Supporting Information

Iron-Catalyzed Direct Alkenylation of \( sp^3(C-H) \) Bonds via Decarboxylation of Cinnamic Acids under Ligand-Free Condition

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**General Information:**

All reactions were carried out under an Ar atmosphere condition. Ferrocene was purchased from Alfa Aesar with high purity (99.5%), various cinnamic acids and various benzylic hydrocarbons were purchased from Aldrich, Acros or Alfa. Column chromatography was generally performed on silica gel (100-200 mesh) and reactions were monitored by thin layer chromatography (TLC) using UV light (254 nm) to visualize the course of the reactions. The $^1$H (300 MHz or 400 MHz) and $^{13}$C NMR (75 MHz or 100 MHz) data were recorded on Varian 300 M or 400 M spectrometers using CDCl$_3$ as solvent. The chemical shifts ($\delta$) are reported in ppm and coupling constants ($J$) in Hz. $^1$H NMR spectra was recorded with tetramethylsilane ($\delta = 0.00$ ppm) as internal reference; $^{13}$C NMR spectra was recorded with CDCl$_3$ ($\delta = 77.500$ ppm) as internal reference. ESI-MS and HRMS were performed by the State-authorized Analytical Center in Soochow University.

**General procedure:** To a Schlenk tube equipped with a magnetic stir bar were added under argon ferrocene (8.4 mg, 0.045 mmol) and cinnamic acid (0.3 mmol). Under argon, benzylic hydrocarbon (2.0 mL, 13-20 mmol) and DTBP (di-tert-butyl peroxide, 0.6 mmol, 113μL) were added. The resulting reaction mixture was kept stirring at the required temperature for 24h. After required reaction time, the mixture was cooled down to room temperature. Evaporation of the solvent followed by purification by flash chromatography (petroleum ether or petroleum ether/ethyl acetate) afforded the corresponding product.
Supplied experimental data:

Synthesis of (Z)-3-(naphthalen-1-yl)acrylic acid

General Procedure for Alkyne Hydroarylation. To a cold mixture of naphthalene (10 mmol), Pd(OAc)$_2$ (1 mol %), TFA (4 mL), and CH$_2$Cl$_2$ (1 mL) on an ice-water bath was added the propiolic acid (5 mmol) with stirring. After continuous stirring at the same temperature for 5 min, the mixture was warmed to room temperature for 48 h. After reaction, the mixture was poured into a saturated NaCl aqueous solution and extracted with ether. The ether layer was washed with saturated NaCl, neutralized with Na$_2$CO$_3$ solution, and dried over anhydrous Na$_2$SO$_4$. The solvent was removed in a vacuum, and the product was separated by flash column chromatography.

References:

(Z)-3-(naphthalen-1-yl)acrylic acid

$^1$H NMR (400 MHz, CDCl$_3$) ($\delta$, ppm) 11.57 (s, 1H), 7.87–7.79 (m, 3H), 7.64 (d, $J$ = 12.0 Hz, 1H), 7.49 (dd, $J$ = 10.9, 5.9 Hz, 3H), 7.40 (t, $J$ = 7.6 Hz, 1H), 6.18 (d, $J$ = 12.2 Hz, 1H). $^{13}$C NMR (100 MHz, CDCl$_3$) ($\delta$, ppm) 145.2, 133.6, 132.7, 131.3, 129.6, 129.1, 127.5, 126.9, 126.4, 125.6, 124.6, 121.9; MS ESI (m/z): [M+H]$^+$ calcd for C$_{13}$H$_{11}$O$_2$, 199.1; found, 199.1.
Competing Kinetic Isotope Effect (KIE) Experiment:

Scheme S1. The kinetic deuterium isotope effect for reactions between toluene and 4-methoxycinnamic acid.

Note: The value of $k_H/k_D$ was calculated from the $^1$H NMR spectra above which should be the mixture of compound a and b (the KIE scheme). The sum of the integral of a and b at chemical shift 6.37-6.42 was integrated as 1.00 (both a and b keep the same double bond hydrogen). Compound a has 2 hydrogen atoms at chemical shift 3.51-3.53, while b has no H atoms. The amount of a could be defined as 0.835 (1.67/2=0.835), on the other hand, the sum of a and b is 1.00, so the amount of b is 0.165 (1.00-0.83=0.165). As a result, $k_H/k_D=0.835/0.165=5.0$.
Investigation into the reaction mechanism:

Scheme S2. Effect of Radical Inhibitors

Scheme S3. Blank reaction without toluene

Scheme S4. Proposed Mechanism for the decarboxylative coupling
Characterization of the corresponding products:

\( (E)-1,1, 3\text{-diphenylpropene (3a).} \)

\(^1\)H NMR (300 MHz, CDCl\(_3\)) (\(\delta\), ppm) 7.39–7.33 (m, 2H), 7.30 (d, \(J = 7.6\) Hz, 3H), 7.28–7.16 (m, 5H), 6.46 (d, \(J = 15.9\) Hz, 1H), 6.41–6.30 (m, 1H), 3.55 (d, \(J = 6.2\) Hz, 2H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) (\(\delta\), ppm) 140.1, 137.4, 131.0, 129.2, 128.6, 128.5, 127.1, 126.1, 126.1, 39.3; HRMS ESI (m/z): [M-H]\(^+\) calcd for C\(_{15}\)H\(_{13}\), 193.1017; found, 193.0963.

\( (E)-1-(4\text{-Chlorophenyl})-3\text{-phenylpropene (3b).} \)

\(^1\)H NMR (300 MHz, CDCl\(_3\)) (\(\delta\), ppm) 7.35–7.28 (m, 2H), 7.26–7.20 (m, 7H), 6.40 (d, \(J = 15.9\) Hz, 1H), 6.37–6.26 (m, 1H), 3.54 (d, \(J = 5.6\) Hz, 2H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) (\(\delta\), ppm) 139.8, 135.9, 132.6, 130.0, 129.8, 128.6, 128.6, 128.5, 127.3, 126.3, 39.3; HRMS ESI (m/z): [M-H]\(^+\) calcd for C\(_{15}\)H\(_{12}\)Cl, 227.0627; found, 227.0630.

\( (E)-1-(4\text{-Fluorophenyl})-3\text{-phenylpropene (3c).} \)

\(^1\)H NMR (300 MHz, CDCl\(_3\)) (\(\delta\), ppm) 7.33–7.27 (m, 4H), 7.23 (d, \(J = 7.0\) Hz, 3H), 6.96 (t, \(J = 8.7\) Hz, 2H), 6.40 (d, \(J = 15.8\) Hz, 1H), 6.26 (dt, \(J = 15.7, 6.7\) Hz, 1H), 3.52 (d, \(J = 6.6\) Hz, 2H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) (\(\delta\), ppm) 162.0 (d, \(J = 244.6\) Hz), 140.0, 133.6 (d, \(J = 3.1\) Hz), 129.8, 129.0, 128.6, 128.5, 127.5 (d, \(J = 7.8\) Hz), 126.2, 115.3 (d, \(J = 21.4\) Hz), 39.3; HRMS ESI (m/z): [M-H]\(^+\) calcd for C\(_{15}\)H\(_{12}\)F, 211.0923; found, 211.0845.

\( (E)-1-(4\text{-Methoxyphenyl})-3\text{-phenylpropene (3d).} \)

\(^1\)H NMR (300 MHz, CDCl\(_3\)) (\(\delta\), ppm) 7.35–7.17 (m, 7H), 6.83 (d, \(J = 8.8\) Hz, 2H), 6.40 (d, \(J = 15.8\) Hz, 1H), 6.27–6.15 (m, 1H), 3.79 (s, 3H), 3.52 (d, \(J = 6.8\) Hz, 2H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) (\(\delta\), ppm) 158.8, 140.4, 130.4, 130.3, 128.6, 128.4, 127.2, 127.0, 126.1, 113.9, 55.25, 39.31; HRMS ESI (m/z): [M-H]\(^+\) calcd for C\(_{16}\)H\(_{15}\)O, 223.1123; found, 223.1127.
(E)-1-(3-Methoxyphenyl)-3-phenylpropene (3e).
\(^1\)H NMR (400 MHz, CDCl\(_3\)) (\(\delta\), ppm) 7.31 (t, \(J = 7.3\) Hz, 2H), 7.25–7.18 (m, 4H), 6.95 (d, \(J = 7.6\) Hz, 1H), 6.89 (s, 1H), 6.76 (d, \(J = 8.1\) Hz, 1H), 6.43 (d, \(J = 15.9\) Hz, 1H), 6.39–6.28 (m, 1H), 3.79 (s, 3H), 3.54 (d, \(J = 6.3\) Hz, 2H); \(^{13}\)C NMR (75MHz, CDCl\(_3\)) (\(\delta\), ppm) 159.7, 140.0, 138.9, 130.9, 129.5, 129.4, 128.6, 128.5, 126.2, 118.8, 112.8, 111.3, 55.1, 39.3; HRMS ESI (m/z): [M+H]\(^+\) calcd for C\(_{16}\)H\(_{17}\)O, 225.1279; found, 225.1274.

(E)-1-(2-Methoxyphenyl)-3-phenylpropene (3f).
\(^1\)H NMR (400 MHz, CDCl\(_3\)) (\(\delta\), ppm) 7.41 (d, \(J = 7.6\) Hz, 1H), 7.32–7.16 (m, 6H), 6.93–6.77 (m, 3H), 6.41–6.27 (m, 1H), 3.83 (s, 3H), 3.57 (d, \(J = 7.1\) Hz, 2H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) (\(\delta\), ppm) 156.4, 140.5, 129.8, 128.6, 128.4, 128.1, 126.6, 126.5, 126.0, 125.7, 120.6, 110.8, 55.42, 39.84; HRMS ESI (m/z): [M-H]\(^+\) calcd for C\(_{16}\)H\(_{15}\)O, 223.1123; found, 223.1134.

(E)-1-(3,4-Dimethoxyphenyl)-3-phenylpropene (3g).
\(^1\)H NMR (300 MHz, CDCl\(_3\)) (\(\delta\), ppm) 7.37–7.16 (m, 5H), 6.89 (d, \(J = 10.2\) Hz, 2H), 6.79 (d, \(J = 8.1\) Hz, 1H), 6.39 (d, \(J = 15.7\) Hz, 1H), 6.28–6.16 (m, 1H), 3.87 (s, 3H), 3.86 (s, 3H), 3.53 (d, \(J = 6.7\) Hz, 2H); \(^{13}\)C NMR (100 MHz, CDCl\(_3\)) (\(\delta\), ppm) 148.89, 148.3, 140.3, 136.0, 130.5, 128.6, 128.4, 127.3, 126.1, 119.1, 111.0, 108.4, 55.8, 55.7, 39.3; HRMS ESI (m/z): [M+H]\(^+\) calcd for C\(_{17}\)H\(_{17}\)O\(_2\), 255.1385; found, 255.1372.

(E)-1-(3,4,5-Trimethoxyphenyl)-3-phenylpropene (3h).
\(^1\)H NMR (300 MHz, CDCl\(_3\)) (\(\delta\), ppm) 7.36–7.28 (m, 2H), 7.28–7.19 (m, 3H), 6.58 (s, 2H), 6.38 (d, \(J = 15.8\) Hz, 1H), 6.32–6.21 (m, 1H), 3.85 (s, 6H), 3.83 (s, 3H), 3.54 (d, \(J = 6.4\) Hz, 2H); \(^{13}\)C NMR (100MHz, CDCl\(_3\)) (\(\delta\), ppm) 153.2, 140.0, 137.3, 133.1, 130.8, 128.7, 128.6, 128.4, 126.2, 103.0, 60.8, 55.9, 39.2; HRMS ESI (m/z): [M+H]\(^+\) calcd for C\(_{18}\)H\(_{21}\)O\(_3\), 285.1491; found, 285.1495.
(E)-1-(3-Methylphenyl)-3-phenylpropene (3i).
$^1$H NMR (300 MHz, CDCl$_3$) (δ, ppm) 7.34–7.26 (m, 2H), 7.26–7.19 (m, 3H), 7.17 (d, $J = 5.6$ Hz, 3H), 7.01 (d, $J = 6.4$ Hz, 1H), 6.42 (d, $J = 15.9$ Hz, 1H), 6.38–6.27 (m, 1H), 3.53 (d, $J = 6.1$ Hz, 2H), 2.31 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) (δ, ppm) 140.2, 138.0, 137.4, 131.1, 129.0, 128.6, 128.4, 127.9, 126.8, 126.1, 123.3, 39.3, 21.4; HRMS ESI (m/z): [M-H]$^+$ calcd for C$_{16}$H$_{15}$, 207.1174; found, 207.1146.

(E)-1-(4-Methyl)-3-phenylpropene (3j).
$^1$H NMR (300 MHz, CDCl$_3$) (δ, ppm) 7.34–7.27 (m, 2H), 7.26–7.20 (m, 4H), 7.09 (d, $J = 7.9$ Hz, 2H), 6.42 (d, $J = 15.9$ Hz, 1H), 6.35–6.23 (m, 1H), 3.53 (d, $J = 6.6$ Hz, 2H), 2.31 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) (δ, ppm) 140.3, 136.8, 134.6, 130.9, 129.2, 128.6, 128.4, 128.1, 126.0, 39.3, 21.1; HRMS ESI (m/z): [M-H]$^+$ calcd for C$_{16}$H$_{15}$, 207.1174; found, 207.1156.

(E)-1-(4-Isopropylphenyl)-3-phenylpropene (3k).
$^1$H NMR (300 MHz, CDCl$_3$) (δ, ppm) 7.28 (d, $J = 8.2$ Hz, 4H), 7.20 (dd, $J = 11.1, 4.5$ Hz, 4H), 7.14 (d, $J = 8.1$ Hz, 2H), 6.43 (d, $J = 15.8$ Hz, 1H), 6.32–6.27 (m, 1H), 3.52 (d, $J = 6.6$ Hz, 2H), 2.84 (dt, $J = 13.8, 6.9$ Hz, 1H), 1.22 (d, $J = 6.9$ Hz, 6H); $^{13}$C NMR (75 MHz, CDCl$_3$) (δ, ppm) 148.4, 140.8, 135.6, 131.4, 129.1, 128.9, 128.7, 127.0, 126.6, 126.4, 39.8, 34.3, 24.4; MS ESI (m/z): [M+H]$^+$ calcd for C$_{18}$H$_{21}$, 237.2; found, 237.2.

(E)-1-(1-Naphthyl)-3-phenylpropene (3l).
$^1$H NMR (300 MHz, CDCl$_3$) (δ, ppm) 8.08 (d, $J = 8.8$ Hz, 1H), 7.80 (d, $J = 7.1$ Hz, 1H), 7.70 (d, $J = 8.2$ Hz, 1H), 7.54 (d, $J = 7.0$ Hz, 1H), 7.47–7.43 (m, 2H), 7.39 (d, $J = 7.7$ Hz, 1H), 7.36–7.26 (m, 4H), 7.22 (d, $J = 6.4$ Hz, 1H), 7.16 (d, $J = 15.4$ Hz, 1H), 6.41–6.29 (m, 1H), 3.63 (d, $J = 6.9$ Hz, 2H); $^{13}$C NMR (75 MHz, CDCl$_3$) (δ, ppm) 140.6, 135.7, 134.1, 132.9, 131.6, 129.2, 129.0, 129.0, 128.8, 128.0, 126.7, 126.3,
126.1, 124.3, 124.2, 40.18; MS ESI (m/z): [M+H]$^+$ calcd for C$_{19}$H$_{17}$, 245.2; found, 245.2.

(E)-1-(3-Nitrophenyl)-3-phenylpropene (3m).
$^1$H NMR (400 MHz, CDCl$_3$) (δ, ppm) 8.17 (s, 1H), 8.02 (d, J = 8.2 Hz, 1H), 7.61 (d, J = 7.8 Hz, 1H), 7.42 (t, J = 8.0 Hz, 1H), 7.35 – 7.30 (m, 2H), 7.23 (d, J = 8.2 Hz, 3H), 6.55 – 6.47 (m, 1H), 6.45 (d, J = 15.9 Hz, 1H), 3.57 (d, J = 5.6 Hz, 2H); $^{13}$C NMR (100 MHz, CDCl$_3$) (δ, ppm) 139.7, 133.2, 132.4, 129.8, 129.2, 129.1, 129.1, 126.9, 122.1, 121.1, 39.7; MS ESI (m/z): [M+H]$^+$ calcd for C$_{15}$H$_{14}$NO$_2$, 240.1; found, 240.1.

(E)-4-(3-phenylprop-1-enyl)benzonitrile (3n).
$^1$H NMR (400 MHz, CDCl$_3$) (δ, ppm) 7.56 (d, J = 8.1 Hz, 2H), 7.41 (d, J = 8.1 Hz, 2H), 7.33 (t, J = 7.4 Hz, 2H), 7.24 (t, J = 7.6 Hz, 3H), 6.55 – 6.46 (m, 1H), 6.43 (d, J = 16.0 Hz, 1H), 3.58 (d, J = 6.2 Hz, 2H); $^{13}$C NMR (100 MHz, CDCl$_3$) (δ, ppm) 142.4, 139.6, 134.0, 132.8, 130.0, 129.1, 129.1, 127.0, 126.9, 119.5, 110.7, 39.8; MS ESI (m/z): [M+H]$^+$ calcd for C$_{16}$H$_{14}$N, 220.1; found, 220.1.

(E)-methyl 4-(3-phenylprop-1-enyl)benzoate (3o).
$^1$H NMR (400 MHz, CDCl$_3$) (δ, ppm) 7.96 (d, J = 8.3 Hz, 2H), 7.40 (d, J = 8.3 Hz, 2H), 7.32 (t, J = 7.5 Hz, 2H), 7.24 (d, J = 7.0 Hz, 3H), 6.48 (dd, J = 5.5, 3.4 Hz, 2H), 3.89 (s, 3H), 3.57 (d, J = 5.0 Hz, 2H); $^{13}$C NMR (100 MHz, CDCl$_3$) (δ, ppm) 167.4, 142.4, 140.0, 132.7, 130.6, 130.3, 129.2, 129.0, 129.0, 126.8, 126.4, 52.5, 39.9; MS ESI (m/z): [M+H]$^+$ calcd for C$_{17}$H$_{17}$O$_2$, 253.1; found, 253.1.

(E)-2-methoxy-4-(3-phenylprop-1-enyl)phenyl acetate (3p).
$^1$H NMR (400 MHz, CDCl$_3$) (δ, ppm) 7.31 (t, J = 7.4 Hz, 2H), 7.23 (d, J = 7.4 Hz, 3H), 6.93 (q, J = 7.6 Hz, 3H), 6.41 (d, J = 15.7 Hz, 1H), 6.35 – 6.25 (m, 1H), 3.81 (s, 3H), 3.54 (d, J = 6.6 Hz, 2H), 2.29 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) (δ, ppm)
169.6, 151.4, 140.4, 139.3, 137.0, 130.9, 130.0, 129.1, 129.0, 126.7, 123.2, 119.2, 110.2, 56.3, 39.7, 21.2. MS ESI (m/z): [M+H]^+ calcd for C_{18}H_{19}O_{3}, 283.1; found, 283.1.

(E)-3-(3-phenylprop-1-enyl)phenyl acetate (3q).
$^1$H NMR (400 MHz, CDCl$_3$) (δ, ppm) 7.34 – 7.28 (m, 3H), 7.25 – 7.18 (m, 5H), 7.07 (s, 1H), 6.92 (d, $J = 8.0$ Hz, 1H), 6.42 (d, $J = 16.0$ Hz, 1H), 6.35 (dt, $J = 15.7$, 6.1 Hz, 1H), 3.53 (d, $J = 6.0$ Hz, 2H), 2.28 (s, 3H); $^{13}$C NMR (100 MHz, CDCl$_3$) (δ, ppm) 170.0, 151.4, 140.3, 139.6, 130.9, 129.9, 129.1, 129.0, 126.7, 124.2, 120.6, 119.5, 39.7, 21.6; MS ESI (m/z): [M+H]^+ calcd for C$_{18}$H$_{19}$O$_{3}$, 283.1; found, 283.1.

(E)-1-(2-Furylphenyl)-3-phenylpropene (3r).
$^1$H NMR (400 MHz, CDCl$_3$) (δ, ppm) 7.30 (t, $J = 7.4$ Hz, 3H), 7.22 (d, $J = 7.7$ Hz, 3H), 6.36–6.27 (m, 2H), 6.22 (d, $J = 16.3$ Hz, 1H), 6.15–6.18 (m, 1H), 3.51 (d, $J = 6.6$ Hz, 2H); $^{13}$C NMR (100 MHz, CDCl$_3$) (δ, ppm) 152.9, 141.4, 139.8, 128.7, 128.5, 128.2, 126.2, 119.6, 111.1, 106.6, 39.0; MS ESI (m/z): [M+H]^+ calcd for C$_{17}$H$_{17}$O$_{2}$, 253.1; found, 253.1.

(E)-1-(2-Thiophene)-3-phenylpropene (3s).
$^1$H NMR (400 MHz, CDCl$_3$) (δ, ppm) 7.28 (d, $J = 7.0$ Hz, 1H), 7.21 (d, $J = 7.2$ Hz, 1H), 7.07 (d, $J = 4.9$ Hz, 1H), 6.94–6.85 (m, 1H), 6.54 (dd, $J = 15.6$, 0.6 Hz, 1H), 6.26–6.13 (m, 1H), 3.49 (d, $J = 6.9$ Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) (δ, ppm) 143.1, 140.3, 129.6, 129.2, 129.0, 127.7, 126.7, 125.2, 124.7, 123.9, 39.6; MS ESI (m/z): [M+H]^+ calcd for C$_{13}$H$_{13}$S, 201.1; found, 201.1.

(E)-1-(3-Pyridine)-3-phenylpropene (3t).
$^1$H NMR (300 MHz, CDCl$_3$) (δ, ppm) 8.56 (s, 1H), 8.42 (d, $J = 5.3$ Hz, 1H), 7.64 (d, $J = 7.9$ Hz, 1H), 7.31 (d, $J = 6.7$ Hz, 2H), 7.23 (d, $J = 6.6$ Hz, 3H), 7.20–7.16 (m, 1H), 6.43–6.41 (m, 2H), 3.56 (d, $J = 4.9$ Hz, 2H); $^{13}$C NMR (75 MHz, CDCl$_3$) (δ, ppm) 148.5, 148.4, 139.9, 133.4, 133.0, 132.2, 129.1, 129.0, 127.8, 126.8, 123.8, 39.8; [M+H]^+ calcd for C$_{14}$H$_{14}$N, 196.1; found, 196.1.
(E)-1-(1-Naphthyl)-3-phenylpropene (3u).

$^1$H NMR (400 MHz, CDCl$_3$) (δ, ppm) 8.09 (d, J = 8.1 Hz, 1H), 7.81 (d, J = 8.1 Hz, 1H), 7.72 (d, J = 8.2 Hz, 1H), 7.55 (d, J = 7.2 Hz, 1H), 7.50 – 7.42 (m, 2H), 7.39 (t, J = 7.7 Hz, 1H), 7.35 – 7.27 (m, 4H), 7.23 (d, J = 6.8 Hz, 1H), 7.17 (d, J = 15.9 Hz, 1H), 6.41 – 6.31 (m, 1H), 3.64 (d, J = 6.9 Hz, 2H);

$^{13}$C NMR (100 MHz, CDCl$_3$) (δ, ppm) 140.6, 135.7, 134.0, 132.9, 131.6, 129.2, 129.0, 128.9, 128.0, 126.7, 126.3, 126.1, 126.1, 124.3, 124.2, 40.18;

MS ESI (m/z): [M+H]$^+$ calcd for C$_{19}$H$_{17}$, 245.1; found, 245.1.

(E)- 1-(3,4-Dimethoxyphenyl)-3-(2-Methylphenyl)-propene (4a).

$^1$H NMR (300 MHz, CDCl$_3$) (δ, ppm) 7.19 (s, 1H), 7.16–7.15 (m, 3H), 6.87 (d, J = 10.4 Hz, 2H), 6.78 (d, J = 8.1 Hz, 1H), 6.30 (d, J = 15.9 Hz, 1H), 6.18 (dt, J = 15.7, 6.2 Hz, 1H), 3.86 (s, 3H), 3.85 (s, 3H), 3.51 (d, J = 6.1 Hz, 2H), 2.33 (s, 3H);

$^{13}$C NMR (75MHz, CDCl$_3$) (δ, ppm) 148.8, 148.2, 138.2, 136.3, 130.5, 130.3, 130.1, 129.1, 126.4, 126.2, 125.9, 118.9, 111.0, 108.4, 55.7, 55.6, 36.7, 19.3; HRMS ESI (m/z): [M+H]$^+$ calcd for C$_{18}$H$_{21}$O$_2$, 269.1542; found, 269.1531.

(E)- 1-(3,4-Dimethoxyphenyl)-3-(3-Methylphenyl)-propene (4b).

$^1$H NMR (300 MHz, CDCl$_3$) (δ, ppm) 7.20 (t, J = 7.6 Hz, 1H), 7.05 (d, J = 5.7 Hz, 3H), 6.94–6.86 (m, 2H), 6.79 (d, J = 8.1 Hz, 1H), 6.39 (d, J = 15.8 Hz, 1H), 6.21 (dt, J = 15.6, 6.8 Hz, 1H), 3.87 (s, 3H), 3.86 (s, 3H), 3.49 (d, J = 6.8 Hz, 2H), 2.34 (s, 3H);

$^{13}$C NMR (75MHz, CDCl$_3$) (δ, ppm) 148.9, 148.3, 140.2, 138.0, 130.5, 130.4, 129.4, 128.3, 127.4, 126.8, 125.6, 119.0, 111.0, 108.4, 55.8, 55.7, 39.2, 21.3; HRMS ESI (m/z): [M+H]$^+$ calcd for C$_{18}$H$_{21}$O$_2$, 269.1542; found, 269.1538.

(E)- 1-(3,4-Dimethoxyphenyl)-3-(4-Methylphenyl)-propene (4c).

$^1$H NMR (300 MHz, CDCl$_3$) (δ, ppm) 7.18–7.08 (m, 4H), 6.91–6.86 (m, 3H), 6.79 (d, J = 8.2 Hz, 1H), 6.38 (d, J = 15.7 Hz, 1H), 6.20 (dt, J = 15.6, 6.8 Hz, 1H), 3.86 (s, 3H), 3.86 (s, 3H), 3.49 (d, J = 6.7 Hz, 2H), 2.33 (s, 3H);

$^{13}$C NMR (75MHz, CDCl$_3$) (δ, ppm) 148.9, 148.3, 137.2, 135.5, 130.6, 130.3, 129.1, 128.5, 127.6, 119.0, 111.0,
108.4, 55.8, 55.7, 38.8, 20.9; HRMS ESI (m/z): [M+H]^+ calcd for C_{18}H_{21}O_{2}, 269.1542; found, 269.1541.

\( (E)-1-(3,4-\text{Dimethoxyphenyl})-3-(3,5-\text{dimethylphenyl})\)-propene (4d).
\( ^1\text{H NMR (400 MHz, CDCl}_3\) \(δ, \text{ppm) 6.94–6.84 (m, 5H), 6.78 (d, } J = 8.2 \text{ Hz, 1H), 6.38 (d, } J = 15.7 \text{ Hz, 1H), 6.24–6.15 (m, 1H), 3.86 (s, 3H), 3.85 (s, 3H), 3.45 (d, } J = 6.8 \text{ Hz, 2H), 2.29 (s, 6H); } ^{13}\text{C NMR (100MHz, CDCl}_3\) \(δ, \text{ppm) 148.9, 148.3, 140.1, 137.9, 130.6, 130.3, 127.7, 127.5, 126.4, 119.0, 111.0, 108.4, 55.8, 55.7, 39.2, 21.2; HRMS ESI (m/z): [M+H]^+ calcd for C_{19}H_{23}O_{2}, 283.1698; found, 283.1701.\)

\( (E)-1-(3,4-\text{Dimethoxyphenyl})-3-\text{phenylbutene (4e).} \)
\( ^1\text{H NMR (300 MHz, CDCl}_3\) \(δ, \text{ppm) 7.35–7.32 (m, 1H), 7.31–7.24 (m, 3H), 7.24–7.18 (m, 1H), 6.91–6.87 (m, 2H), 6.79 (d, } J = 8.1 \text{ Hz, 1H), 6.36 (d, } J = 16.0 \text{ Hz, 1H), 6.24 (dd, } J = 15.9, 6.4 \text{ Hz, 1H), 3.87 (s, 3H), 3.86 (s, 3H), 3.67–3.58 (m, 1H), 1.46 (d, } J = 7.0 \text{ Hz, 3H); } ^{13}\text{C NMR (75MHz, cdcl}_3\) \(δ, \text{ppm) 148.90, 148.30, 145.70, 133.28, 130.59, 128.40, 128.07, 127.25, 126.12, 119.07, 111.04, 108.49, 77.42, 77.00, 76.58, 55.83, 55.71, 42.44, 21.18; HRMS ESI (m/z): [M+H]^+ calcd for C_{19}H_{23}O_{2}, 269.1542; found, 269.1544.\)

\( (E)-1-(3,4-\text{Dimethoxyphenyl})-3,3-\text{dimethyl-4-phenylbutene(4f).} \)
\( ^1\text{H NMR (300 MHz, CDCl}_3\) \(δ, \text{ppm) 7.25–7.19 (m, 3H), 7.13 (d, } J = 6.4 \text{ Hz, 2H), 6.88 (d, } J = 8.4 \text{ Hz, 2H), 6.81 (d, } J = 8.8 \text{ Hz, 1H), 6.17 (d, } J = 16.2 \text{ Hz, 1H), 6.09 (d, } J = 16.2 \text{ Hz, 1H), 3.90 (s, 3H), 3.88 (s, 3H), 2.67 (s, 2H), 1.11 (s, 6H); } ^{13}\text{C NMR (100 MHz, CDCl}_3\) \(δ, \text{ppm) 148.9, 148.2, 138.8, 138.4, 131.1, 130.6, 127.6, 125.9, 125.5, 118.8, 111.2, 108.7, 55.9, 55.8, 49.7, 37.2, 27.0; HRMS ESI (m/z): [M+H]^+ calcd for C_{20}H_{25}O_{2}, 297.1855; found, 297.1844.\)

\( (E)-1-(3,4-\text{Methoxyphenyl})-3-\alpha-\text{naphthalenylpropene (4g).} \)
\(^1\)H NMR (400 MHz, CDCl\(_3\)) (\(\delta\), ppm) 8.08 (d, \(J = 7.8\) Hz, 1H), 7.86 (d, \(J = 6.9\) Hz, 1H), 7.75 (d, \(J = 7.3\) Hz, 1H), 7.50 (dd, \(J = 12.3, 6.8\) Hz, 2H), 7.41 (d, \(J = 7.3\) Hz, 2H), 6.86 (d, \(J = 7.9\) Hz, 2H), 6.76 (d, \(J = 8.0\) Hz, 1H), 6.41 (d, \(J = 16.0\) Hz, 1H), 6.37–6.29 (m, 1H), 3.97 (d, \(J = 5.1\) Hz, 2H), 3.84 (s, 6H); \(^{13}\)C NMR (75MHz, CDCl\(_3\)) (\(\delta\), ppm) 148.9, 148.33, 136.39, 133.798, 132.0, 130.8, 130.5, 128.6, 127.0, 126.9, 126.4, 125.9, 125.6, 125.0, 119.0, 111.0, 108.5, 55.8, 55.7, 36.3; HRMS ESI (m/z): [M+H]+ calcd for C\(_{21}\)H\(_{21}\)O\(_2\), 305.1542; found, 305.1525.

\((E)-1-(3,4-Dimethoxyphenyl)-3-\beta\)-naphthalenylpropene (4h).\(^{1}\)H NMR (400 MHz, CDCl\(_3\)) (\(\delta\), ppm) 7.79 (t, \(J = 7.8\) Hz, 3H), 7.67 (s, 1H), 7.46–7.36 (m, 3H), 6.90 (d, \(J = 12.1\) Hz, 2H), 6.78 (d, \(J = 8.1\) Hz, 1H), 6.42 (d, \(J = 15.8\) Hz, 1H), 6.33–6.24 (m, 1H), 3.85 (s, 3H), 3.84 (s, 3H), 3.68 (d, \(J = 6.6\) Hz, 2H); \(^{13}\)C NMR (75MHz, CDCl\(_3\)) (\(\delta\), ppm) 148.9, 148.4, 137.7, 133.6, 132.1, 130.8, 130.5, 127.9, 127.6, 127.4, 127.1, 126.7, 125.9, 125.2, 119.1, 111.1, 108.5, 55.8, 55.7, 39.4; HRMS ESI (m/z): [M+Na]+ calcd for C\(_{21}\)H\(_{20}\)NaO\(_2\), 327.1361; found, 327.1353.

\((E)-3-(4-Chlorophenyl)-1-(3,4-dimethoxyphenyl)-propene (4i).\(^{1}\)H NMR (300 MHz, CDCl\(_3\)) (\(\delta\), ppm) 7.27 (d, \(J = 8.5\) Hz, 2H), 7.17 (d, \(J = 8.6\) Hz, 2H), 6.89 (d, \(J = 7.9\) Hz, 2H), 6.80 (d, \(J = 8.0\) Hz, 1H), 6.37 (d, \(J = 15.7\) Hz, 1H), 6.17 (dt, \(J = 15.7, 6.8\) Hz, 1H), 3.88 (s, 3H), 3.87 (s, 3H), 3.49 (d, \(J = 6.6\) Hz, 2H); \(^{13}\)C NMR (75MHz, CDCl\(_3\)) (\(\delta\), ppm) 148.9, 148.5, 138.7, 131.9, 131.0, 130.3, 130.0, 128.5, 126.6, 119.1, 111.1, 108.5, 55.9, 55.8, 38.5; HRMS ESI (m/z): [M+Na]+ calcd for C\(_{17}\)H\(_{17}\)ClNaO\(_2\), 311.0815; found, 311.0815.

\((E)-3-(2-Chlorophenyl)-1-(3,4-dimethoxyphenyl)-propene (4j).\(^{1}\)H NMR (300 MHz, CDCl\(_3\)) 7.37 (d, \(J = 7.4\) Hz, 1H), 7.29 (d, \(J = 7.3\) Hz, 1H), 7.24–7.14 (m, 2H), 6.89 (d, \(J = 8.6\) Hz, 2H), 6.79 (d, \(J = 8.0\) Hz, 1H), 6.39 (d, \(J = 15.8\) Hz, 1H), 6.20 (dt, \(J = 15.7, 6.7\) Hz, 1H), 3.88 (s, 3H), 3.86 (s, 3H), 3.64 (d, \(J = 6.6\) Hz, 2H); \(^{13}\)C NMR (100MHz, CDCl\(_3\)) (\(\delta\), ppm) 148.9, 148.4, 138.0, 134.0, 131.2, 130.5, 130.4, 129.4, 127.6, 126.8, 125.3, 119.1, 111.0, 108.6, 55.9, 55.7, 36.7; HRMS ESI (m/z): [M+H]+ calcd for C\(_{17}\)H\(_{18}\)ClO\(_2\), 289.0995; found, 289.0976.
(E)-3-(2-Bromophenyl)-1-(3,4-dimethoxyphenyl)-propene (4k).
$^1$H NMR (400 MHz, CDCl$_3$, δ, ppm) 7.56 (d, $J = 7.7$ Hz, 1H), 7.26 (d, $J = 8.6$ Hz, 2H), 7.08 (t, $J = 7.3$ Hz, 1H), 6.89 (d, $J = 10.8$ Hz, 2H), 6.79 (d, $J = 8.1$ Hz, 1H), 6.39 (d, $J = 15.7$ Hz, 1H), 6.26–6.14 (m, 1H), 3.88 (s, 3H), 3.86 (s, 3H), 3.65 (d, $J = 6.6$ Hz, 2H); $^{13}$C NMR (75MHz, CDCl$_3$, δ, ppm) 148.9, 148.5, 139.7, 132.7, 131.3, 130.5, 130.4, 127.8, 127.5, 125.3, 124.5, 119.1, 111.1, 108.6, 55.9, 55.8, 39.3; HRMS ESI (m/z): [M+Na]$^+$ calcd for C$_{17}$H$_{18}$BrNaO$_2$, 355.0310; found, 355.0298.

(E)-3-(3-Bromophenyl)-1-(3,4-methoxyphenyl)-propene (4l).
$^1$H NMR (300 MHz, CDCl$_3$, δ, ppm) 7.40–7.34 (m, 2H), 7.17 (d, $J = 5.9$ Hz, 2H), 6.90 (d, $J = 7.8$ Hz, 2H), 6.81 (d, $J = 8.1$ Hz, 1H), 6.39 (d, $J = 15.7$ Hz, 1H), 6.17 (dt, $J = 15.7$, 6.9 Hz, 1H), 3.89 (s, 3H), 3.87 (s, 3H), 3.50 (d, $J = 6.8$ Hz, 2H); $^{13}$C NMR (75MHz, CDCl$_3$, δ, ppm) 149.0, 148.6, 142.7, 131.6, 131.3, 130.3, 130.0, 129.2, 127.3, 126.2, 122.5, 119.2, 111.1, 108.6, 55.9, 55.8, 38.9; HRMS ESI (m/z): [M+H]$^+$ calcd for C$_{17}$H$_{18}$BrO$_2$, 333.0490; found, 333.0469.

(E)-3-(4-Bromophenyl)-1-(3,4-dimethoxyphenyl)-propene (4m).
$^1$H NMR (400 MHz, CDCl$_3$, δ, ppm) 7.41 (d, $J = 8.4$ Hz, 2H), 7.10 (d, $J = 8.4$ Hz, 2H), 6.88 (d, $J = 8.1$ Hz, 2H), 6.79 (d, $J = 8.0$ Hz, 1H), 6.36 (d, $J = 15.7$ Hz, 1H), 6.16 (dt, $J = 13.6$, 6.2 Hz, 1H), 3.87 (s, 3H), 3.85 (s, 3H), 3.46 (d, $J = 6.9$ Hz, 2H); $^{13}$C NMR (75MHz, CDCl$_3$, δ, ppm) 148.9, 148.5, 139.2, 131.4, 131.0, 130.4, 130.3, 126.4, 119.9, 119.1, 111.0, 108.5, 55.8, 55.7, 38.5; HRMS ESI (m/z): [M+Na]$^+$ calcd for C$_{17}$H$_{18}$BrNaO$_2$, 355.0310; found, 355.0302.

(E)-1-(3,4-Dimethoxyphenyl)-3-(2-iodophenyl)-propene (4n).
$^1$H NMR (300 MHz, CDCl$_3$, δ, ppm) 7.88 (d, $J = 7.7$ Hz, 1H), 7.31 (t, $J = 6.9$ Hz, 2H), 6.99–6.88 (m, 3H), 6.83 (d, $J = 8.0$ Hz, 1H), 6.43 (d, $J = 15.8$ Hz, 1H), 6.21 (dt, $J = 15.7$, 6.7 Hz, 1H), 3.92 (s, 3H), 3.90 (s, 3H), 3.67 (d, $J = 6.5$ Hz, 2H); $^{13}$C NMR (75MHz, CDCl$_3$, δ, ppm) 148.9, 148.4, 142.9, 139.4, 131.5, 130.4, 129.7, 128.4, 128.0, 125.5, 119.1, 111.0, 108.6, 100.8, 55.9, 55.8, 44.0; HRMS ESI (m/z): [M+H]$^+$ calcd for C$_{17}$H$_{18}$IO$_2$, 381,0352; found, 381,0355.
(E)- 1-(3,4-Dimethoxyphenyl)-3-(3-iodophenyl)-propene (4o).

$^1$H NMR (300 MHz, CDCl$_3$) (δ, ppm) 7.63–7.50 (m, 2H), 7.20 (d, J = 7.7 Hz, 1H), 7.03 (t, J = 7.7 Hz, 1H), 6.89 (d, J = 9.8 Hz, 2H), 6.80 (d, J = 8.1 Hz, 1H), 6.38 (d, J = 15.7 Hz, 1H), 6.15 (dt, J = 15.7, 6.9 Hz, 1H), 3.88 (s, 3H), 3.87 (s, 3H), 3.46 (d, J = 6.8 Hz, 2H); $^{13}$C NMR (75MHz, CDCl$_3$) (δ, ppm) 148.9, 148.5, 142.7, 137.6, 135.2, 131.2, 130.2, 130.1, 127.9, 126.2, 119.2, 111.0, 108.5, 94.5, 55.9, 55.8, 38.8; HRMS ESI (m/z): [M+H]$^+$ calcd for C$_{17}$H$_{18}$O$_2$, 381.0352; found, 381.0355.

![Molecular structure](image)

(£)3-(4-Chloromethyl-phenyl)-1-(3,4-dimethoxyphenyl)-propene (4p).

$^1$H NMR (300 MHz, CDCl$_3$) (δ, ppm) 7.36 (d, J = 7.3 Hz, 1H), 7.31–7.25 (m, 3H), 6.88 (d, J = 8.6 Hz, 2H), 6.79 (d, J = 8.0 Hz, 1H), 6.35 (d, J = 15.9 Hz, 1H), 6.22 (dt, J = 15.7, 6.2 Hz, 1H), 4.66 (s, 2H), 3.87 (s, 3H), 3.86 (s, 3H), 3.68 (d, J = 6.2 Hz, 2H); $^{13}$C NMR (75MHz, CDCl$_3$) (δ, ppm) 149.0, 148.5, 139.1, 135.5, 130.9, 130.3, 129.1, 126.9, 126.4, 119.1, 111.1, 108.6, 55.9, 55.8, 44.3, 35.8; HRMS ESI (m/z): [M+H]$^+$ calcd for C$_{18}$H$_{20}$ClO$_2$, 303.1152; found, 303.1146.

![Molecular structure](image)

(£)3-(2-Acetylphenyl)-1-(3,4-dimethoxyphenyl)-propene (4q).

$^1$H NMR (300 MHz, cdcl$_3$) $^1$H NMR (300 MHz, cdcl$_3$) δ 7.66 (d, J = 7.6 Hz, 1H), 7.46–7.39 (m, 1H), 7.37–7.28 (m, 2H), 6.87 (d, J = 11.2 Hz, 2H), 6.78 (d, J = 8.1 Hz, 1H), 6.35 (d, J = 15.9 Hz, 1H), 6.23 (dt, J = 15.7, 6.4 Hz, 1H), 3.87 (s, 3H), 3.85 (s, 3H), 3.78 (d, J = 6.4 Hz, 2H), 2.57 (s, 3H); $^{13}$C NMR (75MHz, CDCl$_3$) (δ, ppm) 202.2, 148.9, 148.3, 140.1, 131.5, 131.3, 130.6, 129.0, 127.3, 126.1, 119.1, 111.0, 108.5, 55.8, 55.7, 37.1, 29.8; HRMS ESI (m/z): [M+Na]$^+$ calcd for C$_{19}$H$_{20}$NaO$_3$, 319.1310; found, 319.1303.

![Molecular structure](image)

(£)3-(4-Acetylphe~nyl)-1-(3,4-dimethoxyphenyl)-propene (4r).

$^1$H NMR (400 MHz, CDCl$_3$) (δ, ppm) 7.91 (d, J = 7.8 Hz, 2H), 7.34 (d, J = 7.6 Hz, 2H), 6.90 (d, J = 9.0 Hz, 2H), 6.81 (d, J = 7.8 Hz, 1H), 6.40 (d, J = 15.7 Hz, 1H), 6.25–6.14 (m, 1H), 3.88 (s, 6H), 3.59 (d, J = 6.5 Hz, 2H), 2.59 (s, 3H); $^{13}$C NMR (75MHz, CDCl$_3$) (δ, ppm) 197.8, 149.0, 148.6, 146.1, 135.3, 131.4, 130.2, 128.8, 128.6, 126.0, 119.2, 111.1, 108.6, 55.9, 55.8, 39.2, 26.5; HRMS ESI (m/z): [M+H]$^+$ calcd for C$_{19}$H$_{21}$O$_3$, 297.1491; found, 297.1480.

-S16-
(E)-1-(3,4-Methoxyphenyl)-3-phenoxypropene (6a).

\[\text{H NMR (400 MHz, CDCl}_3\text{) (δ, ppm) δ 7.38–7.26 (m, 2H), 6.98–6.93 (m, 5H), 6.82 (d, } J = 8.2 \text{ Hz, 1H), 6.67 (d, } J = 15.9 \text{ Hz, 1H), 6.30 (dt, } J = 15.9, 6.0 \text{ Hz, 1H), 4.68 (d, } J = 5.9 \text{ Hz, 2H), 3.90 (s, 3H), 3.88 (s, 3H); }\]

\[\text{13C NMR (75MHz, CDCl}_3\text{) (δ, ppm) 158.6, 149.0, 132.9, 129.4, 122.4, 120.8, 119.9, 114.7, 111.0, 108.8, 68.6, 55.9, 55.8; HRMS ESI (m/z): [M+Na]^{+} \text{ calcd for C}_{17}H_{18}NaO_{3}, 293.1154; found, 293.1149.}\]

(E)-3-(4-Bromophenoxyloxy)-1-(3,4-Dimethoxyphenyl)-propene (6b).

\[\text{H NMR (300 MHz, CDCl}_3\text{) (δ, ppm) 7.38 (d, } J = 9.0 \text{ Hz, 2H), 6.95 (d, } J = 8.3 \text{ Hz, 2H), 6.83 (dd, } J = 8.4, 4.8 \text{ Hz, 3H), 6.65 (d, } J = 15.9 \text{ Hz, 1H), 6.26 (dt, } J = 15.9, 5.9 \text{ Hz, 1H), 4.65 (d, } J = 5.9 \text{ Hz, 2H), 3.90 (s, 3H), 3.88 (s, 3H); }\]

\[\text{13C NMR (75 MHz, cdcl}_3\text{) δ 157.7, 149.1, 149.0, 133.3, 132.2, 129.3, 121.8, 119.9, 116.6, 113.0, 111.0, 108.9, 69.0, 55.9, 55.8; HRMS ESI (m/z): [M+Na]^{+} \text{ calcd for C}_{17}H_{17}BrNaO_{3}, 371.0259; found, 371.0246.}\]

(E)-3-(3-Bromophenoxyloxy)-1-(3,4-Dimethoxyphenyl)-propene (6c).

\[\text{H NMR (300 MHz, CDCl}_3\text{) (δ, ppm) 7.19–7.06 (m, 3H), 6.95 (d, } J = 8.3 \text{ Hz, 2H), 6.88 (d, } J = 9.0 \text{ Hz, 1H), 6.82 (d, } J = 8.0 \text{ Hz, 1H), 6.66 (d, } J = 15.9 \text{ Hz, 1H), 6.25 (dt, } J = 15.9, 5.9 \text{ Hz, 1H), 4.65 (d, } J = 6.0 \text{ Hz, 2H), 3.90 (s, 3H), 3.88 (s, 3H); }\]

\[\text{13C NMR (75 MHz, cdcl}_3\text{) 159.34, 149.1, 149.0, 133.4, 130.5, 129.3, 123.9, 122.8, 121.6, 119.9, 118.0, 113.7, 111.0, 108.9, 69.0, 55.9, 55.8; HRMS ESI (m/z): [M+Na]^{+} \text{ calcd for C}_{17}H_{17}BrNaO_{3}, 371.0259; found, 371.0246.}\]

(E)-3-(4-Bromophenylsulfanyl)-1-(3,4-dimethoxyphenyl)-propene (6e).

\[\text{H NMR (300 MHz, CDCl}_3\text{) (δ, ppm) 7.39 (d, } J = 8.6 \text{ Hz, 2H), 7.22 (d, } J = 8.6 \text{ Hz, 2H), 6.85 (d, } J = 6.3 \text{ Hz, 2H), 6.78 (d, } J = 8.8 \text{ Hz, 1H), 6.36 (d, } J = 15.7 \text{ Hz, 1H), 6.08 (dt, } J = 15.6, 7.2 \text{ Hz, 1H), 3.88 (s, 3H), 3.86 (s, 3H), 3.67 (d, } J = 7.2 \text{ Hz, 2H); }\]

\[\text{13C NMR (75MHz, CDCl}_3\text{) (δ, ppm) 148.9, 148.9, 135.1, 132.8, 131.8, 131.6, 129.5,}\]

-S17-
122.4, 120.2, 119.5, 111.0, 108.7, 55.9, 55.8, 37.2; HRMS ESI (m/z): [M-H]$^+$ calcd for C$_{17}$H$_{18}$BrO$_2$S, 365.0211; found, 365.0197.

\[\text{(E)}-1-(3,4-	ext{Dimethoxyphenyl})-3-	ext{phenylsulfanyl-propene (6d).}\]

$^1$H NMR (300 MHz, CDCl$_3$) ($\delta$, ppm) 7.38 (d, $J = 7.7$ Hz, 1H), 7.29 (d, $J = 7.2$ Hz, 1H), 7.20 (d, $J = 6.8$ Hz, 1H), 6.85 (d, $J = 8.8$ Hz, 1H), 6.79 (d, $J = 8.1$ Hz, 1H), 6.38 (d, $J = 15.6$ Hz, 1H), 6.18 – 6.06 (m, 1H), 3.88 (s, 1H), 3.87 (s, 1H), 3.71 (d, $J = 7.1$ Hz, 1H); $^{13}$C NMR (75MHz, CDCl$_3$) ($\delta$, ppm) 148.9, 148.8, 132.5, 130.0, 129.8, 129.0, 128.8, 126.3, 123.0, 119.5, 111.0, 108.7, 55.9, 37.1; HRMS ESI (m/z): [M-H]$^+$ calcd for C$_{17}$H$_{17}$O$_2$S, 285.0949; found, 285.0940.

\[\text{(E)}-3-(3,4-	ext{Dimethoxy-phenyl})\text{-acrylic acid 3-bromo-propyl ester (8).}\]

$^1$H NMR (400 MHz, CDCl$_3$) ($\delta$, ppm) 7.64 (d, $J = 15.9$ Hz, 1H), 7.11 (d, $J = 8.1$ Hz, 1H), 7.05 (s, 1H), 6.87 (d, $J = 8.1$ Hz, 1H), 6.31 (d, $J = 15.9$ Hz, 1H), 4.34 (t, $J = 5.5$ Hz, 2H), 3.91 (s, 6H), 3.52 (t, $J = 6.3$ Hz, 2H), 2.30–2.21 (m, 2H); $^{13}$C NMR (75 MHz, cdcl$_3$) 166.6, 150.9, 148.9, 144.7, 126.9, 122.4, 115.0, 110.7, 109.3, 61.8, 55.7, 55.6, 31.6, 29.4; HRMS ESI (m/z): [M+H]$^+$ calcd for C$_{14}$H$_{12}$BrO$_4$, 329.0388; found, 329.0390.
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