Supporting Information

Regiospecific and Site-Selective C−H Allylation of Phenols with Vinyldiazo Compounds Catalyzed by In(III)

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1. General Information:

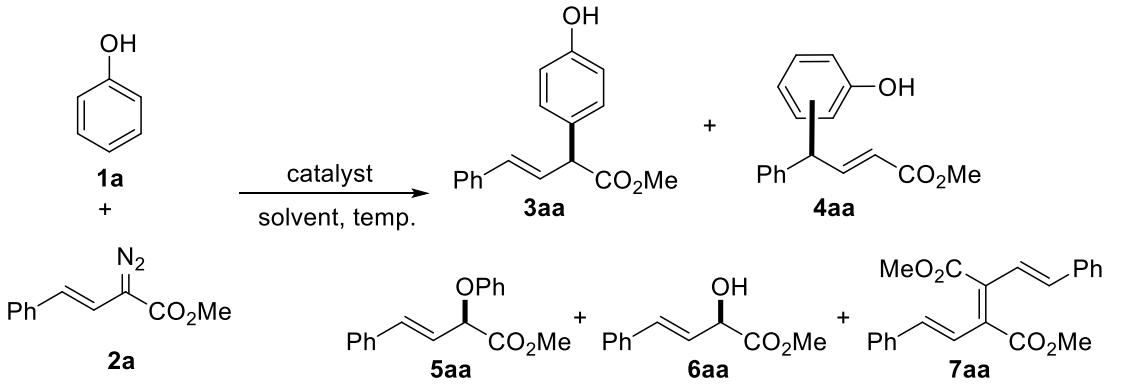
Unless otherwise noted, all reactions were carried out in standard Schlenk techniques with magnetic stirring bar under air. Materials obtained from commercial suppliers were used directly without further purification. ^{1}H NMR spectra were recorded on a BRUKER 500 (500 MHz) spectrometer in $CDCl_3$. Chemical shifts are reported in ppm with tetramethylsilane (TMS: 0 ppm) with the solvent resonance as the internal standard. Data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, dd = doublet of doublet, t = triplet, q = quartet, m = multiplet), coupling constants (Hz), and integration. ^{13}C NMR spectra were recorded on a BRUKER 500 (125 MHz) spectrometer in $CDCl_3$ with complete proton decoupling. Chemical shifts are reported in ppm with the deuterium solvent as the internal standard (e.g. $CDCl_3$: 77.0 ppm).

Anhydrous tetrahydrofuran (THF), toluene, 1,4-Dioxane and diethyl ether (Et_2O) were distilled from sodium and benzophenone to use; Anhydrous dichloromethane (DCM) and 1,2-dichloroethane (DCE) were distilled from CaH_2. Unless otherwise noted, analytical grade solvents and commercially available reagents were used directly.

Reactions were monitored by thin layer chromatography (TLC) using silicycle pre-coated silica gel plates. Flash column chromatography was performed on silica gel 60 (particle size 200-400 mesh ASTM, purchased from Yantai, China) and eluted with petroleum ether/ethyl acetate.

2. Optimization of Conditions

Table S1: Optimization of reaction conditions[a]

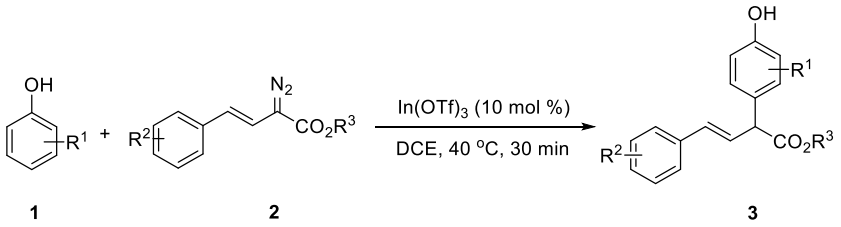


Entry	Catalyst	Solvent	Temp. (°C)	Time (h)	Yield (%)[b] **3/4/5/6/7**
1	$Sc(OTf)_3$	DCM	25	12	0/0/0/0/0
2	$Mn(OTf)_3$	DCM	25	12	0/0/0/0/0
3	$Rh_2(OAc)_4$	DCM	25	0.5	trace/0/33/0/42
4	$[Ir(COD)Cl]_2$	DCM	25	0.5	trace/0/0/0/41
5	$Cu(OTf)_2$	DCM	25	0.5	22(19)/0/23/0/30
6	$Pd(OAc)_2$	DCM	25	12	0/0/0/0/0
7	$Yb(OTf)_3$	DCM	25	12	0/0/0/0/0
8	$AgSbF_6$	DCM	25	0.5	13/0/24/0/29
9	$AgNTf_2$	DCM	25	0.5	15/0/17/0/26
10	AgOTf	DCM	25	0.5	23(18)/0/21/0/37
11	$AuCl_3$	DCM	25	12	0/0/0/0/0
12	$Hg(OTf)_2$	DCM	25	0.5	45/0/22/0/27
13	$Fe(OTf)_2$	DCM	25	12	0/0/0/0/0
14	$Fe(OTf)_3$	DCM	25	0.5	43/0/27/0/25
15[c]	$LPAuCl/AgSbF_6$	DCM	25	0.5	21/0/0/0/40
16[c] [d]	$LPAuCl/AgSbF_6$	DCM	25	0.5	17/0/0/0/32
17	$(C_6F_5)_3B$	DCM	25	0.5	0/0/11/(15)/25
18	$In(OTf)_3$	DCM	25	0.5	(56)/0/0/0/42
19	InF_3	DCM	25	24	0/0/0/0/0
20	$InCl_3$	DCM	25	24	0/0/0/0/0
21	$InBr_3$	DCM	25	0.5	32/0/0/0/24
22	InI_3	DCM	25	0.5	30/0/0/0/27
23	In_2O_3	DCM	25	24	0/0/0/0/0
24	$(AcO)_3In$	DCM	25	24	0/0/0/0/0
25[e]	$In(OTf)_3$	DCM	25	0.5	75/0/0/0/21
26[e]	$In(OTf)_3$	THF	25	16	0/0/0/0/0
27[e]	$In(OTf)_3$	Et_2O	25	16	0/0/0/0/0

28[e]	$In(OTf)_3$	1,4-Dioxane	25	16	0/0/0/0/0
29[e]	$In(OTf)_3$	MeCN	25	0.5	56/0/0/0/36
30[e]	$In(OTf)_3$	Toluene	25	0.5	40/0/0/0/32
31[e]	$In(OTf)_3$	$CHCl_3$	25	0.5	36/0/0/0/39
32[e]	$In(OTf)_3$	Chlorobenzene	25	0.5	42/0/0/0/35
33[e]	$In(OTf)_3$	DCE	25	0.5	83/0/0/0/13
34[e]	$In(OTf)_3$	DCM	40	0.5	84/0/0/0/15
35[e]	$In(OTf)_3$	DCE	40	0.5	99/0/0/0/11
36[e]	$In(OTf)_3$	DCE	50	0.5	76/0/0/0/22
37[e]	$In(OTf)_3$	DCE	60	0.5	74/0/0/0/25
38[e] [f]	$In(OTf)_3$	DCE	25	0.5	45/0/0/0/10
39[e] [g]	$In(OTf)_3$	DCE	25	0.5	85/0/0/0/32
40[e] [h]	$In(OTf)_3$	DCE	25	0.5	trace/0/0/0/0
41[e] [i]	$In(OTf)_3$	DCE	25	0.5	38/0/0/0/14
42[e] [j]	$In(OTf)_3$	DCE	25	0.5	80/0/0/0/19

[a] Reaction conditions: **1a** (0.10 mmol), **2a** (0.20 mmol) catalyst (10 mol %), solvent (2 mL). [b] Yields were determined by ^{1}H-NMR using CH_2Br_2 as internal standard, The numbers in parentheses are isolated yield. [c] L = (2, 4-^{t}Bu$_2$C$_6$H$_3$O)$_3$P. [d] **1a** (0.15 mmol), **2a** (0.10 mmol) catalyst (5 mol %), solvent (1 mL). [e] **1a** (0.10 mmol), catalyst (10 mol %), solvent (1 mL), solution of **2a** (0.20 mmol) in 1 mL of solvent was introduced into the reaction mixture by a syringe in 10 min and then being stirred for another 30 min. [f] **1a** (0.10 mmol), **2a** (0.10 mmol) catalyst (10 mol %), solvent (2 mL). [g] **1a** (0.10 mmol), **2a** (0.30 mmol) catalyst (10 mol %), solvent (2 mL). [h] **1a** (0.10 mmol), **2a** (0.20 mmol) catalyst (1 mol %), solvent (2 mL). [i] **1a** (0.10 mmol), **2a** (0.20 mmol) catalyst (5 mol %), solvent (2 mL). [j] **1a** (0.10 mmol), **2a** (0.20 mmol) catalyst (20 mol %), solvent (2 mL). Tf = trifluoromethanesulfonyl.

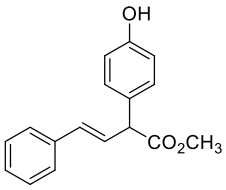
3. General Procedure for the C-H Functionalization:



1 2 3

In a dried Schlenk tube, a solution of $In(OTf)_3$ (16.9 mg, 0.030 mmol, 10 mol %), phenol (28.2 mg, 0.30 mmol) in DCE (1 mL) was stirred at 40 °C. Then a solution of methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (121 mg, 0.60 mmol) in 2 mL of DCE was introduced into the reaction mixture by a syringe in 15 mins. The resulting mixture was continually stirred at room temperature for 30 min and **2a** was consumed completely determined by TLC analysis. The mixture was passed through a short silica gel column and then concentrated under reduced pressure. The residue was purified by column chromatography on silica gel to afford the desired product.

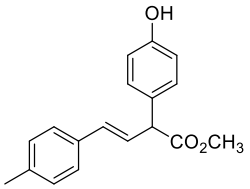
1) Synthesis of methyl (*E*)-2-(4-hydroxyphenyl)-4-phenylbut-3-enoate (3aa).



Phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (121 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3aa** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 79.7 mg; 99% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.40 – 7.33 (m, 2H), 7.32 – 7.27 (m, 2H), 7.26 – 7.16 (m, 3H), 6.90 – 6.73 (m, 2H), 6.55 (dd, *J* = 15.9, 8.1 Hz, 1H), 6.46 (d, *J* = 15.9 Hz, 1H), 5.29 (s, 1H), 4.42 (d, *J* = 8.1 Hz, 1H), 3.73 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.4, 155.0, 136.6, 132.3, 130.3, 129.2, 128.5, 127.7, 127.2, 126.4, 115.7, 54.1, 52.3; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{16}NaO_3$ 291.0992, found 291.0995.

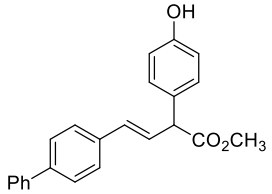
2) Synthesis of methyl (*E*)-2-(4-hydroxyphenyl)-4-(*p*-tolyl)but-3-enoate (3ab).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-(*p*-tolyl)but-3-enoate **2b** (130 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 ^oC, 30 min. **3ab** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 83.9 mg; 99% yield; Yellow oil; ^1H NMR (500 MHz, $CDCl_3$) δ 7.13 – 7.08 (m, 4H), 7.08 – 7.04 (m, 2H), 6.78 – 6.69 (m, 2H), 6.68 – 6.53 (m, 1H), 6.10 (d, *J* = 10.8 Hz, 1H), 5.90 (d, *J* = 12.0 Hz, 1H), 5.22 (s, 1H), 3.73 (s, 3H), 2.31 (s, 3H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 166.8, 154.2, 150.9, 140.1, 136.2, 135.1, 129.4, 129.3, 128.1, 118.2, 115.4, 51.3, 46.9, 21.0; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{18}H_{18}NaO_3$ 305.1148, found 305.1155.

3) Synthesis of methyl (*E*)-4-([1,1'-biphenyl]-4-yl)-2-(4-hydroxyphenyl)but-3-enoate (3ac).

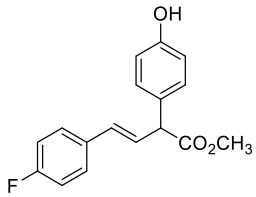


The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.3 mmol), methyl (*E*)-4-([1,1'-biphenyl]-4-yl)-2-diazobut-3-enoate **2c** (167 mg, 0.6 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 ^oC, 30 min. **3ac** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 93.0 mg; 90% yield; White solid; m.p. = 130.2 – 131.2 ^oC; ^1H NMR (500 MHz, $CDCl_3$) δ 7.58 – 7.50 (m, 4H), 7.46 – 7.39 (m, 3H), 7.33 (t, *J* = 7.4 Hz, 1H), 7.21 (d, *J* = 8.2 Hz, 2H), 7.05 (d, *J* = 8.5 Hz, 2H), 6.79 (d, *J* = 8.6 Hz, 2H), 5.78

(dd, *J* = 15.6, 1.3 Hz, 1H), 5.34 (s, 1H), 4.84 (d, *J* = 7.3 Hz, 1H), 3.74 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 167.2, 154.7, 150.6, 140.7, 140.7, 139.8, 133.4, 129.8, 128.9, 128.7, 127.4, 127.3, 127.0, 122.2, 115.6, 52.3, 51.7; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{23}H_{20}NaO_3$ 367.1305, found 367.1301.

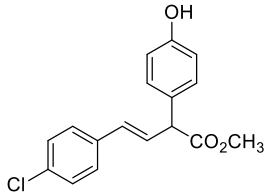
4) Synthesis of methyl (*E*)-4-(4-fluorophenyl)-2-(4-hydroxyphenyl)but-3-enoate (3ad).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-(4-fluorophenyl)but-3-enoate **2d** (132 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3ad** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 85.0 mg; 99% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.40 – 7.29 (m, 2H), 7.20 (d, *J* = 8.6 Hz, 2H), 7.09 – 6.92 (m, 2H), 6.89 – 6.74 (m, 2H), 6.52 – 6.34 (m, 2H), 5.38 (s, 1H), 4.40 (d, *J* = 7.6 Hz, 1H), 3.73 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.4, 163.3, 161.3, 155.1, 132.79, 132.76, 131.1, 130.2, 129.2, 128.0, 127.9, 126.98, 126.96, 115.7, 115.5, 115.3, 54.0, 52.4; ^{19}F NMR (470 MHz, $CDCl_3$) δ -114.29; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{15}FNaO_3$ 309.0897, found 309.0903.

5) Synthesis of methyl (*E*)-4-(4-chlorophenyl)-2-(4-hydroxyphenyl)but-3-enoate (3ae).

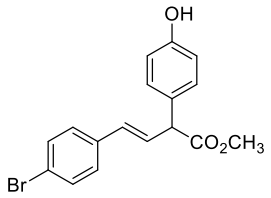


The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl

(*E*)-4-(4-chlorophenyl)-2-diazobut-3-enoate **2e** (142 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3ae** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 86.3 mg; 95% yield; White solid; m.p. = 120.5 – 121.3 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.31 – 7.23 (m, 4H), 7.21 – 7.13 (m, 2H), 6.87 – 6.73 (m, 2H), 6.52 (dd, *J* = 15.9, 8.2 Hz, 1H), 6.39 (d, *J* = 15.9 Hz, 1H), 5.39 (s, 1H), 4.40 (d, *J* = 8.1 Hz, 1H), 3.73 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.3, 155.1, 135.1, 133.3, 131.1, 130.0, 129.2, 128.7, 127.9, 127.6, 115.7, 54.0, 52.4; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{15}ClNaO_3$ 325.0602, found 325.0604.

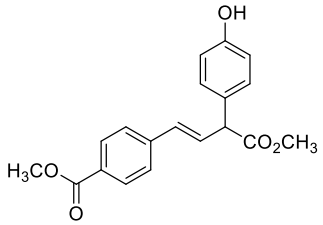
6) Synthesis of methyl (*E*)-4-(4-bromophenyl)-2-(4-hydroxyphenyl)but-3-enoate (3af).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-4-(4-bromophenyl)-2-diazobut-3-enoate **2f** (169 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3af** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 99.0 mg; 95% yield; White solid; m.p. = 140.5 – 141.5 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41 (d, *J* = 8.5 Hz, 2H), 7.21 (dd, *J* = 15.4, 8.5 Hz, 4H), 6.81 (d, *J* = 8.6 Hz, 2H), 6.54 (dd, *J* = 15.9, 8.2 Hz, 1H), 6.38 (d, *J* = 15.9 Hz, 1H), 5.35 (s, 1H), 4.39 (d, *J* = 8.2 Hz, 1H), 3.72 (s, 3H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.1, 155.1, 135.6, 131.6, 131.1, 130.0, 129.2, 128.1, 128.0, 121.4, 115.7, 54.0, 52.4; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{15}BrNaO_3$ 369.0097, found 369.0094.

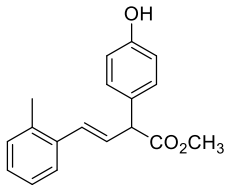
7) Synthesis of methyl (*E*)-4-(3-(4-hydroxyphenyl)-4-methoxy-4-oxobut-1-en-1-yl)benzoate (3ag).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-4-(3-diazo-4-methoxy-4-oxobut-1-en-1-yl)benzoate **2g** (156 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 ^oC, 30 min. **3ag** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 78.3 mg; 80% yield; Yellow oil; ^1H NMR (500 MHz, $CDCl_3$) δ 7.96 (d, *J* = 8.4 Hz, 2H), 7.43 (dd, *J* = 15.7, 6.8 Hz, 1H), 7.26 (d, *J* = 8.2 Hz, 2H), 7.18 – 7.09 (m, 1H), 7.04 (dd, *J* = 7.6, 1.5 Hz, 1H), 6.94 – 6.85 (m, 1H), 6.78 (dd, *J* = 8.0, 0.8 Hz, 1H), 5.72 (dd, *J* = 15.7, 1.6 Hz, 1H), 5.65 (s, 1H), 5.26 (d, *J* = 6.7 Hz, 1H), 3.89 (s, 3H), 3.73 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 167.06, 167.04, 153.2, 149.1, 146.4, 129.8, 129.6, 128.6, 128.6, 128.5, 127.3, 122.8, 120.9, 115.8, 52.1, 51.7, 46.9; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{19}H_{18}NaO_5$ 345.1046, found 349.1055.

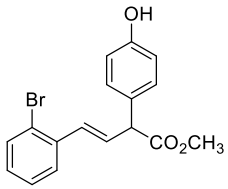
8) Synthesis of methyl (*E*)-2-(4-hydroxyphenyl)-4-(*o*-tolyl)but-3-enoate (3ah).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-(*o*-tolyl)but-3-enoate **2h** (130 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 ^oC, 30 min. **3ah** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 77.1 mg; 91% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.54 – 7.39 (m, 1H), 7.22 (d, *J* = 8.6 Hz, 2H), 7.19 – 7.07 (m, 3H), 6.84 – 6.77 (m, 2H), 6.68 (d, *J* = 15.7 Hz, 1H), 6.44 (dd, *J* = 15.7, 8.4 Hz, 1H), 5.42 (s, 1H), 5.29 (s, 1H), 4.46 (d, *J* = 8.3 Hz, 1H), 3.74 (s, 3H), 2.31 (s, 3H). ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.5, 155.0, 135.7, 135.4, 130.4, 130.2, 130.2, 129.2, 128.5, 127.6, 126.0, 125.7, 115.6, 54.3, 52.3, 19.7; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{18}H_{18}NaO_3$ 305.1148, found 305.1153.

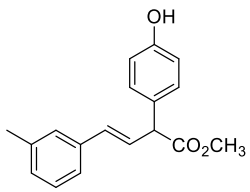
9) Synthesis of methyl (*E*)-4-(2-bromophenyl)-2-(4-hydroxyphenyl)but-3-enoate (3ai).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-4-(2-bromophenyl)-2-diazobut-3-enoate **2i** (169 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3ai** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 85.4 mg; 82% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.58 – 7.44 (m, 2H), 7.30 – 7.18 (m, 3H), 7.14 – 7.05 (m, 1H), 6.89 – 6.75 (m, 3H), 6.50 (dd, *J* = 15.8, 8.4 Hz, 1H), 5.18 (s, 1H), 4.47 (d, *J* = 8.4 Hz, 1H), 3.74 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.1, 155.1, 136.5, 132.9, 131.0, 130.2, 130.1, 129.2, 128.9, 127.4, 127.1, 123.6, 115.7, 54.1, 52.4; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{15}BrNaO_3$ 369.0097, found 369.0098.

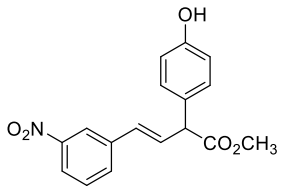
10) Synthesis of methyl (*E*)-2-(4-hydroxyphenyl)-4-(*m*-tolyl)but-3-enoate (3aj).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-(*m*-tolyl)but-3-enoate **2j** (130 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min, **3aj** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 83.9 mg; 99% yield; Yellow oil; ^1H NMR (500 MHz, $CDCl_3$) δ 7.24 –7.14 (m, 5H), 7.05 (d, *J* = 6.7 Hz, 1H), 6.80 (d, *J* = 8.5 Hz, 2H), 6.54 (dd, *J* = 15.8, 8.2 Hz, 1H), 6.43 (d, *J* = 15.9 Hz, 1H), 5.50 (s, 1H), 4.42 (d, *J* = 8.1 Hz, 1H), 3.74 (s, 3H), 2.33 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.5, 155.1, 138.1, 136.5, 132.4, 130.2, 129.2, 128.5, 128.4, 127.1, 126.9, 123.6, 115.6, 54.1, 52.4, 21.3; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{18}H_{18}NaO_3$ 305.1148, found 305.1151.

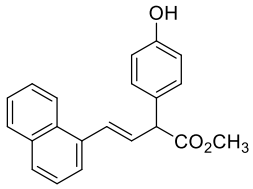
11) Synthesis of methyl (*E*)-2-(4-hydroxyphenyl)-4-(3-nitrophenyl)but-3-enoate (3ak).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-(3-nitrophenyl)but-3-enoate **2k** (148 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3ak** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 47.0 mg; 50% yield; Yellow oil; ^1H NMR (500 MHz, $CDCl_3$) δ 8.23 (s, 1H), 8.10 (dd, *J* = 7.8, 1.7 Hz, 1H), 7.69 (d, *J* = 7.5 Hz, 1H), 7.48 (t, *J* = 8.0 Hz, 1H), 7.27 – 7.18 (m, 2H), 7.09 (s, 1H), 6.96 (t, *J* = 7.8 Hz, 2H), 6.79 (dd, *J* = 15.9, 7.6 Hz, 1H), 6.56 (d, *J* = 15.9 Hz, 1H), 4.69 (d, *J* = 7.6 Hz, 1H), 3.82 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 174.5, 154.2, 148.5, 138.3, 132.3, 130.7, 130.0, 129.4, 128.4, 123.4, 122.4, 121.2, 117.7, 53.0, 51.6; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{15}NNaO_5$ 336.0842, found 336.0851.

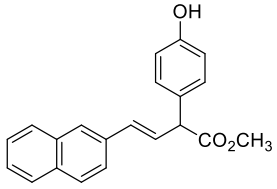
12) Synthesis of methyl (*E*)-2-(4-hydroxyphenyl)-4-(naphthalen-1-yl)but-3-enoate (3al).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-(naphthalen-1-yl)but-3-enoate **2l** (151 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 ºC, 30 min. **3al** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 67.8 mg; 71% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.15 – 8.09 (m, 1H), 7.91 – 7.84 (m, 1H), 7.79 (d, *J* = 8.1 Hz, 1H), 7.51 – 7.40 (m, 3H), 7.38 (d, *J* = 7.1 Hz, 1H), 7.09 (d, *J* = 8.5 Hz, 2H), 6.97 (d, *J* = 10.4 Hz, 1H), 6.85 – 6.69 (m, 3H), 5.99 (d, *J* = 11.3 Hz, 1H), 5.25 (s, 1H), 3.76 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 166.7, 154.3, 151.2, 139.1, 135.2, 134.1, 131.8, 129.3, 128.7, 127.5, 126.2, 125.6, 125.4, 125.3, 124.3, 118.5, 115.5, 51.4, 43.7; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{21}H_{18}NaO_3$ 341.1148, found 341.1156.

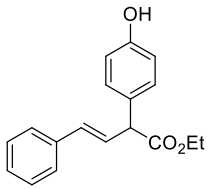
13) Synthesis of methyl (*E*)-2-(4-hydroxyphenyl)-4-(naphthalen-2-yl)but-3-enoate (3am).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-(naphthalen-2-yl)but-3-enoate **2m** (151 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 ºC, 30 min. **3am** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 83.1 mg; 87% yield; White solid; m.p. = 140.2 – 141.2 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.76 (t, *J* = 7.5 Hz, 3H), 7.70 (s, 1H), 7.59 (d, *J* = 8.6 Hz, 1H), 7.49 – 7.35 (m, 2H), 7.24 (d, *J* = 8.4 Hz, 2H), 6.81 (d, *J* = 8.6 Hz, 2H), 6.67 (dd, *J* = 15.8, 7.8 Hz, 1H), 6.60 (d, *J* = 15.9 Hz, 1H), 5.46 (s, 1H), 4.47 (d, *J* = 7.8 Hz, 1H), 3.74 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.5, 155.1, 134.1, 133.5, 133.0, 132.4, 130.2, 129.2, 128.2, 127.9, 127.6, 127.6, 126.4, 126.2, 125.9, 123.6, 115.7, 54.2, 52.4; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{21}H_{18}NaO_3$ 341.1148, found 341.1151.

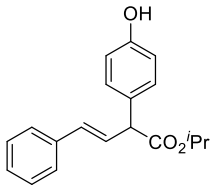
14) Synthesis of ethyl (*E*)-2-(4-hydroxyphenyl)-4-phenylbut-3-enoate (3an).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), ethyl (*E*)-2-diazo-4-phenylbut-3-enoate **2n** (130 mg, 0.6 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3an** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 68.6 mg; 81% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.38 (d, *J* = 7.4 Hz, 2H), 7.30 (t, *J* = 7.5 Hz, 2H), 7.23 (d, *J* = 8.5 Hz, 3H), 6.80 (d, *J* = 8.5 Hz, 2H), 6.55 (dd, *J* = 15.9, 8.1 Hz, 1H), 6.46 (d, *J* = 15.9 Hz, 1H), 5.01 (s, 1H), 4.39 (d, *J* = 8.0 Hz, 1H), 4.27 – 4.01 (m, 2H), 1.26 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.8, 154.9, 136.7, 132.1, 130.6, 129.2, 128.5, 127.6, 127.5, 126.4, 115.6, 61.2, 54.2, 14.1; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{18}H_{18}NaO_3$ 305.1148, found 305.1152.

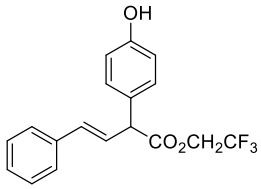
15) Synthesis of isopropyl (*E*)-2-(4-hydroxyphenyl)-4-phenylbut-3-enoate (3ao).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), isopropyl (*E*)-2-diazo-4-phenylbut-3-enoate **2o** (138 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3ao** was obtained after purification by flash chromatography (PE/EA = 15:1)

(PE/EA = 15:1) 88.0 mg; 99% yield; Yellow oil; ^1H NMR (500 MHz, $CDCl_3$) δ 7.38 (d, *J* = 7.4 Hz, 2H), 7.30 (t, *J* = 7.5 Hz, 2H), 7.25 – 7.19 (m, 3H), 6.79 (d, *J* = 8.6 Hz, 2H), 6.54 (dd, *J* = 15.9, 8.0 Hz, 1H), 6.46 (d, *J* = 15.9 Hz, 1H), 5.10 – 5.00 (m, 1H), 4.97 (s, 1H), 4.36 (d, *J* = 8.0 Hz, 1H), 1.23 (dd, *J* = 22.8, 6.3 Hz, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.4, 154.9, 136.8, 132.1, 130.7, 129.2, 128.5, 127.60, 127.59, 126.4, 115.6, 68.6, 54.4, 21.74, 21.66; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{19}H_{20}NaO_3$ 319.1305, found 319.1315.

16) Synthesis of 2,2,2-trifluoroethyl (*E*)-2-(4-hydroxyphenyl)-4-phenylbut-3-enoate (3ap).

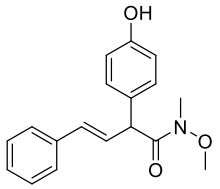


The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), 2,2,2-trifluoroethyl (*E*)-2-diazo-4-phenylbut-3-enoate **2p** (154 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min, **3ap** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 85.8 mg; 85% yield; Yellow oil; ^1H NMR (500 MHz, $CDCl_3$) δ 7.37 (d, *J* = 7.3 Hz, 2H), 7.31 (t, *J* = 7.5 Hz, 2H), 7.27 – 7.20 (m, 3H), 6.87 – 6.69 (m, 2H), 6.58 – 6.40 (m, 2H), 4.98 (s, 1H), 4.62 – 4.31 (m, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ

171.1, 155.2, 136.4, 133.0, 129.4, 129.3, 128.6, 127.9, 126.5, 126.1, 115.8, 60.8, 60.5, 53.5. ^{19}F NMR (470 MHz, $CDCl_3$) δ -73.64; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{18}H_{15}F_3NaO_3$ 359.0865, found 359.0865.

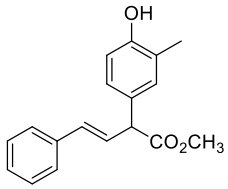
17) Synthesis of (*E*)-2-(4-hydroxyphenyl)-*N*-methoxy-*N*-methyl-4-phenylbut-3-enamide (3aq).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), (*E*)-2-diazo-*N*-methoxy-*N*-methyl-4-phenylbut-3-enamide **2q** (139 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3aq** was obtained after purification by flash chromatography (PE/EA = 4:1).

(PE/EA = 4:1) 79.4 mg; 89% yield; Yellow oil; ^1H NMR (500 MHz, $CDCl_3$) δ 7.36 (d, *J* = 7.5 Hz, 2H), 7.30 – 7.15 (m, 5H), 6.77 (d, *J* = 8.4 Hz, 2H), 6.61 (dd, *J* = 15.9, 8.3 Hz, 1H), 6.42 (d, *J* = 15.9 Hz, 1H), 6.27 (s, 1H), 4.90 (s, 1H), 3.54 (s, 3H), 3.21 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.8, 155.2, 136.9, 131.6, 130.6, 129.3, 128.7, 128.4, 127.4, 126.4, 125.5, 115.7, 61.5, 50.2, 32.3, 30.3; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{18}H_{19}NNaO_3$ 320.1257, found 320.1258.

19) Synthesis of methyl (*E*)-2-(4-hydroxy-3-methylphenyl)-4-phenylbut-3-enoate (3ba).

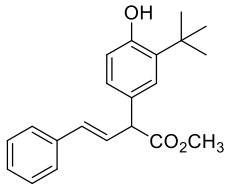


The procedure is similar with that of **3aa**: o-cresol **1b** (32.4 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (121 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3ba** was obtained after purification by flash

chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 83.9 mg; 99% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.43 – 7.38 (m, 2H), 7.34 – 7.30 (m, 2H), 7.27 – 7.21 (m, 1H), 7.13 (d, *J* = 1.9 Hz, 1H), 7.08 (dd, *J* = 8.2, 2.2 Hz, 1H), 6.76 (d, *J* = 8.2 Hz, 1H), 6.58 (dd, *J* = 15.9, 8.2 Hz, 1H), 6.48 (d, *J* = 15.9 Hz, 1H), 4.98 (s, 1H), 4.41 (d, *J* = 8.2 Hz, 1H), 3.75 (s, 3H), 2.26 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.3, 153.2, 136.7, 132.1, 130.5, 130.3, 128.5, 127.6, 127.4, 126.5, 126.4, 124.2, 115.2, 54.1, 52.3, 15.8; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{18}H_{18}NaO_3$ 305.1148, found 305.1157.

20) Synthesis of methyl (*E*)-2-(3-(tert-butyl)-4-hydroxyphenyl)-4-phenylbut-3-enoate (3ca).

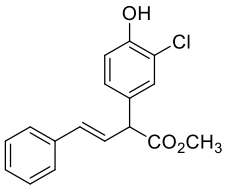


The procedure is similar with that of **3aa**: 2-(tert-butyl)phenol **1c** (45.1 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (121 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3ca** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 82.7 mg; 85% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.40 – 7.36 (m, 2H), 7.32 – 7.27 (m, 2H), 7.25 – 7.20 (m, 2H), 7.07 (dd, *J* = 8.1, 2.2 Hz, 1H), 6.64 (d, *J* = 8.1 Hz, 1H), 6.55 (dd, *J* = 15.8, 8.2 Hz, 1H), 6.46 (d, *J* = 15.9 Hz, 1H), 4.93 (s, 1H), 4.40 (d, *J* = 8.2 Hz, 1H), 3.73 (s, 3H), 1.40 (s, 9H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.4, 153.7, 136.8, 136.4, 132.0, 129.9, 128.6, 128.5, 127.6, 126.9, 126.4, 126.2, 116.8, 54.5, 52.2, 34.6, 29.5; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{21}H_{24}NaO_3$ 347.1618, found 347.1613.

21) Synthesis of methyl (*E*)-2-(3-chloro-4-hydroxyphenyl)-4-phenylbut-3-enoate

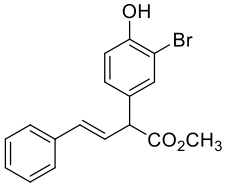
(3da).



The procedure is similar with that of **3aa**: 2-chlorophenol **1d** (38.6 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (121 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3da** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 74.5 mg; 82% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.40 – 7.35 (m, 2H), 7.34 – 7.27 (m, 3H), 7.24 (t, *J* = 7.3 Hz, 1H), 7.17 (dd, *J* = 8.4, 2.1 Hz, 1H), 6.99 (d, *J* = 8.4 Hz, 1H), 6.55 – 6.43 (m, 2H), 5.59 (s, 1H), 4.39 (d, *J* = 7.1 Hz, 1H), 3.74 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.6, 150.7, 136.4, 132.8, 131.4, 128.6, 128.4, 128.1, 127.9, 126.5, 126.5, 120.1, 116.4, 53.8, 52.4; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{15}ClNaO_3$ 325.0602, found 325.0608.

22) Synthesis of methyl (*E*)-2-(3-bromo-4-hydroxyphenyl)-4-phenylbut-3-enoate (3ea).

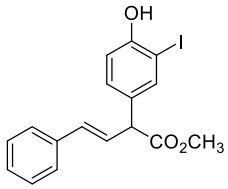


The procedure is similar with that of **3aa**: 2-bromophenol **1e** (84.4 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (121 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3ea** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 74.5 mg; 81% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.47 (d, *J* = 2.1 Hz, 1H), 7.41 – 7.35 (m, 2H), 7.31 (t, *J* = 7.5 Hz, 2H), 7.26 – 7.18 (m, 2H), 6.99 (d, *J* = 8.4 Hz, 1H), 6.55 – 6.42 (m, 1H), 5.59 (s, 1H), 4.39 (d, *J* = 7.1 Hz, 1H),

3.73 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.6, 151.7, 136.4, 132.8, 131.8, 131.4, 128.8, 128.6, 127.9, 126.5, 126.5, 116.3, 110.4, 53.7, 52.4; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{15}BrNaO_3$ 369.0097, found 369.0097.

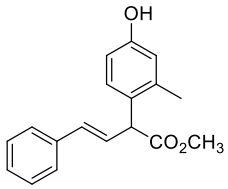
23) Synthesis of methyl (*E*)-2-(4-hydroxy-3-iodophenyl)-4-phenylbut-3-enoate (3fa).



The procedure is similar with that of **3aa**: 2-iodophenol **1f** (66.0 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (121 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3fa** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 104.1 mg; 88% yield; Brown oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.64 (d, *J* = 2.1 Hz, 1H), 7.42 – 7.35 (m, 2H), 7.31 (t, *J* = 7.5 Hz, 2H), 7.27 – 7.19 (m, 2H), 6.96 (d, *J* = 8.4 Hz, 1H), 6.59 – 6.29 (m, 2H), 5.43 (s, 1H), 4.37 (d, *J* = 7.2 Hz, 1H), 3.73 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.7, 154.3, 137.5, 136.4, 132.8, 132.3, 129.9, 128.6, 127.9, 126.6, 126.5, 115.2, 85.9, 53.5, 52.5; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{15}INaO_3$ 416.9958, found 416.9944.

24) Synthesis of methyl (*E*)-2-(4-hydroxy-2-methylphenyl)-4-phenylbut-3-enoate (3ga).

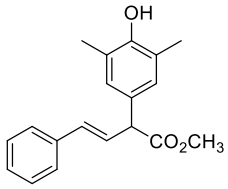


The procedure is similar with that of **3aa**: m-cresol **1g** (32.4 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (121 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3ga** was obtained after purification by flash

chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 61.0 mg; 72% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.36 (d, *J* = 7.4 Hz, 2H), 7.29 (t, *J* = 7.6 Hz, 2H), 7.21 (dd, *J* = 17.5, 8.3 Hz, 2H), 6.70 – 6.63 (m, 2H), 6.54 (dd, *J* = 15.9, 7.6 Hz, 1H), 6.37 (d, *J* = 15.9 Hz, 1H), 5.20 (s, 1H), 4.62 (d, *J* = 7.6 Hz, 1H), 3.73 (s, 3H), 2.32 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.7, 154.7, 137.7, 136.7, 132.0, 129.2, 128.8, 128.5, 127.6, 127.0, 126.4, 117.5, 113.3, 52.3, 50.3, 19.7; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{18}H_{18}NaO_3$ 305.1148, found 305.1148.

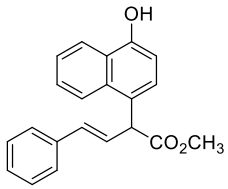
25) Synthesis of methyl (*E*)-2-(4-hydroxy-3,5-dimethylphenyl)-4-phenylbut-3-enoate (3ha).



The procedure is similar with that of **3aa**: 2,6-dimethylphenol **1h** (36.7 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (121 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 ºC, 30 min. **3ha** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 77.3 mg; 87% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.38 (d, *J* = 7.3 Hz, 2H), 7.29 (t, *J* = 7.6 Hz, 2H), 7.22 (t, *J* = 7.3 Hz, 1H), 6.96 (s, 2H), 6.55 (dd, *J* = 15.9, 8.3 Hz, 1H), 6.45 (d, *J* = 15.9 Hz, 1H), 4.65 (s, 1H), 4.34 (d, *J* = 8.3 Hz, 1H), 3.72 (s, 3H), 2.23 (s, 6H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 173.3, 151.6, 136.8, 132.0, 129.8, 128.5, 128.0, 127.6, 127.5, 126.4, 123.4, 54.2, 52.3, 16.0; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{19}H_{20}NaO_3$ 319.1305, found 319.1304.

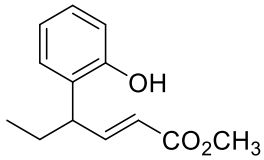
26) Synthesis of methyl (*E*)-2-(4-hydroxynaphthalen-1-yl)-4-phenylbut-3-enoate (3ia).



The procedure is similar with that of **3aa**: naphthalen-1-ol **1i** (43.3 mg, 0.30 mmol), methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (121 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **3ia** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 86.0 mg; 90% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.27 (d, *J* = 8.2 Hz, 1H), 8.04 (d, *J* = 8.5 Hz, 1H), 7.58 – 7.53 (m, 1H), 7.49 (t, *J* = 7.5 Hz, 1H), 7.38 (d, *J* = 7.4 Hz, 2H), 7.34 – 7.27 (m, 3H), 7.22 (t, *J* = 7.3 Hz, 1H), 6.76 (dd, *J* = 15.9, 7.5 Hz, 1H), 6.71 (d, *J* = 7.8 Hz, 1H), 6.50 (d, *J* = 15.9 Hz, 1H), 6.12 (s, 1H), 5.15 (d, *J* = 7.5 Hz, 1H), 3.75 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 174.1, 151.5, 136.7, 132.8, 132.4, 128.5, 127.6, 127.0, 126.7, 126.44, 126.36, 126.34, 125.00, 124.97, 123.1, 122.7, 108.2, 52.5, 50.7; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{21}H_{18}NaO_3$ 341.1148, found 341.1156.

27) Synthesis of methyl (*E*)-4-(2-hydroxyphenyl)hex-2-enoate (4ar).

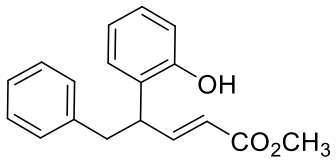


The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-2-diazohex-3-enoate **2r** (92.5 mg, 0.6 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 °C, 30 min. **4ar** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 49.6 mg; 75% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.21 – 7.06 (m, 3H), 6.90 – 6.93 (m, 1H), 6.78 (dd, *J* = 7.9, 1.2 Hz, 1H), 5.87 (dd, *J* = 15.7, 1.3 Hz, 1H), 5.59 (s, 1H), 3.72 – 3.76 (m, 4H), 1.83 – 1.89 (m, 2H), 0.93 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 167.7, 153.5, 152.1, 128.4, 128.2, 127.6,

120.9, 120.3, 115.7, 51.6, 43.5, 26.5, 12.2; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{13}H_{16}NaO_3$ 243.0992, found 243.1003.

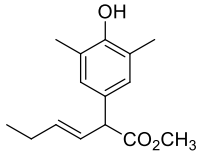
28) Synthesis of methyl (*E*)-4-(2-hydroxyphenyl)-5-phenylpent-2-enoate (4as).



The procedure is similar with that of **3aa**: phenol **1a** (28.2 mg, 0.30 mmol), methyl (*E*)-2-diazo-5-phenylpent-3-enoate **2s** (130 mg, 0.60 mmol), $In(OTf)_3$ (16.9 mg, 0.030 mmol), DCE, 40 ^oC, 30 min. **4as** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 65.2 mg; 77% yield; Yellow oil; ^1H NMR (500 MHz, $CDCl_3$) δ 7.28 – 7.19 (m, 3H), 7.18 – 7.00 (m, 5H), 6.88 – 6.85 (m, 1H), 6.72 (dd, *J* = 7.9, 1.2 Hz, 1H), 5.75 (dd, *J* = 15.7, 1.3 Hz, 1H), 5.50 (s, 1H), 4.13 – 4.08 (m, 1H), 3.69 (s, 3H), 3.29 – 2.99 (m, 2H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 167.5, 153.3, 150.9, 139.4, 129.1, 128.7, 128.2, 127.9, 127.9, 126.2, 120.9, 120.8, 115.8, 51.6, 44.1, 40.0; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{18}H_{18}NaO_3$ 305.1148, found 305.1155.

29) Synthesis of (E)-methyl 2-(4-hydroxy-3,5-dimethylphenyl)hex-3-enoate (4hr).

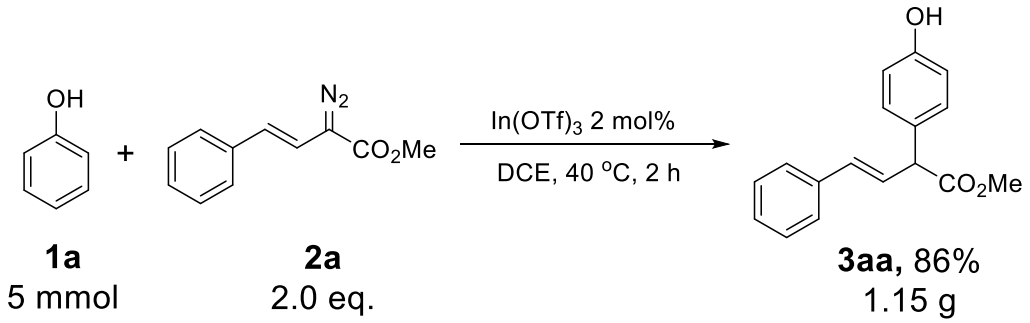


The procedure is similar with that of **3aa**: 2,6-dimethylphenol **1h** (36.7 mg, 0.3 mmol), methyl (*E*)-2-diazohex-3-enoate **2r** (92.5 mg, 0.6 mmol), $In(OTf)_3$ (16.9 mg, 0.03 mmol), DCE, 40 ^oC, 30 min, **4hr** was obtained after purification by flash chromatography (PE/EA = 15:1).

(PE/EA = 15:1) 8.2 mg; 11% yield; Yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.04 (dd, *J* = 15.6, 8.0 Hz, 1H), 6.76 (s, 2H), 5.77 (dd, *J* = 15.6, 1.2 Hz, 1H), 4.61 (s, 1H), 3.71 (s, 3H), 3.15 (q, *J* = 7.6 Hz, 1H), 2.22 (s, 6H), 1.80 – 1.69 (m, 2H), 0.87 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 167.3, 152.8, 150.9, 133.6, 127.8, 123.2, 119.8, 51.5, 49.6, 27.9, 16.0, 12.2; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{15}H_{20}NaO_3$ 271.1305, found 271.1308.

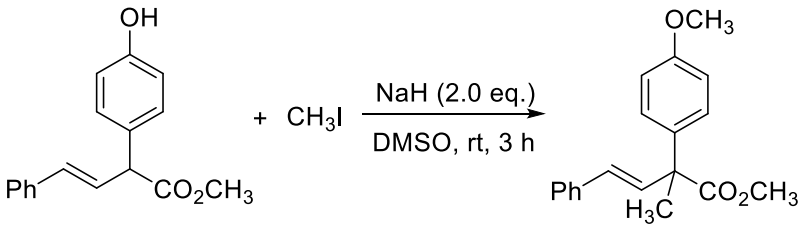
4. Gram Scale Preparation of 3aa and Synthetic Application

1) Gram scale preparation of 3aa



In a dried Schlenk tube, a solution of $In(OTf)_3$ (56.2 mg, 0.10 mmol, 2.0 mol %), phenol (0.471 g, 5.0 mmol) in DCE (10 mL) was stirred at 40 °C. Then a solution of methyl (*E*)-2-diazo-4-phenylbut-3-enoate **2a** (2.02 g, 10.0 mmol) in 20 mL of DCE was introduced into the reaction mixture by a syringe in 1 h. The resulting mixture was continually stirred at room temperature for 1 h and **2a** was consumed completely determined by TLC analysis. The mixture was passed through a short silica gel column and then concentrated under reduced pressure. The residue was purified by column chromatography on silica gel (PE/EA = 15:1) to afford **3aa** (1.15 g, 86%).

2) Methyl (*E*)-2-(4-methoxyphenyl)-2-methyl-4-phenylbut-3-enoate (5).

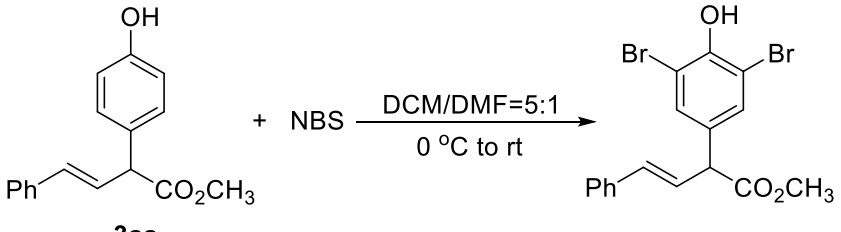


3aa **5**

In a dried flask, **3aa** (268 mg, 1.0 mmol) and DMSO (10 mL) were added at 0 °C. Then NaH (80.0 mg, 2.0 mmol) was added, the reaction was warmed to room temperature and stirred for 30 minutes. Then CH_3I (284 mg, 2.0 mmol) was introduced into the reaction mixture by a syringe. The resulting mixture was continually stirred for 3 hours. Finally, H_2O was added to the mixture, and extracted with DCM. The combined organic phases were dried over anhydrous Na_2SO_4. After being filtrated through celite and concentrated, The residue was purified by silica chromatography (PE/EA = 60:1) to get desired product **5** (267 mg, 90%) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41 (d, *J* = 7.7 Hz, 2H), 7.32 (t, *J* = 7.6 Hz, 2H), 7.26 – 7.20 (m, 4H), 6.90 – 6.82 (m, 2H), 6.76 (d, *J* = 16.3 Hz, 1H), 6.43 (d, *J* = 16.3 Hz, 1H), 3.79 (s, 3H), 3.72 (s, 3H), 1.73 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 175.4, 158.4, 137.0, 135.9, 133.1, 129.7, 128.6, 127.61, 127.57, 126.5, 113.8, 55.2, 52.7, 52.4, 24.3; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{19}H_{20}NaO_3$ 319.1305, found 319.1315.

3) Methyl (*E*)-2-(3,5-dibromo-4-hydroxyphenyl)-4-phenylbut-3-enoate (6).[1]



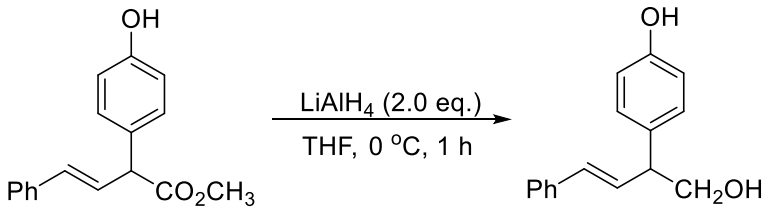
3aa **6**

To a solution of **3aa** (107 mg, 0.40 mmol) in DCM (10 mL) and DMF (2 mL) was added NBS (214 mg, 1.2 mmol) at 0 °C and then the reaction was warmed to room temperature and stirred for 5 minutes. The reaction was quenched with $Na_2S_2O_3$

solution and extracted with ethyl acetate. The organic layer was dried with Na_2SO_4 and concentrated. The residue was purified by silica chromatography (PE/EA = 20:1 to 10:1) to get desired product **6** (145 mg, 85%) as a white solid (m.p. = 124.0 – 125.0 ^oC).

^1H NMR (500 MHz, $CDCl_3$) δ 7.46 (s, 2H), 7.40 – 7.36 (m, 2H), 7.34 – 7.29 (m, 2H), 7.28 – 7.22 (m, 1H), 6.53 – 6.36 (m, 2H), 5.90 (s, 1H), 4.36 (d, *J* = 6.3 Hz, 1H), 3.75 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.1, 148.8, 136.2, 133.3, 132.7, 131.5, 128.6, 128.0, 126.5, 125.8, 110.0, 53.3, 52.6; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{14}Br_2NaO_3$ 446.9202, found 446.9202.

4) (*E*)-4-(1-Hydroxy-4-phenylbut-3-en-2-yl)phenol (7).[2]

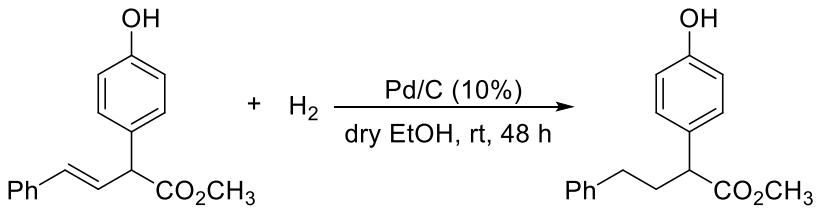


3aa **7**

To a solution of **3aa** (268 mg, 1.0 mmol) in THF (20 mL) was added $LiAlH_4$ (75.9 mg, 2.0 mmol) at 0 ^oC and stirred for 1h. The reaction was quenched with $NaHCO_3$ solution and extracted with ethyl acetate. The combined organic layer was concentrated and dried with Na_2SO_4. The residue was purified by silica chromatography (PE/EA = 2:1) to get desired product **7** (237.9 mg, 99%) as a white solid (m.p. = 127.2 – 128.2 ^oC).

^1H NMR (500 MHz, $CDCl_3$) δ 7.36 (d, *J* = 7.4 Hz, 2H), 7.30 (t, *J* = 7.6 Hz, 2H), 7.22 (t, *J* = 7.3 Hz, 1H), 7.14 (d, *J* = 8.5 Hz, 2H), 6.81 (d, *J* = 8.5 Hz, 2H), 6.50 (d, *J* = 16.0 Hz, 1H), 6.34 (dd, *J* = 15.9, 7.8 Hz, 1H), 3.88 (d, *J* = 7.1 Hz, 2H), 3.64 (q, *J* = 7.3 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 154.7, 137.0, 132.5, 131.9, 129.8, 129.1, 128.5, 127.5, 126.2, 115.7, 66.4, 50.8; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{16}H_{16}NaO_2$ 263.1043, found 263.1049.

5) Methyl 2-(4-hydroxyphenyl)-4-phenylbutanoate (8)

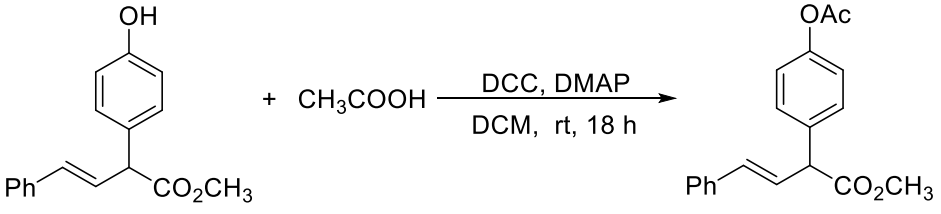


3aa **8**

To a mixture of Pd/C (10.7 mg, 10% w/w Pd on carbon) in dry EtOH (4.0 mL) was added **3aa** (107 mg, 0.40 mmol) under argon atmosphere. Then, the reaction flask was evacuated and refilled with hydrogen through a balloon. The resulting reaction mixture was stirred under the hydrogen atmosphere at room temperature for 48 h. After completion, the reaction mixture was filtered and rinsed with DCM. The filtrate was concentrated under reduced pressure and the residue was purified by column chromatography on silica gel to afford **8** as a colorless oil (107 mg, 99%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30 – 7.23 (m, 2H), 7.21 – 7.11 (m, 5H), 6.77 (d, *J* = 8.5 Hz, 2H), 5.76 (s, 1H), 3.65 (s, 3H), 3.50 (t, *J* = 7.7 Hz, 1H), 2.61 – 2.48 (m, 2H), 2.45 – 2.30 (m, 1H), 2.14 – 2.01 (m, 1H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 175.1, 155.1, 141.2, 130.5, 129.2, 128.4, 128.4, 126.0, 115.6, 52.1, 49.9, 34.8, 33.4; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{17}H_{18}NaO_3$ 293.1148, found 293.1161.

6) Methyl (*E*)-2-(4-acetoxyphenyl)-4-phenylbut-3-enoate (9)



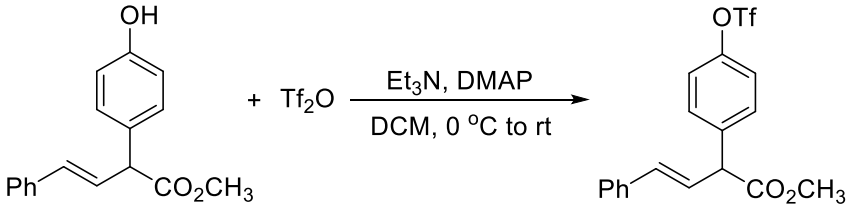
3aa **9**

The mixture of compound **3aa** (268 mg, 1.0 mmol), CH_3COOH (72.1 mg, 1.2 mmol), DCC (227 mg, 1.1 mmol) and DMAP (24.4 mg, 0.20 mmol) in DCM was stirred at room temperature for 18 hours. After being filtrated through celite and concentrated, the residue was purified by column chromatography to get a yellow oil **9** (289 mg, 93%).

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.41 – 7.35 (m, 4H), 7.30 (t, *J* = 7.6 Hz, 2H), 7.25 –

7.20 (m, 1H), 7.09 – 7.05 (m, 2H), 6.55 (dd, *J* = 15.9, 7.9 Hz, 1H), 6.48 (d, *J* = 15.9 Hz, 1H), 4.47 (d, *J* = 7.9 Hz, 1H), 3.73 (s, 4H), 2.29 (s, 4H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.6, 169.4, 149.9, 136.5, 135.7, 132.7, 129.0, 128.5, 127.8, 126.8, 126.5, 121.8, 54.3, 52.4, 21.1; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{19}H_{18}NaO_4$ 333.1097, found 333.1105.

7) Methyl (*E*)-4-phenyl-2-(4-(((trifluoromethyl)sulfonyl)oxy)phenyl)but-3-enoate (10).[3]

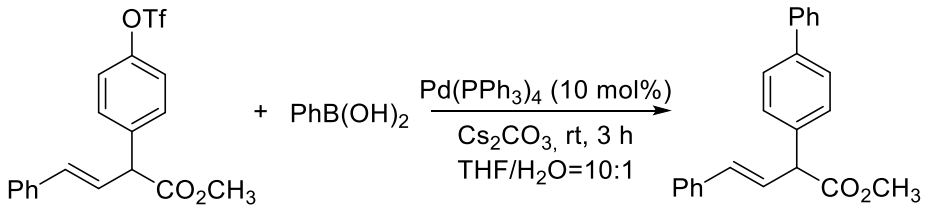


3aa **10**

To a solution of **3aa** (403 mg, 1.5 mmol), Et_3N (233 mg, 2.3 mmol) and DMAP (18.3 mg, 0.15 mmol) in DCM was added Tf_2O (649 mg, 2.3 mmol) dropwise at 0 °C, the reaction was then allowed warmed to room temperature and stirred for another 15 minutes. The reaction was quenched with aqueous saturated $NaHCO_3$ and extracted with ethyl acetate. The combined organic layer was dried and concentrated under reduced pressure after filtration. The residue was purified by silica chromatography (PE/EA = 10:1) to give the desired product **10** (589 mg, 98%) as a yellow oil.

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.48 – 7.43 (m, 2H), 7.40 – 7.36 (m, 2H), 7.33 – 7.29 (m, 2H), 7.28 – 7.22 (m, 3H), 6.57 – 6.44 (m, 2H), 4.51 (d, *J* = 6.8 Hz, 1H), 3.75 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.1, 148.8, 138.7, 136.2, 133.3, 129.9, 128.6, 128.0, 126.5, 126.0, 122.5, 121.6, 120.0, 117.4, 114.9, 54.2, 52.5; ^{19}F NMR (470 MHz, $CDCl_3$) δ -72.85; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{18}H_{15}F_3NaO_5S$ 423.0484, found 423.0494.

8) Methyl (*E*)-2-([1,1'-biphenyl]-4-yl)-4-phenylbut-3-enoate (11).[4]



3aa **11**

The mixture of compound **10** (120 mg, 0.30 mmol), $Ph(OH)_2$ (54.9 mg, 0.45 mmol), Cs_2CO_3 (489 mg, 1.5 mmol), $Pd(PPh_3)_4$ (35.0 mg, 0.030 mmol) in THF/H_2O (11 mL, 10:1) was stirred at room temperature for 3 hours. Then the reaction was extracted with ethyl acetate. The combined organic layer was dried over Na_2SO_4 and concentrated under reduced pressure after filtration. The residue was purified by silica chromatography (PE/EA = 10:1) to give the desired product **11** (82.8 mg, 84%) as a white solid (m.p. = 78.5 – 79.5 ^oC).

^1H NMR (500 MHz, $CDCl_3$) δ 7.60 – 7.55 (m, 4H), 7.46 – 7.38 (m, 6H), 7.36 – 7.28 (m, 4H), 7.25 – 7.20 (m, 2H), 6.61 (dd, *J* = 15.9, 8.2 Hz, 1H), 6.52 (d, *J* = 15.9 Hz, 1H), 4.53 (d, *J* = 8.2 Hz, 1H), 3.75 (s, 3H); ^{13}C NMR (125 MHz, $CDCl_3$) δ 172.9, 140.7, 140.4, 137.3, 136.6, 132.6, 128.8, 128.5, 128.4, 127.7, 127.5, 127.3, 127.1, 127.0, 126.5, 54.6, 52.4; HRMS (ESI-TOF) m/z: $[M+Na]^+$ calculated for $C_{23}H_{20}NaO_2$ 351.1356, found 351.1359.

5. X-Ray Crystal Data

1) Crystal Structure Information of 3ae

0.1 mL of DCM was added to a 10 mL oven-dried glass sample bottle with 10 mg pure **3ae** to dissolve the sample, then 8 mL n-hexane was slowly added to the solution, sealed with perforated paper, and then the solvent was slowly dried at room temperature to obtain crystals. Single crystal X-ray diffraction data were collected on Bruker Smart Apex II CCD diffractometer. The crystal structure has been deposited at the Cambridge Crystallographic Data Centre (CCDC): 2067260

Compound Name: methyl (*E*)-4-(4-chlorophenyl)-2-(4-hydroxyphenyl)but-3-enoate

Formula: $C_{17}H_{15}ClO_3$

Unit Cell Parameters: a 11.0617(2) b 8.39460(10) c 32.7088(5)

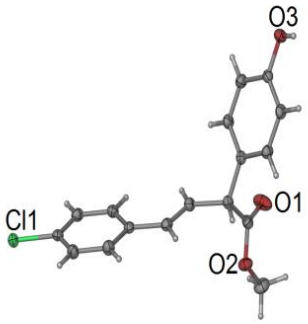


Table S2: crystal data for compounds **3ae**

Compound	**3ae**
Empirical formula	$C_{17}H_{15}ClO_3$
Formula weight	302.75
Temperature/K	100.00(10)
Crystal system	monoclinic
Space group	$P2_1/n$
a/Å	11.0617(2)
b/Å	8.39460(10)
c/Å	32.7088(5)
α/°	90
β/°	95.1310(10)
γ/°	90
Volume/Å^3	3025.12(8)
Z	4
ρ_{calc}g/cm^3	1.329
μ/mm^{-1}	2.298

F(000)	1264.0
Crystal size/mm^3	0.32 × 0.22 × 0.16
Radiation	CuKα (λ = 1.54184)
2Θ range for data collection/°	8.238 to 149.526
Index ranges	$-13 \leq h \leq 13$, $-10 \leq k \leq 7$, $-40 \leq l \leq 40$
Reflections collected	33273
Independent reflections	6116 [R_{int} = 0.0622, R_{sigma} = 0.0460]
Data/restraints/parameters	6116/0/389
Goodness-of-fit on F^2	1.033
Final R indexes [I>=2σ (I)]	R_1 = 0.0406, wR_2 = 0.0990
Final R indexes [all data]	R_1 = 0.0479, wR_2 = 0.1028
Largest diff. peak/hole / e $Å^{-3}$	0.20/-0.36

2) Crystal Structure Information of 7

0.1 mL of DCM was added to a 10 mL oven-dried glass sample bottle with 10 mg pure **7** to dissolve the sample, then 8 mL n-hexane was slowly added to the solution, sealed with perforated paper, and then the solvent was slowly dried at room temperature to obtain crystals. Single crystal X-ray diffraction data were collected on Bruker Smart Apex II CCD diffractometer. The crystal structure has been deposited at the Cambridge Crystallographic Data Centre (CCDC): 2067276

Compound Name: (*E*)-4-(1-hydroxy-4-phenylbut-3-en-2-yl)phenol (7)

Formula: $C_{16}H_{16}O_2$

Unit Cell Parameters: a 16.80664(11) b 12.67126(8) c 6.02846(5)

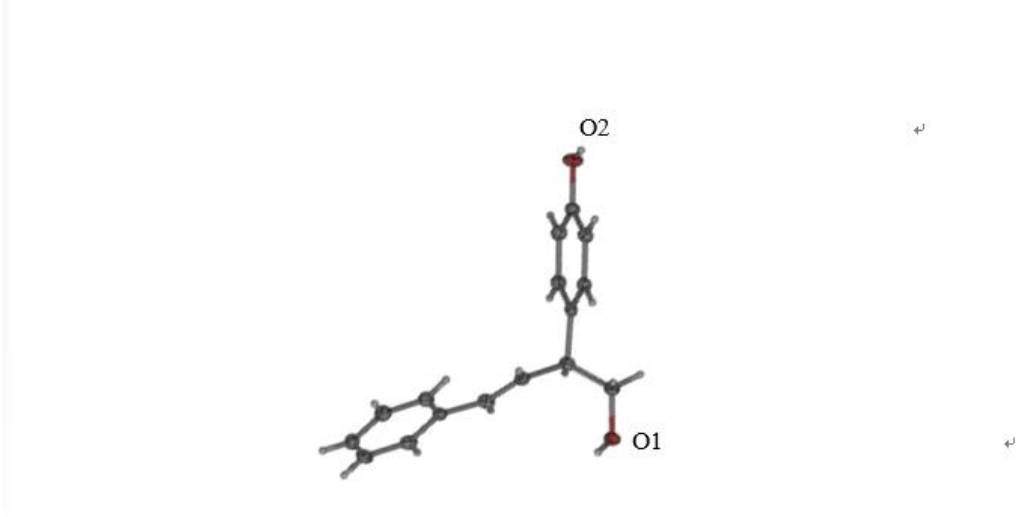


Table S3: crystal data for compounds **7**

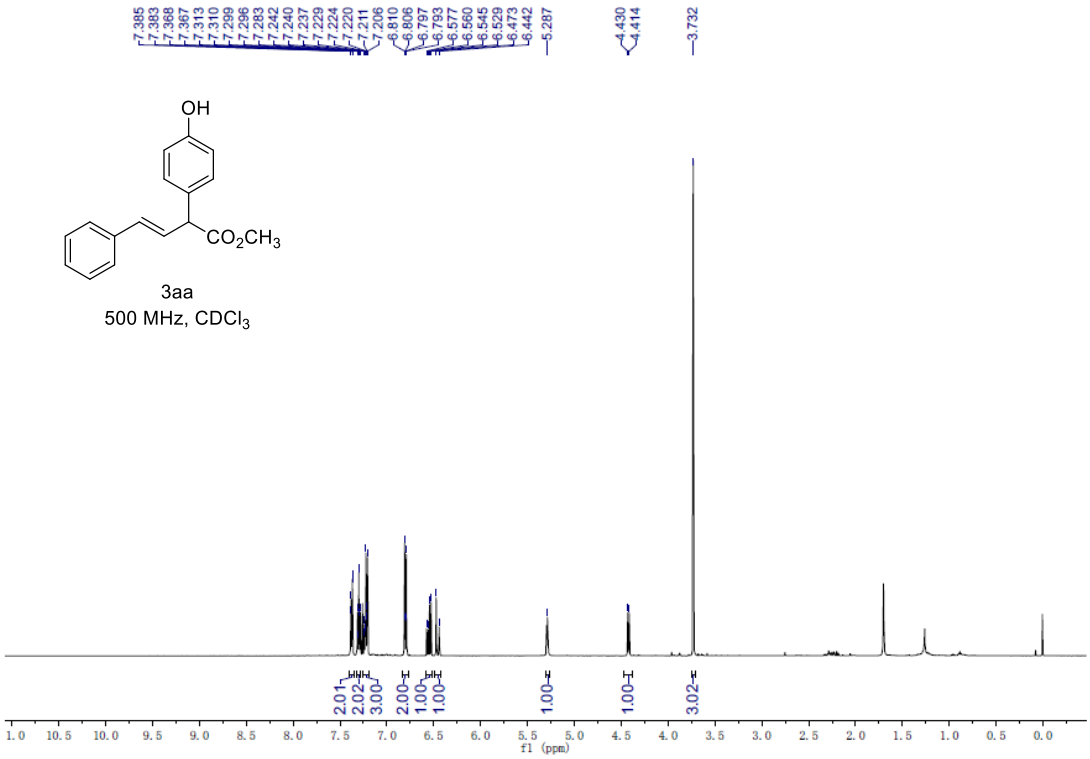
Compound	**7**
Empirical formula	$C_{16}H_{16}O_2$
Formula weight	240.30
Temperature/K	100.1(4)
Crystal system	orthorhombic
Space group	$Pna2_1$
a/Å	16.80664(11)
b/Å	12.67126(8)
c/Å	6.02846(5)
α/°	90
β/°	90
γ/°	90
Volume/Å^3	1283.829(16)
Z	4
ρ_{calc}g/cm^3	1.243
μ/mm^{-1}	0.641
F(000)	512.0
Crystal size/mm^3	0.38 × 0.36 × 0.28
Radiation	CuKα (λ = 1.54184)

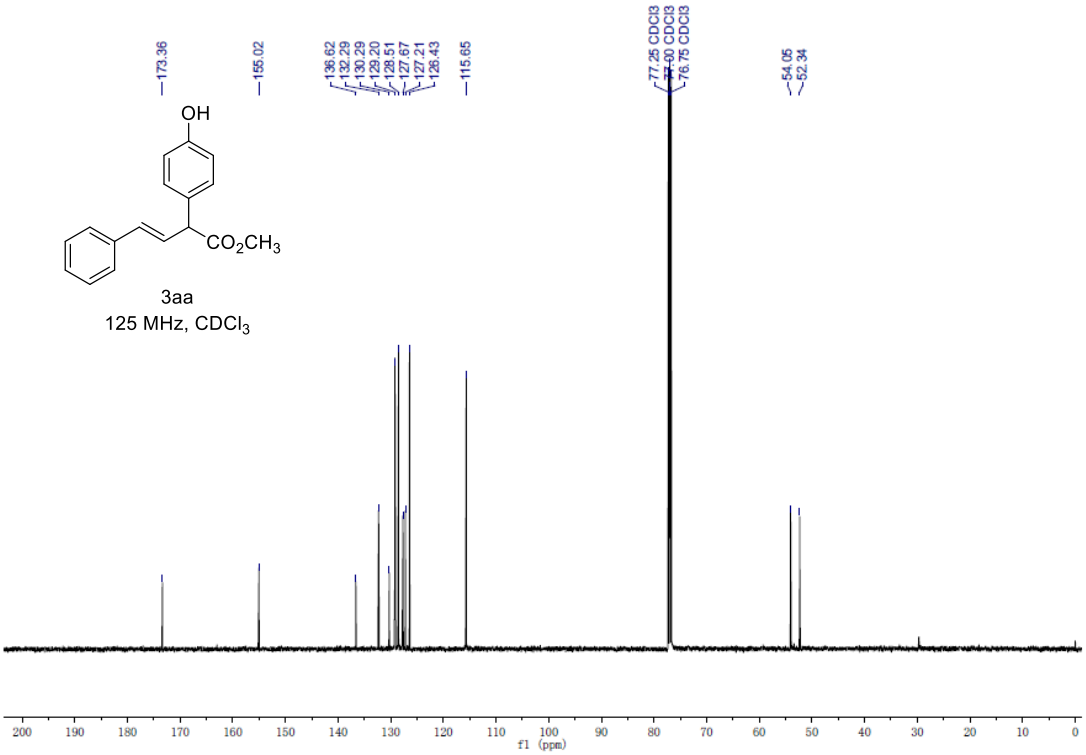
2Θ range for data collection/°	10.528 to 134.1
Index ranges	$-20 \leq h \leq 20$, $-15 \leq k \leq 15$, $-7 \leq l \leq 7$
Reflections collected	26347
Independent reflections	2180 [R_{int} = 0.0298, R_{sigma} = 0.0123]
Data/restraints/parameters	2180/1/166
Goodness-of-fit on F^2	1.060
Final R indexes [I>=2σ (I)]	R_1 = 0.0228, wR_2 = 0.0564
Final R indexes [all data]	R_1 = 0.0229, wR_2 = 0.0564
Largest diff. peak/hole / e $Å^{-3}$	0.16/-0.10

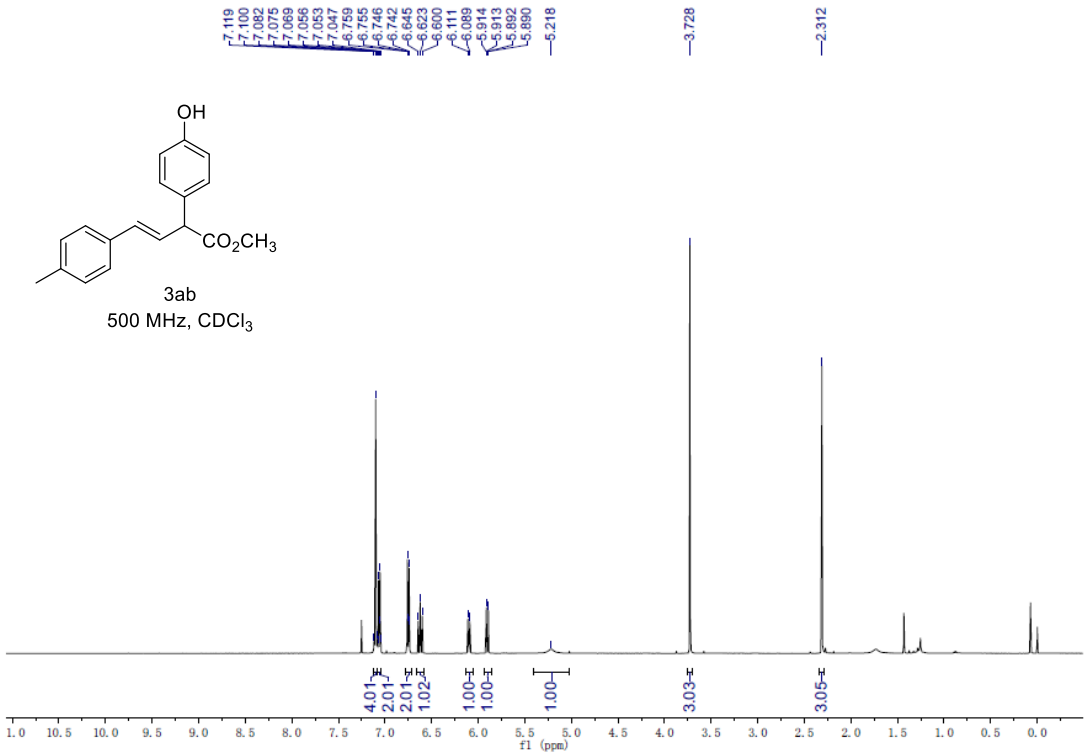
6. References

(1) Zhao, J.-L.; Fan, X.; Shi, J.-G. *J. Nat. Prod.* **2004**, *67*, 1032.
(2) Kuznetsov, A.; Gevorgyan, V. *Org. Lett*. **2012**, *14*, 914.
(3) Yu, Z.-Z.; Ma, B.; Liu, L.; Zhang, J. *J. Am. Chem. Soc.* **2014**, *136*, 6904.
(4) Kovina, I. M.; Tsukervanik, I. P. *Uzbekskii Khimicheskii Zhurnal* **1964**, *8*, 33.

7. NMR Spectra of New Compounds



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7.075
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7.056
7.053
7.047
6.759
6.755
6.746
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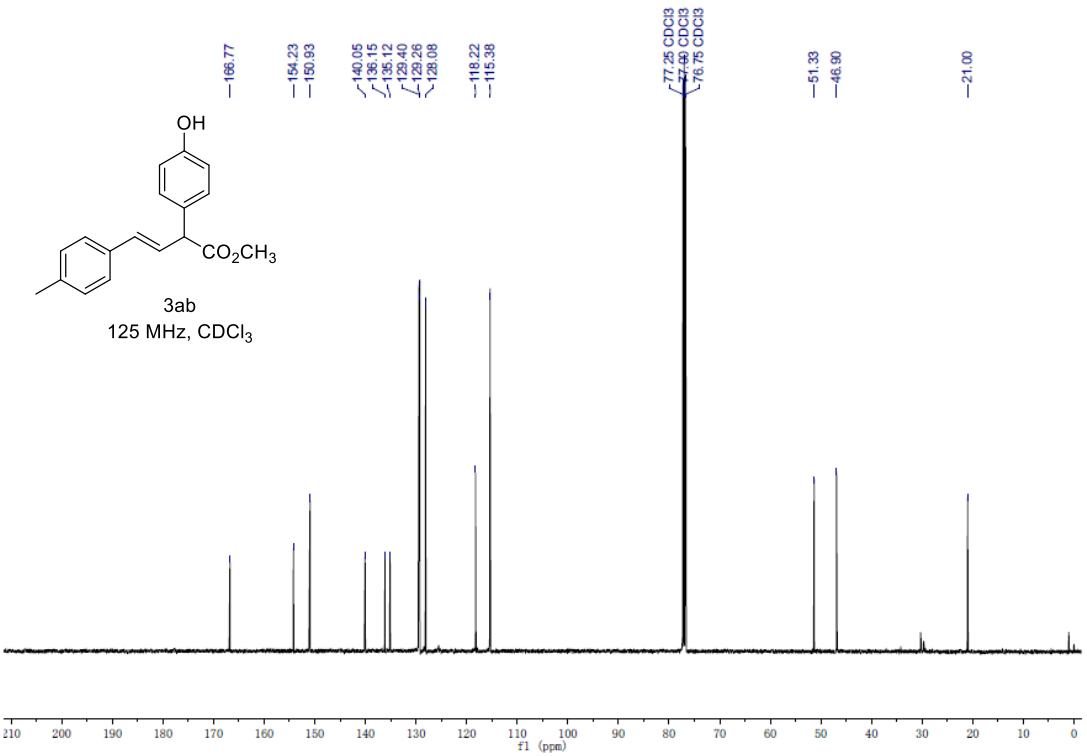
6.645
6.623
6.600
6.111
6.089
5.914
5.913
5.892
5.890
5.218
3.728
2.312
OH
CO2CH3
3ab
500 MHz, CDCl3
4.01
2.01
2.01
1.02
1.00
1.00
1.00
3.03
3.05
f1 (ppm)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136.15
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129.40
129.26
128.08
118.22
115.38
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77.00 CDCl3
76.75 CDCl3
51.33
46.90
21.00
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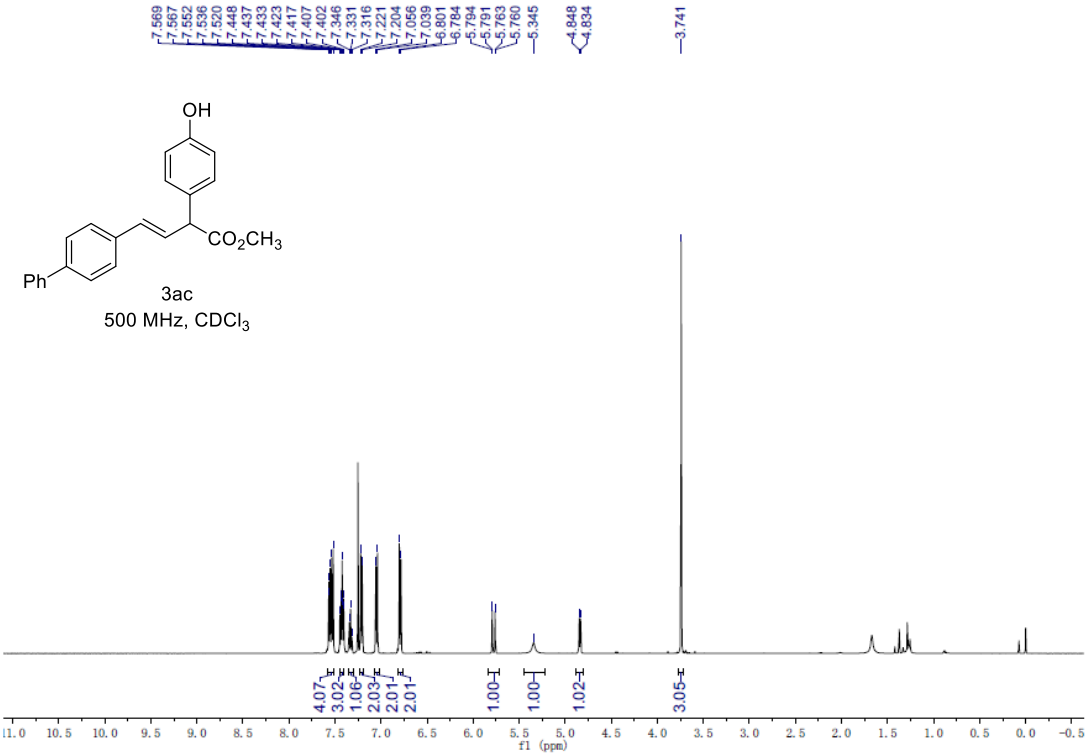
CO2CH3
3ab
125 MHz, CDCl3
f1 (ppm)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7.520
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7.437
7.433
7.423
7.417
7.407
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7.346
7.331
7.316
7.221
7.204
7.056
7.039
6.801
6.784
5.794
5.791
5.763
5.760
5.345
4.848
4.834
3.741
OH
CO2CH3
Ph
3ac
500 MHz, CDCl3
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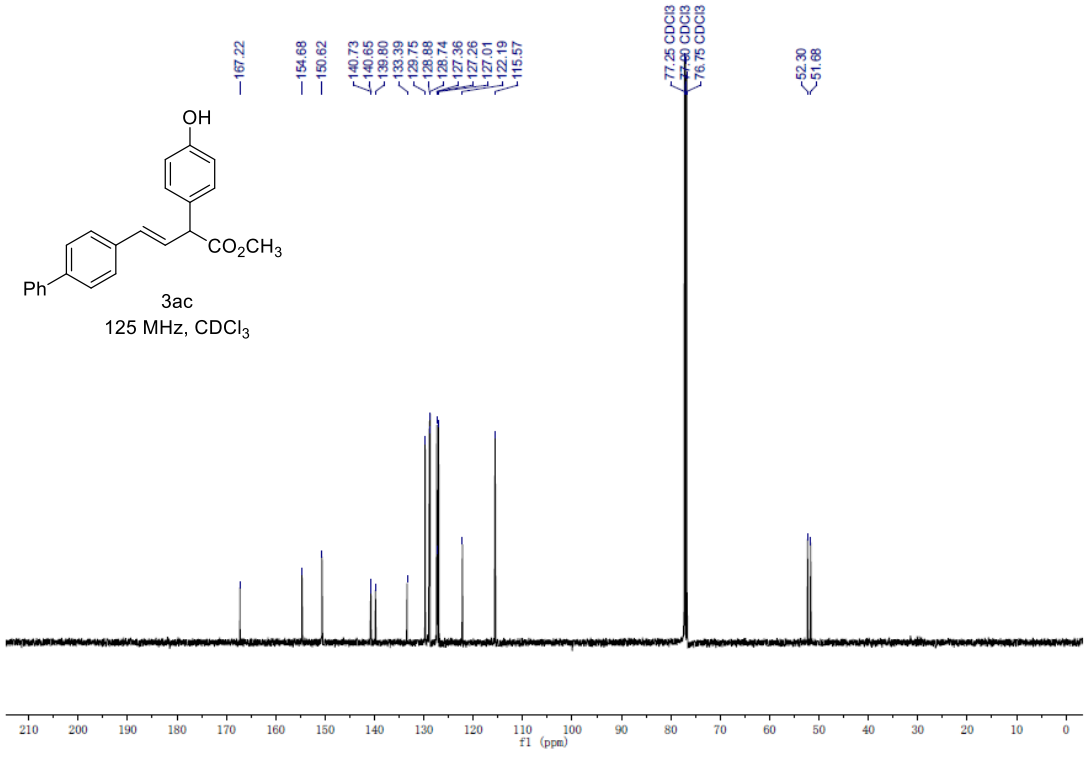
3.02
1.06
2.03
2.01
2.01
1.00
1.00
1.02
3.05
f1 (ppm)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139.80
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129.75
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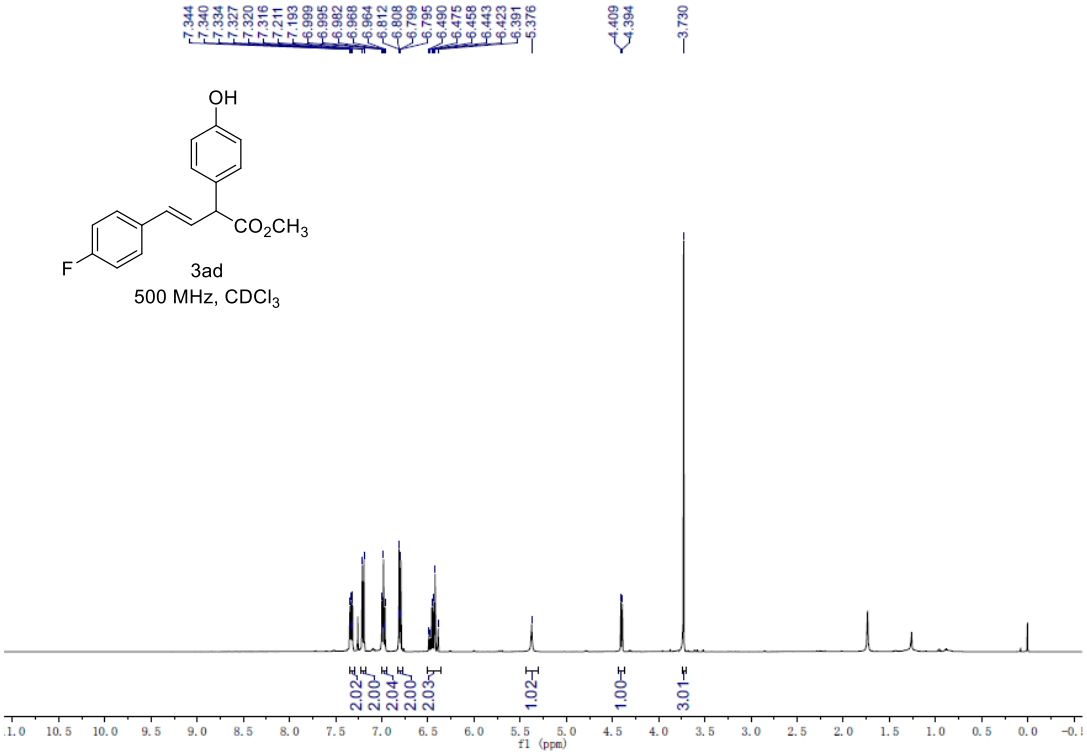
128.74
127.36
127.26
127.01
122.19
115.57
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
52.30
51.88
OH
CO2CH3
Ph
3ac
125 MHz, CDCl3
f1 (ppm)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7.193
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6.995
6.982
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6.964
6.812
6.808
6.799
6.795
6.490
6.475
6.458
6.443
6.423
6.391
5.376
4.409
4.394
3.730
OH
CO2CH3
F
3ad
500 MHz, CDCl3
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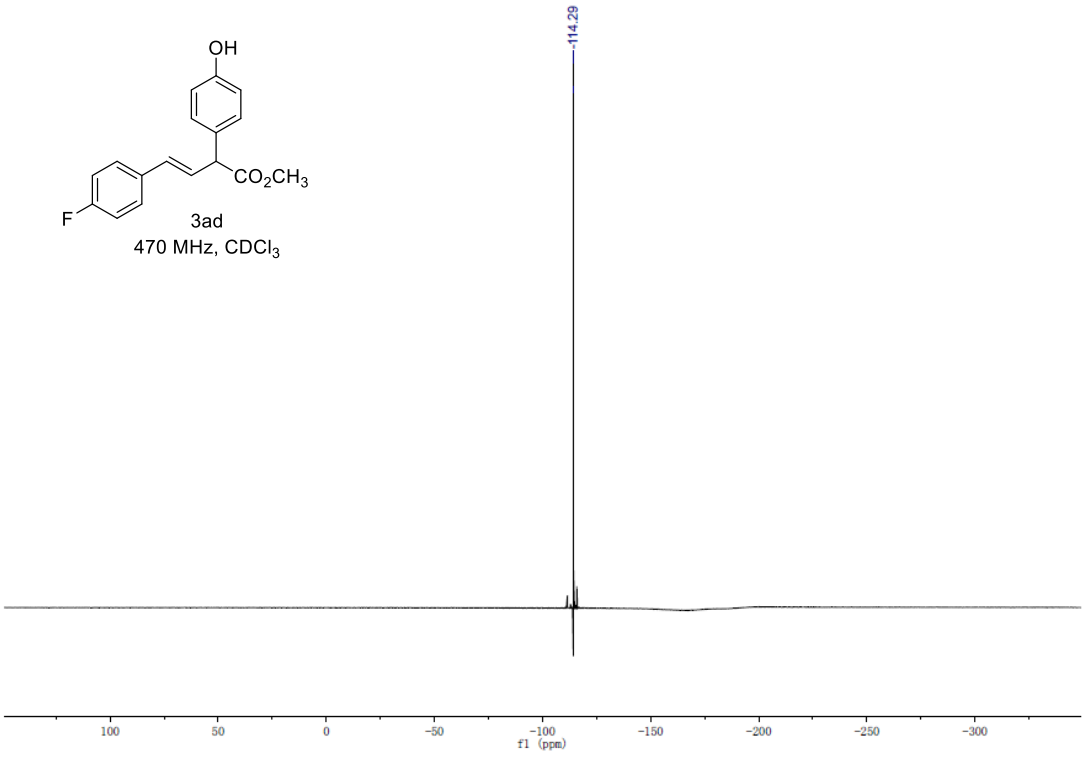
2.00
2.04
2.00
2.03
1.02
1.00
3.01
f1 (ppm)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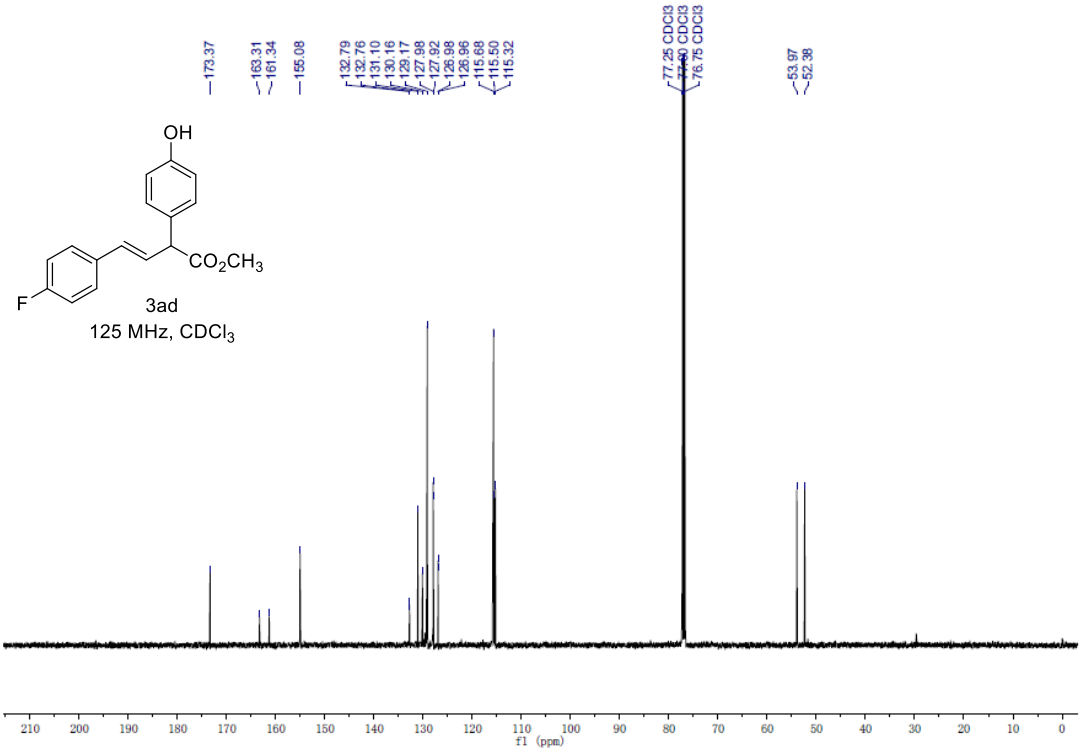
F
3ad
470 MHz, CDCl3
f1 (ppm)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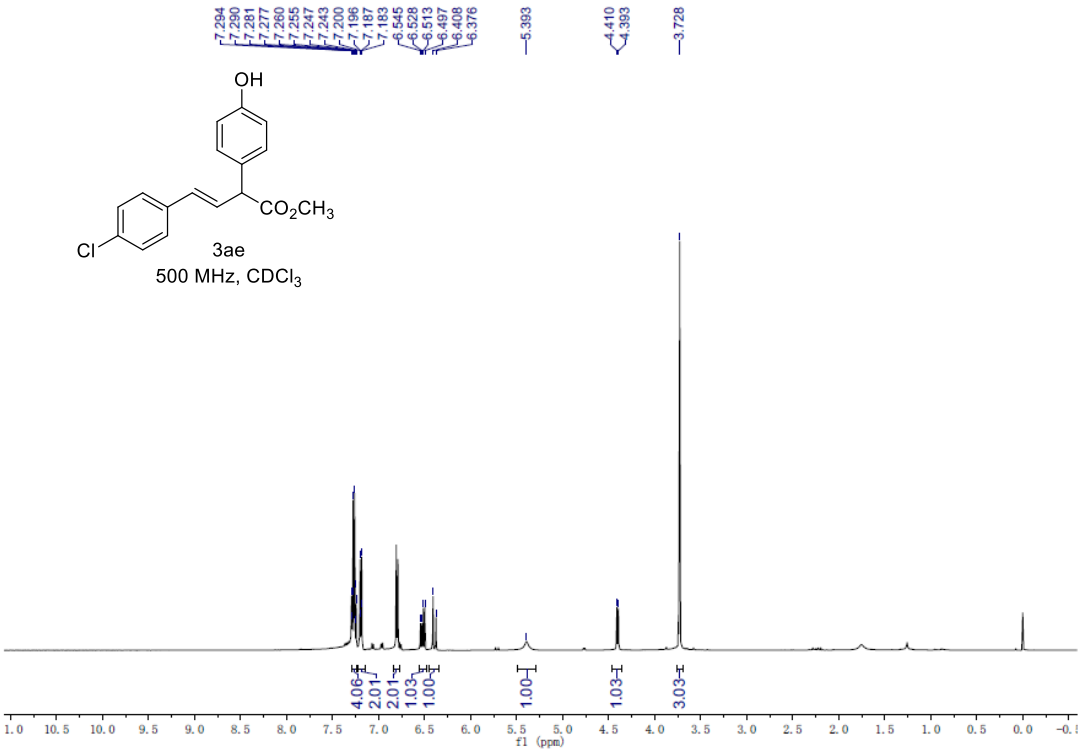
F
3ad
125 MHz, CDCl3
f1 (ppm)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CO2CH3
Cl
3ae
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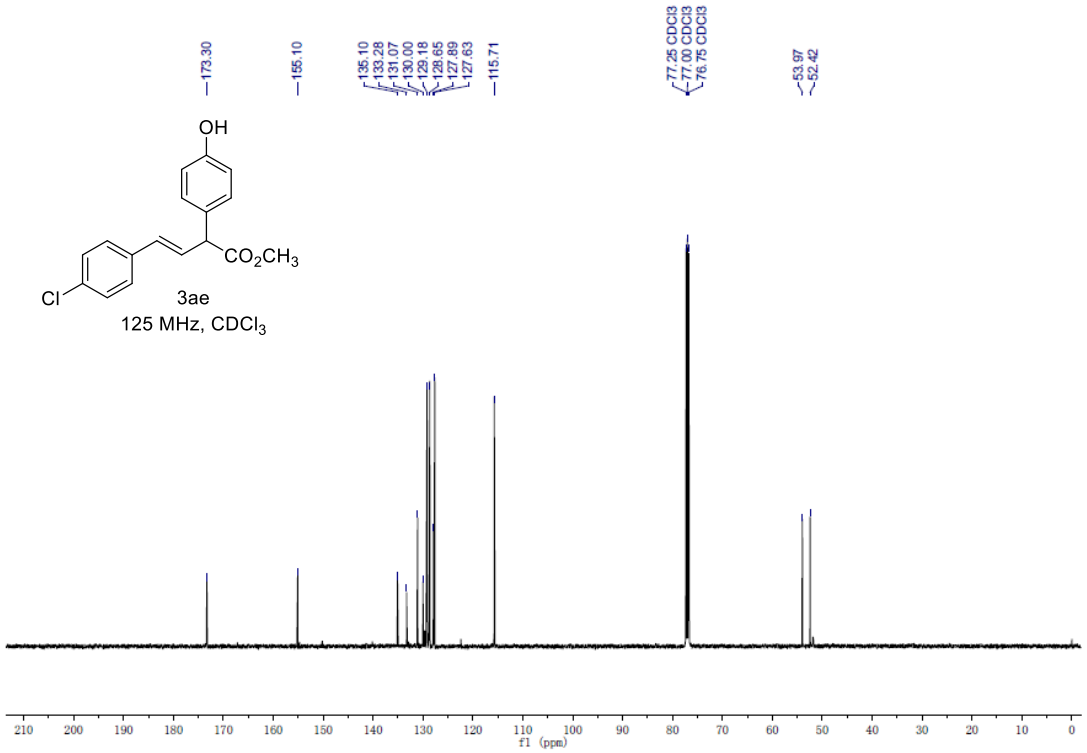
f1 (ppm)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127.63
115.71
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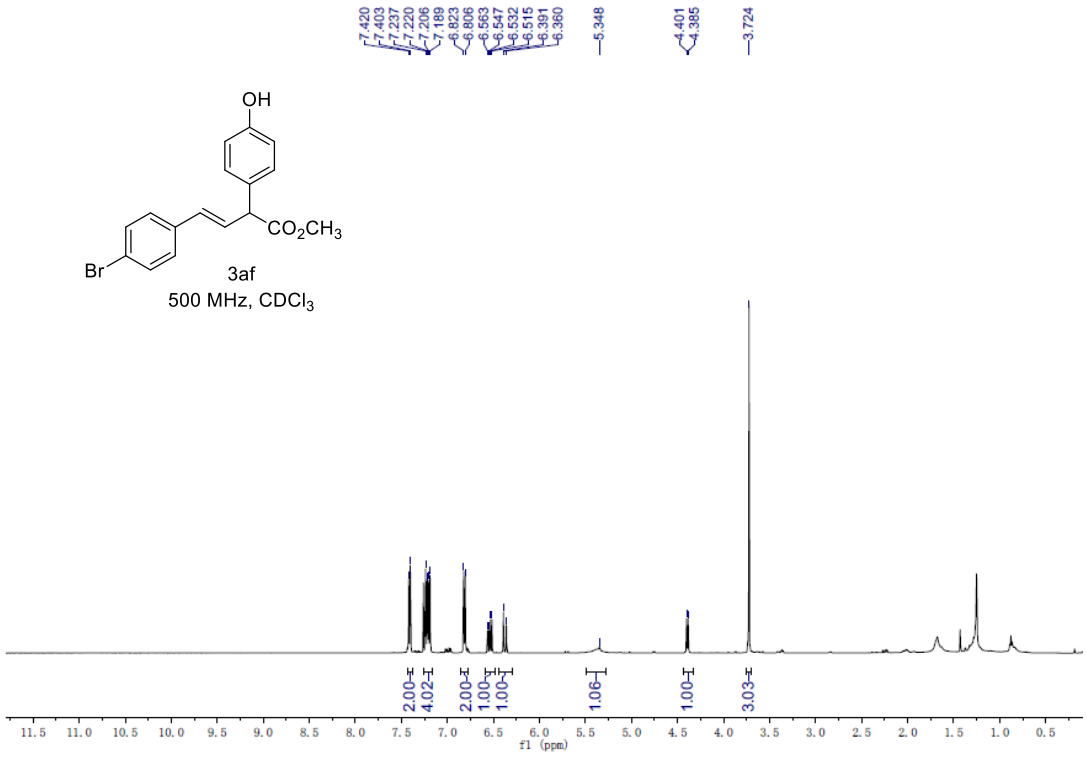
OH
CO2CH3
Cl
3ae
125 MHz, CDCl3
f1 (ppm)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6.806
6.563
6.547
6.532
6.515
6.391
6.360
5.348
4.401
4.385
3.724
OH
CO2CH3
Br
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2.00
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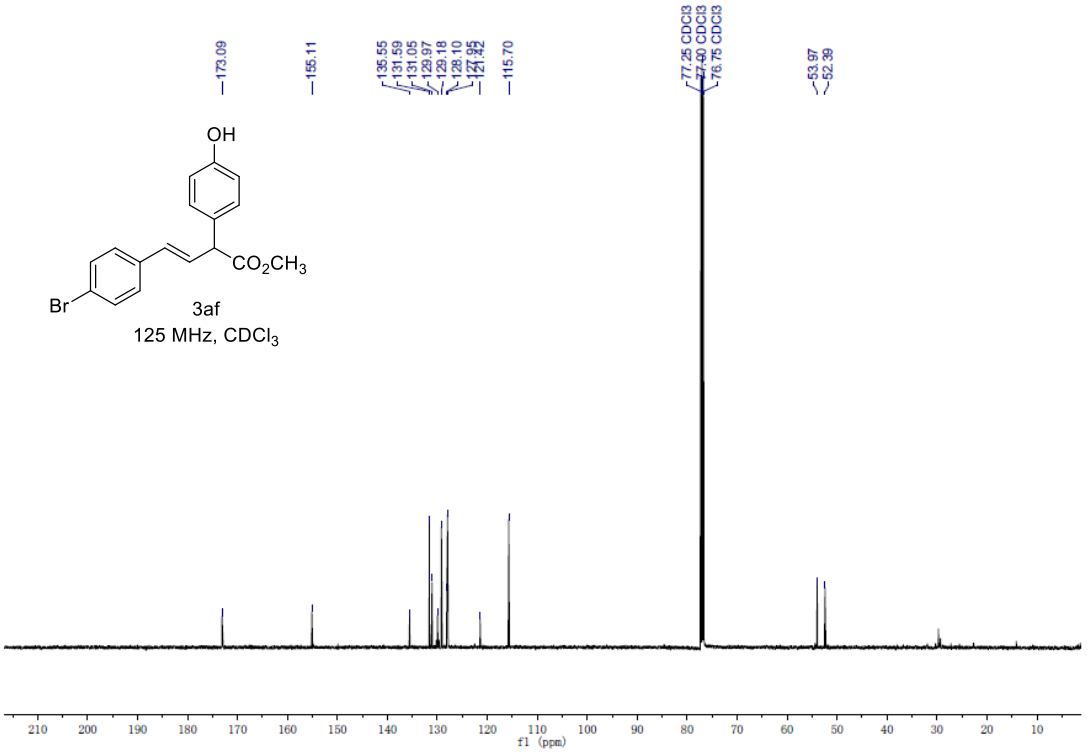
1.00
1.06
1.00
3.03
f1 (ppm)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CO2CH3
Br
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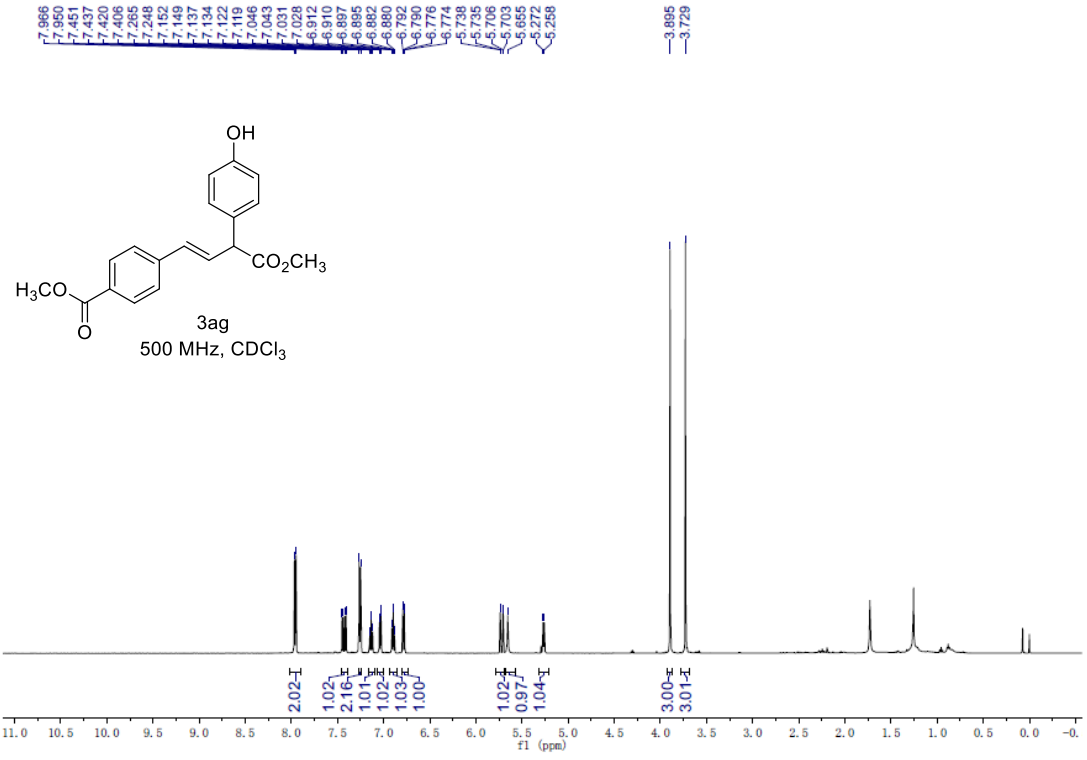
125 MHz, CDCl3
f1 (ppm)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7.119
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7.043
7.031
7.028
6.912
6.910
6.897
6.895
6.882
6.880
6.792
6.790
6.776
6.774
5.738
5.735
5.706
5.703
5.655
5.272
5.258
3.895
3.729
OH
CO2CH3
H3CO
O
3ag
500 MHz, CDCl3
2.02
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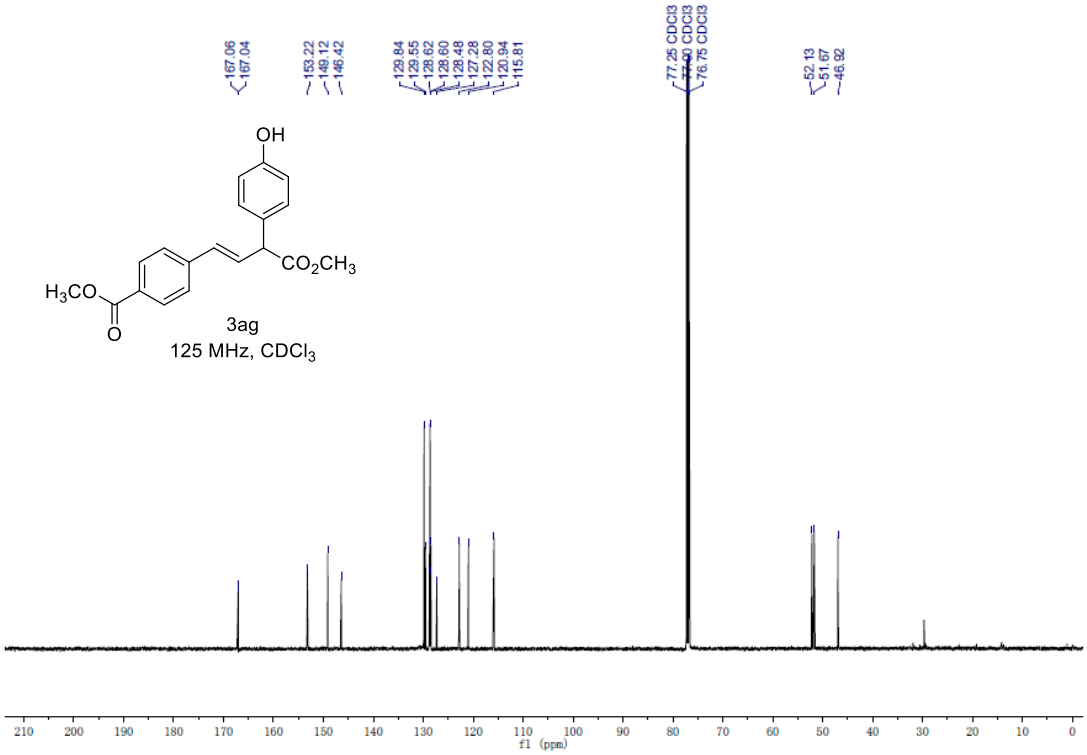
f1 (ppm)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120.94
115.81
77.25 CDCl3
77.00 CDCl3
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H3CO
O
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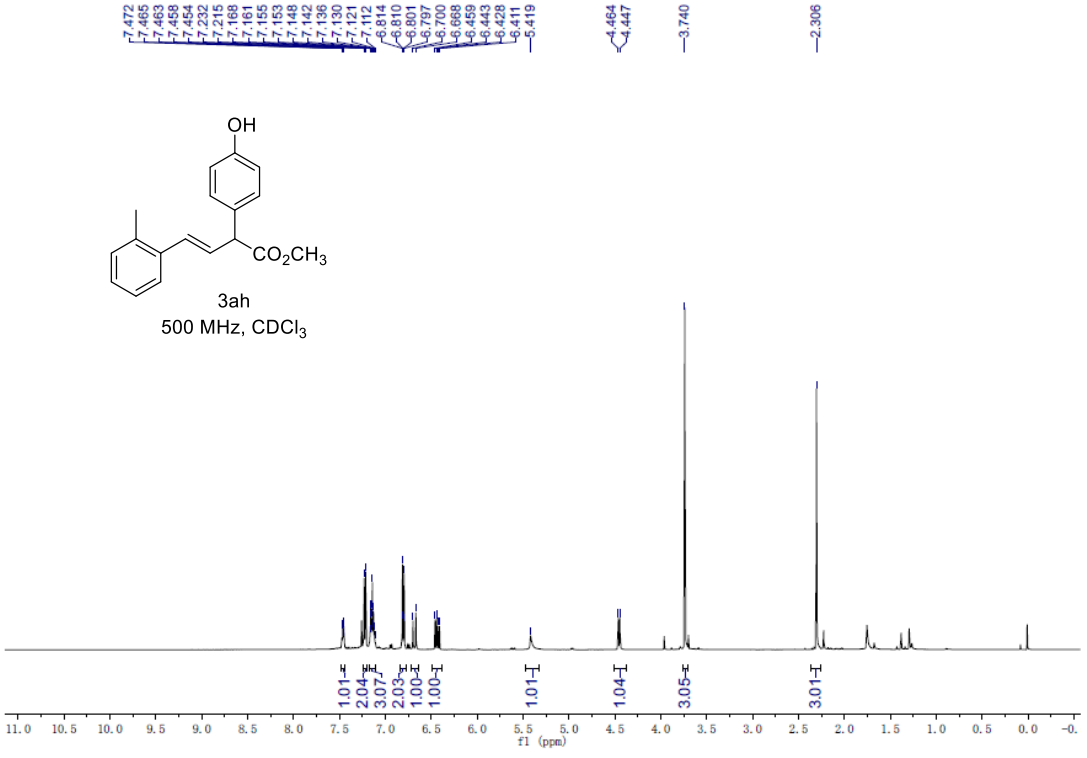
f1 (ppm)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7.136
7.130
7.121
7.112
6.814
6.810
6.801
6.797
6.700
6.668
6.459
6.443
6.428
6.411
5.419
4.464
4.447
3.740
2.306
OH
CO2CH3
3ah
500 MHz, CDCl3
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1.00
1.00
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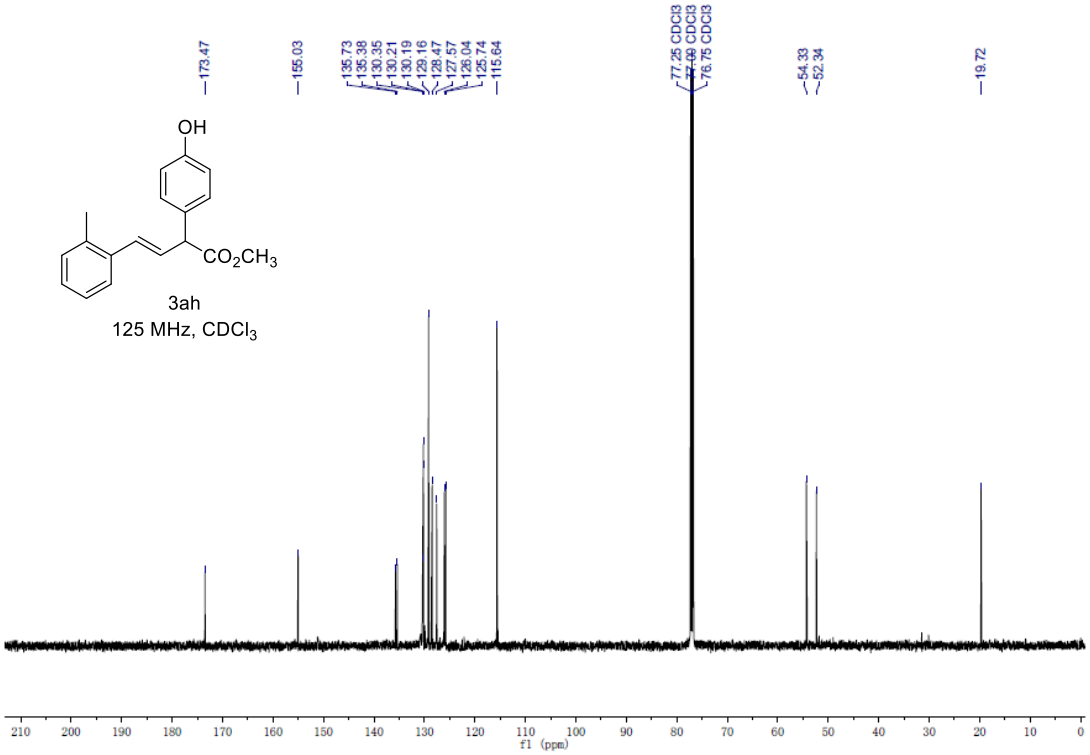
1.04
3.05
3.01
f1 (ppm)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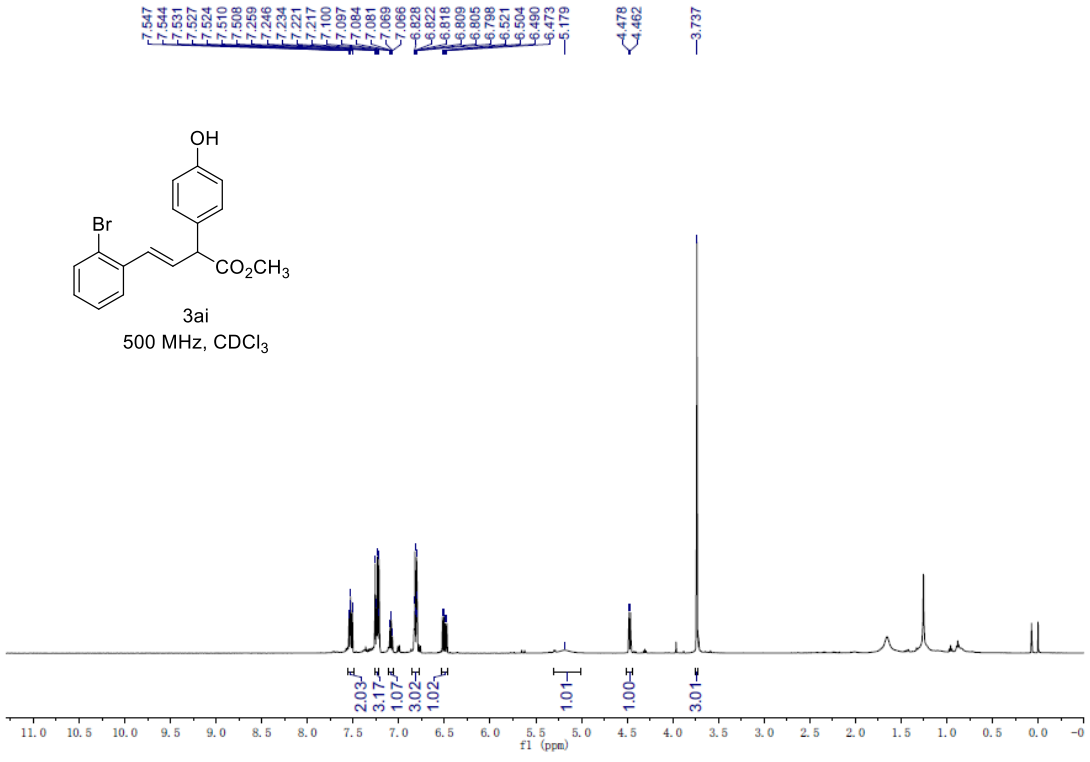
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Br
CO2CH3
3ai
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6.490
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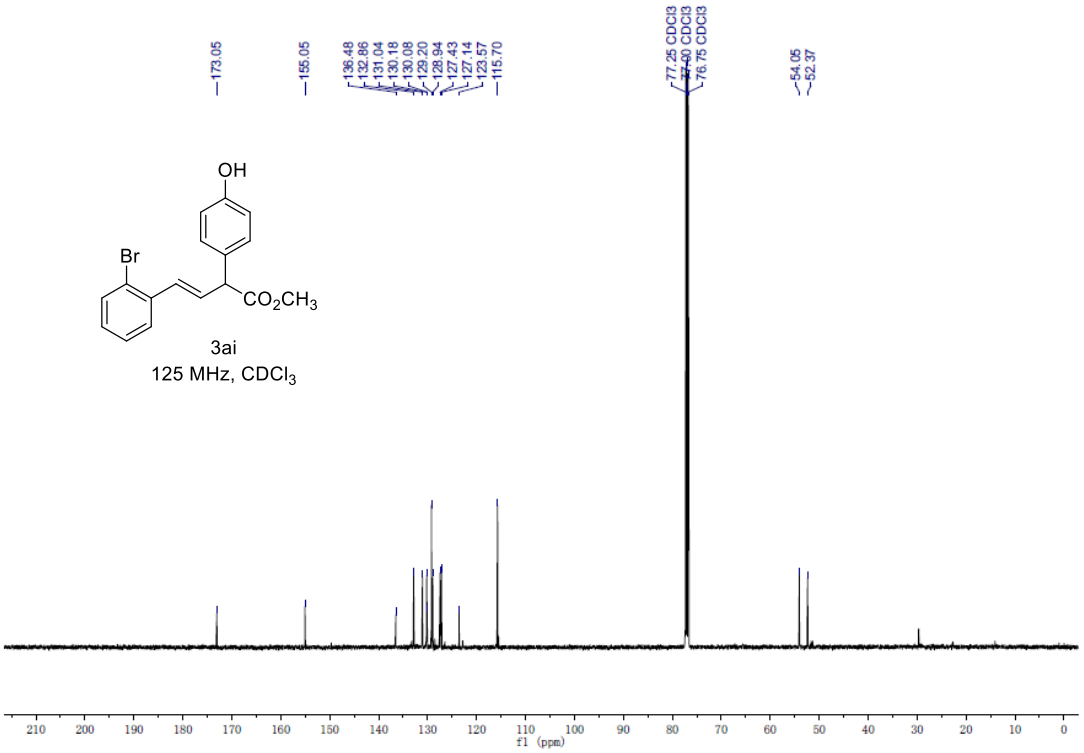
f1 (ppm)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115.70
77.25 CDCl3
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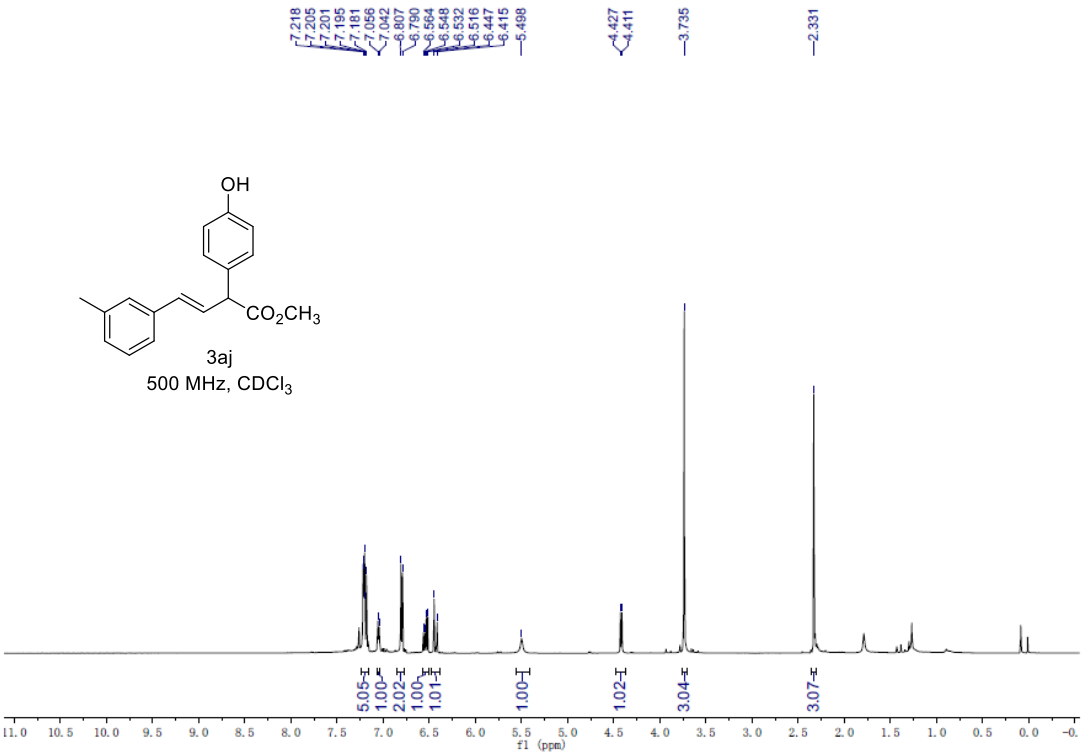
OH
Br
CO2CH3
3ai
125 MHz, CDCl3
f1 (ppm)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6.532
6.516
6.447
6.415
5.498
4.427
4.411
3.735
2.331
OH
CO2CH3
3aj
500 MHz, CDCl3
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1.02
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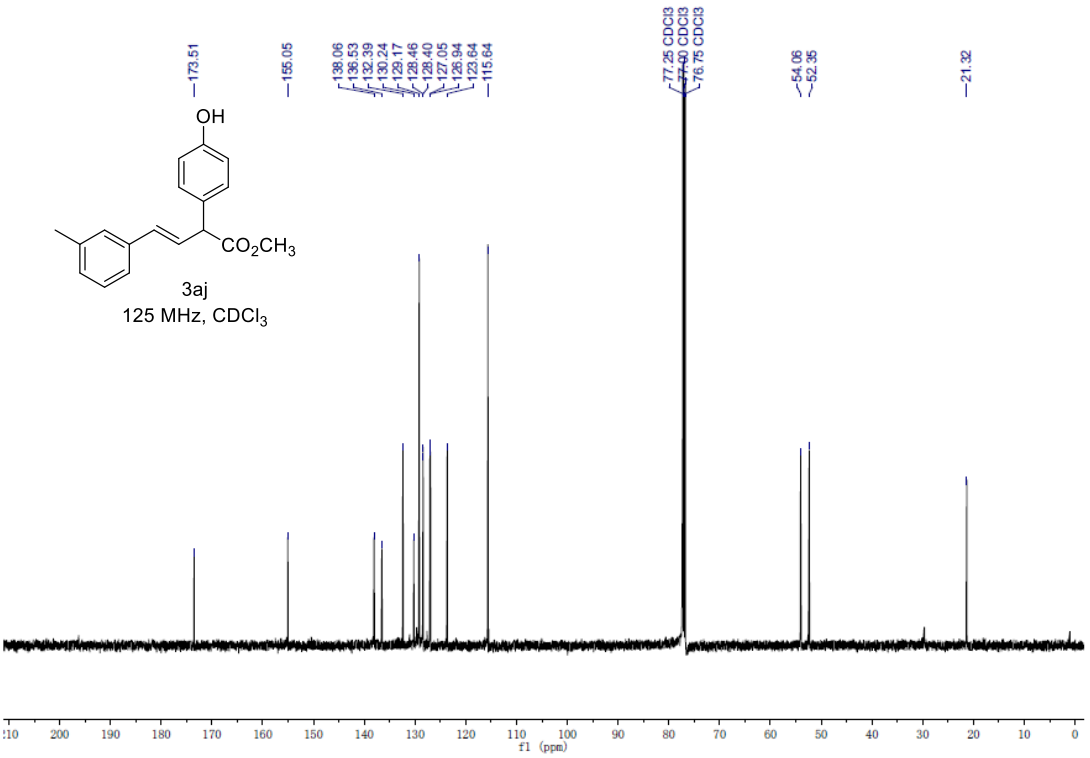
3.07
f1 (ppm)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CO2CH3
3aj
125 MHz, CDCl3
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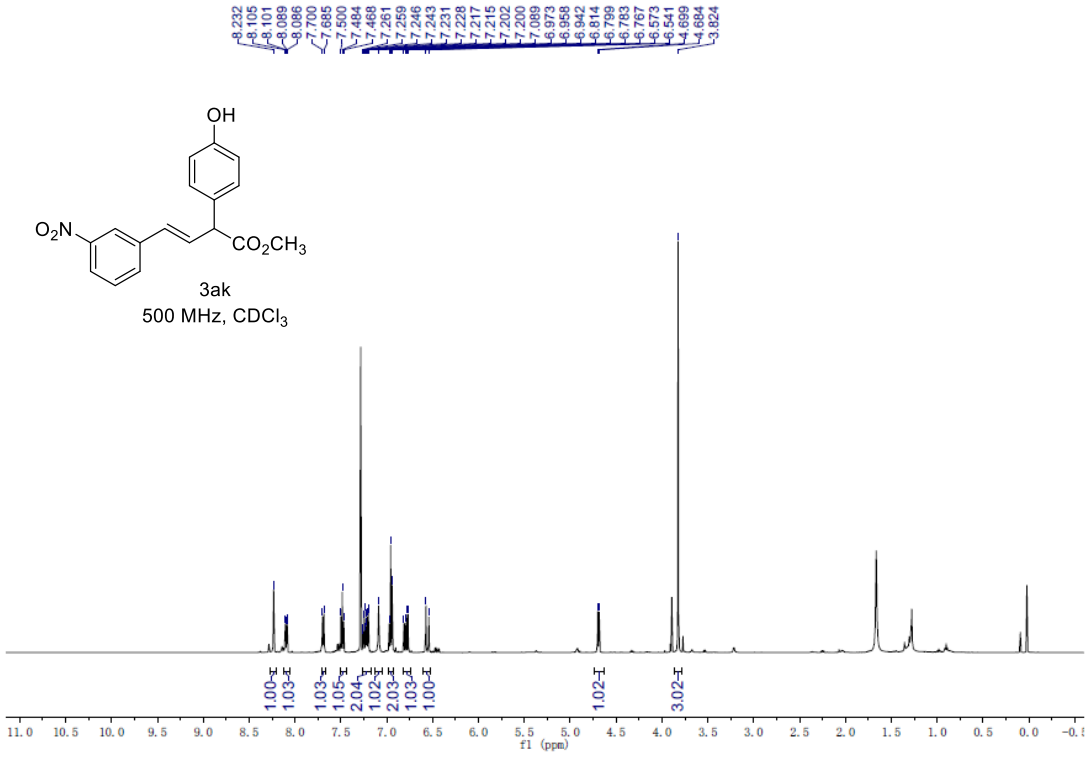
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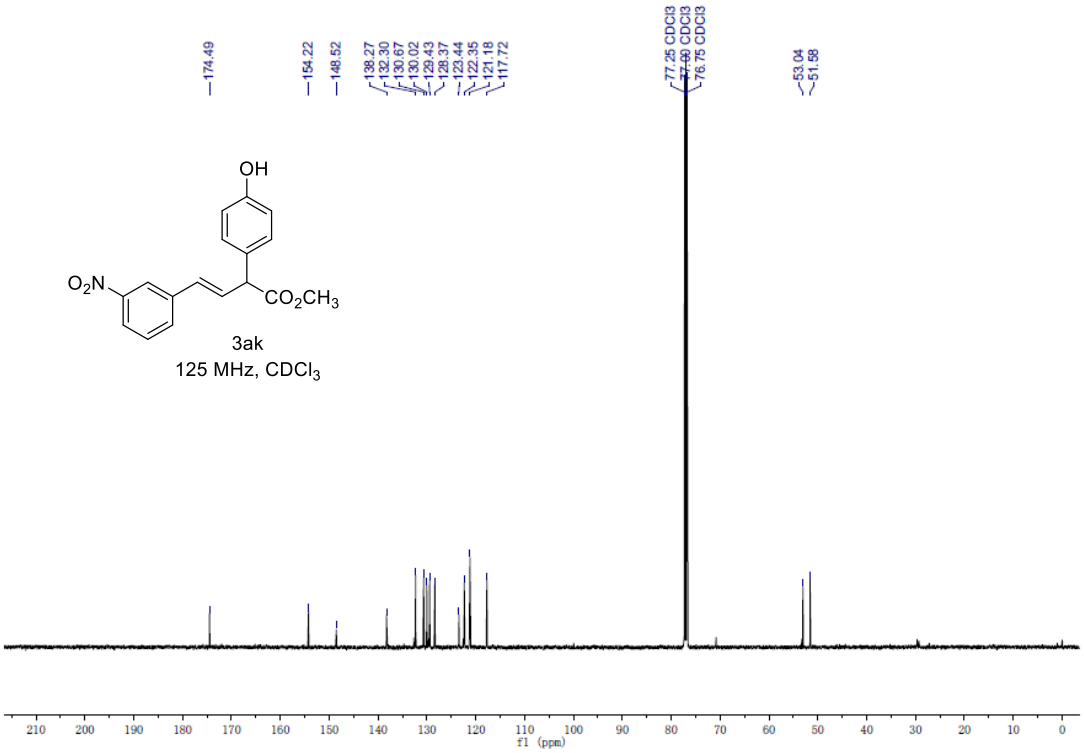
f1 (ppm)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154.22
148.52
138.27
132.30
130.67
130.02
129.43
128.37
123.44
122.35
121.18
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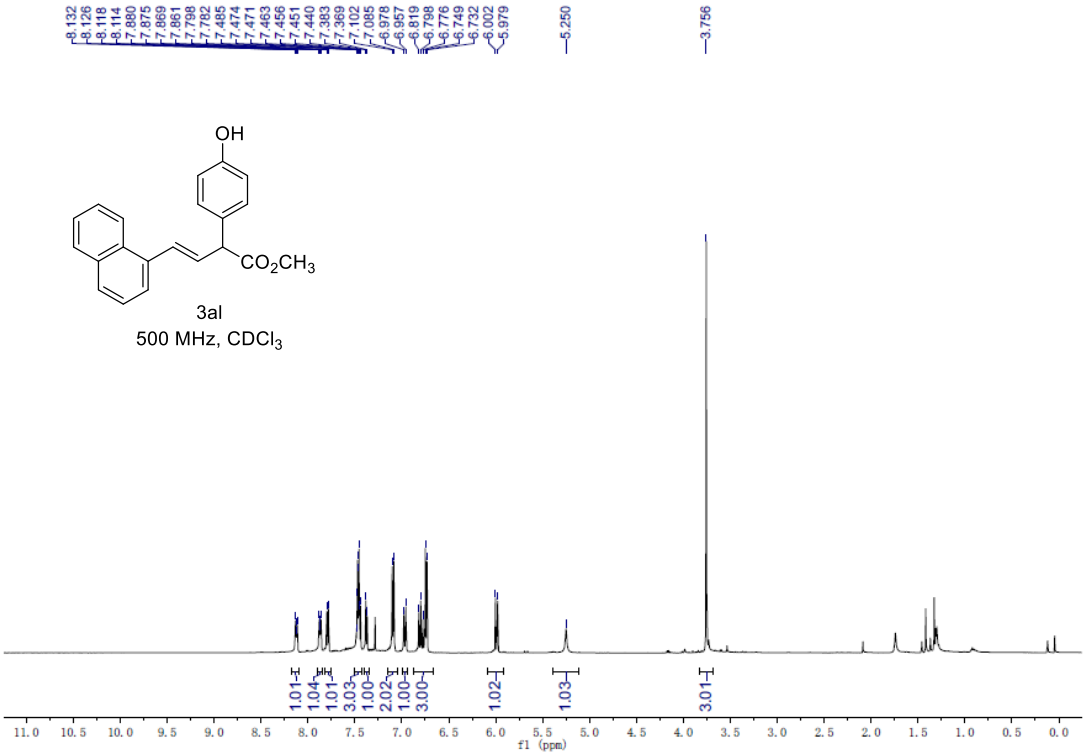
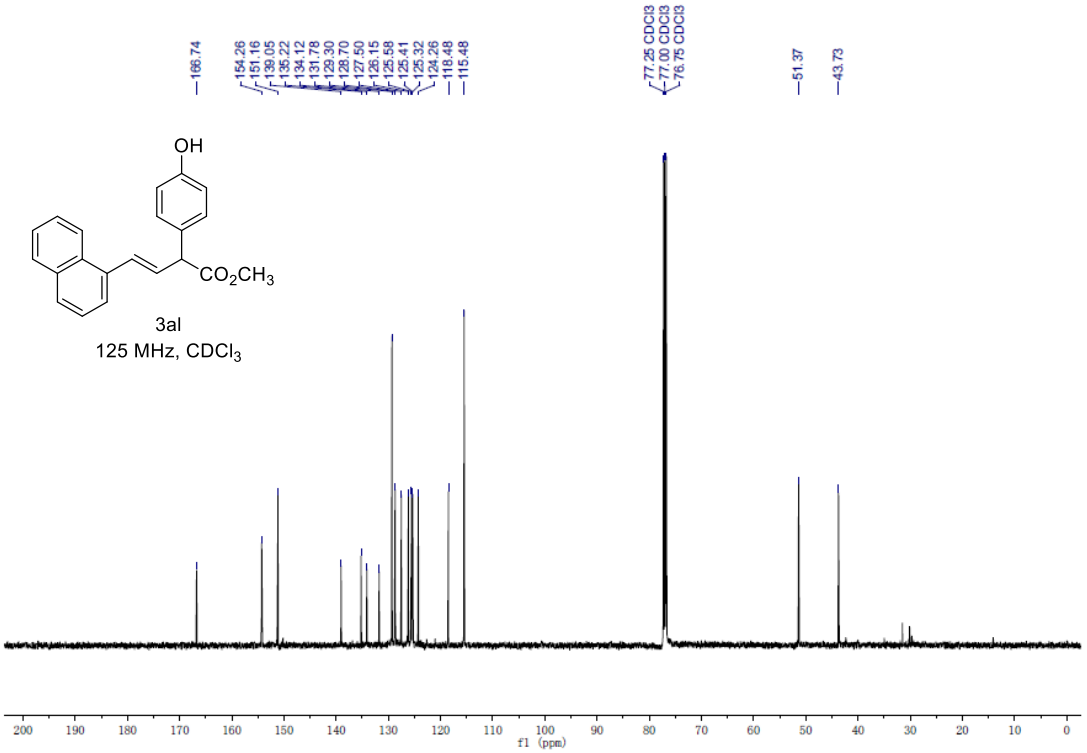
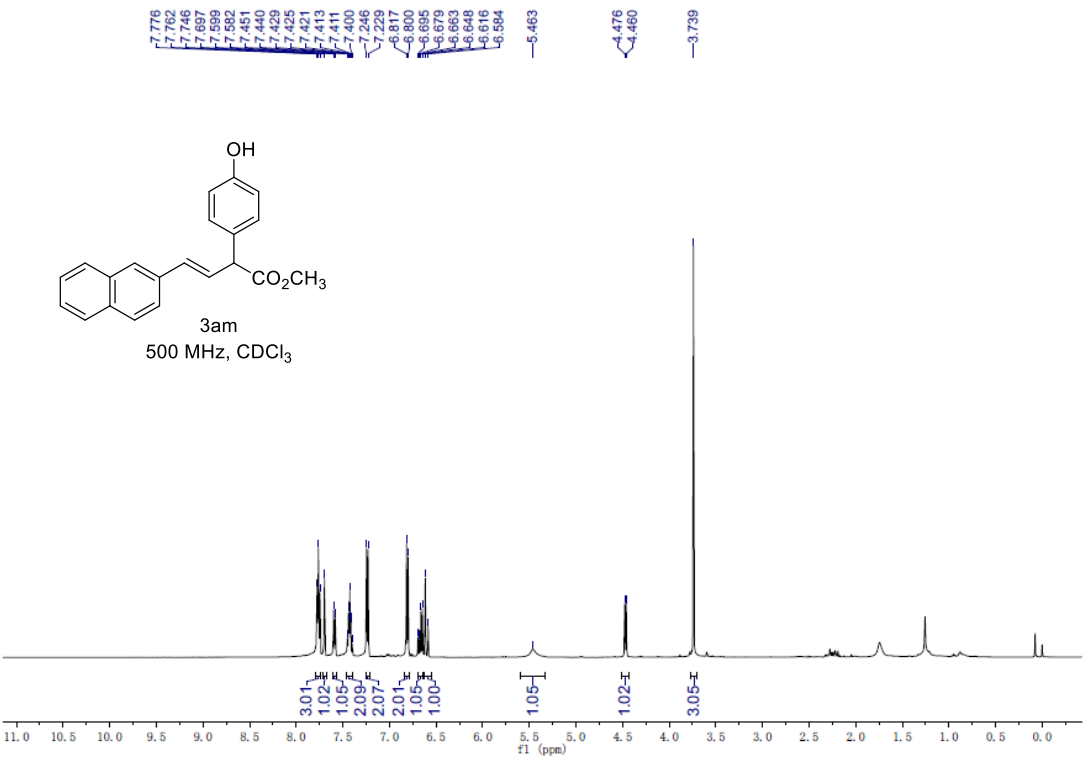
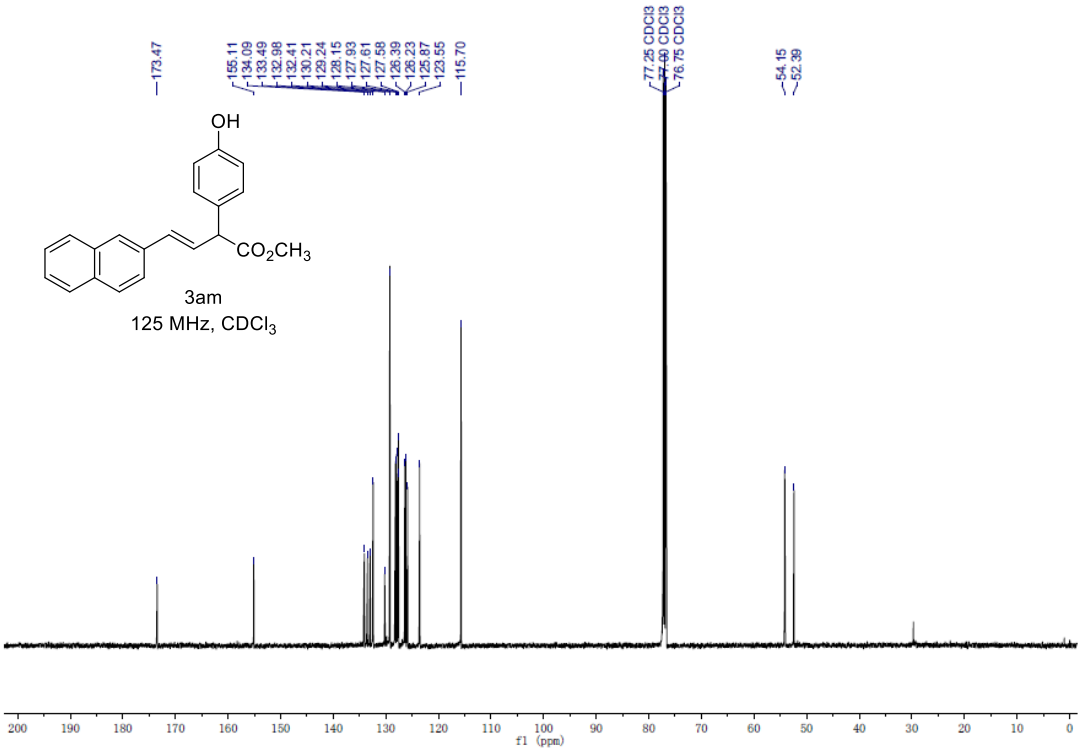
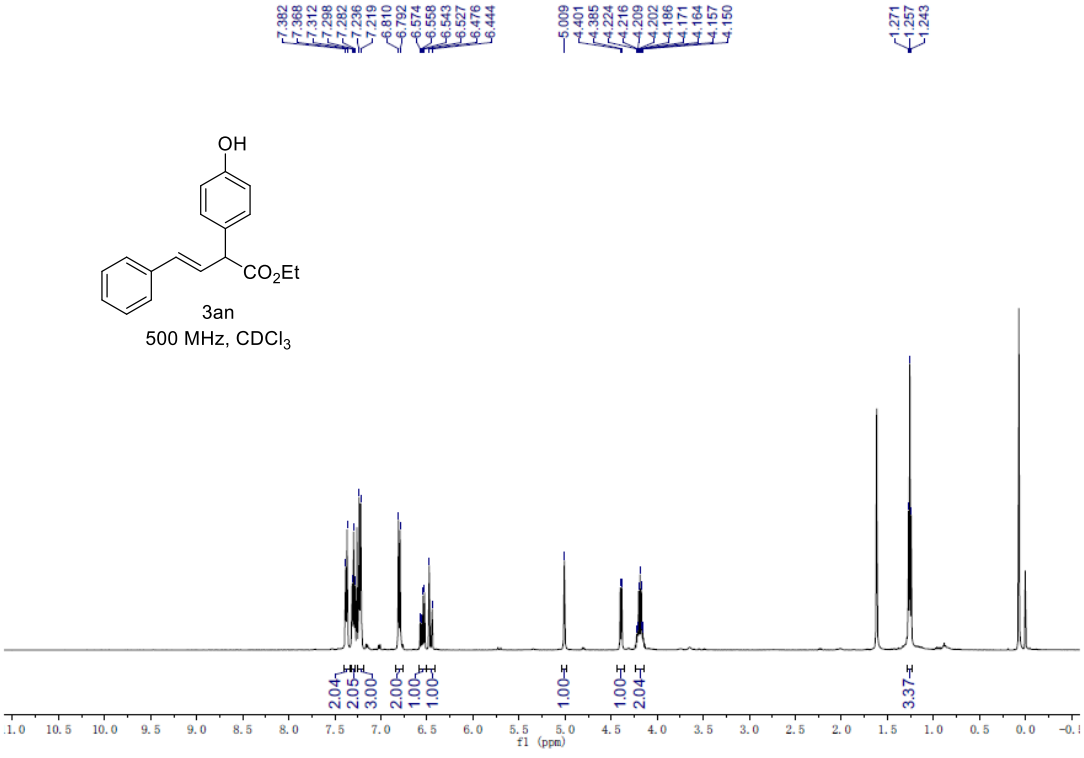
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
53.04
51.58
OH
O2N
CO2CH3
3ak
125 MHz, CDCl3
f1 (ppm)

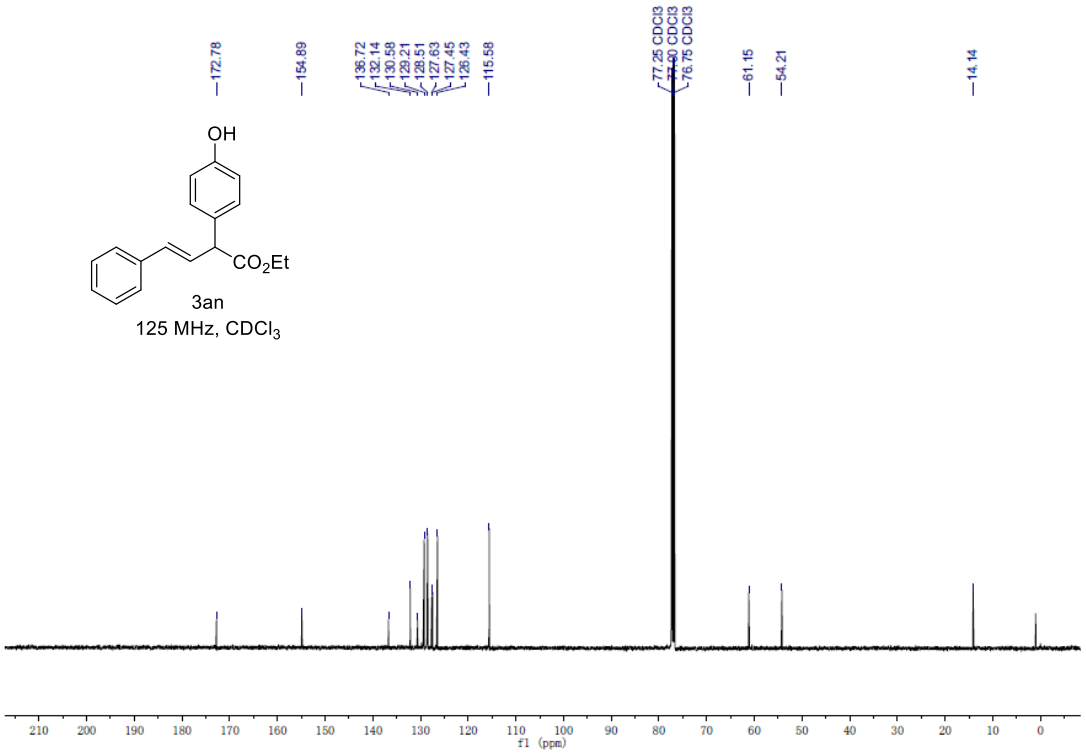

8.132
8.126
8.118
8.114
7.880
7.875
7.869
7.861
7.798
7.782
7.485
7.474
7.471
7.463
7.456
7.451
7.440
7.383
7.369
7.102
7.085
6.978
6.957
6.819
6.798
6.776
6.749
6.732
6.002
5.979
5.250
3.756
OH
CO2CH3
3al
500 MHz, CDCl3
1.01
1.04
1.01
3.03
1.00
2.02
1.00
3.00
1.02
1.03
3.01
f1 (ppm)

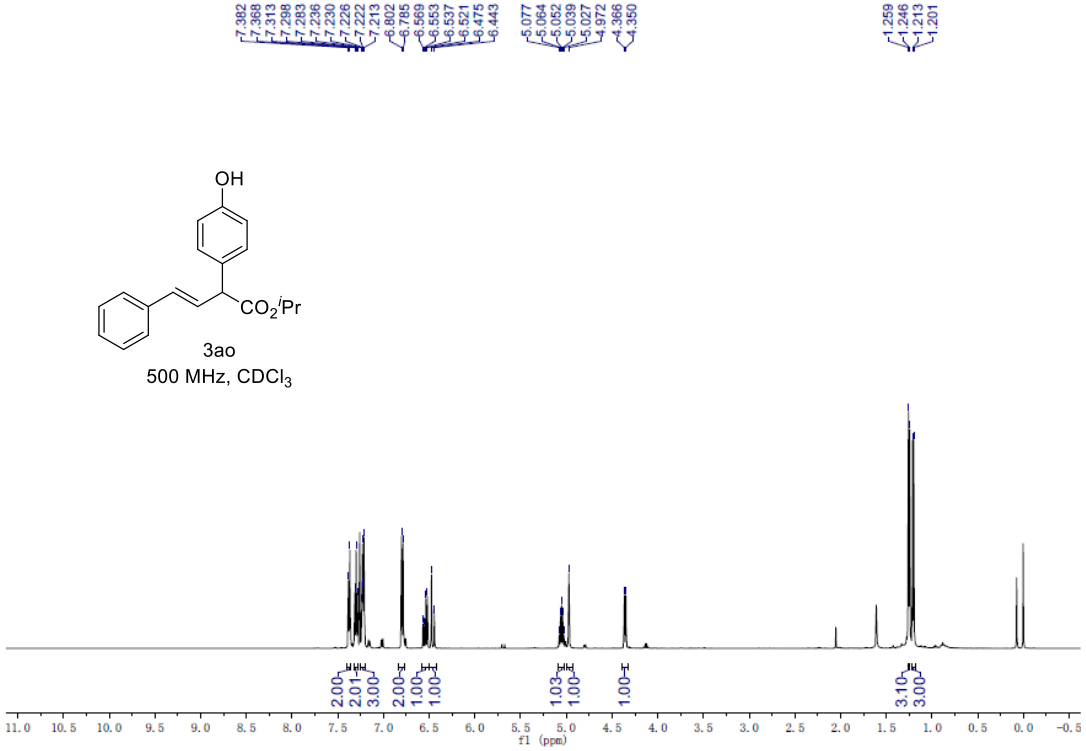

166.74
154.26
151.16
139.05
135.22
134.12
131.78
129.30
128.70
127.50
126.15
125.58
125.41
125.32
124.26
118.48
115.48
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
51.37
43.73
OH
CO2CH3
3al
125 MHz, CDCl3
f1 (ppm)

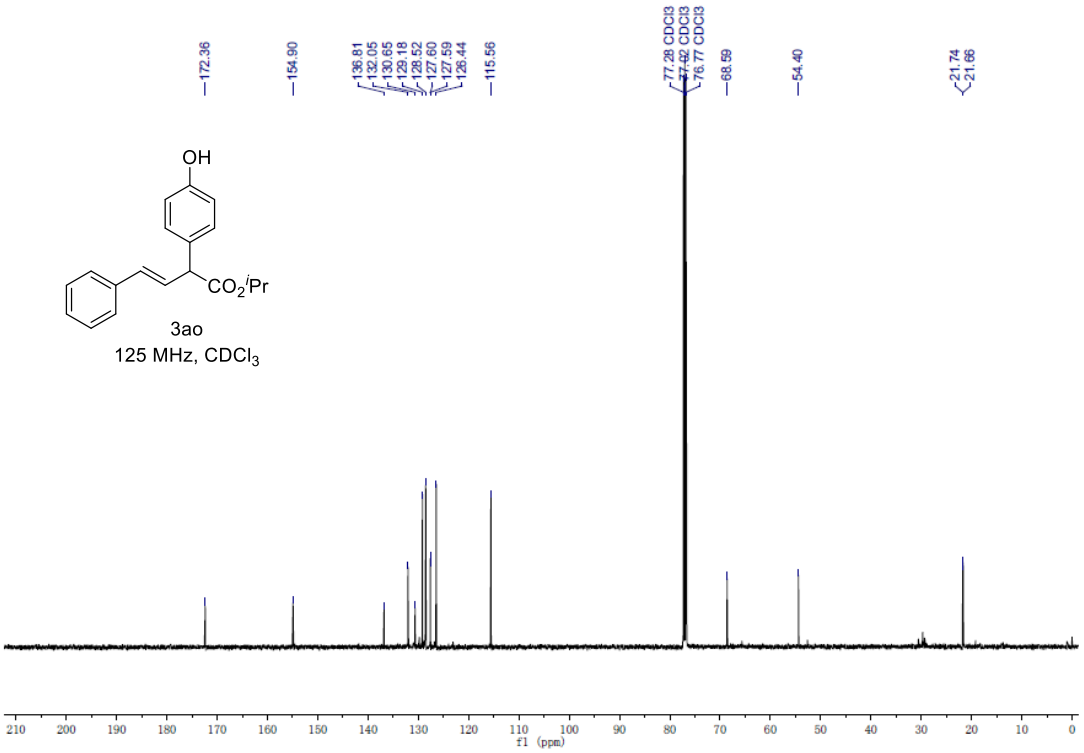

7.776
7.762
7.746
7.697
7.599
7.582
7.451
7.440
7.429
7.425
7.421
7.413
7.411
7.400
7.246
7.229
6.817
6.800
6.695
6.679
6.663
6.648
6.616
6.584
5.463
4.476
4.460
3.739
OH
CO2CH3
3am
500 MHz, CDCl3
3.01
1.02
1.05
2.09
2.07
2.01
1.05
1.00
1.05
1.02
3.05
f1 (ppm)


OH
CO2CH3
3am
125 MHz, CDCl3
f1 (ppm)


OH
CO2Et
3an
500 MHz, CDCl3
f1 (ppm)

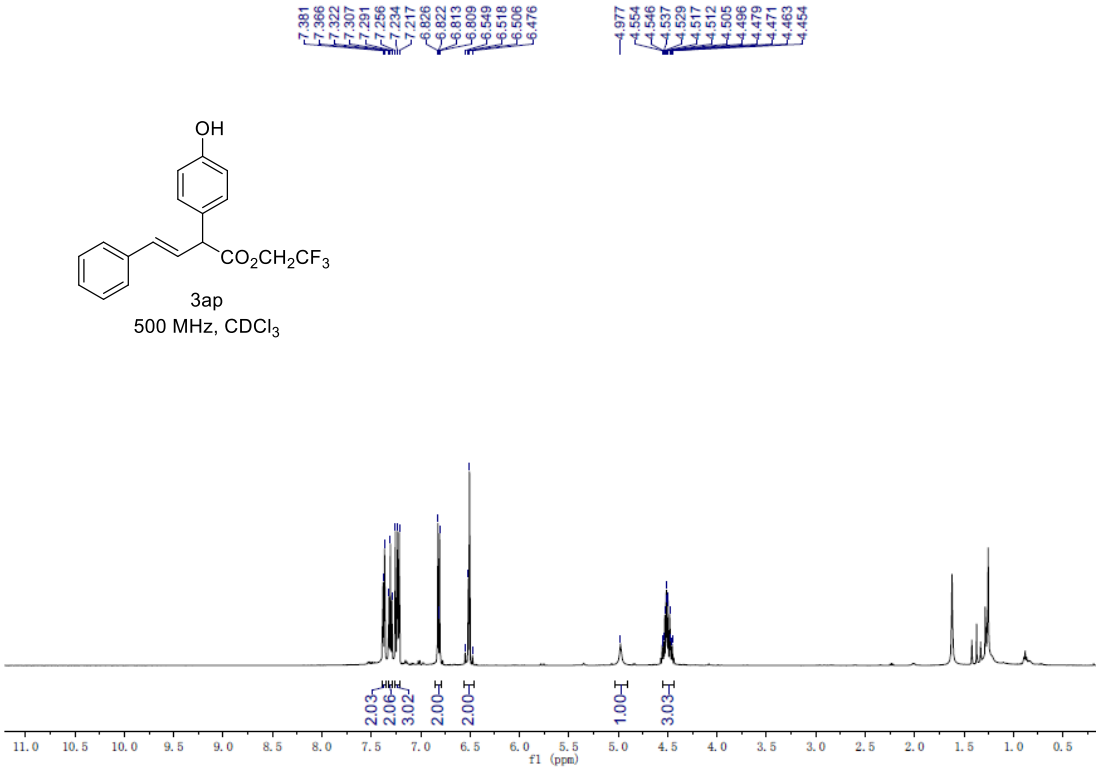

OH
CO2Et
3an
125 MHz, CDCl3
172.78
154.89
136.72
132.14
130.58
129.21
128.51
127.63
127.45
126.43
115.58
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
61.15
54.21
14.14
f1 (ppm)


OH
CO2iPr
3ao
500 MHz, CDCl3
7.382
7.368
7.313
7.298
7.283
7.236
7.230
7.226
7.222
7.213
6.802
6.785
6.569
6.553
6.537
6.521
6.475
6.443
5.077
5.064
5.052
5.039
5.027
4.972
4.366
4.350
1.259
1.246
1.213
1.201
2.00
2.01
3.00
2.00
1.00
1.00
1.03
1.00
1.00
3.10
3.00
f1 (ppm)



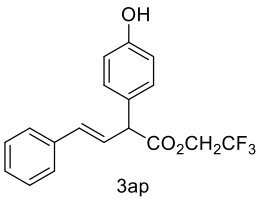
3ao

125 MHz, $CDCl_3$



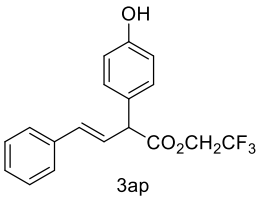
3ap

500 MHz, $CDCl_3$



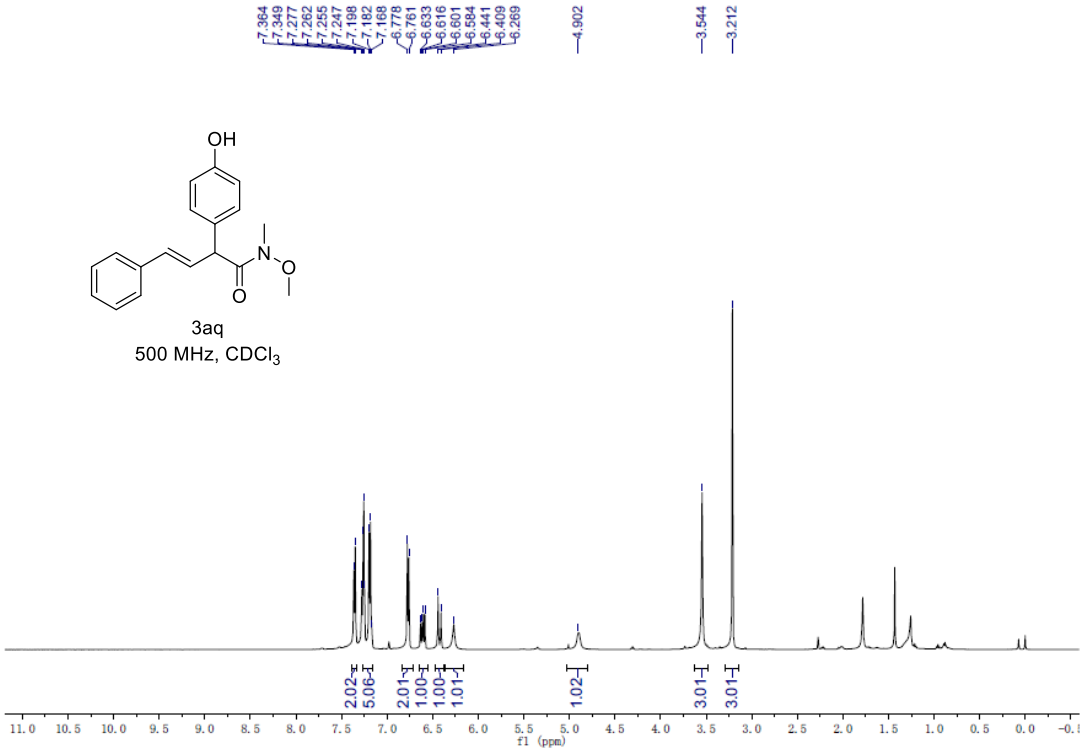
3ap

470 MHz, $CDCl_3$

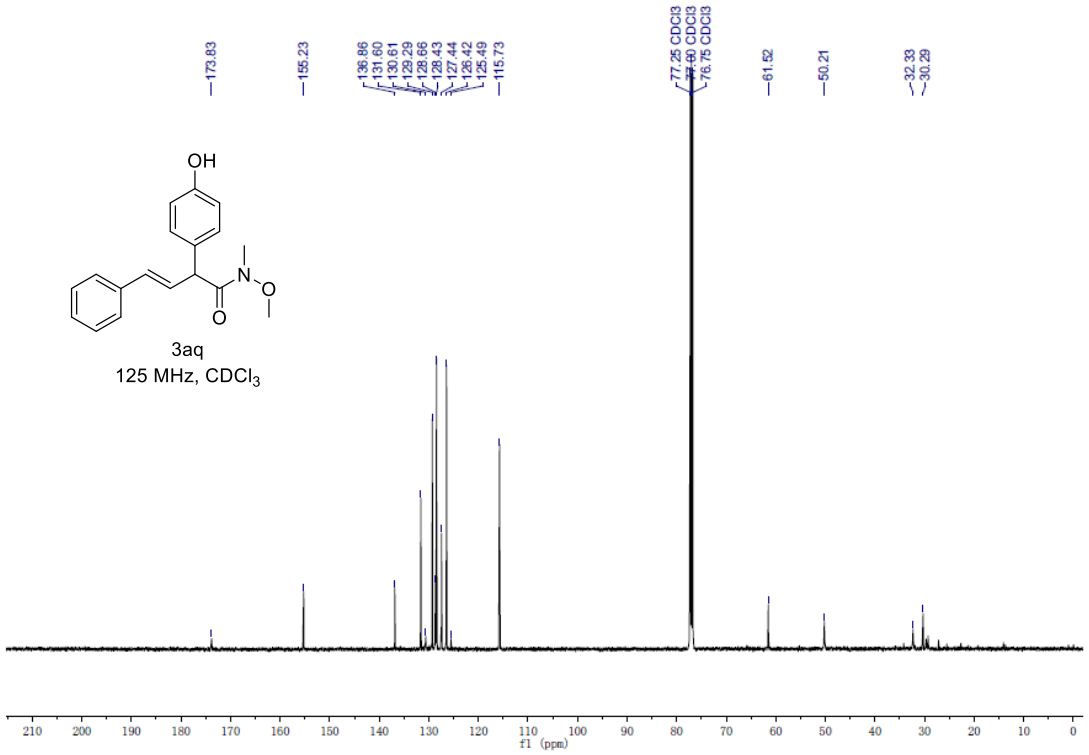


3ap

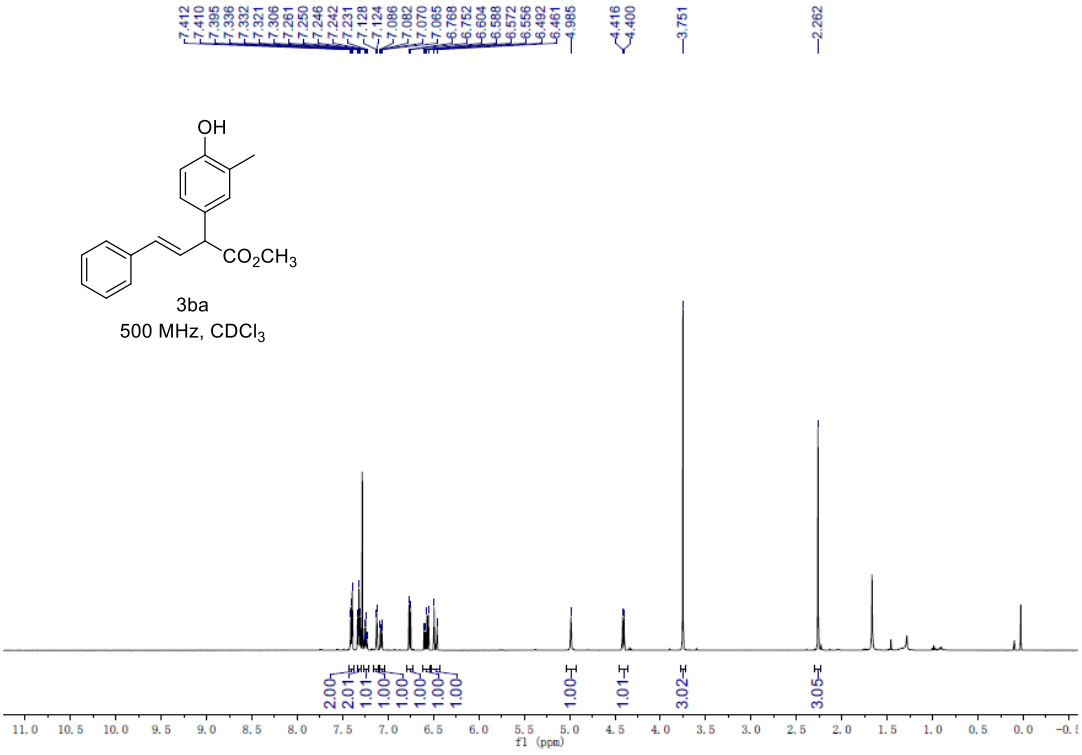
125 MHz, $CDCl_3$

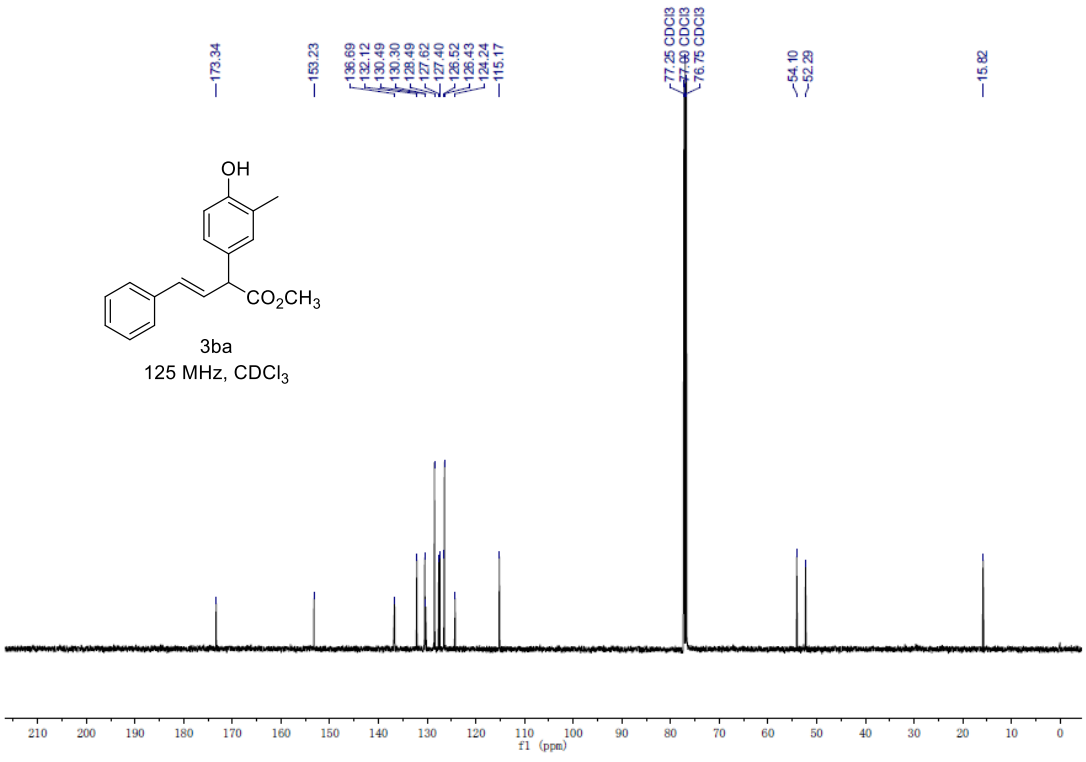


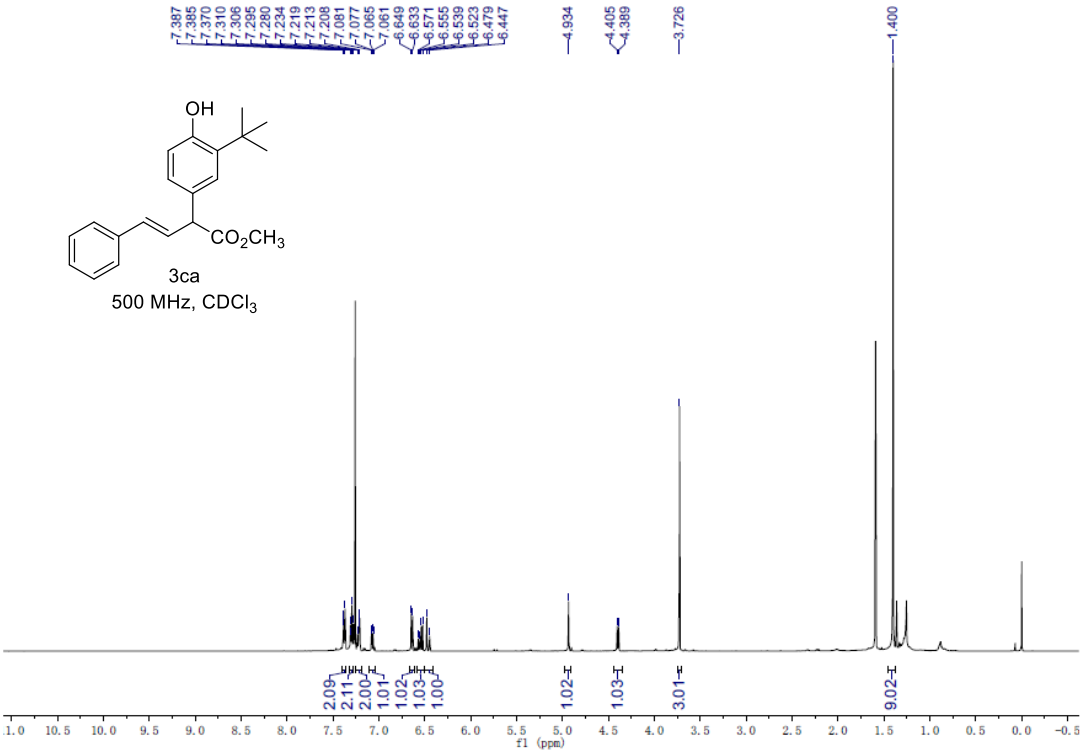
3aq
500 MHz, $CDCl_3$

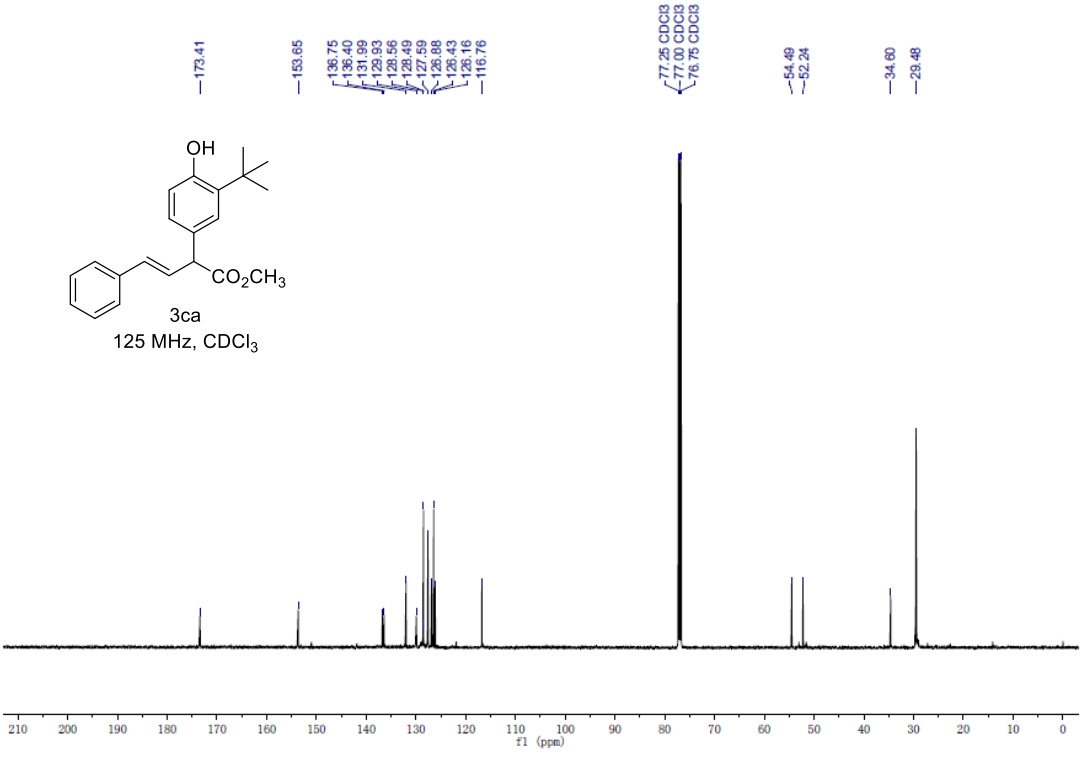


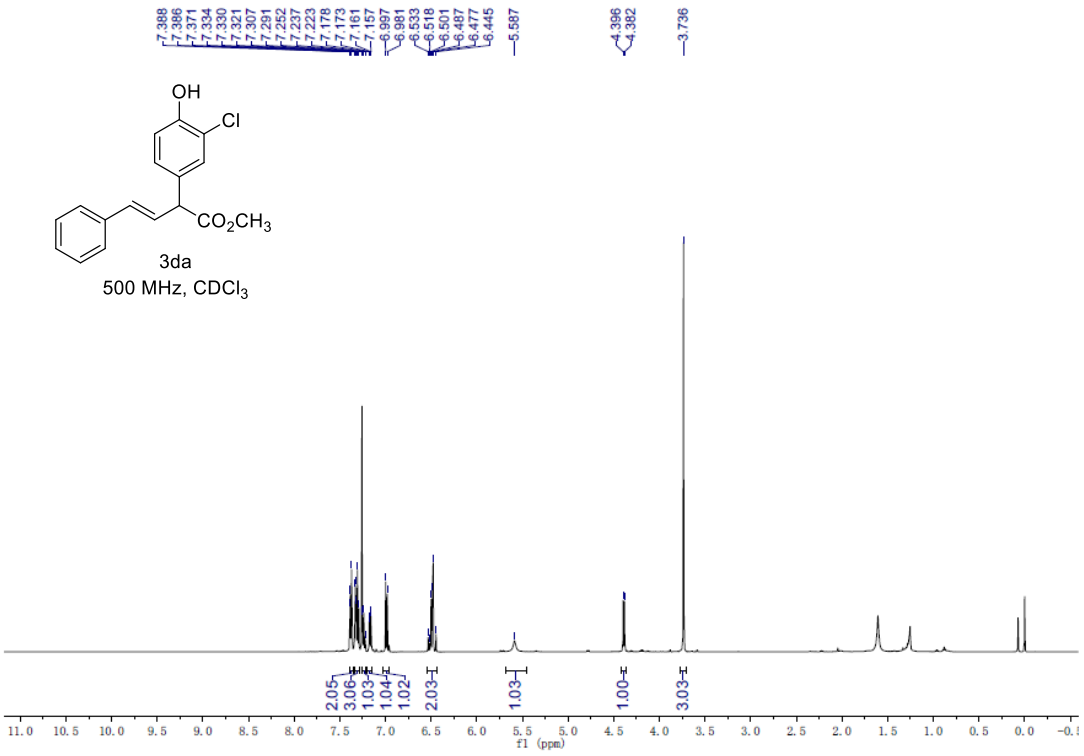
3aq
125 MHz, $CDCl_3$

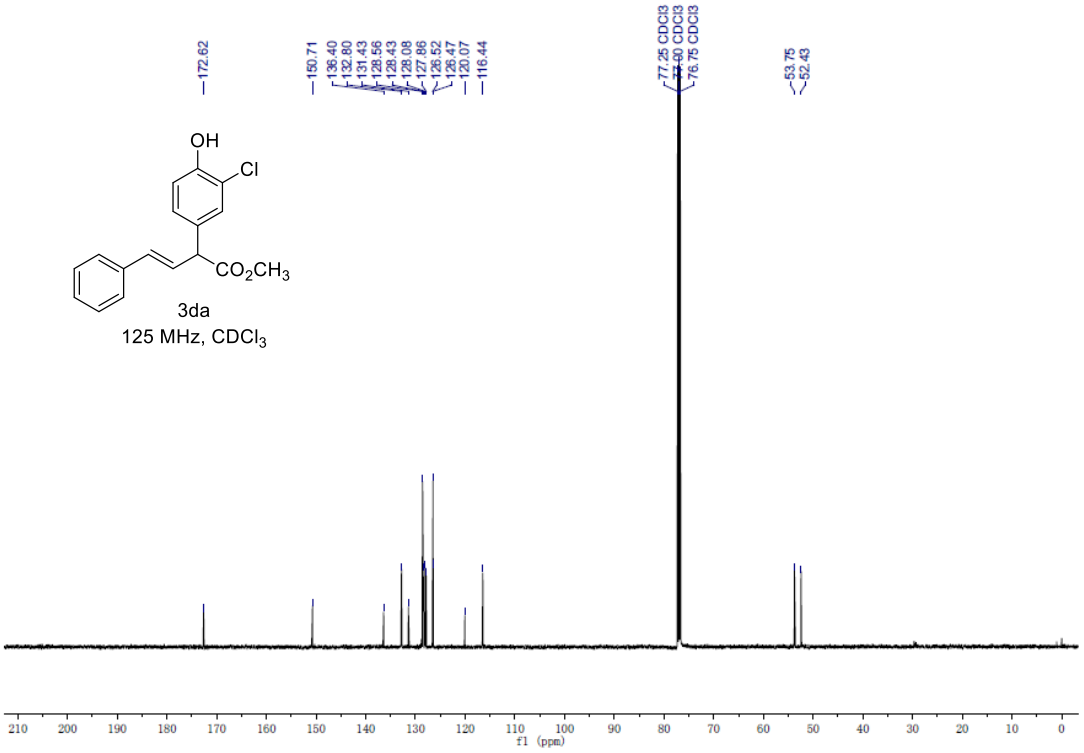

7.412
7.410
7.395
7.336
7.332
7.321
7.306
7.261
7.250
7.246
7.242
7.231
7.128
7.124
7.086
7.082
7.070
7.065
6.768
6.752
6.604
6.588
6.572
6.556
6.492
6.461
4.985
4.416
4.400
3.751
2.262
OH
CO2CH3
3ba
500 MHz, CDCl3
2.00
2.01
1.01
1.00
1.00
1.00
1.00
1.00
1.00
1.01
3.02
3.05
f1 (ppm)

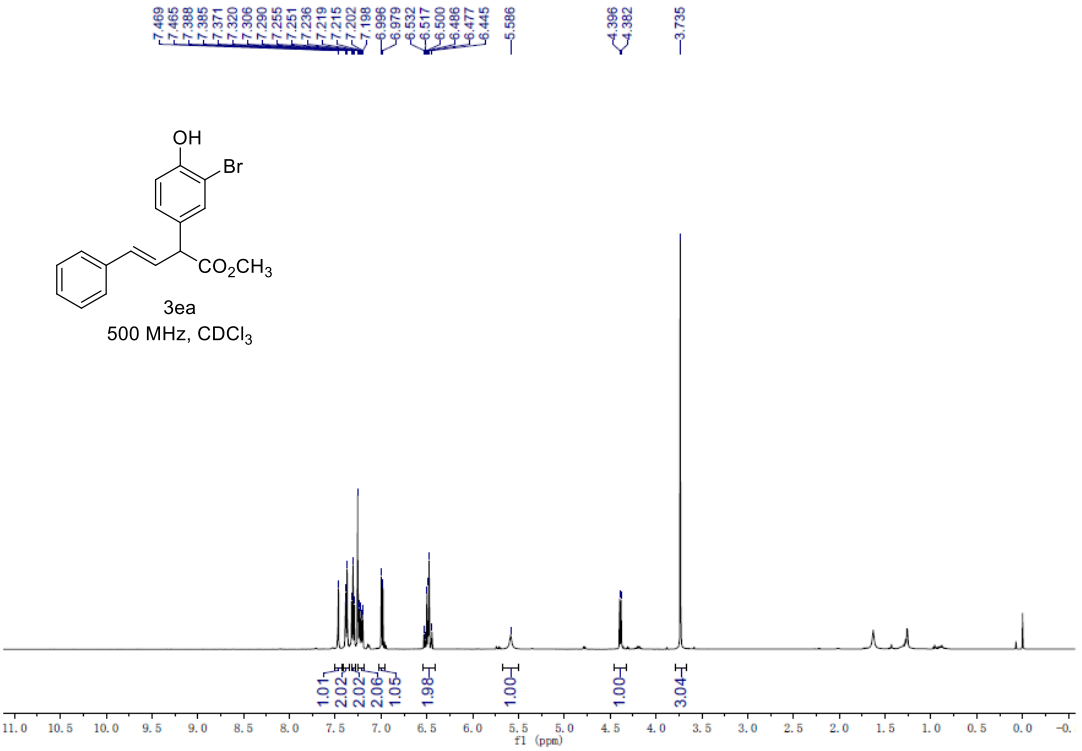

173.34
153.23
136.69
132.12
130.49
130.30
129.49
127.62
127.40
126.52
126.43
124.24
115.17
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
54.10
52.29
15.82
OH
CO2CH3
3ba
125 MHz, CDCl3
f1 (ppm)

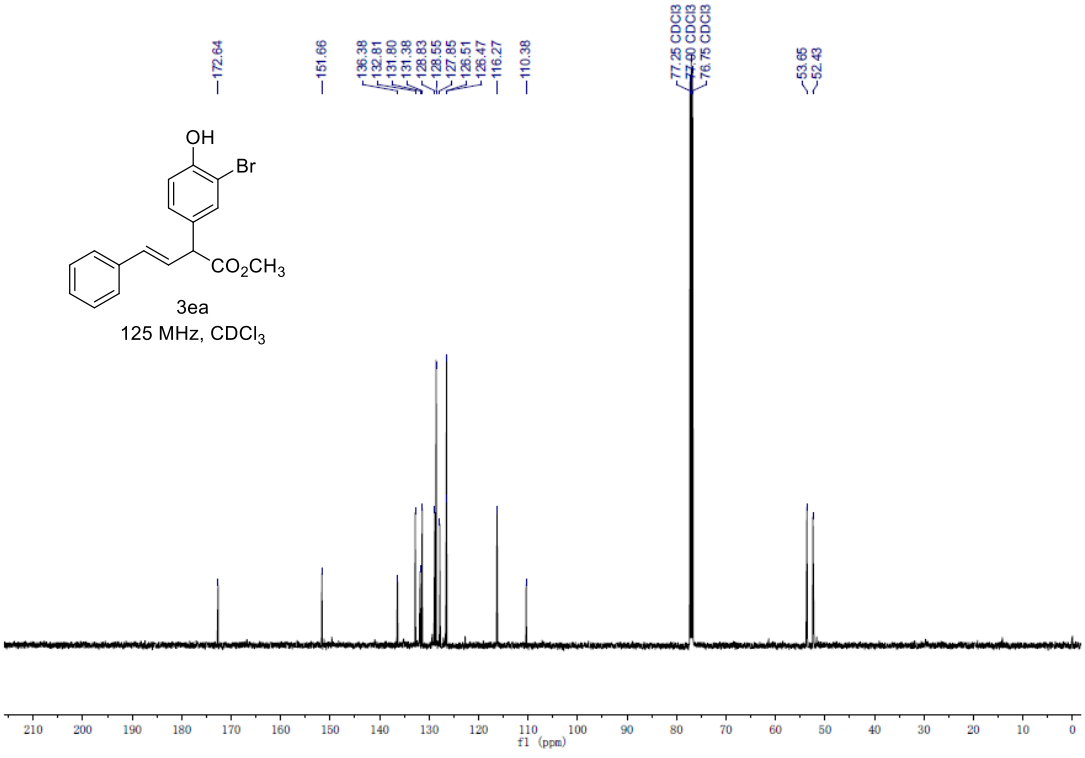

OH
CO2CH3
3ca
500 MHz, CDCl3
7.387
7.385
7.370
7.310
7.306
7.295
7.280
7.234
7.219
7.213
7.208
7.081
7.077
7.065
7.061
6.649
6.633
6.571
6.555
6.539
6.523
6.479
6.447
4.934
4.405
4.389
3.726
1.400
2.09
2.11
2.00
1.01
1.02
1.03
1.00
1.02
1.03
3.01
9.02
f1 (ppm)

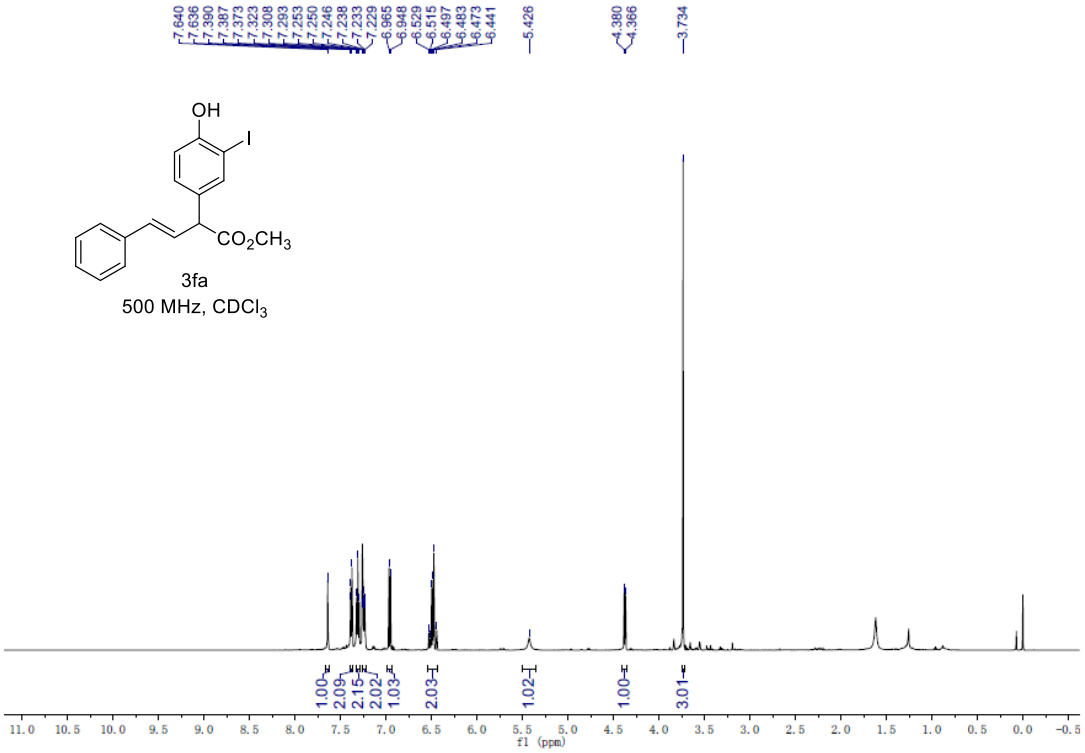

OH
CO2CH3
3ca
125 MHz, CDCl3
173.41
153.65
136.75
136.40
131.99
129.93
128.56
128.49
127.59
126.88
126.43
125.16
116.76
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
54.49
52.24
34.60
29.48
f1 (ppm)

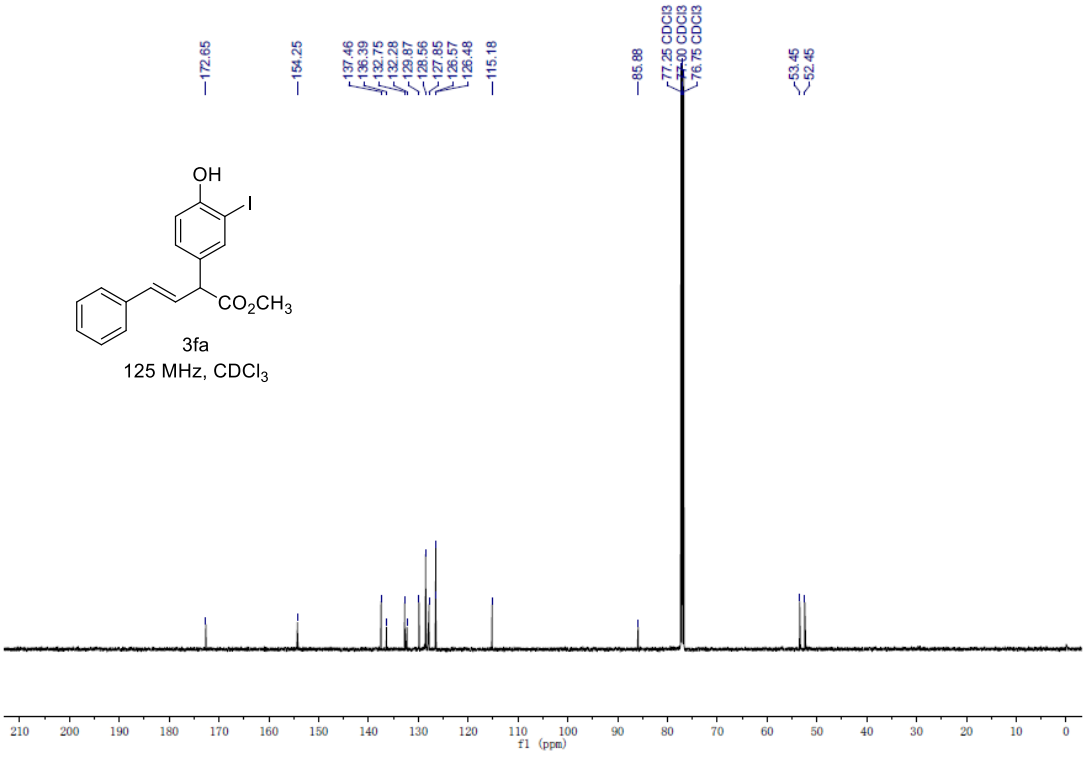

7.388
7.386
7.371
7.334
7.330
7.321
7.307
7.291
7.252
7.237
7.223
7.178
7.173
7.161
7.157
6.997
6.981
6.533
6.518
6.501
6.487
6.477
6.445
5.587
4.396
4.382
3.736
OH
Cl
CO2CH3
3da
500 MHz, CDCl3
2.05
3.06
1.03
1.04
1.02
2.03
1.03
1.00
3.03
f1 (ppm)

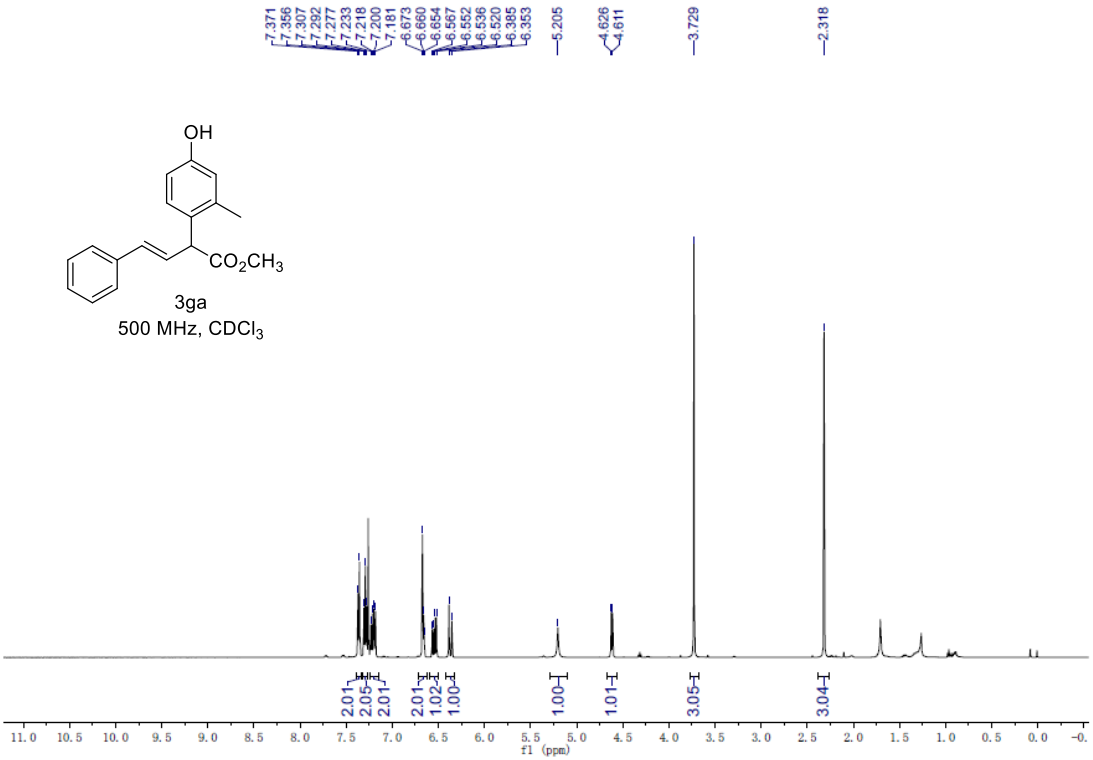

172.62
150.71
136.40
132.80
131.43
128.56
128.43
128.08
127.86
126.52
126.47
120.07
116.44
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
53.75
52.43
OH
Cl
CO2CH3
3da
125 MHz, CDCl3
f1 (ppm)

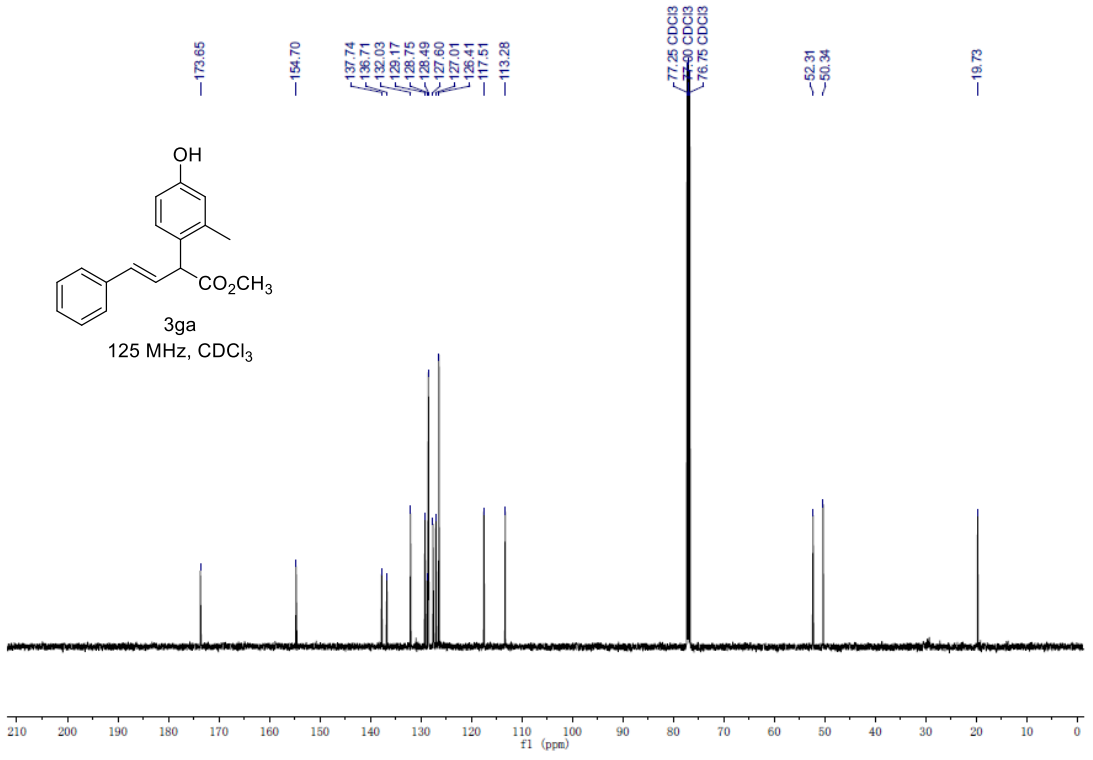

7.469
7.465
7.388
7.385
7.371
7.320
7.306
7.290
7.255
7.251
7.236
7.219
7.215
7.202
7.198
6.996
6.979
6.532
6.517
6.500
6.486
6.477
6.445
5.586
4.396
4.382
3.735
OH
Br
CO2CH3
3ea
500 MHz, CDCl3
1.01
2.02
2.02
2.06
1.05
1.98
1.00
1.00
3.04
f1 (ppm)

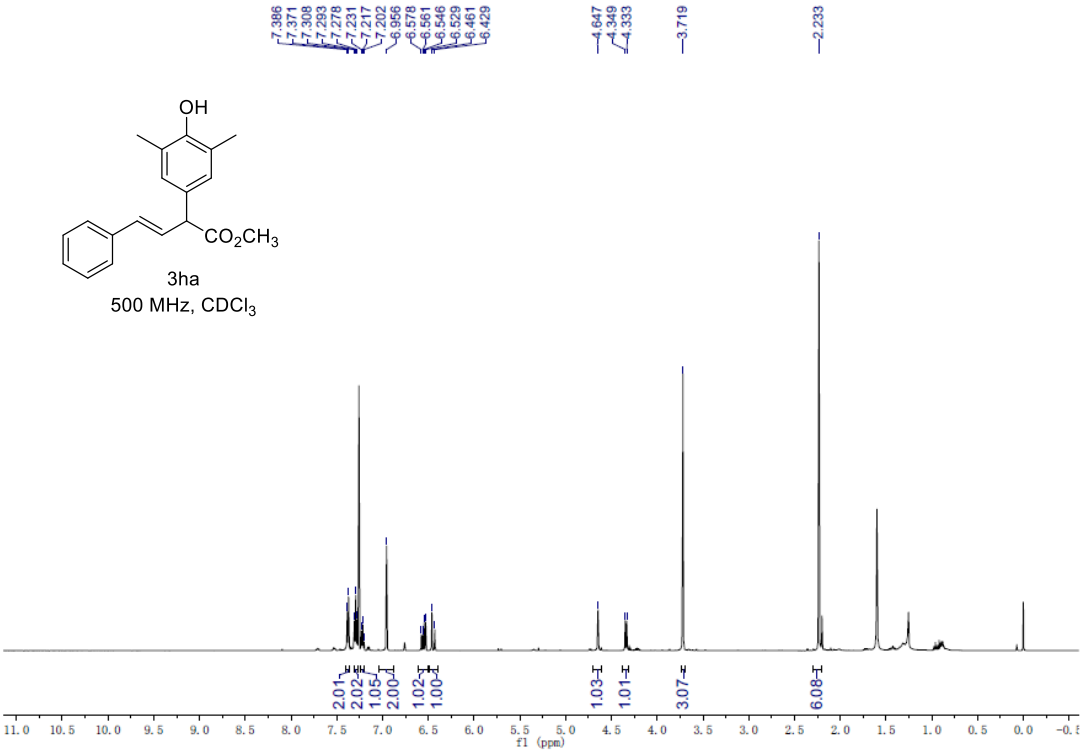

172.64
151.66
136.38
132.81
131.80
131.38
129.83
128.55
127.85
126.51
126.47
116.27
110.38
77.25 CDCl3
77.40 CDCl3
76.75 CDCl3
53.66
52.43
OH
Br
CO2CH3
3ea
125 MHz, CDCl3
f1 (ppm)

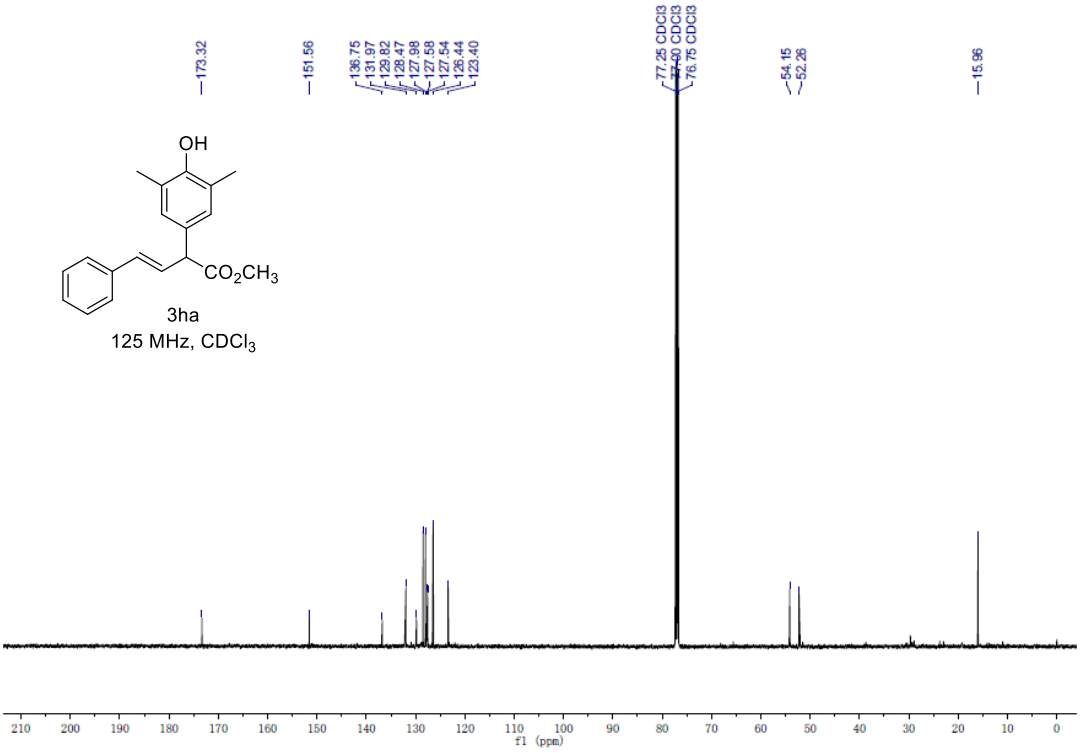

7.640
7.636
7.390
7.387
7.373
7.323
7.308
7.293
7.253
7.250
7.246
7.238
7.233
7.229
6.965
6.948
6.529
6.515
6.497
6.483
6.473
6.441
5.426
4.380
4.366
3.734
OH
I
CO2CH3
3fa
500 MHz, CDCl3
1.00
2.09
2.15
2.02
1.03
2.03
1.02
1.00
3.01
f1 (ppm)

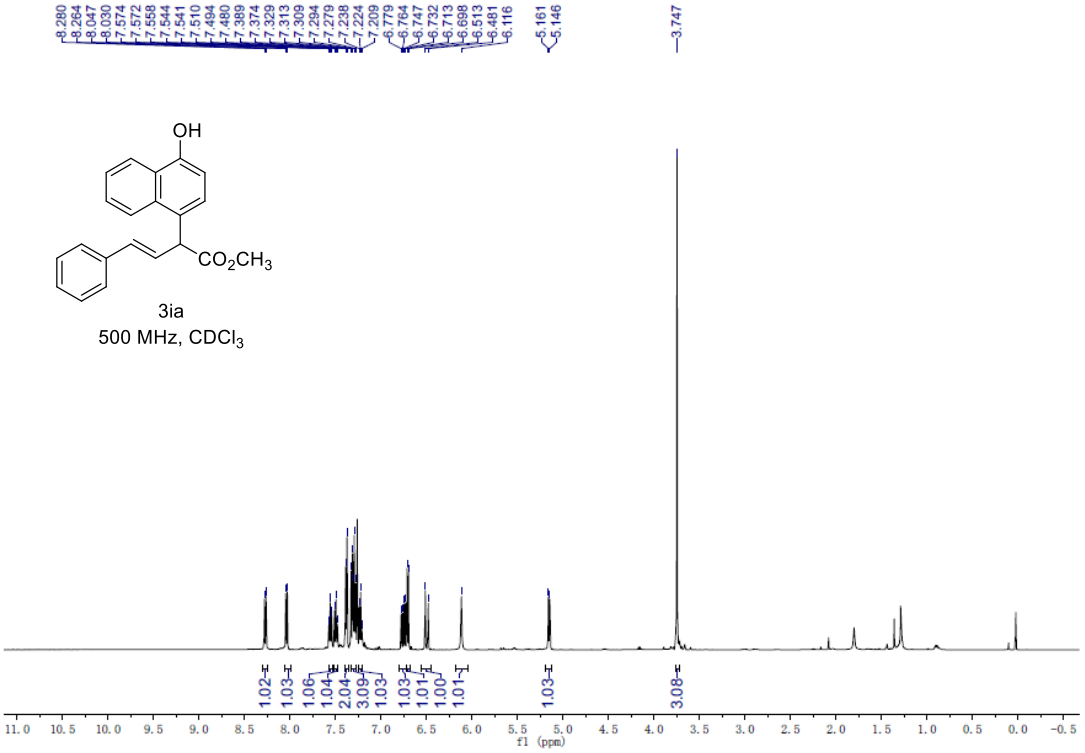

172.65
154.25
137.46
136.39
132.75
132.28
129.87
128.56
127.85
126.57
126.48
115.18
85.88
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
53.45
52.45
OH
I
CO2CH3
3fa
125 MHz, CDCl3
f1 (ppm)


7.371
7.356
7.307
7.292
7.277
7.233
7.218
7.200
7.181
6.673
6.660
6.654
6.567
6.552
6.536
6.520
6.385
6.353
5.205
4.626
4.611
3.729
2.318
OH
CO2CH3
3ga
500 MHz, CDCl3
2.01
2.05
2.01
2.01
1.02
1.00
1.00
1.01
3.05
3.04
f1 (ppm)

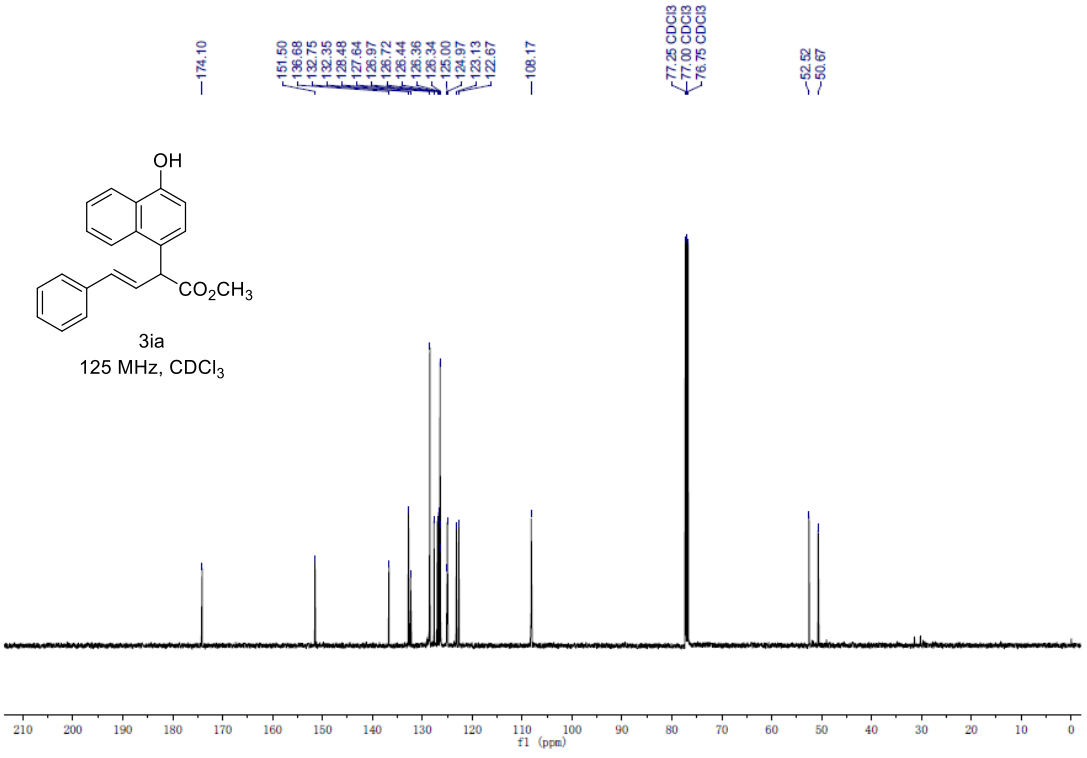

173.65
154.70
137.74
136.71
132.03
129.17
128.75
128.49
127.60
127.01
126.41
117.51
113.28
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
52.31
50.34
19.73
OH
CO2CH3
3ga
125 MHz, CDCl3
f1 (ppm)


7.386
7.371
7.308
7.293
7.278
7.231
7.217
7.202
6.956
6.578
6.561
6.546
6.529
6.461
6.429
4.647
4.349
4.333
3.719
2.233
OH
CO2CH3
3ha
500 MHz, CDCl3
2.01
2.02
1.05
2.00
1.02
1.00
1.03
1.01
3.07
6.08
f1 (ppm)

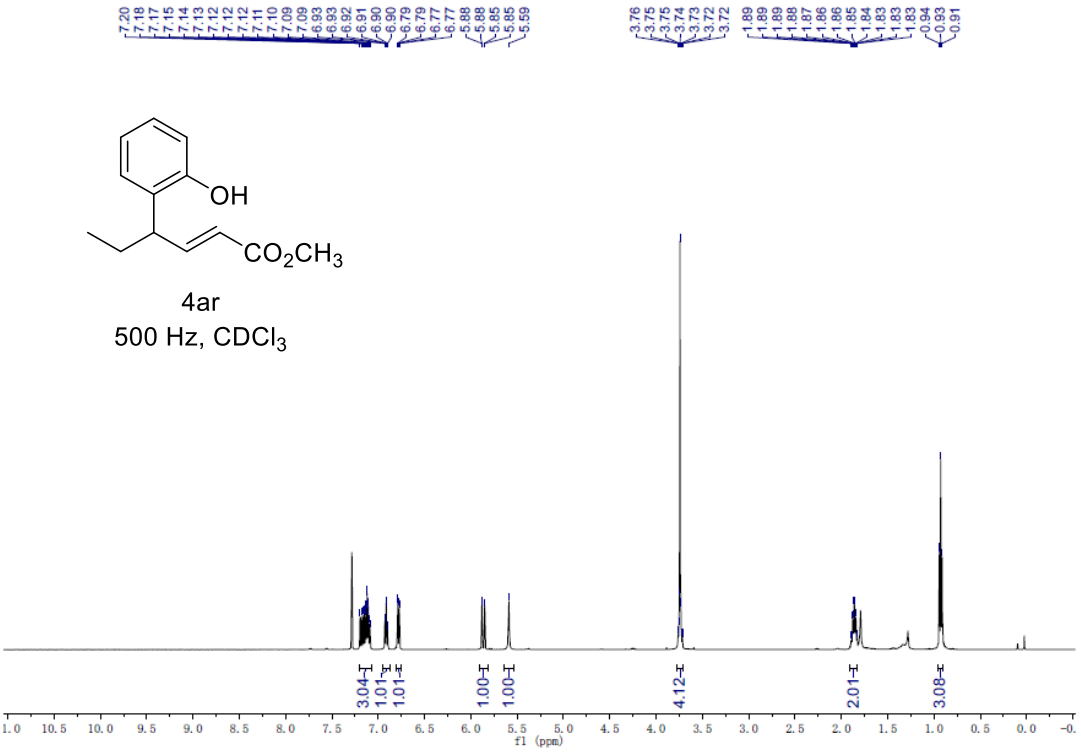

173.32
151.56
136.75
131.97
129.82
128.47
127.98
127.58
127.54
126.44
123.40
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
54.15
52.26
15.96
OH
CO2CH3
3ha
125 MHz, CDCl3
f1 (ppm)

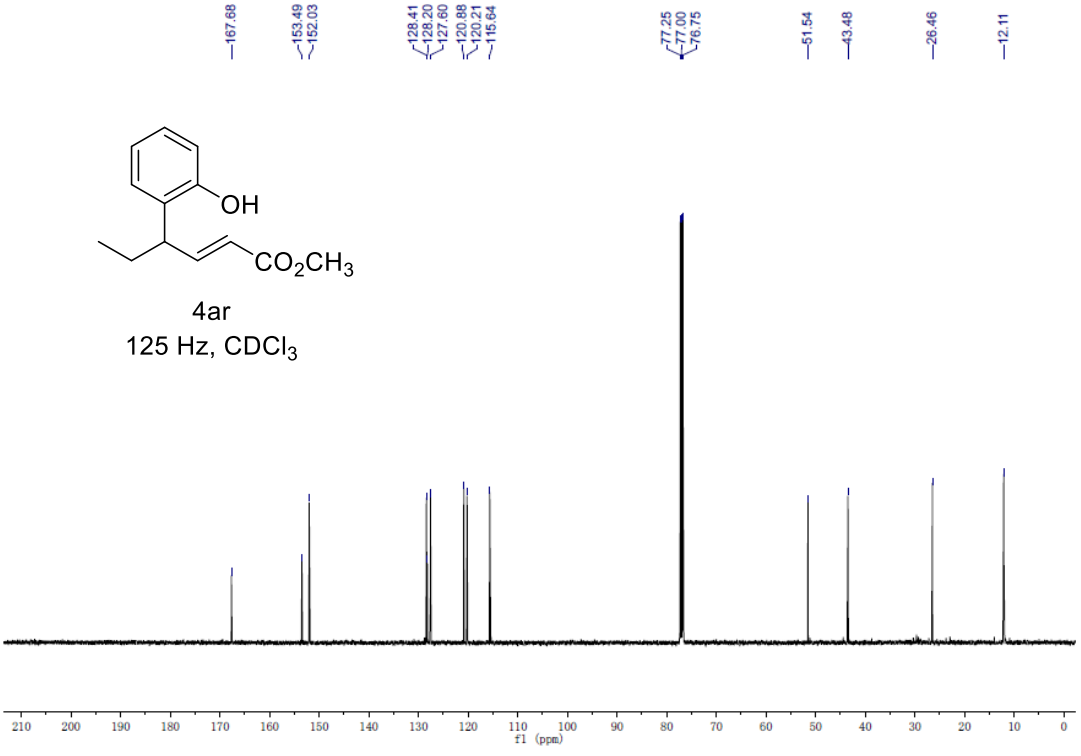


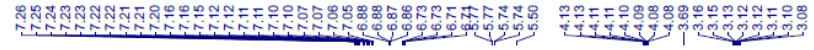
3ia
500 MHz, $CDCl_3$

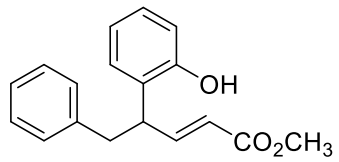


3ia
125 MHz, $CDCl_3$


OH
CO2CH3
4ar
500 Hz, CDCl3
f1 (ppm)

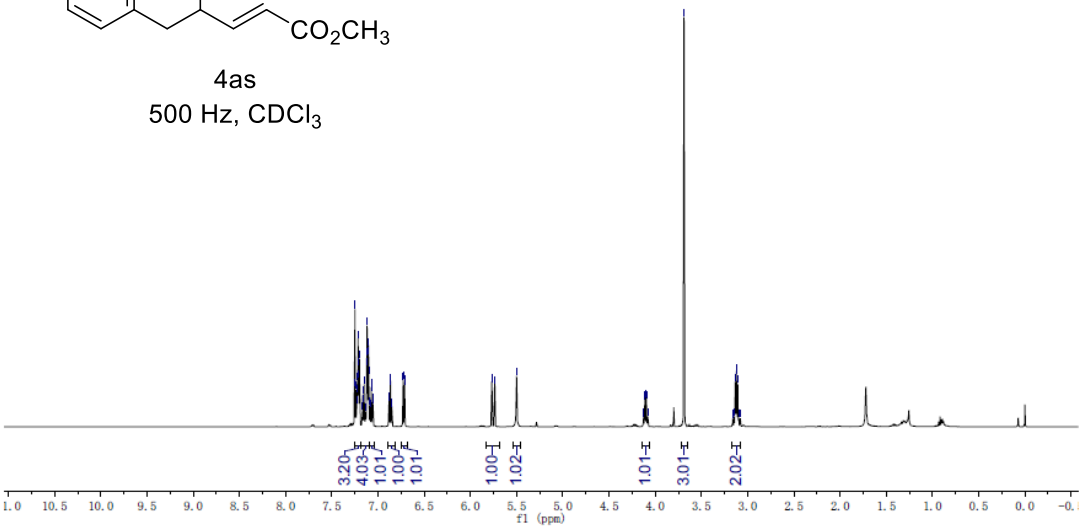

OH
CO2CH3
4ar
125 Hz, CDCl3
f1 (ppm)

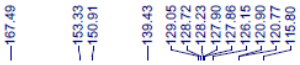


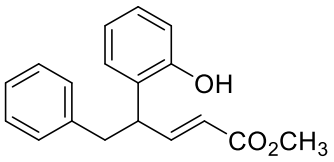


4as

500 Hz, $CDCl_3$

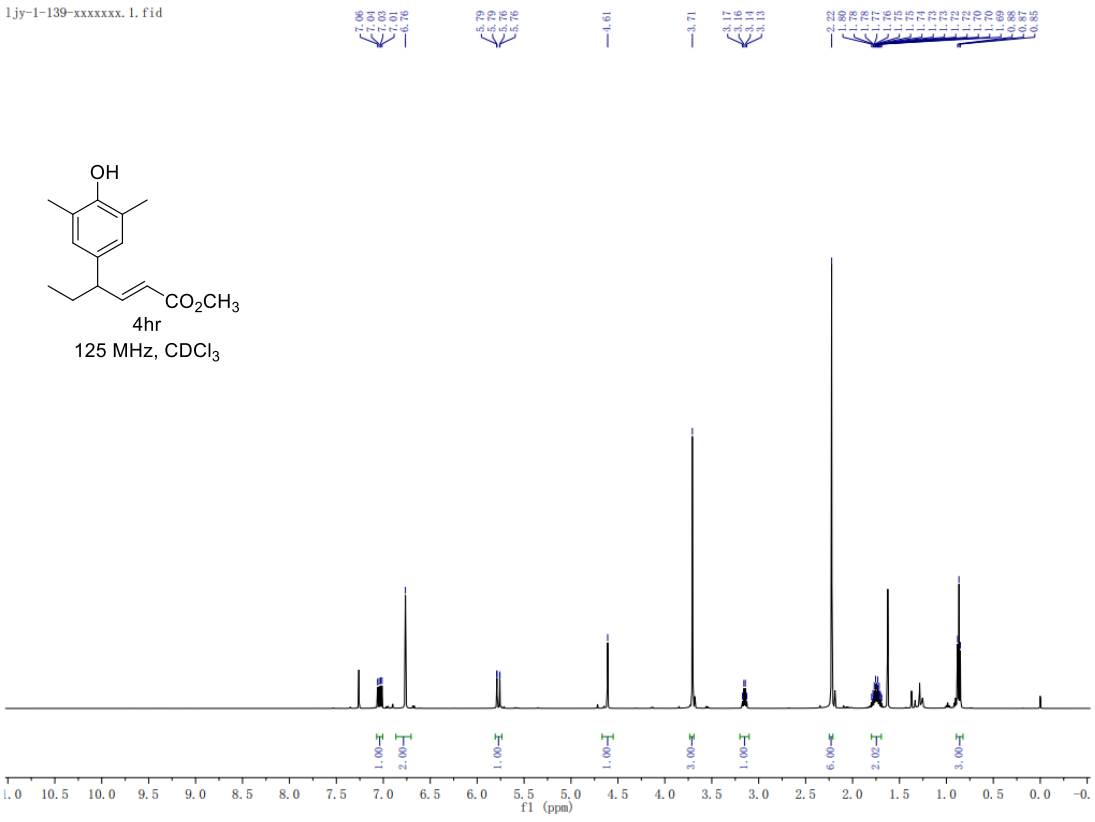


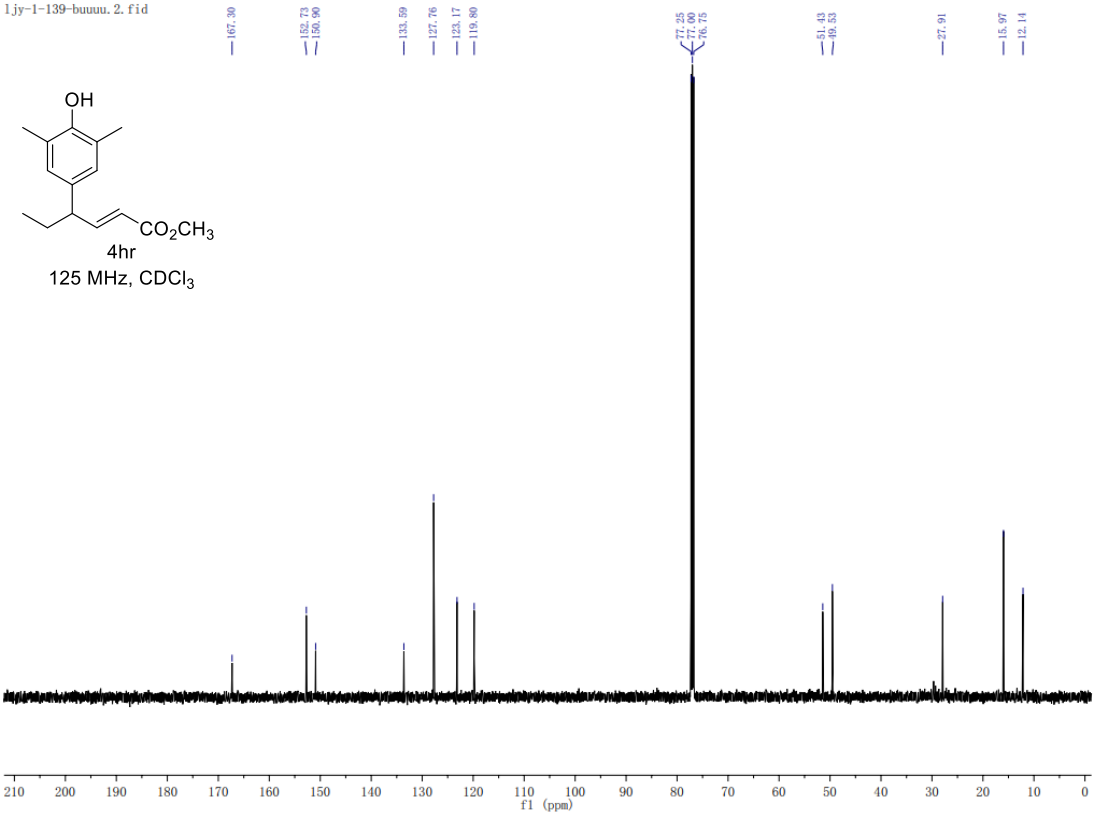


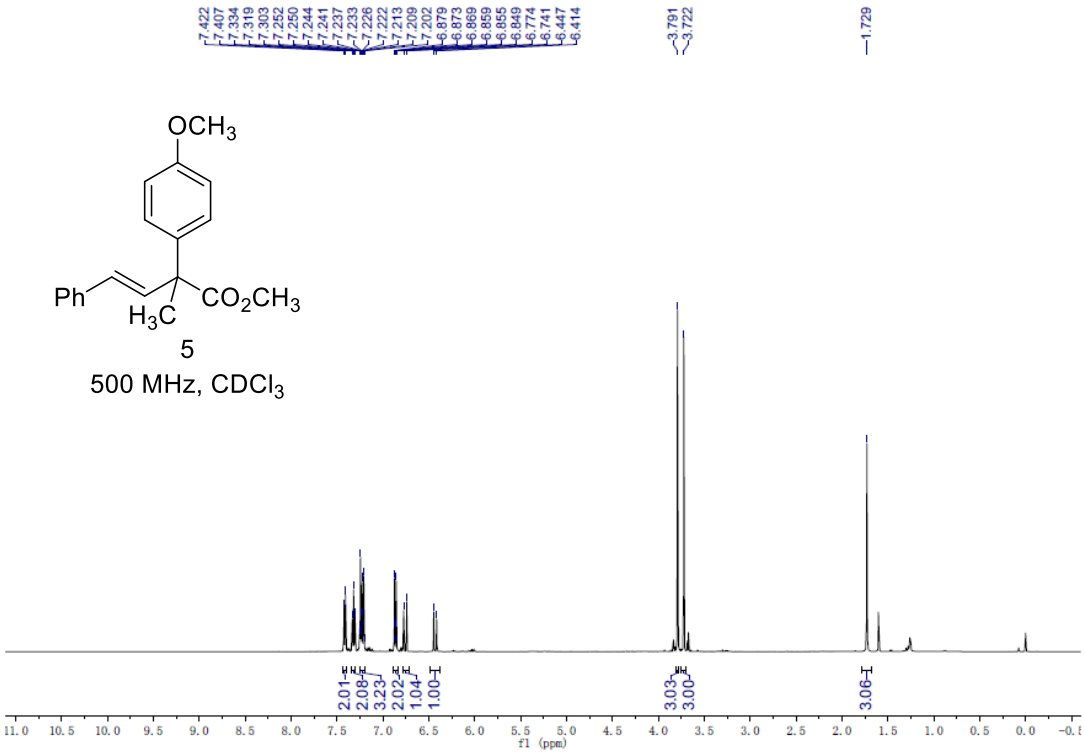


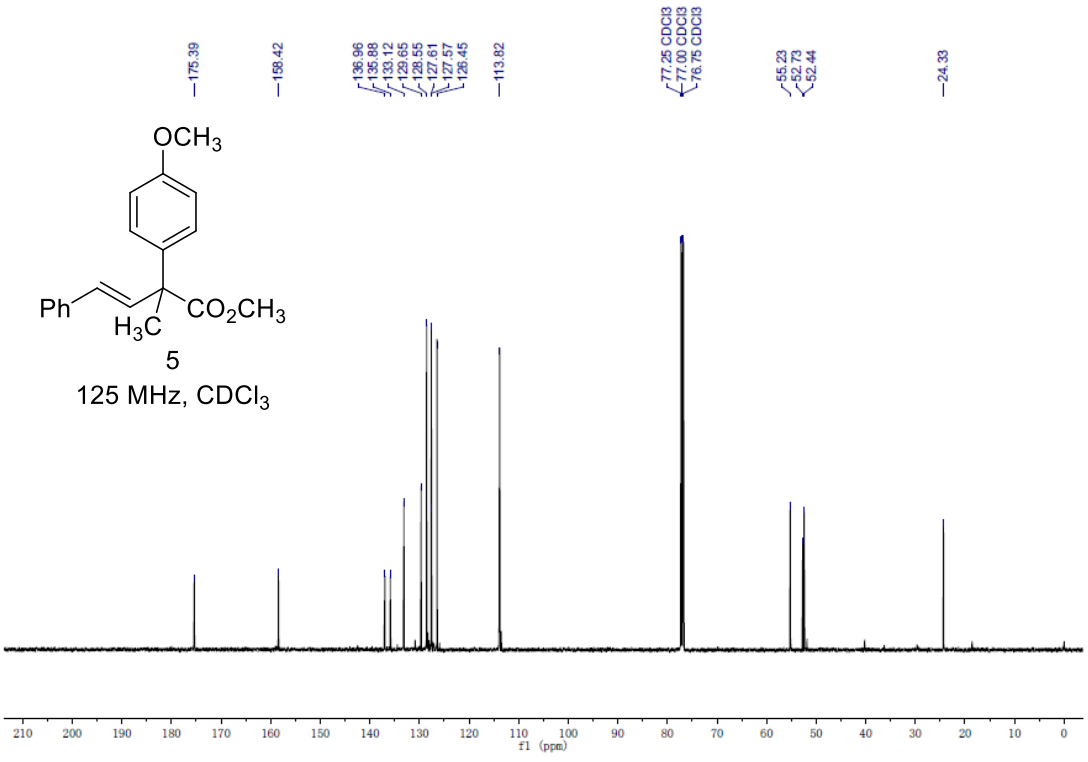
4as

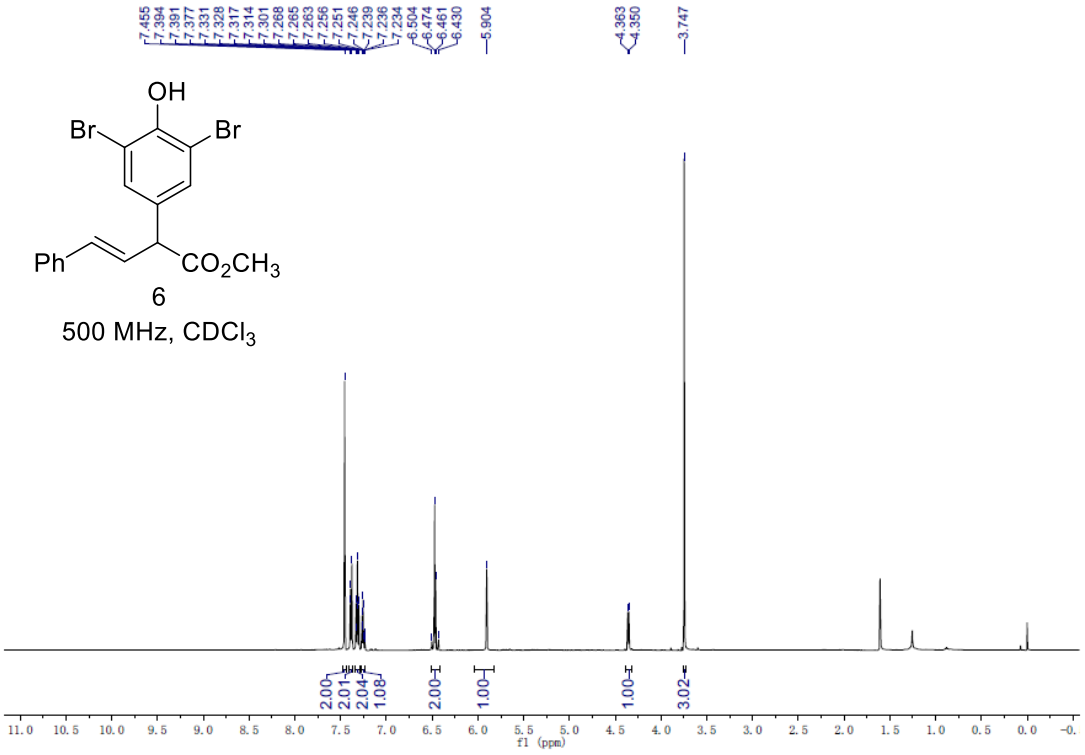
125 Hz, $CDCl_3$

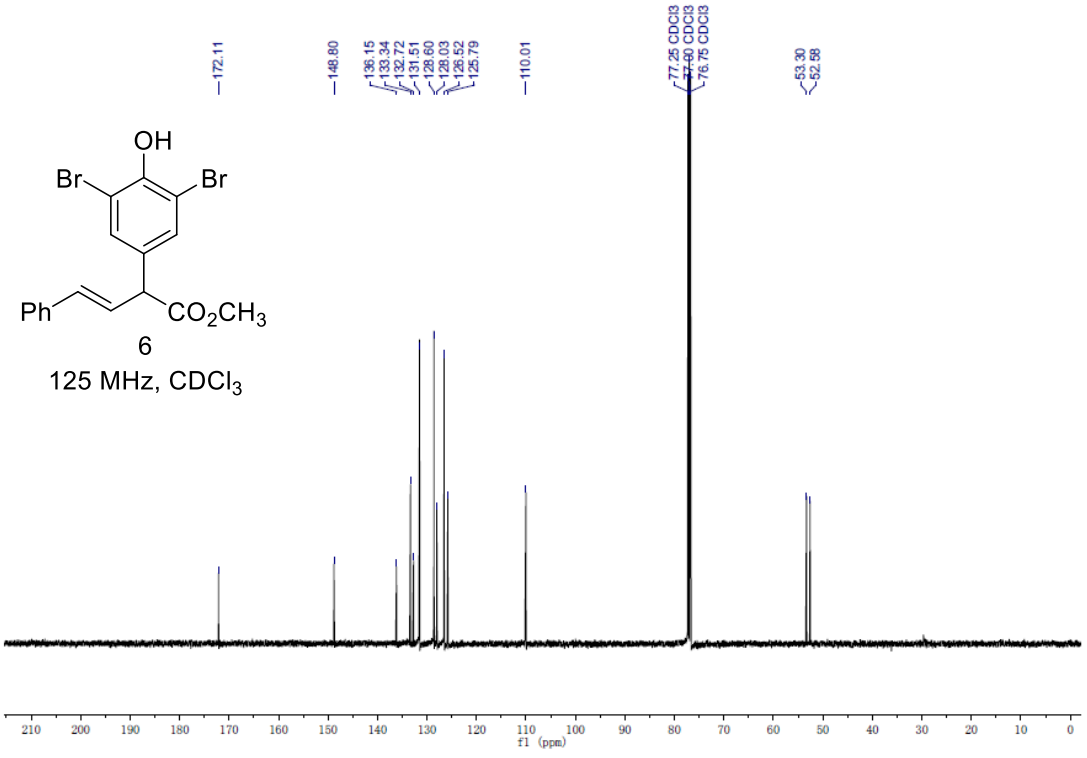

ljy-1-139-xxxxxxx. 1. fid
OH
CO2CH3
4hr
125 MHz, CDCl3
f1 (ppm)

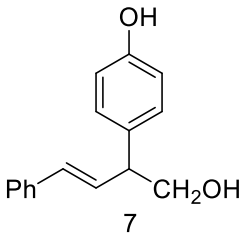

ljy-1-139-buuuu. 2. fid
OH
CO2CH3
4hr
125 MHz, CDCl3
f1 (ppm)


7.422
7.407
7.334
7.319
7.303
7.252
7.250
7.244
7.241
7.237
7.233
7.226
7.222
7.213
7.209
7.202
6.879
6.873
6.869
6.859
6.855
6.849
6.774
6.741
6.447
6.414
3.791
3.722
1.729
OCH3
Ph
CO2CH3
H3C
5
500 MHz, CDCl3
2.01
2.08
3.23
2.02
1.04
1.00
3.03
3.00
3.06
f1 (ppm)


175.39
158.42
136.96
135.88
133.12
129.65
128.55
127.61
127.57
126.45
113.82
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
55.23
52.73
52.44
24.33
OCH3
Ph
CO2CH3
H3C
5
125 MHz, CDCl3
f1 (ppm)

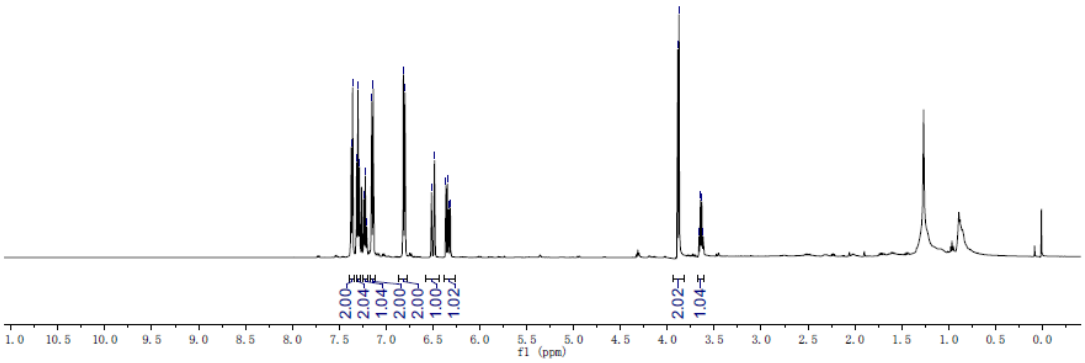

7.455
7.394
7.391
7.377
7.331
7.328
7.317
7.314
7.301
7.268
7.265
7.263
7.256
7.251
7.246
7.239
7.236
7.234
6.504
6.474
6.461
6.430
5.904
4.363
4.350
3.747
OH
Br
Br
Ph
CO2CH3
6
500 MHz, CDCl3
2.00
2.01
2.04
1.08
2.00
1.00
1.00
3.02
f1 (ppm)

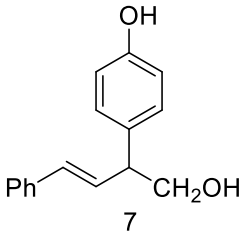

172.11
148.80
136.15
133.34
132.72
131.51
128.60
128.03
126.52
125.79
110.01
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
53.30
52.68
OH
Br
Br
Ph
CO2CH3
6
125 MHz, CDCl3
f1 (ppm)



7

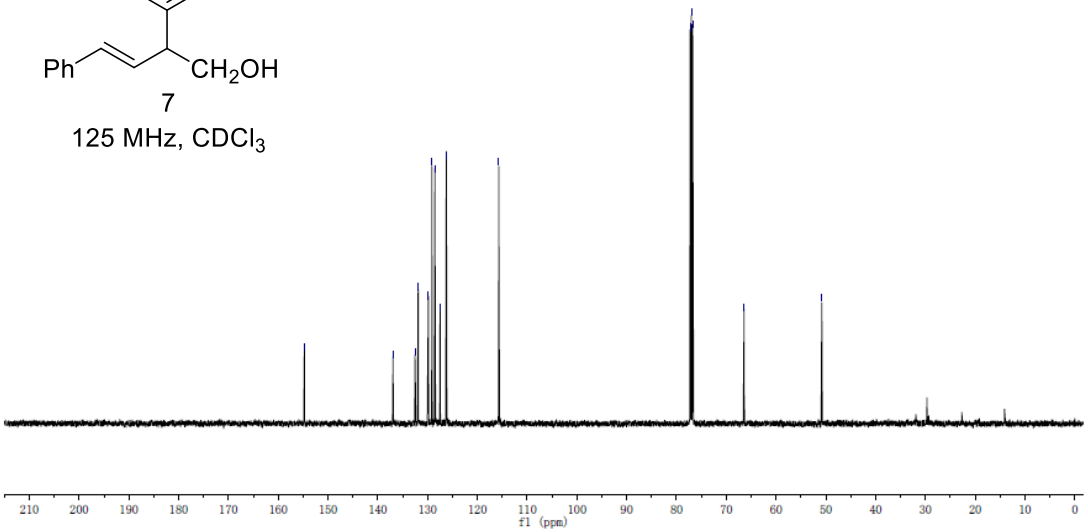
500 MHz, $CDCl_3$

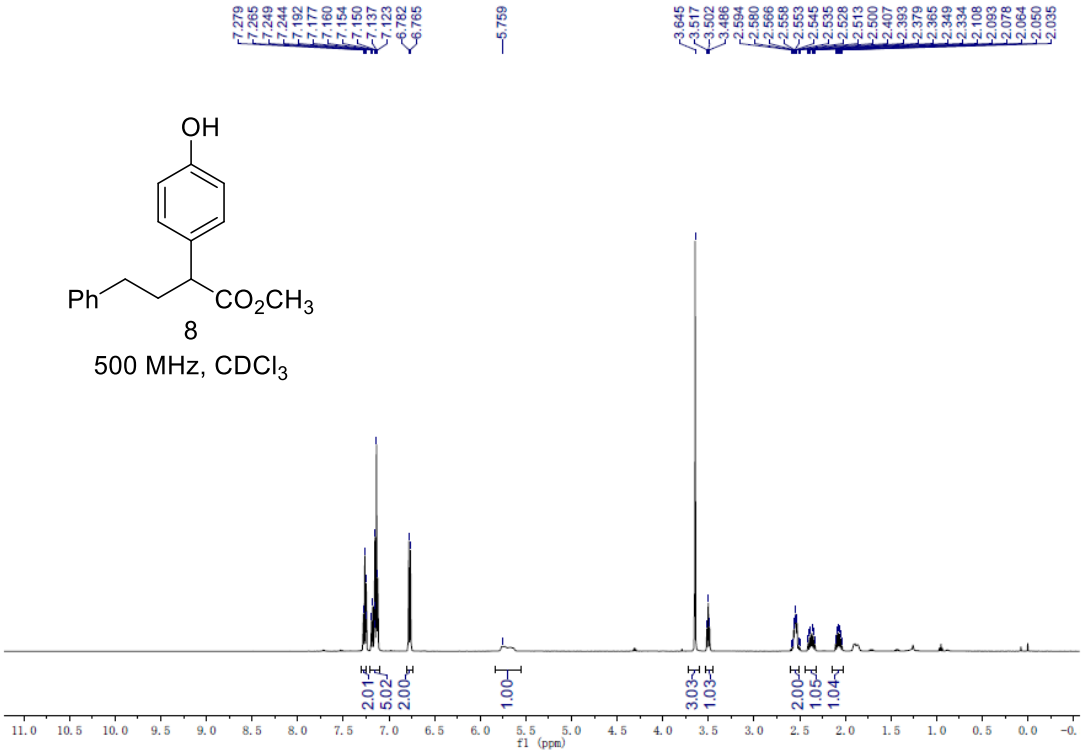


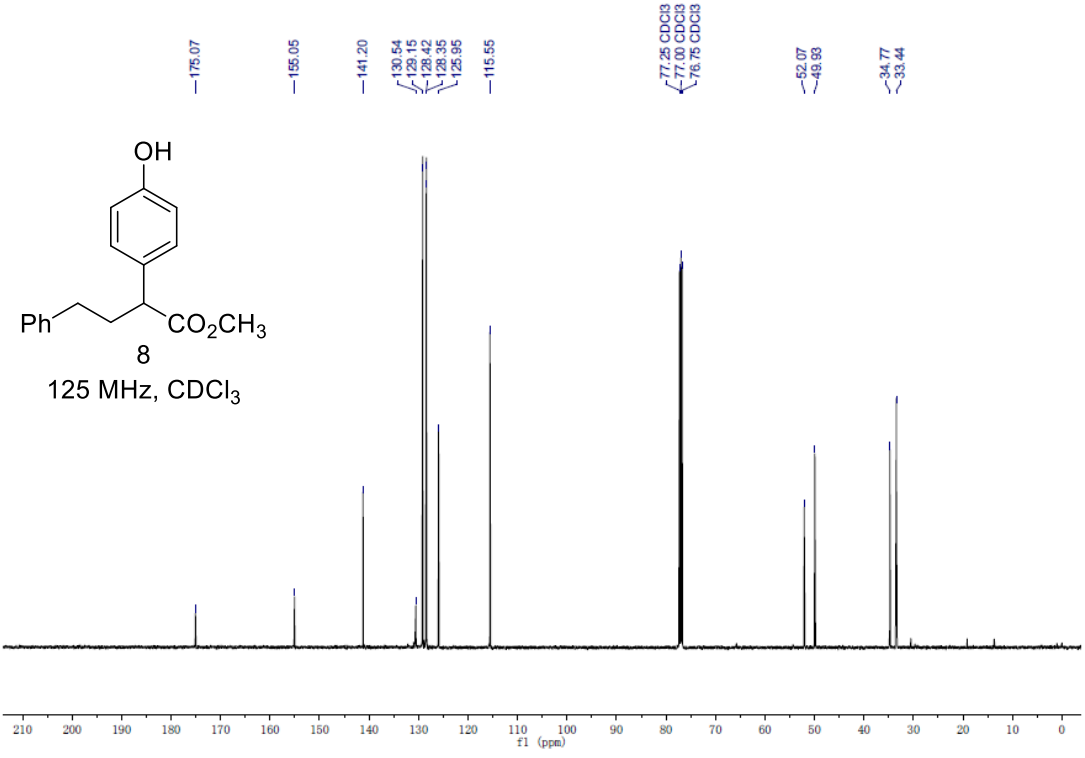


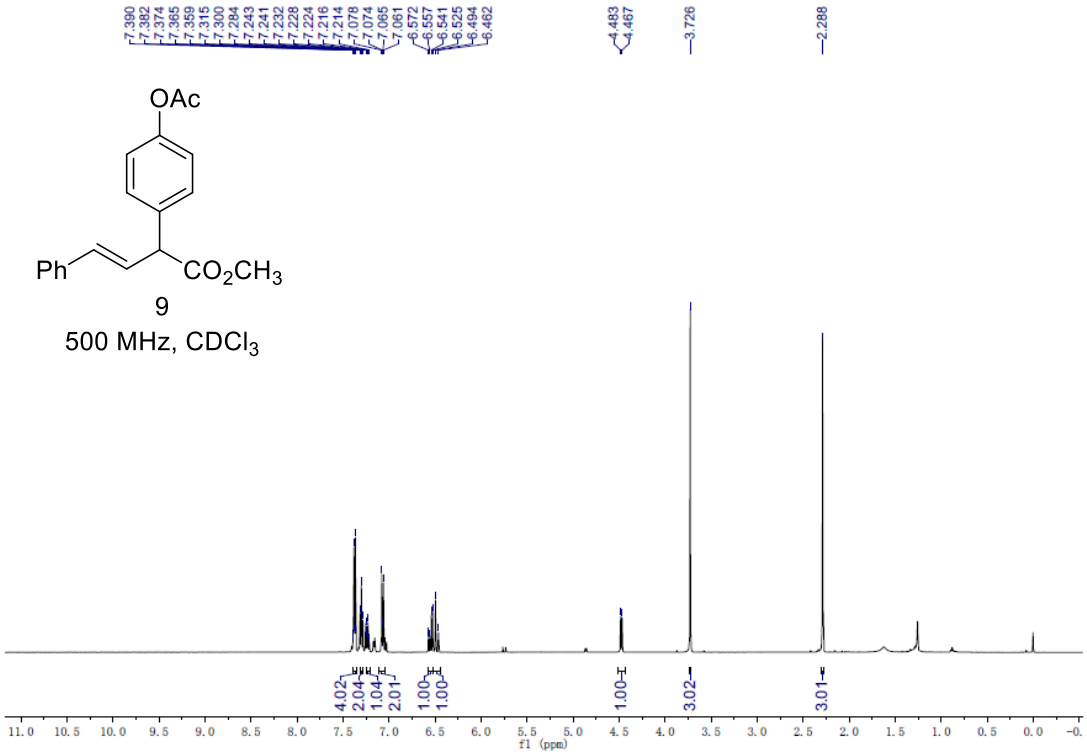
7

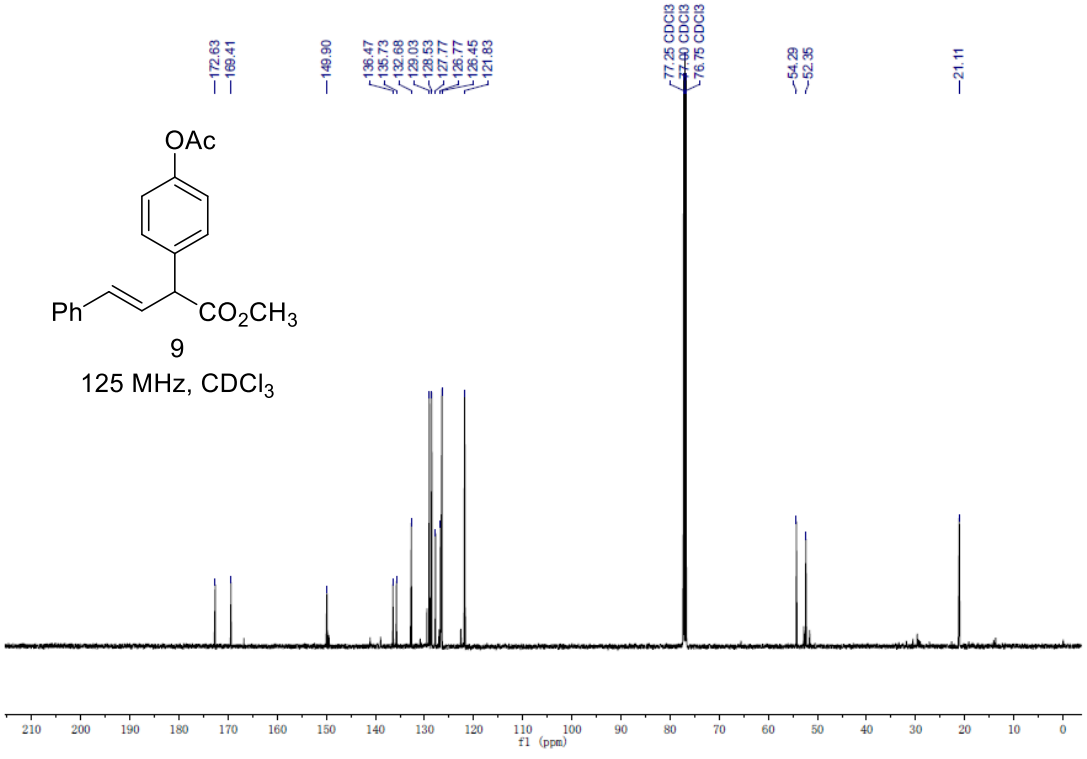
125 MHz, $CDCl_3$

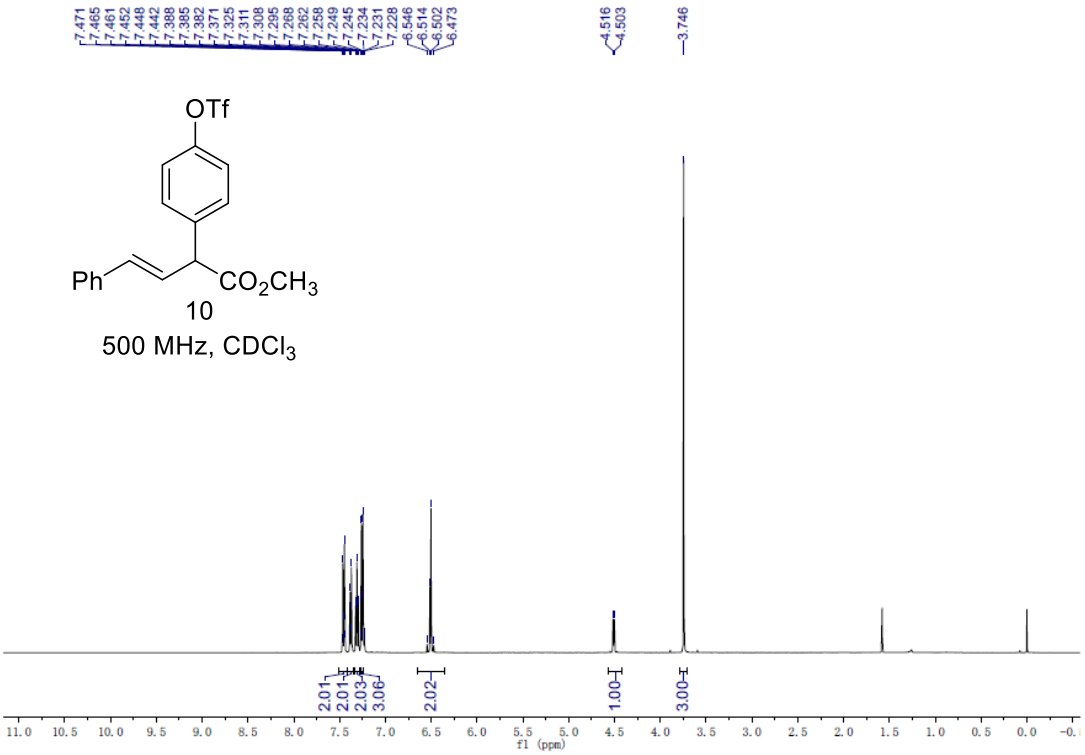


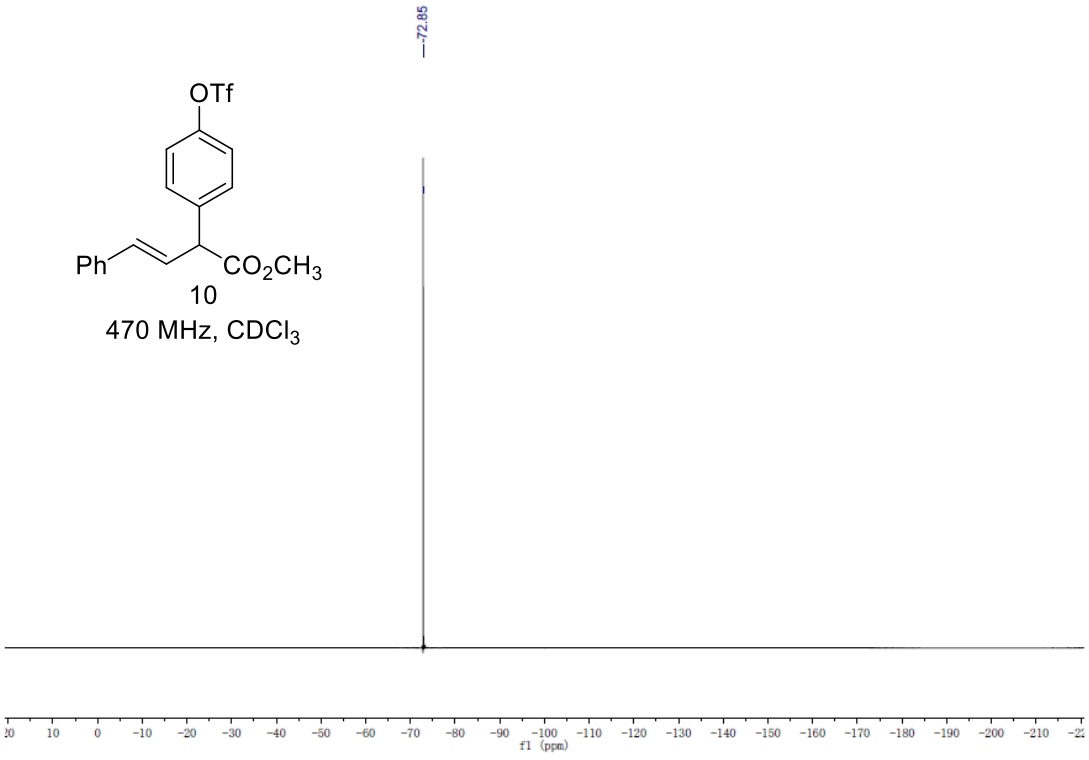

OH
Ph
CO2CH3
8
500 MHz, CDCl3
f1 (ppm)

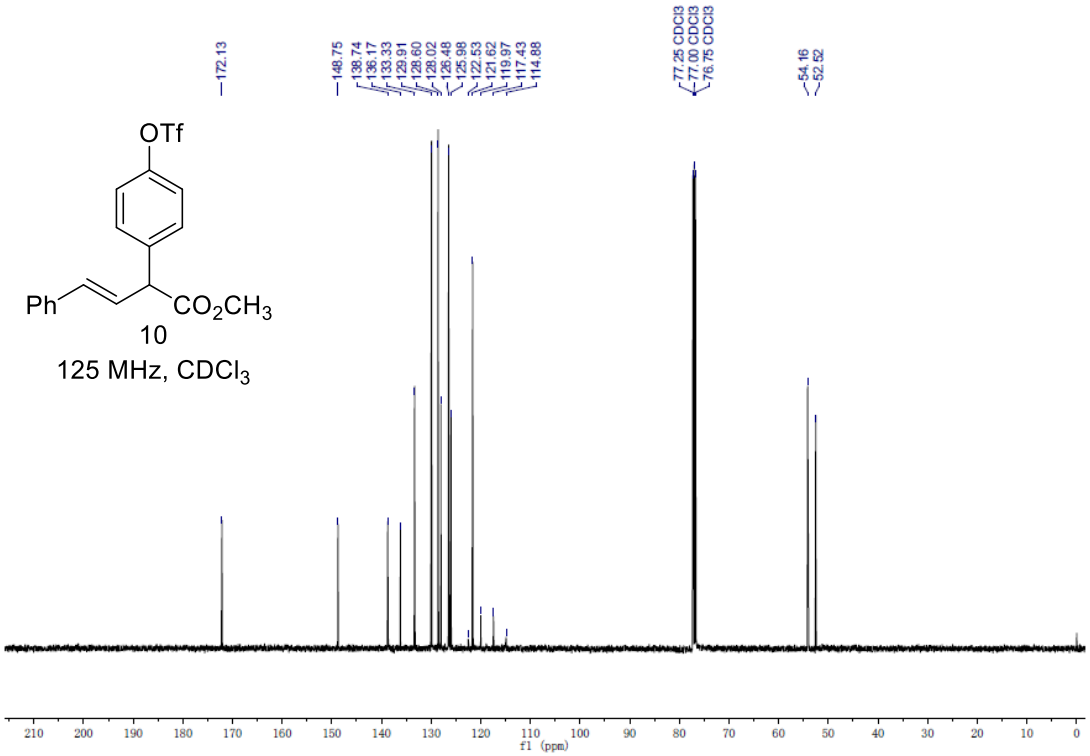

OH
Ph
CO2CH3
8
125 MHz, CDCl3
f1 (ppm)

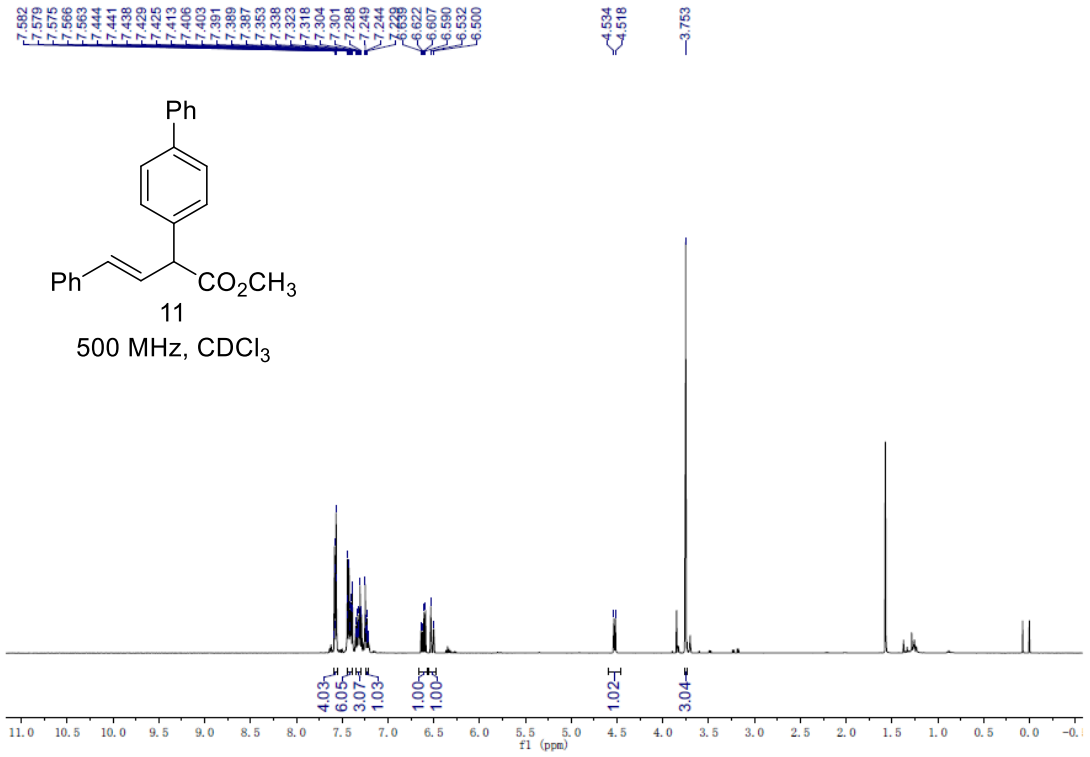

OAc
Ph
CO2CH3
9
500 MHz, CDCl3
f1 (ppm)

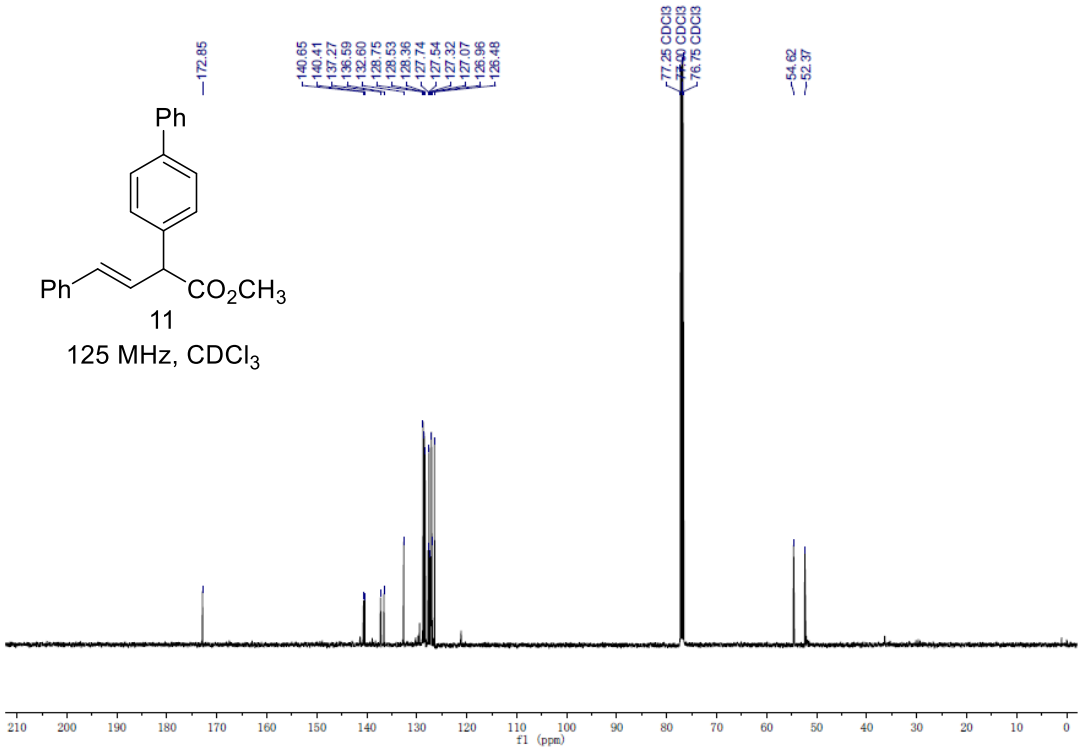

OAc
Ph
CO2CH3
9
125 MHz, CDCl3
f1 (ppm)


OTf
Ph
CO2CH3
10
500 MHz, CDCl3
7.471
7.465
7.461
7.452
7.448
7.442
7.388
7.385
7.382
7.371
7.325
7.311
7.308
7.295
7.268
7.262
7.258
7.249
7.245
7.234
7.231
7.228
6.546
6.514
6.502
6.473
4.516
4.503
3.746
2.01
2.01
2.03
3.06
2.02
1.00
3.00
f1 (ppm)


OTf
Ph
CO2CH3
10
470 MHz, CDCl3
-72.85
f1 (ppm)


OTf
Ph
CO2CH3
10
125 MHz, CDCl3
172.13
148.75
138.74
136.17
133.33
129.91
128.60
128.02
126.48
125.98
122.53
121.62
119.97
117.43
114.88
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
54.16
52.52
f1 (ppm)


7.582
7.579
7.575
7.566
7.563
7.444
7.441
7.438
7.429
7.425
7.413
7.406
7.403
7.391
7.389
7.387
7.353
7.338
7.323
7.318
7.304
7.301
7.288
7.249
7.244
6.622
6.607
6.590
6.532
6.500
4.534
4.518
3.753
Ph
Ph
CO2CH3
11
500 MHz, CDCl3
4.03
6.05
3.07
1.03
1.00
1.00
1.02
3.04
f1 (ppm)


172.85
140.65
140.41
137.27
136.59
132.60
128.75
128.53
128.36
127.74
127.54
127.32
127.07
126.96
126.48
77.25 CDCl3
77.00 CDCl3
76.75 CDCl3
54.62
52.37
Ph
Ph
CO2CH3
11
125 MHz, CDCl3
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)