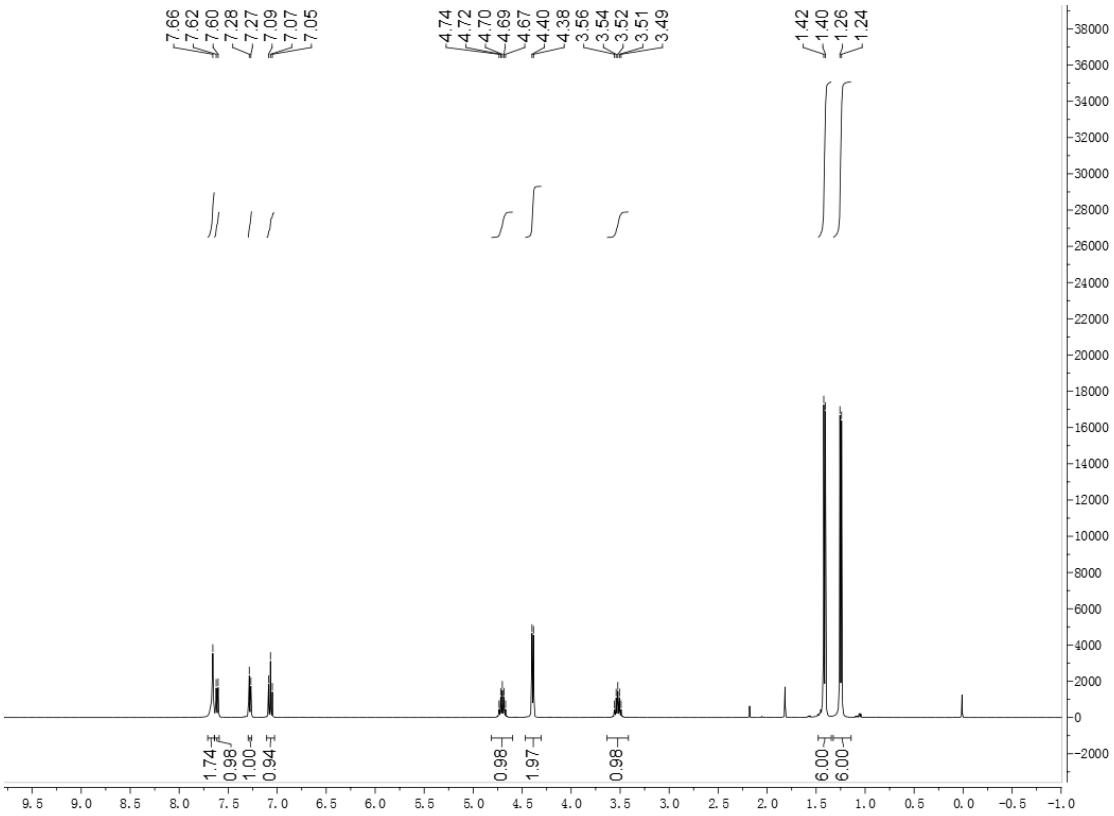
O
N(iPr)2
O
4n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3.54
3.52
3.51
3.49
1.42
1.40
1.26
1.24
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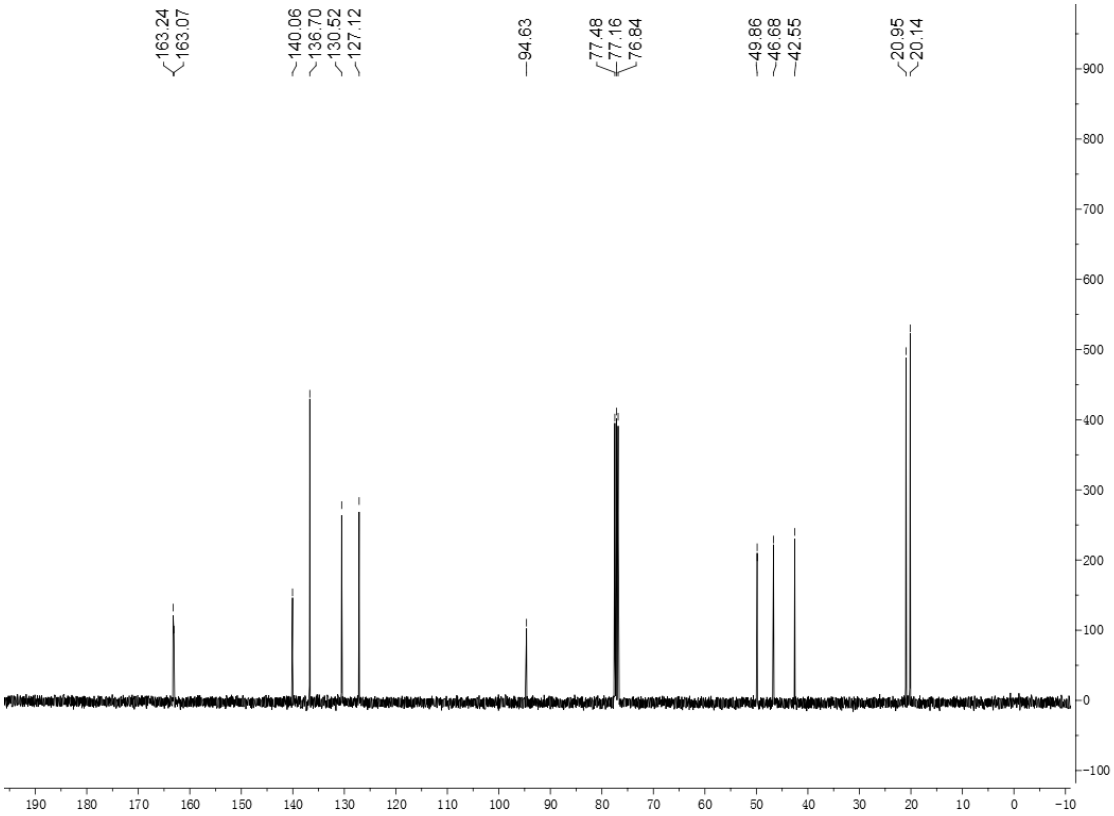
0.94
0.98
1.97
0.98
6.00
6.00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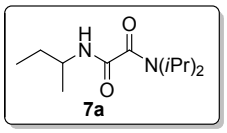
20.14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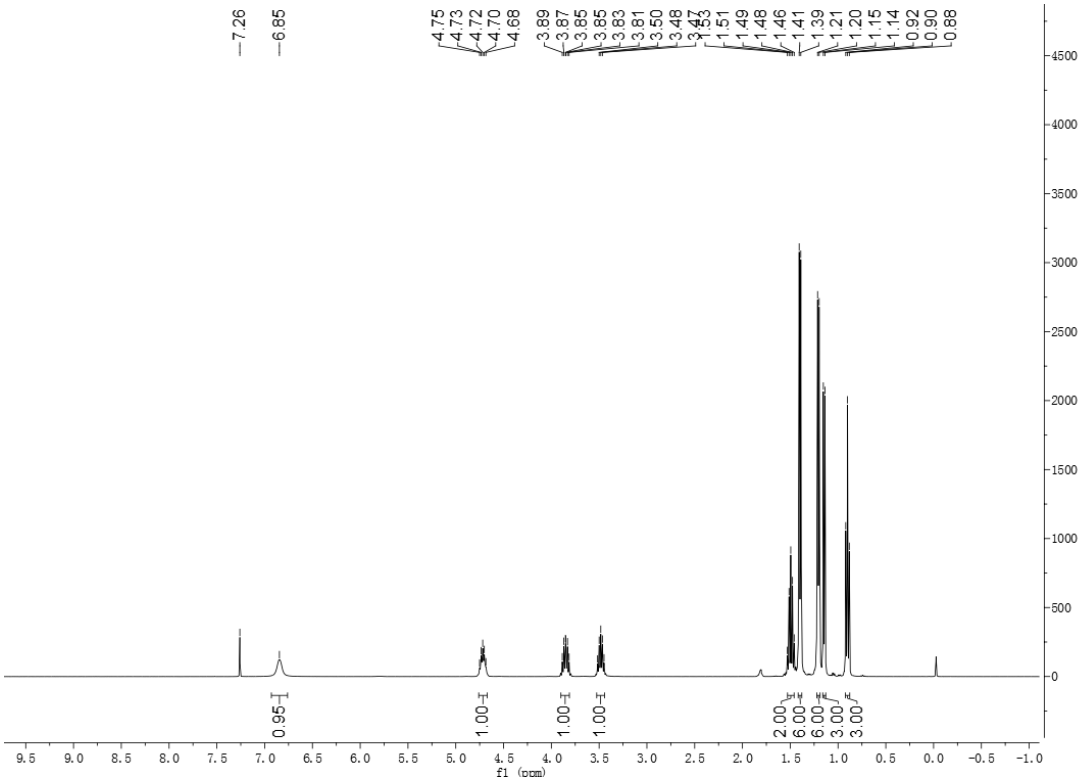
O
O
N(iPr)2
O

7a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3.85
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3.48
1.53
1.51
1.49
1.48
1.46
1.41
1.39
1.21
1.20
1.15
1.14
0.92
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1.00
1.00
2.00
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6.00
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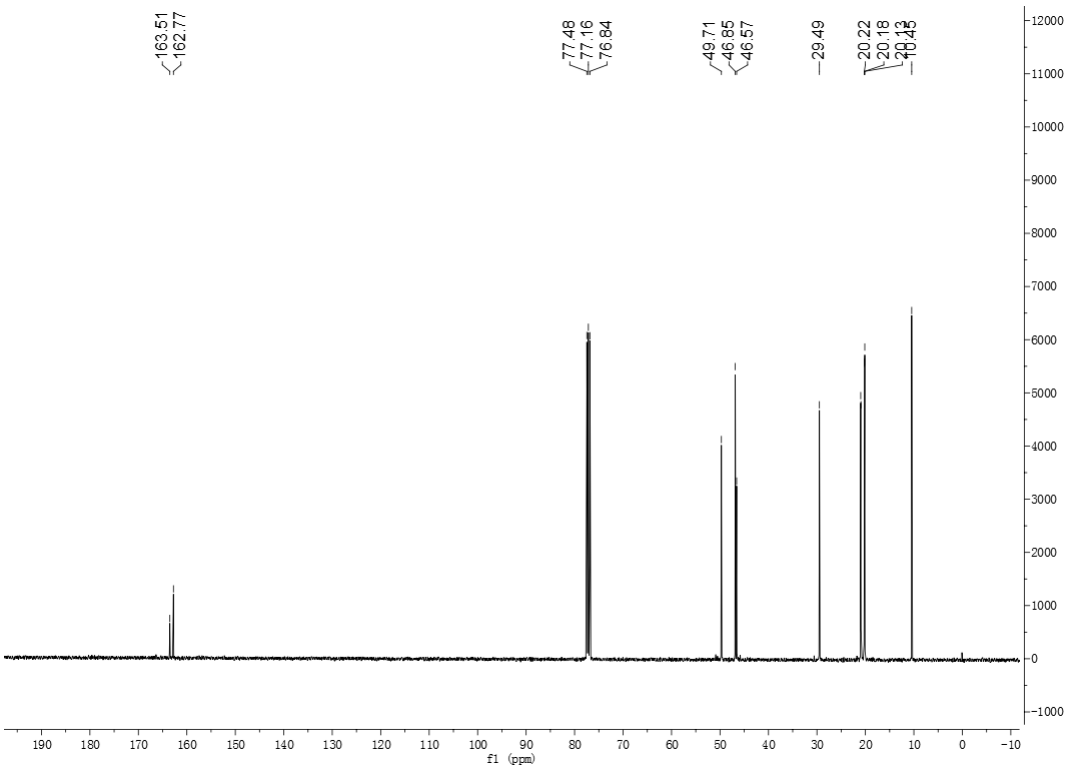
3.00
f1 (ppm)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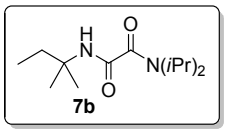
f1 (ppm)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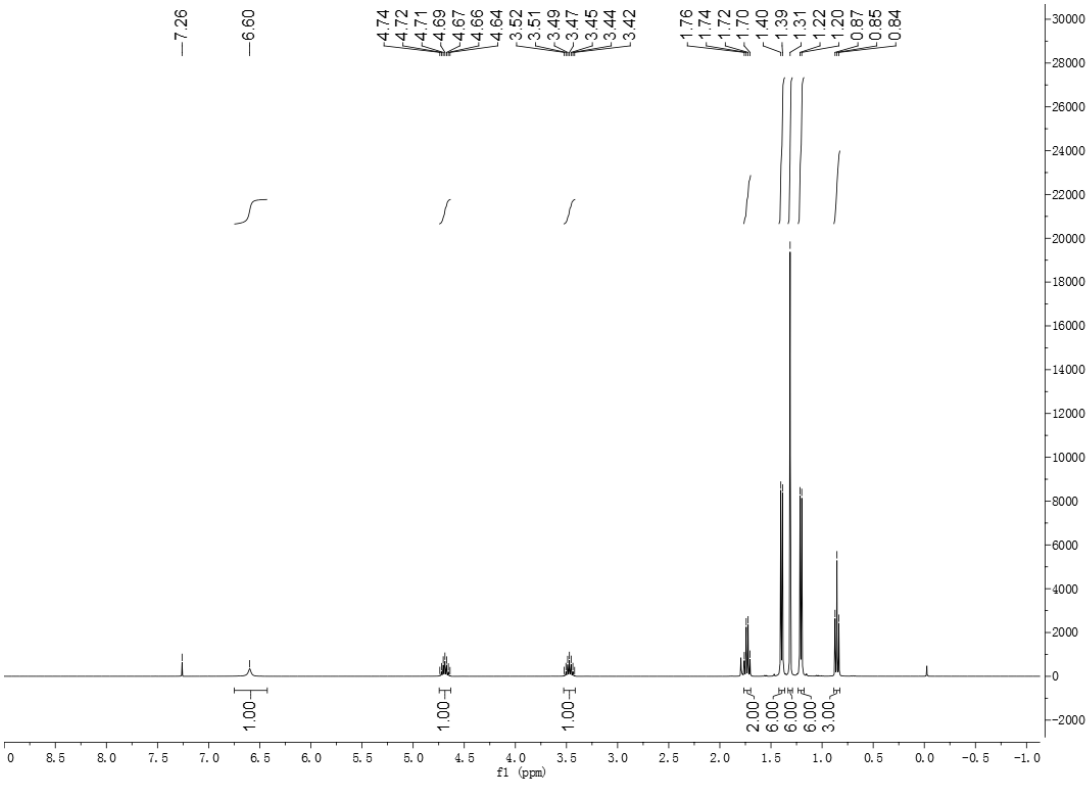
O
O
N(iPr)2
7b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4.69
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3.45
3.44
3.42
1.76
1.74
1.72
1.70
1.40
1.39
1.31
1.22
1.20
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1.00
1.00
2.00
6.00
6.00
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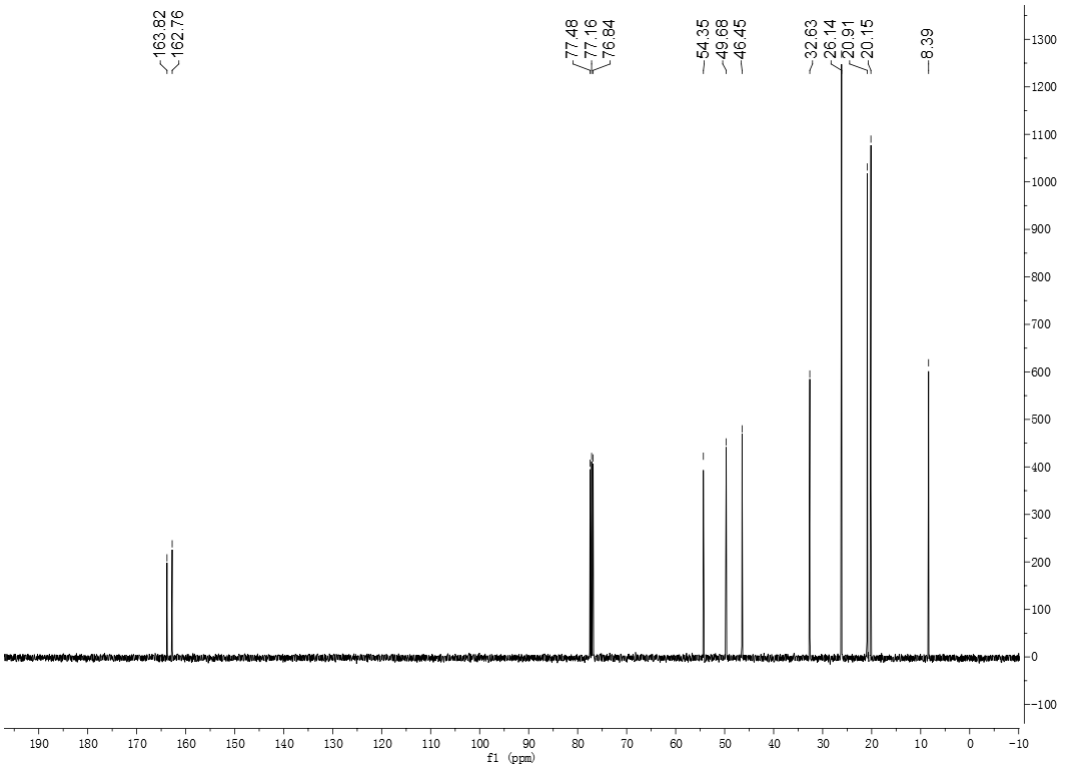
3.00
f1 (ppm)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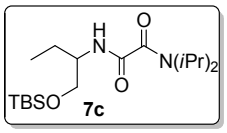
8.39
f1 (ppm)


H
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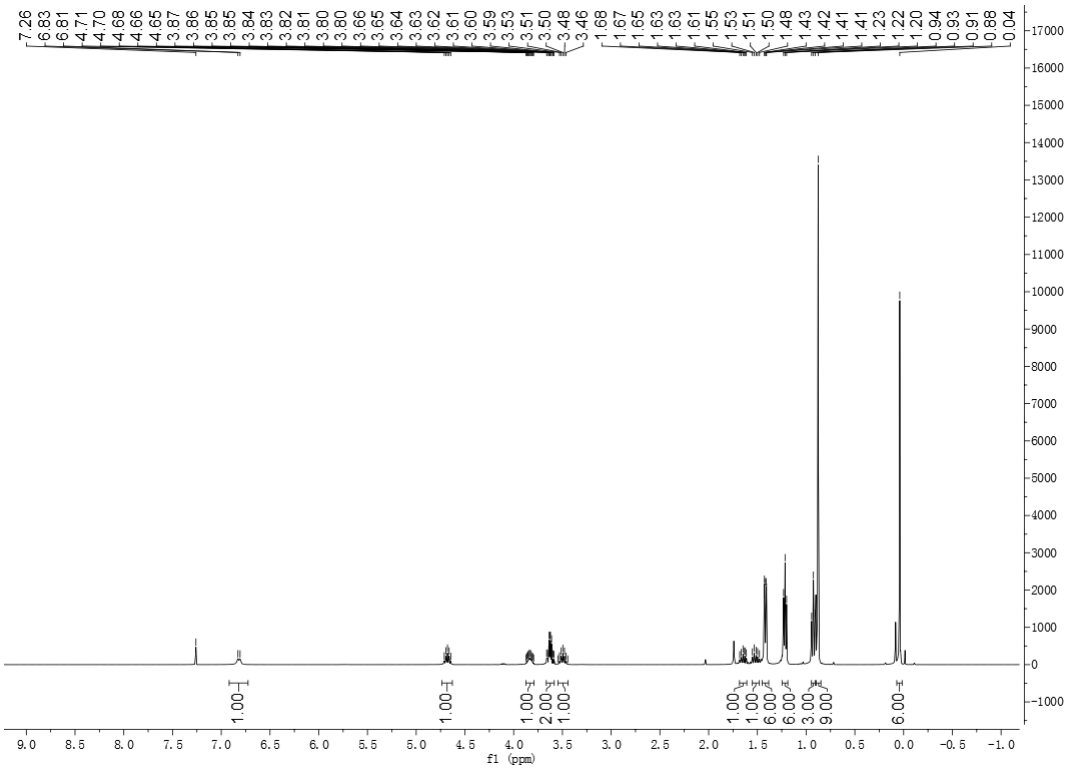
O
O
N(iPr)2
TBSO
7c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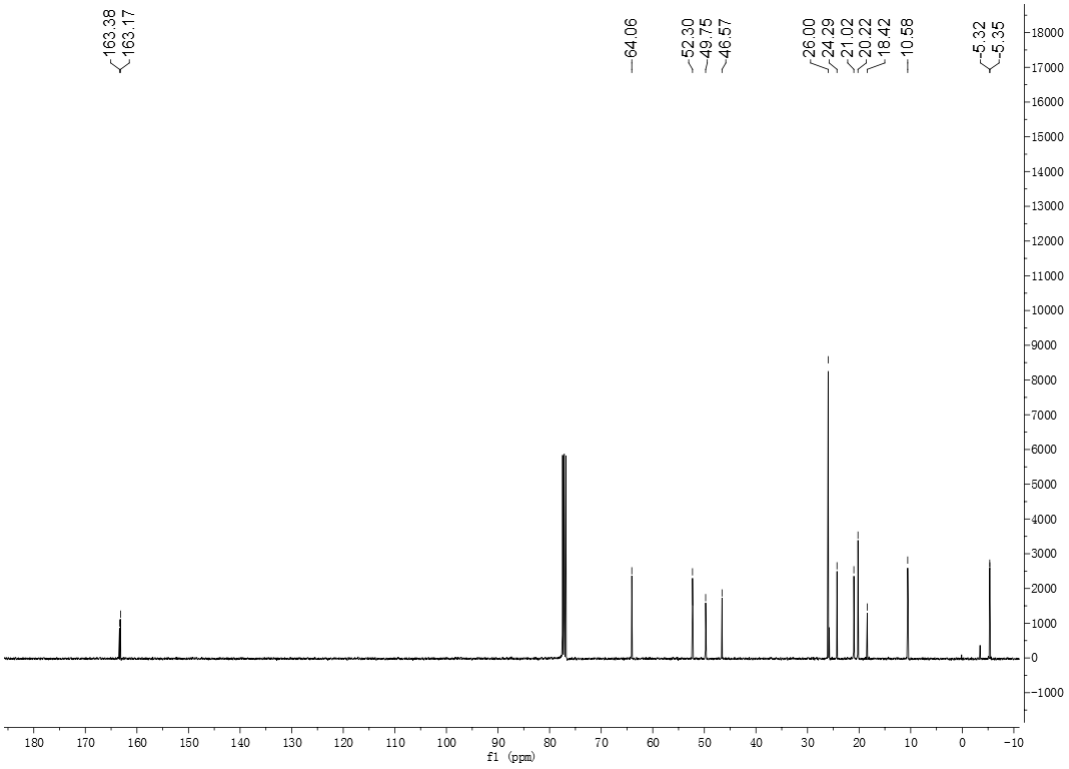
f1 (ppm)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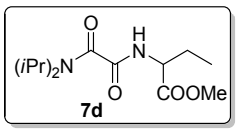
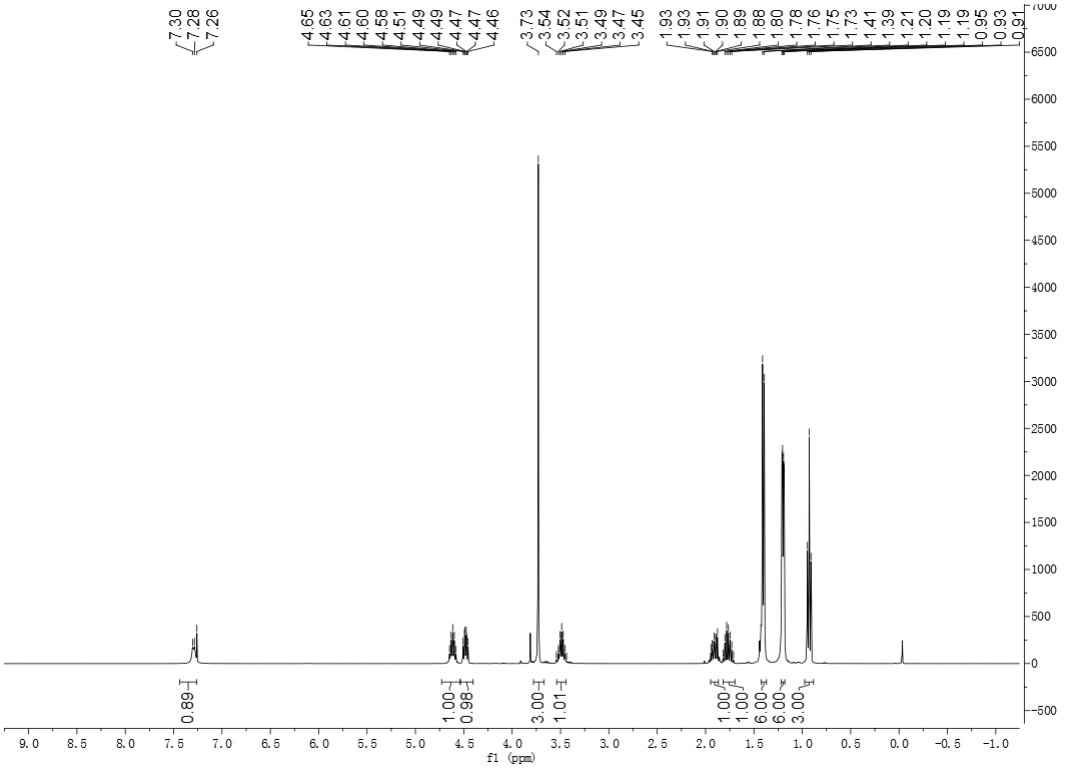
20.22
18.42
10.58
5.32
5.35
f1 (ppm)


O
H
N
(iPr)2N
O
COOMe

7d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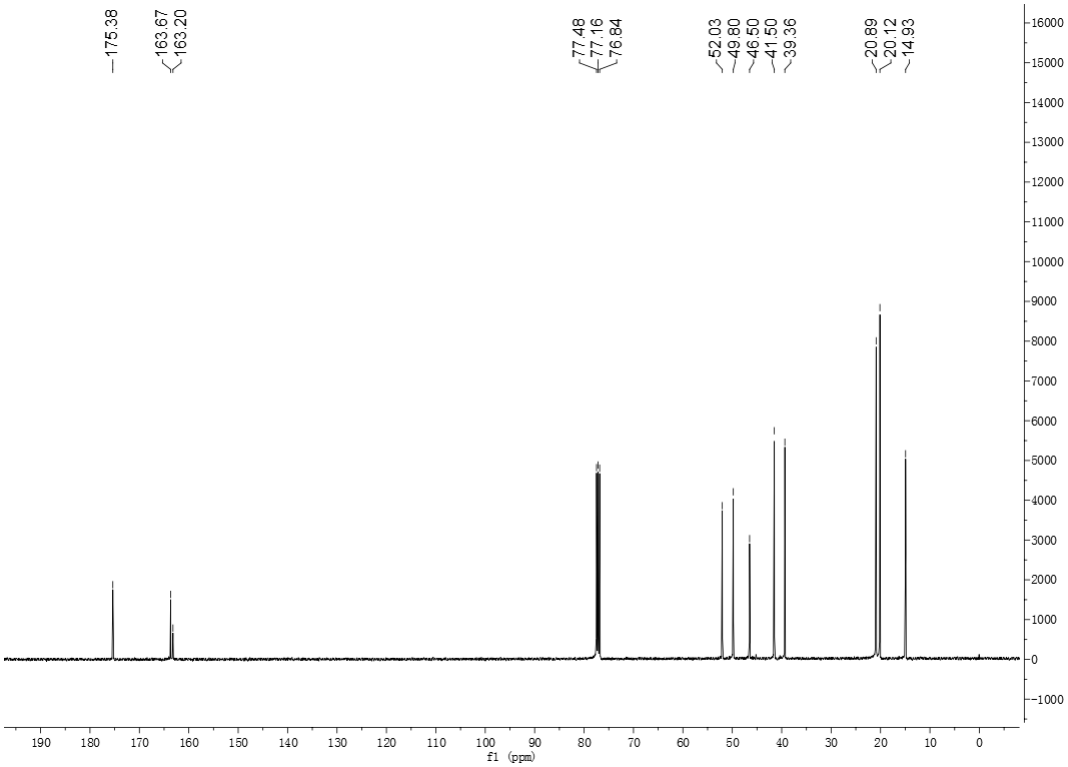
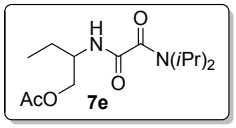
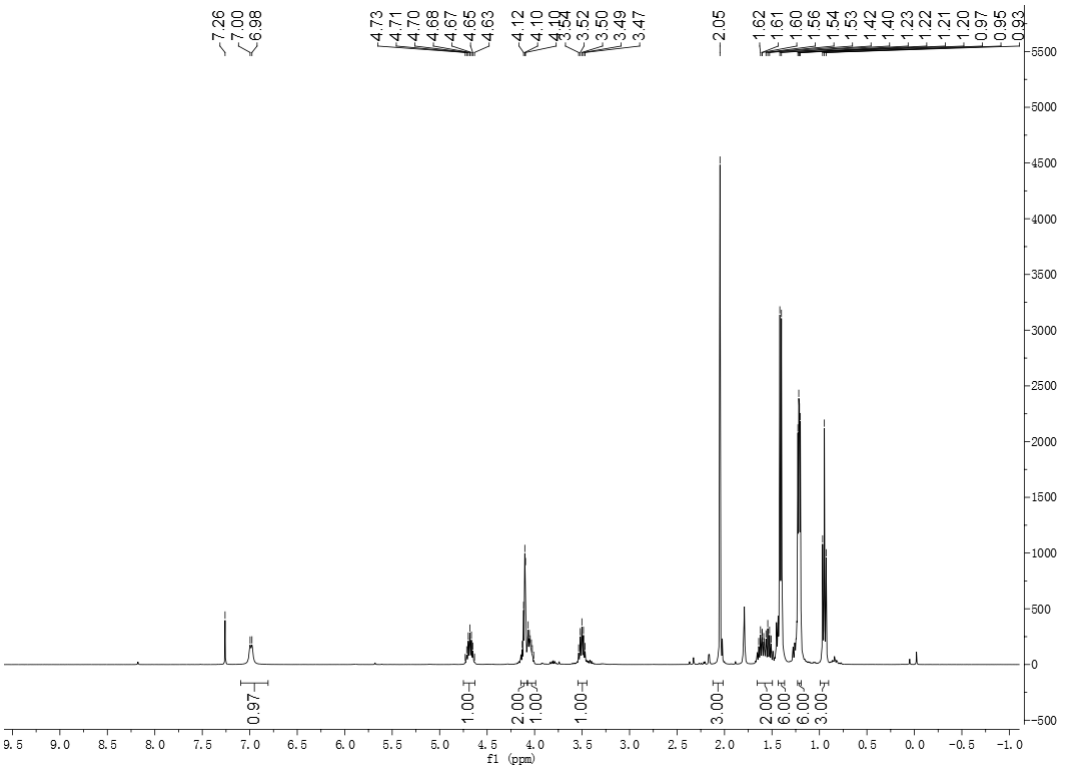
4.63
4.61
4.60
4.58
4.51
4.49
4.49
4.47
4.47
4.46
3.73
3.54
3.52
3.51
3.49
3.47
3.45
1.93
1.93
1.91
1.90
1.89
1.88
1.80
1.78
1.76
1.75
1.73
1.41
1.39
1.21
1.20
1.19
1.19
0.95
0.93
0.91
0.89
1.00
0.98
3.00
1.01
1.00
1.00
6.00
6.00
3.00
f1 (ppm)


175.38
163.67
163.20
77.48
77.16
76.84
52.03
49.80
46.50
41.50
39.36
20.89
20.12
14.93
f1 (ppm)


H
N
O
O
N(iPr)2
O
AcO
7e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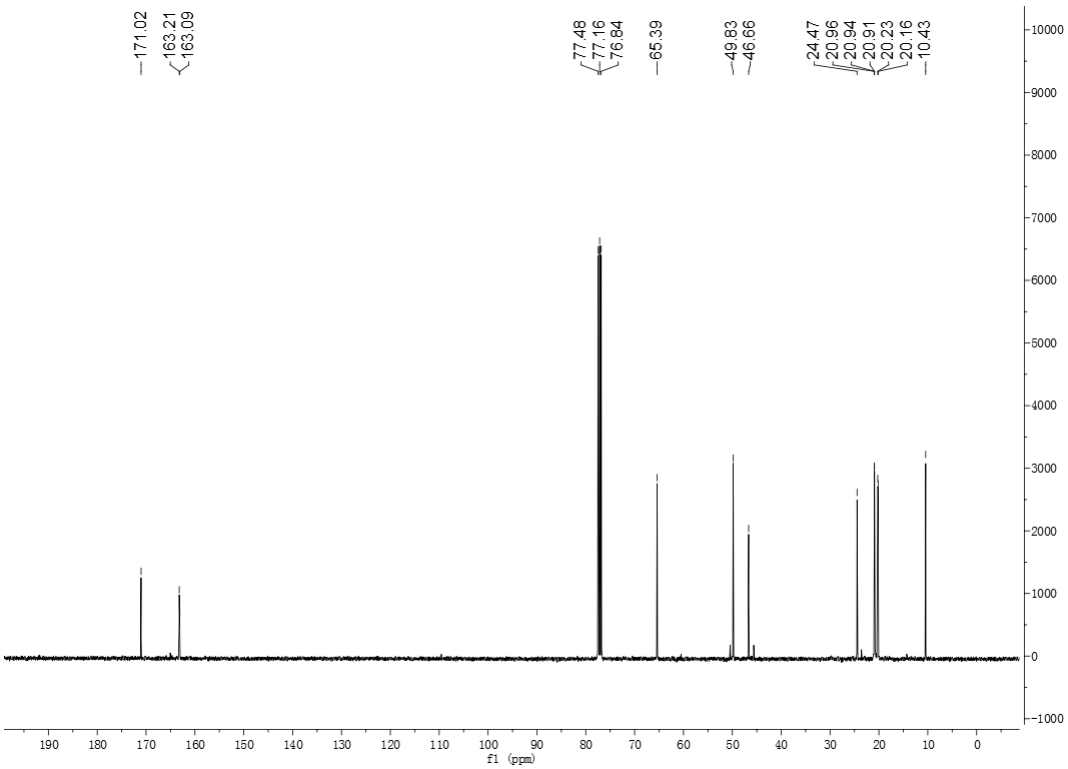
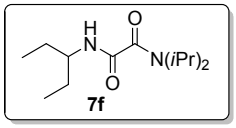
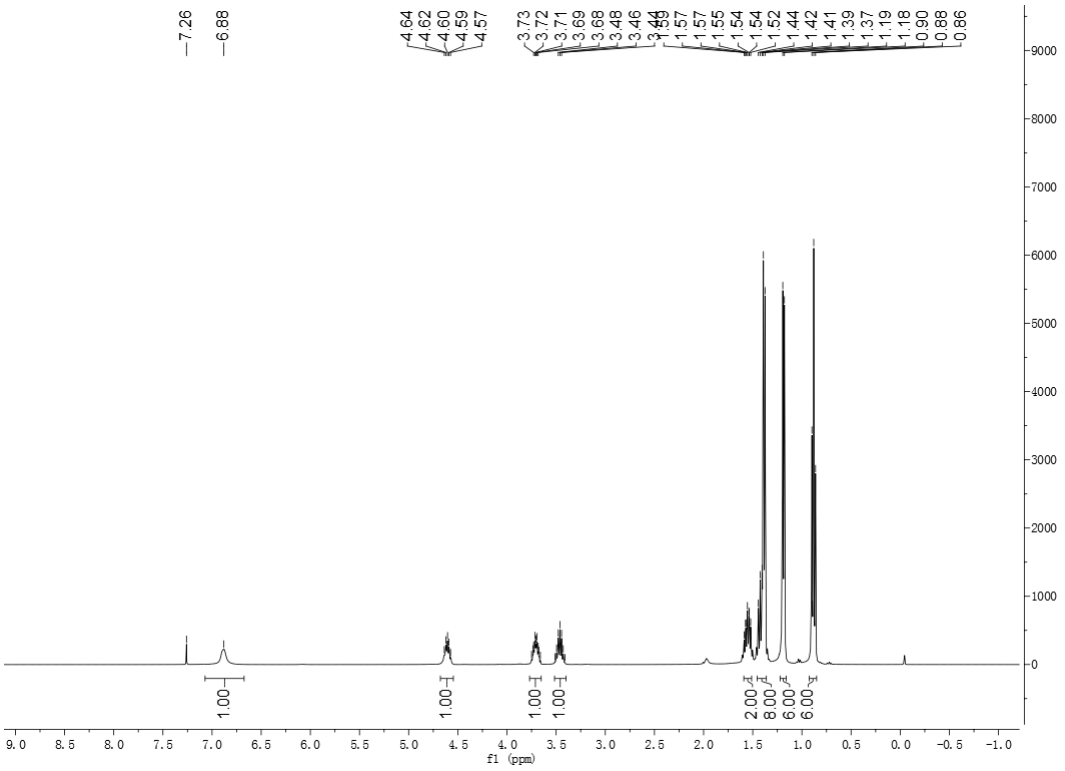
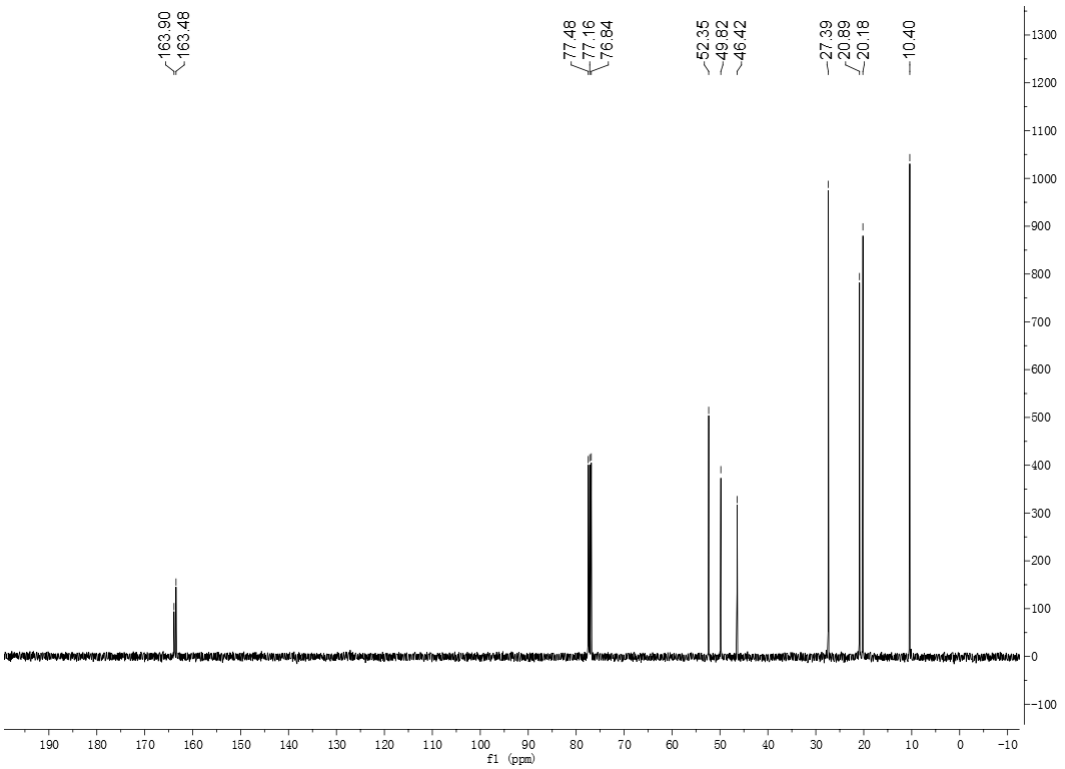
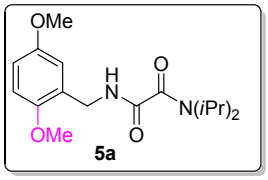
4.70
4.68
4.67
4.65
4.63
4.12
4.10
4.10
3.54
3.52
3.50
3.49
3.47
2.05
1.62
1.61
1.60
1.56
1.54
1.53
1.42
1.40
1.23
1.22
1.21
1.20
0.97
0.95
0.93
0.97
1.00
2.00
1.00
1.00
3.00
2.00
6.00
6.00
3.00
f1 (ppm)


171.02
163.21
163.09
77.48
77.16
76.84
65.39
49.83
46.66
24.47
20.96
20.94
20.91
20.23
20.16
10.43
f1 (ppm)

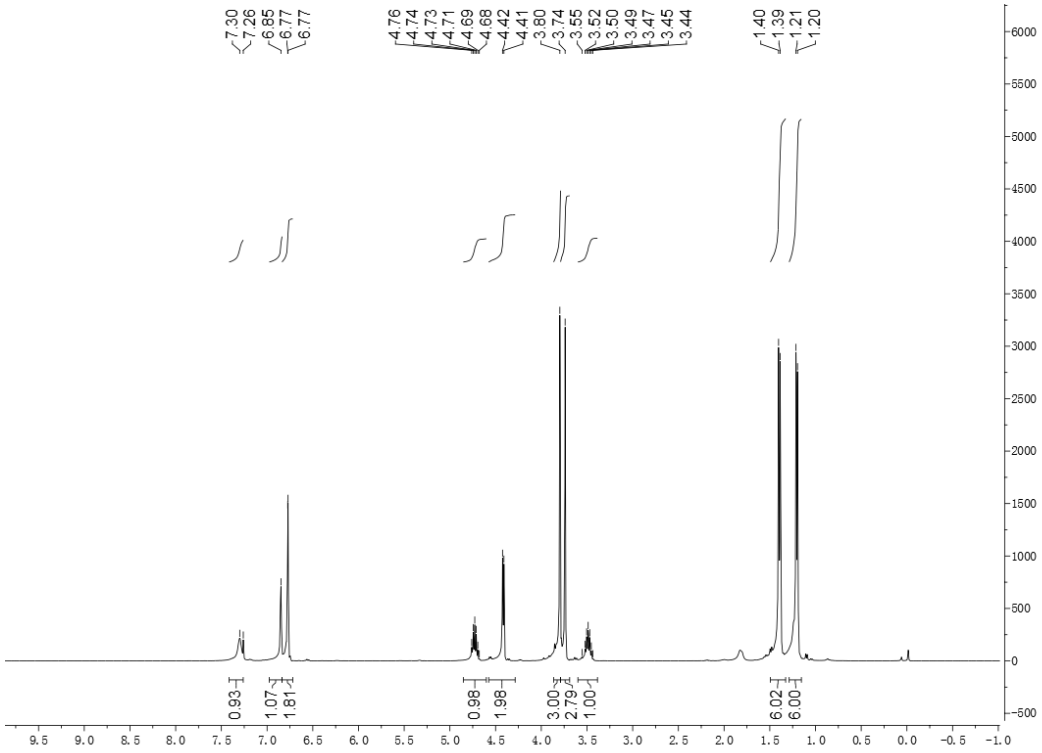

H
N
O
O
N(iPr)2
7f

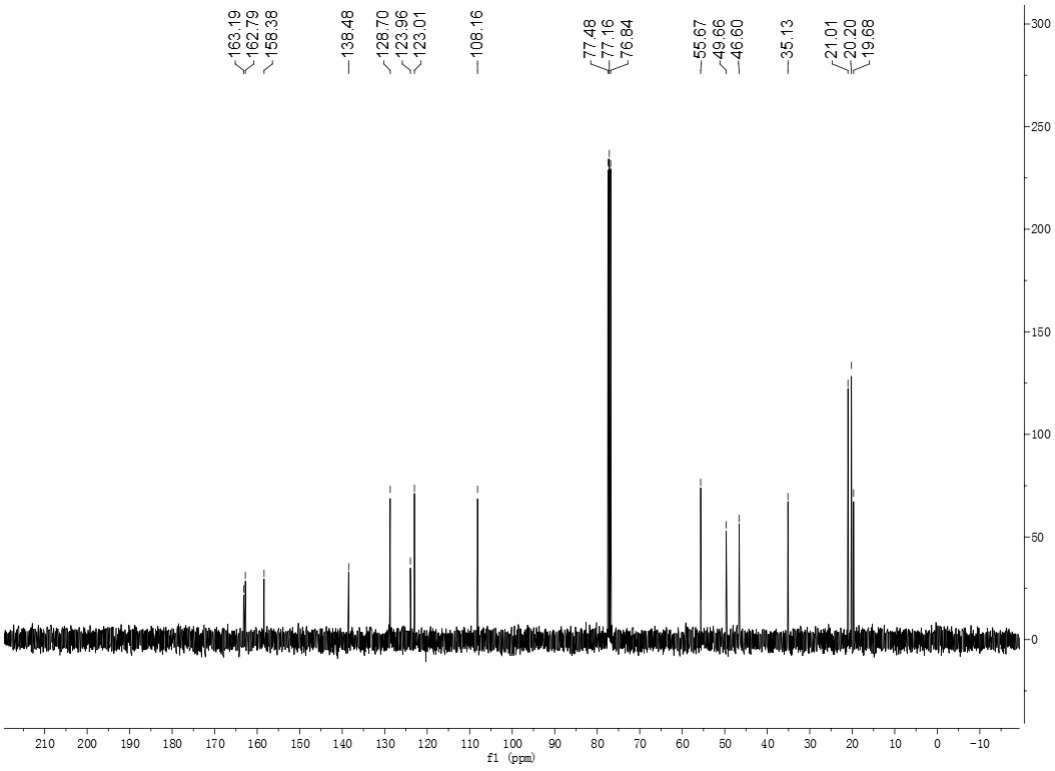

7.26
6.88
4.64
4.62
4.60
4.59
4.57
3.73
3.72
3.71
3.69
3.68
3.48
3.46
1.57
1.57
1.55
1.54
1.54
1.52
1.44
1.42
1.41
1.39
1.37
1.19
1.18
0.90
0.88
0.86
1.00
1.00
1.00
1.00
2.00
8.00
6.00
6.00
f1 (ppm)

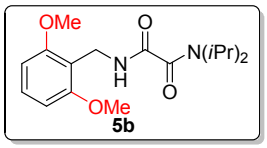

163.90
163.48
77.48
77.16
76.84
52.35
49.82
46.42
27.39
20.89
20.18
10.40
f1 (ppm)

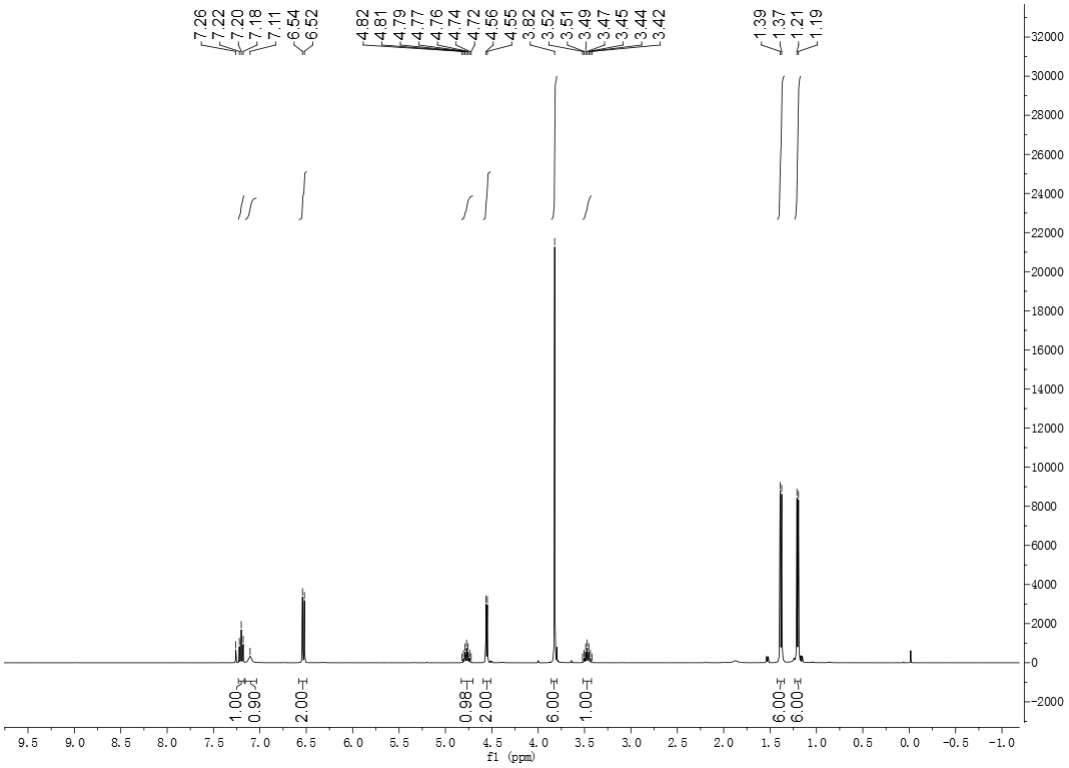

OMe
H
N
O
O
N(iPr)2
OMe

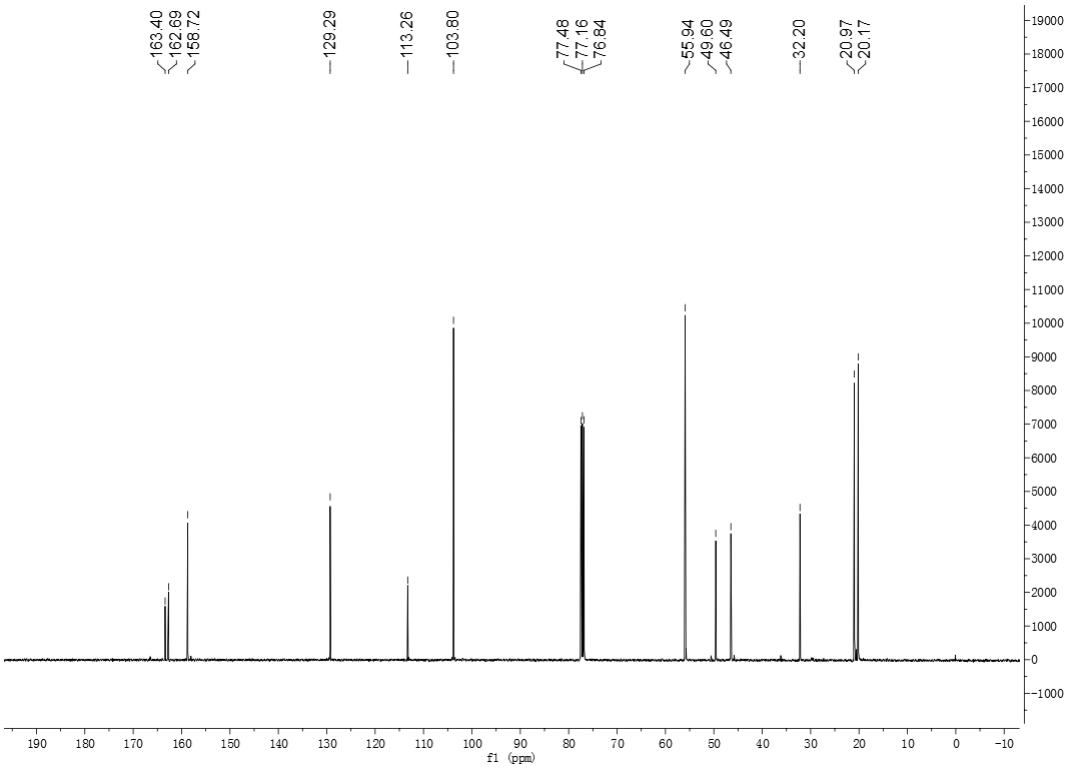
5a


7.30
7.26
6.85
6.77
6.77
4.76
4.74
4.73
4.71
4.69
4.68
4.42
4.41
3.80
3.74
3.55
3.52
3.50
3.49
3.47
3.45
3.44
1.40
1.39
1.21
1.20
0.93
1.07
1.81
0.98
1.98
3.00
2.79
1.00
6.02
6.00


163.19
162.79
158.38
138.48
128.70
123.96
123.01
108.16
77.48
77.16
76.84
55.67
49.66
46.60
35.13
21.01
20.20
19.68
f1 (ppm)


OMe
O
N
H
N(iPr)2
O
OMe
5b


7.26
7.22
7.20
7.18
7.11
6.54
6.52
4.82
4.81
4.79
4.77
4.76
4.74
4.72
4.56
4.55
3.82
3.52
3.51
3.49
3.47
3.45
3.44
3.42
1.39
1.37
1.21
1.19
1.00
0.90
2.00
0.98
2.00
6.00
1.00
6.00
6.00
f1 (ppm)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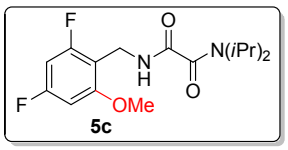
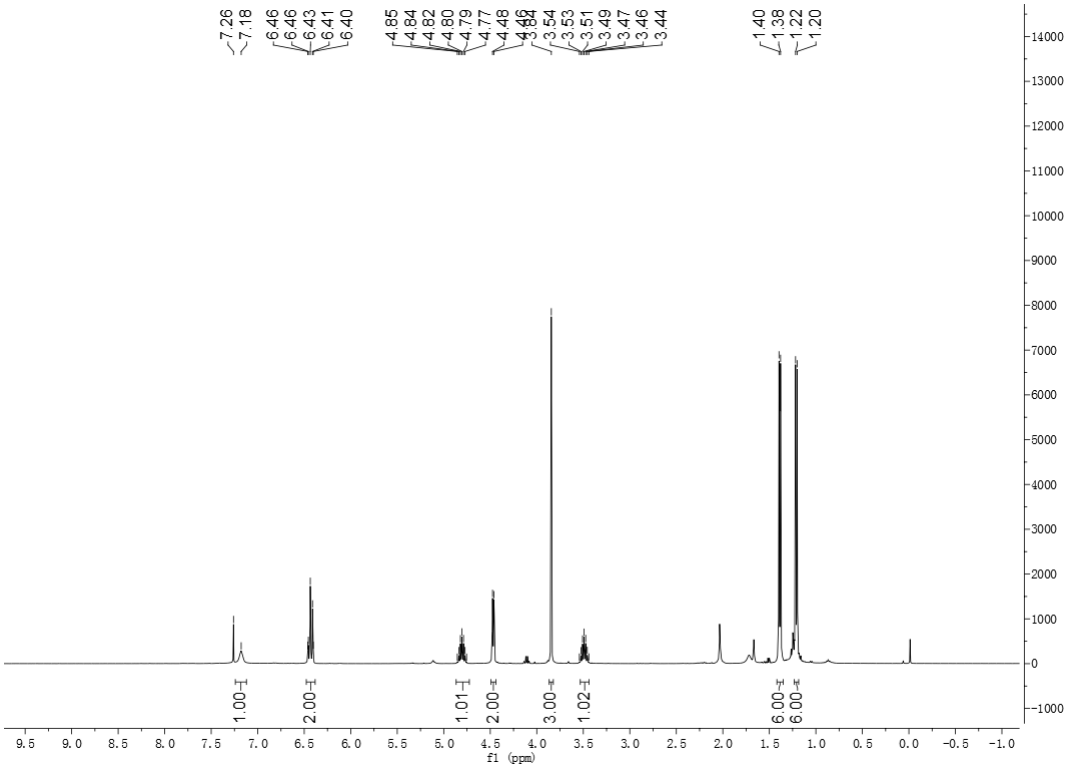
162.69
158.72
129.29
113.26
103.80
77.48
77.16
76.84
55.94
49.60
46.49
32.20
20.97
20.17
f1 (ppm)


F
O
N(iPr)2
N
H
O
F
OMe
5c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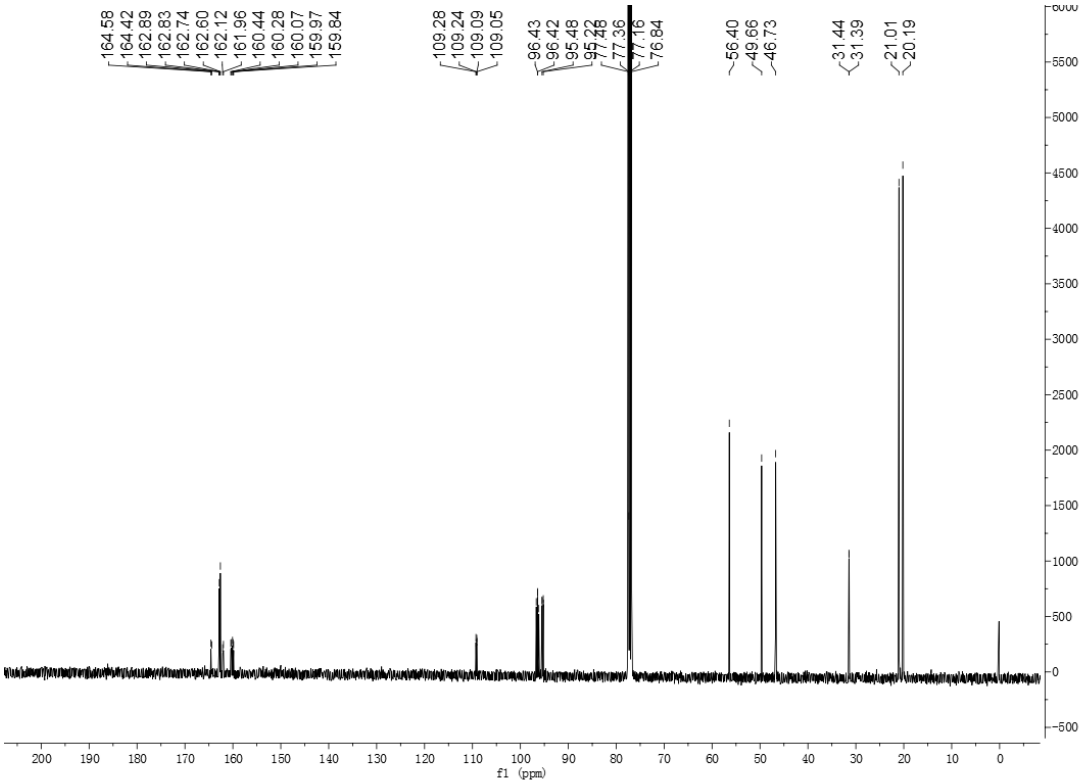
7.18
6.46
6.46
6.43
6.41
6.40
4.85
4.84
4.82
4.80
4.79
4.77
4.48
3.54
3.53
3.51
3.49
3.47
3.46
3.44
1.40
1.38
1.22
1.20
1.00
2.00
1.01
2.00
3.00
1.02
6.00
6.00
f1 (ppm)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164.42
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162.74
162.60
162.12
161.96
160.44
160.28
160.07
159.97
159.84
109.28
109.24
109.09
109.05
96.43
96.42
95.48
95.22
77.36
77.16
76.84
56.40
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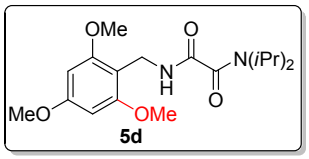
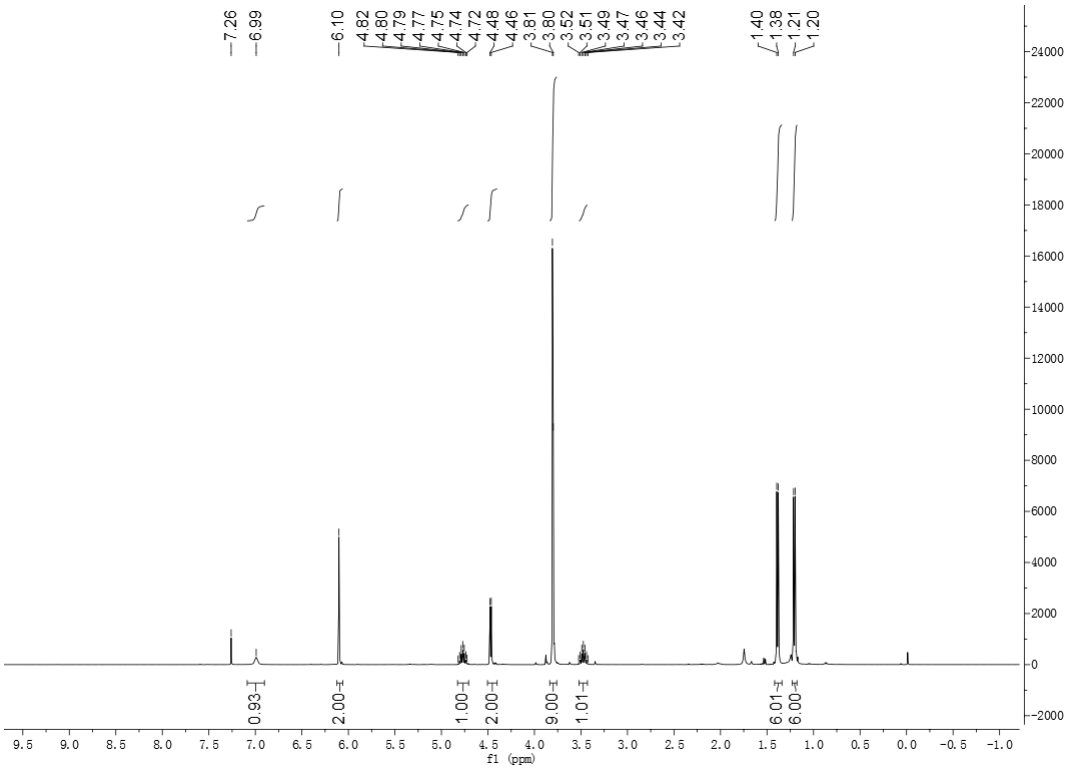
31.44
31.39
21.01
20.19
f1 (ppm)


OMe
O
N(iPr)2
N
H
O
MeO
OMe

5d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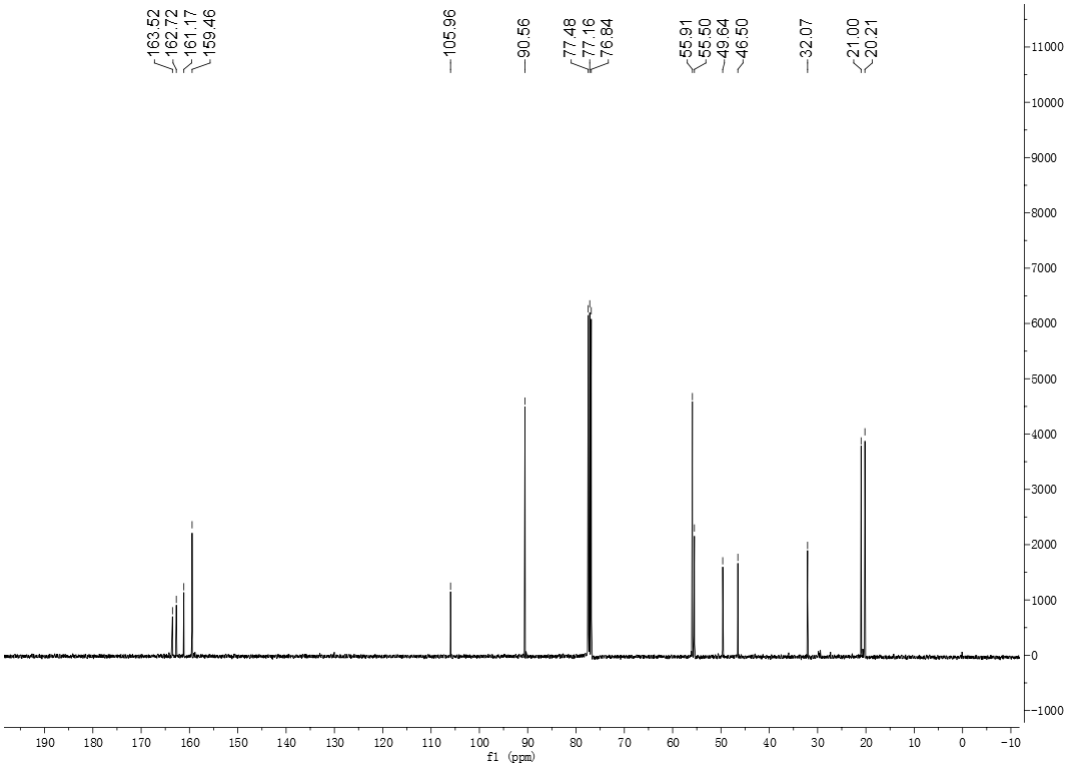
6.10
4.82
4.80
4.79
4.77
4.75
4.74
4.72
4.48
4.46
3.81
3.80
3.52
3.51
3.49
3.47
3.46
3.44
3.42
1.40
1.38
1.21
1.20
0.93
2.00
1.00
2.00
9.00
1.01
6.01
6.00
f1 (ppm)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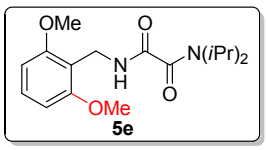
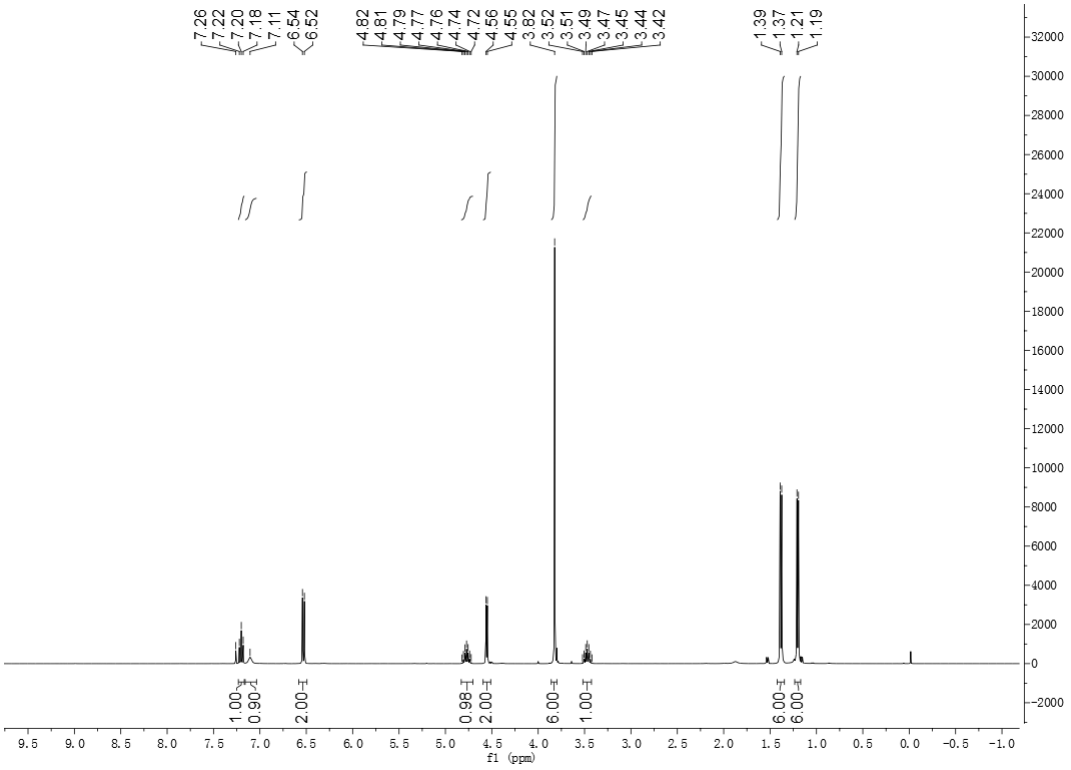
162.72
161.17
159.46
105.96
90.56
77.48
77.16
76.84
55.91
55.50
49.64
46.50
32.07
21.00
20.21
f1 (ppm)


OMe
O
N(iPr)2
N
H
O
OMe
5e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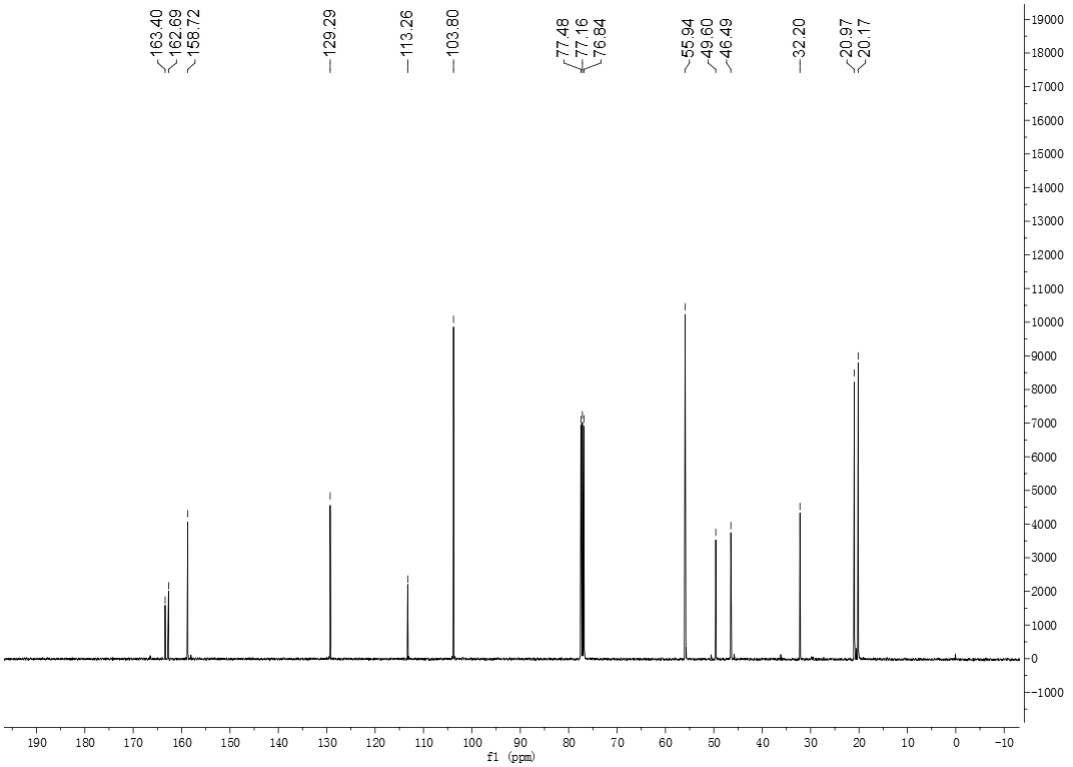
7.22
7.20
7.18
7.11
6.54
6.52
4.82
4.81
4.79
4.77
4.76
4.74
4.72
4.56
4.55
3.82
3.52
3.51
3.49
3.47
3.45
3.44
3.42
1.39
1.37
1.21
1.19
1.00
0.90
2.00
0.98
2.00
6.00
1.00
6.00
6.00
f1 (ppm)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129.29
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103.80
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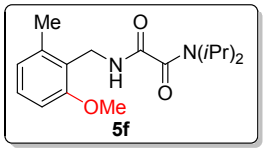
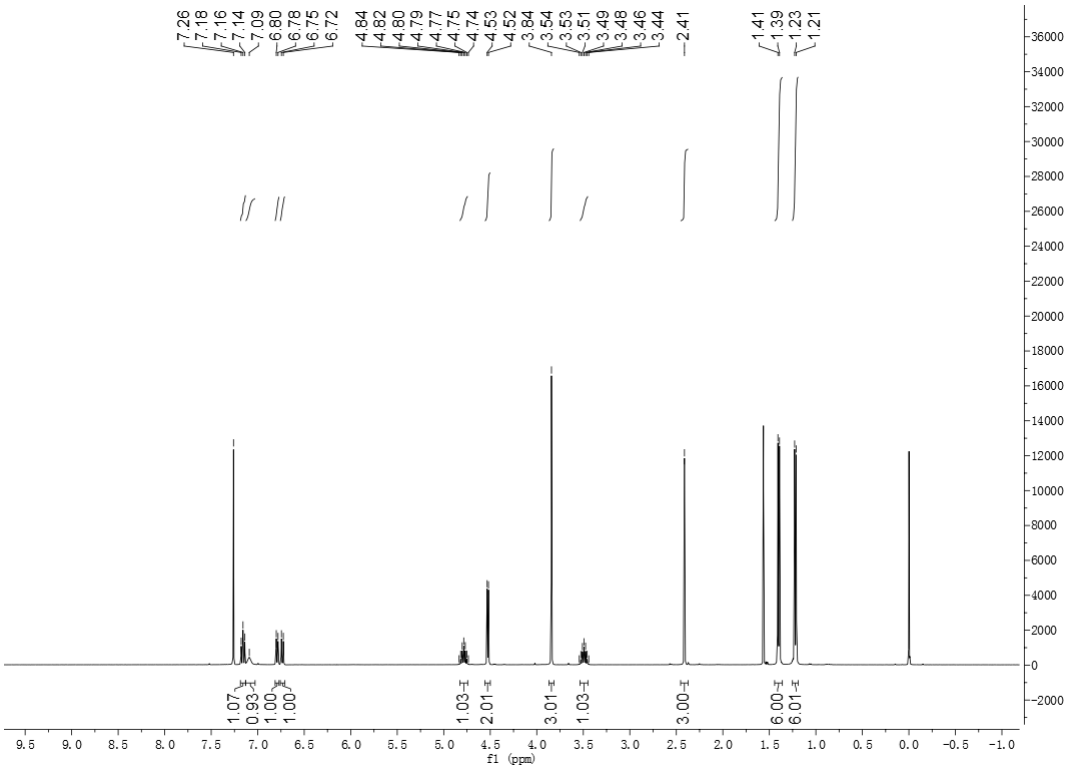
77.16
76.84
55.94
49.60
46.49
32.20
20.97
20.17
f1 (ppm)


Me
O
N(iPr)2
N
H
O
OMe
5f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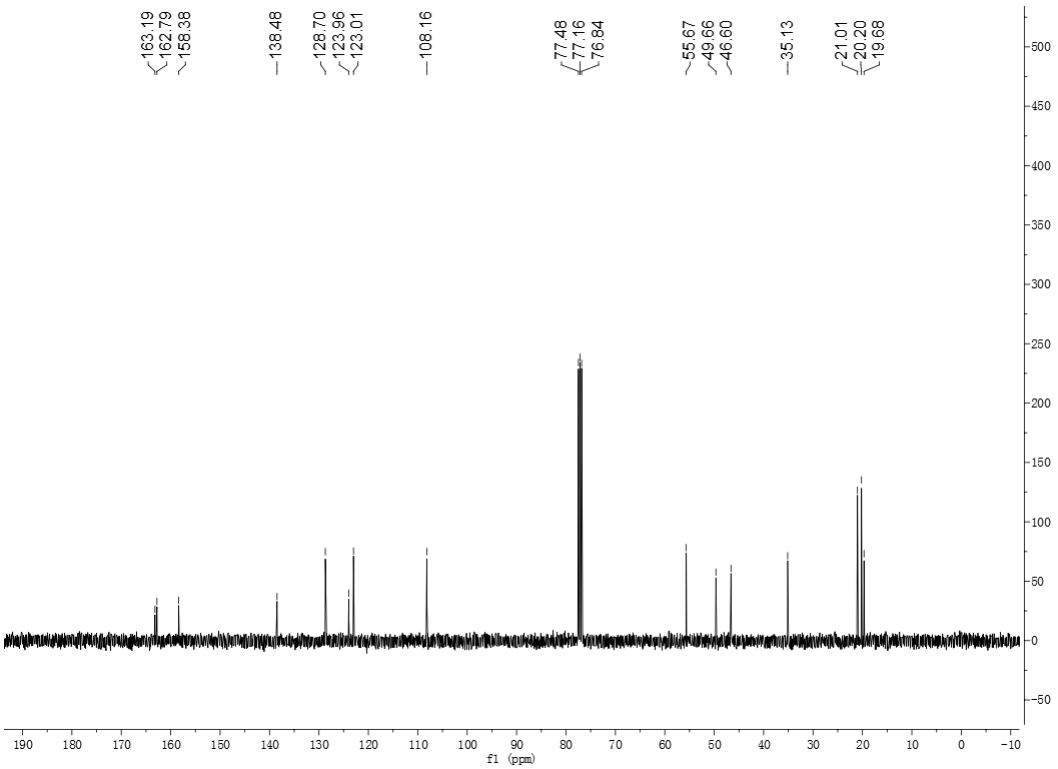
7.14
7.09
6.80
6.78
6.75
6.72
4.84
4.82
4.80
4.79
4.77
4.75
4.74
4.53
4.52
3.84
3.54
3.53
3.51
3.49
3.48
3.46
3.44
2.41
1.41
1.39
1.23
1.21
1.07
0.93
1.00
1.00
1.03
2.01
3.01
1.03
3.00
6.00
6.01
f1 (ppm)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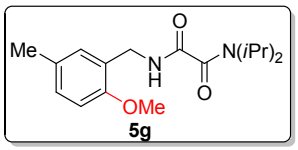
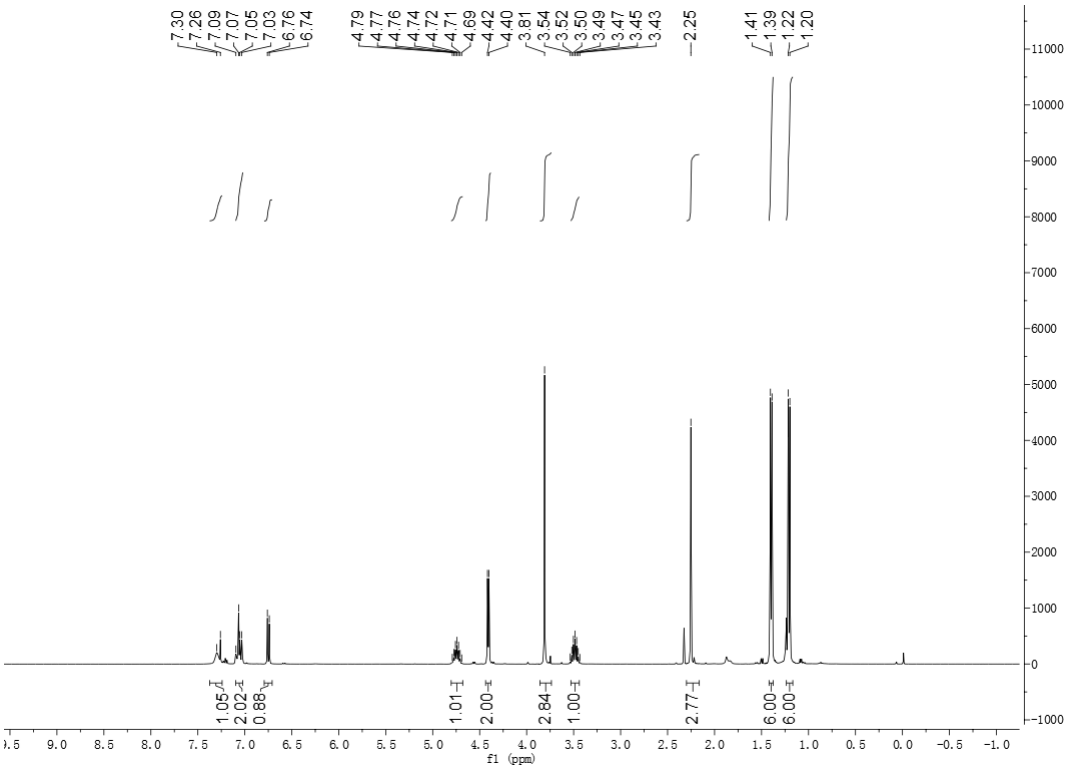
158.38
138.48
128.70
123.96
123.01
108.16
77.48
77.16
76.84
55.67
49.66
46.60
35.13
21.01
20.20
19.68
f1 (ppm)


Me
O
N
H
N(iPr)2
O
OMe

5g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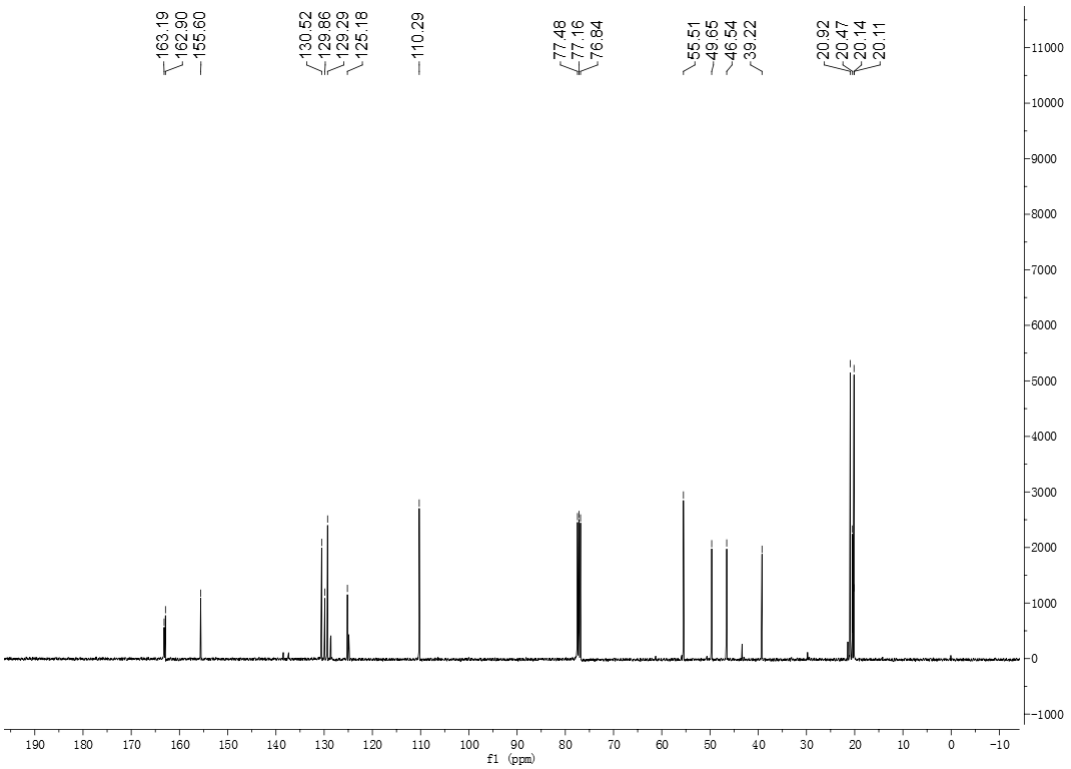
7.09
7.07
7.05
7.03
6.76
6.74
4.79
4.77
4.76
4.74
4.72
4.71
4.69
4.42
4.40
3.81
3.54
3.52
3.50
3.49
3.47
3.45
3.43
2.25
1.41
1.39
1.22
1.20
1.05
2.02
0.88
1.01
2.00
2.84
1.00
2.77
6.00
6.00
f1 (ppm)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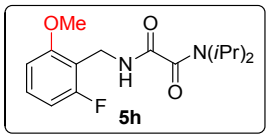
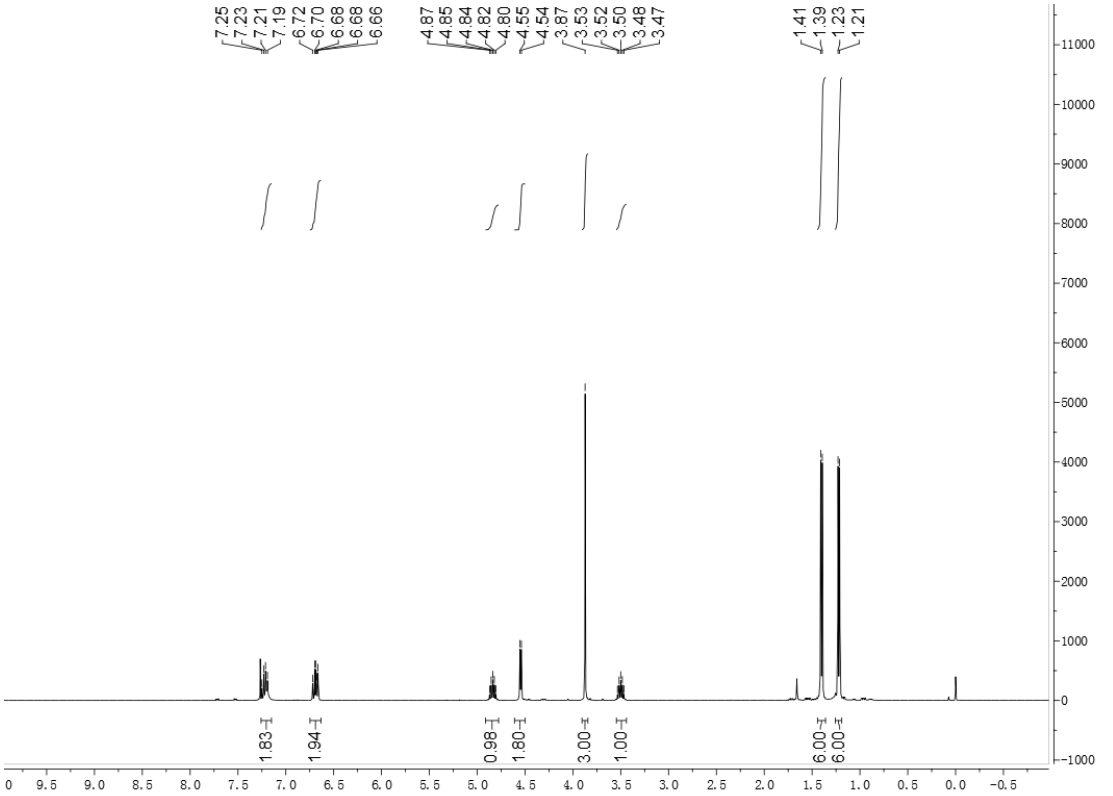
129.29
125.18
110.29
77.48
77.16
76.84
55.51
49.65
46.54
39.22
20.92
20.47
20.14
20.11
f1 (ppm)


OMe
O
N
H
N(iPr)2
O
F
5h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7.23
7.21
7.19
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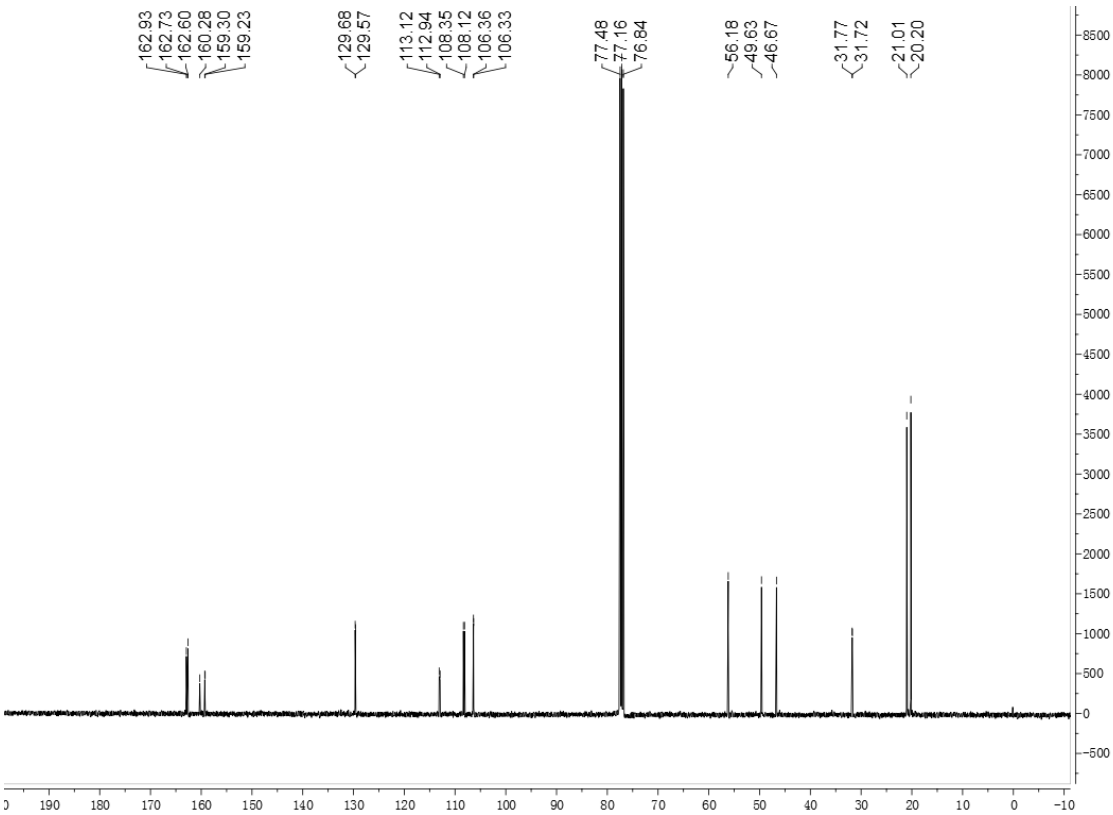
6.70
6.68
6.68
6.66
4.87
4.85
4.84
4.82
4.80
4.55
4.54
3.87
3.53
3.52
3.50
3.48
3.47
1.41
1.39
1.23
1.21
1.83
1.94
0.98
1.80
3.00
1.00
6.00
6.00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159.23
129.68
129.57
113.12
112.94
108.35
108.12
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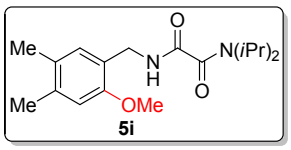
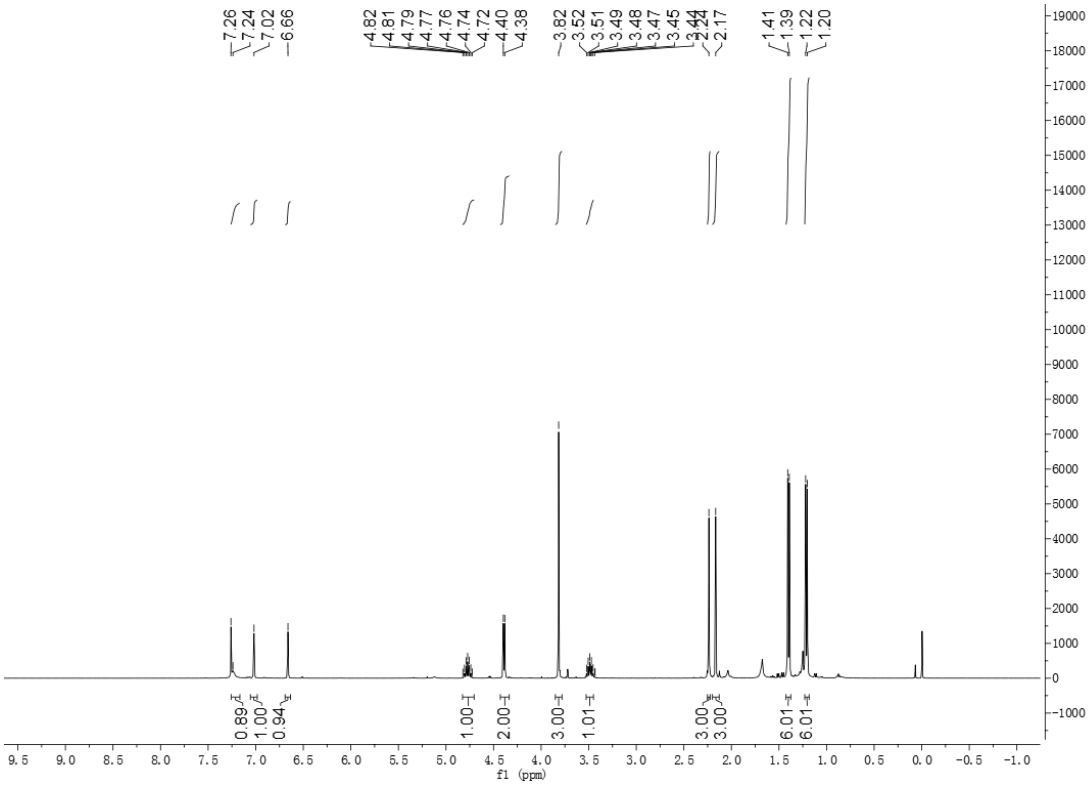
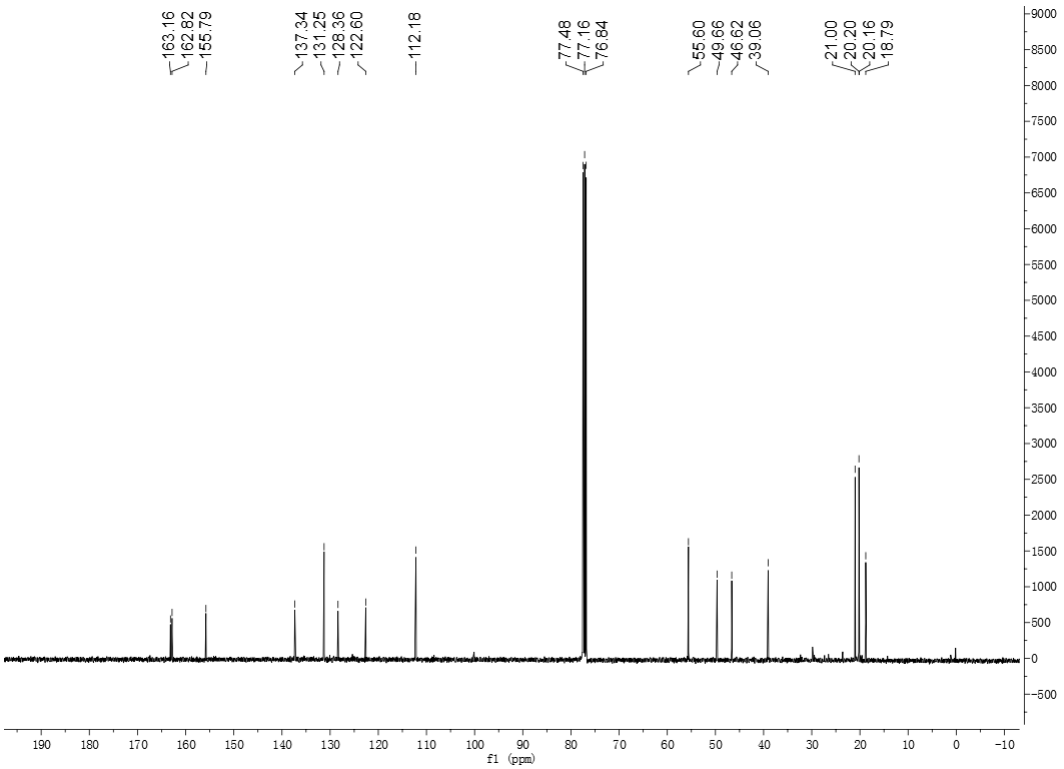
49.63
46.67
31.77
31.72
21.01
20.20


Me
Me
OMe
N
H
O
O
N(iPr)2

5i


7.26
7.24
7.02
6.66
4.82
4.81
4.79
4.77
4.76
4.74
4.72
4.40
4.38
3.82
3.52
3.51
3.49
3.48
3.47
3.45
2.17
1.41
1.39
1.22
1.20
0.89
1.00
0.94
1.00
2.00
3.00
1.01
3.00
3.00
6.01
6.01
f1 (ppm)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162.82
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128.36
122.60
112.18
77.48
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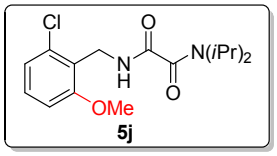
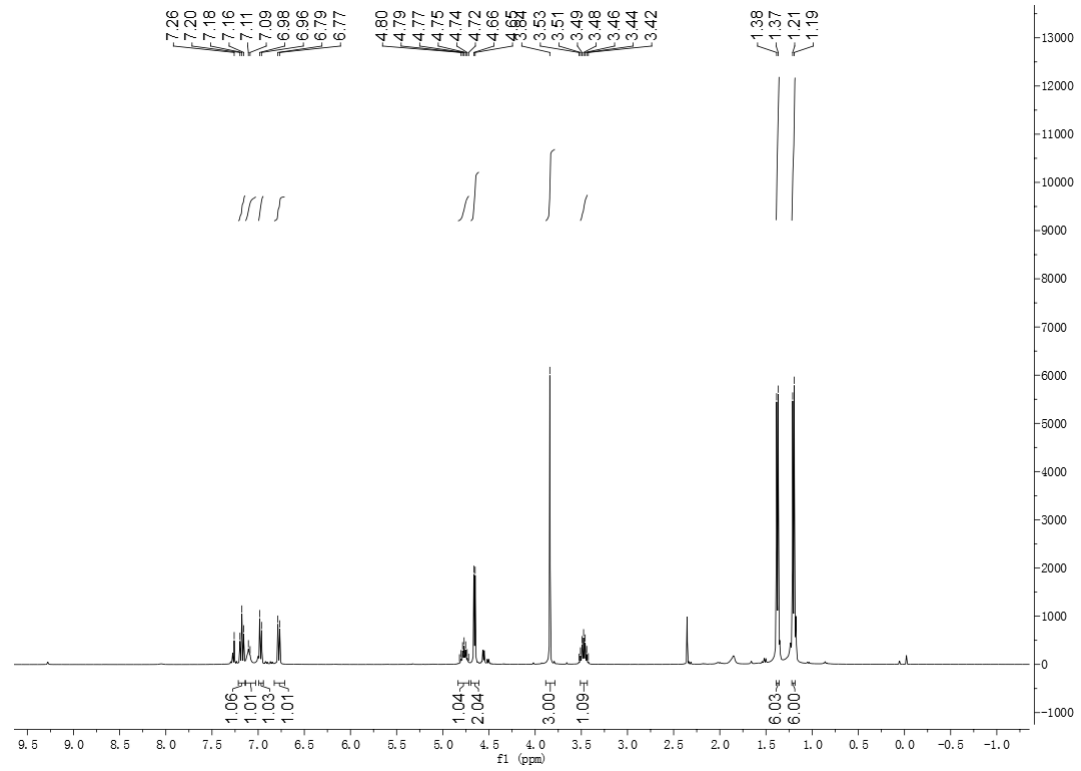
55.60
49.66
46.62
39.06
21.00
20.20
20.16
18.79
f1 (ppm)


Cl
O
N(iPr)2
N
H
O
OMe

5j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7.20
7.18
7.16
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7.09
6.98
6.96
6.79
6.77
4.80
4.79
4.77
4.75
4.74
4.72
4.66
3.53
3.51
3.49
3.48
3.46
3.44
3.42
1.38
1.37
1.21
1.19
1.06
1.01
1.03
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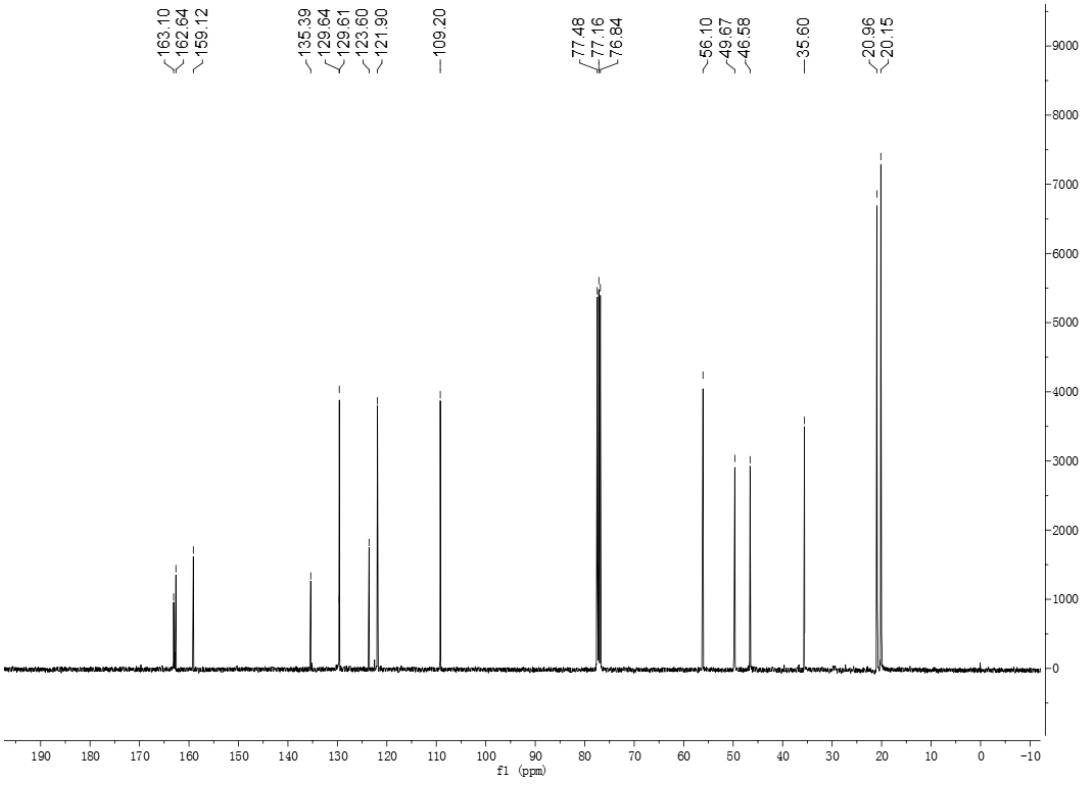
3.00
1.09
6.03
6.00
f1 (ppm)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162.64
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129.61
123.60
121.90
109.20
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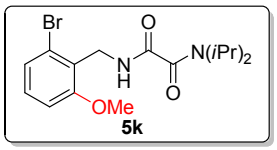
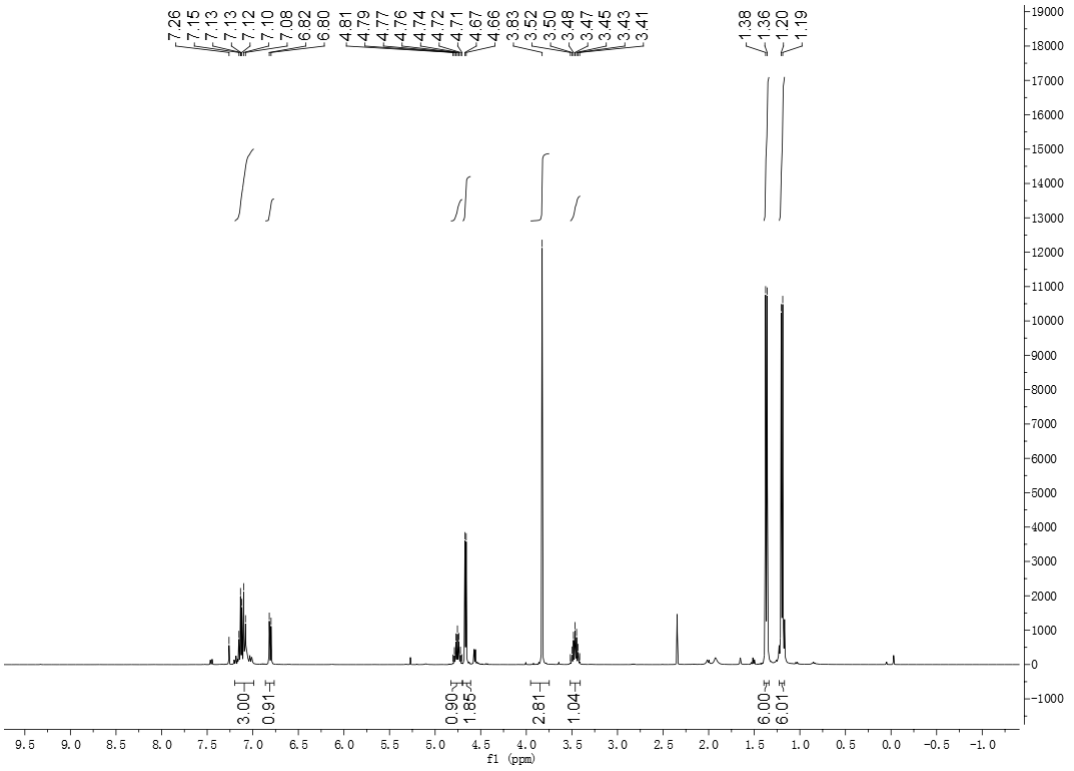
77.16
76.84
56.10
49.67
46.58
35.60
20.96
20.15
f1 (ppm)


Br
O
N(iPr)2
N
H
O
OMe
5k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7.15
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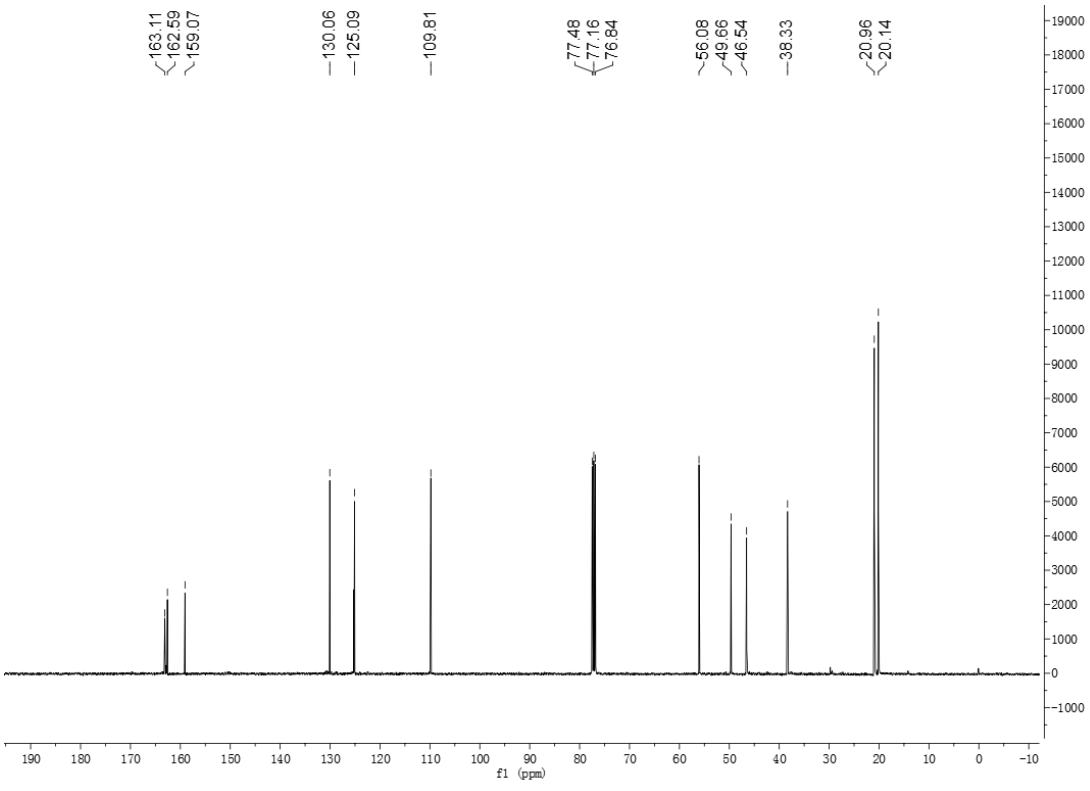
7.13
7.12
7.10
7.08
6.82
6.80
4.81
4.79
4.77
4.76
4.74
4.72
4.71
4.67
4.66
3.83
3.52
3.50
3.48
3.47
3.45
3.43
3.41
1.38
1.36
1.20
1.19
3.00
0.91
0.90
1.85
2.81
1.04
6.00
6.01
f1 (ppm)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130.06
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109.81
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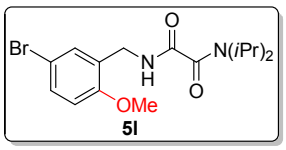
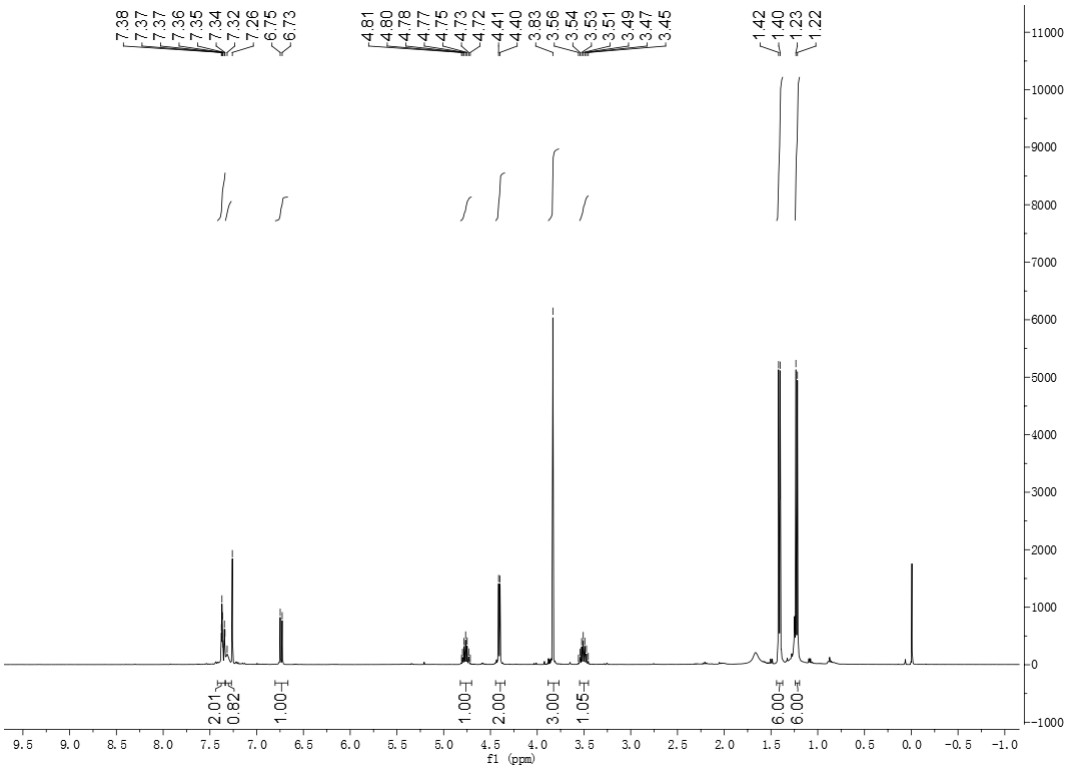
77.16
76.84
56.08
49.66
46.54
38.33
20.96
20.14
f1 (ppm)


Br
O
N
H
N(iPr)2
O
OMe
5l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7.37
7.36
7.35
7.34
7.32
7.26
6.75
6.73
4.81
4.80
4.78
4.77
4.75
4.73
4.72
4.41
4.40
3.83
3.56
3.54
3.53
3.51
3.49
3.47
3.45
1.42
1.40
1.23
1.22
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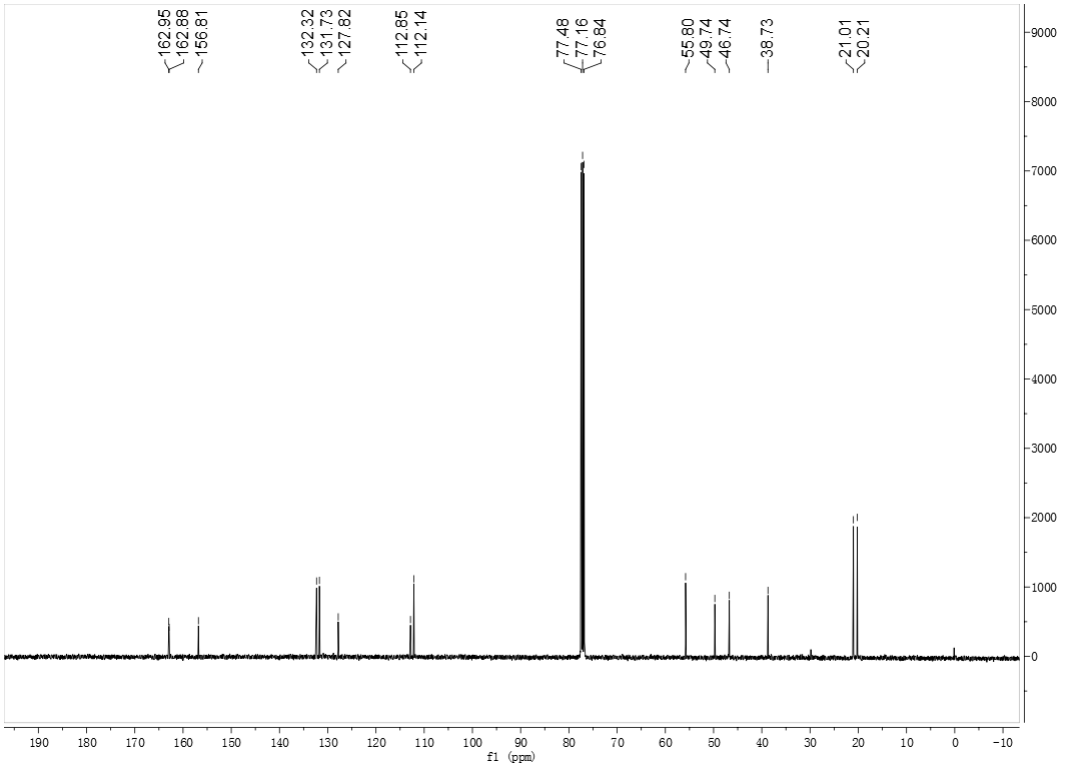
0.82
1.00
1.00
2.00
3.00
1.05
6.00
6.00
f1 (ppm)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162.88
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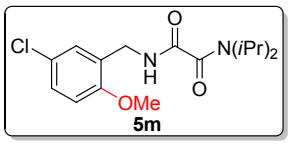
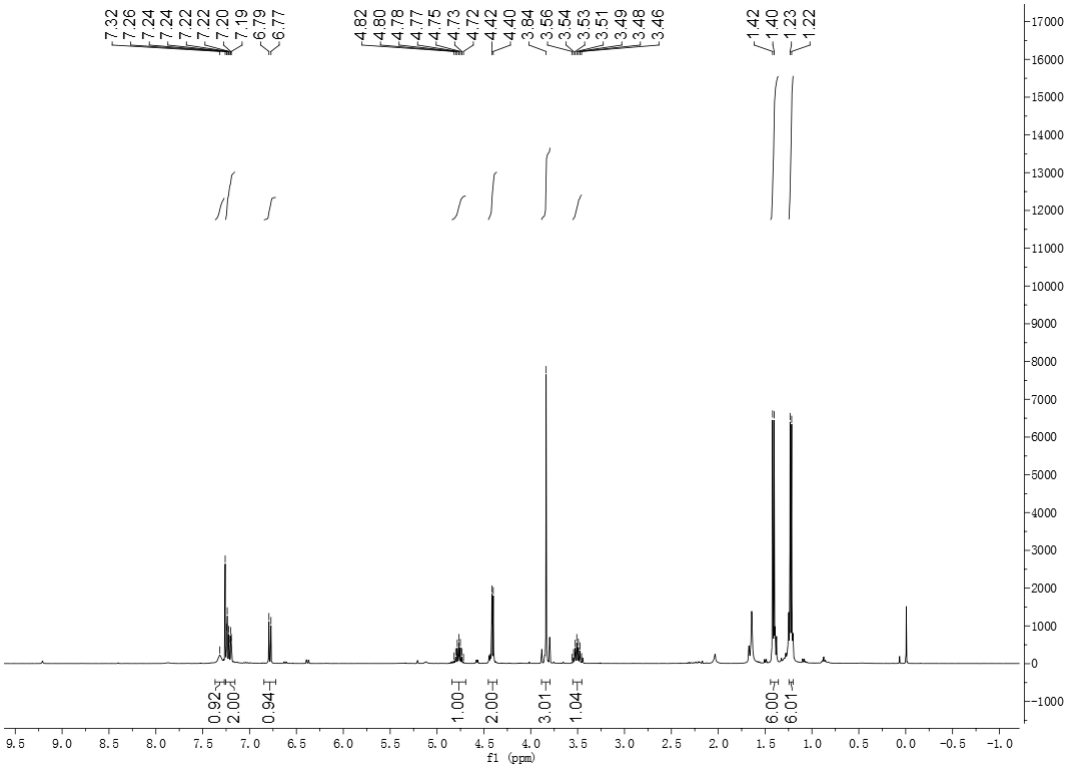
132.32
131.73
127.82
112.85
112.14
77.48
77.16
76.84
55.80
49.74
46.74
38.73
21.01
20.21
f1 (ppm)


Cl
N
H
O
O
N(iPr)2
OMe
5m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7.26
7.24
7.24
7.22
7.22
7.20
7.19
6.79
6.77
4.82
4.80
4.78
4.77
4.75
4.73
4.72
4.42
4.40
3.84
3.56
3.54
3.53
3.51
3.49
3.48
3.46
1.42
1.40
1.23
1.22
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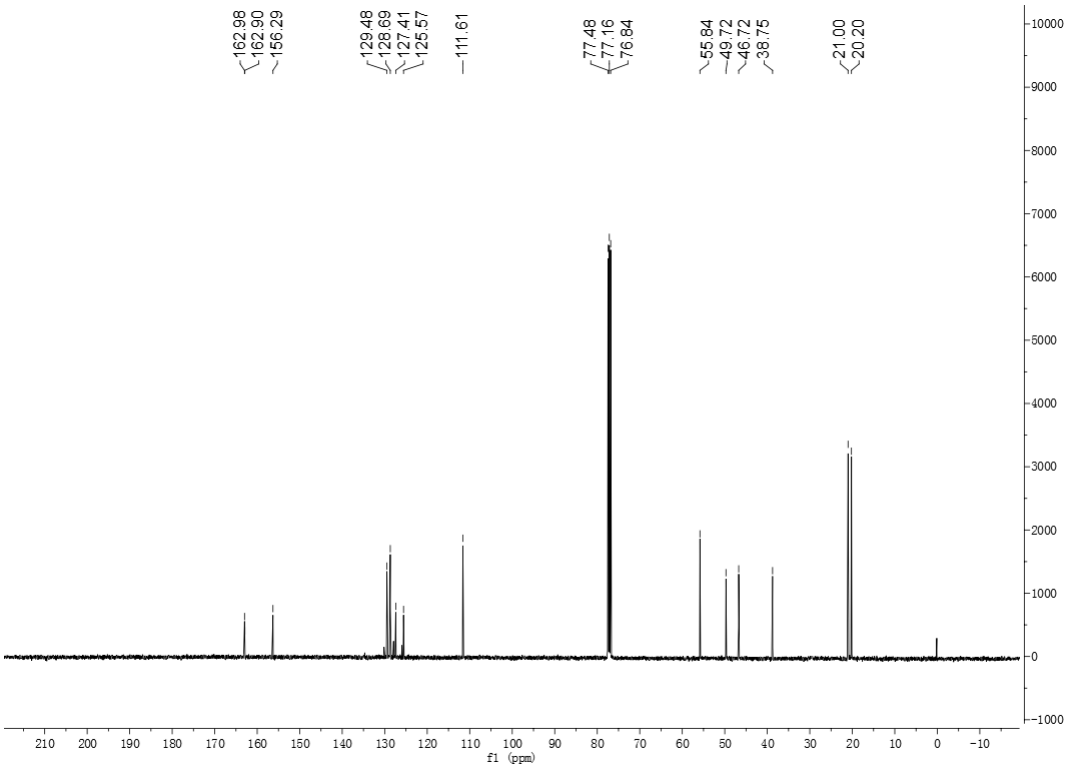
2.00
0.94
1.00
2.00
3.01
1.04
6.00
6.01
f1 (ppm)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129.48
128.69
127.41
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111.61
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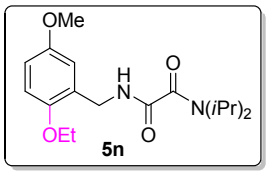
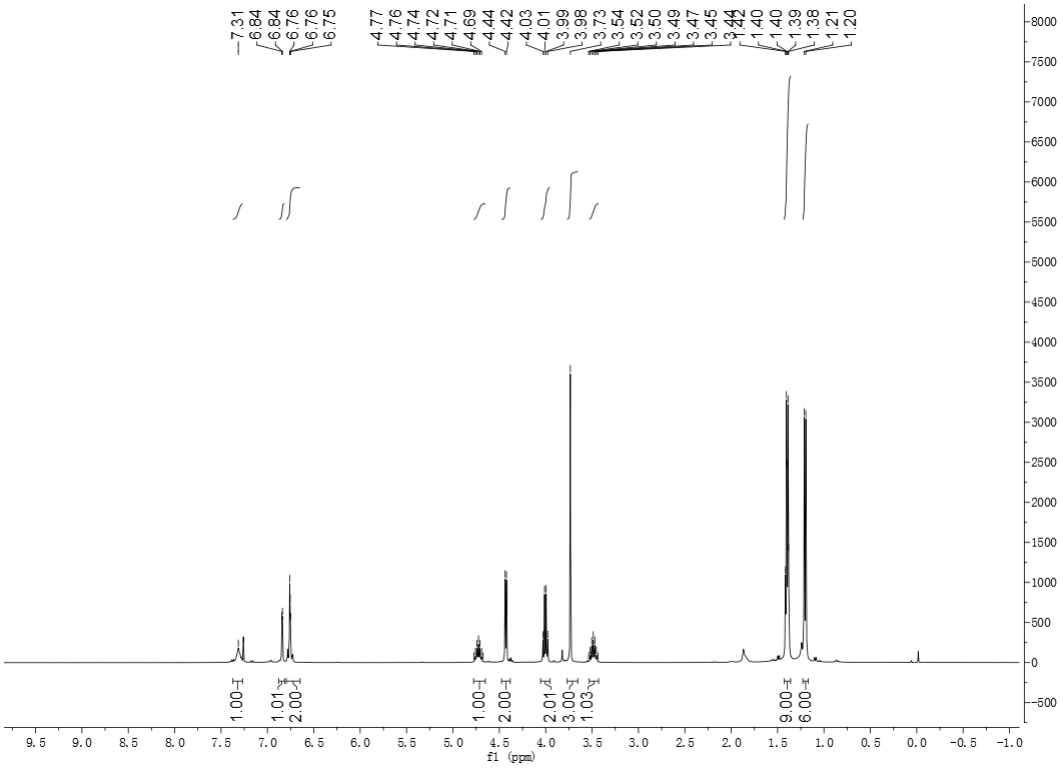
77.16
76.84
55.84
49.72
46.72
38.75
21.00
20.20
f1 (ppm)


OMe
H
N
O
O
N(iPr)2
OEt
5n


7.31
6.84
6.84
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6.76
6.75
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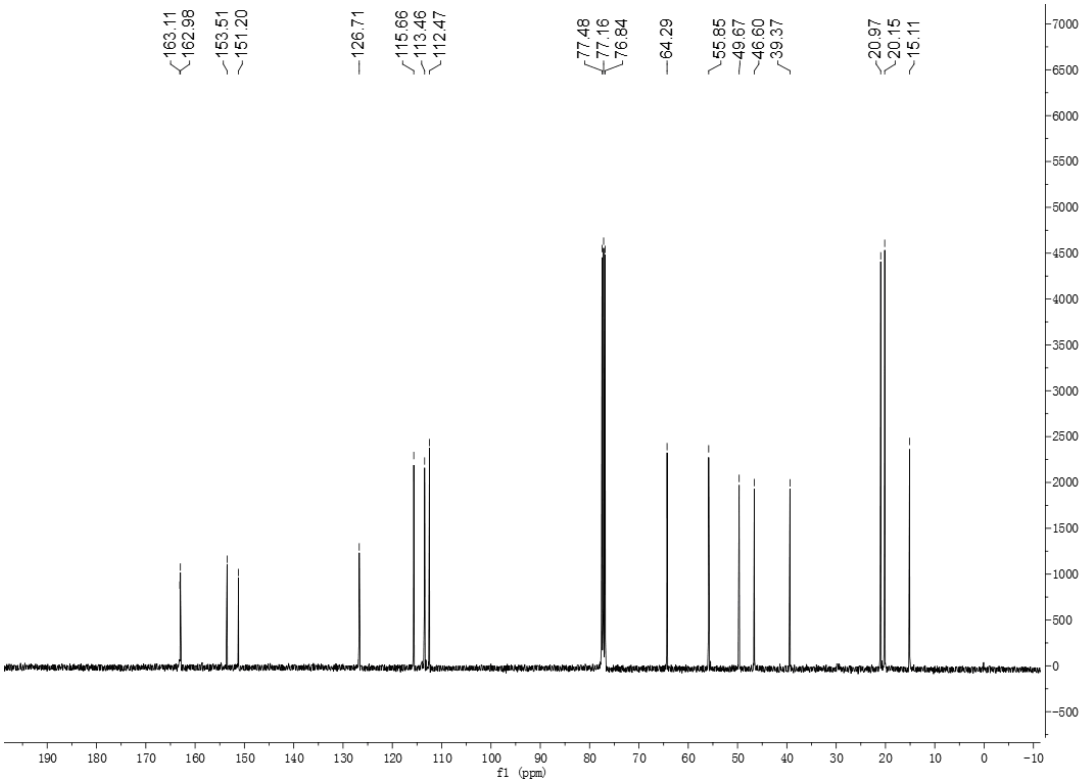
4.76
4.74
4.72
4.71
4.69
4.44
4.42
4.03
4.01
3.99
3.98
3.73
3.54
3.52
3.50
3.49
3.47
3.45
1.40
1.39
1.38
1.21
1.20
1.00
1.01
2.00
1.00
2.00
2.01
3.00
1.03
9.00
6.00
f1 (ppm)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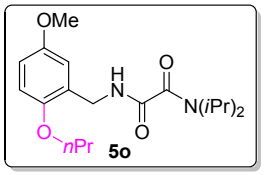
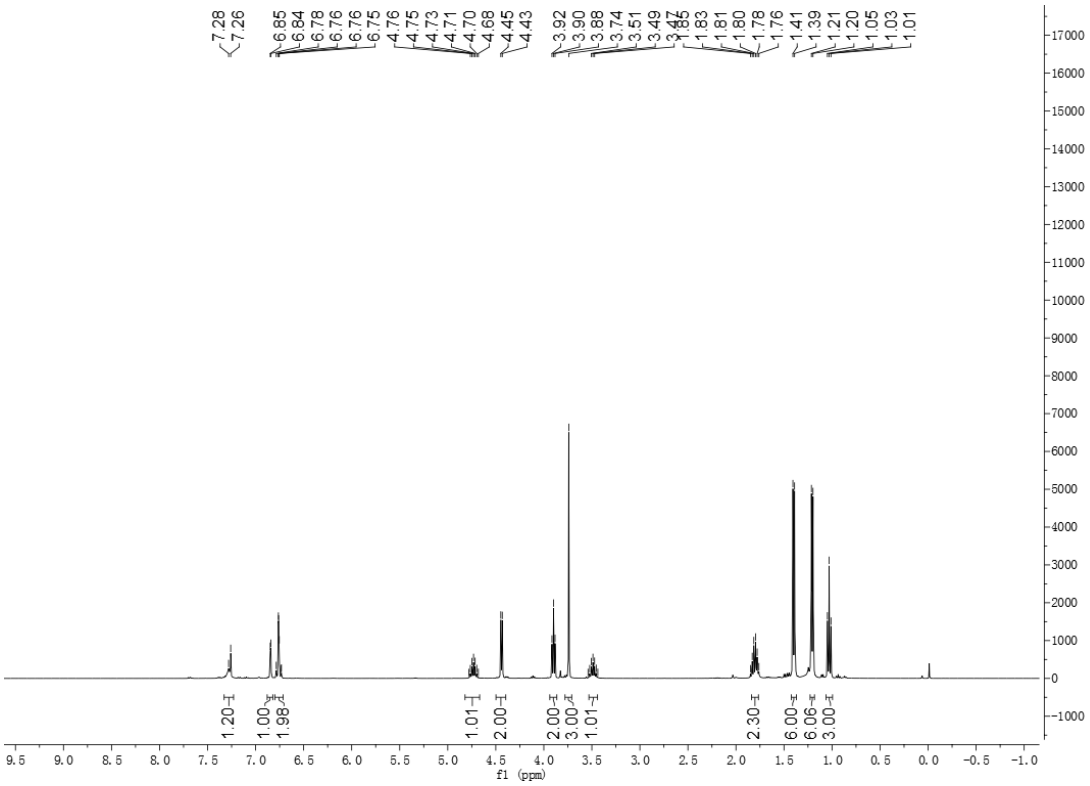
112.47
77.48
77.16
76.84
64.29
55.85
49.67
46.60
39.37
20.97
20.15
15.11
f1 (ppm)


OMe
H
N
O
N(iPr)2
O
O
nPr
5o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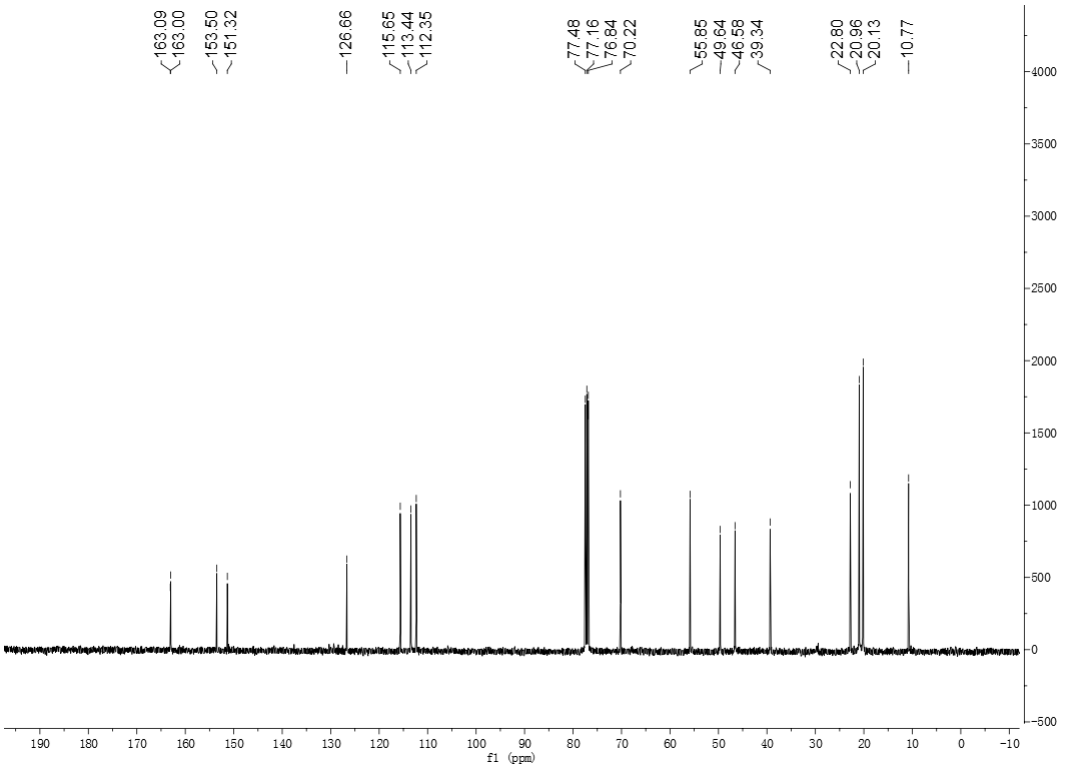
6.76
6.76
6.75
4.76
4.75
4.73
4.71
4.70
4.68
4.45
4.43
3.92
3.90
3.88
3.74
3.51
3.49
1.83
1.81
1.80
1.78
1.76
1.41
1.39
1.21
1.20
1.05
1.03
1.01
1.20
1.00
1.98
1.01
2.00
2.00
3.00
1.01
2.30
6.00
6.06
3.00
f1 (ppm)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113.44
112.35
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77.16
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55.85
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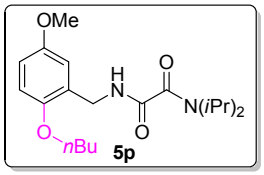
46.58
39.34
22.80
20.96
20.13
10.77
f1 (ppm)


OMe
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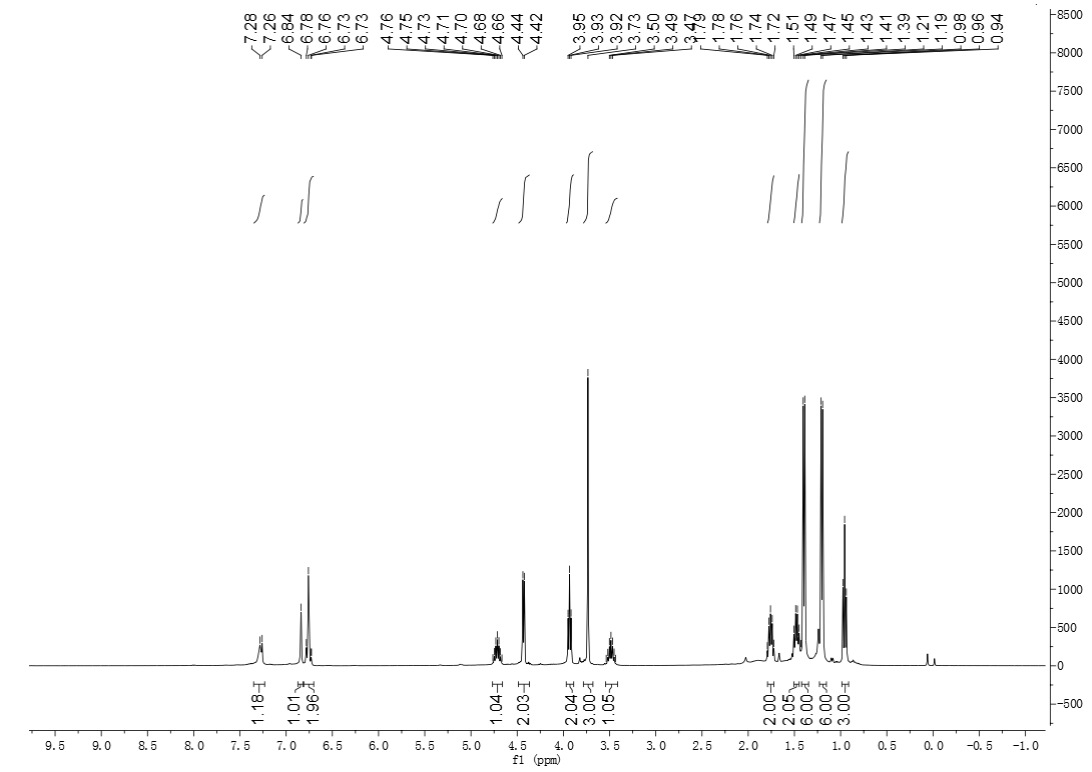
N
O
N(iPr)2
O
O
nBu
5p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4.75
4.73
4.71
4.70
4.68
4.66
4.44
4.42
3.95
3.93
3.92
3.73
3.50
3.49
3.47
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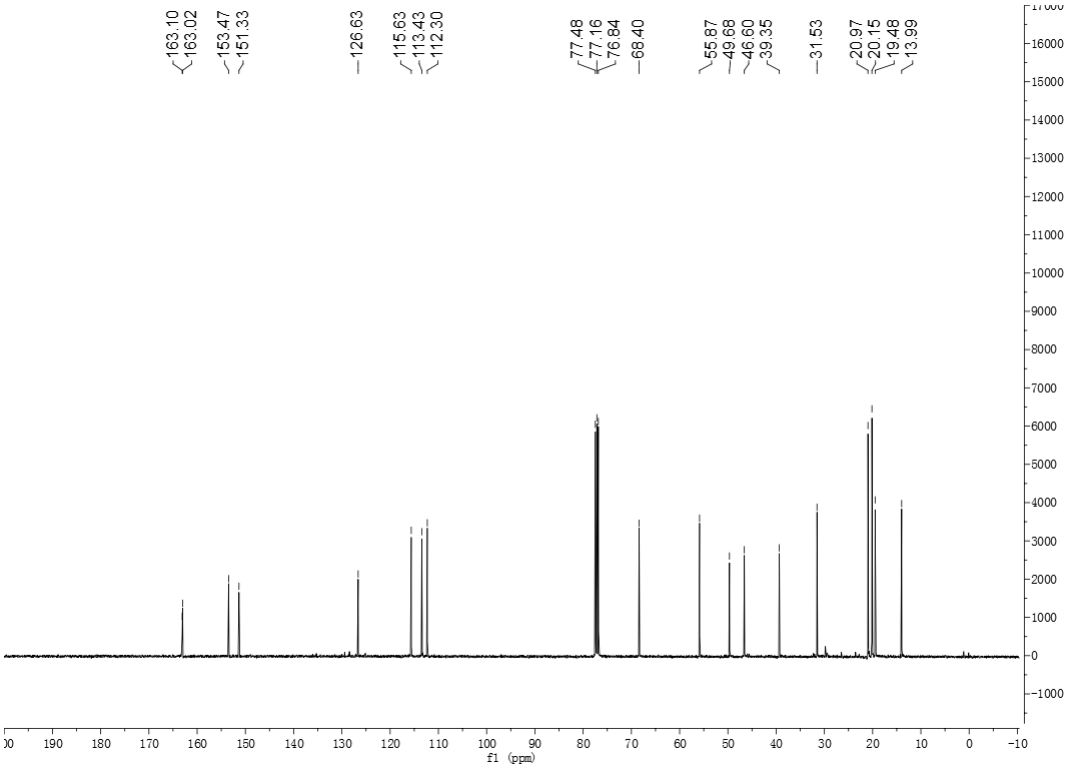
1.78
1.76
1.74
1.72
1.51
1.49
1.47
1.45
1.43
1.41
1.39
1.21
1.19
0.98
0.96
0.94
1.18
1.01
1.96
1.04
2.03
2.04
3.00
1.05
2.00
2.05
6.00
6.00
3.00
f1 (ppm)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77.16
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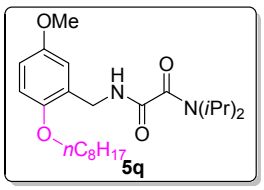
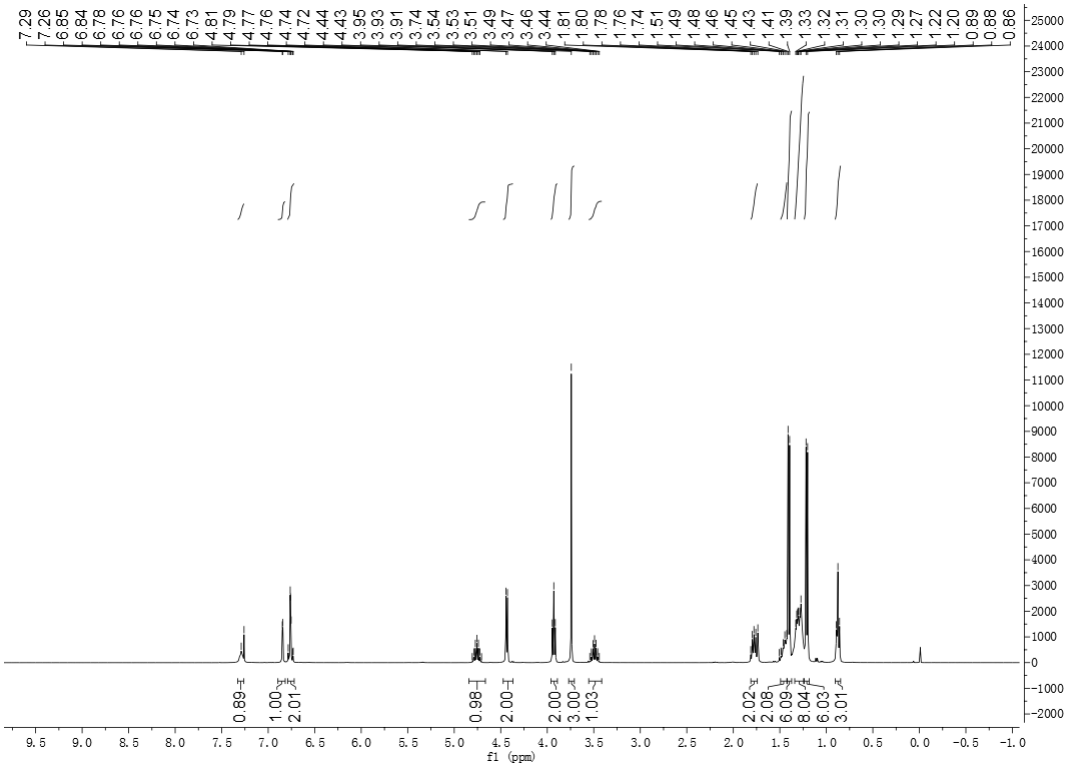
31.53
20.97
20.15
19.48
13.99
f1 (ppm)


OMe
H
N
O
O
N(iPr)2
O
nC8H17

5q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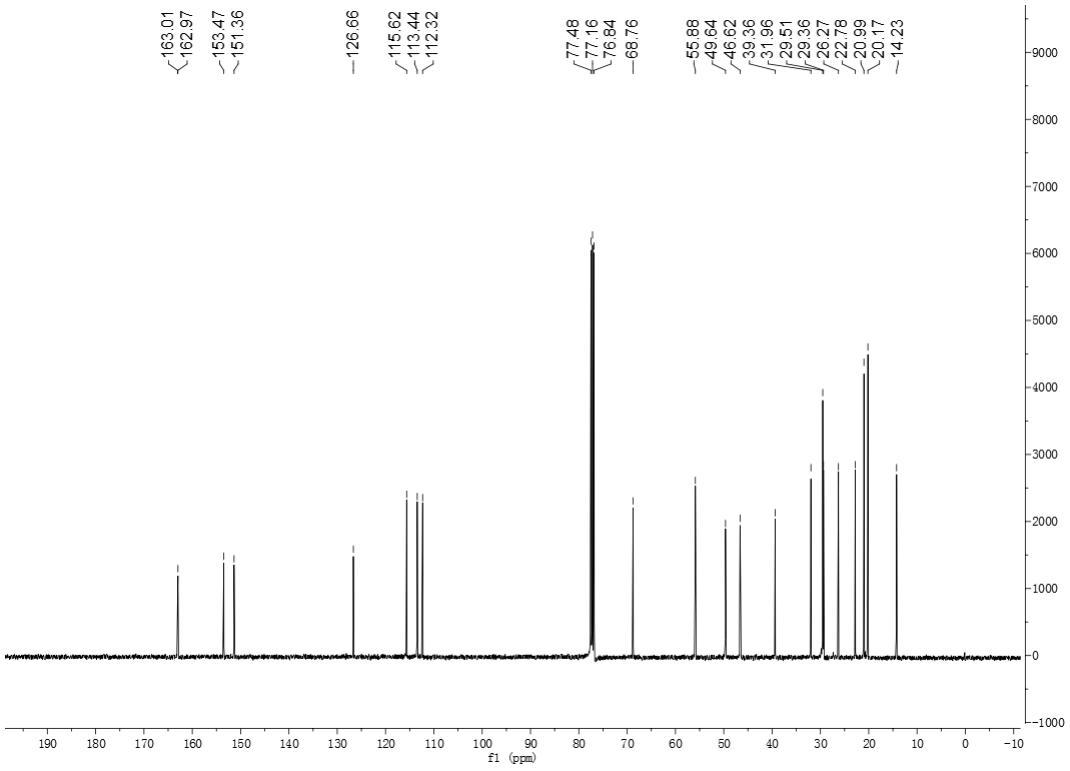
6.76
6.76
6.75
6.74
6.73
4.81
4.79
4.77
4.76
4.74
4.72
4.44
4.43
3.95
3.93
3.91
3.74
3.54
3.53
3.51
3.49
3.47
3.46
3.44
1.81
1.80
1.78
1.76
1.74
1.51
1.49
1.48
1.46
1.45
1.43
1.41
1.39
1.33
1.32
1.31
1.30
1.30
1.29
1.27
1.22
1.20
0.89
0.88
0.86
0.89
1.00
2.01
0.98
2.00
2.00
3.00
1.03
2.02
2.08
6.09
8.04
6.03
3.01
f1 (ppm)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115.62
113.44
112.32
77.48
77.16
76.84
68.76
55.88
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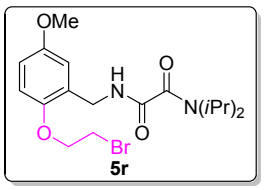
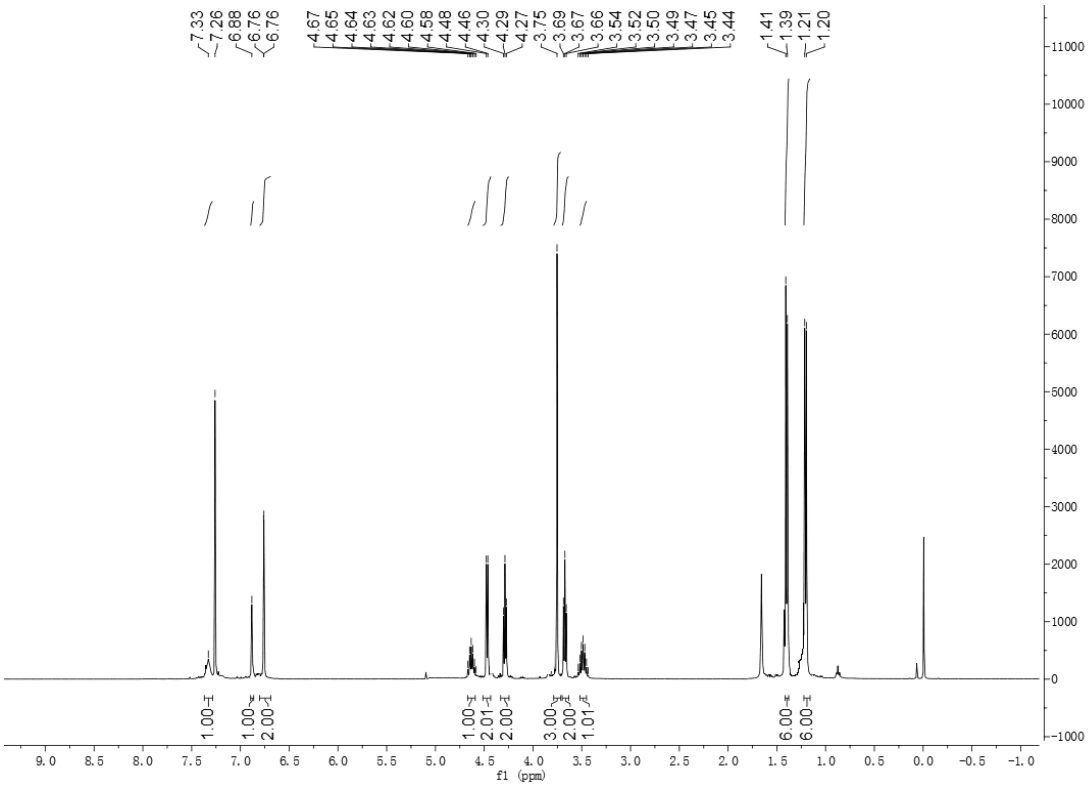
46.62
39.36
31.96
29.51
29.36
26.27
22.78
20.99
20.17
14.23
f1 (ppm)


OMe
H
N
O
N(iPr)2
O
O
Br

5r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7.26
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6.76
4.67
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4.64
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4.62
4.60
4.58
4.48
4.46
4.30
4.29
4.27
3.75
3.69
3.67
3.66
3.54
3.52
3.50
3.49
3.47
3.45
3.44
1.41
1.39
1.21
1.20
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1.00
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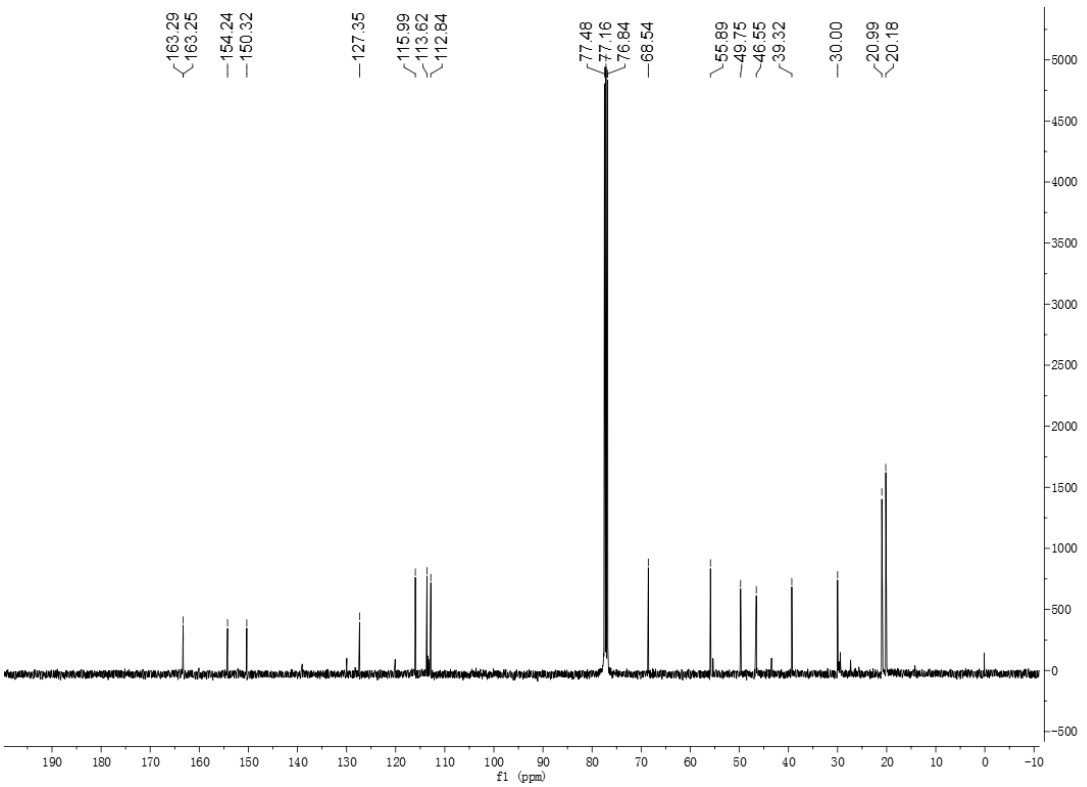
2.01
2.00
3.00
2.00
1.01
6.00
6.00
f1 (ppm)


163.29
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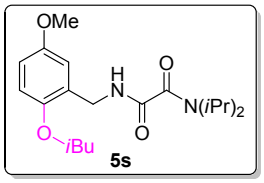
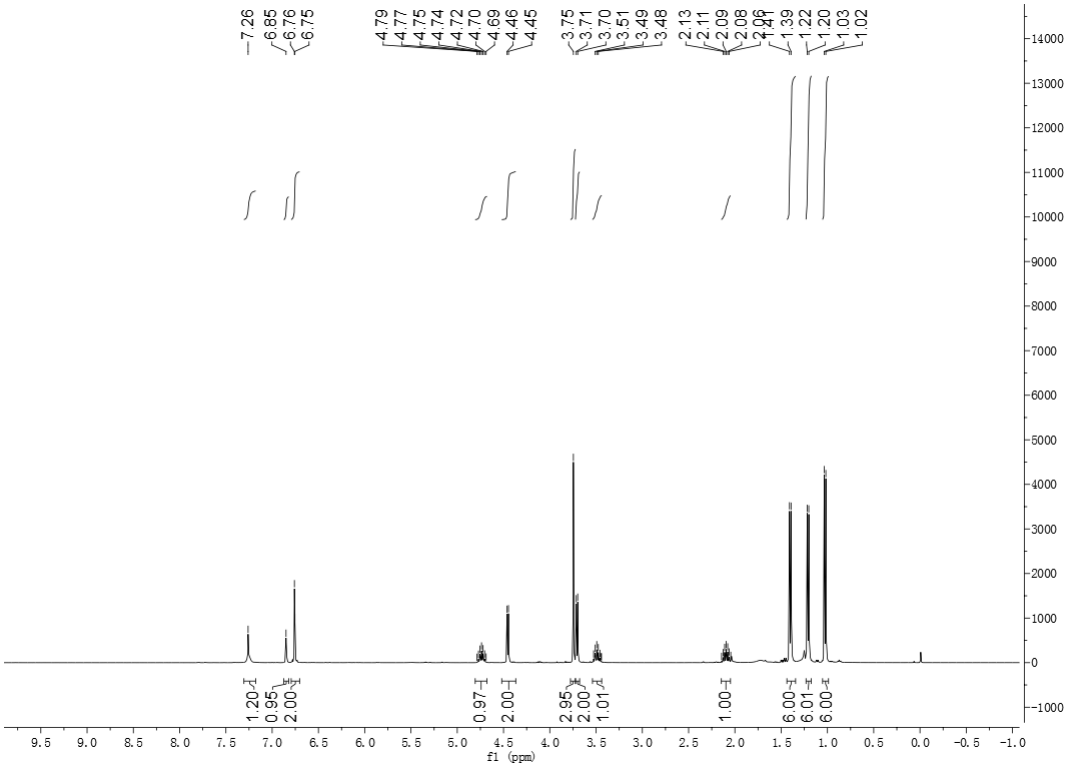
150.32
127.35
115.99
113.62
112.84
77.48
77.16
76.84
68.54
55.89
49.75
46.55
39.32
30.00
20.99
20.18
f1 (ppm)


OMe
H
N
O
N(iPr)2
O
O
iBu

5s


7.26
6.85
6.76
6.75
4.79
4.77
4.75
4.74
4.72
4.70
4.69
4.46
4.45
3.75
3.71
3.70
3.51
3.49
3.48
2.13
2.11
2.09
2.08
2.06
1.39
1.22
1.20
1.03
1.02
1.20
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2.00
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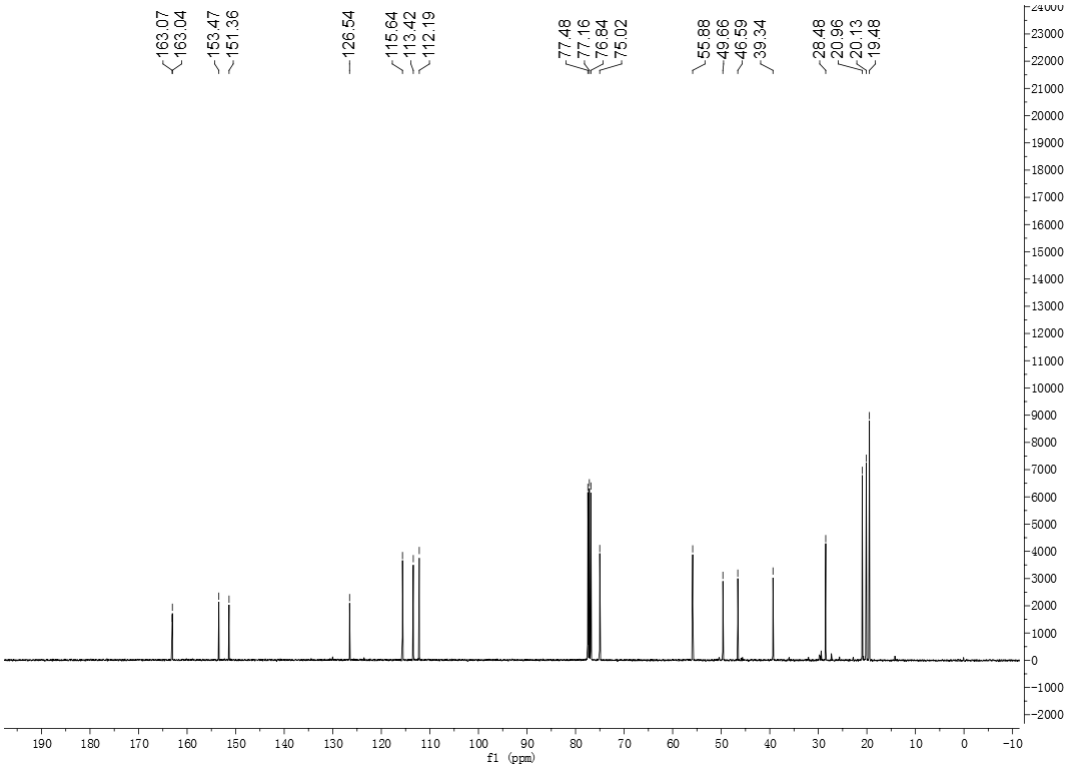
2.00
2.95
2.00
1.01
1.00
6.00
6.01
6.00
f1 (ppm)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151.36
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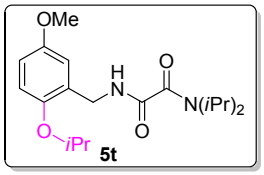
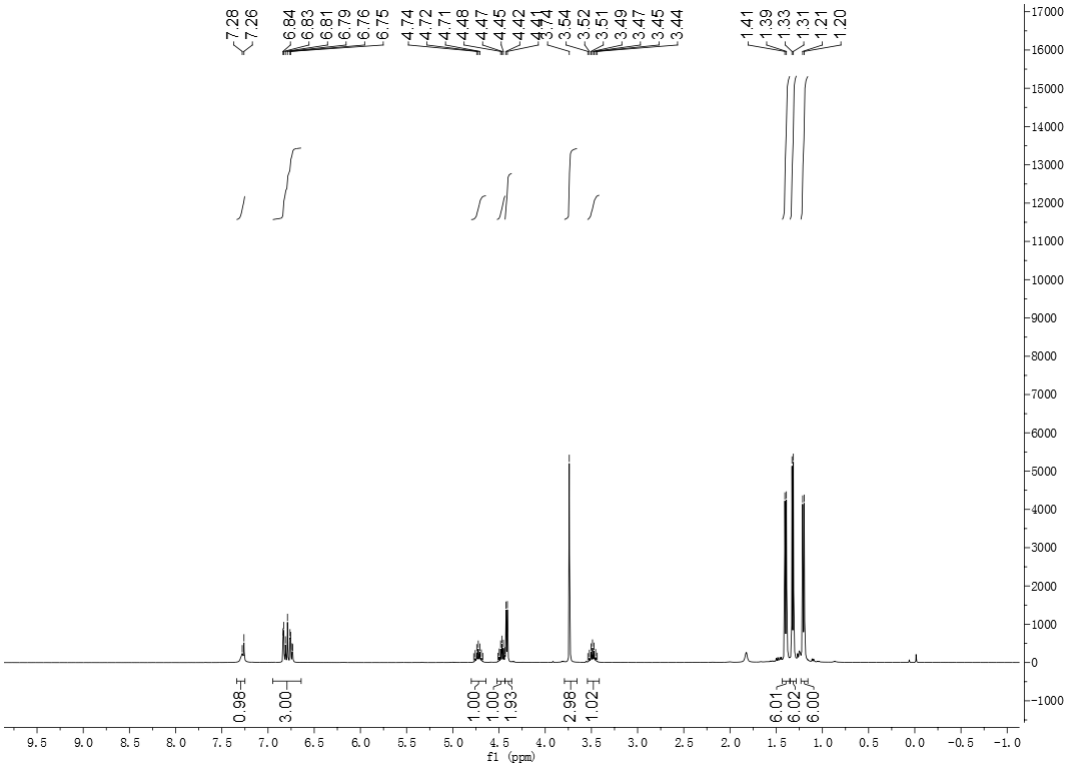
115.64
113.42
112.19
77.48
77.16
76.84
75.02
55.88
49.66
46.59
39.34
28.48
20.96
20.13
19.48
f1 (ppm)


OMe
H
N
O
N(iPr)2
O
O
iPr
5t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7.26
6.84
6.83
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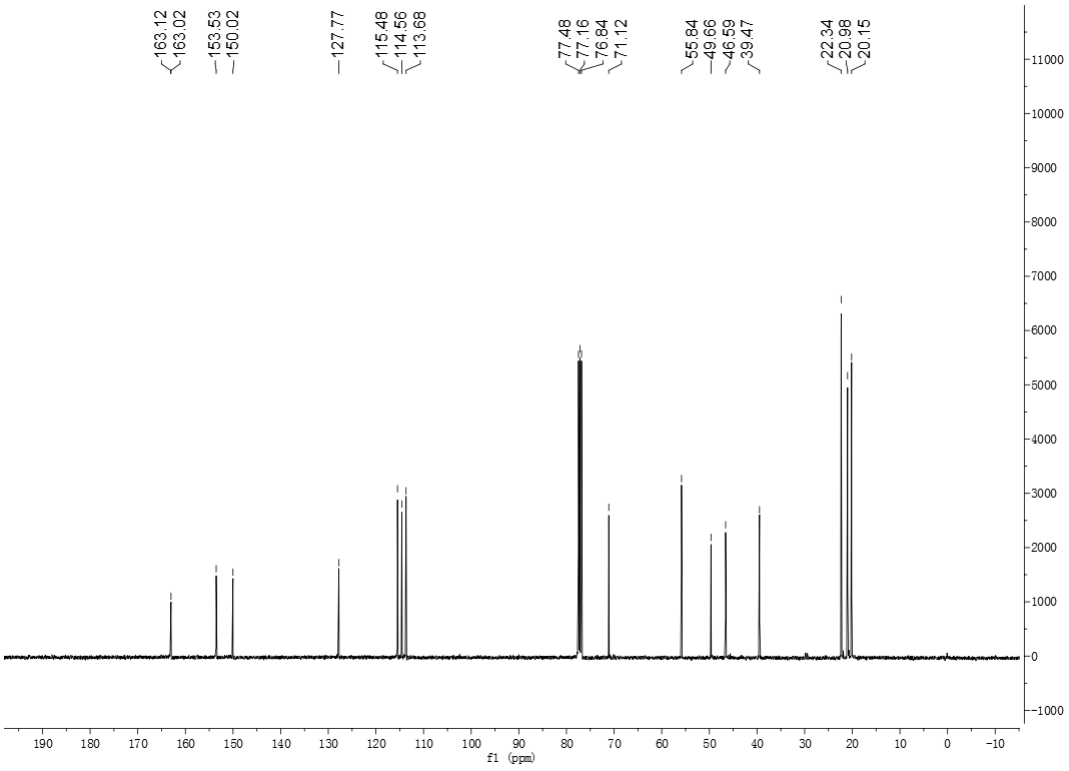
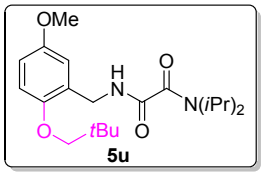
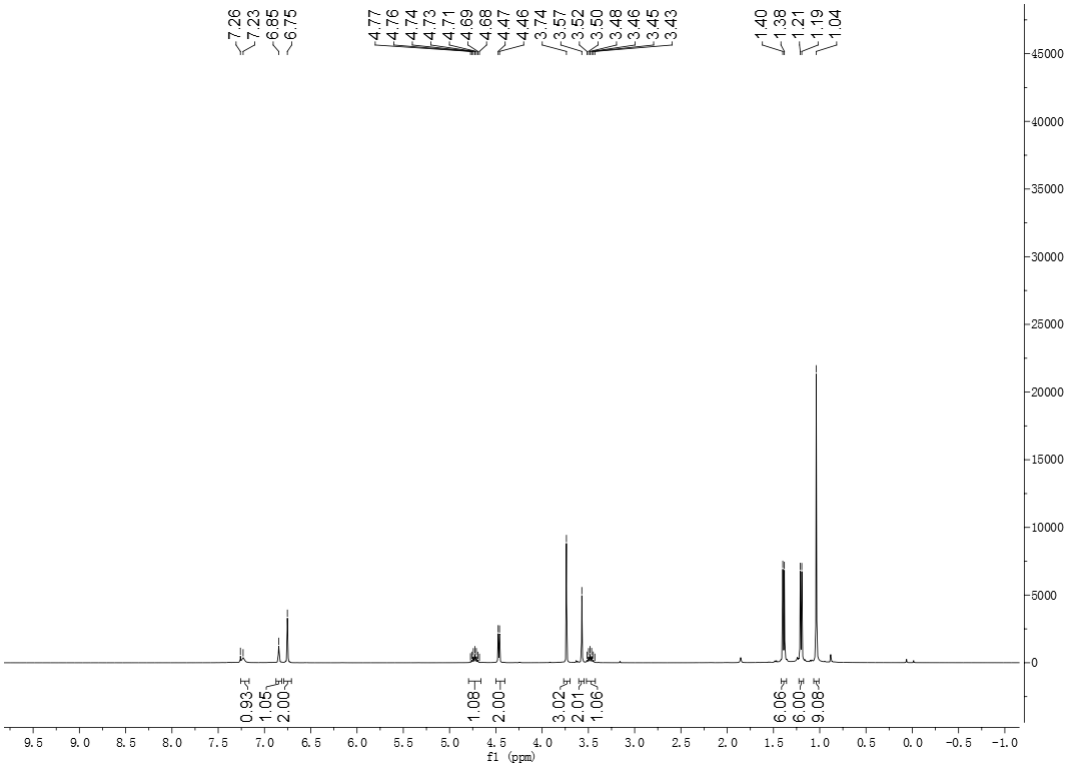
6.79
6.76
6.75
4.74
4.72
4.71
4.48
4.47
4.45
4.42
4.41
4.14
3.54
3.52
3.51
3.49
3.47
3.45
3.44
1.41
1.39
1.33
1.31
1.21
1.20
0.98
3.00
1.00
1.00
1.93
2.98
1.02
6.01
6.02
6.00
f1 (ppm)


163.12
163.02
153.53
150.02
127.77
115.48
114.56
113.68
77.48
77.16
76.84
71.12
55.84
49.66
46.59
39.47
22.34
20.98
20.15
f1 (ppm)


OMe
H
N
O
N(iPr)2
O
O
tBu
5u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7.23
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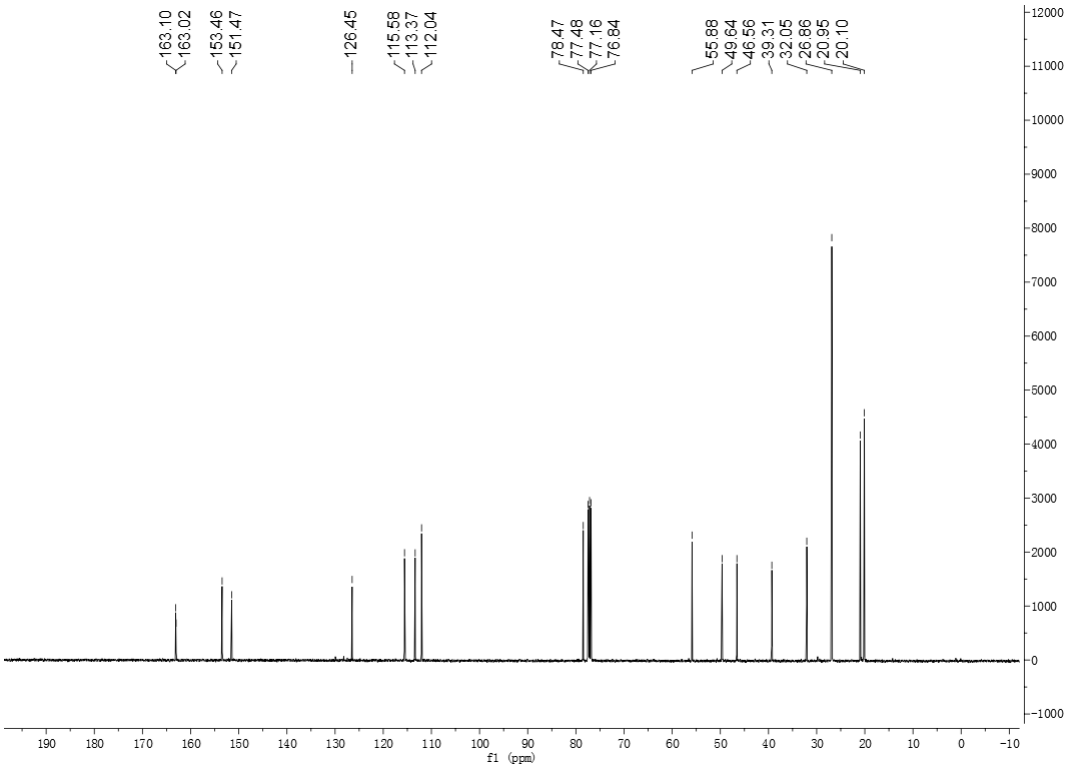
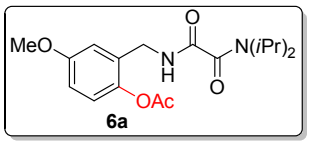
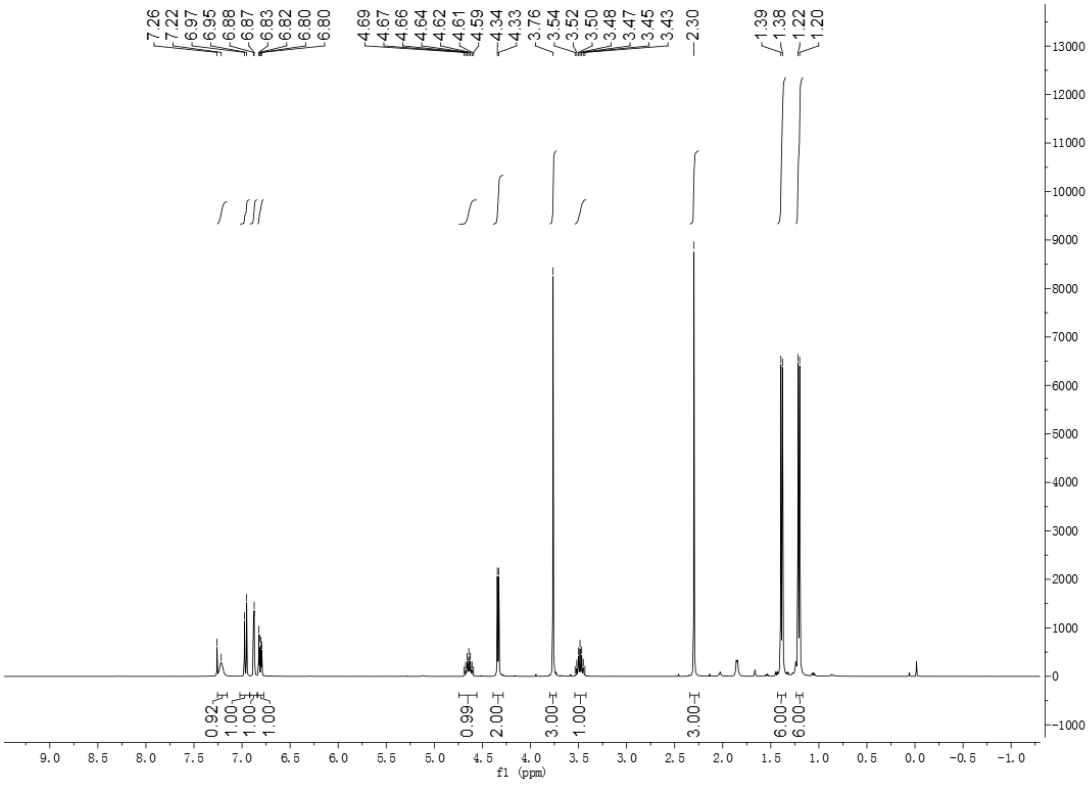
6.75
4.77
4.76
4.74
4.73
4.71
4.69
4.68
4.47
4.46
3.74
3.57
3.52
3.50
3.48
3.46
3.45
3.43
1.40
1.38
1.21
1.19
1.04
0.93
1.05
2.00
1.08
2.00
3.02
2.01
1.06
6.06
6.00
9.08
f1 (ppm)


163.10
163.02
153.46
151.47
126.45
115.58
113.37
112.04
78.47
77.48
77.16
76.84
55.88
49.64
46.56
39.31
32.05
26.86
20.95
20.10
f1 (ppm)


MeO
N
H
O
O
N(iPr)2
OAc

6a


7.26
7.22
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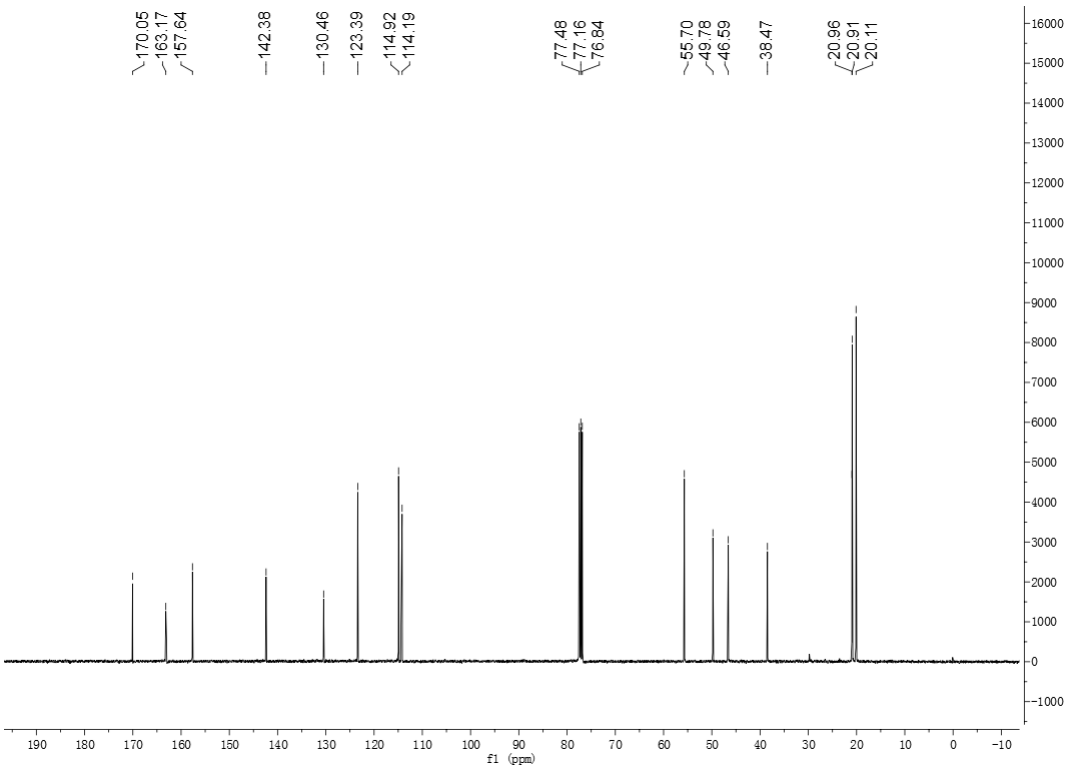
6.87
6.83
6.82
6.80
6.80
4.69
4.67
4.66
4.64
4.62
4.61
4.59
4.34
4.33
3.76
3.54
3.52
3.50
3.48
3.47
3.45
3.43
2.30
1.39
1.38
1.22
1.20
0.92
1.00
1.00
1.00
0.99
2.00
3.00
1.00
3.00
6.00
6.00
f1 (ppm)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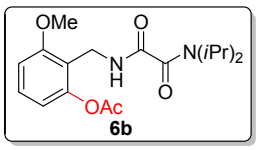
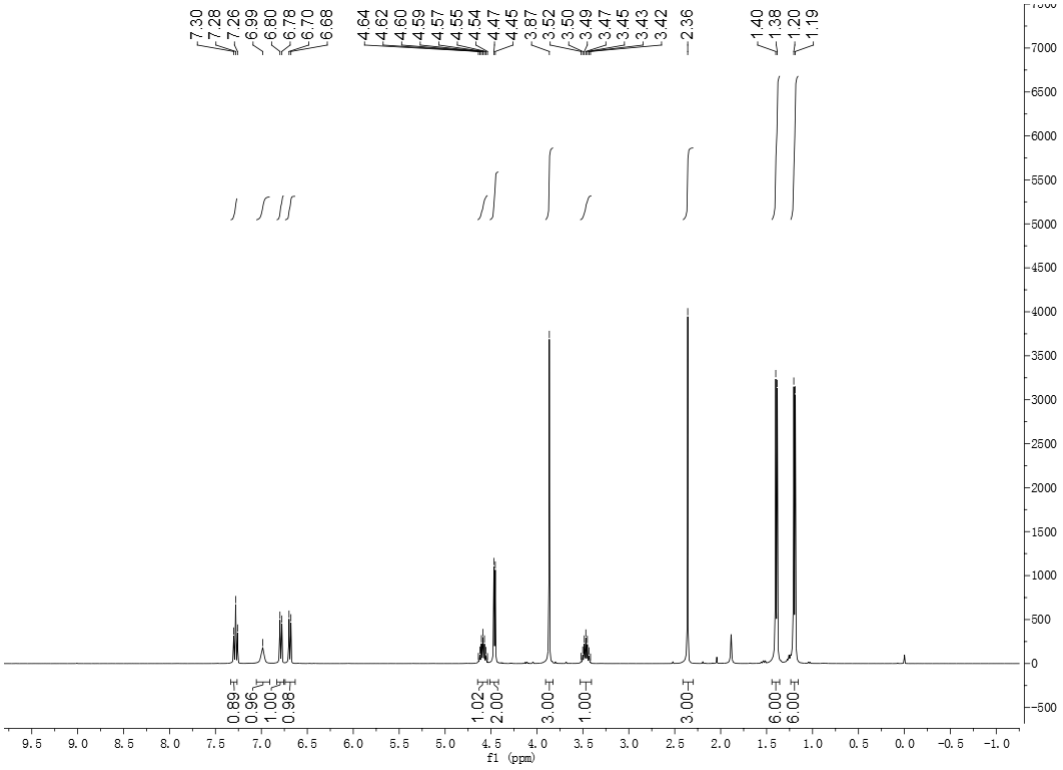
157.64
142.38
130.46
123.39
114.92
114.19
77.48
77.16
76.84
55.70
49.78
46.59
38.47
20.96
20.91
20.11
f1 (ppm)


OMe
O
N(iPr)2
N
H
O
OAc
6b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7.28
7.26
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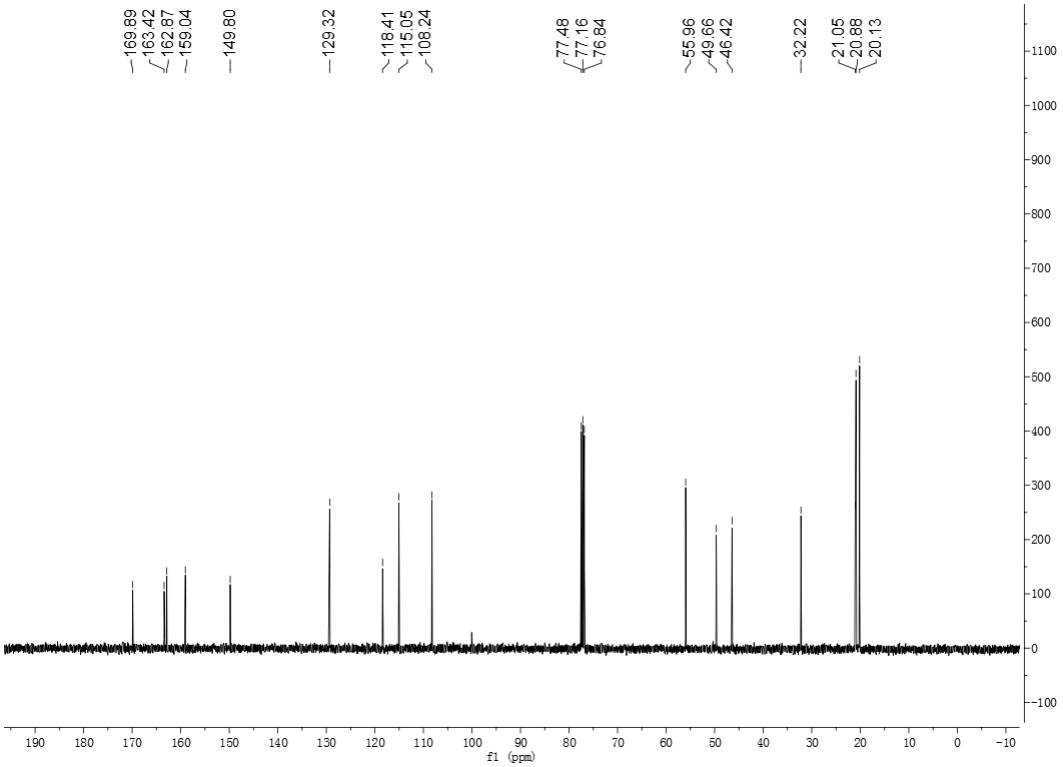
6.78
6.70
6.68
4.64
4.62
4.60
4.59
4.57
4.55
4.54
4.47
4.45
3.87
3.52
3.50
3.49
3.47
3.45
3.43
3.42
2.36
1.40
1.38
1.20
1.19
0.89
0.96
1.00
0.98
1.02
2.00
3.00
1.00
3.00
6.00
6.00
f1 (ppm)


169.89
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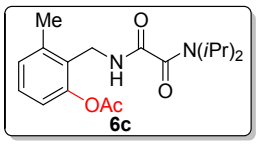
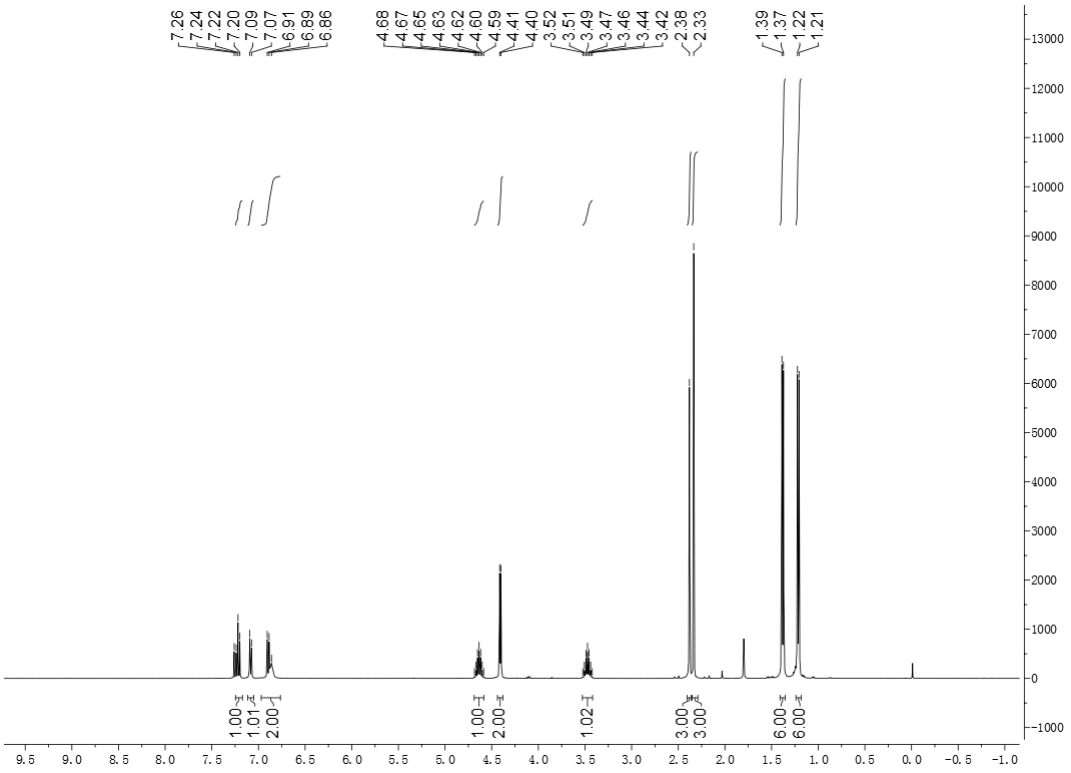
159.04
149.80
129.32
118.41
115.05
108.24
77.48
77.16
76.84
55.96
49.66
46.42
32.22
21.05
20.88
20.13
f1 (ppm)


Me
O
N(iPr)2
N
H
O
OAc
6c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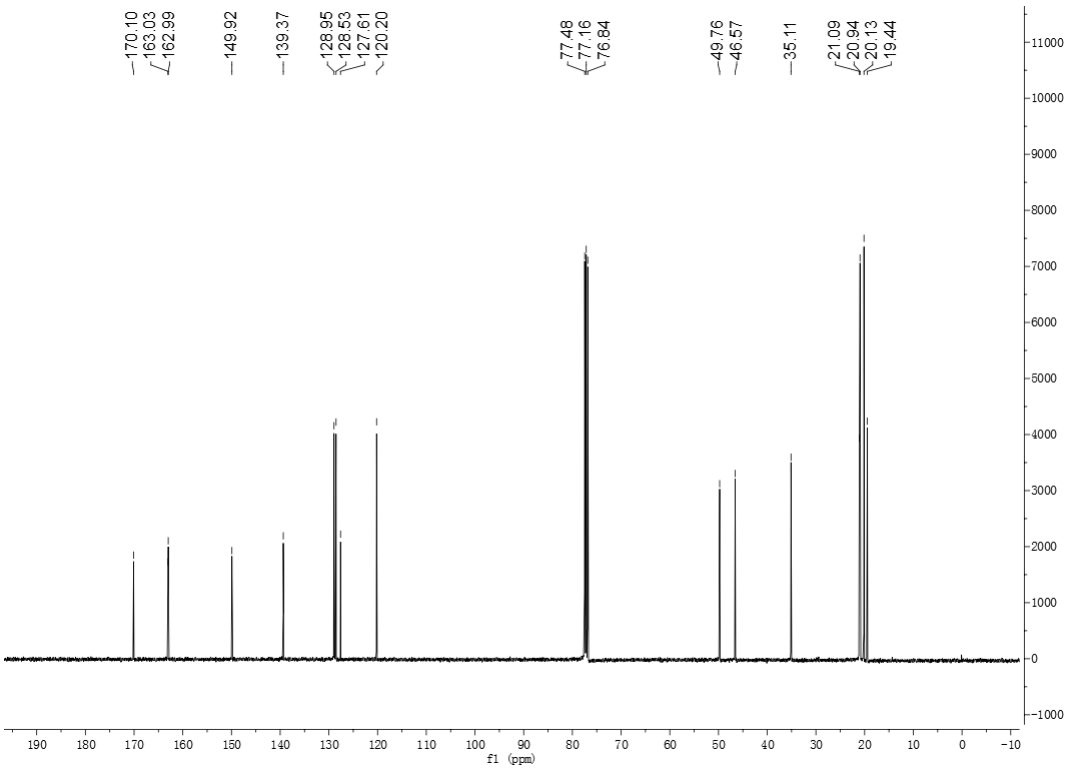
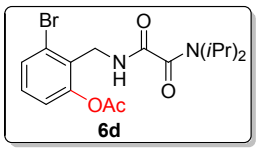
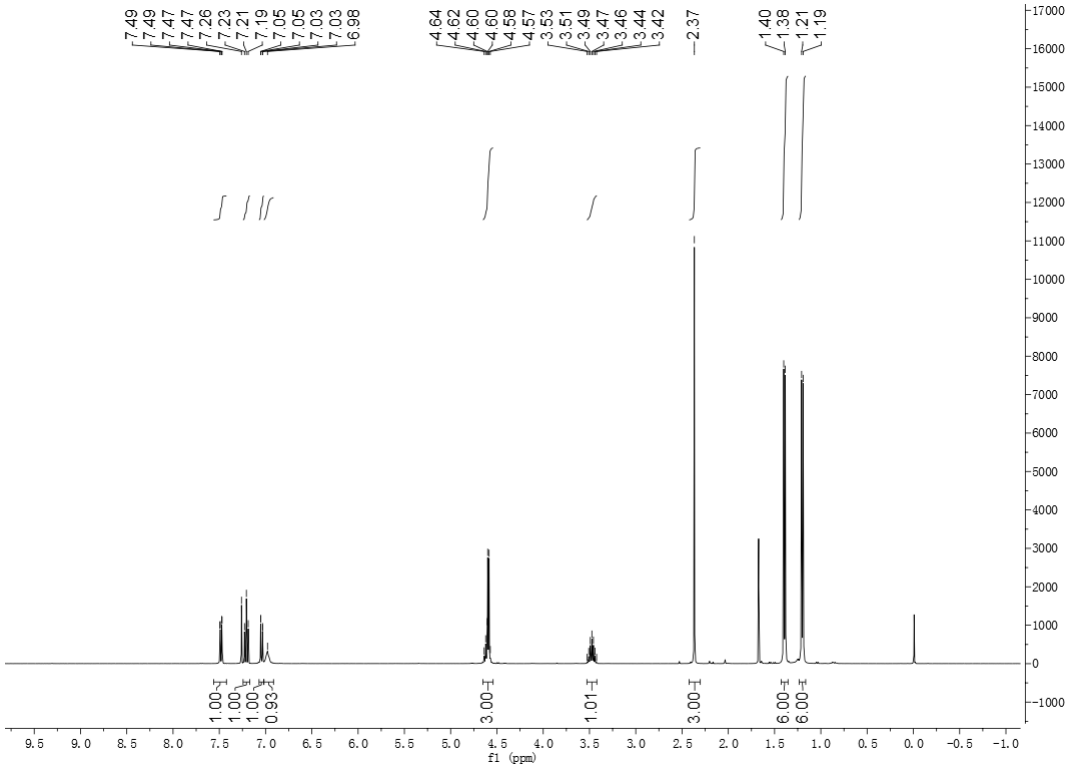
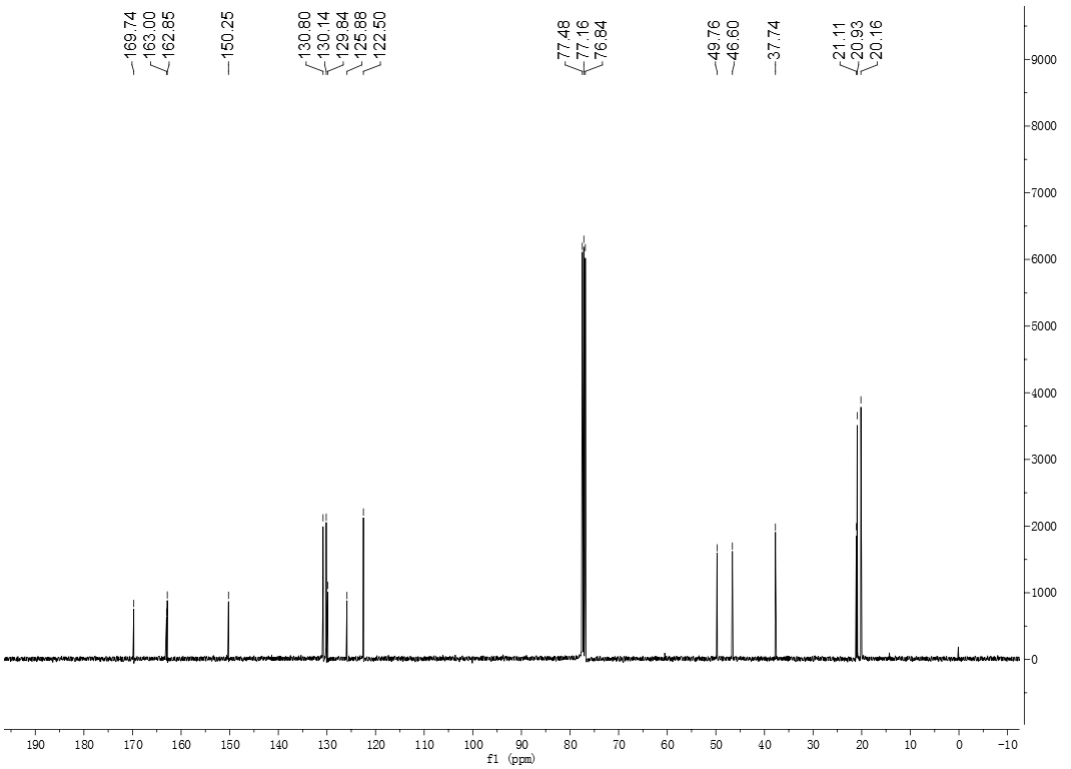
7.24
7.22
7.20
7.09
7.07
6.91
6.89
6.86
4.68
4.67
4.65
4.63
4.62
4.60
4.59
4.41
4.40
3.52
3.51
3.49
3.47
3.46
3.44
3.42
2.38
2.33
1.39
1.37
1.22
1.21
1.00
1.01
2.00
1.00
2.00
1.02
3.00
3.00
6.00
6.00


170.10
163.03
162.99
149.92
139.37
128.95
128.53
127.61
120.20
77.48
77.16
76.84
49.76
46.57
35.11
21.09
20.94
20.13
19.44
f1 (ppm)


Br
O
N(iPr)2
N
H
O
OAc

6d


7.49
7.49
7.47
7.47
7.26
7.23
7.21
7.19
7.05
7.05
7.03
7.03
6.98
4.64
4.62
4.60
4.60
4.58
4.57
3.53
3.51
3.49
3.47
3.46
3.44
3.42
2.37
1.40
1.38
1.21
1.19
1.00
1.00
1.00
0.93
3.00
1.01
3.00
6.00
6.00
f1 (ppm)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122.50
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77.16
76.84
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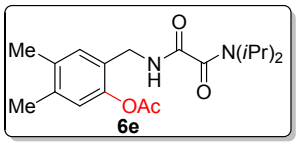
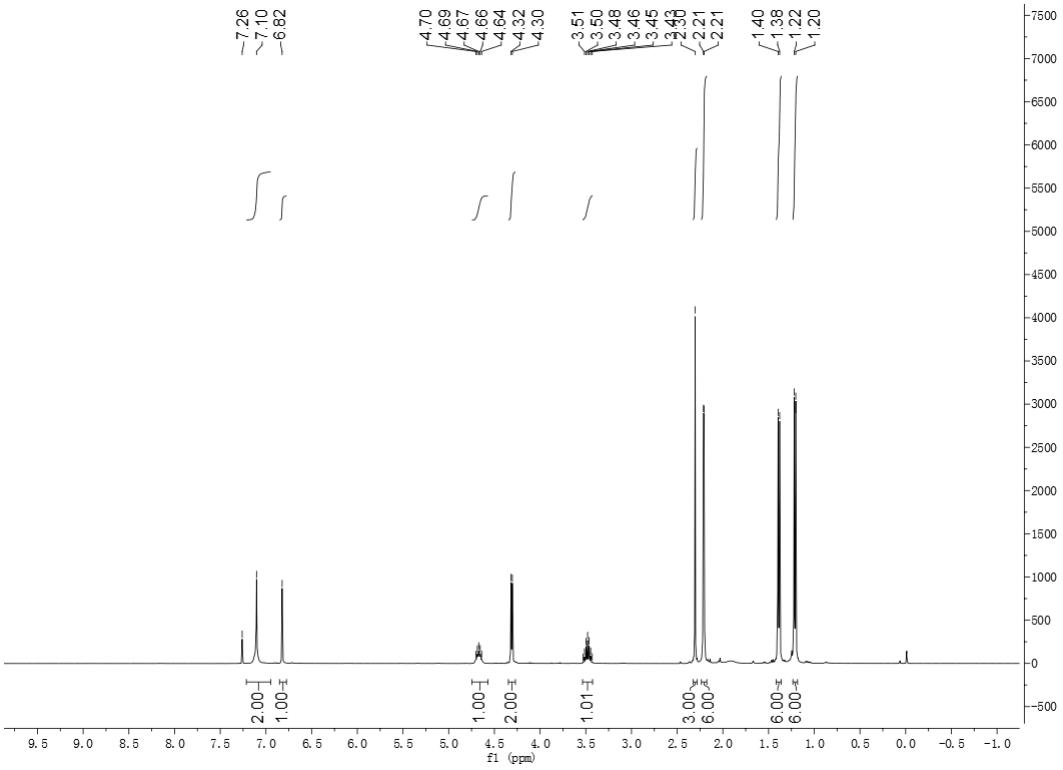
37.74
21.11
20.93
20.16
f1 (ppm)


Me
Me
OAc
N
H
O
O
N(iPr)2

6e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7.10
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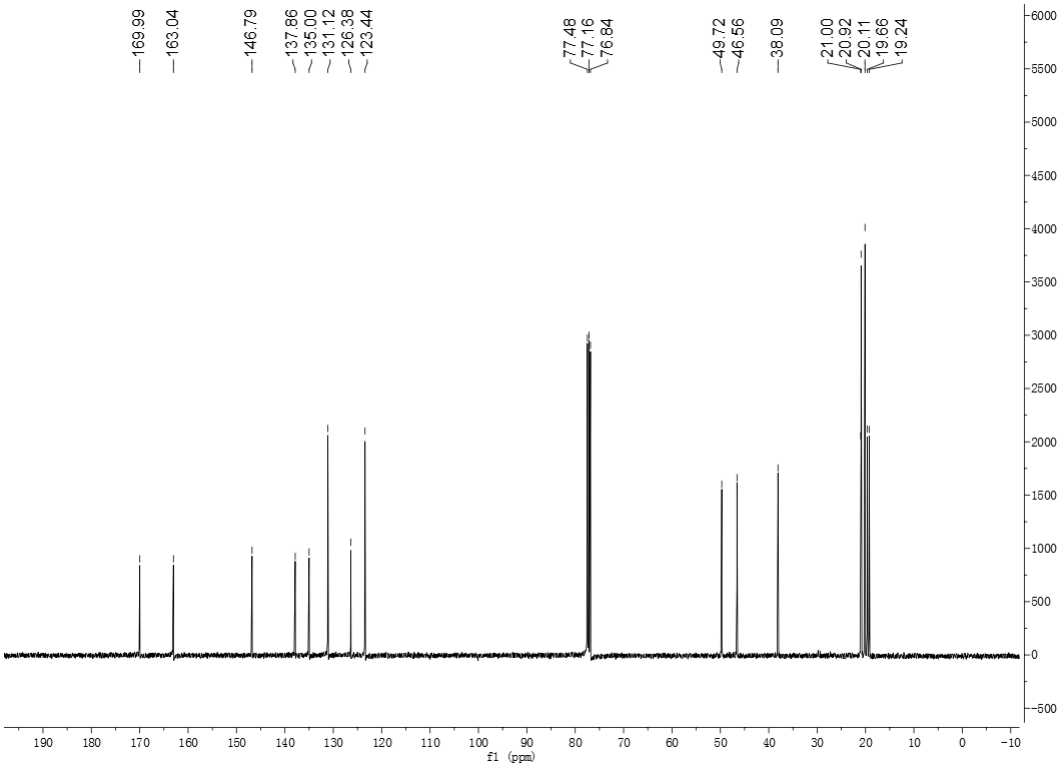
4.70
4.69
4.67
4.66
4.64
4.32
4.30
3.51
3.50
3.48
3.46
3.45
3.43
2.30
2.21
2.21
1.40
1.38
1.22
1.20
2.00
1.00
1.00
2.00
1.01
3.00
6.00
6.00
6.00
f1 (ppm)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137.86
135.00
131.12
126.38
123.44
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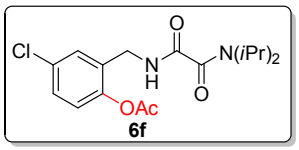
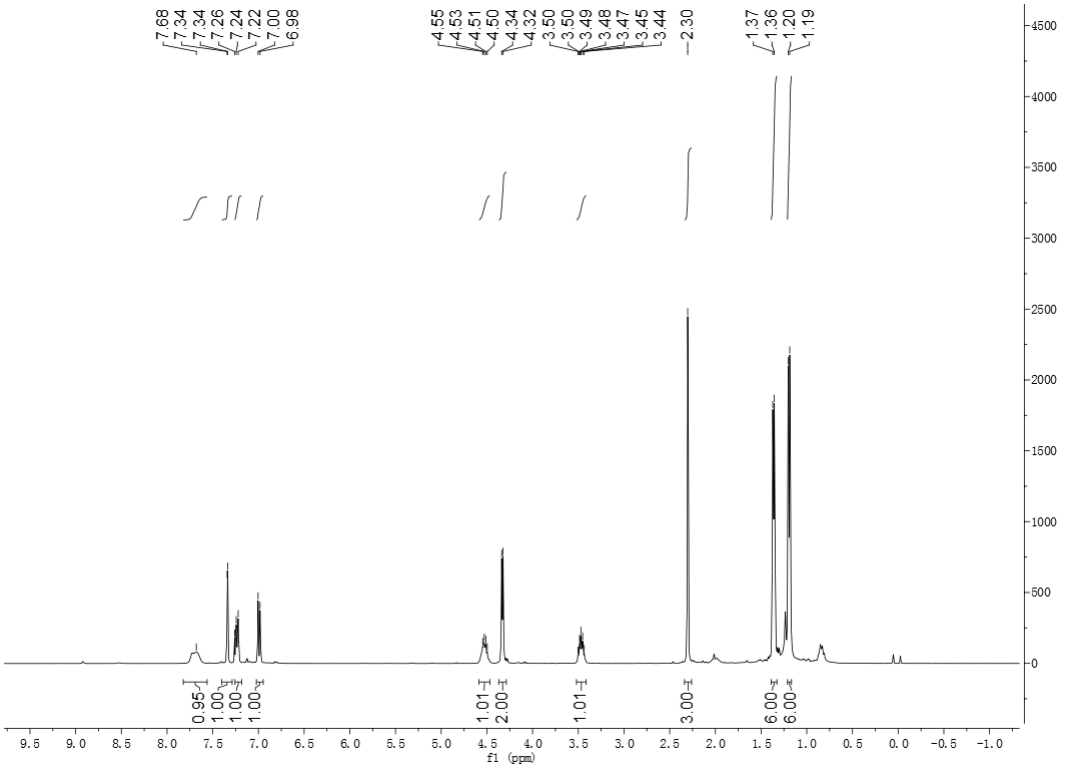
77.16
76.84
49.72
46.56
38.09
21.00
20.92
20.11
19.66
19.24
f1 (ppm)


Cl
O
N
H
O
N(iPr)2
OAc

6f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7.34
7.34
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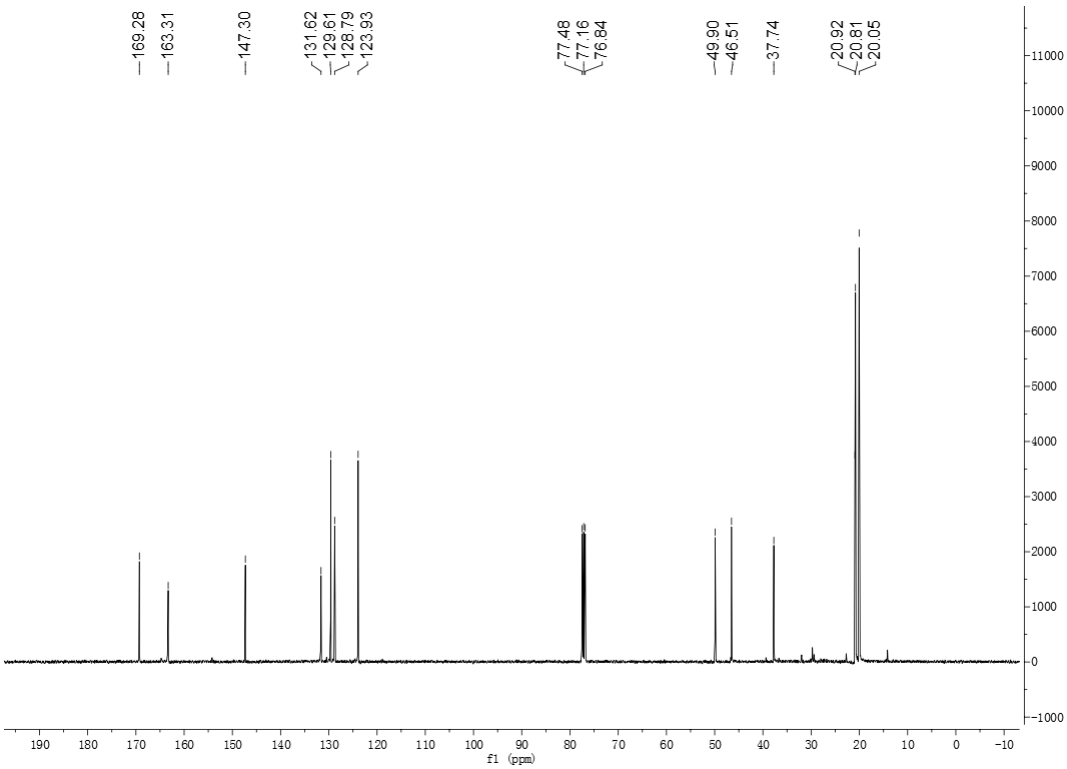
7.22
7.00
6.98
4.55
4.53
4.51
4.50
4.34
4.32
3.50
3.50
3.49
3.48
3.47
3.45
3.44
2.30
1.37
1.36
1.20
1.19
0.95
1.00
1.00
1.00
1.01
2.00
1.01
3.00
6.00
6.00
f1 (ppm)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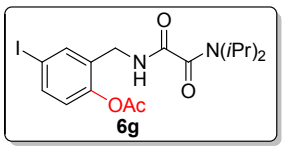
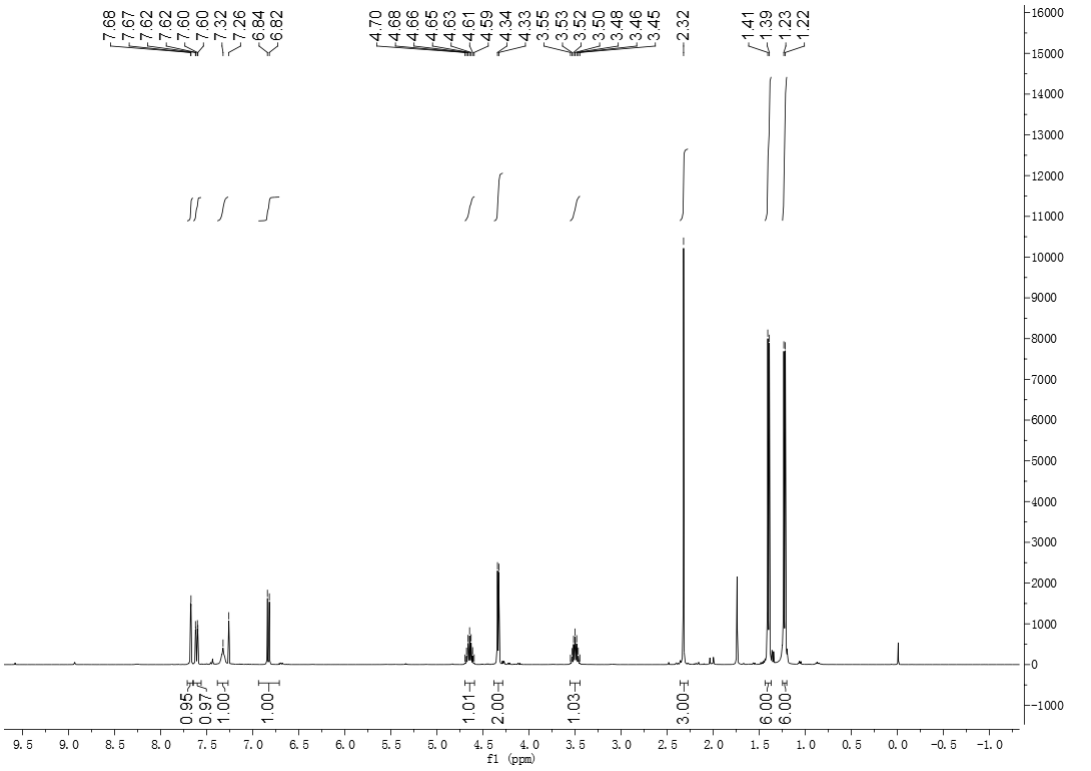
77.16
76.84
49.90
46.51
37.74
20.92
20.81
20.05
f1 (ppm)


I
O
N
H
N(iPr)2
O
OAc

6g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7.62
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7.60
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7.26
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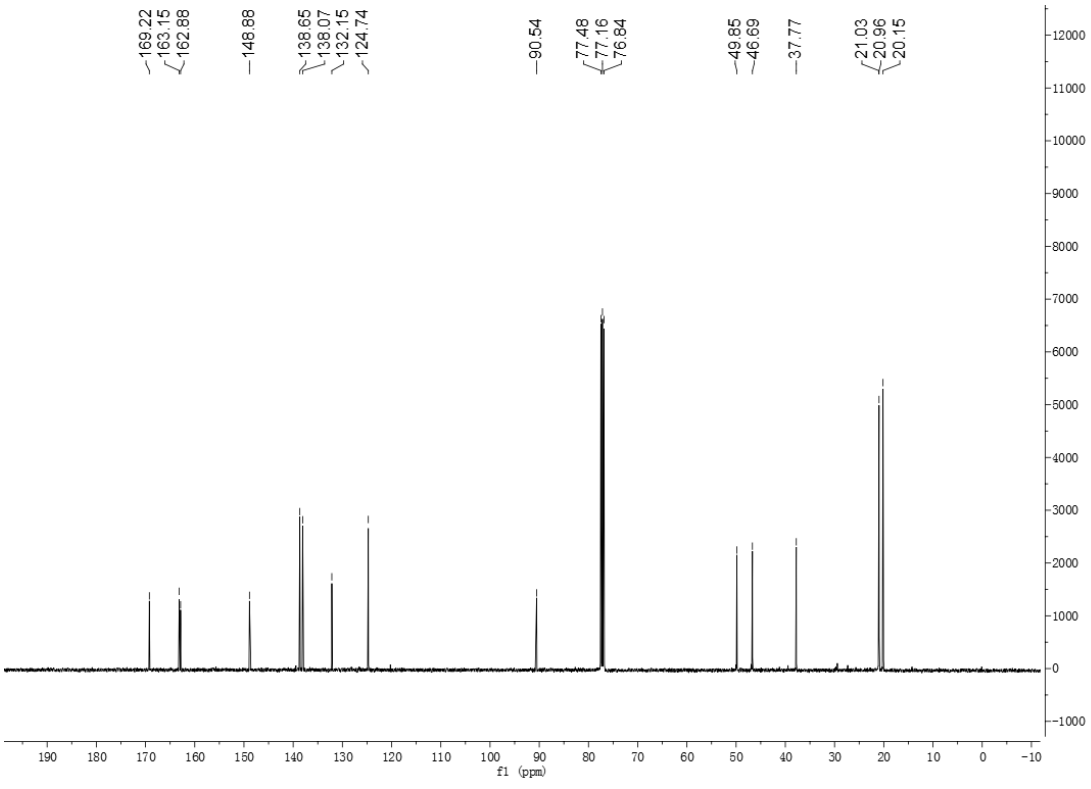
6.82
4.70
4.68
4.66
4.65
4.63
4.61
4.59
4.34
4.33
3.55
3.53
3.52
3.50
3.48
3.46
3.45
2.32
1.41
1.39
1.23
1.22
0.95
0.97
1.00
1.00
1.01
2.00
1.03
3.00
6.00
6.00
f1 (ppm)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148.88
138.65
138.07
132.15
124.74
90.54
77.48
77.16
76.84
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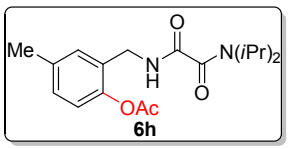
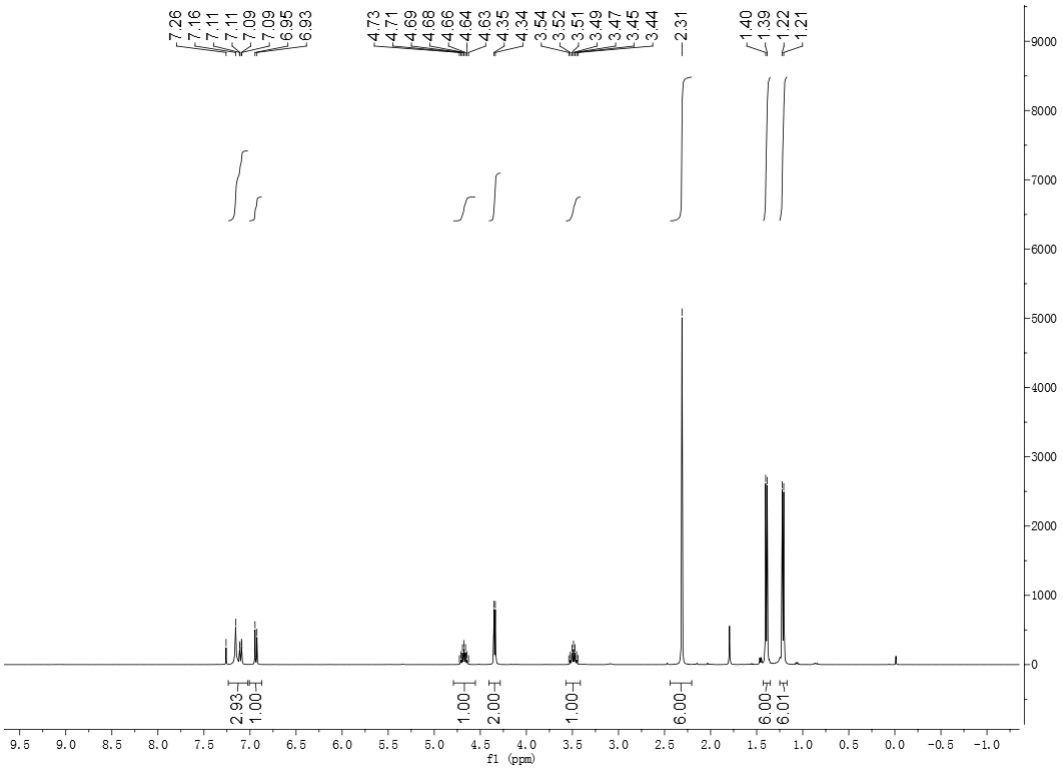
37.77
21.03
20.96
20.15
f1 (ppm)


Me
O
N
H
O
N(iPr)2
OAc

6h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7.16
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7.11
7.09
7.09
6.95
6.93
4.73
4.71
4.69
4.68
4.66
4.64
4.63
4.35
4.34
3.54
3.52
3.51
3.49
3.47
3.45
3.44
2.31
1.40
1.39
1.22
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2.93
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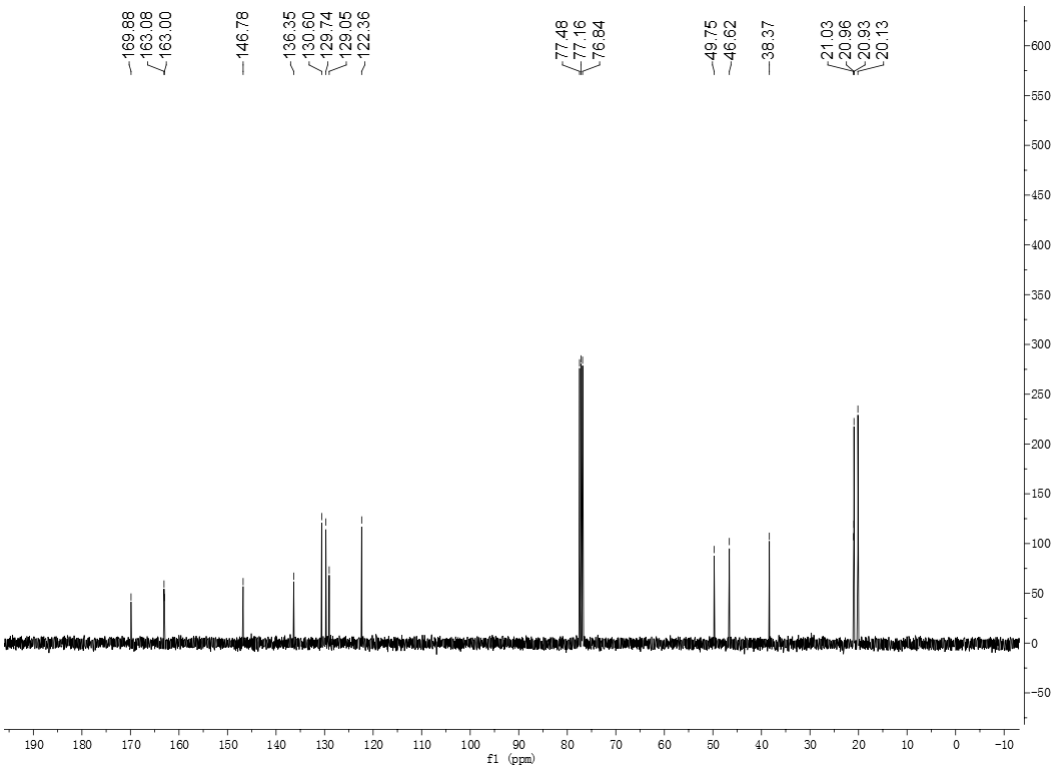
2.00
1.00
6.00
6.00
6.01
f1 (ppm)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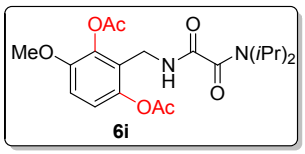
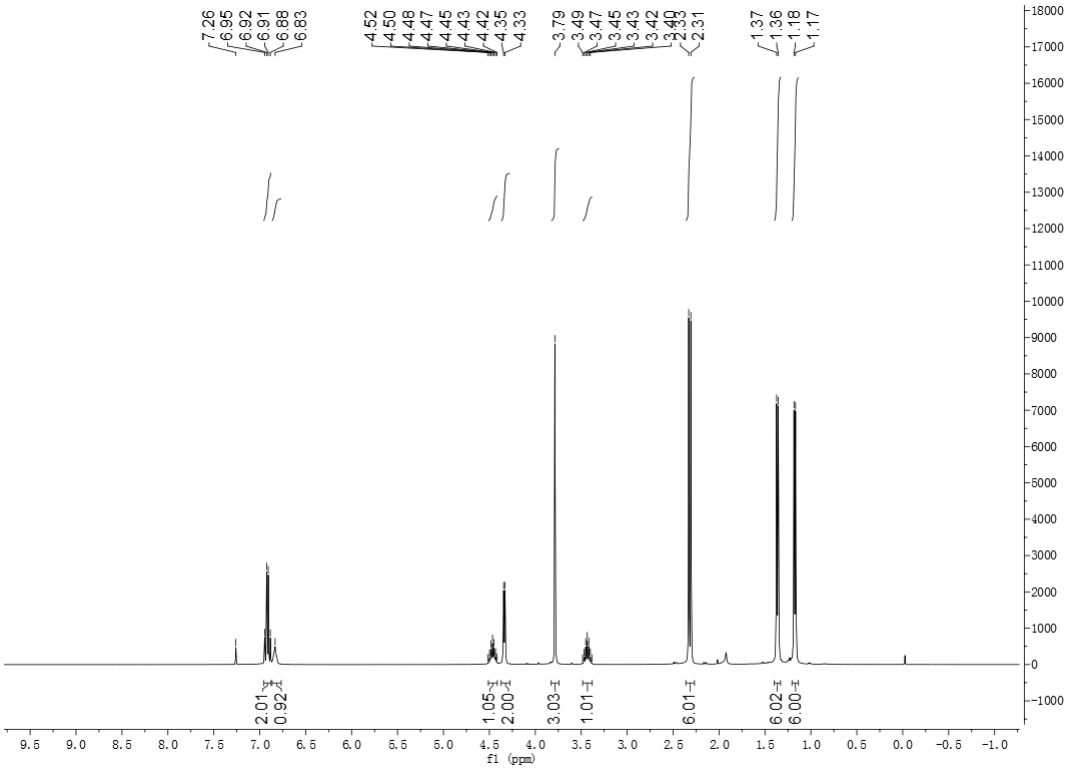
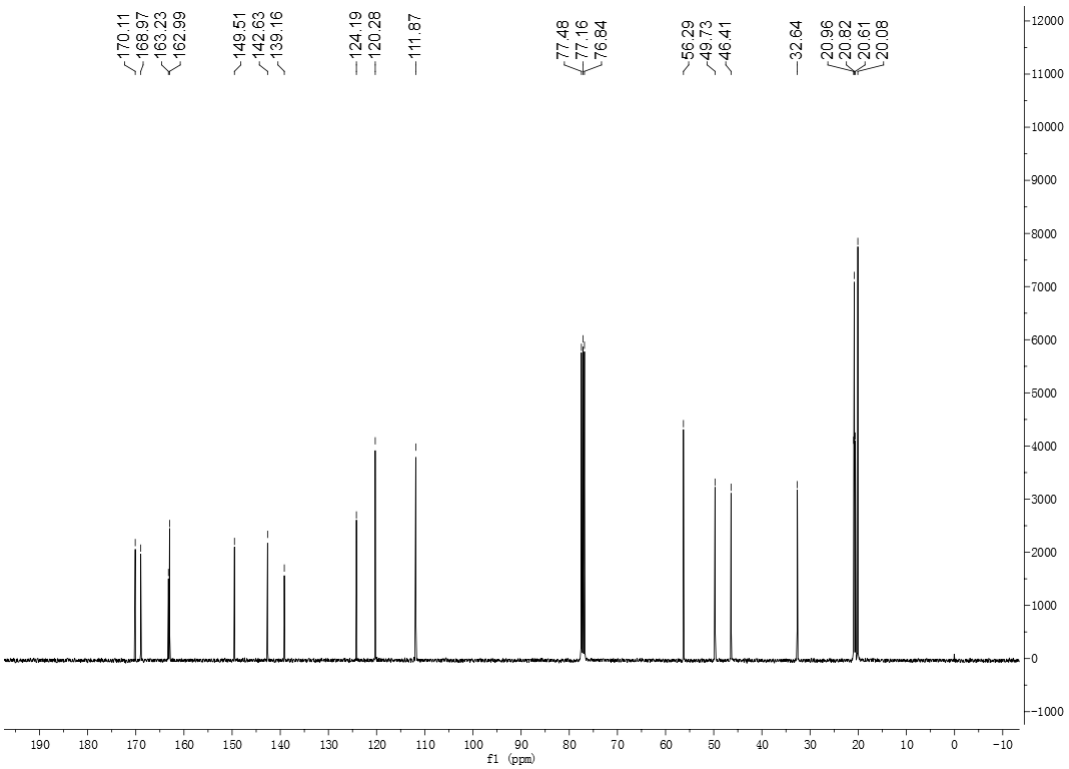
136.35
130.60
129.74
129.05
122.36
77.48
77.16
76.84
49.75
46.62
38.37
21.03
20.96
20.93
20.13
f1 (ppm)


OAc
O
MeO
N(iPr)2
N
H
O
OAc

6i


7.26
6.95
6.92
6.91
6.88
6.83
4.52
4.50
4.48
4.47
4.45
4.43
4.42
4.35
4.33
3.79
3.49
3.47
3.45
3.43
3.42
3.40
2.33
2.31
1.37
1.36
1.18
1.17
2.01
0.92
1.05
2.00
3.03
1.01
6.01
6.02
6.00
f1 (ppm)


170.11
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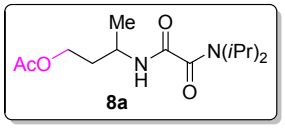
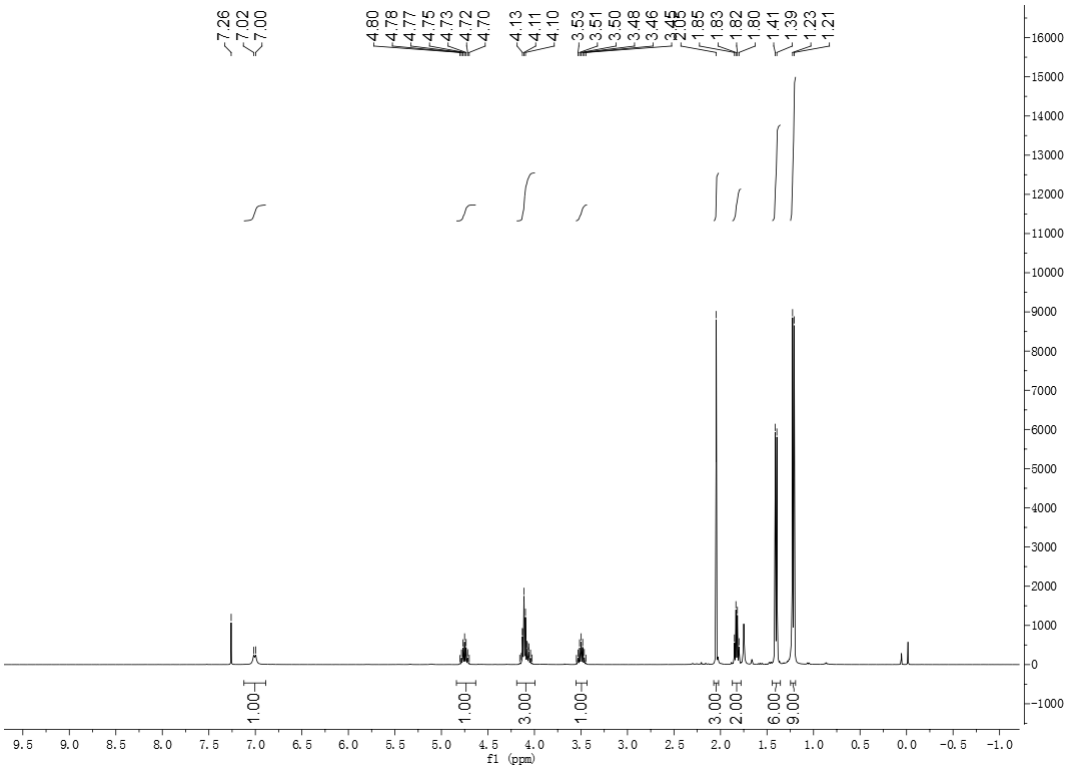
124.19
120.28
111.87
77.48
77.16
76.84
56.29
49.73
46.41
32.64
20.96
20.82
20.61
20.08
f1 (ppm)


Me
O
AcO
N
H
N(iPr)2
O
8a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4.78
4.77
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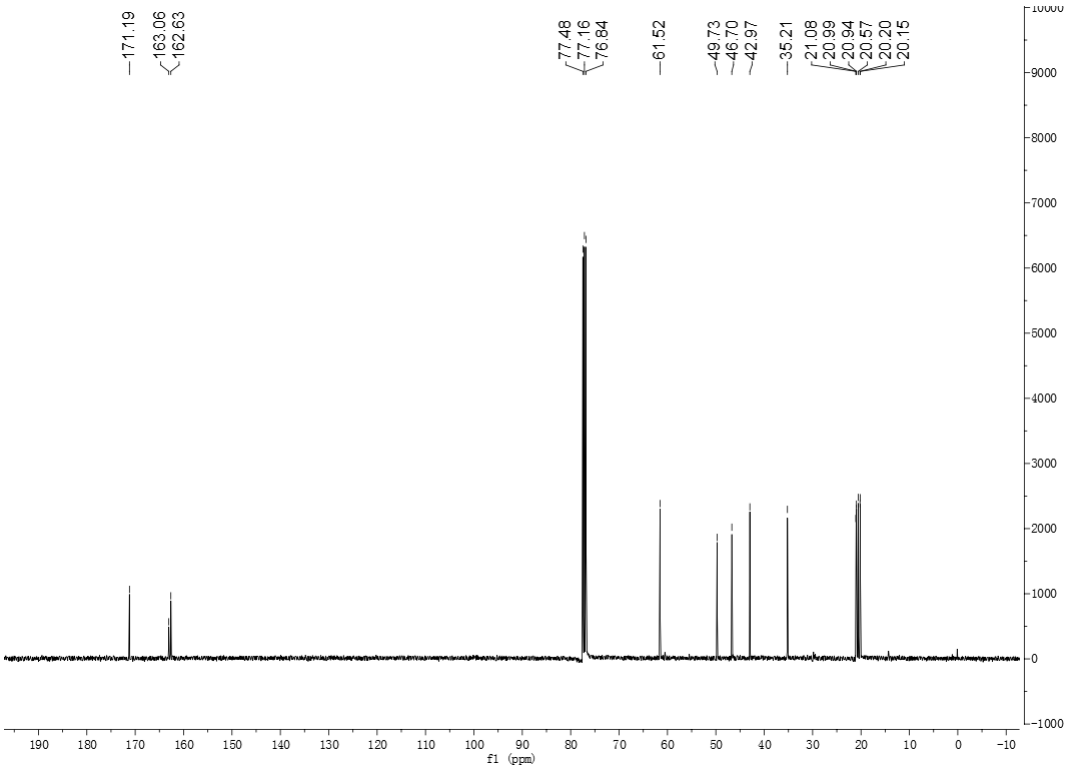
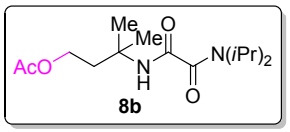
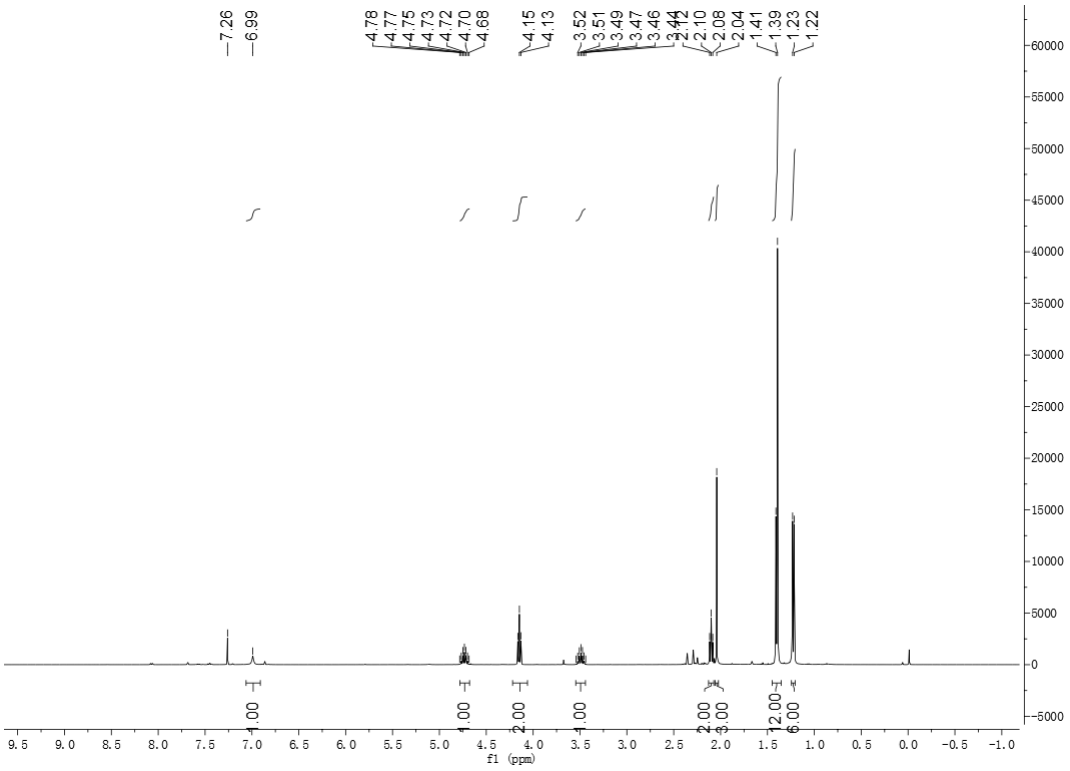
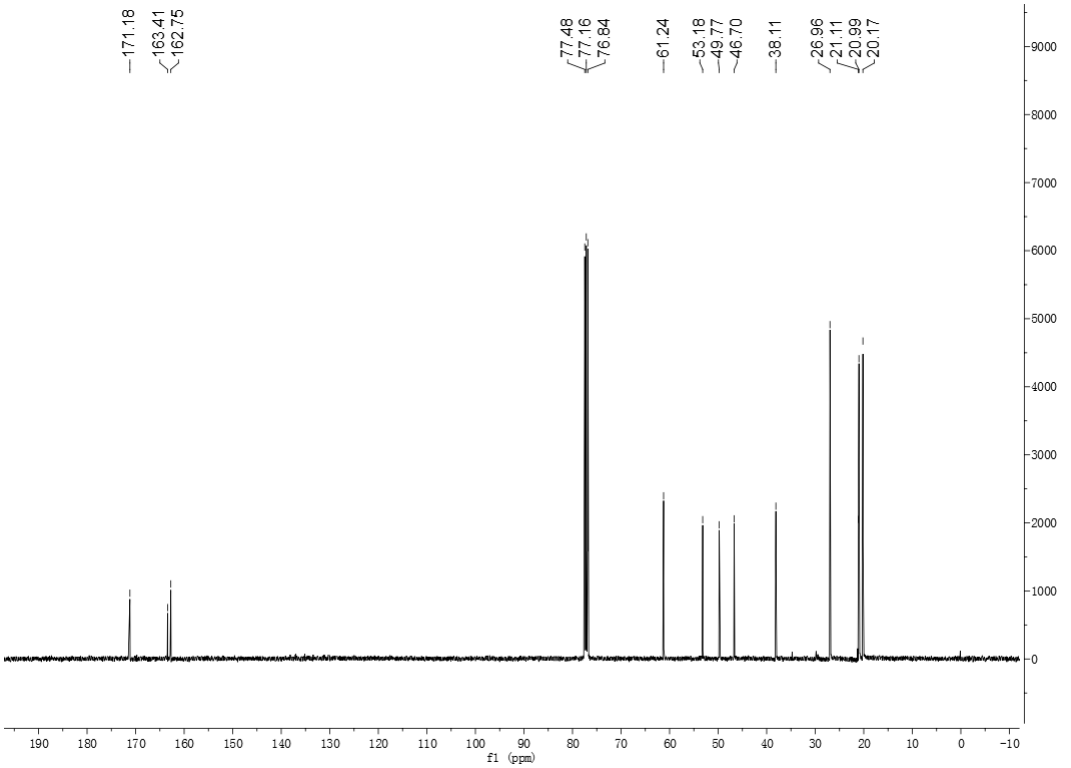
4.73
4.72
4.70
4.13
4.11
4.10
3.53
3.51
3.50
3.48
3.46
1.85
1.83
1.82
1.80
1.41
1.39
1.23
1.21
1.00
1.00
3.00
1.00
3.00
2.00
6.00
9.00
f1 (ppm)


171.19
163.06
162.63
77.48
77.16
76.84
61.52
49.73
46.70
42.97
35.21
21.08
20.99
20.94
20.57
20.20
20.15
f1 (ppm)


Me
Me
O
AcO
N
H
N(iPr)2
O

8b


7.26
6.99
4.78
4.77
4.75
4.73
4.72
4.70
4.68
4.15
4.13
3.52
3.51
3.49
3.47
3.46
2.10
2.08
2.04
1.41
1.39
1.23
1.22
1.00
1.00
2.00
4.00
2.00
3.00
12.00
6.00
f1 (ppm)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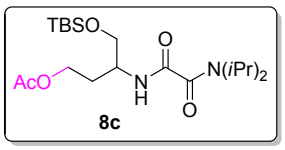
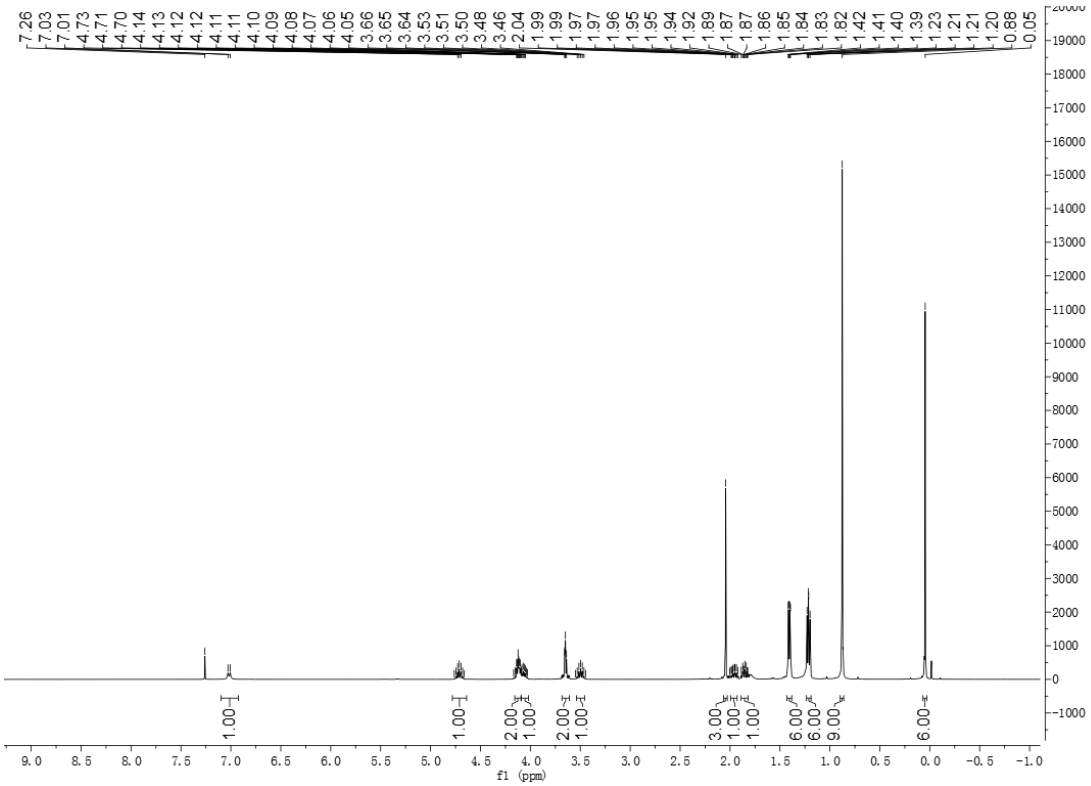
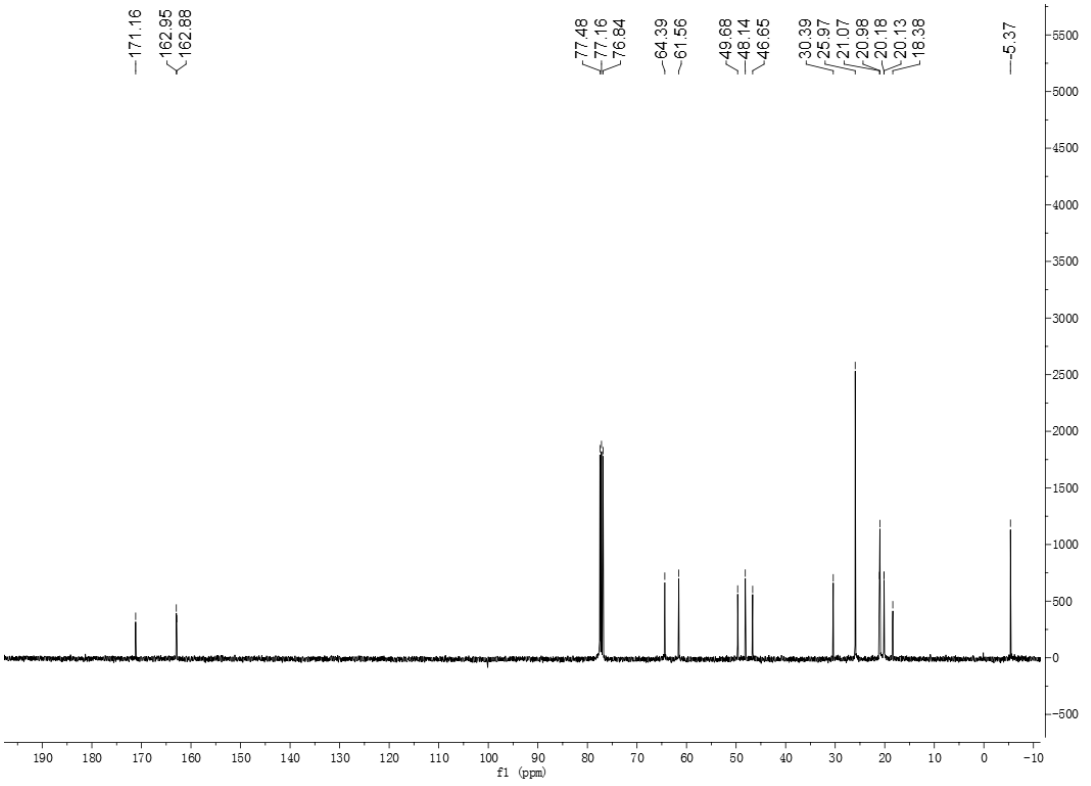
163.41
162.75
77.48
77.16
76.84
61.24
53.18
49.77
46.70
38.11
26.96
21.11
20.99
20.17
f1 (ppm)


TBSO
AcO
N
H
O
O
N(iPr)2
8c


7.26
7.03
7.01
4.73
4.71
4.70
4.14
4.13
4.12
4.12
4.11
4.11
4.10
4.09
4.08
4.07
4.06
4.05
3.66
3.65
3.64
3.53
3.51
3.50
3.48
3.46
2.04
1.99
1.99
1.97
1.97
1.96
1.95
1.95
1.94
1.92
1.89
1.87
1.87
1.86
1.85
1.84
1.83
1.82
1.42
1.41
1.40
1.39
1.23
1.21
1.21
1.20
0.88
0.05
1.00
1.00
2.00
1.00
2.00
1.00
3.00
1.00
1.00
6.00
6.00
9.00
6.00
f1 (ppm)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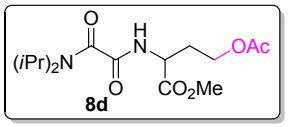
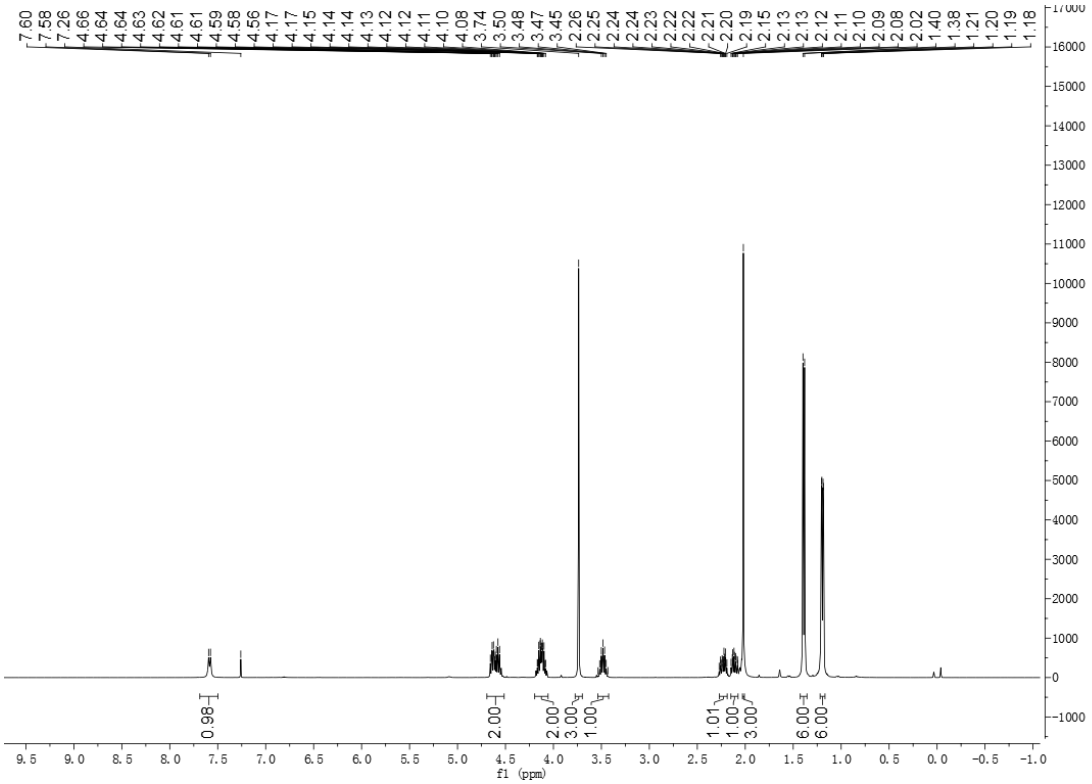
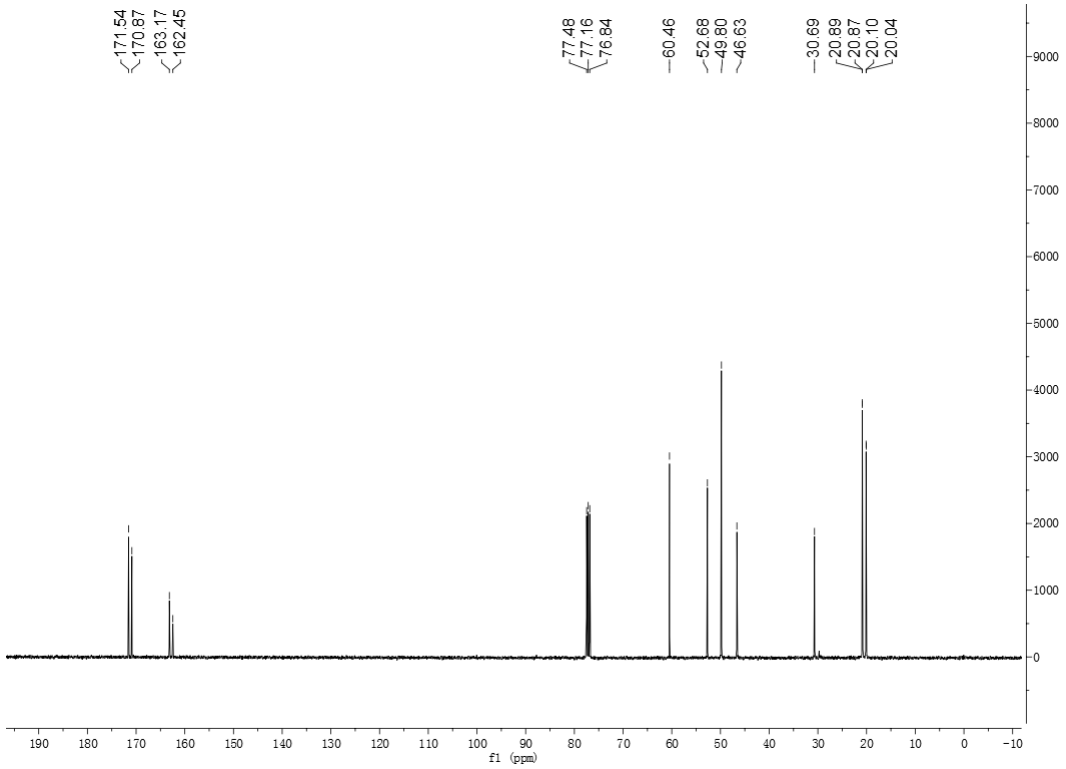
162.95
162.88
77.48
77.16
76.84
64.39
61.56
49.68
48.14
46.65
30.39
25.97
21.07
20.98
20.18
20.13
18.38
-5.37
f1 (ppm)


O
H
N
(iPr)2N
OAc
O
CO2Me
8d


7.60
7.58
7.26
4.66
4.64
4.64
4.63
4.62
4.61
4.61
4.59
4.58
4.56
4.17
4.17
4.15
4.14
4.14
4.13
4.12
4.12
4.11
4.10
4.08
3.74
3.50
3.48
3.47
3.45
2.26
2.25
2.24
2.24
2.23
2.22
2.22
2.21
2.20
2.19
2.15
2.13
2.12
2.11
2.10
2.09
2.08
2.02
1.40
1.38
1.21
1.20
1.19
1.18
0.98
2.00
2.00
3.00
1.00
1.01
1.00
3.00
6.00
6.00
f1 (ppm)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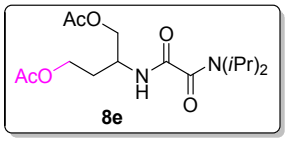
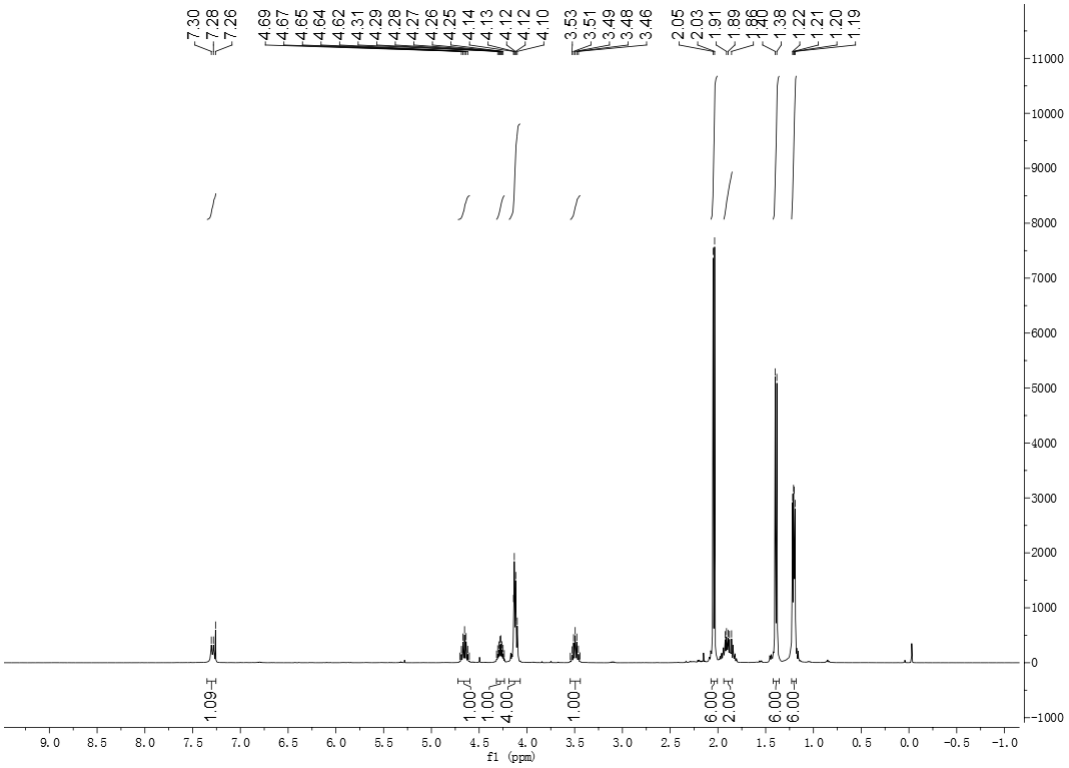
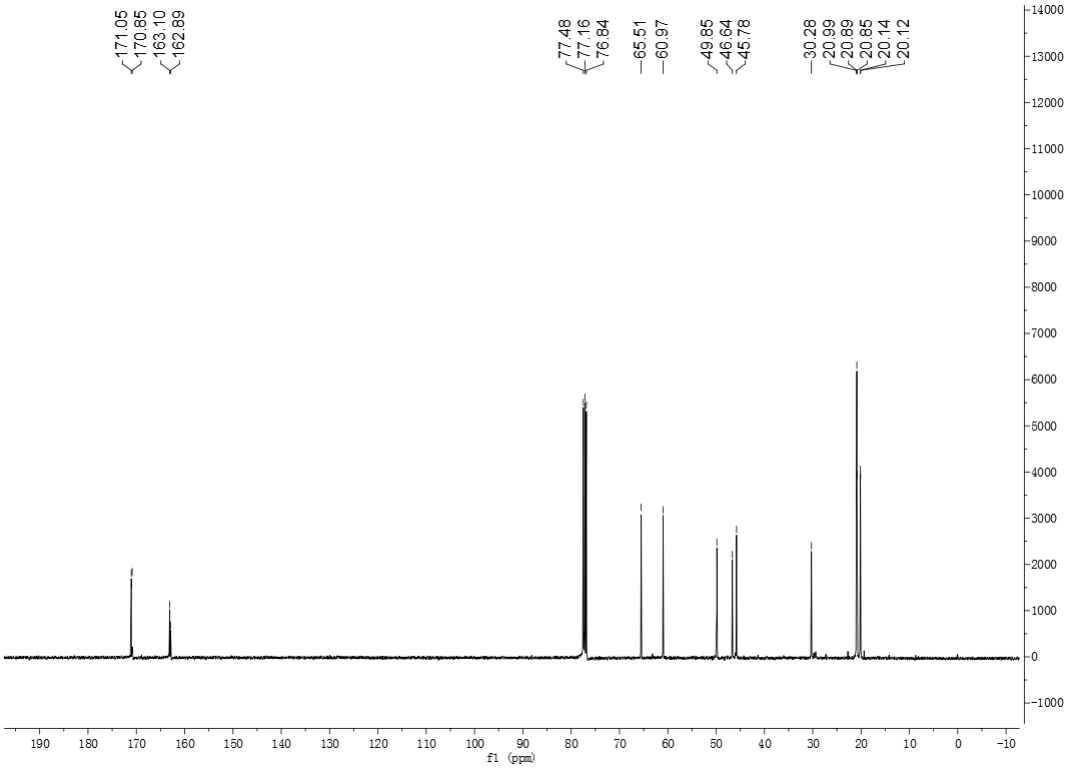
170.87
163.17
162.45
77.48
77.16
76.84
60.46
52.68
49.80
46.63
30.69
20.89
20.87
20.10
20.04
f1 (ppm)


AcO
AcO
N
H
O
O
N(iPr)2
8e


7.30
7.28
7.26
4.69
4.67
4.65
4.64
4.62
4.31
4.29
4.28
4.27
4.26
4.25
4.14
4.13
4.12
4.12
4.10
3.53
3.51
3.49
3.48
3.46
2.05
2.03
1.91
1.89
1.86
1.40
1.38
1.22
1.21
1.20
1.19
1.09
1.00
1.00
4.00
1.00
6.00
2.00
6.00
6.00
f1 (ppm)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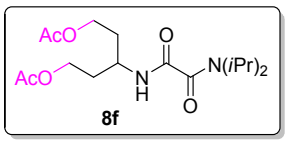
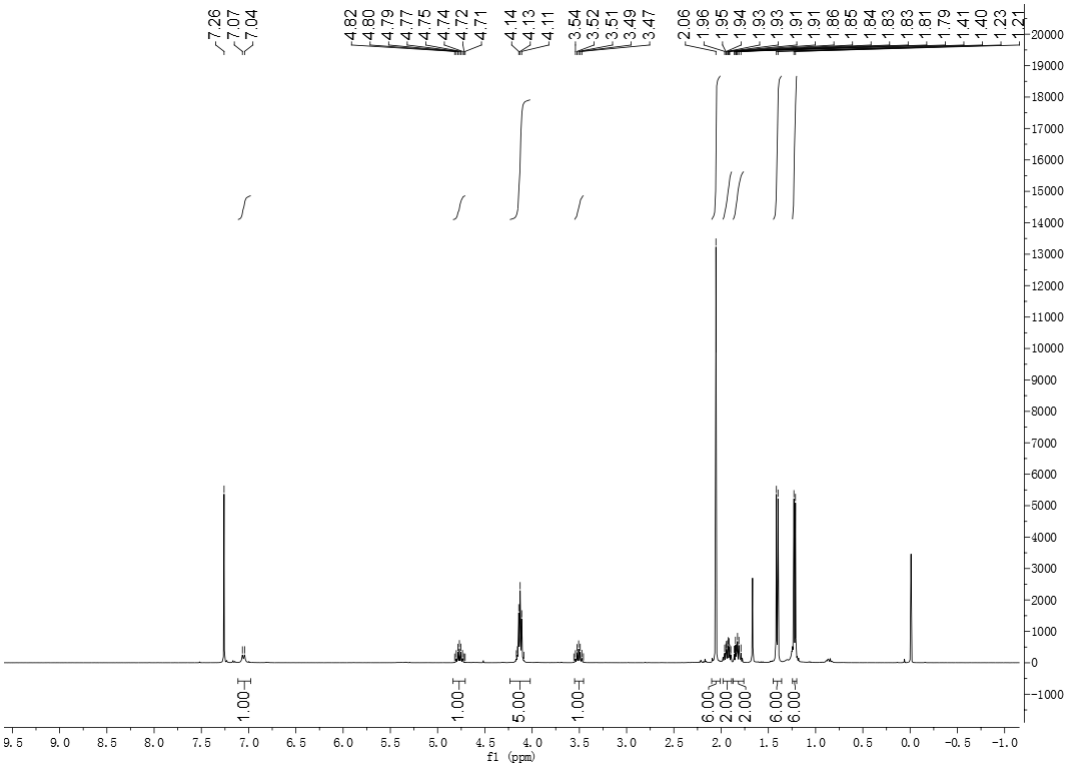
170.85
163.10
162.89
77.48
77.16
76.84
65.51
60.97
49.85
46.64
45.78
30.28
20.99
20.89
20.85
20.14
20.12
f1 (ppm)


AcO
AcO
O
N
H
N(iPr)2
O

8f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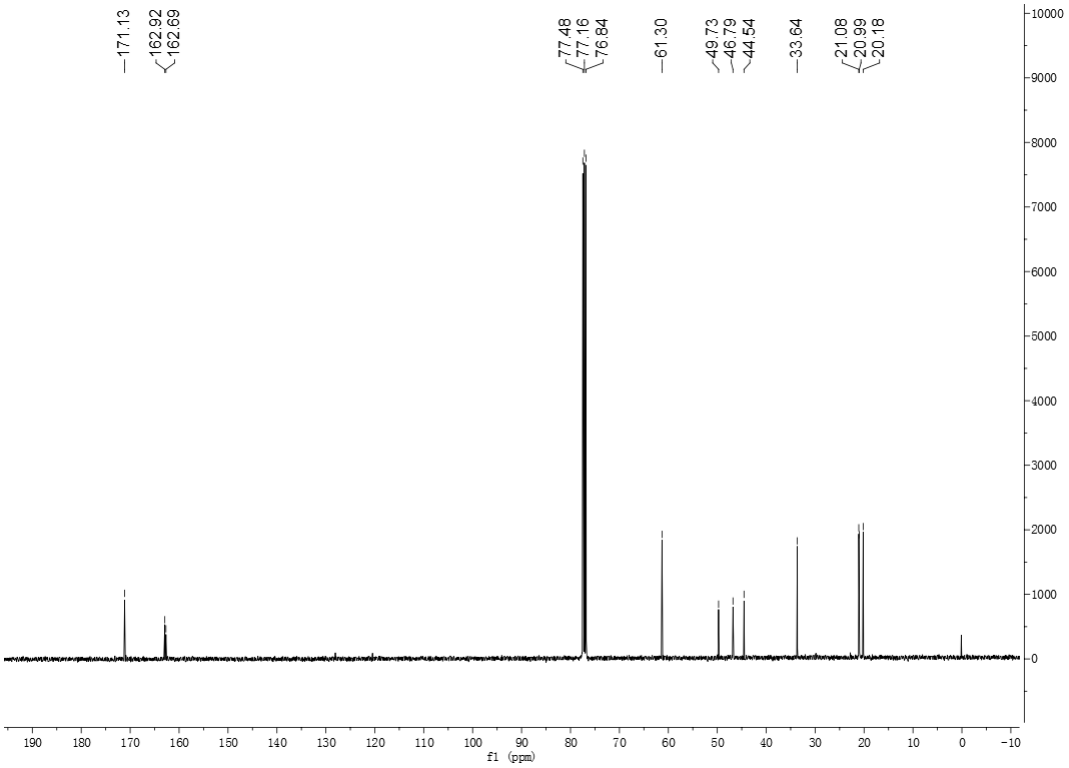
4.80
4.79
4.77
4.75
4.74
4.72
4.71
4.14
4.13
4.11
3.54
3.52
3.51
3.49
3.47
2.06
1.96
1.95
1.94
1.93
1.91
1.91
1.86
1.85
1.84
1.83
1.83
1.81
1.79
1.41
1.40
1.23
1.21
1.00
1.00
5.00
1.00
6.00
2.00
2.00
6.00
6.00
f1 (ppm)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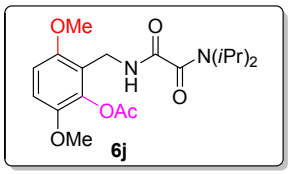
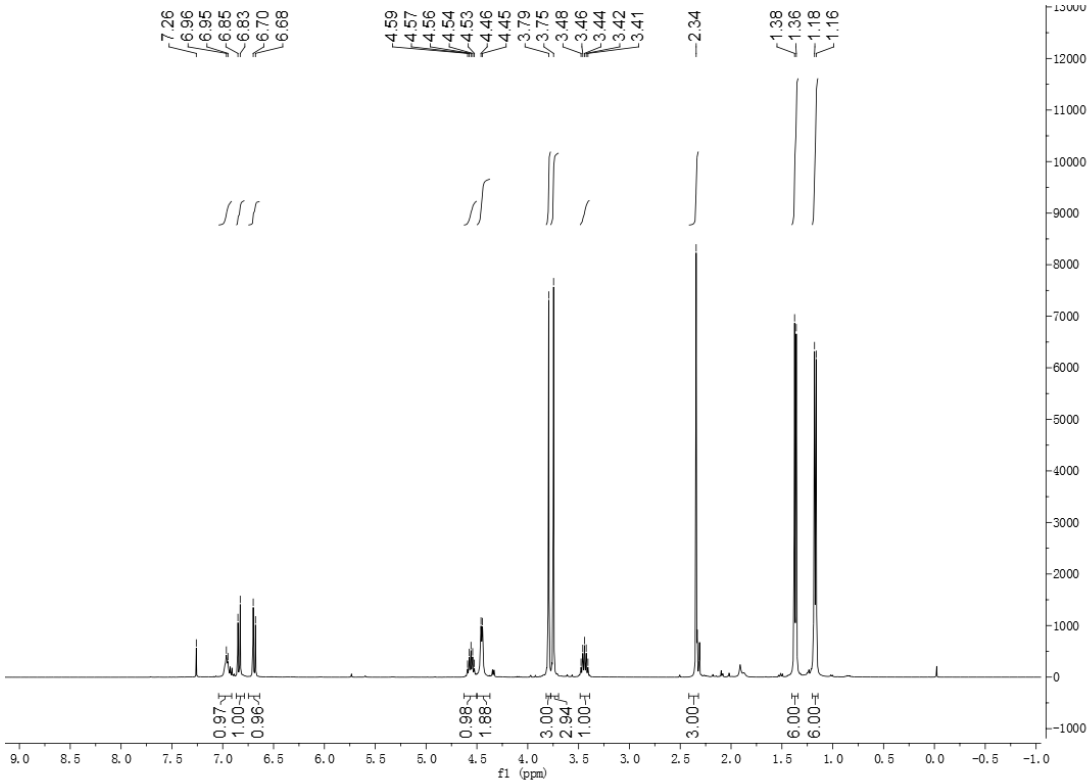
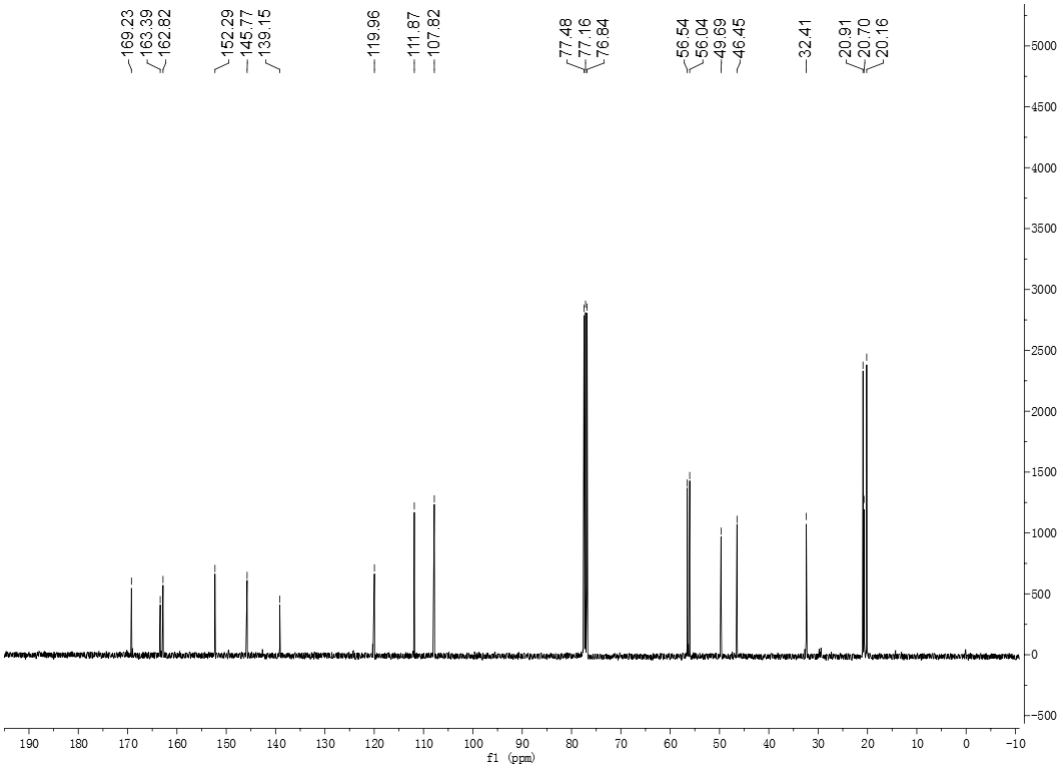
77.48
77.16
76.84
61.30
49.73
46.79
44.54
33.64
21.08
20.99
20.18
f1 (ppm)


OMe
O
N(iPr)2
N
H
OAc
O
OMe
6j


7.26
6.96
6.95
6.85
6.83
6.70
6.68
4.59
4.57
4.56
4.54
4.53
4.46
4.45
3.79
3.75
3.48
3.46
3.44
3.42
3.41
2.34
1.38
1.36
1.18
1.16
0.97
1.00
0.96
0.98
1.88
3.00
2.94
1.00
3.00
6.00
6.00
f1 (ppm)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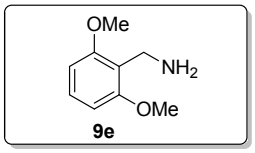
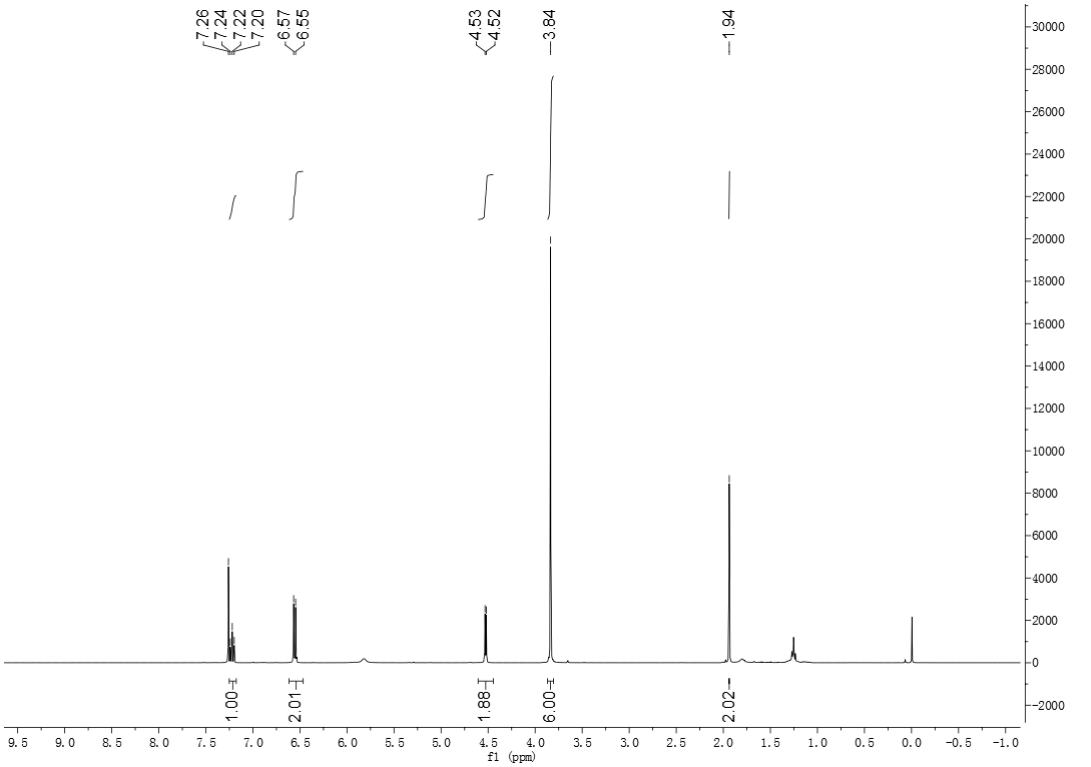
145.77
139.15
119.96
111.87
107.82
77.48
77.16
76.84
56.54
56.04
49.69
46.45
32.41
20.91
20.70
20.16
f1 (ppm)


OMe
NH2
OMe

9e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7.24
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7.20
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6.55
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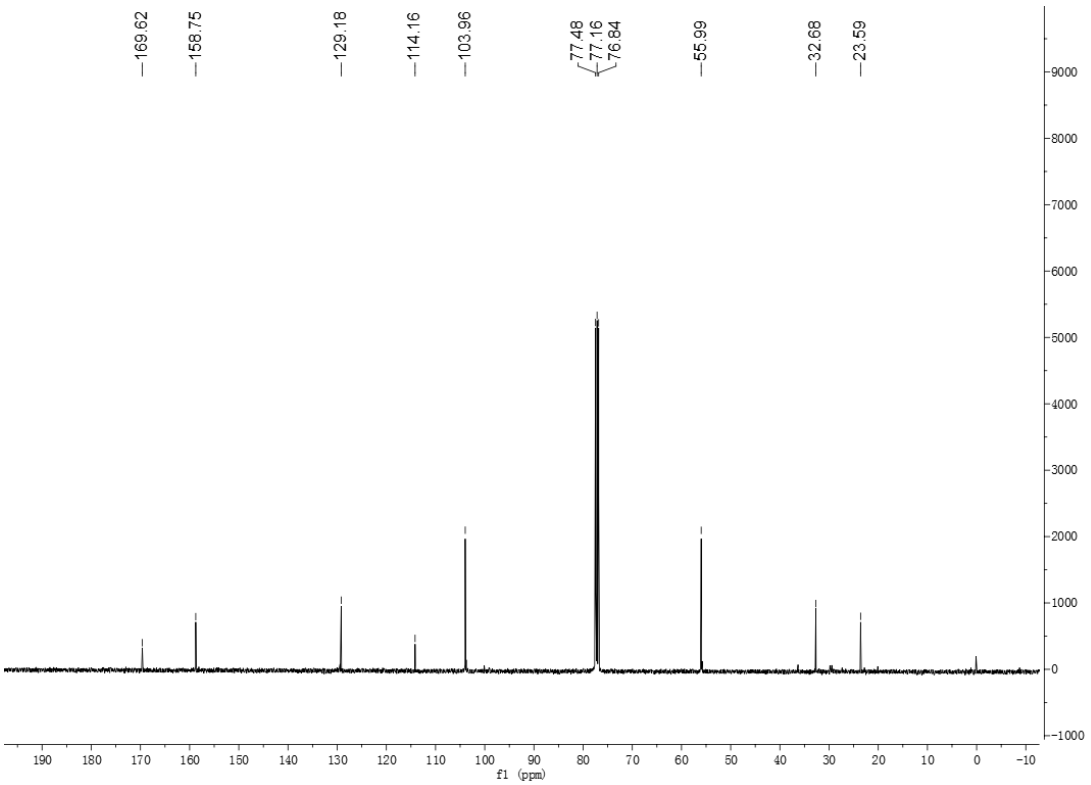
4.52
3.84
1.94
1.00
2.01
1.88
6.00
2.02
f1 (ppm)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77.16
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55.99
32.68
23.59
f1 (ppm)