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Supplementary Information for

Photoelectrochemical Nickel-Catalyzed Carboacylation/ Silanoylation of Alkenes with Unactivated C/Si–H Bonds

Lanfen Wang[1], Xiangyu Huo[3], Xiaozhi He[1], Lutz Ackermann[2,*], and Dingyi Wang[1,*]

[1]College of Sciences, Northeastern University, Shenyang, 110004, China

[2]Institut für Organische und Biomolekulare Chemie, Georg-August-Universität Göttingen, Göttingen, 37077, Germany

[3]College of Pharmacy, Nankai University, Tianjin, 300350, China

*e-mail: wangdingyi@mail.neu.edu.cn, Lutz.Ackermann@chemie.uni-goettingen.de

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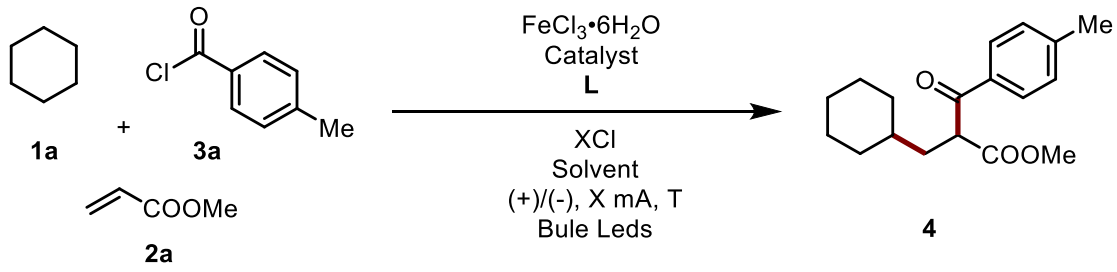
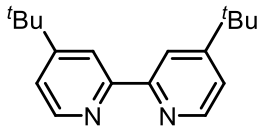
1. General Experimental Details

All new compounds were fully characterized. Compounds were visualized by exposure to UV-light. All reactions and manipulations involving air- or moisture-sensitive compounds were performed using standard Schlenk techniques or in a glovebox. Toluene was purified using Pure Solv MD-5 solvent purification system, from Innovative Technology, Inc., by passing the solvent through two activated alumina columns after purging with argon. ^{1}H, ^{13}C, ^{31}P and ^{19}F NMR spectra were recorded on a Bruker AVANCE III 400 MHz or 500 MHz spectrometer. Chemical shifts (δ values) were reported in ppm with $CDCl_3$ (7.26 and 77.16 ppm for ^{1}H and ^{13}C respectively). Mass spectra were conducted at Agilent 6540 Ultra-High-Definition (UHD) Accurate-Mass Quadrupole Time-of-Flight (Q-TOF) liquid chromatography/mass spectrometry (LC/MS) system and Thermo Scientific TRACE 1300 ISQ LT gas chromatography/mass spectrometry (GC/MS) system. Unless otherwise noted, materials obtained from commercial suppliers were used without further purification.

2. Optimization of the Reaction Condition





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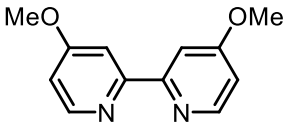

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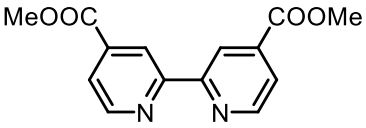

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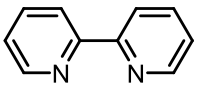

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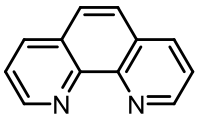

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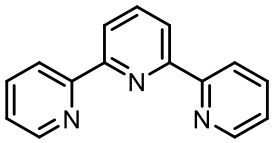


L6

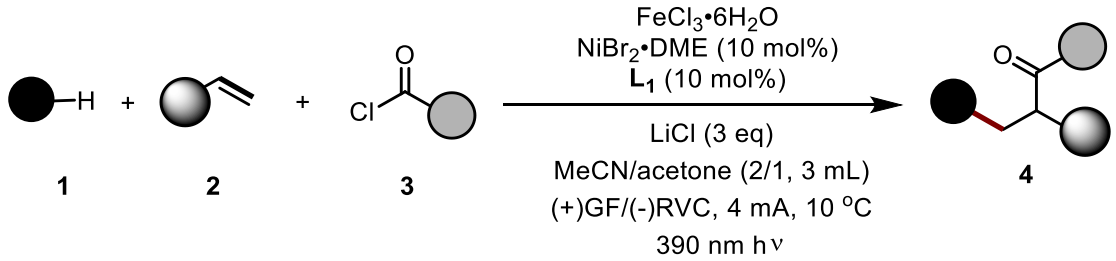
Entry	**1/2/3** (equiv)	**[Ni]** (10 mol%)	**L** (10 mol%)	Current (X mA)	Electrodes (+)-(-)	Solvent (mL)	Yield (%)[b]
1	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	71
2	10/3/1	$NiBr_2$•DME	**L2**	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	26
3	10/3/1	$NiBr_2$•DME	**L3**	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	15
4	10/3/1	$NiBr_2$•DME	**L4**	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	55
5	10/3/1	$NiBr_2$•DME	**L5**	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	22
6	10/3/1	$NiBr_2$•DME	**L6**	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	0
7	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	**MeCN (3 mL)**	42
8	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	**Acetone (3 mL)**	17
9	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	**MeCN/Acetone (1/2, 3 mL)**	55

10	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-GF(-)	**MeCN/Acetone (1/1, 3 mL)**	64
11	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	**DMF (3 mL)**	0
12	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	**DMA (3 mL)**	0
13	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	**DMSO (3 mL)**	0
14	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	**HFIP (3 mL)**	0
15	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	**TFE (3 mL)**	0
16	**5/3/1**	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	41
17	**5/1/1**	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	33
18	10/3/1	$NiBr_2$•DME	L1	**6.0**	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	57
19	10/3/1	$NiBr_2$•DME	L1	**2.0**	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	66
20	10/3/1	$NiBr_2$•DME	L1	4.0	**GF(+)-GF (-)**	MeCN/Acetone (2/1, 3 mL)	60
21	10/3/1	$NiBr_2$•DME	L1	4.0	**GF(+)-Ni foam (-)**	MeCN/Acetone (2/1, 3 mL)	15
22	10/3/1	$NiBr_2$•DME	L1	4.0	**RVC(+)-RVC(-)**	MeCN/Acetone (2/1, 3 mL)	36
23	10/3/1	$NiCl_2$•DME	L1	4.0	**Fe(+)-RVC(-)**	MeCN/Acetone (2/1, 3 mL)	<5
24	10/3/1	**$NiBr_2$**	L1	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	52
25	10/3/1	**$NiCl_2$·DME**	L1	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	62
26	10/3/1	**$Ni(acac)_2$**	L1	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	23
27	10/3/1	**$Ni(OAc)_2$**	L1	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	17
28	10/3/1	$NiBr_2$•DME	L1	**0**	GF(+)-RVC(-)	MeCN/Acetone	0

						(2/1, 3 mL)	
29	10/3/1	-	L1	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	0
30	10/3/1	$NiBr_2$•DME	-	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	0
31[d]	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	0
32[e]	10/3/1	$NiBr_2$•DME	L1	4.0	GF(+)-RVC(-)	MeCN/Acetone (2/1, 3 mL)	42

[a] Reaction conditions: **1a** (2.0 mmol), **2a** (0.6 mmol), **3a** (0.2 mmol), $NiBr_2$•DME (10 mol%), $FeCl_3$•$6H_2O$ (10 mol%), dtbbpy (10 mol%), LiCl (3.0 equiv.), anhydrous MeCN/acetone (3.0 mL, 2/1), 4 mA, 24 h, 390 nm, 10 °C, nitrogen, graphite felt (GF) as an anode, reticulated vitreous carbon (RVC) as a cathode, undivided cell. [b] GC yields using dodecane as an internal standard. [c] isolated yields. [d] No blue LEDs. [e] At 30 °C.

3. General Procedures

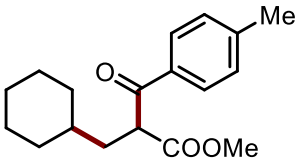


A dry 10 mL vial equipped with a Teflon-coated magnetic stir bar was charged with acyl chlorides (0.30 mmol, 1.0 equiv.), alkanes (3.0 mmol, 10 equiv.) or silanes (1.5 mmol, 5 equiv.), alkenes (0.90 mmol, 3.0 equiv.), LiCl (37.8 mg, 3.0 equiv.) and $FeCl_3 \cdot 6H_2O$ (8.1 mg, 10 mol%) were dissolved in acetone (1.0 mL). Afterward, a pre-catalyst solution (it was prepared by a mix of $NiBr_2 \cdot$DME (6.6 mg, 10 mol%), 4,4'-di-tert-butyl-2,2'-bipyridine (8.1 mg, 10 mol%) in anhydrous MeCN (2.0 mL) under N_2 atmosphere, and was stirred for 10 minutes.) was added via syringe. Then, it was capped with a Teflon lid equipped with Graphite Felt (20×10×15 mm) as the anode and reticulated vitreous carbon (20×10×1 mm) as the cathode. The reaction mixture was stirred under N_2 and electrolyzed at a constant current of 4 mA under irradiation by a 10-W 390-nm LED lamp with a cooling fan to keep the reaction temperature at 10 °C

for 24 h. After the reaction was completed, the mixture was transferred to a 50 mL round bottom flask, electrodes were washed with ethyl acetate. Then H_2O (20 mL) was added and the mixture was extracted with EtOAc (20 mL) for three times. The combined organic layer was washed with H_2O (20 mL) and brine (20 mL). The organic layer was dried with anhydrous Na_2SO_4, then concentrated under vacuum. The product was purified by flash column chromatography on silica gel using hexane/EtOAc as eluent.

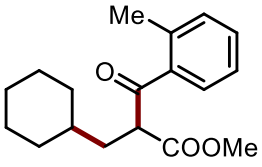
4. Characterization Data of Products

Methyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (4)



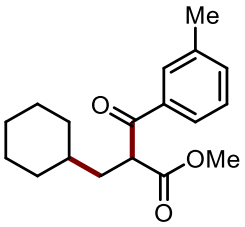
This compound was prepared according to General procedure, 61.3 mg, 71 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.89 (d, *J* = 8.3 Hz, 2H), 7.28 (d, *J* = 7.9 Hz, 2H), 4.44 (dd, *J* = 7.9, 6.4 Hz, 1H), 3.68 (s, 3H), 2.42 (s, 3H), 1.87 – 1.66 (m, 6H), 1.19 – 1.13 (m, 2H), 0.95 – 0.80 (m, 5H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.0, 170.9, 144.5, 133.6, 129.5, 128.8, 52.4, 51.5, 36.5, 35.8, 33.3, 33.0, 29.7, 26.4, 26.1, 21.7. HRMS m/z (ESI): calcd for $C_{18}H_{25}O_3$ $(M + H)^+$ 289.1798, found 289.1780.

Methyl 2-(cyclohexylmethyl)-3-oxo-3-(o-tolyl)propanoate (5)



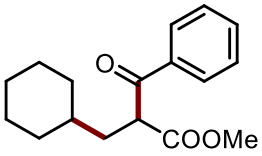
This compound was prepared according to General procedure, 53.6 mg, 62 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.72 – 7.63 (m, 1H), 7.40 (td, *J* = 7.5, 1.4 Hz, 1H), 7.31 – 7.27 (m, 2H), 4.36 (dd, *J* = 8.3, 6.2 Hz, 1H), 3.70 (s, 3H), 2.50 (s, 3H), 1.94 – 1.62 (m, 9H), 1.17 – 1.12 (m, 2H), 0.96 – 0.86 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 199.1, 170.8, 138.9, 137.2, 132.0, 131.6, 128.3, 125.7, 54.2, 52.3, 36.3, 35.9, 33.3, 32.9, 26.4, 26.1, 26.1, 21.0. HRMS m/z (ESI): calcd for $C_{18}H_{25}O_3$ $(M + H)^+$ 289.1798, found 289.1799.

Methyl -2-(cyclohexylmethyl)-3-oxo-3-(m-tolyl)propanoate (6)



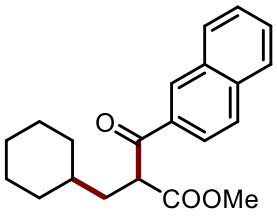
This compound was prepared according to General procedure, 63.9 mg, 74 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.83 – 7.71 (m, 2H), 7.43 – 7.32 (m, 2H), 4.44 (dd, J = 7.9, 6.4 Hz, 1H), 3.68 (s, 3H), 2.42 (s, 3H), 1.98 – 1.77 (m, 3H), 1.71 – 1.60 (m, 4H), 1.28 – 1.17 (m, 4H), 0.98 – 0.87 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.5, 170.8, 138.7, 136.2, 134.3, 129.1, 128.6, 125.8, 52.4, 51.6, 36.5, 35.9, 33.3, 33.0, 26.4, 26.2, 26.1, 21.4. HRMS m/z (ESI): calcd for $C_{18}H_{25}O_3$ $(M + H)^+$ 289.1798, found 289.1798.

Methyl 2-(cyclohexylmethyl)-3-oxo-3-phenylpropanoate (7)



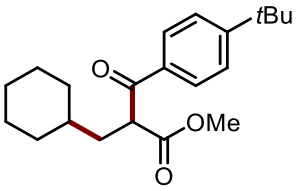
This compound was prepared according to General procedure, 56.7 mg, 69 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.99 (dd, *J* = 8.4, 1.4 Hz, 2H), 7.58 (d, *J* = 7.6 Hz, 1H), 7.48 (dd, *J* = 8.3, 7.1 Hz, 2H), 4.47 (dd, *J* = 7.9, 6.3 Hz, 1H), 3.69 (s, 3H), 1.95 – 1.60 (m, 7H), 1.31 – 1.10 (m, 4H), 0.96 – 0.93 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.3, 170.7, 136.0, 128.7, 128.5, 52.4, 51.5, 36.4, 35.7, 33.2, 32.9, 26.3, 26.0. HRMS m/z (ESI): calcd for $C_{17}H_{23}O_3$ $(M + H)^+$ 275.1642, found 275.1643.

Methyl 2-(cyclohexylmethyl)-3-(naphthalen-2-yl)-3-oxopropanoate (8)



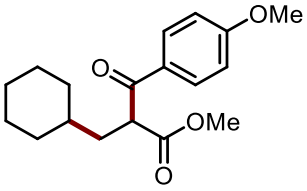
This compound was prepared according to General procedure, 58.3 mg, 60 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.57 – 8.52 (m, 1H), 8.07 – 8.05 (m, 2H), 7.95 – 7.90 (m, 2H), 7.67 – 7.58 (m, 2H), 4.65 (dd, *J* = 7.8, 6.5 Hz, 1H), 3.72 (s, 3H), 2.04 – 1.95 (m, 2H), 1.90 – 1.84 (m, 1H), 1.75 – 1.64 (m, 4H), 1.35 – 1.18 (m, 4H), 1.02 – 0.94 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.3, 170.8, 135.8, 133.5, 132.5, 130.5, 129.8, 128.8, 128.7, 127.8, 126.9, 124.2, 52.5, 51.6, 36.6, 35.9, 33.3, 33.1, 26.4, 26.1. HRMS m/z (ESI): calcd for $C_{21}H_{25}O_3$ $(M + H)^+$ 325.1798, found 325.1800.

Methyl 3-(4-(tert-butyl)phenyl)-2-(cyclohexylmethyl)-3-oxopropanoate (9)



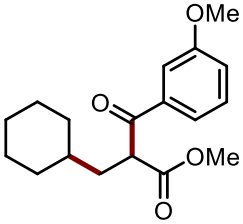
This compound was prepared according to General procedure, 65.3 mg, 66 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.93 (d, *J* = 8.6 Hz, 2H), 7.49 (d, *J* = 8.6 Hz, 2H), 4.44 (dd, *J* = 7.9, 6.4 Hz, 1H), 3.69 (s, 3H), 1.98 – 1.78 (m, 3H), 1.72 – 1.70 (m, 4H), 1.34 (s, 9H), 1.22 – 1.12 (m, 4H), 0.97 – 0.89 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.9, 170.9, 157.3, 133.5, 128.6, 125.7, 52.4, 51.5, 36.5, 35.9, 35.2, 33.3, 33.0, 31.0, 26.4, 26.1. HRMS m/z (ESI): calcd for $C_{21}H_{31}O_3$ $(M + H)^+$ 331.2268, found 331.2270.

Methyl 2-(cyclohexylmethyl)-3-(4-methoxyphenyl)-3-oxopropanoate (10)



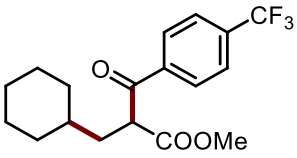
This compound was prepared according to General procedure, 65.7 mg, 72 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.97 (d, *J* = 8.7 Hz, 2H), 6.94 (d, *J* = 8.7 Hz, 2H), 4.41 (t, *J* = 7.2 Hz, 1H), 3.87 (s, 3H), 3.67 (s, 3H), 1.95 – 1.78 (m, 3H), 1.66 (d, *J* = 12.6 Hz, 4H), 1.26 – 1.18 (m, 4H), 0.95 – 0.85 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 193.7, 170.5, 131.4, 131.3, 116.0, 115.8, 52.5, 51.6, 36.4, 35.8, 33.3, 33.0, 26.4, 26.1. HRMS m/z (ESI): calcd for $C_{18}H_{25}O_4$ $(M + H)^+$ 305.1747, found 305.1747.

Methyl 2-(cyclohexylmethyl)-3-(3-methoxyphenyl)-3-oxopropanoate (11)



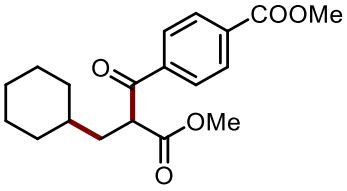
This compound was prepared according to General procedure, 49.2 mg, 72 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.58 – 7.57 (m, 1H), 7.52 – 7.51 (m, 1H), 7.41 – 7.37 (m, 1H), 7.15 – 7.12 (m, 1H), 4.45 – 4.42 (m, 1H), 3.86 (s, 3H), 3.69 (s, 3H), 1.74 – 1.61 (m, 5H), 1.16 – 1.09 (m, 2H), 0.97 – 0.83 (m, 6H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.2, 160.0, 137.4, 129.8, 121.2, 120.2, 112.7, 55.5, 52.5, 51.7, 36.5, 35.8, 33.3, 33.0, 29.7, 26.4, 26.1. HRMS m/z (ESI): calcd for $C_{18}H_{25}O_4$ $(M + H)^+$ 305.1747, found 305.1747.

Methyl 2-(cyclohexylmethyl)-3-oxo-3-(4-(trifluoromethyl)phenyl)propanoate (12)



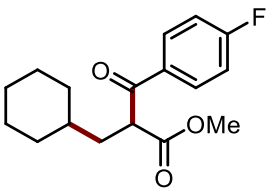
This compound was prepared according to General procedure, 52.3 mg, 51 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.09 – 7.96 (m, 2H), 7.80 – 7.55 (m, 2H), 4.36 (dd, *J* = 7.7, 6.5 Hz, 1H), 3.62 (s, 3H), 1.95 – 1.55 (m, 8H), 1.14 – 1.02 (m, 3H), 0.90 – 0.81 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.4, 170.3, 138.8, 128.9, 125.9 (d, J = 4.1 Hz), 52.7, 51.9, 36.2, 35.8, 33.2, 33.0, 26.3, 26.1. **^{19}F NMR (376 MHz, Chloroform-*d*)** δ -63.21. HRMS m/z (ESI): calcd for $C_{18}H_{22}F_3O_3$ $(M + H)^+$ 343.1516, found 343.1519.

Methyl 4-(2-(cyclohexylmethyl)-3-methoxy-3-oxopropanoyl)benzoate (13)



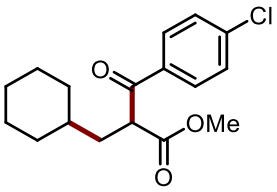
This compound was prepared according to General procedure, 44.8 mg, 45 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.14 (d, *J* = 8.4 Hz, 2H), 8.02 (d, *J* = 8.5 Hz, 2H), 4.44 (dd, *J* = 7.8, 6.5 Hz, 1H), 3.95 (s, 3H), 3.68 (s, 3H), 1.94 – 1.84 (m, 2H), 1.80 – 1.76 (m, 4H), 1.22 – 1.11 (m, 3H), 0.97 – 0.80 (m, 4H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.9, 170.4, 139.4, 134.2, 130.0, 128.5, 52.53, 52.48, 52.0, 36.3, 35.8, 33.3, 33.0, 26.3, 26.1. **MS** (EI) *m*/*z* (relative intensity): 234 [M]+ (100). HRMS m/z (ESI): calcd for $C_{19}H_{25}O_5$ $(M + H)^+$ 333.1697, found 333.1698.

Methyl 2-(cyclohexylmethyl)-3-(4-fluorophenyl)-3-oxopropanoate (14)



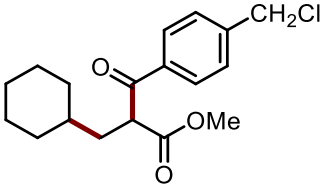
This compound was prepared according to General procedure, 61.3 mg, 70 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.04 (dd, *J* = 8.7, 5.4 Hz, 2H), 7.17 (t, *J* = 8.6 Hz, 2H), 4.42 (dd, *J* = 7.8, 6.5 Hz, 1H), 3.70 (s, 3H), 2.03 – 1.78 (m, 3H), 1.72 – 1.62 (m, 4H), 1.29 – 1.21 (m, 4H), 1.00 – 0.89 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 193.7, 170.5, 166.0 (d, *J* = 255.8 Hz), 132.6 (d, *J* = 3.0 Hz), 131.3 (d, *J* = 9.5 Hz), 115.9 (d, *J* = 22.0 Hz), 52.5, 51.6, 36.4, 35.8, 33.3, 33.0, 26.3, 26.1. HRMS m/z (ESI): calcd for $C_{17}H_{22}O_3F$ $(M + H)^+$ 293.1547, found 293.1547.

Methyl 3-(4-chlorophenyl)-2-(cyclohexylmethyl)-3-oxopropanoate (15)



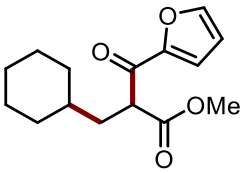
This compound was prepared according to General procedure, 53.6 mg, 58 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.07 – 7.98 (m, 2H), 7.15 (t, *J* = 8.6 Hz, 2H), 4.43 – 4.37 (m, 1H), 3.68 (s, 3H), 1.99 – 1.69 (m, 8H), 1.21 – 1.11 (m, 3H), 0.96 – 0.88 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 193.7, 170.5, 131.4, 131.3, 116.0, 115.8, 52.5, 51.6, 36.4, 35.8, 33.3, 33.0, 26.4, 26.1. HRMS m/z (ESI): calcd for $C_{17}H_{22}O_3Cl$ $(M + H)^+$ 309.1252, found 309.1253.

Methyl 3-(4-(chloromethyl)phenyl)-2-(cyclohexylmethyl)-3-oxopropanoate (16)



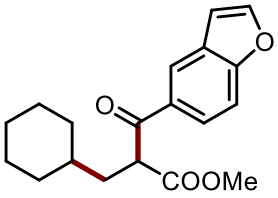
This compound was prepared according to General procedure, 30.9 mg, 32 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.98 (d, *J* = 8.4 Hz, 2H), 7.50 (d, *J* = 8.4 Hz, 2H), 4.62 (s, 2H), 4.43 (dd, *J* = 7.8, 6.5 Hz, 1H), 3.68 (s, 3H), 1.96 – 1.79 (m, 3H), 1.71 – 1.63 (m, 4H), 1.29 – 1.23 (m, 4H), 0.97 – 0.87 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.7, 170.6, 142.8, 135.9, 129.1, 128.9, 52.5, 51.7, 45.2, 36.4, 35.8, 33.3, 33.0, 26.4, 26.1. HRMS m/z (ESI): calcd for $C_{18}H_{24}O_3F$ $(M + H)^+$ 323.1408, found 323.1409.

Methyl 2-(cyclohexylmethyl)-3-(furan-2-yl)-3-oxopropanoate (17)



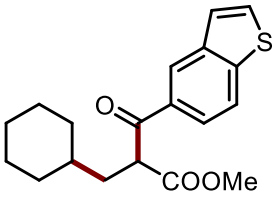
This compound was prepared according to General procedure, 43.6 mg, 55 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.15 (dd, *J* = 2.8, 1.3 Hz, 1H), 7.57 (dd, *J* = 5.1, 1.3 Hz, 1H), 7.33 (dd, *J* = 5.1, 2.9 Hz, 1H), 4.28 – 4.22 (m, 1H), 3.69 (s, 3H), 1.97 – 1.84 (m, 2H), 1.72 – 1.67 (m, 5H), 1.23 – 1.13 (m, 4H), 0.97 – 0.88 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 189.1, 170.6, 141.3, 133.1, 127.3, 126.6, 53.5, 52.5, 36.3, 35.8, 33.3, 33.0, 26.37, 26.07. HRMS m/z (ESI): calcd for $C_{15}H_{21}O_4$ $(M + H)^+$ 265.1434, found 265.1438.

Methyl 3-(benzofuran-5-yl)-2-(cyclohexylmethyl)-3-oxopropanoate (18)



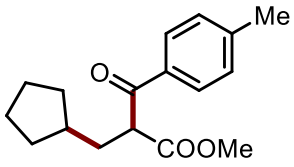
This compound was prepared according to General procedure, 65.9 mg, 70 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.31 (d, *J* = 1.9 Hz, 1H), 8.00 (dd, *J* = 8.7, 1.9 Hz, 1H), 7.71 (d, *J* = 2.2 Hz, 1H), 7.57 (dt, *J* = 8.8, 0.8 Hz, 1H), 6.88 (dd, *J* = 2.2, 1.0 Hz, 1H), 4.55 (dd, *J* = 7.9, 6.5 Hz, 1H), 3.69 (s, 3H), 2.03 – 1.89 (m, 2H), 1.86 – 1.59 (m, 6H), 1.30 – 1.16 (m, 3H), 0.99 – 0.92 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.7, 170.8, 157.6, 146.5, 131.5, 127.6, 125.2, 122.9, 111.7, 107.3, 52.4, 51.5, 36.5, 35.7, 33.2, 32.9, 26.3, 26.0. HRMS m/z (ESI): calcd for $C_{19}H_{23}O_4$ $(M + H)^+$ 315.1591, found 315.1597.

Ethyl 2-(3-methylbenzoyl)-4-oxooctanoate (19)



This compound was prepared according to General procedure, 62.4 mg, 63 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.48 (d, *J* = 1.1 Hz, 1H), 7.97 (d, *J* = 1.4 Hz, 2H), 7.55 (d, *J* = 5.4 Hz, 1H), 7.47 (d, *J* = 5.5 Hz, 1H), 4.56 (t, *J* = 7.2 Hz, 1H), 3.69 (s, 3H), 2.02 – 1.90 (m, 2H), 1.86 – 1.79 (m, 1H), 1.76 – 1.63 (m, 4H), 1.35– 1.31 (m, 1H), 1.22 – 1.09 (m, 3H), 0.99 – 0.92 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.2, 170.9, 144.7, 139.5, 132.7, 128.1, 124.8, 124.7, 123.7, 122.9, 52.6, 51.7, 36.6, 35.9, 33.3, 33.1, 26.4, 26.1. HRMS m/z (ESI): calcd for $C_{19}H_{23}O_3S$ $(M + H)^+$ 331.1362, found 331.1366.

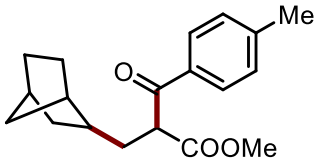
Methyl 2-(cyclopentylmethyl)-3-oxo-3-(p-tolyl)propanoate (20)



This compound was prepared according to General procedure, 59.1 mg, 72 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.90 (d, *J* = 8.3 Hz, 2H), 7.29 (d, *J* = 8.3 Hz, 2H), 4.41 – 4.32 (m, 1H), 3.68 (s, 3H), 2.42 (s, 3H), 2.10 – 2.01 (m, 2H), 1.77 – 1.45 (m, 7H), 1.15 – 1.12 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.0, 170.8, 144.5, 133.7, 130.7, 129.5, 128.8, 53.2, 52.4, 38.3, 35.3,

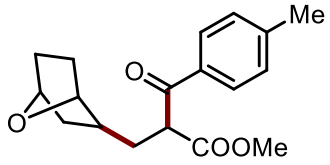
32.6 (d, J = 4.4 Hz), 25.0, 21.7. HRMS m/z (ESI): calcd for $C_{17}H_{23}O_3$ $(M + H)^+$ 275.1642, found 275.1642.

Methyl 2-(bicyclo[2.2.1]heptan-2-ylmethyl)-3-oxo-3-phenylpropanoate (21)



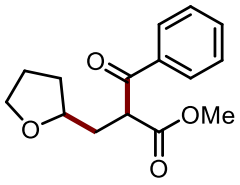
This compound was prepared according to General procedure, 53.2 mg, 62 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.95 – 7.87 (m, 2H), 7.31 – 7.29 (m, 2H), 4.39 – 4.31 (m, 1H), 3.69 (d, *J* = 4.5 Hz, 3H), 2.44 (s, 3H), 2.23 – 2.21 (m, 1H), 2.07 – 1.97 (m, 2H), 1.84 – 1.71 (m, 1H), 1.51 – 1.32 (m, 5H), 1.12 – 1.05 (m, 4H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.1, 195.0, 170.84, 170.80, 144.5, 129.6, 129.5, 128.77, 128.75, 52.4, 52.3, 52.2, 41.2, 41.1, 40.13, 40.05, 38.0, 37.9, 36.6, 35.9, 35.3, 35.3, 29.9, 28.6, 28.6, 21.7. HRMS m/z (ESI): calcd for $C_{18}H_{23}O_3$ $(M + H)^+$ 287.1642, found 287.1642.

Methyl 2-((7-oxabicyclo[2.2.1]heptan-2-yl)methyl)-3-oxo-3-phenylpropanoate (22)



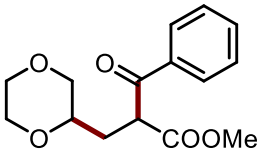
This compound was prepared according to General procedure, 43.2 mg, 50 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.93 – 7.86 (m, 2H), 7.31 – 7.28 (m, 2H), 4.57 (q, *J* = 5.1 Hz, 1H), 4.38 – 4.23 (m, 2H), 3.70 (d, *J* = 4.4 Hz, 3H), 2.44 (s, 3H), 2.17 (dd, *J* = 14.0, 7.4 Hz, 1H), 1.91 – 1.85 (m, 1H), 1.77 – 1.59 (m, 7H), 1.40 – 1.36 (m, 1.6 Hz, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.6, 194.5, 170.53, 170.51, 144.7, 144.6, 133.7, 133.6, 129.6, 128.8, 128.7, 80.2, 80.0, 76.54, 76.53, 52.5, 51.9, 51.7, 41.4, 41.3, 37.9, 37.9, 34.5, 29.7, 29.6, 29.6, 29.5, 21.7. HRMS m/z (ESI): calcd for $C_{18}H_{23}O_4$ $(M + H)^+$ 303.1591, found 303.1595.

Methyl -3-oxo-3-phenyl-2-((tetrahydrofuran-2-yl)methyl)propanoate (23)



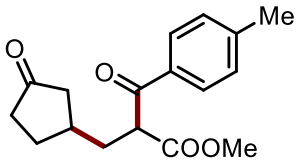
This compound was prepared according to General procedure, 44.0 mg, 56 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.08 – 7.97 (m, 2H), 7.61 – 7.54 (m, 1H), 7.50 – 7.43 (m, 2H), 4.70 – 4.63 (m, 1H), 3.98 – 3.74 (m, 2H), 3.73 – 3.62 (m, 4H), 2.35 – 2.31 (m, 1H), 2.15 – 1.81 (m, 4H), 1.55 – 1.49 (m, 1H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.5, 195.4, 170.5, 170.4, 136.6, 133.5, 133.4, 128.8, 128.8, 128.7, 76.8, 76.4, 67.6, 67.6, 52.5, 52.4, 51.3, 50.8, 35.2, 35.0, 31.5, 31.5, 29.7, 25.7, 25.6. HRMS m/z (ESI): calcd for $C_{15}H_{19}O_4$ $(M + H)^+$ 263.1278, found 263.1279.

Methyl -2-((1,4-dioxan-2-yl)methyl)-3-oxo-3-phenylpropanoate (24)



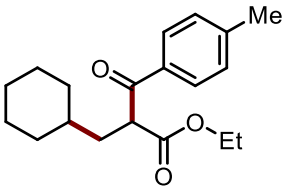
This compound was prepared according to General procedure, 26.6 mg, 32 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 8.05 – 8.01 (m, 2H), 7.64 – 7.55 (m, 1H), 7.52 – 7.47 (m, 2H), 4.72 – 4.68 (m, 1H), 3.82 – 3.52 (m, 9H), 3.32 – 3.24 (m, 1H), 2.24 – 2.14 (m, 1H), 2.06 – 1.91 (m, 1H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.3, 170.4, 133.7, 133.6, 128.9, 128.8, 73.3, 72.6, 71.1, 71.0, 66.8, 66.6, 66.4, 66.4, 52.6, 52.6, 49.6, 48.9, 30.8, 30.7, 29.7, 29.3. HRMS m/z (ESI): calcd for $C_{15}H_{19}O_5$ $(M + H)^+$ 279.1227, found 279.1230.

Methyl 3-oxo-2-((3-oxocyclopentyl)methyl)-3-phenylpropanoate (25)



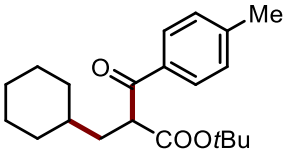
This compound was prepared according to General procedure, 35.4 mg, 41 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.90 (d, *J* = 8.2 Hz, 2H), 7.29 (d, *J* = 8.2 Hz, 2H), 4.44 – 4.32 (m, 1H), 3.69 (s, 3H), 2.43 (s, 3H), 2.39 – 2.06 (m, 7H), 1.87 – 1.75 (m, 1H), 1.58 – 1.52 (m, 1H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 218.4, 194.1, 144.9, 144.9, 129.6, 128.7, 52.6, 52.3, 52.1, 44.9, 44.8, 38.5, 35.3, 35.3, 34.61, 34.58, 29.5, 29.5, 21.7. HRMS m/z (ESI): calcd for $C_{16}H_{19}O_4$ $(M + H)^+$ 275.1278, found 275.1279.

Ethyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (26)



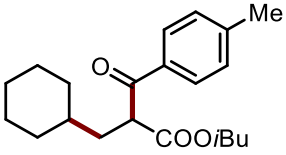
This compound was prepared according to General procedure, 63.4 mg, 70 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.89 (d, *J* = 6.5 Hz, 2H), 7.27 (d, *J* = 7.4 Hz, 2H), 4.44 – 4.37 (m, 1H), 4.14 (q, *J* = 7.1 Hz, 2H), 2.41 (s, 3H), 2.01 – 1.80 (m, 3H), 1.72 – 1.60 (m, 4H), 1.33 – 1.24 (m, 2H), 1.22-1.16 (m, 5H), 0.96 – 0.85 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.0, 170.3, 144.3, 133.6, 129.4, 128.7, 61.2, 51.6, 36.3, 35.8, 33.3, 32.9, 26.3, 26.1, 26.0, 21.6, 14.0. HRMS m/z (ESI): calcd for $C_{19}H_{27}O_3$ $(M + H)^+$ 303.1955, found 303.1955.

Tert-butyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (27)



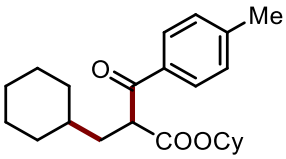
This compound was prepared according to General procedure, 72.2 mg, 73 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.81 (d, *J* = 8.4 Hz, 2H), 7.19 (d, *J* = 7.9 Hz, 2H), 4.19 (dd, *J* = 7.7, 6.6 Hz, 1H), 2.34 (s, 3H), 1.82 – 1.55 (m, 8H), 1.37 (d, *J* = 2.3 Hz, 1H), 1.28 (s, 9H), 1.12 – 1.06 (m, 2H), 0.89 – 0.80 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.3, 169.6, 144.0, 134.0, 129.3, 128.7, 81.5, 52.9, 36.1, 35.8, 33.4, 33.1, 29.7, 27.8, 26.4, 26.2, 21.6. HRMS m/z (ESI): calcd for $C_{21}H_{31}O_3$ $(M + H)^+$ 331.2268, found 331.2268.

Isobutyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (28)



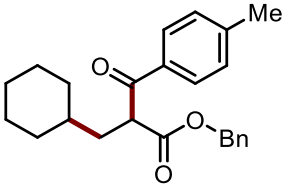
This compound was prepared according to General procedure, 67.3 mg, 68 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.90 (d, *J* = 8.3 Hz, 2H), 7.27 (d, *J* = 8.0 Hz, 2H), 4.42 (dd, *J* = 7.8, 6.5 Hz, 1H), 3.86 (dd, *J* = 6.6, 2.8 Hz, 2H), 2.41 (s, 3H), 1.97 – 1.79 (m, 4H), 1.72 – 1.63 (m, 4H), 1.20 – 1.11 (m, 3H), 0.98 – 0.88 (m, 3H), 0.82 (dd, *J* = 6.7, 1.1 Hz, 6H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.9, 170.5, 144.3, 133.8, 129.4, 128.7, 71.3, 51.7, 36.3, 35.8, 33.3, 33.0, 29.7, 27.6, 26.4, 26.1, 21.7, 18.9. **MS** (EI) *m*/*z* (relative intensity): 234 [M]+ (100). HRMS m/z (ESI): calcd for $C_{21}H_{31}O_3$ $(M + H)^+$ 331.2268, found 331.2269.

Cyclohexyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (29)



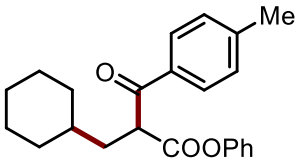
This compound was prepared according to General procedure, 66.2 mg, 62 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.89 (d, *J* = 8.3 Hz, 2H), 7.26 (d, *J* = 8.0 Hz, 2H), 4.78 (dt, *J* = 8.6, 4.4 Hz, 1H), 4.36 (dd, *J* = 8.0, 6.4 Hz, 1H), 2.41 (s, 3H), 1.95 – 1.80 (m, 3H), 1.76 – 1.62 (m, 7H), 1.36 – 1.32 (m, 3H), 1.23 – 1.08 (m, 5H), 0.99 – 0.85 (m, 3H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.0, 169.9, 144.2, 133.9, 129.3, 128.7, 73.3, 52.1, 36.2, 35.8, 33.4, 33.0, 31.3, 31.1, 29.7, 26.4, 26.2, 26.1, 25.3, 23.4, 21.7. HRMS m/z (ESI): calcd for $C_{23}H_{33}O_3$ $(M + H)^+$ 357.2424, found 357.2425.

Benzyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (30)



This compound was prepared according to General procedure, 65.5 mg, 60 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.86 (d, *J* = 8.1 Hz, 2H), 7.32 – 7.20 (m, 7H), 5.12 (s, 2H), 4.45 (dd, *J* = 8.2, 6.2 Hz, 1H), 2.40 (s, 3H), 1.99 – 1.77 (m, 3H), 1.70 – 1.59 (m, 4H), 1.24 – 1.08 (m, 4H), 0.86 – 0.96 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.8, 170.3, 144.4, 135.6, 133.6, 129.5, 128.8, 128.5, 128.2, 128.1, 66.9, 51.7, 36.4, 35.8, 33.4, 32.9, 26.4, 26.1, 26.1, 21.7. HRMS m/z (ESI): calcd for $C_{24}H_{29}O_3$ $(M + H)^+$ 365.2111, found 365.2120.

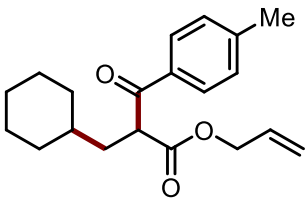
Phenyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (31)



This compound was prepared according to General procedure, 56.7 mg, 54 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.96 (d, *J* = 7.9 Hz, 2H), 7.36 – 7.29 (m, 4H), 7.20 (t, *J* = 7.4 Hz, 1H), 6.99 (d, *J* = 7.9 Hz, 2H), 4.63 (dd, *J* = 8.6, 5.7 Hz, 1H), 2.44 (s, 3H), 2.07 (td, *J* = 8.3, 4.2 Hz, 1H), 1.96 – 1.87 (m, 2H), 1.82 – 1.60 (m, 5H), 1.45 – 1.38 (m, 1H), 1.22 – 1.14 (m, 2H), 1.05 – 0.97 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 218.4, 194.1, 144.9, 144.9, 129.6, 128.7, 52.6, 52.3, 52.1, 44.9, 44.8,

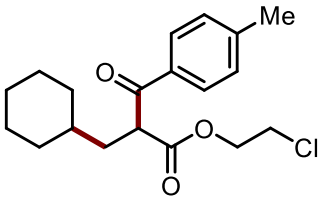
38.5, 35.3, 35.3, 34.61, 34.58, 29.5, 29.5, 21.7. HRMS m/z (ESI): calcd for $C_{23}H_{27}O_3$ $(M + H)^+$ 351.1955, found 351.1956.

Allyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (32)



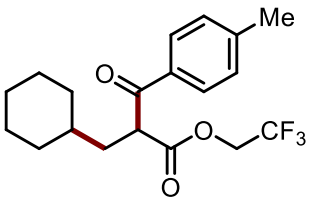
This compound was prepared according to General procedure, 41.4 mg, 44 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.89 (d, *J* = 8.2 Hz, 2H), 7.27 (d, *J* = 8.4 Hz, 2H), 5.88 – 5.75 (m, 1H), 5.27 – 5.14 (m, 2H), 4.59 (dt, *J* = 5.6, 1.5 Hz, 2H), 4.45 (dd, *J* = 8.0, 6.4 Hz, 1H), 2.42 (s, 3H), 1.94 – 1.58 (m, 9H), 1.14 (dt, *J* = 15.6, 5.9 Hz, 2H), 0.95 – 0.91 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.93, 170.1, 144.4, 133.6, 131.7, 129.5, 128.8, 118.4, 65.8, 51.6, 36.5, 35.8, 33.3, 33.0, 26.4, 26.1, 26.1, 21.7. HRMS m/z (ESI): calcd for $C_{20}H_{27}O_3$ $(M + H)^+$ 315.1955, found 315.1957.

2-Chloroethyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (33)



This compound was prepared according to General procedure, 46.4 mg, 46 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.89 (d, *J* = 8.2 Hz, 2H), 7.28 (d, *J* = 9.5 Hz, 2H), 4.47 (dd, *J* = 8.4, 6.0 Hz, 1H), 4.35 (t, *J* = 5.7 Hz, 2H), 3.61 (td, *J* = 5.7, 3.1 Hz, 2H), 2.42 (s, 3H), 1.96 – 1.92 (m, 1H), 1.88 – 1.79 (m, 2H), 1.75 – 1.62 (m, 4H), 1.31 – 1.14 (m, 4H), 0.98 – 0.88 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.7, 170.0, 144.5, 133.4, 129.5, 128.7, 64.5, 51.4, 41.2, 36.4, 35.8, 33.3, 32.8, 26.3, 26.1, 26.0, 21.7. HRMS m/z (ESI): calcd for $C_{19}H_{26}O_3Cl$ $(M + H)^+$ 337.1565, found 337.1565.

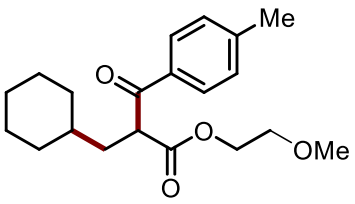
2,2,2-trifluoroethyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (34)



This compound was prepared according to General procedure, 72.6 mg, 68 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.86 (d, *J* = 8.3 Hz, 2H), 7.29

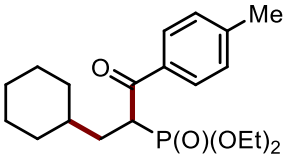
(d, *J* = 8.0 Hz, 2H), 4.58 – 4.38 (m, 3H), 2.43 (s, 3H), 1.97 – 1.94 (m, 1H), 1.87 – 1.80 (m, 2H), 1.73 – 1.61 (m, 4H), 1.33 – 1.13 (m, 4H), 0.96 – 0.91 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.1, 168.9, 144.8, 133.1, 129.6, 128.8, 124.1, 121.4, 60.7 (q, *J* = 36.9 Hz), 51.2, 36.4, 35.88, 33.4, 32.8, 26.3, 26.1 (d, *J* = 4.6 Hz), 21.7. HRMS m/z (ESI): calcd for $C_{19}H_{24}O_3F_3$ $(M + H)^+$ 357.1672, found 357.1680.

2-methoxyethyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (35)



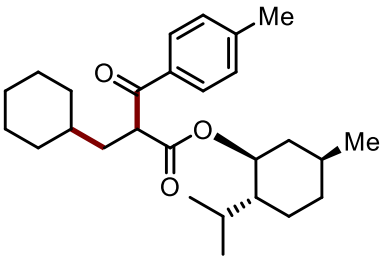
This compound was prepared according to General procedure, 57.7 mg, 58 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.95 – 7.84 (m, 2H), 7.28 – 7.26 (m, 2H), 4.50 – 4.40 (m, 1H), 4.32 – 4.19 (m, 2H), 3.53 – 3.50 (m, 2H), 3.29 (d, *J* = 1.9 Hz, 3H), 2.42 (d, *J* = 1.9 Hz, 3H), 1.95 – 1.63 (m, 7H), 1.31 – 1.11 (m, 4H), 0.99 – 0.84 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.9, 170.4, 144.4, 133.6, 129.4, 128.8, 70.3, 64.2, 58.9, 51.6, 36.4, 35.9, 33.4, 33.0, 26.4, 26.1, 26.1, 21.7. HRMS m/z (ESI): calcd for $C_{20}H_{29}O_4$ $(M + H)^+$ 333.2060, found 333.2062.

Diethyl (3-cyclohexyl-1-oxo-1-(p-tolyl)propan-2-yl)phosphonate (36)



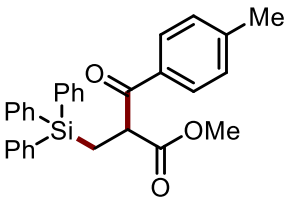
This compound was prepared according to General procedure, 50.5 mg, 46 % yield as colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ ^{1}H NMR (400 MHz, Chloroform-*d*) δ 7.93 (d, *J* = 8.3 Hz, 2H), 7.29 (d, *J* = 6.6 Hz, 2H), 4.25 – 4.00 (m, 5H), 2.44 (s, 3H), 1.86 – 1.64 (m, 8H), 1.28 (d, *J* = 3.2 Hz, 3H), 1.20 (d, *J* = 7.1 Hz, 3H), 1.11 (t, *J* = 10.7, 3H), 0.92 – 0.86 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 199.6, 195.6, 144.1, 135.2, 129.2, 128.8, 62.7, 62.5, 45.2, 43.9, 36.4, 36.2, 33.7, 32.5, 26.3, 26.1, 26.0, 21.6, 16.4. HRMS m/z (ESI): calcd for $C_{20}H_{32}O_4P$ $(M + H)^+$ 367.2033, found 367.2036.

(1S,2R,5S)-2-isopropyl-5-methylcyclohexyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl) propanoate (37)



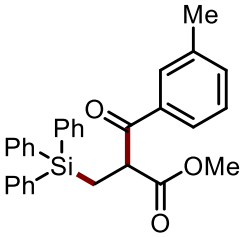
This compound was prepared according to General procedure, 66.7 mg, 54 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.88 (dd, *J* = 8.2, 3.7 Hz, 2H), 7.25 (d, J = 7.8 Hz, 2H), 4.66 – 4.60 (m, 1H), 4.37 – 4.33 (m, 1H), 2.41 (s, 3H), 1.97 – 1.82 (m, 4H), 1.74 – 1.63 (m, 5H), 1.45 – 1.09 (m, 7H), 1.03 – 0.72 (m, 12H), 0.63 – 0.54 (m, 3H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 133.9, 129.3, 128.7, 128.7, 75.3, 75.2, 52.5, 52.3, 46.8, 46.8, 40.4, 40.3, 36.2, 36.1, 35.8, 35.7, 34.2, 33.5, 32.93, 32.90, 31.3, 26.4, 26.2, 26.1, 26.1, 25.8, 25.7, 23.0, 22.9, 22.0, 21.7, 20.8, 20.7, 15.8, 15.7. HRMS m/z (ESI): calcd for $C_{27}H_{41}O_3$ $(M + H)^+$ 413.3050, found 413.3055.

Methyl 3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (38)



This compound was prepared according to General procedure, 94.6 mg, 68 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.64 – 7.52 (m, 8H), 7.39– 7.31 (m, 9H), 7.13 (d, *J* = 7.9 Hz, 2H), 4.48– 4.44 (m, 1H), 3.32 (s, 3H), 2.37 (s, 3H), 2.25 – 2.19 (m, 1H), 2.09 – 2.03 (m, 1H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.0, 170.8, 144.2, 135.8, 133.8, 133.1, 129.7, 129.2, 128.8, 128.0, 52.3, 49.4, 21.7, 12.9. HRMS m/z (ESI): calcd for $C_{30}H_{29}O_3Si$ $(M + H)^+$ 465.1880, found 465.1882.

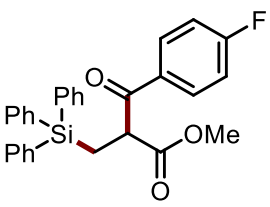
Methyl 3-oxo-3-(m-tolyl)-2-((triphenylsilyl)methyl)propanoate (39)



This compound was prepared according to General procedure, 98.7 mg, 71 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.66 – 7.48 (m, 8H), 7.47 – 7.32 (m, 10H), 7.26 – 7.24 (m, 1H), 4.51 (dd, *J* = 8.5, 5.8 Hz, 1H), 3.38 (s, 3H), 2.35 (s, 3H), 2.25 (dd, *J* = 15.2, 8.5 Hz, 1H), 2.11 (dd, *J* = 15.2, 5.8 Hz, 1H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.8, 170.8, 135.8, 135.6, 134.1, 133.7, 129.7, 129.2, 128.4,

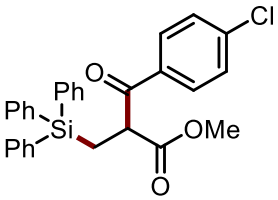
128.0, 125.9, 52.3, 49.5, 21.3, 12.9. HRMS m/z (ESI): calcd for $C_{30}H_{29}O_3Si$ $(M + H)^+$ 465.1880, found 465.1884.

Methyl 3-(4-fluorophenyl)-3-oxo-2-((triphenylsilyl)methyl)propanoate (40)



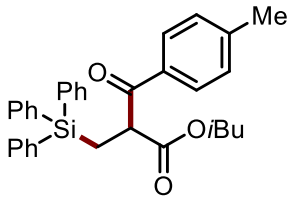
This compound was prepared according to General procedure, 91.2 mg, 65 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.74 – 7.65 (m, 2H), 7.55 – 7.53 (m, 6H), 7.41 – 7.31 (m, 9H), 7.01 – 6.97 (m, 2H), 4.45 – 4.42 (m, 1H), 3.37 (s, 3H), 2.26 – 2.07 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 193.8, 170.7, 165.8 (d, J = 255.5 Hz), 135.8, 133.7, 132.1(d, J = 3.2 Hz), 131.3 (d, J = 9.3 Hz), 129.8, 128.0, 115.6 (d, J = 21.9 Hz), 52.4, 49.5, 12.8. **^{19}F NMR (376 MHz, Chloroform-*d*)** δ -104.7. HRMS m/z (ESI): calcd for $C_{29}H_{26}FO_3Si$ $(M + H)^+$ 469.1630, found 469.1631.

Methyl 3-(4-chlorophenyl)-3-oxo-2-((triphenylsilyl)methyl)propanoate (41)



This compound was prepared according to General procedure, 90.2 mg, 62 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.62 – 7.49 (m, 8H), 7.41 – 7.28 (m, 11H), 4.42 (dd, *J* = 7.7, 6.5 Hz, 1H), 3.38 (s, 3H), 2.25 – 2.08 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.2, 170.6, 139.8, 135.8, 134.0, 133.6, 130.0, 129.8, 128.8, 128.0, 52.4, 49.5, 12.7. HRMS m/z (ESI): calcd for $C_{29}H_{26}ClO_3Si$ $(M + H)^+$ 485.1334, found 485.1337.

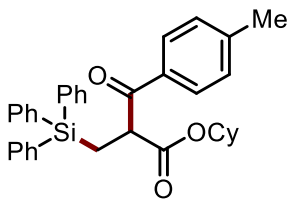
Isobutyl 3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (42)



This compound was prepared according to General procedure, 76.1 mg, 69 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.75 – 7.53 (m, 8H), 7.50 – 7.29 (m, 9H), 7.16 (d, *J* = 8.0 Hz, 2H), 4.49 (dd, *J* = 8.0, 6.1 Hz, 1H), 3.55 (ddd, *J* = 39.2, 10.6, 6.7 Hz, 2H), 2.40 (s, 3H), 2.30 – 2.11 (m, 2H), 1.70 (dt, *J* = 13.4, 6.7 Hz, 1H), 0.76 (dd, *J* = 6.7, 1.8 Hz, 6H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ

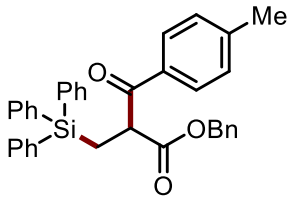
195.0, 170.6, 144.0, 135.9, 133.9, 133.3, 129.7, 129.1, 128.8, 127.9, 71.4, 49.5, 27.4, 21.7, 18.9, 12.5. HRMS m/z (ESI): calcd for $C_{33}H_{35}O_3Si$ $(M + H)^+$ 507.2350, found 507.2361.

Cyclohexyl 3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (43)



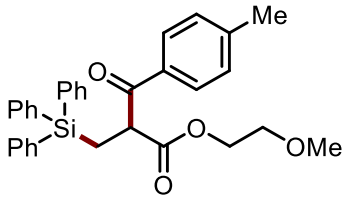
This compound was prepared according to General procedure, 104.9 mg, 67 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.70 – 7.44 (m, 8H), 7.48 – 7.29 (m, 9H), 7.15 (d, *J* = 8.0 Hz, 2H), 4.50 (dq, *J* = 8.8, 4.0 Hz, 1H), 4.42 (dd, *J* = 7.7, 6.2 Hz, 1H), 2.40 (s, 3H), 2.28 – 2.10 (m, 2H), 1.59 – 1.09 (m, 11H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ170.0, 135.9, 134.0, 129.6, 129.0, 128.8, 127.9, 73.6, 49.9, 30.92, 30.89, 25.3, 23.3, 21.7, 12.3. HRMS m/z (ESI): calcd for $C_{36}H_{33}O_3Si$ $(M + H)^+$ 533.2506, found 533.2515.

Benzyl 3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (44)



This compound was prepared according to General procedure, 76.1 mg, 47 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.62 – 7.50 (m, 8H), 7.41 – 7.28 (m, 11H), 4.42 (dd, *J* = 7.7, 6.5 Hz, 1H), 3.38 (s, 3H), 2.23 – 2.07 (m, 2H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.9, 170.3, 144.1, 135.9, 133.8, 129.7, 129.1, 128.8, 128.4, 128.1, 128.0, 127.95, 66.9, 49.6, 21.6, 12.6. HRMS m/z (ESI): calcd for $C_{36}H_{33}O_3Si$ $(M + H)^+$ 541.2193, found 541.2208.

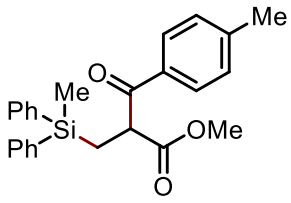
3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (45)



This compound was prepared according to General procedure, 79.2 mg, 52 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.61 – 7.52 (m, 8H), 7.39 – 7.32 (m, 9H), 7.12 (d, *J* = 8.0 Hz, 2H), 4.48 – 4.45 (m, 1H), 3.96 – 3.81 (m, 2H), 3.35 – 3.27 (m, 2H), 3.21 (s, 3H), 2.36 (s, 3H), 2.21 (dd,

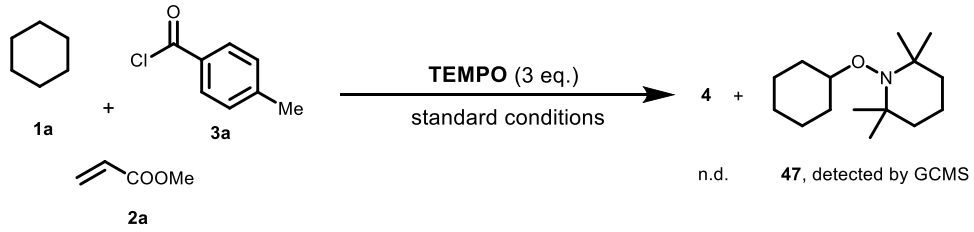
J = 15.2, 8.6 Hz, 1H), 2.08 (dd, *J* = 15.2, 5.6 Hz, 1H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 194.9, 170.5, 144.1, 135.9, 133.8, 133.1, 129.7, 129.1, 128.9, 128.0, 70.0, 64.1, 58.8, 49.5, 21.6, 12.7. HRMS m/z (ESI): calcd for $C_{32}H_{33}O_4Si$ $(M + H)^+$ 509.2143, found 509.2150.

Methyl 2-((methyldiphenylsilyl)methyl)-3-oxo-3-(p-tolyl)propanoate (46)



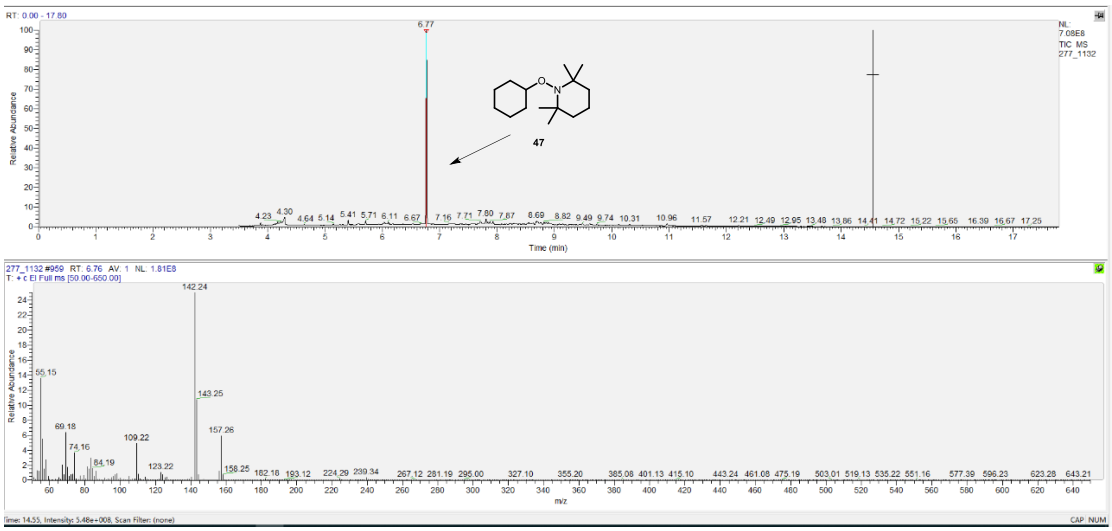
This compound was prepared according to General procedure, 86.8 mg, 72 % yield as a colorless oil. **^{1}H NMR (400 MHz, Chloroform-*d*)** δ 7.67 – 7.61 (m, 2H), 7.53 – 7.49 (m, 4H), 7.39 –7.31 (m, 6H), 7.16 (d, *J* = 8.0 Hz, 2H), 4.31 (dd, *J* = 8.5, 6.0 Hz, 1H), 3.49 (s, 3H), 2.38 (s, 3H), 1.89 (dd, *J* = 15.0, 8.6 Hz, 1H), 1.73 (dd, *J* = 15.0, 6.0 Hz, 1H), 0.55 (s, 3H). **^{13}C NMR (101 MHz, Chloroform-*d*)** δ 195.3, 171.2, 144.3, 135.9, 135.7, 134.6, 133.1, 129.5, 129.49, 129.3, 128.8, 128.0, 127.9, 52.4, 49.3, 21.6, 14.1, -4.1. HRMS m/z (ESI): calcd for $C_{25}H_{27}O_3Si$ $(M + H)^+$ 403.1724, found 403.1728.

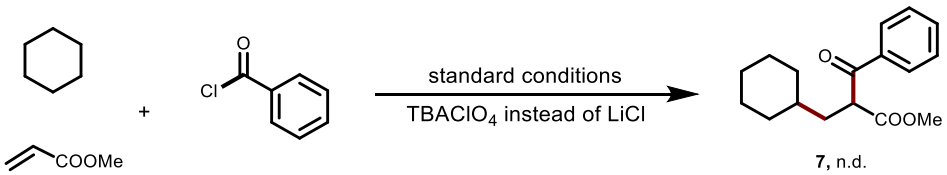
5. Mechanistic Investigations



A dry 10 mL vial equipped with a Teflon-coated magnetic stir bar was charged with acyl chlorides (0.30 mmol, 1.0 equiv.), alkanes (3.0 mmol, 10 equiv.), alkenes (0.90 mmol, 3.0 equiv.), and 2,2,6,6-Tetramethylpiperidinooxy (0.9 mmol, 3.0 equiv.), LiCl (37.8 mg, 3.0 equiv.) and $FeCl_3 \cdot 6H_2O$ (8.1 mg, 10 mol%) were dissolved in acetone (1.0 mL). Afterward, a pre-catalyst solution (it was prepared by a mix of $NiBr_2 \cdot$DME (6.6 mg, 10 mol%), 4,4'-di-tert-butyl-2,2'-bipyridine (8.1 mg, 10 mol%) in anhydrous MeCN (2.0 mL) under N_2 atmosphere, and was stirred for 10 minutes.) was added via

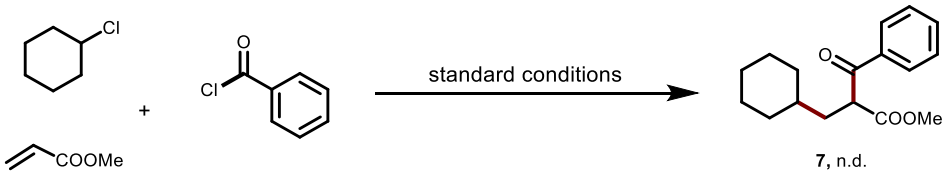
syringe. Then, it was capped with a Teflon lid equipped with Graphite Felt (20×10×15 mm) as the anode and reticulated vitreous carbon (20×10×1 mm) as the cathode. The reaction mixture was stirred under N_2 and electrolyzed at a constant current of 4 mA under irradiation by a 10-W 390-nm LED lamp with a cooling fan. After being stirred at 10 °C for 24 h, the reaction mixture was analyzed by GCMS.





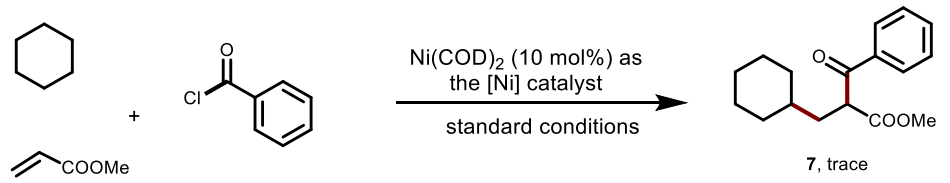
7, n.d.

A dry 10 mL vial equipped with a Teflon-coated magnetic stir bar was charged with benzoyl chloride (0.30 mmol, 1.0 equiv.), cyclohexane (3.0 mmol, 10 equiv.), methyl acrylate (0.90 mmol, 3.0 equiv.), $TBACIO_4$ (846.9 mg, 3.0 equiv.) and $FeCl_3·6H_2O$ (8.1 mg, 10 mol%) were dissolved in acetone (1.0 mL). Afterward, a pre-catalyst solution (it was prepared by a mix of $NiBr_2$·DME (6.6 mg, 10 mol%), 4,4'-di-tert-butyl-2,2'-bipyridine (8.1 mg, 10 mol%) in anhydrous MeCN (2.0 mL) under N_2 atmosphere, and was stirred for 10 minutes.) was added via syringe. Then, it was capped with a Teflon lid equipped with Graphite Felt (20×10×15 mm) as the anode and reticulated vitreous carbon (20×10×1 mm) as the cathode. The reaction mixture was stirred under N_2 and electrolyzed at a constant current of 4 mA under irradiation by a 10-W 390-nm LED lamp for 24 h. After the reaction is completed, the reaction mixture was analyzed by GCMS. We have no found the corresponding compound **7**.



7, n.d.

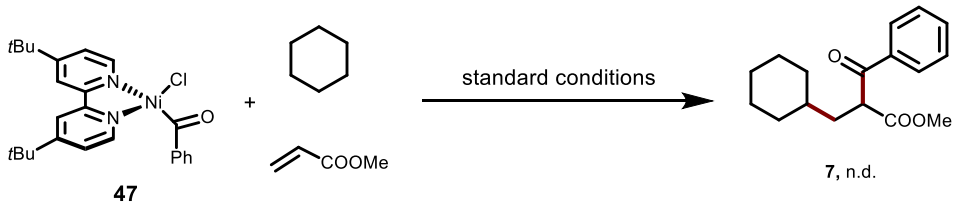
A dry 10 mL vial equipped with a Teflon-coated magnetic stir bar was charged with benzoyl chloride (0.30 mmol, 1.0 equiv.), chlorocyclohexane (3.0 mmol, 10 equiv.), methyl acrylate (0.90 mmol, 3.0 equiv.), LiCl (37.8 mg, 3.0 equiv.) and $FeCl_3 \cdot 6H_2O$ (8.1 mg, 10 mol%) were dissolved in acetone (1.0 mL). Afterward, a pre-catalyst solution (it was prepared by a mix of $NiBr_2 \cdot DME$ (6.6 mg, 10 mol%), 4,4'-di-tert-butyl-2,2'-bipyridine (8.1 mg, 10 mol%) in anhydrous MeCN (2.0 mL) under N_2 atmosphere, and was stirred for 10 minutes.) was added via syringe. Then, it was capped with a Teflon lid equipped with Graphite Felt (20×10×15 mm) as the anode and reticulated vitreous carbon (20×10×1 mm) as the cathode. The reaction mixture was stirred under N_2 and electrolyzed at a constant current of 4 mA under irradiation by a 10-W 390-nm LED lamp for 24 h. After the reaction is completed, the reaction mixture was analyzed by GCMS. We have no found the corresponding compound **7**.



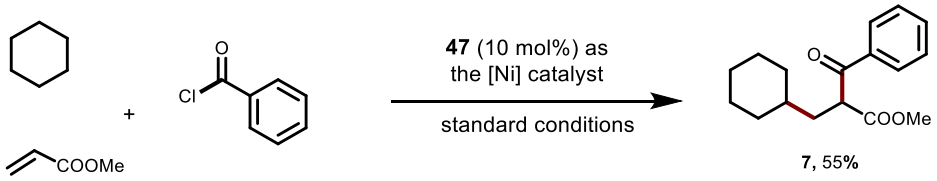
7, trace

A dry 10 mL vial equipped with a Teflon-coated magnetic stir bar was charged with benzoyl chloride (0.30 mmol, 1.0 equiv.), cyclohexane (3.0 mmol, 10 equiv.), methyl acrylate (0.90 mmol, 3.0 equiv.), LiCl (37.8 mg, 3.0 equiv.) and $FeCl_3 \cdot 6H_2O$ (8.1 mg, 10 mol%) were dissolved in acetone (1.0 mL). Afterward, $Ni(COD)_2$ (0.03 mmol. 10 mol%) in anhydrous MeCN (2.0 mL) under N_2 atmosphere, and was stirred for 10 minutes.) was added via syringe. Then, it was capped with a Teflon lid equipped with Graphite Felt (20×10×15 mm) as the anode and reticulated vitreous carbon (20×10×1 mm) as the cathode. The reaction mixture was stirred under N_2 and electrolyzed at a constant current of 4 mA with a cooling fan to keep the reaction temperature at 10 ºC under irradiation by a 10-W 390-nm LED lamp for 24 h. After the reaction was

completed, the reaction mixture was analyzed by GCMS.

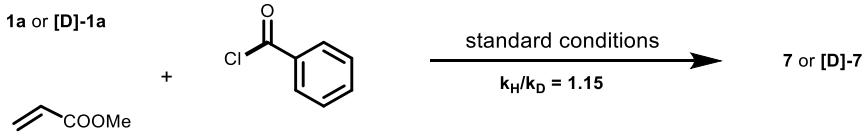


A dry 10 mL vial equipped with a Teflon-coated magnetic stir bar was charged with cyclohexane (3.0 mmol, 10 equiv.), methyl acrylate (0.90 mmol, 3.0 equiv.), LiCl (37.8 mg, 3.0 equiv.) and $FeCl_3 \cdot 6H_2O$ (8.1 mg, 10 mol%) were dissolved in acetone (1.0 mL). Afterward, complex **47** (0.3 mmol, 1.0 equiv.) in anhydrous MeCN (2.0 mL) under N_2 atmosphere, and was stirred for 10 minutes.) was added via syringe. Then, it was capped with a Teflon lid equipped with Graphite Felt (20×10×15 mm) as the anode and reticulated vitreous carbon (20×10×1 mm) as the cathode. The reaction mixture was stirred under N_2 and electrolyzed at a constant current of 4 mA under irradiation by a 10-W 390-nm LED lamp with a cooling fan to keep the reaction temperature at 10 ºC for 24 h. After the reaction was completed, the reaction mixture was analyzed by GCMS.

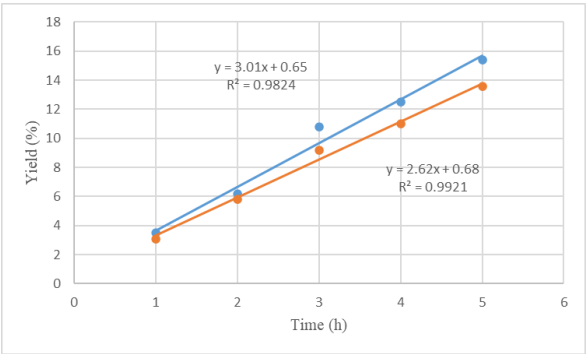


A dry 10 mL vial equipped with a Teflon-coated magnetic stir bar was charged with benzoyl chloride (0.30 mmol, 1.0 equiv.), cyclohexane (3.0 mmol, 10 equiv.), methyl acrylate (0.90 mmol, 3.0 equiv.), LiCl (37.8 mg, 3.0 equiv.) and $FeCl_3 \cdot 6H_2O$ (8.1 mg, 10 mol%) were dissolved in acetone (1.0 mL). Afterward, complex **47** (0.03 mmol. 10 mol%) in anhydrous MeCN (2.0 mL) under N_2 atmosphere, and was stirred for 10 minutes.) was added via syringe. Then, it was capped with a Teflon lid equipped with Graphite Felt (20×10×15 mm) as the anode and reticulated vitreous carbon (20×10×1 mm) as the cathode. The reaction mixture was stirred under N_2 and electrolyzed at a constant current of 4 mA with a cooling fan to keep the reaction temperature at 10 ºC under irradiation by a 10-W 390-nm LED lamp for 24 h. After the reaction was

completed, the reaction mixture was analyzed by gas chromatography to obtain the yield of **7** using dodecane as an internal standard.

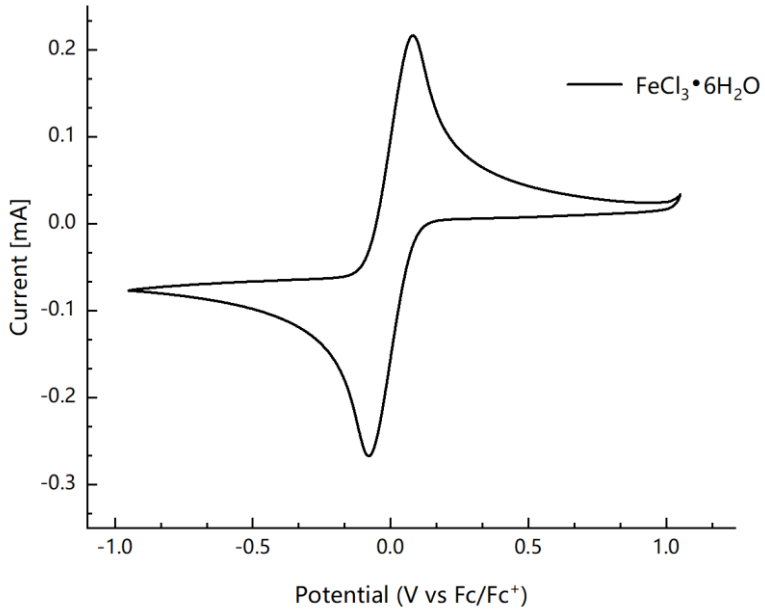


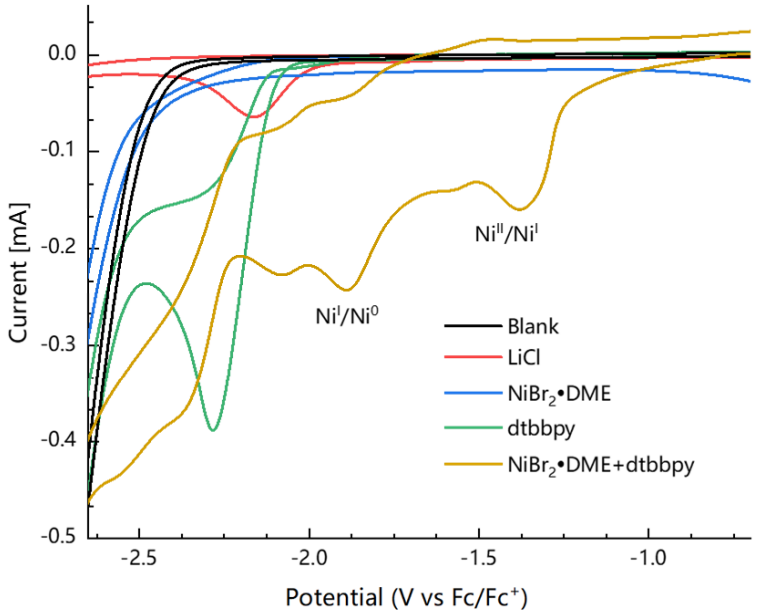
A dry 10 mL vial equipped with a Teflon-coated magnetic stir bar was charged with benzoyl chloride (0.30 mmol, 1.0 equiv.), **1a** or **[D]-1a** (3.0 mmol, 10 equiv.), methyl acrylate (0.90 mmol, 3.0 equiv.), LiCl (37.8 mg, 3.0 equiv.) and $FeCl_3 \cdot 6H_2O$ (8.1 mg, 10 mol%) were dissolved in acetone (1.0 mL). Afterward, a pre-catalyst solution (it was prepared by a mix of $NiBr_2 \cdot DME$ (6.6 mg, 10 mol%), 4,4'-di-tert-butyl-2,2'-bipyridine (8.1 mg, 10 mol%) in anhydrous MeCN (2.0 mL) under N_2 atmosphere, and was stirred for 10 minutes.) was added via syringe. Then, it was capped with a Teflon lid equipped with Graphite Felt (20×10×15 mm) as the anode and reticulated vitreous carbon (20×10×1 mm) as the cathode. The reaction mixture was stirred under N_2 and electrolyzed at a constant current of 4 mA with a cooling fan to keep the reaction temperature at 10 ºC under irradiation by a 10-W 390-nm LED lamp for the indicated time (five parallel runs). After the reaction was completed, the reaction mixture was analyzed by gas chromatography to obtain the yield of **7** using dodecane as an internal standard. KIE value was measured averaging the slopes obtained for each run, and kH/kD = 1.15 was obtained.



6. Cyclic Voltammetry (CV) Measurements

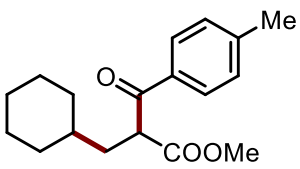
All measurements were performed under anhydrous conditions in argon-filled glovebox. All supporting electrolytes were dried under dynamic vacuum (less than 0.1 mbar) over 24 h at 100 °C and stored inside the glovebox. The cell for the analysis was equipped with a glass vial (working volume is 10 mL) and Teflon cap, equipped with O-ring for tight sealing. Glassy carbon was used as working electrodes (circle, d = 3 mm), and an Ag/AgCl as the reference electrode. Each sample was calibrated against the Fc/Fc^{+} reference. All measurements were conducted in 0.1 M solutions of nBu_4NPF_6 in MeCN/acetone (2/1). All analyte concentration was 10 mM. The scan rate was typically 50 mV/s.

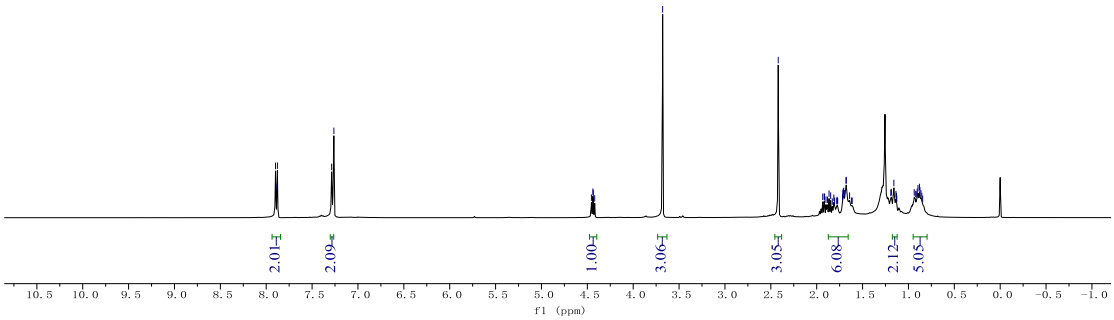


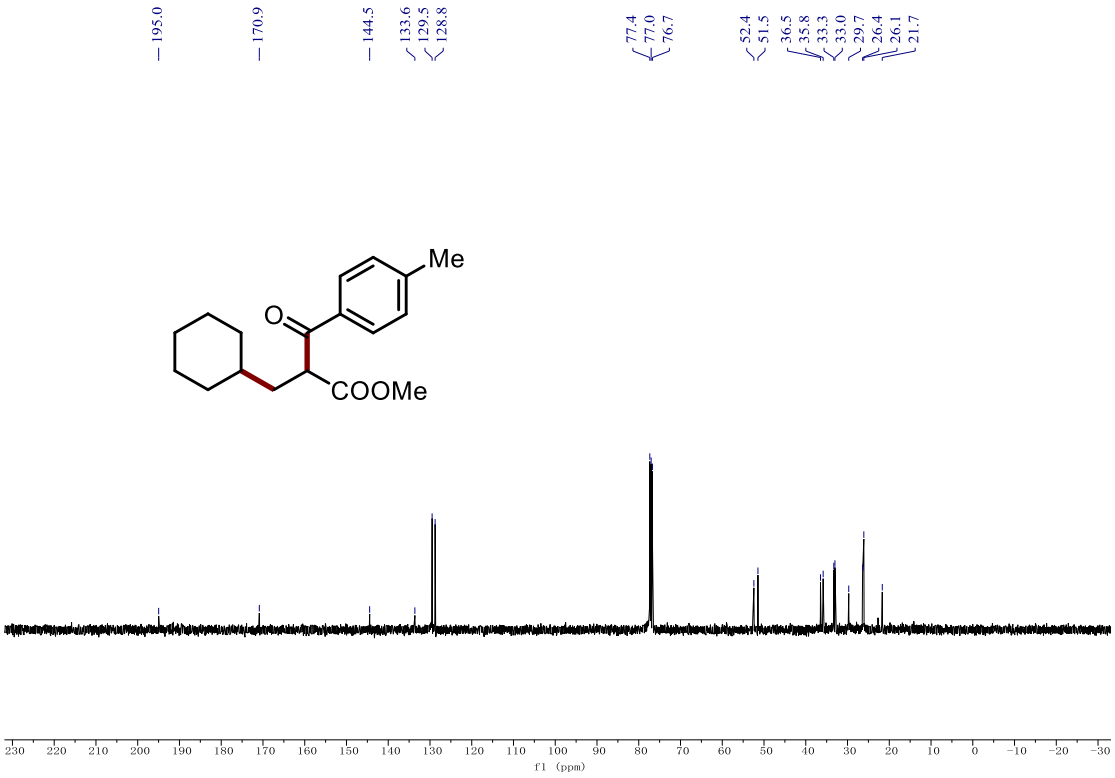


7. NMR Spectra

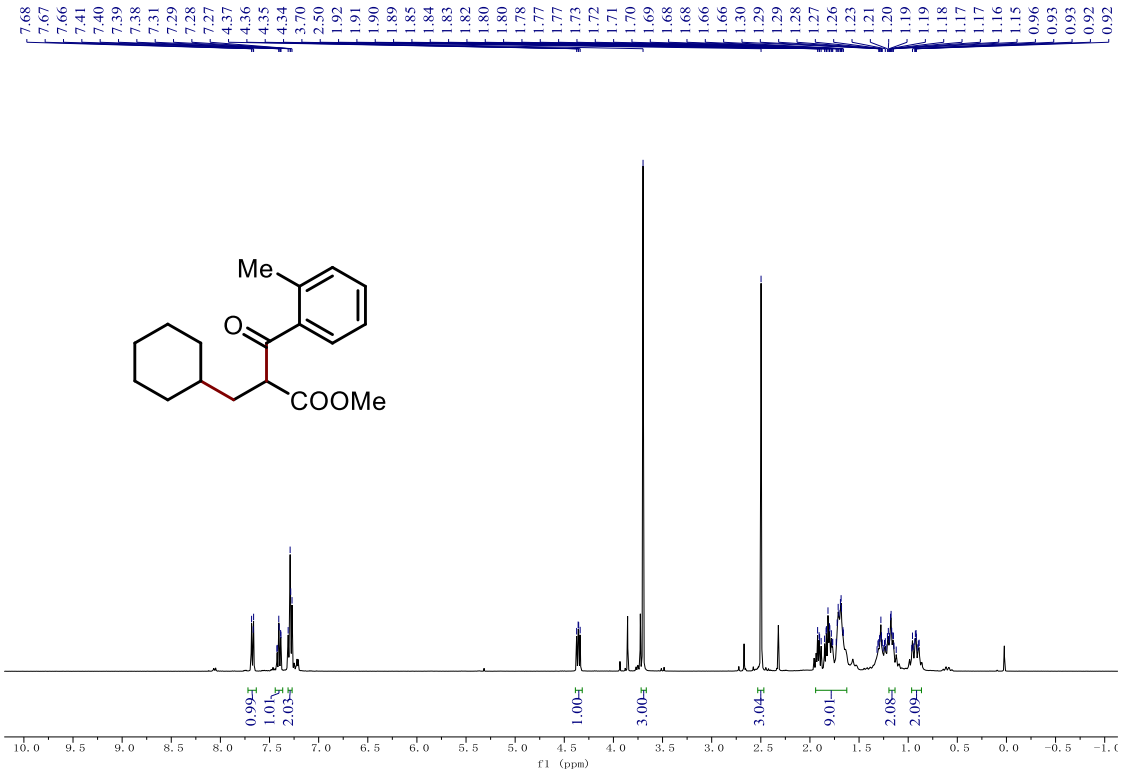
Methyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (4)

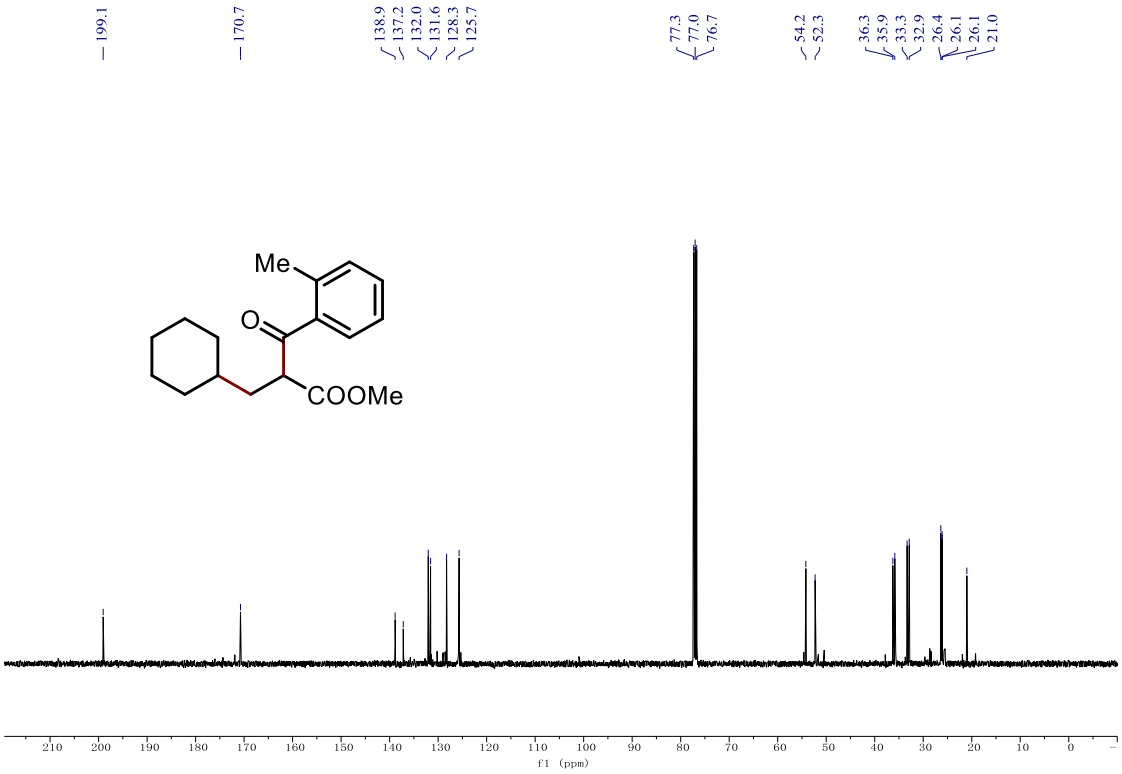




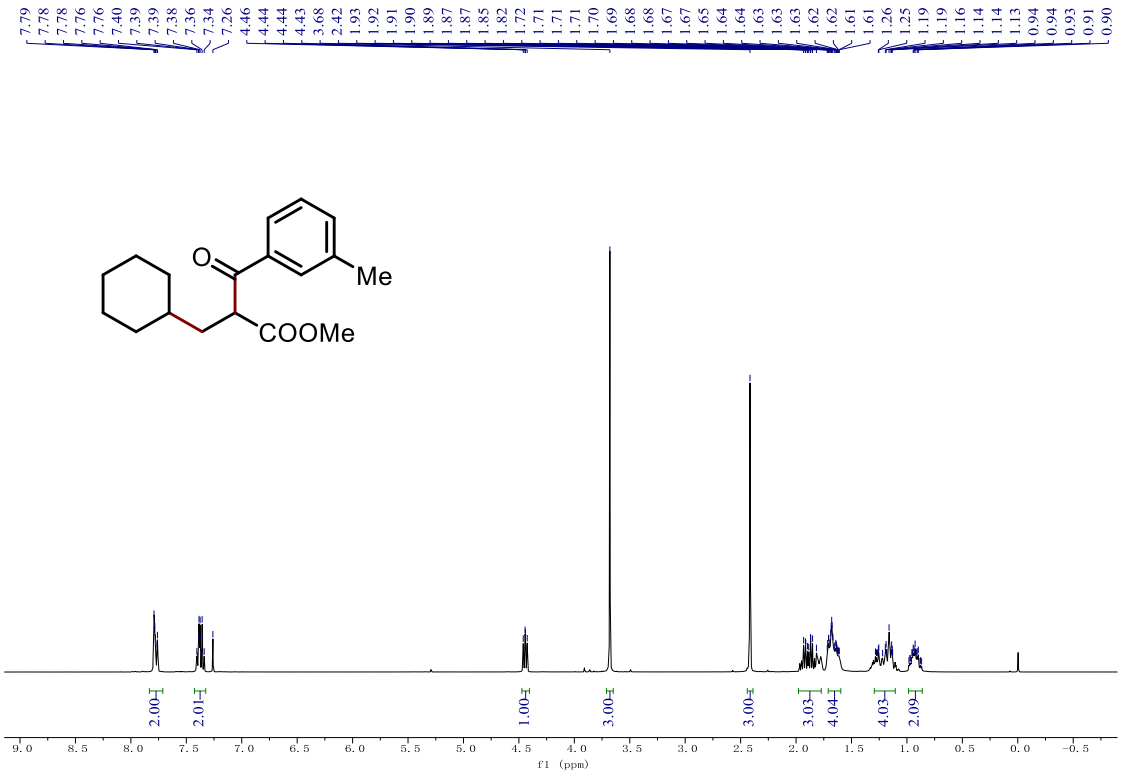


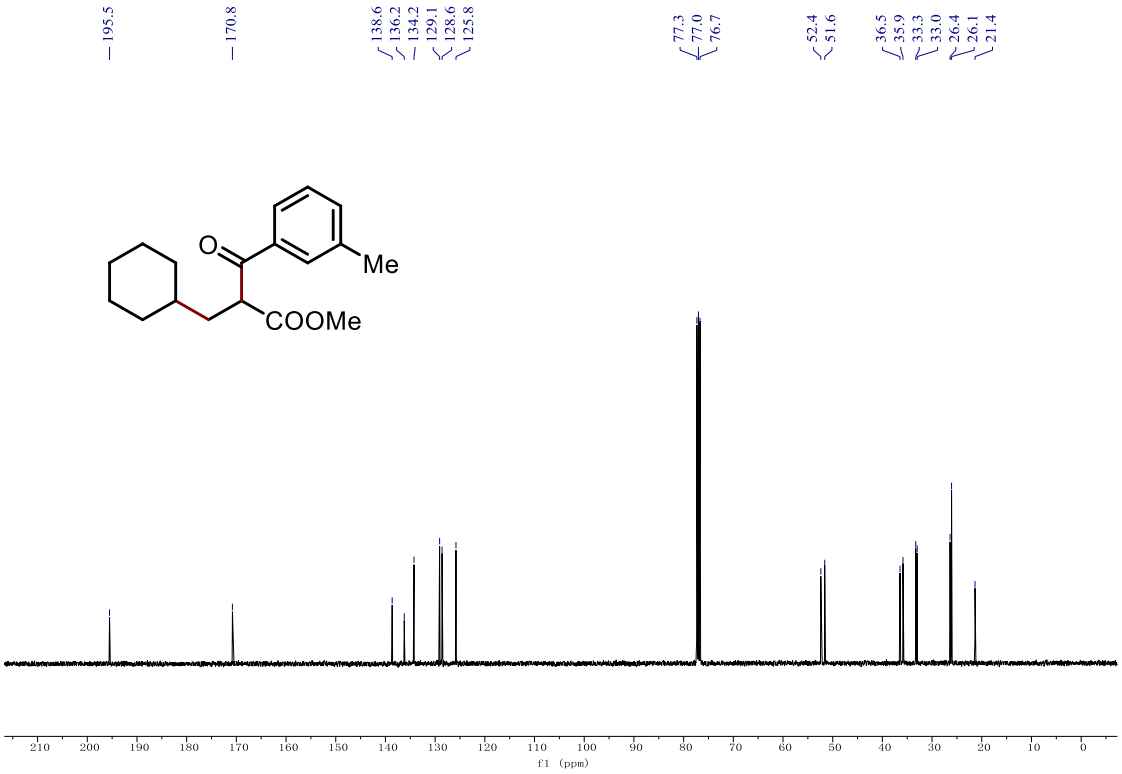
Methyl 2-(cyclohexylmethyl)-3-oxo-3-(o-tolyl)propanoate (5)



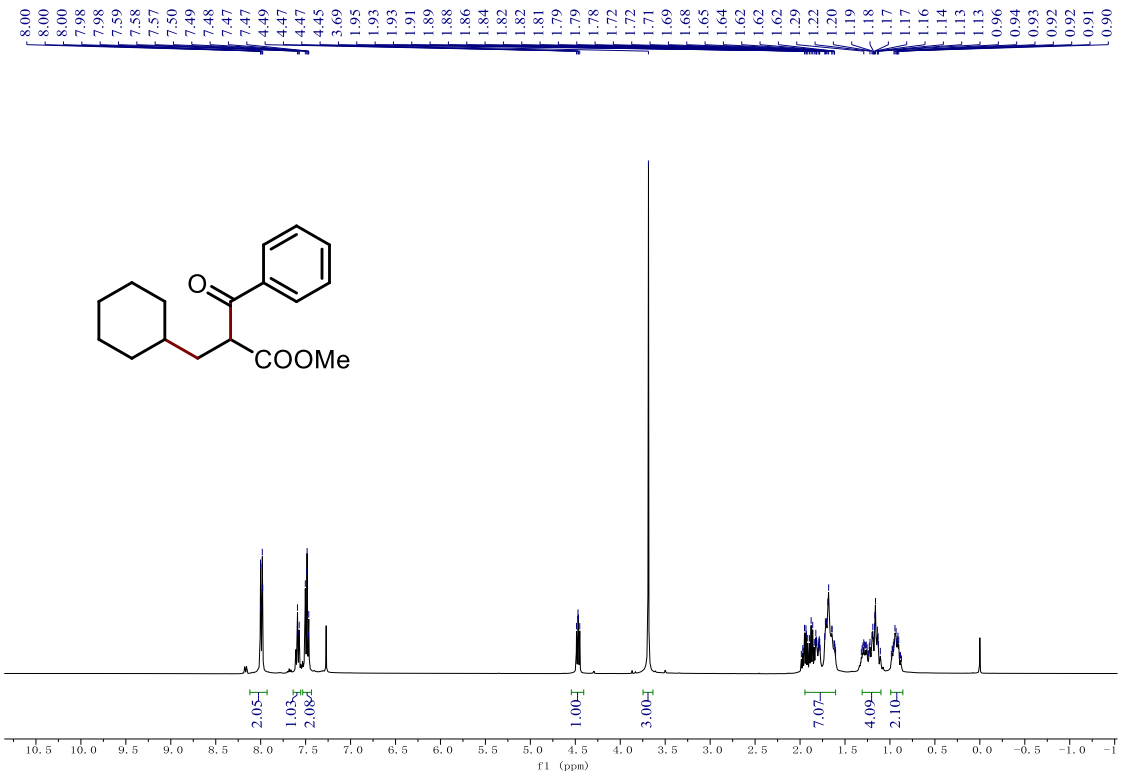


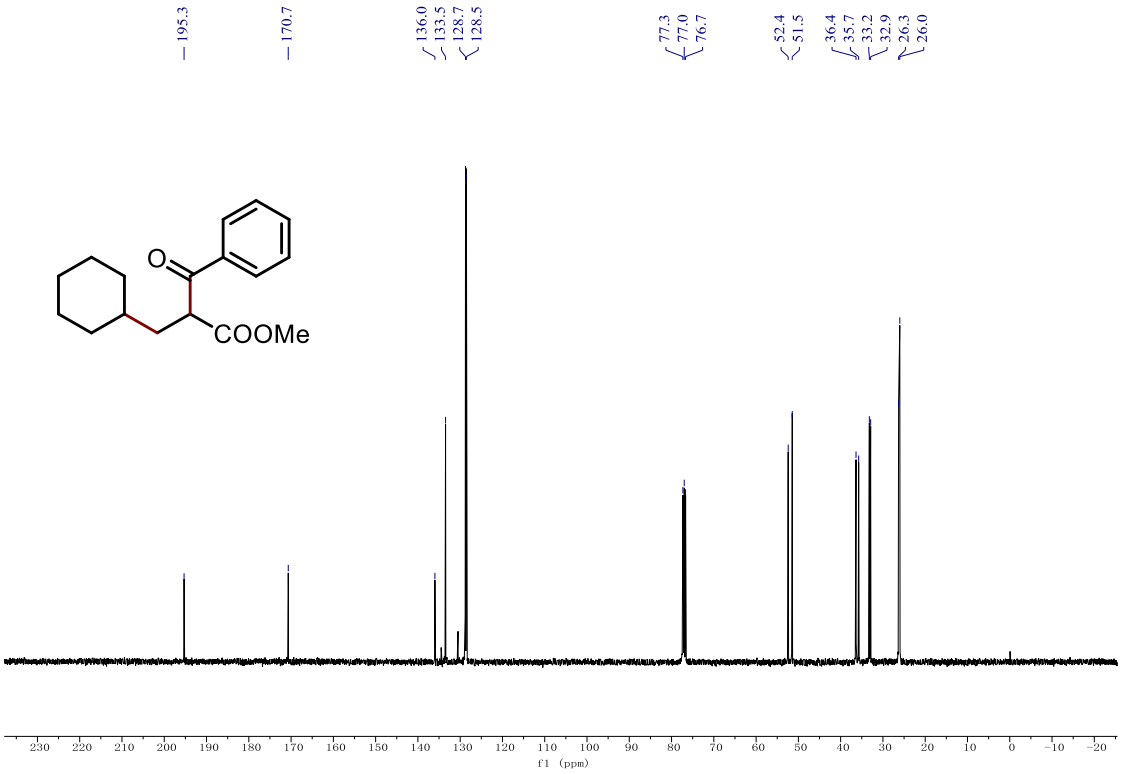
Methyl -2-(cyclohexylmethyl)-3-oxo-3-(m-tolyl)propanoate (6)



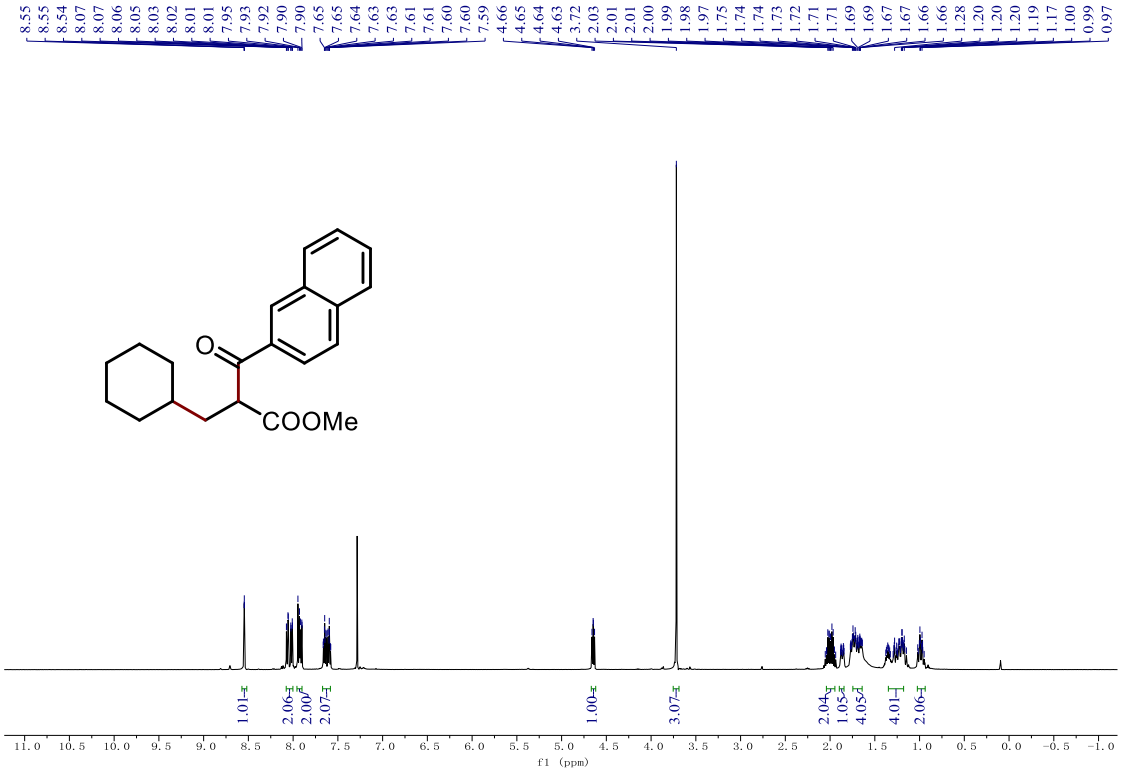


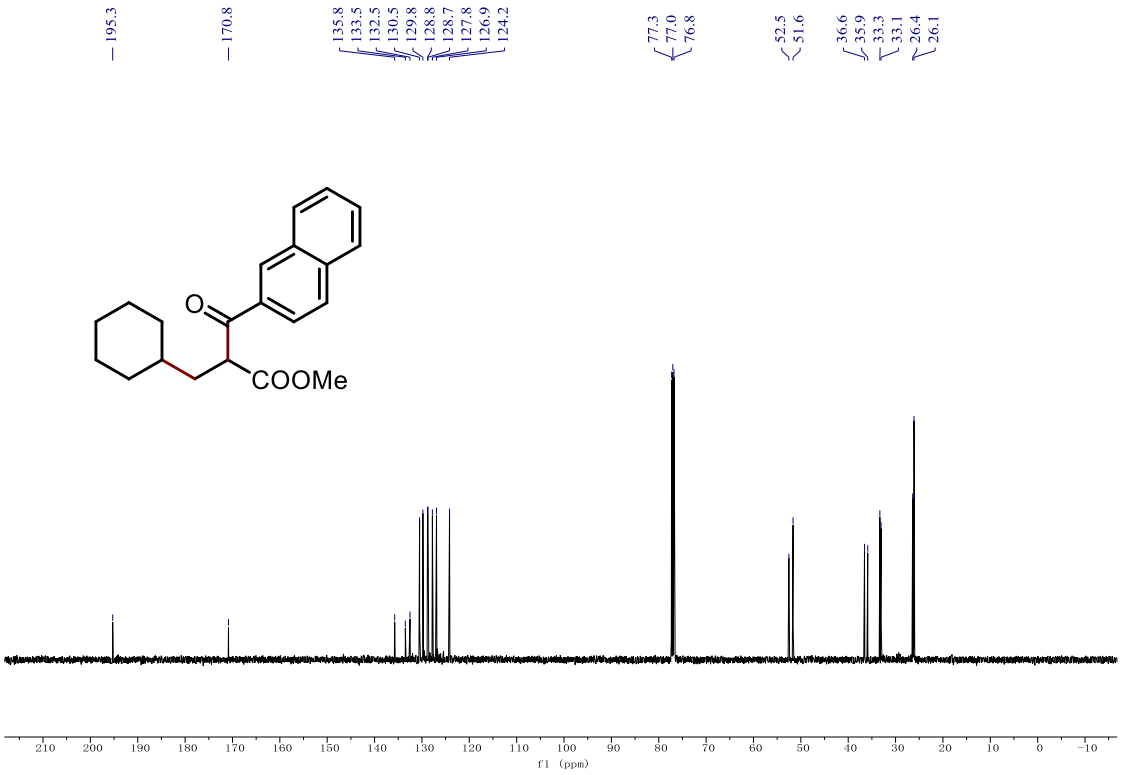
Methyl 2-(cyclohexylmethyl)-3-oxo-3-phenylpropanoate (7)



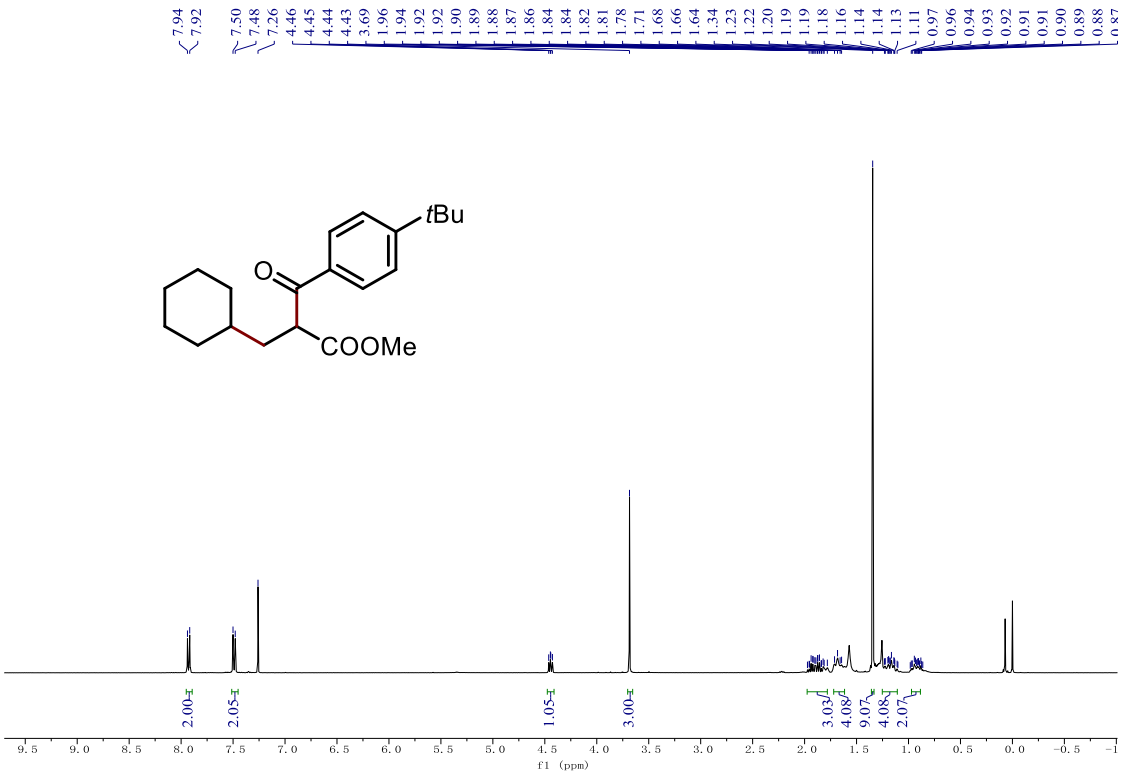


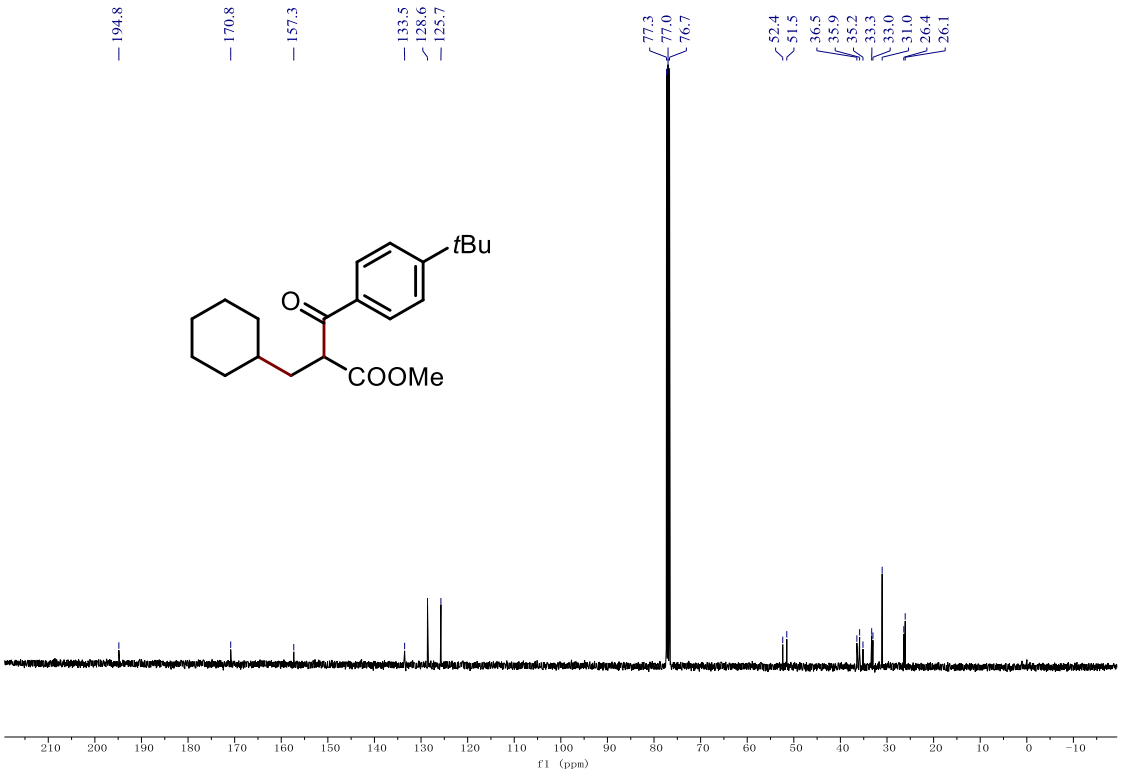
Methyl 2-(cyclohexylmethyl)-3-(naphthalen-2-yl)-3-oxopropanoate (8)



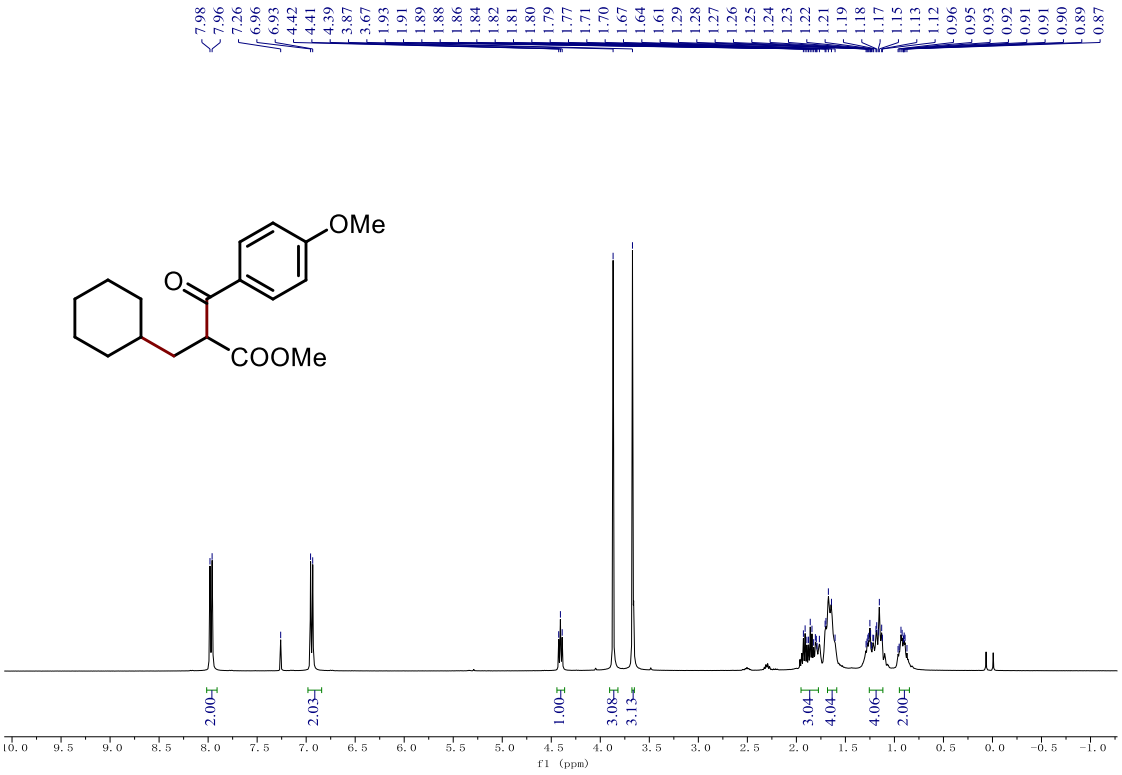


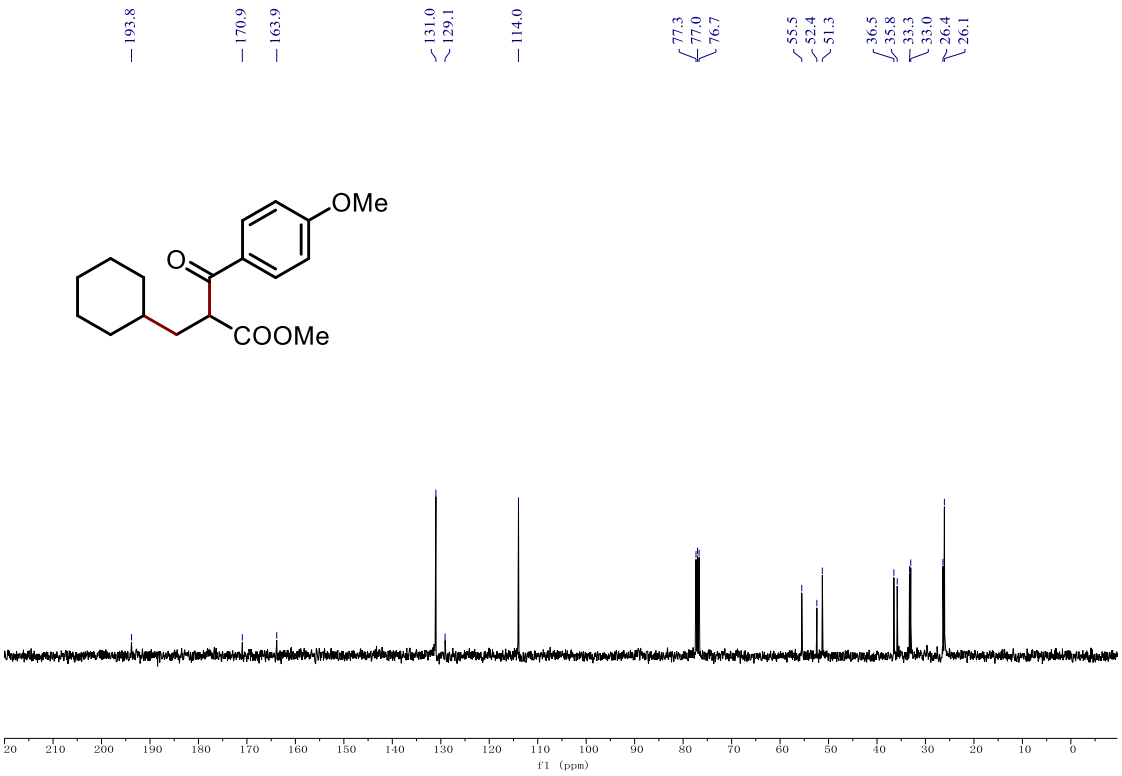
Methyl 3-(4-(tert-butyl)phenyl)-2-(cyclohexylmethyl)-3-oxopropanoate (9)



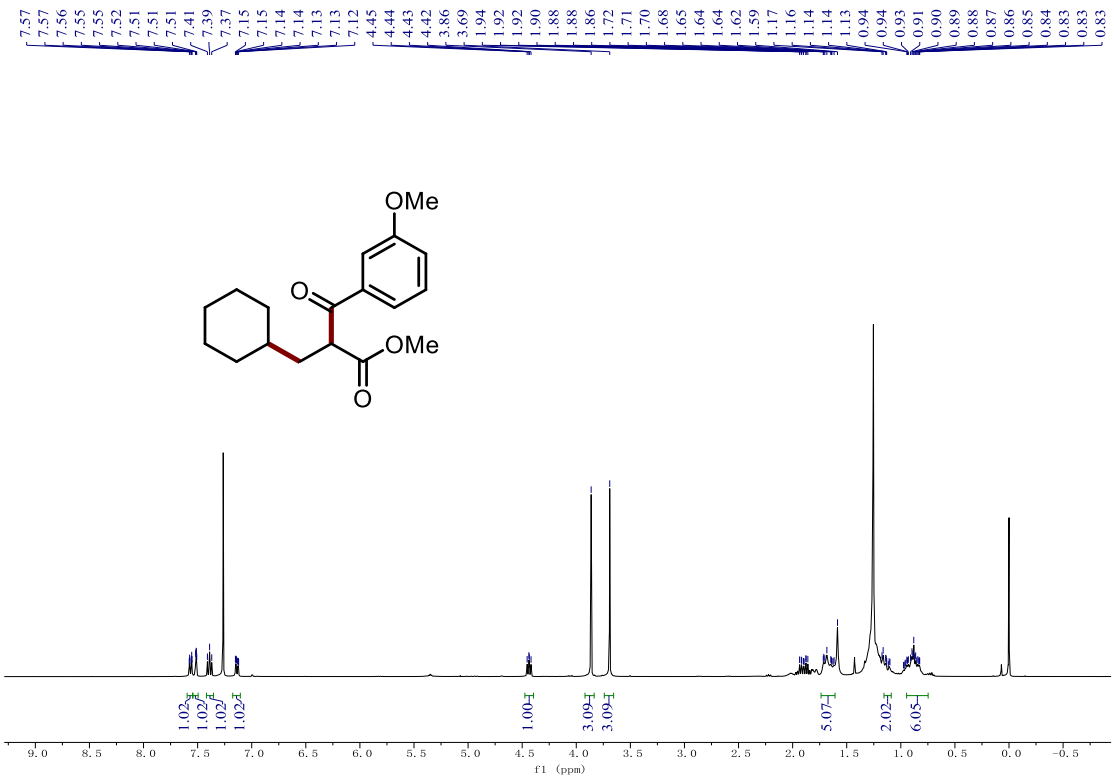


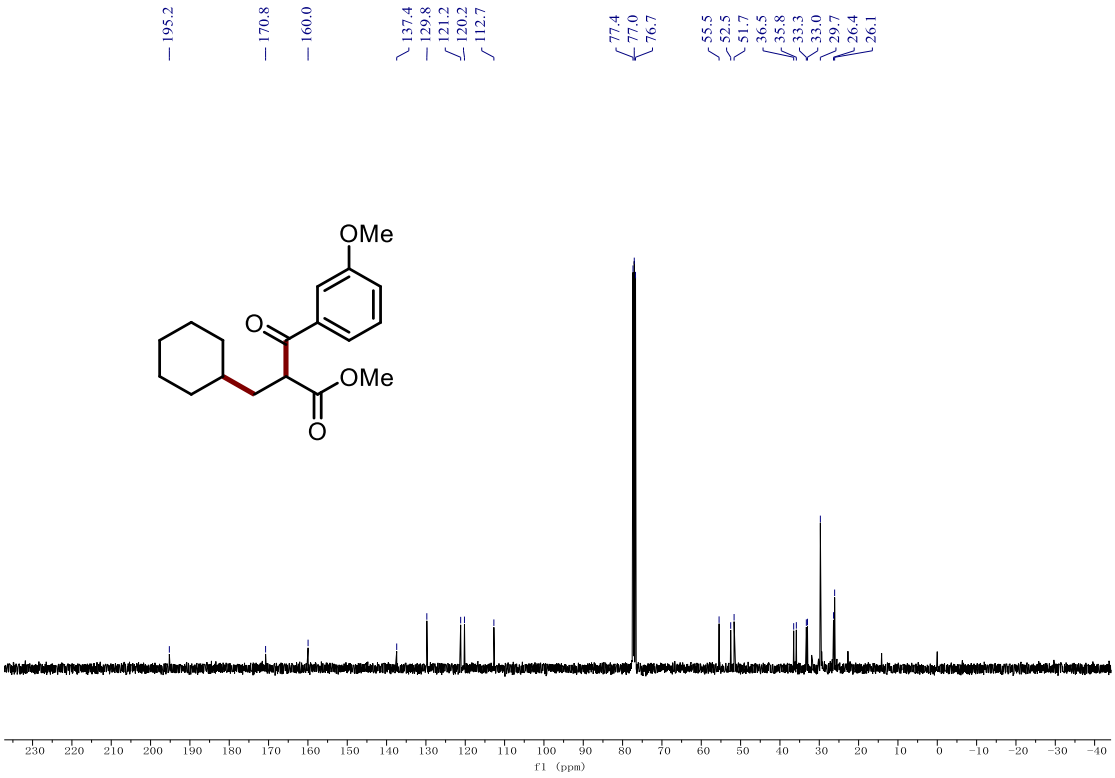
Methyl 2-(cyclohexylmethyl)-3-(4-methoxyphenyl)-3-oxopropanoate (10)



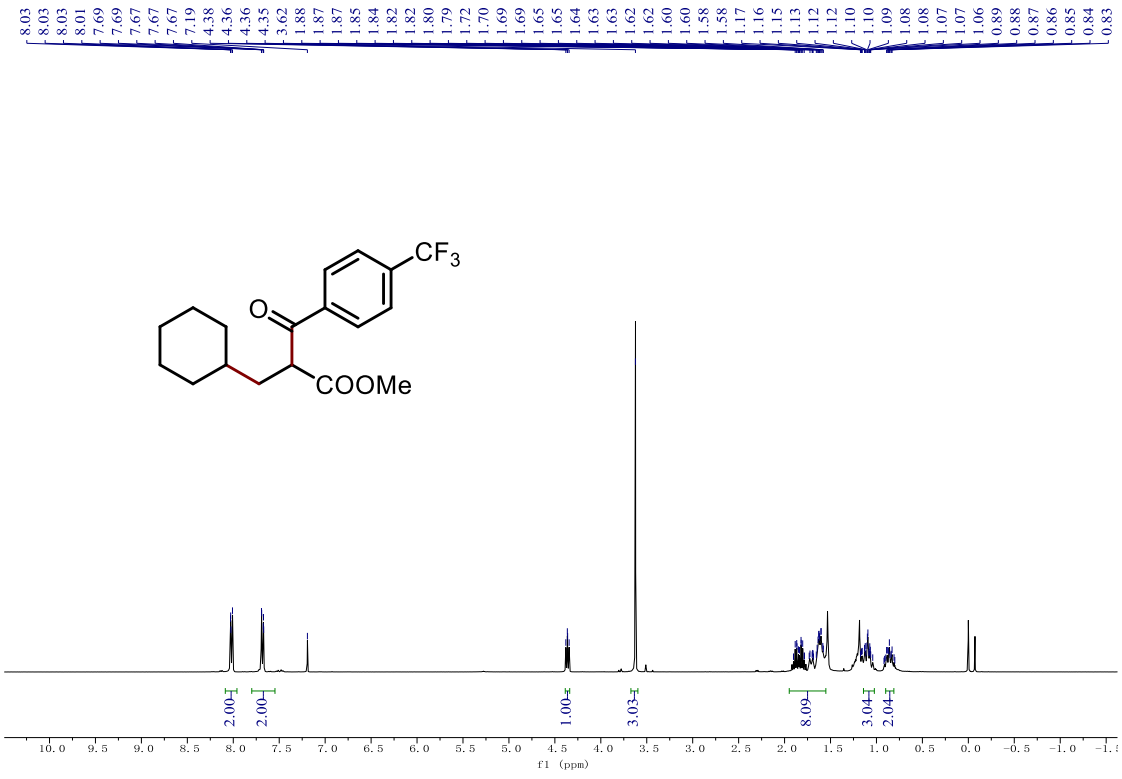


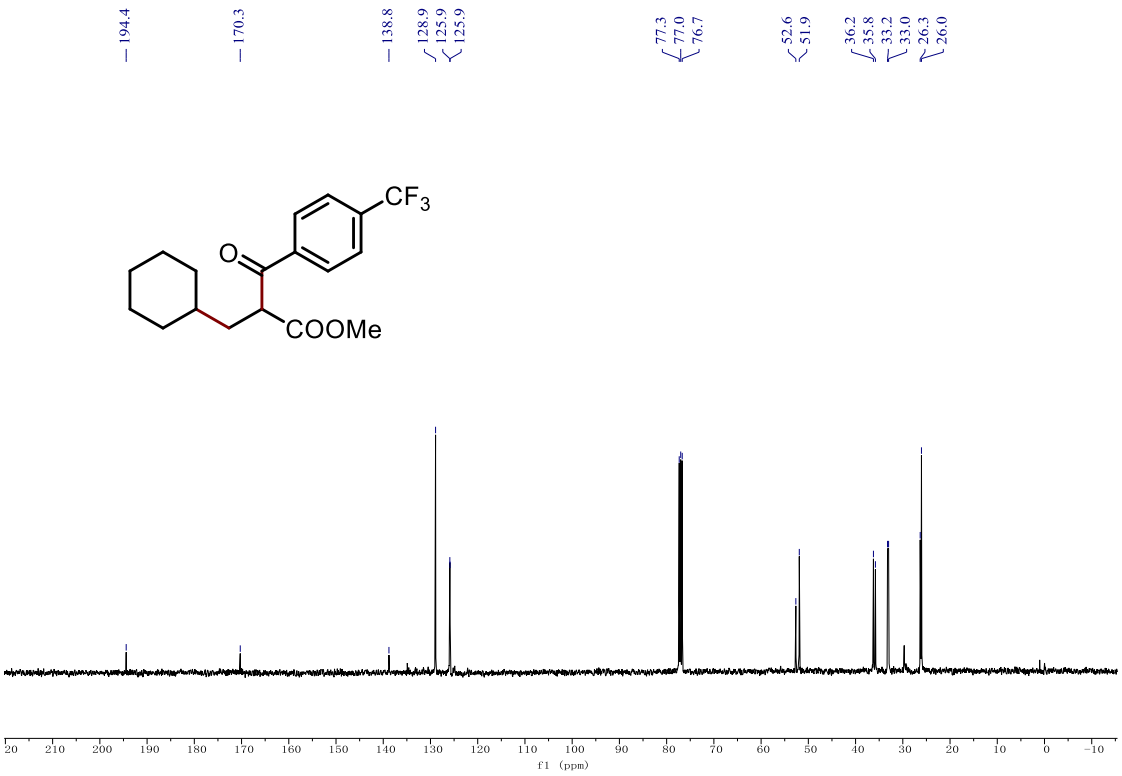
Methyl 2-(cyclohexylmethyl)-3-(3-methoxyphenyl)-3-oxopropanoate (11)

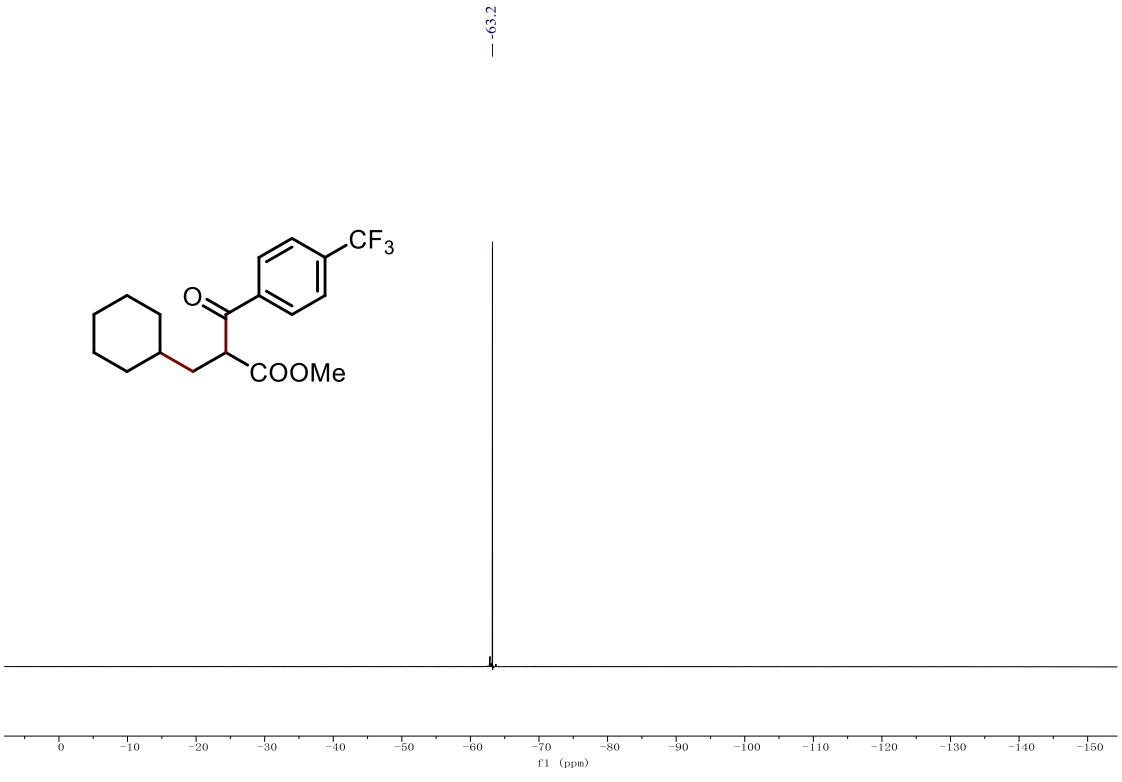




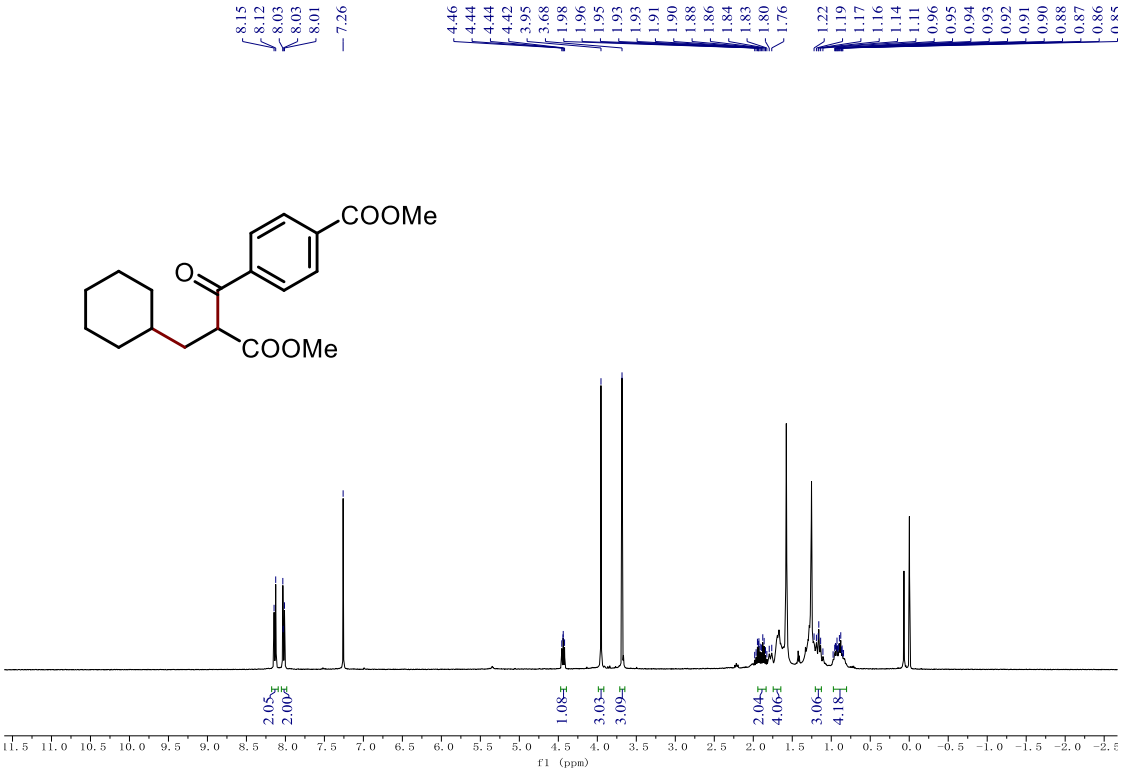
Methyl 2-(cyclohexylmethyl)-3-oxo-3-(4-(trifluoromethyl)phenyl)propanoate (12)

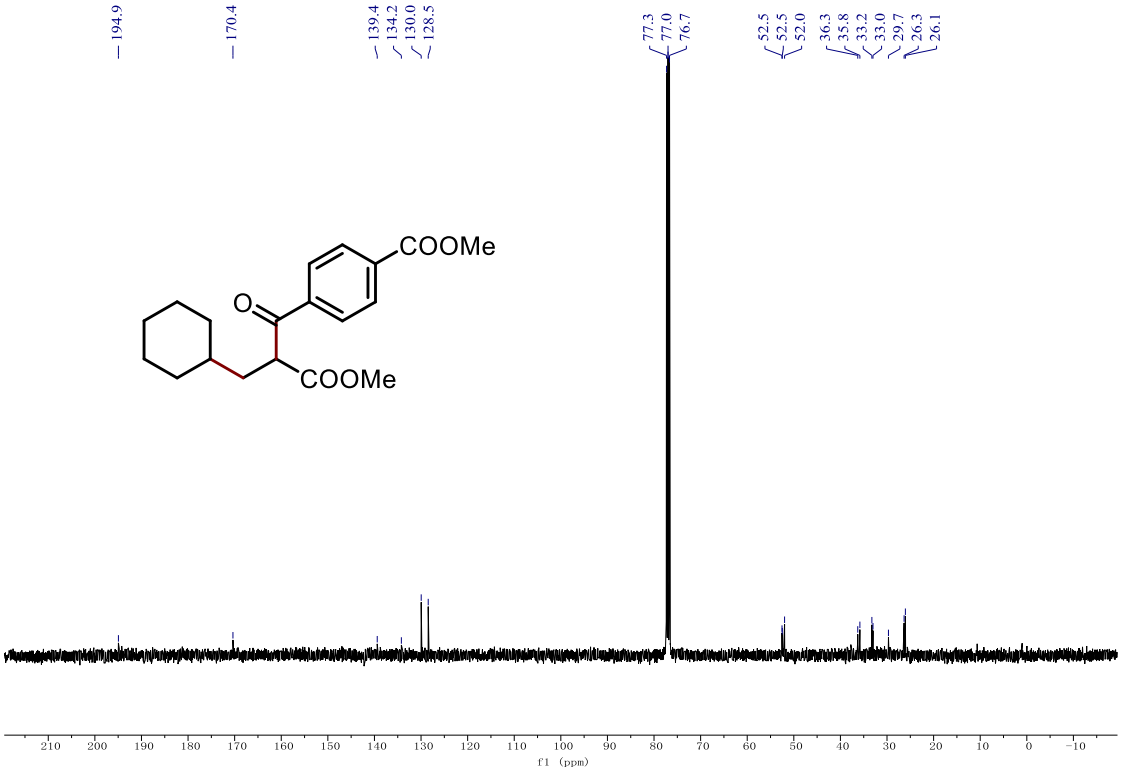



194.4
170.3
138.8
128.9
125.9
125.9
77.3
77.0
76.7
52.6
51.9
36.2
35.8
33.2
33.0
26.3
26.0
CF3
O
COOMe
f1 (ppm)

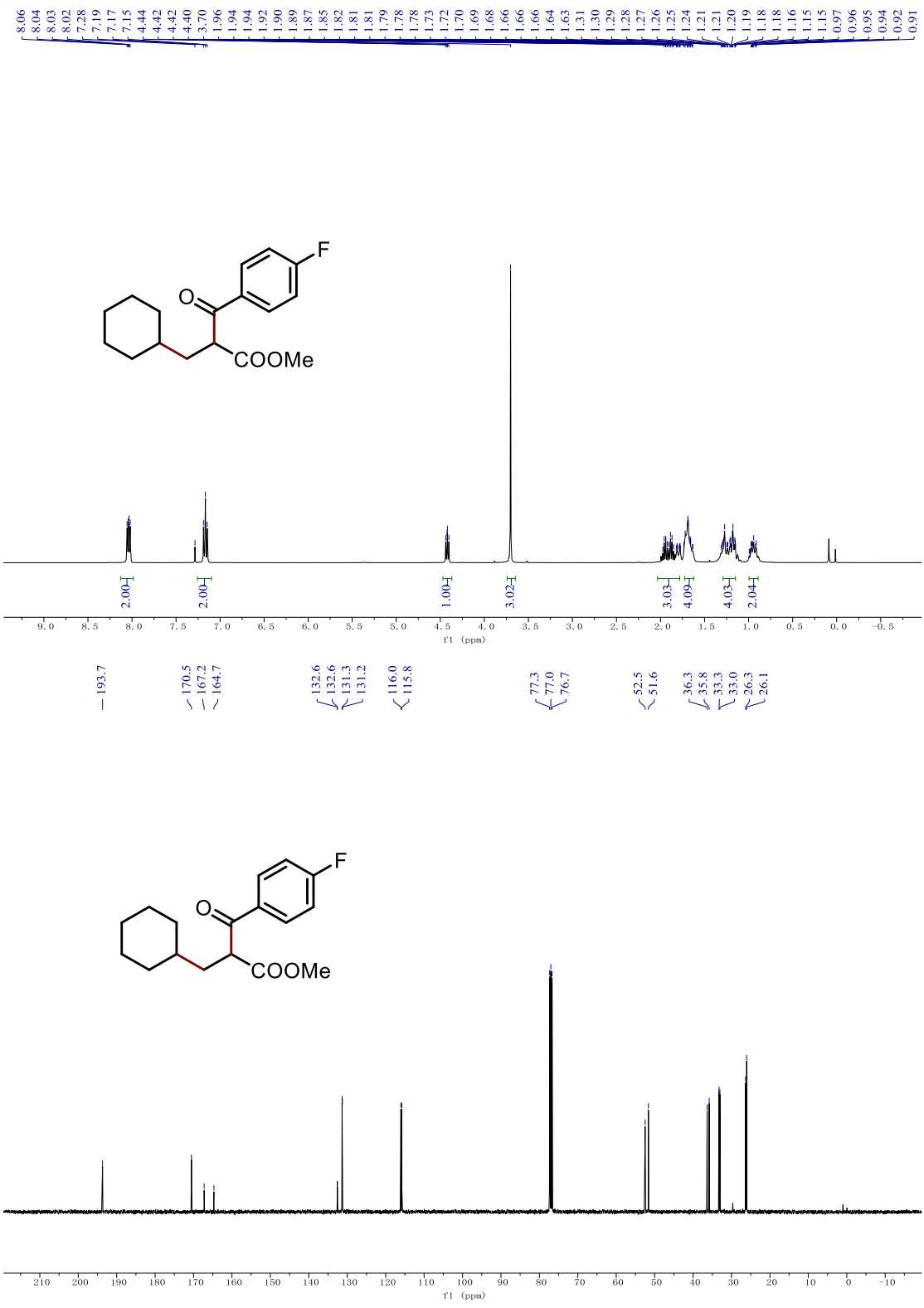

-63.2
CF3
O
COOMe
f1 (ppm)

Methyl 4-(2-(cyclohexylmethyl)-3-methoxy-3-oxopropanoyl)benzoate (13)



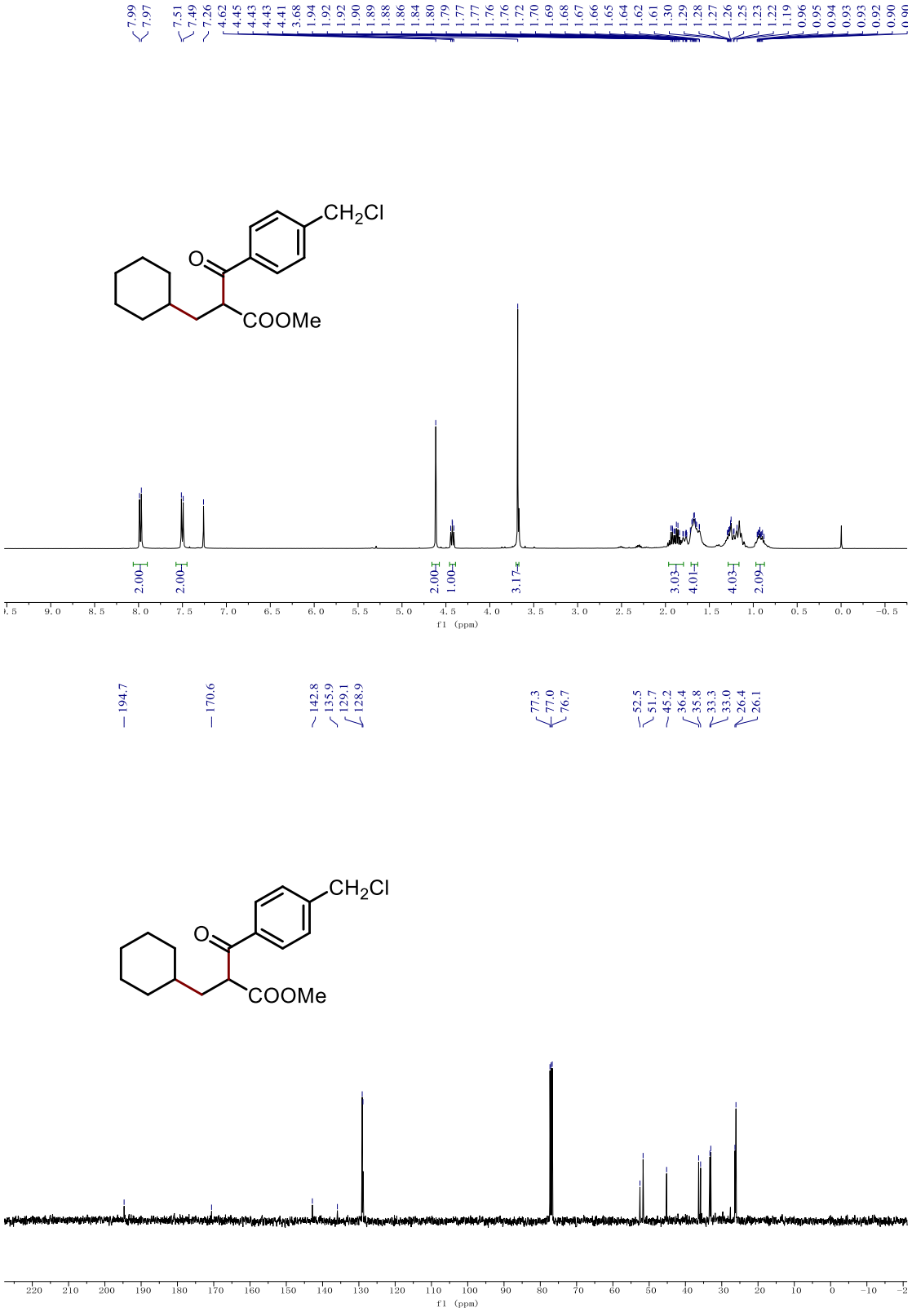


Methyl 2-(cyclohexylmethyl)-3-(4-fluorophenyl)-3-oxopropanoate (14)

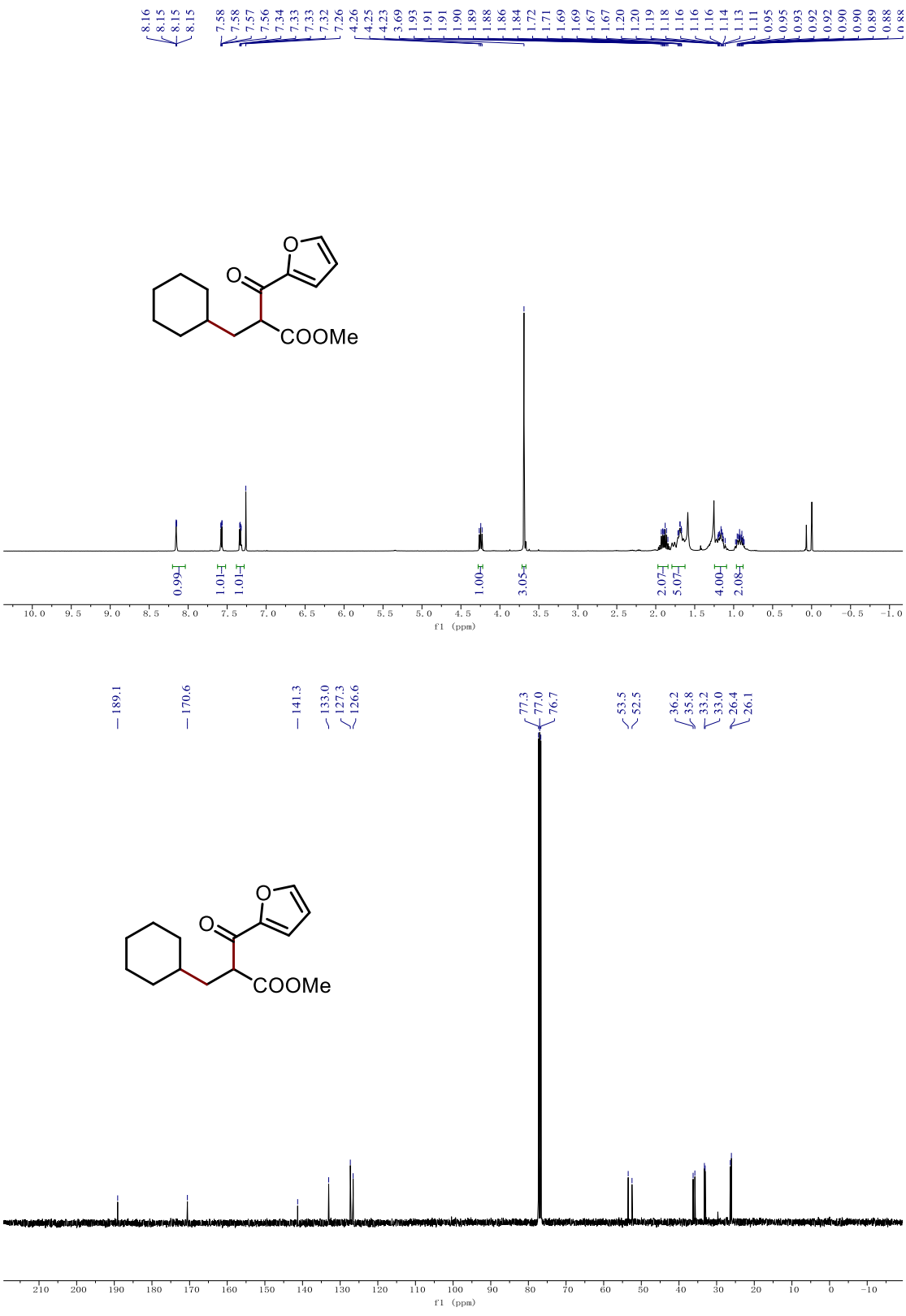


Methyl 3-(4-chlorophenyl)-2-(cyclohexylmethyl)-3-oxopropanoate (15)

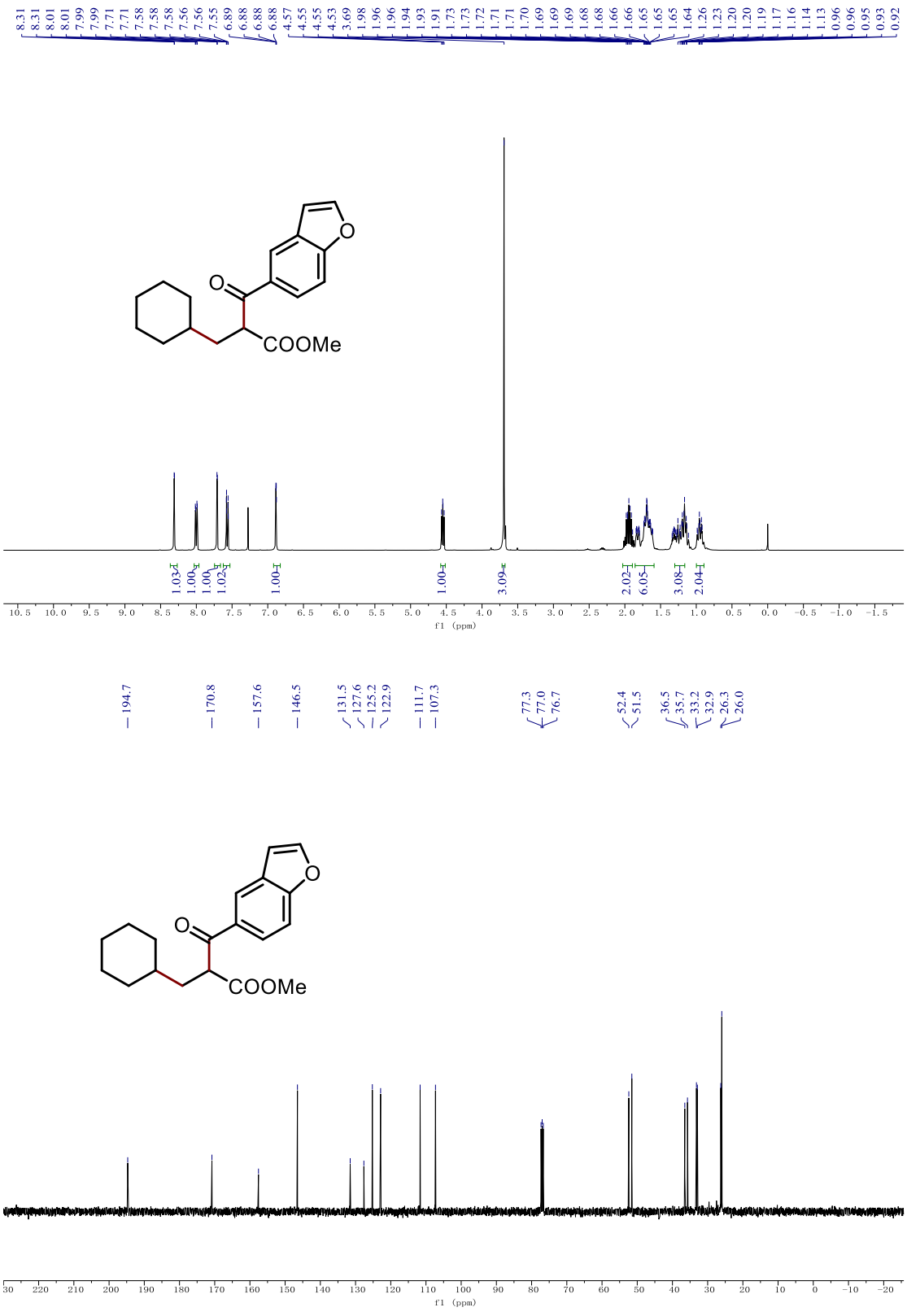
Methyl 3-(4-(chloromethyl)phenyl)-2-(cyclohexylmethyl)-3-oxopropanoate (16)



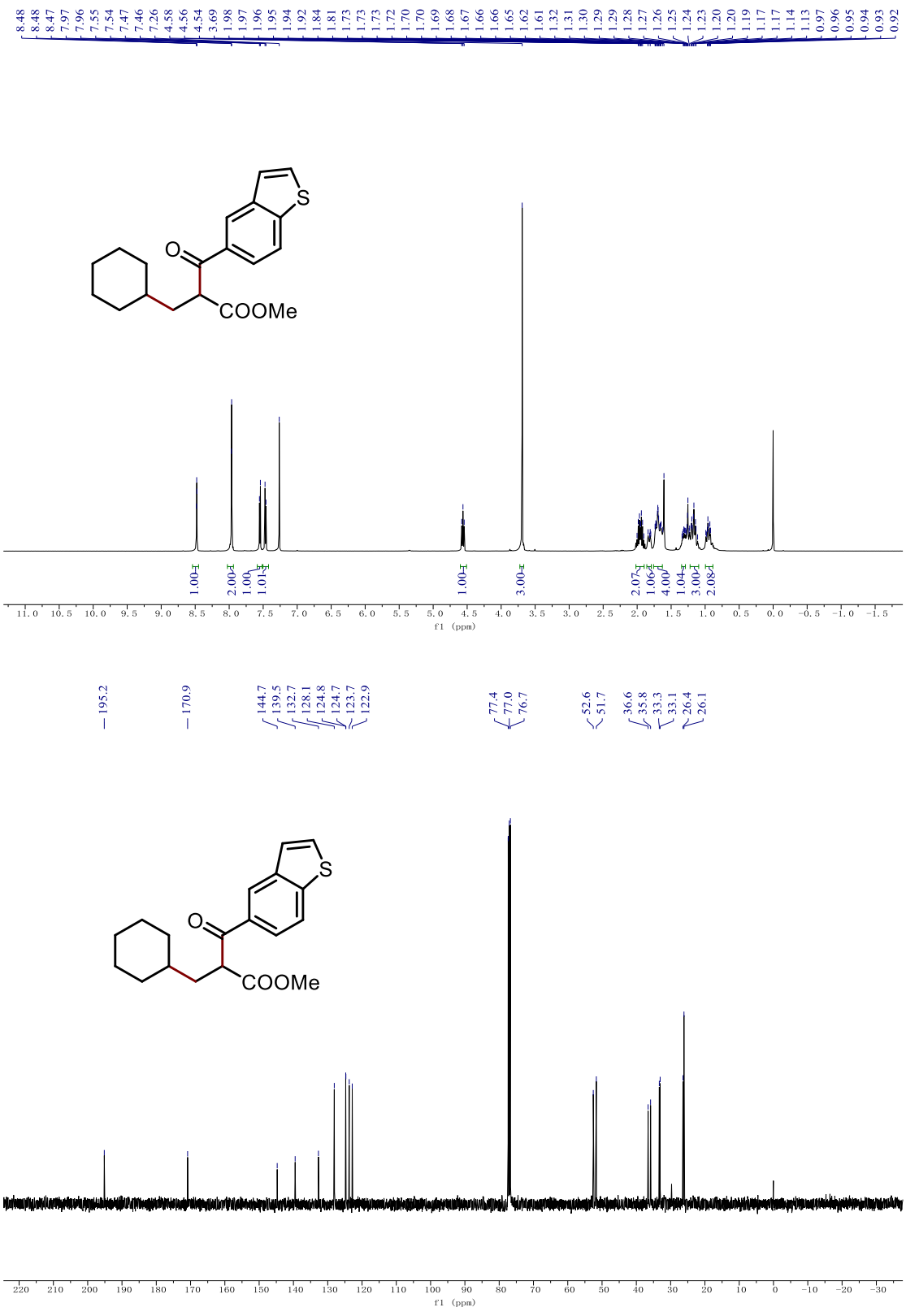
Methyl 2-(cyclohexylmethyl)-3-(furan-2-yl)-3-oxopropanoate (17)



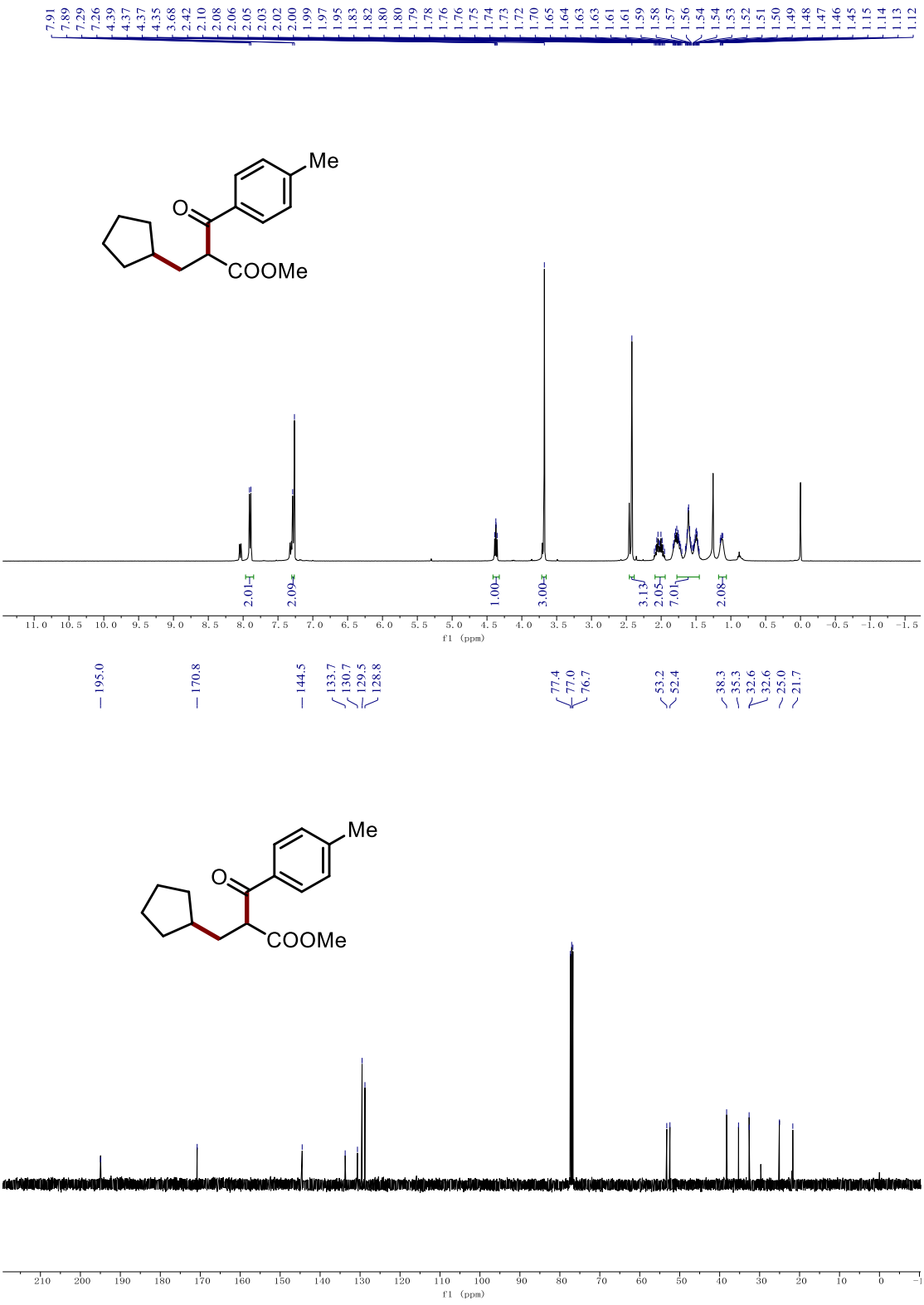
Methyl 3-(benzofuran-5-yl)-2-(cyclohexylmethyl)-3-oxopropanoate (18)



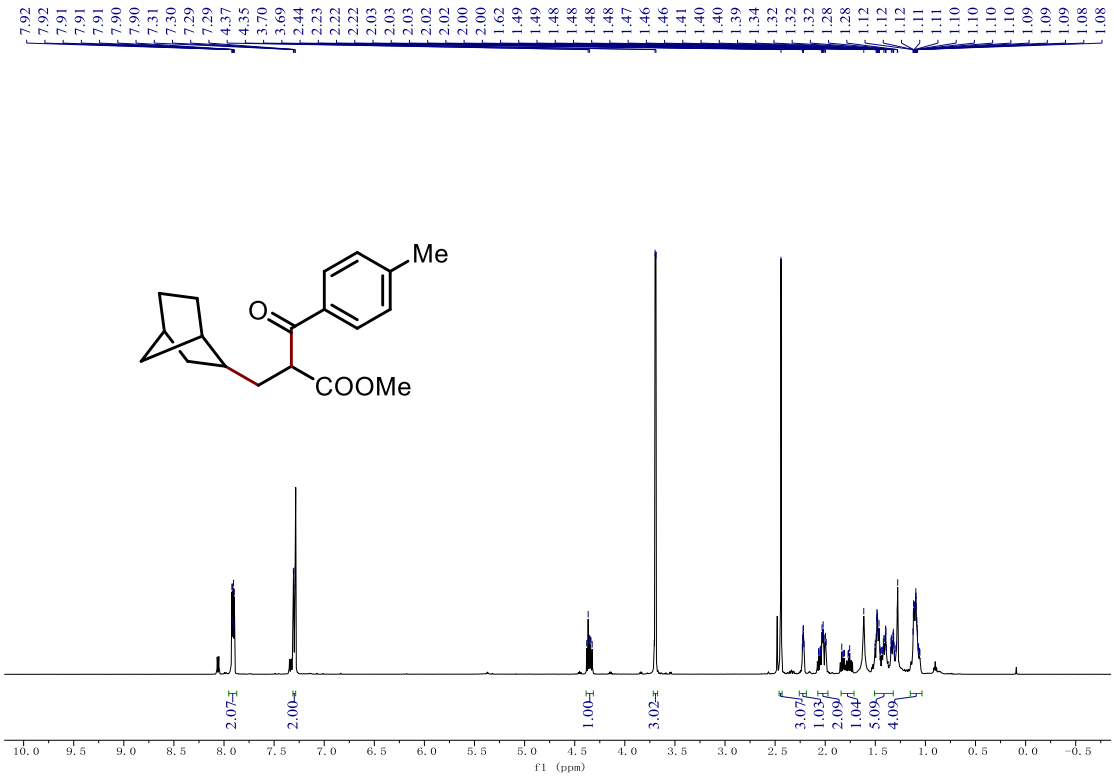
Ethyl 2-(3-methylbenzoyl)-4-oxooctanoate (19)

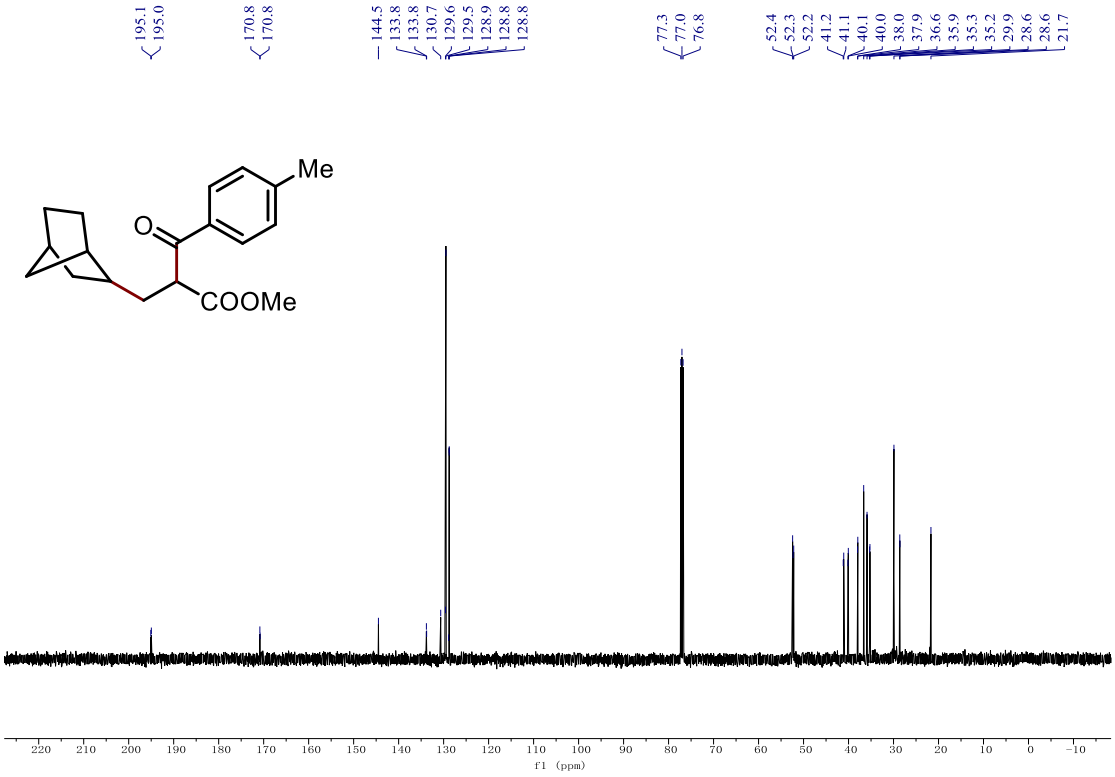


Methyl 2-(cyclopentylmethyl)-3-oxo-3-(p-tolyl)propanoate (20)

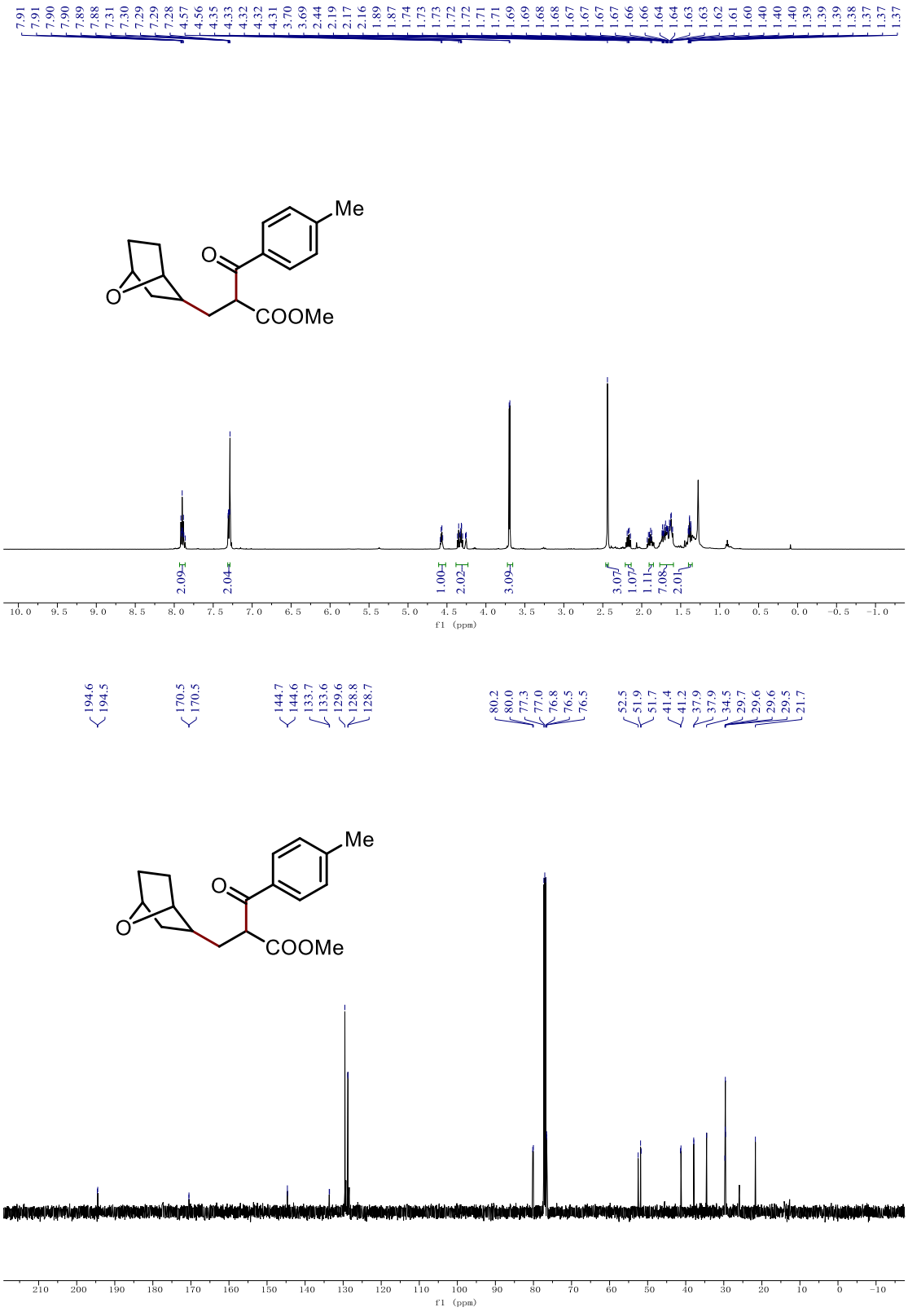


Methyl 2-(bicyclo[2.2.1]heptan-2-ylmethyl)-3-oxo-3-phenylpropanoate (21)

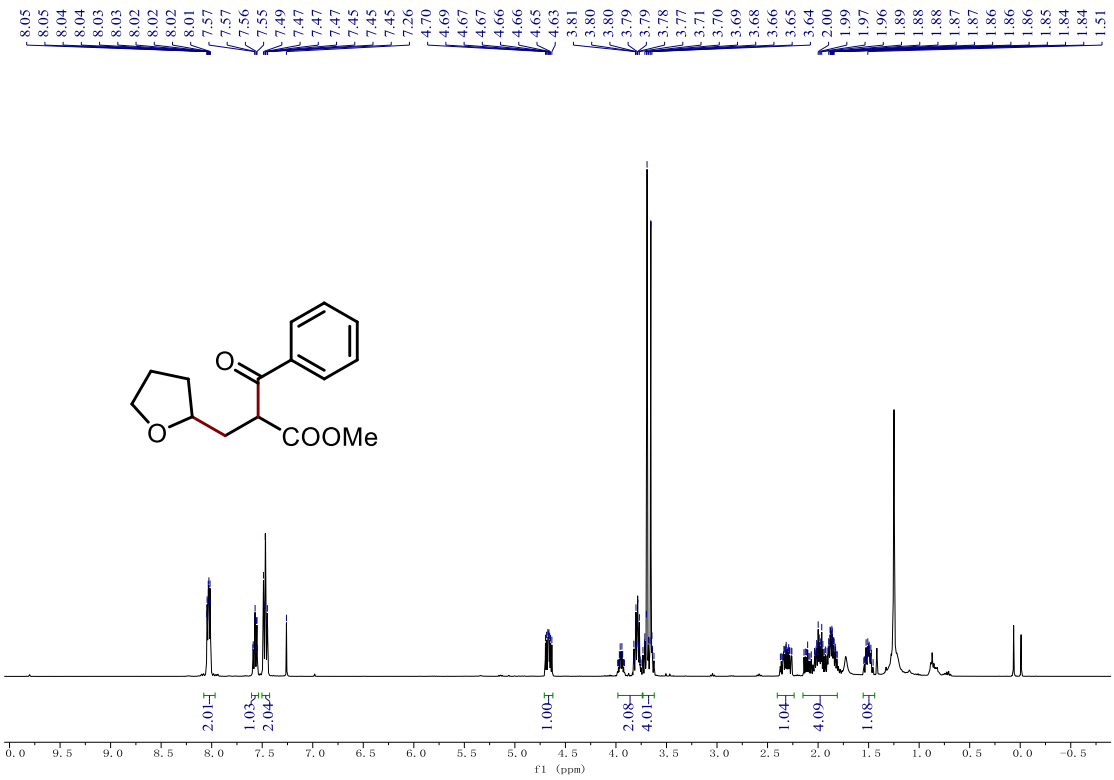


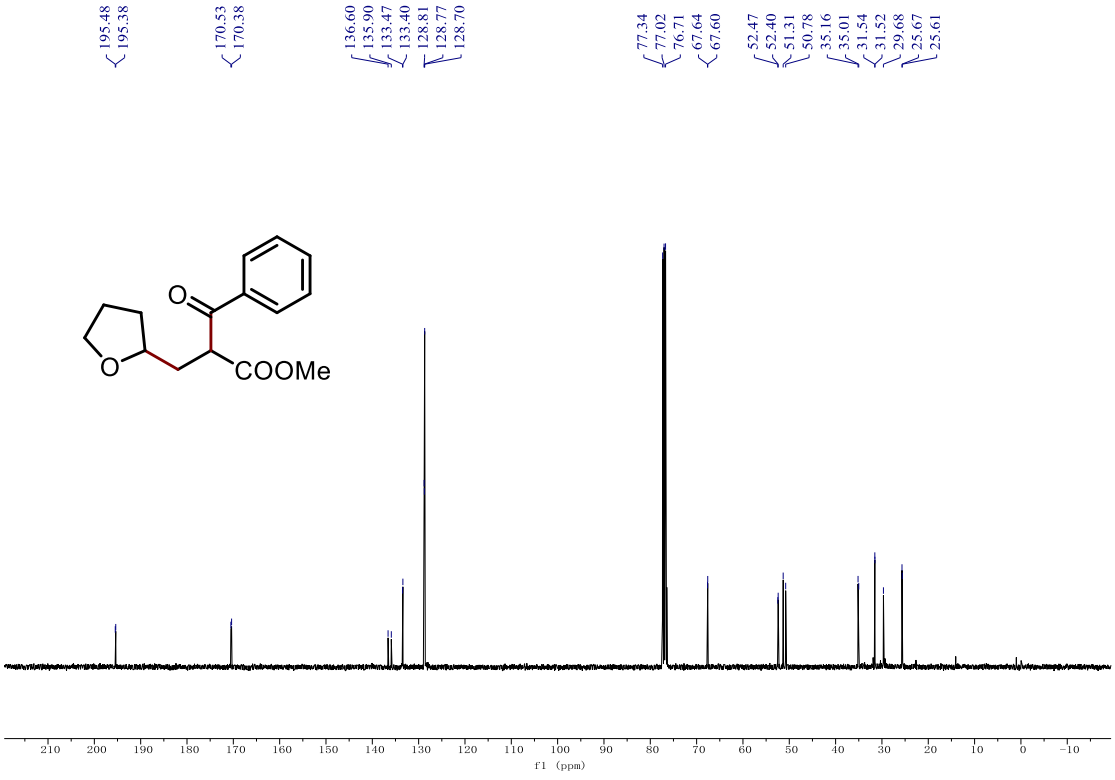


Methyl 2-((7-oxabicyclo[2.2.1]heptan-2-yl)methyl)-3-oxo-3-phenylpropanoate (22)

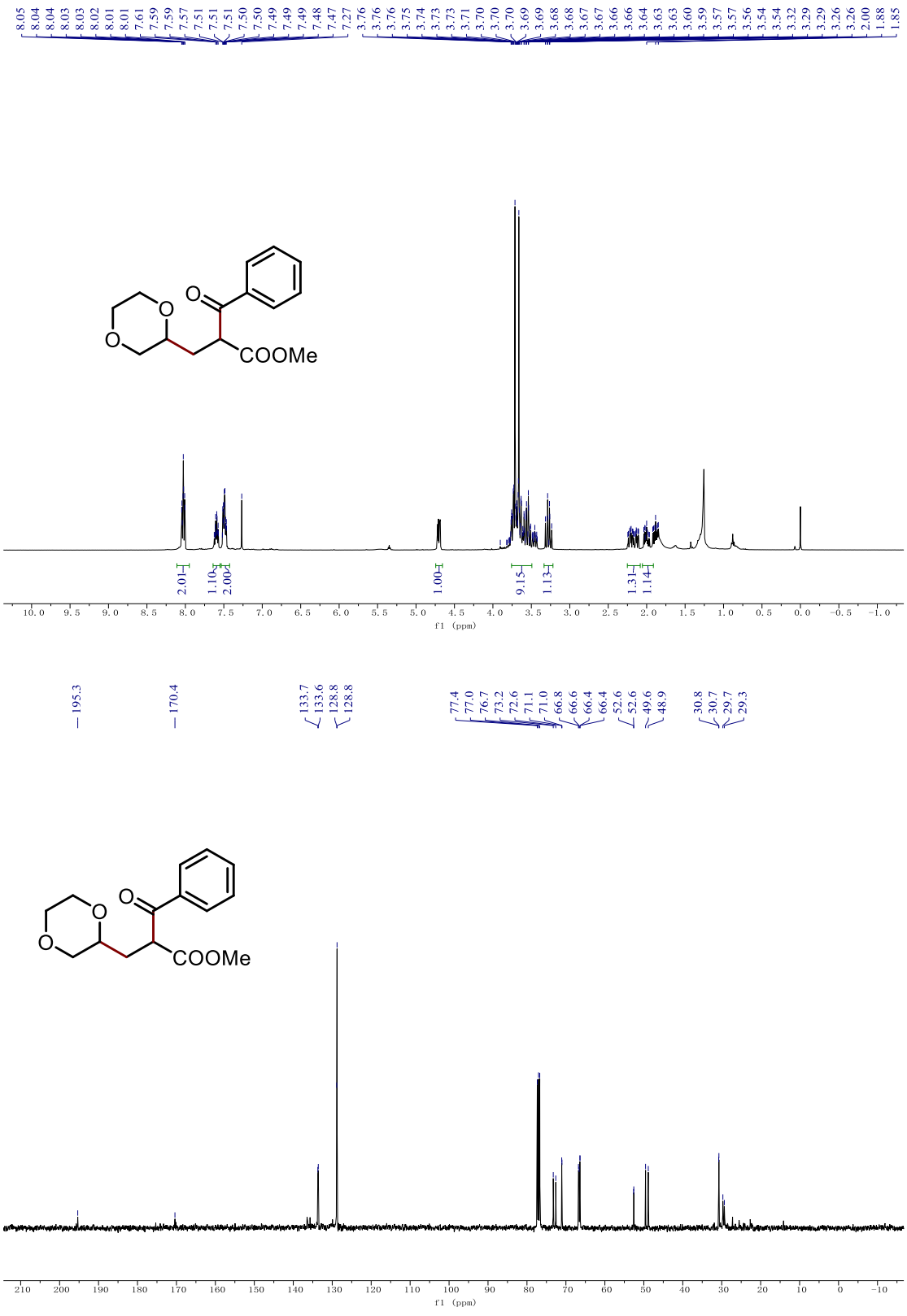


Methyl -3-oxo-3-phenyl-2-((tetrahydrofuran-2-yl)methyl)propanoate (23)

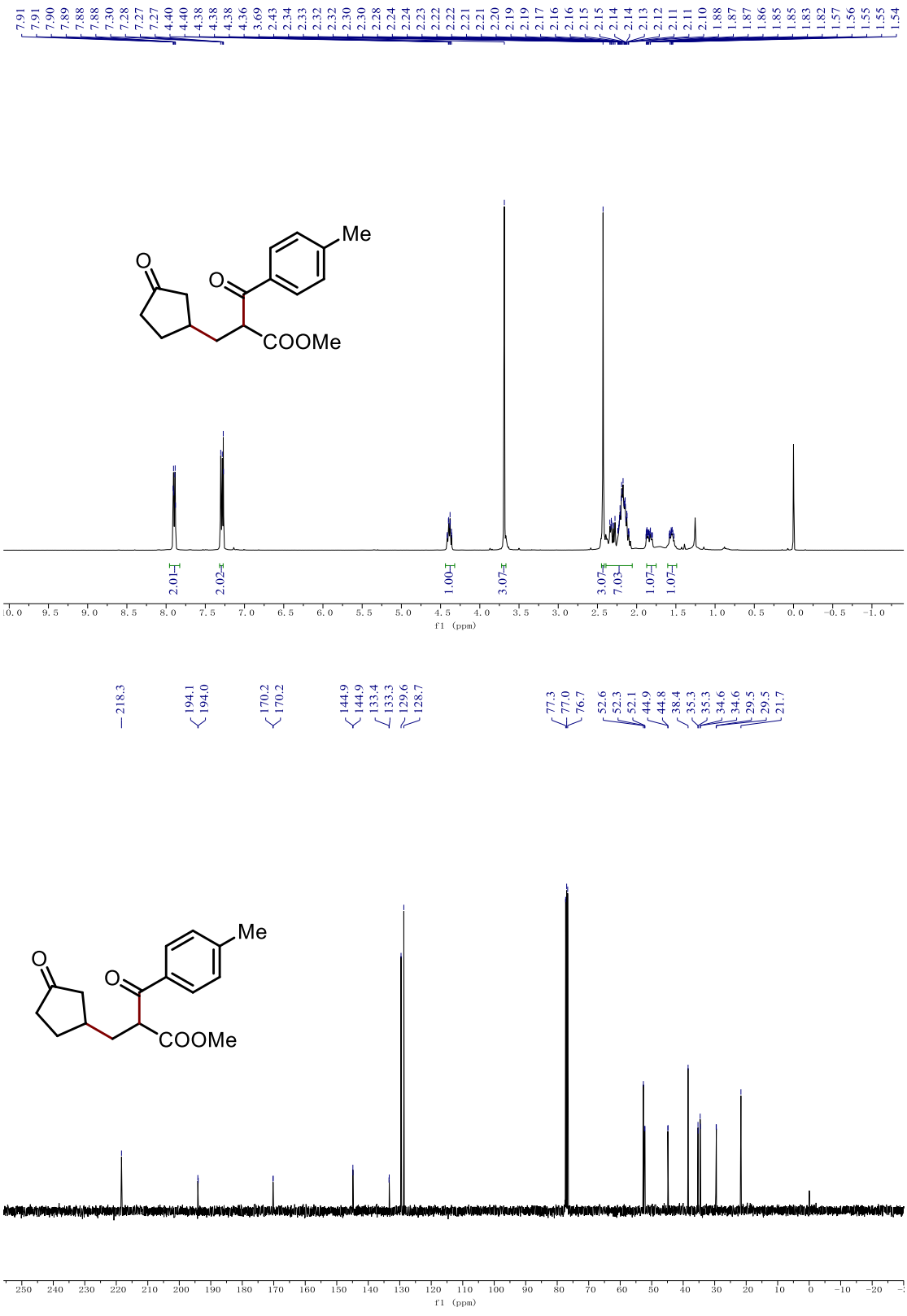




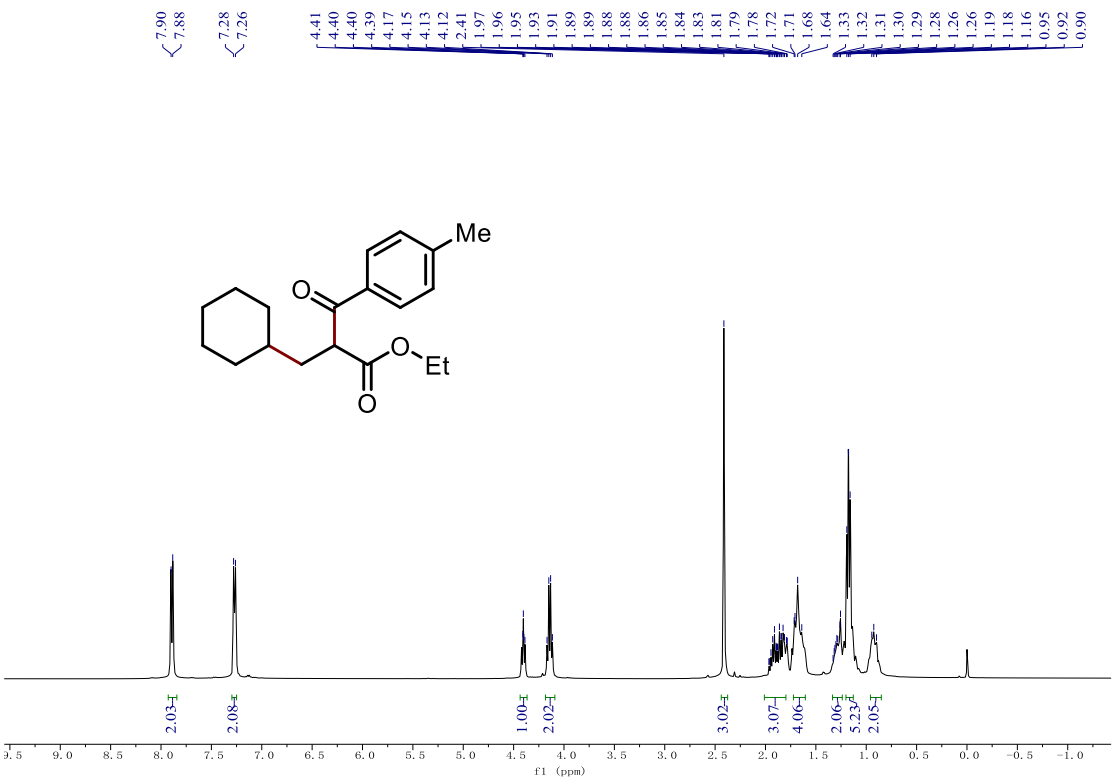
Methyl -2-((1,4-dioxan-2-yl)methyl)-3-oxo-3-phenylpropanoate (24)

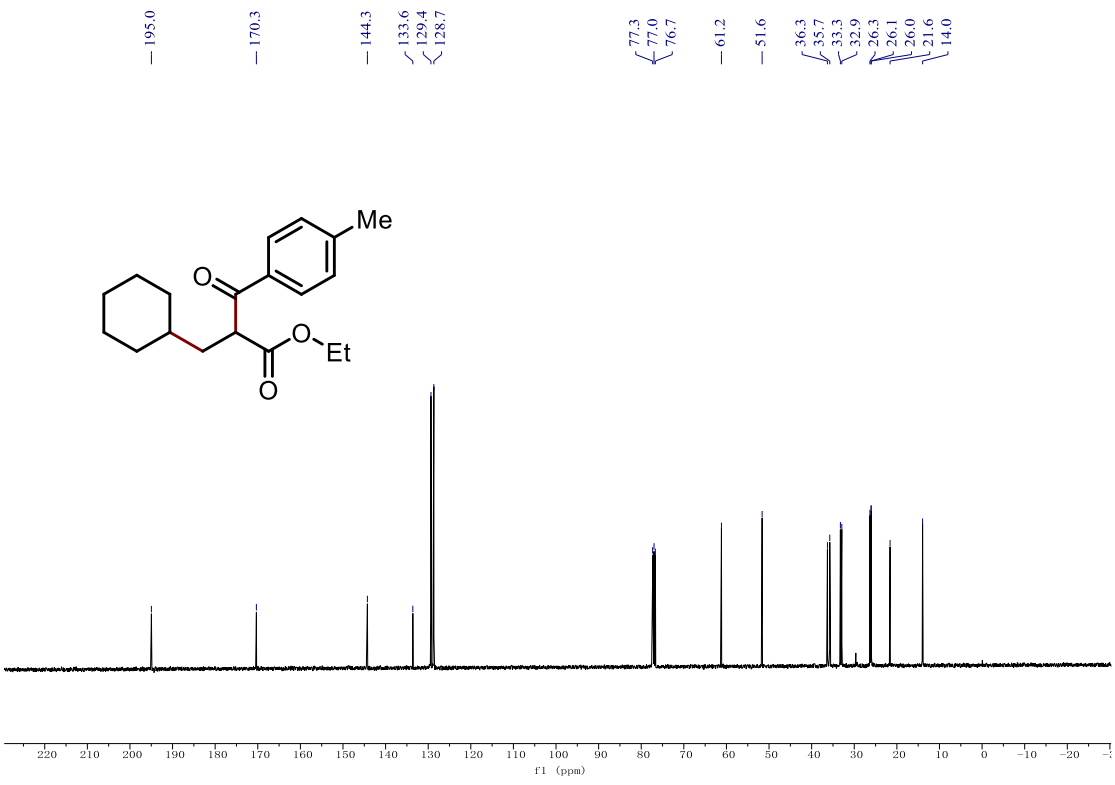


Methyl 3-oxo-2-((3-oxocyclopentyl)methyl)-3-phenylpropanoate (25)

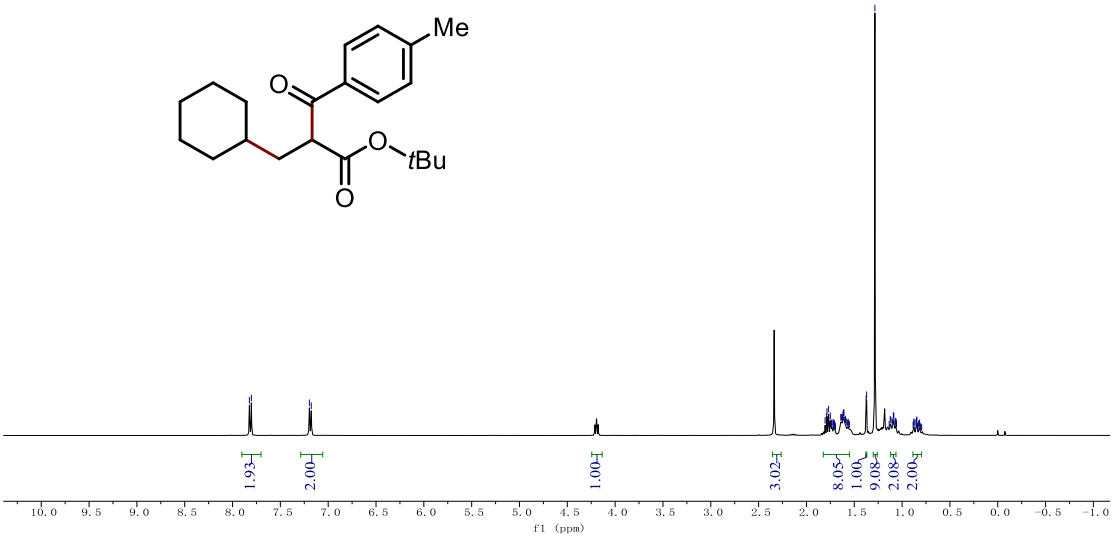


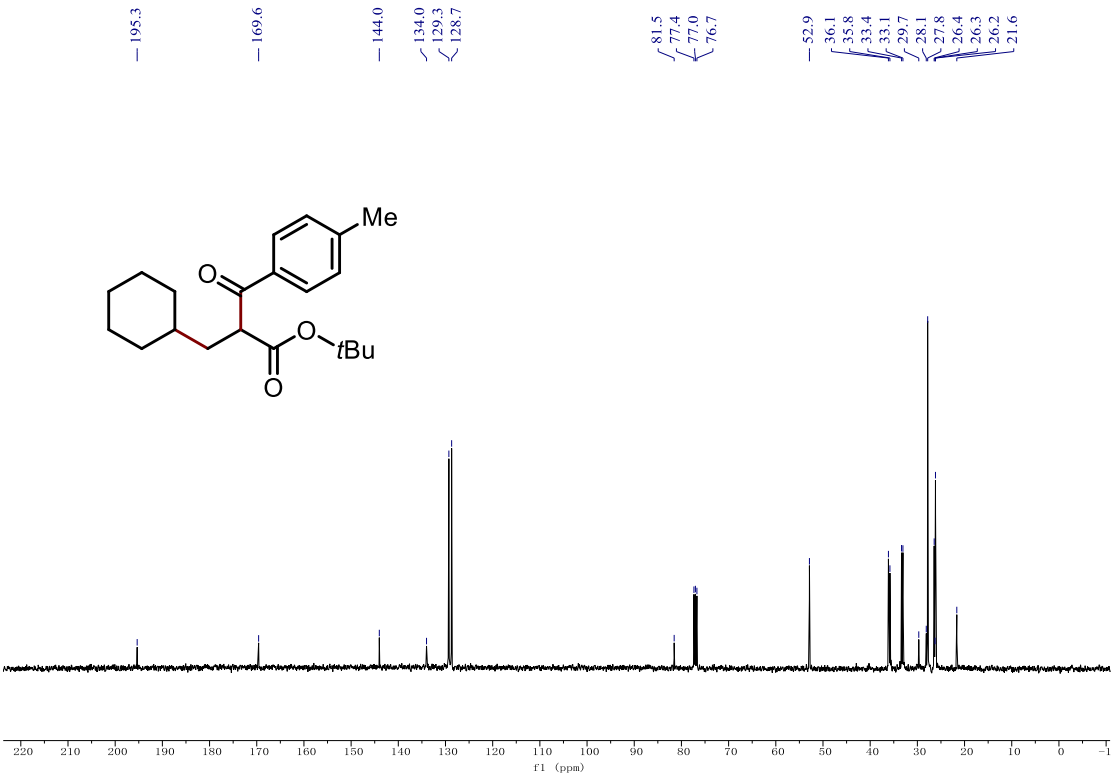
Ethyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (26)



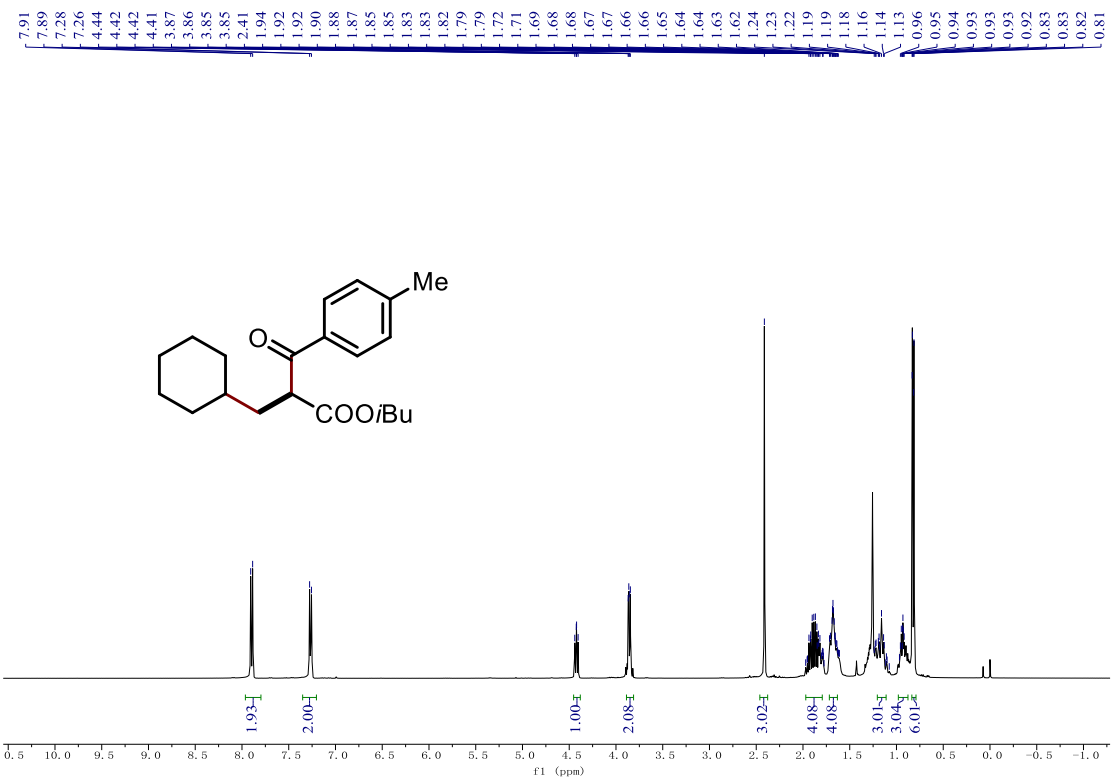


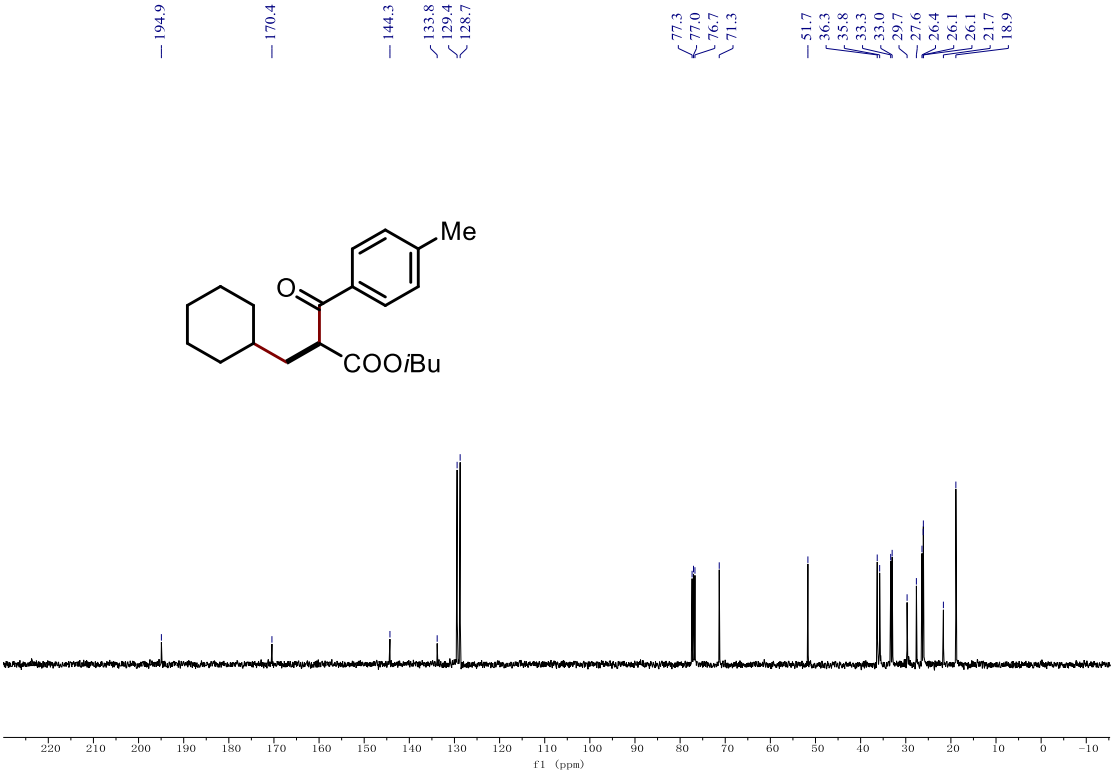
Tert-butyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (27)



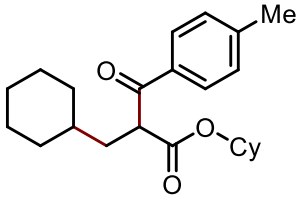


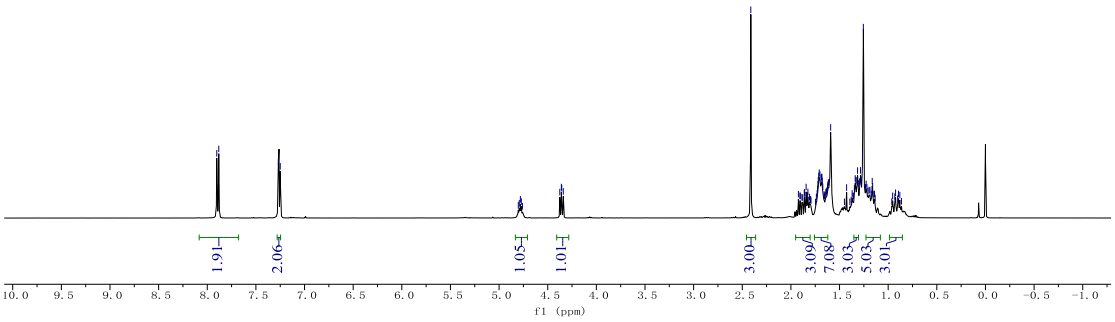
Isobutyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (28)

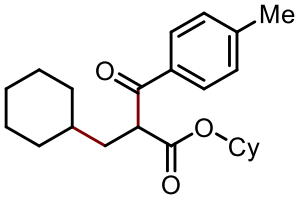


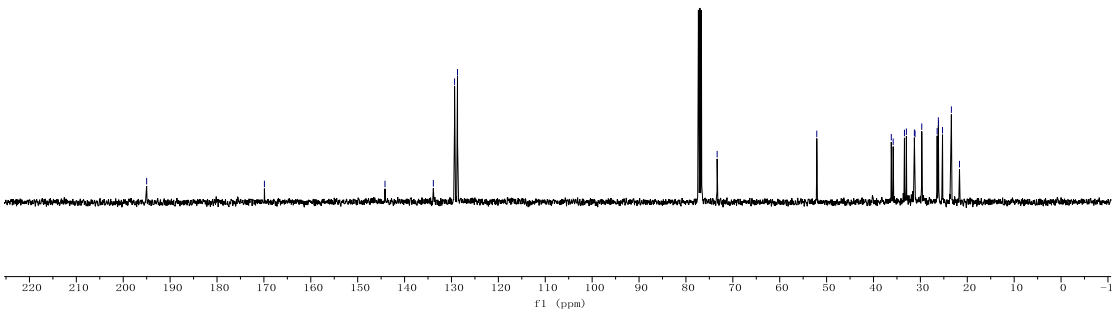


Cyclohexyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (29)

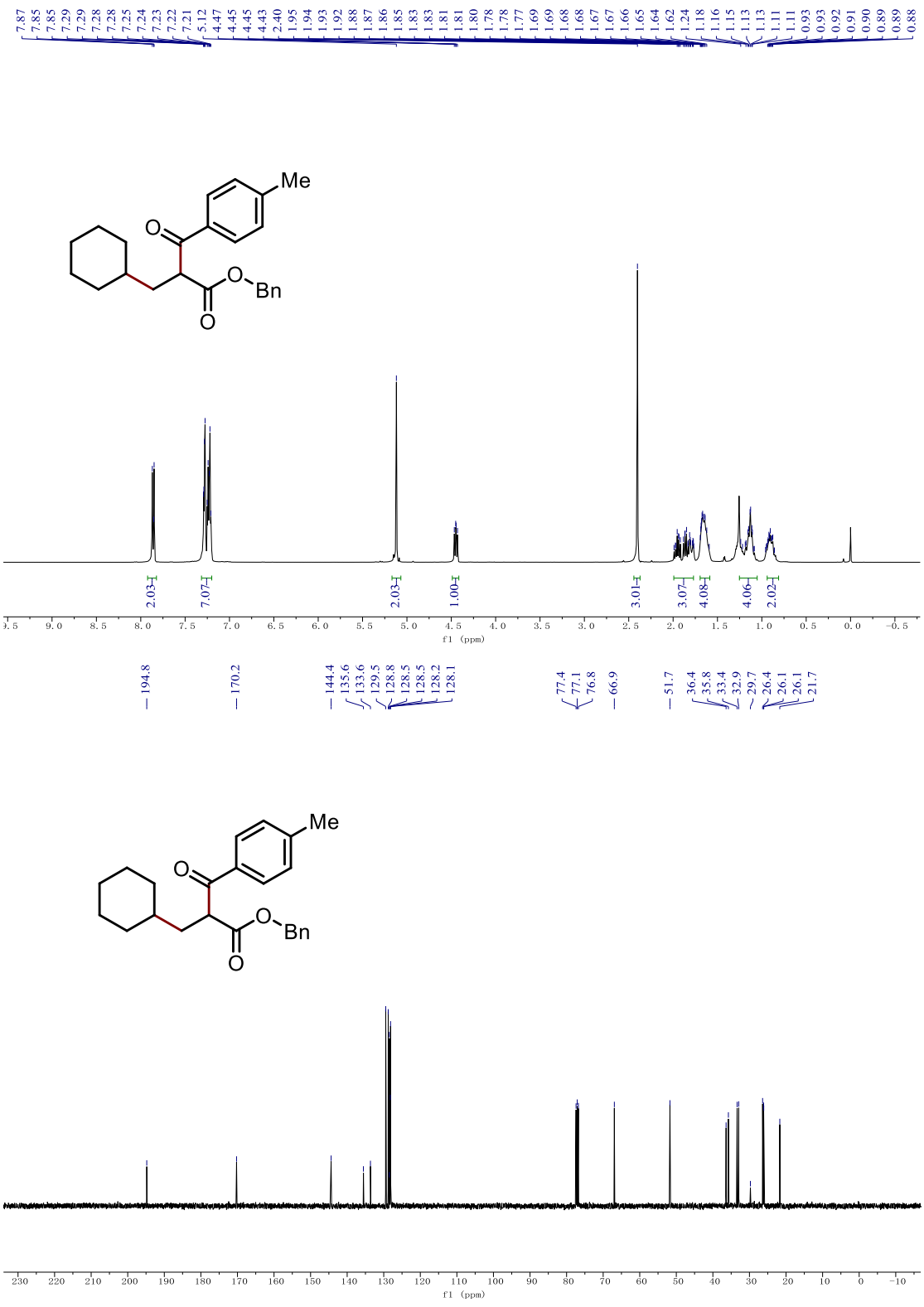




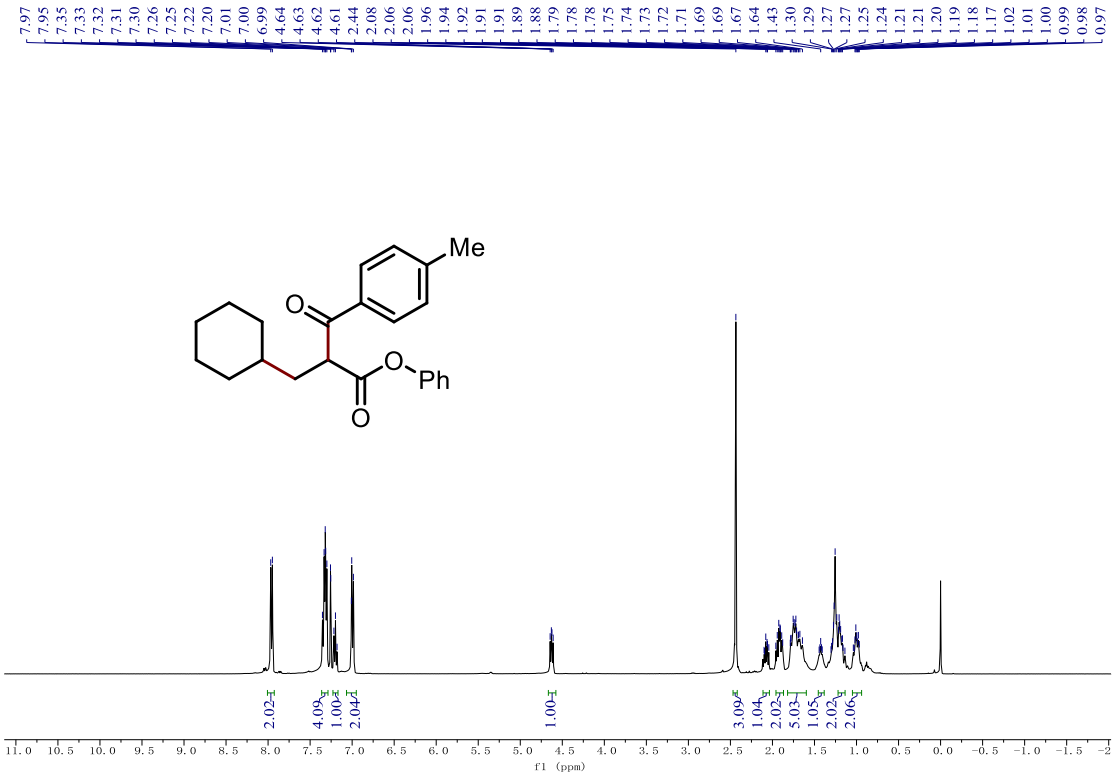


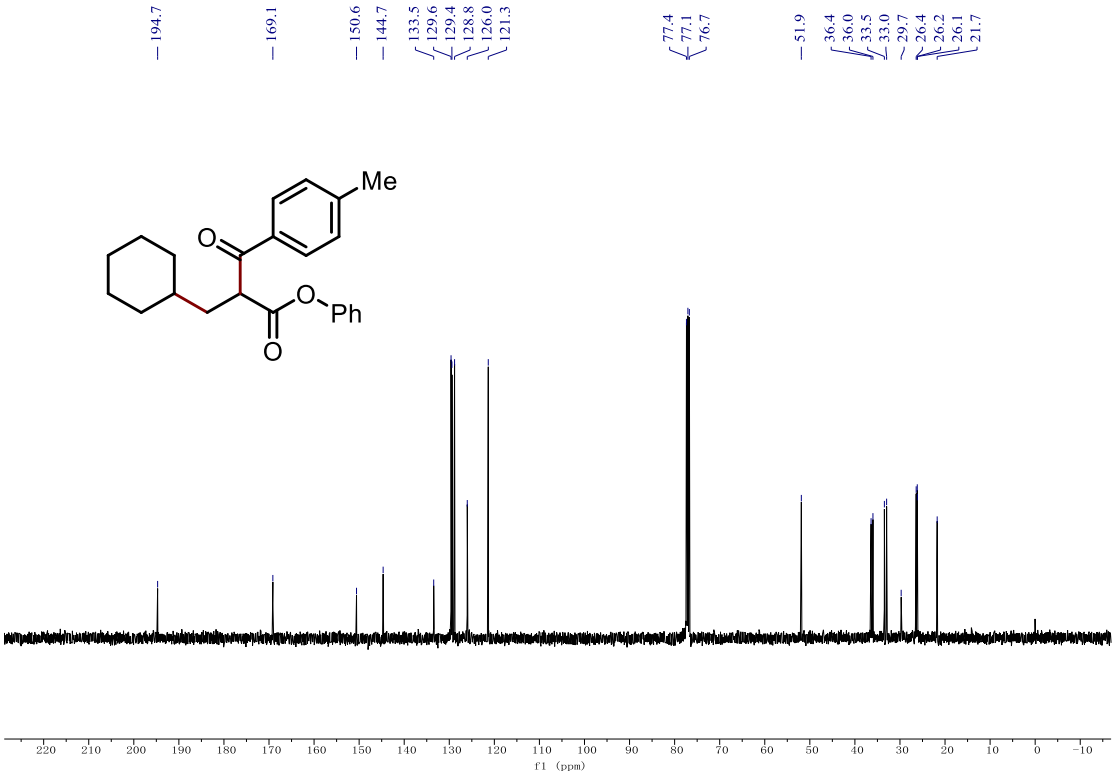


Benzyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (30)

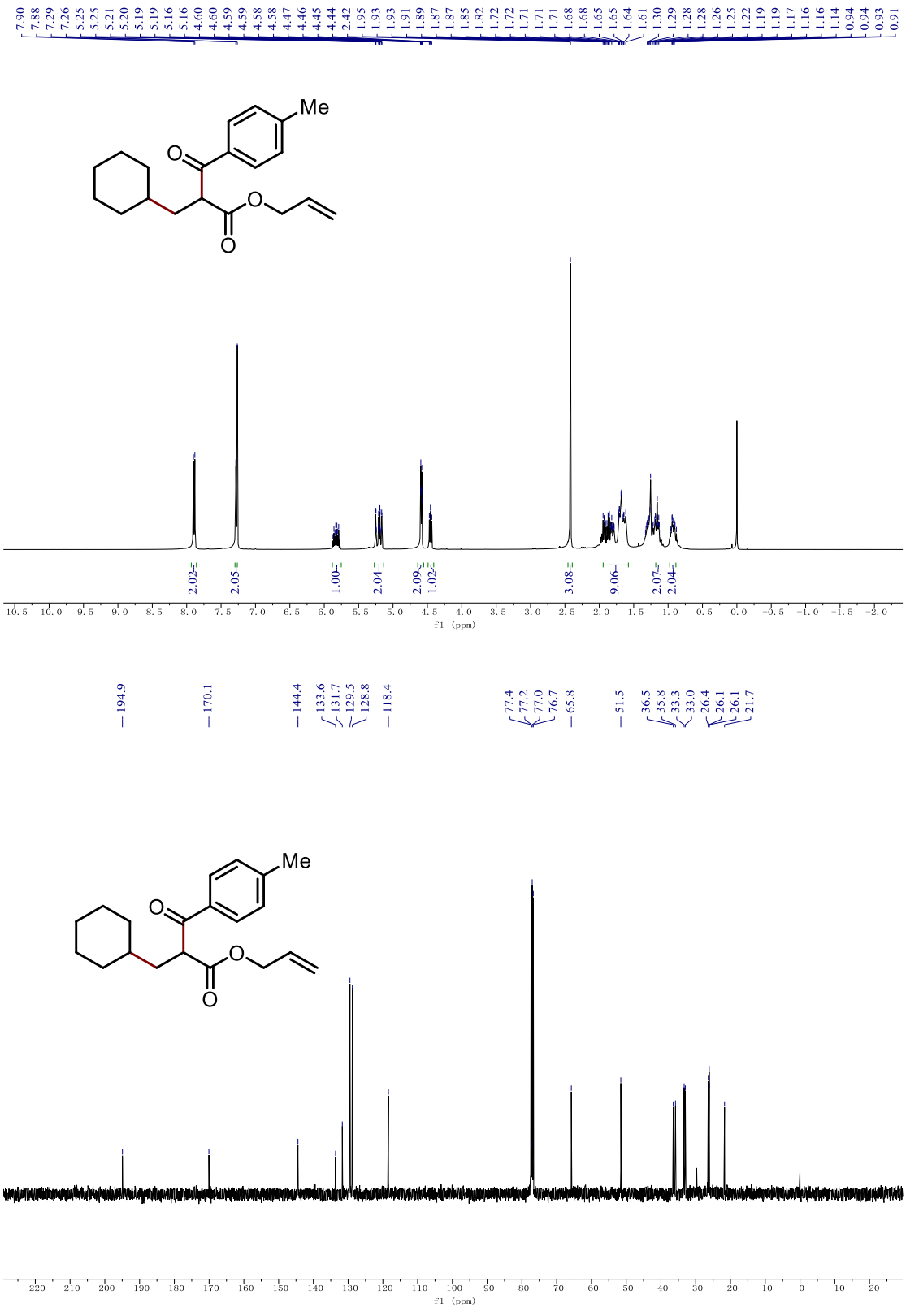


Phenyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (31)

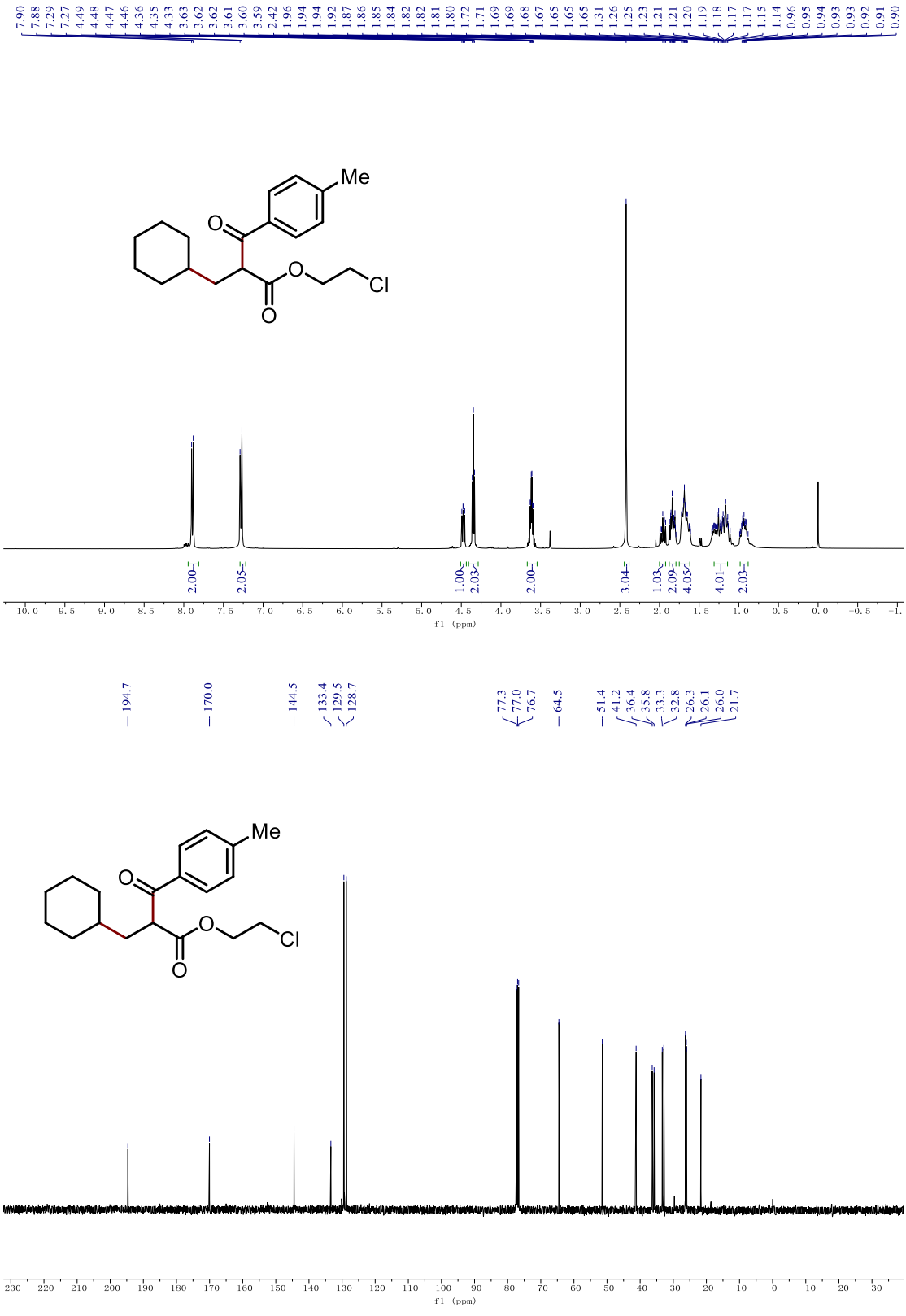




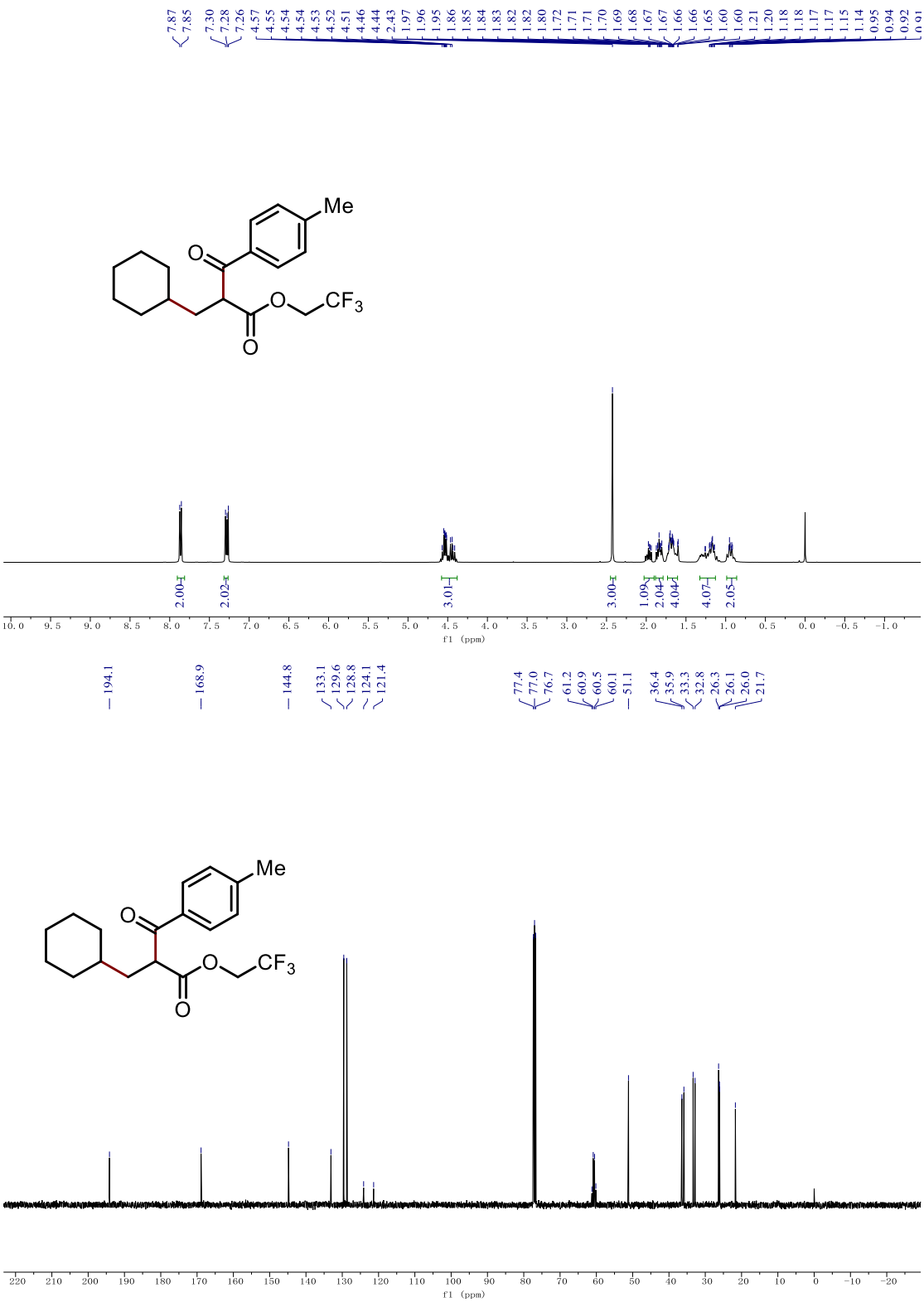
Allyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (32)



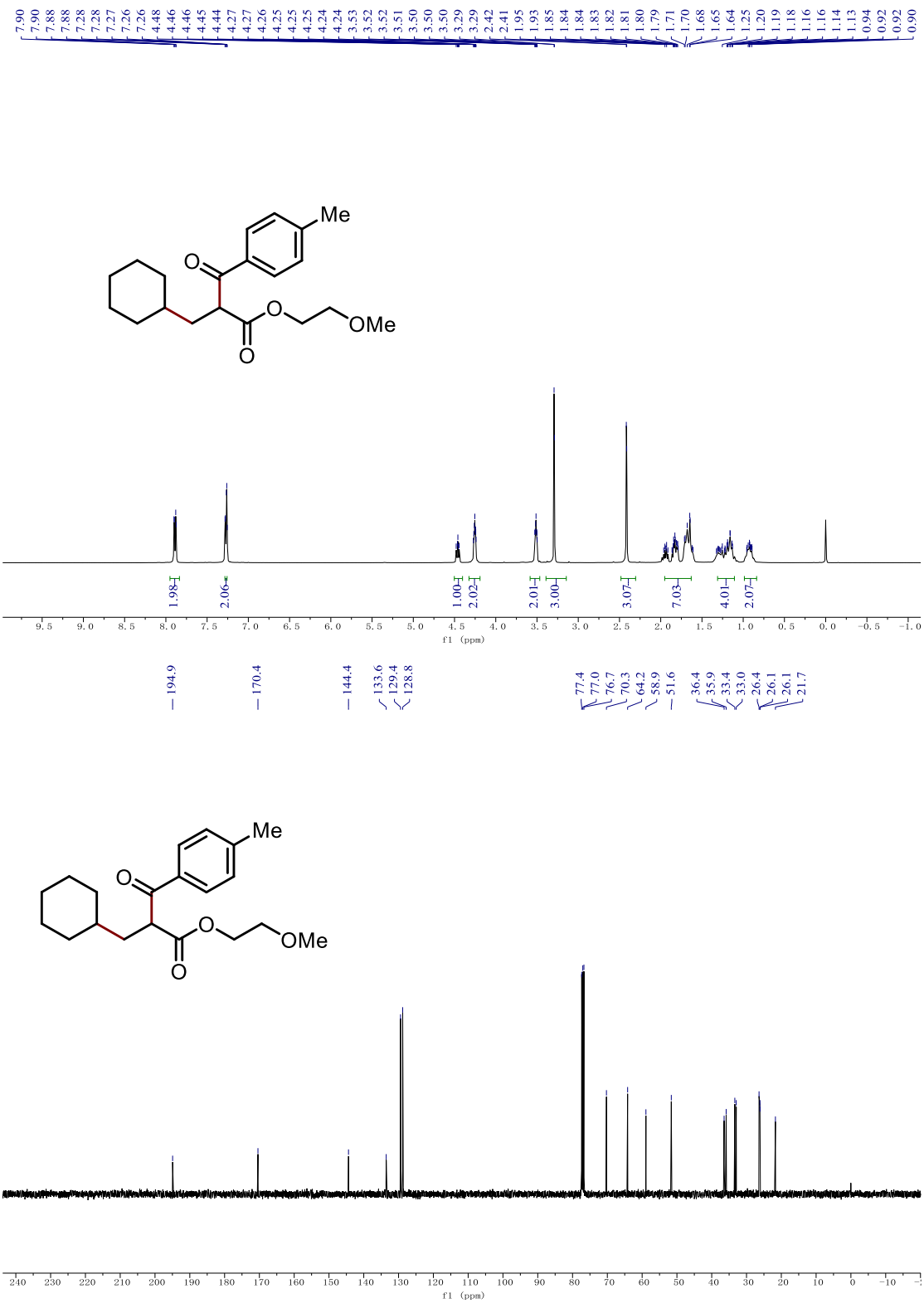
2-Chloroethyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (33)



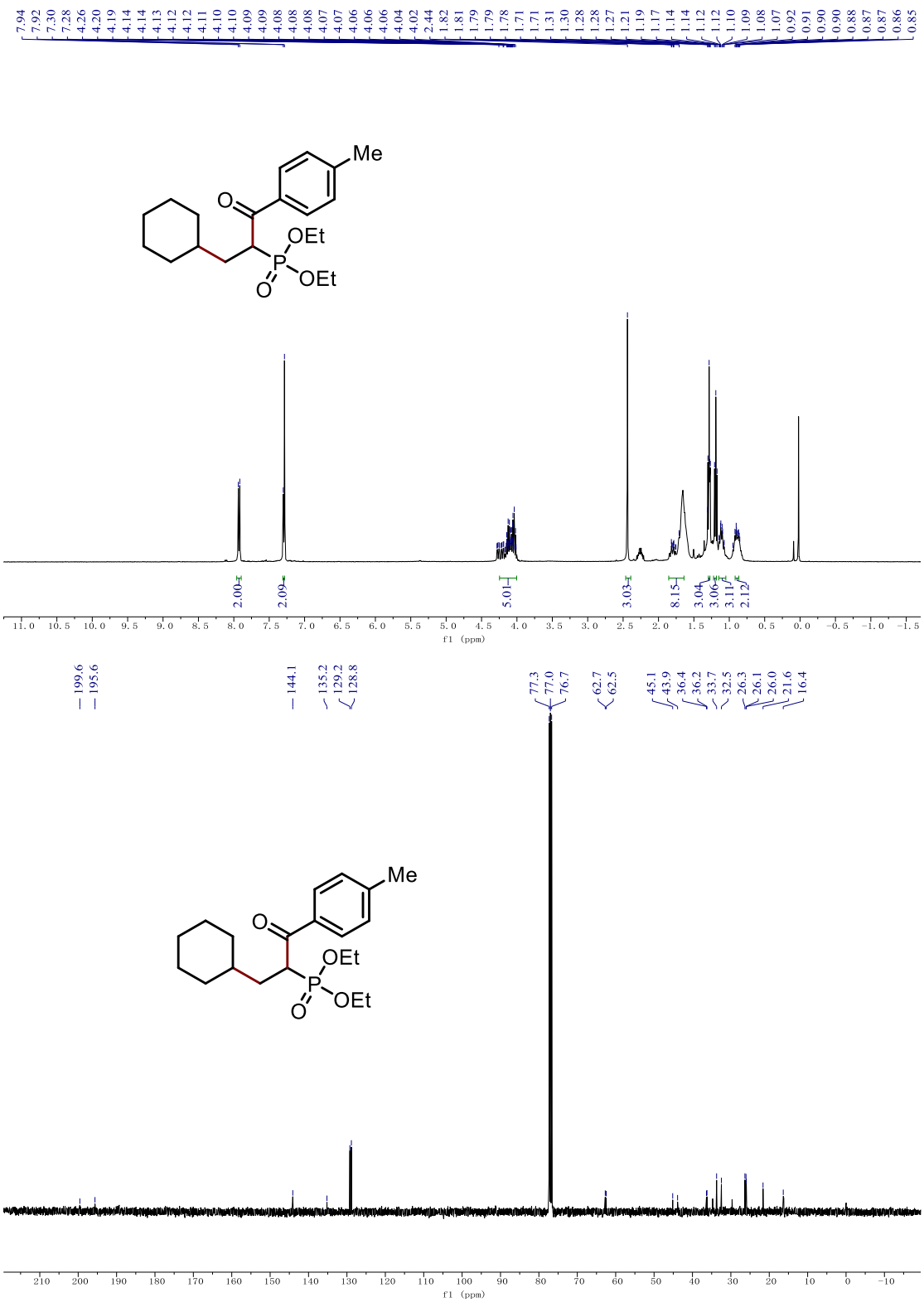
2,2,2-trifluoroethyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (34)



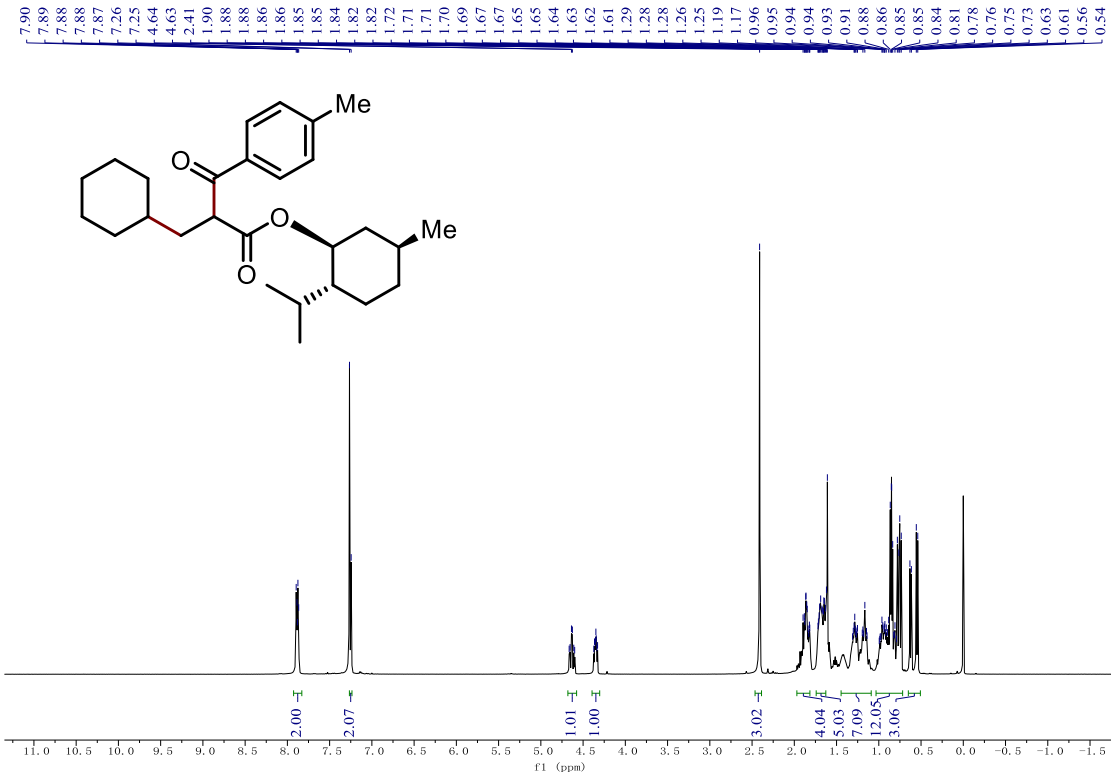
2-methoxyethyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (35)

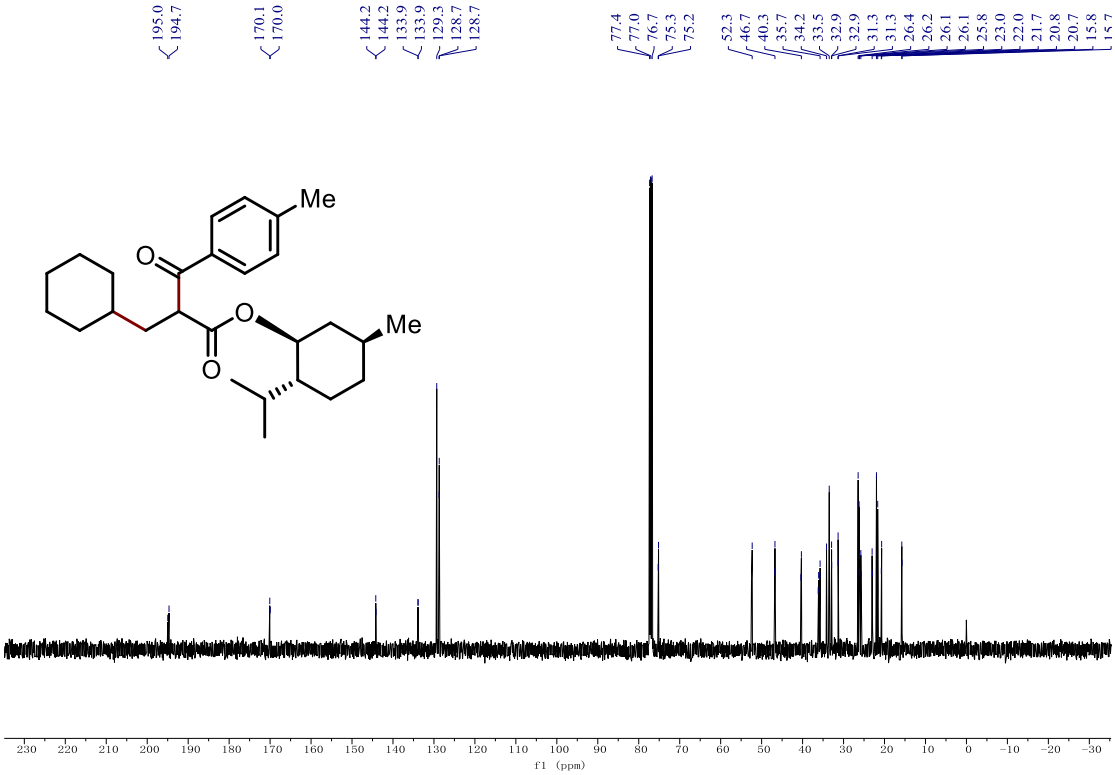


Diethyl (3-cyclohexyl-1-oxo-1-(p-tolyl)propan-2-yl)phosphonate (36)

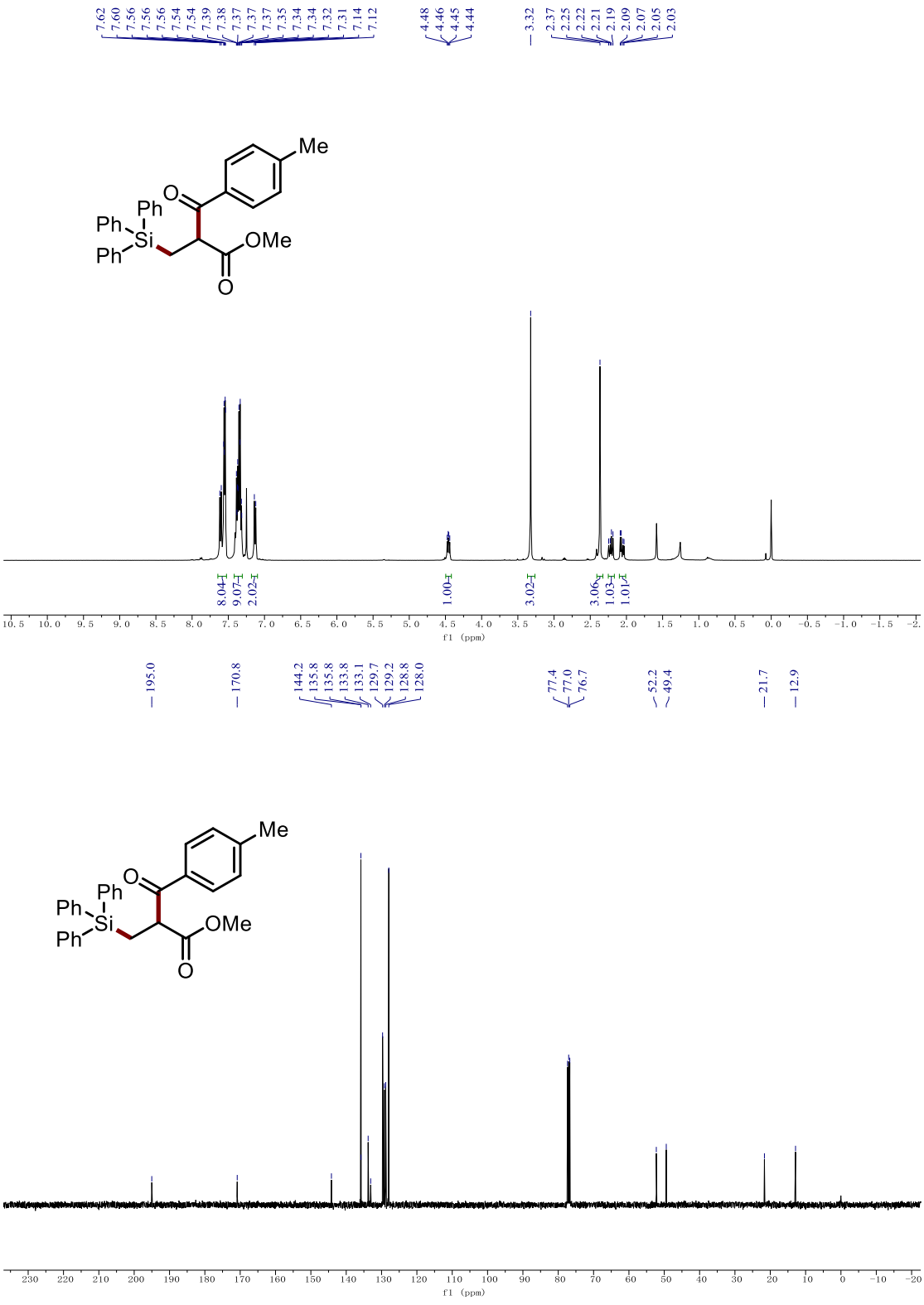


(1S,2R,5S)-2-isopropyl-5-methylcyclohexyl 2-(cyclohexylmethyl)-3-oxo-3-(p-tolyl)propanoate (37)

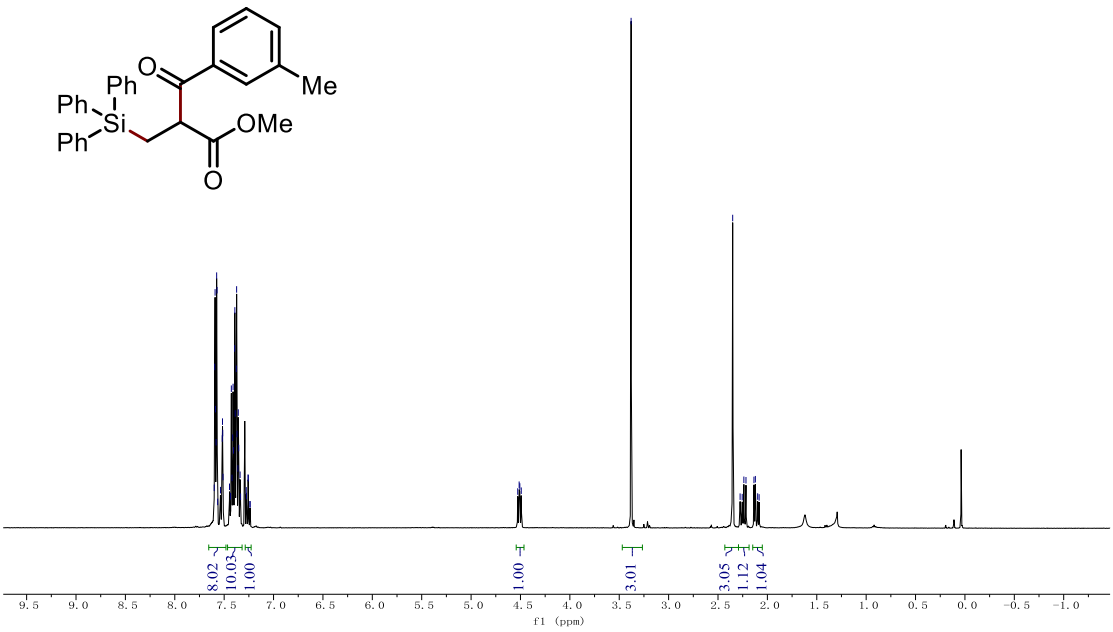


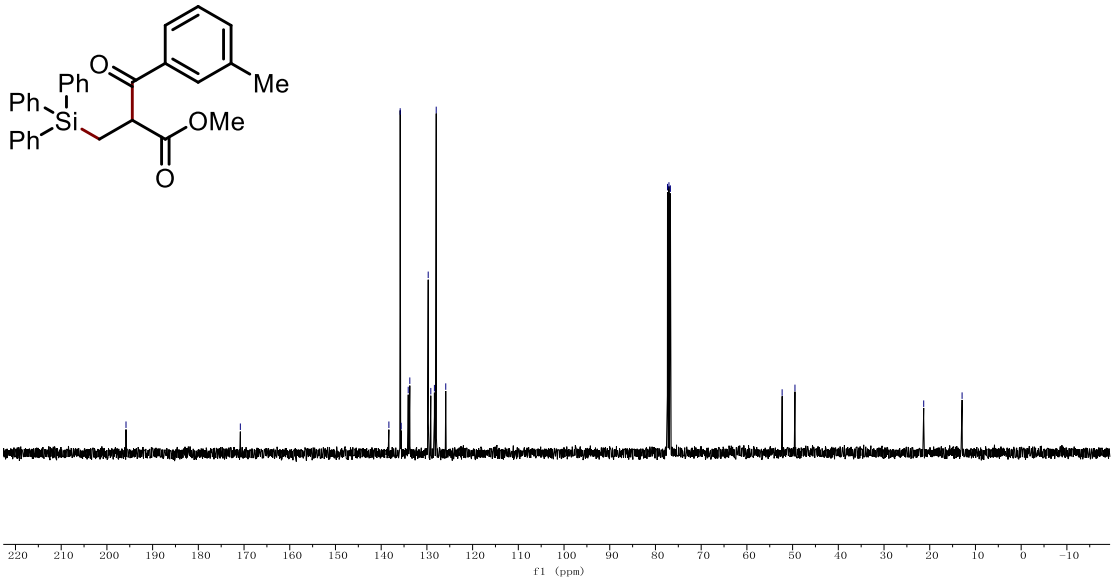


Methyl 3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (38)

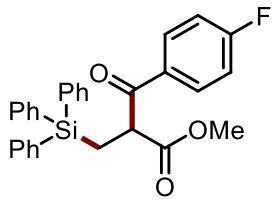


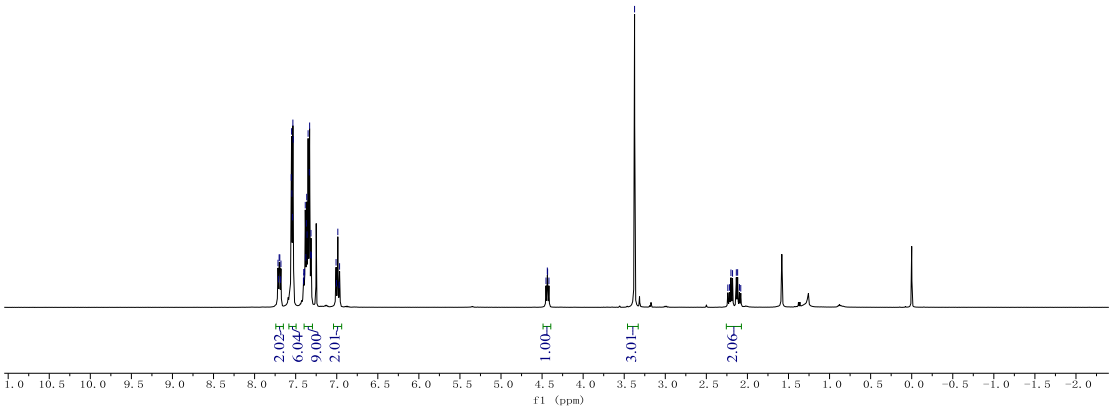
Methyl 3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (40)

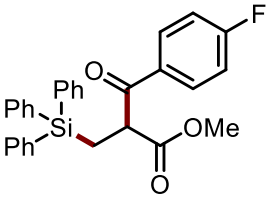


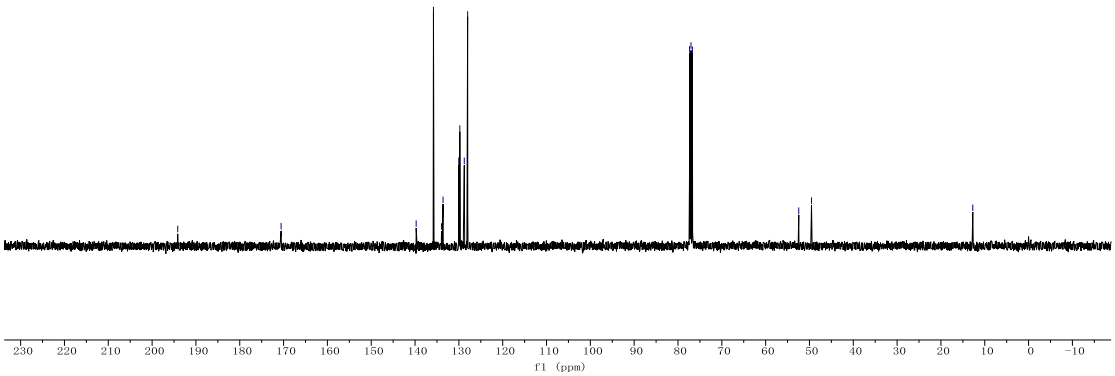


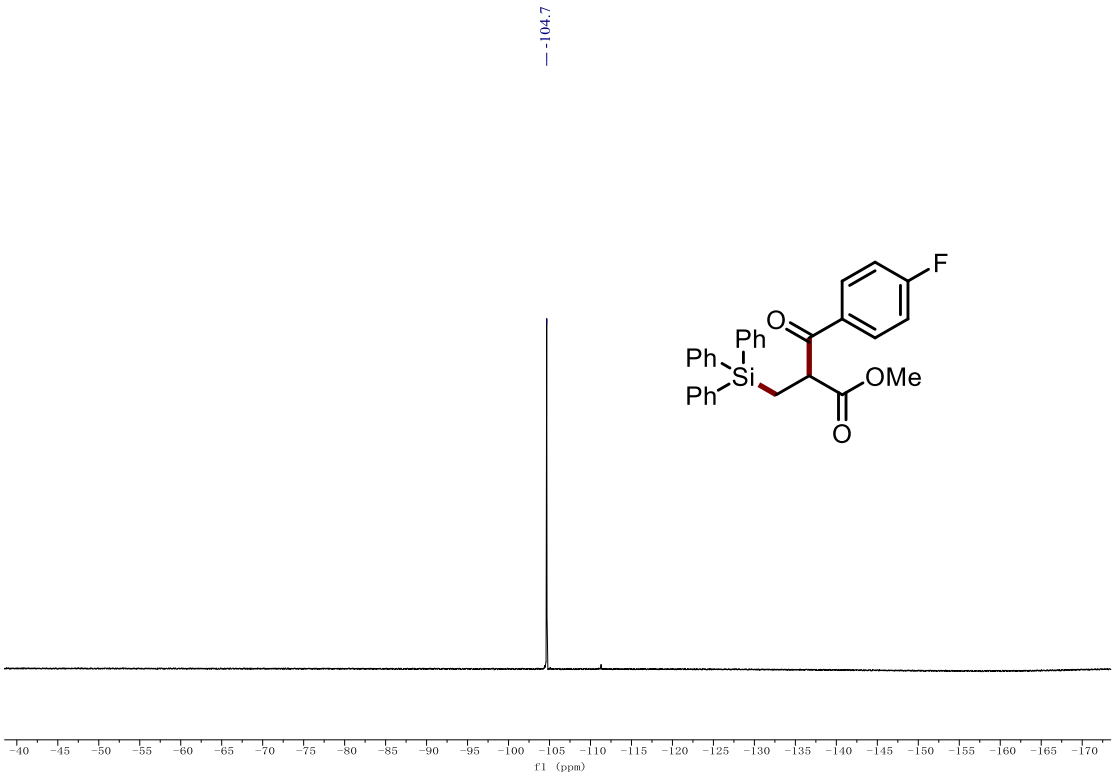
Methyl 3-(4-fluorophenyl)-3-oxo-2-((triphenylsilyl)methyl)propanoate (39)



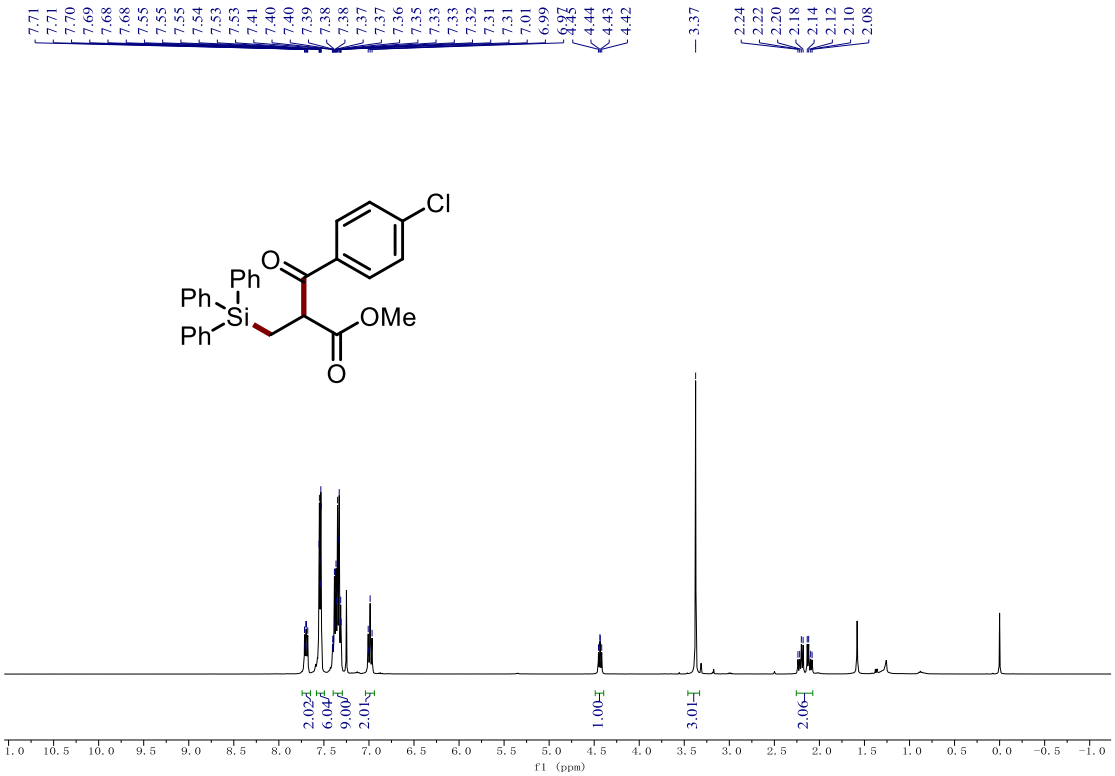


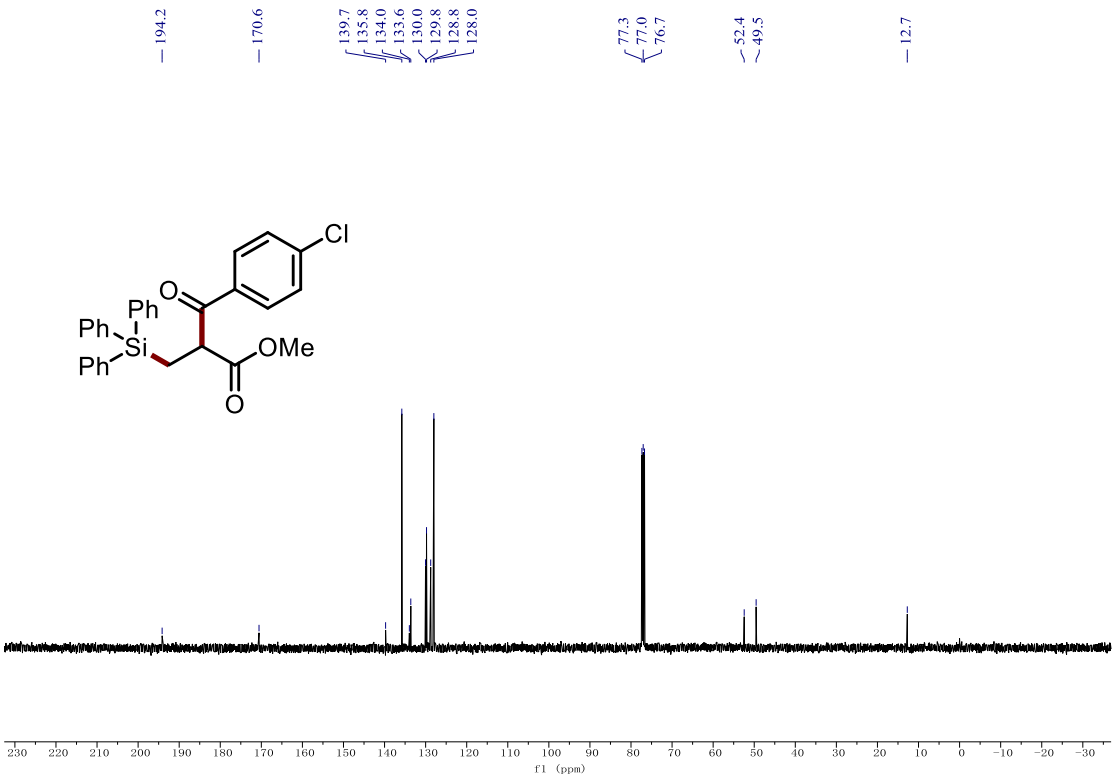




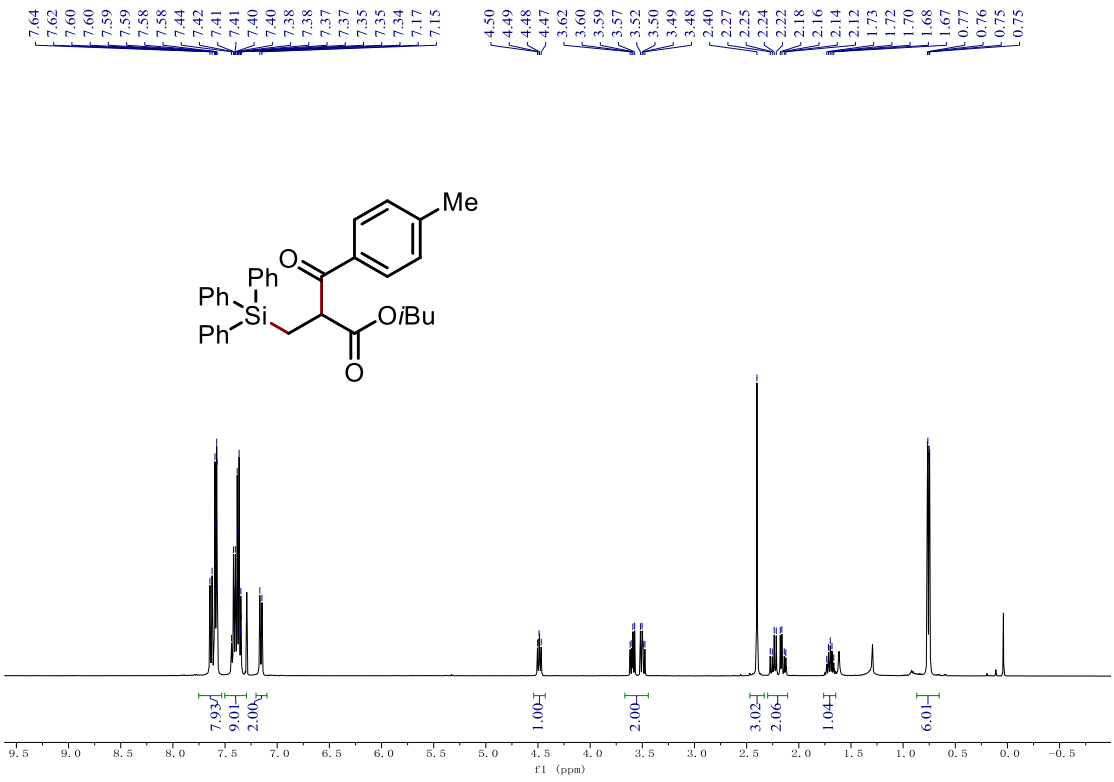


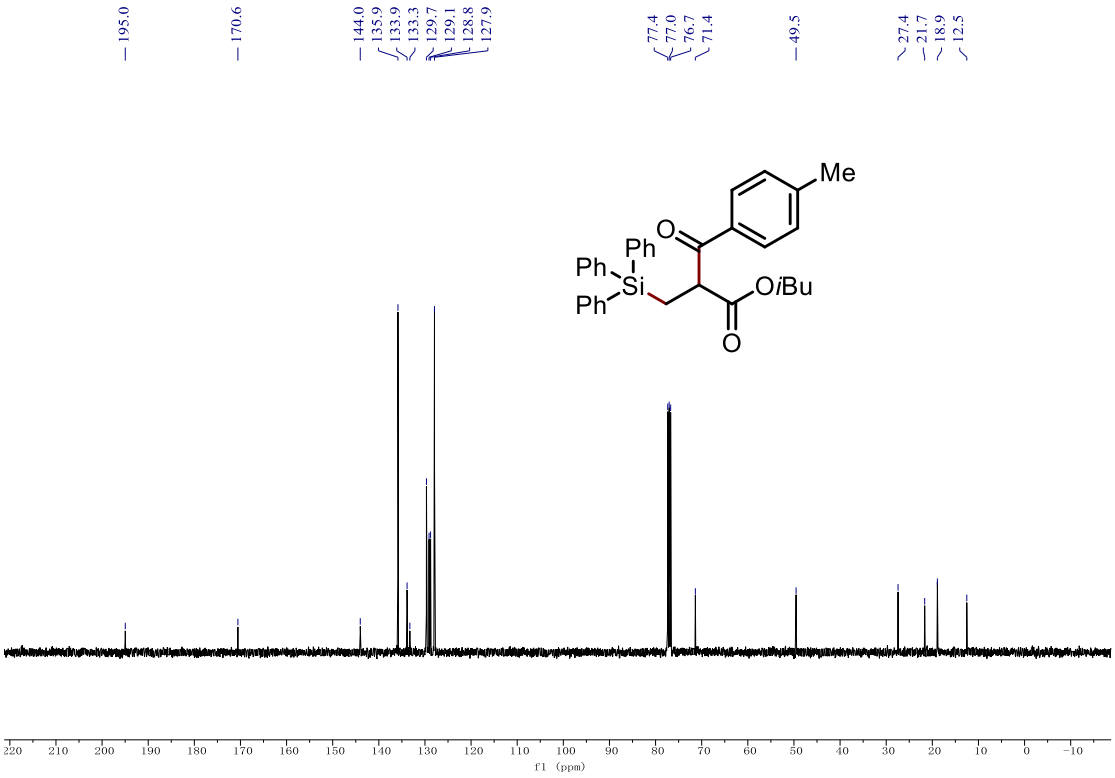
Methyl 3-(4-chlorophenyl)-3-oxo-2-((triphenylsilyl)methyl)propanoate (40)



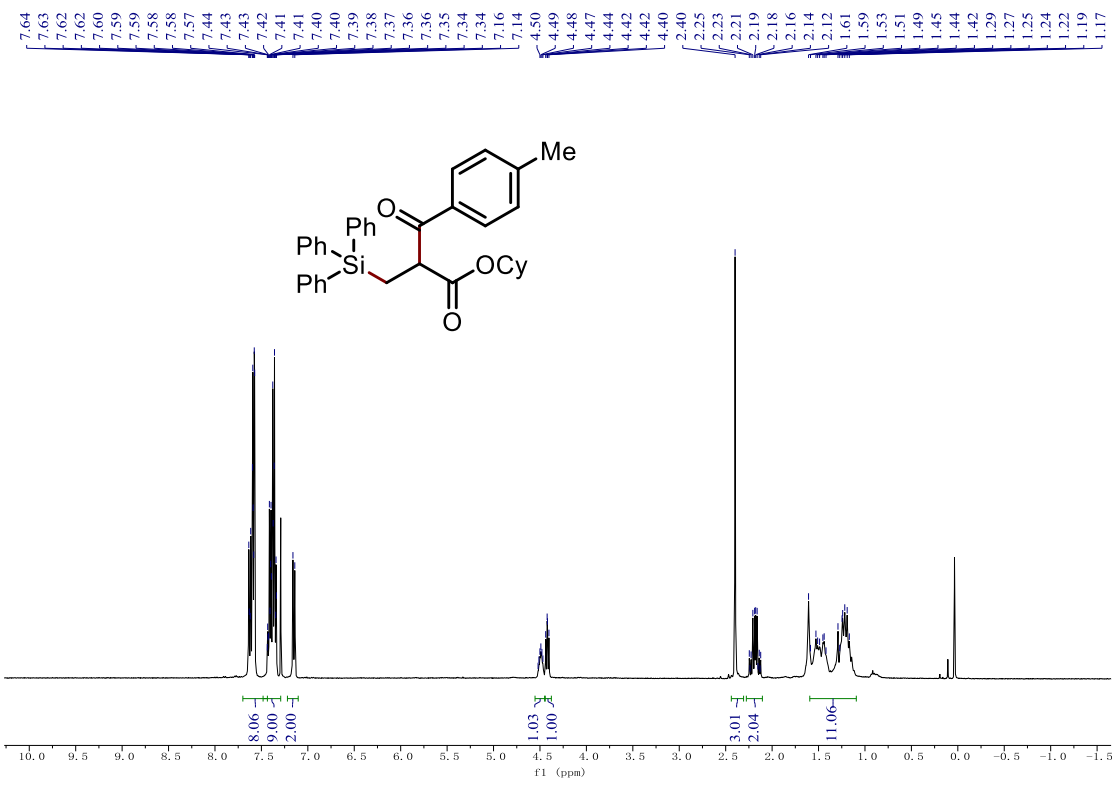


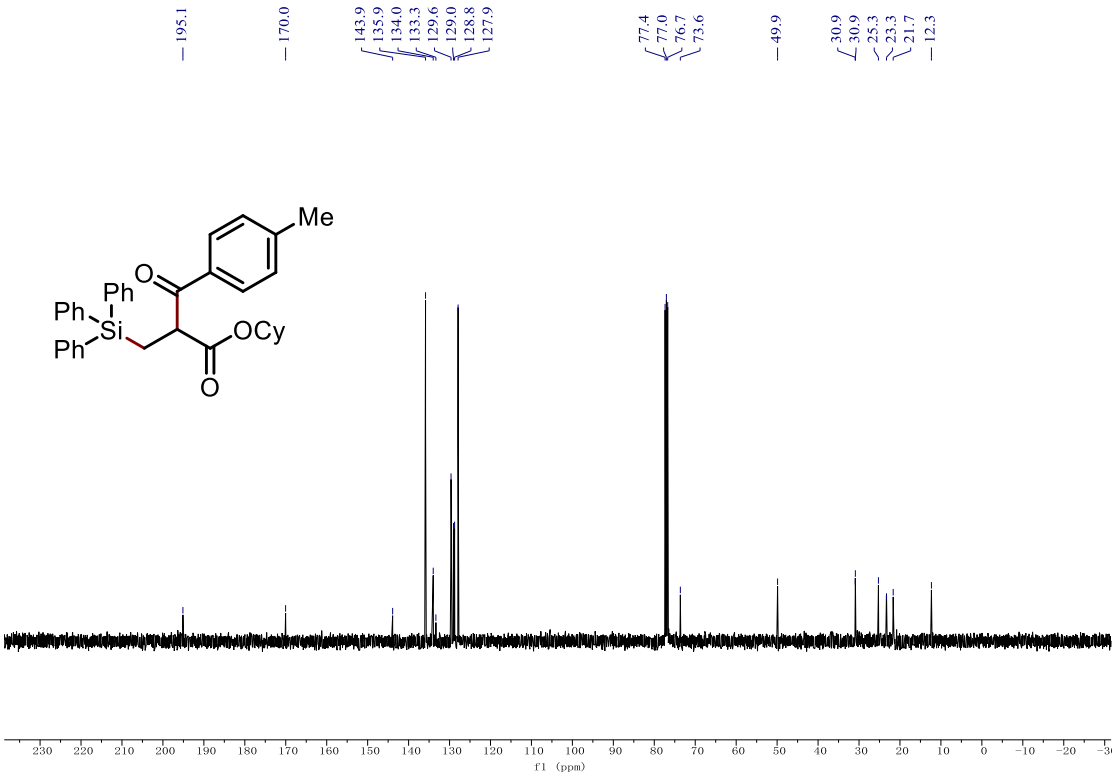
Isobutyl 3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (42)



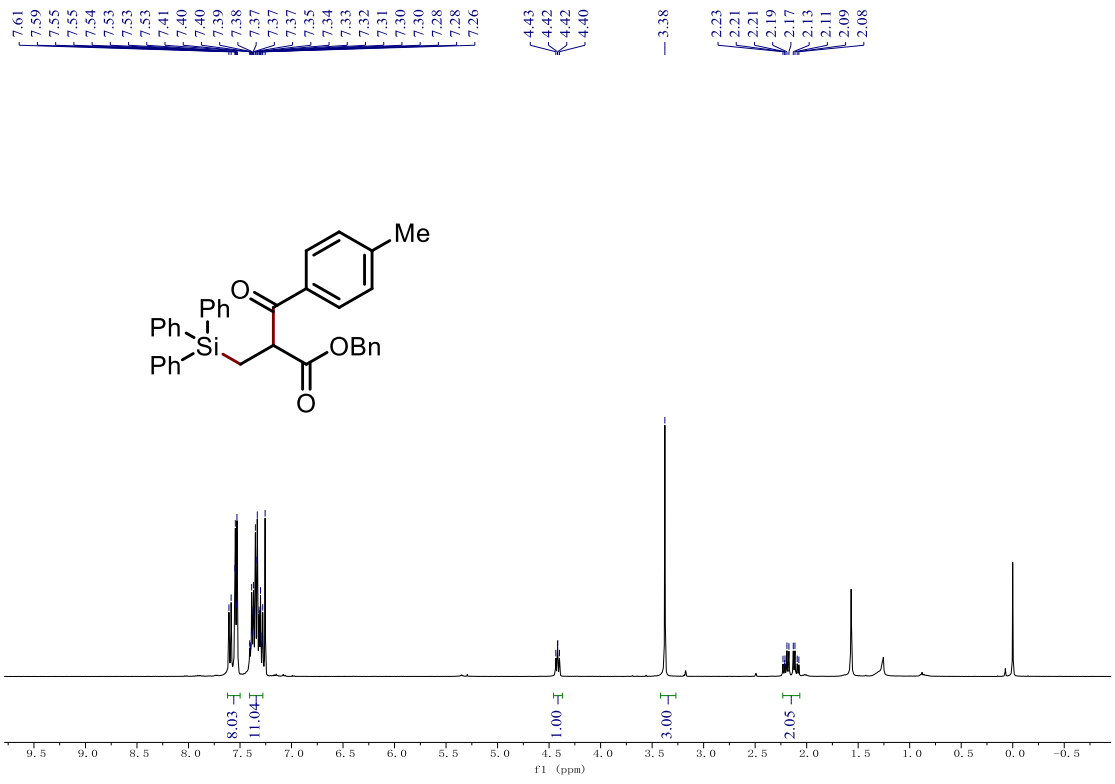


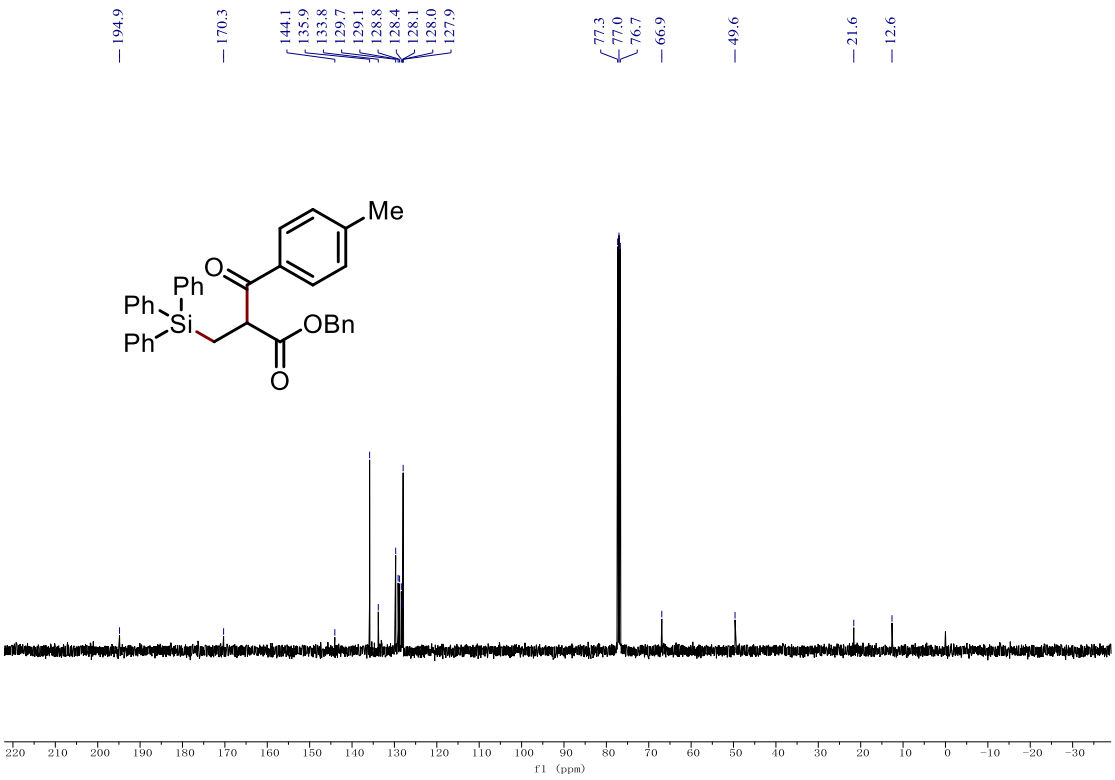
Cyclohexyl 3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (43)



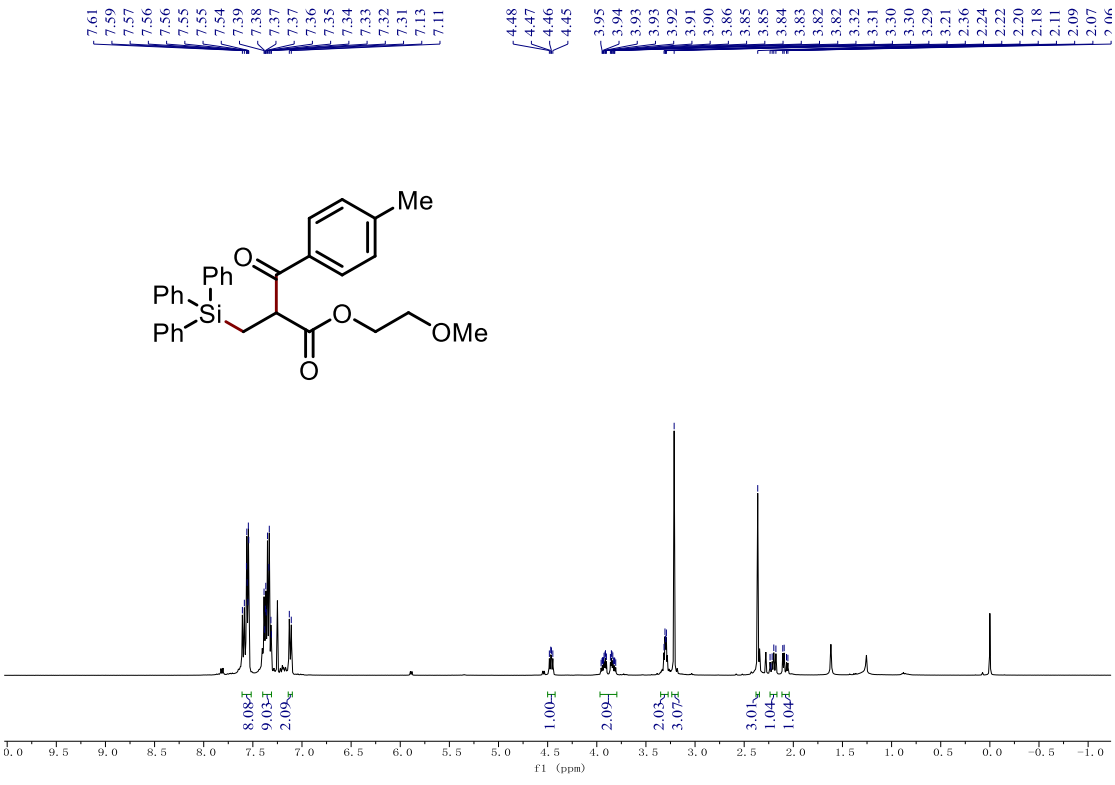


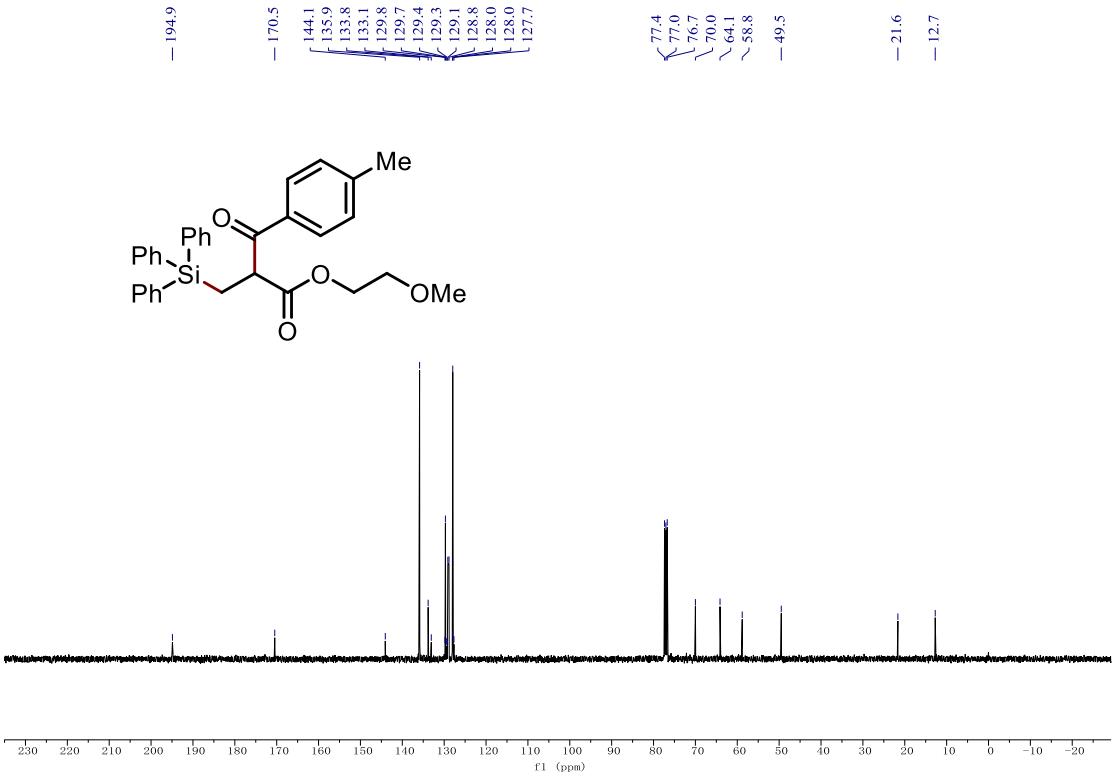
Benzyl 3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (44)



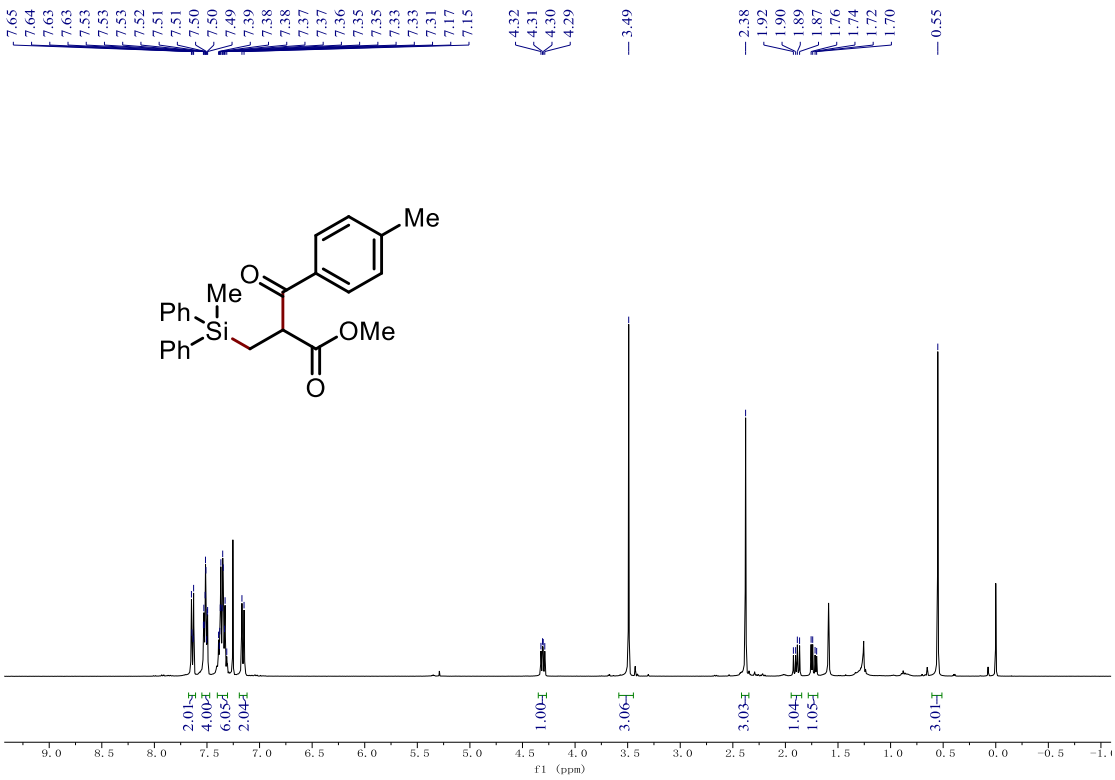


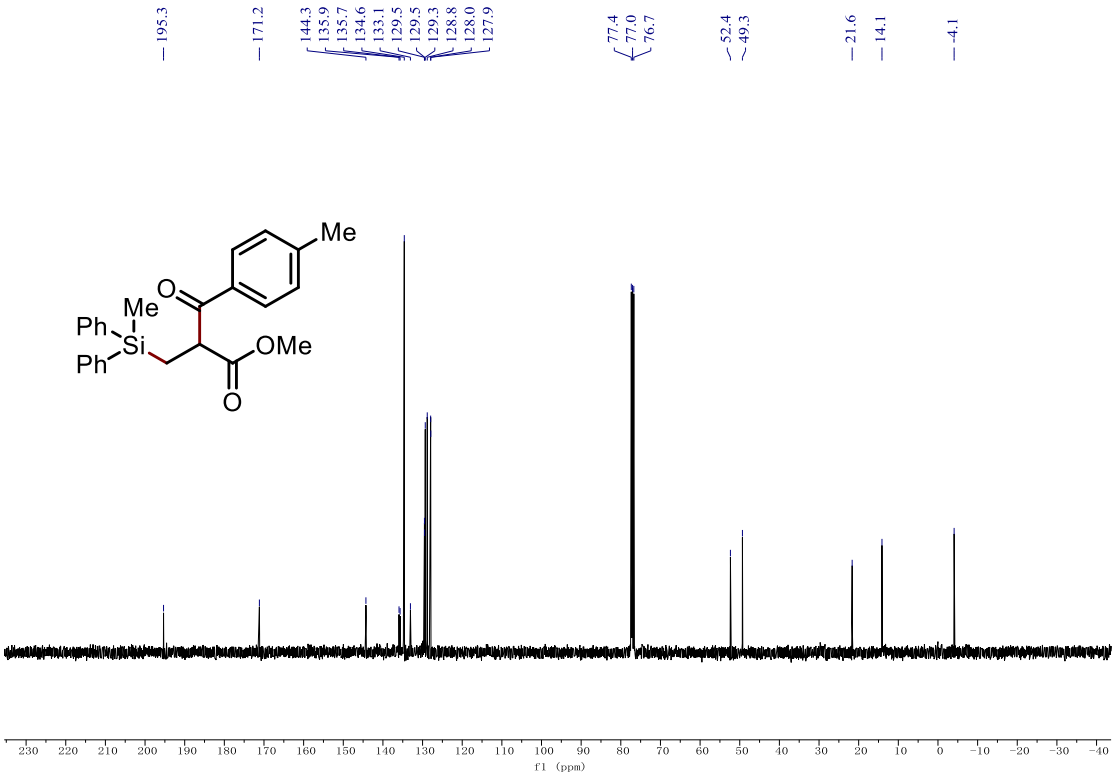
3-oxo-3-(p-tolyl)-2-((triphenylsilyl)methyl)propanoate (45)





Methyl 2-((methyldiphenylsilyl)methyl)-3-oxo-3-(p-tolyl)propanoate (46)

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Me
O
Me
Ph
Si
Ph
OMe
O
f1 (ppm)