Supporting information

Expedient Access to Substituted 3-Amino-cyclopentenones By Dirhodium-catalyzed [3+2]-Annulation of Silylated Ketene Imines and Enol Diazoacetates

Xichen Xu, John S. Leszczynski, Savannah M. Mason, Peter Y. Zavalij, and Michael P. Doyle*

Department of Chemistry and Biochemistry, University of Maryland, College Park, 20742, United States

mdoyle3@umd.edu

Table of Contents

General Information: Experiments involving moisture and/or air sensitive components were performed in flame-dried glassware under a nitrogen atmosphere using freshly distilled solvents. Dichloromethane and 1,2-dichloroethane were dried over activated molecular sieves 4Å under argon and distilled prior to use. Commercial reagents and chromatography solvents (hexanes and ethyl acetate) were used without further purification. Thin layer chromatography (TLC) was carried out using EM Science silica gel 60 F254 plates. Chromatograms were analyzed by UV lamp (254 nm) or by development using cerium ammonium molybdate (CAM). Liquid chromatography was performed using a forced flow (flash chromatography) of the indicated system on silica gel (230-400 mesh). Proton nuclear magnetic resonance spectra (^{1}H NMR) were recorded on a Bruker AMX 400 spectrophotometer (in $CDCl_3$ or DMSO-d^6 as solvent). Chemical shifts for ^{1}H NMR spectra are reported as δ in units of parts per million (ppm) downfield from $SiMe_4$ (δ = 0.00) and relative to the signal of chloroform-*d* (δ = 7.26, singlet) or DMSO-d^6 (δ = 2.50, pentet). Multiplicities were given as: s (singlet); d (doublet); t (triplet); q (quartet); p (pentet); dd (doublet of doublets); ddd (doublet of doublet of doublets); dddd (doublet of doublet of doublet of doublets); dt (doublet of triplets); m (multiplet); comp (composite). The number of protons (n) for a given resonance is indicated by *n*H. Coupling constants are reported as a *J* value in Hz. Carbon nuclear magnetic resonance spectra (^{13}C NMR) are reported in δ units of parts per million (ppm) downfield from $SiMe_4$ (δ = 0.00) and relative to the central singlet for the signal of chloroform-*d* (δ = 77.00, triplet) or DMSO-d^6 (δ = 39.50, septet). High-resolution mass spectra (HRMS) were obtained on a JEOL AccuTOF-ESI mass spectrometer using CsI as the standard.

Molecular sieves 4Å (powder, ~325 mesh), $Sc(OTf)_3$, $AgSbF_6$, $Cu(OTf)_2$ were purchased from Sigma-Aldrich. $Rh_2(OAc)_4$ and $Rh_2(Oct)_4$ were obtained from Pressure Chemical and Johnson Matthey, respectively. $Rh_2(Cap)_4$ was prepared according to established protocol.[1] Silylated ketene imines **1a-l** were synthesized according to literature procedures.[2] Enol diazoacetate **2**[3] was prepared by the known method.

Sample procedure for the [3+2]-annulation of silylated ketene imine 1a and enol diazoacetate 2a: A 10-mL Schlenk tube charged with 4Å molecular sieves (200 mg) and a magnetic stirring bar was heated by an oil bath at 200 °C under high vacuum (0.05 Torr) for 30 min. Then the Schlenk tube was cooled to room temperature with high vacuum (0.05 Torr) persisting. $Rh_2(Oct)_4$ (6.3 mg, 0.0080 mmol) was added to the Schlenk tube under a positive

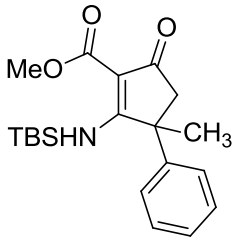
nitrogen atmosphere and the Schlenk tube was then sealed by a rubber septum. Dichloromethane (2.0 mL) and silylated ketene imine **1a** (102 mg, 0.40 mmol) were added sequentially by syringe at room temperature. The resulting green solution was stirred at room temperature while enol diazoacetate **2a** (113 mg, 0.44 mmol) dissolved in 2.0 ml dichloromethane was added to the Schlenk tube via syringe pump over 30 min. The reaction was continued for 6h with stirring. Then the reaction mixture was filtrated through a short pad of celite. The celite pad was washed with ~1 ml EtOAc three times, and the combined filtrate was concentrated under reduced pressure. The residue was purified by column chromatography to afford the TBS-protected product **3a** together with a small amount of **4a**. The two fractions were combined and dissolved in 1.0 ml THF. Two droplets (~ 0.05 ml) of 1.0 M aqueous HCl were added to the resulting THF solution, which was further stirred for 5 min at room temperature. The THF solution was concentrated under reduced pressure and the solid residue was washed with ~3 ml of hexanes to afford the 3-aminocyclopentenone **4a** (89 mg, 91% yield).

Reference:

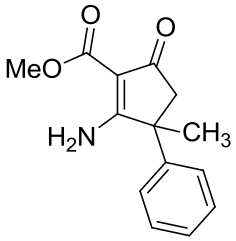
(1) Ratnikov, M. O.; Goldmann, P. L.; McLaughlin, E. C.; Doyle, M. P. *Org. Synth.* **2012**, *89*, 19.

(2) Guin, J.; Varseev, G.; List, B. *J. Am. Chem. Soc.* **2013**, *135*, 2100.

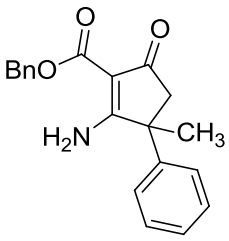
(3) Doyle, M. P.; Kundu, K.; Russell, A. E. *Org. Lett.* **2005**, 7, 5171.



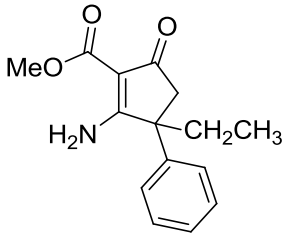
Methyl 2-(*tert*-Butyldimethylsilyl)amino-3-methyl-5-oxo-3-phenylcyclopent-1-enecarboxyl--ate (3a). ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.64 (s, 1H), 7.38 – 7.30 (comp, 2H), 7.30 – 7.19 (comp, 3H), 3.90 (s, 3H), 2.57 (s, 2H), 1.77 (s, 3H), 0.93 (s, 9H), 0.09 (s, 3H), -0.55 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.8, 193.4, 167.7, 144.1, 128.9, 127.2, 126.0, 105.5, 55.8, 51.3, 47.1, 25.6, 24.6, 17.5, -2.6, -4.8. HRMS (ESI^+): calcd for $C_{20}H_{30}NO_3Si$ $[M+H]^+$ 360.1989, found 360.1970.



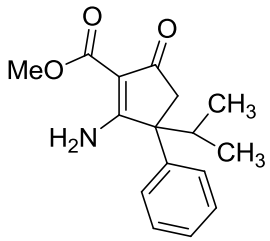
Methyl 2-Amino-3-methyl-5-oxo-3-phenylcyclopent-1-enecarboxylate (4a). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.44 (br s, 1H), 7.40 – 7.33 (comp, 2H), 7.33 – 7.25 (comp, 3H), 5.59 (br s, 1H), 3.87 (s, 3H), 2.71 (d, *J* = 18.0 Hz, 1H), 2.58 (d, *J* = 18.0 Hz, 1H), 1.75 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.7, 187.9, 166.5, 142.7, 129.1, 127.6, 126.0, 102.1, 53.2, 51.4, 45.6, 25.0. HRMS (ESI^+): calcd for $C_{14}H_{16}NO_3$ $[M+H]^+$ 246.1125, found 246.1133.



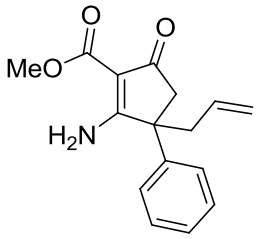
Benzyl 2-Amino-3-methyl-5-oxo-3-phenylcyclopent-1-enecarboxylate (4b). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.35 (br s, 1H), 7.53 (dd, *J* = 7.9, 0.9 Hz, 2H), 7.42 – 7.27 (comp, 8H), 5.59 (br s, 1H), 5.38 (br s, 2H), 2.72 (d, *J* = 18.0 Hz, 1H), 2.59 (d, *J* = 18.0 Hz, 1H), 1.75 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$ δ 196.5, 187.7, 165.6, 142.8, 136.4, 129.0, 128.5, 127.8, 127.7, 127.6, 126.1, 102.1, 65.5, 53.3, 45.6, 25.0. HRMS (ESI^+): calcd for $C_{20}H_{20}NO_3$ $[M+H]^+$ 322.1438, found 322.1450.



Methyl 2-Amino-3-ethyl-5-oxo-3-phenylcyclopent-1-enecarboxylate (4c). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.49 (br s, 1H), 7.38 – 7.31 (comp, 2H), 7.31 – 7.22 (comp, 3H), 5.92 (br s, 1H), 3.85 (s, 3H), 2.60 (d, *J* = 18.2 Hz, 1H), 2.53 (d, *J* = 18.2 Hz, 1H), 2.24 (dq, *J* = 14.6, 7.3 Hz, 1H), 2.08 (dq, *J* = 14.6, 7.3 Hz, 1H), 0.94 (t, *J* = 7.3 Hz, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 197.6, 186.5, 166.7, 143.6, 129.5, 127.9, 126.6, 104.1, 51.7, 50.1, 49.9, 29.1, 8.8. HRMS (ESI^+): calcd for $C_{15}H_{18}NO_3$ $[M+H]^+$ 260.1281, found 260.1288.

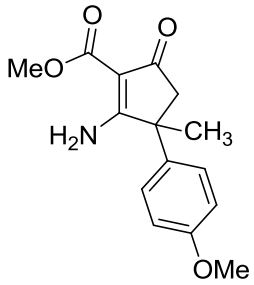


Methyl 2-Amino-3-isopropyl-5-oxo-3-phenylcyclopent-1-enecarboxylate (4d). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.48 (br s, 1H), 7.44 – 7.35 (comp, 4H), 7.34 – 7.29 (m, 1H), 5.61 (br s, 1H), 3.87 (s, 3H), 2.79 (dq, *J* = 13.3, 6.6 Hz, 1H), 2.74 (d, *J* = 18.5 Hz, 1H), 2.68 (d, *J* = 18.5 Hz, 1H), 1.06 (d, *J* = 6.6 Hz, 3H), 1.00 (d, *J* = 6.6 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 198.0, 186.8, 166.9, 142.2, 129.7, 127.9, 126.9, 103.0, 53.5, 51.8, 45.3, 30.8, 18.7, 17.8. HRMS (ESI^+): calcd for $C_{16}H_{20}NO_3$ $[M+H]^+$ 274.1438, found 274.1450.

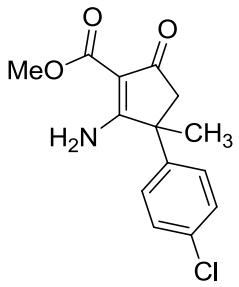


Methyl 3-Allyl-2-amino-5-oxo-3-phenylcyclopent-1-enecarboxylate (4e). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.54 (br s, 1H), 7.45 – 7.36 (comp, 2H), 7.36 – 7.29 (comp, 3H), 5.79 – 5.56 (comp, 2H), 5.27 (dd, *J* = 16.9, 1.4 Hz, 1H), 5.21 (dd, *J* = 10.1, 1.4 Hz, 1H), 3.89 (s, 3H), 2.99 – 2.81 (m, 2H), 2.75 (d, *J* = 18.1 Hz, 1H), 2.61 (d, *J* = 18.1 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ

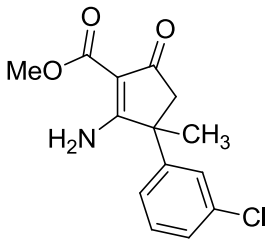
197.0, 186.0, 166.8, 142.8, 132.0, 129.6, 128.1, 126.6, 121.2, 104.1, 51.8, 50.4, 49.3, 41.2. HRMS (ESI^+): calcd for $C_{16}H_{18}NO_3$ $[M+H]^+$ 272.1281, found 272.1293.



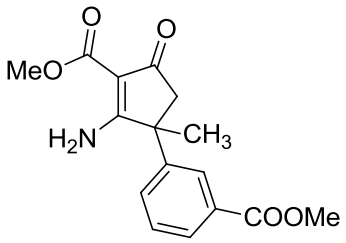
Methyl 2-Amino-3-(4-methoxyphenyl)-3-methyl-5-oxocyclopent-1-enecarboxylate (4f). ^1H NMR (400 MHz, $CDCl_3$) δ 8.41 (br s, 1H), 7.20 (d, *J* = 8.0 Hz, 2H), 6.88 (d, *J* = 8.0 Hz, 2H), 5.53 (br s, 1H), 3.88 (s, 3H), 3.80 (s, 3H), 2.70 (d, *J* = 18.0 Hz, 1H), 2.57 (d, *J* = 18.0 Hz, 1H), 1.72 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 197.3, 188.6, 166.9, 159.4, 135.0, 127.7, 114.8, 102.4, 55.8, 53.7, 51.8, 45.5, 25.8. HRMS (ESI^+): calcd for $C_{15}H_{18}NO_4$ $[M+H]^+$ 276.1230, found 276.1243.



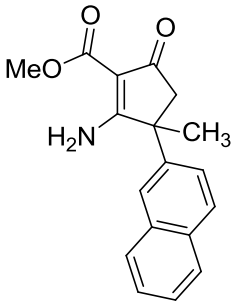
Methyl 2-Amino-3-(4-chlorophenyl)-3-methyl-5-oxocyclopent-1-enecarboxylate (4g). ^1H NMR (400 MHz, $CDCl_3$) δ 8.46 (br s, 1H), 7.34 (dt, *J* = 8.8, 2.7 Hz, 2H), 7.22 (dt, *J* = 8.8, 2.7 Hz, 2H), 5.64 (br s, 1H), 3.88 (s, 3H), 2.65 (d, *J* = 18.0 Hz, 1H), 2.57 (d, *J* = 18.0 Hz, 1H), 1.74 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 196.7, 187.7, 166.8, 141.8, 134.1, 129.7, 127.9, 102.6, 53.5, 51.9, 45.7, 25.3. HRMS (ESI^+): calcd for $C_{14}H_{15}ClNO_3$ $[M+H]^+$ 280.0735, found 280.0737.



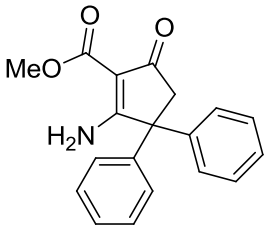
Methyl 2-Amino-3-(3-chlorophenyl)-3-methyl-5-oxocyclopent-1-enecarboxylate (4h). ^{1}H NMR (400 MHz, DMSO-d^6) δ 8.51 (br s, 1H), 8.47 (br s, 1H), 7.40 (dd, *J* = 14.7, 7.9 Hz, 1H), 7.37 – 7.33 (m, 1H), 7.31 (t, *J* = 1.8 Hz, 1H), 7.20 (dt, *J* = 7.9, 1.8 Hz, 1H), 3.68 (s, 3H), 2.46 (d, *J* = 17.7 Hz, 1H), 2.33 (d, *J* = 17.7 Hz, 1H), 1.70 (s, 3H).^{13}C NMR (100 MHz, DMSO-d^6) δ 194.4, 185.9, 165.1, 147.3, 133.1, 130.5, 126.8, 125.8, 124.7, 99.8, 52.9, 50.2, 45.1, 23.6. HRMS (ESI$^+$): calcd for $C_{14}H_{15}ClNO_3$ $[M+H]^+$ 280.0735, found 280.0739.



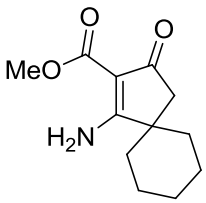
Methyl 3-(2-Amino-3-(methoxycarbonyl)-1-methyl-4-oxocyclopent-2-en-1-yl)benzoate (4i). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.47 (br s, 1H), 8.03 – 7.92 (comp, 2H), 7.51 – 7.44 (comp, 2H), 5.50 (br s, 1H), 3.93 (s, 3H), 3.89 (s, 3H), 2.71 (d, *J* = 18.1 Hz, 1H), 2.62 (d, *J* = 18.1 Hz, 1H), 1.80 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 196.7, 187.6, 167.0, 166.9, 143.7, 131.4, 131.1, 129.8, 129.4, 127.4, 102.8, 53.5, 52.8, 51.9, 46.0, 25.4. HRMS (ESI$^+$): calcd for $C_{16}H_{18}NO_5$ $[M+H]^+$ 304.1179, found 304.1190.



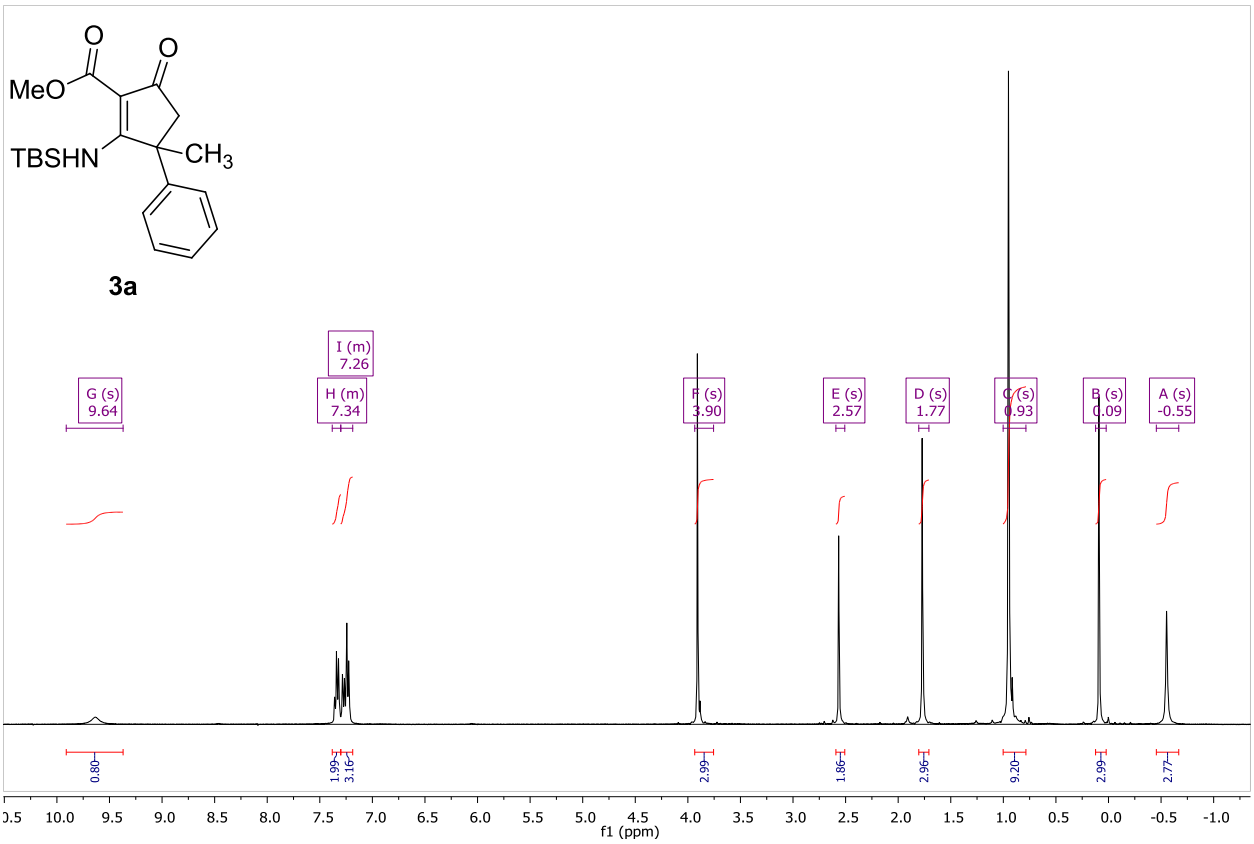
Methyl 2-Amino-3-methyl-3-(naphthalen-2-yl)-5-oxocyclopent-1-enecarboxylate (4j). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.40 (br d, *J* = 2.9 Hz, 1H), 7.82 – 7.68 (comp, 4H), 7.50 – 7.39 (comp, 2H), 7.16 (dd, *J* = 8.7, 2.0 Hz, 1H), 6.34 (br d, *J* = 2.9 Hz, 1H), 3.81 (s, 3H), 2.57 (d, *J* = 18.1 Hz, 1H), 2.37 (d, *J* = 18.1 Hz, 1H), 1.74 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$) δ 197.4, 188.4, 166.7, 140.5, 133.4, 132.7, 129.5, 128.3, 127.9, 127.1, 126.9, 125.1, 124.4, 102.2, 53.2, 51.7, 46.1, 25.1. HRMS (ESI$^+$): calcd for $C_{18}H_{18}NO_3$ $[M+H]^+$ 296.1281, found 296.1266.



Methyl 2-Amino-5-oxo-3,3-diphenylcyclopent-1-enecarboxylate (4k). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.71 (br d, *J* = 2.5 Hz, 1H), 7.39 – 7.26 (comp, 6H), 7.26 – 7.21 (comp, 4H), 5.99 (br d, *J* = 2.5 Hz, 1H), 3.83 (s, 3H), 3.12 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 195.8, 184.4, 166.3, 142.8, 128.8, 127.7, 127.5, 102.6, 55.8, 54.0, 51.3. HRMS (ESI^+): calcd for $C_{19}H_{18}NO_3$ $[M+H]^+$ 308.1281, found 308.1273.



Methyl 1-Amino-3-oxospiro[4.5]dec-1-ene-2-carboxylate (4l). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.63 (br s, 1H), 6.28 (br s, 1H), 3.83 (s, 3H), 2.36 (s, 2H), 1.83 – 1.71 (comp, 3H), 1.66 – 1.51 (comp, 4H), 1.49 – 1.32 (comp, 2H), 1.30 – 1.14 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 197.3, 189.5, 167.2, 101.1, 51.6, 46.5, 43.5, 35.6, 25.5, 23.1. HRMS (ESI^+): calcd for $C_{12}H_{18}NO_3$ $[M+H]^+$ 224.1281, found 224.1288.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O
TBSHN
CH3
3a
G (s) 9.64
I (m) 7.26
H (m) 7.34
F (s) 3.90
E (s) 2.57
D (s) 1.77
C (s) 0.93
B (s) 0.09
A (s) -0.55
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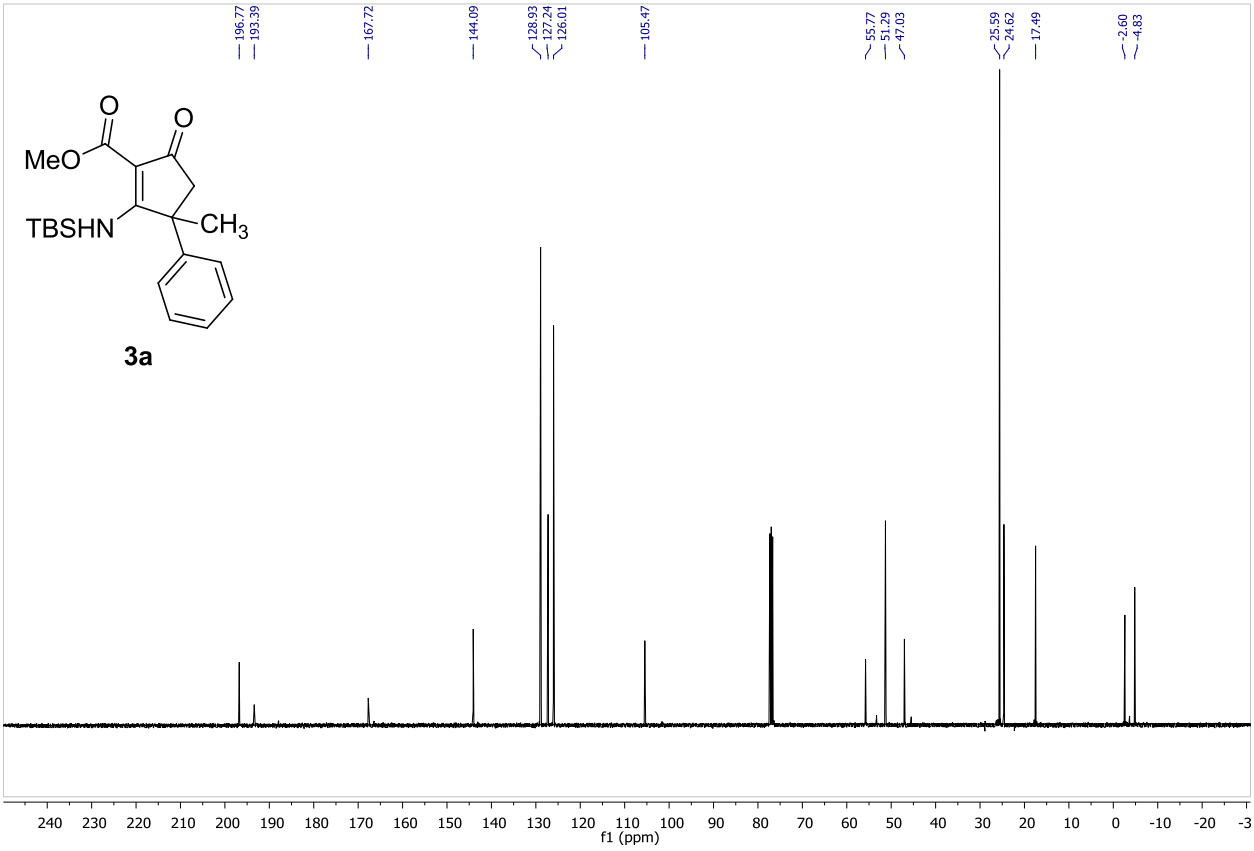
3.16
2.99
1.86
2.96
9.20
2.99
2.77
f1 (ppm)


196.77
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128.93
127.24
126.01
105.47
55.77
51.29
47.03
25.59
24.62
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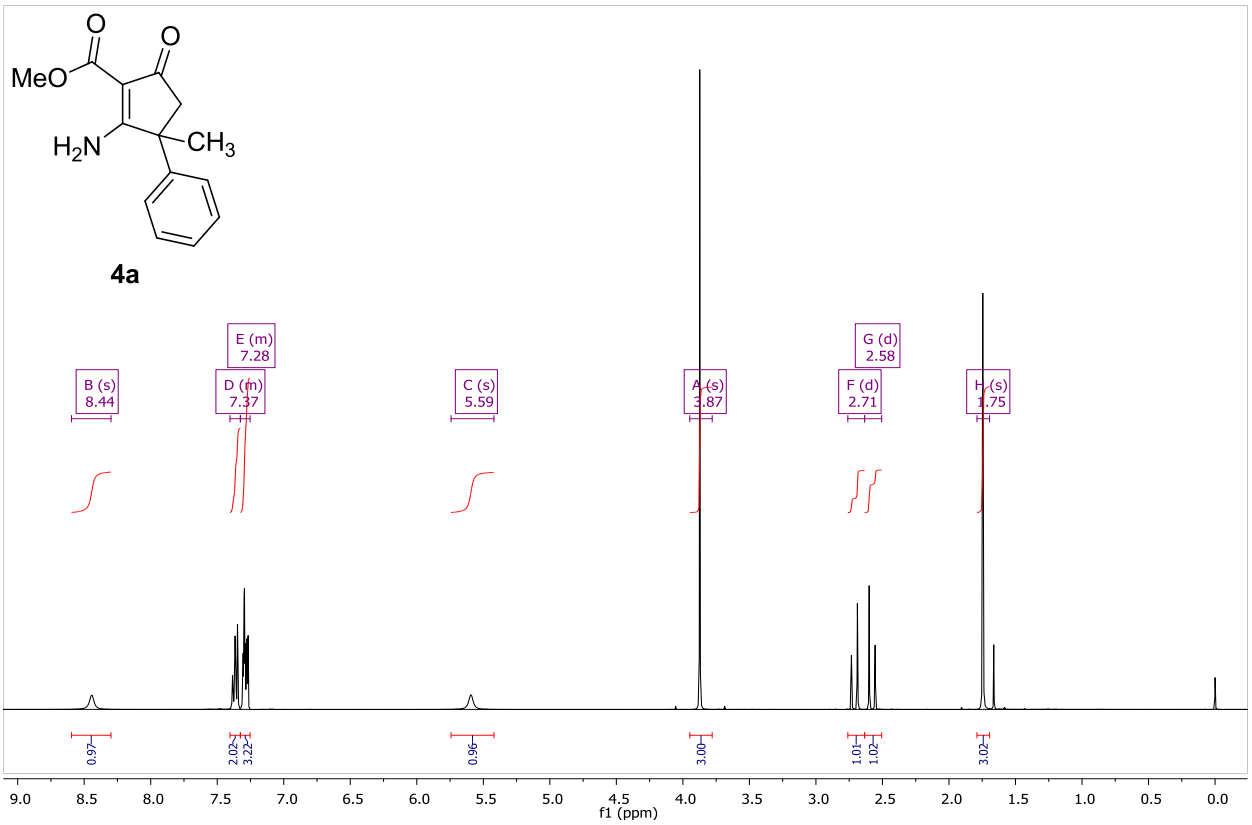
MeO
O
O
TBSHN
CH3
3a
f1 (ppm)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CH3
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F (d) 2.71
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1.01
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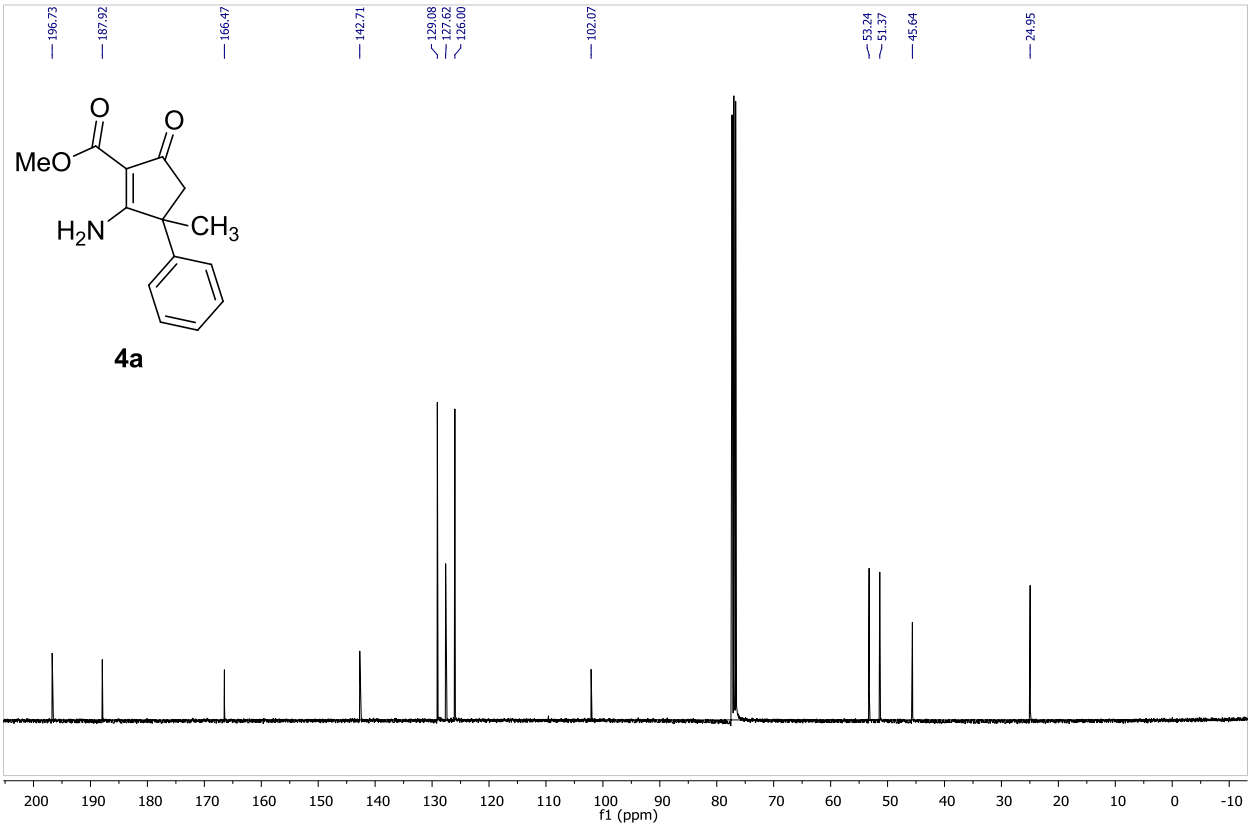
3.02
f1 (ppm)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129.08
127.62
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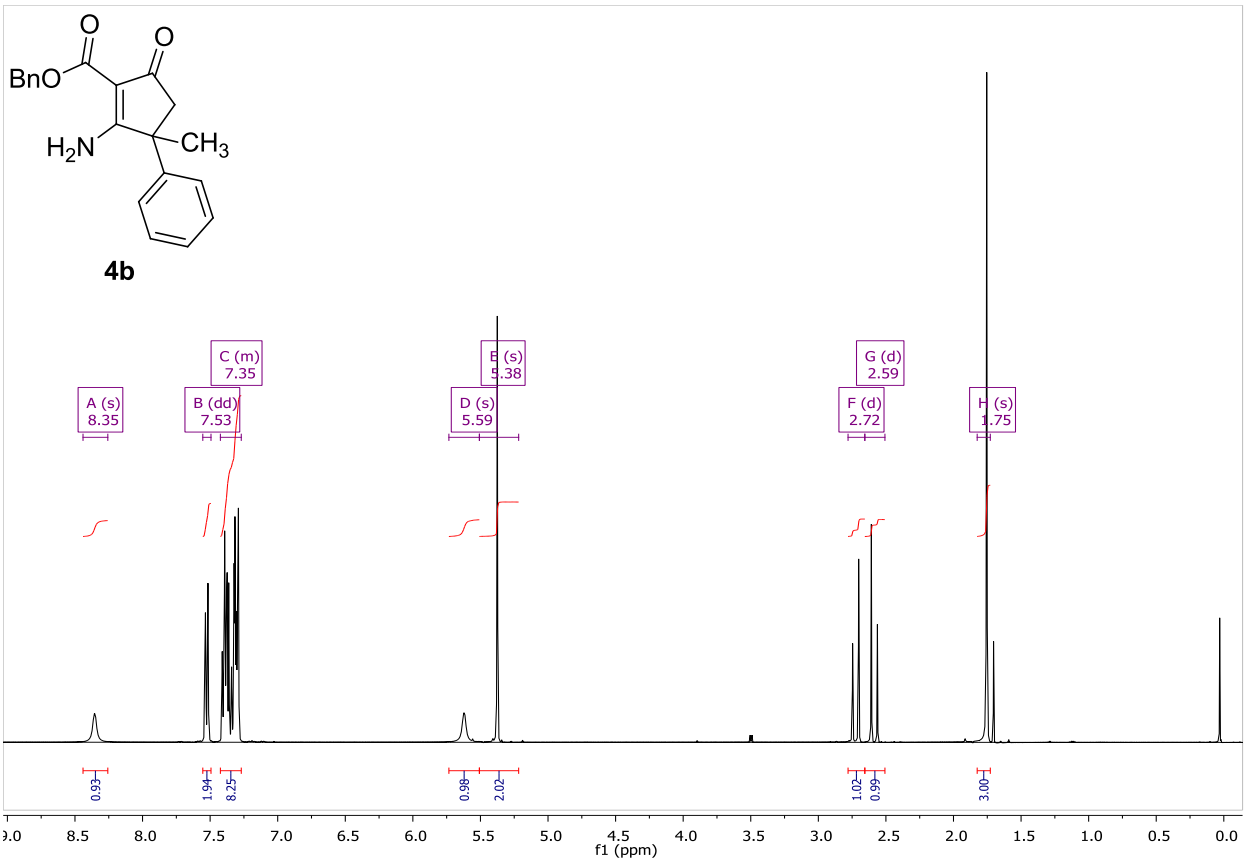
O
H2N
CH3
4a
f1 (ppm)


BnO
O
O
H2N
CH3
4b
A (s) 8.35
B (dd) 7.53
C (m) 7.35
D (s) 5.59
E (s) 5.38
F (d) 2.72
G (d) 2.59
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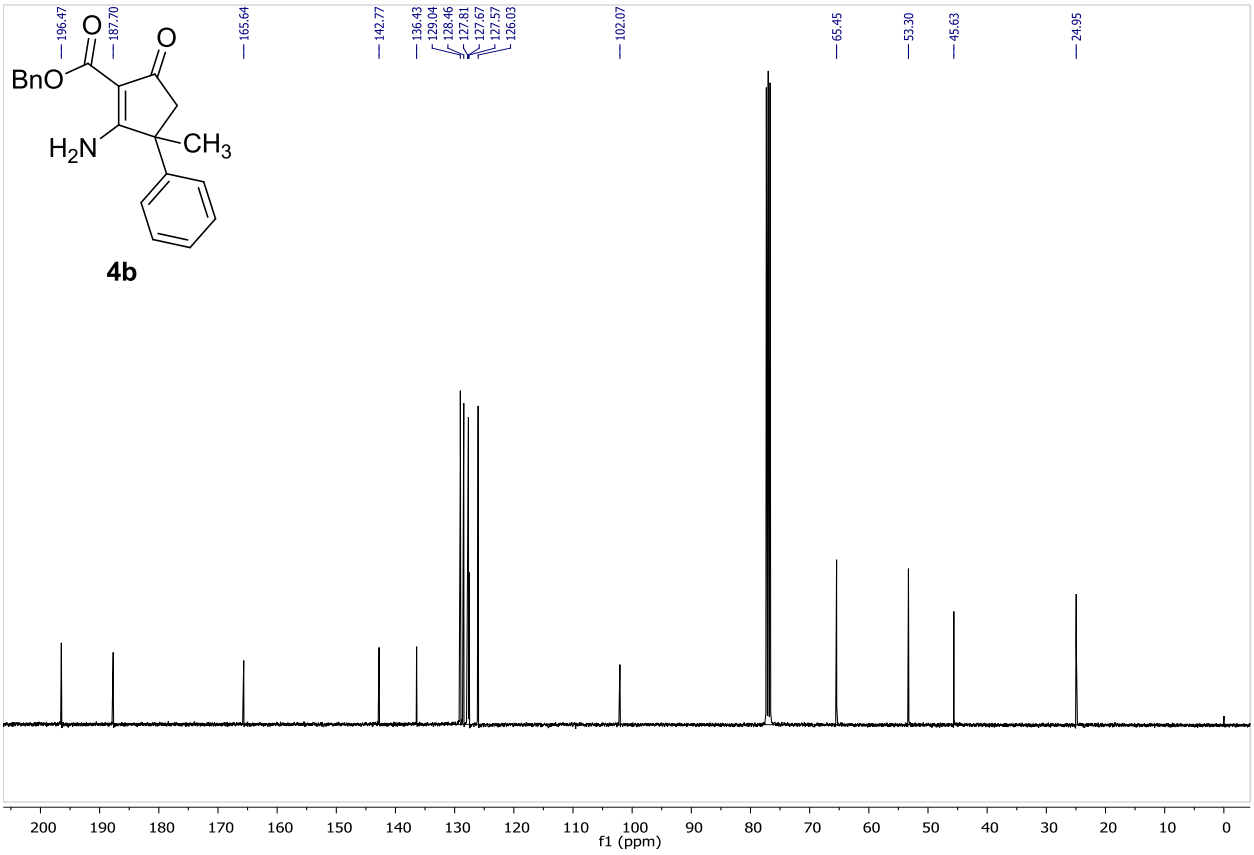
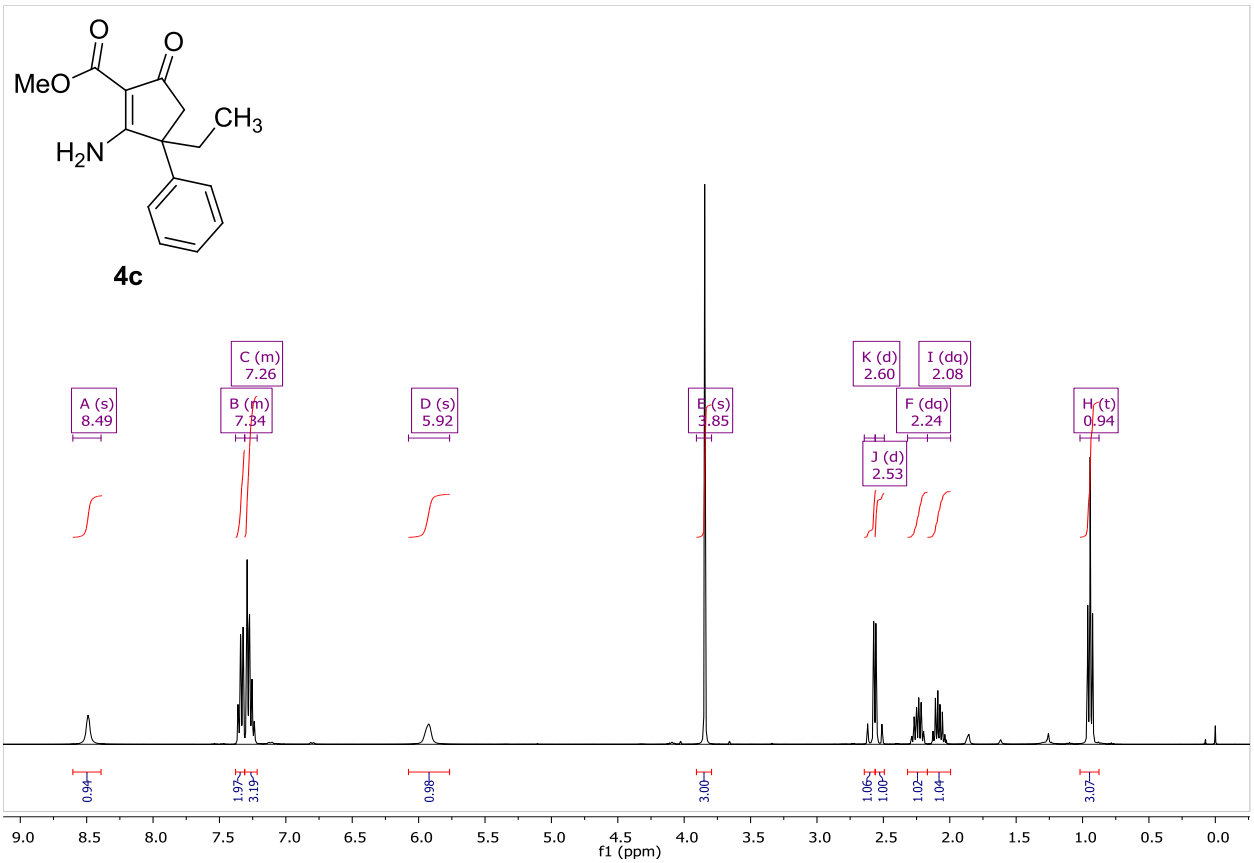
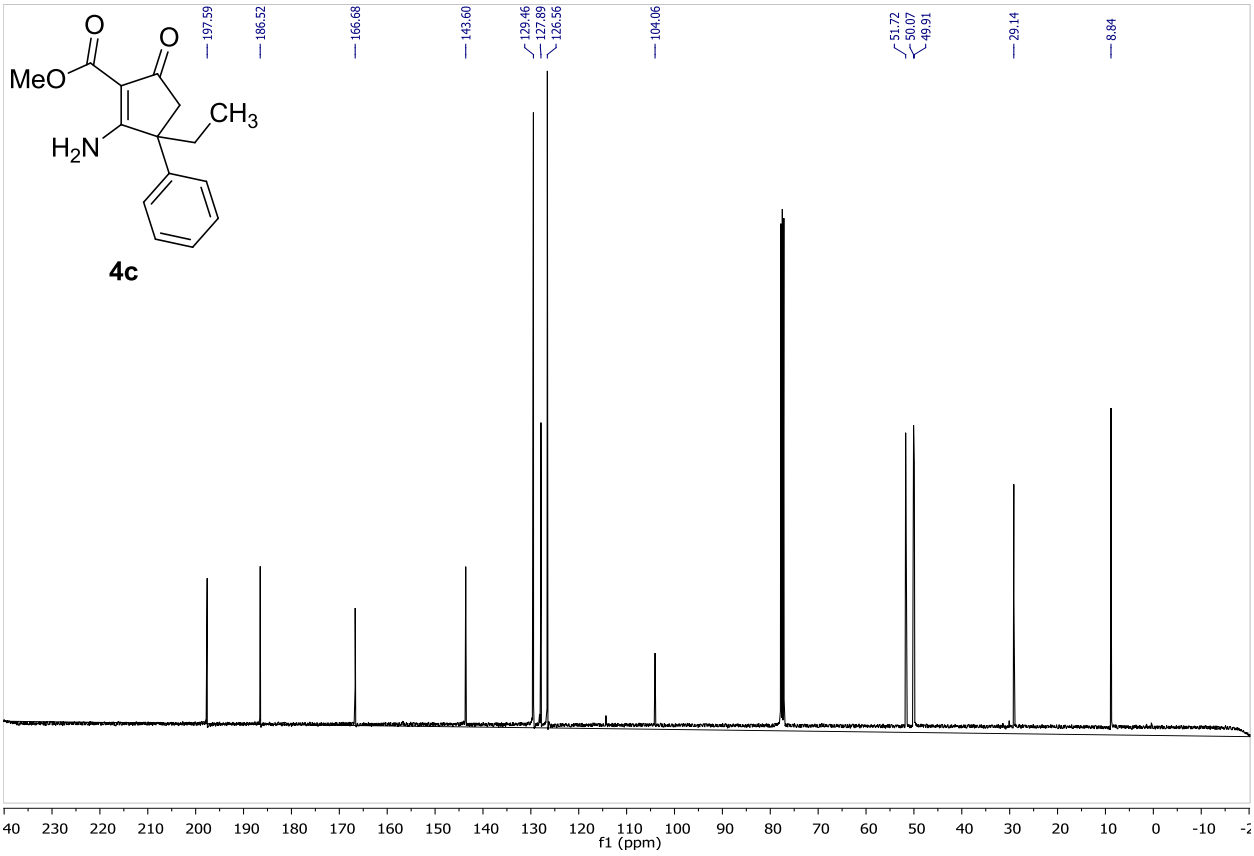
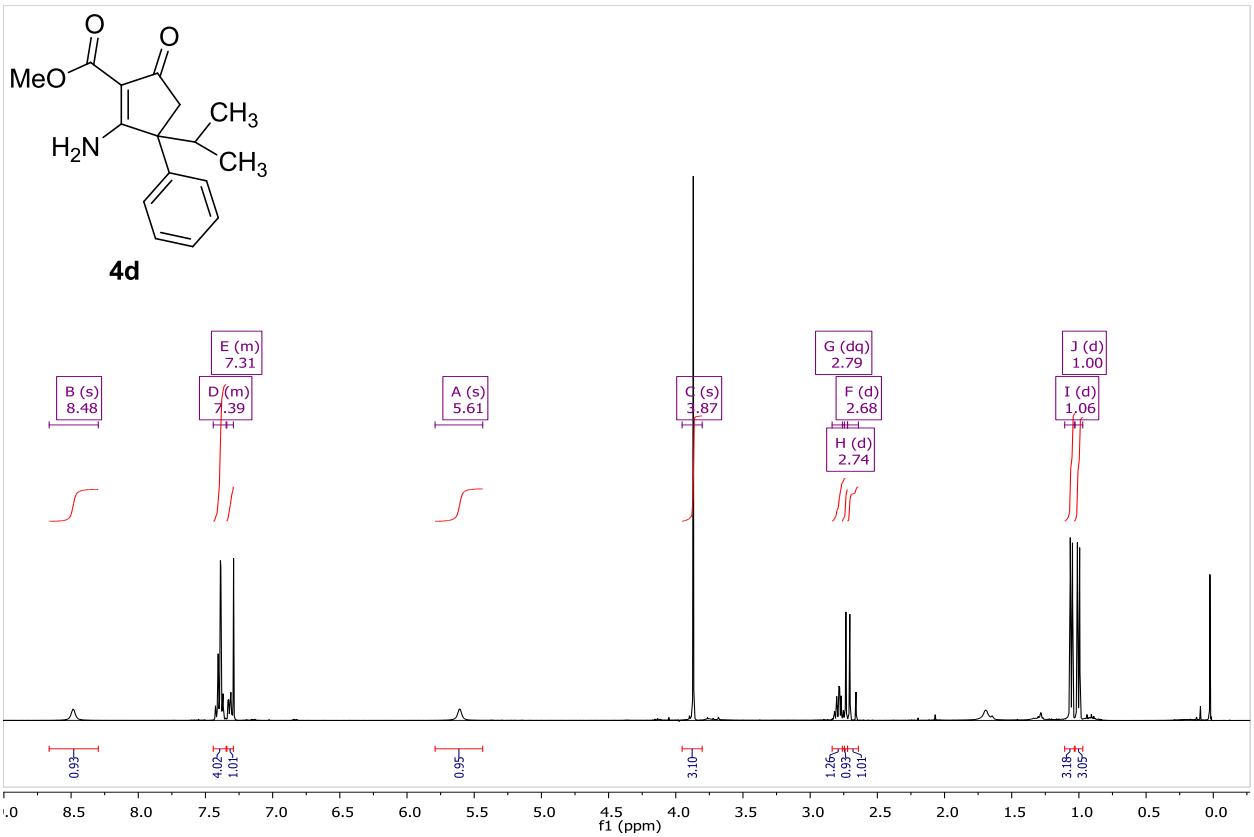
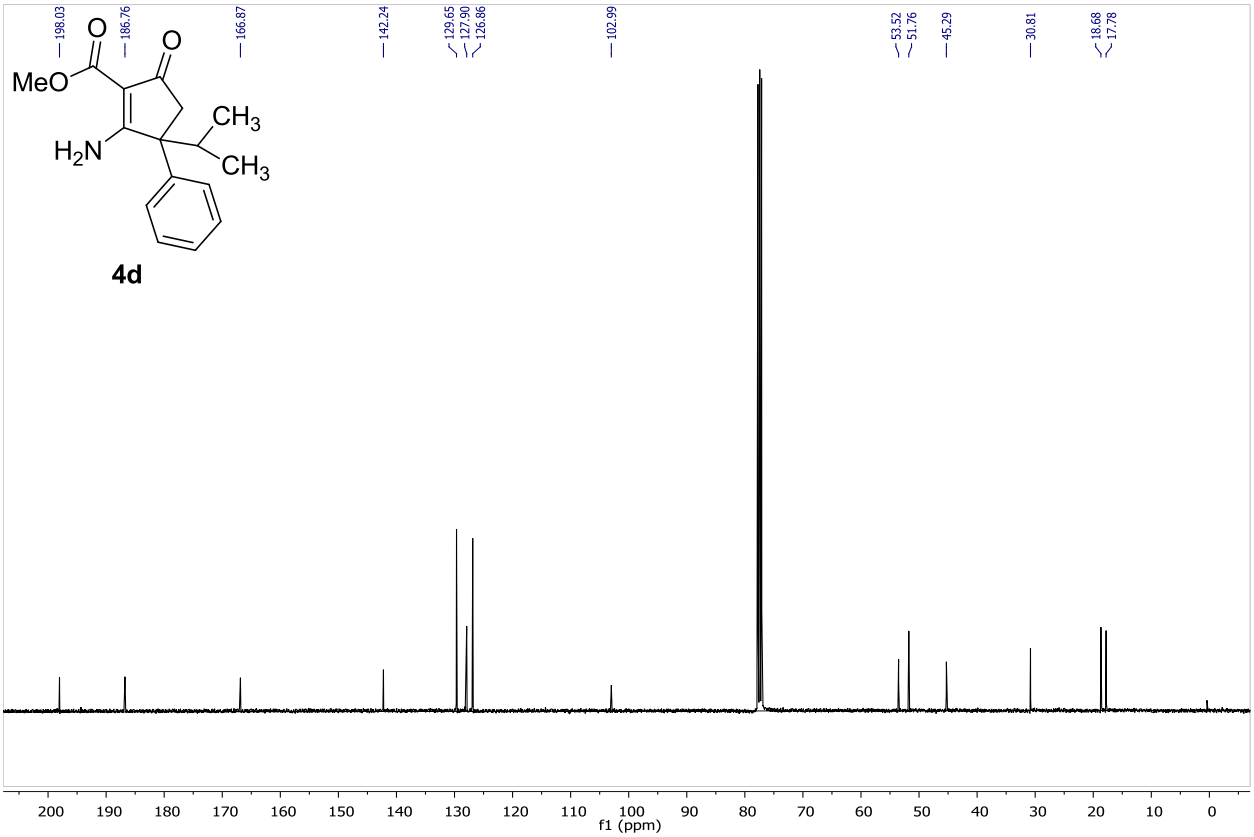
f1 (ppm)

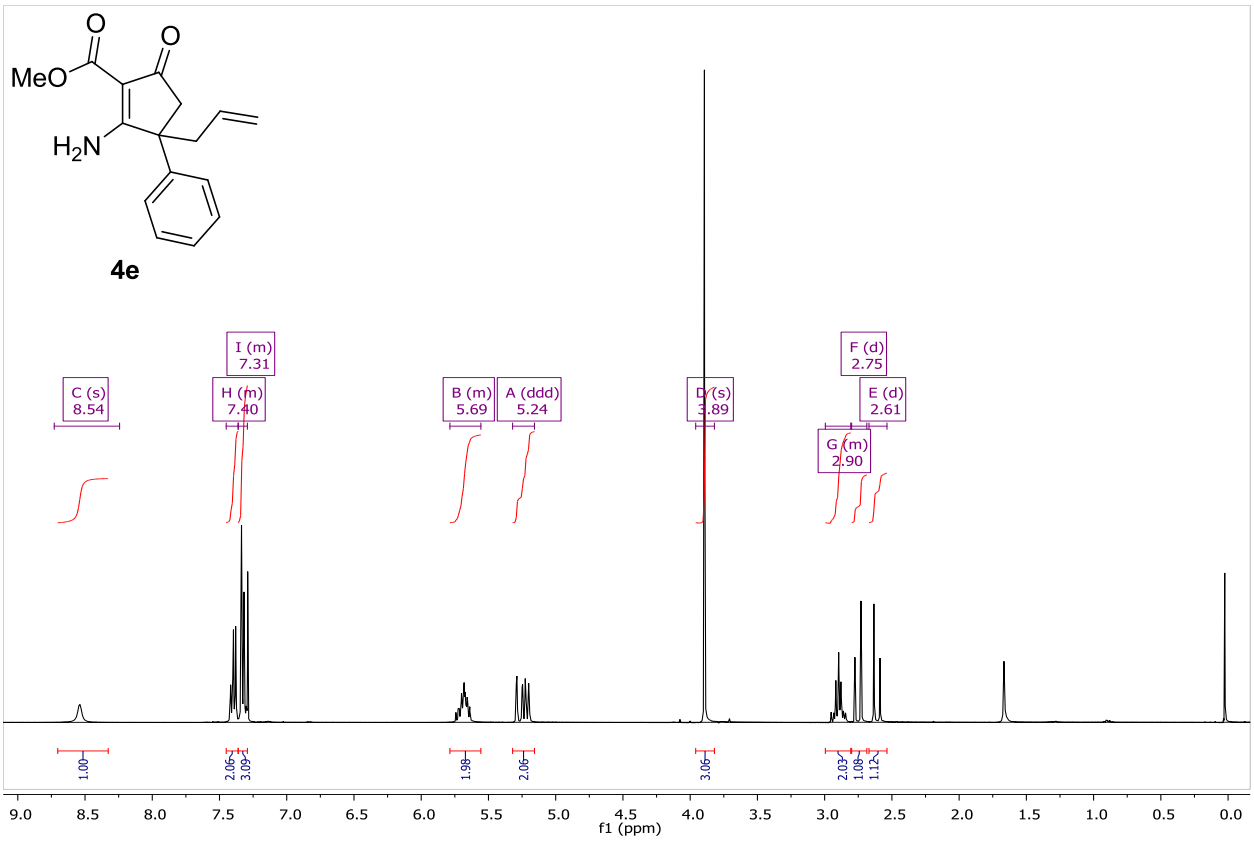

196.47
187.70
165.64
142.77
136.43
129.04
128.46
127.81
127.67
127.57
126.03
102.07
65.45
53.30
45.63
24.95
BnO
O
O
H2N
CH3
4b
f1 (ppm)

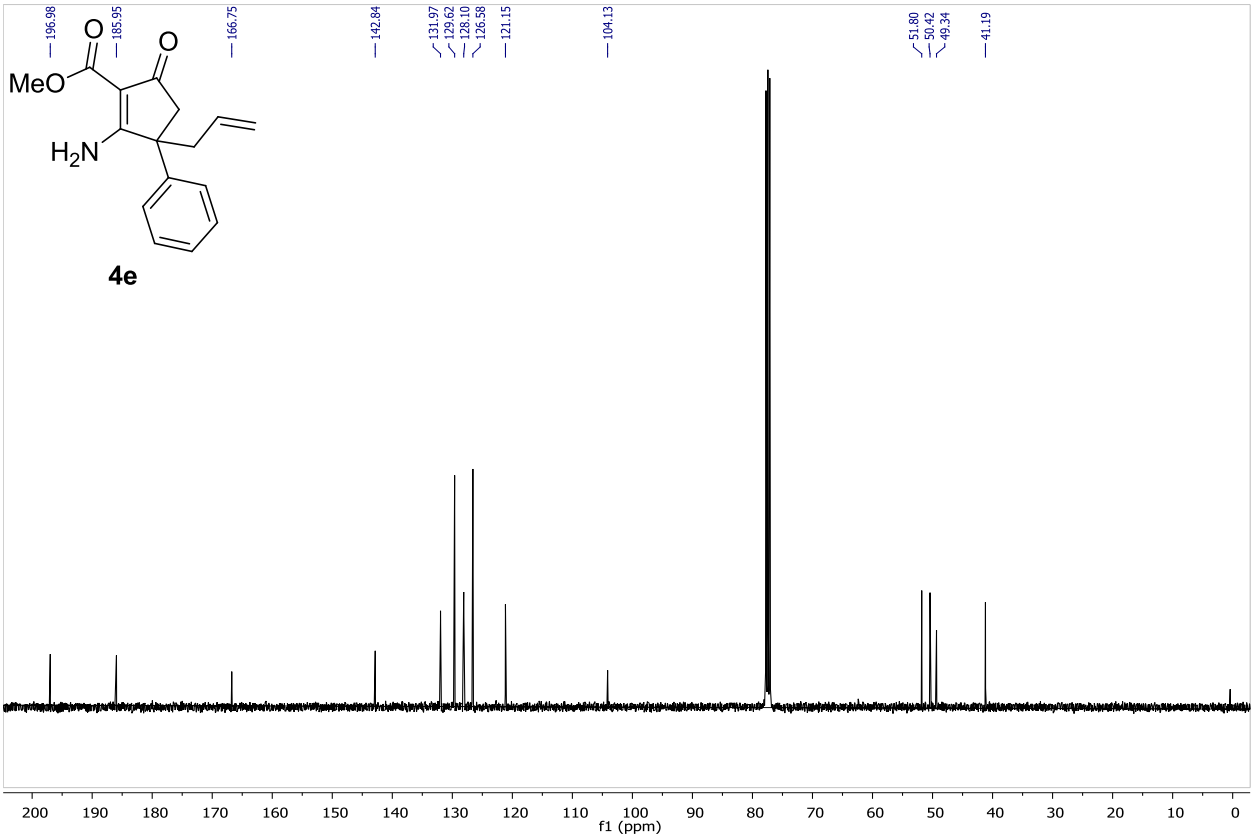

MeO
O
O
CH3
H2N
4c
A (s) 8.49
C (m) 7.26
B (m) 7.34
D (s) 5.92
E (s) 3.85
K (d) 2.60
I (dq) 2.08
F (dq) 2.24
J (d) 2.53
H (t) 0.94
0.94
1.97
3.19
0.98
3.00
1.06
1.00
1.02
1.04
3.07
f1 (ppm)

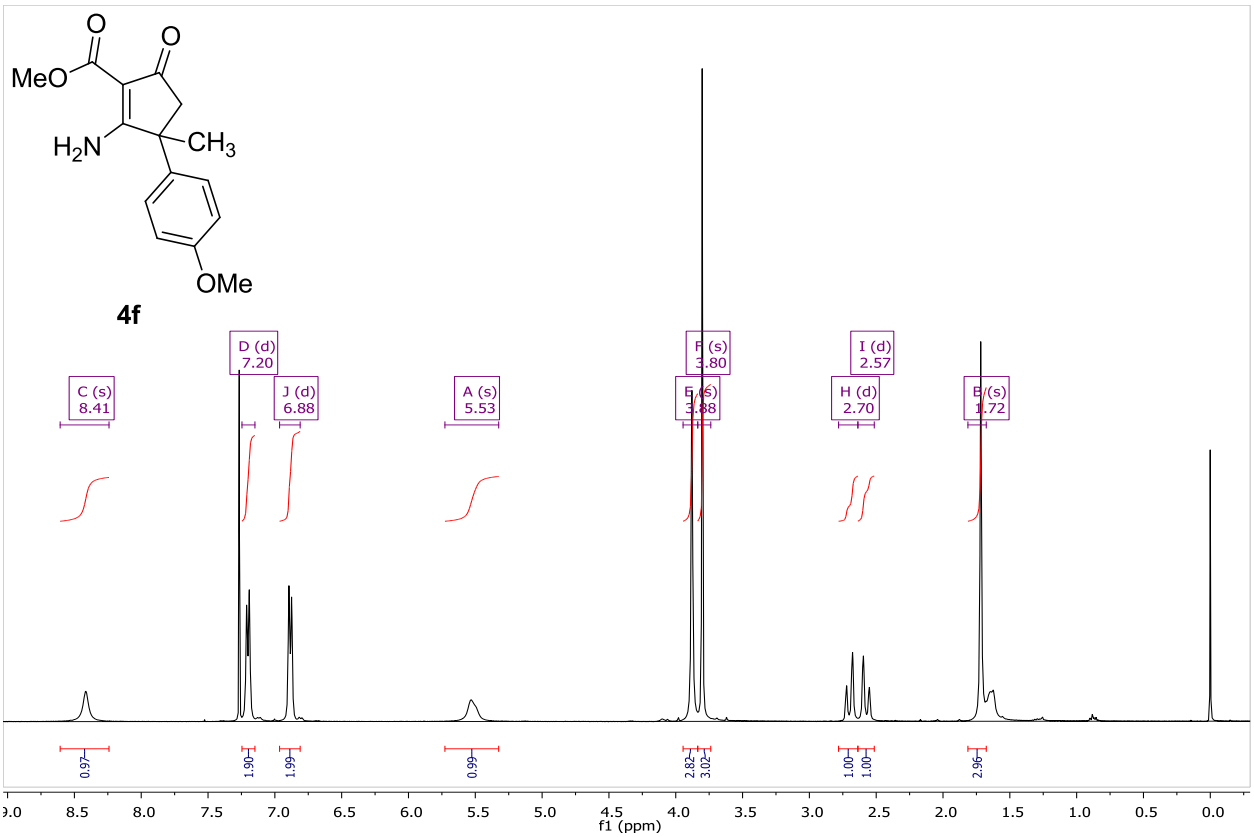

MeO
O
O
CH3
H2N
4c
197.59
186.52
166.68
143.60
129.46
127.89
126.56
104.06
51.72
50.07
49.91
29.14
8.84
f1 (ppm)

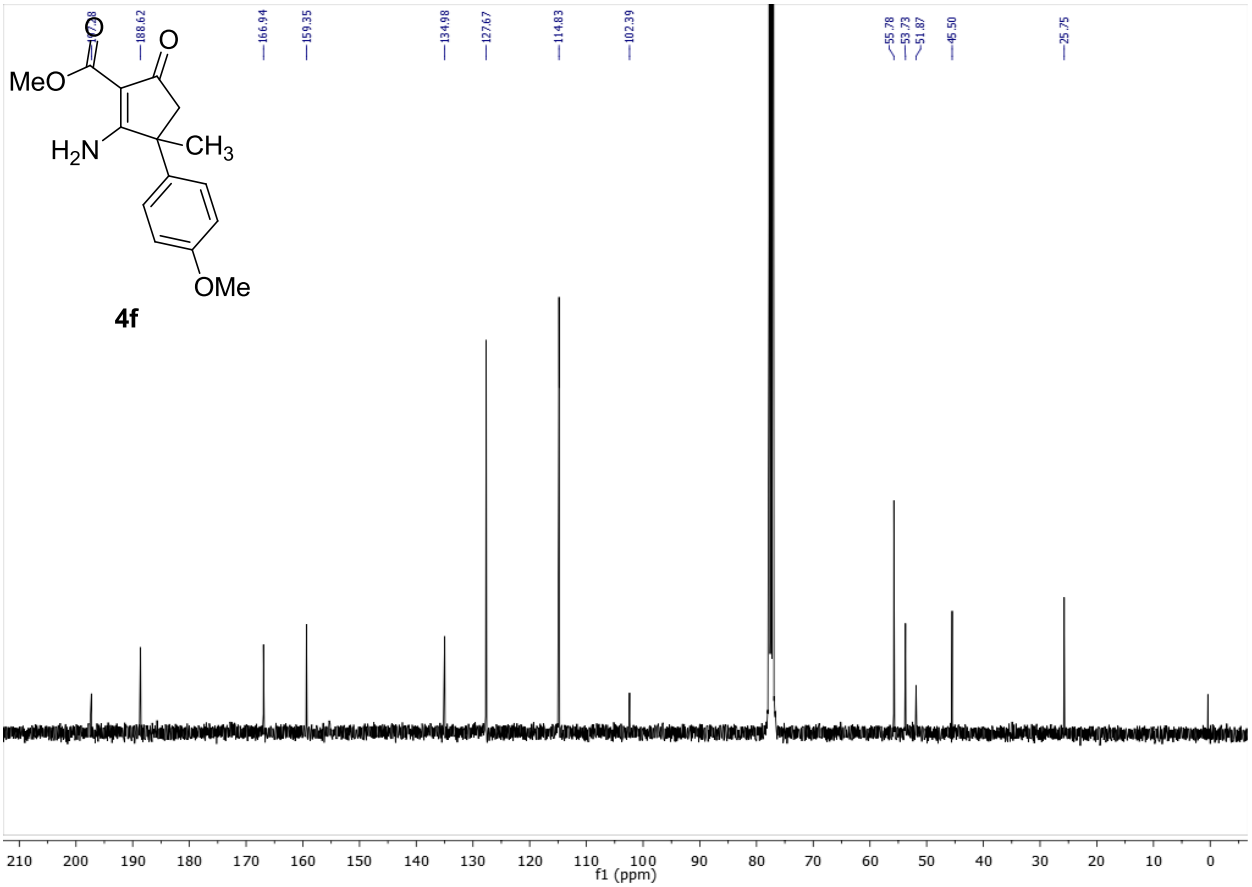

MeO
O
O
CH3
H2N
CH3
4d
B (s) 8.48
E (m) 7.31
D (m) 7.39
A (s) 5.61
C (s) 3.87
G (dq) 2.79
F (d) 2.68
H (d) 2.74
J (d) 1.00
I (d) 1.06
0.93
4.02
1.01
0.95
3.10
1.26
0.93
1.01
3.18
3.05
f1 (ppm)

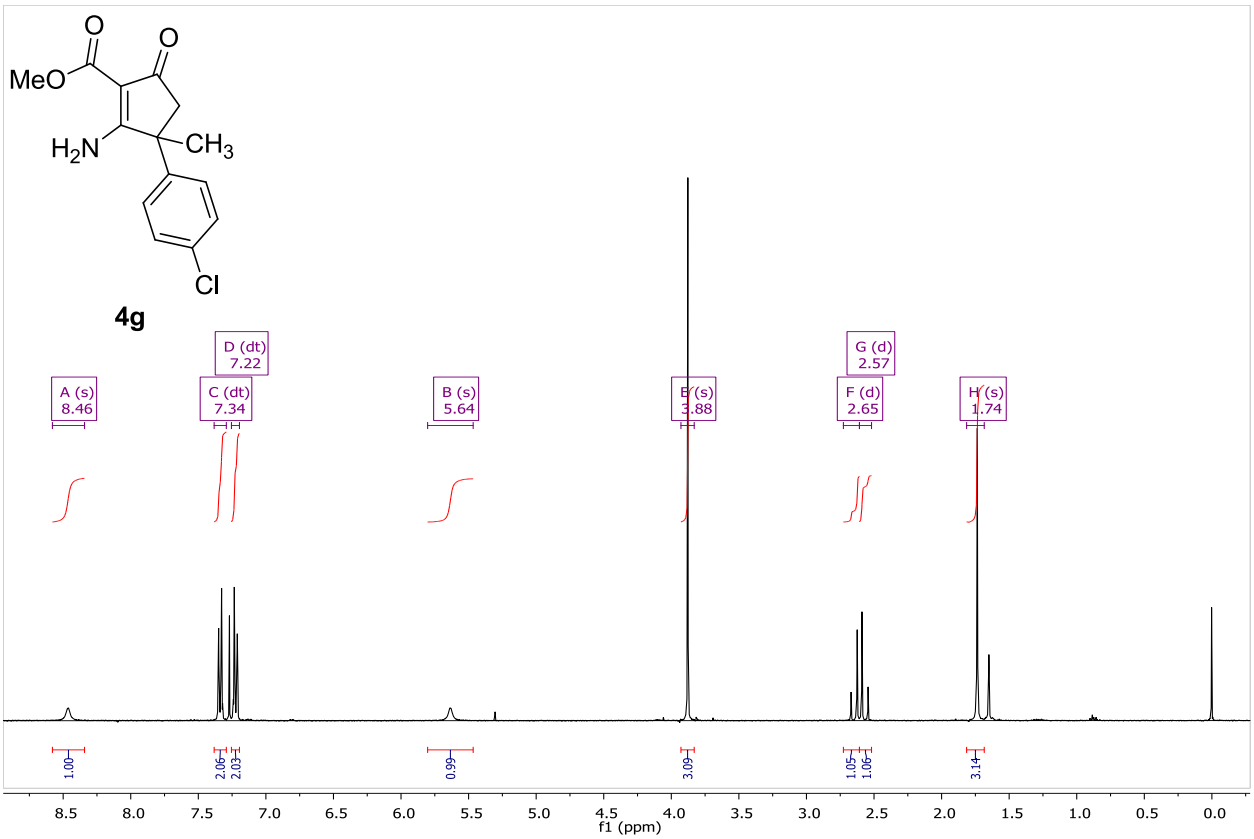

198.03
186.76
166.87
142.24
129.65
127.90
126.86
102.99
53.52
51.76
45.29
30.81
18.68
17.78
MeO
O
O
CH3
H2N
CH3
4d
f1 (ppm)

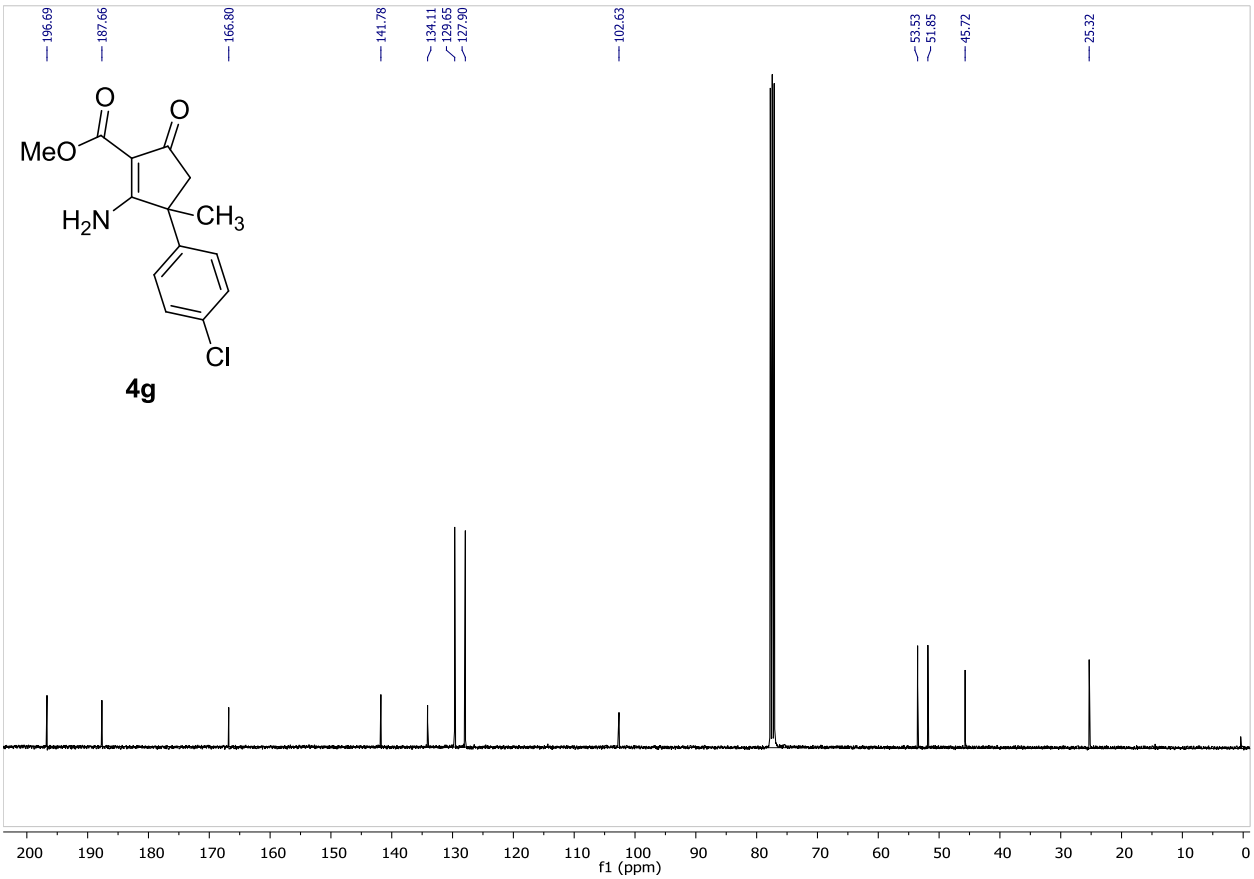

MeO
O
O
H_2N
4e
C (s) 8.54
I (m) 7.31
H (m) 7.40
B (m) 5.69
A (ddd) 5.24
D (s) 3.89
F (d) 2.75
E (d) 2.61
G (m) 2.90
1.00
2.06
3.09
1.98
2.06
3.06
2.03
1.08
1.12
f1 (ppm)

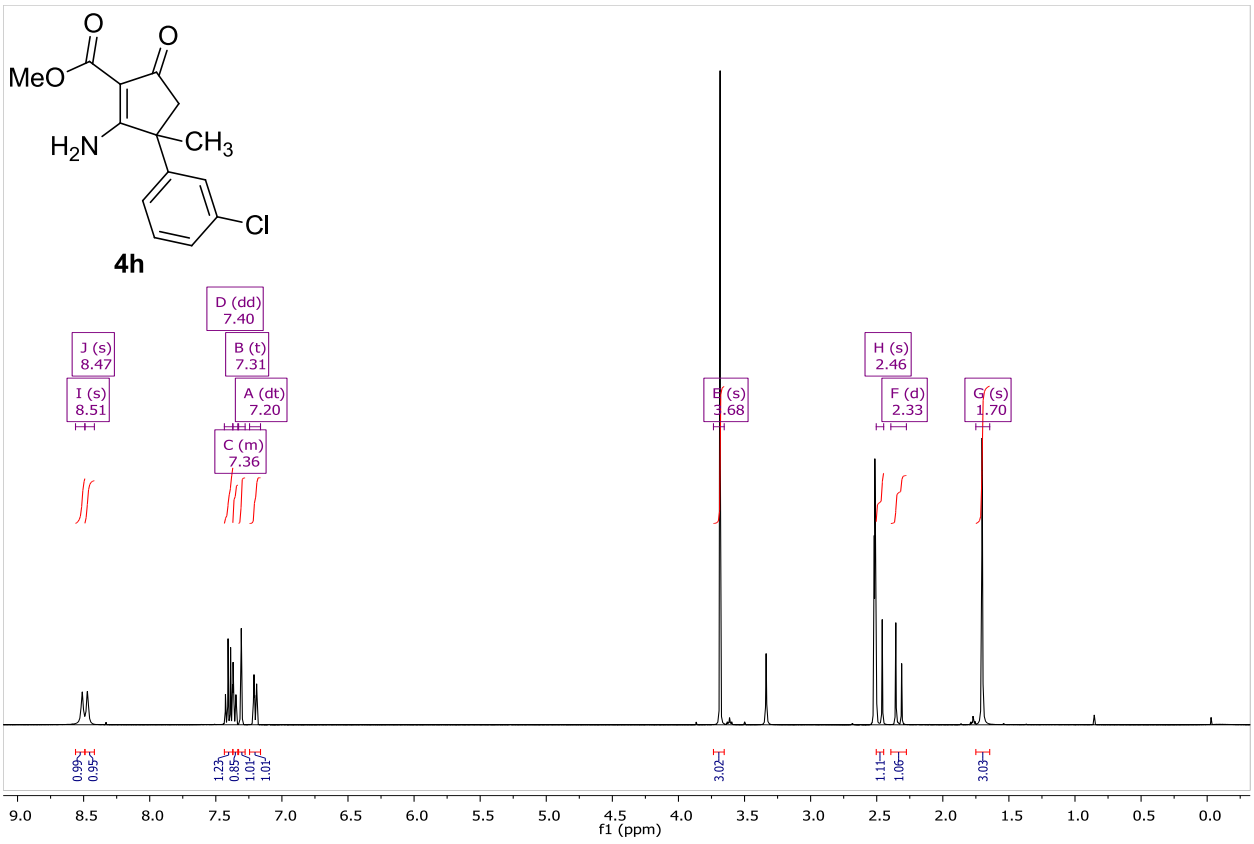

196.98
185.95
166.75
142.84
131.97
129.62
128.10
126.58
121.15
104.13
51.80
50.42
49.34
41.19
MeO
O
O
H_2N
4e
f1 (ppm)

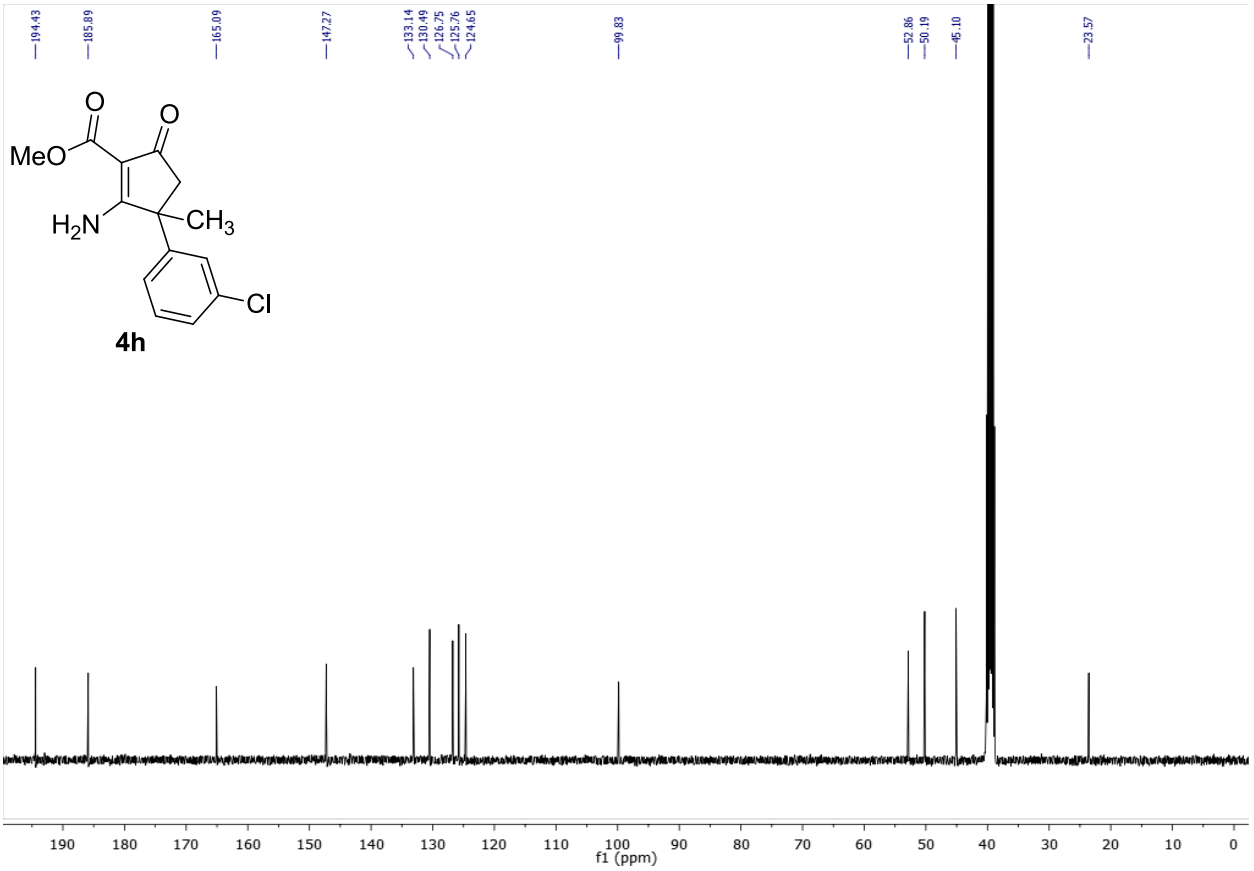

MeO
O
O
H2N
CH3
OMe
4f
C (s) 8.41
D (d) 7.20
J (d) 6.88
A (s) 5.53
F (s) 3.80
E (s) 3.88
I (d) 2.57
H (d) 2.70
B (s) 1.72
0.97
1.90
1.99
0.99
2.82
3.02
1.00
1.00
2.96
f1 (ppm)

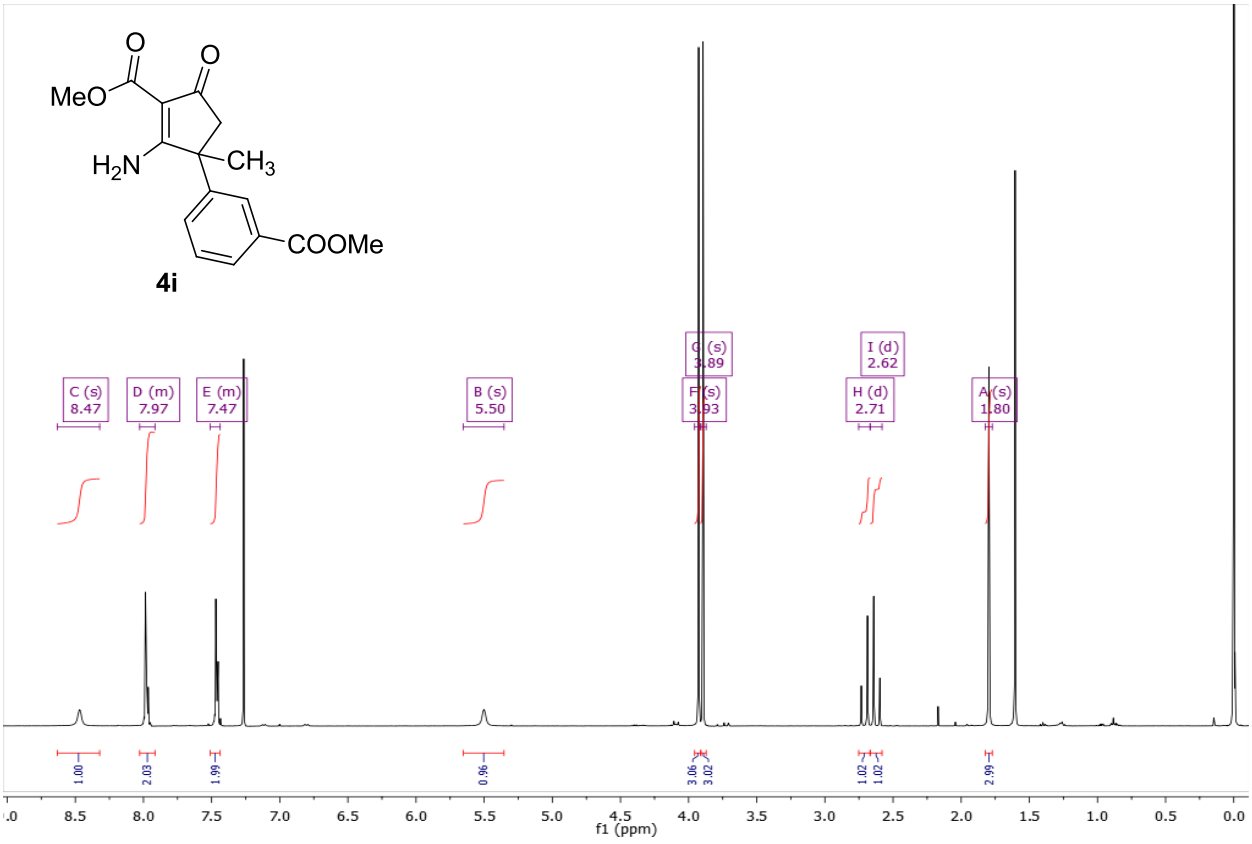

MeO
O
O
H2N
CH3
OMe
4f
188.62
166.94
159.35
134.98
127.67
114.83
102.39
55.78
53.73
51.87
46.50
25.75
f1 (ppm)

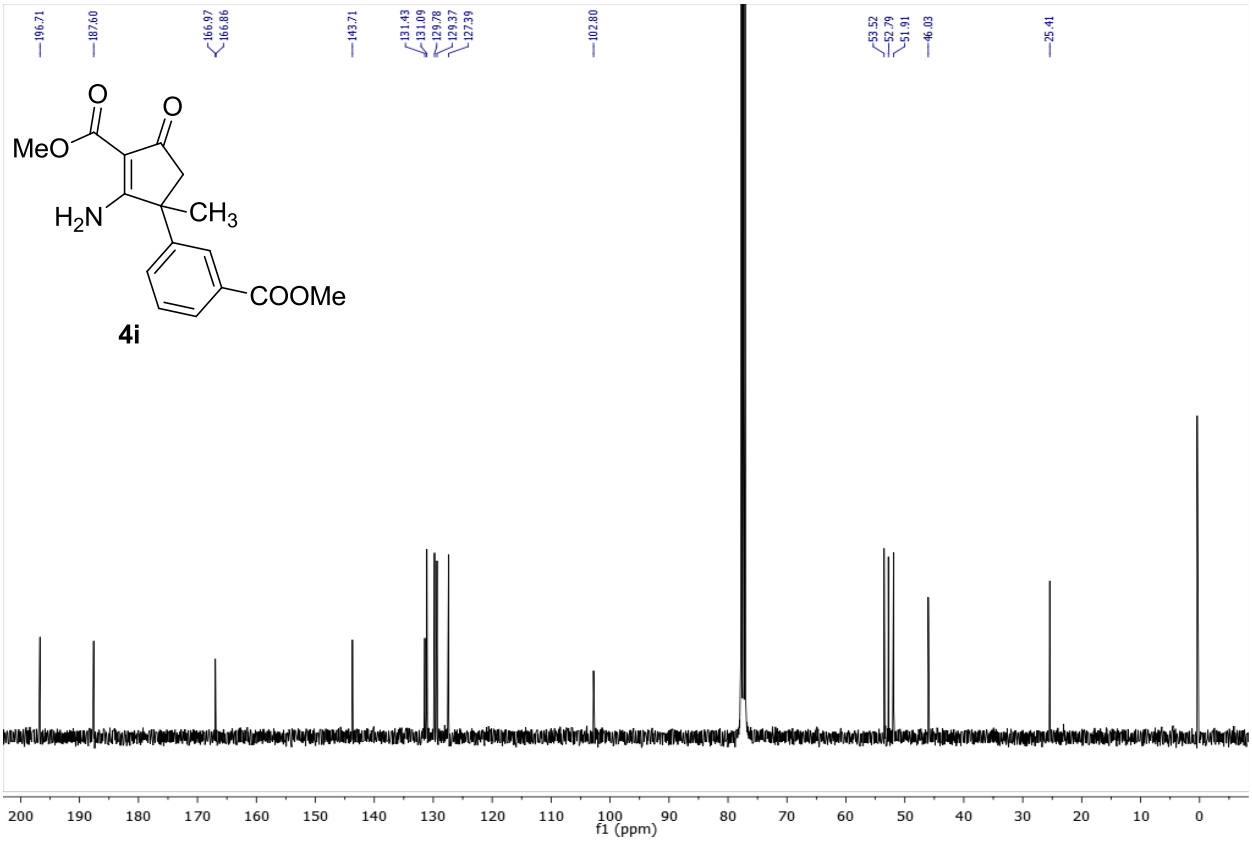

MeO
O
O
H2N
CH3
Cl
4g
A (s) 8.46
D (dt) 7.22
C (dt) 7.34
B (s) 5.64
E (s) 3.88
G (d) 2.57
F (d) 2.65
H (s) 1.74
1.00
2.06
2.03
0.99
3.09
1.05
1.06
3.14
f1 (ppm)

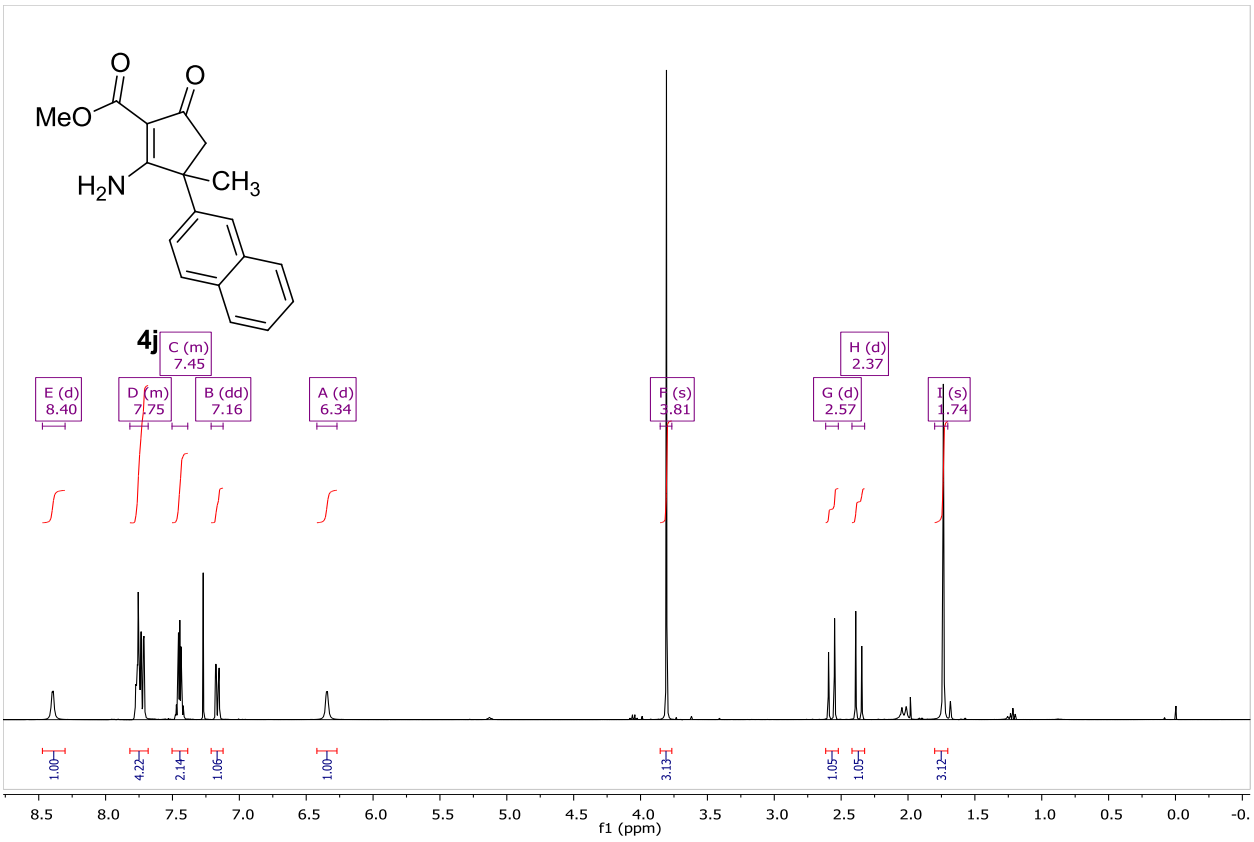

196.69
187.66
166.80
141.78
134.11
129.65
127.90
102.63
53.53
51.85
45.72
25.32
MeO
O
O
H2N
CH3
Cl
4g
f1 (ppm)

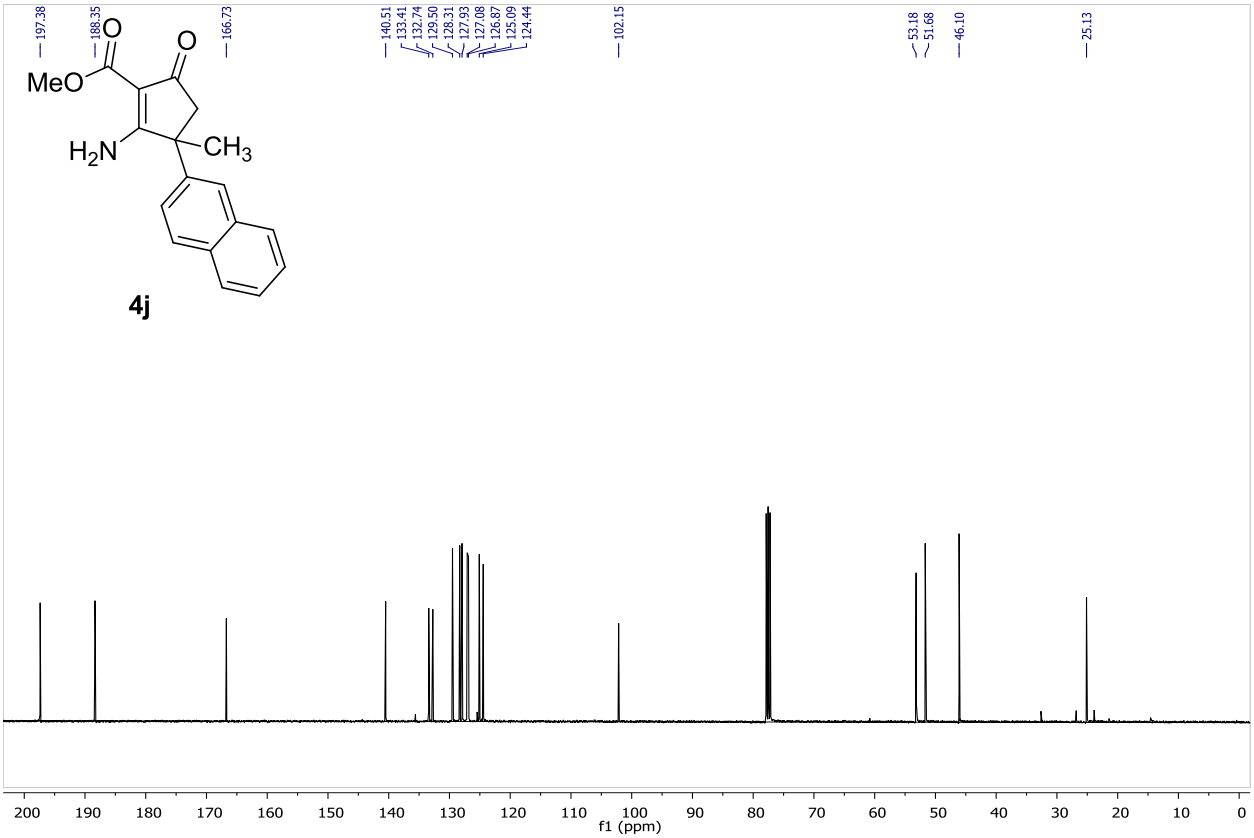

MeO
O
O
H2N
CH3
Cl
4h
D (dd) 7.40
J (s) 8.47
B (t) 7.31
I (s) 8.51
A (dt) 7.20
C (m) 7.36
E (s) 3.68
H (s) 2.46
F (d) 2.33
G (s) 1.70
0.99
0.95
1.23
0.85
1.01
1.01
3.02
1.11
1.06
3.03
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

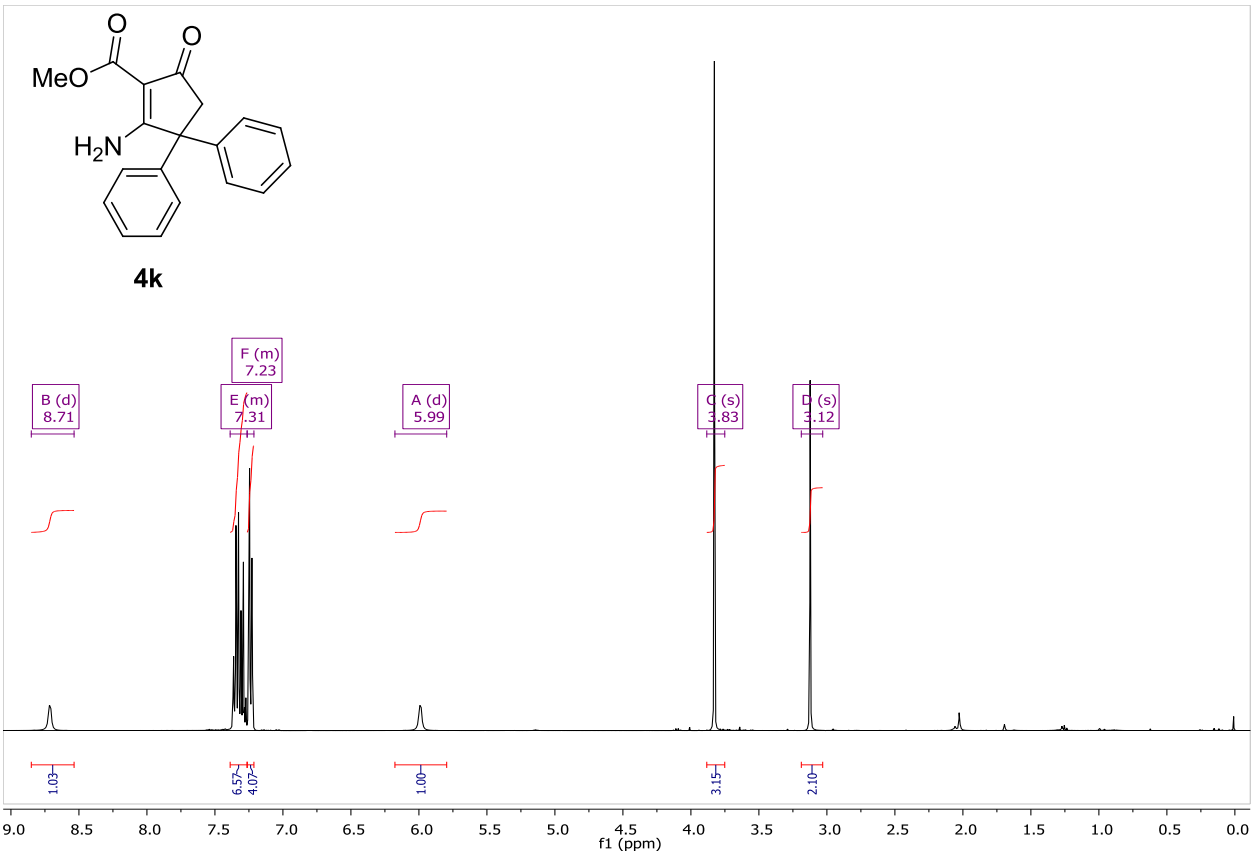

194.43
185.89
165.09
147.27
133.14
130.49
126.75
125.76
124.65
99.83
52.86
50.19
45.10
23.57
MeO
O
O
H2N
CH3
Cl
4h
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

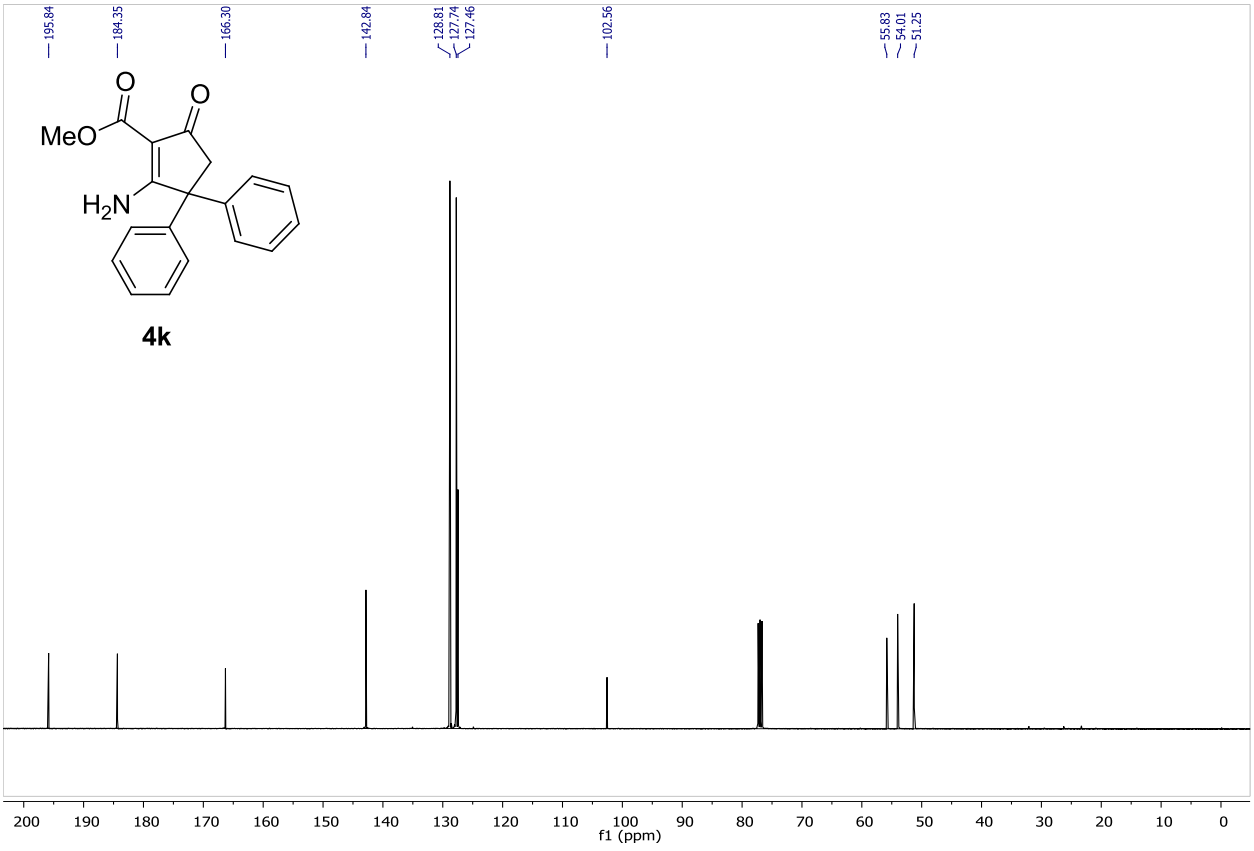

MeO
O
O
H_2N
CH_3
COOMe
4i
C (s) 8.47
D (m) 7.97
E (m) 7.47
B (s) 5.50
G (s) 3.89
F (s) 3.93
I (d) 2.62
H (d) 2.71
A (s) 1.80
1.00
2.03
1.99
0.96
3.06
3.02
1.02
1.02
2.99
f1 (ppm)

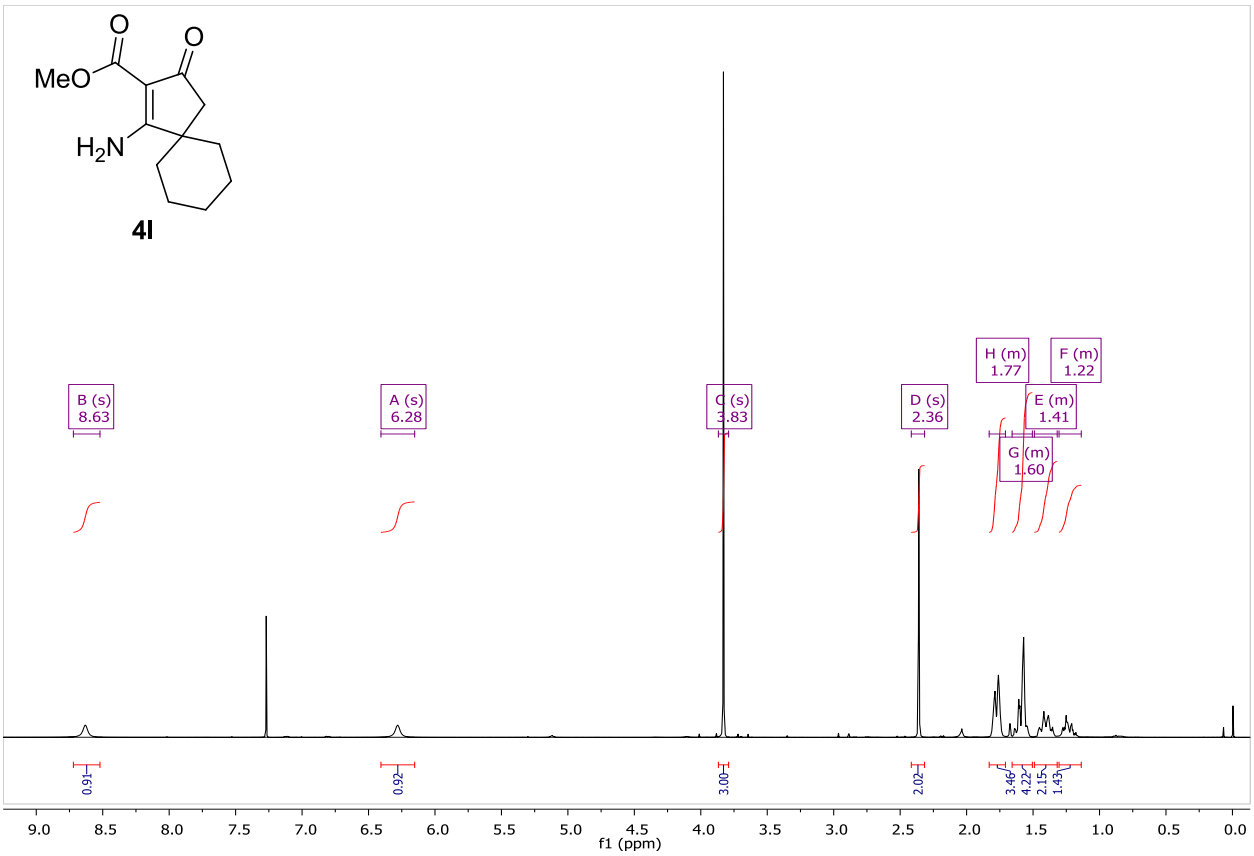

196.71
187.60
166.97
166.86
143.71
131.43
131.09
129.78
129.37
127.39
102.80
53.52
52.79
51.91
46.03
25.41
MeO
O
O
H_2N
CH_3
COOMe
4i
f1 (ppm)

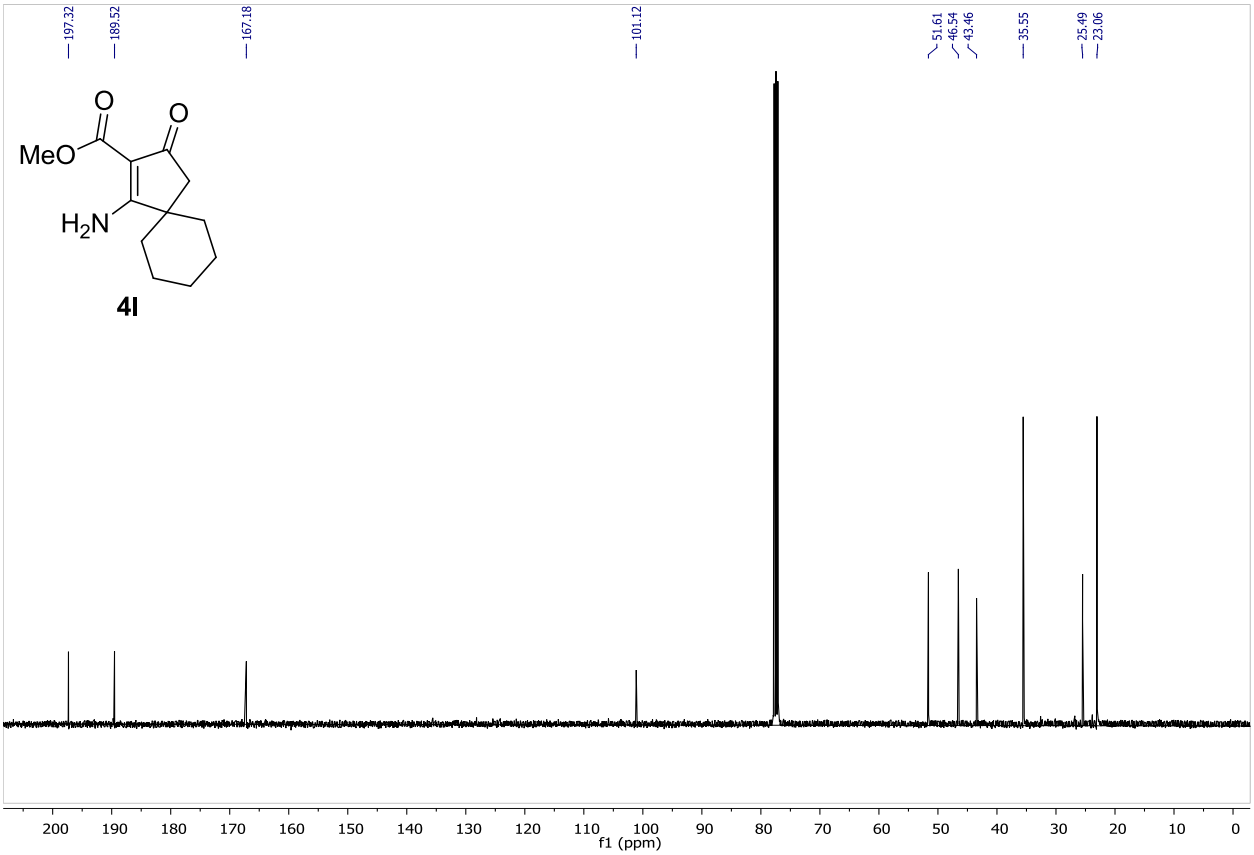

MeO
O
O
H2N
CH3
4j
E (d) 8.40
D (m) 7.75
C (m) 7.45
B (dd) 7.16
A (d) 6.34
F (s) 3.81
G (d) 2.57
H (d) 2.37
I (s) 1.74
1.00
4.22
2.14
1.06
1.00
3.13
1.05
1.05
3.12
f1 (ppm)


197.38
188.35
166.73
140.51
133.41
132.74
129.50
128.31
127.93
127.08
126.87
125.09
124.44
102.15
53.18
51.68
46.10
25.13
MeO
O
O
H2N
CH3
4j
f1 (ppm)


MeO
O
O
H2N
4k
F (m)
7.23
B (d)
8.71
E (m)
7.31
A (d)
5.99
C (s)
3.83
D (s)
3.12
1.03
6.57
4.07
1.00
3.15
2.10
f1 (ppm)


195.84
184.35
166.30
142.84
128.81
127.74
127.46
102.56
55.83
54.01
51.25
MeO
O
O
H2N
4k
f1 (ppm)


MeO
O
O
H_2N
4l
B (s) 8.63
A (s) 6.28
C (s) 3.83
D (s) 2.36
H (m) 1.77
F (m) 1.22
E (m) 1.41
G (m) 1.60
0.91
0.92
3.00
2.02
3.46
4.22
2.15
1.43
f1 (ppm)


197.32
189.52
167.18
101.12
51.61
46.54
43.46
35.55
25.49
23.06
MeO
O
O
H_2N
4l
f1 (ppm)