Angewandte Chemie
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Supporting Information

69451 Weinheim, Germany

A General and Efficient Method for the Suzuki-Miyaura Coupling of 2-Pyridyl Nucleophilies

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Experimental Section

General. All reactions were carried out under an argon atmosphere. 1,4-Dioxane (anhydrous) was purchased from Aldrich Chemical Co. in a SureSeal® bottle. Commercially available materials were used without further purification unless otherwise noted. Diphenylphosphine oxide was purchased from Alfa Aesar, and di-*tert*-butylphosphine oxide was purchased from Strem Chemicals, Inc. Both ligands are hygroscopic and must be stored in a benchtop desiccator. Aryl halides were purchased from Aldrich Chemical Co. Liquid aryl halides were purified by passage through a pad of basic alumina prior to use. Potassium fluoride (anhydrous, Alfa Aesar) and Pd_2dba_3 (Strem Chemicals, Inc.) were stored in a benchtop desiccator. All lithium triisopropyl 2-pyridylborates were prepared in our laboratories via the procedure described in this experimental (Page 2). These were stored in a round bottom flask under an argon atmosphere inside a benchtop desiccator for up to a month.

All new compounds were characterized by ^{1}H NMR, ^{13}C NMR, IR spectroscopy, melting points (for solids) and, in most cases, elemental analysis. Known compounds were characterized by ^{1}H NMR, ^{13}C NMR and melting points (for solids) and compared to their literature values. ^{1}H and ^{13}C NMR spectra were recorded on a Varian Mercury

300. Infrared spectra were recorded on an ASI Applied Systems ReactIR 1000 (neat samples were placed directly on the DiComp probe). Elemental analyses were preformed by Atlantic Microlabs Inc., Norcross, GA. All ^{1}H NMR experiments are reported in δ units, parts per million (ppm) downfield of TMS and were measured relative to the signals for the residual benzene (7.16 ppm), chloroform (7.26 ppm), dimethylsulfoxide (2.50 ppm) or methanol (3.31 ppm). All ^{13}C NMR spectra were reported in ppm relative to residual chloroform (77 ppm), dimethylsulfoxide (39.5 ppm) or methanol (49 ppm) and were obtained with ^{1}H decoupling. Melting points were obtained on a Mel-Temp capillary melting point apparatus and are uncorrected. Gas chromatographic analyses were performed on Hewlett-Packard 6890 gas chromatography instrument with a FID detector using 25 m x 0.20 mm capillary column with cross-linked methyl siloxane as a stationary phase.

The yields in tables 2 and 3 refer to isolated yields (average of two runs) of compounds estimated to be ≥ 95% pure as determined by ^{1}H NMR and GC analysis and/or combustion analysis.

I. Experimental for Preparation of Lithium Triisopropyl 2-Pyridylborates

General Procedure for the Preparation of Lithium Triisopropyl 2-Pyridylborates.[1]

An oven-dried round-bottomed flask equipped with a magnetic stir bar and fitted with a rubber septum was charged with toluene (60 mL) and THF (15 mL) and placed under an argon atmosphere. The flask was charged with triisopropylborate (3.81 mL, 3.10 g, 16.5 mmol) and the heteroaryl bromide (15.0 mmol). The reaction mixture was cooled to -78 °C using a dry ice/acetone bath. *n*-Butyllithium (2.5 M in hexanes, 6.6 mL, 16.5 mmol) was added dropwise via a syringe pump over 1.5 h, and the mixture was stirred for an additional 0.5 h while the temperature was held at -78 °C. The reaction mixture was then allowed to warm to room temperature overnight (15 h). The resulting solution was then concentrated under reduced pressure, followed by further drying under high vacuum at 110 °C for 12 h to yield the desired borate.

[1] For a related protocol for the synthesis of 3-Pyridine boronic acid, see: Li, W.; Nelson, D. P.; Jensen, M. S.; Hoerrner, R. S.; Cai, D.; Larsen, R. D.; Reider, P. J. *J. Org. Chem.* **2002**, *67*, 5394-5397.

Lithium Triisopropyl 2-Pyridyl Borate (A). The general procedure was followed on a larger scale using toluene (120 mL), THF (30 mL), triisopropylborate (8.03 mL, 6.55 g, 34.8 mmol), 2-bromopyridine (31.6 mmol), *n*-Butyllithium (2.5 M in hexanes, 13.9 mL, 34.8 mmol) to provide the title compound in a 99% yield (8.67 g) as a brown solid, mp >250 °C. ^{1}H NMR (300 MHz, CD_3OD) δ: 8.38 (d, J = 5 Hz, 1H), 7.58 (dt, J = 8,1 Hz, 1H), 7.54 (t, J = 8 Hz, 1H), 7.07 (dt, J = 8,1 Hz, 1H), 3.93 (sept, J = 6 Hz, 3H), 1.15 (d, J = 6 Hz, 18H). ^{13}C NMR (75 MHz, CD_3OD) δ: 148.2, 135.5, 128.5, 121.7, 64.7, 25.4. (No C-B Signal) IR (neat, cm^{-1}): 3372, 2941, 2913, 1653, 1557, 1538, 1421, 1149, 1004, 931. ^{1}H and ^{13}C NMR spectrum included.

Lithium Triisopropyl 2-(6-Methoxypyridyl) Borate (B). The general procedure was followed to provide the title compound in a 90% yield (4.10 g) as a white solid, mp 226-227 °C. ^{1}H NMR (300 MHz, CD_3OD) δ: 7.52 (t, J = 8 Hz, 1H), 7.13 (d, J = 8 Hz, 1H), 6.52 (d, J = 8 Hz, 1H), 3.93 (sept, J = 6 Hz, 3H), 3.87 (s, 3H), 1.15 (d, J = 6 Hz, 18H). ^{13}C NMR (75 MHz, CD_3OD) δ: 165.4, 138.9, 121.9, 105.3, 64.7, 54.4, 25.3. (No C-B Signal) IR (neat, cm^{-1}): 3284, 2952, 2901, 2851, 1647, 1589, 1559, 1487, 1425, 1401, 1282, 1226, 1043, 934, 903. ^{1}H and ^{13}C NMR spectrum included.

Lithium Triisopropyl 2-(5-fluoropyridyl) Borate (C). The general procedure was followed on a smaller scale using toluene (40 mL), THF (10 mL), triisopropylborate (2.88 mL, 2.35 g, 12.5 mmol), 2-bromo-5-fluoropyridine (2.00 g, 11.4 mmol), *n*-Butyllithium (2.5 M in hexanes, 5.00 mL, 12.5 mmol) to provide the title compound in a 96% yield (3.24 g) as a brown solid, mp >250 °C. ^{1}H NMR (300 MHz, CD_3OD) δ: 8.26 (s, 1H), 7.55 (dd, J = 8,6 Hz, 1H), 7.39 (dt, J = 8,6 Hz, 1H), 3.93 (sept, J = 6 Hz, 3H), 1.15 (d, J = 6 Hz, 18H). ^{13}C NMR (75 MHz, CD_3OD) δ: 161.0, 159.0, 135.8, 129.4, 122.6, 64.7, 25.5. IR (neat, cm^{-1}): 3282, 2959, 171, 1471, 1375, 1326, 1171, 1129, 950. ^{1}H and ^{13}C NMR spectrum included.

Lithium Triisopropyl 2-(6-(1,3-dioxolan-2-yl)pyridin-2-yl) Borate (D). The general procedure was followed on a smaller scale using toluene (16.0 mL), THF (4.0 mL),

triisopropylborate (1.05 mL, 0.856 g, 4.55 mmol), 2-bromo-6-(1,3-dioxolan-2-yl)pyridine (0.952 g, 4.14 mmol), *n*-Butyllithium (2.5 M in hexanes, 1.82 mL, 4.55 mmol) to provide the title compound in a 73% yield (1.04 g) as a brown solid, mp 159-161 °C. ^{1}H NMR (300 MHz, CD_3OD) δ: 7.64 (t, J = 8 Hz, 1H), 7.55 (dd, J = 8,1 Hz, 1H), 7.30 (dd, J = 8,1 Hz, 1H), 5.81 (s, 1H), 3.95-4.10 (m, 4H), 3.92 (sept, J = 6 Hz, 3H), 1.15 (d, J = 6 Hz, 18H). ^{13}C NMR (75 MHz, CD_3OD) δ: 155.9, 136.2, 128.7, 121.0, 119.0, 105.2, 66.4, 64.7, 25.5. IR (neat, cm^{-1}): 2964, 2892, 1593, 1464, 1376, 1202, 1127, 1007. ^{1}H and ^{13}C NMR spectrum included.

Lithium Triisopropyl 2-(5-cyanopyridyl) Borate (E). The general procedure was followed on a smaller scale using toluene (20.0 mL), THF (5.0 mL), triisopropylborate (1.27 mL, 1.03 g, 5.50 mmol), 6-bromopyridine-3-carbonitrile (0.915 g, 5.00 mmol), *n*-Butyllithium (2.5 M in hexanes, 2.20 mL, 5.50 mmol) to provide the title compound in a 95% yield (1.42 g) as a brown solid, mp >250 °C. ^{1}H NMR (300 MHz, CD_3OD) δ: 8.73 (d, J = 3 Hz, 1H), 7.93 (dd, J = 8,3 Hz, 1H), 7.71 (d, J = 8 Hz, 1H), 3.93 (sept, J = 6 Hz, 3H), 1.15 (d, J = 6 Hz, 18H). ^{13}C NMR (75 MHz, CD_3OD) δ: 151.1, 138.3, 132.0, 128.8, 118.6, 107.8, 64.8, 25.4. IR (neat, cm^{-1}): 2952, 2862, 2218, 1591, 1448, 1363, 1126, 999. ^{1}H and ^{13}C NMR spectrum included.

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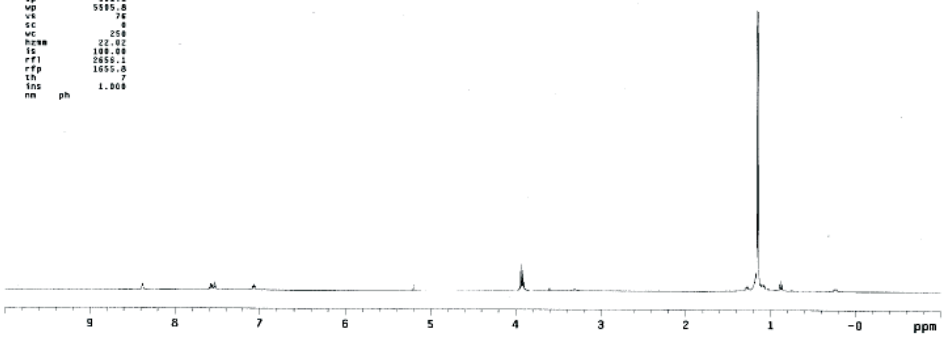

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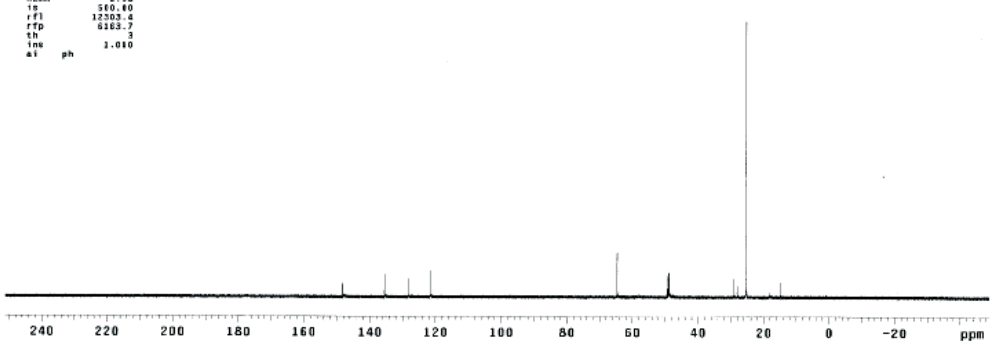

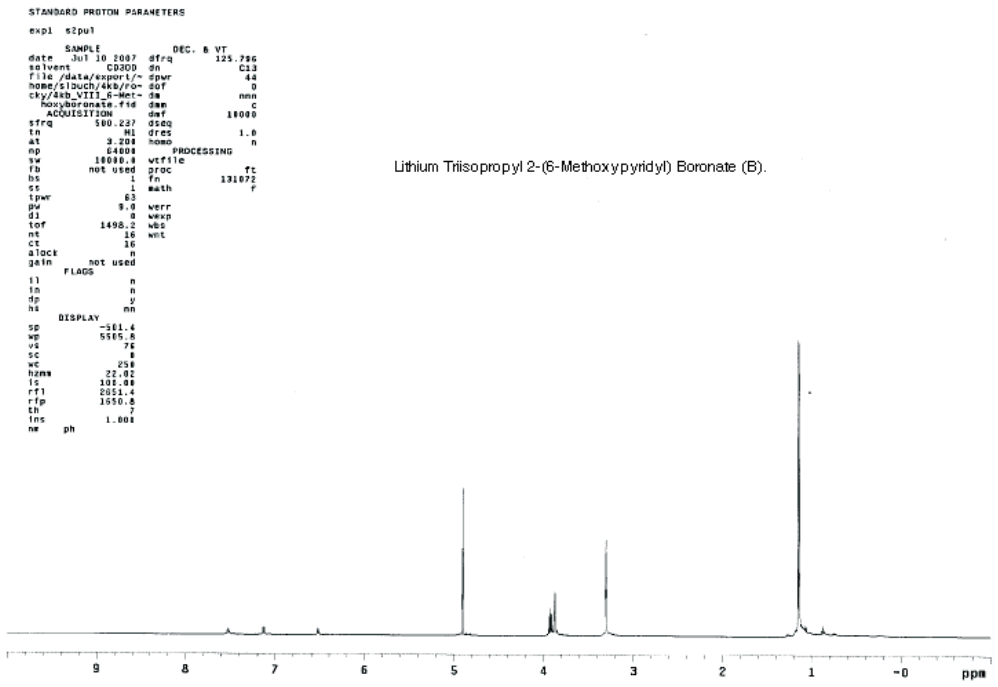
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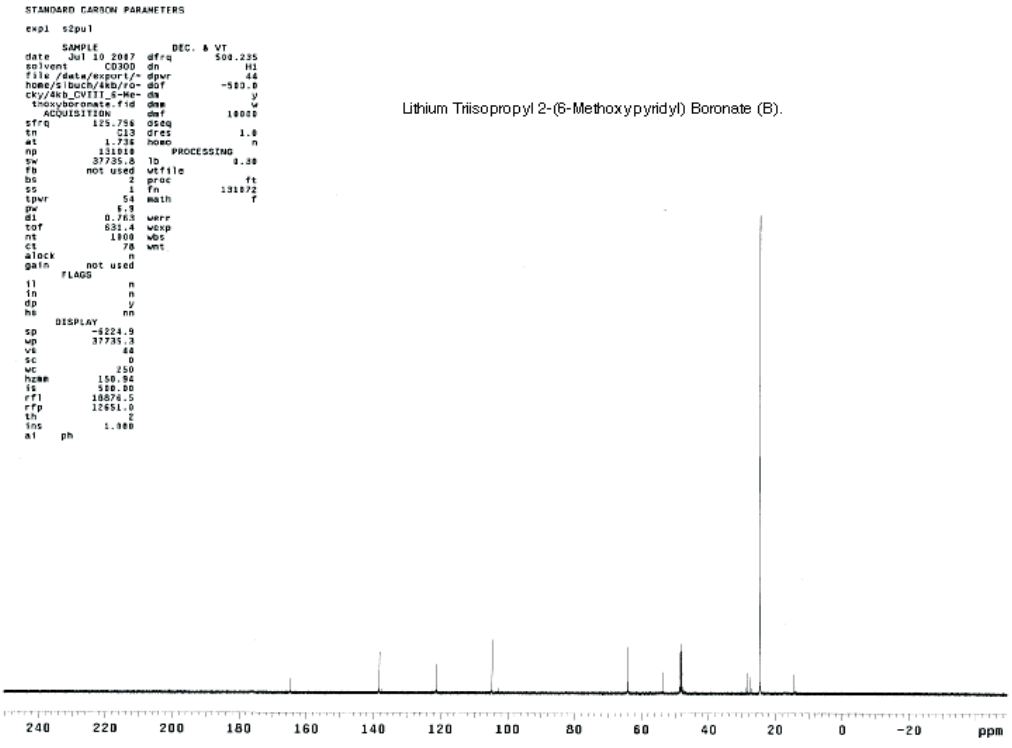
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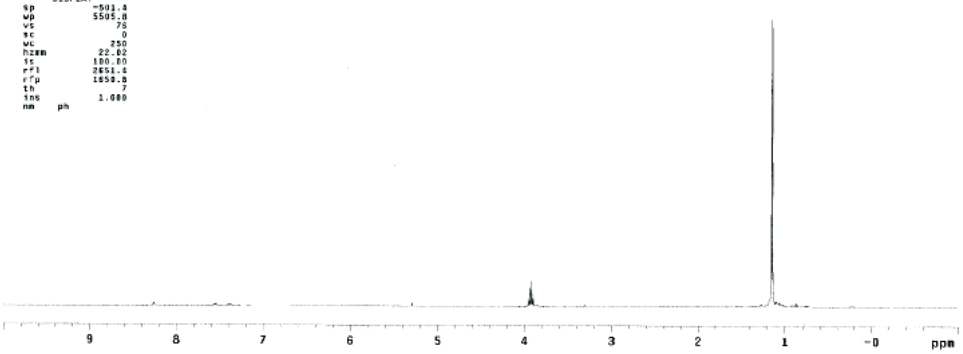
Lithium Triisopropyl 2-(5-fluoropyridyl) Boronate (C).



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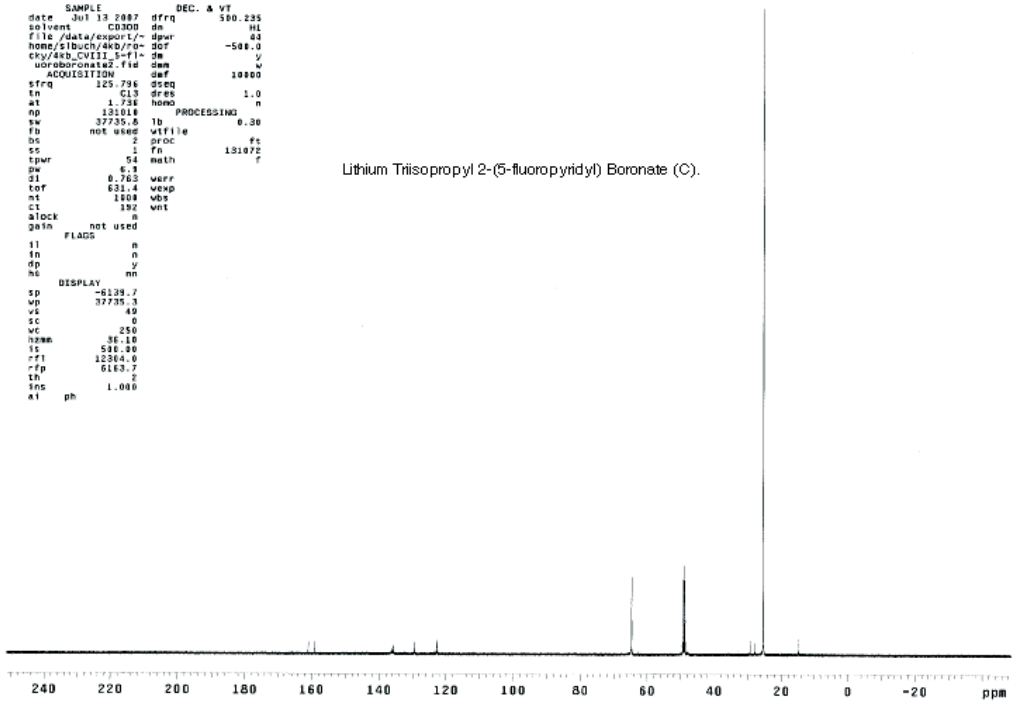

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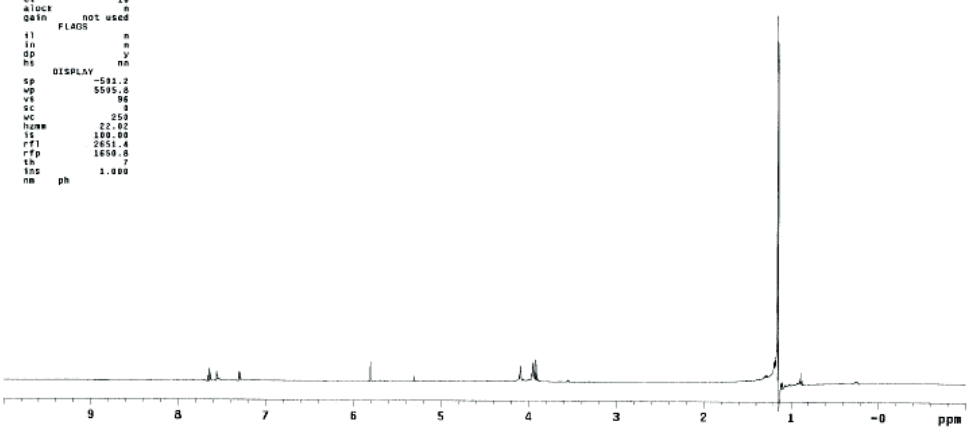


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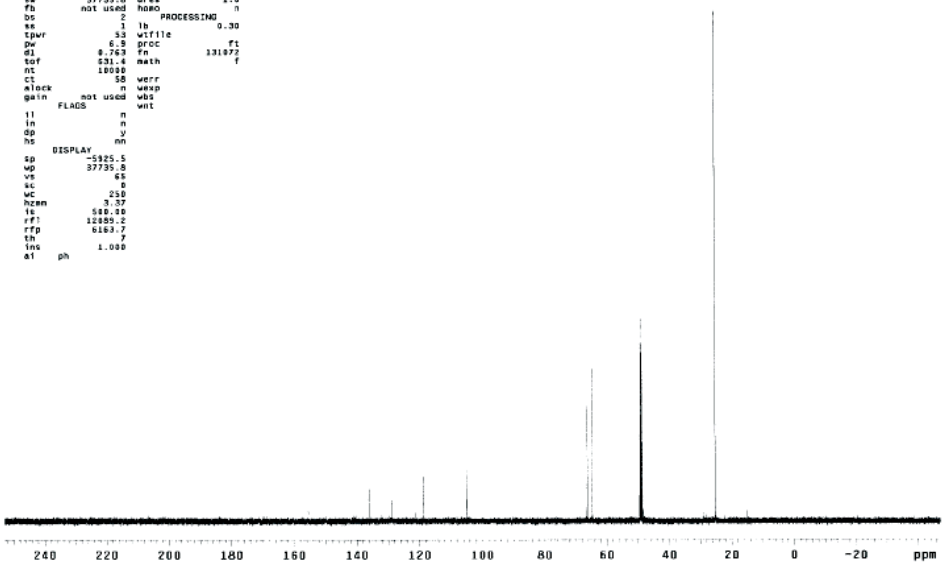

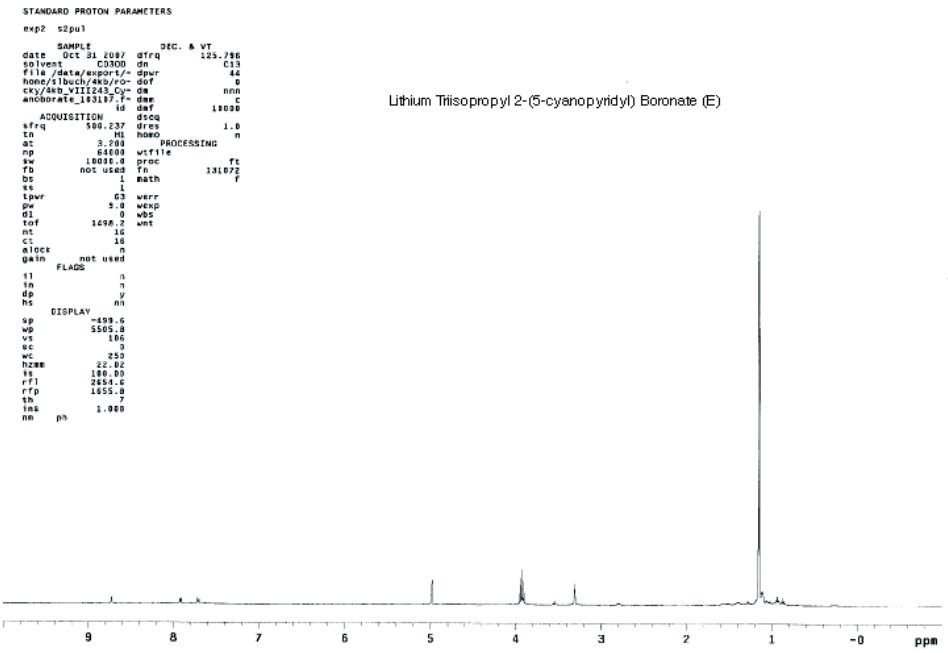
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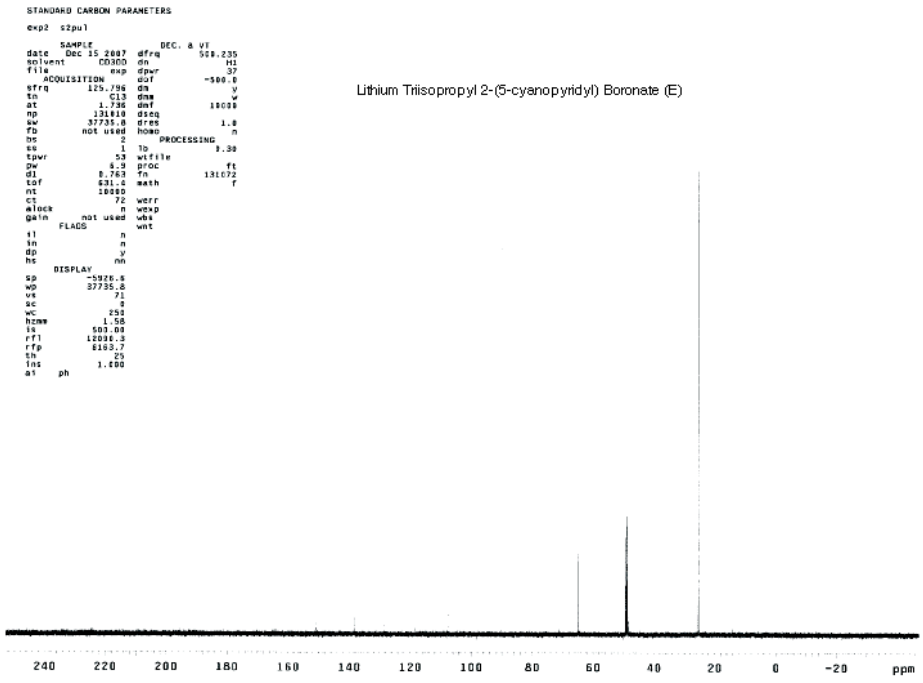
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Lithium Triisopropyl 2-(5-cyanopyridyl) Boronate (E)
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm

II. Experimental for the Reactions with Aryl Bromides

General Procedure A: Pd-Catalyzed Suzuki-Miyaura Reaction of Lithium Triisopropyl 2-Pyridylborates with Aryl Halides.

An oven-dried resealable Schlenk tube possessing a Teflon screw valve was charged with Pd_2dba_3 (2.0-3.0%), ligand (6.0-9.0%), lithium triisopropyl 2-pyridylborate (0.375 mmol) and anhydrous KF (43.5 mg, 0.75 mmol). The Schlenk tube was capped with a rubber septum and then evacuated and backfilled with argon (this sequence was carried out two times). 1,4-Dioxane (0.75 mL) was added via syringe, through the septum, followed by the addition of the aryl halide (0.25 mmol) in a like manner (aryl halides that were solids were added with the other solid reagents). The septum was then replaced with a Teflon screw valve and the Schlenk tube was sealed. The reaction mixture was heated to 110 °C until the aryl halide had been completely consumed as determined by gas chromatography and was allowed to cool to room temperature. The reaction solution was then filtered through a thin pad of silica gel (eluting with ethyl acetate) and the eluent was concentrated under reduced pressure. The crude material so obtained was purified via flash chromatography on silica gel.

2-(4-butylphenyl)pyridine (Table 2, Entry 1).[2] Following general procedure A, a mixture of 4-*n*-butylbromobenzene (44.1 μL, 53.3 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **1** (3.0 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (10% EtOAc/Hexanes) yielded the title compound in 45 mg (85% yield) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.66 (dt, J = 6,1 Hz, 1H), 7.88 (d, J = 8 Hz, 2H), 7.67-7.71 (m, 2H), 7.26 (d, J = 8 Hz, 2H), 7.16 (dt, J = 6,1 Hz, 1H), 2.64 (t, J = 8 Hz, 2H), 1.62 (pent, J = 8 Hz, 2H), 1.36 (hex, J = 8 Hz, 2H), 0.92 (t, J = 8 Hz, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 157.4, 149.5, 143.9, 136.7, 136.6, 128.8, 126.7, 121.7, 120.2, 35.4, 33.5, 22.3, 13.9. ^{1}H and ^{13}C NMR spectrum included.

2-(3,5-bis(trifluoromethyl)phenyl)pyridine (Table 2, Entry 2).[3] Following general procedure A, a mixture of 3,5-bis(trifluoromethyl)bromobenzene (43.1 μL, 73.3 mg, 0.25

[2] Iwasawa, T.; Ajami, D.; Rebek, Jr. J. *Org. Lett.* **2006**, *8*, 2925.
[3] Coppo, P.; Plummer, E. A.; Cola, L. D. *Chem. Commun.* **2004**, 1774.

mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **1** (3.0 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (10% EtOAc/Hexanes) yielded the title compound in 60 mg (82% yield) as a white solid, mp 45-46 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.75 (dt, J = 5,1 Hz, 1H), 8.48 (s, 2H), 7.91 (s, 1H), 7.81-7.86 (m, 2H), 7.35 (dt, J = 5,1 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 154.1, 150.1, 141.3, 137.2, 132.1, 126.9, 124.4, 123.6, 122.4, 120.6. ^{1}H and ^{13}C NMR spectrum included.

2-(4-methoxyphenyl)pyridine (Table 2, Entry 3).[4] Following general procedure A, a mixture of 4-bromoanisole (31.3 μL, 46.8 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **1** (3.0 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (15% EtOAc/Hexanes) yielded the title compound in 34 mg (74% yield) as a white solid, mp 47-48 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.65 (dt, J = 5,1 Hz, 1H), 7.96 (d, J = 9 Hz, 2H), 7.71 (dt, J = 8,2 Hz, 1H), 7.66 (dt, J = 8,1 Hz, 1H), 7.17 (dd, J = 5,1 Hz, 1H), 7.00 (d, J = 9 HZ, 2H), 3.86 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 160.4, 157.0, 149.4, 136.6, 132.0, 128.1, 121.4, 119.8, 114.1, 55.3. ^{1}H and ^{13}C NMR spectrum included.

2-(2,5-dimethylphenyl)pyridine (Table 2, Entry 4). Following general procedure A, a mixture of 2-bromo-*p*-xylene (34.5 μL, 46.3 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **1** (3.0 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (10% EtOAc/Hexanes) yielded the title compound in 39 mg (87% yield) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.71 (dt, J = 5,1 Hz, 1H), 7.74 (dt, J = 7,1 Hz, 1H), 7.42 (dt, J = 8,1 Hz, 1H), 7.23-7.26 (m, 2H), 7.16 (dt, J = 6,1 Hz, 1H), 7.20 (d, J = 8 Hz, 1H), 7.14 (dt, J = 8,1 Hz, 1H), 2.38 (s, 3H), 2.34 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 160.0, 149.2, 140.2, 135.9, 135.2, 132.4, 130.6, 130.2, 128.9, 124.0, 121.5, 20.9, 19.7. IR (neat, cm^{-1}): 3394, 3014, 2922, 1598, 1563, 1501, 1471, 1426, 1378, 1149, 1039, 992, 792, 749. ^{1}H and ^{13}C NMR spectrum included.

2-(pyridin-2-yl)benzonitrile (Table 2, Entry 5).[5] Following general procedure A, a mixture of 2-bromobenzonitrile (45.5 mg, 0.25 mmol), lithium triisopropyl 2-

[4] Andersson, H.; Almqvist, F.; Olsson, R. *Org. Lett.* **2007**, *9*, 1335.
[5] Chen, X.; Hao, X.-S.; Goodhue, C. E.; Yu, J.-Q. *J. Am. Chem. Soc.* **2006**, *127*, 6790.

pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **1** (3.0 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (25% EtOAc/Hexanes) yielded the title compound in 41 mg (90% yield) as a yellow oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.77 (dt, J = 5,1 Hz, 1H), 7.76-7.84 (m, 4H), 7.79 (dt, J = 8,2 Hz, 1H), 7.50 (dt, J = 8,2 Hz, 1H), 7.35 (ddd, J = 8,5,1 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 155.2, 149.9, 143.4, 136.8, 134.1, 132.8, 129.9, 128.7, 123.3, 123.2, 118.7, 111.0. ^{1}H and ^{13}C NMR spectrum included.

5-(pyridin-2-yl)pyrimidine (Table 2, Entry 6).[6] Following general procedure A, a mixture of 5-bromopyrimidine (39.7 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **1** (3.0 mg, 0.015 mmol) was heated for 20 h. Recrystallization (Hexanes) yielded the title compound in 36 mg (91% yield) as a brown solid, mp 129-130 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 9.33 (s, 2H), 9.25 (s, 1H), 8.75 (dt, J = 5,1 Hz, 1H), 7.83 (dt, J = 8,2 Hz 1H), 7.76 (dt, J = 8,1 Hz, 1H), 7.35 (ddd, J = 8,5,2 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 158.6, 155.1, 152.0, 150.4, 137.2, 132.4, 123.6, 120.5. ^{1}H and ^{13}C NMR spectrum included.

4-(pyridin-2-yl)isoquinoline (Table 2, Entry 7).[7] Following general procedure A, a mixture of 4-bromoisoquinoline (52.0 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **1** (3.0 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (50% EtOAc/Hexanes) yielded the title compound in 42 mg (82% yield) as a yellow oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 9.29 (s, 1H), 8.82 (dt, J = 5,1 Hz, 1H), 8.64 (s, 1H), 8.20 (d, J = 8 Hz, 1H), 8.03 (d, J = 8 Hz, 1H), 7.86 (dt, J = 8,1 Hz, 1H), 7.70 (dt, J = 8,1 Hz, 1H), 7.63 (t, J = 8 Hz, 1H), 7.37 (ddd, J = 8,5,1 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 156.3, 153.0, 149.7, 143.4, 136.8, 133.7, 131.5, 130.9, 128.5, 127.9, 127.3, 124.9, 124.7, 122.5. ^{1}H and ^{13}C NMR spectrum included.

2,3'-bipyridine (Table 2, Entry 8).[8] Following general procedure A, a mixture of 3-bromopyridine (24.1 μL, 39.5 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104

[6] Berghian, C.; Darabantu, M.; Turck, A.; Pié, N. *Tetrahedron* **2005**, *61*, 9637.
[7] Ishikura, M.; Oda, I.; Terashima, M. *Heterocycles* **1987**, *26*, 1603.
[8] Cioffi, C. L.; Spencer, W. T.; Richards, J. J.; Herr, R. J. *J. Org. Chem.* **2004**, *69*, 2210.

mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **1** (3.0 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (EtOAc) yielded the title compound in 29 mg (73% yield) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 9.17 (d, J = 3 Hz, 1H), 8.71 (dt, J = 5,1 Hz, 1H), 8.64 (dt, J = 5,1 Hz, 1H), 8.31 (dt, J = 8,1 Hz, 1H), 7.79 (dt, J = 8,1 Hz, 1H), 7.75 (dt, J = 8,1 Hz, 1H), 7.39 (dd, J = 8,3 Hz, 1H), 7.28 (ddd, J = 8,5,1 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 154.7, 150.0, 149.9, 148.2, 136.9, 134.8, 134.3, 123.5, 122.8, 120.6. ^{1}H and ^{13}C NMR spectrum included.

2-(4-butylphenyl)-6-methoxypyridine (Table 2, Entry 9). Following general procedure A, a mixture of 4-*n*-butylbromobenzene (44.1 μL, 53.3 mg, 0.25 mmol), lithium triisopropyl 2-(6-methoxypyridyl)borate (114 mg, 0.375 mmol), KF, Pd_2dba_3 (3.4 mg, 0.00375 mmol) and **2** (3.6 mg, 0.0225 mmol) was heated for 20 h. Flash column chromatography (5% EtOAc/Hexanes) yielded the title compound in 54 mg (90% yield) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.97 (d, J = 8 Hz, 2H), 7.62 (t, J = 8 Hz, 1H), 7.32 (d, J = 8 Hz, 1H), 7.28 (d, J = 8 Hz, 2H), 6.67 (d, J = 8 Hz, 1H), 4.05 (s, 3H), 2.67 (t, J = 8 Hz, 2H), 1.65 (pent, J = 8 Hz, 2H), 1.39 (hex, J = Hz, 2H), 0.96 (t, J = 8 Hz, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 163.6, 154.7, 143.8, 139.1, 136.5, 128.7, 126.5, 112.4, 108.8, 53.1, 35.4, 33.6, 22.3, 14.0. IR (neat, cm^{-1}): 3060, 2955, 2929, 2857, 1587, 1514, 1463, 1435, 1398, 1324, 1302, 1255, 1151, 1075, 1025, 795. ^{1}H and ^{13}C NMR spectrum included.

2-methoxy-6-(4-methoxyphenyl)pyridine (Table 2, Entry 10).[9] Following general procedure A, a mixture of 4-bromoanisole (31.3 μL, 46.8 mg, 0.25 mmol), lithium triisopropyl 2-(6-methoxypyridyl)borate (114 mg, 0.375 mmol), KF, Pd_2dba_3 (3.4 mg, 0.00375 mmol) and **2** (3.6 mg, 0.0225 mmol) was heated for 20 h. Flash column chromatography (5% EtOAc/Hexanes) yielded the title compound in 33 mg (61% yield) as a white solid, mp 120-121 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.01 (d, J = 7 Hz, 2H), 7.59 (dt, J= 7,2 Hz, 1H), 7.27 (d, J = 7 Hz, 1H), 6.98 (d, J = 7 Hz, 2H), 6.63 (d, J = 7 Hz, 2H), 4.03 (s, 3H), 3.86 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 163.6, 160.3, 154.4, 139.1, 131.7, 127.9, 113.9, 111.9, 108.2, 55.3, 53.1. ^{1}H and ^{13}C NMR spectrum included.

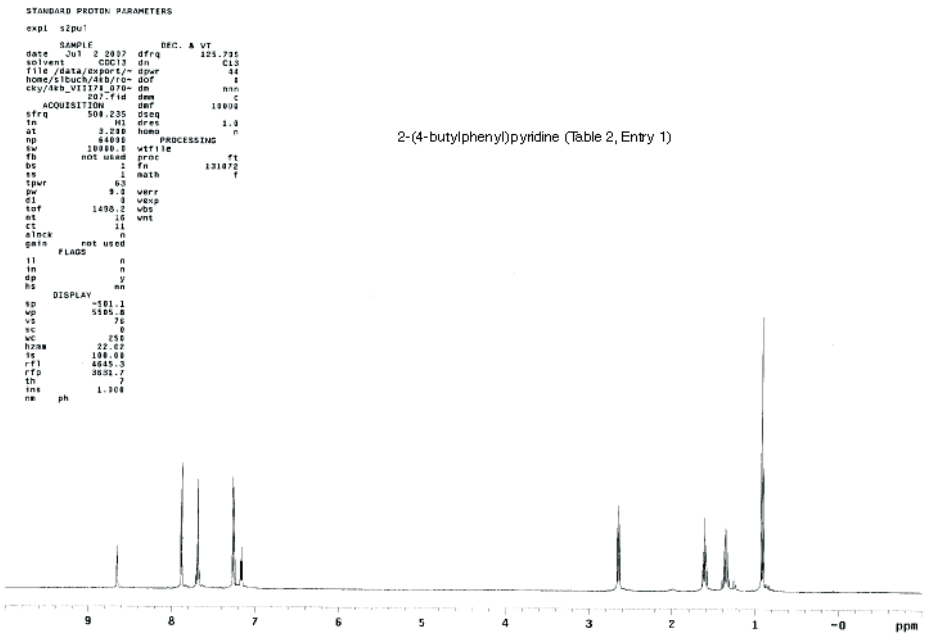
4-(5-fluoropyridin-2-yl)benzonitrile (Table 2, Entry 11). Following general procedure A, a mixture of 4-bromobenzonitrile (45.5 mg, 0.25 mmol), lithium triisopropyl 2-(5-

[9] Gosmini, C.; Nédélec, J. Y.; Périchon, R. *Tetrahedron Lett.* **2000**, *41*, 5039.

fluoropyridyl)borate (109 mg, 0.375 mmol), KF, Pd_2dba_3 (3.4 mg, 0.00375 mmol) and **2** (3.6 mg, 0.0225 mmol) was heated for 20 h. Recrystallization (Hexanes) yielded the title compound in 32 mg (65% yield) as a brown solid, mp 61-62 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.57 (d, J = 3 Hz, 1H), 8.06 (d, J = 8 Hz, 2H), 7.78 (dd, J = 8,3 Hz, 1H), 7.75 (d, J = 8 Hz, 2H), 7.52 (dt, J = 8,3 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 160.3, 158.3, 142.3, 138.3, 132.6, 127.2, 123.7, 121.8, 118.6, 112.4. IR (neat, cm^{-1}): 2917, 2226, 1585, 1476, 1225, 1069, 1014, 791. Anal. Calcd. For $C_{12}H_7N_2F$: C, 72.72; H, 3.56. Found C, 72.52; H, 3.55.

2-(2,5-dimethylphenyl)-5-fluoropyridine (Table 2, Entry 12). Following general procedure A, a mixture of 2-bromo-*p*-xylene (34.5 μL, 46.3 mg, 0.25 mmol), lithium triisopropyl 2-(5-fluoropyridyl)borate (109 mg, 0.375 mmol), KF, Pd_2dba_3 (3.4 mg, 0.00375 mmol) and **2** (3.6 mg, 0.0225 mmol) was heated for 20 h. Flash column chromatography (5% EtOAc/Hexanes) yielded the title compound in 20 mg (40% yield) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.55 (d, J = 3 Hz, 1H), 7.45 (dt, J = 8,3 Hz, 1H), 7.39 (dd, J = 8,3 Hz, 1H), 7.20 (s, 1H), 7.17 (d, J = 8 Hz, 1H), 7.12 (d, J = 8 Hz, 1H), 2.36 (s, 3H), 2.30 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 159.3, 157.2, 139.1, 137.2, 135.4, 132.5, 130.7, 130.2, 129.1, 124.8, 122.8, 20.9, 19.8. IR (neat, cm^{-1}): 3019, 2923, 2862, 1630, 1580, 1479, 1380, 1237, 1220, 1020, 812. ^{1}H and ^{13}C NMR spectrum included.

4-(6-(1,3-dioxolan-2-yl)pyridin-2-yl)benzonitrile (Table 2, Entry 13). Following general procedure A, a mixture 4-bromobenzonitrile (45.5 mg, 0.25 mmol), lithium triisopropyl 2-(6-(1,3-dioxolan-2-yl)pyridin-2-yl)borate (129 mg, 0.375 mmol), KF, Pd_2dba_3 (3.4 mg, 0.00375 mmol) and **1** (4.5 mg, 0.0225 mmol) was heated for 20 h. Flash column chromatography (25% EtOAc/Hexanes) yielded the title compound in 38 mg (63% yield) as a white solid, mp 80-81 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.14 (d, J = 8 Hz, 2H), 7.85 (t, J = 8 Hz, 1H), 7.73-7.76 (m, 3H), 7.57 (d, J = 8 Hz, 1H), 5.92 (s, 1H), 4.11-4.22 (m, 4H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 157.6, 154.6, 143.0, 137.9, 132.4, 127.5, 121.0, 120.1, 118.8, 112.4, 103.7, 65.7. IR (neat, cm^{-1}): 2955, 2876, 2223, 1593, 1459, 1367, 1110. ^{1}H and ^{13}C NMR spectrum included.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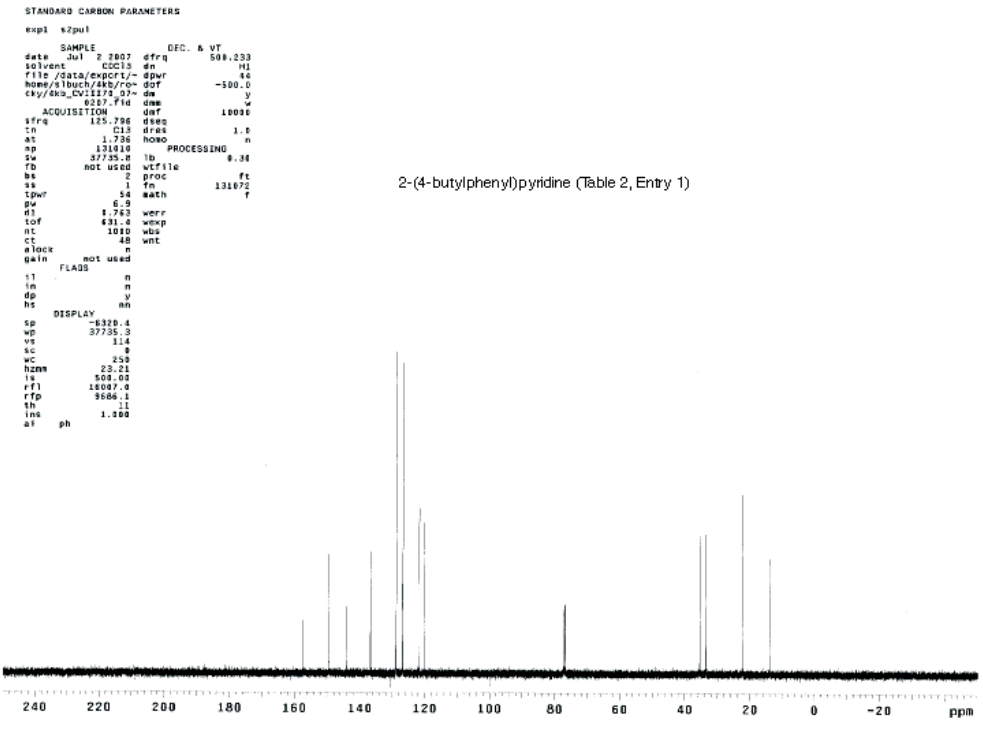
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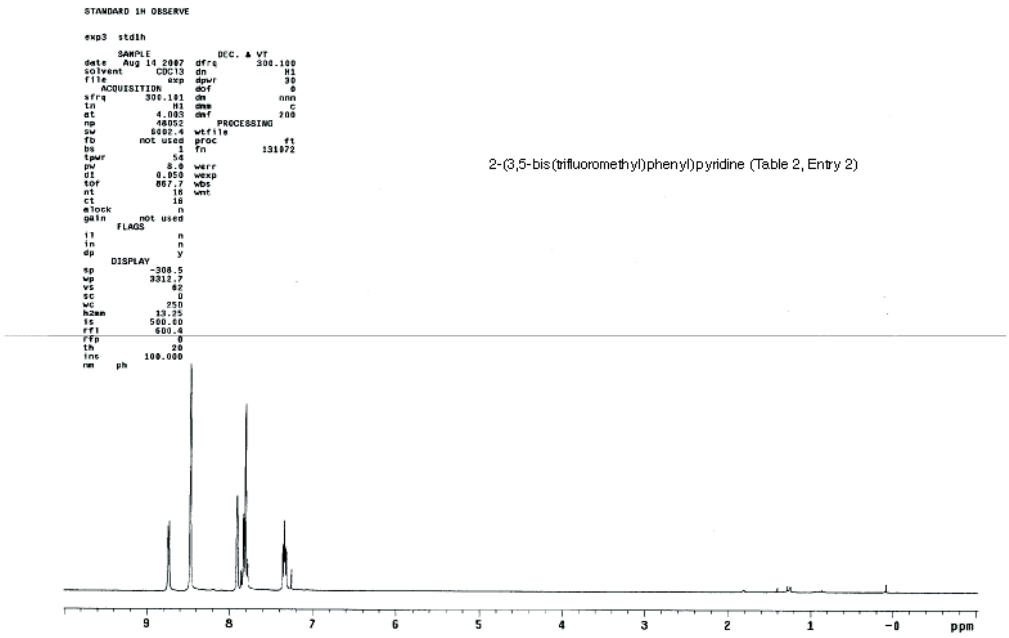
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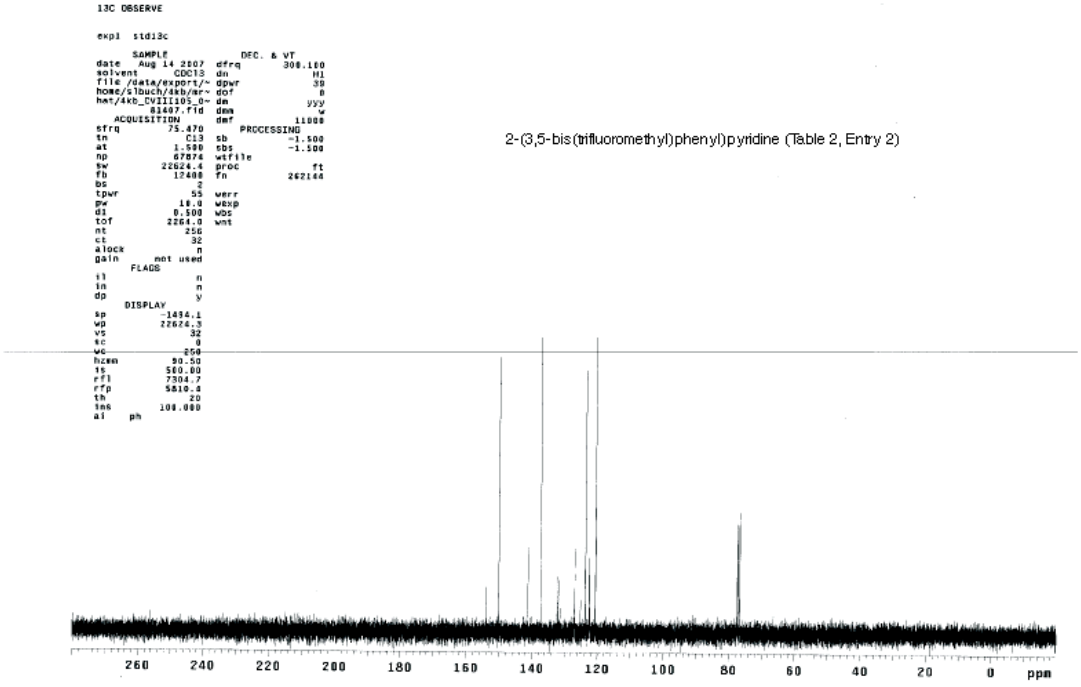
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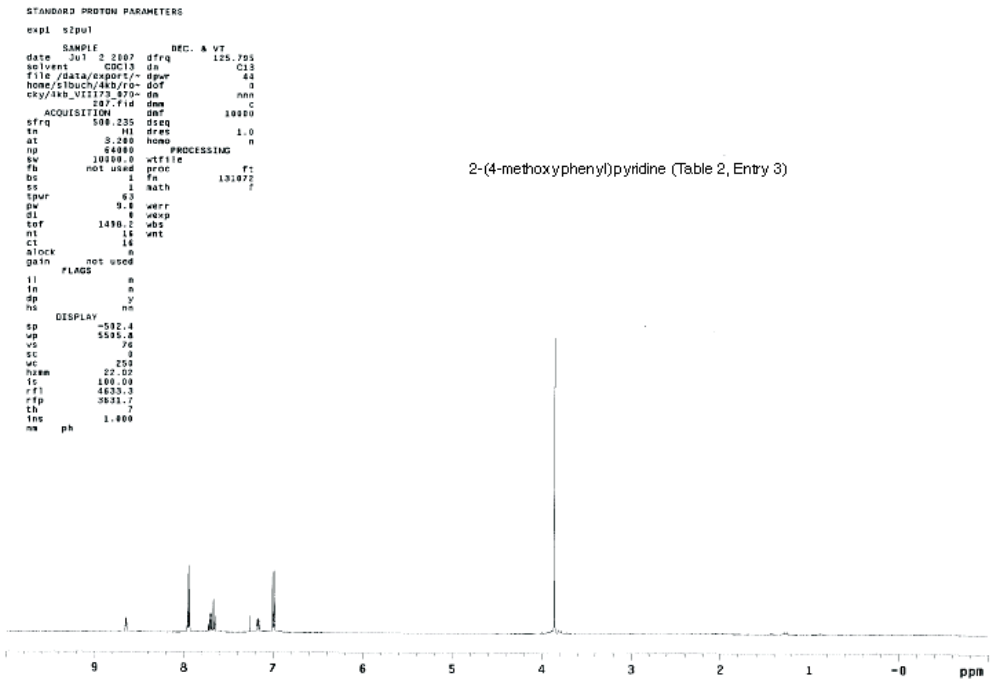
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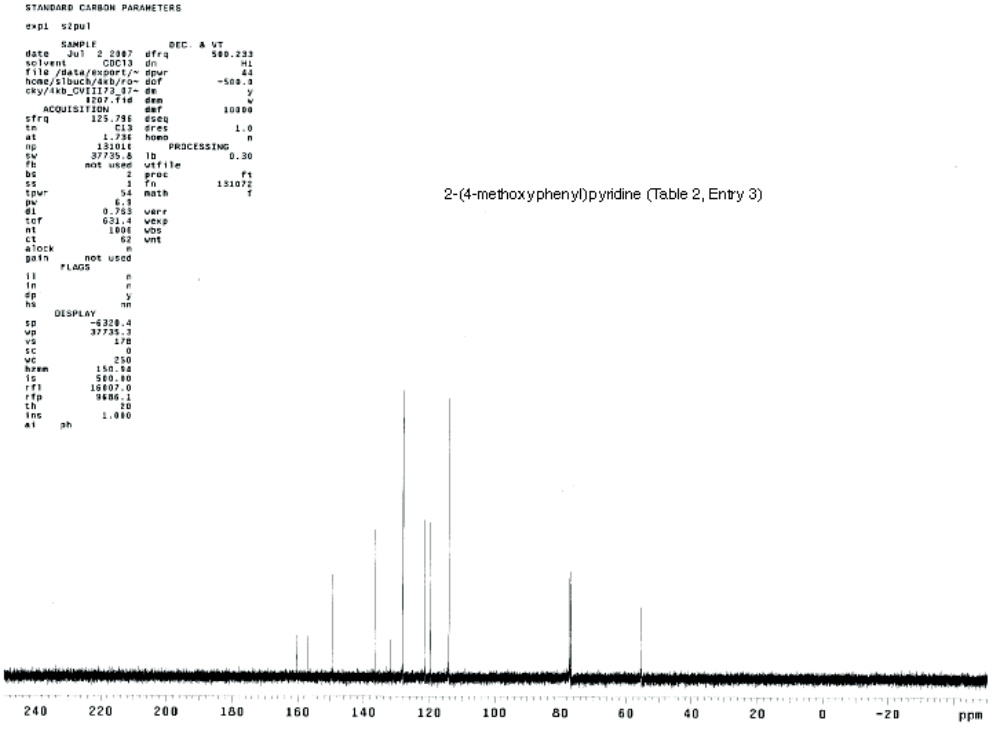
dmf 10080
dseq
dres 1.0
homo n
PROCESSING
wtfile
proc ft
fn 131072
math f
werr
wexp
wbs
wnt
2-(4-methoxyphenyl)pyridine (Table 2, Entry 3)
9
8
7
6
5
4
3
2
1
-0
ppm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solvent CDCl3
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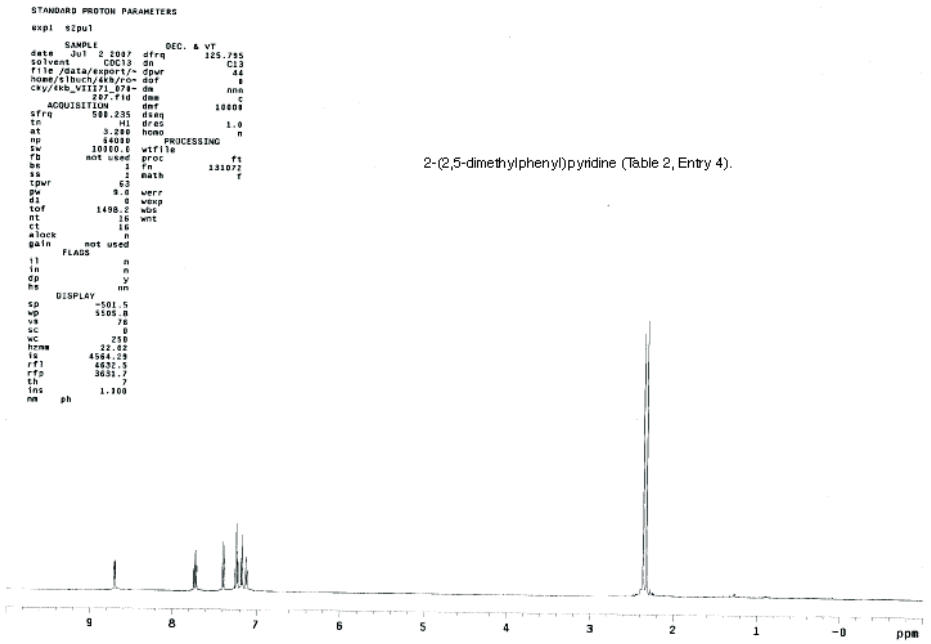
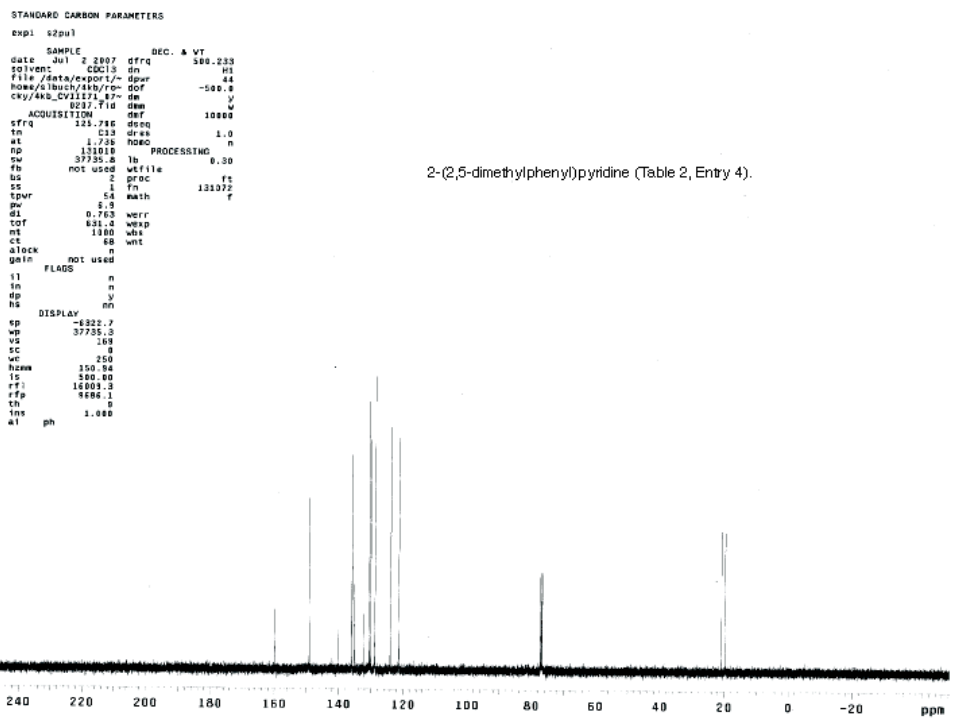
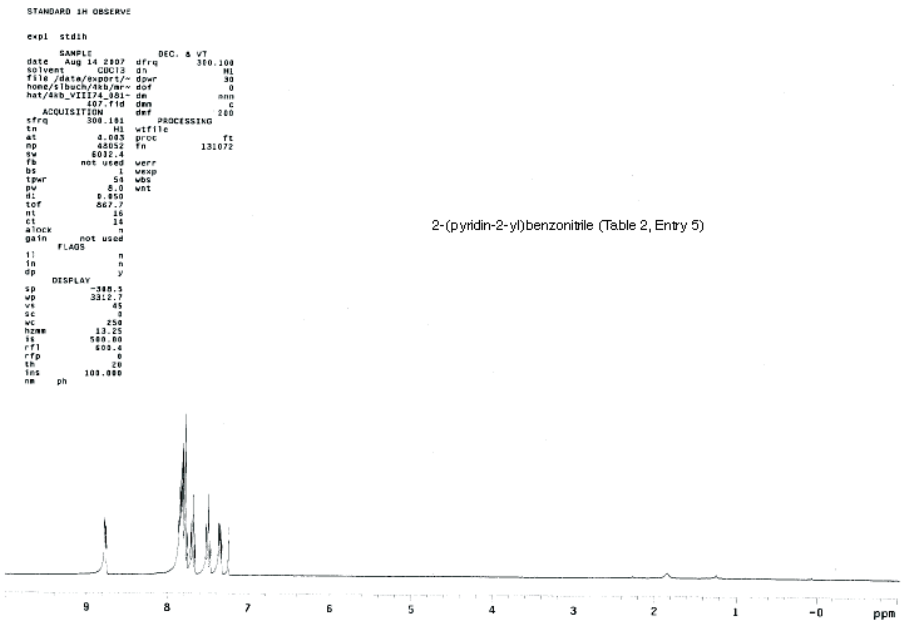
cky/4kb_VIII73_07~
207.fid
ACQUISITION
sfrq 125.796
tn C13
at 1.736
np 131016
sw 37735.8
fb not used
bs 2
ss 1
tpwr 54
pw 6.8
dl 0.763
tof 631.4
nt 1808
ct 62
alock n
gain not used
FLAGS
il n
in n
dp y
hs nn
DISPLAY
sp -6328.4
wp 37735.3
vs 178
sc 0
wc 250
hzcm 150.94
is 580.80
rfl 16807.0
rfp 9686.1
th 20
ins 1.000
ph
DEC. & VT
dfrq 500.233
dn H1
dpwr 44
dof -502.4
dm y
dmm w
dmf 10080
dseq
dres 1.0
homo n
PROCESSING
lb 0.30
wtfile
proc ft
fn 131072
math f
werr
wexp
wbs
wnt
2-(4-methoxyphenyl)pyridine (Table 2, Entry 3)
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm



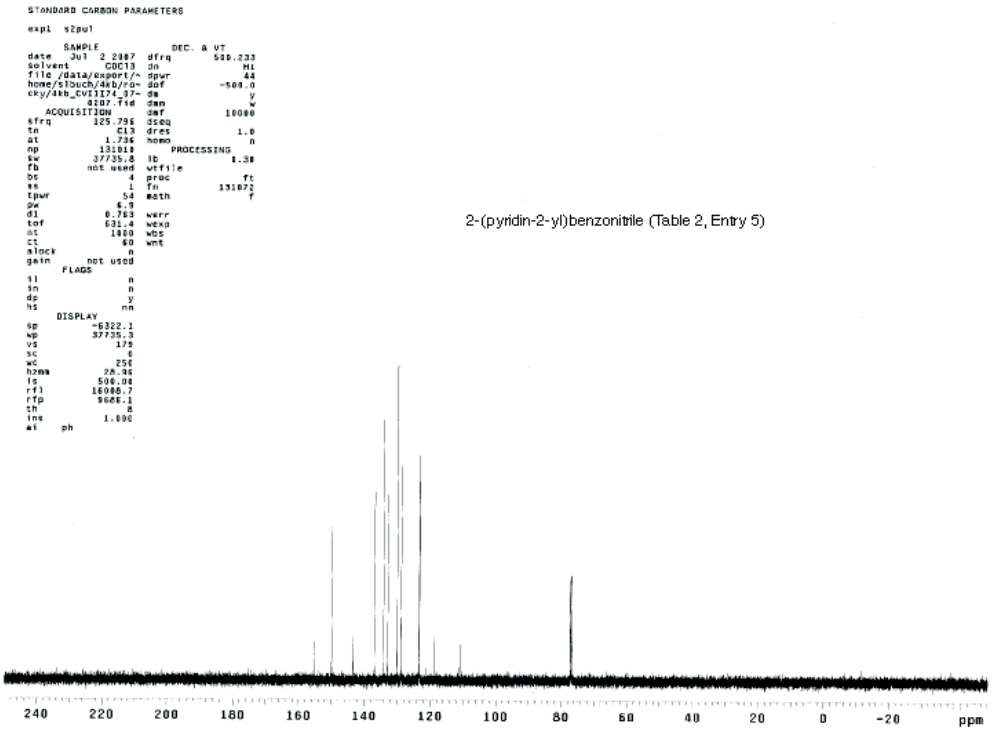
2-(2,5-dimethylphenyl)pyridine (Table 2, Entry 4).



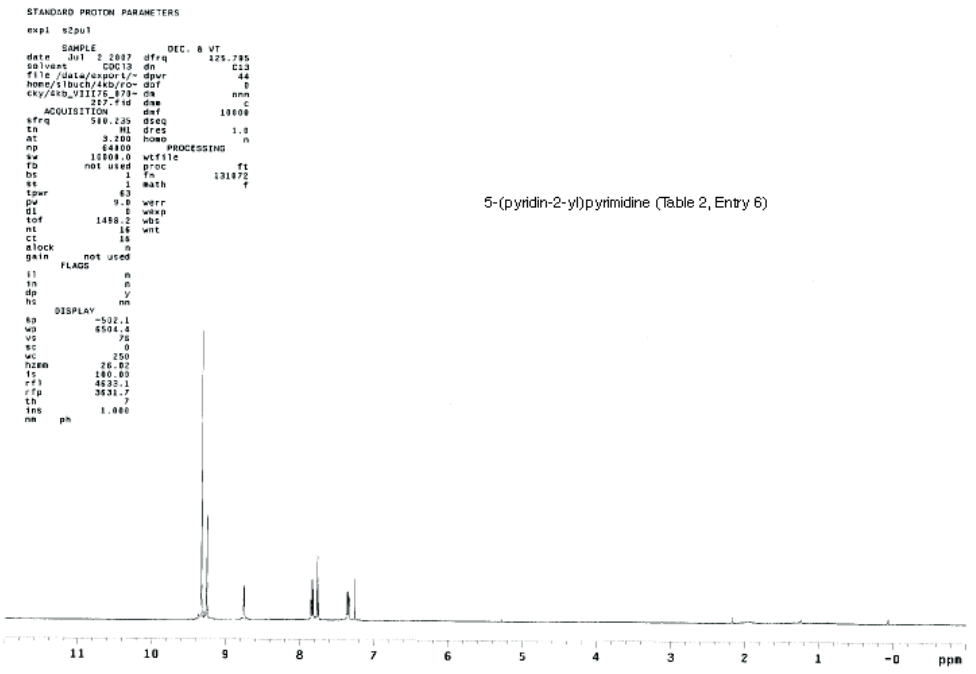
2-(2,5-dimethylphenyl)pyridine (Table 2, Entry 4).



2-(pyridin-2-yl)benzonitrile (Table 2, Entry 5)



2-(pyridin-2-yl)benzonitrile (Table 2, Entry 5)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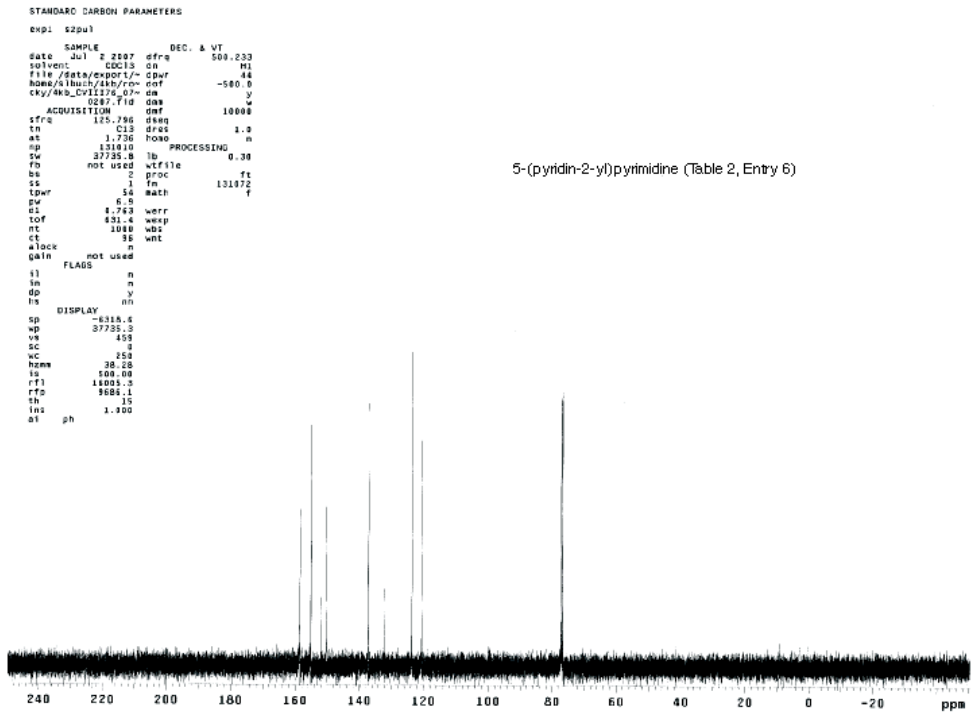
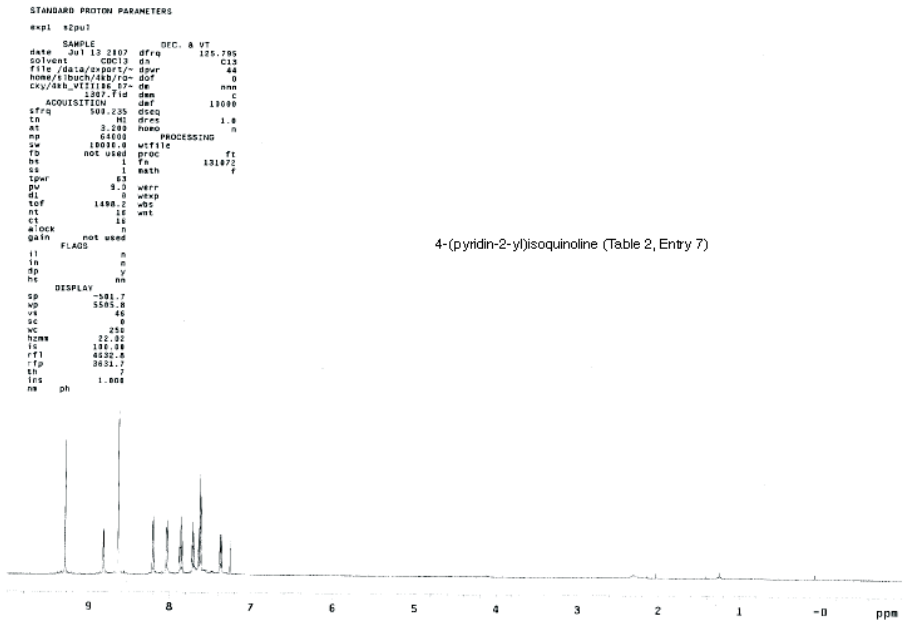
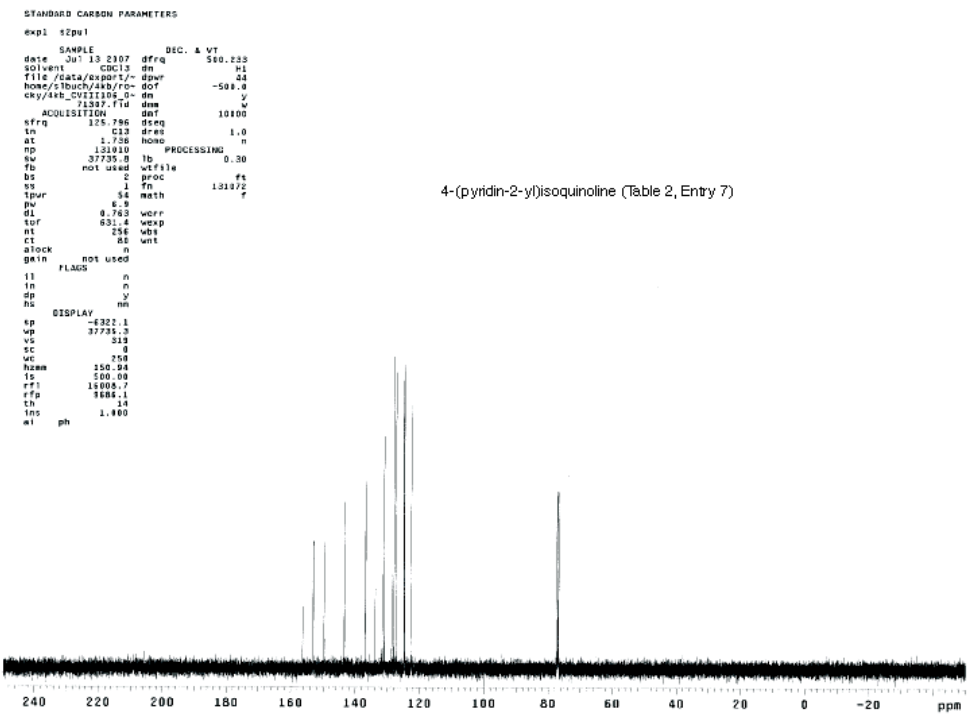
date Jul 2 2007
solvent CDCl3
file /data/export/~
home/slbuch/4kb/ro~
cky/4kb_VIII76_87~
87.fid
ACQUISITION
sfrq 500.235
tn H1
at 3.200
np 64000
sw 10000.0
fb not used
bs 1
ss 1
tpwr 63
pw 9.0
d1 0
tof 1498.2
nt 16
ct 16
alock n
gain not used
FLAGS
il n
in n
dp y
hs nn
DISPLAY
sp -502.1
wp 6504.4
vs 76
sc 0
wc 250
hzmm 26.02
is 180.00
rfl 4633.1
rfp 3631.7
th 7
ins 1.000
nm ph
DEC. 8 VT
dfrq 125.785
dn C13
dpwr 44
dof 0
dm nnn
dmm c
dmf 10000
dseq
dres 1.8
homo n
PROCESSING
wtfile
proc ft
fn 131072
math f
werr
wexp
wbs
wnt
5-(pyridin-2-yl)pyrimidine (Table 2, Entry 6)
11
10
9
8
7
6
5
4
3
2
1
-0
ppm

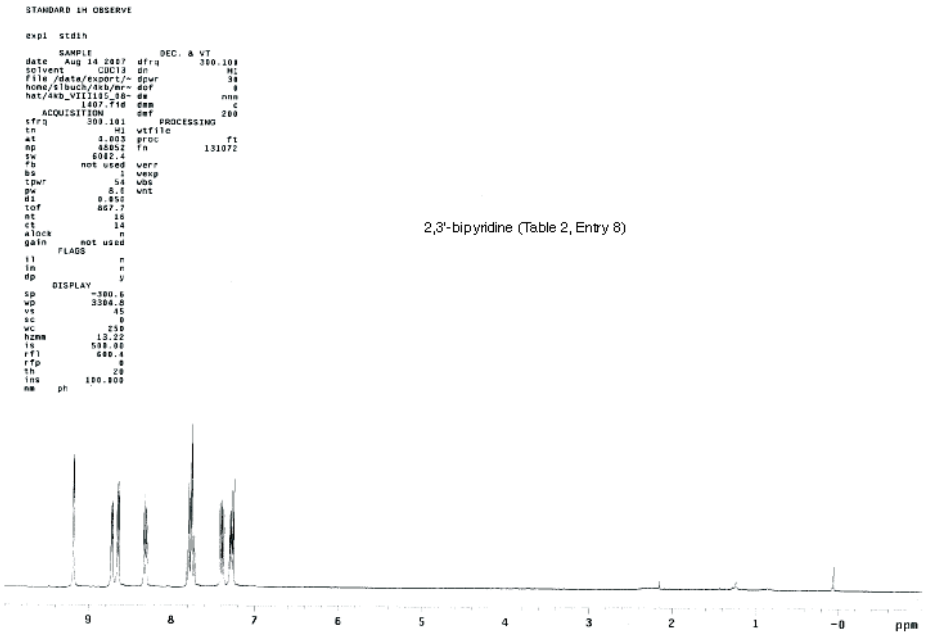

STANDARC CARBON PARAMETERS
expl s2pul
SAMPLE
date Jul 2 2007
solvent CDCl3
file /data/export/~
home/slbuch/4kb/ro~
cky/4kb_CVIII76_07~
0287.fid
ACQUISITION
sfrq 125.796
tn C13
at 1.736
np 131010
sw 37735.8
fb not used
bs 2
ss 1
tpwr 54
pw 6.9
d1 1.763
tof 831.4
nt 1080
ct 96
alock n
gain not used
FLAGS
il n
in n
dp y
hs nn
DISPLAY
sp -6318.6
wp 37735.3
vs 458
sc 0
wc 250
hzmm 38.28
is 500.00
rfl 14005.5
rfp 9686.1
th 15
ins 1.000
ai ph
DEC. 8 VT
dfrq 500.233
dn H1
dpwr 44
dof -580.0
dm y
dmm w
dmf 10000
dseq
dres 1.8
homo n
PROCESSING
lb 0.30
wtfile
proc ft
fn 131072
math f
werr
wexp
wbs
wnt
5-(pyridin-2-yl)pyrimidine (Table 2, Entry 6)
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm



4-(pyridin-2-yl)isoquinoline (Table 2, Entry 7)



4-(pyridin-2-yl)isoquinoline (Table 2, Entry 7)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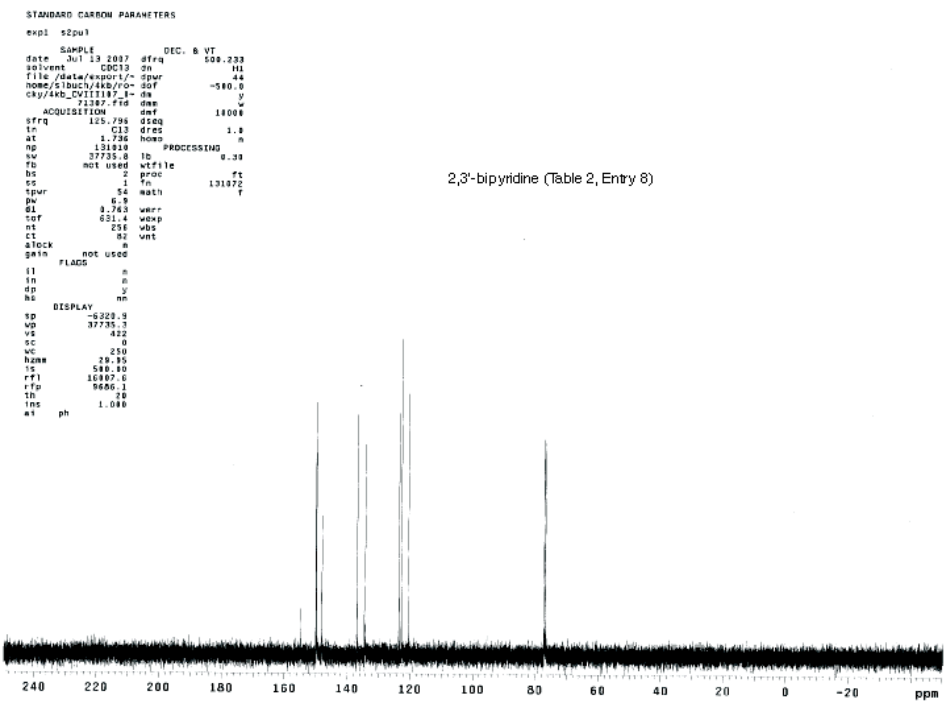
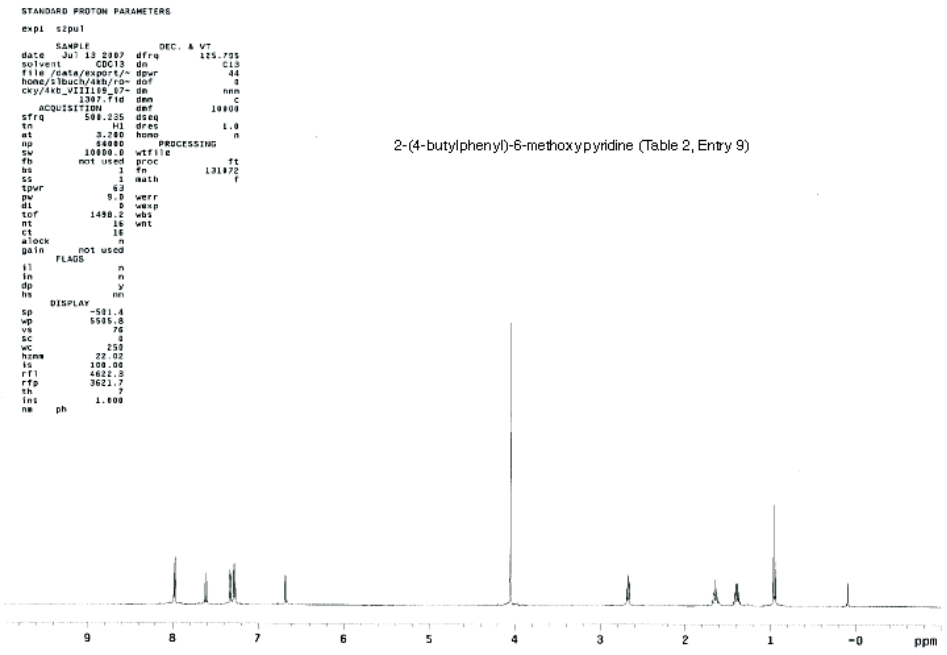
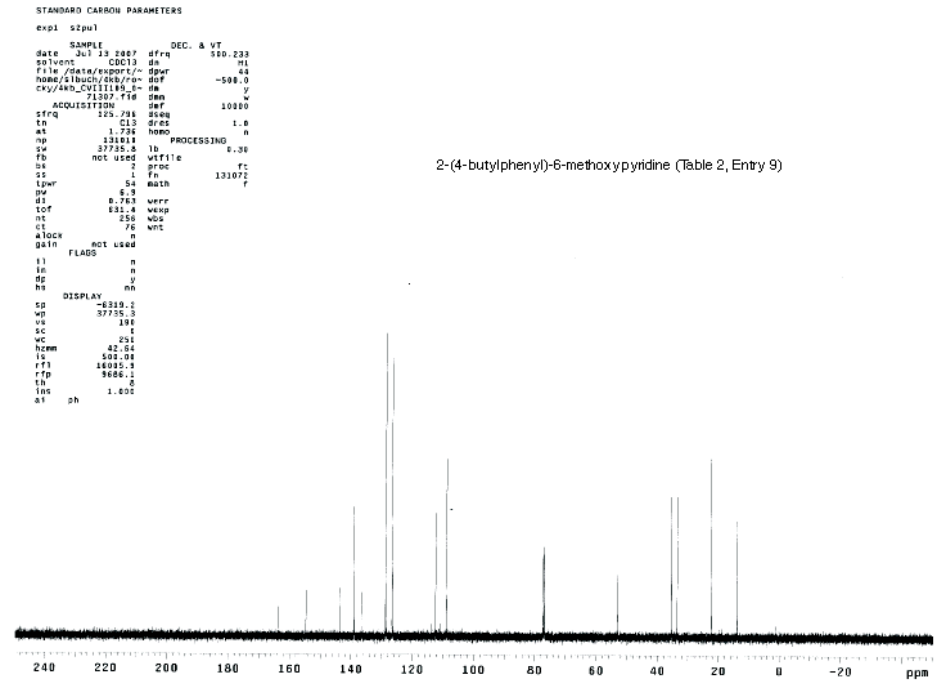
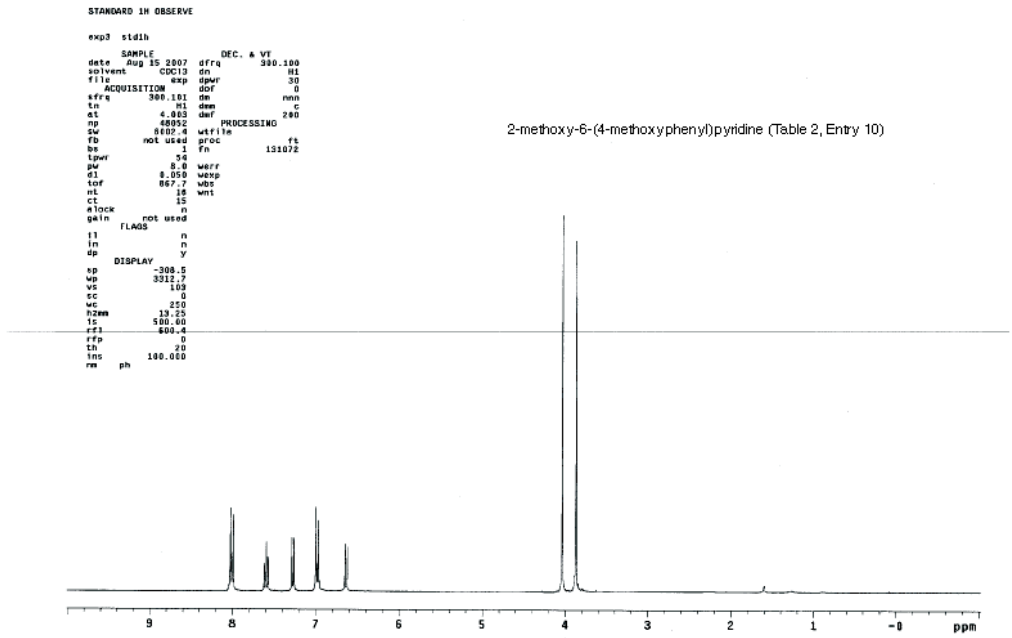
expl stdih
SAMPLE
date Aug 14 2007
solvent CDCl3
file /data/export/~
home/slbuch/4kb/mr~
hat/4kb_VII1135_38~
1407.fid
ACQUISITION
sfrq 300.101
tn H1
at 3.003
np 48052
sw 6042.4
fb not used
bs 1
tpwr 54
pw 8.5
d1 0.850
tof 867.7
nt 16
ct 14
alock n
gain not used
FLAGS
il n
in n
dp y
DISPLAY
sp -380.6
wp 3304.8
vs 45
sc 0
wc 250
hzmm 13.22
is 500.00
rfl 680.4
rfp 0
th 20
ins 180.189
ap ph
DEC. 8 VT
dfrq 300.101
dn H1
dpwr 38
dof 0
dm nnn
dmm c
dmf 200
PROCESSING
vtfile
proc ft
fn 131072
werr
wexp
wbs
wnt
2,3'-bipyridine (Table 2, Entry 8)
9
8
7
6
5
4
3
2
1
-0
ppm


STANDARD CARBON PARAMETERS
expl s2pul
SAMPLE
date Jul 13 2007
solvent CDCl3
file /data/export/~
home/slbuch/4kb/ro~
cky/4kb_CVII117_1~
71307.fid
ACQUISITION
sfrq 125.796
tn C13
at 1.736
np 131810
sw 37735.8
fb not used
bs 2
ss 1
tpwr 54
pw 6.9
d1 3.763
tof 651.4
nt 256
ct 82
alock n
gain not used
FLAGS
il n
in n
dp y
hs nn
DISPLAY
sp -6328.9
wp 37735.3
vs 422
sc 0
wc 250
hzmm 29.95
is 500.00
rfl 16807.6
rfp 9686.1
th 20
ins 1.000
ap ph
DEC. 8 VT
dfrq 500.233
dn H1
dpwr 44
dof -580.0
dm y
dmm w
dmf 18000
dseq
dres 1.8
homo n
PROCESSING
lb 0.30
wtfile
proc ft
fn 131072
math f
wexp
wbs
wnt
2,3'-bipyridine (Table 2, Entry 8)
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm


STANDARD PROTON PARAMETERS
expl s2pul
SAMPLE
date Jul 13 2007
solvent CDCl3
file /data/export/~
home/slbuch/4kb/ro~
cky/4kb_CVIII189_67~
1307.fid
ACQUISITION
sfrq 500.235
tn H1
at 3.280
np 64000
sw 10000.0
fb not used
bs 1
ss 1
tpwr 63
pw 9.0
dl 0
tof 1498.2
nt 16
ct 16
alock n
gain not used
FLAGS
il n
in n
dp y
hs nn
DISPLAY
sp -581.4
wp 5595.8
vs 76
sc 0
wc 250
hzmm 22.02
is 100.00
rfl 4822.8
rfp 3621.7
th 7
ins 1.000
ph
DEC. & VT
dfrq 125.755
dn C13
dpwr 44
dof 0
dm nnn
dmm C
dmf 10000
dseq
dres 1.0
homo n
PROCESSING
wtfile
proc ft
fn 131072
math f
werr
wexp
wbs
wnt
2-(4-butylphenyl)-6-methoxypyridine (Table 2, Entry 9)
9
8
7
6
5
4
3
2
1
-0
ppm


STANDARD CARBON PARAMETERS
expl s2pul
SAMPLE
date Jul 13 2007
solvent CDCl3
file /data/export/~
home/slbuch/4kb/ro~
cky/4kb_CVIII189_6~
71307.fid
ACQUISITION
sfrq 125.791
tn C13
at 1.736
np 131810
sw 37735.8
fb not used
bs 7
ss 1
tpwr 54
pw 6.9
dl 0.763
tof 631.4
nt 256
ct 76
alock n
gain not used
FLAGS
il n
in n
dp y
hs nn
DISPLAY
sp -6319.2
wp 37735.8
vs 198
sc 6
wc 251
hzmm 42.64
is 500.08
rfl 16035.1
rfp 9686.1
th 8
ins 1.000
ph
DEC. & VT
dfrq 500.233
dn H1
dpwr 44
dof -500.0
dm y
dmm w
dmf 10000
dseq
dres 1.0
homo n
PROCESSING
lb 0.30
wtfile
proc ft
fn 131072
math f
werr
wexp
wbs
wnt
2-(4-butylphenyl)-6-methoxypyridine (Table 2, Entry 9)
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm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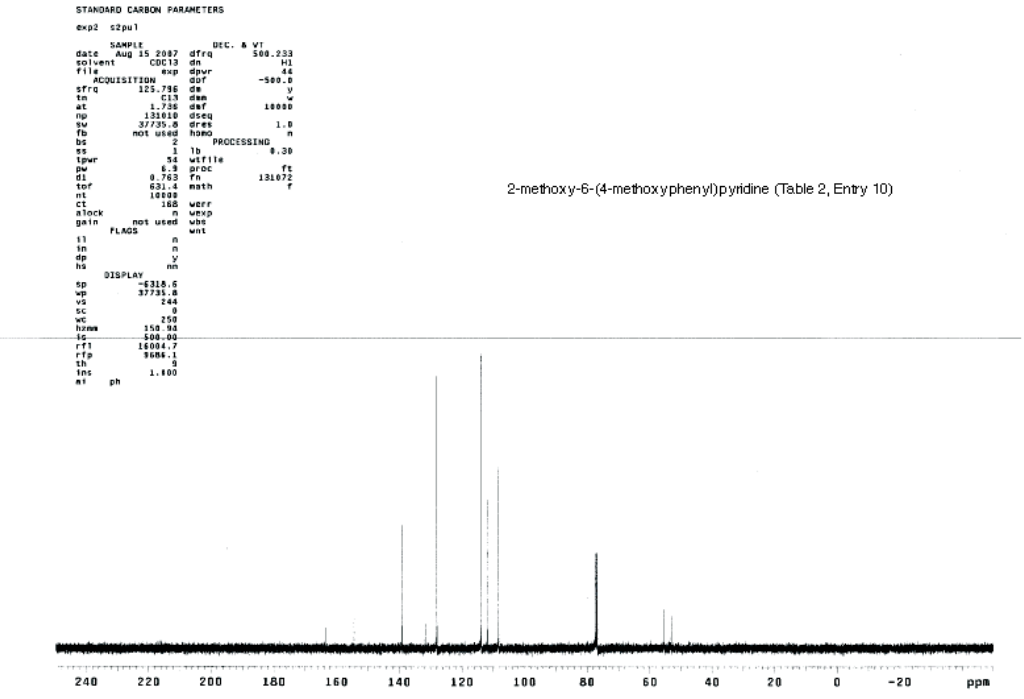
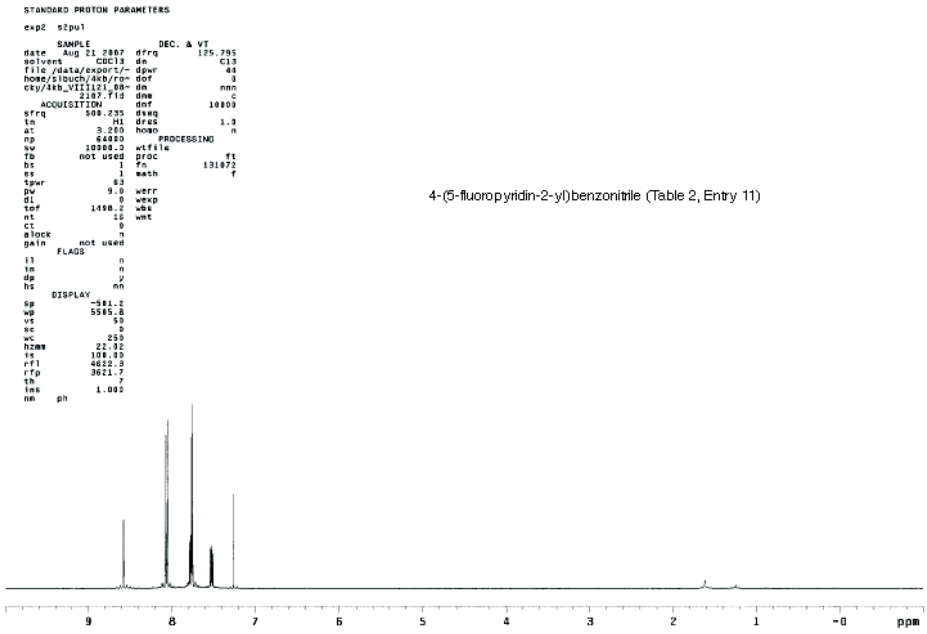
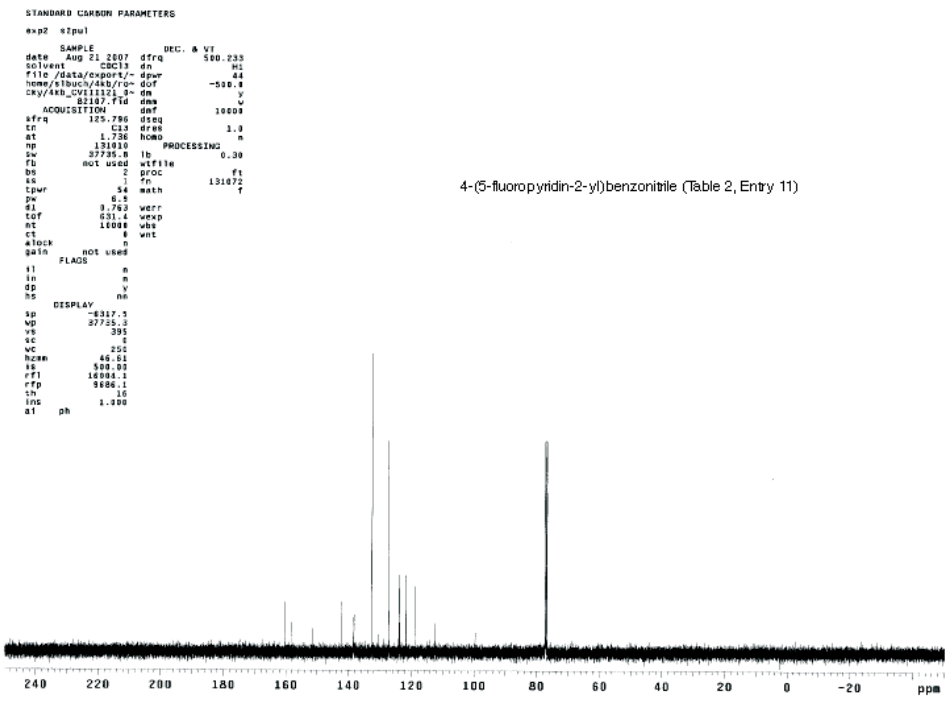
SAMPLE
date Aug 15 2007
solvent CDCl3
file exp
ACQUISITION
sfrq 300.101
tn H1
at 4.063
np 48052
sw 8602.4
fb not used
bs 1
tpwr 54
pw 8.0
d1 8.050
tof 867.7
nt 16
ct 15
alock n
gain not used
FLAGS
il n
in n
dp y
DISPLAY
sp -308.5
wp 3312.7
vs 109
sc 0
wc 250
hzmm 13.25
is 500.00
rf1 -600.4
rfp 0
th 20
ins 100.000
vm ph
DEC. & VT
dfrq 300.100
dn H1
dpwr 30
dof 0
dm nnn
dmm c
dmf 200
PROCESSING
wtfile
proc ft
fn 131072
werr
wexp
wbs
wnt
2-methoxy-6-(4-methoxyphenyl)pyridine (Table 2, Entry 10)
9
8
7
6
5
4
3
2
1
-0
ppm

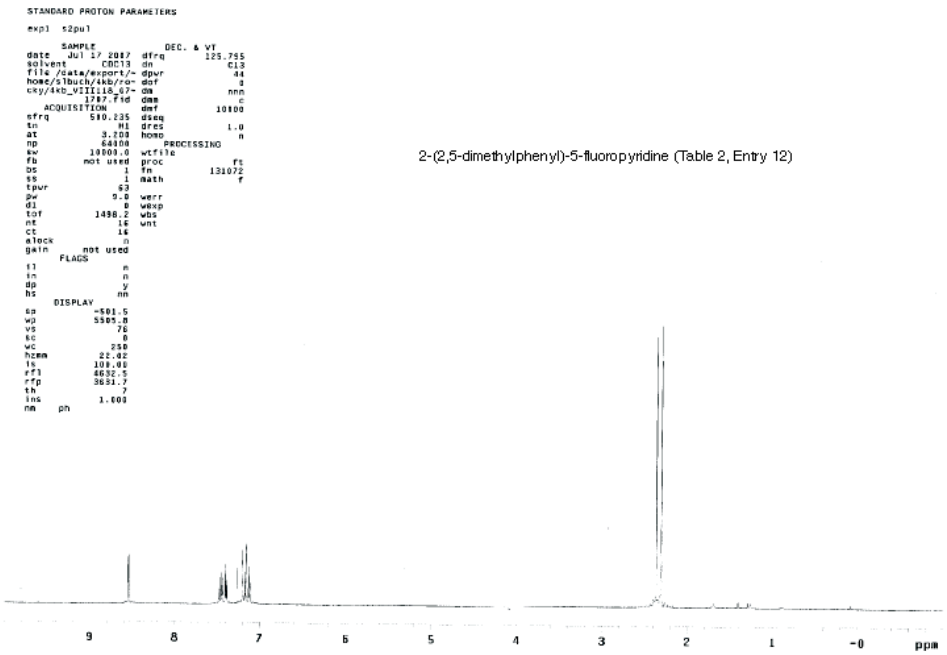

STANDARD CARBON PARAMETERS
exp2 s2pul
SAMPLE
date Aug 15 2007
solvent CDCl3
file exp
ACQUISITION
sfrq 125.796
tn C13
at 1.736
np 131010
sw 37735.8
fb not used
bs 2
ss 1
tpwr 54
pw 6.9
d1 0.763
tof 631.4
nt 10803
ct 168
alock n
gain not used
FLAGS
il n
in n
dp y
hs nn
DISPLAY
sp -6318.6
wp 37735.8
vs 244
sc 0
wc 250
hzmm 150.98
is 500.00
rf1 16004.7
rfp 9684.1
th 9
ins 1.100
ai ph
DEC. & VT
dfrq 500.233
dn H1
dpwr 44
dof -500.0
dm y
dmm w
dmf 10000
dseq
dres 1.0
homo n
PROCESSING
lb 0.30
wtfile
proc ft
fn 131072
math f
werr
wexp
wbs
wnt
2-methoxy-6-(4-methoxyphenyl)pyridine (Table 2, Entry 10)
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm

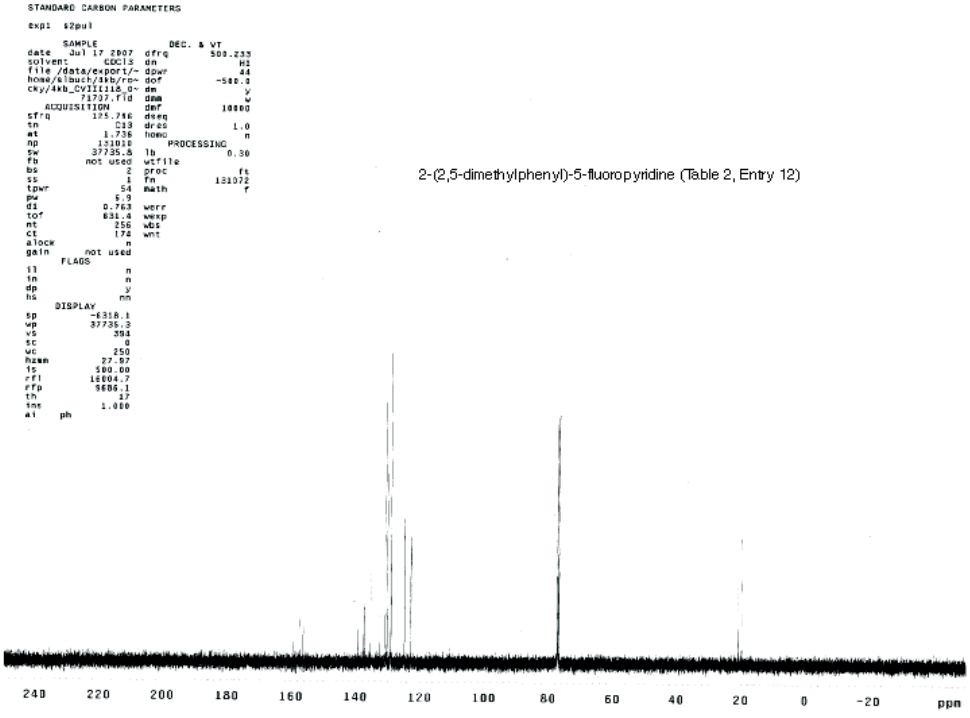


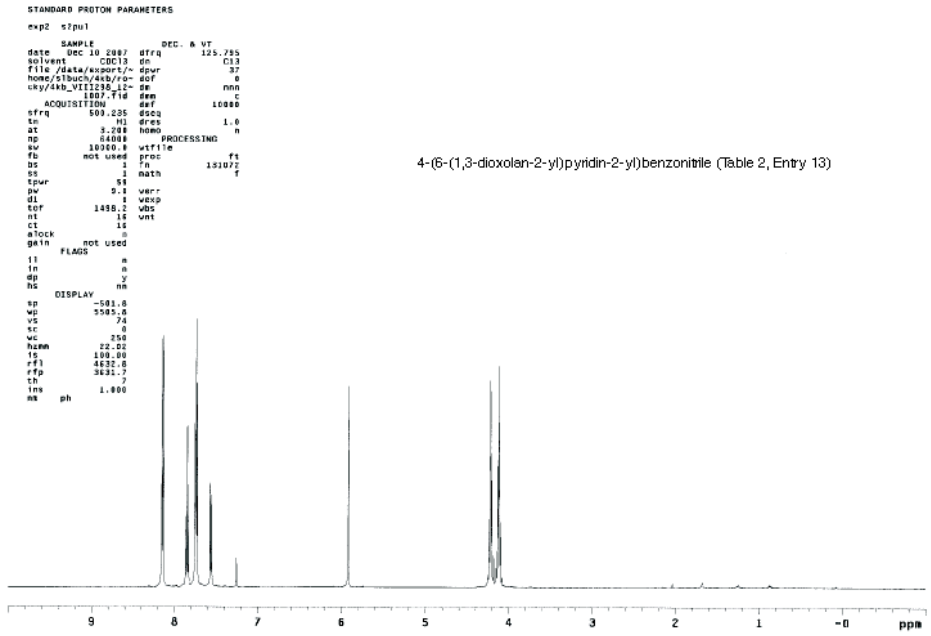
4-(5-fluoropyridin-2-yl)benzonitrile (Table 2, Entry 11)



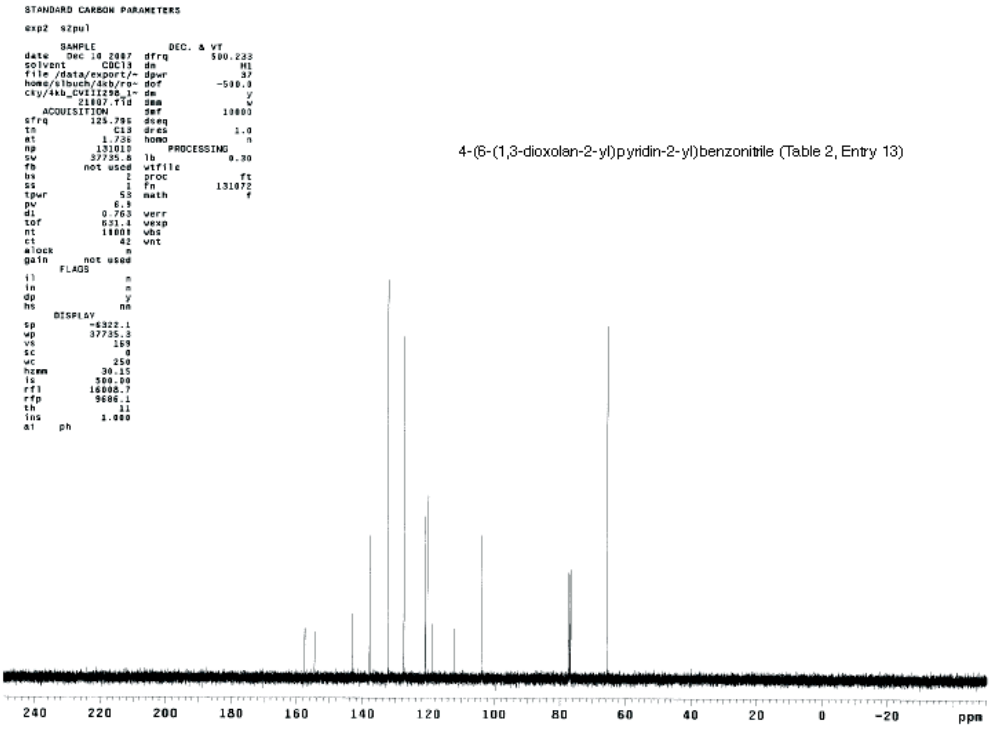
4-(5-fluoropyridin-2-yl)benzonitrile (Table 2, Entry 11)


STANDARD PROTON PARAMETERS
expl s2pul
SAMPLE
date Jul 17 2007
solvent CDCl3
file /data/export/~
home/stbuch/4kb/ro~
cky/4kb_VIII118_67~
1787.fid
ACQUISITION
sfrq 500.235
tn H1
at 3.200
np 64000
sw 10000.0
fb not used
bs 1
ss 1
tpwr 63
pw 9.8
dl 0
tof 1498.2
nt 16
ct 16
alock n
gain not used
FLAGS
il n
in n
dp y
hs nn
DISPLAY
sp -501.5
wp 5305.8
vs 76
sc 0
wc 250
hzmm 22.02
is 109.00
rfl 4632.5
rfp 3631.7
th 7
ins 1.000
nm ph
DEC. & VT
dfrq 125.795
dn C13
dpwr 44
dof 0
dm nnn
dmm c
dmf 10000
dseq
dres 1.0
homo n
PROCESSING
wtfile
proc ft
fn 131072
math f
werr
wexp
wbs
wnt
2-(2,5-dimethylphenyl)-5-fluoropyridine (Table 2, Entry 12)
9
8
7
6
5
4
3
2
1
-0
ppm


STANDARD CARBON PARAMETERS
expl s2pul
SAMPLE
date Jul 17 2007
solvent CDCl3
file /data/export/~
home/stbuch/4kb/ro~
cky/4kb_CVIII118_0~
71707.fid
ACQUISITION
sfrq 125.746
tn C13
at 1.736
np 131018
sw 37735.5
fb not used
bs 2
ss 1
tpwr 54
pw 5.9
dl 0.763
tof 831.4
nt 256
ct 172
alock n
gain not used
FLAGS
il n
in n
dp y
hs nn
DISPLAY
sp -6318.1
wp 37735.3
vs 394
sc 0
wc 250
hzmm 27.87
is 500.00
rfl 16804.7
rfp 5606.1
th 17
ins 1.000
ai ph
DEC. & VT
dfrq 500.233
dn H1
dpwr 44
dof -560.0
dm y
dmm w
dmf 10000
dseq
dres 1.0
homo n
PROCESSING
lb 0.30
wtfile
proc ft
fn 131072
math f
werr
wexp
wbs
wnt
2-(2,5-dimethylphenyl)-5-fluoropyridine (Table 2, Entry 12)
240
220
200
180
160
140
120
100
80
60
40
20
0
-20
ppm



4-(6-(1,3-dioxolan-2-yl)pyridin-2-yl)benzonitrile (Table 2, Entry 13)



4-(6-(1,3-dioxolan-2-yl)pyridin-2-yl)benzonitrile (Table 2, Entry 13)

III. Experimental for the Reactions with Aryl Chlorides

4-(pyridin-2-yl)benzonitrile (Table 3, Entry 1).[10] Following general procedure A, a mixture of 4-chlorobenzonitrile (34.4 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **2** (3.0 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (15% EtOAc/Hexanes) yielded the title compound in 33 mg (73% yield) as a white solid, mp 91-92 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.72 (dt, J= 8,1 Hz, 1H), 8.11 (d, J = 8 Hz, 2H), 7.81 (dt, J = 8,1 Hz, 1H), 7.74-7.77 (m, 3H), 7.31 (dt, J = 8,1 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 155.1, 150.0, 143.4, 137.0, 132.5, 127.4, 123.3, 120.9, 118.8, 112.3. ^{1}H and ^{13}C NMR spectrum included.

2-(4-butylphenyl)pyridine (Table 3, Entry 2).[2] Following general procedure A, a mixture of 4-*n*-butylchlorobenzene (41.0 μL, 42.2 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **2** (2.4 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (10% EtOAc/Hexanes) yielded the title compound in 39 mg (76% yield) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.66 (dt, J = 6,1 Hz, 1H), 7.88 (d, J = 8 Hz, 2H), 7.67-7.71 (m, 2H), 7.26 (d, J = 8 Hz, 2H), 7.16 (dt, J = 6,1 Hz, 1H), 2.64 (t, J = 8 Hz, 2H), 1.62 (pent, J = 8 Hz, 2H), 1.36 (hex, J = 8 Hz, 2H), 0.92 (t, J = 8 Hz, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: δ: 157.4, 149.5, 143.9, 136.7, 136.6, 128.8, 126.7, 121.7, 120.2, 35.4, 33.5, 22.3, 13.9. ^{1}H and ^{13}C NMR spectrum included.

2-(2,5-dimethylphenyl)pyridine (Table 3, Entry 3). Following general procedure A, a mixture of 2-chloro-*p*-xylene (33.5 μL, 35.1 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **2** (2.4 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (10% EtOAc/Hexanes) yielded the title compound in 32 mg (70% yield) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.71 (dt, J = 5,1 Hz, 1H), 7.74 (dt, J = 7,1 Hz, 1H), 7.42 (dt, J = 8,1 Hz, 1H), 7.23-7.26 (m, 2H), 7.16 (dt, J = 6,1 Hz, 1H), 7.20 (d, J = 8 Hz, 1H), 7.14 (dt, J = 8,1 Hz, 1H), 2.38 (s, 3H), 2.34 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 160.0, 149.2, 140.2, 135.9, 135.2, 132.4, 130.6, 130.2, 128.9, 124.0, 121.5, 20.9, 19.7. IR (neat, cm^{-1}): 3394,

[10] Gosmini, C.; Lasry, S.; Nedelec, J.-Y.; Perichon, J. *Tetrahedron* **1998**, *54*, 1289.

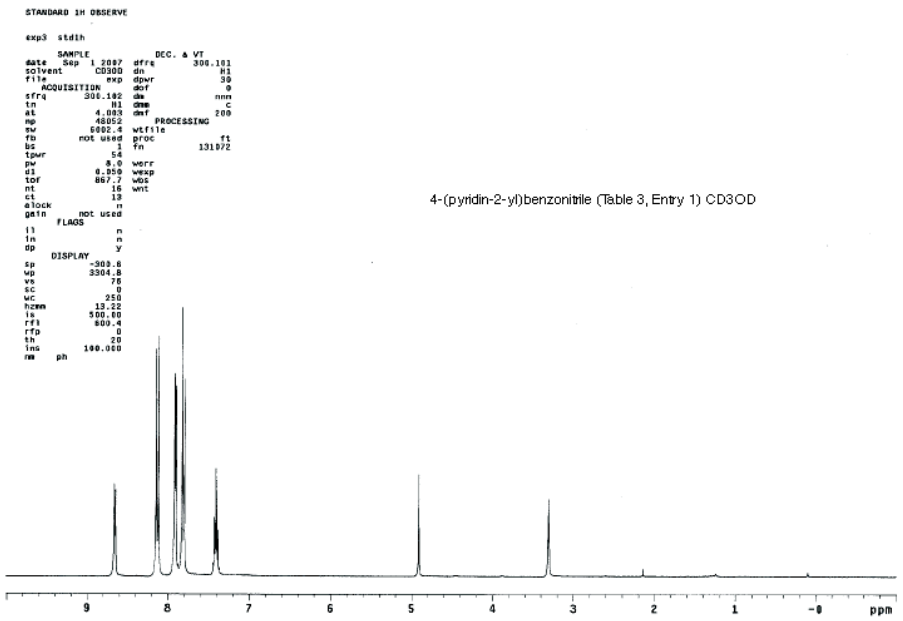
3014, 2922, 1598, 1563, 1501, 1471, 1426, 1378, 1149, 1039, 992, 792, 749. ^{1}H and ^{13}C NMR spectrum included.

2-(4-methoxyphenyl)pyridine (Table 3, Entry 4).[3] Following general procedure A, a mixture of 4-chloroanisole (30.4 μL, 35.6 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **2** (2.4 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (15% EtOAc/Hexanes) yielded the title compound in 36 mg (78% yield) as a white solid, mp 47-48 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.65 (dt, J = 5,1 Hz, 1H), 7.96 (d, J = 9 Hz, 2H), 7.71 (dt, J = 8,2 Hz, 1H), 7.66 (dt, J = 8,1 Hz, 1H), 7.17 (dd, J = 5,1 Hz, 1H), 7.00 (d, J = 9 HZ, 2H), 3.86 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 160.4, 157.0, 149.4, 136.6, 132.0, 128.1, 121.4, 119.8, 114.1, 55.3. ^{1}H and ^{13}C NMR spectrum included.

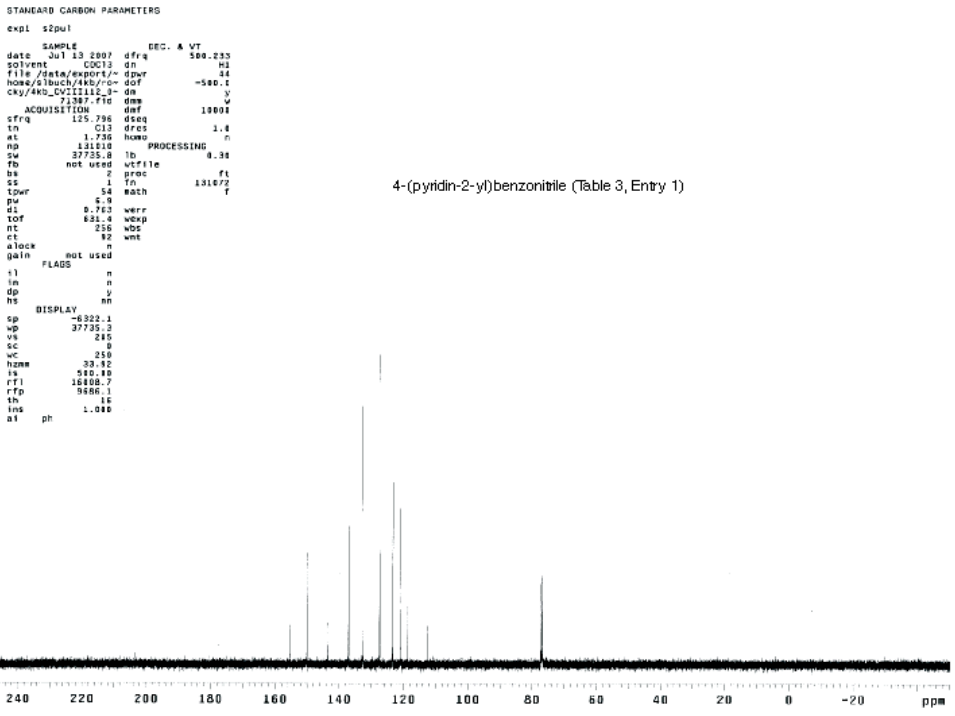
2-(3-(trifluoromethyl)phenyl)pyridine (Table 3, Entry 5). Following general procedure A, a mixture of 3-chlorobenzotrifluoride (33.9 μL, 45.1 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **2** (2.4 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (10% EtOAc/Hexanes) yielded the title compound in 32 mg (57% yield) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 8.70 (dt, J = 5,1 Hz, 1H), 8.26 (s, 1H), 8.15 (d, J = 8 Hz, 1H), 7.71-7.77 (m, 2H), 7.64 (d, J = 8 Hz, 1H), 7.56 (t, J = 8 Hz, 1H), 7.26 (ddd, J = 8,5,1 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 155.8, 149.9, 140.1, 137.0, 130.5, 130.0, 129.2, 125.5, 123.7, 122.8, 120.6, 112.3. IR (neat, cm^{-1}): 2963, 2913, 1631, 1586, 1464, 1437, 1417, 1301, 1262, 1166, 1123, 1073, 775. Anal. Calcd. for $C_{12}H_8NF_3$: C, 64.58; H, 3.61. Found C, 64.68; H, 3.56.

2,3'-bipyridine (Table 3, Entry 6).[8] Following general procedure A, a mixture of 3-chloropyridine (23.8 μL, 28.3 mg, 0.25 mmol), lithium triisopropyl 2-pyridylborate (104 mg, 0.375 mmol), KF, Pd_2dba_3 (2.3 mg, 0.0025 mmol) and **2** (2.4 mg, 0.015 mmol) was heated for 20 h. Flash column chromatography (EtOAc) yielded the title compound in 36 mg (92% yield) as a colorless oil. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 9.17 (d, J = 3 Hz, 1H), 8.71 (dt, J = 5,1 Hz, 1H), 8.64 (dt, J = 5,1 Hz, 1H), 8.31 (dt, J = 8,1 Hz, 1H), 7.79 (dt, J = 8,1 Hz, 1H), 7.75 (dt, J = 8,1 Hz, 1H), 7.39 (dd, J = 8,3 Hz, 1H), 7.28 (ddd, J = 8,5,1 Hz, 1H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 154.7, 150.0, 149.9, 148.2, 136.9, 134.8, 134.3, 123.5, 122.8, 120.6. ^{1}H and ^{13}C NMR spectrum included.

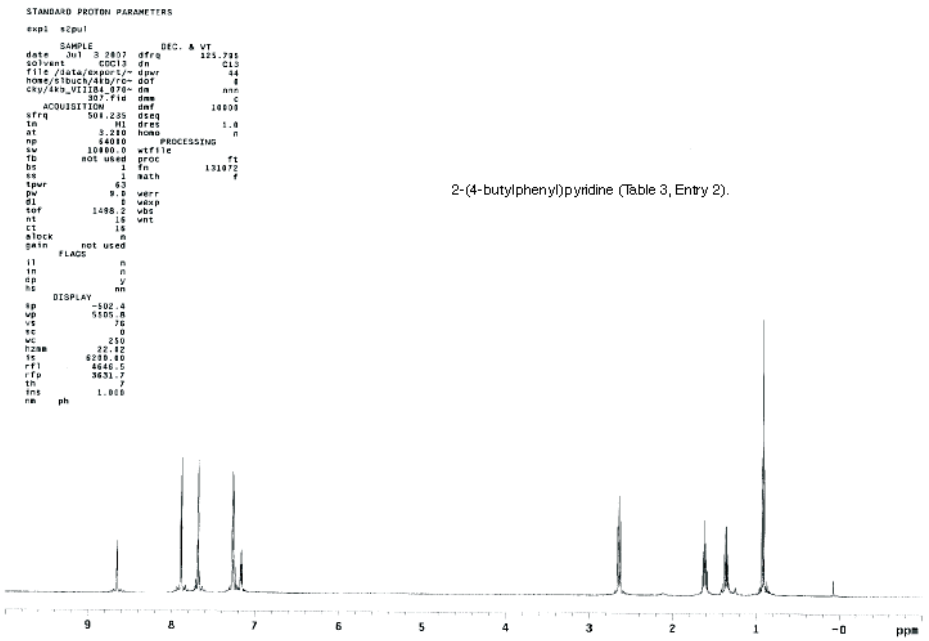
2-(6-methoxypyridin-2-yl)benzonitrile (Table 3, Entry 7). Following general procedure A, a mixture of 2-chlorobenzonitrile (34.4 mg, 0.25 mmol), lithium triisopropyl 2-(6-methoxypyridyl)borate (114 mg, 0.375 mmol), KF, Pd_2dba_3 (3.4 mg, 0.00375 mmol) and **2** (3.6 mg, 0.0225 mmol) was heated for 20 h. Flash column chromatography (5% EtOAc/Hexanes) yielded the title compound in 40 mg (76% yield) as a white solid, mp 48-49 °C. ^{1}H NMR (300 MHz, $CDCl_3$) δ: 7.79-7.83 (m, 2H), 7.63-7.70 (m, 2H), 7.48 (dt, J = 8,1 Hz, 1H), 7.31 (d, J = 8 Hz, 1H), 6.80 (d, J = 8 Hz, 1H), 4.09 (s, 3H). ^{13}C NMR (75 MHz, $CDCl_3$) δ: 163.8, 152.4, 142.9, 139.2, 134.7, 132.5, 129.4, 128.5, 119.2, 115.2, 111.0, 99.7, 54.0. IR (neat, cm^{-1}): 2969, 2946, 2223, 1602, 1574, 1461, 1426, 1406, 1325, 1247, 1152, 1017, 804, 780. ^{1}H and ^{13}C NMR spectrum included.



4-(pyridin-2-yl)benzonitrile (Table 3, Entry 1) CD3OD



4-(pyridin-2-yl)benzonitrile (Table 3, Entry 1)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5
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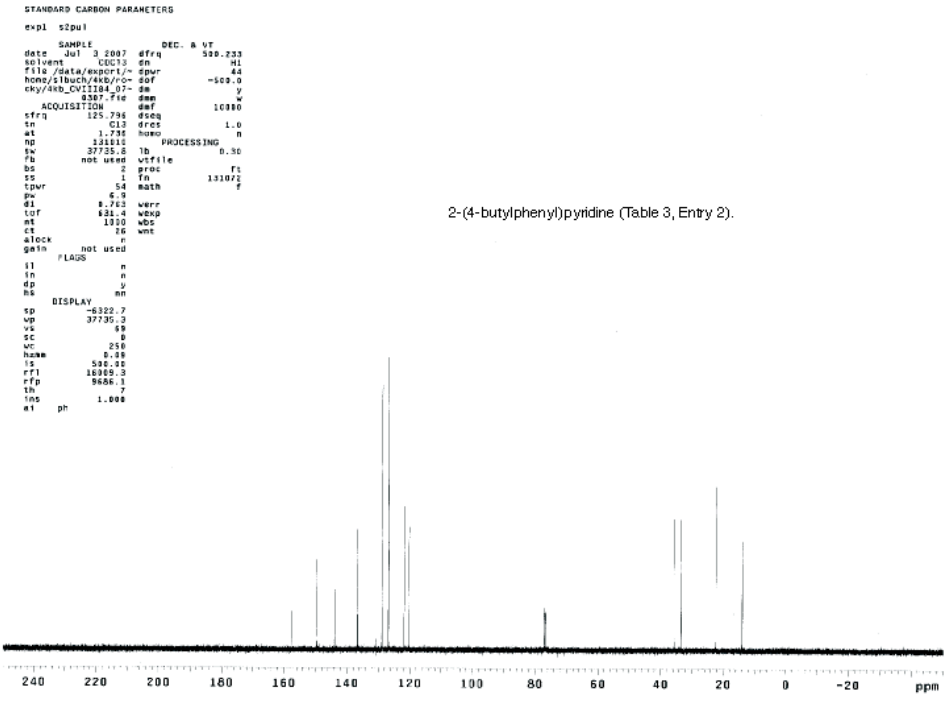
ppm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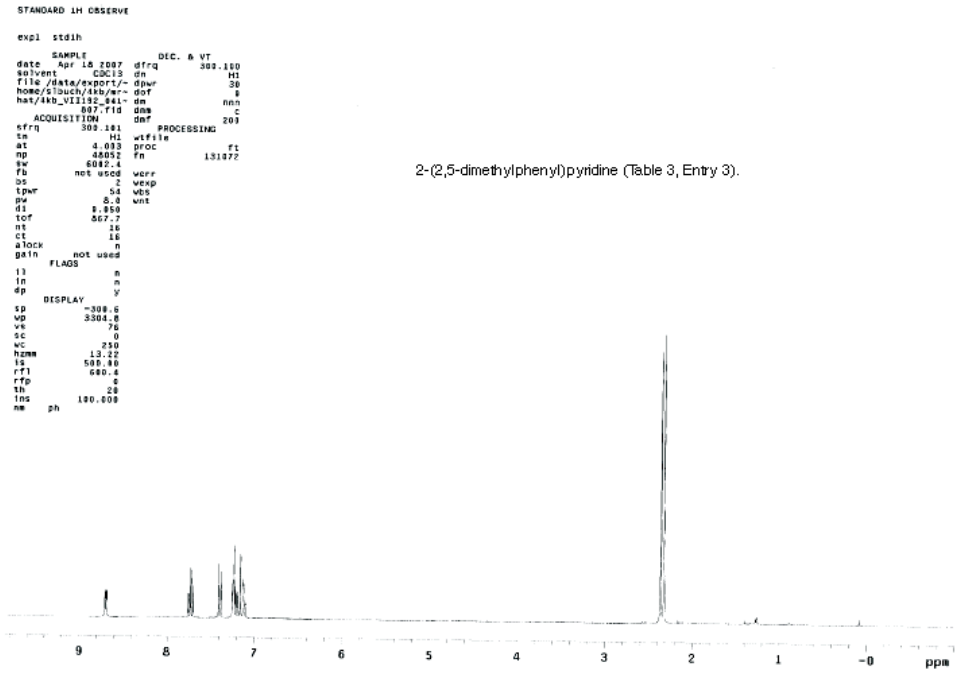
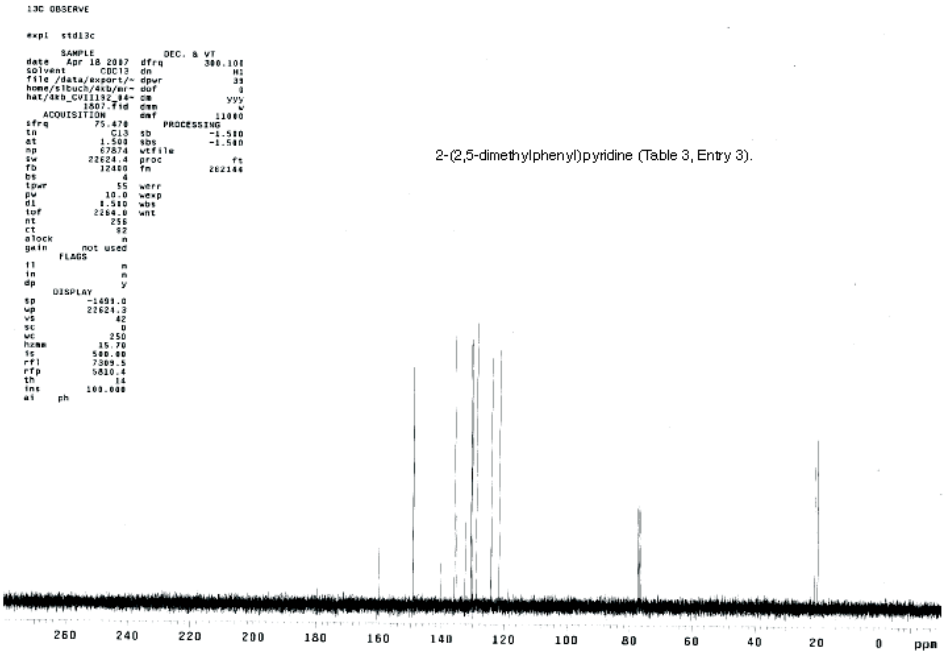


2-(2,5-dimethylphenyl)pyridine (Table 3, Entry 3).



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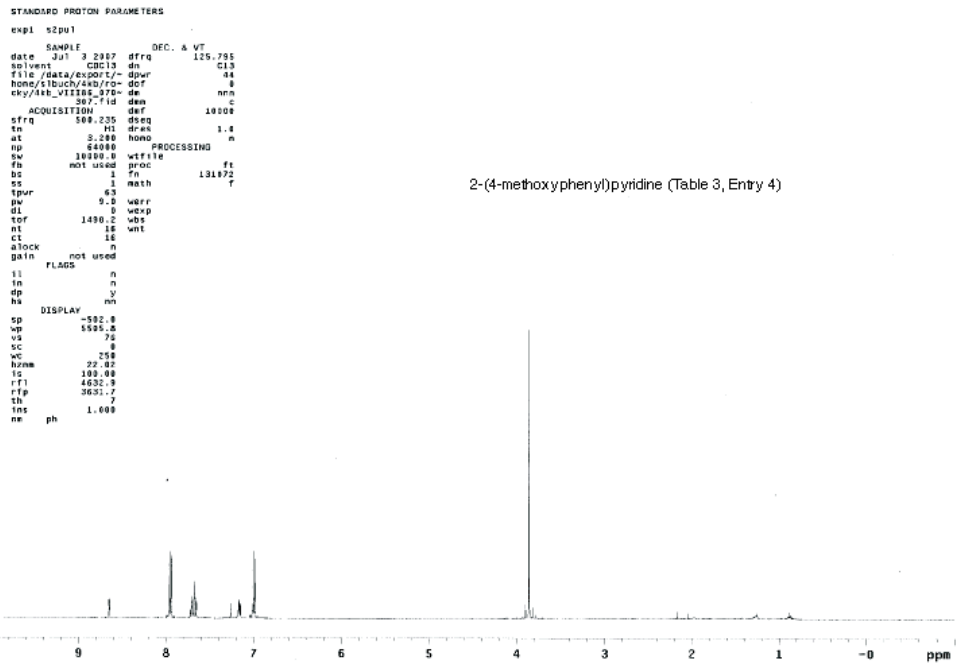
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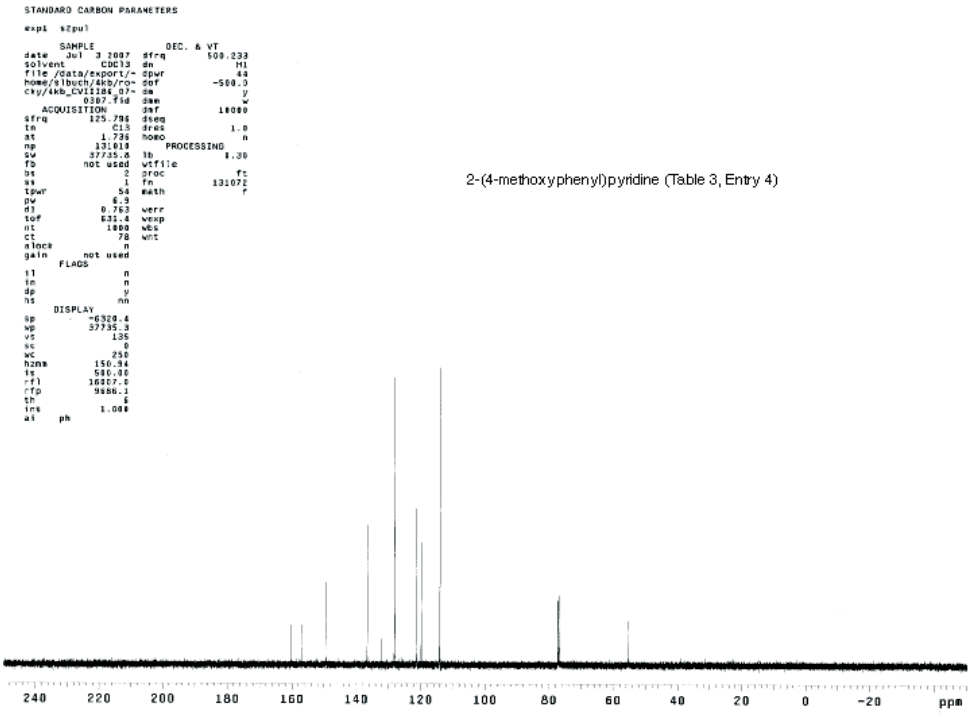
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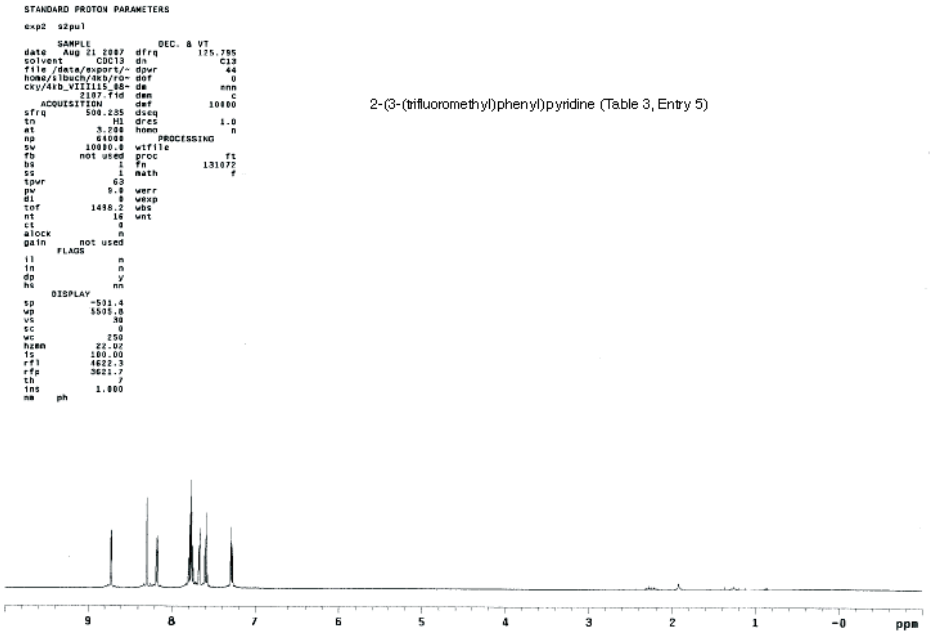
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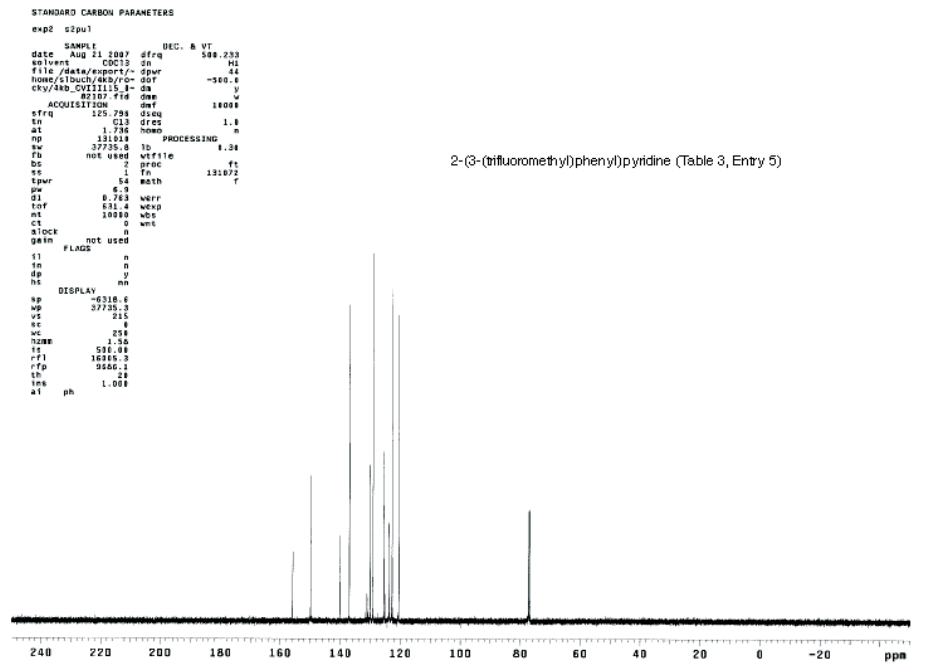
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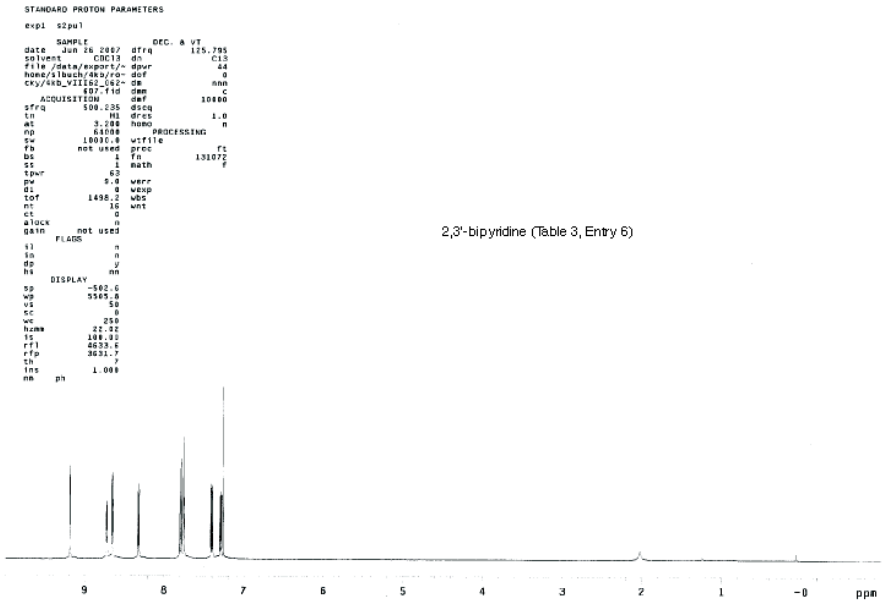

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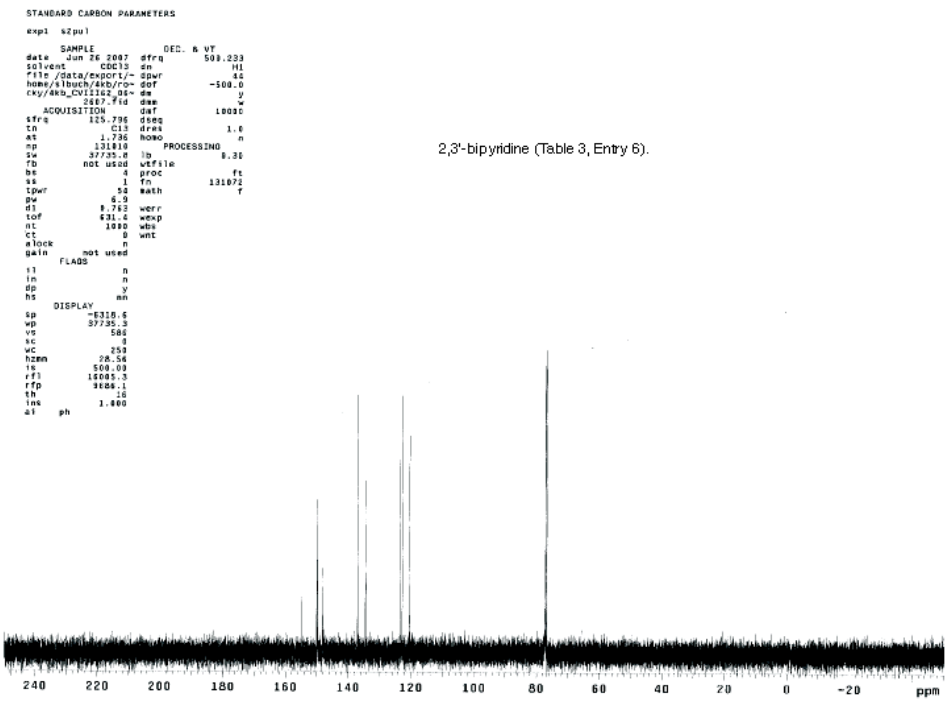
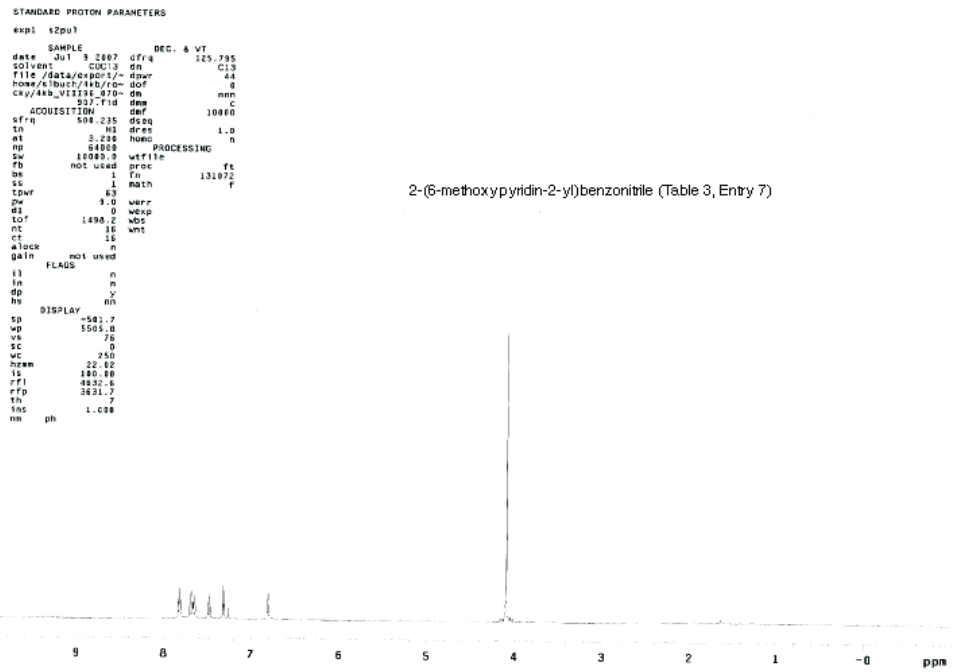


2,3'-bipyridine (Table 3, Entry 6).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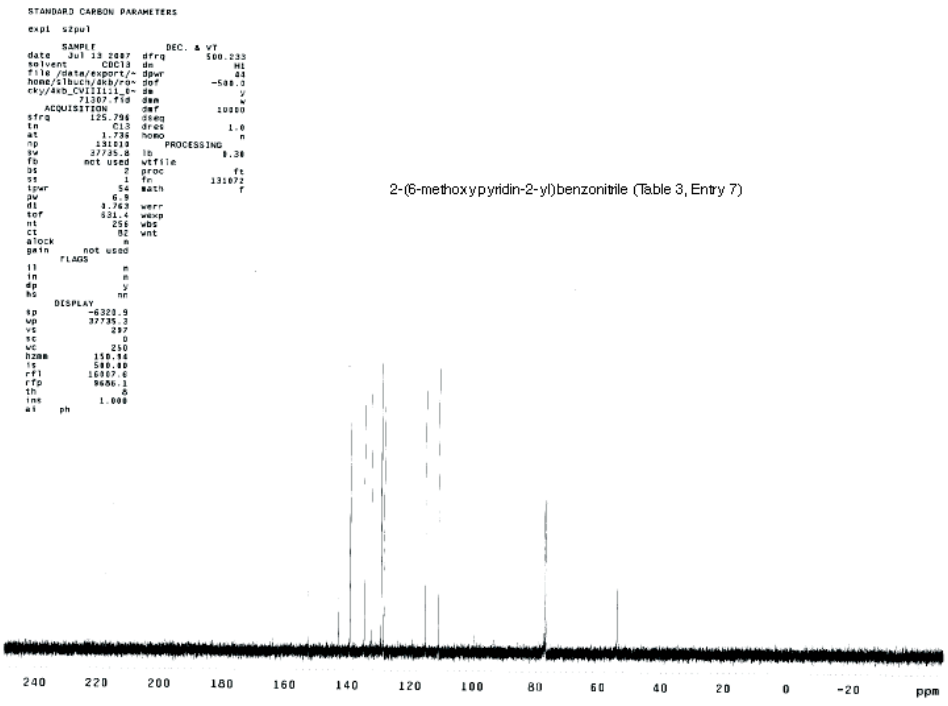
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wnt
2-(6-methoxypyridin-2-yl)benzonitrile (Table 3, Entry 7)
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100
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60
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20
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