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Principles for the Selection of Highly-Reactive, Long-Lived, General Catalysts for the Coupling of Heteroaryl and Aryl Chlorides with Primary Nitrogen Nucleophiles

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General Methods. Unless otherwise noted, all manipulation were carried inside an inert atmosphere. ^{1}H and ^{13}C NMR spectra were recorded on a Bruker DPX 400 or 500 MHz Spectrometer and ^{31}P {^{1}H} NMR spectra were recorded on a General Electric QE 300 MHz spectrometer with tetramethylsilane or residual protiated solvent as a reference. All ^{31}P {^{1}H} NMR chemical shifts are reported in parts per million relative to an 85% H_3PO_4 external standard. Shifts downfield of the standard are reported as positive. Elemental analyses were performed by Atlantic Microlabs Inc., Norcross, GA or Robertson Microlab, Inc., Madison, NJ. GC and GC/MS analyses were conducted with an HP-1 methyl silicone column. CyPF-*t*-Bu (CyPF-*t*-Bu = 1-dicyclohexylphosphino-2-di-*t*-butylphosphinoethylferrocene) was obtained from Solvias AG and Strem Chemicals and used without further purification. Ethylene glycol dimethyl ether (DME, 99.9% purity, HPLC grade) was purchased and used without further purification. All other chemicals were used as received from commercial sources.

Synthesis of Pd(py)$_2$(Cl)(*o*-Tol). Pyridine (0.079 g, 1.0 mmol) was added to the mixture of Pd[P(*t*-Bu)$_3$]$_2$ (0.051 g, 0.10 mmol) and 2-chlorotoluene (0.633 g, 5.00 mmol) in a screw-capped NMR tube. The resulting mixture was allowed to react at 90 °C for 16 h during which time pale yellow crystals formed. After 16 h the reaction was complete, as determined by ^{31}P {^{1}H} NMR spectroscopy. The NMR tube was then allowed to cool to room temperature. The crystals were isolated by filtration, washed with pentane, and dried under vacuum to produce 33.2 mg (85 %) of Pd(py)$_2$(Cl)(*o*-Tol) as white crystals. ^{1}H NMR (CD_2Cl_2) δ 8.76 (dt, *J* = 4.8, 1.6 Hz, 4 H), 7.72 (tt, *J* = 7.6, 1.6 Hz, 2 H), 7.41 (dd, *J* = 7.2, 1.6 Hz, 1 H), 7.24 (ddd, *J* = 7.6, 5.2, 1.6 Hz, 4 H), 6.82 (td, *J* = 6.8, 1.6 Hz, 1 H), 6.79 (td, *J* = 6.8, 1.6 Hz, 1 H), 6.75 (dd, *J* = 7.2, 1.6 Hz, 1 H), 2.64 (s, 3 H); ^{13}C NMR (CD_2Cl_2) δ 154.57, 153.41, 141.45, 138.01, 133.43, 128.44, 125.14, 124.91, 123.90, 24.20. Anal. Calcd. For $C_{17}H_{17}ClN_2Pd$: C, 52.19; H, 4.38; N, 7.16. Found: C, 51.90; H, 4.09; N, 7.05.

Stability of Josiphos CyPF-*t*-Bu. Josiphos CyPF-*t*-Bu (11.0 mg, 2×10^{-5} mmol) was dissolved in C_6D_6 (0.5 mL) in an uncapped NMR tube in air. The ^{1}H NMR and ^{31}P NMR spectra of Josiphos CyPF-*t*-Bu were unchanged after 24 hr. Alternately, Josiphos CyPF-*t*-Bu (11.0 mg, 2×10^{-5} mmol) was weighed into an open vial in air. The solid was dissolved in C_6D_6 (0.5 mL) after 24h. The ^{1}H NMR and ^{31}P NMR spectra of Josiphos CyPF-*t*-Bu also were unchanged.

General Procedure for Catalytic Amination of Heteroaryl and Aryl Chlorides. The reaction conditions and average yields for each reaction are shown in Table 1 and 2. A typical procedure is given for the second entry in Table 1.

Stock Solution A (1.0×10^{-2} M): DME (1.0 mL) was added to the mixture of $Pd(OAc)_2$ (2.2 mg) and CyPF-*t*-Bu (5.5 mg). The resulting orange colored solution was stirred at room temperature for one minute before using.

Stock Solution B (1.0×10^{-4} M): 10.0 μL of the stock solution **A** was diluted to 1.0 mL with DME. The resulting pale yellow colored solution was stirred at room temperature for one minute before using.

***N*-Octyl-2-aminopyridine. (Table 1, entry 2).** A solution of $Pd(OAc)_2$ and CyPF-*t*-Bu (100.0 μL from stock solution **B**, 1.0×10^{-5} mmol) was added to a 4 mL vial containing 2-chloropyridine (0.114 g, 1.00 mmol) and sodium *tert*-butoxide (0.135 g, 1.40 mmol) in 1.0 mL of DME. Octylamine (0.155 g, 1.20 mmol) was then added by syringe. The vial was sealed with a cap containing a PTFE septum, and the reaction mixture was stirred at 100 °C until 2-chloropyridine was consumed, as determined by GC. The reaction solution was directly adsorbed onto silica gel, and the product was isolated by eluting with hexane/ethyl acetate (85/15) to give 178.1 mg (86%) of *N*-octyl-2-aminopyridine as a yellow solid. ^1H NMR ($CDCl_3$) δ 8.07 (d, J = 4.8 Hz, 1 H), 7.42 (dd, J = 8.6, 7.2 Hz, 1 H), 6.38 (d, J = 8.4 Hz, 1 H), 6.55 (dd, J = 7.0, 4.8 Hz, 1 H), 4.55 (s, b, 1 H), 3.24 (q, J = 6.8 Hz, 2 H), 1.62 (quint, J = 7.2 Hz, 2 H), 1.20-1.42 (m, 10 H), 0.89 (t, J = 6.8 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 158.88, 148.14, 137.19, 12.32, 106.1, 42.32, 31.68, 29.59, 29.42, 29.24, 27.11, 22.51, 13.95; Anal. Calcd. For $C_{13}H_{22}N_2$: C, 75.68; H, 10.75; N, 13.58. Found: C, 75.71; H, 10.67; N, 13.74.

***N*-*Iso*-butyl-2-aminopyridine. (Table 1, entry 3).** 2-Chloropyridine (0.114 g, 1.00 mmol), *iso*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0×10^{-5} mmol) gave 133.1 mg (89%) of *N*-*iso*-butyl-2-aminopyridine as a colorless liquid. ^{1}H NMR ($CDCl_3$) δ 7.97 (dd, *J* = 4.8, 1.2 Hz, 1 H), 7.29 (ddd, *J* = 8.8, 7.2, 1.6 Hz, 1 H), 6.43 (ddd, *J* = 7.2, 5.2, 0.8 Hz, 1 H), 6.27 (d, *J* = 8.8 Hz, 1 H), 4.78 (s, b, 1 H), 2.97 (t, *J* = 6.4 Hz, 2 H), 1.79 (nonet, *J* = 7.2 Hz, 2 H), 0.89 (d, *J* = 6.4 Hz, 6 H); ^{13}C NMR ($CDCl_3$) δ 158.94, 147.94, 137.19, 112.23, 106.05, 49.77, 28.06, 20.22. Anal. Calcd. For $C_9H_{14}N_2$: C, 71.96; H, 9.39; N, 18.65. Found: C, 71.78; H, 9.46; N, 18.33.

***N*-Cyclohexyl-2-aminopyridine.**[1] **(Table 1, entry 4).** 2-Chloropyridine (0.114 g, 1.00 mmol), cyclohexylamine (0.119 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (10.0 μL from stock solution **A**, 1.0×10^{-4} mmol) gave 173.1 mg (98%) of *N*-cyclonexyl-2-aminopyridine as a white solid. ^{1}H NMR ($CDCl_3$) δ 7.97 (dt, *J* = 5.0, 0.8 Hz, 1 H), 7.28 (ddd, *J* = 8.4, 6.8, 1.6 Hz, 1 H), 6.42 (dd, *J* = 6.8, 5.0 Hz, 1 H), 6.26 (d, *J* = 8.0 Hz, 1 H), 4.48 (d, *J* = 6.4 Hz, 1 H), 3.41-3.49 (m, 1 H), 1.93-1.97 (m, 2 H), 1.66 (dt, *J* = 13.2, 3.6 Hz, 2 H), 1.55 (dt, *J* = 12.4, 4.0 Hz, 1 H), 1.25-1.36 (m, 2 H), 1.06-1.19 (m, 3 H); ^{13}C NMR ($CDCl_3$) δ 158.03, 148.13, 137.11, 112.14, 106.57, 49.95, 33.23, 25.67, 24.78.

***N*-*tert*-Butyl-2-aminopyridine.**[2] **(Table 1, entry 5).** 2-Chloropyridine (0.114 g, 1.00 mmol), *tert*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ (2.2 mg, 1.0×10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0×10^{-2} mmol) gave 108.6 mg (73%) of *N*-*tert*-butyl-2-aminopyridine as a white solid ^{1}H NMR ($CDCl_3$) δ 8.06 (dd, *J* = 4.8, 1.2 Hz, 1 H), 7.35 (ddd, *J* = 8.8, 7.2, 1.8 Hz, 1 H), 6.43 (ddd, *J* = 7.2, 4.8, 0.8 Hz, 1 H), 6.44 (d, *J* = 8.8 Hz, 1 H), 4.49 (s, b, 1 H), 1.42 (s, 9 H); ^{13}C NMR ($CDCl_3$) δ 158.33, 148.07, 136.76, 112.24, 108.52, 50.62, 29.47.

***N*-(2-Pyridinyl)benzophenone imine. (Table 1, entry 6).** 2-Chloropyridine (0.114 g, 1.00 mmol), benzophenone imine (0.217 g, 1.20 mmol), Pd(OAc)$_2$ (2.2 mg, 1.0 × 10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0 × 10^{-2} mmol) gave 237.5 mg (92%) of *N*-(2-pyridyl)benzophenone imine as a yellow solid. ^{1}H NMR (CDCl$_3$) δ 8.03 (ddd, *J* = 4.8, 2.0, 0.8 Hz, 1 H), 7.81 (d, *J* = 7.2 Hz, 2 H), 7.37-7.49 (m, 4 H), 7.21-7.27 (m, 3 H), 7.16 (dd, *J* = 7.2, 1.6 Hz, 2 H), 6.82 (ddd, *J* = 7.2, 4.8, 0.8 Hz, 1 H), 6.58 (d, *J* = 8.0 Hz, 1 H); ^{13}C NMR δ 170.05, 163.40, 148.43, 138.75, 137.05, 136.04, 131.08, 129.60, 129.16, 128.70, 128.03, 127.75, 118.38, 115.31. Anal. Calcd. For $C_{18}H_{14}N_2$: C, 83.69; H, 5.46; N, 10.84. Found: C, 83.56; H, 5.54; N, 10.75.

***N*-(2-Pyridinyl)benzophenone hydrazone. (Table 1, entry 7).** 2-Chloropyridine (0.114 g, 1.00 mmol), benzophenone hydrazone (0.236 g, 1.20 mmol), Pd(OAc)$_2$ (2.2 mg, 1.0 × 10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0 × 10^{-2} mmol) gave 273.5 mg (99%) of *N*-(2-pyridyl)benzophenone hydrazone as a yellow solid. ^{1}H NMR (CDCl$_3$) δ 8.15 (s, b, 1 H), 8.05 (ddd, *J* = 4.8, 1.6, 0.8 Hz, 1 H), 7.46-7.64 (m, 7 H), 7.24-7.35 (m, 5 H), 6.74 (ddd, *J* = 7.2, 4.8, 1.2 Hz, 1 H); ^{13}C NMR (CDCl$_3$) δ 156.50, 147.54, 146.10, 138.06, 137.91, 132.43, 129.70, 129.37, 128.86, 128.42, 128.17, 126.67, 115.75, 107.50; Anal. Calcd. For $C_{18}H_{15}N_3$: C, 79.10; H, 5.53; N, 15.37. Found: C, 79.24; H, 5.61; N, 15.33.

***N*-(2-pyridinyl)benzamide. (Table 1, entry 8).** 2-Chloropyridine (0.114 g, 1.00 mmol), benzamide (0.145 g, 1.20 mmol), Pd(OAc)$_2$ (2.2 mg, 1.0 × 10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0 × 10^{-2} mmol) were used. The reaction mixture was acidified with HCl (1.0 N, 1.0 mL) then neutrized with a saturated NaHCO$_3$ solution. After extraction with CH$_2$Cl$_2$ (3 × 30.0 mL), the organic layer was separated and dried over

Na_2SO_4. The solvent was evaporated and the crude product was isolated by eluting with hexane/ethyl acetate to give 197.3 mg (99%) of *N*-(2-pyridyl)benzamide as a white solid. ^{1}H NMR ($CDCl_3$) δ 9.14 (s, b, 1 H), 8.41 (d, *J* = 8.4 Hz, 1 H), 8.15 (d, *J* = 4.4 Hz, 1 H), 7.93 (d, *J* = 8.0 Hz, 2 H), 7.74 (ddd, *J* = 8.4, 7.2, 1.8 Hz, 1 H), 7.56 (t, *J* = 7.4 Hz, 1 H), 7.47 (t, *J* = 8.0 Hz, 2 H), 7.03 (dd, *J* = 7.2, 4.8 Hz, 1 H); ^{13}C NMR ($CDCl_3$) δ 165.93, 151.67, 147.6, 138.42, 134.33, 132.13, 128.72, 127.26, 119.82, 114.28; Anal. Calcd. For $C_{12}H_{10}N_2O$: C, 72.71; H, 5.08; N, 14.13. Found: C, 72.45; H, 5.08; N, 13.94.

***N*-Octyl-2-amino-3-methylpyridine. (Table 1, entry 9)**. 2-Chloro-3-methylpyridine (0.126 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0×10^{-5} mmol) gave 211.6 mg (96%) of *N*-octyl-2-amino-3-methylpyridine as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.98 (d, *J* = 4.2 Hz, 1 H), 7.14 (d, *J* = 7.2 Hz, 1 H), 6.44 (dd, *J* = 6.8, 5.2 Hz, 1 H), 4.03 (s, b, 1 H), 3.41 (q, *J* = 6.5 Hz, 2 H), 2.02 (s, 3 H), 1.60 (quint, *J* = 7.2 Hz, 2 H), 1.19-1.40 (m, 10 H), 0.84 (t, *J* = 6.8 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 156.90, 145.38, 136.44, 116.18, 112.10, 41.68, 31.75, 29.81, 29.35, 29.19, 27.11, 22.57, 16.86, 14.00. Anal. Calcd. For $C_{14}H_{24}N_2$: C, 76.31; H, 10.98; N, 12.71. Found: C, 76.25; H, 10.99; N, 12.41.

***N*-Octyl-3-aminopyridine. (Table 1, entry 10)**. 3-Chloropyridine (0.114 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0×10^{-5} mmol) gave 197.2 mg (93%) of *N*-octyl-3-aminopyridine as a yellow solid. ^{1}H NMR ($CDCl_3$) δ 8.02 (d, *J* = 2.8 Hz, 1 H), 7.93 (dd, *J* = 4.4, 1.6 Hz, 1 H), 7.07 (dd, *J* = 8.4, 4.6 Hz, 1 H), 6.86 (ddd, *J* = 8.8, 3.2, 1.6 Hz, 1 H), 3.72 (s, b, 1 H), 3.11 (t, *J* = 7.2 Hz, 2 H), 1.63

(quint, *J* = 7.2 Hz, 2 H), 1.26-1.42 (m, 10 H), 0.89 (t, *J* = 7.2 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 144.37, 138.0, 135.69, 123.49, 118.01, 43.35, 31.63, 29.19, 29.16, 29.06, 26.92, 22.47, 13.91; Anal. Calcd. For $C_{13}H_{22}N_2$: C, 75.68; H, 10.75; N, 13.58. Found: C, 75.74; H, 10.94; N, 13.79.

***N*-Benzyl-3-aminopyridine.**[3] **(Table 1, entry 11).** 3-Chloropyridine (0.114 g, 1.00 mmol), benzylamine (0.129 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (10.0 μL from stock solution **A**, 1.0 × 10^{-4} mmol) gave 174.8 mg (95%) of *N*-benzyl-3-aminopyridine as a yellow solid. ^{1}H NMR ($CDCl_3$) δ 7.93 (d, *J* = 2.8 Hz, 1 H), 7.83 (dd, *J* = 4.8, 1.6 Hz, 1 H), 7.23 (d, *J* = 4.4 Hz, 4 H), 7.14-7.19 (m, 1 H), 6.91 (dd, *J* = 8.0, 4.4 Hz, 1 H), 6.72 (ddd, *J* = 8.4, 2.8, 1.2 Hz, 1 H), 4.37 (s, b, 1 H), 4.19 (d, *J* = 6.0 Hz, 2 H); ^{13}C NMR ($CDCl_3$) δ 143.97, 138.51, 138.45, 135.97, 128.54, 127.23, 127.19, 123.52, 118.26, 47.54.

***N*-*sec*-Butyl-3-aminopyridine. (Table 1, entry 12).** 3-Chloropyridine (0.114 g, 1.00 mmol), *sec*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (10.0 μL from stock solution **A**, 1.0 × 10^{-4} mmol) gave 135.4 mg (90%) of *N*-*sec*-butyl-3-aminopyridine as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.91 (d, *J* = 2.8 Hz, 1 H), 7.80 (dd, *J* = 4.4, 1.2 Hz, 1 H), 6.95 (ddd, *J* = 8.0, 4.4, 0.8 Hz, 1 H), 6.73 (ddd, *J* = 8.4, 2.8, 1.4 Hz, 1 H), 3.74 (s, b, 1 H), 3.28-3.31 (m, 1 H), 1.44-1.55 (m, 1 H), 1.33-1.42 (m, 1 H), 1.07 (d, *J* = 6.4 Hz, 3 H), 0.85 (t, *J* = 7.6 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 143.61, 137.62, 135.99, 123.48, 118.32, 49.30, 29.18, 19.76, 10.08; Anal. Calcd. For $C_9H_{14}N_2$: C, 71.96; H, 9.39; N, 18.65. Found: C, 71.69; H, 9.41; N, 18.65.

***N*-Cyclohexyl-3-aminopyridine.**[1] **(Table 1, entry 13).** 3-Chloropyridine (0.114 g, 1.00 mmol), cyclohexylamine (0.119 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (10.0 μL from stock solution **A**, 1.0 × 10^{-4} mmol) gave 138.4 mg (79%) of *N*-cyclohexyl-3-aminopyridine as a white solid. ^{1}H NMR ($CDCl_3$) δ 7.91 (d, *J* = 2.4 Hz, 1 H), 7.81 (dd, *J* = 4.8, 1.4 Hz, 1 H), 6.95 (dd, *J* = 8.0, 4.8 Hz, 1 H), 6.75 (ddd, *J* = 8.0, 2.8, 1.2 Hz, 1 H), 3.73 (s, b, 1 H), 3.10-3.21 (m, 1 H), 1.94 (dd, *J* = 13.2, 3.2 Hz, 2 H), 1.67 (dt, *J* = 13.2, 3.6 Hz, 2 H), 1.56 (dd, *J* = 12.4, 3.6 Hz, 1 H), 1.22-1.33 (m, 2 H), 1.02-1.18 (m, 3 H); ^{13}C NMR ($CDCl_3$) δ 143.25, 137.77, 136.09, 123.48, 118.39, 51.16, 32.94, 25.59, 24.68.

***N-tert*-Butyl-3-aminopyridine.**[4] **(Table 1, entry 14).** 3-Chloropyridine (0.114 g, 1.00 mmol), *tert*-butylamine (87.8 mg, 1.20 mmol), Pd(OAc)$_2$ (2.2 mg, 1.0 × 10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0 × 10^{-2} mmol) gave 100.3 mg (67%) of *N*-*tert*-butyl-3-aminopyridine as a colorless liquid. ^{1}H NMR ($CDCl_3$) δ 8.03 (s, 1 H), 7.91 (t, *J* = 3.0 Hz, 1 H), 6.98 (d, *J* = 3.2 Hz, 1 H), 6.97 (d, *J* = 3.6 Hz, 1 H), 3.55 (s, b, 1 H), 1.27 (s, 9 H); ^{13}C NMR ($CDCl_3$) δ 142.89, 139.32, 139.03, 123.21, 122.42, 51.36, 29.66.

***N*-(3-Pyridinyl)-*p*-toluidine. (Table 1, entry 15).** 3-Chloropyridine (0.114 g, 1.00 mmol), *p*-toluidine (0.130 g, 1.20 mmol), Pd(OAc)$_2$ (2.2 mg, 1.0 × 10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0 × 10^{-2} mmol) gave 155.9 mg (85%) of *N*-(3-pyridyl)-*p*-toluidine as a yellow solid. ^{1}H NMR ($CDCl_3$) δ 8.34 (s, 1 H), 8.12 (d, *J* = 4.4 Hz, 1 H), 7.35 (t, *J* = 7.6 Hz, 1 H), 7.10-7.19 (m, 3 H), 7.02 (d, *J* = 8.0 Hz, 2 H), 5.75 (s, b, 1 H), 2.33 (s, 3 H); ^{13}C NMR ($CDCl_3$) δ 140.79, 140.42, 139.10, 138.87, 131.46, 129.81, 123.56, 121.97, 119.02, 20.54; Anal. Calcd. For $C_{12}H_{12}N_2$: C, 78.23; H, 6.57; N, 15.21. Found: C, 78.19; H, 6.61; N, 15.01.

***N*-(3-Pyridinyl)benzophenone imine. (Table 1, entry 16).** 3-Chloropyridine (0.114 g, 1.00 mmol), benzophenone imine (0.217 g, 1.20 mmol), Pd(OAc)$_2$ (2.2 mg, 1.0 × 10^{-2} mmol) and

CyPF-*t*-Bu (5.5 mg, 1.0 × 10^{-2} mmol) gave 220.6 mg (85%) of *N*-(3-pyridyl)-benzophenone imine as a yellow solid. ^{1}H NMR ($CDCl_3$) δ 8.17 (dd, *J* = 4.8, 1.6 Hz, 1 H), 8.04 (dd, *J* = 2.4, 0.8 Hz, 1 H), 7.77 (dt, *J* = 7.2, 1.2 Hz, 2 H), 7.49 (tt, *J* = 7.2, 1.6 Hz, 1 H), 7.42 (tt, *J* = 7.2, 1.4 Hz, 1 H), 7.26-7.30 (m, 3 H), 7.03-7.11 (m, 5 H); ^{13}C NMR ($CDCl_3$) δ 170.24, 147.11, 144.37, 142.41, 138.91, 135.40, 131.17, 129.38, 129.32, 128.95, 128.25, 128.16, 127.99, 123.00; Anal. Calcd. For $C_{18}H_{14}N_2$: C, 83.69; H, 5.46; N, 10.84. Found: C, 83.74; H, 5.48; N, 10.82.

***N*-(3-Pyridinyl)benzophenone hydrazone. (Table 1, entry 17).** 3-Chloropyridine (0.114 g, 1.00 mmol), benzophenone hydrazone (0.236 g, 1.20 mmol), $Pd(OAc)_2$ (2.2 mg, 1.0 × 10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0 × 10^{-2} mmol) gave 273.0 mg (99%) of *N*-(3-pyridyl)benzophenone hydrazone as yellow solid. ^{1}H NMR ($CDCl_3$) δ 8.28 (d, *J* = 2.4 Hz, 1 H), 8.09 (dd, *J* = 4.4, 1.4 Hz, 1 H), 7.49-7.61 (m, 7 H), 7.29-7.35 (m, 5 H), 6.16 (dd, *J* = 4.4, 0.4 Hz, 1 H); ^{13}C NMR δ 146.19, 141.40, 140.88, 137.85, 135.70, 132.25, 129.75, 129.49, 128.95, 128.44, 128.22, 126.60, 123.75, 119.55; Anal. Calcd. For $C_{18}H_{15}N_3$: C, 79.10; H, 5.53; N, 15.37. Found: C, 79.30; H, 5.53; N, 15.36.

***N*-Octyl-4-aminopyridine. (Table 1, entry 19).** 4-Chloropyridine hydrochloride (0.150 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (10.0 μL from stock solution **A**, 1.0 × 10^{-4} mmol) gave 171.5 mg (83%) of *N*-octyl-4-aminopyridine as a yellow solid. ^{1}H NMR ($CDCl_3$) δ 8.11 (d, *J* = 4.8 Hz, 2 H), 6.37 (d, *J* = 4.8 Hz, 2 H), 4.44 (s, b, 1 H), 3.08 (q, *J* = 7.2 Hz, 2 H), 1.55 (quint, *J* = 7.2 Hz, 2 H), 1.19-1.39 (m, 10 H), 0.84 (t, *J* = 7.2 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 153.50, 149.48, 107.18, 42.38, 31.59, 29.12, 29.02, 28.84, 26.85, 22.44, 13.89;

Anal. Calcd. For $C_{13}H_{22}N_2$: C, 75.68; H, 10.75; N, 13.58. Found: C, 75.45; H, 10.80; N, 13.62.

***N*-(4-Pyridinyl)benzophenone imine. (Table 1, entry 20).** 4-Chloropyridine hydrochloride (0.150 g, 1.00 mmol), benzophone imine (0.217 g, 1.20 mmol), $Pd(OAc)_2$ (2.2 mg, 1.0×10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0×10^{-2} mmol) gave 254.9 mg (99%) of *N*-(4-pyridyl)benzophenone imine as a white solid. ^1H NMR ($CDCl_3$, -30 °C) δ 8.29 (d, *J* = 6.4 Hz, 2 H), 7.68 (d, *J* = 7.6 Hz, 2 H), 7.49 (t, *J* = 7.2 Hz, 1 H), 7.40 (t, *J* = 7.6 Hz, 2 H), 7.22-7.30 (m, 3 H), 7.06 (d, *J* = 7.2 Hz, 2 H), 6.61 (d, *J* = 6.0 Hz, 2 H); ^{13}C NMR ($CDCl_3$) δ 169.46, 157.96, 149.93, 138.14, 134.48, 131.46, 129.41, 129.20, 129.13, 128.29, 128.01, 115.70; Anal. Calcd. For $C_{18}H_{14}N_2$: C, 83.69; H, 5.46; N, 10.84. Found: C, 83.36; H, 5.44; N, 10.73.

4-Benzamidopyridine.[5] **(Table 1, entry 21).** 4-Chloropyridine hydrochloride (0.150 g, 1.00 mmol), benzamide (0.145 g, 1.20 mmol), $Pd(OAc)_2$ (2.2 mg, 1.0×10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0×10^{-2} mmol) gave 148.5 mg (75%) of 4-benzamidopyridine as a white solid. . ^1H NMR (CD_3COCD_3) δ 9.82 (s, b, 1 H), 8.48 (d, *J* = 6.4 Hz, 2 H), 8.00 (dt, *J* = 7.2, 2.0 Hz, 2 H), 7.81 (dd, *J* = 6.8, 2.0 Hz, 2 H), 7.60 (tt, *J* = 7.2, 1.4 Hz, 1 H), 7.52 (tt, *J* = 7.6, 1.2 Hz, 2 H); ^{13}C NMR (CD_3COCD_3) δ 166.95, 151.20, 146.76, 135.36, 132.74, 129.24, 128.34, 114.54.

***N*-Octyl-2-aminoquinoline. (Table 1, entry 22).** 2-Chloroquinoline (0.164 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0×10^{-5} mmol) gave 241.0 mg (94%) of *N*-octyl-2-aminoquinoline as a yellow liquid. ^1H NMR ($CDCl_3$) δ 7.79 (d, *J* = 9.2 Hz, 1 H), 7.64 (d, *J* = 8.4 Hz, 1 H), 7.55 (d, *J* = 7.6 Hz, 1 H), 7.50 (ddd, *J* = 8.6, 7.2, 1.6 Hz, 1 H), 7.17

(td, *J* = 7.8, 0.8 Hz, 1 H), 6.62 (d, *J* = 8.8 Hz, 1 H), 4.72 (s, b, 1 H), 3.44 (q, *J* = 6.8 Hz, 2 H), 1.64 (quint, *J* = 6.8 Hz, 2 H), 1.26-1.44 (m, 10 H), 0.86 (t, *J* = 6.8 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 156.92, 147.90, 136.93, 129.23, 127.20, 125.70, 123.09, 121.54, 111.04, 41.57, 31.63, 29.48, 29.18, 29.06, 26.89, 22.47, 13.92; Anal. Calcd. For $C_{17}H_{24}N_2$: C, 79.64; H, 9.44; N, 10.93. Found: C, 79.50; H, 9.44; N, 10.96

***N*-Cyclohexyl-2-aminoquinoline. (Table 1, entry 23).** 2-Chloroquinoline (0.163 g, 1.00 mmol), cyclohexylamine (0.119 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (10.0 μL from stock solution **A**, 1.0×10^{-4} mmol) gave 138.4 mg (79%) of *N*-cyclohexyl-2-aminoquinoline as a white solid. ^{1}H NMR ($CDCl_3$) δ 7.67 (d, *J* = 9.2 Hz, 1 H), 7.56 (dd, *J* = 8.4, 0.4 Hz, 1 H), 7.45 (dd, *J* = 8.4, 1.2 Hz, 1 H), 7.40 (d, *J* = 8.8 Hz, 1 H), 7.07 (ddd, *J* = 8.0, 7.0, 1.2 Hz, 1 H), 6.50 (d, *J* = 8.8 Hz, 1 H), 4. 66 (d, *J* = 8.0 Hz, 1 H), 3.71-3.78 (m, 1 H), 1.97-2.01 (m, 2 H), 1.66 (dt, *J* = 13.6, 4.9 Hz, 2 H), 1.55 (dt, *J* = 13.2, 4.9 Hz, 1 H), 1.27-1.38 (m, 2 H), 1.06-1.17 (m, 3 H); ^{13}C NMR ($CDCl_3$) δ 156.26, 148.15, 137.14, 129.34, 127.28, 125.85, 123.17, 121.60, 111.02, 49.70, 33.38, 25.66, 24.82; Anal. Calcd. For $C_{15}H_{18}N_2$: C, 79.61; H, 8.02; N, 12.38. Found: C, 79.49; H, 8.03; N, 12.23.

***N*-Octyl-2-amino-3-methylquinoline. (Table 1, entry 24).** 2-Chloro-3-methylquinoline (0.178 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (100.0 μL from stock solution **B**, 1.0×10^{-5} mmol) gave 240.1 mg (89%) of *N*-octyl-2-amino-3-methylquinoline as a yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.73 (d, *J* = 8.4 Hz, 1 H), 7.56 (s, 1 H), 7.52 (d, *J* = 8.0 Hz, 1 H), 7.47 (ddd, *J* = 8.4, 6.8, 1.6 Hz, 1 H), 7.17 (td, *J* = 8.4, 0.8 Hz, 1 H), 4.45 (s, b, 1 H), 3.62 (q, *J* = 6.7 Hz, 2 H), 2.20 (s, 3 H), 1.69 (quint, *J* = 7.2 Hz, 2

H), 1.30-1.48 (m, 10 H), 0.90 (t, *J* = 6.8 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 155.86, 147.12, 135.23, 128.20, 126.50, 125.99, 123.57, 121.63, 119.43, 41.50, 31.81, 29.70, 29.39, 29.24, 27.17, 22.63, 17.27, 14.07; Anal. Calcd. For $C_{18}H_{26}N_2$: C, 79.95; H, 9.69; N, 10.36. Found: C, 79.96; H, 9.87; N, 10.27.

***N*-Octyl-1-aminoisoquinoline. (Table 1, entry 25).** 1-Chloroisoquinoline (0.164 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0 × 10^{-5} mmol) gave 233.8 mg (91%) of *N*-octyl-1-aminoisoquinoline as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.98 (d, *J* = 6.0 Hz, 1 H), 7.72 (d, *J* = 7.6 Hz, 1 H), 7.65 (d, *J* = 8.4 Hz, 1 H), 7.56 (dd, *J* = 8.0, 6.8 Hz, 1 H), 7.43 (dd, *J* = 8.2, 6.8 Hz, 1 H), 6.89 (d, *J* = 5.6 Hz, 1 H), 5.16 (s, b, 1 H), 3.58 (q, *J* = 7.6 Hz, 2 H), 1.72 (quint, *J* = 7.6 Hz, 2 H), 1.45 (quint, *J* = 7.6 Hz, 2 H), 1.23-1.37 (m, 8 H), 0.86 (t, *J* = 6.8 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 155.07, 141.22, 136.82, 129.32, 126.87, 125.49, 121.25, 117.96, 110.32, 41.77, 31.66, 29.43, 29.27, 29.11, 27.09, 22.49, 13.95; Anal. Calcd. For $C_{17}H_{24}N_2$: C, 79.64; H, 9.44; N, 10.93. Found: C, 79.56; H, 9.57; N, 10.90.

***N*-Octylaminopyrazine. (Table 1, entry 26).** Chloropyrazine (0.115 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0 × 10^{-5} mmol) gave 170.0 mg (82%) of *N*-octylaminopyrazine as a pale yellow solid. ^{1}H NMR ($CDCl_3$) δ 7.89 (dd, *J* = 2.8, 1.6 Hz, 1 H), 7.80 (d, *J* = 1.6 Hz, 1 H), 7.69 (d, *J* = 2.8 Hz, 1 H), 4.94 (s, b, 1 H), 3.24 (q, *J* = 6.7 Hz, 2 H), 1.54 (quint, *J* = 7.3 Hz, 2 H), 1.20-1.42 (m, 10 H), 0.80 (t, *J* = 6.8 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 154.70, 141.83, 132.16, 131.72, 41.40, 31.65, 29.28, 29.17, 29.09, 26.87, 22.50, 13.96; Anal. Calcd. For $C_{12}H_{21}N_3$: C, 69.52; H, 10.21; N, 20.27. Found: C, 69.58; H, 10.26; N, 20.45.

***N*-(3-Pyridyl)-α-methyl-benzylamine. (Table 1, entry 27).** 3-Chloropyridine (0.114 g, 1.00 mmol), α-methyl-benzylamine (0.145 g, 1.20 mmol, 99 % ee), $Pd(OAc)_2$ and CyPF-*t*-Bu (50.0 μL from stock solution **A**, 5.0×10^{-4} mmol) gave 181.3 mg (91%, 94.5% ee) of *N*-(3-pyridyl)-α-methyl-benzylamine. The ee was determined on Chiralcel OD-H column with hexane/2-propanol = 90/10, flow = 1.0 ml/min, wavelength = 254 nm. Retention time 15.83 mins (S-isomer), 33.17 mins (R-isomer). ^{1}H NMR ($CDCl_3$) δ 7.90 (d, *J* = 2.8 Hz, 1 H), 7.78 (dd, *J* = 4.8, 1.2 Hz, 1 H), 7.09-7.24 (m, 5 H), 6.83 (dd, *J* = 8.4, 4.8 Hz, 1 H), 6.58 (ddd, *J* = 8.4, 2.8, 1.2 Hz, 1 H), 4.39 (s, b, 1 H), 4.30-4.38 (m, 1 H), 1.40 (d, *J* = 6.8 Hz, 3 H); ^{13}C NMR ($CDCl_3$) 144.15, 143.18, 138.16, 136.33, 128.58, 126.93, 125.57, 123.41, 118.71, 53.03, 24.75.

***N*-Phenyloctylamine.**[6] **(Table 2, entry 1).** Phenyl Chloride (0.113 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0×10^{-5} mmol) gave 193.5 mg (94%) of *N*-phenyloctylamine as a colorless liquid. ^{1}H NMR ($CDCl_3$) δ 7.09 (tt, *J* = 7.2, 2.0 Hz, 2 H), 6.60 (tt, *J* = 7.2, 1.0 Hz, 1 H), 6.50 (dd, *J* = 7.2, 2.0 Hz, 2 H), 3 .47 (s, b, 1 H), 3.00 (t, *J* = 7.2 Hz, 2 H), 1.52 (quint, *J* = 7.2 Hz, 2 H), 1.21-1.32 (m, 10 H), 0.82 (t, *J* = 6.8 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 148.45, 129.11, 116.94, 112.57, 43.90, 31.79, 29.51, 29.39, 29.23, 27.14, 22.62, 14.07.

***N*-(*o*-Tolyl)octylamine. (Table 2, entry 2).** 2-Chlorotoluene (0.127 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (10.0 μL from stock solution **A**, 1.0×10^{-4} mmol) gave 214.1 mg (98%) of *N*-(*o*-tolyl)octylamine as a yellow solid. ^{1}H NMR ($CDCl_3$) δ 7.20 (t, *J* = 7.6 Hz, 1 H), 7.12 (d, *J* = 7.2 Hz, 1 H), 6.72 (d, *J* = 7.4 Hz, 1 H), 6.69 (d, *J* = 8.0 Hz, 1 H), 3.50 (s, b, 1 H), 3.22 (t, *J* = 7.2 Hz, 2 H), 2.21 (s, 3 H), 1.74 (quint, *J* = 7.3 Hz, 2 H), 1.38-1.52 (m, 10 H), 0.99 (t, *J* = 7.2 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 146.35, 129.92, 127.07, 121.55, 116.53, 109.52, 43.91, 31.82, 29.59, 29.42, 29.26, 27.23, 22.65, 17.38, 14.00; Anal. Calcd. For $C_{15}H_{25}N$: C, 82.13; H, 11.94; N, 6.39. Found: C, 82.23; H, 11.67; N, 6.10.

***N*-(2-Methoxyphenyl)octylamine.**[7] **(Table 2, entry 3).** 2-Chloroanisole (0.143 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (50.0 μL from stock solution **A**, 5.0×10^{-4} mmol) gave 218.0 mg (93%) of *N*-(2-methoxyphenyl)octylamine as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 6.86 (td, *J* = 7.2, 1.2 Hz, 1 H), 6.75 (dd, *J* = 7.8, 1.4 Hz, 1 H), 6.64 (td, *J* = 8.0, 1.6 Hz, 1 H), 6.59 (dd, *J* = 7.6, 1.2 Hz, 1 H), 4.16 (s, b, 1 H), 3.83 (s, 3 H), 3.10 (t, *J* = 7.2 Hz, 2 H), 1.64 (quint, *J* = 7.4 Hz, 2 H), 1.22-1.46 (m, 10 H), 0.88 (t, *J* = 7.2 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 146.66, 138.46, 121.25, 115.99, 109.66, 109.25, 55.30, 43.68, 31.82, 29.51, 29.41, 29.24, 27.23, 22.63, 14.07.

***N*-(4-Methoxyphenyl)octylamine. (Table 2, entry 4).** 4-Chloroanisole (0.143 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (100.0 μL from stock solution **A**, 1.0×10^{-3} mmol) gave 217.2 mg (92%) of *N*-(4-methoxyphenyl)octylamine as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 6.68 (d, *J* = 6.4 Hz, 21 H), 6.47 (d, *J* = 6.8 Hz, 21 H), 3.63 (s, 3 H), 3.17 (s, b, 1 H), 2.94 (t, *J* = 7.0 Hz, 2 H), 1.49 (quint, *J* = 7.0 Hz, 2 H), 1.20-1.28 (m, 10 H), 0.80 (t, *J* = 6.8 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 151.77, 142.76, 114.71, 113.83, 55.60, 44.88, 31.75, 29.58, 29.37, 29.20, 27.13, 22.58, 14.02. Anal. Calcd. For $C_{15}H_{25}NO$: C, 76.55; H, 10.71; N, 5.95. Found: C, 76.46; H, 10.41; N, 6.04.

***N*-(2, 6-Xylyl)octylamine. (Table 2, entry 5).** 2, 6-Dimethyl-1-chloro-benzene (0.141 g, 1.00 mmol), octylamine (0.155 g, 1.20 mmol), Pd(OAc)$_2$ and CyPF-*t*-Bu (100.0 μL from stock solution **A**, 1.0 × 10^{-3} mmol) gave 226.3 mg (97%) of *N*-(2, 6-xylyl)octylamine as a yellow liquid. ^{1}H NMR (CDCl$_3$) δ 7.10 (d, *J* = 7.6 Hz, 2 H), 6.92 (t, *J* = 7.6 Hz, 1 H), 3.10 (t, *J* = 7.2 Hz, 2 H), 3.07 (s, b, 1 H), 2.41 (s, 6 H), 1.71 (quint, *J* = 7.2 Hz, 2 H), 1.43-1.53 (m, 10 H), 1.04 (t, *J* = 6.8 Hz, 3 H); ^{13}C NMR (CDCl$_3$) δ 146.34, 128.91, 128.66, 121.41, 48.56, 31.77, 31.16, 29.46, 29.24, 27.13, 22.60, 18.43, 14.01; Anal. Calcd. For $C_{16}H_{27}N$: C, 82.34; H, 11.66; N, 6.00. Found: C, 82.16; H, 11.78; N, 5.94.

***N*-Phenyl-*iso*-butylamine.**[8] **(Table 2, entry 6).** Phenyl Chloride (0.113 g, 1.00 mmol), *iso*-butylamine (87.8 mg, 1.20 mmol), Pd(OAc)$_2$ and CyPF-*t*-Bu (50.0 μL from stock solution **A**, 5.0 × 10^{-4} mmol) gave 137.0 mg (92%) of *N*-phenyl-*iso*-butylamine as a pale yellow liquid. ^{1}H NMR (CDCl$_3$) δ 7.07 (t, *J* = 7.6 Hz, 2 H), 6.58 (td, *J* = 7.2, 0.8 Hz, 1 H), 6.49 (dd, *J* = 7.2, 0.8 Hz, 2 H), 3 .54 (s, b, 1 H), 2.81 (d, *J* = 6.8 Hz, 2 H), 1.78 (nonet, *J* = 6.8 Hz, 1 H), 0.89 (d, *J* = 6.8 Hz, 6 H); ^{13}C NMR (CDCl$_3$) δ 148.51, 129.13, 116.86, 112.57, 51.73, 27.96, 20.42.

***N*-(*p*-Tolyl)-*iso*-butylamine.**[9] **(Table 2, entry 7).** 4-Chlorotoluene (0.127 g, 1.00 mmol), *iso*-butylamine (87.8 mg, 1.20 mmol), Pd(OAc)$_2$ and CyPF-*t*-Bu (50.0 μL from stock solution **A**, 5.0 × 10^{-4} mmol) gave 135.5 mg (83%) of *N*-(*p*-tolyl)-*iso*-butylamine as a pale yellow liquid. ^{1}H NMR (CDCl$_3$) δ 6.99 (d, *J* = 8.0 Hz, 2 H), 6.54 (d, *J* = 7.8 Hz, 2 H), 3 .47 (s, b, 1 H), 2.92 (d, *J* = 6.8 Hz, 2 H), 2.25 (s, 3 H), 1.89 (nonet, *J* = 6.8 Hz, 1 H), 0.99 (d, *J* = 6.8 Hz, 6

H); ^{13}C NMR ($CDCl_3$) δ 146.29, 129.66, 126.11, 112.83, 52.20, 27.97, 20.46, 20.33.

***N*-(4-Methoxyphenyl)-*iso*-butylamine. (Table 2, entry 8)**. 4-Chloroanisole (0.143 g, 1.00 mmol), *iso*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ (2.2 mg, 1.0×10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0×10^{-2} mmol) gave 168.6 mg (94%) of *N*-(4-methoxyphenyl)-*iso*-butylamine as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 6.68 (d, *J* = 8.8 Hz, 2 H), 6.47 (d, *J* = 8.8 Hz, 2 H), 3.64 (s, b, 1 H), 3.16 (s, 3 H), 2.80 (d, *J* = 6.4 Hz, 2 H), 1.77 (nonet, *J* = 6.8 Hz, 1 H), 0.89 (d, *J* = 6.4 Hz, 6 H); ^{13}C NMR ($CDCl_3$) δ 152.10, 143.10, 115.13, 114.03, 55.93, 53.03, 28.19, 20.43; Anal. Calcd. For $C_{11}H_{17}NO$: C, 73.70; H, 9.56; N, 7.81. Found: C, 73.65; H, 9.63; N, 7.83.

***N*-(4-Cyanophenyl)-*iso*-butylamine. (Table 2, entry 9)**. 4-Cyano-1-chlorobenzene (0.138 g, 1.00 mmol), *iso*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0×10^{-5} mmol) gave 156.0 mg (90%) of *N*-(4-cyanoxyphenyl)-*iso*-butylamine as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.27 (d, *J* = 8.8 Hz, 2 H), 7.46 (d, *J* = 8.8 Hz, 2 H), 4.32 (s, b, 1 H), 2.87 (d, *J* = 6.8 Hz, 2 H), 1.80 (nonet, *J* = 6.8 Hz, 1 H), 0.89 (d, *J* = 6.8 Hz, 6 H); ^{13}C NMR ($CDCl_3$) δ 151.74, 133.43, 120.38, 112.01, 98.00, 50.86, 27.90, 20.12; Anal. Calcd. For $C_{11}H_{14}N_2$: C, 75.82; H, 8.10; N, 16.08. Found: C, 75.96; H, 8.03; N, 16.01.

N-(Phenyl)cyclohexylamime.[11] **(Table 2, entry 10).** Phenylchloride (0.113 g, 1.00 mmol), cyclohexylamine (0.119 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0×10^{-5} mmol) gave 174.7 mg (99%) of *N*-(phenyl)cyclohexylamine as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.05 (t, *J* = 7.6 Hz, 2 H), 6.56 (td, *J* = 7.2, 1.2 Hz, 1 H), 6.48 (dd, *J* = 7.6, 0.8 Hz, 2 H), 3.38 (s, b, 1 H), 3.11-3.18 (m, 1 H), 1.94-1.97 (m, 2 H), 1.66 (dt, *J* =

13.2, 4.0 Hz, 2 H), 1.55 (dt, *J* = 12.0, 3.6 Hz, 1 H), 1.22-1.32 (m, 2 H), 0.99-1.18 (m, 3 H); ^{13}C NMR ($CDCl_3$) δ 147.31, 129.16, 116.71, 113.02, 51.56, 33.39, 25.88, 24.96.

***N*-(Cyclohexylamino)-*o*-anisidine. (Table 2, entry 11).** 2-Chloroanisole (0.143 g, 1.00 mmol), cyclohexylamine (0.119 g, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0×10^{-3} mmol) and CyPF-*t*-Bu (2.8 mg, 5.0×10^{-3} mmol) gave 205.7 mg (99%) of *N*-(cyclohexylamino)-*o*-anisidine as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 6.88 (td, *J* = 8.0, 1.6 Hz, 1 H), 6.78 (dd, *J* = 8.4, 1.2 Hz, 1 H), 6.23-6.67 (m, 2 H), 4.17 (s, b, 1 H), 3.86 (s, 3 H), 3.28 (tt, *J* = 10.0, 3.8 Hz, 1 H), 2.10 (dd, *J* = 12.0, 3.0 Hz, 2 H), 1.80 (dt, *J* = 12.8, 3.6 Hz, 2 H), 1.68 (dt, *J* = 12.8, 4.0 Hz, 1 H), 1.35-1.46 (m, 2 H), 1.18-1.31 (m, 3 H); ^{13}C NMR ($CDCl_3$) δ 146.62, 137.19, 121.16, 115.67, 110.09, 109.47, 55.28, 51.25, 33.37, 25.96, 25.03; Anal. Calcd. For $C_{13}H_{19}N_2O$: C, 76.06; H, 9.33; N, 6.82. Found: C, 76.04; H, 9.32; N, 6.71.

***N*-(Cyclohexylamino)-*m*-anisidine.[10] (Table 2, entry 12).** 3-Chloroanisole (0.143 g, 1.00 mmol), cyclohexylamine (0.119 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (10.0 μL from stock solution **A**, 1.0×10^{-4} mmol) gave 139.1 mg (68%) of *N*-(cyclohexylamino)-*m*-anisidine as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.08 (t, *J* = 8.4 Hz, 1 H), 6.26 (dd, *J* = 8.4, 2.0 Hz, 1 H), 6.23 (dd, *J* = 8.0, 2.0 Hz, 1 H), 6.18 (7, *J* = 2.0 Hz, 1 H), 3.78 (s, 3 H), 3.52 (s, b, 1 H), 3.28 (tt, *J* = 10.0, 3.8 Hz, 1 H), 2.08 (dd, *J* = 12.6, 3.0 Hz, 2 H), 1.78 (dt, *J* = 13.2, 3.6 Hz, 2 H), 1.67 (dt, *J* = 12.4, 3.6 Hz, 1 H), 1.33-1.44 (m, 2 H), 1.25 (tt, *J* = 12.0, 3.6 Hz, 1 H), 1.11-1.21 (m, 2 H); ^{13}C NMR ($CDCl_3$) δ 160.74, 148.67, 129.82, 106.24, 101.61, 98.98, 54.90, 51.57, 33.32, 25.82, 24.92.

***N*-(Phenyl)benzylamine.**[11] **(Table 2, entry 13).** Phenyl chloride (0.113 g, 1.00 mmol), benzylamine (0.129 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0 × 10^{-5} mmol) gave 183.0 mg (99%) of *N*-(Phenyl)benzylamine as a pale yellow liquid. ^1H NMR ($CDCl_3$) δ 7.49 (d, *J* = 6.0 Hz, 2 H), 7.46 (d, *J* = 7.2 Hz, 2 H), 7.38-7.41 (m, 1 H), 7.30 (t, *J* = 7.2 Hz, 2 H), 6.86 (td, *J* = 7.2, 1.2 Hz, 1 H), 6.74 (dd, *J* = 7.6, 1.2 Hz, 2 H), 4.42 (s, 2 H), 4.09 (s, b, 1 H); ^{13}C NMR ($CDCl_3$) δ 148.04, 139.36, 129.15, 128.51, 127.37, 127.09, 117.41, 112.73, 48.13.

***N*-(Benzylamino)-*m*-anisidine. (Table 2, entry 14).** 3-Chloroanisole (0.143 g, 1.00 mmol), benzylamine (0.129 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (5.0 μL from stock solution **A**, 5.0 × 10^{-5} mmol) gave 208.0 mg (98%) of *N*-(benzylamino)-*m*-anisidine as a pale yellow liquid. ^1H NMR ($CDCl_3$) δ 7.45 (dd, *J* = 8.4, 2.0 Hz, 2 H), 7.42 (t, *J* = 7.6 Hz, 2 H), 7.36 (tt, *J* = 6.4, 2.0 Hz, 1 H), 7.17 (t, *J* = 8.0 Hz, 1 H), 6.39 (dd, *J* = 8.0, 1.6 Hz, 1 H), 6.34 (dd, *J* = 8.0, 1.6 Hz, 1 H), 6.28 (t, *J* = 1.6 Hz, 1 H), 4.37 (s, 2 H), 4.13 (s, b, 1 H), 3.81 (s, 3 H); ^{13}C NMR ($CDCl_3$) δ 160.65, 149.42, 139.23, 129.84, 128.46, 127.33, 127.05, 105.80, 102.45, 98.70, 54.85, 48.06. Anal. Calcd. For $C_{14}H_{15}NO$: C, 78.84; H, 7.09; N, 6.57. Found: C, 78.83; H, 7.13; N, 6.54.

***N*-(Benzylamino)-*p*-anisidine.**[11] **(Table 2, entry 15).** 4-Chloroanisole (0.143 g, 1.00 mmol), benzylamine (0.129 g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (100.0 μL from stock solution **A**, 1.0 × 10^{-3} mmol) gave 192.2 mg (90%) of *N*-(benzylamino)-*p*-anisidine as a pale yellow liquid. ^1H NMR ($CDCl_3$) δ 7.33-7.46 (m, 5 H), 6.86 (d, *J* = 9.0 Hz, 2 H), 6.67 (d, *J* = 8.8 Hz, 2 H), 4.33 (s, 2 H), 3.85 (s, b, 1 H), 3.80 (s, 3 H); ^{13}C NMR ($CDCl_3$) δ 151.94, 142.28, 139.56, 128.42, 127.36, 126.98, 114.70, 113.90, 55.56, 48.97.

***N*-(Phenyl)-*sec*-butylamine.**[12] **(Table 2, entry 16).** Phenyl chloride (0.113 g, 1.00 mmol), *sec*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (50.0 μL from stock solution **A**, 5.0 × 10^{-4} mmol) gave 151.6 mg (99%) of *N*-(Phenyl)-*sec*-butylamine as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.08 (dd, *J* = 8.4, 7.2 Hz, 2 H), 6.58 (tt, *J* = 7.2, 1.2 Hz, 1 H), 6.49 (dd, *J* = 8.4, 0.8 Hz, 2 H), 3.34 (s, b, 1 H), 3.32 (sext, *J* = 6.2 Hz, 1 H), 1.49-1.54 (m, 1 H), 1.35-1.42 (m, 1 H), 1.09 (d, *J* = 6.4 Hz, 3 H), 0.87 (t, *J* = 7.4 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 147.68, 129.23, 116.73, 113.06, 49.75, 29.62, 20.23, 10.35.

***N*-(4-Cyanophenyl)-*sec*-butylamine.**[13] **(Table 2, entry 17).** 4-Cyano-1-chlorobenzene (0.138 g, 1.00 mmol), *sec*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (10.0 μL from stock solution **A**, 1.0 × 10^{-4} mmol) gave 151.0 mg (87%) of *N*-(4-cyanophenyl)-*sec*-butylamine as a colorless liquid. ^{1}H NMR ($CDCl_3$) δ 7.35 (d, *J* = 8.8 Hz, 2 H), 6.49 (d, *J* = 8.8 Hz, 2 H), 4.12 (s, b, 1 H), 3.40 (sext, *J* = 6.0 Hz, 1 H), 1.45-1.60 (m, 2 H), 1.16 (d, *J* = 6.4 Hz, 3 H), 0.92 (t, *J* = 7.2 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 150.78, 133.50, 120.64, 112.12, 97.31, 49.30, 29.21, 19.77, 10.17.

***N*-(*p*-Tolyl)-*sec*-butylamine. (Table 2, entry 18).** 4-Chlorotoluene (0.127 g, 1.00 mmol), *sec*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (100.0 μL from stock solution **A**, 1.0 × 10^{-3} mmol) gave 133.8 mg (82%) of *N*-(*p*-tolyl)-*sec*-butylamine as a colorless liquid. ^{1}H NMR ($CDCl_3$) δ 7.01 (d, *J* = 8.4 Hz, 2 H), 6.65 (dd, *J* = 8.4 Hz, 2 H), 3.40 (sext, *J* = 6.0 Hz, 1 H), 3.22 (s, b, 1 H), 2.27 (s, 3 H), 1.63 (sept, *J* = 6.0 Hz, 1 H), 1.49 (sept, *J* = 7.0 Hz, 1 H), 1.19 (d, *J* = 6.4 Hz, 3 H), 0.98 (t, *J* = 7.2 Hz, 3

H); ^{13}C NMR ($CDCl_3$) δ 145.40, 129.70, 125.91, 113.33, 50.04, 29.59, 20.30, 20.22, 10.32; Anal. Calcd. For $C_{11}H_{17}N$: C, 80.93; H, 10.50; N, 8.58. Found: C, 80.71; H, 10.24; N, 8.66.

***N*-(*o*-Tolyl)benzophenone imine.**[14] **(Table 2, entry 19).** 2-Chlorotoluene (0.127 g, 1.00 mmol), benzophenone imine (0.217 g, 1.20 mmol), $Pd(OAc)_2$ (2.2 mg, 1.0 × 10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0 × 10^{-2} mmol) gave 164.8 mg (61%) of *N*-(*o*-tolyl)-benzophenone imine as a yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.20 (d, J = 7.6 Hz, 2 H), 7.32-7.40 (m, 3 H), 7.15-7.18 (m, 3 H), 7.01-7.03 (m, 2 H), 6.99 (d, J = 7.6 Hz, 1 H), 6.84 (t, J = 7.4 Hz, 1 H), 6.77 (t, J = 7.4 Hz, 1 H), 6.37 (d, J = 7.2 Hz, 1 H), 2.11 (s, 3 H); ^{13}C NMR ($CDCl_3$) δ 167.35, 150.01, 139.47, 136.40, 134.69, 130.59, 129.89, 129.27, 128.86, 128.60, 128.14, 127.82, 125.81, 123.10, 119.53, 18.21.

***N*-(2-Methoxyphenyl)benzophenone imine.**[14] **(Table 2, entry 20).** 2-Chloroanisole (0.143 g, 1.00 mmol), benzophenone imine (0.217 g, 1.20 mmol), $Pd(OAc)_2$ (2.2 mg, 1.0 × 10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0 × 10^{-2} mmol) gave 221.9 mg (77%) of *N*-(2-methoxyphenyl)benzophenone imine as a yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.69 (d, J = 8.0 Hz, 2 H), 7.28-7.39 (m, 3 H), 7.11-7.15 (m, 3 H), 7.04-7.06 (m, 2 H), 6.81 (t, J = 7.2 Hz, 1 H), 6.63 (t, J = 7.2 Hz, 1 H), 6.65 (t, J = 7.6 Hz, 1 H), 6.50 (d, J = 8.0 Hz, 1 H), 3.60 (s, 3 H); ^{13}C NMR ($CDCl_3$) δ 169.61, 149.41, 141.04, 139.40, 136.82, 130.58, 129.45, 128.68, 128.44, 128.05, 127.53, 123.96, 120.98, 120.41, 110.95, 55.26.

***N*-(3-Methoxyphenyl)benzophenone imine. (Table 2, entry 21).** 3-Chloroanisole (0.143 g, 1.00 mmol), benzophenone imine (0.217 g, 1.20 mmol), $Pd(OAc)_2$ (2.2 mg, 1.0 × 10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0 × 10^{-2} mmol) gave 247.6 mg (86%) of

N-(3-methoxyphenyl)benzophenone imine as a yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.67 (d, *J* = 8.0 Hz, 2 H), 7.31-7.41 (m, 3 H), 7.16-7.23 (m, 3 H), 7. 06 (dd, *J* = 7.6, 1.6 Hz, 2 H), 6.95 (t, *J* = 8.0 Hz, 1 H), 6.41 (dd, *J* = 8.0, 2.2 Hz, 1 H), 6.26 (t, *J* = 2.2 Hz, 1 H), 6.21 (dd, *J* = 7.6, 1.6 Hz, 1 H), 3.59 (s, 3 H); ^{13}C NMR ($CDCl_3$) δ 168.20, 159.75, 152.44, 139.53, 136.16, 130.67, 129.31, 129.26, 129.16, 128.54, 128.11, 127.84, 113.32, 109.15, 106.50, 55.03. Anal. Calcd. For $C_{20}H_{17}NO$: C, 83.59; H, 5.96; N, 4.87. Found: C, 83.65; H, 5.96; N, 4.86.

***N*-(2-Methoxyphenyl)benzophenone hydrazone.**[15] **(Table 2, entry 22).** 2-Chloroanisole (0.143 g, 1.00 mmol), benzophenone hydrazone (0.236 g, 1.20 mmol), $Pd(OAc)_2$ (2.2 mg, 1.0×10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0×10^{-2} mmol) gave 261.5 mg (87%) of *N*-(2-methoxyphenyl)benzophenone hydrazone as a yellow liquid. ^{1}H NMR ($CDCl_3$) δ 8.03 (s, 1 H), 7.71 (d, *J* = 7.6, 1.4 Hz, 1 H), 7.60 (tt, *J* = 7.2, 1.6 Hz, 2 H), 7.52 (tt, *J* = 7.6, 1.6 Hz, 1 H), 7.45 (dt, *J* = 6.8, 1.6 Hz, 2 H), 7.37-7.39 (m, 2 H), 7.30-7.36 (m, 3 H), 7.01 (td, *J* = 7.6, 1.2 Hz, 1 H), 6.82 (td, *J* = 7.6, 1.2 Hz, 1 H), 6.78 (dd, *J* = 8.0, 1.2 Hz, 1 H), 3.69 (s, 3 H); ^{13}C NMR ($CDCl_3$) δ 145.34, 144.76, 138.52, 134.16, 133.00, 129.49, 129.02, 128.10, 127.85, 126.48, 121.50, 119.11, 112.29, 110.00, 55.46.

***N*-(3-Methoxyphenyl)benzophenone hydrazone.**[16] **(Table 2, entry 23).** 3-Chloroanisole (0.143 g, 1.00 mmol), benzophenone hydrazone (0.236 g, 1.20 mmol), $Pd(OAc)_2$ (2.2 mg, 1.0×10^{-2} mmol) and CyPF-*t*-Bu (5.5 mg, 1.0×10^{-2} mmol) gave 247.9 mg (82%) of *N*-(3-methoxyphenyl)benzophenone hydrazone as an orange solid. ^{1}H NMR ($CDCl_3$) δ 7.59-7.64 (m, 4 H), 7.53-7.56 (m, 2 H), 7.29-7.37 (m, 5 H), 7.16 (t, *J* = 8.0 Hz, 1 H), 6.82 (t, *J* = 2.2 Hz, 1 H), 6.59 (dd, *J* = 7.6, 1.6 Hz, 1 H), 6.45 (dd, *J* = 8.0, 2.0 Hz, 1 H), 3.85 (s, 3 H); ^{13}C NMR ($CDCl_3$) δ 160.77, 145.88, 144.19, 138.24, 132.66, 129.88, 129.62, 129.19, 129.06, 128.10, 127.98, 126.44, 105.62, 105.57, 98.72, 55.14.

General Procedure for Catalytic Amination of Functionalized Aryl Chlorides. The reaction conditions and average yields for each reaction are shown in Table 3. A typical procedure is given for the first entry in Table 3.

1-(4-*N*-*Iso*-butylamino-phenyl)-ethanol. (Table 3, entry 1) 4-Chlorophenyl-1-ethanol (0.157 g, 1.00 mmol) was added to a 4 mL vial containing $Pd(OAc)_2$ (1.1 mg, 5.0×10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0×10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) in 1.0 mL of DME. Isobutylamine (87.8 mg, 1.20 mmol) was then added by syringe. The vial was sealed with a cap containing a PTFE septum, and the reaction mixture was stirred at 100° C for 18 h. The reaction mixture then was allowed to cool to room temperature. To the reaction mixture was added 1 M HCl (0.5-1.0 mL). The mixture was stirred at room temperature for 5 min and was then neutralized with a saturated solution of $NaHCO_3$ (0.5-1.0 mL). After extraction with CH_2Cl_2 (3 × 30.0 mL), the organic layer was separated and dried over Na_2SO_4. The solvent was evaporated, and the crude product was isolated by eluting with hexane/ethyl acetate (95/5) to give 174.4 mg (90%) of 1-(*N*-Isobutylamino-phenyl)-ethanol as a pale yellow liquid. ^{1}H NMR ($CDCl_3$) δ 7.08 (d, *J* = 8.4 Hz, 2 H), 6.45 (d, *J* = 8.4 Hz, 2 H), 4.66 (q, *J* = 6.4 Hz, 1 H), 3.65 (s, b, 1H), 2.84 (d, *J* = 6.8 Hz, 2 H), 1.80 (nonet, *J* = 6.6 Hz, 1 H), 1.36 (d, *J* = 6.4 Hz, 3 H), 0.90 (d, *J* = 6.8 Hz, 6 H); ^{13}C NMR ($CDCl_3$) δ 147.89, 134.17, 126.52, 112.43, 69.96, 51.77, 27.84, 24.60, 20.38.

Anal. Calcd. For $C_{12}H_{19}NO$: C, 74.57; H, 9.91; N, 7.25. Found: C, 74.30; H, 9.99; N, 7.19.

1-(4-*N*-cyclohexylamino-phenyl)-ethanol. (Table 3, entry 2) 4-Chlorophenyl-1-ethanol (0.157 g, 1.00 mmol), cyclohexylamine (0.119 g, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0×10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0×10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 153.3 mg (70%) of 1-(*N*-cyclohexylamino-phenyl)-ethanol as a white solid. ^1H NMR ($CDCl_3$) δ 7.14 (d, J = 6.8Hz, 2 H), 6.55 (d, J = 7.2 Hz, 2 H), 4.74 (q, J = 5.2 Hz, 1 H), 3.23 (tt, J = 8.2, 3.2 Hz, 1 H), 3.00 s, b, 1 H), 2.04 (dd, J = 10.6, 1.8 Hz, 2 H), 1.75 (dt, J = 11.2, 3.0 Hz, 2 H), 1.64 (dt, J = 10.8, 3.2 Hz, 1 H), 1.44 (d, J = 5.2 Hz, 3 H), 1.32-1.46 (m, 2 H), 1.10-1.25 (m, 3 H); ^{13}C NMR ($CDCl_3$) δ 146.82, 134.05, 126.59, 112.97, 70.05, 51.70, 33.38, 25.85, 24.92, 24.57. Anal. Calcd. For $C_{14}H_{21}NO$: C, 76.67; H, 9.65; N, 6.39. Found: C, 76.68; H, 9.76; N, 6.34.

1-(4-*N*-*sec*-Butylamino-phenyl)-ethanol. (Table 3, entry 3) 4-Chlorophenyl-1-ethanol (0.157 g, 1.00 mmol), *sec*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0×10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0×10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 160.7 mg (83%) of 1-(*N*-*sec*-butylamino-phenyl)-ethanol as a pale yellow liquid. ^1H NMR ($CDCl_3$) δ 7.15 (d, J = 8.8 Hz, 2 H), 6.54 (d, J = 8.0 Hz, 2 H), 4.74 (q, J = 6.6 Hz, 1 H), 3.38 (sext, J = 6.2 Hz, 1 H), 3.00 (s, b, 1H), 2.20 (s, b, 1 H), 1.54-1.62 (m, 1 H), 1.41-1.51 (m, 1 H), 1.44 (d, J = 6.4 Hz, 3 H), 1.16 (d, J = 6.0 Hz, 3 H), 0.95 (t, J = 7.4 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 147.03, 133.93, 126.56, 112.84, 69.93, 49.73, 29.46, 24.52, 20.08, 10.26.Anal. Calcd. For $C_{12}H_{19}NO$: C, 74.57; H, 9.91; N, 7.25. Found: C, 74.20; H, 9.86; N, 7.20.

2-(4-*N*-*Iso*-butylamino-phenyl)-ethanol. (Table 3, entry 4) 4-Chlorophenyl-2-ethanol (0.157 g, 1.00 mmol), Isobutylamine (87.8 mg, 1.20 mmol), Pd(OAc)$_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 167.4 mg (87%) of 2-(*N*-*Iso*-butylamino-phenyl)-ethanol as a pale yellow solid. ^{1}H NMR (CDCl$_3$) δ 7.01 (d, *J* = 8.4 Hz, 2 H), 6.55 (d, *J* = 8.4 Hz, 2 H), 3.76 (t, *J* = 6.6 Hz, 2 H), 3.35 (s, b, 1 H), 2.90 (d, *J* = 6.8 Hz, 2 H), 2.73 (t, *J* = 6.4 Hz, 2 H), 2.00 (s, b, 1 H), 1.86 (nonet, *J* = 6.6 Hz, 1 H), 0.96 (d, *J* = 6.8 Hz, 6 H); ^{13}C NMR (CDCl$_3$) δ 147.14, 129.77, 126.41, 112.91, 63.93, 51.96, 38.20, 27.94, 20.45.Anal. Calcd. For $C_{12}H_{19}NO$: C, 74.57; H, 9.91; N, 7.25. Found: C, 74.31; H, 9.95; N, 7.17.

2-(4-*N*-cyclohexylamino-phenyl)-ethanol. (Table 3, entry 5) 4-Chlorophenyl-2-ethanol (0.157 g, 1.00 mmol), cyclohexylamine (0.119 g, 1.20 mmol), Pd(OAc)$_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 188.1 mg (86%) of 2-(*N*-cyclohexylamino-phenyl)-ethanol as a colorless liquid. ^{1}H NMR (CDCl$_3$) δ 6.99 (d, *J* = 8.8 Hz, 2H), 6.53 (d, *J* = 8.0 Hz, 2H), 3.77 (t, *J* = 6.6 Hz, 2H), 3.21 (tt, *J* = 10.2, 3.6 Hz, 1H), 3.40 s, b, 1H), 2.72 (t, *J* = 6.6 Hz, 2 H), 2.03 (dd, *J* = 13.2, 3.2 Hz, 2H), 1.74 (dt, *J* = 13.2, 4.0 Hz, 2H), 1.63 (dt, *J* = 12.8, 4.0 Hz, 1 H), 1.30--1.41 (m, 2H), 1.08-1.26 (m, 3H); ^{13}C NMR (CDCl$_3$) δ 146.05, 129.82, 126.31, 113.47, 63.94, 51.89, 38.26, 33.51, 25.93, 24.99. Anal. Calcd. For $C_{14}H_{21}NO$: C, 76.67; H, 9.65; N, 6.39. Found: C, 76.45; H, 9.76; N, 6.41.

4-Hydroxy-*N*-octyl-aniline. (Table 3, entry 6) 4-Chlorophenol (0.129 g, 1.00 mmol), octylamine (0.155g, 1.20 mmol), Pd(OAc)$_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8

mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 159.6 mg (72%) of 4-hydroxy-*N*-octyl-aniline as a white solid. ^{1}H NMR ($CDCl_3$) δ 6.62 (d, *J* = 6.4 Hz, 2 H), 6.53 (d, *J* = 6.4 Hz, 2 H), 4.50-5.20 (s, b, 2 H), 3.02 (t, *J* = 6.8 Hz, 2 H), 1.56 (quint, *J* = 7.0 Hz, 2 H), 1.27-1.35 (m, 10 H), 0.88 (t, *J* = 7.0 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 148.45, 141.73, 116.28, 115.29, 45.68, 31.76, 29.42, 29.35, 29.19, 27.11, 22.60, 14.06. Anal. Calcd. For $C_{14}H_{23}NO$: C, 75.97; H, 10.47; N, 6.33. Found: C, 75.88; H, 10.57; N, 6.33.

4-Hydroxy-*N*-*sec*-butyl-aniline. (Table 3, entry 7) 4-Chlorophenol (0.129 g, 1.00 mmol), *sec*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 109.1 mg (66%) of 4-hydroxy-*N*-*sec*-butyl-aniline as a pale yellow solid. ^{1}H NMR ($CDCl_3$) δ 6.62 (d, *J* = 6.4Hz, 2 H), 6.52 (d, *J* = 6.4 Hz, 2 H), 4.55 (s, b, 2 H), 3.27 (s, b, 1H), 1.56-1.62 (m, 1 H), 1.35-1.42 (m, 1 H), 1.12 (d, *J* = 6.4 Hz, 3 H), 0.91 (t, *J* = 7.6 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 148.16, 140.96, 116.32, 116.00, 51.50, 29.32, 19.94, 10.74. Anal. Calcd. For $C_{10}H_{15}NO$: C, 72.69; H, 9.15; N, 8.48. Found: C, 72.51; H, 9.19; N, 8.37.

3-Hydroxy-*N*-octyl-aniline.[17] **(Table 3, entry 8)** 3-Chlorophenol (0.129 g, 1.00 mmol), octylamine (0.155g, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 188.6 mg (85%) of 3-hydroxy-*N*-octyl-aniline as a pale yellow solid. ^{1}H NMR ($CDCl_3$) δ 6.99 (t, *J* = 8.0 Hz, 1 H), 6.20 (dd, *J* = 7.4, 2.0 Hz, 1 H), 6.17 (dd, *J* = 7.4, 2.0 Hz, 1 H), 6.06 (t, *J* = 2.0 Hz, 1 H), 4.20-5.20 (s, b, 2H), 3.00 (t, *J* = 7.2 Hz, 2 H), 1.56

(quint, *J* = 7.2 Hz, 2 H), 1.27-1.35 (m, 10 H), 0.89 (t, *J* = 7.0 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 156.67, 149.73, 130.11, 106.10, 104.93, 100.40, 44.24, 31.76, 29.34, 29.32, 29.21, 27.07, 22.60, 14.05.

3-Hydroxy-*N*-*sec*-butyl-aniline. (Table 3, entry 9) 3-Chlorophenol (0.129 g, 1.00 mmol), *sec*-butylamine (0.119 g, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 111.4 mg (67%) of 3-hydroxy-*N*-*sec*-butyl-aniline as a pale yellow solid. ^{1}H NMR ($CDCl_3$) δ 6.98 (t, *J* = 8.0 Hz, 1 H), 6.17 (dd, *J* = 8.2, 1.4 Hz, 1 H), 6.14 (dd, *J* = 8.0, 1.2 Hz, 1 H), 6.05 (t, *J* = 2.4 Hz, 1 H), 4.20-5.20 (s, b, 2 H), 3.31 (sext, *J* = 6.4 Hz, 1 H), 1.39-1.61 (m, 2 H), 1.12 (d, *J* = 7.6 Hz, 3 H), 0.91 (t, *J* = 7.6 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 156.65, 149.08, 130.15, 106.46, 104.22, 100.33, 49.98, 29.44, 20.04, 10.26. Anal. Calcd. For $C_{10}H_{15}NO$: C, 72.69; H, 9.15; N, 8.48. Found: C, 72.49; H, 9.28; N, 8.29.

3-Hydroxy-*N*-benzyl-aniline. (Table 3, entry 10) 3-Chlorophenol (0.129 g, 1.00 mmol), benzylamine (0.129 g, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 168.1 mg (84%) of 3-hydroxy-*N*-benzyl-aniline as a pale yellow solid. ^{1}H NMR ($CDCl_3$) δ 7.34-7.42 (m, 5 H), 7.07 (t, *J* = 8.0 Hz, 1 H), 6.29 (dd, *J* = 8.6, 1.8 Hz, 1 H), 6.26 (dd, *J* = 8.0, 2.4 Hz, 1 H), 6.16 (t, *J* = 2.2 Hz, 1 H), 4.50-5.50 (s, b, 2H), 4.29 (s, 2 H); ^{13}C NMR ($CDCl_3$) δ 156.47, 149.46, 139.01, 130.18, 128.53, 127.44, 127.16, 106.01, 104.92, 100.12, 48.17. Anal. Calcd. For $C_{13}H_{13}NO$: C, 78.36; H, 6.58; N, 7.03. Found: C, 78.17; H, 6.51; N, 6.84.

4'-*N*-*sec*-Butylamino-acetophenone. (Table 3, entry 11) 4'-Chloro-acetophenone (0.155 g, 1.00 mmol), *sec*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 166.2 mg (87%) of 4'-*N*-*sec*-butylaminoacetophenone as a pale yellow liquid. ^1H NMR ($CDCl_3$) δ 7.78 (d, *J* = 7.6 Hz, 2 H), 6.50 (d, *J* = 8.0 Hz, 2 H), 4.14 (s, b, 1H), 3.40-3.50 (m, 1 H), 2.45 (s, 3 H), 1.46-1.60 (m, 2 H), 1.17 (d, *J* = 5.2 Hz, 3 H), 0.93 (t, *J* = 6.0 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 196.09, 151.67, 130.80, 125.97, 111.42, 49.41, 29.46, 25.84, 20.01, 10.24. Anal. Calcd. For $C_{12}H_{17}NO$: C, 75.35; H, 8.96; N, 7.32. Found: C, 74.97; H, 9.05; N, 7.25.

4'-*N*-*Iso*-Butylamino-acetophenone. (Table 3, entry 12) 4'-Chloro-acetophenone (0.155 g, 1.00 mmol), *iso*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 175.5 mg (92%) of 4'-*N*-*iso*-butylaminoacetophenone as a pale yellow liquid. ^1H NMR ($CDCl_3$) δ 7.78 (d, *J* = 7.2 Hz, 2 H), 6.52 (d, *J* = 7.2 Hz, 2 H), 4.38 (s, b, 1H), 2.97 (d, *J* = 5.6 Hz, 2 H), 2.46 (s, 3 H), 1.88 (nonet, *J* = 5.2 Hz, 1 H), 0.96 (d, *J* = 6.8 Hz, 6 H); ^{13}C NMR ($CDCl_3$) δ 196.18, 152.44, 130.74, 126.21, 111.15, 50.94, 27.99, 25.88, 20.29. Anal. Calcd. For $C_{12}H_{17}NO$: C, 75.35; H, 8.96; N, 7.32. Found: C, 75.01; H, 9.03; N, 7.26.

4'-*N*-Benzyl-acetophenone. (Table 3, entry 13) 4'-Chloro-acetophenone (0.155 g, 1.00 mmol), benzylamine (0.129 g, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 155.9 mg (69%) of 4'-*N*-benzylacetophenone as a yellow solid. ^1H

NMR ($CDCl_3$) δ 7.69 (d, *J* = 7.4 Hz, 2 H), 7.18-7.25 (m, 5 H), 6.48 (d, *J* = 6.8 Hz, 2 H), 4.70 (s, b, 1H), 4.28 (s, 2 H), 2.36 (s, 3 H); ^{13}C NMR ($CDCl_3$) δ 196.23, 151.94, 138.19, 130.67, 128.65, 127.38, 127.20, 126.73, 111.49, 47.39, 25.87. Anal. Calcd. For $C_{15}H_{15}NO$: C, 79.97; H, 6.71; N, 6.22. Found: C, 79.81; H, 6.72; N, 6.29.

4-*N*-*Iso*-Butylamino-benzamide (Table 3, entry 14) 4-Chlorobenzamide (0.156 g, 1.00 mmol), *iso*-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ (1.1 mg, 5.0 × 10^{-3} mmol), CyPF-*t*-Bu (2.8 mg, 5.0 × 10^{-3} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 129.6 mg (67%) of 4-*N*-*Iso*-Butylamino-benzamide as a white solid. ^1H NMR ($CDCl_3$) δ 7.63 (d, *J* = 7.2 Hz, 2 H), 6.53 (d, *J* = 7.2 Hz, 2 H), 5.96 (s, b, 2 H), 4.04 (s, b, 2 H), 2.94 (d, *J* = 5.2 Hz, 2 H), 1.86 (nonet, *J* = 5.2 Hz, 1 H), 0.95 (d, *J* = 5.6 Hz, 6 H); ^{13}C NMR ($CDCl_3$) δ 169.50, 151.52, 129.23, 120.87, 111.48, 51.13, 27.98, 20.33. Anal. Calcd. For $C_{11}H_{16}N_2O$: C, 68.72; H, 8.39; N, 14.57. Found: C, 68.70; H, 8.43; N, 14.32.

4-*N*-Octylamino-benzoic acid. (Table 3, entry 15) 4-Chlorobenzoic acid (0.157 g, 1.00 mmol), octylamine (0.155g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (50.0 μL from stock solution **A**, 5.0 × 10^{-4} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 202.2 mg (81%) of *N*-octyl-aminobenzoic acid as a white solid. ^1H NMR (CD_3OD) δ 7.75 (d, *J* = 9.2 Hz, 2 H), 6.55 (d, *J* = 9.2 Hz, 2 H), 4.70-5.20 (s, b, 2 H), 3.09 (t, *J* = 7.2 Hz, 2 H), 1.59 (quint, *J* = 7.2 Hz, 2 H), 1.27-1.35 (m, 10 H), 0.88 (t, *J* = 7.0 Hz, 3 H); ^{13}C NMR (CD_3OD) δ 171.02, 154.82, 132.92, 117.93, 112.09, 44.15, 33.17, 30.72, 30.60, 30.31, 28.40, 23.89, 14.62. Anal. Calcd. For :$C_{15}H_{23}NO_2$ C, 72.25; H, 9.30; N, 5.62. Found: C, 72.19; H, 9.43; N, 5.56.

4-*N*-*sec*-butylamino-benzoic acid (Table 3, entry 16) 4-Chlorobenzoic acid (0.157 g, 1.00 mmol), sec-butylamine (87.8 mg, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (50.0 μL from stock solution **A**, 5.0 × 10^{-4} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 168.8 mg (85%) of 4-*N*-*sec*-butylbenzoic acid as a white solid. ^1H NMR ($CDCl_3$) δ 7.25-9.00 (s, b, 1 H), 7.89 (d, *J* = 6.8 Hz, 2 H), 6.52 (d, *J* = 6.8 Hz, 2 H), 4.70-5.20 (s, b, 1H), 3.47 (sext, *J* = 5.2 Hz, 1 H), 1.46-1.62 (m, 2 H), 1.19 (d, *J* = 4.8 Hz, 3 H), 0.94 (t, *J* = 6.0 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 172.55, 152.03, 132.37, 116.67, 111.61, 49.53, 29.51, 20.04, 10.29.

3-*N*-cyclohexylamino-acetanilide. (Table 3, entry 17) 3-Chloroacetanilide (0.170 g, 1.00 mmol), cyclohexylamine (0.119g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (50.0 μL from stock solution **A**, 5.0 × 10^{-4} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 172.6 mg (74%) of 3-*N*-cyclohexylamino-acetanilide as a yellow solid. ^1H NMR ($CDCl_3$) δ 7.81 (s, 1H), 7.02 (t, *J* = 6.4 Hz, 1 H), 6.99 (s, 1 H), 6.62 (d, *J* = 6.4 Hz, 1 H), 6.29 (d, *J* = 6.4 Hz, 1 H), 3.40 (s, b, 1H), 3.18 (tt, *J* = 8.0, 3.0 Hz, 1 H), 2.08 (s, 3 H), 1.98 (dd, *J* = 10.0, 2.0 Hz, 2 H), 1.70 (dt, *J* = 10.8, 2.8 Hz, 2 H), 1.59 (dt, *J* = 10.0, 3.0 Hz, 1 H), 1.26-1.34 (m, 2 H), 1.04-1.23 (m, 3 H); ^{13}C NMR ($CDCl_3$) δ 168.64, 147.95, 139.03, 129.43, 108.80, 108.17, 104.75, 51.52, 31.22, 25.78, 24.84, 24.47.

3-*N*-Octylamino-acetanilide (Table 3, entry 18) 3-Chloroacetanilide (0.170 g, 1.00 mmol), octylamine (0.155g, 1.20 mmol), $Pd(OAc)_2$ and CyPF-*t*-Bu (50.0 μL from stock solution **A**, 5.0 × 10^{-4} mmol) and lithium bis(trimethylsilyl)amide (0.402 g, 2.40 mmol) gave 202.2 mg (99%) of 3-*N*-octyl-amino-acetanilide as a yelow solid. ^1H

NMR ($CDCl_3$) δ 7.65 (s, 1H), 7.04 (t, *J* = 8.0 Hz, 1 H), 7.00 (s, 1 H), 6.63 (d, *J* = 7.6 Hz, 1 H), 6.31 (d, *J* = 8.0 Hz, 1 H), 3.59 (s, b, 1H), 3.03 (t, *J* = 7.0 Hz, 2 H), 2.08 (s, 3 H), 1.55 (quint, *J* = 7.2 Hz, 1 H), 1.27-1.35 (m, 10 H), 0.86 (t, *J* = 7.0 Hz, 3 H); ^{13}C NMR ($CDCl_3$) δ 168.58, 149.18, 138.97, 129.47, 108.38, 104.32, 43.90, 31.79, 29.43, 29.38, 29.23, 27.12, 24.60, 22.62, 14.09. Anal. Calcd. For $C_{16}H_{26}N_2O$: C, 73.24; H, 9.99; N, 10.68. Found: C, 73.12; H, 10.18; N, 10.57.

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Table 1, entry 4, *N*-Cyclohexyl-2-aminopyridine

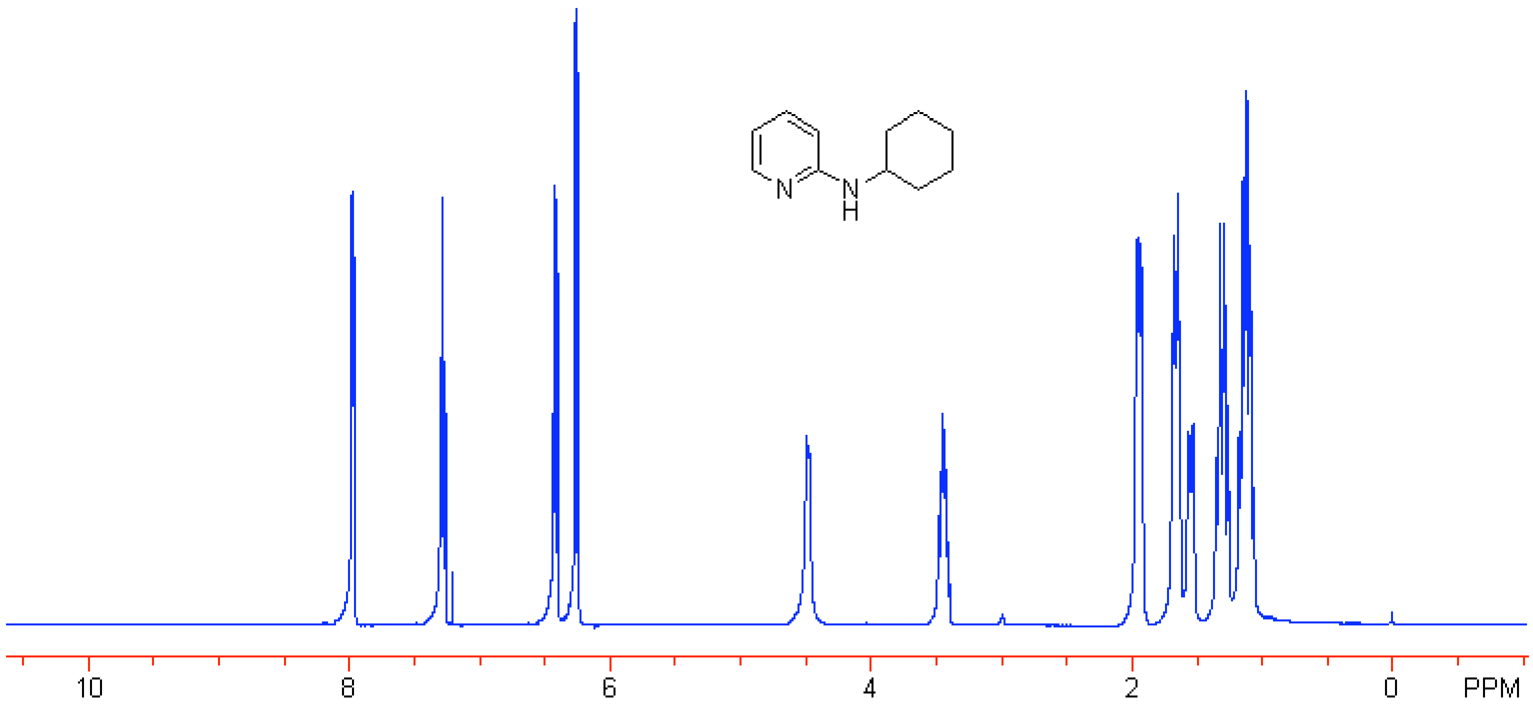


Table 1, entry 4, *N*-Cyclohexyl-2-aminopyridine

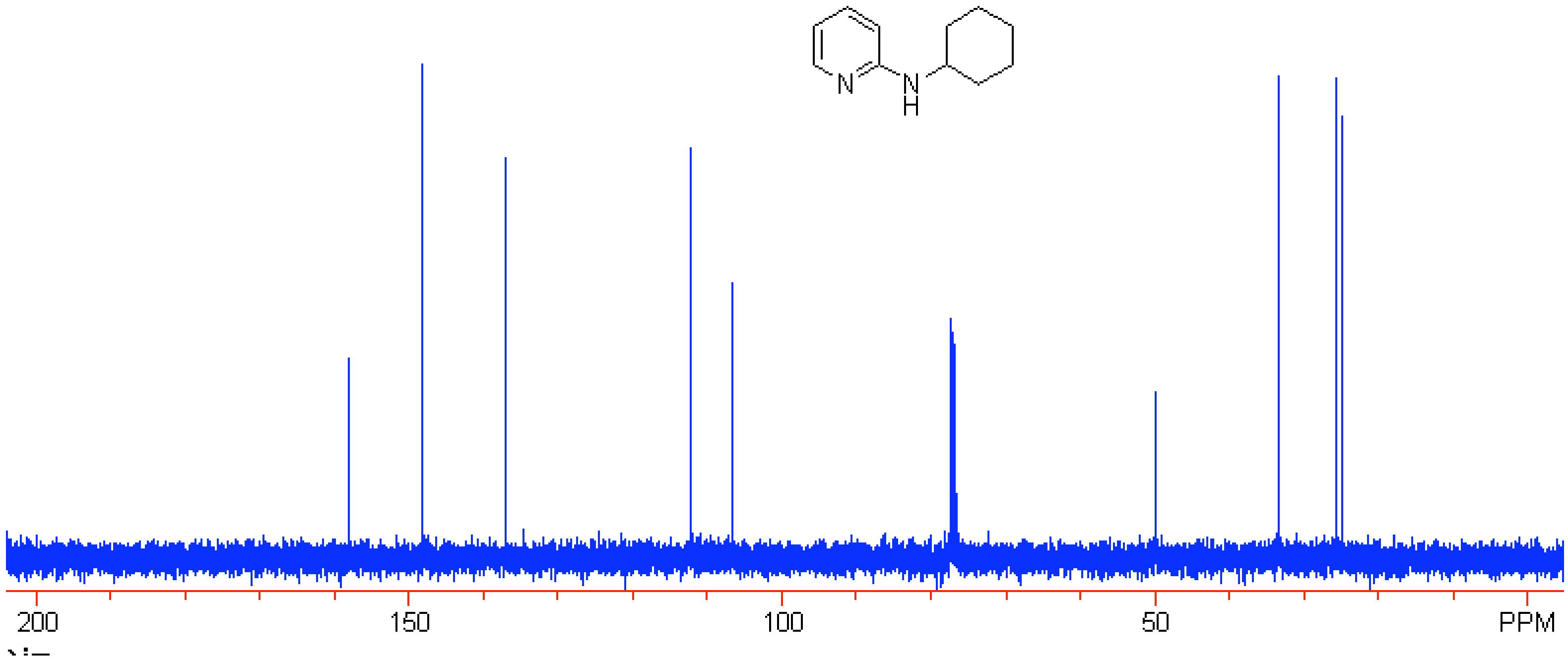


Table 1, entry 5, *N*-*tert*-Butyl-2-aminopyridine

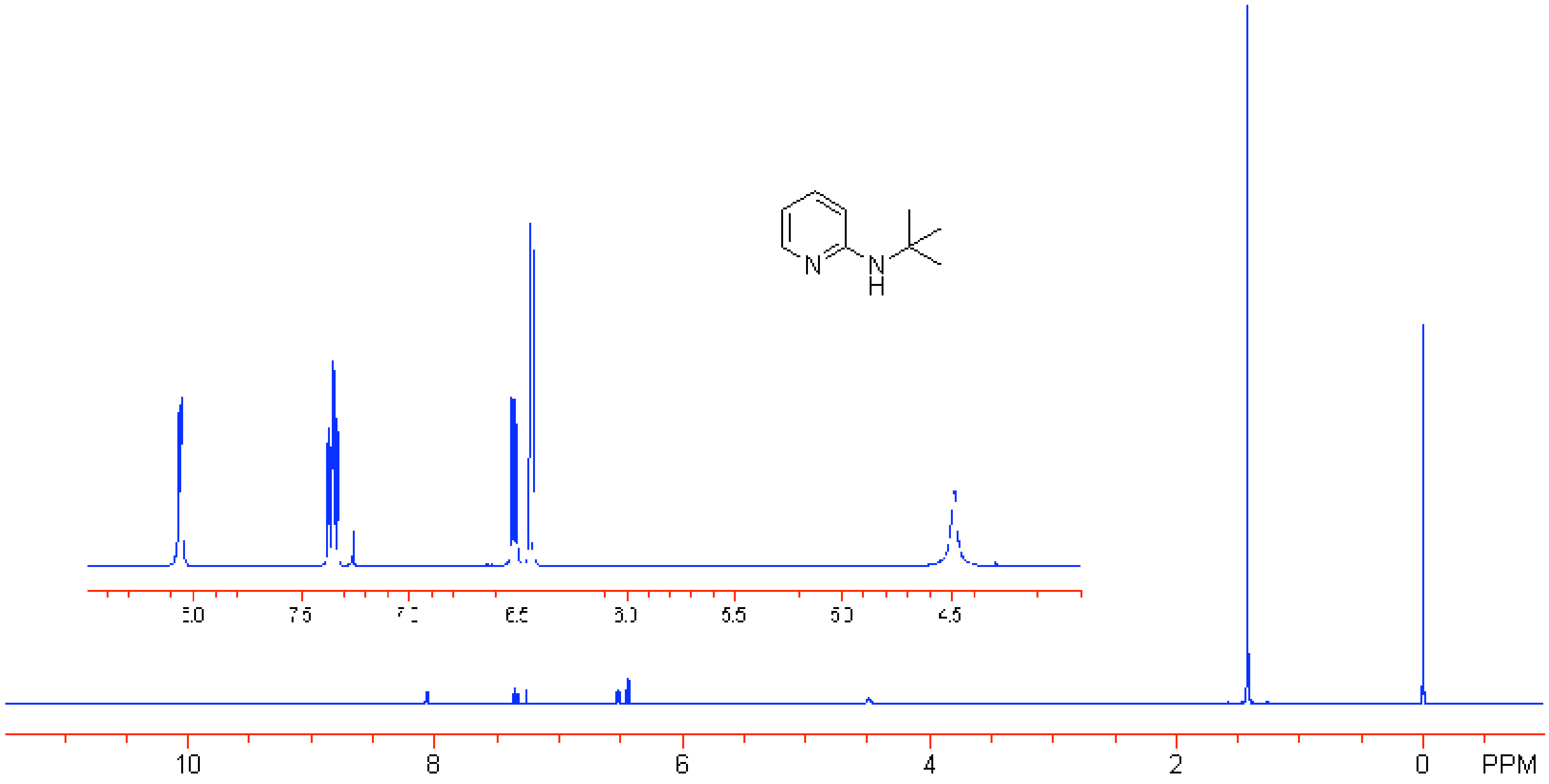


Table 1, entry 5, *N-tert*-Butyl-2-aminopyridine

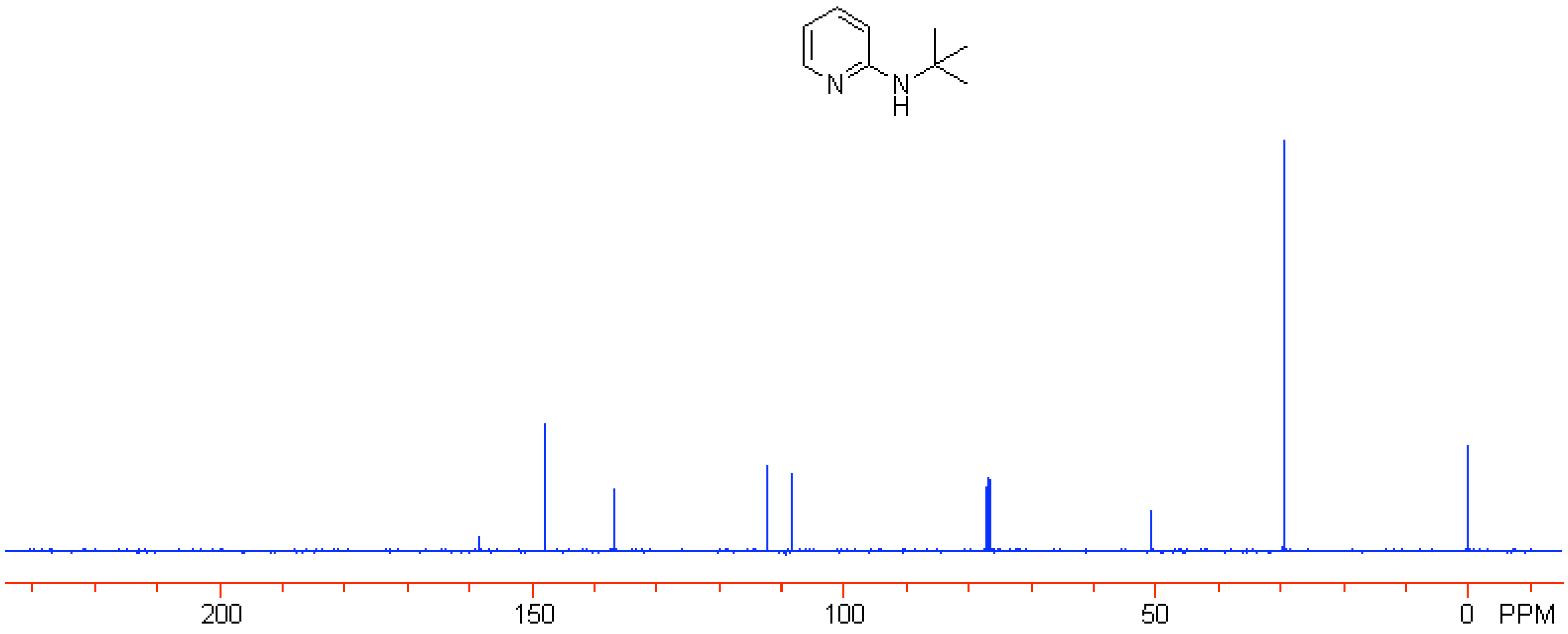


Table 1, entry 11, *N*-Benzyl-3-aminopyridine

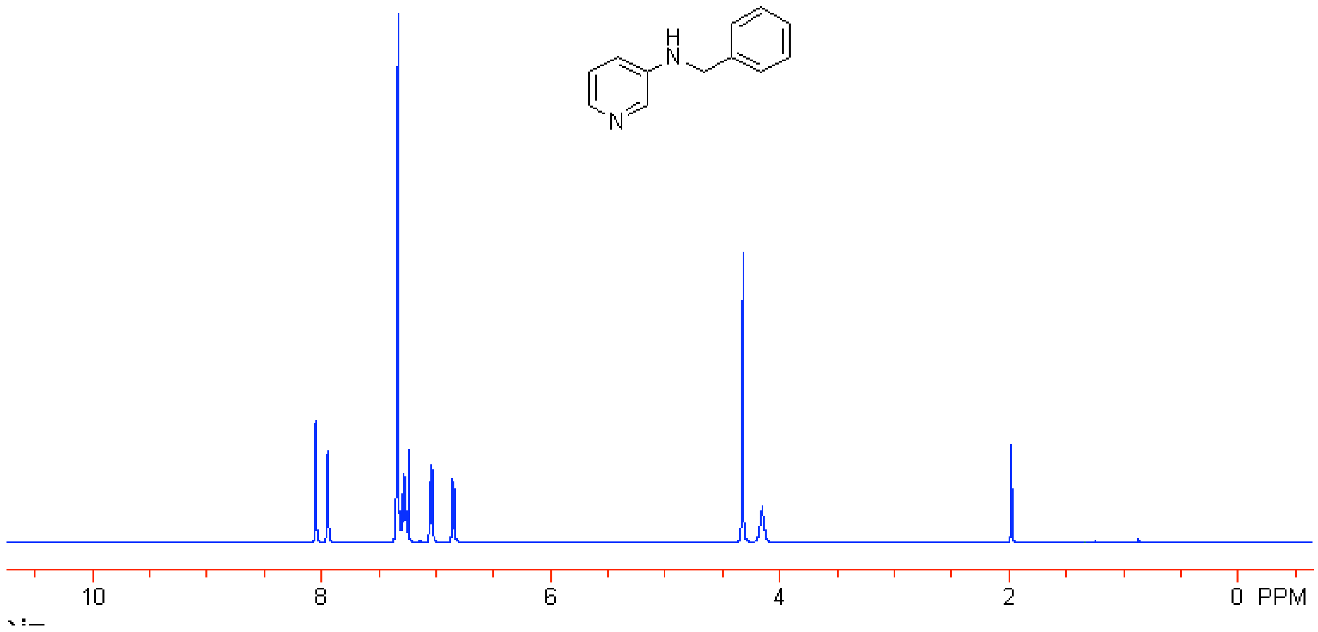
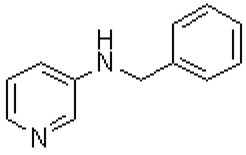


Table 1, entry 11, *N*-Benzyl-3-aminopyridine



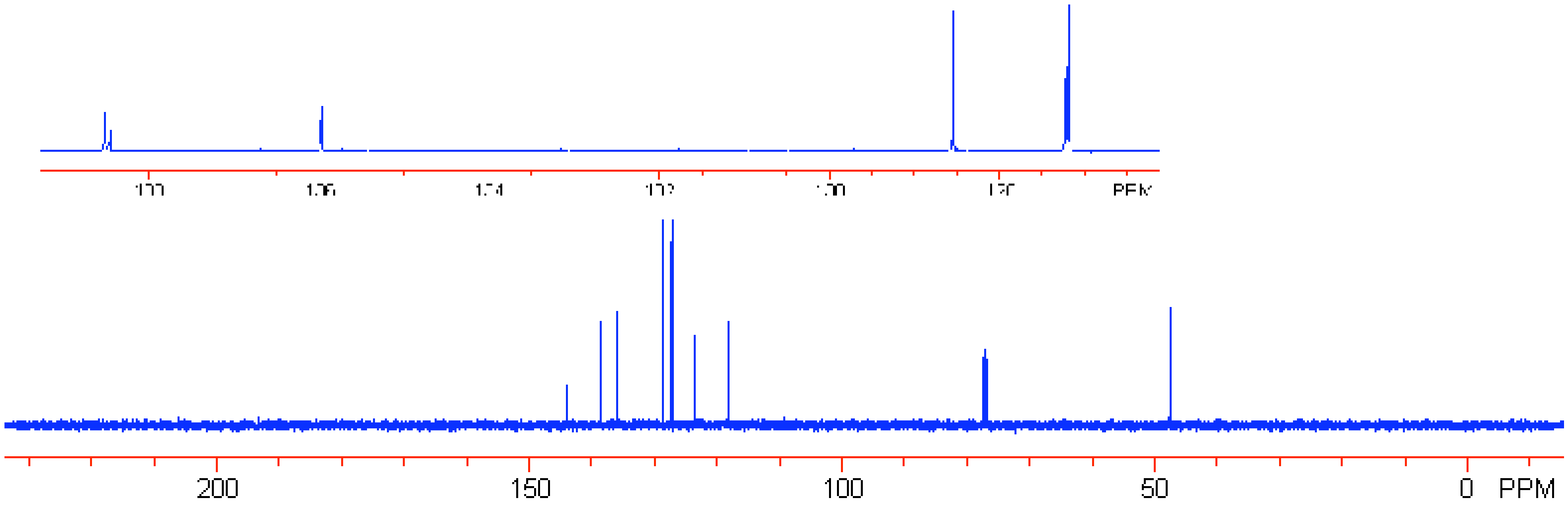
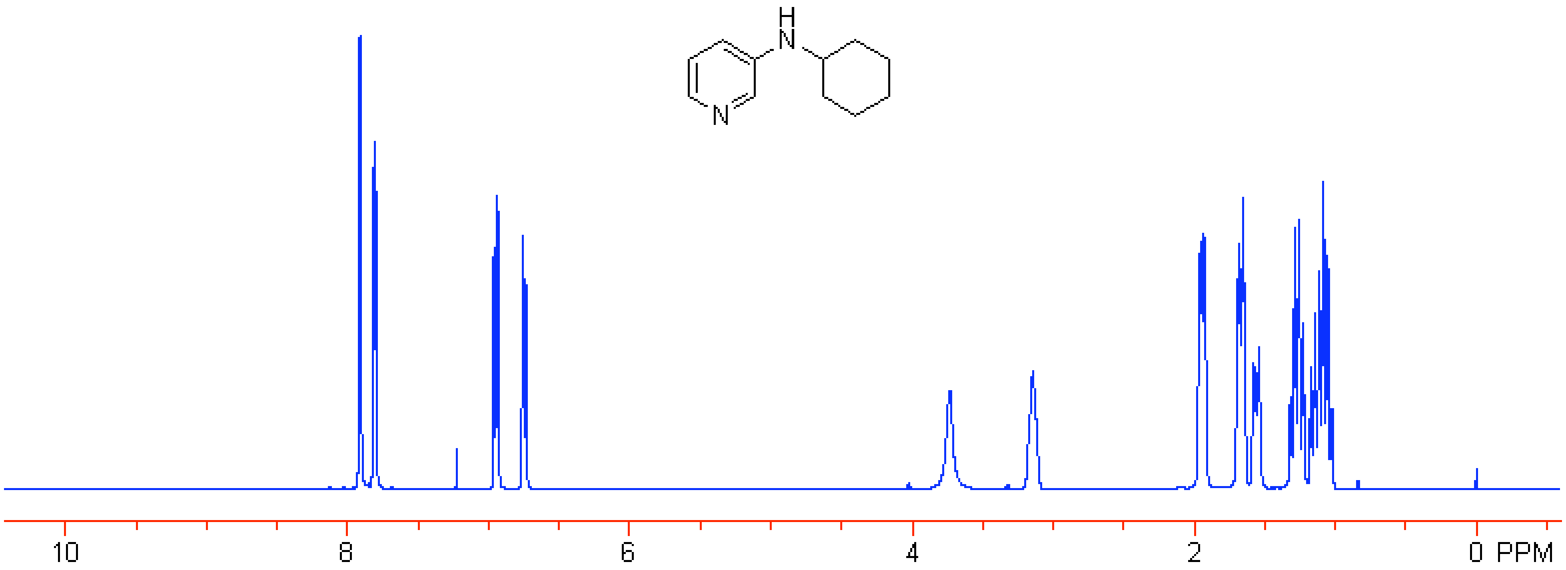


Table 1, entry 13, N-Cyclohexyl-3-aminopyridine



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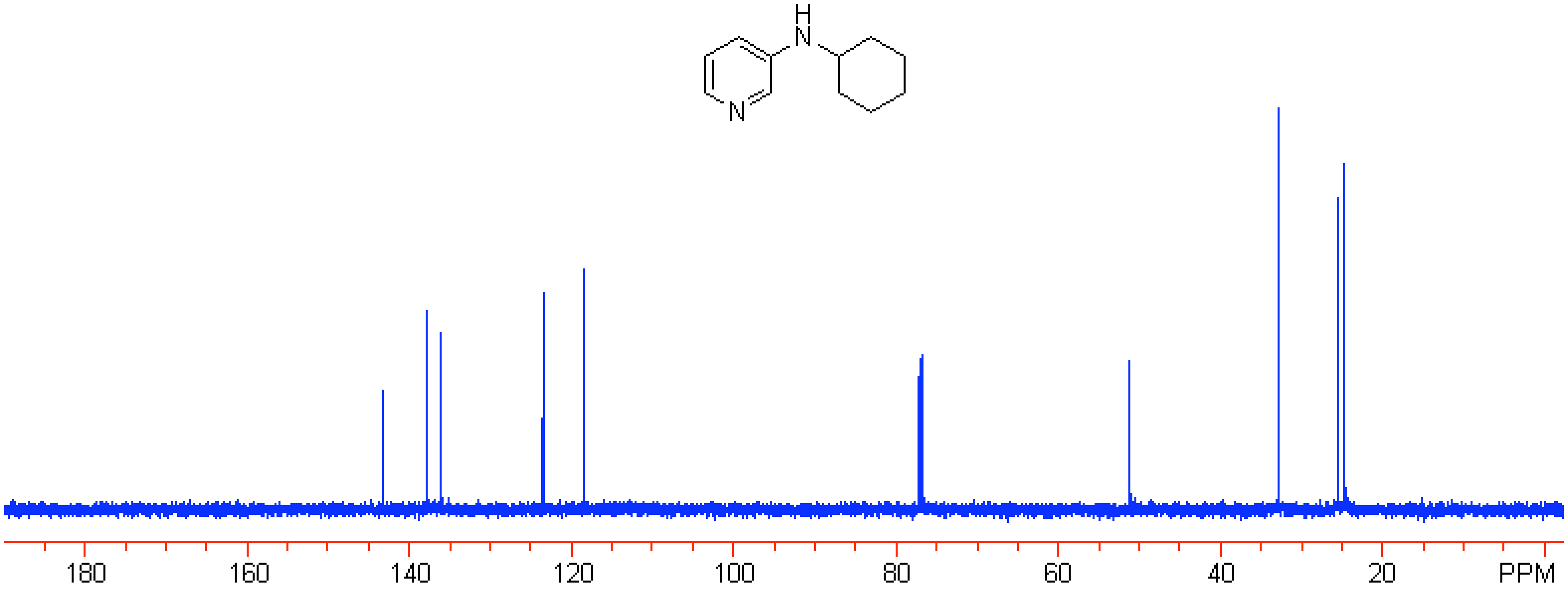


Table 1, entry 14, *N*-*tert*-butyl-3-aminopyridine

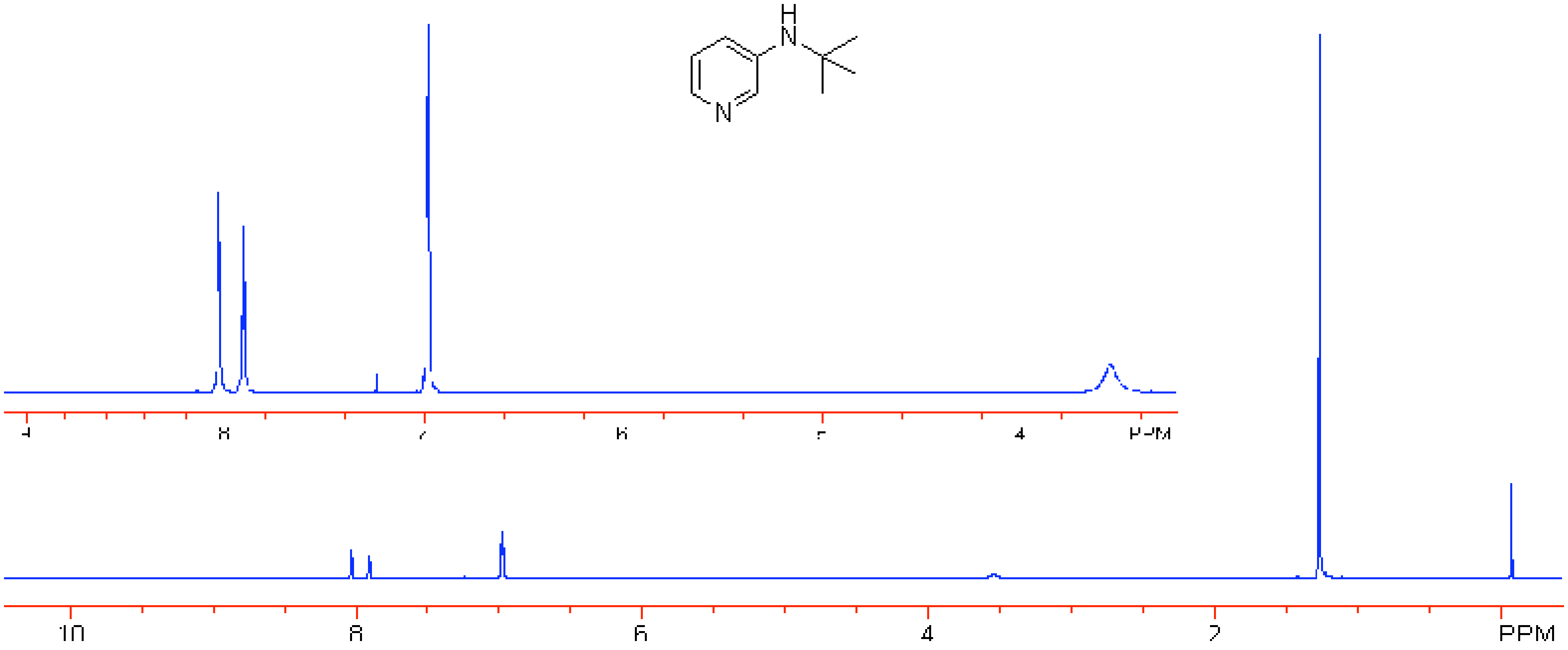


Table 1, entry 14, *N*-*tert*-butyl-3-aminopyridine

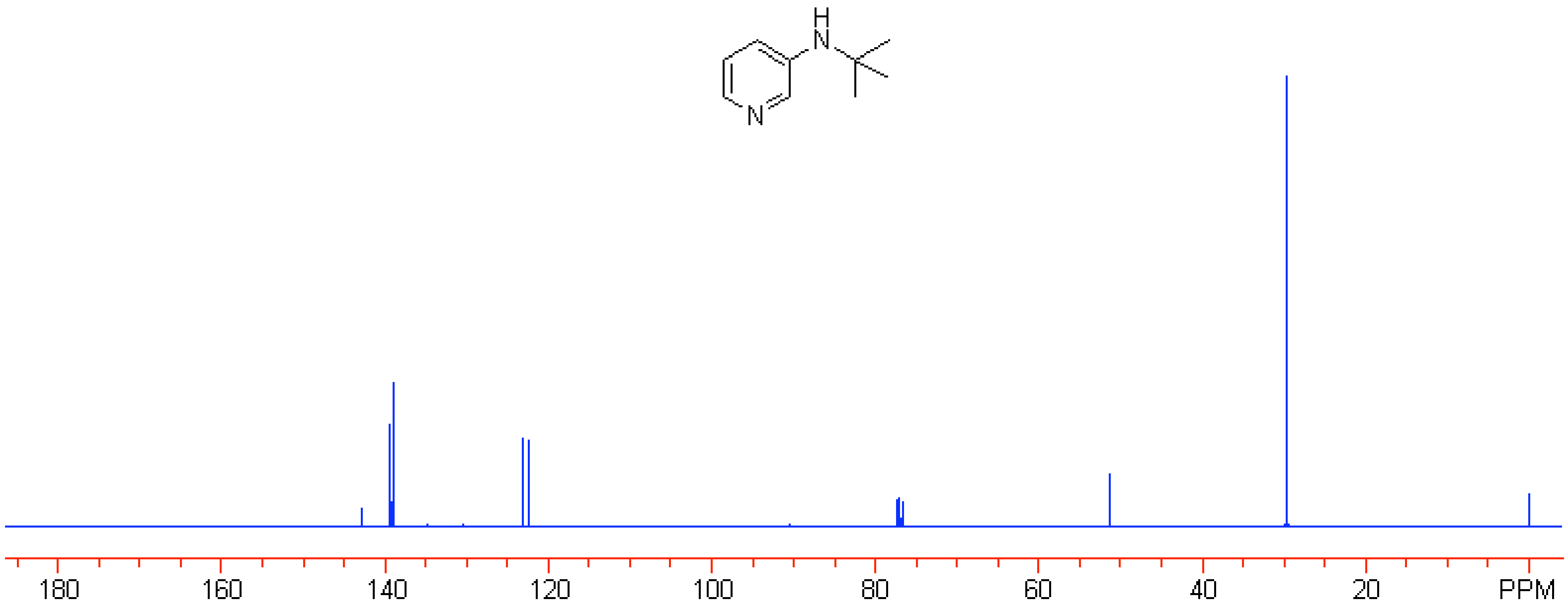


Table 1, entry 21, 4-benzamidopyridine

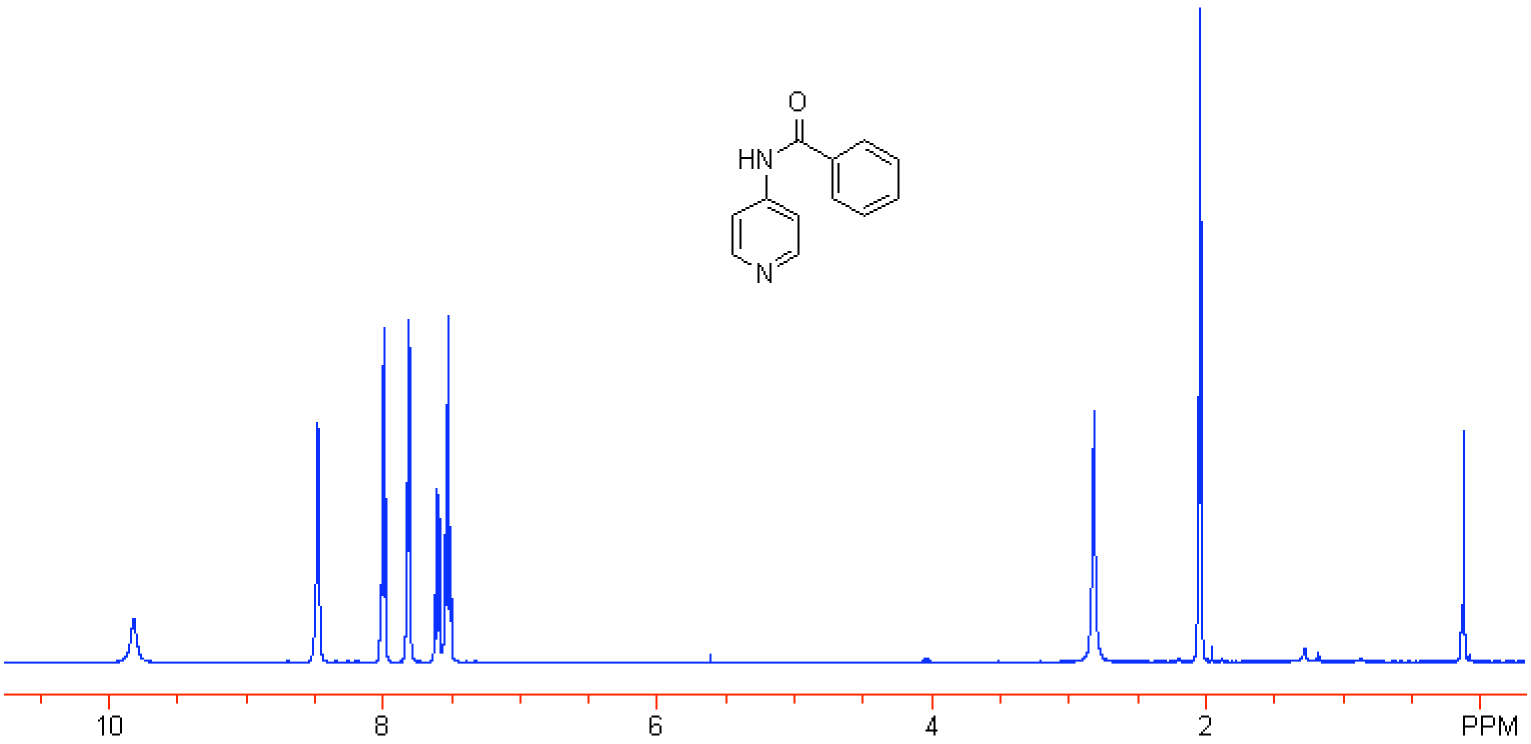


Table 1, entry 21, 4-benzamidopyridine

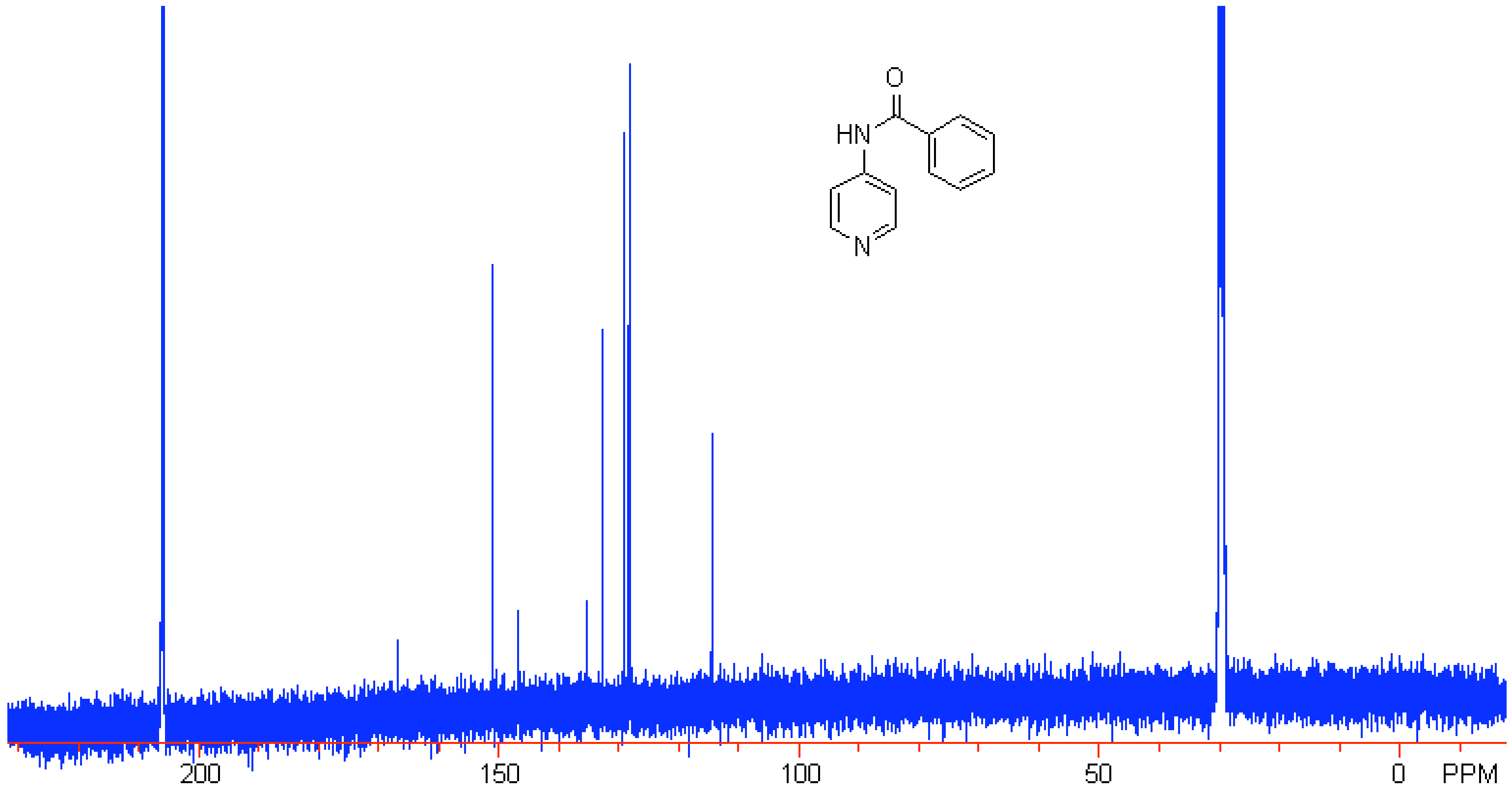


Table 1, entry 27, *N*-(3-pyridyl)-α-Methylbenzylamine

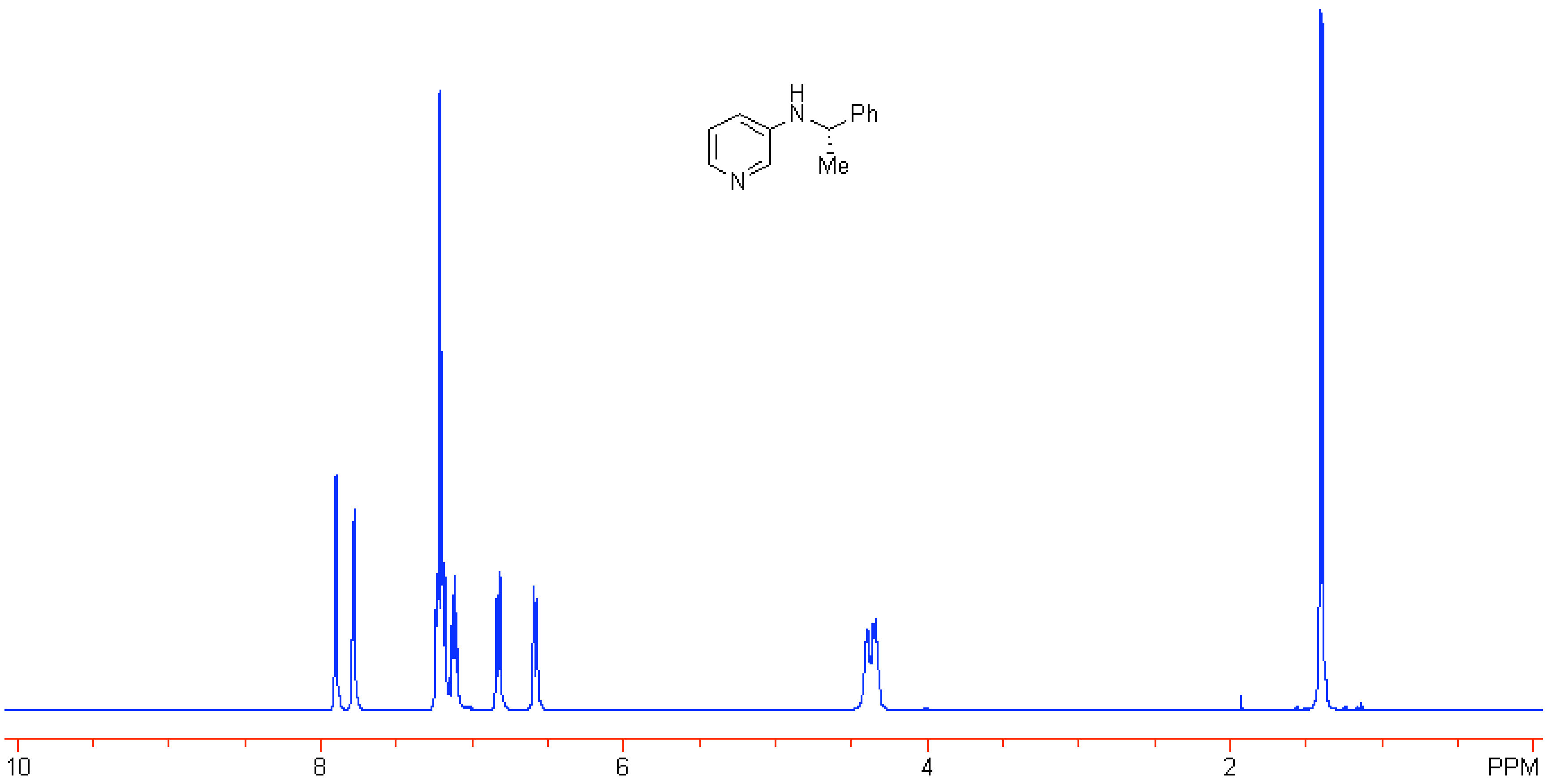


Table 1, entry 27, *N*-(3-pyridyl)-α-Methylbenzylamine

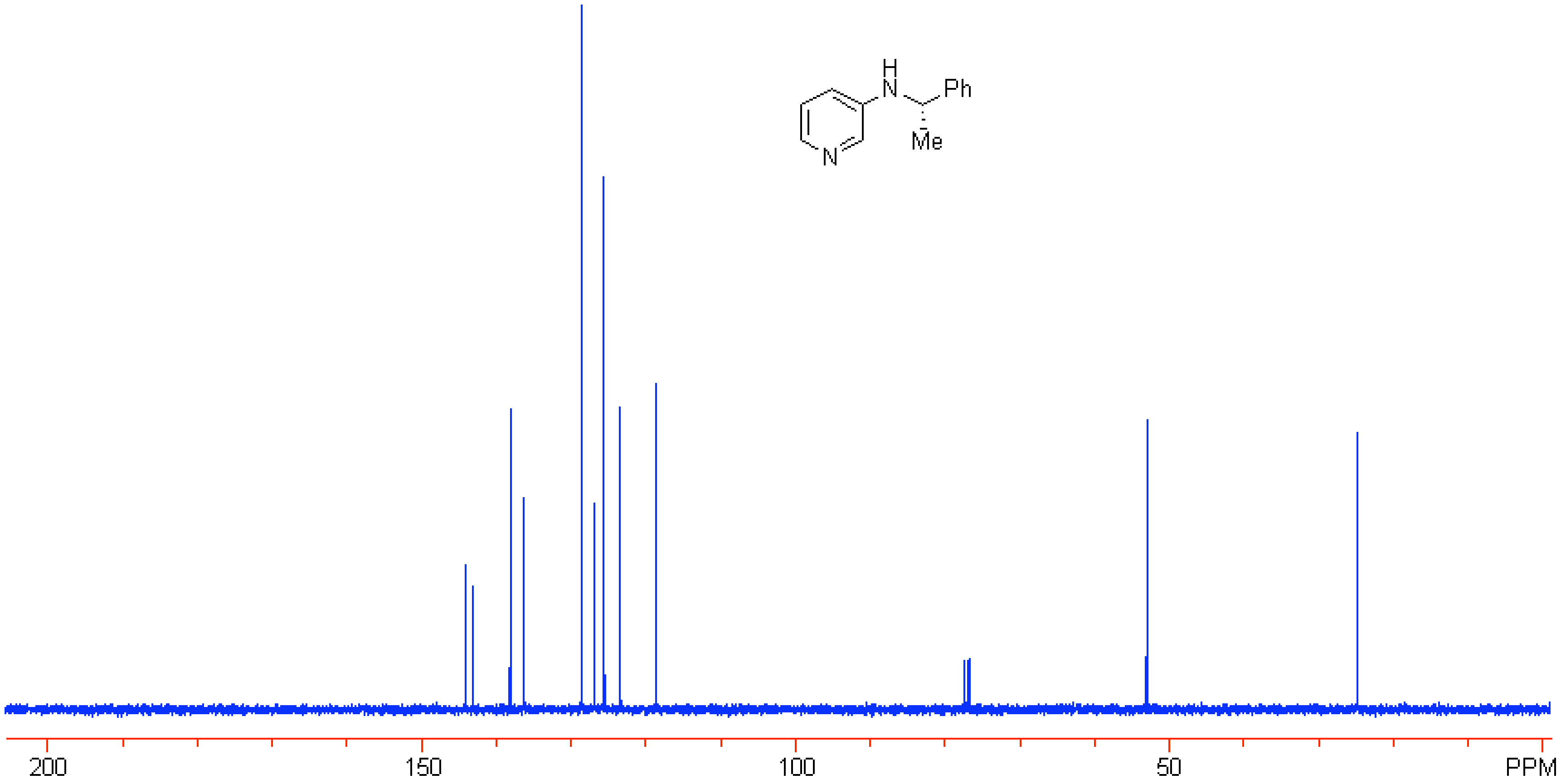


Table 2, entry 1, *N*-Phenyloctylamine

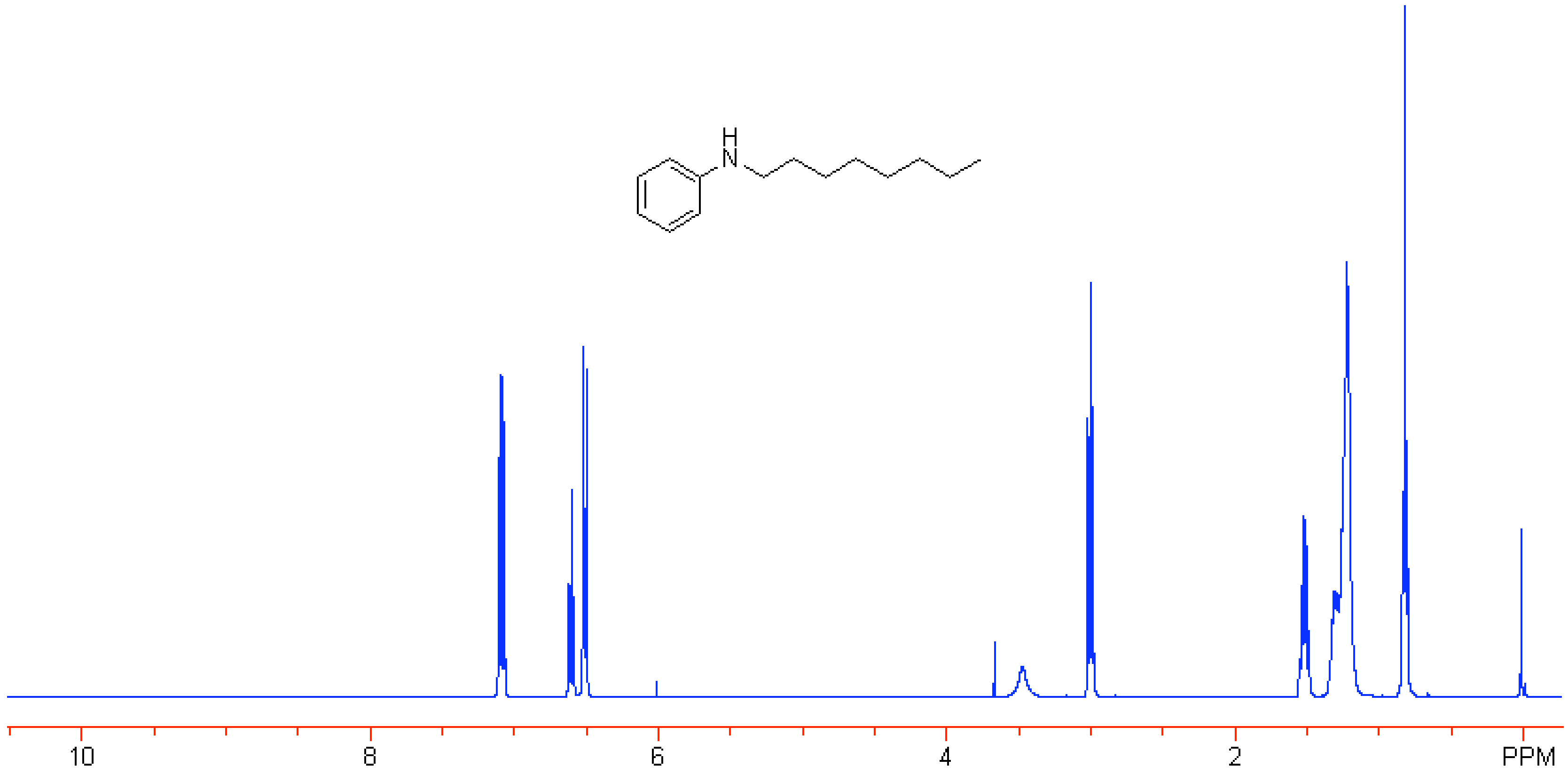


Table 2, entry 1, *N*-Phenyloctylamine

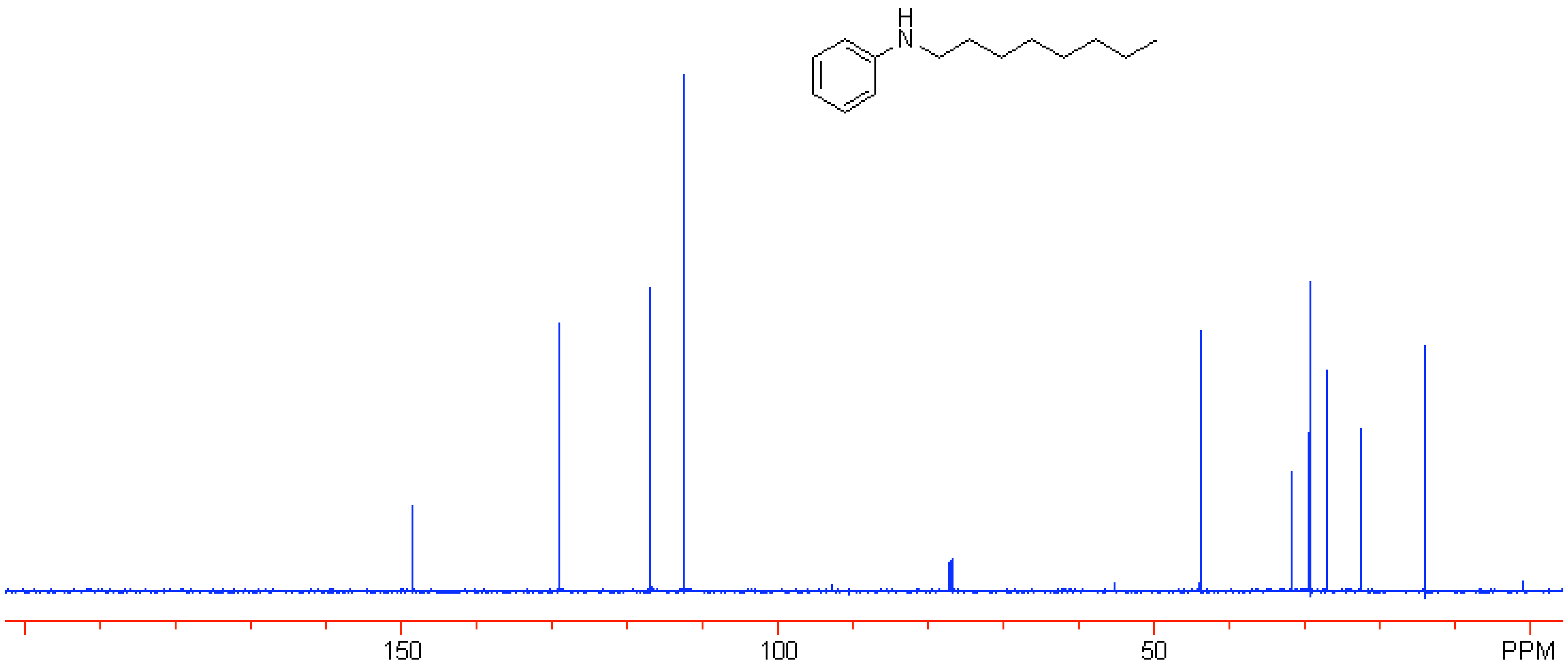


Table 2, entry 3, *N*-(2-Methoxyphenyl)octylamine

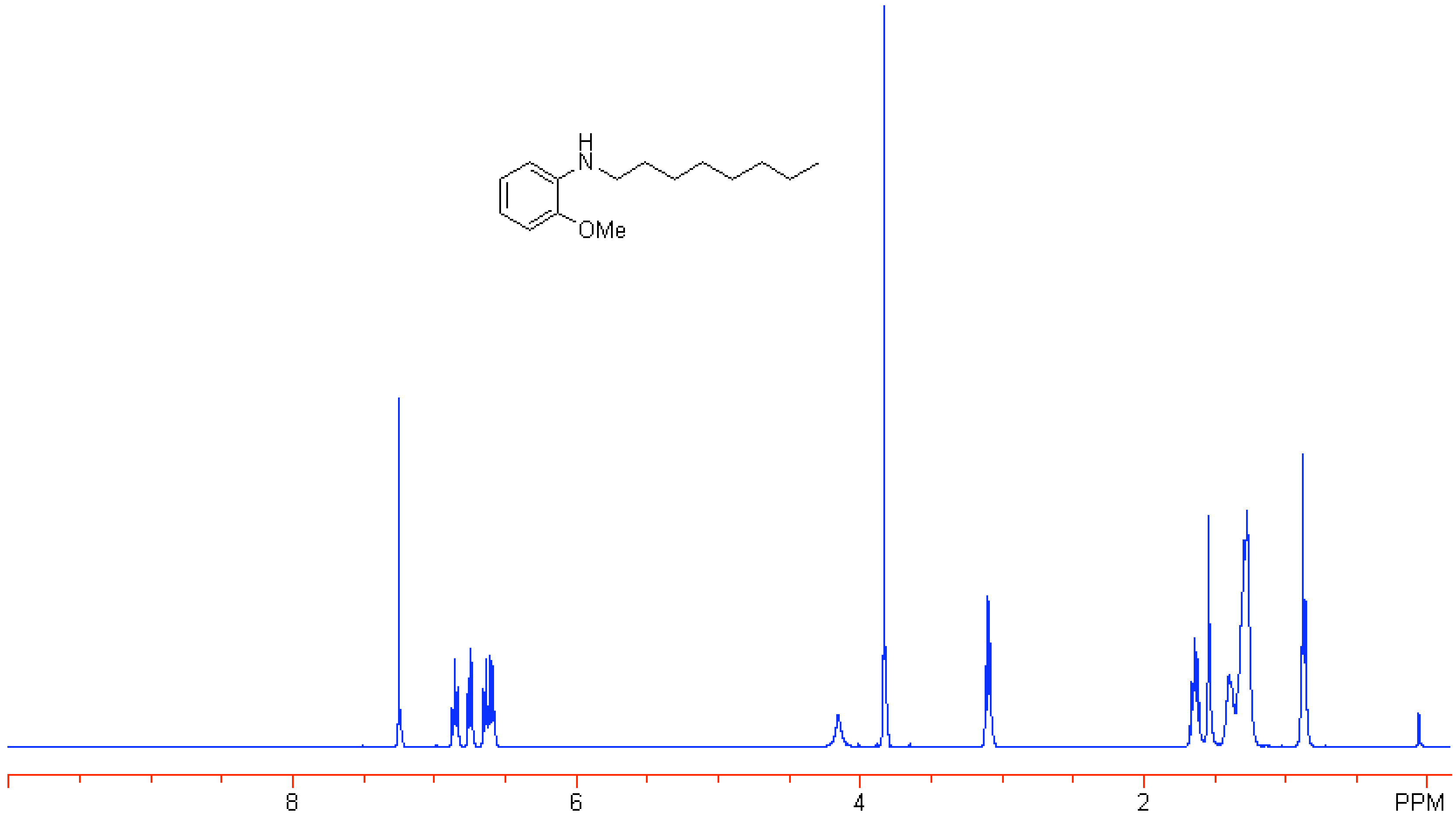


Table 2, entry 3, *N*-(2-Methoxyphenyl)octylamine

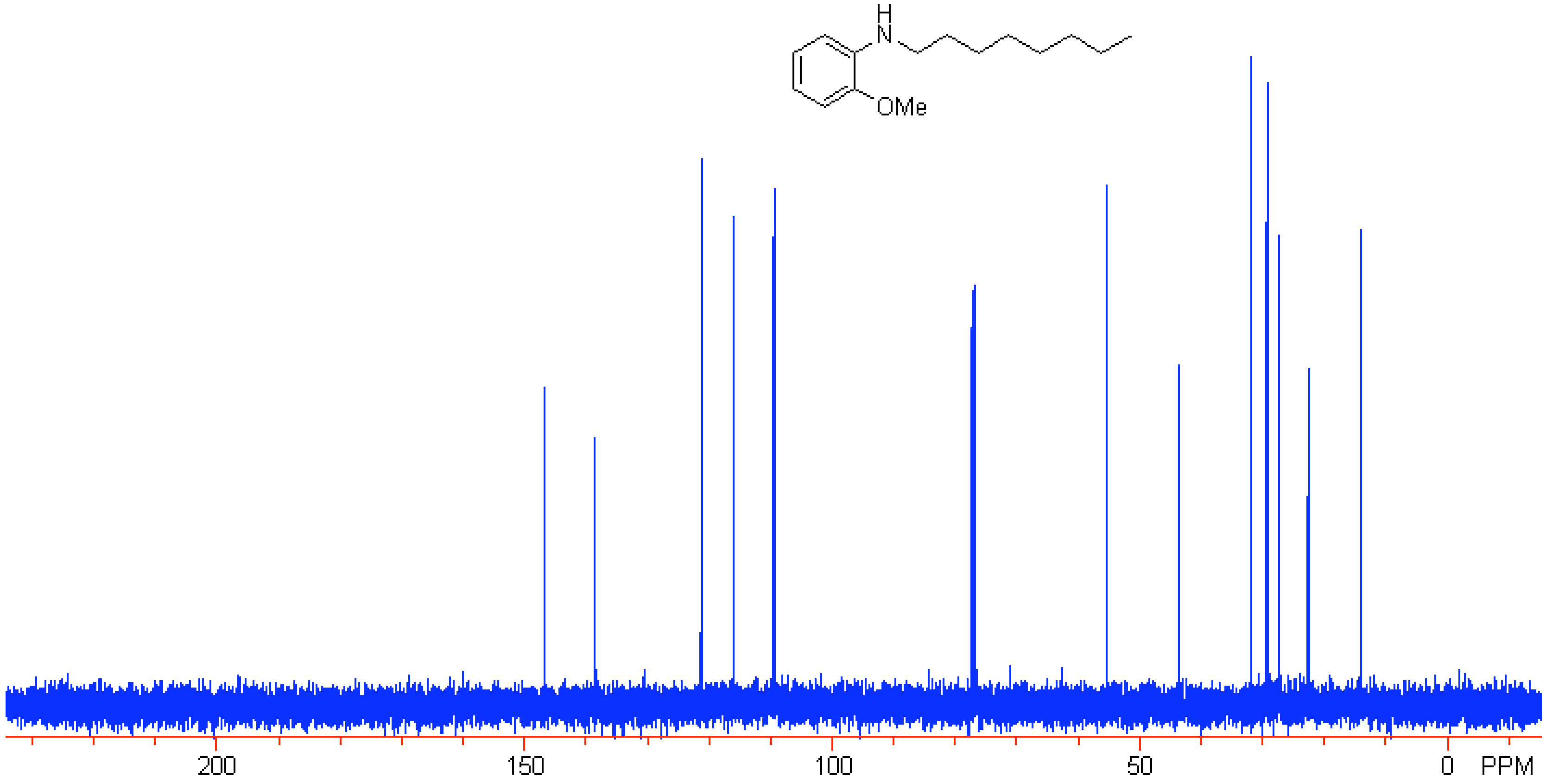


Table 2, entry 6, *N*-phenyl-*iso*-butylamine

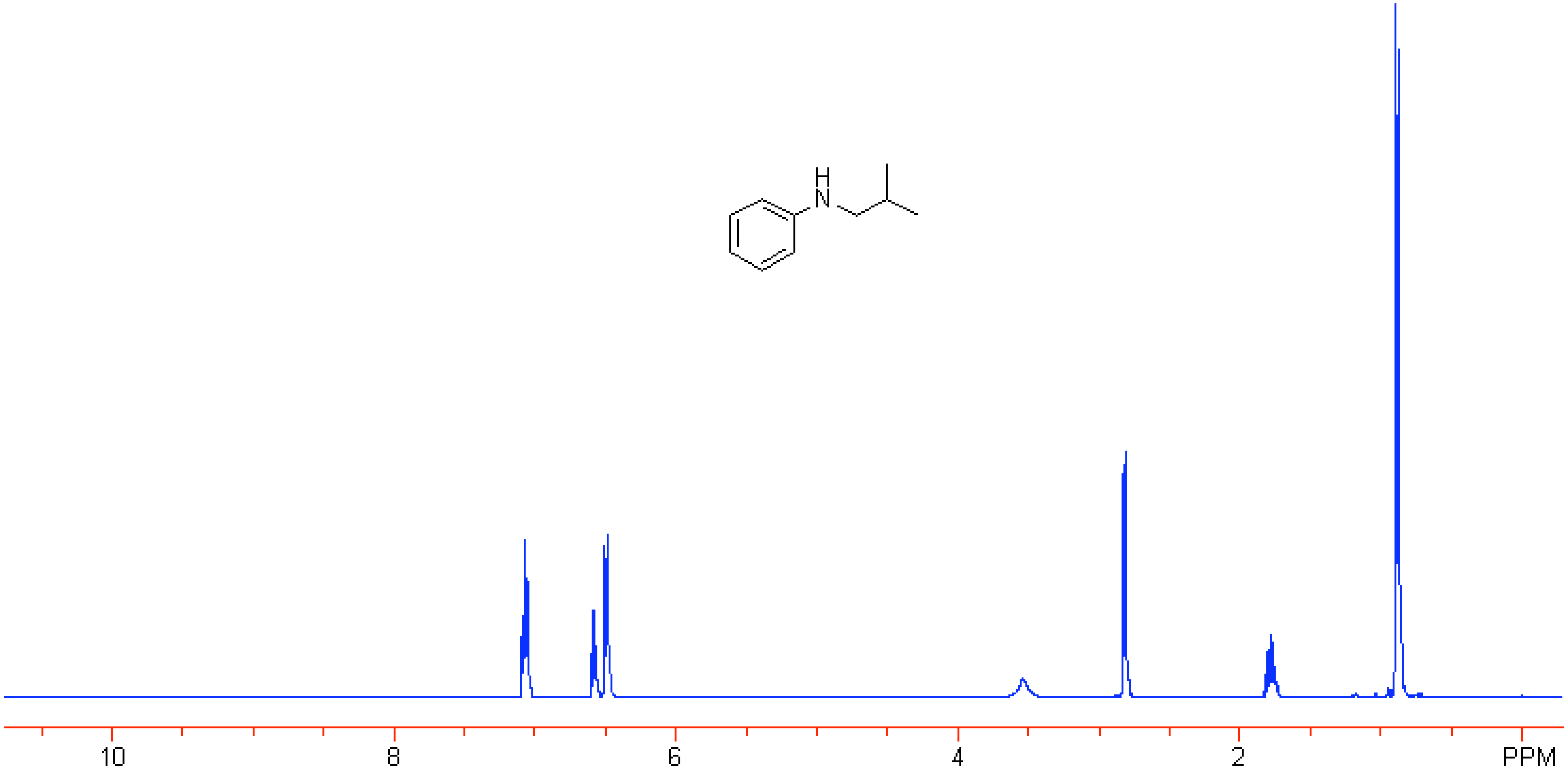


Table 2, entry 6, *N*-phenyl-*iso*-butylamine

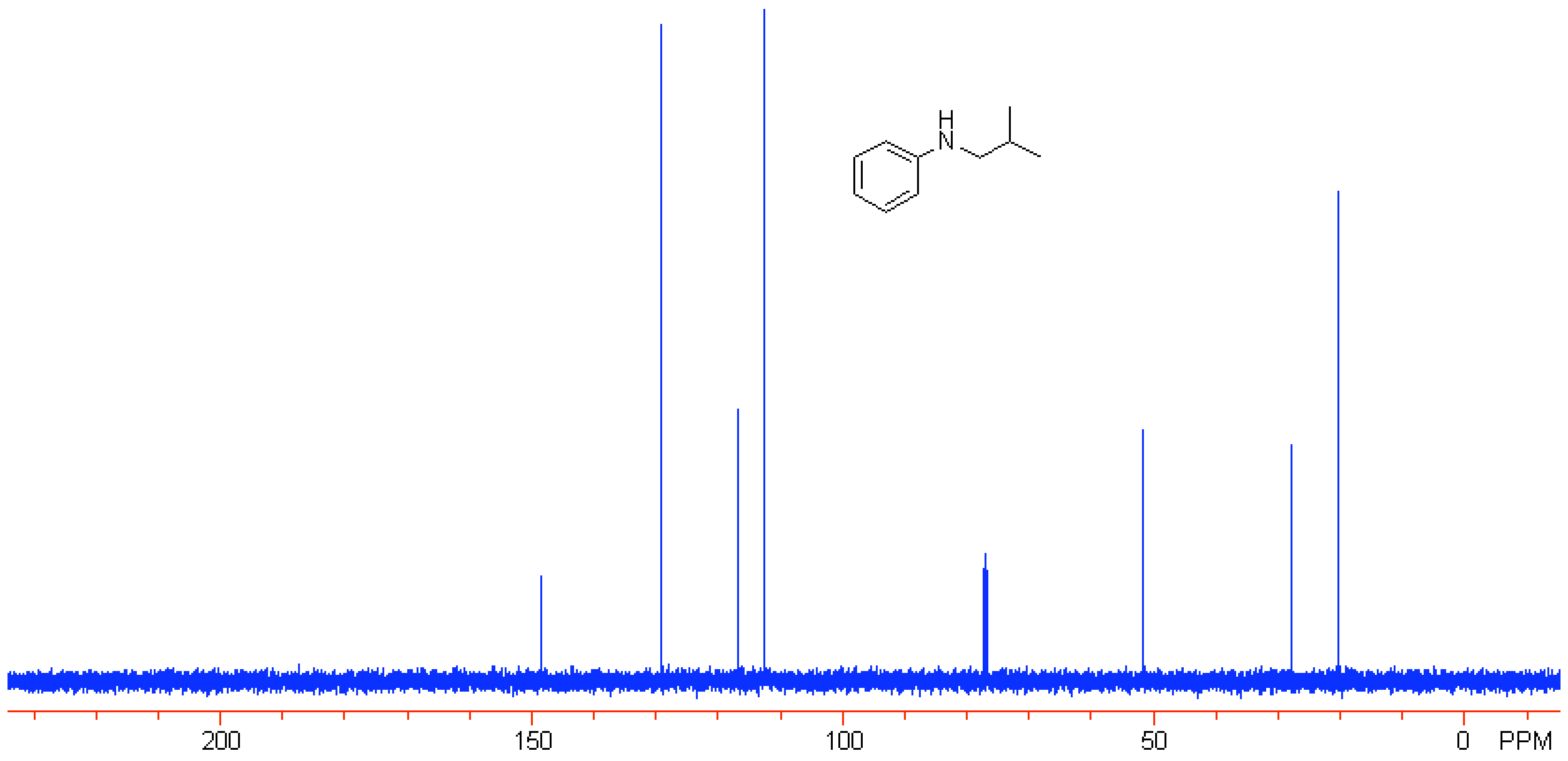


Table 2, entry 7, *N*-(*p*-Tolyl)-*iso*-butylamine

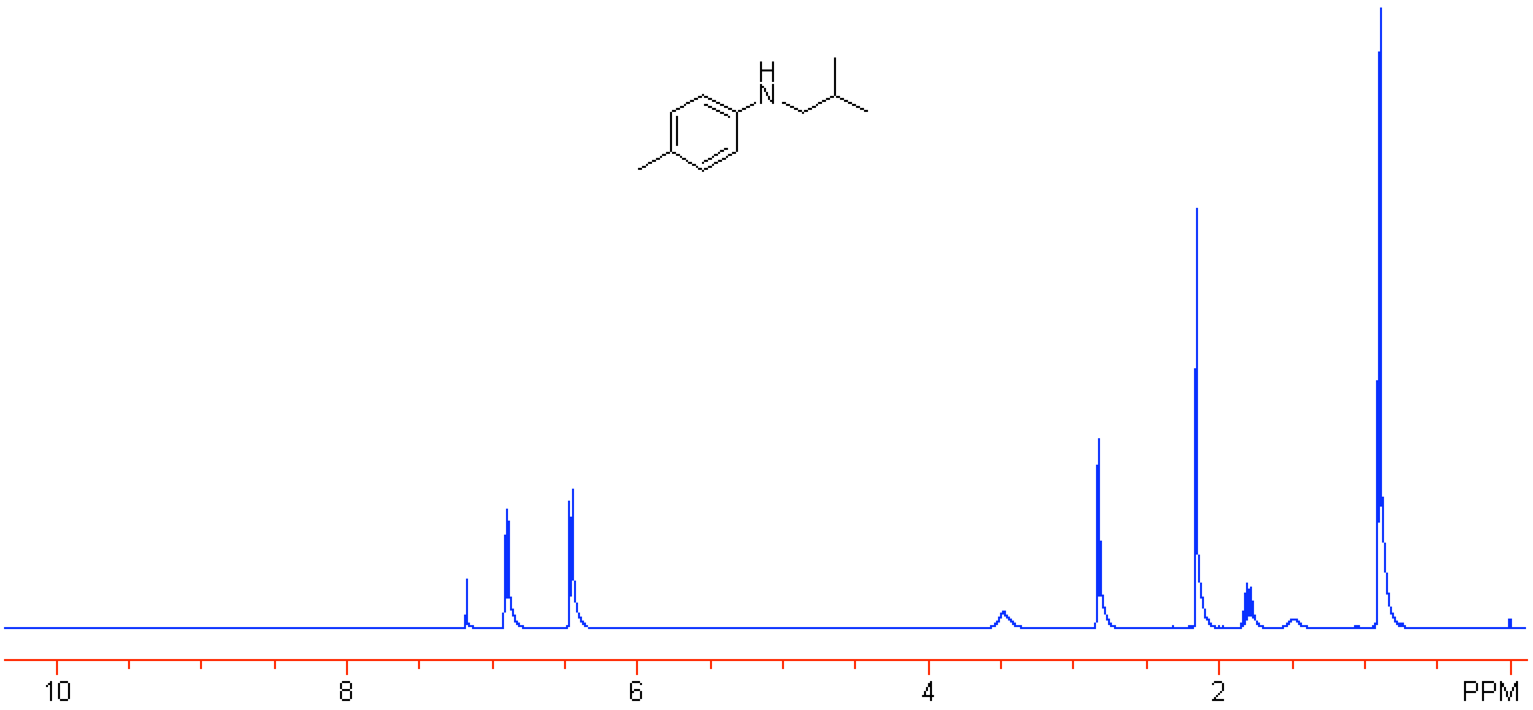


Table 2, entry 7, *N*-(*p*-Tolyl)-*iso*-butylamine

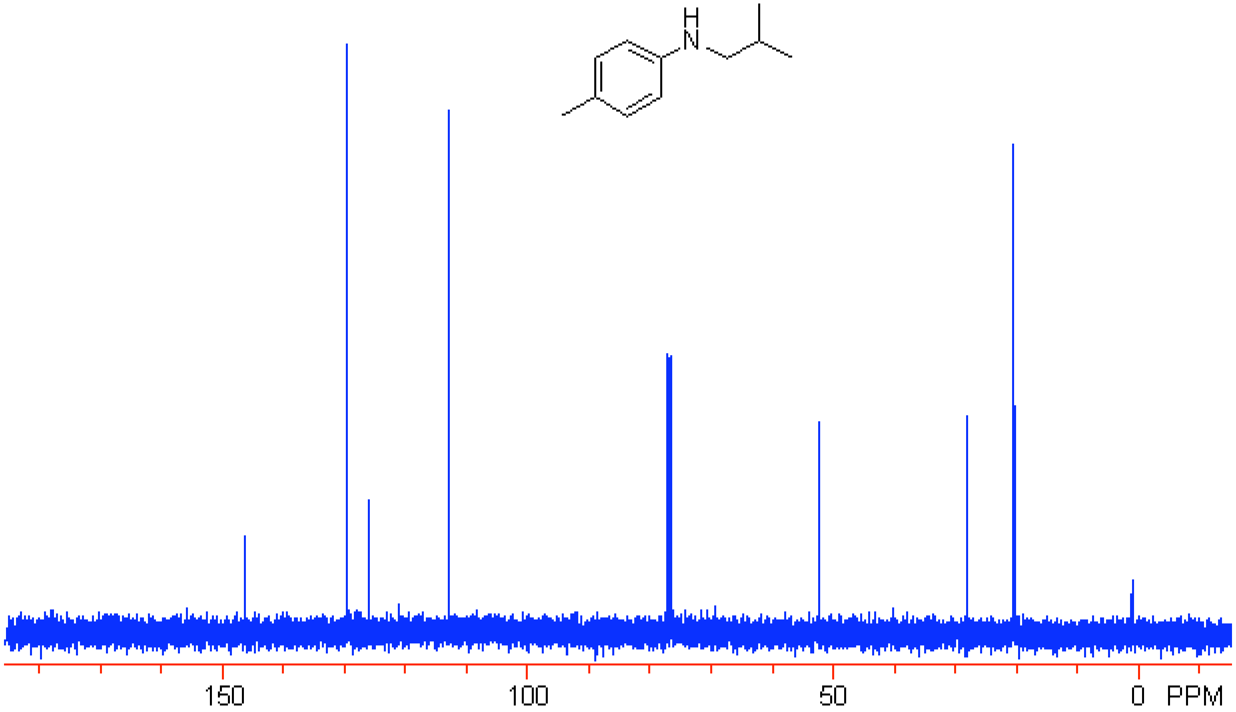


Table 2, entry 10, *N*-(Phenyl)-cyclohexylamine

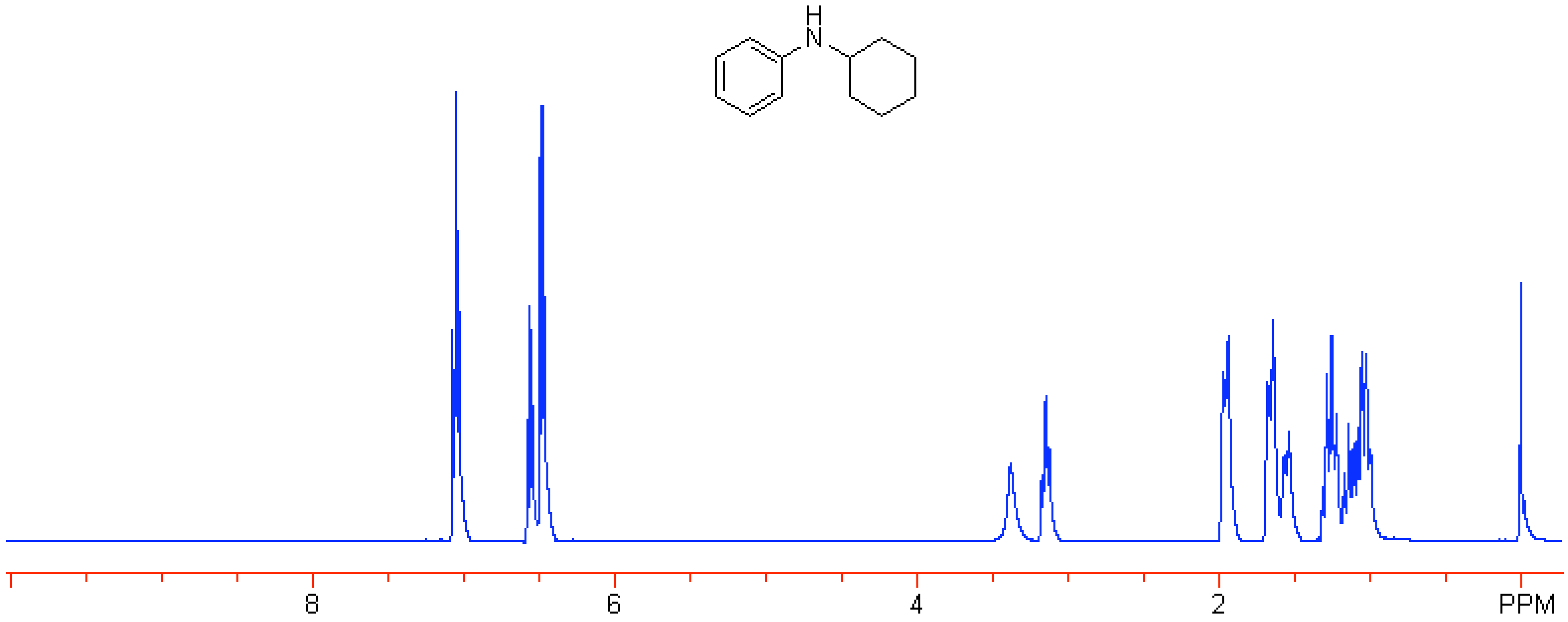
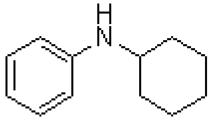


Table 2, entry 10, *N*-(Phenyl)-cyclohexylamine



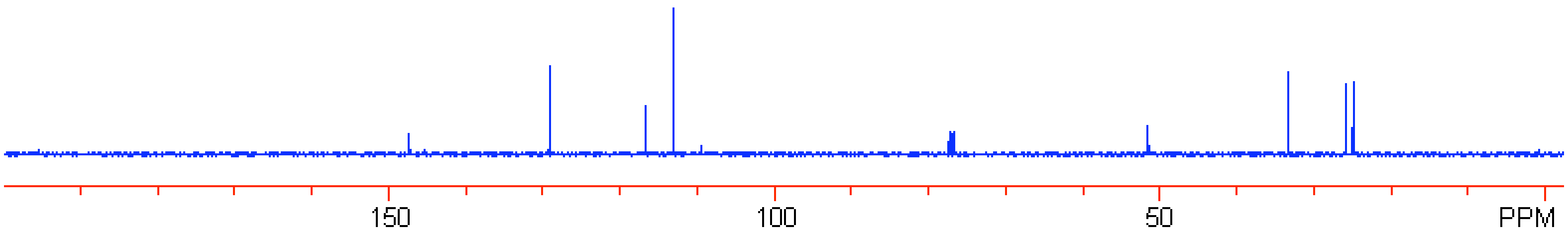


Table 2, entry 12, *N*-(Cyclohexylamino)-*m*-anisidine

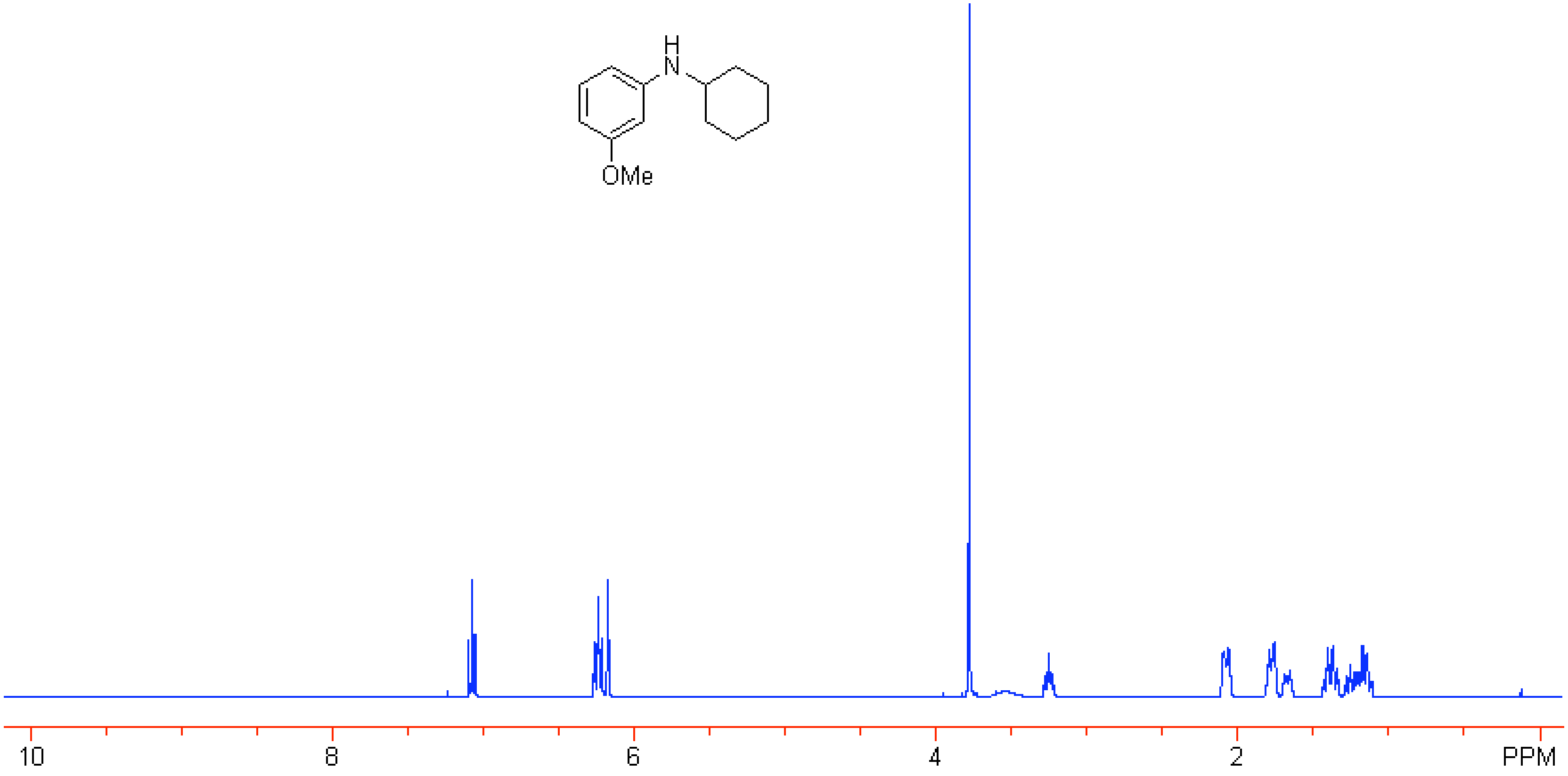


Table 2, entry 12, *N*-(Cyclohexylamino)-*m*-anisidine

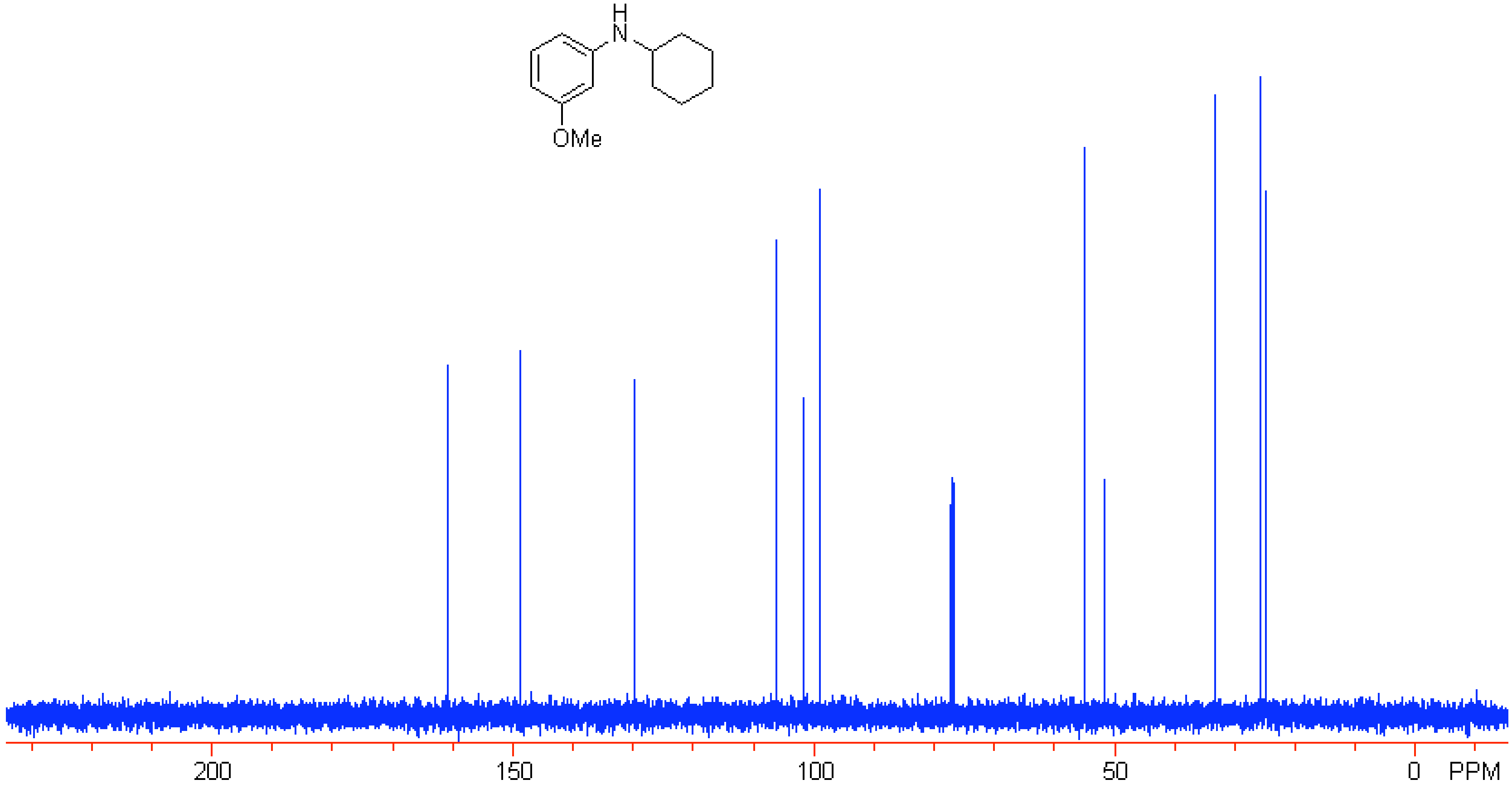


Table 2, entry 13, *N*-(Phenyl)-benzylamine

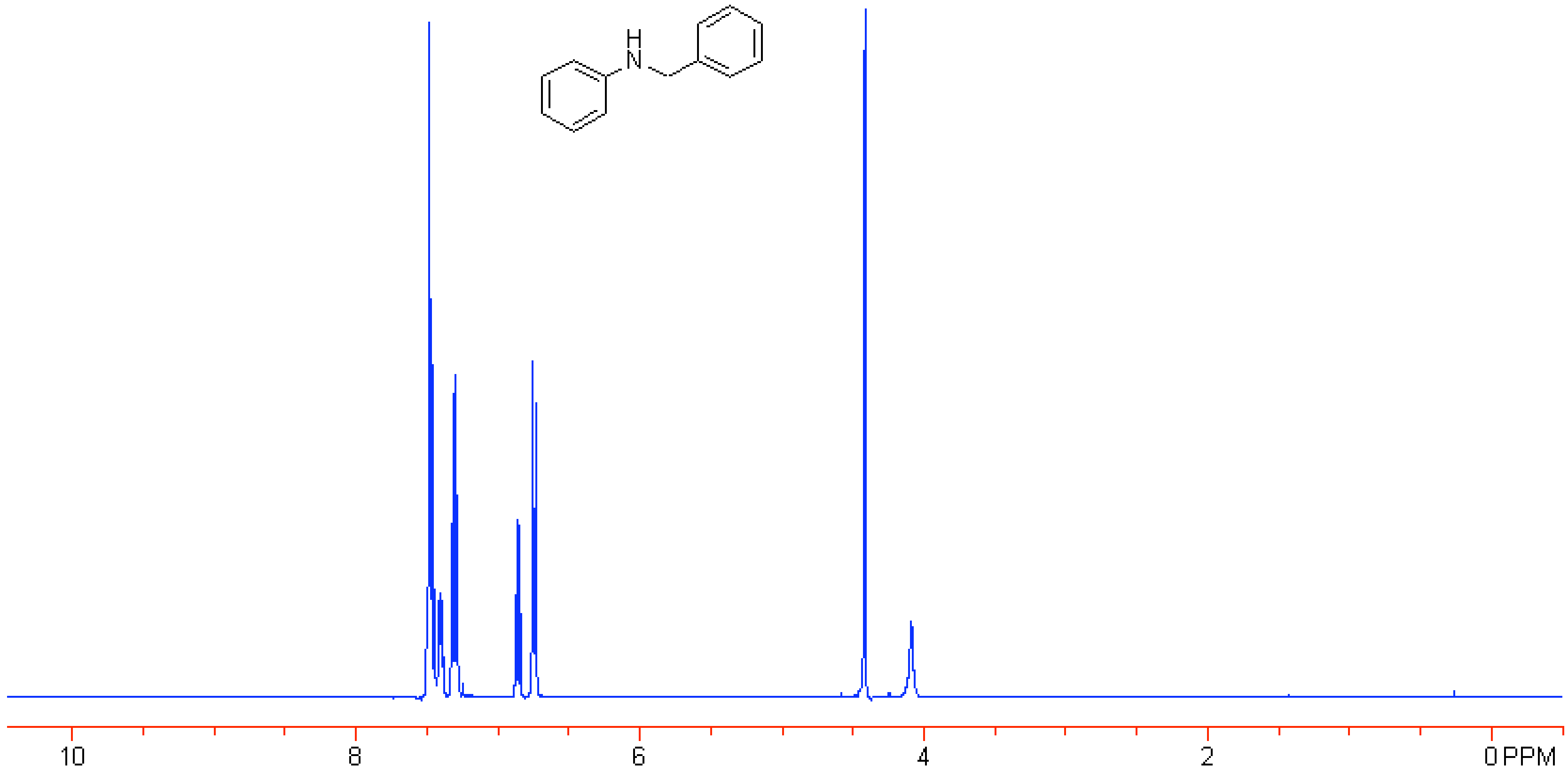


Table 2, entry 13, *N*-(Phenyl)-benzylamine

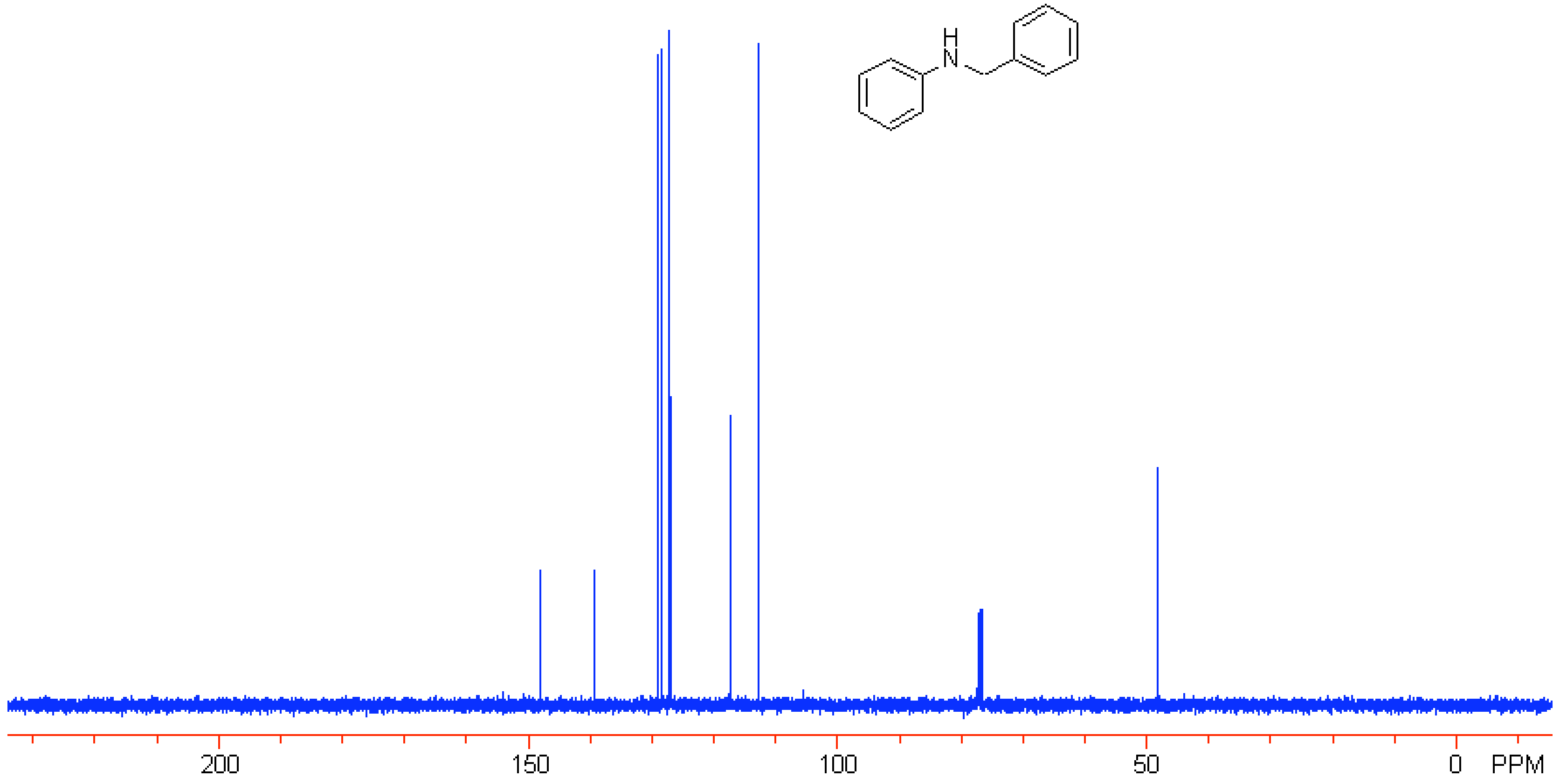


Table 2, entry 15, *N*-(Benzyamino)-*p*-anisidine

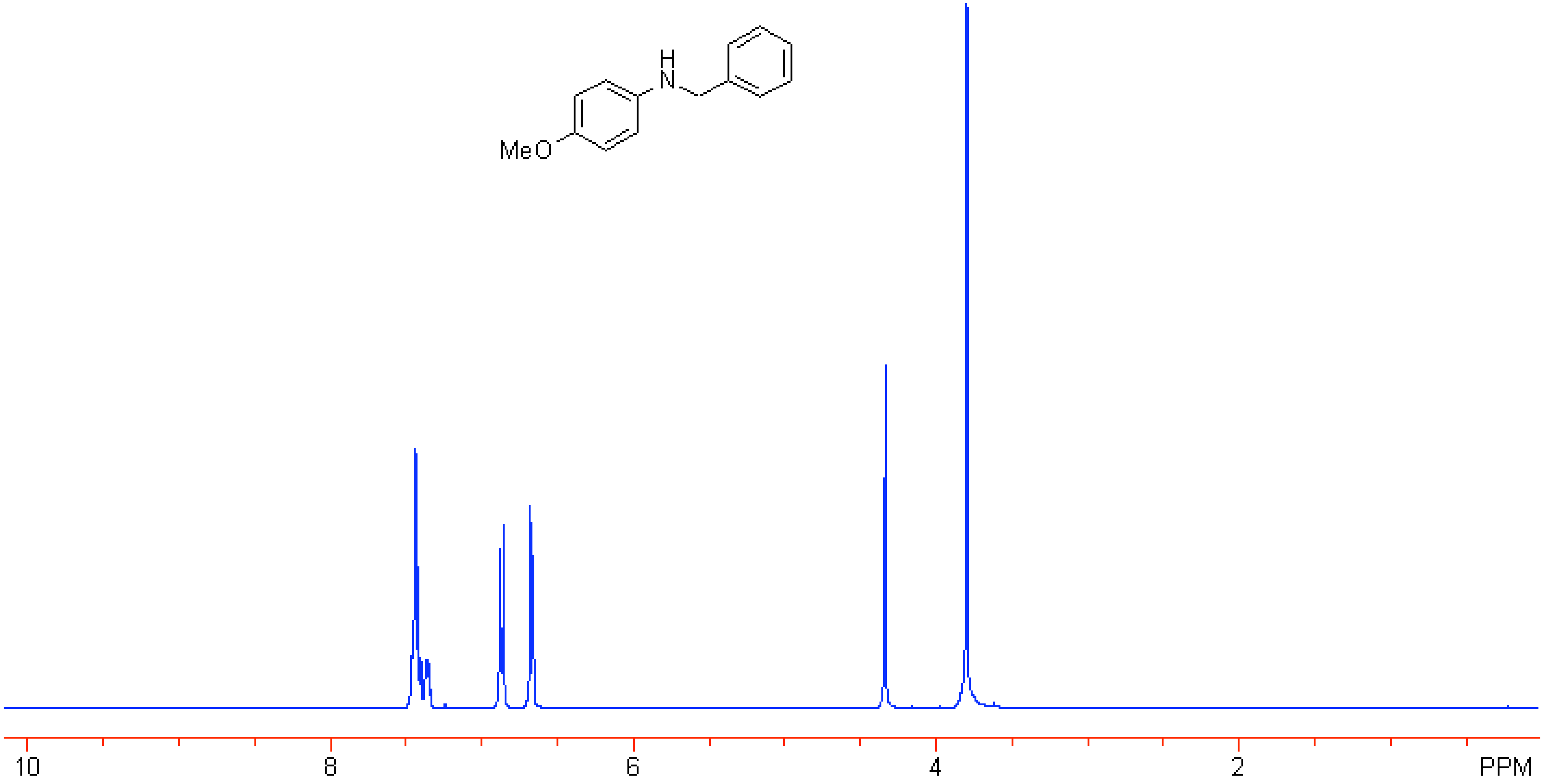


Table 2, entry 15, *N*-(Benzyamino)-*p*-anisidine

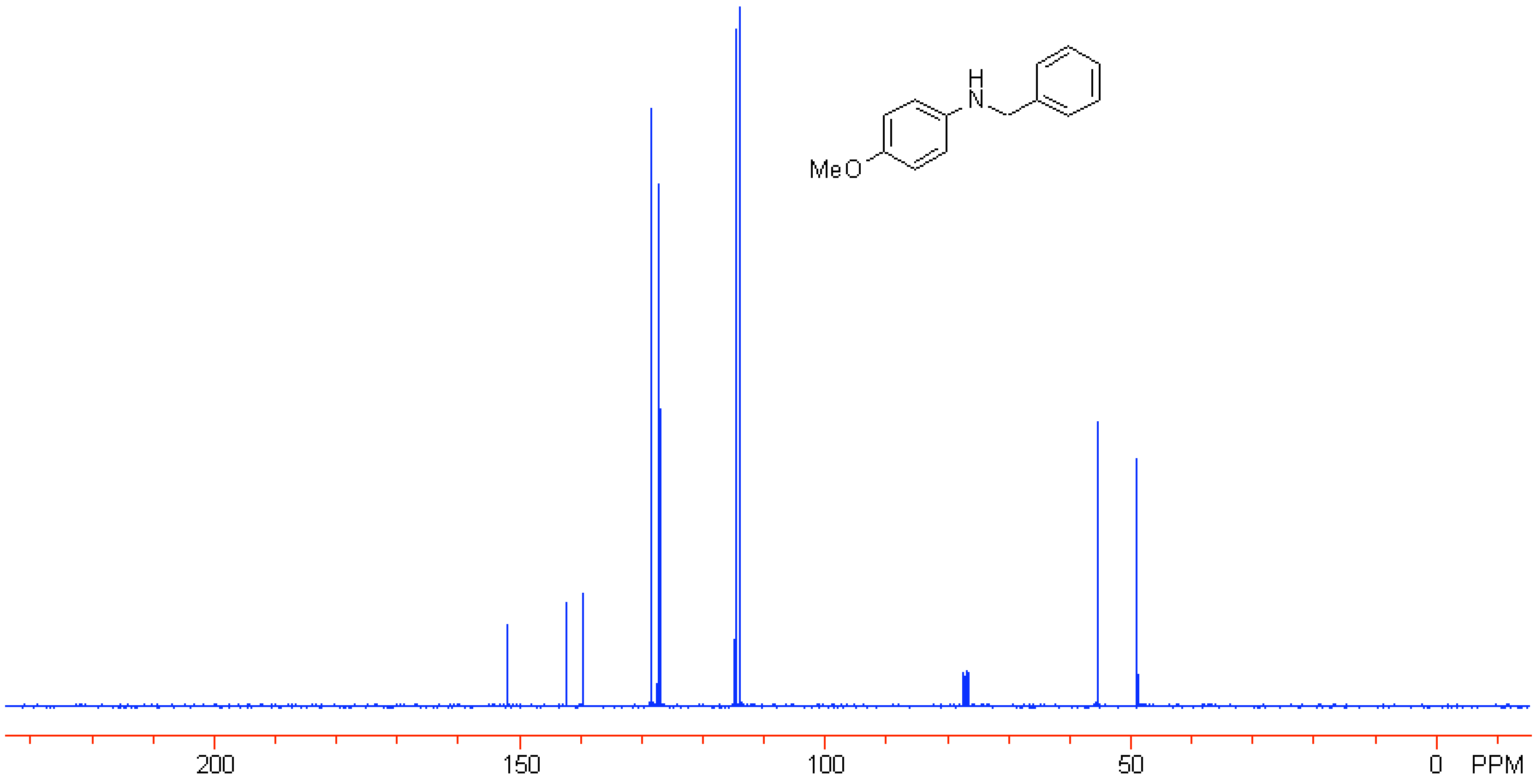


Table 2, entry 16, *N*-(Phenyl)-*sec*-butylamine

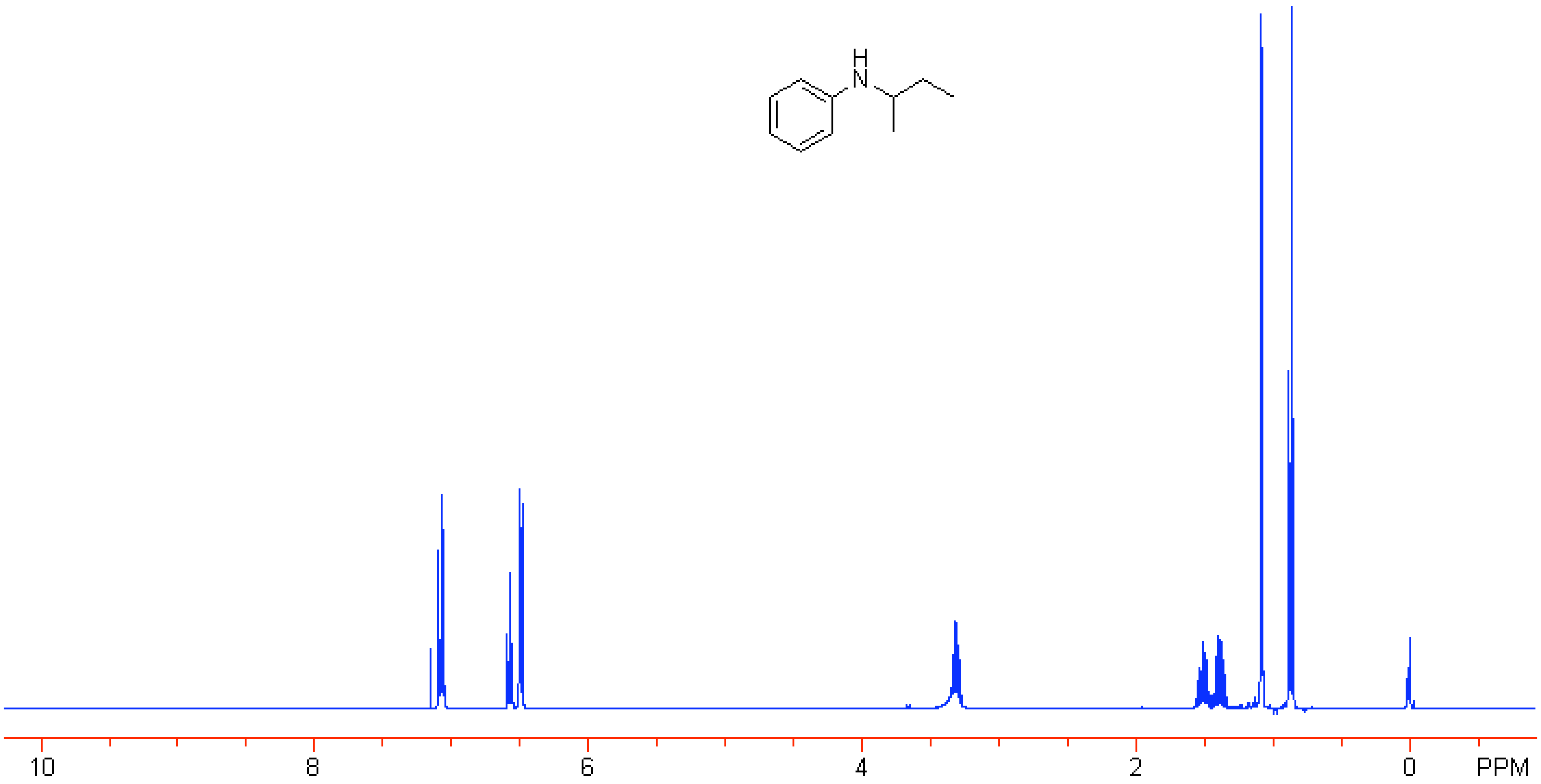


Table 2, entry 16, *N*-(Phenyl)-*sec*-butylamine

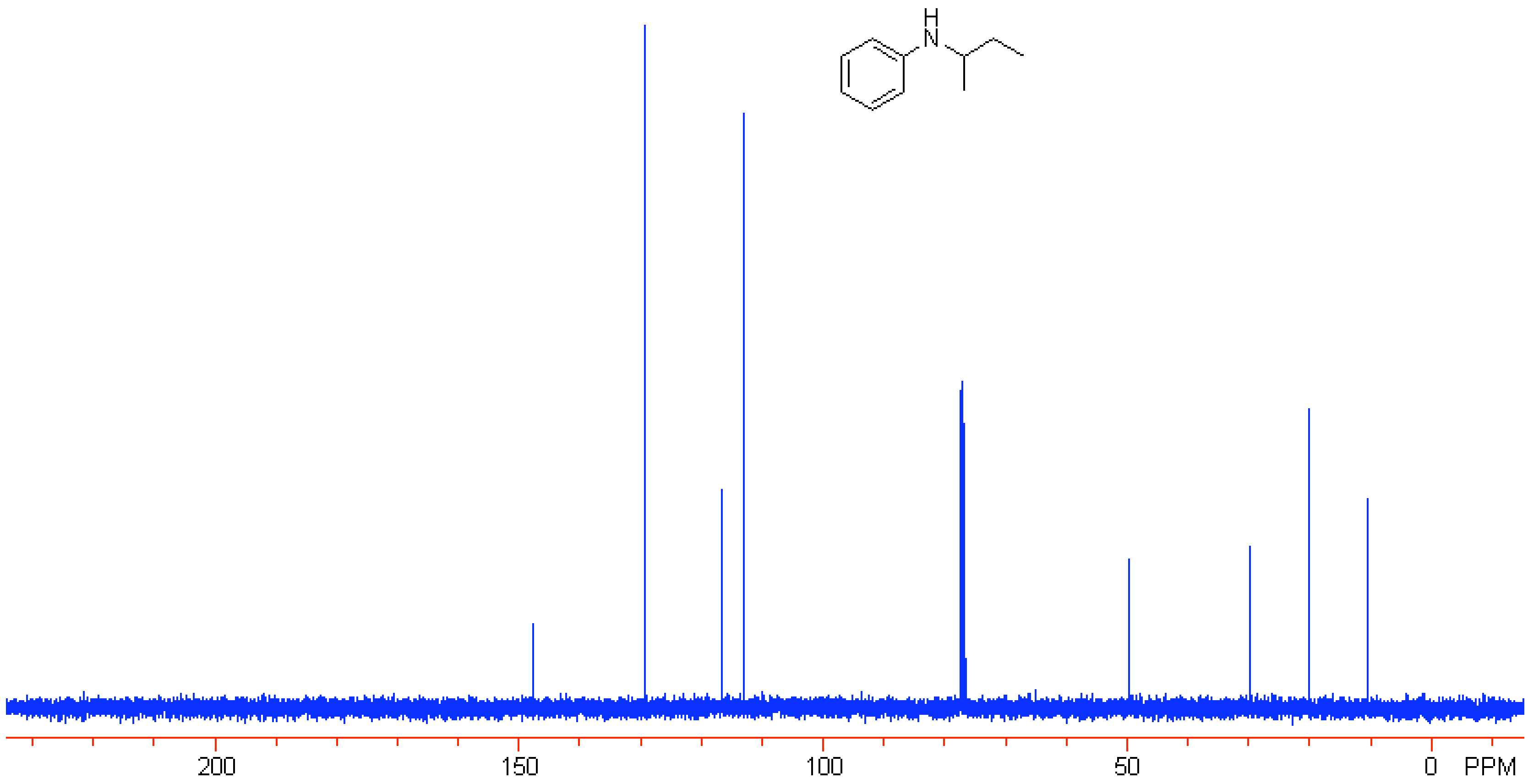


Table 2, entry 17, *N*-(4-Cyanophenyl)-*sec*-butylamine

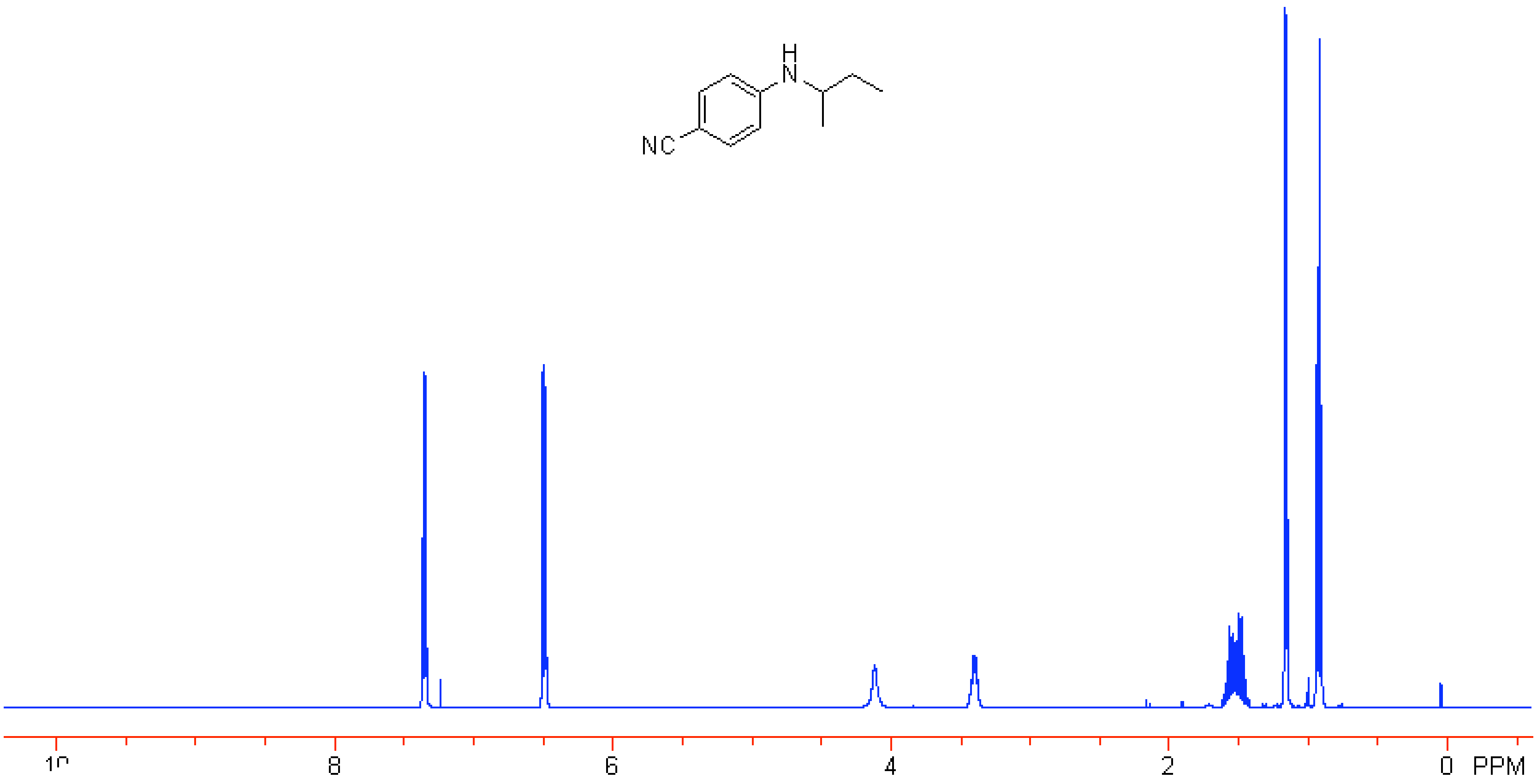


Table 2, entry 17, *N*-(4-Cyanophenyl)-*sec*-butylamine

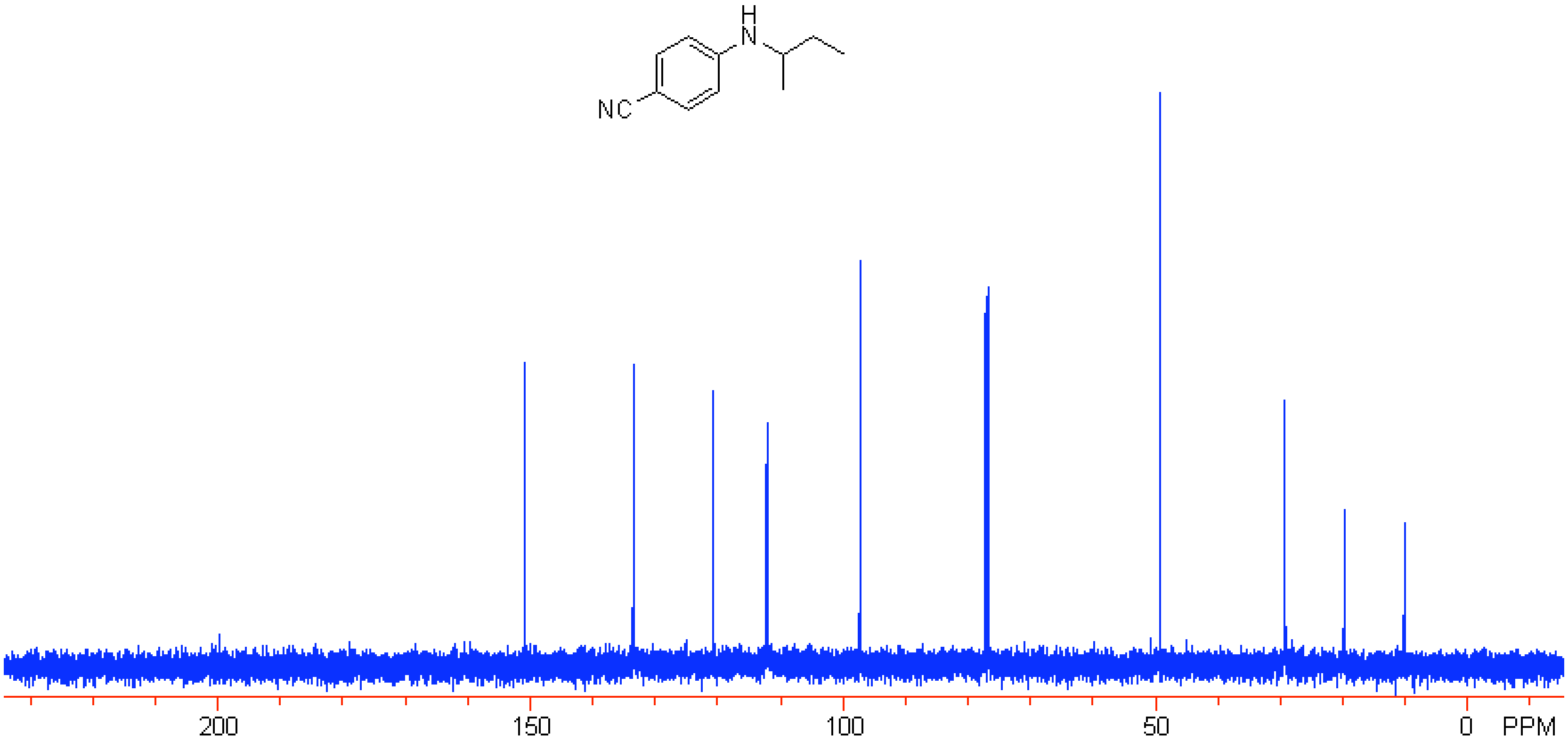


Table 2, entry 19, *N*-(*o*-Tolyl)benzophenone imine

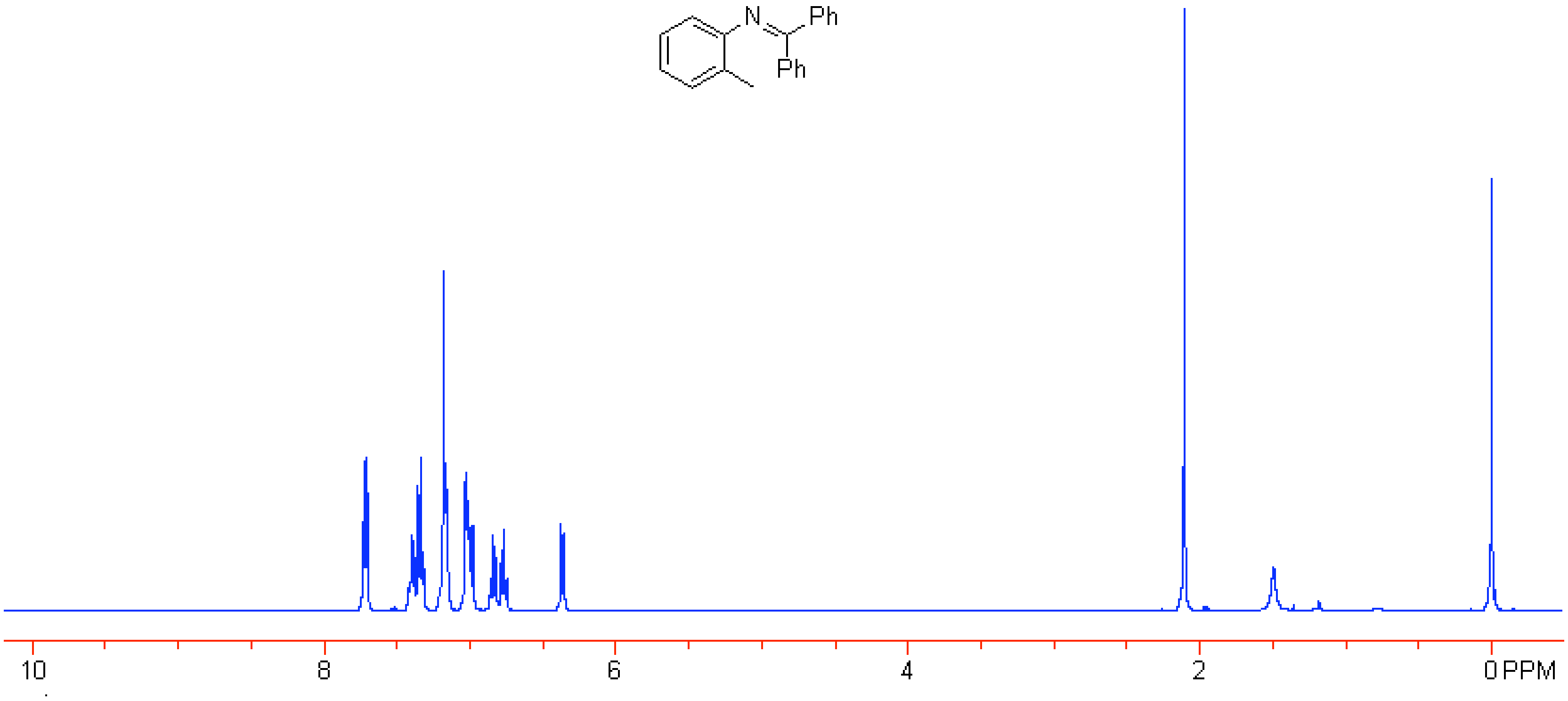


Table 2, entry 19, *N*-(*o*-Tolyl)benzophenone imine

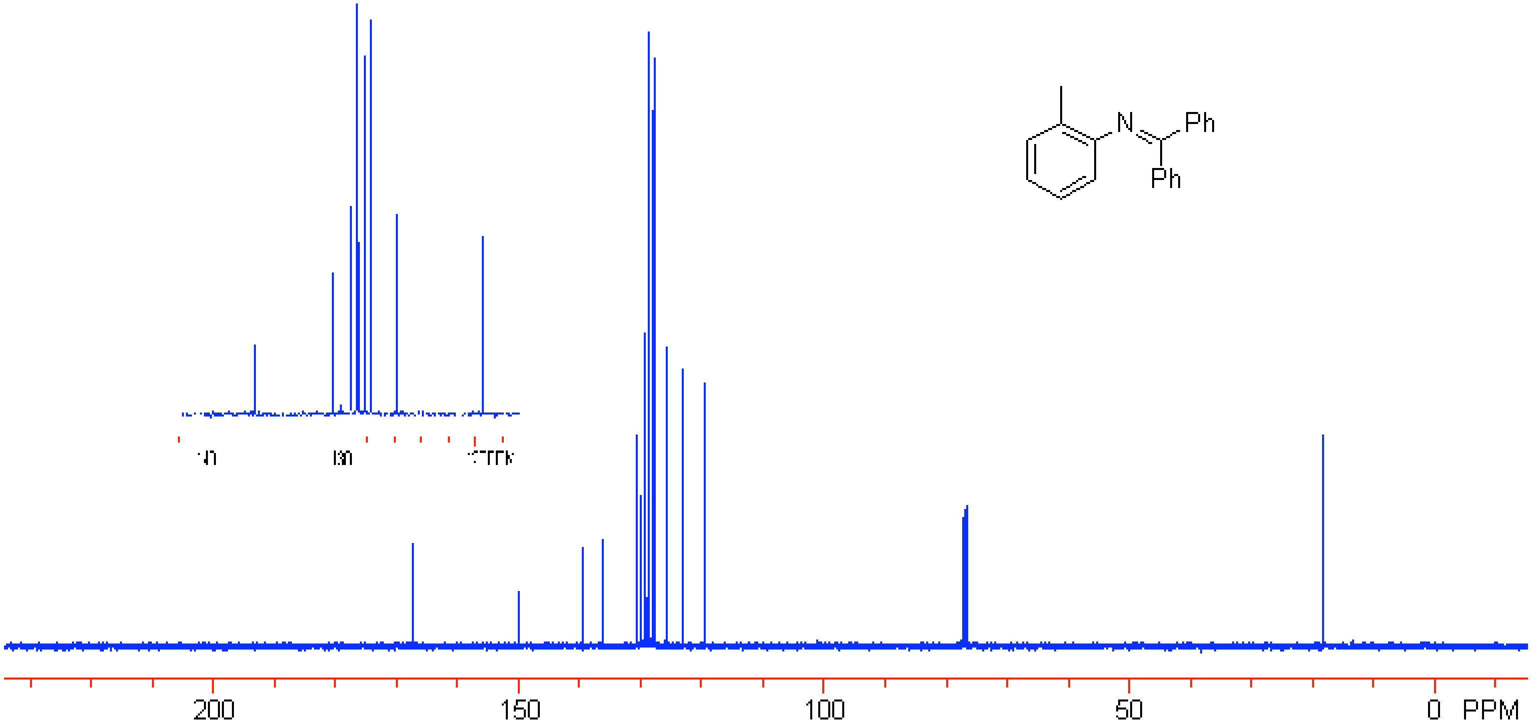


Table 2, entry 20, *N*-(2-Methoxyphenyl)benzophone imine

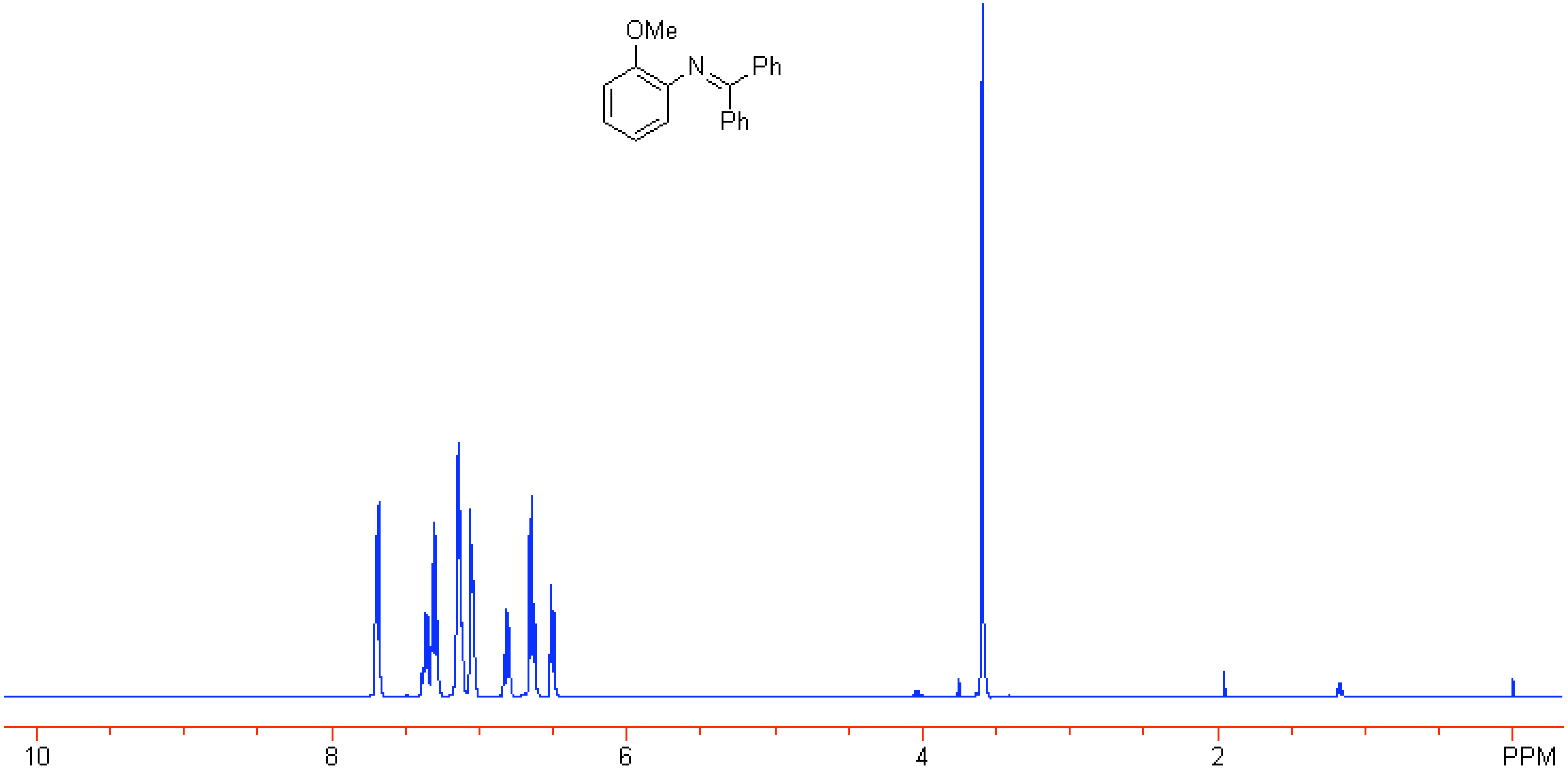


Table 2, entry 20, *N*-(2-Methoxyphenyl)benzophone imine

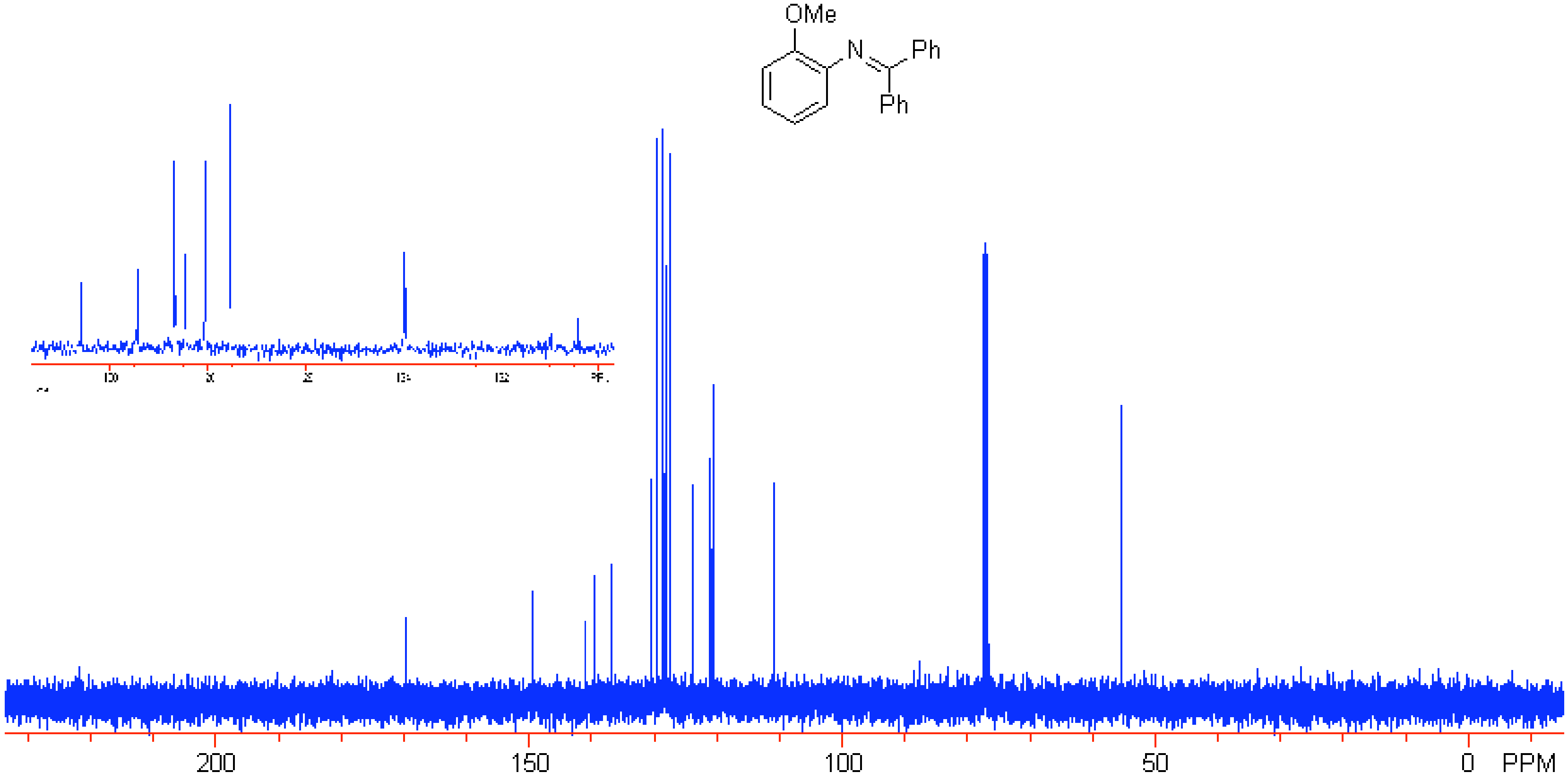


Table 2, entry 22, *N*-(2-Methoxyphenyl)benzophenone hydrazone

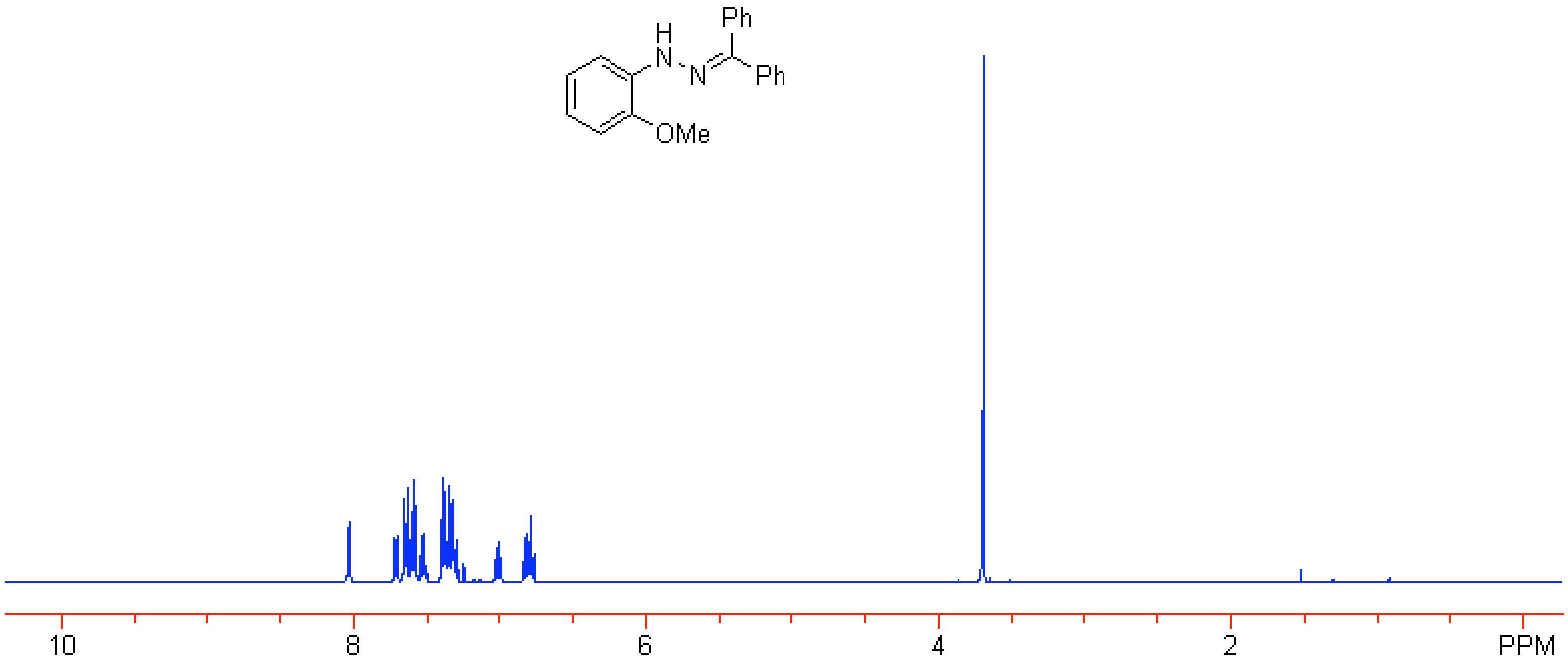


Table 2, entry 22, *N*-(2-Methoxyphenyl)benzophenone hydrazone

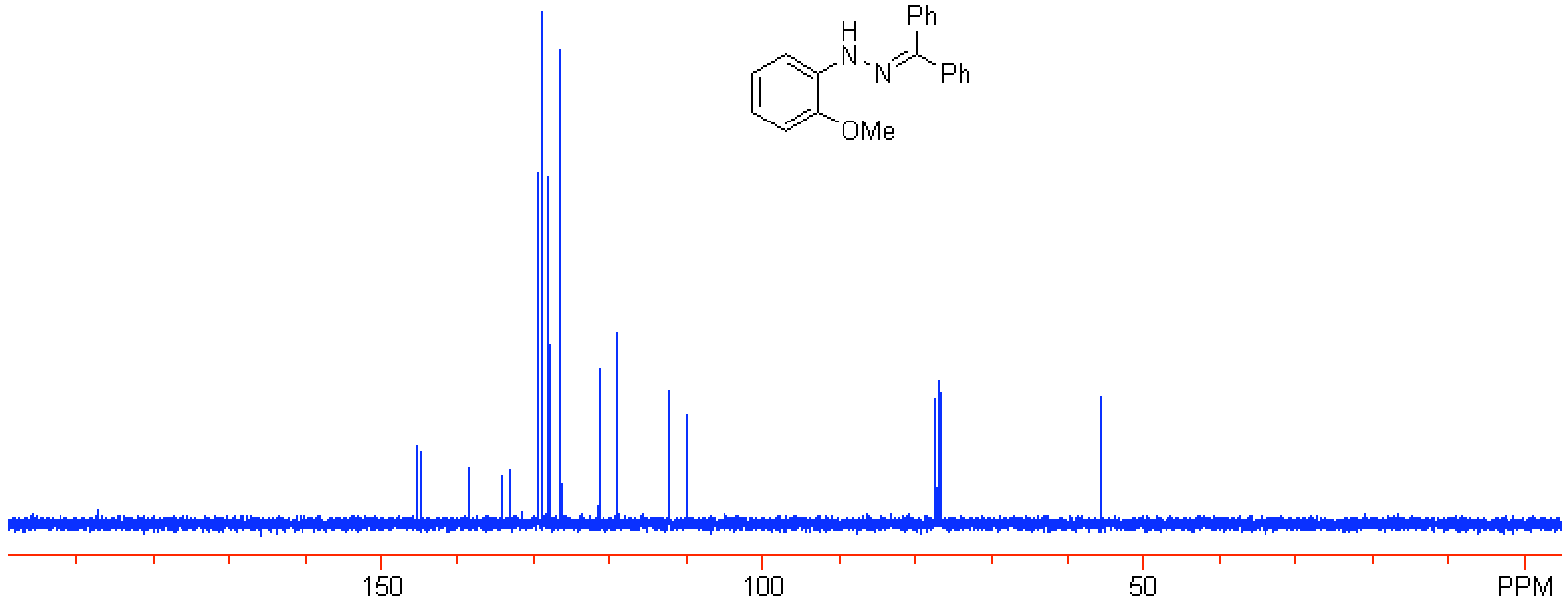


Table 2, entry 23, *N*-(3-Methoxyphenyl)benzophenone hydrozone

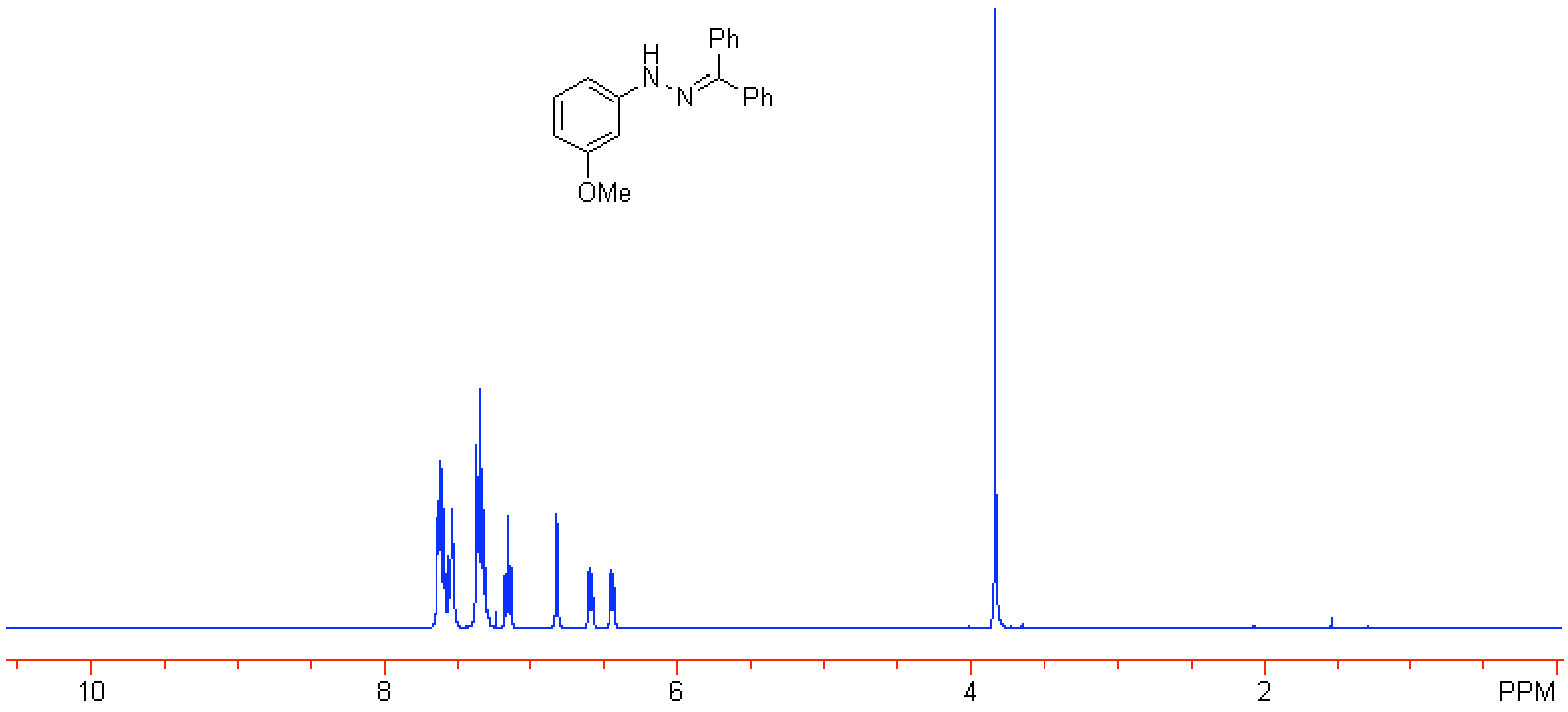


Table 2, entry 23, *N*-(3-Methoxyphenyl)benzophenone hydrozone

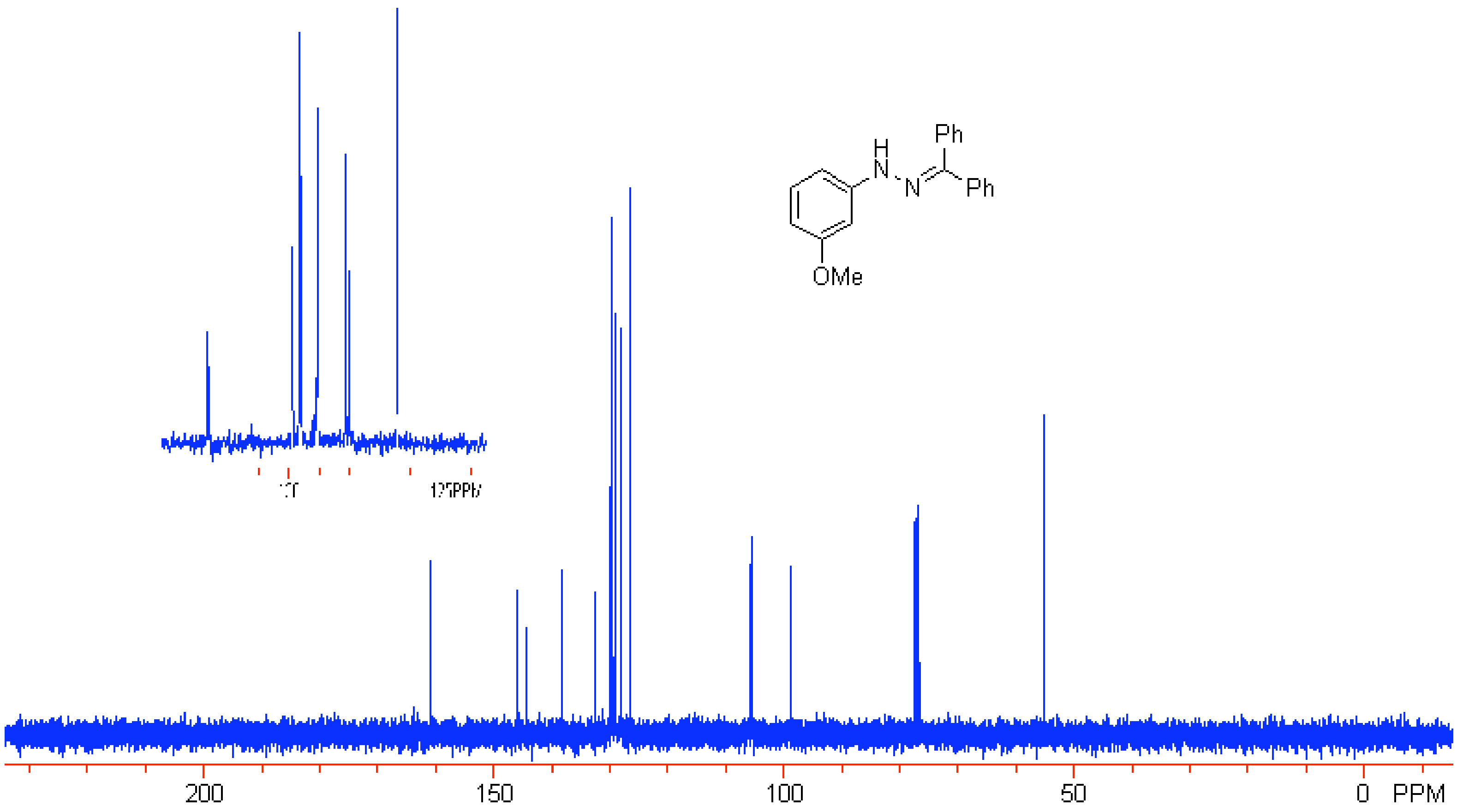


Table 3, entry 8, 3-Hydoxy-N-octyl-aniline

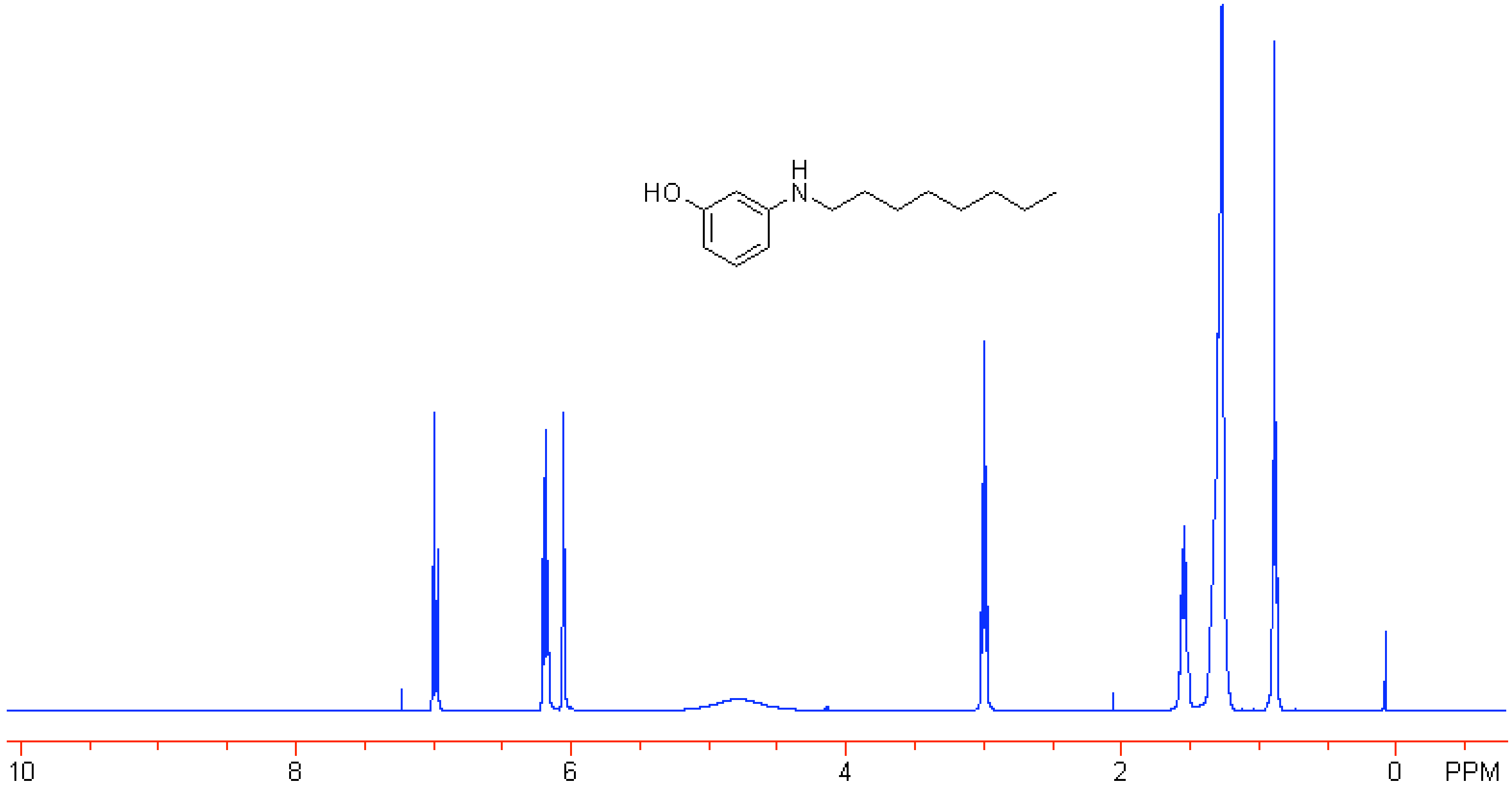


Table 3, entry 8, 3-Hydoxy-N-octyl-aniline

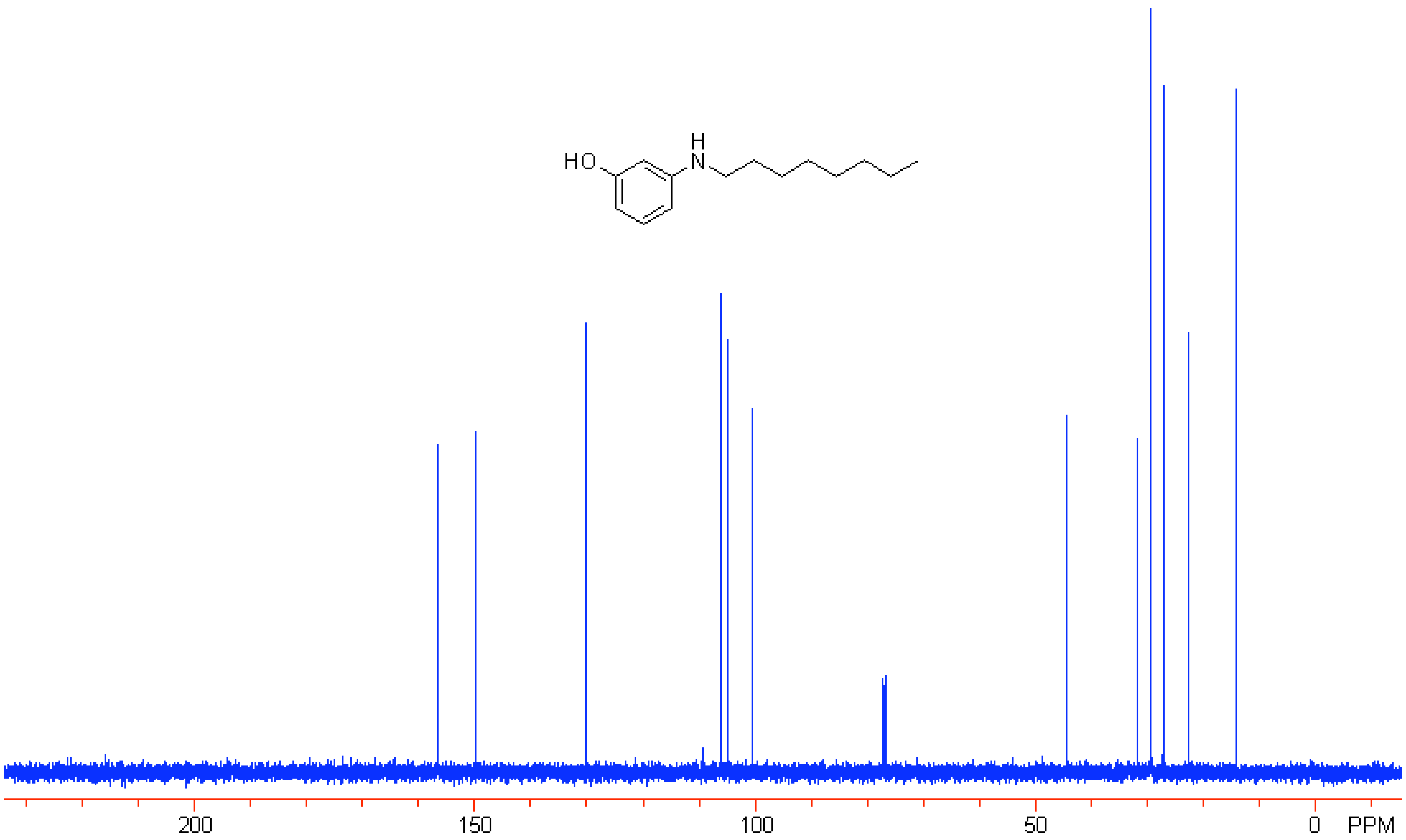


Table 3, entry16, 4-*N*-*sec*-Butylamino-benzoic aicd

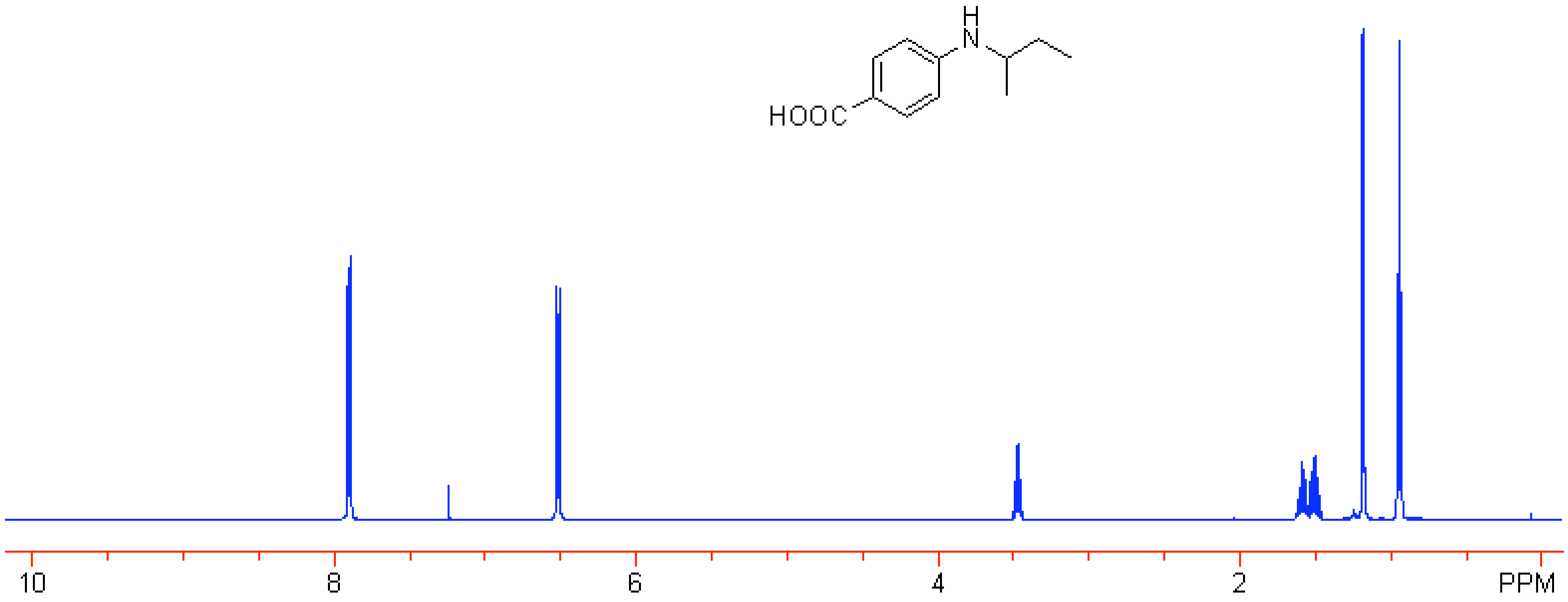


Table 3, entry16, 4-*N*-*sec*-Butylamino-benzoic aicd

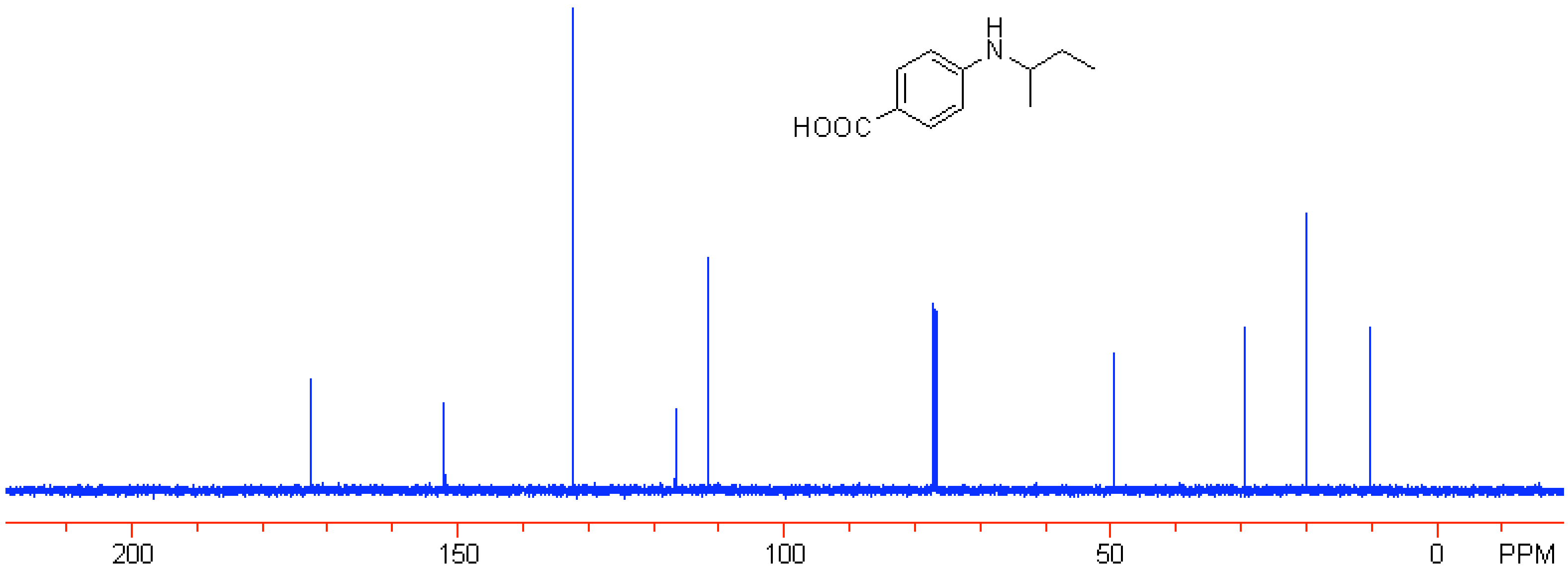


Table 3, entry 17, 3-N-Cyclohexylamino-acetaniline

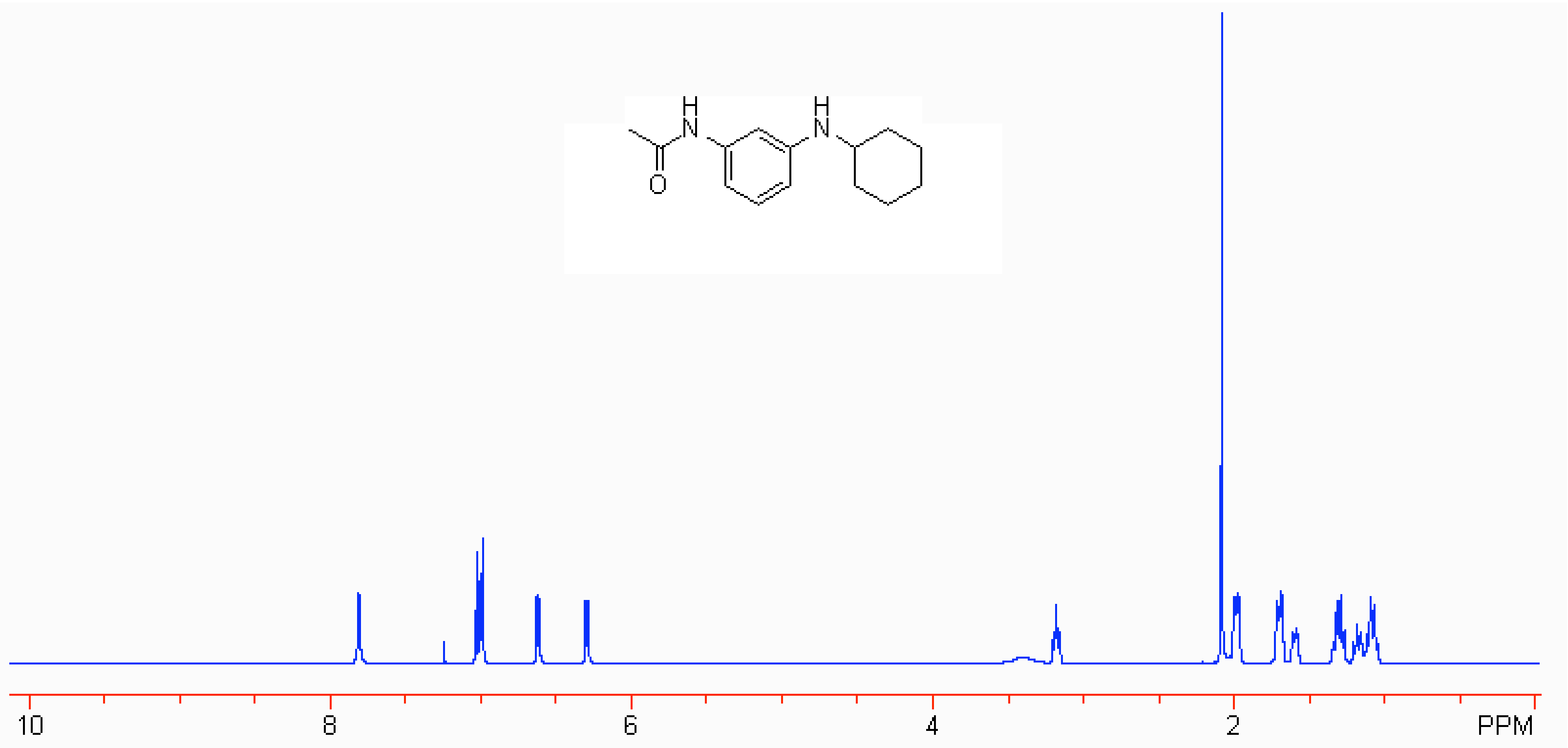


Table 3, entry 17, 3-N-Cyclohexylamino-acetaniline