

Silica-assisted Suzuki-Miyaura reactions of heteroaryl bromides in aqueous media

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Supporting Information

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General procedure for Suzuki-Miyaura reaction.....S2

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General All the starting materials and solvents were purchased from common commercial sources and were used without additional purification. The gas chromatography analysis was performed on a GC instrument. ^1H NMR spectra were recorded at 500 MHz or 400 MHz using TMS as internal standard. ^{13}C NMR spectra were recorded at 125 MHz using TMS as internal standard. Mass spectroscopy data of the product was collected on a MS-EI instrument. The transmission electron micrographs (TEM) and selected area electron diffraction (SAED) patterns were obtained by employing JEM-2010 microscopes under 200 kV. Samples for observation of TEM were prepared by placing CH_3OH solution of reaction remnant onto a carbon-coated copper grid.

Except T3-13 and T3-14, which were new compounds and thoroughly characterized by ^1H NMR, ^{13}C NMR, MS, and HRMS, the other prepared compounds are known and the analysis of ^1H NMR as well as MS for them is performed. In addition, the CA numbers as well as the related preparation and characterization references are presented in this supporting information.

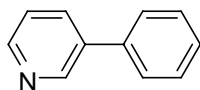
General procedure for the Suzuki-Miyaura reaction: A mixture of NaOH (0.80 g, 2 mmol) or Na_2CO_3 (0.216 g, 2mmol), $\text{Pd}(\text{OAc})_2$ (1 mg, 0.5 mol%), silica gel (10-40 μm) (0.2 g), aryl bromide (1 mmol), arylboronic acid (1.5 mmol), distilled water (3 mL) and PEG 2000 (3.5 g) was stirred at 80 $^\circ\text{C}$ for the indicated time. Afterward, the reaction solution was cooled to room temperature and extracted four times with diethyl ether (4×15 mL). GC and GC/MS analyzed the combined organic

phase. The further purification of the product was achieved by flash chromatography on a silica gel column.

In the recycling experiment, the residue was subjected to a second run of the Suzuki reaction by charging it with the same substrates (3-bromopyridine, phenylboronic acid, NaOH) without further addition of Pd(OAc)₂ or PEG 2000 or silica gel. In the third, fifth, seventh, ninth and eleventh run, 0.5 ml distilled water was added to the reaction mixture. In the thirteenth, fifteenth and seventeenth run, 1.0 ml distilled water was added to the reaction mixture.

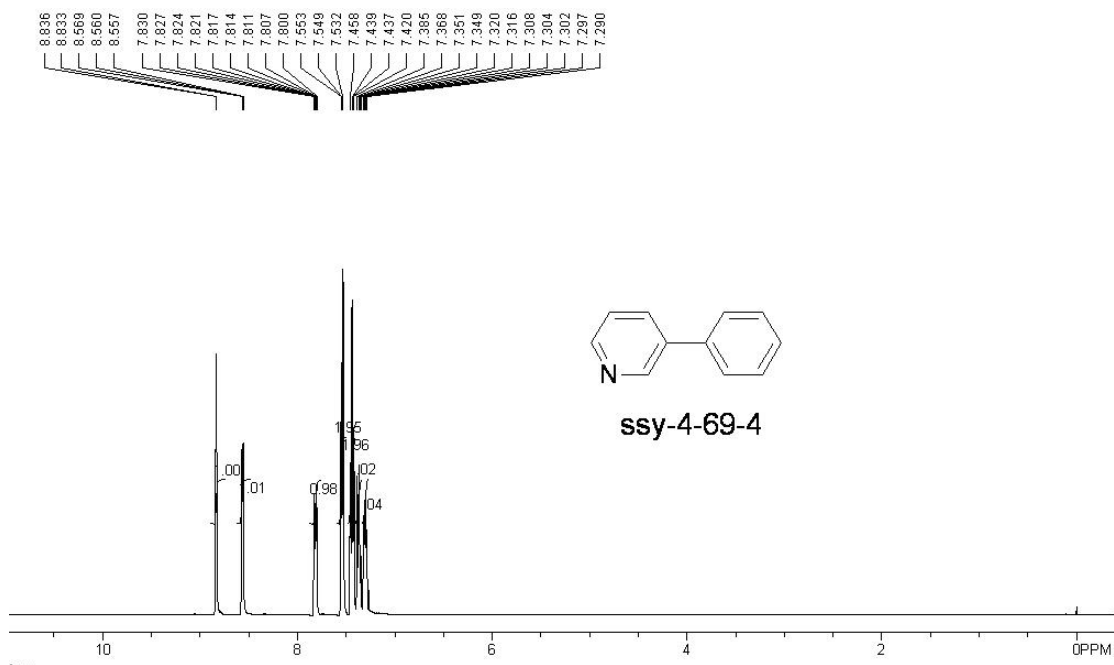
Characterization data of the products of Suzuki-Miyaura reaction

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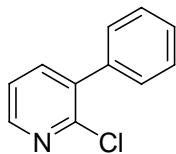


3-Phenyl-pyridine [T2-1, 1008-88-4, Ref. 1]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.83 (d, 1 H, $J = 1.2$ Hz), 8.55-8.56 (m, 1 H), 7.80-7.83 (m, 1 H), 7.53-7.55 (m, 2 H), 7.42-7.45 (m, 2 H), 7.29-7.38 (m, 2 H). MS (EI): m/z (%): 155 (100) [M^+], 154 (22), 153 (15), 76 (9)

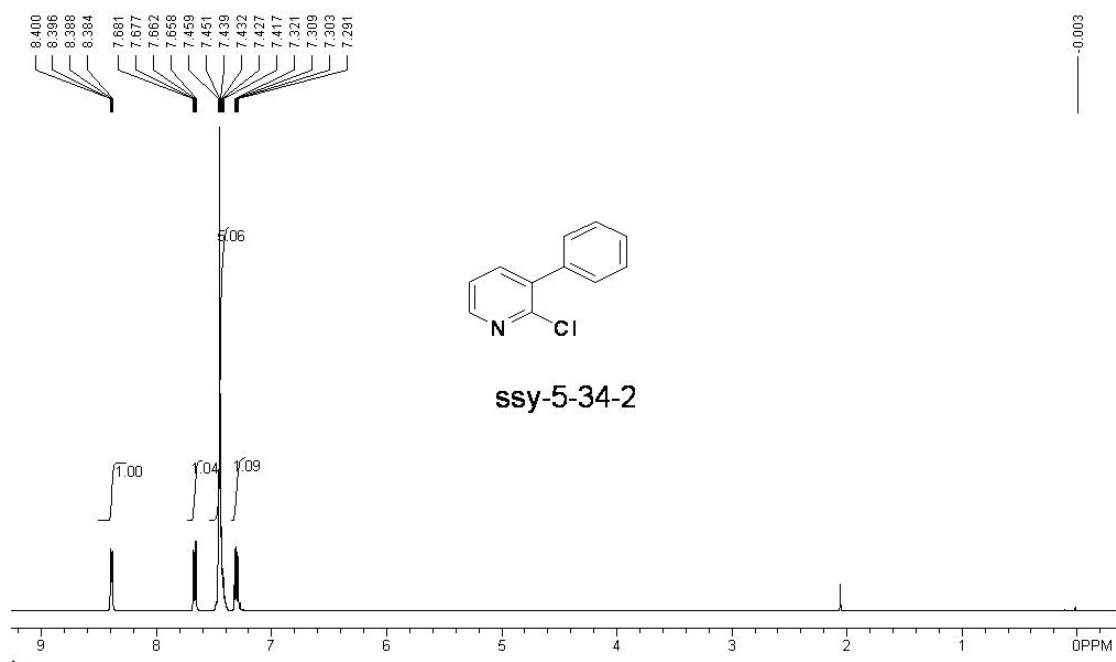


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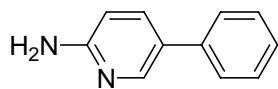


2-chloro-3-phenylpyridine [T2-2, 31557-57-0, Ref. 2]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.39 (dd, 1 H, $J = 4.8, 1.6$ Hz), 7.67 (dd, 1 H, $J = 7.6, 1.6$ Hz), 7.41-7.45 (m, 5 H), 7.30 (dd, 1 H, $J = 7.2, 4.8$ Hz). MS (EI): m/z (%): 191 (31) [M^+] (^{37}Cl), 189 (100) [M^+] (^{35}Cl), 154 (50), 127 (35).

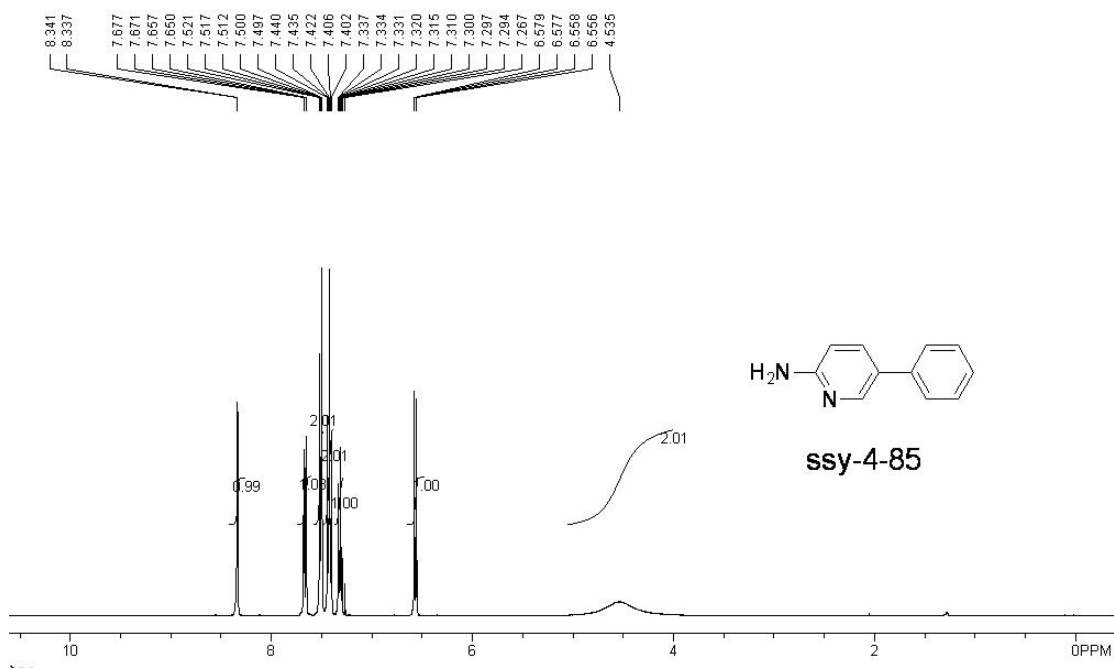


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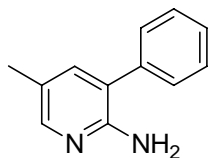


5-phenylpyridin-2-amine [T2-3, 33421-40-8, Ref. 3]

¹H NMR (400 MHz, CDCl₃, TMS) δ 8.33 (d, 1 H, *J* = 1.6 Hz), 7.66 (dd, 1 H, *J* = 8.0, 2.4 Hz), 7.49-7.52 (m, 2 H), 7.40-7.44 (m, 2 H), 7.29-7.33 (m, 1 H), 6.56 (dd, 1 H, *J* = 8.4, 0.8 Hz), 4.53 (brs, 2 H). MS (EI): *m/z* (%): 171 (12) [M⁺+1], 170 (100) [M⁺], 169 (18) [M⁺-1], 143 (24), 115 (21).

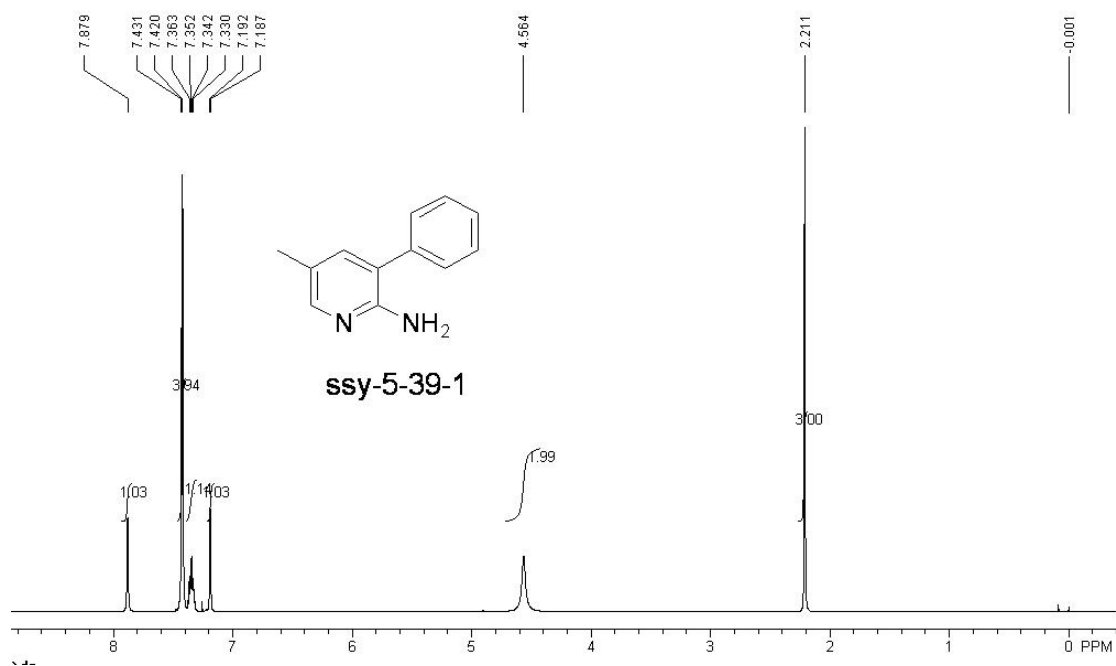


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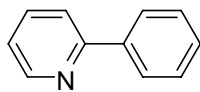


5-methyl-3-phenylpyridin-2-amine [T2-4, 351001-77-9, Ref. 4]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.87 (s, 1 H), 7.42-7.43 (m, 4 H), 7.33-7.36 (m, 1 H), 7.18-7.19 (d, 1 H, $J = 2.0$ Hz), 4.56 (brs, 2 H), 2.21 (s, 3 H). MS (EI): m/z (%): 184 (57) [M^+], 183 (100) [M^+-1], 168 (8).

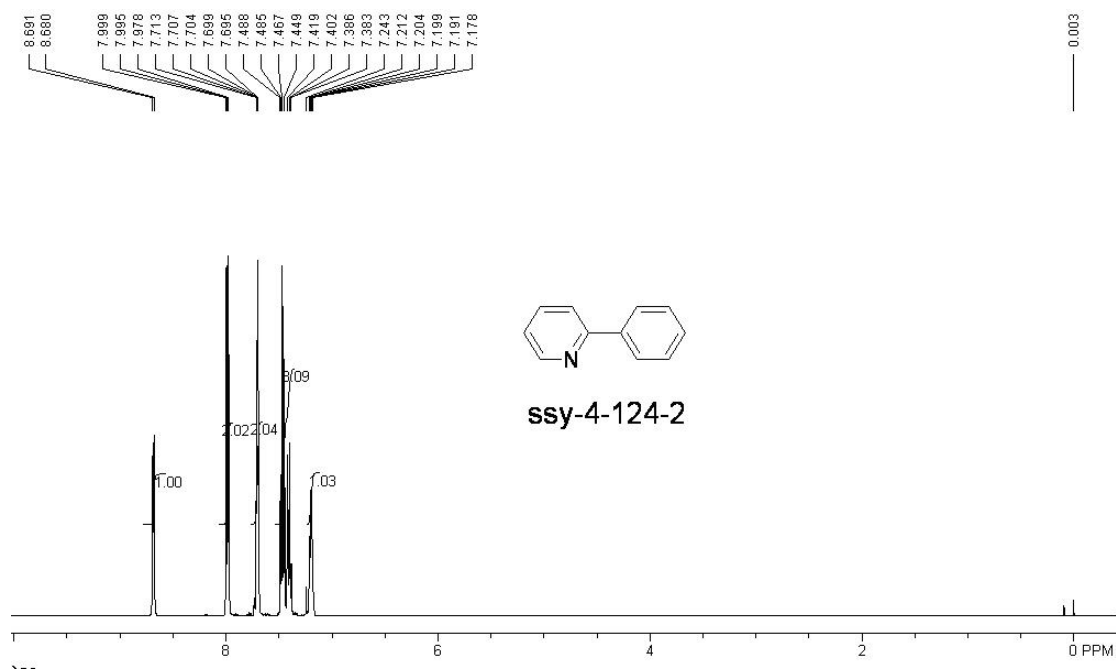


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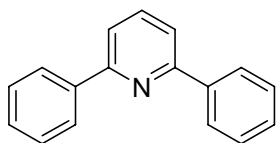


2-Phenyl-pyridine [T2-5, 1008-89-5, Ref. 1,5]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.68-8.69 (m, 1 H), 7.97-7.99 (m, 2 H), 7.69-7.71 (m, 2 H), 7.38-7.48 (m, 3 H), 7.17-7.21 (m, 1 H). MS (EI): m/z (%): 155 (100) [M^+], 154 (21), 153 (7), 115 (7), 76 (9).

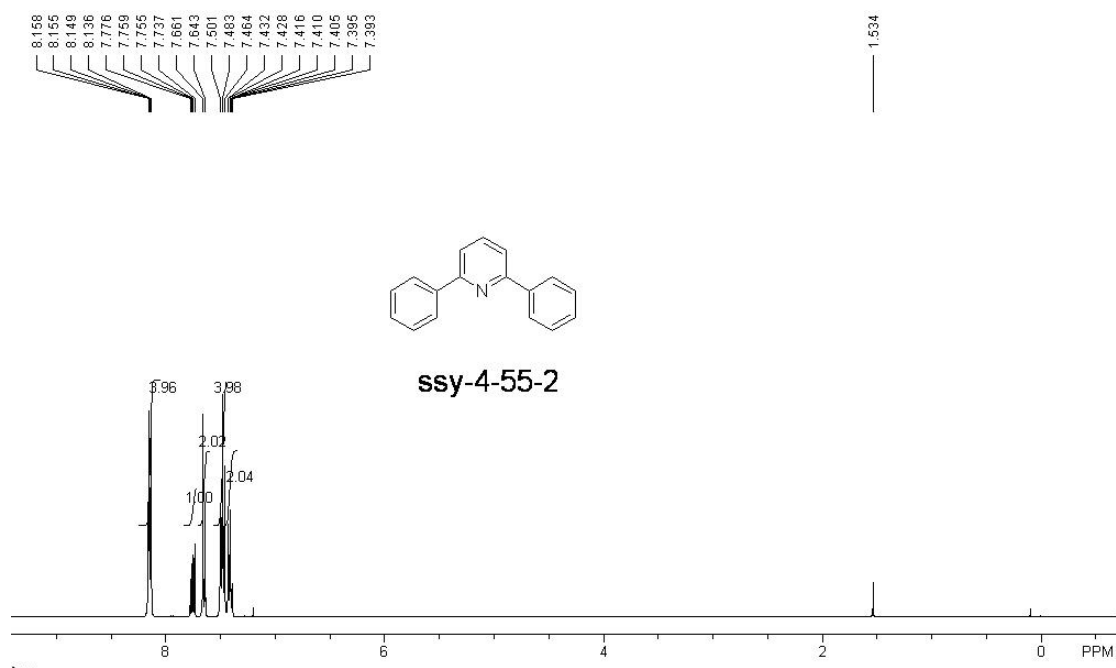


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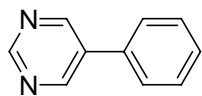


2,6-diphenylpyridine [T2-6, 3558-69-8, Ref. 6]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.13-8.15 (m, 4 H), 7.75 (dd, 1 H, $J = 8.8, 7.2$ Hz), 7.64-7.66 (d, 2 H, $J = 7.2$ Hz), 7.46-7.50 (m, 4 H), 7.39-7.43 (m, 2 H). MS (EI): m/z (%): 232 (16) [$\text{M}^+ + 1$], 231 (100) [M^+], 230 (63) [$\text{M}^+ - 1$], 102 (11).



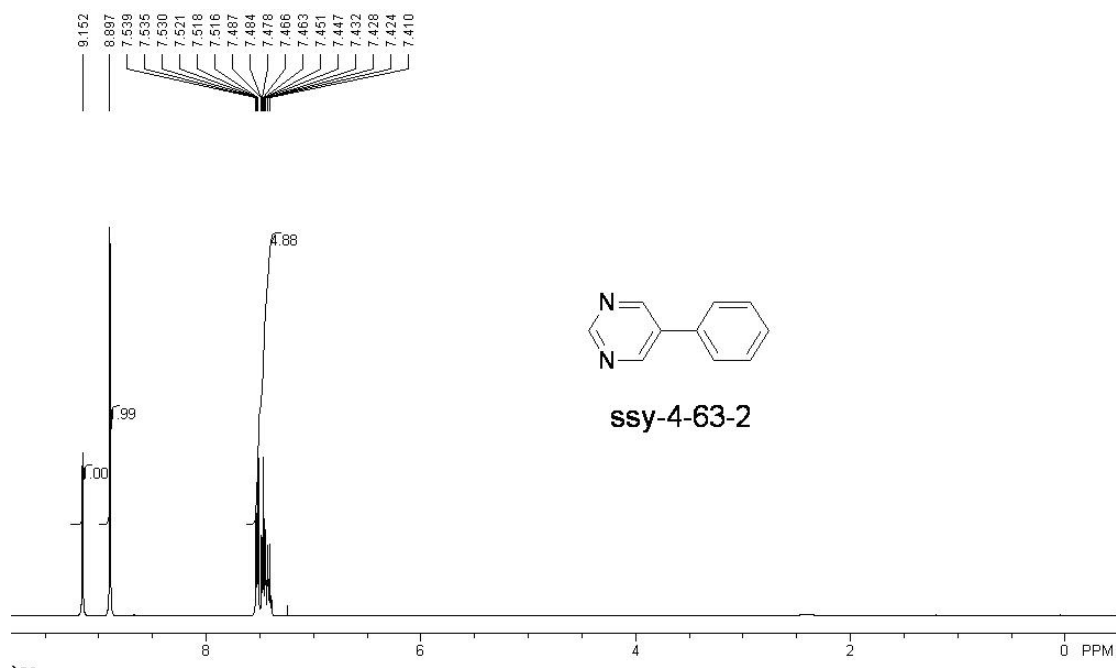
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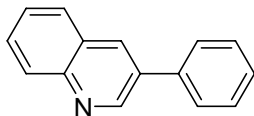
5-phenylpyrimidine [T2-7, 34771-45-4, Ref. 7]

$^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 9.15 (s, 1 H), 8.89 (s, 2 H), 7.41-7.53 (m, 5 H).

MS (EI): m/z (%): 157 (10) [$\text{M}^+ + 1$], 156 (100) [M^+], 155 (15) [$\text{M}^+ - 1$], 102 (54).

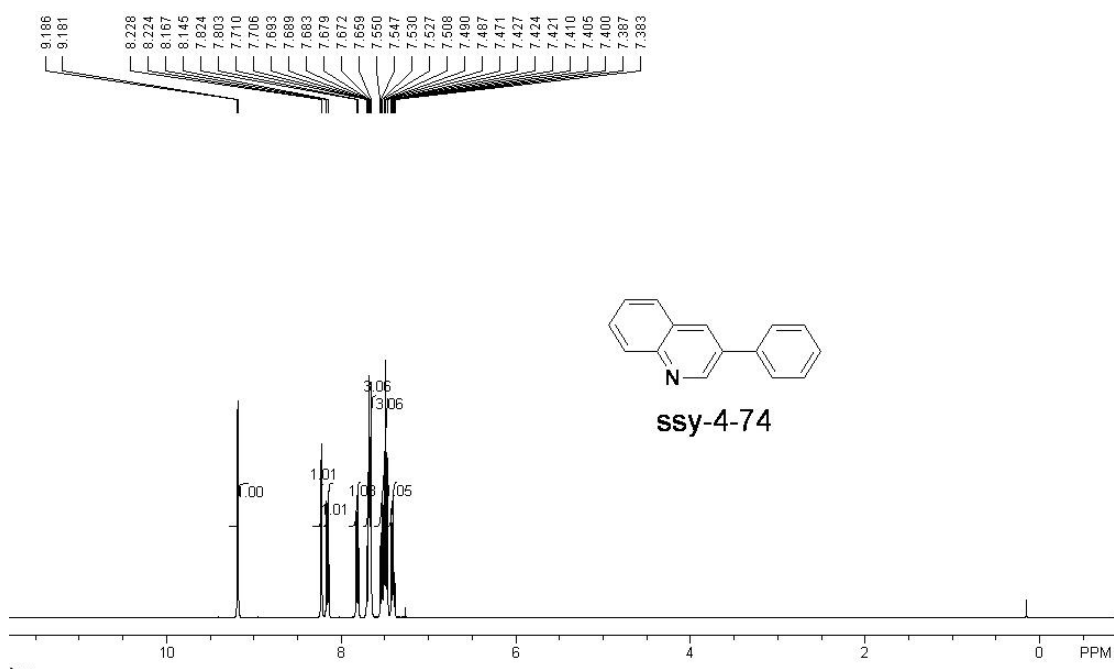


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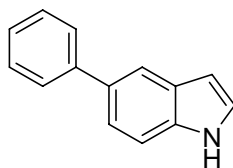


3-phenylquinoline [T2-8, 1666-96-2, Ref. 8]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 9.18 (d, 1 H, $J = 2.0$ Hz), 8.22 (d, 1 H, $J = 1.6$ Hz), 8.14-8.16 (d, 1 H, $J = 8.8$ Hz), 7.80-7.82 (d, 1 H, $J = 8.4$ Hz), 7.65-7.71 (m, 3 H), 7.47-7.55 (m, 3 H), 7.38-7.42 (m, 1 H). MS (EI): m/z (%): 206 (17) [$\text{M}^+ + 1$], 205 (100) [M^+], 204 (51) [$\text{M}^+ - 1$], 176 (13), 151 (8), 102 (10), 88 (11), 76 (15), 44 (14).

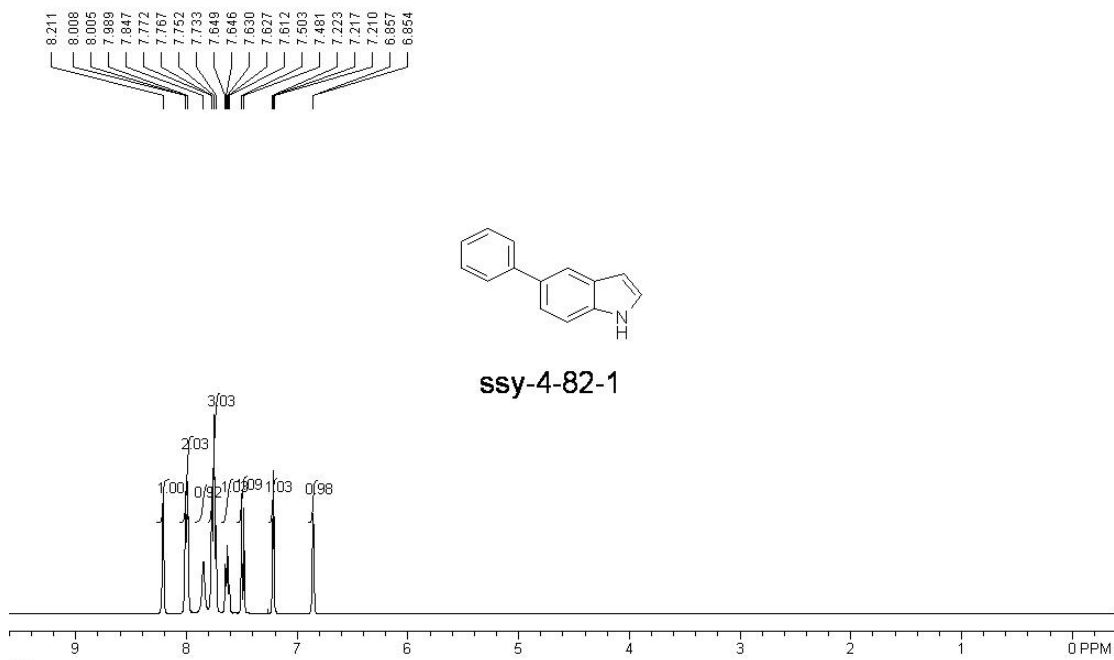


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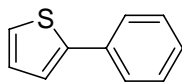


5-phenyl-1H-indole [T2-10, 66616-72-6, Ref. 9]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.21 (s, 1 H), 7.98-8.00 (m, 2 H), 7.84 (s, 1 H), 7.73-7.77 (m, 1 H), 7.61-7.64 (m, 1 H), 7.48-7.50 (d, 1 H, $J = 7.2$ Hz), 7.21-7.22 (t, 1 H, $J = 2.4$ Hz), 6.85 (d, 1 H, $J = 1.2$ Hz). MS (EI): m/z (%): 194 (14) [$\text{M}^+ + 1$], 193 (100) [M^+], 192 (46) [$\text{M}^+ - 1$], 165 (31), 96 (11).

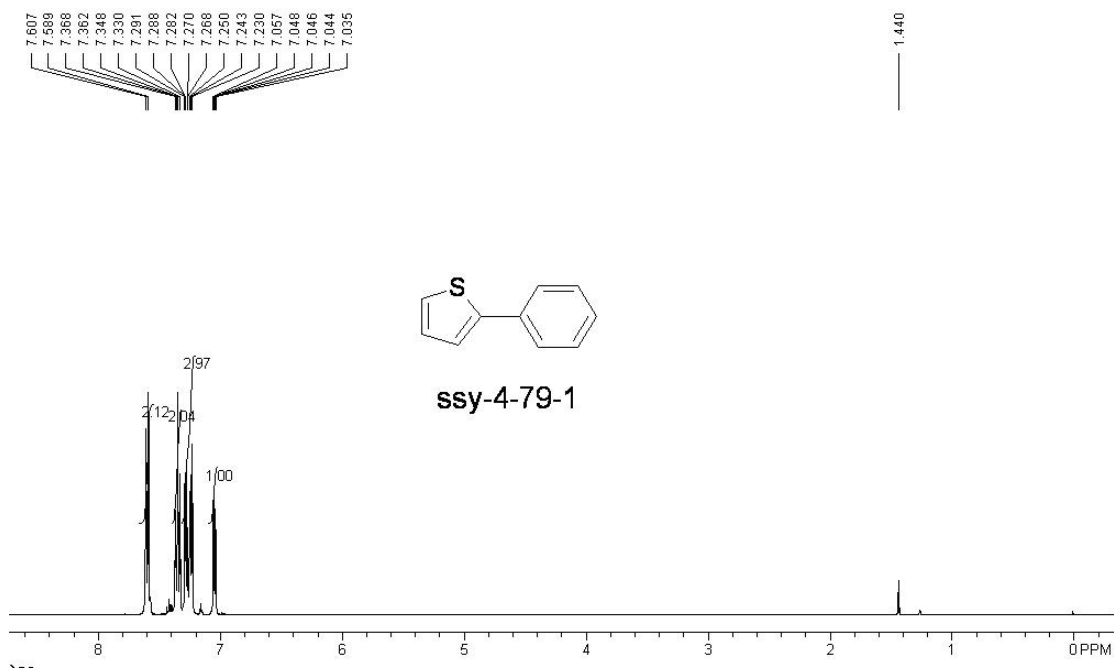


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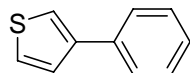


2-phenylthiophene [T2-11, 825-55-8, Ref. 5]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.58-7.60 (d, 2 H, $J = 7.2$ Hz), 7.33-7.36 (m, 2 H), 7.23-7.29 (m, 3 H), 7.03-7.05 (m, 1 H). MS (EI): m/z (%): 161 (11) [$\text{M}^+ + 1$], 160 (100) [M^+], 115 (26).

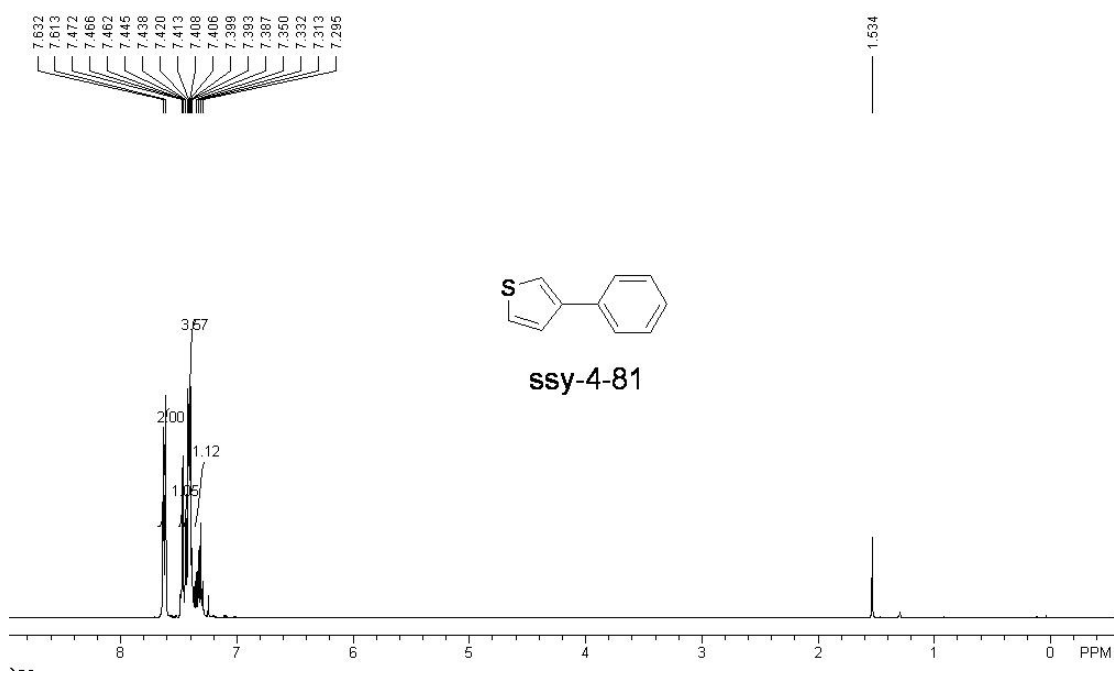


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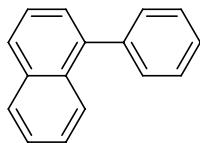


3-phenylthiophene [T2-12, 2404-87-7, Ref. 5]

$^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 7.61-7.63 (d, 2 H, $J = 7.8$ Hz), 7.42-7.47 (m, 1 H), 7.38-7.41 (m, 4 H), 7.29-7.35 (m, 1 H). MS (EI): m/z (%): 161 (13) [$\text{M}^+ + 1$], 160 (100) [M^+], 115 (33).

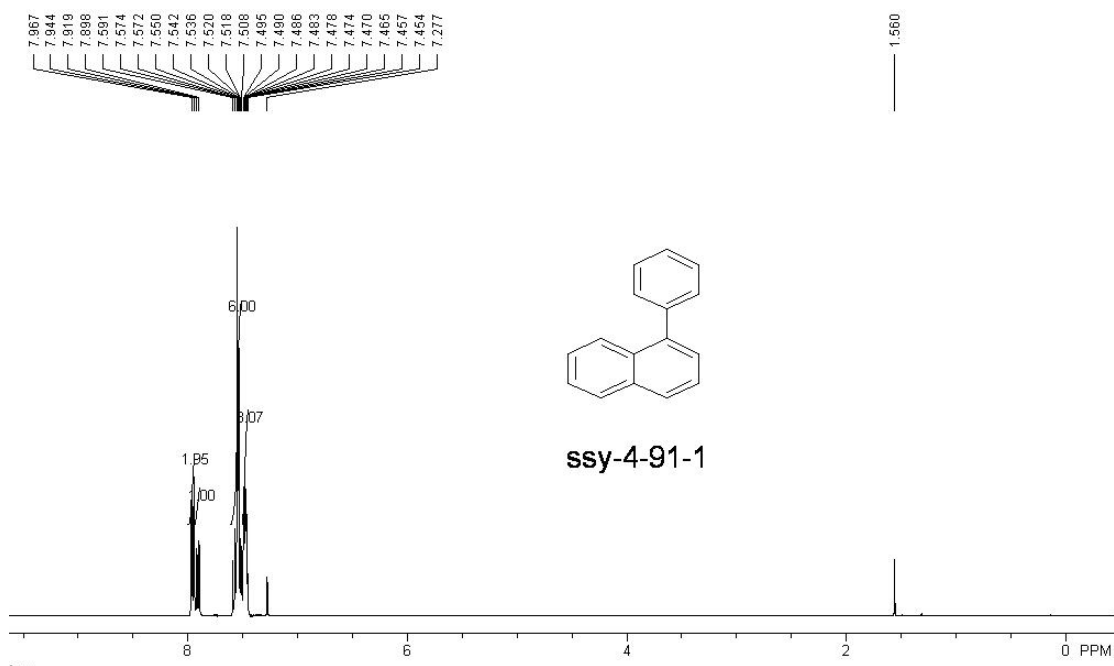


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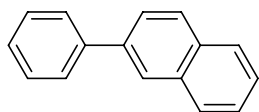


1-phenylnaphthalene [T2-13, 605-02-7, Ref. 5]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.94-7.96 (d, 2 H, $J = 9.2$ Hz), 7.89-7.91 (d, 1 H, $J = 8.4$ Hz), 7.51-7.59 (m, 6 H), 7.45-7.49 (m, 3 H). MS (EI): m/z (%): 204 (100) [M^+], 203 (97), 101 (21).

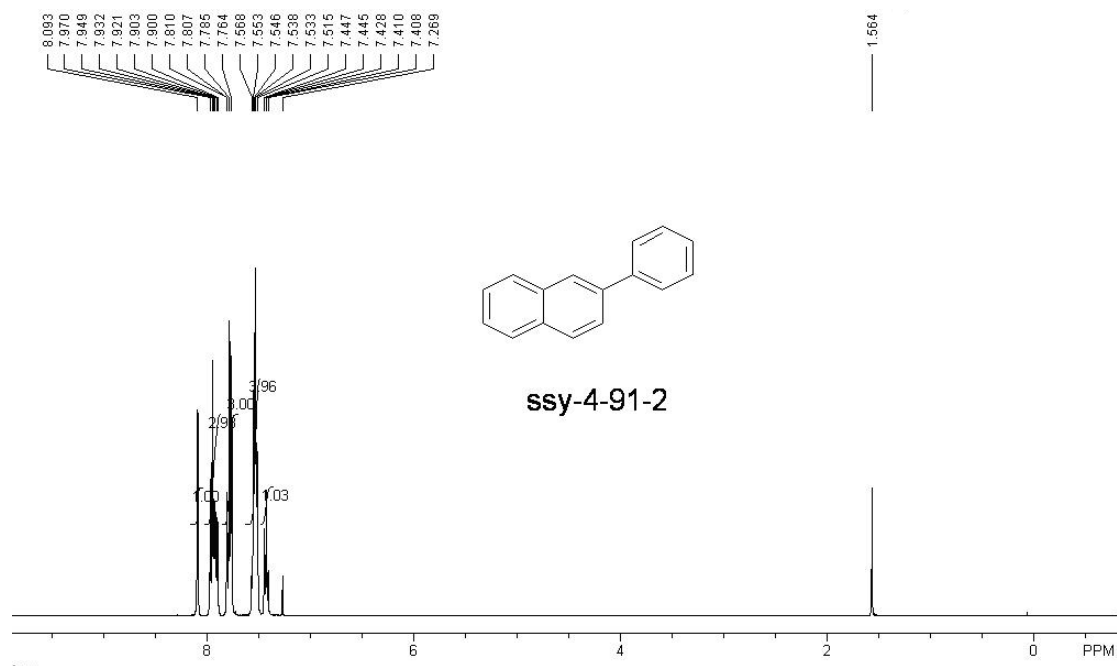


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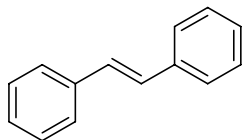


2-phenylnaphthalene [T2-14, 612-94-2, Ref. 10]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.09 (s, 1 H), 7.90-7.97 (m, 3 H), 7.76-7.81 (m, 3 H), 7.51-7.56 (m, 4 H), 7.40-7.44 (m, 1 H). MS (EI): m/z (%): 204 (100) [M^+], 101 (11).

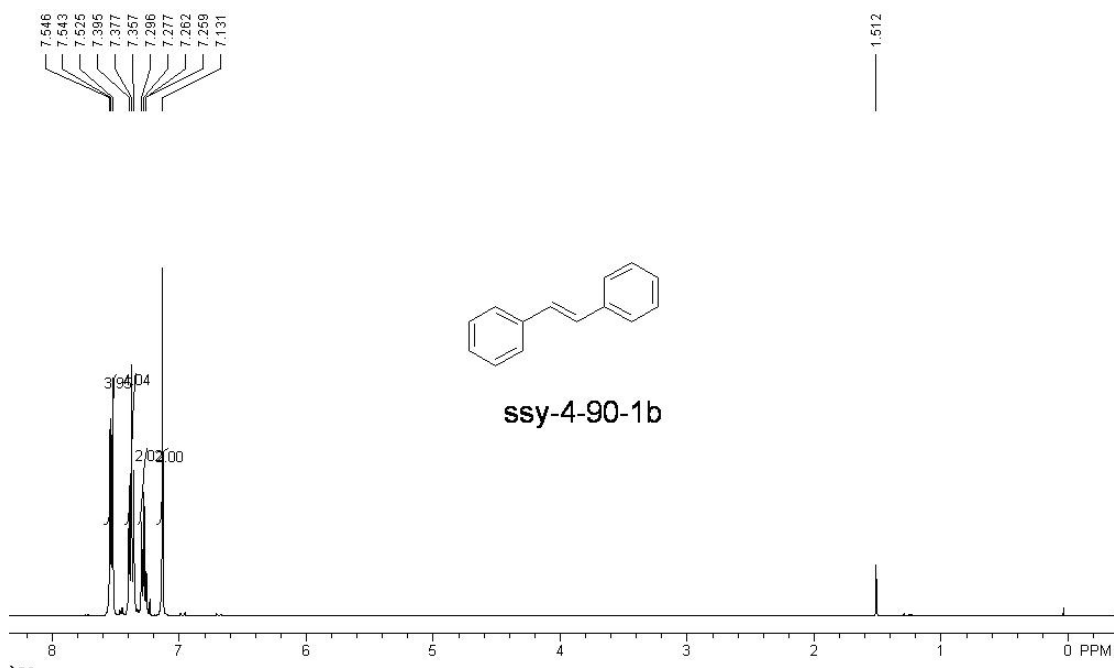


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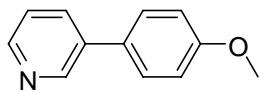


(E)-1,2-diphenylethene [T2-15, 103-30-0, Ref. 11]

^1H NMR (400MHz, CDCl_3 , TMS) δ 7.52-7.54 (m, 4 H), 7.35-7.39 (t, 4 H, $J = 8.0$ Hz), 7.25-7.29 (m, 2 H), 7.13 (s, 2 H). MS (EI): m/z (%): 180 (100) [M^+], 165 (57), 152 (25), 102 (11), 89 (23).

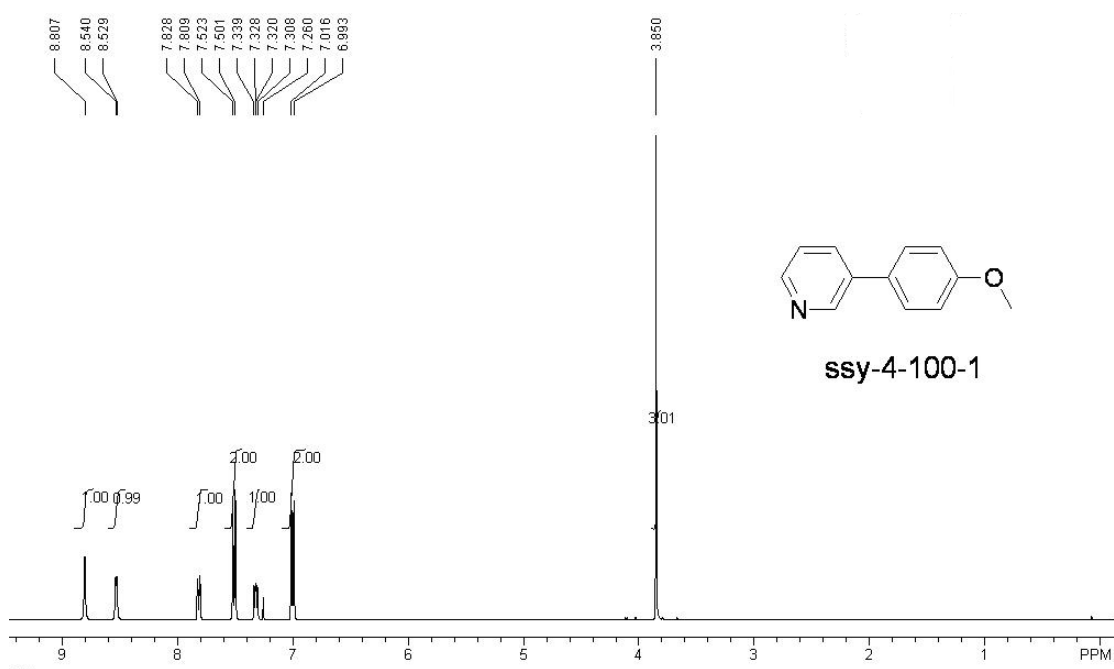


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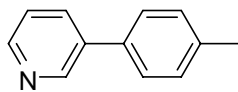


3-(4-methoxyphenyl)pyridine [T3-1, 5958-02-1 , Ref. 12, 13]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.80 (s, 1 H), 8.52-8.54 (d, 1 H, $J = 4.4$ Hz), 7.80-7.82 (d, 1 H, $J = 7.6$ Hz), 7.50-7.52 (d, 2 H, $J = 8.8$ Hz), 7.32 (dd, 1 H, $J = 8.0$, 4.8 Hz), 6.99-7.01 (d, 2 H, $J = 5.2$ Hz), 3.85 (s, 3 H). MS (EI): m/z (%):186 (16) [M^++1], 185 (100) [M^+], 170 (50), 142 (37), 115 (16), 89 (7), 63 (5).

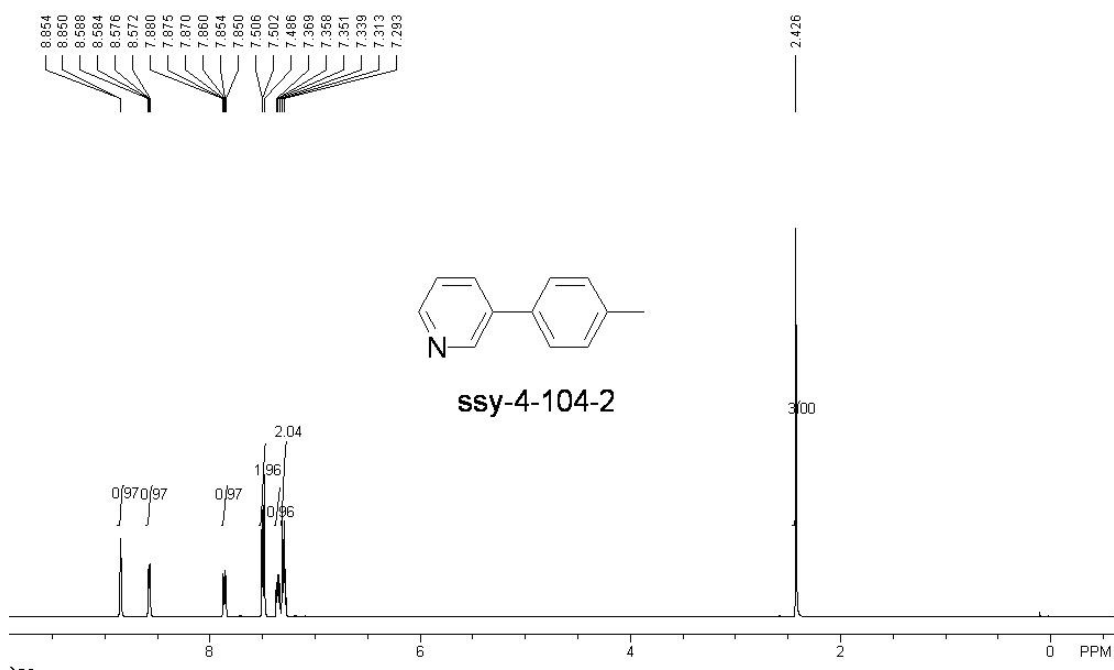


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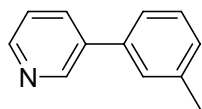


3-(4-Methyl-phenyl)-pyridine [T3-2, 1008-88-4, Ref. 13]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.85 (d, 1 H), 8.58 (dd, 1 H, $J = 4.8, 1.6$ Hz), 7.85-7.88 (m, 1 H), 7.48-7.50 (m, 2 H), 7.33-7.36 (m, 1 H), 7.29-7.31 (d, 2 H, $J = 8.0$ Hz), 2.42 (s, 3 H). MS (EI): m/z (%): 169 (100) [M^+], 154 (22), 153 (15), 76 (9).



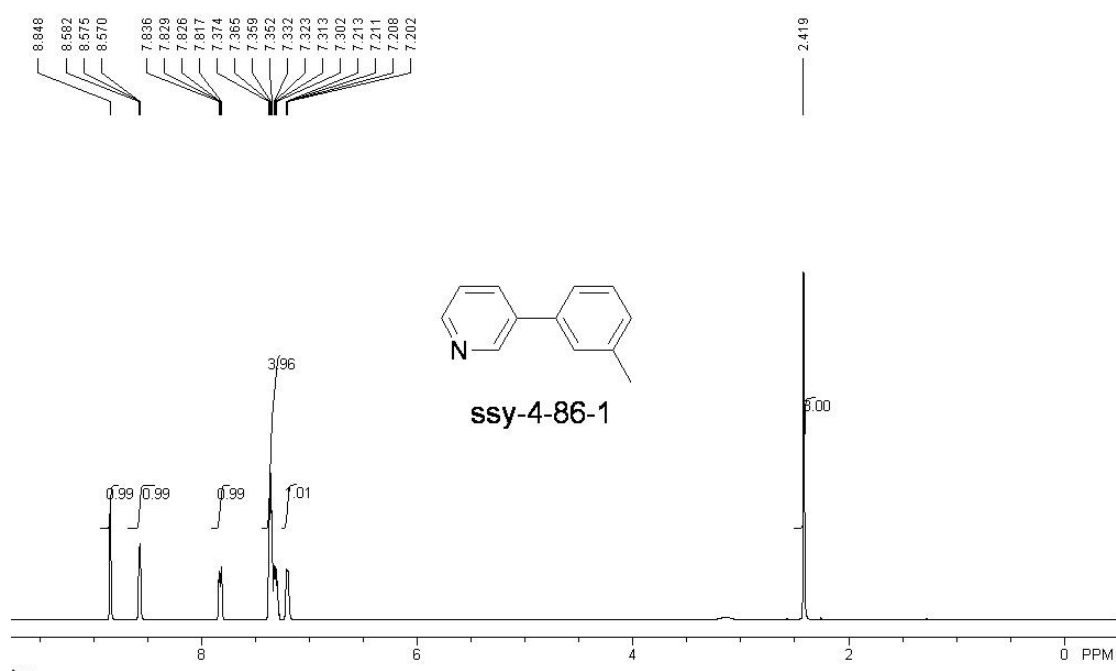
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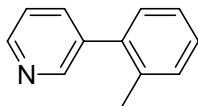
3-m-tolylpyridine [T3-3, 4385-67-5, Ref. 14]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.84 (s, 1 H), 8.57-8.58 (t, 1 H, $J = 2.4$ Hz), 7.82 (dd, 1 H, $J = 4.8, 3.2$ Hz), 7.30-7.37 (m, 4 H), 7.20-7.21 (m, 1 H), 2.41 (s, 3 H).

MS (EI): m/z (%): 170 (15) [$\text{M}^+ + 1$], 169 (100) [M^+], 168 (67) [$\text{M}^+ - 1$], 141 (10), 115 (16).

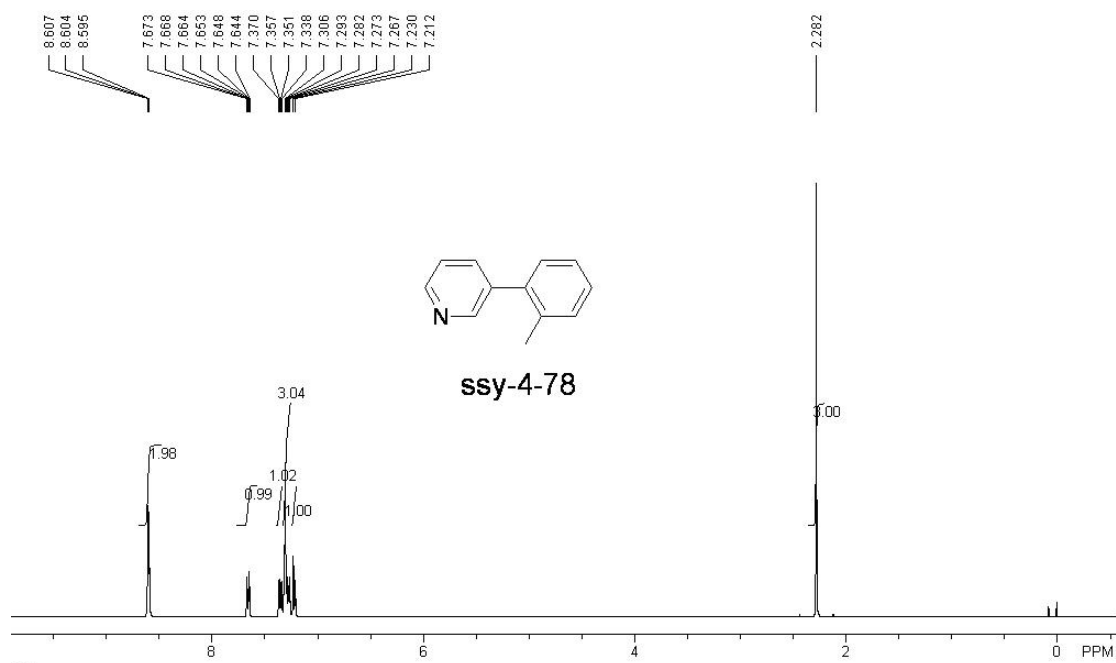


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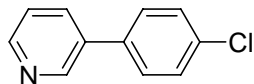


3-o-tolylpyridine [T3-4, 90395-49-6, Ref. 9]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.59-8.60 (m, 2 H), 7.64-7.67 (m, 1 H), 7.35 (dd, 1 H, $J = 7.6, 5.2$ Hz), 7.26-7.30 (m, 3 H), 7.21-7.23 (d, 1 H, $J = 7.2$ Hz), 2.28 (s, 3 H). MS (EI): m/z (%): 170 (12) [$\text{M}^+ + 1$], 169 (100) [M^+], 168 (90) [$\text{M}^+ - 1$], 167 (35) [$\text{M}^+ - 2$], 141 (15), 115 (16), 83 (7).

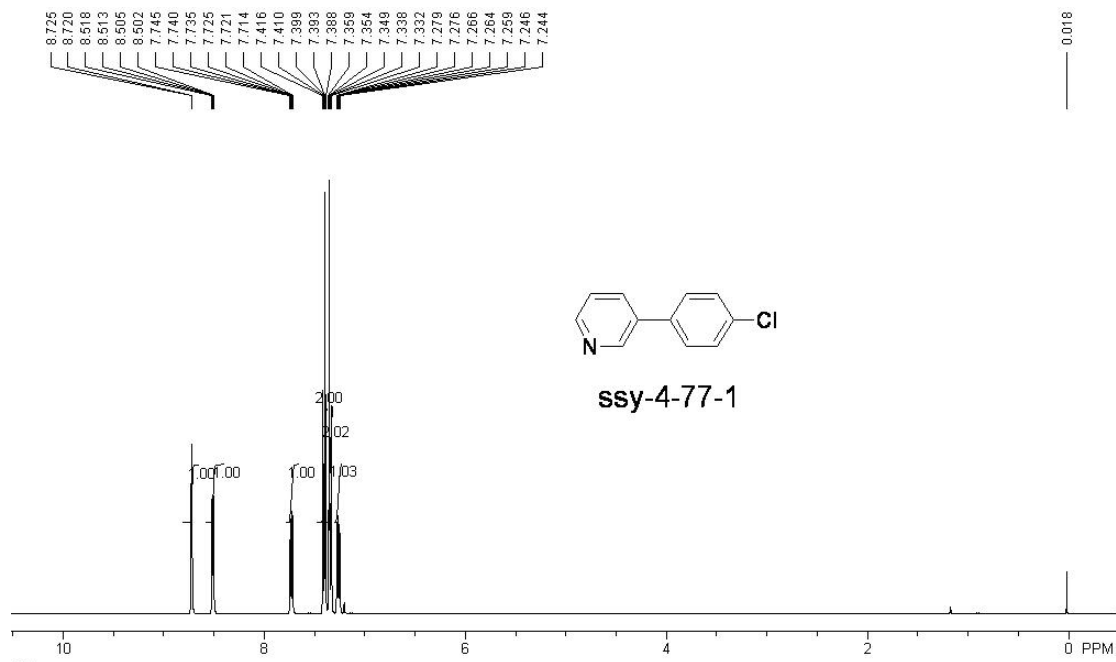


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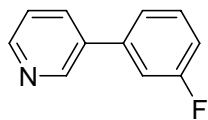


3-(4-chlorophenyl)pyridine [T3-5, 5957-97-1, Ref. 15]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.72 (d, 1 H, $J = 2.0$ Hz), 8.51 (dd, 1 H, $J = 4.8, 1.6$ Hz), 7.71-7.74(m, 1 H), 7.38-7.41 (m, 2 H), 7.33-7.35 (m, 2 H), 7.24-7.27 (m, 1 H). MS (EI): m/z (%): 191 (34) [M^+] (^{37}Cl), 189 (100) [M^+] (^{35}Cl), 154 (36), 127 (24), 101 (7), 75 (8).

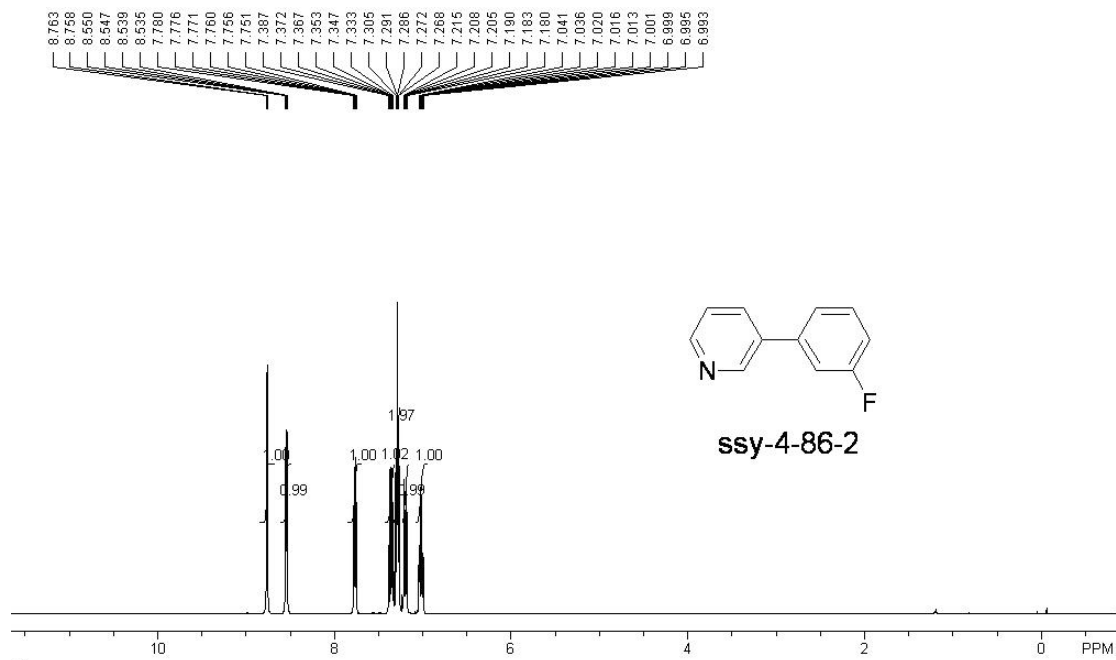


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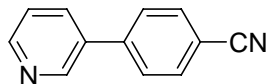


3-(3-fluorophenyl)pyridine [T3-6, 79412-32-1, Ref. 15]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.75-8.76 (d, 1 H, $J = 2.0$ Hz), 8.54 (dd, 1 H, $J = 4.8, 1.6$ Hz), 7.75-7.78 (m, 1 H), 7.33-7.38 (m, 1 H), 7.26-7.30 (m, 2 H), 7.18-7.21 (m, 1 H), 6.99-7.04 (m, 1 H). MS (EI): m/z (%): 174 (13) [$\text{M}^+ + 1$], 173 (100) [M^+], 172 (44) [$\text{M}^+ - 1$], 146 (14), 120 (15), 73 (9).

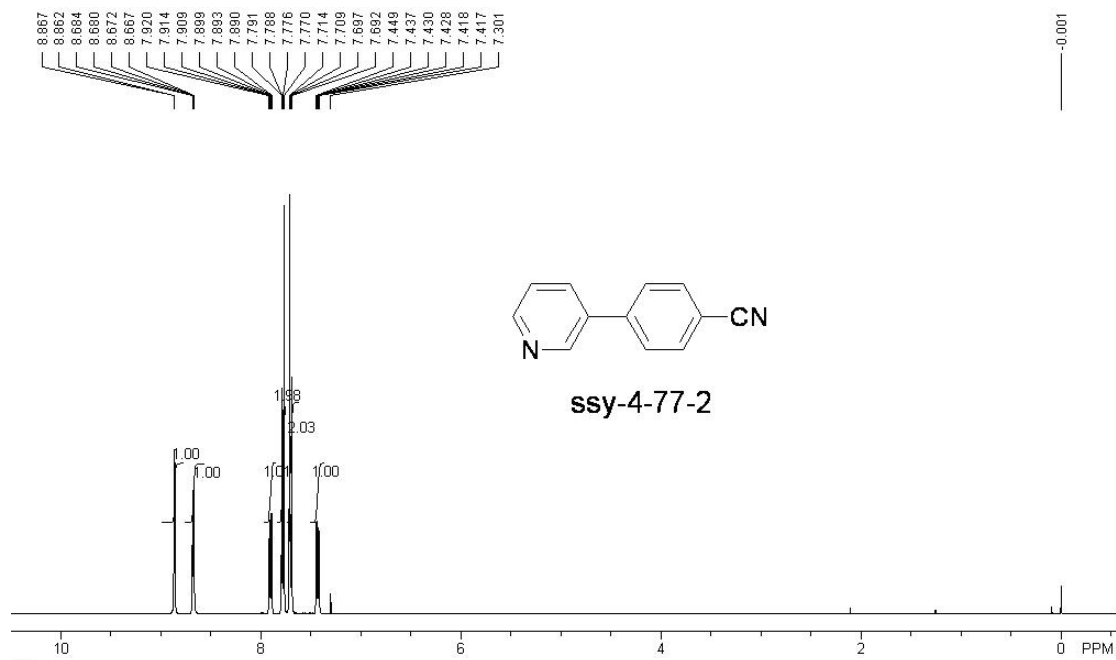


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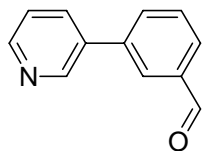


4-(pyridin-3-yl)benzonitrile [T3-7, 294648-03-6, Ref. 13]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.86 (d, 1 H, $J = 2.0$ Hz), 8.67 (dd, 1 H, $J = 4.8, 1.6$ Hz), 7.89-7.92(m, 1 H), 7.77-7.79 (m, 2 H), 7.70 (dd, 2 H, $J = 6.8, 2.0$ Hz), 7.41-7.44 (m, 1 H). MS (EI): m/z (%): 181 (13) [$\text{M}^+ + 1$], 180 (100) [M^+], 179 (37) [$\text{M}^+ - 1$], 153 (10), 127 (13), 76 (7).

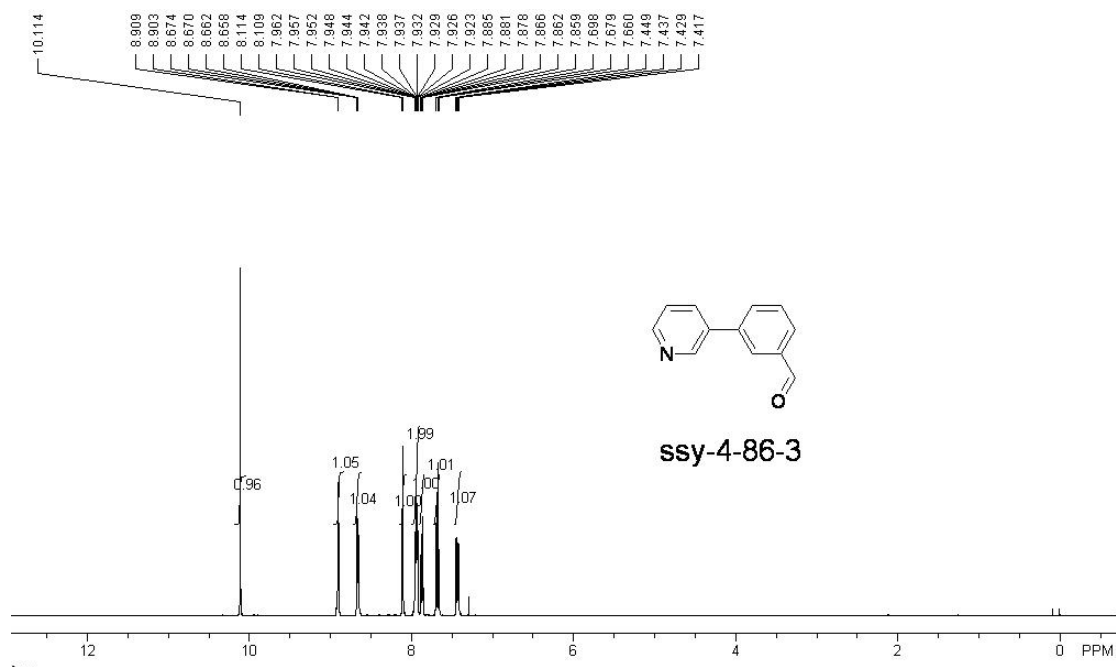


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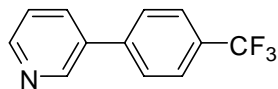


3-(pyridin-3-yl)benzaldehyde [T3-8, 131231-24-8, Ref. 16]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 10.11 (s, 1 H), 8.90 (d, 1 H, $J = 2.4$ Hz), 8.66 (dd, 1 H, $J = 4.8, 1.6$ Hz), 8.11 (d, 1 H, $J = 2.0$ Hz), 7.92-7.96 (m, 2 H), 7.85-7.88 (m, 1 H), 7.66-7.69 (t, 1 H, $J = 7.6$ Hz), 7.41-7.44 (m, 1 H). MS (EI): m/z (%): 183 (100) [M^+], 182 (78) [M^+-1], 154 (54), 127 (40).

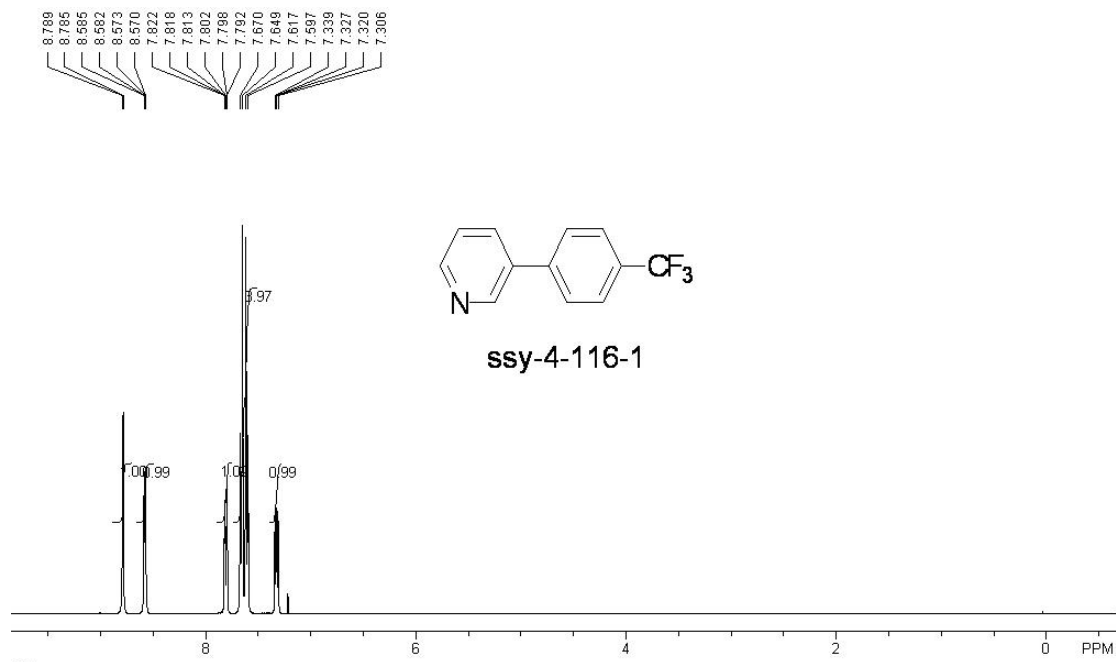


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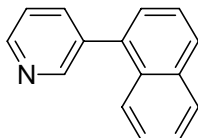


3-(4-(trifluoromethyl)phenyl)pyridine [T3-9, 426823-25-8 , Ref. 12]

¹H NMR (400 MHz, CDCl₃, TMS) δ 8.78 (d, 1 H, *J* = 2.0 Hz), 8.57 (dd, 1 H, *J* = 4.8, 1.2 Hz), 7.79-7.82 (m, 1 H), 7.64-7.67 (d, 2 H, *J* = 8.4 Hz), 7.59-7.61 (d, 2 H, *J* = 8.0 Hz), 7.30-7.33 (m, 1 H). MS (EI): *m/z* (%):224 (17) [M⁺+1], 223 (100) [M⁺], 204 (10), 191 (26), 154 (19), 127 (8).



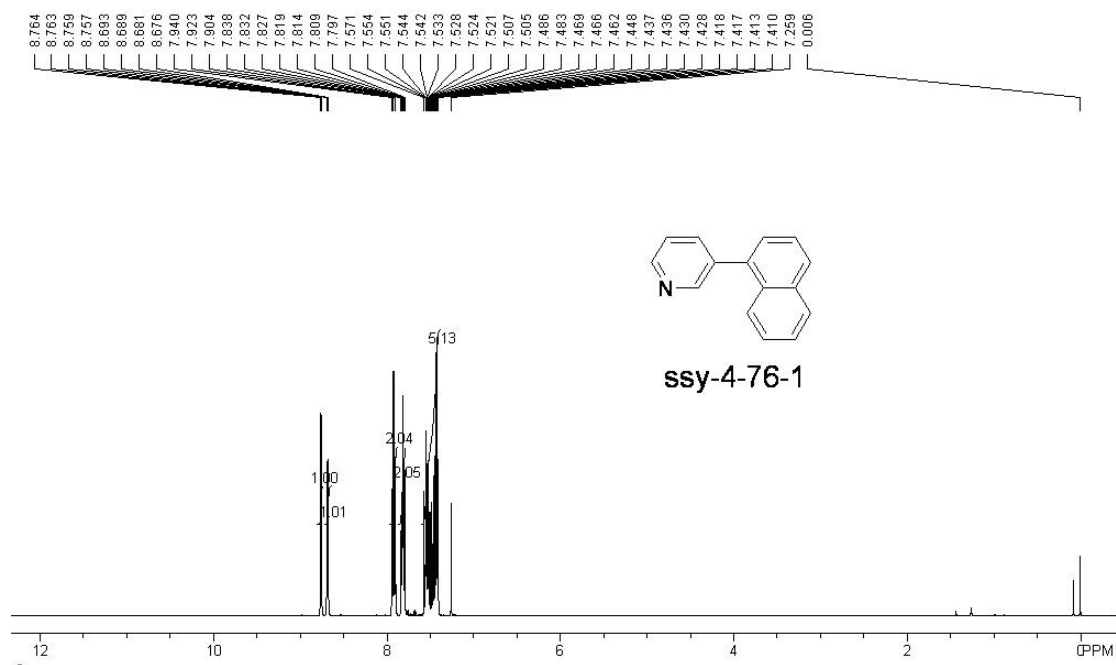
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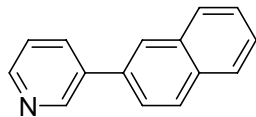
3-(naphthalen-1-yl)pyridine [T3-10, 189193-21-3, Ref. 13]

$^1\text{H NMR}$ (400 MHz, CDCl_3 , TMS) δ 8.76 (dd, 1 H, $J = 2.0, 0.8$ Hz), 8.68 (dd, 1 H, $J = 4.8, 1.6$ Hz), 7.90-7.94 (t, 2 H, $J = 7.2$ Hz), 7.79-7.83 (m, 2 H), 7.41-7.57 (m, 5 H).

MS (EI): m/z (%): 205 (93) [M^+], 204 (100) [M^+-1], 176 (22), 151 (14), 102 (14), 88 (12), 76 (9).

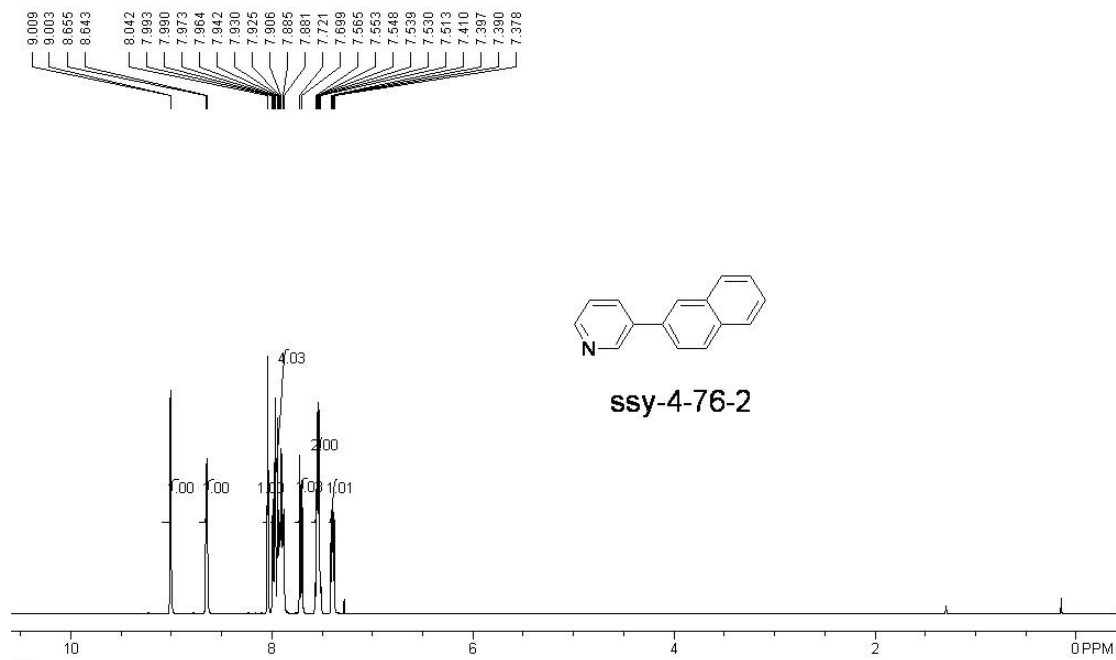


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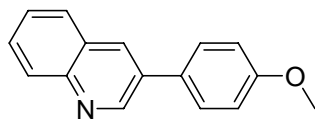


3-(naphthalen-2-yl)pyridine [T3-11, 92497-48-8, Ref. 17]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 9.00 (d, 1 H, $J = 2.4$ Hz), 8.64-8.65 (d, 1 H, $J = 4.8$ Hz), 8.04 (s, 1 H), 7.88-7.99 (m, 4 H), 7.69-7.72 (d, 1 H, $J = 8.8$ Hz), 7.51-7.56 (m, 2 H), 7.39 (dd, 1 H, $J = 8.0, 4.8$ Hz). MS (EI): m/z (%): 206 (18) [$\text{M}^+ + 1$], 205 (100) [M^+], 204 (46) [$\text{M}^+ - 1$], 176 (11), 151 (7), 102 (5), 88 (6), 76 (9).

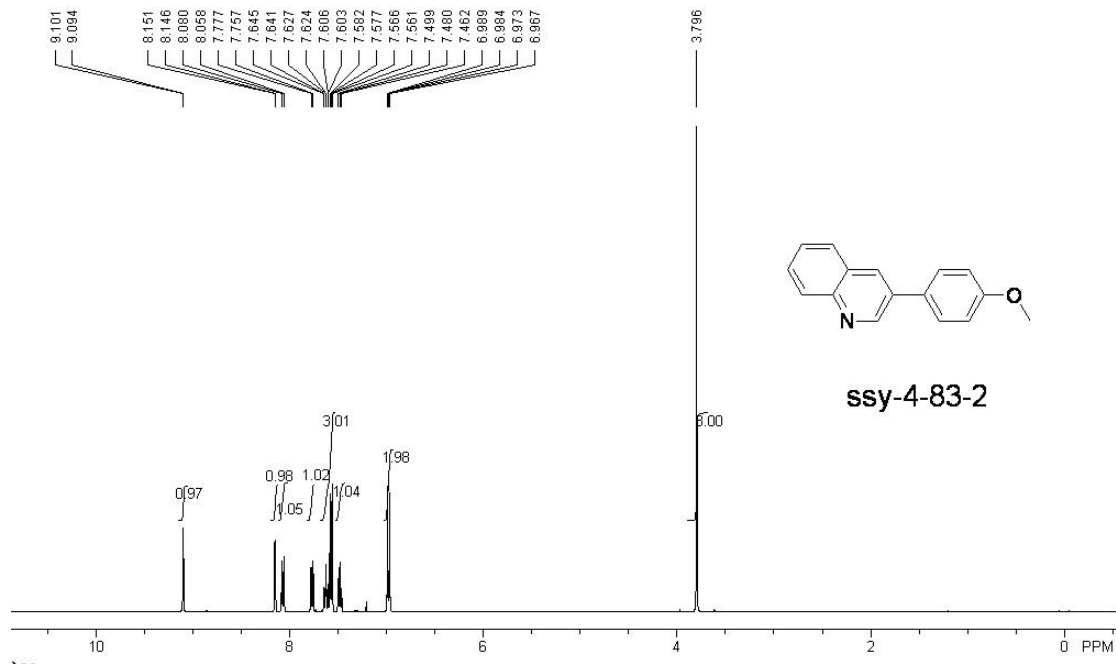


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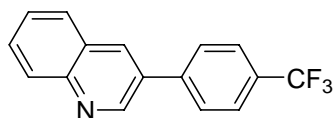


3-(4-methoxyphenyl)quinoline [T3-12, 57479-32-0, Ref. 18]

¹H NMR (400 MHz, CDCl₃, TMS) δ 9.09-9.10 (d, 1 H, *J* = 2.8 Hz), 8.15-8.14 (d, 1 H, *J* = 2.0 Hz), 8.05-8.08 (d, 1 H, *J* = 8.8 Hz), 7.75-7.77 (d, 1 H, *J* = 8.0 Hz), 7.56-7.64 (m, 3 H), 7.46-7.49 (t, 1 H, *J* = 7.2 Hz), 6.97 (dd, 2 H, *J* = 6.4, 2.0 Hz), 3.79 (s, 3 H). MS (EI): *m/z* (%): 236 (16) [M⁺+1], 235 (100) [M⁺], 220 (42), 207 (9), 192 (23), 165 (15), 117 (10), 44 (24).

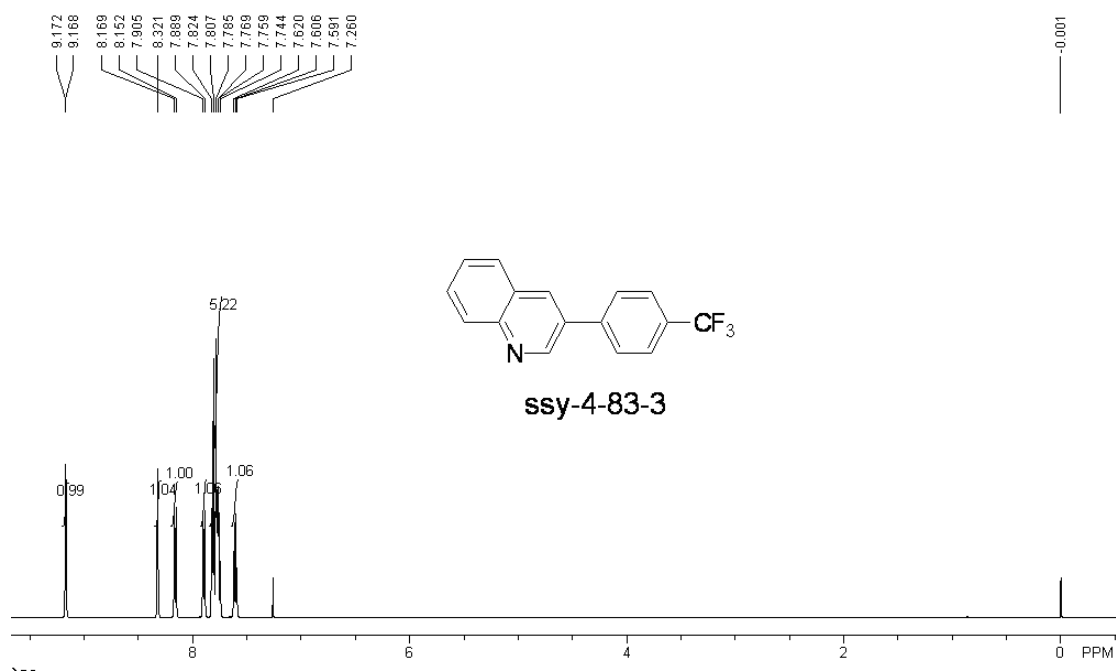


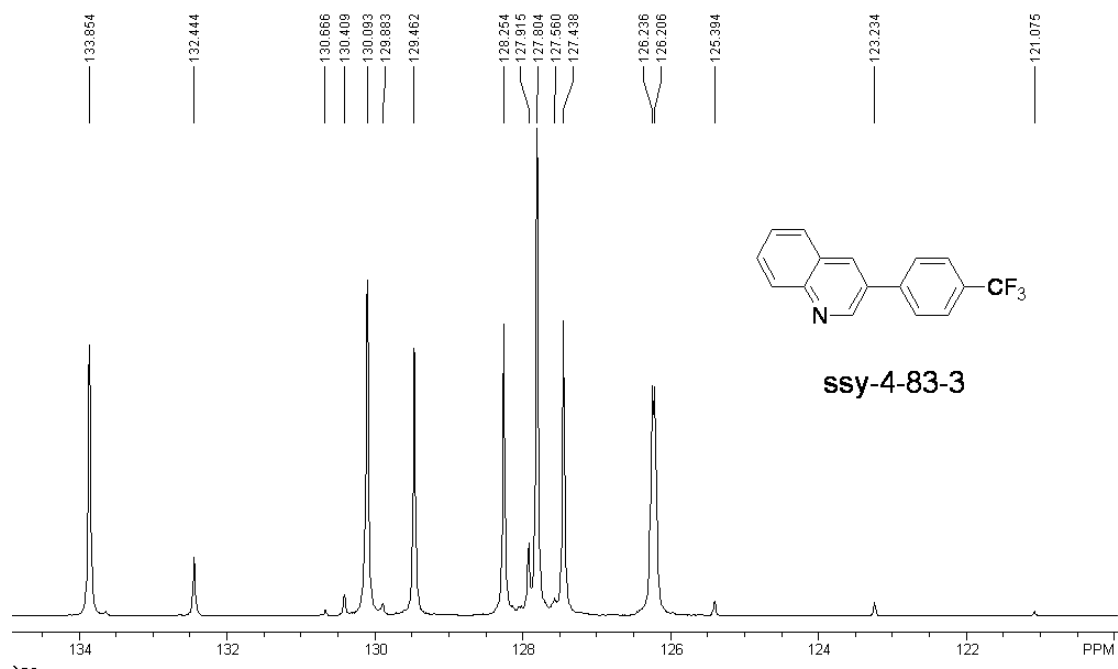
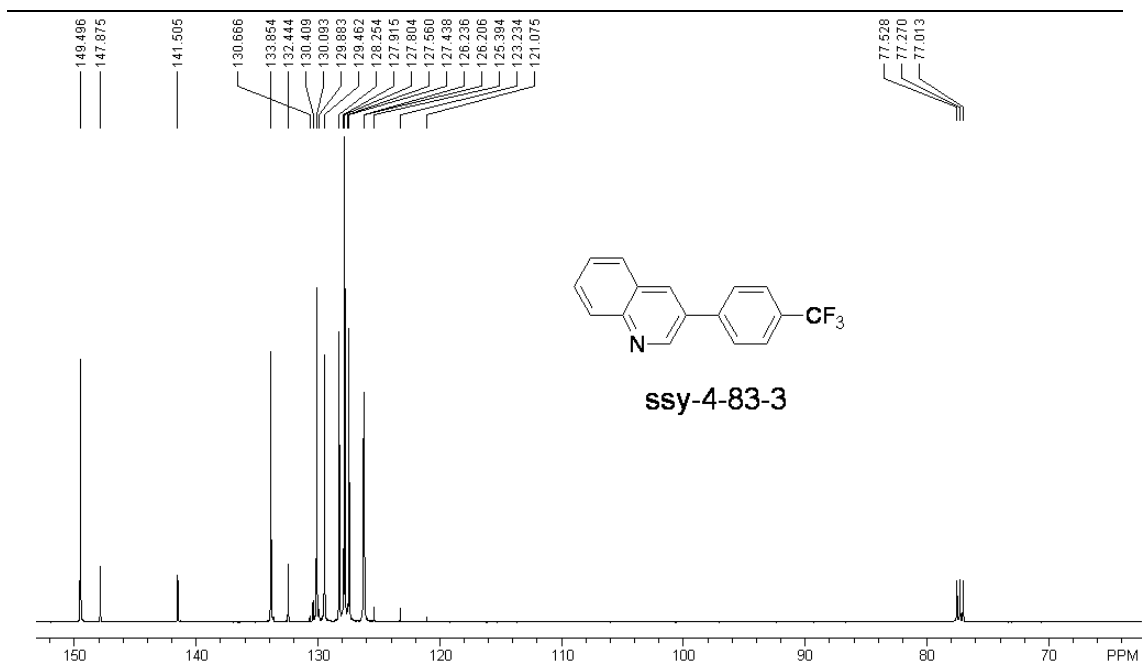
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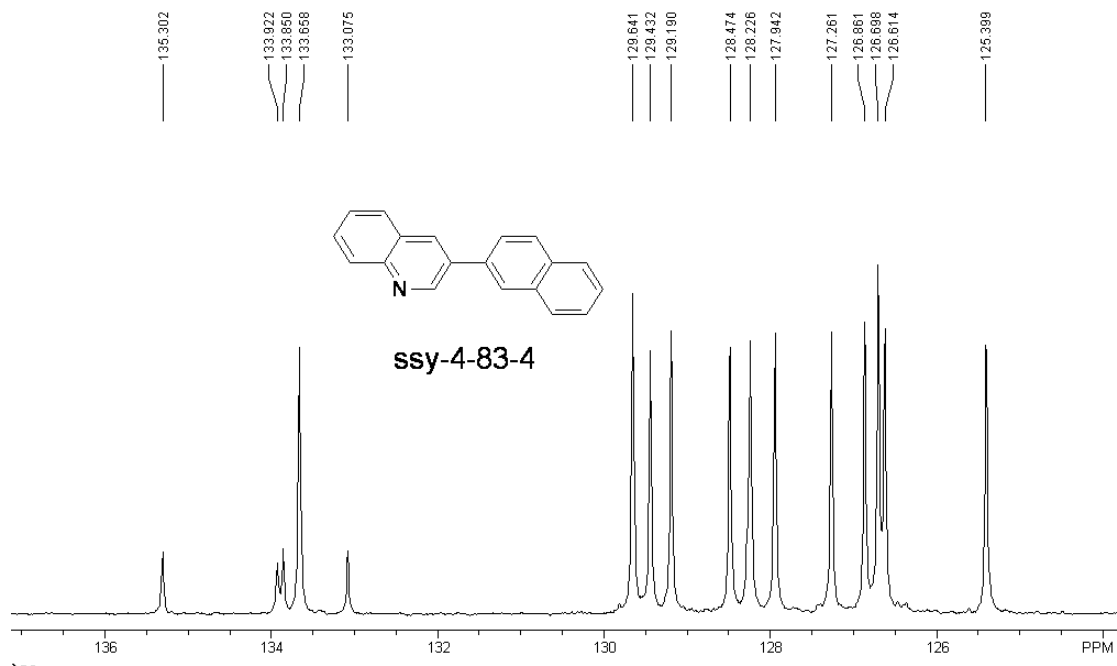
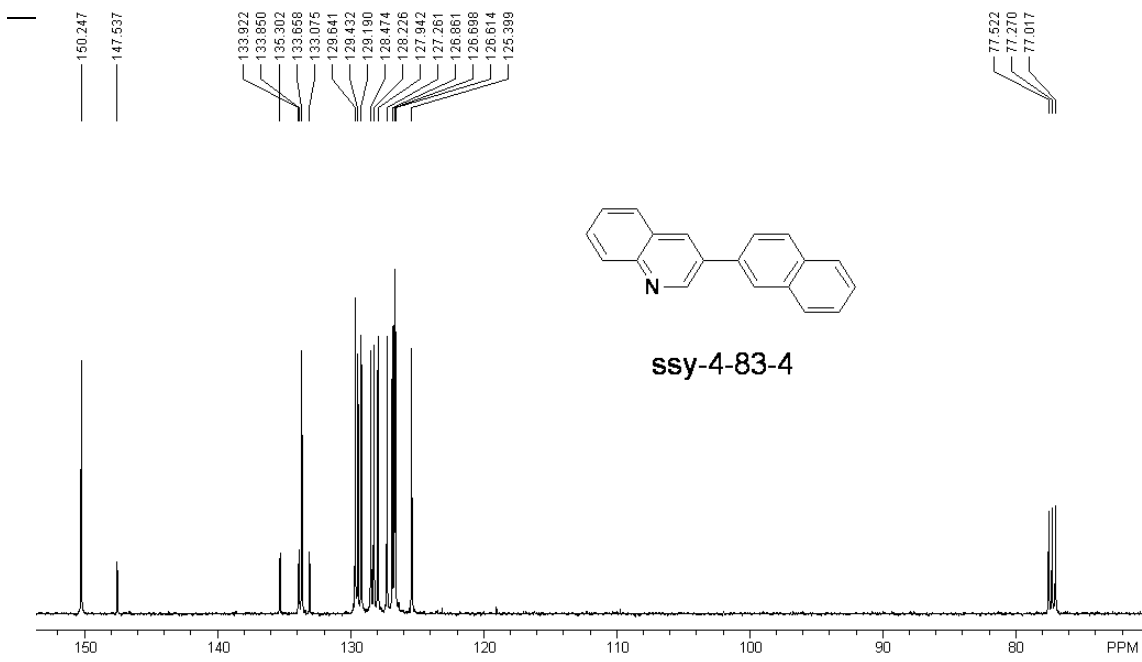


3-(4-(trifluoromethyl)phenyl)quinoline [T3-13, New compound]

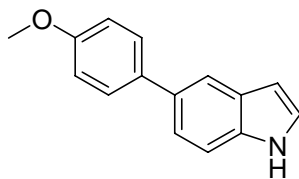
^1H NMR (500 MHz, CDCl_3 , TMS) δ 9.16-9.17 (d, 1 H, $J = 2.0$ Hz), 8.32 (s, 1 H), 8.15-8.16 (d, 1 H, $J = 8.5$ Hz), 7.88-7.90 (d, 1 H, $J = 8.0$ Hz), 7.74-7.82 (m, 5 H), 7.59-7.62 (t, 1 H, $J = 7.0$ Hz). ^{13}C NMR (125 MHz, CDCl_3) δ 149.5, 147.9, 141.5, 133.9, 132.4, 130.3 (q, $J = 32.1$ Hz), 130.1, 129.5, 128.3, 127.9, 127.8, 127.4, 126.2 (q, $J = 3.8$ Hz), 124.3 (q, $J = 270$ Hz). MS (EI): m/z (%): 274 (15) [$\text{M}^+ + 1$], 273 (100) [M^+], 272 (27) [$\text{M}^+ - 1$], 204 (13). HRMS (EI) calcd for $\text{C}_{16}\text{H}_{10}\text{NF}_3$, 273.0765; found, 273.0759.





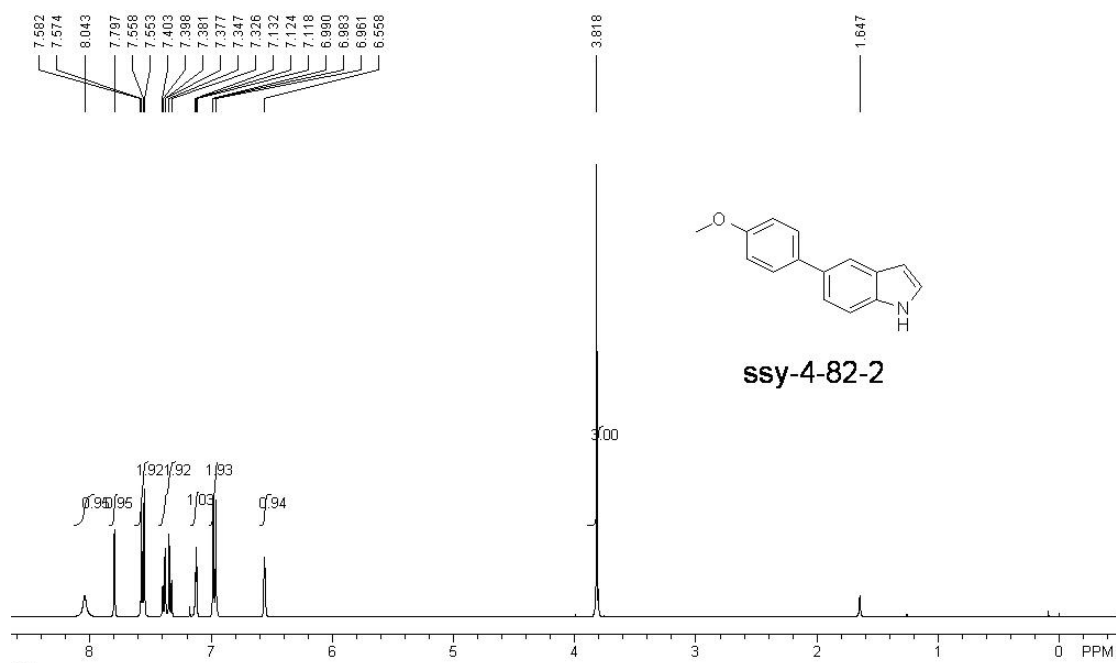


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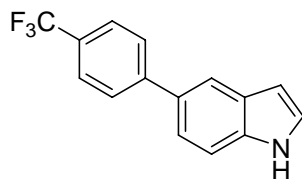


5-(4-methoxyphenyl)-1H-indole [T3-15, 144104-46-1, Ref. 19]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.04 (s, 1 H), 7.79 (s, 1 H), 7.55-7.58 (m, 2 H), 7.32-7.40 (m, 2 H), 7.11-7.13 (t, 1 H, $J = 2.8$ Hz), 6.96-6.99 (m, 2 H), 6.55 (s, 1 H), 3.81 (s, 3 H). MS (EI): m/z (%): 224 (17) [M^++1], 223 (100) [M^+], 208 (80), 180 (30), 152 (17), 112 (10), 77 (7).

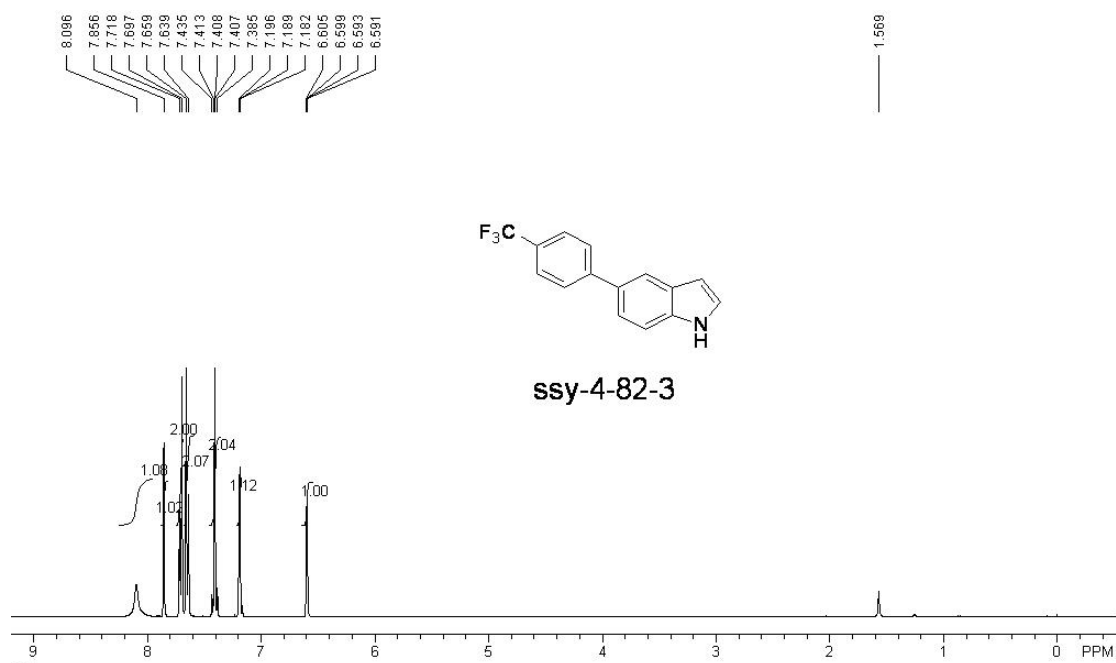


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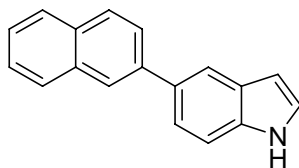


5-(4-(trifluoromethyl)phenyl)-1H-indole [T3-16, 163105-69-9, Ref. 19]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.09 (s, 1 H), 7.85 (s, 1 H), 7.69-7.71 (d, 2 H, $J = 8.4$ Hz), 7.63-7.65 (d, 2 H, $J = 8.0$ Hz), 7.38-7.43 (m, 2 H), 7.18-7.19 (t, 1 H, $J = 2.8$ Hz), 6.59-6.60 (m, 1 H). MS (EI): m/z (%): 262 (16) [$\text{M}^+ + 1$], 261 (100) [M^+], 191 (9), 165 (13).

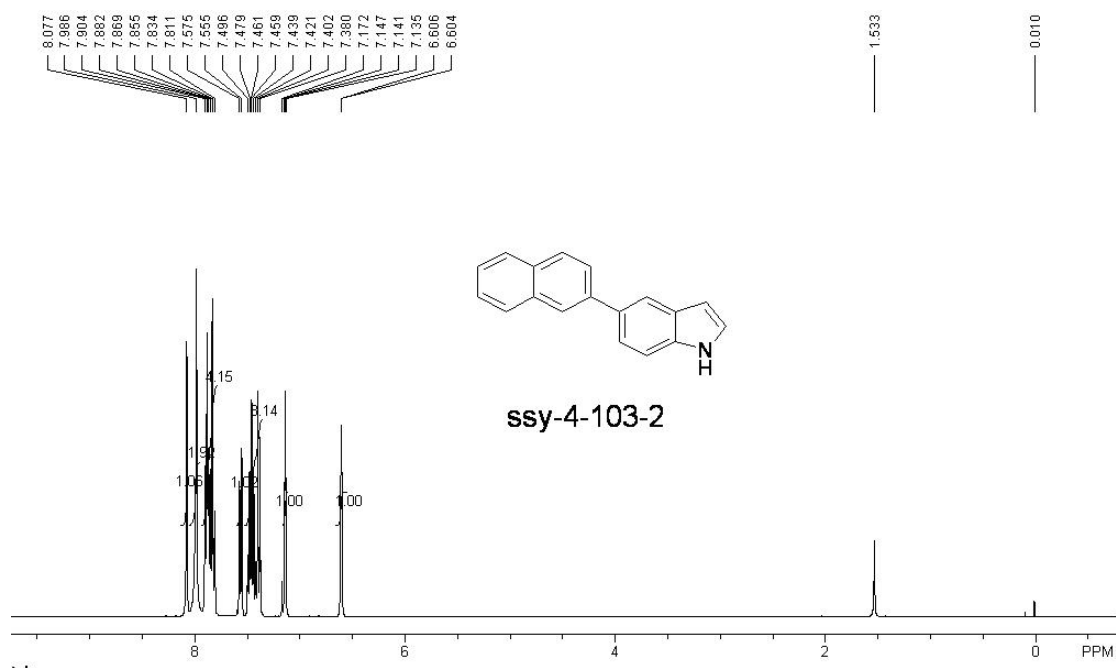


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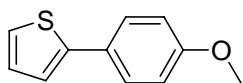


5-(naphthalen-2-yl)-1H-indole [T3-17, 916439-58-2, Ref. 20]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.07 (s, 1 H), 7.98 (s, 2 H), 7.81-7.90 (m, 4 H), 7.55-7.57 (d, 1 H, $J = 8.0$ Hz), 7.38-7.49 (m, 3 H), 7.13-7.17 (m, 1 H), 6.60 (d, 1 H, $J = 0.8$ Hz). MS (EI): m/z (%): 244 (21) [$\text{M}^+ + 1$], 243 (100) [M^+], 215 (12), 121 (12), 107 (8).

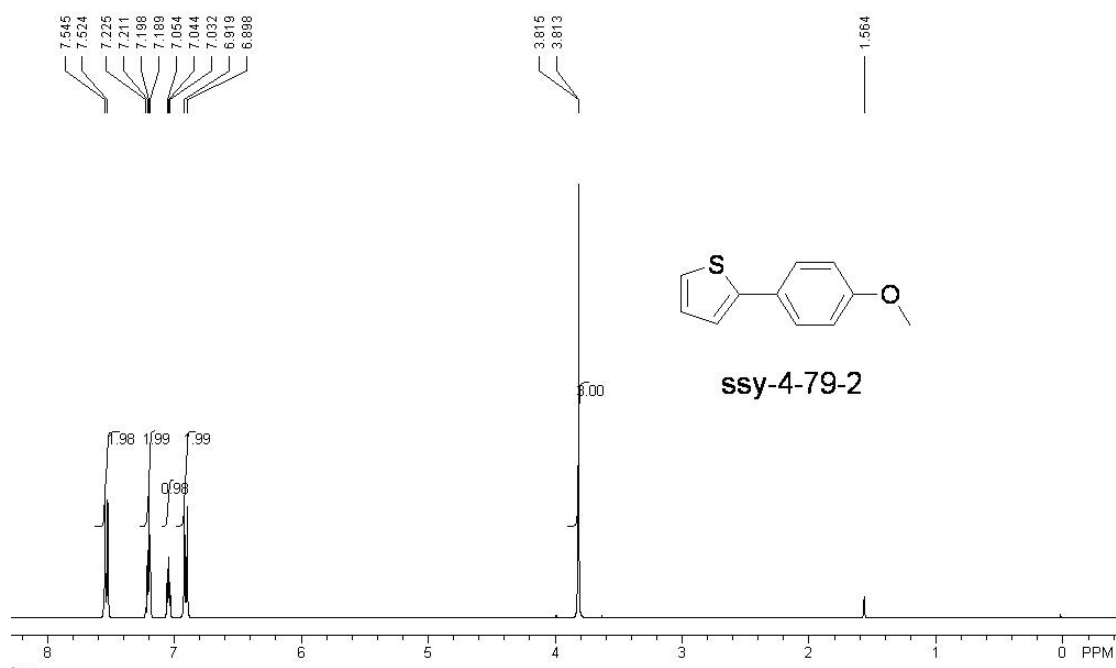


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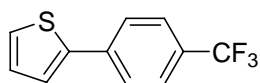


2-(4-methoxyphenyl)thiophene [T3-18, 42545-43-7, Ref. 21]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 7.52-7.54 (d, 2 H, $J = 8.4$ Hz), 7.18-7.22 (m, 2 H), 7.03-7.05 (t, 1 H, $J = 4.4$ Hz), 6.89-6.91 (d, 2 H, $J = 8.4$ Hz), 3.81 (d, 3 H). MS (EI): m/z (%): 190 (100) [M^+], 175 (16), 159 (12), 76 (5).

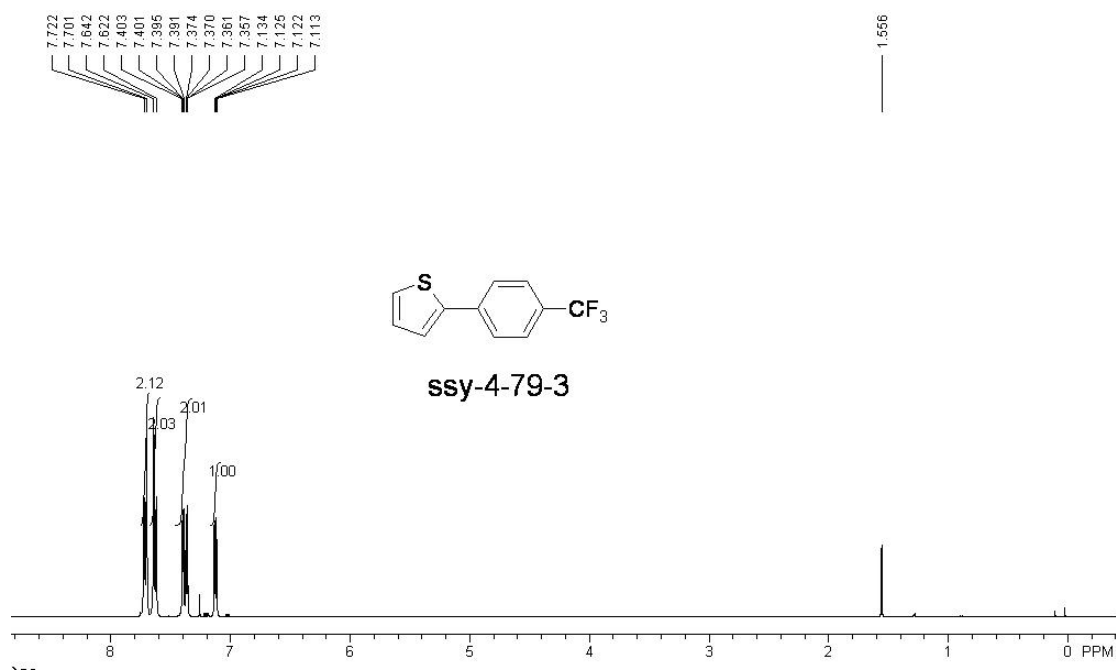


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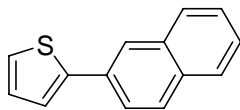


2-(4-(trifluoromethyl)phenyl)thiophene [T3-19, 115933-15-8, Ref. 21]

¹H NMR (400 MHz, CDCl₃, TMS) δ 7.70-7.72 (d, 2 H, *J* = 8.4 Hz), 7.62-7.64 (d, 2 H, *J* = 8.0 Hz), 7.35-7.40 (m, 2 H), 7.12 (d, 1 H, *J* = 4.8, 3.6 Hz). MS (EI): *m/z* (%): 229 (12) [M⁺+1], 228 (100) [M⁺], 183 (21), 149 (32).

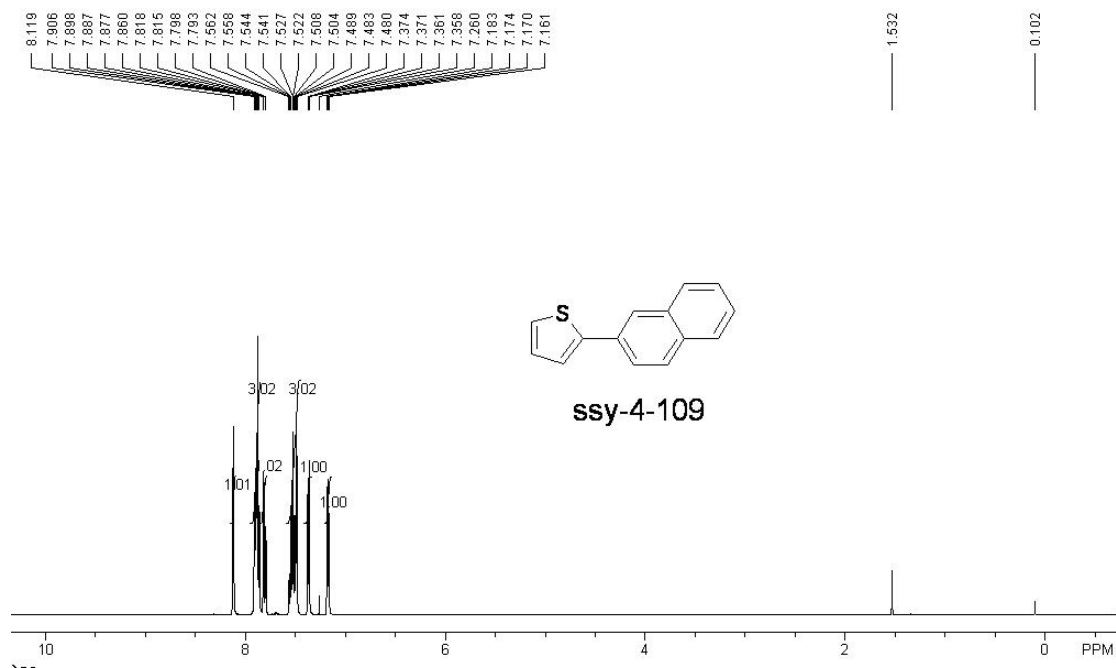


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2-(naphthalen-2-yl)thiophene [T3-20, 16939-09-6, Ref. 22]

^1H NMR (400 MHz, CDCl_3 , TMS) δ 8.11 (s, 1 H), 7.86-7.90 (m, 3 H), 7.80 (dd, 1 H, $J = 8.0, 1.6$ Hz), 7.48-7.56 (m, 3 H), 7.36 (dd, 1 H, $J = 5.2, 1.2$ Hz), 7.17 (dd, 1 H, $J = 5.2, 3.6$ Hz). MS (EI): m/z (%): 211 (19) [$\text{M}^+ + 1$], 210 (100) [M^+], 165 (20), 105 (8).



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