Supporting Information

for

An effective Pd nanocatalyst in aqueous media: stilbene synthesis by Mizoroki–Heck coupling reaction under microwave irradiation

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TEM images of Pd nanoparticles, characterization data, and NMR spectra

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Experimental methods

1 TEM images *of Pd nanoparticles*

1.1- TEM images of Pd nanoparticles synthesized by electrochemical reduction

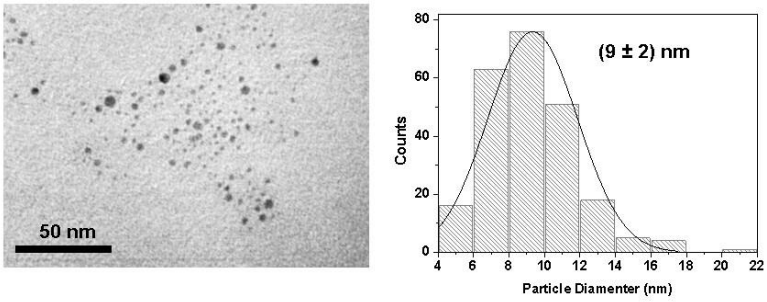


Figure S1: TEM image of PdNPs before catalysis.

1.2- TEM images of Pd nanoparticles recovery after catalysis

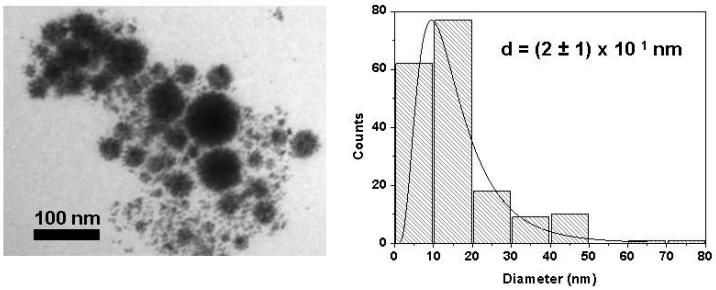


Figure S2: TEM image of PdNPs after one catalytic cycle.

1.3- TEM images of Pd nanoparticles synthesized by microwave irradiation

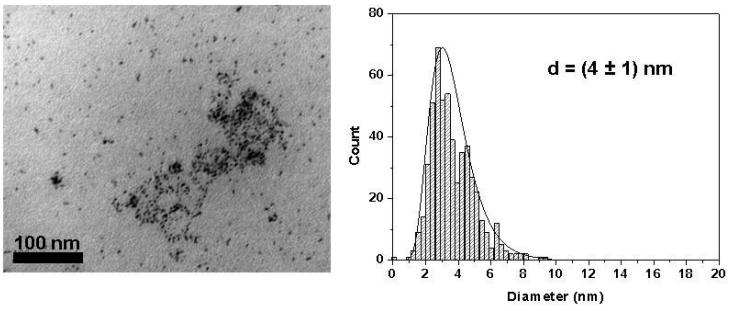
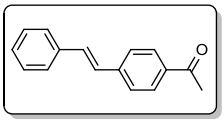


Figure S3: TEM images of the PdNPs obtained under microwave irradiation at 130 °C during 10 minutes.

2. Characterization data

The stilbene products were characterized by ^{1}H NMR, ^{13}C NMR, and GC–MS. All spectroscopic data were in agreement with those previously reported for the following compounds: (*E*)-1-(4-styrylphenyl)ethanone (**3**)[3], (*E*)-phenyl(4-styrylphenyl)methanone (**4**) [3], (*E*)-3-styrylquinoline (**5**)[4],

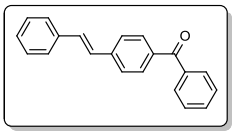
(*E*)-1,3-dimethoxy-5-styrylbenzene (**6**)[3], (*E*)-1-methoxy-4-styrylbenzene (**7**) [3], (*E*)-1-methyl-4-styrylbenzene (**8**)[5], (*E*)-1-methyl-2-styrylbenzene (**9**) [5], (*E*)-4-styrylphenol (**10**) [6], (*E*)-4-(3,5-dimethoxystyryl)pyridine (**14**)[7], 1-(4-(2,2-diphenylvinyl)phenyl)ethanone (**15**)[8], (*E*)-1,1'-(ethene-1,2-diylbis (4,1-phenylene))diethanone (**17**)[9], (E)-1,2-bis(3,5-dimethoxyphenyl)ethane (**18**)[10], and (*E*)-4-(3,5-dimethoxystyryl)phenol or pterostilbene (**19**)[11].



(*E*)-1-(4-Styrylphenyl)ethanone (3)

The product was separated by column chromatography on silica gel eluting with pentane/ethyl acetate gradient (100:0➔80:20) as a white solid.[1]

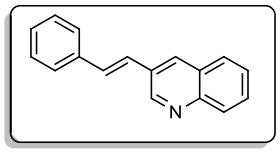
^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.93 (d, *J* = 8.4 Hz, 2H), 7.57-7.51 (m, 4H), 7.38-7.35 (m, 2H), 7.31-7.29 (m, 1H), 7.20 (d, *J* = 16.4 Hz, 1H), 7.10 (d, *J* = 16.3 Hz, 1H), 2.58 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 197.5 (C), 142.1 (C), 136.8 (C), 136.0 (C), 131.5(CH), 129.0 (CH), 128.9 (CH), 128.4 (CH), 127.5 (CH), 126.9 (CH), 126.6 (CH), 26.6 (CH_3). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 7.93/7.57-7.51, 7.57-7.51/7.38-7.35, 7.38-7.35/7.31-7.29, 7.20/7.10. ^{1}H-**^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.93/129.0, 7.57-7.51/126.9, 7.57-7.51/126.6, 7.38-7.35/128.9, 7.31-7.29/128.4, 7.20/131.5, 7.10/127.5, 2.58/26.6. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.93/128.9, 7.93/142.1, 7.93/197.5, 7.57-7.51/126.6, 7.57-7.51/128.4, 7.57-7.51/131.5, 7.57-7.51/136.0, 7.38-7.35/128.9, 7.38-7.35/136.9, 7.31-7.29/126.9, 7.20/126.9, 7.20/127.5, 7.20/136.8, 7.20/142.1, 7.10/126.6 7.10/131.5, 7.10/136.8, 7.10/142.1, 2.58/197.5, 2.58/136.0, 2.58/128.9. **GC-MS (70eV) m/z (%):** 43(20), 89 (15), 178 (62), 179 (22), 207 (100), [M^+] 222 (57).



(*E*)-Phenyl(4-styrylphenyl)methanone (4)

The product was separated by column chromatography on silica gel eluting with pentane/ethyl ether gradient (100:0➔90:10) as a white solid.1

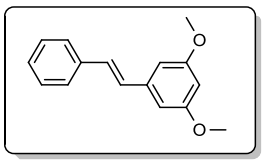
^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.83-7.79 (m, 4H), 7.61-7.53 (m, 5H), 7.48 (t, *J* = 7.5 Hz, 2H), 7.38 (t, *J* = 7.5 Hz, 2H), 7.30 (d, *J* = 7.3 Hz, 1H), 7.24 (d, *J* = 16.3 Hz, 1H), 7.15 (d, *J* = 16.3 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 196.2 (C), 141.6 (C), 137.9 (C), 136.9 (C), 136.4 (C), 132.4 (CH), 131.5 (CH), 130.9 (CH), 130.1 (CH), 128.9 (CH), 128.4 (CH), 127.6 (CH), 126.9 (CH), 126.4 (CH). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 7.83-7.79/7.61-7.53, 7.83-7.79/7.48, 7.83-7.79/7.15 7.61-7.53/7.48, 7.61-7.53/7.38, 7.61-7.53/7.30, 7.61-7.53/7.24, 7.61-7.53/7.15, 7.38/7.30, 7.24/7.15. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.83-7.79/130.9, 7.83-7.79/130.1, 7.61-7.53/132.4, 7.61-7.53/128.4, 7.61-7.53/126.9, 7.61-7.53/126.4, 7.48/127.6, 7.38/128.9, 7.29/128.4, 7.24/131.5, 7.15/127.6. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.83-7.79/196.2, 7.83-7.79/141.6, 7.83-7.79/132.4, 7.83-7.79/130.9, 7.83-7.79/130.9, 7.83-7.79/130.1, 7.61-7.53/136.4, 7.61-7.53/131.5, 7.61-7.53/130.9, 7.61-7.53/130.1, 7.61-7.53/128.4, 7.61-7.53/127.6, 7.61-7.53/126.9, 7.61-7.53/126.4, 7.48/137.9, 7.48/128.4, 7.38/136.9, 7.38/128.9, 7.30/126.9, 7.24/141.6, 7.24/127.6, 7.24/126.9, 7.15/141.6, 7.15/136.9, 7.15/131.5, 7.15/126.4. **GC-MS (70eV) m/z (%):** 51 (16), 77 (50), 105 (62), 152 (17), 178 (75), 179 (45), 207 (100), 208 (15), [M^+] 284 (99), [M^++*1*] 285 (24).



***(E)*-3-Styrylquinoline (5)**

The product was separated by column chromatography on silica gel eluting with pentane/ethyl acetate (100:0➔85:15) as a white solid.[2]

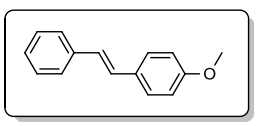
^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.12 (d, *J* = 2.2 Hz, 1H), 8.16 (d, *J* = 2.0 Hz, 1H), 8.09 (d, *J* = 8.4 Hz, 1H), 7.81 (d, *J* = 7.5 Hz, 1H), 7.69-7.65 (m, 1H), 7.59-7.51 (m, 3H), 7.41-7.38 (m, 2H), 7.34-7.30 (m, 2H), 7.22 (d, *J* = 16.4 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 149.6 (CH), 147.6 (C), 136.8 (C), 132.4 (CH), 131.0 (CH), 130.4 (C), 129.4 (CH), 129.3 (CH), 128.9 (CH), 128.4 (CH), 128.2 (C), 127.9 (CH), 127.1 (CH), 126.8 (CH), 125.3 (CH). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 9.12/8.16, 9.12/7.22, 8.16/8.09, 7.81/7.96-7.65, 8.09/7.59-7.51, 7.69-7.65/7.59-7.51, 7.59-7.51/7.41-7.38, 7.59-7.51/7.34-7.30, 7.41-7.38/7.34-7.30, 7.34-7.30/7.22. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 9.12/149.6, 8.16/132.4, 8.09/129.4, 7.81/129.4, 7.59-7.51/127.1, 7.59-7.51/126.8, 7.41-7.38/128.9, 7.34-7.30/128.4, 7.34-7.30/125.3, 7.22/131.0. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 9.12/147.6, 9.12/132.4, 9.12/130.4, 8.16/149.6, 8.16/147.6, 8.16/127.9, 8.16/125.3, 8.09/128.2, 8.09/127.1, 7.81/147.6, 7.81/132.4 7.81/129.3, 7.69-7.65/147.6, 7.69-7.65/127.9, 7.59-7.51/131.0, 7.59-7.51/129.4, 7.59-7.51/129.3, 7.59-7.51/128.4, 7.59-7.51/128.2, 7.59-7.51/126.8, 7.41-7.38/136.8, 7.41-7.38/128.9, 7.34-7.30/136.8, 7.34-7.30/130.4, 7.34-7.30/126.8, 7.34-7.30/125.3, 7.22/149.7, 7.22/136.8, 7.22/132.4, 7.22/131.0, 7.22/130.4. **GC-MS (70eV) m/z (%):** 101 (16), 115 (18), 202 (17), 230 (100), [M^+] 231 (71).



***(E)*-1,3-Dimethoxy-5-styrylbenzene (6)**

The product was separated by column chromatography on silica gel eluting with pentane/diethyl ether (100:00➔90:10) as a white solid.1

^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.49 (d, *J* = 7.4 Hz, 2H), 7.36-7.32 (m, 2H), 7.26-7.23 (m, 1H), 7.08 (d, *J* = 16.3 Hz, 1H), 7.02 (d, *J* = 16.3 Hz, 1H), 6.67 (d, *J* = 2.2 Hz, 2H), 6.39 (t, *J* = 2.2 Hz, 1H), 3.81 (s, 6H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 161.1 (C), 139.5 (C), 137.3 (C), 129.3 (CH), 128.8 (CH), 127.8 (CH), 126.7 (CH), 104.7 (CH), 100.1 (CH), 55.5 (CH_3). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 7.49/7.36-7.32, 7.49/7.26-7.23, 7.08/7.02, 6.67/6.39. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.49/126.7, 7.36-7.32/128.8, 7.26-7.23/127.8, 7.08/129.3, 7.02/128.8, 6.67/104.7, 6.39/100.1, 3.81/55.5. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.49/129.3, 7.49/127.8, 7.49/126.7, 7.36-7.32/128.8, 7.36-7.32/137.3, 7.26-7.23/126.7, 7.08/139.5, 7.08/137.3, 7.08/128.8, 7.08/126.7, 7.02/139.5, 7.02/137.3, 7.02/129.3, 7.02/104.7, 6.67/161.1, 6.67/128.8, 6.67/104.1, 6.67/100.1, 3.81/161.1. **GC-MS (70eV) m/z (%):** 152 (17), 165 (39), 209 (21), 239 (24), [M^+] 240 (100), [M^++*1*] 241 (21).

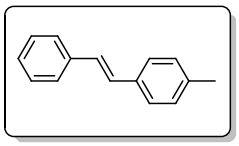


***(E)*-1-Methoxy-4-styrylbenzene (7)**

The product was separated by column chromatography on silica gel eluting with pentane/diethyl ether gradient (100:0➔90:10) as a white solid.1

^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.50-7.44 (m, 4H), 7.34 (t, *J* = 7.6 Hz, 2H), 7.25 – 7.21 (m, 1H), 7.07 (d, *J* = 16.3 Hz 1H), 6.97 (d, *J* = 16.3, 1H), 6.90 (d, *J* = 8.7 Hz, 2H) 3.83 (s, 1H). **^{13}C NMR (101**

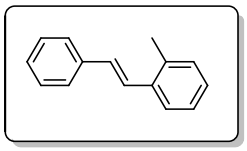
MHz, $CDCl_3$) δ: 159.4 (C), 137.8 (C), 130.3 (C), 128.8 (CH), 128.3 (CH), 127.9 (CH), 127.4 (CH), 126.7 (CH), 126.4 (CH), 114.3 (CH), 55.5 (CH_3). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 7.50-7.44/7.34, 7.50-7.44/6.90, 7.34/7.25 – 7.21, 7.07/6.97. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.50-7.44/127.9, 7.50-7.44/126.4, 7.34/128.8, 7.25 – 7.21/127.4, 7.07/128.3, 6.97/126.7, 6.90/114.3, 3.83/55.5. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.50-7.44/159.4, 7.50-7.44/127.9, 7.50-7.44/127.4, 7.50-7.44/127.3, 7.50-7.44/126.4, 7.34/137.8, 7.34/128.8, 7.25-7.21/126.4, 7.07/137.8, 7.07/127.9, 7.07/126.7, 6.97/130.2, 6.97/128.3, 6.97/126.4, 6.90/159.4, 6.90/130.3, 3.83/159.4. **GC-MS (70eV) m/z (%):** 152 (21), 165 (32), 167 (34), 179 (15), 195 (18), [M^+] 210 (100), [M^++*1*] 211 (15).



***(E)*-1-Methyl-4-styrylbenzene (8)**

The product was separated by column chromatography on silica gel eluting with pentane/dichloromethane (100:0➔98:2) as a white solid.[3]

^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.51-7.49 (m, 2H), 7.41 (d, *J* = 8.1 Hz, 2H), 7.36-7.32 (m, 2H), 7.26-7.21 (m, 1H), 7.16 (d, *J* = 7.9 Hz, 2H), 7.09 (d, *J* = 16.4 Hz, 1H), 7.05 (d, *J* = 16.4 Hz, 1H), 2.35 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 137.7 (C), 134.7(C), 129.5 (CH), 128.8 (CH), 128.7 (CH), 127.8 (CH), 127.5 (CH), 126.6 (CH), 126.5 (CH), 21.4 (CH_3). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 7.51-7.49/7.36-7.32, 7.41/7.16, 7.17/2.35. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.51-7.49/126.5, 7.41/126.6, 7.36-7.32/128.7, 7.26-7.21/127.5, 7.16/129.5, 7.09/127.8, 7.05/128.8, 2.35/21.4. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.51-7.49/127.8, 7.51-7.49/127.5, 7.51-7.49/126.6, 7.41/137.7, 7.41/128.8, 7.41/128.7, 7.41/126.5, 7.36-7.32/137.7, 7.36-7.32/128.8, 7.26-7.21/126.6, 7.16/134.7, 7.16/129.5, 7.16/21.4, 7.09/126.6, 7.09/134.7, 7.09/137.7, 7.05/137.6, 7.05/134,7,7.05/126.5, 2.35/137.7, 2.35/129.5. **GC-MS (70eV) m/z (%):** 178 (79), 179 (100), 193 (16), [M^+] 194 (89), [M^++*1*] 195 (15).

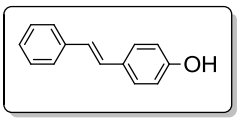


***(E)*-1-Methyl-2-styrylbenzene (9)**

The product was separated by column chromatography on silica gel eluting with pentane/diethyl ether (100:00➔90:10) as a white solid (i.y: 28.9 mg; 53% without optimization).3

^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.59 (d, *J* = 6.9 Hz, 1H), 7.53-7.51 (m, 2H), 7.37-7.31 (m, 3H), 7.28-7.24 (m, 1H), 7.22-7.16 (m, 3H), 6.99 (d, *J* = 16.1 Hz, 1H), 2.42 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 137.8 (C), 136.5 (C), 135.9 (C), 130.5 (CH), 130.2 (CH), 128.8 (CH), 127.7 (CH), 127.6 (CH), 126.7 (CH), 126.3 (CH), 125.5 (CH), 20.0 (CH_3). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 7.59/7.28-7.24, 7.59/7.22-7.16, 7.53-7.51/7.37-7.31, 7.53-7.51/7.28-7.24, 7.53-7.51/6.99, 7.37-7.31/7.28-7.24, 7.37-7.31/6.99, 7.28-7.24/7.22-7.16. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.59/125.5, 7.53-7.51/126.7, 7.37-7.31/128.8, 7.37-7.31/126.7, 7.28-7.24/127.7, 7.22-7.16/130.5, 7.22-7.16/127.6, 7.22-7.16/126.3, 6.99/130.2, 2.42/20.0. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.59/135.9, 7.59/127.6, 7.53-7.51/130.2, 7.53-7.51/127.6, 7.53- 7.51/126.7, 7.37-7.31/137.8, 7.37-7.31/136.5, 7.37-7.31/135.9, 7.37-7.31/128.8, 7.37-7.31/125.5, 7.28-7.24/126.7, 6.99/136.5,

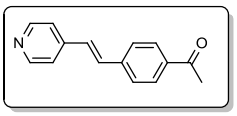
6.99/126.6, 2.42/136.5, 2.42/135.9, 2.42/130.5. **GC-MS (70eV) m/z (%):** 89 (16), 115 (32), 116 (21), 165 (15), 178 (75), 179 (100), 193 (17), [M^+] 194 (80).



***(E)*-4-Styrylphenol (10)**

The product was separated by radial chromatography (centrifugal thin-layer chromatography) eluting with pentane/ethyl acetate (100:00➔85:15) as a white solid.[4]

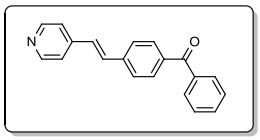
^{1}H NMR (400 MHz, Acetone-d$_6$) δ: 8.48 (s, 1H), 7.56-7.54 (m, 2H), 7.46 (dt, *J* = 9.5 Hz, 1.76 Hz, 2H), 7.36-7.32 (m, 2H), 7.24-7.20 (m, 1H), 7.17 (d, *J* = 16.4 Hz, 1H), 7.05 (d, *J* = 16.4 Hz, 1H), 6.85 (dt, *J* = 9.5 Hz, 2 Hz, 2H). **^{13}C NMR (101 MHz, Acetone-d$_6$) δ:** 158.2 (C), 138.8 (C), 129.9 (C), 129.4 (CH), 129.3 (CH), 128.7 (CH), 127.8 (CH), 126.9 (CH), 126.4 (CH), 116.4 (CH). **^{1}H-^{1}H COSY NMR (400 MHz, Acetone- *d$_6$*) δ$_H$/δ$_H$:** 7.56-7.54/7.36-7.32, 7.56-7.54/7.24-7.20, 7.56-7.54/7.05, 7.46/7.17, 7.46/6.86, 7.36-7.32/7.24-7.20, 7.17/7.05, 7.17/6.86. **^{1}H-^{13}C HSQC NMR (400 MHz, Acetone- *d$_6$*) δ$_H$/δ$_C$:** 7.56-7.54/126.9, 7.46/128.7, 7.36-7.32/129.4, 7.24-7.20/127.8, 7.17/129.3, 7.05/126.4, 6.86/116.4. **^{1}H-^{13}C HMBC NMR (400 MHz, Acetone- *d$_6$*) δ$_H$/δ$_C$:** 7.56-7.54/129.4, 7.56-7.54/127.8, 7.56-7.54/126.9, 7.56-7.54/126.4, 7.46/158.2, 7.46/129.4, 7.46/128.3, 7.46/128.7, 7.46/116.4, 7.36-7.32/138.8, 7.36-7.32/129.4, 7.36-7.32/126.9, 7.24-7.20/126.9, 7.24-7.20/126.5, 7.17/138.8, 7.17/128.7, 7.17/126.4, 7.05/138.8, 7.05/129.9, 7.05/129.3, 7.05/126.8, 6.86/158.2, 6.86/129.8, 6.86/126.4, 6.86/116.4. **GC-MS (70eV) m/z (%):** 152 (18), 165 (26), 167 (24), 181 (20), 195 (43), [M^+] 196 (100).



***(E)*-1-(4-(2-(Pyridin-4-yl)vinyl)phenyl)ethanone (11)**

The product was separated by column chromatography on silica gel eluting with pentane/ethyl acetate (100:00➔20:80) as a yellow solid (35.8 mg; 64%). Melting point: 104.2-105.2 °C.

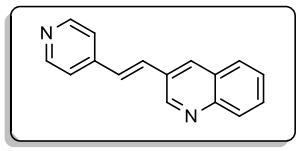
^{1}H NMR (400 MHz, CDCl$_3$) δ: 8.60 (d, *J* = 5.7 Hz, 2H), 7.98-7.96 (m, 2H), 7.61 (d, *J* = 8.4 Hz, 2H), 7.37 (dd, *J* = 4.7, 1.4 Hz, 2H), 7.30 (d, *J* = 16.4 Hz, 1H), 7.11 (d, *J* = 16.4 Hz, 1H), 2.60 (s, 1H). **^{13}C NMR (101 MHz, CDCl$_3$) δ:** 197.4 (C), 150.4 (CH), 144.0 (C), 140.7 (C), 136.9 (C), 131.9 (CH), 129.0 (CH), 128.7 (CH), 127.1 (CH), 121.1 (CH), 26.7 (CH). **^{1}H-^{1}H COSY NMR (400 MHz, CDCl$_3$) δ$_H$/δ$_H$:** 8.60/7.37, 7.98-7.96/7.61, 7.30/7.11. **^{1}H-^{13}C HSQC NMR (400 MHz, CDCl$_3$) δ$_H$/δ$_C$:** 8.60/150.4, 7.98-7.96/129.0, 7.61/127.1, 7.37/121.1, 7.30/128.7, 7.14/131.9, 2.60/26.7. **^{1}H-^{13}C HMBC NMR (400 MHz, CDCl$_3$) δ$_H$/δ$_C$:** 8.60/150.4, 8.60/144.0, 8.60/121.1, 7.98-7.96/197.4, 7.98-7.96/140.7, 7.98-7.96/129.0, 7.61/136.9, 7.61/131.9, 7.61/127.1, 7.37/150.4, 7.37/128.7, 7.37/121.1, 7.30/144.0, 7.30/140.7, 7.30/131.9, 7.30/121.1, 7.11/144.0, 7.11/140.7, 7.11/131.9, 7.11/121.1, 2.60/197.4, 2.60/136.9, 2.60/129.0. **GC-MS (70eV) m/z (%):** 151 (16), 152 (45), 180 (21), 208 (100), [M^+] 223 (57). **HRMS (TOF; ESI$^+$):** calcd for $C_{15}H_{13}NNa^+$ (M + Na)$^+$: 246,0889; found: 246,0891.



***(E)*-Phenyl(4-(2-(pyridin-4-yl)vinyl)phenyl)methanone (12)**

The product was separated by column chromatography on silica gel eluting with pentane/ethyl acetate (100:00➔30:70) as a white solid (59.4 mg; 84%). Melting point: 186.1-187.1°C.

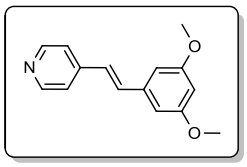
^{1}H NMR (400 MHz, $CDCl_3$) δ: 8.61 (d, *J* = 4.2 Hz, 2H), 7.85-7.80 (m, 4H), 7.64-7.58 (m, 3H), 7.50 (t, *J* = 7.5 Hz, 2H), 7.40 (d, *J* = 5.0 Hz, 2H), 7.35 (d, *J* = 16.4 Hz, 1H), 7.14 (d, *J* = 16.3 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 196.0 (C), 150.5 (CH), 144.1 (C), 140.2 (C), 137.7 (C), 137.5 (C), 132.6 (CH), 132.1 (CH), 130.8 (CH), 130.1 (CH), 128.7 (CH), 128.5 (CH), 126.9 (CH), 121.1 (CH). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 8.61/7.40, 7.85-7.80/7.64-7.58, 7.64-7.58/7.50, 7.64-7.58/7.50, 7.64-7.58/7.35, 7.35/7.14. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 8.61/150.5, 7.85-7.80/130.8, 7.85-7.80/130.1, 7.64-7.58/132.6, 7.64-7.58/126.9, 7.50/128.5, 7.40/121.1, 7.35/132.1, 7.14/128.7. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 8.60/144.1, 8.60/121.1, 7.85-7.80/196.0, 7.85-7.80/140.2, 7.85-7.80/132.6, 7.85-7.80/130.8, 7.85-7.80/130.1, 7.85-7.80/126.9, 7.64-7.58/137.5, 7.64-7.58/132.1, 7.64-7.58/130.8, 7.64-7.58/130.1, 7.64-7.58/126.9, 7.50/137.7, 7.50/128.7, 7.50/121.1, 7.35/144.1, 7.35/128.7, 7.35/126.9, 7.14/140.2, 7.14/132.1, 7.14/121.1. **GC-MS (70eV) m/z (%):** 51 (16), 77 (59), 105 (69), 151 (19), 152 (51), 180 (18), 208 (94), [M^+] 285 (100), [M^++1] 286 (21). **HRMS (TOF; ESI$^+$):** calcd. for $C_{20}H_{15}NNaO^+$ (M + Na)$^+$:308,1046; found: 308,1058.



***(E)*-3-(2-(Pyridin-4-yl)vinyl)quinoline (13)**

The product was separated by column chromatography on silica gel eluting with ethyl acetate/ethanol (100:00➔90:10) as a white solid (38.4 mg; 66%). Melting point: 113-115°C.

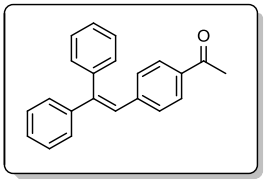
^{1}H NMR (400 MHz, $CDCl_3$) δ: 9.13 (d, *J* = 2.2 Hz, 1H), 8.63 (dd, *J* = 4.6, 1.4 Hz, 2H), 8.22 (d, *J* = 2.0 Hz, 1H), 8.11 (d, *J* = 8.4 Hz, 1H), 7.84 (d, *J* = 8.1 Hz, 1H) (**e**), 7.72 (ddd, *J* = 8.4, 6.9, 1.4 Hz, 1H) (**f**), 7.57 (ddd, *J* = 8.1, 7.0, 1.1 Hz, 1H), 7.45-7.41 (m, 3H), 7.23 (d, *J* = 16.4 Hz, 1H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 150.5 (CH), 149.3 (CH), 148.1 (C), 144.1 (C), 133.6 (CH), 130.0 (CH), 129.9 (CH), 129.5 (CH), 129.3 (C), 128.3 (CH), 128.1 (CH), 128.0 (C), 127.4 (CH), 121.0 (CH). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 9.13/8.22, 8.63/7.45-7.41, 8.11/7.72, 7.84/7.57, 7.72/7.57, 7.45-7.41/7.23. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 9.13/149.3, 8.63/150.5, 8.22/133.6, 8.11/129.5, 7.84/128.1, 7.72/130.0, 7.57/127.4, 7.45-7.41/129.9, 7.45-7.41/121.0, 7.23/128.3. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 9.13/148.1, 9.13/133.6, 9.13/129.3, 8.63/150.5, 8.63/144.1, 8.63/121.0, 8.22/149.3, 8.22/148.1 8.22/129.9, 8.22/128.1, 8.11/128.0, 8.11/127.4, 7.84/148.1, 7.84/133.6, 7.84/130.0, 7.72/148.1, 7.72/128.1, 7.57/130.0, 7.57/129.5, 7.57/128.1, 7.45-7.41/150.5, 7.45-7.41/149.3, 7.45-7.41/144.1, 7.45-7.41/133.6, 7.45-7.41/128.3, 7.45-7.41/121.0, 7.23/129.9, 7.23/129.3, 7.23/121.0. **GC-MS (70eV) m/z (%):** 51 (17), 102 (22), 204 (44), 231 (100), [M^+] 232 (99), [M^++1] 233 (18). **HRMS (TOF, ESI$^+$):** calcd for $C_{16}H_{12}N_2Na^+$ (M + Na)$^+$: 255.0893, found: 255.0888.



***(E)*-4-(3,5-Dimethoxystyryl)pyridine (14)**

The product was separated by column chromatography on silica gel eluting with pentane/ethyl acetate (100:00➔40:60) as yellow oil.[5]

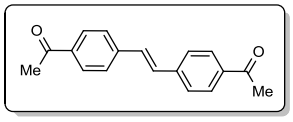
^{1}H NMR (400 MHz, $CDCl_3$) δ: 8.57 (dd. *J* = 4.7, 1.4 Hz, 2H), 7.34 (dd, *J* = 4.7, 1.4 Hz, 2H), 7.21 (d, *J* = 16.3 Hz, 1H), 6.96 (d, *J* = 16.2 Hz, 1H), 6.68 (d, *J* = 2.2 Hz, 2H), 6.45 (t, *J* = 2.2 Hz, 1H), 3.83 (s, 6H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 161.2 (C), 150.3 (CH), 144.6 (C), 138.2 (C), 133.3 (CH), 126.6 (CH), 121.0 (CH), 105.2 (CH), 101.1 (CH), 55.5 (CH_3). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 8.57/7.34, 7.21/6.96, 6.68/6.45. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 8.57/150.3, 7.34/121.0, 7.21/133.3, 6.96/126.6, 6.68/105.2, 6.45/101.1, 3.83/55.5. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 8.57/150.3, 8.57/144.6, 8.57/121.0, 7.34/150.3, 7.34/126.6, 7.34/121.0, 7.21/144.6, 7.21/105.2, 6.96/138.2, 6.96/121.0, 6.68/161.2, 6.68/133.3, 6.68/195.2, 6.68/101.1, 6.45/161.2, 6.45/105.2, 3.83/161.2, **GC-MS (70eV) m/z (%):** 154 (15), 166 (15), 167 (23), 210 (19), 240 (52), [M^+] 241 (100).



1-(4-(2,2-Diphenylvinyl)phenyl)ethanone (15)

The product was separated by column chromatography on silica gel eluting with pentane/ethyl ether (100:00➔90:10) as a white solid.[6]

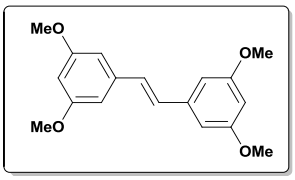
^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.72 (d, *J* = 8.5 Hz, 2H), 7.35-7.31 (m, 8H), 7.20-7.17 (m, 2H), 7.09 (d, *J* = 8.4 Hz, 2H), 6.99 (s, 1H), 2.53 (s, 3H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 197.7 (C), 145.4 (C), 143.0 (C), 142.5 (C), 140.0 (C), 135.2 (C), 130.4 (CH), 129.7 (CH), 128.9 (CH), 128.4 (CH), 128.2 (CH), 128.1 (CH), 128.0 (CH), 127.9 (CH), 127.1 (CH), 26.7 (CH_3). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 7.72/7.09, 7.72/6.99, 7.35-7.31/7.20-7.17, 7.09/6.99. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.72/128.2, 7.35-7.31/128.9, 7.35-7.31/128.4, 7.35-7.31/128.1, 7.35-7.31/128.0, 7.35-7.31/127.9, 7.20-7.17/130.4, 7.09/129.7, 6.99/127.1, 2.53/26.7. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.72/197.7, 7.72/142.5, 7.72/128.2, 7.35-7.31/145.4, 7.35-7.31/143.0, 7.35-7.31/140.0, 7.35-7.31/128.9, 7.35-7.31/128.4, 7.35-7.31/128.0, 7.20-7.17/127.9, 7.09/135.2, 7.09/129.7, 7.09/127.1, 6.99/145.4, 6.99/143.0, 6.99/140.0, 6.99/129.7, 2.53/197.7, 2.53/135.3, 2.53/128.2. **GC-MS (70eV) m/z (%):** 43 (44), 113 (15), 126 (32), 178 (15), 215 (16), 226 (15), 239 (34), 240 (26), 252 (30), 253 (36), 25 (40), 283 (82), 284 (21), [M^+] 298 (100), [M^++*1*] 299 (22).



(*E*)-1,1'-(Ethene-1,2-diylbis(4,1-phenylene))diethanone (17)

The product was separated by column chromatography on silica gel eluting with pentane/ ethyl acetate (100:0➔50:50) as a yellow solid.[7] **^{1}H NMR (400 MHz, $CDCl_3$) δ**: 7.97 (d, J = 8.5 Hz, 4H), 7.62 (d, J = 8.4 Hz, 4H), 7.25 (s, 2H), 2.62 (s, 6H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 197.5 (C), 141.4 (C), 136.6 (C), 130.3 (CH), 129.1 (CH), 127.0 (CH), 26.7 (CH3). **^{1}H-^{1}H COSY NMR (400 MHz; $CDCl_3$) δH/δH**: 7.97/7.62. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δH/δC**: 7.97/129.1, 7.62/127.0, 7.25/130.3, 2.62/26.7. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δH/δC**: 7.97/197.5, 7.97/141.4, 7.97/129.1, 7.62/136.6, 7.62/130.3, 7.62/127.0,

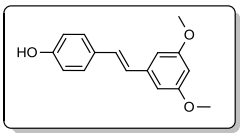
7.25/141.4, 7.25/127.0, 2.62/197.5, 2.62/136.6. **GC-MS (70eV) m/z (%):** 43 (100), 176 (15), 249 (95), [M^+] 264 (48).



(*E*)-1,2-Bis(3,5-dimethoxyphenyl)ethane (18)

The product was separated by column chromatography on silica gel eluting with pentane/ diethyl ether (100:0➔90:10) as a white solid. [8]

^{1}H NMR (400 MHz; $CDCl_3$) δ: 7.01 (s, 2H), 6.66 (d, J = 2.2 Hz, 4H), 6.40 (t, J = 2.2 Hz, 2H), 3.83 (s, 12H). **^{13}C NMR (101 MHz; $CDCl_3$) δ**: 161.1 (C), 139.3 (C), 129.3 (CH), 104.8 (CH), 100.3 (CH), 55.5 (CH3). **^{1}H-^{1}H COSY NMR (400 MHz; $CDCl_3$) δH/δH**: 7.01/6.66, 6.66/6.40. **^{1}H-^{13}C HSQC NMR (400 MHz; $CDCl_3$) δH/δC**: 7.01/129.3, 6.66/104.8, 6.40/100.3, 3.83/55.5. **^{1}H-^{13}C HMBC NMR (400 MHz; $CDCl_3$) δH/δC**: 7.01/139.3, 7.01/129.3, 7.01/104.8, 6.66/161.1, 6.66/129.3, 6.66/104.8, 6.66/100.3, 6.40/161.1, 3.83/161.1. **GC-MS (70eV) m/z (%)**: 152 (15), 254 (15), 269 (49), 270 (22), 299 (16), [M^+] 300 (100), [M^++1] 301 (15).



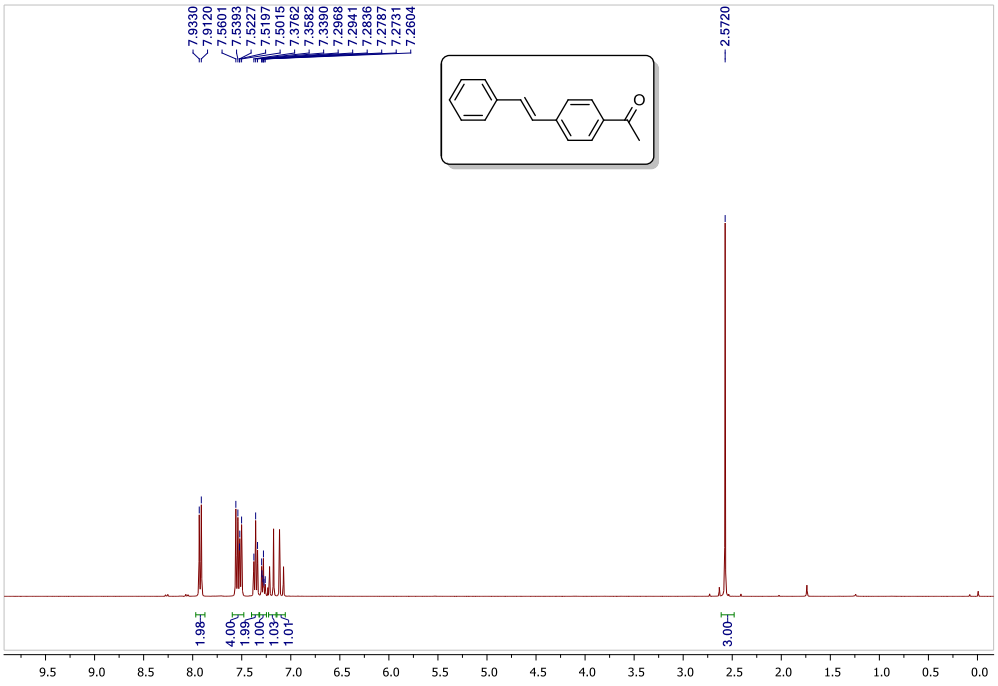
***(E)*-4-(3,5-Dimethoxystyryl)phenol (19)**

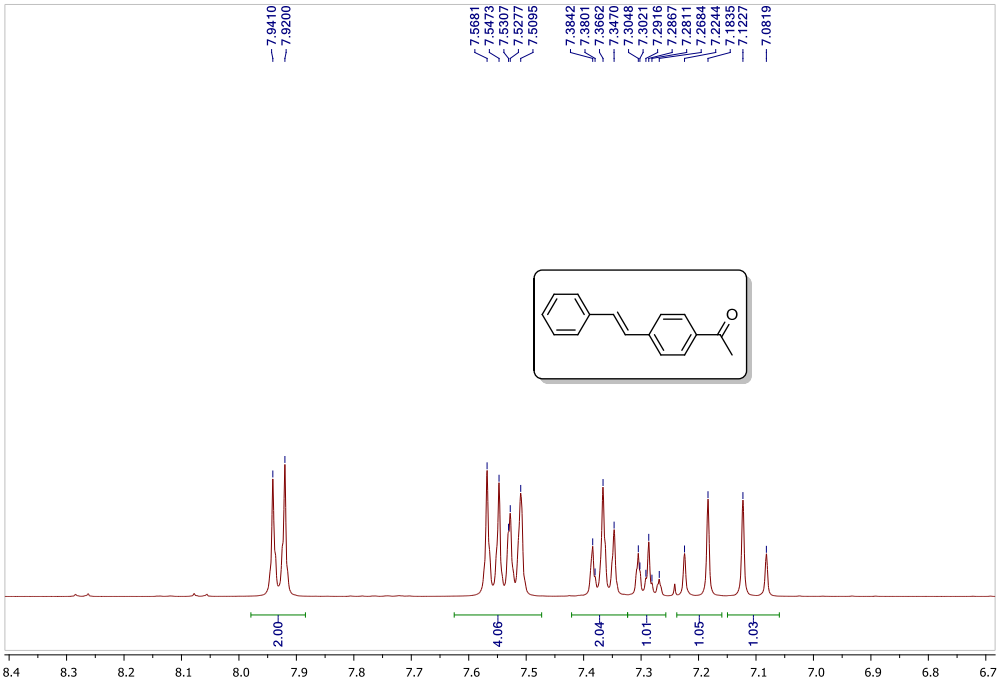
The product was separated by radial chromatography (centrifugal thin-layer chromatography) eluting with pentane/ethyl acetate (100:00➔70:30) as a white solid.[9]

^{1}H NMR (400 MHz, $CDCl_3$) δ: 7.39 (d, *J* = 8.6 Hz, 2H), 7.02 (d, *J* = 16.2 Hz, 1H), 6.88 (d, *J* = 16.2 Hz, 1H), 6.81 (d, *J* = 8.6 Hz, 2H), 6.65 (d, *J* = 2.2 Hz, 2H), 6.38 (t, *J* = 2.2 Hz, 1H), 5.28 (s, 1H), 3.82 (s, 6H). **^{13}C NMR (101 MHz, $CDCl_3$) δ:** 161.1 (C), 155.6 (C), 139.8 (C), 130.2 (C), 128.9 (CH), 128.1 (CH), 126.7 (CH), 115.8 (CH), 104.6 (CH), 99.8 (CH), 55.5 (CH_3). **^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) δ_H/δ_H:** 7.39/6.81, 7.02/6.88, 6.65/6.38. **^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.39/128.1, 7.02/128.9, 6.88/126.7, 6.81/115.8, 6.65/104.6, 6.38/99.8, 3.82/55.5. **^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) δ_H/δ_C:** 7.39/155.6, 7.39/128.9, 7.39/128.1, 7.02/139.8, 7.02/128.1, 7.02/126.7, 6.88/130.2, 6.88/128.9, 6.88/104.6, 6.81/155.6, 6.81/130.2, 6.81/115.8, 6.65/161.1, 6.65/126.7, 6.65/104.6, 6.65/99.8, 6.38/161.1, 6.38/104.6, 3.82/161.1. **GC-MS (70eV) m/z (%):** 76 (15), 181 (20), 182 (17), 207 (59), 225 (18), [M^+] 256 (100), [M^++1] 257 (34).

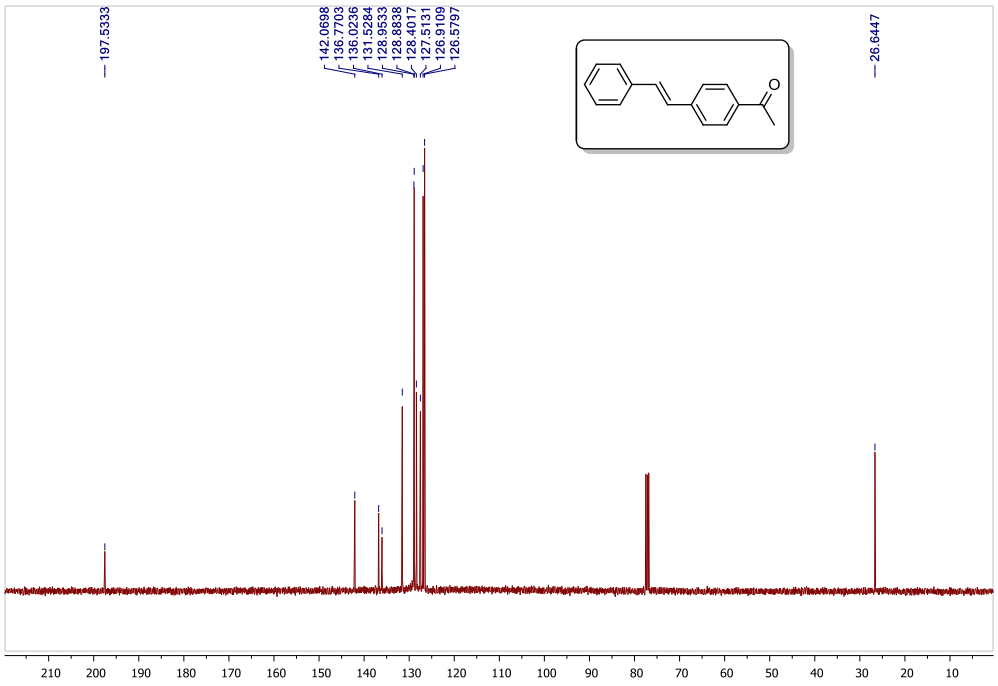
3. NMR Spectroscopy

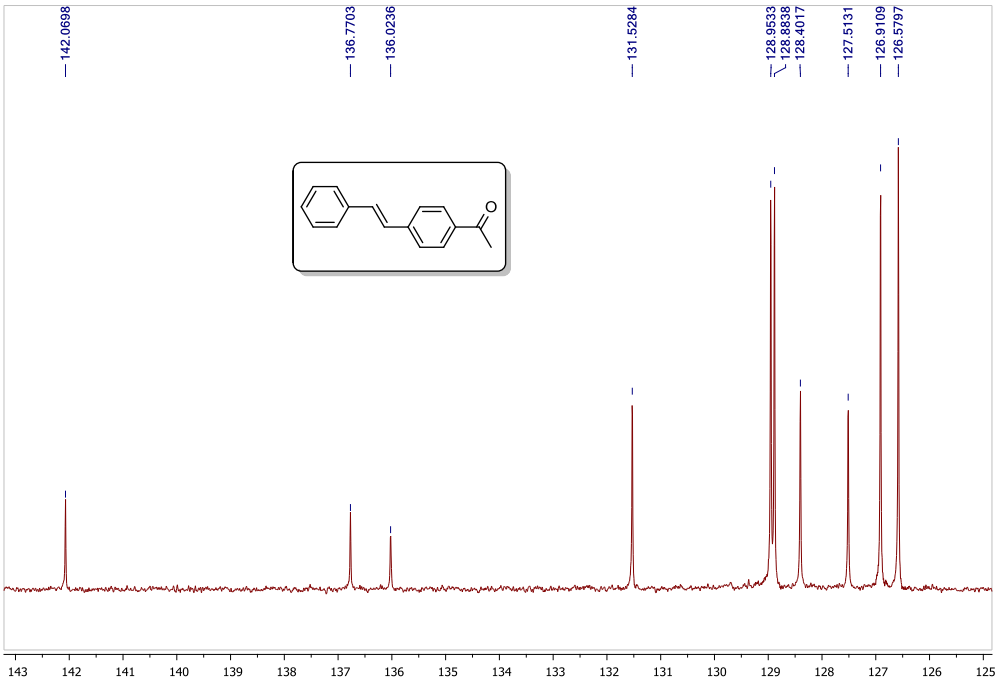
^{1}H NMR (400 MHz, $CDCl_3$) (*E*)-1-(4-styrylphenyl)ethanone (3)



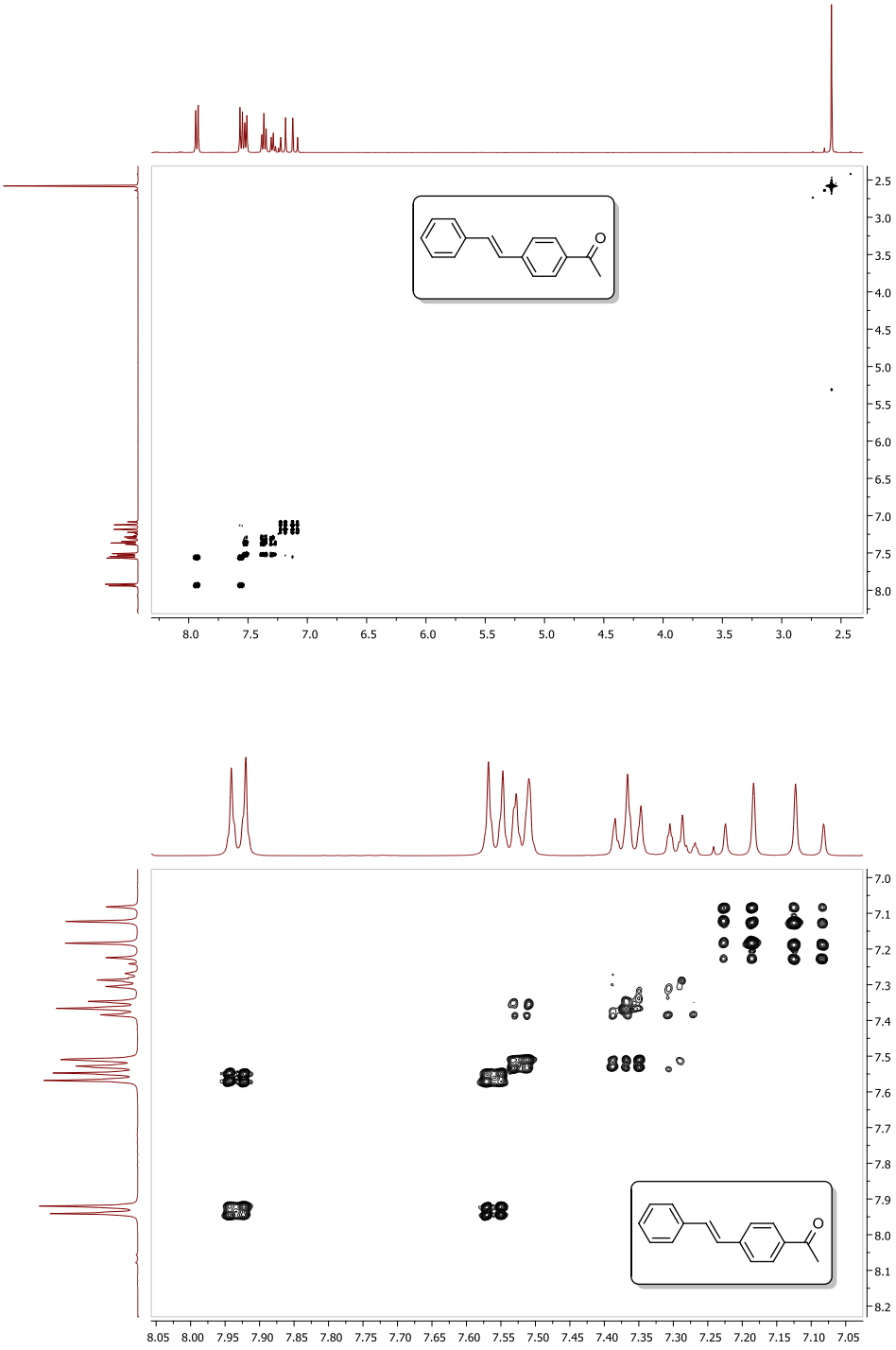


^{13}C NMR (101 MHz, $CDCl_3$) (*E*)-1-(4-styrylphenyl)ethanone (3)

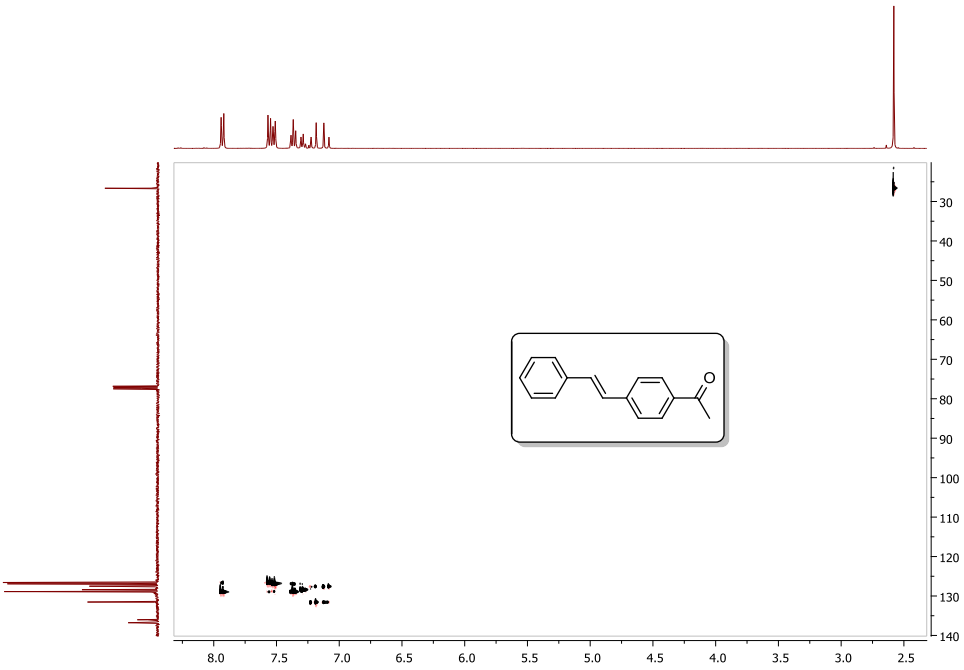


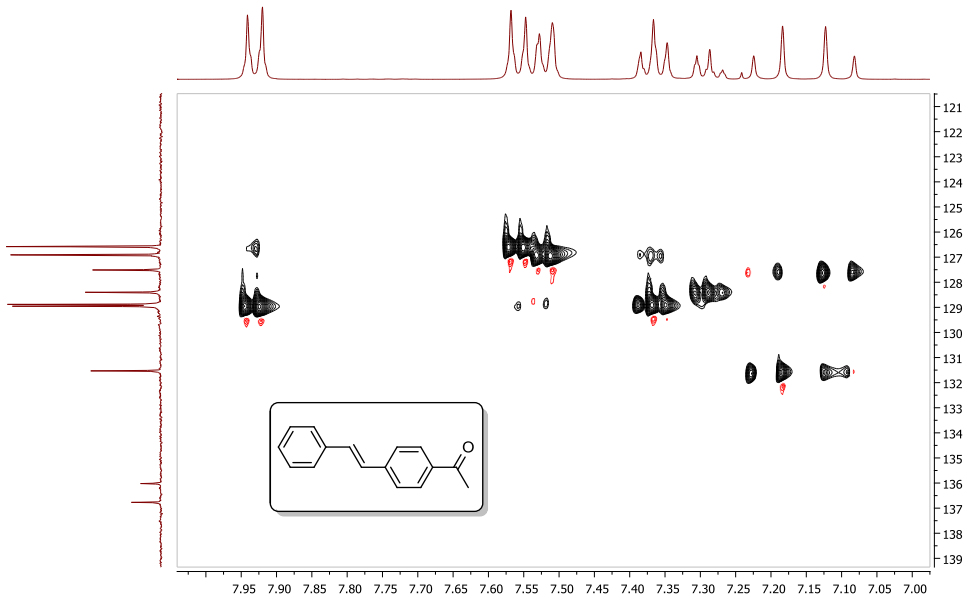


^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) (*E*)-1-(4-styrylphenyl)ethanone (3)

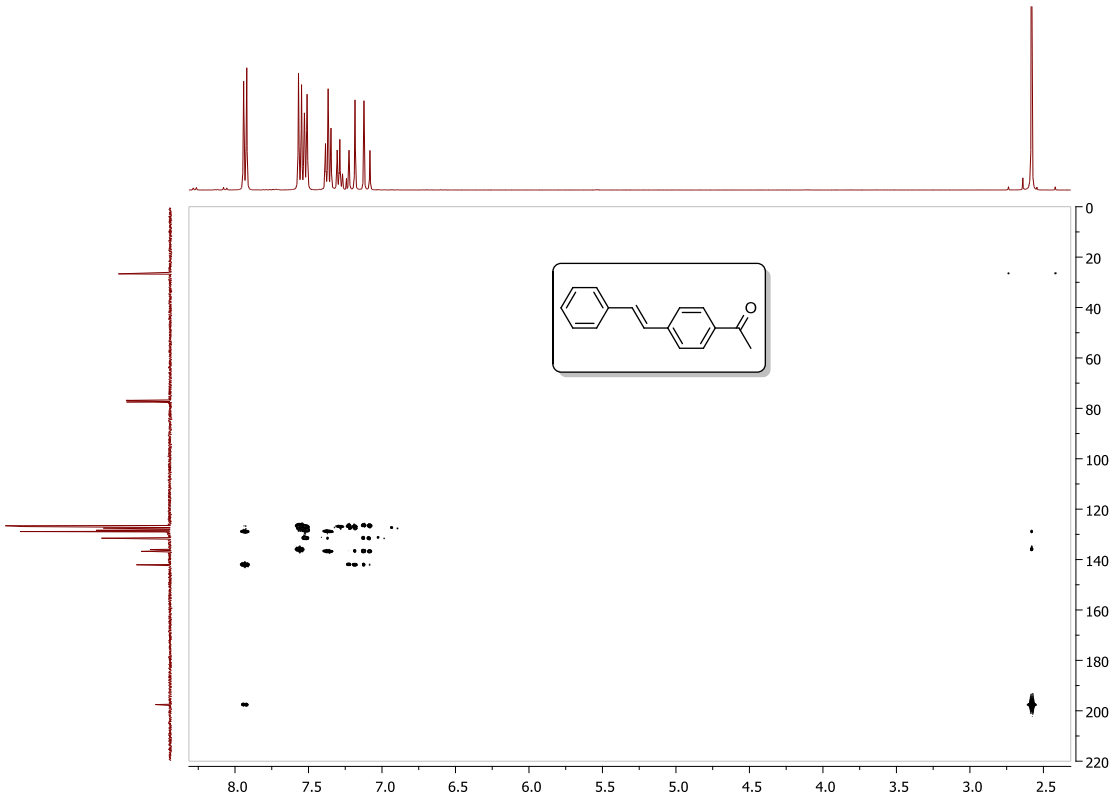


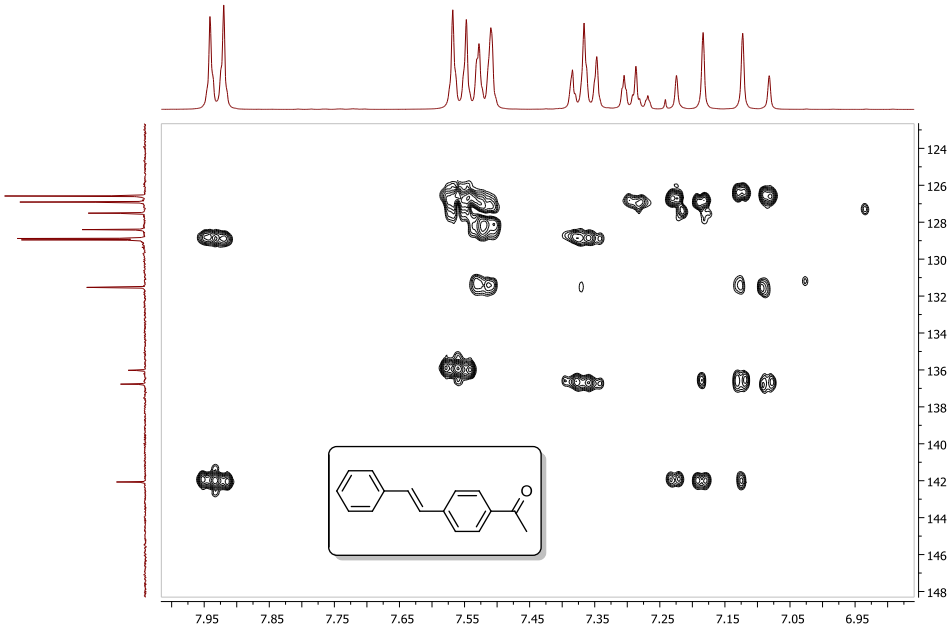
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) (*E*)-1-(4-styrylphenyl)ethanone (3)



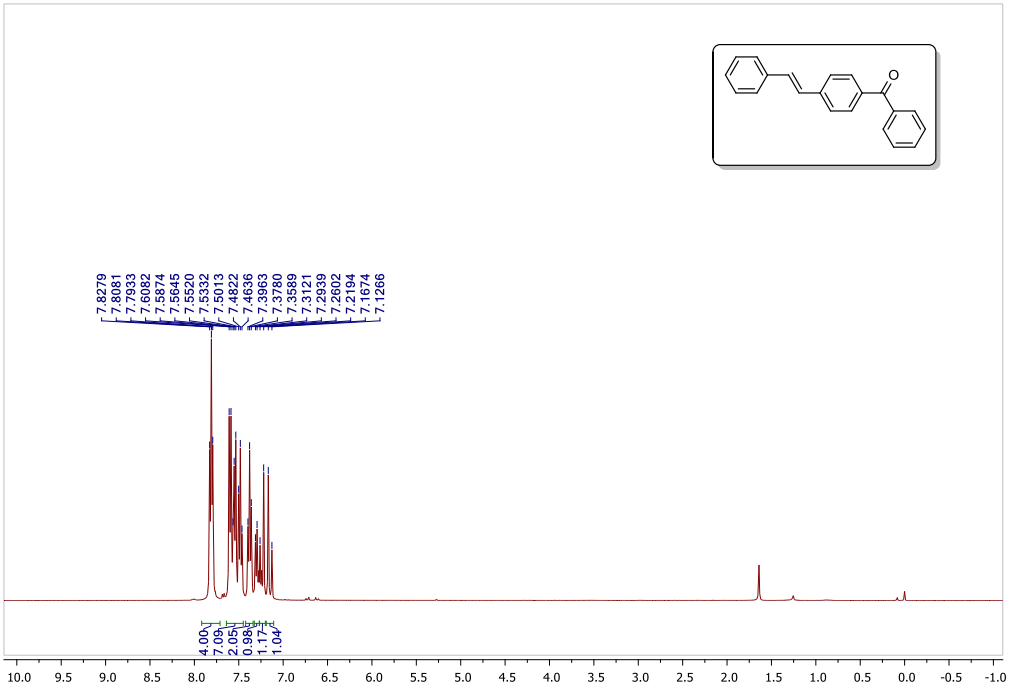


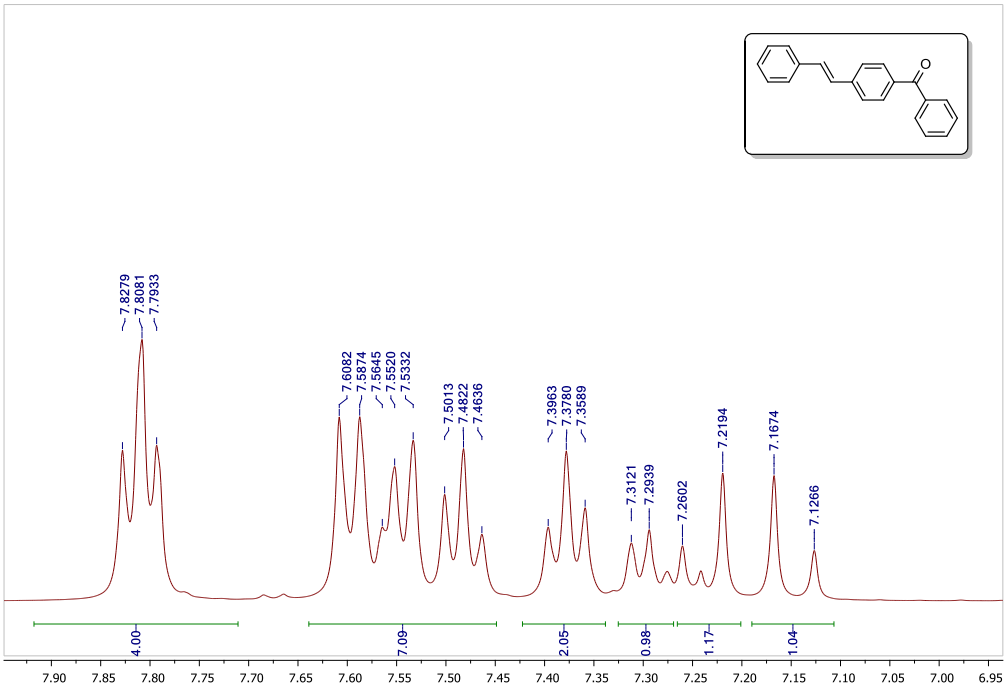
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) (*E*)-1-(4-styrylphenyl)ethanone (3)



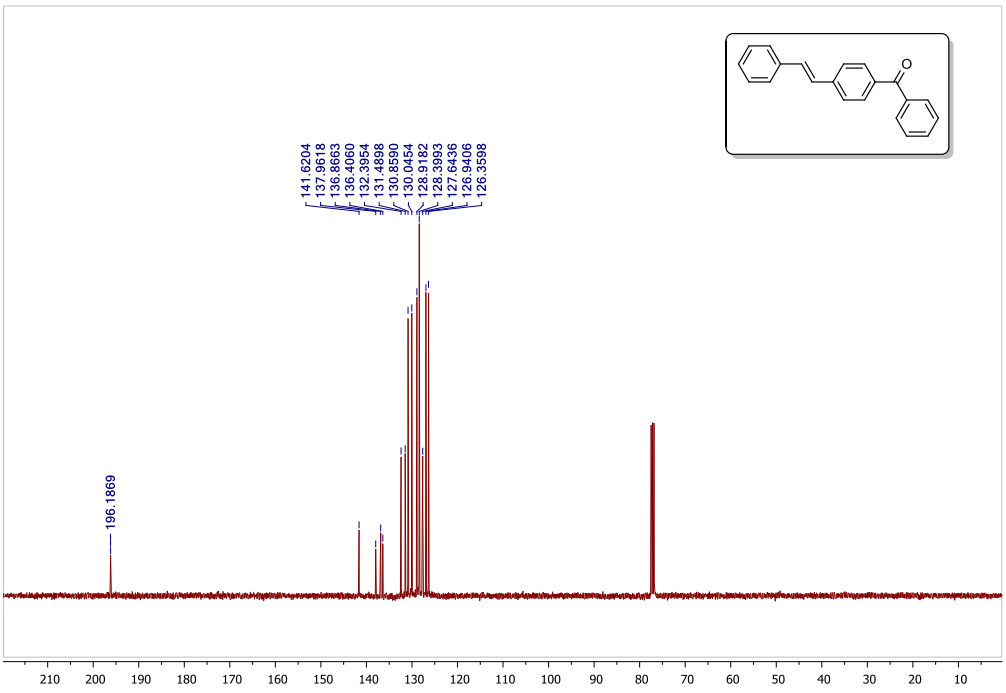


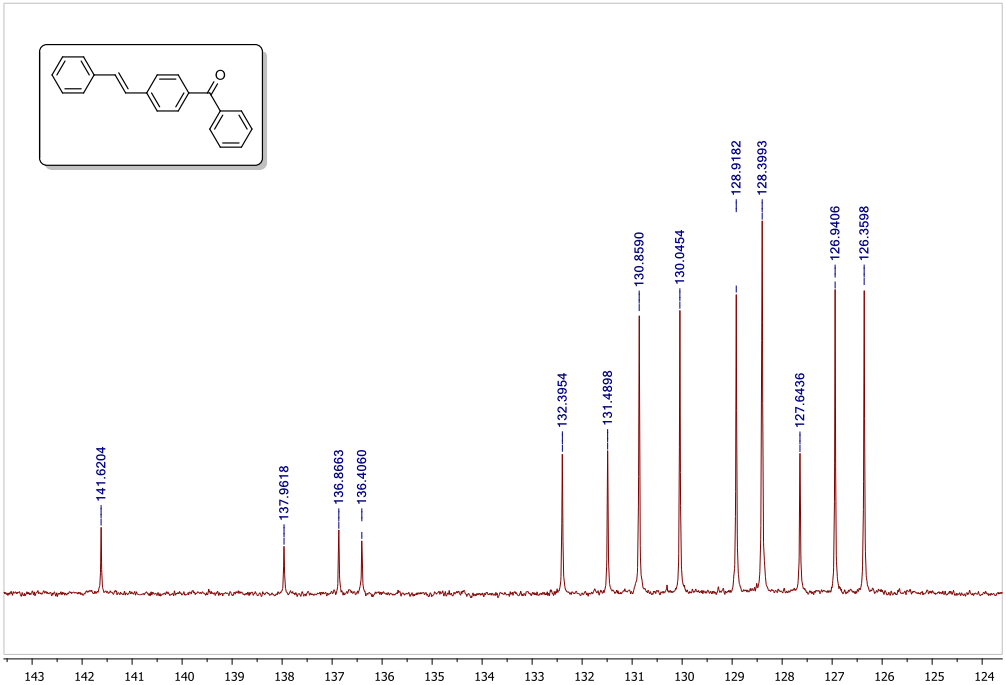
^{1}H NMR (400 MHz, $CDCl_3$) (*E*)-phenyl(4-styrylphenyl)methanone (4)



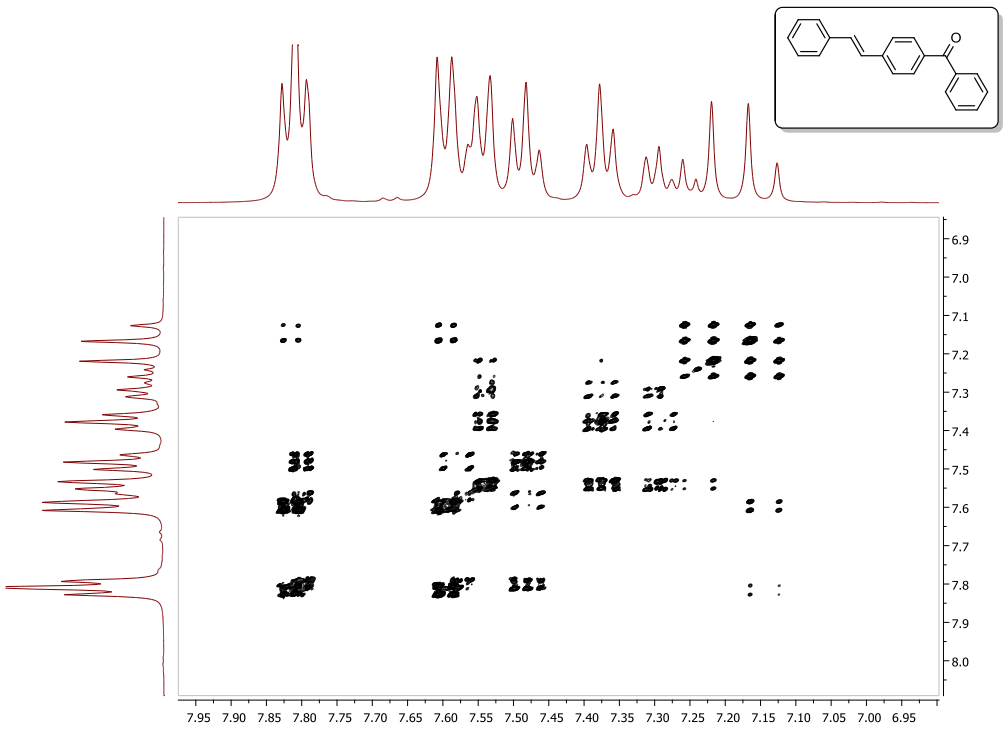


^{13}C NMR (101 MHz, $CDCl_3$) (*E*)-phenyl(4-styrylphenyl)methanone (4)

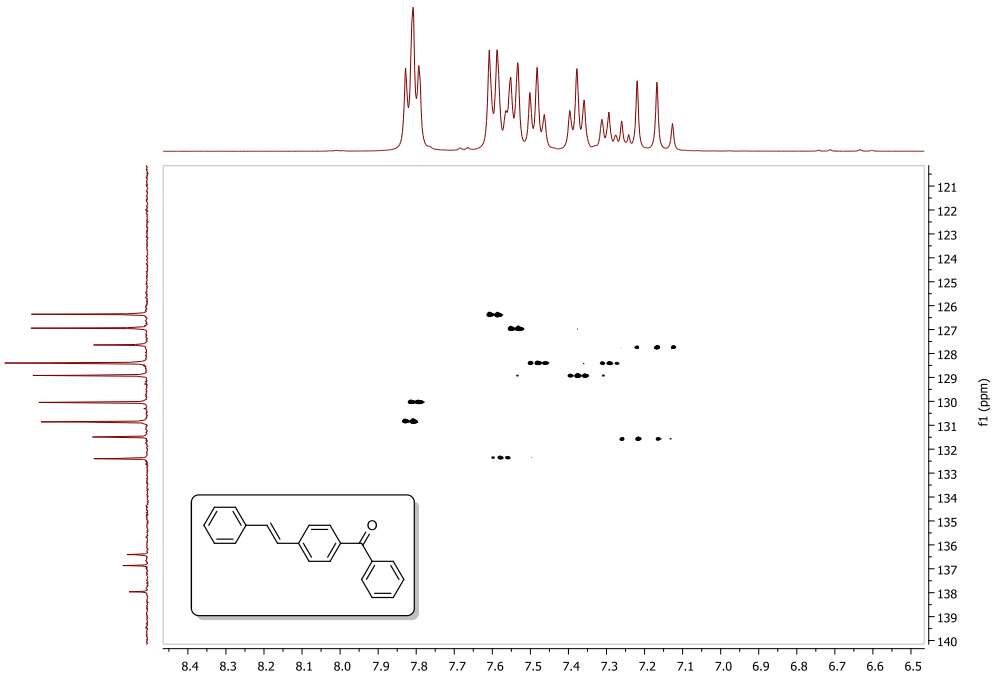




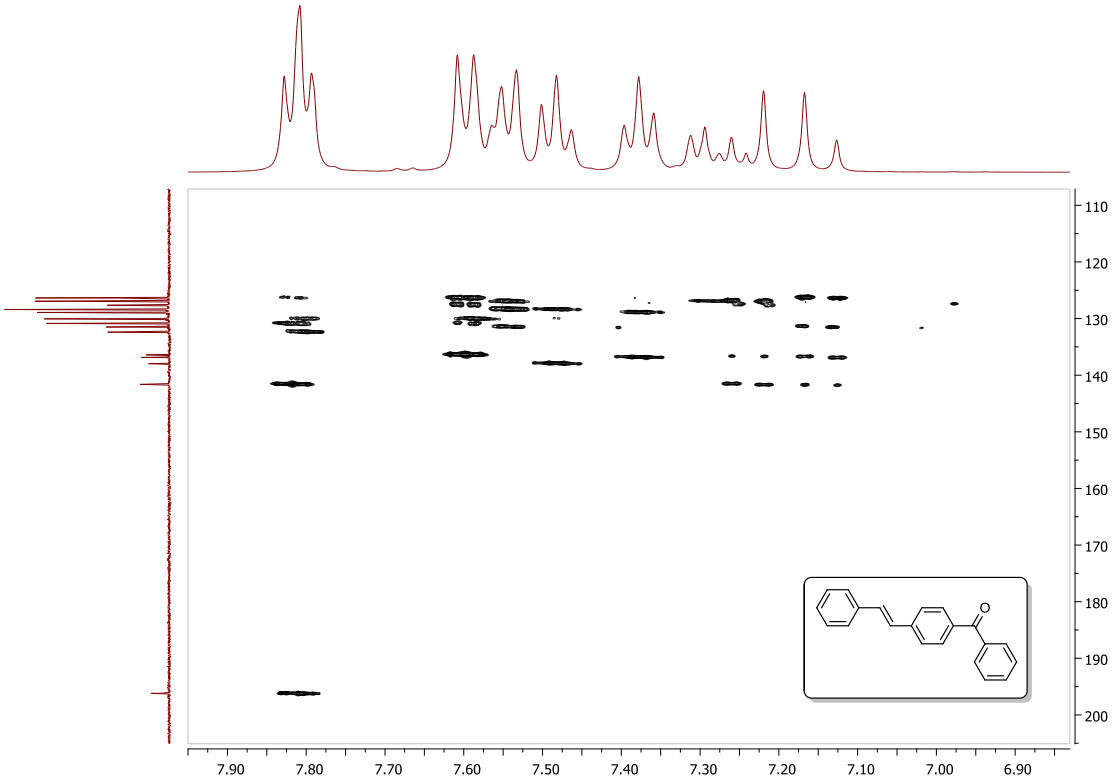
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) (*E*)-phenyl(4-styrylphenyl)methanone (4)



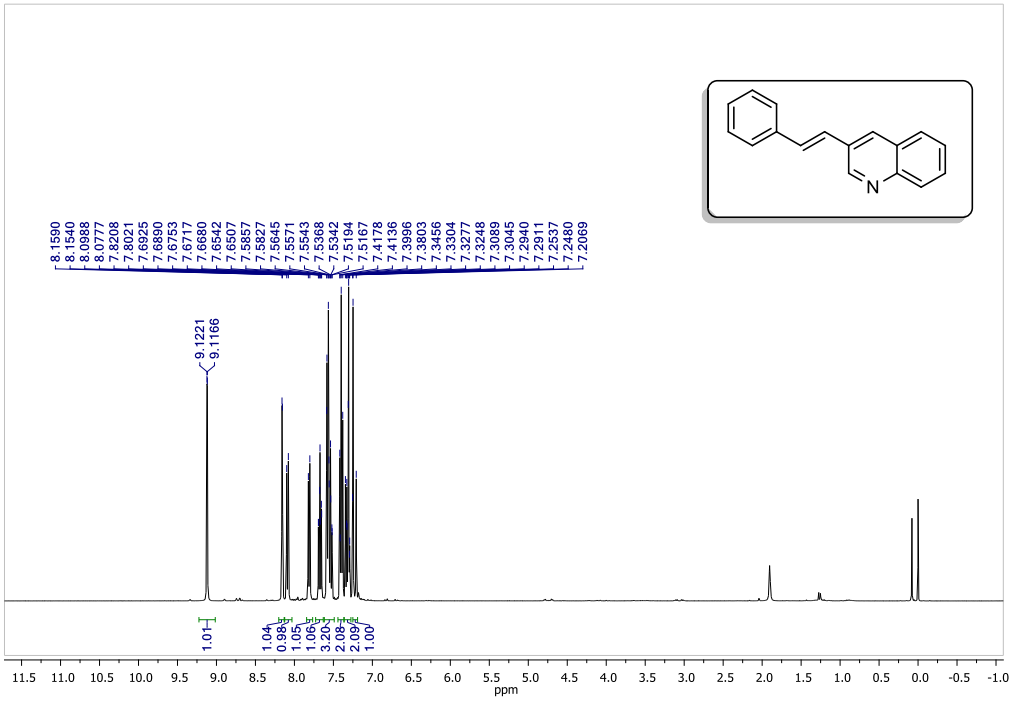
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) (*E*)-phenyl(4-styrylphenyl)methanone (4)



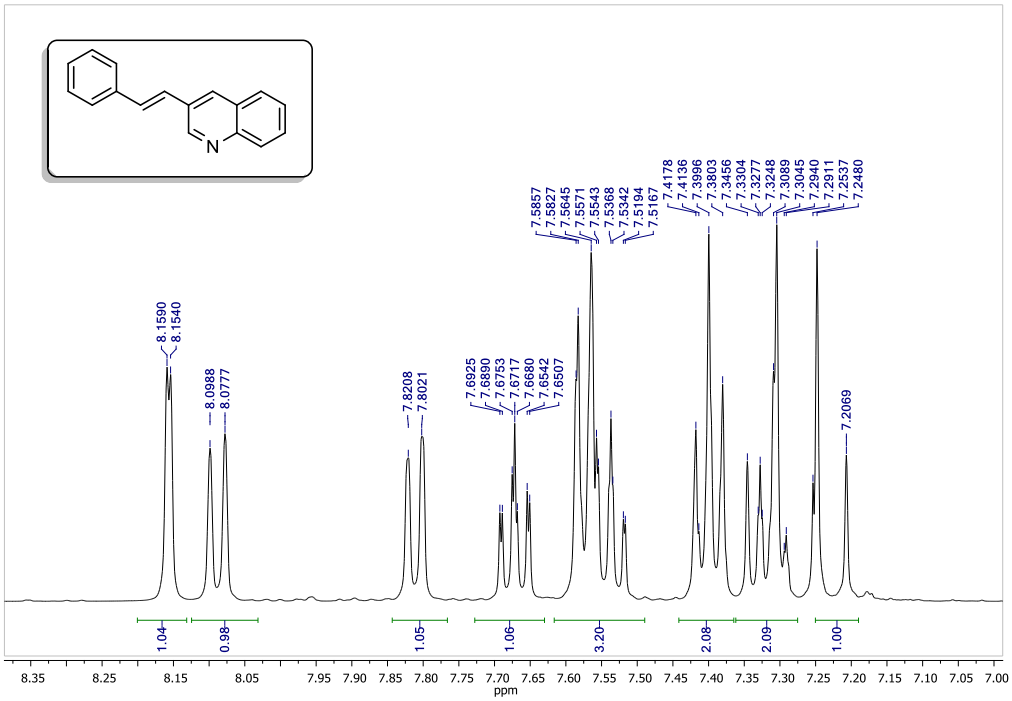
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) (*E*)-phenyl(4-styrylphenyl)methanone (4)



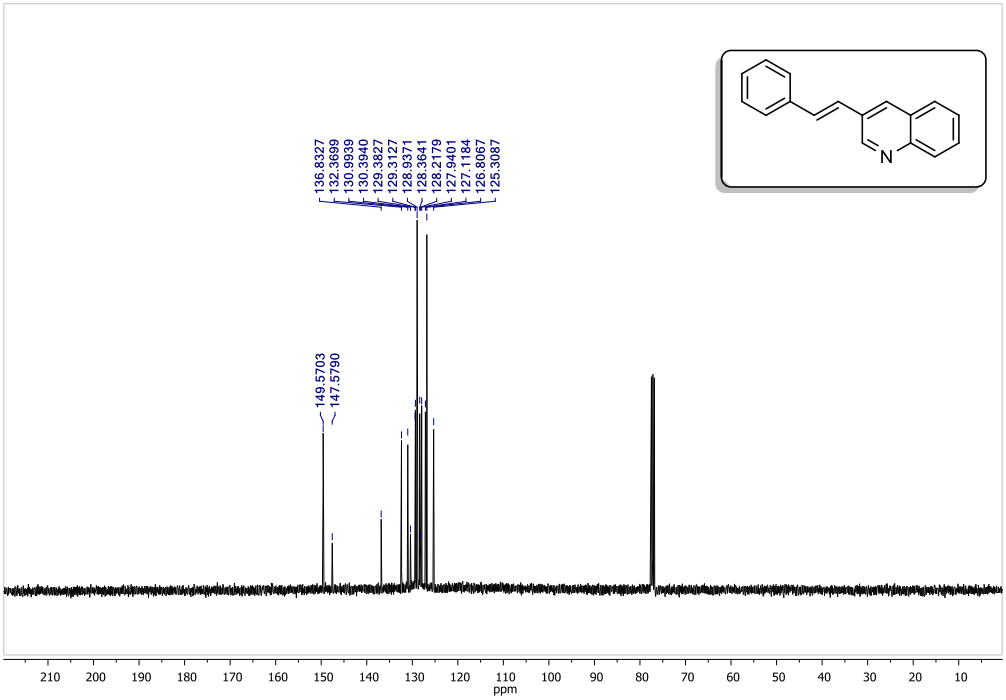
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-3-styrylquinoline (5)



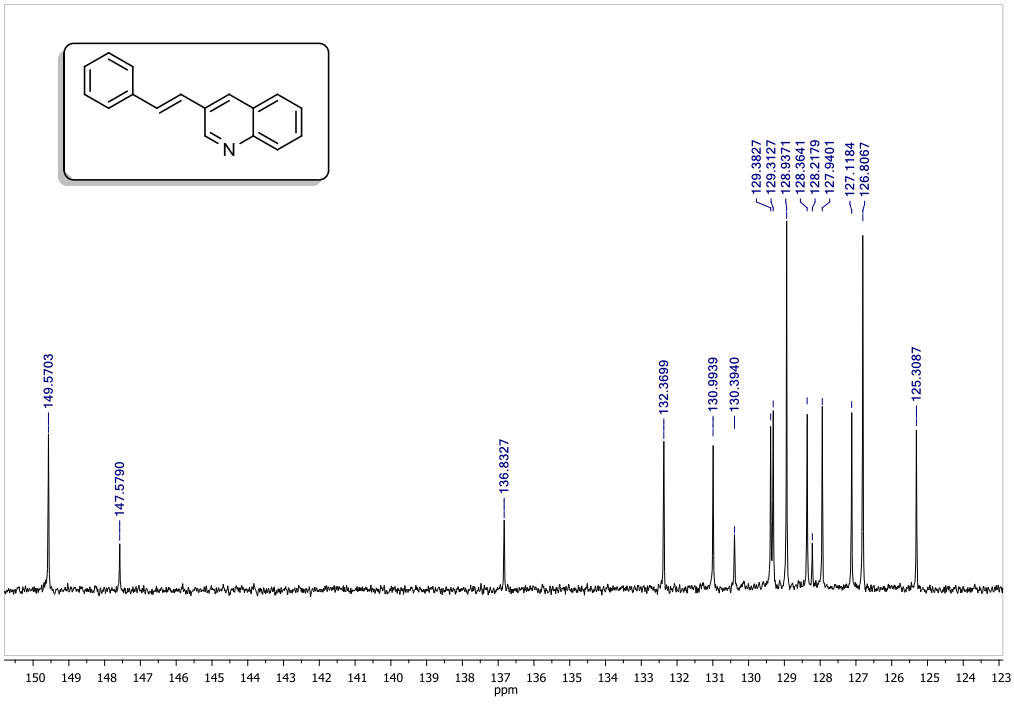
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-3-styrylquinoline (5)



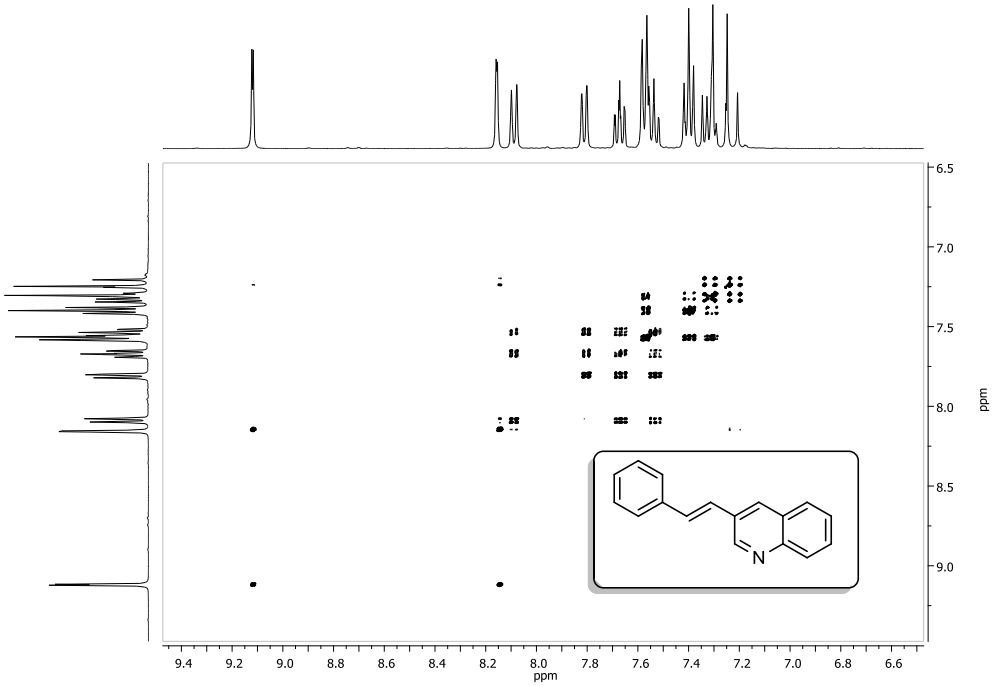
^{13}C NMR (100 MHz, $CDCl_3$) *(E)*-3-styrylquinoline (5)



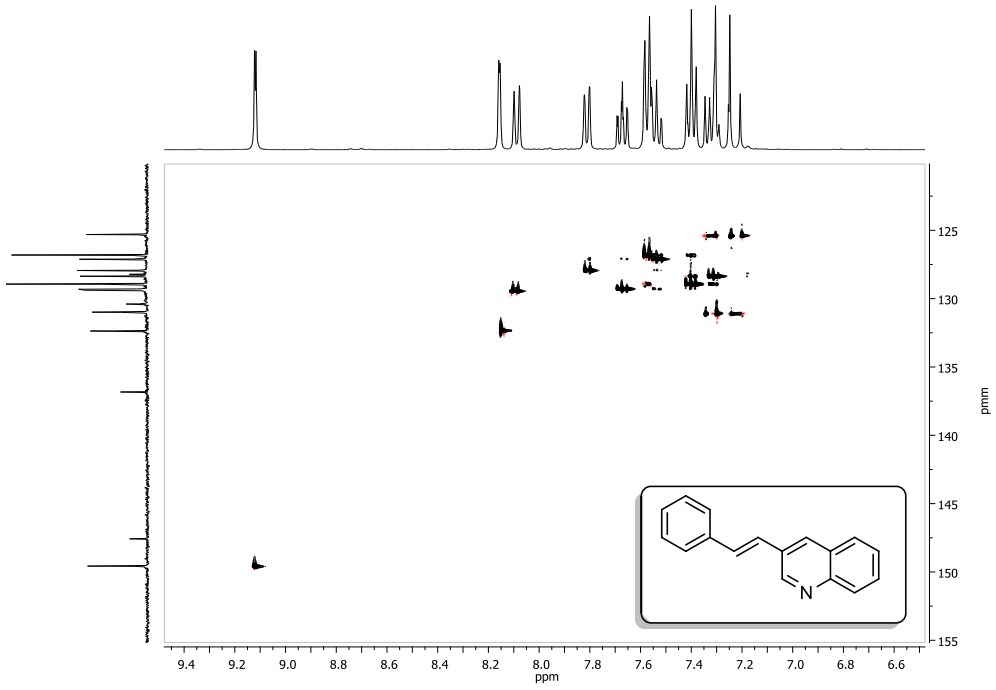
^{13}C NMR (100 MHz, $CDCl_3$) *(E)*-3-styrylquinoline (5)

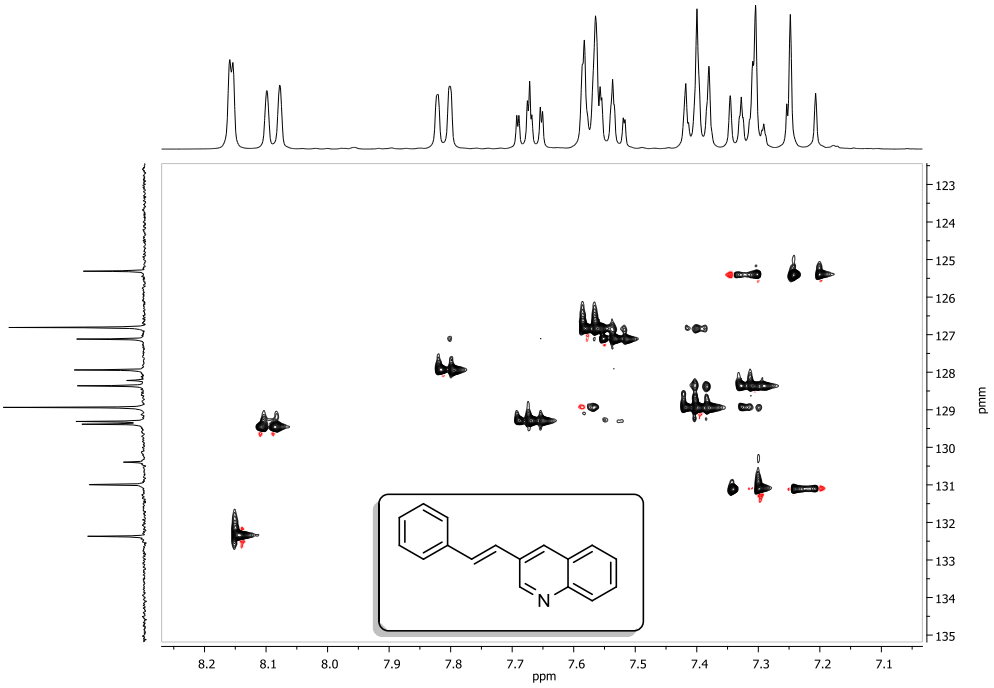


^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) *(E)*-3-styrylquinoline (5)

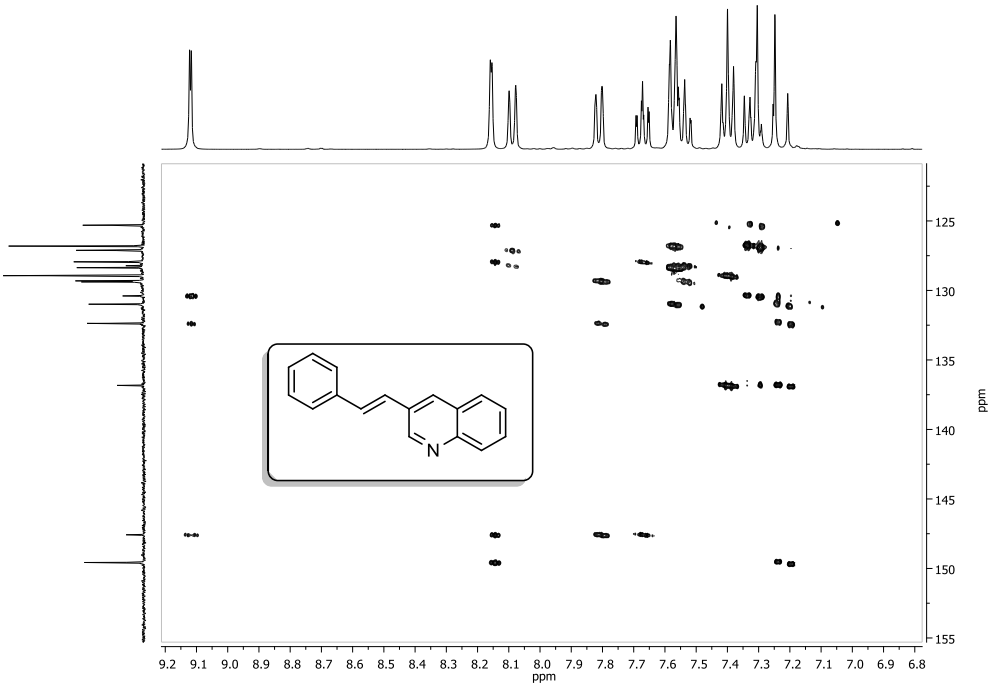


^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-3-styrylquinoline (5)

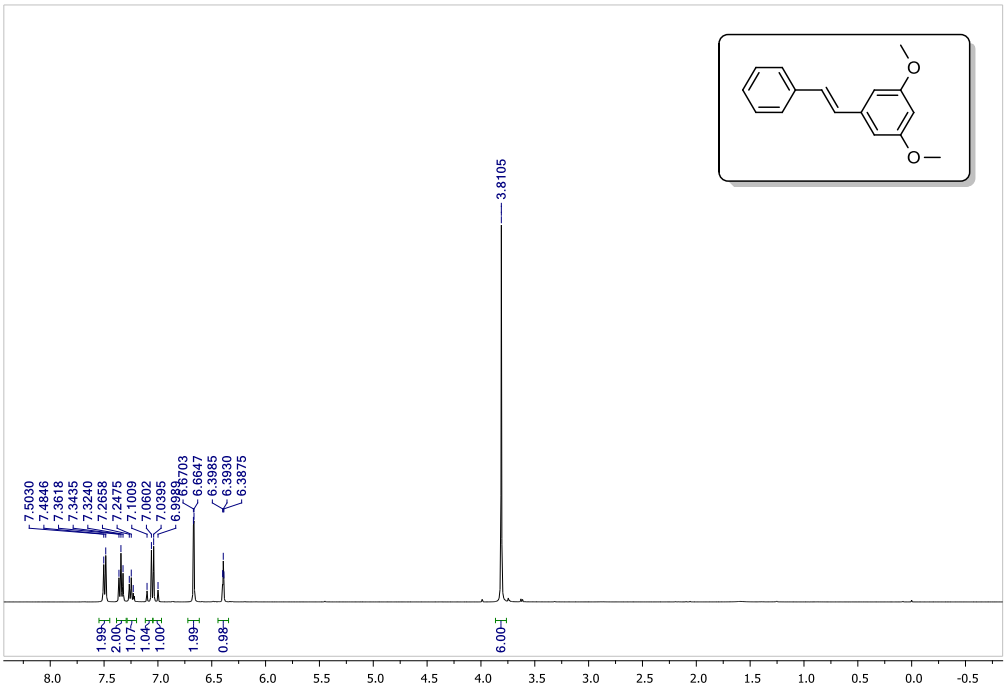




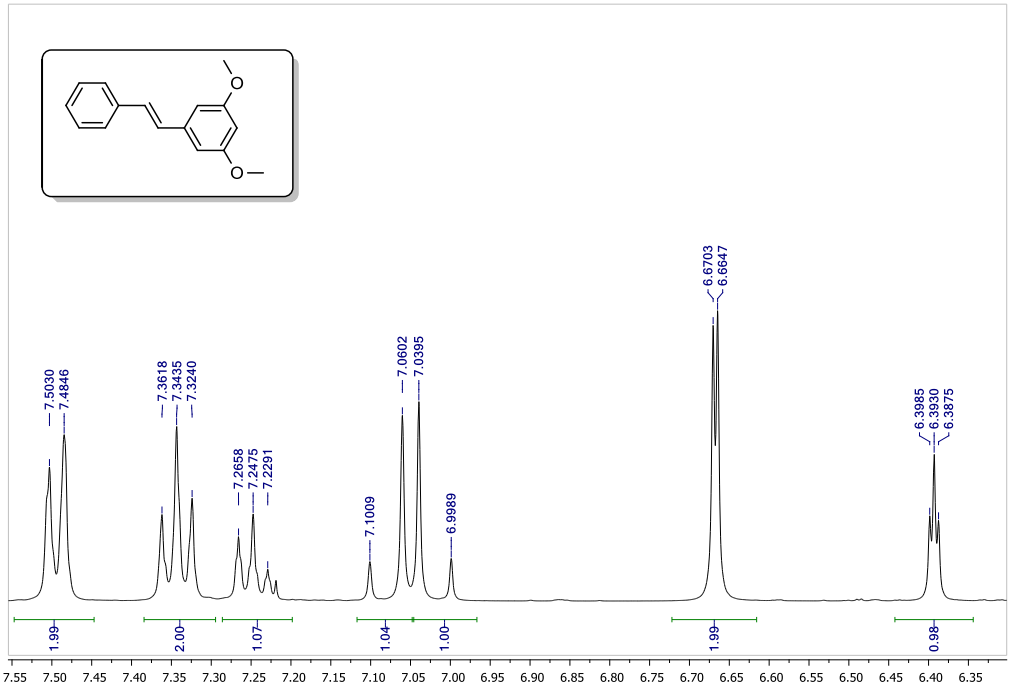
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-3-styrylquinoline (5)



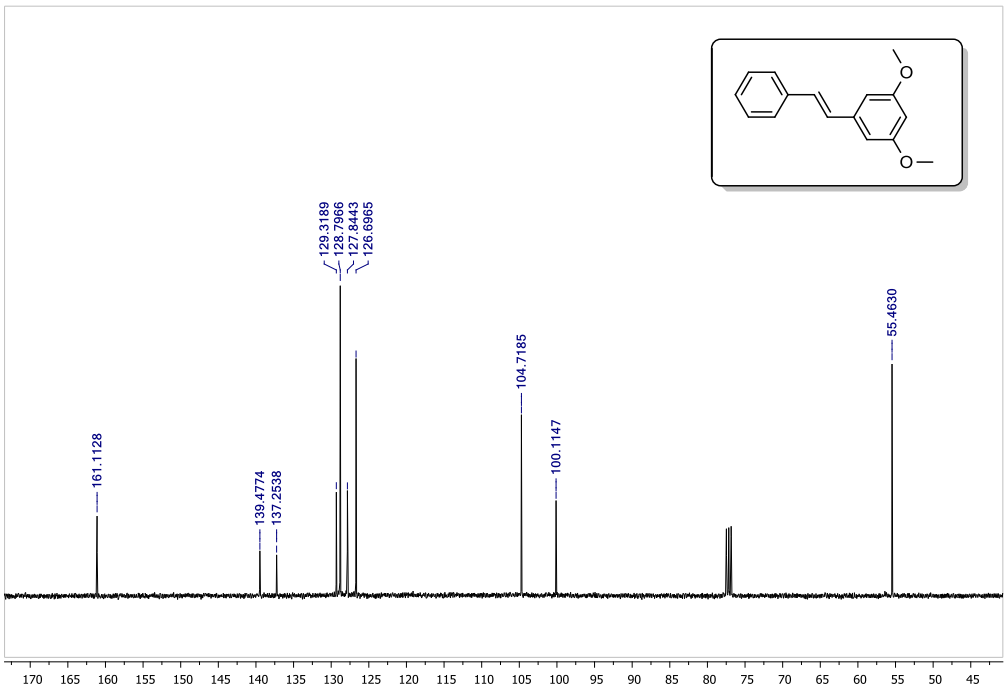
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-1,3-dimethoxy-5-styrylbenzene (6)



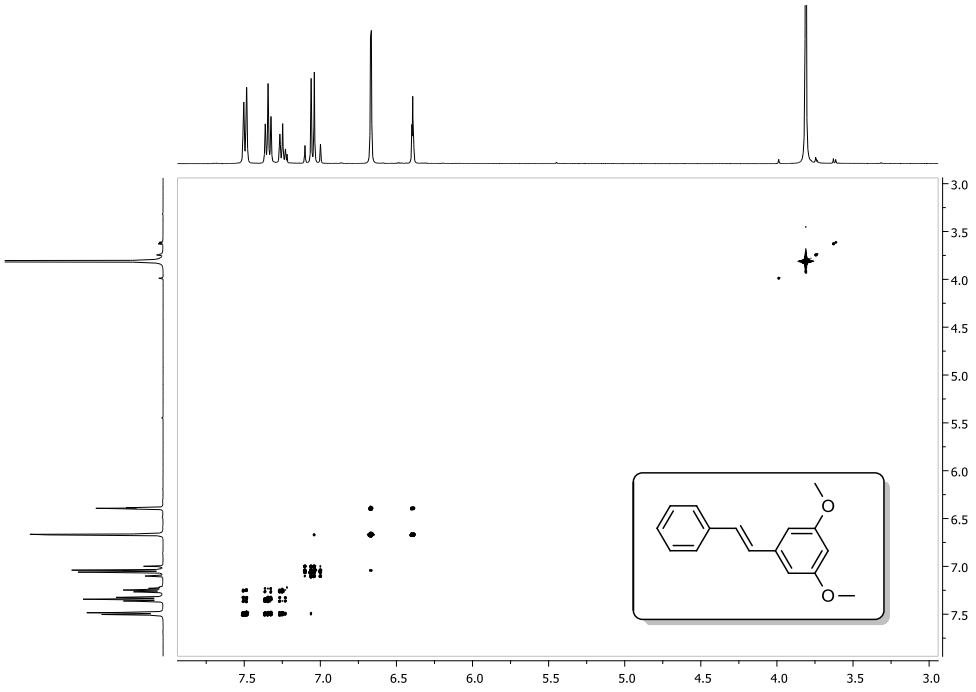
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-1,3-dimethoxy-5-styrylbenzene (6)

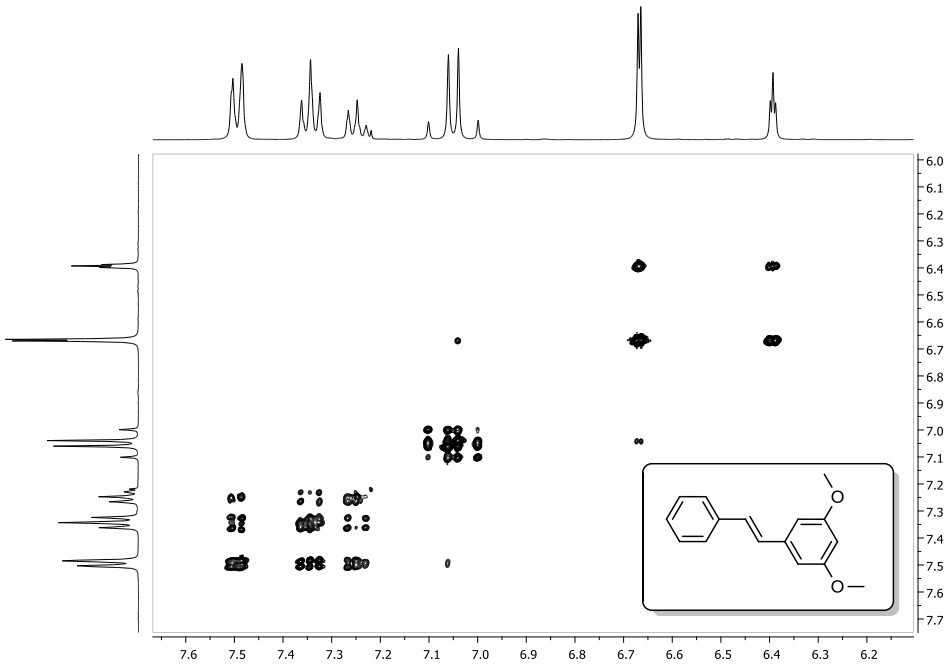


^{13}C NMR (101 MHz, $CDCl_3$) *(E)*-1,3-dimethoxy-5-styrylbenzene (6)

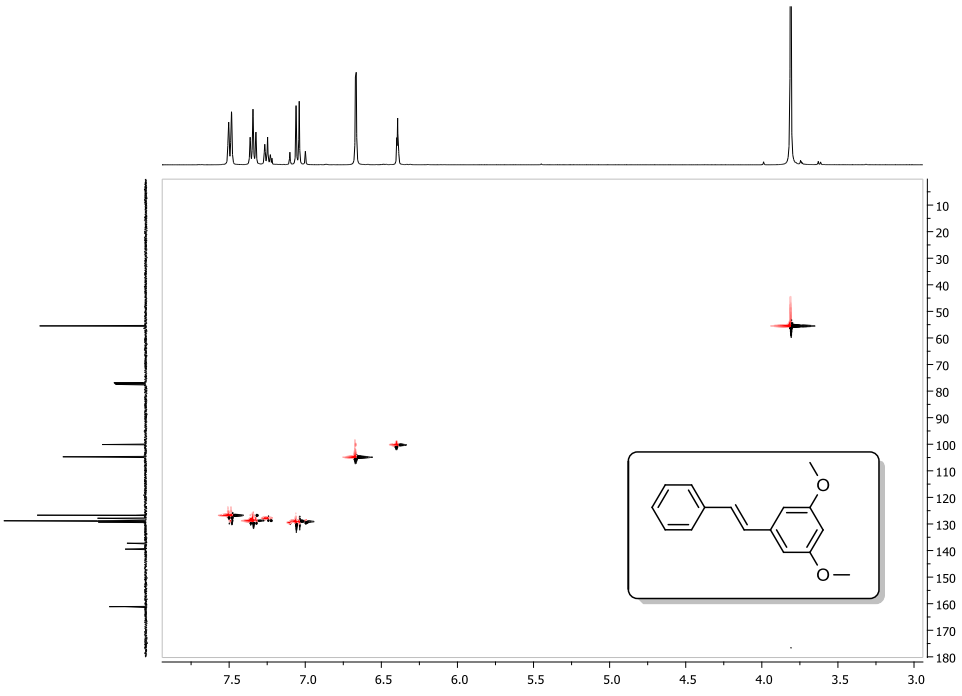


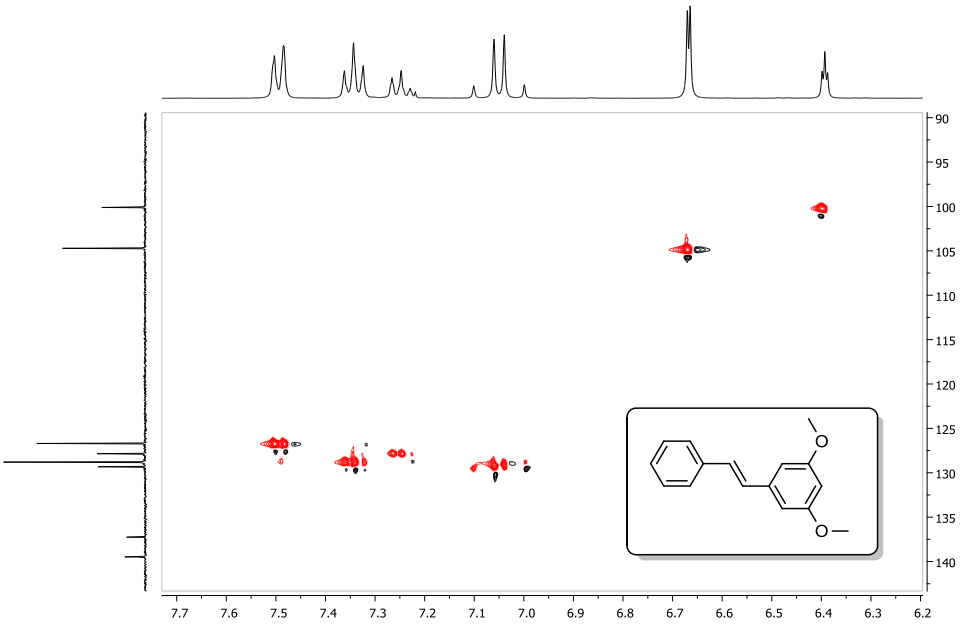
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) *(E)*-1,3-dimethoxy-5-styrylbenzene (6)



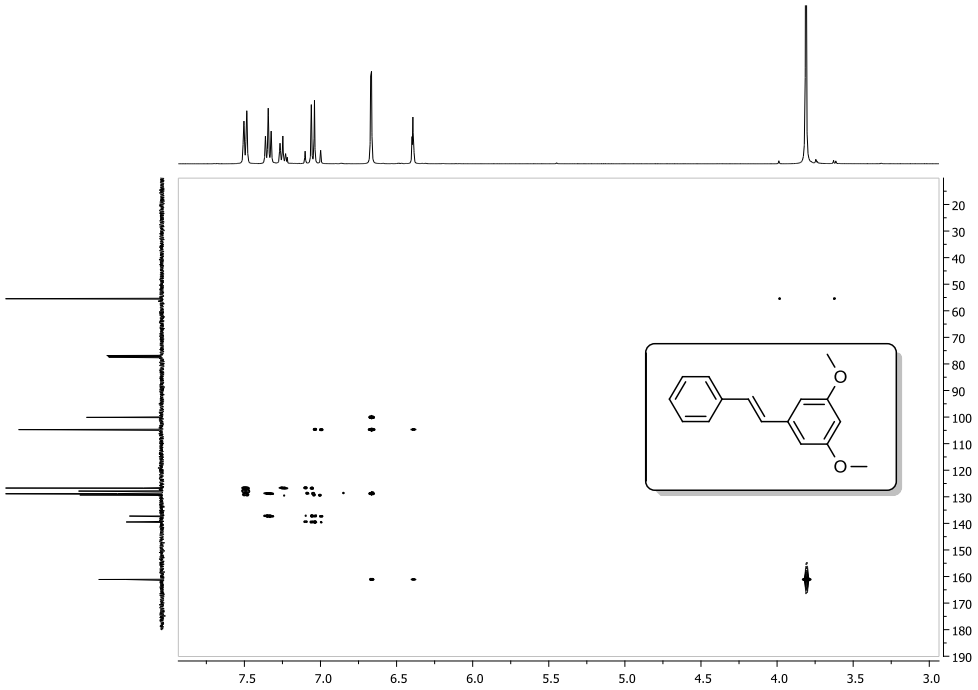


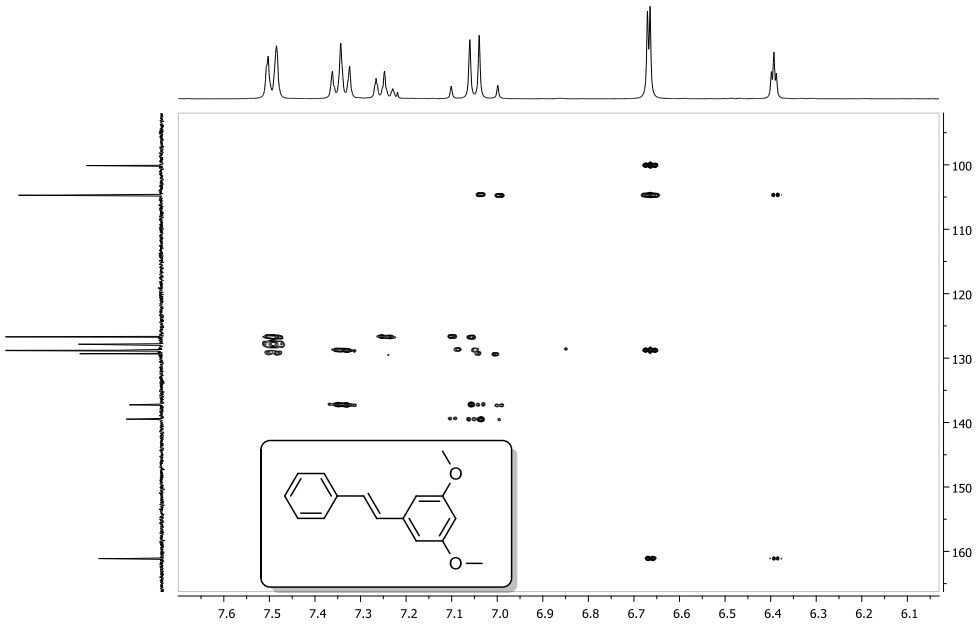
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-1,3-dimethoxy-5-styrylbenzene (6)



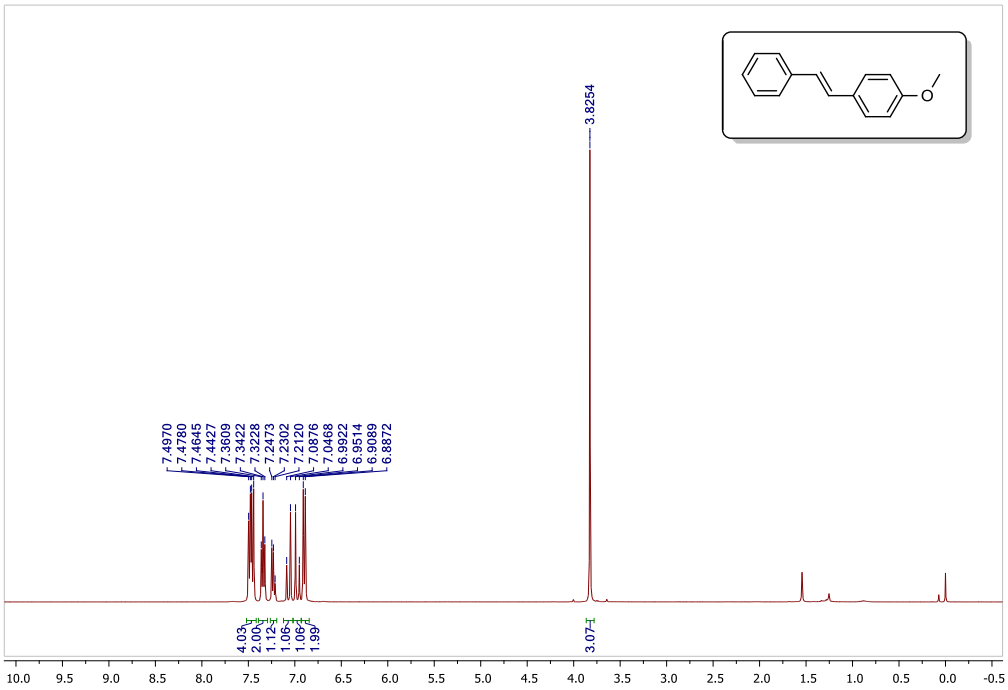


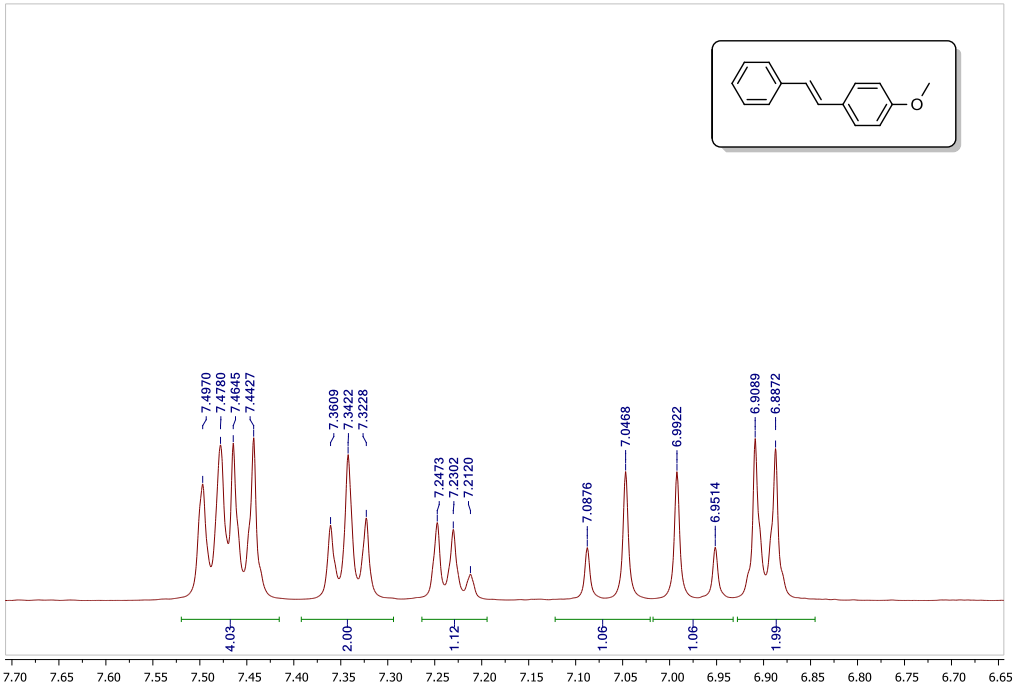
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-1,3-dimethoxy-5-styrylbenzene (6)



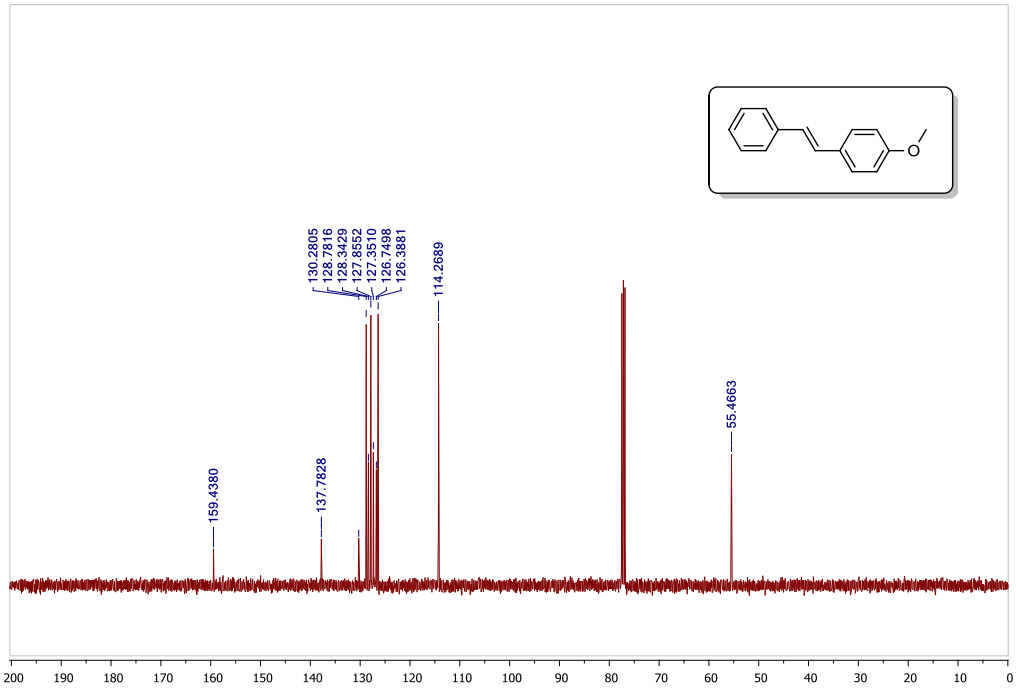

100
110
120
130
140
150
160
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
O
O

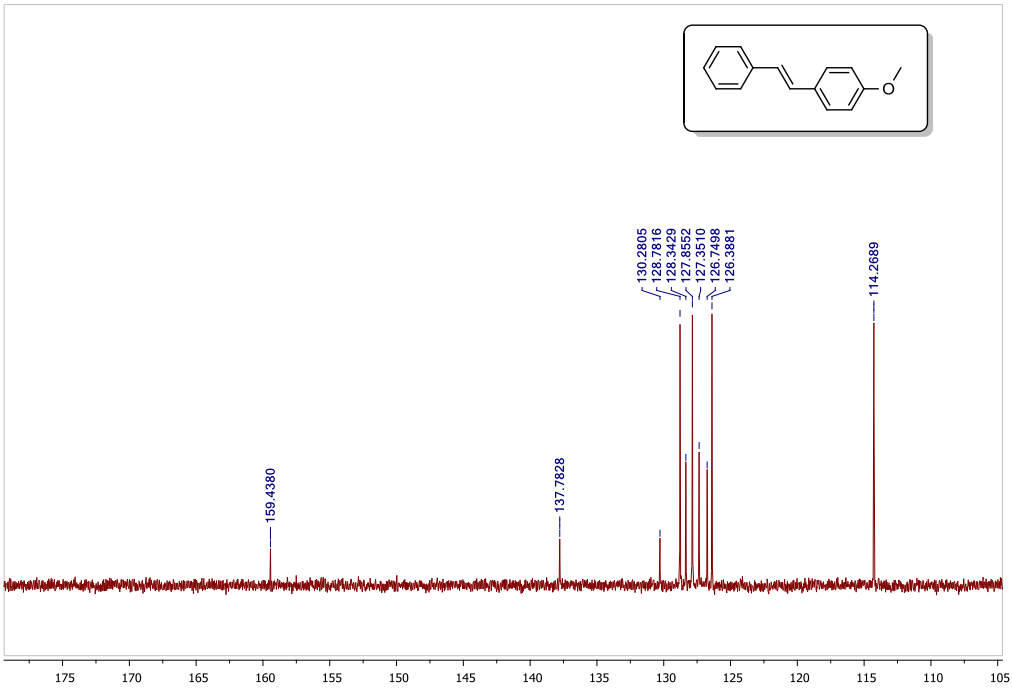
^{1}H NMR (400 MHz, $CDCl_3$) (*E*)-1-methoxy-4-styrylbenzene (7)



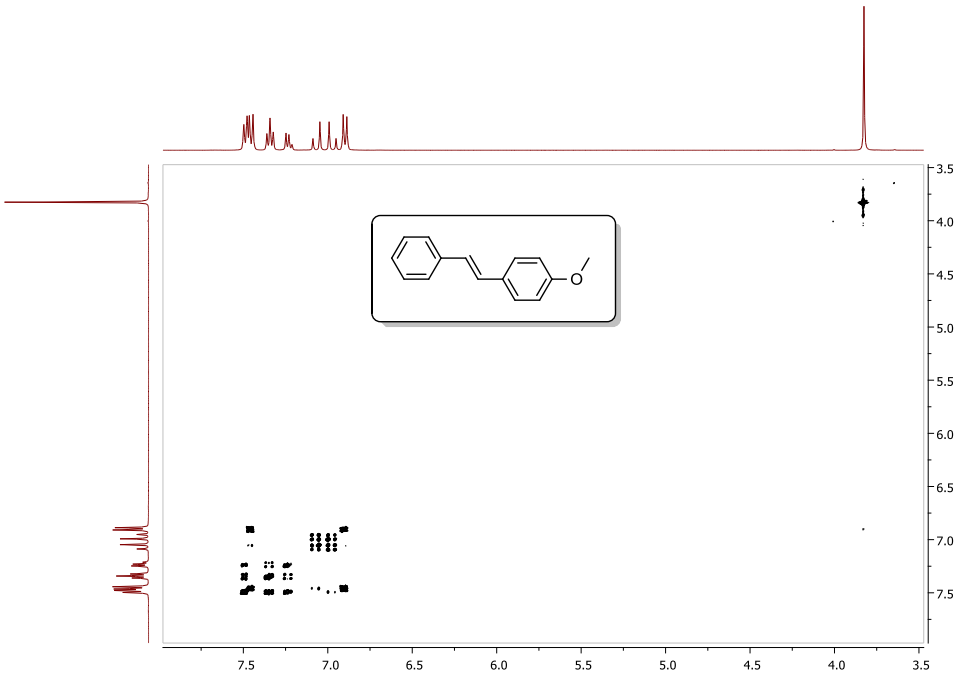


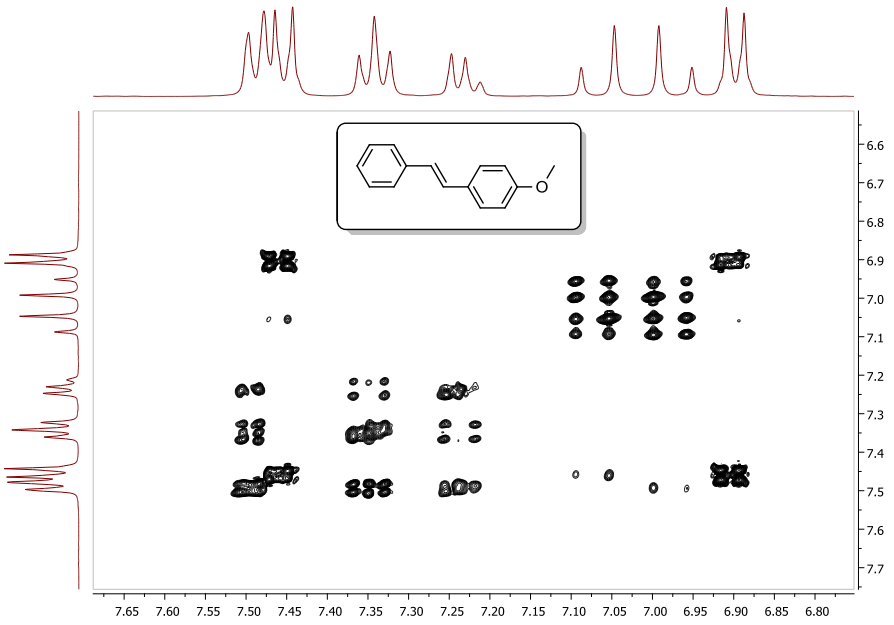
^{13}C NMR (101 MHz, $CDCl_3$) (*E*)-1-methoxy-4-styrylbenzene (7)



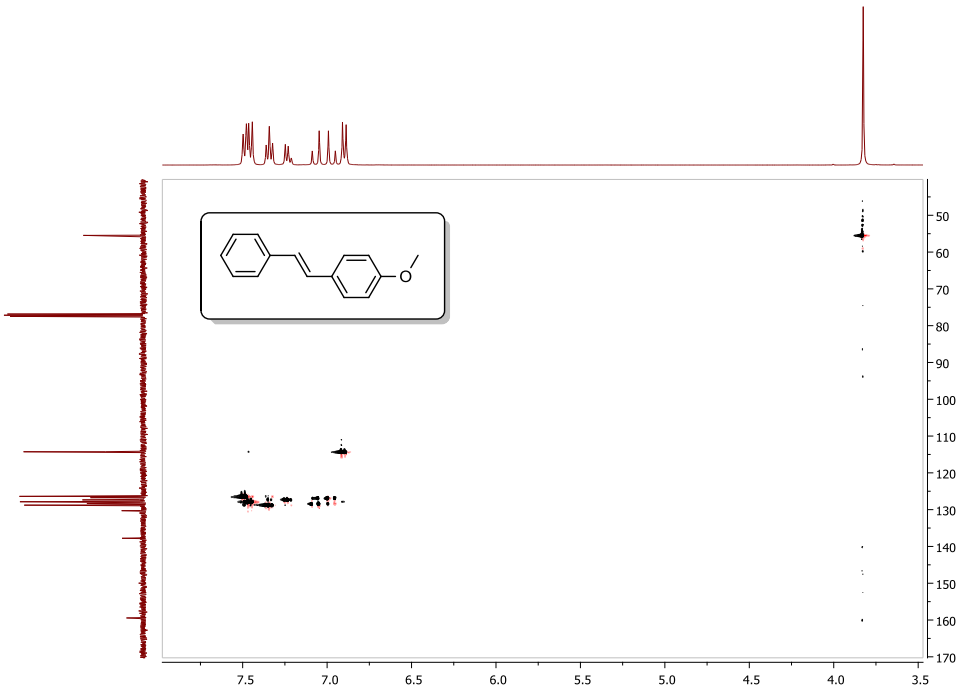


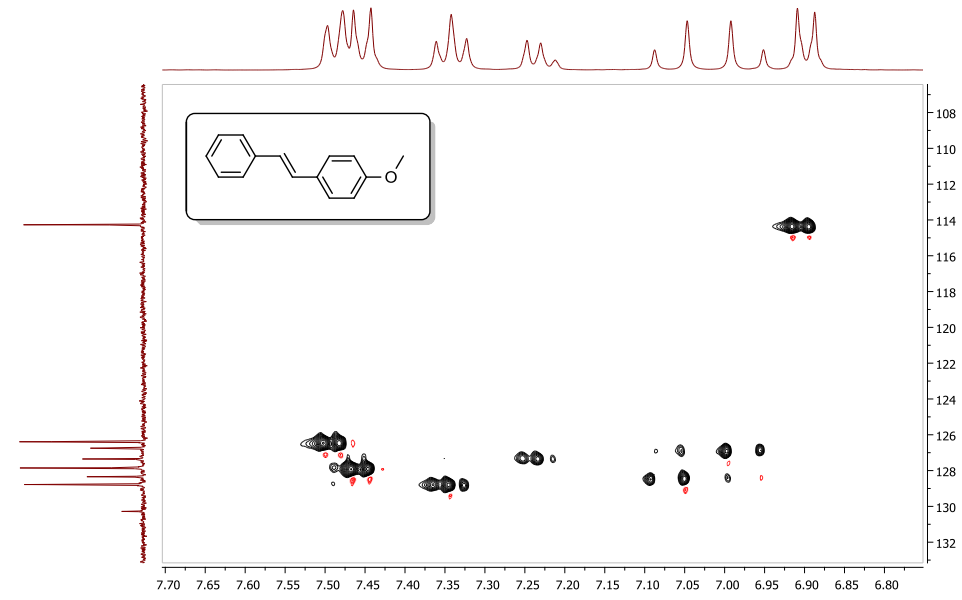
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) (*E*)-1-methoxy-4-styrylbenzene (7)



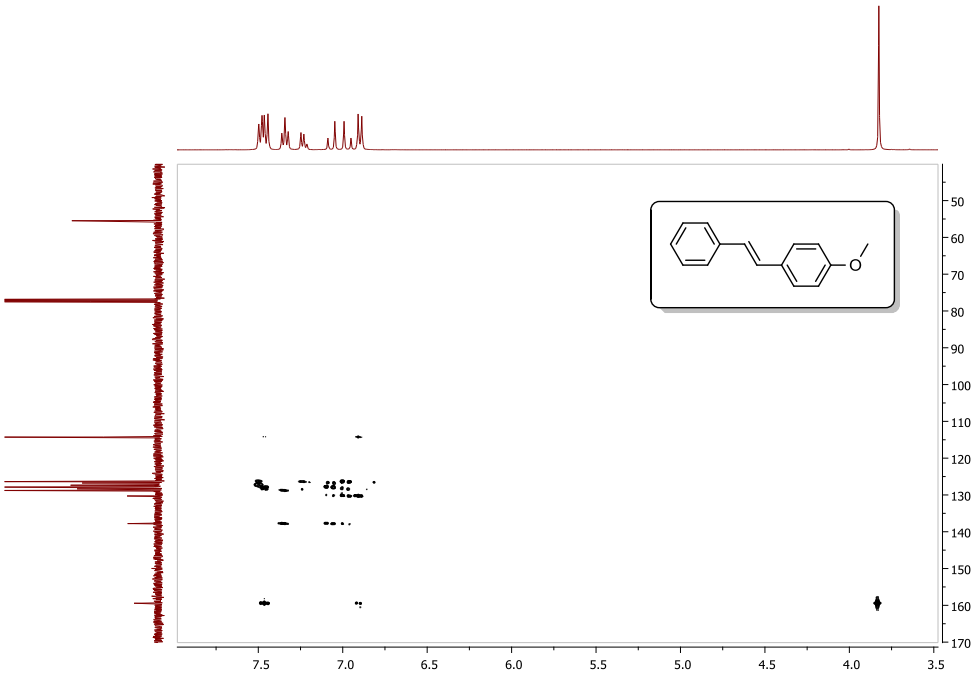


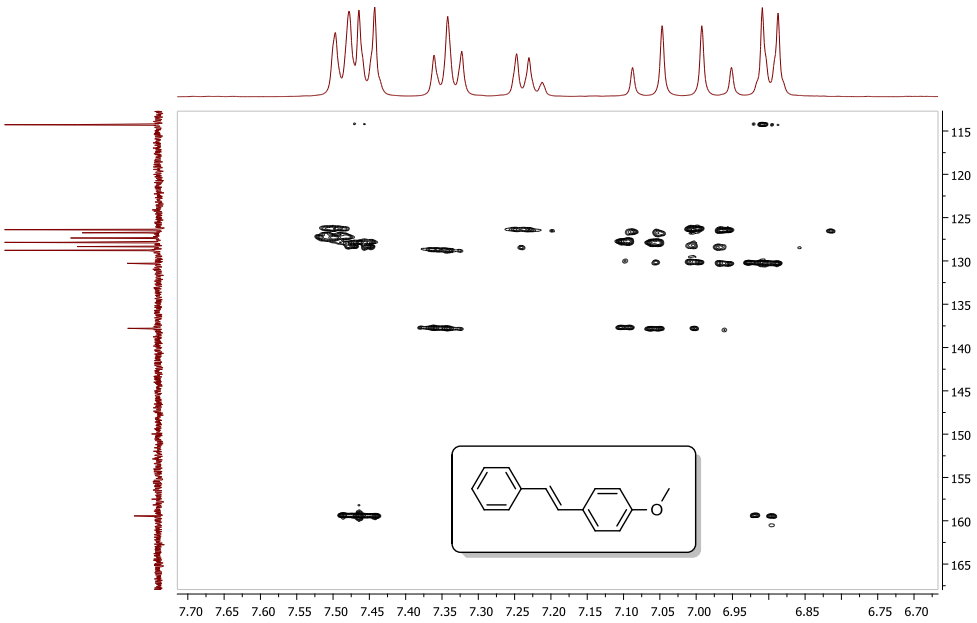
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) (*E*)-1-methoxy-4-styrylbenzene (7)



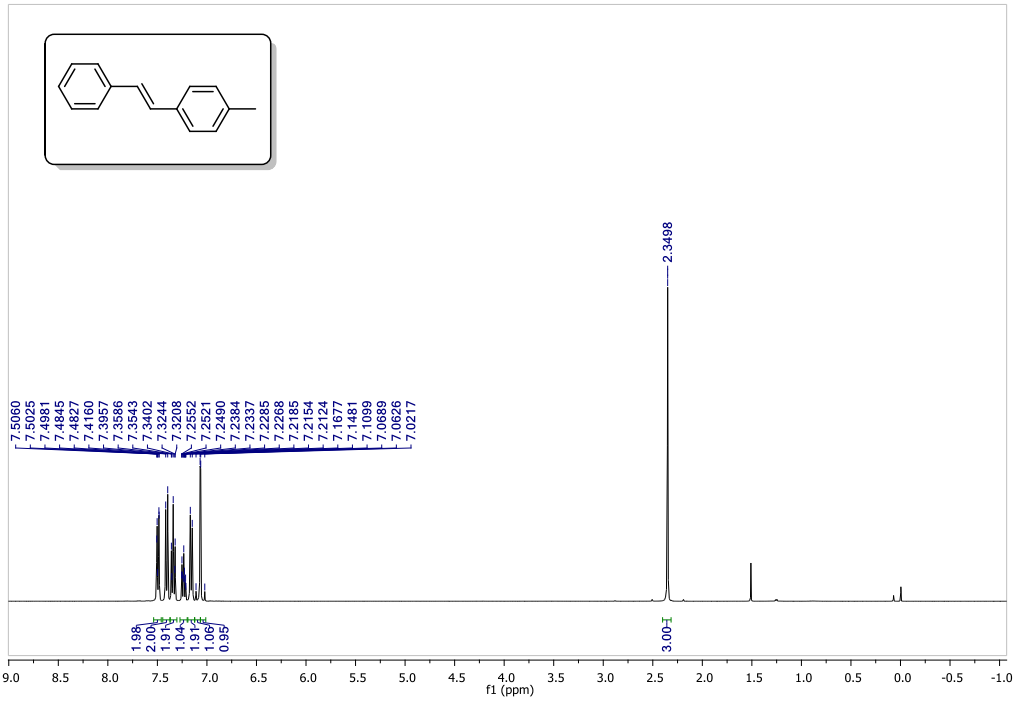


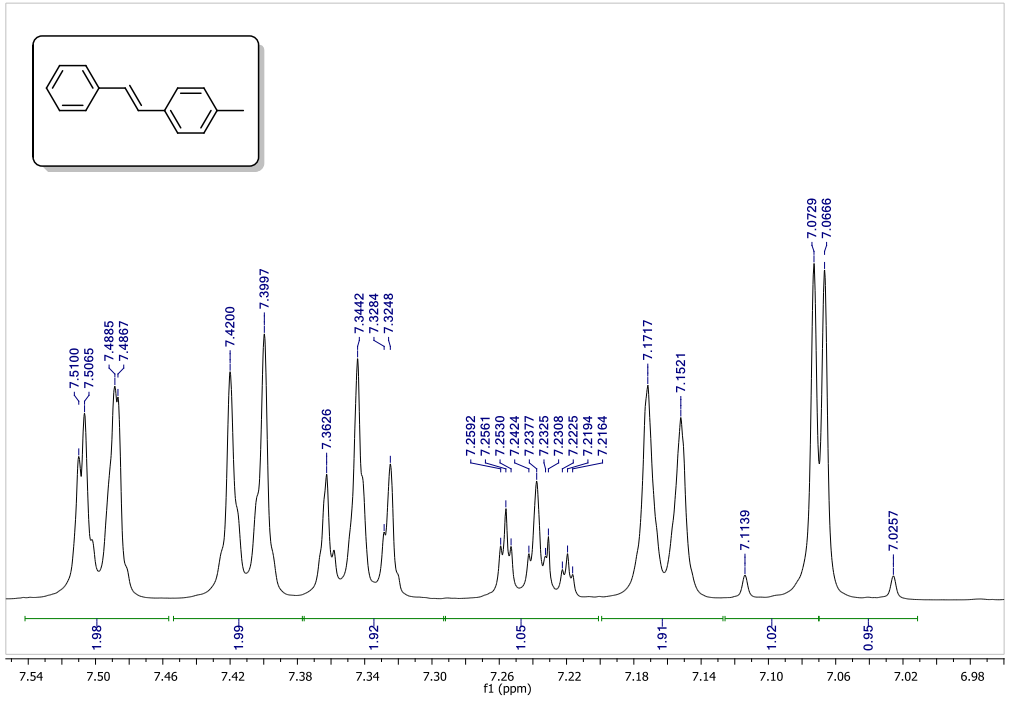
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) (*E*)-1-methoxy-4-styrylbenzene (7)



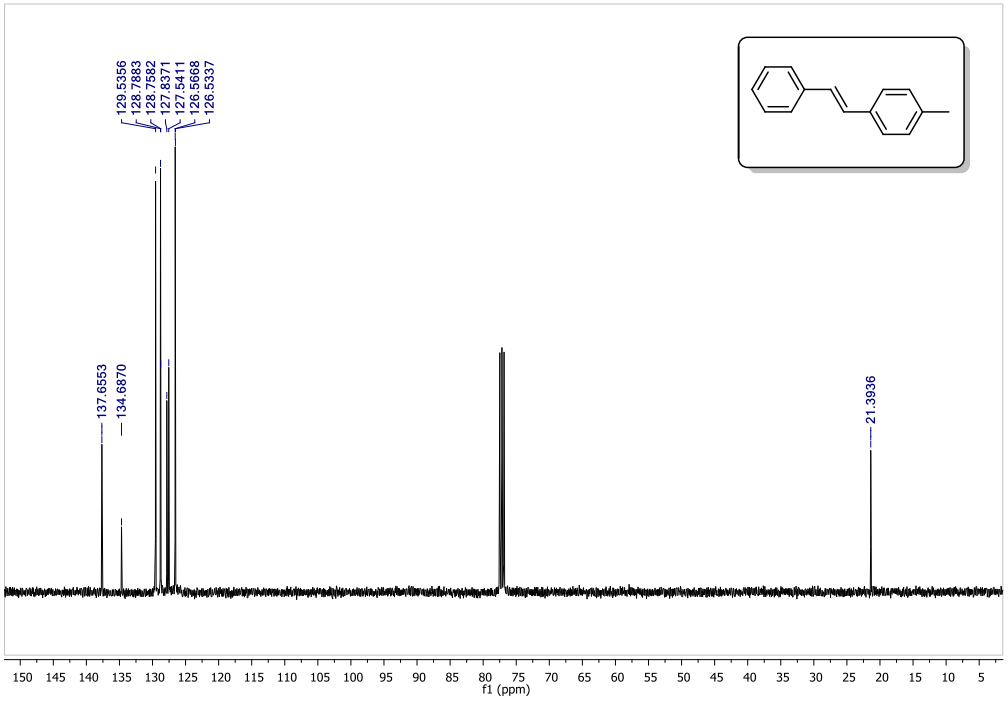


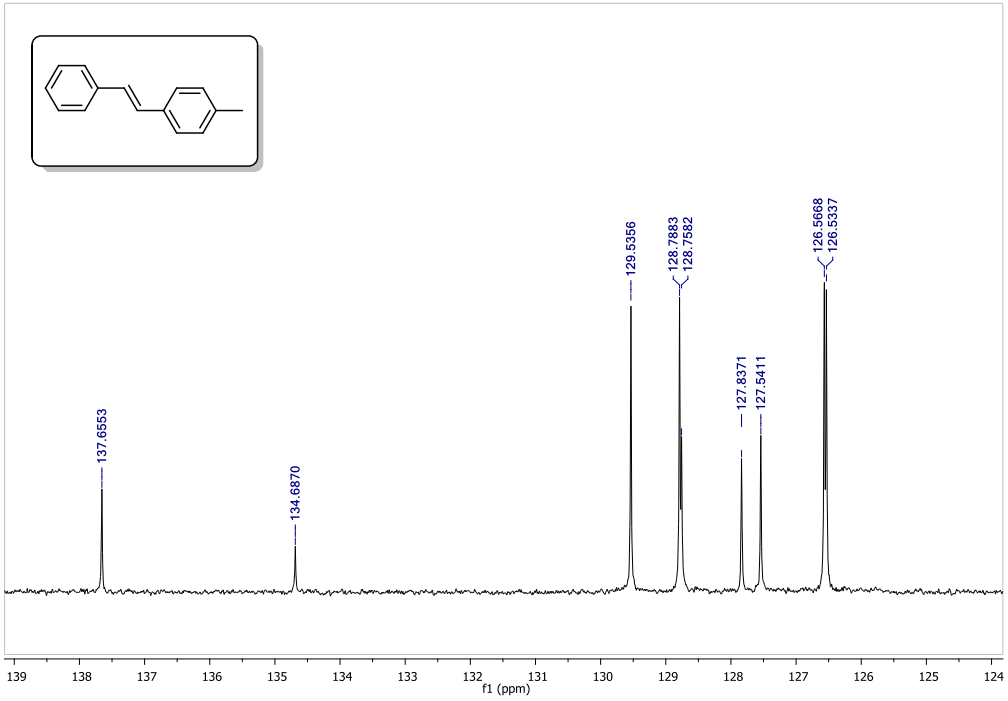
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-1-methyl-4-styrylbenzene (8)



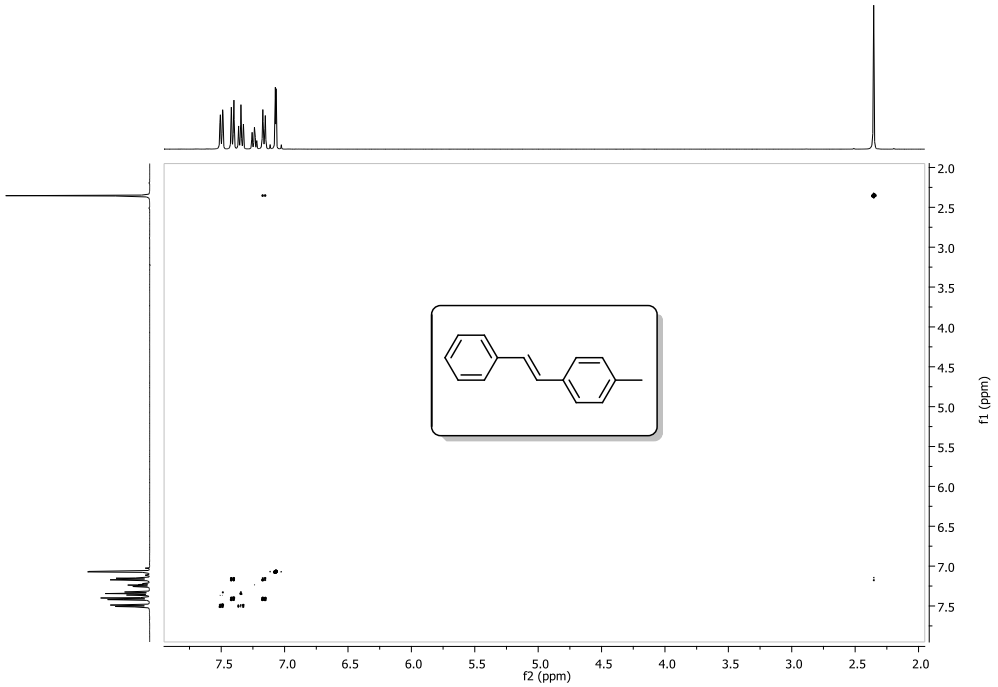


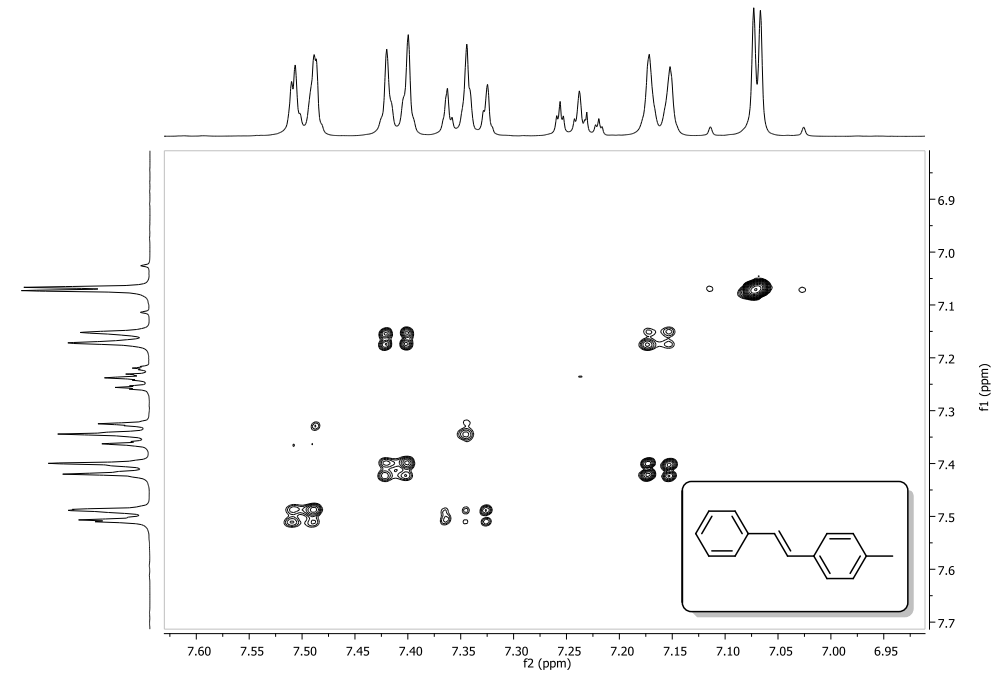
^{13}C NMR (100 MHz, $CDCl_3$) *(E)*-1-methyl-4-styrylbenzene (8)



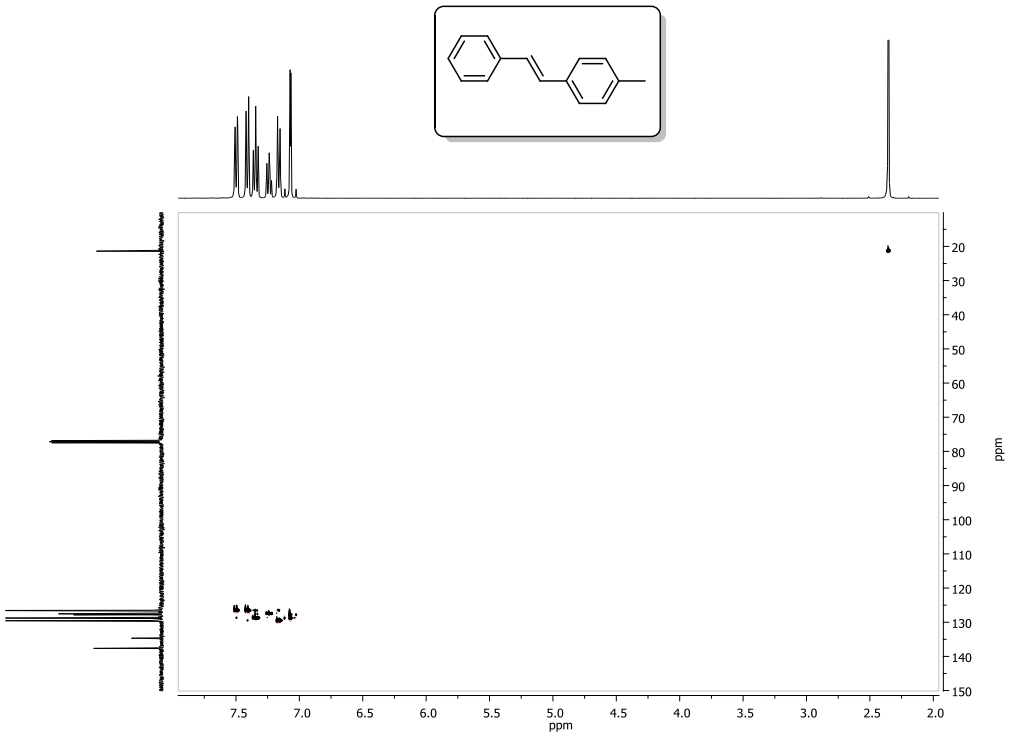


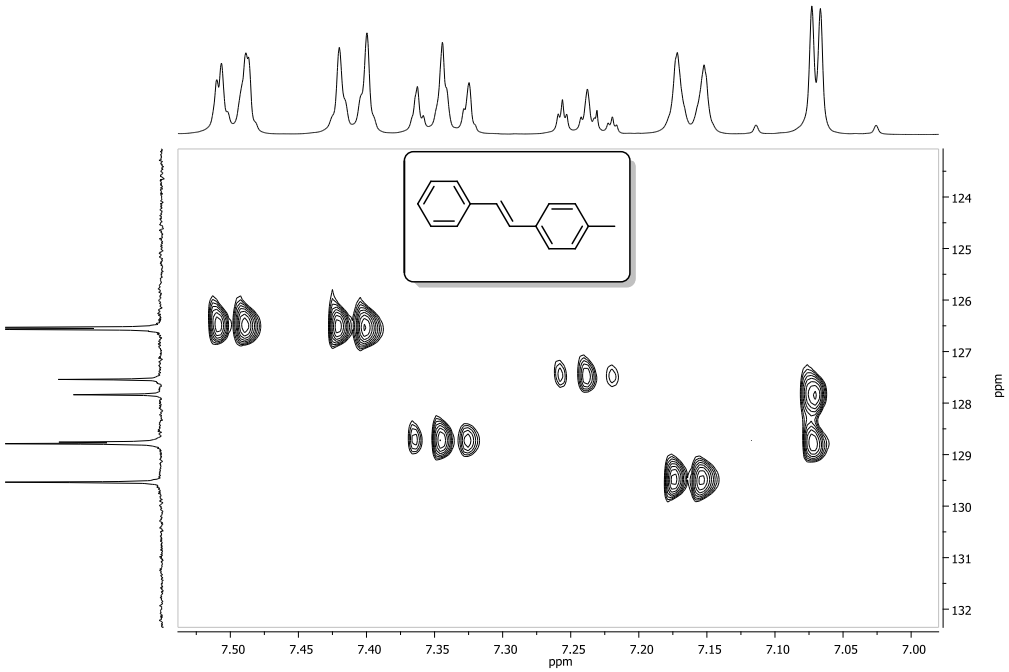
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) *(E)*-1-methyl-4-styrylbenzene (8)



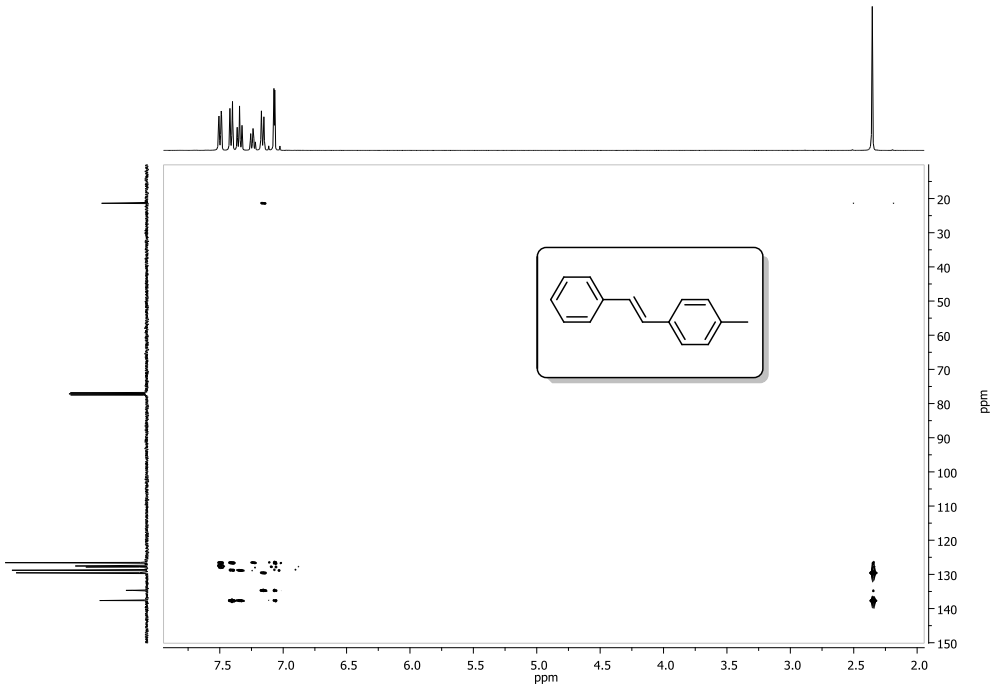


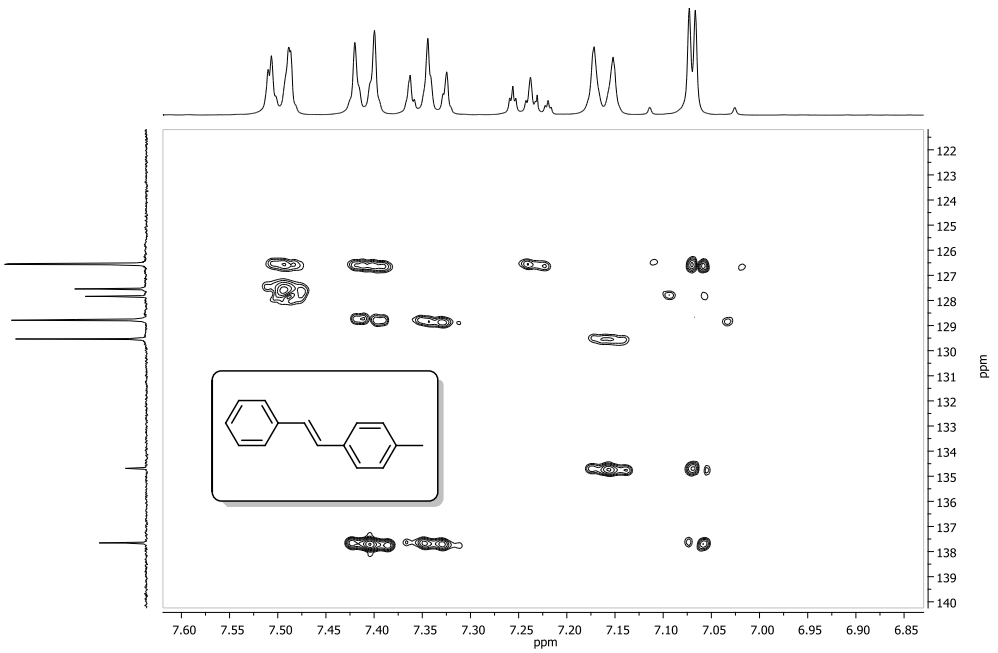
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-1-methyl-4-styrylbenzene (8)



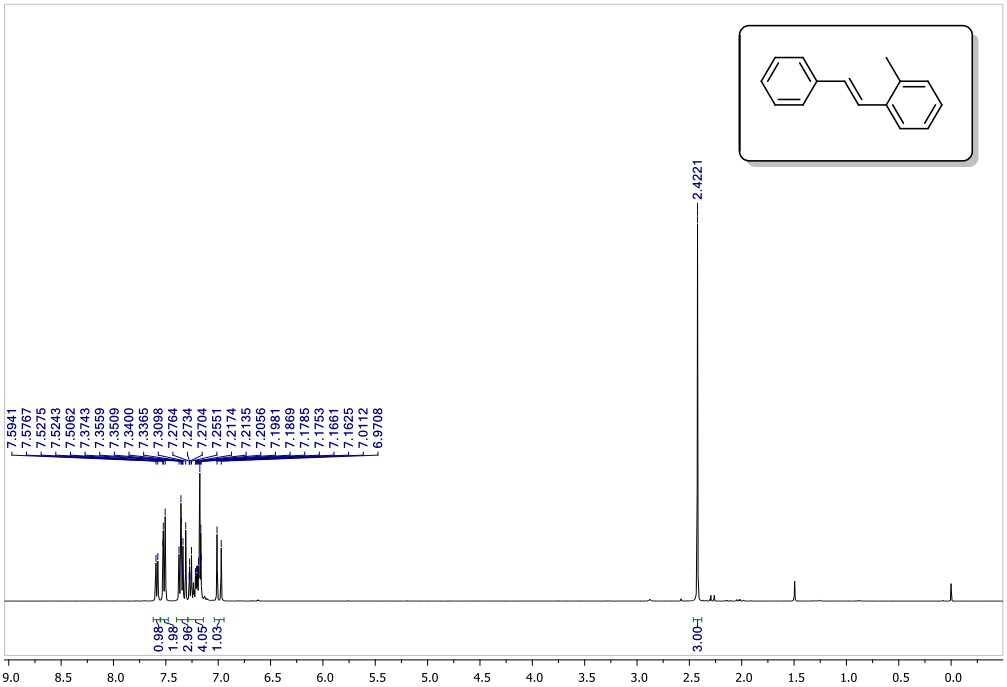


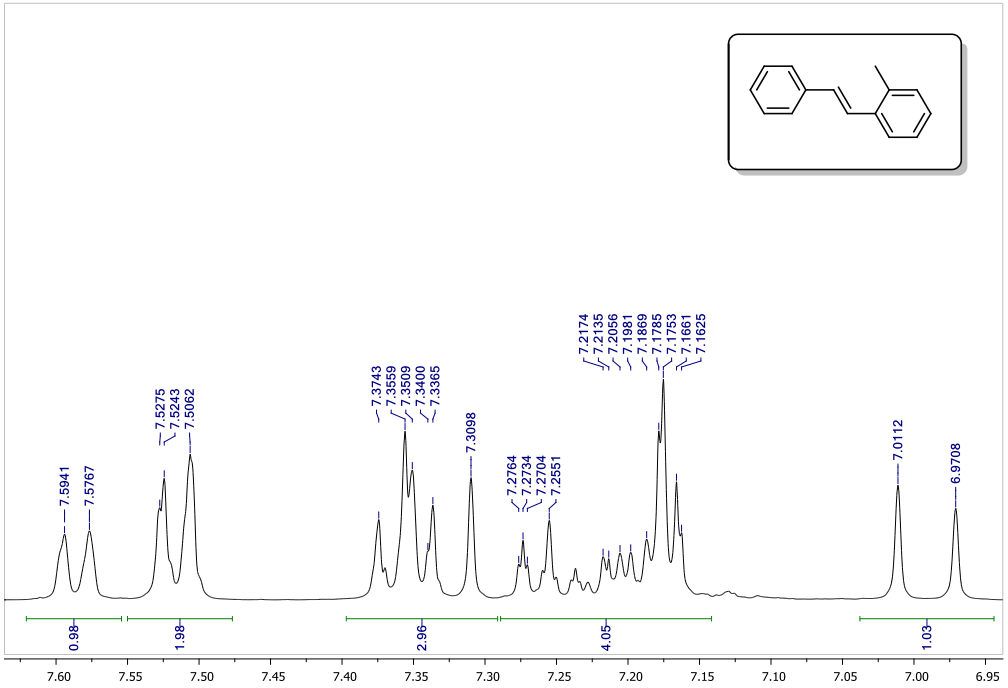
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-1-methyl-4-styrylbenzene (8)



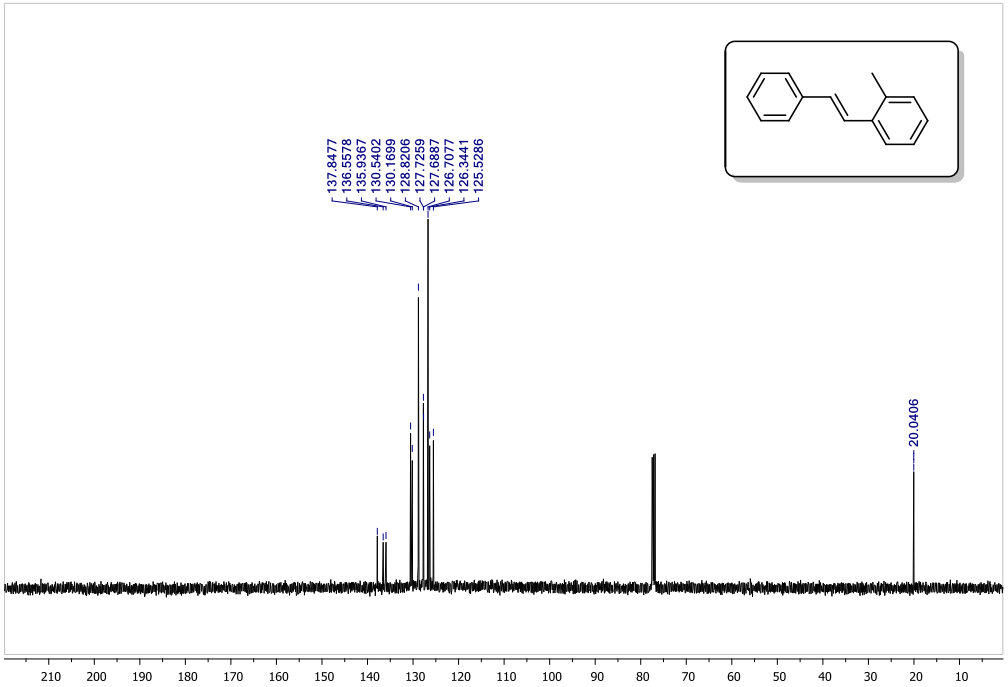


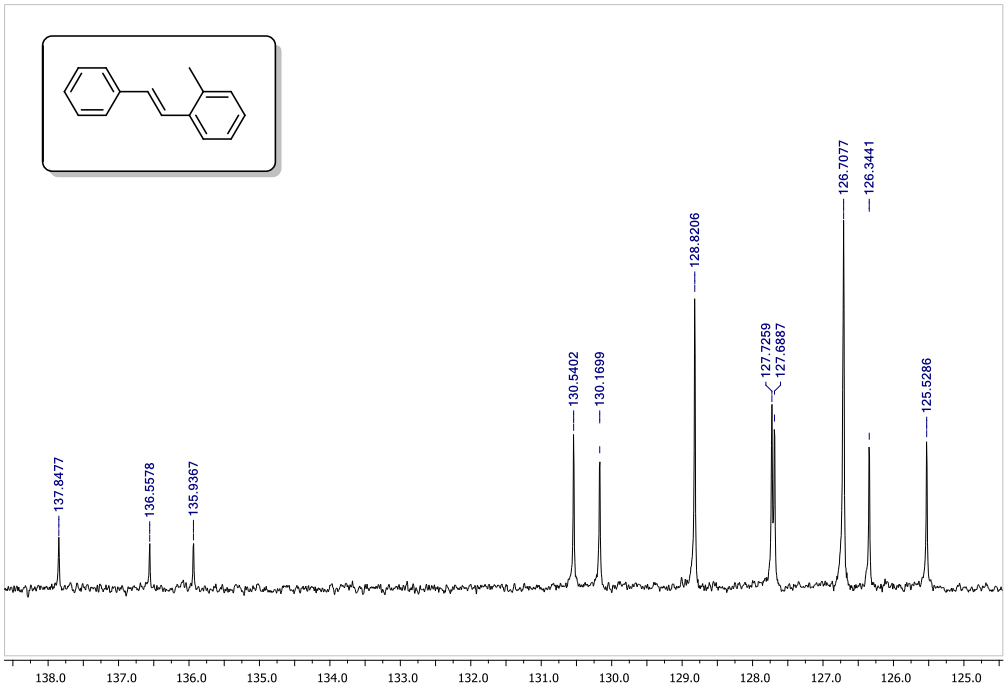
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-1-methyl-2-styrylbenzene (9)



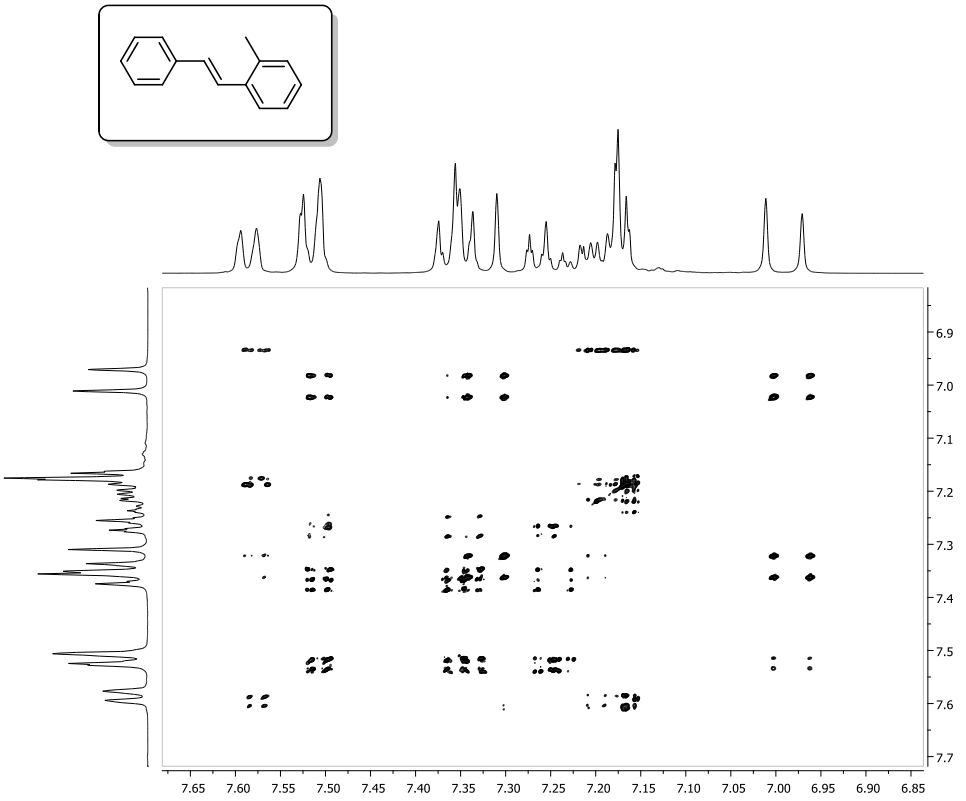


^{13}C NMR (101 MHz, $CDCl_3$) *(E)*-1-methyl-2-styrylbenzene (9)

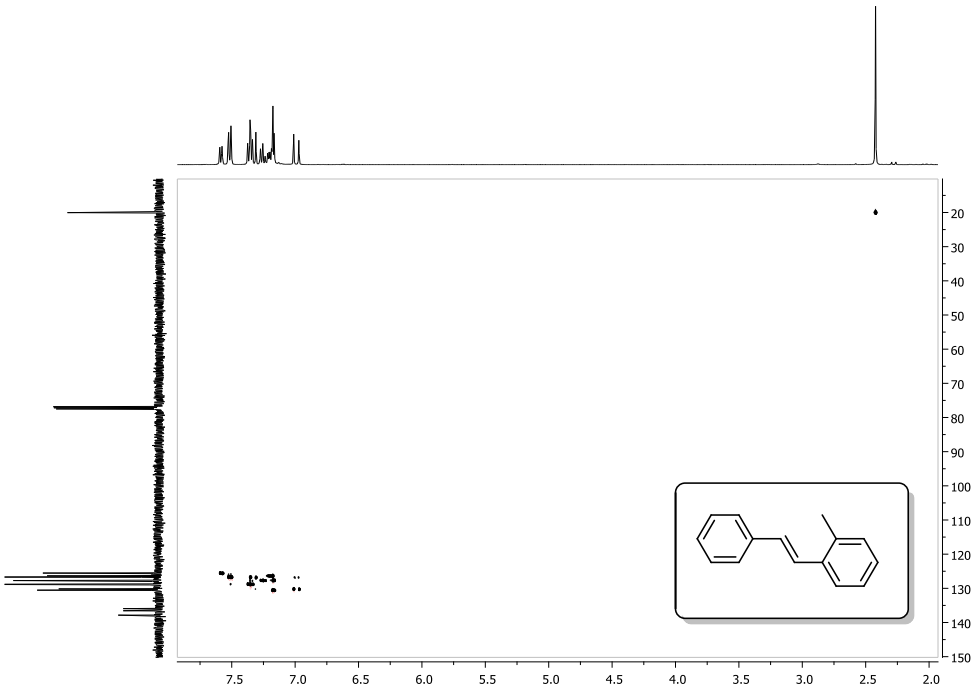




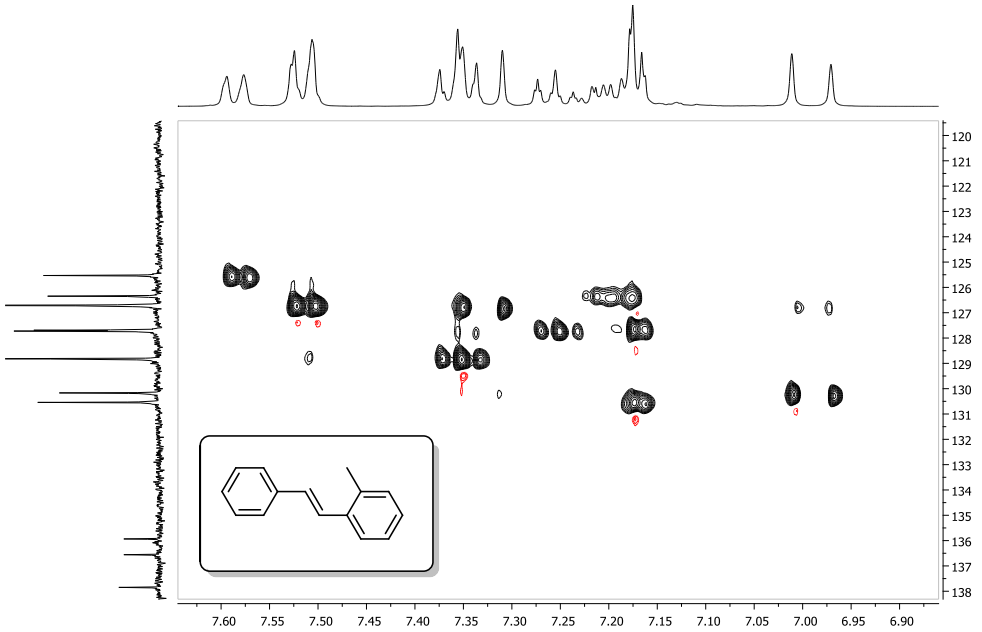
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) *(E)*-1-methyl-2-styrylbenzene (9)



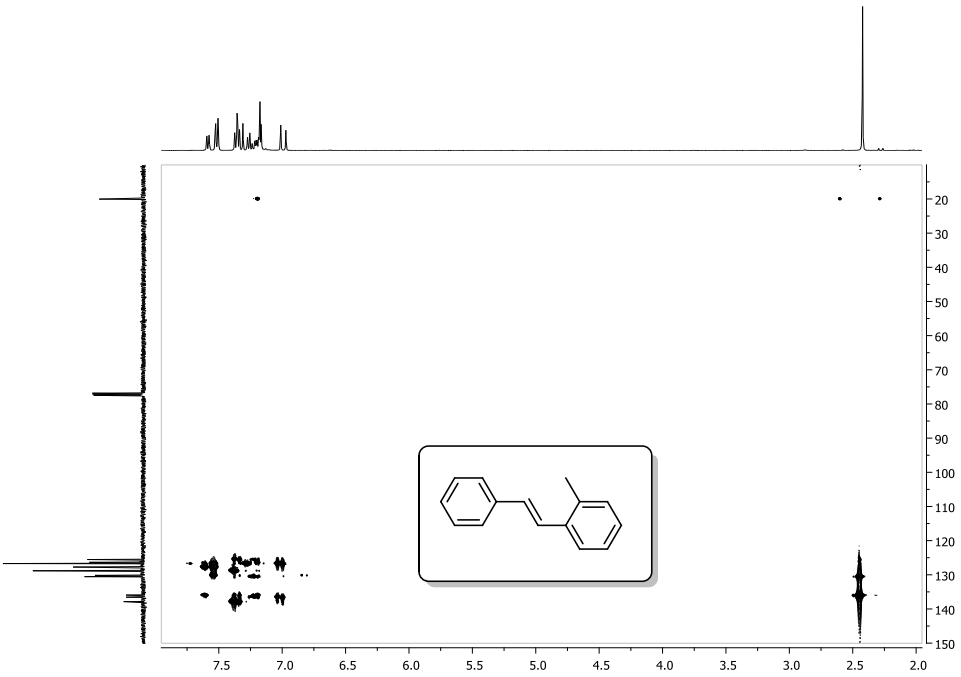
H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-1-methyl-2-styrylbenzene (9)



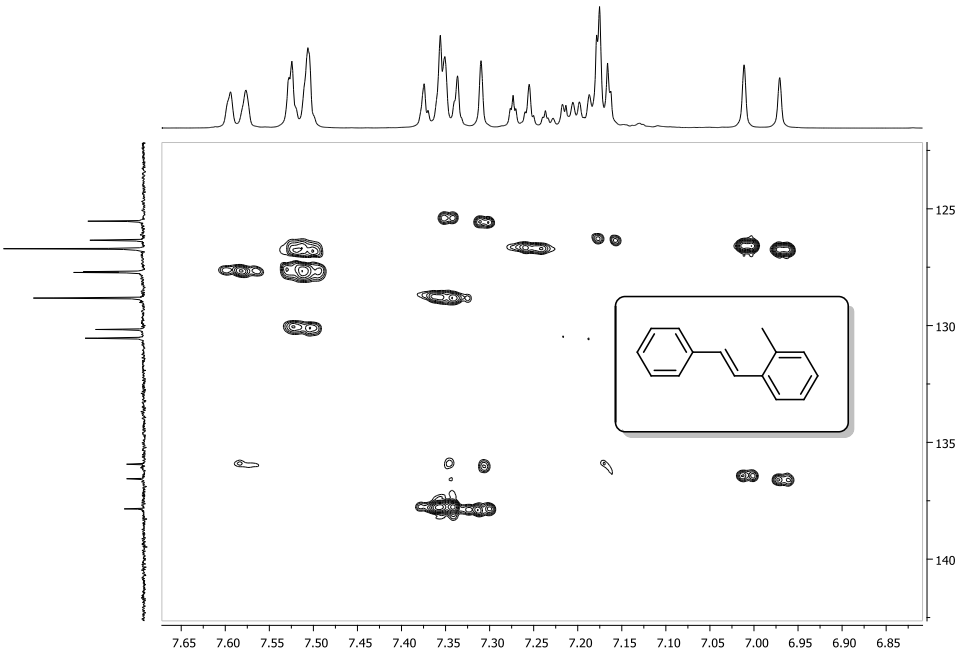
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-1-methyl-2-styrylbenzene (9)



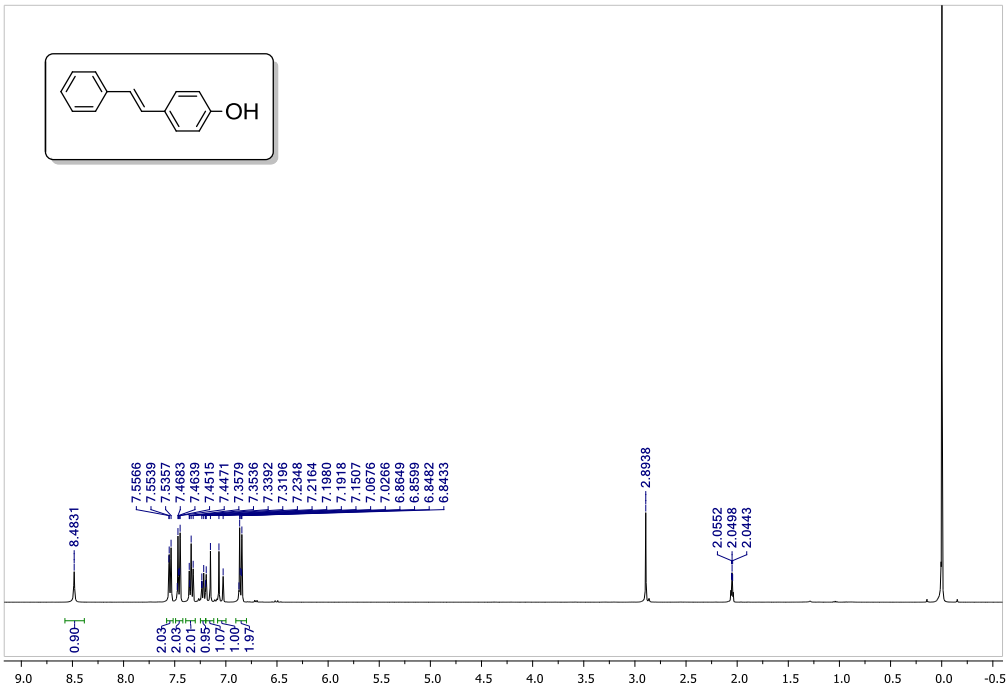
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-1-methyl-2-styrylbenzene (9)



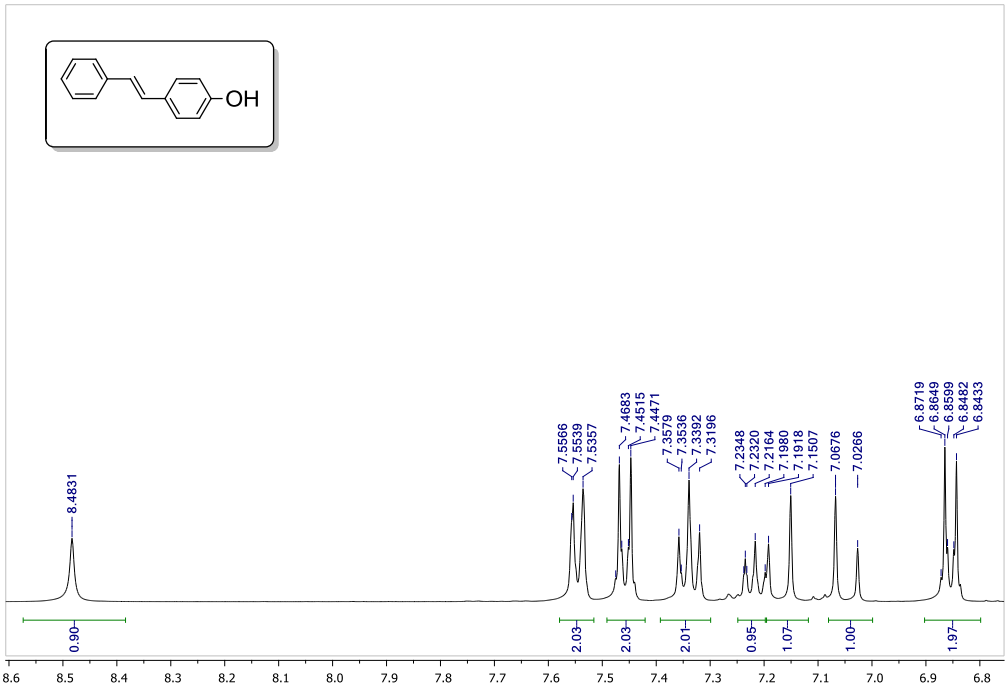
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-1-methyl-2-styrylbenzene (9)



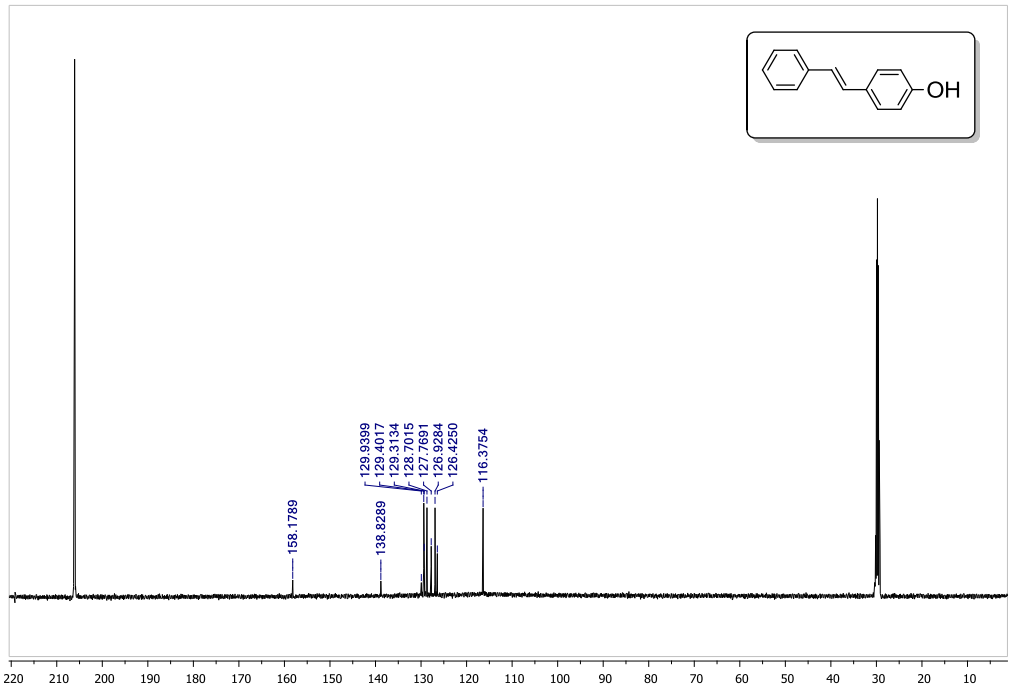
^{1}H NMR (400 MHz, Acetone-d_6) *(E)*-4-styrylphenol (10)



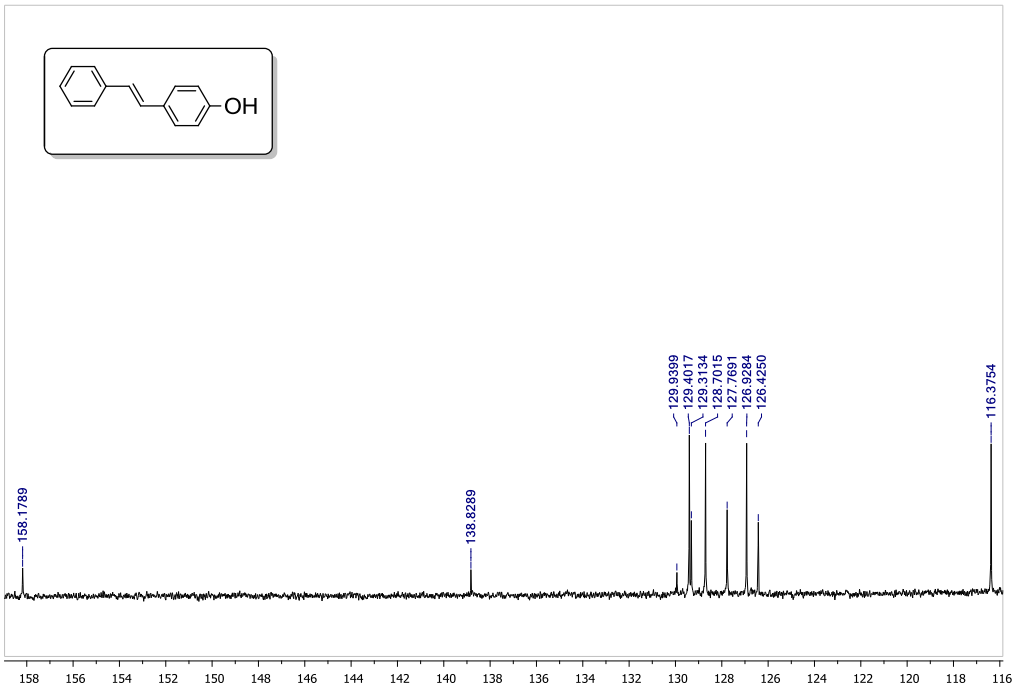
^{1}H NMR (400 MHz, Acetone-d_6) *(E)*-4-styrylphenol (10)



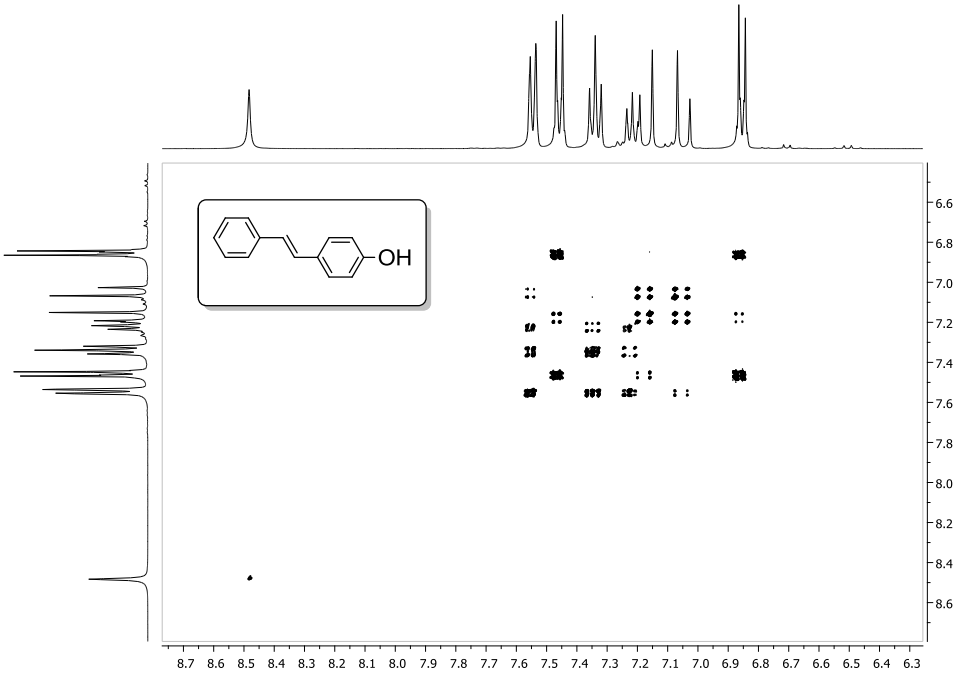
^{13}C NMR (101 MHz, Acetone-d_6) *(E)*-4-styrylphenol (10)



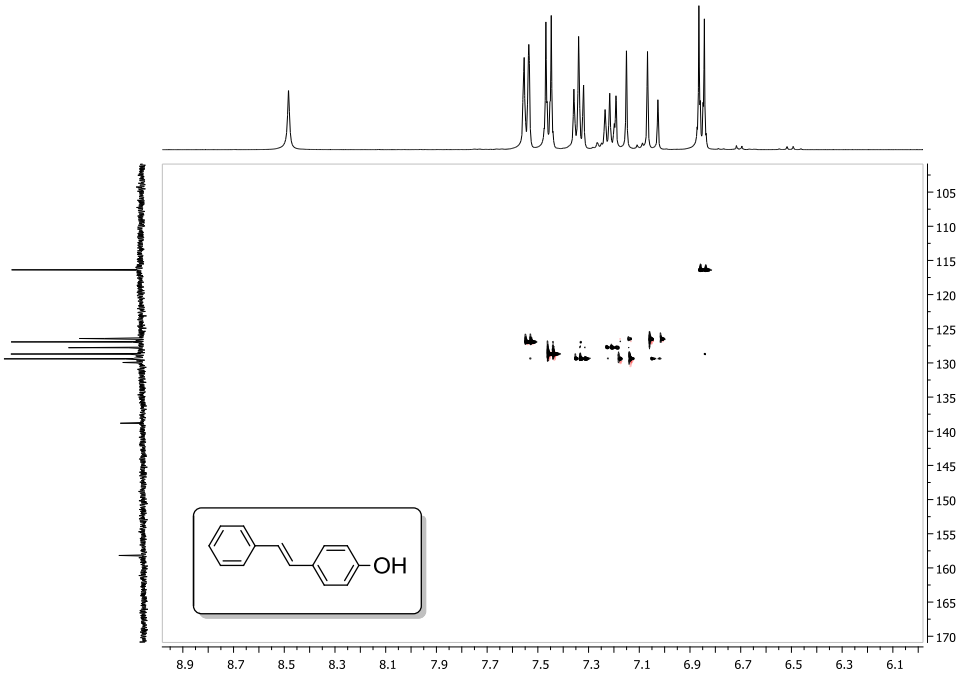
^{13}C NMR (101 MHz, Acetone-d_6) *(E)*-4-styrylphenol (10)

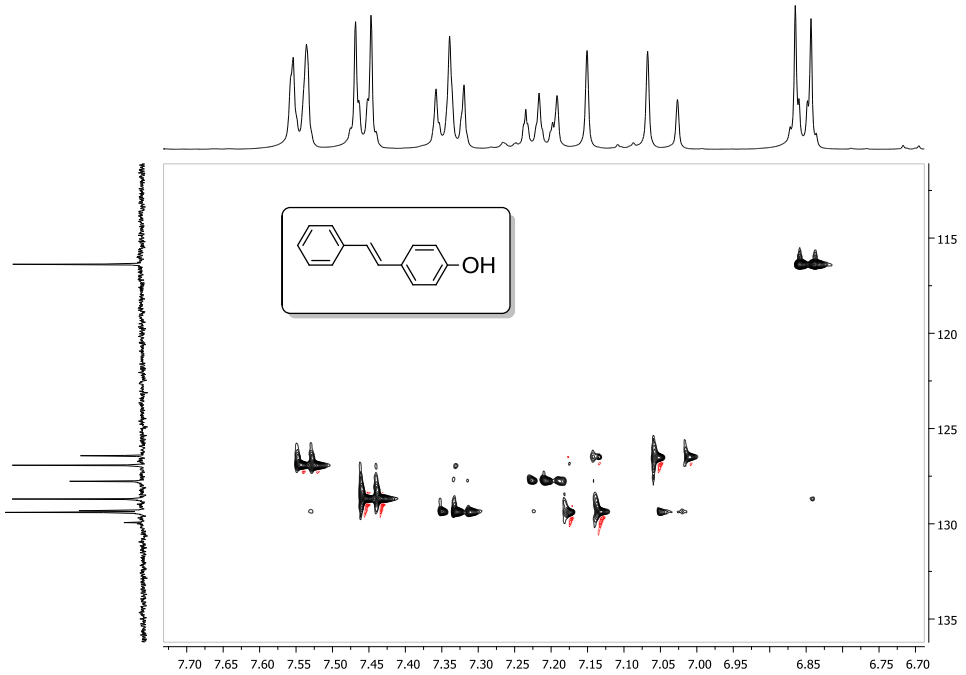


^{1}H-^{1}H COSY NMR (400 MHz, Acetone-*d*$_6$) *(E)*-4-styrylphenol (10)

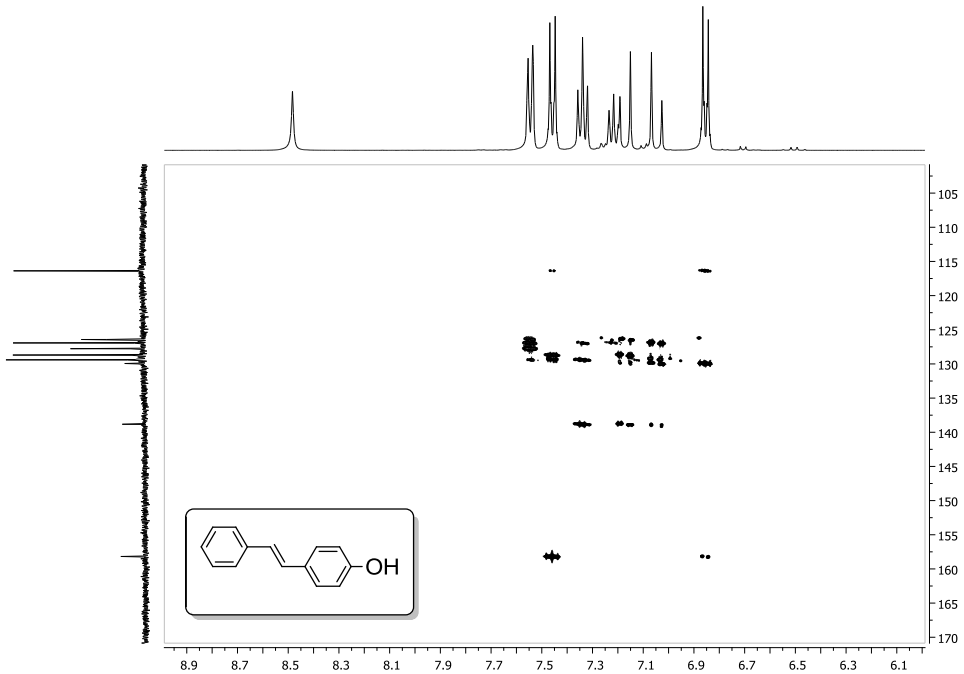


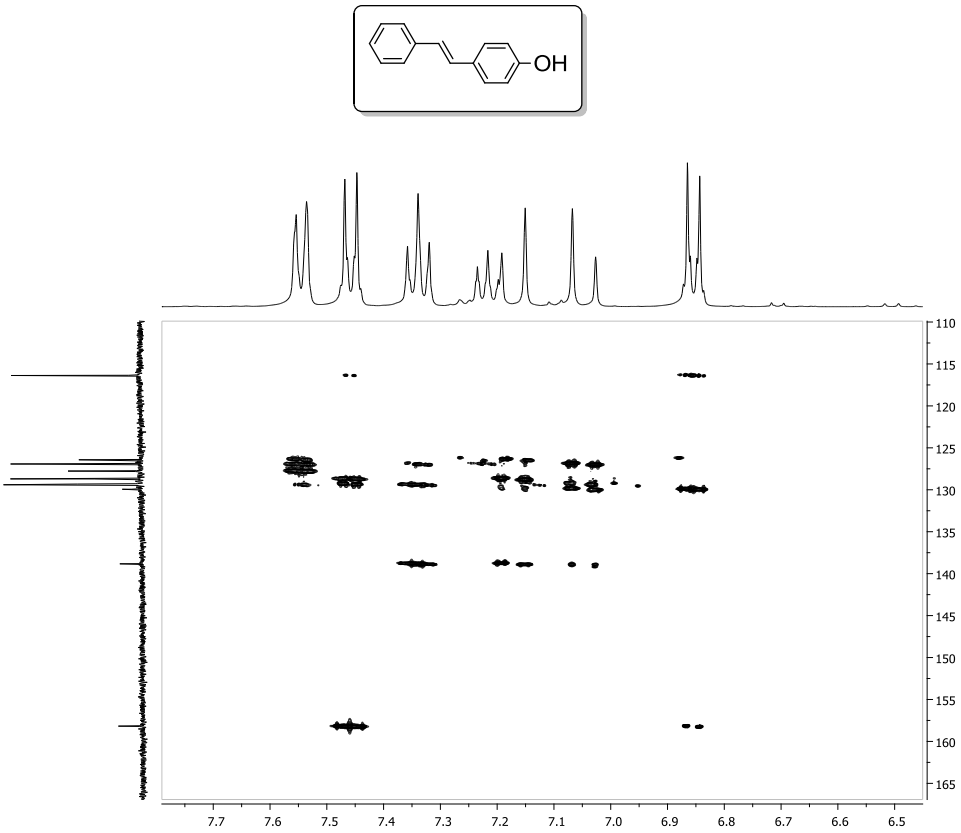
^{1}H-^{13}C HSQC NMR (400 MHz, Acetone-*d*$_6$) *(E)*-4-styrylphenol (10)





^{1}H-^{13}C HMBC NMR (400 MHz, Acetone-*d*$_6$) *(E)*-4-styrylphenol (10)

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130
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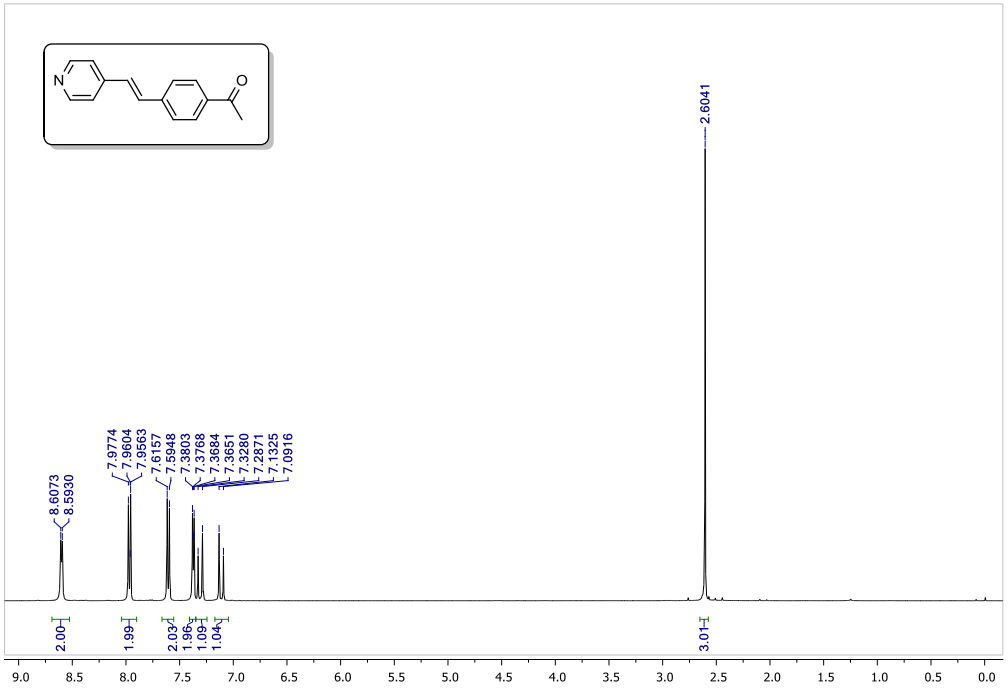
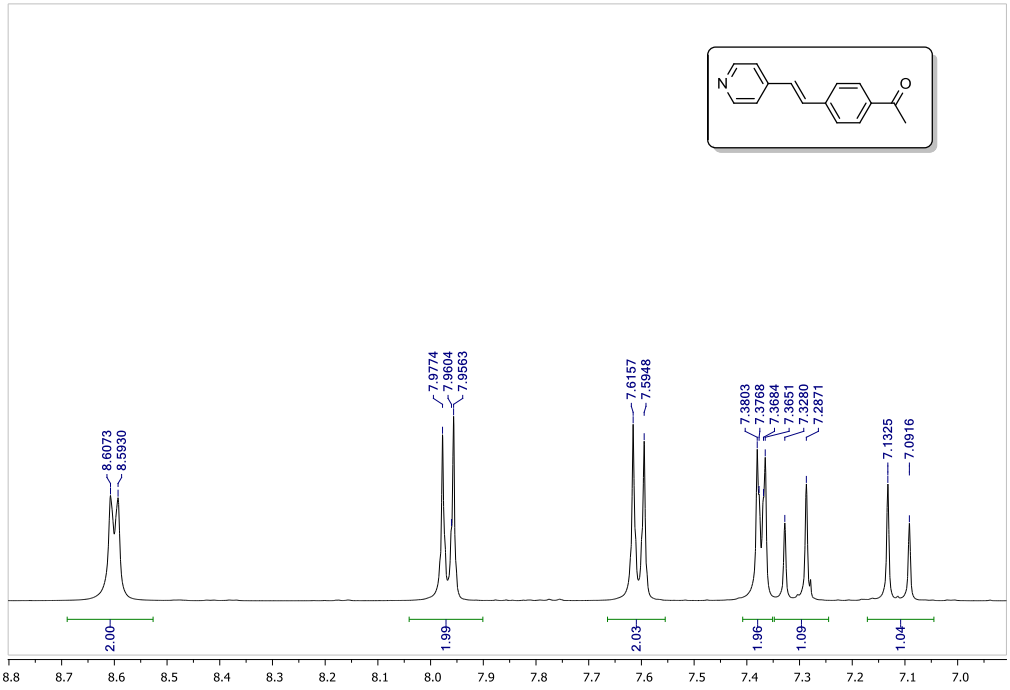
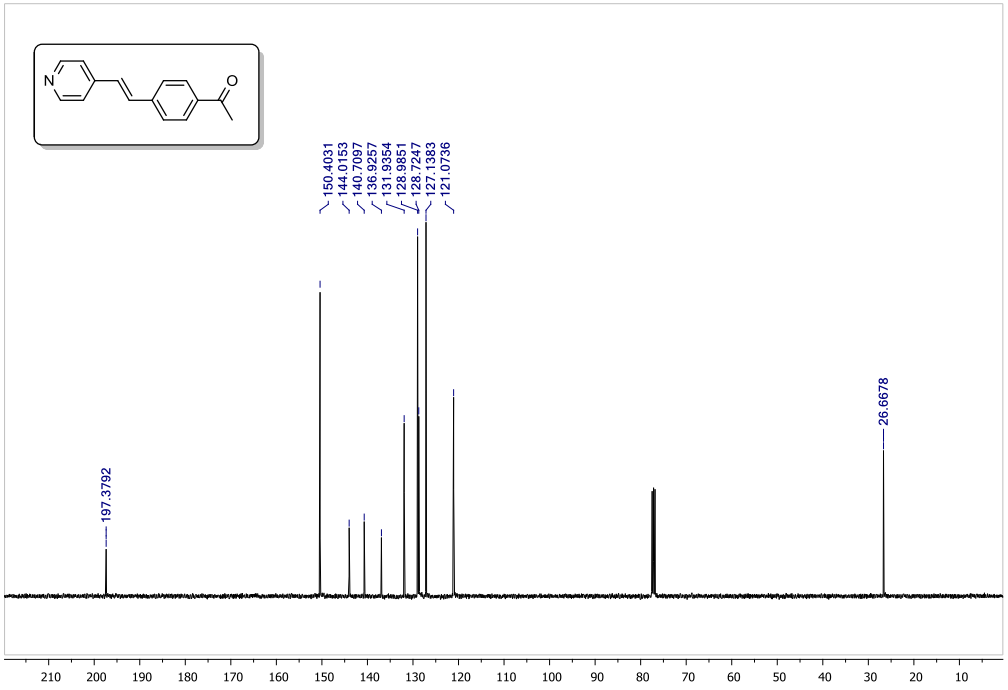
145
150
155
160
165
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7.0
6.9
6.8
6.7
6.6
6.5

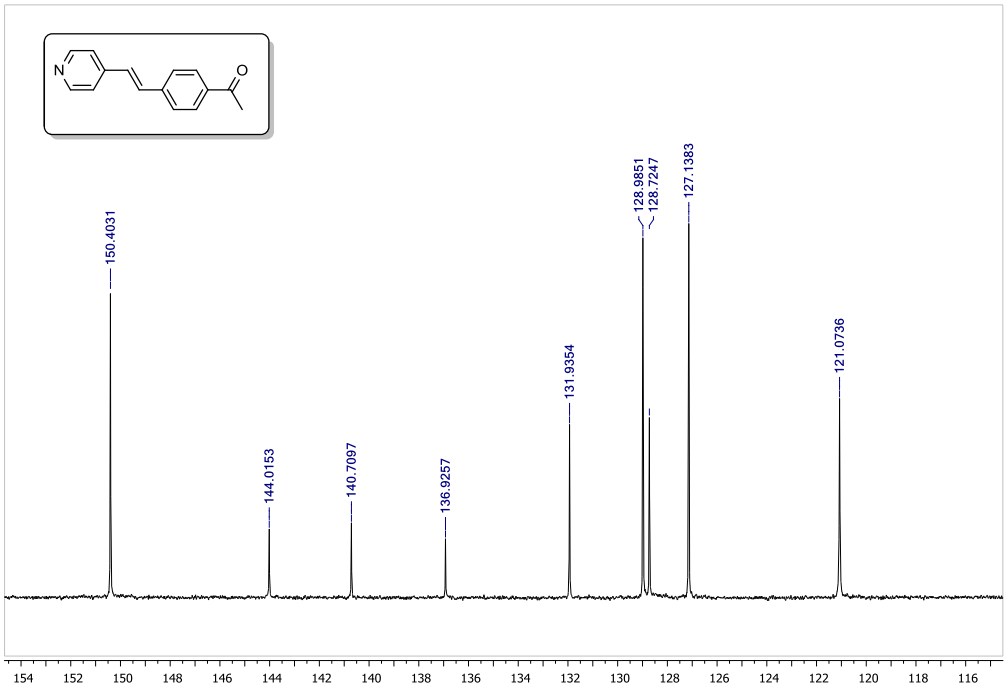
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-1-(4-(2-(pyridin-4-yl)vinyl)phenyl)ethanone (11)



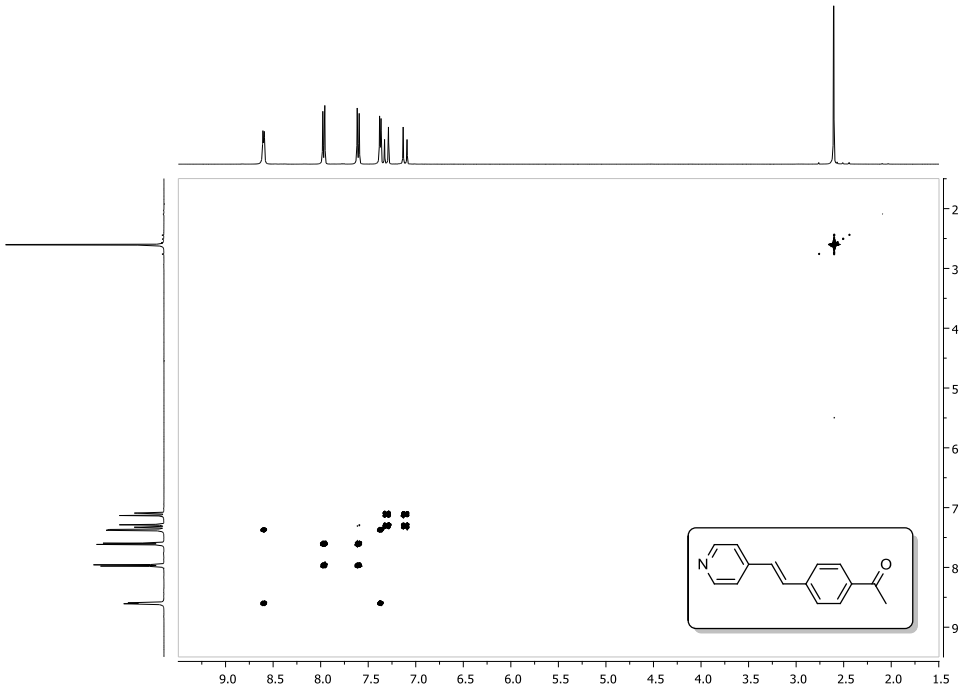


^{13}C NMR (101 MHz, $CDCl_3$) *(E)*-1-(4-(2-(pyridin-4-yl)vinyl)phenyl)ethanone (11)

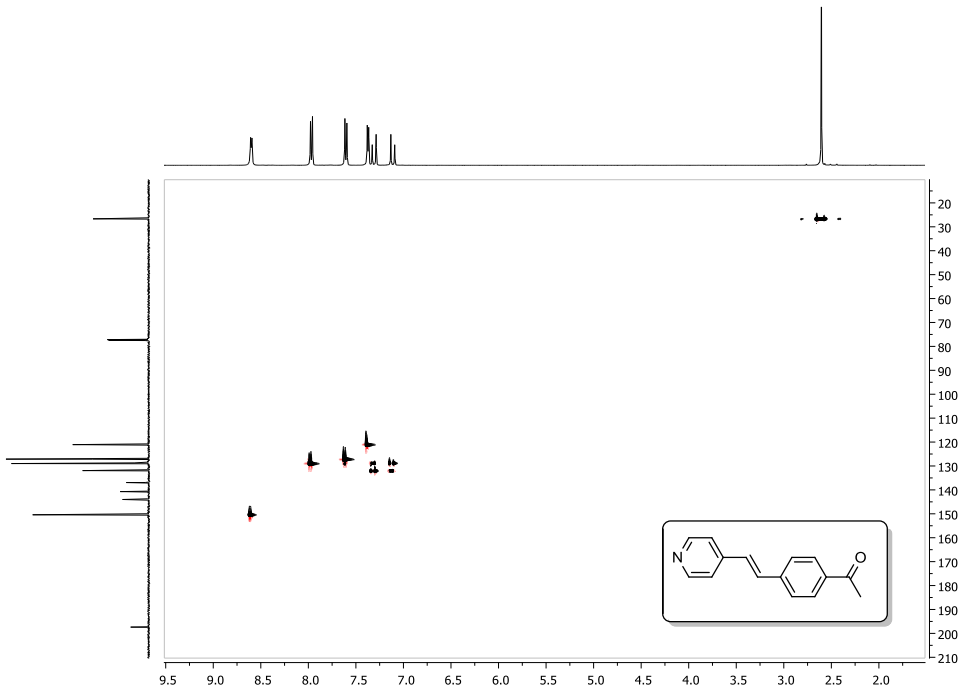




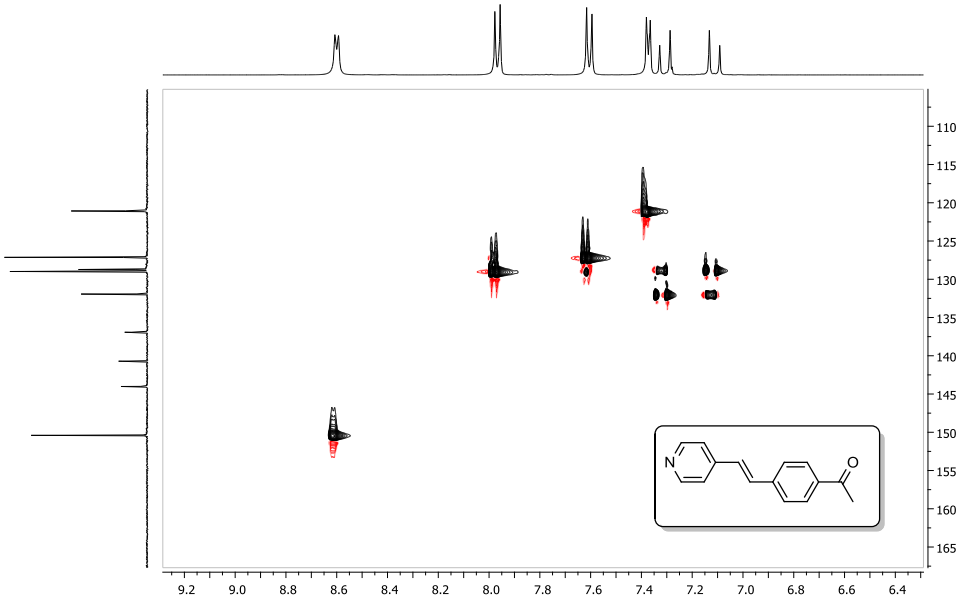
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) *(E)*-1-(4-(2-(pyridin-4-yl)vinyl)phenyl)ethanone (11)



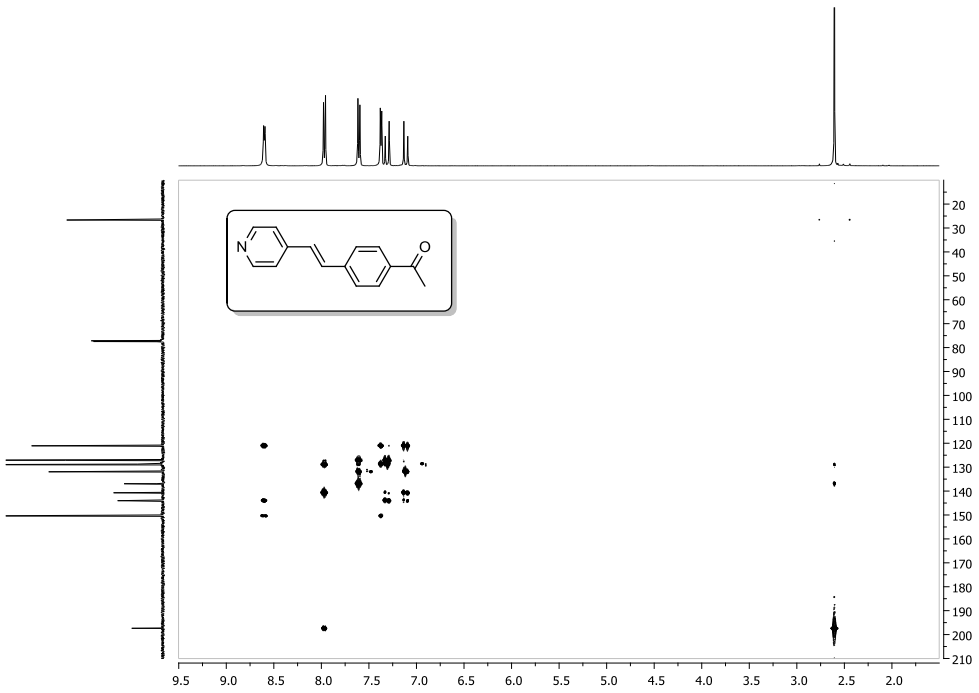
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-1-(4-(2-(pyridin-4-yl)vinyl)phenyl)ethanone (11)



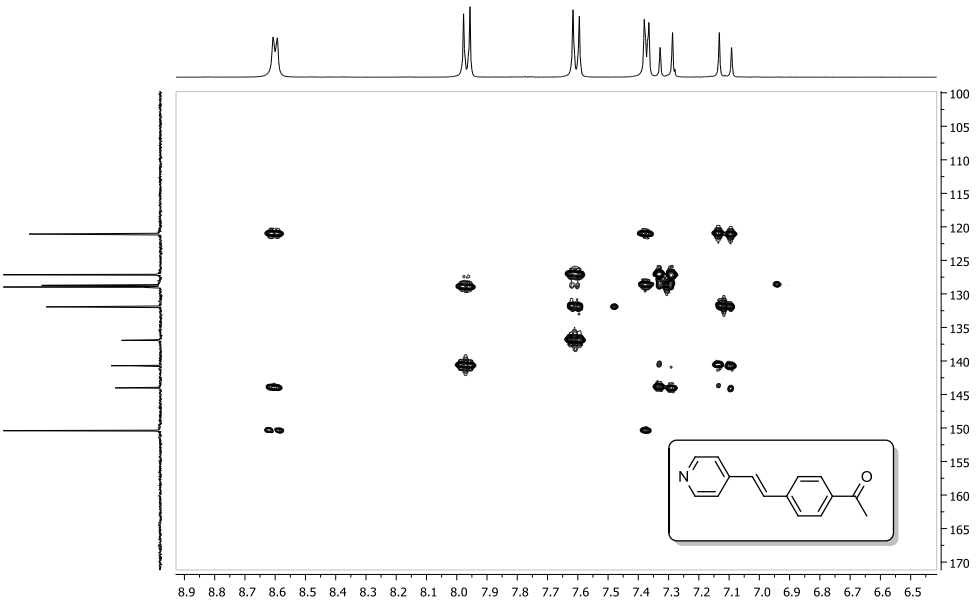
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-1-(4-(2-(pyridin-4-yl)vinyl)phenyl)ethanone (11)



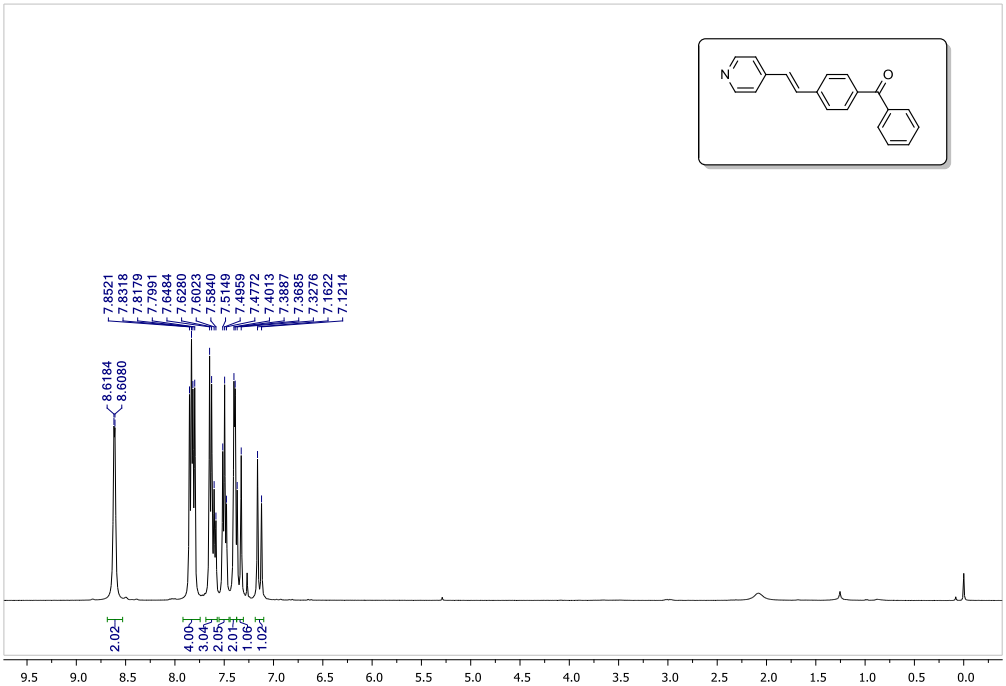
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-1-(4-(2-(pyridin-4-yl)vinyl)phenyl)ethanone (11)



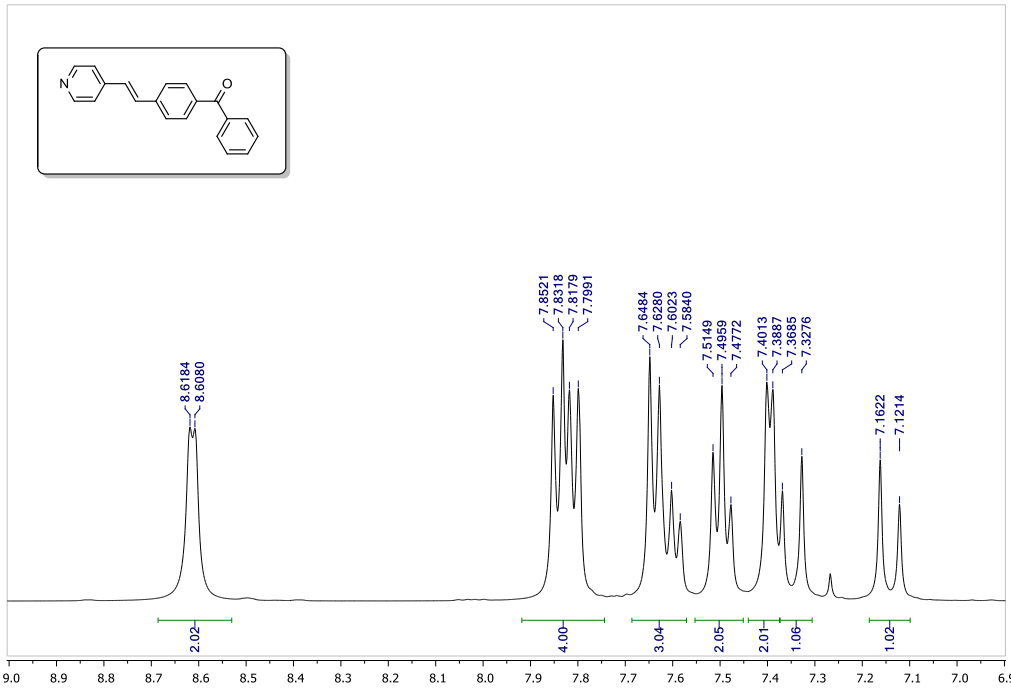
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-1-(4-(2-(pyridin-4-yl)vinyl)phenyl)ethanone (11)



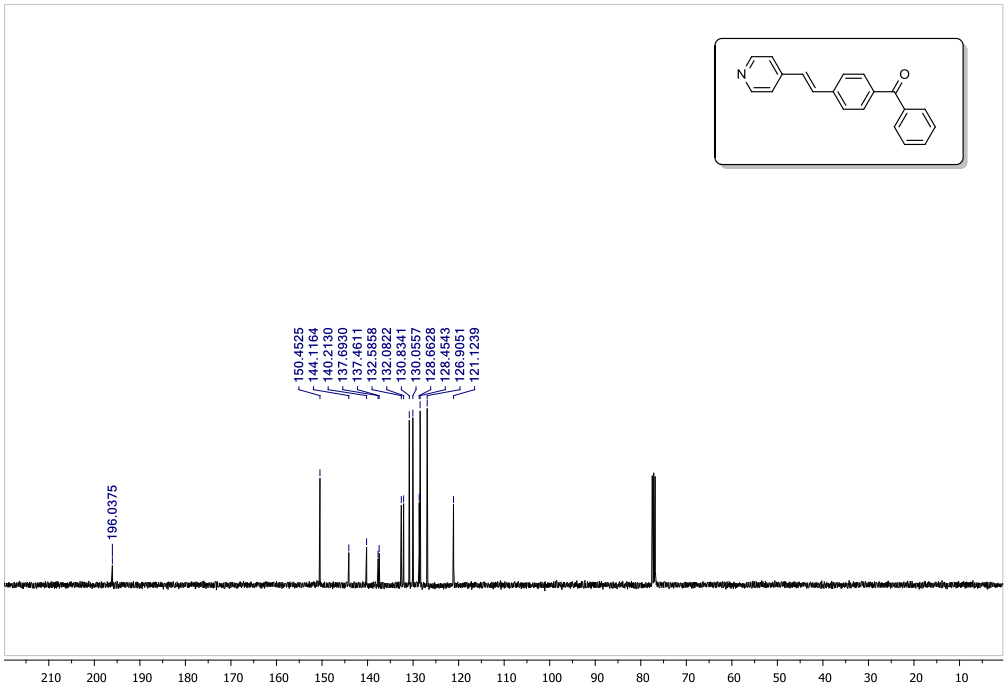
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-phenyl(4-(2-(pyridin-4-yl)vinyl)phenyl)methanone (12)



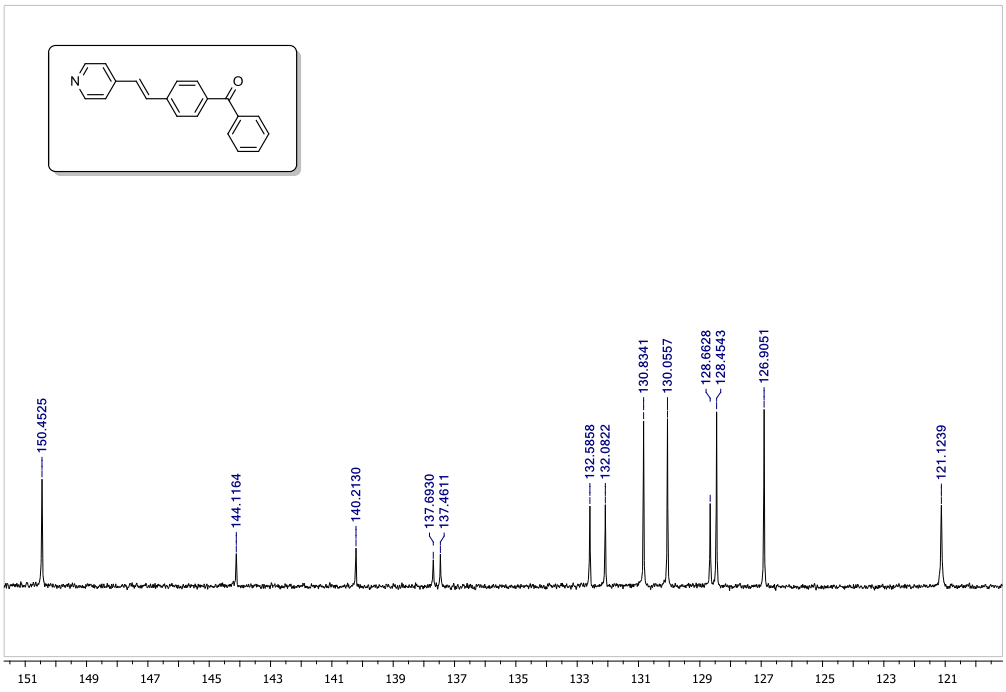
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-phenyl(4-(2-(pyridin-4-yl)vinyl)phenyl)methanone (12)



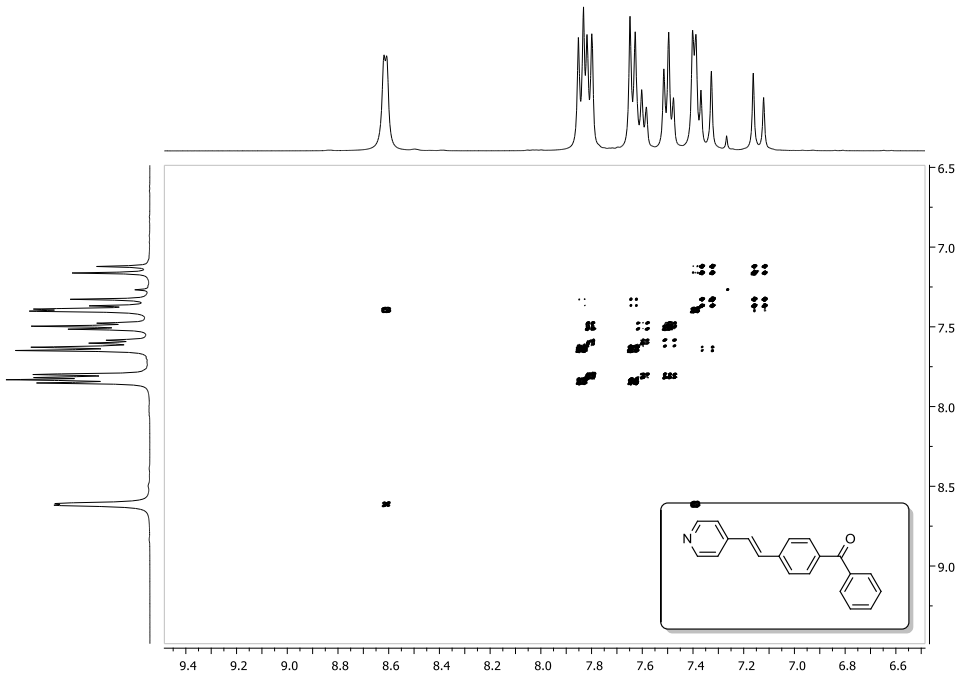
^{13}C NMR (101 MHz, $CDCl_3$) *(E)*-phenyl(4-(2-(pyridin-4-yl)vinyl)phenyl)methanone (12)



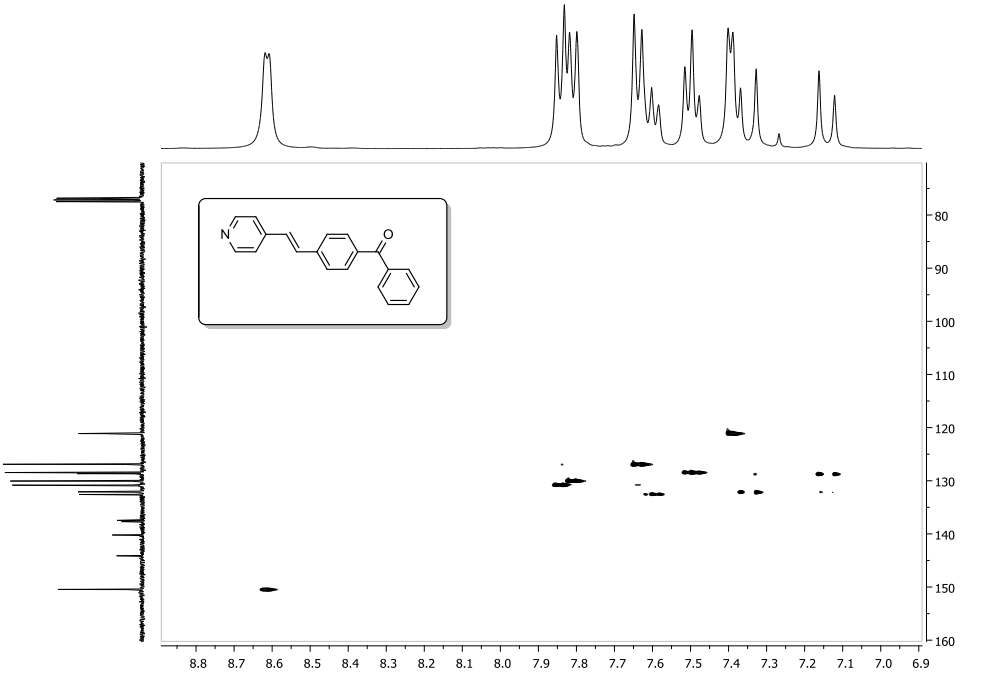
^{13}C NMR (101 MHz, $CDCl_3$) *(E)*-phenyl(4-(2-(pyridin-4-yl)vinyl)phenyl)methanone (12)

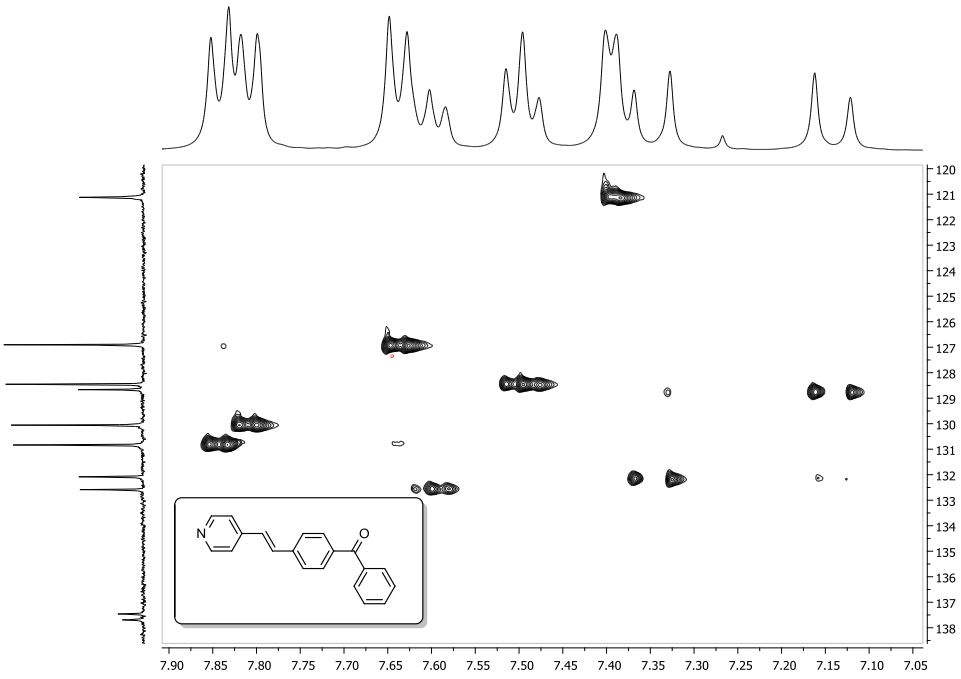


^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) *(E)*-phenyl(4-(2-(pyridin-4-yl)vinyl)phenyl)methanone (12)

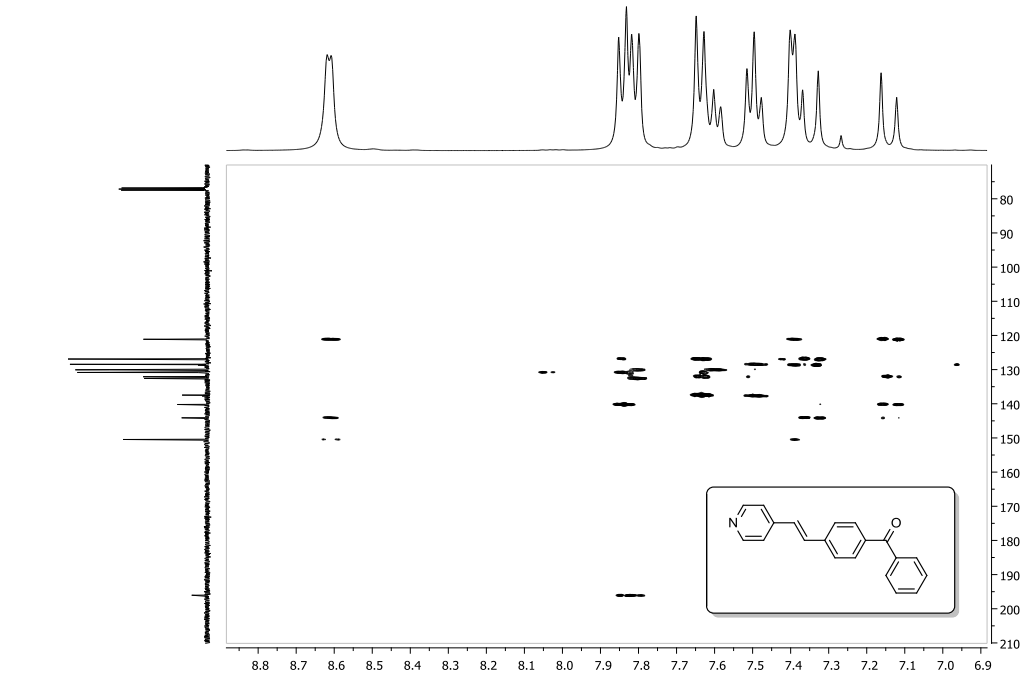


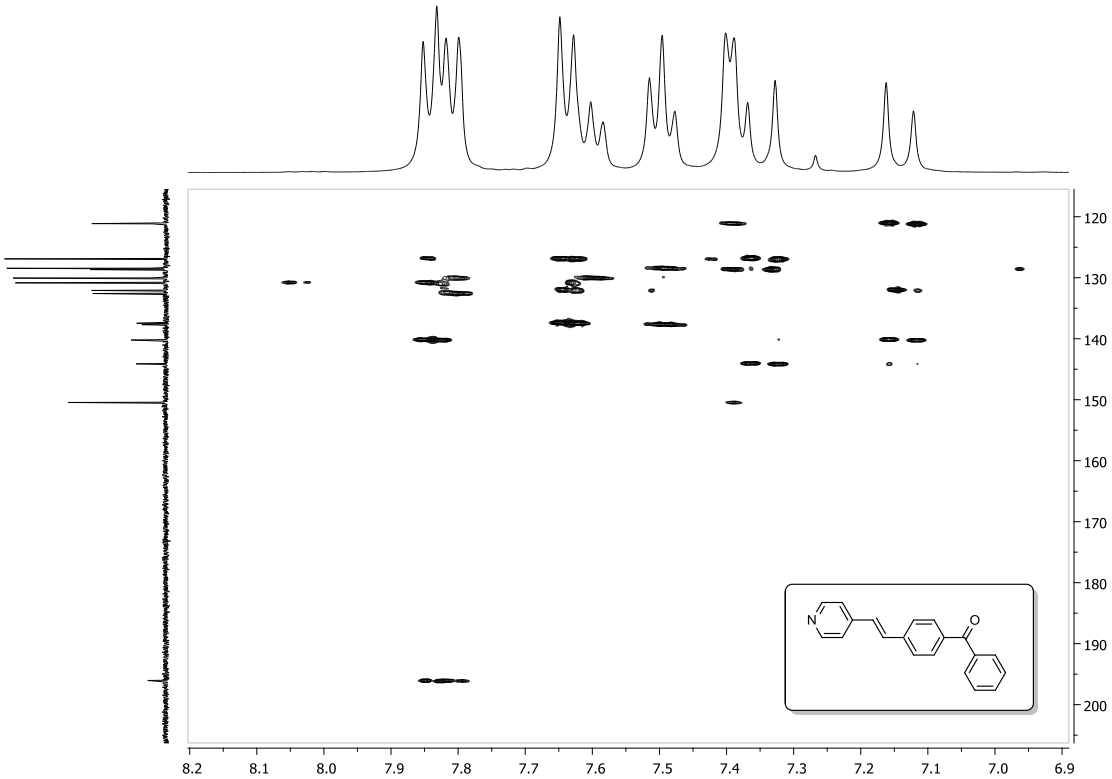
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-phenyl(4-(2-(pyridin-4-yl)vinyl)phenyl)methanone (12)



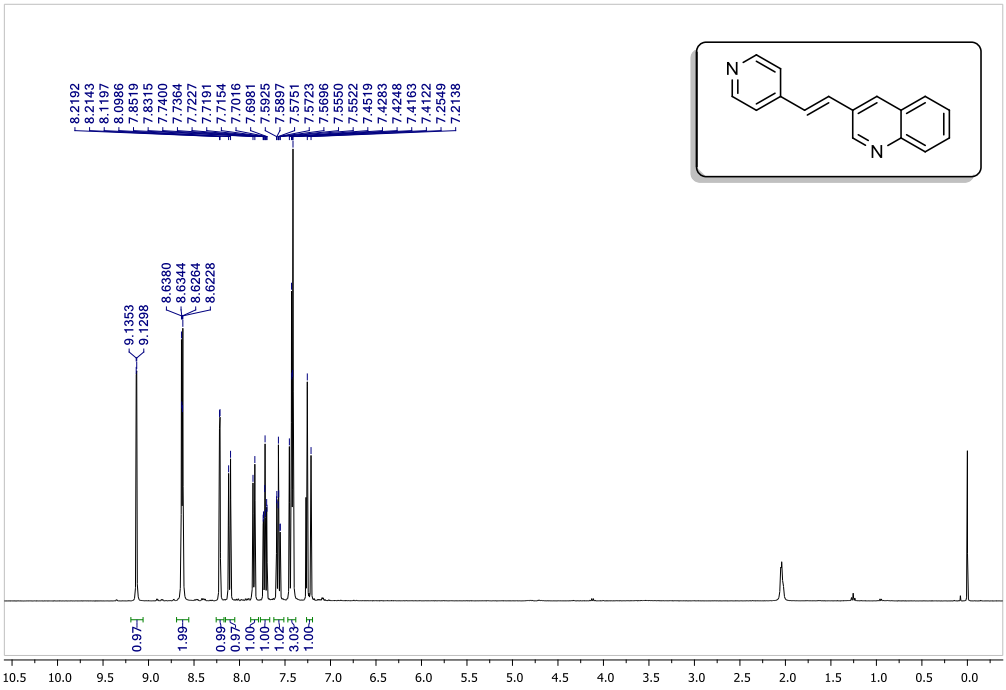


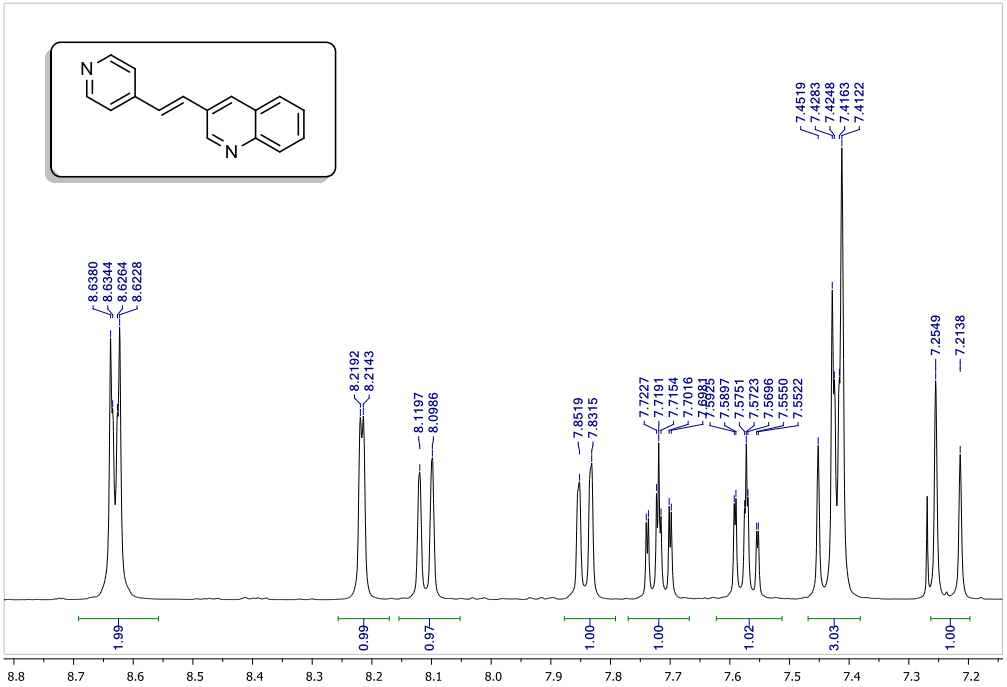
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-phenyl(4-(2-(pyridin-4-yl)vinyl)phenyl)methanone (12)



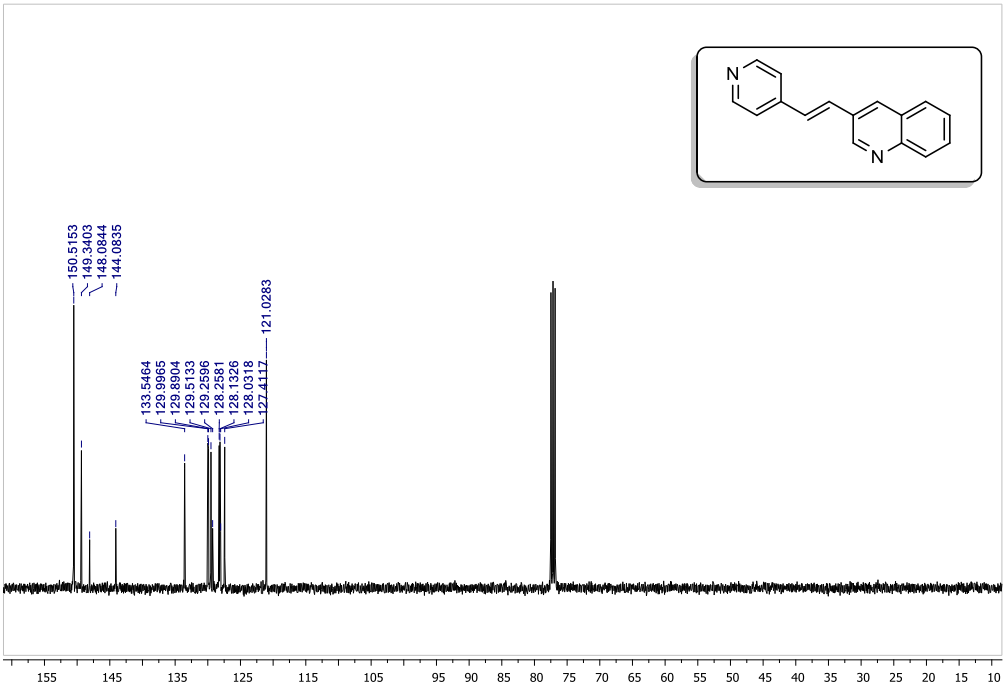


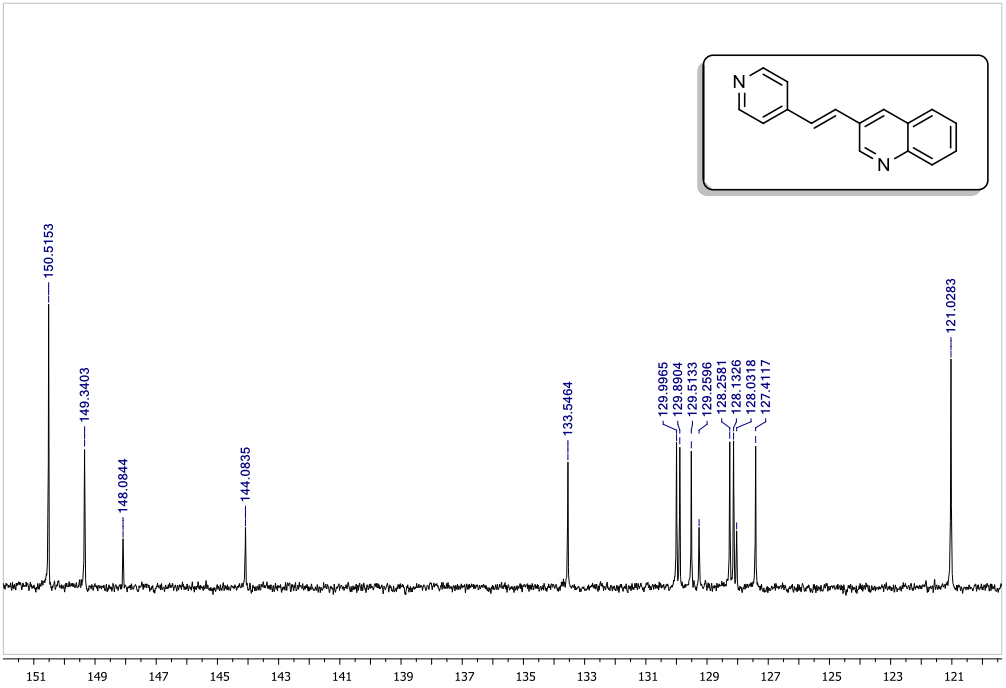
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-3-(2-(pyridin-4-yl)vinyl)quinoline (13)



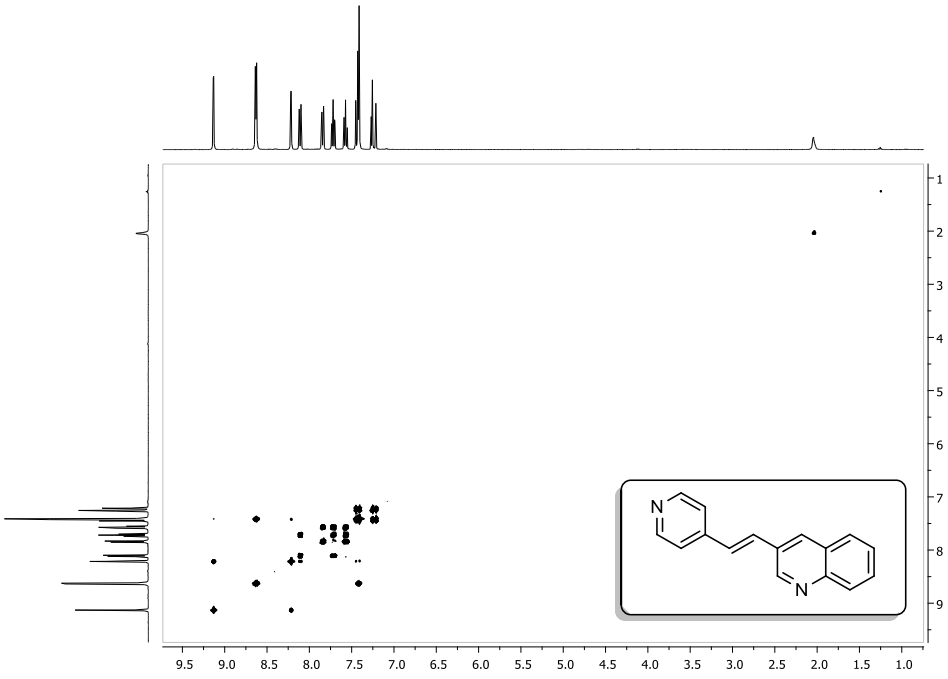


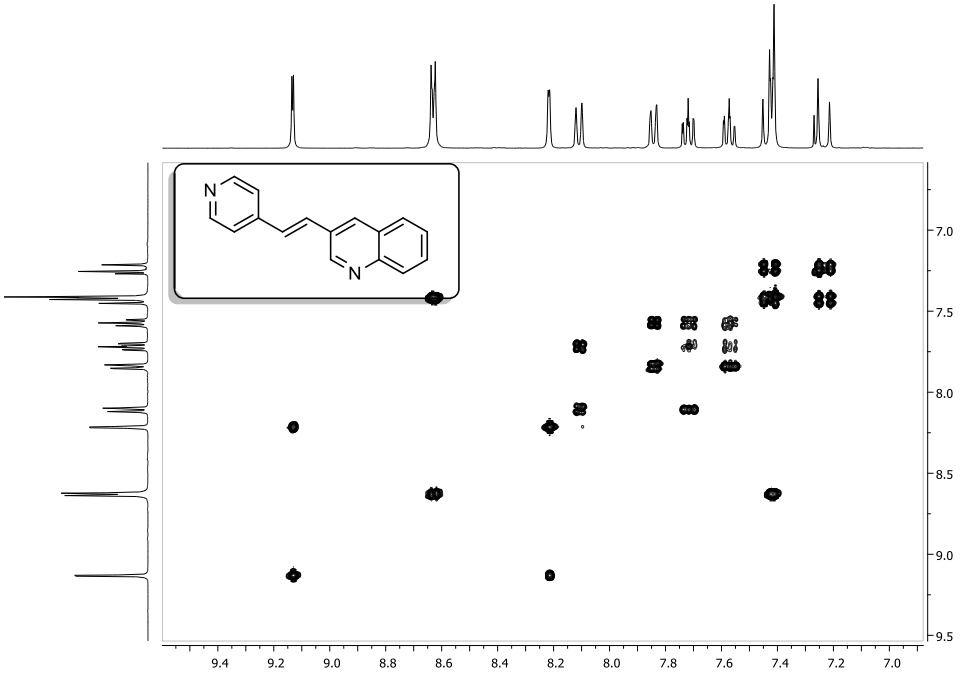
^{13}C NMR (101 MHz, $CDCl_3$) *(E)*-3-(2-(pyridin-4-yl)vinyl)quinoline (13)



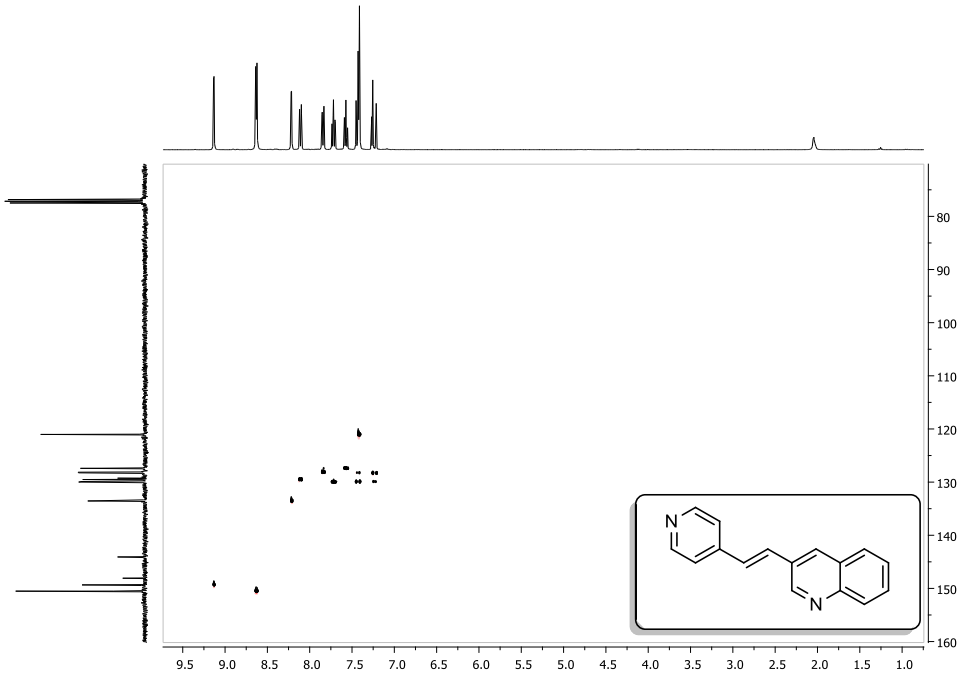


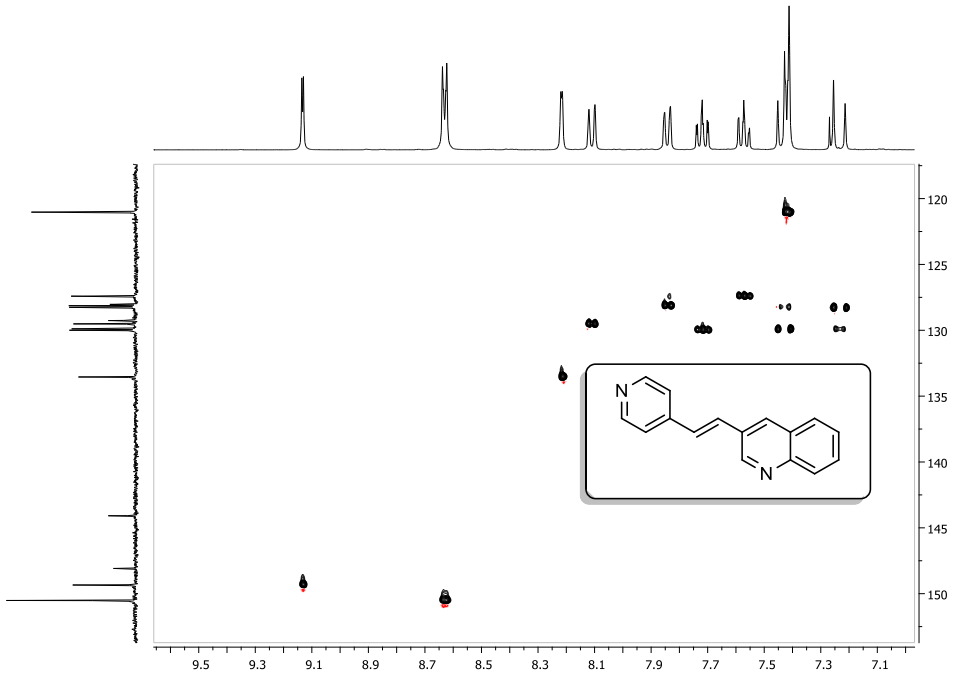
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) *(E)*-3-(2-(pyridin-4-yl)vinyl)quinoline (13)



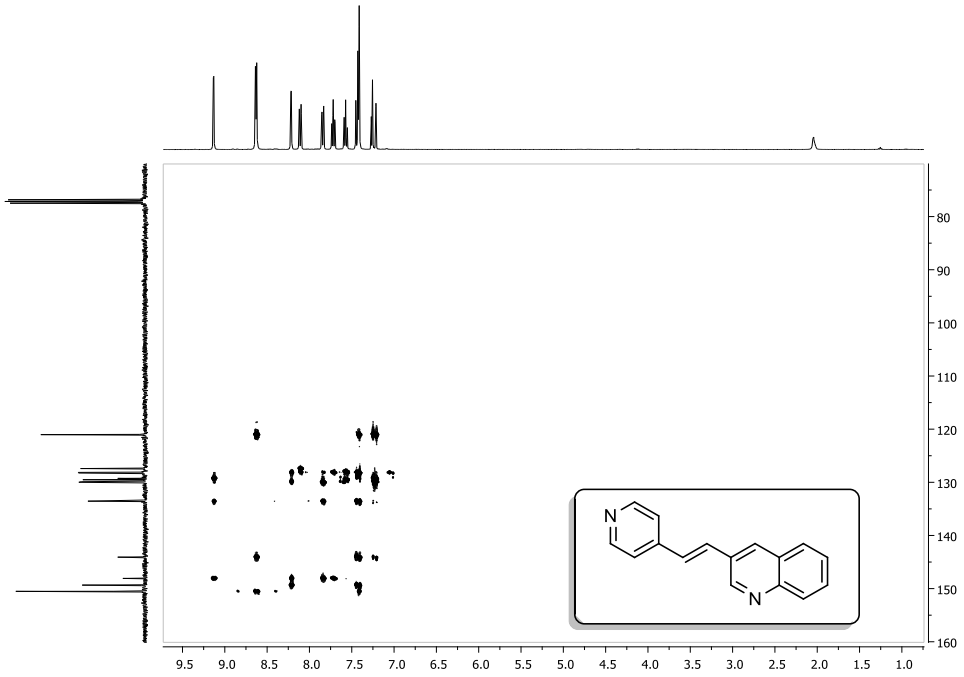


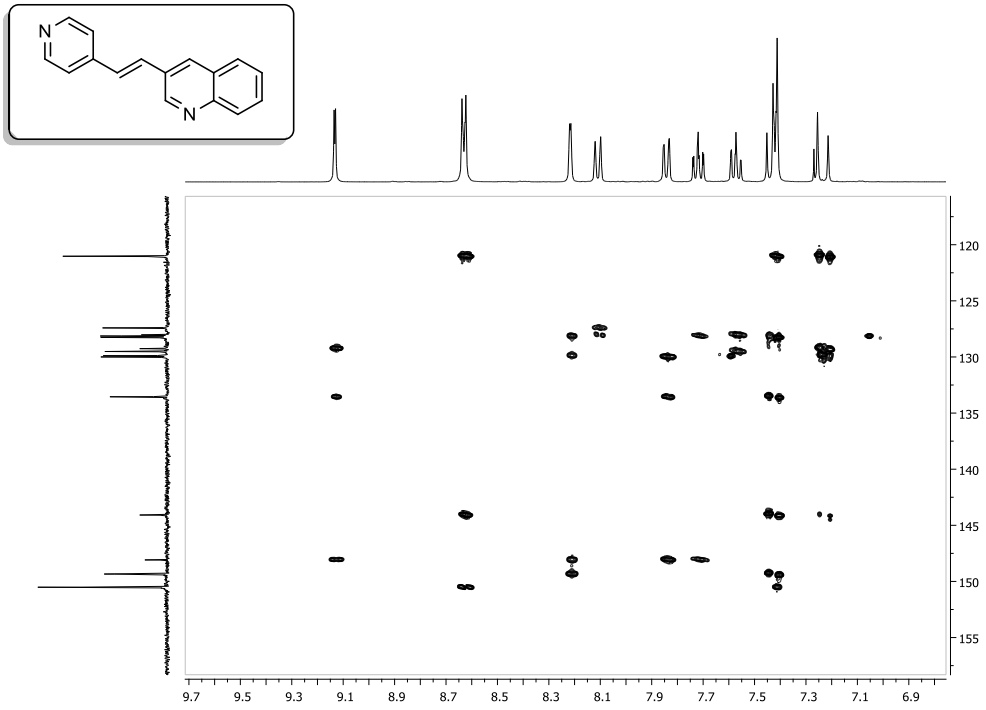
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-3-(2-(pyridin-4-yl)vinyl)quinoline (13)



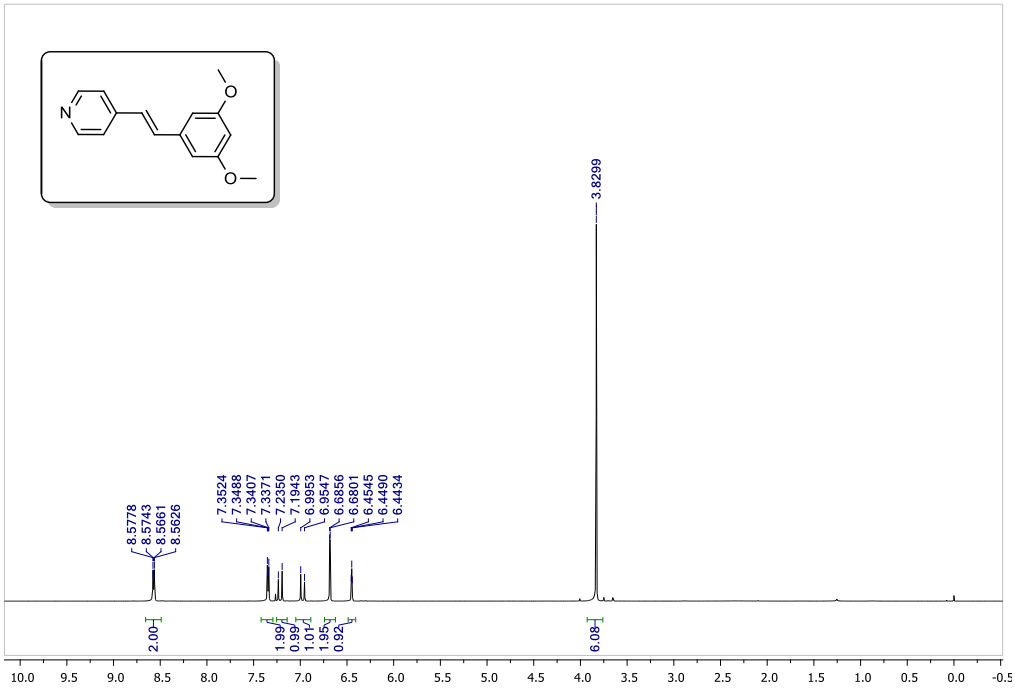


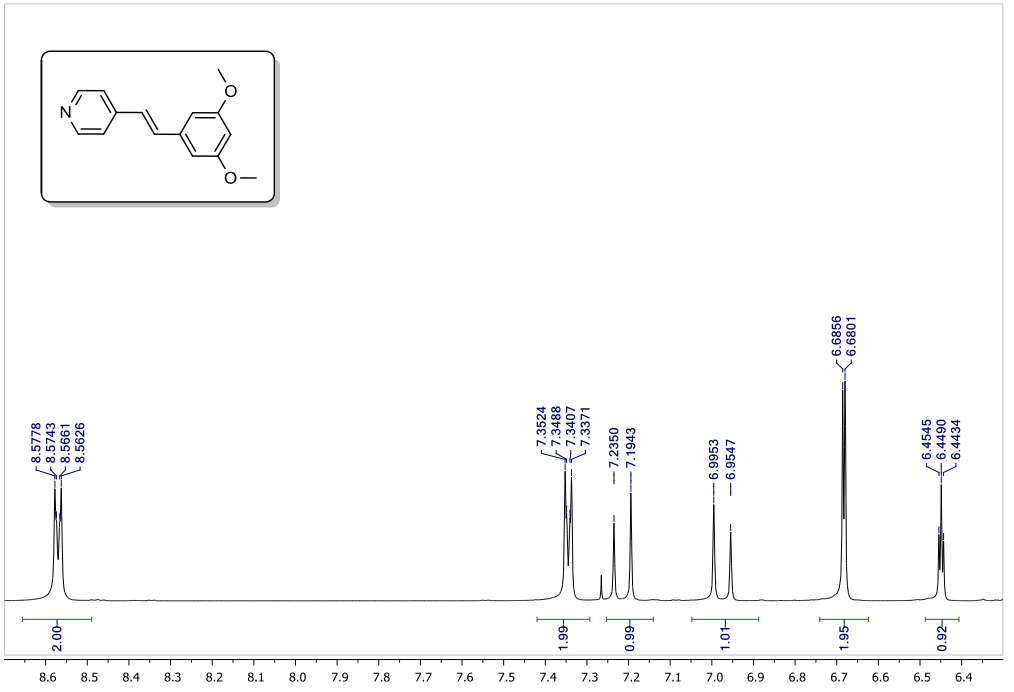
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-3-(2-(pyridin-4-yl)vinyl)quinoline (13)



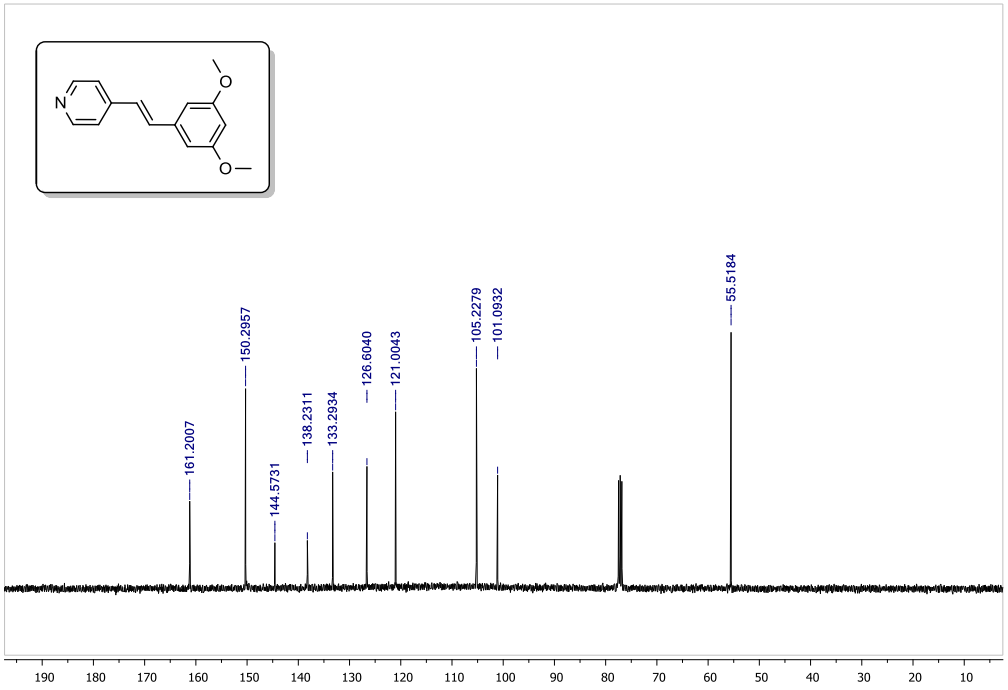


^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-4-(3, 5-dimethoxystyryl)pyridine (14)

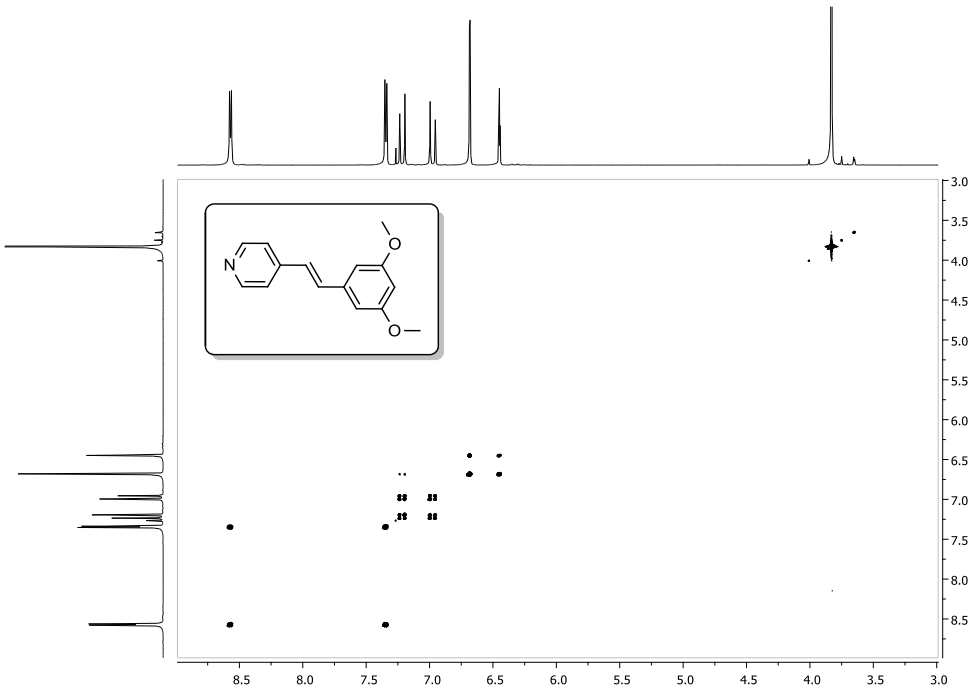




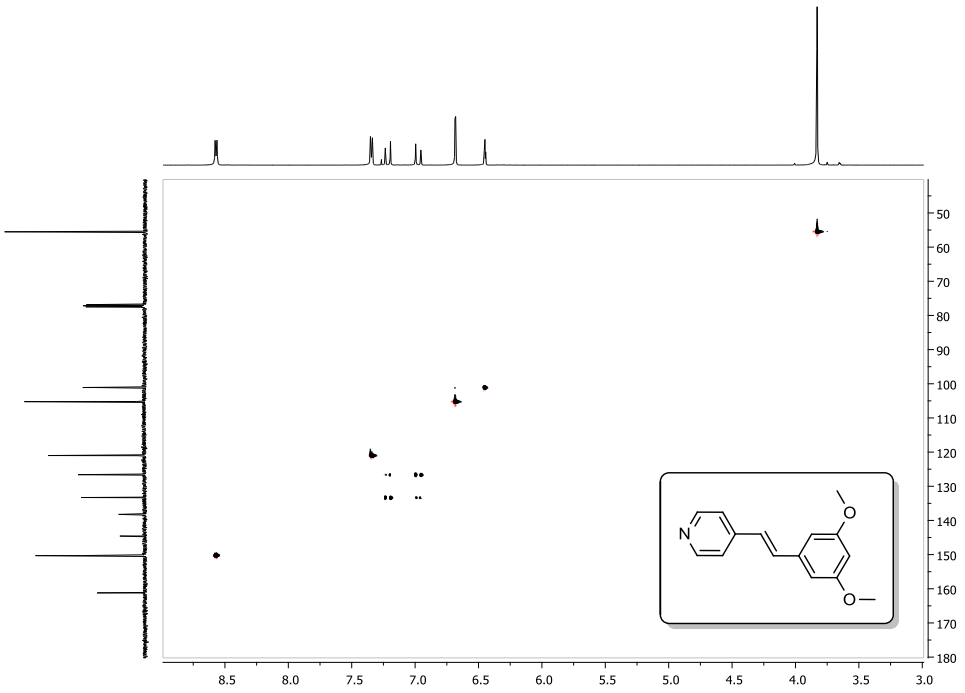
^{13}C NMR (101 MHz, $CDCl_3$) *(E)*-4-(3, 5-dimethoxystyryl)pyridine (14)



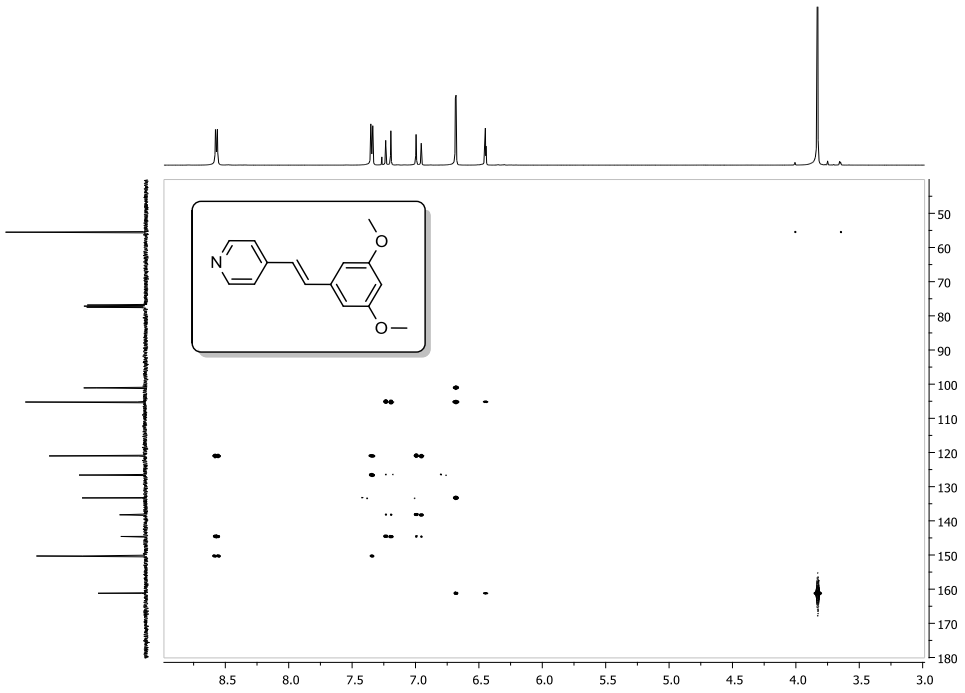
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) *(E)*-4-(3, 5-dimethoxystyryl)pyridine (14)



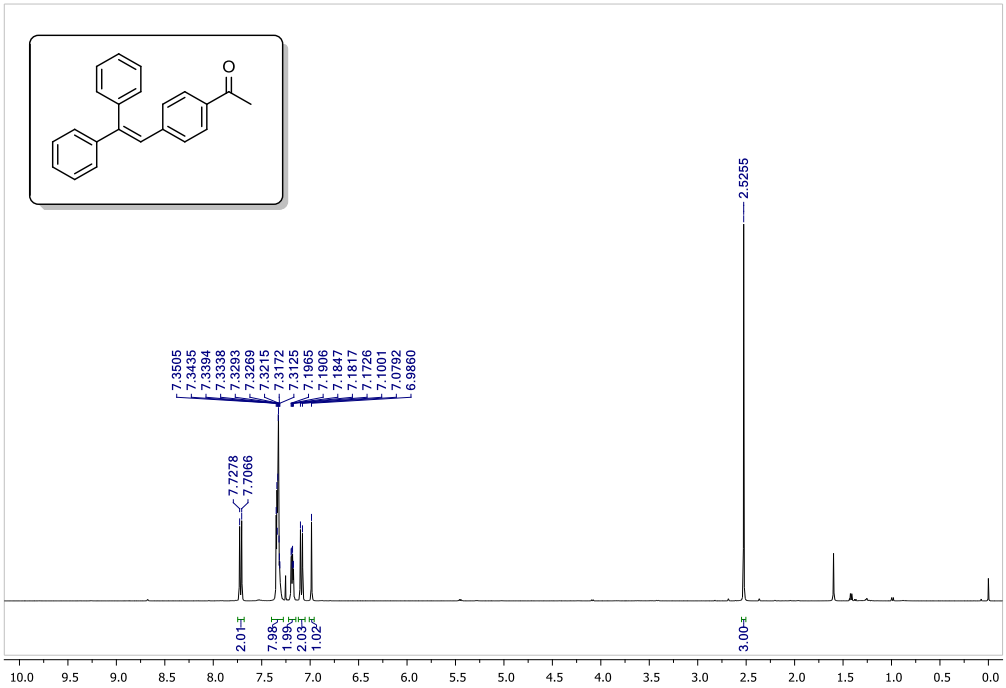
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-4-(3, 5-dimethoxystyryl)pyridine (14)

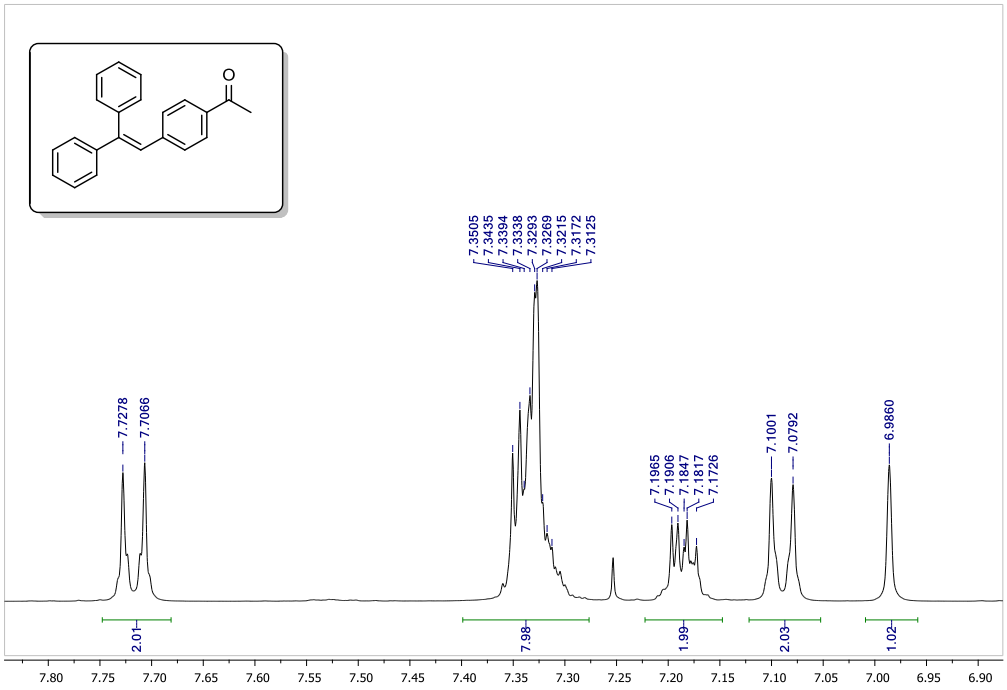


^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-4-(3, 5-dimethoxystyryl)pyridine (14)

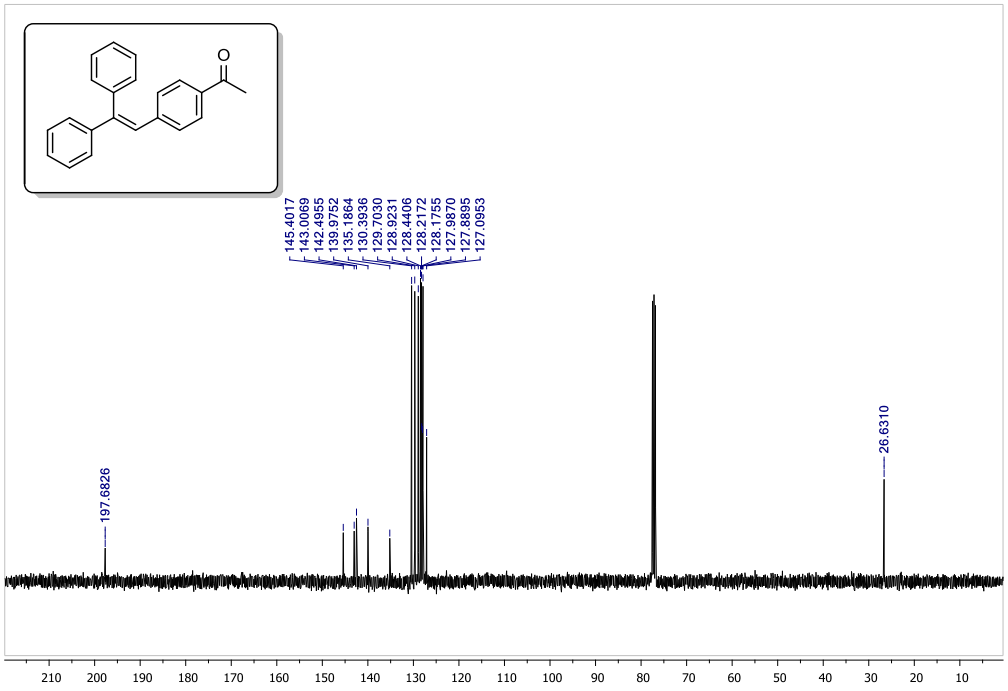


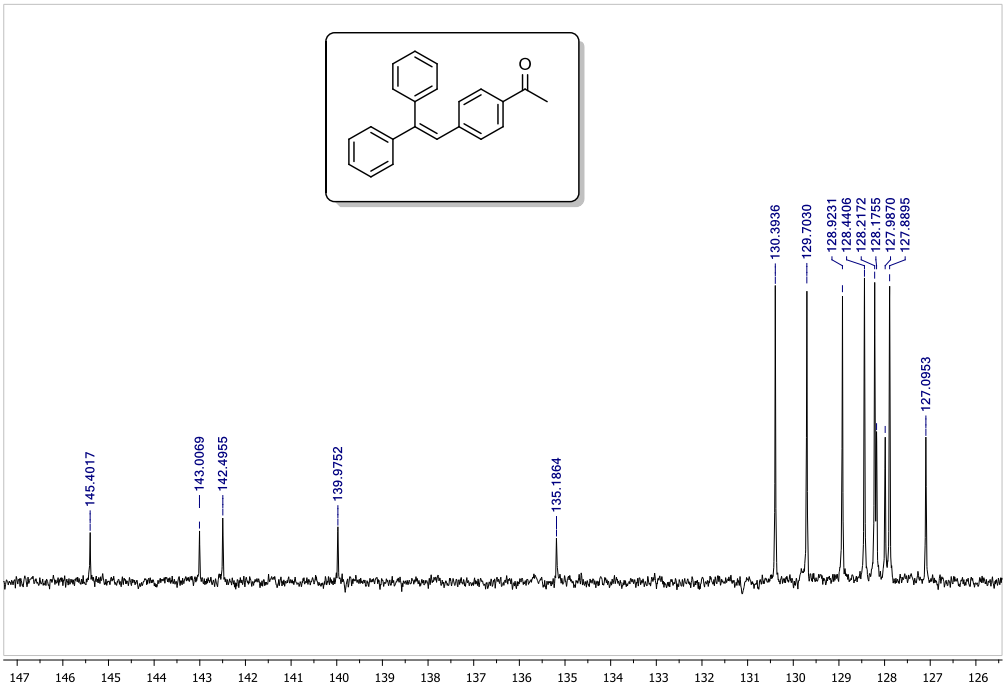
^{1}H NMR (400 MHz, $CDCl_3$) 1-(4-(2,2-diphenylvinyl)phenyl)ethanone (15)



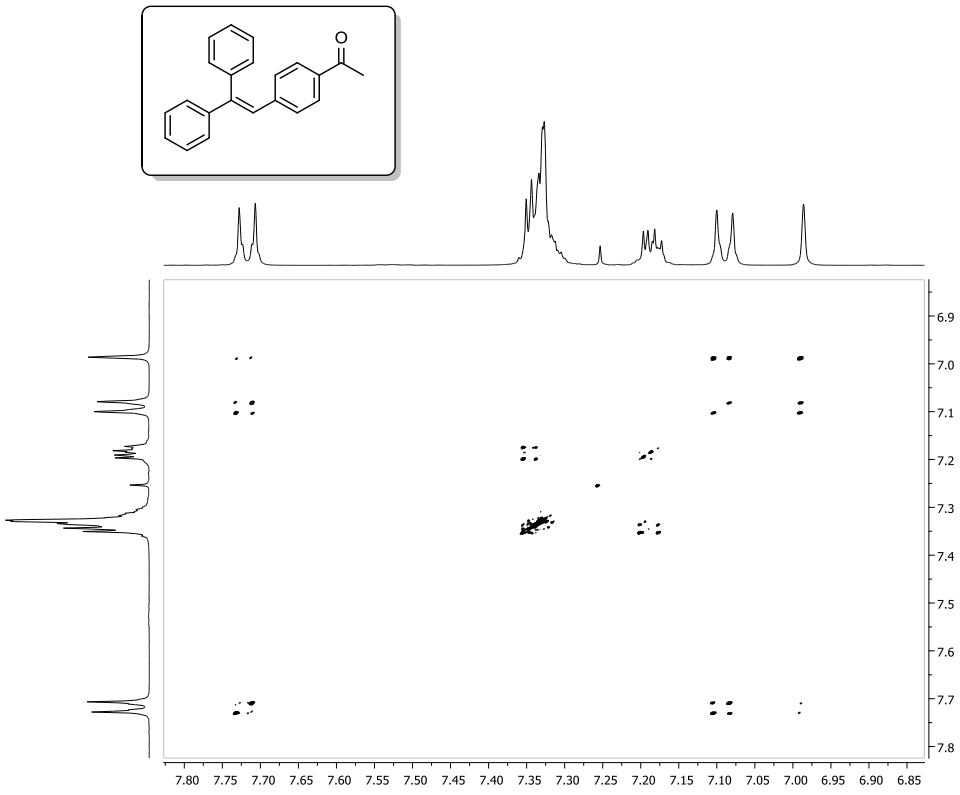


^{13}C NMR (101 MHz, $CDCl_3$) 1-(4-(2,2-diphenylvinyl)phenyl)ethanone (15)

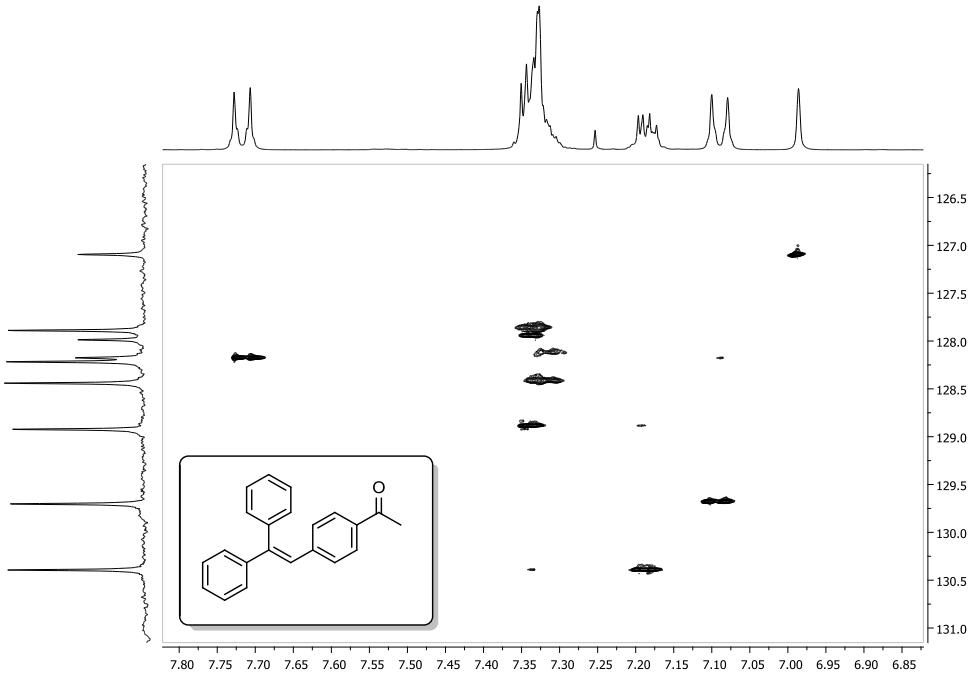




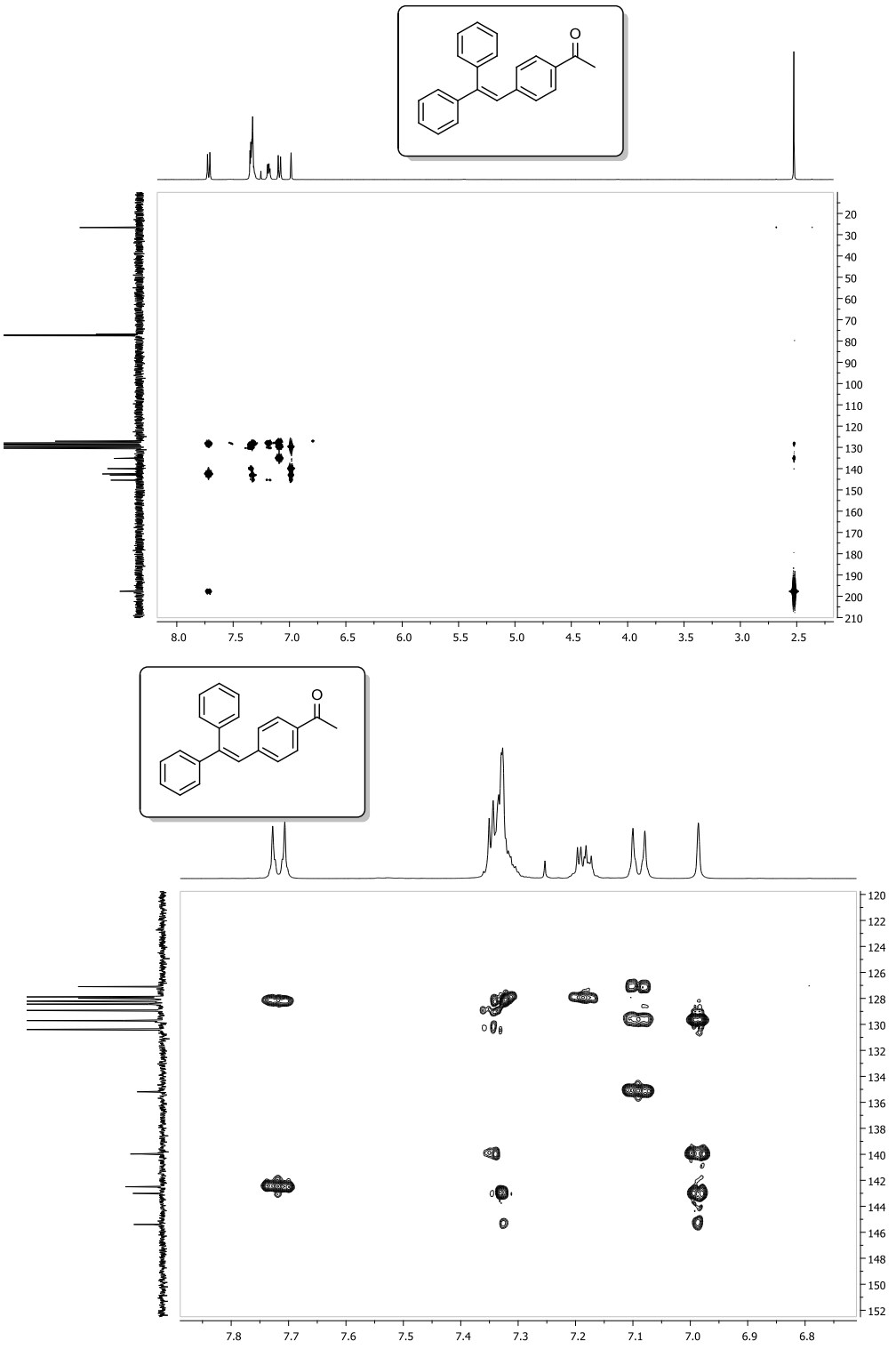
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) 1-(4-(2,2-diphenylvinyl)phenyl)ethanone (15)



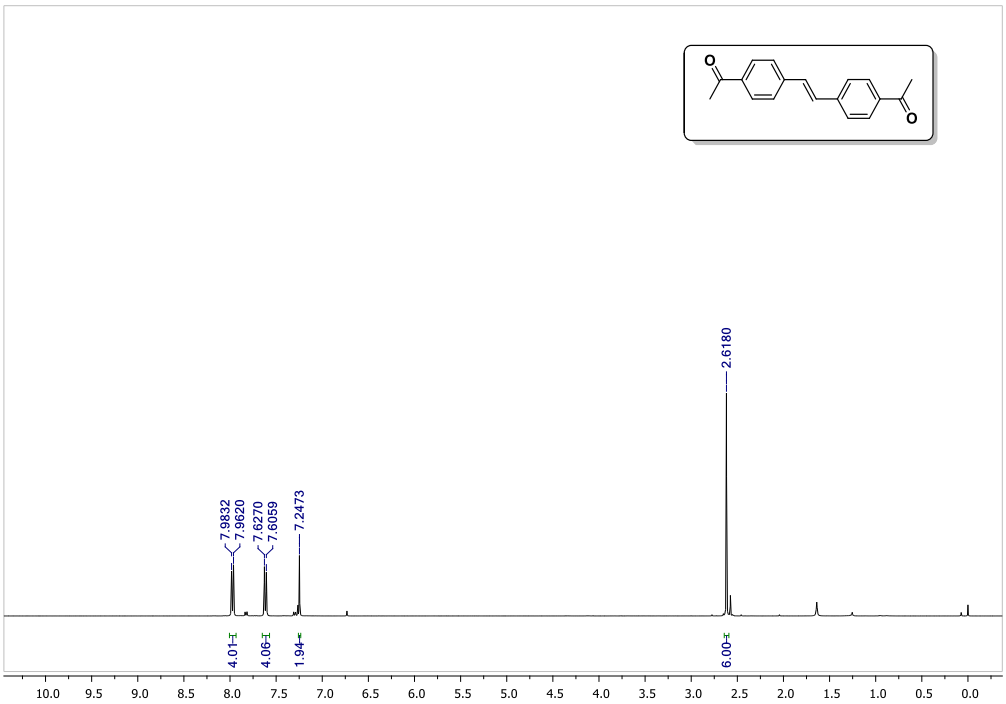
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) 1-(4-(2,2-diphenylvinyl)phenyl)ethanone (15)



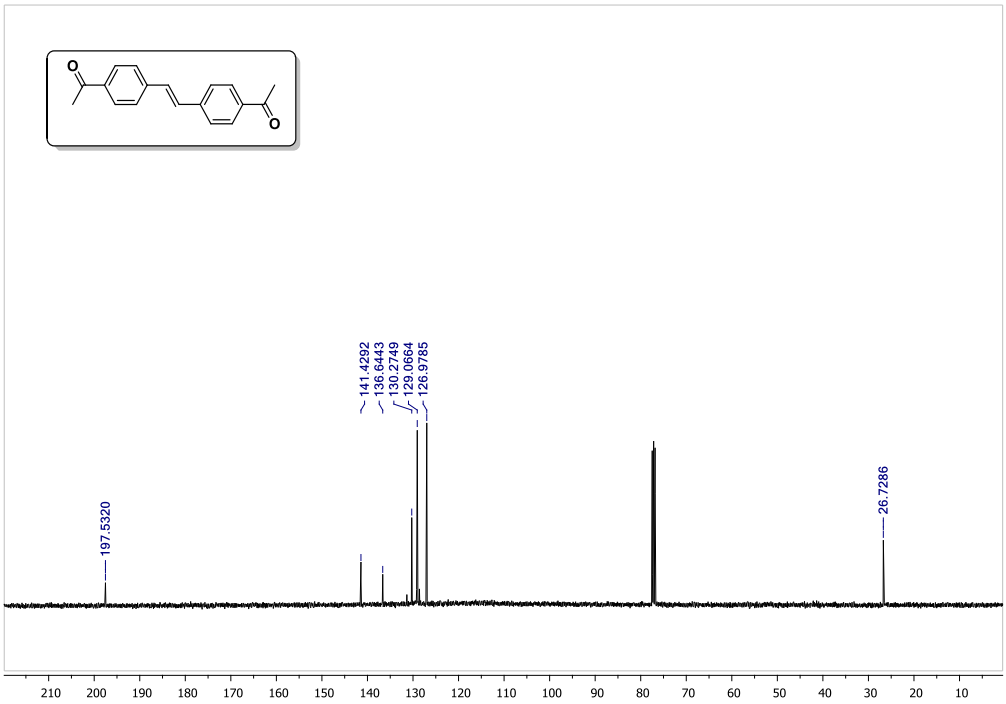
^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) 1-(4-(2,2-diphenylvinyl)phenyl)ethanone (15)



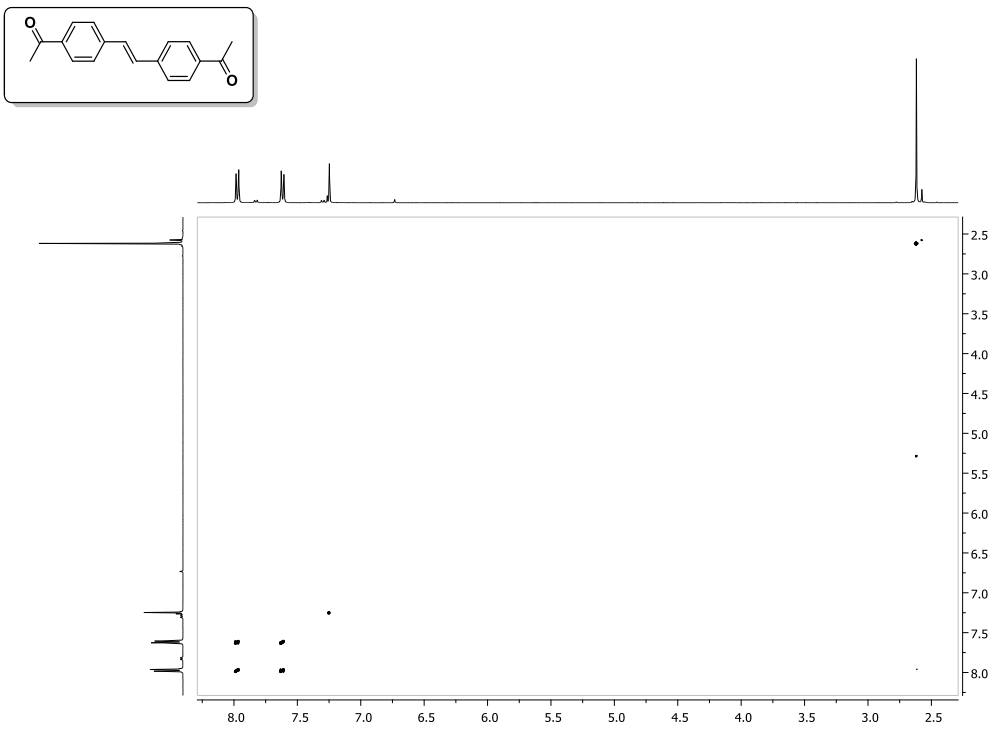
^{1}H NMR (400 MHz, $CDCl_3$) (*E*)-1,1'-(ethene-1,2-diylbis(4,1-phenylene))diethanone (17)



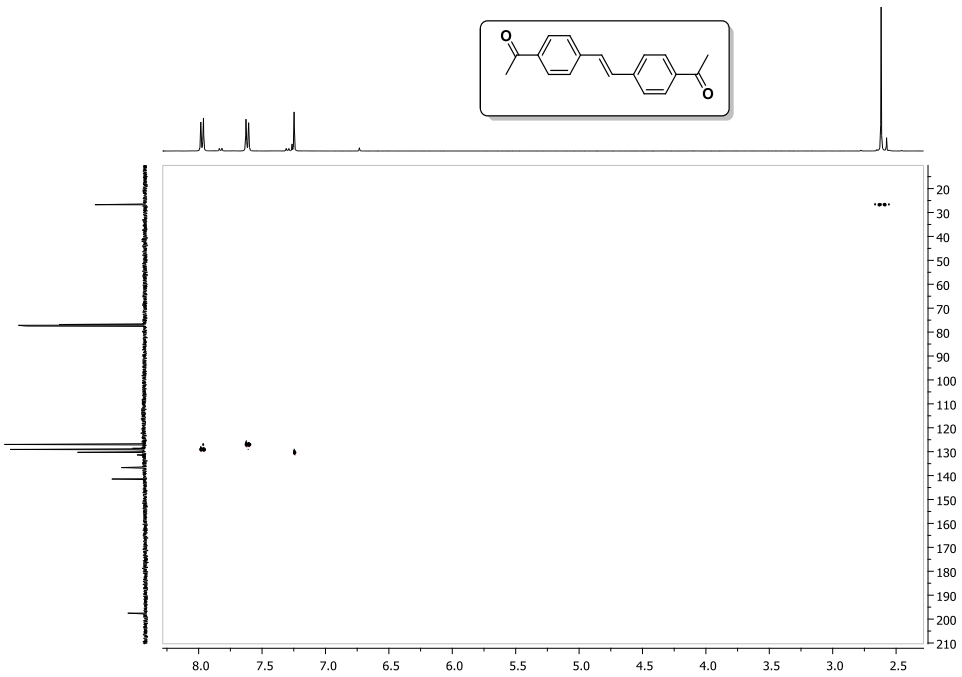
^{13}C NMR (101 MHz, $CDCl_3$) (*E*)-1,1'-(ethene-1,2-diylbis(4,1-phenylene))diethanone (17)



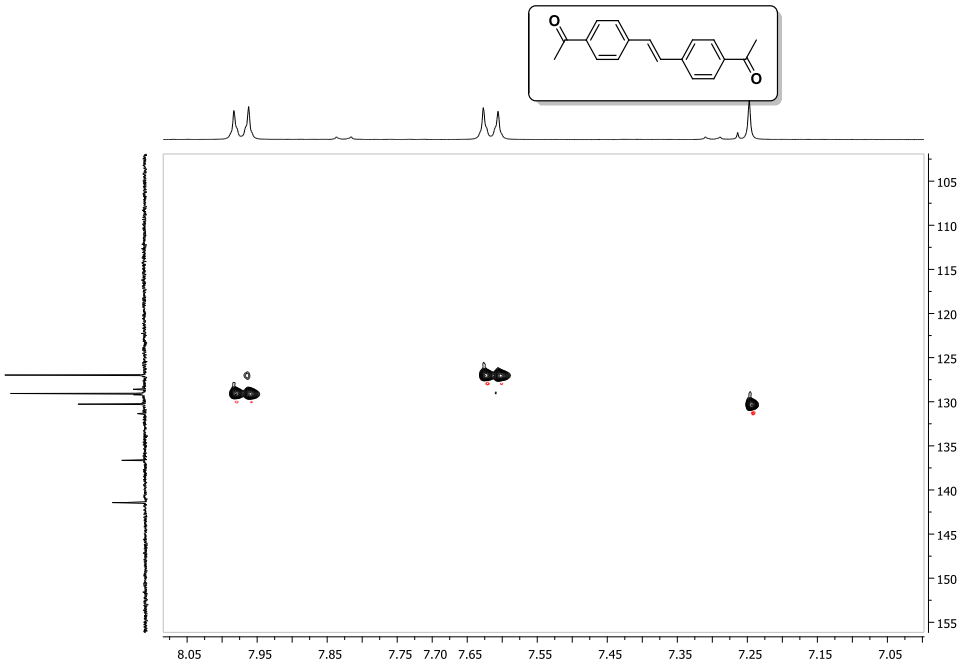
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) (*E*)-1,1'-(ethene-1,2-diylbis(4,1-phenylene))diethanone (17)



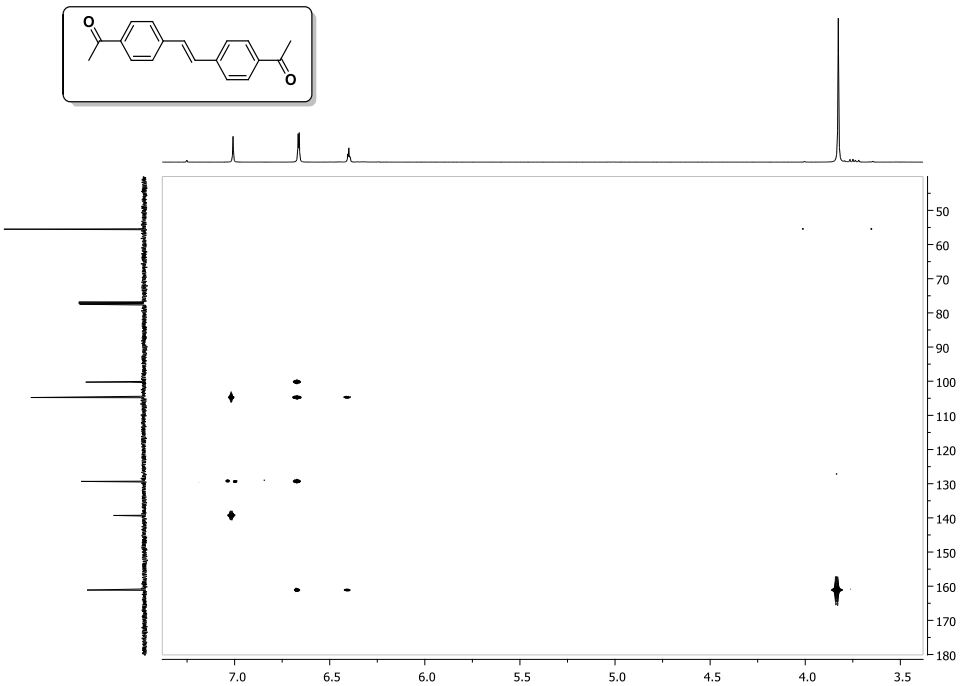
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) (*E*)-1,1'-(ethene-1,2-diylbis(4,1-phenylene))diethanone (17)



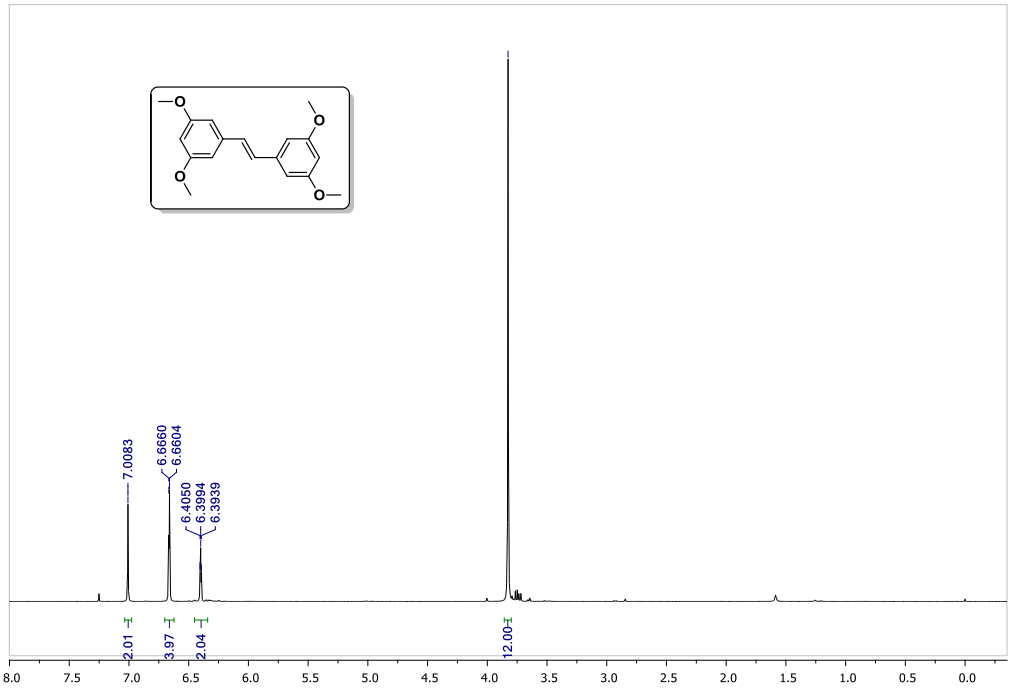
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) (*E*)-1,1'-(ethene-1,2-diylbis(4,1-phenylene))diethanone (17)

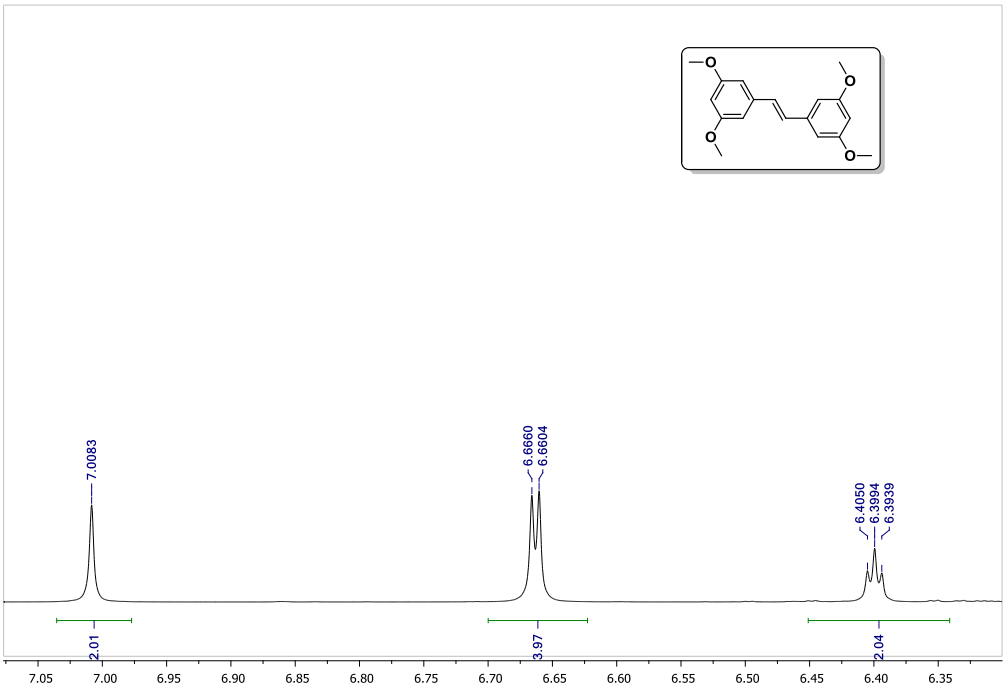


^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) (*E*)-1,1'-(ethene-1,2-diylbis(4,1-phenylene))diethanone (17)

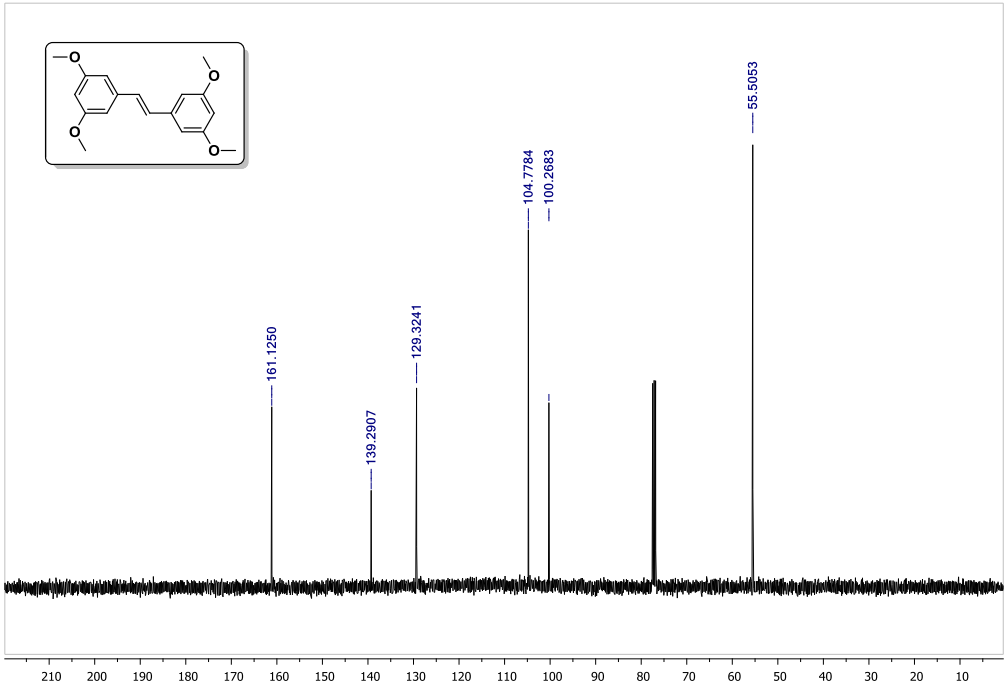


^{1}H NMR (400 MHz, $CDCl_3$) (*E*)-1,2-bis(3,5-dimethoxyphenyl)ethane (18)

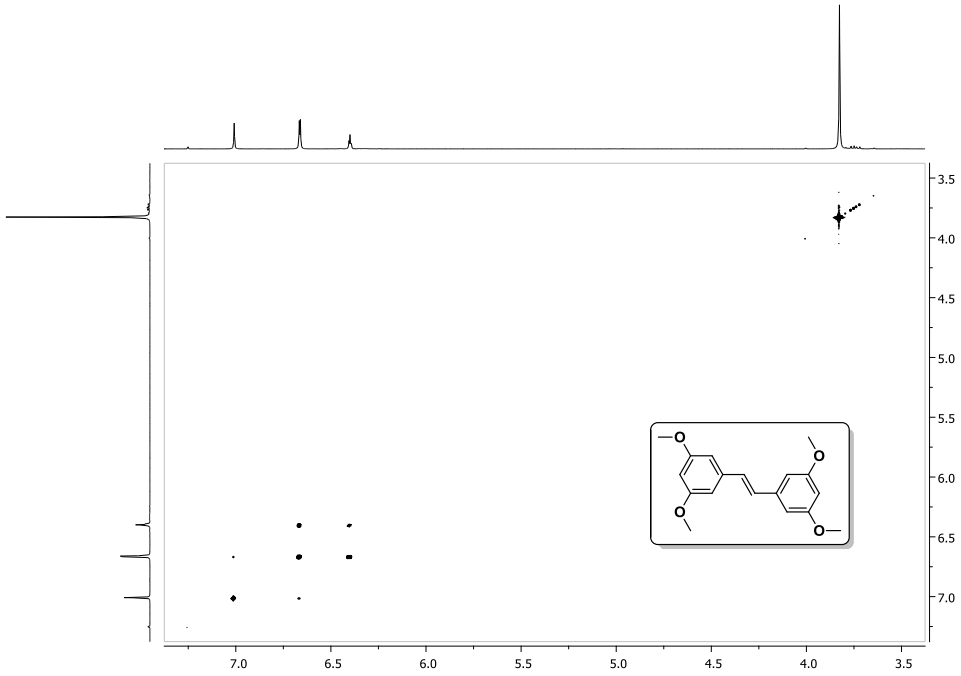




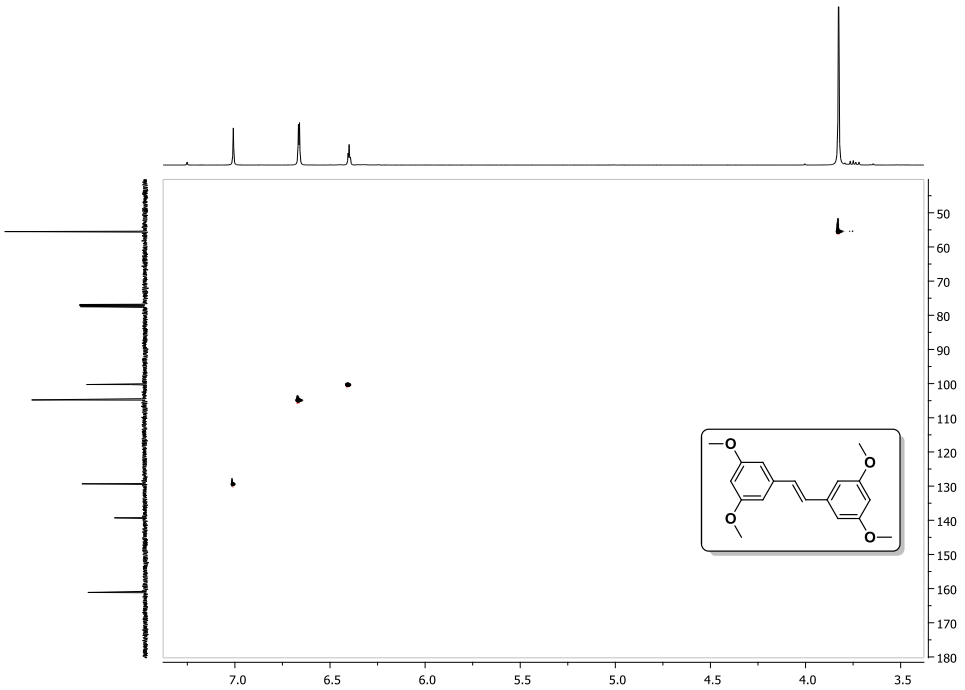
^{13}C NMR (101 MHz, $CDCl_3$) (*E*)-1,2-bis(3,5-dimethoxyphenyl)ethane (18)



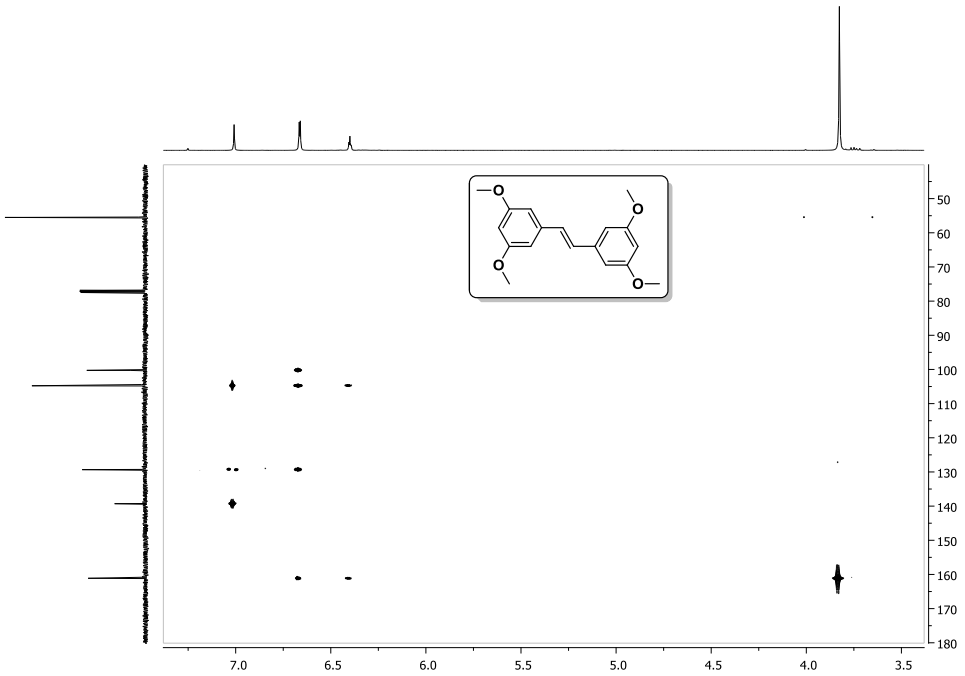
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) (*E*)-1,2-bis(3,5-dimethoxyphenyl)ethane (18)



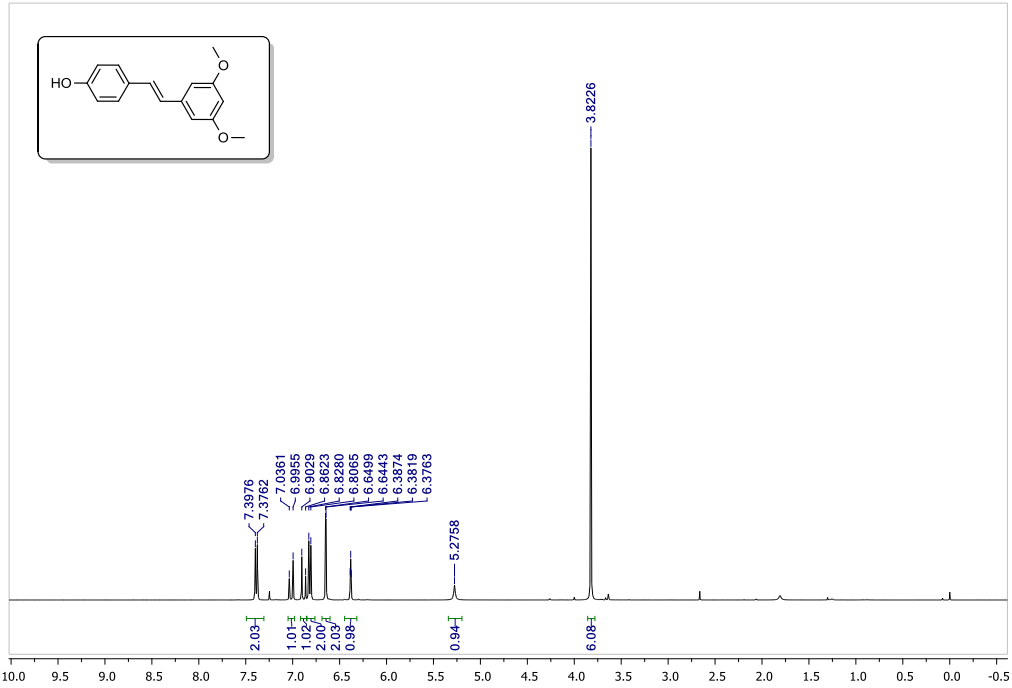
^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) (*E*)-1,2-bis(3,5-dimethoxyphenyl)ethane (18)

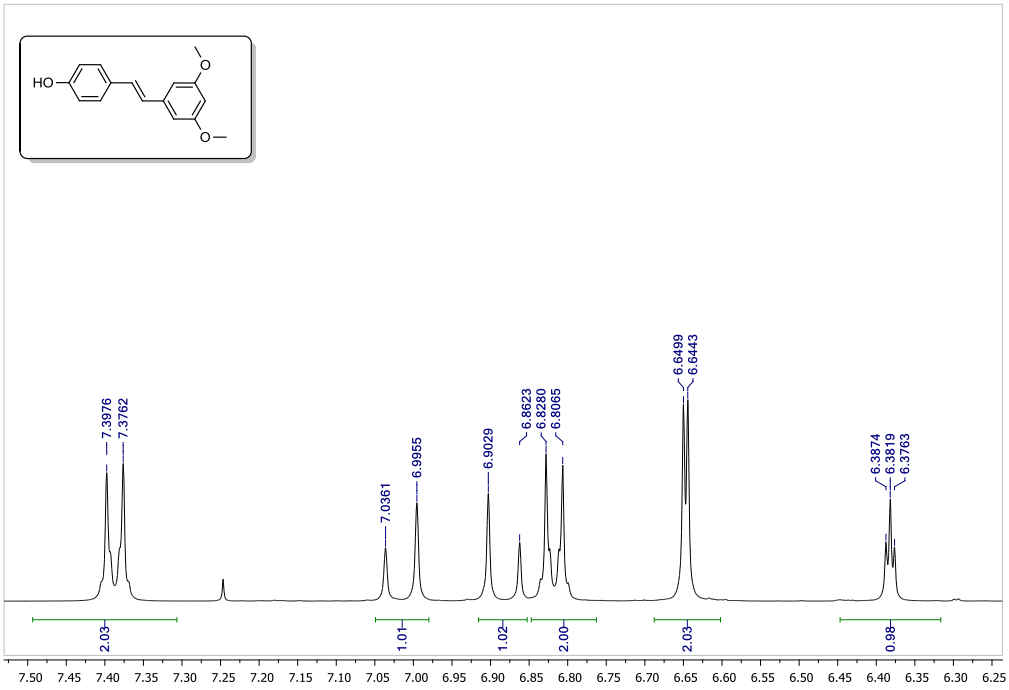


^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) (*E*)-1,2-bis(3,5-dimethoxyphenyl)ethane (18)

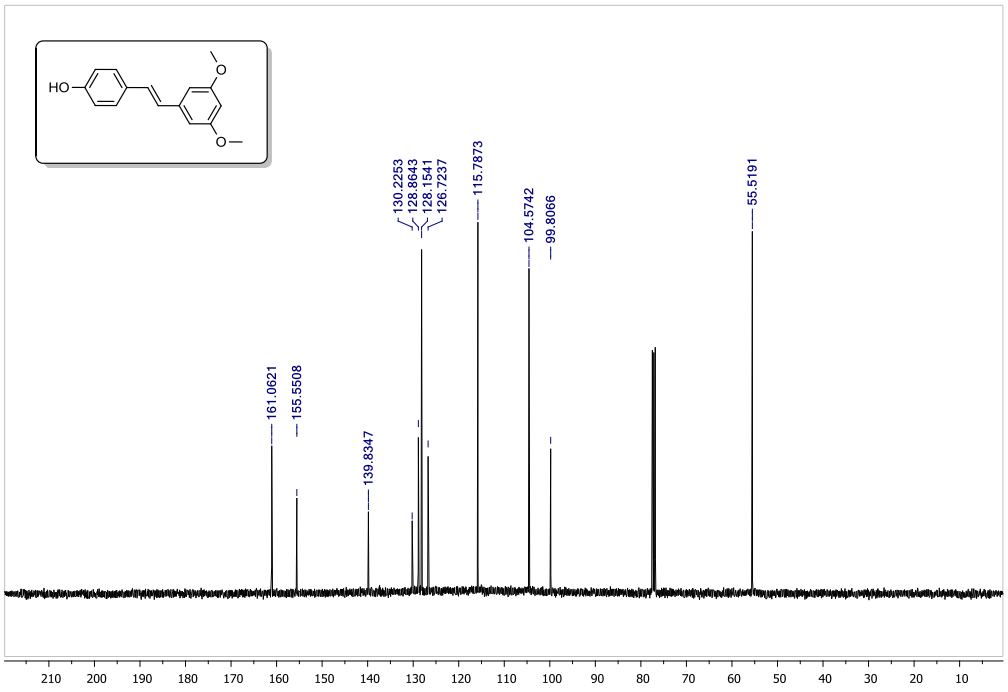


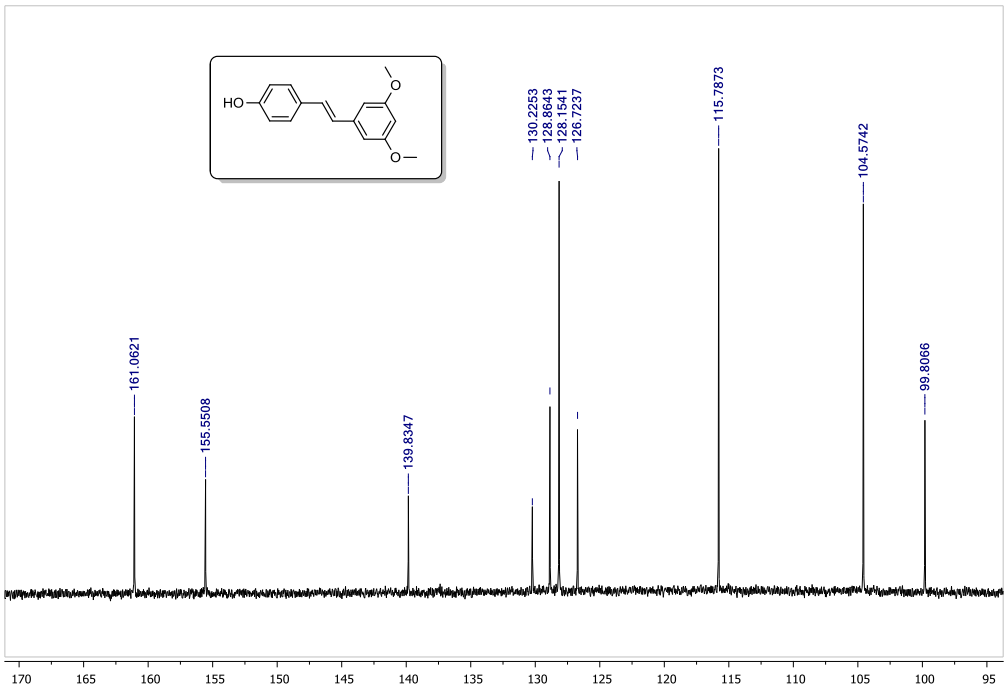
^{1}H NMR (400 MHz, $CDCl_3$) *(E)*-4-(3,5-dimethoxystyryl)phenol (19)



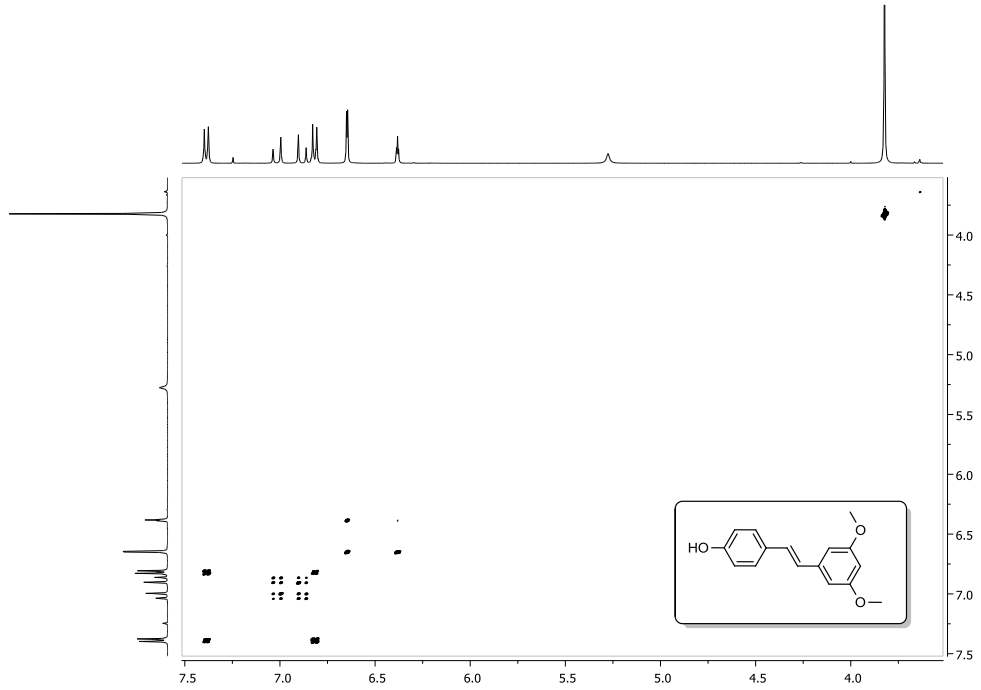


^{13}C NMR (101 MHz, $CDCl_3$) *(E)*-4-(3,5-dimethoxystyryl)phenol (19)

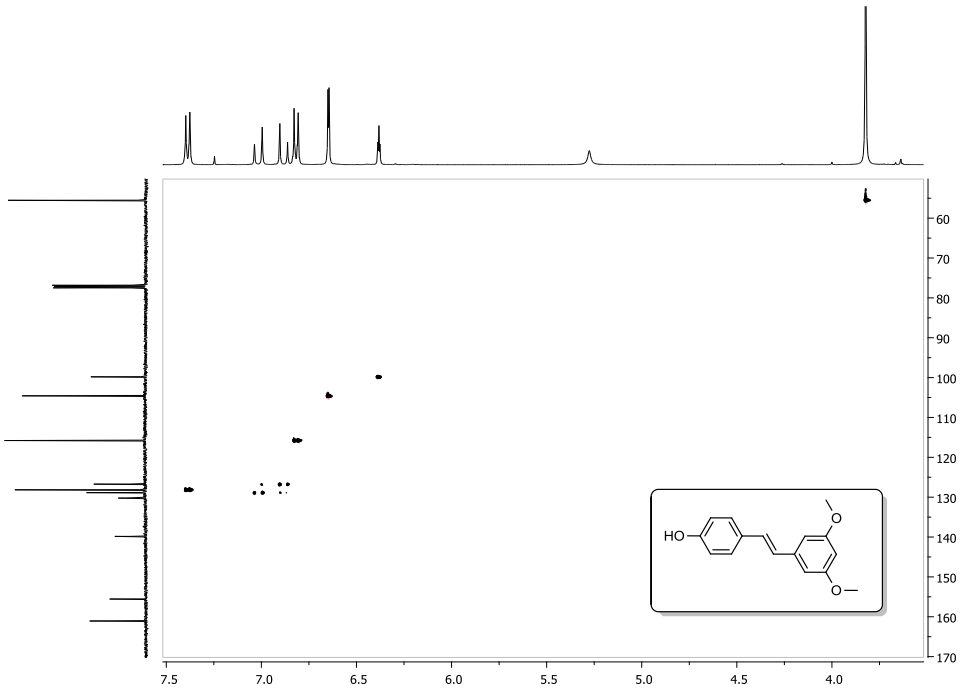




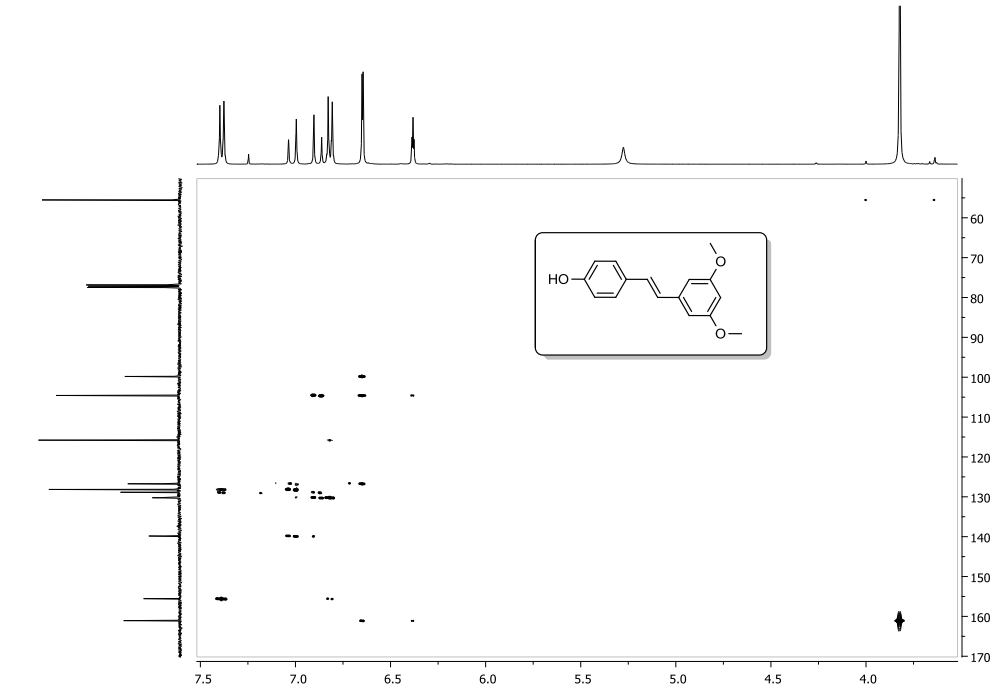
^{1}H-^{1}H COSY NMR (400 MHz, $CDCl_3$) *(E)*-4-(3,5-dimethoxystyryl)phenol (19)

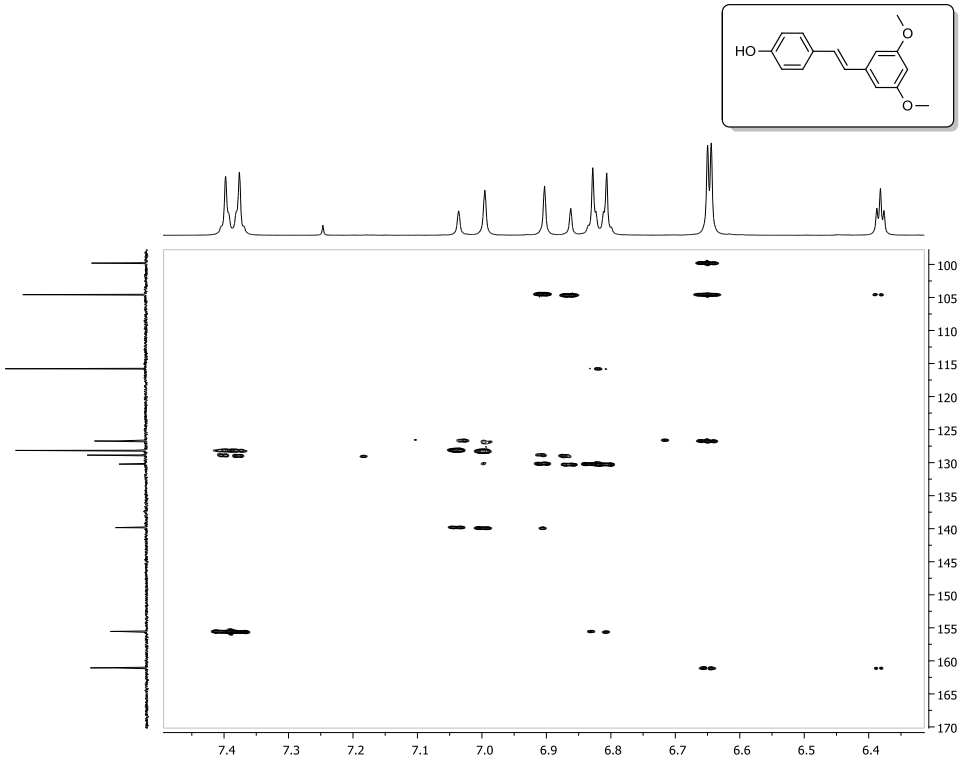


^{1}H-^{13}C HSQC NMR (400 MHz, $CDCl_3$) *(E)*-4-(3,5-dimethoxystyryl)phenol (19)



^{1}H-^{13}C HMBC NMR (400 MHz, $CDCl_3$) *(E)*-4-(3,5-dimethoxystyryl)phenol (19)





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