Supporting Information

Zinc-catalyzed dehydrogenative coupling of primary alcohols and secondary/benzyl phosphine oxides for alkenes synthesis

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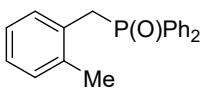
1. Experimental Section

1.1. General Information

Unless otherwise noted, the experiments were carried out under a N_2 atmosphere using standard Schlenk techniques or in a dry glovebox. All heating (heating module) and stirring were conducted on the IKA (Model: RCT basic). Phosphine oxides were either purchased or prepared from the corresponding alcohols and P(O)−H compounds chloride according to the literature procedure[1]. Column chromatography was performed using Silica Gel 60 (200-300 mesh). The reactions were monitored by GC and GC-MS. GC-MS data were recorded on GC-MS QP 2010 plus, and GC analysis was performed on GC 2014 and the H_2 measurement was performed on FuLi GC9790II. ^{1}H, ^{13}C and ^{19}F NMR spectra of the products were acquired on a Brucker ADVANCE III 400 (400 MHz for ^{1}H, 100 MHz for ^{13}C and 376 MHz for ^{19}F NMR spectroscopy). Chemical shifts for ^{1}H NMR are referred to internal Me_4Si (0 ppm) and reported as follows: chemical shift (δ ppm), multiplicity, coupling constant (Hz) and integration. The following abbreviations were used to explain the multiplicities: s (singlet), d (doublet), dd (doublet of doublets), t (triplet), q (quartet), m (multiple), td (triplet of doublets). Melting points were measured using a melting point instrument and are uncorrected. High-resolution mass spectra (HRMS) were recorded on Agilent 7200GC-Q/TOF instrument by the EI technique. All solvents, reagents and alcohols were purchased from Meryer, Energy Chemical and Aladdin.

We and others have previously reported the synthesis of phosphine oxides shown below[1].



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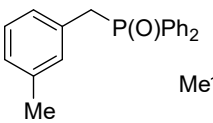

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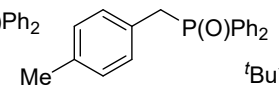

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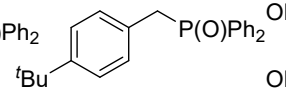

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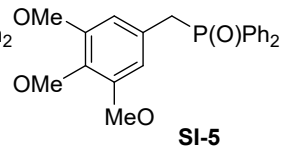

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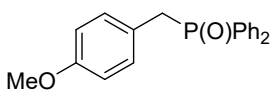

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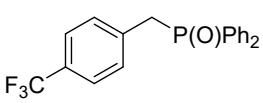

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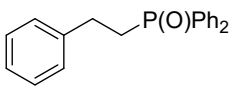

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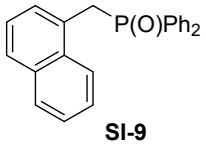
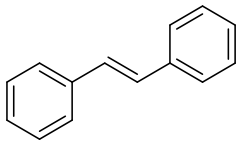


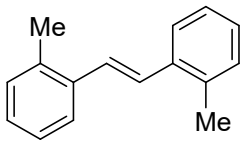
SI-9

1.2. Typical procedures for the Reaction

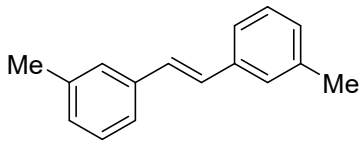
$HP(O)Ph_2$ (60.6 mg, 0.3 mmol), NaO^{t}Bu (38.4 mg, 0.4 mmol) and $Zn(OTf)_2$ (5.4 mg, 7.5 mol%) were added into a 10 mL Schlenk tube. Then dixoane (0.5 mL) and benzyl alcohol **1a** (20.7 μL, 0.2 mmol) were sequentially added under N_2 atmosphere. After the addition of all substances, the tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. Pure **2a** was obtained by passing through a short silica gel column using petroleum ether-ethyl acetate as eluent in 96% (17.3 mg) isolated yield.



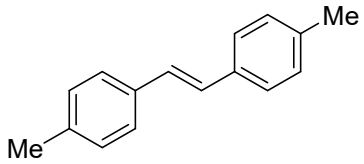
(*E*)-1,2-diphenylethene (2a). Purified by chromatography (Pure petroleum ether), White solid (17.3 mg, 96%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.0 Hz, 4H), 7.35 (t, *J* = 7.2 Hz, 4H), 7.29-7.21 (m, 2H), 7.10 (s, 2H). ^{13}C NMR (100 MHz, CDCl3): δ 137.3, 128.7, 128.7, 127.6, 126.5. This compound is known[2].



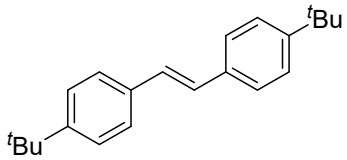
(*E*)-1,2-di-o-tolylethene (2b). Purified by chromatography (Pure petroleum ether), White solid (14.8 mg, 71%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.65 (d, *J* = 7.0 Hz, 2H), 7.33-7.20 (m, 8H), 2.48 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 136.8, 135.8, 130.4, 128.0, 127.5, 126.2, 125.5, 19.9. This compound is known[3].



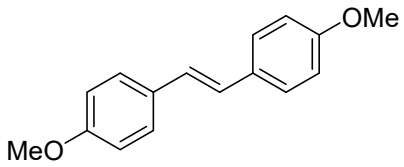
(*E*)-1,2-di-m-tolylethene (2c). Purified by chromatography (Pure petroleum ether), White solid (19.1 mg, 92%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37-7.34 (m, 4H), 7.30-7.26 (m, 2H), 7.12-7.10 (m, 4H), 2.41 (s, 6H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 138.2, 137.3, 128.5, 128.4, 127.2, 123.7, 21.4. This compound is known[3].



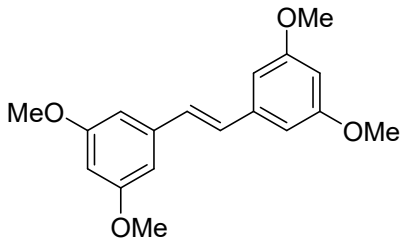
(*E*)-1,2-di-p-tolylethene (**2d**). Purified by chromatography (Pure petroleum ether), White solid (18.7 mg, 90%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 (d, *J* = 8.0 Hz, 4H), 7.17 (d, *J* = 8.0 Hz, 4H), 7.05 (s, 2H), 2.37 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 137.2, 134.7, 129.3, 127.6, 126.3, 21.2. This compound is known[3].



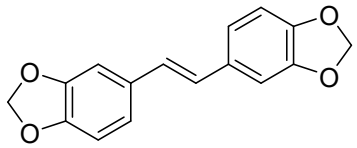
(*E*)-1,2-bis(4-(tert-butyl)phenyl)ethene (2e). Purified by chromatography (Pure petroleum ether), White solid (27.7 mg, 95%).^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 (d, *J* = 8.4 Hz, 4H), 7.40 (d, *J* = 8.4 Hz, 4H), 7.09 (s, 2H), 1.36 (s, 18H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 150.5, 134.8, 127.7, 126.1, 125.6, 34.6, 31.3. This compound is known[2].



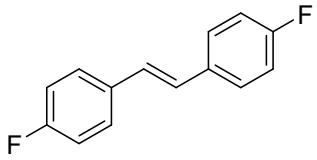
(*E*)-1,2-bis(4-methoxyphenyl)ethene (2f). Purified by chromatography (PE/EA=10:1), White solid (21.6 mg, 90%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43 (d, *J* = 8.8 Hz, 4H), 6.93 (s, 2H), 6.89 (d, *J* = 8.8 Hz, 4H), 3.83 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 159.0, 130.5, 127.4, 126.2, 114.1, 55.3. This compound is known[3].



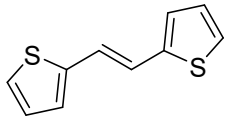
(*E*)-1,2-bis(3,5-methoxyphenyl)ethene (2g). Purified by chromatography (PE/EA=5:1), White solid (16.8 mg, 56%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.01 (s, 2H), 6.67 (d, *J* = 2.2 Hz, 4H), 6.41 (t, *J* = 2.2 Hz, 2H), 3.83 (s, 12H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 161.0, 139.1, 129.2, 104.6, 100.1, 55.4. This compound is known[4].



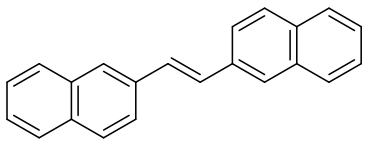
(*E*)-1,2-bis(benzo[d][1,3]dioxol-5-yl)ethene (2h). Purified by chromatography PE, White solid (8.6 mg, 32%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.03 (d, J = 1.5 Hz, 2H), 6.90 (dd, J = 8.0, 1.6 Hz, 2H), 6.85 (s, 2H), 6.79 (d, J = 8.0 Hz, 2H), 5.97 (s, 4H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 148.1, 147.1, 131.9, 126.7, 121.2, 108.4, 105,4, 101.1. This compound is known[5].



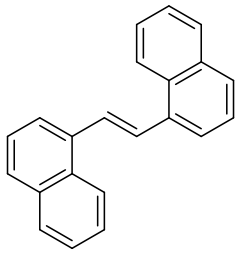
(*E*)-1,2-bis(4-fluorophenyl)ethene (2i). Purified by chromatography PE, White solid (9.3 mg, 43%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.46-7.20 (m, 4H), 7.05-6.91 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 162.3 (d, $J_{C\text{-}F}$ = 247.5 Hz), 133.3, 127.9 (d, $J_{C\text{-}F}$ = 14.3 Hz), 127.9, 115.6 (d, $J_{C\text{-}F}$ = 21.6 Hz). ^{19}F NMR (376 MHz, $CDCl_3$) δ -114.08. This compound is known[3].



(*E*)-1,2-di(thiophen-2-yl)ethene (2j). Purified by chromatography PE, White solid (6.3 mg, 33%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.18 (dd, J = 5.0, 0.5 Hz, 2H), 7.06 (s, 2H), 7.04 (dd, J = 3.6, 1.2 Hz, 2H), 7.00 (dd, J = 5.0, 3.6 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 142.4, 127.6, 125.9, 124.3, 121.4. This compound is known[6].



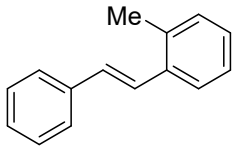
(*E*)-1,2-di(naphthalen-2-yl)ethene (2k). Purified by chromatography PE, and then purified and isolated by GPC, White solid (11.8 mg, 42%) ^{1}H NMR (400 MHz, $CDCl_3$): 7.91-7.76 (m, 8H), 7.66 (s, 2H), 7.47-7.42 (m, 4H), 7.38-7.36 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 139.2, 133.6, 132.0, 127.9, 127.6, 127.5, 127.3, 126.5, 125.9, 125.2. This compound is known[7].



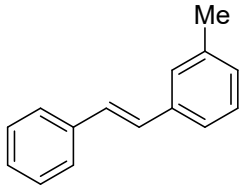
(*E*)-1,2-di(naphthalen-1-yl)ethene (2l). Purified by chromatography PE, and then purified and isolated by GPC, White solid (12.9 mg, 46%) ^{1}H NMR (400 MHz, $CDCl_3$): 8.26-8.18 (m, 2H), 7.92-7.76 (m, 8H), 7.56-7.45 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 135.3, 133.7, 131.4, 129.0, 128.6, 128.2, 126.2, 125.9, 125.7, 123.9, 123.8. This compound is known[3].

1.3. Typical procedures for the Reaction

Benzylphosphine oxide **3a** (43.8 mg, 0.15 mmol), NaO^{t}Bu (38.4 mg, 0.4 mmol) and $Zn(OTf)_2$ (2.7 mg, 7.5 mol%) were added into a 10 mL Schlenk tube. Then dixoane (0.3 mL) and o-tolylmethanol **1a** (11.9 μL, 0.1 mmol) were sequentially added under N_2 atmosphere. After the addition of all substances, the tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. Pure **4a** was obtained by passing through a short silica gel column using petroleum ether-ethyl acetate as eluent in 92% (17.8 mg) isolated yield.

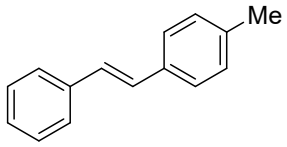


(*E*)-1-methyl-o-styrylbenzene (4a). Purified by chromatography PE, White solid (17.8 mg, 92%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 (d, J = 7.0 Hz, 1H), 7.52 (d, J = 7.4 Hz, 2H), 7.39-7.31 (m, 3H), 7.28-7.17 (m, 4H), 7.00 (d, J = 16.2 Hz, 1H), 2.43 (s, 3H)**.** ^{13}C NMR (100 MHz, $CDCl_3$): δ 137.7, 136.4, 135.8, 130.4, 130.0, 128.7, 127.6, 127.5, 126.5, 126.5, 125.3, 19.9. This compound is known[2].

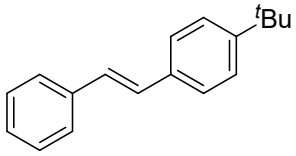


(*E*)-1-methyl-m-styrylbenzene (4b). Purified by chromatography PE, White solid

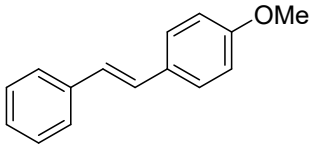
(18.4 mg, 95%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, *J* = 7.4 Hz, 2H), 7.37-7.30 (m, 4H), 7.24 (t, *J* = 7.6 Hz, 2H), 7.11-7.04 (m, 3H), 2.37 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 138.2, 137.4, 137.2, 128.8, 128.6, 128.4, 128.4, 127.5, 127.2, 126.5, 123.7, 21.4. This compound is known[2].



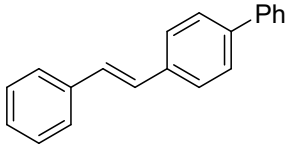
(*E*)-1-methyl-p-styrylbenzene (4c). Purified by chromatography PE, White solid (18.4 mg, 95%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.50 (d, *J* = 7.2 Hz, 2H), 7.41 (d, *J* = 8.1 Hz, 2H), 7.37-7.31 (m, 2H), 7.26-7.22 (m, 1H), 7.16 (d, *J* = 7.8 Hz, 2H), 7.11-7.02 (m, 2H), 2.35 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 137.5, 134.5, 129.4, 128.6, 128.6, 127.7, 127.4, 126.4, 126.4, 21.2. This compound is known[2].



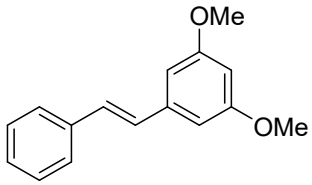
(*E*)-1-(tert-butyl)-4-styrylbenzene (4d). Purified by chromatography PE, White solid (22.7 mg, 96%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54-7.48 (m, 2H), 7.48-7.43 (m, 2H), 7.41-7.30 (m, 4H), 7.26-7.22 (m, 1H), 7.08 (dd, *J* = 19.0, 16.3 Hz, 2H), 1.33 (s, 9H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 150.8, 137.5, 134.5, 128.6, 128.5, 127.9, 127.4, 126.4, 126.2, 125.6, 34.6, 31.3. This compound is known[2].



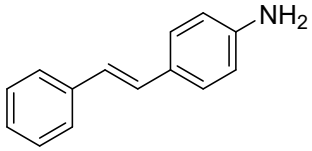
(*E*)-1-methoxy-4-styrylbenzene (4e). Purified by chromatography PE, White solid (20.0 mg, 95%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.43-7.35 (m, 4H), 7.29-7.23 (m, 2H), 7.17-7.13 (m, 1H), 6.92 (dd, *J* = 38.2, 16.3 Hz, 2H), 6.82 (d, *J* = 8.6 Hz, 2H), 3.74 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 159.3, 137.6, 130.1, 128.6, 128.2, 127.7, 127.2, 126.6, 126.2, 114.1, 55.3. This compound is known[2].



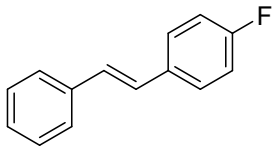
(*E*)-4-styryl-1,1'-biphenyl (4f). Purified by chromatography PE, White solid (24.1 mg, 94%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.67-7.57 (m, 6H), 7.54 (d, *J* = 7.4 Hz, 2H), 7.47-7.42 (m, 2H), 7.40-7.33 (m, 3H), 7.28-7.24 (m, 1H), 7.15 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 140.6, 140.3, 137.3, 136.4, 128.8, 128.7, 128.7, 128.2, 127.6, 127.3, 127.3, 126.9, 126.9, 126.5. This compound is known[2].



(*E*)-1,3-dimethoxy-5-styrylbenzene (4g). Purified by chromatography (petroleum ether to petroleum ether/ethyl acetate = 10:1), White solid (21.6 mg, 90%). ^{1}H NMR (400 MHz, CDCl3) δ 7.50 (d, *J* = 7.4 Hz, 2H), 7.39-7.31 (m, 2H), 7.30-7.22 (m, 1H), 7.04 (dd, *J* = 24.2, 16.3 Hz, 2H), 6.67 (d, *J* = 2.2 Hz, 2H), 6.40 (t, *J* = 2.2 Hz, 1H), 3.83 (s, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 160.9, 139.3, 137.1, 129.2, 128.7, 127.7, 126.5, 104.5, 100.0, 55.3. This compound is known[2].

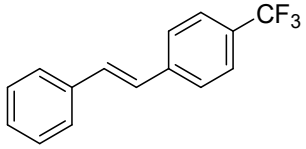


(*E*)-4-styrylaniline (4h). Purified by chromatography PE, White solid (12.1 mg, 62%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48-7.45 (m, 2H), 7.35-7.30 (m, 4H), 7.23-7.18 (m, 1H), 6.97 (dd, *J* = 43.6, 16.3 Hz, 2H), 6.67 (d, *J* = 8.5 Hz, 2H), 3.74 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 146.1, 137.9, 128.6, 128.6, 128.0, 127.7, 126.9, 126.1, 125.1, 115.2. This compound is known[8].

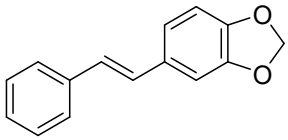


(*E*)-1-fluoro-4-styrylbenzene (4i). Purified by chromatography PE, White solid (15.4 mg, 78%). ^{1}H NMR (400 MHz, $CDCl_3$): *δ* 7.50-7.45 (m, 4H), 7.37-7.33 (m, 2H), 7.27-7.22 (m, 1H), 7.09-6.98 (m, 4H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 162.3 (d, $J_{C\text{-}F}$ = 245.6 Hz), 137.1, 133.5 (d, $J_{C\text{-}F}$ = 3.1 Hz), 128.7, 128.5 (d, $J_{C\text{-}F}$ = 2.4 Hz), 128.0 (d, $J_{C\text{-}F}$ = 7.9 Hz), 127.6, 127.4, 126.4, 115.6 (d, $J_{C\text{-}F}$ = 21.5 Hz). ^{19}F NMR (376 MHz,

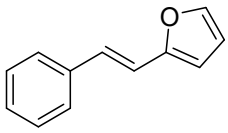
$CDCl_3$) δ -114.24. This compound is known[2].



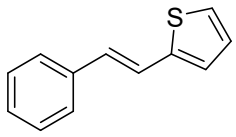
(*E*)-1-styryl-4-(trifluoromethyl)benzene (4j). Purified by chromatography PE, White solid (11.9 mg, 48%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 (t, *J* = 9.0 Hz, 4H), 7.55 (d, *J* = 7.4 Hz, 2H), 7.40 (t, *J* = 7.3 Hz, 2H), 7.32 (t, *J* = 7.3 Hz, 1H), 7.17 (q, *J* = 16.4 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 140.8, 136.6, 131.2, 129.2 (q, J_{C-F} = 32.3 Hz), 128.8, 128.3, 127.1, 126.8, 126.5, 125.6 (q, J_{C-F} = 3.8 Hz), 124.2 (q, J_{C-F} = 270.1 Hz). ^{19}F NMR (376 MHz, $CDCl_3$) δ -62.35. This compound is known[8].



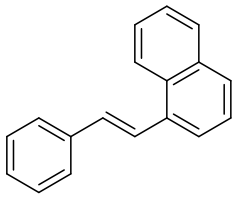
(*E*)-5-styrylbenzo[d][1,3]dioxole (4k). Purified by chromatography PE, White solid (16.8 mg, 75%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 (dd, *J* = 8.6, 1.3 Hz, 2H), 7.34 (t, *J* = 7.4 Hz, 2H), 7.28-7.19 (m, 1H), 7.07 (d, *J* = 1.7 Hz, 1H), 7.02 (d, *J* = 16.3 Hz, 1H), 6.97-6.88 (m, 2H), 6.79 (d, *J* = 8.0 Hz, 1H), 5.97 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 148.1, 147.3, 137.4, 131.8, 128.6, 128.3, 127.3, 127.0, 126.3, 121.5,108.4, 105.5, 101.1. This compound is known[9].



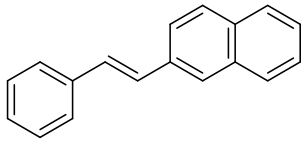
(*E*)-2-styrylfuran (4l). Purified by chromatography PE, White solid (5.8 mg, 34%). ^{1}H NMR (400 MHz, $CDCl_3$): *δ* 7.47 (d, *J* = 7.4 Hz, 2H), 7.41 (d, *J* = 1.5 Hz, 1H), 7.34 (t, *J* = 7.4 Hz, 2H), 7.24-7.22 (m, 1H), 7.04 (d, *J* = 16.3 Hz, 1H), 6.90 (d, *J* = 16.3 Hz,1H), 6.43 (dd, *J* = 3.3, 1.9 Hz, 1H), 6.36 (d, *J* = 3.3 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 153.2, 142.1, 137.0, 128.7, 127.6, 127.1, 126.3, 116.5, 111.6, 108.6. This compound is known[9].



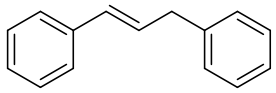
(*E*)-2-styrylthiophene (4m). Purified by chromatography PE, White solid (16.0 mg, 86%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, *J* = 7.5 Hz, 2H), 7.34 (t, *J* = 7.6 Hz, 2H), 7.27-7.17 (m, 3H), 7.07 (d, *J* = 3.4 Hz, 1H), 7.00 (dd, *J* = 5.0, 3.6 Hz, 1H), 6.93 (d, *J* = 16.1 Hz, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 142.9, 136.9, 128.7, 128.3, 127.6, 126.3, 126.1, 124.3, 121.7. This compound is known[9].



(*E*)-1-styrylnaphthalene (4n). Purified by chromatography (petroleum ether to petroleum ether/ethyl acetate = 40:1), White solid (18.2 mg, 79%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.21 (d, *J* = 8.0 Hz, 1H), 7.91-7.85 (m, 2H), 7.79 (d, *J* = 8.2 Hz, 1H), 7.74 (d, *J* = 7.2 Hz, 1H), 7.62-7.58 (m, 2H), 7.54-7.46 (m, 3H), 7.42-7.37 (m, 2H), 7.31-7.27 (m, 1H), 7.14 (d, *J* = 16.0 Hz, 1H).^{13}C NMR (100 MHz, $CDCl_3$): *δ* 137.6, 135.0, 133.7, 131.7, 131.4, 128.7, 128.6, 128.0, 127.8, 126.7, 126.1, 125.8, 125.8, 125.7, 123.8, 123.6. This compound is known[2].

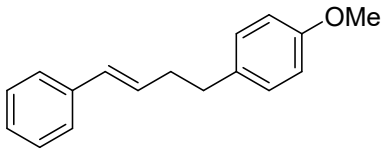


(*E*)-2-styrylnaphthalene (4o). Purified by chromatography (petroleum ether to petroleum ether/ethyl acetate = 40:1), White solid (16.1 mg, 70%). ^{1}H NMR (400 MHz, $CDCl_3$): *δ* 7.84-7.79 (m, 4H), 7.75-7.72 (m, 1H), 7.57-7.54 (m, 2H), 7.49-7.41 (m, 2H), 7.39-7.36 (m, 2H), 7.30-7.20 (m, 3H), 6.36-6.35 (m, 1H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 137.3, 134.8, 133.7, 133.0, 129.0, 128.7, 128.7, 128.3, 128.0, 127.7, 127.7, 126.6, 126.5, 126.3, 125.9, 123.5. This compound is known[9].

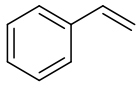


(*E*)-prop-1-ene-1,3-diyldibenzene (4p). Purified by chromatography PE, White solid (16.9 mg, 87%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37-7.17 (m, 10H), 6.46 (d, *J* = 15.8 Hz, 1H), 6.35 (dt, *J* = 15.6, 6.6 Hz, 1H), 3.55 (d, *J* = 6.6 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): *δ* 140.2, 137.5, 131.1, 129.3, 128.7, 128.5, 127.1, 126.2, 126.2, 39.4.

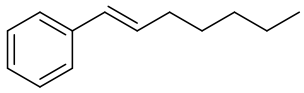
This compound is known[10].



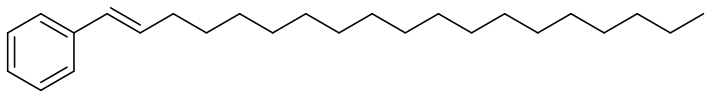
(*E*)-1-methoxy-4-(4-phenylbut-3-en-1-yl)benzene (4q). Purified by chromatography PE, White solid (16.4 mg, 69%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.33-7.27 (m, 3H), 7.25-7.17 (m, 3H), 7.14-7.09 (m, 1H), 6.85-6.82 (m, 2H), 6.42-6.34 (t, d = 16.2 MHz, 1H), 6.28-6.07 (m, 1H), 3.79 (s, 3H), 2.79-2.71 (m, 2H), 2.53-2.46 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 158.7, 141.9, 129.3, 128.5, 128.3, 127.0, 125.9, 113.9, 113.7, 55.3, 36.0, 34.9. This compound is known[11].



Styrene (4r). Purified by chromatography PE, White solid (6.3 mg, 61%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.42-7.40 (m, 2H), 7.34-7.30 (m, 2H), 7.26-7.22 (m, 1H), 6.71 (dd, J = 17.6, 10.9 Hz, 1H), 5.75 (d, J = 17.6 Hz, 1H), 5.24 (d, J = 10.8 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 137.5, 136.8, 128.5, 127.8, 126.2, 113.8. This compound is known[9].

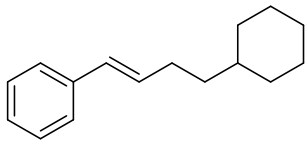


(*E*)-hept-1-en-1-ylbenzene (4s). Purified by chromatography PE, colorless oil (13.7 mg, 79%). ^{1}H NMR (400 MHz, $CDCl_3$): δ7.34 (d, J = 7.3 Hz, 2H), 7.29 (m, 2H), 7.20-7.17 (m, 1H), 6.38 (d, J = 15.8 Hz, 1H), 6.23 (dt, J = 15.8, 6.8 Hz, 1H), 2.23-2.18 (m, 2H), 1.51-1.44 (m, 2H), 1.35-1.31 (m, 4H), 0.92-0.89 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 138.0, 131.3, 129.7, 128.4, 126.7, 125.9, 33.0, 31.4, 29.1, 22.6, 14.1. This compound is known[12].

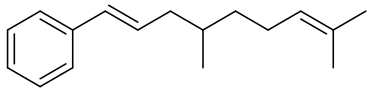


(*E*)-nonadec-1-en-1-ylbenzene (4t). Purified by chromatography PE, colorless oil (26.7 mg, 78%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.35-7.33 (m, 2H), 7.30-7.26 (m, 2H), 7.20-7.16 (m, 1H), 6.37 (d, J = 15.8 Hz, 1H), 6.26-6.19 (m, 1H), 2.23-2.17 (m, 2H),

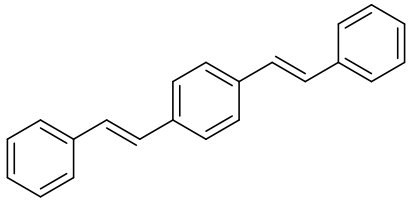
1.57 (s, 3H), 1.48-1.42 (m, 2H), 1.30-1.26 (m, 25H), 0.90-0.86 (m, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 138.0, 131.3, 130.0, 128.4, 126.7, 125.9, 33.0, 31.9, 29.7, 29.6, 29.5, 29.4, 29.4, 29.2, 22.7, 14.1. Calcd. For ($C_{25}H_{42}$): 342.3287; Found: 342.3292.



(*E*)-(4-cyclohexylbut-1-en-1-yl)benzene (4u). Purified by chromatography PE, and then purified and isolated by GPC. colorless oil (16.0 mg, 75%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.37-7.28 (m, 4H), 7.22-7.18 (m, 1H), 6.39 (d, J = 15.8 Hz, 1H), 6.27-6.20 (m, 1H), 2.26-2.20 (m, 2H), 1.77-1.69 (m, 4H), 1.40-1.35 (m, 3H), 1.29-1.15 (m, 4H), 0.97-0.88 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 138.0, 131.5, 129.4, 128.4, 126.7, 125.9, 37.1, 37.1, 33.3, 30.4, 26.7, 26.4. Calcd. For ($C_{16}H_{22}$): 214.1722; Found: 214.1716.

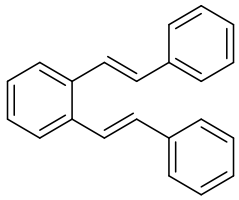


(*E*)-(4,8-dimethylnona-1,7-dien-1-yl)benzene (4v). Purified by chromatography PE, and then purified and isolated by GPC, colorless oil (16.0 mg, 70%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.37-7.29 (m, 4H), 7.22-7.18 (m, 1H), 6.39 (d, J = 15.8 Hz, 1H), 6.26-6.19 (m, 1H), 5.13 (t, J = 7.1 Hz, 1H), 2.28-2.21 (m, 1H), 1.71 (s, 3H), 1.63 (s, 3H), 1.61-1.56 (m, 1H), 1.47-1.38 (m, 1H), 1.26-1.18 (m, 1H), 0.95 (d, J = 1.7Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 138.0, 131.2, 130.9, 129.6, 128.4, 126.7, 125.9, 124.8, 40.5, 36.7, 32.9, 25.7, 25.6, 19.5, 17.6. Calcd. For ($C_{17}H_{24}$): 228.1878; Found: 228.1873.

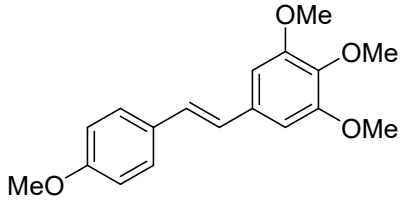


1,4-di((*E*)-styryl)benzene (4w). Purified by chromatography PE, and then purified and isolated by GPC. Light green solid (20.0 mg, 71%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.54-7.52 (m, 7H), 7.39-7.35 (m, 3H), 7.28-7.25 (m, 4H), 7.13-7.12 (m, 4H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 137.3, 136.7, 128.7, 128.6, 128.3, 127.6, 126.8, 126.5.

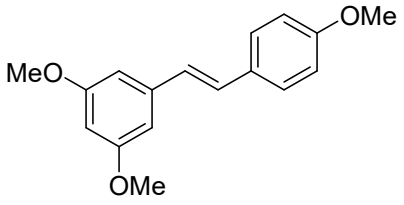
This compound is known[13].



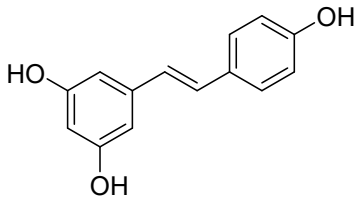
1,2-di((*E*)-styryl)benzene (4x). Purified by chromatography PE, and then purified and isolated by GPC. White solid (12.1 mg, 43%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.61 (dd, J = 5.7, 3.5 Hz, 2H), 7.56-7.54 (m, 4H), 7.48 (d, J = 16.1 Hz, 2H), 7.40-7.37 (m, 4H), 7.32-7.27 (m, 4H), 7.02 (d, J = 16.1 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 137.5, 136.0, 131.4, 128.7, 127.7, 126.7, 126.6. This compound is known[14].



(*E*)-1,2,3-trimethoxy-5-(4-methoxystyryl)benzene (4y). Purified by chromatography (petroleum ether to petroleum ether/ethyl acetate = 3:1). White solid (12.3 mg, 41%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.45 (d, J = 8.7 Hz, 2H), 6.99-6.88 (m, 4H), 6.71 (s, 2H), 3.92 (s, 6H), 3.86 (s, 3H), 3.83 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 159.3, 153.4, 137.6, 133.4, 130.0, 127.7, 127.6, 126.5, 114.1, 103.3, 61.0, 56.1, 55.3. This compound is known[15].

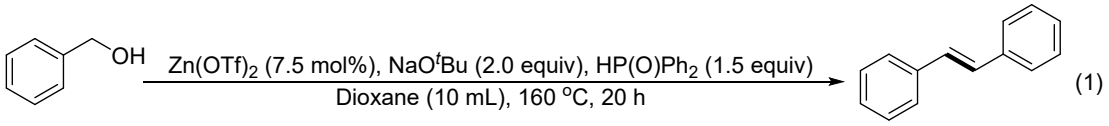


(*E*)-1,3-dimethoxy-5-(4-methoxystyryl)benzene (4z). Purified by chromatography (petroleum ether to petroleum ether/ethyl acetate = 10:1), White solid (20.2 mg, 75%). ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.45 (d, J = 8.7 Hz, 2H), 7.04 (d, J = 16.2 Hz, 1H), 6.93-6.89 (m, 3H), 6.65 (d, J = 2.2 Hz, 2H), 6.38 (t, J = 2.2 Hz, 1H), 3.83 (s, 9H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 160.9, 159.4, 139.7, 129.9, 128.7, 127.8, 126.5, 114.1, 104.3, 99.6, 55.3, 55.3. This compound is known[15].

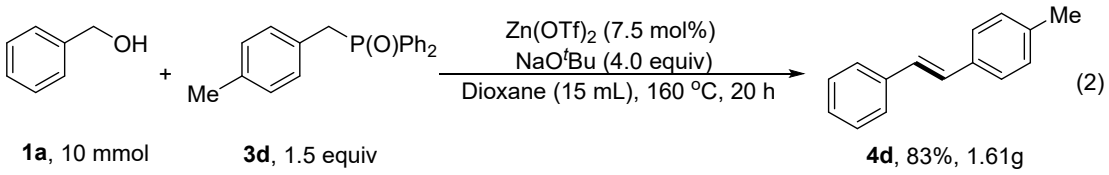


(*E*)-5-(4-hydroxystyryl)benzene-1,3-diol (11). Purified by chromatography (petroleum ether to petroleum ether/ethyl acetate = 10:1), White solid (16.4 mg, 72%). ^{1}H NMR (400 MHz, DMSO-D_6): δ 9.55 (s, 1H), 9.19 (s, 2H), 7.39 (d, J = 8.5 Hz, 2H), 6.86 (dd, J = 46.8, 16.3 Hz, 2H), 6.76-6.73 (m, 2H), 6.37 (d, J = 1.5 Hz, 2H), 6.11 (s, 1H). ^{13}C NMR (100 MHz, DMSO-D_6): δ 159.0, 157.7, 139.7, 128.5, 128.3, 126.1, 116.0, 104.8, 102.2. This compound is known[15].

1.4 Typical Procedure for Gram Scale Reaction

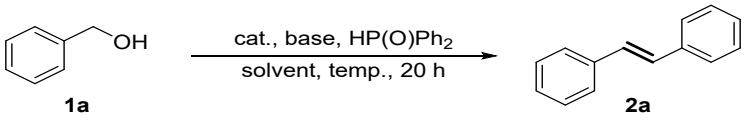


Detailed Procedure: To a 100 mL Schlenk tube were successively added $Zn(OTf)_2$ (272.6 mg, 7.5 mol%), NaO^{t}Bu (1.92 g, 2.0 equiv, 10 mmol), $HP(O)Ph_2$ (3.03 g, 1.5 equiv, 15 mmol), benzyl alcohol (**1a**) (1.04 mL, 10 mmol), dioxane (10 mL) under N_2. The tube was heated and stirred at 160 °C using a heating aluminum block for 20 h. **2a** was purified by column chromatography in 93% yield, 1.67g.



Detailed Procedure: To a 100 mL Schlenk tube were successively added $Zn(OTf)_2$ (272.6 mg, 7.5 mol%), (4-methylbenzyl)diphenylphosphine oxide (**3d**) (4.59 g, 1.5 equiv, 15 mmol), NaO^{t}Bu (1.92 g, 4.0 equiv, 10 mmol), benzyl alcohol (**1a**) (1.04 mL, 10 mmol), dioxane (15 mL) under N_2. The tube was heated and stirred at 160 °C using a heating aluminum block for 20 h. **4d** was purified by column chromatography in 83% yield, 1.61g.

2. Optimization of the Reaction Conditions

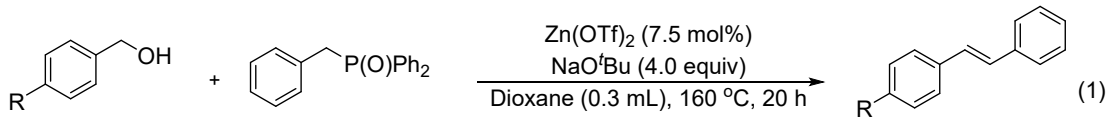


1a **2a**

entry	cat.	base	solvent	**2a** yield[b]
1	$Zn(OTf)_2$	NaO^{t}Bu	Dioxane	99% (96%)
2	$Zn(OAc)_2$	NaO^{t}Bu	Dioxane	64%
3	$Zn(acac)_2$	NaO^{t}Bu	Dioxane	80%
4	$Fe(OTf)_3$	NaO^{t}Bu	Dioxane	22%
5	$Fe(acac)_2$	NaO^{t}Bu	Dioxane	15%
6	$Cu(OTf)_2$	NaO^{t}Bu	Dioxane	37%
7	$Mg(OTf)_2$	NaO^{t}Bu	Dioxane	none
8	$Sc(OTf)_3$	NaO^{t}Bu	Dioxane	none
9	$Ni(acac)_2$	NaO^{t}Bu	Dioxane	42%
10	$Pd(OAc)_2$	NaO^{t}Bu	Dioxane	50%
11	-	NaO^{t}Bu	Dioxane	none
12	$Zn(OTf)_2$	-	Dioxane	none
13	$Zn(OTf)_2$	$NaOCH_3$	Dioxane	26%
14	$Zn(OTf)_2$	KO^{t}Bu	Dioxane	37%
15	$Zn(OTf)_2$	Na_2CO_3	Dioxane	none
16	$Zn(OTf)_2$	Et_3N	Dioxane	none
17	$Zn(OTf)_2$	DBU	Dioxane	none
18	$Zn(OTf)_2$	NaO^{t}Bu	THF	35%
19	$Zn(OTf)_2$	NaO^{t}Bu	Toluene	42%
20	$Zn(OTf)_2$	NaO^{t}Bu	Cyclohexane	41%
21	$Zn(OTf)_2$	NaO^{t}Bu	DMF	13%
22	$Zn(OTf)_2$	NaO^{t}Bu	CH_3CN	none
23	$Zn(OTf)_2$	NaO^{t}Bu	DMSO	none
24[c]	$Zn(OTf)_2$	NaO^{t}Bu	Dioxane	71%
25[d]	$Zn(OTf)_2$	NaO^{t}Bu	Dioxane	none
26[e]	$Zn(OTf)_2$	NaO^{t}Bu	Dioxane	58%
27[f]	$Zn(OTf)_2$	NaO^{t}Bu	Dioxane	63%

[a]Reaction conditions: the mixture of 1a (0.2 mmol), $HP(O)Ph_2$ (0.3 mmol), catalyst (7.5 mol%), base (0.4 mmol) in a solvent (0.5 mL) were heated at 160 °C in a sealed 10 mL glass tube for 20 h under N_2. [b]GC yields using dodecane as an internal standard (isolated yield was shown in parenthesis). [c]Dioxane (1.0 mL). [d]$HP(OEt)_2$. [e]150 °C. [f]catalyst (5.0 mol%).

3. Competing Experiments



R = H, **1a**, 0.1 mmol
R = OMe, **1e**, 0.1 mmol

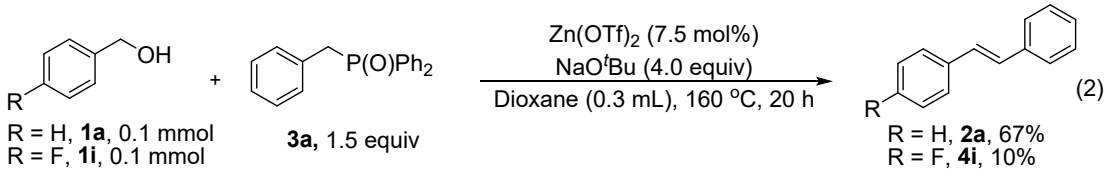
3a, 1.5 equiv

R = H, **2a**, 65%
R = OMe, **4e**, 72%

(1)

Detailed Procedure: To a 10 mL Schlenk tube were successively added benzyl alcohol (**1a**) (10.4 μL, 0.1 mmol), (4-methoxyphenyl)methanol (**1e)** (13.0 μL, 0.1 mmol), benzylphosphine oxide (**3a)** (43.8 mg, 1.5 equiv, 0.15 mmol), $Zn(OTf)_2$ (2.7

mg, 7.5 mol%), NaO^{t}Bu (38.4 mg, 4.0 equiv, 0.4 mmol) and dioxane (0.3 mL) under N_2. The tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. **2a** was detected by GC in 65% yield and **4e** was detected by GC in 72% yield (GC yields using dodecane as an internal standard).

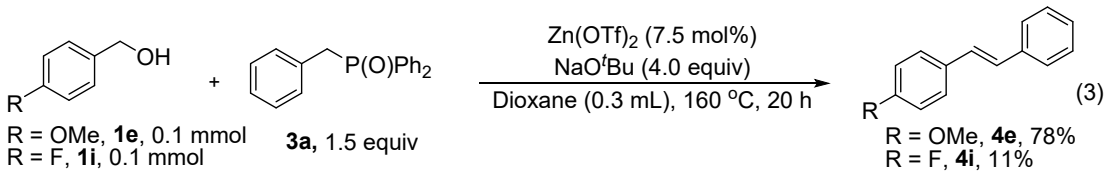


R = H, **1a**, 0.1 mmol
R = F, **1i**, 0.1 mmol

3a, 1.5 equiv

R = H, **2a**, 67%
R = F, **4i**, 10%

Detailed Procedure: To a 10 mL Schlenk tube were successively added benzyl alcohol (**1a**) (10.4 μL, 0.1 mmol), (4-fluorophenyl)methanol (**1i)** (11.0 μL, 0.1 mmol), benzylphosphine oxide (**3a)** (43.8 mg, 1.5 equiv, 0.15 mmol), Zn(OTf)$_2$ (2.7 mg, 7.5 mol%), NaO^{t}Bu (38.4 mg, 4.0 equiv, 0.4 mmol) and dioxane (0.3 mL) under N_2. The tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. **2a** was detected by GC in 67% yield and **4i** was detected by GC in 10% yield (GC yields using dodecane as an internal standard).



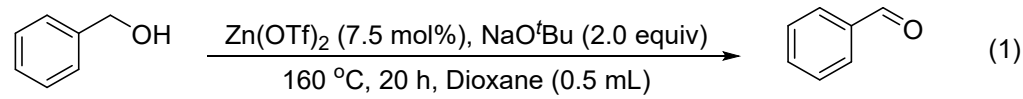
R = OMe, **1e**, 0.1 mmol
R = F, **1i**, 0.1 mmol

3a, 1.5 equiv

R = OMe, **4e**, 78%
R = F, **4i**, 11%

Detailed Procedure: To a 10 mL Schlenk tube were successively added (4-methoxyphenyl)methanol (**1e**) (10.4 μL, 0.1 mmol), (4-fluorophenyl)methanol (**1i)** (11.0 μL, 0.1 mmol), benzylphosphine oxide (**3a)** (43.8 mg, 1.5 equiv, 0.15 mmol), Zn(OTf)$_2$ (2.7 mg, 7.5 mol%), NaO^{t}Bu (38.4 mg, 4.0 equiv, 0.4 mmol) and dioxane (0.3 mL) under N_2. The tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. **4e** was detected by GC in 78% yield and **4i** was detected by GC in 11% yield (GC yields using dodecane as an internal standard).

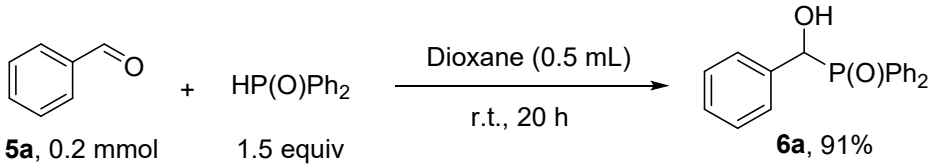
4. Control Reactions of the Mechanistic Studies



1a, 0.2 mmol

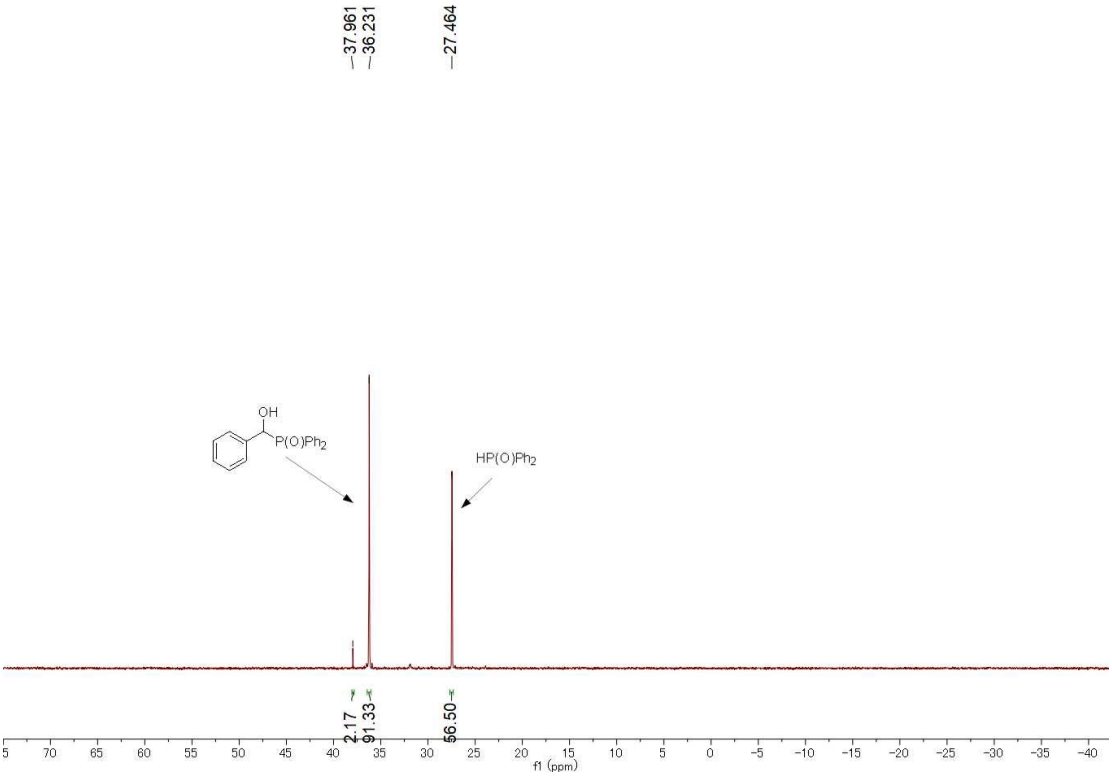
5a, 8%

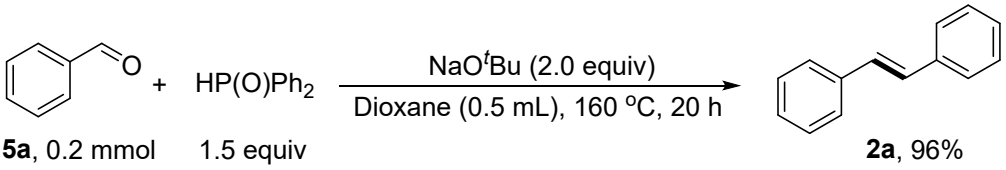
Detailed Procedure: To a 10 mL Schlenk tube were successively added $Zn(OTf)_2$ (5.4 mg, 7.5 mol%), NaO^{t}Bu (38.4 mg, 2.0 equiv, 0.4 mmol), benzyl alcohol (**1a**) (20.7 μL, 0.2 mmol), dioxane (0.5 mL) under N_2. The tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. **5a** was detected by GC in 8% yield (GC yield using dodecane as an internal standard).



5a, 0.2 mmol 1.5 equiv **6a**, 91% (2)

Detailed Procedure: To a 10 mL Schlenk tube were successively added benzaldehyde (**5a**) (20.3 μL, 0.2 mmol), $HP(O)Ph_2$ (60.6 mg, 1.5 equiv, 0.3 mmol), dioxane (0.5 mL) under N_2, room temperature for 20 h, no stirred. **6a** was detected by ^{31}P NMR in 91% yield.

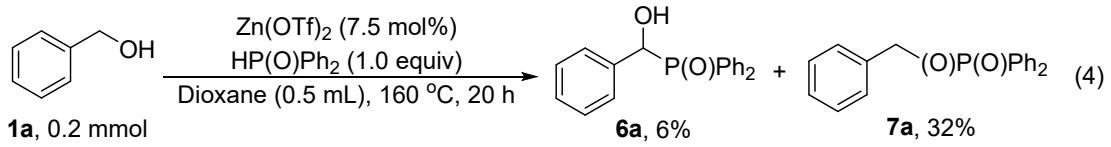




5a, 0.2 mmol 1.5 equiv **2a**, 96% (3)

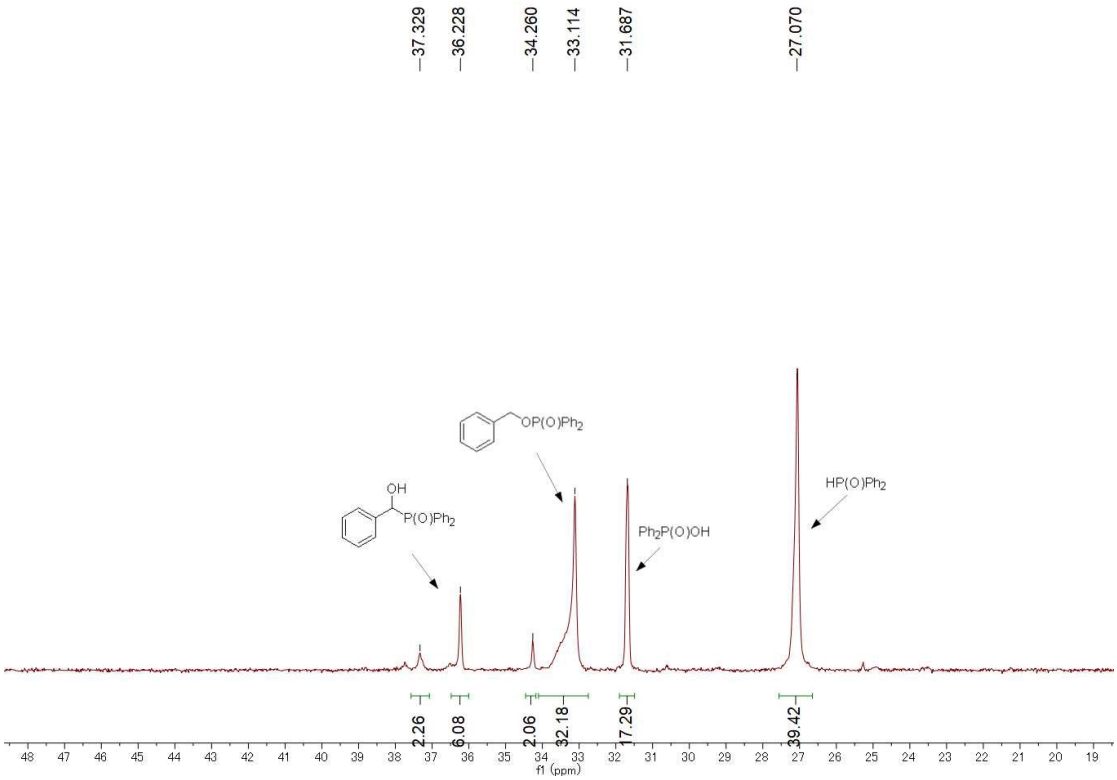
Detailed Procedure: To a 10 mL Schlenk tube were successively added NaO^{t}Bu

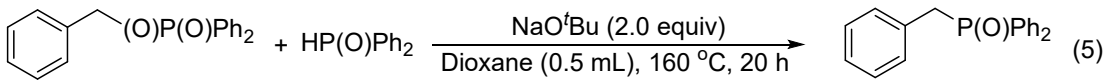
(38.4 mg, 2.0 equiv, 0.4 mmol), $HP(O)Ph_2$ (60.6 mg, 1.5 equiv, 0.3 mmol), benzaldehyde (**5a**) (20.3 μL, 0.2 mmol), dioxane (0.5 mL) under N_2. The tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. **2a** were detected by GC in 96% yield (GC yields using dodecane as an internal standard).



1a, 0.2 mmol **6a**, 6% **7a**, 32% (4)

Detailed Procedure: To a 10 mL Schlenk tube were successively added $Zn(OTf)_2$ (5.4 mg, 7.5 mol%), $HP(O)Ph_2$ (40.4 mg, 1.0 equiv, 0.2 mmol), benzyl alcohol (**1a**) (20.7 μL, 0.2 mmol), dioxane (0.5 mL) under N_2. The tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. **6a** was detected by ^{31}P NMR in 6% yield and **7a** was detected by ^{31}P NMR in 32% yield.

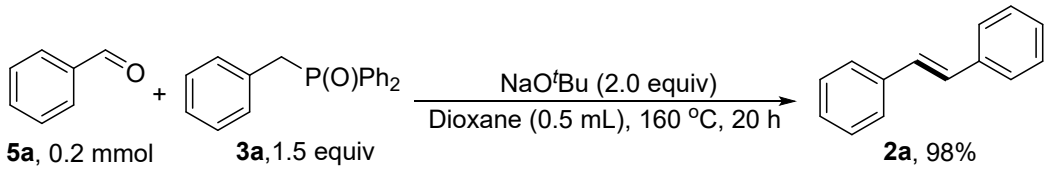




7a, 0.2 mmol 1.0 equiv **3a**, 82% (5)

Detailed Procedure: To a 10 mL Schlenk tube were successively added benzyl diphenylphosphinate **7a** (61.6 mg, 0.2 mmol), $HP(O)Ph_2$ (40.4 mg, 1.0 equiv, 0.2 mmol), NaO^tBu (38.4 mg, 2.0 equiv, 0.4 mmol), dioxane (0.5 mL) under N_2. The tube

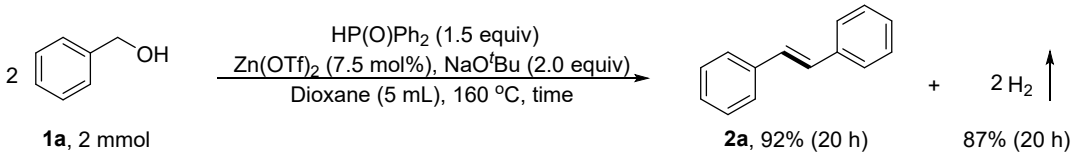
was heated at 160 °C using a heating aluminum block for 20 h, no stirred. **3a** was detected by GC in 82% yield (GC yield using dodecane as an internal standard).



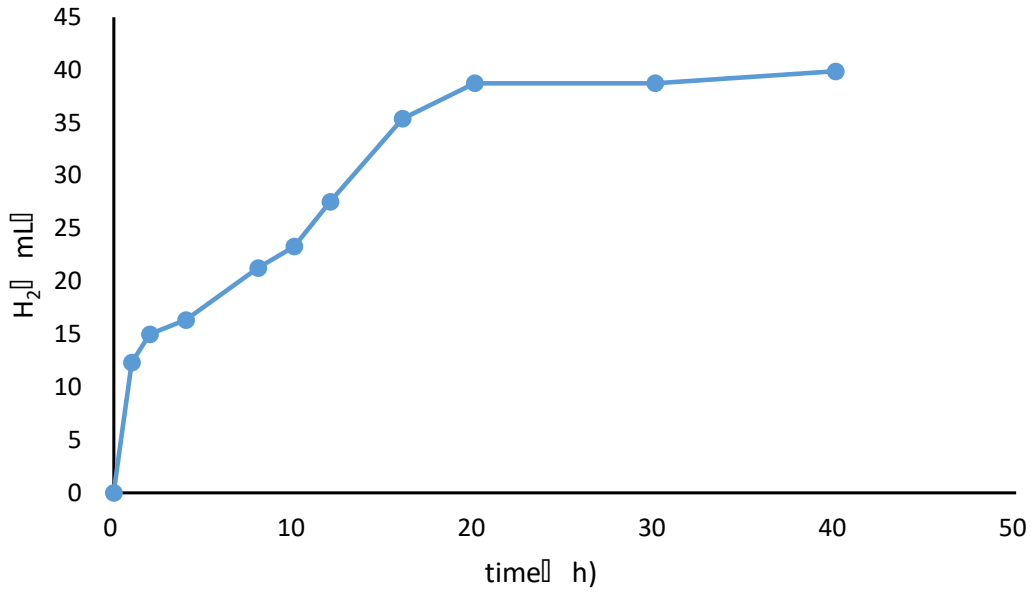
(6)

Detailed Procedure: To a 10 mL Schlenk tube were successively added benzylphosphine oxide **3a** (87.6 mg, 1.5 equiv, 0.3 mmol), NaO^{t}Bu (38.4 mg, 2.0 equiv, 0.4 mmol), benzaldehyde (**5a**) (20.3 μL, 0.2 mmol), dioxane (0.5 mL) under N_2. The tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. **2a** were detected by GC in 98% yield (GC yields using dodecane as an internal standard).

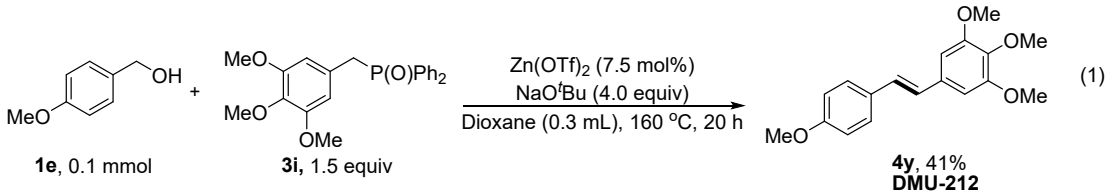
5. Quantification of H_2 evolution over time



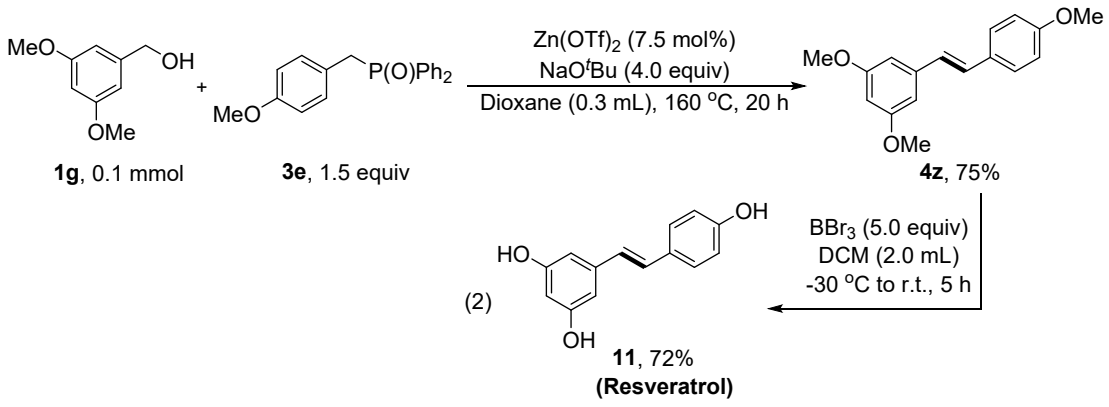
Detailed Procedure: To a 100 mL Schlenk tube were successively added NaO^{t}Bu (384.4 mg, 2.0 equiv, 4.0 mmol), $Zn(OTf)_2$ (54.5 mg, 7.5 mol%), $HP(O)Ph_2$ (606.6 mg, 1.5 equiv, 3 mmol), benzyl alcohol (**1a**) (207.0 μL, 2 mmol), dioxane (5 mL) under N_2. The tube was heated at 160 °C using a heating aluminum block, no stirred. Monitor the hydrogen production at reaction times of 1h, 2h, 4h, 8h, 10h, 12h, 16h, 20h, 30h, and 40h by GC. After 20 hours, the reaction was found to be nearly complete, with 1.74 mmol (39 mL) of hydrogen was detected, corresponding to approximately one equivalent with an yield of 87%, and the product 2a was obtained by GC in 92% yield (GC yield using dodecane as an internal standard). We employed the external standard method to determine the quantity of hydrogen.



6. Exploration of Reaction Utilities



Detailed Procedure: To a 10 mL Schlenk tube were successively added diphenyl(3,4,5-trimethoxybenzyl)phosphine oxide (**3i**) (57.3 mg, 1.5 equiv, 0.15 mmol), $Zn(OTf)_2$ (2.7 mg, 7.5 mol%), NaO^tBu (38.4 mg, 4.0 equiv, 0.4 mmol), (4-methoxyphenyl)methanol (**1e**) (12.4 μL, 0.1 mmol), dioxane (0.3 mL) under N_2. The tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. **4y** was purified by column chromatography in 41% yield.



Detailed Procedure: To a 10 mL Schlenk tube were successively added (4-

methoxybenzyl)diphenylphosphine oxide (**3e**) (48.3 mg, 1.5 equiv, 0.15 mmol), $Zn(OTf)_2$ (2.7 mg, 7.5 mol%), NaO^tBu (38.4 mg, 4.0 equiv, 0.4 mmol), (4-methoxyphenyl)methanol (**1g**) (14.9 μL, 0.1 mmol), dioxane (0.3 mL) under N_2. The tube was heated at 160 °C using a heating aluminum block for 20 h, no stirred. **4z** was purified by column chromatography in 75% yield. Under conditions of -30°C, BBr_3 (5.0 equiv, 0.5 mmol) and DCM (2.0 mL) were added sequentially to the separated **4z**, which was then transferred to room temperature and reacted for 5 hours. **9** was purified by column chromatography in 72% yield.

7. Reference

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8. Copies of ^{1}H ,^{13}C and ^{19}F NMR Spectra of the Products

(*E*)-1,2-diphenylethene (2a)

Figure S1. ^{1}H NMR (400 MHz, $CDCl_3$)

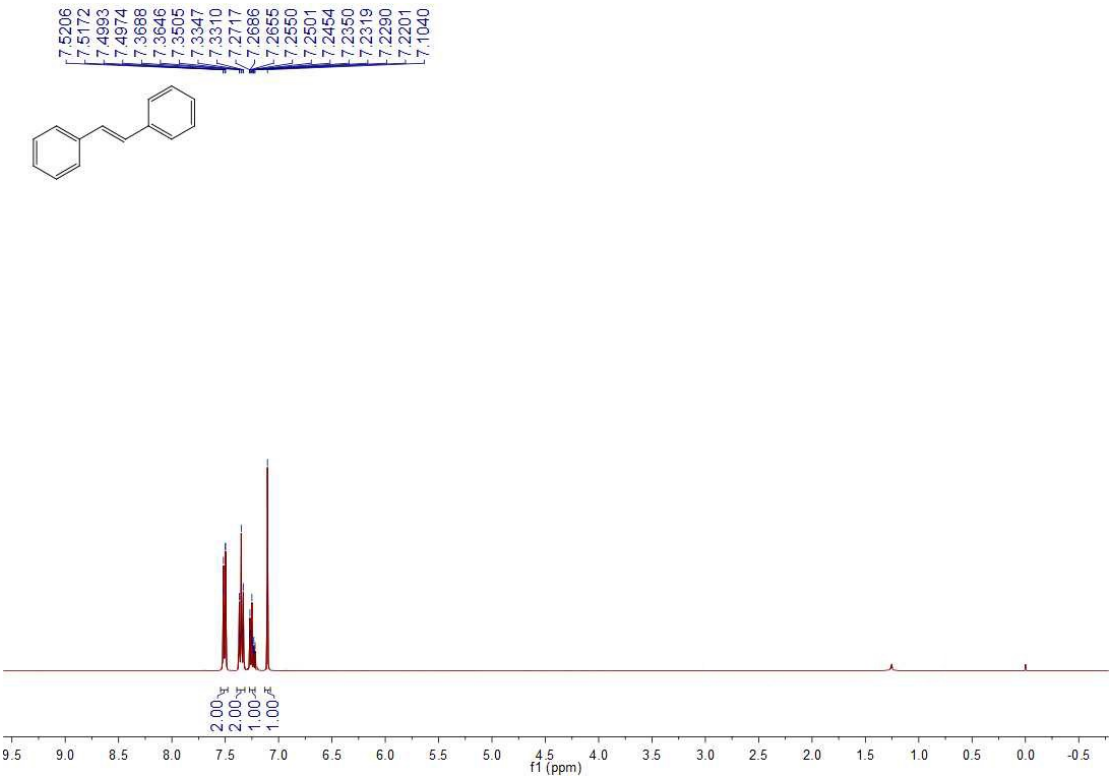
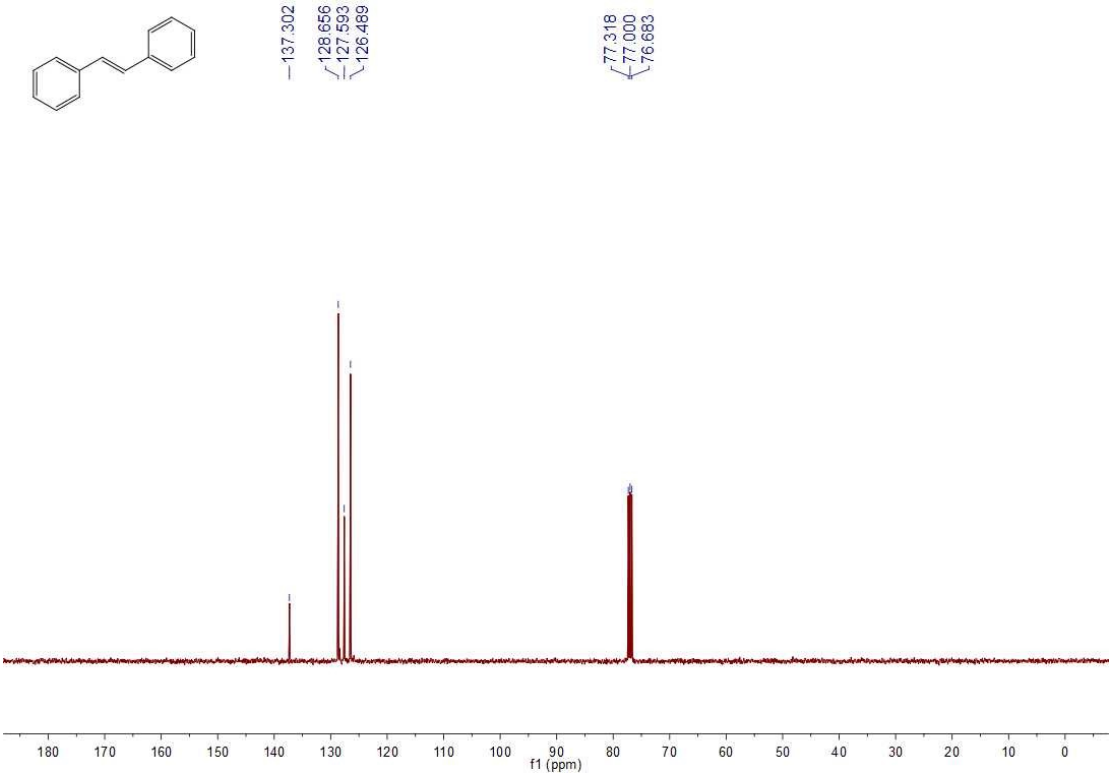


Figure S2. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-1,2-di-o-tolylethene (2b)

Figure S3. ^{1}H NMR (400 MHz, $CDCl_3$)

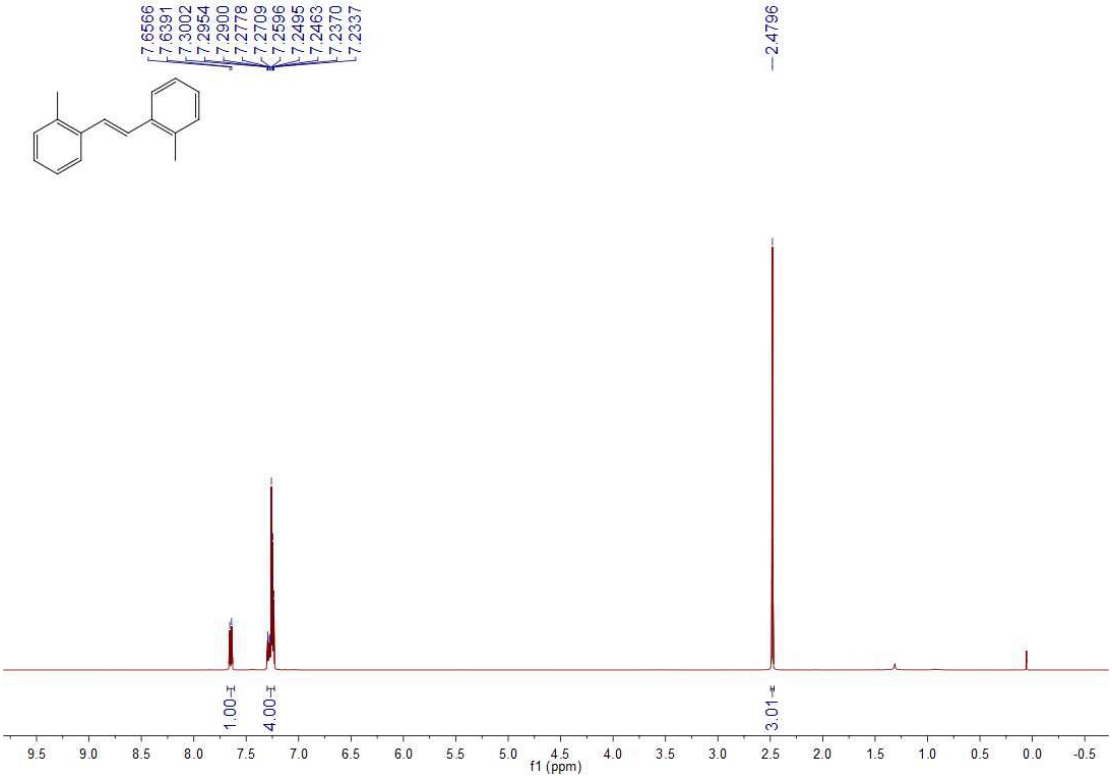
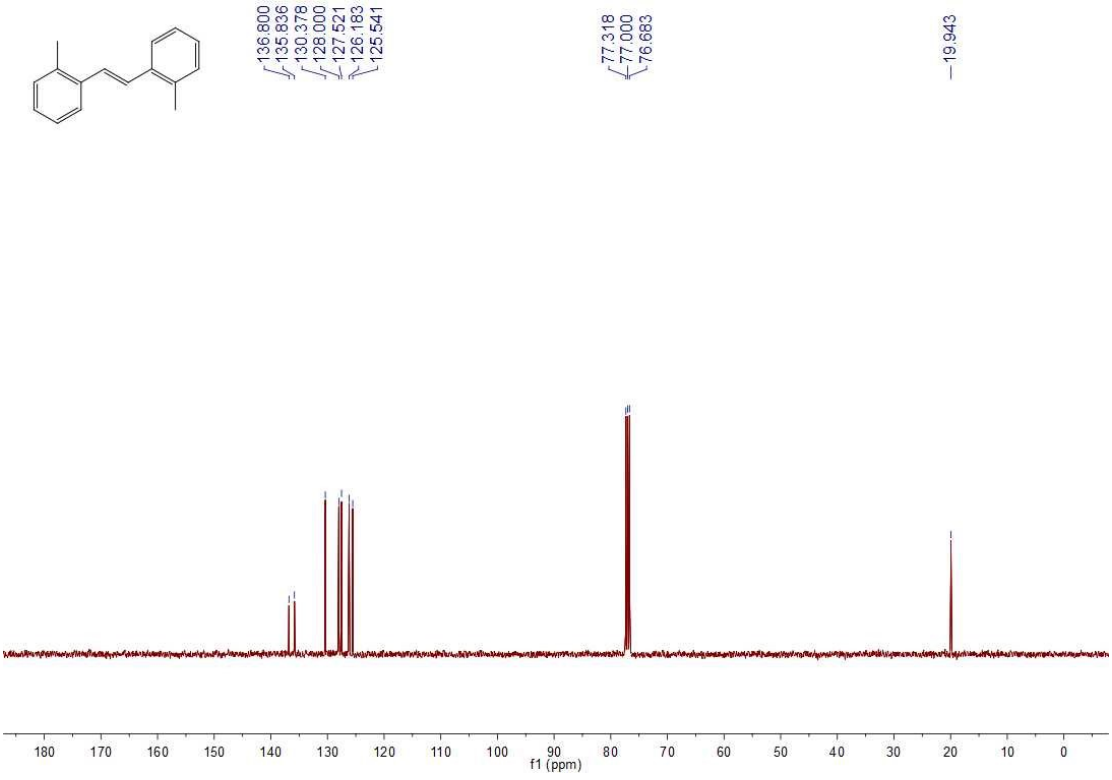


Figure S4. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-1,2-di-m-tolylethene (2c)

Figure S5. ^{1}H NMR (400 MHz, $CDCl_3$)

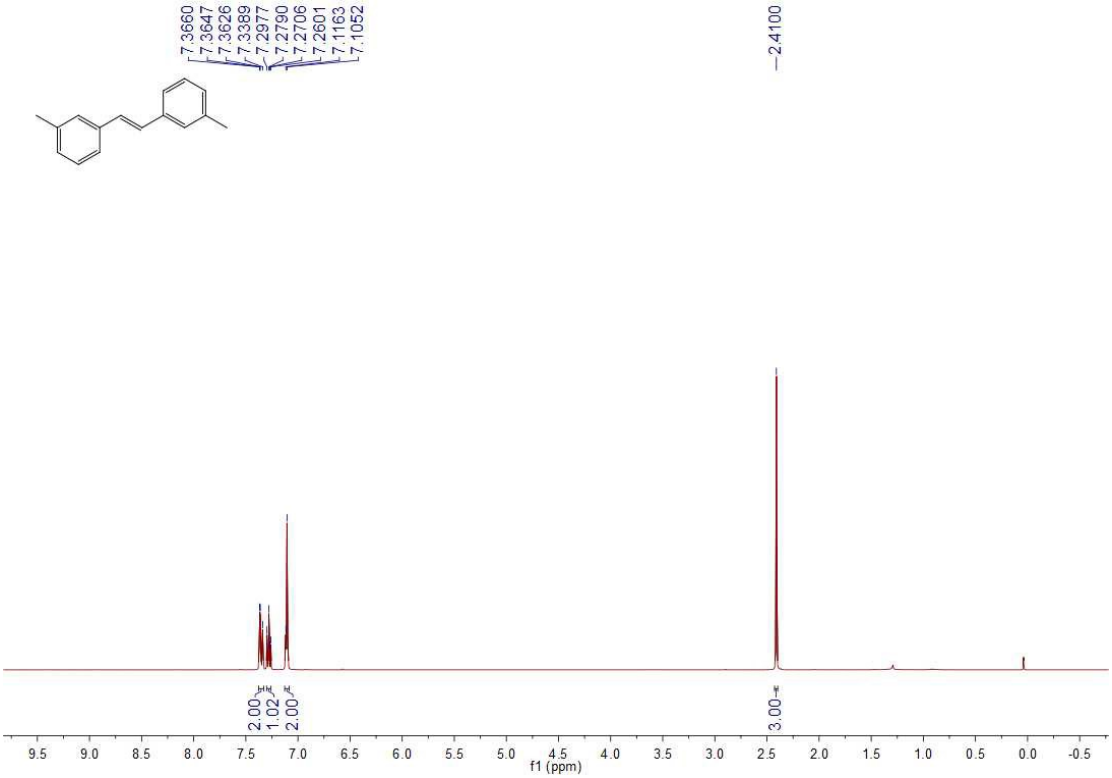
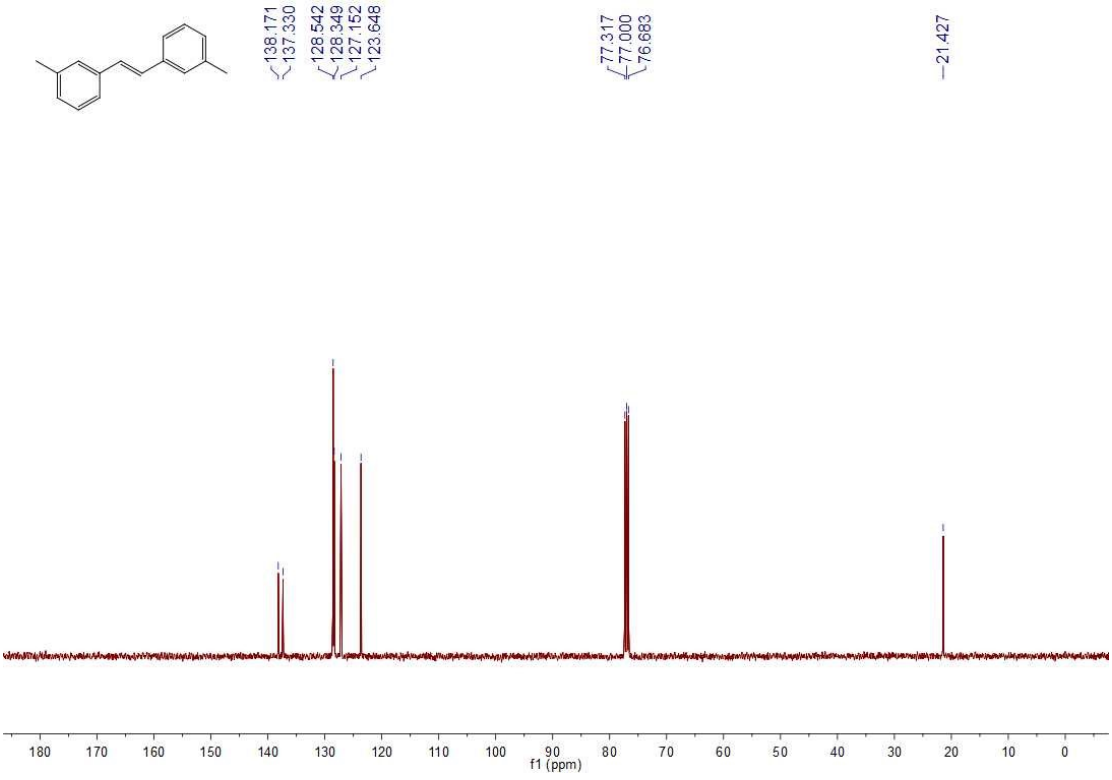


Figure S6. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-1,2-di-p-tolylethene (2d)

Figure S7. ^{1}H NMR (400 MHz, $CDCl_3$)

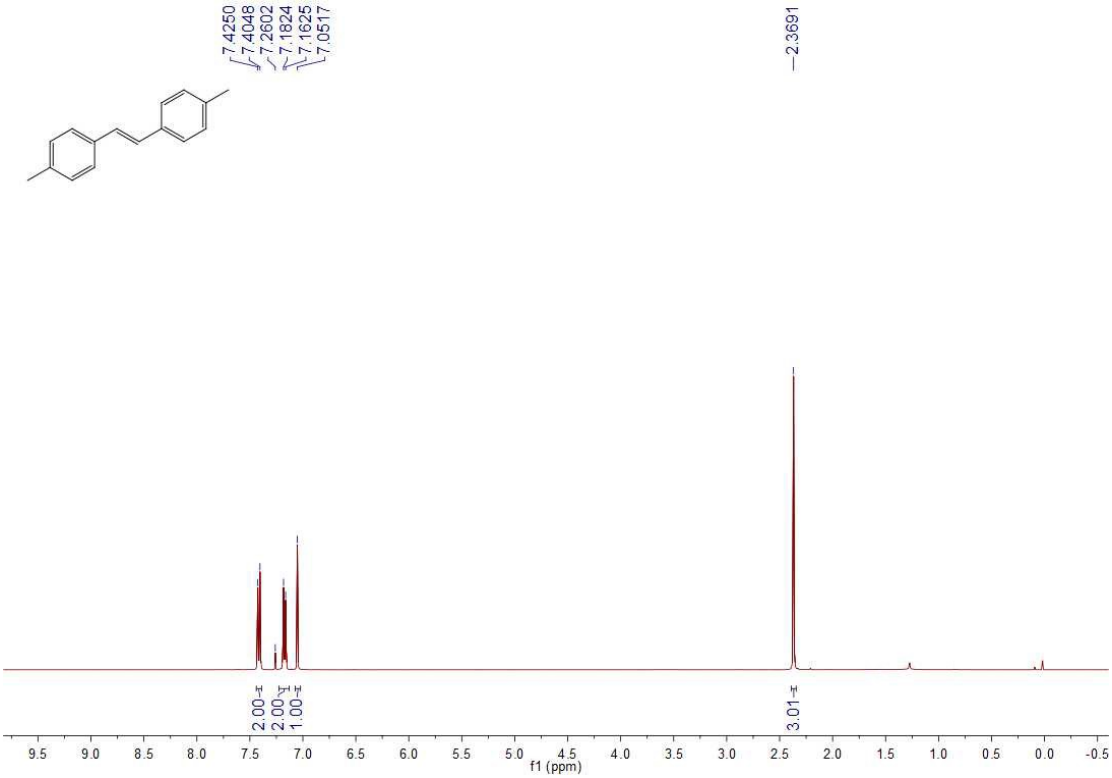
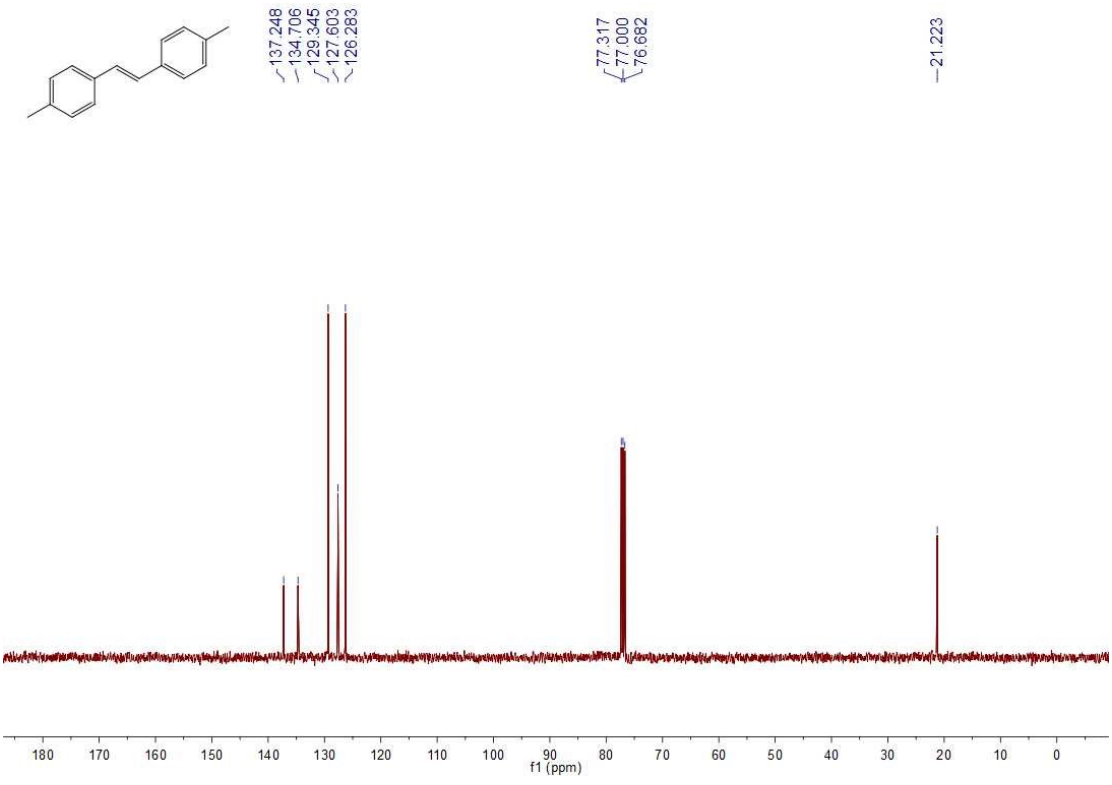


Figure S8. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-1,2-bis(4-(tert-butyl)phenyl)ethene (2e)

Figure S9. ^{1}H NMR (400 MHz, $CDCl_3$)

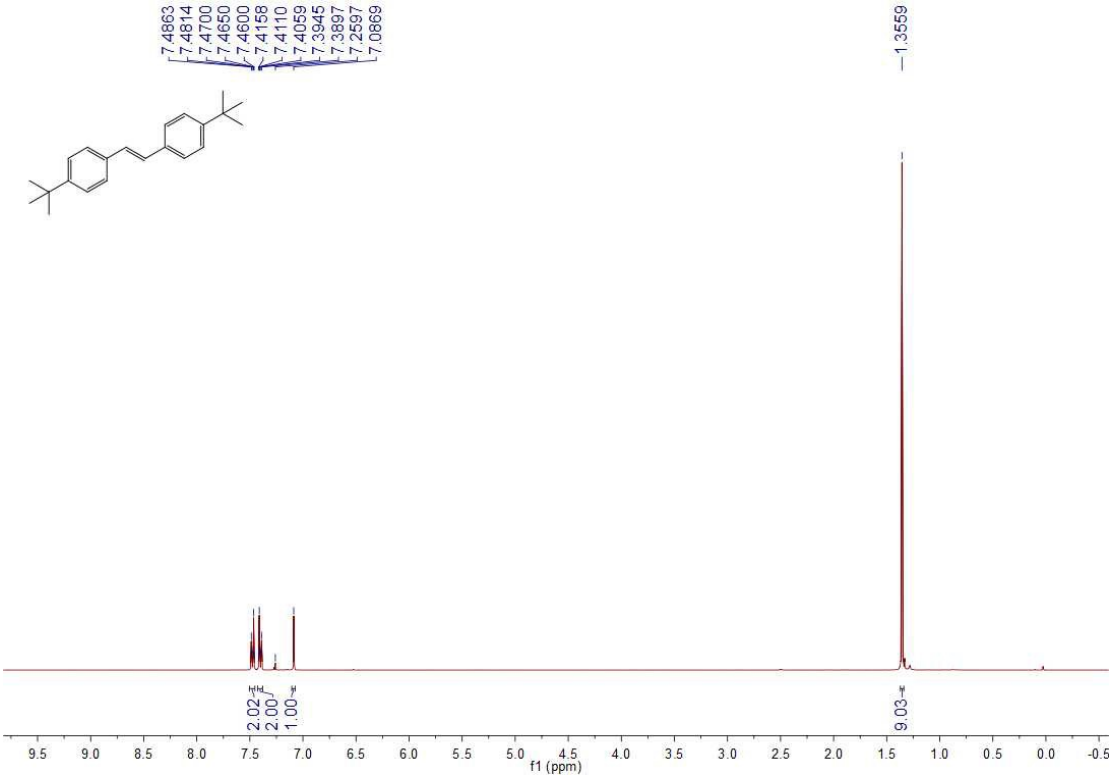
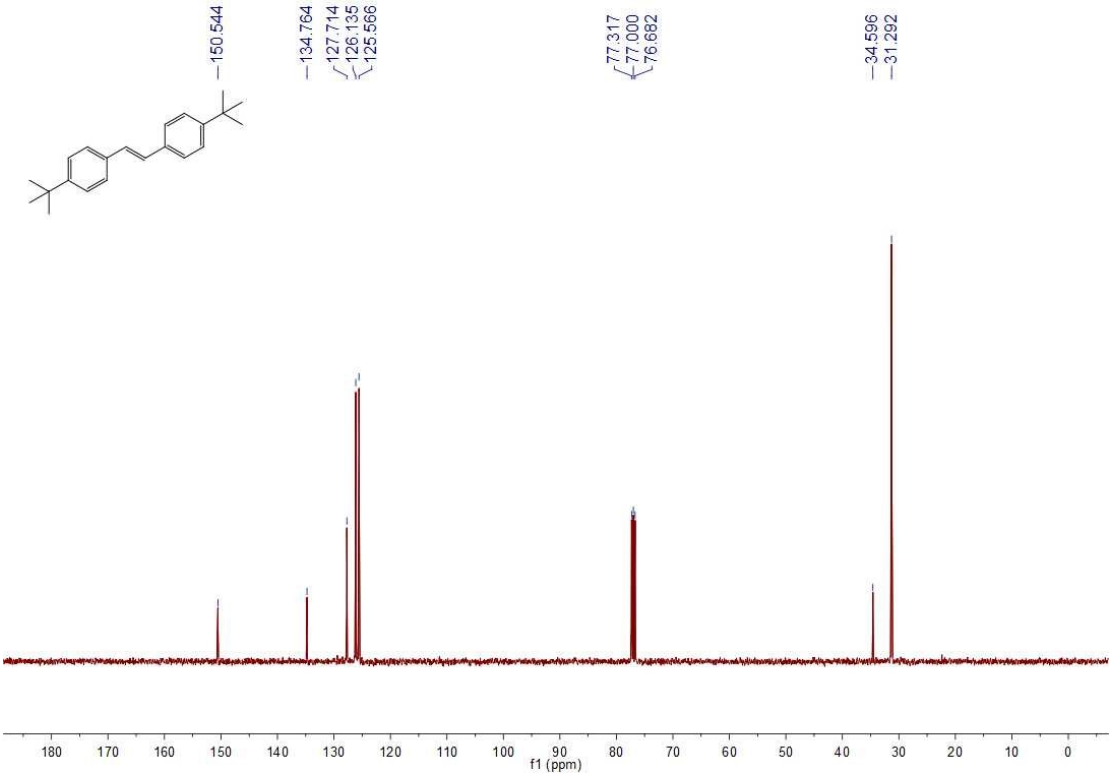


Figure S10. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-1,2-bis(4-methoxyphenyl)ethene (2f)

Figure S11. ^{1}H NMR (400 MHz, $CDCl_3$)

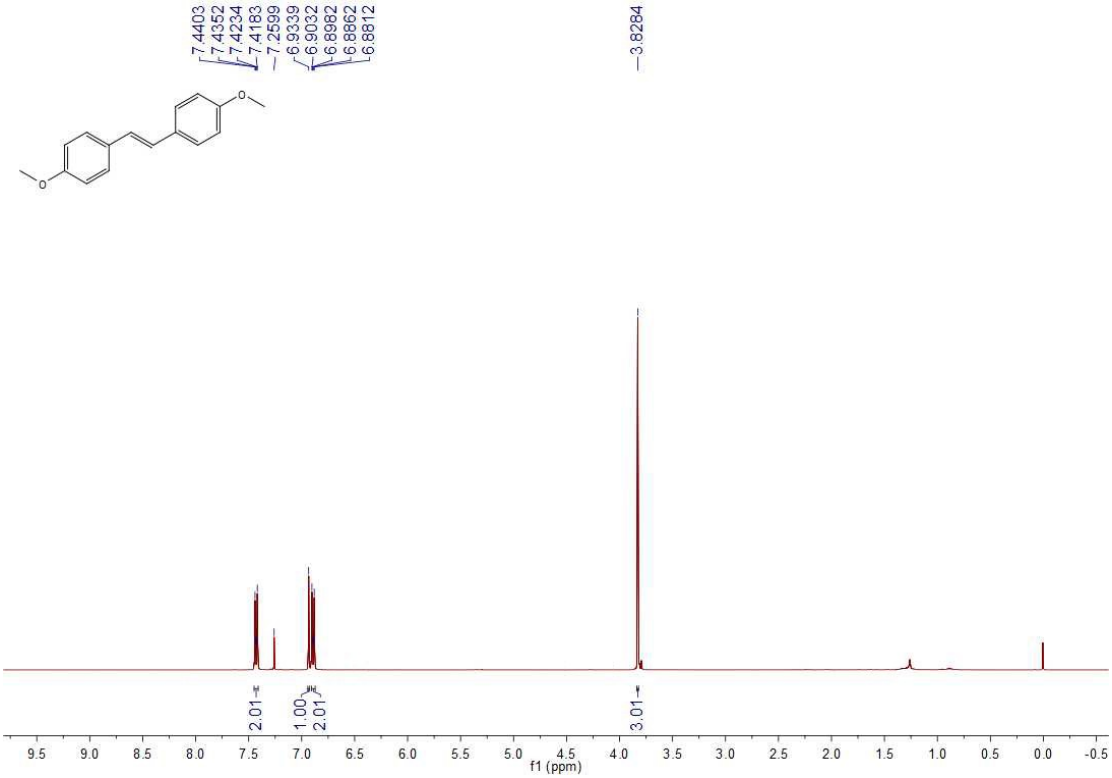
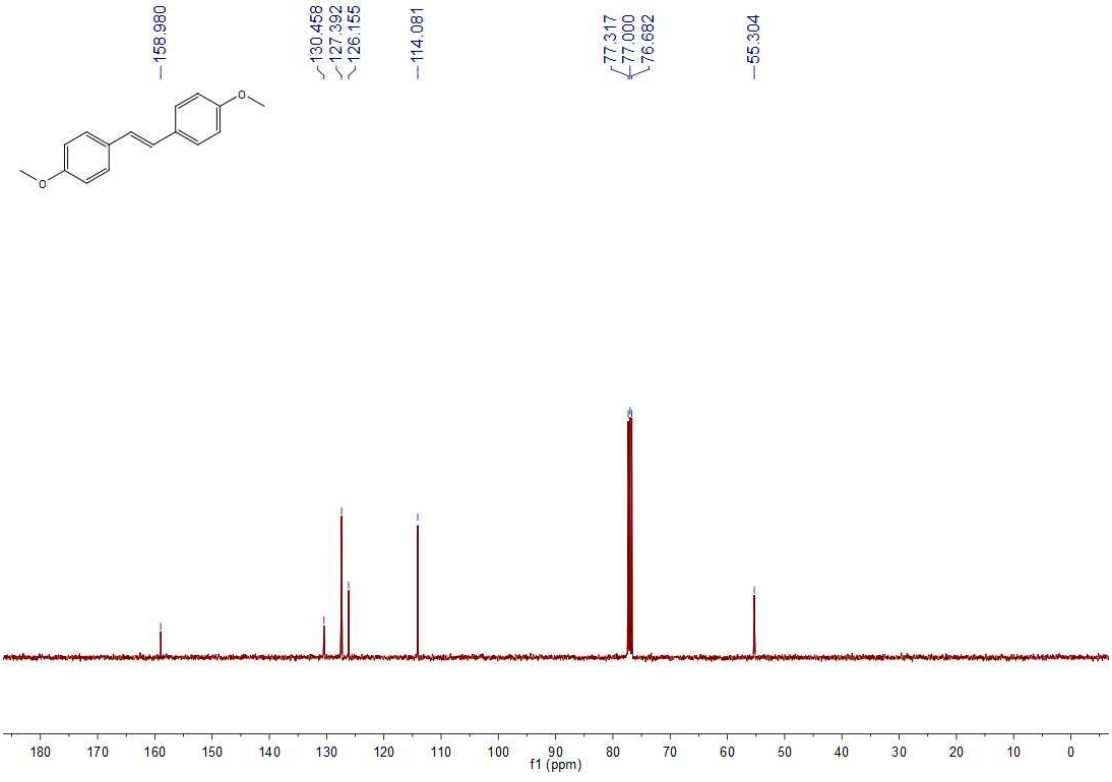


Figure S12. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-1,2-bis(3,5-dimethoxyphenyl)ethene (2g)

Figure S13. ^{1}H NMR (400 MHz, $CDCl_3$)

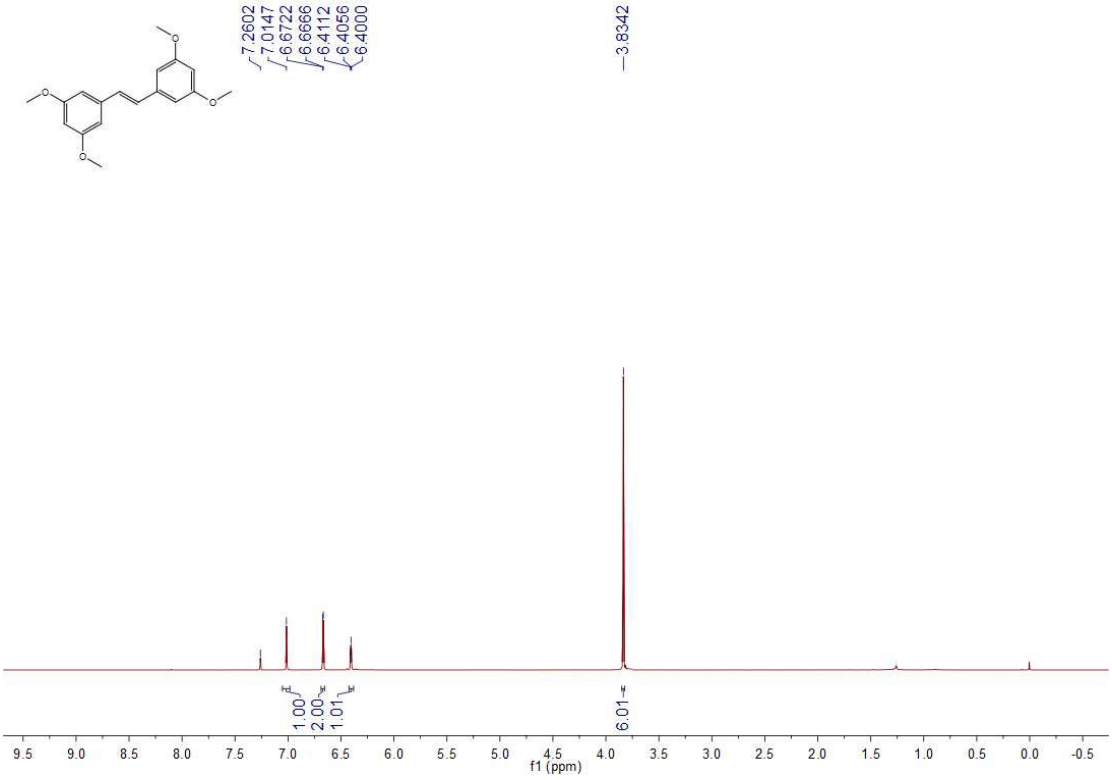
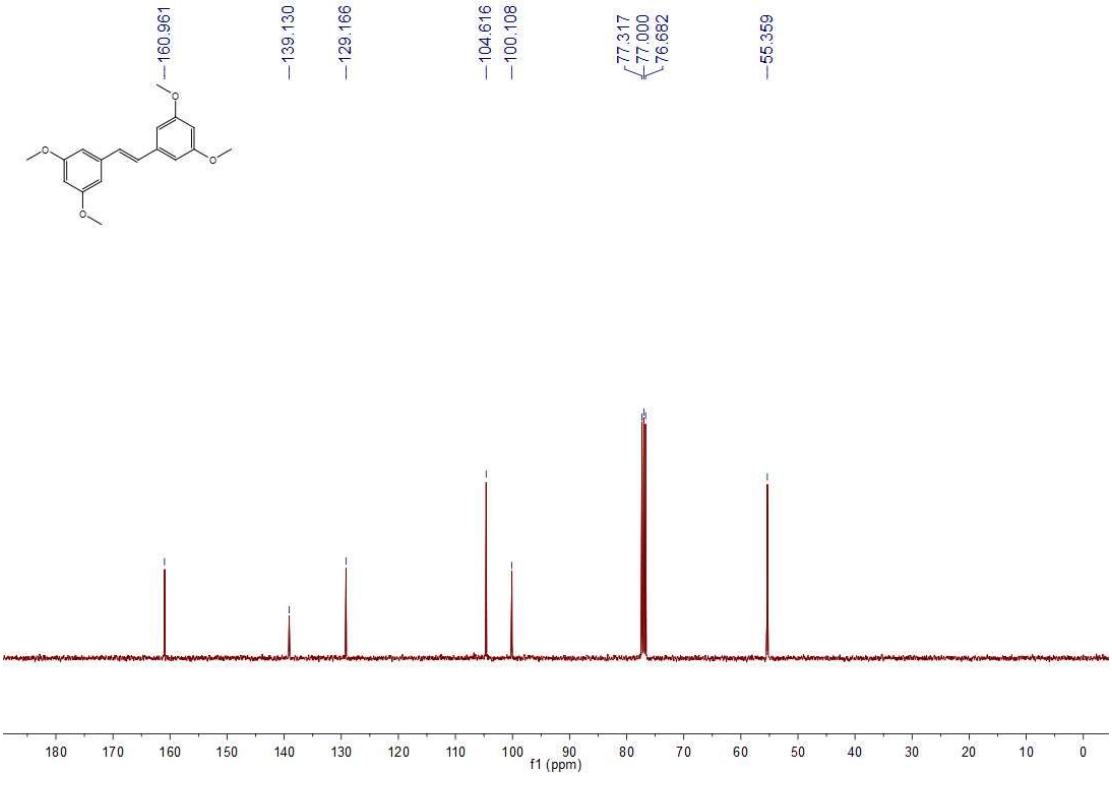


Figure S14. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-1,2-bis(benzo[d][1,3]dioxol-5-yl)ethene (2h)

Figure S15. ^{1}H NMR (400 MHz, $CDCl_3$)

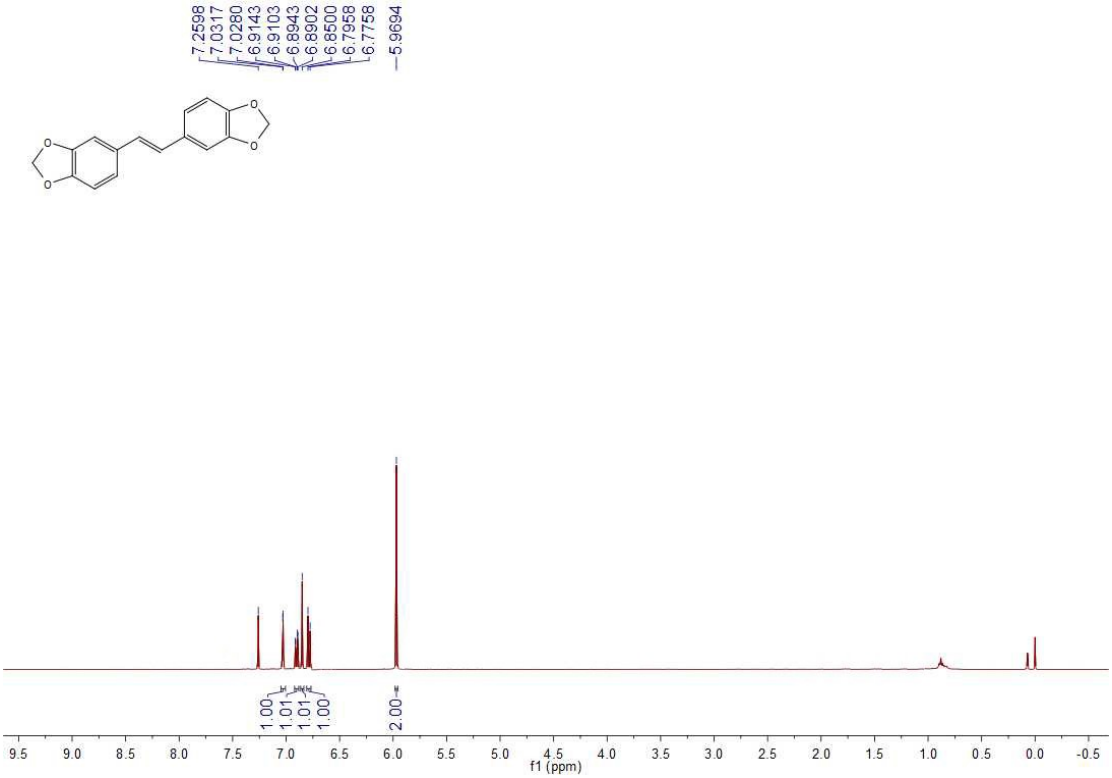
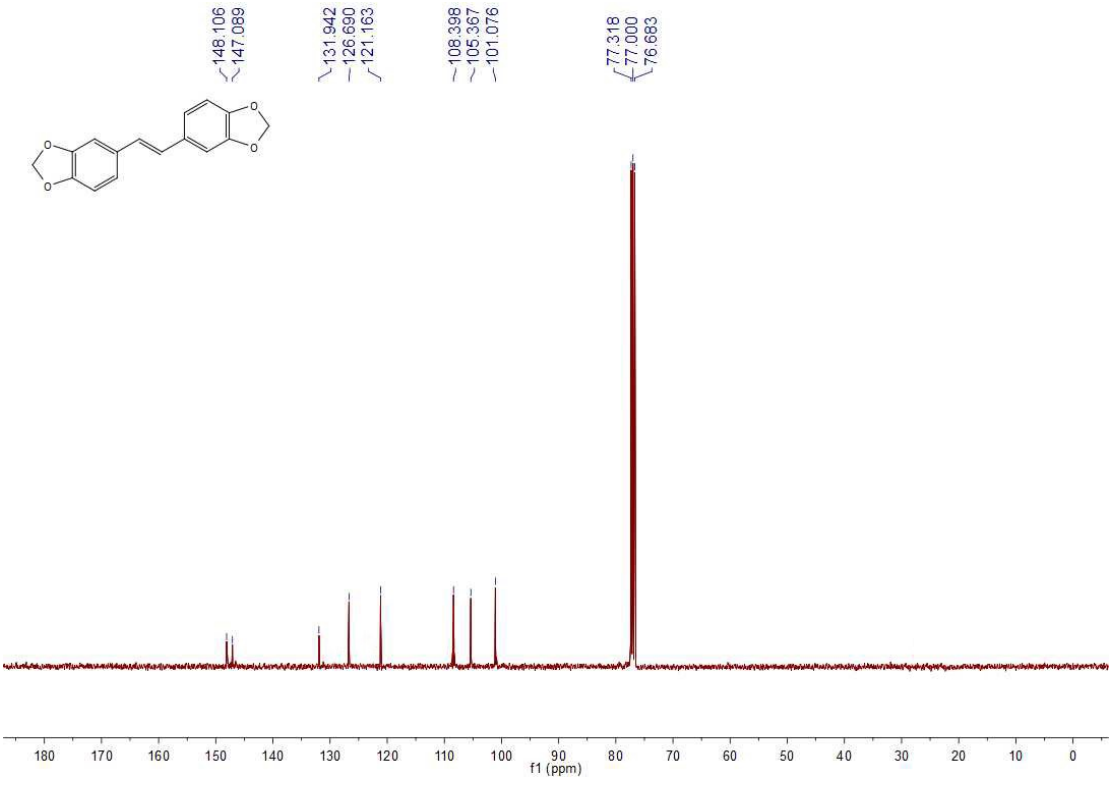


Figure S16. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-1,2-bis(4-fluorophenyl)ethene (2i)

Figure S17. ^{1}H NMR (400 MHz, $CDCl_3$)

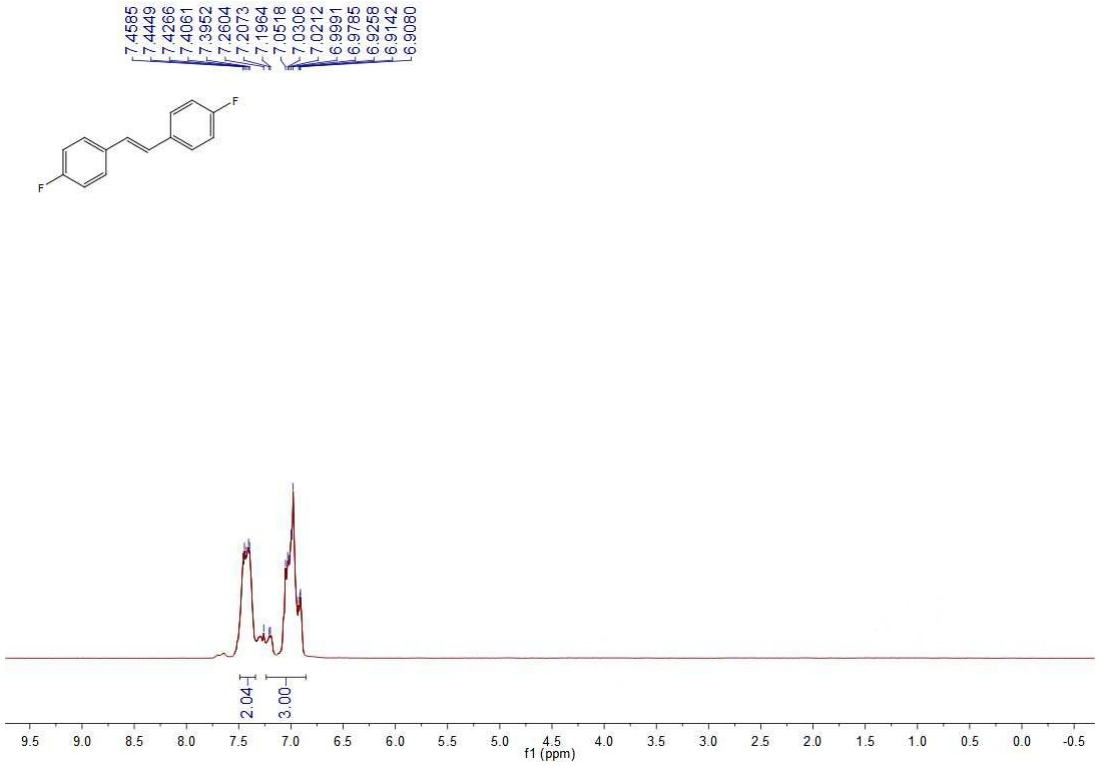
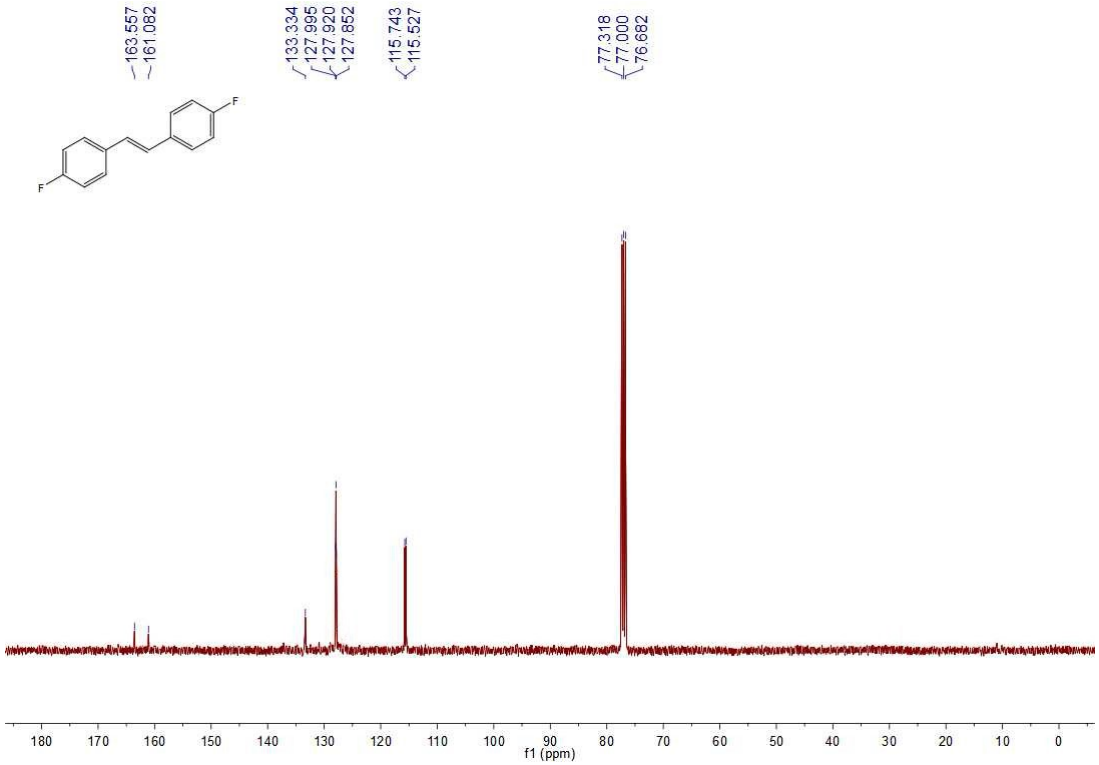
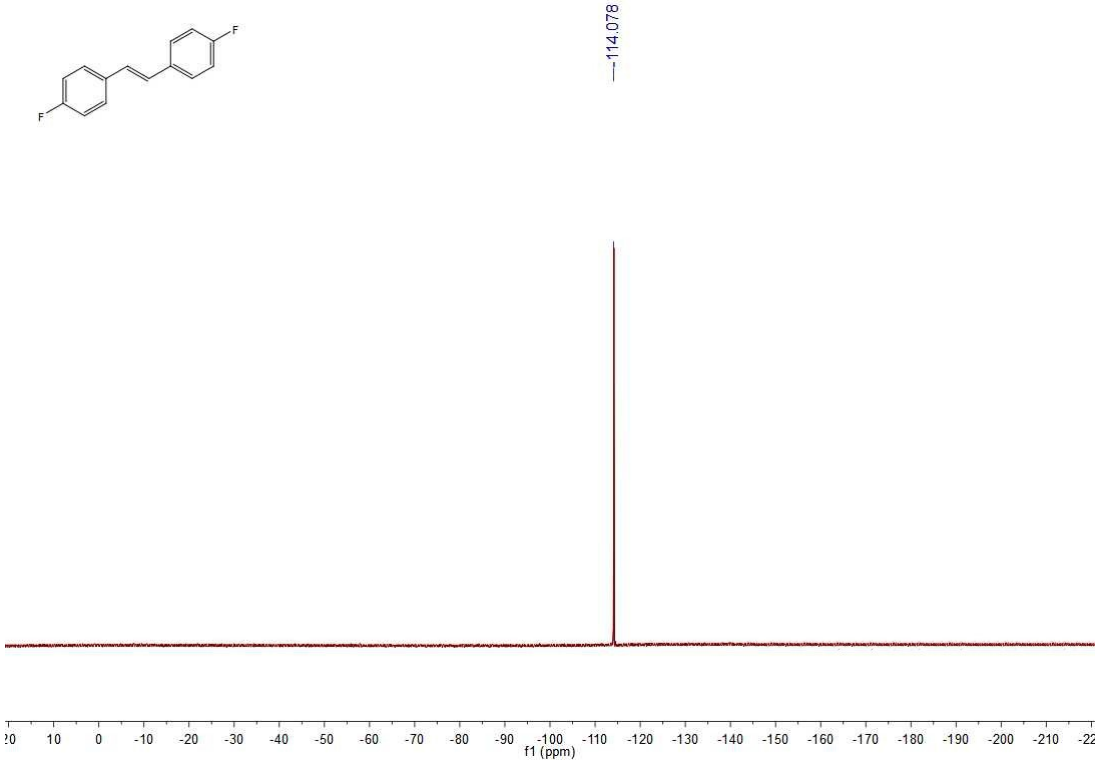


Figure S18. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-1,2-bis(4-fluorophenyl)ethene (2i)

Figure S19. ^{19}F NMR (376 MHz, $CDCl_3$)



(*E*)-1,2-di(thiophen-2-yl)ethene (2j)

Figure S20. ^{1}H NMR (400 MHz, $CDCl_3$)

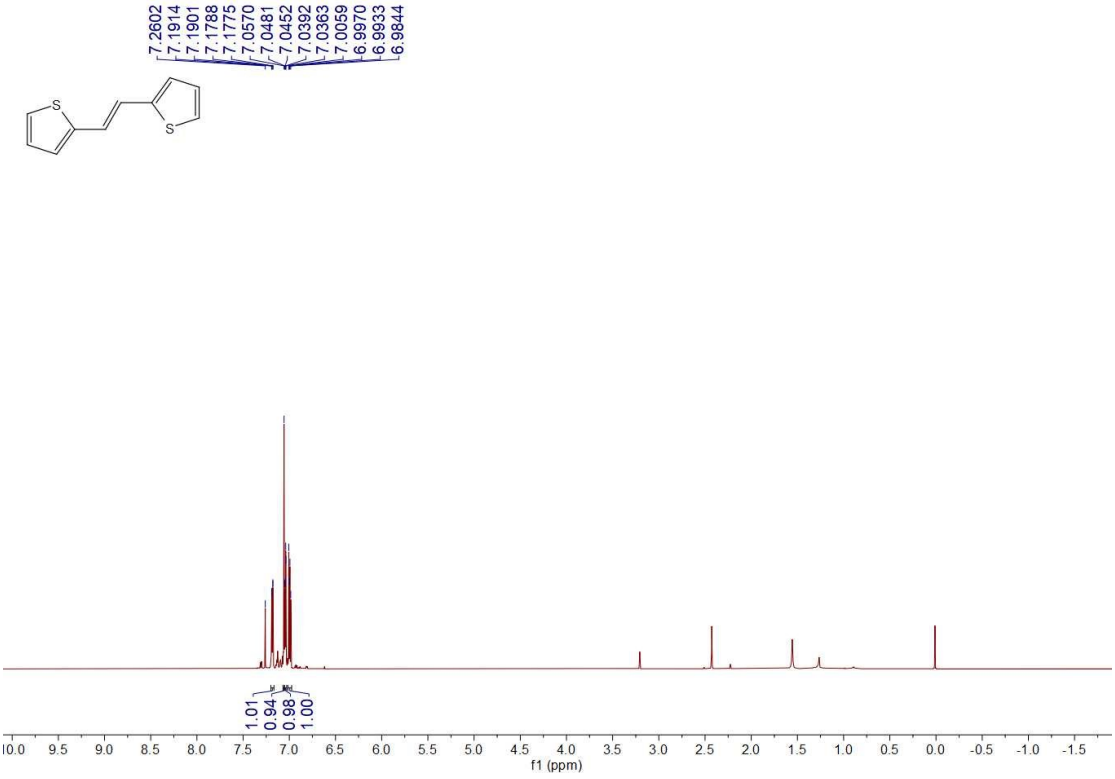
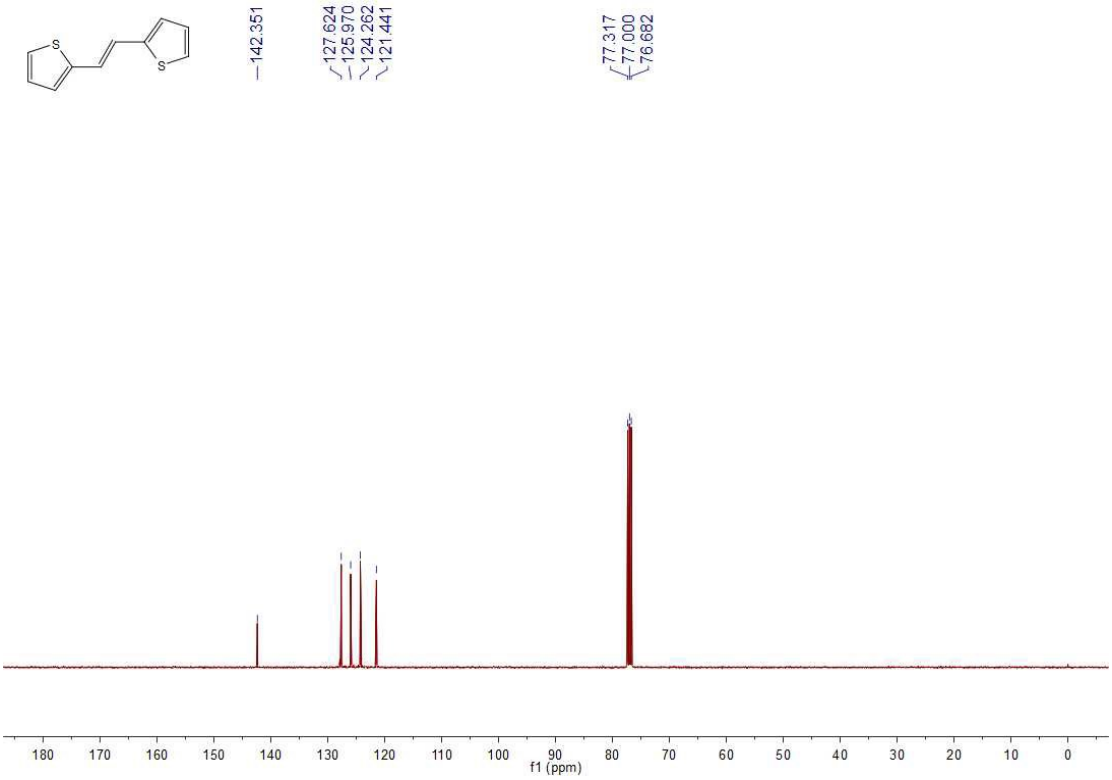
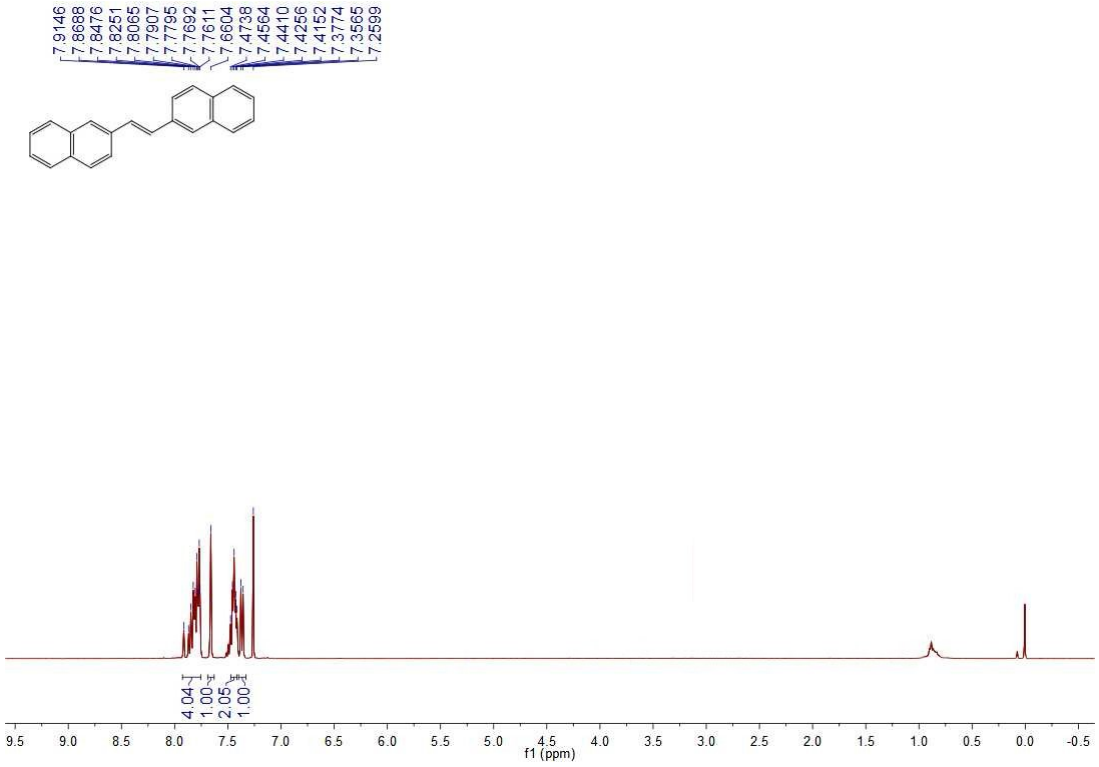


Figure S21. ^{13}C NMR (100 MHz, $CDCl_3$)



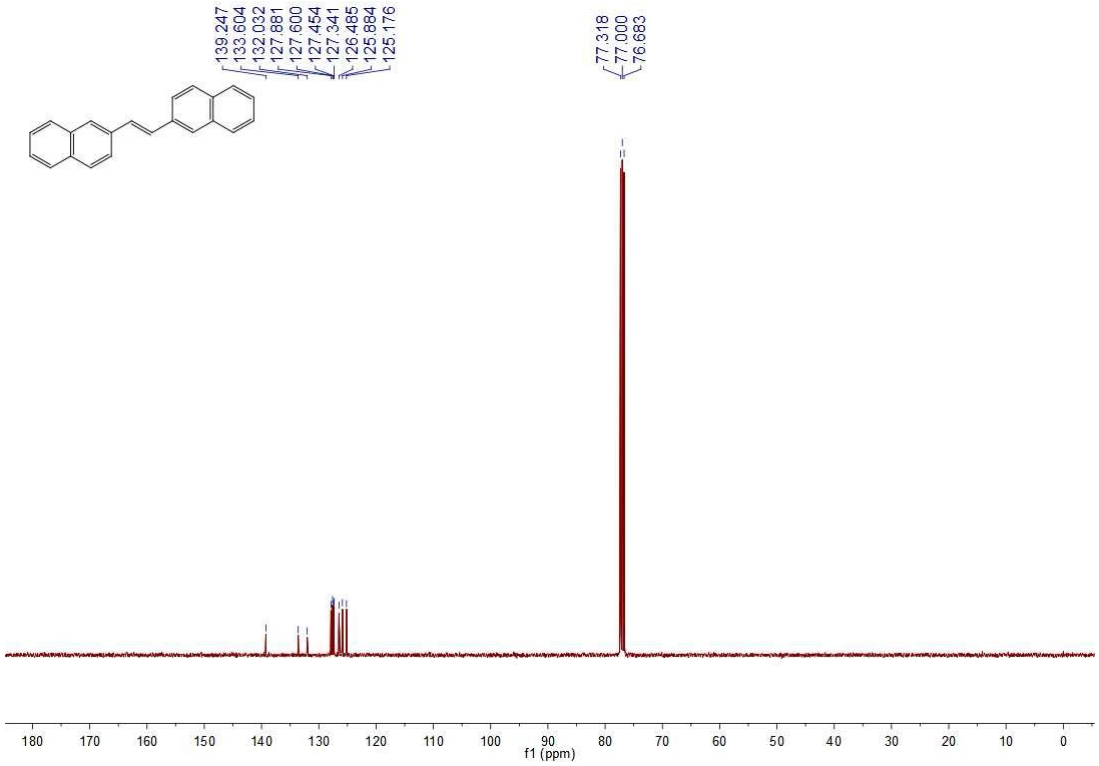
(*E*)-1,2-di(naphthalen-2-yl)ethene (2k)

Figure S22. ^{1}H NMR (400 MHz, $CDCl_3$)



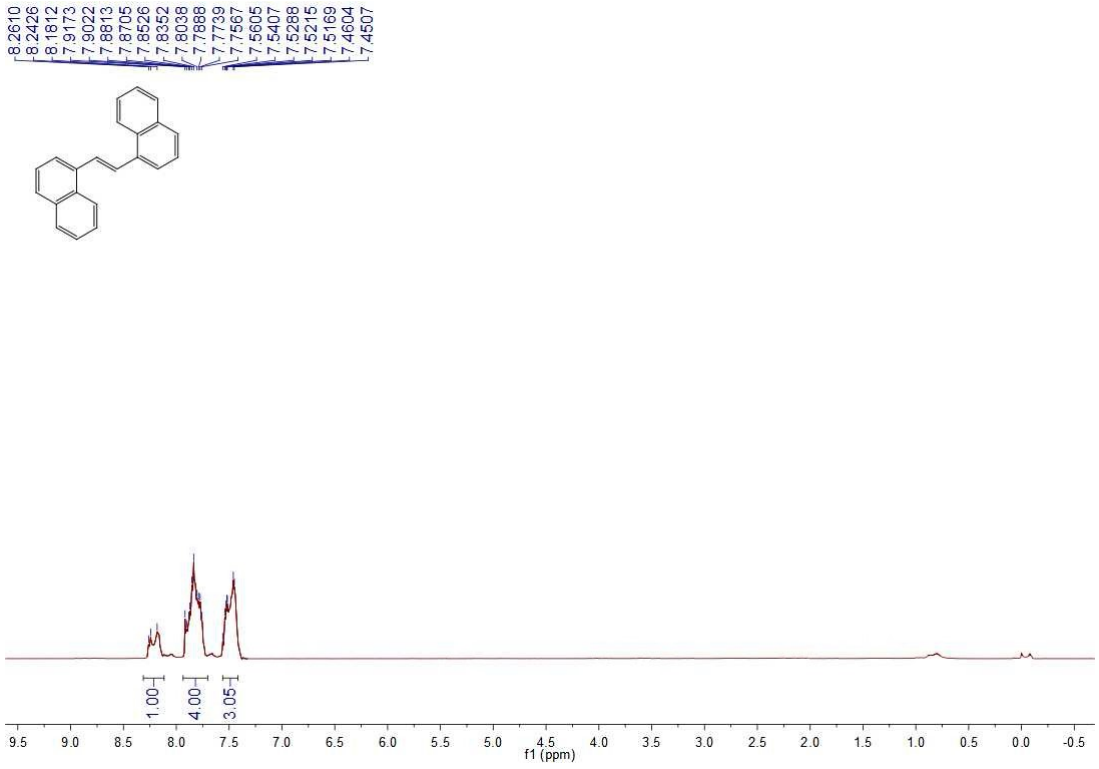
(*E*)-1,2-di(naphthalen-2-yl)ethene (2k)

Figure S23. ^{13}C NMR (100 MHz, $CDCl_3$)



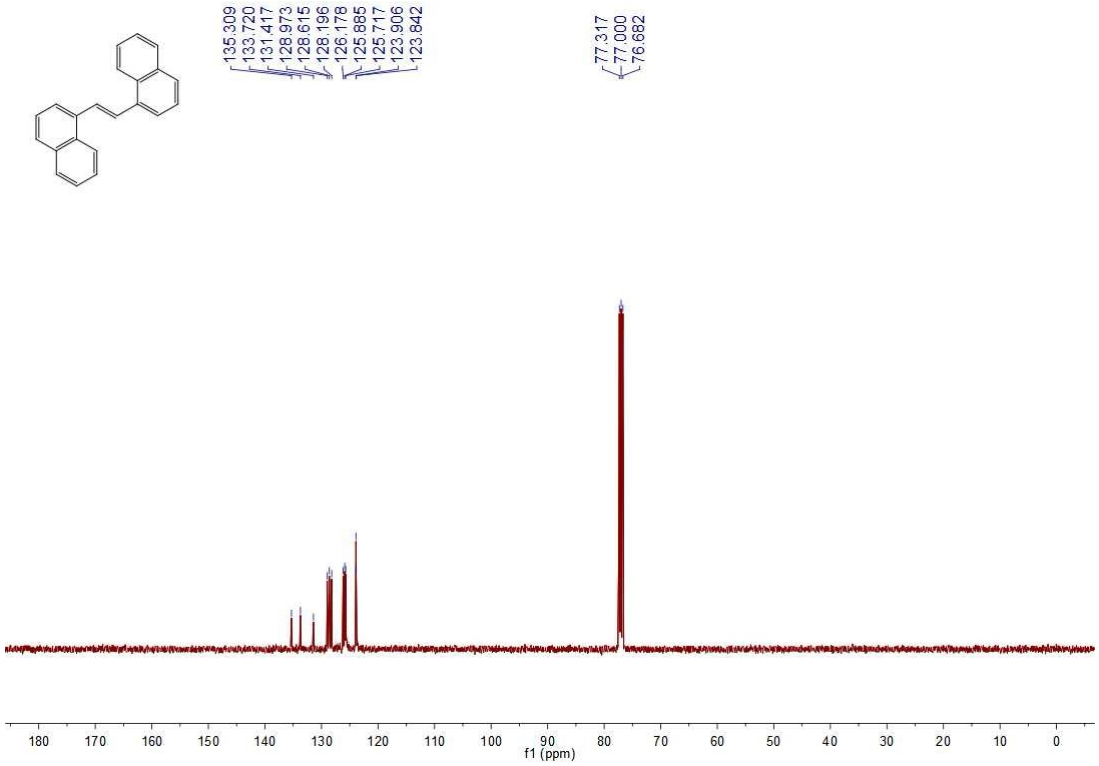
(*E*)-1,2-di(naphthalen-1-yl)ethene (2l)

Figure S24. ^{1}H NMR (400 MHz, $CDCl_3$)



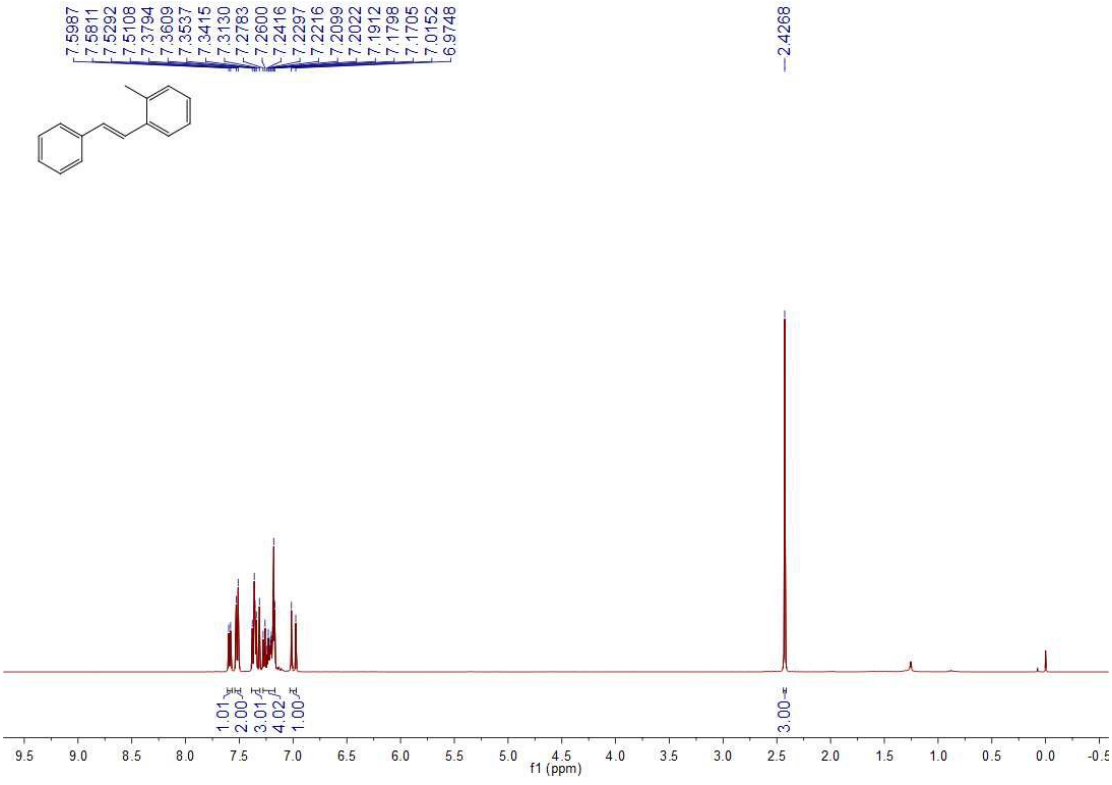
(*E*)-1,2-di(naphthalen-1-yl)ethene (2l)

Figure S25. ^{13}C NMR (100 MHz, $CDCl_3$)



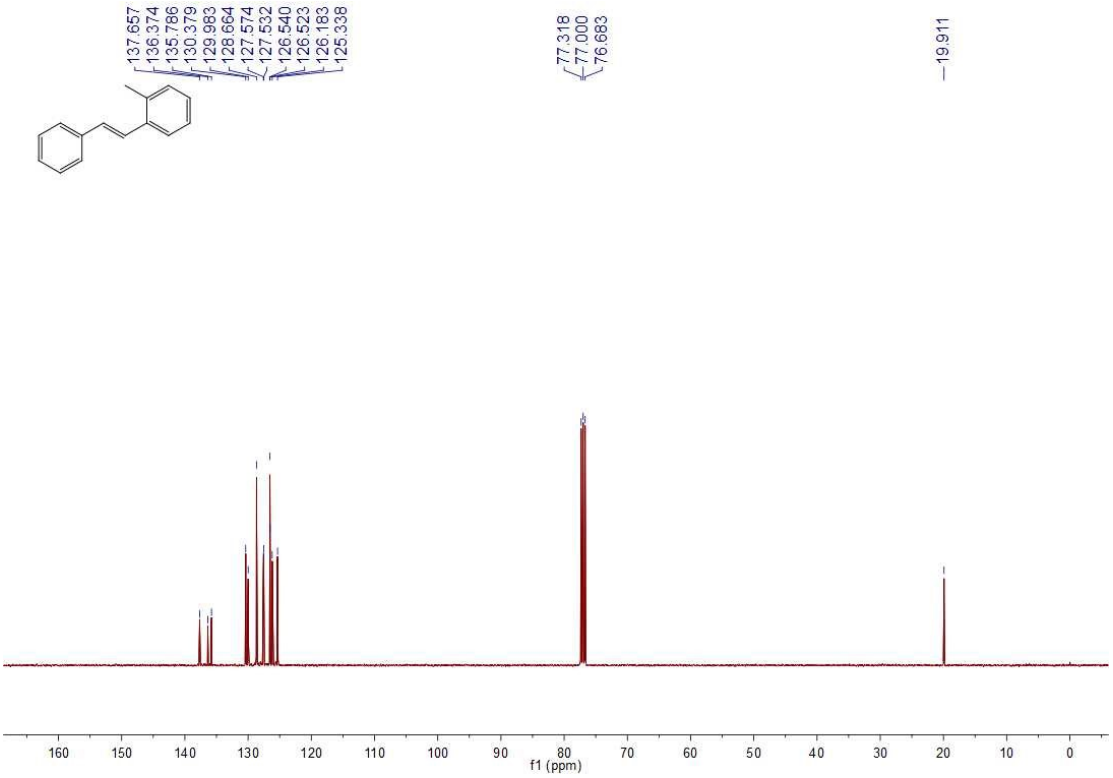
(*E*)-1-methyl-2-styrylbenzene (4a)

Figure S26. ^{1}H NMR (400 MHz, $CDCl_3$)



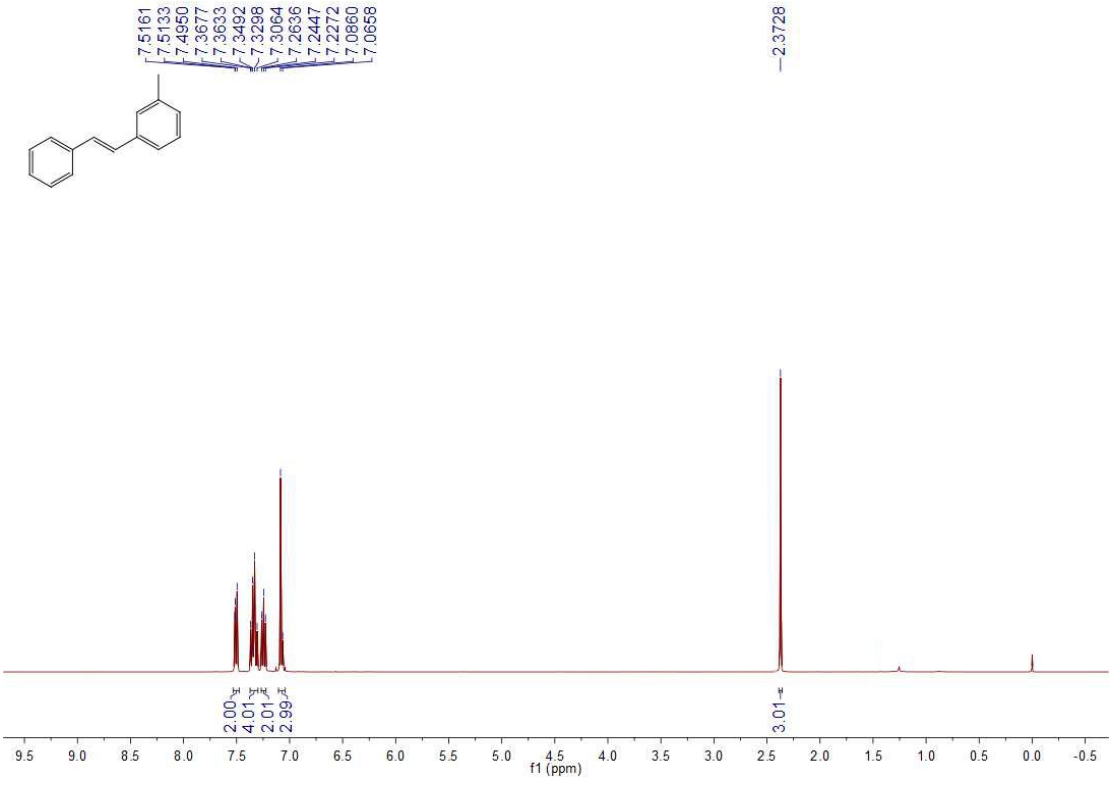
(*E*)-1-methyl-2-styrylbenzene (4a)

Figure S27. ^{13}C NMR (100 MHz, $CDCl_3$)



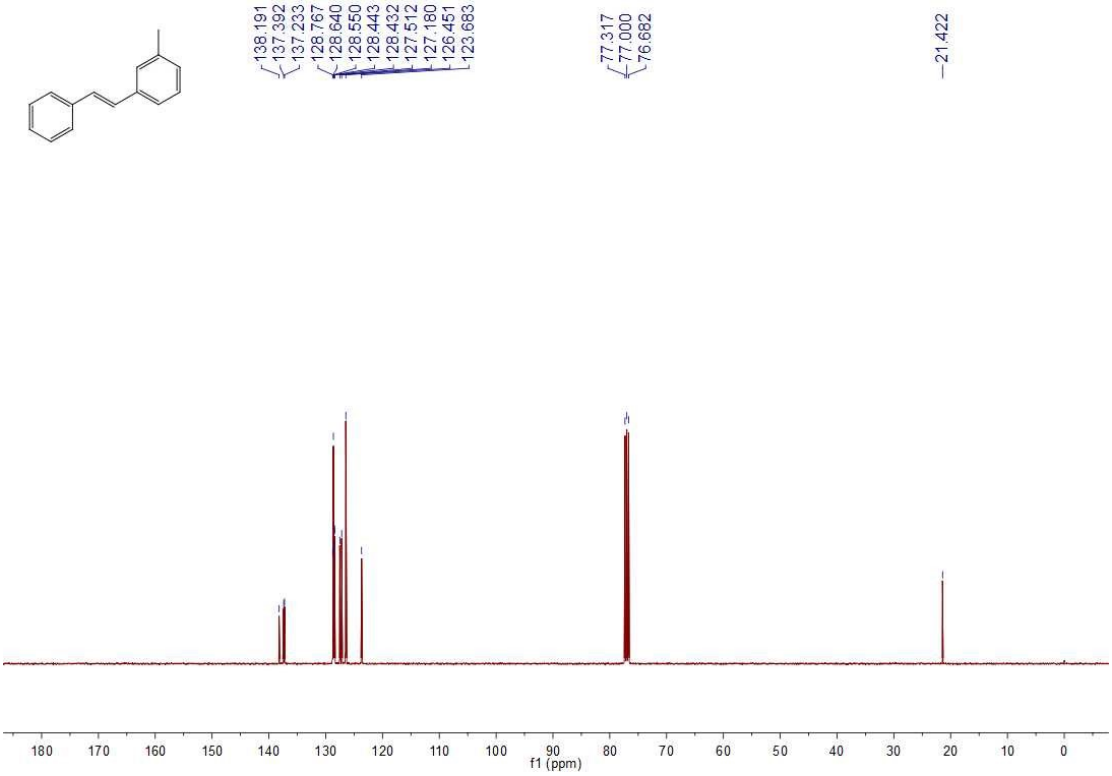
(*E*)-1-methyl-3-styrylbenzene (4b)

Figure S28. ^{1}H NMR (400 MHz, $CDCl_3$)



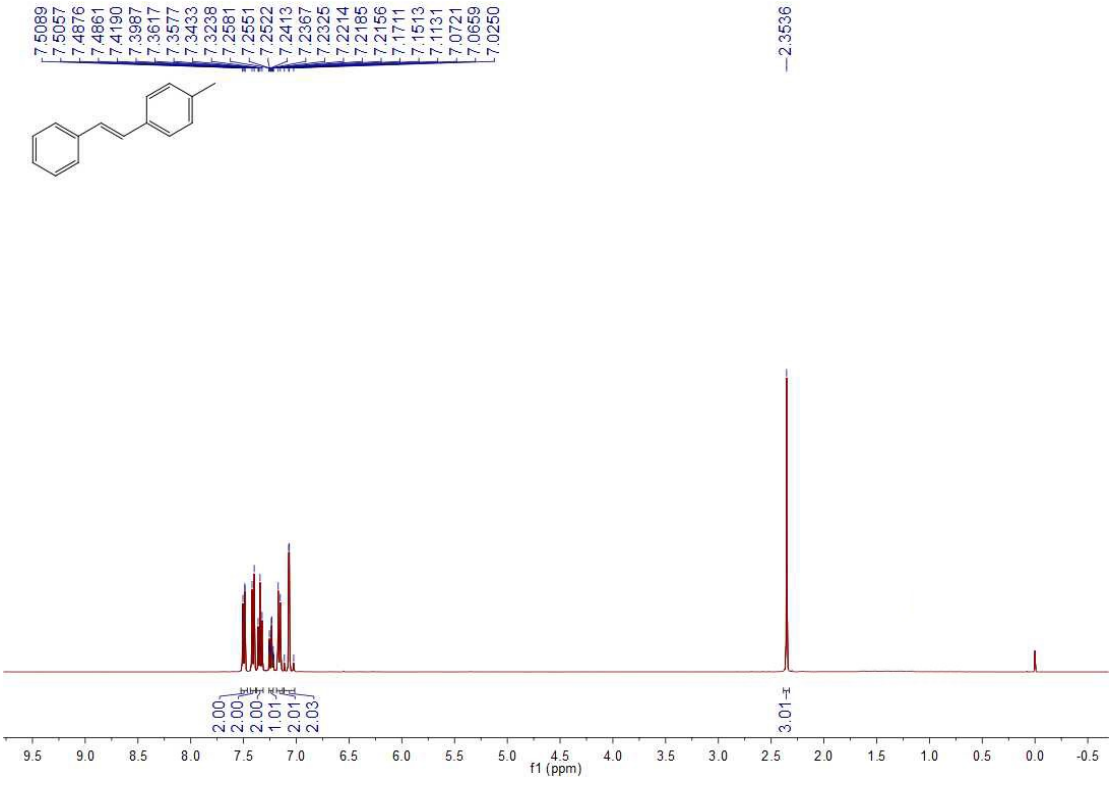
(*E*)-1-methyl-3-styrylbenzene (4b)

Figure S29. ^{13}C NMR (100 MHz, $CDCl_3$)



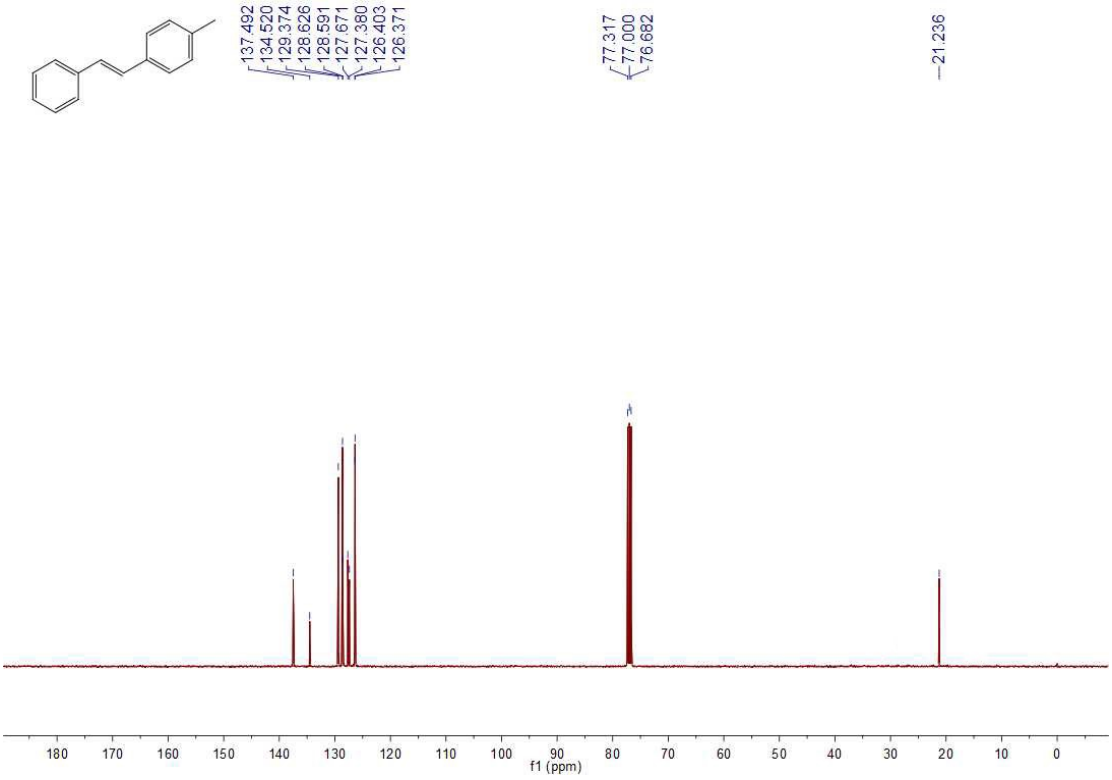
(*E*)-1-methyl-4-styrylbenzene (4c)

Figure S30. ^{1}H NMR (400 MHz, $CDCl_3$)



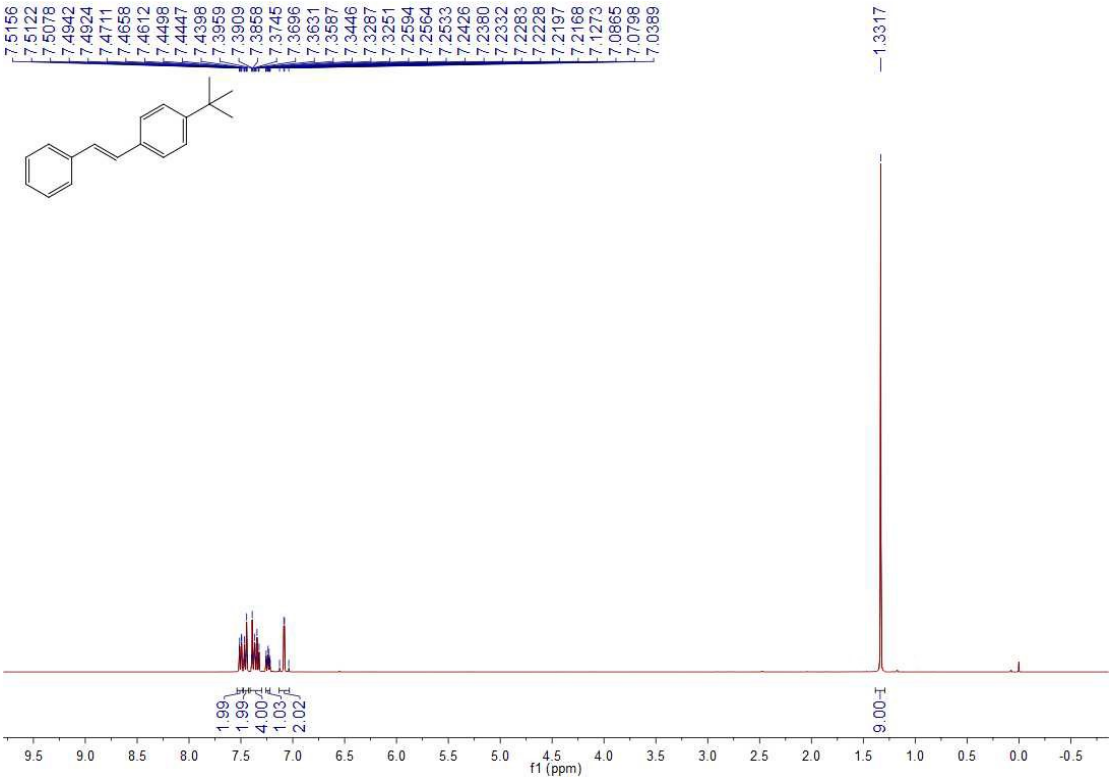
(*E*)-1-methyl-4-styrylbenzene (4c)

Figure S31. ^{13}C NMR (100 MHz, $CDCl_3$)



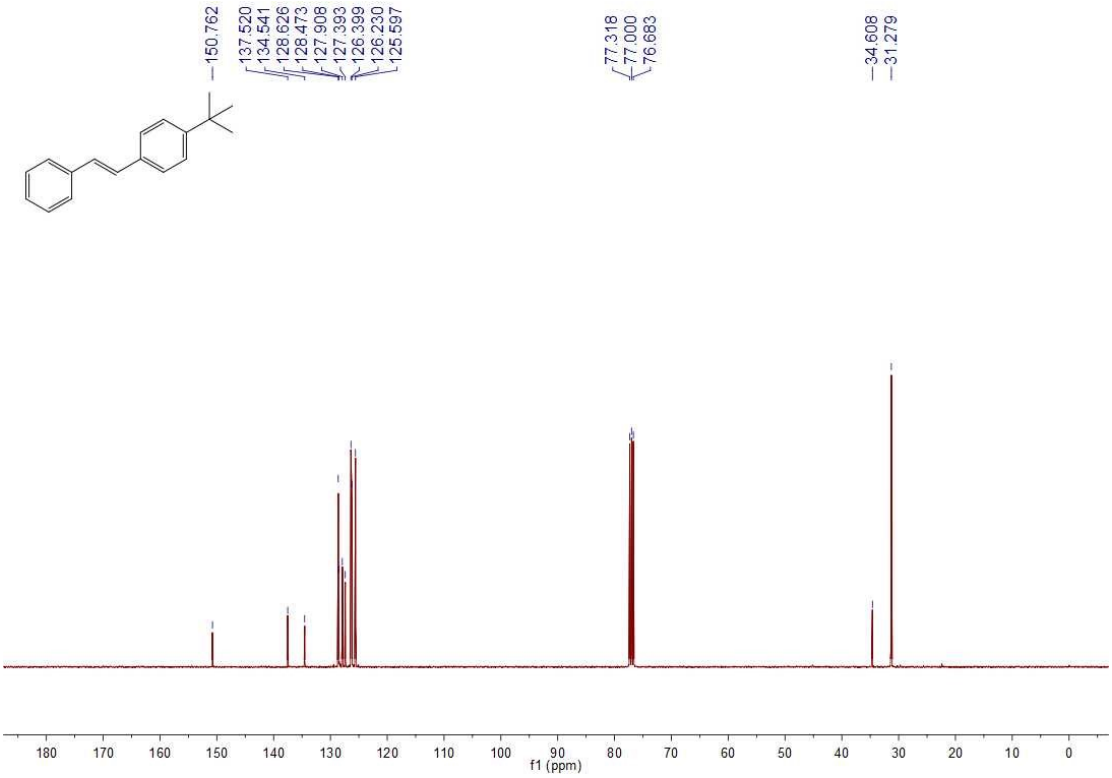
(*E*)-1-(tert-butyl)-4-styrylbenzene (4d)

Figure S32. ^{1}H NMR (400 MHz, $CDCl_3$)



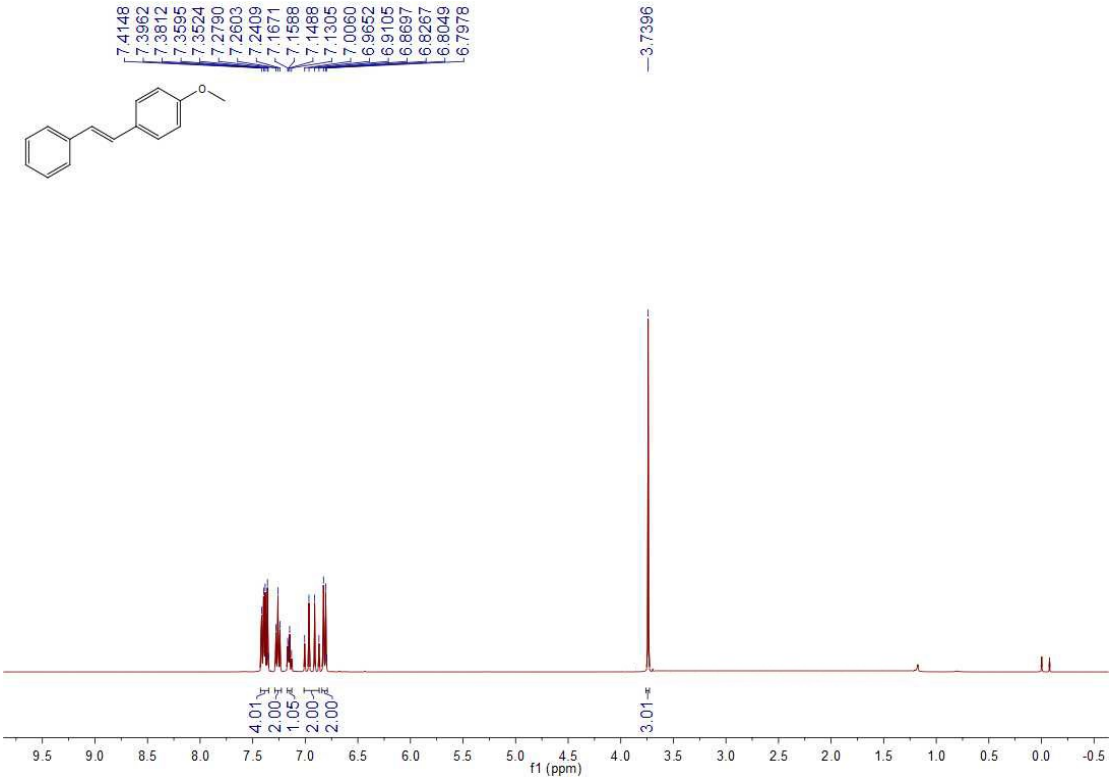
(*E*)-1-(tert-butyl)-4-styrylbenzene (4d)

Figure S33. ^{13}C NMR (100 MHz, $CDCl_3$)



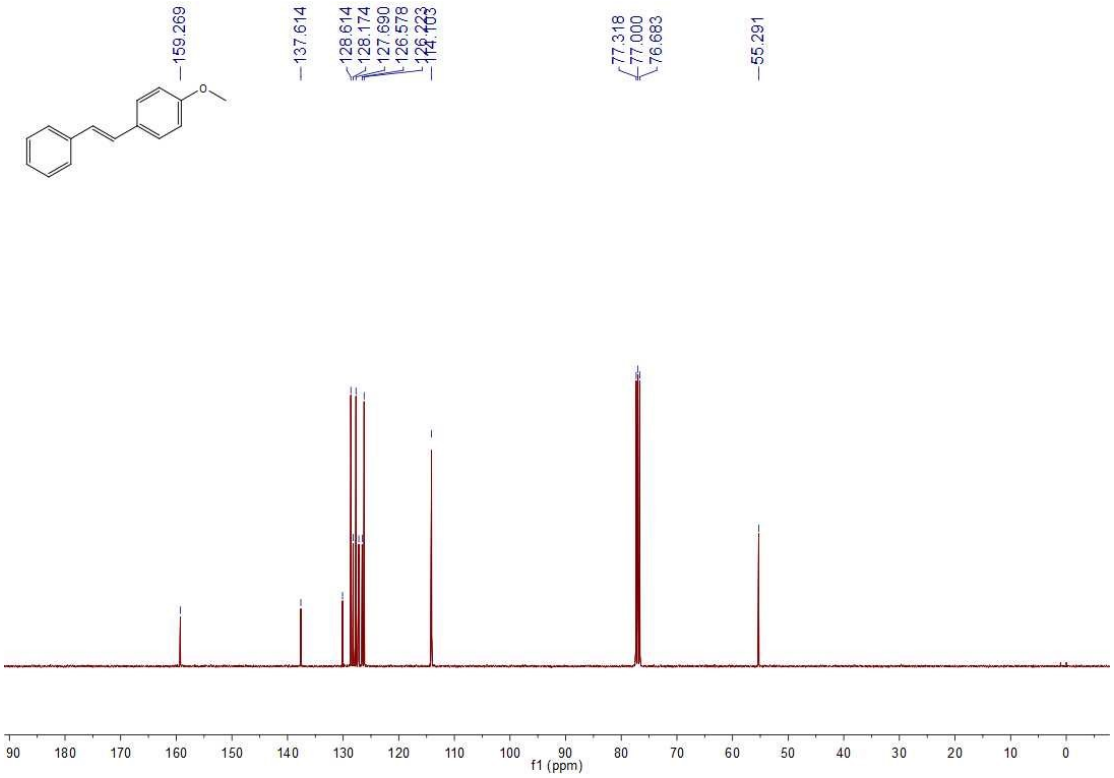
(*E*)-1-methoxy-4-styrylbenzene (4e)

Figure S34. ^{1}H NMR (400 MHz, $CDCl_3$)



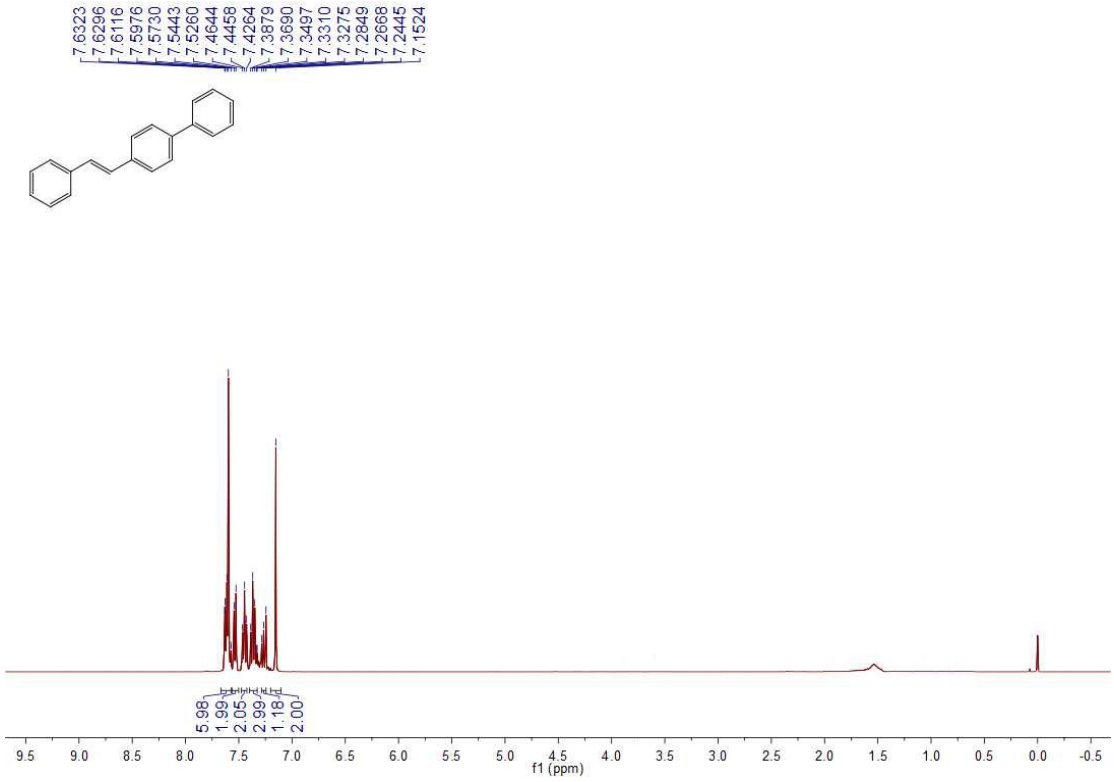
(*E*)-1-methoxy-4-styrylbenzene (4e)

Figure S35. ^{13}C NMR (100 MHz, $CDCl_3$)



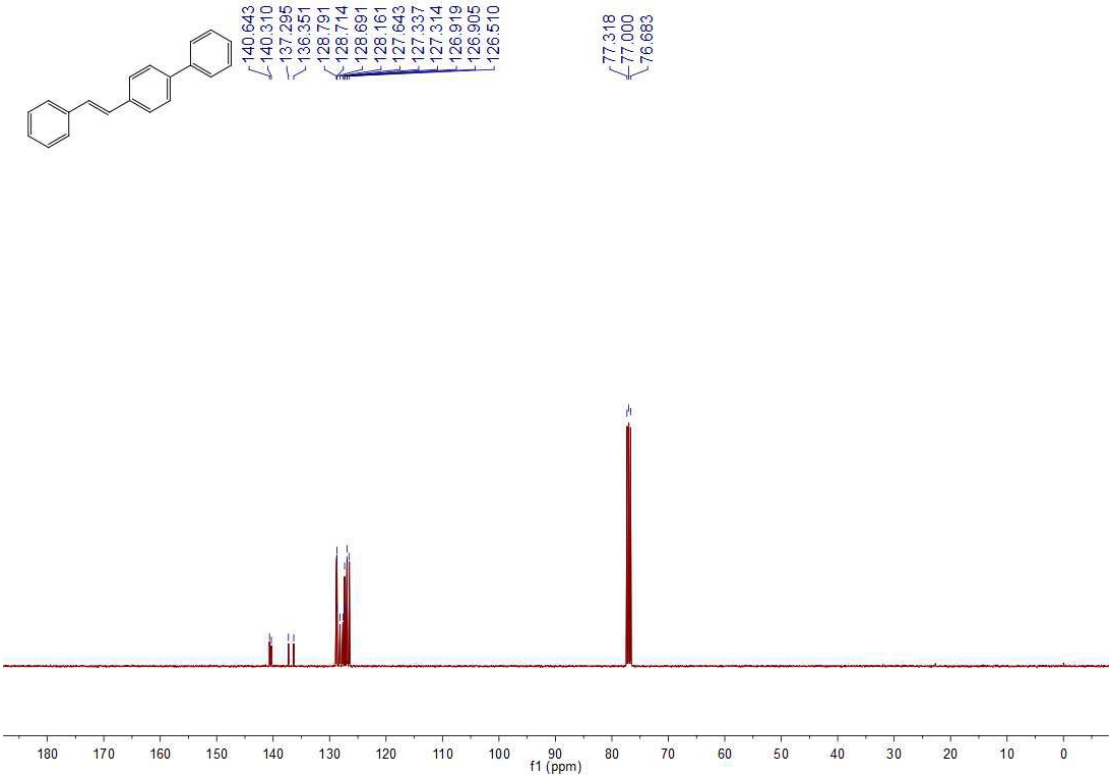
(*E*)-4-styryl-1,1'-biphenyl (4f)

Figure S36. ^{1}H NMR (400 MHz, $CDCl_3$)



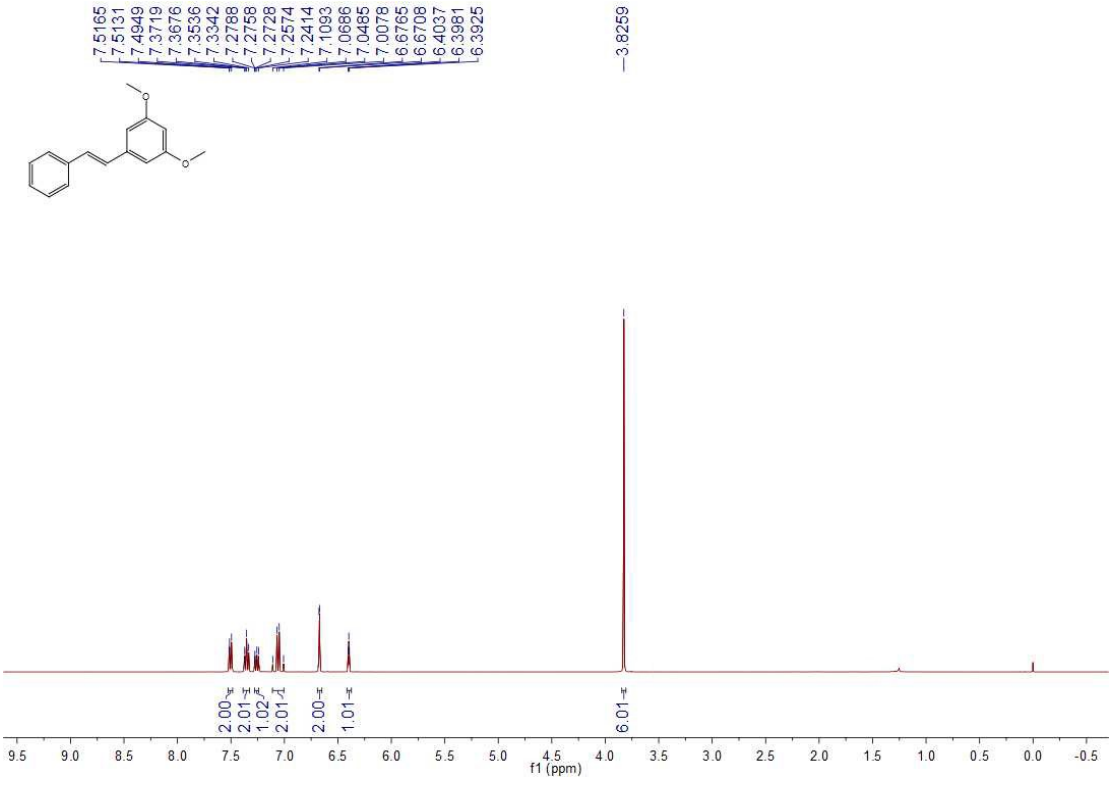
(*E*)-4-styryl-1,1'-biphenyl (4f)

Figure S37. ^{13}C NMR (100 MHz, $CDCl_3$)



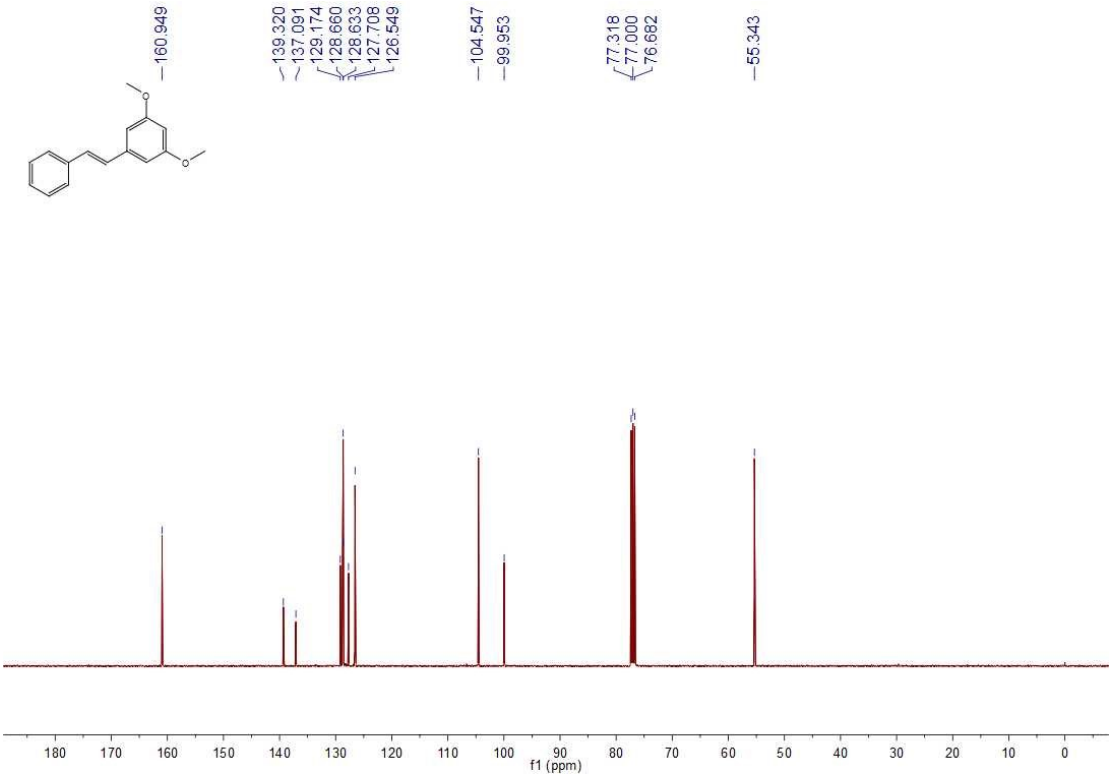
(*E*)-1,3-dimethoxy-5-styrylbenzene (4g)

Figure S38. ^{1}H NMR (400 MHz, $CDCl_3$)



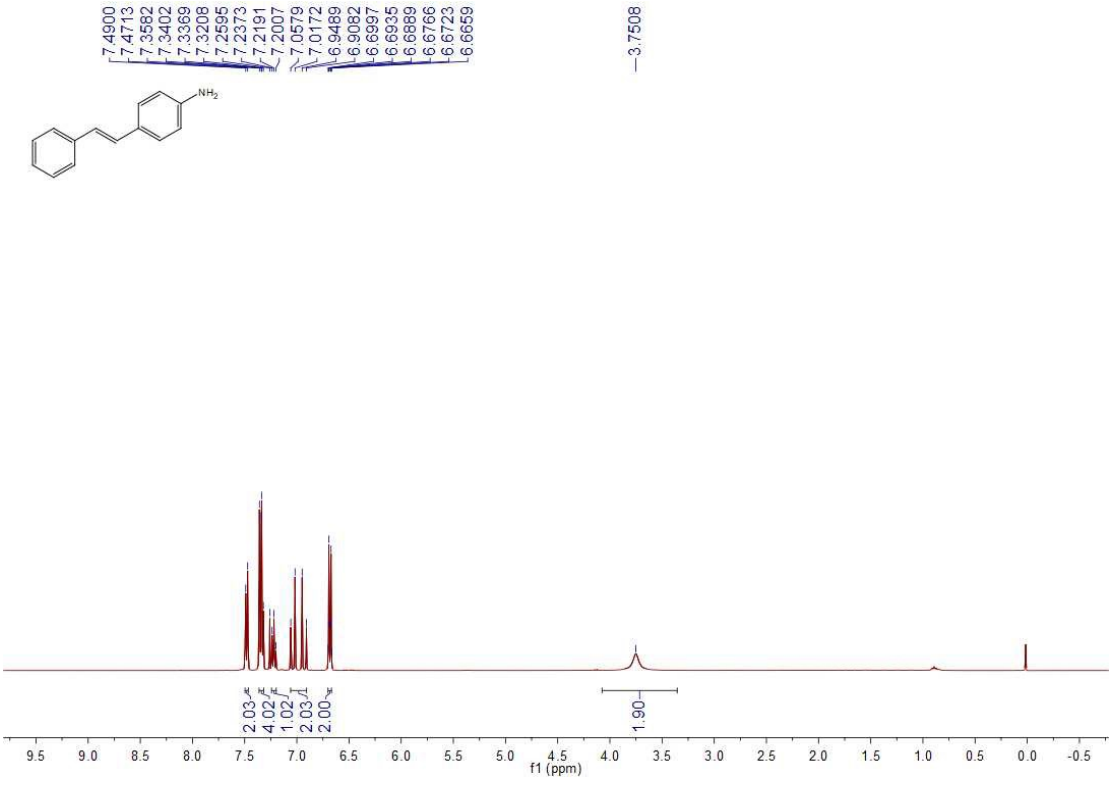
(*E*)-1,3-dimethoxy-5-styrylbenzene (4g)

Figure S39. ^{13}C NMR (100 MHz, $CDCl_3$)



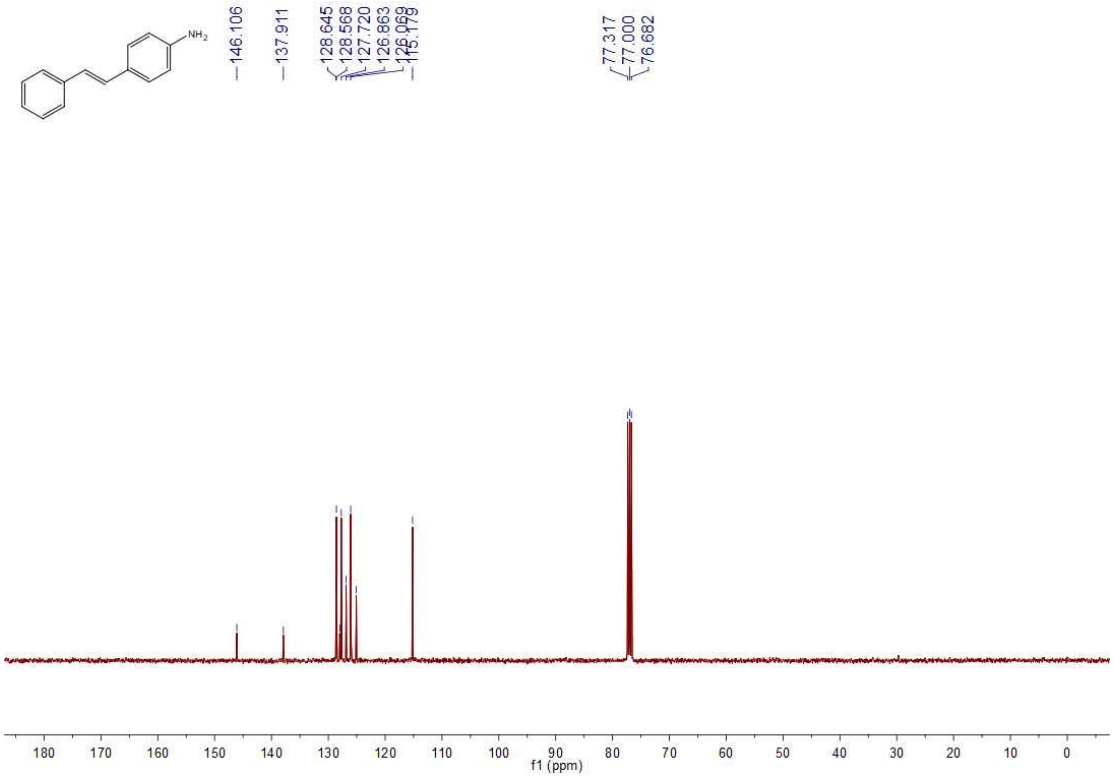
(*E*)-4-styrylaniline (4h)

Figure S40. ^{1}H NMR (400 MHz, $CDCl_3$)



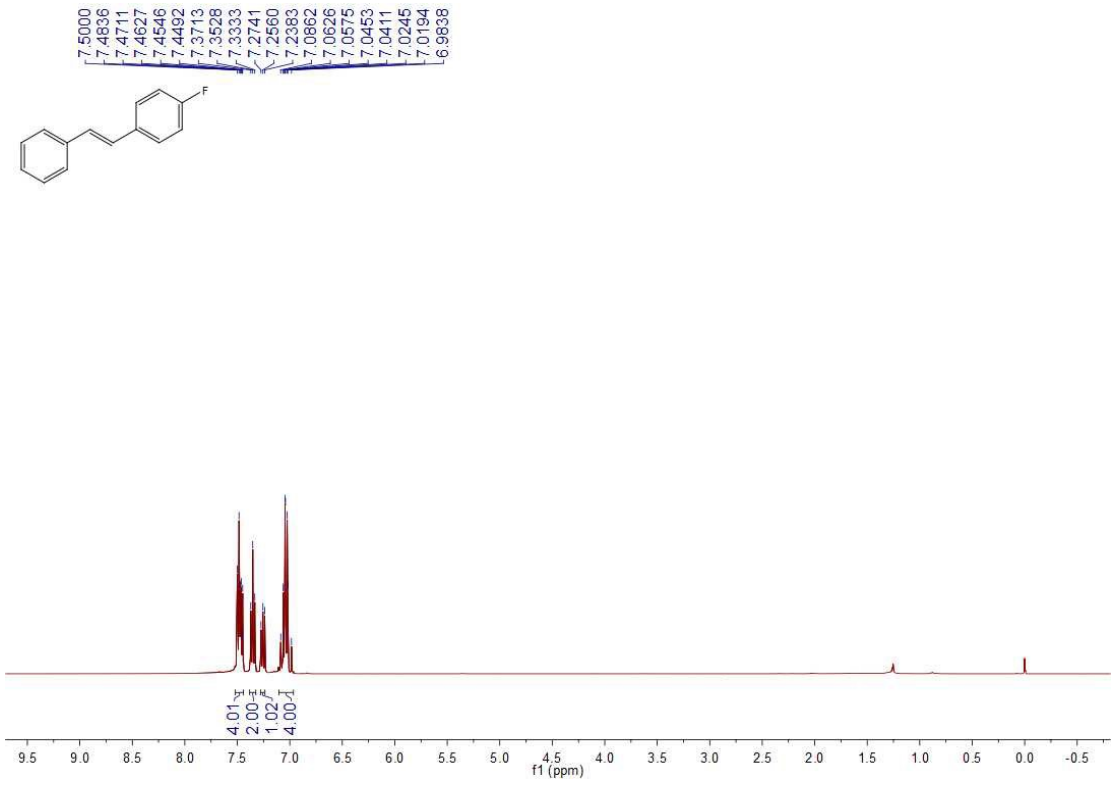
(*E*)-4-styrylaniline (4h)

Figure S41. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-1-fluoro-4-styrylbenzene (4i)

Figure S42. ^{1}H NMR (400 MHz, $CDCl_3$)



(*E*)-1-fluoro-4-styrylbenzene (4i)

Figure S43. ^{13}C NMR (100 MHz, $CDCl_3$)

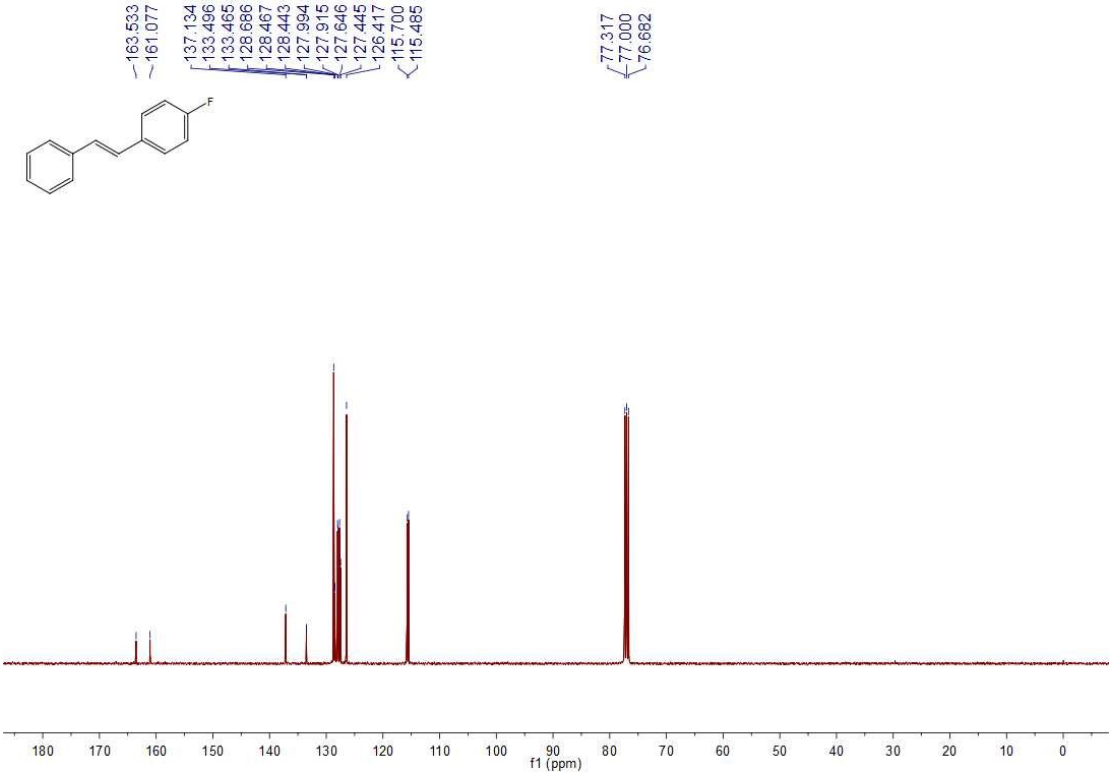
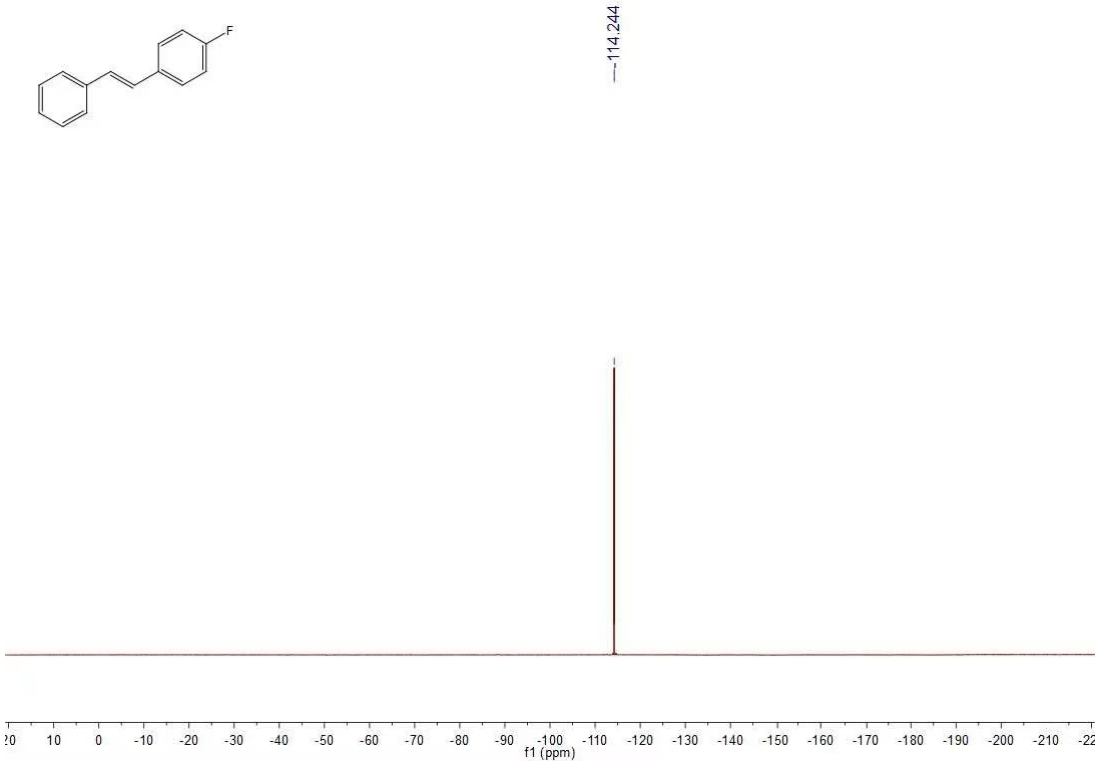


Figure S44. ^{19}F NMR (376 MHz, $CDCl_3$)



(*E*)-1-styryl-4-(trifluoromethyl)benzene (4j)

Figure S45. ^{1}H NMR (400 MHz, $CDCl_3$)

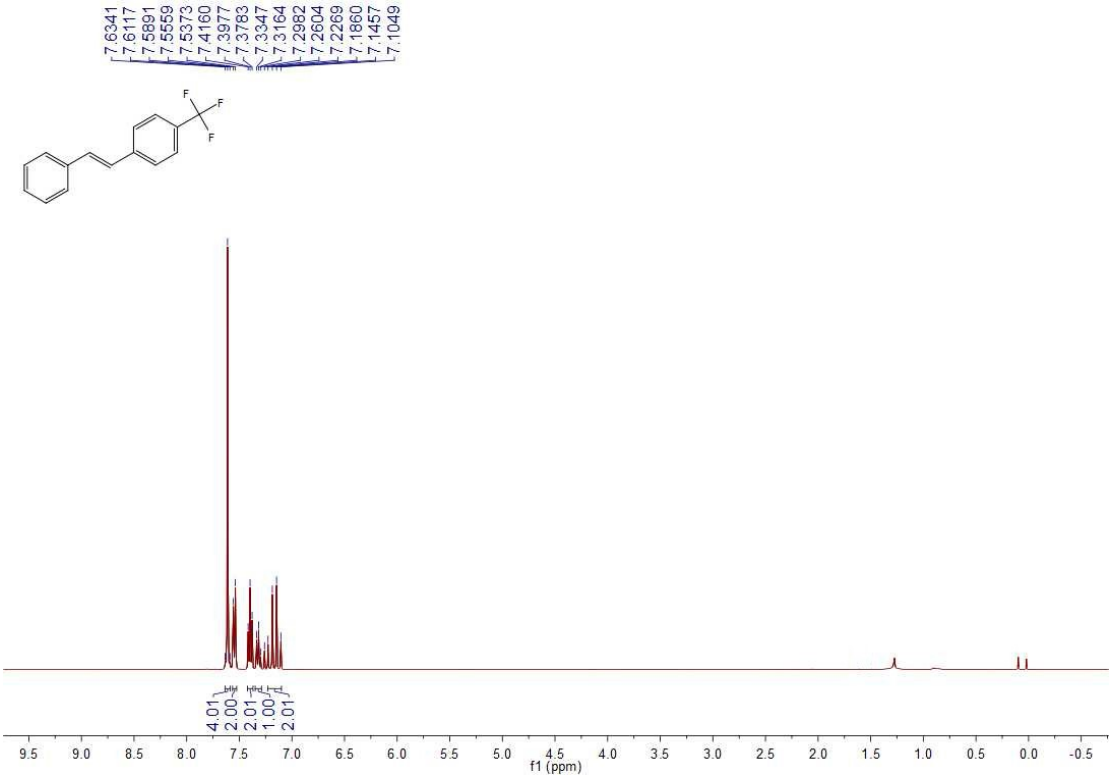
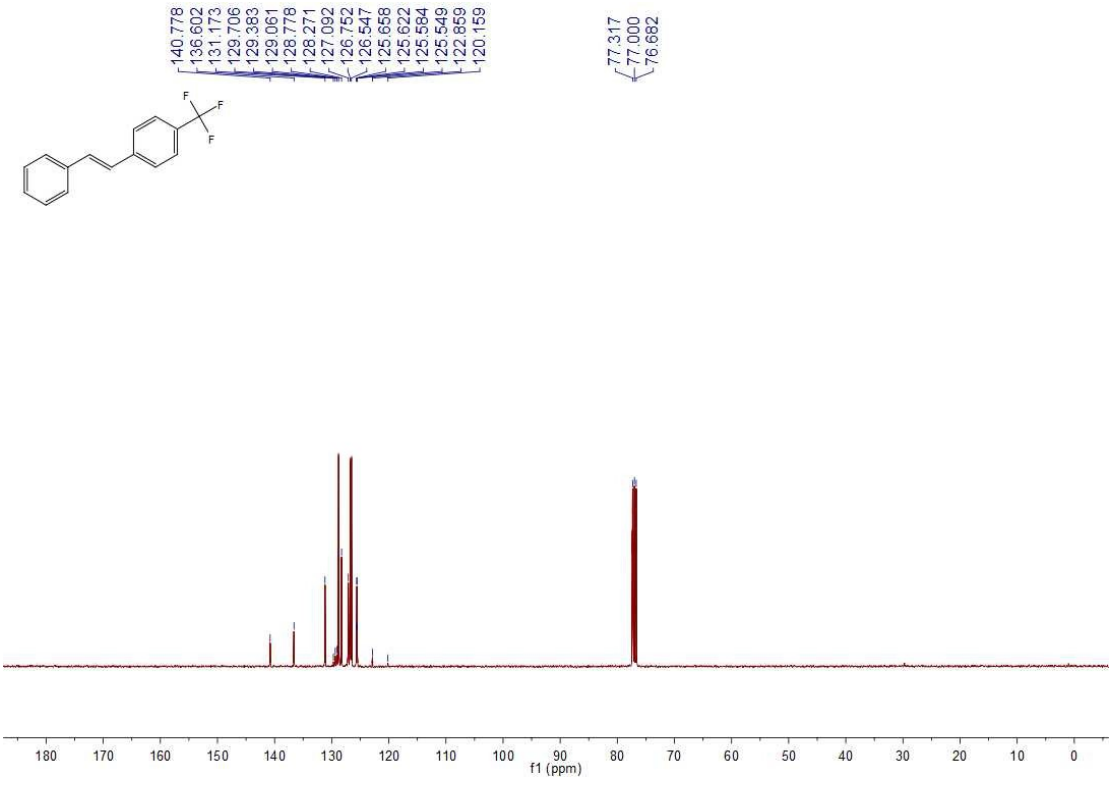
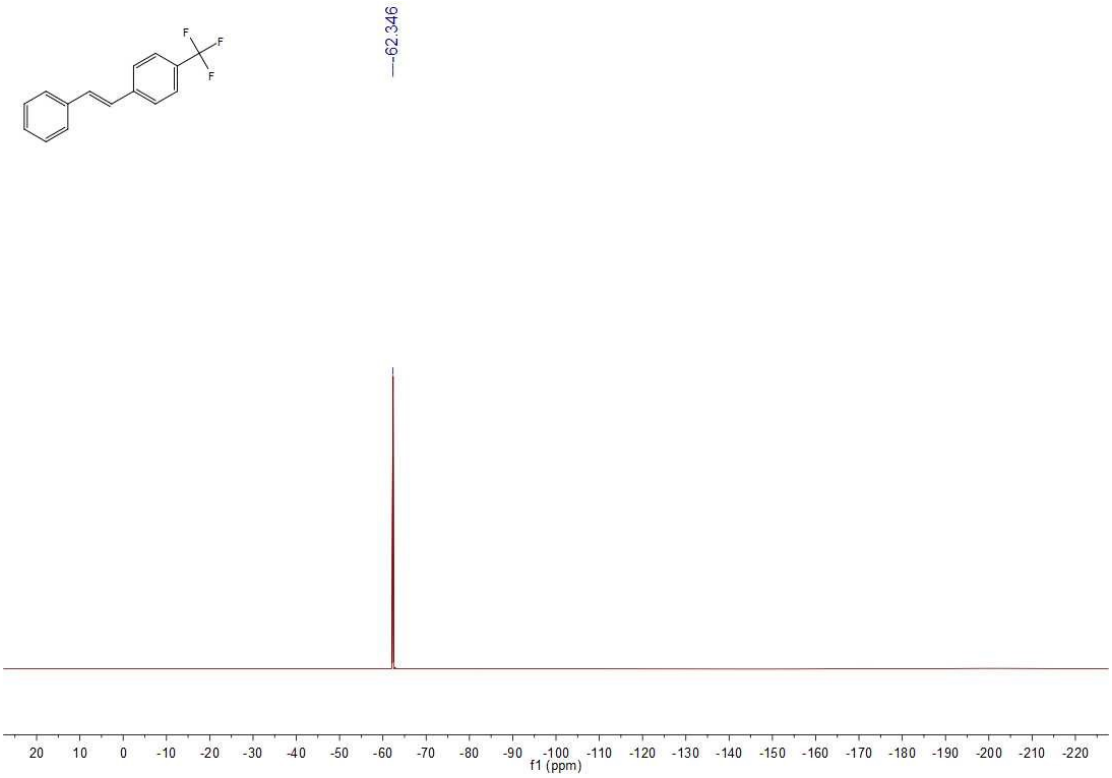


Figure S46. ^{13}C NMR (100 MHz, $CDCl_3$)



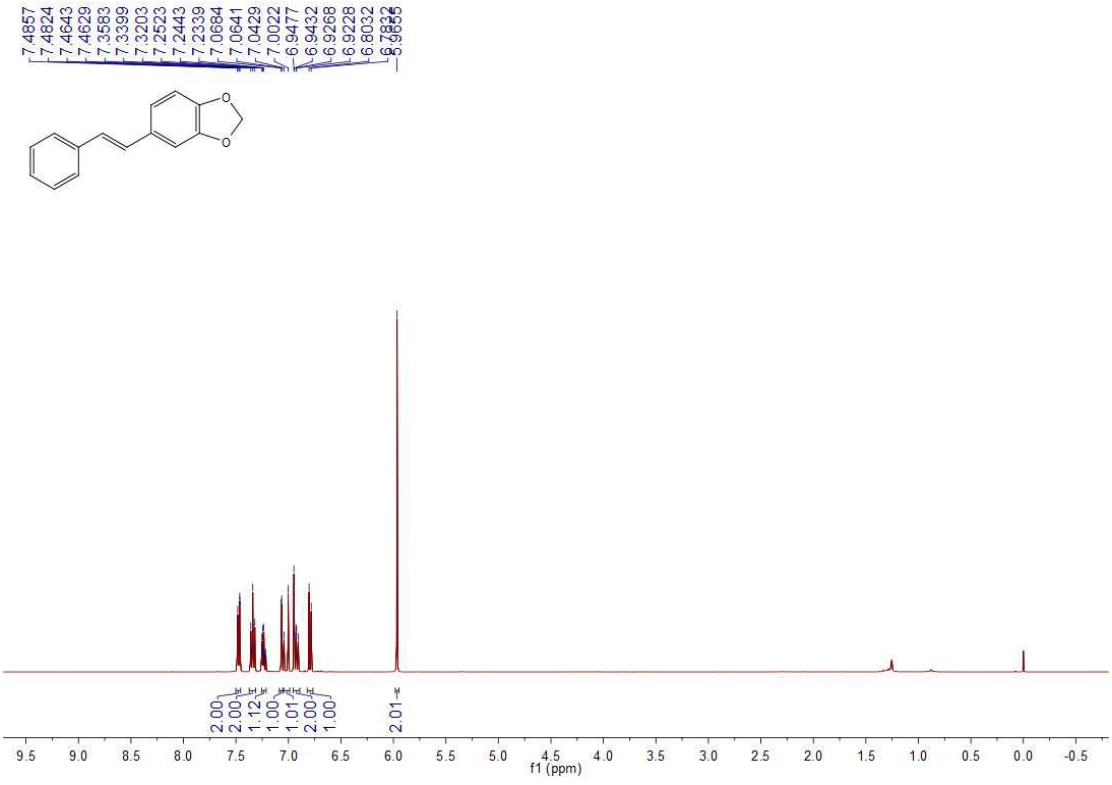
(*E*)-1-styryl-4-(trifluoromethyl)benzene (4j)

Figure S47. ^{19}F NMR (376 MHz, $CDCl_3$)



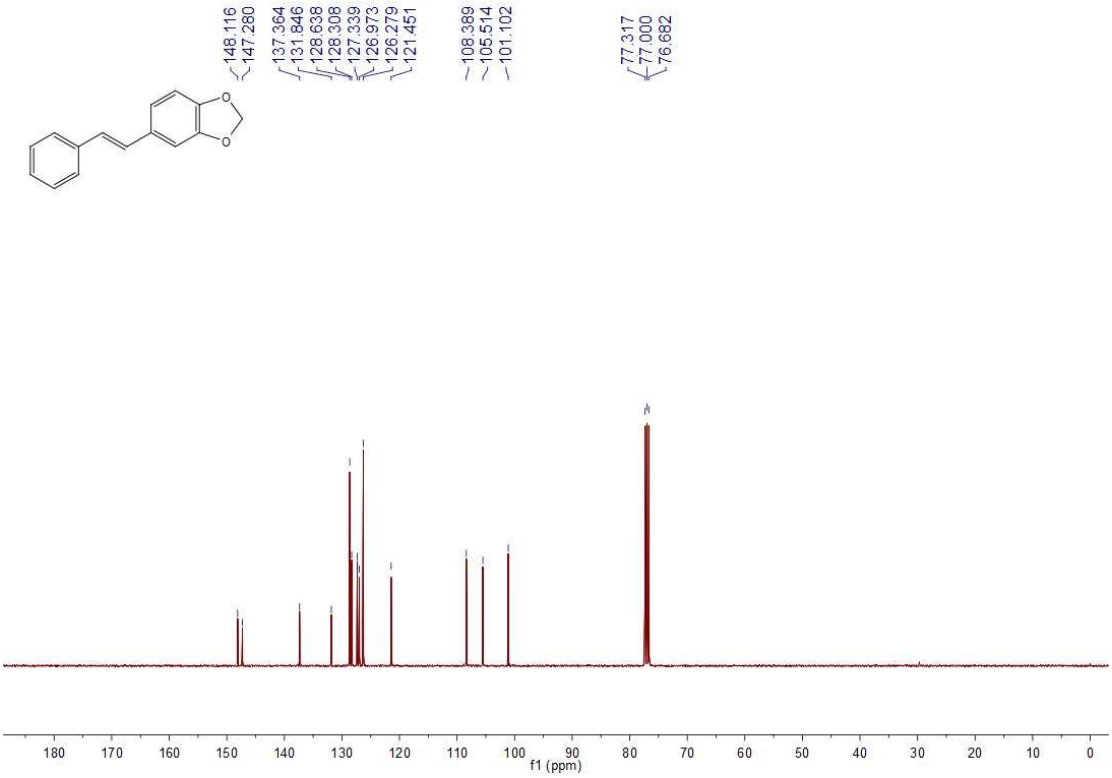
(*E*)-5-styrylbenzo[d][1,3]dioxole (4k)

Figure S48. ^{1}H NMR (400 MHz, $CDCl_3$)



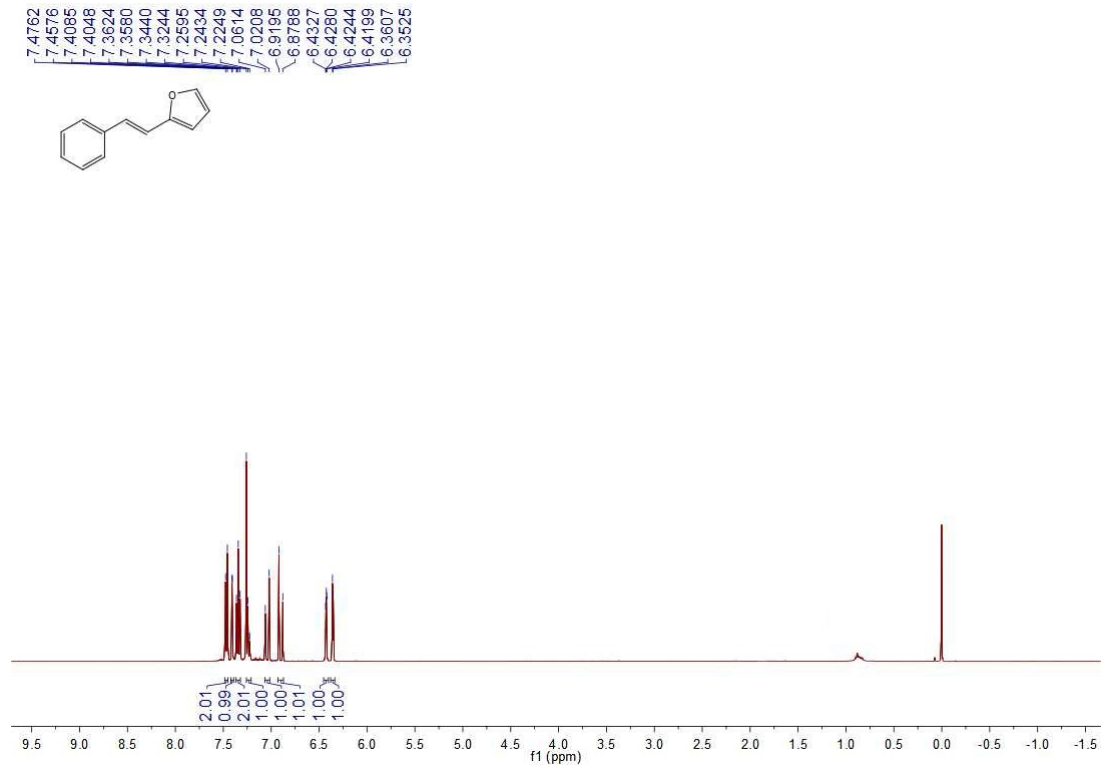
(*E*)-5-styrylbenzo[d][1,3]dioxole (4k)

Figure S49. ^{13}C NMR (100 MHz, $CDCl_3$)



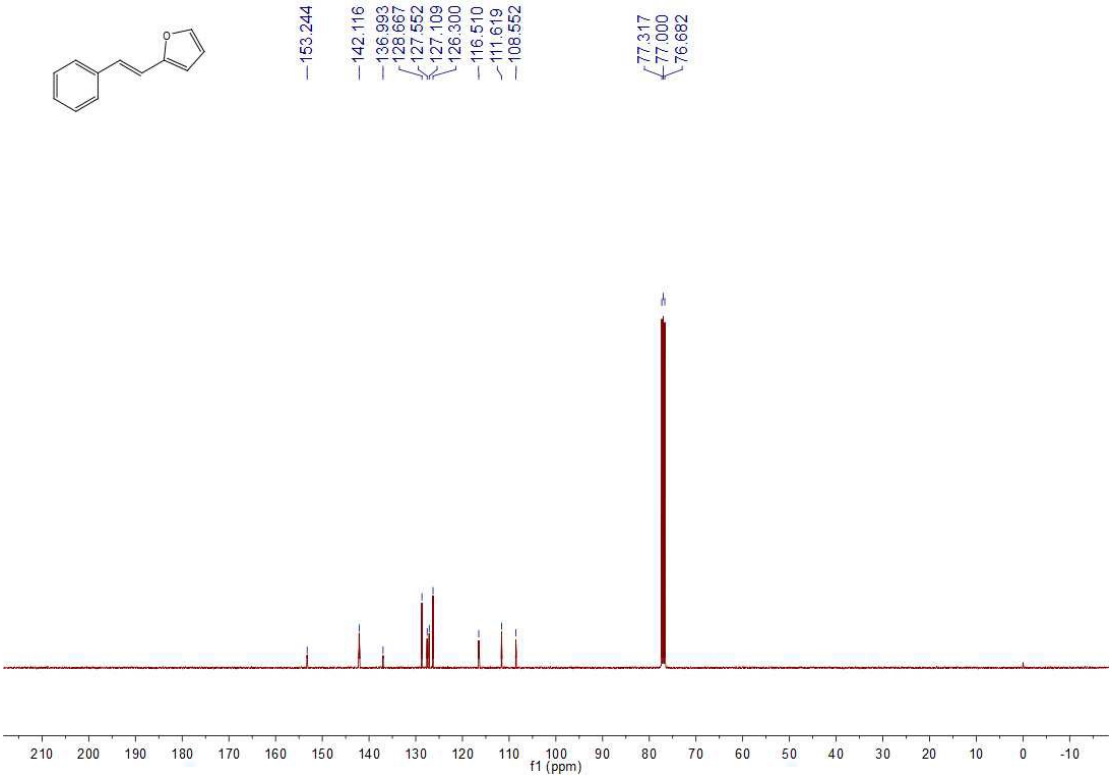
(*E*)-2-styrylfuran (4l)

Figure S50. ^{1}H NMR (400 MHz, $CDCl_3$)



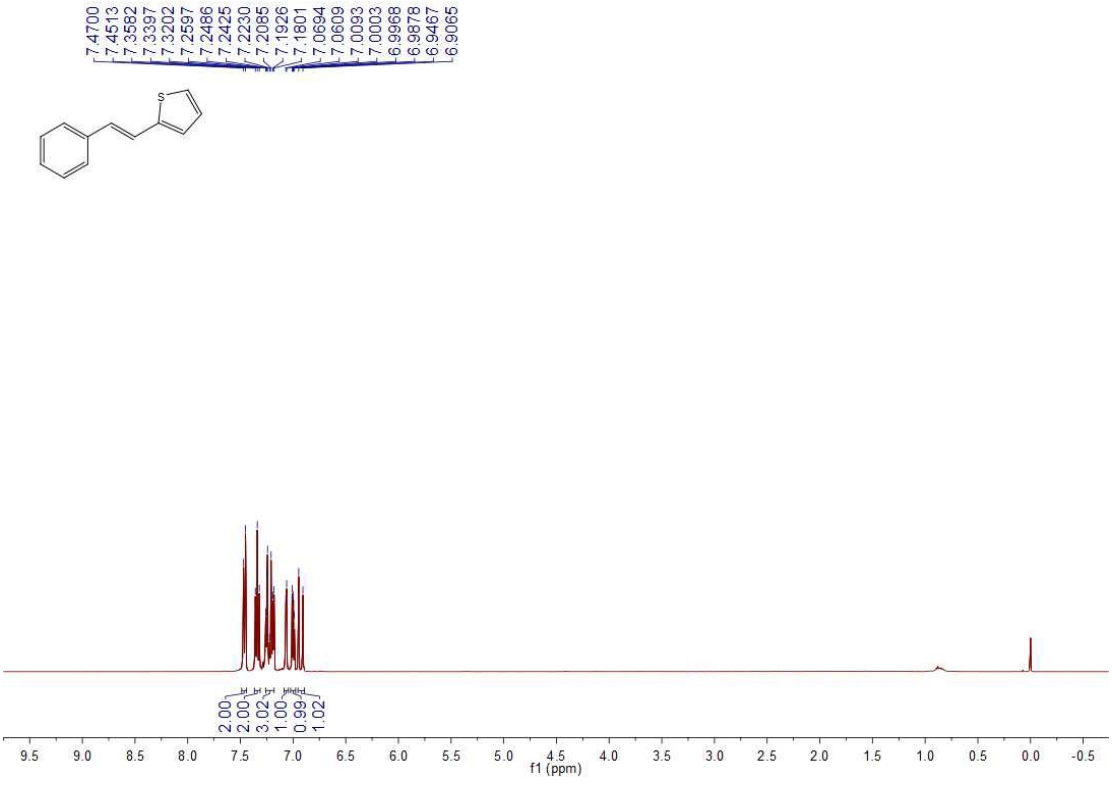
(*E*)-2-styrylfuran (4l)

Figure S51. ^{13}C NMR (100 MHz, $CDCl_3$)



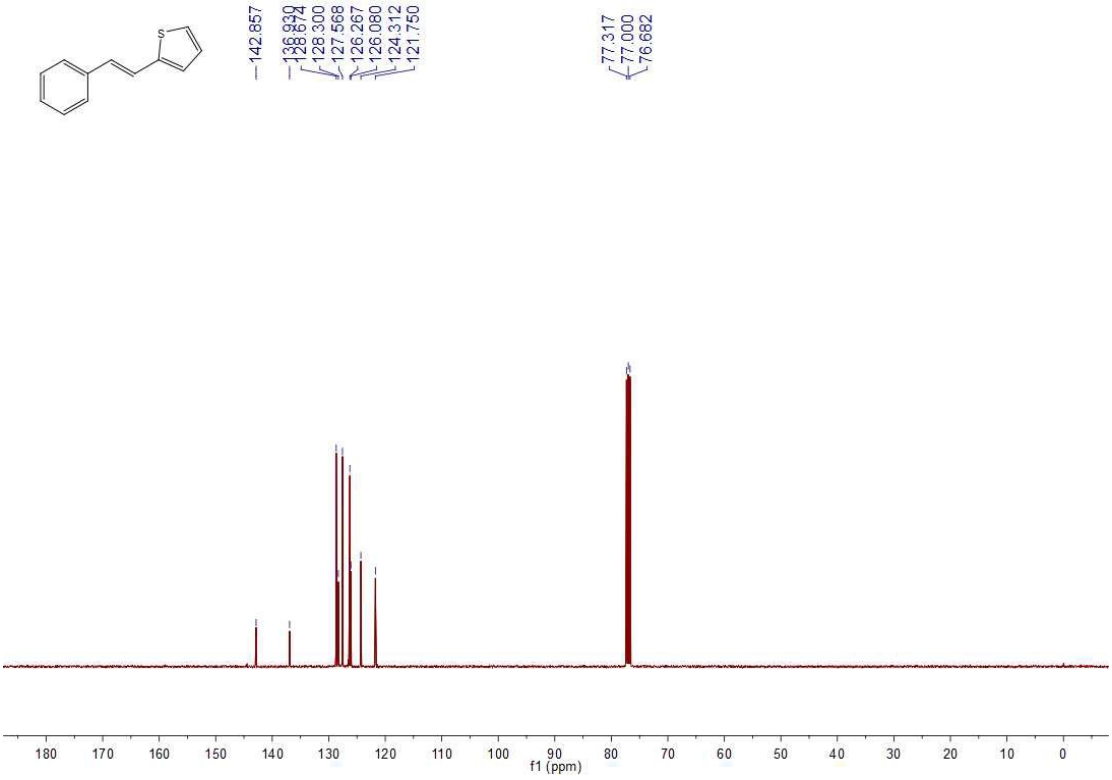
(*E*)-2-styrylthiophene (4m)

Figure S52. ^{1}H NMR (400 MHz, $CDCl_3$)



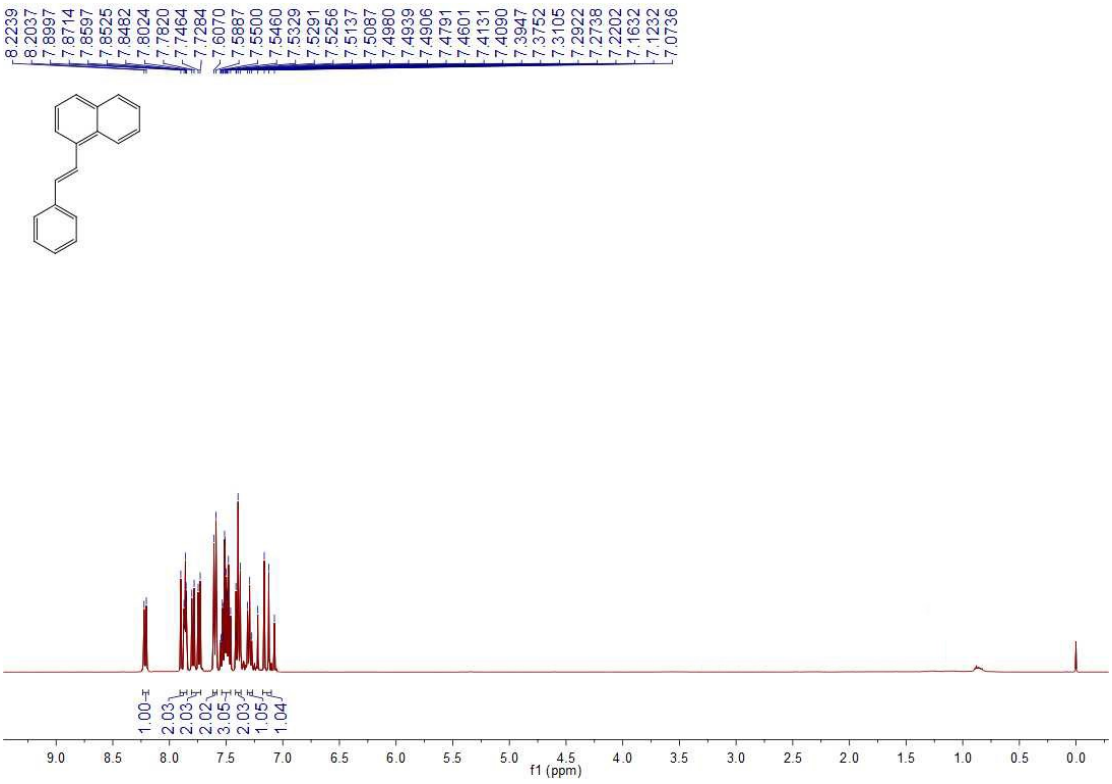
(*E*)-2-styrylthiophene (4m)

Figure S53. ^{13}C NMR (100 MHz, $CDCl_3$)



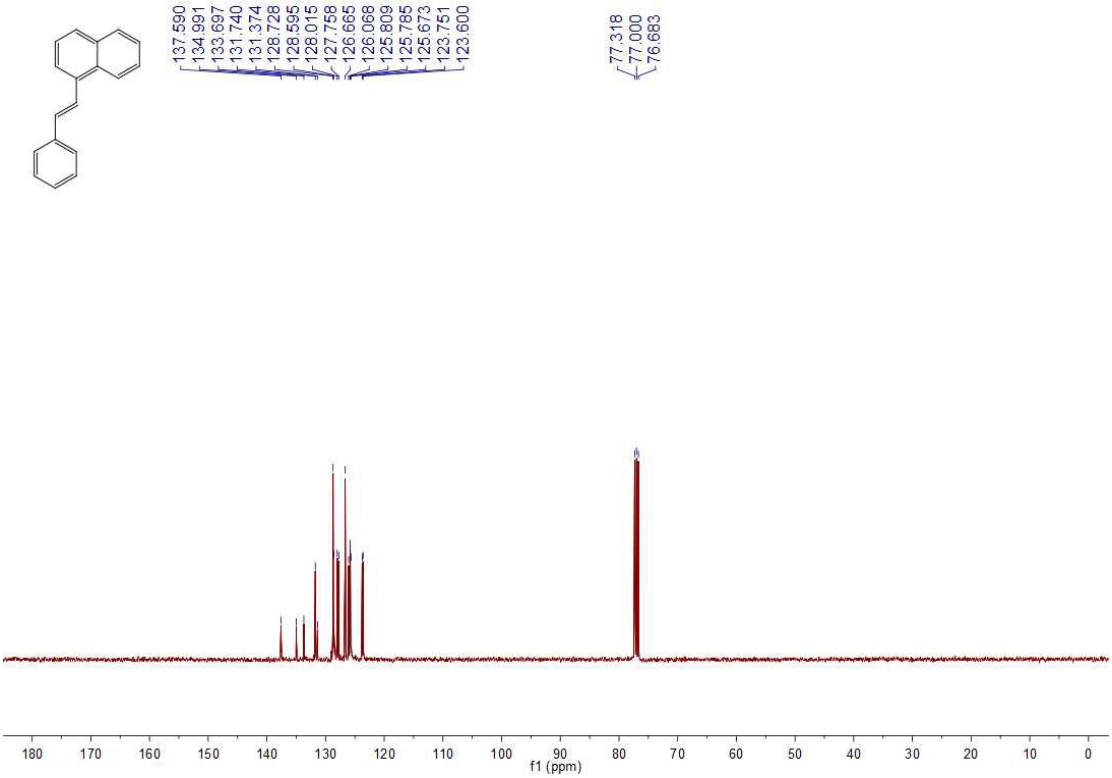
(*E*)-1-styrylnaphthalene (4n)

Figure S54. ^{1}H NMR (400 MHz, $CDCl_3$)



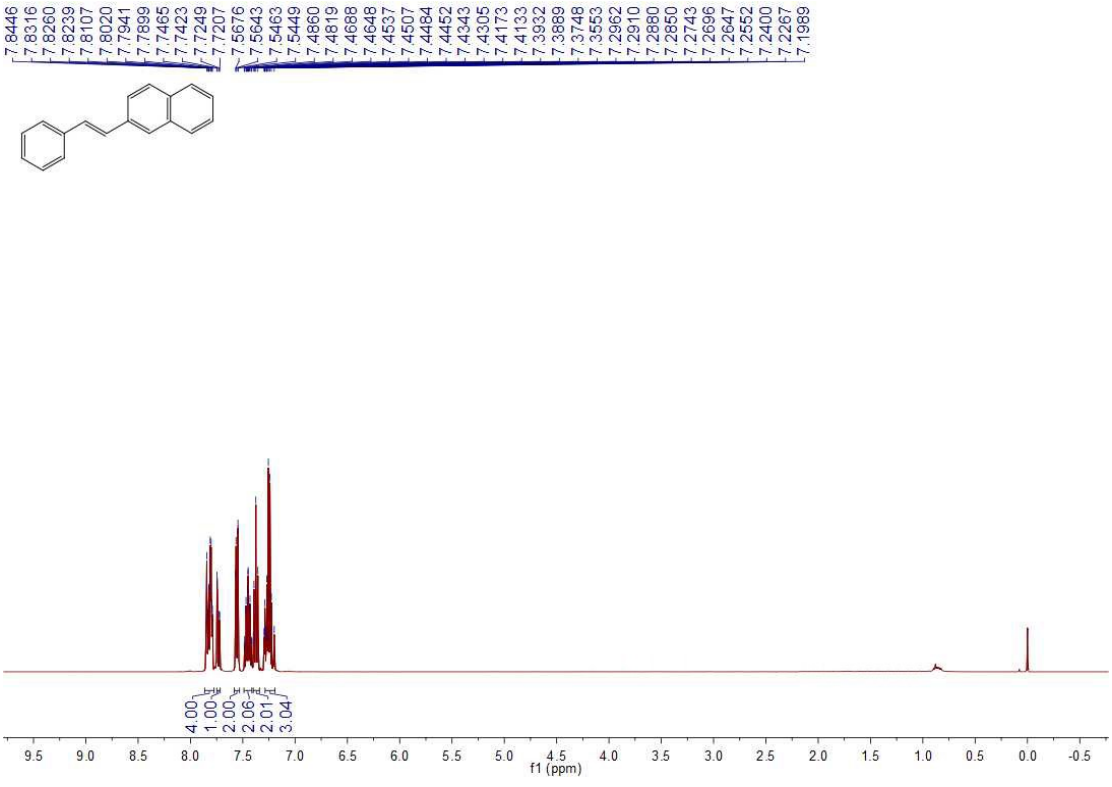
(*E*)-1-styrylnaphthalene (4n)

Figure S55. ^{13}C NMR (100 MHz, $CDCl_3$)



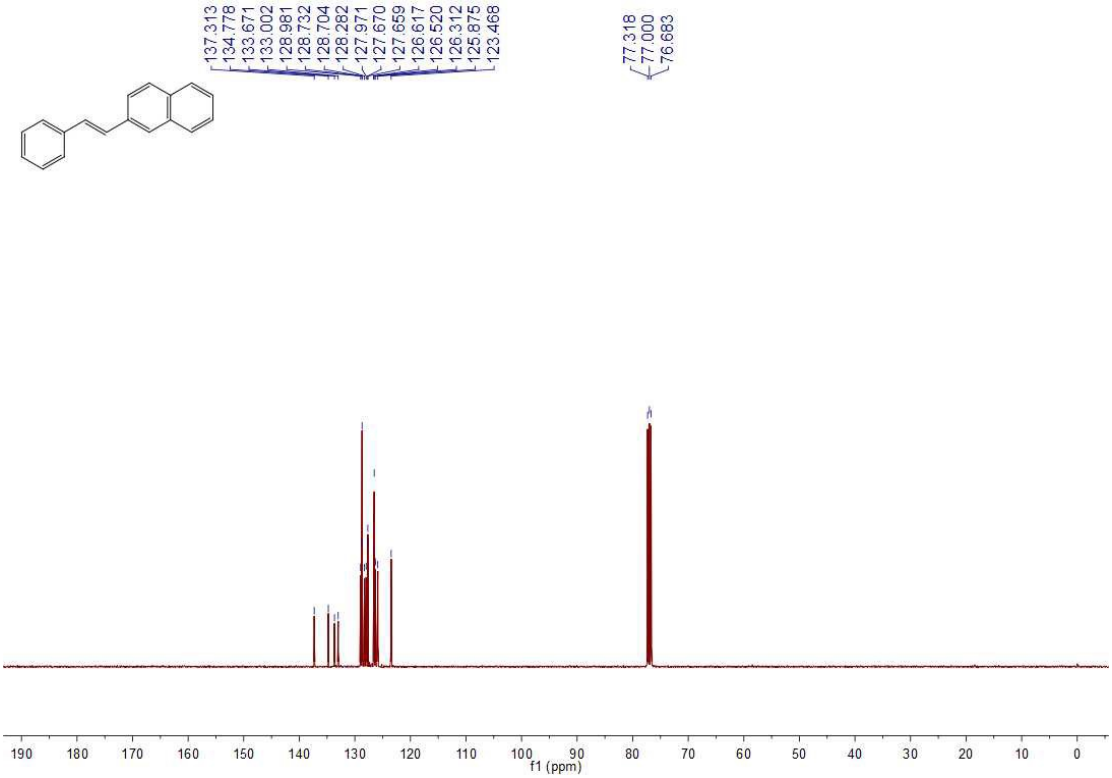
(*E*)-2-styrylnaphthalene (4o)

Figure S56. ^{1}H NMR (400 MHz, $CDCl_3$)



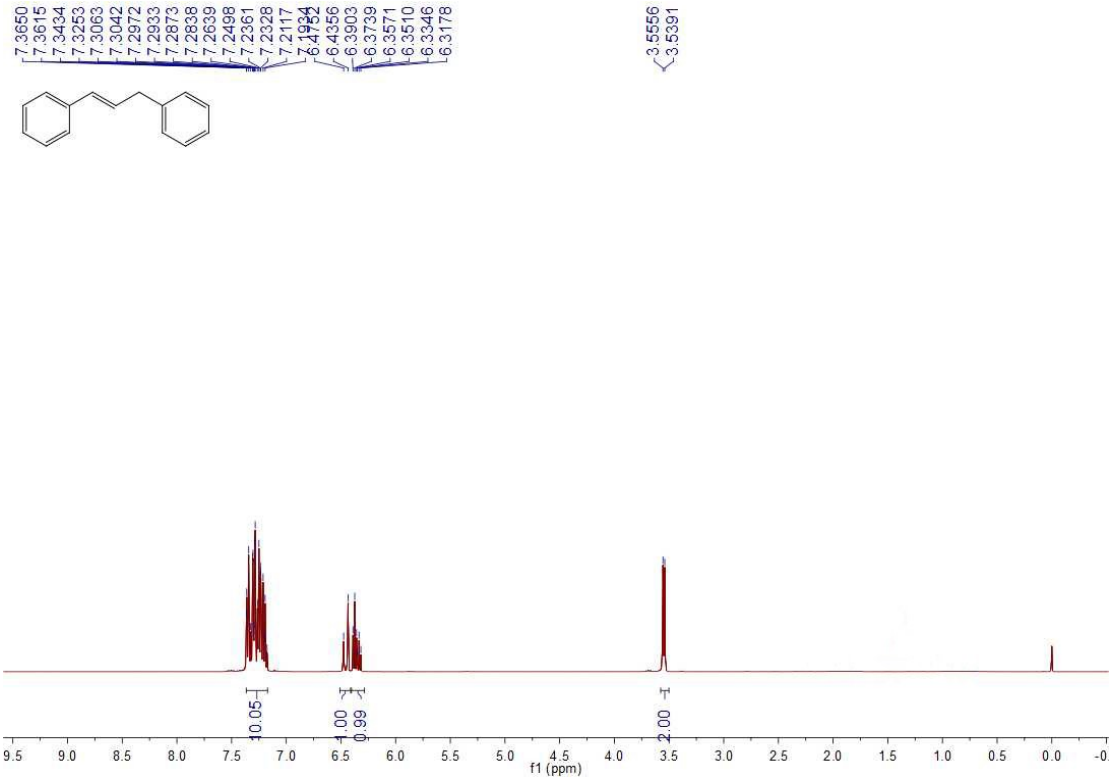
(*E*)-2-styrylnaphthalene (4o)

Figure S57. ^{13}C NMR (100 MHz, $CDCl_3$)



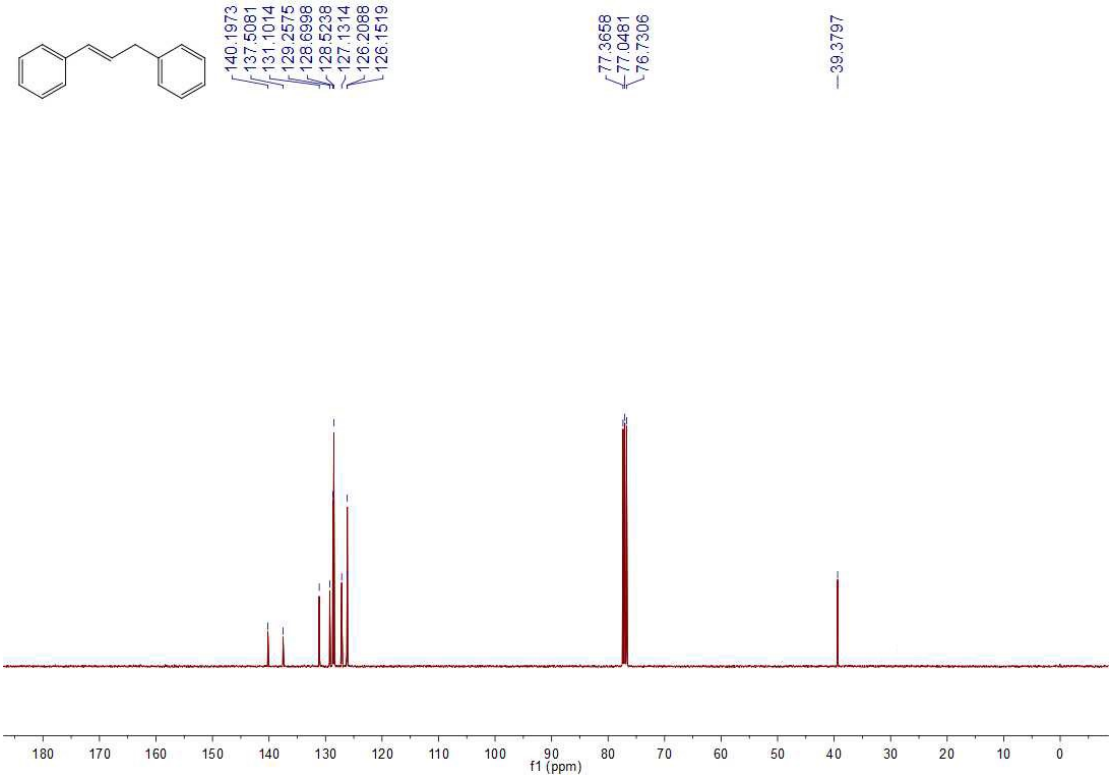
(*E*)-prop-1-ene-1,3-diyldibenzene (4p)

Figure S58. ^{1}H NMR (400 MHz, $CDCl_3$)



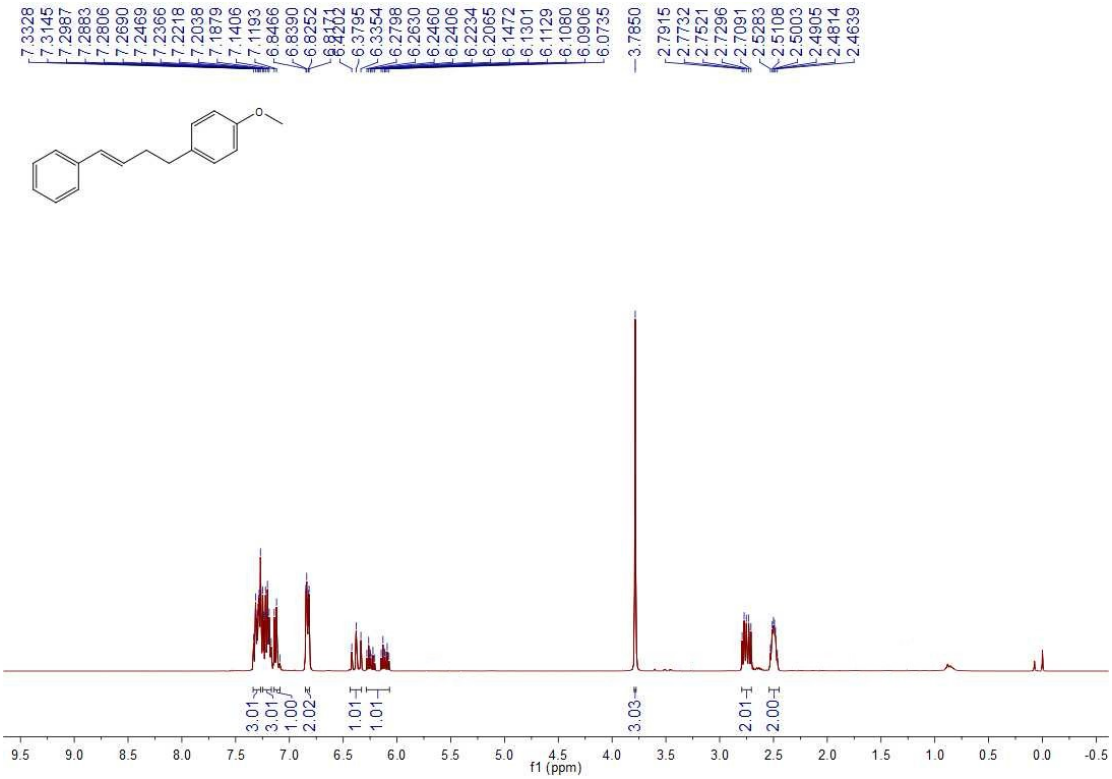
(*E*)-prop-1-ene-1,3-diyldibenzene (4p)

Figure S59. ^{13}C NMR (100 MHz, $CDCl_3$)



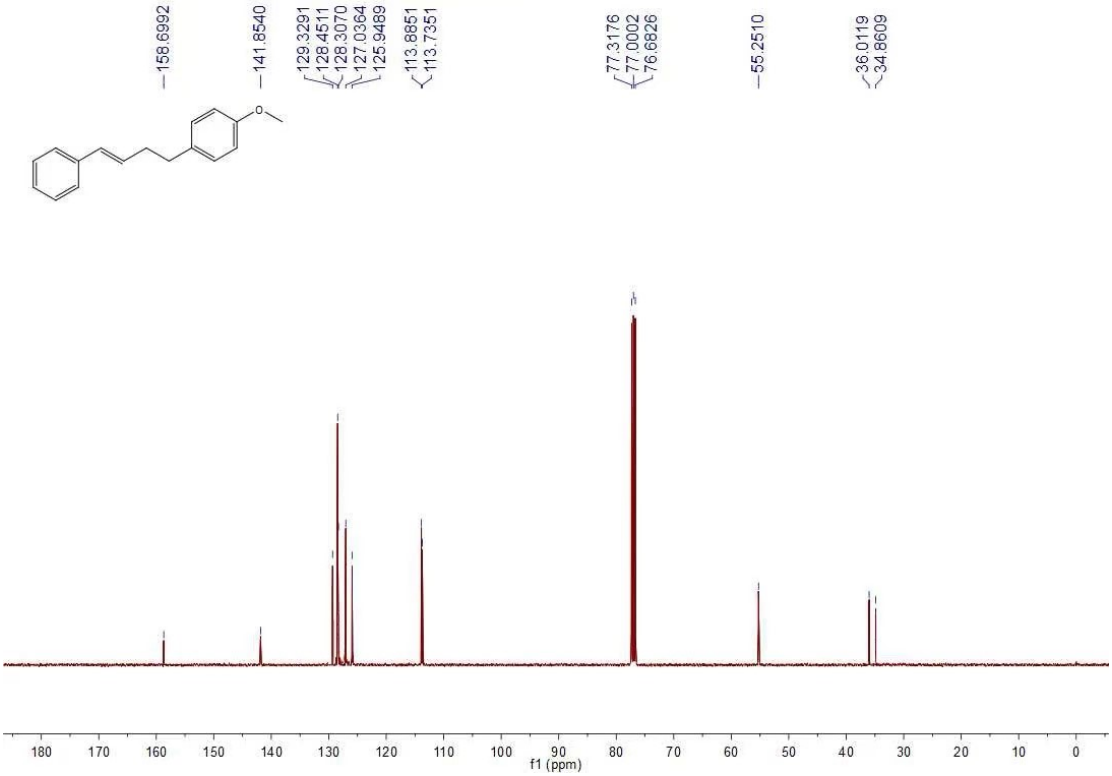
(*E*)-1-methoxy-4-(4-phenylbut-3-en-1-yl)benzene (4q)

Figure S60. ^{1}H NMR (400 MHz, $CDCl_3$)



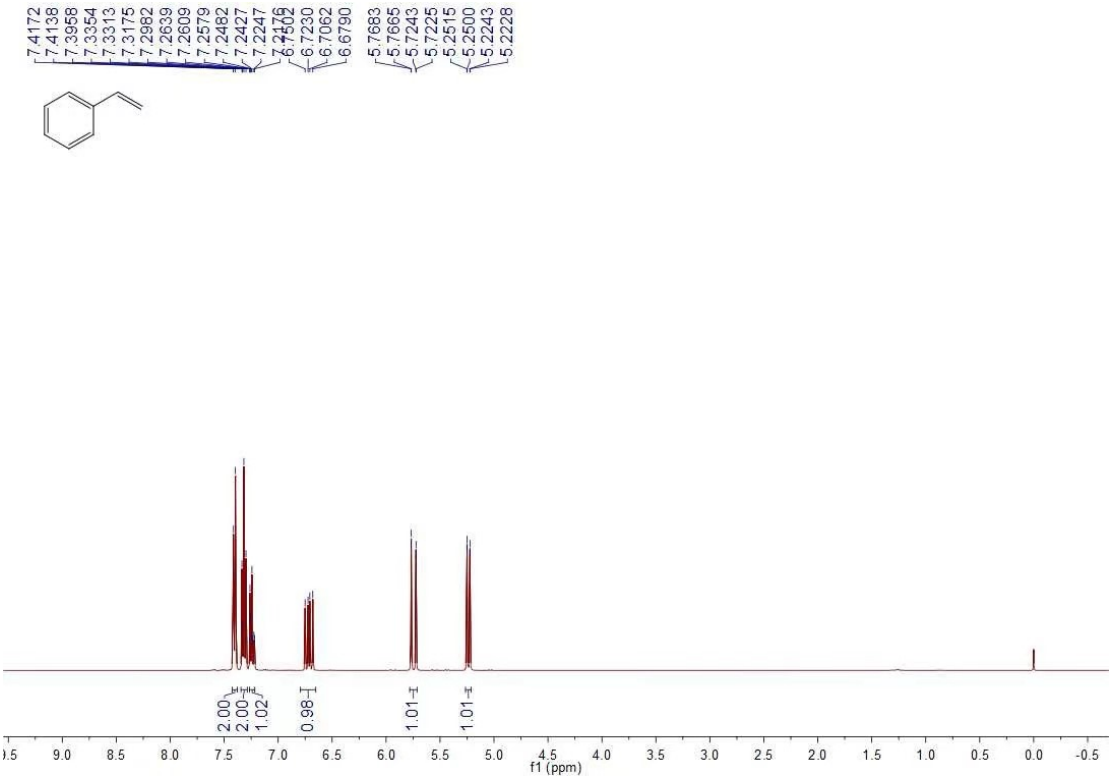
(*E*)-1-methoxy-4-(4-phenylbut-3-en-1-yl)benzene (4q)

Figure S61. ^{13}C NMR (100 MHz, $CDCl_3$)



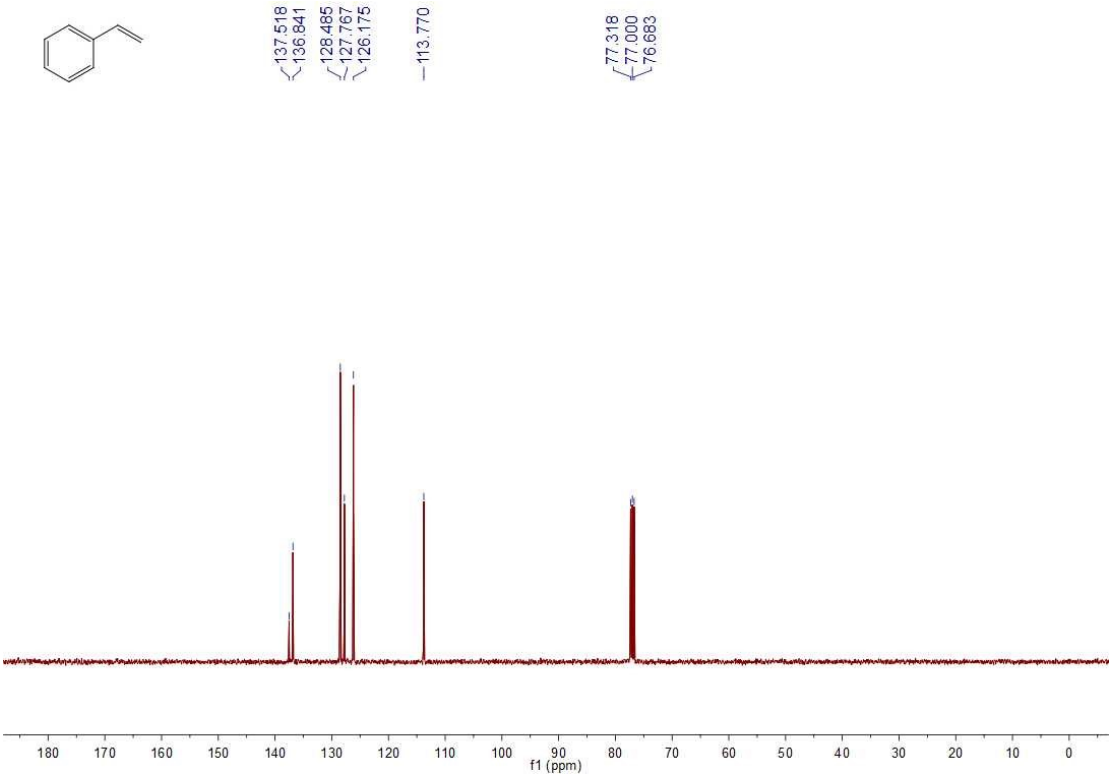
styrene (4r)

Figure S62. ^{1}H NMR (400 MHz, $CDCl_3$)



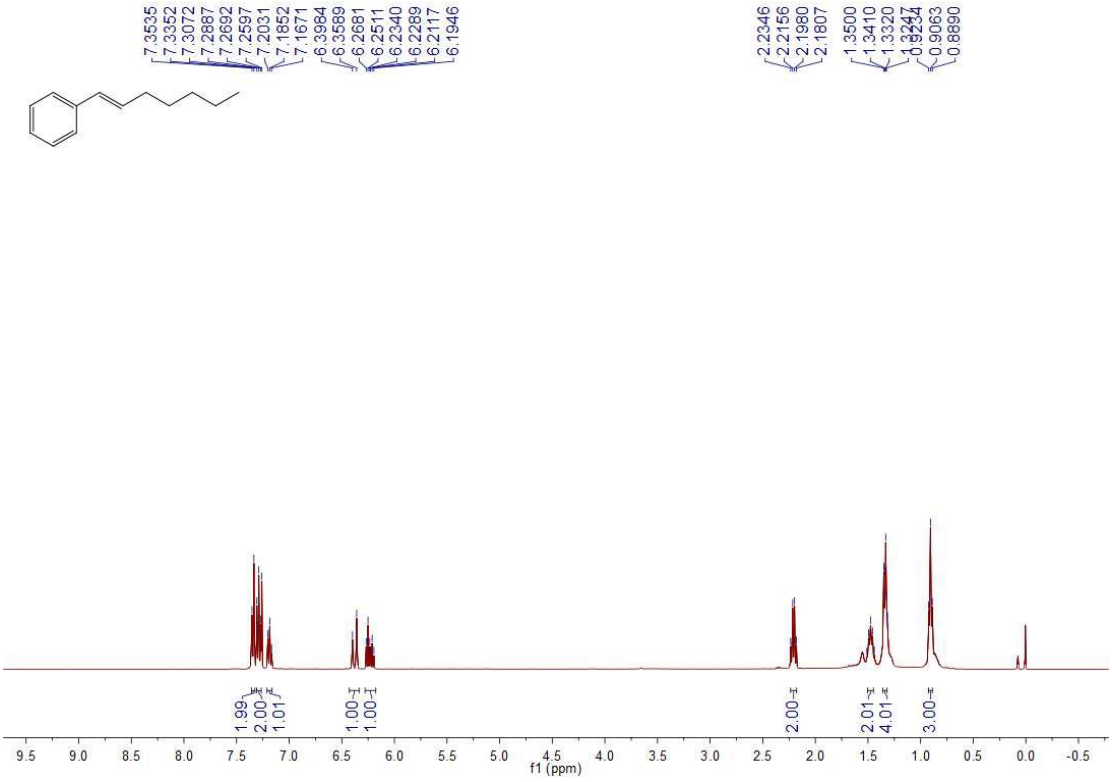
styrene (4r)

Figure S63. ^{13}C NMR (100 MHz, $CDCl_3$)



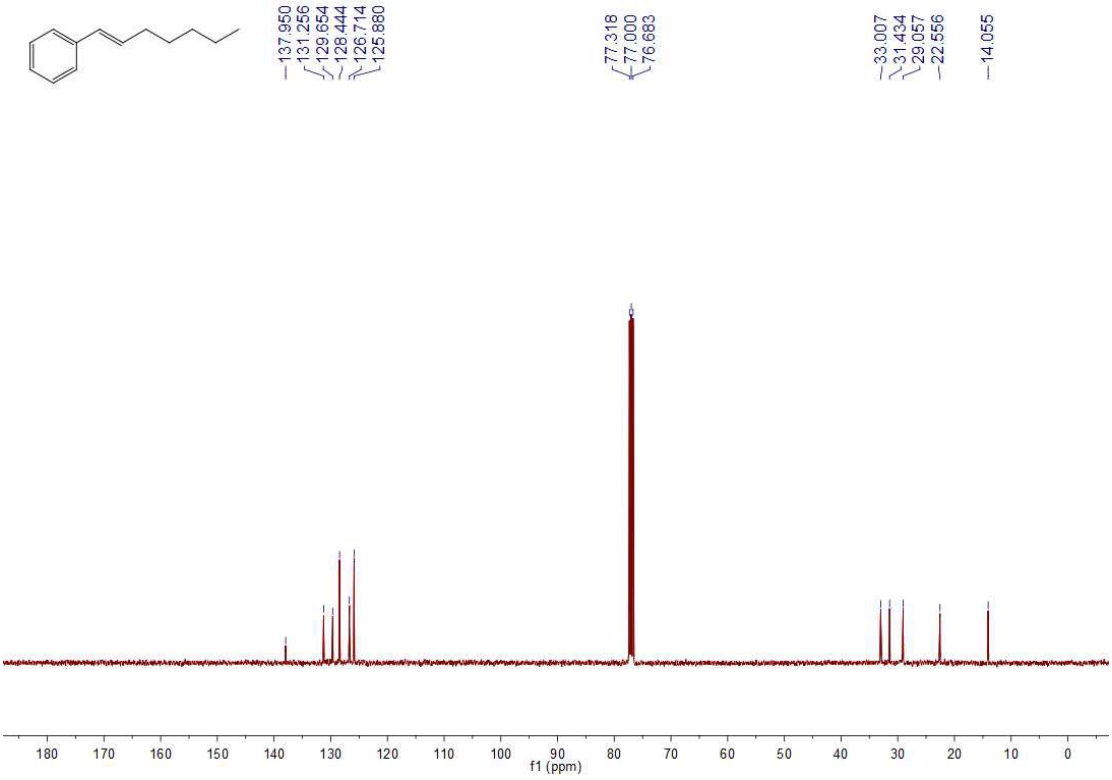
(*E*)-hept-1-en-1-ylbenzene (4s)

Figure S64. ^{1}H NMR (400 MHz, $CDCl_3$)



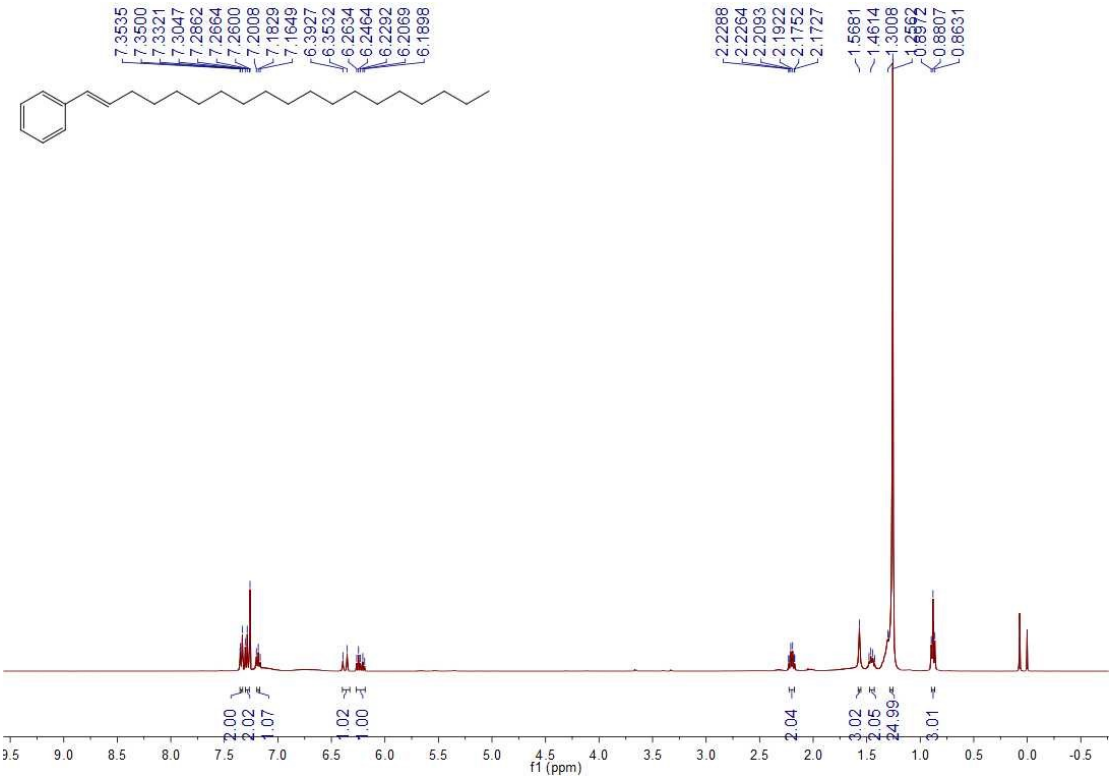
(*E*)-hept-1-en-1-ylbenzene (4s)

Figure S65. ^{13}C NMR (100 MHz, $CDCl_3$)



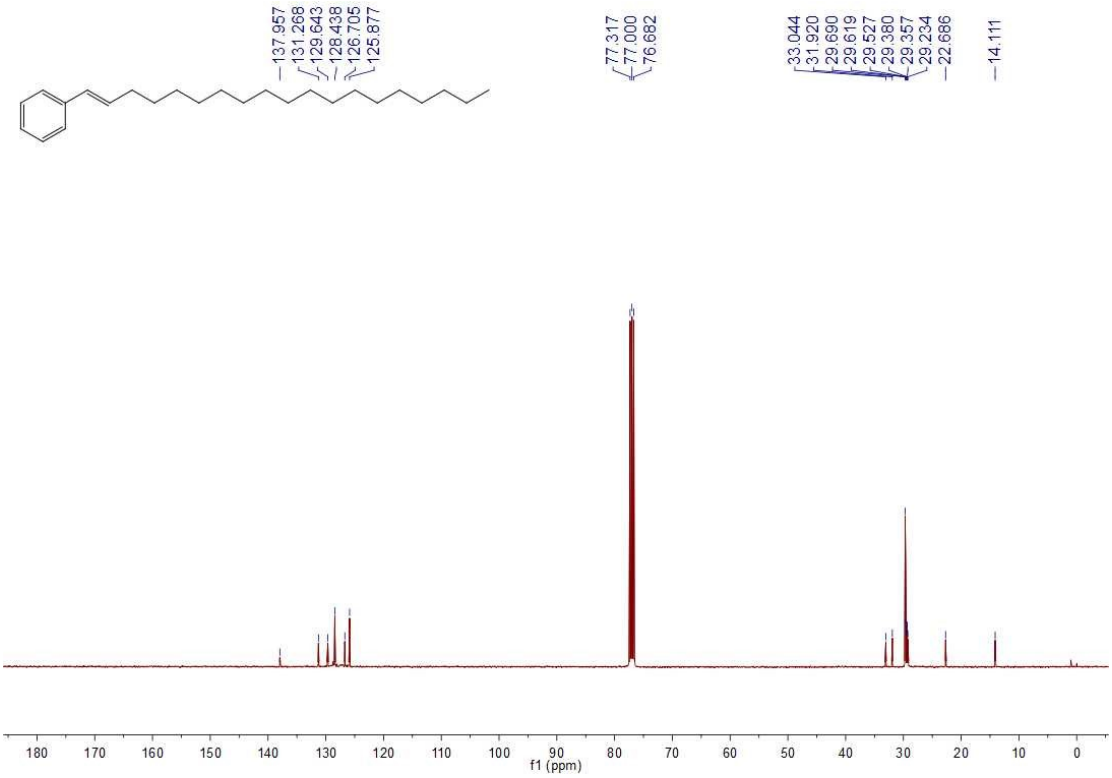
(*E*)-nonadec-1-en-1-ylbenzene (4t)

Figure S66. ^{1}H NMR (400 MHz, $CDCl_3$)



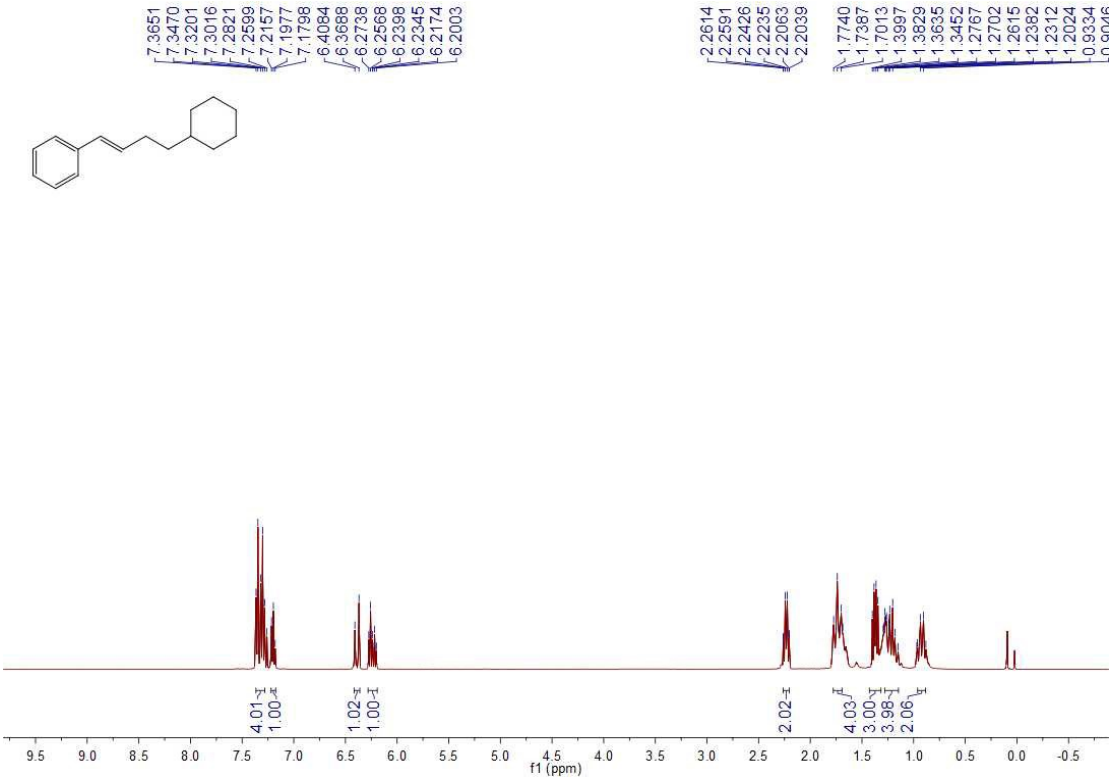
(*E*)-nonadec-1-en-1-ylbenzene (4t)

Figure S67. ^{13}C NMR (100 MHz, $CDCl_3$)



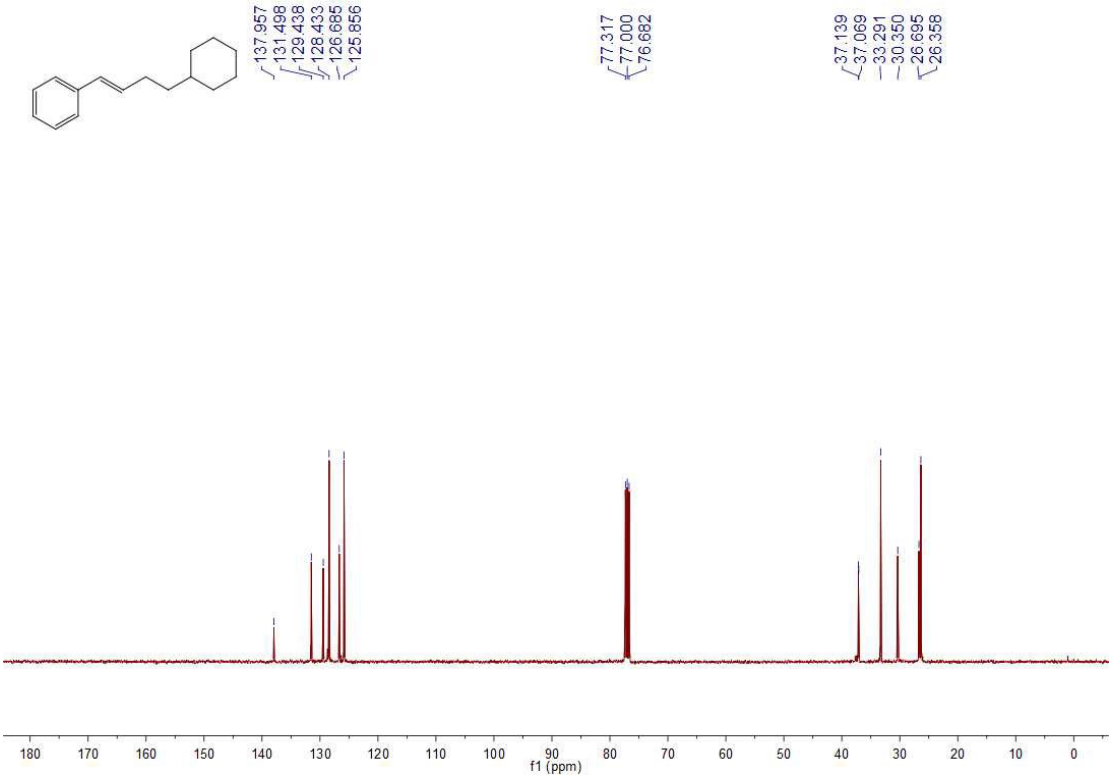
(*E*)-(4-cyclohexylbut-1-en-1-yl)benzene (4u)

Figure S68. ^{1}H NMR (400 MHz, $CDCl_3$)



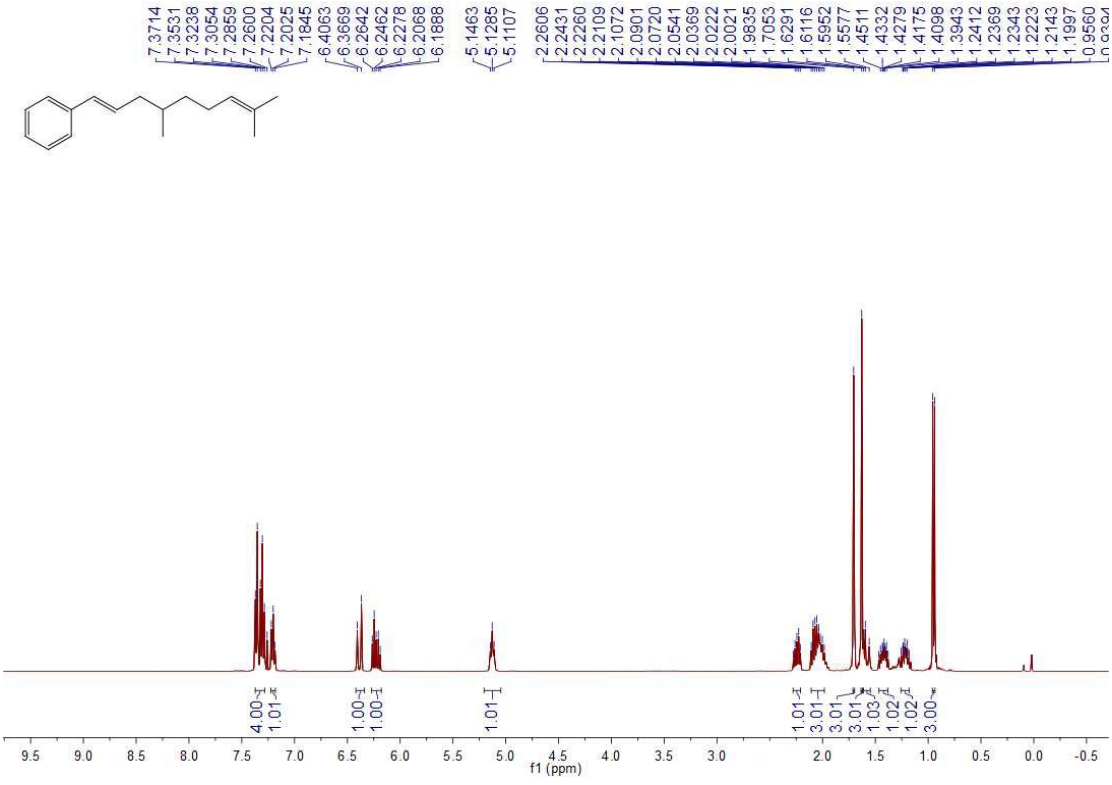
(*E*)-(4-cyclohexylbut-1-en-1-yl)benzene (4u)

Figure S69. ^{13}C NMR (100 MHz, $CDCl_3$)



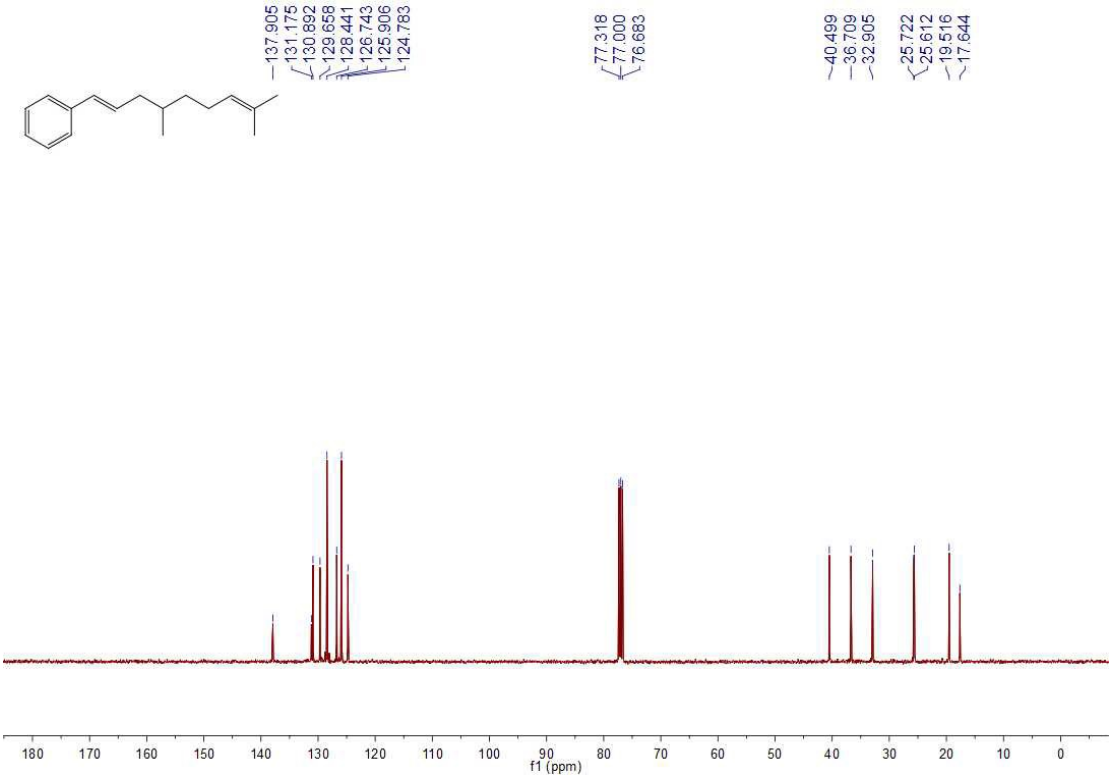
(*E*)-(4,8-dimethylnona-1,7-dien-1-yl)benzene (4v)

Figure S70. ^{1}H NMR (400 MHz, $CDCl_3$)



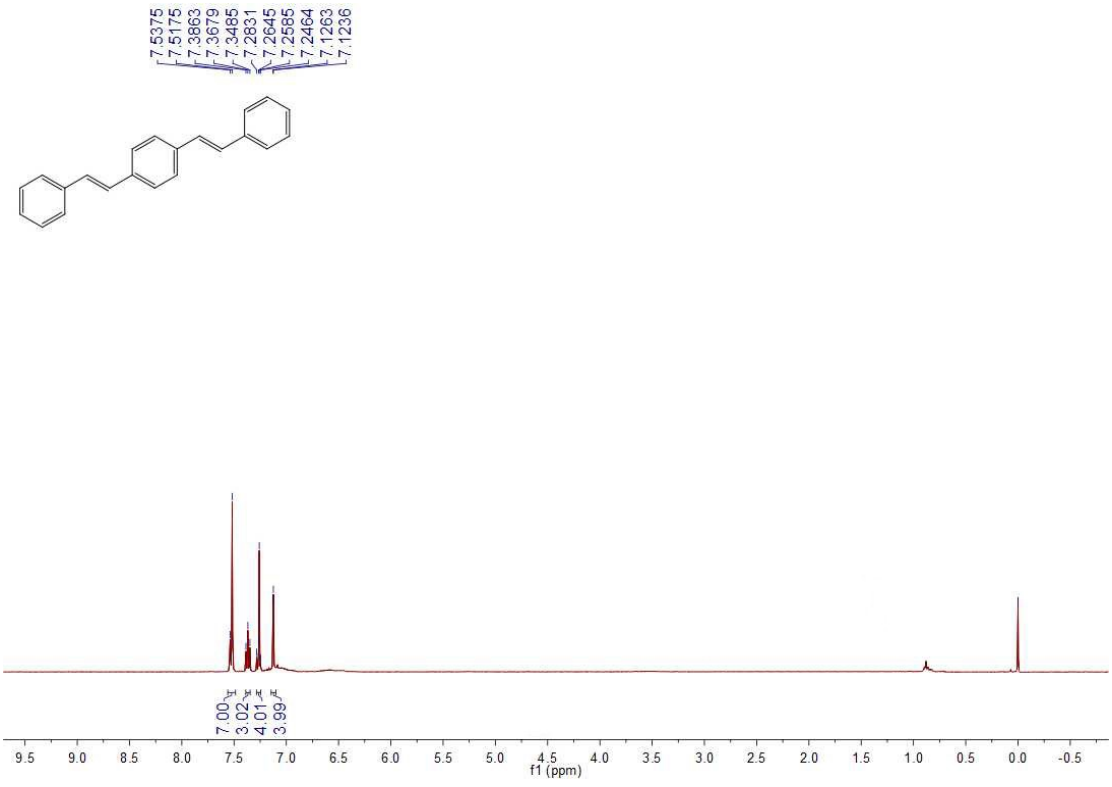
(*E*)-(4,8-dimethylnona-1,7-dien-1-yl)benzene (4v)

Figure S71. ^{13}C NMR (100 MHz, $CDCl_3$)



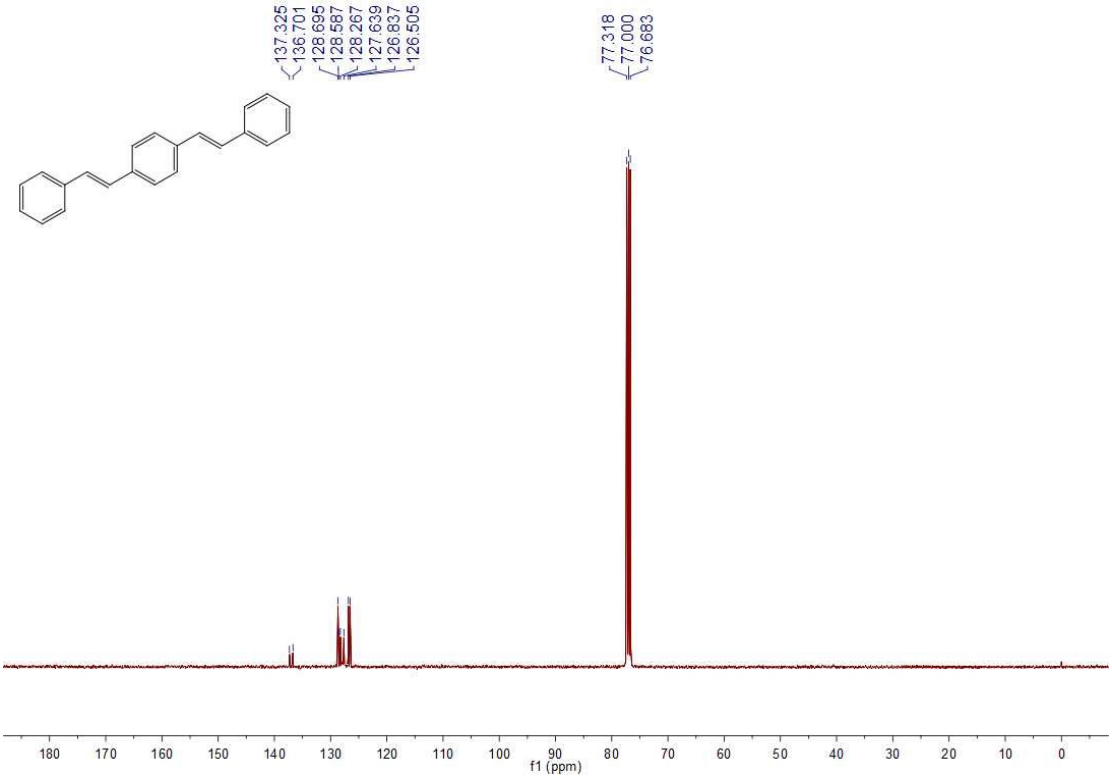
1,4-di((*E*)-styryl)benzene (4w)

Figure S72. ^{1}H NMR (400 MHz, $CDCl_3$)



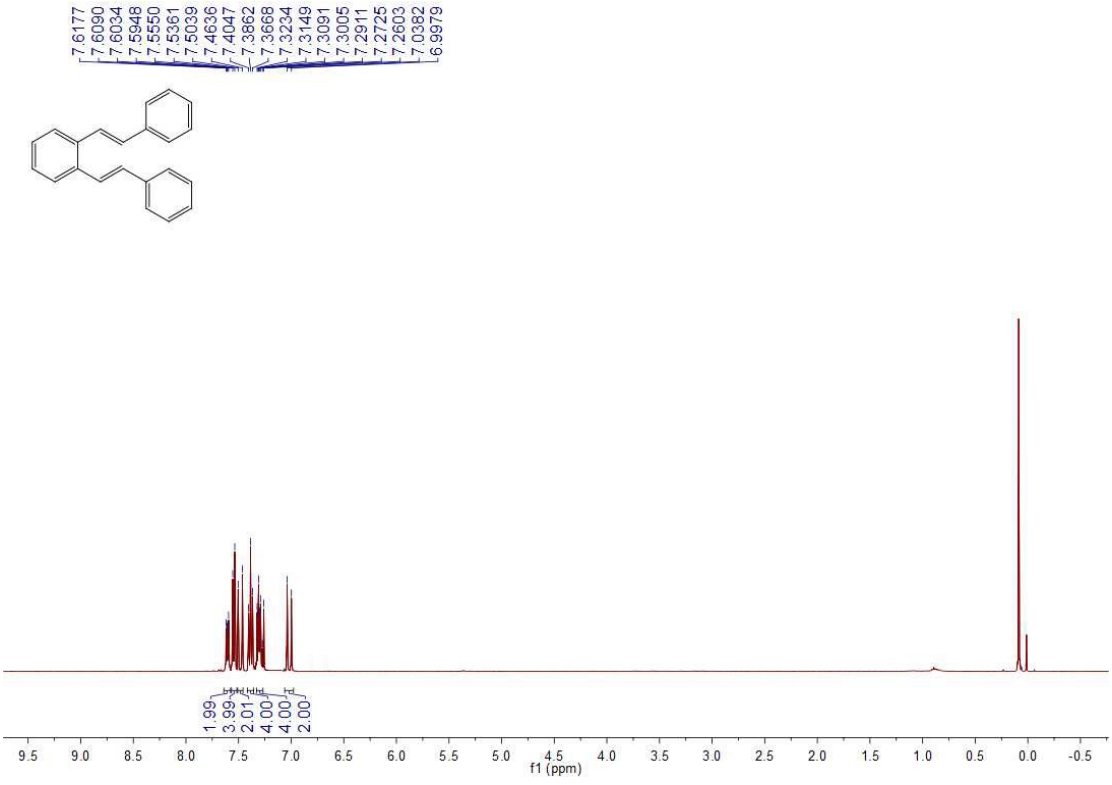
1,4-di((*E*)-styryl)benzene (4w)

Figure S73. ^{13}C NMR (100 MHz, $CDCl_3$)



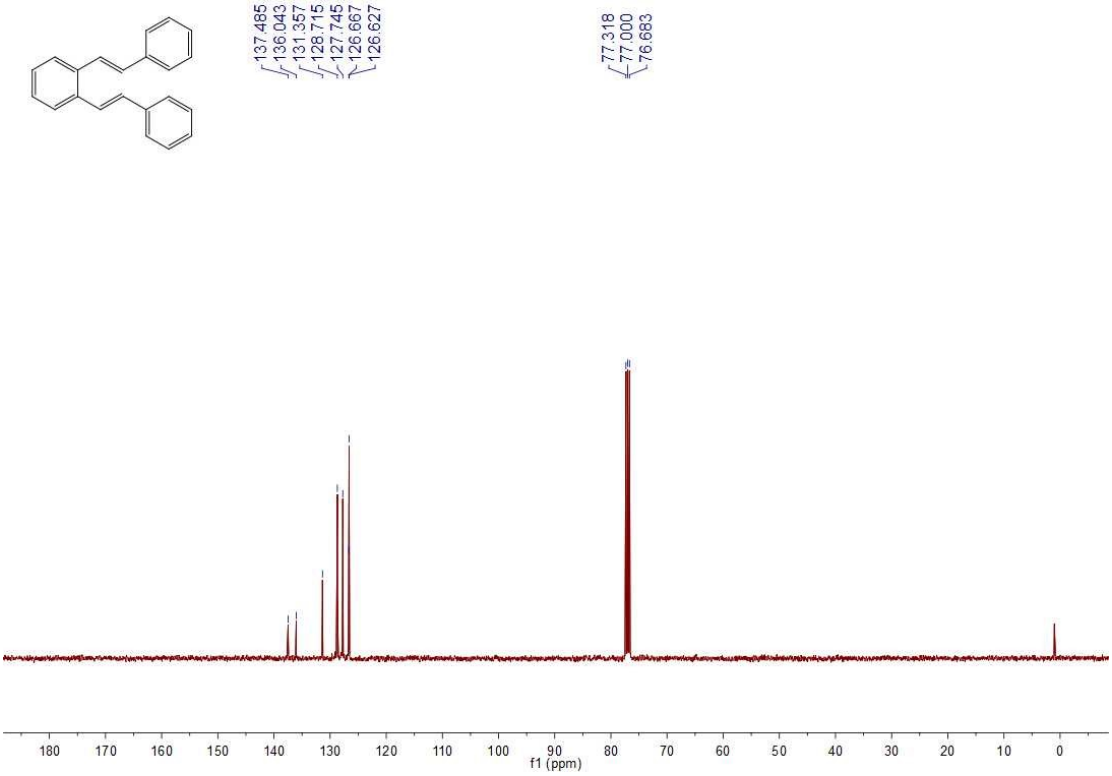
1,2-di((*E*)-styryl)benzene (4x)

Figure S74. ^{1}H NMR (400 MHz, $CDCl_3$)



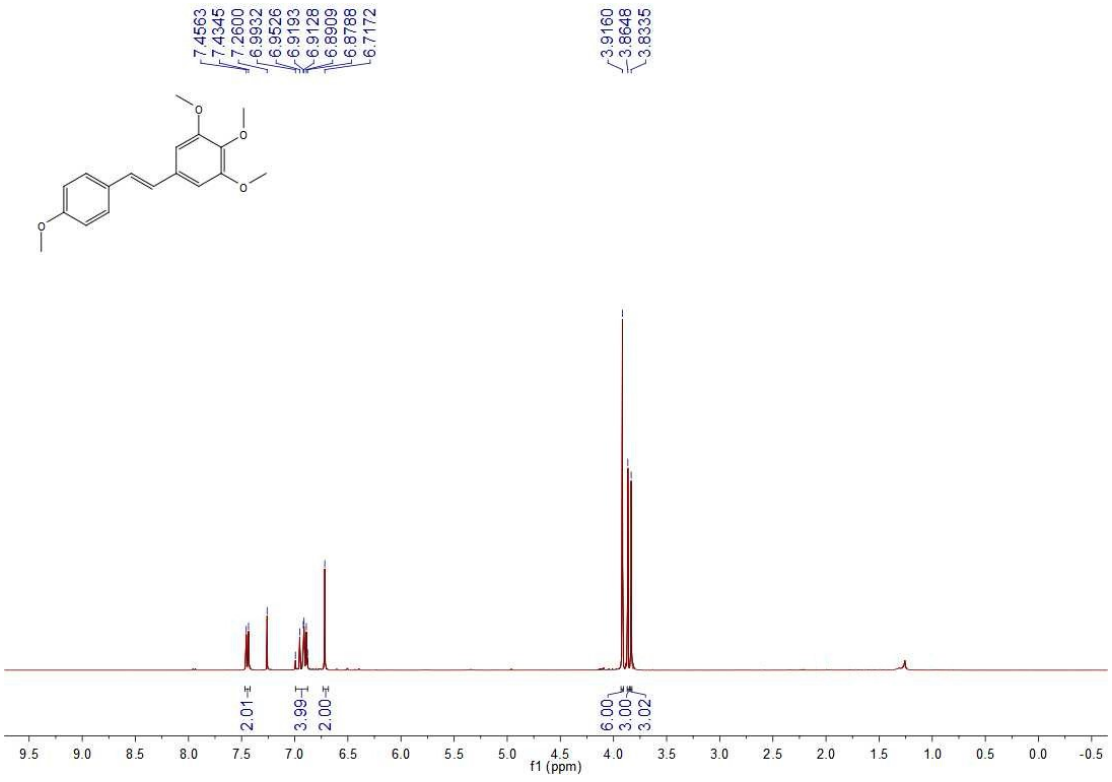
1,2-di((*E*)-styryl)benzene (4x)

Figure S75. ^{13}C NMR (100 MHz, $CDCl_3$)



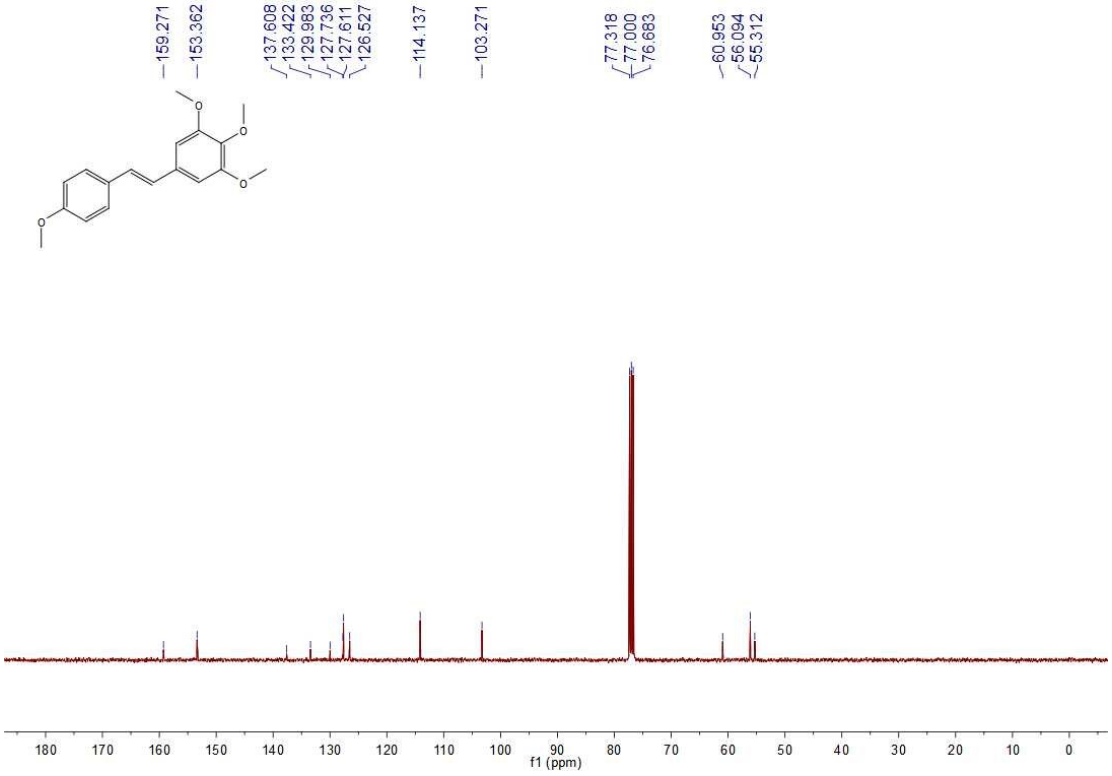
(*E*)-1,2,3-trimethoxy-5-(4-methoxystyryl)benzene (4y)

Figure S76. ^{1}H NMR (400 MHz, $CDCl_3$)



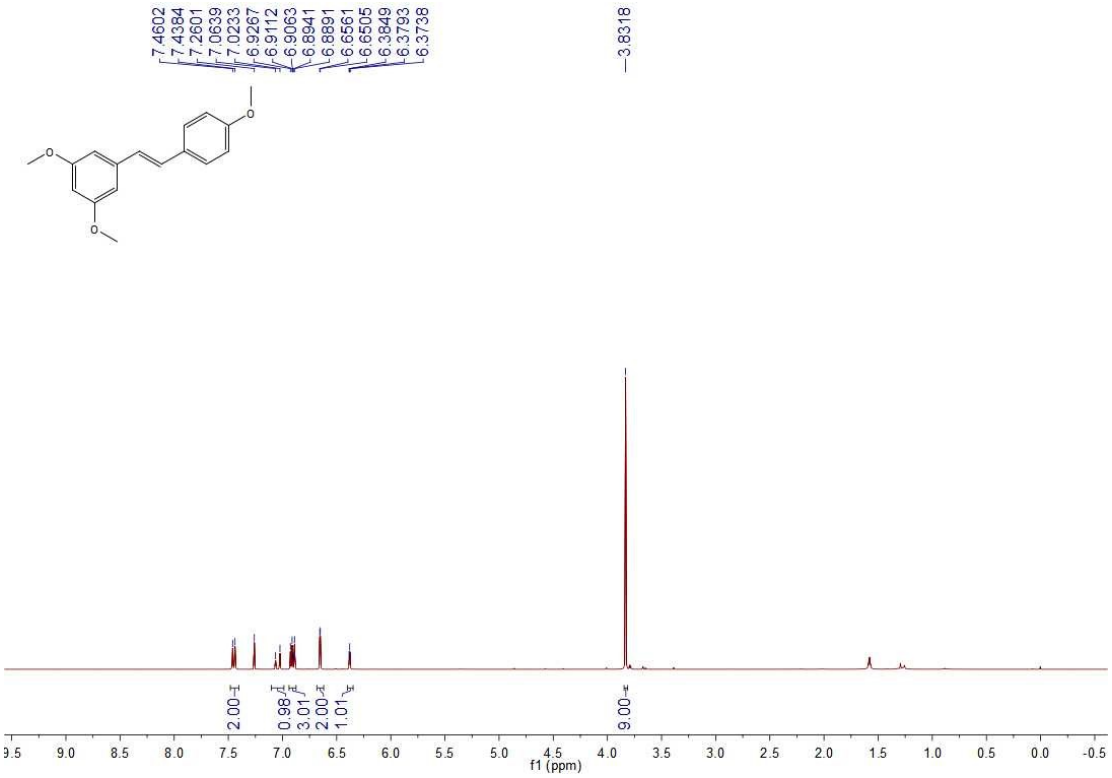
(*E*)-1,2,3-trimethoxy-5-(4-methoxystyryl)benzene (4y)

Figure S77. ^{13}C NMR (100 MHz, $CDCl_3$)



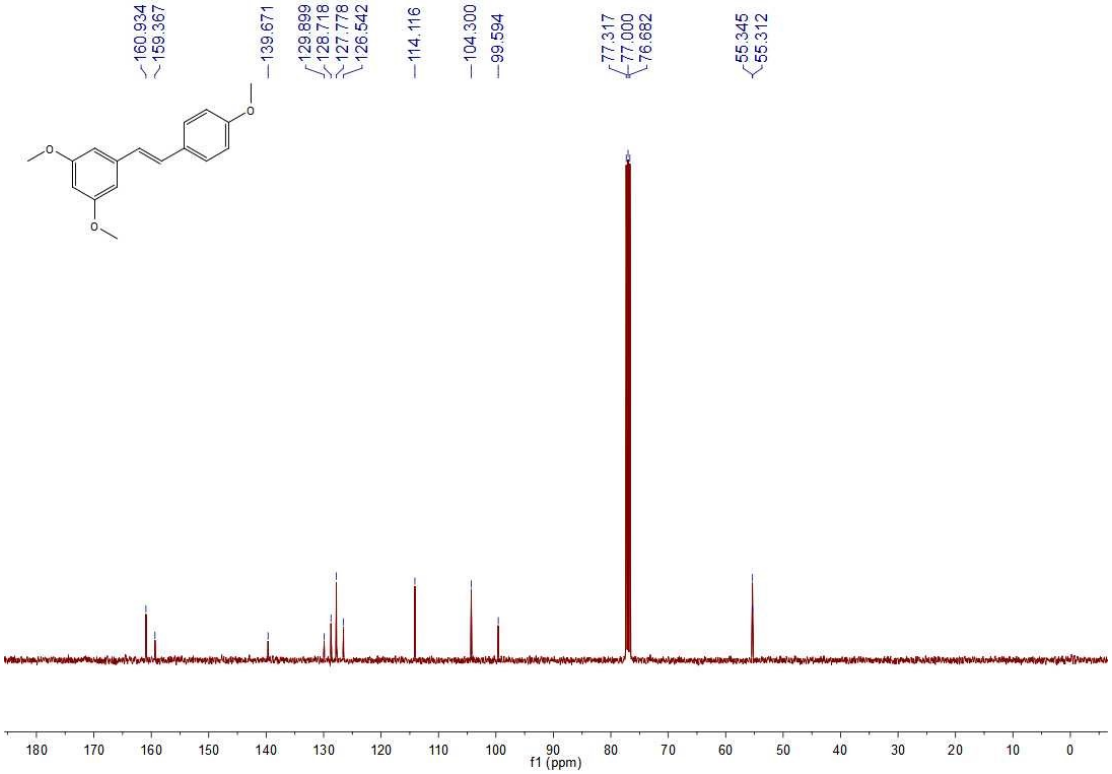
(*E*)-1,3-dimethoxy-5-(4-methoxystyryl)benzene (4z)

Figure S78. ^{1}H NMR (400 MHz, $CDCl_3$)



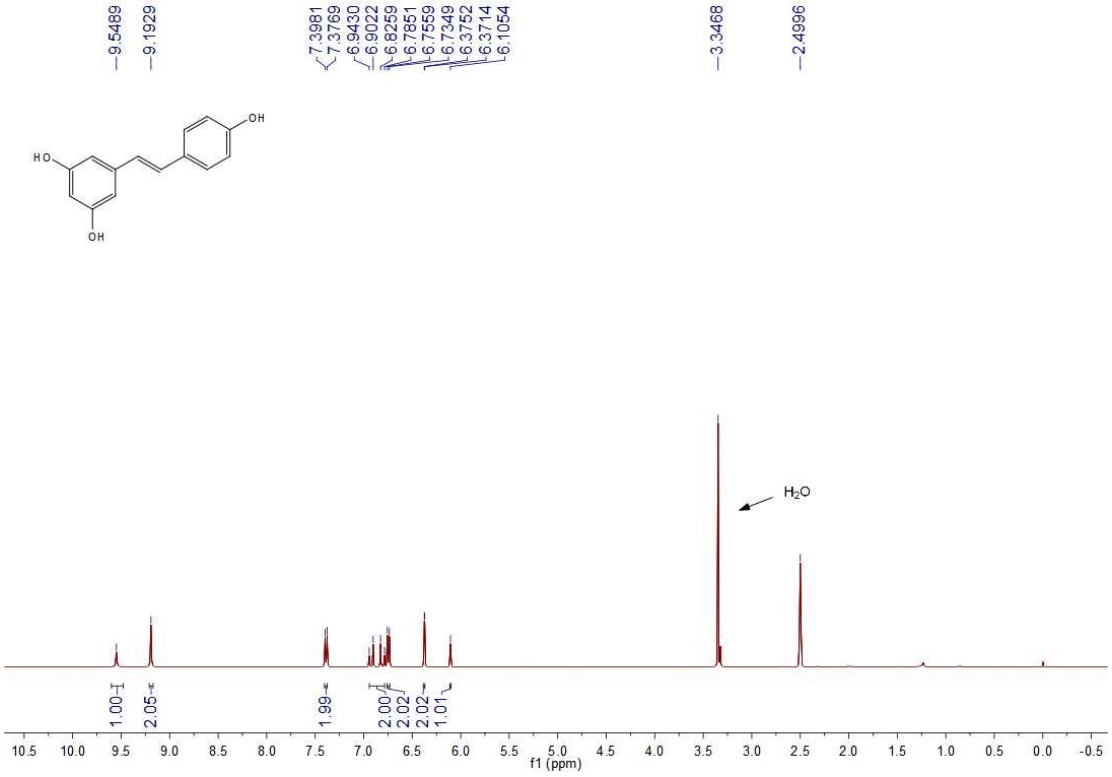
(*E*)-1,3-dimethoxy-5-(4-methoxystyryl)benzene (4z)

Figure S79. ^{13}C NMR (100 MHz, $CDCl_3$)



(*E*)-5-(4-hydroxystyryl)benzene-1,3-diol (12)

Figure S80. ^{1}H NMR (400 MHz, DMSO)



(*E*)-5-(4-hydroxystyryl)benzene-1,3-diol (12)

Figure S81. ^{13}C NMR (100 MHz, DMSO)