Supporting Information for

CuBr-Catalyzed Coupling of *N*-Tosylhydrazones and Terminal Alkynes: Synthesis of Benzofurans and Indoles

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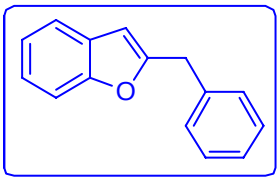
CONTENTS

General All reactions were performed under a nitrogen atmosphere in a 10 mL Schlenk tube. MeCN was dried over CaH_2 before use. For chromatography, 200-300 mesh silica gel (Qingdao, China) was employed. ^{1}H NMR and ^{13}CNMR spectra were recorded on Varian 300 or Brucker ARX 400 spectrometer in $CDCl_3$ solution and the chemical shifts were reported in parts per million (d) relative to internal standard TMS (0 ppm). *N*-Tosylhydrazones was prepared by literature procedure.[1] Unless otherwise noted, materials obtained from commercial suppliers were used without further purification.

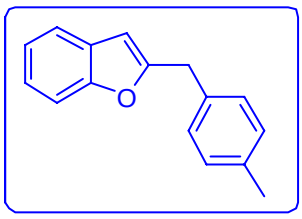
Spectral data for the products

2-Benzylbenzofuran (3a)[2]



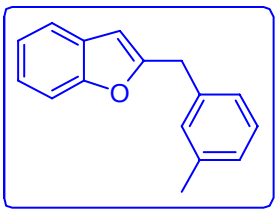
^{1}H NMR (400 MHz, $CDCl_3$) δ 4.09 (s, 2H), 6.35 (s, 1H), 7.16-7.31 (m, 7H), 7.38-7.46 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 35.2, 103.5, 111.1, 120.6, 122.7, 123.6, 126.9, 128.8, 129.0, 129.1, 137.4, 155.1, 157.9;

2-(4-Methylbenzyl)benzofuran (3b)



IR (film) 2917, 1454, 954, 749 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.33 (s, 3H), 4.06 (s, 2H), 6.35 (s, 1H), 7.12-7.21 (m, 6H), 7.38-7.46 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 21.2, 34.7, 103.4, 111.0, 120.5, 122.6, 123.5, 128.9, 129.0, 129.4, 134.3, 136.5, 155.1, 158.3; EI-MS (*m*/*z*, relative intensity): 222 (M^+, 100), 207 (68), 178 (26), 131 (27). HRMS (ESI) calcd for $C_{16}H_{15}O$ [$(M+H)^+$] 223.1117. Found: 223.1110.

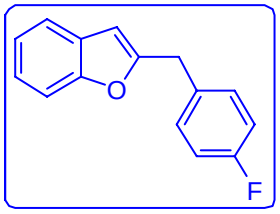
2-(3-Methylbenzyl)benzofuran (3c)



IR (film) 1454, 1252,955, 907, 731 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 2.33 (s, 3H), 4.06 (s, 2H), 6.37 (s, 1H), 7.05-7.10 (m, 3H), 7.16-7.22 (m, 3H), 7.39-7.47 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 21.5, 35.1, 103.5, 111.1, 120.5, 122.6, 123.5, 126.1, 127.7, 128.6, 129.0, 129.8, 137.3, 138.4, 155.1, 158.1; EI-MS (*m*/*z*, relative intensity): 222 (M^+, 100), 207 (60),

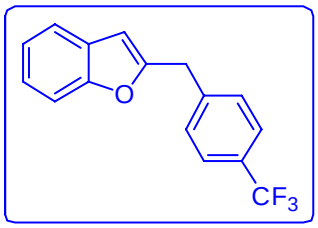
178 (28), 131 (34). HRMS (ESI) calcd for $C_{16}H_{15}O$ [$(M+H)^+$] 223.1117. Found: 223.1109.

2-(4-Fluorobenzyl)benzofuran (3d)



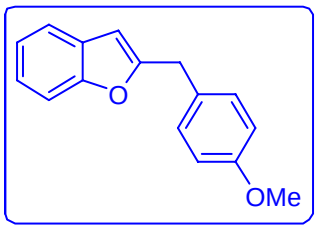
IR (film) 1603, 1509, 1455, 1224, 814, 750 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 4.07 (s, 2H), 6.36 (s, 1H), 6.98-7.03 (m, 2H), 7.15-7.27 (m, 4H), 7.39-7.48 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 34.4, 103.6, 111.1, 115.6 (d, J = 21.3 Hz), 120.6, 122.7, 123.7, 128.9, 130.5 (d, J = 7.9 Hz), 133.04 (d, J = 3.2 Hz), 155,1, 157.6, 161.9 (d, J = 243.3 Hz); EI-MS (*m*/*z*, relative intensity): 226 (M^+, 93), 225 (100), 207 (9), 196 (14), 131 (26). HRMS (ESI) calcd for $C_{15}H_{12}FO$ [$(M+H)^+$] 227.0866. Found: 227.0862.

2-(4-(Trifluoromethyl)benzyl)benzofuran (3e)



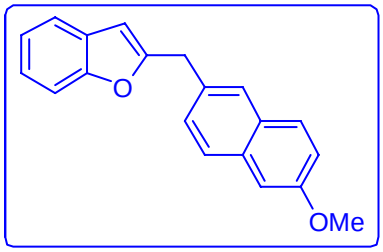
IR (film) 1323, 1164, 1122, 1067, 750 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 4.14 (s, 2H), 6.40 (s, 1H), 7.16-7.24 (m, 2H), 7.38-7.40 (m, 3H), 7.47-7.49 (m, 1H), 7.56-7,58 (m, 2H); ^{13} C NMR (100 MHz, $CDCl_3$) δ 34.9,104.0, 111.1, 120.7, 122.9, 123.0, 123.9, 125.7 (q, J = 3.7 Hz), 128.7, 129.3 (d, J = 32.2 Hz), 129.4, 141.5, 155.2, 156.5; EI-MS (*m*/*z*, relative intensity): 276 (M^+, 100), 257 (7), 207 (15), 178 (13), 131 (41). HRMS (ESI) calcd for $C_{16}H_{12}F_3O$ [$(M+H)^+$] 277.0834. Found: 277.0833.

2-(4-Methoxybenzyl)benzofuran (3f)[3]



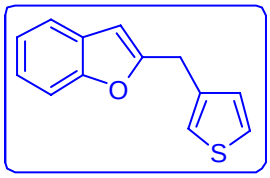
^1H NMR (400 MHz, $CDCl_3$) δ 3.79 (s, 3H), 4.04 (s, 2H), 6.34 (s, 1H), 6.86 (m, 2H), 7.16-7.24 (m, 4H), 7.38-7.46 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 34.3, 55.4, 103.3, 111.0, 114.2, 120.5, 122.6, 123.5, 129.0, 129.4, 130.1, 155.1, 158.4, 158.6; EI-MS (*m*/*z*, relative intensity): 220 (M^+, 100), 205 (81), 177 (40), 161 (72), 128 (69).

2-((6-Methoxynaphthalen-2-yl)methyl)benzofuran (3g)



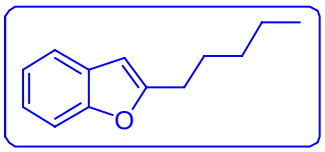
IR (film) 2923, 2852, 2089, 1607, 1263, 1030 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.89 (s, 3H), 4.22 (s, 2H), 6.38 (s, 1H), 7.11-7.23 (m, 4H), 7.37-7.47 (m, 3H), 7.66-7.70 (m, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 35.1, 55.4, 103.6, 105.8, 111.1, 119.1, 120.6, 122.7, 123.6, 127.3, 127.4, 127.9, 129.0, 129.2, 129.3, 132.5, 133.6, 155.1, 157.7, 158.1; EI-MS (*m*/*z*, relative intensity): 288 (M^+, 100), 273 (10), 257 (11), 215 (8); HRMS (ESI) calcd for $C_{20}H_{17}O_2$ $[(M+H)^+]$ 289.1223. Found: 289.1217.

2-(Thiophen-3-ylmethyl)benzofuran (3h)[4]



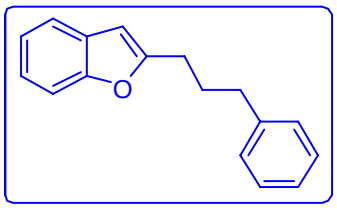
IR (film) 2916, 1454, 1254, 908, 730 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.10 (s, 2H), 6.37 (s, 1H), 7.01-7.27 (m, 5H), 7.40-7.47 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 29.8, 103.2, 111.0, 120.6, 122.2, 122.7, 123.6, 125.9, 128.5, 128.9, 137.3, 155.0, 157.4; EI-MS (*m*/*z*, relative intensity): 214 (M^+, 97), 213 (100), 184 (11), 131 (10).

2-Pentylbenzofuran (3i)[5]



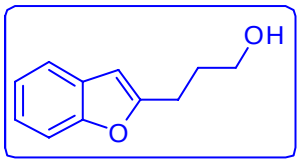
^{1}H NMR (400 MHz, $CDCl_3$) δ 0.91 (t, *J* = 6.4 Hz, 3H), 1.36-1.39 (m, 4H), 1.73-1.76 (m, 2H), 2.76 (t, *J* = 7.6 Hz, 2H), 6.37 (s, 1H), 7.14-7.21 (m, 2H), 7.39-7.48 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 14.2, 22.6, 27.5, 28.6, 31.5, 101.9, 110.8, 120.3, 122.5, 123.1, 129.2, 154.8, 159.9.

2-(3-Phenylpropyl)benzofuran (3j)[6]



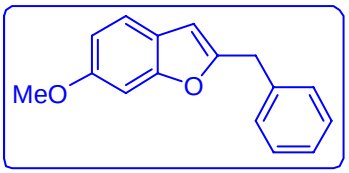
^{1}H NMR (400 MHz, $CDCl_3$) δ 2.04-2.12 (m, 2H), 2.71 (t, *J* = 8.0 Hz, 2H), 2.78 (t, *J* = 7.6 Hz, 2H), 6.38 (s, 1H), 7.17-7.22 (m, 5H), 7.27-7.31 (m, 2H), 7.39-7.48 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 28.0, 29.4, 35.4, 102.3, 110.9, 120.4, 122.6, 123.3, 126.1, 128.5, 128.7, 141.9, 154.8, 159.3.

3-(Benzofuran-2-yl)propan-1-ol (3k)[7]



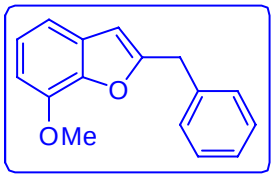
^{1}H NMR (400 MHz, $CDCl_3$) δ 1.50 (s, 1H), 2.00-2.05 (m, 2H), 2.89 (t, *J* = 7.6 Hz, 2H), 3.74, (t, *J* = 6.0 Hz, 2H), 6.41 (s, 1H), 7.18-7.26 (m, 2H), 7.40-7.49 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 24.9, 30.8, 62.1, 102.4, 110.9, 120.4, 122.6, 123.4, 129.0, 154.8, 158.8.

2-Benzyl-6-methoxybenzofuran (3l)



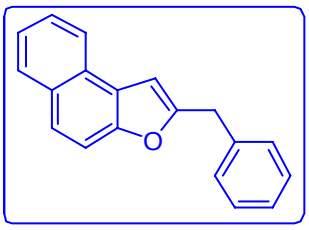
IR (film) 2918, 1629, 1492, 1149, 1106, 704 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 3.81 (s, 3H), 4.07 (s, 2H), 6.29 (s, 1H), 6.81 (d, *J* = 8.4 Hz, 1H), 6.96 (s, 1H), 7.24-7.33 (m, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 35.1, 55.9, 96.1, 103.2, 111.4, 120.6, 122.2, 126.8, 128.7, 129.0, 137.6, 156.0, 156.9, 157.5; EI-MS (*m*/*z*, relative intensity): 238 (M^+, 100), 223 (12), 207 (7), 195 (8), 161 (36). HRMS (ESI) calcd for $C_{16}H_{15}O_2$ [$(M+H)^+$] 239.1066. Found: 239.1062.

2-Benzyl-7-methoxybenzofuran (3m)[8]



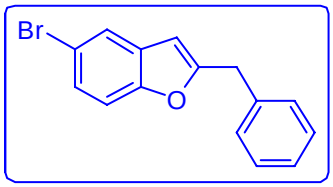
^{1}H NMR (400 MHz, $CDCl_3$) δ 3.97 (s, 3H), 4.12 (s, 2H), 6.30 (s, 1H), 6.73 (d, *J* = 7.6 Hz, 1H), 7.04-7.09 (m, 2H), 7.23-7.31 (m, 5H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 35.1, 56.1, 103.9, 105.9, 113.0, 123.3, 126.9, 128.7, 129.1, 130.6, 137.3, 144.1, 145.1, 158.3.

2-Benzylnaphtho[2,1-b]furan (3n)



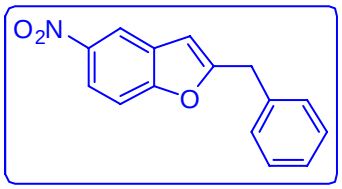
IR (film) 2919, 1575, 1384, 800, 773, 731 cm^{-1}; ^{1}H NMR (400 MHz, $CDCl_3$) δ 4.20 (s, 2H), 6.86 (s, 1H), 7.24-7.29 (m, 1H), 7.34-7.35 (m, 4H), 7.42-7.46 (m, 1H), 7.50-7.54 (m, 1H), 7.57-7.59 (m, 1H), 7.63-7.66 (m, 1H), 7.90 (m, 1H), 8.04 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 35.3, 102.7, 112.4, 123.6, 124.0, 124.4, 124.4, 126.1, 126.9, 128.8, 129.1, 130.4, 137.6, 152.4, 157.2; EI-MS (*m*/*z*, relative intensity): 258 (M^+, 100), 228 (10), 181 (46), 152 (20). HRMS (ESI) calcd. for $C_{19}H_{15}O$ [$(M+H)^+$] 259.1117. Found: 259.1120.

2-Benzyl-5-bromobenzofuran (3o)



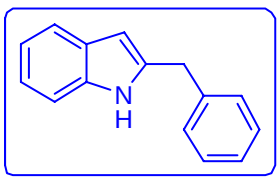
IR (film) 1596, 1444, 1259, 953, 794, 705 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 4.07 (s, 2H), 6.28 (s, 1H), 7.23-7.34 (m, 7H), 7.56 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 35.1, 103.0, 112.5, 115.7, 123.2, 126.4, 127.1, 128.8, 129.0, 130.9, 136.9, 153.8, 159.4; EI-MS (*m*/*z*, relative intensity): 288 [(M^+(Br^{81}), 98], 286 [(M^+(Br^{79}), 98], 209 (33), 178 (54),152 (20). HRMS (ESI) calcd for $C_{15}H_{10}Br^{81}O$ [$(M+H)^+$] 284.9909. Found: 284.9905.

2-Benzyl-5-nitrobenzofuran (3p)



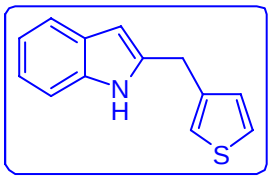
IR (film) 2917, 1523, 1263, 753, 707 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 4.14 (s, 2H), 6.50 (s, 1H), 7.30-7.37 (m, 5H), 7.45 (d, *J* = 9.2 Hz, 1H), 8.12-8.15 (m, 1H), 8.37-8.38 (m, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 35.1, 104.2, 111.3, 117.0, 119.6, 127.3, 128.9, 129.1, 129.3, 136.3, 144.2, 157.9, 161.7; EI-MS (*m*/*z*, relative intensity): 253 (M^+, 100), 206 (21), 178 (36),152 (12). HRMS (ESI) calcd for $C_{15}H_{12}NO_3$ [$(M+H)^+$] 254.0811. Found: 254.0808.

2-Benzyl-1*H*-indole (3q)[9]



^1H NMR (400 MHz, $CDCl_3$) δ 4.12 (s, 2H), 6.32 (s, 1H), 7.04-7.12 (m, 2H), 7.22-7.26 (m, 4H), 7.30-7.34 (m, 2H), 7.53-7.55 (m, 1H), 7.76 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 34.9, 101.3, 110.6, 119.9, 120.1, 121.5, 126.9, 128.8, 129.0, 136.4, 137.9, 138.7.

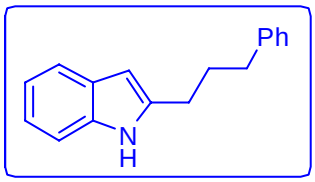
2-(Thiophen-3-ylmethyl)-1*H*-indole (3r)



IR (film) 3403, 2922, 1456, 1296, 907, 730 cm^{-1}; ^1H NMR (400 MHz, $CDCl_3$) δ 4.12 (s, 2H), 6.32 (s, 1H), 6.85 (d, *J* = 4.8 Hz, 1H), 7.04-7.13 (m, 3H), 7.23-7.29 (m, 2H), 7.536 (m, 1H), 7.77 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 29.5, 100.9, 110.6, 119.9, 120.2, 121.5, 122.0, 126.3, 128.5, 128.8, 136.3, 137.5, 139.0; EI-MS (*m*/*z*, relative intensity): 213 (M^+, 100), 212 (85), 180 (9), 167 (11), 130 (30); HRMS (ESI) calcd for $C_{13}H_{12}NS$ [$(M+H)^+$] 214.0685.

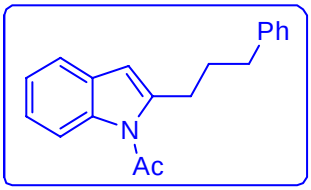
Found: 214.0678.

2-(3-Phenylpropyl)-1H-indole (3s)[10]



^{1}H NMR (400 MHz, $CDCl_3$) δ 2.03-2.10 (m, 2H), 2.70-2.80 (m, 4H), 6.26 (s, 1H), 7.05-7.13 (m, 2H), 7.18-7.32 (m, 6H), 7.52-7.54 (m, 1H), 7.81 (s, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 27.8, 30.8, 35.4, 99.9, 110.4, 119.8, 119.9, 121.2, 126.1, 128.7, 129.0, 136.0, 139.5, 141.9.

1-(2-(3-Phenylpropyl)-1H-indol-1-yl)ethanone (3t)[11]



^{1}H NMR (400 MHz, $CDCl_3$) δ 2.01-2.09 (m, 2H), 2.73-2.77 (m, 5H), 3.05 (t, *J* = 7.2 Hz, 2H), 6.42 (s, 1H), 7.19-7.31 (m, 7H), 7.47 (d, *J* = 7.6 Hz, 1H), 7.80 (d, *J* = 7.6 Hz, 1H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 27.8, 30.2, 30.6, 35.7, 108.5, 114.8, 120.4, 123.1, 123.6, 126.0, 128.53, 128.59, 128.62, 128.68, 142.1, 142.6, 170.4.

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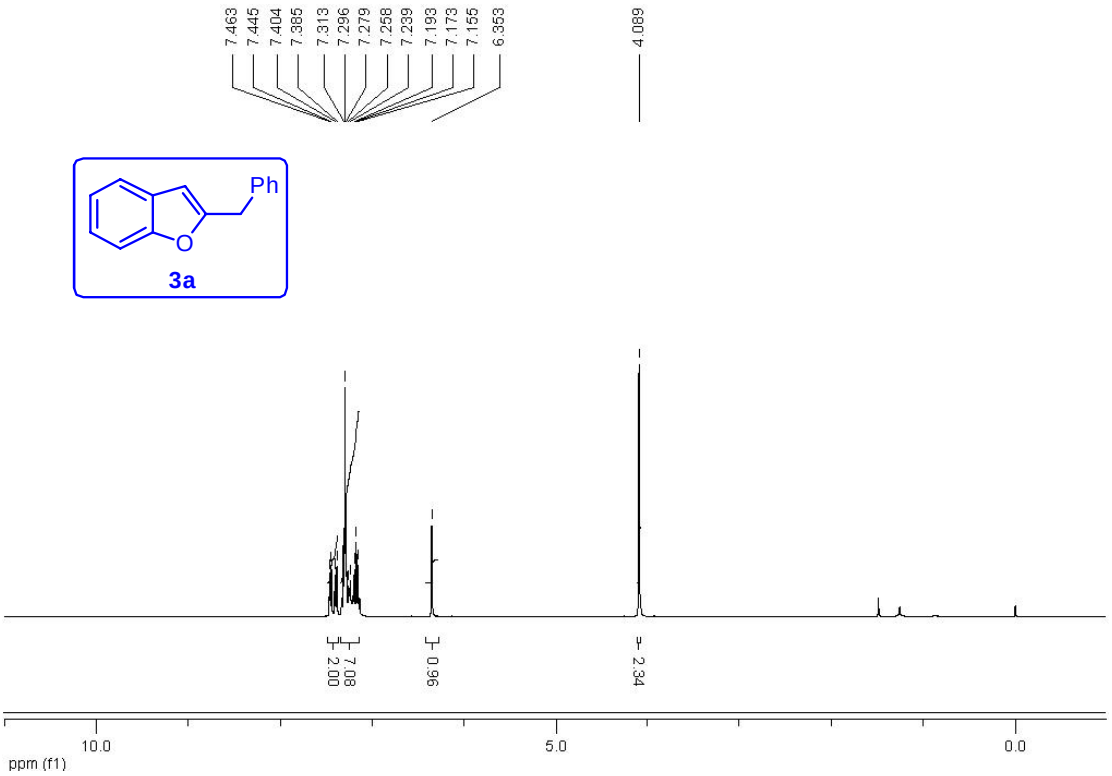
(11) Mohri, K.; Oikawa, Y.; Hirao, K.; Yonemitsu, O. *Heterocycles* **1982**, *19*, 515.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7.258
7.239
7.193
7.173
7.155
6.353
4.089
Ph
O
3a
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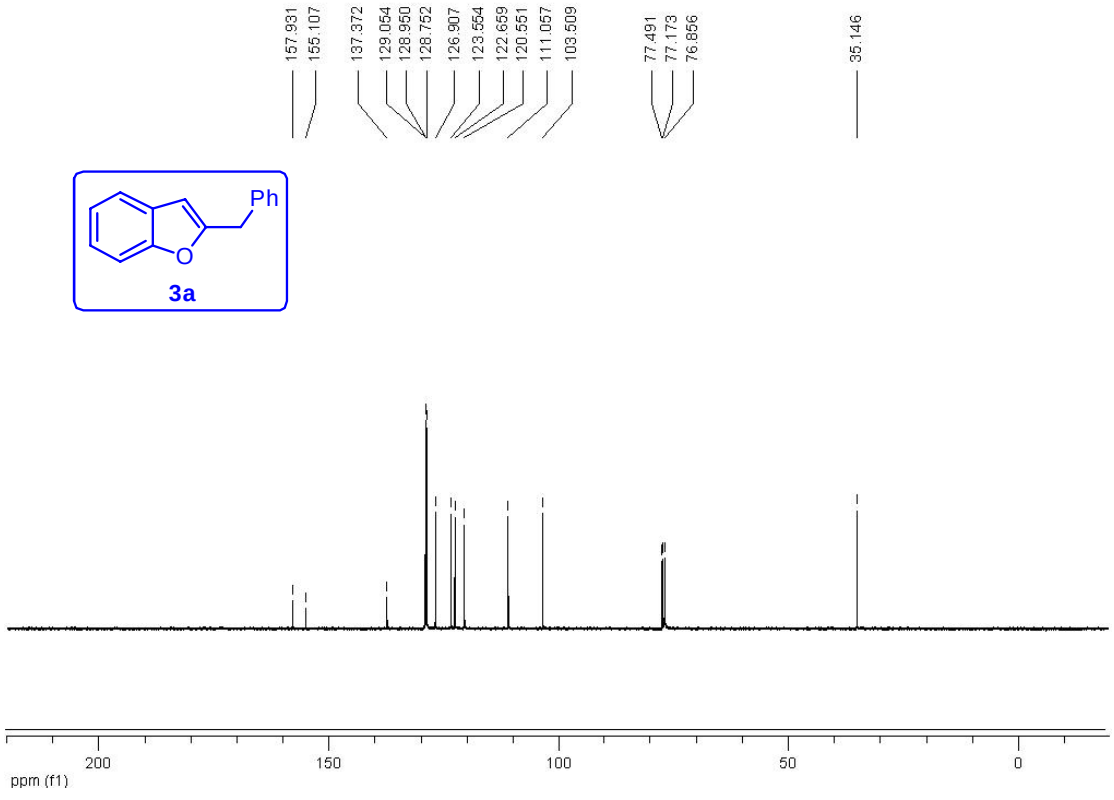
7.08
0.96
2.34
10.0
5.0
0.0
ppm (f1)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123.554
122.659
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77.173
76.856
35.146
Ph
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200
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50
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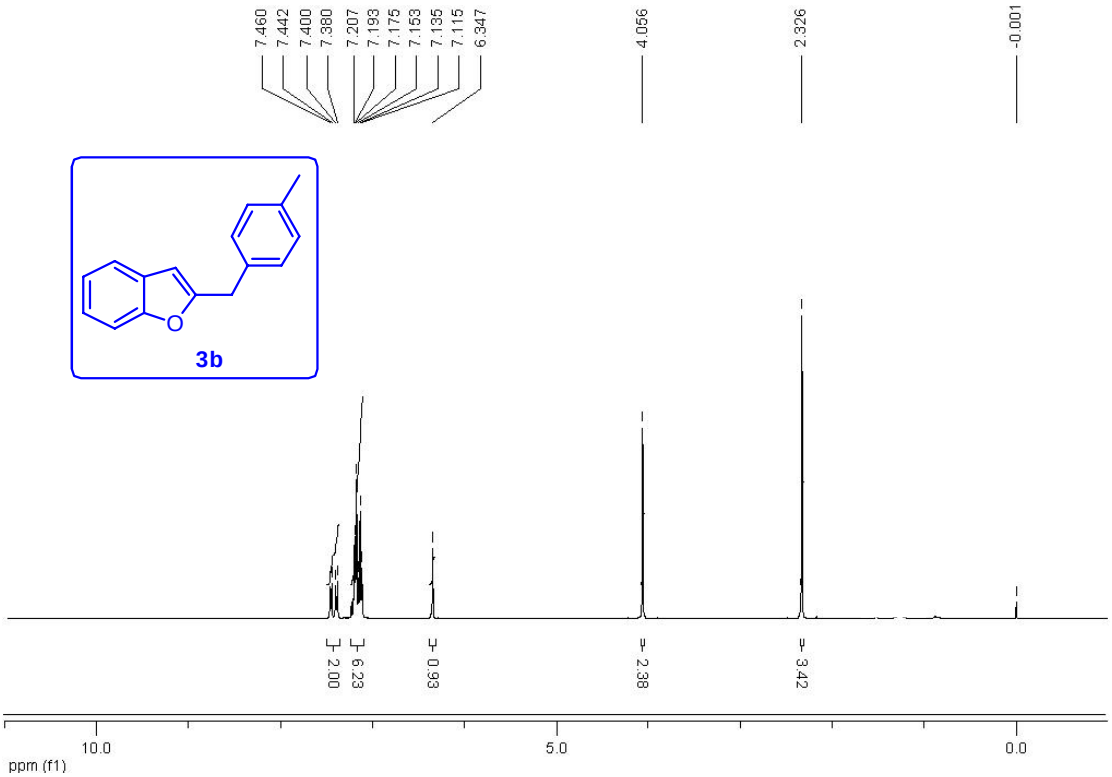
ppm (f1)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7.175
7.153
7.135
7.115
6.347
4.056
2.326
-0.001
3b
2.00
2.23
0.93
2.38
3.42
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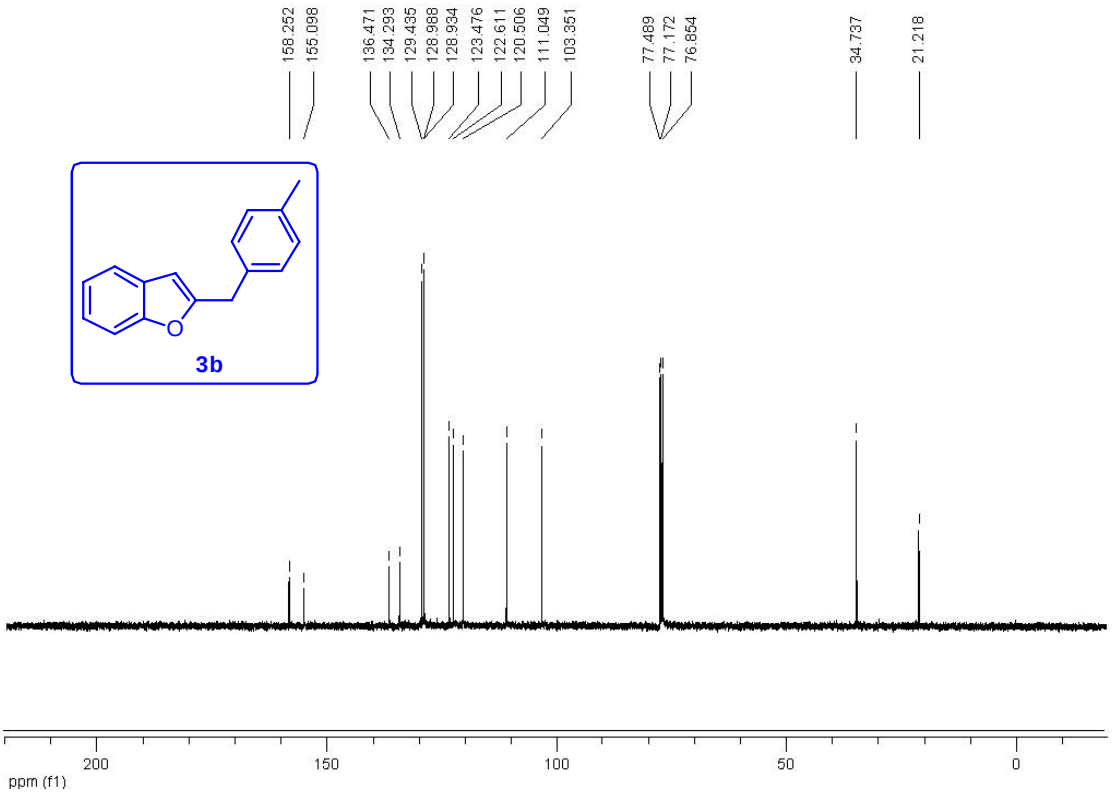
0.0
ppm (f1)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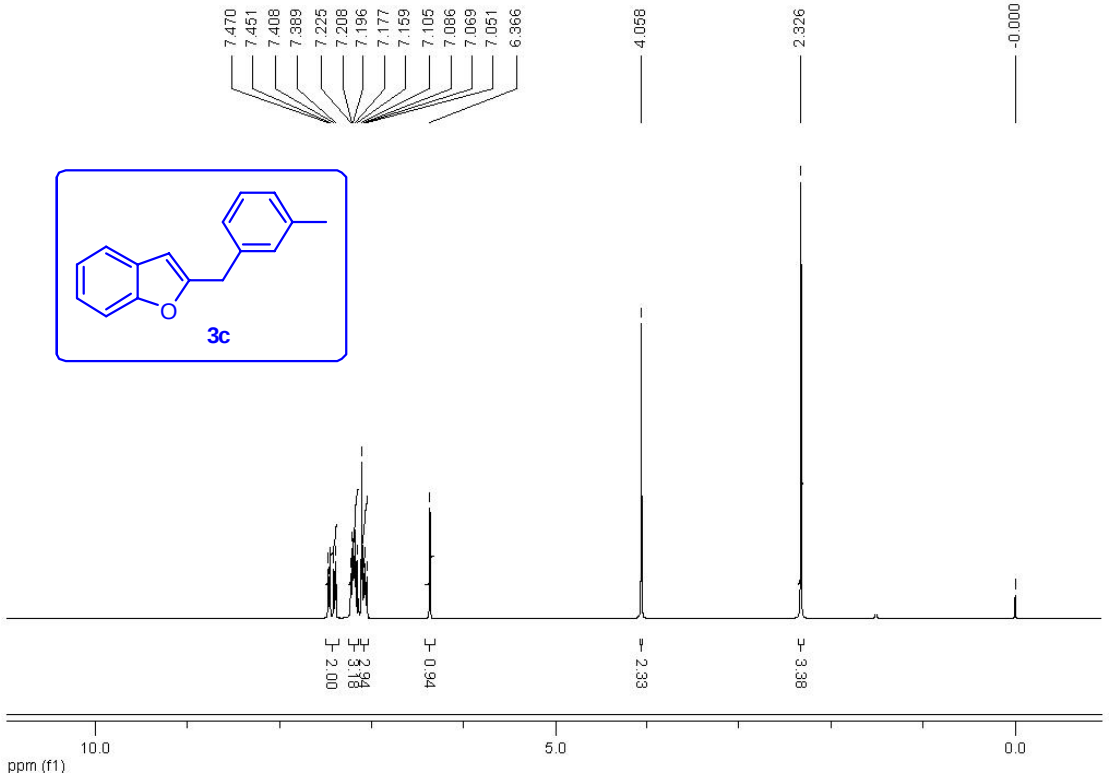
ppm (f1)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7.225
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7.177
7.159
7.105
7.086
7.069
7.051
6.366
4.058
2.326
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2.33
3.38
10.0
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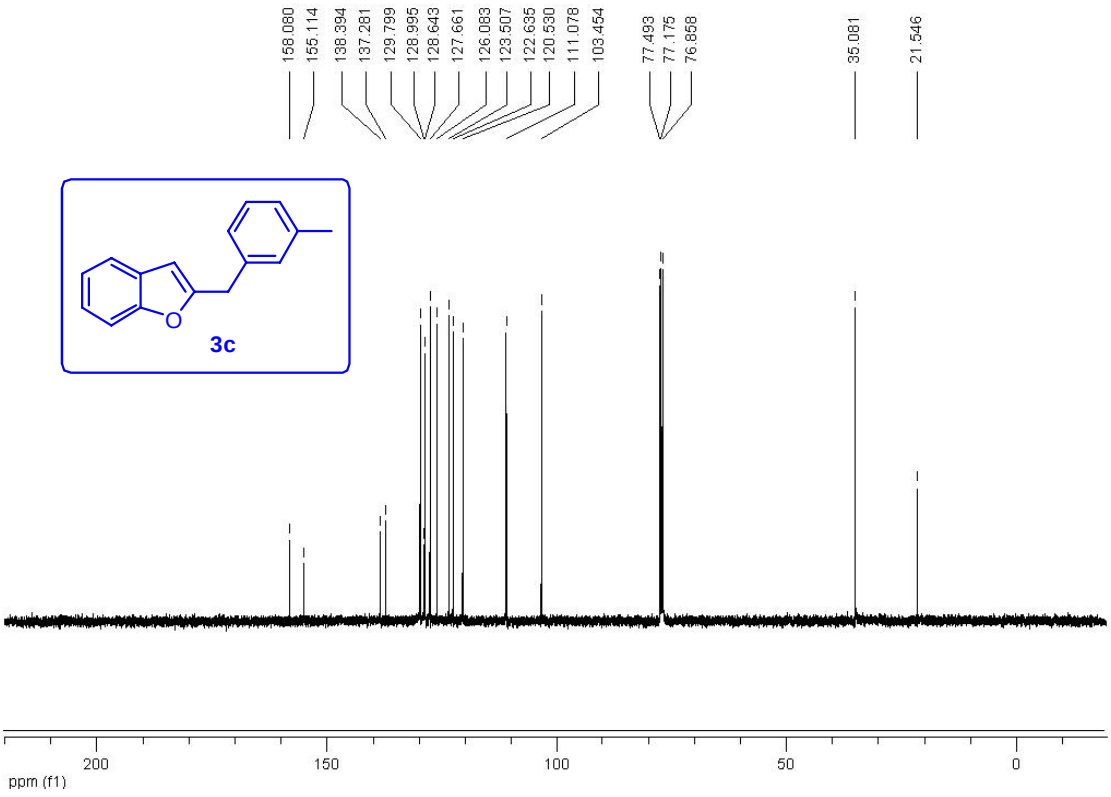
0.0
ppm (f1)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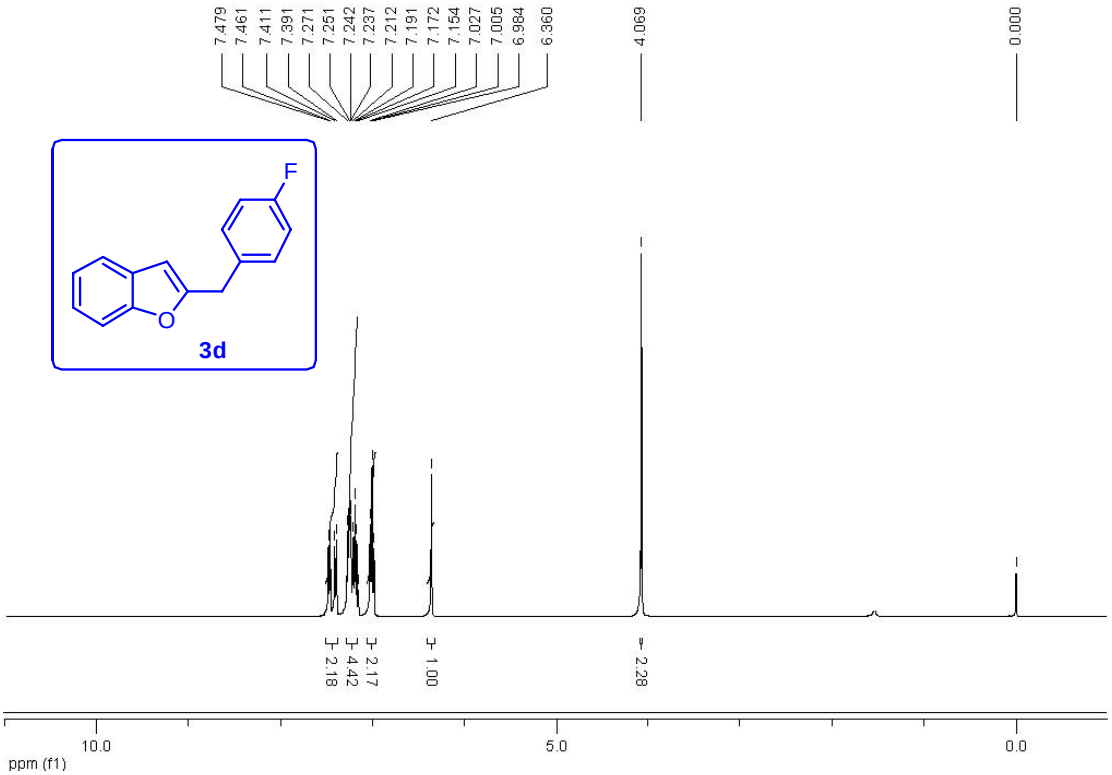
ppm (f1)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7.237
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7.005
6.984
6.360
4.069
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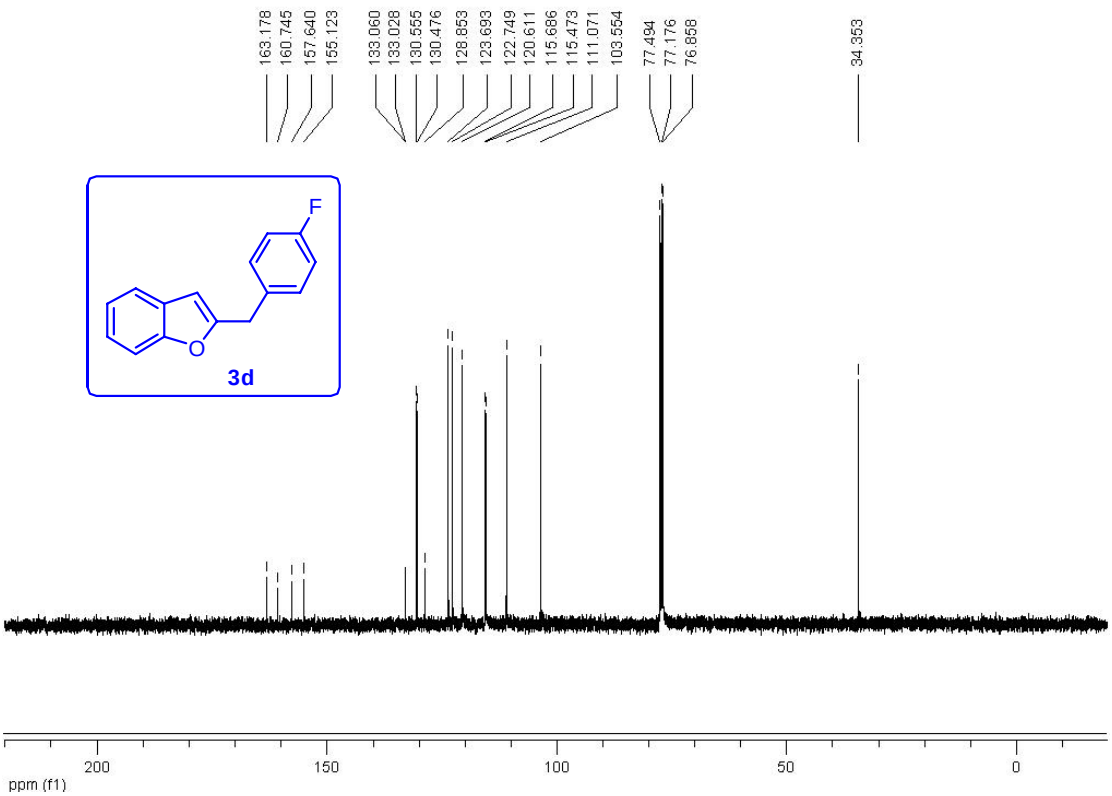
ppm (f1)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115.686
115.473
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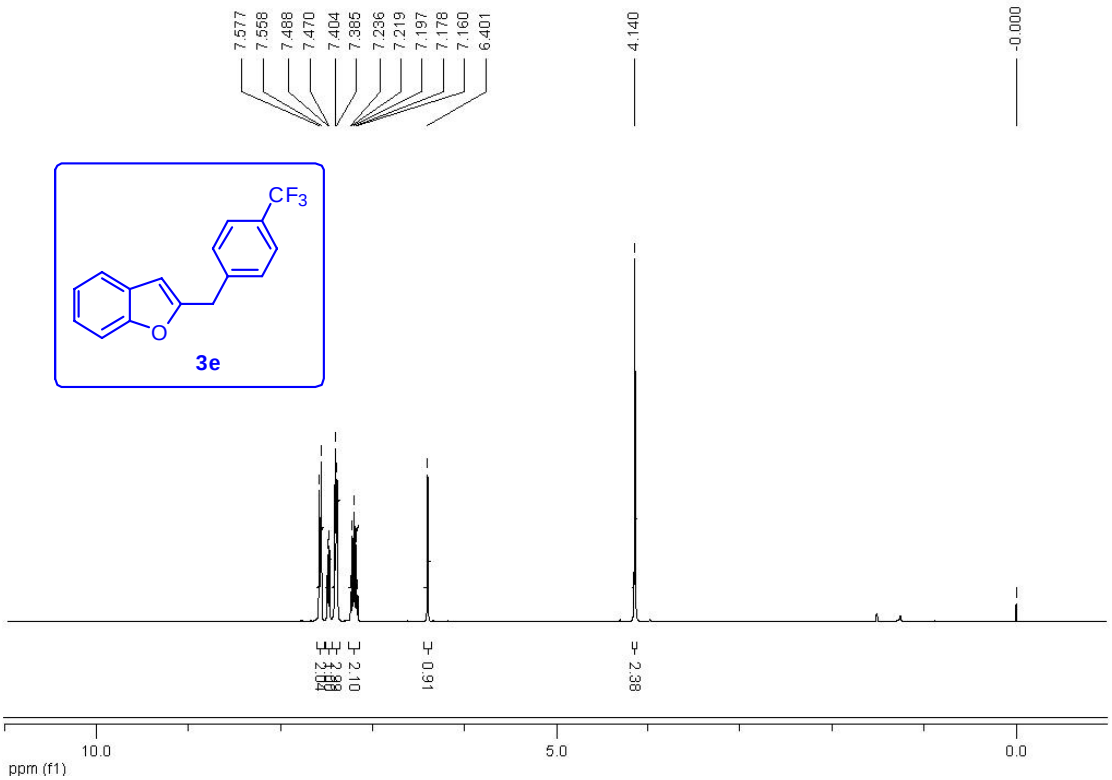
77.176
76.858
34.353
F
O
3d
200
150
100
50
0
ppm (f1)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7.404
7.385
7.236
7.219
7.197
7.178
7.160
6.401
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CF3
O
3e
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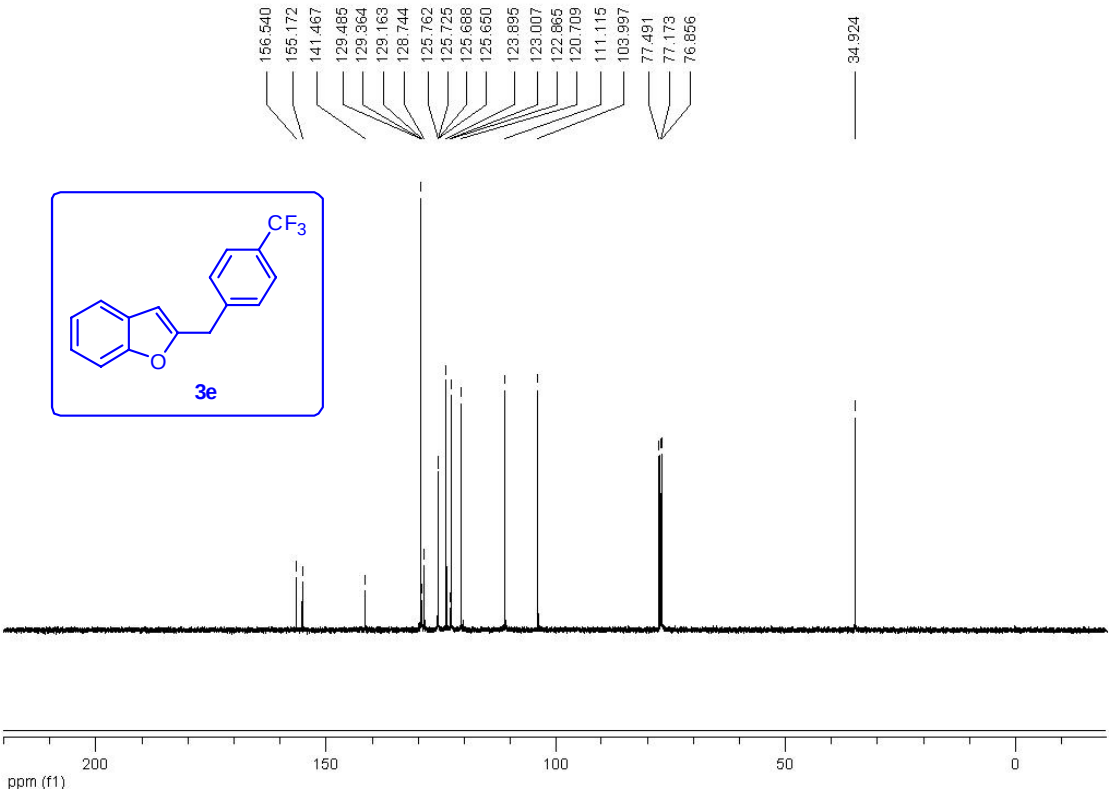
10.0
5.0
0.0
ppm (f1)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125.650
123.895
123.007
122.865
120.709
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77.173
76.856
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CF3
O
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200
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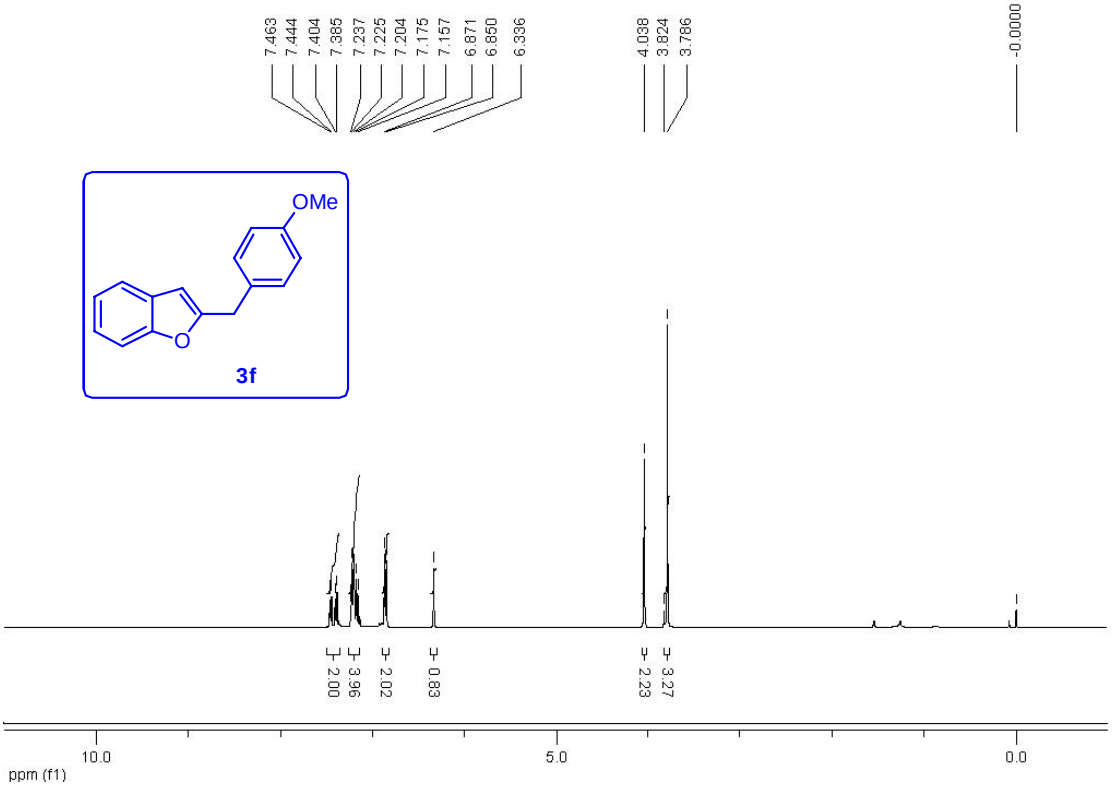
100
50
0
ppm (f1)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6.336
4.038
3.824
3.786
-0.0000
OMe
O
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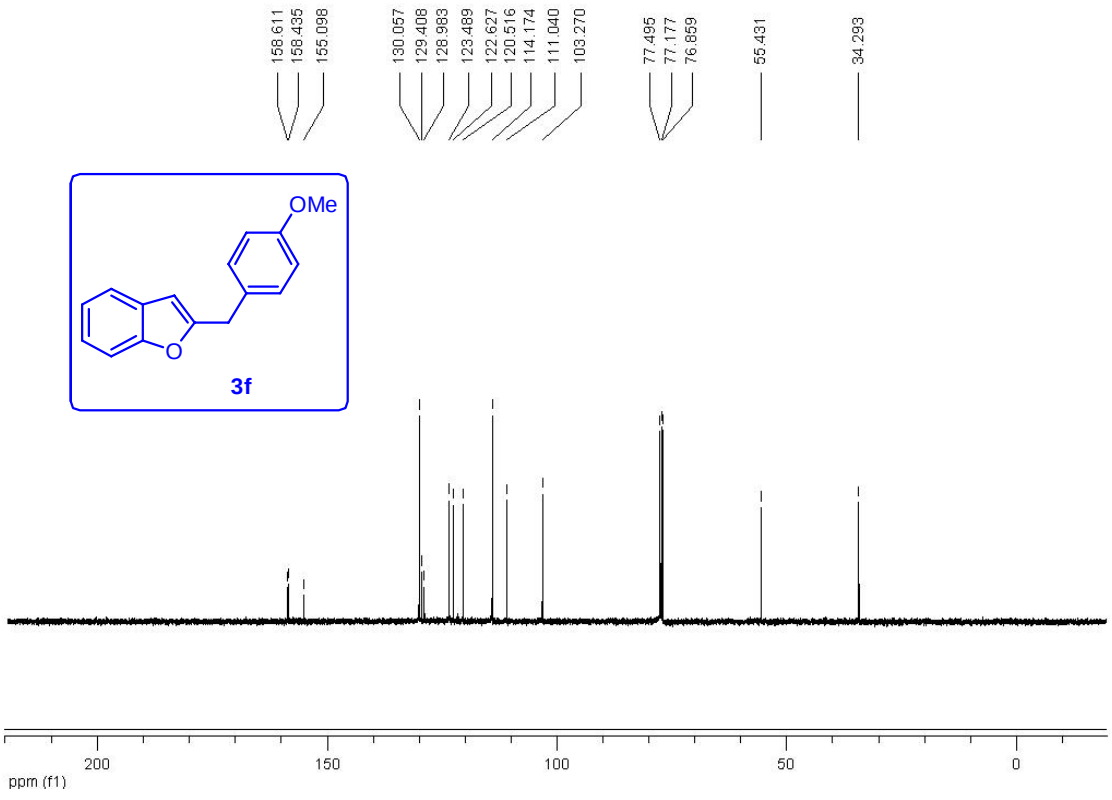
2.02
0.83
2.23
3.27
10.0
5.0
0.0
ppm (f1)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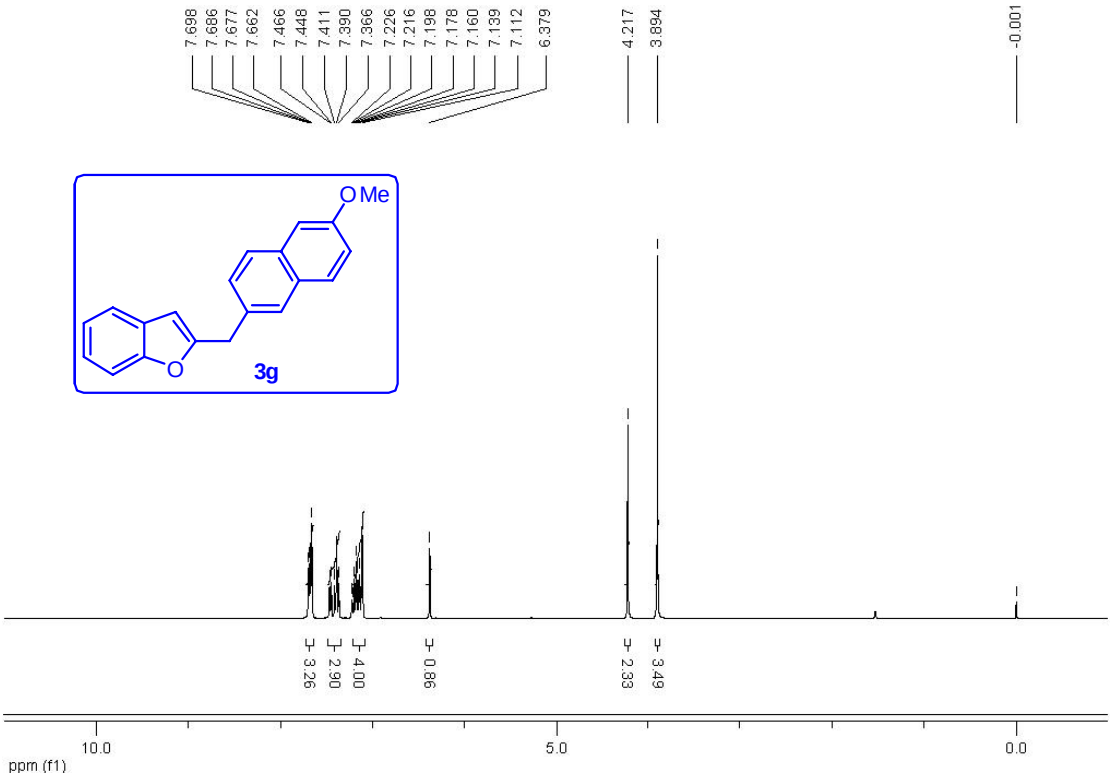
76.859
55.431
34.293
OMe
O
3f
200
150
100
50
0
ppm (f1)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7.216
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7.178
7.160
7.139
7.112
6.379
4.217
3.894
-0.001
OMe
O
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2.00
4.00
0.86
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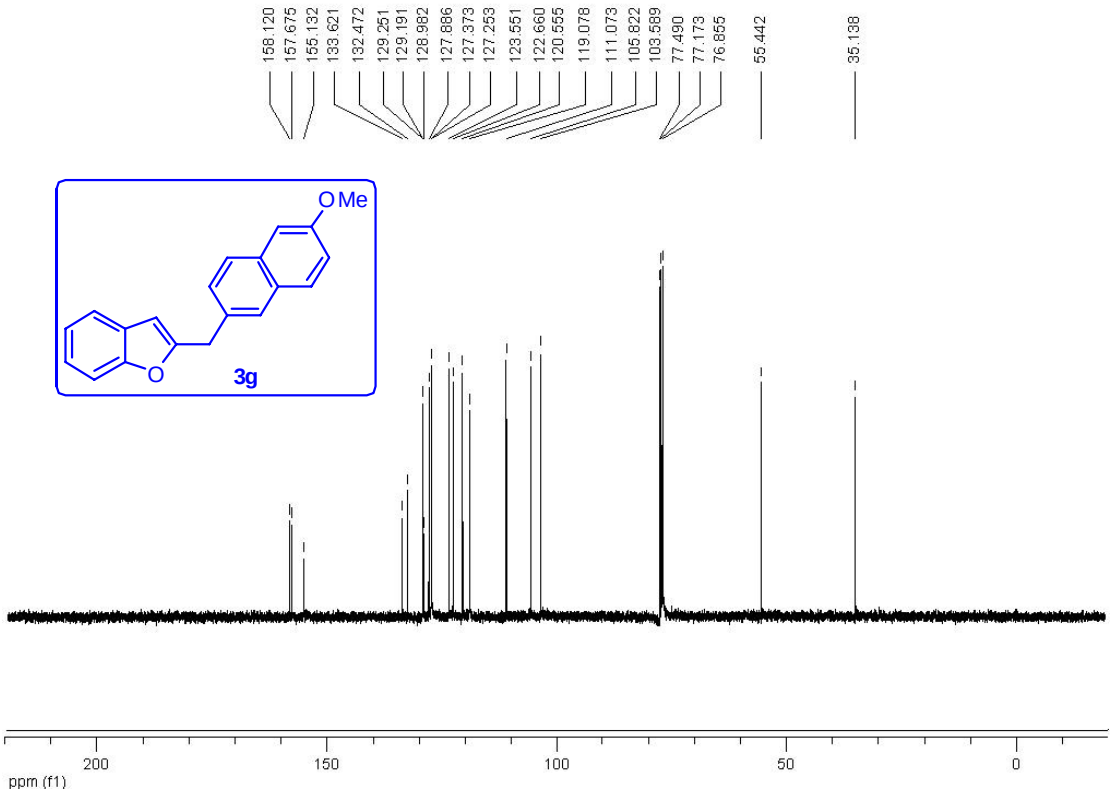
10.0
5.0
0.0
ppm (f1)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120.555
119.078
111.073
105.822
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76.855
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OMe
O
3g
200
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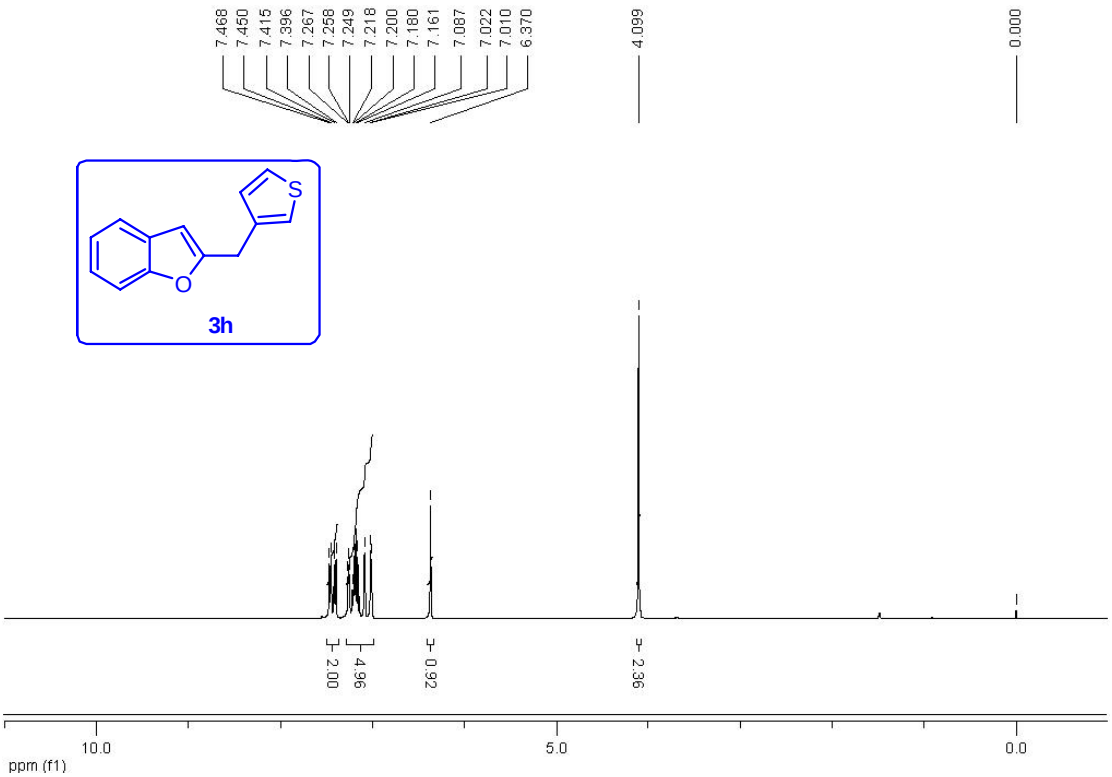
100
50
0
ppm (f1)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7.218
7.200
7.180
7.161
7.087
7.022
7.010
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3h
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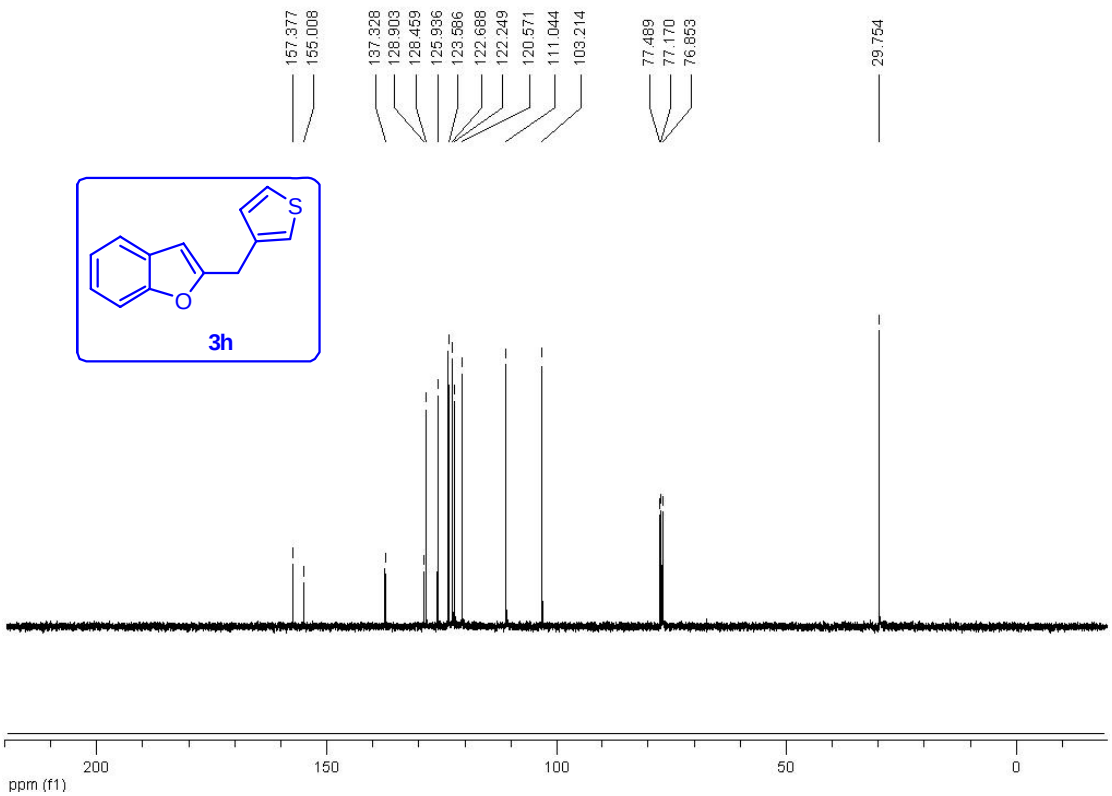
ppm (f1)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3h
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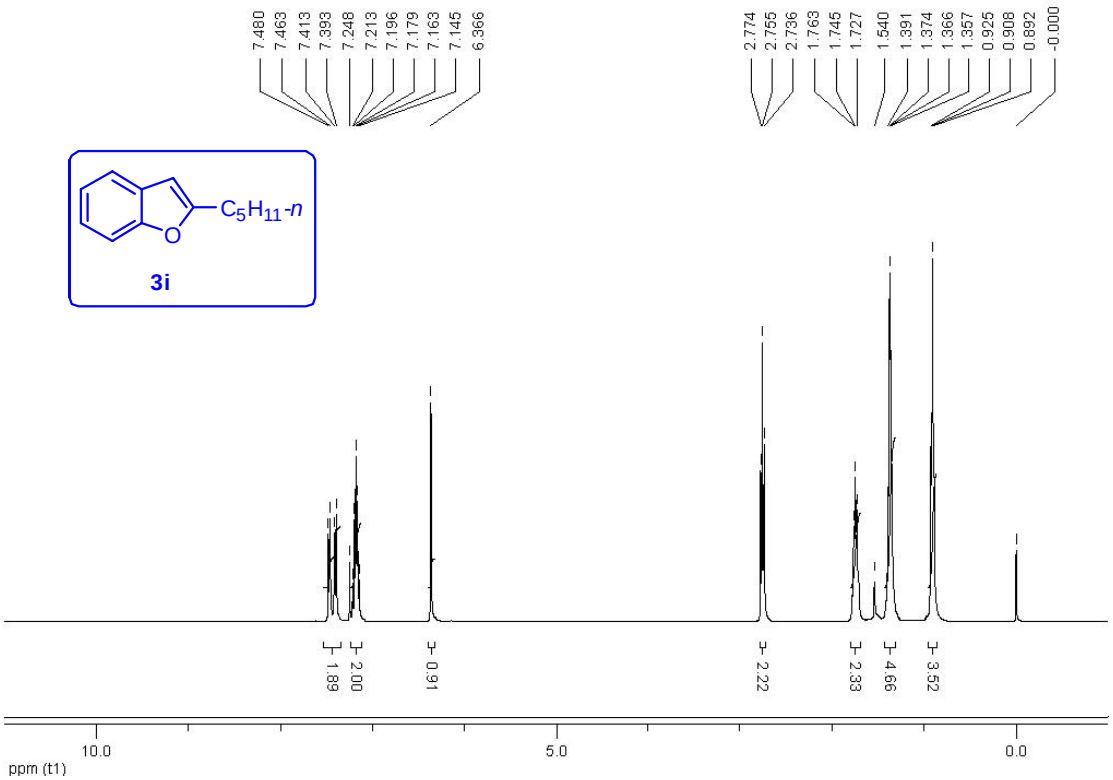
100
50
0
ppm (f1)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7.248
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7.196
7.179
7.163
7.145
6.366
2.774
2.755
2.736
1.763
1.745
1.727
1.540
1.391
1.374
1.366
1.357
0.925
0.908
0.892
-0.000
C5H11-n
3i
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2.00
0.91
2.22
2.33
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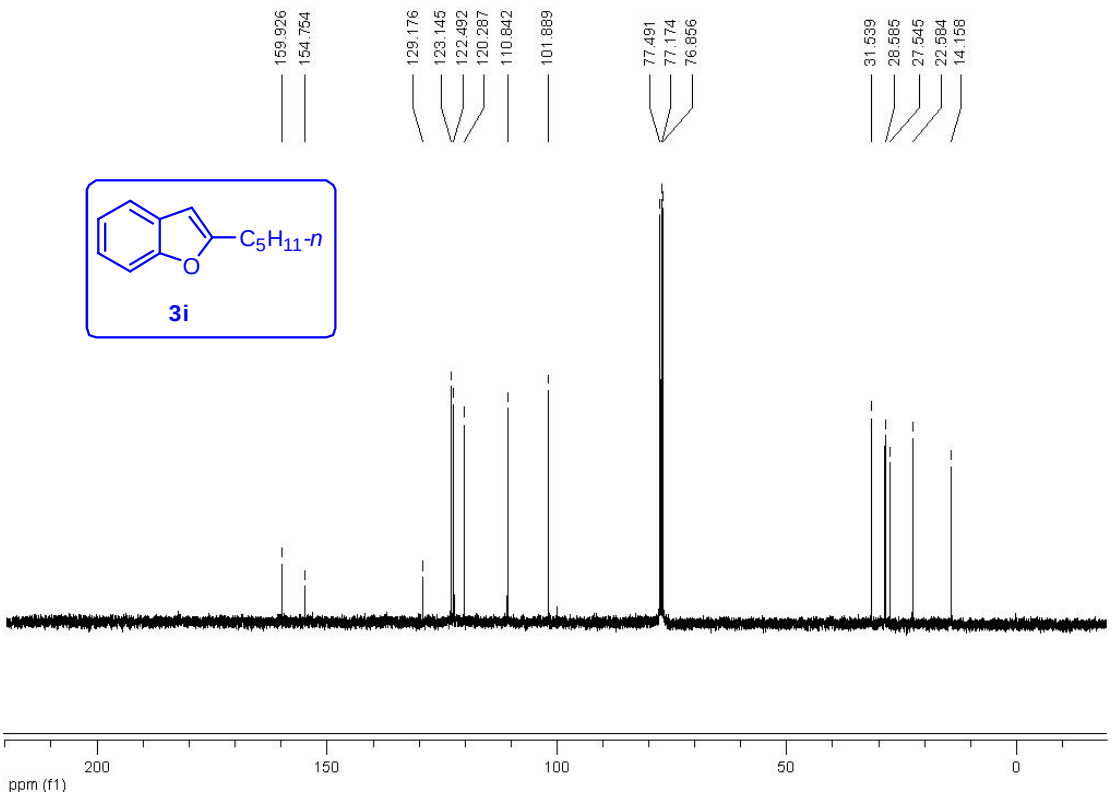
ppm (t1)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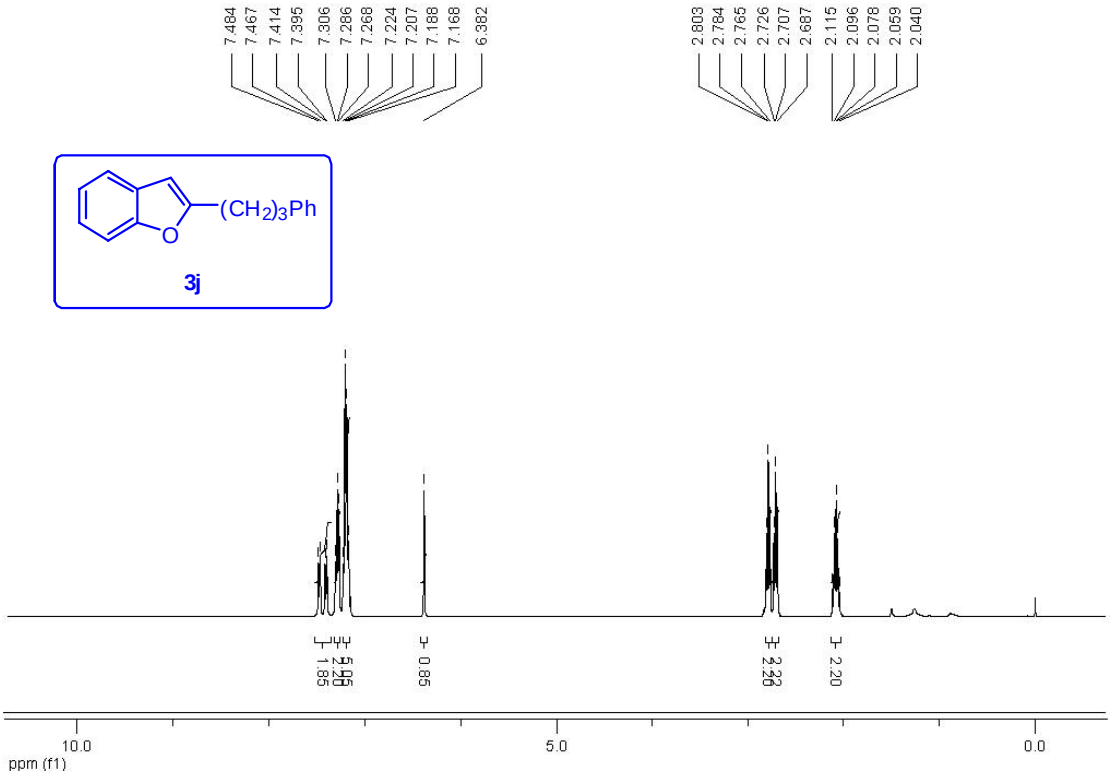
150
100
50
0
ppm (f1)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7.188
7.168
6.382
2.803
2.784
2.765
2.726
2.707
2.687
2.115
2.096
2.078
2.059
2.040
(CH2)3Ph
O
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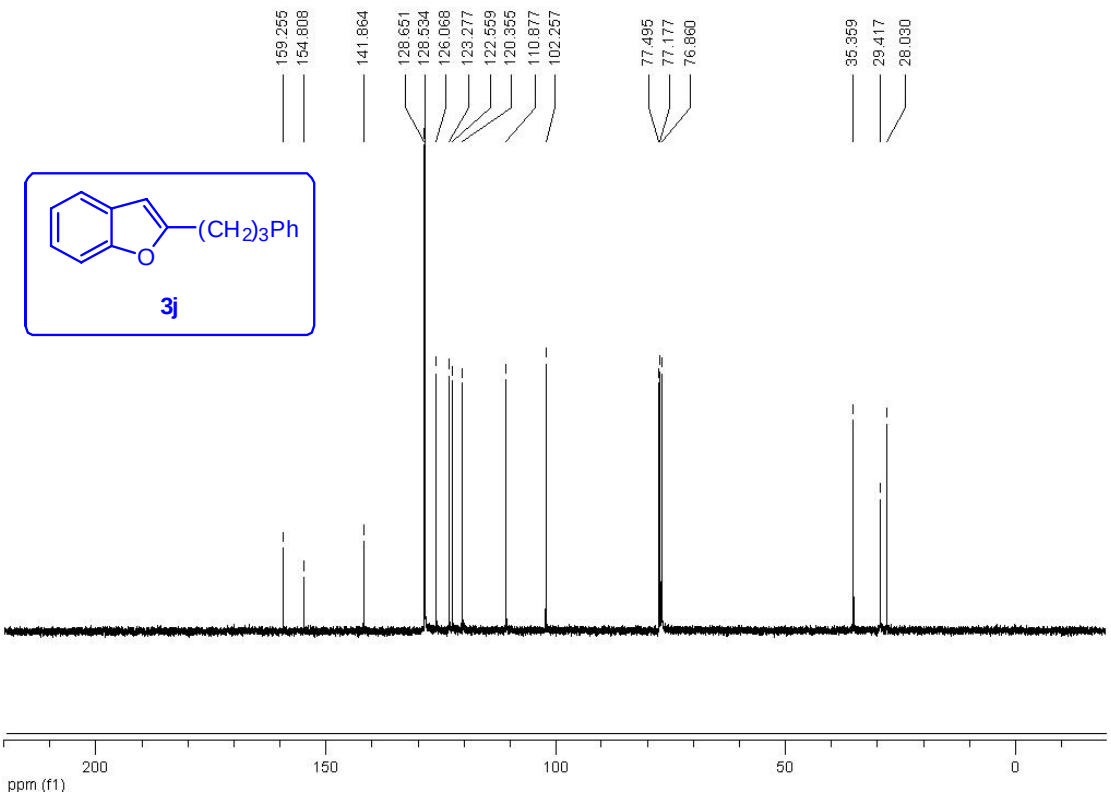
ppm (f1)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77.495
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76.860
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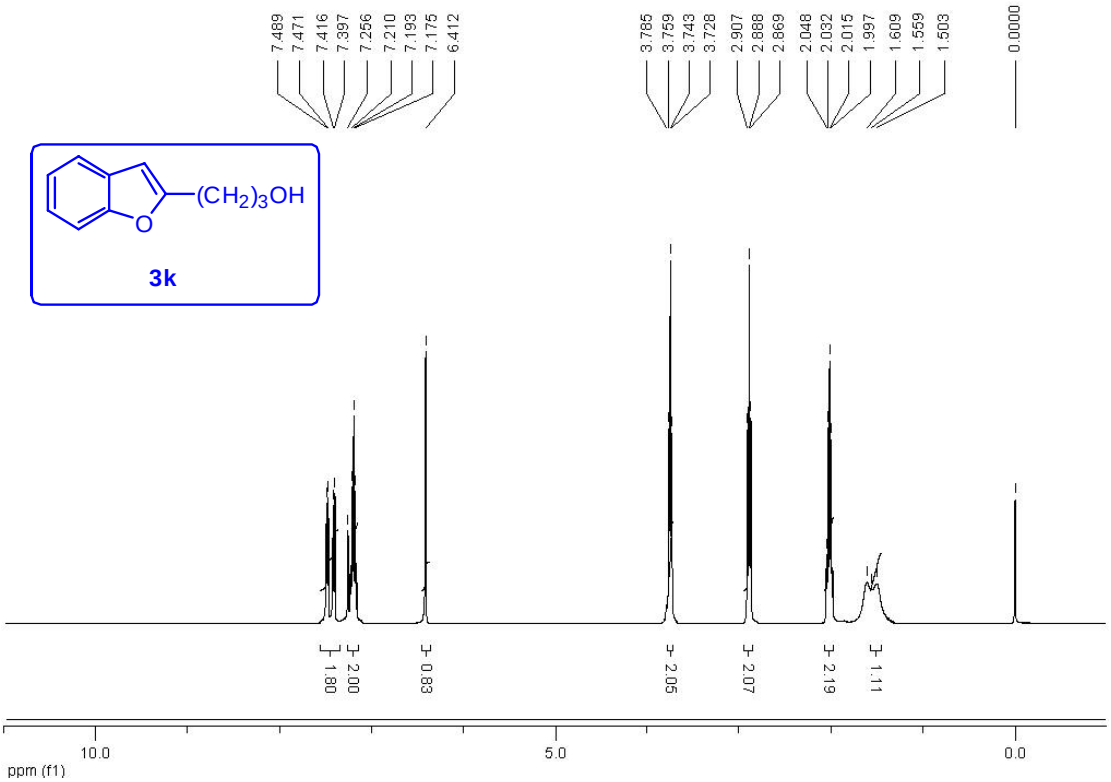
29.417
28.030
(CH2)3Ph
O
3j
200
150
100
50
0
ppm (f1)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7.175
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3.759
3.743
3.728
2.907
2.888
2.869
2.048
2.032
2.015
1.997
1.609
1.559
1.503
0.0000
(CH2)3OH
O
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2.07
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1.11
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5.0
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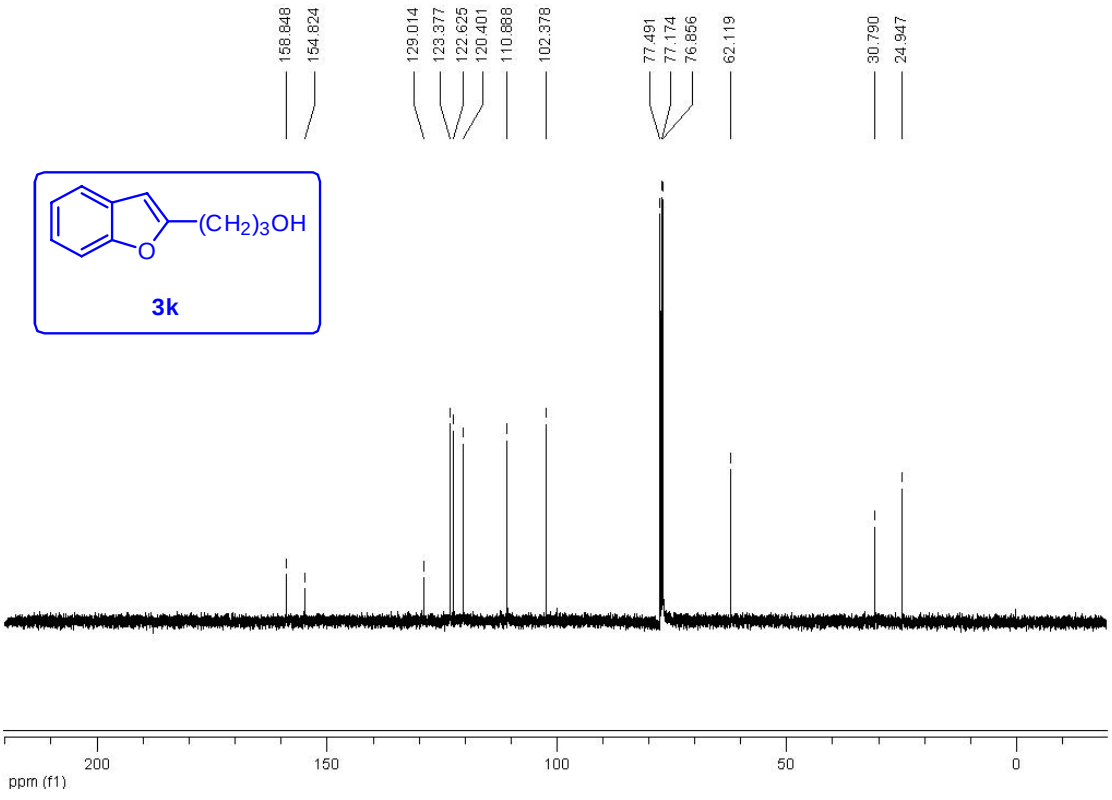
ppm (f1)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110.888
102.378
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76.856
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30.790
24.947
(CH2)3OH
O
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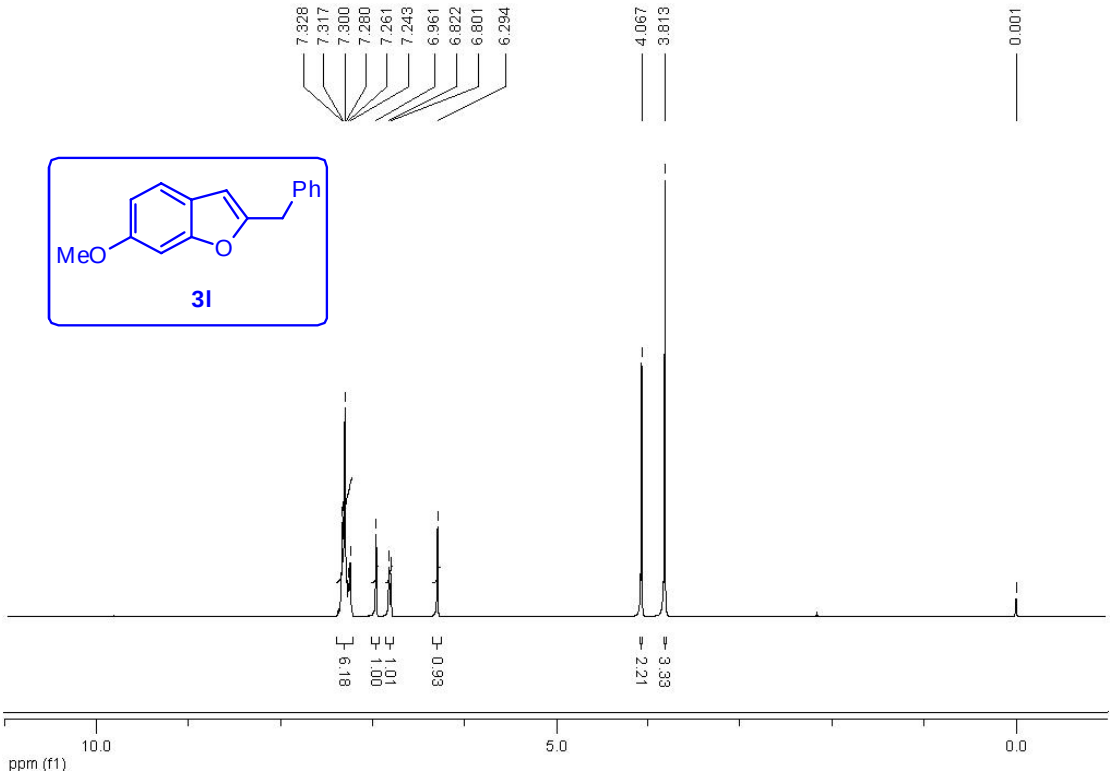
100
50
0
ppm (f1)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7.261
7.243
6.961
6.822
6.801
6.294
4.067
3.813
0.001
Ph
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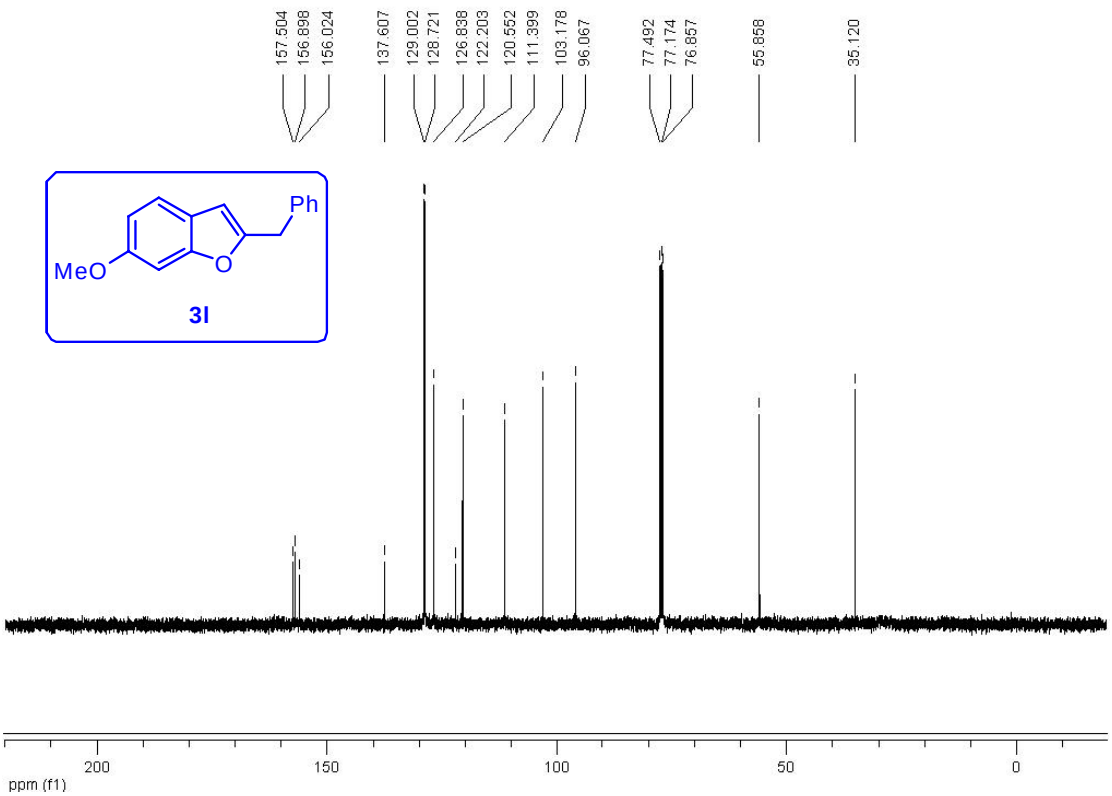
10.0
5.0
0.0
ppm (f1)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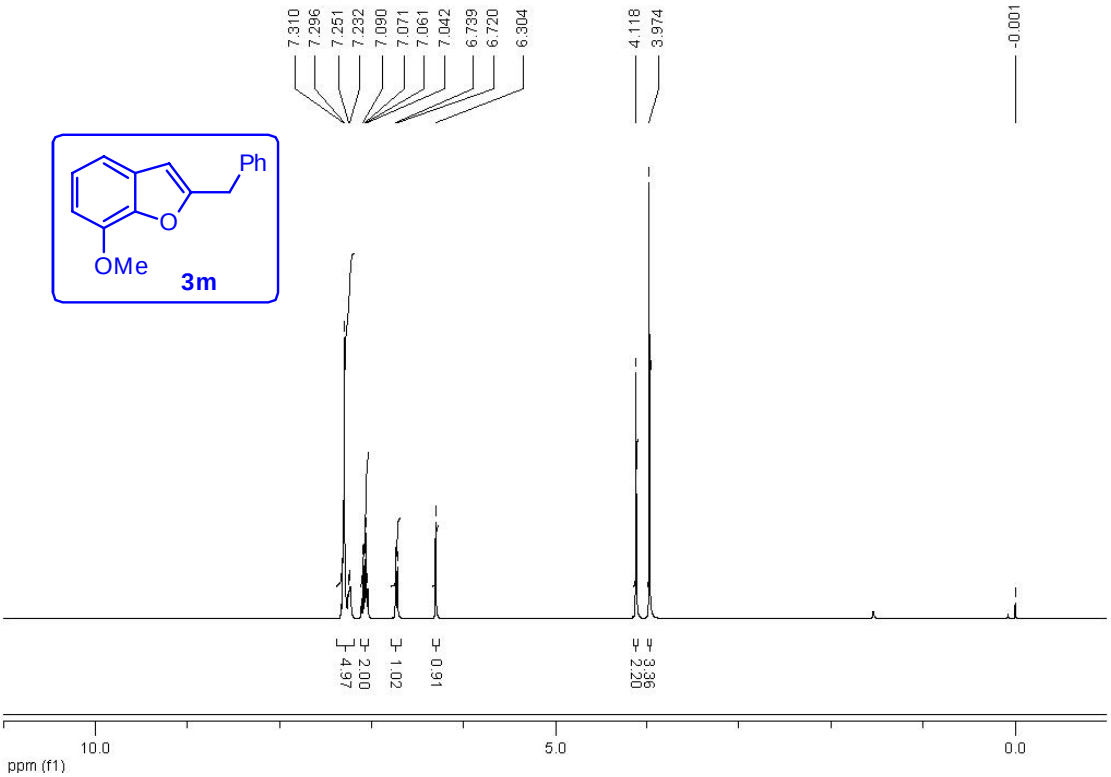
122.203
120.552
111.399
103.178
96.067
77.492
77.174
76.857
55.658
35.120
Ph
MeO
O
3l
200
150
100
50
0
ppm (f1)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7.232
7.090
7.071
7.061
7.042
6.739
6.720
6.304
4.118
3.974
-0.001
Ph
O
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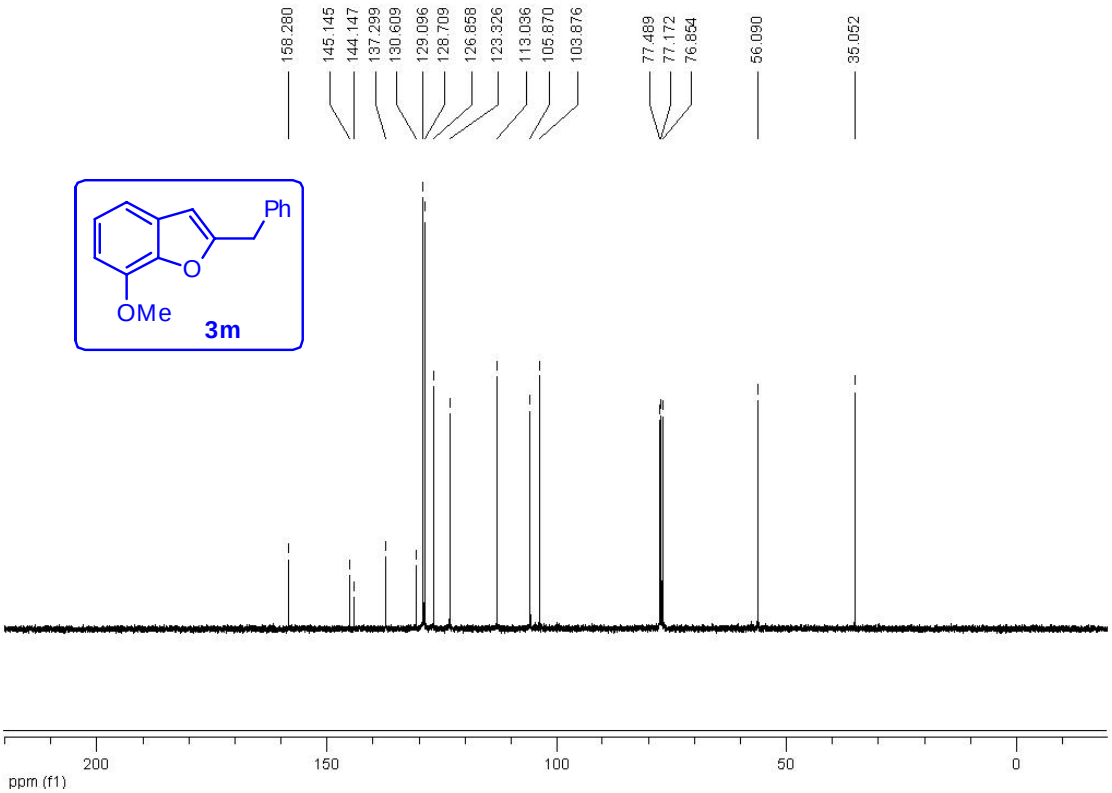
ppm (f1)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129.096
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126.858
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113.036
105.870
103.876
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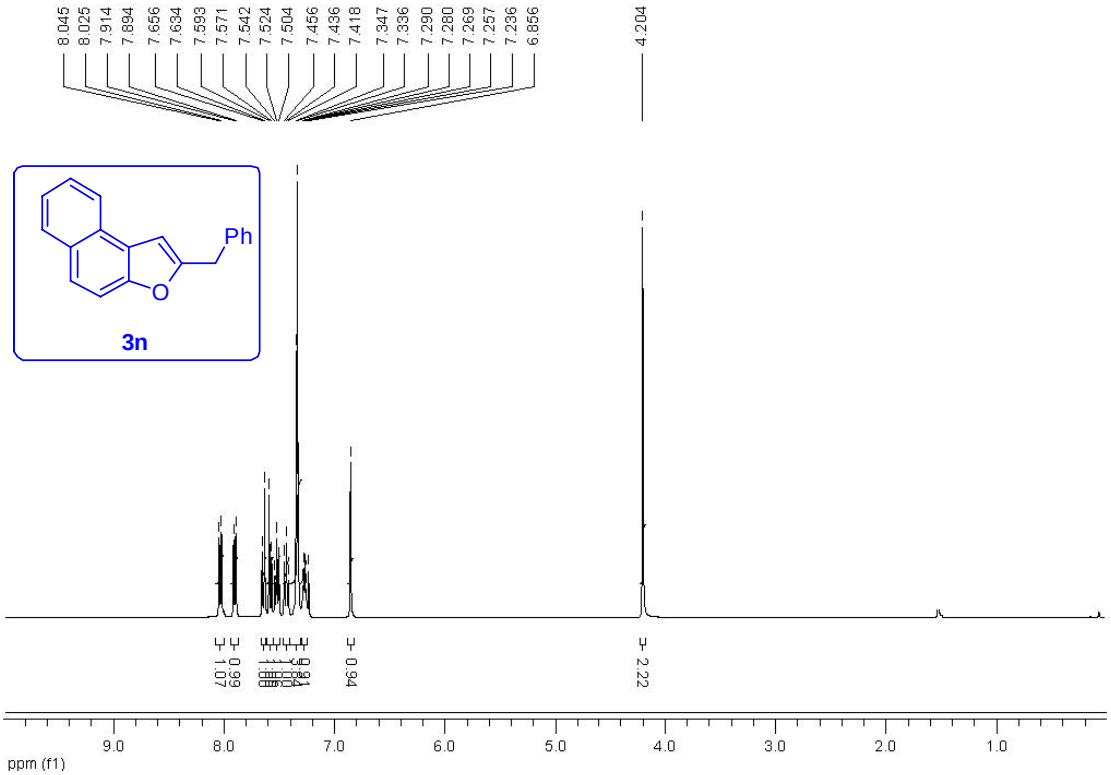
76.854
56.090
35.052
Ph
O
OMe
3m
200
150
100
50
0
ppm (f1)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7.504
7.456
7.436
7.418
7.347
7.336
7.290
7.280
7.269
7.257
7.236
6.856
4.204
Ph
O
3n
3.07
2.99
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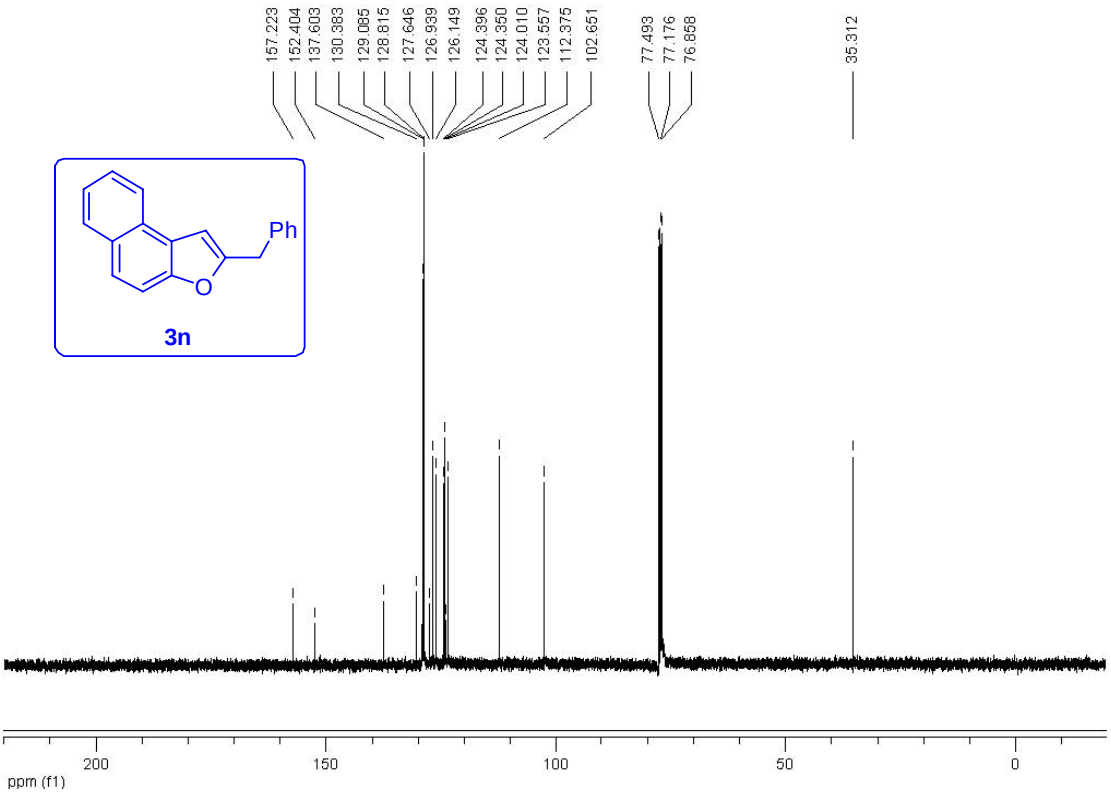
3.0
2.0
1.0
ppm (f1)


157.223
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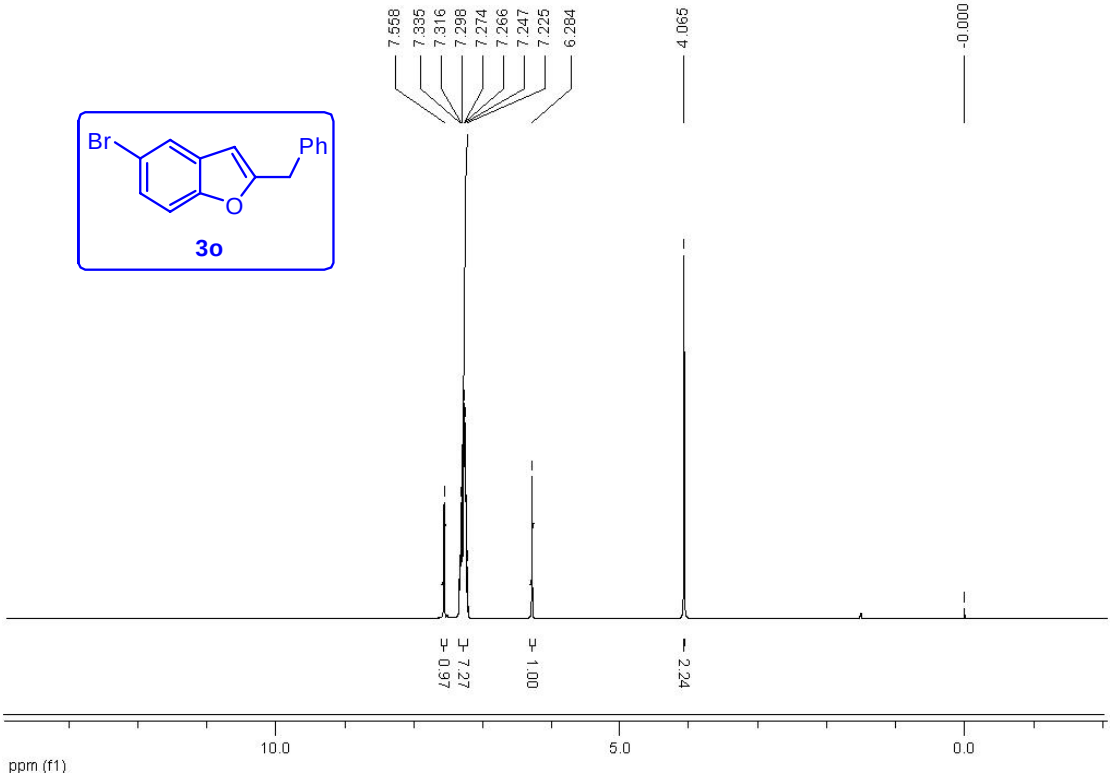
124.010
123.557
112.375
102.651
77.493
77.176
76.858
35.312
Ph
O
3n
200
150
100
50
0
ppm (f1)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7.335
7.316
7.298
7.274
7.266
7.247
7.225
6.284
4.065
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Br
Ph
O
3o
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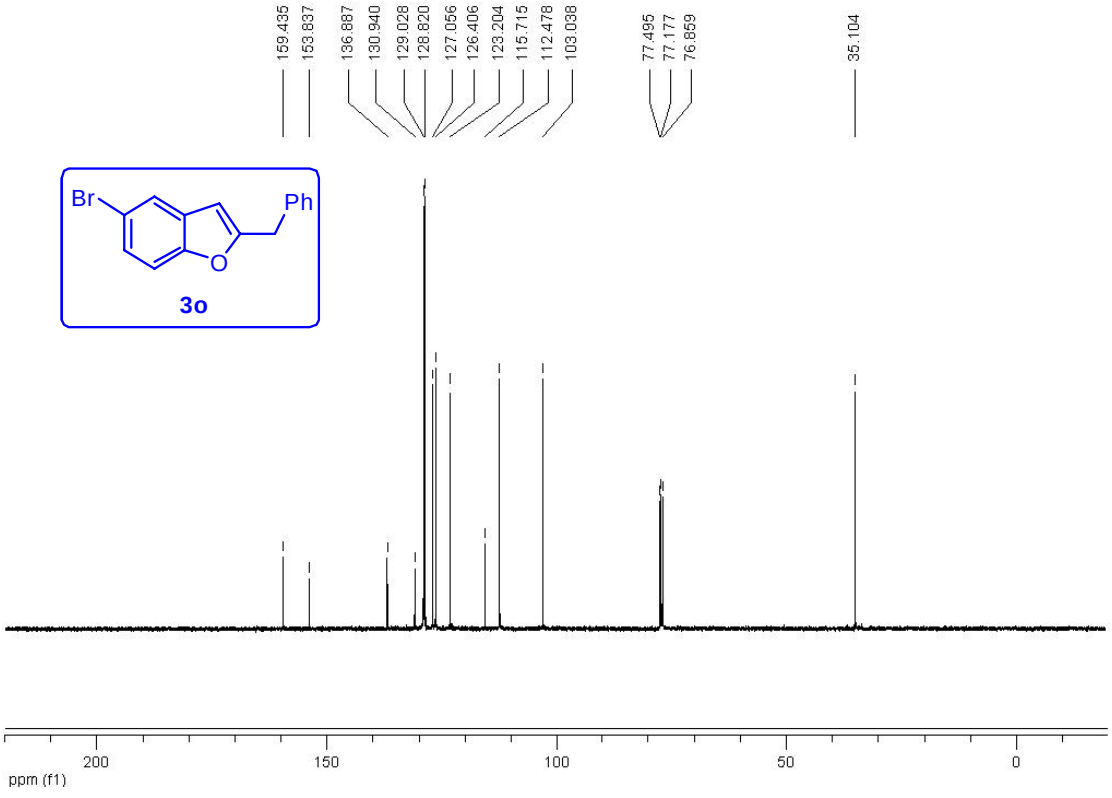
2.24
10.0
5.0
0.0
ppm (f1)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130.940
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128.820
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126.406
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115.715
112.478
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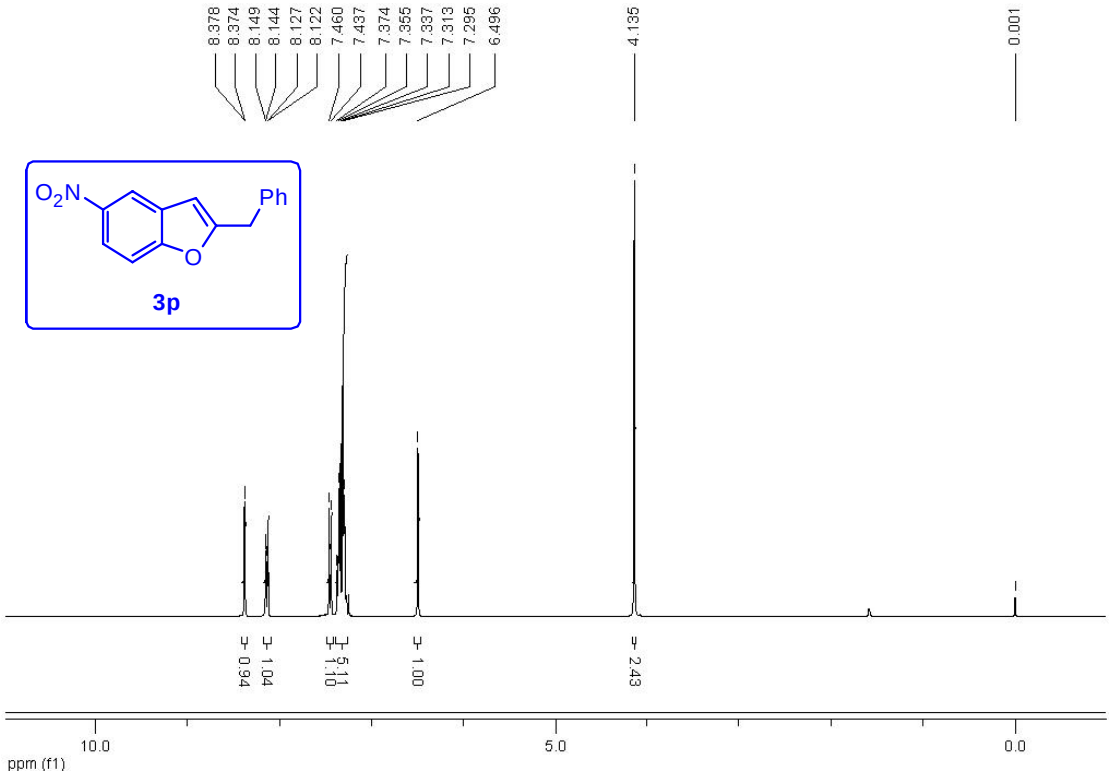
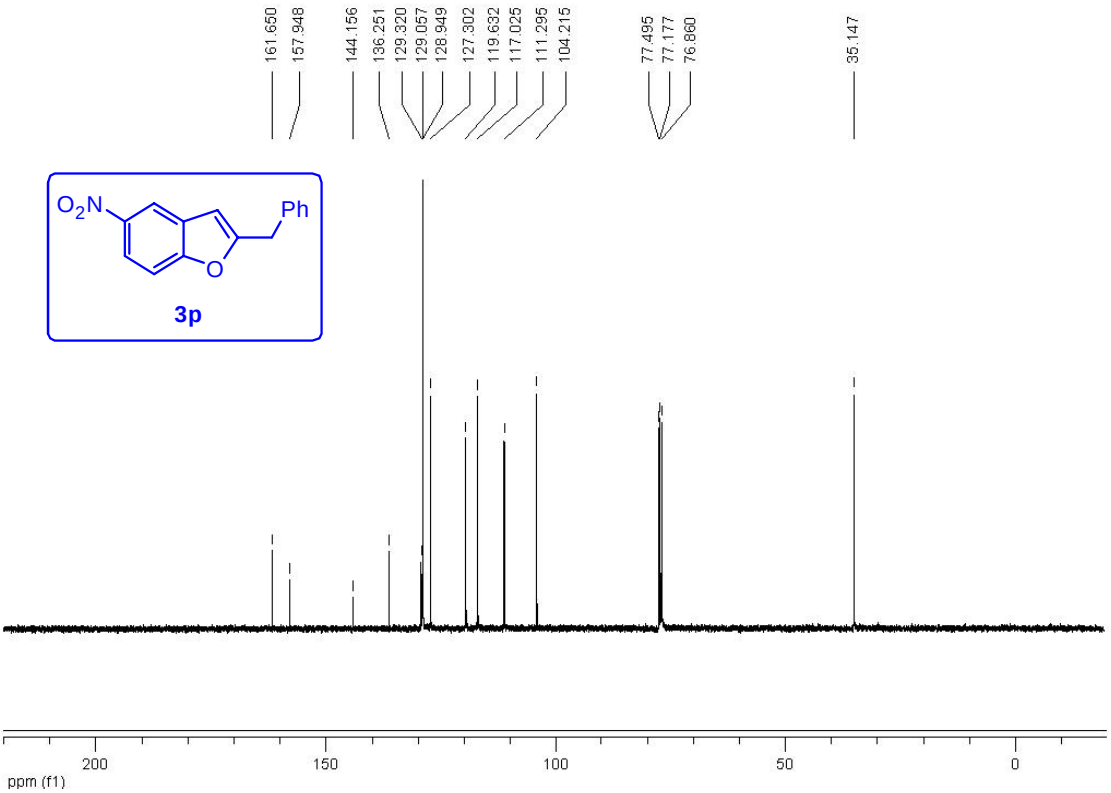
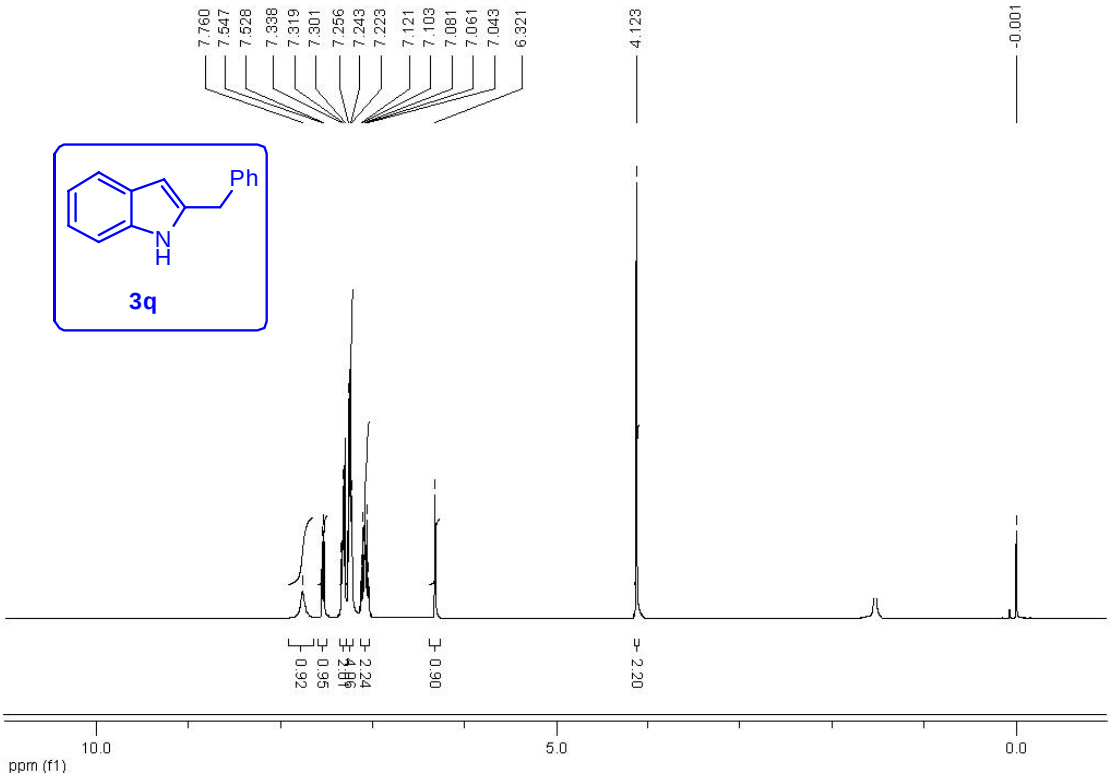
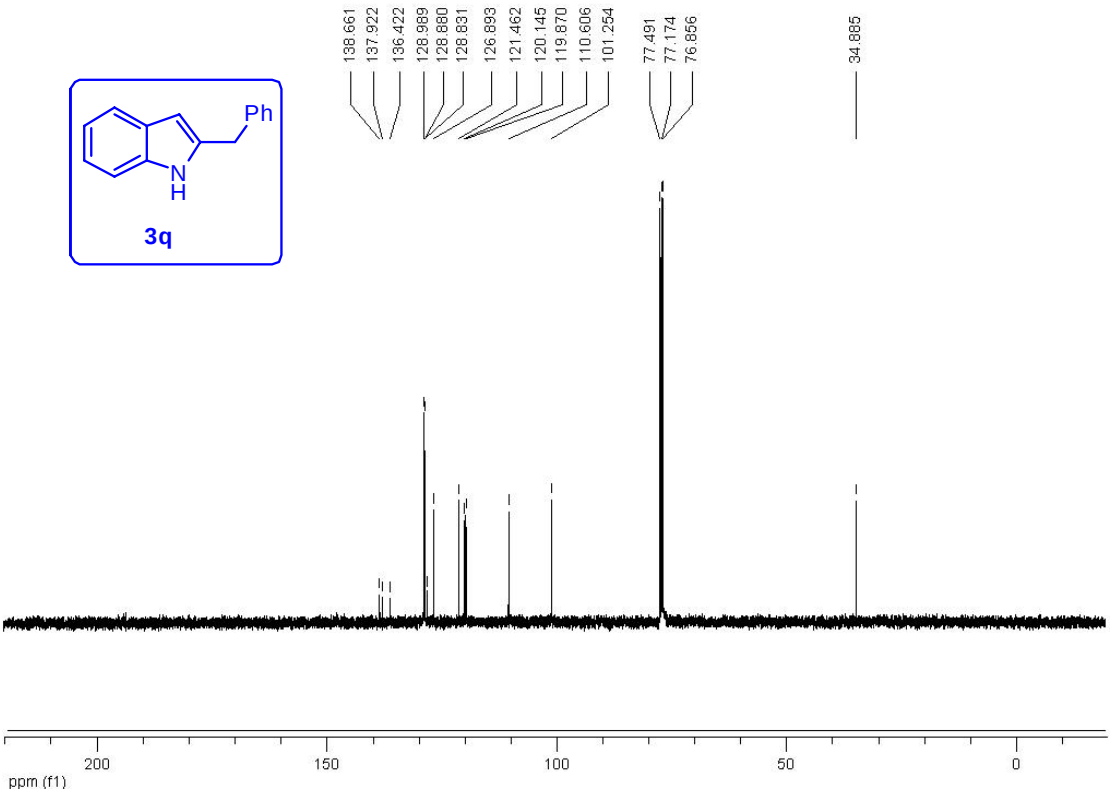
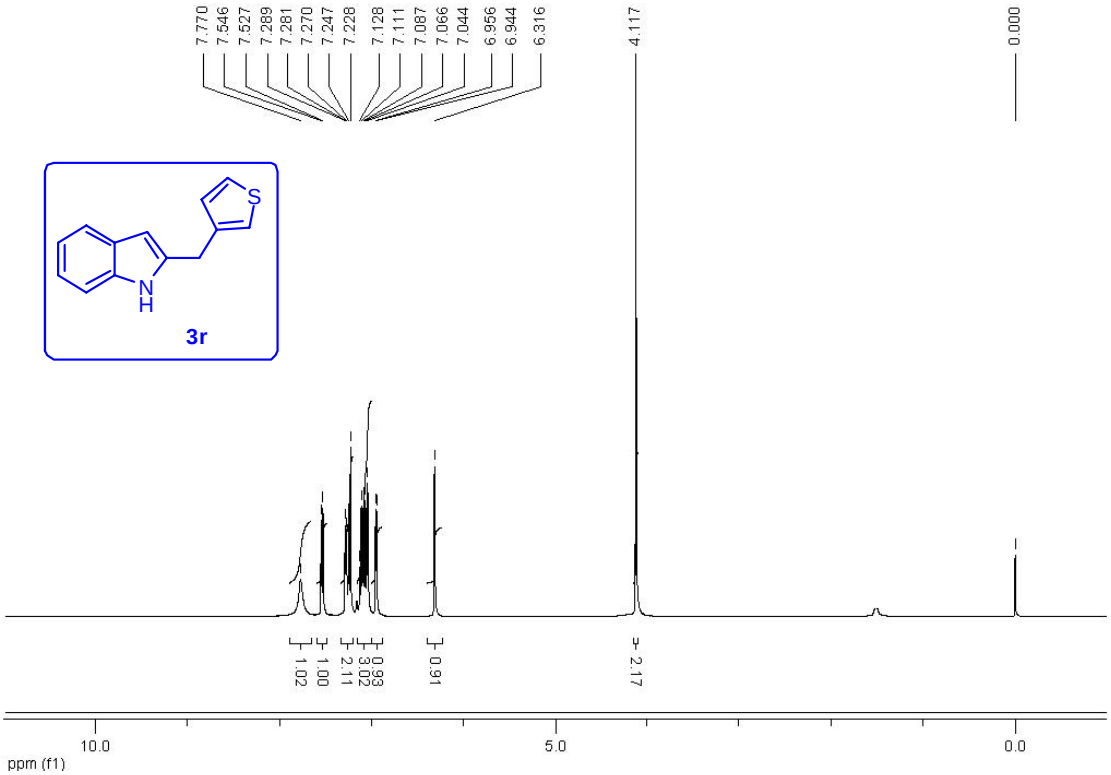
77.495
77.177
76.859
35.104
Br
Ph
O
3o
200
150
100
50
0
ppm (f1)

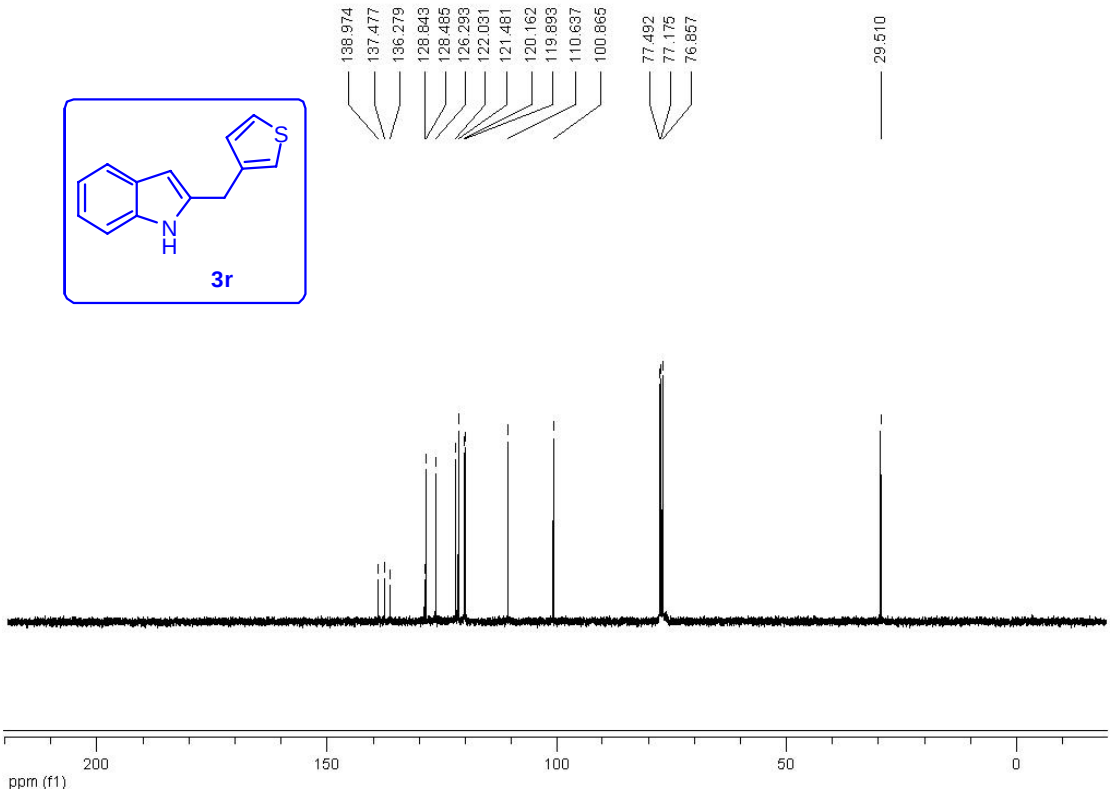

8.378
8.374
8.149
8.144
8.127
8.122
7.460
7.437
7.374
7.355
7.337
7.313
7.295
6.496
4.135
0.001
O2N
Ph
O
3p
0.94
1.04
5.11
1.10
1.00
2.43
10.0
5.0
0.0
ppm (f1)

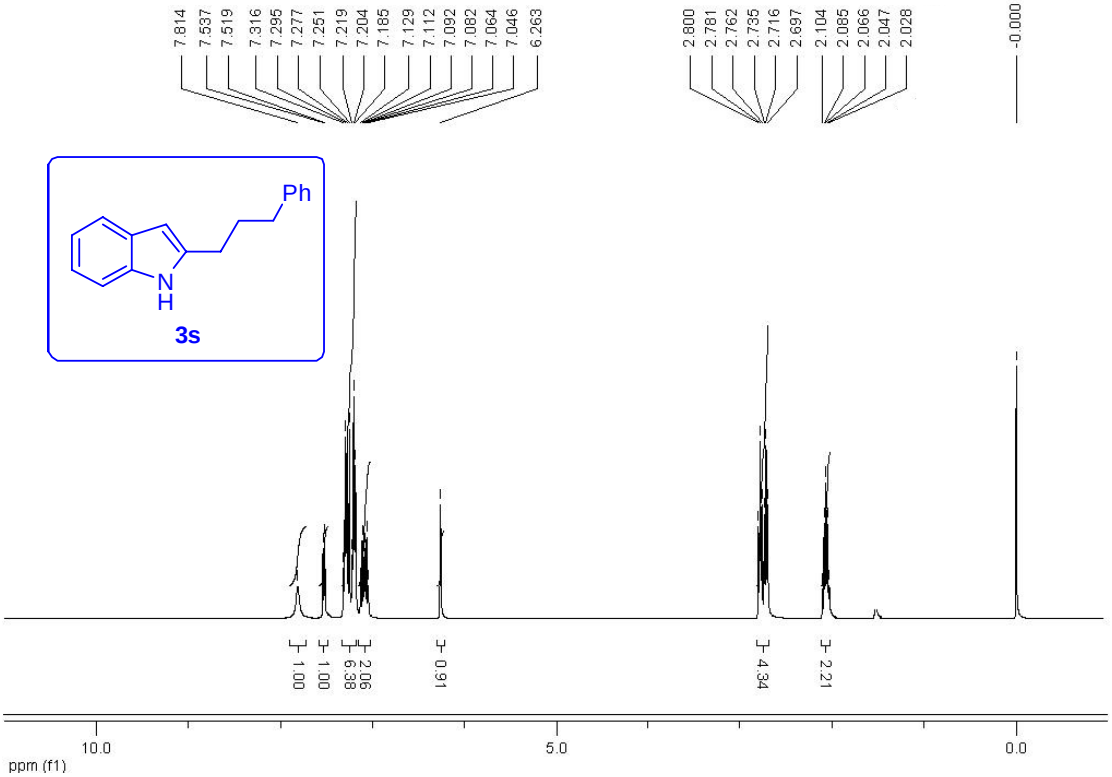

161.650
157.948
144.156
136.251
129.320
129.057
128.949
127.302
119.632
117.025
111.295
104.215
77.495
77.177
76.860
35.147
O2N
Ph
O
3p
200
150
100
50
0
ppm (f1)

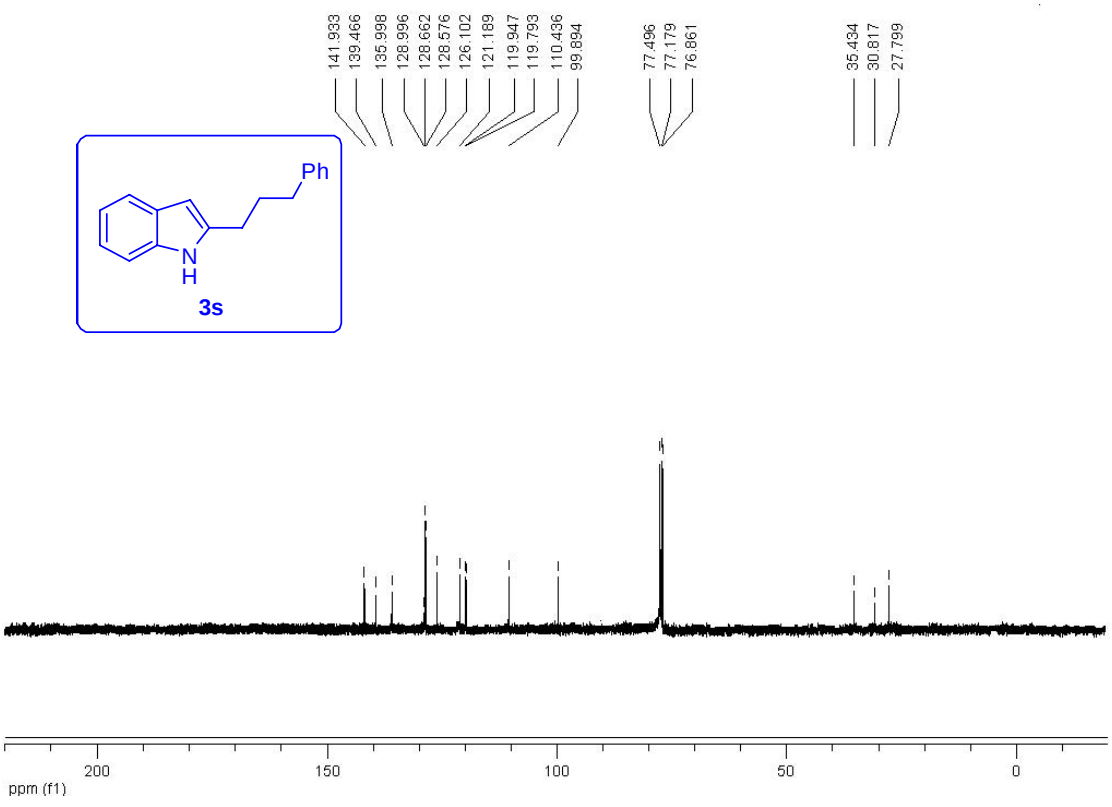

7.760
7.547
7.528
7.338
7.319
7.301
7.256
7.243
7.223
7.121
7.103
7.081
7.061
7.043
6.321
4.123
-0.001
Ph
N
H
3q
0.92
0.95
1.96
2.24
0.90
2.20
10.0
5.0
0.0
ppm (f1)

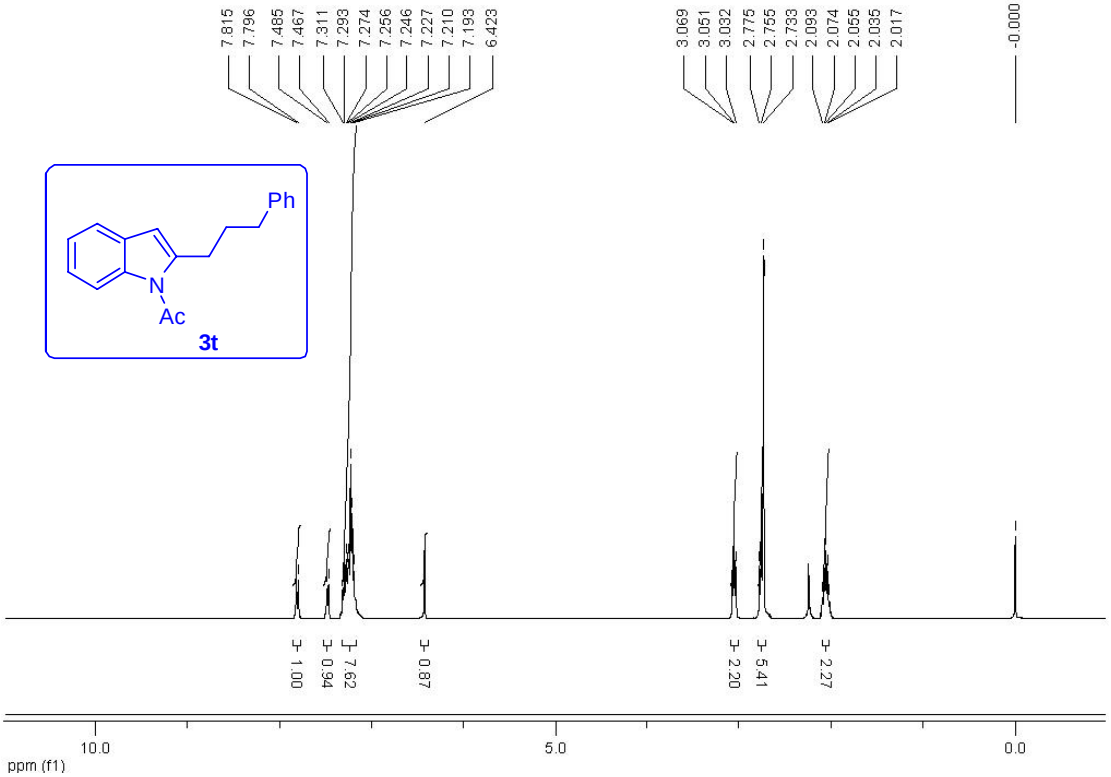

138.661
137.922
136.422
128.989
128.880
128.831
126.893
121.462
120.145
119.870
110.606
101.254
77.491
77.174
76.856
34.885
Ph
N
H
3q
200
150
100
50
0
ppm (f1)

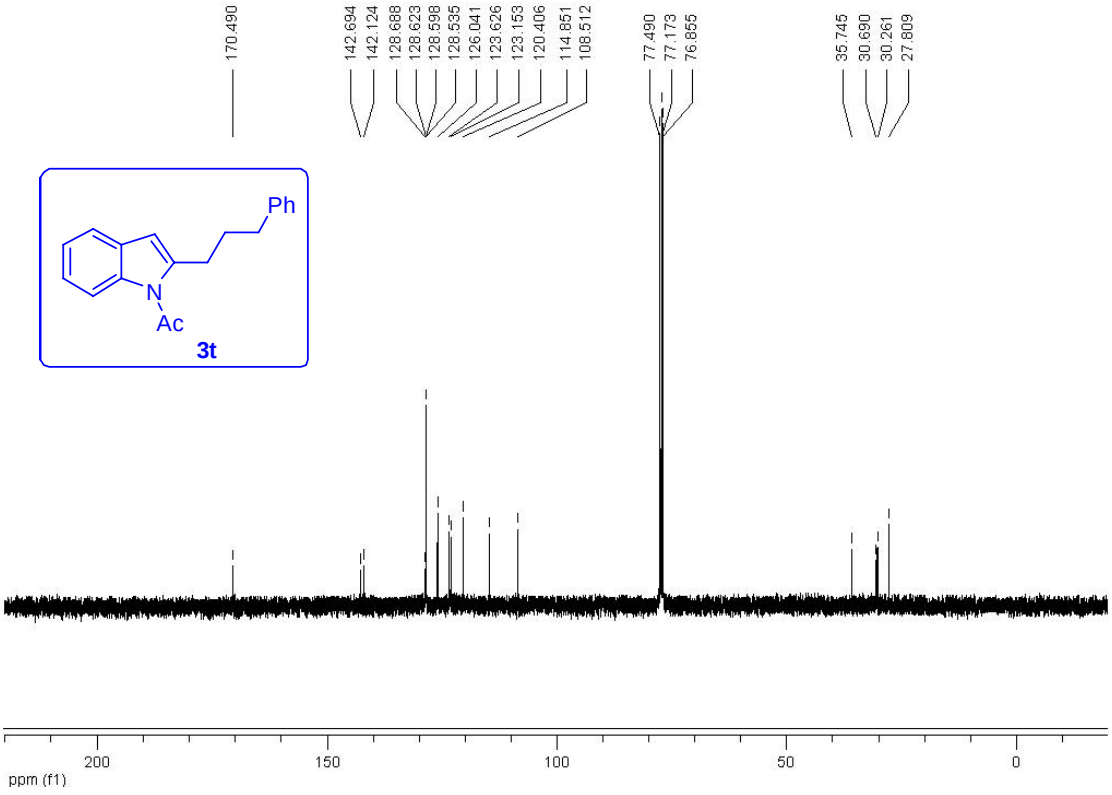

7.770
7.546
7.527
7.289
7.281
7.270
7.247
7.228
7.128
7.111
7.087
7.066
7.044
6.956
6.944
6.316
4.117
0.000
3r
1.02
1.00
2.11
3.03
0.93
0.91
2.17
10.0
5.0
0.0
ppm (f1)


138.974
137.477
136.279
128.843
128.485
126.293
122.031
121.481
120.162
119.893
110.637
100.865
77.492
77.175
76.857
29.510
3r
200
150
100
50
0
ppm (f1)


7.814
7.537
7.519
7.316
7.295
7.277
7.251
7.219
7.204
7.185
7.129
7.112
7.092
7.082
7.064
7.046
6.263
2.800
2.781
2.762
2.735
2.716
2.697
2.104
2.085
2.066
2.047
2.028
-0.000
Ph
N
H
3s
1.00
1.00
2.06
3.88
0.91
4.34
2.21
10.0
5.0
0.0
ppm (f1)


141.933
139.466
135.998
128.996
128.662
128.576
126.102
121.189
119.947
119.793
110.436
99.894
77.496
77.179
76.861
35.434
30.817
27.799
Ph
N
H
3s
200
150
100
50
0
ppm (f1)


7.815
7.796
7.485
7.467
7.311
7.293
7.274
7.256
7.246
7.227
7.210
7.193
6.423
3.069
3.051
3.032
2.775
2.755
2.733
2.093
2.074
2.055
2.035
2.017
-0.000
Ph
N
Ac
3t
1.00
0.94
7.92
0.87
2.20
5.41
2.27
10.0
5.0
0.0
ppm (f1)


170.490
142.694
142.124
128.688
128.623
128.598
128.535
126.041
123.626
123.153
120.406
114.851
108.512
77.490
77.173
76.855
35.745
30.690
30.261
27.809
Ph
N
Ac
3t
200
150
100
50
0
ppm (f1)