SUPPORTING INFORMATION

FOR

Mizoroki-Heck Reactions Catalyzed by Palladium Dichloro-bis(aminophosphine) Complexes Under Mild Reaction Conditions. The Importance of Ligand Composition on the Catalytic Activity

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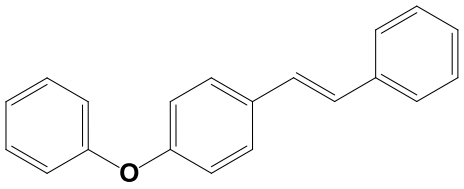
Experimental Section

General procedures. 1,1',1''-(phosphinetriyl)tripiperidine and $[(P\{(NC_5H_{10})_3\})_2Pd(Cl)_2]$ (**1**) were prepared in air, using oven-dried glassware. All other synthetic operations were carried out in oven-dried glassware using a combination of glovebox (M. Braun 150B-G-II) and Schlenk techniques under a dinitrogen atmosphere even if for the preparation of **2** and **3** not necessarily required. Solvents were reagent grade or better, freshly distilled under N_2 atmosphere by standard procedures, and degassed by freeze-thaw cycles before use. Deuterated solvents were purchased from Armar and used as received. All the chemicals were purchased from Aldrich Chemical Co. and used without further purification.

Analysis. ^1H and $^{13}C\{^1H\}$ NMR data were recorded at 300.0 and 75.4 MHz on a Varian Gemini 300 spectrometer. Chemical shifts (d) are expressed in parts per million (ppm) coupling constants (*J)* are in Hz. The ^1H and $^{13}C\{^1H\}$ NMR chemical shifts are reported relative to tetramethylsilane; the resonance of the residual protons of the solvent were used as internal standard for ^1H (δ 7.26 $CDCl_3$) and all deuterium solvent signals for ^{13}C (δ 77.0 $CDCl_3$) All measurements were carried out at 298 K. Abbreviations used in the description of NMR data are as follows: br, broad; s, singlet; d, dublet; t, triplet; m, multiplet. The GC/MS spectra were recorded on a Varian Saturn 2000 spectrometer. The exact mass and the fragmentations did always correspond to the proposed structure. High-resolution electrospray mass spectra were recorded on a Bruker maXis QTOFBMS instrument (Bruker Daltonics GmbH, Bremen, Germany). The samples were dissolved in MeOH in the presence of NaI and analyzed via onflow injection (0.5 µl) at a flow rate of 140 µl/min. The mass spectrometer was operated in positive ion mode with a capillary voltage of 4 kV, an endplate offset of -500 V, nebulizer pressure of 0.4 bar, and a drying gas flow rate of 4 l/min at 180°C. The instrument was calibrated with a Fluka electrospray calibration solution (Sigma-Aldrich, Buchs, Switzerland) that was 100 times diluted with acetonitrile. Elemental analyses were performed on a Leco CHNS-932 analysator at the University of Zürich, Switzerland. Cyclo voltammetry spectra were recorded on a Metrohm 757VA Computrace electrochemical analyzer with a standard three-electrode setup of Gold as working and Pt as auxiliary electrodes and a Ag/AgClas reference electrode. TEM-EDX analysis was performed on a Tecnai G2 Spirit 120kV (FEI, Eindhoven, Netherlands) using an Oxford X-Max 80 EDX Detector (Oxford Instruments, Oxfordshire, UK) at the center for microscopy and image analysis at the University of Zürich, Switzerland.

General procedure for Heck reactions. A Young Schlenk (10 mL) was charged under a dinitrogen atmosphere with the appropriate amounts of the olefin (1.5 mmol), aryl halide (1 mmol), K_2CO_3 (2 mmol), tetrabutylammonium bromide (~10 mol% relative to the aryl bromide), and DMF or NMP (2.5 ml). The mixture was vigorously stirred and heated to 100 °C. Then the correct amount of catalyst was added by syringe as a solution in THF (0.05 mol%, 0.1 ml of a $5x10^{-3}$ M solution). Samples were periodically taken from the reaction mixture, quenched with 1M HCl (or 1M Na_2CO_3, if basic functional groups were present in the substrates), extracted with ethyl acetate, and analyzed by GC/MS. At the end of catalysis, the reaction mixtures were allowed to cool to room temperature, quenched with 1M HCl (or 1M NaOH respectively), and extracted with ethyl acetate (3*25 mL). The combined extracts were dried ($MgSO_4$) and evaporated to dryness. The crude material was purified by flash chromatography on silica gel or Alox, as necessary.

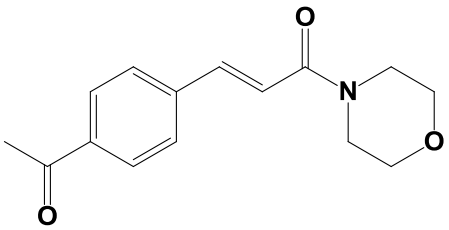
(*E*)-1-phenoxy-4-styrylbenzene



The title compound was purified by flash chromatography (silica gel, hexane). The product was obtained as colorless crystals in 93% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.55-7.49 (m, 4H), 7.42-7.34 (m, 4H),7.31-7.25 (m, 1H), 7.18-7.12 (m, 1H), 7.10-7.01 (m, overlapping signals, 6H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 157.1, 156.9, 137.4, 132.6, 129.8, 128.7, 127.9, 127.8, 127.7, 127.5, 126.4, 123.4, 119.0. HRMS (ESI) calcd for $C_{20}H_{16}O$ $[M]^{+}$: 272.12012 Found: 272.11990.

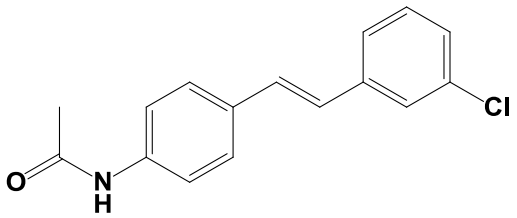
(*E*)-3-(4-acetylphenyl)-1-morpholinoprop-2-en-1-one



The crude product was washed with cold mixture of ethyl acetate and hexane (1:1) and dried, which gave the title compound as colourless powder in 90% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.94 (d, *J* = 8.1 Hz, 2H), 7.69 (d, *J* = 15.3 Hz, 1H), 7.58 (d, *J* = 8.1 Hz, 2H), 6.94 (d, *J* = 15.3 Hz, 1H), 3.74 (br s, 8H), 2.61 (s, 3H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 197.3, 165.0, 141.6, 139.5, 137.6, 128.8, 127.8, 119.1, 66.8, 46.3, 42.6, 26.7. Elemental analysis: Calcd. for $C_{15}H_{17}NO_3$: C, 69.48; H, 6.61; N, 5.40. Found: C, 69.34; H, 6.40; N, 5.35.

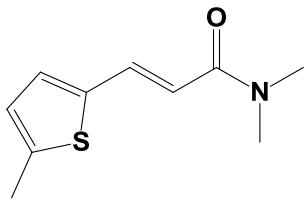
(*E*)-*N*-(4-(3-chlorostyryl)phenyl)acetamide



The crude product was washed with cold mixture of diethyl ether and hexane (1:1) and dried, which gave the title compound as colourless powder in 87% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.54-7.20 (m, overlapping signals, 9H), 7.07 (d, $^{3}J_{H,H}$ = 16.2 Hz, 1H), 6.96 (d, *J* = 16.2 Hz, 1H), 2.22 (s, 3H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 168.2, 139.2, 137.6, 134.6, 132.9, 129.8, 129.3, 127.4, 127.3, 126.4, 126.1, 124.6, 119.9, 24.7. Elemental analysis: Calcd. for $C_{16}H_{14}NClO$: C, 70.72; H, 5.19; N, 5.15. Found: C, 70.58; H, 5.23; N, 5.10.

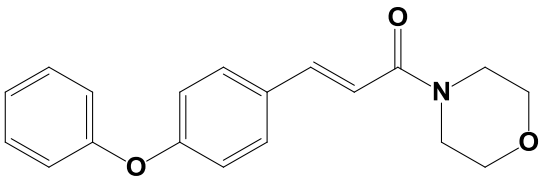
(*E*)-*N*,*N*-dimethyl-3-(5-methylthiophen-2-yl)acrylamide



The title compound was purified by flash chromatography (silica gel, diethyl ether). The product was obtained as pale colourless crystals in 84% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.70 (d, *J* = 15.0 Hz, 1H), 7.01 (d, *J* = 3.0 Hz, 1H), 6.68 (d, *J* = 3.0 Hz, 1H), 6.55 (d, *J* = 15.0 Hz, 1H), 3.15 (s, 3H), 3.06 (s, 3H), 2.50 (s, 3H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 166.5, 142.4, 138.5, 135.5, 130.8, 126.3, 114.7, 37.3, 35.9, 15.8. Elemental analysis: Calcd. for $C_{10}H_{13}NOS$: C, 61.50; H, 6.71; N, 7.17. Found: C, 61.50; H, 6.66; N, 7.05.

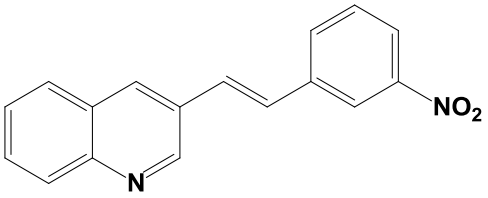
(E)-1-morpholino-3-(4-phenoxyphenyl)prop-2-en-1-one



The crude product was washed with cold mixture of ethyl acetate and hexane (1:1) and dried, which gave the title compound as colourless powder in 94% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.78 (d, *J* = 15.3 Hz, 1H), 7.49 (d, *J* = 8.7 Hz, 2H),7.39-7.33 (m, 2H), 7.17-7.12 (m, 1H), 7.06-7.02 (m, 2H), 6.98 (d, *J* = 8.7 Hz, 2H), 6.76 (d, *J* = 15.3 Hz, 1H), 3.73 (br s, 8H). ^{13}C{^{1}H} NMR (75 MHz, $CDCl_3$) δ 165.6, 158.9, 156.3, 142.5, 130.0, 129.9, 129.4, 123.9, 119.5, 118.5, 115.2, 66.9, 46.2, 42.6. Elemental analysis: Calcd. for $C_{19}H_{19}NO_3$: C, 73.77; H, 6.19; N, 4.53. Found: C, 73.92; H, 6.21; N, 4.46.

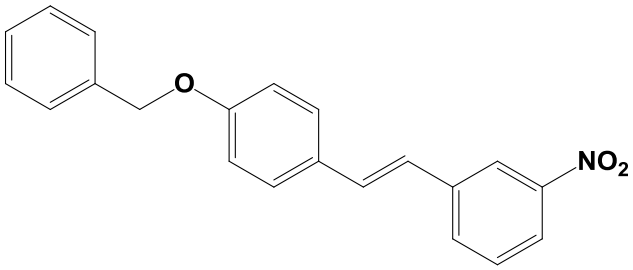
(*E*)-3-(3-nitrostyryl)quinoline



The crude product was washed with cold mixture of ethyl acetate and hexane (1:20) and dried, which gave the title compound as yellow powder in 83% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 9.13-9.11 (m, 1H), 8.42-8.40 (m, 1H), 8.20 (br s, 1H), 8.15-8.08 (m, 2H), 7.85-7.82 (m, 2H), 7.74-7.68 (m, 1H), 7.60-7.52 (m, 2H), 7.35-7.34 (m, 2H). ^{13}C{^{1}H} NMR (75 MHz, $CDCl_3$) δ 149.1, 148.7, 147.8, 138.5, 133.1, 132.4, 129.7, 129.3, 129.2, 128.3, 128.1, 128.0, 127.9, 127.2, 122.5, 121.0. Elemental analysis: Calcd. for $C_{17}H_{12}N_2O_2$: C, 73.90; H, 4.38; N, 10.14. Found: C, 73.99; H, 4.43; N, 10.11.

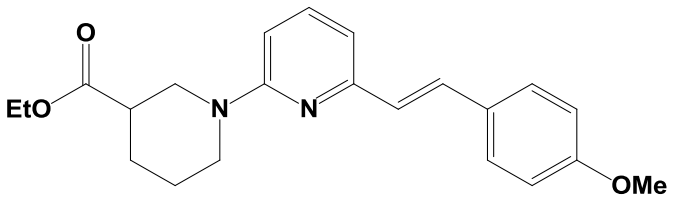
(*E*)-1-(4-(benzyloxy)styryl)-3-nitrobenzene



The crude product was washed with cold ethyl acetate and dried, which gave the title compound as yellow powder in 84% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 8.33 (br s, 1H), 8.08-8.05 (m, 1H), 7.78-7.74 (m, 1H), 7.53-7.35 (m, overlapping signals, 8H), 7.19 (d, *J* = 16.5 Hz, 1H), 7.03-6.97 (m, 2 overlapping signals, 3H), 5.12 (s, 2H). ^{13}C{^{1}H} NMR (75 MHz, $CDCl_3$) δ 159.1, 148.7, 139.5, 136.7, 132.0, 131.2, 129.5, 129.3, 128.6, 128.2, 128.1, 127.4, 124.0, 121.6, 120.6, 115.2, 70.1. Elemental analysis: Calcd. for $C_{21}H_{17}NO_3$: C, 76.12; H, 5.17; N, 4.23. Found: C, 76.48; H, 5.16; N, 4.02.

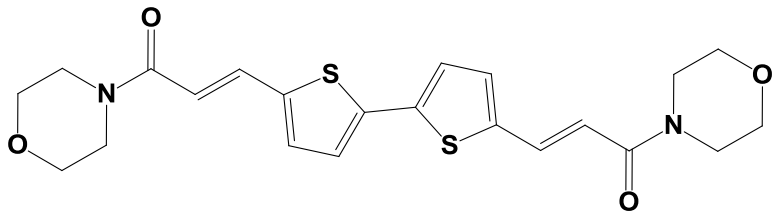
(*E*)-ethyl 1-(6-(4-methoxystyryl)pyridine-2-yl)piperidine-3-carboxylate



The title compound was purified by flash chromatography (silica gel, hexane / diethyl ether 5:1). The product was obtained as pale yellow oil in 93% isolated yield.

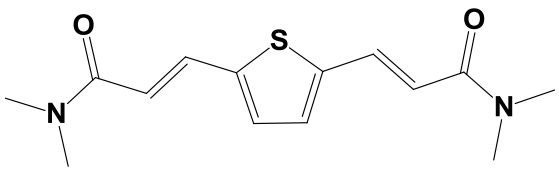
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.58 (d, *J* = 15.9 Hz, 1H), 7.52-7.49 (m, 2H), 7.43 (dd, *J* = 8.4 and 7.2 Hz, 1H), 6.94-6.89 (m, 2 overlapping signals, 3H), 6.64 (d, *J* = 7.2 Hz, 1H), 6.58 (d, *J* = 8.4 Hz, 1H), 4.52-4.46 (m, 1H), 4.24-4.16 (m, 1H), 4.19 (q, *J* = 7.2 Hz, 2H), 3.84 (s, 3H), 3.19 (dd, *J* = 12.9 and 10.2 Hz, 1H), 3.10-3.02 (m, 1H), 2.69-2.61 (m, 1H), 2.16-2.09 (m, 1H), 1.87-1.60 (m, overlapping signals, 3H), 1.31 (t, *J* = 7.2 Hz, 3H). ^{13}C{^{1}H} NMR (75 MHz, $CDCl_3$) δ 174.0, 159.5, 158.6, 153.8, 137.9, 131.1, 129.9, 128.3, 126.6, 114.0, 112.0, 106.0, 60.5, 55.3, 47.6, 45.8, 41.1, 27.6, 24.0, 14.3. HRMS (ESI) calcd for $C_{22}H_{26}N_2O_3$ $[M+H]^+$: 367.20162. Found: 367.20197.

(2*E*,2'*E*)-3,3'-([2,2'-bithiophene]-5,5'-diyl)bis(1-morpholinoprop-2-en-1-one)



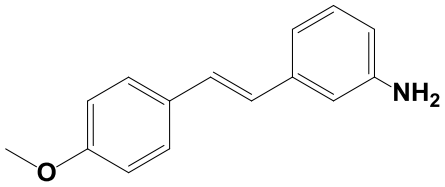
At the end of the reaction KBr (~30 mol%) was added to the reaction mixture and stirred for additional 30 minutes (to fully convert the title compound in its KBr adduct). The yellow precipitate was thoroughly washed with water and THF and dried under reduced pressure. The KBr adduct of the title compound was received as yellow powder in 98% isolated yield. Filtration over silica gel (MeOH) yielded the red (KBr free) organic compound quantitatively.
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.79 (d, *J* = 15.0 Hz, 2H), 7.15-7.13 (m, 4H), 6.62 (d, *J* = 15.0 Hz, 2H), 3.75 (br s, 16H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 164.9, 139.9, 138.4, 135.5, 131.5, 125.1, 115.4, 66.8, 46.2, 42.6. HRMS (ESI) calcd for $C_{22}H_{24}N_2O_4S_2$ $[M+Na]^+$: 467.10697. Found: 467.10713.

(2*E*,2'*E*)-3,3'-(thiophene-2,5-diyl)bis(*N*,*N*-dimethylacrylamide)



The crude product was washed with cold ethyl acetate and dried, which gave the title compound as yellow powder in 98% isolated yield.
^{1}H NMR (300 MHz, $CDCl_3$) δ 7.69 (d, *J* = 15.0 Hz, 2H), 7.11 (s, 2H), 6.68 (d, *J* = 15.0 Hz, 2H), 3.15 (s, 6H), 3.06 (s, 6H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 165.9, 141.7, 134.6, 130.9, 117.4, 37.4, 36.0. Elemental analysis: Calcd. for $C_{14}H_{18}N_2O_2S$: C, 60.41; H, 6.52; N, 10.06. Found: C, 60.27; H, 6.34; N, 9.83.

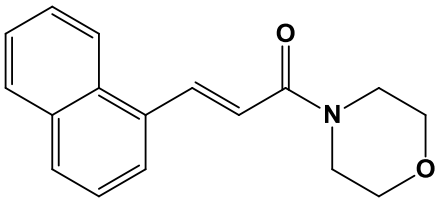
(*E*)-3-(4-methoxystyryl)aniline



The title compound was purified by flash chromatography (aluminum oxide, diethyl ether). The Product was obtained as yellow solid in 72% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 7.49-7.44 (m, 2H), 7.17 (t, $^{3}J_{H,H}$ = 7.8 Hz, 1H), 6.99 (d, $^{3}J_{H,H}$ = 17.4 Hz, 1H), 6.95-6.89 (m, overlapping signals, 6H), 6.85-6.84 (m, 1H), 6.63-6.59 (m, 1H), 3.85 (s, 3H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 159.2, 146.6, 138.7, 130.2, 129.5, 128.0, 127.7, 126.8, 117.1, 114.3, 114.1, 112.7, 55.3. Elemental analysis: Calcd. for $C_{15}H_{15}NO$: C, 79.97; H, 6.71; N, 6.21. Found: C, 80.21; H, 6.94; N, 6.03.

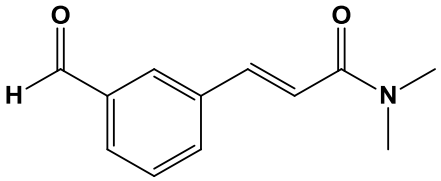
(*E*)-1-morpholino-3-(naphthalen-1-yl)prop-2-en-1-one[1]



The title compound was purified by flash chromatography (silica gel, ethyl acetate). The Product was obtained as colorless solid in 95% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 8.54 (d, $^{3}J_{H,H}$ = 15.3 Hz, 1H), 8.24-8.20 (m, 1H), 7.90-7.85 (m, 2H), 7.73-7.70 (m, 1H), 7.60-7.45 (m, 3H), 6.92 (d, $^{3}J_{H,H}$ = 15.3 Hz, 1H), 3.78 (br s, 8H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 165.4, 140.6, 133.7, 132.9, 131.5, 130.0, 128.6, 126.8, 126.2, 125.4, 124.6, 123.7, 119.6, 66.9, 46.3, 42.6.

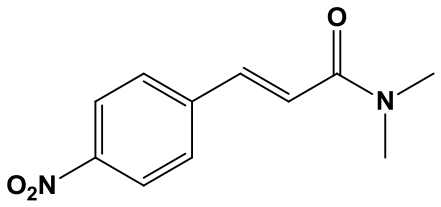
(*E*)-3-(3-formylphenyl)-*N,N*-dimethylacrylamide[1]



The title compound was purified by filtration through silica gel (methylene chloride / diethyl ether 1:1). The Product was obtained as colorless powder in 93% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 10.03 (s, 1H), 8.05-8.03 (m, 1H), 7.86-7.82 (m, 1H), 7.77-7.67 (m, 2 overlapping signals, 2H), 7.58-7.52 (m, 1H), 7.00 (d, $^{3}J_{H,H}$ = 15.3 Hz, 1H), 3.15 (br s, 6H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 191.9, 166.1, 140.7, 136.8, 136.3, 133.9, 130.6, 129.5, 127.8, 119.3, 37.2, 36.2.

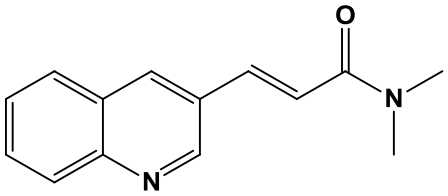
***(E)-N,N*-dimethyl-3-(4-nitrophenyl)acrylamide**[1]



The title compound was purified by filtration through silica gel (diethyl ether / methanol 10:1). The Product was obtained as colorless powder in 93% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 8.24-8.21 (m, 2H), 7.71-7.64 (m, 2 overlapping signals, 3H), 7.03 (d, $^{3}J_{H,H}$ = 15.3 Hz, 1H), 3.21 (s, 3H), 3.11 (s, 3H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 165.6, 148.0, 141.6, 139.6, 128.4, 124.1, 121.8, 37.5, 36.1.

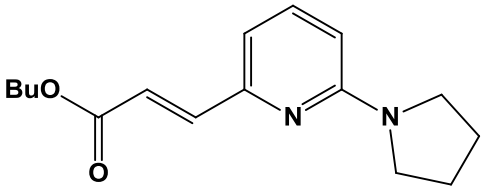
(*E*)-*N*,*N*-dimethyl-3-(quinolin-3-yl)acrylamide[1]



The title compound was purified by filtration through silica gel (methylene chloride / methanol 10:1). The Product was obtained as colorless powder in 96% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 9.10-9.08 (m, 1H), 8.21-8.19 (m, 1H), 8.09 (d, $^{3}J_{H,H}$ = 8.4 Hz, 1H), 7.84-7.78 (m, 2 overlapping signals, 2H), 7.75-7.69 (m, 1H), 7.59-7.53 (m, 1H), 7.11 (d, $^{3}J_{H,H}$ = 15.3 Hz, 1H), 3.24 (s, 3H), 3.11 (s, 3H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 166.0, 149.1, 148.1, 138.9, 135.1, 130.2, 129.2, 128.3, 128.2, 127.7, 127.3, 119.3, 37.5, 36.0.

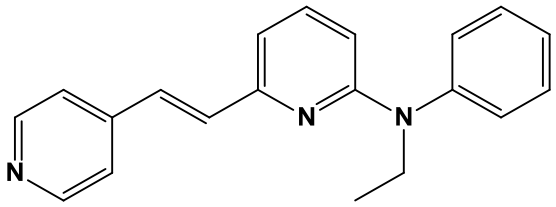
***(E)*-butyl 3-(6-(pyrrolidin-1-yl)pyridin-2-yl)acrylate**[1]



The title compound was purified by flash chromatography (silica gel, diethyl ether). The product was obtained as yellow solid in 84 % isolated yield.

^{1}H-NMR (200 MHz, $CDCl_3$) δ 7.52 (d, *J* = 15.4 Hz, 1H), 7.41 (dd, *J* = 8.6 and 7.2 Hz, 1H), 6.92 (d, *J* = 15.4 Hz, 1H), 6.62 (d, *J* = 7.2 Hz, 1H), 6.37 (d, *J* = 8.6 Hz, 1H), 4.20 (t, *J* = 7.2 Hz, 2H), 3.50-3.44 (m, 4H), 2.01-1.95 (m, 4H), 1.68 (quint., *J* = 7.2 Hz, 2H), 1.43 (sext., *J* = 7.2 Hz, 2H), 0.95 (t, *J* = 7.2 Hz, 3H). $^{13}C\{^{1}H\}$ NMR (75 MHz, $CDCl_3$) δ 167.4, 156.8, 150.7, 144.4, 137.2, 120.6, 113.3, 108.4, 64.3, 46.6, 30.8, 25.5, 19.2, 13.8.

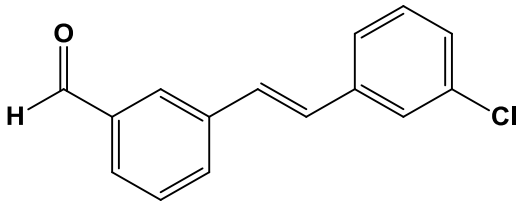
(*E*)-*N*-ethyl-*N*-phenyl-6-(2-(pyridin-4-yl)vinyl)pyridine-2-amine[1]



The title compound was purified by flash chromatography (silica gel, diethyl ether). The product was obtained as pale yellow powder in 98% isolated yield.

^{1}H-NMR (300 MHz, $CDCl_3$) δ 8.60-8.57 (m, 2H), 7.59 (d, *J* = 15.6 Hz, 1H), 7.46-7.40 (m, 4H), 7.30-7.24 (m, 4H), 7.23 (d, *J* = 15.6 Hz, 1H), 6.67 (d, *J* = 7.2 Hz, 1H), 6.32 (d, *J* = 8.7 Hz, 1H), 4.15 (q, *J* = 7.2 Hz, 2H), 1.32 (t, *J* = 7.2 Hz, 3H). ^{13}C{^{1}H} NMR (75 MHz, $CDCl_3$) δ 157.8, 151.9, 150.1, 145.1, 144.6, 137.0, 133.1, 129.8, 128.5, 127.8, 126.0, 121.3, 113.3, 109.5, 44.8, 13.1.

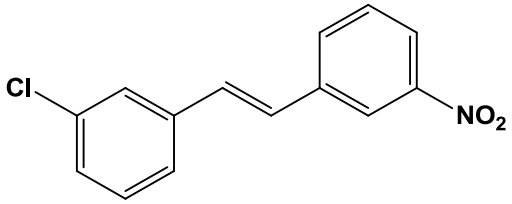
(*E*)-3-(3-chlorostyryl)benzaldehyde[1]



The title compound was purified by flash chromatography (silica gel, first hexane to elute 3-chlorostyrene, afterwards diethyl ether to elute the product). The Product was obtained as colorless solid in 91% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 10.05 (s, 1H), 8.03-8.01 (m, 1H), 7.81-7.73 (m, 2 overlapping signals 2H), 7.58-7.52 (m, 2 overlapping signals, 2H), 7.42-7.38 (m, 1H), 7.34-7.25 (m, 2 overlapping signals, 2H), 7.15 (s, 2H). ^{13}C{^{1}H} NMR (75 MHz, $CDCl_3$) δ 192.2, 138.6, 137.9, 136.9, 134.8, 132.5, 130.0, 129.5, 129.3, 129.1, 128.5 128.1, 127.3, 126.5, 125.0.

(*E*)-1-chloro-3-(3-nitrostyryl)benzene[1]



The title compound was purified by washing the extracted compound with ethyl acetate. The Product was obtained as yellow greenish powder in 95% isolated yield.

^{1}H NMR (300 MHz, $CDCl_3$) δ 8.36 (s, 1H), 8.14-8.10 (m, 1H), 7.81-7.77 (m, 1H), 7.57-7.51 (m, 2H), 7.42-7.27 (m, 3H), 7.22-7.09 (m, 2H). ^{13}C{^{1}H} NMR (75 MHz, $CDCl_3$) δ 148.7, 138.6, 138.1, 134.9, 132.4, 130.3, 130.1, 129.7, 128.4, 127.5, 126.6, 125.1, 122.4, 121.0.

All the spectral data for the following compounds were identical to the Heck products reported in literature: *(E)*-1-nitro-4-styrylbenzene,[2] *(E)*-1-fluoro-4-styrylbenzene,[3] *(E)*-3-styrylbenzaldehyde,[4] *(E)*-1-(4-styrylphenyl)ethanone,[2] *(E)*-phenyl(4-styrylphenyl)methanone,[5] *(E)*-ethyl-4-styrylbenzoate,[6] *(E)*-1-chloro-4-styrylbenzene,[7] *(E)*-1-(*tert*-butyl)-4-styrylbenzene,[8] *(E)*-1-methoxy-4-styrylbenzene,[2] *(E)*-1,3-dimethoxy-4-styrylbenzene,[9] *(E)*-*N,N*-dimethyl-4-styrylaniline,[2] *(E)*-4-styrylphenol,[10] *(E)*-1-methyl-2-styrylbenzene,[2] *(E)*-1-styrylnaphthalene,[2] *(E)*-3-styrylpyridine,[2] *(E)*-3-styrylquinoline,[11] *(E)*-methyl(4-styrylphenyl)sulfane,[12] *(E)*-1-chloro-3-(4-methoxystyryl)-benzene,[13] *(E)*-ethyl-4-(4-methoxystyryl)benzoate,[14] *(E)*-1-(*tert*-butyl)-4-(4-methoxystyryl)benzene,[15] *(E)*-4-(3-methylstyryl)-pyridine,[16] *(E)*-4-(4-methoxystyryl)pyridine,[17] *(E)*-butyl 3-(3-(trifluoromethyl)phenyl)acrylate,[18] *(E)*-butyl 3-(*m*-tolyl)acrylate,[19] *(E)*-butyl 3-(2-cyanophenyl)acrylate,[20] *(E)*-butyl 3-(*o*-tolyl)acrylate,[21] *(E)*-butyl 3-(thiophen-2-yl)acrylate.[20]

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