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Supporting Information

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Cooperative Catalysis of Ru and Pd for the Direct Coupling of Chelating Aldehyde with Iodoarenes and Organostannanes

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General methods. All oxygen or moisture sensitive reactions were carried out in oven-dried glassware under the positive pressure of nitrogen. Sensitive liquids and solutions were transferred by syringe or cannula and introduced through rubber septa through which a high flow of nitrogen was maintained. Concentration of solution was accomplished by using a Buchi rotary evaporator with a water aspirator. This was generally followed by removal of residual solvents on a vacuum line held at 0.1–1.0 torr. Unless otherwise stated, all commercial reagents and solvents were used without additional purification. Analytical thin layer chromatography (TLC) was performed on Merck pre-coated silica gel 60 F_{254} plates. Visualization on TLC was achieved by use of UV light (254 nm), treatment with acidic anisaldehdye, 10 % ninhydrin in ethanol, 5 % phosphomolybdic acid in ethanol, or ceric ammonium molybdate stain followed by heating. Flash column chromatography was undertaken on silica gel (Merck Kieselgel 60 F_{254} 400-630 mesh). Proton nuclear magnetic resonance spectroscopy (^{1}H NMR) was recorded on Bruker FT AM 300 (300 MHz). Chemical shifts were quoted in parts per million (ppm) referenced to the appropriate solvent peak or 0.0 ppm for TMSCl. The following abbreviations were used to describe peak patterns when appropriate: br = broad, s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet. Coupling constant, *J* was reported in Hertz unit (Hz). Carbon-13 nuclear

magnetic resonance spectroscopy (^{13}C NMR) was recorded on Brucker FT AM 300 (75 MHz) and was fully decoupled by broad band decoupling. Chemical shifts were reported in ppm referenced to the center line of a triplet at 77.0 ppm of chloroform-*d*. Infrared (IR) spectra were recorded neat in 0.5 mm path length sodium chloride cells on Bruker EQUINOX 55. Frequencies are given in reciprocal centimeters (cm^{-1}) and only selected absorbances are reported. High resolution mass spectra were recorded on a Jeol JMS-HX110/110A by using FAB method. Commercially available chemicals including Rh, Ru, and Pd complexes were purchased from a commercial supplier and used as obtained without further purification. Quinoline-8-carboxaldehyde (**1**) was prepared according to the reported procedure.[1]

Procedure for the isolation of an acylrhodium hydride species: Addition of quinoline-8-carboxaldehyde (**1**, 100 mg, 0.640 mmol) to a saturated solution of $RhCl(PPh_3)_3$ (590 mg, 0.637 mmol) in dichloromethane (2.0 mL) gave a yellow precipitate after 5 min at room temperature. One recrystallization of the filtered solid from CH_2Cl_2-ether gave the acylrhodium(III) hydride (648 mg, 94%) as a yellowish solid, spectra data of which are the as reported ones[2]: ^{1}H NMR ($CDCl_3$, 300 MHz) δ 9.00 (d, 1H, J = 4.6 Hz, α-H on quinoline ring), 7.92 (d, 1H, J = 8.3 Hz), 7.72-6.90 (4H), -11.9 (1H, overlapping d of t, $J_{P\text{-}H}$ =6.0, $J_{Rh\text{-}H}$ = 15 Hz); IR (KBr) 3050, 2023, 1684, 1651, 1628, 1434, 1092, 745, 694 cm^{-1}.

Procedure for the coupling of the isolated acylrhodium hydride intermediate with iodobenzene: To a solution of the above acylrhodium(III) hydride intermediate (100 mg, 0.0924 mmol) in benzene (0.3 mL) was added iodobenzene (37.7 mg, 0.185 mmol) followed by $Pd_2(dba)_3{\cdot}CHCl_3$ (4.78 mg, 5 mol %) and $NaHCO_3$ (11.6 mg, 0.139 mmol). The reaction mixture was stirred at 135 ^{o}C for 5 h in a sealed vial. After removal of the solvent under reduced pressure, the residue was purified by flash column chromatography on silica gel (20% EtOAc/hexane) to afford phenyl (8-quinolinyl)methanone (12.9 mg, 60 %) as a yellowish liquid: ^{1}H NMR ($CDCl_3$, 300 MHz) δ 8.81 (dd, 1H, J = 4.1, 1.7 Hz), 8.18 (dd, 1H, J = 8.3, 1.6 Hz), 7.92 (d, 1H, J = 8.2 Hz), 7.81 (dd, 2H, J = 6.4, 1.1 Hz), 7.71 (dd, 1H, J = 7.0, 1.2 Hz), 7.61 (dd, 1H, J = 6.1, 0.7 Hz), 7.52 (t, 1H, J = 7.2 Hz), 7.38 (m, 3H); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 197.8, 150.7, 146.0, 139.2, 137.7, 135.9, 133.1, 130.0, 129.6, 128.2, 128.1, 125.7, 121.5; IR (neat) 3057, 2963, 1670, 1575, 1496, 1278, 930, 797, 712 cm^{-1}; HRMS (EI) calcd for $C_{16}H_{11}NO$ 233.0841 (M^+), found 233.0841.

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[1] C. G. Anklin, P. S. Pregosin, *J. Organomet. Chem.* **1983**, *243*, 101.

[2] L. W. Suggs, *J. Am. Chem. Soc*. **1978**, *100*, 640.

Procedure of the coupling of the quinoline-8-carboxaldehyde (1) with iodobenzene by a use of both Rh and Pd catalyst: To a solution of quinoline-8-carboxaldehyde (31.4 mg, 0.20 mmol) in benzene (0.4 mL) was added iodobenzene (81.6 mg, 0.40 mmol) followed by $RhCl(PPh_3)_3$ (9.2 mg, 5 mol %), $Pd_2(dba)_3 \cdot CHCl_3$ (10.5 mg, 5 mol %) and $NaHCO_3$ (25.2 mg, 0.3 mmol). The reaction mixture was stirred at 135 ^oC for 24 h in a sealed vial. After removal of the solvent under reduced pressure, the residue was purified by flash column chromatography on silica gel (20% EtOAc/Hexane) to afford phenyl (8-quinolinyl)methanone (22.4 mg, 48 %).

General procedure of the coupling of 1 with aryl iodides with both Ru and Pd catalyst: To a solution of quinoline-8-carboxaldehyde (**1**, 78.6 mg, 0.50 mmol) in benzene (1.0 mL) was added iodobenzene (204 mg, 1.0 mmol) followed by $Ru_3(CO)_{12}$ (16.0 mg, 5 mol %), $Pd_2(dba)_3 \cdot CHCl_3$ (25.9 mg, 5 mol %) and $NaHCO_3$ (63.0 mg, 1.5 mmol). The reaction mixture was stirred at 135 ^oC for 20 h in a sealed vial. After removal of the solvent under reduced pressure, the residue was purified by flash column chromatography on silica gel (20% EtOAc/hexane) to afford phenyl (8-quinolinyl)methanone (96.7 mg, 83 %, Table 1, entry 1).

8-Quinolinyl-(4-methylphenyl)methanone (Table 1, entry 2): yellowish solid; mp 112 ^oC (dec.); ^1H NMR ($CDCl_3$, 300 MHz) δ 8.86 (dd, 1H, J = 4.1, 1.6 Hz), 8.22 (dd, 1H, J = 8.4, 1.6 Hz), 7.96 (dd, 1H, J = 8.0, 1.2 Hz), 7.74 (m, 3H), 7.63 (t, 1H, J = 8.3 Hz), 7.43 (m, 1H), 7.22 (t, 2H, J = 8.0 Hz), 2.41 (s, 3H); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 197.5, 150.8, 146.1, 144.1, 139.6, 136.0, 135.3, 130.4, 129.5, 129.0, 128.2, 128.1, 125.8, 121.6, 21.7; IR (KBr) 3051, 1666, 1605, 1494, 1279, 930, 798, 740 cm^{-1}; HRMS (EI) calcd for $C_{17}H_{13}NO$ 247.0998 (M^+), found 247.0993.

4-Methoxyphenyl-(8-quinolinyl)methanone (Table 1, entry 3): yellowish solid; mp 113 ^oC (dec.); ^1H NMR ($CDCl_3$, 300 MHz) δ 8.84 (dd, 1H, J = 4.2, 1.8 Hz), 8.22 (dd, 1H, J = 8.3, 1.8 Hz), 7.91 (dd, 1H, J = 8.1, 1.5 Hz), 7.79 (d, 2H, J = 8.9 Hz), 7.68 (m, 1H), 7.59 (m, 1H), 7.39 (m, 1H), 6.86 (d, 2H, J = 9.0 Hz), 3.82 (s, 3H); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 196.4, 163.7, 150.8, 146.1, 139.7, 136.0, 132.6, 139.9, 129.4, 128.2, 128.0, 125.8, 121.5, 113.6, 55.4; IR (KBr) 3050, 1660, 1598, 1508, 1322, 1261, 1171, 930, 798 cm^{-1}; HRMS (EI) calcd for $C_{17}H_{13}NO_2$ 263.0947 (M^+), found 263.0949.

4-Acetylphenyl-(8-quinolinyl)methanone (Table 1, entry 4): yellowish solid; mp 127 ^oC

(dec.); ^{1}H NMR ($CDCl_3$, 300 MHz) δ 8.84 (dd, 1H, *J* = 4.2, 1.7 Hz), 8.20 (d, 1H, *J* = 8.3 Hz), 7.95 (m, 3H), 7.85 (d, 2H, *J* = 8.6 Hz), 7.75 (dd, 1H, *J* = 7.0, 1.5 Hz), 7.40 (t, 1H, *J* = 4.2 Hz), 7.24 (m, 1H), 2.60 (s, 3H); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 197.6, 197.4, 150.8, 146.0, 141.1, 140.0, 138.6, 136.0, 130.3, 130.1, 128.6, 128.1, 126.0, 121.7; IR (KBr) 2924, 1735, 1682, 1496, 1263, 931, 796, 735 cm^{-1}; HRMS (EI) calcd for $C_{18}H_{13}NO_2$ 275.0947 (M^+), found 275.0947.

4-Nitrophenyl-(8-quinolinyl)methanone (Table 1, entry 5): yellowish solid; 193 ^{o}C (dec.); ^{1}H NMR ($CDCl_3$, 300 MHz) δ 8.74 (dd, 1H, *J* = 4.2, 1.6 Hz), 8.22 (m, 3H), 8.02 (dd, 1H, *J* = 8.1, 1.2 Hz), 7.91 (m, 2H), 7.82 (dd, 1H, *J* = 7.0, 1.3 Hz), 7.67 (m, 1H), 7.42 (dd, 1H, *J* = 4.2, 4.2 Hz); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 196.5, 150.8, 150.1, 145.8, 142.7, 137.8, 136.3, 130.9, 130.8, 129.3, 128.2, 126.2, 123.5, 121.9; IR (KBr) 3007, 1658, 1511, 1276, 751 cm^{-1}; HRMS (EI) calcd for $C_{16}H_{10}N_2O_3$ 278.0691 (M^+), found 278.0690.

4-(Quinoline-8-oxo)benzaldehyde (Table 1, entry 6): yellowish solid; mp 137 ^{o}C (dec.); ^{1}H NMR ($CDCl_3$, 300 MHz) δ 10.06 (s, 1H), 8.75 (dd, 1H, *J* = 4.2, 1.8 Hz), 8.20 (dd, 1H, *J* = 8.3, 1.7 Hz), 7.98 (dd, 1H, *J* = 8.2, 1.4 Hz), 7.90 (m, 4H), 7.78 (dd, 1H, *J* = 7.1, 1.4 Hz), 7.64 (dd, 1H, *J* = 8.1, 1.0 Hz), 7.40 (dd, 1H, *J* = 4.2 Hz); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 197.4, 191.7, 150.8, 146.0, 142.3, 138.8, 138.5, 136.1, 130.4, 130.4, 129.5, 128.8, 128.2, 126.0, 122.6, 121.8; IR (KBr) 2925,1707, 1674, 1499, 1464, 1277, 910, 734 cm^{-1}; HRMS (EI) calcd for $C_{17}H_{11}NO_2$ 261.0790 (M^+), found 261.0788.

Ethyl 4-[quinoline-8-oxo]benzoate (Table 1, entry 7): yellowish solid; mp 94 ^{o}C (dec.); ^{1}H NMR ($CDCl_3$, 300 MHz) δ 8.76 (dd, 1H, *J* = 4.2, 1.7 Hz), 8.20 (dd, 1H, *J* = 8.3, 1.7 Hz), 8.04 (d, 2H, *J* = 8.5 Hz), 7.96 (dd, 1H, *J* = 8.2, 1.3 Hz), 7.83 (d, 1H, *J* = 8.2 Hz), 7.75 (dd, 1H, *J* = 7.0, 1.4 Hz), 7.62 (dd, 1H, *J* = 8.0, 0.6 Hz), 7.39 (dd, 1H, *J* = 4.2 Hz), 4.36 (q, 2H, *J* = 7.1 Hz), 1.36 (t, 3H, *J* = 7.2 Hz); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 197.4, 165.8, 150.8, 146.0, 141.1, 138.7, 136.0, 134.1, 130.2, 129.8, 129.4, 128.6, 128.1, 125.9, 121.7, 61.3, 14.2; IR (KBr) 3054, 2983, 1719, 1675, 1575, 1496, 1407, 1269, 1105, 931, 798, 730 cm^{-1}; HRMS (EI) calcd for $C_{19}H_{15}NO_3$ 305.1052 (M^+), found 305.1055.

3-Bromophenyl-(8-quinolinyl)methanone (Table 1, entry 8): yellowish solid; mp 103 ^{o}C (dec.); ^{1}H NMR ($CDCl_3$, 300 MHz) δ 8.80 (dd, 1H, *J* = 4.2, 1.7 Hz), 8.19 (dd, 1H, *J* = 8.3, 1.7 Hz), 7.96 (m, 2H), 7.72 (dd, 1H, *J* = 7.0, 1.4 Hz), 7.63 (m, 3H), 7.40 (m, 1H), 7.24 (t, 1H, *J* = 7.9 Hz); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 196.5, 150.9, 146.0, 139.6, 138.5, 136.0, 135.9, 132.7, 130.1, 129.9, 128.8, 128.4, 128.2, 125.9, 122.6, 121.7; IR (KBr) 3061, 1673,

1569, 1496, 1276, 1207, 937, 742 cm^{-1}; HRMS (EI) calcd for $C_{16}H_{10}NOBr$ 310.9946 (M^+), found 310.9935.

8-Quinolinyl-[4-(4,4,5,5-tetramethyl-[1,3,2]dioxaborolan-2-yl)phenyl]methanone (Table 1, entry 9): yellowish solid; mp 157 °C (dec.); ^1H NMR ($CDCl_3$, 300 MHz) δ 8.80 (dd, 1H, *J* = 4.2, 1.7 Hz), 8.19 (dd, 1H, *J* = 8.3, 1.7 Hz), 7.95 (dd, 1H, *J* = 8.2, 1.5 Hz), 7.79 (m, 4H), 7.72 (dd, 1H, *J* = 7.0, 1.5 Hz), 7.61 (dd, 1H, *J* = 7.1, 1.0 Hz), 7.39 (dd, 1H, *J* = 4.2 Hz); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 198.2, 150.8, 146.2, 139.8, 139.3, 137.3, 136.0, 134.6, 129.8, 129.1, 128.4, 128.2, 125.9, 121.6, 84.1, 24.8; IR (KBr) 2980, 1672, 1361, 1276, 1144, 1090, 930, 857, 733, 651 cm^{-1}; HRMS (EI) calcd for $C_{22}H_{22}BNO_3$ 359.1693 (M^+), found 359.1686.

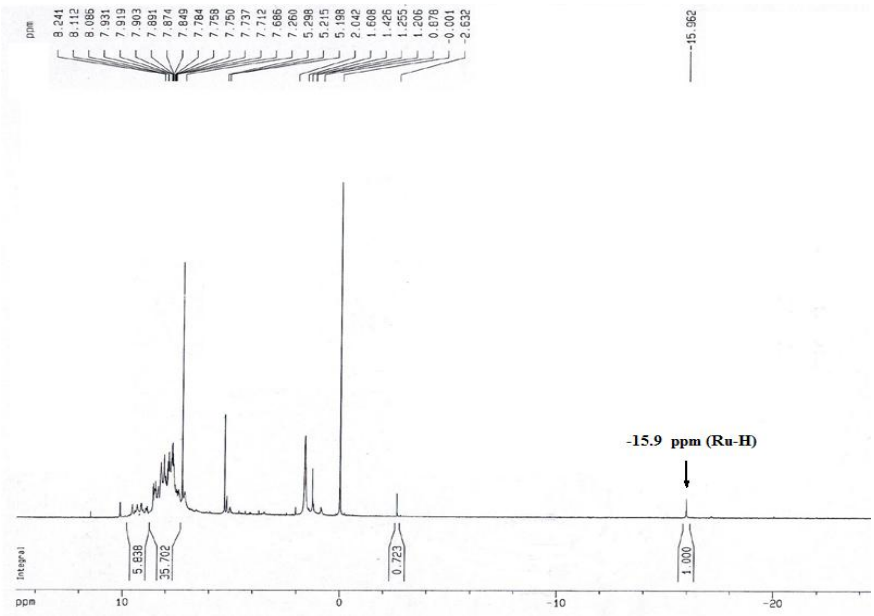
8-Quinolinyl-(2-thiophenyl)methanone (Table 1, entry 10): yellowish liquid; ^1H NMR ($CDCl_3$, 300 MHz) δ 8.92 (dd, 1H, *J* = 4.2, 1.7 Hz), 8.21 (dd, 1H, *J* = 8.3, 1.7 Hz), 7.96 (dd, 1H, *J* = 8.2, 1.5 Hz), 7.81 (dd, 1H, *J* = 7.0, 1.4 Hz), 7.71 (dd, 1H, *J* = 4.9, 1.2 Hz), 7.62 (dd, 1H, *J* = 8.1, 1.0 Hz), 7.44 (dd, 1H, *J* = 4.2 Hz), 7.37 (dd, 1H, *J* = 3.8, 1.0 Hz), 7.06 (dd, 1H, *J* = 4.8, 1.0 Hz); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 189.5, 151.1, 145.8, 145.2, 138.9, 136.0, 135.6, 134.9, 130.0, 128.3, 128.2, 128.0, 125.6, 121.7, 84.1, 24.8; IR (neat) 2956, 1652, 1575, 1412, 1279, 801, 692 cm^{-1}; HRMS (EI) calcd for $C_{14}H_9NOS$ 239.0405 (M^+), found 239.0408.

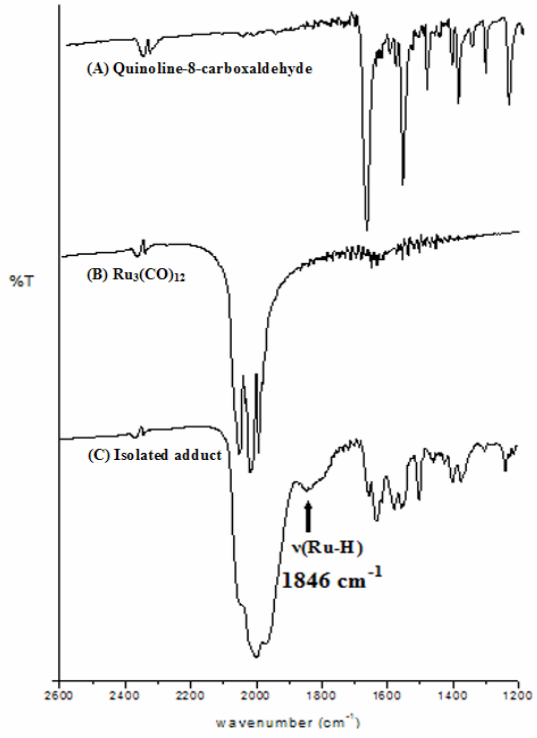
(6-Chloro-3-pyridinyl)-(8-quinolinyl)methanone (Table 1, entry 11): colorless solid; 104 °C (dec.); ^1H NMR ($CDCl_3$, 300 MHz) δ 8.79 (dd, 1H, *J* = 4.2, 1.8 Hz), 8.59 (dd, 1H, *J* = 2.4, 0.6 Hz), 8.24 (dd, 1H, *J* = 8.4, 1.8 Hz), 8.14 (dd, 1H, *J* = 7.0, 1.4 Hz), 7.71 (dd, 1H, *J* = 4.9, 1.2 Hz), 7.62 (dd, 1H, *J* = 8.3, 2.4 Hz), 8.02 (dd, 1H, *J* = 8.2, 1.4 Hz), 7.84 (dd, 1H, *J* = 7.1, 1.5 Hz), 7.68 (dd, 1H, *J* = 8.1, 1.0 Hz), 7.43 (m, 2H); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 195.5, 155.2, 152.0, 150.9, 145.8, 139.2, 137.6, 136.2, 132.5, 131.0, 129.2, 128.2, 126.2, 124.2, 121.9; IR (KBr) 3054, 1676, 1578, 1362, 1277, 1106, 750 cm^{-1}; HRMS (EI) calcd for $C_{15}H_9ClN_2O$ 268.0403 (M^+), found 268.0449.

Experimental procedure for the reaction of quinoline-8-carboxaldehyde (1) with $Ru_3(CO)_{12}$: To a stirred solution of quinoline-8-carboxaldehyde (94 mg, 0.60 mmol) in 1,2-dichloroethane (10 mL, 0.06 M) was added $Ru_3(CO)_{12}$ (384 mg, 0.60 mmol). The reaction mixture was stirred at 120 °C for 30 min. After placing the reaction mixture at 0 °C for 2 h, the unreacted ruthenium complex was separated from the reaction mixture by filtration. Upon addition of *n*-pentane to the filtrate, it was observed that a pale gray solid

was precipitated from the solution. The solid thus obtained was dried over a nitrogen stream for 1 h at room temperature, and then ^{1}H NMR (300 MHz, $CDCl_3$) and FT-IR (KBr) analysis were carried out (Figure 1S).

Figure 1S. ^{1}H NMR and IR Spectra of the isolated adduct



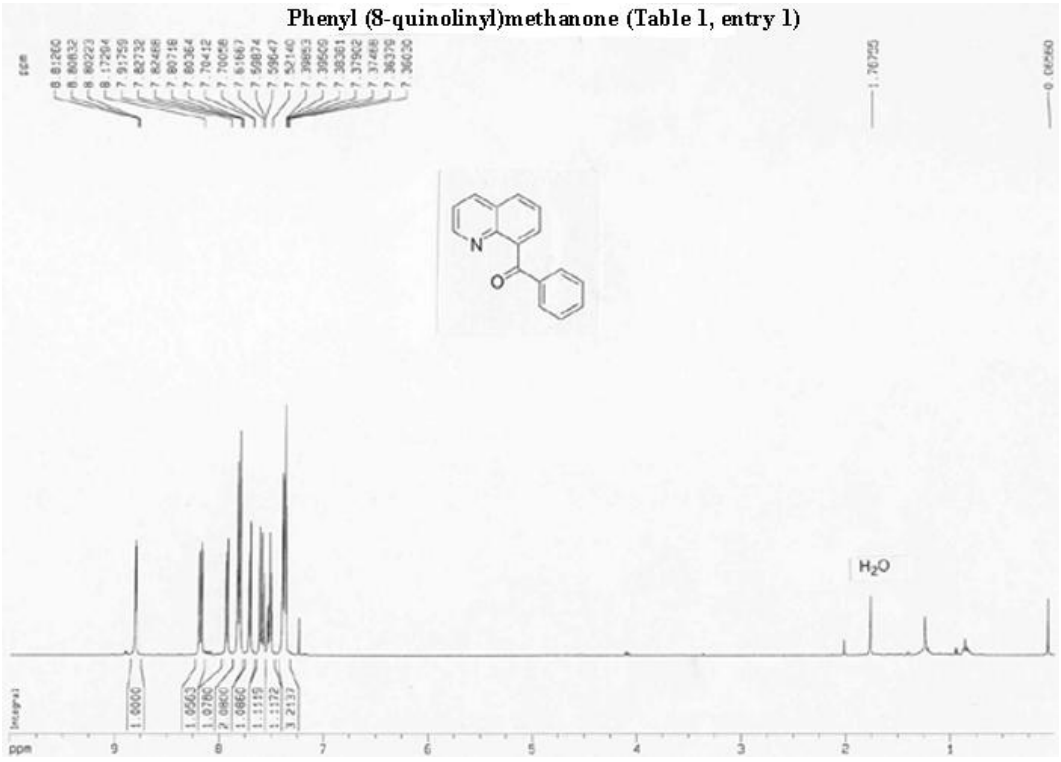


General procedure of coupling between quinoline-8-carboxaldehyde (1) and organostannanes with the Ru and Pd cocatalyst system: To a solution of quinoline-8-carboxaldehyde (**1**, 78.6 mg, 0.50 mmol) in 1,2-dichloroethane (1.0 mL) was added tributylphenyltin (275.4 mg, 0.75 mmol) followed by $Ru_3(CO)_{12}$ (25.9 mg, 5 mol %) and $PdCl_2(PPh_3)_2$ (10.5 mg, 3 mol %). The reaction mixture was stirred at 120 ^oC for 12 h in a sealed vial. After removal of the solvent under reduced pressure, the residue was purified by flash column chromatography on silica gel (20% EtOAc/hexane) to afford the desired ketone product, phenyl (8-quinolinyl) ketone (70 mg, 60 %).

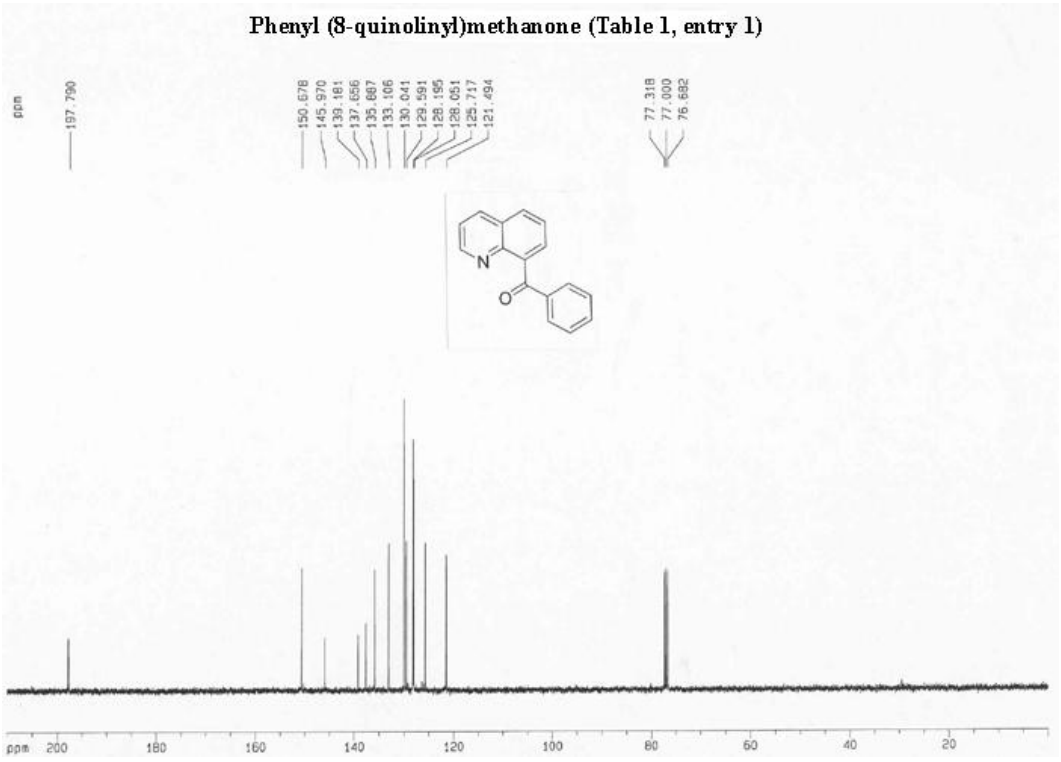
4-(Quinoline-8-oxo)benzonitrile (eq 4): yellowish solid; mp 129 ^oC (dec.); ^1H NMR ($CDCl_3$, 300 MHz) δ 8.75 (dd, 1H, *J* = 4.1, 1.5 Hz), 8.22 (dd, 1H, *J* = 8.3, 1.4 Hz), 8.00 (d, 1H, *J* = 8.2 Hz), 7.85 (d, 2H, *J* = 8.5 Hz), 7.79 (dd, 1H, *J* = 7.0, 1.1 Hz), 7.66 (m, 3H), 7.41 (dd, 1H, *J* = 4.2 Hz); ^{13}C NMR ($CDCl_3$, 75 MHz) δ 196.7, 150.8, 146.0, 146.0, 141.2, 138.0, 136.1, 132.2, 130.7, 130.2, 129.0, 128.2, 126.1, 121.9, 118.2, 116.0; IR (KBr) 3051, 2229, 1675, 1573, 1497, 1276, 930, 795 cm^{-1}; HRMS (EI) calcd for $C_{17}H_{10}N_2O$ 258.0793 (M^+), found 258.0748.

Copies of ^{1}H and ^{13}C-NMR Spectral Data of New Compounds

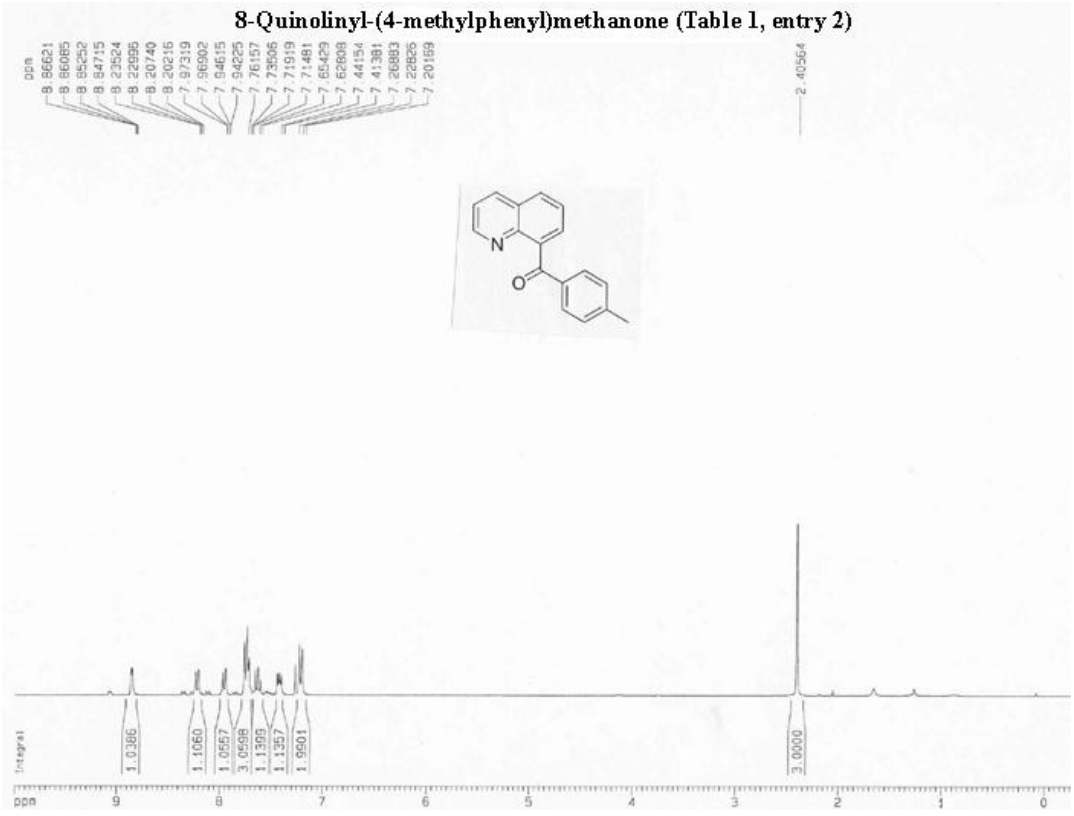
Phenyl (8-quinolinyl)methanone (Table 1, entry 1)



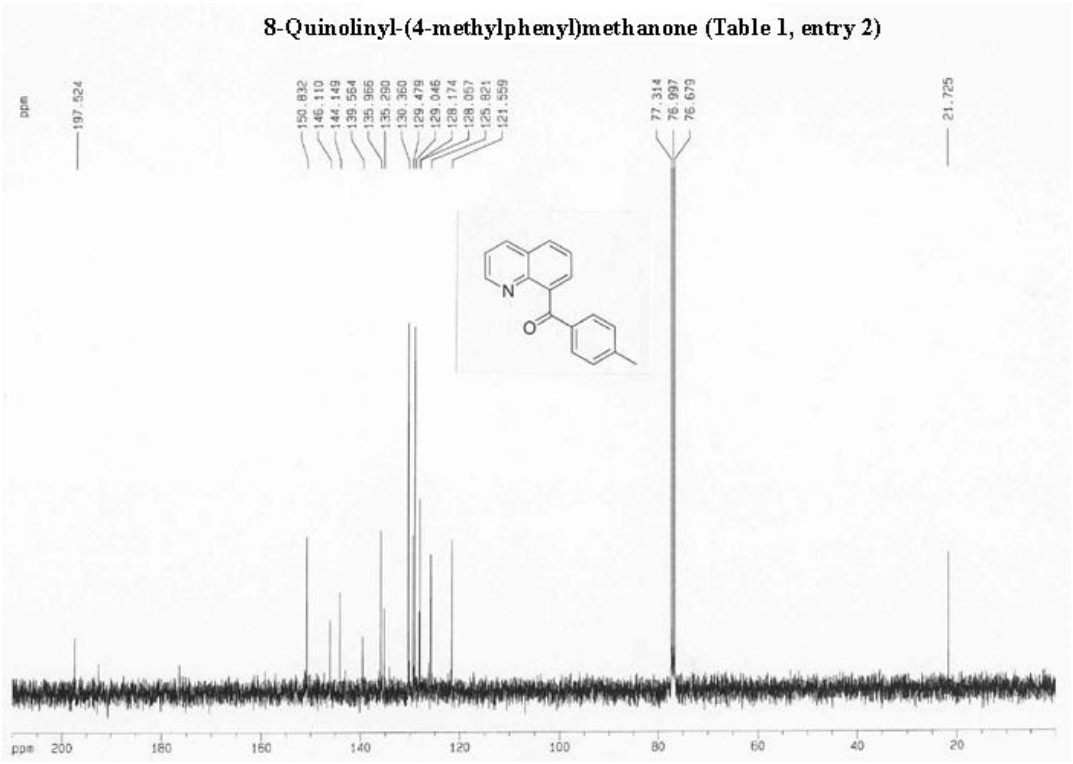
Phenyl (8-quinolinyl)methanone (Table 1, entry 1)



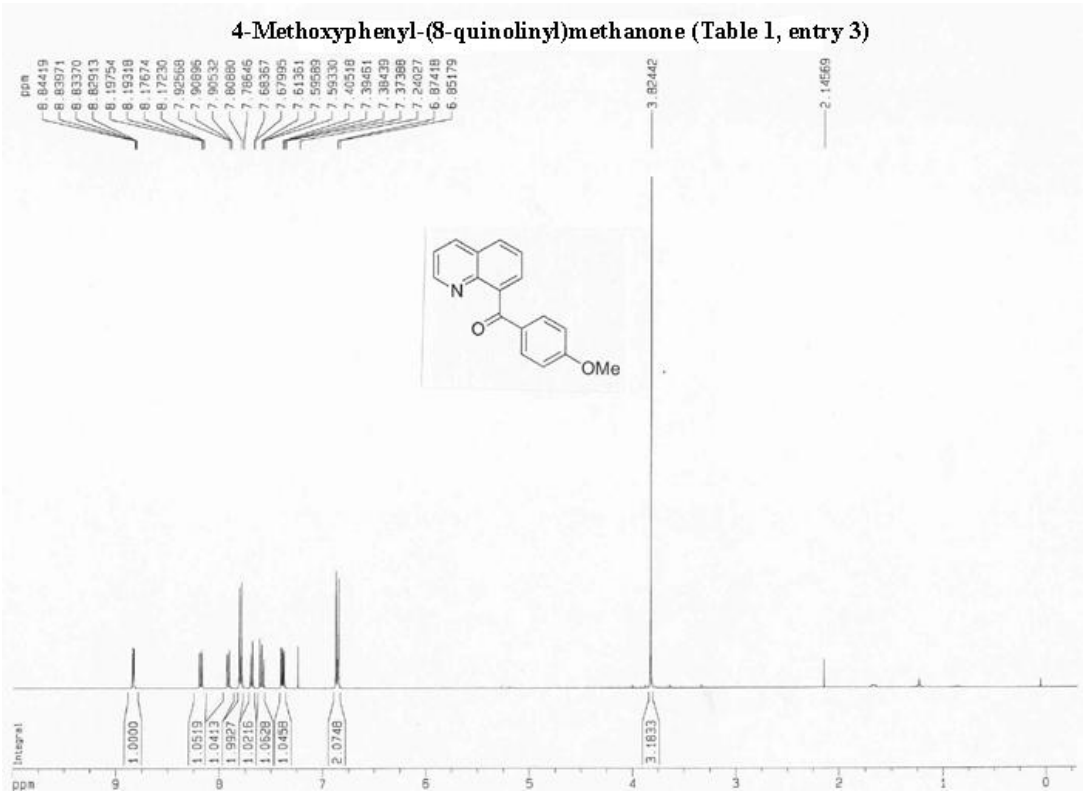
8-Quinolinyl-(4-methylphenyl)methanone (Table 1, entry 2)



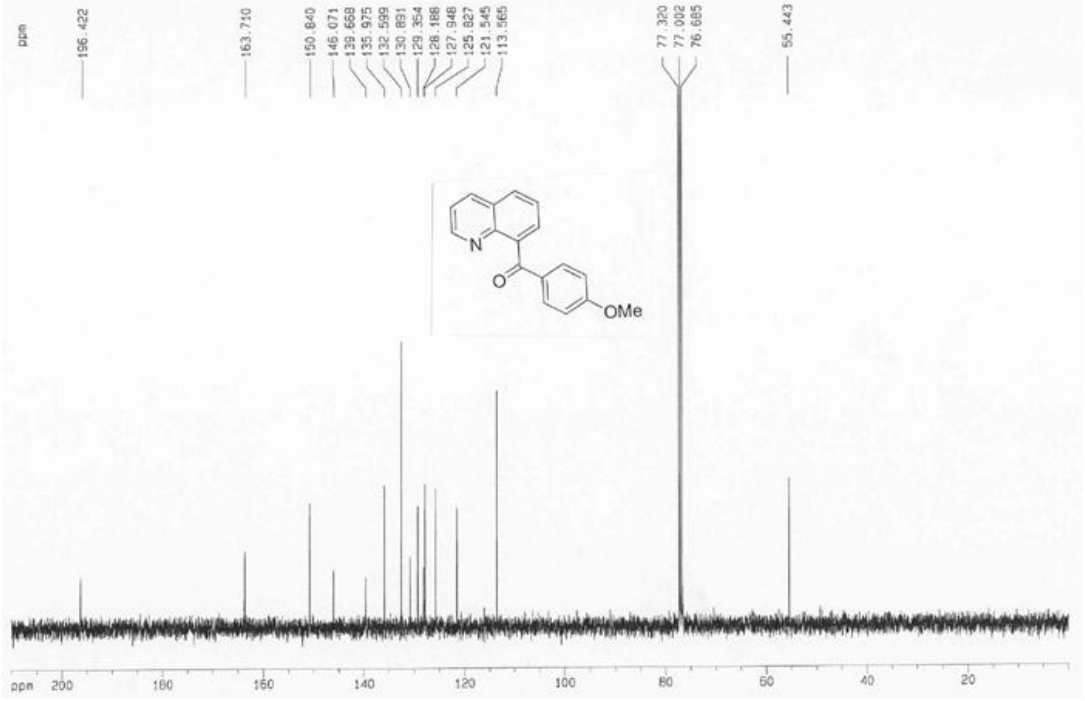
8-Quinolinyl-(4-methylphenyl)methanone (Table 1, entry 2)



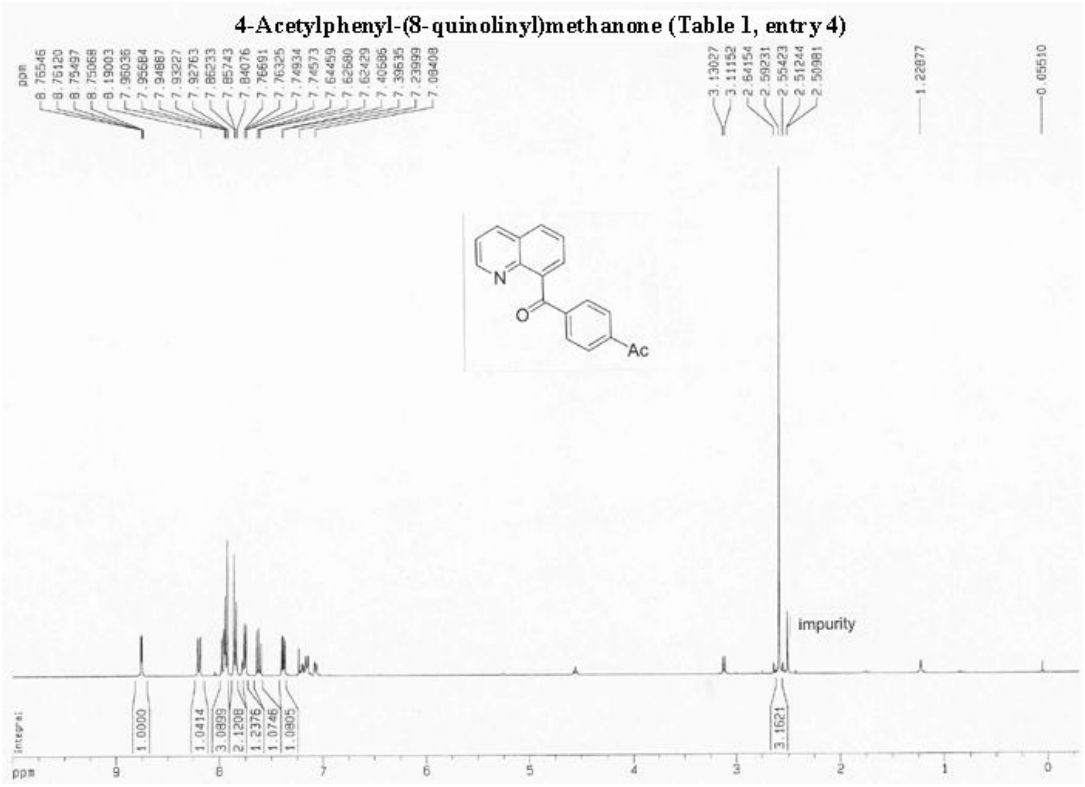
4-Methoxyphenyl-(8-quinolinyl)methanone (Table 1, entry 3)



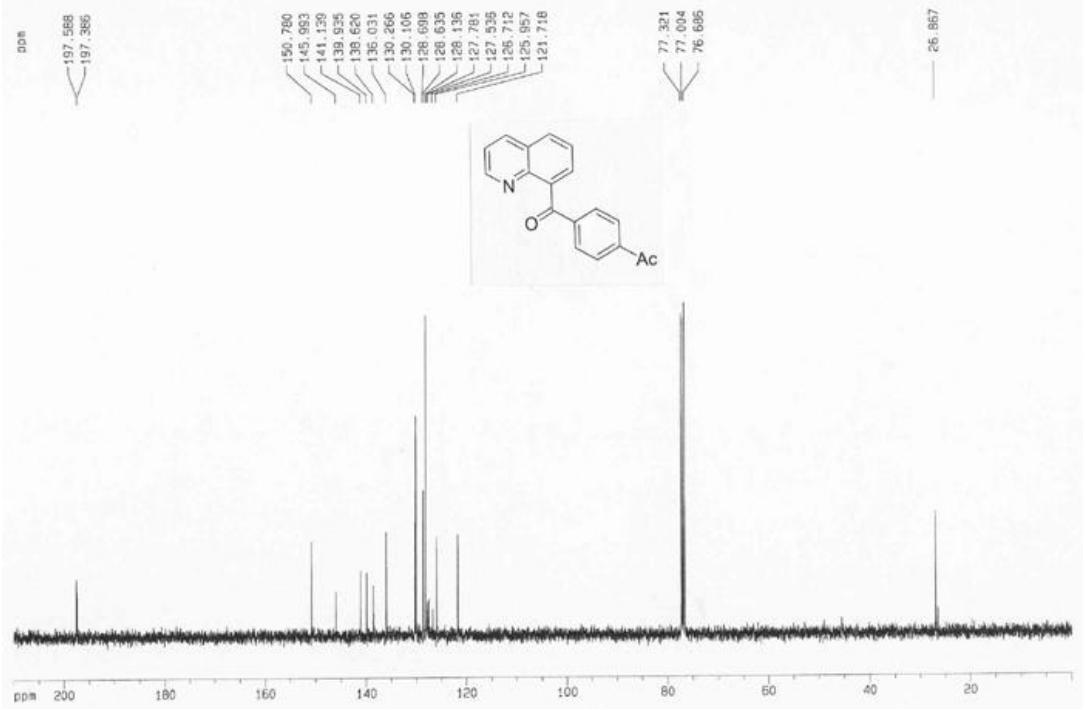
4-Methoxyphenyl-(8-quinolinyl)methanone (Table 1, entry 3)



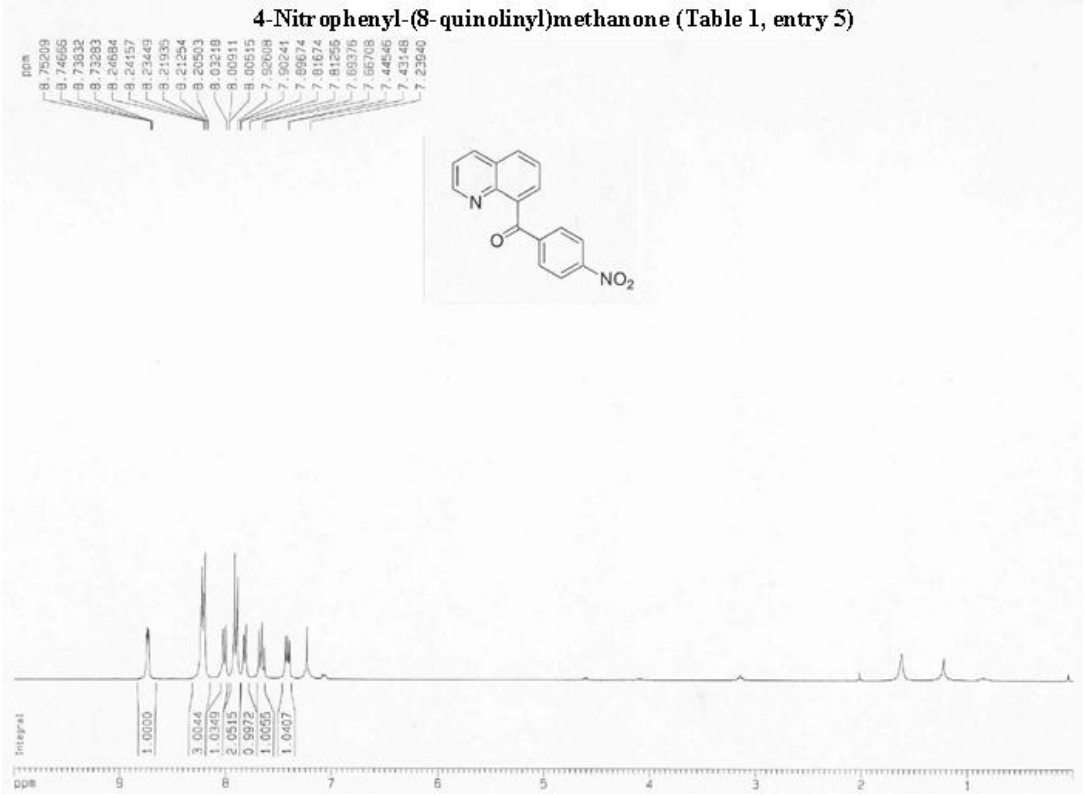
4-Acetylphenyl-(8-quinolinyl)methanone (Table 1, entry 4)



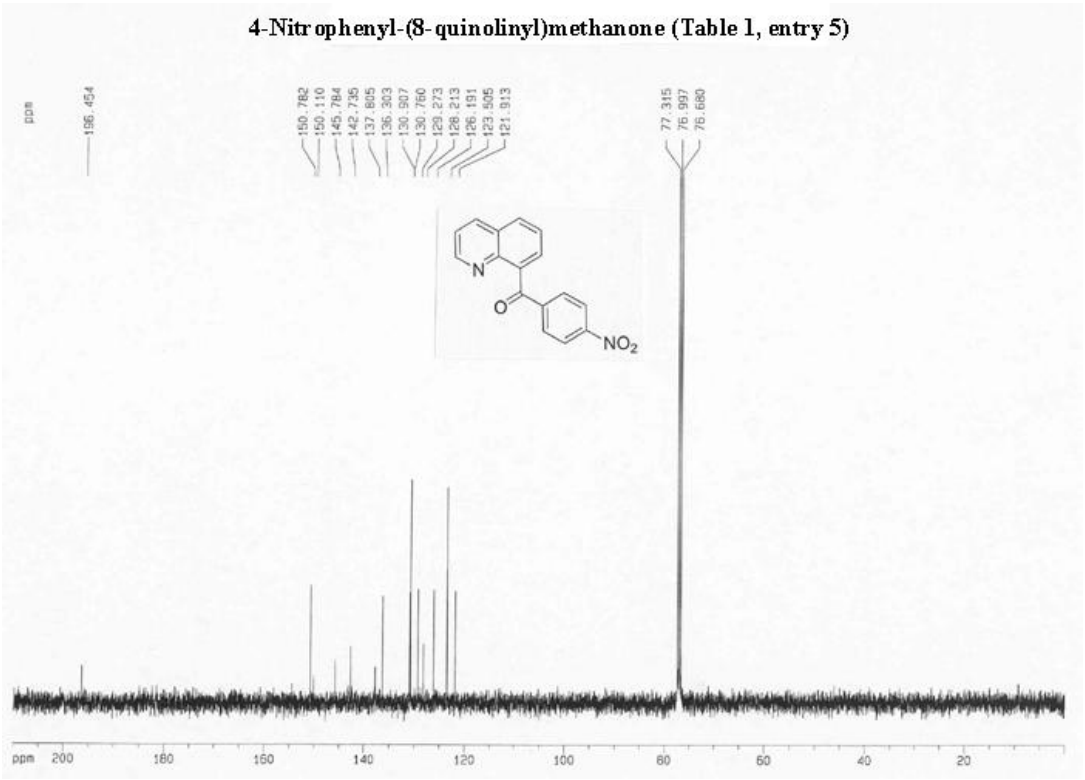
4-Acetylphenyl-(8-quinolinyl)methanone (Table 1, entry 4)



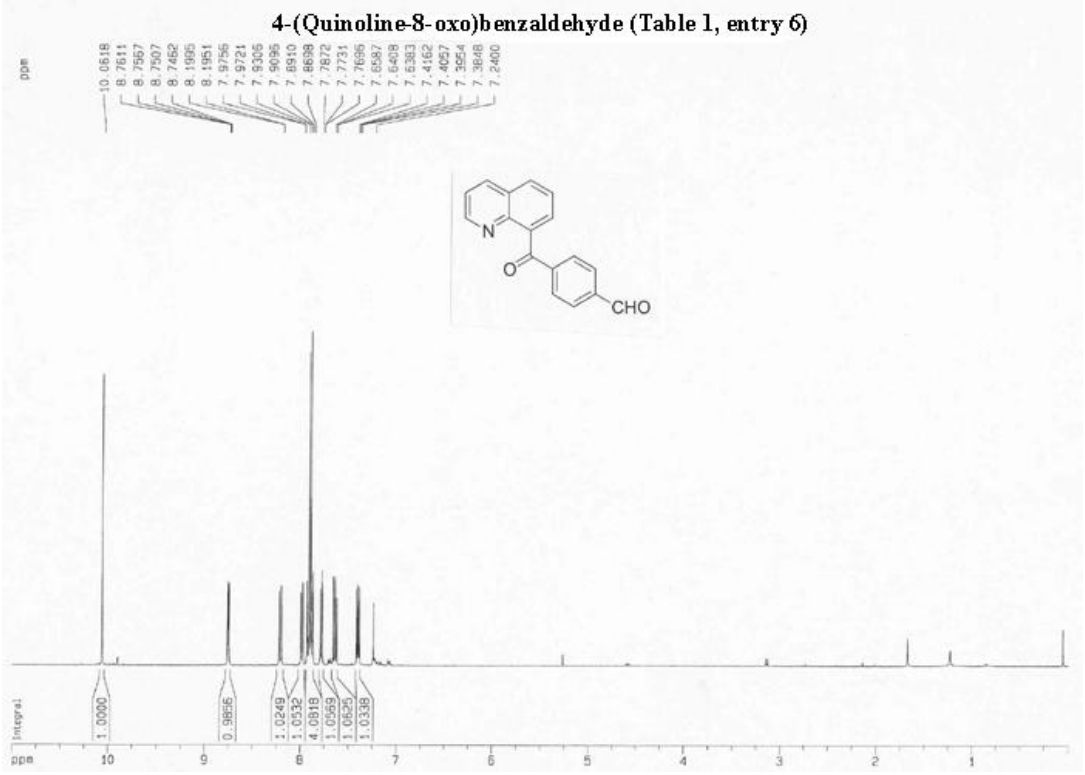
4-Nitrophenyl-(8-quinolinyl)methanone (Table 1, entry 5)



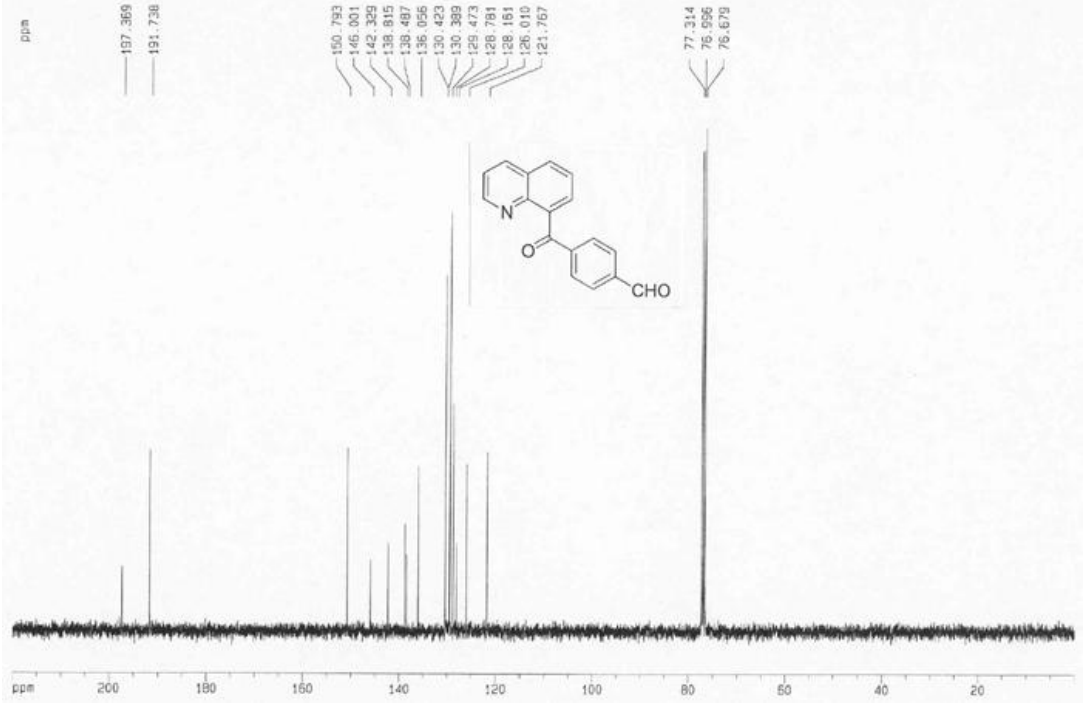
4-Nitrophenyl-(8-quinolinyl)methanone (Table 1, entry 5)



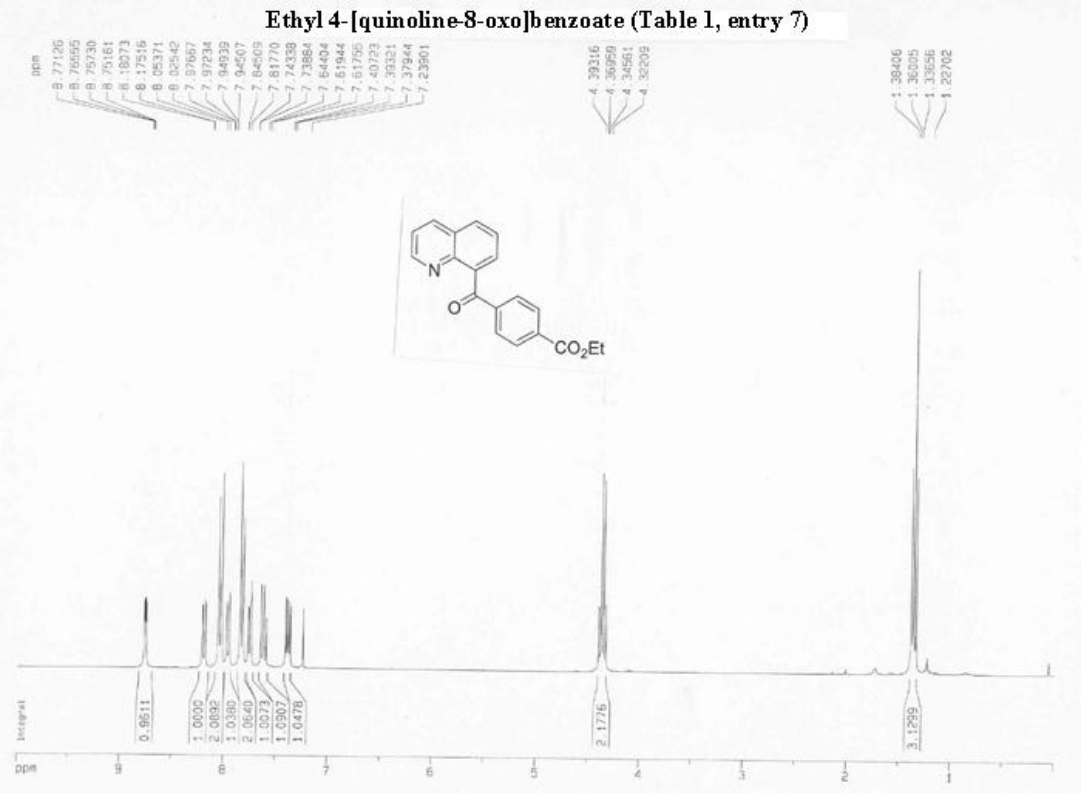
4-(Quinoline-8-oxo)benzaldehyde (Table 1, entry 6)



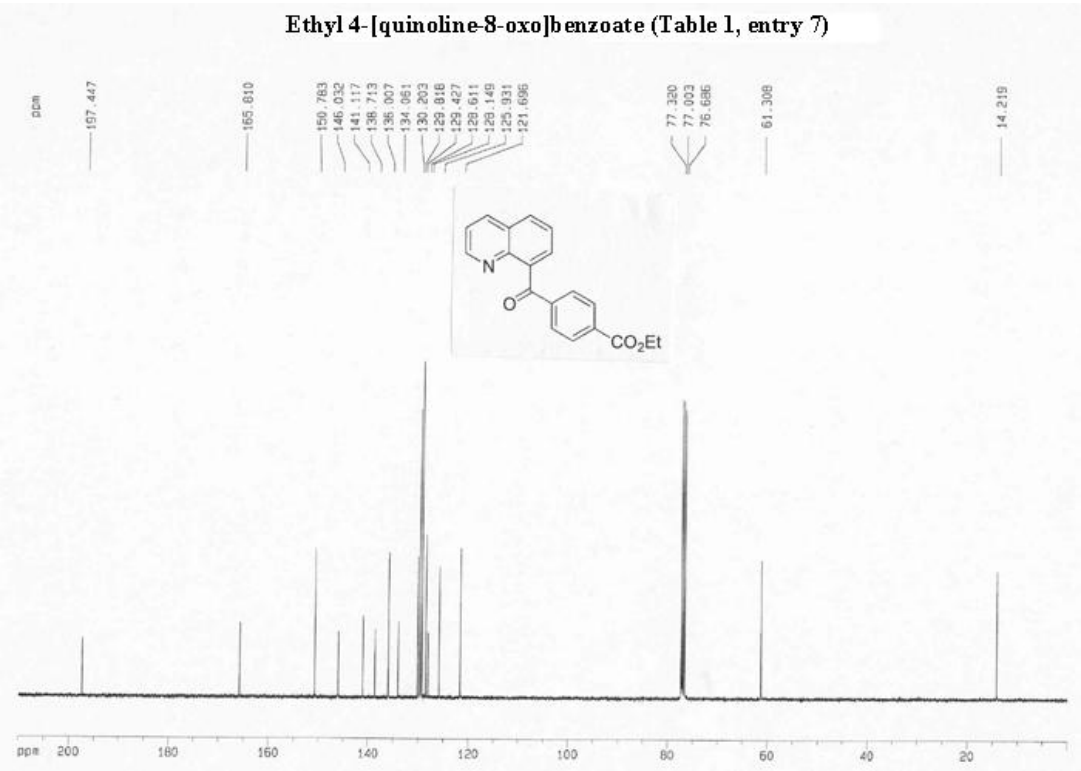
4-(Quinoline-8-oxo)benzaldehyde (Table 1, entry 6)



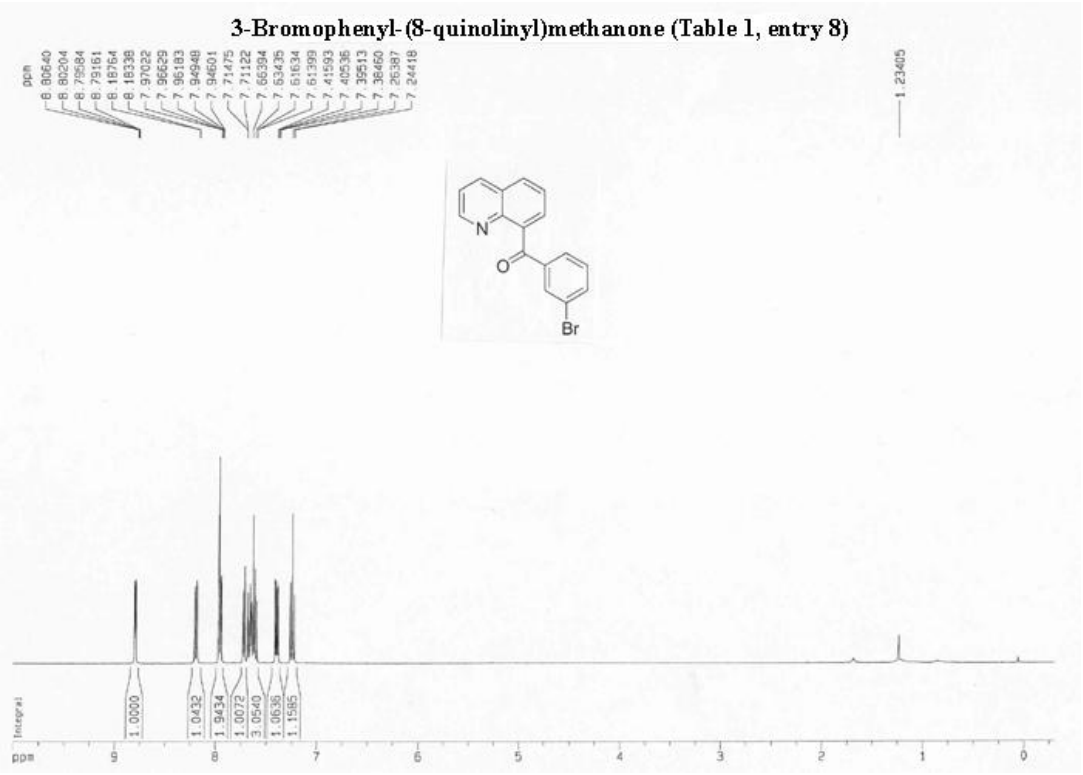
Ethyl 4-[quinoline-8-oxo]benzoate (Table 1, entry 7)



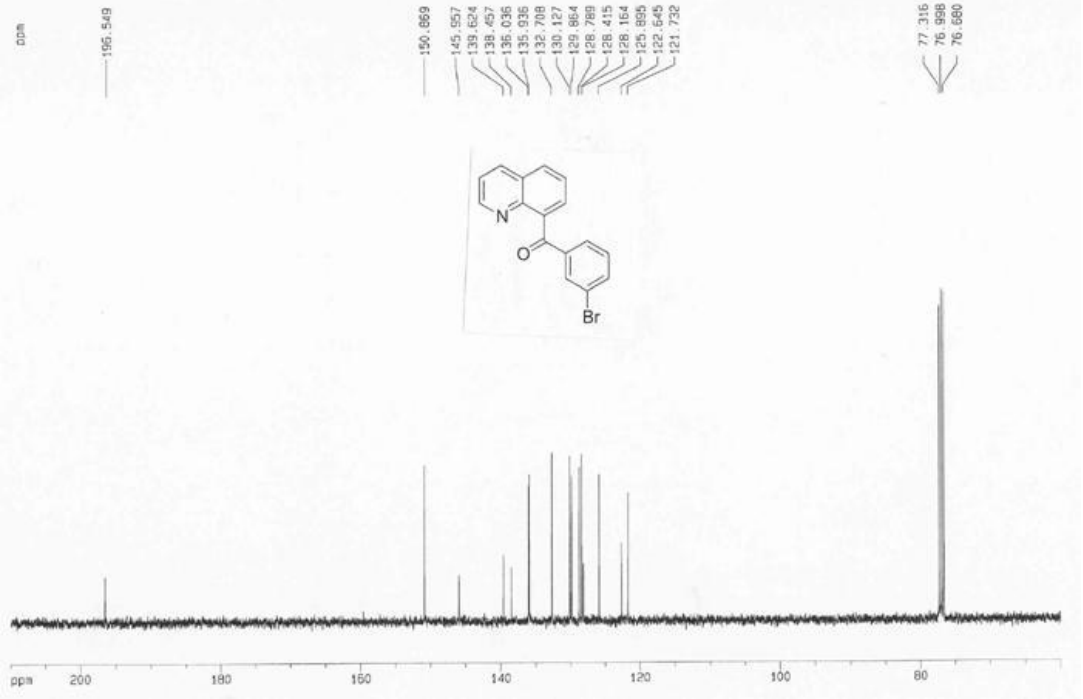
Ethyl 4-[quinoline-8-oxo]benzoate (Table 1, entry 7)



3-Bromophenyl-(8-quinolinyl)methanone (Table 1, entry 8)

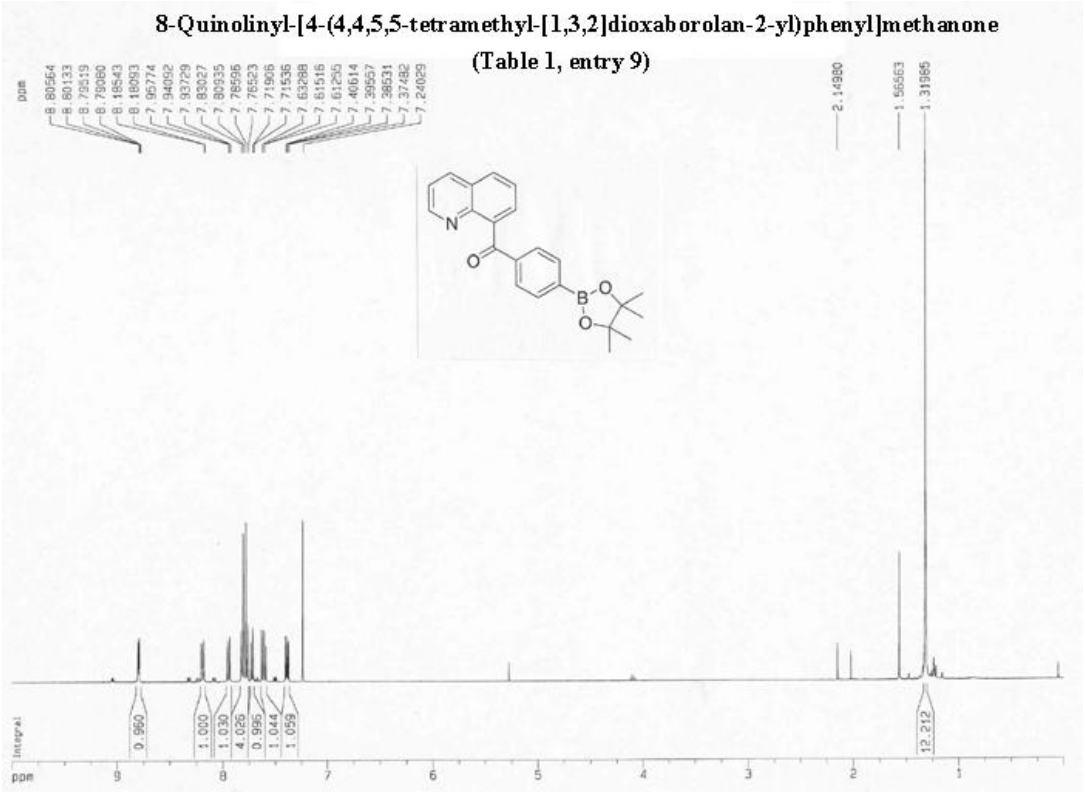


3-Bromophenyl-(8-quinolinyl)methanone (Table 1, entry 8)



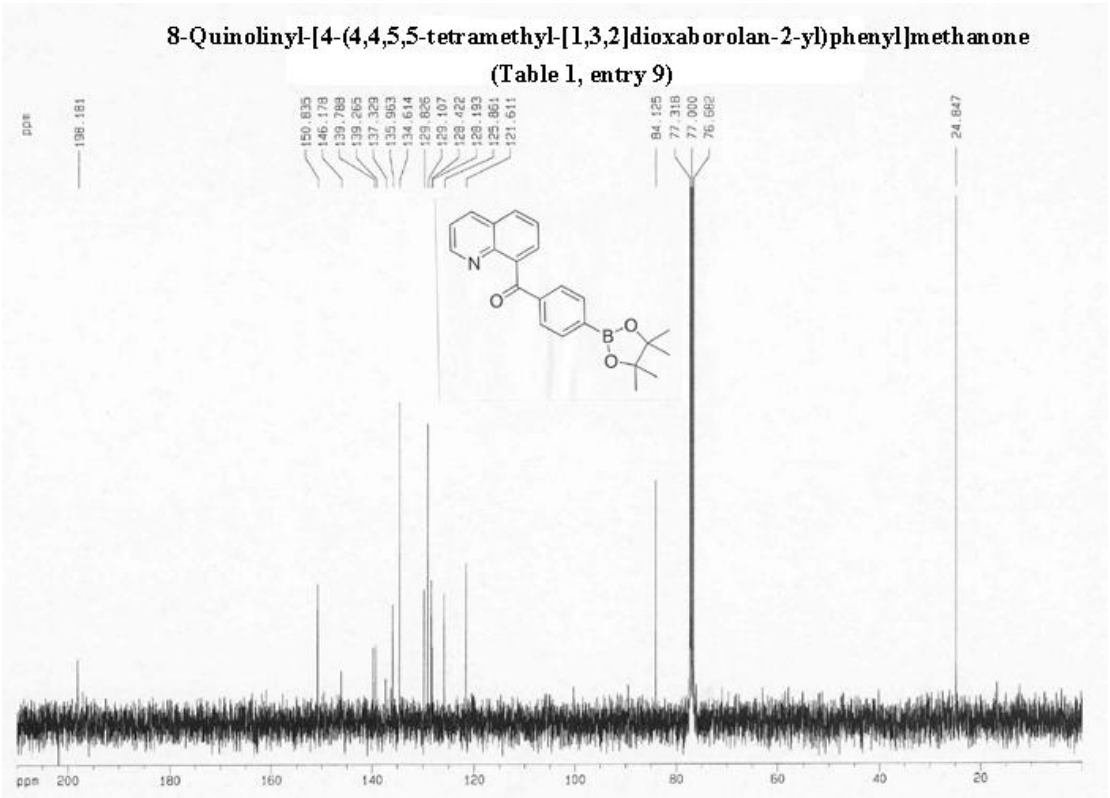
8-Quinolinyl-[4-(4,4,5,5-tetramethyl-[1,3,2]dioxaborolan-2-yl)phenyl]methanone

(Table 1, entry 9)

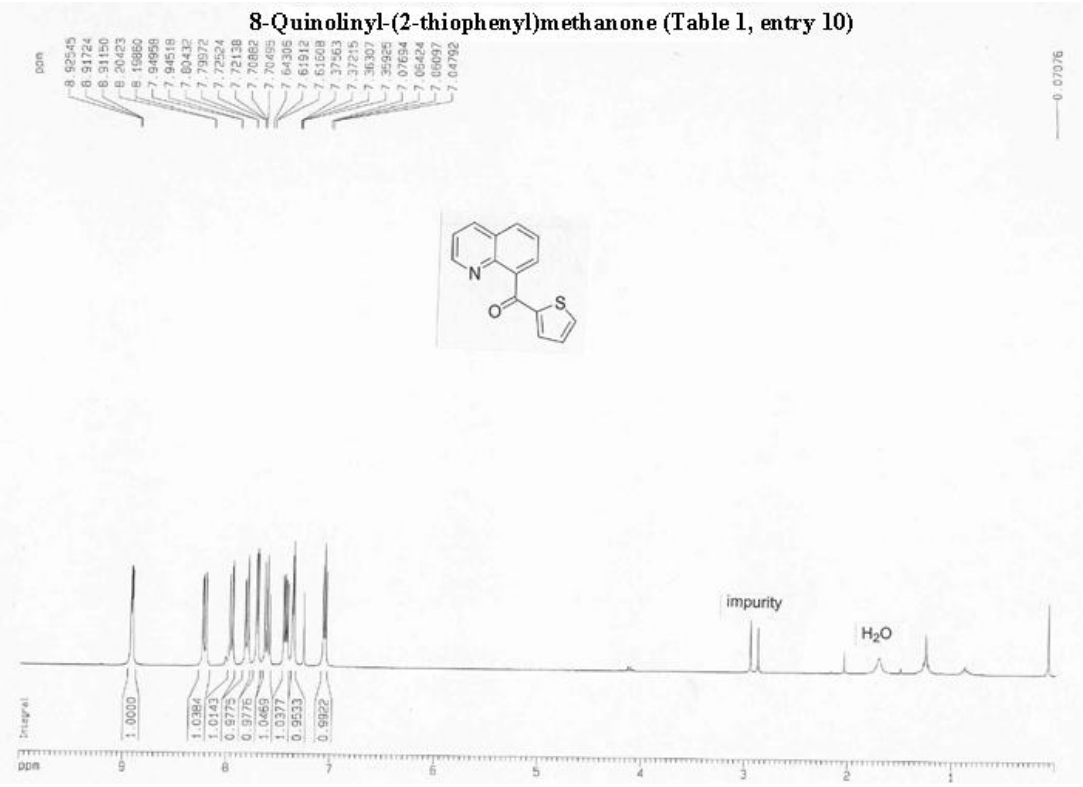


8-Quinolinyl-[4-(4,4,5,5-tetramethyl-[1,3,2]dioxaborolan-2-yl)phenyl]methanone

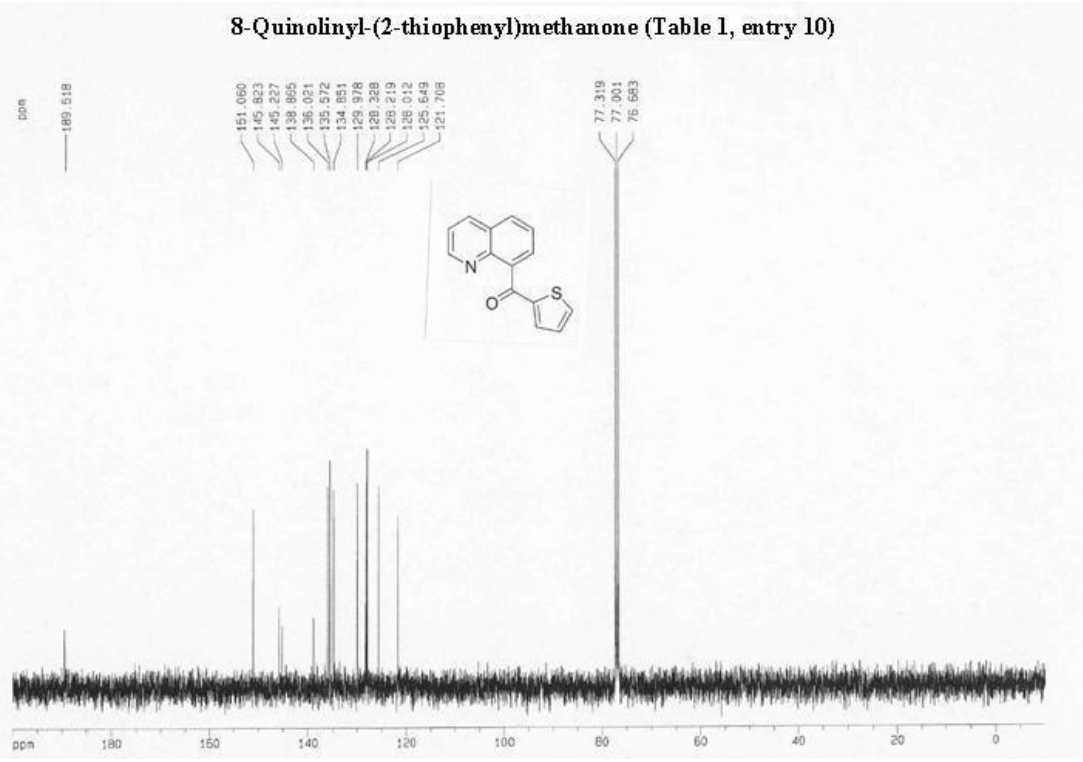
(Table 1, entry 9)



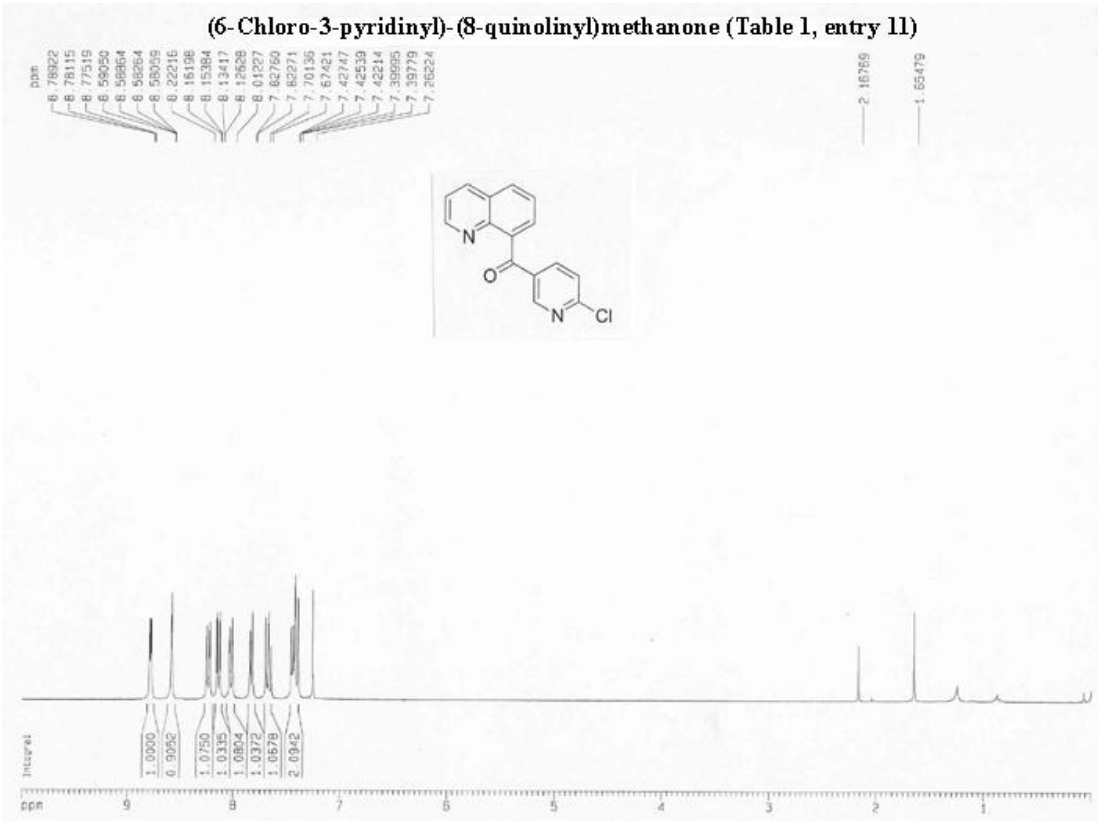
8-Quinolinyl-(2-thiophenyl)methanone (Table 1, entry 10)



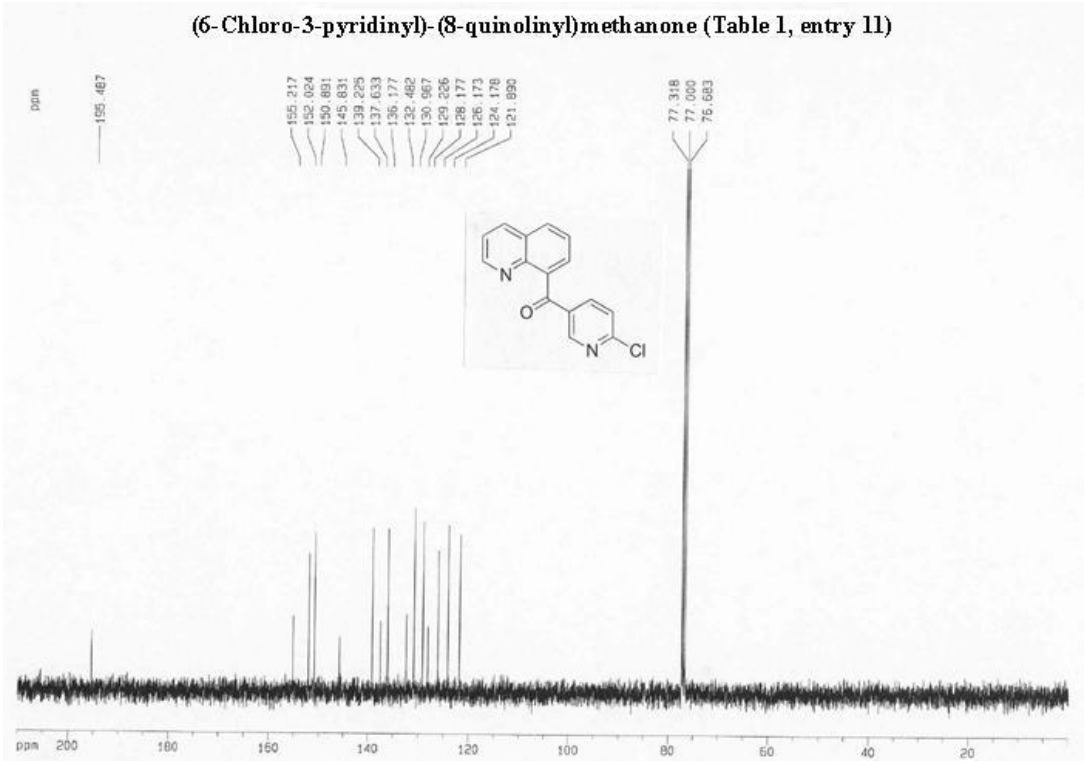
8-Quinolinyl-(2-thiophenyl)methanone (Table 1, entry 10)



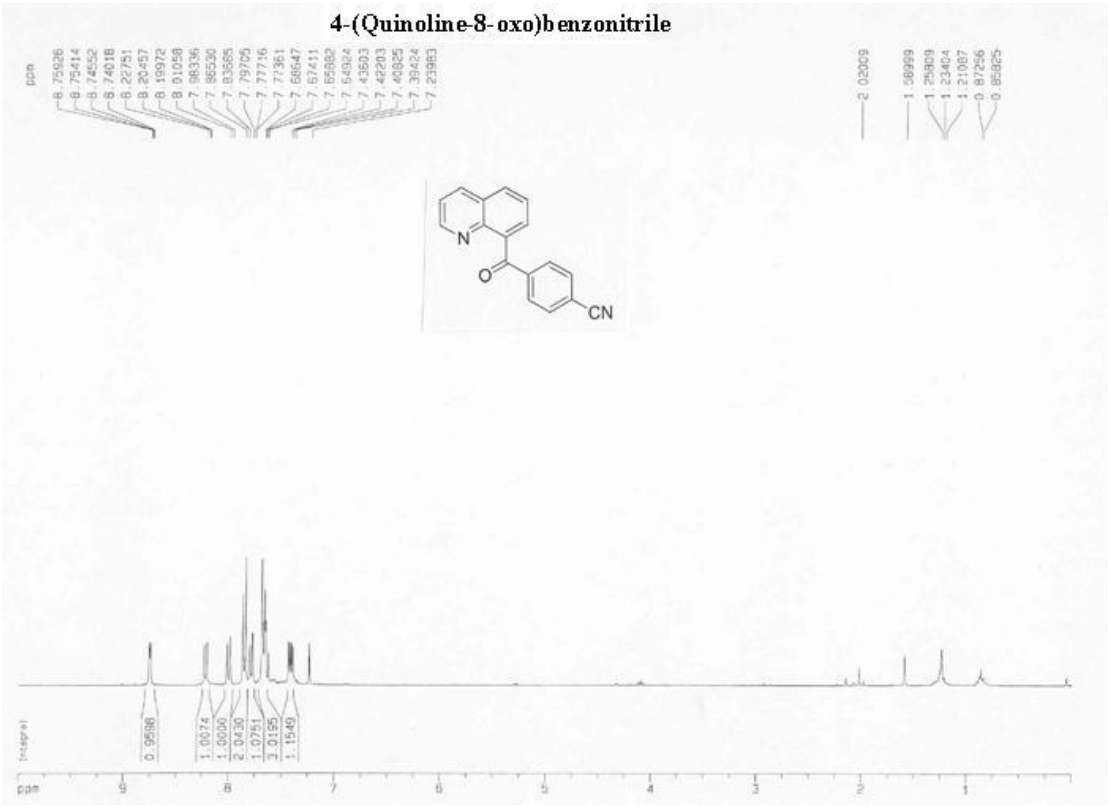
(6-Chloro-3-pyridinyl)-(8-quinolinyl)methanone (Table 1, entry 11)



(6-Chloro-3-pyridinyl)-(8-quinolinyl)methanone (Table 1, entry 11)



4-(Quinoline-8-oxo)benzonitrile



4-(Quinoline-8-oxo)benzonitrile