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1. General Considerations

Chemicals and solvents were purchased from commerically available sources and used without any purification. Dry solvents were obtained from a solvent purification system using columns of Al_2O_3 under argon. ^1H, ^{13}C and ^{19}F NMR spectra were obtained with Bruker Avance-400 MHz with residual solvent peaks or tetramethylsilane as the internal reference. Multiplicities are described using the following abbreviations: s = singlet, bs = broad singlet, d = doublet, dd = doublet of doublet, t = triplet, m = multiplet. High-resolution mass spectra were obtained using a Thermo Q Exactive^{TM} Plus via (ASAP-MS) by the mass spectrometry facility at the University of Wisconsin-Madison (funded by NIH grant: 1S10OD020022-1). Voltammetric experiments and bulk electrolysis reactions were performed using a Nuvant Array PGStats, from Nuvant System Inc.

2. CV Study

For all the voltammetric experiments, a glassy carbon disk electrode (2 mm diameter) and a platinum wire (1.0 cm, spiral wire) were used as working and counter electrodes, respectively. The working electrode potentials were measured versus $Ag/AgNO_3$ reference electrode (internal solution, 0.1 M Bu_4NClO_4 and 0.01 M $AgNO_3$ in CH_3CN). The redox potential of ferrocene/ferrocenium (Fc/Fc^+) was measured (same experimental conditions) and used to provide an internal reference. The potential values were then adjusted relative to Fc/Fc^+, and electrochemical studies in organic solvents were recorded accordingly.

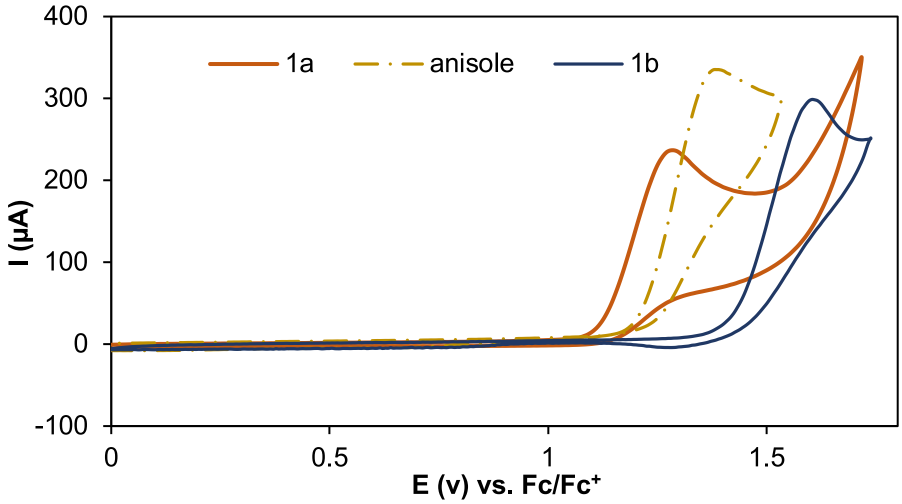


Figure S1. CVs of **1a**, **1b**, and anisole (5 mM) in acetonitrile with NaClO4 (0.1 M) as supporting electrolyte, glassy carbon as working electrode (~ 7.0 mm^2) and a platinum wire (1.0 cm, spiral wire) as counter electrode, scan rate = 100 mV/s.

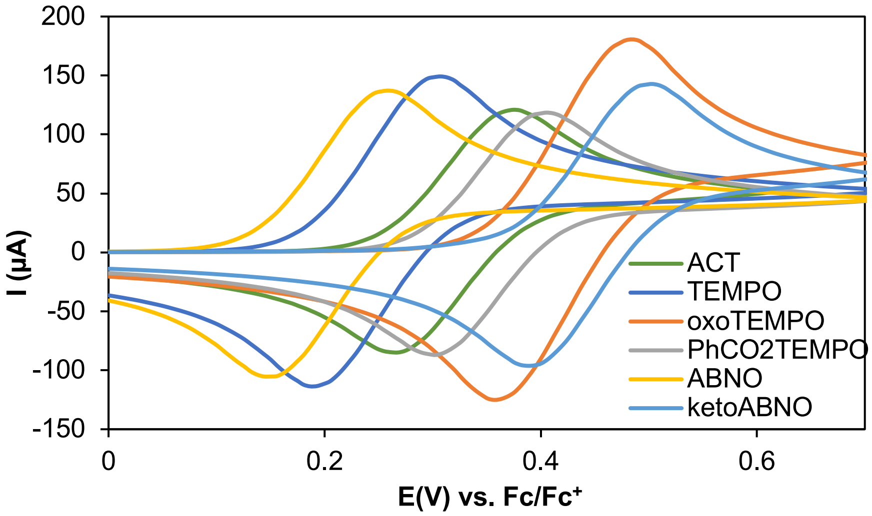


Figure S2. CVs of different mediators (5 mM) in acetonitrile with NaClO4 (0.1 M) as supporting electrolyte, glassy carbon as working electrode (~ 7.0 mm^2) and a platinum wire (1.0 cm, spiral wire) as counter electrode, scan rate = 100 mV/s.

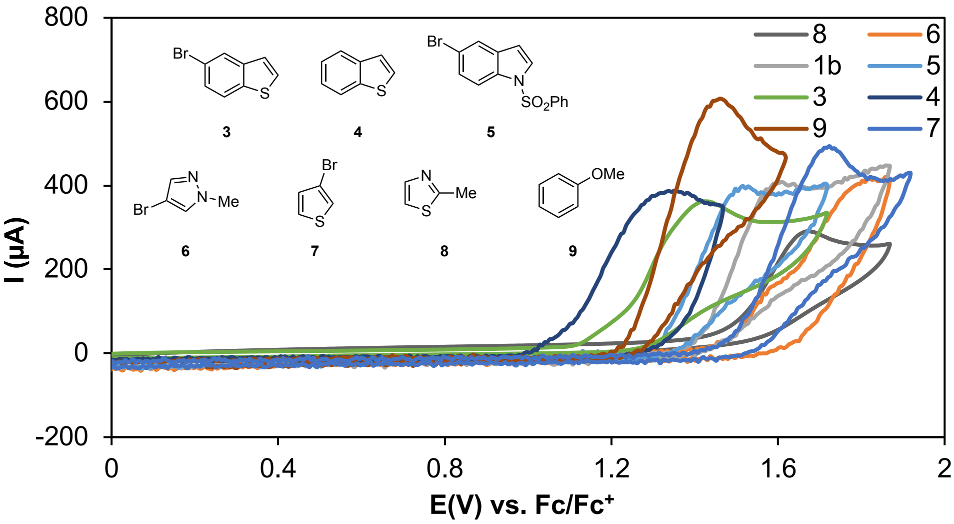


Figure S3. CVs of different additives (5 mM) in acetonitrile with NaClO4 (0.1 M) as supporting electrolyte, glassy carbon as working electrode (~ 7.0 mm^2) and a platinum wire (1.0 cm, spiral wire) as counter electrode, scan rate = 100 mV/s.

3. Shono Oxidation with Water as Nucleophile

These reactions were conducted following the reported procedure.[1] A mixture of **1** (0.5 mmol), Et_4NOTs (1.0 mmol) as supporting electrolyte, acetonitrile (5 mL), and water (1.0 mL) was electrolyzed in an undivided cell, with a Ag/Ag^+ reference electrode, platinum mesh as working and counter electrodes. Constant current at 10 mA was passed at room temperature with a potential of 1.3 - 2.0 V vs Ag/Ag^+. After 5 F/mol had been passed, solvent was removed under reduced pressure to leave a residue. Yields were determined by crude ^1H NMR with mesitylene as internal standard.

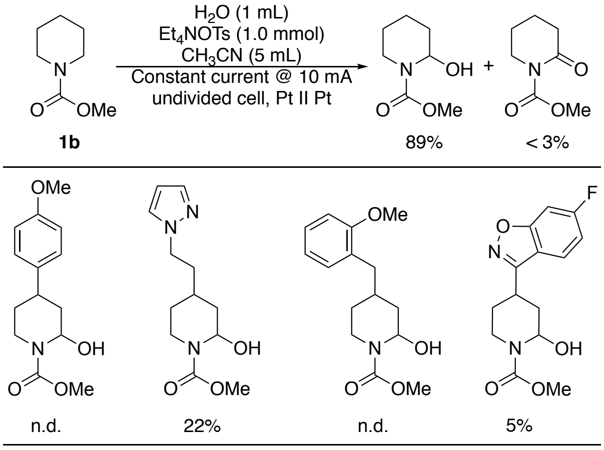
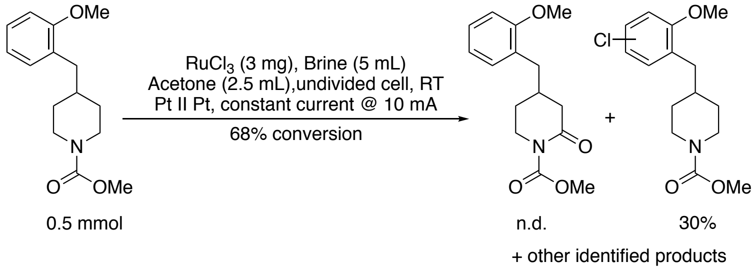


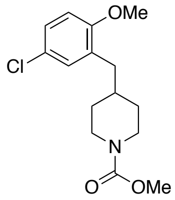
Table S1. Substrates evaluation under Shono oxidation conditions.

4. Testing of the Cl^-/RuO_2 Dual-Mediator System

Torii and coworkers reported a Cl^-/RuO_2 dual-mediator electrochemical system for α-oxygenation of amides and carbamates, in which the applied potential was lower than direct bulk electrolysis.[2] However, the involvement of Cl^+ species causes other side reactions. For example, when **1d** was subjected to Torii's conditions, only chlorination of arometic ring was observed, rather than the desired oxygenation product.



A mixture of **1d** (0.5 mmol) and $RuCl_3$ (3 mg) in an aqueous NaCl (5 mL) and acetone (2.5 mL) was placed in an undivided cell. To this solution was immersed with two platinum mesh electrodes (3 cm x 2.5 cm) and the entired mixture was electrolyzed at room temperature under a constant current of 10 mA with changing the current direction every 30s. After passage of 7.0 F/mol of electricity, the mixture was filtered through a short pad of celite and the filtrate was subjected to extractive workup with DCM. The reaction was analyzed by crude ^1H NMR with mesitylene as internal standard.

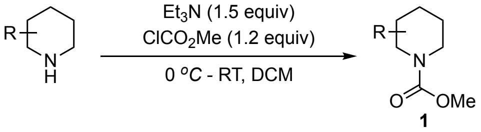


^1H NMR (500 MHz, $CDCl_3$) δ 7.13 (dd, J = 8.7, 2.6 Hz, 1H), 7.03 (d, J = 2.6 Hz, 1H), 6.75 (d, J = 8.7 Hz, 1H), 4.26 – 3.95 (m, 2H), 3.78 (s, 3H), 3.68 (s, 3H), 2.69 (t, J = 11.3 Hz, 2H), 2.50 (d, J = 6.6 Hz, 2H), 1.78 – 1.65 (m, 1H), 1.59 (d, J = 11.0 Hz, 2H), 1.26 – 1.09 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 156.2, 155.9, 130.5, 130.4, 126.8, 124.9, 111.4, 55.5, 52.4, 44.1, 36.8, 36.4, 31.9.

HRMS (**ESI**) Calculated for [$M+H^+$]: 298.1205, measured: 298.1205.

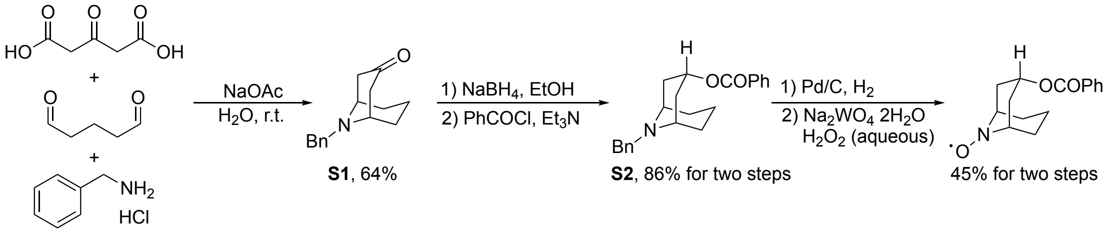
5. Procedures for the Synthesis of Substrates and Mediator

5.1 Substrate synthesis



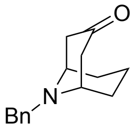
To a mixture of cyclic amine or its HCl salt (1.0 equiv, 0.1 M) and Et_3N (1.5 equiv for free amine, 2.5 equiv for HCl salt) in DCM was added $ClCO_2Me$ (1.2 equiv) dropwise at 0 °C with ice-water bath. Next, the reaction was warmed to room temperature and stirred further for 1 h or full consumption of the substrate, as monitorred by TLC. The mixture was then quenched with saturated aqueous NH_4Cl, and extracted three times with DCM. The combined organic phase was dried, concentrated and purified by chromatography with silica thereafter to afford the desired products **1**.

5.2 Mediator synthesis



Synthesis of **S1**:

The reaction was conducted following the reported procedure with the same scale.[3] Benzylamine hydrochloride (37.7 g, 0.263 mol) and glutaraldehyde (25% in water, 88 mL, 0.219 mol) were added in a 1.0 L beaker containing water (100 mL) under air. The mixture was cooled to 0 °C, then acetonedicarboxylic acid (32.0 g, 0.219 mol) and 10% aqueous sodium acetate (75 mL) were added. After removal of ice bath, the mixture was stirred vigorously for two hours at room temperature then stirred for 12 hours at 50 °C. The pH value was adjusted to 6-7 by careful addition of $NaHCO_3$. The mixture was extracted with chloroform several times. The combined organic layer was washed with brine and dried over sodium sulfate. After concentration of filtered organic layer under reduced pressure, the residue was purified via flash column chromatography (hexane/ethyl acetate = 2/1) to afford **S1** as a light yellow solid in 64% yield (32.1 g). All analytical data of **S1** are consistent with reported data.[iii]

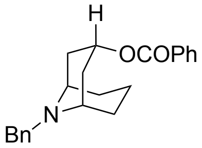


S1

^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (d, J = 7.2 Hz, 2H), 7.37 – 7.31 (m, 2H), 7.29 – 7.24 (m, 1H), 3.90 (s, 2H), 3.31 (s, 2H), 2.73 (dd, J = 16.6, 6.6 Hz, 2H), 2.25 (d, J = 16.7 Hz, 2H), 1.98 – 1.87 (m, 2H), 1.60 – 1.40 (m, 4H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 211.5, 139.2, 128.3, 128.3, 127.1, 57.0, 53.5, 42.8, 29.3, 16.5.

Synthesis of **S2**:

The reaction was conducted following the reported procedure.[3,4] In a round bottom flask, **S1** (10.0 g, 43.7 mmol) was dissolved in 150 mL ethanol and cooled to 0 °C. After that, sodium borohydride (2.5 g, 66.0 mmol, 1.5 equiv) was added and the reaction mixture was allowed to warm to room temperature. Upon completion, as monitored by TLC, the reaction mixture was quenched with 100 mL water. The crude product was extracted with ethyl acetate (3 x 100 mL). The solvent was evaporated and the crude product was redissolved in DCM (200 mL) for esterification without purification. To the solution was added benzoyl chloride (7.5 mL, 66.0 mmol, 1.5 equiv), followed by cooling to 0 °C with ice bath. Et_3N (12 mL, 87.4 mmol, 2.0 equiv) was added into the mixture dropwise, after which it was warmed to room temperature and stirred overnight. Then the reaction mixture was diluted with saturated aqueous sodium bicarbonate and separated using separatory funnel. The aqueous solution was further extracted with DCM, and the combined organic phases were dried over anhydrous $MgSO_4$, filtered, concentrated. The residue was purified via flash column chromatography (hexane/ethyl acetate/Et_3N = 10/1/0.2) to give **S2** (12.6 g, 86% for two steps) as a colorless viscous oil.



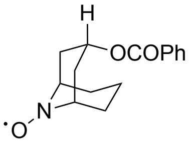
S2

^1H NMR (400 MHz, $CDCl_3$) δ 8.11 – 8.04 (m, 2H), 7.56 (t, *J* = 7.4 Hz, 1H), 7.45 (t, *J* = 7.6 Hz, 2H), 7.39 (d, *J* = 7.3 Hz, 2H), 7.33 (t, *J* = 7.4 Hz, 2H), 7.28 – 7.21 (m, 1H), 5.50 (p, *J* = 6.8 Hz, 1H), 3.84 (s, 2H), 3.07 (br, 2H), 2.60 – 2.44 (m, 2H), 2.43 – 2.24 (m, 1H), 2.08 – 1.90 (m, 2H), 1.69 – 1.52 (m, 3H), 1.24 (d, *J* = 11.7 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 166.2, 140.1, 132.7, 130.9, 129.5, 128.3, 128.2, 126.8, 68.0, 56.2, 49.3, 31.6, 25.3, 14.8.

HRMS (**ESI**) Calculated for $[M+H^+]$: 336.1958, measured: 336.1953.

Synthesis of $PhCO_2ABNO$:

The reaction was conducted following the reported procedure.[3] **S2** (12.6 g, 37.6 mmol), Pd/C (10% Pd, 5 mol%, 2.0 g) and degassed methanol (200 mL) were added under inert gas to a 500 mL three-neck round-bottom flask equipped with reflux condenser. Afterwards, the flask was purged with hydrogen gas and a balloon with pure hydrogen gas (1 atm) was attached to the reflux condenser. The reaction mixture was stirred at 50 °C for 24 hours and afterwards cooled to room temperature. The black suspension was filtered over celite and washed with methanol. All volatiles were removed under reduced pressure, and the residue was subjected to the next step without purification. The above crude product was dissolved in acetonitrile (75 mL), $Na_2WO_4 \cdot H_2O$ (1.3 g, 4.0 mmol) and 30% hydrogen peroxide (8.5 mL, 120.0 mmol) were added and the reaction mixture was stirred at room temperature overnight. Water was added to the reaction mixture and the aqueous solution was extracted with chloroform. The organic layer was dried over $MgSO_4$ and concentrated. The residue was purified by flash column chromatography (hexane/ethyl acetate = 1/1). $PhCO_2ABNO$ was obtained as a yellow solid (4.4 g, 45% for two steps).

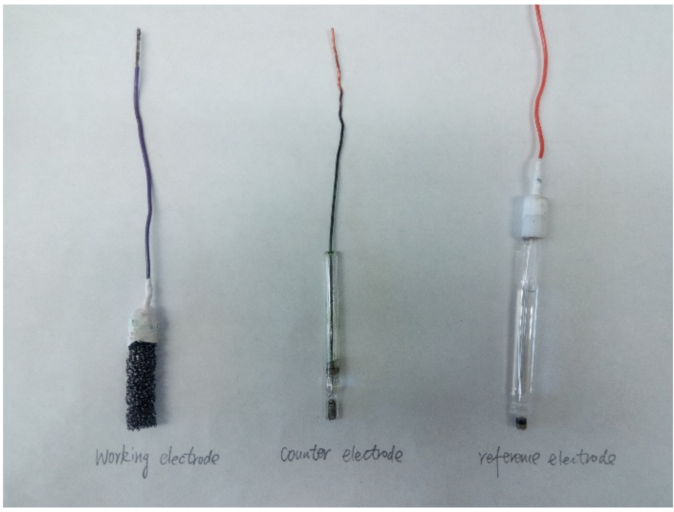


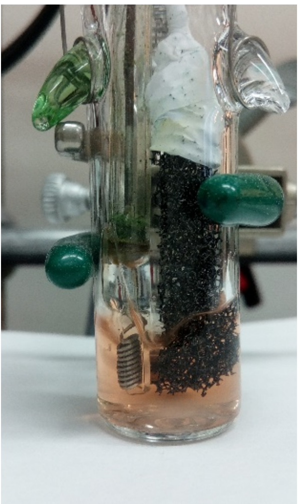
$PhCO_2ABNO$

HRMS (**ESI**) Calculated for $[M+Na^+]$: 283.1179, measured: 283.1174.

6. Procedures for Electrochemical Oxygenation

Reactions were carried out using an undivided cell equipped with a reticulated vitreous carbon anode (RVC, 60 PPI, 4.0 cm x 1.0 cm x 0.6 cm, ~ 0.5 cm was immersed in the solution), a platinum wire cathode (1.0 cm, spiral wire) and a Ag/Ag^+ reference electrode. A mixture of **1** (0.2 mmol), $NaClO_4$ (0.2 mmol) as supporting electrolyte, mediator (0.08-0.12 mmol), acetonitrile (2 mL), and water (45-180 μL) was electrolyzed at room temperature with magnetic stirring, and constant current at 3 mA or 5 mA was applied. The working electrode potential was tracked with the cutoff potential at 0.5 V above the initial potential. The reaction was stoped automatically when reached to cutoff potential or manully after full consumption of substrates detected by TLC. After that, solvent was removed under reduced pressure to leave a residue. The reaction was analyzed by crude ^1H NMR spectroscopy with mesitylene as internal standard, followed by chromatography on silica to afford the pure products.





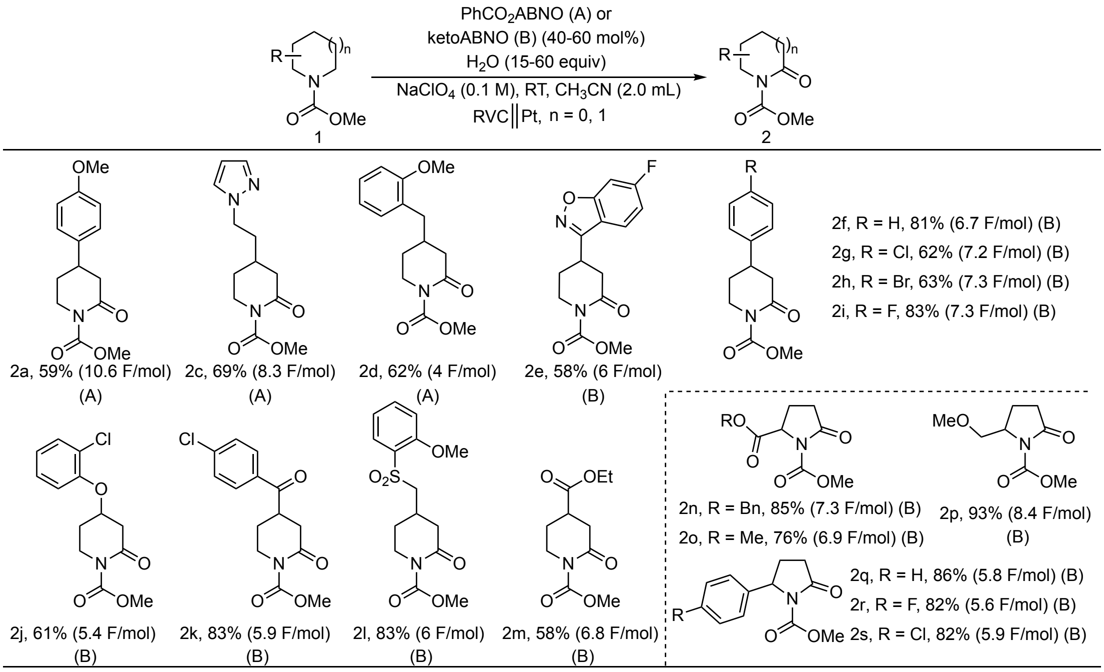
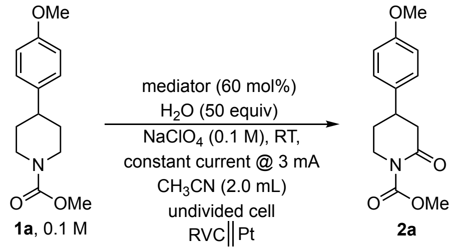


Table S2. Yields and consumed charge.

7. Optimization of Conditions

These reactions were carried out using an undivided cell equipped with a reticulated vitreous carbon anode (RVC, 60 PPI, 4.0 cm x 1.0 cm x 0.6 cm, ~ 0.5 cm immersed in the solution), a platinum wire cathode (1.0 cm, spiral wire) and a Ag/Ag$^+$ reference electrode. A mixture of **1** (0.2 mmol), NaClO4 (0.2 mmol) as supporting electrolyte, acetonitrile (2 mL), and water (180 µL) was electrolyzed at room temperature with magnetic stirring, and constant current at 3 mA was applied. The working electrode potential was tracked with the cutoff potential at 0.5 V above the initial applied potential. After that, the reactions were analyzed by ^{1}H NMR spectroscopy with mesitylene as internal standard.

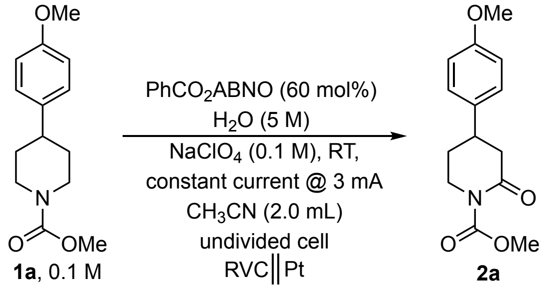
7.1 Evaluation of different mediators



Mediator	$E_{1/2}$ vs Fc/Fc$^+$	yield
TEMPO	0.25 V	n.d.
ACT	0.32 V	n.d.
PhCO$_2$TEMPO	0.35 V	n.d.
OxoTEMPO	0.43	n.d.
ABNO	0.2 V	13%
PhCO$_2$ABNO	0.33 V	62%
ketoABNO	0.45 V	36%

Scheme S1. Evaluation of different mediators.

7.2 Evaluation of other parameters



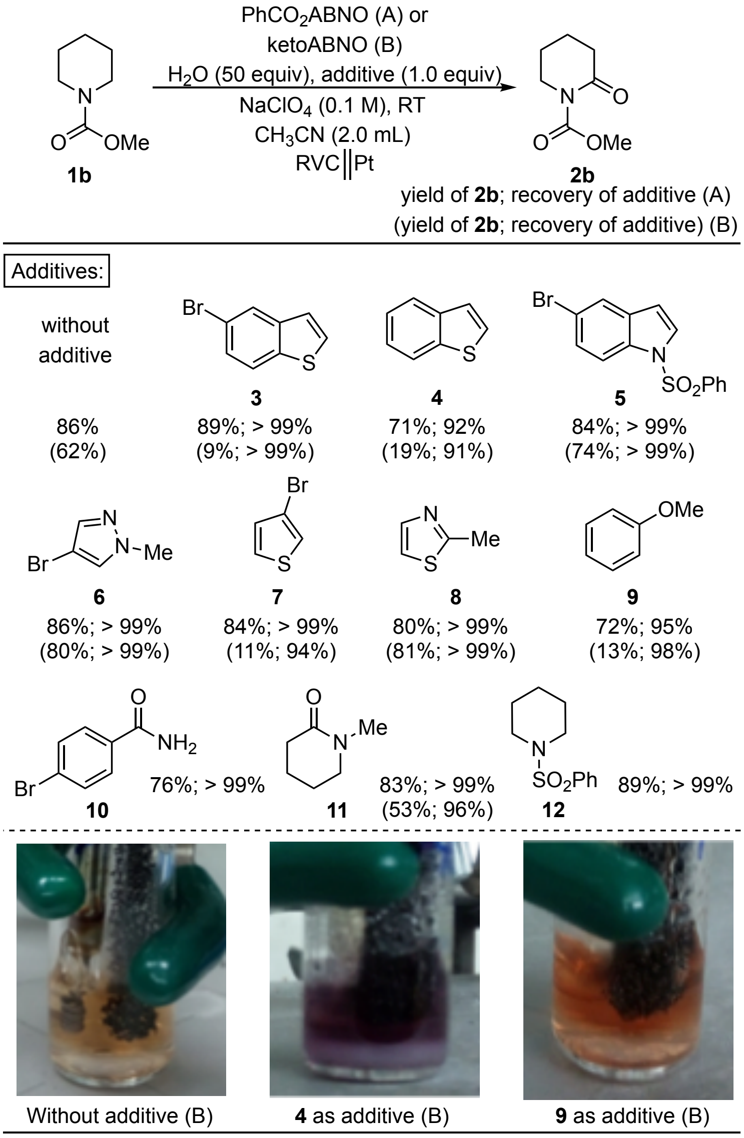
Entry	Water concentration/M	Catalyst loading/%	Supporting electrolyte	Applied current/mA	Yield/%
1	4	60	$NaClO_4$	3	48%
2	5	60	$NaClO_4$	3	62%
3	6	60	$NaClO_4$	3	43%
4	7	60	$NaClO_4$	3	59%
5	5	60	$NaClO_4$	2	62%
6	5	60	$NaClO_4$	4	52%
7	5	60	$NaClO_4$	5	39%
8	5	60	$LiClO_4$	3	62%
9	5	60	TEAOTs	3	16%
10	5	60	TBAP	3	27%
11	5	60	KPF_6	3	11%
12	5	60	$NaPF_6$	3	8%
13	5	40	$NaClO_4$	3	43%
14	5	50	$NaClO_4$	3	52%
15[a]	5	60	$NaClO_4$	3	48%
16[b]	5	60	$NaClO_4$	3	56%
17[c]	5	60	$NaClO_4$	5	52%

[a] 0.05 M **1a**. [b] With graphite as working electrode. [c] IKA® ElectraSyn 2.0 was used, 0.4 mmol scale, 0.1 M, constant current @ 5 mA for 24 h. The reaction was conducted with 0.2 mmol scale, and ^{1}H NMR yield with mesitylene as internal standard was shown.

Scheme S2. Evaluation of other parameters.

8. Robustness Screening of Mediated Electrolysis

These reactions were carried out by following the general procedure with $PhCO_2ABNO$ (@ 3 mA) or ketoABNO (@ 5 mA) as mediator, **1b** as model substrate and 1 equiv of additive. After bulk electrolysis, these experiments were analyzed by crude ^{1}H NMR with mesitylene as internal standard. These data clearly showed that reactions proceeded well in the presence of these sensitive functional groups and negligible effect was observed in the presence of $PhCO_2ABNO$, with almost all the additives recovered. On the other hand, although most of additives were recovered from the reaction with ketoABNO as mediator, low yields and darker color were observed for these reactions with electron rich additives (**3**, **4**, **7**, **9**). The origin of this observation is not known, but it may reflect formation of a non-productive adduct between the electrophilic $ketoABNO^+$ species and the electron-rich aromatic ring (i.e., a donor-acceptor interaction), which could hinder the desired reactivity.

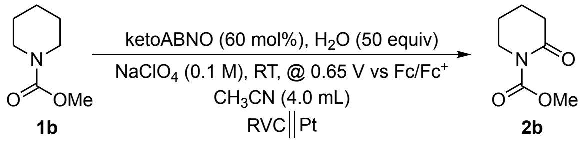


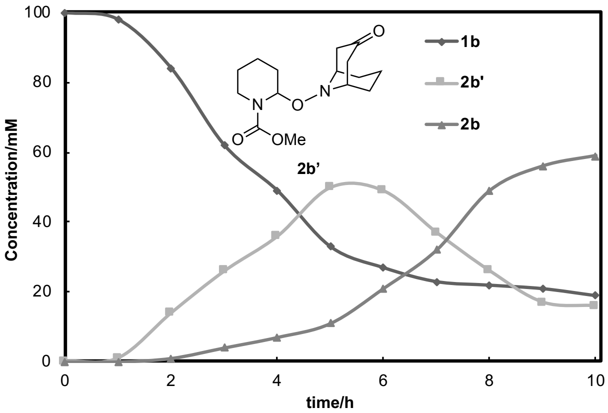
Without additive (B) | **4** as additive (B) | **9** as additive (B)

Table S3. Robustness screening of mediated electrolysis with $PhCO_2ABNO$ (ketoABNO) as mediator.

9. Time Course and Control Experiment

The reaction was conducted under constant potential @ 0.65 V vs Fc/Fc$^+$, and during the bulk electrolysis, an aliquot of reaction mixture (~ 50 µL) was withdrawn and submitted for ^{1}H NMR with mesitylene as internal standard.

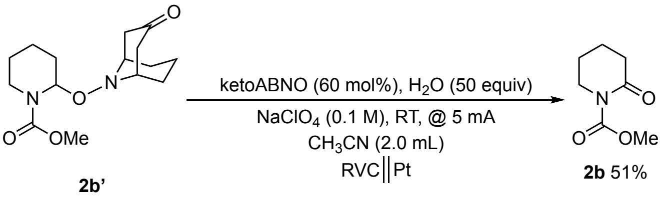




These data reveal formation of an intermediate **2b'** during the first five hours, which subsequently converts to product. The concentration of **2b** grows in only slowly at the beginning of the reaction, followed by more rapid growth following formation of **2b'**.

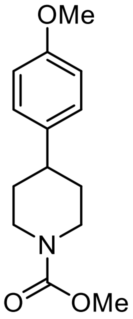
2b': ^{1}H NMR (500 MHz, CDCl$_3$) δ 5.59 (br, 1H), 3.90 – 3.74 (m, 1H), 3.73 – 3.56 (m, 5H), 3.00 – 2.83 (m, 3H), 2.08 (d, *J* = 16.1 Hz, 2H), 1.80 – 1.72 (m, 3H), 1.67 – 1.51 (m, 6H), 1.45 – 1.35 (m, 1H), 1.33 – 1.17 (m, 2H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 210.6, 157.4, 81.4, 58.7, 57.5, 52.5, 41.0, 40.9, 31.84, 31.83, 28.5, 24.8, 18.6, 15.4. **HRMS** (**ESI**) Calculated for [M+H$^+$]: 297.1809, measured: 297.1806.

Furthermore, when **2b'** was subjected to the standard condition, **2b** was obtained with 51% yield.



10. Substrate and Product Characterization Data

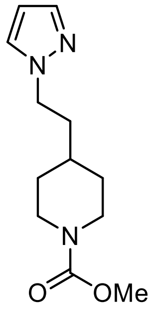
10.1 Characterization of substrates



1a

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.14 – 7.08 (m, 2H), 6.88 – 6.82 (m, 2H), 4.27 (br, 2H), 3.79 (s, 3H), 3.72 (s, 3H), 2.85 (t, *J* = 12.1 Hz, 2H), 2.61 (tt, *J* = 12.1, 3.5 Hz, 1H), 1.81 (d, *J* = 12.9 Hz, 2H), 1.68 – 1.49 (m, 2H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 158.1, 155.9, 137.8, 127.6, 113.9, 55.2, 52.5, 44.6, 41.7, 33.3.

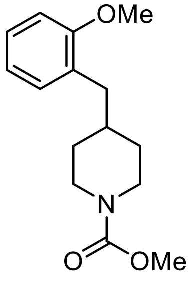
HRMS (**ESI**) Calculated for [M+H$^+$]: 250.1438, measured: 250.1434.



1c

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.49 (d, *J* = 1.6 Hz, 1H), 7.36 (d, *J* = 2.2 Hz, 1H), 6.24 (t, *J* = 2.0 Hz, 1H), 4.20 – 4.01 (m, 4H), 3.67 (s, 3H), 2.71 (t, *J* = 11.8 Hz, 2H), 1.82 (q, *J* = 7.0 Hz, 2H), 1.68 (d, *J* = 12.6 Hz, 2H), 1.44 – 1.34 (m, 1H), 1.15 (qd, *J* = 12.5, 4.0 Hz, 2H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 155.9, 139.1, 128.7, 105.4, 52.5, 49.4, 43.9, 36.9, 33.2, 31.7.

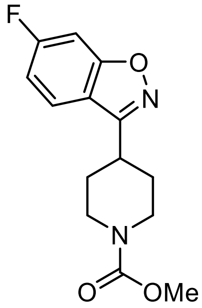
HRMS (**ESI**) Calculated for [M+H$^+$]: 238.1550, measured: 238.1546.



1d

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.19 (td, *J* = 8.0, 1.7 Hz, 1H), 7.06 (dd, *J* = 7.3, 1.6 Hz, 1H), 6.90 – 6.82 (m, 2H), 4.10 (br, 2H), 3.81 (s, 3H), 3.68 (s, 3H), 2.70 (t, *J* = 12.0 Hz, 2H), 2.55 (d, *J* = 7.1 Hz, 2H), 1.79 – 1.68 (m, 1H), 1.61 (d, *J* = 12.6 Hz, 2H), 1.29 – 1.09 (m, 2H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 157.6, 156.0, 130.9, 128.6, 127.2, 120.1, 110.3, 55.2, 52.4, 44.2, 37.1, 36.4, 32.0.

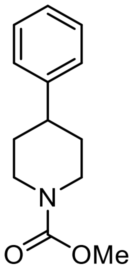
HRMS (**ESI**) Calculated for [M+H$^+$]: 264.1594, measured: 264.1591.



1e

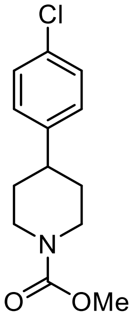
^{1}H NMR (400 MHz, CDCl$_3$) δ 7.62 (dd, *J* = 8.7, 5.1 Hz, 1H), 7.22 (dd, *J* = 8.5, 2.1 Hz, 1H), 7.04 (td, *J* = 8.8, 2.1 Hz, 1H), 4.24 (s, 2H), 3.70 (s, 3H), 3.23 (tt, *J* = 11.4, 3.8 Hz, 1H), 3.01 (t, *J* = 12.0 Hz, 2H), 2.05 (d, *J* = 11.4 Hz, 2H), 1.99 – 1.81 (m, 2H). ^{13}C NMR (101 MHz, CDCl$_3$) δ 164.06 (d, *J* = 250.9 Hz), 163.79 (d, *J* = 13.6 Hz), 160.36 (s), 155.79 (s), 122.18 (d, *J* = 11.1 Hz), 117.02 (d, *J* = 1.2 Hz), 112.45 (d, *J* = 25.4 Hz), 97.44 (d, *J* = 26.8 Hz), 52.60 (s), 43.63 (s), 34.16 (s), 30.02 (s). ^{19}F NMR (377 MHz, CDCl$_3$) δ -109.26 (s).

HRMS (**ESI**) Calculated for [M+H$^+$]: 279.1140, measured: 279.1136.


1f

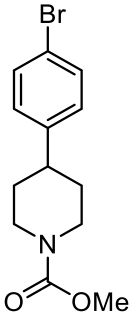
^{1}H NMR (400 MHz, CDCl$_3$) δ 7.34 – 7.28 (m, 2H), 7.23 – 7.17 (m, 3H), 4.29 (br, 2H), 3.72 (s, 3H), 2.86 (t, *J* = 12.0 Hz, 2H), 2.66 (tt, *J* = 12.2, 3.6 Hz, 1H), 1.84 (d, *J* = 12.9 Hz, 2H), 1.74 – 1.53 (m, 2H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 155.9, 145.6, 128.5, 126.7, 126.4, 52.5, 44.5, 42.6, 33.1.

HRMS (**ESI**) Calculated for [M+H$^+$]: 220.1332, measured: 220.1330.


1g

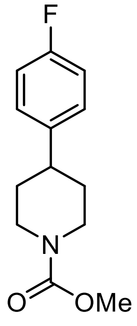
^{1}H NMR (400 MHz, CDCl$_3$) δ 7.29 – 7.26 (m, 2H), 7.15 – 7.09 (m, 2H), 4.28 (br, 2H), 3.72 (s, 3H), 2.85 (t, *J* = 12.0 Hz, 2H), 2.64 (tt, *J* = 12.2, 3.5 Hz, 1H), 1.81 (d, *J* = 13.3 Hz, 2H), 1.60 (qd, *J* = 12.9, 6.4 Hz, 2H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 155.9, 144.0, 132.0, 128.6, 128.1, 52.6, 44.4, 42.0, 33.0.

HRMS (**ESI**) Calculated for [M+H$^+$]: 254.0942, measured: 254.0939.


1h

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.48 – 7.38 (m, 2H), 7.07 (dd, *J* = 8.7, 2.0 Hz, 2H), 4.28 (br, 2H), 3.71 (s, 3H), 2.85 (t, *J* = 11.8 Hz, 2H), 2.63 (tt, *J* = 12.2, 3.5 Hz, 1H), 1.81 (d, *J* = 13.0 Hz, 2H), 1.69 – 1.47 (m, 2H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 155.9, 144.5, 131.6, 128.5, 120.1, 52.6, 44.4, 42.1, 33.0.

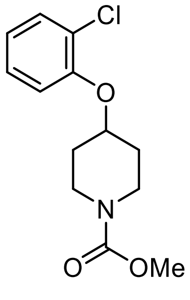
HRMS (**ESI**) Calculated for [M+H$^+$]: 298.0437, measured: 298.0435.



1i

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.18 – 7.09 (m, 2H), 7.03 – 6.93 (m, 2H), 4.28 (br, 2H), 3.72 (s, 3H), 2.85 (t, *J* = 11.8 Hz, 2H), 2.65 (tt, *J* = 12.2, 3.6 Hz, 1H), 1.82 (d, *J* = 12.9 Hz, 2H), 1.68 – 1.49 (m, 2H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 161.4 (d, *J* = 244.2 Hz), 155.9, 141.2 (d, *J* = 3.2 Hz), 128.1 (d, *J* = 7.8 Hz), 115.2 (d, *J* = 21.1 Hz), 52.6, 44.5, 41.9, 33.2.

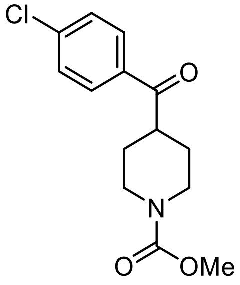
HRMS (**ESI**) Calculated for [M+H$^+$]: 238.1238, measured: 238.1234.



1j

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.37 (dd, *J* = 7.9, 1.6 Hz, 1H), 7.23 – 7.15 (m, 1H), 6.98 – 6.88 (m, 2H), 4.60 – 4.52 (m, 1H), 3.74 – 3.64 (m, 5H), 3.54 (s, 2H), 1.97 – 1.78 (m, 4H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 155.9, 152.8, 130.6, 127.6, 124.7, 122.1, 116.3, 73.2, 52.6, 40.4, 30.2.

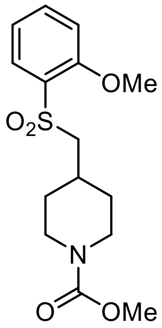
HRMS (**ESI**) Calculated for [M+H$^+$]: 270.0892, measured: 270.0890.



1k

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.87 (d, *J* = 8.6 Hz, 2H), 7.45 (d, *J* = 8.6 Hz, 2H), 4.19 (br, 2H), 3.70 (s, 3H), 3.37 (tt, *J* = 11.0, 3.8 Hz, 1H), 2.96 (t, *J* = 12.1 Hz, 2H), 1.84 (d, *J* = 11.5 Hz, 2H), 1.77 – 1.64 (m, 2H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 200.6, 155.8, 139.6, 134.0, 129.7, 129.1, 52.6, 43.3, 43.2, 28.2.

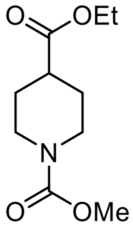
HRMS (**ESI**) Calculated for [M+H$^+$]: 282.0892, measured: 282.0888.



1l

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.95 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.64 – 7.54 (m, 1H), 7.15 – 7.07 (m, 1H), 7.04 (d, *J* = 8.3 Hz, 1H), 4.06 (s, 2H), 3.97 (s, 3H), 3.66 (s, 3H), 3.28 (d, *J* = 5.5 Hz, 2H), 2.76 (t, *J* = 11.7 Hz, 2H), 2.28 – 2.09 (m, 1H), 1.84 (d, *J* = 9.7 Hz, 2H), 1.25 (qd, *J* = 12.3, 4.4 Hz, 2H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 157.2, 155.8, 135.6, 130.1, 127.8, 120.9, 112.4, 60.0, 56.3, 52.5, 43.6, 31.8, 31.0.

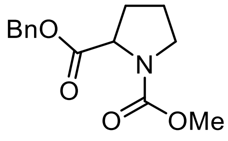
HRMS (**ESI**) Calculated for [M+H$^+$]: 328.1207, measured: 328.1213.



1m

^{1}H NMR (500 MHz, CDCl$_3$) δ 4.12 (q, *J* = 7.1 Hz, 2H), 4.03 (br, 2H), 3.67 (s, 3H), 2.89 (t, *J* = 11.6 Hz, 2H), 2.43 (tt, *J* = 10.9, 3.9 Hz, 1H), 1.87 (d, *J* = 11.7 Hz, 2H), 1.68 – 1.57 (m, 2H), 1.24 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 174.4, 155.8, 60.5, 52.5, 43.2, 40.9, 27.8, 14.1.

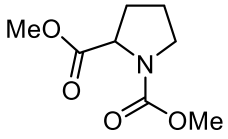
HRMS (**ESI**) Calculated for [M+H$^+$]: 216.1230, measured: 216.1229.



1n (dr = 1:1)

Two isomers: ^{1}H NMR (500 MHz, CDCl$_3$) δ 7.40 – 7.28 (m, 5H), 5.27 – 5.10 (m, 2H), 4.43 (dd, *J* = 8.6, 3.4 Hz, 0.5H), 4.33 (dd, *J* = 8.6, 3.8 Hz, 0.5H), 3.72 (s, 1.5H), 3.57 (s, 1.5H), 3.64 – 3.39 (m, 2H), 2.31 – 2.14 (m, 1H), 2.07 – 1.82 (m, 3H). ^{13}C NMR (126 MHz, CDCl$_3$) δ (172.6, 172.5), (155.5, 155.0), 135.7, (128.6, 128.5), (128.3, 128.2), (128.1, 128.), (66.8, 66.6), (59.2, 58.9), (52.5, 52.4), (46.9, 46.3), (30.9, 29.9), (24.3, 23.5).

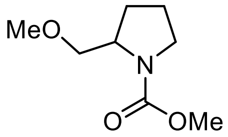
HRMS (**ESI**) Calculated for [M+H$^+$]: 264.1230, measured: 264.1227.



1o (dr = 1.2:1)

Major: ^{1}H NMR (500 MHz, CDCl$_3$) δ 4.36 (dd, *J* = 8.6, 3.4 Hz, 1H), 3.73 (s, 3H), 3.70 (s, 3H), 3.62 – 3.38 (m, 2H), 2.27 – 2.13 (m, 1H), 2.06 – 1.81 (m, 3H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 173.2, 155.5, 59.1, 52.2, 46.3, 29.9, 24.3. Minor: ^{1}H NMR (500 MHz, CDCl$_3$) δ 4.29 (dd, *J* = 8.6, 3.6 Hz, 1H), 3.71 (s, 3H), 3.66 (s, 3H), 3.61 – 3.38 (m, 2H), 2.27 – 2.13 (m, 1H), 2.04 – 1.83 (m, 3H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 173.3, 155.0, 58.7, 52.5, 46.8, 30.9, 23.4.

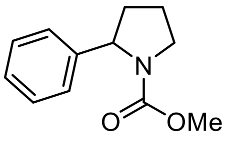
HRMS (**ESI**) Calculated for [M+H$^+$]: 188.0917, measured: 188.0915.



1p (dr = 1.5:1)

^{1}H NMR (500 MHz, CDCl$_3$) δ 3.99 (s, 0.6H), 3.89 (s, 0.4zzH), 3.68 (s, 3H), 3.56 – 3.16 (m, 7H), 1.96 – 1.85 (s, 3H), 1.84 – 1.77 (m, 1H). Major: ^{13}C NMR (125 MHz, CDCl$_3$) δ 155.7, 72.9, 59.0, 56.9, 52.2, 46.6, 27.9, 23.8. Minor: ^{13}C NMR (125 MHz, CDCl$_3$) δ 155.7, 73.5, 59.0, 56.3, 52.2, 46.9, 28.7, 22.9.

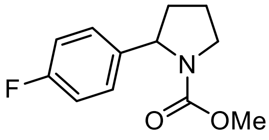
HRMS (**ESI**) Calculated for [M+H$^+$]: 174.1125, measured: 174.1124.



1q (dr = 1.2:1)

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.31 (t, *J* = 7.5 Hz, 2H), 7.25 – 7.12 (m, 3H), 5.08 – 4.81 (m, 1H), 3.79 – 3.49 (m, 5H), 2.37 – 2.23 (m, 1H), 1.97 – 1.78 (m, 3H). Major: ^{13}C NMR (125 MHz, CDCl$_3$) δ 155.9, 144.0, 128.3, 126.6, 125.2, 60.7, 52.3, 47.5, 35.7, 22.6. Minor: ^{13}C NMR (125 MHz, CDCl$_3$) δ 155.5, 143.6, 128.3, 126.6, 125.5, 61.2, 52.3, 47.1, 34.7, 23.6.

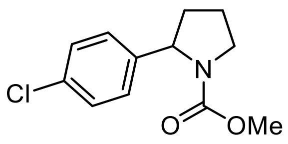
HRMS (**ESI**) Calculated for [M+H$^+$]: 206.1176, measured: 206.1174.



1r (dr = 1.1:1)

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.19 – 7.07 (m, 2H), 7.02 – 6.93 (m, 2H), 4.94 (br, 0.48H), 4.89 (br, 0.52H), 3.76 – 3.47 (m, 5H), 2.29 (br, 1H), 2.00 – 1.75 (m, 3H). Major: ^{13}C NMR (125 MHz, CDCl$_3$) δ 161.7 (d, *J* = 245.8 Hz), 155.8, 139.5 (d, *J* = 57.5 Hz), 126.9 (d, *J* = 24.7 Hz), 115.1 (d, *J* = 21.4 Hz), 60.2, 52.4, 47.5, 35.7, 22.6. Minor: ^{13}C NMR (125 MHz, CDCl$_3$) δ 161.7 (d, *J* = 245.8 Hz), 155.6, 139.5 (d, *J* = 57.5 Hz), 126.9 (d, *J* = 24.7 Hz), 115.1 (d, *J* = 21.4 Hz), 60.7, 52.4, 47.1, 34.8, 23.6. Major: ^{19}F NMR (377 MHz, CDCl$_3$) δ -116.58 (s). Minor: ^{19}F NMR (377 MHz, CDCl$_3$) δ -116.63 (s)

HRMS (**ESI**) Calculated for [M+H$^+$]: 224.1081, measured: 224.1079.

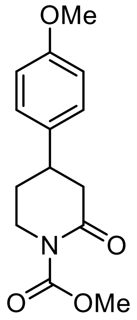


1s (dr = 1.1:1)

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.29 – 7.24 (m, 2H), 7.17 – 7.06 (m, 2H), 4.90 (d, *J* = 21.9 Hz, 1H), 3.80 – 3.43 (m, 5H), 2.30 (s, 1H), 1.99 – 1.75 (m, 3H). Major: ^{13}C NMR (125 MHz, CDCl$_3$) δ 155.8, 142.6, 132.4, 128.5, 126.7, 60.3, 52.4, 47.5, 35.7, 22.6. Minor: ^{13}C NMR (126 MHz, CDCl$_3$) δ 155.6, 142.2, 132.4, 128.5, 126.9, 60.8, 52.4, 47.1, 34.7, 23.7.

HRMS (**ESI**) Calculated for [M+H$^+$]: 240.0786, measured: 240.0783.

10.2 Characterization of products

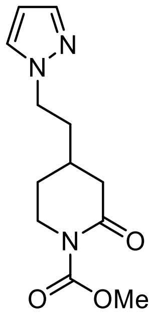


2a

The reaction was conducted with PhCO$_2$ABNO, 50 equiv of water @ 3 mA, and the product was obtained with 31 mg as colorless oil (59%).

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.11 (d, *J* = 8.6 Hz, 2H), 6.87 (d, *J* = 8.7 Hz, 2H), 3.95 (dt, *J* = 12.9, 4.7 Hz, 1H), 3.88 (s, 3H), 3.79 (s, 3H), 3.66 (ddd, *J* = 12.9, 10.8, 4.3 Hz, 1H), 3.10 (ddd, *J* = 15.5, 10.8, 4.7 Hz, 1H), 2.85 (ddd, *J* = 17.2, 5.4, 2.0 Hz, 1H), 2.62 (dd, *J* = 17.2, 11.0 Hz, 1H), 2.19 (dqd, *J* = 12.6, 4.2, 2.1 Hz, 1H), 1.93 (dtd, *J* = 13.7, 10.8, 5.0 Hz, 1H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 170.5, 158.5, 155.0, 134.9, 127.4, 114.2, 55.3, 53.9, 45.9, 42.2, 37.5, 30.4.

HRMS (**ESI**) Calculated for [M+H$^+$]: 264.1230, measured: 264.1228.

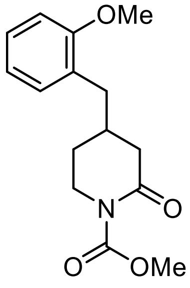


2c

The reaction was conducted with PhCO2ABNO, 30 equiv of water @ 5 mA, and the product was obtained with 35 mg as light yellow oil (69%).

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.48 (d, *J* = 1.4 Hz, 1H), 7.35 (d, *J* = 2.1 Hz, 1H), 6.23 (t, *J* = 2.0 Hz, 1H), 4.24 – 4.11 (m, 2H), 3.88 (dt, *J* = 13.0, 4.7 Hz, 1H), 3.83 (s, 3H), 3.52 (ddd, *J* = 13.0, 10.9, 4.4 Hz, 1H), 2.65 (ddd, *J* = 16.9, 5.2, 1.8 Hz, 1H), 2.19 (dd, *J* = 17.0, 10.2 Hz, 1H), 2.00 – 1.79 (m, 4H), 1.54 – 1.41 (m, 1H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 170.1, 154.7, 139.4, 128.9, 105.6, 53.9, 49.1, 45.4, 40.7, 36.1, 29.7, 28.5.

HRMS (**ESI**) Calculated for [M+H$^+$]: 252.1343, measured: 252.1339.

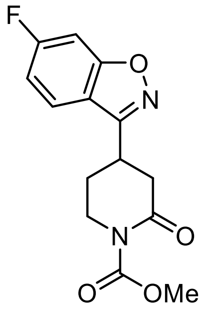


2d

The reaction was conducted with PhCO2ABNO, 30 equiv of water @ 5 mA, and the product was obtained with 34 mg as light yellow oil (62%).

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.21 (t, *J* = 7.8 Hz, 1H), 7.06 (d, *J* = 7.3 Hz, 1H), 6.87 (t, *J* = 7.4 Hz, 1H), 6.85 (d, *J* = 8.5 Hz, 1H), 3.89 (dt, *J* = 12.9, 4.7 Hz, 1H), 3.85 (s, 3H), 3.81 (s, 3H), 3.51 (ddd, *J* = 12.9, 11.2, 4.4 Hz, 1H), 2.74 – 2.50 (m, 3H), 2.30 – 2.15 (m, 2H), 2.01 – 1.83 (m, 1H), 1.58 – 1.41 (m, 1H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 171.1, 157.5, 155.0, 130.8, 127.8, 127.1, 120.4, 110.4, 55.2, 53.8, 45.9, 41.1, 36.3, 32.9, 28.7.

HRMS (**ESI**) Calculated for [M+H$^+$]: 278.1387, measured: 278.1383.

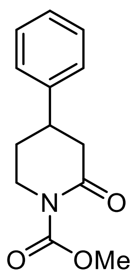


2e

The reaction was conducted with ketoABNO, 50 equiv of water @ 5 mA, and the product was obtained with 34 mg as white solid (58%).

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.63 (dd, *J* = 8.7, 5.0 Hz, 1H), 7.25 (dd, *J* = 8.4, 2.0 Hz, 1H), 7.09 (td, *J* = 8.8, 2.1 Hz, 1H), 3.95 (dt, *J* = 13.2, 5.3 Hz, 1H), 3.86 (s, 3H), 3.85 – 3.79 (m, 1H), 3.74 – 3.65 (m, 1H), 3.07 (ddd, *J* = 17.3, 6.0, 1.4 Hz, 1H), 2.99 (dd, *J* = 17.3, 9.7 Hz, 1H), 2.51 – 2.39 (m, 1H), 2.25 (dtd, *J* = 14.3, 9.5, 4.9 Hz, 1H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 169.2, 164.3 (d, *J* = 251.8 Hz), 164.1 (d, *J* = 13.6 Hz), 158.7, 154.5, 121.8 (d, *J* = 11.1 Hz), 116.6, 113.0 (d, *J* = 25.5 Hz), 97.7 (d, *J* = 26.9 Hz), 54.1, 45.0, 38.5, 30.4, 27.3. ^{19}F NMR (377 MHz, CDCl$_3$) δ -108.40 (s).

HRMS (**ESI**) Calculated for [M+H$^+$]: 293.0932, measured: 293.0931.

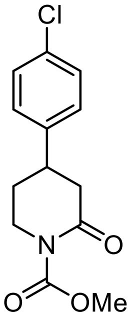


2f

The reaction was conducted with ketoABNO, 40 equiv of water @ 5 mA, and the product was obtained with 38 mg as white solid (81%).

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.34 (t, *J* = 7.5 Hz, 2H), 7.28 – 7.24 (m, 1H), 7.20 (d, *J* = 7.2 Hz, 2H), 3.96 (dt, *J* = 13.0, 4.7 Hz, 1H), 3.88 (s, 3H), 3.68 (ddd, *J* = 13.0, 10.8, 4.3 Hz, 1H), 3.15 (ddd, *J* = 15.5, 10.8, 4.7 Hz, 1H), 2.87 (ddd, *J* = 17.2, 5.4, 2.0 Hz, 1H), 2.66 (dd, *J* = 17.2, 11.0 Hz, 1H), 2.27 – 2.18 (m, 1H), 1.98 (dtd, *J* = 13.7, 10.8, 5.0 Hz, 1H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 170.4, 154.9, 142.8, 128.9, 127.1, 126.4, 54.0, 45.9, 42.0, 38.2, 30.2.

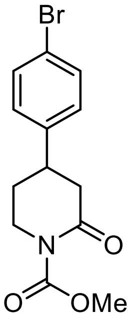
HRMS (**ESI**) Calculated for [M+H$^+$]: 234.1125, measured: 234.1122.


2g

The reaction was conducted with ketoABNO, 40 equiv of water @ 5 mA, and the product was obtained with 33 mg as light yellow oil (62%).

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.31 (d, *J* = 8.5 Hz, 2H), 7.13 (d, *J* = 8.5 Hz, 2H), 3.96 (dt, *J* = 13.0, 4.7 Hz, 1H), 3.89 (s, 3H), 3.67 (ddd, *J* = 13.0, 10.8, 4.3 Hz, 1H), 3.13 (ddd, *J* = 15.5, 10.7, 4.7 Hz, 1H), 2.86 (ddd, *J* = 17.2, 5.4, 2.0 Hz, 1H), 2.61 (dd, *J* = 17.2, 11.0 Hz, 1H), 2.21 (dqd, *J* = 12.7, 4.2, 2.1 Hz, 1H), 1.94 (dtd, *J* = 13.7, 10.9, 5.0 Hz, 1H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 169.0, 153.8, 140.3, 131.9, 128.0, 126.8, 53.0, 44.7, 40.9, 36.7, 29.2.

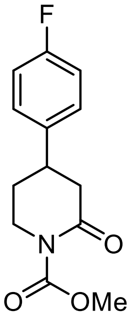
HRMS (**ESI**) Calculated for [M+H$^+$]: 268.0735, measured: 268.0730.


2h

The reaction was conducted with ketoABNO, 50 equiv of water @ 5 mA, and the product was obtained with 39 mg as light yellow solid (63%).

^{1}H NMR (400 MHz, CDCl$_3$) δ 7.45 (d, *J* = 8.4 Hz, 2H), 7.07 (d, *J* = 8.4 Hz, 2H), 3.96 (dt, *J* = 13.0, 4.7 Hz, 1H), 3.88 (s, 3H), 3.66 (ddd, *J* = 13.0, 10.9, 4.3 Hz, 1H), 3.11 (ddd, *J* = 15.4, 10.7, 4.7 Hz, 1H), 2.85 (ddd, *J* = 17.2, 5.4, 2.0 Hz, 1H), 2.60 (dd, *J* = 17.2, 11.0 Hz, 1H), 2.23 – 2.16 (m, 1H), 1.93 (dtd, *J* = 13.8, 10.9, 5.0 Hz, 1H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 169.9, 154.8, 141.8, 131.9, 128.1, 120.8, 54.0, 45.7, 41.8, 37.7, 30.0.

HRMS (**ESI**) Calculated for [M+H$^+$]: 312.0230, measured: 312.0225.

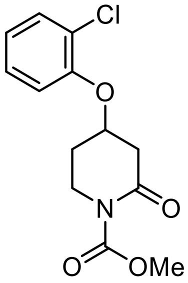


2i

The reaction was conducted with ketoABNO, 40 equiv of water @ 5 mA, and the product was obtained with 42 mg as light yellow oil (83%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.16 (dd, *J* = 8.6, 5.3 Hz, 2H), 7.05 – 7.00 (m, 2H), 3.96 (dt, *J* = 13.0, 4.6 Hz, 1H), 3.88 (s, 3H), 3.67 (ddd, *J* = 13.0, 10.9, 4.3 Hz, 1H), 3.14 (ddd, *J* = 15.5, 10.7, 4.7 Hz, 1H), 2.86 (ddd, *J* = 17.2, 5.4, 1.9 Hz, 1H), 2.61 (dd, *J* = 17.2, 11.0 Hz, 1H), 2.23 – 2.16 (m, 1H), 1.94 (dtd, *J* = 13.7, 10.9, 5.0 Hz, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 170.0, 161.7 (d, *J* = 245.5 Hz), 154.8, 138.5 (d, *J* = 3.2 Hz), 127.8 (d, *J* = 8.0 Hz), 115.6 (d, *J* = 21.3 Hz), 53.9, 45.7, 42.1, 37.5, 30.2. ^{19}F NMR (377 MHz, $CDCl_3$) δ -115.58 (s).

HRMS (**ESI**) Calculated for [M+H$^+$]: 252.1031, measured: 252.1027.



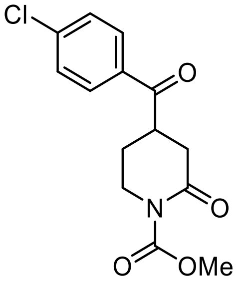
2j

The reaction was conducted with ketoABNO, 50 equiv of water @ 5 mA, and the product was obtained with 34.5 mg as light yellow oil (61%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.38 (dd, *J* = 7.9, 1.6 Hz, 1H), 7.23 – 7.18 (m, 1H), 6.97 (td, *J* = 7.7, 1.4 Hz, 1H), 6.93 (dd, *J* = 8.2, 1.3 Hz, 1H), 4.80 – 4.75 (m, 1H), 4.03 (ddd, *J* = 13.9, 8.9, 4.4 Hz, 1H), 3.89 (s, 3H), 3.85 (dt, *J* = 13.1, 5.3 Hz, 1H), 2.92 (ddd, *J* = 18.4, 5.1, 1.7 Hz, 1H), 2.87 (dd, *J* = 17.5, 4.9 Hz, 1H), 2.29 – 2.21 (m, 1H), 2.15 (ddd,

J = 14.2, 9.1, 4.6 Hz, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 168.3, 154.6, 152.2, 130.8, 127.7, 125.0, 123.1, 116.8, 71.5, 54.1, 41.9, 40.2, 28.01.

HRMS (**ESI**) Calculated for [$M+H^+$]: 284.0684, measured: 284.0681.

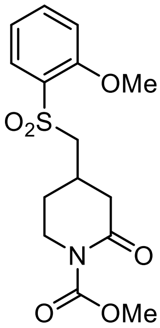


2k

The reaction was conducted with ketoABNO, 40 equiv of water @ 5 mA, and the product was obtained with 49 mg as yellow solid (83%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.88 (d, J = 8.6 Hz, 2H), 7.47 (d, J = 8.6 Hz, 2H), 3.88 (s, 3H), 3.91 – 3.80 (m, 2H), 3.78 – 3.72 (m, 1H), 2.89 (dd, J = 16.8, 9.3 Hz, 1H), 2.69 (dd, J = 16.8, 5.7 Hz, 1H), 2.21 (dq, J = 6.3, 5.4 Hz, 1H), 2.02 (dtd, J = 12.6, 7.9, 4.7 Hz, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 197.2, 168.6, 153.5, 139.4, 132.2, 128.8, 128.3, 53.1, 43.1, 38.0, 35.4, 25.0.

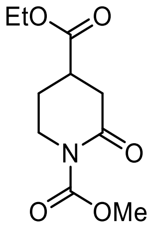
HRMS (**ESI**) Calculated for [$M+H^+$]: 296.0684, measured: 296.0681.



2l

The reaction was conducted with ketoABNO, 50 equiv of water @ 5 mA, and the product was obtained with 57 mg as white solid (83%).

^{1}H NMR (500 MHz, CD_3CN) δ 7.90 (dd, J = 7.8, 1.7 Hz, 1H), 7.71 (ddd, J = 8.4, 7.4, 1.8 Hz, 1H), 7.23 (d, J = 8.1 Hz, 1H), 7.17 (td, J = 7.8, 0.9 Hz, 1H), 3.99 (s, 3H), 3.80 (dt, J = 12.9, 4.8 Hz, 1H), 3.76 (s, 3H), 3.51 (ddd, J = 12.9, 10.7, 4.3 Hz, 1H), 3.44 (dd, J = 14.3, 6.5 Hz, 1H), 3.40 (dd, J = 14.3, 6.7 Hz, 1H), 2.61 (ddd, J = 16.8, 5.3, 1.9 Hz, 1H), 2.48 – 2.38 (m, 1H), 2.31 (dd, *J* = 16.8, 10.3 Hz, 1H), 2.09 (dqd, *J* = 10.7, 4.4, 2.0 Hz, 1H), 1.65 (dtd, *J* = 13.8, 10.5, 5.0 Hz, 1H). ^{13}C NMR (125 MHz, CD$_3$CN) δ 169.6, 158.0, 155.1, 136.5, 130.1, 128.0, 121.3, 113.6, 59.0, 56.6, 53.7, 45.5, 40.4, 28.5, 28.4. **HRMS** (**ESI**) Calculated for [M+H$^+$]: 342.1006, measured: 342.1002.

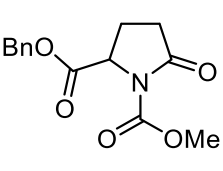


2m

The reaction was conducted with ketoABNO, 30 equiv of water @ 5 mA, and the product was obtained with 27 mg as colorless oil (58%).

^{1}H NMR (400 MHz, CDCl$_3$) δ 4.18 (q, *J* = 7.2 Hz, 2H), 3.87 (s, 3H), 3.86 – 3.81 (m, 1H), 3.71 (ddd, *J* = 13.3, 8.9, 4.5 Hz, 1H), 2.96 – 2.81 (m, 1H), 2.77 (d, *J* = 7.5 Hz, 2H), 2.19 (ddd, *J* = 15.8, 11.0, 4.9 Hz, 1H), 2.07 – 1.95 (m, 1H), 1.27 (t, *J* = 7.1 Hz, 3H). ^{13}C NMR (100 MHz, CDCl$_3$) δ 172.8, 169.0, 154.5, 61.2, 53.9, 44.5, 37.4, 36.4, 25.4, 14.0.

HRMS (**ESI**) Calculated for [M+H$^+$]: 230.1023, measured: 230.1021.

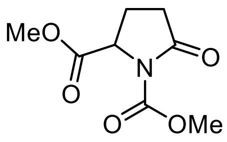


2n

The reaction was conducted with ketoABNO, 20 equiv of water, constant applied potential @ 0.68 V vs Fc/Fc$^+$, and the product was obtained with 47 mg as light yellow oil (85%).

^{1}H NMR (500 MHz, CDCl$_3$) δ 7.42 – 7.31 (m, 5H), 5.24 (d, *J* = 12.2 Hz, 1H), 5.20 (d, *J* = 12.2 Hz, 1H), 4.72 (dd, *J* = 9.4, 2.6 Hz, 1H), 3.80 (s, 3H), 2.63 (dt, *J* = 17.6, 9.9 Hz, 1H), 2.51 (ddd, *J* = 17.6, 9.3, 3.2 Hz, 1H), 2.40 –2.31 (m, 1H), 2.11 – 2.03 (m, 1H). ^{13}C NMR (125 MHz, CDCl$_3$) δ 172.5, 170.6, 151.6, 134.9, 128.5, 128.4, 128.1, 67.2, 58.6, 53.6, 30.9, 21.6.

HRMS (**ESI**) Calculated for [M+H$^+$]: 278.1023, measured: 278.1019.

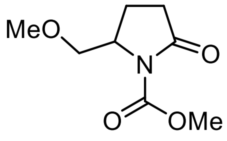


2o

The reaction was conducted with ketoABNO, 20 equiv of water, constant applied potential @ 0.68 V vs Fc/Fc$^+$, and the product was obtained with 31 mg as light yellow oil (76%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 4.69 (dd, *J* = 9.5, 2.6 Hz, 1H), 3.86 (s, 3H), 3.79 (s, 3H), 2.72 – 2.61 (m, 1H), 2.52 (ddd, *J* = 17.6, 9.3, 3.1 Hz, 1H), 2.41 – 2.31 (m, 1H), 2.13 – 2.05 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.6, 171.5, 151.9, 58.7, 53.9, 52.8, 31.1, 21.8.

HRMS (**ESI**) Calculated for [M+H$^+$]: 202.0710, measured: 202.0708.

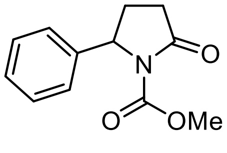


2p

The reaction was conducted with ketoABNO, 40 equiv of water @ 5 mA, and the product was obtained with 34 mg as white solid (93%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 4.35 – 4.28 (m, 1H), 3.87 (s, 3H), 3.63 (dd, *J* = 9.7, 4.6 Hz, 1H), 3.50 (dd, *J* = 9.7, 2.6 Hz, 1H), 3.34 (s, 3H), 2.79 – 2.69 (m, 1H), 2.40 (ddd, *J* = 17.7, 9.7, 1.8 Hz, 1H), 2.19 – 2.09 (m, 1H), 2.04 (dd, *J* = 11.9, 10.6 Hz, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 174.5, 152.3, 73.2, 59.3, 57.5, 53.5, 32.1, 21.5.

HRMS (**ESI**) Calculated for [M+H$^+$]: 188.0917, measured: 188.0916.

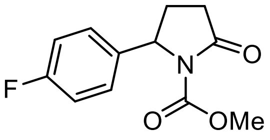


2q

The reaction was conducted with ketoABNO (40 mol%), 15 equiv of water @ 5 mA, and the product was obtained with 38 mg as white solid (86%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.36 (t, *J* = 7.4 Hz, 2H), 7.29 (t, *J* = 7.3 Hz, 1H), 7.21 (d, *J* = 7.3 Hz, 2H), 5.27 (dd, *J* = 8.3, 2.8 Hz, 1H), 3.75 (s, 3H), 2.78 – 2.65 (m, 1H), 2.57 – 2.48 (m, 2H), 2.00 – 1.91 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 174.2, 151.9, 141.5, 128.9, 127.7, 125.0, 61.2, 53.5, 31.1, 27.5.

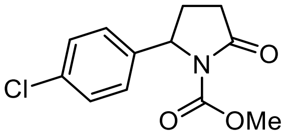
HRMS (**ESI**) Calculated for [M+H$^+$]: 220.0968, measured: 220.0966.



2r

The reaction was conducted with ketoABNO (40 mol%), 30 equiv of water @ 5 mA, and the product was obtained with 39 mg as light yellow oil (82%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.19 (dd, *J* = 8.5, 5.2 Hz, 2H), 7.04 (t, *J* = 8.6 Hz, 2H), 5.24 (dd, *J* = 8.1, 2.7 Hz, 1H), 3.75 (s, 3H), 2.75 – 2.63 (m, 1H), 2.59 – 2.46 (m, 2H), 1.97 – 1.88 (m, 1H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.7, 162.0 (d, *J* = 246.3 Hz), 151.7, 137.2 (d, *J* = 3.2 Hz), 126.6 (d, *J* = 8.2 Hz), 115.6 (d, *J* = 21.7 Hz), 60.4, 53.4, 30.9, 27.3. ^{19}F NMR (377 MHz, $CDCl_3$) δ -114.50 (s).



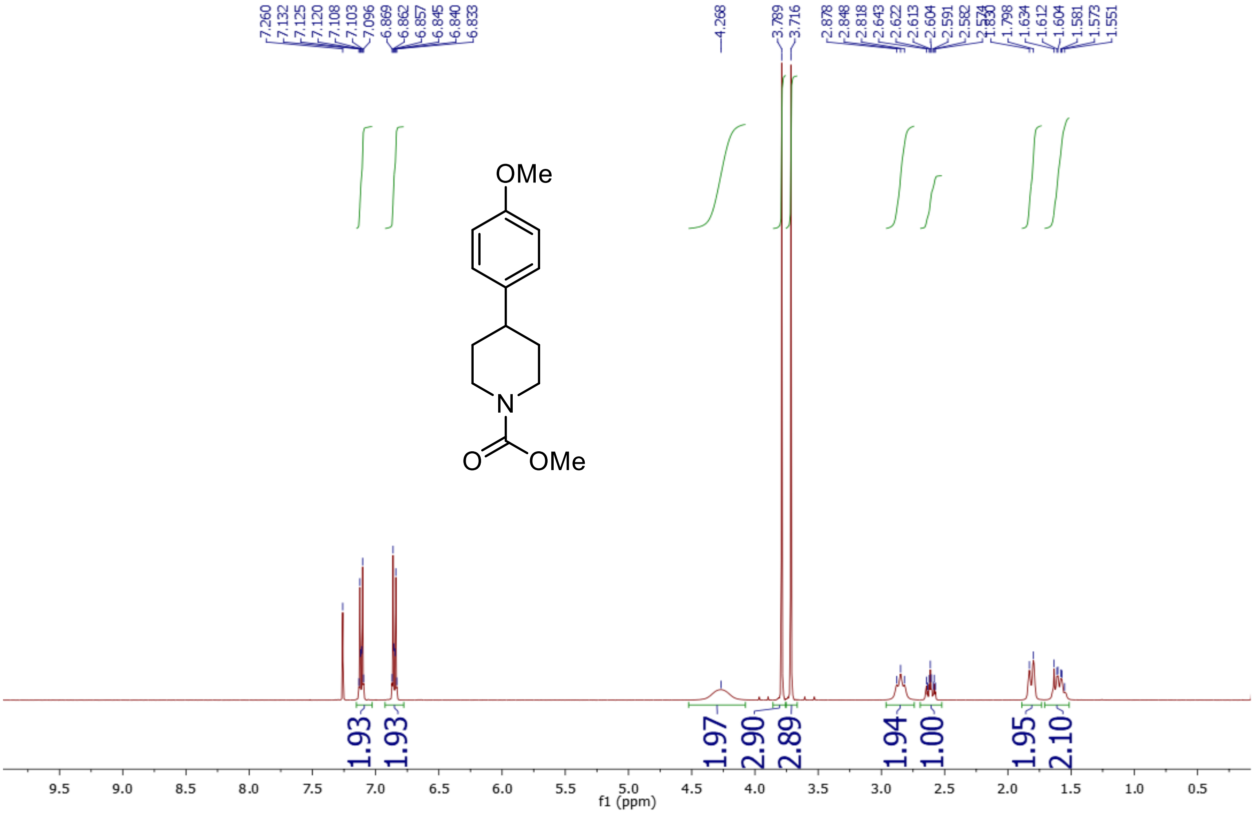
2s

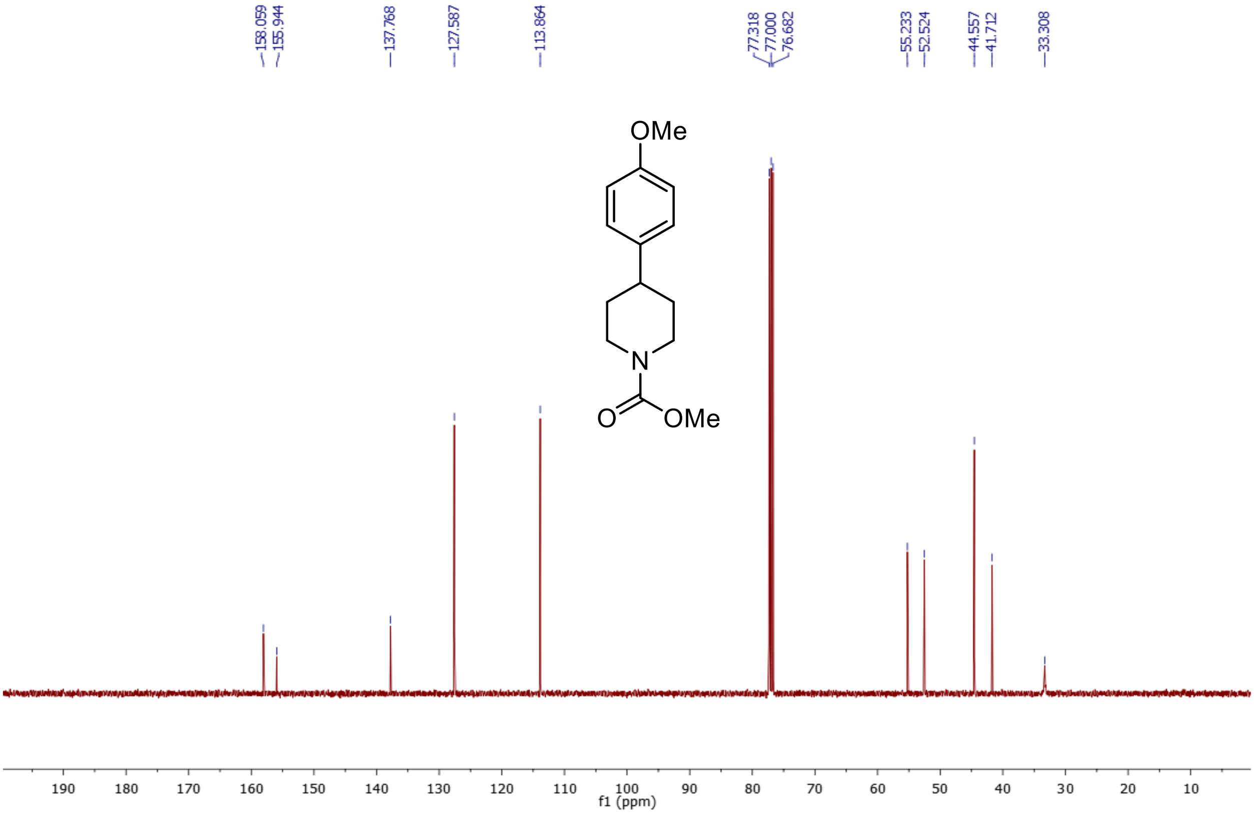
The reaction was conducted with ketoABNO (40 mol%), 30 equiv of water @ 5 mA, and the product was obtained with 41 mg as white solid (82%).

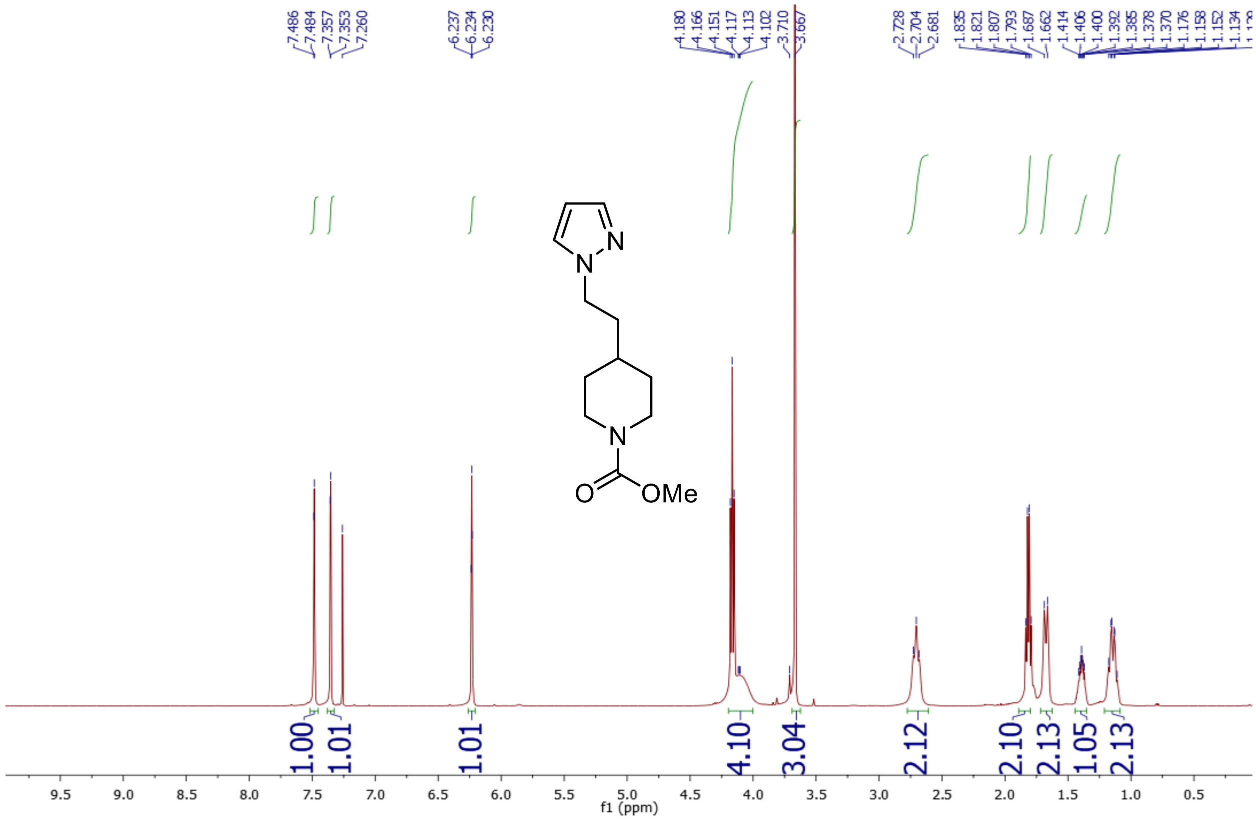
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.33 (d, *J* = 8.2 Hz, 2H), 7.16 (d, *J* = 7.4 Hz, 2H), 5.23 (d, *J* = 7.0 Hz, 1H), 3.76 (s, 3H), 2.74 – 2.63 (m, 1H), 2.60 – 2.46 (m, 2H), 1.96 – 1.88 (m, 1H). ^{13}C NMR (1z25 MHz, $CDCl_3$) δ 173.7, 151.8, 140.0, 133.5, 129.0, 126.4, 60.5, 53.6, 30.9, 27.3.

HRMS (**ESI**) Calculated for [M+H$^+$]: 254.0579, measured: 254.0575.

11.NMR Spectrum



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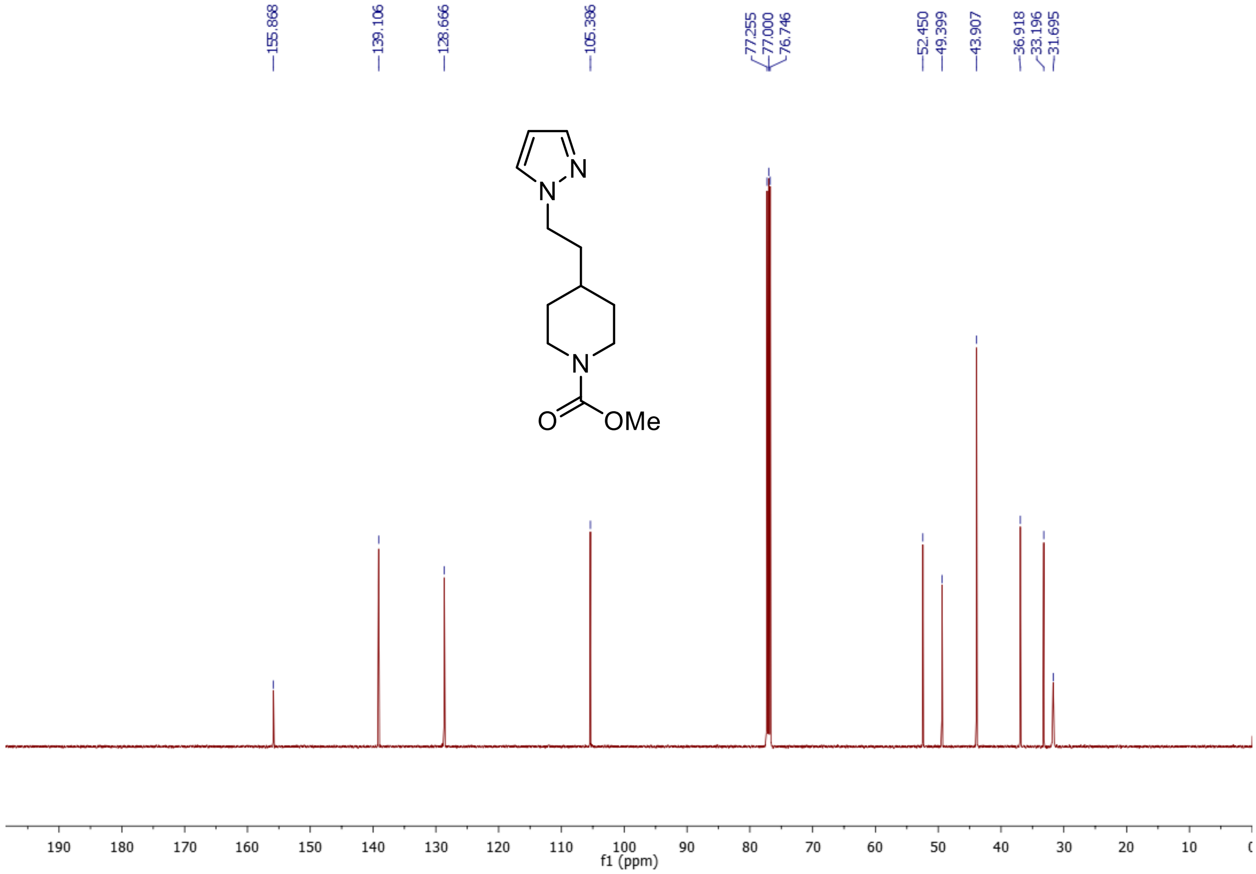
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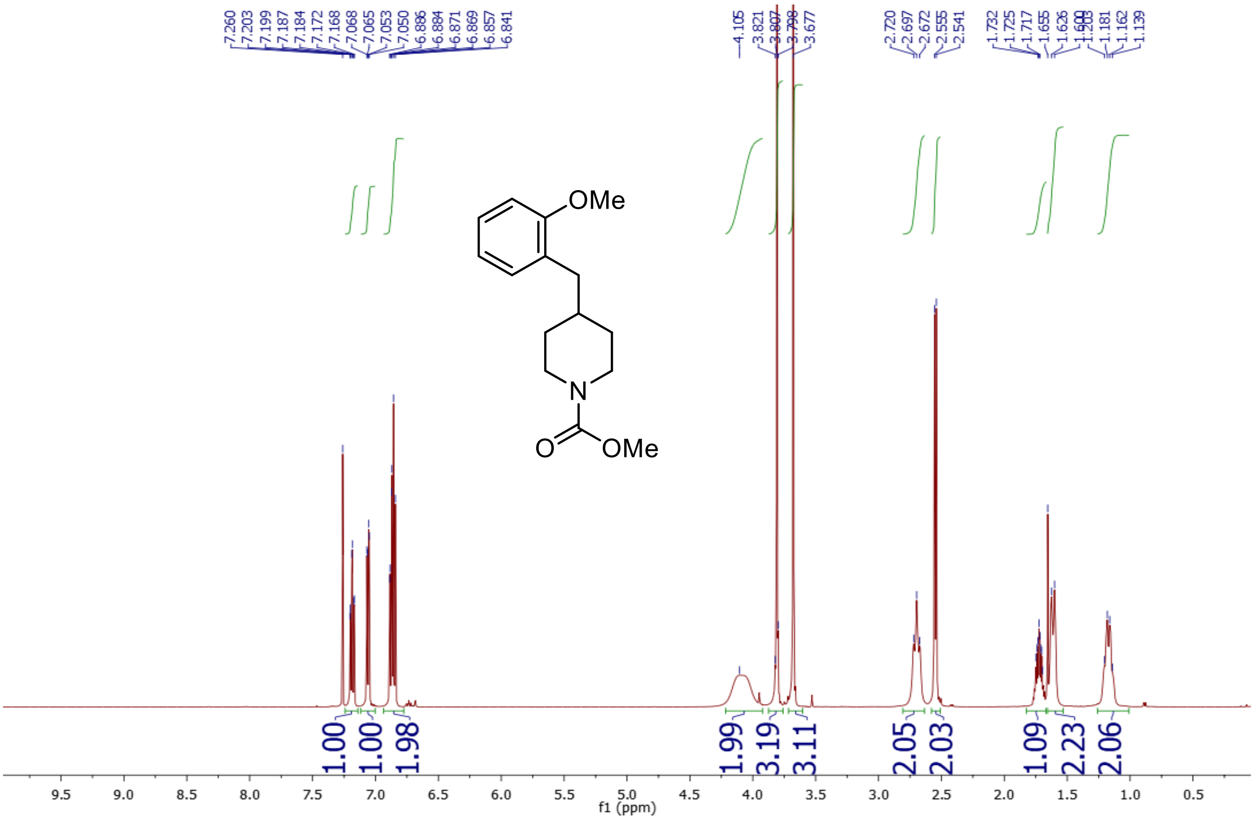
f1 (ppm)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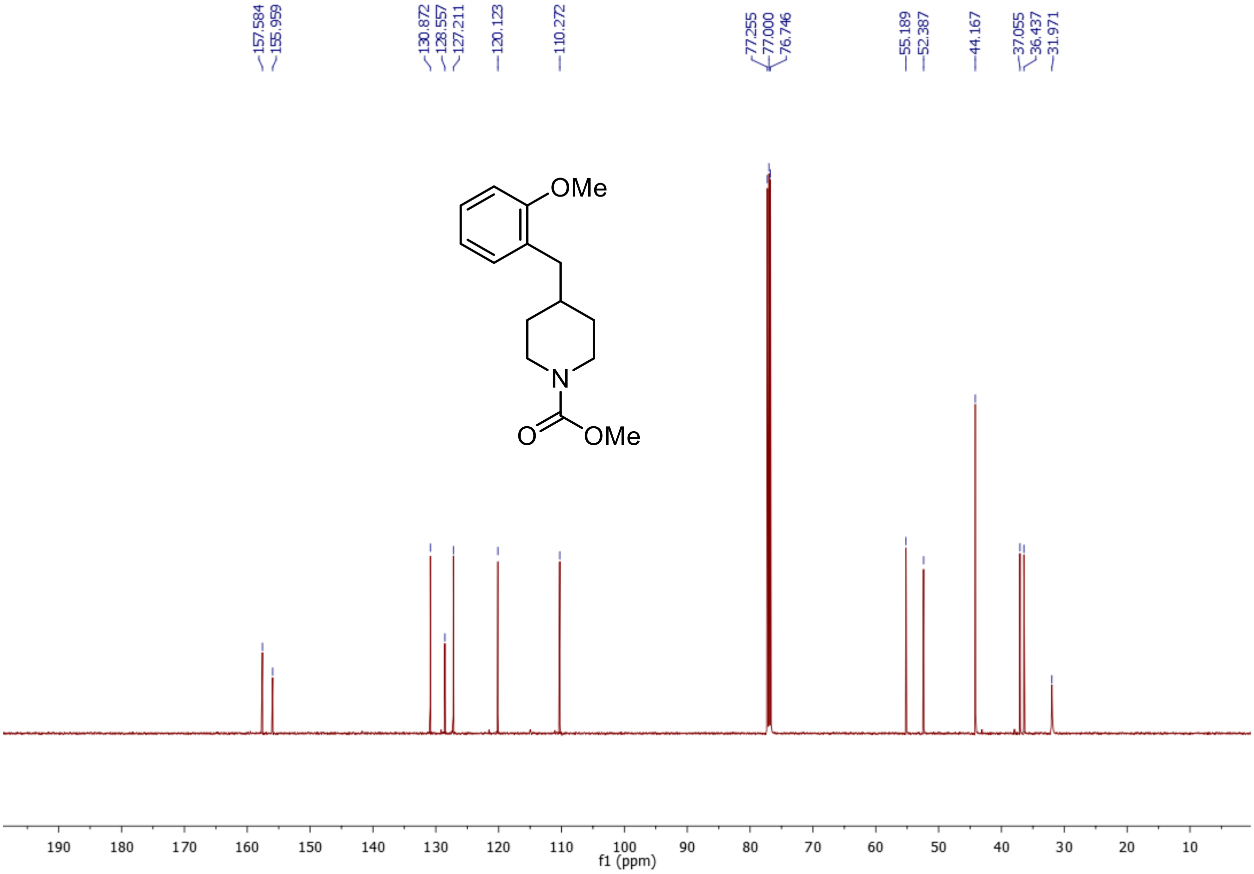
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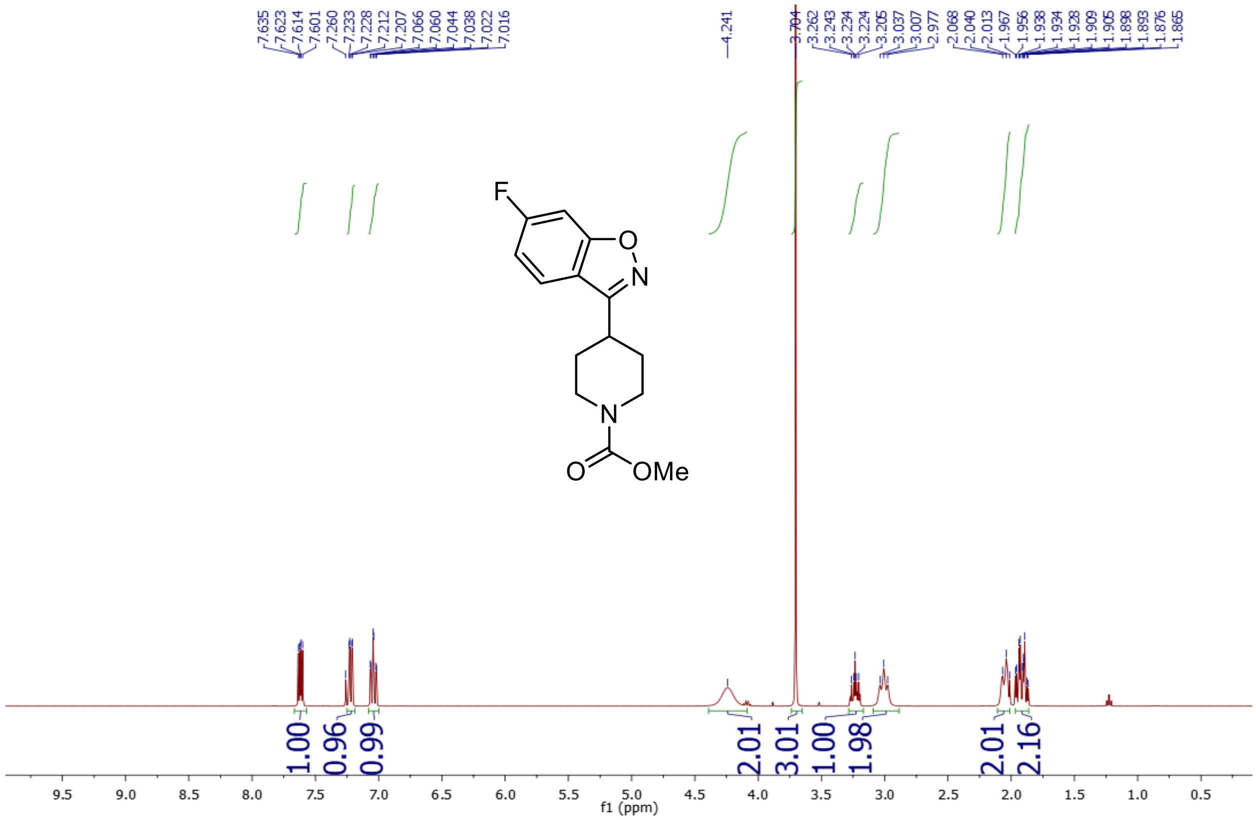
f1 (ppm)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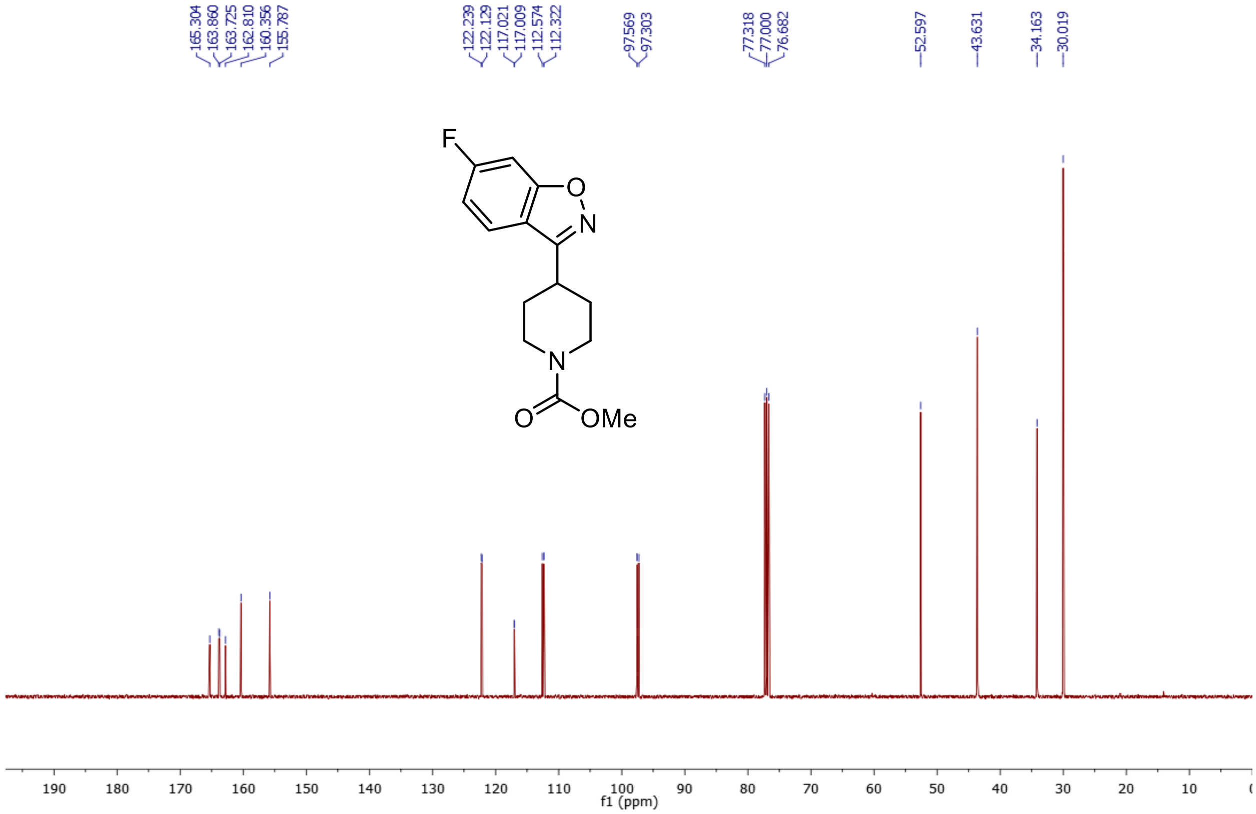
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170
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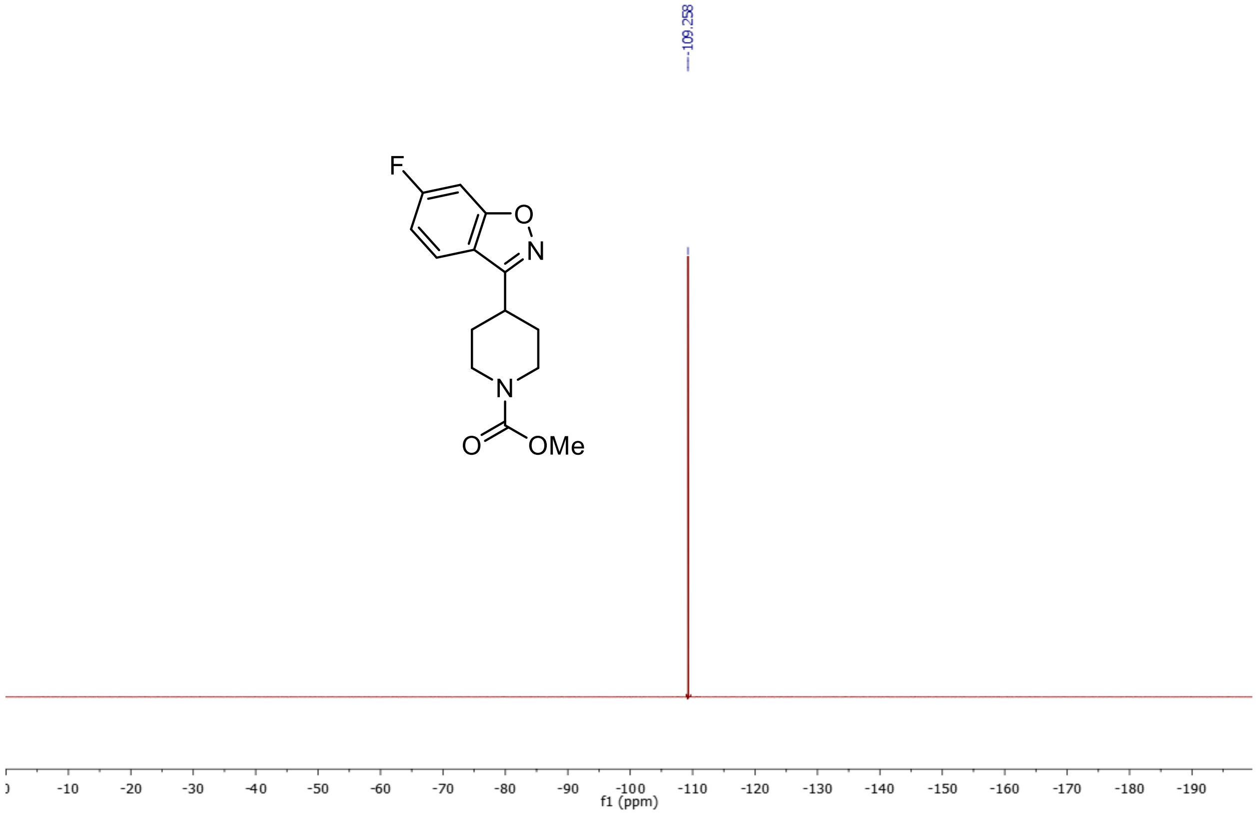
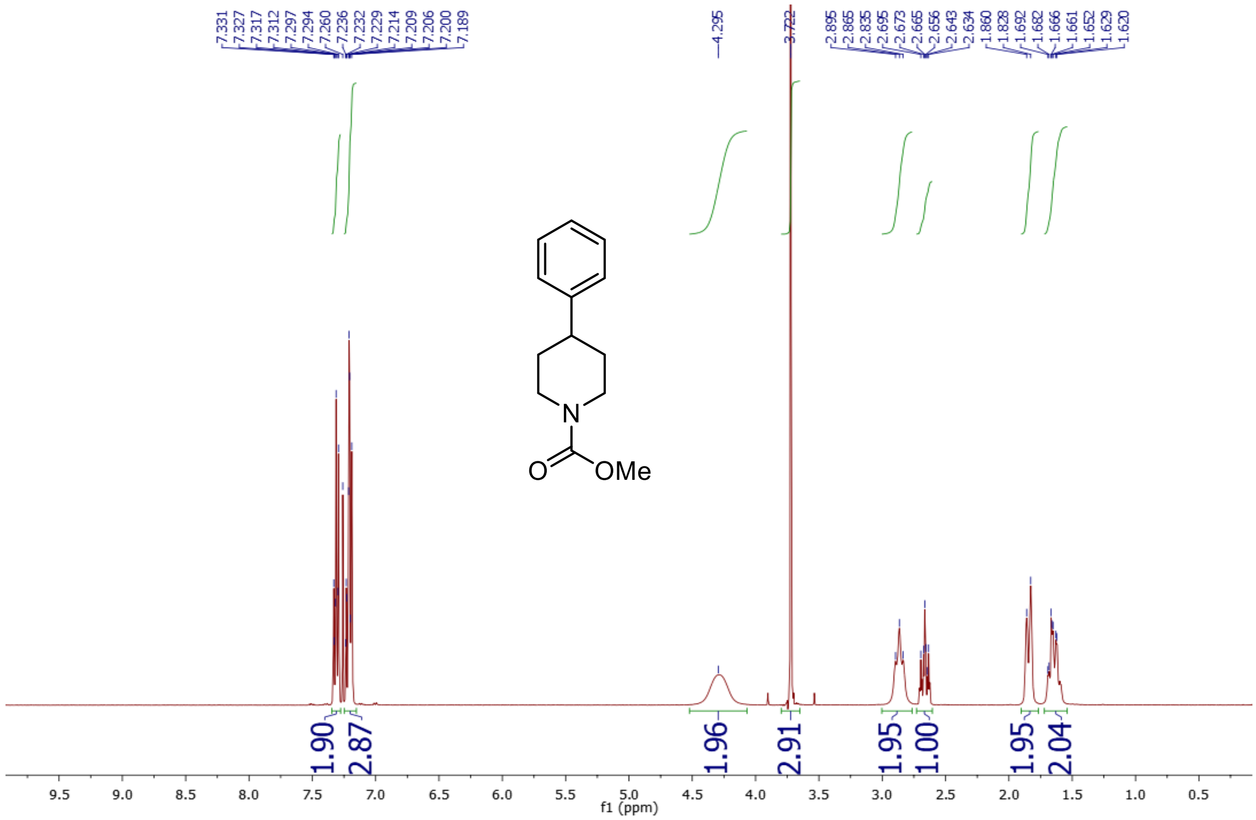
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)


-109.258
F
O
N
OMe
O
N
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
f1 (ppm)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7.317
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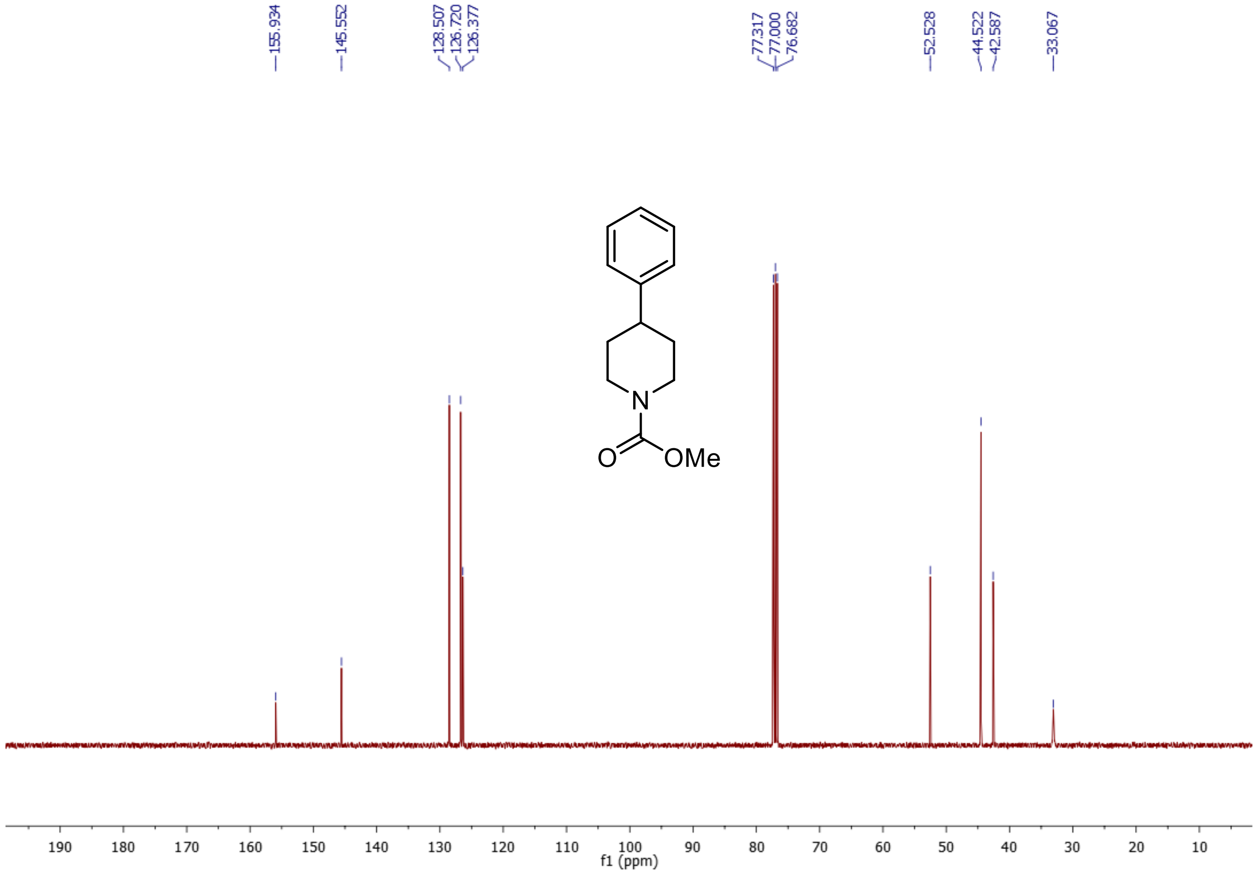
7.294
7.260
7.236
7.232
7.229
7.214
7.209
7.206
7.200
7.189
4.295
3.722
2.895
2.865
2.835
2.695
2.673
2.665
2.656
2.643
2.634
1.860
1.828
1.692
1.682
1.666
1.661
1.652
1.629
1.620
N
O
OMe
1.90
2.87
1.96
2.91
1.95
1.00
1.95
2.04
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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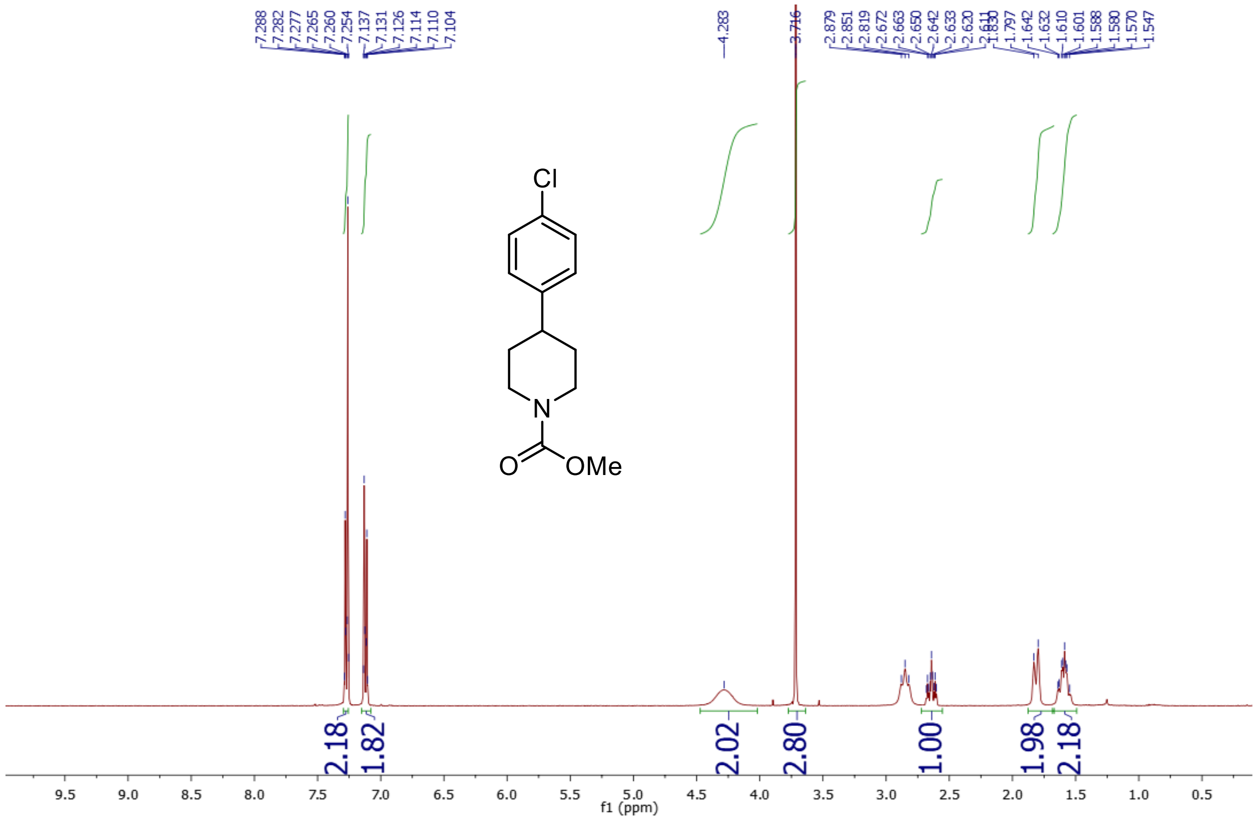
145.552
128.507
126.720
126.377
77.317
77.000
76.682
52.528
44.522
42.587
33.067
N
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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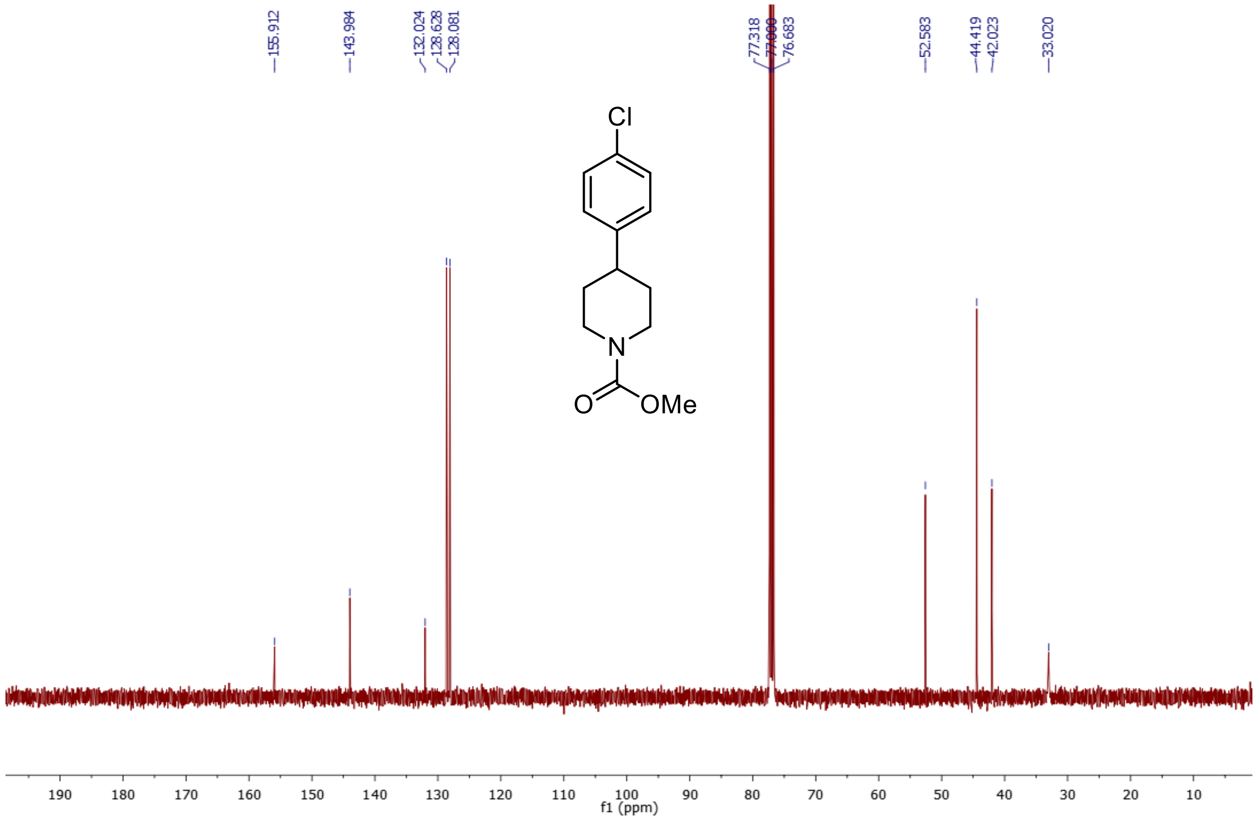
7.277
7.265
7.260
7.254
7.137
7.131
7.126
7.114
7.110
7.104
4.283
3.716
2.879
2.851
2.819
2.672
2.663
2.650
2.642
2.633
2.620
2.611
1.830
1.797
1.642
1.632
1.610
1.601
1.588
1.580
1.570
1.547
Cl
N
O
OMe
2.18
1.82
2.02
2.80
1.00
1.98
2.18
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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143.984
132.024
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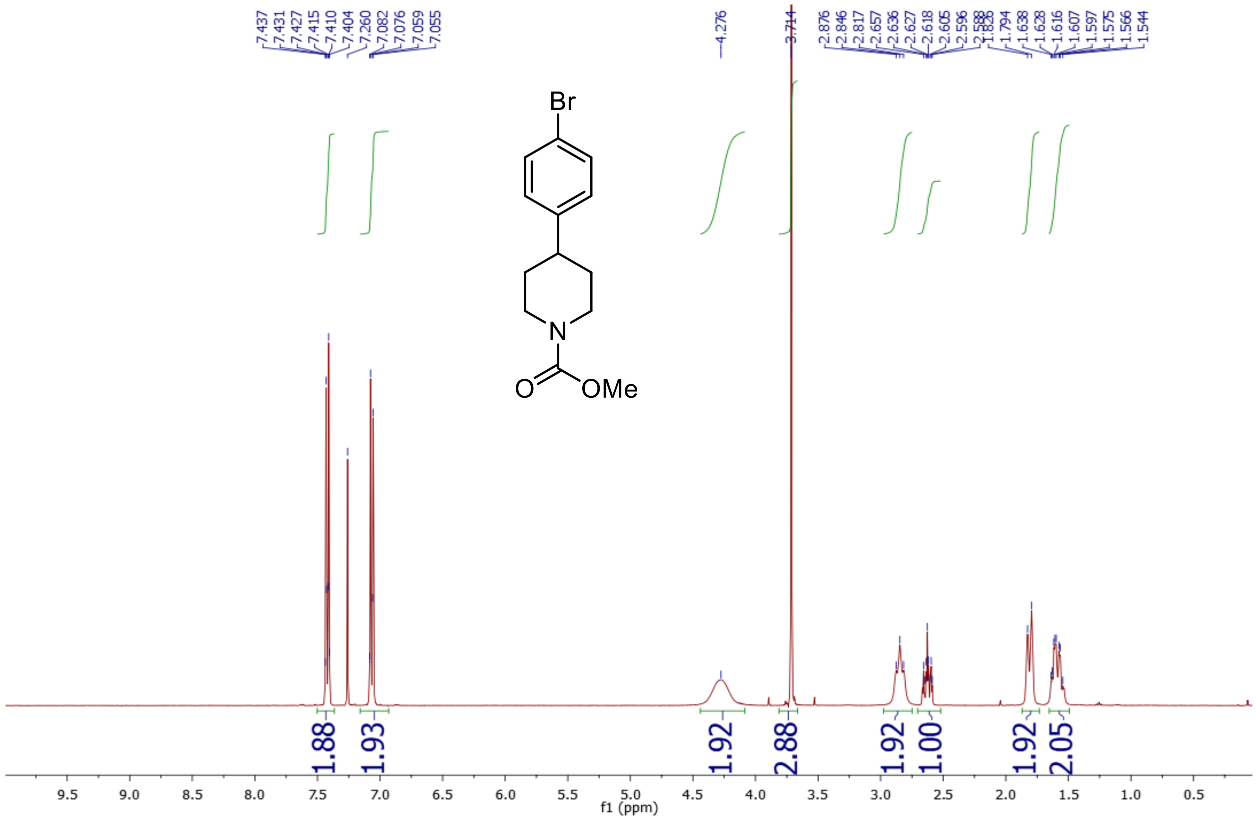
77.318
77.000
76.683
52.583
44.419
42.023
33.020
Cl
N
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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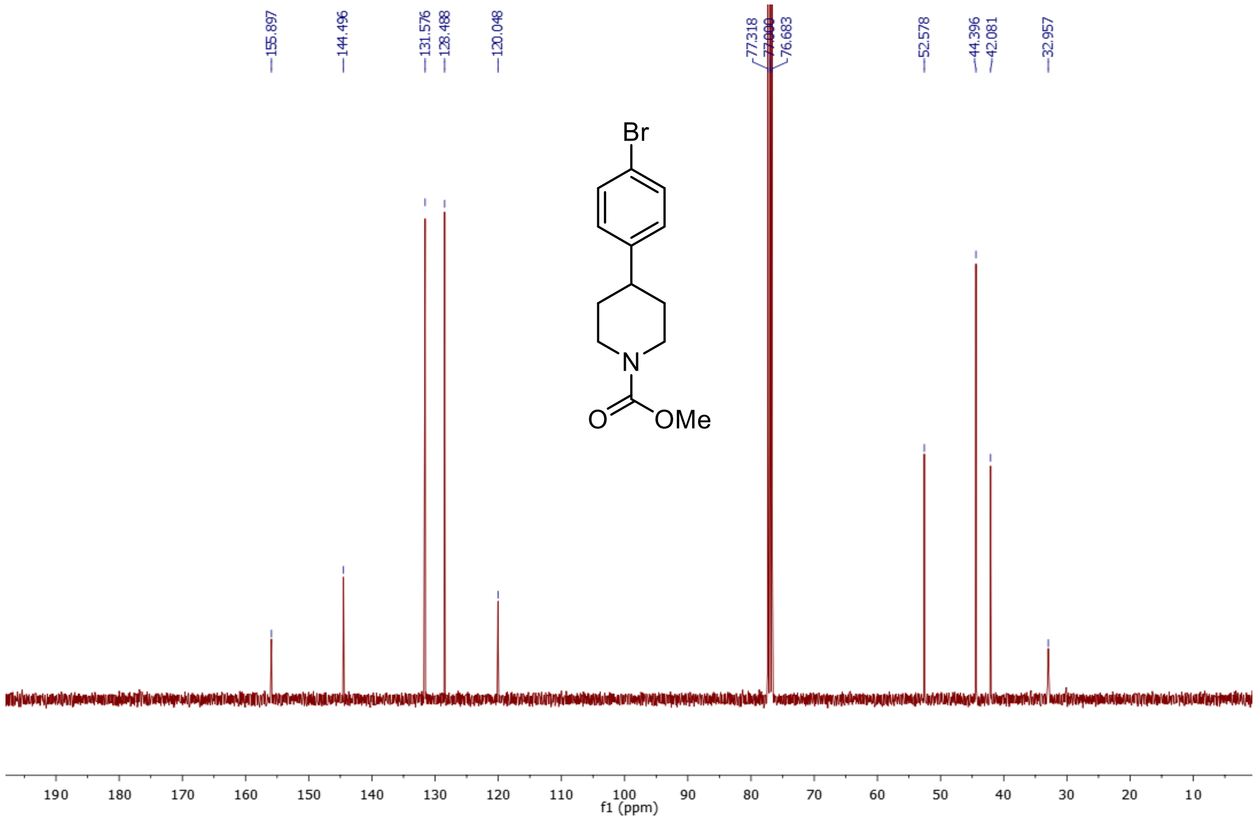
7.431
7.427
7.415
7.410
7.404
7.260
7.082
7.076
7.059
7.055
4.276
3.714
2.876
2.846
2.817
2.657
2.636
2.627
2.618
2.605
2.596
2.588
1.826
1.794
1.638
1.628
1.616
1.607
1.597
1.575
1.566
1.544
Br
N
O
OMe
1.88
1.93
1.92
2.88
1.92
1.00
1.92
2.05
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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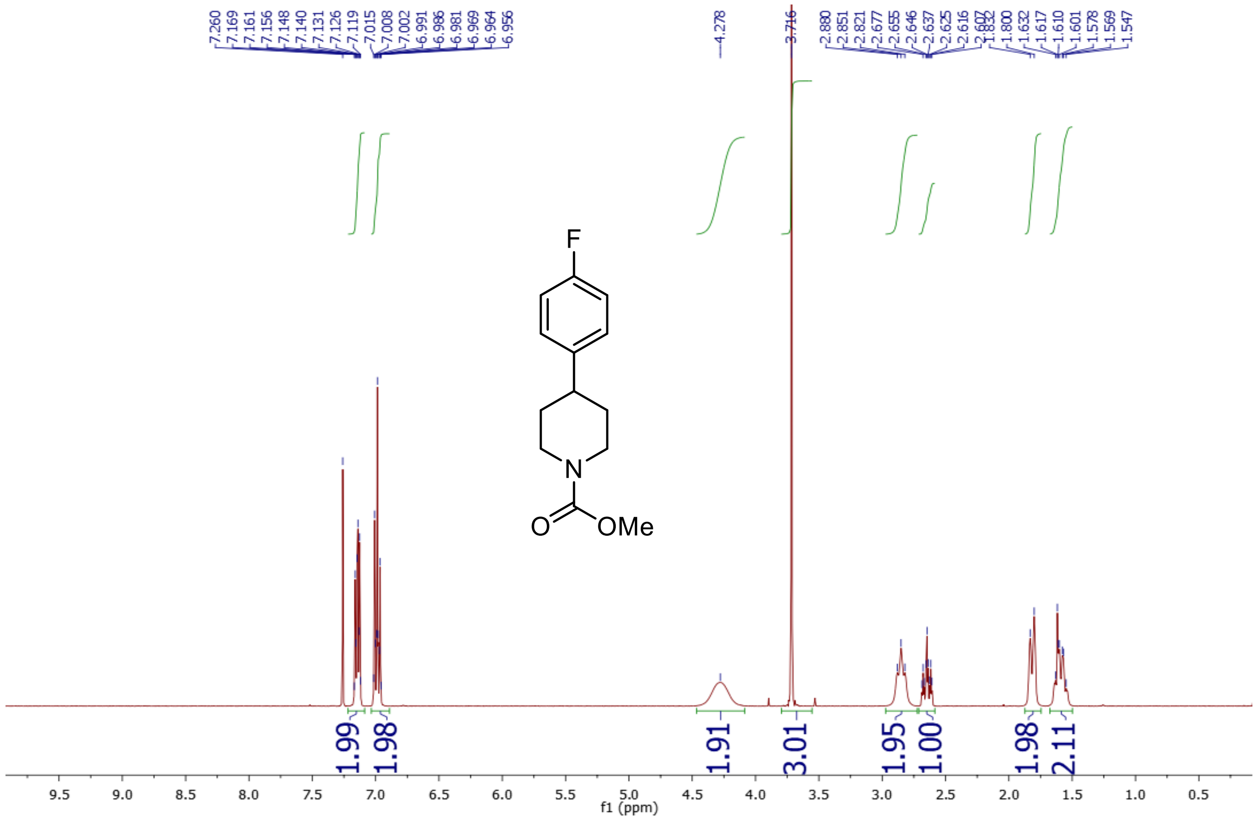
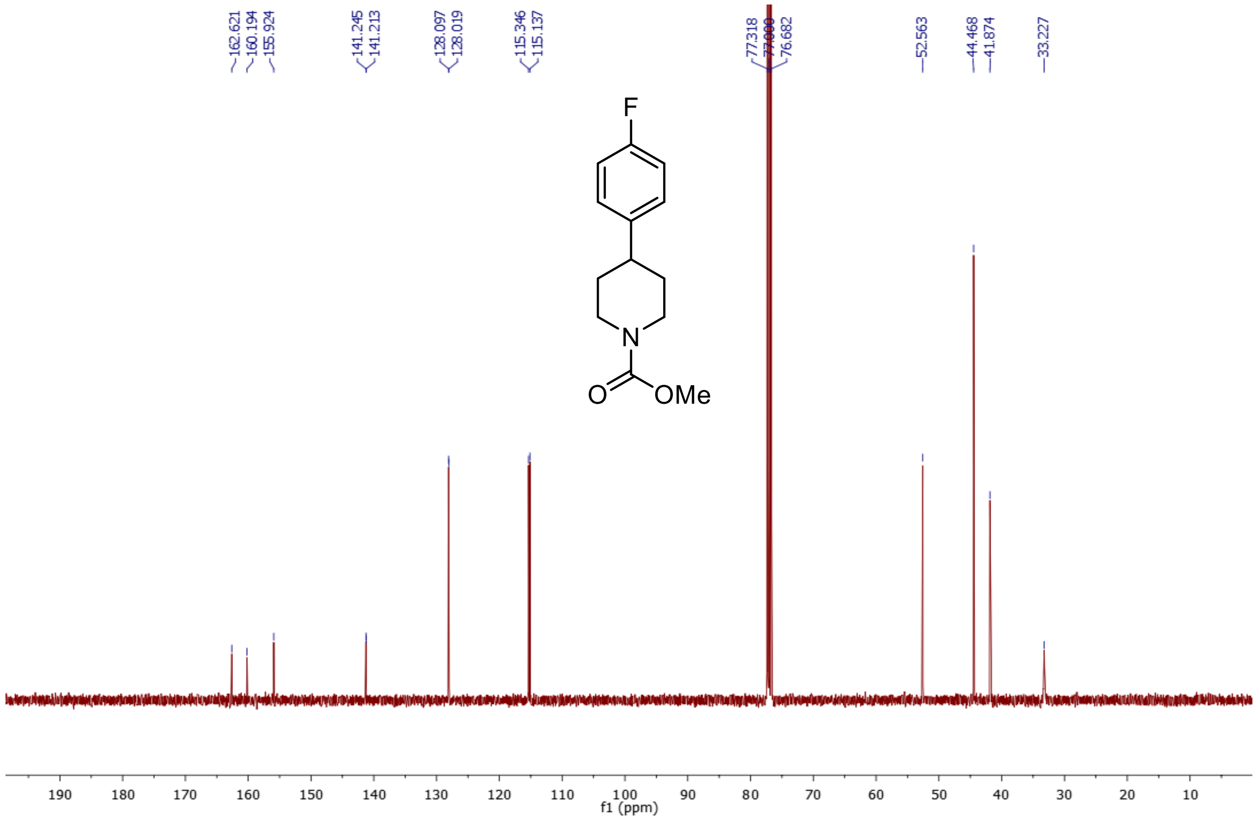
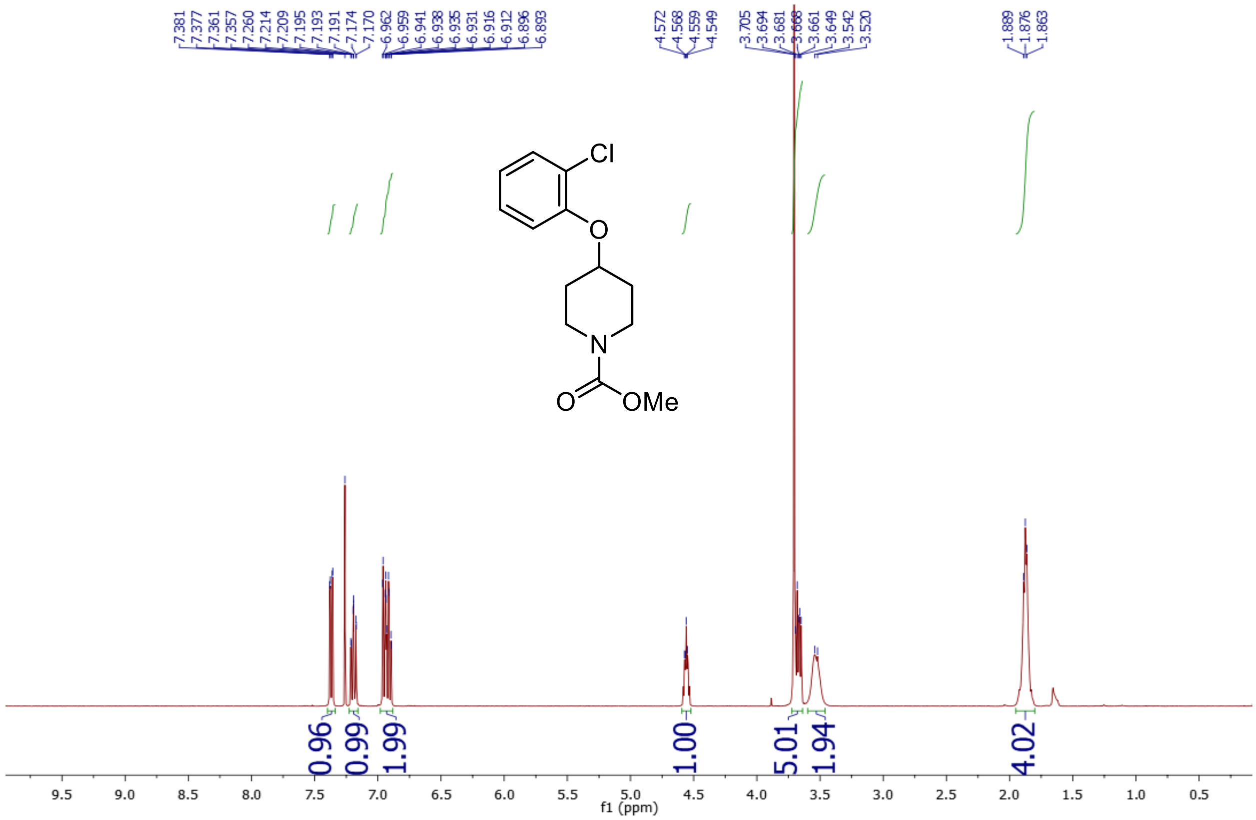
144.496
131.576
128.488
120.048
77.318
77.000
76.683
52.578
44.396
42.081
32.957
Br
N
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)


7.260
7.169
7.161
7.156
7.148
7.140
7.131
7.126
7.119
7.015
7.008
7.002
6.991
6.986
6.981
6.969
6.964
6.956
4.278
3.716
2.880
2.851
2.821
2.677
2.655
2.646
2.637
2.625
2.616
2.607
1.832
1.800
1.632
1.617
1.610
1.601
1.578
1.569
1.547
F
N
O
OMe
1.99
1.98
1.91
3.01
1.95
1.00
1.98
2.11
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


162.621
160.194
155.924
141.245
141.213
128.097
128.019
115.346
115.137
77.318
77.000
76.682
52.563
44.468
41.874
33.227
F
N
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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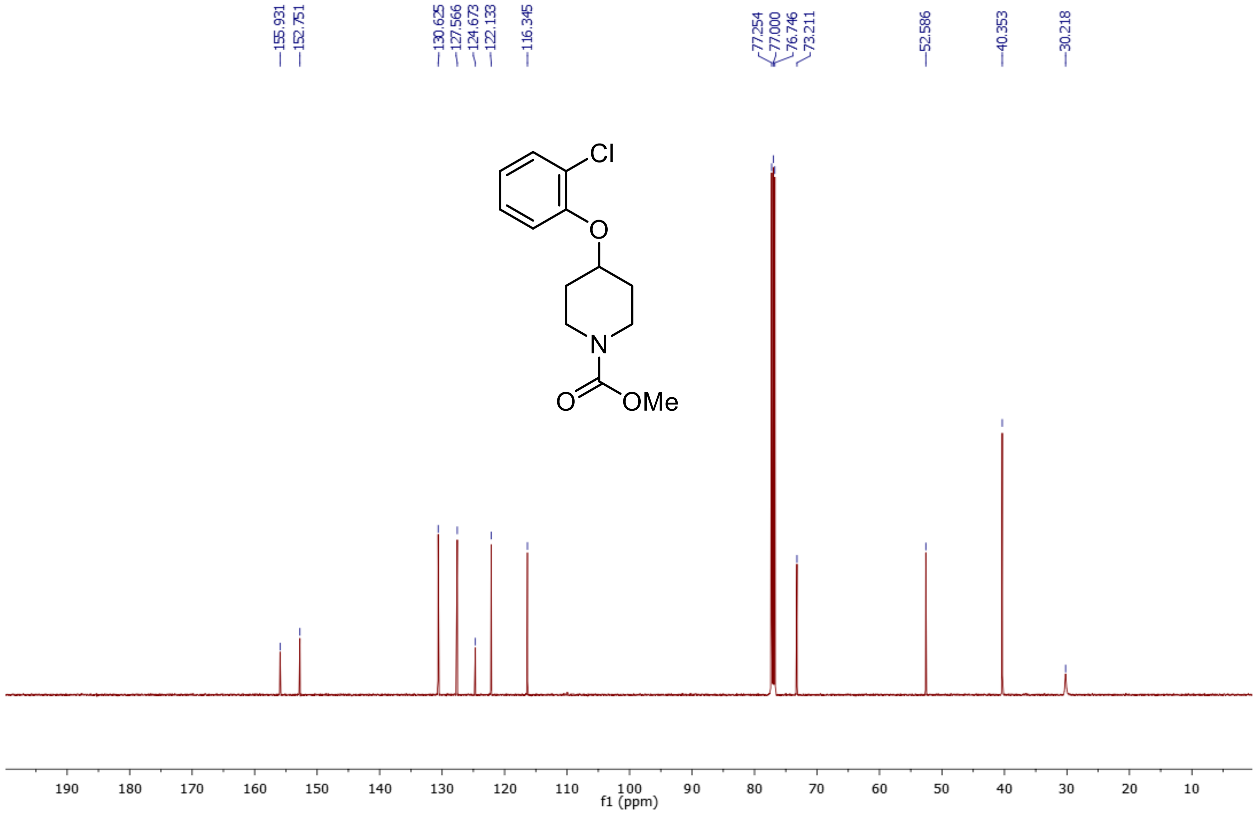
7.361
7.357
7.260
7.214
7.209
7.195
7.193
7.191
7.174
7.170
6.962
6.959
6.941
6.938
6.935
6.931
6.916
6.912
6.896
6.893
4.572
4.568
4.559
4.549
3.705
3.694
3.681
3.668
3.661
3.649
3.542
3.520
1.889
1.876
1.863
Cl
O
N
O
OMe
0.96
0.99
1.99
1.00
5.01
1.94
4.02
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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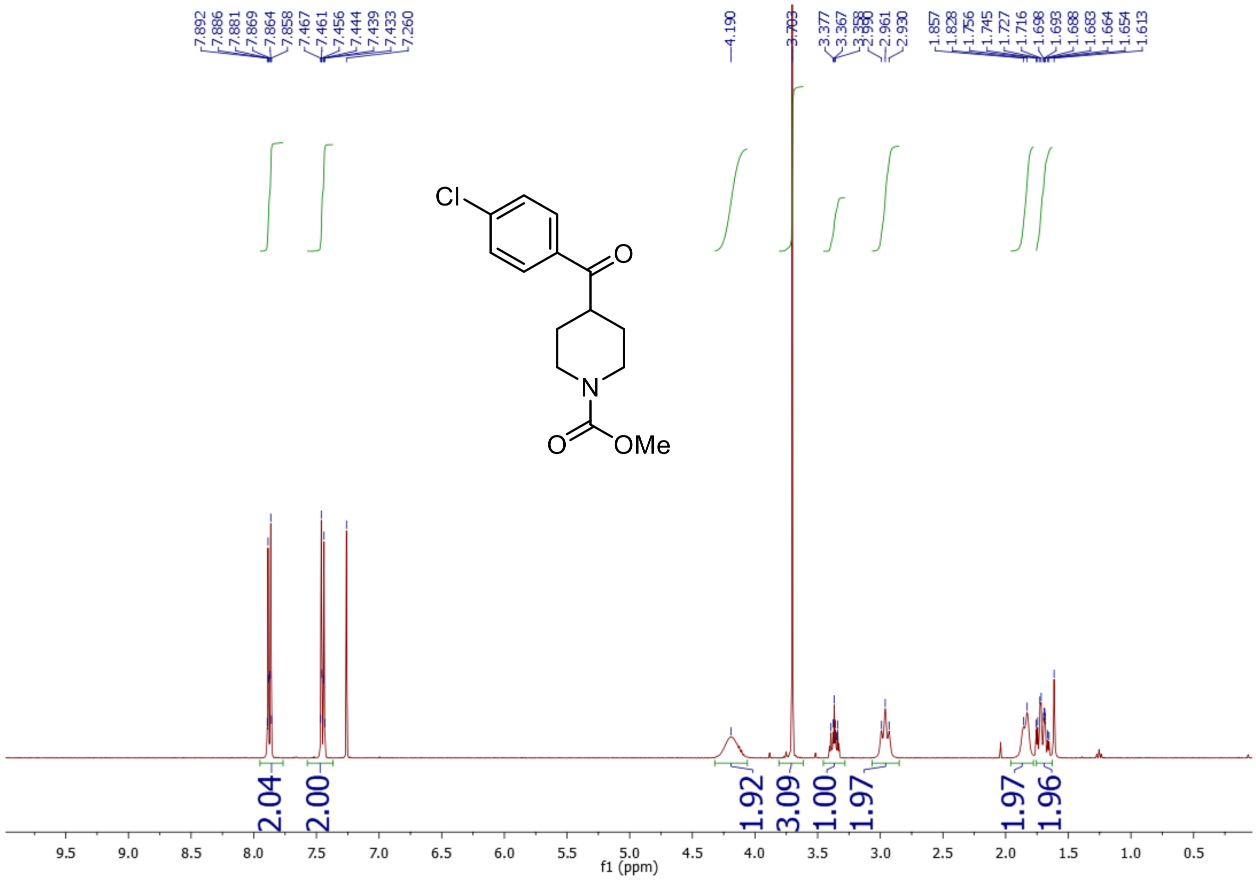
152.751
130.625
127.566
124.673
122.133
116.345
77.254
77.000
76.746
73.211
52.586
40.353
30.218
Cl
O
N
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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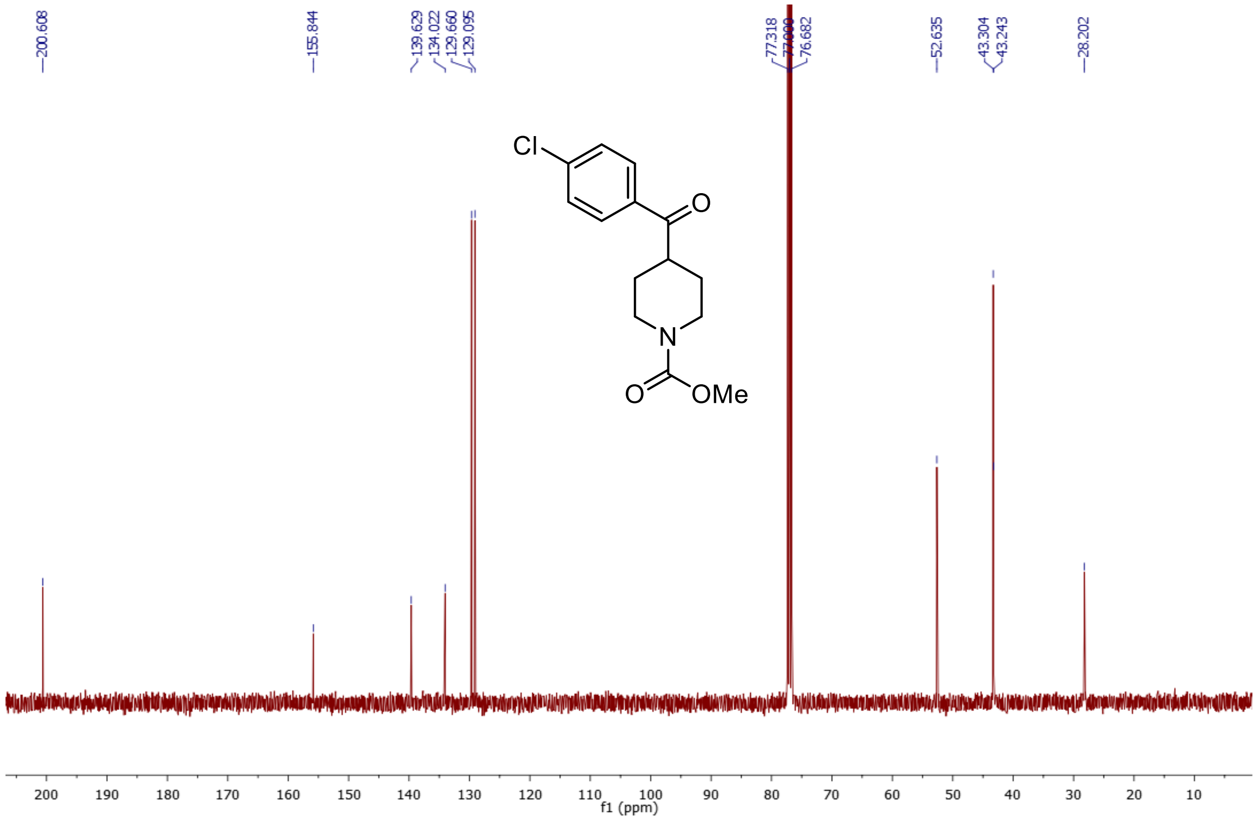
7.886
7.881
7.869
7.864
7.858
7.467
7.461
7.456
7.444
7.439
7.433
7.260
4.190
3.703
3.377
3.367
3.358
2.990
2.961
2.930
1.857
1.828
1.756
1.745
1.727
1.716
1.698
1.693
1.688
1.683
1.664
1.654
1.613
Cl
O
N
O
OMe
2.04
2.00
1.92
3.09
1.00
1.97
1.97
1.96
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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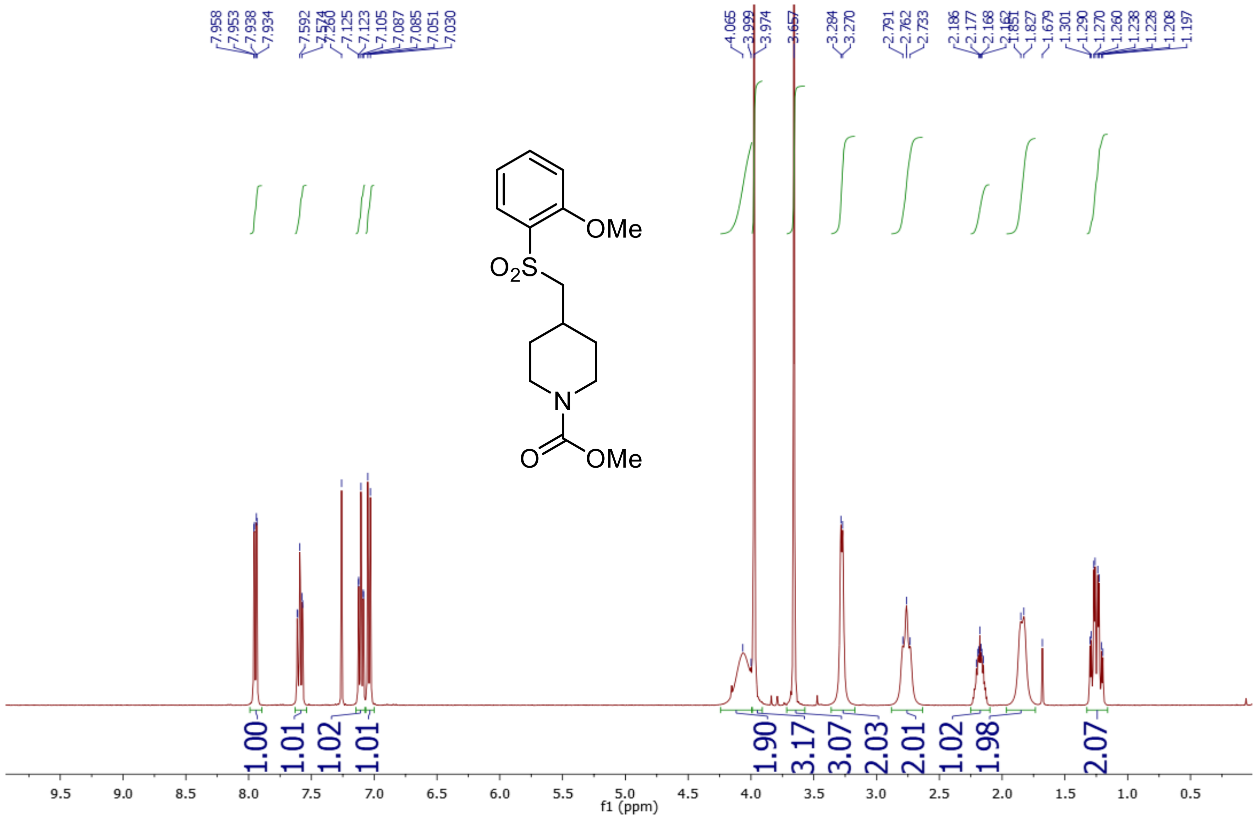
129.660
129.095
77.318
77.000
76.682
52.635
43.304
43.243
28.202
Cl
O
N
O
OMe
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.592
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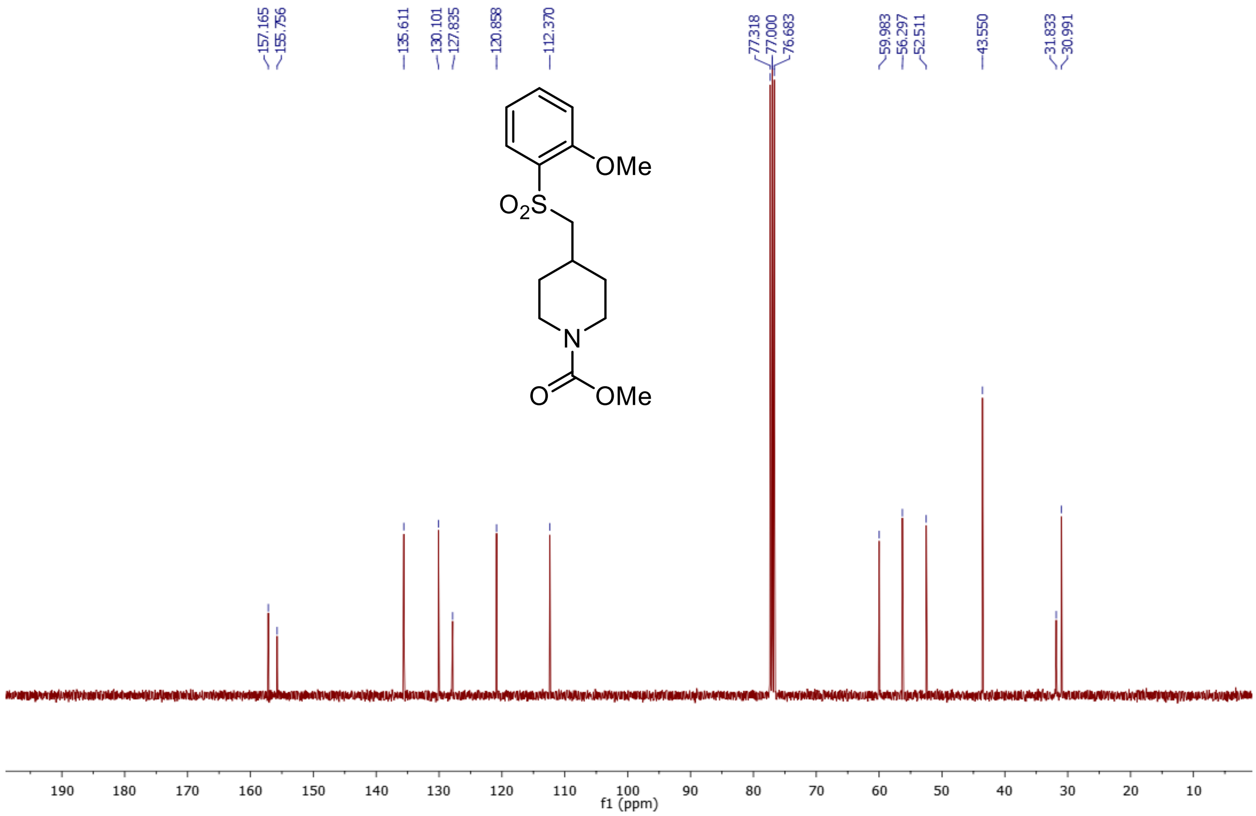
7.260
7.125
7.123
7.105
7.087
7.085
7.051
7.030
4.065
3.999
3.974
3.657
3.284
3.270
2.791
2.762
2.733
2.186
2.177
2.168
2.162
1.851
1.827
1.679
1.301
1.290
1.270
1.260
1.238
1.228
1.208
1.197
OMe
O_2S
N
O
OMe
1.00
1.01
1.02
1.01
1.90
3.17
3.07
2.03
2.01
1.02
1.98
2.07
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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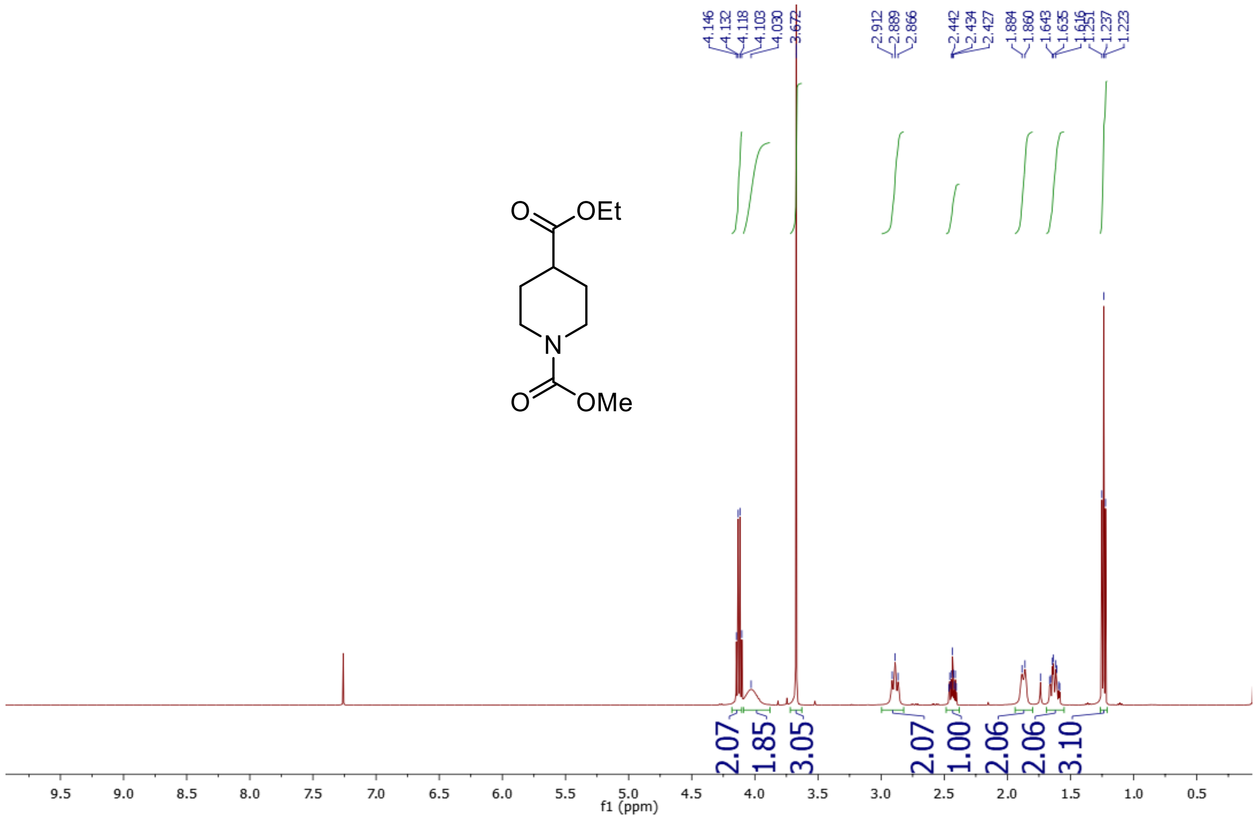
112.370
77.318
77.000
76.683
59.983
56.297
52.511
43.550
31.833
30.991
OMe
O$_2$S
N
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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4.030
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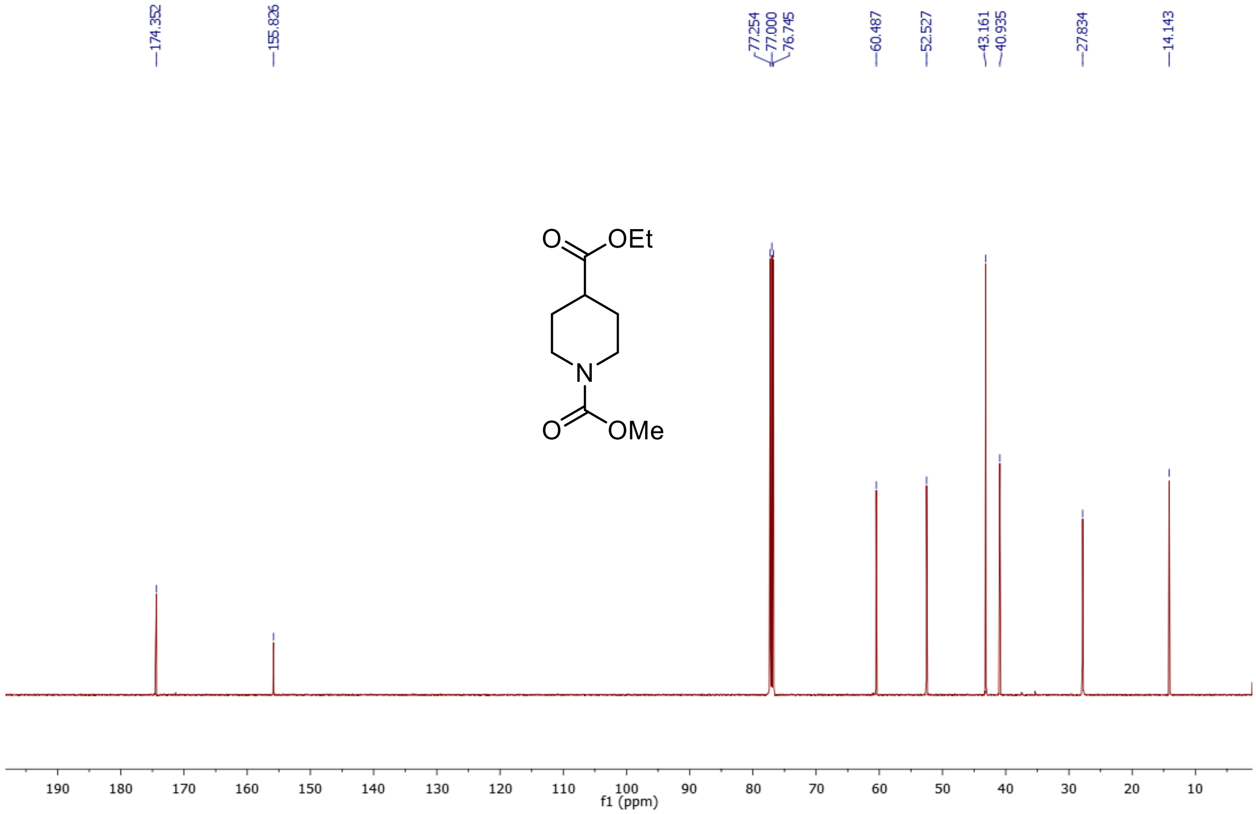
2.442
2.434
2.427
1.884
1.860
1.643
1.635
1.616
1.251
1.237
1.223
O
OEt
N
O
OMe
2.07
1.85
3.05
2.07
1.00
2.06
2.06
3.10
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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60.487
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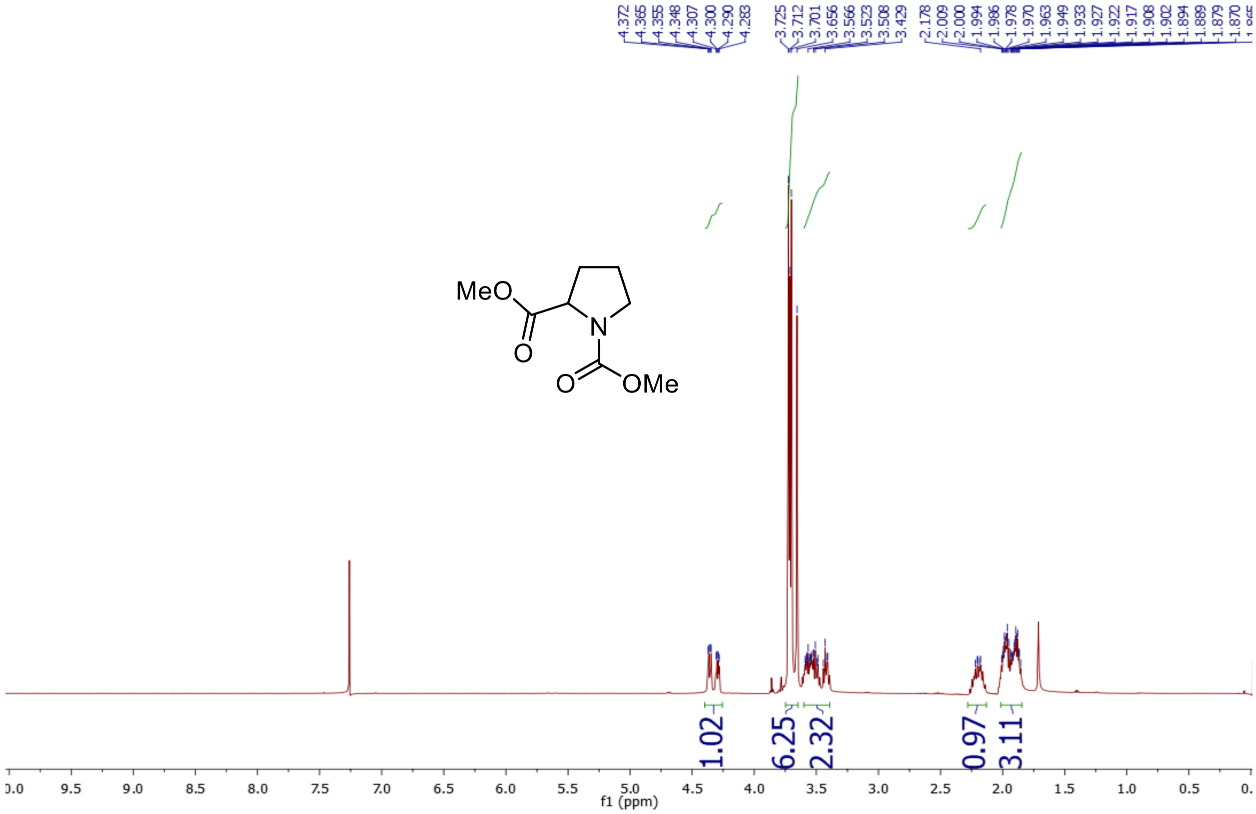
43.161
40.935
27.834
14.143
O
OEt
N
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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4.300
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4.283
3.725
3.712
3.701
3.656
3.566
3.523
3.508
3.429
2.178
2.009
2.000
1.994
1.986
1.978
1.970
1.963
1.949
1.933
1.927
1.922
1.917
1.908
1.902
1.894
1.889
1.879
1.870
MeO
O
N
O
OMe
1.02
6.25
2.32
0.97
3.11
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
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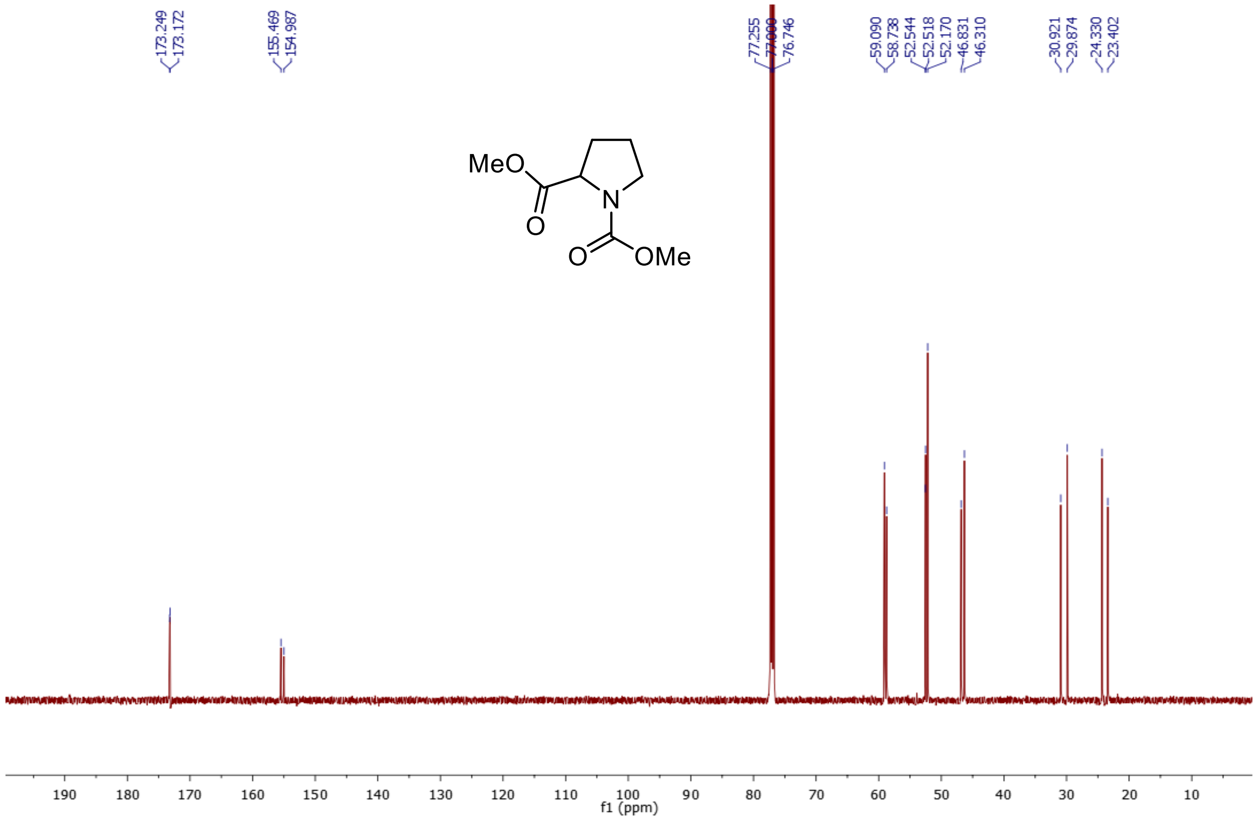
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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59.090
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52.544
52.518
52.170
46.831
46.310
30.921
29.874
24.330
23.402
MeO
O
N
O
OMe
190
180
170
160
150
140
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120
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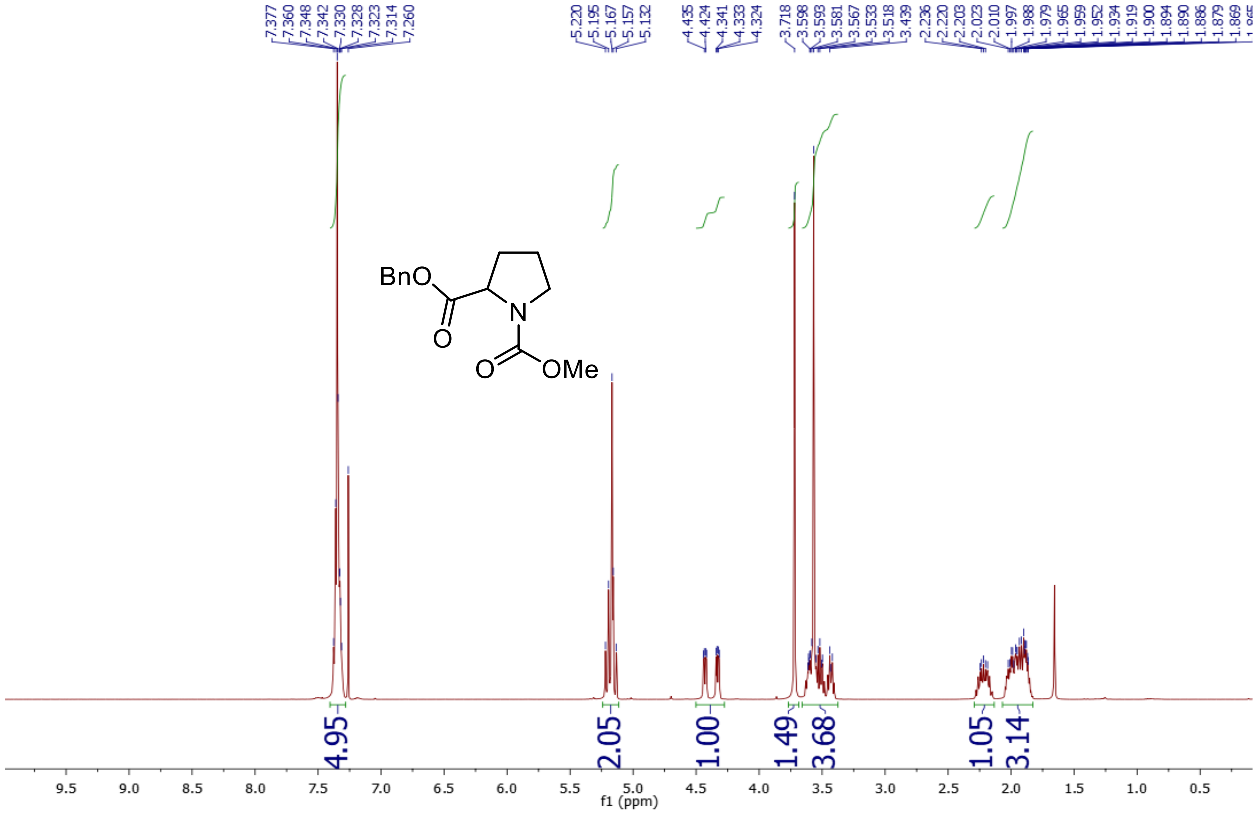
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.328
7.323
7.314
7.260
5.220
5.195
5.167
5.157
5.132
4.435
4.424
4.341
4.333
4.324
3.718
3.598
3.593
3.581
3.567
3.533
3.518
3.439
2.236
2.220
2.203
2.023
2.010
1.997
1.988
1.979
1.965
1.959
1.952
1.934
1.919
1.900
1.894
1.890
1.886
1.879
1.869
BnO
O
N
O
OMe
4.95
2.05
1.00
1.49
3.68
1.05
3.14
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
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5.0
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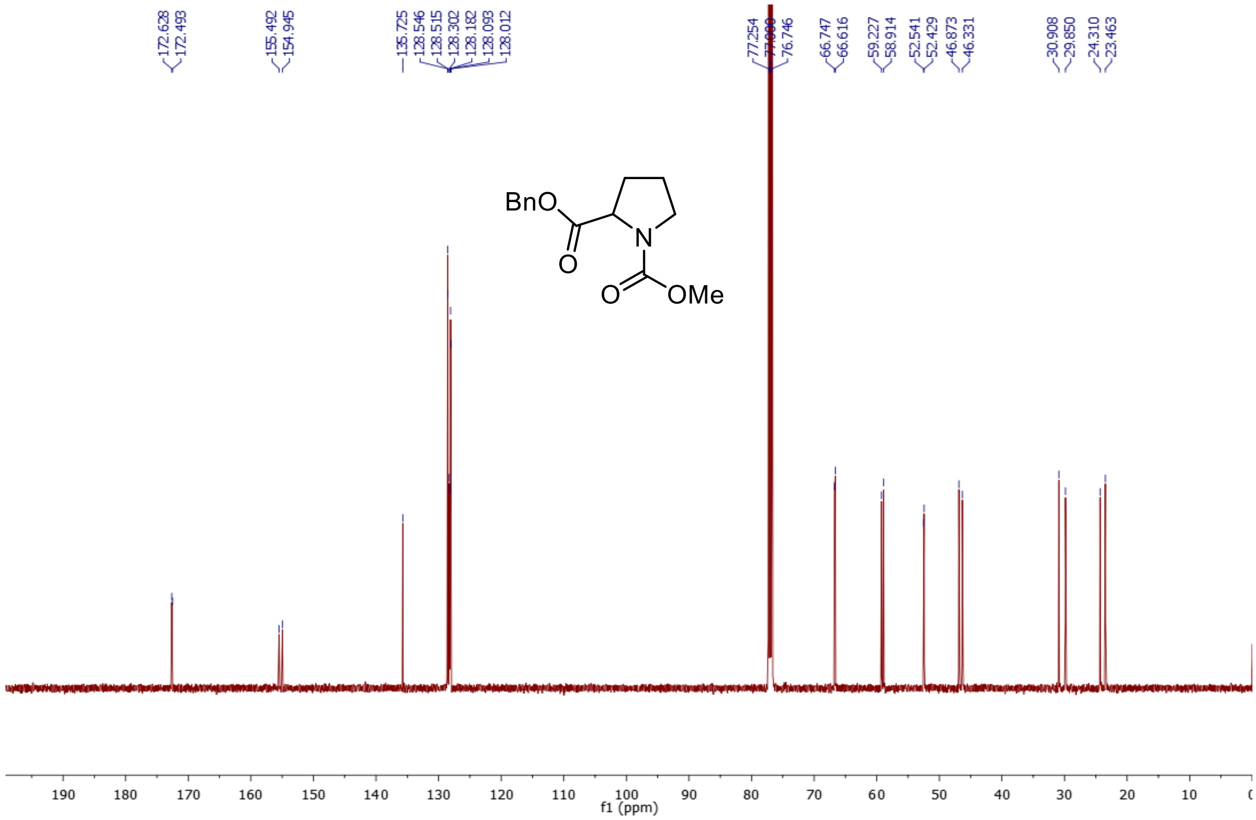
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


172.628
172.493
155.492
154.945
135.725
128.546
128.515
128.302
128.182
128.093
128.012
77.254
77.000
76.746
66.747
66.616
59.227
58.914
52.541
52.429
46.873
46.331
30.908
29.850
24.310
23.463
BnO
O
N
O
OMe
190
180
170
160
150
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130
120
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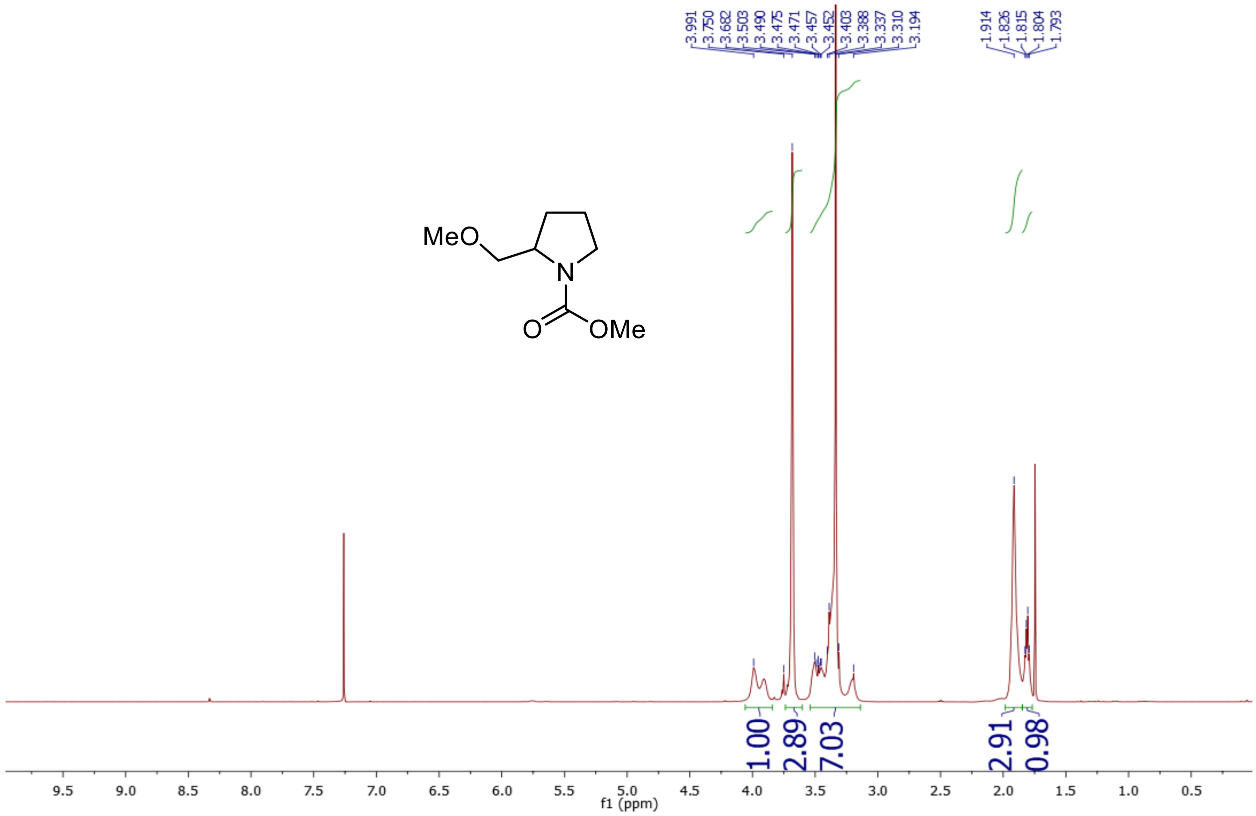
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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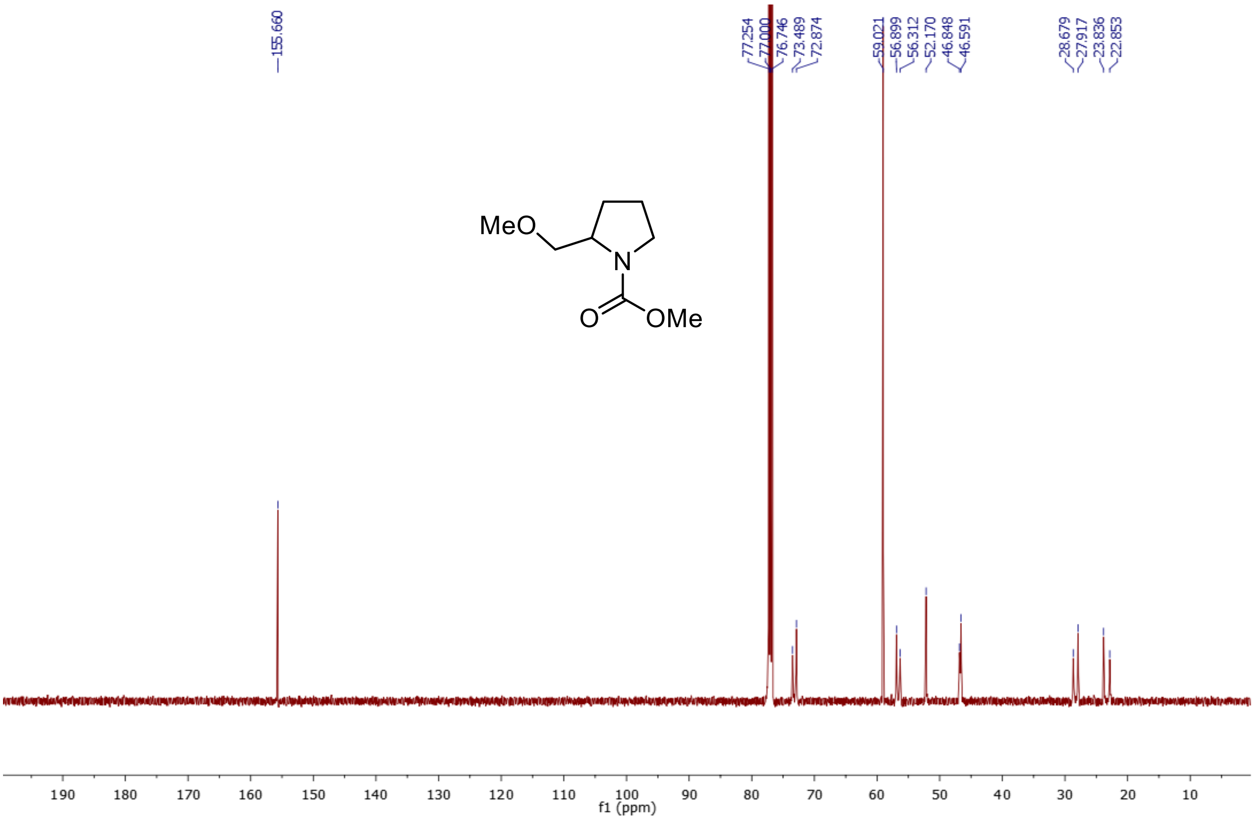
3.403
3.388
3.337
3.310
3.194
1.914
1.826
1.815
1.804
1.793
MeO
N
O
OMe
1.00
2.89
7.03
2.91
0.98
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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77.000
76.746
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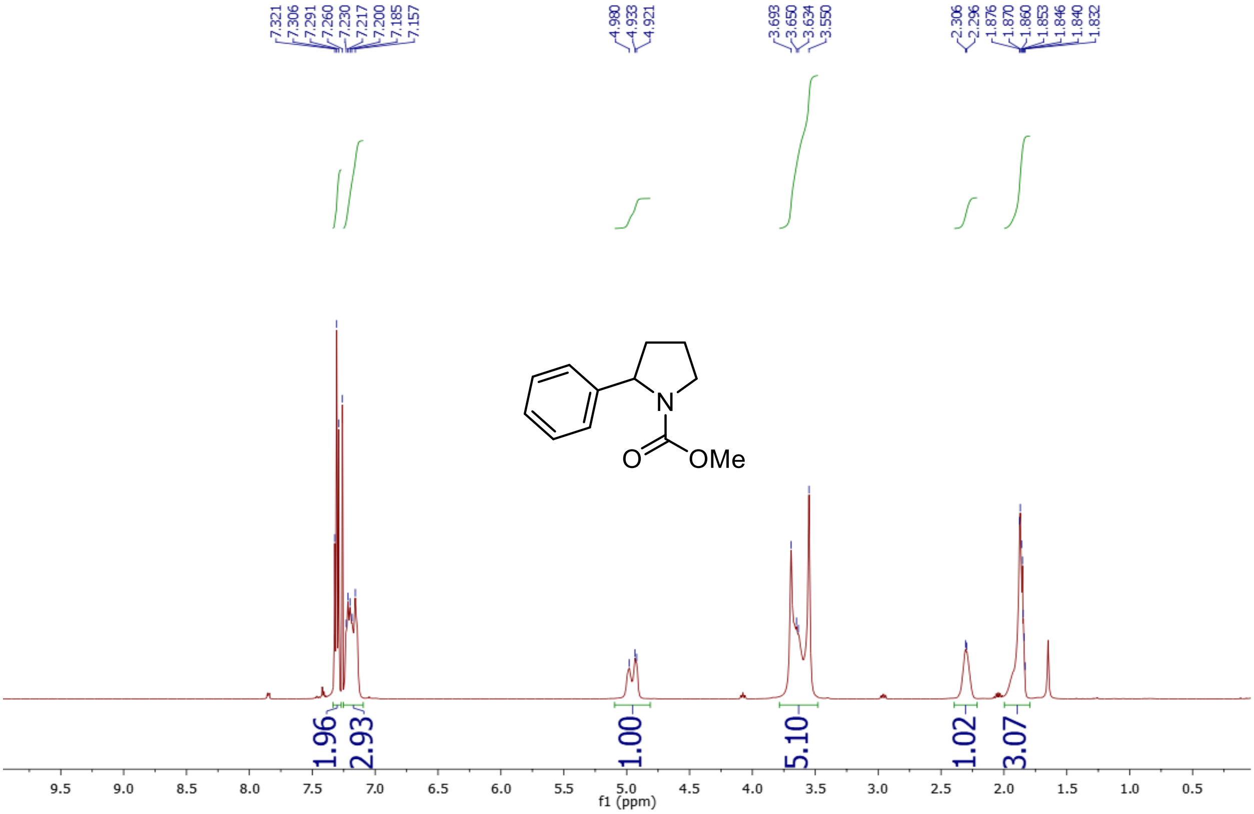
72.874
59.021
56.899
56.312
52.170
46.848
46.591
28.679
27.917
23.836
22.853
MeO
N
O
OMe
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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7.217
7.200
7.185
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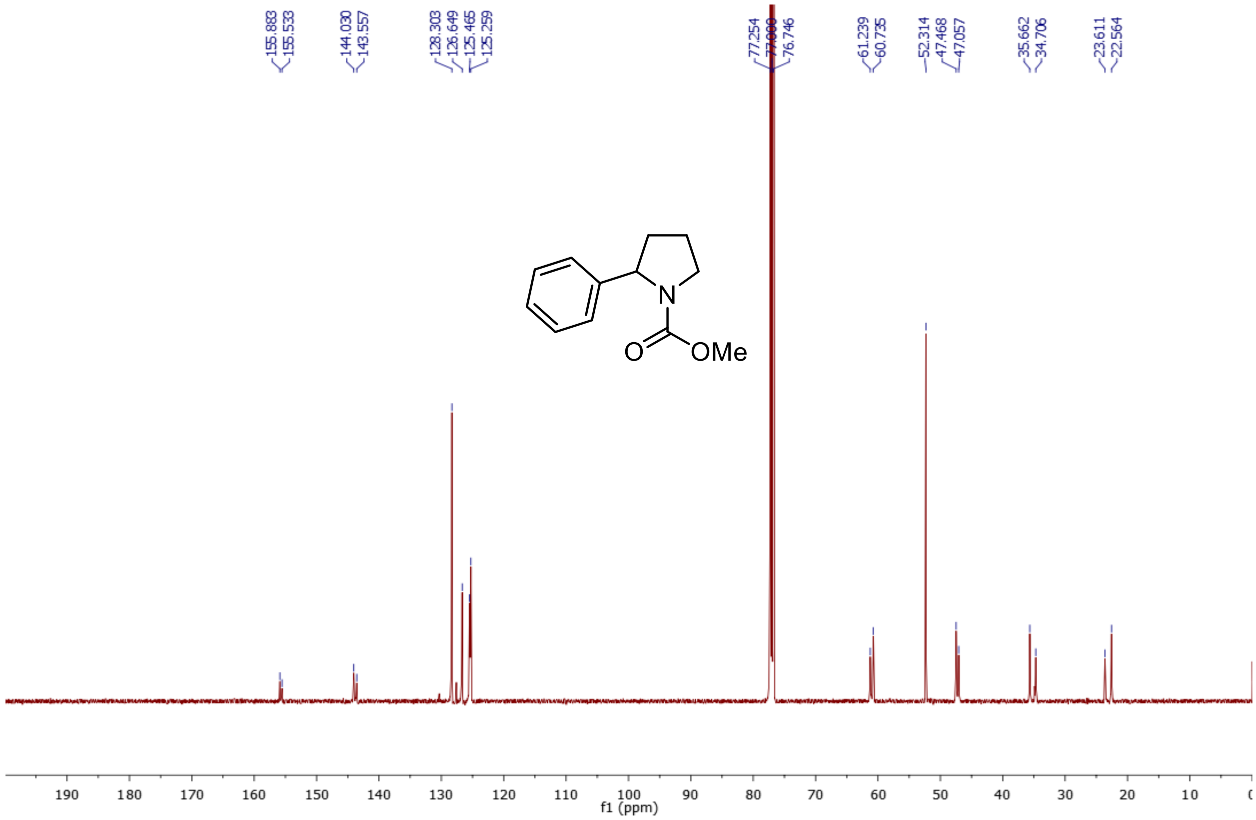
4.933
4.921
3.693
3.650
3.634
3.550
2.306
2.296
1.876
1.870
1.860
1.853
1.846
1.840
1.832
N
O
OMe
1.96
2.93
1.00
5.10
1.02
3.07
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)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77.000
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61.239
60.735
52.314
47.468
47.057
35.662
34.706
23.611
22.564
N
O
OMe
190
180
170
160
150
140
130
120
110
100
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80
70
60
50
40
30
20
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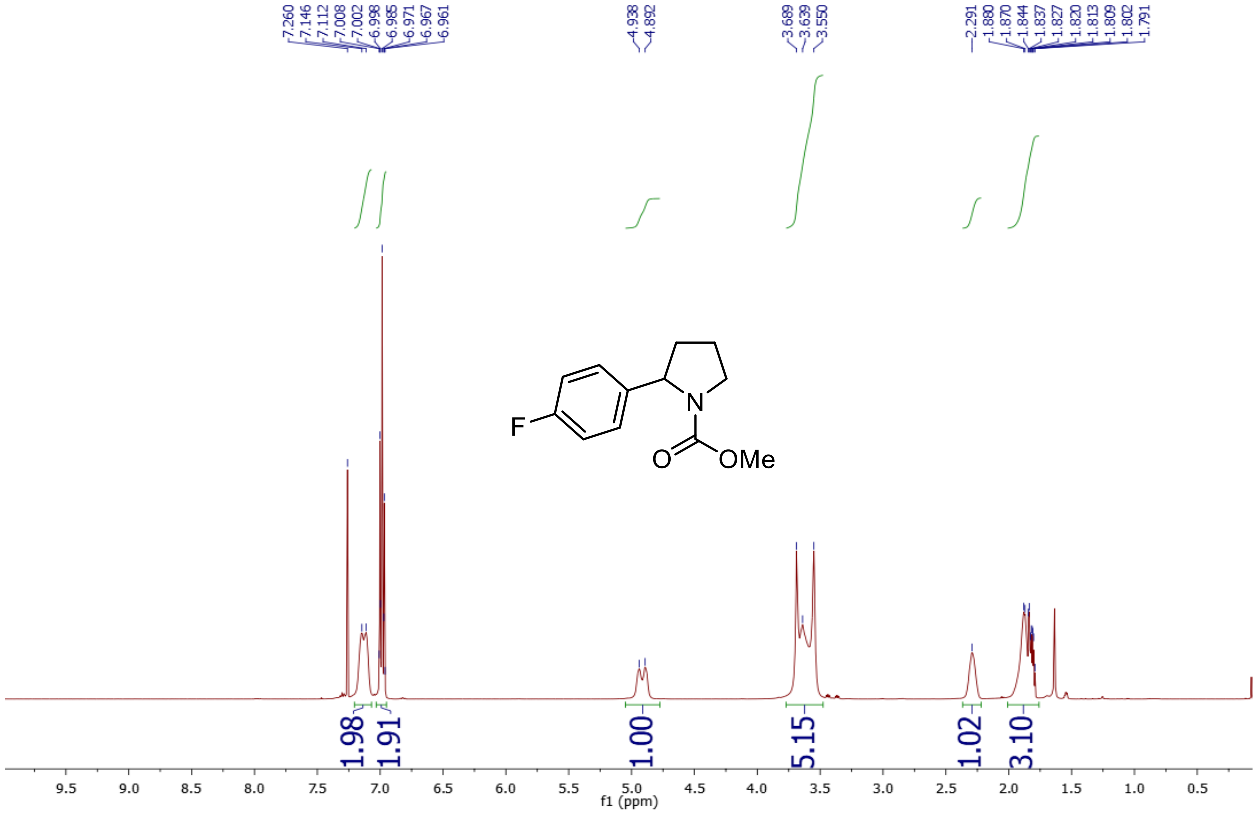
f1 (ppm)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6.961
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4.892
3.689
3.639
3.550
2.291
1.880
1.870
1.844
1.837
1.827
1.820
1.813
1.809
1.802
1.791
F
N
O
OMe
1.98
1.91
1.00
5.15
1.02
3.10
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
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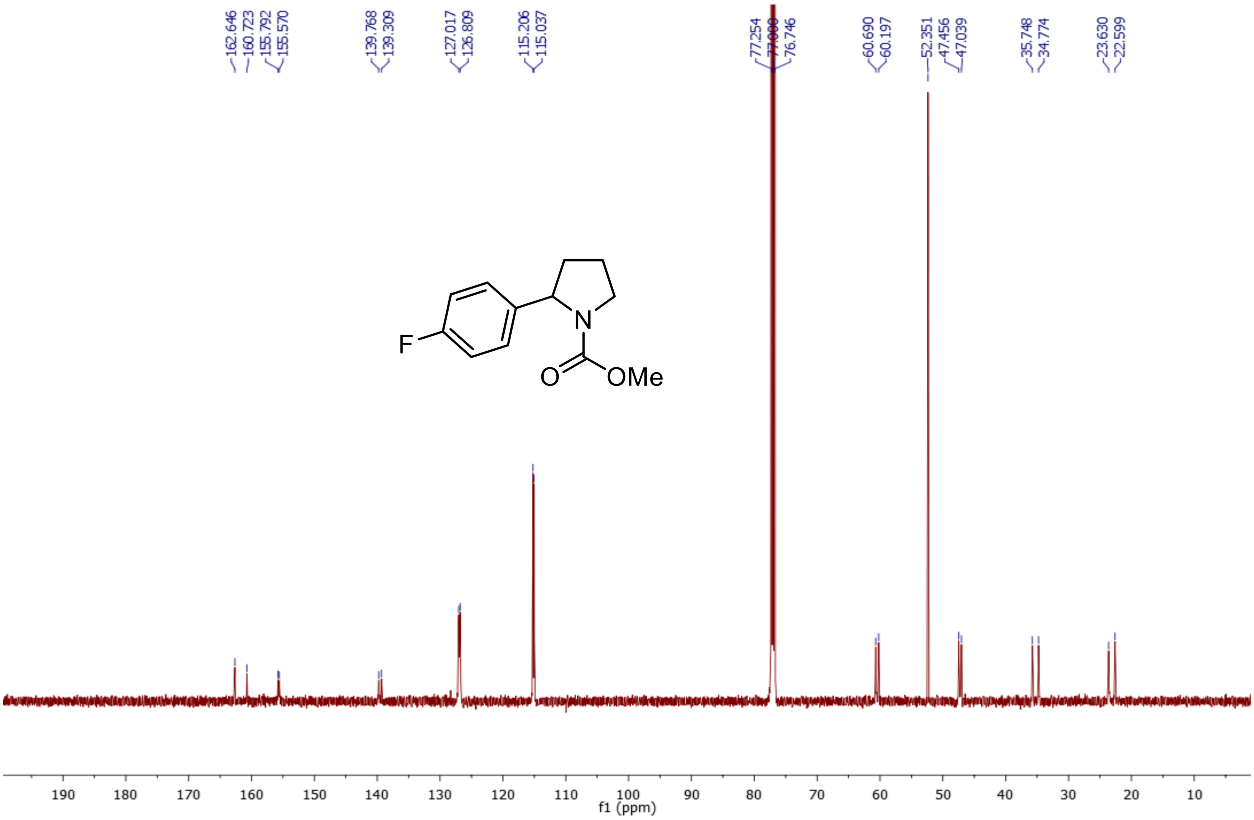
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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60.690
60.197
52.351
47.456
47.039
35.748
34.774
23.630
22.599
F
N
O
OMe
190
180
170
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150
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120
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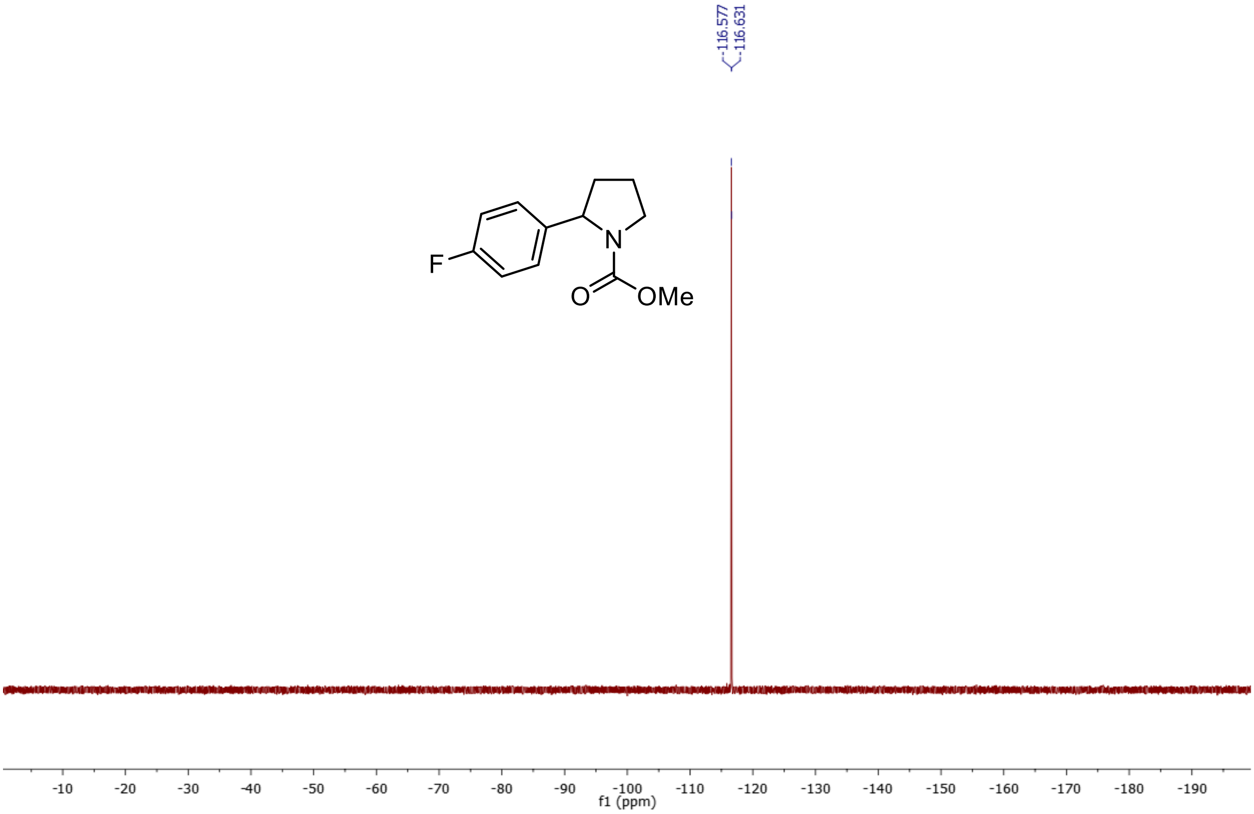
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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-116.631
F
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O
OMe
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-20
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-60
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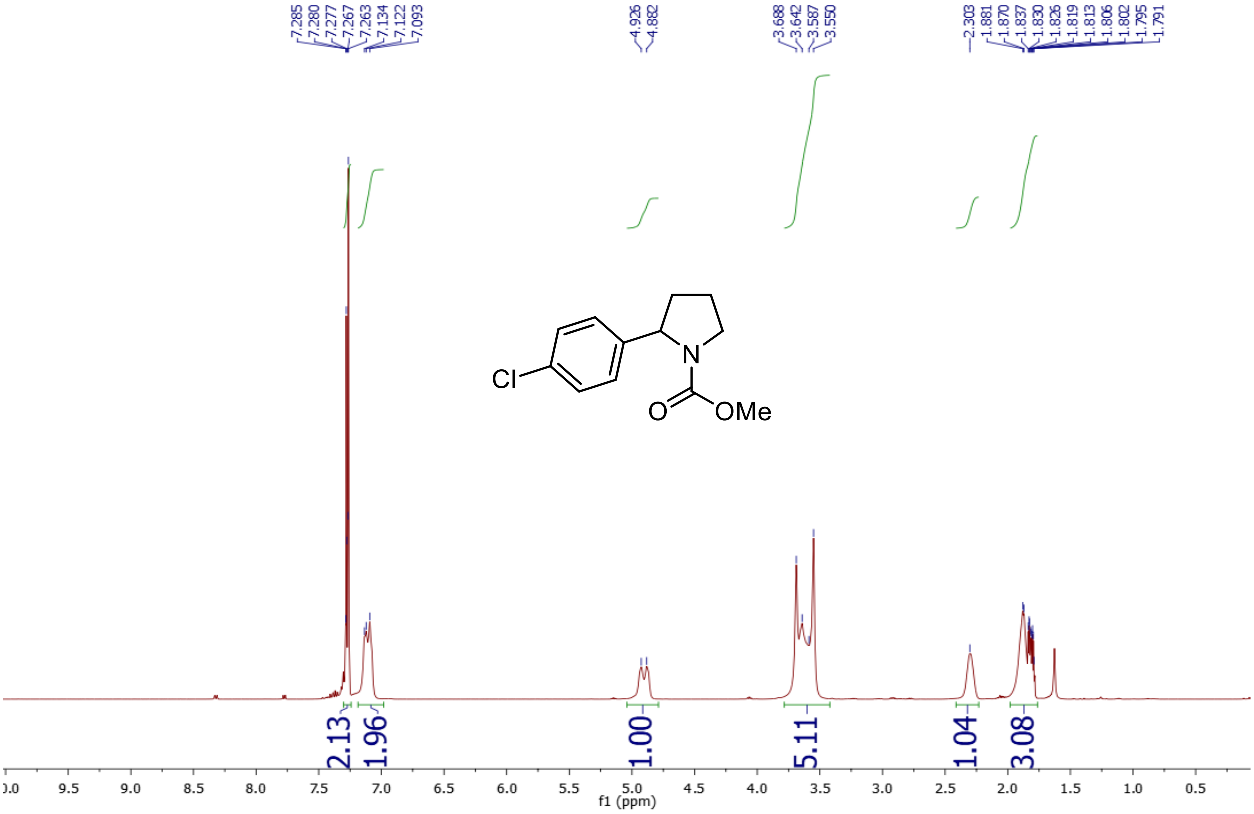
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
f1 (ppm)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3.642
3.587
3.550
2.303
1.881
1.870
1.837
1.830
1.826
1.819
1.813
1.806
1.802
1.795
1.791
Cl
N
O
OMe
2.13
1.96
1.00
5.11
1.04
3.08
0.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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3.0
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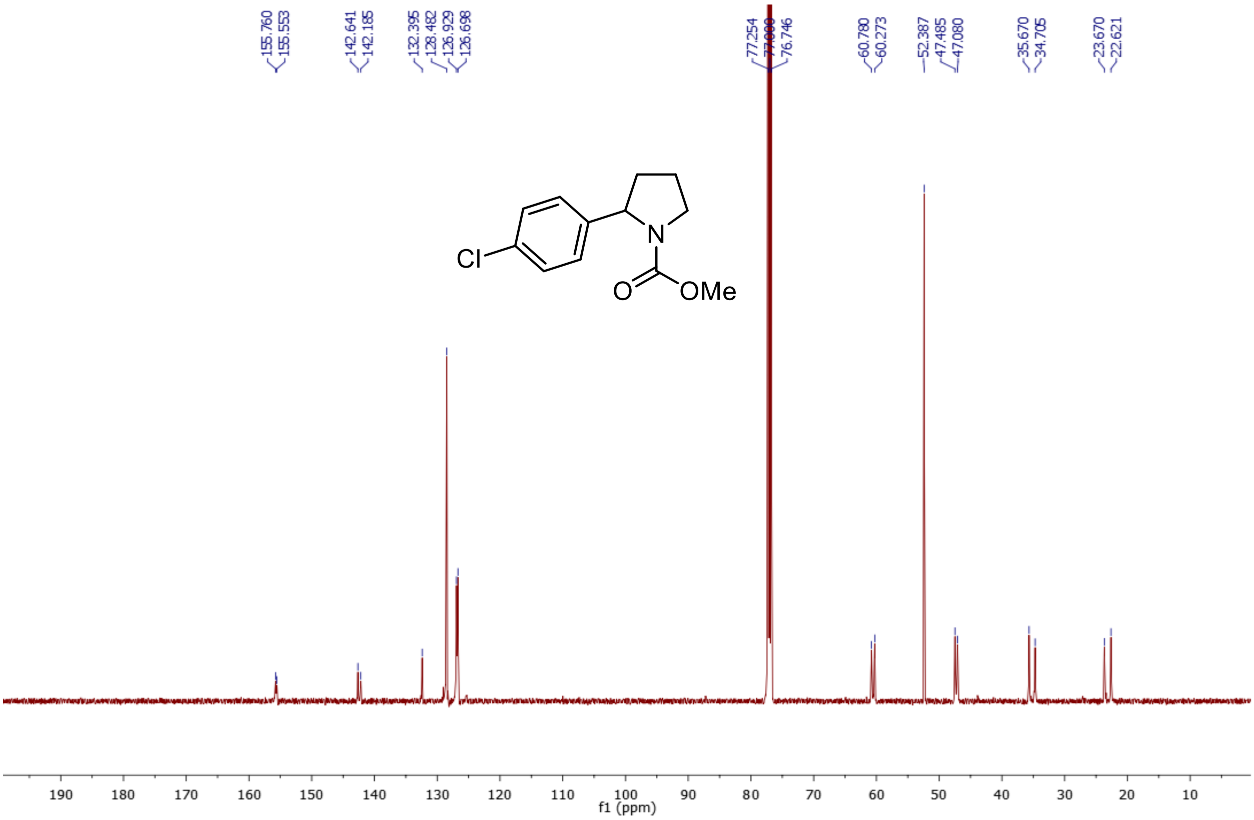
2.0
1.5
1.0
0.5
f1 (ppm)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126.698
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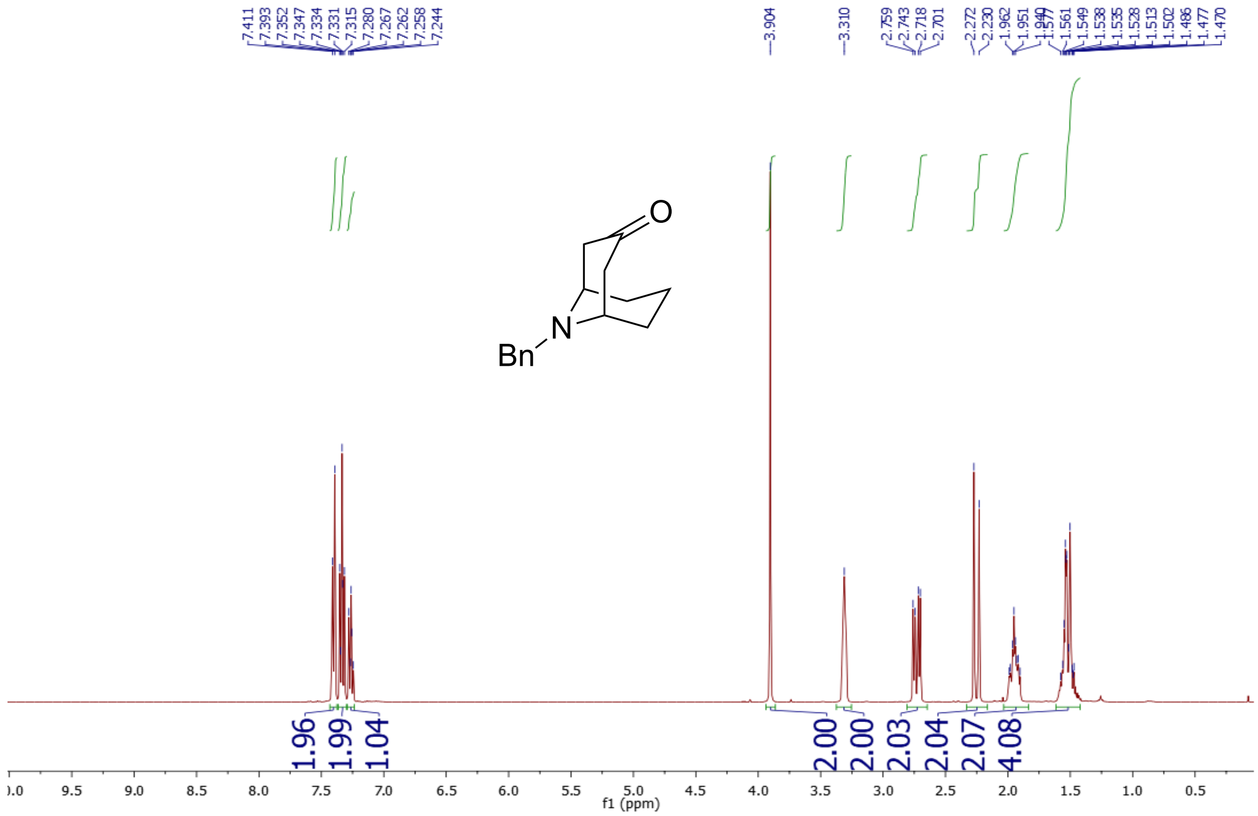
77.000
76.746
60.780
60.273
52.387
47.485
47.080
35.670
34.705
23.670
22.621
Cl
N
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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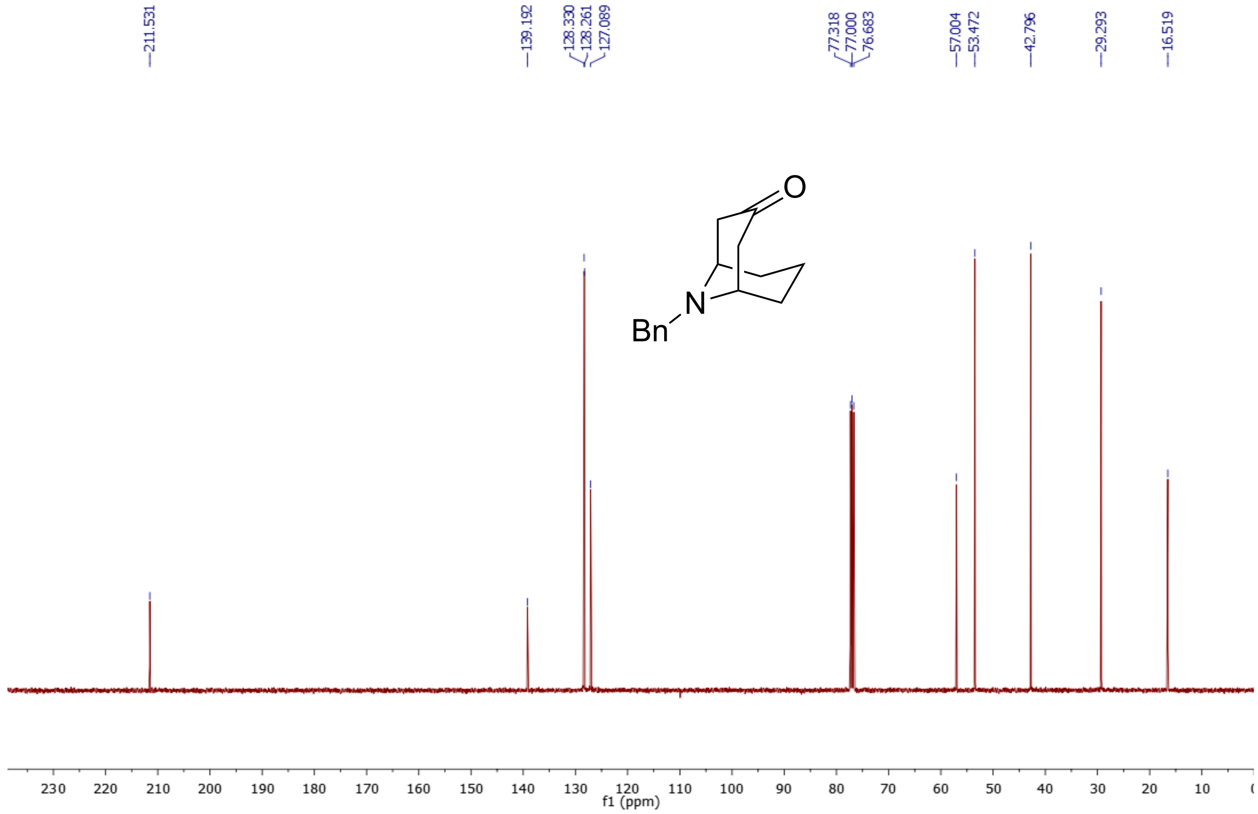
7.258
7.244
3.904
3.310
2.759
2.743
2.718
2.701
2.272
2.230
1.962
1.951
1.940
1.577
1.561
1.549
1.538
1.535
1.528
1.513
1.502
1.486
1.477
1.470
O
N
Bn
1.96
1.99
1.04
2.00
2.00
2.03
2.04
2.07
4.08
0.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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128.330
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77.000
76.683
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53.472
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29.293
16.519
O
N
Bn
230
220
210
200
190
180
170
160
150
140
130
120
110
100
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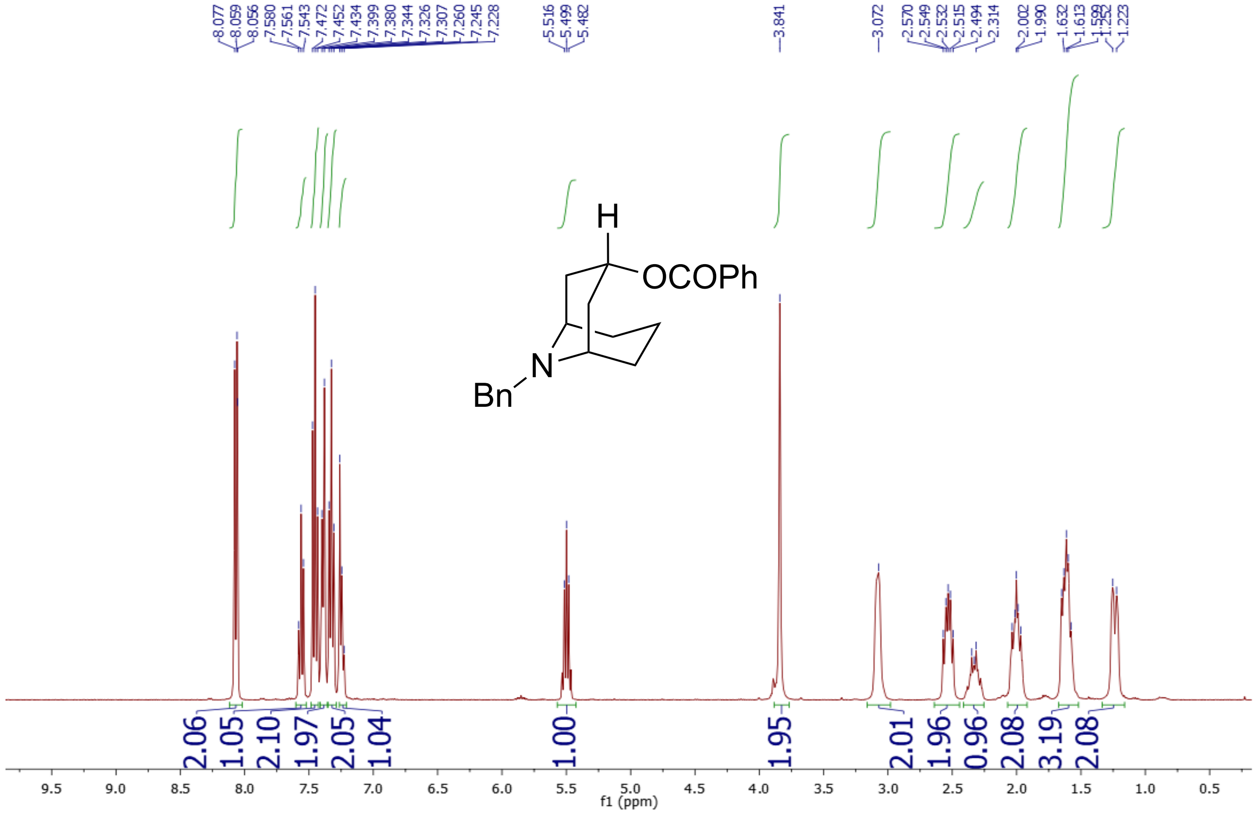
80
70
60
50
40
30
20
10
f1 (ppm)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8.059
8.056
7.580
7.561
7.543
7.472
7.452
7.434
7.399
7.380
7.344
7.326
7.307
7.260
7.245
7.228
5.516
5.499
5.482
3.841
3.072
2.570
2.549
2.532
2.515
2.494
2.314
2.002
1.990
1.632
1.613
1.599
1.252
1.223
H
OCOPh
N
Bn
2.06
1.05
2.10
1.97
2.05
1.04
1.00
1.95
2.01
1.96
0.96
2.08
3.19
2.08
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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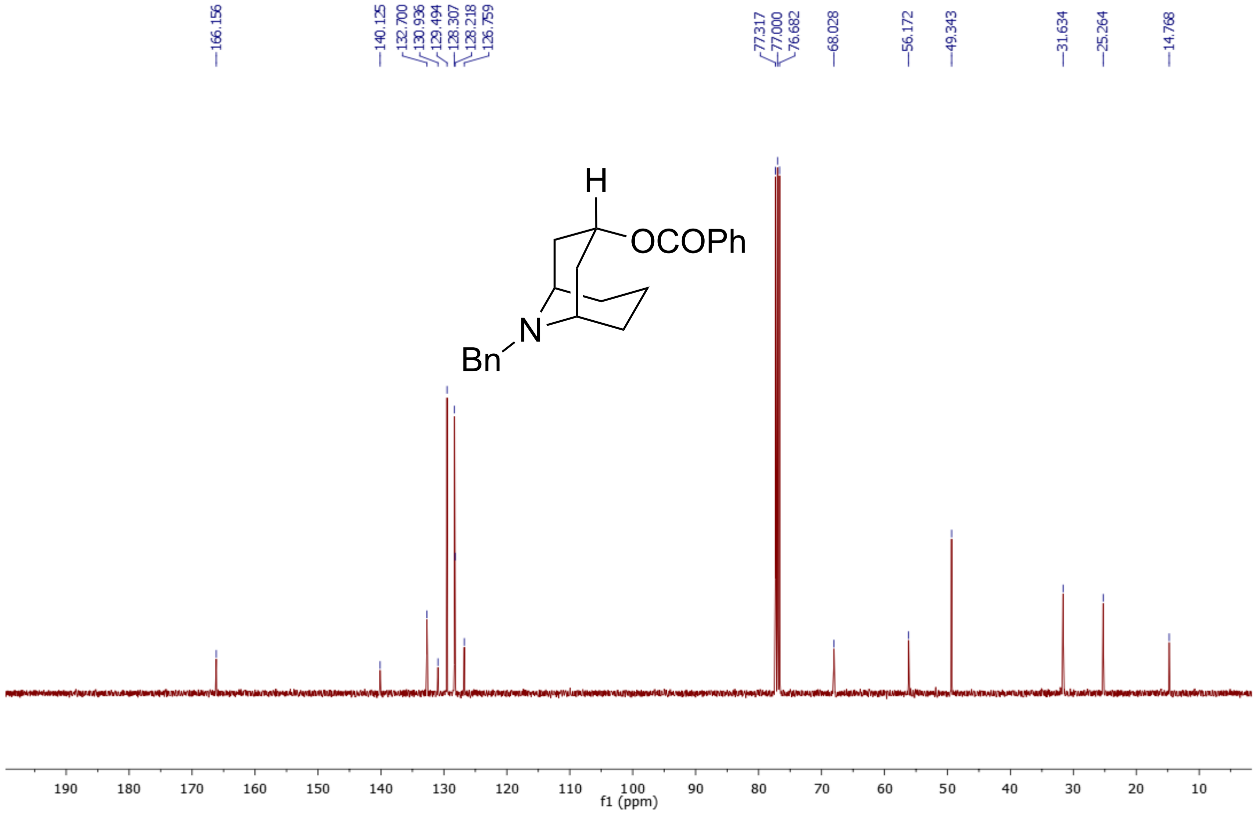
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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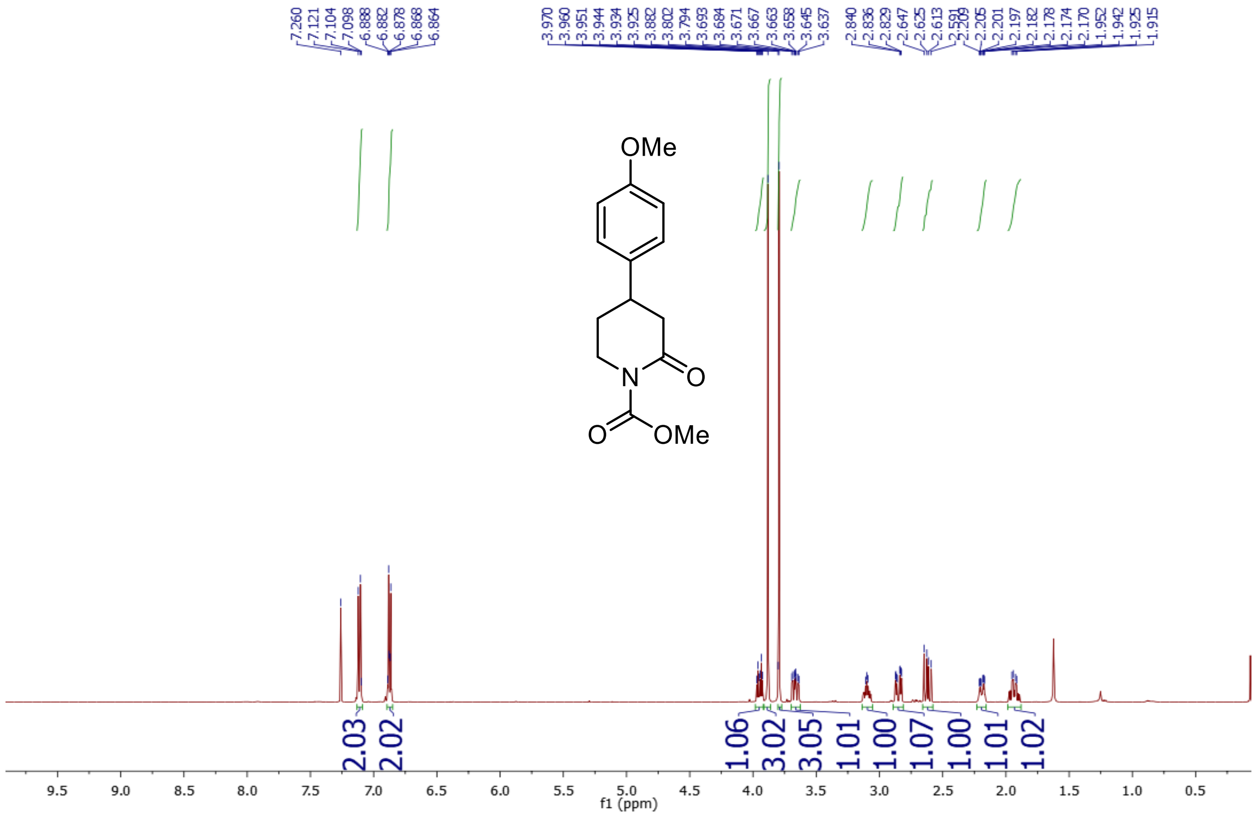
128.218
126.759
77.317
77.000
76.682
68.028
56.172
49.343
31.634
25.264
14.768
H
OCOPh
N
Bn
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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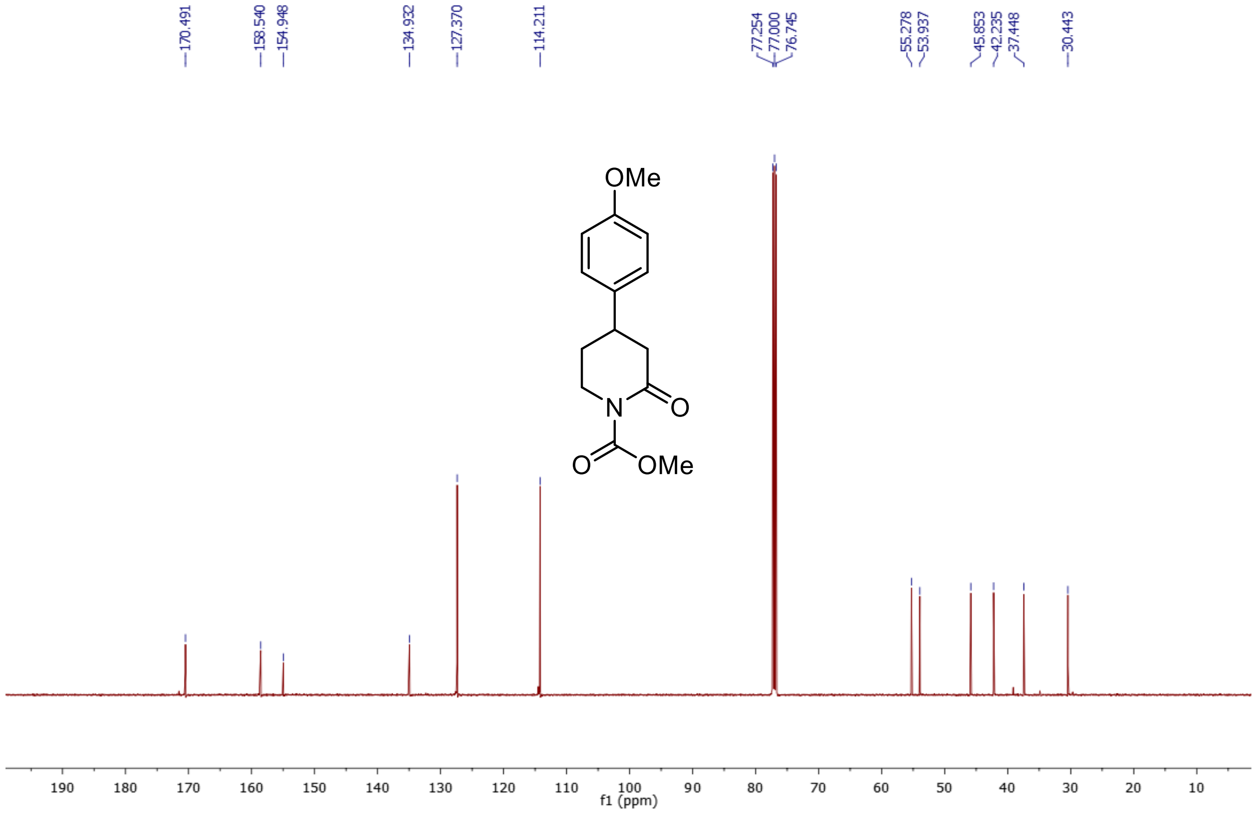
6.882
6.878
6.868
6.864
3.970
3.960
3.951
3.944
3.934
3.925
3.882
3.802
3.794
3.693
3.684
3.671
3.667
3.663
3.658
3.645
3.637
2.840
2.836
2.829
2.647
2.625
2.613
2.591
2.209
2.205
2.201
2.197
2.182
2.178
2.174
2.170
1.952
1.942
1.925
1.915
OMe
N
O
O
OMe
2.03
2.02
1.06
3.02
3.05
1.01
1.00
1.07
1.00
1.01
1.02
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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77.000
76.745
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53.937
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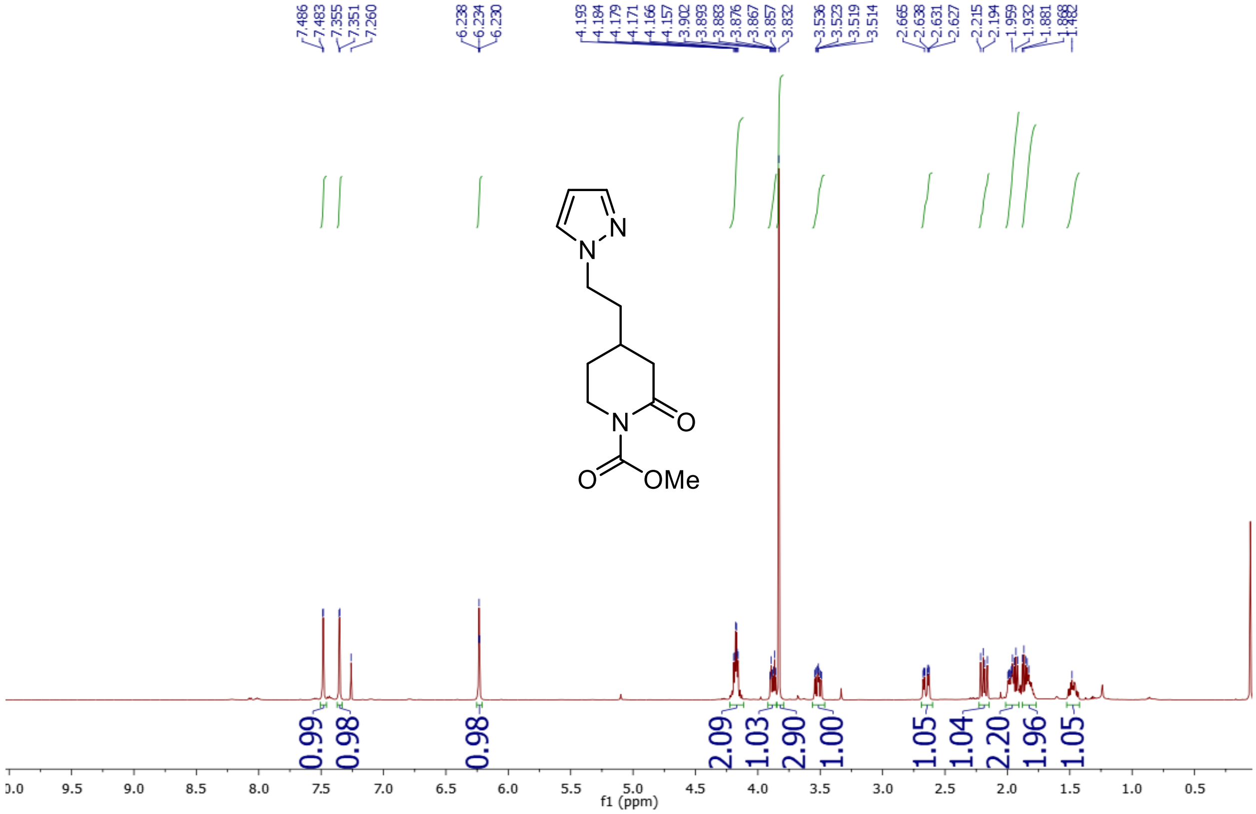
37.448
30.443
OMe
N
O
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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6.230
4.193
4.184
4.179
4.171
4.166
4.157
3.902
3.893
3.883
3.876
3.867
3.857
3.832
3.536
3.523
3.519
3.514
2.665
2.638
2.631
2.627
2.215
2.194
1.959
1.932
1.881
1.868
1.482
N
N
N
O
O
OMe
0.99
0.98
0.98
2.09
1.03
2.90
1.00
1.05
1.04
2.20
1.96
1.05
9.5
9.0
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8.0
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6.5
6.0
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3.5
3.0
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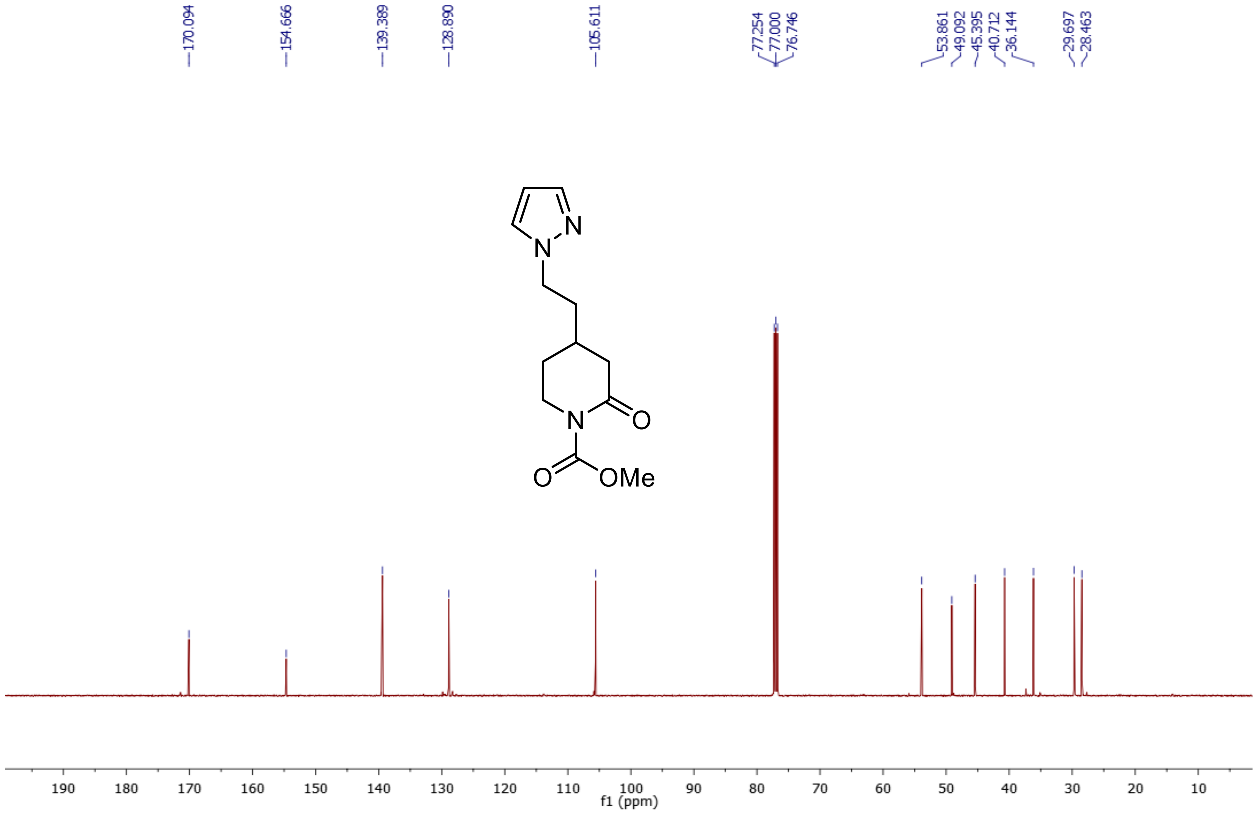
2.0
1.5
1.0
0.5
f1 (ppm)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28.463
N
N
N
O
O
OMe
190
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160
150
140
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120
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100
90
80
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50
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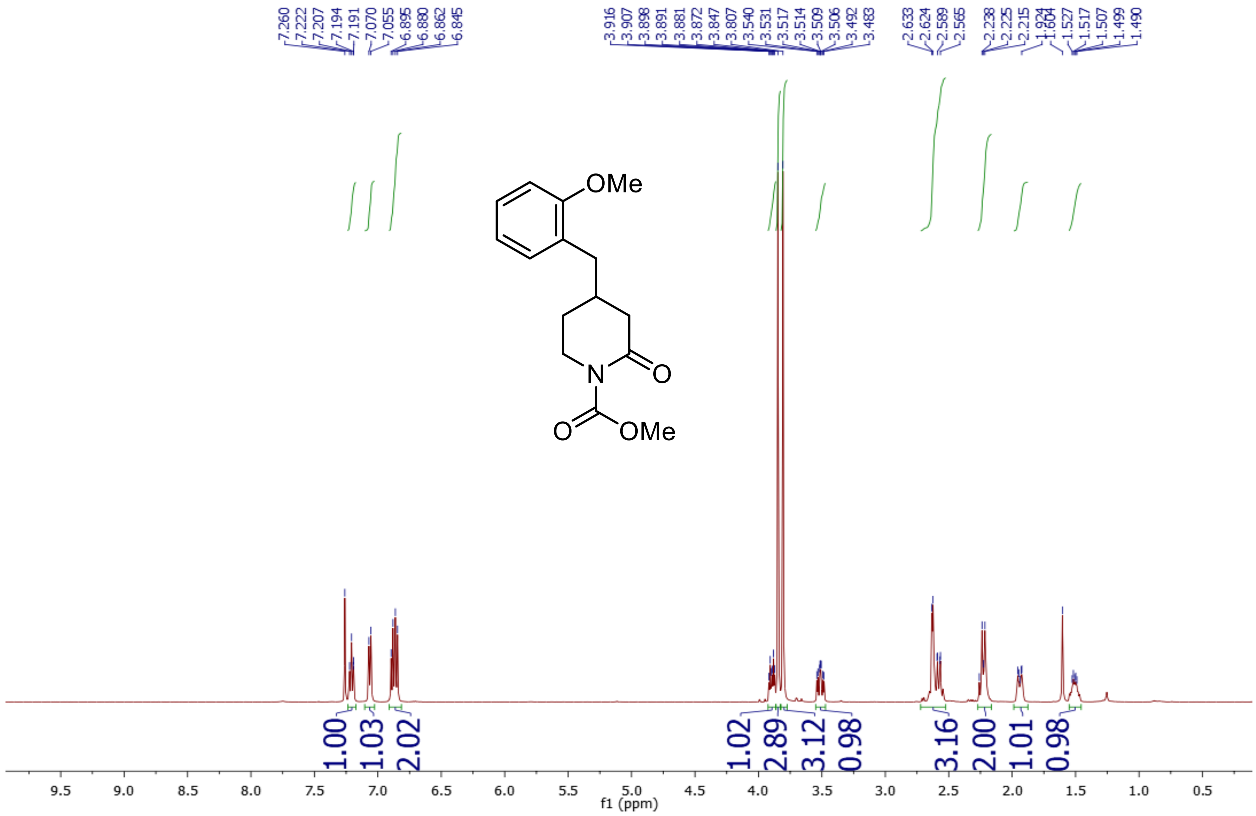
30
20
10
f1 (ppm)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6.845
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3.907
3.898
3.891
3.881
3.872
3.847
3.807
3.540
3.531
3.517
3.514
3.509
3.506
3.492
3.483
2.633
2.624
2.589
2.565
2.238
2.225
2.215
1.924
1.604
1.527
1.517
1.507
1.499
1.490
OMe
N
O
O
OMe
1.00
1.03
2.02
1.02
2.89
3.12
0.98
3.16
2.00
1.01
0.98
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
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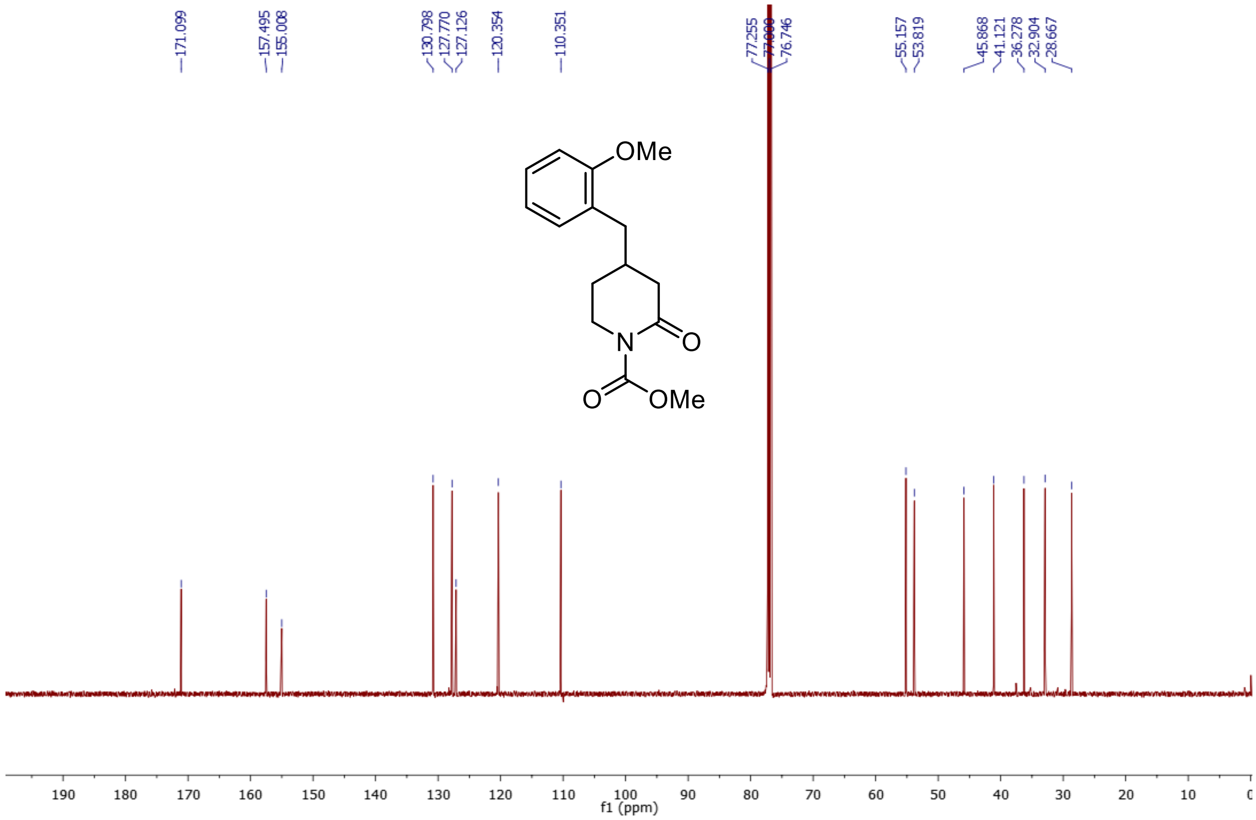
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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77.000
76.746
55.157
53.819
45.868
41.121
36.278
32.904
28.667
OMe
N
O
O
OMe
190
180
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160
150
140
130
120
110
100
90
80
70
60
50
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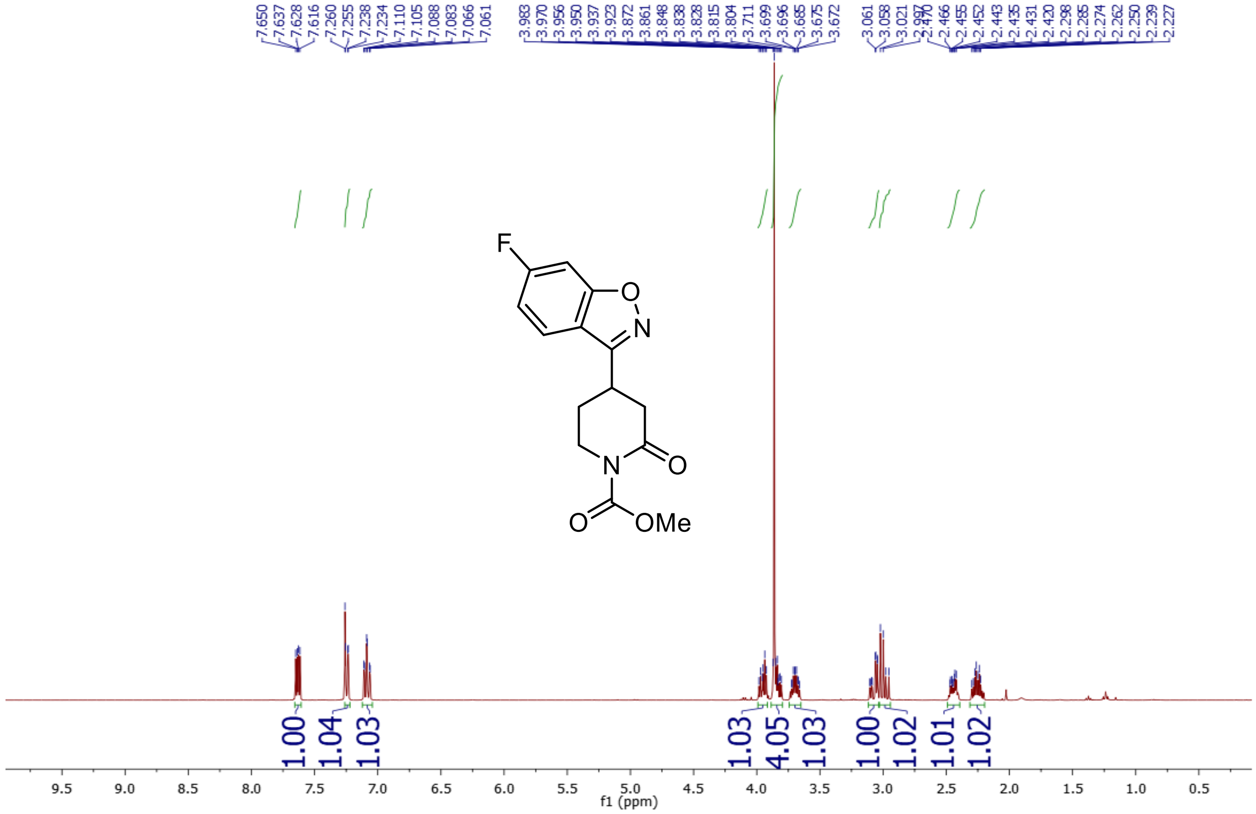
10
0
f1 (ppm)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7.066
7.061
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3.970
3.956
3.950
3.937
3.923
3.872
3.861
3.848
3.838
3.828
3.815
3.804
3.711
3.699
3.696
3.685
3.675
3.672
3.061
3.058
3.021
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2.455
2.452
2.443
2.435
2.431
2.420
2.298
2.285
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2.250
2.239
2.227
F
O
N
N
O
O
OMe
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1.04
1.03
1.03
4.05
1.03
1.00
1.02
1.01
1.02
9.5
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8.5
8.0
7.5
7.0
6.5
6.0
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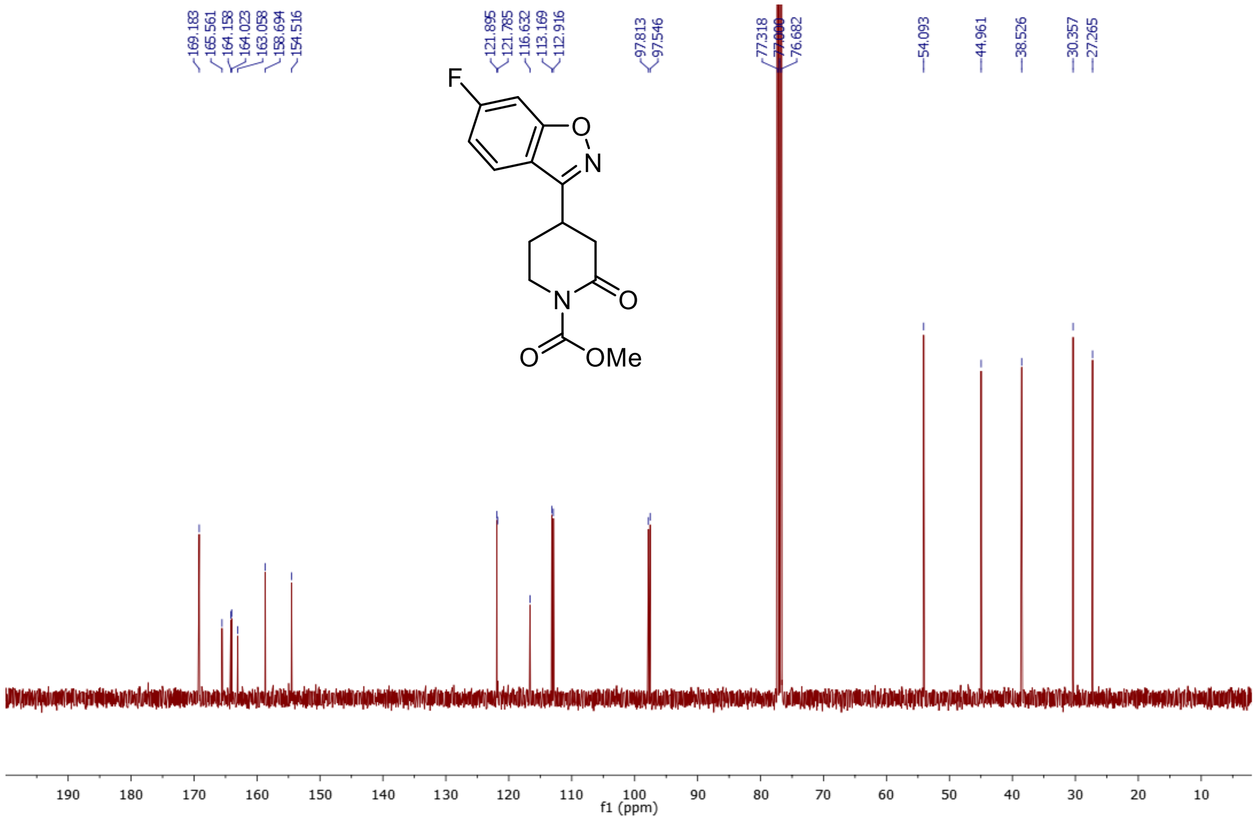
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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112.916
97.813
97.546
77.318
77.000
76.682
54.093
44.961
38.526
30.357
27.265
F
O
N
N
O
O
OMe
190
180
170
160
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140
130
120
110
100
90
80
70
60
50
40
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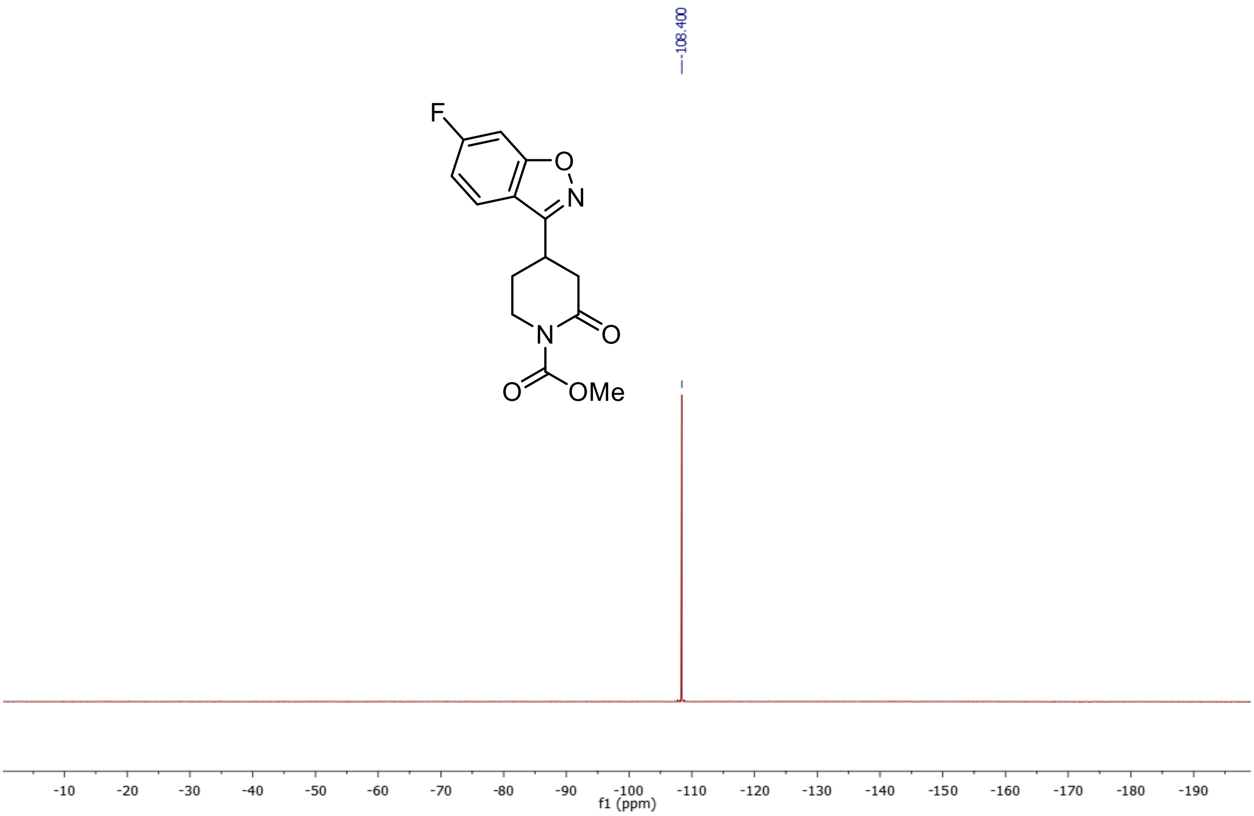
20
10
f1 (ppm)


-108.400
F
O
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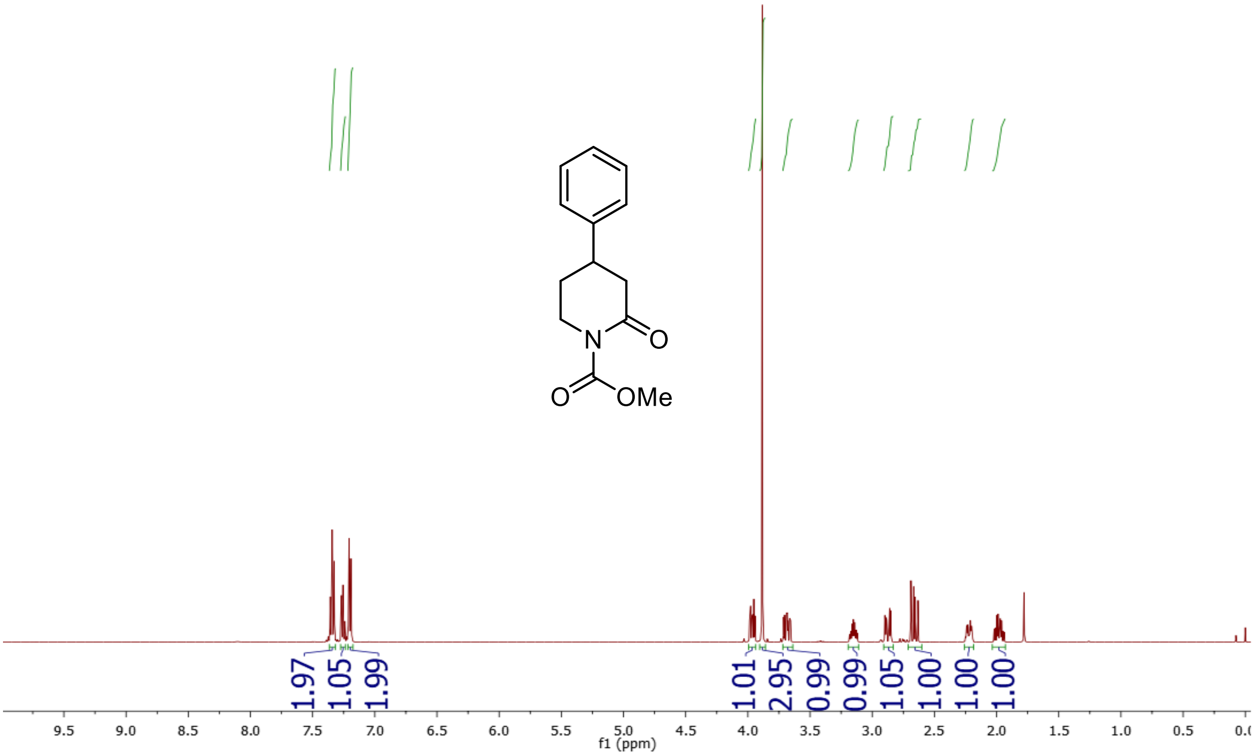
O
O
OMe
-10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190
f1 (ppm)


N
O
O
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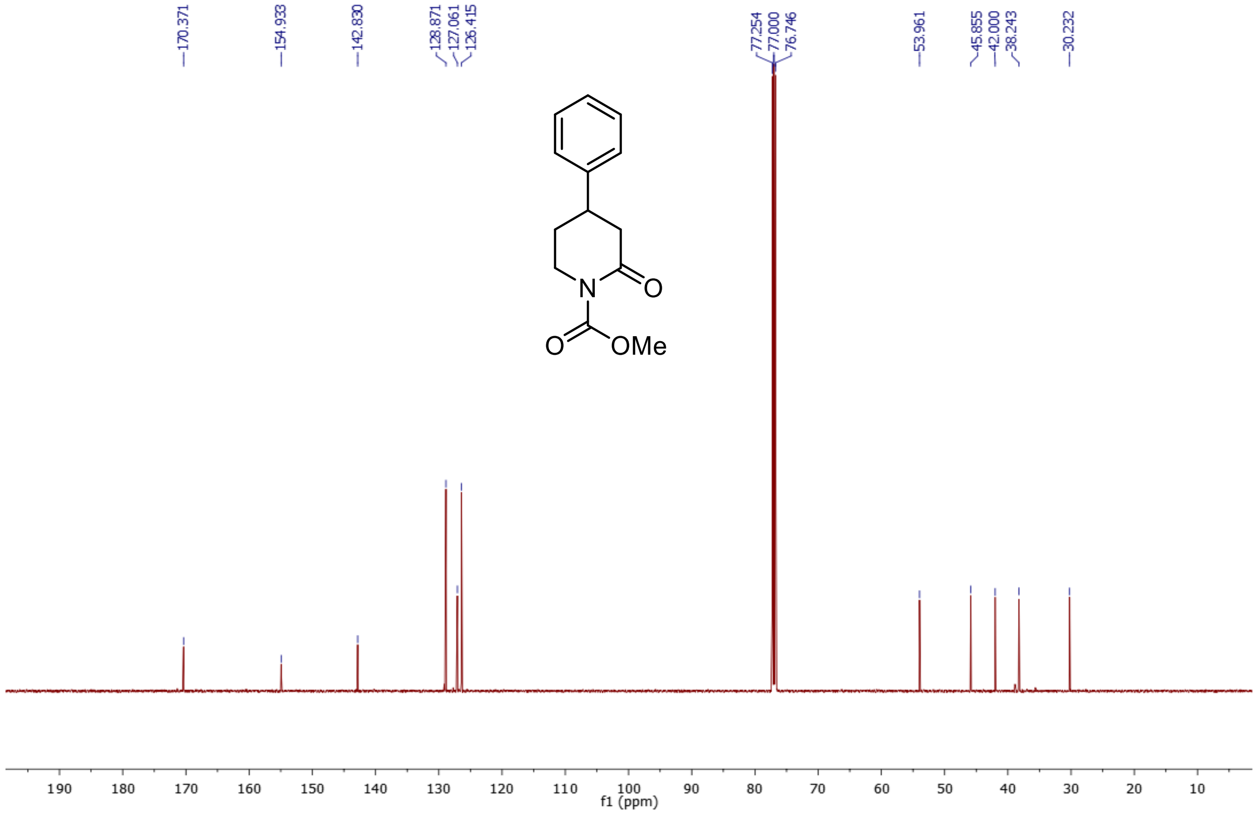
1.99
1.01
2.95
0.99
0.99
1.05
1.00
1.00
1.00
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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77.254
77.000
76.746
53.961
45.855
42.000
38.243
30.232
N
O
O
OMe
190
180
170
160
150
140
130
120
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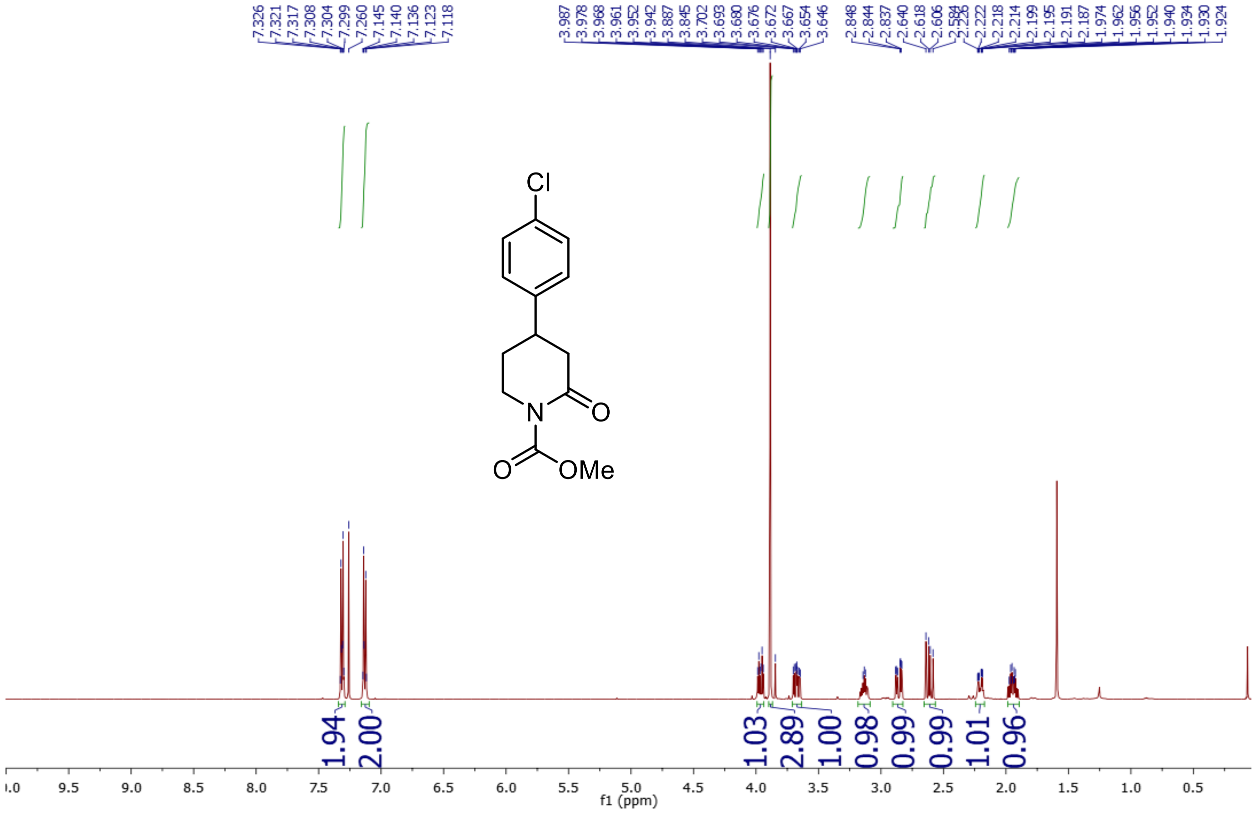
100
90
80
70
60
50
40
30
20
10
f1 (ppm)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7.123
7.118
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3.978
3.968
3.961
3.952
3.942
3.887
3.845
3.702
3.693
3.680
3.676
3.672
3.667
3.654
3.646
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2.844
2.837
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2.618
2.606
2.584
2.226
2.222
2.218
2.214
2.199
2.195
2.191
2.187
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1.956
1.952
1.940
1.934
1.930
1.924
Cl
N
O
O
OMe
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2.00
1.03
2.89
1.00
0.98
0.99
0.99
1.01
0.96
9.5
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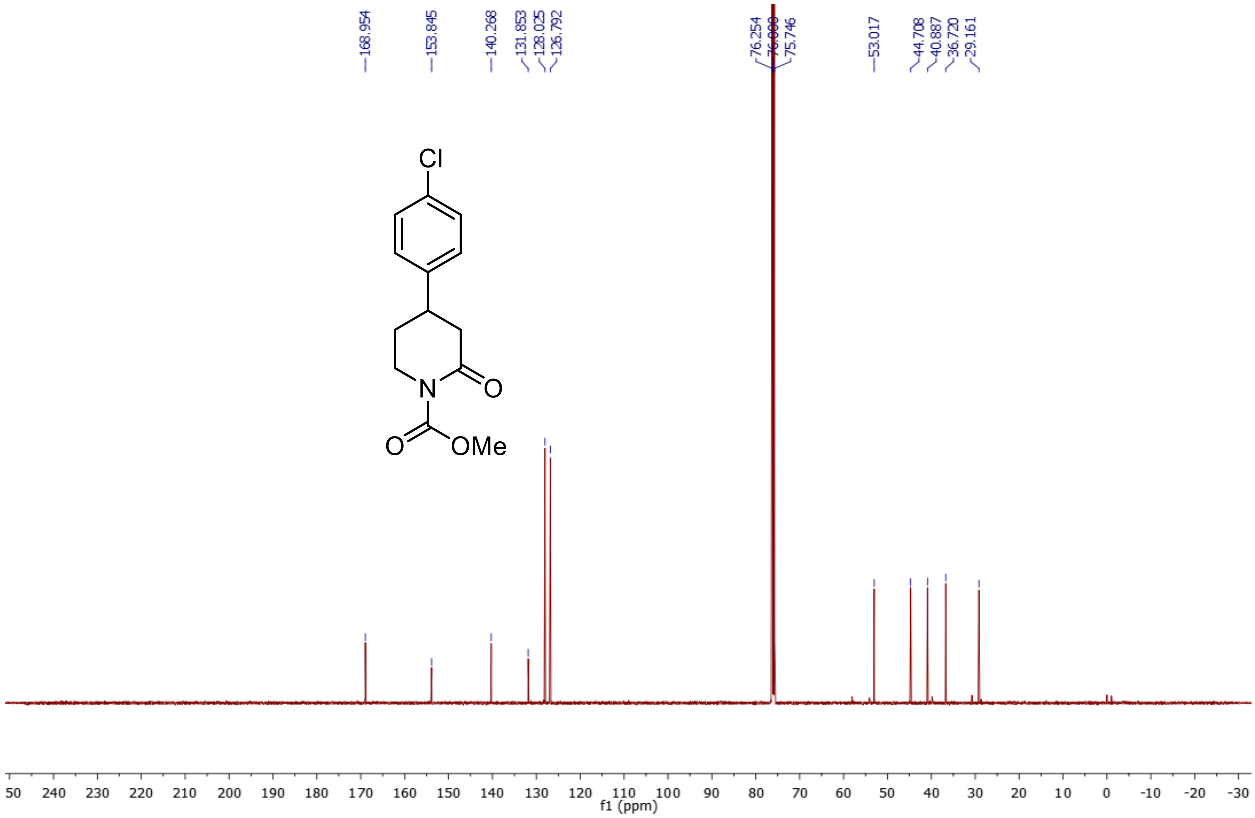
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)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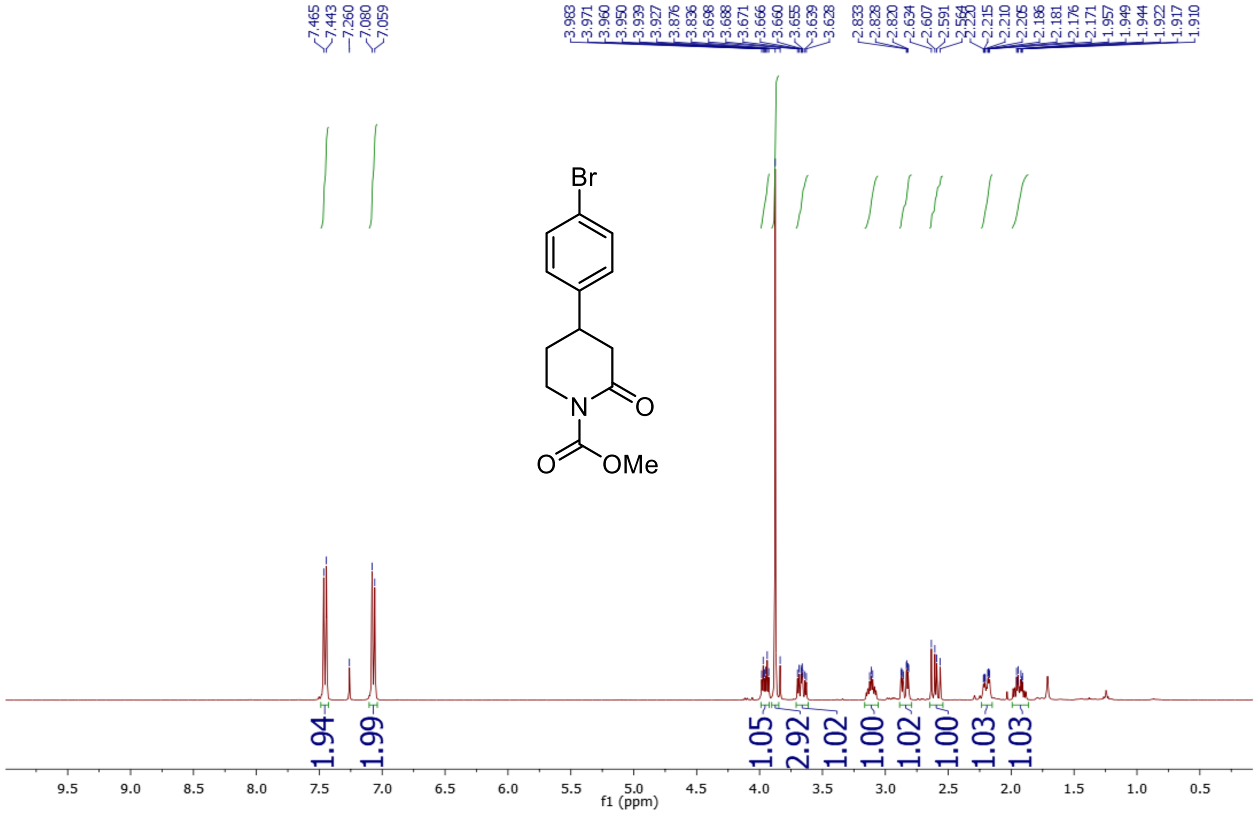
131.853
128.025
126.792
76.254
76.000
75.746
53.017
44.708
40.887
36.720
29.161
Cl
N
O
O
OMe
50 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30
f1 (ppm)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7.260
7.080
7.059
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3.960
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3.939
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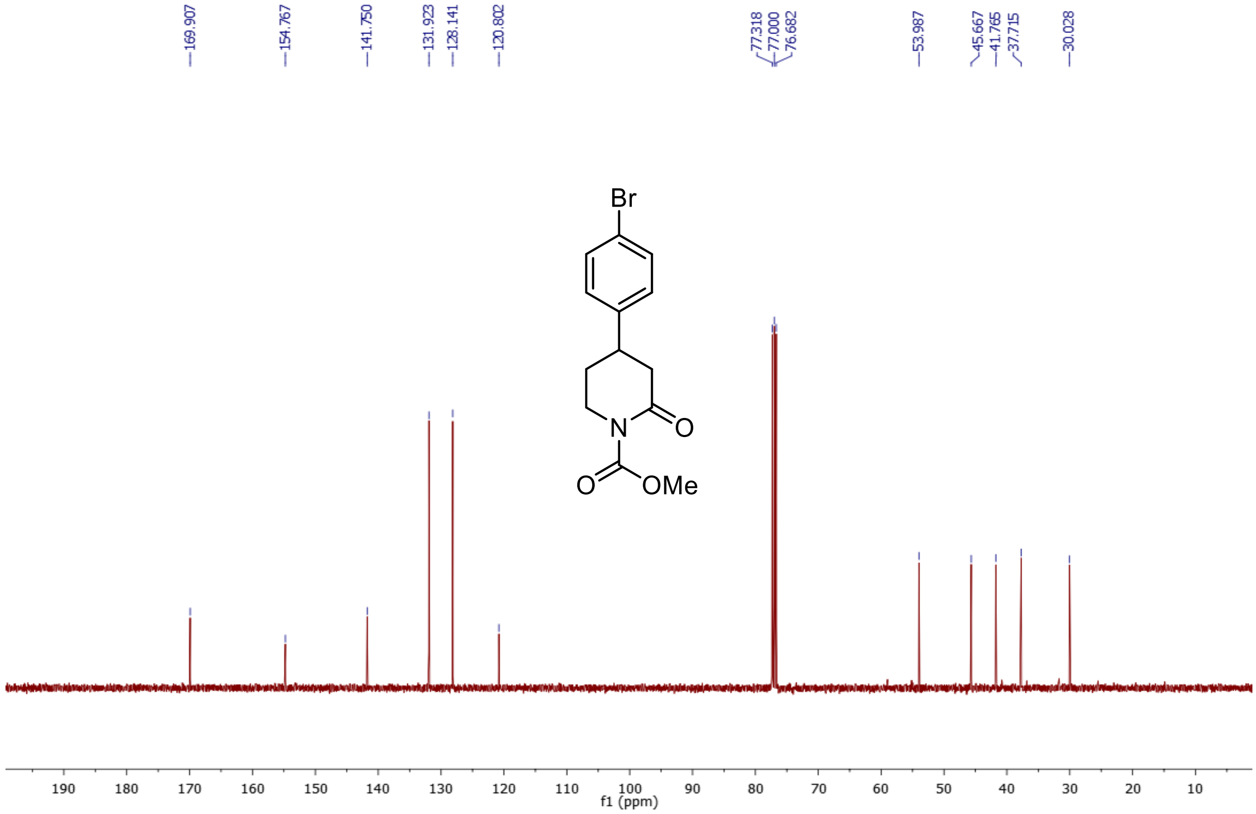
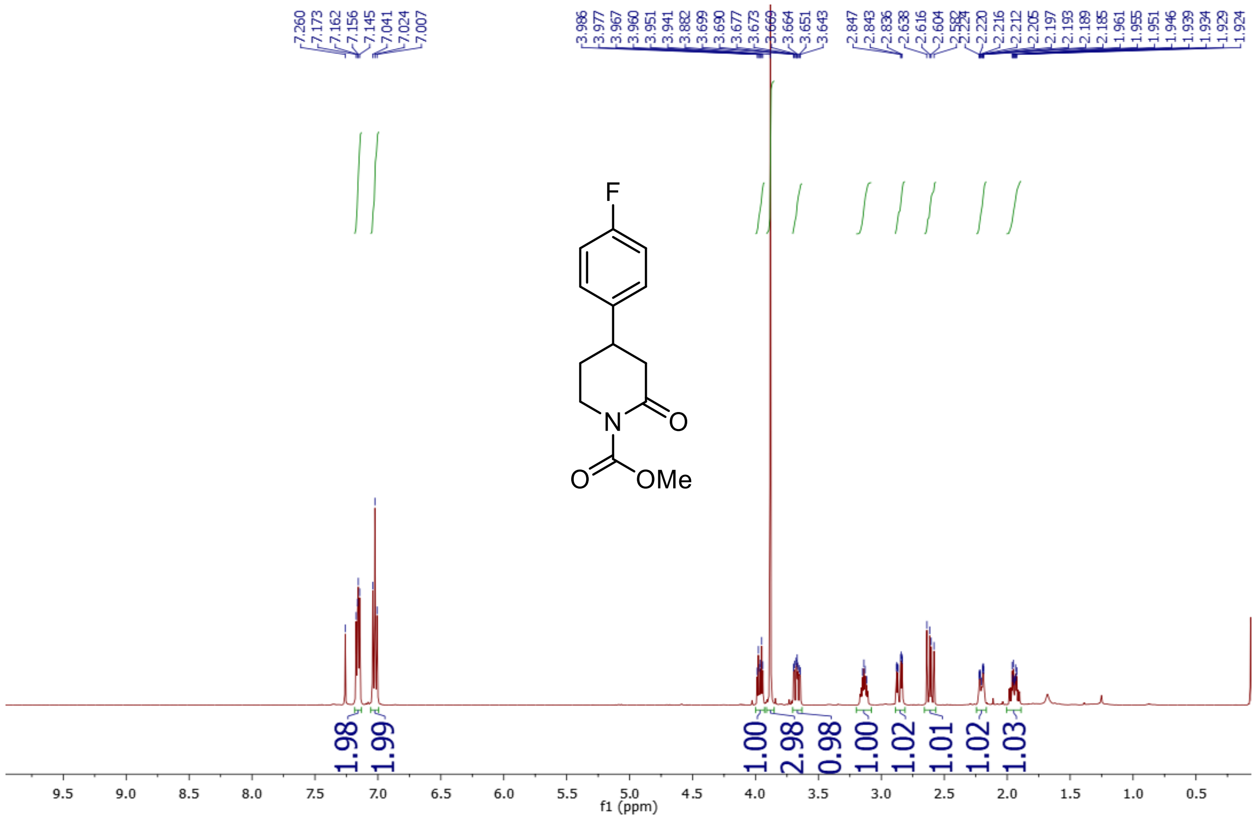
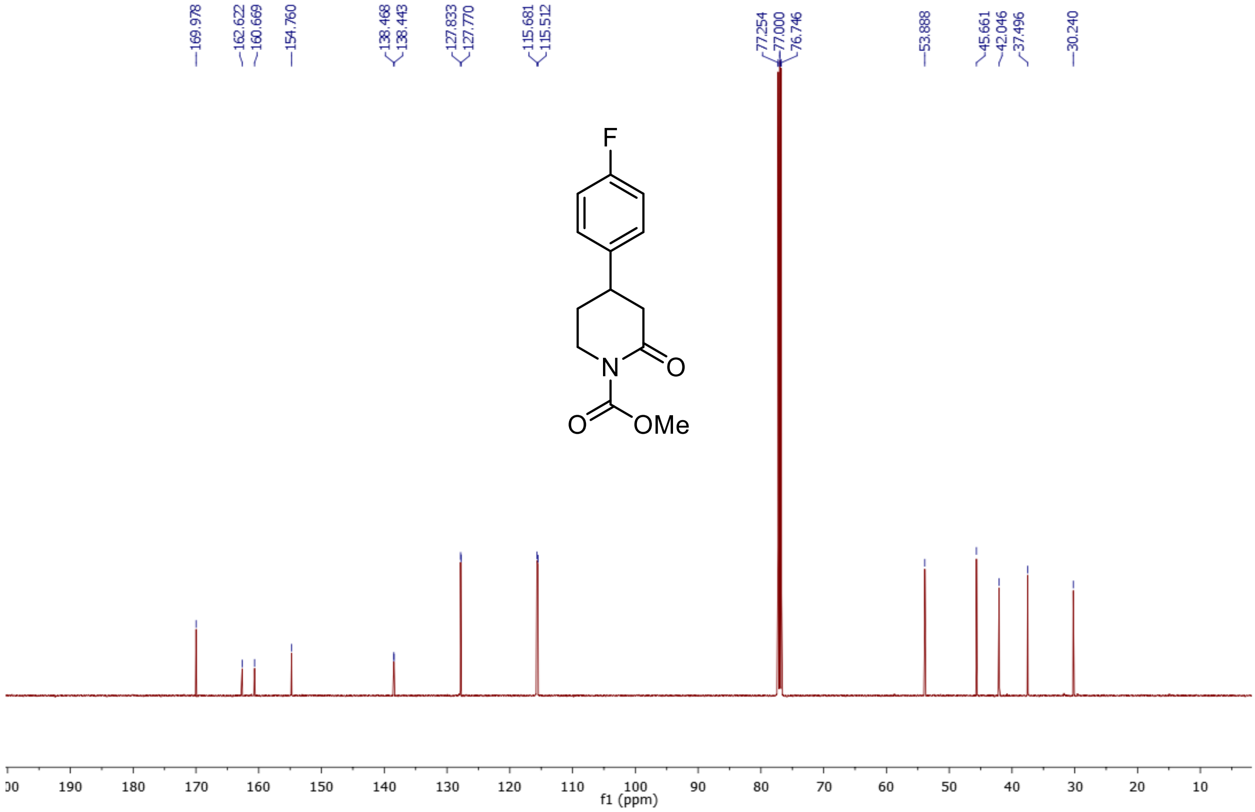
2.833
2.828
2.820
2.634
2.607
2.591
2.564
2.220
2.215
2.210
2.205
2.186
2.181
2.176
2.171
1.957
1.949
1.944
1.922
1.917
1.910
Br
N
O
O
OMe
1.94
1.99
1.05
2.92
1.02
1.00
1.02
1.00
1.03
1.03
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)


169.907
154.767
141.750
131.923
128.141
120.802
77.318
77.000
76.682
53.987
45.667
41.765
37.715
30.028
Br
N
O
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)


7.260
7.173
7.162
7.156
7.145
7.041
7.024
7.007
3.986
3.977
3.967
3.960
3.951
3.941
3.882
3.699
3.690
3.677
3.673
3.669
3.664
3.651
3.643
2.847
2.843
2.836
2.638
2.616
2.604
2.582
2.224
2.220
2.216
2.212
2.205
2.197
2.193
2.189
2.185
1.961
1.955
1.951
1.946
1.939
1.934
1.929
1.924
F
N
O
O
OMe
1.98
1.99
1.00
2.98
0.98
1.00
1.02
1.01
1.02
1.03
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


169.978
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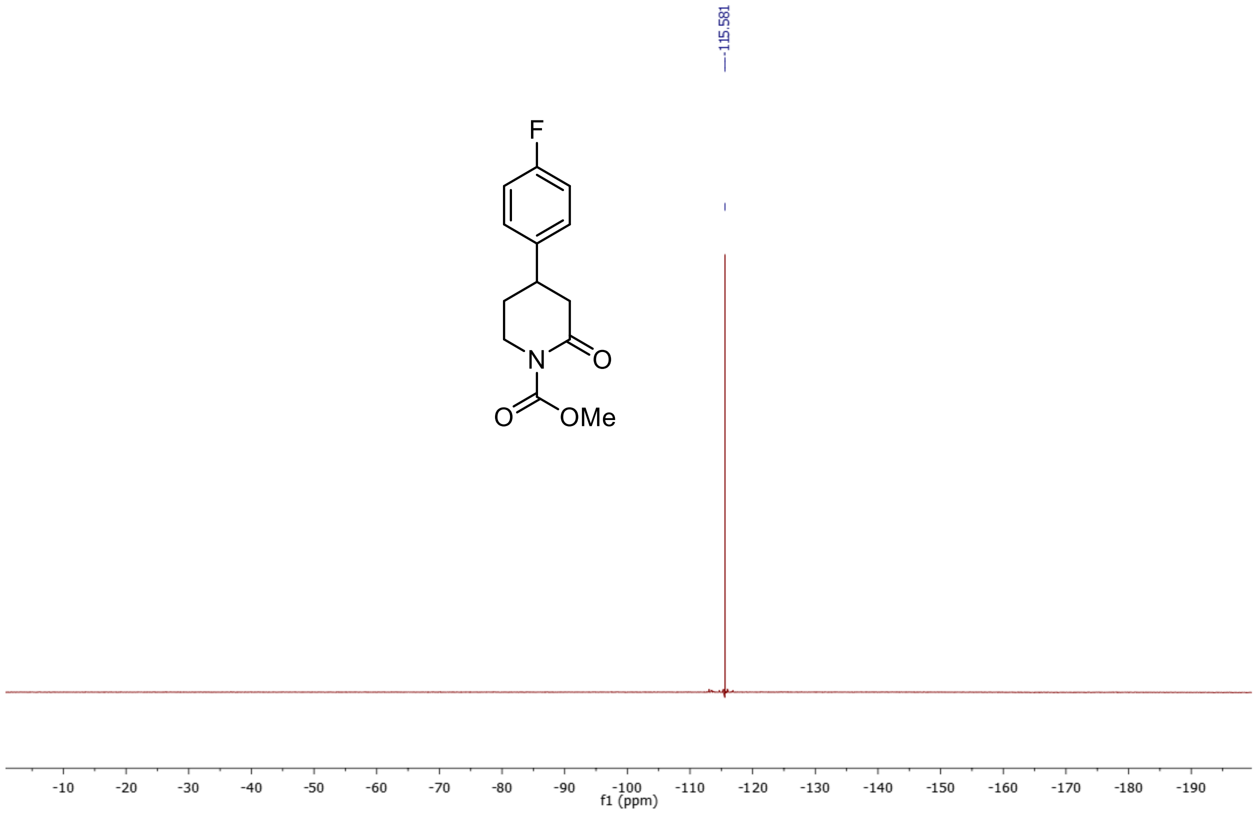
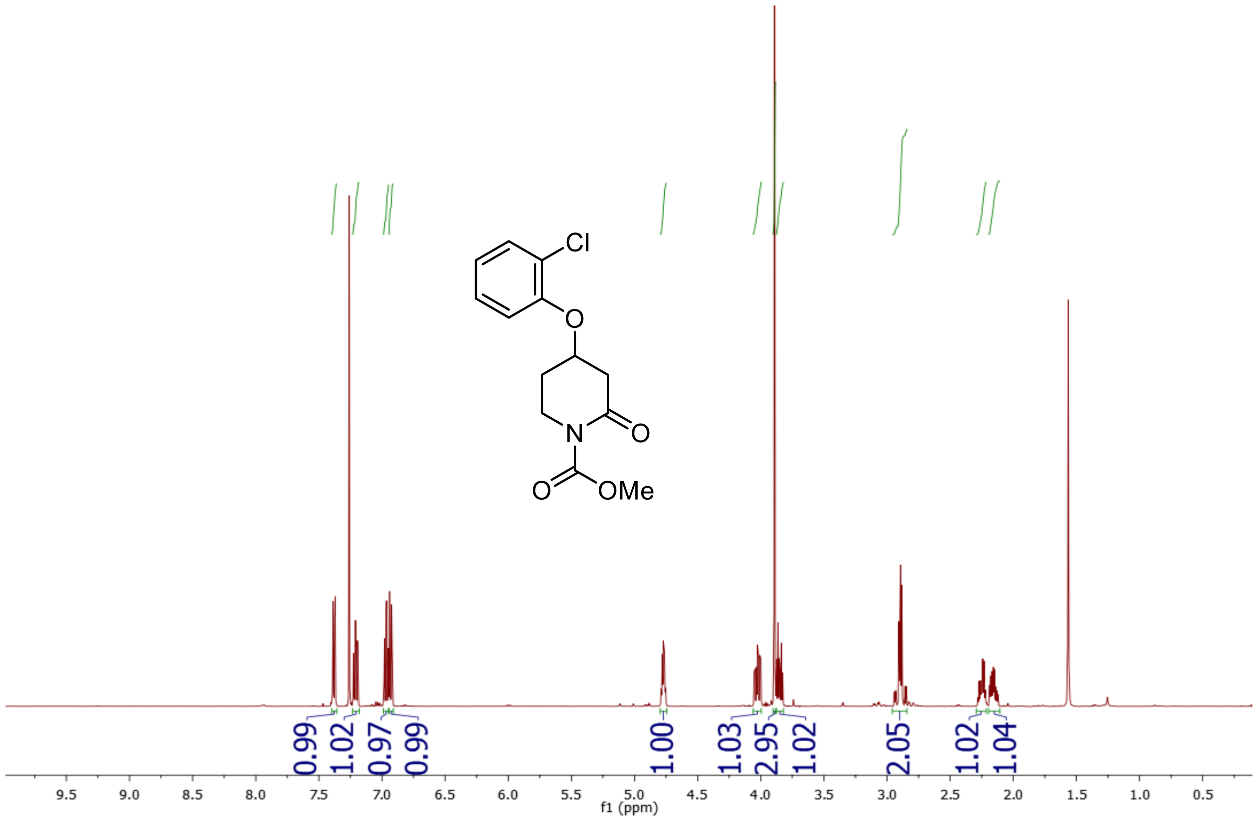
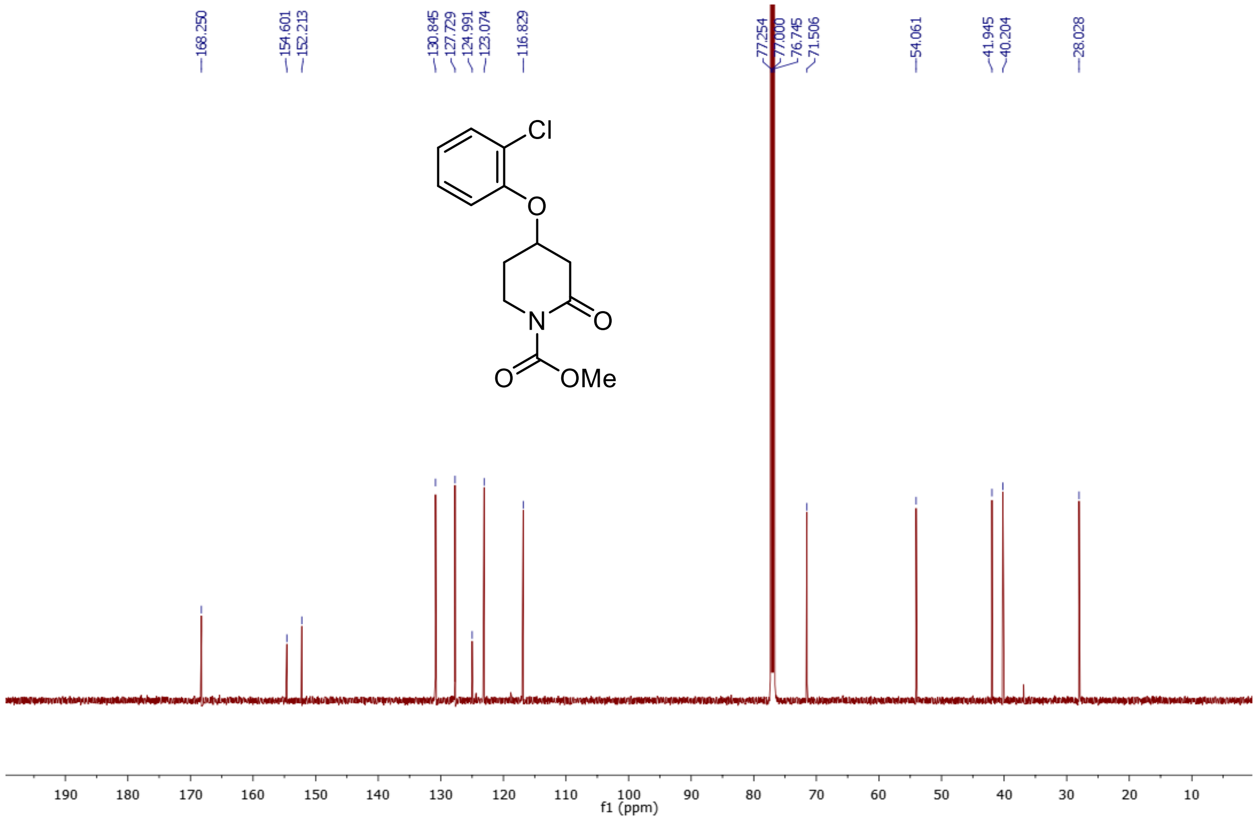
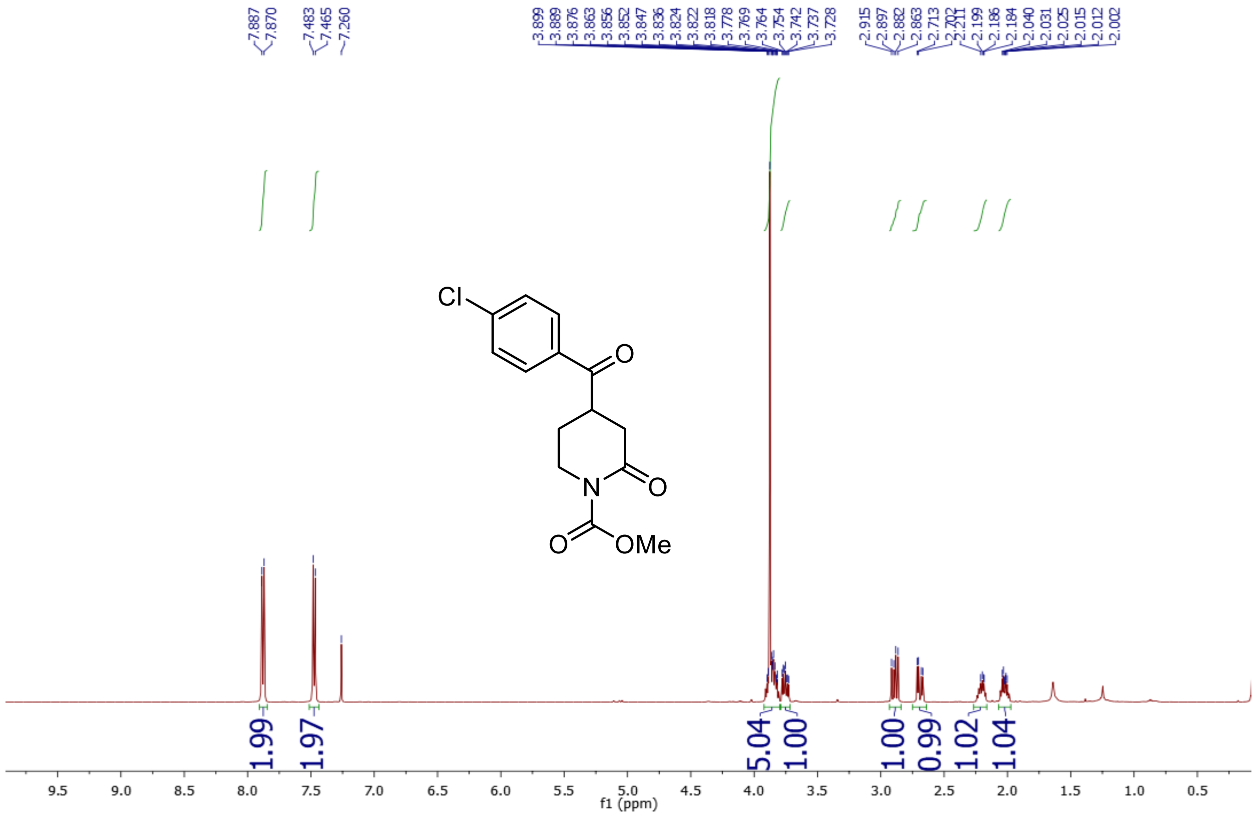
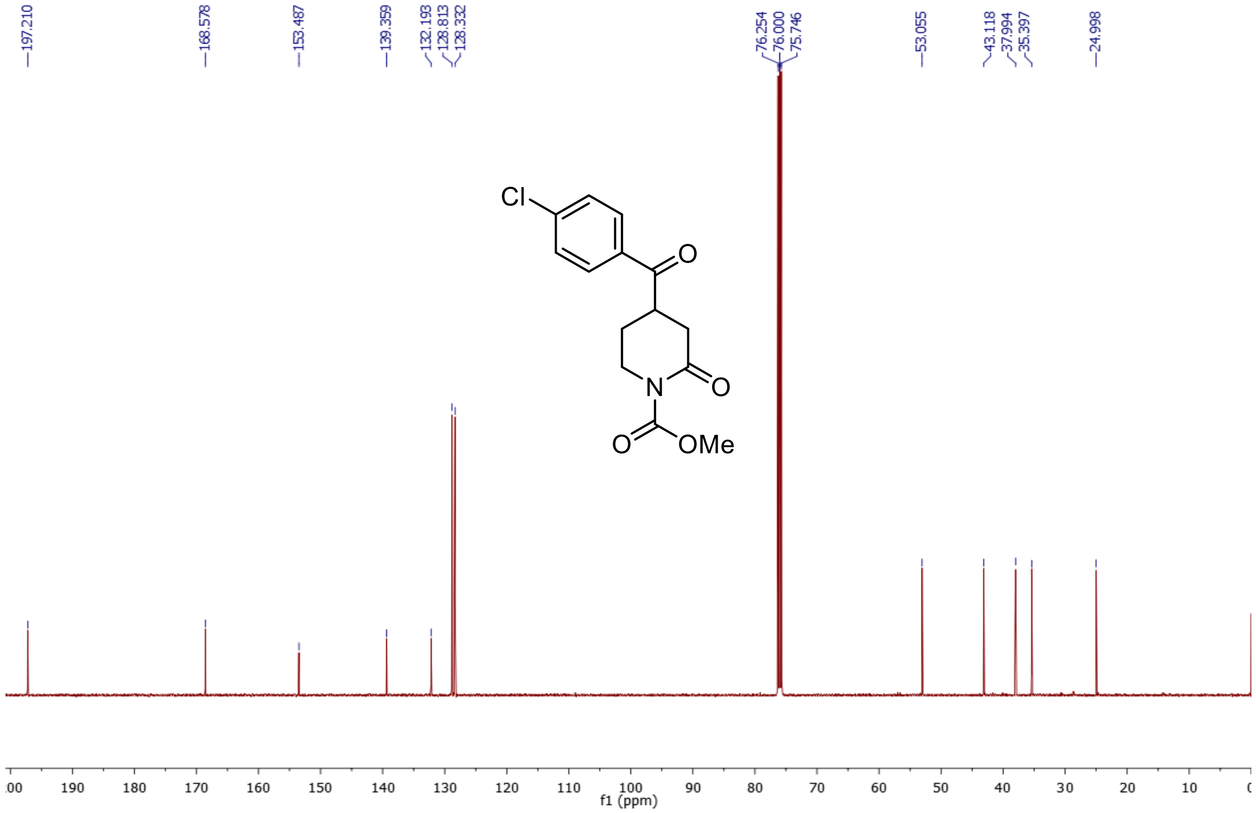
160.669
154.760
138.468
138.443
127.833
127.770
115.681
115.512
77.254
77.000
76.746
53.888
45.661
42.046
37.496
30.240
F
N
O
O
OMe
00
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

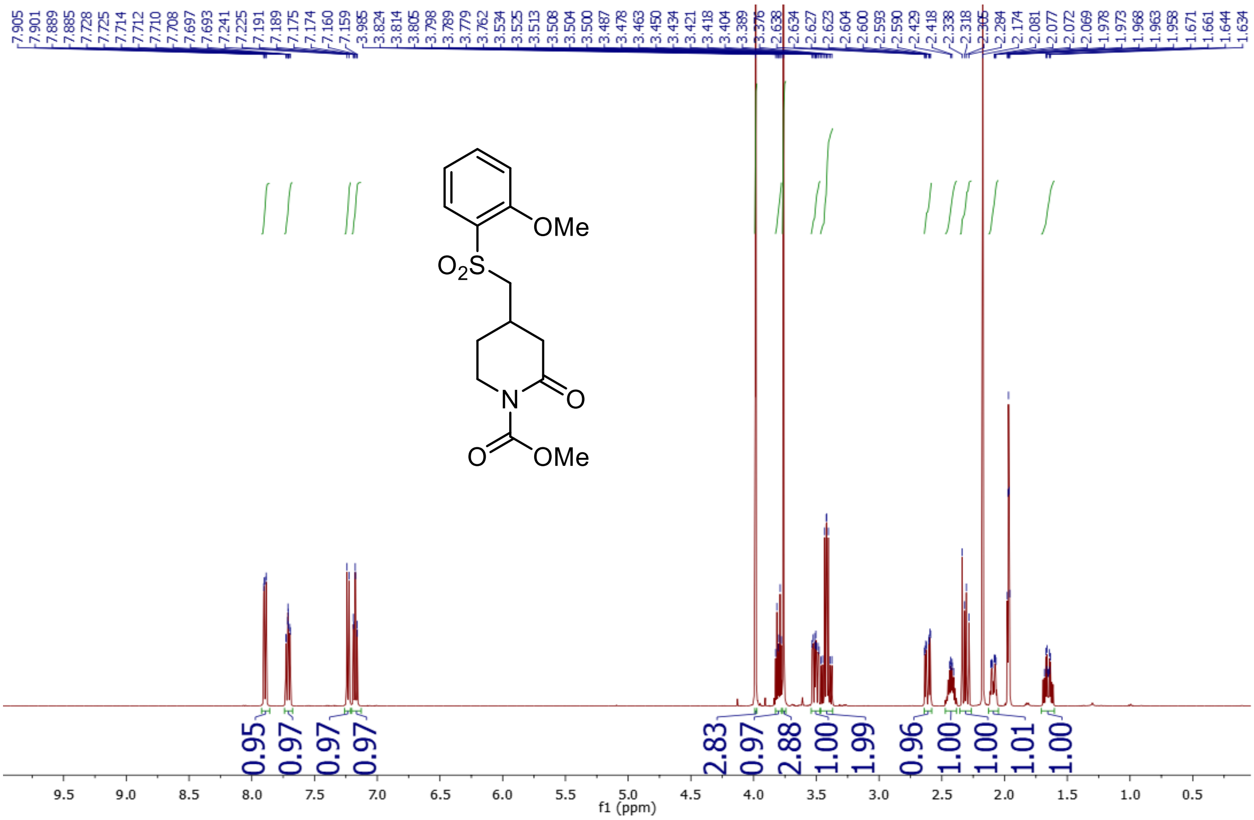

-115.581
F
N
O
O
OMe
-10
-20
-30
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
-150
-160
-170
-180
-190
f1 (ppm)

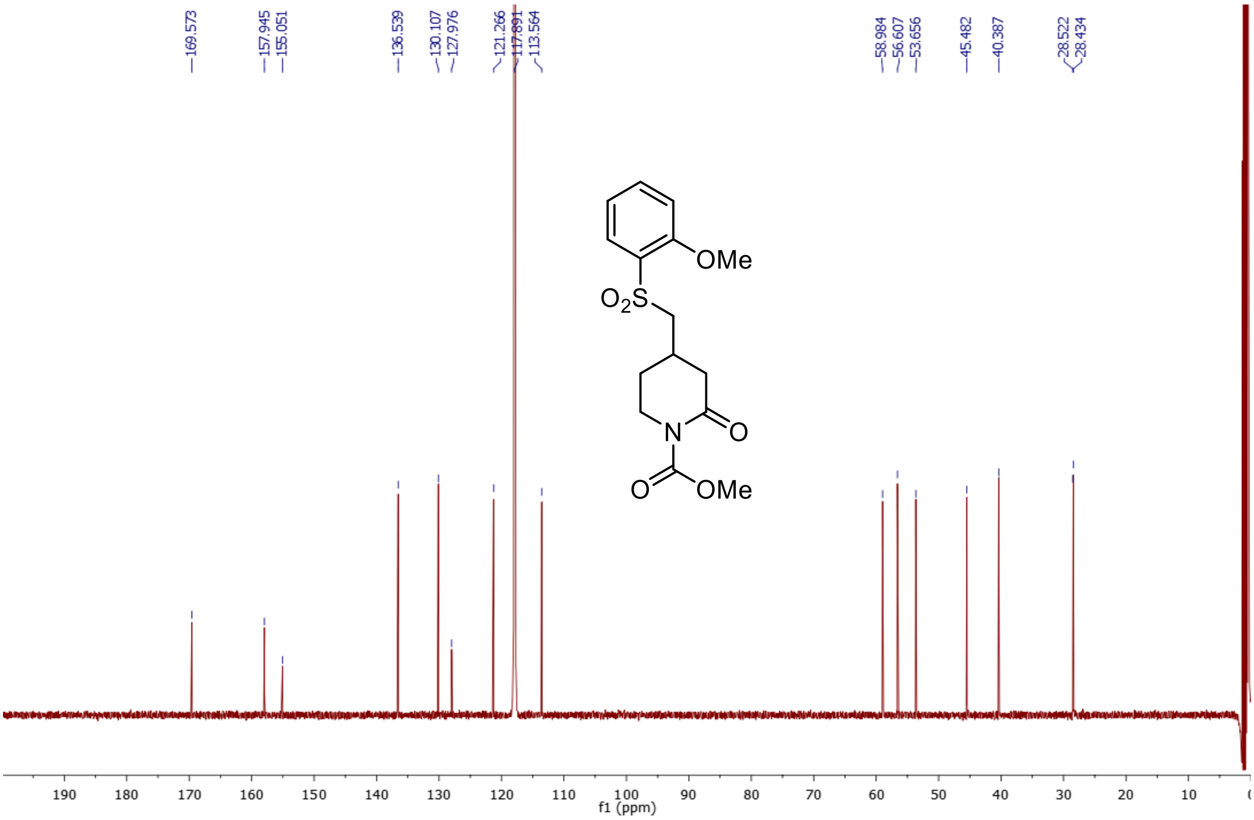

Cl
O
N
O
O
OMe
0.99
1.02
0.97
0.99
1.00
1.03
2.95
1.02
2.05
1.02
1.04
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

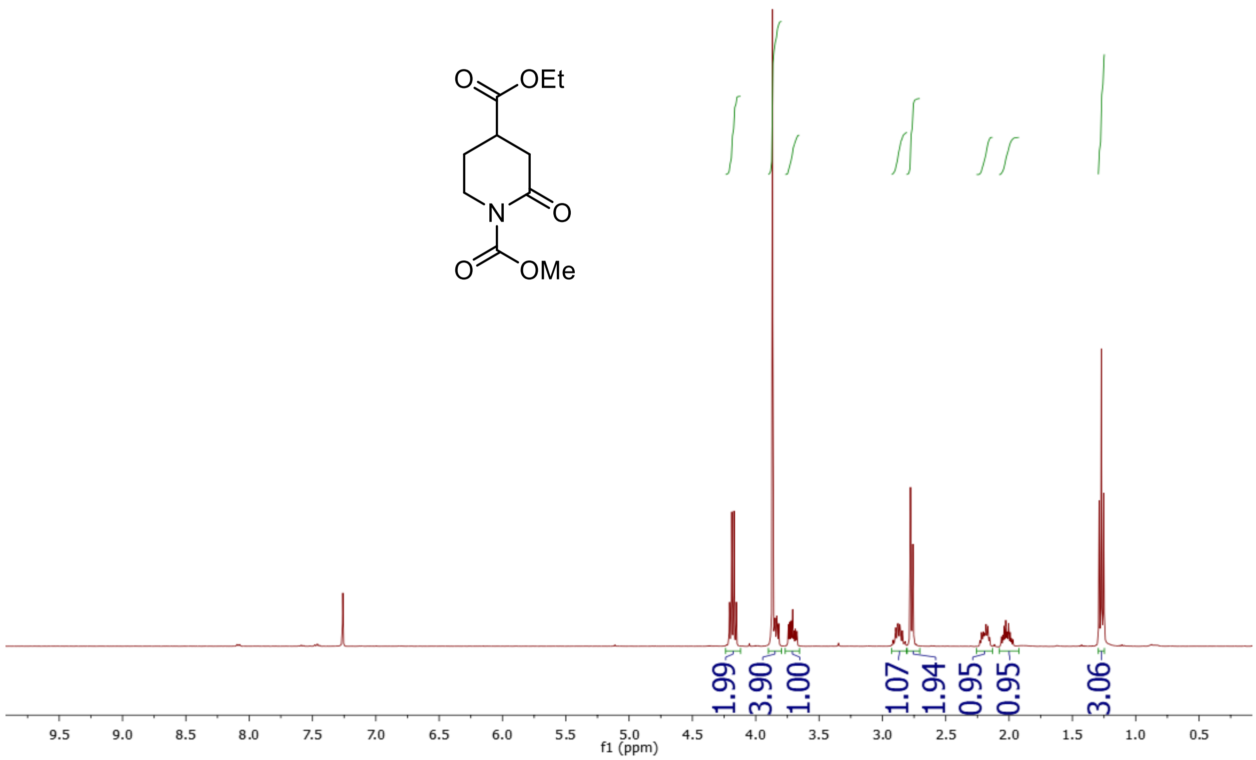

168.250
154.601
152.213
130.845
127.729
124.991
123.074
116.829
77.254
77.000
76.745
71.506
54.061
41.945
40.204
28.028
Cl
O
N
O
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

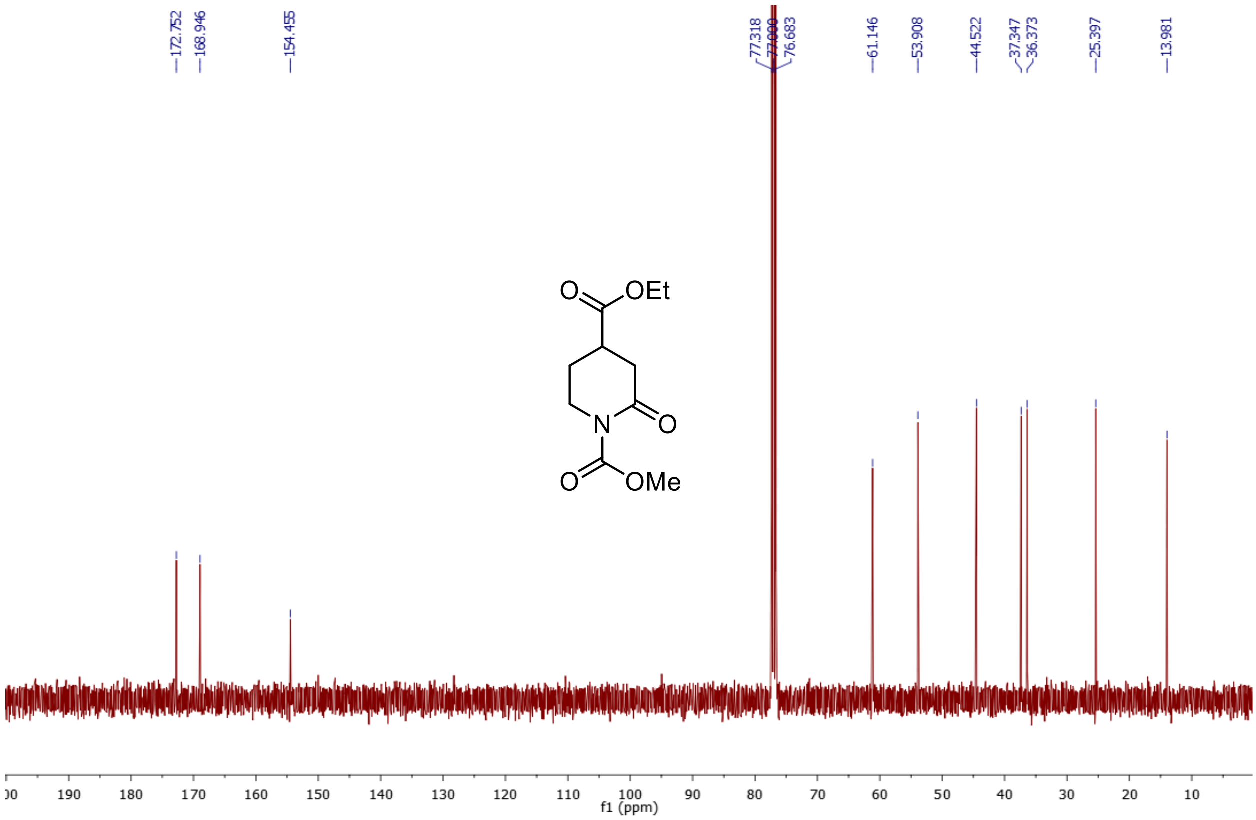

7.887
7.870
7.483
7.465
7.260
3.899
3.889
3.876
3.863
3.856
3.852
3.847
3.836
3.824
3.822
3.818
3.778
3.769
3.764
3.754
3.742
3.737
3.728
2.915
2.897
2.882
2.863
2.713
2.702
2.211
2.199
2.186
2.184
2.040
2.031
2.025
2.015
2.012
2.002
Cl
O
N
O
O
OMe
1.99
1.97
5.04
1.00
1.00
0.99
1.02
1.04
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

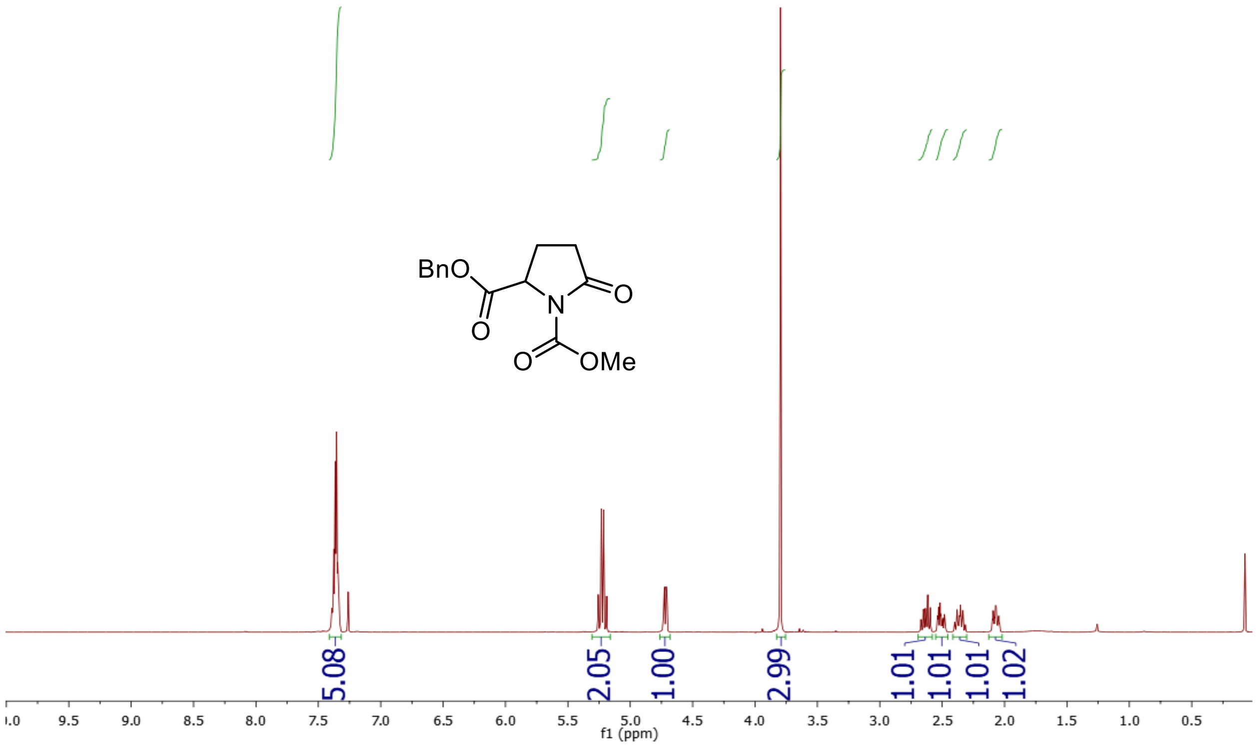

197.210
168.578
153.487
139.359
132.193
128.813
128.332
76.254
76.000
75.746
53.055
43.118
37.994
35.397
24.998
Cl
O
N
O
O
OMe
00
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

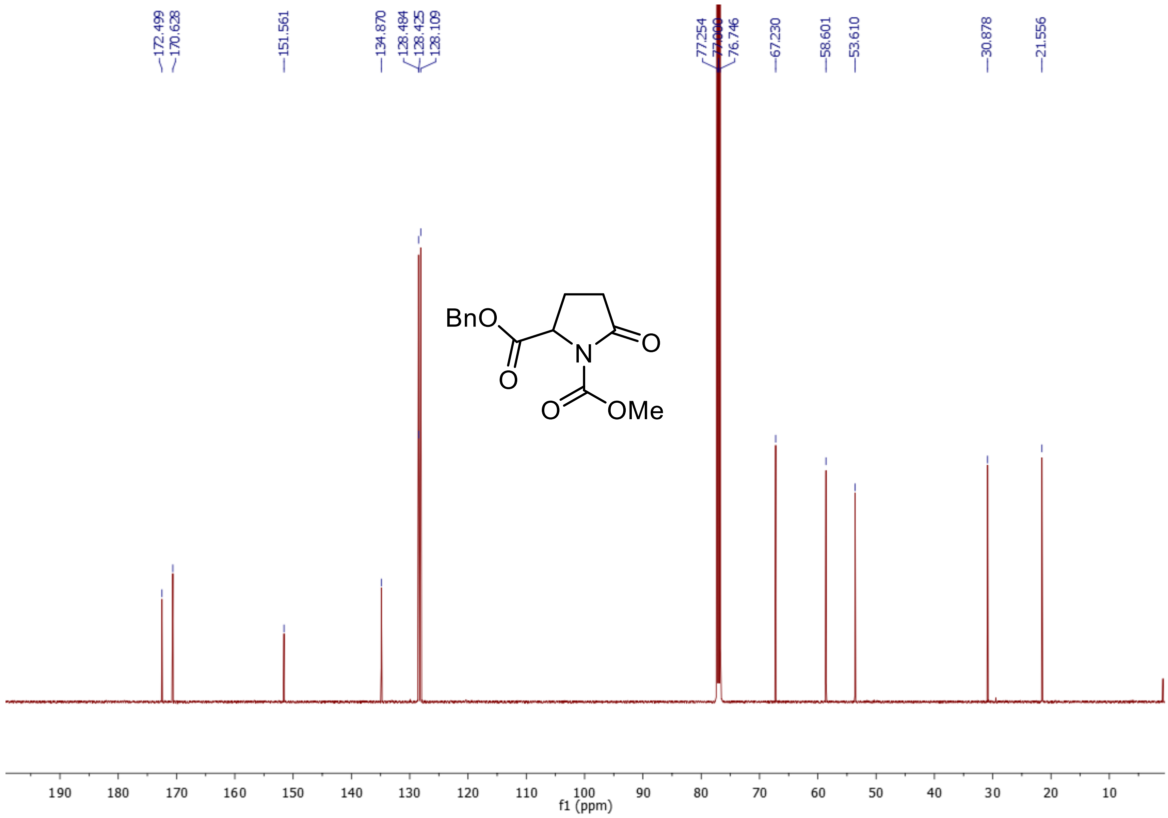

7.905
7.901
7.889
7.885
7.728
7.725
7.714
7.712
7.710
7.708
7.697
7.693
7.241
7.225
7.191
7.189
7.175
7.174
7.160
7.159
3.985
3.824
3.814
3.805
3.798
3.789
3.779
3.762
3.534
3.525
3.513
3.508
3.504
3.500
3.487
3.478
3.463
3.450
3.434
3.421
3.418
3.404
3.389
3.376
2.638
2.634
2.627
2.623
2.604
2.600
2.593
2.590
2.429
2.418
2.338
2.318
2.305
2.284
2.174
2.081
2.077
2.072
2.069
1.978
1.973
1.968
1.963
1.958
1.671
1.661
1.644
1.634
OMe
O2S
N
O
O
OMe
0.95
0.97
0.97
0.97
2.83
0.97
2.88
1.00
1.99
0.96
1.00
1.00
1.01
1.00
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

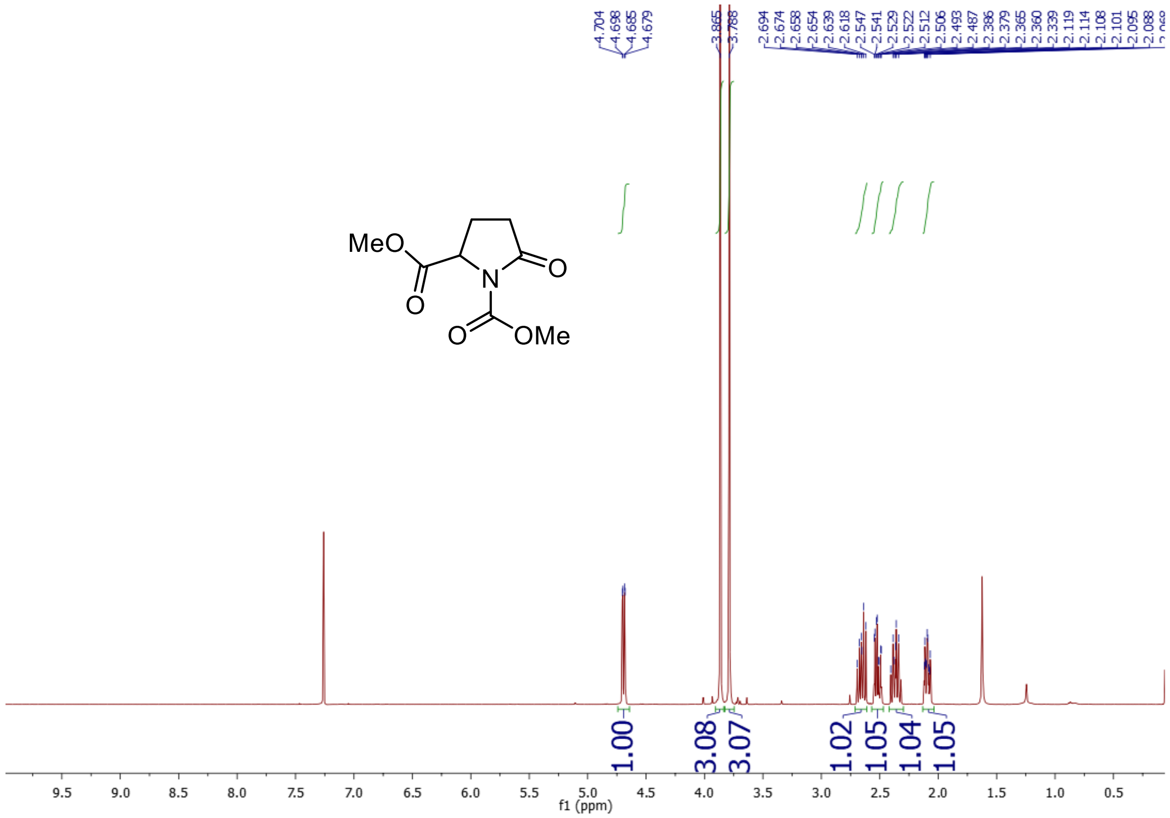

169.573
157.945
155.051
136.539
130.107
127.976
121.266
117.891
113.564
58.984
56.607
53.656
45.482
40.387
28.522
28.434
OMe
O2S
N
O
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

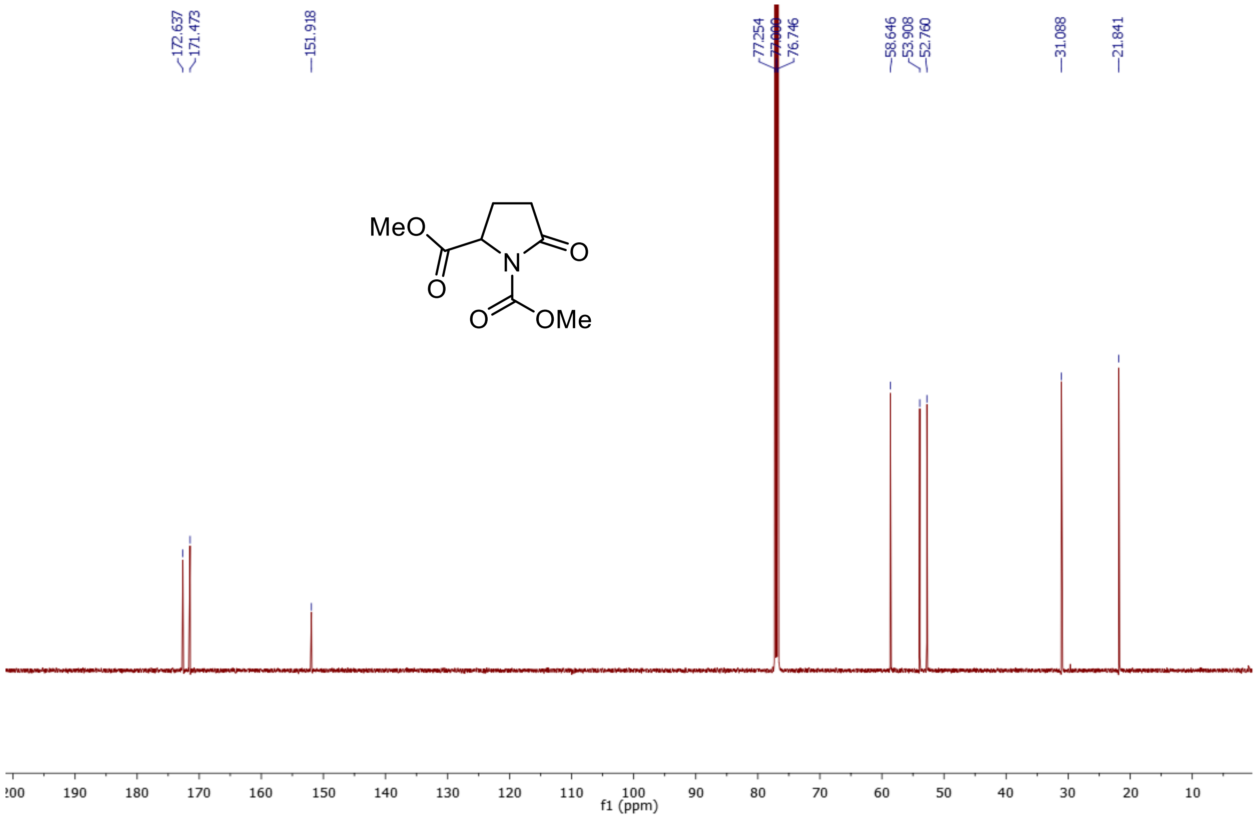

O
OEt
N
O
O
OMe
1.99
3.90
1.00
1.07
1.94
0.95
0.95
3.06
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

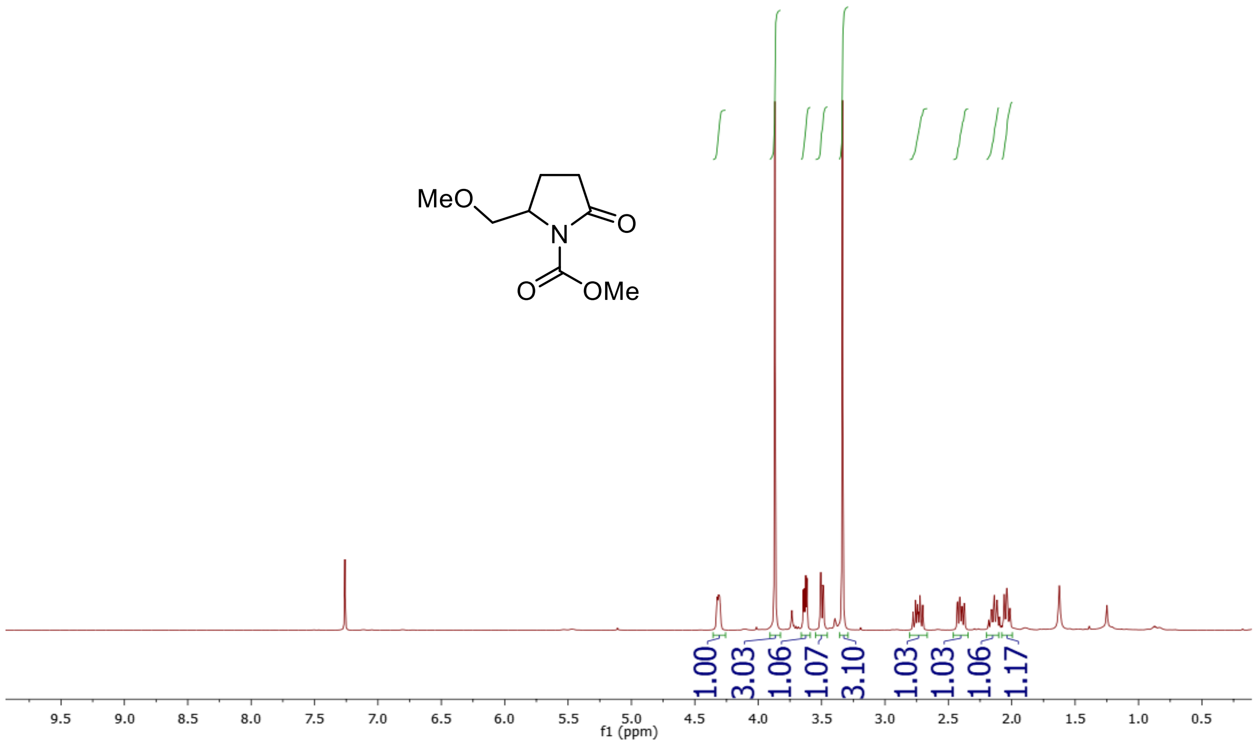

172.752
168.946
154.455
77.318
77.000
76.683
61.146
53.908
44.522
37.347
36.373
25.397
13.981
O
OEt
N
O
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)


BnO
O
N
O
O
OMe
5.08
2.05
1.00
2.99
1.01
1.01
1.01
1.02
.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

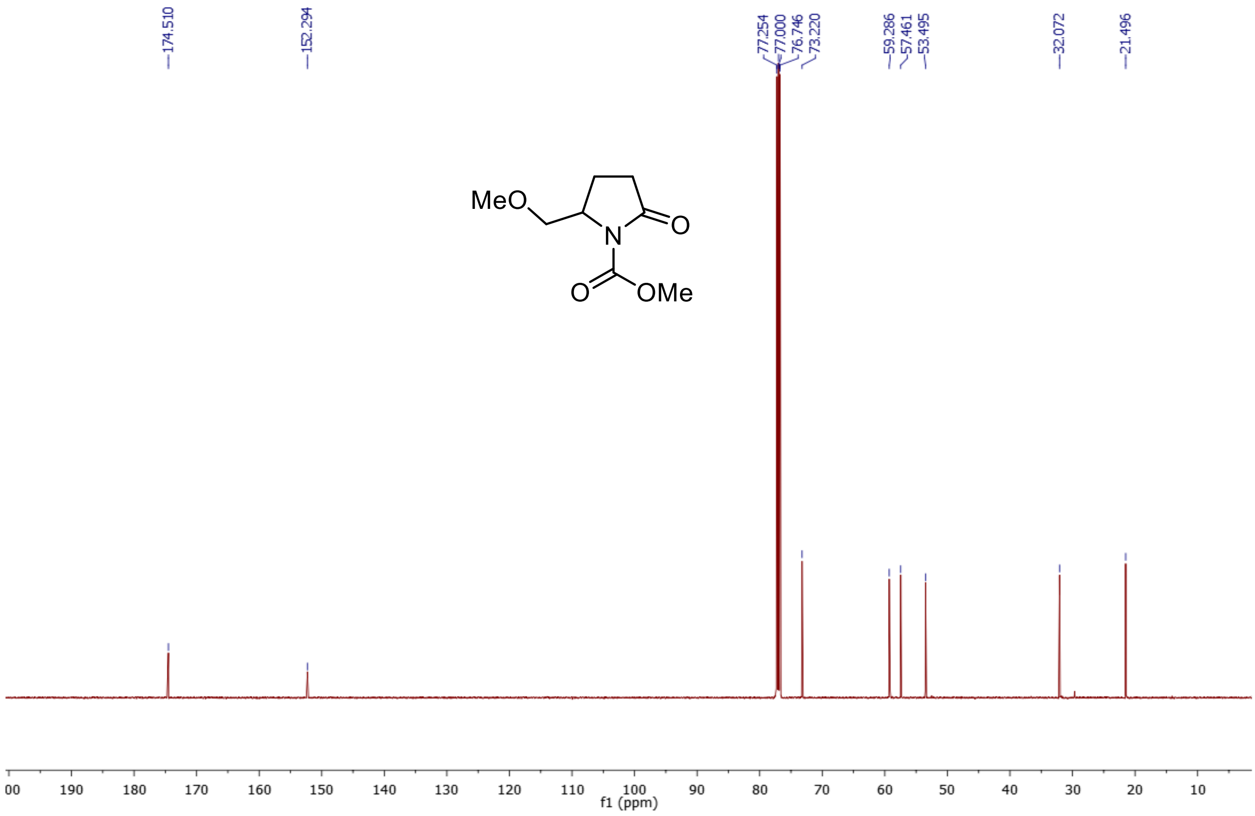

172.499
170.628
151.561
134.870
128.484
128.425
128.109
77.254
77.000
76.746
67.230
58.601
53.610
30.878
21.556
BnO
O
N
O
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

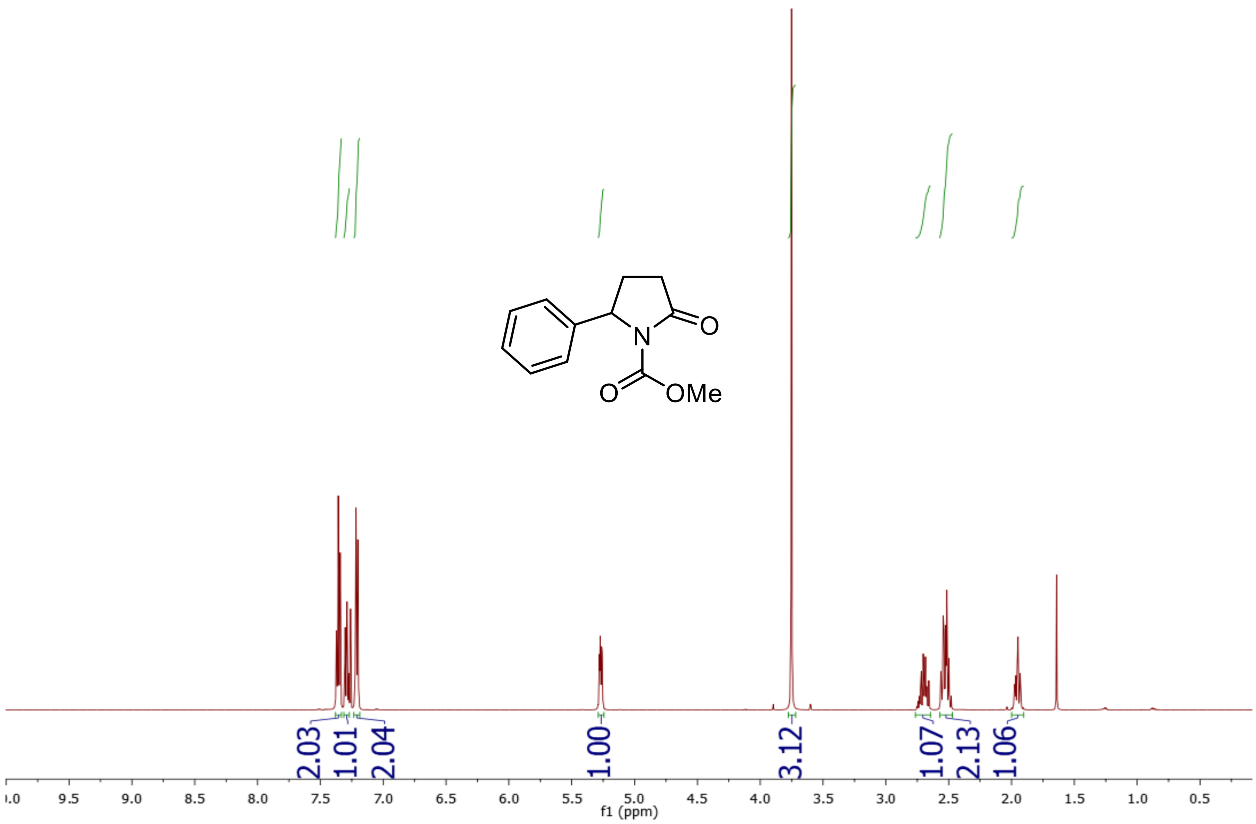

4.704
4.698
4.685
4.679
3.865
3.788
2.694
2.674
2.658
2.654
2.639
2.618
2.547
2.541
2.529
2.522
2.512
2.506
2.493
2.487
2.386
2.379
2.365
2.360
2.339
2.119
2.114
2.108
2.101
2.095
2.088
MeO
N
O
O
O
OMe
1.00
3.08
3.07
1.02
1.05
1.04
1.05
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

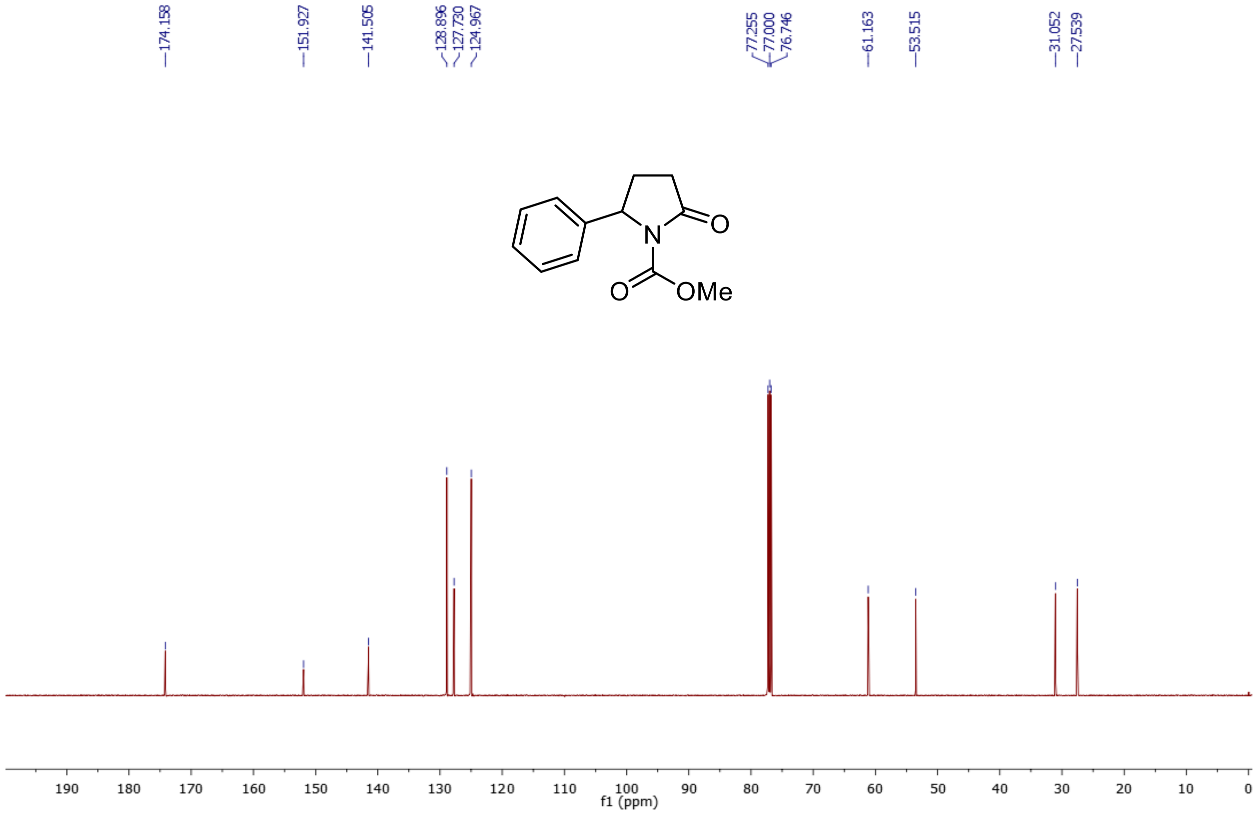

172.637
171.473
151.918
77.254
77.000
76.746
58.646
53.908
52.760
31.088
21.841
MeO
N
O
O
O
OMe
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

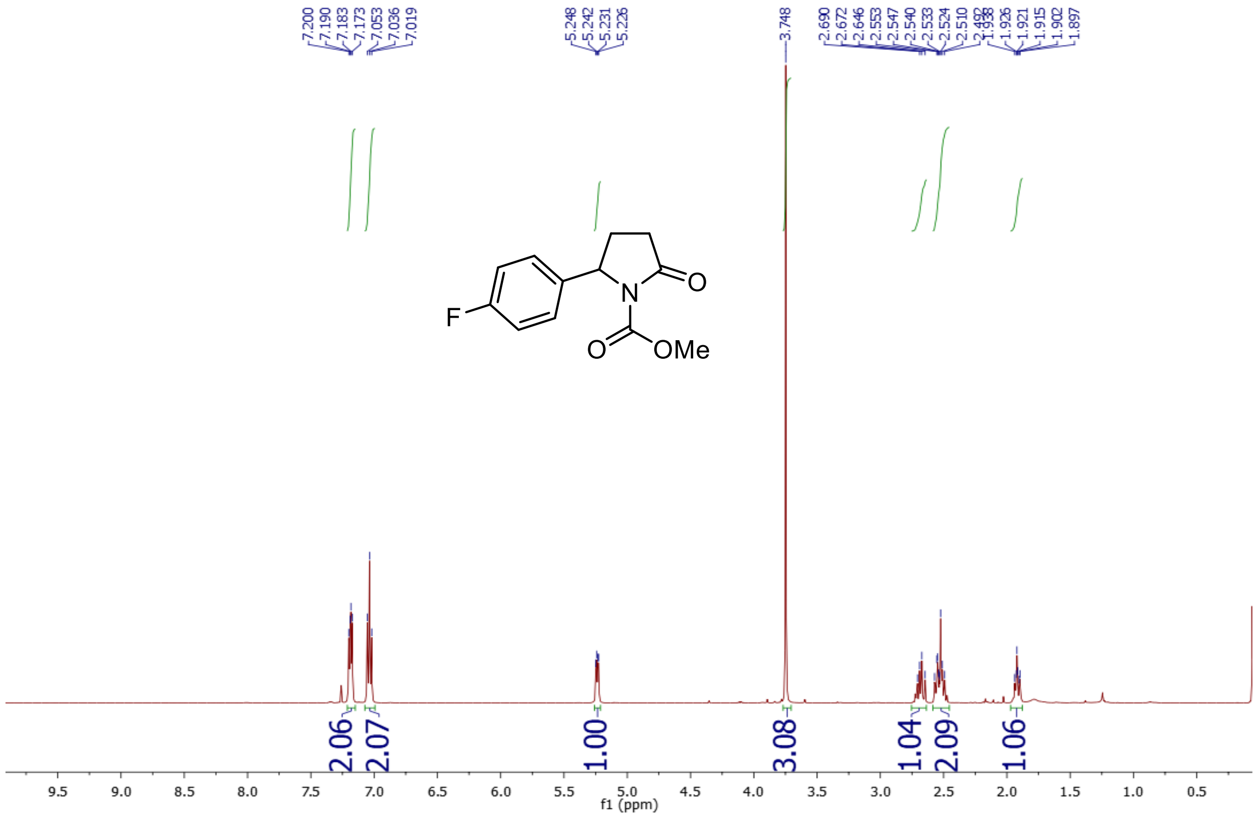

MeO
N
O
O
OMe
1.00
3.03
1.06
1.07
3.10
1.03
1.03
1.06
1.17
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

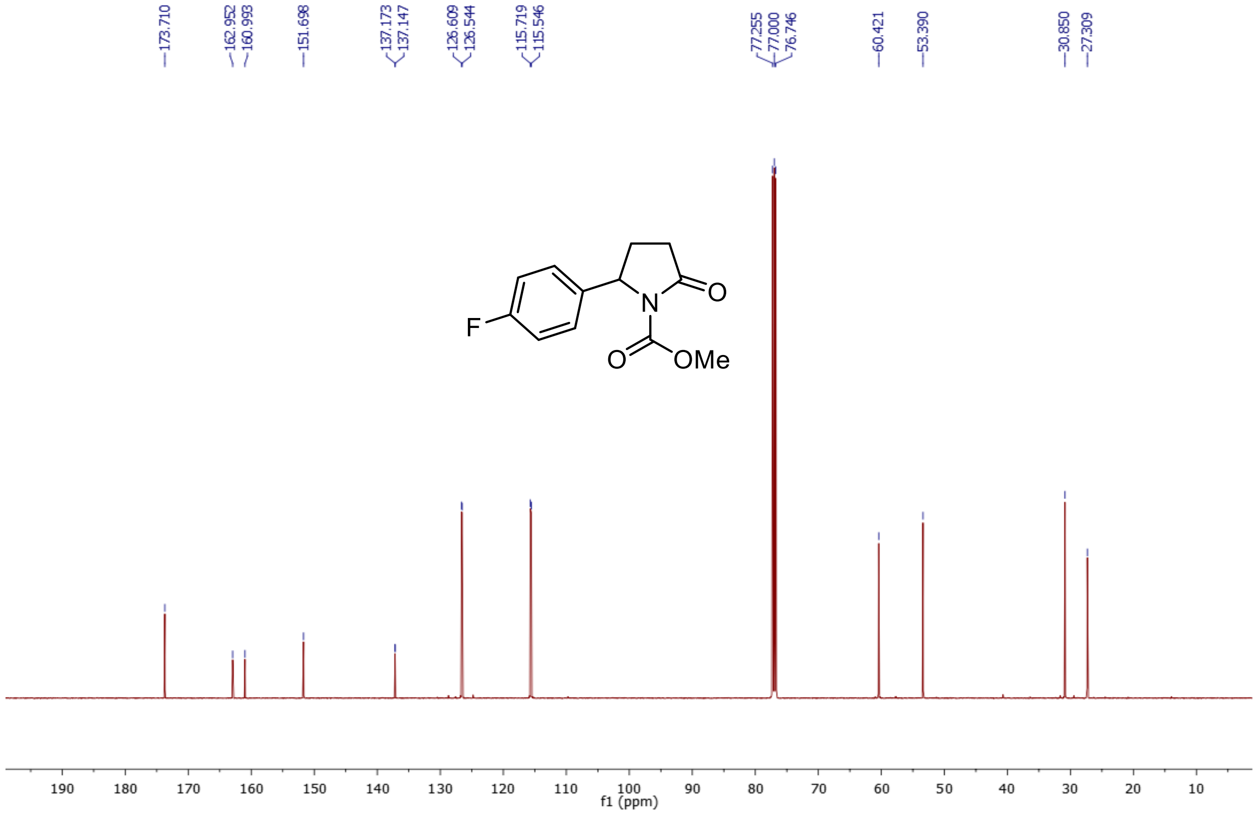
1

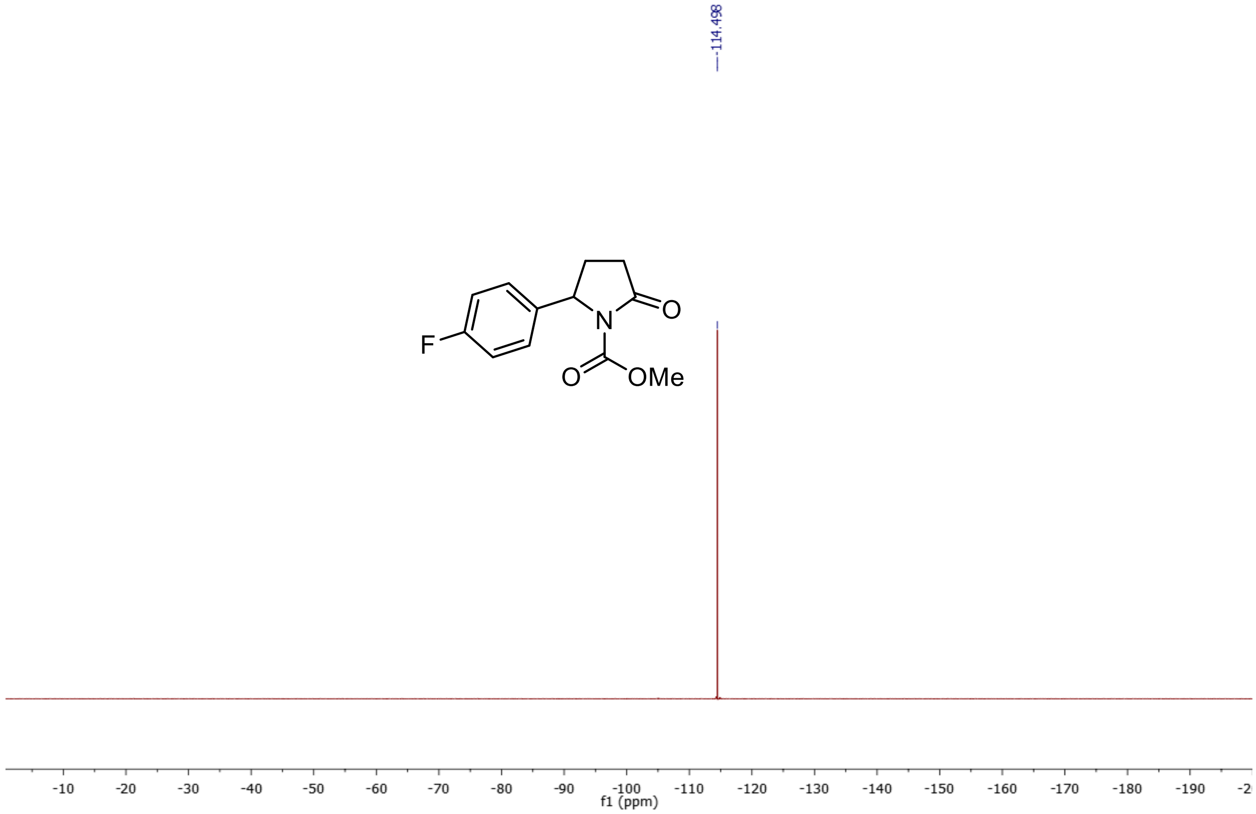

174.510
152.294
77.254
77.000
76.746
73.220
59.286
57.461
53.495
32.072
21.496
MeO
N
O
O
OMe
00
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

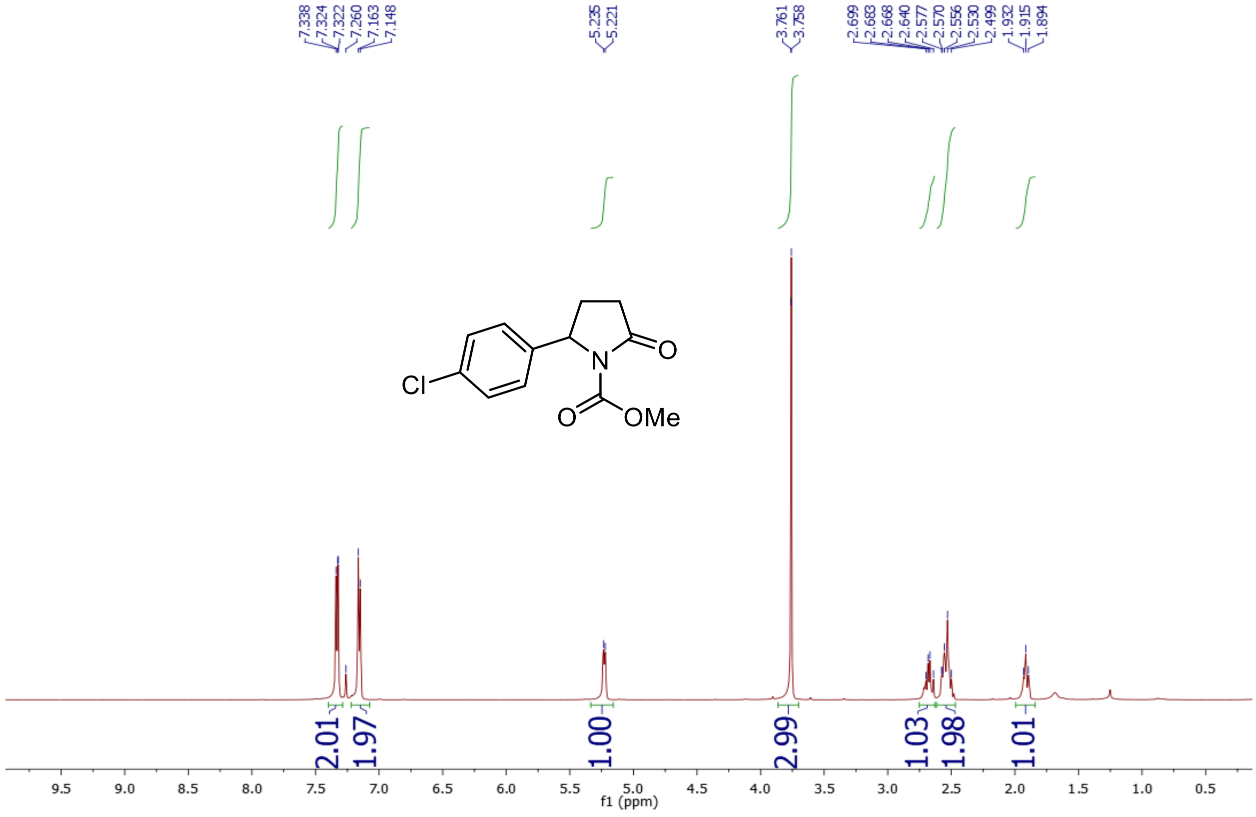

N
O
O
OMe
2.03
1.01
2.04
1.00
3.12
1.07
2.13
1.06
.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

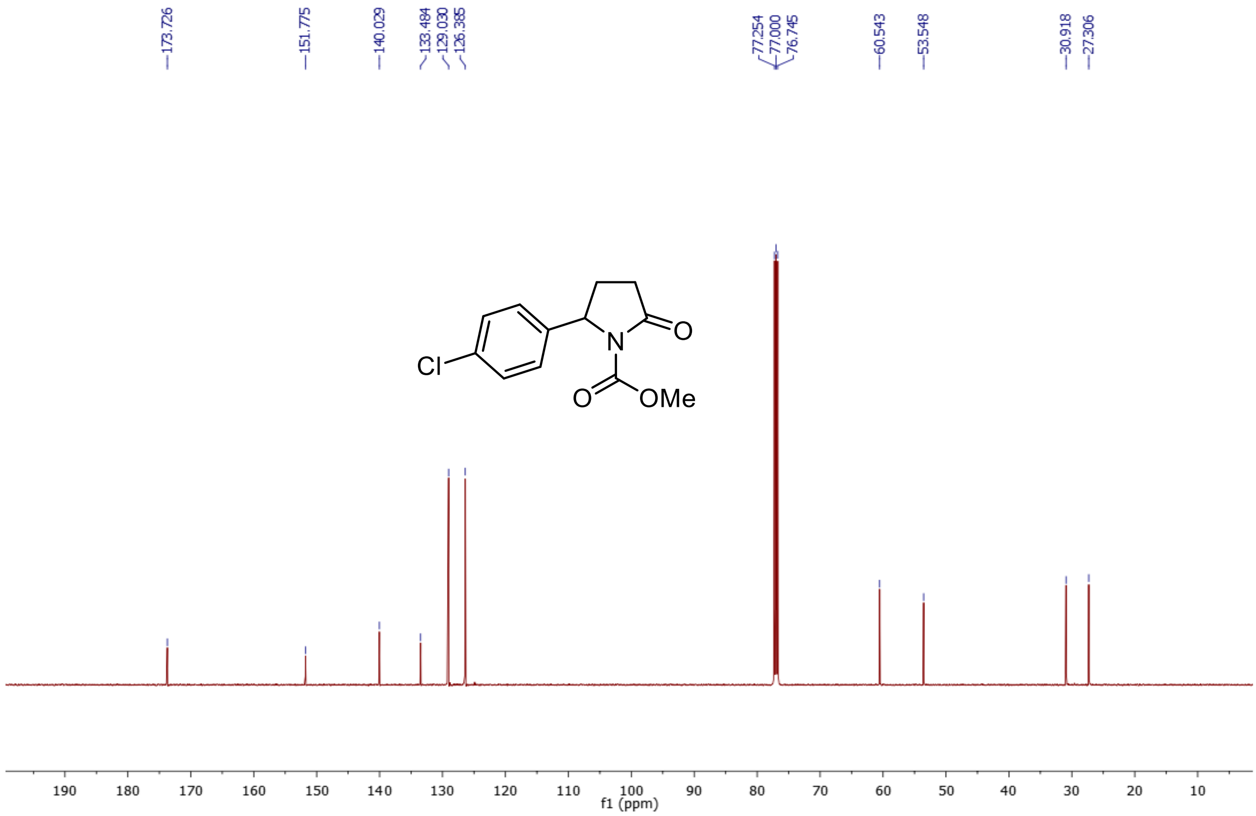

174.158
151.927
141.505
128.896
127.730
124.967
77.255
77.000
76.746
61.163
53.515
31.052
27.539
N
O
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


7.200
7.190
7.183
7.173
7.053
7.036
7.019
5.248
5.242
5.231
5.226
3.748
2.690
2.672
2.646
2.553
2.547
2.540
2.533
2.524
2.510
2.492
1.938
1.926
1.921
1.915
1.902
1.897
F
N
O
O
OMe
2.06
2.07
1.00
3.08
1.04
2.09
1.06
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

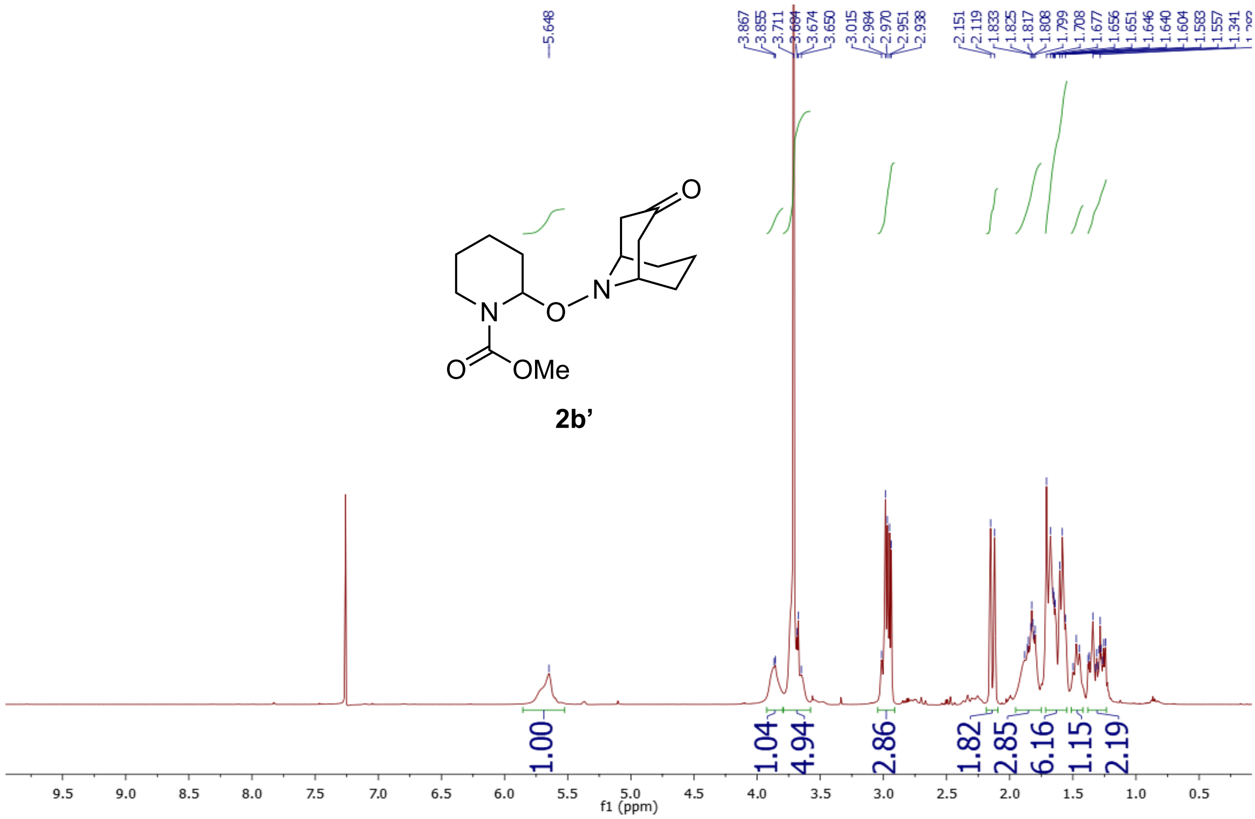

173.710
162.952
160.993
151.698
137.173
137.147
126.609
126.544
115.719
115.546
77.255
77.000
76.746
60.421
53.390
30.850
27.309
F
N
O
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)


-114.498
F
N
O
O
OMe
-10 -20 -30 -40 -50 -60 -70 -80 -90 -100 -110 -120 -130 -140 -150 -160 -170 -180 -190 -2
f1 (ppm)


7.338
7.324
7.322
7.260
7.163
7.148
5.235
5.221
3.761
3.758
2.699
2.683
2.668
2.640
2.577
2.570
2.556
2.530
2.499
1.932
1.915
1.894
Cl
N
O
O
OMe
2.01
1.97
1.00
2.99
1.03
1.98
1.01
9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)

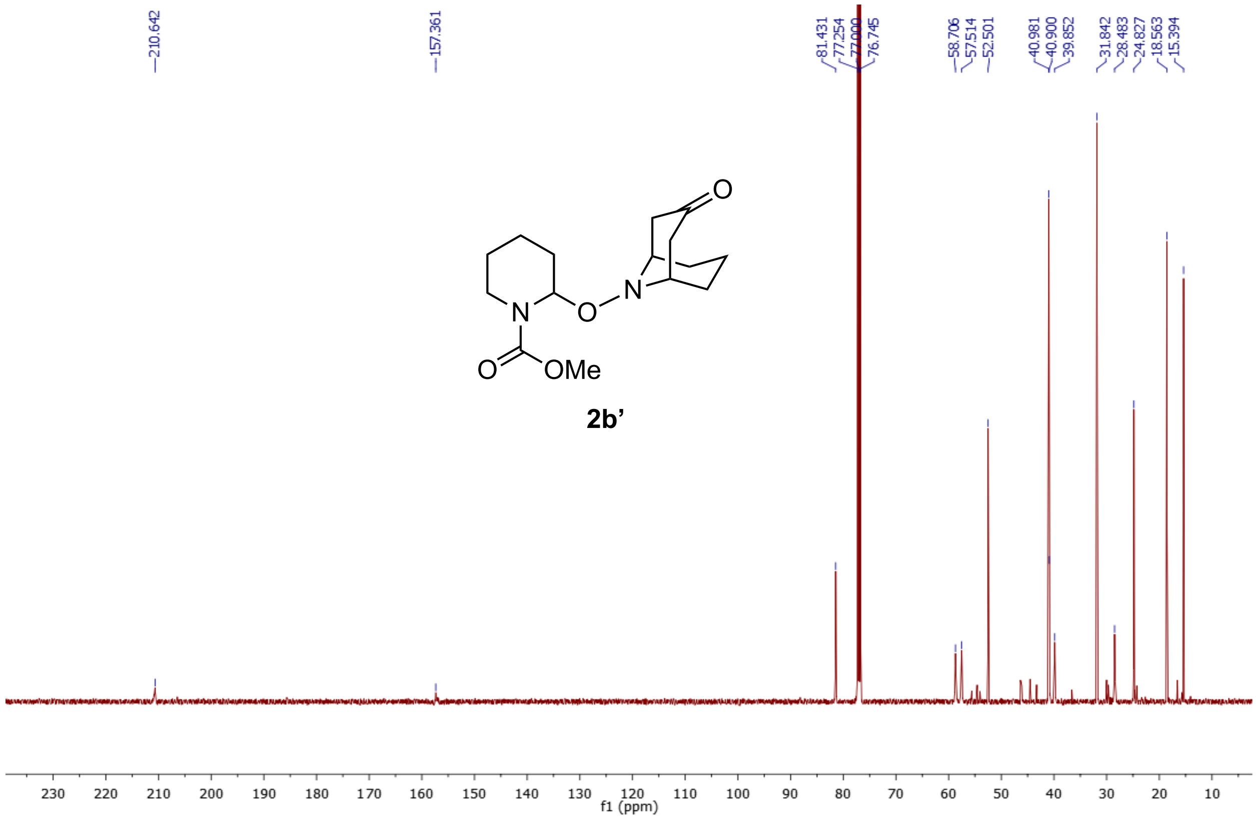


173.726
151.775
140.029
133.484
129.030
126.385
77.254
77.000
76.745
60.543
53.548
30.918
27.306
Cl
N
O
O
OMe
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)



5.648
3.867
3.855
3.711
3.684
3.674
3.650
3.015
2.984
2.970
2.951
2.938
2.151
2.119
1.833
1.825
1.817
1.808
1.799
1.708
1.677
1.656
1.651
1.646
1.640
1.604
1.583
1.557
1.341
O
N
O
N
O
OMe
1.00
1.04
4.94
2.86
1.82
2.85
6.16
1.15
2.19
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

2b’



2b’

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